CHRYSLER INTERNATIONAL

SERVICE MANUAL

1998
CHRYSLER VOYAGER

CHRYSLER INTERNATIONAL

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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. This manual does not cover theory of operation, which is addressed in service training material. 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 general information, 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.

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.

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

GROUP TAB LOCATOR

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7	Cooling System
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8H	Vehicle Speed Control System
8K	Wiper and Washer Systems
8L	Lamps
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9	Engine
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INTRODUCTION

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GENERAL INFORMATION

VEHICLE SAFETY CERTIFICATION LABEL

A vehicle safety certification label (Fig. 1) is located on the rear shut face of the driver's door. This label indicates date of manufacture (month and year), Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating (GAWR) front, Gross Axle Weight Rating (GAWR) rear and the Vehicle Identification Number (VIN). The Month, Day and Hour of manufacture is also included.

When it is necessary to contact the manufacturer regarding service or warranty, the information on the Vehicle Safety Certification Label would be required.

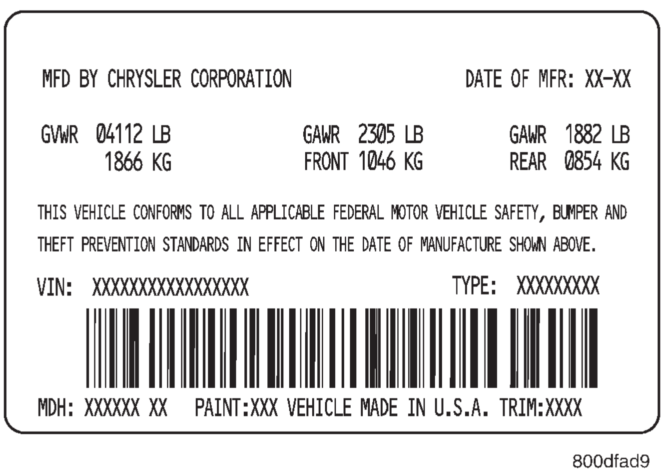


Fig. 1 Vehicle Safety Certification Label

VEHICLE IDENTIFICATION NUMBER

The Vehicle Identification Number (VIN) can be viewed through the windshield at the upper left corner of the instrument panel, near the left windshield pillar (Fig. 2). The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle. Refer to VIN Code Breakdown Chart for decoding information.

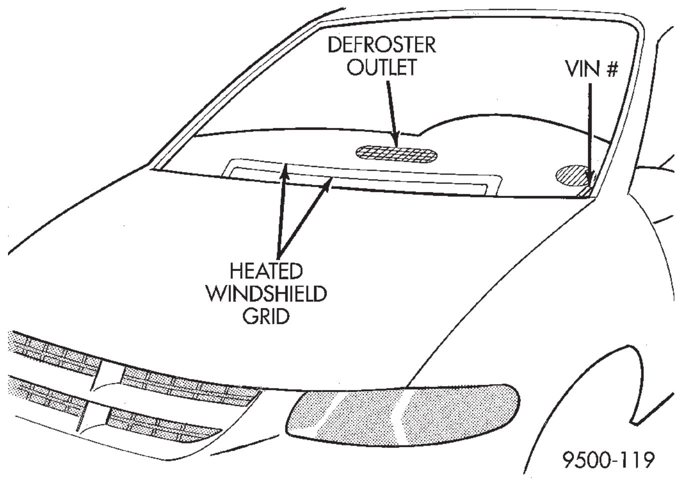


Fig. 2 Vehicle Identification Number (VIN Plate)

VIN CHECK DIGIT

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.

BODY CODE PLATE

LOCATION AND DECODING

The Body Code Plate (Fig. 3) is located in the engine compartment on the radiator closure panel crossmember. 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.

GENERAL INFORMATION (Continued)

VIN CODE BREAKDOWN CHART

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = United States 2 = Canada
2	Make	B = Dodge
		C = Chrysler P = Plymouth
3	Vehicle Type	4 = Multipurpose Pass. Vehicle
4	Gross Vehicle Weight Rating	G = 2268 - 2721 kg (5001 - 6000 lbs)
5	Car Line	P = Chrysler, Town & Country P = Dodge, Caravan/Grand Caravan P = Plymouth, Voyager/Grand Voyager T = AWD Chrysler, Town & Country T = AWD Dodge, Grand Caravan T = AWD Plymouth, Grand Voyager
6	Series	2 = FWD Caravan/Grand Caravan, Voyager/ Grand Voyager 4 = Caravan SE/Grand Caravan SE, Voyager SE/Grand Voyager SE 5 = Caravan LE or ES/Grand Caravan LE or ES, Voyager LE/Grand Voyager LE, Town & Country LX 6 = Town & Country LXI
7	Body Style	4 = Long Wheel Base 5 = Short Wheel Base
8	Engine	B = 2.4 L 4 cyl. MPI 16-VALVE DOHC
		3 = 3.0 L 6 cyl. gas MPI R = 3.3L 6 cyl. gas MPI L = 3.8 L 6 cyl. gas MPI
9	Check Digit	See explanation in this section.
10	Model Year	V = 1997
11	Assembly Plant	B = St. Louis South R = Windsor
12 thru 17	Sequence Number	6 digit number assigned by assembly plant.

BODY CODE PLATE – LINE 3

DIGITS 1 THROUGH 12

Vehicle Order Number

DIGITS 13 THROUGH 17

Open space

DIGITS 18 AND 19

Vehicle Shell Line
- NS

DIGIT 20

Carline

FWD

- H = Plymouth
- K = Dodge
- S = Chrysler

AWD

- C = Chrysler
- D = Dodge
- P = Plymouth

GENERAL INFORMATION (Continued)

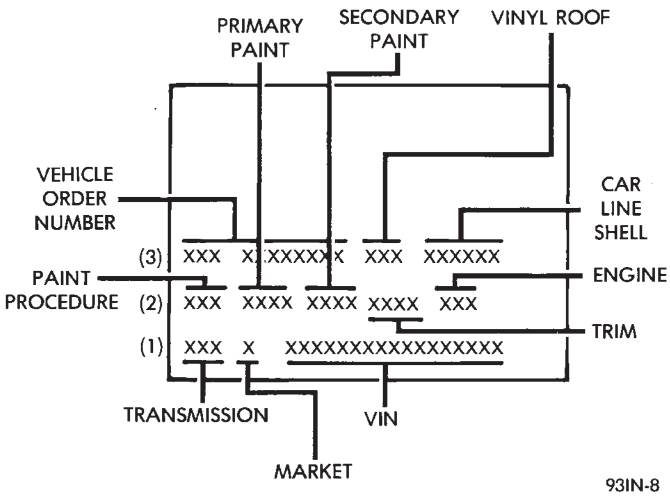


Fig. 3 Body Code Plate

DIGIT 21

Price Class
- H = Highline
- L = Lowline
- P = Premium
- S = Luxury

DIGITS 22 AND 23

Body Type
- 52 = Short Wheel Base
- 53 = Long Wheel Base

BODY CODE PLATE LINE 2

DIGITS 1, 2 AND 3

Paint procedure

DIGIT 4

Open Space

DIGITS 5 THROUGH 8

Primary paint
See Group 23, Body 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
- EDZ = 2.4L 4 cyl. DOHC Gasoline
- EFA = 3.0L 6 cyl. Gasoline
- EGA = 3.3L 6 cyl. Gasoline
- EGH = 3.8L 6 cyl. Gasoline

BODY CODE PLATE LINE 1

DIGITS 1, 2, AND 3

Transaxle Codes
- DGB = 31TH 3-Speed Automatic Transaxle
- DGL = 41TE 4-speed Electronic Automatic Transaxle
- DGM = 31TH 3-Speed Automatic Transaxle

DIGIT 4

Open Space

DIGIT 5

Market Code
- C = Canada
- B = International
- M = Mexico
- U = United States

DIGIT 6

Open Space

DIGITS 7 THROUGH 23

Vehicle Identification Number
- Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

IF TWO BODY CODE PLATES ARE REQUIRED

The last code shown on either plate will be followed by END. When two plates are required, the last code space on the first plate will indicate (CTD)

When a second plate is required, the first four spaces of each line will not be used due to overlap of the plates.

GENERAL INFORMATION (Continued)

INTERNATIONAL CONTROL AND DISPLAY SYMBOLS

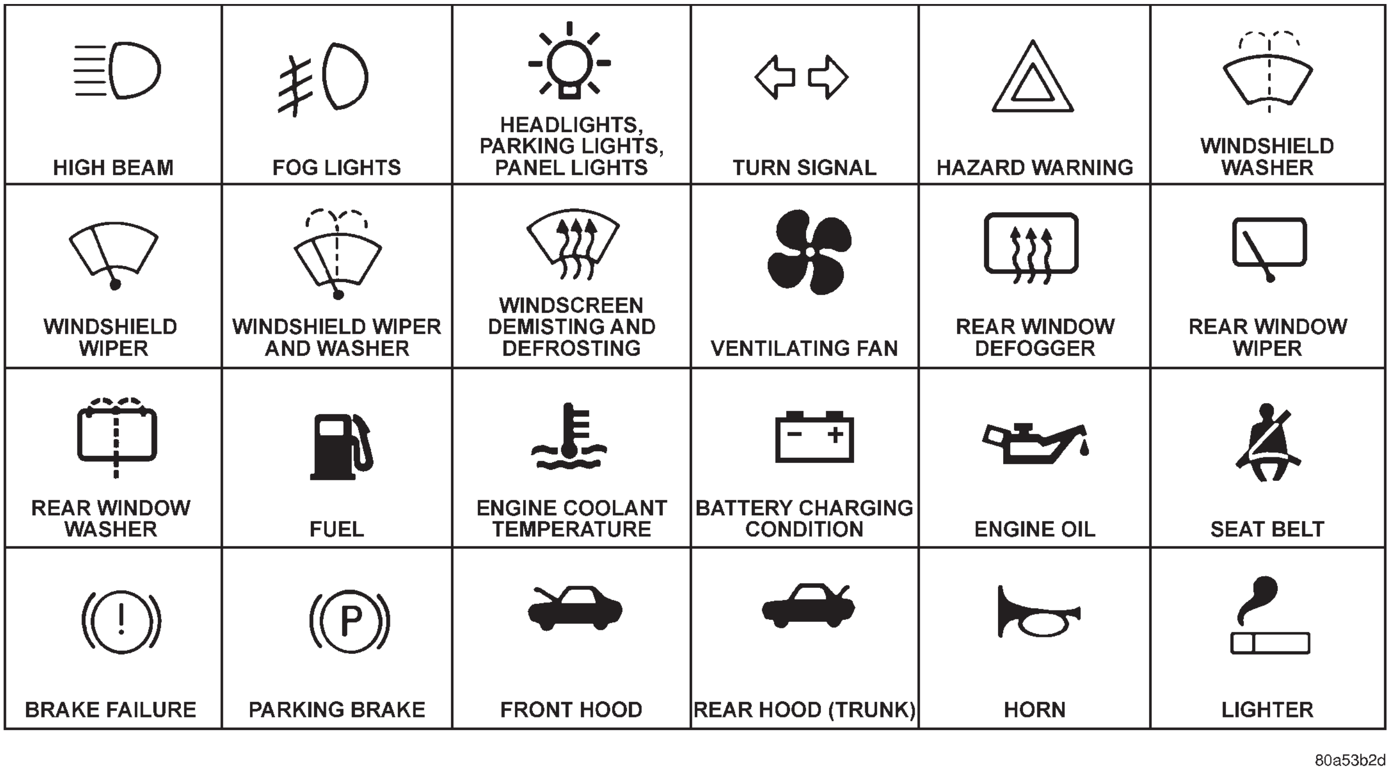


Fig. 4

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

The graphic symbols illustrated in the following chart (Fig. 4) are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

FASTENER IDENTIFICATION

FASTENER IDENTIFICATION

THREAD IDENTIFICATION

SAE and metric bolt/nut threads are not the same. The difference is described in the Thread Notation chart (Fig. 5).

GRADE/CLASS IDENTIFICATION

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 12.9. 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.

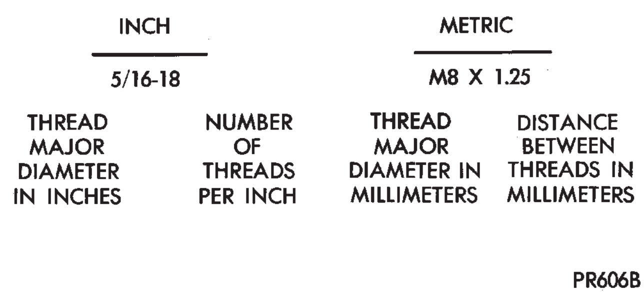


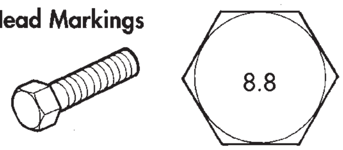
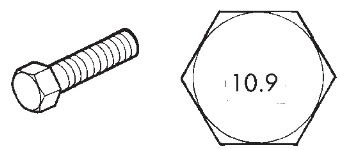
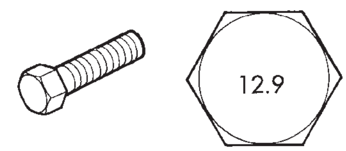
Fig. 5 Thread Notation—SAE and Metric

GENERAL INFORMATION (Continued)

FASTENER IDENTIFICATION

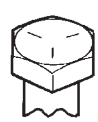
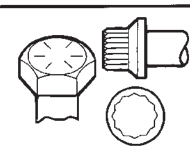
Bolt Markings and Torque - Metric

Commercial Steel Class

	8.8	10.9	12.9
Bolt Head Markings			

Body Size Diam. mm	8.8 Torque Cast Iron N•m	8.8 Cast Iron ft-lb	8.8 Aluminum N•m	8.8 Aluminum ft-lb	10.9 Torque Cast Iron N•m	10.9 Cast Iron ft-lb	10.9 Aluminum N•m	10.9 Aluminum ft-lb	12.9 Torque Cast Iron N•m	12.9 Cast Iron ft-lb	12.9 Aluminum N•m	12.9 Aluminum 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 Cast Iron N•m	Grade 5 Cast Iron ft-lb	Grade 5 Aluminum N•m	Grade 5 Aluminum ft-lb	Bolt Torque - Grade 8 Bolt Cast Iron N•m	Grade 8 Cast Iron ft-lb	Grade 8 Aluminum N•m	Grade 8 Aluminum 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

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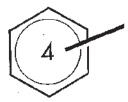
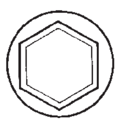
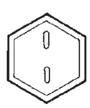
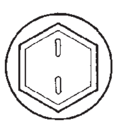
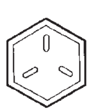
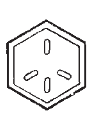
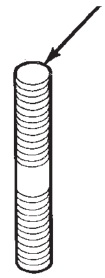
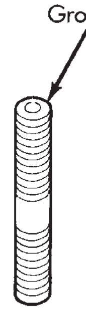
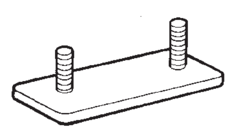
GENERAL INFORMATION (Continued)

FASTENER STRENGTH

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

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GENERAL INFORMATION (Continued)

METRIC SYSTEM

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

Figure art, specifications and torque references in this Service Manual are identified in metric and SAE format.

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

The metric system is based on quantities of one, ten, one hundred, one thousand and one million (Fig. 6).

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

Refer to the 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.)

Mega -	(M) Million	Deci -	(D) Tenth
Kilo -	(K) Thousand	Centi -	(C) Hundreth
Milli -	(m) Thousandth		

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Fig. 6 Metric Prefixes

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)	M	x 1.0936	= Yards
Miles	x 1.6093	= Kilometers (Km)	Km	x 0.6214	= Miles
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.
Kilometers/Hr.	x 0.27778	= Meters/Sec. (M/S)	M/S	x 3.600	= Kilometers/Hr.
mph	x 0.4470	= Meters/Sec. (M/S)	M/S	x 2.237	= mph

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		

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TORQUE REFERENCES

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

GENERAL INFORMATION (Continued)

METRIC CONVERSION

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

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GENERAL INFORMATION (Continued)

TORQUE SPECIFICATIONS

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

INTRODUCTION

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GENERAL INFORMATION
BODY CODE PLATE 1
E-MARK LABEL 1
MANUFACTURER PLATE 3
VEHICLE IDENTIFICATION NUMBER 1

GENERAL INFORMATION

E-MARK LABEL

An E-mark Label (Fig. 1) is located on the rear shut face of the driver's door. The label contains the following information:

- Date of Manufacture
- Month-Day-Hour (MDH)
- Vehicle Identification Number (VIN)
- Country Codes
- Regulation Number
- Regulation Amendment Number
- Approval Number

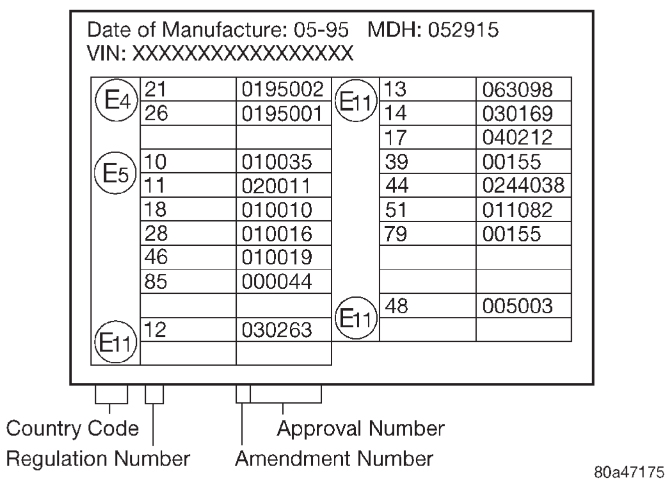

Fig. 1 E-Mark Label

VEHICLE IDENTIFICATION NUMBER

The Vehicle Identification Number (VIN) can be viewed through the windshield at the upper left corner of the instrument panel next to the left A-pillar (Fig. 2). The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle. Refer to the VIN Decoding Information Table to interpret VIN code.

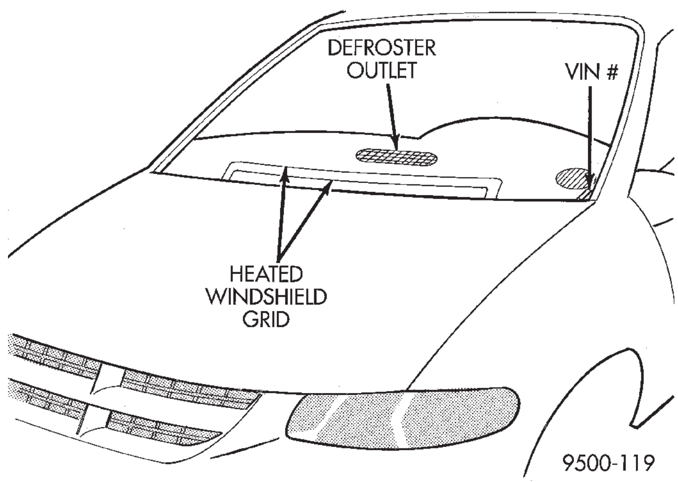

Fig. 2 VIN PLATE LOCATION

VIN CHECK DIGIT

To protect the consumer from theft and possible fraud the manufacturer is required to include a check Digit at the ninth position of the VIN. 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.

BODY CODE PLATE

LOCATION AND DECODING

The Body Code Plate is located (Fig. 3) in the engine compartment on the radiator closure panel crossmember. 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.

BODY CODE PLATE—LINE 3

DIGITS 1 THROUGH 12

Vehicle Order Number

DIGITS 13, 14, AND 15

Open Space

GENERAL INFORMATION (Continued)

VIN DECODING INFORMATION

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of origin	1 = United States or Austria 2 = Canada
2	Make	C = Chrysler D = Dodge
3	Vehicle Type	4 = Multipurpose Pass. Veh.
4	Gross Vehicle Weight Rating	G = 2268-2721 kg (5001-6000 lbs)
5	Car Line	C = Voyager/Grand Voyager AWD Y = Voyager/Grand Voyager FWD
6	Series	4 = Voyager/Grand Voyager SE FWD 5 = Voyager/Grand Voyager LE FWD/AWD 6 = Voyager LX FWD/AWD N = 5-Speed Manual Transmission B = 4-Speed Automatic Transmission
7	Body Style	2 = Short Wheelbase 4-Door 3 = Short Wheelbase 3-Door 4 = Long Wheelbase Premium 4-Door 5 = Long Wheelbase Highline 4-door 7 = Short Wheelbase Commercial Van
8	Engine	B = 2.4 L 4cyl. MPI 16-Valve DOHC C = 2.0L 4cyl. MPI 16-Valve SOHC M = 2.5L 4cyl Turbo Diesel (Intercooler) R = 3.3 L 6 cyl. gas MPI L = 3.8 L 6 cyl. gas MPI
9	Check Digit	See explanation in this section.
10	Model Year	W = 1998
11	Assembly Plant	B = St. Louis South, U.S.A. R = Windsor, Canada U = Graz, Austria
12	Build Sequence	6 Digit number assigned by assembly plant

DIGITS 16, 17, AND 18

Vehicle Shell Car Line
- GSYH = Voyager/Grand Voyager SE FWD
- GSYP = Voyager/Grand Voyager LE FWD
- GSYS = Voyager LX FWD
- GSCP = Voyager/Grand Voyager LE AWD
- GSCS = Voyager LX AWD

DIGIT 19

Price Class
- H = High Line
- P = Premium
- S = Special/Sport

DIGITS 20 AND 21

Body Type
- 52 = Short Wheel Base
- 53 = Long Wheel Base

BODY CODE PLATE—LINE 2

DIGITS 1,2, AND 3

Paint Procedure

DIGIT 4

Open Space

GENERAL INFORMATION (Continued)

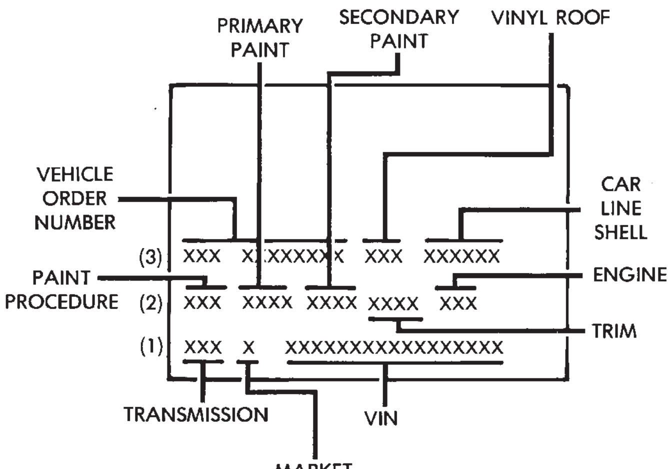

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Fig. 3 Body Code Plate

DIGITS 5 THROUGH 8

Primary Paint
See Group 23, Body 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

- ECB = 2.0L 4cyl 16 valve SOHC gasoline
- EDZ = 2.4 L 4 cyl. 16 valve DOHC gasoline
- ENC = 2.5 L 4 cyl. Turbo Diesel (Intercooler)
- EGA = 3.3 L 6 cyl. gasoline
- EGH = 3.8 L 6 cyl. gasoline

BODY CODE PLATE LINE 1

DIGITS 1, 2, AND 3

Transaxle Codes

- DGL = 41TE 4-speed Electronic Automatic Transaxle
- DD3 = A-598 5–speed Manual Transaxle

DIGIT 4

Open Space

DIGIT 5

Market Code

- B = International
- M = Mexico

DIGIT 6

Open Space

DIGITS 7 THROUGH 23

Vehicle Identification Number (VIN)
Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

IF TWO BODY CODE PLATES ARE REQUIRED

The last code shown on either plate will be followed by END. When two plates are required, the last code space on the first plate will indicate continued (CTD).

When a second plate is required, the first four spaces of each line will not be used due to overlap of the plates.

MANUFACTURER PLATE

The Manufacturer Plate (Fig. 4) is located in the engine compartment on the radiator closure panel crossmember adjacent to the Body Code Plate. The plate contains five lines of information:

1. Vehicle Identification Number (VIN)
2. Gross Vehicle Mass (GVM)
3. Gross Train Mass (GTM)
4. Gross Front Axle Rating (GFAR)
5. Gross Rear Axle Rating (GRAR)

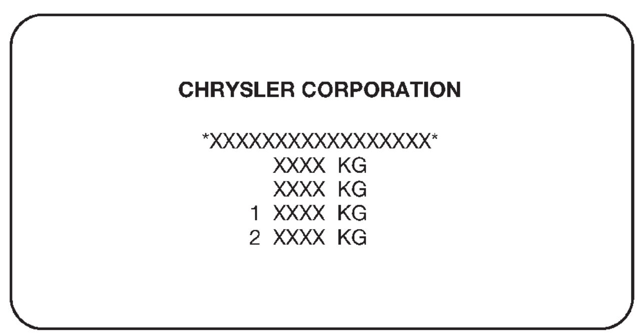

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Fig. 4 Manufacturer Plate

LUBRICATION AND MAINTENANCE

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GENERAL INFORMATION

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GENERAL INFORMATION

INTRODUCTION

Service and maintenance procedures for components and systems listed in Schedule – A or B can be found by using the Group Tab Locator index at the front of this manual. If it is not clear which group contains the information needed, refer to the index at the back of this manual.

There are two maintenance schedules that show proper service based on the conditions that the vehicle is subjected to.

Schedule – **A**, lists scheduled maintenance to be performed when the vehicle is used for general transportation.

Schedule – **B**, lists maintenance intervals for vehicles that are operated under the conditions listed at the beginning of the Maintenance Schedule section.

Use the schedule that best describes your driving conditions.

Where time and mileage are listed, follow the interval that occurs first.

PARTS AND LUBRICANT RECOMMENDATIONS

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

INTERNATIONAL SYMBOLS

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

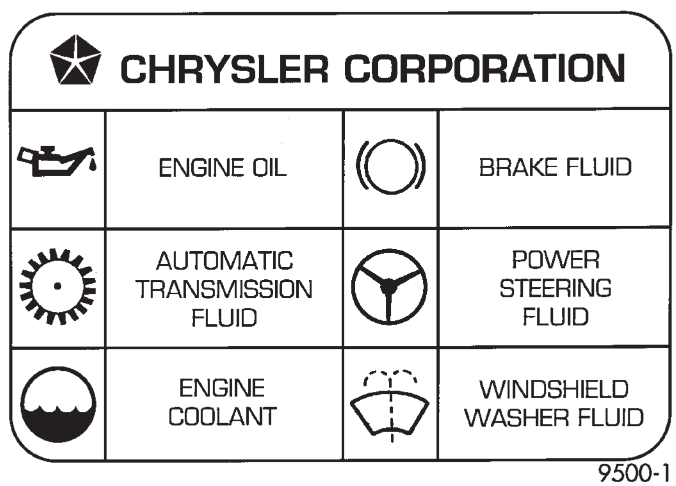

Fig. 1 International Symbols

CLASSIFICATION OF LUBRICANTS

Only lubricants that are endorsed by the following organization should be used to service a Chrysler Corporation vehicle.

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API) (Fig. 2)
- National Lubricating Grease Institute (NLGI) (Fig. 3)

GENERAL INFORMATION (Continued)

Fig. 2 API Symbol

ENGINE OIL

SAE VISCOSITY RATING INDICATES ENGINE OIL VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 30 specifies a single viscosity engine oil. Engine oils also have multiple viscosities. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range.

- SAE 30 = single grade engine oil.
- SAE 10W-30 = multiple grade engine oil.

API QUALITY CLASSIFICATION

The API Service Grade specifies the type of performance the engine oil is intended to provide. The API Service Grade specifications also apply to energy conserving engine oils.

Use engine oils that are API Service Certified. 5W-30 and 10W-30 MOPAR engine oils conform to specifications.

Refer to Group 9, Engine for engine oil specification.

GEAR LUBRICANTS

SAE ratings also apply to multiple grade gear lubricants. In addition, API classification defines the lubricants usage.

LUBRICANTS AND GREASES

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 3) on the label. At the bottom NLGI symbol is the usage and quality identification letters. Wheel bearing lubricant is identified by the letter "G". Chassis lubricant is identified by the latter "L". The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.

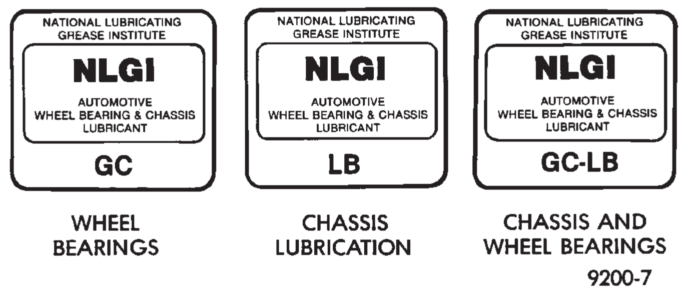

Fig. 3 NLGI Symbol

FLUID CAPACITIES

Fuel Tank	76 L (20 gal.)
Engine Oil, With Filter	4.3 L (4.5 qts.)
Engine Oil, W/O Filter	3.8 L (4.0 qts.)
Cooling System 2.4L Engine	9.0 L (9.5 qts.)
Cooling System 3.OL Engine	9.5 L (10.5 qts.)
Cooling System 3.3 or 3.8L Engine	9.5 L (10.5 qts.)
Automatic Transaxle Service Fill	3.8 L (4.0 qts.)
Automatic Transaxle 31TH/O-haul Fill	8.0 L (8.5 qts.)
Automatic Transaxle 41TE/O-haul Fill	8.6 L (9.1 qts.)
Power Steering	0.81 L (1.7 pts.)

MAINTENANCE SCHEDULES

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SCHEDULE – A 3	

GENERAL INFORMATION

INTRODUCTION

Service and maintenance procedures for components and systems listed in Schedule – A or B can be found by using the Group Tab Locator index at the front of this manual. If it is not clear which group contains the information needed, refer to the index at the back of this manual.

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Schedule – **A**, lists scheduled maintenance to be performed when the vehicle is used for general transportation.

Schedule – **B**, lists maintenance intervals for vehicles that are operated under the conditions listed at the beginning of the Maintenance Schedule section.

Use the schedule that best describes your driving conditions.

Where time and mileage are listed, follow the interval that occurs first.

UNSCHEDULED INSPECTION

At Each Stop for Fuel

- Check engine oil level, add as required.
- Check windshield washer solvent and add if required.

Once a Month

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

At Each Oil Change

- Inspect exhaust system.
- Inspect brake hoses
- Inspect the CV joints and front suspension components
- Rotate the tires at each oil change interval shown on Schedule – A (7,500 miles) or every other interval shown on Schedule – B (6,000 miles).
- Check the coolant level, hoses, and clamps.
- If your mileage is less than 7,500 miles (12 000 km) yearly, replace the engine oil filter at each oil change.
- Replace engine oil filter on 2.4L engines.

SCHEDULE – A

7,500 Miles (12 000 km) or at 6 months

- Change engine oil.

15,000 Miles (24 000 km) or at 12 months

- Change engine oil.
- Replace engine oil filter.

22,500 Miles (36 000 km) or at 18 months

- Change engine oil.
- Inspect brake linings.

30,000 Miles (48 000 km) or at 24 months

- Change engine oil.
- Change automatic transmission fluid.
- Replace engine oil filter.
- **Replace air cleaner element.**
- Inspect tie rod ends and boot seals.

37,500 Miles (60 000 km) or at 30 months

- Change engine oil.

45,000 Miles (72 000 km) or at 36 months

- Change engine oil.
- Replace engine oil filter.
- Inspect brake linings.
- Flush and replace engine coolant at 36 months, regardless of mileage.

GENERAL INFORMATION (Continued)

52,500 Miles (84 000 km) or at 42 months

- Change engine oil.
- Flush and replace engine coolant if not done at 36 months.

60,000 Miles (96 000 km) or at 48 months

- Change engine oil.
- Replace engine oil filter.
- **Replace air cleaner element.**
- **Check PCV valve and replace, if necessary. ***
- Inspect serpentine drive belt, replace if necessary.
- Inspect tie rod ends and boot seals.

67,500 Miles (108 000 km) or at 54 months

- Change engine oil.
- Inspect brake linings.

75,000 Miles (120 000 km) or at 60 months

- Change engine oil.
- Replace engine oil filter.
- Inspect serpentine drive belt, replace if necessary. This maintenance is not required if belt was previously replaced.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

82,500 Miles (132 000 km) or at 66 months

- Change engine oil.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

90,000 Miles (144 000 km) or at 72 months

- Change engine oil.
- Replace engine oil filter.
- **Replace air cleaner element.**
- **Check PCV valve and replace, if necessary. Not required if previously changed. ***
- Inspect serpentine drive belt, replace if necessary. This maintenance is not required if belt was previously replaced.
- Inspect tie rod ends and boot seals.
- Inspect brake linings.

97,500 Miles (156 000 km) or at 78 months

- Change engine oil.

100,000 Miles (160,000 km)

- **Replace spark plugs on 3.3L and 3.8L engines.**
- **Replace ignition cables on 3.3L and 3.8L engines.**

105,000 Miles (168 000 km) or at 84 months

- Change engine oil.
- Replace engine oil filter.
- Inspect serpentine drive belt, replace if necessary. This maintenance is not required if belt was previously replaced.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

112,500 Miles (180 000 km) or at 90 months

- Change engine oil.
- Inspect brake linings.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

120,000 Miles (192 000 km) or at 96 months

- Change engine oil.
- Replace engine oil filter.
- Replace automatic transmission fluid.
- **Replace engine air cleaner element.**
- **Check and replace PCV valve, if necessary. ***
- Inspect serpentine drive belt. Not required if replaced at 75,000, 90,000 or 105,000 miles.
- Inspect tie rod ends and boot seals.

* This maintenance is recommended by Chrysler to the owner but is not required to maintain the warranty on the PCV valve.

** If California vehicle, this maintenance is recommended by Chrysler to the owner but is not required to maintain the warranty of the timing belt.

SCHEDULE – B

3,000 Miles (5 000 km)

- Change engine oil.

6,000 Miles (10 000 km)

- Change engine oil.
- Replace engine oil filter.

9,000 Miles (14 000 km)

- Change engine oil.
- Inspect brake linings.

12,000 Miles (19 000 km)

- Change engine oil.
- Replace engine oil filter.

15,000 Miles (24 000 km)

- Change engine oil.
- **Inspect air cleaner element. Replace as necessary.**

GENERAL INFORMATION (Continued)

• Drain and refill automatic transmission fluid and replace filter. Adjust bands, if so equipped. (See note)
• Change AWD powertransfer fluid unit.

18,000 Miles (29 000 km)
• Change engine oil.
• Replace engine oil filter.
• Inspect brake linings.

21,000 Miles (34 000 km)
• Change engine oil.
• Check AWD overrunning clutch and rear carrier fluid.

24,000 Miles (38 000 km)
• Change engine oil.
• Replace engine oil filter.

27,000 Miles (43 000 km)
• Change engine oil.
• Inspect brake linings.

30,000 Miles (48 000 km)
• Change engine oil.
• Replace engine oil filter.
• **Replace air cleaner element.**
• **Inspect PCV valve. Replace as necessary. ***
• Drain and refill automatic transmission fluid and replace filter. Adjust bands, if so equipped. (See note)
• Change AWD power transfer unit fluid.
• Inspect tie rod ends and boot seals.

33,000 Miles (53 000 km)
• Change engine oil.

36,000 Miles (58 000 km)
• Change engine oil.
• Replace engine oil filter.
• Inspect brake linings.

39,000 Miles (62 000 km)
• Change engine oil.

42,000 Miles (67 000 km)
• Change engine oil.
• Replace engine oil filter.
• Change AWD overrunning clutch and rear carrier fluid.

45,000 Miles (72 000 km)
• Change engine oil.
• **Inspect air cleaner element. Replace as necessary.**
• Drain and refill automatic transmission fluid and replace filter. Adjust bands, if so equipped. (See note)
• Inspect brake linings.
• Change AWD power transfer unit fluid.

48,000 Miles (77 000 km)
• Change engine oil.
• Replace engine oil filter.

51,000 Miles (82 000 km)
• Change engine oil.
• Flush and replace engine coolant.

54,000 Miles (86 000 km)
• Change engine oil.
• Replace engine oil filter.
• Inspect brake linings.

57,000 Miles (91 000 km)
• Change engine oil.

60,000 Miles (96 000 km)
• Change engine oil.
• Replace engine oil filter.
• **Replace air cleaner element.**
• **Inspect PCV valve, replace if necessary. ***
• Inspect serpentine drive belt, replace if necessary.
• Drain and refill automatic transmission fluid and replace filter. Adjust bands, if so equipped. (See note)
• Change AWD power transfer unit fluid.
• Inspect tie rod ends and boot seals.

63,000 Miles (101 000 km)
• Change engine oil.
• Change AWD overrunning clutch and rear carrier fluid.
• Inspect brake linings.

66,000 Miles (106 000 km)
• Change engine oil.
• Replace engine oil filter.

69,000 Miles (110 000 km)
• Change engine oil.

72,000 Miles (115 000 km)
• Change engine oil.
• Replace engine oil filter.
• Inspect brake linings.

75,000 Miles (120 000 km)
• Change engine oil.
• **Inspect air cleaner element. Replace as necessary.**

GENERAL INFORMATION (Continued)

• **Replace spark plugs.**
• **Replace ignition cables.**
• Inspect serpentine drive belt, replace if necessary. This maintenance is not required if belt was previously replaced.
• Drain and refill automatic transaxle fluid and replace filter. Adjust band, if so equipped. (See note)
• Change AWD power transfer unit fluid.

78,000 Miles (125 000 km)

• Change engine oil.
• Replace engine oil filter.

81,000 Miles (130 000 km)

• Change engine oil.
• Inspect brake linings.
• Flush and replace engine coolant.

84,000 Miles (134 000 km)

• Change engine oil.
• Replace engine oil filter.
• Change AWD overrunning clutch and rear carrier fluid.

87,000 Miles (139 000 km)

• Change engine oil.

90,000 Miles (144 000 km)

• Change engine oil.
• Replace engine oil filter.
• **Replace air cleaner element.**
• **Check PCV valve and replace if necessary. Not required if previously changed. ***
• Inspect serpentine drive belt, replace if necessary. This maintenance is not required if belt was previously replaced.
• Drain and refill automatic transmission fluid and replace filter. Adjust bands, if so equipped. (See note)
• Change AWD power transfer unit fluid.
• Inspect tie rod ends and boot seals.
• Inspect brake linings.

93,000 Miles (149 000 km)

• Change engine oil.

96,000 Miles (154 000 km)

• Change engine oil.
• Replace engine oil filter.

99,000 Miles (158 000 km)

• Change engine oil.
• Inspect brake linings.

102,000 Miles (163 000 km)

• Change engine oil.
• Replace engine oil filter.

105,000 Miles (168 000 km)

• Change engine oil.
• **Inspect air cleaner element. Replace as necessary.**
• Inspect serpentine drive belt, replace if necessary. This maintenance is not required if belt was previously replaced.
• Drain and refill automatic transmission fluid and filter. Adjust bands, if so equipped. (See note)
• Change AWD power transfer unit fluid.
• Change AWD overrunning clutch and rear carrier fluid.

108,000 Miles (173 000 km)

• Change engine oil.
• Replace engine oil filter.
• Inspect brake linings.

111,000 Miles (178 000 km)

• Change engine oil.
• Flush and replace engine coolant.

114,000 Miles (182 000 km)

• Change engine oil.
• Replace engine oil filter.

117,000 Miles (187 000 km)

• Change engine oil.
• Inspect brake linings.

120,000 Miles (192 000 km)

• Change engine oil.
• Replace engine oil filter.
• **Replace air cleaner element.**
• **Inspect PCV valve. Replace as necessary. ***
• Inspect serpentine drive belt. Not required if replaced at 75,000, 90,000 or 105,000 miles.
• Drain and refill automatic transmission fluid and replace filter. Adjust bands, if so equipped.
• Change AWD power transfer unit fluid.
• Inspect tie rod ends and boot seals.

* This maintenance is recommended by Chrysler to the owner but is not required to maintain the warranty on the PCV valve.

** If California vehicle, this maintenance is recommended by Chrysler to the owner but is not required to maintain the warranty of the timing belt.

NOTE: Operating vehicle more than 50% in heavy traffic during hot weather, above 90°F (32°C), using vehicle for police, taxi, limousine type operation or trailer towing require the more frequent transaxle service noted in Schedule – B. Perform these services if vehicle is usually operated under these conditions.

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

JUMP STARTING, HOISTING AND TOWING

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SERVICE PROCEDURES

JUMP STARTING PROCEDURE

WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN GROUP 8A, BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS. DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT. 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.

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

TO JUMP START A DISABLED VEHICLE:

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

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

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, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.

(3) On disabled vehicle, place gear selector in park or neutral and set park brake. 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. Review all warnings in this procedure.

(5) On disabled vehicle, connect RED jumper cable clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground as close to the ground cable attaching point as possible (Fig. 1).

(6) Start the engine in the vehicle which has the booster battery, let the engine idle a few minutes, then start the engine in the vehicle with the discharged battery.

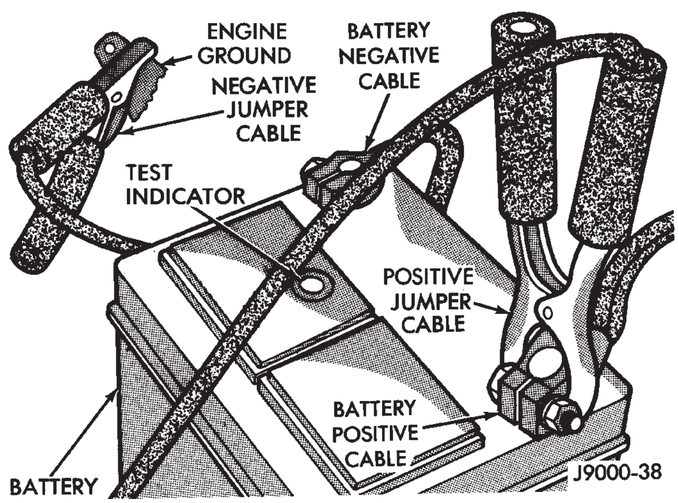

Fig. 1 Jumper Cable Clamp Connections

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

(7) 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.

SERVICE PROCEDURES (Continued)

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

TOWING RECOMMENDATIONS

WARNINGS AND CAUTIONS

WARNING: DO NOT ALLOW TOWING ATTACHMENT DEVICES TO CONTACT THE FUEL TANK OR LINES, FUEL LEAK CAN RESULT.

DO NOT LIFT OR TOW VEHICLE BY FRONT OR REAR BUMPER, OR BUMPER ENERGY ABSORBER UNITS.

DO NOT GO UNDER A LIFTED VEHICLE IF NOT SUPPORTED PROPERLY ON SAFETY STANDS.

DO NOT ALLOW PASSENGERS TO RIDE IN A TOWED VEHICLE.

USE A SAFETY CHAIN THAT IS INDEPENDENT FROM THE TOWING ATTACHMENT DEVICE.

CAUTION: Do not damage brake lines, exhaust system, shock absorbers, sway bars, or any other under vehicle components when attaching towing device to vehicle.

Do not attach towing device to front or rear suspension components.

Do not secure vehicle to towing device by the use of front or rear suspension or steering components.

Remove or secure loose or protruding objects from a damaged vehicle before towing.

Refer to state and local rules and regulations before towing a vehicle.

Do not allow weight of towed vehicle to bear on lower fascia, air dams, or spoilers.

RECOMMENDED TOWING EQUIPMENT

To avoid damage to bumper fascia and air dams use of a flat bed towing device or wheel lift (Fig. 2) is recommended. When using a wheel lift towing device, be sure the disabled vehicle has at least 100 mm (4 in.) ground clearance. If minimum ground clearance cannot be reached, use a towing dolly. If a flat bed device is used, the approach angle should not exceed 15 degrees.

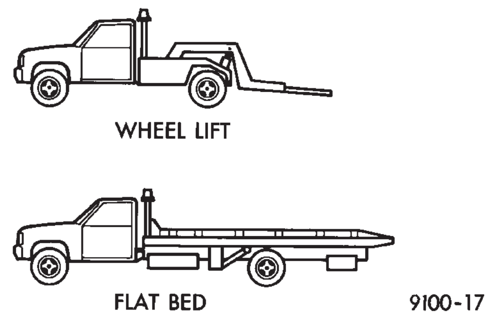

Fig. 2 Recommended Towing Devices

GROUND CLEARANCE

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

A towed vehicle should be raised until the lifted wheels are a minimum 100 mm (4 in.) from the ground. Be sure there is at least 100 mm (4 in.) clearance between the tail pipe and the ground. 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 rear of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums or rotors.

LOCKED VEHICLE TOWING

When a locked vehicle must be towed with the front wheels on the ground, use a towing dolly or flat bed hauler.

FLAT TOWING WITH TOW BAR

- 3-speed automatic transaxle vehicles can be flat towed at speeds not to exceed 40 km/h (25 mph) for not more than 25 km (15 miles). The steering column must be unlocked and gear selector in neutral.
- 4-speed electronic automatic transaxle vehicles can be flat towed at speeds not to exceed 72 km/h (44 mph) for not more than 160 km (100 miles). The steering column must be unlocked and gear selector in neutral.

FLAT BED TOWING TIE DOWNS

CAUTION: Do not tie vehicle down by attaching chains or cables to suspension components or engine mounts, damage to vehicle can result.

NS vehicles can be tied to a flat bed device using the reinforced loops located under the front and rear bumpers on the drivers side of the vehicle. There are also four reinforced elongated holes for T or R-hooks located on the bottom of the front frame rail torque

SERVICE PROCEDURES (Continued)

boxes behind the front wheels and forward of the rear wheels inboard of the rocker panel weld seam.

TOWING—FRONT WHEEL LIFT

Chrysler Corporation recommends that a vehicle be towed with the front end lifted, whenever possible. A 90 cm (36 in.) length of 4x4 wood beam can be placed between the wheel lift device and the bottom of the fascia to prevent damage to vehicle during the lifting operation. The beam can removed after lifting the front of the vehicle.

TOWING—REAR WHEEL LIFT

If a vehicle cannot be towed with the front wheels lifted, the rear wheels can be lifted provided the following guide lines are observed.

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

- On AWD vehicles, all four wheels must be free to rotate. Use towing dollies at unlifted end of vehicle.
- Unlock steering column and secure steering wheel in straight ahead position with a clamp device designed for towing.
- 3-speed automatic transaxle vehicles can be flat towed at speeds not to exceed 40 km/h (25 mph) for not more than 25 km (15 miles). The steering column must be unlocked and gear selector in neutral.
- 4-speed electronic automatic transaxle vehicles can be flat towed at speeds not to exceed 72 km/h (44 mph) for not more than 160 km (100 miles). The steering column must be unlocked and gear selector in neutral.

HOISTING RECOMMENDATIONS

Refer to Owner's Manual provided with vehicle for proper emergency jacking procedures.

WARNING: THE HOISTING AND JACK LIFTING POINTS PROVIDED ARE FOR A COMPLETE VEHICLE. WHEN THE ENGINE OR REAR SUSPENSION 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.

CAUTION: Do not position hoisting device on suspension components or front crossmember, damage to vehicle can result.

TO HOIST OR JACK VEHICLE SEE (Fig. 3).

Vehicles with factory installed ground effects are equipped with front and rear hoisting pads. These pads are stamped, “Hoist Point”.

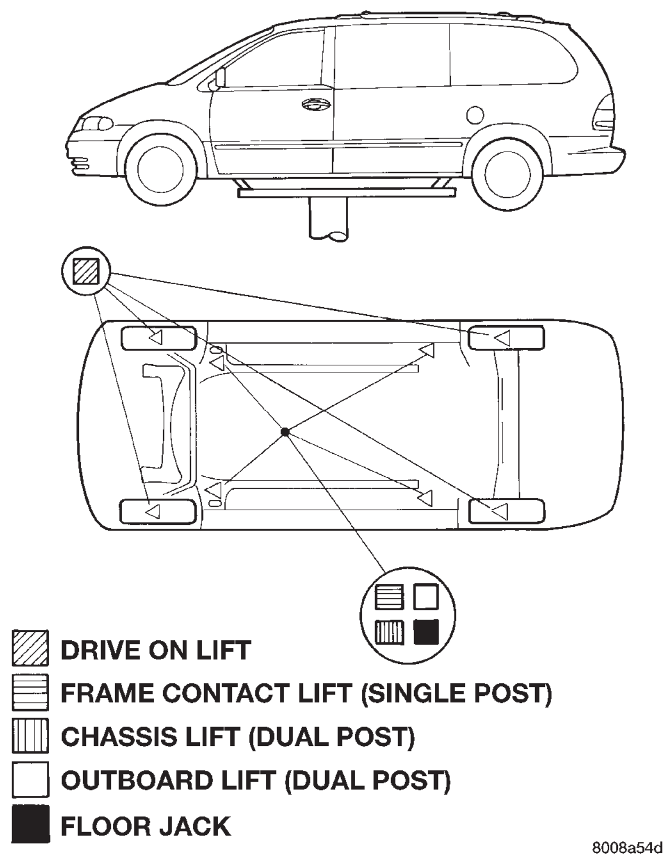

Fig. 3 HOISTING AND JACKING POINTS

LUBRICATION AND MAINTENANCE

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GENERAL INFORMATION

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GENERAL INFORMATION

ENGINE OIL — GASOLINE ENGINES

Use only oils conforming to API (American Petroleum Institute) Quality SJ and Energy Conserving II, or SH and Energy Conserving II, or ACEA A1–96.

SAE VISCOSITY GRADE

To assure of properly formulated engine oils, it is recommended that SAE Grade 5W-30 engine oils that meet Chrysler material standard MS-6395, be used. SAE Grade 10W-30 oils are also acceptable when the temperatures do not fall below 0°C. In areas where these grades are not generally available, higher SAE grades may be used.

Lubricants which have both an SAE grade number and the proper API service classification shown on the container should be used.

ENGINE OIL—DIESEL ENGINES

Use only Diesel Engine Oil meeting standard **MIL-2104C** or API Classification **SG/CD** or **CCMC PD2**.

SAE VISCOSITY GRADE

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

To assure of properly formulated engine oils, it is recommended that SAE Grade 15W-40 engine oils that meet Chrysler material standard MS-6395, be used. European Grade 10W-40 oils are also acceptable.

Oils of the SAE 5W-30 or 10W-30 grade number are preferred when minimum temperatures consistently fall below -12°C.

MANUAL TRANSMISSION FLUID (A-558 and A-598 Models)

Use only SAE 10W-40 engine oils carrying the European CCMC-G5 classification to fill the A-598 5–speed manual transmission.

FLUID CAPACITIES

Fuel Tank	76 L
2.0L Gasoline Engine Oil with Filter	4.3L
2.5L VM Diesel Engine Oil With Filter	6.5 L
2.0L Gasoline Engine Cooling System*	6.0L
2.5L VM Diesel Engine Cooling System*	10.0 L
Transmission—5-Speed Manual	2.2 L

* Includes heater and coolant recovery tank filled to Max level. Add 2.76L if equipped with Rear Heater.

MAINTENANCE SCHEDULES

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GENERAL INFORMATION

MAINTENANCE SCHEDULE

Refer to the 1998 GS Service Manual for Gasoline Engine and non-engine related Maintenance Schedules.

MAINTENANCE SCHEDULE—DIESEL ENGINE

The following are engine related Maintenance items which are unique to Diesel engine-equipped vehicles. Refer to the 1998 GS Service Manual for Gasoline Engine and non-engine related Maintenance Schedules.

The service intervals are based on odometer readings in kilometers. There are two maintenance schedules that show proper service intervals. Use the schedule that best describes the conditions the vehicle is operated under. **Schedule-A** lists all the scheduled maintenance to be performed under normal operating conditions. **Schedule-B** is the schedule for vehicles that are operated under one or more of the following conditions:

- Day and night temperatures are below freezing.
- Stop and go driving.
- Long periods of engine idling.
- Driving in dusty conditions.
- Short trips of less than 5 miles.
- Operation at sustained high speeds during hot weather above 32°C (90°F).
- Taxi, police or delivery service.
- Trailer towing.

UNSCHEDULED INSPECTION

At Each Stop for Fuel

- Check engine oil level, add as required.
- Check windshield washer solvent and add if required.

Once a Month

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

At Each Oil Change

- Inspect exhaust system.
- Inspect brake hoses
- Inspect the CV joints and front suspension components
- Rotate the tires at each oil change interval shown on Schedule—A (7,500 miles) or every other interval shown on Schedule— B (6,000 miles).
- Check the coolant level, hoses, and clamps.
- If your mileage is less than 7,500 miles (12 000 km) yearly, replace the engine oil filter at each oil change.
- Replace engine oil filter.

SCHEDULE—A (DIESEL)

1 000 KM

- Change engine oil.
- Change engine oil filter.
- Check all fluid levels.
- Check correct torque, intake manifold mounting nuts.
- Check correct torque, exhaust manifold mounting nuts.
- Check correct torque, turbocharger mounting nuts.
- Check correct torque, water manifold bolts.

10 000 KM

- Change engine oil.
- Change engine oil filter.

20 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.

GENERAL INFORMATION (Continued)

- Check drive belt tension.
- Check glow plug operation.

30 000 KM

- Change engine oil.
- Change engine oil filter.

40 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.
- Replace fuel filter/water separator element.**

50 000 KM

- Change engine oil.
- Change engine oil filter.

60 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check glow plug operation.
- Replace drive belt.
- Check engine smoke.
- Replace engine coolant.

70 000 KM

- Change engine oil.
- Change engine oil filter.

80 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.
- Replace fuel filter/water separator element.**

90 000 KM

- Change engine oil.
- Change engine oil filter.

100 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

EVERY 40 000 KM AFTER 80 000 KM

- Replace fuel filter/water separator element.**

**The fuel filter/water separator element should be replaced once a year if the vehicle is driven less than 40 000 km annually or if power loss from fuel starvation is detected.

EVERY 10 000 KM AFTER 100 000 KM

- Change engine oil.
- Change engine oil filter.

EVERY 20 000 KM AFTER 100 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

SCHEDULE—B (DIESEL)

500 KM

- Check correct torque, intake manifold mounting nuts.
- Check correct torque, exhaust manifold mounting nuts.
- Check correct torque, turbocharger mounting nuts.
- Check correct torque, water manifold bolts.

1 000 KM

- Change engine oil.
- Change engine oil filter.
- Check all fluid levels.

5 000 KM

- Change engine oil.
- Change engine oil filter.

10 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

15 000 KM

- Change engine oil.
- Change engine oil filter.

20 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

25 000 KM

- Change engine oil.
- Change engine oil filter.

30 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.

GENERAL INFORMATION (Continued)

- Check glow plug operation.
- Replace drive belt.
- Check engine smoke.
- Replace engine coolant.

35 000 KM

- Change engine oil.
- Change engine oil filter.
- Change MTX Fluid

40 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.
- Diesel engines only—Replace fuel filter/water separator element.

45 000 KM

- Change engine oil.
- Change engine oil filter.

50 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

55 000 KM

- Change engine oil.
- Change engine oil filter.

60 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.
- Diesel engines only—Replace fuel filter/water separator element.

65 000 KM

- Change engine oil.
- Change engine oil filter.

70 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.
- Change MTX fluid

75 000 KM

- Change engine oil.
- Change engine oil filter.

80 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check glow plug operation.
- Replace drive belt.
- Check engine smoke.
- Replace engine coolant.

85 000 KM

- Change engine oil.
- Change engine oil filter.

90 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

95 000 KM

- Change engine oil.
- Change engine oil filter.

100 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.
- Diesel engines only—Replace fuel filter/water separator element.
- Change MTX fluid

EVERY 5 000 KM AFTER 100 000 KM

- Change engine oil.
- Change engine oil filter.

EVERY 10 000 KM AFTER 100 000 KM

- Change engine oil.
- Change engine oil filter.
- Replace air filter element.
- Check drive belt tension.
- Check glow plug operation.

EVERY 20 000 KM AFTER 100 000 KM

- Diesel engines only—Replace fuel filter/water separator element.

EVERY 35 000 KM AFTER 100 000 KM

- Change MTX fluid

JUMP STARTING, HOISTING AND TOWING

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SERVICE PROCEDURES
TOWING RECOMMENDATIONS 5

SERVICE PROCEDURES

TOWING RECOMMENDATIONS

WARNINGS AND CAUTIONS

WARNING: DO NOT ALLOW TOWING ATTACHMENT DEVICES TO CONTACT THE FUEL TANK OR LINES, FUEL LEAK CAN RESULT.

DO NOT LIFT OR TOW VEHICLE BY FRONT OR REAR BUMPER, OR BUMPER ENERGY ABSORBER UNITS.

DO NOT GO UNDER A LIFTED VEHICLE IF NOT SUPPORTED PROPERLY ON SAFETY STANDS.

DO NOT ALLOW PASSENGERS TO RIDE IN A TOWED VEHICLE.

USE A SAFETY CHAIN THAT IS INDEPENDENT FROM THE TOWING ATTACHMENT DEVICE.

CAUTION: Do not damage brake lines, exhaust system, shock absorbers, sway bars, or any other under vehicle components when attaching towing device to vehicle.

Do not attach towing device to front or rear suspension components.

Do not secure vehicle to towing device by the use of front or rear suspension or steering components.

Remove or secure loose or protruding objects from a damaged vehicle before towing.

Refer to state and local rules and regulations before towing a vehicle.

Do not allow weight of towed vehicle to bear on lower fascia, air dams, or spoilers.

RECOMMENDED TOWING EQUIPMENT

To avoid damage to bumper fascia and air dams use of a flat bed towing device or wheel lift (Fig. 1) is recommended. When using a wheel lift towing device, be sure the disabled vehicle has at least 100 mm (4 in.) ground clearance. If minimum ground clearance cannot be reached, use a towing dolly. If a flat bed device is used, the approach angle should not exceed 15 degrees.

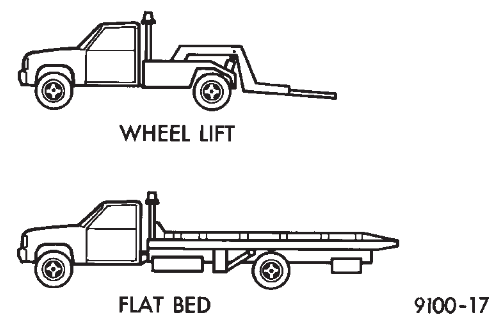

Fig. 1 Recommended Towing Devices

GROUND CLEARANCE

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

A towed vehicle should be raised until the lifted wheels are a minimum 100 mm (4 in.) from the ground. Be sure there is at least 100 mm (4 in.) clearance between the tail pipe and the ground. 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 rear of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums or rotors.

LOCKED VEHICLE TOWING

When a locked vehicle must be towed with the front wheels on the ground, use a towing dolly or flat bed hauler.

FLAT TOWING WITH TOW BAR

- 4-speed electronic automatic transaxle vehicles can be flat towed at speeds not to exceed 72 km/h (44 mph) for not more than 160 km (100 miles). The steering column must be unlocked and gear selector in neutral.

FLAT BED TOWING TIE DOWNS

CAUTION: Do not tie vehicle down by attaching chains or cables to suspension components or engine mounts, damage to vehicle can result.

SERVICE PROCEDURES (Continued)

NS vehicles can be tied to a flat bed device using the reinforced loops located under the front and rear bumpers on the drivers side of the vehicle. There are also four reinforced elongated holes for T or R-hooks located on the bottom of the front frame rail torque boxes behind the front wheels and forward of the rear wheels inboard of the rocker panel weld seam.

TOWING—FRONT WHEEL LIFT

Chrysler International recommends that a vehicle be towed with the front end lifted, whenever possible. A 90 cm (36 in.) length of 4x4 wood beam can be placed between the wheel lift device and the bottom of the fascia to prevent damage to vehicle during the lifting operation. The beam can removed after lifting the front of the vehicle.

TOWING—REAR WHEEL LIFT

If a vehicle cannot be towed with the front wheels lifted, the rear wheels can be lifted provided the following guide lines are observed.

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

- On AWD vehicles, all four wheels must be free to rotate. Use towing dollies at unlifted end of vehicle.
- Unlock steering column and secure steering wheel in straight ahead position with a clamp device designed for towing.
- 4-speed electronic automatic transaxle vehicles can be flat towed at speeds not to exceed 72 km/h (44 mph) for not more than 160 km (100 miles). The steering column must be unlocked and gear selector in neutral.

TOWING—TOW HOOKS

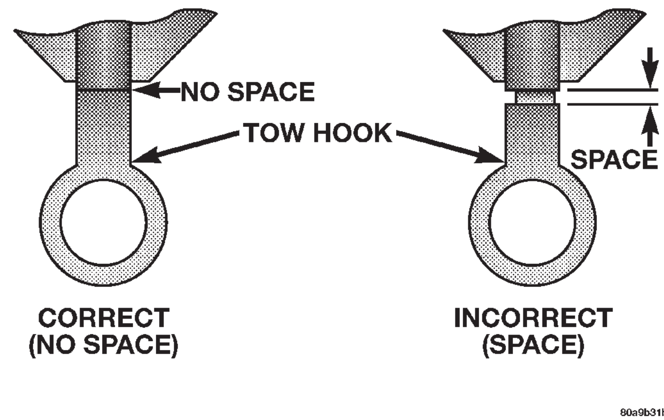

Fig. 2

WARNING: Do not use the tow hook to lift the vehicle off the ground.

A tow-hook bolt, located in the rear interior trim storage compartment (with jack), is provided with your vehicle. The tow hook is used for towing the vehicle with all four wheels on the ground only. It can be attached to the vehicle through an opening in the lower front fascia. The tow hook must be fully seated to the attach bracket through the lower front fascia as shown. If the tow hook is not fully seated to the attach bracket the vehicle should not be towed.

NOTE: The tow hook bolt protective plug must be removed from the tow hook bracket prior to bolt attachment. The tow hook is used ONLY for towing the vehicle with all four wheels on the ground.

SUSPENSION

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WHEEL ALIGNMENT

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DESCRIPTION AND OPERATION

GENERAL INFORMATION

Wheel alignment is the proper adjustment of all the interrelated suspension angles affecting the running and steering of the front and rear wheels of the vehicle.

The method of checking front and rear wheel alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should always be followed. With the exception that the wheel alignment specifications recommended by Chrysler Corporation should always be used. The Chrysler Corporation recommended alignment specifications, are listed in Specifications at the end of this group in the service manual section.

There are six basic factors which are the foundation to front wheel alignment. These are vehicle height, caster, camber, toe-in, steering axis inclination and toe-out on turns. Of the six basic factors only toe-in is normally mechanically adjustable on this vehicle (Fig. 1).

DESCRIPTION AND OPERATION (Continued)

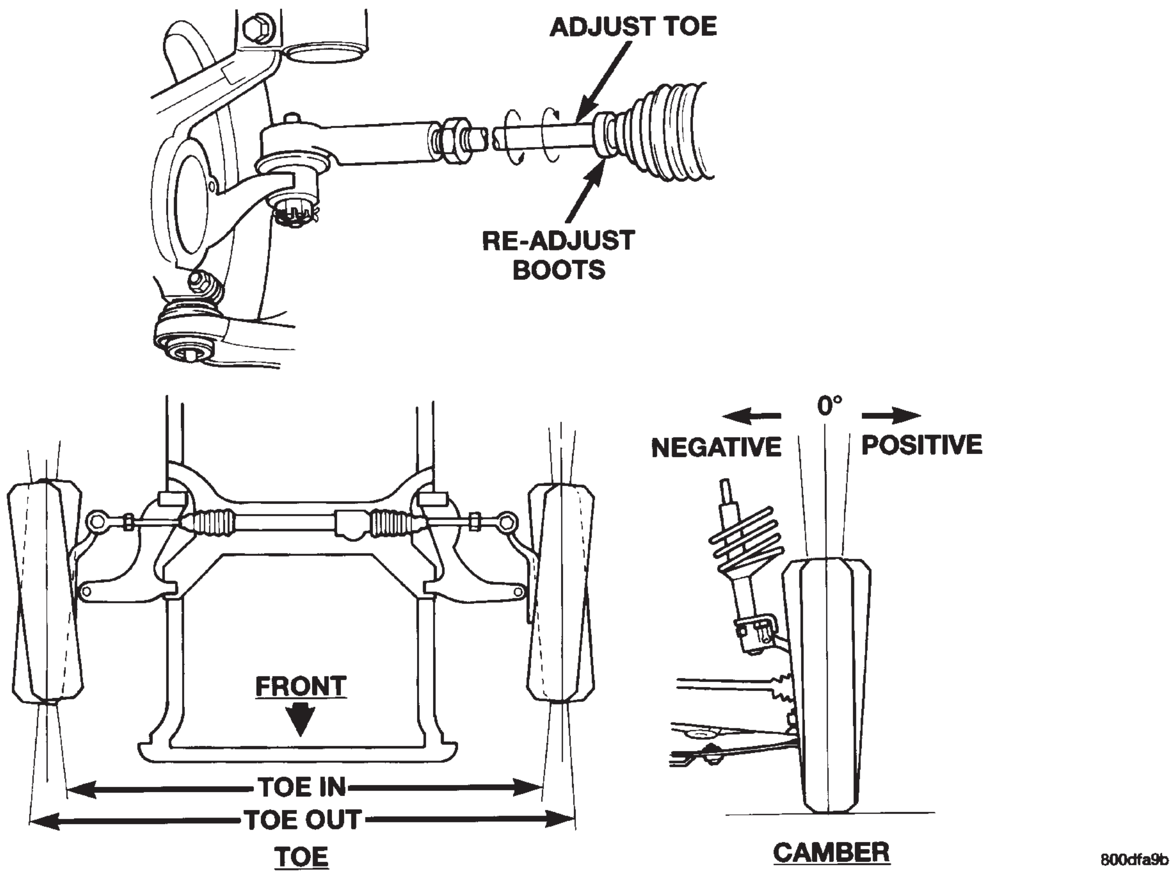

Fig. 1 Front Suspension Alignment Angles

Camber adjustment is allowed in the event that a vehicle is involved in an accident and after repairs are made meeting manufacturers tolerance specifications, the camber setting will not meet manufacturers specifications. If camber adjustment is required, refer to the following Service Camber Adjustment Procedure for the required steps to be followed.

CAUTION: Do not attempt to modify any suspension or steering components to meet vehicle alignment specifications, by heating and or bending.

Alignment checks and adjustments should be made in the following sequence.

(1) Camber

(2) Toe

Camber is the number of degrees the top of the wheel and tire assembly is tilted inboard or outboard from a true vertical line. Inboard tilt is negative camber. Outboard tilt is positive camber (Fig. 1).

Excessive camber is a tire wear factor: negative camber causes wear on the inside of the tires tread surface, while positive camber causes wear to the outside of the tires tread surface. See Front Wheel Drive Specifications for **Camber.** settings.

Toe is measured in degrees or inches and is the distance the front edges of the tires are closer (or farther apart) than the rear edges. See Front Wheel Drive Specifications for **Toe.** settings.

DIAGNOSIS AND TESTING

SUSPENSION AND STEERING DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
Front End Whine On Turns	1. Defective wheel bearing 2. Incorrect wheel alignment 3. Worn tires	1. Replace wheel bearing 2. Check and reset wheel alignment 3. Replace tires
Front End Growl Or Grinding On Turns	1. Defective wheel bearing 2. Engine mount grounding 3. Worn or broken C/V joint 4. Loose wheel lug nuts 5. Incorrect wheel alignment 6. Worn tires 7. Front strut pin in upper strut mount	1. Replace wheel bearing 2. Check for motor mount hitting frame rail and reposition engine as required 3. Replace C/V joint 4. Verify wheel lug nut torque 5. Check and reset wheel alignment 6. Replace tires 7. Replace the front strut upper mount and bearing
Front End Clunk Or Snap On Turns	1. Loose lug nuts 2. Worn or broken C/V joint 3. Worn or loose tie rod 4. Worn or loose ball joint 5. Worn/loose control arm bushing 6. Loose stabilizer bar. 7. Loose strut mount to body attachment 8. Loose crossmember bolts	1. Verify wheel lug nut torque 2. Replace C/V joint 3. Tighten or replace tie rod end 4. Tighten or replace ball joint 5. Replace control arm bushing 6. Tighten stabilizer bar to specified torque 7. Tighten strut attachment to specified torque 8. Tighten crossmember bolts to specified torque
Front End Whine With Vehicle Going Straight At A Constant Speed	1. Defective wheel bearing 2. Incorrect wheel alignment 3. Worn tires 4. Worn or defective transaxle gears or bearings	1. Replace wheel bearing 2. Check and reset wheel alignment 3. Replace tires 4. Replace transaxle gears or bearings
Front End Growl Or Grinding With Vehicle Going Straight At A Constant Speed	1. Engine mount grounding 2. Worn or broken C/V joint	1. Reposition engine as required 2. Replace C/V joint
Front End Whine When Accelerating Or Decelerating	1. Worn or defective transaxle gears or bearings	1. Replace transaxle gears or bearings
Front End Clunk When Accelerating Or Decelerating	1. Worn or broken engine mount 2. Worn or defective transaxle gears or bearings 3. Loose lug nuts 4. Worn or broken C/V joint 5. Worn or loose ball joint 6. Worn or loose control arm bushing 7. Loose crossmember bolts 8. Worn tie rod end	1. Replace engine mount 2. Replace transaxle gears or bearings 3. Verify wheel lug nut torque 4. Replace C/V joint 5. Tighten or replace ball joint 6. Replace control arm bushing 7. Tighten crossmember bolts to specified torque 8. Replace tie rod end

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Road Wander	1. Incorrect tire pressure 2. Incorrect front or rear wheel toe 3. Worn wheel bearings 4. Worn control arm bushings 5. Excessive friction in steering gear 6. Excessive friction in steering shaft coupling 7. Excessive friction in strut upper bearing	1. Inflate tires to recommended pressure 2. Check and reset wheel toe 3. Replace wheel bearing 4. Replace control arm bushing 5. Replace steering gear 6. Replace steering coupler 7. Replace strut bearing
Lateral Pull	1. Unequal tire pressure 2. Radial tire lead 3. Incorrect front wheel camber 4. Power steering gear imbalance 5. Wheel braking	1. Inflate all tires to recommended pressure 2. Perform lead correction procedure 3. Check and reset front wheel camber 4. Replace power steering gear 5. Correct braking condition causing lateral pull
Excessive Steering Free Play	1. Incorrect Steering Gear Adjustment 2. Worn or loose tie rod ends 3. Loose steering gear mounting bolts 4. Loose or worn steering shaft coupler	1. Adjust Or Replace Steering Gear 2. Replace or tighten tie rod ends 3. Tighten steering gear bolts to specified torque 4. Replace steering shaft coupler
Excessive Steering Effort	1. Low tire pressure 2. Lack of lubricant in steering gear 3. Low power steering fluid level 4. Loose power steering pump drive belt 5. Lack of lubricant in ball joints 6. Steering gear malfunction 7. Lack of lubricant in steering coupler	1. Inflate all tires to recommended pressure 2. Replace steering gear 3. Fill power steering fluid reservoir to correct level 4. Correctly adjust power steering pump drive belt 5. Lubricate or replace ball joints 6. Replace steering gear 7. Replace steering coupler

PRE-WHEEL ALIGNMENT INSPECTION

Before any attempt is made to change or correct the wheel alignment factors. The following part inspection and the necessary corrections should be made to those parts which influence the steering of the vehicle.

(1) Check and inflate all tires to recommended pressure. All tires should be the same size and in good condition and have approximately the same wear. Note the type of tread wear which will aid in diagnosing, see Wheels and Tires, Group 22.

(2) Check front wheel and tire assembly for radial runout.

(3) Inspect lower ball joints and all steering linkage for looseness.

(4) Check for broken or sagged front and rear springs.

(5) Check vehicle ride height to verify it is within specifications.

(6) Alignment **MUST** only be checked after the vehicle has the following areas inspected and or adjusted. Recommended tire pressures, full tank of fuel, no passenger or luggage compartment load and is on a level floor or a properly calibrated alignment rack.

SERVICE PROCEDURES

WHEEL ALIGNMENT CHECK AND ADJUSTMENT PROCEDURE

CASTER AND CAMBER

Front suspension Caster and Camber settings on this vehicle are determined at the time the vehicle is designed. This is done by determining the precise

SERVICE PROCEDURES (Continued)

mounting location of the vehicle's suspension components throughout the design and assembly processes of the vehicle. This is called a Net Build vehicle and results in no normal requirement to adjustment the Caster and Camber after a vehicle is built or when servicing the suspension components. Thus Caster and Camber are not normally considered an adjustable specification when performing an alignment on this vehicle. Though Caster and Camber are not adjustable they should be checked during the alignment procedure to ensure they meet the manufacturers specifications.

If front camber does not meet the vehicle alignment specifications, it can be adjusted using a Mopar Service Kit developed to allow for camber adjustment. If a vehicle's front camber does not meet required specifications, the vehicles suspension components should be inspected for any signs of damage or bending and the vehicle ride height should be checked to verify it is within required specification. **This inspection must be done before using the Mopar Service Kit for setting camber to the vehicle specification.**

CAUTION: Do not attempt to adjust the vehicles Caster or Camber by heating, bending or by performing any other modification to the vehicle's front suspension components.

(1) Correctly position the vehicle on the alignment rack. Then install all required alignment equipment on the vehicle, per the alignment equipment manufacturers specifications.

NOTE: Prior to reading each alignment specification, front and rear of vehicle should be jounced an equal number of times. Induce jounce (rear first then front) by grasping center of bumper and jouncing each end of vehicle an equal number of times. Bumper should always be released when vehicle is at the bottom of the jounce cycle.

(2) Correctly jounce vehicle and then read the vehicle's current front and rear alignment settings. Compare the vehicle's current alignment settings to the vehicle specifications for camber, caster and Toe-in. See Alignment Specifications in this group of the service manual for the required specifications. **If front and rear camber readings are within required specifications proceed to step Step 3 for the Toe-in adjustment procedure if required. If Camber readings are not within specifications refer to step Step 1 in the front camber adjustment cam bolt adjustment procedure.**

CAMBER ADJUSTMENT CAM BOLT PACKAGE INSTALLATION PROCEDURE

(1) If the front camber readings obtained are not within the vehicle's specifications, use the following procedure and the Mopar Clevis Bolt Service Kit to provide camber adjustment. The kit contains 2 flange bolts, 2 cam bolts, and 2 dog bone washers. These components of the service kit are necessary to assemble the strut to the steering knuckle, after modification of the strut clevis bracket.

(2) Verify that the strut and steering knuckle are not bent or otherwise damaged. If either component is bent or show other signs of damage, replace required component(s) and check the camber setting again. Refer to Strut Damper Assembly Service in this group of the service manual for the required strut replacement procedure.

(3) If no component is bent or damaged, use the following procedure for modifying the strut clevis bracket and adjusting the camber setting.

(4) Raise front of vehicle until tires are not supporting the weight of the vehicle. Then remove wheel and tire assembly from the location on the vehicle requiring the strut to be modified.

CAUTION: When removing the steering knuckle from the strut clevis bracket, do not put a strain on the brake flex hose. Also, do not let the weight of the steering knuckle assembly be supported by the brake flex hose when removed from the strut assembly. If necessary use a wire hanger to support the steering knuckle assembly or if required remove the brake flex hose from the caliper assembly.

CAUTION: The steering knuckle strut assembly attaching bolts are serrated and must not be turned during removal. Remove nuts while holding bolts stationary in the steering knuckles.

(5) Remove the top and bottom, strut clevis bracket to steering knuckle attaching bolts (Fig. 2) and discard. Separate the steering knuckle from the strut clevis bracket and position steering knuckle so it is out of the way of the strut.

CAUTION: When slotting the bottom mounting hole on the strut clevis bracket, do not enlarge the hole beyond the indentations (Fig. 3) on the sides of the strut clevis bracket.

SERVICE PROCEDURES (Continued)

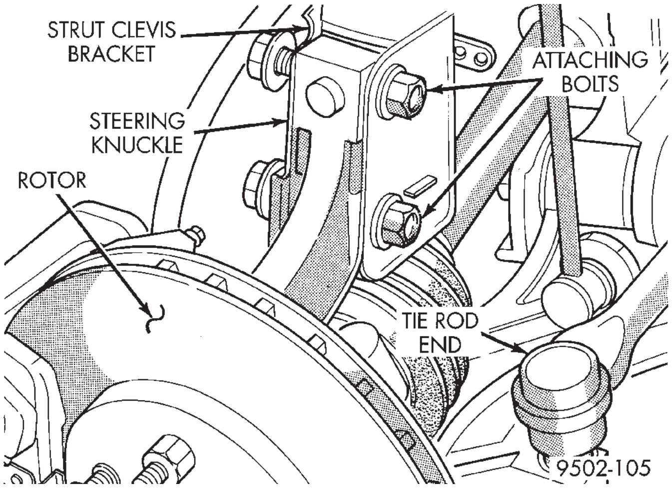

Fig. 2 Clevis Bracket To Steering Knuckle Attaching Bolts

(6) Using an appropriate grinder and grinding wheel slot the bottom hole (Fig. 3) in both sides of the strut clevis bracket. **When grinding slot do not go beyond the indentation area on the sides of the clevis bracket (Fig. 3).**

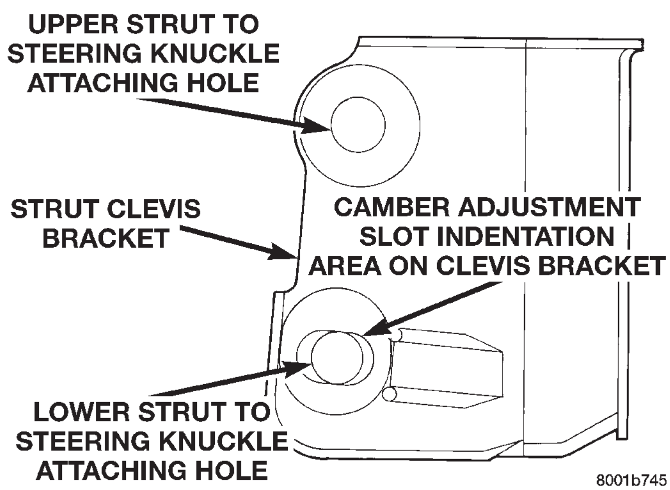

Fig. 3 Strut Clevis Bracket Bolt Hole Grinding Area

CAUTION: After slotting the strut clevis bracket hole, do not install the original attaching bolts when assembling the steering knuckle to the strut assembly. Only the flange bolts, cam bolts, and dog bone washers from the Mopar Clevis Bolt Service Kit, can be used to attach the steering knuckle to the strut after the mounting hole is slotted.

(7) Install the flanged bolt (Fig. 4) from the Mopar Clevis Bolt Service Kit, into the top clevis bracket to steering knuckle mounting hole. Install the cam bolt (Fig. 4) into the bottom clevis bracket to steering knuckle mounting hole.

(8) Install the dog bone washer (Fig. 5) on the steering knuckle to strut clevis bracket attaching

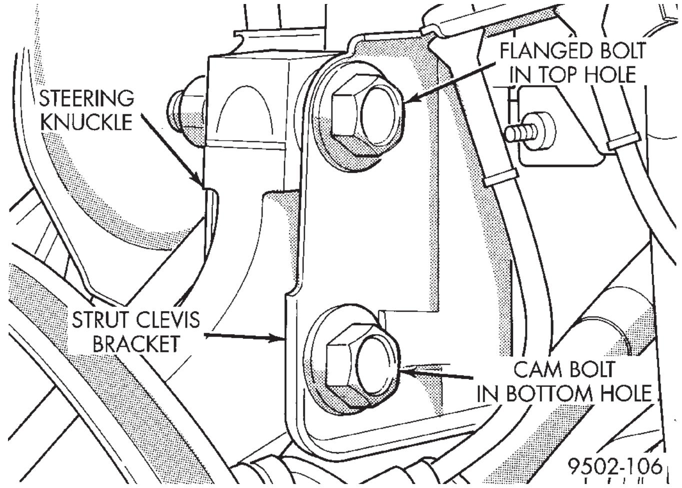

Fig. 4 Mopar Service Kit Bolts Correctly Installed

bolts. Then install the nuts from the original attaching bolts onto the replacement bolts from the service kit. Tighten the bolts just enough to hold the steering knuckle in position when adjusting camber, while still allowing the steering knuckle to move in clevis bracket.

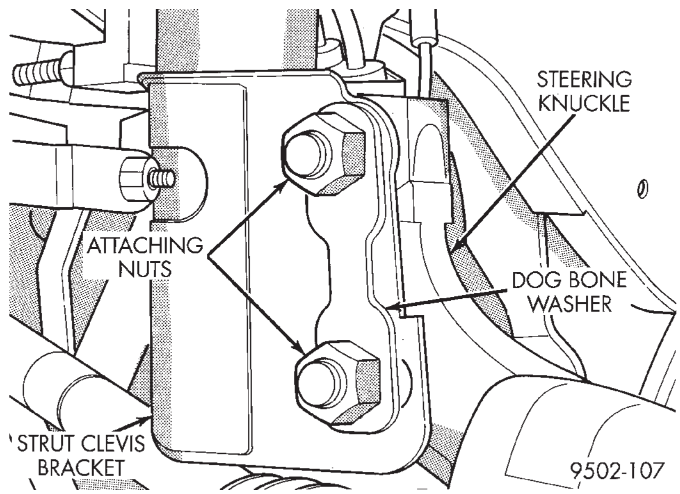

Fig. 5 Dog Bone Washer And Nuts Installed On Attaching Bolts

(9) Lower vehicle until the full weight of the vehicle is supported by the vehicles' suspension. Then correctly jounce the front and rear of vehicle an equal amount of times.

(10) Adjust the front camber to the preferred setting by rotating the lower eccentric cam bolt (Fig. 6) against the cam stop areas on the strut clevis bracket. When camber is correctly set, tighten the upper strut clevis bracket bolt and lower cam bolt. Again jounce front and rear of vehicle an equal amount of times and verify front camber setting. See Alignment Specifications in this group of the service manual for required specifications.

SERVICE PROCEDURES (Continued)

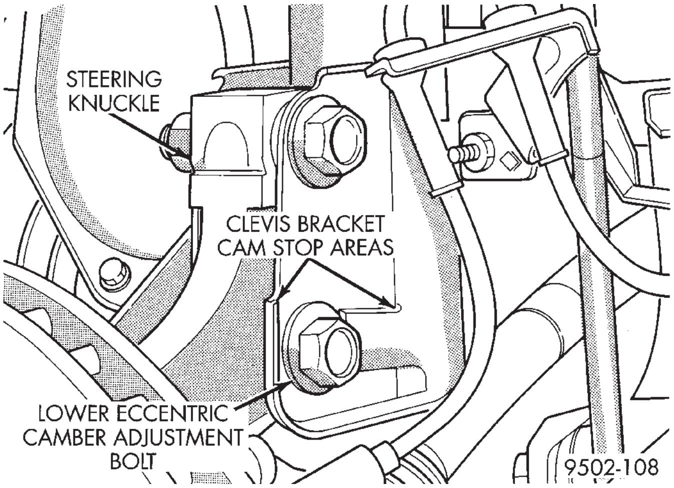

Fig. 6 Camber Adjustment Cam Bolt

(11) When vehicle is at correct camber setting torque both front strut to steering knuckle attaching bolts to 90 N·m (65 ft. lbs.) plus an additional 1/4 turn after required torque is met.

(12) If Toe readings obtained are not within the required specification range, adjust Toe to meet the preferred specification setting. Toe is adjustable using the following Toe setting procedure.

FRONT TOE SETTING PROCEDURE

(1) Prepare vehicle as described in the Pre-Alignment Vehicle Inspection procedure.

(2) Center steering wheel and lock in place using a steering wheel clamp.

CAUTION: Do not twist front inner tie rod to steering gear rubber boots during front wheel Toe adjustment.

(3) Loosen front inner to outer tie rod end jam nuts (Fig. 7). Grasp inner tie rods at serrations and rotate inner tie rods of steering gear (Fig. 7) to set front Toe to the preferred Toe specification. See Alignment Specifications in this group of the service manual for preferred specification.

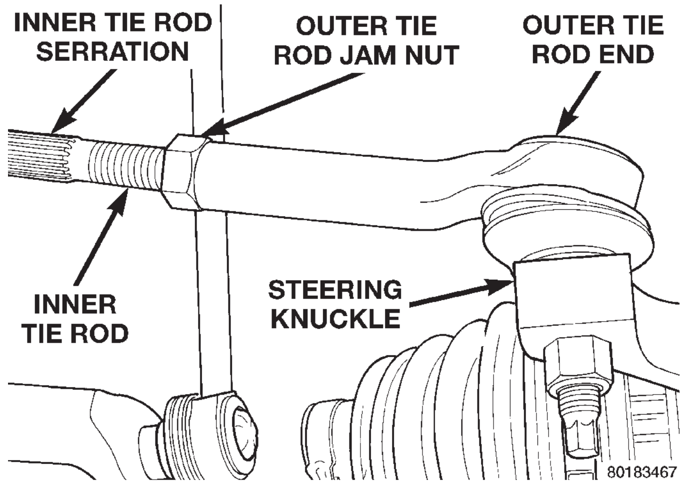

Fig. 7 Front Wheel Toe Adjustment

(4) Tighten tie rod jam nuts (Fig. 7) to 75 N·m (55 ft.lbs.) torque.

(5) Adjust steering gear to tie rod boots at tie rod.

(6) Remove steering wheel clamp.

SPECIFICATIONS

ALIGNMENT SPECIFICATIONS

All alignment specifications are to be checked and adjusted with the vehicle at its correct ride height. Refer to the ride height specifications listed in the following alignment specifications chart.

SPECIFICATIONS (Continued)

ALIGNMENT ANGLE	TIRE SIZES	TIRE SIZES	ALTERNATIVE FUELS
	P205/75/R14 P215/65/R15	P205/75/R15 P215/65/R16	C.N.G. ELECTRIC
* FRONT INDIVIDUAL CAMBER IN DEGREES...	+0.15° +or- 0.40°	+0.05° +or- 0.40°	+0.15° +or- 0.40°
Front Side To Side Camber Difference Not To Exceed..................	0.00° - 0.50° MAX	0.00° - 0.50° MAX	0.00° - 0.50° MAX
** FRONT INDIVIDUAL CASTER IN DEGREES...	+1.40° + or - 1.00°	+1.40° + or - 1.00°	+1.40° +or- 1.00°
Front Side To Side Caster Difference Not To Exceed....................................	0.00° - 1.00° MAX	0.00° - 1.00° MAX	0.00° - 1.00° MAX
*** FRONT INDIVIDUAL TOE RIGHT/ LEFT..	+0.05°+or- 0.10°	+0.05° +or- 0.10°	+0.05° +or- 0.10°
FRONT TOTAL TOE... Specified In Degrees	+0.10° +or- 0.20°	+0.10° +or- 0.20°	+0.10° +or- 0.20°
FRONT SIDE TO SIDE TOE DIFFERENTIAL....................................	0.00° - 0.06° MAX	0.00° - 0.06° MAX	0.00° - 0.06° MAX
****REAR INDIVIDUAL CAMBER IN DEGREES...	+0.00° +or- 0.25°	+0.00° +or- 0.25°	-0.10° +or- 0.25
REAR INDIVIDUAL TOE RIGHT/ LEFT......................................	0.00° +or- 0.40°	0.00° +or- 0.40°	0.00° +or- 0.40°
**** REAR TOTAL TOE.................... Specified In Degrees TOE OUT: When Backed On Alignment Rack Is TOE In When Driving	0.00° +or- 0.40°	0.00° +or- 0.40°	0.00° +or- 0.40°
****REAR THRUST ANGLE................	0.00° +or- 0.30°	0.00° +or- 0.30°	0.00° +or- 0.30°
STEERING WHEEL ANGLE................	0.00° +or- 2.50°	0.00° +or- 2.50°	0.00° +or- 2.50°
FRONT RIDE HEIGHT (MEASURED AT TOP OF FENDER WHEEL OPENING)...	747.5 mm +or-10.0mm	753.5 mm +or-10.0mm	783.5 mm +or-10.0mm
FRONT RIDE HEIGHT SIDE TO SIDE DIFFERENTIAL....................................	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX
*****REAR RIDE HEIGHT (MEASURED AT TOP OF FENDER WHEEL OPENING)...	766.0 mm +or-10.0mm	772.0 mm +or-10.0mm	802.5 mm +or-10.0mm
*****REAR RIDE HEIGHT SIDE TO SIDE DIFFERENTIAL....................................	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX

*** Camber is adjustable using the Mopar Camber Adjustment Service Kit. Refer to the Mopar Parts Catalog for the required service kit part number.**

**** Caster is not adjustable. If found to be out of specification check for proper ride heights and damaged/worn out suspension components and replace as necessary.**

***** Toe-In is positive.**

****** Toe, Camber and thrust angle are not adjustable. If found to be out of specification check for proper ride heights and damaged/worn out suspension components and replace as necessary.**

******* When Measuring ride heights: 1) Ensure that the tire pressures are correct. 2) Jounce the vehicle at the bumper several times and release at the bottom of the stroke. 3) Measure from the ground to the outboard, lower, center section of the fender wheel well opening. Ride heights are not adjustable. If found to be out of specification check for damaged and/or worn out suspension components and replace as necessary.**

FRONT SUSPENSION

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DESCRIPTION AND OPERATION

FRONT SUSPENSION DESCRIPTION

An independent Mc Pherson Strut type front suspension is used on these vehicles. Vertical shock absorbing Mc Pherson Struts attach to the top of the steering knuckle and to the front strut tower. This interconnection between the steering knuckle and the body of the vehicle, provides for the correct steering knuckle position. This steering knuckle position provides for the correct front Caster and Camber settings for the vehicle, at the time the vehicle is designed.

Lower control arms are attached inboard to the cast aluminum front suspension cradle and outboard to the bottom of the steering knuckle. Attachment of the lower control arm to the steering knuckle is done through a ball joint in the lower control arm.

During steering maneuvers, the strut and the steering knuckle (through the ball joint and a pivot bearing in the strut's upper retainer) turn as an assembly.

SUSPENSION CRADLE (CROSSMEMBER)

This vehicle uses a one piece cast aluminum cradle for the front suspension. The cradle is used as the attaching points for the lower control arms, stabilizer bar and steering gear. The cradle also has the power steering hoses and the chassis brake tubes attached to it.

The cradle is mounted to the front frame rails at four points, two on each side of the vehicle. The cradle is isolated from the body of the vehicle using four isolators, one located at each mounting bolt location.

WARNING: If a threaded hole in the suspension cradle needs to be repaired, only use the type of thread insert and installation procedure specified for this application.

The threaded holes in the cradle that are used for attachment of the lower control arm rear bushing retainer, power steering hose and chassis brake tubes can be repaired. The repair is done by the installation of a Heli-Coil® thread insert which has been specifically developed for this application. Refer to the Mopar Parts Catalog for the specified Heli-Coil thread insert to be used for this application. The procedure for installing the Heli-Coil® thread insert is detailed in the Service Procedures section in this group of the service manual.

DESCRIPTION AND OPERATION (Continued)

Mc PHERSON STRUT ASSEMBLY

The front suspension of the vehicle is supported by coil springs positioned around the strut assembly. The springs are contained between an upper seat, located just below the top strut mount assembly and a lower spring seat on the strut fluid reservoir.

The top of each strut assembly is bolted to the upper fender reinforcement (strut tower) through a rubber isolated mount.

The bottom of the strut assembly attaches to the steering knuckle with two through bolts. Caster is a fixed setting on all vehicles and is not adjustable when an alignment is performed. In the event the camber setting on a vehicle requires adjustment, a service strut is available which will provide a method by which the camber can be adjusted.

The strut assemblies on this vehicle are inter-connected by the front stabilizer bar through 2 link assemblies attaching the struts to the stabilizer bar.

STEERING KNUCKLE

The steering knuckle (Fig. 1) is a single casting with legs machined for attachment of the strut damper, steering linkage, disc brake caliper, and lower control arm ball joint. The steering knuckle also has the front hub/bearing assembly mounted to it. The hub is positioned through the bearing and knuckle, with the constant velocity stub shaft splined through the hub.

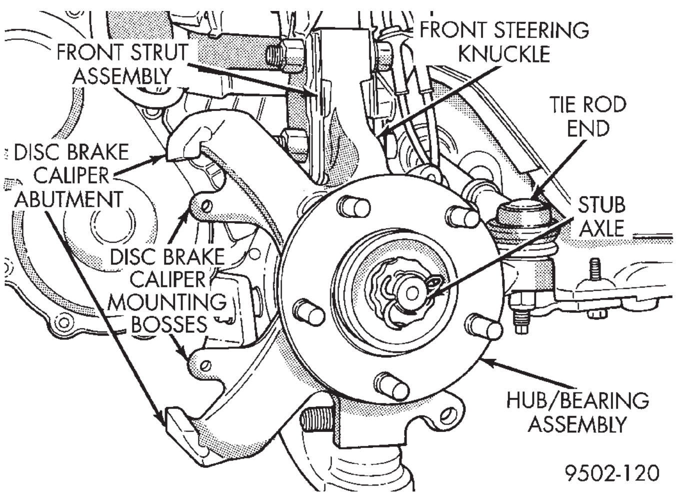


Fig. 1 Front Steering Knuckle

LOWER CONTROL ARM

The lower control arm is an iron casting. The lower control arm is mounted to and isolated from the body of the vehicle using 2 types of rubber bushings. The front lower control arm bushing is the spool type and is pressed into the lower control arm, while the rear uses a bushing that is pushed over a stem on the lower control arm. The front and rear of the lower control arm is mounted to the cast crossmember using a pivot bolt through the center of the front pivot bushing, and a retainer which traps the rear bushing in the crossmember.

The ball joint is pressed into the control arm and has a non-tapered stud with a notch for clamp bolt clearance. The stud is clamped and locked into the steering knuckle leg with a clamp bolt.

The ball joint is lubricated for the life of the vehicle and does not require any periodic lubrication.

STABILIZER BAR

The stabilizer bar interconnects both Mc Pherson strut assemblies of the vehicle and is attached through rubber isolator bushings to the front suspension cradle

Jounce and rebound movements affecting one wheel are partially transmitted to the opposite wheel to stabilize body roll.

Attachment of the stabilizer bar to the front suspension cradle is through 2 rubber-isolator bushings and bushing retainers. The stabilizer bar to Mc Pherson strut assembly attachment is done utilizing a sway bar attaching link. All parts of the stabilizer bar are serviceable, and the stabilizer bar to crossmember bushings are split for easy removal and installation. The split in the stabilizer bar to crossmember bushing should be positioned toward the rear of the vehicle, with the square corner down toward the ground, when the stabilizer bar is installed in the vehicle.

STABILIZER BAR ATTACHING LINK

The stabilizer bar attaching links are used to attach each end of the stabilizer bar to the front strut assemblies. This reduces the fore-and-aft rate of the stabilizer bar from the rest of the vehicle's front suspension.

HUB AND BEARING ASSEMBLY

The Unit III Front Hub and Bearing Assembly is used on all front wheel drive vans.

All hub and bearing assemblies mount to the steering knuckle the same way, but very by the wheel size on the vehicle. Vehicles equipped with 14 inch wheels have a 4 inch wheel mounting stud pattern. Vehicles equipped with 15 inch wheels have a 4 1/2 inch wheel mounting stud pattern. If a hub and bearing assembly needs to be replaced, be sure that the replacement assembly has the same size wheel mounting stud pattern as the original part.

This unit is serviced only as a complete assembly. It is mounted to the steering knuckle by four mounting bolts that are removed from the rear of the steering knuckle.

DESCRIPTION AND OPERATION (Continued)

COIL SPRING

Coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. During service procedures when both springs are removed, mark springs to ensure installation in original position. Each coil spring comes with a plastic sleeve on the second coil of the spring. This plastic sleeve is a noise insulator for the coil spring.

NOTE: If coil springs require replacement, be sure that the springs needing replacement, are replaced with springs meeting the correct load rating for the vehicle and its specific options.

BALL JOINT

The ball joint (Fig. 2) is pressed into the lower control arm. The ball joint has a non-tapered stud with a notch (Fig. 2) to provide clearance for the steering knuckle clamp bolt and to provide retention of the ball stud in the steering knuckle. The ball joint stud is clamped and locked into the steering knuckle leg using a pinch bolt. The ball joint used on this vehicle is replaceable and if found defective can be serviced as a separate component of the lower control arm assembly.

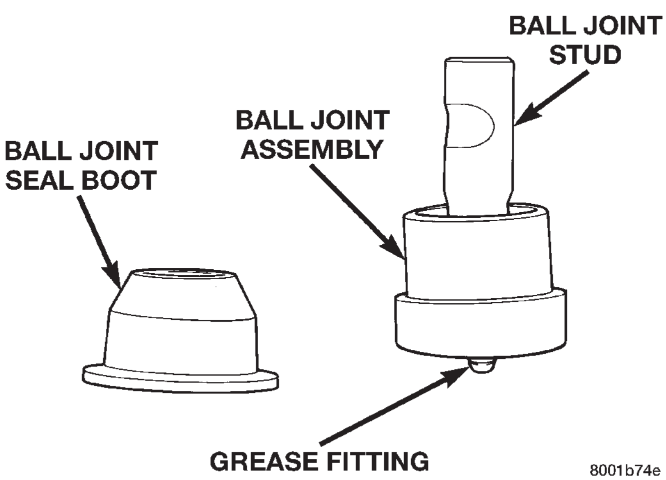


Fig. 2 Ball Joint Assembly

WHEEL MOUNTING STUDS

If wheel attaching studs need to be replaced in the hub and bearing assembly the studs **CAN NOT** be hammered out of the hub flange. If a stud is removed by hammering it out of the bearing flange, damage to the hub and bearing assembly will occur leading to premature bearing failure.

Use the procedure and special tools shown in the service procedures section for the wheel mounting studs when replacing the wheel attaching studs.

The hub and bearing assembly does not require removal from the steering knuckle or the rear knuckle to replace the wheel attaching studs in the hub and bearing assembly.

DIAGNOSIS AND TESTING

Mc PHERSON STRUT

(1) Inspect for damaged or broken coil springs (Fig. 3).

(2) Inspect for torn or damaged strut assembly dust boots (Fig. 3).

(3) Inspect the coil spring isolator on the lower spring seat, (Fig. 3) for any signs of damage or deterioration.

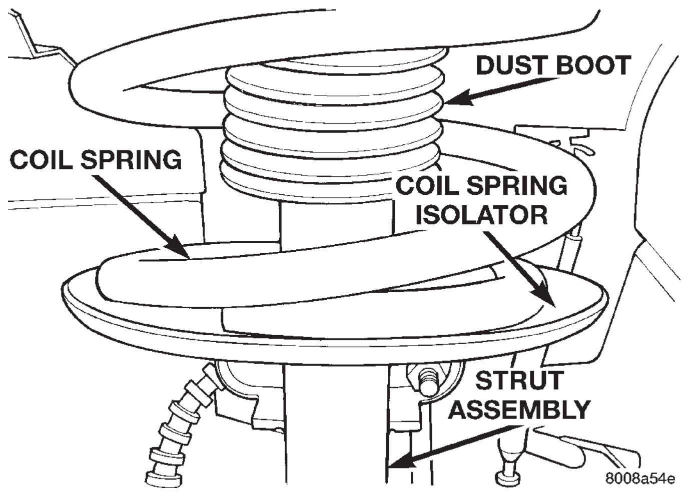


Fig. 3 Mc Pherson Strut Assembly Inspection

(4) Lift dust boot (Fig. 4) and inspect strut assembly for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off lower end of unit). A slight amount of seepage between the strut rod and strut shaft seal is not unusual and does not affect performance of the strut assembly (Fig. 4). Also inspect jounce bumpers for signs of damage or deterioration.

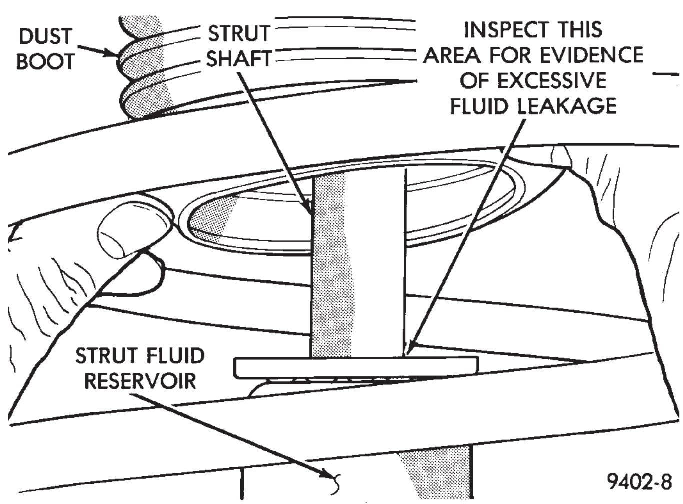


Fig. 4 Strut Assembly Leakage Inspection

DIAGNOSIS AND TESTING (Continued)

STEERING KNUCKLE

The front suspension knuckle is not a repairable component of the vehicles front suspension **IT MUST BE REPLACED.** If bent, broken or damaged in any way, do not attempt to straighten or repair the steering knuckle.

Service replacement of the front hub/bearing assembly can be done with the front steering knuckle remaining on the vehicle.

LOWER CONTROL ARM

If damaged, the lower control arm casting is serviced only as a complete component. Inspect lower control arm for signs of damage from contact with the ground or road debris. If lower control arm shows any sign of damage, inspect lower control arm for distortion. **Do not attempt to repair or straighten a broken or bent lower control arm.**

The serviceable components of the lower control arm are: the ball joint assembly, ball joint assembly grease seal and control arm bushings. Inspect both control arm bushings for severe deterioration, and replace if required. Inspect ball joint per inspection procedure in this section of the service manual and replace if required. Service procedures to replace these components are detailed in the specific component removal and installation sections in this group of the service manual.

BALL JOINT (LOWER)

With the weight of the vehicle resting on the road wheels, grasp the grease fitting as shown in (Fig. 5) and with no mechanical assistance or added force attempt to rotate the grease fitting.

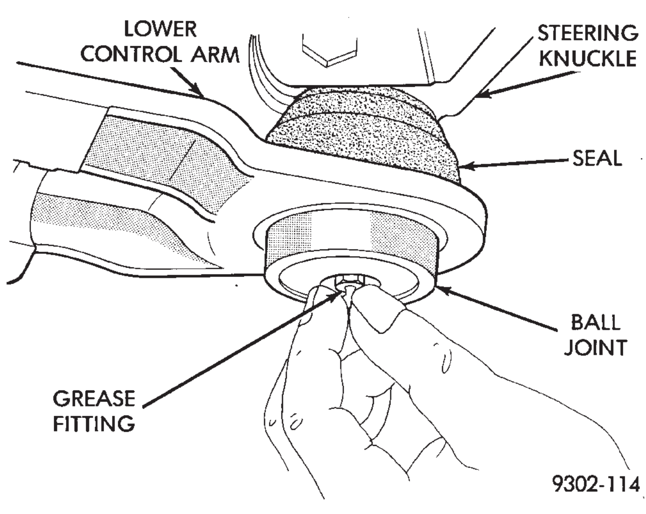


Fig. 5 Checking Ball Joint Wear

If the ball joint is worn the grease fitting will rotate easily. If movement is noted, replacement of the ball joint is recommended.

STABILIZER BAR

Inspect for broken or distorted sway bar bushings, bushing retainers, and worn or damaged sway bar to strut attaching links. If sway bar to front suspension cradle bushing replacement is required, bushing can be removed from sway bar by opening slit and peeling bushing off sway bar.

HUB AND BEARING ASSEMBLY

The condition of the front hub and bearing assembly is diagnosed using the inspection and testing procedure detailed below.

The bearing contained in the Unit III front hub/bearing assembly will produce noise and vibration when worn or damaged. The noise will generally change when the bearings are loaded. A road test of the vehicle is normally required to determine the location of a worn or damaged bearing.

Find a smooth level road surface and bring the vehicle up to a constant speed. When vehicle is at a constant speed, swerve the vehicle back and forth from the left and to the right. This will load and unload the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 m.p.h..

SERVICE PROCEDURES

SUSPENSION CRADLE THREAD REPAIR PROCEDURE

WARNING: When performing this procedure use only the thread inserts which are specified in the Mopar Parts Catalog for this repair procedure. These thread inserts have been specifically developed for this application and use of other types of thread inserts can result in an inferior long term repair.

The threaded holes in the front suspension cradle, if damaged, can repaired by installing a Heli-Coil® thread insert.

The threaded holes that are repairable using the thread insert, are the lower control arm rear bushing retainer mounting bolt holes, routing bracket attaching locations for the power steering hoses, and brake hose attachment holes.

This repair procedure now allows the threaded holes in the suspension crossmember to be repaired, eliminating the need to replace the crossmember if damage occurs to one of the threaded holes.

The thread inserts for this application are specified by part number in the Mopar Parts Catalog. **Do not use a substitute thread insert.**

The specific tools and equipment required to install the thread insert are listed below. Refer to the

SERVICE PROCEDURES (Continued)

instructions included with the thread insert for the detailed procedure used for the installation of the thread insert.

NOTE: The thread inserts for this application are for the repair of M8x1.25 and M10x1.5 threads. Be sure the correct tools are used for the required thread insert size.

TOOL REQUIREMENT FOR M8x1.25 Thread

- 8.3mm (5/16 in.) Drill Bit
- 120° Countersink
- Heli-Coil® Tap #4863-8
- Heli-Coil® Gage #4624-8
- Heli-Coil® Hand Inserting Tool 7751-8
- Needle Nose Pliers – For Removal Of Thread Insert Driving Tang

TOOL REQUIREMENT FOR M10x1.5 Thread

- 10.5mm (25/64 in.) Drill Bit
- 120° Countersink
- Heli-Coil® Tap #4863-10
- Heli-Coil® Gage #4624-10
- Heli-Coil® Hand Inserting Tool 7751-10
- Needle Nose Pliers – For Removal Of Thread Insert Driving Tang

REMOVAL AND INSTALLATION

Mc PHERSON STRUT

REMOVAL

WARNING: DO NOT REMOVE THE NUT FROM THE STRUT ROD WHILE STRUT ASSEMBLY IS INSTALLED IN VEHICLE, OR BEFORE STRUT ASSEMBLY SPRING IS COMPRESSED.

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the wheel and tire assembly from location on front of vehicle requiring strut removal.

(3) If both strut assemblies are to be removed, mark the strut assemblies right or left according to which side of the vehicle they were removed from.

(4) Remove the hydraulic brake hose routing bracket and the speed sensor cable routing bracket from the strut damper brackets (Fig. 6).

NOTE: When removing nut from stud of stabilizer bar attaching link, do not allow stud to rotate. Hold stud from rotating by inserting a Torx Plus 40IP bit in the end of the stud as shown in (Fig. 7).

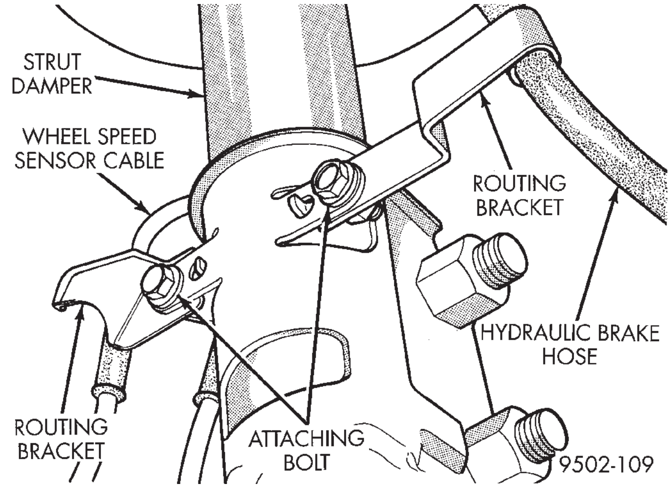


Fig. 6 Brake Hose And Speed Sensor Cable Routing

(5) Remove the stabilizer bar attaching link (Fig. 7) from the bracket on the strut assembly.

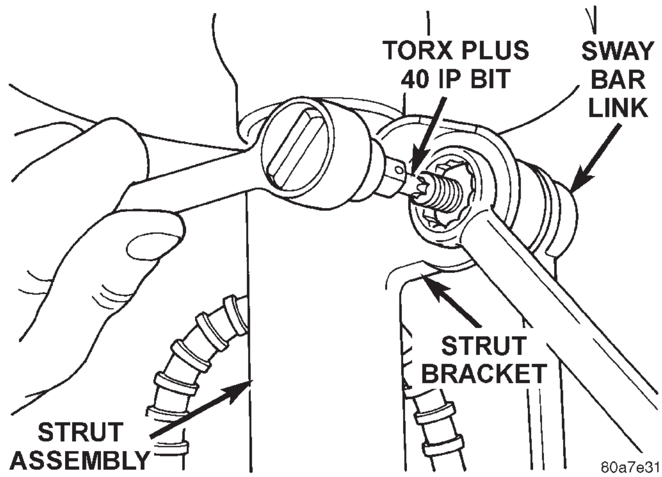


Fig. 7 Stabilizer Bar Link To Strut Attachment

CAUTION: The steering knuckle to strut assembly attaching bolts are serrated and must not be turned during removal. Remove nuts while holding bolts stationary in the steering knuckles.

(6) Remove the 2 strut assembly clevis bracket to steering knuckle attaching bolts (Fig. 8).

(7) Remove the 3 nuts attaching the strut assembly upper mount to the strut tower (Fig. 9).

INSTALLATION

(1) Install strut assembly into strut tower, aligning and installing the 3 studs on the upper strut mount into the holes in shock tower. Install the 3 upper strut mount attaching nut/washer assemblies (Fig. 9). Then using a crow foot. tighten the 3 attaching nuts to a torque of 28 N·m (250 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

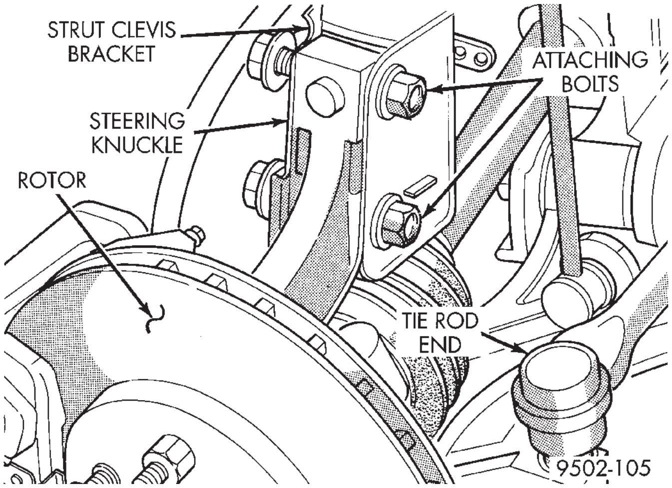


Fig. 8 Strut Damper Attachment To Steering Knuckle

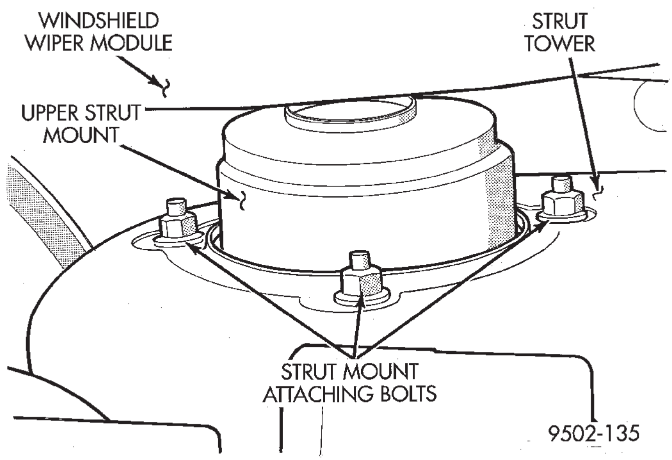


Fig. 9 Strut Assembly To Strut Tower Attaching Nuts

CAUTION: The steering knuckle to strut assembly attaching bolts are serrated and must not be turned during installation. Install nuts while holding bolts stationary in the steering knuckles.

(2) Align strut assembly with steering knuckle. Position arm of steering knuckle into strut assembly clevis bracket. Align the strut assembly clevis bracket mounting holes with the steering knuckle mounting holes. Install the 2 strut assembly to steering knuckle attaching bolts (Fig. 8). **If strut assembly is attached to steering knuckle using a cam bolt, the cam bolt must be installed in the lower slotted hole on strut clevis bracket. Also, attaching bolts should be installed with the nuts facing the front of the vehicle (Fig. 8). Tighten the strut assembly to steering knuckle attaching bolts to a torque of 88 N·m (65 ft. lbs.) plus an additional 1/4 turn after specified torque is met.**

(3) Install stabilizer bar attaching link (Fig. 7) on bracket of strut assembly. Install stabilizer bar attaching link to strut bracket attaching nut.

NOTE: When torquing nut on stud of stabilizer bar attaching link, do not allow stud to rotate. Hold stud from rotating by inserting a Torx Plus 40IP bit in the end of the stud as shown in (Fig. 10).

(4) Tighten the stabilizer bar link to strut attaching nut using a Torx Plus 40IP bit and crowfoot as shown in (Fig. 10) to a torque of 88 N·m (65 ft. lbs.).

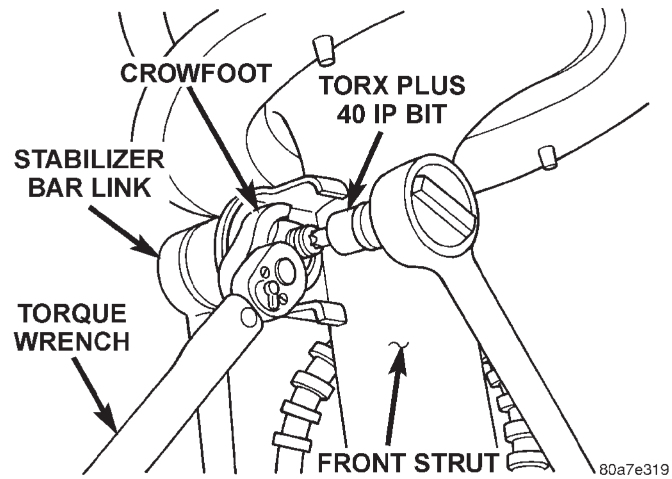


Fig. 10 Torquing Stabilizer Bar Link To Strut Attaching Nut

(5) Install hydraulic brake hose and speed sensor cable routing brackets on the strut assembly brackets (Fig. 6). Tighten the routing bracket attaching bolts to a torque of 13 N·m (10 ft. lbs.).

(6) Install the wheel/tire assembly on the vehicle.

(7) Install and tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

STEERING KNUCKLE

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance Section of this manual for the required lifting procedure to be used for this vehicle.

(2) Remove the cotter pin and nut lock (Fig. 11) from the end of the stub axle.

(3) Remove the wheel and tire assembly from the vehicle.

(4) Remove the wave washer (Fig. 12) from the end of the stub axle

REMOVAL AND INSTALLATION (Continued)

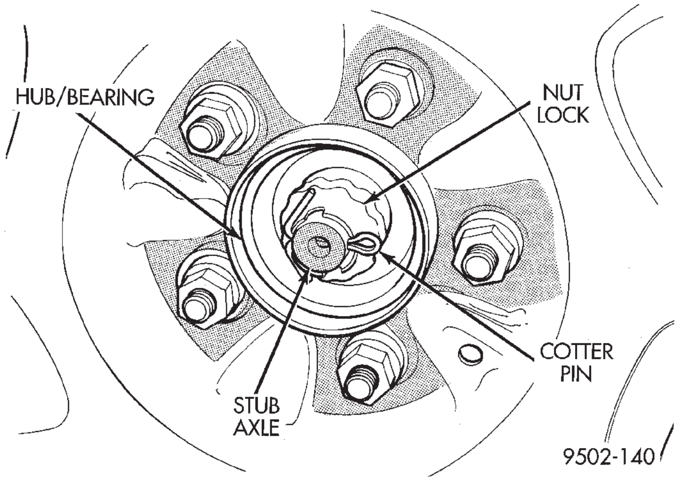


Fig. 11 Hub/Bearing To Stub Axle Retaining Nut

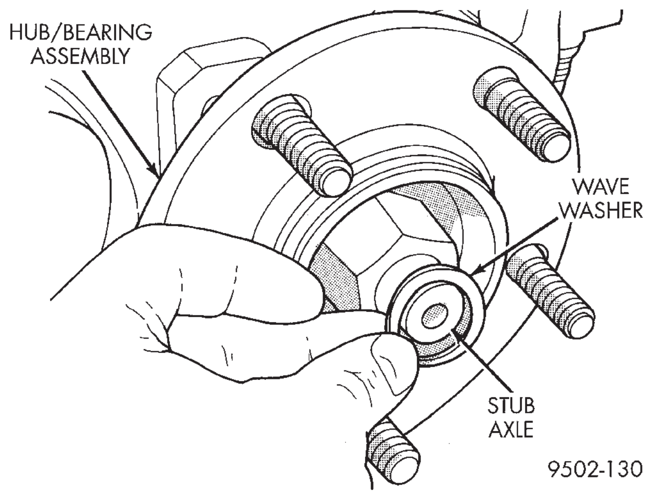


Fig. 12 Wave Washer

CAUTION: Wheel bearing damage will result if after loosening hub nut, vehicle is rolled on the ground or the weight of the vehicle is allowed to be supported by the tires.

(5) With the vehicle's brakes applied to keep hub from turning, **loosen and remove** the stub axle to hub nut.

(6) Remove the 2 front disc brake caliper to steering knuckle attaching bolts (Fig. 13).

(7) Remove the disc brake caliper from the steering knuckle. Caliper is removed by first rotating top of caliper away from steering knuckle and then removing bottom of caliper out from under machined abutment on steering knuckle (Fig. 14).

(8) Support disc brake caliper assembly by using a wire hook and suspending it from the strut assembly (Fig. 15). **Do not allow the brake caliper assembly to hang by the brake flex hose.**

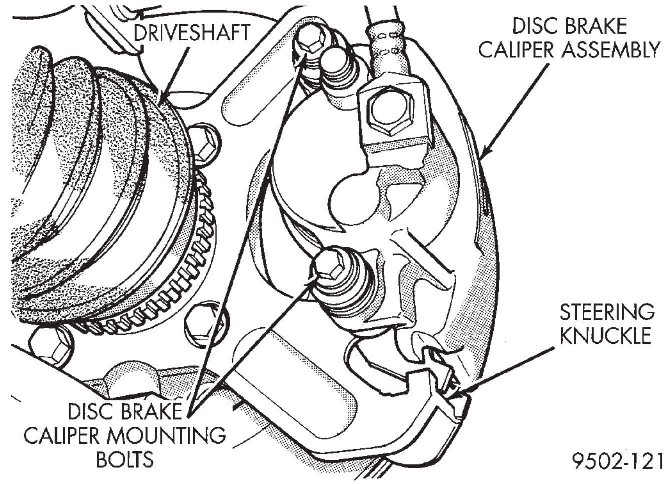


Fig. 13 Front Disc Brake Caliper Attaching Bolts

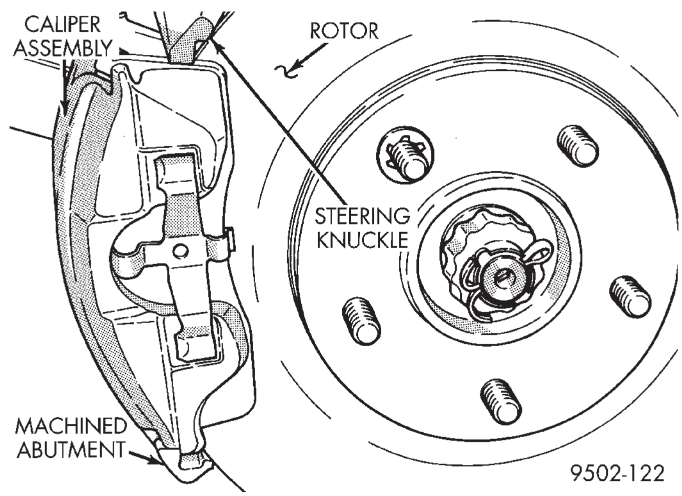


Fig. 14 Brake Caliper Mounting To Steering Knuckle

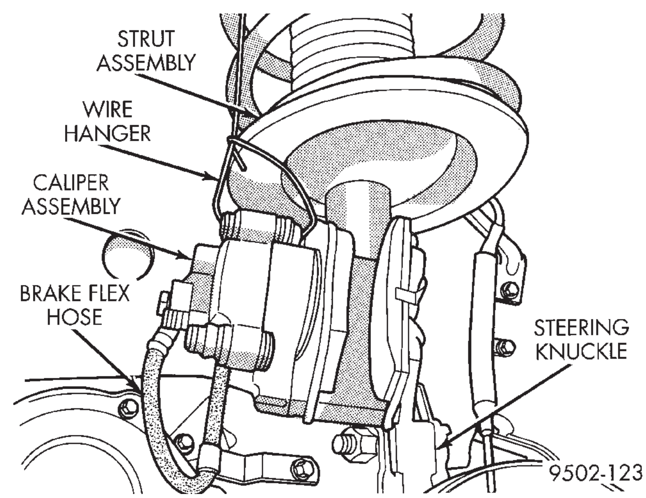


Fig. 15 Correctly Supported Disc Brake Caliper

REMOVAL AND INSTALLATION (Continued)

(9) Remove the brake rotor from the hub and bearing assembly (Fig. 16).

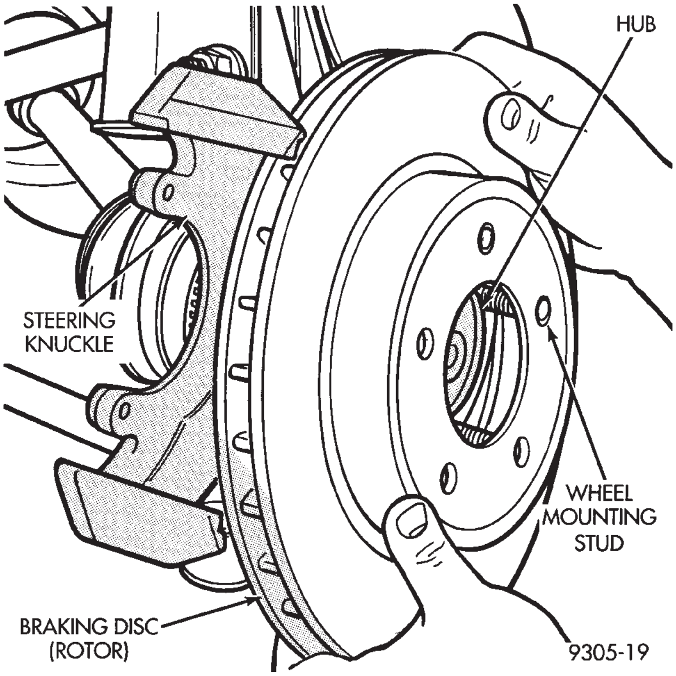


Fig. 16 Remove/Install Brake Rotor

(10) Remove nut attaching outer tie rod end to steering knuckle (Fig. 17). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with a wrench.**

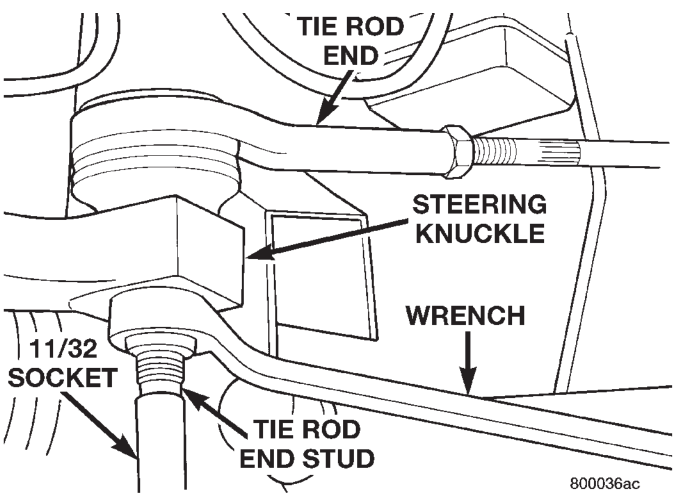


Fig. 17 Removing Tie Rod End Attaching Nut

(11) Remove tie rod end from steering knuckle using Remover, Special Tool MB-991113 (Fig. 18).

(12) Remove the front wheel speed sensor (Fig. 19) from the steering knuckle.

(13) If equipped, remove the wheel stop (Fig. 20) from the steering knuckle. **When installing the pinch bolt when assembling the steering knuckle to the ball joint, the pinch bolt must be installed from the rear facing the front on the vehicle.**

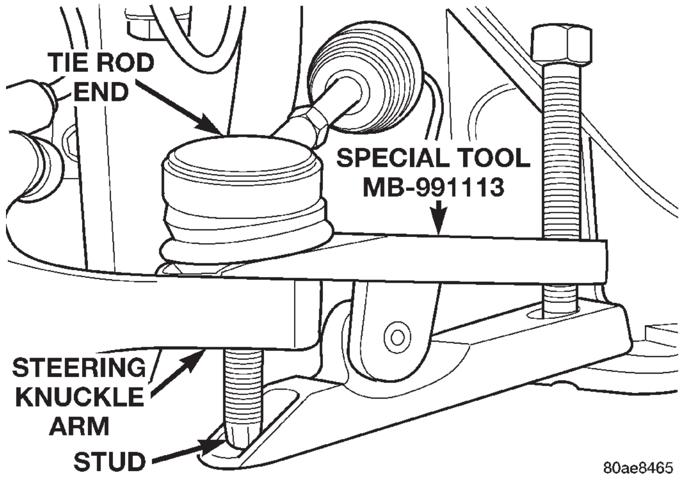


Fig. 18 Tie Rod End Removal From Steering Knuckle Arm

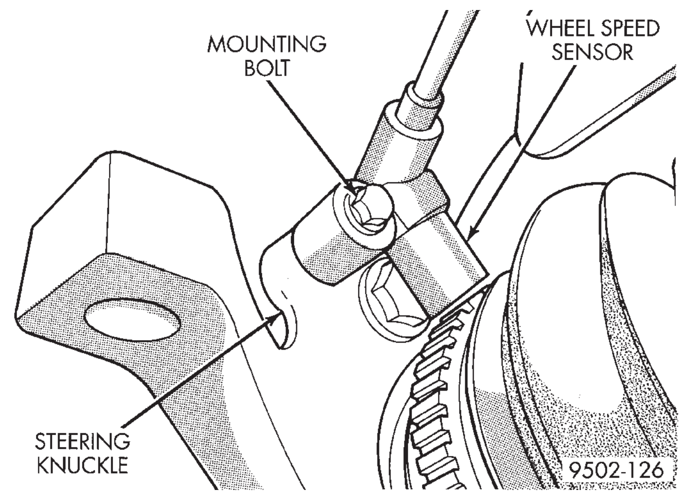


Fig. 19 Front Wheel Speed Sensor

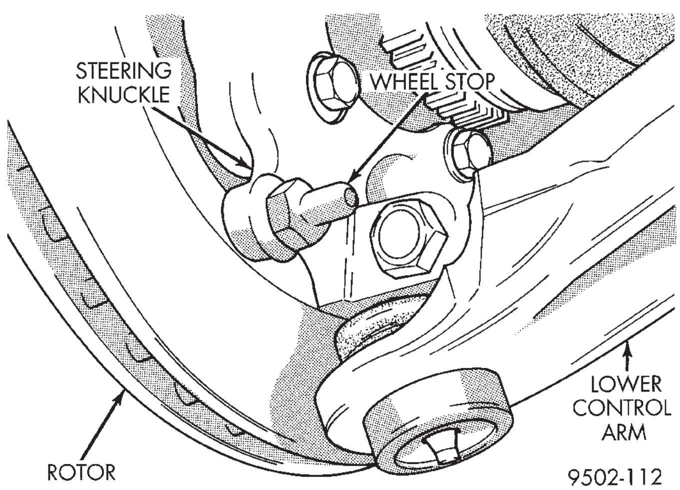


Fig. 20 Wheel Stop Location On Steering Knuckle

REMOVAL AND INSTALLATION (Continued)

(14) Remove the steering knuckle to ball joint stud, clamping nut and bolt (Fig. 21) from the steering knuckle.

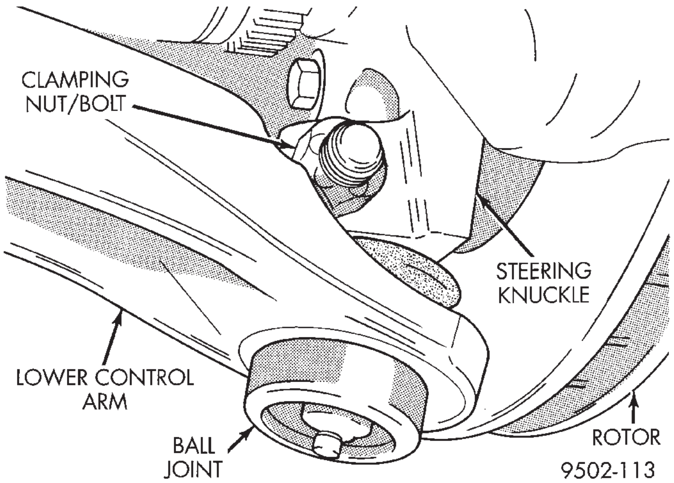


Fig. 21 Control Arm To Steering Knuckle Attachment

(15) Using a pry bar, separate steering knuckle from ball joint stud (Fig. 22). **Note: Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.**

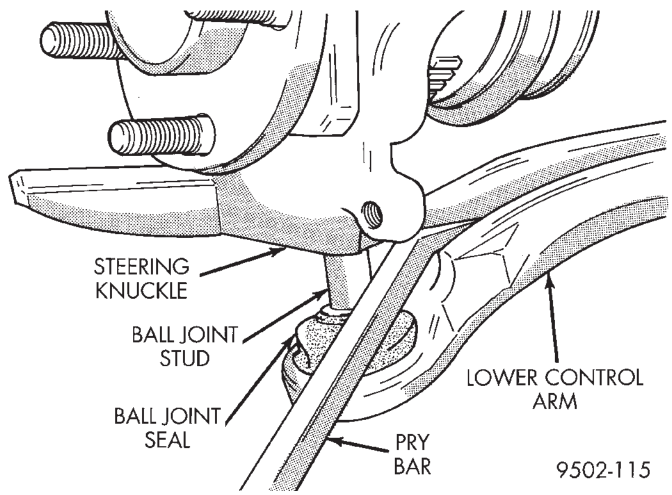


Fig. 22 Separating Ball Joint Stud From Steering Knuckle

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint after removing outer C/V Joint from the hub/bearing assembly in steering knuckle, end of driveshaft must be supported.

(16) Pull steering knuckle assembly out and away from the outer C/V joint of the driveshaft assembly (Fig. 23).

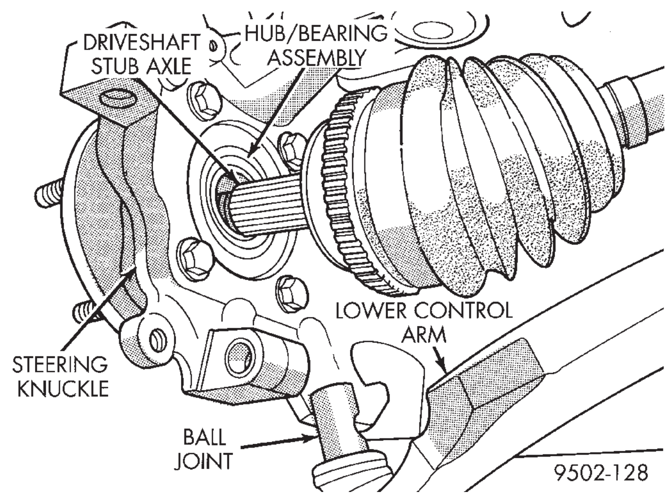


Fig. 23 Steering Knuckle Separation From Driveshaft

CAUTION: The steering knuckle to strut assembly attaching bolts are serrated and must not be turned during removal. Remove nuts while holding bolts stationary in the steering knuckles.

(17) Remove the 2 steering knuckle to strut damper clevis bracket attaching bolts (Fig. 24).

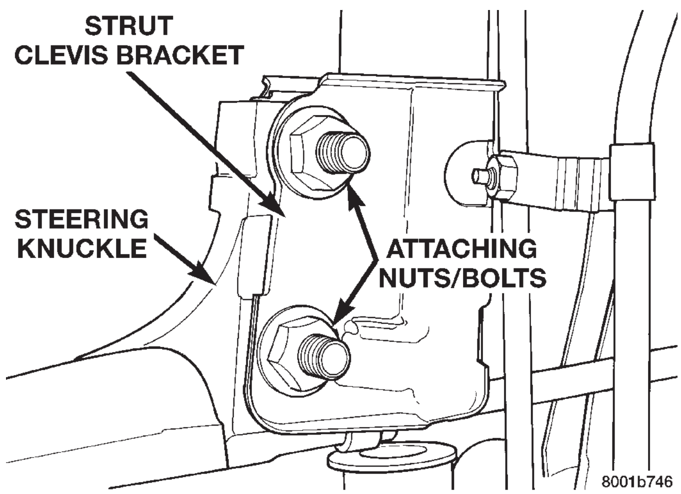


Fig. 24 Strut To Steering Knuckle Attaching Bolts

(18) Remove the steering knuckle from the strut.

INSTALL

(1) Transfer, or install if necessary, a new hub/bearing assembly into the steering knuckle. Refer to Hub And Bearing Assembly Service in this section of the service manual for the required removal and installation procedure for the front hub/bearing assembly.

CAUTION: The steering knuckle to strut assembly attaching bolts are serrated and must not be turned during installation. Install nuts while holding bolts stationary in the steering knuckles.

REMOVAL AND INSTALLATION (Continued)

CAUTION: If the vehicle being serviced is equipped with eccentric strut assembly attaching bolts, the eccentric bolt must be installed in the bottom (slotted) hole on the strut clevis bracket (Fig. 25).

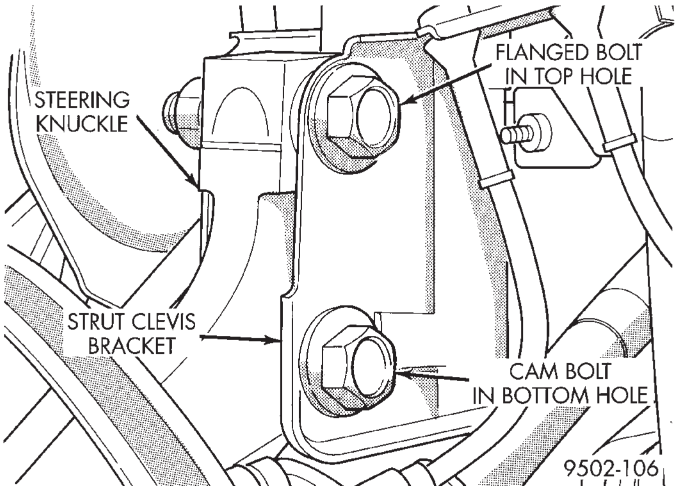


Fig. 25 Correctly Installed Eccentric Attaching Bolt

(2) Install steering knuckle back in clevis bracket of strut damper assembly (Fig. 24). Install the strut damper to steering knuckle attaching bolts. Tighten both attaching bolts to a torque of 90 N·m (65 ft. lbs.) plus an additional 1/4 turn.

(3) Slide drive shaft back into front hub and bearing assembly. Then install steering knuckle onto the stud of the ball joint assembly (Fig. 23).

(4) Install a **NEW** steering knuckle to ball joint stud, clamping bolt and nut (Fig. 21). Tighten the clamping bolt and nut to a torque of 145 N·m (105 ft. lbs.).

(5) Install tie rod end into steering knuckle. Start attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary using a 11/32 socket, (Fig. 17) tighten tie rod end to steering knuckle attaching nut. Then using a crowfoot and 11/32 socket (Fig. 26), tighten the tie rod end attaching nut to a torque of 54 N·m (40 ft. lbs.).

(6) Install braking disc on hub and bearing assembly (Fig. 16).

(7) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding bottom of caliper under abutment on steering knuckle, and then rotating top of caliper against top abutment (Fig. 14).

(8) Install disc brake caliper assembly to steering knuckle attaching bolts (Fig. 13). Tighten the disc brake caliper assembly attaching bolts to a torque of 35 N·m (30 ft. lbs.).

(9) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install the washer and stub axle to hub/bearing assembly nut on stub axle and securely tighten nut.

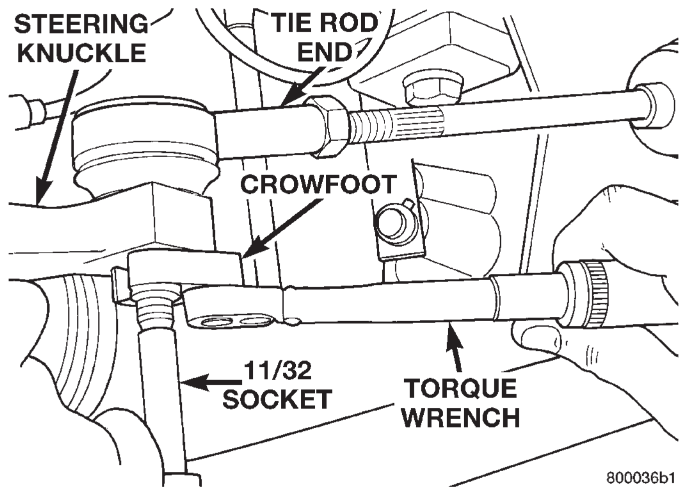


Fig. 26 Torquing Tie Rod End Attaching Nut

(10) Install wheel speed sensor and mounting bolt (Fig. 19) on steering knuckle. Tighten the speed sensor attaching bolt to a torque of 7 N·m (60 in. lbs.).

(11) Install front wheel and tire assembly. Install and tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half the required specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(12) Lower vehicle.

(13) With the vehicle's brakes applied to keep hub from turning, tighten the hub nut to a torque of 203 N·m (150 ft. lbs.) (Fig. 27).

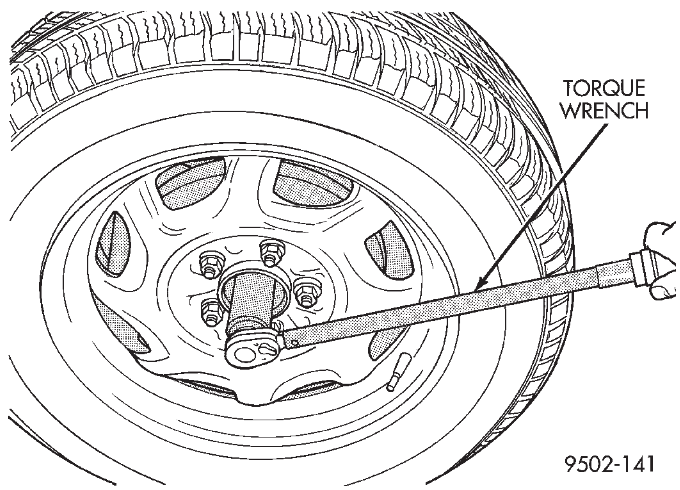


Fig. 27 Torquing Front Stub Axle To Hub Nut

(14) Install the spring wave washer on the end of the stub axle.

(15) Install the hub nut lock, and a **new** cotter pin (Fig. 11). Wrap cotter pin prongs tightly around the hub nut lock as shown in (Fig. 11).

(16) Set front Toe on vehicle to required specification. Use procedure listed under Wheel Alignment, in the Front Suspension Service Procedures section of this service manual.

REMOVAL AND INSTALLATION (Continued)

LOWER CONTROL ARM

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove wheel and tire assembly from the side of vehicle requiring service to the lower control arm.

(3) Remove the wheel stop (Fig. 28) from the steering knuckle. **When installing the pinch bolt when assembling the steering knuckle to the ball joint, the pinch bolt must be installed from the rear facing the front on the vehicle (Fig. 28).**

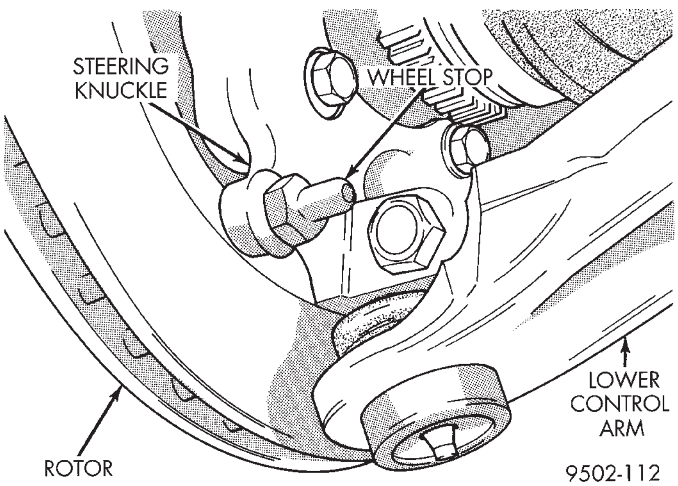


Fig. 28 Wheel Stop Location On Steering Knuckle

(4) Remove the nut and bolt clamping the steering knuckle to the ball joint stud. (Fig. 29)

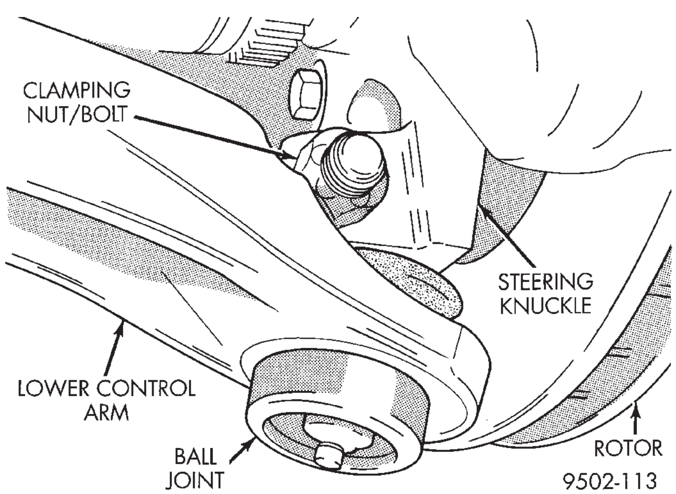


Fig. 29 Control Arm To Steering Knuckle Attachment

NOTE: The attaching bolts for the cradle plate are of two different thread sizes. Nine of the bolts are a M-14 thread and one of the bolts is a M-12 thread. Refer to (Fig. 30) for the cradle plate attaching bolt locations.

(5) Remove the 10 bolts (Fig. 30) attaching the cradle plate to the front suspension cradle. Then remove the cradle plate from the cradle.

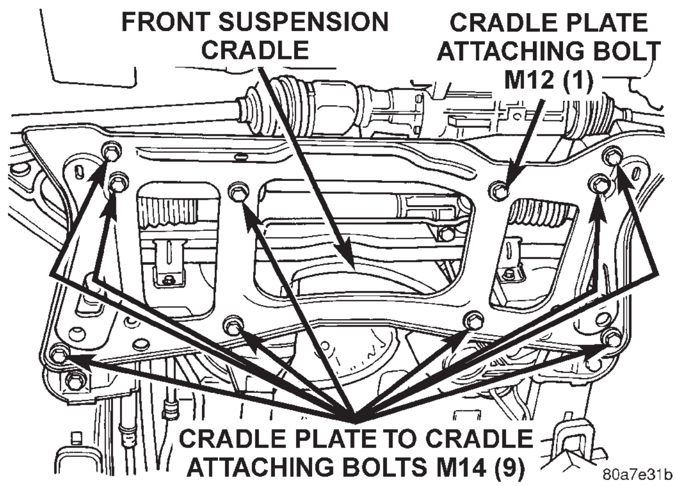


Fig. 30 Front Suspension Cradle Plate And Mounting Bolts

CAUTION: Pulling steering knuckle out from vehicle after releasing from ball joint can separate inner C/V joint. See Driveshafts.

(6) Using a pry bar, separate steering knuckle from ball joint stud (Fig. 31). **Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.**

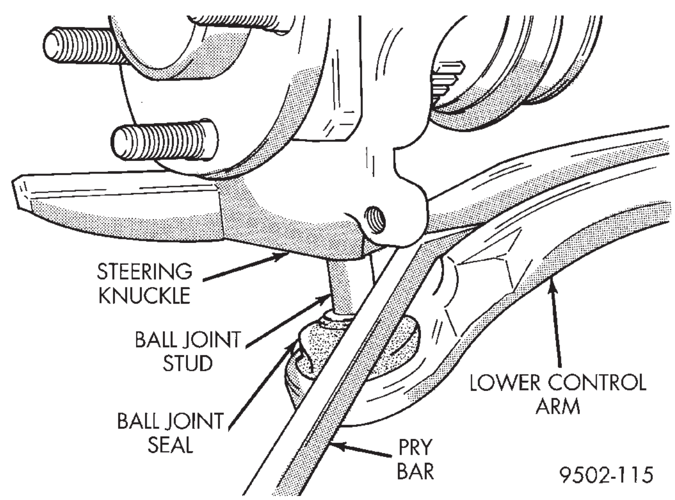


Fig. 31 Separating Ball Joint Stud From Steering Knuckle

REMOVAL AND INSTALLATION (Continued)

(7) Loosen but do not remove the pivot bolt (Fig. 32) attaching the front bushing of the lower control arm to the front suspension cradle.

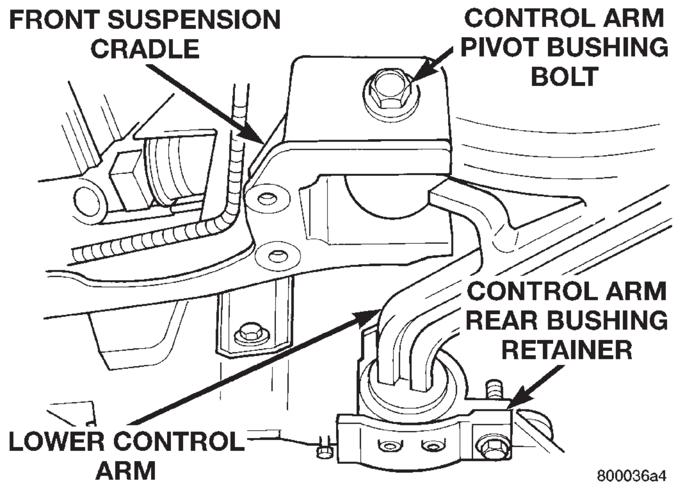


Fig. 32 Lower Control Arm Bushing To Cradle Pivot Bolt

(8) Remove retainer (Fig. 33) attaching rear bushing of lower control arm to front suspension cradle.

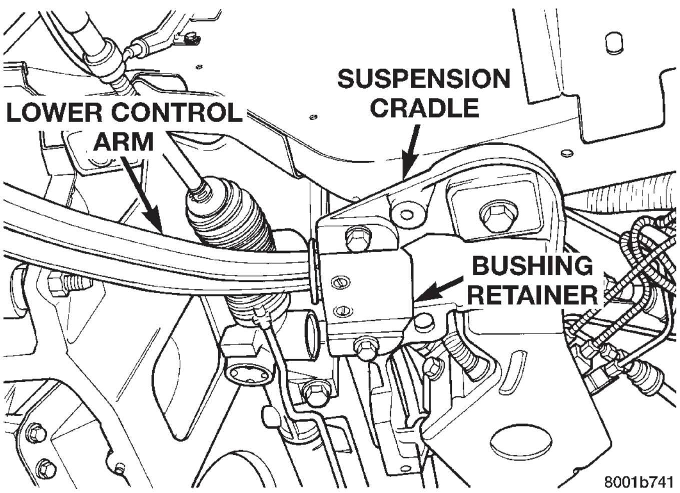


Fig. 33 Control Arm Bushing To Suspension Cradle Retainer

CAUTION: Make location reference marks where the front suspension cradle is mounted against the front frame rails before loosening and lowering the cradle. This is required so the cradle can be re-installed in the design location to achieve proper front suspension alignment.

(9) Loosen but not fully removing the 2 left side suspension cradle to frame rail attaching bolts (Fig. 34).

NOTE: When removing the left lower control arm from the vehicle, the front suspension cradle needs to be lowered for the pivot bolt to clear the transaxle.

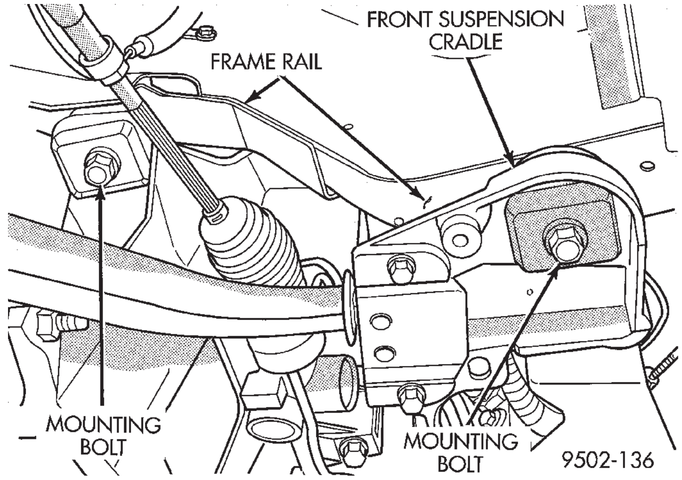


Fig. 34 Suspension Cradle To Frame Rail Mounting Bolts

(10) Lower the left front corner of the suspension cradle until pivot bolt will clear end of transaxle (Fig. 35). Remove the pivot bolt and the lower control arm from the cradle.

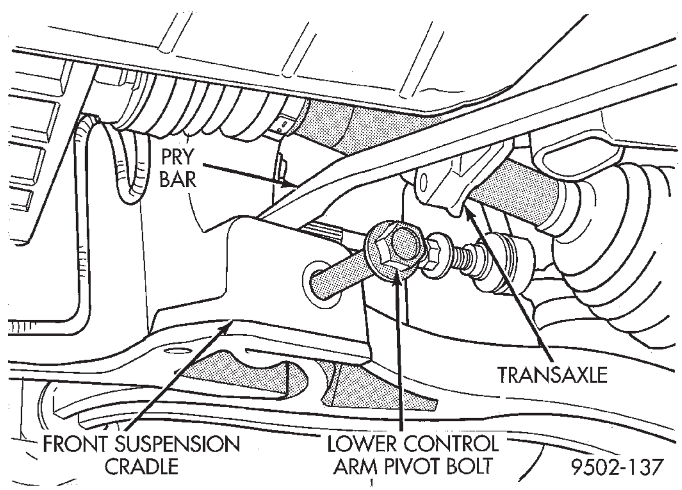


Fig. 35 Lowering Front Suspension Cradle

INSTALL

NOTE: If the left lower control arm is being installed on the vehicle the front suspension cradle needs to be lowered for the pivot bolt to clear the transaxle.

(1) Position lower control arm assembly into front suspension cradle. **If installing the left lower control arm, pry down on the left front corner of the suspension cradle until the pivot bolt clears the end of the transaxle (Fig. 35).** Install pivot bolt attaching front bushing of lower control arm to front

REMOVAL AND INSTALLATION (Continued)

suspension cradle (Fig. 36). **Do not tighten or torque pivot bolt at this time**.

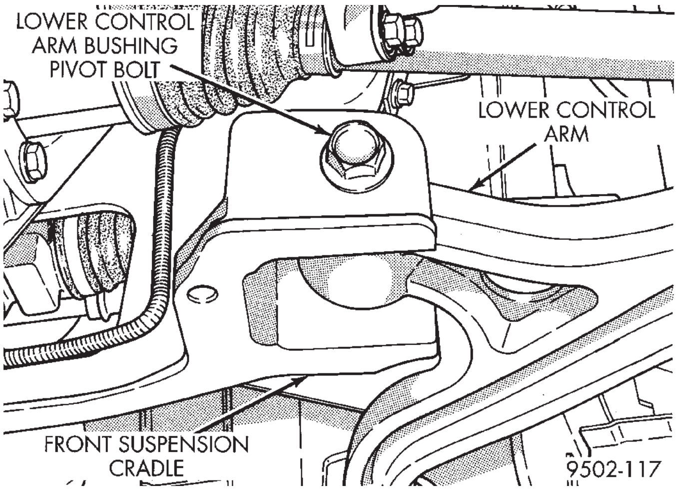


Fig. 36 Lower Control Arm Bushing Pivot Bolt Correctly Installed

(2) Install retainer (Fig. 37) attaching rear bushing of lower control arm to front suspension cradle. **When installing retainer, be sure raised rib on rear bushing (Fig. 37) is positioned in the groove on the retainer. Do not torque attaching bolts at this time.**

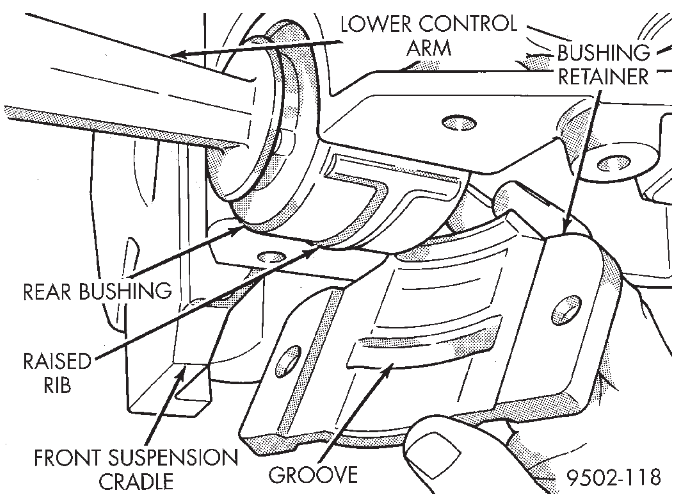


Fig. 37 Installing Lower Control Arm Rear Bushing Retainer

NOTE: If reference marks were not put on the frame rails prior to lowering the suspension cradle, Refer to group 13 Frame And Bumpers for the cradle positioning procedure.

(3) Raise the front suspension cradle against the front frame rails. Align the cradle with the reference marks on the frame rails.

(4) Tighten the 4 mounting bolts for the front suspension cradle to a torque of 163 N·m (120 ft. lbs.).

(5) Install lower control arm ball joint stud into steering knuckle. Then install the bolt and nut, clamping the steering knuckle to the ball joint stud (Fig. 29). Tighten the clamping bolt to a torque of 145 N·m (105 ft. lbs.).

(6) Install the cradle plate on front suspension cradle and then install the 10 cradle plate to cradle attaching bolts (Fig. 30). Tighten the 9 M-14 attaching bolts (Fig. 30) to a torque of 165 N·m (123 ft. lbs.). Tighten the 1 M-12 attaching bolt (Fig. 30) to a torque of 108 N·m (80 ft. lbs.).

CAUTION: When locating jack stands under lower control arm, do not place the jack stands under the ball joints (Fig. 38).

(7) Position jack stands under the lower control arms as close to the ball joints as possible (Fig. 38). Lower the vehicle onto the jack stands, until the jack stands are supporting the total weight of the vehicle (Fig. 38).

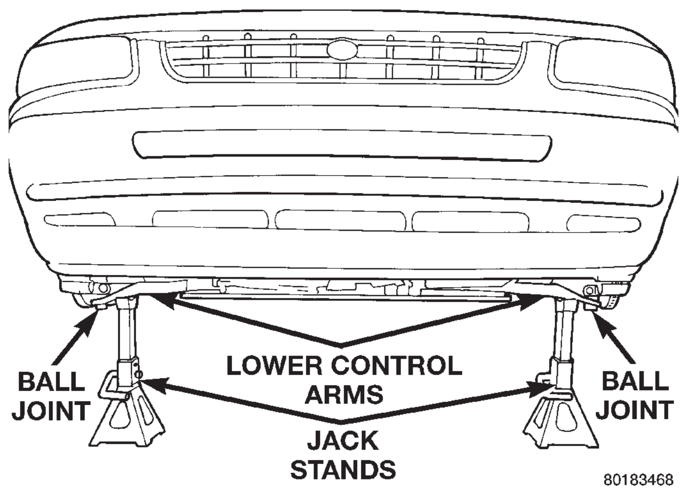


Fig. 38 Jack Stands Supporting Vehicle Weight

(8) Tighten front lower control arm pivot bolt (Fig. 36) to a torque of 183 N·m (135 ft. lbs.) first, then tighten rear lower control arm bushing retainer attaching bolts (Fig. 33) to a torque of 68 N·m (50 ft. lbs.).

(9) Install the wheel/tire assembly on the vehicle.

(10) Install and tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jack stands and lower vehicle to the ground.

REMOVAL AND INSTALLATION (Continued)

BALL JOINT

REMOVE

(1) Using a screw driver or other suitable tool, pry the seal boot off of the ball joint assembly (Fig. 39)

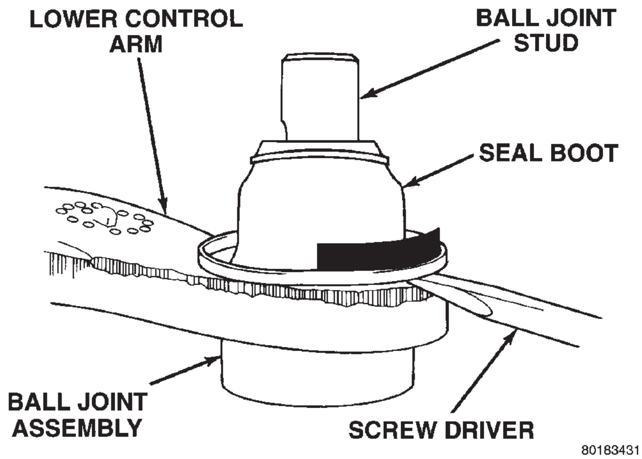


Fig. 39 Ball Joint Seal Boot Removal

(2) Position receiving cup, Special Tool 6758 to support lower control arm when removing ball joint assembly (Fig. 40). Install Remover, Special Tool 6919 on top of the ball joint assembly (Fig. 40).

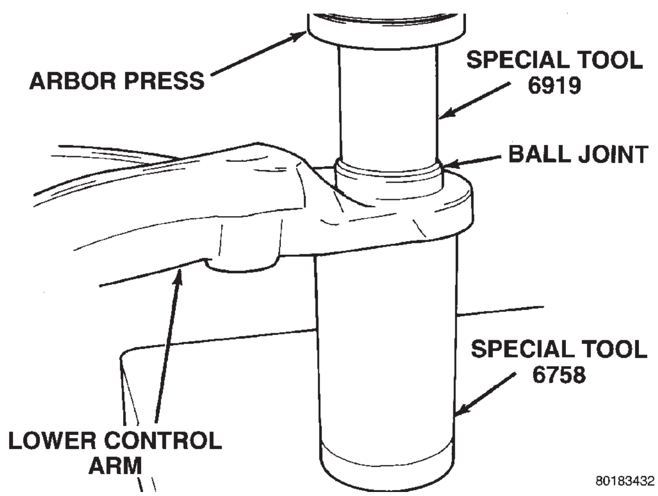


Fig. 40 Ball Joint Removal From Lower Control Arm

(3) Using the arbor press, press the ball joint assembly completely out of the lower control arm.

INSTALL

NOTE: When installing ball joint in lower control arm, position the ball joint in control arm so notch in ball joint stud is in the direction shown (Fig. 41). This will ease assembly of the ball joint to the steering when installing pinch bolt.

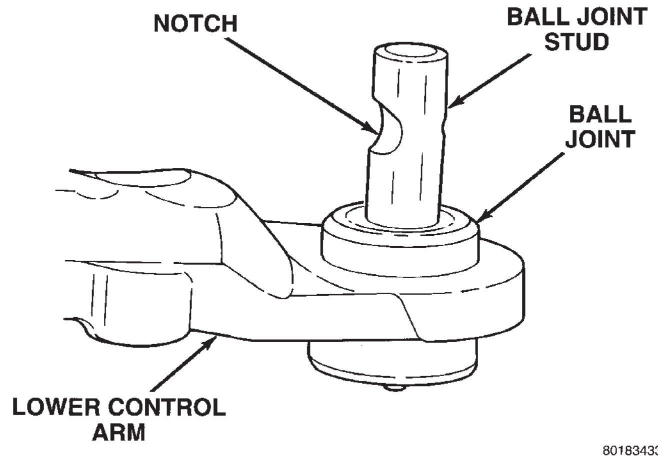


Fig. 41 Installation Position Of Ball Joint In Control Arm

(1) By hand, position ball joint into ball joint bore of lower control arm. **Be sure ball joint is not cocked in the bore of the control arm, this will cause the ball joint to bind when being pressed into control arm.**

(2) Position control arm with installed ball joint, in an arbor press with Receiving Cup, Special Tool 6758 supporting the lower control arm (Fig. 42). Then center Installer, Special Tool 6908–4 on the bottom of the ball joint (Fig. 42)

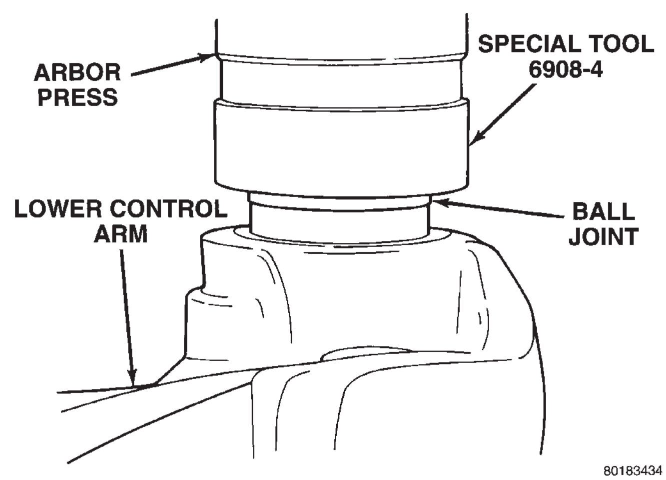


Fig. 42 Installing Ball Joint In Control Arm

(3) Carefully align all pieces. Then press the ball joint into the lower control arm until it is completely seated against surface of lower control arm. The ball joint is correctly installed when there is no gap between the ball joint and the lower control arm (Fig. 43). **Do not apply excessive force against the ball joint or the lower control arm.**

REMOVAL AND INSTALLATION (Continued)

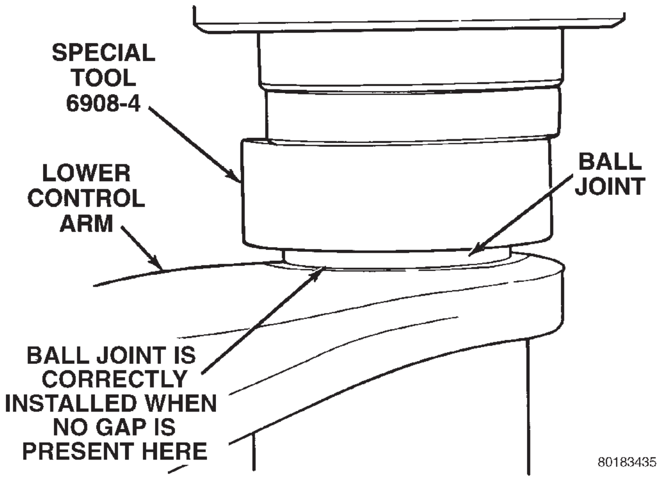


Fig. 43 Correctly Installed Lower Ball Joint

CAUTION: When installing the ball joint seal on the ball joint/lower control arm, the shield (Fig. 44) on the ball joint seal must be positioned as shown.

(4) Install a **NEW** seal boot by hand as far as possible on the ball joint. Installation of the seal boot is to be with the shield positioned as shown (Fig. 44).

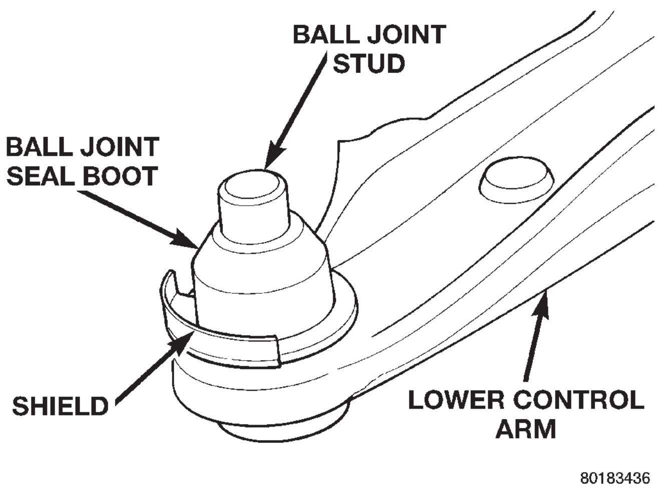


Fig. 44 Ball Joint Seal Boot Installed Position

CAUTION: Do not use an arbor press to install the sealing boot on the ball joint. Damage to the sealing boot will occur if excessive pressure is applied to the sealing boot when it is being installed.

(5) Place Installer, Special Tool 6758 over seal boot and squarely align it with bottom edge of seal boot (Fig. 45). Apply hand pressure to Special Tool 6758 until seal boot is pressed squarely against top surface of lower control arm.

CAUTION: A replacement ball joint is not prelubricated. Properly lubricate the replacement ball joint using Mopar Multi–Mile grease or an equivalent. Lubricate ball joint after seal boot is installed but prior to top of seal boot being pushed down below notch in ball joint stud (Fig. 41). Air must vent out of the seal boot at notch when grease is pumped into ball joint, failure to do so will balloon and damage seal boot. Do not over grease the ball joint, this will prevent the seal boot from pushing down on the stud of the ball joint.

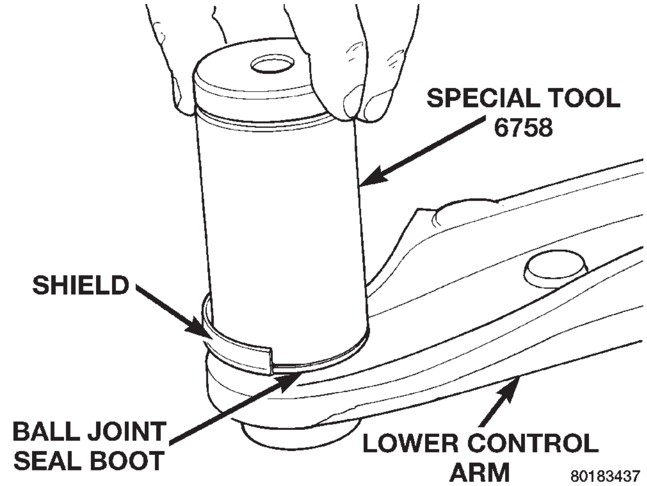


Fig. 45 Installing Ball Joint Seal Boot

CAUTION: After the ball joint is properly greased, clip the end of the grease fitting off below the hex. The ball joint seal boot is non-purgeable and further greasing is not required and can result in damage to the seal boot.

STABILIZER BAR

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

NOTE: The attaching bolts for the cradle plate are of two different thread sizes. Nine of the bolts are a M-14 thread and one of the bolts is a M-12 thread. Refer to (Fig. 46) for the cradle plate attaching bolt locations.

(2) Remove the 10 bolts (Fig. 46) attaching the cradle plate to the front suspension cradle. Then remove the cradle plate from the cradle.

NOTE: When removing nut from stud of stabilizer bar attaching link, do not allow the stud to rotate. Hold stud from rotating by inserting a Torx Plus 40 IP bit in the end of the stud (Fig. 47).

REMOVAL AND INSTALLATION (Continued)

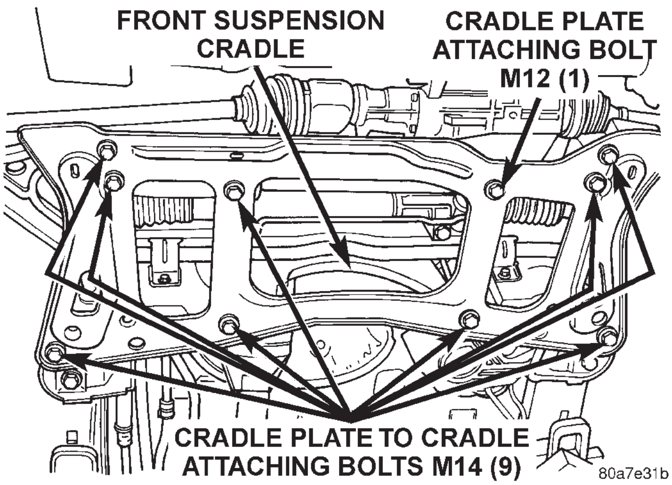


Fig. 46 Cradle Plate And Mounting Bolts

(3) Remove the nuts (Fig. 47) attaching the stabilizer bar attaching links to the stabilizer bar. Then remove the attaching links from the stabilizer bar.

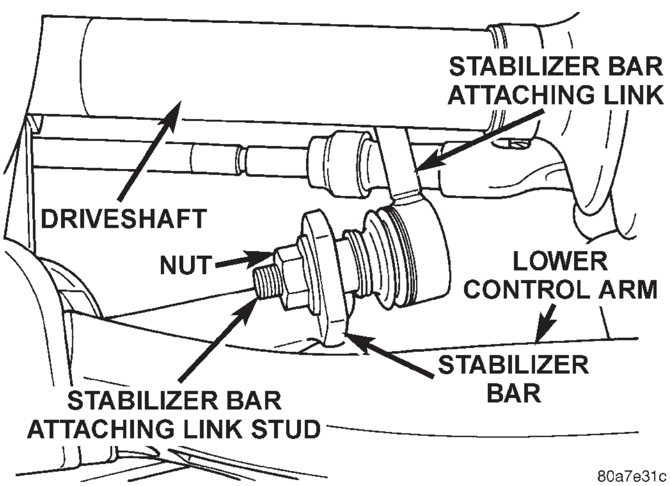


Fig. 47 Stabilizer Bar Link Attachment To Stabilizer Bar

(4) Remove the stabilizer bar bushing retainers from the front suspension cradle (Fig. 48).

(5) Remove the stabilizer bar and bushings as an assembly from the front suspension cradle.

INSTALL

(1) If the stabilizer bar to front suspension cradle bushings require replacement at time of inspection, install new bushings before installing stabilizer bar. Bushings are replaced by opening slit on bushings and peeling them off stabilizer bar. Install new bushings on stabilizer bar by spreading bushing at slit and forcing them on the stabilizer bar. **Bushings must be installed on stabilizer bar so slit in bushing will be facing toward the rear of vehicle with the square corner toward the ground,**

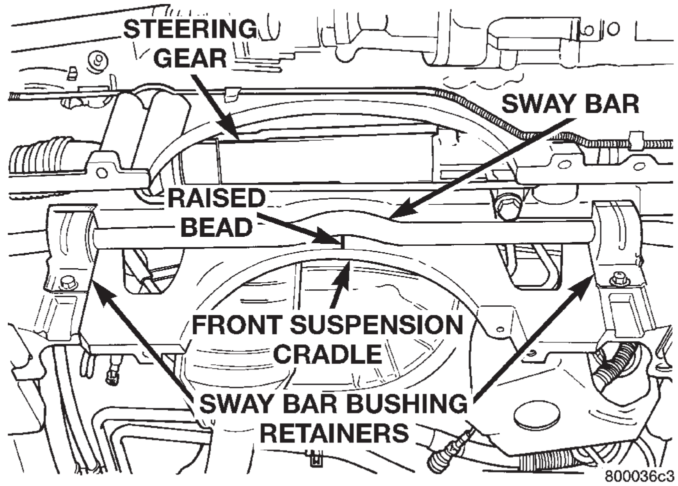


Fig. 48 Front Stabilizer Bar Bushing Retainers

when the stabilizer bar is installed on the vehicle (Fig. 49).

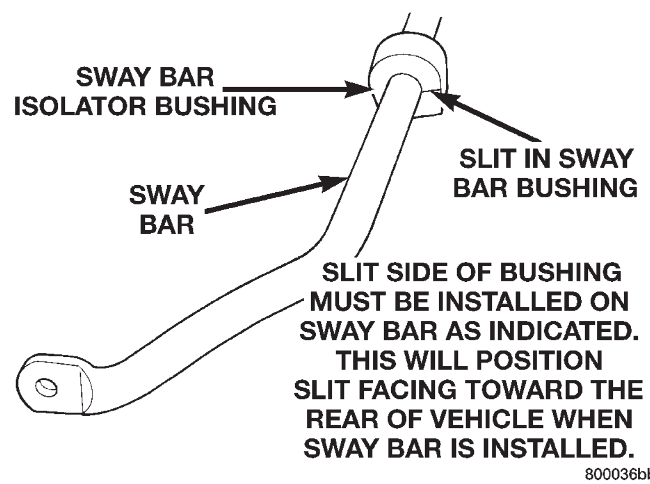


Fig. 49 Correctly Installed Stabilizer Bar To Cradle Bushing

(2) Position stabilizer bar into front suspension cradle so stabilizer bar bushings are aligned with depressions in cradle. Install stabilizer bar bushing retainers onto crossmember aligning raised bead on retainer with cutouts in bushings (Fig. 50). **Do not tighten Stabilizer bar bushing retainers at this time.**

(3) Check position of the stabilizer bar in the front suspension cradle. The center of the curved section of the stabilizer bar must be aligned with the raised line in the center of the front suspension cradle (Fig. 51).

(4) Align holes in stabilizer bar with attaching link assemblies. Install the stabilizer bar attaching links into the stabilizer bar and install the attaching nuts (Fig. 47).

REMOVAL AND INSTALLATION (Continued)

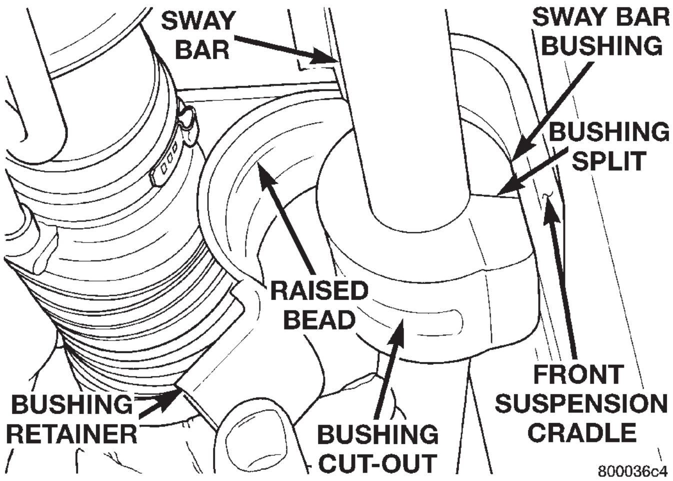


Fig. 50 Stabilizer Bar Bushing Retainer Installation

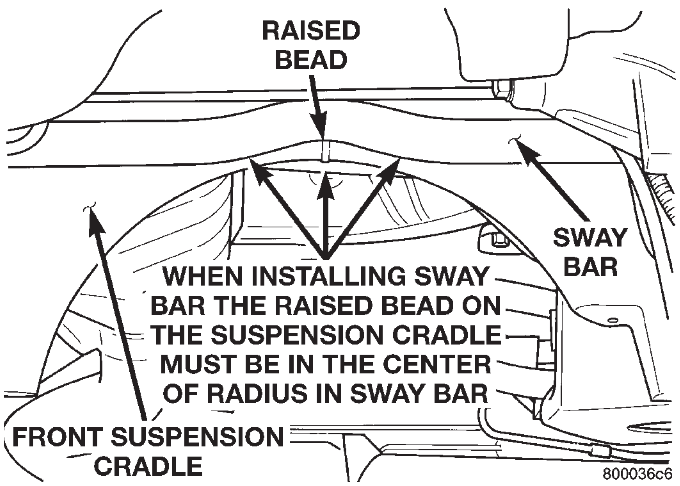


Fig. 51 Stabilizer Bar Correctly Positioned In Cradle

NOTE: When torquing nut on stud of stabilizer bar attaching link, do not allow the stud to rotate. Hold stud from rotating by inserting a Torx Plus 40 IP bit in the end of the the stud (Fig. 47).

(5) Tighten the stabilizer bar attaching link nuts (Fig. 47) to a torque of 88 N·m (65 ft. lbs.).

(6) Tighten the stabilizer bar bushing retainer to cradle attaching bolts (Fig. 48) to 68 N·m (50 ft. lbs.) torque.

(7) Install the cradle plate on front suspension cradle and then install the 10 cradle plate to cradle attaching bolts (Fig. 46). Tighten the 9 M-14 attaching bolts (Fig. 46) to a torque of 165 N·m (123 ft. lbs.). Tighten the 1 M-12 attaching bolt (Fig. 46) to a torque of 108 N·m (80 ft. lbs.).

(8) Lower vehicle.

HUB AND BEARING ASSEMBLY

REMOVE

NOTE: Replacement of the Unit III front hub/bearing assembly can be normally done without having to remove the steering knuckle from the vehicle. In the event that the hub/bearing is frozen in the steering knuckle and cannot be removed by hand it will have to be pressed out of the steering knuckle. The steering knuckle will require removal from the vehicle to allow the hub/bearing assembly to be pressed out of the steering knuckle. Refer to Front Steering Knuckle in this section of the service manual for the required removal and installation procedure.

(1) Remove the cotter pin, and nut lock from the stub axle (Fig. 52).

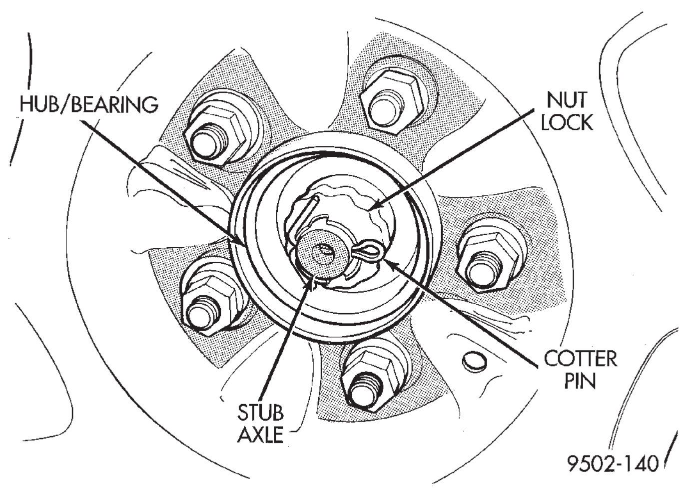


Fig. 52 Cotter Pin And Nut Lock

(2) Remove the spring wave washer (Fig. 53) from the end of the stub axle.

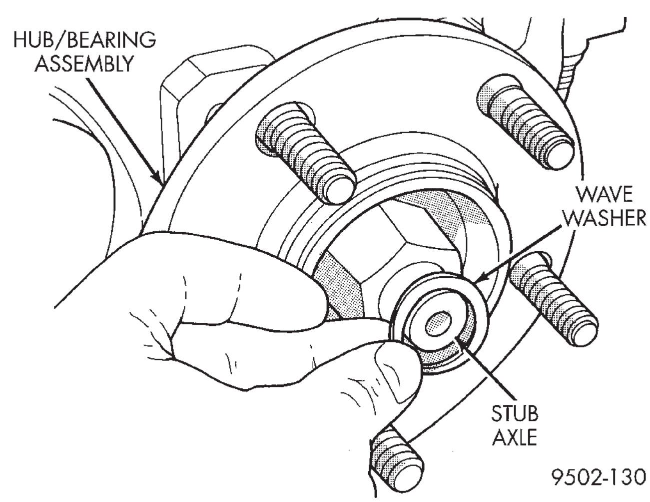


Fig. 53 Nut Lock Wave Washer

REMOVAL AND INSTALLATION (Continued)

CAUTION: Wheel bearing damage will result if after loosening hub nut, vehicle is rolled on the ground or the weight of the vehicle is allowed to be supported by the tires.

(3) With the aid of a helper applying the brakes to keep the front hub from turning, **loosen but do not remove** the hub nut. **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

(4) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(5) Remove wheel lug nuts, and front tire and wheel assembly.

(6) Remove front disc brake caliper to steering knuckle attaching bolts. (Fig. 54).

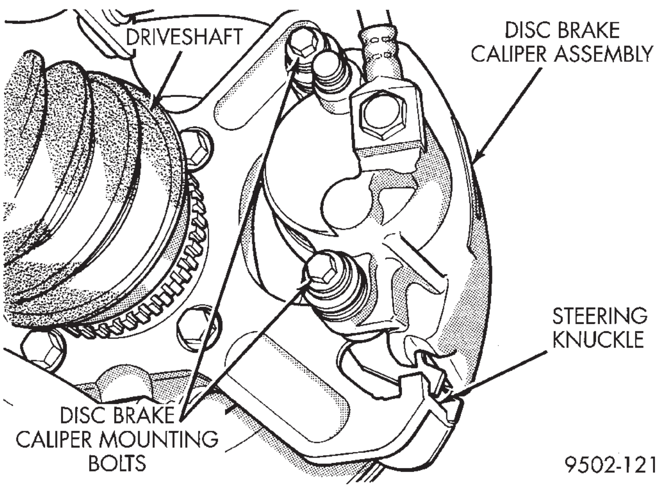


Fig. 54 Front Disc Brake Caliper Mounting Bolts

(7) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first rotating top of caliper away from steering knuckle, and then removing bottom of caliper out from under machined abutment. (Fig. 55)

(8) Support disc brake caliper assembly using a wire hook, (Fig. 56) **do not hang caliper assembly by hydraulic hose.**

(9) Remove the braking disc from the front hub/bearing assembly.

(10) Remove the retaining nut and the washer (Fig. 57) from the end of the stub axle.

(11) Remove the four hub and bearing assembly mounting bolts from the rear of steering knuckle (Fig. 58).

(12) Remove the hub and bearing assembly from the steering knuckle (Fig. 59).

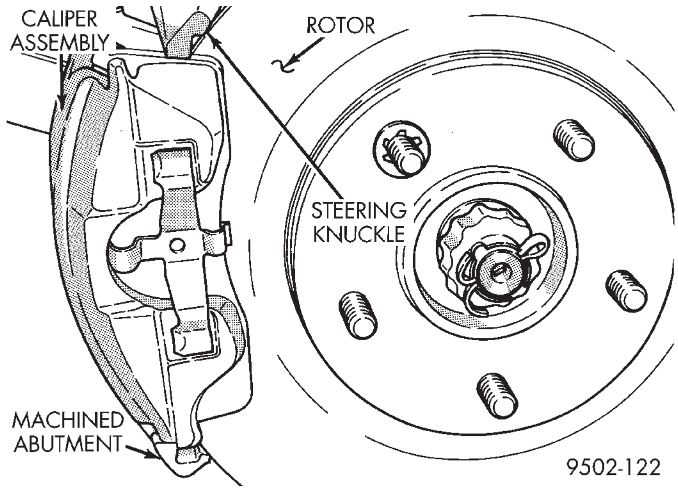


Fig. 55 Brake Caliper Assembly Removal/Installation

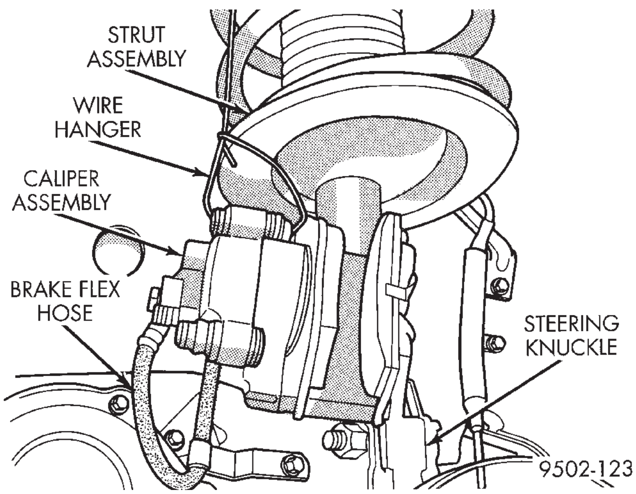


Fig. 56 Supporting Brake Caliper

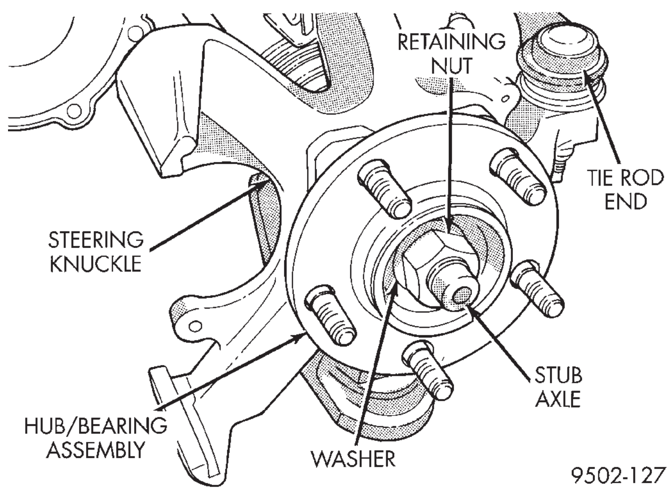


Fig. 57 Hub/Bearing To Stub Axle Retaining Nut And Washer

REMOVAL AND INSTALLATION (Continued)

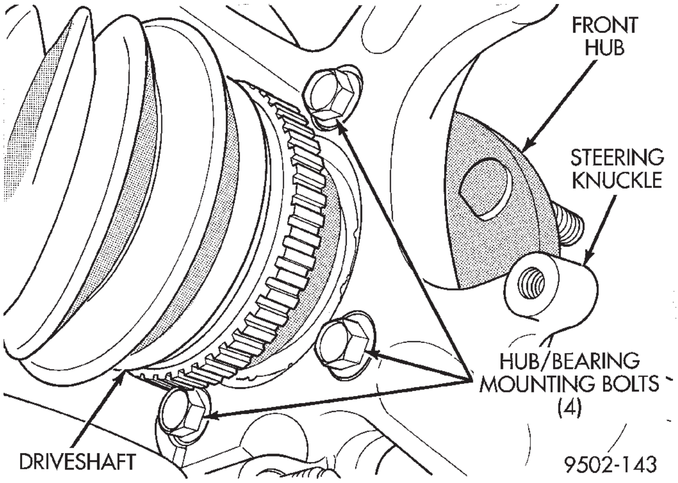


Fig. 58 Hub/Bearing Assembly Mounting Bolts

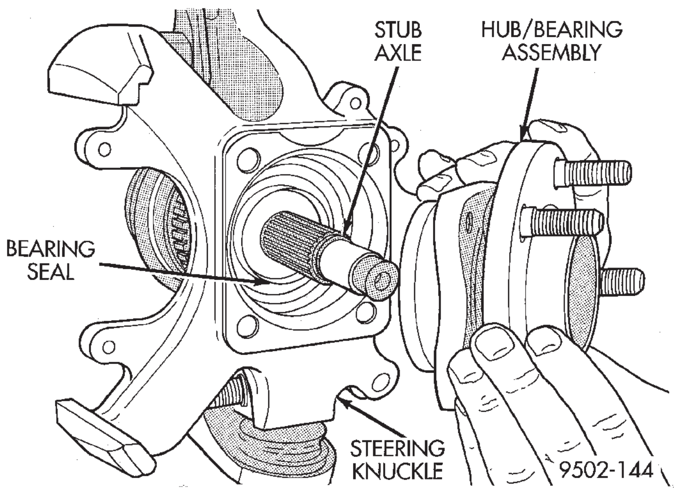


Fig. 59 Hub and Bearing Assembly Removal From Steering Knuckle

INSTALL

CAUTION: Hub and bearing assembly mounting surfaces on the steering knuckle and halfshaft (Fig. 60) must be smooth and completely free of foreign material or nicks prior to installing hub and bearing assembly.

CAUTION: When installing hub and bearing assembly into steering knuckle, be careful not to damage the bearing seal (Fig. 60) on the outer C/V joint.

(1) Install hub/bearing assembly onto stub axle and into steering knuckle until squarely seated on the face of the steering knuckle.

(2) Install the 4 hub/bearing assembly to steering knuckle attaching bolts (Fig. 58). Equally tighten all 4 mounting bolts in a criss-cross pattern until hub/bearing assembly is squarely seated against front of

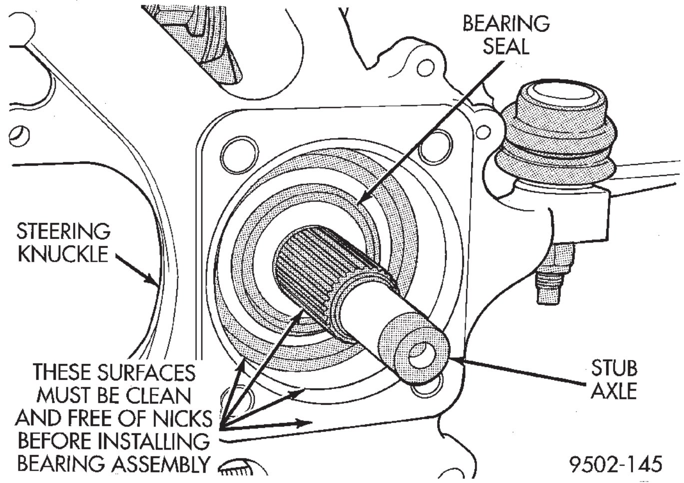


Fig. 60 Hub And Bearing Assembly Mounting Surfaces

steering knuckle. Then tighten the 4 hub and bearing assembly mounting bolts to a torque of 65 N·m (45 ft.lbs.)

(3) Install the hub/bearing assembly to stub shaft washer and retaining nut (Fig. 61).**Tighten, but do not torque the hub nut at this time.**

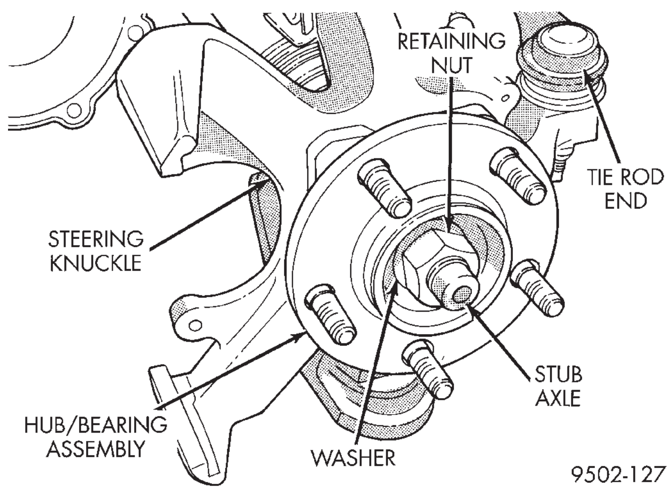


Fig. 61 Hub/Bearing To Stub Axle Washer And Retaining Nut

(4) Install the braking disk on the hub and bearing assembly.

(5) Install front brake caliper back over braking disc and align with caliper mounting holes on steering knuckle (Fig. 55). Caliper is installed by first installing bottom of caliper under machined abutment on bottom of steering knuckle and then rotating top of caliper toward steering knuckle. Install the disc brake caliper to steering knuckle attaching bolts (Fig. 54) and tighten to a torque of 19 N·m (168 in. lbs.).

(6) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper

sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(7) Lower vehicle to the ground.

CAUTION: When tightening hub/bearing assembly to stub shaft retaining nut, do not exceed the maximum torque of 244 N·m (180 ft. lbs.).

(8) With vehicle brakes applied to keep vehicle from moving, torque stub shaft to hub/bearing assembly retaining nut to 244 N·m (180 ft. lbs.).

(9) Check the Toe setting on the vehicle and reset if not within specifications.

FRONT WHEEL MOUNTING STUDS

REMOVE

CAUTION: If a wheel attaching stud needs to be replaced in the hub and bearing assembly the studs CAN NOT be hammered out of the hub flange. If a stud is removed by hammering it out of the bearing flange, damage to the hub and bearing assembly will occur leading to premature bearing failure.

The following procedure and special tools shown **MUST BE** used when replacing wheel attaching studs.

The hub and bearing assembly does not require removal from the steering knuckle to replace wheel attaching studs in the hub and bearing assembly.

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(2) Remove the front wheel and tire assembly from the vehicle.

(3) Remove the front caliper assembly from the front steering knuckle assembly. (Fig. 62) Refer to Front Disc Brake Service in the Brake Section of this service manual for caliper removal procedure.

(4) Remove front rotor from hub, by pulling it straight off wheel mounting studs. (Fig. 63)

(5) Install a lug nut on the wheel stud to be removed from the hub and bearing assembly, so the threads on the stud are even with end of lug nut. Install Remover, Special Tool C-4150A on hub and bearing assembly flange and wheel stud (Fig. 64).

(6) Tightening down on special tool will push wheel stud out of the hub and bearing assembly flange. When shoulder of wheel stud is past flange remove special tool from hub and bearing assembly. Remove lug nut from stud and remove wheel stud from flange.

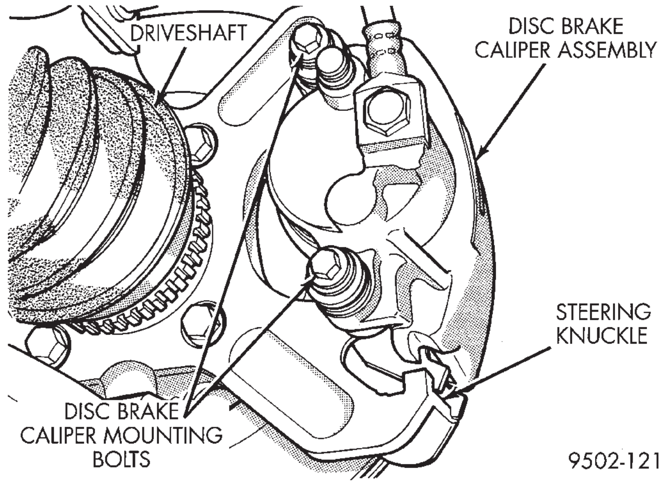


Fig. 62 Disc Brake Caliper Mounting

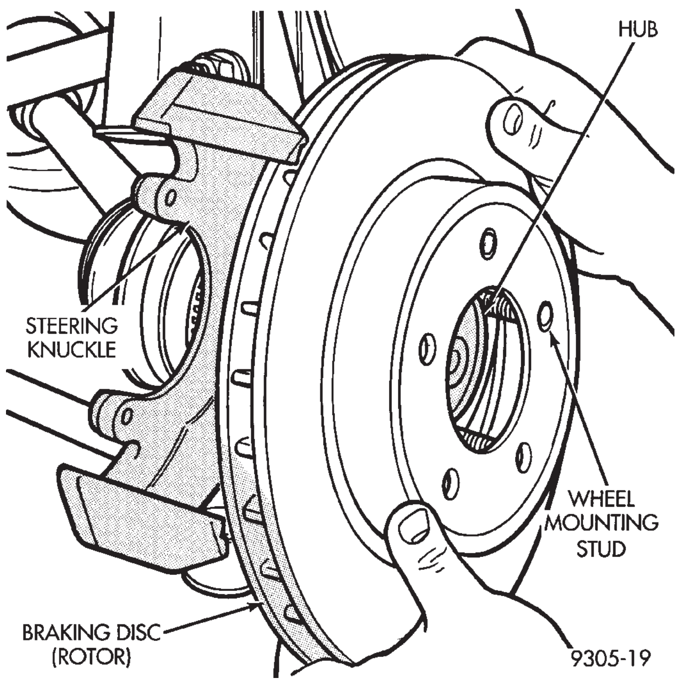


Fig. 63 Removing Braking Disc

INSTALL

(1) Install replacement wheel stud into flange of hub and bearing assembly. Install washers on wheel stud, then install a wheel lug nut on stud with flat side of lug nut against washers (Fig. 65).

(2) Tighten the wheel lug nut, pulling the wheel stud into the flange of the hub and bearing assembly. When the head of the stud is fully seated against the bearing flange, remove lug nut and washers from wheel stud.

(3) Install the braking disk back on the hub and bearing assembly. (Fig. 63)

REMOVAL AND INSTALLATION (Continued)

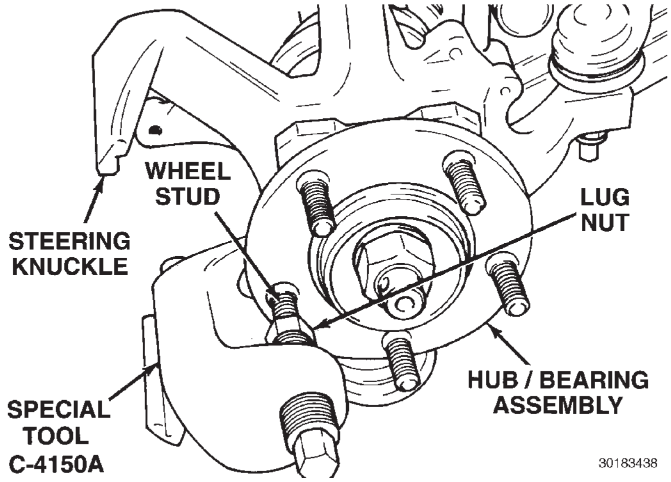


Fig. 64 Wheel Stud Removal From Hub/Bearing Assembly

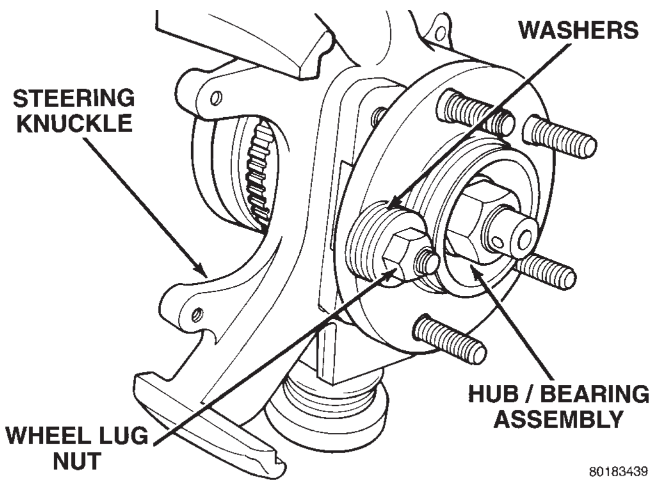


Fig. 65 Installing Wheel Stud Into Hub And Bearing

(4) Install front brake caliper back over braking disc and align with caliper mounting holes on steering knuckle (Fig. 62). Refer to Front Disc Brake Service in the Brake Section of this service manual for caliper installation procedure. Install the caliper adapter to steering knuckle attaching bolts and torque to 19 N·m (168 in. lbs.).

(5) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(6) Lower vehicle to the ground.

REAR WHEEL MOUNTING STUDS

REMOVE

CAUTION: If a wheel attaching stud needs to be replaced in the hub and bearing assembly the studs CAN NOT be hammered out of the hub flange. If a stud is removed by hammering it out of the bearing flange, damage to the hub and bearing assembly will occur leading to premature hub and bearing failure.

The following procedure and special tools shown **MUST** be used when replacing wheel attaching studs.

The hub and bearing assembly does not require removal from the rear axle for replacement of the wheel attaching studs.

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the rear wheel and tire assembly.

(3) Remove the rear brake drum.

(4) Install a lug nut on the wheel stud to be removed from the hub and bearing assembly (Fig. 66) so the threads on stud are even with end of lug nut. Install Remover, Special Tool C-4150A on hub and bearing assembly flange and wheel stud (Fig. 66).

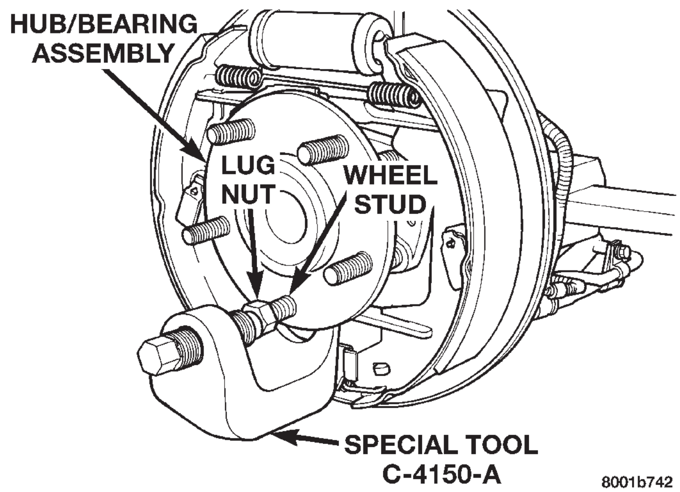


Fig. 66 Removing Wheel Stud From Hub And Bearing

(5) Tightening down on special tool will push wheel stud out of the hub and bearing assembly flange. Remove lug nut from stud and remove wheel stud from flange.

INSTALL

(1) Install replacement wheel stud into flange of hub and bearing assembly. Install washers on wheel stud, then install a wheel lug nut on stud with flat side of lug nut against washers (Fig. 67).

(2) Tighten the wheel lug nut, pulling the wheel stud into the flange of the hub and bearing assembly. When the head of the stud is fully seated against the bearing flange, remove lug nut and washers from wheel stud.

REMOVAL AND INSTALLATION (Continued)

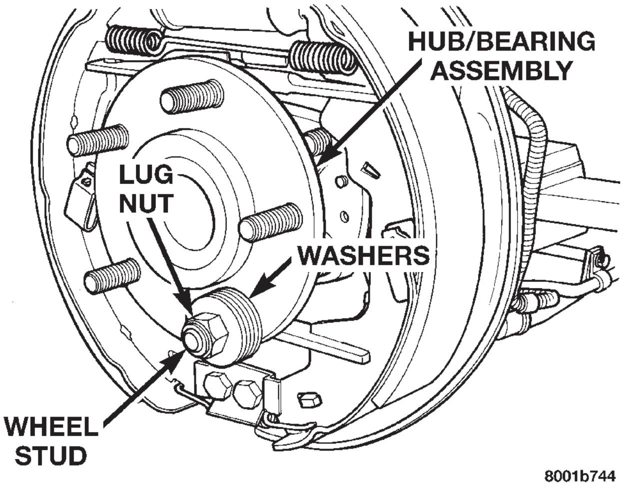


Fig. 67 Installing Wheel Stud Into Hub And Bearing

(3) Install the rear brake drum on the hub and bearing assembly.

(4) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(5) Lower vehicle to the ground.

DISASSEMBLY AND ASSEMBLY

Mc PHERSON STRUT

DISASSEMBLY

The Mc Pherson Strut must be remove from the vehicle for it to be disassembled and assembled. Refer to Mc Pherson Strut in the Removal And Installation Section in this group of the service manual for the required procedure to remove and install the Mc Pherson Strut.

(1) Clamp strut assembly in vise, with strut in a vertical position. **Do not clamp reservoir of strut assembly in vise, only clamp strut assembly using strut clevis bracket (Fig. 68).**

(2) Mark coil spring and strut assembly right or left, according to which side of vehicle strut was removed from, and which strut coil spring was removed from.

WARNING: DO NOT REMOVE STRUT ROD NUT, BEFORE STRUT ASSEMBLY COIL SPRING IS COMPRESSED, REMOVING SPRING TENSION FROM UPPER SPRING SEAT AND BEARING ASSEMBLY.

WARNING: WHEN COMPRESSING COIL SPRING FOR REMOVAL FROM STRUT ASSEMBLY, THE UPPER SPRING SEAT AND SECOND COIL OF THE

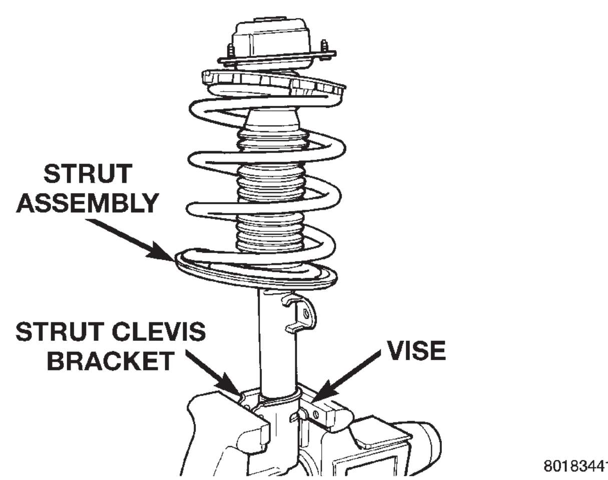


Fig. 68 Strut Assembly Correctly Installed In Vise

COIL SPRING MUST BE CAPTURED BY THE JAWS OF THE COIL SPRING COMPRESSOR (Fig. 69).

(3) Compress strut coil spring, using Pentastar Service Equipment Spring Compressor, 7522A (Fig. 69). Be sure the top and bottom attachment shoe selected, (Fig. 69) properly fit the coil spring.

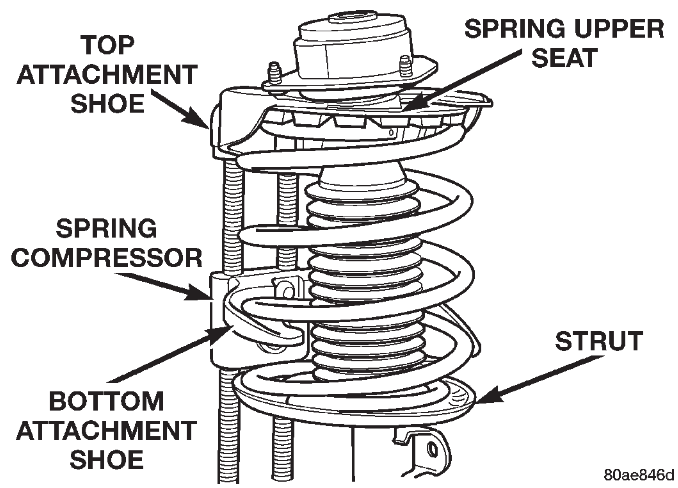


Fig. 69 Compressing Strut Assembly Coil Spring

(4) Install Socket, Strut Nut, Special Tool 6864 on the strut shaft retaining nut (Fig. 70). Then install a 10 mm socket on the hex of the strut shaft (Fig. 70). While holding strut shaft from turning, remove nut from strut shaft.

(5) Remove the upper mount (Fig. 71) from the strut shaft and coil spring upper seat.

(6) Release the coil spring from the spring compressor. Remove spring compressor from coil spring (Fig. 72).

(7) Remove the coil spring upper seat and pivot bearing (Fig. 72) as an assembly from the coil spring. Remove the coil spring from the strut. **Mark left**

DISASSEMBLY AND ASSEMBLY (Continued)

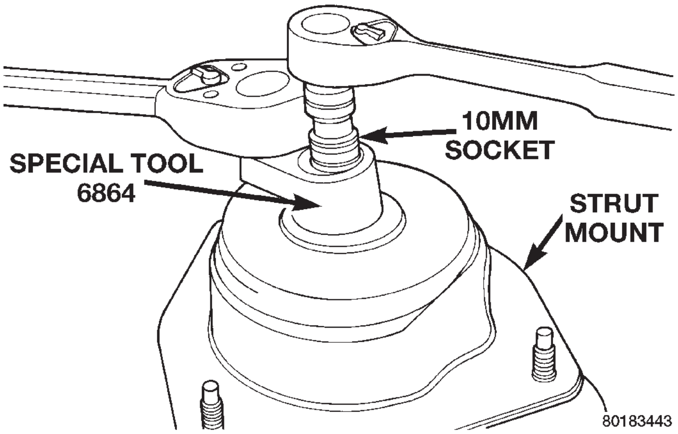


Fig. 70 Strut Shaft Retaining Nut Removal Tools

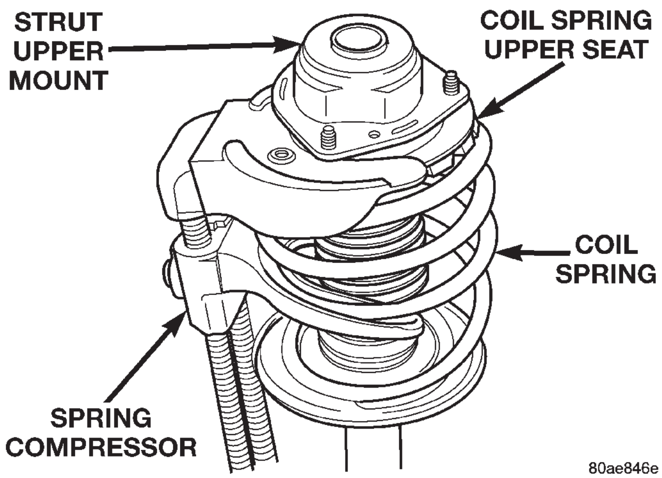


Fig. 71 Strut Assembly Upper Mount

and right springs for installation back on correct side of vehicle.

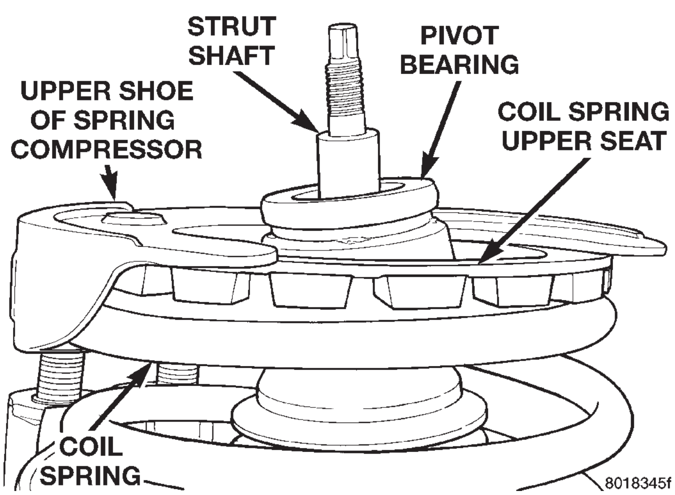


Fig. 72 Strut Assembly Pivot Bearing And Spring Seat

(8) Remove the dust shield and jounce bumper (Fig. 73) as an assembly from the strut shaft. The dust shield can not be removed from the jounce bumper until after it is removed from strut shaft.

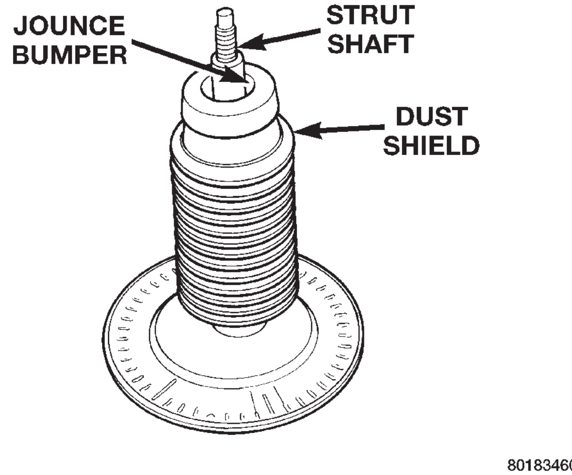


Fig. 73 Dust Shield Jounce Bumper

(9) Remove the jounce bumper from the dust shield. Jounce bumper is removed from dust shield by collapsing dust shield until jounce bumper can be grabbed and pulled out of the dust boot.

(10) Remove the spring isolator from the lower spring seat on the strut (Fig. 74).

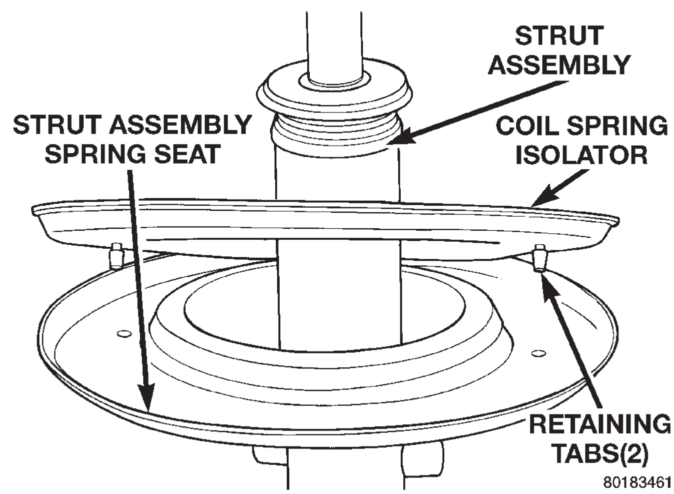


Fig. 74 Strut Lower Spring Seat Isolator

(11) Inspect strut damper for any condition of shaft binding over full stroke of the shaft.

(12) Inspect the strut mount and the upper spring seat assembly for the following:

- Mount for cracks and distortion and retaining studs for any sign of damage.
- Severe deterioration of rubber isolator,
- Binding strut assembly pivot bearing. If pivot bearing is replaced it is to be installed with the larger diameter end of bearing facing up.
- Inspect dust shield for rips and/or deterioration.

DISASSEMBLY AND ASSEMBLY (Continued)

• Inspect jounce bumper for cracks and signs of deterioration.

(13) Replace any components of the strut assembly found to be worn or defective during the inspection, before re-assembling the strut.

ASSEMBLY

(1) Clamp strut in vise, with strut in vertical position. **Do not clamp strut in vise by body of strut, only by the clevis bracket (Fig. 68).**

(2) Install the spring isolator on the strut lower spring seat (Fig. 74). When installing the spring isolator, be sure the 2 retaining tabs on the spring isolator (Fig. 74) are installed in the 2 holes in the spring seat. When properly installed, the oversize holes in the spring seat should line up with the holes in the spring isolator.

(3) Install the jounce bumper (Fig. 75) on the strut shaft. Jounce bumper is to be installed with the small end of the jounce bumper pointing down (Fig. 75).

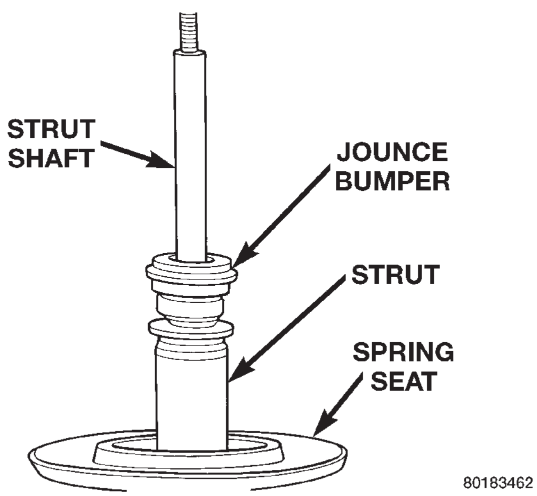


Fig. 75 Correctly Installed Jounce Bumper

(4) Install dust shield (Fig. 76) on the strut. **After dust shield is installed on strut, collapse dust shield down on top of jounce bumper until jounce bumper snaps into dust shield. Then return the dust shield to its fully extended length.**

(5) Install coil spring on strut. Spring is to be installed with the end of the bottom coil aligned with the clevis bracket on the strut assembly (Fig. 77).

(6) Install the upper spring seat on the coil spring (Fig. 77). Spring seat must be installed with the notch in the spring seat (Fig. 77) aligned with the clevis bracket on the strut.

WARNING: WHEN COMPRESSING THE COIL SPRING, THE COIL SPRING UPPER SEAT AND THE BOTTOM COIL OF THE SPRING MUST BE CAPTURED BY THE JAWS OF THE COIL SPRING COMPRESSOR.

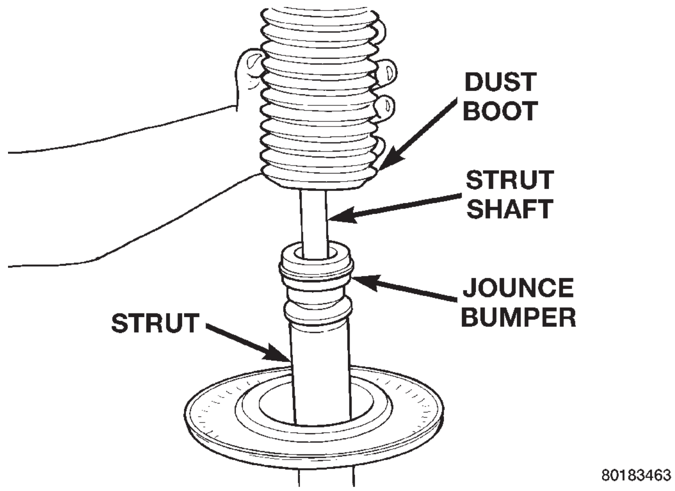


Fig. 76 Installing Dust Boot

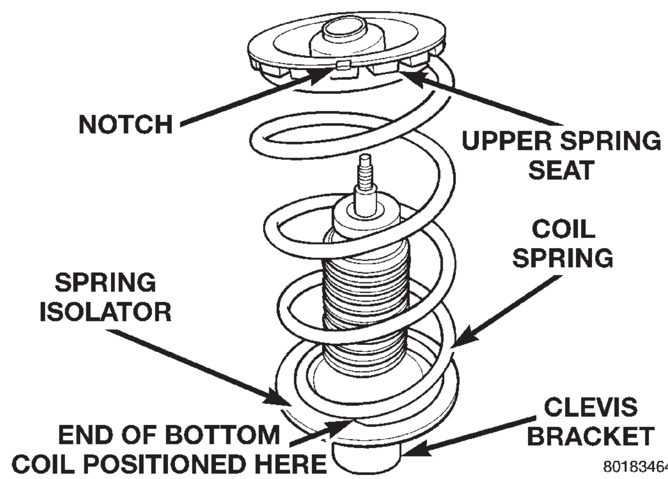


Fig. 77 Coil Spring And Spring Seat Correctly Installed

(7) Compress strut coil spring using Pentastar Service Equipment Spring Compressor, 7522A (Fig. 69). Be sure the top and bottom attachment shoe selected, (Fig. 69) properly fit the coil spring.

(8) Install the pivot bearing on the top of the upper spring seat (Fig. 78). **Bearing must be installed on spring seat with the smaller diameter side of the pivot bearing toward the spring seat (Fig. 78). Also, be sure the pivot bearing is sitting flat on the spring seat.**

(9) Install the strut mount on the upper spring seat of the strut. Loosely install the nut on strut shaft.

WARNING: THE FOLLOWING 2 STEPS MUST BE COMPLETELY DONE BEFORE SPRING COMPRESSOR IS RELEASED FROM THE COIL SPRING.

DISASSEMBLY AND ASSEMBLY (Continued)

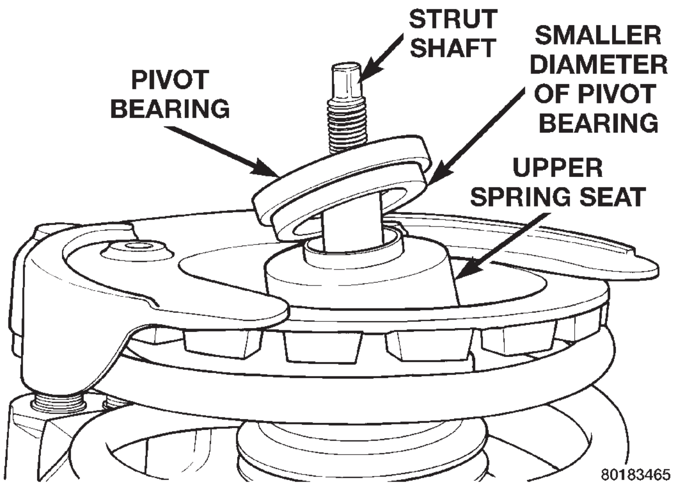


Fig. 78 Installing Pivot Bearing On Upper Spring Seat

(10) Install Socket, Strut Nut, Special Tool 6864 on the strut shaft retaining nut (Fig. 70). Then install a 10 mm socket on the hex of the strut damper shaft (Fig. 70). While holding strut shaft from turning, torque strut shaft retaining nut to 94 N·m (70 ft. lbs.).

(11) Loosen spring compressor until top coil of spring is fully seated against upper spring seat. Then relieve all tension from spring compressor and remove spring compressor from strut spring.

(12) Install strut back in vehicle. Refer to Mc Pherson Strut in the Removal And Installation Section in this group of the service manual for the required procedure to install the Mc Pherson Strut.

BALL JOINT SEAL BOOT

REMOVE

(1) Using a screw driver or other suitable tool, pry the seal boot off of the ball joint assembly (Fig. 79)

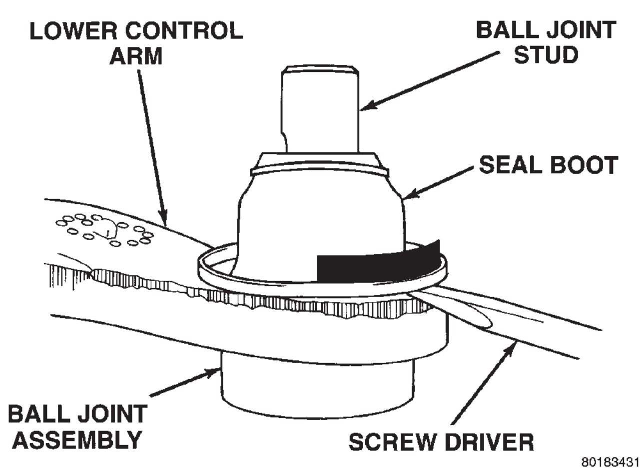


Fig. 79 Ball Joint Seal Boot Removal

INSTALL

CAUTION: When installing the ball joint seal on the ball joint/lower control arm, the shield (Fig. 80) on the ball joint seal must be positioned as shown.

(1) Install a **NEW** seal boot by hand as far as possible on the ball joint. Installation of the seal boot is to be with the shield positioned as shown (Fig. 80).

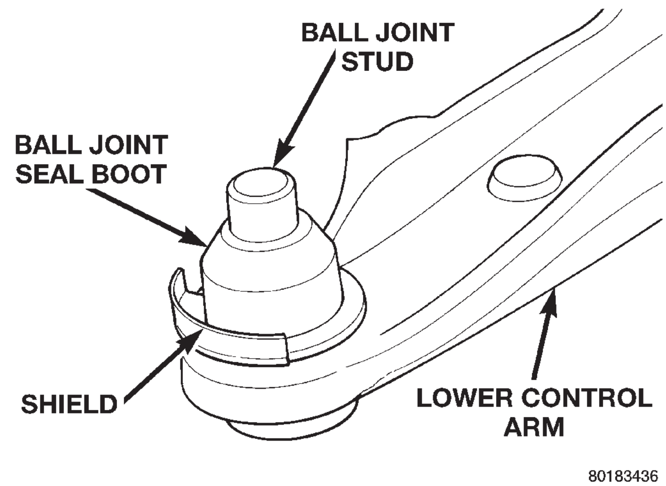


Fig. 80 Ball Joint Seal Boot Installed Position

CAUTION: Do not use an arbor press to install the sealing boot on the ball joint. Damage to the sealing boot will occur if excessive pressure is applied to the sealing boot when it is being installed.

(2) Place Installer, Special Tool 6758 over seal boot and squarely align it with bottom edge of seal boot (Fig. 81). Apply hand pressure to Special Tool 6758 until seal boot is pressed squarely against top surface of lower control arm.

CAUTION: A replacement ball joint is not prelubricated. Properly lubricate the replacement ball joint using Mopar Multi–Mile grease or an equivalent. Lubricate ball joint after seal boot is installed but prior to top of seal boot being pushed down below notch in ball joint stud. Air must vent out of the seal boot at notch when grease is pumped into ball joint, failure to do so will balloon and damage seal boot. Do not over grease the ball joint, this will prevent the seal boot from pushing down on the stud of the ball joint.

CAUTION: After the ball joint is properly greased, clip the end of the grease fitting off below the hex. The ball joint seal boot is non-purgeable and further greasing is not required and can result in damage to the seal boot.

DISASSEMBLY AND ASSEMBLY (Continued)

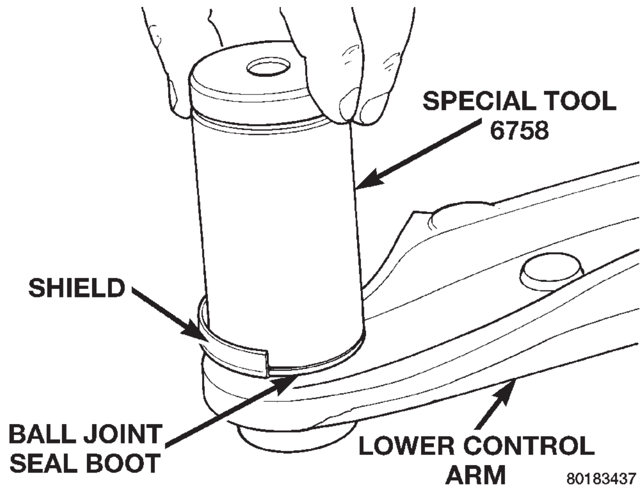


Fig. 81 Installing Ball Joint Seal Boot

LOWER CONTROL ARM FRONT BUSHING

REMOVE

(1) Remove the lower control arm from the front suspension cradle. Refer to Lower Control Arm in the Removal And Installation Section in this section of the service manual for the required procedure.

(2) Securely mount the lower control arm in a vise.

(3) Assemble for removal of the front bushing, the Bushing Receiver, Special Tool 6908–2, Bushing Remover, Special Tool 6908–1, Nut, Special Tool 6908–3 thrust washer, threaded rod and small nut, as shown in (Fig. 82) on the lower control arm and front bushing.

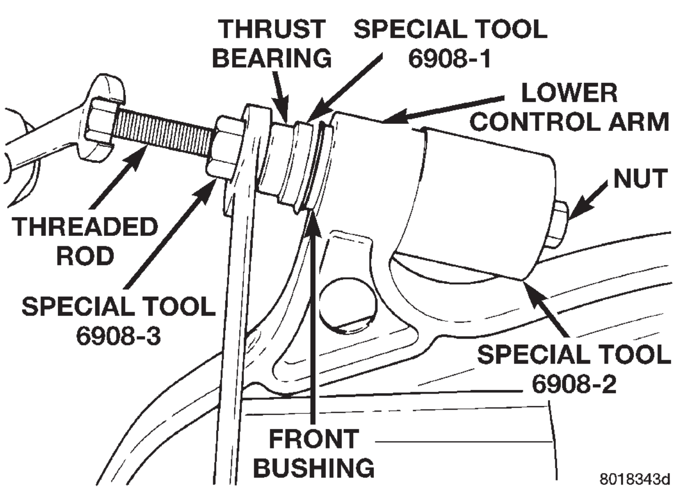


Fig. 82 Tools Assembled For Removal Of Front Bushing

(4) To remove front bushing from lower control arm, hold the threaded rod stationary and tighten the Nut, Special Tool 6908–3 (Fig. 82). This will force the front bushing out of the lower control arm and into Bushing Receiver, Special Tool 6908–2 (Fig. 82).

INSTALL

(1) Securely mount the lower control arm in a vise.

NOTE: The lower control arm front bushing is a directional bushing. It must be installed in the lower control arm positioned as shown in (Fig. 83).

(2) Position the front bushing in the lower control arm so that the 2 rubber blocks on the bushing are positioned horizontally as shown in (Fig. 83).

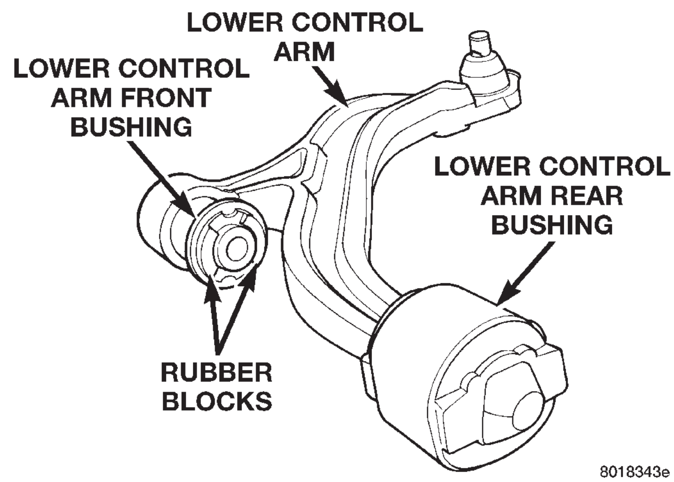


Fig. 83 Installation Position Of Lower Control Arm Front Bushing

(3) Assemble for installation of the front bushing, the Bushing Receiver, Special Tool 6908–5, Bushing Installer, Special Tool 6908–4, Nut, Special Tool 6908–3 thrust washer, threaded rod and small nut, as shown in (Fig. 84) on the lower control arm and front bushing.

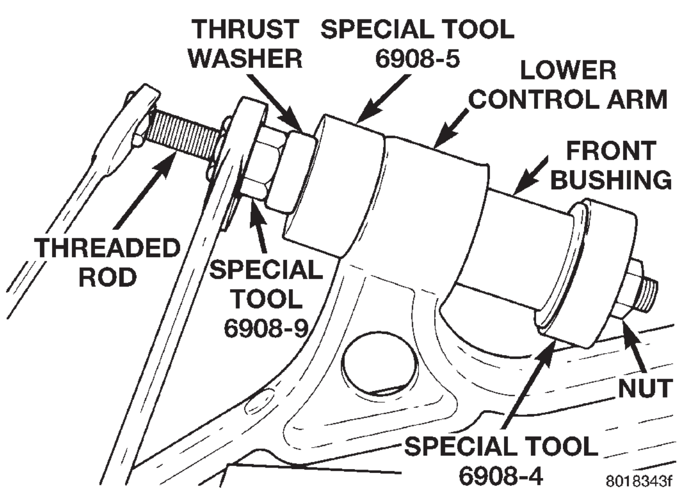


Fig. 84 Tools Assembled For Installation Of Front Bushing

(4) To install the front bushing in lower control arm, hold the threaded rod stationary and tighten

DISASSEMBLY AND ASSEMBLY (Continued)

the Nut, Special Tool 6908–3 (Fig. 84). This will pull the front bushing into the lower control arm.

(5) Continue pulling the bushing into the lower control arm until bushing is seated squarely against the lower control arm and there is no gap between the bushing and the lower control arm (Fig. 85).

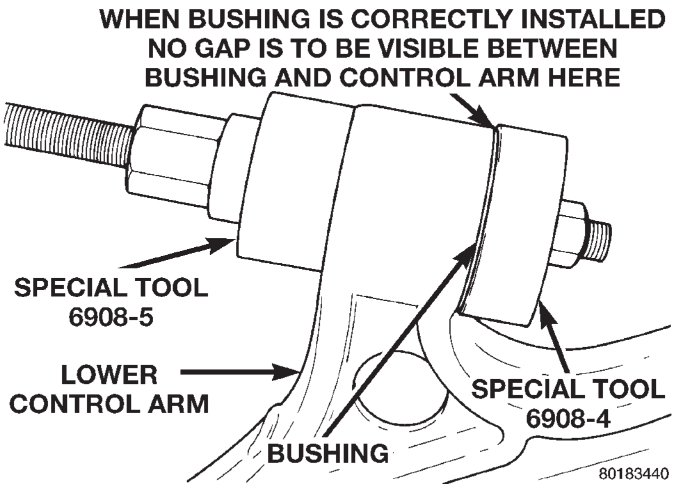


Fig. 85 Correctly Installed Lower Control Arm Bushing

(6) Install the lower control arm on the front suspension cradle. Refer to Lower Control Arm in the Removal And Installation Section in this group of the service manual for the required procedure.

LOWER CONTROL ARM REAR BUSHING

REMOVE

(1) Remove the lower control arm from the front suspension cradle. Refer to Lower Control Arm in the Removal And Installation Section in this group of the service manual for the required procedure.

(2) Mount the lower control arm in a vise **without** using excessive clamping force.

(3) Using a sharp knife, (such as a razor) slit the bushing lengthwise (Fig. 86) to allow its removal from the lower control arm (Fig. 86).

(4) Remove the bushing from the lower control arm.

INSTALL

CAUTION: Do not apply grease or any other type of lubricant other than the silicone lubricant specified below to the control arm bushing.

(1) Apply Mopar Silicone Spray Lube or an equivalent, to the hole in lower control arm rear bushing. This will aid in the installation of the bushing on the lower control arm.

(2) With the lower control arm held securely in a vise, install bushing on lower control arm. Install

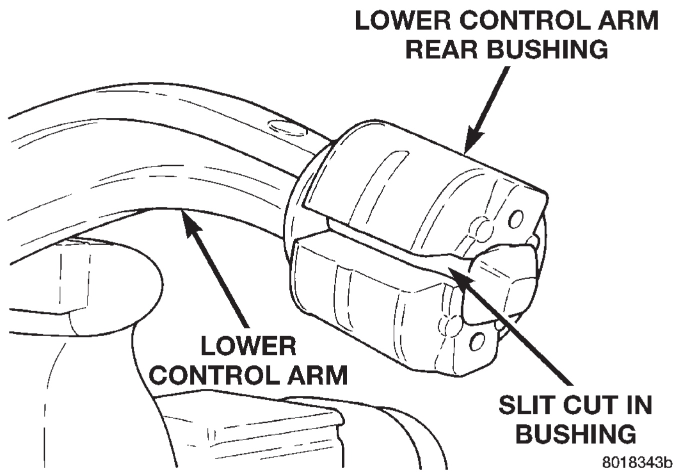


Fig. 86 Slit Lower Control Arm Rear Bushing

bushing by pushing and rocking the bushing until it is fully installed on lower control arm. Be sure when bushing is installed it is past the upset on the end of the lower control arm (Fig. 87).

(3) The rear bushing of the lower control arm, when correctly installed, is to be positioned on the lower control arm as shown in (Fig. 87).

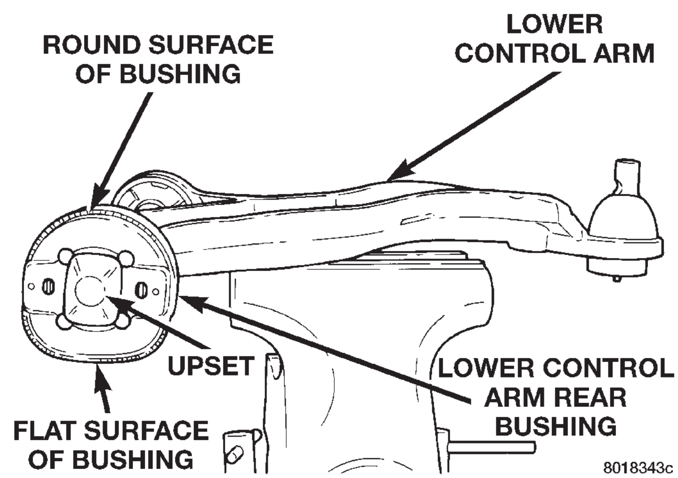


Fig. 87 Correctly Installed Lower Control Arm Bushing

STABILIZER BAR BUSHING

Disassembly/Assembly

(1) If stabilizer bar to front suspension cradle bushings require replacement at time of inspection, install new bushings before installing stabilizer bar. Stabilizer bar bushings are replaced by opening the slit on the bushings and peeling them off the stabilizer bar. Install new bushings on stabilizer bar, by spreading bushing at slit and forcing them on stabilizer bar.

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Bushings must be installed on stabilizer bar so the square corner of the bushing will be down and slit in bushing will be facing the rear of the vehicle when the stabilizer is installed (Fig. 88).

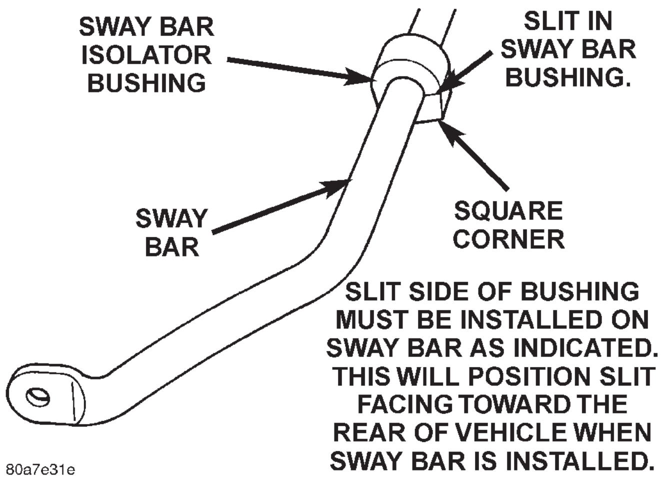


Fig. 88 Correctly Installed Stabilizer Bar To Cradle Bushing

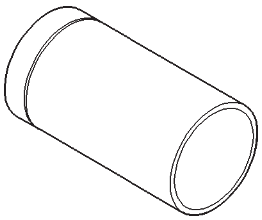
SPECIFICATIONS

FRONT SUSPENSION FASTENER TORQUES

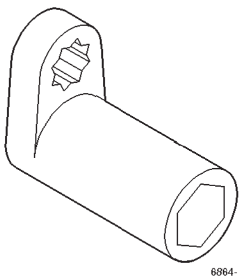
DESCRIPTION	TORQUE
McPHERSON STRUT:	
To Strut Tower Attaching Nuts	28 N·m (250 in. lbs.)
Clevis Bracket To Steering Knuckle	88 N·m (65 ft. lbs.) Plus 1/4 Additional Turn
Strut Shaft Nut	100 N·m (75 ft. lbs.)
STEERING KNUCKLE:	
Ball Joint Stud To Steering Knuckle Nut/Bolt	136 N·m (100 ft. lbs.)
Disc Brake Caliper Bolts	22 N·m (16 ft. lbs.)
Wheel Stop	95 N·m (70 ft. lbs.)
STEERING GEAR:	
To Suspension Cradle Attaching Bolts	183 N·m (135 ft. lbs.)
Tie Rod End Adjusting Sleeve Nut	75 N·m (55 ft. lbs.)
Tie Rod End To Steering Knuckle Nut	61 N·m (45 ft. lbs.)
FRONT SUSPENSION CRADLE:	
To Body Attaching Bolts	163 N·m (120 ft. lbs.)
Lower Control Arm Pivot Bolt	185 N·m (137 ft. lbs.)
Lower Control Arm Rear Bushing Retainer Bolt	68 N·m (50 ft. lbs.)
Reinforcement Plate Attaching Bolts M-12	108 N·m (80 ft. lbs.)
Reinforcement Plate Attaching Bolts M-14	166 N·m (123 ft. lbs.)
STABILIZER BAR:	
Bushing Retainer ToSuspension Cradle Attaching Bolts	70 N·m (50 ft. lbs.)
Attaching Link Nuts	88 N·m (65 ft. lbs.)
HUB AND BEARING:	
To Steering Knuckle Bolts	110 N·m (80 ft. lbs.)
Front Stub Axle To Hub Bearing Nut	183 N·m (135 ft. lbs.)
Wheel Mounting Lug Nut	110-135 N·m (85-115 ft. lbs.)

SPECIAL TOOLS

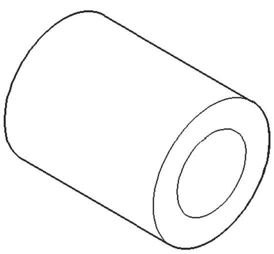
FRONT SUSPENSION



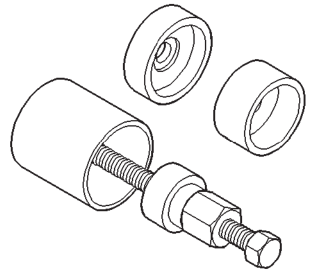
Installer Ball Joint 6758



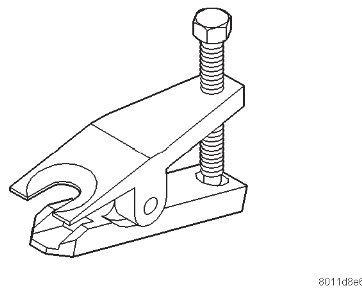
Wrench Strut Rod Nut 6864



Remover Ball Joint 6919



Remover/Installer Control Arm Bushing 6908



Remover Tie Rod End MB–991113

REAR SUSPENSION

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GENERAL INFORMATION

REAR SUSPENSION

The rear suspension design on this vehicle uses leaf springs and a tube and casting axle (Fig. 1) and (Fig. 2). It is designed to handle the various load requirements of the vehicle. The leaf springs used on the rear suspension of this vehicle are of either a mono-leaf or multi-leaf design.

The rear axle used on front wheel drive applications of this vehicle is mounted to the rear leaf springs using isolator bushings at the axle mounting brackets.

The rear axle used on all wheel drive applications of this vehicle is also mounted to the rear leaf springs but does not use isolator bushings between the rear axle and the leaf springs.

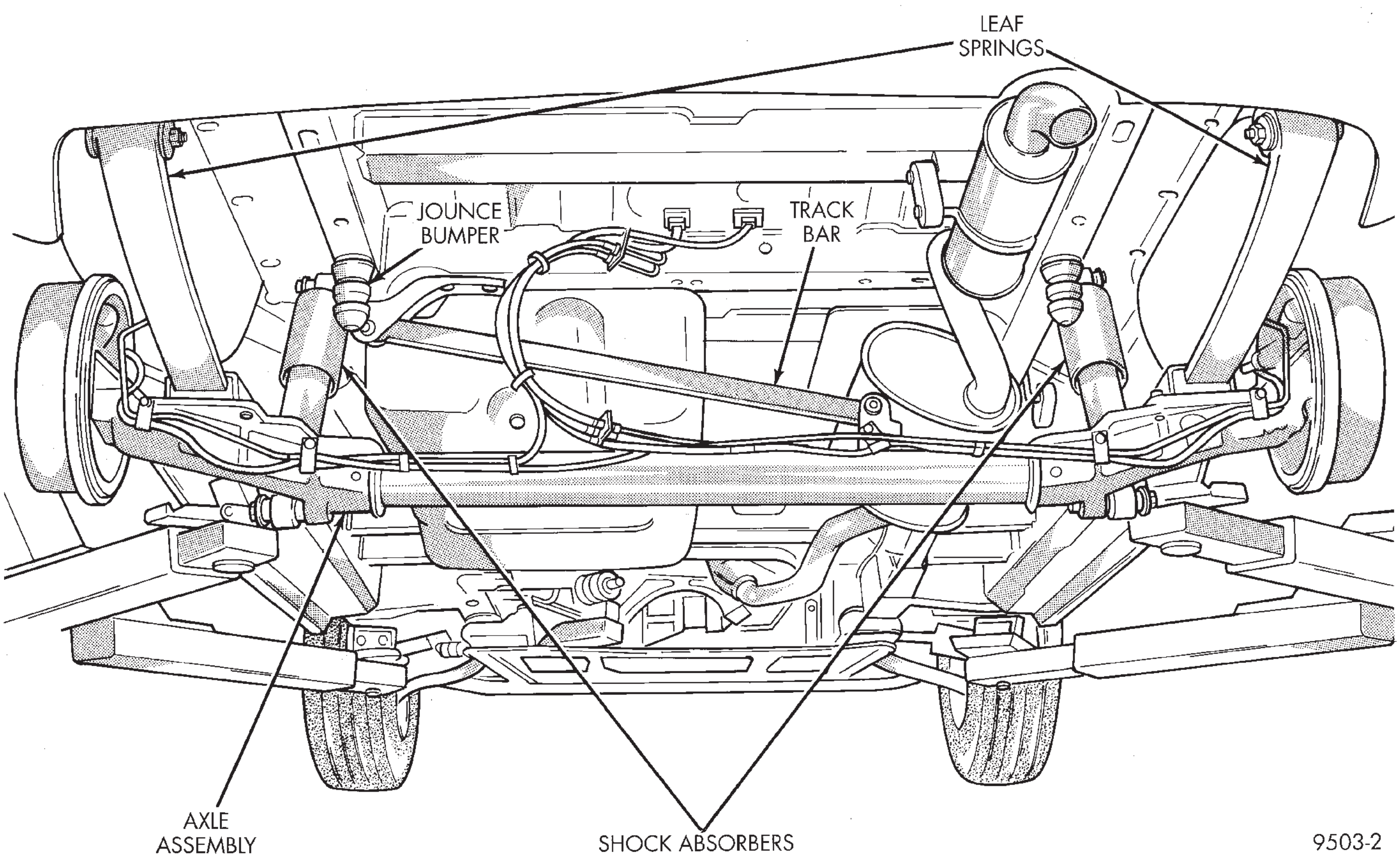

Fig. 1 Front Wheel Drive Rear Suspension

GENERAL INFORMATION (Continued)

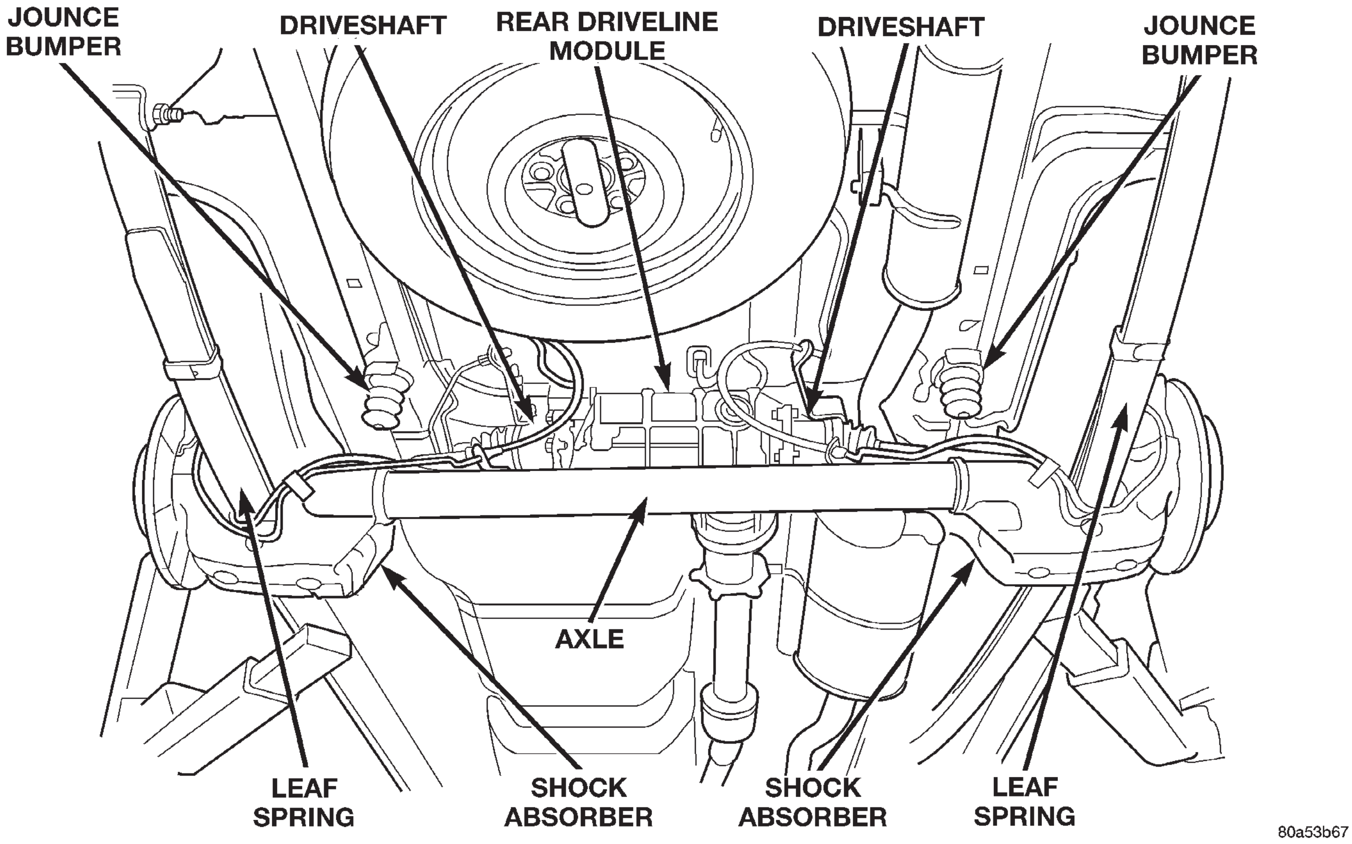

Fig. 2 All Wheel Drive Rear Suspension

The rear suspension used on the front wheel drive commercial version of this vehicle is unique to this application. The rear axle is mounted to the rear leaf springs as on the non-commercial application of this vehicle but does not use any isolators between the spring and the axle. The leaf spring used on the commercial version of this vehicle is a multi-leaf spring but is a unique design for the commercial application.

The rear leaf spring shackle angles provide increasing suspension rates as the vehicle is loaded. This provides a comfortable unloaded ride and also ample rear suspension travel when the vehicle is loaded.

A new type of load-leveling shock is available. The self leveling shock absorbers are a self-contained vehicle leveling system and shock absorber combined. The shock absorbers are mounted at an angle, parallel to the springs and forward at the top. This design provides greater stability in addition to controlling ride motion.

The rear wheel bearings used are similar to the bearings used in the front wheels. The bearings are permanently sealed and require no maintenance. The bearing and hub are serviced as an assembly. For service procedures, refer to Group 5, Brakes.

DESCRIPTION AND OPERATION

REAR WHEEL ALIGNMENT

Alignment adjustment is not required. The rear axle alignment settings are preset at the factory and therefore no alignment is necessary.

REAR TRACK BAR

On front wheel drive applications of this vehicle that are equipped with single leaf rear springs a track bar (Fig. 3) is used on the rear axle.

The track bar connects the rear axle to the frame/body of the vehicle. The track bar is isolated from the body of the vehicle by an isloator bushing located in each end of the track bar.

The track bar (Fig. 3) prevents excessive side to side movement of the rear axle. The track bar is used to keep the location of the axle in the correct position for optimum handling and control of the vehicle.

STABILIZER BAR

The stabilizer bar (Fig. 4) interconnects both sides of the rear axle and attaches to the rear frame rails using 2 rubber isolated link arms.

Jounce and rebound movements affecting one wheel are partially transmitted to the opposite wheel to reduce body roll.

DESCRIPTION AND OPERATION (Continued)

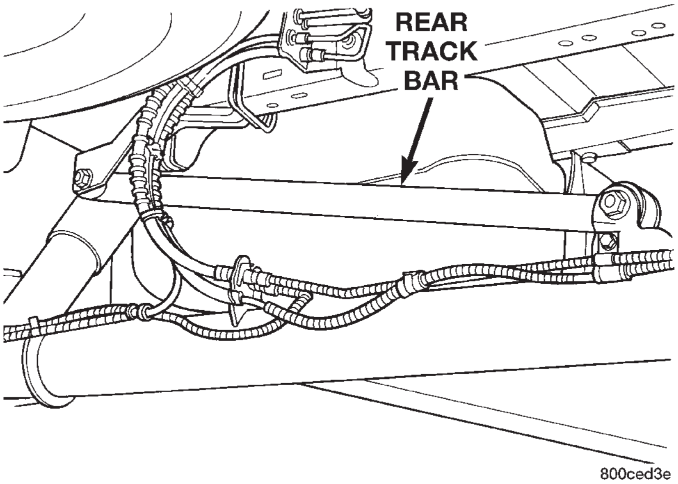

Fig. 3 Rear Track Bar

Attachment to the rear axle tube, and rear frame rails is through rubber-isolated bushings. All parts are serviceable, and the stabilizer bar to axle bushings are split for easy removal and installation. The split in the bushing should be positioned up when the stabilizer bar is installed on the vehicle.

The 2 rubber isolated link arms are connected to the rear frame rails by brackets. These brackets are bolted to the bottom of the frame rails.

SHOCK ABSORBERS (REAR LOAD LEVELING)

A new type of load-leveling shock is available. The self leveling shock absorbers are a self-contained vehicle leveling system and shock absorber combined. It does not require an external compressor, hoses, height leveling sensors, etc. It uses road inputs (bumps, stops, starts, turns, acceleration, deceleration, etc.) to activate pumping, which is just the extension and compression of the shock absorber. On the outside, it looks like a larger than normal shock absorber. Internally, it consists of a hydraulic pump and gas-spring cushion for leveling, as well as the normal shock absorbing mechanism. All the height leveling sensors, pump, etc., are contained inside the shocks. The shocks are mounted at an angle, parallel to the springs and forward at the top. This design provides greater stability in addition to controlling ride motion. These new load-leveling shock absorbers use longer fasteners than the standard shock absorbers, although the fasteners are longer, the torque specifications are the same.

REMOVAL AND INSTALLATION

REAR SPRINGS (FWD)

REMOVAL

(1) Raise vehicle on frame contact hoist to a comfortable working position.

(2) Support axle with a jack stand. Pad should just contact axle.

(3) Begin removal of the shock absorber lower mounting bolt (Fig. 5).

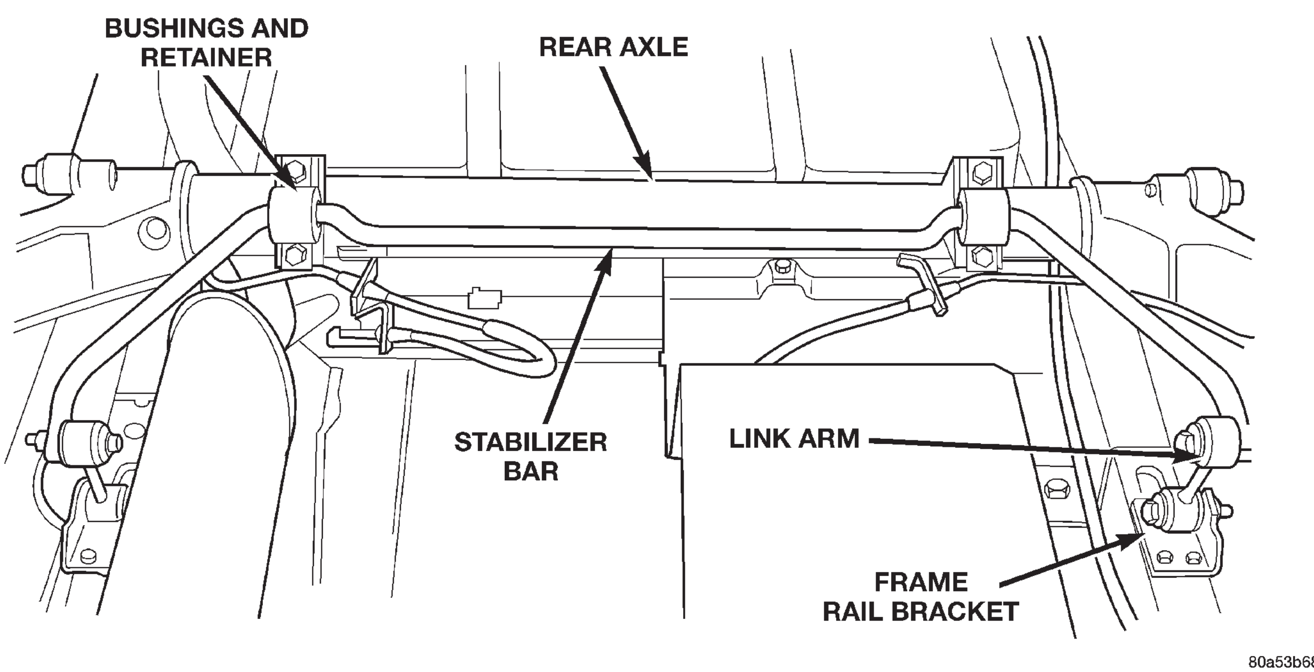

Fig. 4 Stabilizer Bar

REMOVAL AND INSTALLATION (Continued)

NOTE: If shock absorber bolt deflects upward during removal, raise axle by adjusting support jack. If shock absorber bolt deflects downward during removal, lower axle by adjusting support jack (or by pulling on axle).

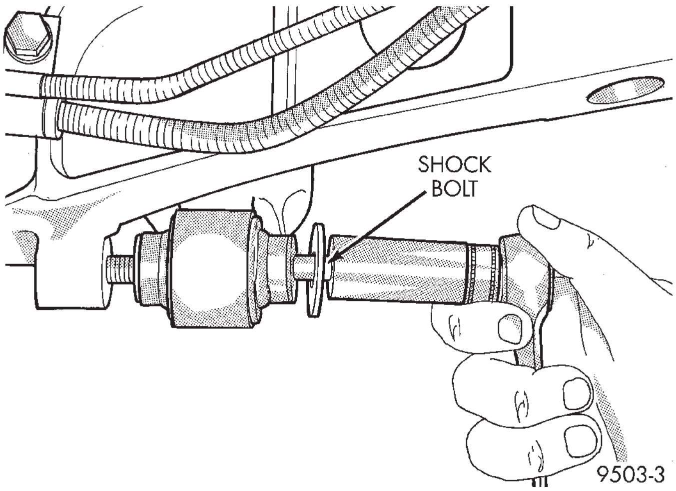

Fig. 5 Rear Shock Mounting Bolt

(4) Using 2 jack stands positioned under the outer ends of the axle, raise the axle enough to remove the weight of the axle from the rear springs.

(5) Loosen and remove the axle plate bolts from the rear axle (Fig. 6).

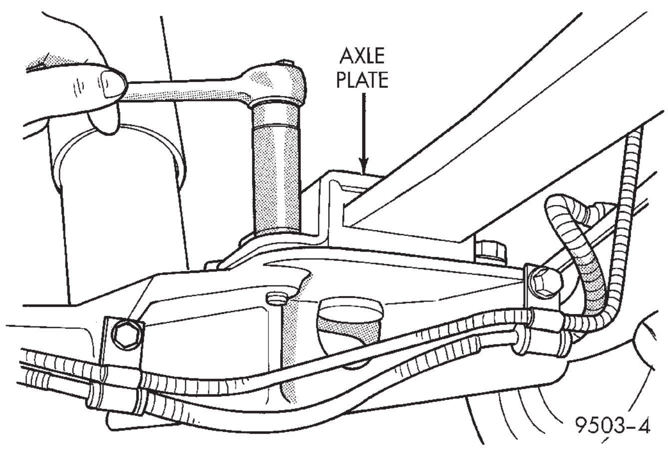

Fig. 6 Axle Plate Bolts

(6) Remove the axle plate from the rear axle and the leaf spring (Fig. 7).

(7) Using the jack stands **slowly** lower the rear axle, permitting the rear springs to hang free.

(8) Loosen and remove the 4 bolts (Fig. 8) from the front mount of the leaf spring.

(9) Loosen and remove the nuts from the spring hanger (Fig. 9) for the rear leaf spring. Then remove the hanger plate from the hanger and remove the spring from the spring hanger (Fig. 9).

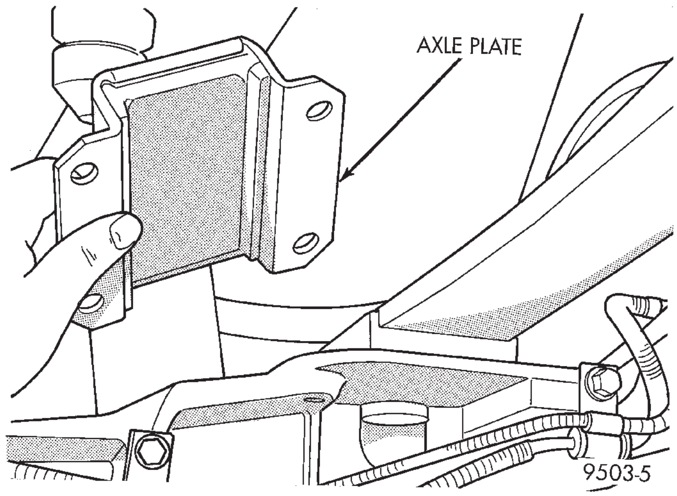

Fig. 7 Axle Plate

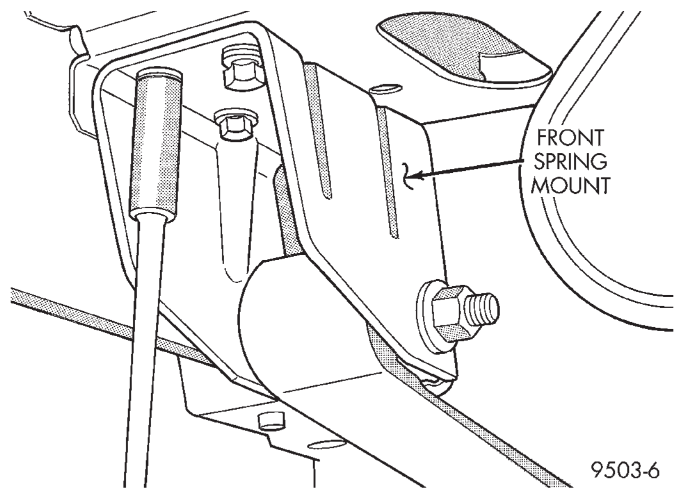

Fig. 8 Leaf Spring Front Mount

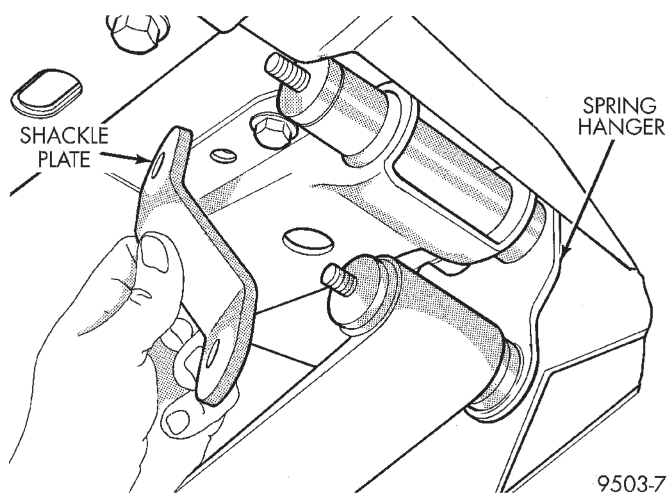

Fig. 9 Rear Spring Hanger

REMOVAL AND INSTALLATION (Continued)

(10) Remove the leaf spring from the vehicle (Fig. 10).

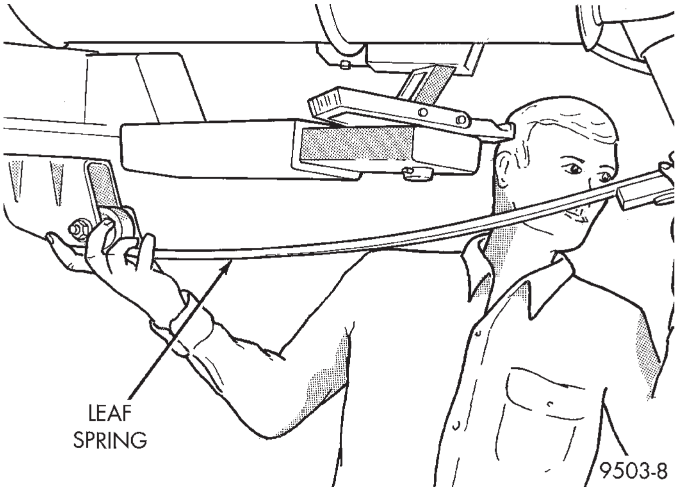

Fig. 10 Leaf Spring Remove/Install

(11) Loosen and remove the pivot bolt from the front mount of the rear leaf spring. (Fig. 11).

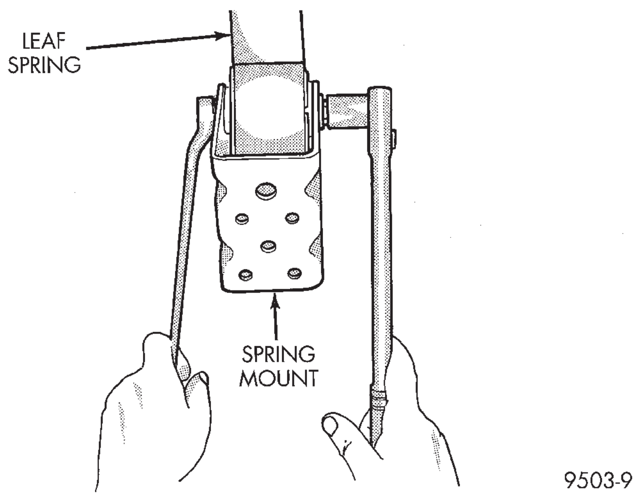

Fig. 11 Leaf Spring Front Mount

FRONT BUSHING REPLACEMENT

(1) Install leaf spring in a proper holding fixture.
(2) Install leaf spring press Special Tool C-4212–F.
(3) Install adapter Special Tool C-4212–3.
(4) Tighten leaf spring press until bushing is extracted from leaf spring.
(5) Remove leaf spring press from leaf spring.
(6) Insert replacement bushing into the leaf spring eye. **Verify that the bushing flange is on the left side of the leaf spring when leaf spring is in the in vehicle installed position.**
(7) Install leaf spring press Special Tool C-4212–F.
(8) Install adapter Special Tool C-4212–4.
(9) Tighten leaf spring press until bushing flange bottoms solidly against leaf spring eye.
(10) Remove leaf spring press and adapter.
(11) Bend the bushing tabs so that they are contacting the leaf spring.

INSTALLATION

(1) Assemble front spring mount to front of spring eye and install pivot bolt and nut. Do not tighten.

CAUTION: Pivot bolt must face inboard to prevent structural damage during installation of spring.

(2) Raise front of spring and install four hanger bolts, tighten to 61 N·m (45 ft. lbs.) torque.
(3) Install rear of spring onto rear spring shackle. Install shackle plate. Do not tighten.
(4) Verify lower leaf spring isolator is in position.
(5) Raise axle into correct position on leaf spring with axle centered under spring locator post (Fig. 12).

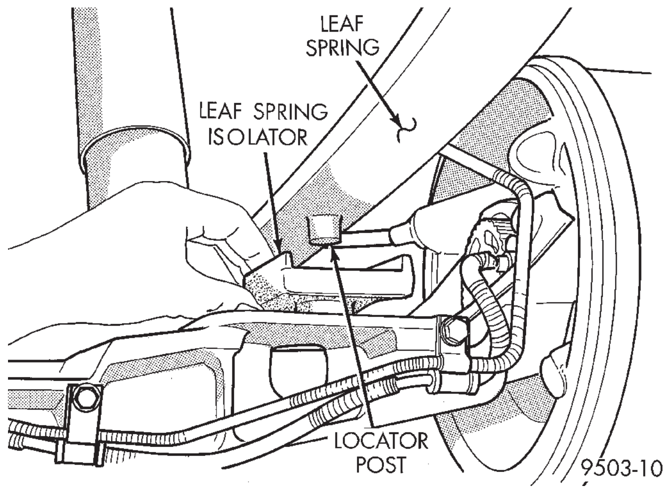

Fig. 12 Leaf Spring Locator Post

(6) Verify that the leaf spring isolator is correctly positioned in the axle plate.
(7) Install axle plate on the spring.
(8) Install axle plate bolts. Tighten bolts to 108 N·m (80 ft. lbs.) torque.
(9) Install shock absorber bolts. Do not tighten.
(10) Lower vehicle to floor so that the full weight of vehicle is supported by the tires.
(11) Tighten component fasteners as follows:

- Front pivot bolt—156 N·m (115 ft. lbs.)
- Shackle nuts—61 N·m (45 ft. lbs.)
- Shock absorber bolts—101 N·m (75 ft. lbs.)

(12) If the vehicle is not equipped with antilock brakes, raise vehicle and the connect the actuator for the height sensing proportioning valve on the rear leaf spring. Adjust the height sensing proportioning valve. Refer to the Adjustment Section in this group of the service manual for the required adjustment procedure.

REMOVAL AND INSTALLATION (Continued)

REAR SPRINGS (AWD)

REMOVE

(1) Raise vehicle on frame contact hoist to a comfortable working position.

(2) Remove the driveshaft from the side of the vehicle that requires the removal of the leaf spring. Refer to Group 3 Driveline in this service manual for the procedure covering the removal of the rear driveshafts.

(3) Support axle with a jack stand. Pad should just contact axle.

NOTE: If shock absorber bolt deflects upward during removal, raise axle by adjusting support jack. If shock absorber bolt deflects downward during removal, lower axle by adjusting support jack (or by pulling on axle).

(4) Begin removal of the shock absorber lower mounting bolt (Fig. 13).

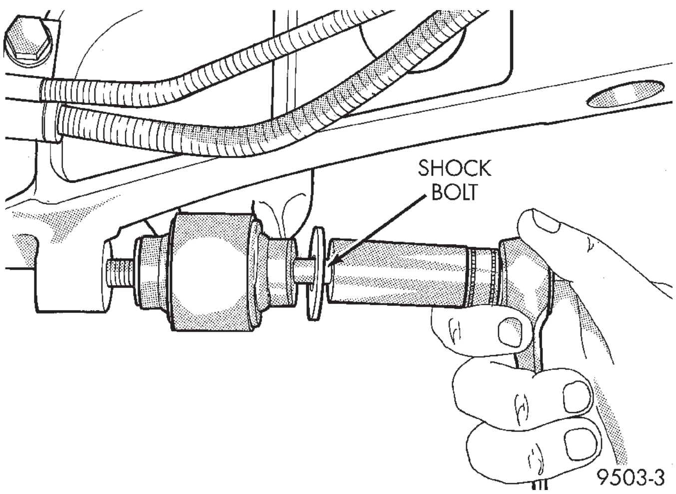

Fig. 13 Rear Shock Absorber Mounting Bolt

(5) Using 2 jack stands positioned under the outer ends of the axle, raise the axle enough to remove the weight of the axle from the rear springs.

(6) Loosen and remove the axle plate bolts from the rear axle (Fig. 14).

(7) Using the jack stands **slowly** lower the rear axle, permitting the rear springs to hang free.

(8) Loosen and remove the 4 bolts (Fig. 15) at the front mount of the rear leaf spring.

(9) Loosen and remove the 2 bolts and the 2 nuts from the spring hanger (Fig. 16) for the rear leaf spring. Then remove the inner half of the spring hanger from the outer half hanger of the spring hanger and the spring. (Fig. 16).

(10) Remove the rear leaf spring from the outer half of the spring hanger

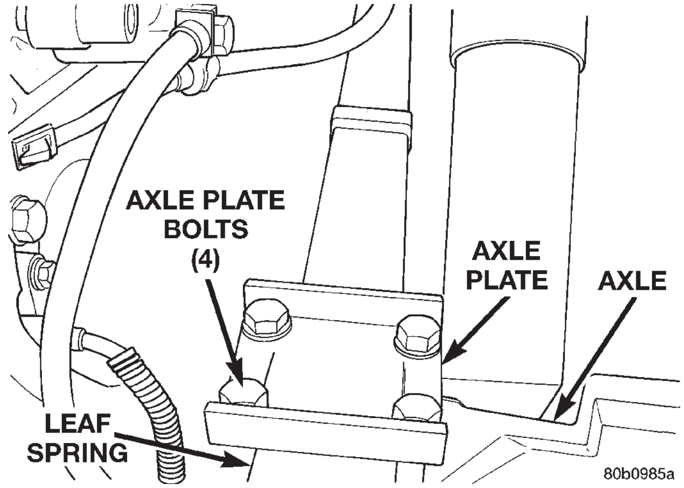

Fig. 14 Axle Plate Bolts

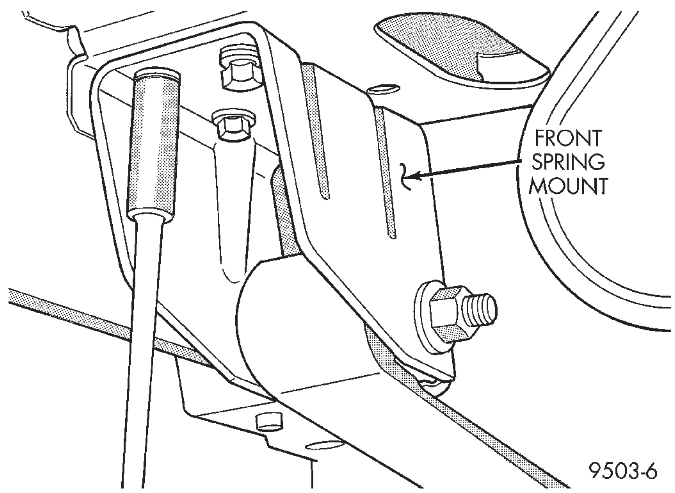

Fig. 15 Leaf Spring Front Mount

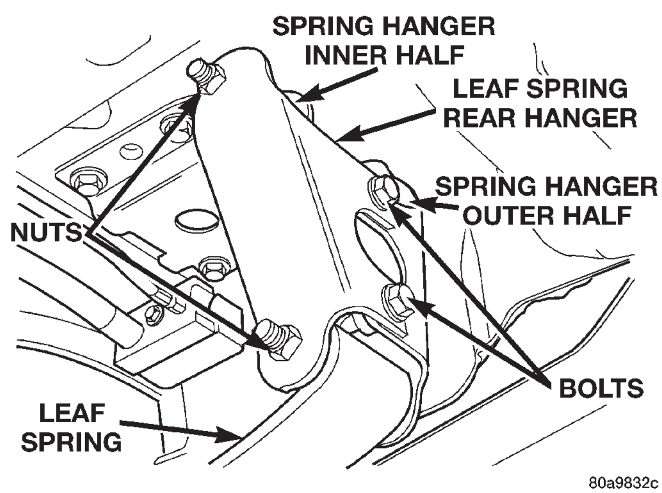

Fig. 16 Rear Spring Hanger

REMOVAL AND INSTALLATION (Continued)

(11) Remove the leaf spring from the vehicle (Fig. 17).

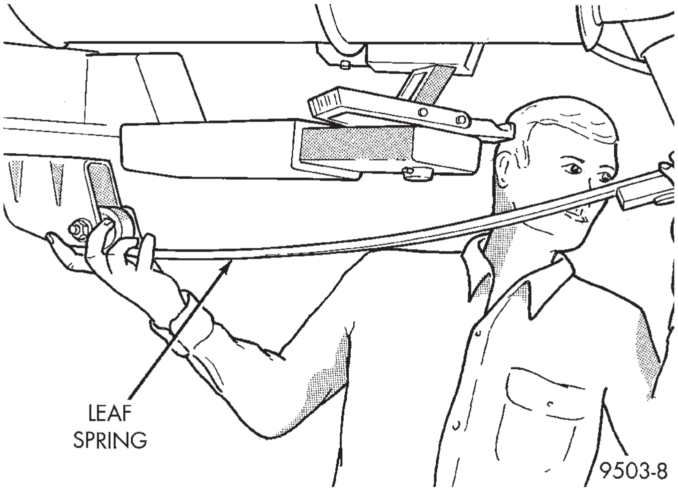

Fig. 17 Leaf Spring Remove/Install

(12) Loosen and remove the pivot bolt from the front mount of the rear leaf spring. (Fig. 18).

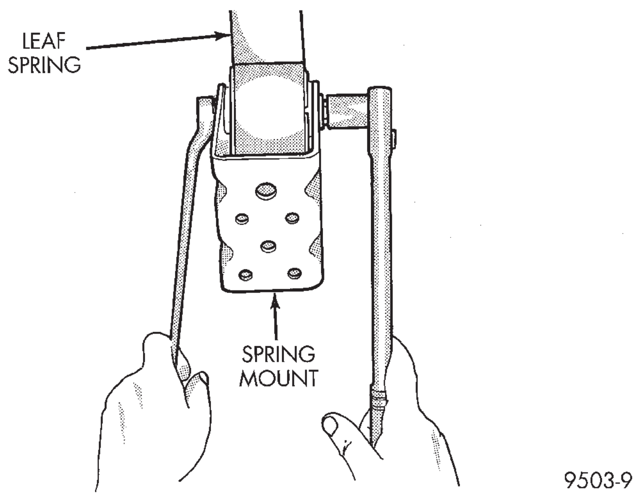

Fig. 18 Leaf Spring Front Mount

FRONT BUSHING REPLACEMENT

(1) Install leaf spring in a proper holding fixture.
(2) Install leaf spring press Special Tool C-4212–F.
(3) Install adapter Special Tool C-4212–3.
(4) Tighten leaf spring press until bushing is extracted from leaf spring.
(5) Remove leaf spring press from leaf spring.
(6) Insert replacement bushing into the leaf spring eye. Verify that the bushing flange is on the outboard side of the leaf spring.
(7) Install leaf spring press Special Tool C-4212–F.
(8) Install adapter Special Tool C-4212–4.
(9) Tighten leaf spring press until bushing flange bottoms solidly against leaf spring eye.
(10) Remove leaf spring press and adapter.
(11) Bend the tabs on the bushing until they are contacting the leaf spring.

INSTALL

CAUTION: Pivot bolt must face inboard to prevent structural damage during installation of spring.

(1) Install the front of the rear leaf spring into the spring mount (Fig. 18). Install the pivot bolt and nut. **Do not tighten the pivot bolt at this time.**
(2) Position the front spring mount for the rear leaf spring against the floor pan of the vehicle. Install the 4 mounting bolts for the spring mount. Tighten the 4 mounting bolts to a torque of 61 N·m (45 ft. lbs.).
(3) Install the rear of the leaf spring onto the outer half of the rear hanger. Install the inner half of the rear hanger. Install the nut and bolts on the rear hanger **but do not tighten at this time.**
(4) Raise axle assembly into correct position with axle centered under spring locator post.
(5) Install axle plate bolts. Tighten bolts to 108 N·m (80 ft. lbs.) torque.
(6) Install shock absorber bolts. Do not tighten.
(7) Lower vehicle to floor and with full weight of vehicle on wheels. Tighten component fasteners as follows:

CAUTION: The following sequence must be followed when tightening the pin nuts on the rear hanger for the rear leaf spring. First the hanger pin nuts must be tightened to the specified torque shown below. Then tighten the retaining bolts for the inner to outer half of the spring hanger to the torque specification listed below. This sequence must be followed to properly seat the bushings into the springs and to avoid bending the spring hanger.

- Front pivot bolt-156 N·m (115 ft. lbs.)
- Rear spring hanger pin nuts-61 N·m (45 ft. lbs.)
- Rear spring hanger inner to outer half retaining bolts-61 N·m (45 ft. lbs.)
- Shock absorber upper mounting bolt-115 N·m (85 ft. lbs.)
- Shock absorber lower mounting bolt-108 N·m (80 ft. lbs.)

(8) If the vehicle is not equipped with antilock brakes, raise vehicle and connect the actuator for the height sensing proportioning valve on the rear leaf spring. Adjust the height sensing proportioning valve. Refer to the Adjustment Section in this group of the service manual for the required adjustment procedure.

REMOVAL AND INSTALLATION (Continued)

SHOCK ABSORBER

REMOVE/INSTALL

(1) Raise vehicle. Vehicle is to be raised and supported on jackstands or on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section of this service manual.

(2) Support the rear axle of the vehicle using 2 jackstands positioned at the outer ends of the axle.

NOTE: If the shock absorber lower mounting bolt deflects upward during removal, raise axle by adjusting the support jack. If the lower shock absorber bolt deflects downward during removal, lower the axle by adjusting the support jack.

(3) Remove the shock absorber lower mounting bolt.

(4) While holding shock absorber, remove the shock absorber upper mounting bolt.

(5) To install the shock absorber use the reverse sequence of its removal.

(6) Lower the vehicle to the ground so the full weight of the vehicle is supported by the suspension.

(7) Tighten the upper and lower shock absorber mounting bolt to their specified torques.

REAR TRACK BAR

REMOVE

(1) Remove the nut and bolt mounting the track bar to the rear axle (Fig. 19).

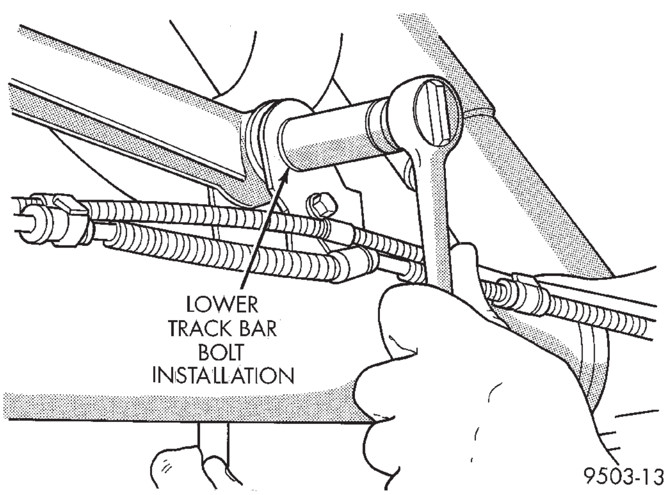

Fig. 19 Track Bar Mounting To Axle

(2) Remove the nut and bolt attaching the track bar to the track bar mount on the body of the vehicle. Remove the track bar from the track bar mount.

INSTALL

(1) Install the track bar first into the body mount for the track bar (Fig. 20). Install the track bar bolt with the head of the bolt facing toward the rear of the vehicle (Fig. 21). Do not tighten.

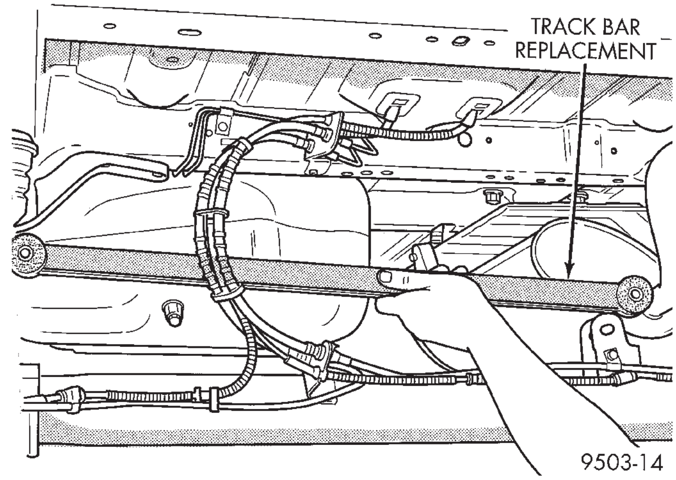

Fig. 20 Track Bar Installation

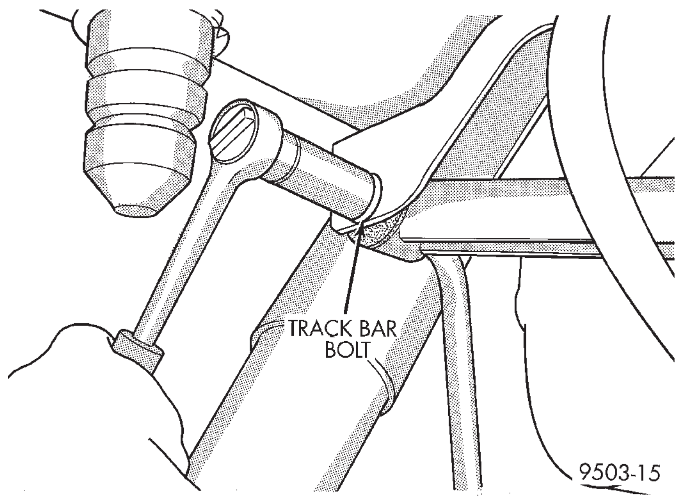

Fig. 21 Track Bar Bolt Installation

(2) Install the track bar into its mounting bracket on the rear axle (Fig. 19). Install the track bar bolt with the head of the bolt facing toward the rear of the vehicle. Do not tighten.

(3) Lower the vehicle to the ground until the full weight of the vehicle is supported by the wheels. Tighten both track bar attaching bolts to a torque of 95 N·m (70 ft. lbs.).

TRACK BAR MOUNT

REMOVE

(1) Remove the track bar from the track bar mount.

(2) Remove the three bolts attaching the track bar mount to the body (Fig. 22).

REMOVAL AND INSTALLATION (Continued)

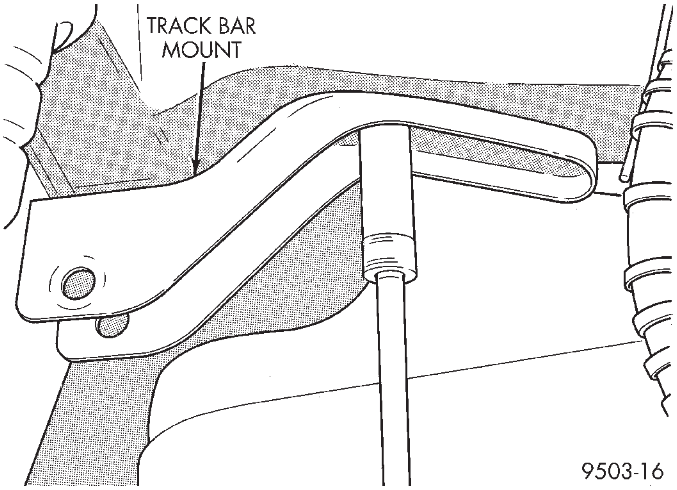

Fig. 22 Track Bar Mount

INSTALLATION

(1) For installation, reverse removal procedure. Tighten bolts to 61 N·m (45 ft. lbs.).

STABILIZER BAR

REMOVAL

(1) Raise vehicle. Vehicle is to be raised and supported on jack stands or on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual.

(2) Remove the 2 lower bolts which hold the stabilizer bar to the link arm on each side of the vehicle.

(3) Loosen but do not fully remove the four bolts that attach the stabilizer bar bushing retainers to the rear axle brackets.

(4) While holding the stabilizer bar in place. Fully remove the 4 bolts loosened in step 3.

(5) Remove the stabilizer bar from the vehicle.

(6) If the link arms need to be serviced, remove the upper link arm to bracket bolt. Then remove link arm from frame rail attaching bracket.

INSPECTION

Inspect for broken or distorted clamps, retainers, and bushings. If bushing replacement is required, the stabilizer bar to axle bushings can be removed from the stabilizer bar by opening the split.

INSTALLATION

(1) Install the link arms onto the frame rail brackets. DO NOT TIGHTEN.

(2) Position the axle to stabilizer bar bushings on the stabilizer bar with the slit in the bushings facing up.

(3) Lift the stabilizer bar onto the rear axle and install the retainers and the four mounting bolts. DO NOT TIGHTEN.

(4) Install the two lower link arm bolts on the stabilizer bar. DO NOT TIGHTEN.

(5) Lower the vehicle so that the full weight of the vehicle is on all four tires. With the vehicle at its curb height, tighten all attaching bolts to the torques listed below.

- Stabilizer bar bushing to axle bracket bolts 61 N·m (45 ft. lbs.)
- Link arm to frame rail bracket 61 N·m (45 ft. lbs.)
- Stabilizer bar to link arm 61 N·m (45 ft. lbs.)
- Frame rail bracket to frame rail 61 N·m (45 ft. lbs.)

JOUNCE BUMPER

There are two types of jounce bumpers available depending on which suspension option the vehicle is equipped with.

REMOVAL-STANDARD

The jounce bumper is serviced as an assembly. The jounce bumper mounts to the frame rail at a weld nut located on the frame rail (Fig. 23).

(1) Using the proper tool, remove the bolt attaching the jounce bumper to frame rail.

(2) Remove the jounce bumper from the frame rail.

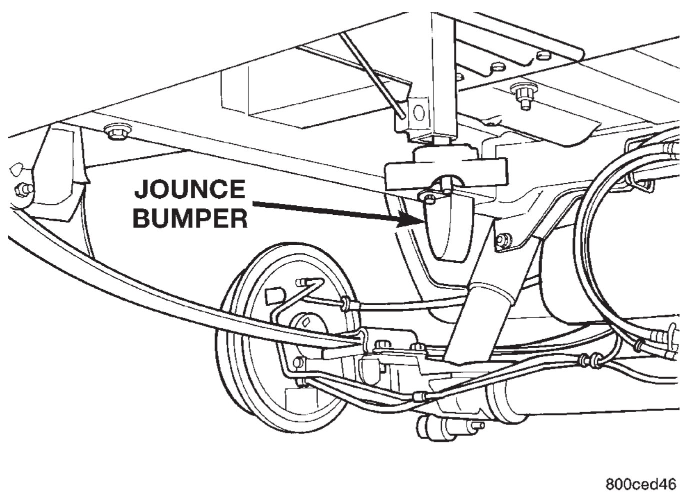

Fig. 23 Jounce Bumper-Standard

INSTALLATION-STANDARD

(1) For installation, reverse the removal procedure. Tighten the jounce bumper mounting bolt to a torque of 33 N·m (290 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

REMOVAL-HEAVY DUTY

The jounce bumpers are serviced as an assembly. The jounce bumpers screw into a weld nut located in the frame rail (Fig. 24).

(1) Using slip-joint pliers grasp the base of the jounce bumper. Turn the base counterclockwise (Fig. 25).

(2) Remove the jounce bumper from the frame rail.

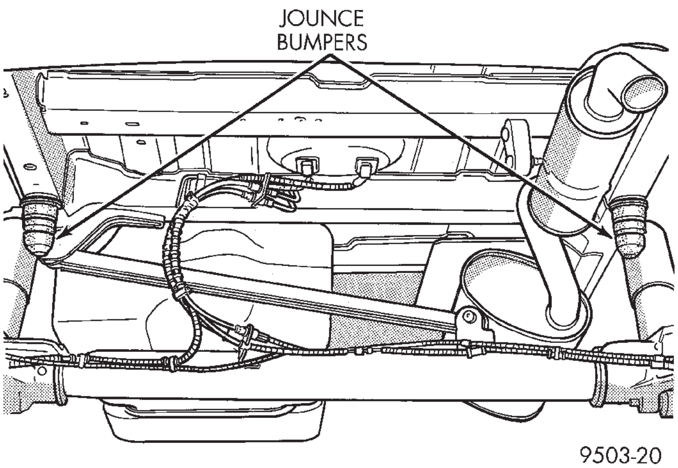

Fig. 24 Jounce Bumper-Heavy Duty

INSTALLATION-HEAVY DUTY

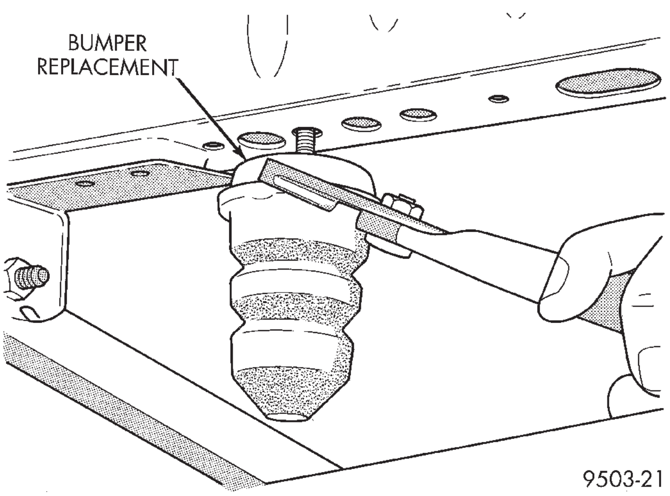

Fig. 25 Bumper Replacement

(1) For installation, reverse the removal procedure. Tighten the jounce bumper to a torque of 33 N·m (290 in. lbs.).

LEAF SPRING FRONT MOUNT

REMOVE

(1) Loosen the pivot bolt attaching the front of the leaf spring to the spring mount (Fig. 26).

(2) Install a jackstand under the side of the axle having the leaf spring mount removed. Using the jackstand support the weight of the axle and leaf spring.

(3) Remove the lower mounting bolt from the shock absorber.

(4) Remove the bolts attaching the leaf spring front mount (Fig. 26) to the body of the vehicle.

(5) Lower the leaf spring and remove the front mount from the spring.

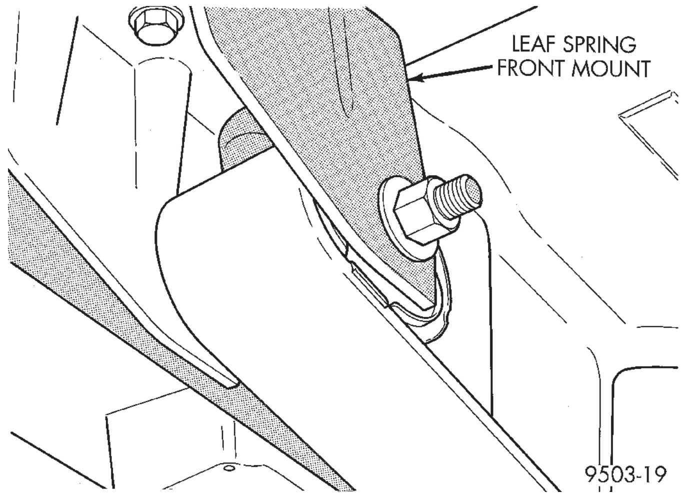

Fig. 26 Leaf Spring Front Mount

INSTALLATION

(1) For installation, reverse removal procedure. Do not tighten front through bolt fully until vehicle is lowered and the full vehicle weight is applied to the rear wheels. Tighten leaf spring front mount bolts to 61 N·m (45 ft. lbs.). Tighten leaf spring front through bolt to 156 N·m (115 ft. lbs.).

LEAF SPRING REAR MOUNT

REMOVE

(1) Remove the attaching nuts and bolts from the leaf spring rear shackle (Fig. 27) and (Fig. 28).

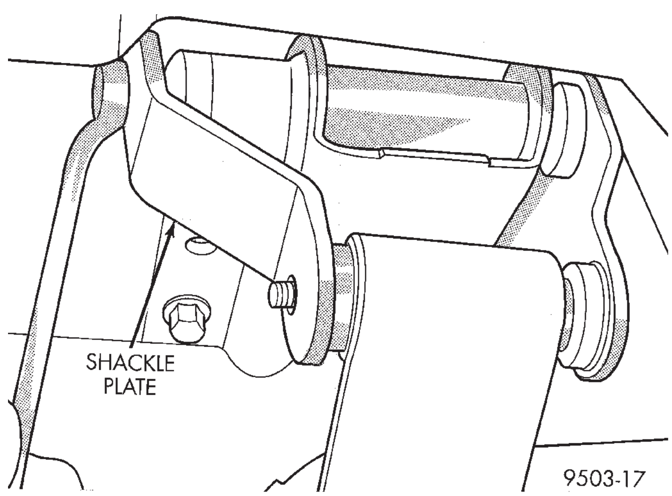

Fig. 27 Leaf Spring Shackle Nuts (FWD)

REMOVAL AND INSTALLATION (Continued)

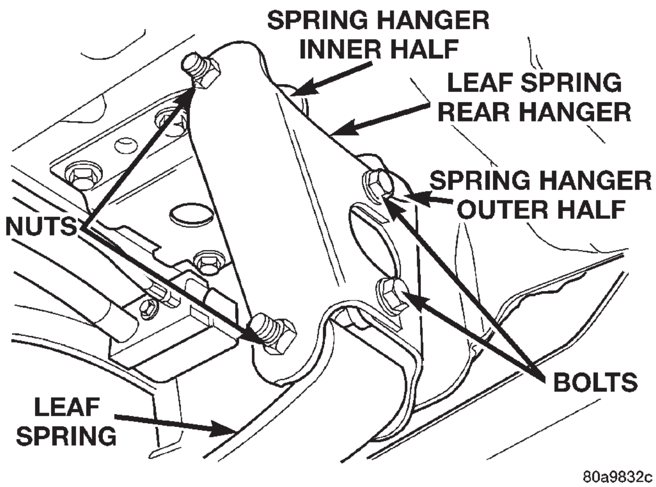

Fig. 28 Leaf Spring Shackle Nuts/Bolts (AWD)

(2) Install a jackstand under the side of the axle having the leaf spring mount removed. Using the jackstand, support the weight of the axle and leaf spring.

(3) Remove the lower mounting bolt from the shock absorber.

(4) Remove the bolts attaching the leaf spring rear mount to the body of the vehicle (Fig. 29).

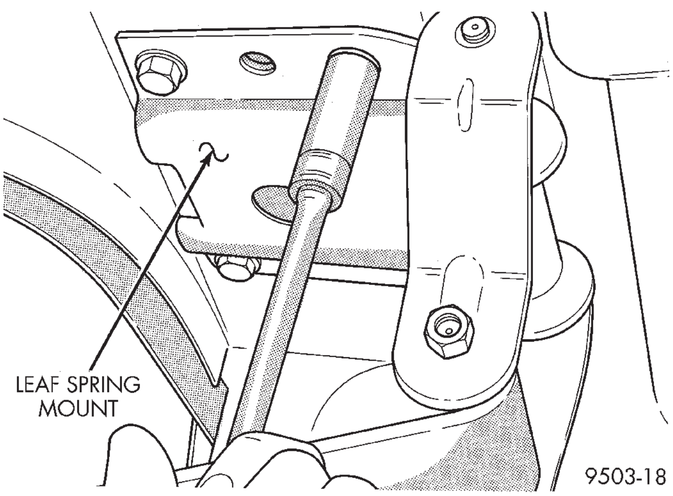

Fig. 29 Rear Spring Mount

(5) Lower the jackstand and the rear of the leaf spring. Remove the shackle from the leaf spring bushing.

INSTALL

CAUTION: The following sequence must be followed when tightening the pin nuts on the rear hanger for the rear leaf spring. First the hanger pin nuts must be tightened to the specified torque. Then tighten the retaining bolts for the inner to outer half of the spring hanger to the specified torque. This sequence must be followed to avoid bending the spring hanger.

(1) For installation, reverse removal procedure. Do not tighten rear spring shackle nuts fully until vehicle is lowered and the full vehicle weight is applied to the rear wheels. Tighten rear spring mount bolts to 61 N·m (45 ft. lbs.). Tighten shackle nuts to 61 N·m (45 ft. lbs.).

SPECIFICATIONS

REAR SUSPENSION FASTENER TORQUES

DESCRIPTION	TORQUE
SHOCK ABSORBER MOUNTING BOLTS:	
Standard Shock Absorber	101 N·m (75 ft. lbs.)
Self Load Leveling Shock Absorber	101 N·m (75 ft. lbs.)
JOUNCE BUMPER:	
To Frame Rail	33 N·m (290 in. lbs.)
TRACK BAR:	
To Axle And Mounting Bracket Pivot Bolt	95 N·m (70 ft. lbs.)
Bracket To Body Attaching	61 N·m (45 ft. lbs.)
LEAF SPRING:	
Spring Plate To Axle Attaching Bolts	108 N·m (80 ft. lbs.)
Rear Mount To Body Bolts	61 N·m (45 ft. lbs.)
Front Mount To Body Bolts	61 N·m (45 ft. lbs.)
To Front Hanger Mounting Nut	156 N·m (115 ft. lbs.)
Shackle Plate Nuts	61 N·m (45 ft. lbs.)
STABILIZER BAR:	
Bushing Retainer To Axle Attaching Bolts	61 N·m (45 ft. lbs.)
Attaching Link Nuts	61 N·m (45 ft. lbs.)
Frame Rail Bracket Mounting Bolts	61 N·m (45 ft. lbs.)
Link Arm To Frame Rail Bracket	61 N·m (45 ft. lbs.)
HUB AND BEARING:	
To Axle Mounting Bolts	129 N·m (95 ft. lbs.)
Stub Axle Nut	224 N·m (180 ft. lbs.)
Wheel Mounting Lug Nut	110-135 N·m (85-115 ft. lbs.)

SUSPENSION

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SPECIFICATIONS

ALIGNMENT SPECIFICATIONS

All alignment specifications are to be checked and adjusted with the vehicle at its correct ride height. Refer to the ride height specifications listed in the following alignment specifications chart.

*** Camber is adjustable using the Mopar Camber Adjustment Service Kit. Refer to the Mopar Parts Catalog for the required service kit part number.**

**** Caster is not adjustable. If found to be out of specification check for proper ride heights and damaged/worn out suspension components and replace as necessary.**

***** Toe-In is positive.**

****** Toe, Camber and thrust angle are not adjustable. If found to be out of specification check for proper ride heights and damaged/worn out suspension components and replace as necessary.**

******* When Measuring ride heights: 1) Ensure that the tire pressures are correct. 2) Jounce the vehicle at the bumper several times and release at the bottom of the stroke. 3) Measure from the ground to the outboard, lower, center section of the fender wheel well opening. Ride heights are not adjustable. If found to be out of specification check for damaged and/or worn out suspension components and replace as necessary.**

SPECIFICATIONS (Continued)

ALIGNMENT ANGLE	TIRE SIZES	TIRE SIZES	ALTERNATIVE FUELS
	P205/75/R14 P215/65/R15	P205/75/R15 P215/65/R16	C.N.G. ELECTRIC
* FRONT INDIVIDUAL CAMBER IN DEGREES..	+0.15° +or- 0.40°	+0.05° +or- 0.40°	+0.15° +or- 0.40°
Front Side To Side Camber Difference Not To Exceed..................	0.00° - 0.50° MAX	0.00° - 0.50° MAX	0.00° - 0.50° MAX
** FRONT INDIVIDUAL CASTER IN DEGREES..	+1.40° + or - 1.00°	+1.40° + or - 1.00°	+1.40° +or- 1.00°
Front Side To Side Caster Difference Not To Exceed....................................	0.00° - 1.00° MAX	0.00° - 1.00° MAX	0.00° - 1.00° MAX
*** FRONT INDIVIDUAL TOE RIGHT/ LEFT..	+0.05°+or- 0.10°	+0.05° +or- 0.10°	+0.05° +or- 0.10°
FRONT TOTAL TOE.. Specified In Degrees	+0.10° +or- 0.20°	+0.10° +or- 0.20°	+0.10° +or- 0.20°
FRONT SIDE TO SIDE TOE DIFFERENTIAL....................................	0.00° - 0.06° MAX	0.00° - 0.06° MAX	0.00° - 0.06° MAX
****REAR INDIVIDUAL CAMBER IN DEGREES..	+0.00° +or- 0.25°	+0.00° +or- 0.25°	-0.10° +or- 0.25
REAR INDIVIDUAL TOE RIGHT/ LEFT.......................................	0.00° +or- 0.40°	0.00° +or- 0.40°	0.00° +or- 0.40°
**** REAR TOTAL TOE.................... Specified In Degrees TOE OUT: When Backed On Alignment Rack Is TOE In When Driving	0.00° +or- 0.40°	0.00° +or- 0.40°	0.00° +or- 0.40°
****REAR THRUST ANGLE................	0.00° +or- 0.30°	0.00° +or- 0.30°	0.00° +or- 0.30°
STEERING WHEEL ANGLE................	0.00° +or- 2.50°	0.00° +or- 2.50°	0.00° +or- 2.50°
FRONT RIDE HEIGHT (MEASURED AT TOP OF FENDER WHEEL OPENING)...	747.5 mm +or-10.0mm	753.5 mm +or-10.0mm	783.5 mm +or-10.0mm
FRONT RIDE HEIGHT SIDE TO SIDE DIFFERENTIAL....................................	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX
*****REAR RIDE HEIGHT (MEASURED AT TOP OF FENDER WHEEL OPENING)...	766.0 mm +or-10.0mm	772.0 mm +or-10.0mm	802.5 mm +or-10.0mm
*****REAR RIDE HEIGHT SIDE TO SIDE DIFFERENTIAL....................................	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX	0.0 mm 12.5 mm MAX

BRAKES

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GENERAL INFORMATION

GENERAL VEHICLE SERVICE CAUTIONS

CAUTION: At no time when servicing a vehicle, can a sheet metal screw, bolt or other metal fastener be installed in the shock tower to take the place of an original plastic clip. Also, NO holes can be drilled into the front shock tower in the area shown in (Fig. 1), for the installation of any metal fasteners into the shock tower. Because of the minimum clearance in this area (Fig. 1), installation of metal fasteners could damage the coil spring coating and lead to a corrosion failure of the spring. If a plastic clip is missing, or is lost or broken during servicing a vehicle, replace only with the equivalent part listed in the Mopar parts catalog.

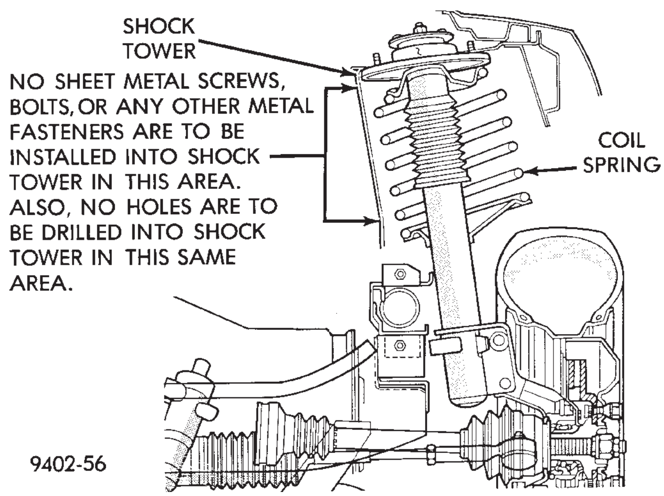

Fig. 1 Shock Tower To Spring Minimum Clearance Area

CAUTION: Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

BASE BRAKE SYSTEM COMPONENT DESCRIPTION

The standard brake system on this vehicle consists of the following components:

- Double pin floating caliper disc front brakes.
- Double pin floating caliper rear disc brakes on all wheel drive applications.
- Rear automatic adjusting drum brakes.
- Master cylinder with brake fluid level sensor.
- Vacuum booster.
- Height sensing proportioning valve (non-antilock brake applications)
- Non-height sensing proportioning valve (antilock brake applications)

The brakes hydraulic system on both non-antilock and antilock brake systems is diagonally split (Fig. 2) (Fig. 3). A diagonally split brake system means the left front and right rear brakes on one hydraulic system and the right front and left rear on the other.

GENERAL INFORMATION (Continued)

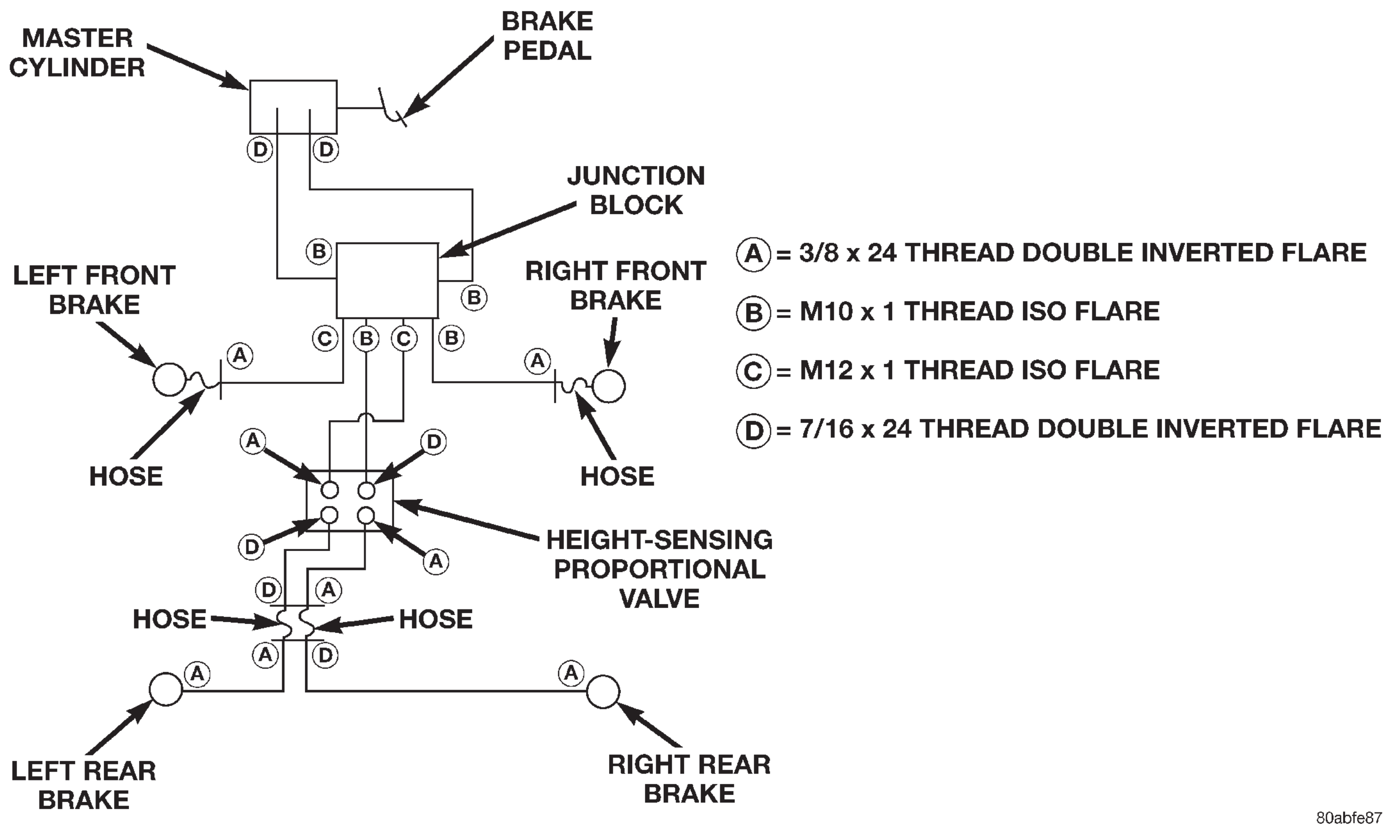

Fig. 2 Non-Antilock Brakes Hydraulic Brake Tube Routing And Fitting Locations

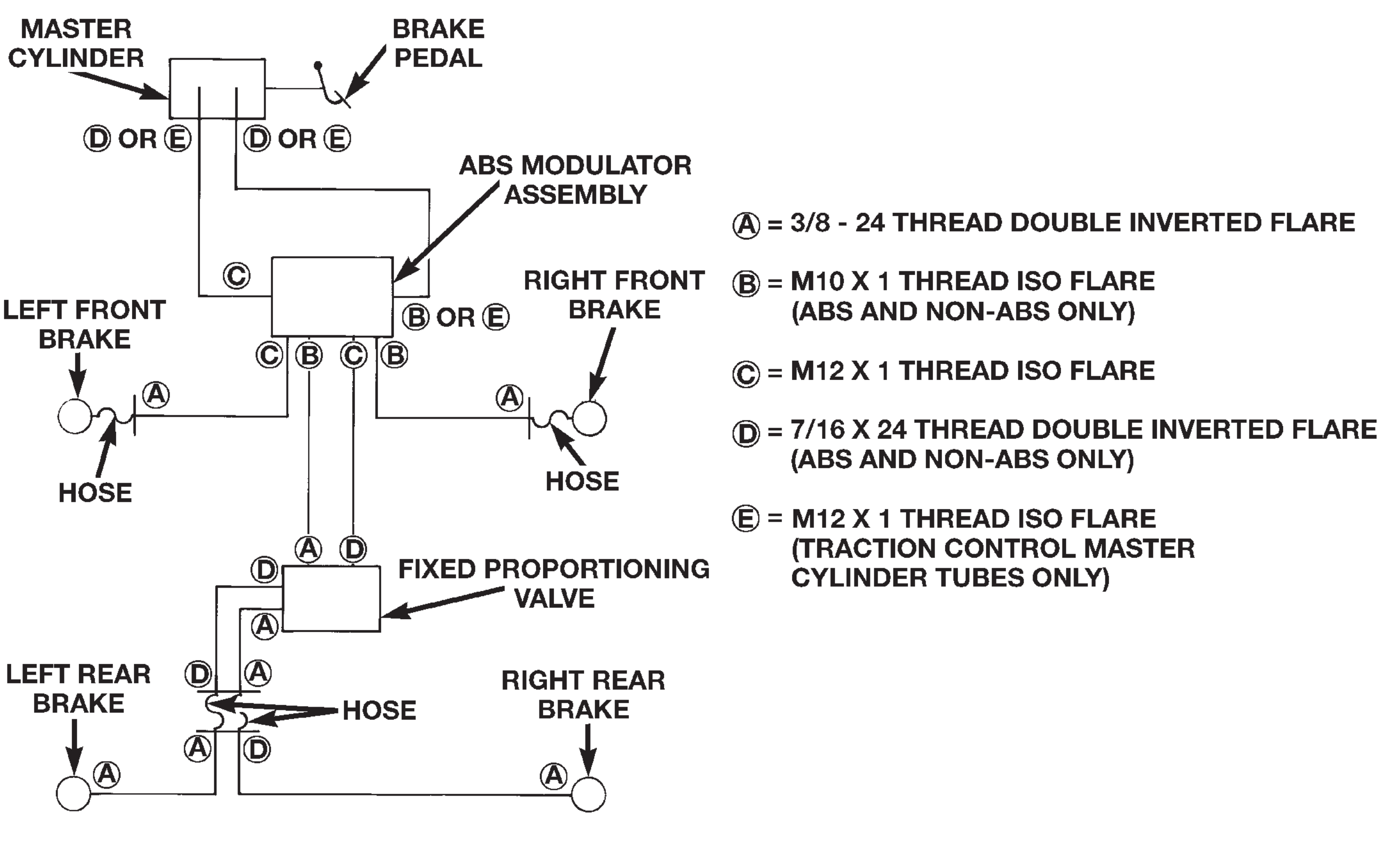

Fig. 3 Antilock Brakes/Traction Control Hydraulic Brake Tube Routing And Fitting Locations

BASE BRAKE SYSTEM

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DESCRIPTION AND OPERATION

FRONT DISC BRAKE SYSTEM

The single piston, floating caliper disc brake assembly (Fig. 1) and (Fig. 2) consists of:

- The driving hub.
- Braking disc (rotor).
- Caliper assembly.
- Shoes and linings.

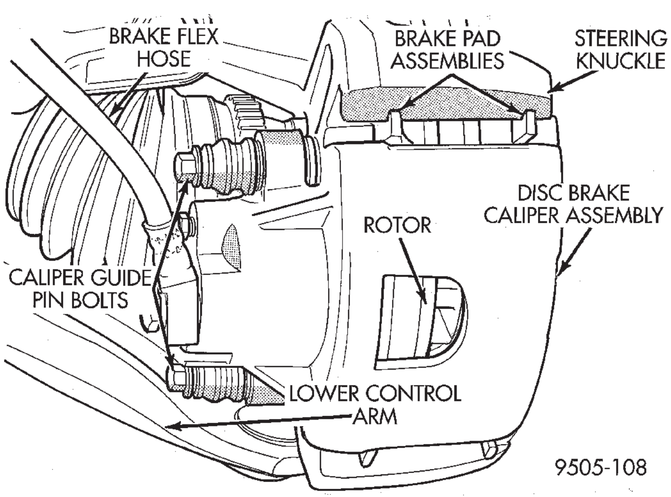


Fig. 1 Front Disc Brake System Components

The double pin Kelsey-Hayes caliper is mounted directly to the steering knuckle, using bushings, sleeves, and 2 caliper guide pin bolts which thread directly into the steering knuckle (Fig. 3).

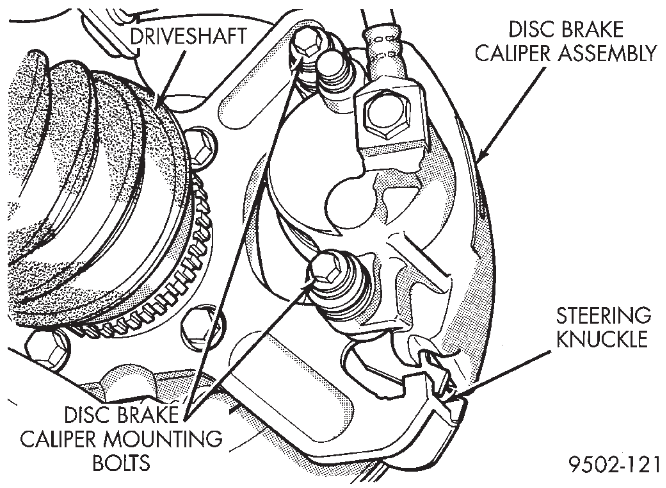


Fig. 3 Disc Brake Caliper Mounting To Steering Knuckle

The two machined abutments on the steering knuckle, position and align the caliper fore and aft. The guide pin bolts, sleeves, and bushings control the side to side movement of the caliper. The piston seal is designed to assist in maintaining the proper brake shoe to rotor clearance.

All the front brake forces generated during braking of the vehicle are taken up directly by the steering knuckles of the vehicle.

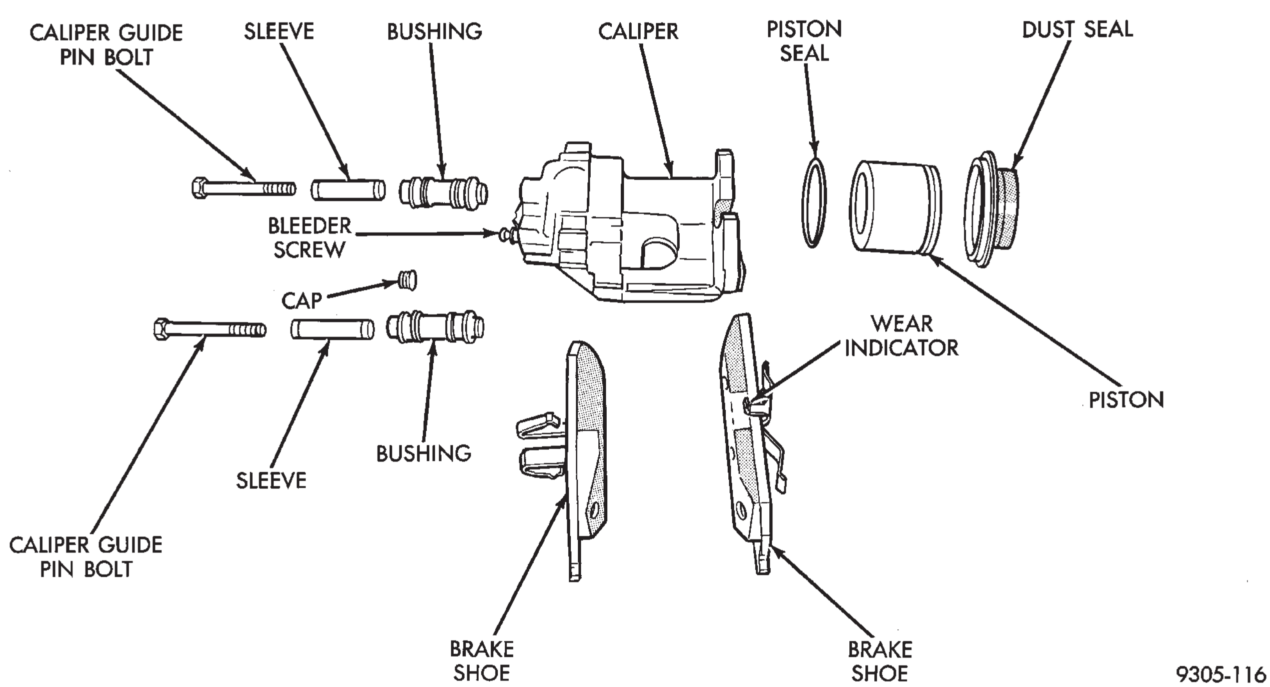


Fig. 2 Front Disc Brake Caliper Assembly (Exploded View)

DESCRIPTION AND OPERATION (Continued)

The caliper is a one piece casting with the inboard side containing a single piston cylinder bore.

The phenolic piston is 60 mm (2.36 inch) in diameter.

A square cut rubber piston seal is located in a machined groove in the cylinder bore. It provides a hydraulic seal between the piston and the cylinder wall (Fig. 4).

The molded rubber dust boot mounts in a counter bore of the cylinder bore opening and in a groove which is machined in the outer surface of the piston (Fig. 4). This prevents contamination of the piston and the bore area.

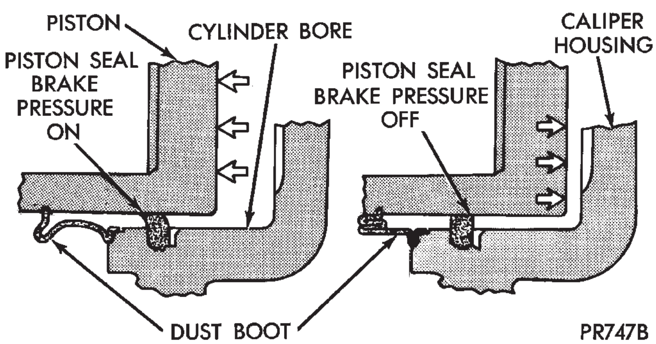


Fig. 4 Caliper Piston Seal Function For Automatic Adjustment

As lining wears, reservoir level will go down. If fluid has been added, reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided by removing a small amount of fluid from the master cylinder reservoir.

REAR DRUM BRAKES

The rear wheel drum brakes are a two shoe, internal expanding type with an automatic adjuster screw. The automatic adjuster screw is actuated each time the brakes are applied. The automatic adjuster screw is located directly below the wheel cylinder.

REAR DISC BRAKES

The rear disc brakes are similar to front disc brakes, however, there are several distinctive features that require different service procedures. The single piston, floating caliper rear disc brake system includes a hub and bearing assembly, adapter, rotor, caliper, and brake shoes. The parking brake system on vehicles equipped with rear disc brakes, consists of a small duo-servo drum brake mounted to the caliper adapter. The drum brake shoes expand out against a braking surface (hat section) on the inside area of the rotor.

This vehicle is equipped with a caliper having a 42 mm (1.65 in.) piston and uses a 15 inch solid non-vented rotor.

The disc brake caliper floats on rubber bushings using threaded guide pin bolts which are attached to the back side of the adapter.

The adapter and rotor shield are mounted to the rear axle. The adapter is used to mount the brake shoes and actuating cables for the parking brake system. The adapter is also used to mount the rear caliper. The adapter has two machined abutments which are used to position and align the caliper and brake shoes for movement inboard and outboard (Fig. 5).

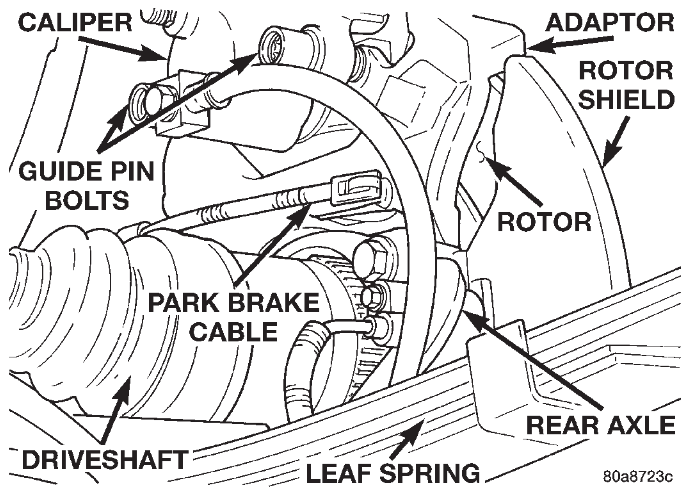


Fig. 5 Rear Disc Brake Components

PARKING BRAKE SYSTEM OPERATION

The rear wheel service brakes also act as parking brakes. The brake shoes are mechanically operated by an internal lever and strut connected to a flexible steel cable. The rear cables and intermediate cable are connected to the front cable by an equalizer. The front cable extends to the parking brake foot pedal assembly.

PROPORTIONING VALVES

FIXED PROPORTIONING VALVE

The hydraulic brake system on all vehicles is diagonally split. This means that the left front and right rear brakes are on one hydraulic circuit with the right front and left rear brakes on the other hydraulic circuit.

On vehicles equipped with ABS brakes, the brake systems hydraulic control unit (HCU) is mounted to the front suspension crossmember on the driver's side of the vehicle. The (HCU) acts as the hydraulic system junction block, diagonally splitting the brakes hydraulic system.

All vehicles equipped with ABS brakes use 2 fixed proportioning valves. The fixed proportioning valves are mounted in a common bracket on the left frame rail at the rear of the vehicle (Fig. 6).

DESCRIPTION AND OPERATION (Continued)

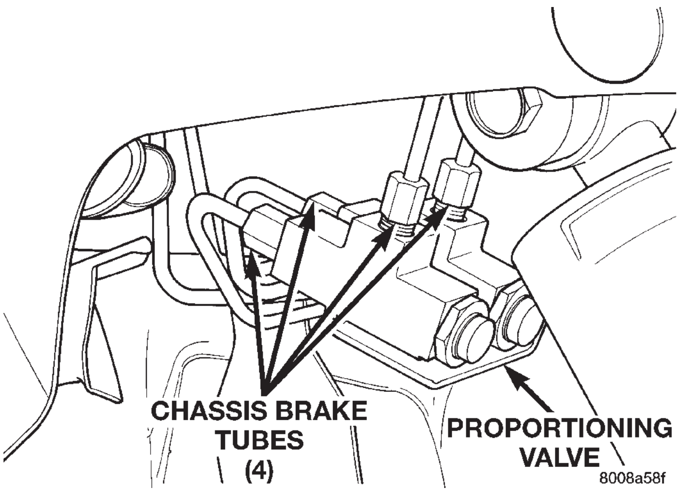


Fig. 6 Fixed Proportioning Valve Location

FIXED PROPORTIONING VALVE OPERATION

The fixed proportioning valve is made out of aluminum and has an integral mounting bracket. The fixed proportioning valve is non-serviceable component and must be replaced as an assembly if found to be functioning improperly.

The fixed proportioning valve is mounted to the bottom of the left rear frame rail, just forward of the rear shock absorber to frame rail mounting location (Fig. 6). The proportioning valve has 2 inlet ports for brake fluid coming from the ABS modulator, and 2 outlet ports for brake fluid going to the rear wheel brakes.

The fixed proportioning valve operates by allowing full hydraulic pressure to the rear brakes up to a set point, called the valve's split point. Beyond this split point the proportioning valve reduces the amount of hydraulic pressure to the rear brakes according to a certain ratio.

Thus, on light brake pedal applications the proportioning valve allows approximately equal brake hydraulic pressure to be supplied to both the front and rear brakes. On heavier brake pedal applications though, the proportioning valve will control hydraulic pressure to the rear brakes, so that hydraulic pressure at the rear brakes will be lower than that at the front brakes. This controlled hydraulic pressure to the rear brakes prevents excessive rear wheel ABS cycling during moderate stops.

HEIGHT SENSING PROPORTIONING VALVE

CAUTION: The use of after-market load leveling or load capacity increasing devices on this vehicle are prohibited. Using air shock absorbers or helper springs on this vehicle will cause the height sensing proportioning valve to inappropriately reduce the hydraulic pressure to the rear brakes. This inappropriate reduction in hydraulic pressure potentially could result in increased stopping distance of the vehicle.

On vehicles not equipped with ABS brakes, the brake systems hydraulic control unit (HCU) is replaced by a junction block (Fig. 7). The junction block is made of aluminum and is mounted to the front suspension crossmember on the drivers side of the vehicle in the same location as the (HCU) on an ABS equipped vehicle. The junction block is permanently attached to its mounting bracket and must be replaced as an assembly with its mounting bracket. The junction block is used for diagonally splitting the brake's hydraulic system.

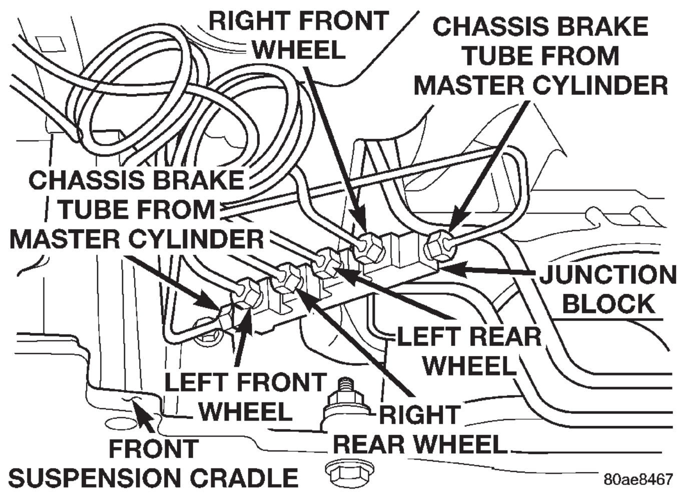


Fig. 7 Junction Block Location

Vehicles not equipped with ABS brakes use a height sensing proportioning valve. The height sensing proportioning valve is mounted on the left frame rail at the rear of the vehicle (Fig. 8). The height sensing proportioning valve uses an actuator assembly (Fig. 8) to attach the proportioning valve to the left rear spring for sensing changes in vehicle height.

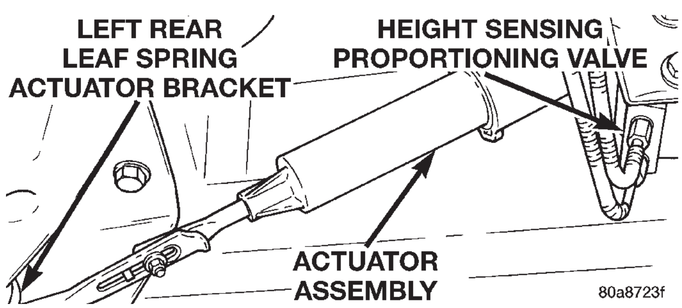


Fig. 8 Height Sensing Proportioning Valve

HEIGHT SENSING PROPORTIONING VALVE OPERATION

The height sensing proportioning valve regulates the hydraulic pressure to the rear brakes. The proportioning valve regulates the pressure by sensing the load condition of the vehicle through the movement of the proportioning valve actuator assembly

DESCRIPTION AND OPERATION (Continued)

(Fig. 8). The actuator assembly is mounted between the height sensing proportioning valve and the actuator bracket on the left rear leaf spring (Fig. 8). As the rear height of the vehicle changes depending on the load the vehicle is carrying the height change is transferred to the height sensing proportioning valve. This change in vehicle height is transferred through the movement of the left rear leaf spring. As the position of the left rear leaf spring changes this movement is transferred through the actuator bracket (Fig. 8) to the actuator assembly (Fig. 8) and then to the proportioning valve.

Thus, the height sensing proportioning valve allows the brake system to maintain the optimal front to rear brake balance regardless of the vehicle load condition. Under a light load condition, hydraulic pressure to the rear brakes is minimized. As the load condition of the vehicle increases, so does the hydraulic pressure to the rear brakes.

The proportioning valve section of the valve operates by transmitting full input hydraulic pressure to the rear brakes up to a certain point, called the split point. Beyond the split point the proportioning valve reduces the amount of hydraulic pressure to the rear brakes according to a certain ratio. Thus, on light brake applications, approximately equal hydraulic pressure will be transmitted to the front and rear brakes. At heavier brake applications, the hydraulic pressure transmitted to the rear brakes will be lower then the front brakes. This will prevent premature rear wheel lock-up and skid.

The height sensing section of the valve thus changes the split point of the proportioning valve, based on the rear suspension height of the vehicle. When the height of the rear suspension is low, the proportioning valve interprets this as extra load and the split point of the proportioning valve is raised to allow more rear braking. When the height of the rear suspension is high, the proportioning valve interprets this as a lightly loaded vehicle and the split point of the proportioning valve is lowered and rear braking is reduced.

CHASSIS TUBES AND HOSES

The purpose of the chassis brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the wheel brakes of the vehicle. The chassis tubes are steel with a corrosion resistant coating applied to the external surfaces and the flex hoses are made of reinforced rubber. The rubber flex hoses allow for the movement of the vehicles suspension.

MASTER CYLINDER

The master cylinder (Fig. 9) consists of the following components. The body of the master cylinder is an anodized aluminum casting. It has a machined bore to accept the master cylinder piston and threaded ports with seats for the hydraulic brake line connections. The brake fluid reservoir of the master cylinder assembly is made of a see through polypropylene type plastic. A low fluid switch is also part of the reservoir assembly.

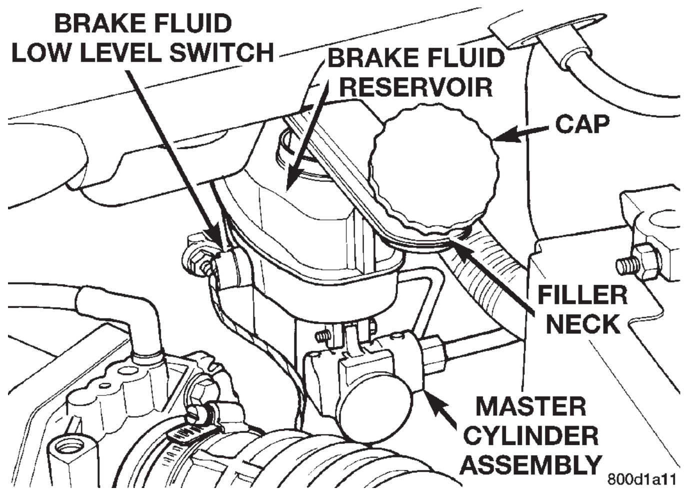


Fig. 9 Master Cylinder Assembly

This vehicle uses 3 different master cylinders. Master cylinder usage depends on what type of brake system the vehicle is equipped with. If a vehicle is not equipped with antilock brakes, or is equipped with antilock brakes without traction control, a conventional compensating port master cylinder is used. If a vehicle is equipped with antilock brakes with traction control, a dual center port master cylinder is used.

The third master cylinder used on this vehicle is unique to vehicles equipped with four wheel disc brakes. The master cylinder used for this brake application has a different bore diameter and stroke then the master cylinder used for the other available brake applications.

The master cylinders used on front wheel drive applications (non four wheel disc brake vehicles) have a master cylinder piston bore diameter of 23.8 mm. The master cylinder used on the all wheel drive applications (four wheel disc brake vehicles) have a master cylinder piston bore diameter of 25.4 mm. **When replacing a master cylinder, be sure to use the correct master cylinder for the type of brake system the vehicle is equipped with.**

The master cylinder is not a repairable component and must be replaced if diagnosed to be functioning improperly

CAUTION: Do not hone the bore of the cylinder as this will remove the anodized surface from the bore.

The master cylinder primary outlet port supplies hydraulic pressure to the right front and left rear

DESCRIPTION AND OPERATION (Continued)

brakes. The secondary outlet port supplies hydraulic pressure to the left front and right rear brakes.

POWER BRAKE VACUUM BOOSTER OPERATION

All vehicles use a 270 mm single diaphragm power brake vacuum booster.

The power brake booster can be identified if required, by the tag attached to the body of the booster assembly (Fig. 10). This tag contains the following information: The production part number of the power booster assembly, the date it was built, and who was the manufacturer of the power brake vacuum booster.

NOTE: The power brake booster assembly is not a repairable component and must be replaced as a complete assembly if it is found to be faulty in any way. The check valve located in the power brake booster (Fig. 10) is not repairable but it can be replaced as an assembly separate from the power brake booster.

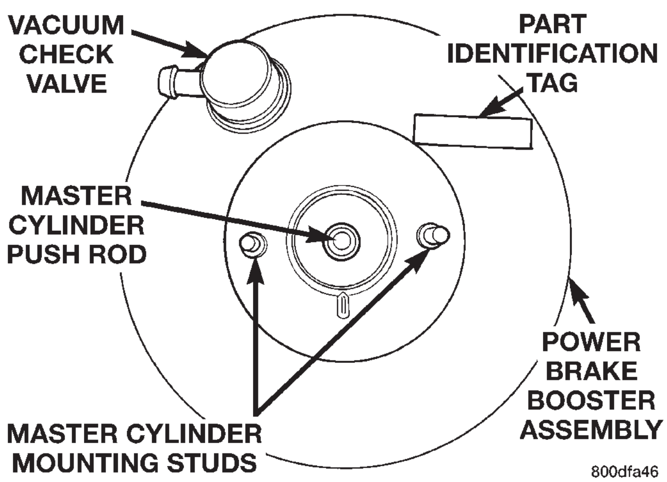


Fig. 10 Power Brake Booster Identification

The power brake booster reduces the amount of force required by the driver to obtain the necessary hydraulic pressure to stop vehicle.

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 10) and (Fig. 11).

As the brake pedal is depressed, the power brake boosters input rod moves forward (Fig. 11). This opens and closes valves in the power booster, allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the power booster (Fig. 11) out against the primary piston of the master cylinder. As the pistons in the master cylinder move forward this creates the hydraulic pressure in the brake system.

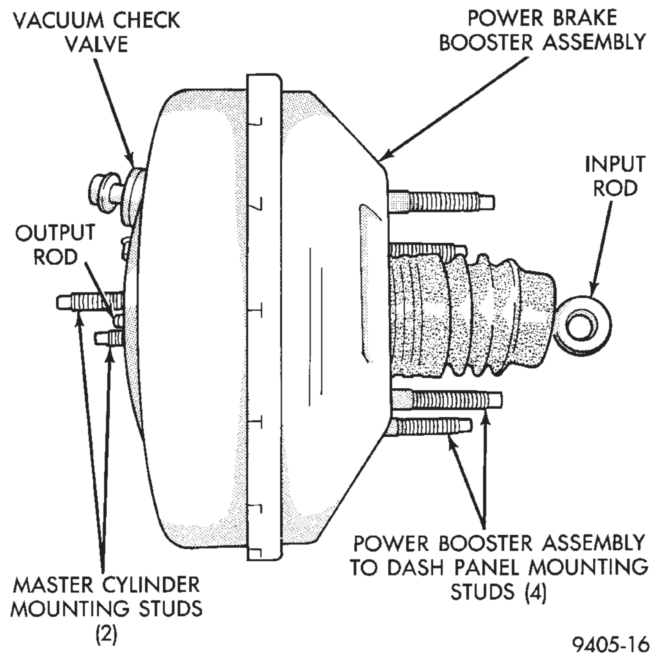


Fig. 11 Power Brake Booster Assembly

The different engine combinations used on this vehicle require that different vacuum hose routings to the power brake vacuum booster be used.

All vacuum hoses must be routed from the engine to the power brake vacuum booster without kinks, excessively tight bends or potential for damage to the vacuum hose.

The power brake vacuum booster assembly mounts on the engine side of the dash panel, and is connected to the brake pedal by the input push rod (Fig. 11). A vacuum line connects the power booster to the intake manifold. The master cylinder is bolted to the front of the power brake vacuum booster assembly.

RED BRAKE WARNING LAMP OPERATION

The red Brake warning lamp is located in the instrument panel cluster and is used to indicate a low brake fluid condition or that the parking brake is applied. In addition, the brake warning lamp is turned on as a bulb check by the ignition switch every time the ignition switch is turned to the crank position.

The warning lamp bulb is supplied a 12 volt ignition feed anytime the ignition switch is on. The bulb is then illuminated by completing the ground circuit either through the park brake switch, the fluid level sensor in the master cylinder reservoir, or the ignition switch when it is turned to the crank position.

The Brake Fluid Level sensor is located in the brake fluid reservoir of the master cylinder assembly. The purpose of the sensor is to provide the driver with an early warning that brake fluid level in the master cylinder fluid reservoir has dropped to below

DESCRIPTION AND OPERATION (Continued)

normal. This may indicate: **(1)** Abnormal loss of brake fluid in the master cylinder fluid reservoir resulting from a leak in the hydraulic system. **(2) Brake shoe linings which have worn to a point requiring replacement.**

As the brake fluid drops below the minimum level, the brake fluid level sensor closes to ground the brake warning light circuit. This will turn on the red brake warning light. At this time, master cylinder fluid reservoir should be checked and filled to the full mark with DOT 3 brake fluid. **If brake fluid level has dropped below the add line in the master cylinder fluid reservoir, the entire brake hydraulic system should be checked for evidence of a leak.**

STOP LAMP SWITCH

The stop lamp switch controls operation of the vehicles stop lamps. Also, if the vehicle is equipped with speed control, the stop lamp switch will deactivate speed control when the brake pedal is depressed.

The stop lamp switch controls operation of the right and left tail, stop and turn signal lamp and CHMSL lamp, by supplying battery current to these lamps.

The stop lamp switch controls the lamp operation by opening and closing the electrical circuit to the stop lamps.

HUB/BEARING REAR WHEEL

The rear hub and bearing assembly used on this vehicle is serviceable only as a complete assembly. No attempt should be made to disassemble a rear hub and bearing assembly in an effort to repair it.

The rear hub and bearing assembly is attached to the rear axle using 4 mounting bolts that are removable from the back of the rear hub/bearing.

DIAGNOSIS AND TESTING

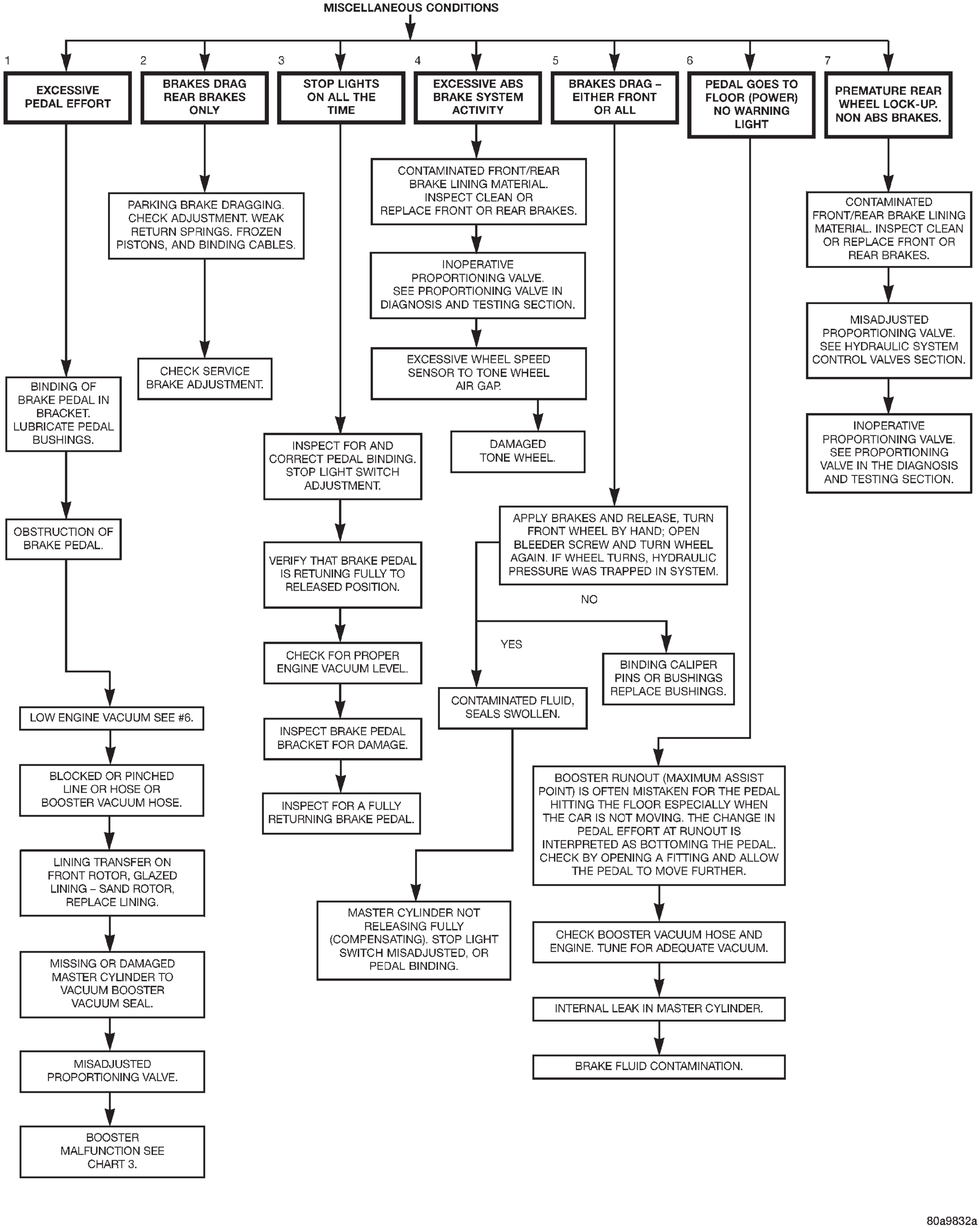
BRAKE SYSTEM BASIC DIAGNOSIS GUIDE

SYMPTOM	CHART 1 MISC. COND.	CHART 2 WARNING LIGHT	CHART 3 POWER BRAKES	CHART 4 BRAKE NOISE	CHART 5 WHEEL BRAKES
Brake Warning Light On		X	NO	NO	
Excessive Pedal Travel	6	X	NO		O
Pedal Goes To The Floor	6	X			
Stop Light On Without Brakes	3				
All Brakes Drag	5				
Rear Brakes Drag	2	NO	NO		
Grabby Brakes			O		X
Spongy Brake Pedal		X	NO		
Premature Rear Brake Lockup	4	NO	NO		O
Excessive Pedal Effort	1		O		
Rough Engine Idle		NO	O		
Brake Chatter (Rough)		NO	NO		X
Surge During Braking		NO	NO		X
Noise During Braking		NO	NO	X	
Rattle Or Clunking Noise		NO	NO	X	
Pedal Pulsates During Braking		NO	NO		X
Pull To Right Or Left		NO	NO		X
No: Not A Possible Cause		X: Most Likely Cause		O: Possible Cause	

DIAGNOSIS AND TESTING (Continued)

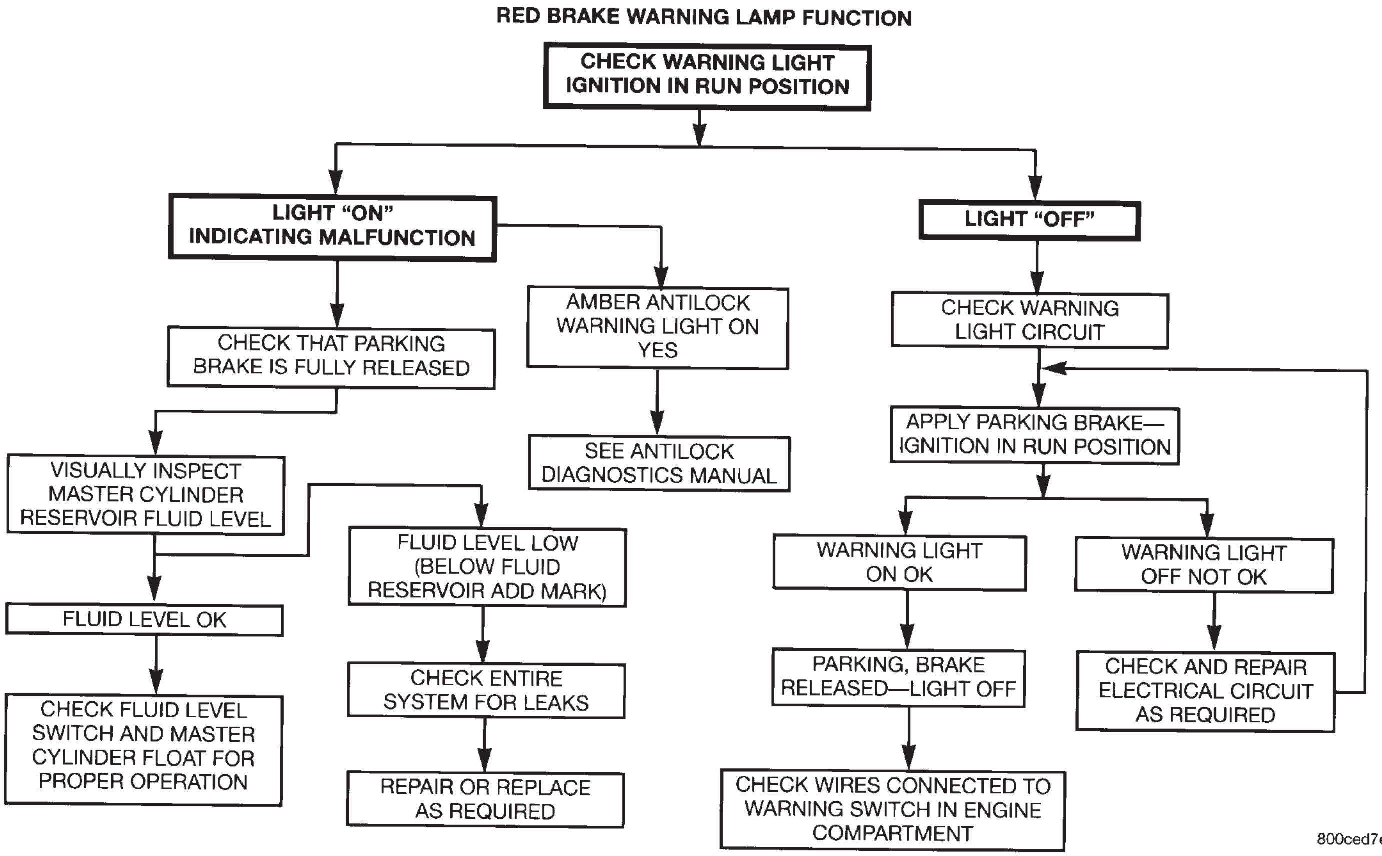
BRAKE SYSTEM DIAGNOSIS CHARTS

MISCELLANEOUS BRAKE SYSTEM CONDITIONS



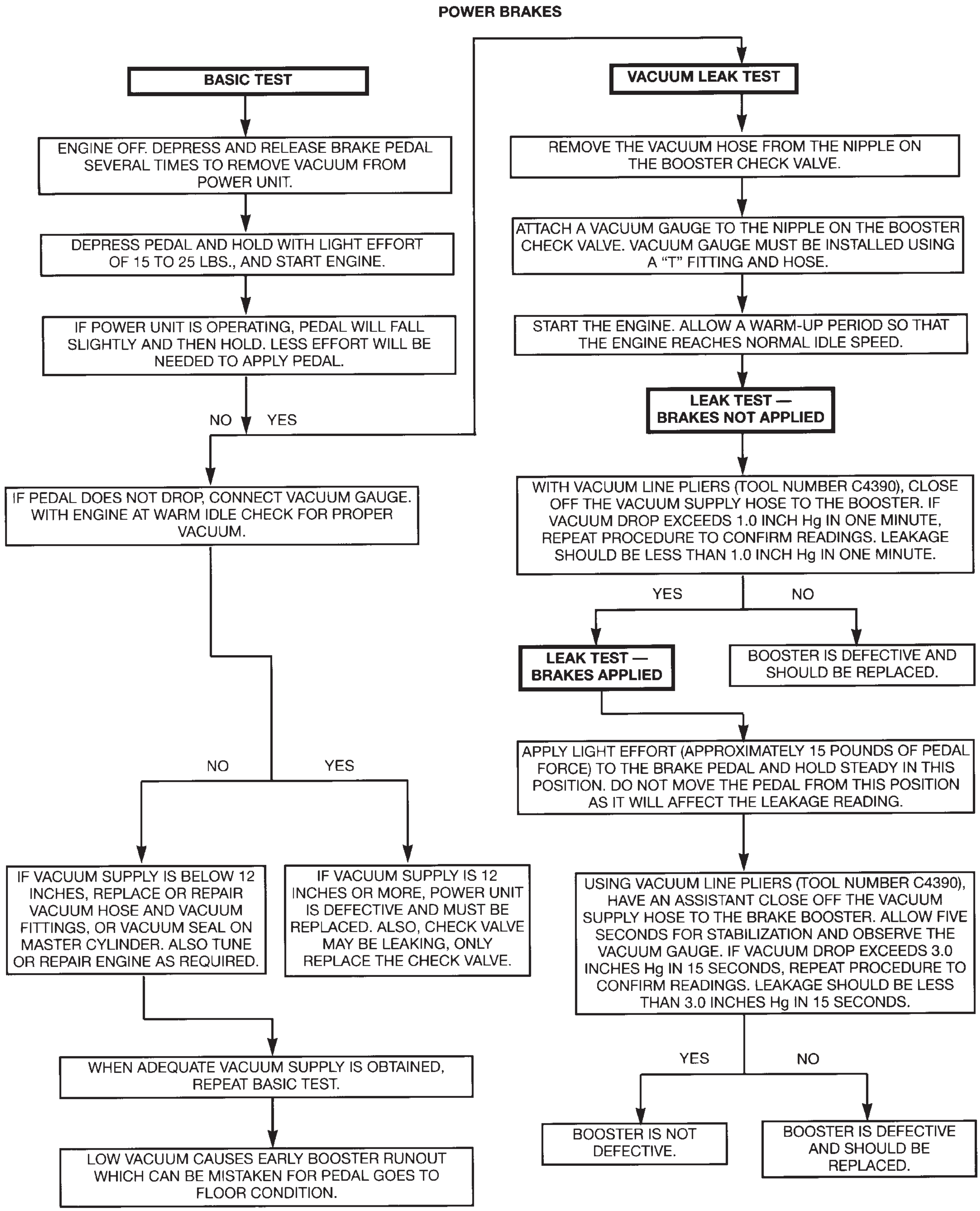
DIAGNOSIS AND TESTING (Continued)

RED BRAKE WARNING LAMP FUNCTION



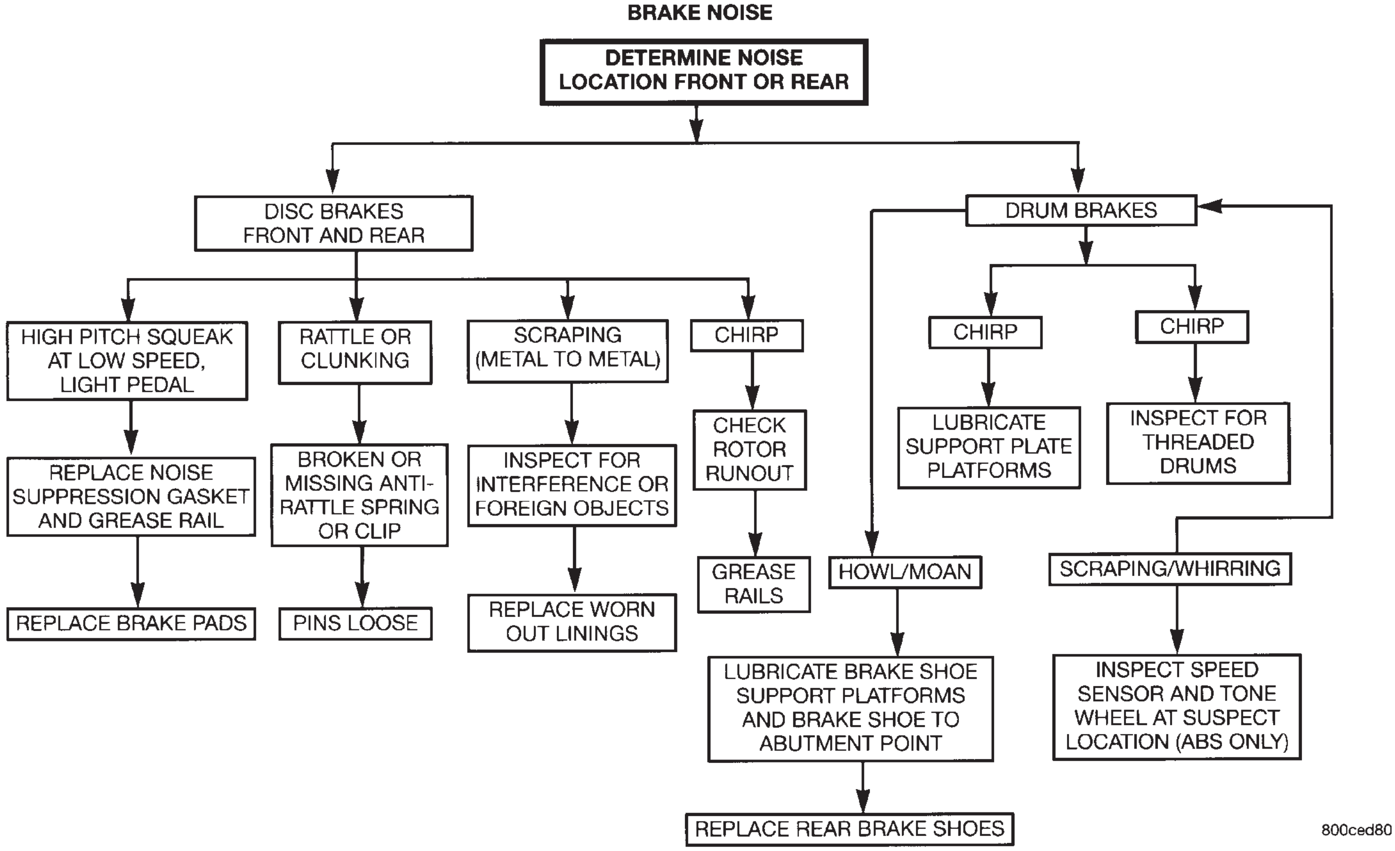
DIAGNOSIS AND TESTING (Continued)

POWER BRAKE SYSTEM DIAGNOSTICS

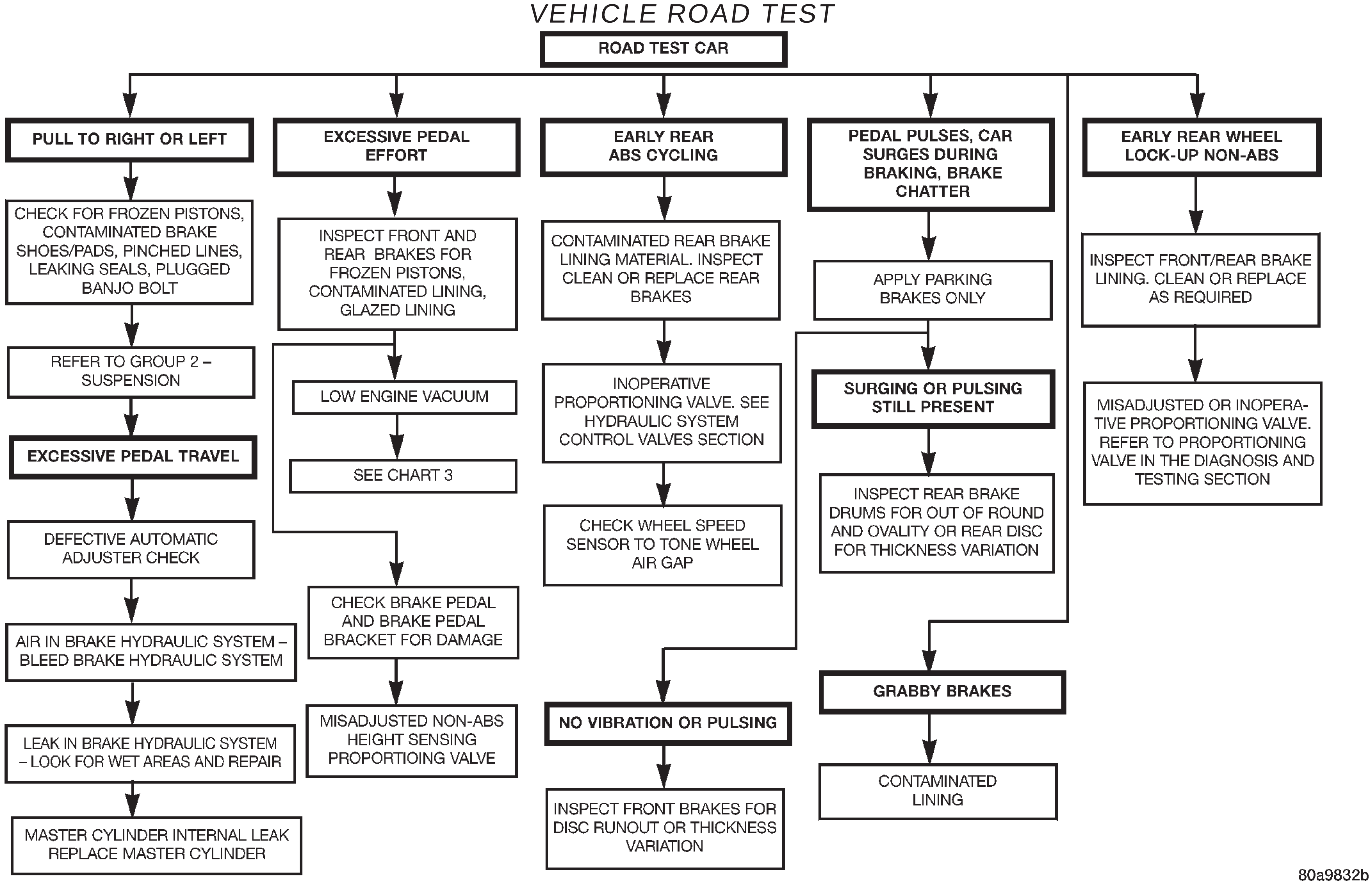


DIAGNOSIS AND TESTING (Continued)

BRAKE NOISE



VEHICLE ROAD TEST



DIAGNOSIS AND TESTING (Continued)

ADJUSTER REAR DRUM BRAKE (AUTOMATIC)

The rear drum brakes on this vehicle automatically adjust, when required, during the normal operation of the vehicle every time the brakes are applied. Use the following procedure to test the operation of the automatic adjuster.

Place the vehicle on a hoist with a helper in the driver's seat to apply the brakes. Remove the access plug from the adjustment hole in each brake support plate to provide visual access of the brake adjuster star wheel.

Remove the park brake cable, for the wheel of the vehicle that is being worked on, from the park brake cable equalizer (Fig. 12). This is required to gain access to the star wheel. If the cable is not removed from the equalizer, the cable and spring inside of the brake drum is in the way of the star wheel.

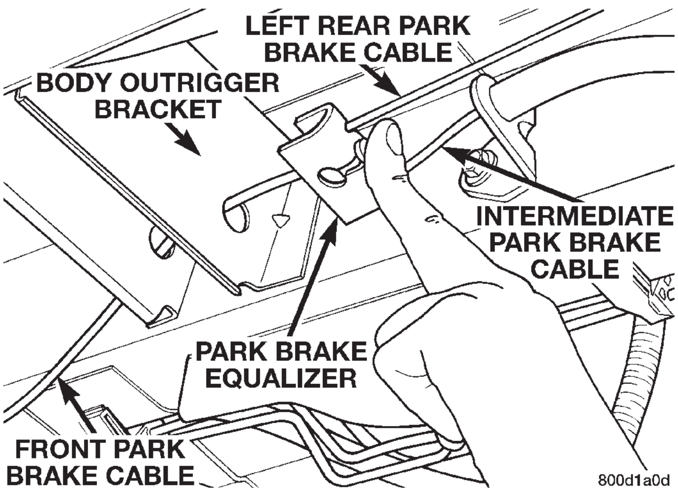


Fig. 12 Park Brake Cable Equlizer

To eliminate the condition where maximum adjustment of the rear brake shoes, does not allow the automatic adjuster to operate when tested, back the star wheel off approximately 30 notches. It will be necessary to hold the adjuster lever away from the star wheel to permit this adjustment.

Have the helper apply the brakes. Upon application of the brake pedal, the adjuster lever lever should move down, turning the adjuster star wheel. Thus, a definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly. If one or more adjusters do not function properly, the respective drum must be removed for adjuster servicing.

BRAKE ROTOR

Any servicing of the rotor requires extreme care to maintain the rotor to within service tolerances to ensure proper brake action.

Before refinishing or refacing a rotor, the rotor should be checked and inspected for the following conditions:

Braking surface scoring, rust, impregnation of lining material and worn ridges.

Excessive rotor lateral runout or wobble.

Thickness variation in braking surface of the rotor (Parallelism).

Dishing or distortion in braking surface of the rotor (Flatness).

If a vehicle has not been driven for a period of time, the rotors will rust in the area not covered by the brake lining and cause noise and chatter when the brakes are applied.

Excessive wear and scoring of the rotor can cause temporary improper lining contact if ridges are not removed from braking surface of rotor before installation of new brake shoe assemblies.

Some discoloration and/or wear of the rotor surface is normal and does not require resurfacing when linings are replaced.

Excessive runout or wobble in a rotor can increase pedal travel due to piston knock-back. This will also increase guide pin bushing wear due to the tendency of the caliper to follow rotor wobble.

Thickness variation in a rotor can also result in pedal pulsation, chatter and surge due to variation in brake output. This can also be caused by excessive runout in the rotor and/or the hub.

Dishing or distortion can be caused by extreme heat and abuse of the brakes.

CHECKING ROTOR FOR RUNOUT AND THICKNESS

NOTE: The procedure for checking rotor runout and thickness is the same for the front and rear rotor. If there is a specification difference between the front and rear rotor it will be designated as such in the specifications of the following procedure.

On-vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable). To measure runout on the vehicle, remove the wheel and reinstall the lug nuts tightening the rotor to the hub. Mount Dial Indicator, Special Tool C-3339 with Mounting Adaptor, Special Tool SP- 1910 on steering arm. Dial indicator plunger should contact braking surface of rotor approximately 10 mm (0.393 in.) from outer edge of rotor (Fig. 13). Check lateral runout on both sides of rotor. Lateral runout of the rotor should not exceed 0.13 mm (0.005 inch).

If lateral runout is in excess of the specification, check the lateral runout of the hub face. Before removing rotor from hub, make a chalk mark across

DIAGNOSIS AND TESTING (Continued)

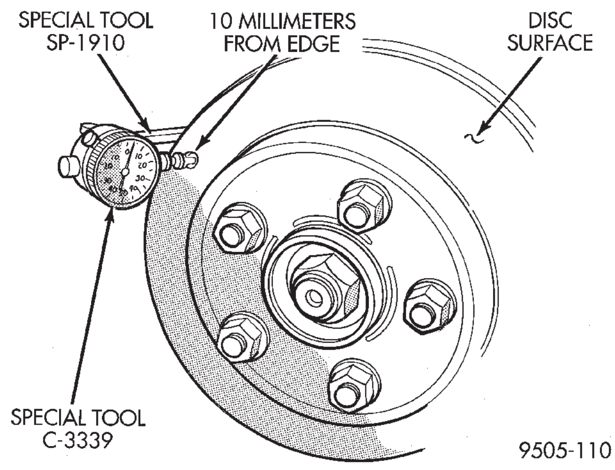


Fig. 13 Checking Brake Rotor For Runout

both the rotor and one wheel stud on the high side of the runout. This will ensure that the original location of the rotor in relation to the hub can be retained (Fig. 14). Remove rotor from hub.

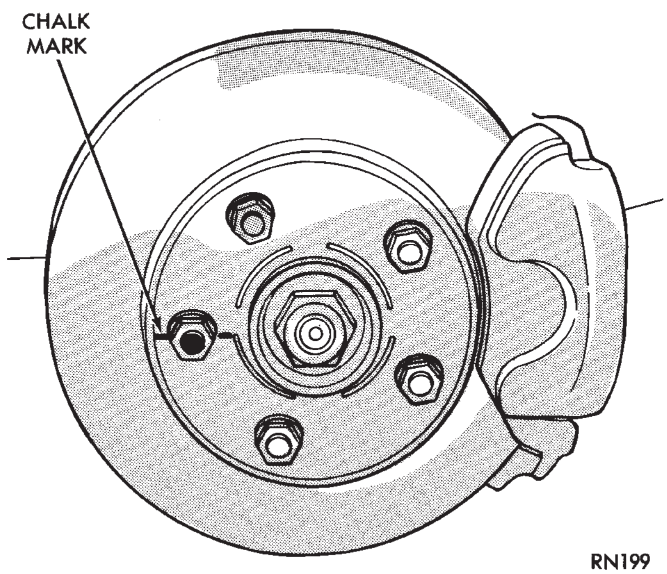


Fig. 14 Marking Rotor And Wheel Stud

Thoroughly clean the front surface of the front hub. Then install Dial Indicator, Special Tool C-3339 and Mounting Adaptor, Special Tool SP-1910 on steering knuckle. Position stem so it contacts hub face near outer diameter. Care must be taken to position stem outside the stud circle but inside the chamfer on the hub face (Fig. 15). **Clean hub surface before checking.**

Lateral runout should not exceed 0.08 mm (0.003 inch). If runout exceeds this specification, the hub must be replaced. See Suspension Group 2. If lateral runout of the hub does not exceed this specification, install rotor on hub with chalk marks two wheel studs apart (Fig. 16). Tighten nuts in the propersequence and torque to specification. Finally, check lat-

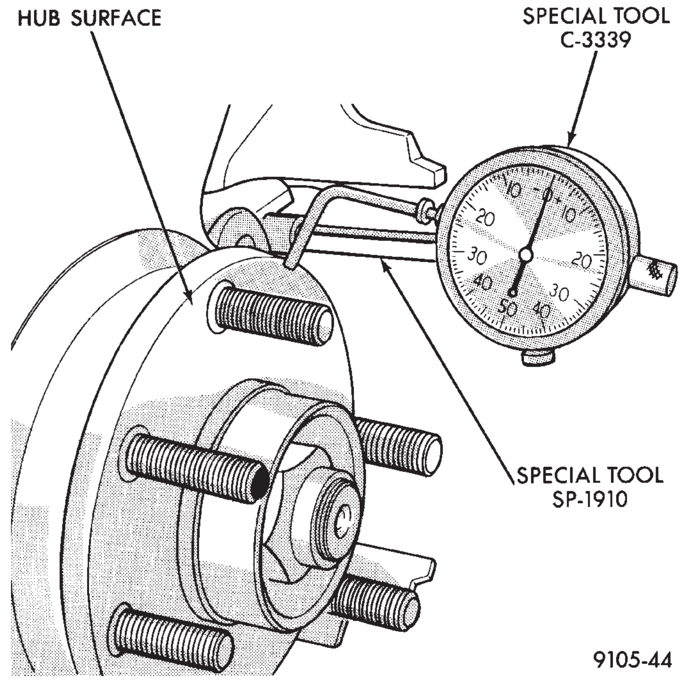


Fig. 15 Checking Disc Brake Rotor For Runout

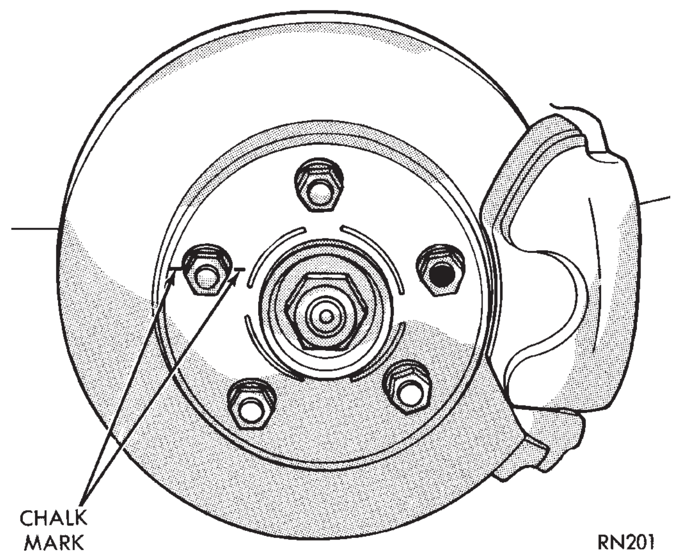


Fig. 16 Indexing Rotor And Wheel Stud

eral runout of rotor to see if lateral runout is now within specification.

If lateral runout is not within specification, install a new rotor or reface rotor, being careful to remove as little rotor material as possible from each side of rotor. Remove equal amounts from each side of rotor. Do not reduce thickness below minimum thickness marking cast into the un-machined surface (Fig. 17) of the rotor .

Thickness variation measurements of the rotor should be made in conjunction with the lateral runout measurements. Measure the thickness of the rotor at 12 circumferentially equal points with a

DIAGNOSIS AND TESTING (Continued)

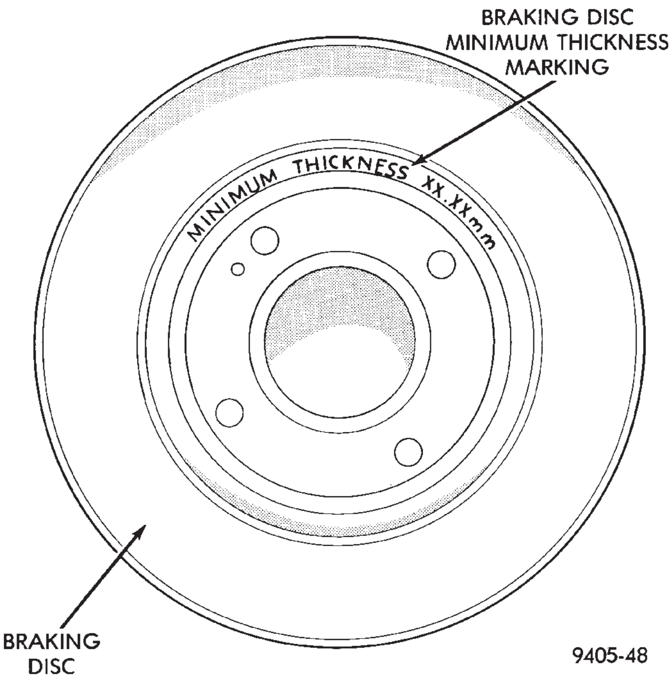


Fig. 17 Minimum Rotor Thickness Markings

micrometer at a radius approximately 25.4 mm (1 inch) from outer edge of rotor (Fig. 18). If thickness measurements vary by more than 0.013 mm (0.0005 inch), rotor should be removed and resurfaced, or a new rotor installed. If cracks or burned spots are evident, rotor must be replaced.

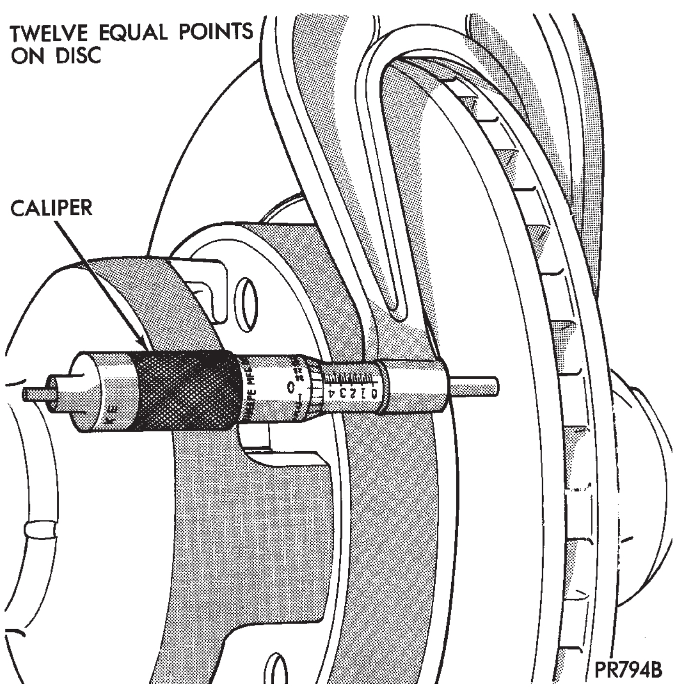


Fig. 18 Checking Rotor For Thickness Variation

Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the rotor must be refinished or replaced (See Refinishing/Refacing Rotor). If cracks are evident in the rotor, replace the rotor.

PROPORTIONING VALVES

FIXED PROPORTIONING VALVE TEST PROCEDURE

On a vehicle equipped with ABS, premature or excessive rear wheel ABS cycling may be an indication that the brake fluid pressure to the rear brakes is above the desired output.

Prior to testing a proportioning valve for function, check that all tire pressures are correct. Also, ensure the front and rear brake linings are in satisfactory condition. **It is also necessary to verify that the brakes shoe assemblies on a vehicle being tested, are either original equipment manufacturers (OEM), or original replacement brake shoe assemblies meeting the OEM lining material specification. The vehicles brake system is not balanced for after market brake shoe assembly lining material.**

If brake shoe assembly lining material is of satisfactory condition, and of the correct material specification, check for proper proportioning valve function using the following procedure.

(1) Road test vehicle to be sure the vehicle is truly exhibiting a condition of excessive rear wheel ABS cycling. Since ABS cycles both rear brakes together **both proportioning valves of the assembly** (Fig. 19) must be tested. Use the following procedure to test the proportioning valve.

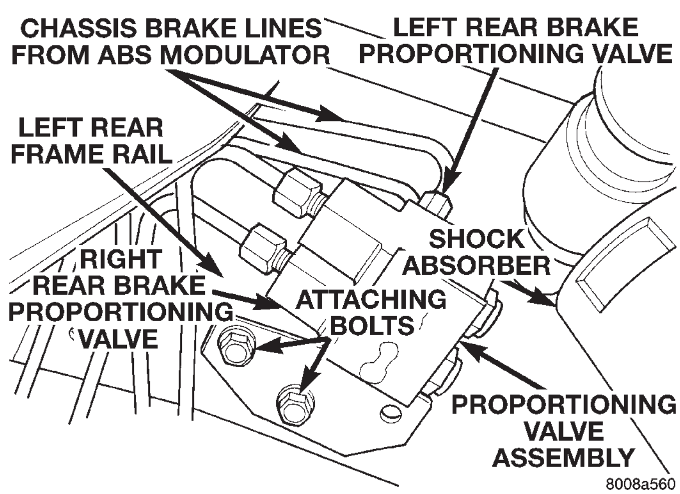


Fig. 19 Rear Brake Proportioning Valve And Brake Tube Locations

(2) Remove one of the chassis brake lines (Fig. 19) coming from the ABS modulator, at

(3) the proportioning valve assembly. Remove the hydraulic brake line going to one of the rear wheels of the vehicle from the proportioning valve (Fig. 19)

DIAGNOSIS AND TESTING (Continued)

(4) Remove the 2 bolts (Fig. 19) attaching the proportioning valve to the frame rail.

CAUTION: When lowering the proportioning valve, care must be taken not to kink any of the chassis brake lines.

(5) Carefully lower the proportioning valve for clearance to install the proportioning valve test fittings.

(6) Install the required fitting from Pressure Test Fittings, Special Tool 6833 (Fig. 20) into the inlet port of the proportioning valve assembly, from which the chassis brake line was removed. Install the removed chassis brake line into the Pressure Test Fitting (Fig. 20). Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve. Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve (Fig. 20). Then install the removed chassis brake line into the Pressure Test Fitting (Fig. 20).

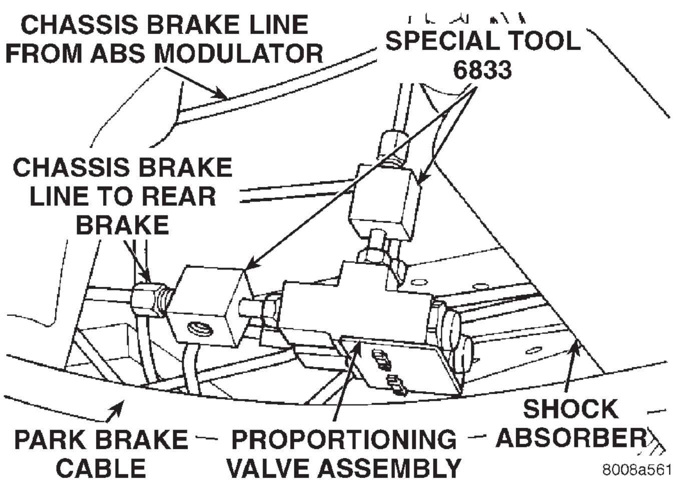


Fig. 20 Proportioning Valve Test Fitting Installation

(7) Install a pressure gauge from Gauge Set, Special Tool C-4007-A into each pressure test fitting (Fig. 21). Bleed air out of hose from pressure test fittings to pressure gauges, at the pressure gauges (Fig. 21). Then bleed air out of the brake line being tested, at that rear wheel cylinder.

(8) With the aid of a helper, apply pressure to the brake pedal until a pressure of 6895 kPa (1000 psi) is obtained on the proportioning valve inlet gauge. Then based on the type of brake system the vehicle is equipped with and the pressure specification shown on the following table, compare the pressure reading on the outlet gauge to the specification. If outlet pressure at the proportioning valve is not within specification when required inlet pressure is obtained, replace the proportioning valve.

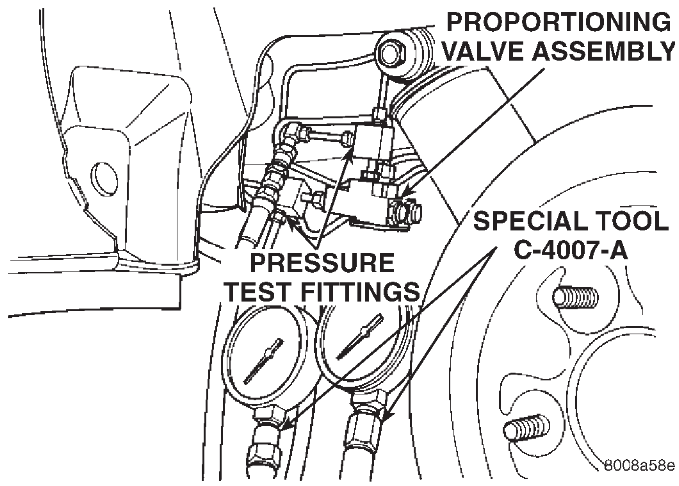


Fig. 21 Pressure Gauges Installed On Pressure Test Fittings

(9) Repeat steps 2 through 7 for the other proportioning valve of the assembly.

CAUTION: When mounting the original or a replacement proportion valve on the frame rail of the vehicle install the mounting bolts in only the two forward holes of the mounting bracket (Fig. 19).

HEIGHT SENSING PROPORTIONING VALVE

CAUTION: The use of after-market load leveling or load capacity increasing devices on this vehicle are prohibited. Using air shock absorbers or helper springs on this vehicle will cause the height sensing proportioning valve to inappropriately reduce the hydraulic pressure to the rear brakes. This inappropriate reduction in hydraulic pressure potentially could result in increased stopping distance of the vehicle.

When a premature rear wheel skid is obtained on a brake application, it may be an indication that the hydraulic pressure to the rear brakes is above the specified output from the proportioning valve. This condition indicates a possible malfunction of the height sensing proportioning valve, which will require testing to verify that it is properly controlling the hydraulic pressure allowed to the rear brakes. Premature rear wheel skid may also be caused by an incorrectly adjusted proportioning valve actuator assembly, or contaminated front or rear brake linings.

Prior to testing a proportioning valve for function, check that all tire pressures are correct. Also, ensure the front and rear brake linings are in satisfactory condition. **It is also necessary to verify that the brakes shoe assemblies on a vehicle being tested, are either original equipment manufacturers (OEM), or original replacement brake**

DIAGNOSIS AND TESTING (Continued)

shoe assemblies meeting the OEM lining material specification. The vehicles brake system is not balanced for after market brake shoe assembly lining material.

If both front and rear brakes check OK, proceed to verify that the actuator assembly for the height sensing proportioning valve is adjusted correctly. See Height Sensing Proportioning Valve in the Adjustment Section in this group of the service manual for the adjustment procedure. If the proportioning valve is adjusted correctly, proceed with the test procedure for the height sensing proportioning valve as follows:

(1) Remove the actuator assembly adjustment nut (Fig. 22). Remove the actuator assembly from the lever on the height sensing proportioning valve.

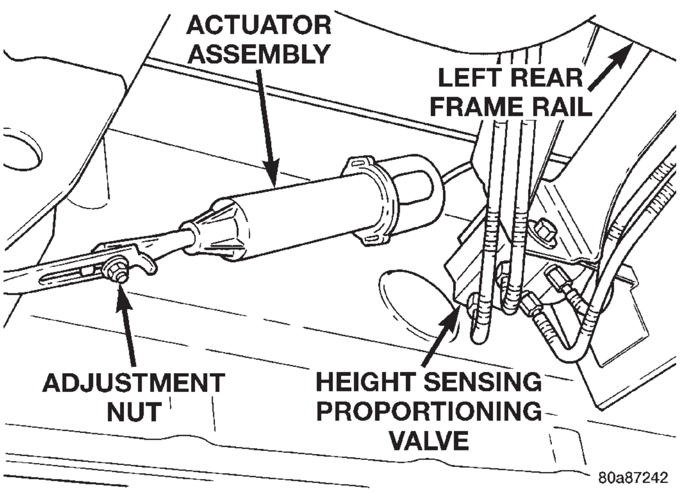


Fig. 22 Actuator Assembly Adjustment Nut

(2) Remove the chassis brake tube coming from the junction block from the front of the height sensing proportioning valve (Fig. 23). Remove the chassis brake tube going to the rear brakes from the back of the height sensing proportioning valve (Fig. 23).

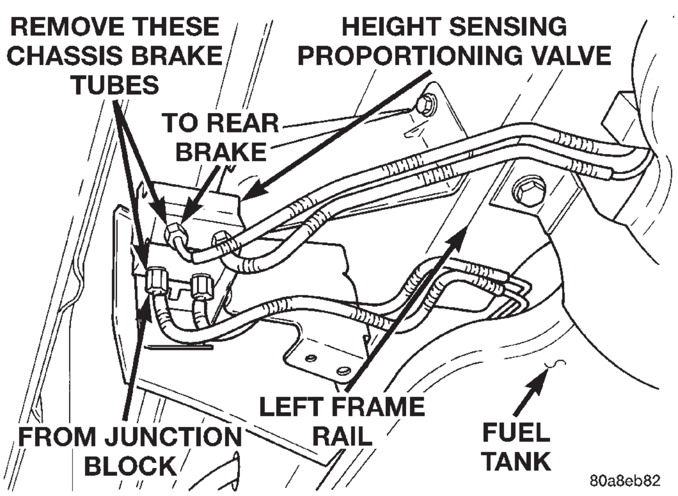


Fig. 23 Brake Tube Connections To Proportioning Valve

(3) Install the required fittings from Pressure Test Fittings, Special Tool 6833 (Fig. 24) into the inlet port of the proportioning valve assembly, from which the chassis brake line was removed. Install the removed chassis brake line into the Pressure Test Fitting (Fig. 24). Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve. Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve (Fig. 24). Then install the removed chassis brake line into the Pressure Test Fitting (Fig. 20).

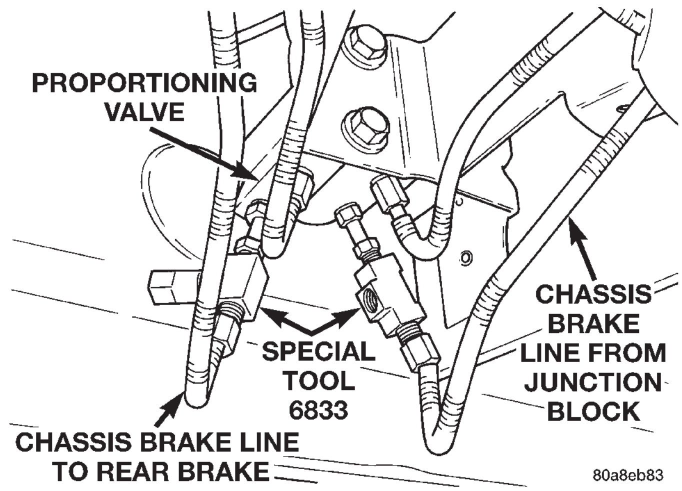


Fig. 24 Proportioning Valve Test Fitting Installation

(4) Install a pressure gauge from Gauge Set, Special Tool C-4007-A into each pressure test fitting (Fig. 25). Bleed air out of hose from pressure test fittings to pressure gauges, at the pressure gauges (Fig. 25). Then bleed air out of the brake line being tested, at that rear wheel cylinder.

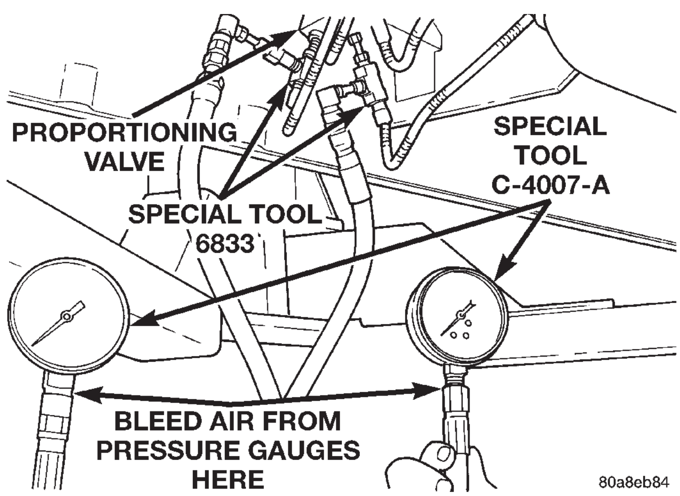


Fig. 25 Pressure Gauges Installed On Pressure Test Fittings

DIAGNOSIS AND TESTING (Continued)

(5) With the aid of a helper, apply pressure to the brake pedal until a pressure of 6895 kPa (1000 psi) is obtained on the proportioning valve inlet gauge. Then based on the type of brake system the vehicle is equipped with and the pressure specification shown on the following table, compare the pressure reading on the outlet gauge to the specification. If outlet pressure at the proportioning valve is not within specification when required inlet pressure is obtained, replace the proportioning valve.

(6) Remove the pressure test fittings and pressure gauges from the proportioning valve.

(7) Install the chassis brake lines in the correct ports of the proportioning valve.

(8) Install the pressure test fittings and pressure gauges in the opposite inlet and outlet port of the height sensing proportioning valve. Repeat steps 4 and 5 for the other proportioning valve.

(9) Remove the pressure test fittings and pressure gauges from the proportioning valve.

(10) Install the chassis brake lines in the correct ports of the proportioning valve.

(11) Install the actuator (Fig. 22) on the height sensing proportioning valve. Adjust the proportioning valve actuator. See Height Sensing Proportioning Valve in the Adjustment Section in this group of the service manual for the adjustment procedure.

(12) Bleed both rear hydraulic circuits at the rear brakes.

(13) Road test vehicle.

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.

RED BRAKE WARNING LAMP TEST

For diagnosis of specific problems with the red brake warning lamp system, refer to Brake System Diagnostics Chart 2, located in the Diagnosis And Testing section in this group of the service manual.

TRACTION CONTROL LAMP TEST

The traction control light is tested by cycling the traction control switch on and off. The traction control switch used on this vehicle is a momentary contact type switch. The test procedure for the traction control light is performed as follows: Press the traction control switch once and the “Trac Off” lamp will illuminate. With the “Trac Off” lamp illuminated, press the traction control switch again and the “Trac Off” lamp will turn off.

If the traction control lamp does not function as described in the test above, diagnosis of the traction control switch, lamp, wiring and other related components of the traction control system is required.

STOP LAMP SWITCH TEST PROCEDURE

The required procedure for testing the stop lamp switch is covered in Group 8H, Vehicle Speed Control System in this service manual. The electrical circuit tests for stop lamps is covered in Group 8W Rear-Lighting in this service manual.

WHEEL BASE	DRIVE TRAIN	SALES CODE	BRAKE SYSTEM	SPLIT POINT	SLOPE	INLET PRESSURE PSI	OUTLET PRESSURE PSI
SWB	FWD	BRA+BGF	14″ DISC/DRUM W/O ANTILOCK	VAR.	.30	1000 PSI	250-350 PSI
SWB	FWD	BRA+BGF BRB+BGF BRV+BGF	14″,15″,15″HD DISC/DRUM WITH ANTILOCK	25 BAR	.59	1000 PSI	660-780 PSI
LWB	FWD	BRA+BGF	14″ DISC/DRUM W/O ANTILOCK	VAR.	.30	1000 PSI	250-350 PSI
LWB	FWD	BRA+BGF BRB+BGF BRV+BGF	14″,15″,15″HD DISC/DRUM WITH ANTILOCK	25 BAR	.59	1000 PSI	660-780 PSI
SWB	AWD	BRE+BGF	15″ DISC/DISC WITH ANTILOCK	25 BAR	.36	1000 PSI	525-640 PSI
LWB	AWD	BRE+BGF	15″ DISC/DISC WITH ANTILOCK	41 BAR	.36	1000 PSI	690-800 PSI

SERVICE PROCEDURES

MASTER CYLINDER FLUID LEVEL CHECK

Check master cylinder reservoir fluid level a minimum of twice annually.

Master cylinder reservoirs are marked with the words FULL and ADD to indicate proper brake fluid fill level of the master cylinder (Fig. 26).

If necessary, add brake fluid to bring the level to the bottom of the FULL mark on the side of the master cylinder fluid reservoir. **When filling master cylinder fluid reservoir do not fill the filler neck of the fluid reservoir (Fig. 26) with brake fluid.**

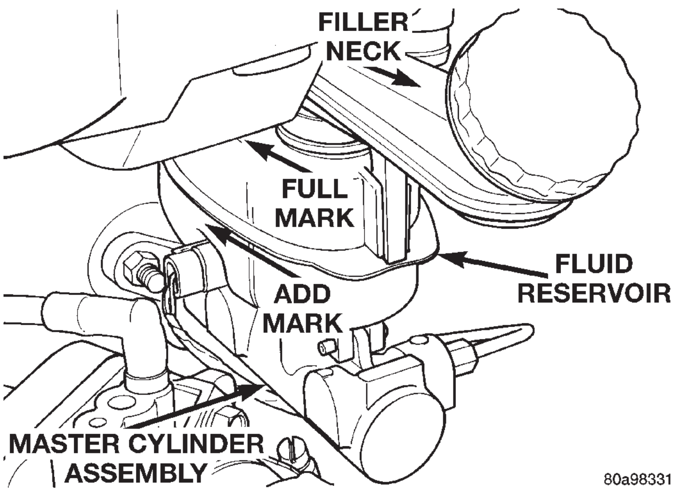


Fig. 26 Master Cylinder Fluid Level Marks

Use only Mopar® brake fluid or an equivalent from a sealed container. Brake fluid must conform to DOT 3, specifications.

DO NOT use brake fluid with a lower boiling point, as brake failure could result during prolonged hard braking.

Use only brake fluid that was stored in a tightly-sealed container.

DO NOT use petroleum-based fluid because seal damage will result. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid ect.

BLEEDING BASE BRAKE HYDRAULIC SYSTEM

NOTE: This bleeding procedure is only for the vehicle's base brakes hydraulic system. For bleeding the antilock brakes hydraulic system, refer to the ITT Teves Mark 20 Antilock Brake System bleeding procedure in the antilock brakes section of this service manual.

PRESSURE BLEEDING PROCEDURE

CAUTION: Before removing the master cylinder cover, throughly clean the cover and master cylinder fluid reservoir to prevent dirt and other foreign matter from dropping into the master cylinder fluid reservoir.

CAUTION: Use bleeder tank Special Tool C-3496-B with adapter Special Tool 6921 to pressurize the hydraulic system for bleeding.

CAUTION: When pressure bleeding the brakes hydraulic system the fluid reservoir filler neck must be removed from the master cylinder fluid reservoir. Failure to remove the filler neck from the fluid reservoir, may result in the filler neck separating from the fluid reservoir when the hydraulic system is pressurized.

Follow pressure bleeder manufacturer's instructions, for use of pressure bleeding equipment.

When bleeding the brake system, some air may be trapped in the brake lines or valves far upstream, as much as ten feet from the bleeder screw (Fig. 27). Therefore, it is essential to have a fast flow of a large volume of brake fluid when bleeding the brakes to ensure all the air gets out.

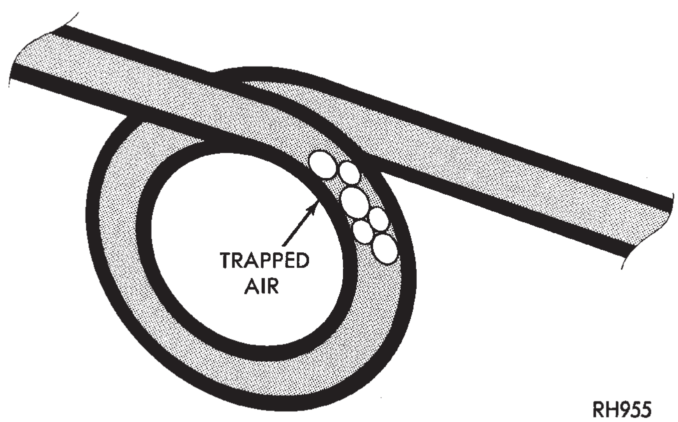


Fig. 27 Trapped Air In Brake Fluid Line

(1) Remove the filler neck from the master cylinder fluid reservoir.

(2) Install the Adapter Master Cylinder Pressure Bleed Cap, Special Tool 6921 on the fluid reservoir of the master cylinder (Fig. 28). Attach the fluid hose from the pressure bleeder to the fitting on Special Tool 6921.

(3) Attach a clear plastic hose to the bleeder screw at one wheel and feed the hose into a clear jar containing fresh brake fluid.

SERVICE PROCEDURES (Continued)

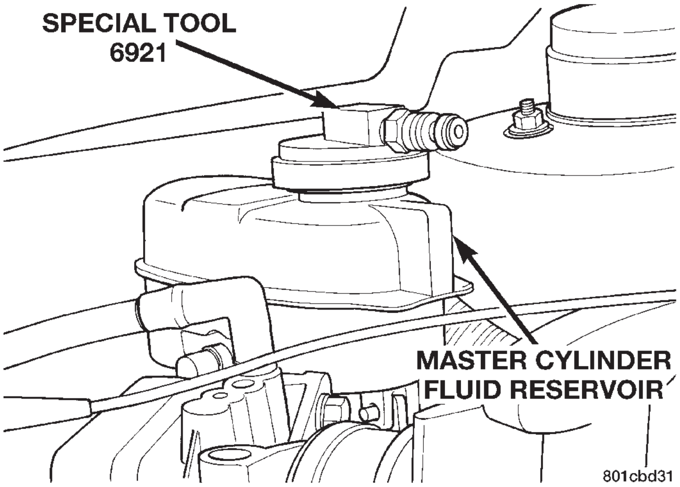


Fig. 28 Pressure Bleeding Cap Installed On Master Cylinder

NOTE: The following wheel sequence should be used when bleeding the brake hydraulic system. The use of this wheel sequence will ensure adequate removal of all trapped air from the brake hydraulic system.

- Left Rear Wheel
- Right Front Wheel
- Right Rear Wheel
- Left Front Wheel

(4) Open the left rear wheel bleeder screw at least **one full turn** or more to obtain an adequate flow of brake fluid (Fig. 29).

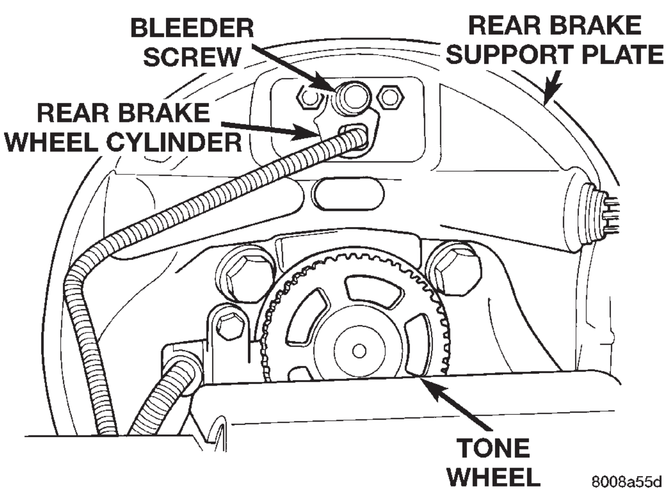


Fig. 29 Rear Wheel Cylinder Bleeder Screw

CAUTION: Just cracking the bleeder screw often restricts fluid flow, and a slow, weak fluid discharge will NOT get all the air out.

(5) After 4 to 8 ounces of brake fluid has been bled through the hydraulic system, and an air-free flow is maintained in the hose and jar, this will indicate a good bleed of the hydraulic system has been obtained.

(6) Repeat the procedure at all the other remaining bleeder screws. Then check the pedal for travel. If pedal travel is excessive or has not been improved, enough fluid has not passed through the system to expel all the trapped air. Be sure to monitor the fluid level in the pressure bleeder, so it stays at a proper level so air will not enter the brake system through the master cylinder.

(7) Perform a final adjustment of the rear brake shoes and then test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

BLEEDING WITHOUT A PRESSURE BLEEDER

NOTE: Correct manual bleeding of the brakes hydraulic system will require the aid of a helper.

NOTE: To adequately bleed the brakes using the manual bleeding procedure the rear brakes must be correctly adjusted. Prior to the manual bleeding of the brake hydraulic system, correctly adjust the rear brakes.

NOTE: The following wheel sequence should be used when bleeding the brake hydraulic system. The use of this wheel sequence will ensure adequate removal of all trapped air from the brake hydraulic system.

- Left Rear Wheel
- Right Front Wheel
- Right Rear Wheel
- Left Front Wheel

(1) Pump the brake pedal three or four times and hold it down before the bleeder screw is opened.

(2) Push the brake pedal toward the floor and hold it down. Then open the left rear bleeder screw at least 1 full turn. When the bleeder screw opens the brake pedal will drop all the way to the floor.

(3) Release the brake pedal only **after** the bleeder screw is closed.

(4) Repeat steps 1 through 3, four or five times, at each bleeder screw in the required sequence. This should pass a sufficient amount of fluid to expel all the trapped air from the brake system. Be sure to monitor the fluid level in the master cylinder, so it stays at a proper level so air will not enter the brake system through the master cylinder.

(5) Perform a final adjustment of the rear brake shoes and then test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

SERVICE PROCEDURES (Continued)

MASTER CYLINDER BLEEDING PROCEDURE

CAUTION: When clamping master cylinder in vise, only clamp master cylinder by its mounting flange, do not clamp on primary piston, seal\boot or body of master cylinder.

(1) Clamp the master cylinder in a vise using only the mounting flange (Fig. 30).

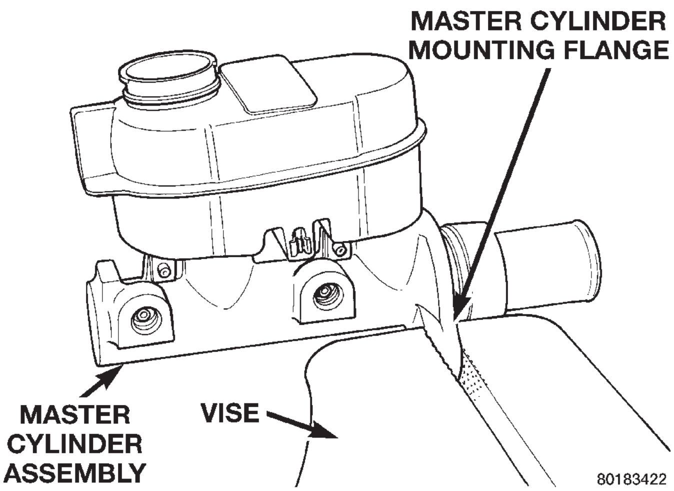


Fig. 30 Master Cylinder Mounted In Vise

NOTE: Two different size bleeding tubes are used depending on which type of master cylinder the vehicle is equipped with. Vehicles equipped with traction control use a center port master cylinder with a larger diameter brake tube. Vehicles not equipped with traction control use a compensating port master cylinder using a standard 3/16 inch diameter brake tube. Be sure the correct size bleeding tubes are used when bleeding the master cylinder.

(2) Install the Bleeding Tubes, Special Tool 6920 for a non traction control master cylinder or Special Tool 8129 for a traction control master cylinder on the master cylinder (Fig. 102). Position bleeding tubes so the outlets of bleeding tubes will be below surface of brake fluid when reservoir is filled to its proper level.

(3) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(4) Using a wooden dowel, depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled from master cylinder.

(5) Remove bleeding tubes from master cylinder outlet ports, and then plug outlet ports and install fill cap on reservoir.

(6) Remove master cylinder from vise.

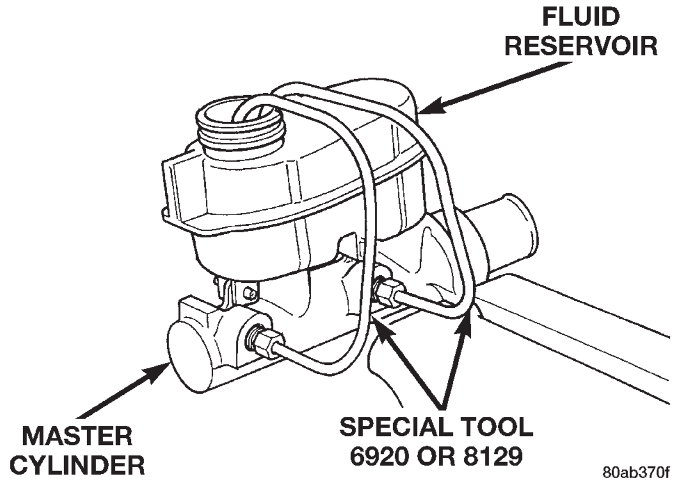


Fig. 31 Bleed Tubes Installed On Master Cylinder

(7) Install the filler cap from the master cylinder filler neck, on the master cylinder fluid reservoir.

(8) Install the master cylinder assembly on the power brake vacuum booster.

NOTE: Note: It is not necessary to bleed the ABS hydraulic control unit (HCU) after replacing the master cylinder. But, the base brake hydraulic system must be bled to ensure no air is entered the hydraulic system when the master cylinder was removed.

ROTOR MACHINING (FRONT/REAR)

BRAKE ROTOR MACHINING PROCEDURES

Any servicing of the rotor requires extreme care to maintain the rotor to within service tolerances to ensure proper brake action.

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or brake pedal pulsation, the rotor should be resurfaced, refaced (Fig. 32) or (Fig. 33) or replaced.

NOTE: All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 34) or (Fig. 35).

This marking includes 0.76 mm (0.030 inch) allowable rotor wear beyond the recommended 0.76 mm (0.030 inch) of rotor refacing.

The collets, shafts and adapters used on the brake lathe and the bearing cups in the rotor MUST be clean and free from any chips or contamination.

When mounting the rotor on the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

If the rotor is not mounted properly, the lateral runout will be worse after refacing or resurfacing than before.

SERVICE PROCEDURES (Continued)

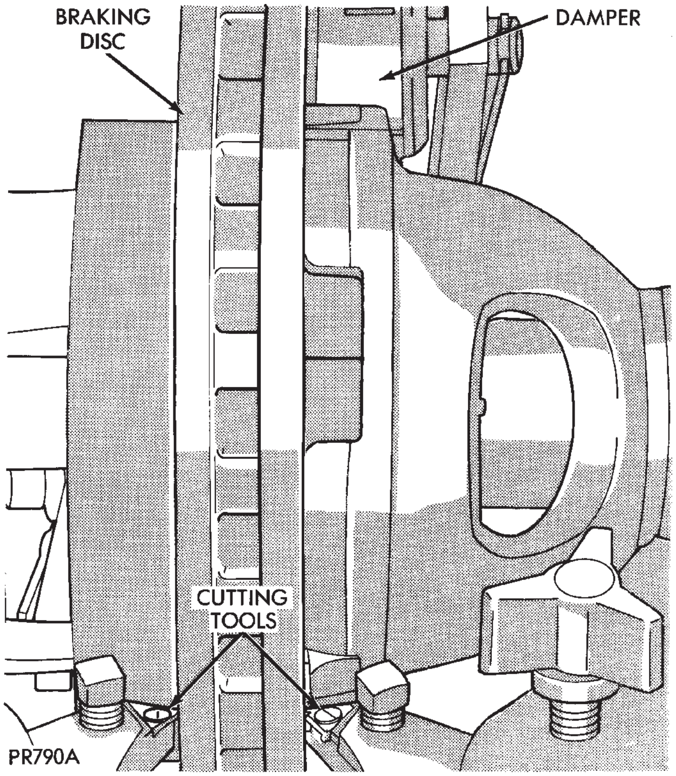


Fig. 32 Refacing Brake Rotor

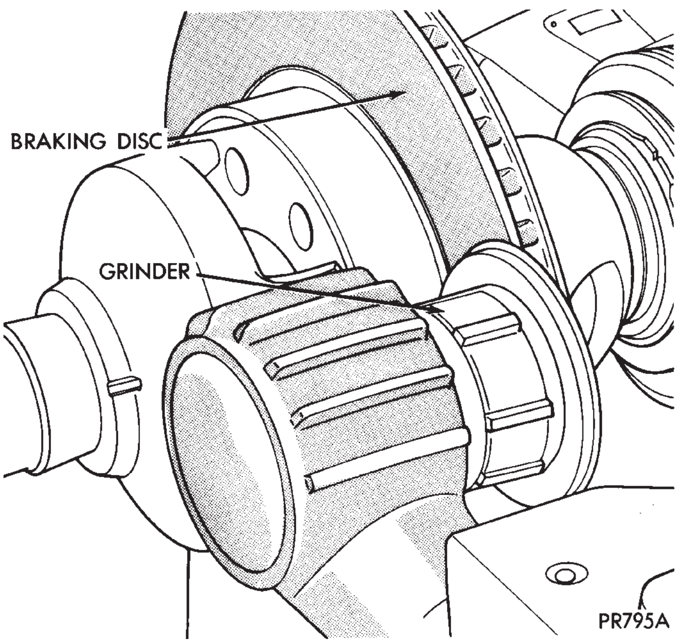


Fig. 33 Resurfacing Brake Rotor (Final Finish)

REFACING BRAKE ROTOR

Refacing of the rotor is not required each time the brake pads are replaced.

When refacing a rotor the required 0.08 mm (0.003 inch) TIR (Total Indicator Reading) and 0.013 mm (0.0005 inch) thickness variation limits MUST BE MAINTAINED. **Extreme care** in the operation of rotor turning equipment is required.

The use of a double straddle cutter (Fig. 32) that machines both sides of the rotor at the same time is highly recommended.

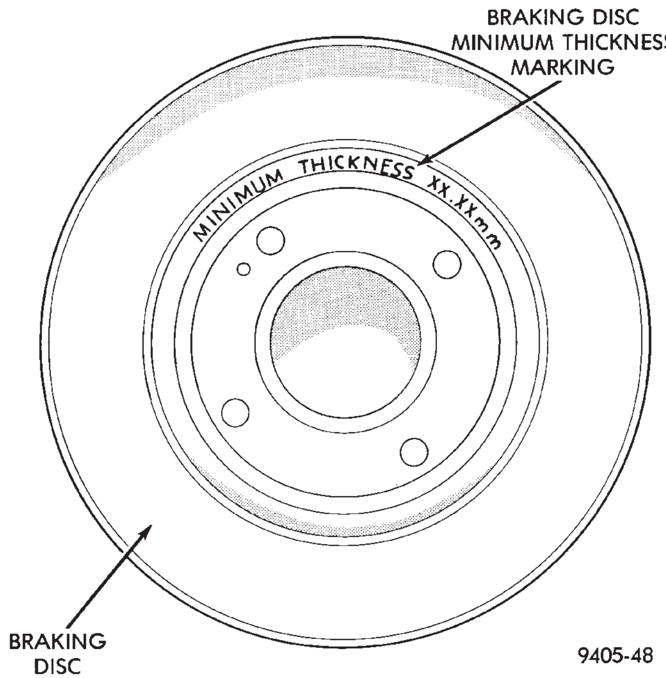


Fig. 34 Front Rotor Thickness Markings

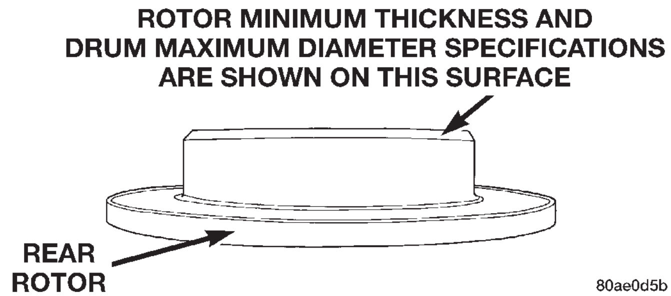


Fig. 35 Rear Rotor Thickness Markings

RESURFACNG BRAKE ROTOR

This operation can be used when rotor surface is rusty, has lining deposits or excessive lateral runout or thickness variation is evident.

A sanding rotor attachment (Fig. 33) will remove surface contamination without removing much rotor material.

It will generally follow variations in thickness that are in the rotor.

SERVICE PROCEDURES (Continued)

ROTOR REFINISHING LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Run Out*	Rotor Micro Finish
Front Rotor	23.87-24.13 mm .939 -.949 in.	22.4 mm .881 in.	.013 mm .0005 in.	.08 mm .003 in.	15-80 RMS
Rear Rotor	12.75-12.25 mm .502 -.482 in.	11.25 mm .443 in.	.013 mm .0005 in.	.08 mm .003 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

BRAKE DRUM MACHINING

Measure the runout and diameter of the rear brake using only accurate measuring equipment. There should be no variation in the drum diameter greater than 0.090 mm (0.004 inch). Drum runout should not exceed 0.15 mm (0.006 inch) out of round. If the drum runout or diameter variation exceed these values the drum should be refaced. For best results in eliminating the irregularities that cause brake roughness and surge, the amount of material removed during a single cut should be limited to 0.13 mm (0.005 inch). When the entire braking surface has been cleaned. A final cut of 0.0254 mm (0.001 inch) will assure a good drum surface providing the equipment used is capable of the precision required for resurfacing brake drums. Deeper cuts are permissible for the sole purpose of removing deep score marks. **Do not reface more than 1.52 mm (0.060 inch) over the standard drum diameter.**

All drums will show markings of maximum allowable diameter (Fig. 36). For example, a drum will have a marking of MAX. DIA. 251.55 mm (9.90 inch). This marking includes 0.76 mm (0.030 inch) for allowable drum wear beyond the recommended 1.52 mm (0.060 inch) of drum refacing

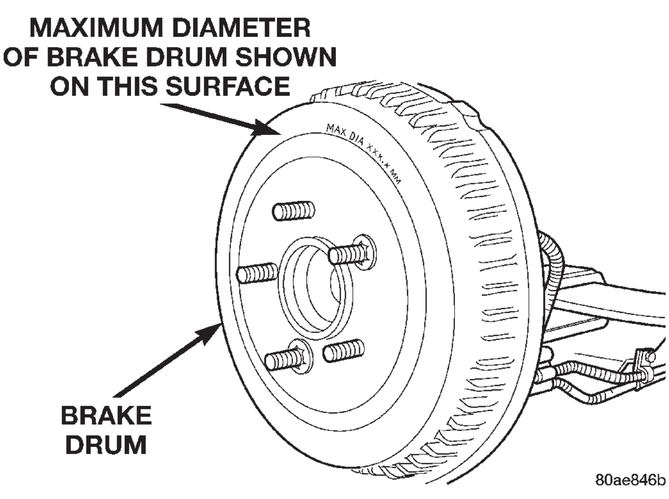


Fig. 36 Rear Brake Drum Maximum Diameter Identification

BRAKE TUBE REPAIR PROCEDURE

CAUTION: When repairing brake chassis lines or flex hoses, the correct fasteners must be used to attach the routing clips or hoses to the front suspension cradle. The fasteners used to attach components to the front suspension cradle have an anti-corrosion coating due to the suspension cradle being made of aluminum. Only Mopar replacement fasteners with the required anti-corrosion coating are to be used if a replacement fastener is required when installing a brake chassis line or flex hose.

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZW-AC alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

NOTE: On vehicles equipped with traction control, the primary and secondary hydraulic tubes between the master cylinder and the hydraulic control unit are 6 mm (15/64 in.). These tubes are also coated with the Al-rich/ZW-AC alloy and must be replaced with tubes having the same anti-corrosion coating. Be sure the correct tube nuts are used for the replacement of these hydraulic brake tubes.

Care should be taken when repairing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

If the primary or secondary brake line from the master cylinder to the ABS Hydraulic Control Unit, or the flexible brake lines between the hydraulic control unit and the proportioning valve require replacement **only** the original factory brake lines containing a flexible section can be used. This is required due to the movement of the front suspension cradle while the vehicle is in motion.

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 37). Ream out any burrs or rough edges showing on inside of tubing (Fig. 38). This will make the ends of tubing square (Fig. 38) and ensure better seating of

SERVICE PROCEDURES (Continued)

flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**

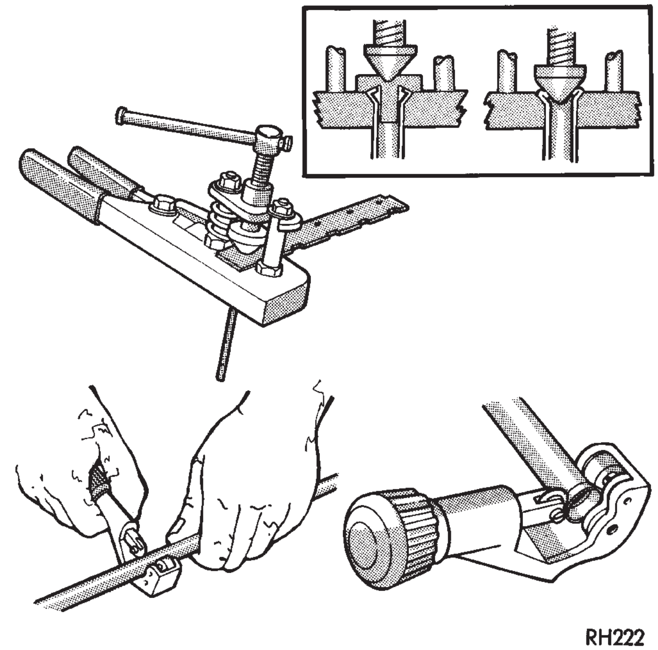


Fig. 37 Cutting And Flaring Of Brake Fluid Tubing

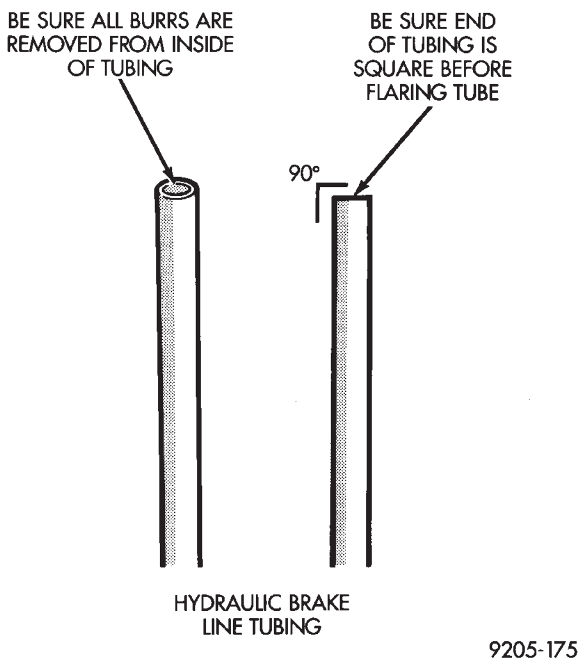


Fig. 38 Brake Fluid Tube Preparation For Flaring

DOUBLE INVERTED TUBING FLARES

To make a double inverted tubing flare (Fig. 39) and (Fig. 40). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the tubing size. Squeeze handles of flaring tool and lock tubing in place. Place 3/16 inch plug of gauge (A) down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.

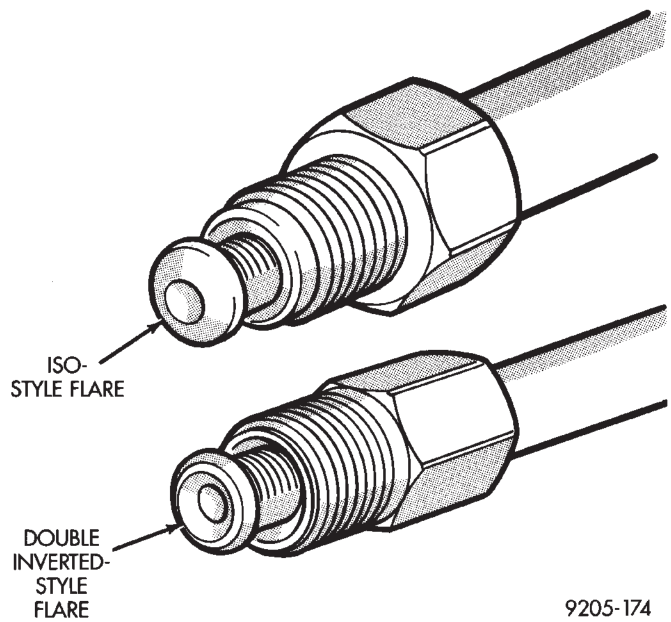


Fig. 39 Hydraulic Brake Tubing Flare Styles

ISO TUBING FLARES

CAUTION: All ISO style tubing flares (Fig. 39) and (Fig. 40) are of metric dimensions. When performing any service procedures on vehicles using ISO style tubing flares, metric size tubing of 4.75 mm MUST be used with metric ISO tube flaring equipment.

To create a (metric) ISO style tubing flare, Use Snap-On Flaring Tool TFM-428, or equivalent. See (Fig. 41) and proceed with the steps listed below. **Be sure to place the tubing nut on the tube before flaring the tubing.**

(1) Carefully prepare the end of the tubing to be flared. Be sure the end of the tubing to be flared is square and all burrs on the inside of the tubing are removed (Fig. 38). **This preparation is essential to**

SERVICE PROCEDURES (Continued)

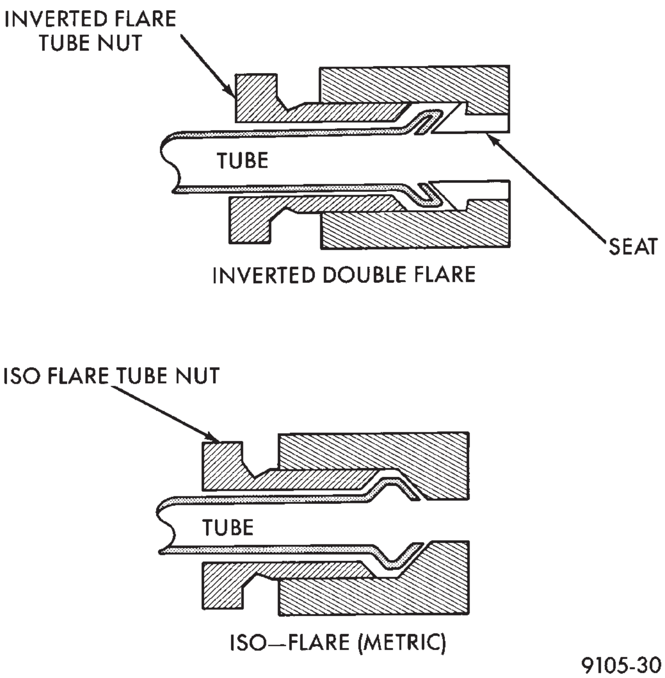


Fig. 40 Inverted Double Wall Flare And ISO Flare Tubing Connections

obtain the correct form of a (metric) ISO tubing flare.

(2) Open jaws of the Flaring Tool. Align the mating size jaws of the flaring tool around the size of the tubing to be flared. Close the jaws of the Flaring Tool around the tubing to keep it from sliding out of the flaring tool, but do not lock the tubing in place. See (Fig. 41)

(3) Position the tubing in the jaws of the Flaring Tool so that it is flush with the top surface of the flaring tool bar assembly. (Fig. 41))

(4) Install the correct size adaptor for the brake tubing being flared, on the feed screw of the yoke assembly. Center the yoke and adapter over the end of the tubing. Apply lubricant to the adapter area that contacts brake tubing. Making sure the adapter pilot is fully inserted in the end of the brake tubing. Screw in the feed screw of the yoke assembly until the adaptor has seated squarely on the surface of the bar assembly (Fig. 41). This process has created the (metric) ISO tubing flare.

PARK BRAKE AUTO ADJUSTER MECHANISM RELEASE

The park brake pedal mechanism used in this vehicle is designed so that the auto adjuster is not required to be locked out when servicing the park brake pedal and or the park brake cables.

This park brake pedal mechanism is designed so that the adjuster mechanism will rotate only half a turn when the tension is released from the park brake cable. This eliminates the requirement to lock

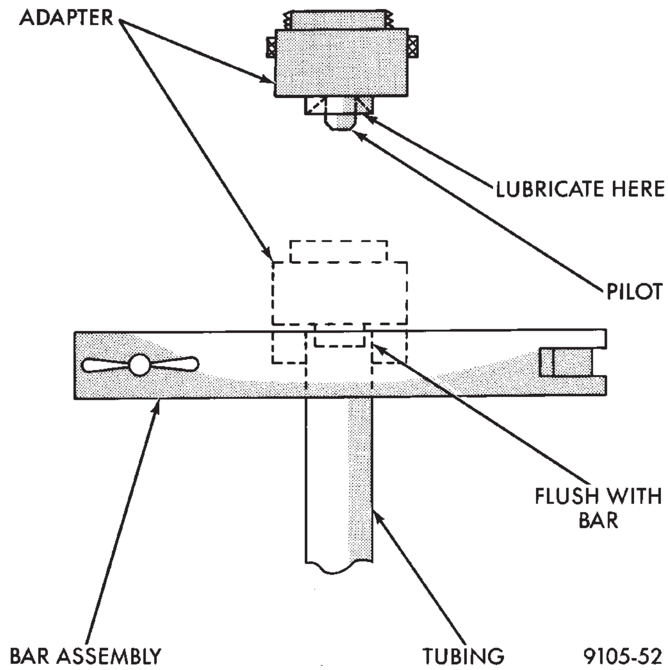


Fig. 41 Brake Tubing ISO Flaring Process

out the automatic adjuster when servicing the park brake pedal mechanism and cables.

Use the following procedure to release the tension from the park brake cables and the auto adjuster in the park brake pedal mechanism.

(1) Grasp the exposed section of the front park brake cable and pull rearward on it. While holding the park brake in this position, install a pair of locking pliers on the front park brake cable just rearward of the second body outrigger bracket (Fig. 42).

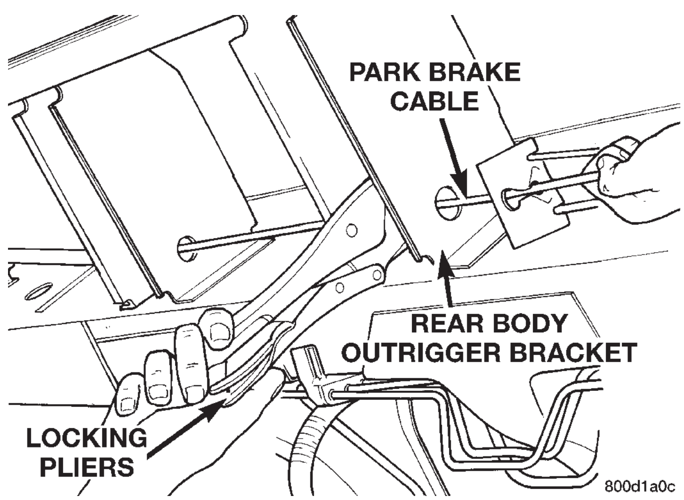


Fig. 42 Locking Out Automatic Adjuster

(2) Remove the left rear and intermediate park brake cable from the park brake cable equalizer (Fig. 43).

(3) Remove the equalizer from the front park brake cable.

SERVICE PROCEDURES (Continued)

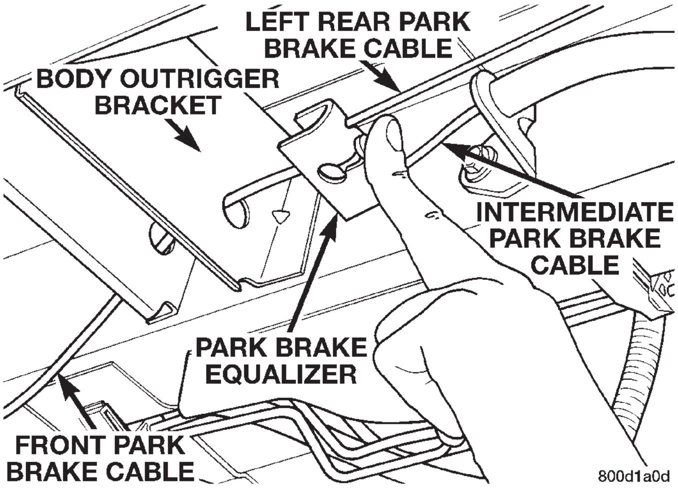


Fig. 43 Park Brake Cable Attachment To Equalizer

(4) Remove the locking pliers from the front park brake cable. This will allow the adjuster in the park brake pedal mechanism to rotate around to its stop. This will remove the tension from the adjuster and front park brake cable.

Use the following procedure to reset the auto adjuster in the park brake pedal mechanism.

(5) Grasp the exposed section of the front park brake cable and pull rearward on it. While holding the park brake in this position, install a pair of locking pliers on the front park brake cable just rearward of the second body outrigger bracket (Fig. 42).

(6) Install the equalizer on the front park brake cable.

(7) Install the left rear and intermediate park brake cable in the correct location on the park brake cable equalizer (Fig. 43).

(8) Remove the locking pliers from the front park brake cable. This will allow the adjuster in the park brake pedal mechanism to tension the park brake cables.

(9) Apply and release the park brake pedal one time. This will seat the park brake cables and allow the auto adjuster in the park brake pedal mechanism to correctly tension the park brake cables.

REMOVAL AND INSTALLATION

WHEEL AND TIRE INSTALLATION

To install the wheel and tire assembly, first position it properly on the mounting surface using the hub pilot as a guide. Then progressively tighten the lug nuts in the proper sequence to half of the required torque. Finally tighten the lug nuts in the proper sequence to 129 N·m (95 ft. lbs.). Never use oil or grease on studs or nuts.

FRONT DISC BRAKE CALIPER

SERVICE PRECAUTIONS

WARNING: ALTHOUGH FACTORY INSTALLED BRAKE LININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKE LINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKE LININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER–DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

CAUTION: During service procedures, grease or any other foreign material must be kept off brake shoe assemblies, and braking surfaces of brake drum and external surfaces of hub/bearing assembly.

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Remove front wheel and tire assemblies.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the 2 caliper to steering knuckle guide pin bolts (Fig. 44).

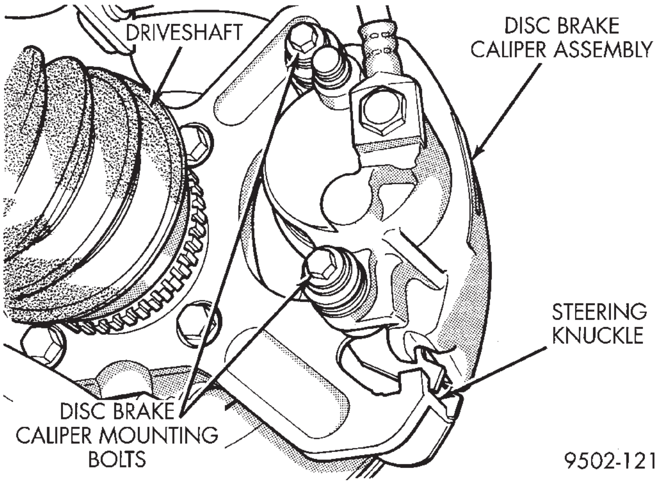


Fig. 44 Removing Caliper Guide Pin Bolts

(4) Remove caliper from steering knuckle, by first rotating free end of caliper away from steering knuckle. Then slide opposite end of caliper out from under machined abutment on steering knuckle (Fig. 45).

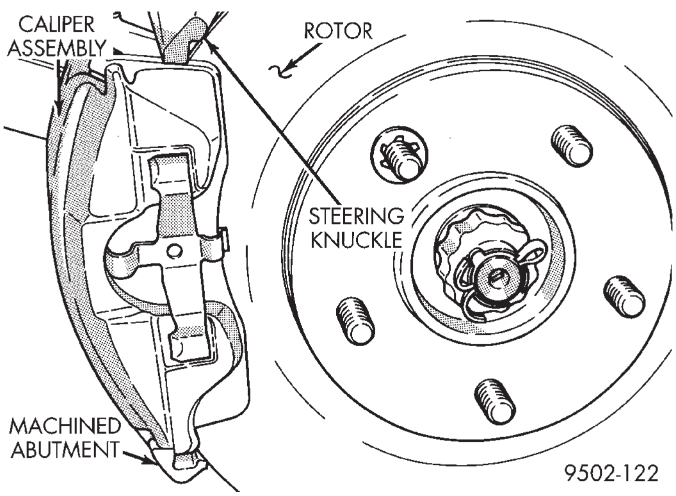


Fig. 45 Caliper Assembly Mounting On Steering Knuckle (Typical)

(5) Support caliper firmly to prevent weight of caliper from being supported by the brake fluid flex hose. Supporting weight of caliper by the brake fluid flex hose, can damage the flexible brake hose (Fig. 46).

INSTALL

(1) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

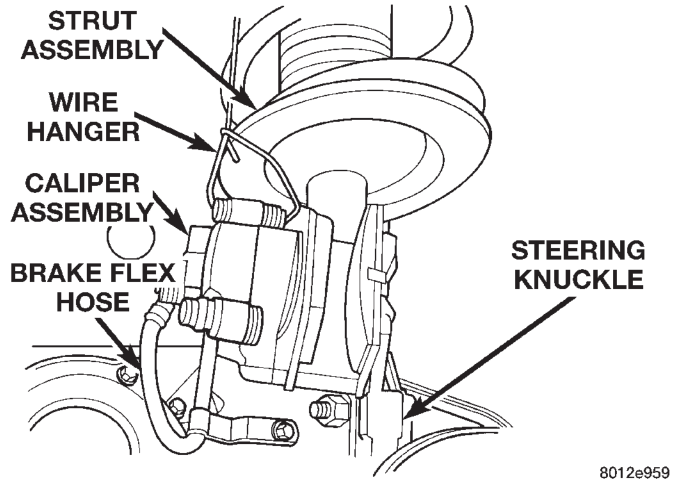


Fig. 46 Storing Front Disc Brake Caliper

CAUTION: Use care when installing the caliper assembly onto the steering knuckle, so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(2) Carefully position caliper and brake pad assemblies over brake rotor by hooking lower or upper end of caliper over the machined abutment on steering knuckle (Fig. 45). Then rotate caliper into position at the top of the steering knuckle (Fig. 45). Make sure that caliper guide pin bolts, bushings and sleeves are clear of the steering knuckle bosses.

(3) Install the caliper guide pin bolts (Fig. 44) and tighten to a torque of 41 N·m (40 ft. lbs.). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

(4) Install the wheel and tire assembly.

(5) Using a torque wrench, tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(6) Remove jackstands or lower hoist.

(7) **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.**

REAR DISC BRAKE CALIPER

During service procedures, grease or any other foreign material must be kept off brake shoe assemblies, and braking surfaces of rotor.

Handling of the rotor and caliper, must be done in such a way as to avoid damage to the rotor and scratching or nicking of lining on the brake shoes.

If inspection reveals that the caliper piston seal is leaking, it **MUST** be replaced immediately.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

REMOVAL AND INSTALLATION (Continued)

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheel and tire assemblies from vehicle.

(3) Remove the disc brake caliper to adapter guide pin bolts (Fig. 47).

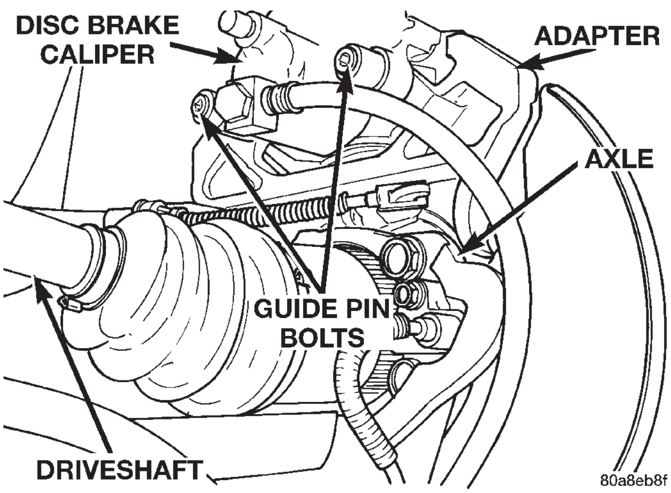


Fig. 47 Removing Caliper Guide Pin Bolts

(4) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up from the adapter. Then pull the front of the caliper and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 48).

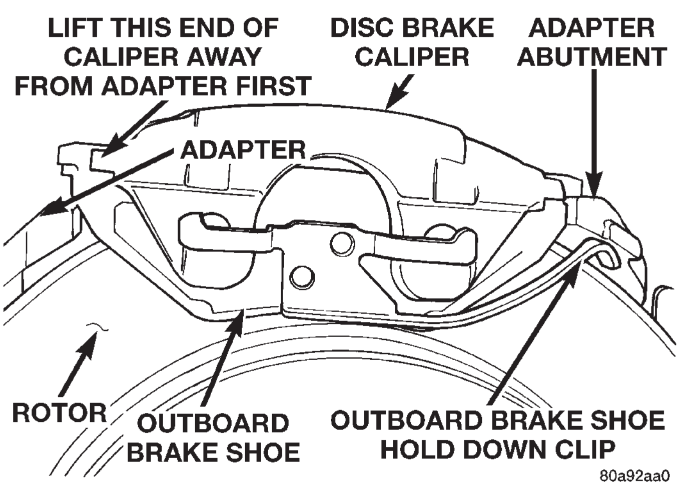


Fig. 48 Removing / Installing Caliper

(5) Support caliper to prevent the weight of the caliper from damaging the flexible brake hose (Fig. 49).

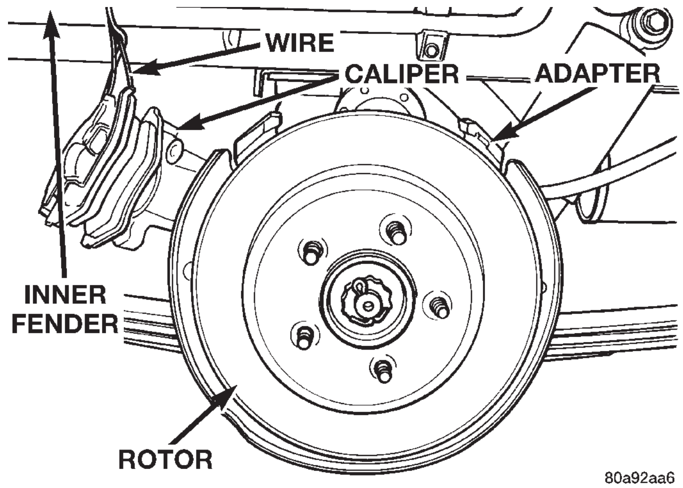


Fig. 49 Correctly Supported Caliper

INSTALL

NOTE: Step 1 below is only required when installing the disc brake caliper after new brake shoes have been installed.

(1) Completely retract caliper piston back into piston bore of caliper assembly.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the rear rotor on the hub, making sure it is squarely seated on the face of the hub.

CAUTION: Use care when installing the caliper assembly onto the adapter, so the caliper guide pin bushings do not get damaged by the mounting bosses.

(4) Carefully lower caliper and brake shoes over rotor and onto the adapter using the reverse procedure for removal (Fig. 48).

CAUTION: When installing guide pin bolts extreme caution should be taken not to crossthread the caliper guide pin bolts.

(5) Install the caliper guide pin bolts. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(6) Install the wheel and tire assembly.

(7) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(8) Remove jackstands or lower hoist.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop vehicle.

REMOVAL AND INSTALLATION (Continued)

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

FRONT DISC BRAKE PADS

REMOVE

WARNING: ALTHOUGH FACTORY INSTALLED BRAKE LININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTERMARKET BRAKE LININGS MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKE LININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER–DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

CAUTION: During service procedures, grease or any other foreign material must be kept off brake shoe assemblies, and braking surfaces of brake drum and external surfaces of hub/bearing assembly.

(1) Remove outboard brake pad, by prying the pad retaining clip over raised area on caliper (Fig. 50). Then slide the pad down and off the caliper.

(2) Pull inboard brake pad away from piston, until retaining clip on brake pad is free from cavity in caliper piston (Fig. 51).

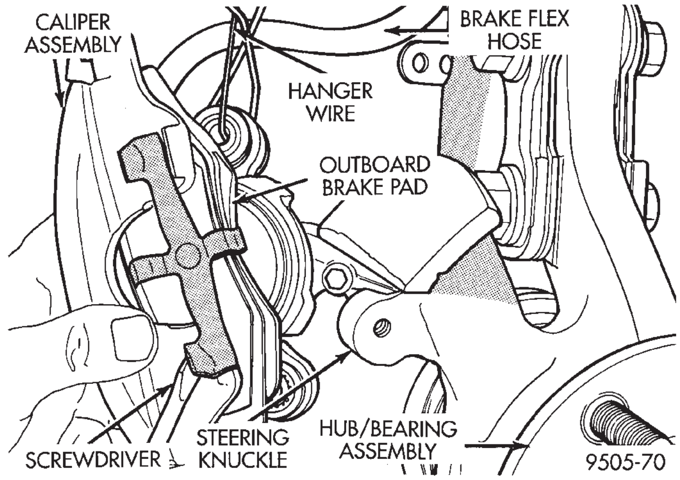


Fig. 50 Removing Outboard Brake Pad From Caliper

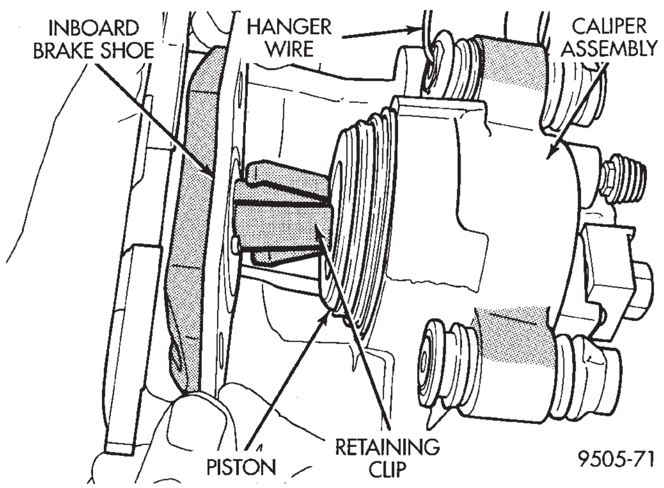


Fig. 51 Removing Inboard Brake Pad From Piston

INSTALL

(1) Completely retract caliper piston back into piston bore of caliper assembly. This is required for caliper installation with new brake pad assemblies.

(2) Remove the protective paper from the noise suppression gasket on both the inner and outer brake pad assemblies (if equipped).

NOTE: The inboard and outboard brake pads are not common, refer to (Fig. 52) for inboard and outboard brake pad assembly identification.

(3) Install the new inboard brake pad assembly into the caliper piston by firmly pressing into piston bore (Fig. 53). Be sure inboard brake pad assembly is positioned squarely against face of caliper piston.

(4) Slide the new outboard brake pad assembly onto the caliper assembly (Fig. 54).

REMOVAL AND INSTALLATION (Continued)

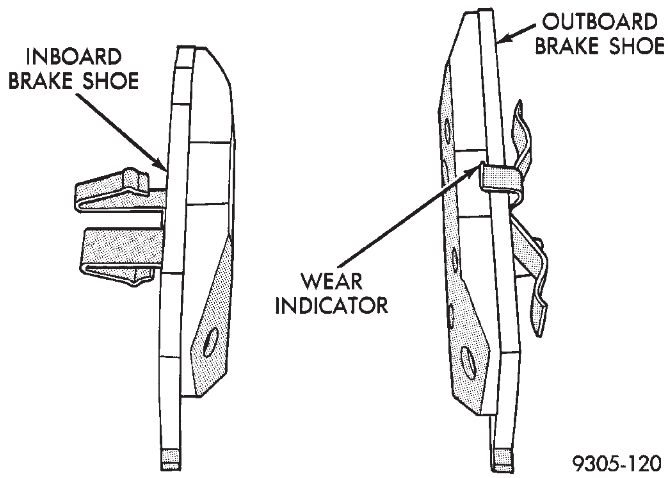


Fig. 52 Front Brake Pad Assembly Identification

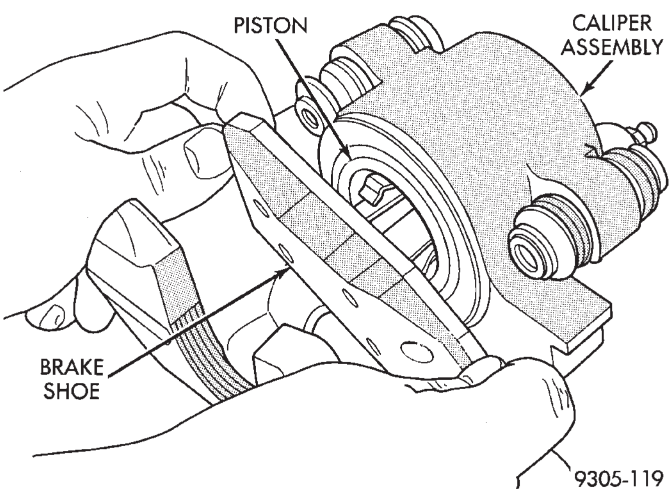


Fig. 53 Installing Inboard Brake Pad Assembly

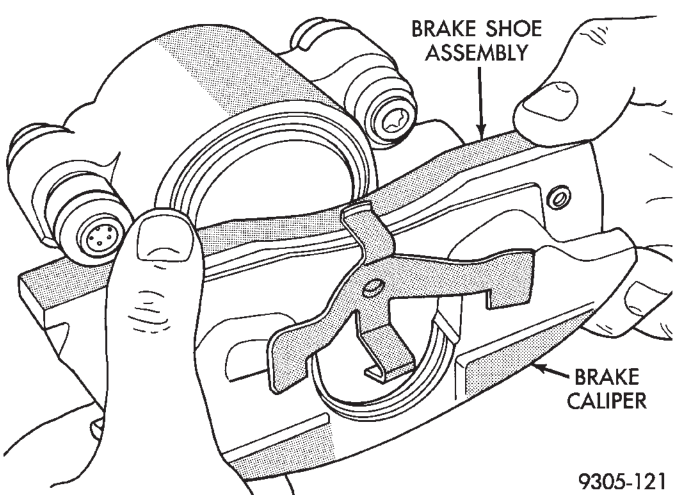


Fig. 54 Installing Outboard Brake Shoe Assembly

REAR DISC BRAKE SHOES

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKELININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

During service procedures, grease or any other foreign material must be kept off brake shoe assemblies, and braking surfaces of brake drum and external surfaces of hub/bearing assembly.

Handling of the braking disc and caliper is to be done in such a way as to avoid deformation of the disc and scratching or nicking of brake linings.

If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it **MUST** be replaced immediately.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheel and tire assemblies from vehicle.

(3) Remove the caliper to adapter guide pin bolts (Fig. 55).

(4) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up from the adapter. Then pull the front of the caliper and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 56).

(5) Support caliper to prevent the weight of the caliper from damaging the flexible brake hose (Fig. 57).

REMOVAL AND INSTALLATION (Continued)

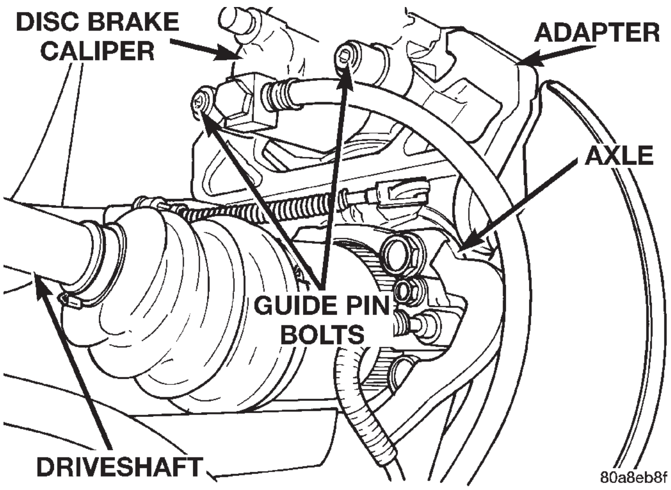


Fig. 55 Caliper Guide Pin Bolts

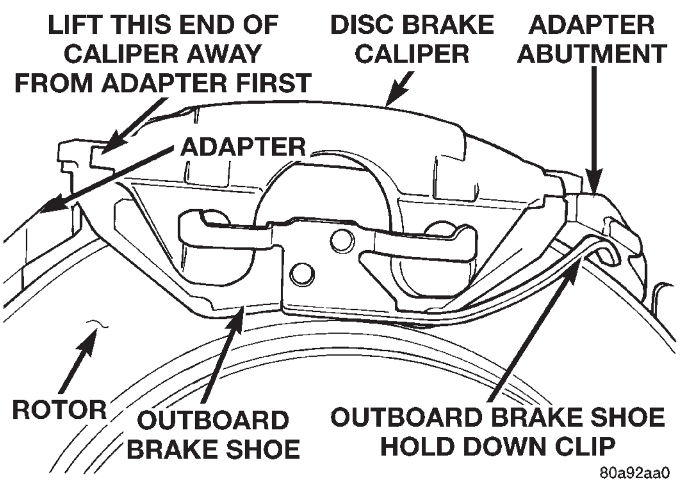


Fig. 56 Removing / Installing Caliper

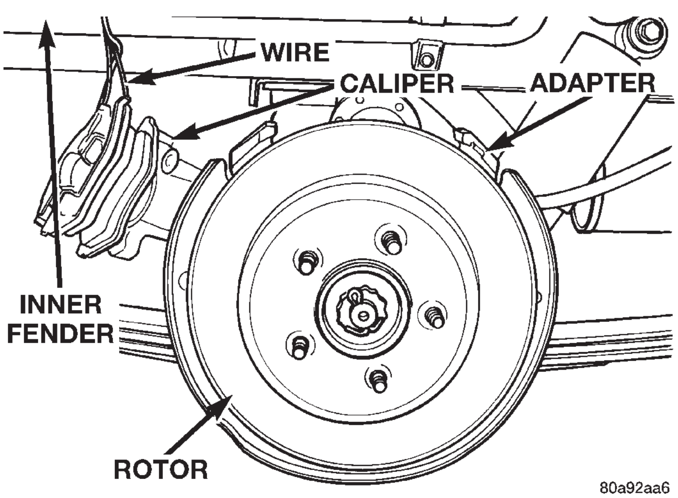


Fig. 57 Correctly Supported Caliper

(6) Remove the rear rotor from the hub by pulling it straight off the wheel mounting studs.

(7) Remove the outboard brake shoe from the caliper. Brake shoe is removed by prying brake shoe retaining clip over raised area on caliper and sliding the brake shoe off the caliper.

(8) Remove inboard brake shoe from caliper. Inboard brake shoe is removed by pulling it out of the caliper piston, until the retaining clip is free of the piston (Fig. 58).

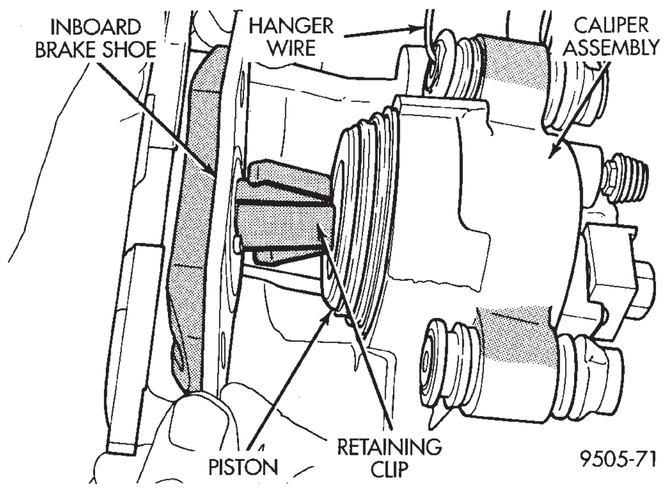


Fig. 58 Removing Inboard Brake Shoe

CALIPER INSPECTION

Check for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper assembly and install a new seal and boot, (and piston if scored). Refer to procedures titled Disc Brake Caliper Disassembly.

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Cleaning And Inspection Of Brake Caliper.

INSTALL

NOTE: Step 1 below is only required when installing a caliper after new brake shoes have been installed.

(1) Completely retract caliper piston back into piston bore of caliper assembly.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the rear rotor on the hub, making sure it is squarely seated on the face of the hub.

(4) Install the inboard brake shoe into the caliper piston by firmly pressing it into the piston bore using your thumbs. Be sure inboard brake shoe is positioned squarely against the face of the caliper piston (Fig. 59).

REMOVAL AND INSTALLATION (Continued)

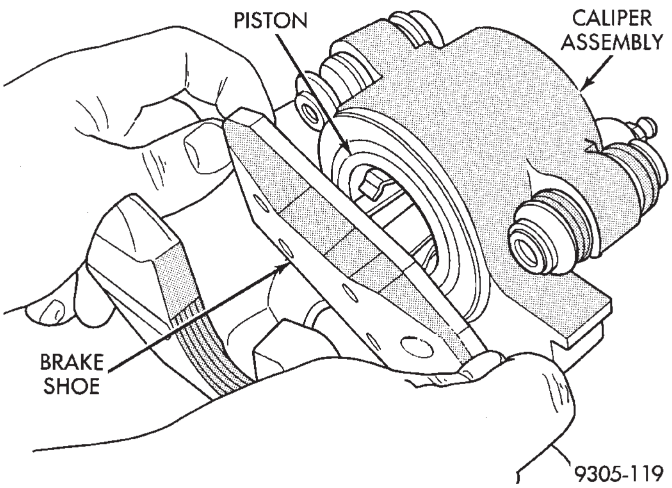


Fig. 59 Installing Inboard Brake Shoe

(5) Install the outboard brake shoe on the disc brake caliper

CAUTION: Use care when installing the caliper assembly onto the adapter, so the caliper guide pin bushings do not get damaged by the mounting bosses.

(6) Carefully lower caliper and brake shoes over rotor and onto adapter, reversing the removal procedure (Fig. 56)

CAUTION: When installing the caliper guide pin bolts extreme caution should be taken not to crossthread the guide pin bolts.

(7) Install the caliper guide pin bolts. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).
(8) Install the wheel and tire assembly.
(9) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).
(10) Remove jackstands or lower hoist.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop the vehicle.

(11) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

REAR BRAKE DRUM

REMOVE

(1) Remove the tire and wheel assembly from the vehicle
Remove the park brake cable, for the wheel of the vehicle that is being worked on, from the park brake cable equalizer (Fig. 60). This is required to gain access to the star wheel. If the cable is not removed from the equalizer, the cable and spring inside of the brake drum is in the way of the star wheel.

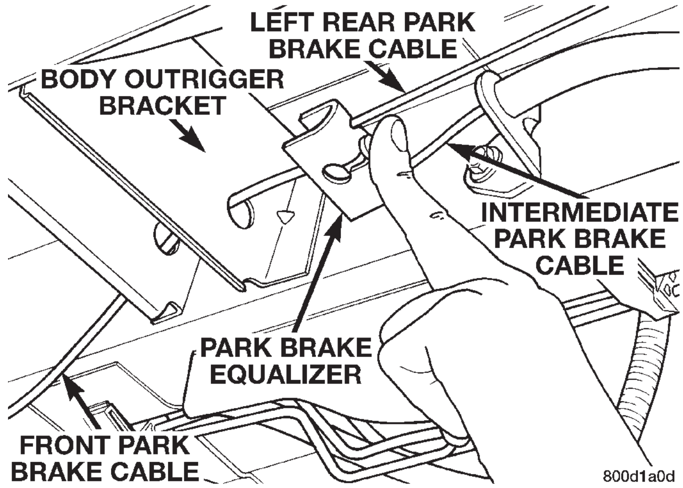


Fig. 60 Park Brake Cable Equlizer

(2) Remove the rear brake shoe adjusting hole cover plug.
(3) Insert a thin screwdriver into brake adjusting hole and hold adjusting lever away from notches of adjusting screw star wheel.
(4) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting screw star wheel. Release brake adjustment by prying down with adjusting tool.
(5) Remove rear brake drum from rear hub/bearing assembly.

INSTALL

(1) Adjust brake shoes assemblies so as not to interfere with brake drum installation.
(2) Install the rear brake drums on the hubs.
(3) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.
(4) Install the removed park brake cable back on the park brake cable equalizer (Fig. 60)
(5) Install wheel and tire.
(6) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 130 N·m (95 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

REAR DRUM BRAKE SHOES

REMOVE

WARNING: ALTHOUGH FACTORY INSTALLED BRAKE LININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTERMARKET BRAKLINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKE LININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER–DAMPENED SHOP TOWELS. DO NOT CREATE BRAKE LINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove rear brake drum to hub retaining nuts (if equipped). Then remove rear brake drums from hub and bearing assemblies.

NOTE: When creating slack in the park brake cables by locking out the automatic adjuster, (Fig. 61) be sure that the park brake pedal is in the released (most upward) position.

(4) Create slack in the rear park brake cables. Slack is created by grabbing exposed section of front park brake cable and pulling it down and rearward. Slack is maintained in the park brake cable by installing a pair of locking pliers on the park brake cable just rearward of **only the rear** body outrigger bracket. (Fig. 61)

(5) Remove adjustment lever spring (Fig. 62) from adjustment lever and front brake shoe.

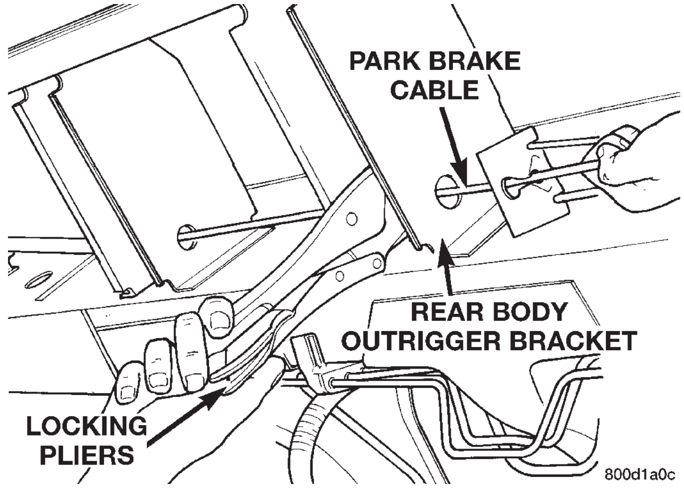


Fig. 61 Locked Out Park Brake Automatic Adjuster

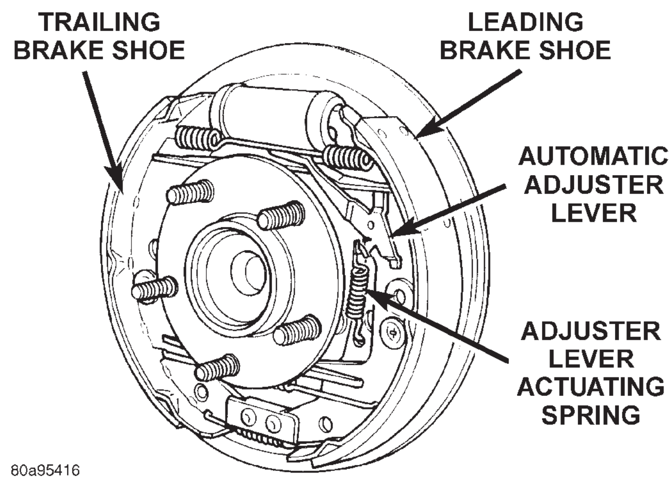


Fig. 62 Adjustment Lever Actuating Spring

(6) Remove adjustment lever (Fig. 63) from leading brake shoe.

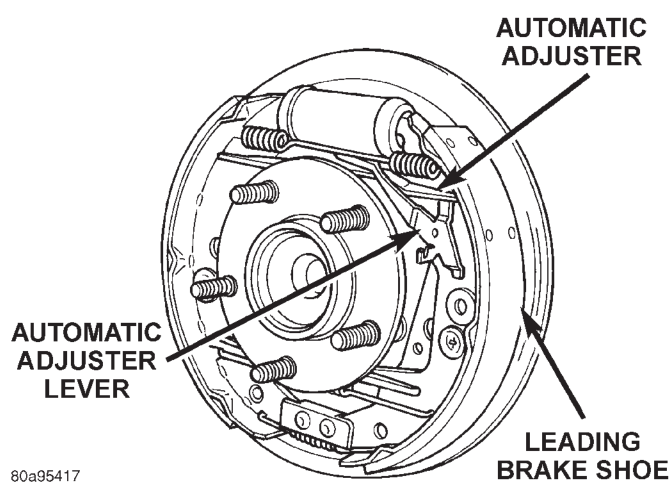


Fig. 63 Adjustment Lever

REMOVAL AND INSTALLATION (Continued)

(7) Remove the brake shoe to brake shoe lower return springs (Fig. 64) and (Fig. 65).

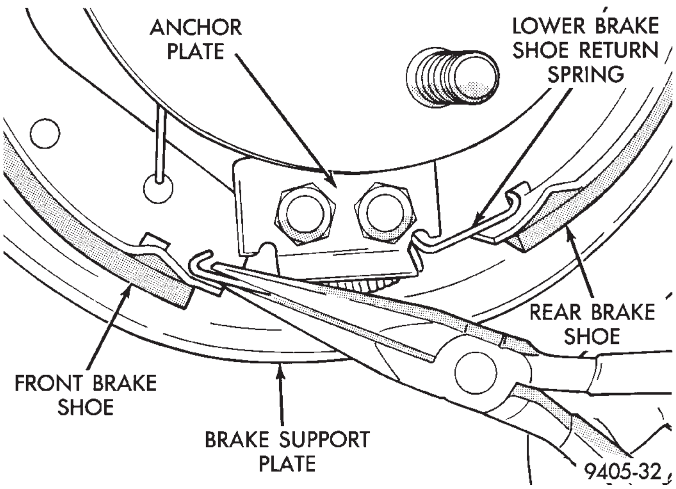


Fig. 64 Remove/Install Brake Shoe Lower Return Spring

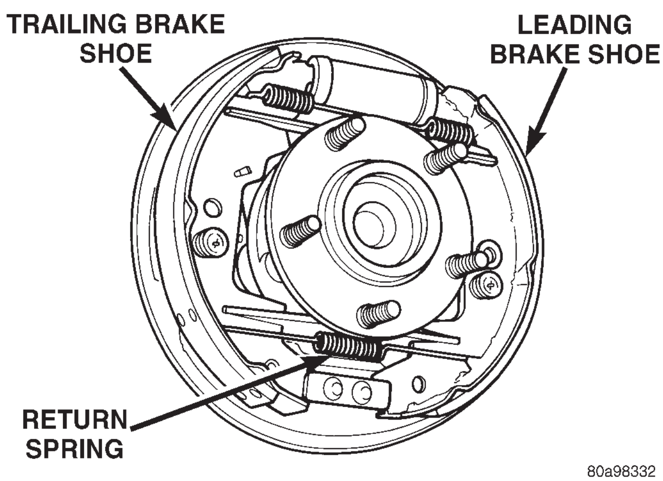


Fig. 65 Brake Shoe Lower Return Spring

(8) Remove the tension clip (Fig. 66) attaching the upper return spring to the automatic adjuster assembly.

(9) Remove the brake shoe to brake shoe upper return spring (Fig. 67).

(10) Remove the trailing brake shoe assembly to brake support plate hold down spring and pin (Fig. 68) from the brake shoe assembly.

(11) Remove the trailing brake shoe assembly from the brake support plate, park brake actuating lever and park brake actuating strut (Fig. 69). Remove the automatic adjuster assembly from the leading brake shoe.

(12) Remove the leading brake shoe assembly to brake support plate hold down spring and pin (Fig. 70) from the brake shoe. Remove the leading brake shoe from the brake support plate.

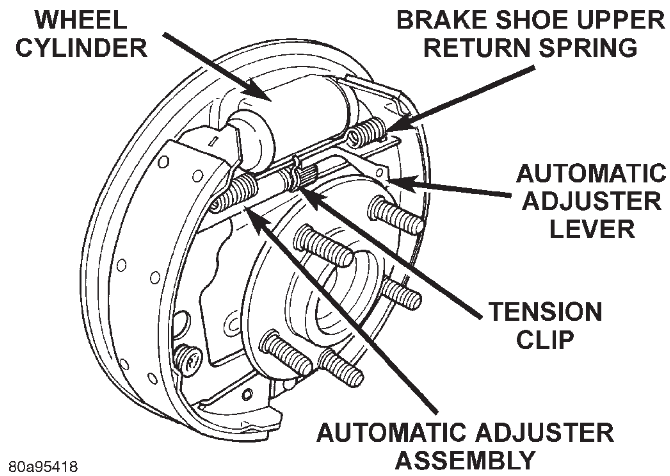


Fig. 66 Tension Clip Attachment To Adjuster

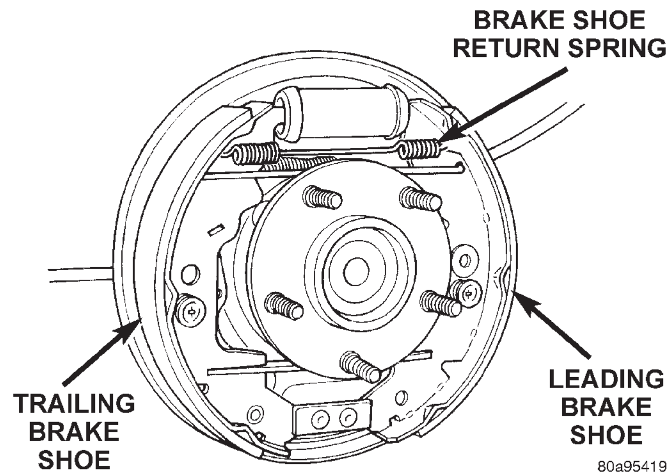


Fig. 67 Brake Shoe Upper Return Spring

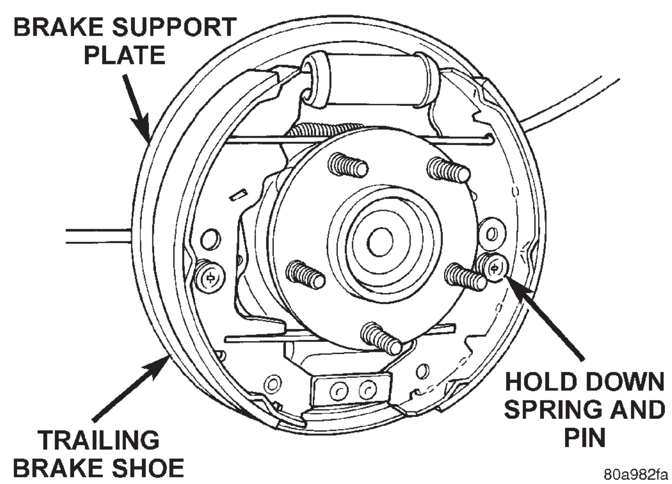


Fig. 68 Trailing Brake Shoe Hold Down Spring And Pin

(13) Remove the park brake actuator (Fig. 71) from the leading brake shoe and transfer to the replacement brake shoe.

REMOVAL AND INSTALLATION (Continued)

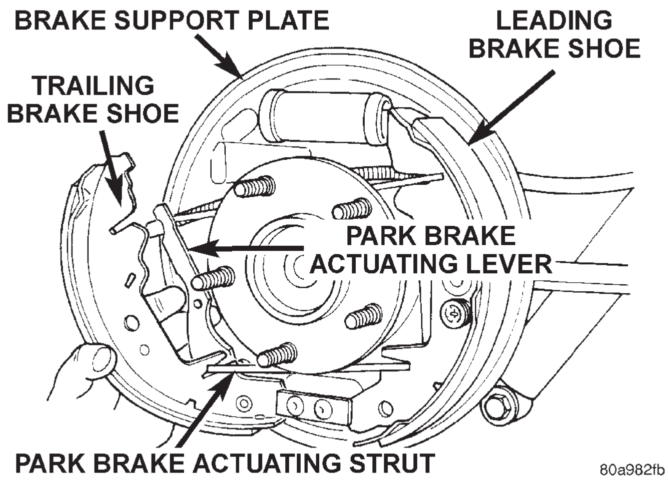


Fig. 69 Trailing Brake Shoe Removal/Installation

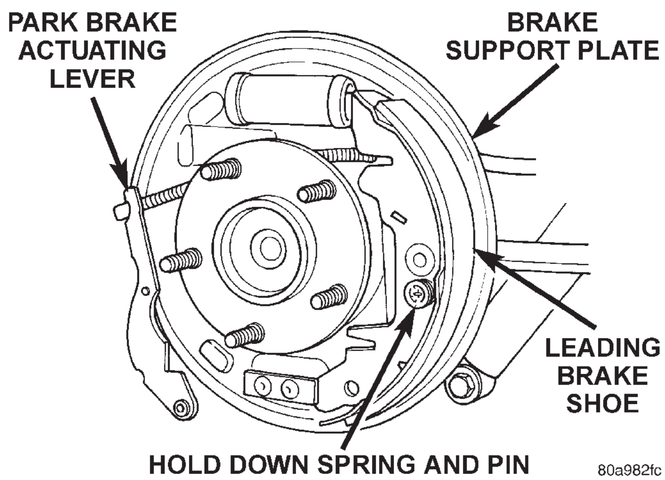


Fig. 70 Leading Brake Shoe Hold Down Spring And Pin

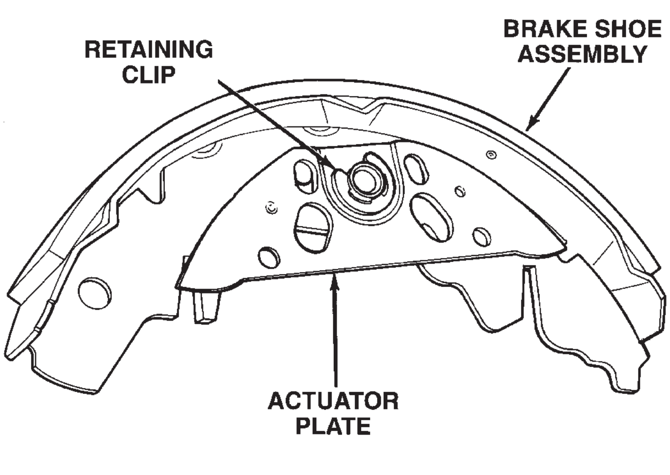


Fig. 71 Park Brake Actuator Plate

INSTALL

(1) Lubricate the eight shoe contact areas on the support plate and anchor, (Fig. 72) using the required special Mopar Brake Lubricant, P/N 4796269.

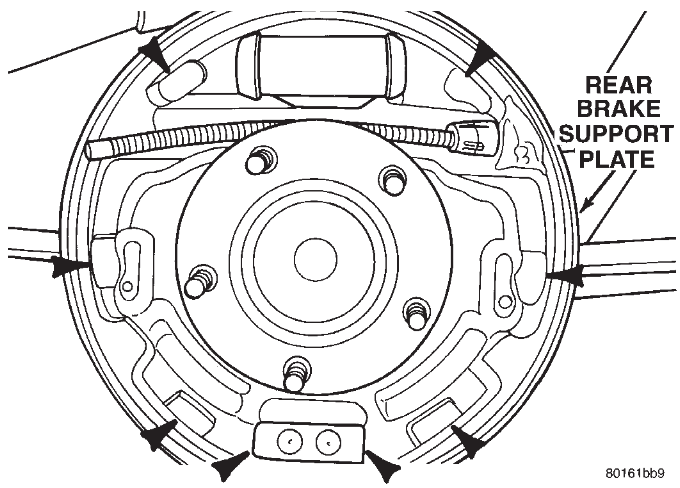


Fig. 72 Brake Support Plate Contact Areas

(2) Install leading brake shoe on brake support plate. Install the leading brake shoe hold down spring and pin (Fig. 70) on the brake shoe.

(3) Install the park brake actuator strut (Fig. 73) on the leading brake shoe. Then install the park brake actuator lever on the strut (Fig. 73).

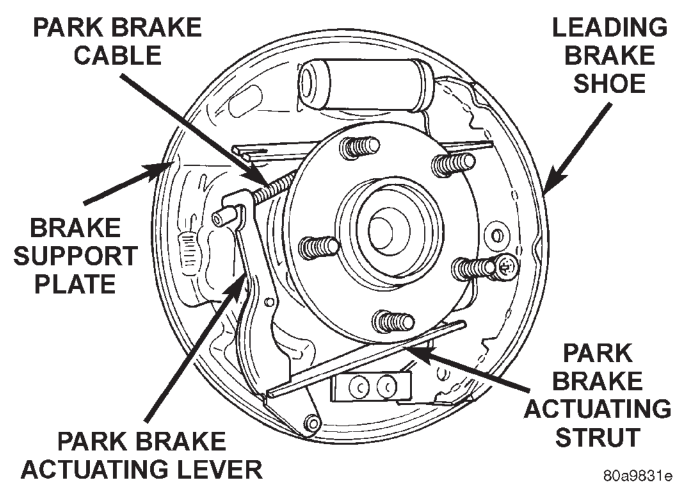


Fig. 73 Park Brake Components Assembled On Leading Brake Shoe

(4) Install the automatic adjuster screw on the leading brake shoe. Then install the trailing brake shoe on the park brake actuating lever and park brake actuating strut (Fig. 69). Position trailing brake shoe on brake support plate.

(5) Install the brake shoe hold down pin and spring on the trailing brake shoe (Fig. 68).

(6) Install the brake shoe to brake shoe upper return spring (Fig. 67).

REMOVAL AND INSTALLATION (Continued)

CAUTION: When installing the tension clip on the automatic adjuster, it must be located on only the threaded area of the adjuster assembly (Fig. 66). If it is located on a non-threaded area of the adjuster, the function of the automatic adjuster will be affected.

(7) Install the tension clip (Fig. 66) attaching the upper return spring to the automatic adjuster assembly.

(8) Install the brake shoe to brake shoe lower return springs on the brake shoes (Fig. 64) and (Fig. 65).

(9) Install automatic adjustment lever on the leading brake shoe of the rear brake assembly (Fig. 63).

(10) Install the actuating spring on the automatic adjustment lever and leading brake shoe assembly (Fig. 62).

(11) Verify that the automatic adjuster lever has positive contact with the star wheel on the automatic adjuster assembly.

(12) When all components of both rear brake assemblies are correctly and fully installed, remove the locking pliers from the front park brake cable.

(13) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(14) Install the rear brake drums on the hubs.

(15) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.

(16) Install the wheel and tire assembly.

(17) Push the park brake pedal to the floor once and release pedal. This will automatically remove the slack from and correctly adjust the park brake cables.

(18) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 130 N·m (95 ft. lbs.).

(19) Road test vehicle. The automatic adjuster will continue the brake adjustment during the road test of the vehicle.

BRAKE SUPPORT PLATE (REAR DRUM BRAKES)

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual for required lifting procedure.

(2) Remove wheel and tire.

(3) Remove brake drum from hub/bearing.

(4) Remove brake shoes from brake support plate. Refer to Rear Brake Shoe Removal in the removal and installation section in this group of the service manual for the required procedure.

(5) Disconnect the park brake cable from the park brake actuation lever.

(6) Remove the rear wheel speed sensor from the rear hub/bearing flange (Fig. 74). This will prevent damage to the speed sensor during removal and installation of the hub/bearing. **The rear wheel speed sensor bolts to the hub/bearing. It can not be removed unless the speed sensor is removed first.**

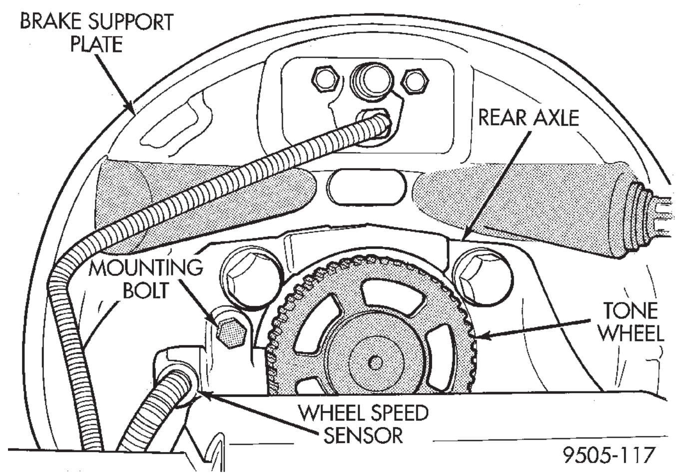


Fig. 74 Rear Wheel Speed Sensor

CAUTION: When working in the area of the rear hub/bearing and when removing it from the rear axle, care must be used so the teeth on the tone wheel are not damaged. Damage to the teeth on the tone wheel will result in false ABS cycling and corrosion of the tone wheel.

(7) Remove the 4 bolts (Fig. 75) attaching the hub/bearing to the flange of the rear axle .

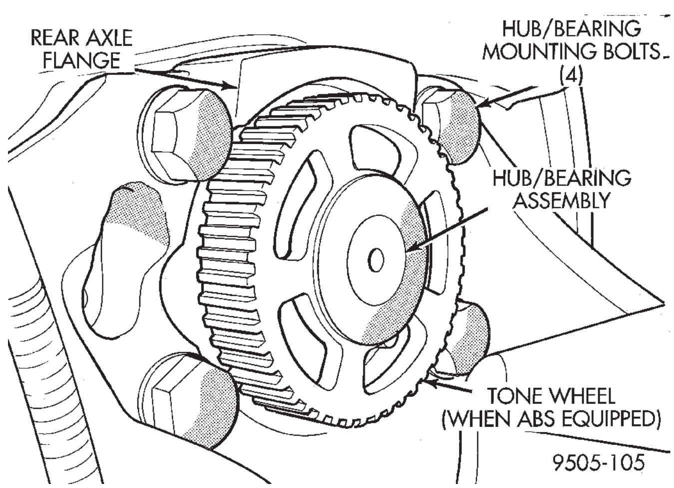


Fig. 75 Rear Hub/Bearing Mounting Bolts

REMOVAL AND INSTALLATION (Continued)

CAUTION: Corrosion may occur between the hub/bearing and the axle. If this occurs the hub/bearing will be difficult to remove from the axle. If the hub/bearing will not come out of the axle by pulling on it by hand, do not pound on the hub/bearing to remove it from the axle. Pounding on the hub/bearing to remove it from the axle will damage the hub/bearing. This damage will result in noise or failure of the bearing.

(8) If hub/bearing cannot be removed from the axle by hand, use Remover Special Tool 8214 (Fig. 76) and following procedure to press the hub/bearing out of the axle.

(a) Place Special Tool 8214-1 over tone wheel and against cast flange of hub/bearing (Fig. 76)

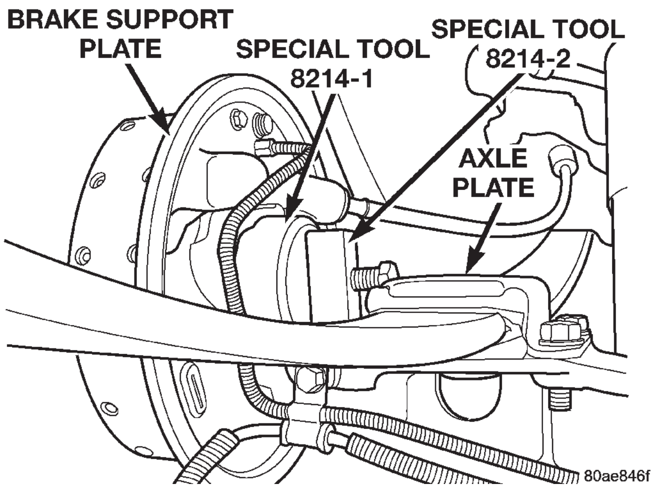


Fig. 76 Special Tool 8214 Installed

(b) Put a dab of grease in the bolt pilot hole on the back of Special Tool 8214-1.

(c) Insert Special Tool 8214-2 into the hole in the bottom of the end casting on the axle (Fig. 76). Special Tool 8214-2 should be against and supported by the axle plate (Fig. 76) when pressing the wheel bearing out of the axle.**If Special Tool 8214-2 will not fit into the hole in the end casting, file or grind the flashing from the hole until tool fits properly.**

(d) Align bolt in Special Tool 8214-2 with pilot hole in Special Tool 8214-1. Tighten bolt against Special Tool 8214-1.

(e) Press hub/bearing out of axle by continuing to tighten bolt in Special Tool 8214-2 against Special Tool 8214-1.

(9) Remove the hub/bearing from the rear axle and brake support plate (Fig. 77).

(10) Using a suitable tool such as a 14 mm box wrench (Fig. 78) or an aircraft type hose clamp, compress the flared legs on park brake cable retainer. Then pull the park brake cable out of brake support plate.

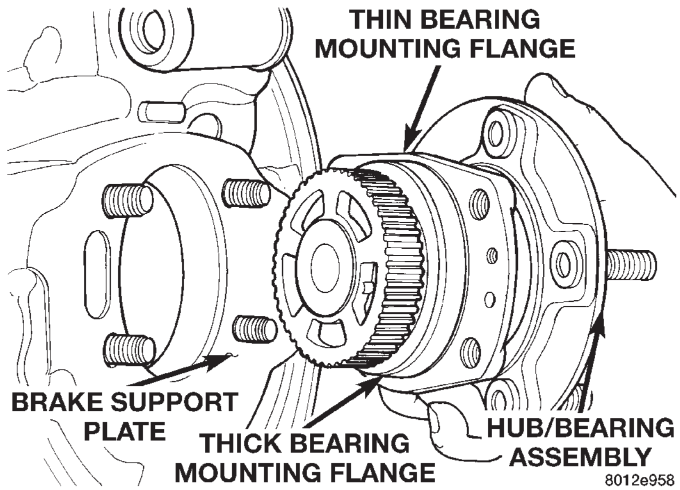


Fig. 77 Hub/Bearing Removal And Installation On Axle

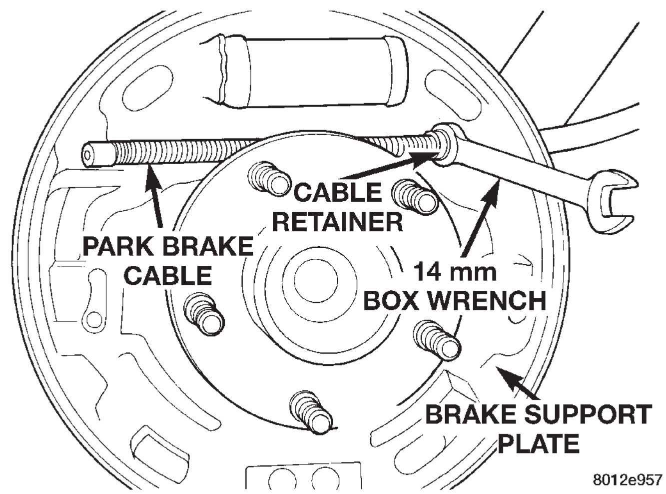


Fig. 78 Removing Park Brake Cable From Brake Support Plate

(11) Lower vehicle enough to access the brake pedal.

(12) Using a brake pedal depressor, move brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of master cylinder when brake tube is remove from wheel cylinder.

(13) Raise vehicle.

(14) Disconnect brake tube from wheel cylinder (Fig. 79).

(15) Remove the 2 bolts attaching the wheel cylinder to the brake support plate (Fig. 79).

(16) Remove the wheel cylinder from the brake support plate.

(17) Remove the rear brake support plate from the rear axle.

REMOVAL AND INSTALLATION (Continued)

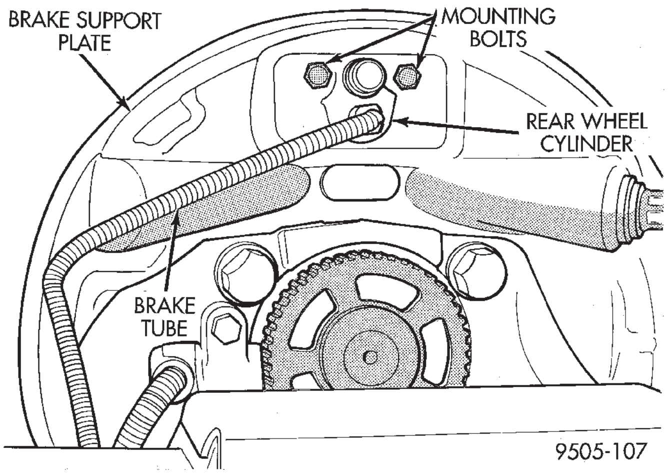


Fig. 79 Rear Wheel Cylinder Mounting Bolts And Brake Tube

INSTALL

(1) Install the 4 hub/bearing to axle mounting bolts into the mounting holes in the flange of the rear axle.

(2) Install the rear brake support plate on the 4 mounting bolts installed in the flange of the rear axle (Fig. 80).

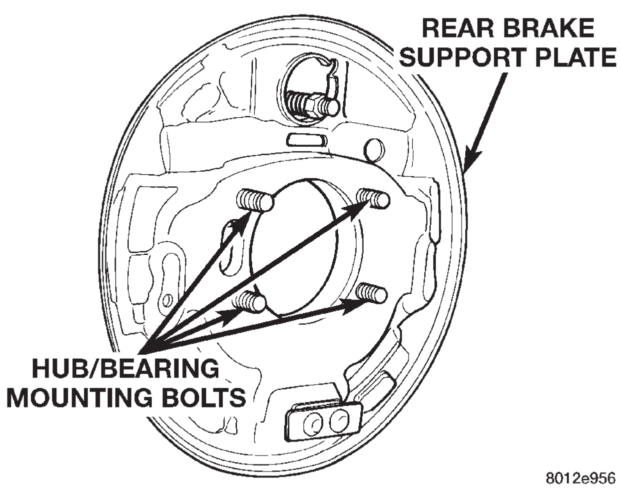


Fig. 80 Brake Support Plate Mounted On Bearing Attaching Bolts

NOTE: When installing the hub/bearing on the rear axle, the bearing is to be installed with the thick bearing mounting flange (Fig. 77) pointing down.

(3) Align the rear hub/bearing with the 4 mounting bolts and start mounting bolts into hub/bearing. Tighten the 4 bolts in a criss-cross pattern until the hub/bearing and brake support plate is fully and squarely seated onto flange of rear axle.

(4) Tighten the 4 hub/bearing mounting bolts (Fig. 75) to a torque of 129 N·m (95 ft. lbs.)

(5) Apply sealant such as Mopar Gasket-In-A-Tube or an equivalent around the wheel cylinder opening in the brake support plate.

(6) Install wheel cylinder onto brake support and tighten the wheel cylinder to brake support plate attaching bolts (Fig. 79) to 8 N·m (75 in. lbs.).

(7) Install brake tube (Fig. 79) on rear wheel cylinder. Tighten tube nut to a torque of 16 N·m (142 in. lbs.).

(8) Install the rear wheel speed sensor on the rear hub/bearing flange (Fig. 74). Install the speed sensor attaching bolt and tighten to a torque of 12 N·m (105 in. lbs.).

(9) Install the rear park brake cable into its mounting hole in the rear brake support plate.

(10) Install the park brake cable on the park brake actuation lever.

(11) Install the rear brake shoes on the brake support plate. Refer to Brake Shoe Service in this section of the service manual for the proper brake shoe installation procedure.

(12) Install brake drum onto hub/bearing.

(13) Install wheel and tire.

(14) Tighten wheel stud nuts to 129 N·m (95 ft. lbs.).

(15) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

(16) Bleed the entire brake system. See Bleeding Brake System in the Service Procedures section in this group of the service manual.

REAR BRAKE WHEEL CYLINDER

REMOVE

(1) In case of a leak, remove brake shoes, (replace if soaked with grease or brake fluid.)

(2) Disconnect the rear brake hydraulic tube from the wheel cylinder (Fig. 81).

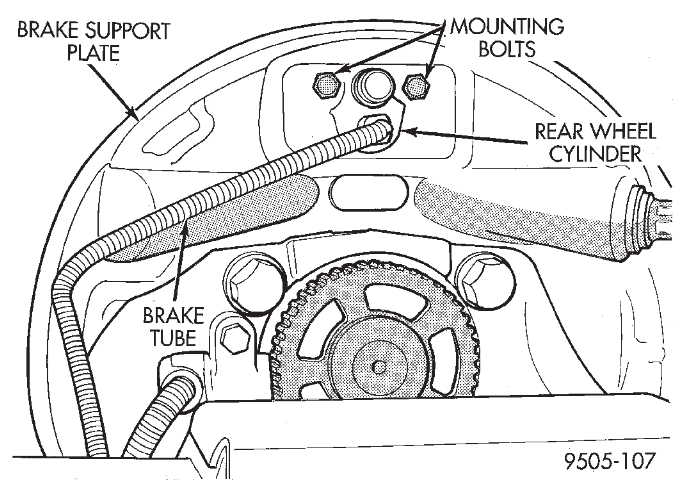


Fig. 81 Brake Hydraulic Tube At Wheel Cylinder

REMOVAL AND INSTALLATION (Continued)

(3) Remove the rear wheel cylinder attaching bolts (Fig. 81). Then pull wheel cylinder assembly off the brake support plate.

INSTALL

(1) Apply Mopar® Gasket In-A-Tube or equivalent sealant around wheel cylinder mounting surface in brake support plate.

(2) Install wheel cylinder onto brake support, and tighten the wheel cylinder to brake support plate attaching bolts (Fig. 81) to 8 N·m (75 in. lbs.).

(3) Attach hydraulic brake tube to wheel cylinder, (Fig. 81) and tighten tube to wheel cylinder fitting to 16 N·m (142 in. lbs.).

(4) Install brake shoes on support plate.

(5) Install rear brake drum onto rear hub. Install rear wheel and tire assembly, tighten wheel stud nuts to 129 N·m (95 ft. lbs.).

(6) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

(7) Bleed the entire brake system. See (Bleeding Brake System) in Service Adjustments section in this group of the service manual.

HUB/BEARING

FRONT WHEEL DRIVE

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual for required lifting procedure.

(2) Remove wheel and tire.

(3) Remove brake drum from hub/bearing.

(4) Remove rear wheel speed sensor from rear hub/bearing (Fig. 82). This will prevent damage to the speed sensor during removal and installation of the hub/bearing. **The rear wheel speed sensor bolts to the hub/bearing. It can not be removed unless the speed sensor is removed first.**

CAUTION: When working in the area of the rear hub/bearing and when removing it from the rear axle, care must be used so the teeth on the tone wheel are not damaged. Damage to the teeth on the tone wheel will result in false ABS cycling and corrosion of the tone wheel.

(5) Remove the 4 bolts (Fig. 83) attaching the hub/bearing to the rear axle.

CAUTION: Corrosion may occur between the hub/bearing and the axle. If this occurs the hub/bearing will be difficult to remove from the axle. If the hub/bearing will not come out of the axle by pulling on it by hand, do not pound on the hub/bearing to remove it from the axle. Pounding on the hub/bearing to remove it from the axle will damage the hub/bearing. This damage will result in noise or failure of the bearing.

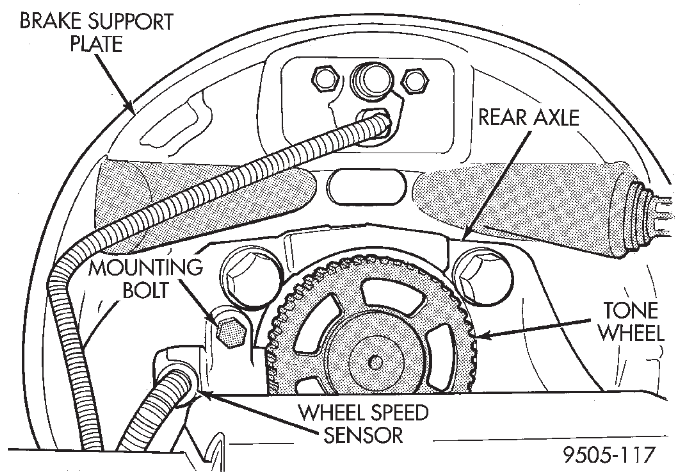


Fig. 82 Rear Wheel Speed Sensor

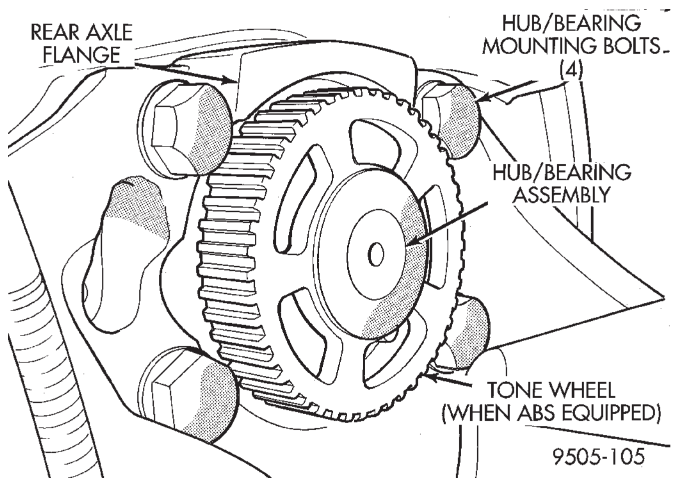


Fig. 83 Rear Hub/Bearing Mounting Bolts

(6) If hub/bearing cannot be removed from the axle by hand, use Remover Special Tool 8214 (Fig. 84) and following procedure to press the hub/bearing out of the axle.

(a) Place Special Tool 8214-1 over tone wheel and against cast flange of hub/bearing (Fig. 84)

(b) Put a dab of grease in the bolt pilot hole on the back of Special Tool 8214-1.

(c) Insert Special Tool 8214-2 into the hole in the bottom of the end casting on the axle (Fig. 84). Special Tool 8214-2 should be against and supported by the axle plate (Fig. 84) when pressing the wheel bearing out of the axle. **If Special Tool 8214-2 will not fit into the hole in the end casting, file or grind the flashing from the hole until tool fits properly.**

REMOVAL AND INSTALLATION (Continued)

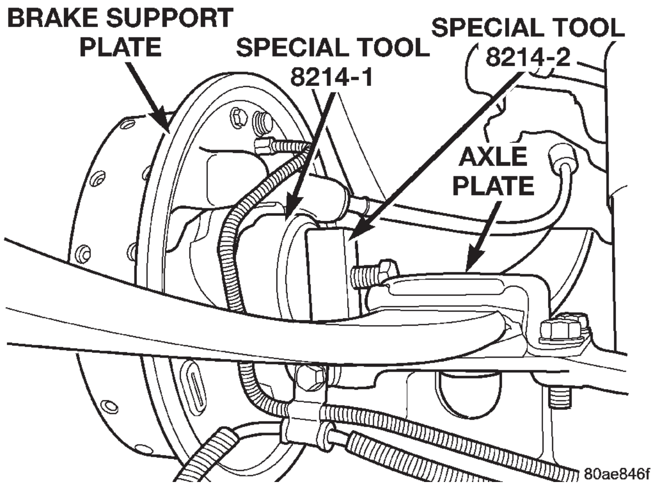


Fig. 84 Special Tool 8214 Installed

(d) Align bolt in Special Tool 8214-2 with pilot hole in Special Tool 8214-1. Tighten bolt against Special Tool 8214-1.

(e) Press hub/bearing out of axle by continuing to tighten bolt in Special Tool 8214-2 against Special Tool 8214-1.

(7) Remove the hub/bearing from the rear axle and brake support plate (Fig. 85).

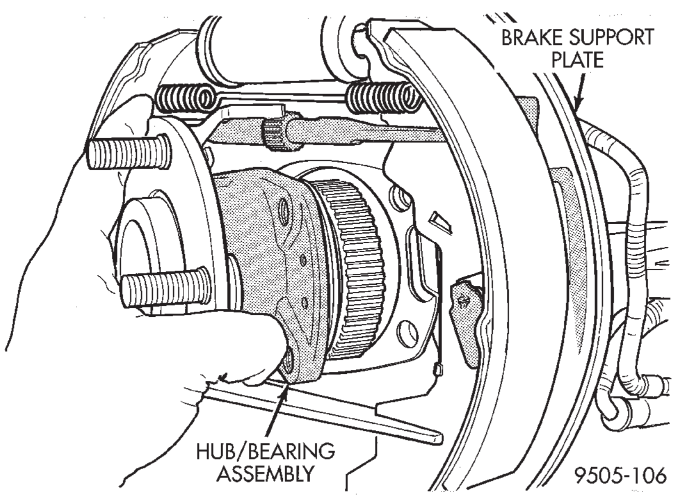


Fig. 85 Removing Rear Hub/Bearing From Axle

INSTALL

(1) Install the 4 hub/bearing to axle mounting bolts into the holes in the flange of the rear axle.

(2) Install the rear brake support plate on the 4 mounting bolts installed in the flange of the rear axle.

(3) Align the rear hub/bearing with the 4 mounting bolts and start mounting bolts into hub/bearing. Tighten the 4 bolts in a criss-cross pattern until the hub/bearing and brake support plate is fully and squarely seated onto flange of rear axle.

(4) Tighten the 4 hub/bearing mounting bolts (Fig. 83) to a torque of 129 N·m (95 ft. lbs.)

(5) Install the rear wheel speed sensor on the rear hub/bearing flange (Fig. 82). Install the speed sensor attaching bolt and tighten to a torque of 12 N·m (105 in. lbs.).

(6) Install brake drum on hub/bearing.

(7) Install wheel and tire.

(8) Tighten the wheel stud nuts in the proper sequence to a torque of 129 N·m (95 ft. lbs.).

(9) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

ALL WHEEL DRIVE

REMOVE

(1) Set the parking brake. **The parking brake is set to keep the hub/bearing and axle shaft from rotating when loosening the hub nut.**

(2) Raise vehicle. Vehicle is to be raised and supported on jackstands or on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section of this service manual.

(3) Remove the wheel/tire.

(4) Remove the cotter pin and nut retainer (Fig. 86) from the stub shaft of the outer C/V joint.

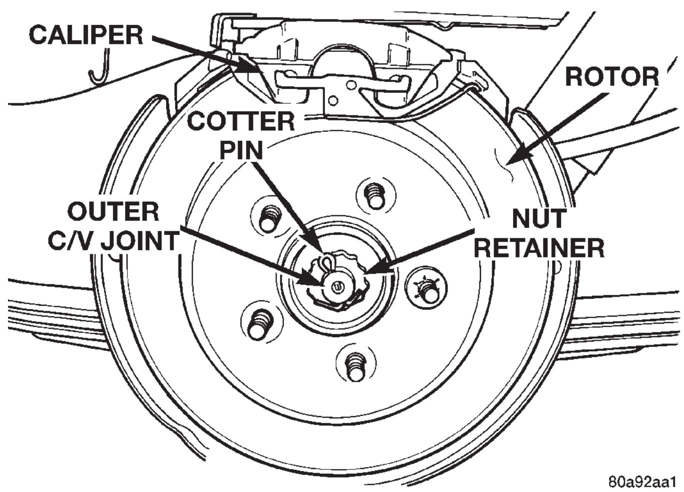


Fig. 86 Cotter Pin And Nut Retainer

(5) Remove the spring washer (Fig. 87) from the stub shaft of the outer C/V joint.

(6) Remove the hub nut and washer (Fig. 88) from the stub shaft of the outer C/V joint.

(7) Remove the 6 bolts (Fig. 89) mounting the driveshaft inner joint to the output shaft of the rear drive line module.

(8) Remove the rear wheel speed sensor (Fig. 90) from the rear hub/bearing.

(9) Release the parking brake.

(10) Remove the disc brake caliper to adapter guide pin bolts (Fig. 91).

(11) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up

REMOVAL AND INSTALLATION (Continued)

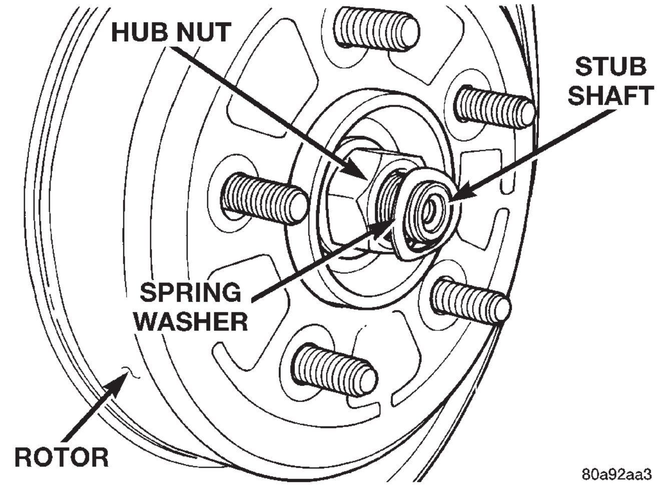


Fig. 87 Spring Washer

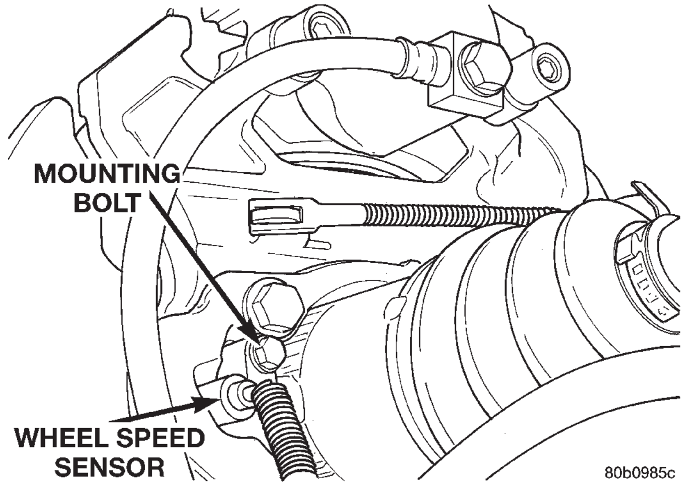


Fig. 90 Wheel Speed Sensor

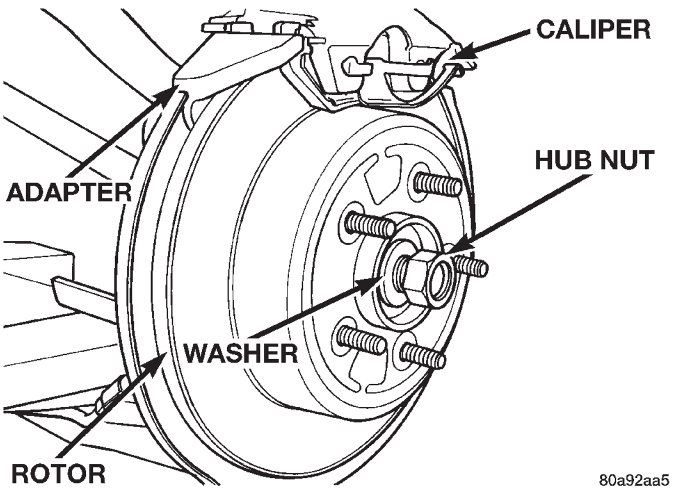


Fig. 88 Hub Nut And Washer

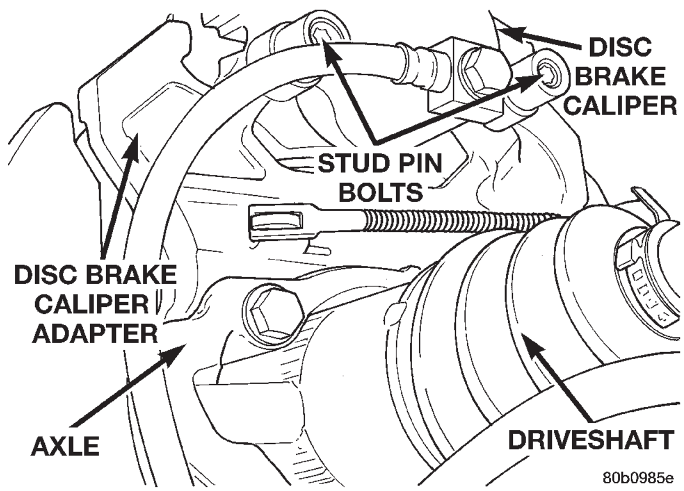


Fig. 91 Caliper Guide Pin Bolts

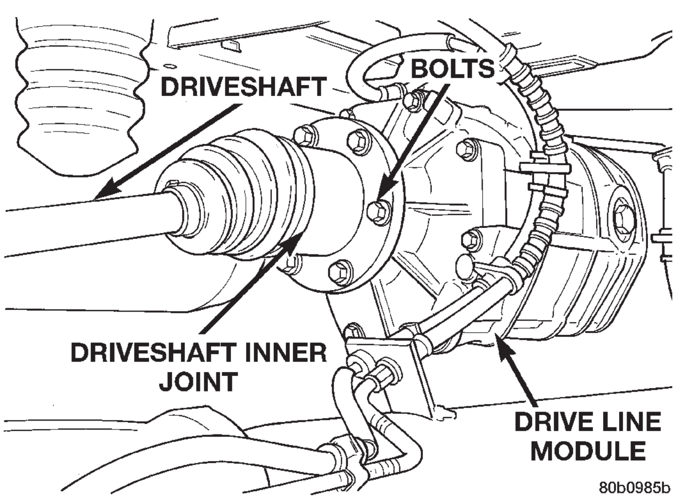


Fig. 89 Driveshaft Attachment To Driveline Module

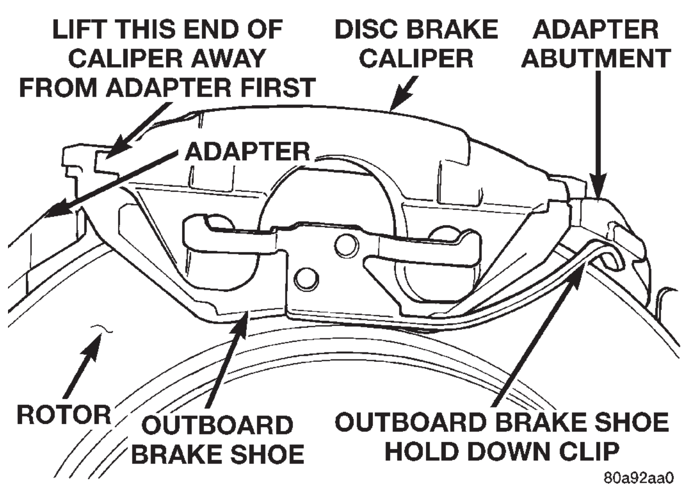


Fig. 92 Removing / Installing Caliper

from the adapter. Then pull the front of the caliper and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 92).

(12) Support caliper to prevent the weight of the caliper from damaging the flexible brake hose (Fig. 93).

(13) Remove the rotor from the hub/bearing.

REMOVAL AND INSTALLATION (Continued)

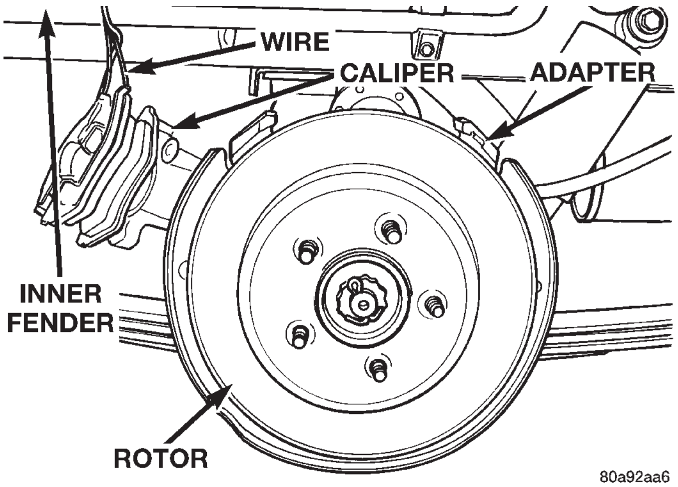


Fig. 93 Correctly Supported Caliper

(14) Remove driveshaft from rear drive line module and hub/bearing. Driveshaft is removed by first compressing the inner joint on the driveshaft and removing it from the drive line module. Then, slide the outer joint of the driveshaft out of the hub/bearing.

(15) Remove the hub/bearing to axle mounting bolts (Fig. 94).

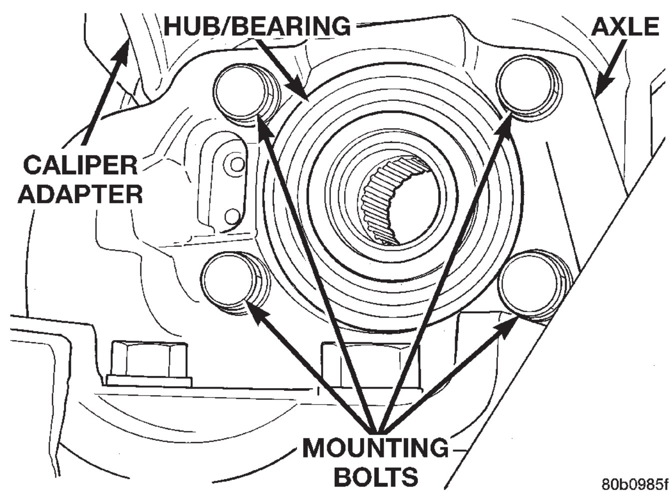


Fig. 94 Hub/Bearing Mounting Bolts

CAUTION: Corrosion may occur between the hub/bearing and the axle. If this occurs the hub/bearing will be difficult to remove from the axle. If the hub/bearing will not come out of the axle by pulling on it by hand, do not pound on the hub/bearing to remove it from the axle. Pounding on the hub/bearing to remove it from the axle will damage the hub/bearing. This damage will result in noise or failure of the hub/bearing. To remove a hub/bearing which is corroded to the axle, lightly tap the disc brake caliper adapter using a soft faced hammer. This will remove both the disc brake caliper adapter and hub/bearing from the axle. The hub/bearing will then need to be removed from the caliper adapter.

(16) Remove the hub/bearing from the axle. (Fig. 95).

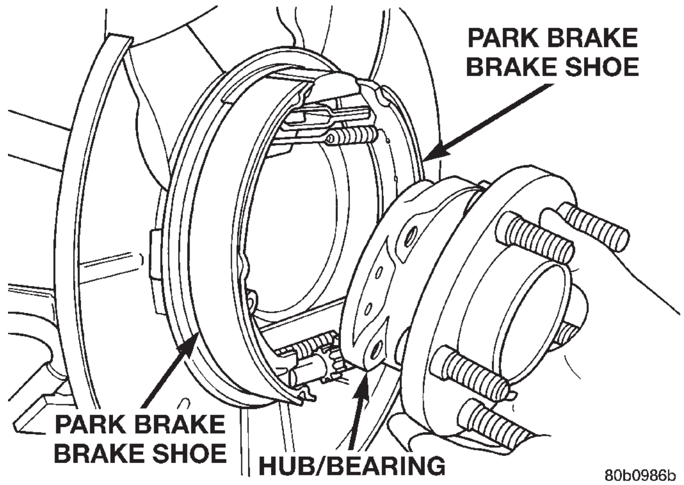


Fig. 95 Hub/Bearing Removal And Installation

(17) If the disc brake caliper adapter and hub/bearing were removed as an assembly from the axle and the hub/bearing cannot be removed from the adapter by hand, use the following procedure to remove it from the adapter. With a helper supporting the caliper adapter in his hands, position Remover, Special Tool 8214-1 on the cast housing of hub/bearing (Fig. 96). **Do not position special tool on inner race of hub/bearing.** Lightly strike Remover, Special Tool 8214-1 with a hammer to remove the bearing.

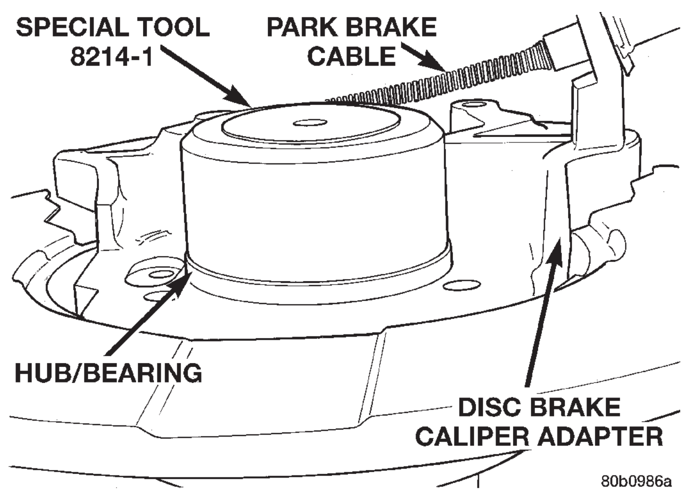


Fig. 96 Hub/Bearing Removal From Caliper Adapter

INSTALL

(1) Install hub/bearing on end of axle. (Fig. 95).

(2) Install the hub/bearing mounting bolts. In a progressive criss-cross pattern, tighten the 4 hub/bearing mounting bolts (Fig. 94) until the disc brake

REMOVAL AND INSTALLATION (Continued)

caliper adapter and hub/bearing are squarely seated against the axle. Then tighten the hub/bearing mounting bolts to a torque of 129 N·m (95 ft. lbs.).

(3) Install driveshaft in hub/bearing and on output shaft of rear drive line module. Driveshaft is installed by first sliding the outer joint of the driveshaft into the hub/bearing and then compressing the inner joint on the driveshaft and installing it on the output shaft the drive line module.

(4) Install rotor on hub/bearing.

(5) Carefully lower disc brake caliper and brake shoes over rotor and onto caliper adapter by reversing the removal procedure (Fig. 92).

CAUTION: When installing guide pin bolts extreme caution should be taken not to crossthread the caliper guide pin bolts.

(6) Install the disc brake caliper guide pin bolts (Fig. 91). Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(7) Clean all foreign material off the threads of the outer C/V joint stub shaft. Install the washer and hub nut (Fig. 88) on the stub shaft of the outer C/V joint.

(8) Lower vehicle.

(9) Set the park brake. **This is required to keep the driveshaft from rotating when tightening and torquing the hub nut and driveshaft inner joint to driveline module mounting nuts.**

(10) Raise vehicle.

(11) Tighten the driveshaft inner joint to drive line module output shaft mounting bolts (Fig. 89) to a torque of 61 N·m (45 ft. lbs.).

(12) Tighten the outer C/V joint hub nut (Fig. 88) to a torque of 244 N·m (180 ft. lbs.).

(13) Install the spring washer (Fig. 87) on the stub shaft of the outer C/V joint.

(14) Install the nut retainer and cotter pin (Fig. 86) on the stub shaft of the outer C/V joint.

(15) Install the wheel speed sensor on the hub/bearing and adapter. Install the wheel speed sensor attaching bolt (Fig. 90). Tighten the wheel speed sensor attaching bolt to a torque of 12 N·m (105 in. lbs).

(16) Install wheel and tire.

(17) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(18) Remove jackstands or lower hoist.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop vehicle.

(19) Road test vehicle to ensure proper operation of the brake system.

MASTER CYLINDER

CAUTION: Different types of master cylinders are used on this vehicle. Vehicles equipped with traction control use a center port master cylinder. Vehicles not equipped with traction control use a compensating port master cylinder. Be sure to verify if the vehicle is equipped with traction control and that the correct replacement master cylinder is used. Also, vehicles that are equipped with four wheel disc brakes have a master with a different size piston bore than the other master cylinders. If a new master cylinder is being installed, be sure the correct master cylinder is used for the type of brake system the vehicle is equipped with.

REMOVE

CAUTION: Vacuum in the power brake booster must be pumped down (removed) before removing master cylinder from power brake booster. This is necessary to prevent the power brake booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

CAUTION: Before removing the master cylinder filler tube from the brake fluid reservoir, the filler tube, brake fluid reservoir and master cylinder must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the brake fluid reservoir and entering the brakes hydraulic system.

(2) Thoroughly clean all surfaces of the filler neck, brake fluid reservoir, and master cylinder. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(3) Remove master cylinder filler tube from brake fluid reservoir by pushing down and rotating (Fig. 97). Then remove the cap from the removed filler tube and install it on the master cylinder reservoir.

(4) Remove vehicle wiring harness connector, from the brake fluid level sensor, in master cylinder brake fluid reservoir (Fig. 98).

(5) Disconnect the primary and secondary brake tubes from the master cylinder housing (Fig. 99). Install sealing plugs in the open brake tube outlets on master cylinder assembly.

REMOVAL AND INSTALLATION (Continued)

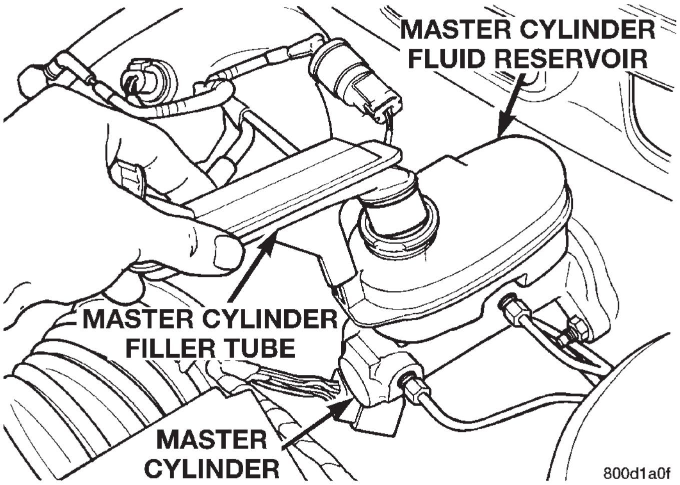


Fig. 97 Master Cylinder Filler Tube Removal

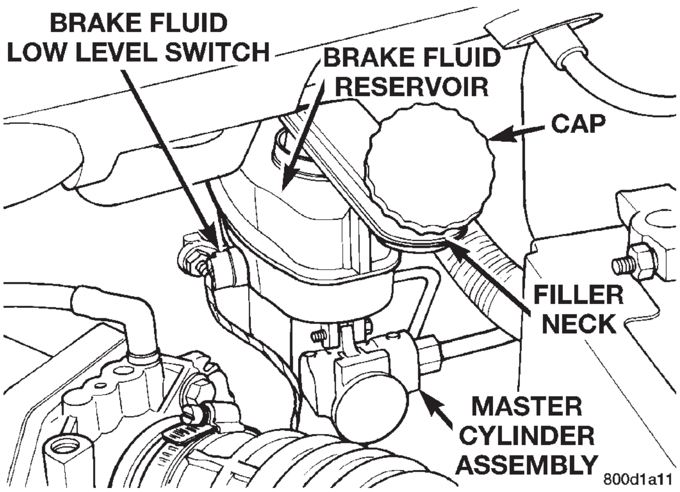


Fig. 98 Electrical Connector At Fluid Level Sensor

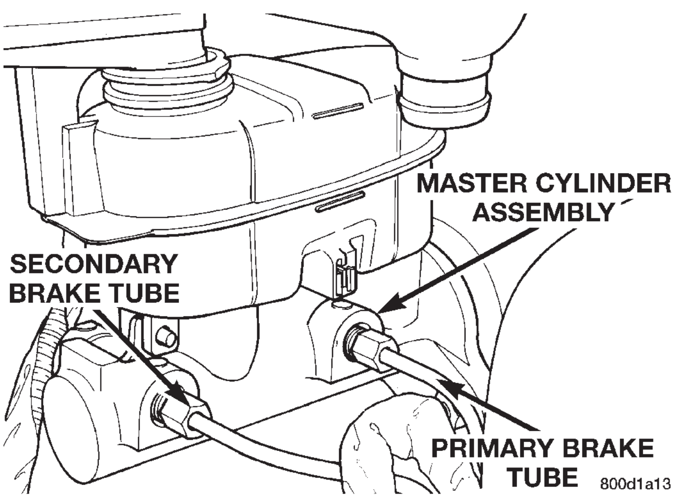


Fig. 99 Primary/Secondary Brake Tubes At Master Cylinder

CAUTION: Before removing the master cylinder from the power brake vacuum booster, the master cylinder and vacuum booster must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the power brake vacuum booster.

(6) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(7) Remove the 2 nuts attaching the master cylinder assembly to the brake vacuum booster (Fig. 100).

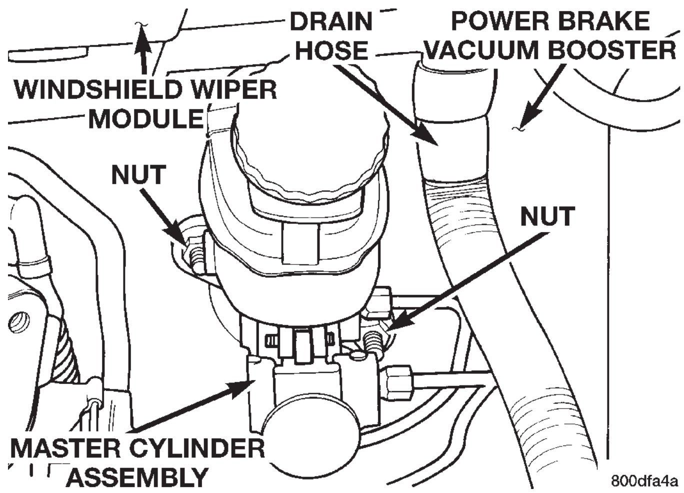


Fig. 100 Master Cylinder Mounting To Vacuum Booster

(8) Slide master cylinder assembly straight out of the power brake vacuum booster.

CAUTION: The master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal/boot on the master cylinder MUST be replaced whenever the master cylinder is removed from the power brake vacuum booster.

(9) Remove the vacuum seal located on the mounting flange of the master cylinder. The vacuum seal is removed from the master cylinder by **carefully** pulling it away from the master cylinder. **Do not attempt to pry the seal off the master cylinder by inserting a sharp tool between seal and master cylinder casting.**

BLEEDING MASTER CYLINDER

CAUTION: When clamping master cylinder in vise, only clamp master cylinder by its mounting flange, do not clamp on primary piston, seal or body of master cylinder.

(1) Clamp the master cylinder in a vise using only the mounting flange (Fig. 101).

REMOVAL AND INSTALLATION (Continued)

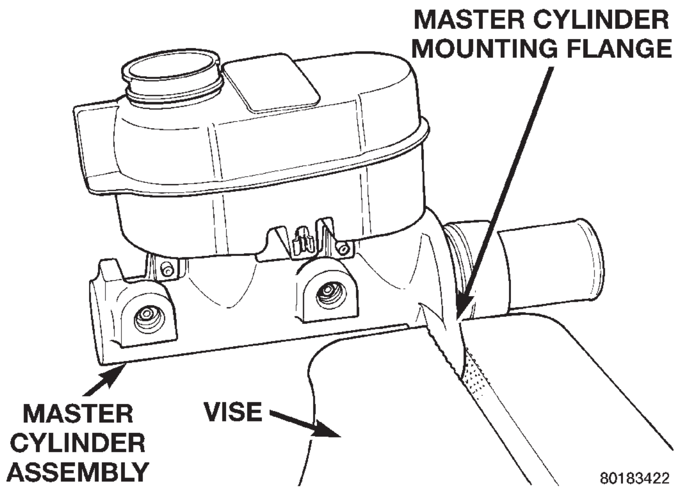


Fig. 101 Master Cylinder Correctly Mounted In Vise

NOTE: Two different size bleeding tubes are used depending on which type of master cylinder the vehicle is equipped with. Vehicles equipped with traction control use a center port master cylinder with a larger diameter brake tube. Vehicles not equipped with traction control use a compensating port master cylinder using a standard 3/16 inch diameter brake tube. Be sure the correct size bleeding tubes are used when bleeding the master cylinder.

(2) Install the Bleeding Tubes, Special Tool 6920 for a non traction control master cylinder or Special Tool 8129 for a traction control master cylinder on the master cylinder (Fig. 102). Position bleeding tubes so the outlets of bleeding tubes will be below surface of brake fluid when reservoir is filled to its proper level.

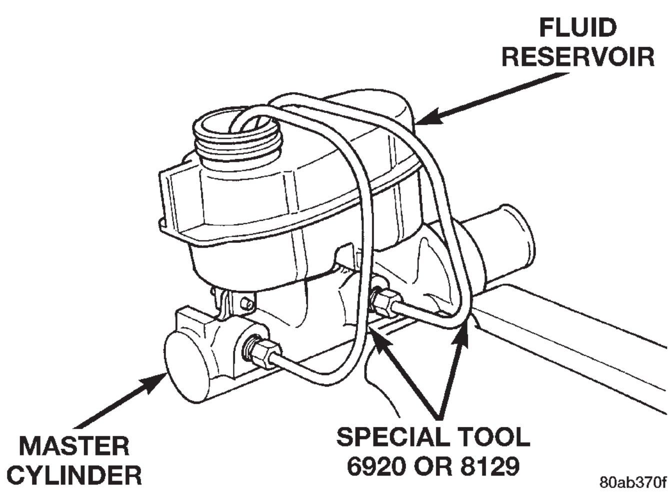


Fig. 102 Bleeding Tubes Installed On Master Cylinder

(3) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(4) Using a wooden dowel, (Fig. 102) depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled from master cylinder.

(5) Remove bleeding tubes from master cylinder outlet ports, and then plug outlet ports and install fill cap on reservoir.

(6) Remove master cylinder from vise.

NOTE: Note: It is not necessary to bleed the ABS hydraulic control unit (HCU) after replacing the master cylinder. But, the base brake hydraulic system must be bled to ensure no air is entered the hydraulic system when the master cylinder was removed.

INSTALL

CAUTION: When replacing the master cylinder on a vehicle, a NEW vacuum seal MUST be installed on the master cylinder. Use only procedure detailed below for installing the vacuum seal onto the master cylinder.

(1) Install a **NEW** vacuum seal on master cylinder making sure seal sits squarely in groove of master cylinder casting (Fig. 103).

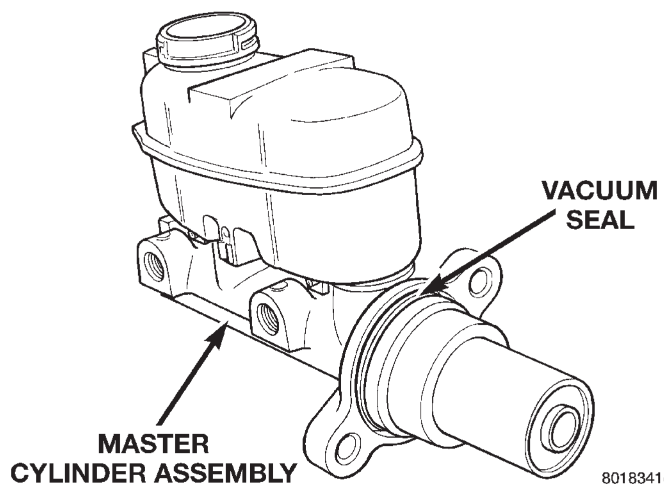


Fig. 103 Vacuum Seal Installed On Master Cylinder

(2) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

(3) Install the 2 master cylinder to power brake unit mounting nuts. Then tighten both mounting nuts to a torque of 25 N·m (225 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

CAUTION: When installing the primary and secondary brake tubes on master cylinder, be sure brake tubes do not contact any other components within the vehicle and that there is slack in the flexible sections of the tubes. This is required due to the movement between the ABS hydraulic control module (HCU) and the master cylinder, when the vehicle is in motion.

(4) Connect the primary and secondary brake tubes to master cylinder primary and secondary ports (Fig. 99). Brake tubes must be held securely when tightened to control orientation of flex section. Then fully tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

(5) Install the vehicle wiring harness connector, on the brake fluid level sensor in the master cylinder brake fluid reservoir (Fig. 98).

(6) Install filler tube into the master cylinder fluid reservoir (Fig. 97).

VACUUM BOOSTER 2.4 LITER ENGINE

REMOVE

CAUTION: Reserve vacuum in the vacuum booster must be pumped down (removed) before removing master cylinder from vacuum booster. This is necessary to prevent the vacuum booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove both battery cables from battery.

(3) Remove the battery thermal guard and the battery from the battery tray.

(4) Remove the air inlet resonator and hoses as an assembly from the throttle body and air cleaner housing (Fig. 104)

(5) If vehicle is equipped with speed control, unplug wiring harness connector from the speed control servo. Then disconnect vacuum lines from the speed control servo and vacuum reservoir on battery tray.

(6) Remove bolt attaching the speed control servo bracket to the battery tray. Slide the bracket forward to unhook it from the battery tray and remove.

(7) Remove the 2 bolts and the nut (Fig. 105) attaching the battery tray to the body.

(8) Remove wiring harness connector from brake fluid level sensor in master cylinder fluid reservoir (Fig. 106).

(9) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(10) Remove clip attaching drain hose for wiper module to brake tube at master cylinder. Remove

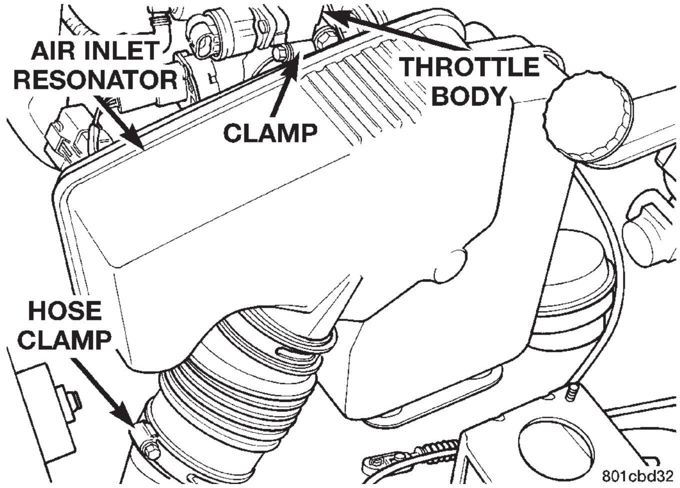


Fig. 104 Air Inlet Resonator

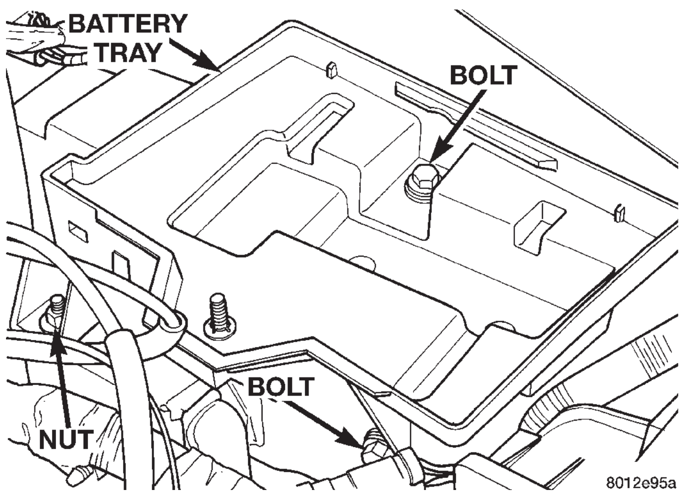


Fig. 105 Battery Tray Mounting Locations

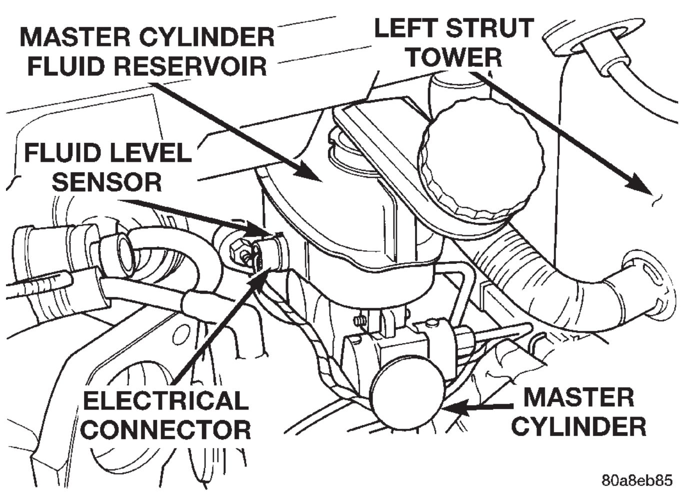


Fig. 106 Fluid Level Sensor Electrical Connection

REMOVAL AND INSTALLATION (Continued)

drain hose (Fig. 107) from wiper module. Remove the 2 nuts attaching the master cylinder to the vacuum booster (Fig. 107).

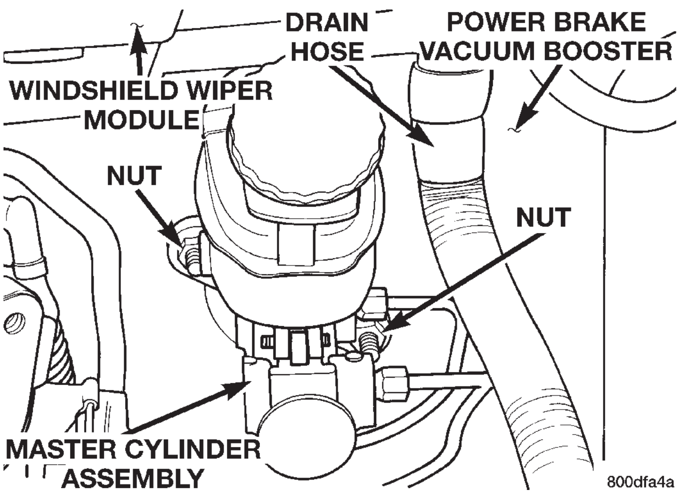


Fig. 107 Master Cylinder Attachment To Vacuum Booster

NOTE: It is not necessary to remove the brake tubes from the master cylinder when removing the master cylinder from the vacuum booster.

(11) Remove the master cylinder and brake tubes as an assembly from the vacuum booster. When master cylinder is removed, lay it out of the way on top of the left motor mount

(12) Disconnect vacuum hose from check valve located on vacuum booster. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(13) Locate the vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the vacuum booster input rod to brake pedal pin retaining clip (Fig. 108).

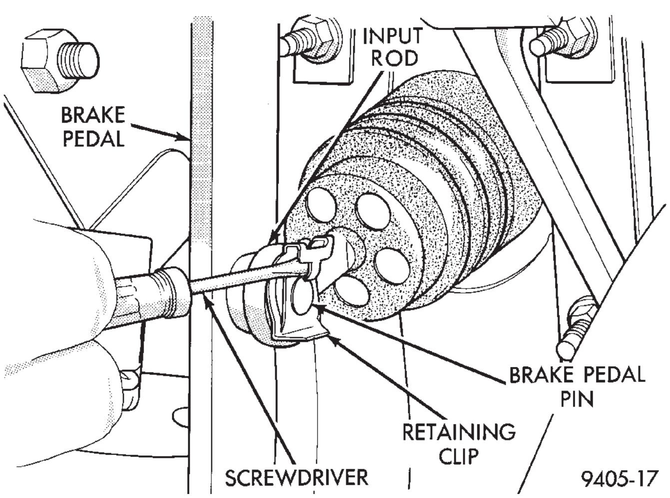


Fig. 108 Input Rod Retaining Pin

(14) Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. It is not to be reused. Replace only with a new retaining clip when assembled.**

(15) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly.

(16) From outside the vehicle, slide vacuum booster forward until its mounting studs clear dash panel. Then tilt the booster up and toward the center of vehicle to remove.

CAUTION: Do not attempt to disassemble the vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALL

CAUTION: When installing the vacuum booster in the vehicle be sure the heater hoses do not become trapped between the booster and the dash panel of the vehicle.

(1) Position vacuum booster onto dash panel using the reverse procedure for its removal.

(2) Install the 4 mounting nuts for the vacuum booster. Tighten the 4 mounting nuts to a torque of 29 N·m (250 in. lbs.).

(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the vacuum booster input rod.

CAUTION: When installing the brake pedal pin on the vacuum booster input rod, do not re-use the old retaining clip.

(4) Connect the vacuum booster input rod on the brake pedal pin and install a **NEW** retaining clip (Fig. 109).

(5) Connect the vacuum hose on the check valve in the vacuum booster.

CAUTION: The master cylinder is used to create the seal for holding vacuum in the vacuum booster. The vacuum seal on the master cylinder MUST be replaced with a NEW seal whenever the master cylinder is removed from the vacuum booster.

CAUTION: When removing the vacuum seal from the master cylinder do not use a sharp tool.

(6) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

REMOVAL AND INSTALLATION (Continued)

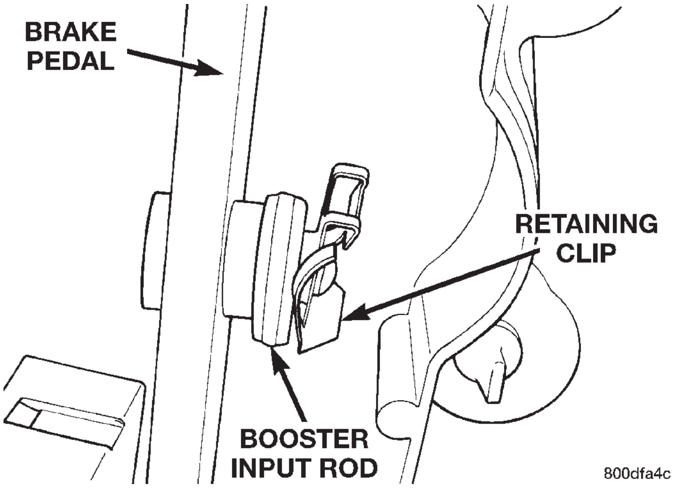


Fig. 109 Retaining Clip Installed On Brake Pedal Pin

(7) Install a **NEW**vacuum seal on mounting flange of master cylinder (Fig. 110).

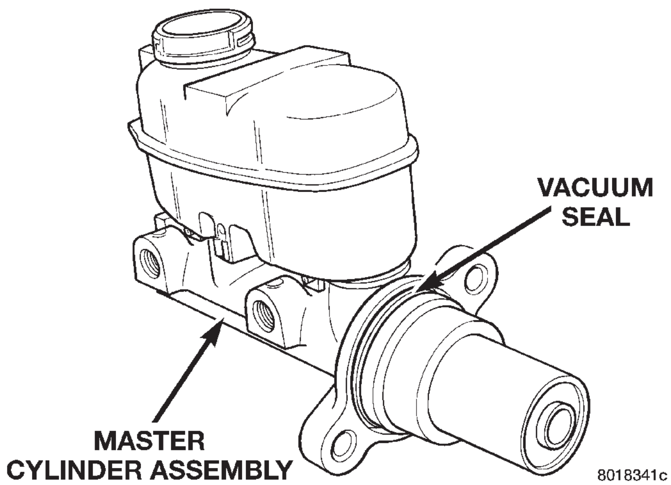


Fig. 110 Vacuum Seal Installed On Master Cylinder

(8) Position master cylinder on studs of vacuum booster aligning push rod on vacuum booster with master cylinder piston.

(9) Install the 2 nuts (Fig. 107) mounting the master cylinder to the vacuum booster. Tighten the mounting nuts to a torque of 25 N·m (225 in. lbs.).

(10) Install the wiper module drain hose (Fig. 107) on the wiper module. Install the tie strap attaching the wiper module drain hose to the brake tube at the master cylinder. **Tie strap should be loosely tightened so as not to collapse the wiper module drain hose.**

(11) Install the wiring harness connector on the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 106).

(12) Install the battery tray in the vehicle. Install the 2 bolts and the nut (Fig. 105) attaching the battery tray. Tighten the 2 bolts and the nut to a torque of 14 N·m (125 in lbs.).

(13) If vehicle is equipped with speed control, install the speed control servo and bracket on the battery tray. Install and securely tighten bolt attaching bracket to battery tray.

(14) If vehicle is equipped with speed control, install the wiring harness connector on the speed control servo. Then connect the vacuum lines onto the speed control servo and vacuum reservoir on battery tray.

(15) Install the air inlet resonator and hoses as an assembly on the throttle body and air cleaner housing (Fig. 104). Securely tighten the hose clamp at the air cleaner housing and throttle body.

(16) Install the battery and the battery thermal guard.

(17) Install the battery cables on the battery.

(18) Check the operation of the stop lamp switch and adjust if necessary.

VACUUM BOOSTER 3.0 LITER ENGINE

REMOVE

CAUTION: Stored vacuum in the vacuum booster must be pumped down (removed) before removing master cylinder from power brake booster. This is necessary to prevent the power brake booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove both battery cables from battery.

(3) Remove the battery thermal guard and the battery from the battery tray.

(4) Remove the air inlet resonator and hoses as an assembly from the throttle body and air cleaner housing (Fig. 111)

(5) If vehicle is equipped with speed control, unplug wiring harness connector from the speed control servo. Then disconnect vacuum lines from the speed control servo and vacuum reservoir on battery tray.

(6) Remove bolt attaching the speed control servo bracket to the battery tray. Slide the bracket forward to unhook it from the battery tray and remove.

(7) Remove the 2 bolts and the nut (Fig. 112) attaching the battery tray to the body of the vehicle.

(8) Remove wiring harness connector from brake fluid level sensor in master cylinder fluid reservoir (Fig. 113).

(9) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

REMOVAL AND INSTALLATION (Continued)

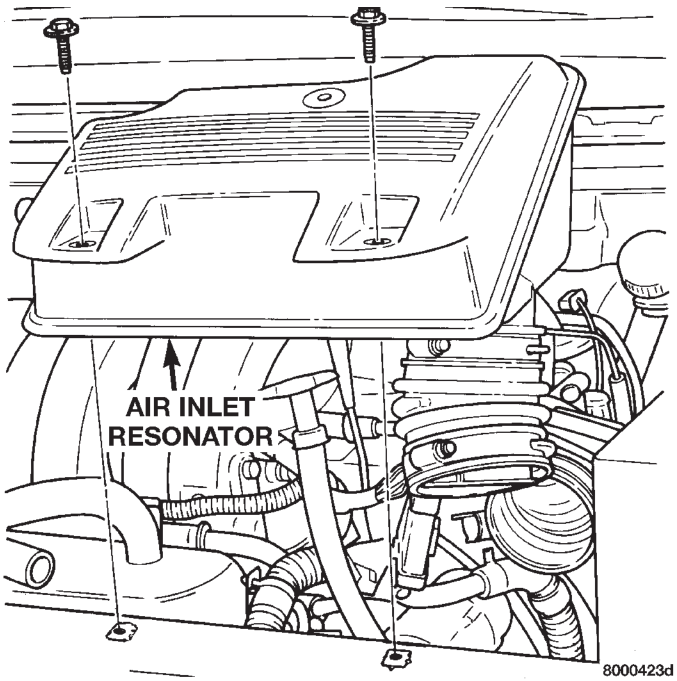


Fig. 111 Air Inlet Resonator

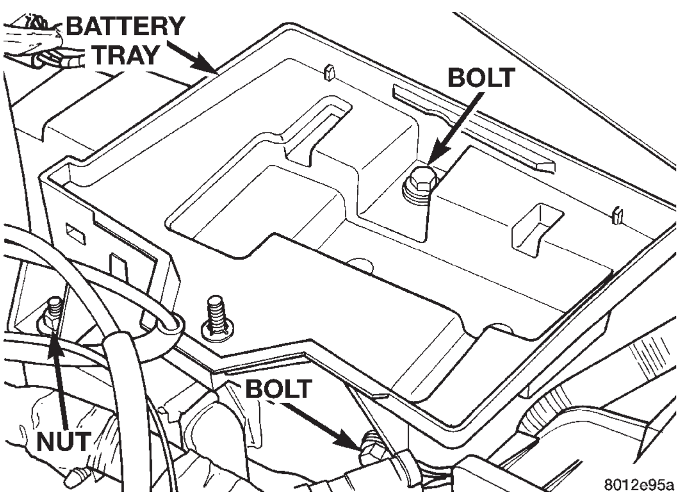


Fig. 112 Battery Tray Mounting Locations

(10) Remove clip attaching drain hose to brake tube at master cylinder. Remove drain hose (Fig. 114) from wiper module. Remove the 2 nuts attaching the master cylinder assembly to the power brake vacuum booster (Fig. 114).

NOTE: It is not necessary to remove the brake tubes from the master cylinder when removing the master cylinder from the power brake vacuum booster.

(11) Remove the master cylinder and the brake tubes as an assembly from power brake vacuum booster. When master cylinder is removed, lay it out of the way on top of the left motor mount

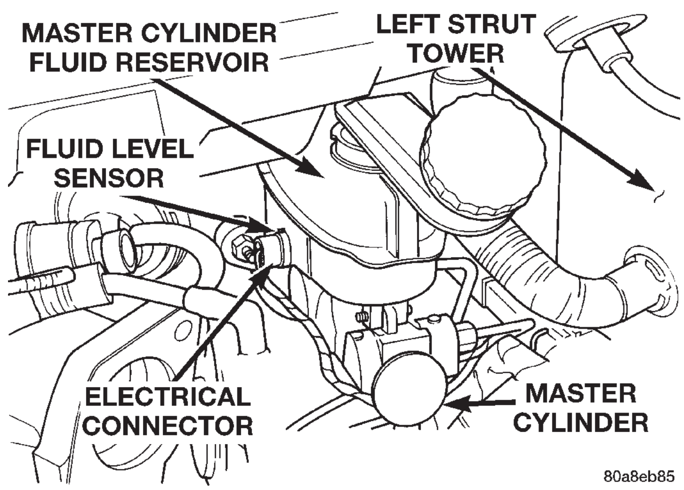


Fig. 113 Electrical Connection To Fluid Level Sensor

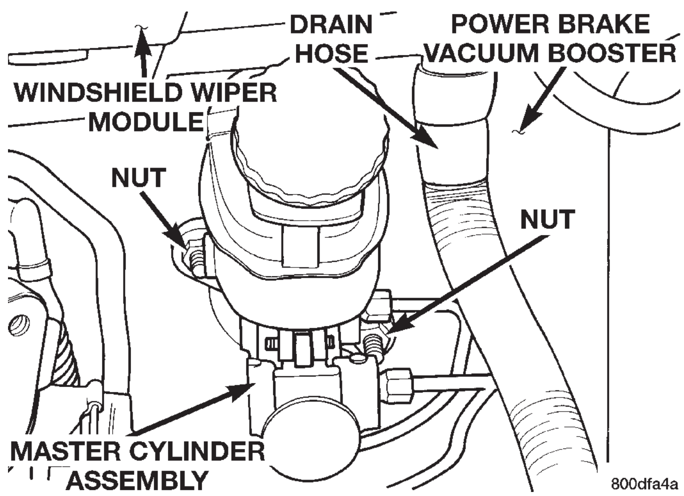


Fig. 114 Master Cylinder Attachment To Power Brake Vacuum Booster

(12) Disconnect vacuum hose from check valve located on power brake vacuum booster. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(13) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 115).

(14) Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. It is not to be reused. Replace only with a new retaining clip when assembled.**

(15) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly.

(16) From outside the vehicle, slide power brake vacuum booster forward until its mounting studs

REMOVAL AND INSTALLATION (Continued)

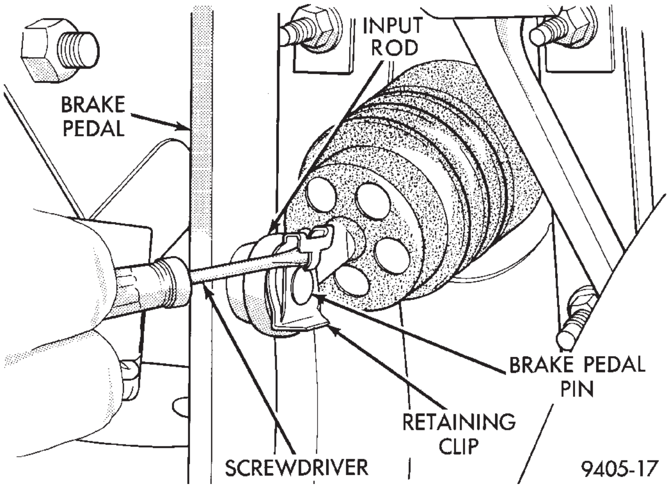


Fig. 115 Booster Input Rod Retaining Pin

clear dash panel. Then tilt the booster up and toward the center of vehicle to remove.

CAUTION: Do not attempt to disassemble the power brake vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALL

CAUTION: When installing the power brake vacuum booster in the vehicle be sure the heater hoses do not become trapped between the booster and the dash panel of the vehicle.

(1) Position power brake booster onto dash panel using the reverse procedure for its removal.

(2) Install the 4 power brake vacuum booster mounting nuts. Tighten the 4 mounting nuts to a torque of 29 N·m (250 in. lbs.).

(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the brake vacuum booster input rod.

CAUTION: When installing the brake pedal pin on the power brake vacuum booster input rod, do not re-use the old retaining clip.

(4) Connect power brake vacuum booster input rod on the brake pedal pin and install a **NEW** retaining clip (Fig. 116).

(5) Connect the vacuum hose on the check valve in the power brake vacuum booster.

CAUTION: The master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal on the master cylinder MUST be replaced with a NEW seal whenever the master cylinder is removed from the power brake vacuum booster.

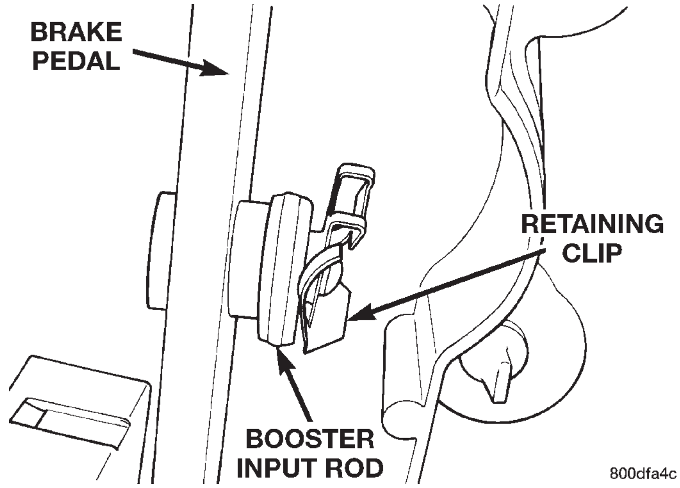


Fig. 116 Retaining Pin Installed On Brake Pedal Pin

CAUTION: When removing the vacuum seal from the master cylinder do not use a sharp tool.

(6) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

(7) Install a **NEW** vacuum seal on mounting flange of master cylinder assembly (Fig. 117).

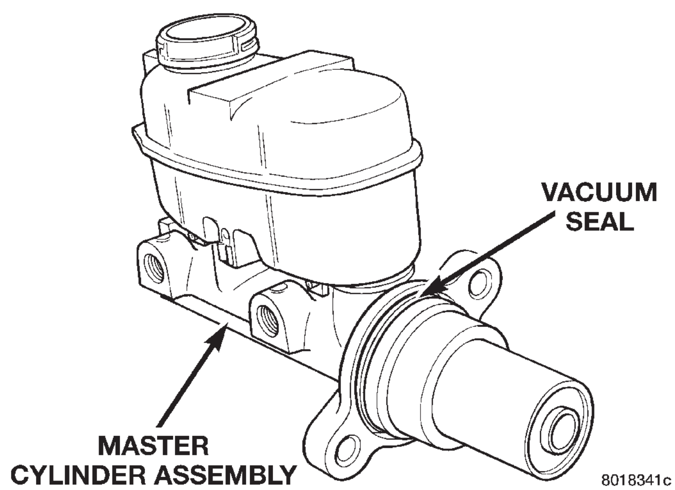


Fig. 117 Vacuum Seal Installed On Master Cylinder

(8) Position master cylinder on studs of power brake booster, aligning push rod on power brake vacuum booster with master cylinder push rod.

(9) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 114). Tighten both mounting nuts to a torque of 25 N·m (225 in. lbs.).

(10) Install the wiper module drain hose (Fig. 114) on the wiper module. Install the tie strap attaching the wiper module drain hose to brake tube at the master cylinder. **Tie strap should be loosely tightened so as not to collapse the wiper module drain hose.**

REMOVAL AND INSTALLATION (Continued)

(11) Install the wiring harness connector on the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 113).

(12) Install the battery tray in the vehicle. Install the 2 bolts and the nut (Fig. 112) attaching the battery tray to the vehicle. Tighten the 2 bolts and the nut to a torque of 14 N·m (125 in lbs.).

(13) If vehicle is equipped with speed control, install the speed control servo and bracket on the battery tray. Install and securely tighten bolt attaching bracket to battery tray.

(14) If vehicle is equipped with speed control, install the wiring harness connector on the speed control servo. Then connect the vacuum lines onto the speed control servo and vacuum reservoir on battery tray.

(15) Install the air inlet resonator and hoses as an assembly on the throttle body and air cleaner housing (Fig. 111). Securely tighten the hose clamp at the air cleaner housing and throttle body.

(16) Install the battery and the battery thermal guard.

(17) Install the battery cables on the battery.

(18) Check the operation of the stop lamp switch and adjust if necessary.

VACUUM BOOSTER 3.3/3.8 LITER ENGINE

REMOVE

CAUTION: Reserve vacuum in the vacuum booster must be pumped down (removed) before removing master cylinder from vacuum booster. This is necessary to prevent the vacuum booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove both battery cables from battery.

(3) Remove the battery thermal guard and the battery from the battery tray.

(4) Remove the air inlet resonator and hoses as an assembly from the throttle body and air cleaner housing (Fig. 118)

(5) If vehicle is equipped with speed control, unplug wiring harness connector from the speed control servo. Then disconnect vacuum lines from the speed control servo and vacuum reservoir on battery tray.

(6) Remove bolt attaching the speed control servo bracket to the battery tray. Slide the bracket forward to unhook it from the battery tray and remove.

(7) Remove the 2 bolts and the nut (Fig. 119) attaching the battery tray to the body of the vehicle.

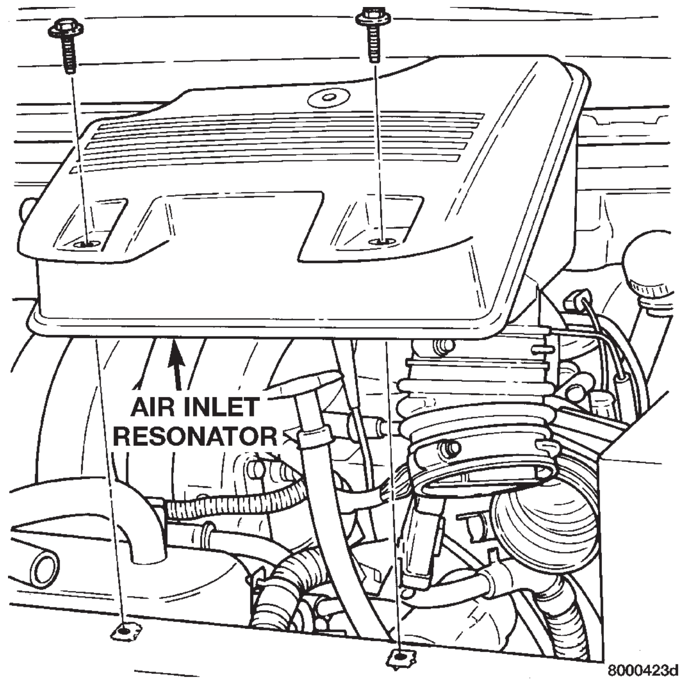


Fig. 118 Air Inlet Resonator

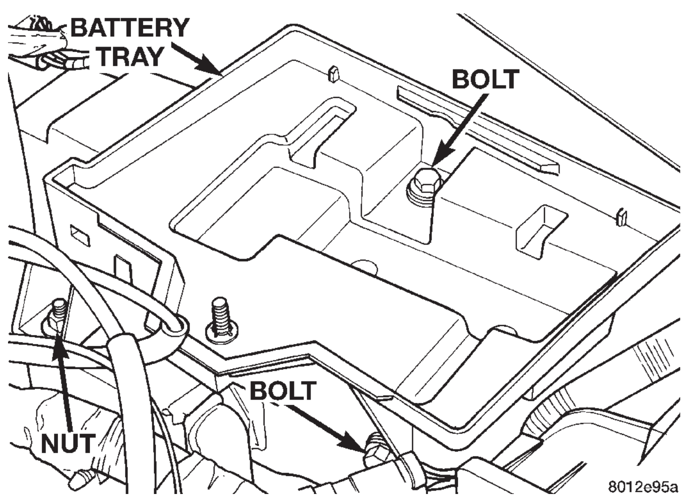


Fig. 119 Battery Tray Mounting Locations

(8) Remove the wiring harness connector (Fig. 120) from the EGR valve transducer.

(9) Remove wiring harness connectors from throttle position sensor and AIS motor on throttle body (Fig. 121).

(10) Remove the 2 bolts (Fig. 122) attaching the throttle body to the intake manifold and the clip (Fig. 122) attaching the wiring harness to the throttle cable bracket. Then remove the throttle body and throttle cable bracket as an assembly from the intake manifold.

(11) Remove wiring harness connector from brake fluid level sensor in master cylinder fluid reservoir (Fig. 123).

(12) Clean the area where the master cylinder assembly attaches to the power brake booster. Use

REMOVAL AND INSTALLATION (Continued)

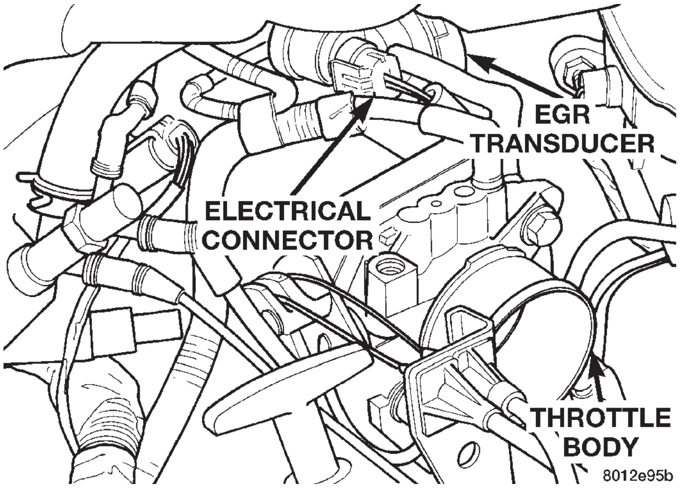


Fig. 120 Electrical Connector At EGR Transducer

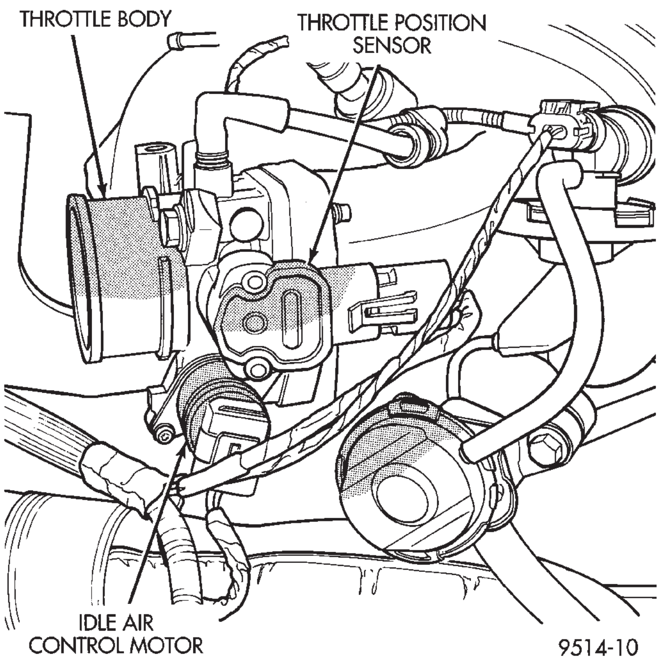


Fig. 121 Electrical And Vacuum Connections To Throttle Body

only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(13) Remove clip, attaching drain hose for wiper module to brake tube at master cylinder. Remove drain hose (Fig. 124) from wiper module. Remove the 2 nuts, attaching the master cylinder to the vacuum booster (Fig. 124).

NOTE: It is not necessary to remove the brake tubes from the master cylinder when removing the master cylinder from the vacuum booster.

(14) Remove master cylinder and brake tubes as an assembly from the vacuum booster. When master

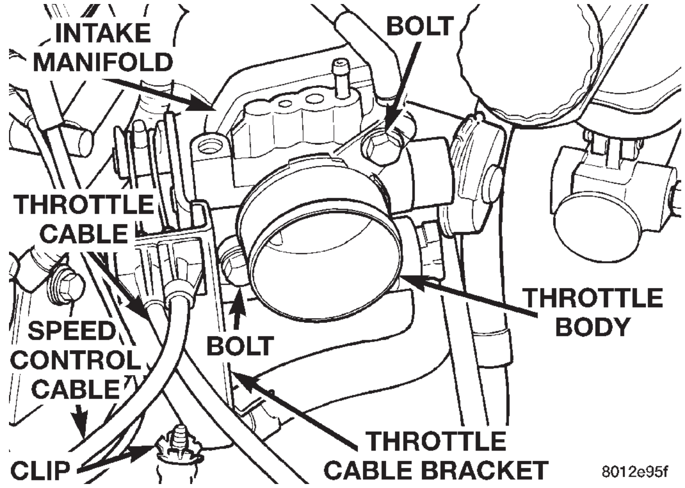


Fig. 122 Throttle Body Attachment To Intake Manifold

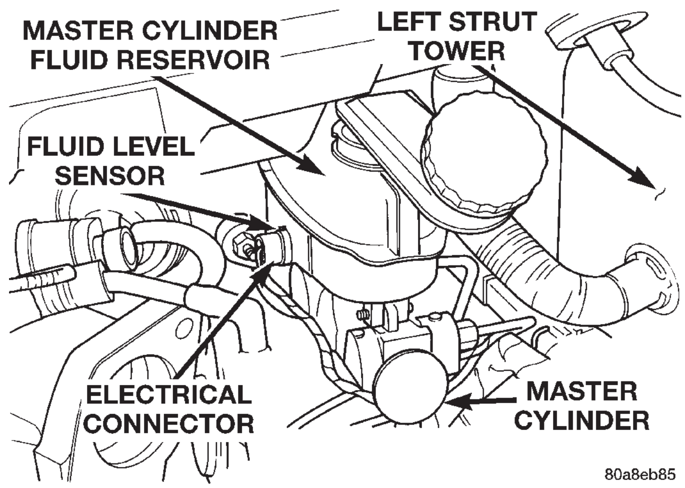


Fig. 123 Fluid Level Sensor Electrical Connection

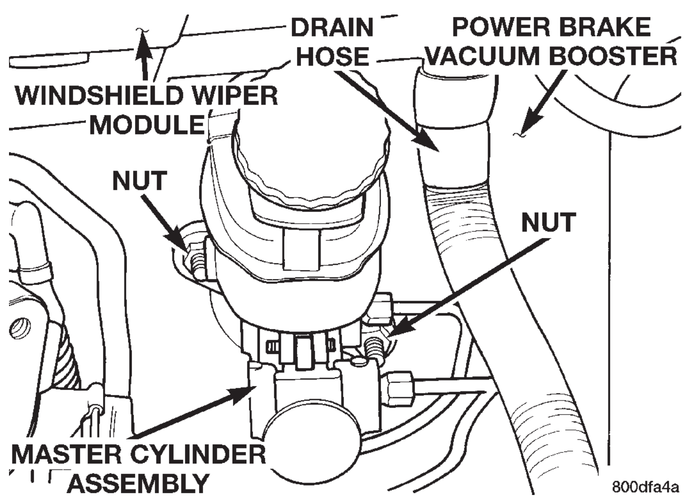


Fig. 124 Master Cylinder Attachment To Vacuum Booster

cylinder is removed, lay it out of the way on top of the left motor mount

REMOVAL AND INSTALLATION (Continued)

(15) Remove the EGR Valve and the vacuum transducer (Fig. 125) as an assembly from the intake manifold.

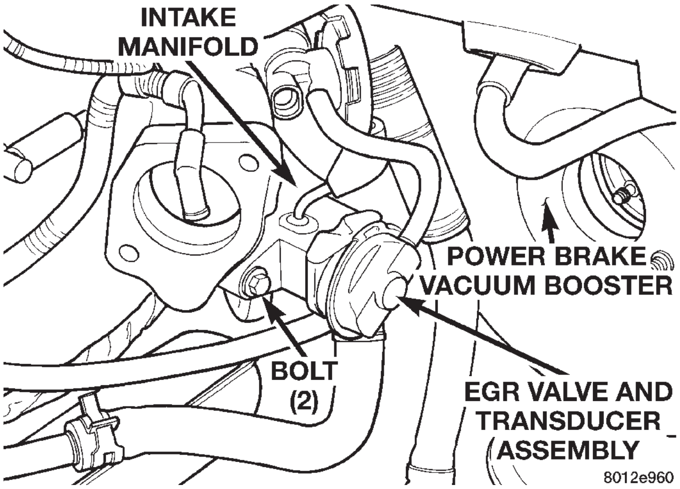


Fig. 125 EGR Valve Attachment To Intake Manifold

(16) Disconnect vacuum hose from check valve located on vacuum booster. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(17) Locate the vacuum booster input rod to brake pedal connection under the instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 126).

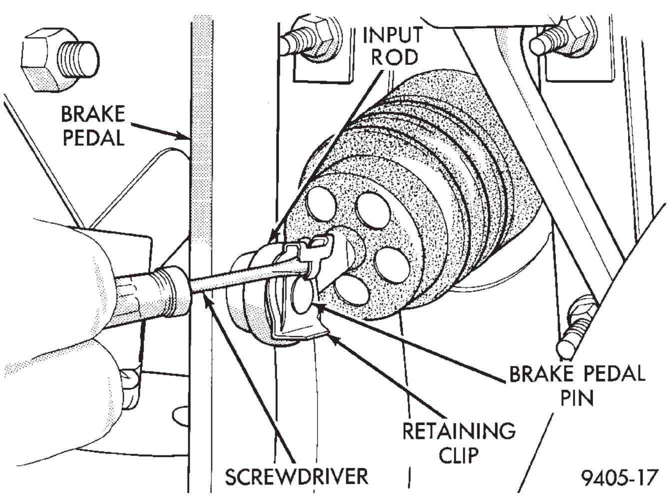


Fig. 126 Vacuum Booster Input Rod Retaining Pin

(18) Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. It is not to be reused. Replace only with a new retaining clip when assembling.**

(19) Remove the 4 nuts attaching the power brake vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly.

(20) From outside the vehicle, slide power brake vacuum booster forward until its mounting studs clear dash panel. Then tilt the booster up and toward the center of vehicle to remove.

CAUTION: Do not attempt to disassemble the power brake vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALL

CAUTION: When installing the power brake vacuum booster in the vehicle be sure the heater hoses do not become trapped between the booster and the dash panel of the vehicle.

(1) Position vacuum booster on dash panel using the reverse procedure of its removal.

(2) Install the 4 nuts mounting the vacuum booster to the dash panel. Tighten the 4 mounting nuts to a torque of 29 N·m (250 in. lbs.).

(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the vacuum booster input rod.

CAUTION: When installing the brake pedal pin on the power brake vacuum booster input rod, do not re-use the old retaining clip.

(4) Install vacuum booster input rod on brake pedal pin and install a **NEW** retaining clip (Fig. 127).

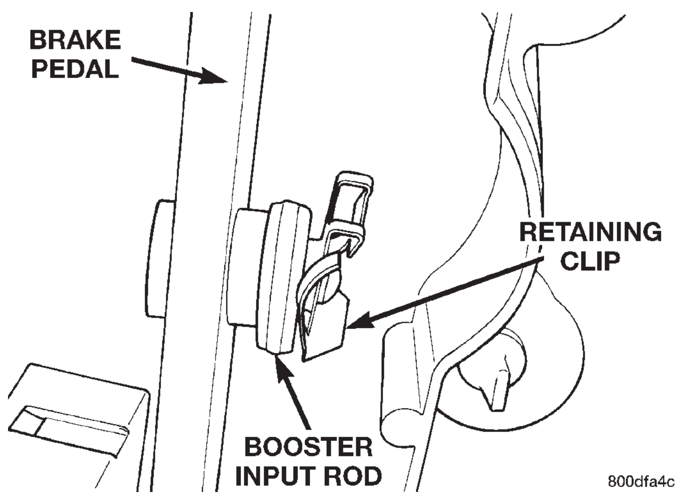


Fig. 127 Retaining Pin Installed On Brake Pedal Pin

(5) Connect the vacuum hose on the check valve in the power brake vacuum booster.

(6) Install EGR Valve and vacuum transducer (Fig. 125) on the intake manifold. Install and tighten the 2 EGR valve mounting bolts to a torque of 22 N·m (200 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

CAUTION: The master cylinder is used to create the seal for holding vacuum in the vacuum booster. The vacuum seal on the master cylinder MUST be replaced with a NEW seal whenever the master cylinder is removed from the vacuum booster.

CAUTION: When removing the vacuum seal from the master cylinder do not use a sharp tool.

(7) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

(8) Install a **NEW** vacuum seal on mounting flange of the master cylinder (Fig. 128).

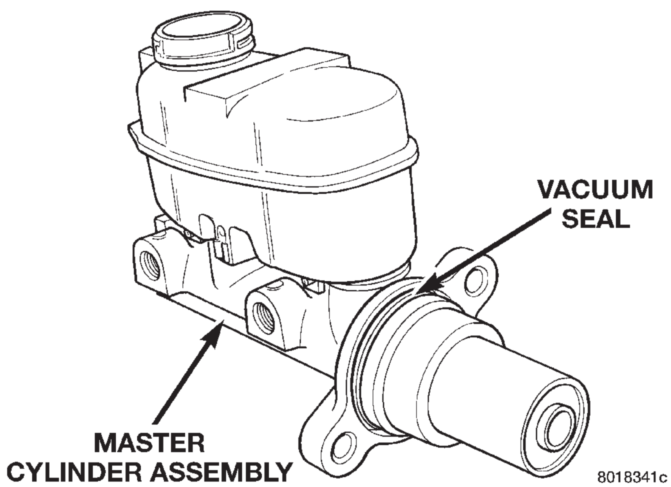


Fig. 128 Vacuum Seal Installed On Master Cylinder

(9) Position master cylinder on studs of vacuum booster, aligning push rod on vacuum booster with master cylinder piston.

(10) Install the 2 nuts mounting the master cylinder to the vacuum booster (Fig. 124). Tighten both mounting nuts to a torque of 25 N·m (225 in. lbs.).

(11) Install the wiper module drain hose (Fig. 124) on the wiper module. Install the tie strap attaching the wiper module drain hose to brake tube at the master cylinder. **Tie strap should be loosely tightened so as not to collapse the wiper module drain hose.**

(12) Install the wiring harness connector on the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 123).

(13) Install the throttle body and throttle cable bracket on the intake manifold. Install the 2 bolts (Fig. 122) attaching the throttle body to the intake manifold and tighten to a torque of 25 N·m (225 in. lbs.) Install clip (Fig. 122) attaching the wiring harness to the throttle cable bracket.

(14) Install the wiring harness connectors on the throttle position sensor and the AIS motor on throttle body (Fig. 121).

(15) Install the wiring harness connector (Fig. 120) on the EGR valve transducer.

(16) Install the battery tray. Install the 2 bolts and the nut (Fig. 119) attaching the battery tray to the vehicle. Tighten the 2 bolts and the nut to a torque of 14 N·m (125 in lbs.).

(17) If vehicle is equipped with speed control, install the speed control servo and bracket on the battery tray. Install and securely tighten bolt attaching bracket to battery tray.

(18) If vehicle is equipped with speed control, install the wiring harness connector on the speed control servo. Then connect the vacuum lines onto the speed control servo and vacuum reservoir on battery tray.

(19) Install the air inlet resonator and hoses as an assembly on the throttle body and air cleaner housing (Fig. 118). Securely tighten hose clamp at air cleaner housing and throttle body.

(20) Install the battery and the battery thermal guard.

(21) Install the battery cables on the battery.

(22) Check the operation of the stop lamp switch and adjust if necessary.

JUNCTION BLOCK

REMOVE

(1) Using a brake pedal depressor, move and lock the brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the junction block.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication And Maintenance Group of this service manual.

CAUTION: Before removing the brake tubes from the junction block, the junction block and the brake tubes must be thoroughly cleaned. This is required to prevent contamination from entering the brake hudraulic system.

(3) Remove the 6 chassis brake tubes (Fig. 129) from the junction block.

(4) Remove the bolt (Fig. 130) attaching the junction block mounting braket to the front suspension cradle.

INSTALL

(1) Install the junction block and mounting bracket (Fig. 130) on the front suspension cradle. Install the attaching bolt and tighten to a torque of 28 N·m (250 in. lbs.).

(2) Install the 6 chassis brake tubes (Fig. 131) into the inlet and outlet ports of the junction block.

REMOVAL AND INSTALLATION (Continued)

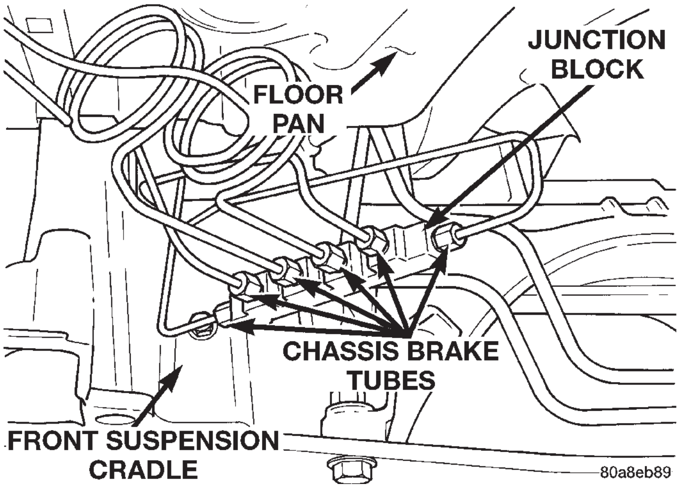


Fig. 129 Junction Block Brake Tubes

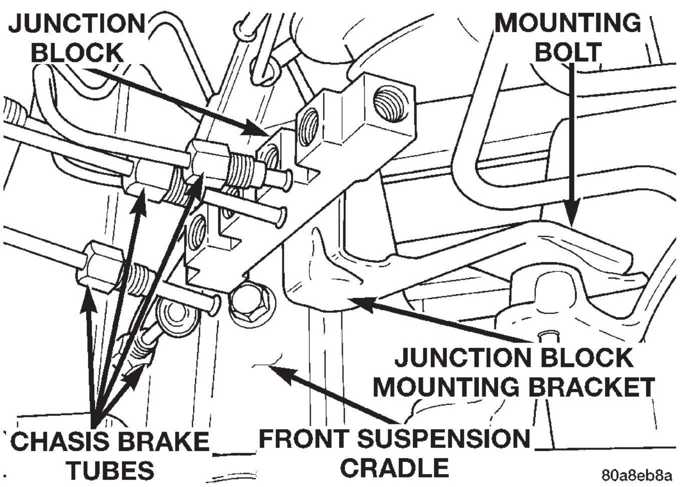


Fig. 130 Junction Block Mounting

Tighten all 6 tube nuts to a torque of 16 N·m (145 in. lbs.).

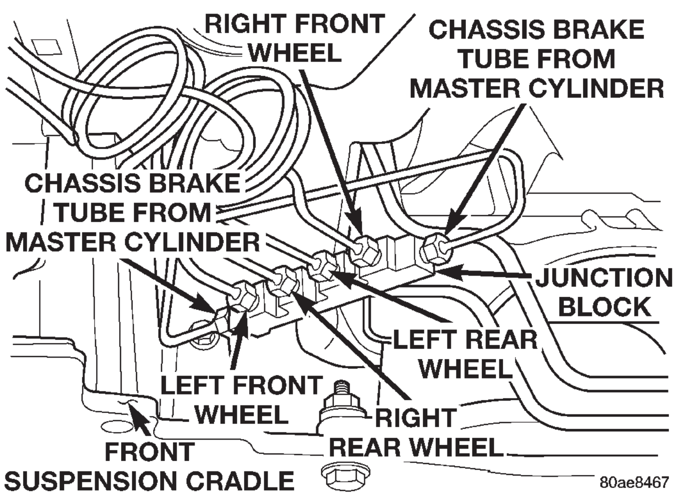


Fig. 131 Brake Tube Connections To Junction Block

(3) Bleed the brake system thoroughly to ensure that all air has been expelled from the hydraulic system. See Bleeding Brake System in the Service Adjustments section in this group of the service manual for the proper bleeding procedure.

(4) Lower the vehicle.

(5) Road test the vehicle to verify proper operation of the vehicles brake system.

PROPORTIONING VALVE (W/ABS BRAKES)

The actual proportioning valves of the proportioning valve assembly are not serviceable or replaceable. If a proportioning valve of the proportioning valve assembly is not functioning properly, the fixed proportioning valve must be replaced as an assembly.

REMOVE

(1) Using a brake pedal depressor, move and lock the brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the proportioning valve.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication And Maintenance Group of this service manual.

CAUTION: Before removing the brake tubes from the proportioning valve, the proportioning valve and the brake tubes must be thoroughly cleaned. This is required to prevent contamination from entering the proportioning valve or the brake tubes.

(3) Remove the 4 chassis brake lines from the inlet and outlet ports of the proportioning valve (Fig. 132).

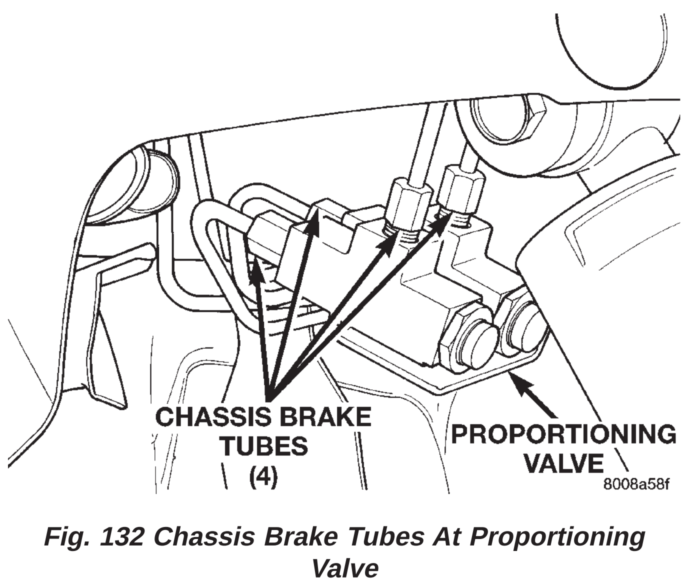


Fig. 132 Chassis Brake Tubes At Proportioning Valve

(4) Remove the bolts (Fig. 133) attaching the proportioning valve bracket to the frame rail of the vehicle. Remove the fixed proportioning valve assembly from the vehicle.

REMOVAL AND INSTALLATION (Continued)

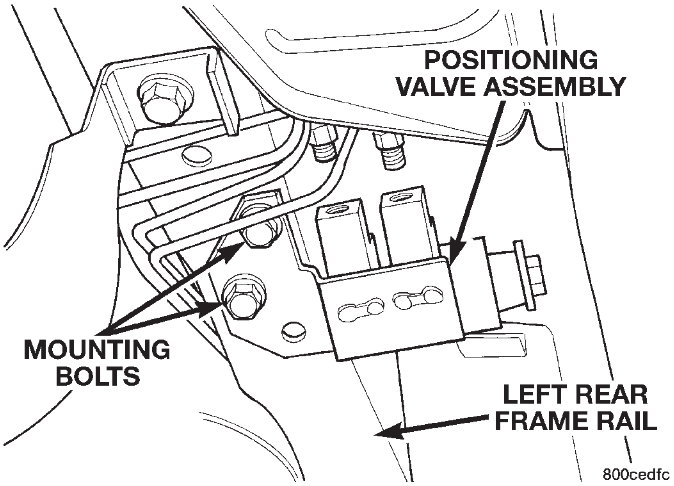


Fig. 133 Proportioning Valve Attachment To Vehicle

INSTALL

CAUTION: When mounting the original or a replacement proportioning valve on the frame rail of the vehicle install the mounting bolts in only the two forward holes of the mounting bracket (Fig. 133).

(1) Install proportioning valve assembly on the frame rail of the vehicle. Install the proportioning valve assembly attaching bolts (Fig. 133). Tighten the attaching bolts to a torque of 14 N·m (125 in. lbs.).

(2) Install the 4 chassis brake lines (Fig. 132) into the inlet and outlet ports of the proportioning valve assembly. Tighten all 4 line nuts to a torque of 16 N·m (142 in. lbs.).

(3) Bleed the brake system thoroughly enough to ensure that all air has been expelled from the hydraulic system. See Bleeding Brake System in the Service Adjustments section in this group of the service manual for the proper bleeding procedure.

(4) Lower the vehicle to the ground.

(5) Road test the vehicle to verify proper operation of the vehicles brake system.

PROPORTIONING VALVE (W/O ABS BRAKES)

The components of the proportioning valve assembly are not serviceable or replaceable. If a component of the proportioning valve assembly is not functioning properly, the proportioning valve must be replaced as an assembly.

REMOVE

(1) Using a brake pedal depressor, move and lock the brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the proportioning valve.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication And Maintenance Group of this service manual.

CAUTION: Before removing the brake tubes from the proportioning valve, the proportioning valve and the brake tubes must be thoroughly cleaned. This is required to prevent contamination from entering the proportioning valve or the brake tubes.

(3) Remove the 4 chassis brake tubes from the inlet and outlet ports of the proportioning valve (Fig. 134).

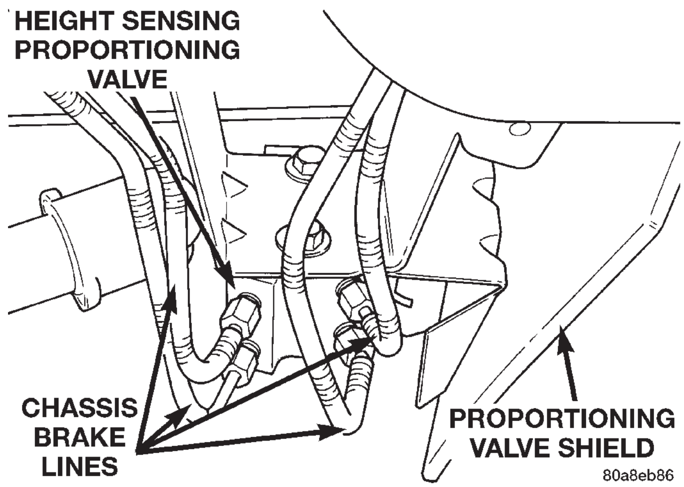


Fig. 134 Chassis Brake Tubes At Proportioning Valve

(4) Remove the 2 bolts (Fig. 135) attaching the proportioning valve to the proportioning valve mounting bracket. Remove the proportioning valve from the mounting bracket.

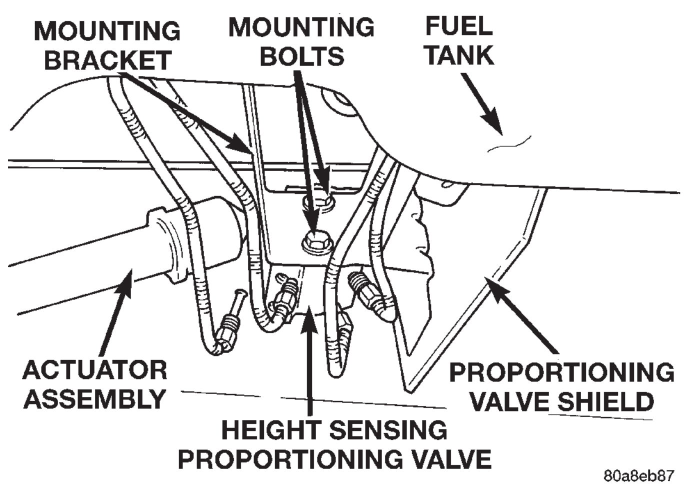


Fig. 135 Proportioning Valve Mounting

(5) Remove the hooked end of the proportioning valve actuator (Fig. 136) from the isolator bushing on the lever of the height proportioning valve (Fig. 136).

REMOVAL AND INSTALLATION (Continued)

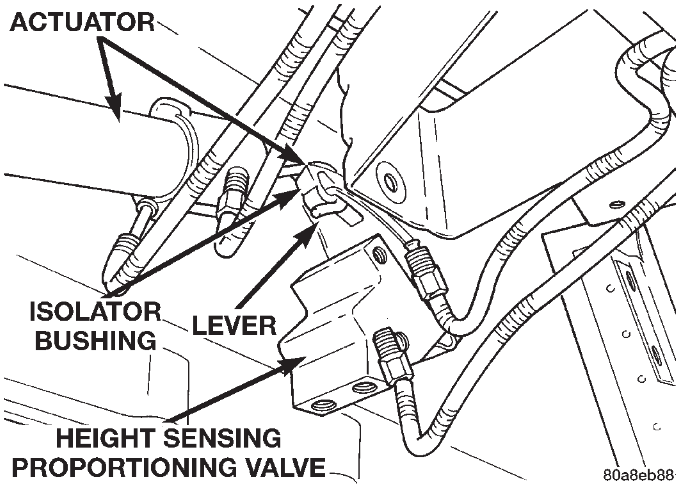


Fig. 136 Actuator Attachment To Proportioning Valve

INSTALL

(1) Install the hooked end of the actuator on the proportioning valve lever (Fig. 136). **Be sure isolator bushing on lever of proportioning valve (Fig. 136) is fully seated in hook of actuator.**

NOTE: When installing height sensing proportioning valve on mounting bracket be sure proportioning valve shield (Fig. 135) is installed between the proportioning valve and the mounting bracket.

(2) Install height sensing proportioning valve on mounting bracket. Install the proportioning valve attaching bolts (Fig. 135). Tighten the attaching bolts to a torque of 23 N·m (200 in. lbs.).

(3) Install the 4 chassis brake lines (Fig. 134) into the inlet and outlet ports of the proportioning valve. Tighten all 4 line nuts to a torque of 16 N·m (142 in. lbs.).

(4) Adjust the proportioning valve actuator. See Height Sensing Proportioning Valve in the Adjustment Section in this group of the service manual for the adjustment procedure.

(5) Bleed the brake system thoroughly to ensure that all air has been expelled from the hydraulic system. See Bleeding Brake System in the Service Adjustments section in this group of the service manual for the proper bleeding procedure.

(6) Lower the vehicle to the ground.

(7) Road test the vehicle to verify proper operation of the vehicles brake system.

HYDRAULIC BRAKE TUBES AND HOSES

CAUTION: When installing brake chassis lines or flex hoses on the vehicle, the correct fasteners must be used to attach the routing clips or hoses to the front suspension cradle. The fasteners used to attach components to the front suspension cradle have an anti—corrosion coating due to the suspension cradle being made of aluminum. Only Mopar replacement fasteners with the required anti-corrosion coating are to be used if a replacement fastener is required when installing a brake chassis line or flex hose.

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZW-AC alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

NOTE: On vehicles equipped with traction control, the primary and secondary hydraulic tubes between the master cylinder and the hydraulic control unit are 6 mm (15/64 in.). These tubes are also coated with the Al-rich/ZW-AC alloy and must be replaced with tubes having the same anti-corrosion coating. Be sure that the correct tube nuts are used for the replacement of these hydraulic brake tubes.

Care should be taken when replacing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

If the primary or secondary brake tube from the master cylinder to the ABS Hydraulic Control Unit (HCU) or the brake tubes from the HCU to the proportioing valve require replacement, **only** the original factory brake line containing the flexible section can be used as the replacement part. This is required due to cradle movement while the vehicle is in motion.

PARK BRAKE PEDAL MECHANISM

REMOVE

(1) Disconnect negative (ground) cable from the battery and isolate cable from battery terminal.

(2) Remove sill scuff plate from left door sill.

(3) Remove the left side kick panel.

(4) Remove the steering column cover from the lower instrument panel.

(5) Remove the reinforcement from the lower instrument panel.

(6) Lock out front park brake cable using the following procedure. Grasp the exposed section of the front park brake cable and pull rearward on it. While holding the park brake in this position, install a pair of locking pliers on the front park brake cable just rearward of the second body outrigger bracket (Fig. 137).

(7) Remove the front park brake cable from the park brake cable equalizer.

REMOVAL AND INSTALLATION (Continued)

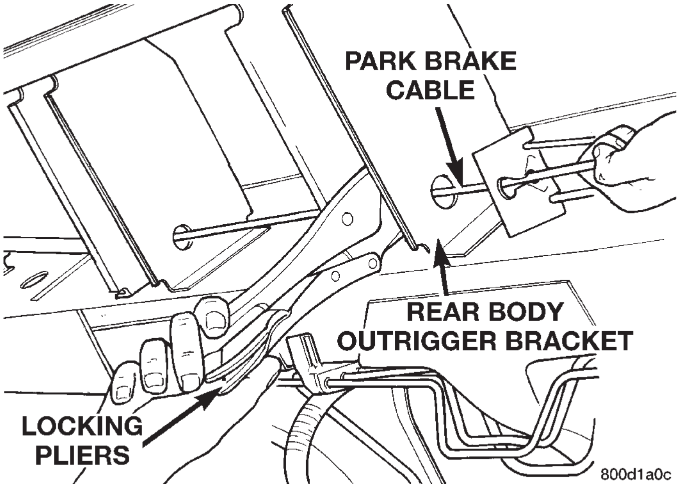


Fig. 137 Locking Out Automatic Adjuster

(8) Remove tension from front park brake cable. Tension is removed by releasing the locking pliers from the front park brake cable.

(9) Remove the 3 bolts mounting the wiring junction block to the instrument panel.

NOTE: When removing the lower mounting bolt, push the park brake pedal down 5 clicks to access the lower mounting bolt.

(10) Remove the lower bolt mounting the park brake pedal to the body.

(11) Remove the forward bolt mounting the park brake pedal to the body.

(12) Remove the upper bolt mounting the park brake pedal to the body.

(13) Disconnect the electrical connector for the brake light switch (Fig. 138).

(14) Pull downward on front park brake cable while rotating park brake pedal mechanism out from behind junction block.

(15) Remove park brake pedal release cable (Fig. 138) from park brake mechanism.

(16) Remove the ground switch for the red brake warning lamp from the park brake pedal mechanism.

(17) Remove front park brake cable button from park brake pedal mechanism. Tap end housing of front park brake cable out of park brake pedal mechanism (Fig. 138).

INSTALL

(1) Install the ground switch for the red brake warning lamp on the park brake pedal mechanism

(2) Install park brake cable end housing (Fig. 138) into park brake pedal mechanism.

(3) Install cable retainer (Fig. 138) onto the park brake cable strand and then install retainer into pedal bracket.

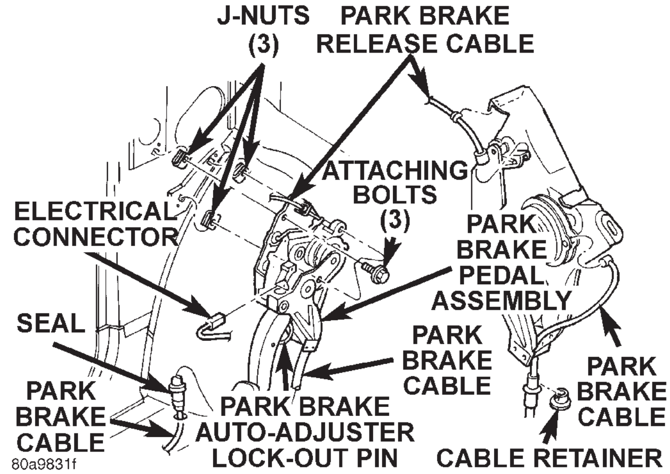


Fig. 138 Park Brake Pedal Mounting

(4) Install cable strand button into the clevis on the park brake pedal mechanism.

(5) Install wiring harness connector on red brake warning lamp ground switch.

(6) Install the park brake release cable on the release mechanism of the park brake pedal.

(7) Position the park brake pedal mechanism into its installed position on the body of the vehicle.

(8) Remove the lock-out pin from the park brake pedal release mechanism.

(9) Loosely install the top bolt (Fig. 138) mounting the park brake pedal mechanism to the body.

(10) Loosely install the forward bolt (Fig. 138) mounting the park brake pedal mechanism to the body.

(11) Loosely install the lower bolt (Fig. 138) mounting the park brake pedal mechanism to the body.

(12) Tighten pedal mechanism attaching bolts to 28 N·m (250 in. lbs.).

(13) Verify that the park brake pedal is in the fully released (full up) position.

(14) Raise vehicle.

(15) Install the front park brake cable on the park brake cable equalizer.

(16) Lower vehicle.

(17) Remove the lock-out pin (Fig. 138) from the automatic cable adjuster on the park brake pedal mechanism.

(18) Install the electrical junction block on the instrument panel.

(19) Install the reinforcement on the lower instrument panel.

(20) Install the steering column cover on the lower instrument panel.

(21) Install the left side kick panel.

(22) Install the sill scuff plate on the lower sill of the left door.

REMOVAL AND INSTALLATION (Continued)

(23) Install the negative (ground) cable on the battery.

(24) Cycle the park brake pedal one time. This will seat the park brake cables and will allow the automatic self adjuster to properly tension the park brake cables.

PARK BRAKE SHOES (WITH REAR DISC BRAKES)

On this vehicle, the park brake shoes are removed from the disc brake adapter with the disc brake adapter removed from the vehicle.

REMOVE

(1) Set the parking brake. **The parking brake is set to keep the hub/bearing and axle shaft from rotating when loosening the hub nut.**

(2) Raise vehicle. Vehicle is to be raised and supported on jackstands or on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section of this service manual.

(3) Remove the wheel/tire.

(4) Remove the cotter pin and nut retainer (Fig. 139) from the stub shaft of the outer C/V joint.

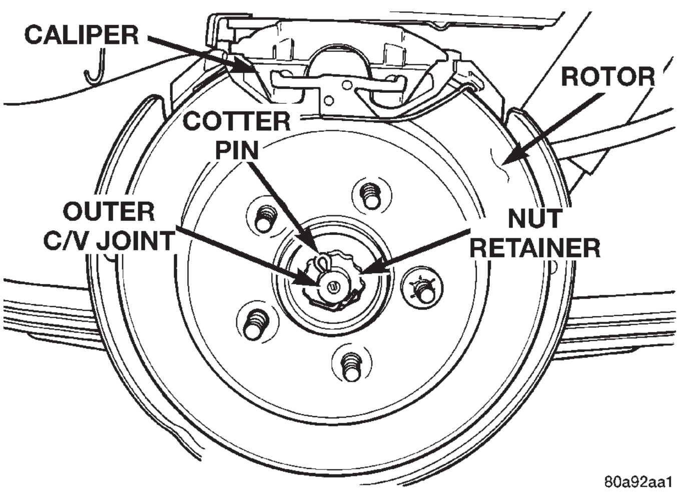


Fig. 139 Cotter Pin And Nut Retainer

(5) Remove the spring washer (Fig. 140) from the stub shaft of the outer C/V joint.

(6) Remove the hub nut and washer (Fig. 141) from the stub shaft of the outer C/V joint.

(7) Release the parking brake.

(8) Create slack in the rear park brake cables by locking the out the automatic adjuster as described. Grasp the exposed section of front park brake cable and pull downward on it. Then install a pair of locking pliers on the front park brake cable just rearward of the second body outrigger bracket (Fig. 142).

(9) Remove the disc brake caliper to adapter guide pin bolts (Fig. 143).

(10) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up from the adapter. Then pull the front of the caliper

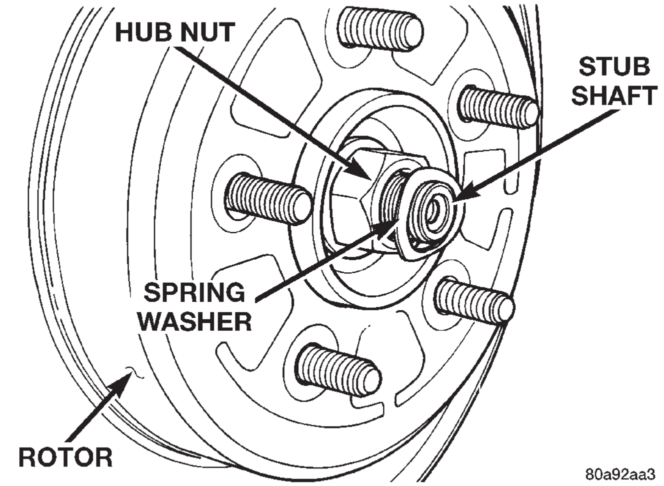


Fig. 140 Spring Washer

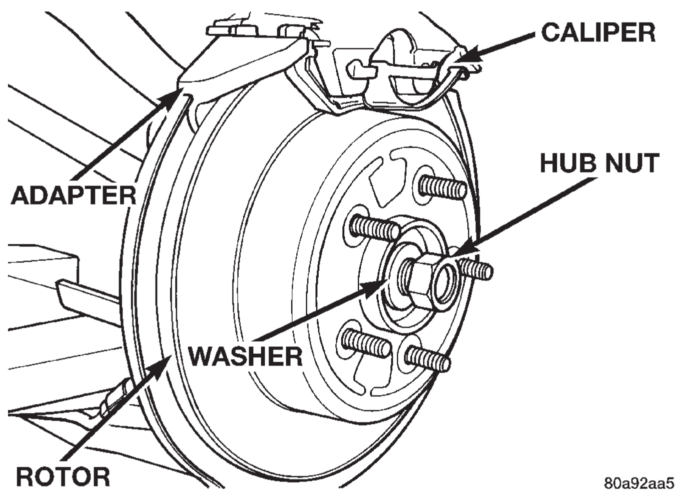


Fig. 141 Hub Nut And Washer

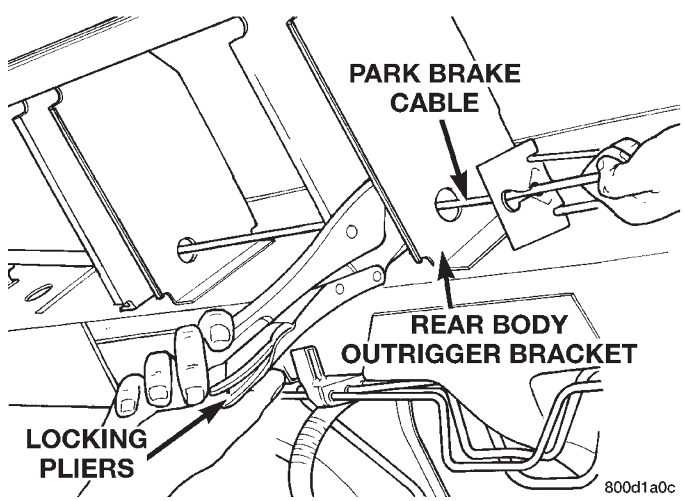


Fig. 142 Locking Out Automatic Adjuster

and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 144).

(11) Support caliper to prevent the weight of the caliper from damaging the flexible brake hose (Fig.

REMOVAL AND INSTALLATION (Continued)

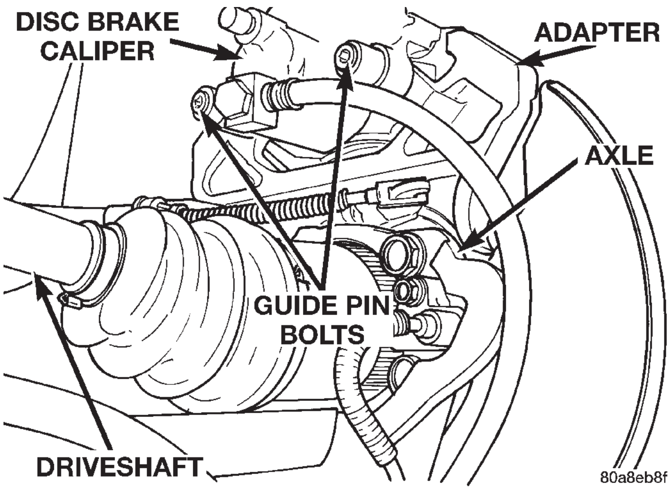


Fig. 143 Removing Caliper Guide Pin Bolts

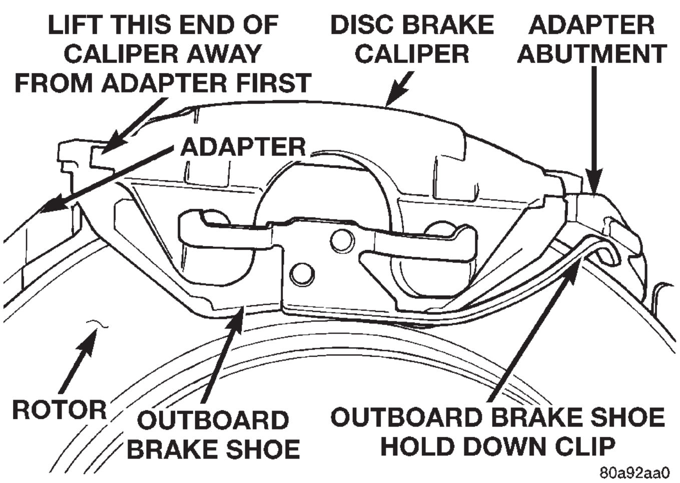


Fig. 144 Removing / Installing Caliper

145).

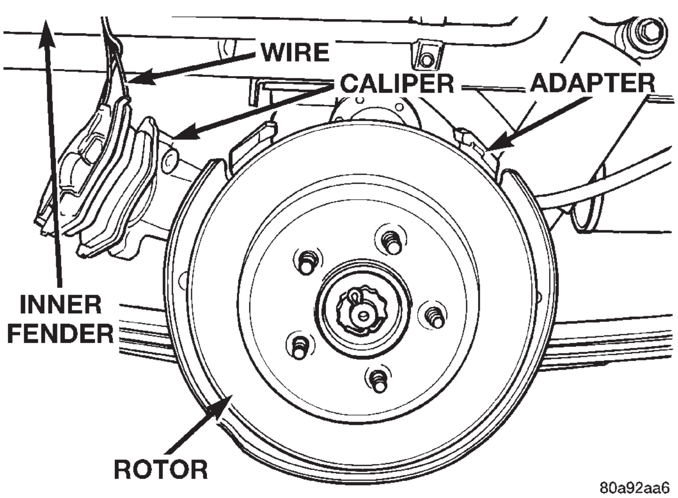


Fig. 145 Correctly Supported Caliper

(12) Remove the rotor from the hub/bearing.

(13) Remove the horseshoe clip (Fig. 146) from the retainer on the end of the park brake cable.

(14) Remove the end of the park brake cable from the actuator lever on the adapter (Fig. 146).

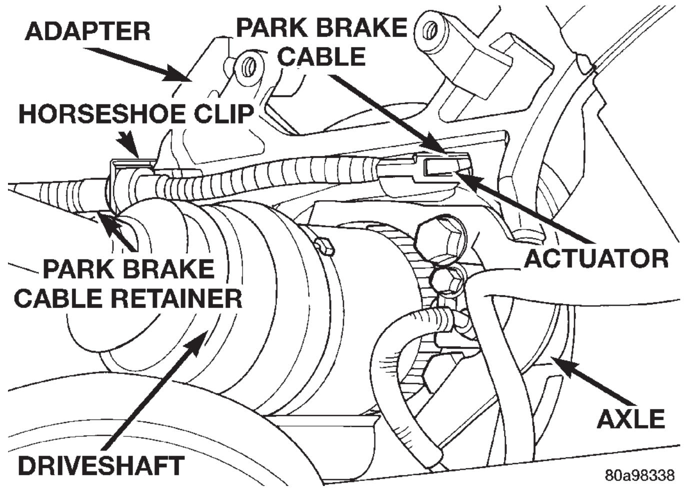


Fig. 146 Park Brake Cable Attachment To Actuator

(15) Remove the end of the park brake cable from the adapter. Park brake cable is removed from adapter using a 1/2 wrench slipped over the park brake cable retainer as show in (Fig. 147) to compress the locking tabs on the park brake cable retainer.

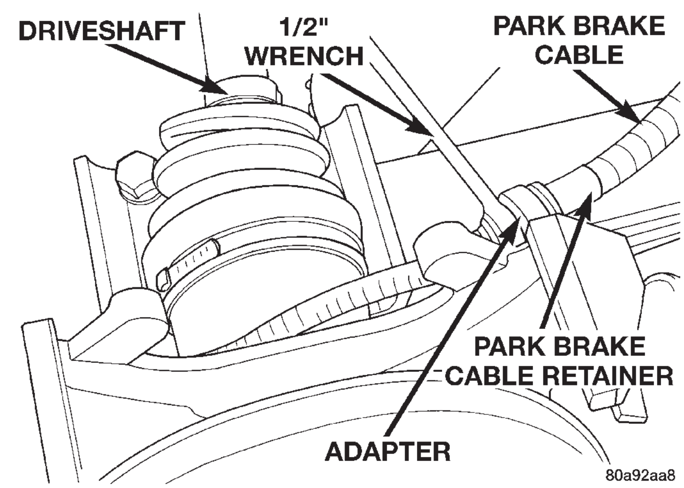


Fig. 147 Park Brake Cable Removal From Adapter

(16) Remove the attaching bolt from the wheel speed sensor (Fig. 148). Then remove wheel speed sensor from hub/bearing and adapter.

(17) Remove the hub/bearing to axle mounting bolts (Fig. 149).

(18) Remove the hub/bearing from the axle and the stub shaft of the outer C/V joint (Fig. 150).

(19) Remove the adapter from the rear axle.

(20) Mount the adapter in a vise using the anchor boss for the park brake cable (Fig. 151).

REMOVAL AND INSTALLATION (Continued)

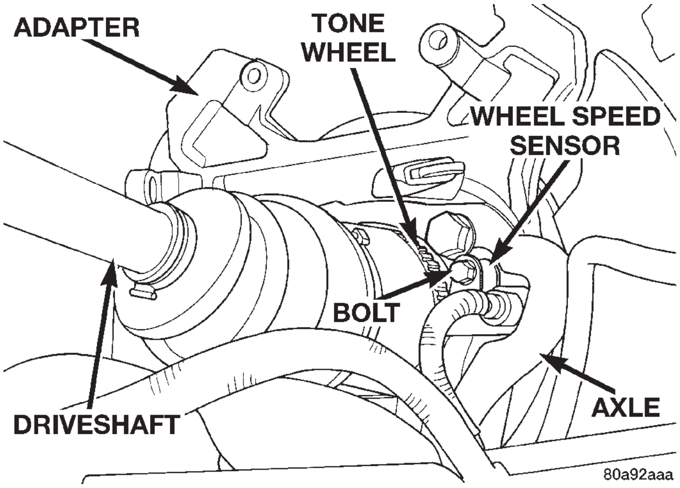


Fig. 148 Speed Sensor Attaching Bolt

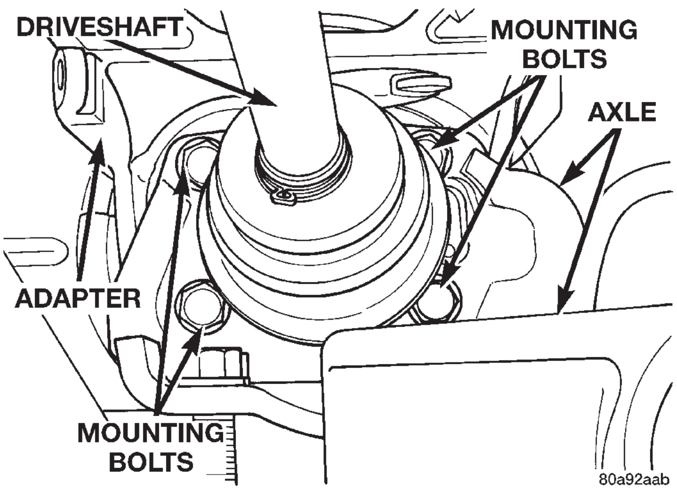


Fig. 149 Hub/Bearing Mounting Bolts

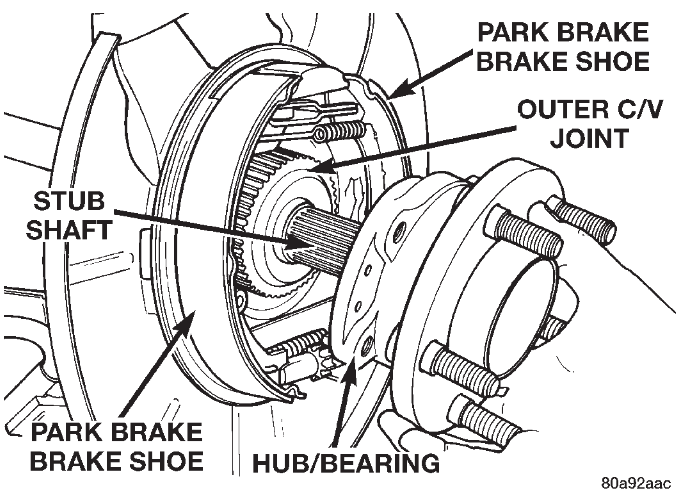


Fig. 150 Hub/Bearing Removal And Installation

(21) Remove the lower return spring (Fig. 152) from the leading and trailing park brake shoes.

(22) Remove the hold down spring and pin (Fig. 153) from the leading park brake shoe.

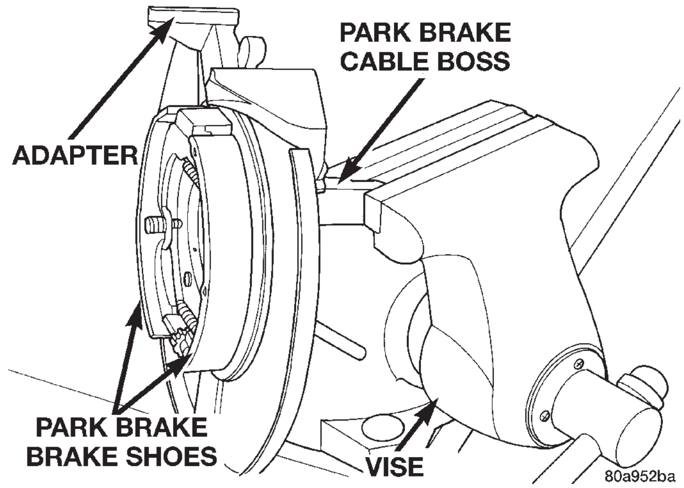


Fig. 151 Adapter Mounted In Vise

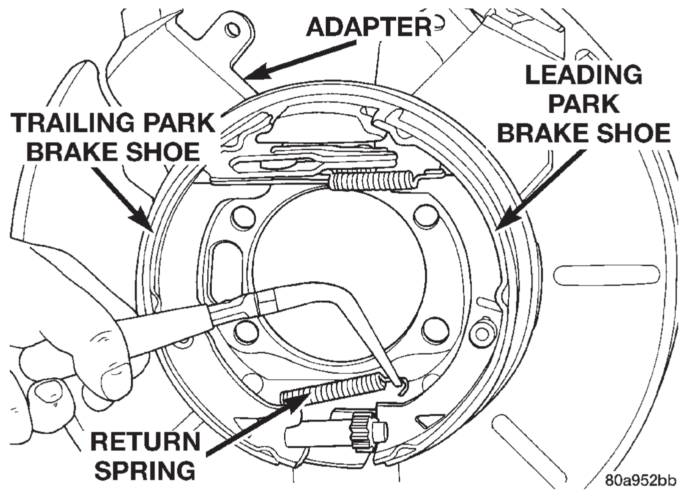


Fig. 152 Lower Return Spring

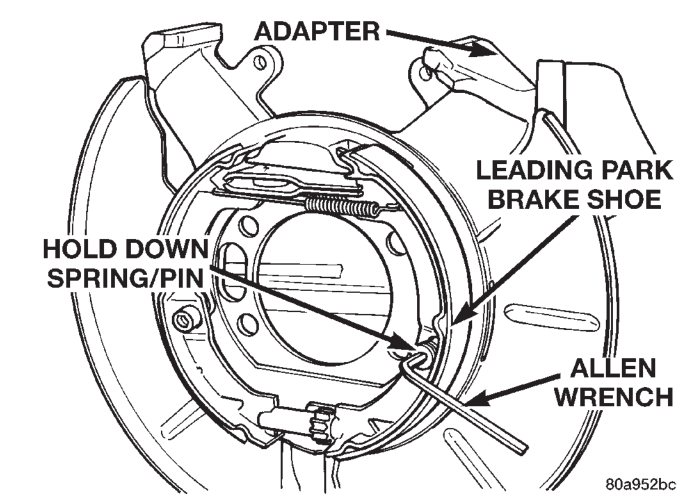


Fig. 153 Leading Brake Shoe Hold Down Pin And Spring

REMOVAL AND INSTALLATION (Continued)

(23) Remove the adjuster (Fig. 154) from the leading and trailing park brake shoe.

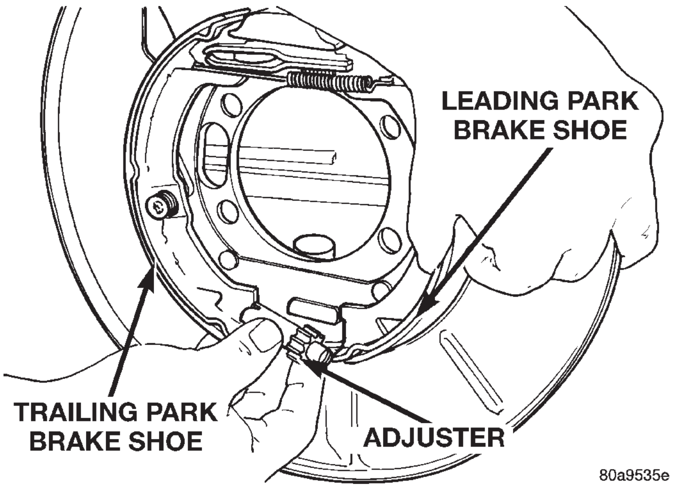


Fig. 154 Brake Shoe Adjuster

(24) Remove the leading park brake shoe (Fig. 155) from the adapter. Leading brake shoe is removed by rotating the bottom of the brake shoe inward (Fig. 155) until the top of the brake shoe can be removed from the brake shoe anchor. Then remove the upper return springs (Fig. 155) from the leading brake shoe.

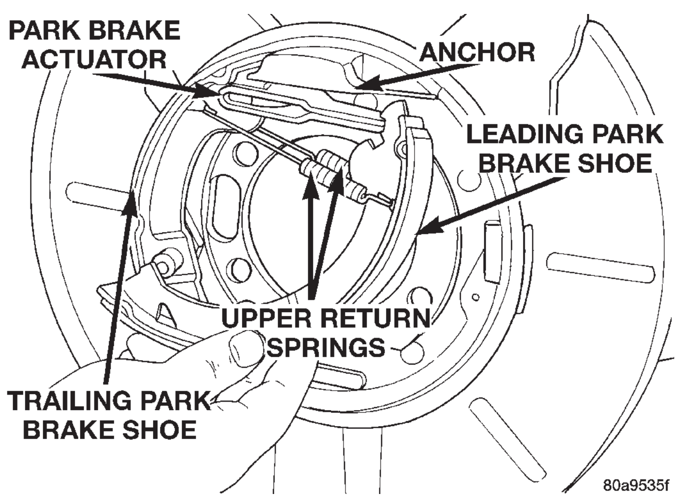


Fig. 155 Primary Brake Shoe Remove/Install

(25) Remove the upper return springs (Fig. 156) from the trailing park brake shoe.

(26) Remove the hold down spring and pin (Fig. 157) from the trailing park brake shoe.

(27) Remove the trailing park brake shoe from the adapter.

(28) Remove the park brake shoe actuator from the adapter and inspect for signs of abnormal wear and binding at the pivot point.

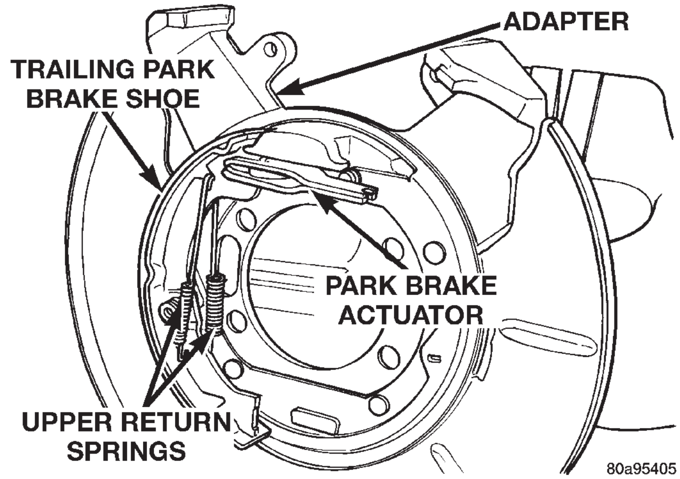


Fig. 156 Upper Return Springs

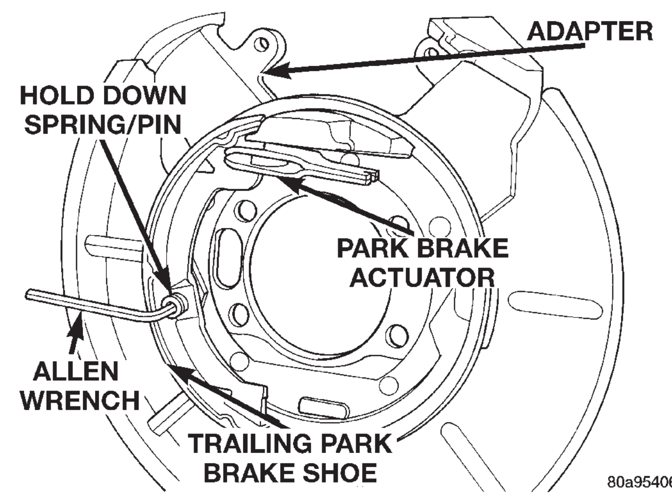


Fig. 157 Trailing Brake Shoe Hold Down Pin And Spring

INSTALL

(1) Install the trailing brake shoe on the adapter.

NOTE: When the hold down pin is installed, the long part of the hold down pin is to be positioned strait up and down. This will ensure that the hold down pin is correctly engaged with the adapter.

(2) Install the hold down spring and pin (Fig. 157) on the trailing park brake shoe.

(3) Install the upper return springs (Fig. 156) on the trailing park brake shoe.

(4) Install the upper return springs on the leading park brake shoe (Fig. 155). Then position the top of the leading park brake shoe at the upper anchor and rotate the bottom of the shoe outward until correctly installed on the adapter.

(5) Install the adjuster (Fig. 154) between the leading and trailing park brake shoe.

REMOVAL AND INSTALLATION (Continued)

NOTE: When the hold down pin is installed, the long part of the hold down pin is to be positioned strait up and down. This will ensure that the hold down pin is correctly engaged with the adapter.

(6) Install the hold down spring and pin (Fig. 153) on the leading park brake shoe.

(7) Install the lower return spring (Fig. 152) on the leading and trailing park brake shoes. **When installing the hold down spring it is to be installed behind the park brake shoes (Fig. 152).**

(8) Install the 4 mounting bolts for the adapter and hub/bearing into the bolt holes in the axle.

(9) Position the adapter on the 4 mounting bolts installed in the rear axle (Fig. 158).

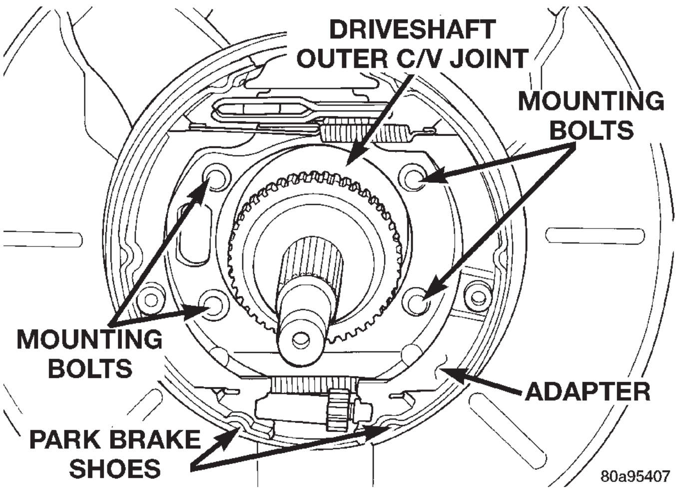


Fig. 158 Adapter Installed On Mounting Bolts

(10) Install the hub/bearing on the stub shaft of outer C/V joint and into the end of the axle. (Fig. 150).

(11) In a progressive criss-cross pattern, tighten the 4 hub/bearing mounting bolts until the hub/bearing is squarely seated against the axle. Then tighten the hub/bearing mounting bolts to a torque of 129 N·m (95 ft. lbs.).

(12) Install the wheel speed sensor on the hub/bearing and adapter. Install the wheel speed sensor attaching bolt (Fig. 148). Tighten the wheel speed sensor attaching bolt to a torque of 12 N·m (105 in. lbs).

(13) Install the park brake cable into its mounting hole in the adapter. **Be sure all the locking tabs on the park brake cable retainer are expanded out to ensure the cable will not pull out of the adapter.**

(14) Install the end of the park brake cable on the park brake actuator lever (Fig. 146).

NOTE: The horseshoe clip must be installed and installed properly when the park brake cable is installed in the adapter. The purpose of the horseshoe clip is to prevent park brake cable retainer from moving in the adapter. If horseshoe clip is not installed the park brake cable retainer will rattle in the adapter.

(15) Install a **NEW** horseshoe clip on the park brake cable retainer (Fig. 146). The horseshoe clip is installed between the retainer for the park brake cable and the adapter. Horseshoe clip must be installed with the curved end of the clip pointing straight up and the edge of the curved end facing toward the rear of the vehicle (Fig. 146).

(16) Remove the locking pliers (Fig. 142) from the front park brake cable.

(17) Adjust the park brake drum-in-hat brake shoes. See Park Brake Shoe Adjustment in the adjustment section in this group of the service manual for the proper park brake shoe adjustment procedure.

(18) Install the rotor on the hub/bearing.

(19) Carefully lower caliper and brake shoes over rotor and onto the adapter using the reverse procedure for removal (Fig. 144).

CAUTION: When installing guide pin bolts extreme caution should be taken not to crossthread the caliper guide pin bolts.

(20) Install the caliper guide pin bolts (Fig. 143). Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(21) Clean all foreign material off the threads of the outer C/V joint stub shaft. Install the washer and hub nut (Fig. 141) on the stub shaft of the outer C/V joint.

(22) Set the parking brake.

(23) Tighten the hub nut to a torque of 244 N·m (180 ft. lbs.).

(24) Install the spring washer (Fig. 140) on the stub shaft of the outer C/V joint.

(25) Install the nut retainer and cotter pin (Fig. 139) on the stub shaft of the outer C/V joint.

(26) Install the wheel and tire assembly.

(27) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(28) Remove jackstands or lower hoist.

(29) **Fully apply and release the park brake pedal one time. This will seat and correctly adjust the park brake cables.**

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop vehicle.

REMOVAL AND INSTALLATION (Continued)

(30) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

FRONT PARK BRAKE CABLE

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Manually lockout the automatic self adjusting mechanism of the park brake pedal assembly. Refer to Manual Lockout Of Auto Adjuster Mechanism in this section of the service manual for the required procedure.

(3) Remove the intermediate and left rear park brake cable from the park brake cable equalizer (Fig. 159).

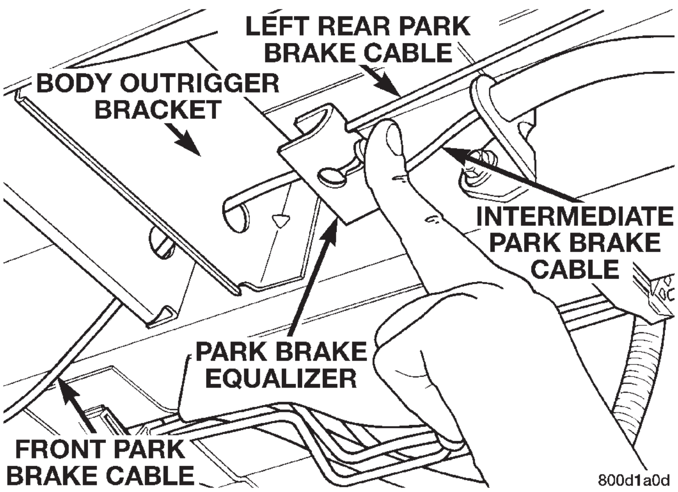


Fig. 159 Park Brake Cable Attachment To Equalizer

(4) Remove the front park cable housing retainer from body outrigger bracket (Fig. 160). Cable is removable by sliding a 14 mm box wrench over cable retainer and compressing the three retaining fingers. Alternate method is to use an aircraft type hose clamp and screwdriver.

(5) Lower vehicle.

(6) Remove the left front door sill molding.

(7) Remove the left front kick panel for access to the park brake cable and park brake pedal assembly.

(8) Lift floor mat for access to park brake cable and floor pan. Pull the seal and the park brake cable (Fig. 161) out of the floor pan of vehicle.

(9) Pull park brake cable strand end forward and disconnect button from clevis. Tap cable housing end fitting out of pedal assembly bracket.

(10) Remove cable retainer from the park brake pedal assembly bracket.

(11) Pull park brake cable assembly out of vehicle through hole in floor pan.

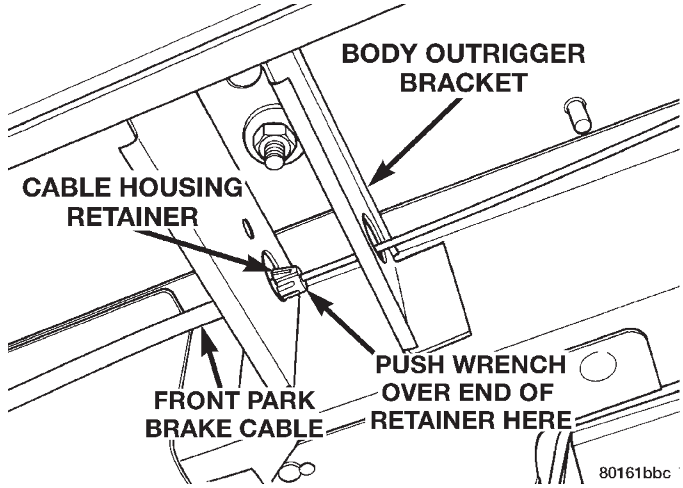


Fig. 160 Front Park Brake Cable Attachment To Body

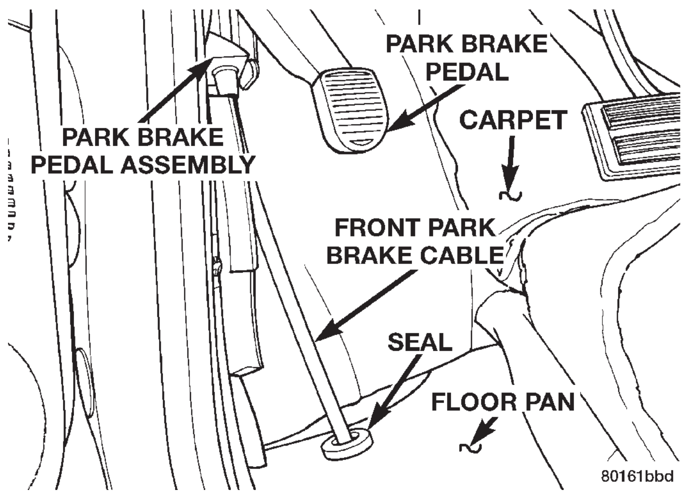


Fig. 161 Front Park Brake Cable At Floor Pan

INSTALL

(1) Pass park brake cable assembly through hole in floor pan from the inside of the vehicle.

(2) Pass cable strand button through the hole in the pedal assembly bracket.

(3) Install cable retainer onto the park brake cable and then install cable retainer into pedal assembly bracket.

(4) Install the end of the park brake cable into the retainer previously installed into the park brake pedal bracket.

(5) Install cable strand button into the clevis on the park brake pedal mechanism.

(6) Install the front park brake cable floor pan seal into hole in floor pan. Seal is to be installed so the flange on the seal is flush with the floor pan (Fig. 161). Fold carpeting back down on floor.

(7) Raise vehicle.

(8) Insert brake cable and housing into body outrigger bracket making certain that housing retainer fingers lock the housing firmly into place (Fig. 160).

REMOVAL AND INSTALLATION (Continued)

(9) Assemble the park brake cables onto the park brake cable equalizer (Fig. 159).

(10) Release the automatic adjuster mechanism on the park brake pedal assembly. Refer to Parking Brake Automatic Adjuster in the Service Procedures Section in this group of the service manual for the required procedure.

(11) Lower vehicle and apply the park brake pedal 1 time, this will seat the park brake cables.

INTERMEDIATE PARK BRAKE CABLE

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Manually lockout the automatic self adjusting mechanism of the park brake pedal assembly. Refer to Manual Lockout Of Auto Adjuster Mechanism in this section of the service manual for the required procedure.

(3) Remove the intermediate park brake cable from the park brake cable equalizer (Fig. 162).

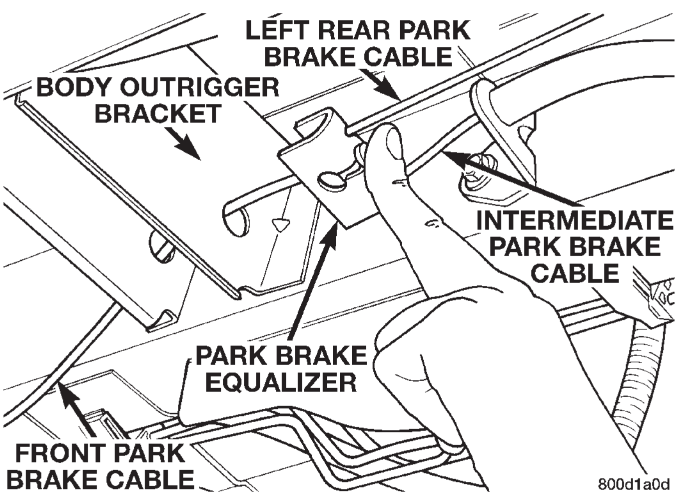


Fig. 162 Park Brake Cable Attachment To Equalizer

(4) Remove the intermediate park brake cable from the cable connector attaching it to the right rear park brake cable (Fig. 163)

(5) Remove the intermediate park brake cable from the cable guides on the frame rails (Fig. 163).

INSTALL

(1) Install the ends of the park brake cables through the cable guides.

(2) Install the intermediate park brake cable on the cable connector at the right rear park brake cable (Fig. 163).

(3) Install the intermediate park brake cable on the cable equalizer (Fig. 162).

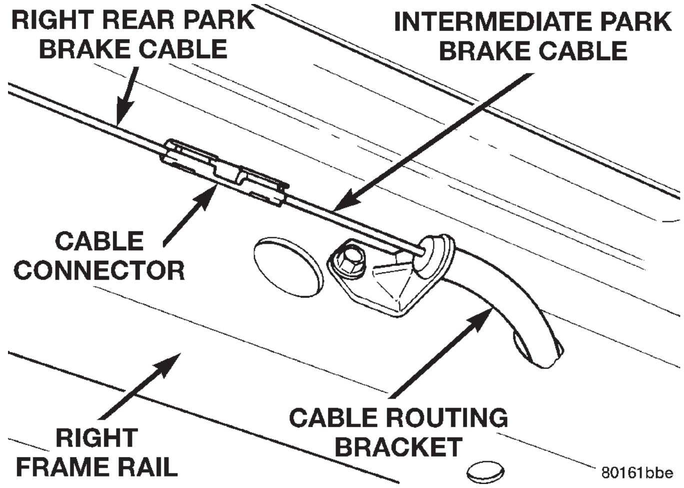


Fig. 163 Intermediate Cable Attachment To Right Rear Cable

(4) Remove the locking pliers from the front park brake cable. This will activate the automatic adjuster and correctly adjust the park brake cables.

(5) Install and position the foam collar on the park brake cable to prevent it from rattling against floor.

(6) Lower vehicle and apply the park brake pedal 1 time, this will seat the park brake cables.

RIGHT REAR PARK BRAKE CABLE

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Remove rear tire and wheel assembly.

(3) Remove rear brake drum from the rear wheel of the vehicle requiring service to the rear park brake cable.

(4) Create slack in the rear park brake cables by locking out the automatic adjuster as described. Grasp exposed section of front park brake cable and pull down on it. Then install a pair of locking pliers on the cable just rearward of the second body outrigger bracket (Fig. 164).

(5) Disconnect the right rear park brake cable from the connector on the intermediate cable (Fig. 165).

(6) To remove the right park brake cable housing from the body bracket, slide a 14 mm box end wrench over the end of cable retainer to compress the retaining fingers (Fig. 166). The alternate method using an aircraft type hose clamp will not work on the right side of the vehicle.

(7) Remove the brake shoes from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section of this service manual for the required procedure.

REMOVAL AND INSTALLATION (Continued)

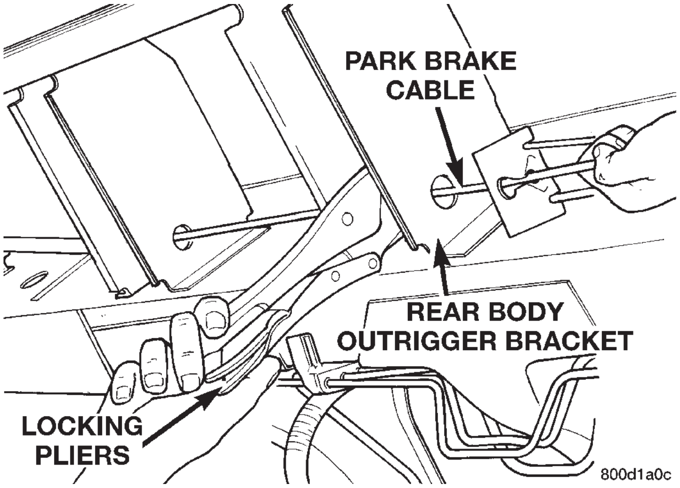


Fig. 164 Locking Out Automatic Adjuster

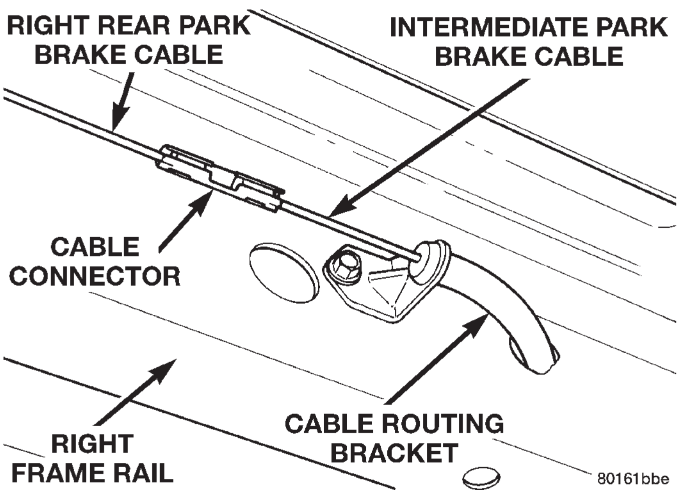


Fig. 165 Right Rear Cable Connection To Intermediate Cable

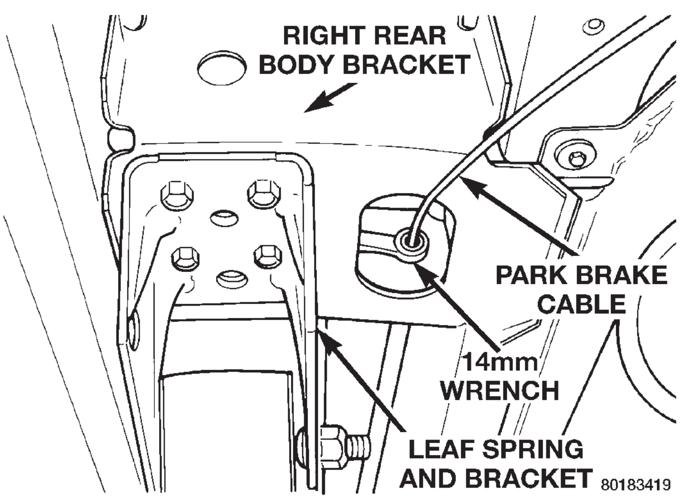


Fig. 166 Right Park Brake Cable Removal From Body Bracket

(8) Disconnect park brake cable from park brake actuator lever.

(9) Remove the park brake cable housing retainer from the brake support plate using a 14mm wrench to compress the retaining fingers (Fig. 167).

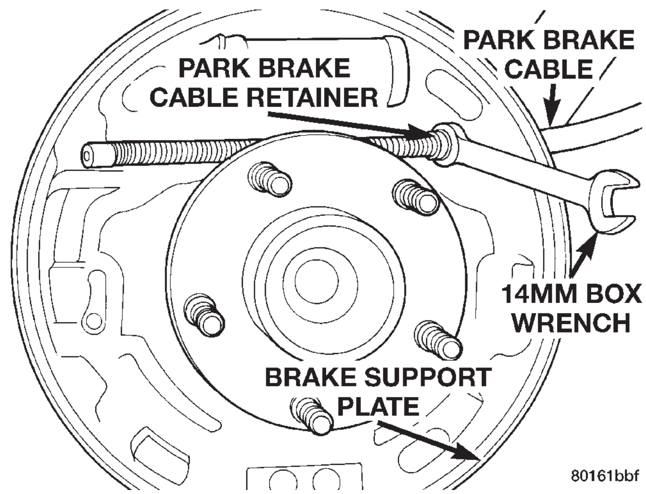


Fig. 167 Removing Park Brake Cable From Brake Support Plate

INSTALL

(1) Install the park brake cable in the brake support plate. Insert cable housing retainer into brake support plate making certain that cable housing retainer fingers lock the housing and retainer firmly into place.

(2) Attach the park brake cable onto the park brake actuator lever.

(3) Install the brake shoes on the rear brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section of this service manual for the required procedure.

(4) Insert cable housing retainer into body bracket making certain that cable housing retainer fingers lock the housing firmly into place.

(5) Connect the right rear park brake cable to the connector on the intermediate park brake cable (Fig. 165).

(6) Install the brake drum, and the wheel and tire assembly.

(7) Remove the locking pliers from the front park brake cable. This will automatically adjust the park brake cables.

(8) Apply and release park brake pedal 1 time, this will seat the park brake cables.

LEFT REAR PARK BRAKE CABLE

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Remove rear tire and wheel assembly.

REMOVAL AND INSTALLATION (Continued)

(3) Remove rear brake drum from the rear wheel of the vehicle requiring service to the rear park brake cable.

(4) Create slack in rear park brake cables by locking out the automatic adjuster as described. Grasp exposed section of front park brake cable and pull down on it. Then install a pair of locking pliers on the cable just rearward of the second body outrigger bracket (Fig. 168).

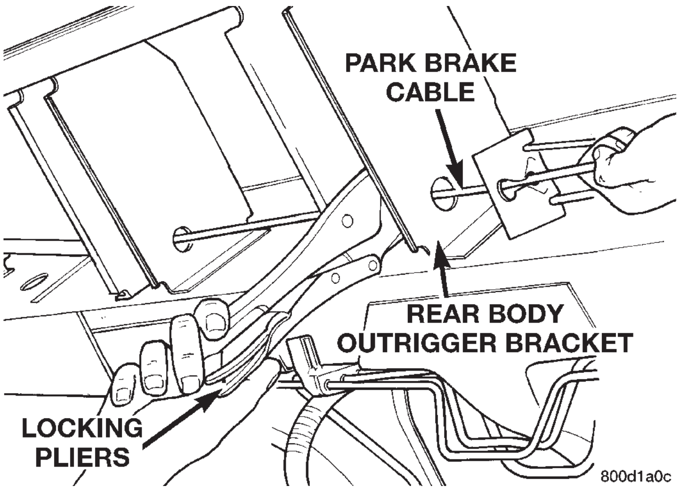


Fig. 168 Locked Out Park Brake Automatic Adjuster

(5) Disconnect the left rear park brake cable from the park brake cable equalizer (Fig. 169).

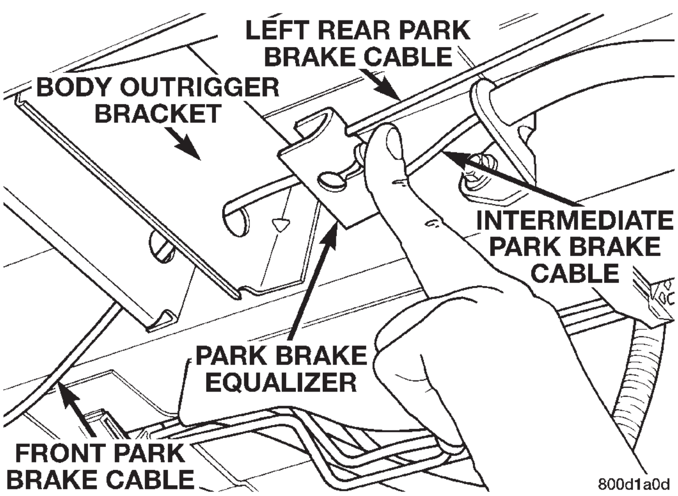


Fig. 169 Rear Park Brake Cables At Equalizer

(6) To remove park brake cable housing from the body bracket, slide a 14 mm box end wrench over retainer end compressing the three fingers (Fig. 170). Alternate method is to use an aircraft type hose clamp.

(7) Remove the brake shoes from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section of this service manual for the required procedure.

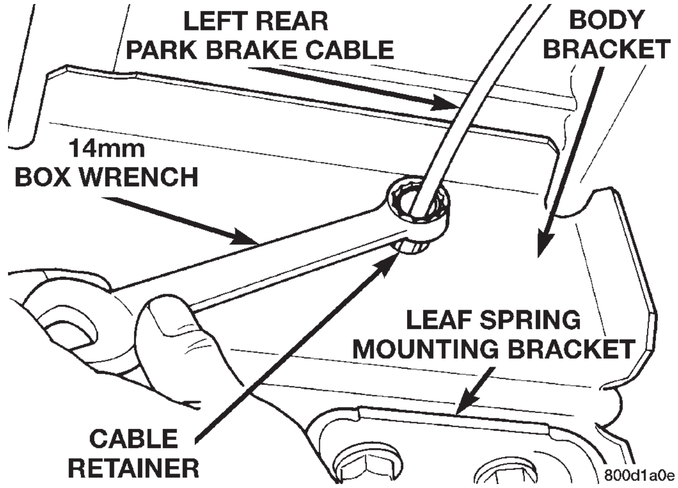


Fig. 170 Park Brake Cable Removal From Body Bracket

(8) Disconnect park brake cable from park brake actuator lever.

(9) Remove the park brake cable housing retainer from the brake support plate using a 14mm wrench to compress the retaining fingers (Fig. 171).

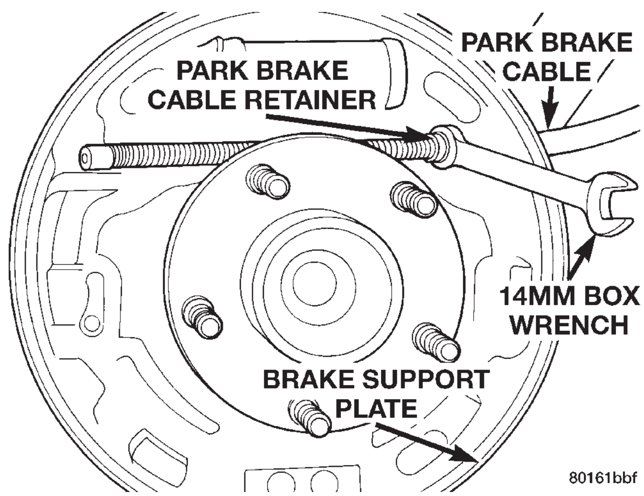


Fig. 171 Removing Park Brake Cable From Brake Support Plate

INSTALL

(1) Install the park brake cable in the brake support plate. Insert cable housing retainer into brake support plate making certain that cable housing retainer fingers lock the housing and retainer firmly into place.

(2) Attach the park brake cable onto the park brake actuator lever.

(3) Install the brake shoes on the rear brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section of this service manual for the required procedure.

REMOVAL AND INSTALLATION (Continued)

(4) Insert cable housing retainer into body outrigger bracket making certain that cable housing retainer fingers lock the housing firmly into place.

(5) Connect rear park brake cable to the equalizer bracket (Fig. 169).

(6) Install brake drum, and wheel and tire assembly.

(7) Remove the locking pliers from the front park brake cable. This will automatically adjust the park brake cables.

(8) Apply and release park brake pedal 1 time, this will seat the park brake cables.

STOP LAMP SWITCH

REMOVE

(1) Depress and hold the brake pedal while rotating stop lamp switch (Fig. 172) in a counter-clockwise direction approximately 30 degrees.

(2) Pull the switch rearward and remove from its mounting bracket.

(3) Disconnect wiring harness connector from stop lamp switch.

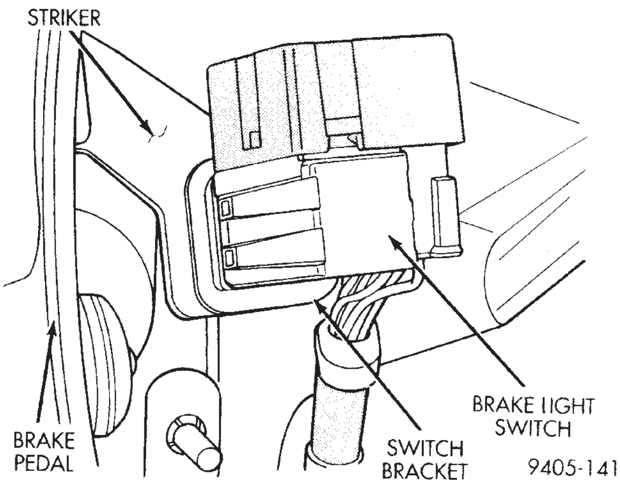


Fig. 172 Stop Lamp Switch

INSTALL

NOTE: Prior to installing stop lamp switch into bracket, the plunger must be moved to its fully extended position using procedure in Step 1.

(1) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(2) Connect the wiring harness connector to the stop lamp switch.

(3) Mount the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then install switch in bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in bracket, rotate switch clockwise approximately 30° to lock switch into bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If to much force is used, damage to the stop lamp switch or striker (Fig. 172) can result.

(4) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger to ratchet backward to the correct position.

DISASSEMBLY AND ASSEMBLY

MASTER CYLINDER TO POWER BRAKE BOOSTER VACUUM SEAL

(1) Remove the master cylinder from the power brake vacuum booster. Refer to Master Cylinder removal, for the required procedure to remove master cylinder from power brake vacuum booster.

(2) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

(3) Using Mopar Brake Parts Cleaner or an equivalent, thoroughly clean end of master cylinder housing and master cylinder push rod.

(4) Install new master cylinder to power brake booster vacuum seal on master cylinder. **When installing new vacuum seal, be sure it is squarely seated against master cylinder mounting flange and in groove of push rod (Fig. 173).**

(5) Bleed the master cylinder assembly prior to installing it on the power brake vacuum booster.

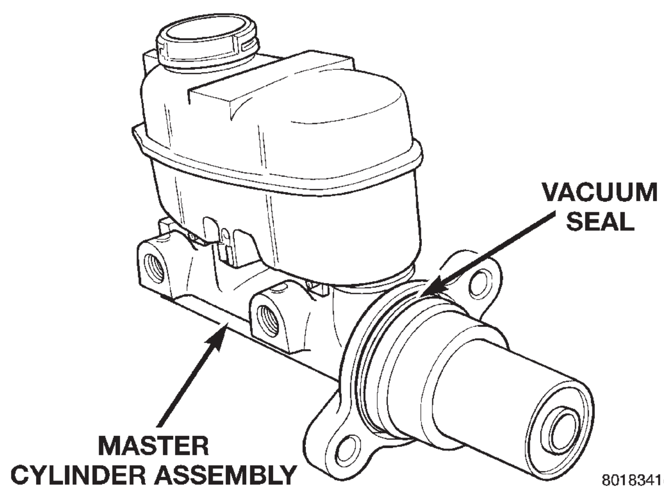


Fig. 173 Vacuum Seal Installed On Master Cylinder

(6) Install master cylinder assembly on the power brake vacuum booster. Refer to Master Cylinder Installation for the required procedure to install the master cylinder on the power brake vacuum booster.

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Road test vehicle to ensure proper operation of the vehicle's power brake system.

MASTER CYLINDER FLUID RESERVOIR

(1) Clean master cylinder housing and brake fluid reservoir. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(2) Remove the filler tube and brake fluid reservoir cap. Using a syringe or equivalent type tool empty as much brake fluid as possible from the reservoir.

CAUTION: When removing fluid reservoir from the master cylinder, do not pry off using any type of tool. This can damage the fluid reservoir or master cylinder housing.

(3) Remove the master cylinder assembly from the power brake vacuum booster. Refer to master cylinder, in the removal and installation section in this group of the service manual for the required procedure

(4) Mount the master cylinder in a vise using the master cylinder mounting flange (Fig. 174).

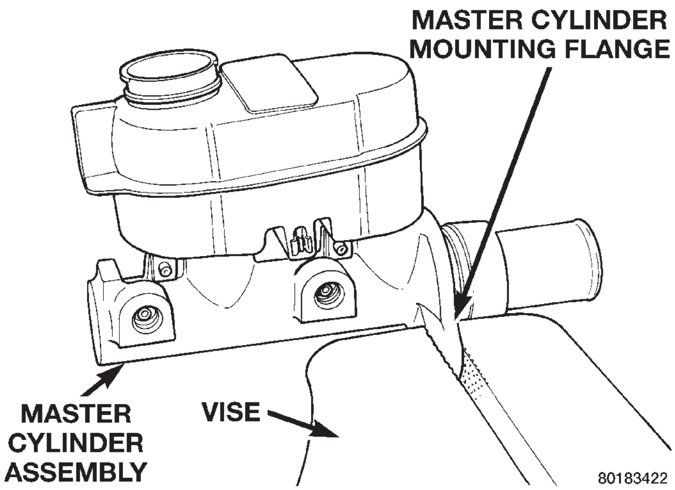


Fig. 174 Master Cylinder Correctly Mounted In Vise

(5) Using correct size pin punch, remove the 2 retaining pins between the fluid reservoir and master cylinder housing (Fig. 175). Rock the brake fluid reservoir from side to side while pulling up to remove it from the seal grommets in master cylinder housing.

(6) Remove the 2 master cylinder housing to brake fluid reservoir seal grommets (Fig. 176).

(7) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 176) in master cylinder housing.

(8) Lubricate reservoir mounting area with fresh clean brake fluid. Place reservoir in position over sealing grommets. Seat reservoir into sealing grommets using a rocking motion while firmly pressing down on fluid reservoir.

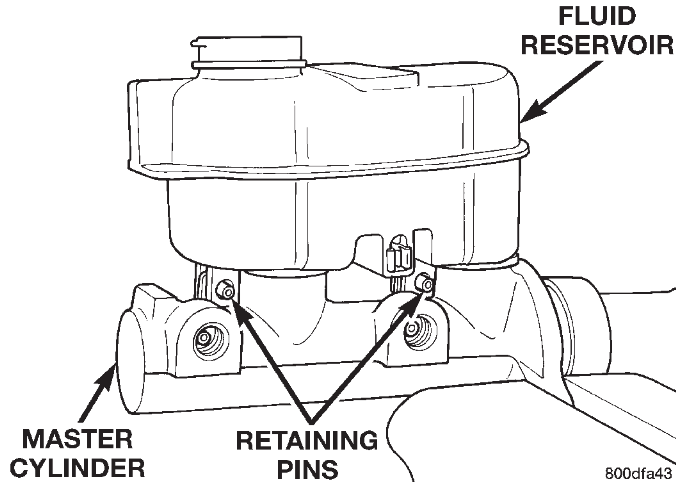


Fig. 175 Fluid Reservoir Retaining Pins

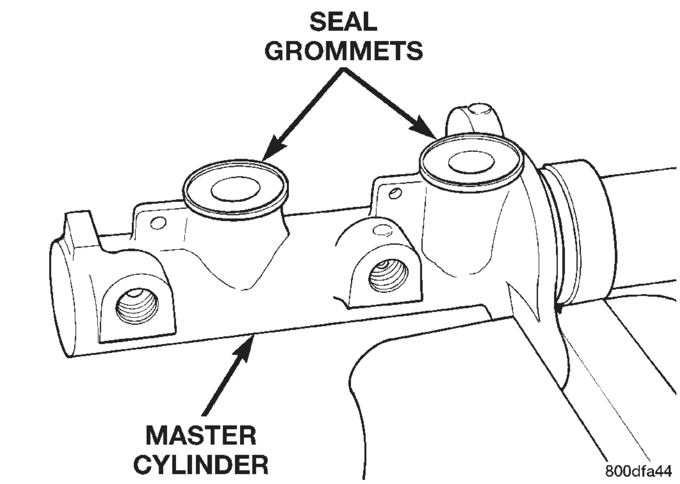


Fig. 176 Master Cylinder To Fluid Reservoir Seal Grommets

(9) Be sure fluid reservoir is positioned properly on master cylinder. **Bottom of fluid reservoir is to be touching the top of both sealing grommets when properly installed on master cylinder housing.**

(10) Install the 2 fluid reservoir to master cylinder retaining pins (Fig. 175).

(11) Install the master cylinder assembly on the power brake vacuum booster. Refer to master cylinder, in the removal and installation section in this group of the service manual for the required procedure

(12) Install filler tube on the fluid reservoir. Fill fluid reservoir to its proper level as indicated on the outboard side of the fluid reservoir. **Be careful not to over fill the fluid reservoir, fluid is not intended to be stored in the filler tube. Install cap on fluid reservoir filler tube.**

DISASSEMBLY AND ASSEMBLY (Continued)

MASTER CYLINDER FLUID RESERVOIR FILL TUBE

The master cylinder fluid reservoir filler neck is removable from the master cylinder fluid reservoir. The filler neck if required, can be replaced as a separate component of the fluid reservoir.

The filler neck is removed and installed using the following procedure.

REMOVE

(1) Check brake fluid level in master cylinder fluid reservoir to be sure brake fluid is not in the filler neck. If brake fluid is in filler neck, lower fluid level before removing filler neck from fluid reservoir

(2) Grasp filler neck at cap end (Fig. 177) and push straight down. This will cause the filler neck to pop out of the fluid reservoir.

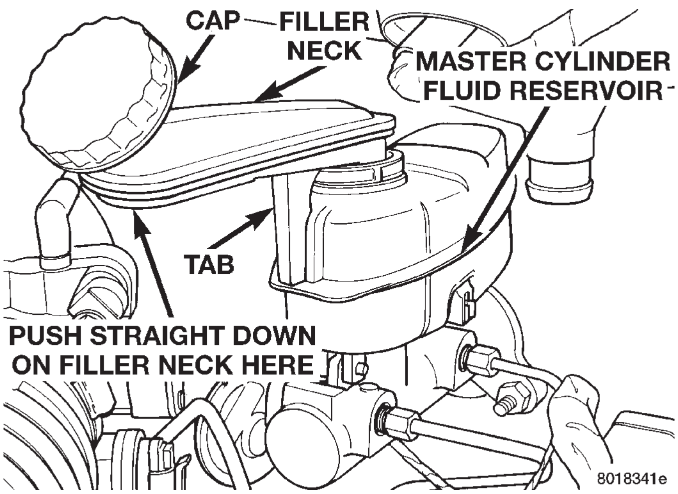


Fig. 177 Master Cylinder Fluid Reservoir Filler Neck

INSTALL

(1) Wet the O-ring on the reservoir end of the filler neck with fresh clean brake fluid.

(2) Position the filler neck in the opening on the fluid reservoir. Ensure tab on filler neck (Fig. 177) is in the groove on the front of the fluid reservoir.

(3) Push down while slightly rocking filler neck until filler neck snaps into the fluid reservoir opening.

(4) Install cap on filler neck.

(5) Check and/or add brake fluid in reservoir to ensure it is at the correct level.

MASTER CYLINDER BRAKE FLUID LEVEL SWITCH

The master cylinder or brake fluid reservoir does not have to be removed from the vehicle for replacement of the brake fluid level sensor.

(1) Remove wiring harness connector from brake fluid reservoir level sensor (Fig. 178).

(2) Using fingers, compress the retaining tabs on the end of brake fluid level switch (Fig. 179).

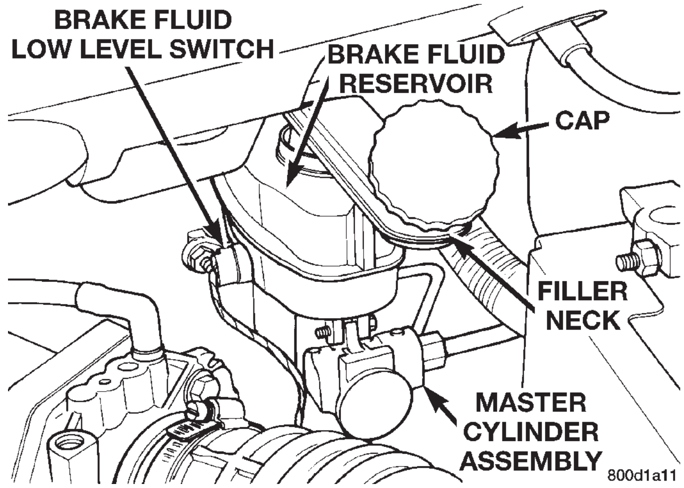


Fig. 178 Fluid Level Sensor Electrical Connection

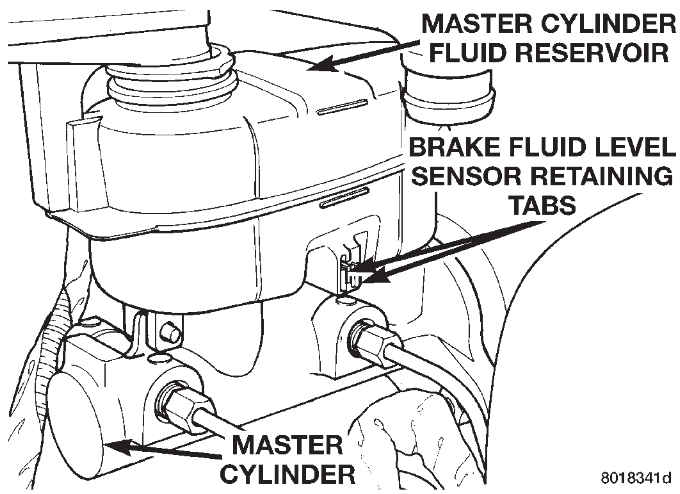


Fig. 179 Master Cylinder Brake Fluid Level Sensor

(3) With retaining tabs compressed, (Fig. 179) grasp opposite end of brake fluid level switch and pull it out of master cylinder brake fluid reservoir.

(4) Insert the replacement brake fluid level sensor into brake fluid reservoir. Be sure sensor is pushed in until retaining tabs (Fig. 179) lock it to the brake fluid reservoir.

(5) Connect the vehicle wiring harness connector to the brake fluid level sensor (Fig. 178).

FRONT DISC BRAKE CALIPER

CLEANING AND INSPECTION

Check for brake fluid leaks in and around dust boot area and inboard brake pad, and for any ruptures, brittleness or damage to the piston dust boot. If the dust boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new piston seal and dust boot, and piston if scored. Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

DISASSEMBLY AND ASSEMBLY (Continued)

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

CALIPER GUIDE PIN BUSHING SERVICE

The double pin caliper uses a sealed for life bushing and sleeve assembly. If required this assembly can be serviced using the following procedure.

REMOVING CALIPER GUIDE PIN BUSHINGS

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang caliper assembly on a wire hook away from the brake rotor.

(2) Push out and then pull the steel sleeve from the inside of the bushing using your fingers as shown in (Fig. 180).

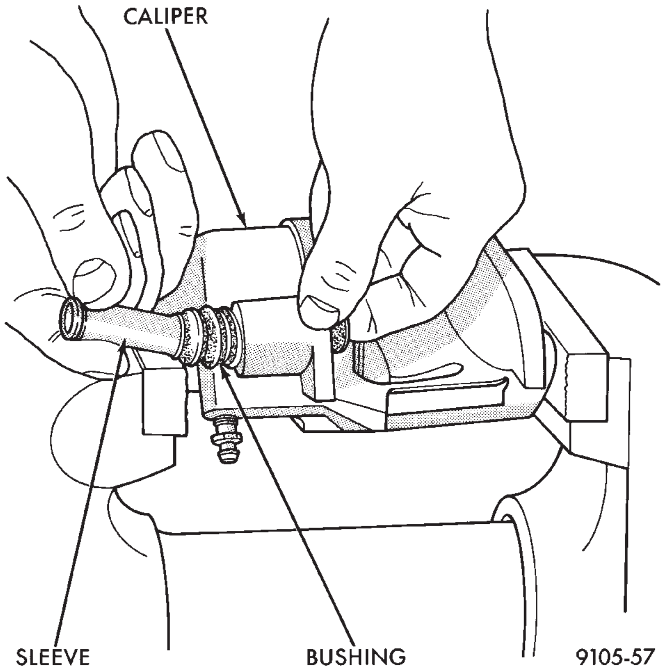


Fig. 180 Removing Inner Sleeve From Bushing

(3) Using your fingers, collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the brake caliper housing (Fig. 181).

INSTALLING CALIPER GUIDE PIN BUSHINGS

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 182).

(2) Insert the folded bushing into the caliper housing (Fig. 183). **Do not use a sharp object to perform this step due to possible damage to the bushing.**

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into

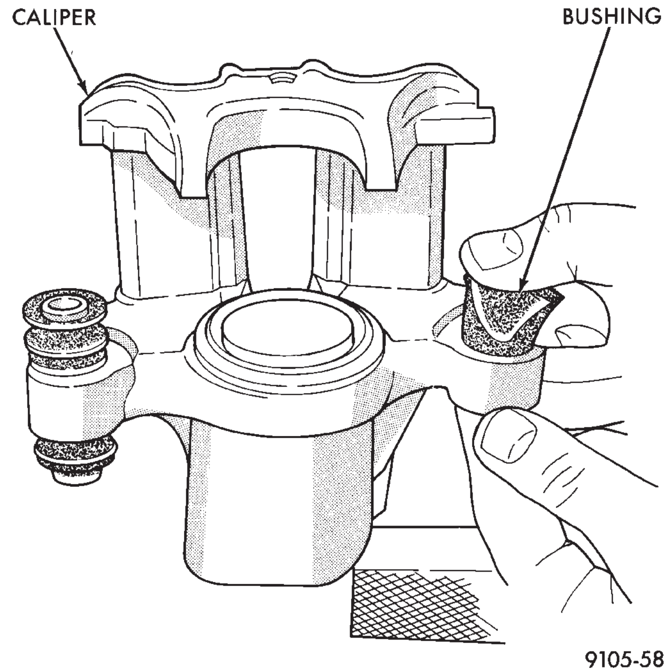


Fig. 181 Removing Bushing From Caliper

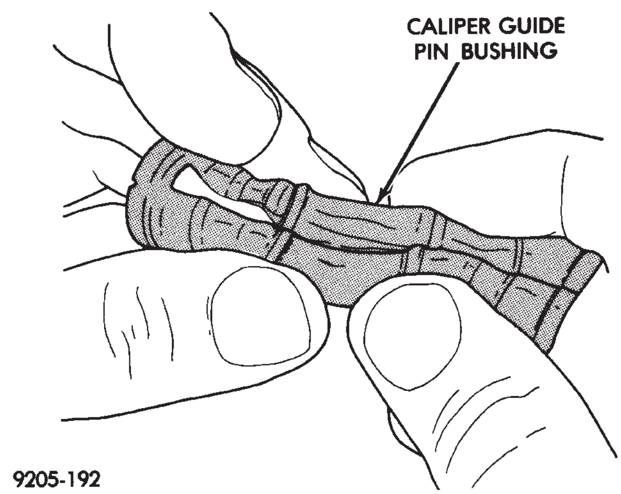


Fig. 182 Folded Caliper Guide Pin Bushing

the caliper housing. Flanges should be seated evenly on both sides of the bushing hole (Fig. 184).

(4) Lubricate the inside surfaces of the bushing using Mopar, Silicone Dielectric Compound or an equivalent.

(5) Install guide pin sleeve into one end of bushing until seal area of bushing is past seal groove in sleeve (Fig. 185).

(6) Holding convoluted boot end of bushing with one hand, push steel sleeve bushing through boot until one end of bushing is fully seated into seal groove on one end of sleeve (Fig. 185).

(7) Holding sleeve in place, work other end of bushing over end of sleeve and into the seal grove on sleeve (Fig. 186). Be sure other end of bushing did not come out of seal grove in sleeve.

DISASSEMBLY AND ASSEMBLY (Continued)

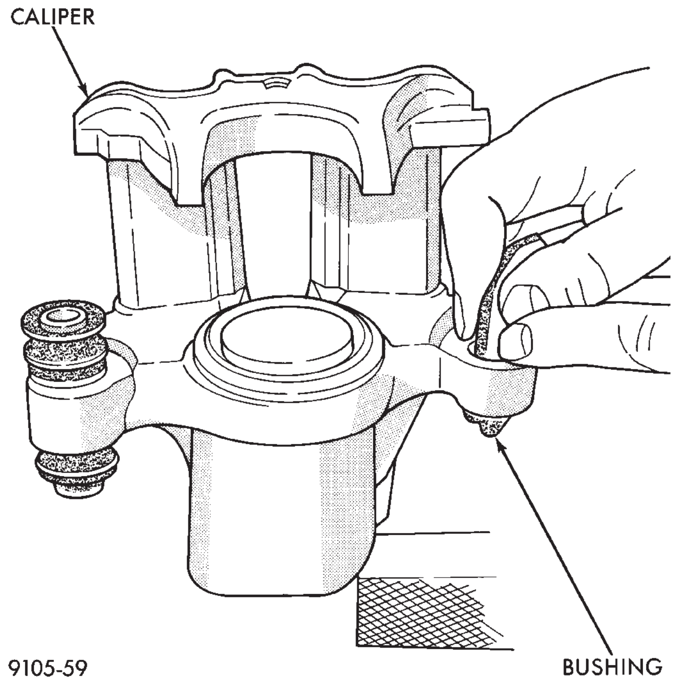


Fig. 183 Installing Caliper Guide Pin Bushing

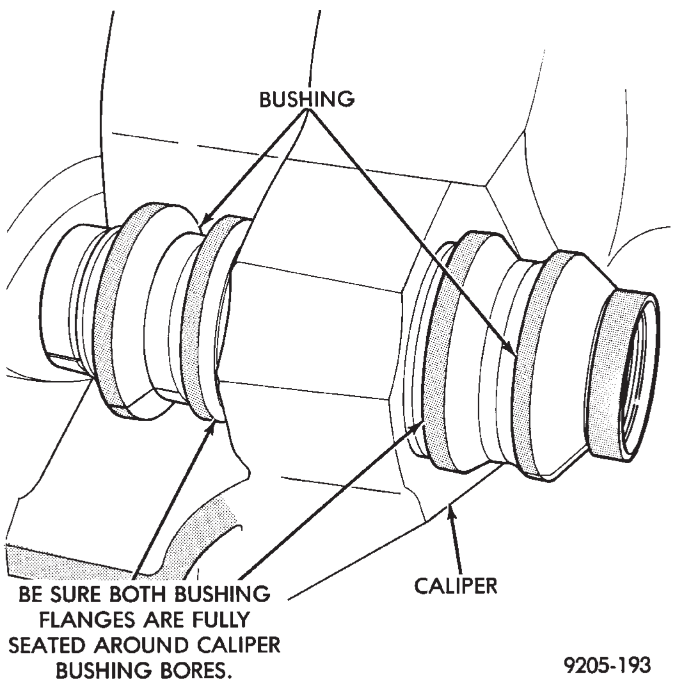


Fig. 184 Bushing Correctly Installed In Caliper

(8) When the sleeve is seated properly into the bushing, the sealed for life sleeve/bushing can be held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

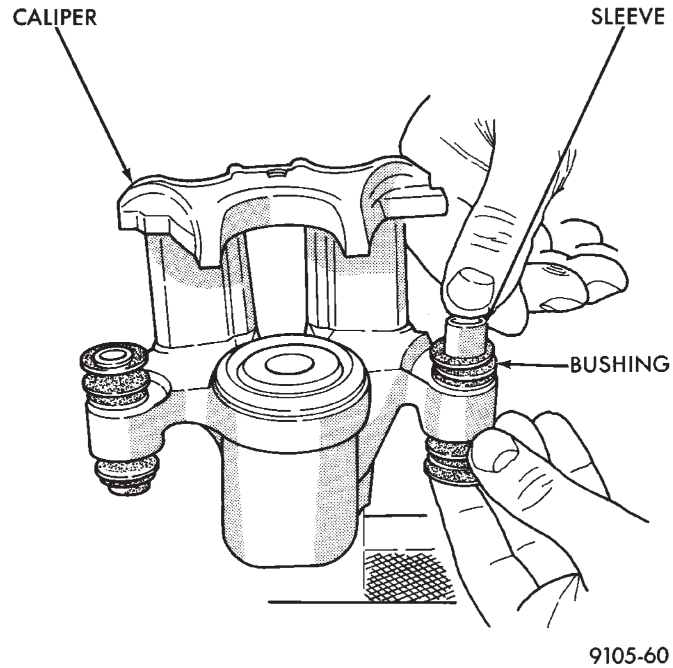


Fig. 185 Installing Sleeve In Bushing

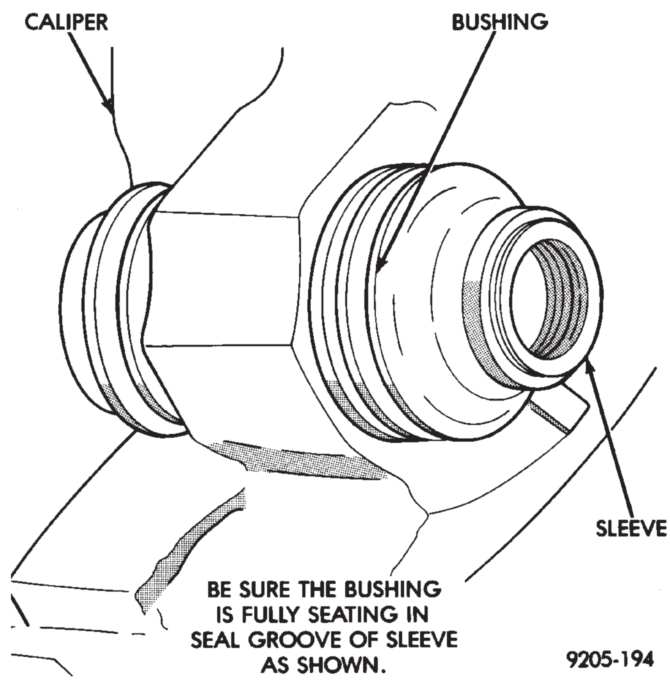


Fig. 186 Correctly Installed Caliper Sleeve And Bushing

CALIPER DISASSEMBLY

WARNING: UNDER NO CONDITION SHOULD AIR PRESSURE EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang assembly on a wire hook away

DISASSEMBLY AND ASSEMBLY (Continued)

from rotor, so hydraulic fluid cannot get on rotor. Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. Then apply and hold down the brake pedal to any position beyond the first inch of pedal travel. This will prevent loss of brake fluid from the master cylinder.

(3) If both front caliper pistons are to be removed, disconnect brake tube at flexible brake hose at frame rail. Plug brake tube and remove piston from opposite caliper using the same process as above for the first piston removal.

(4) Disconnect the brake fluid flex hose from the caliper assembly.

CAUTION: Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion and binding of piston.

(5) To disassemble caliper, mount in a vise equipped with protective jaws.

(6) Remove guide pin sleeves and guide pin bushings. See Removing Guide Pin Bushings in the caliper disassembly section of this manual.

(7) Remove the piston dust boot from the caliper and discard (Fig. 187).

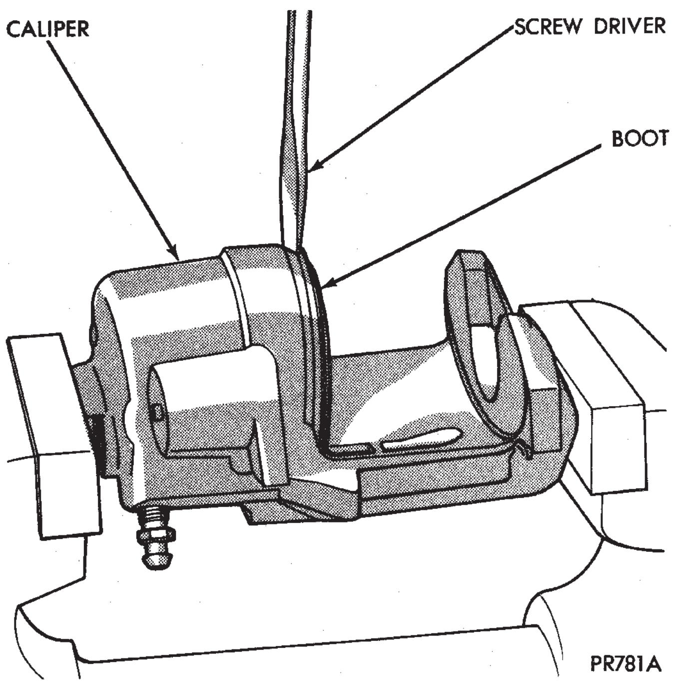


Fig. 187 Removing Caliper/Piston Dust Boot

(8) Using a soft tool, such as a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 188). Discard old seal. **Do not use a screw driver or other metal tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.**

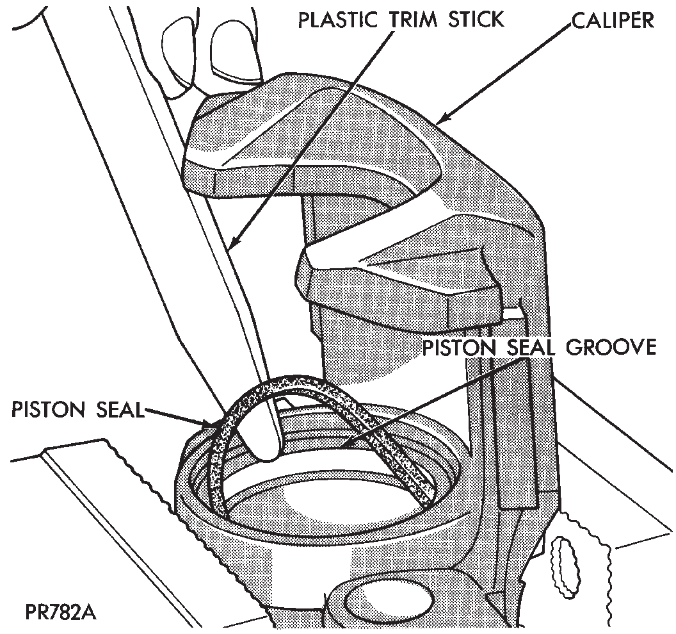


Fig. 188 Removing Piston Seal From Caliper

(9) Clean all parts using alcohol or a suitable solvent and wipe dry **using only a lint free cloth.** No lint residue can remain in caliper bore. Clean out all drilled passages and bores. **Whenever a caliper has been disassembled, a new boot and seal must be installed at assembly.**

(10) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095, or equivalent providing the diameter of the bore is not increased more than 0.0254 mm (0.001 inch) (Fig. 189).

(11) If the bore does not clean up within this specification, a new caliper housing should be installed. Install a new piston if the old one is pitted or scored.

NOTE: When using Caliper Honing Tool, Special Tool C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush.

NOTE: Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lint free cloth and then clean a second time.

CAUTION: When inspecting caliper piston, do not use anything but solvents to clean piston surface. If surface of piston cannot be cleaned using only solvents, piston must be replaced.

DISASSEMBLY AND ASSEMBLY (Continued)

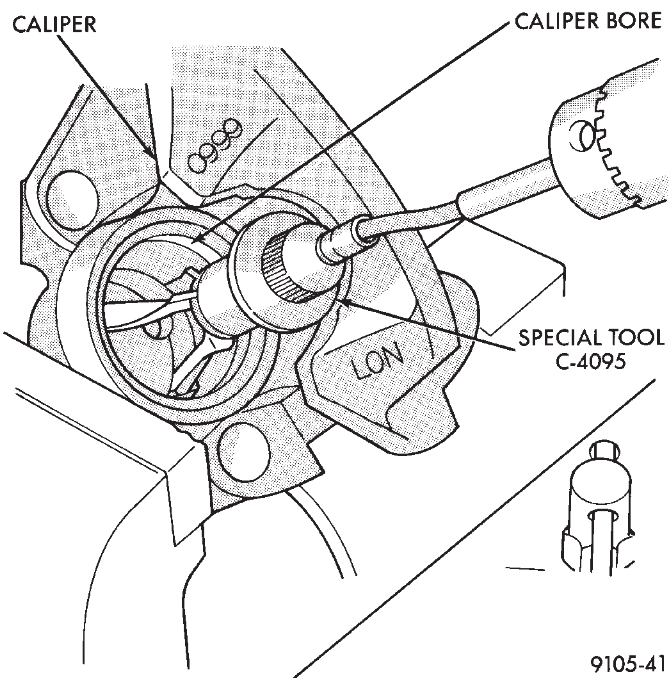


Fig. 189 Honing Brake Caliper Piston Bore

(12) Inspect caliper piston for pitting, scratches, or any physical damage. Replace piston if there is evidence of scratches, pitting or physical damage.

CALIPER ASSEMBLY

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(1) Clamp caliper in a vise (with protective caps installed on jaws of vise).

(2) Dip new piston seal in clean brake fluid and install in the groove of the caliper bore. Seal should be positioned at one area in groove and gently worked around the groove (Fig. 190), using only your fingers until properly seated. **NEVER USE AN OLD PISTON SEAL.** Be sure that fingers are clean and seal is not twisted or rolled (Fig. 190).

(3) Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

(4) Position dust boot over piston after coating with brake fluid.

CAUTION: Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

(5) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 191).

(6) Position dust boot into the counterbore of the caliper assembly piston bore.

(7) Using a hammer and Installer Piston Caliper Boot, Special Tool C-4689 and Handle, Special Tool C-4171, drive boot into counterbore of the caliper (Fig. 192).

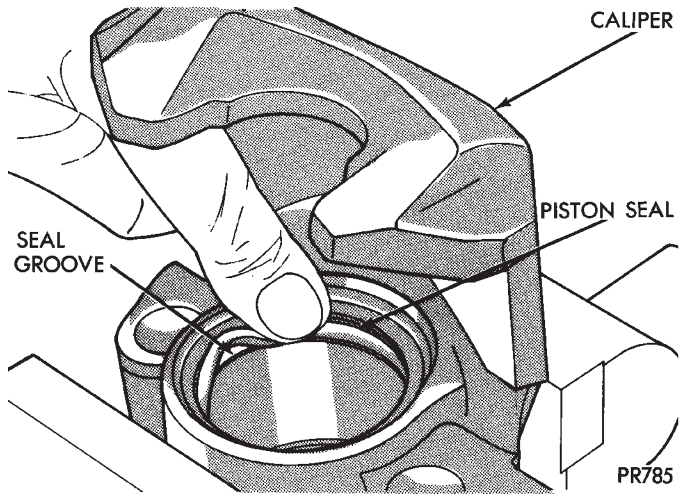


Fig. 190 Installing New Piston Seal In Caliper

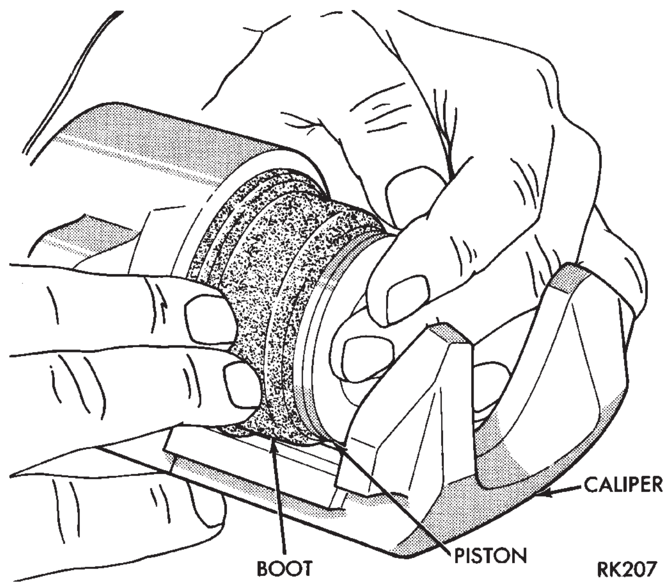


Fig. 191 Installing Piston Into Caliper Bore

(8) Install guide pin sleeves and bushings. See Install Guide Pin Bushings section in the caliper disassembly section of this manual.

(9) Install brake pads. See Installing Brake Pads in the Brake Pad Service Procedures section of this manual.

(10) Before installing caliper assembly on vehicle, inspect brake rotor. If any conditions as described in Checking Brake Rotor for Runout and Thickness are present the rotor, must be replaced or refaced. If the rotor does not require any servicing, install caliper assembly.

(11) Install brake hose onto caliper using banjo bolt. Torque the brake hose to caliper assembly banjo bolt to 33 N·m (24 ft. lbs.). **New seal washers**

DISASSEMBLY AND ASSEMBLY (Continued)

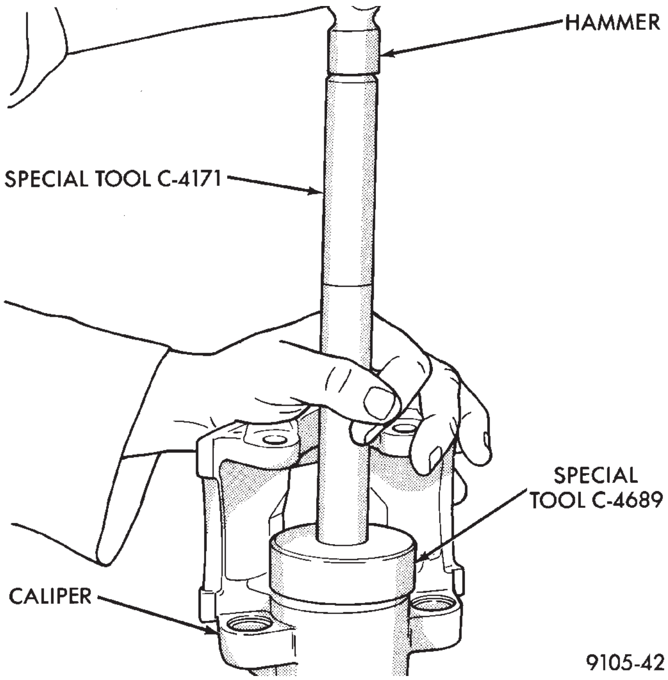


Fig. 192 Installing Dust Boot In Caliper Counterbore

MUST always be used when installing brake hose to caliper.

(12) Bleed the brake system (see Bleeding Brake System).

WHEEL CYLINDER REAR DRUM BRAKE

DISASSEMBLE

To disassemble the wheel cylinders, proceed as follows:

(1) Pry boots away from cylinders and remove (Fig. 193).

(2) Press **IN** on one piston to force out opposite piston, cup and spring (Fig. 193). Then using a soft tool such as a dowel rod, press out the cup and piston that remain in the wheel cylinder.

(3) Wash wheel cylinder, pistons, and spring (Fig. 193) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

ASSEMBLE

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with **only Mopar Protect-A-Cup Lubricant p/n 04883068 and no substitute.**

(3) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 193).

(4) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 193).

(5) Install a boot over each end of cylinder (Fig. 193). **Be careful not to damage boot during installation.**

CLEANING AND INSPECTION

FRONT DISC BRAKE PAD LINING INSPECTION

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the shoe and lining assemblies. (See Brake Shoe Removal).

Combined shoe and lining thickness should be measured at the thinnest part of the brake shoe assembly.

When a shoe and lining assembly is worn to a thickness of approximately 7.95 mm (0.313 inch) it should be replaced.

Replace **both** shoe assemblies (inboard and outboard) on the front wheels. It is also necessary that **both** front wheel brake shoe assembly sets be replaced, whenever shoe assemblies on either side of the vehicle require replacement.

If a shoe assembly does not require replacement, reinstall it, making sure each shoe assembly is returned to its original position. (See Brake Shoe Installation).

REAR DISC BRAKES

BRAKE PAD LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the rear disc brake shoes. Refer to Rear Disc Brake Shoe Removal in the Removal And Instal-

CLEANING AND INSPECTION (Continued)

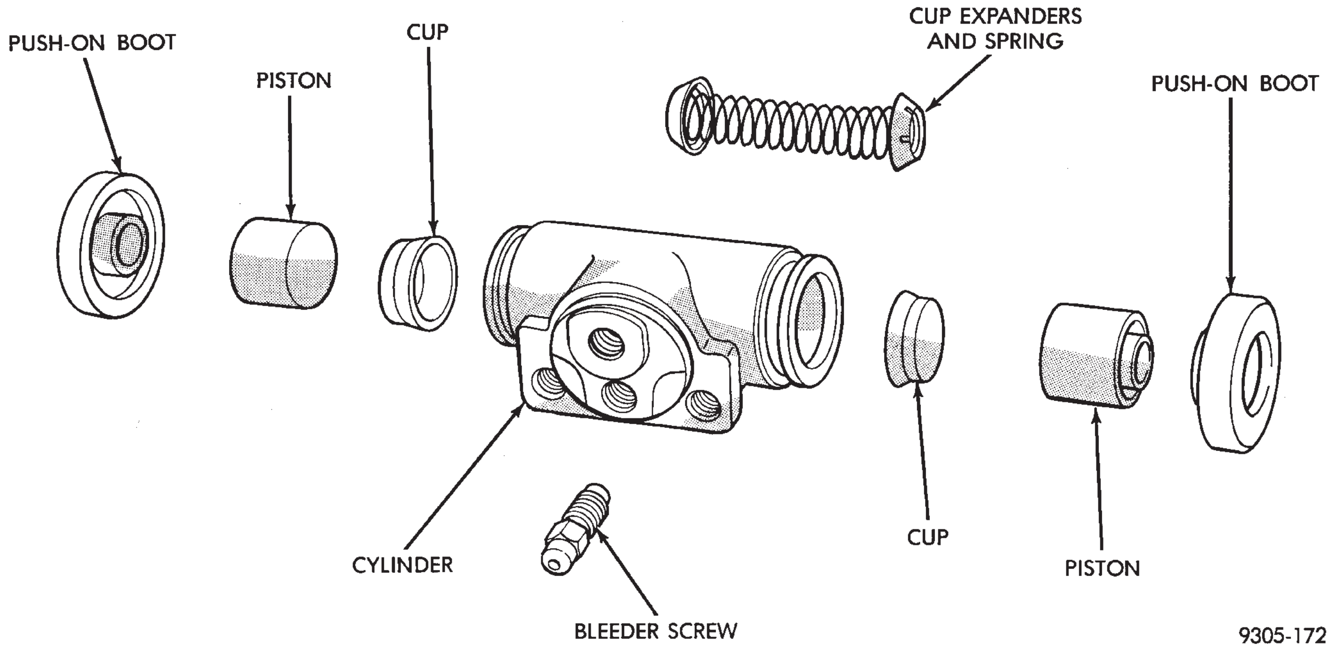


Fig. 193 Rear Wheel Cylinder (Exploded View)

lation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.0 mm (9/32 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** rear wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Rear Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

REAR DRUM BRAKE SHOE LINING INSPECTION

(1) Remove the tire and wheel assembly from the vehicle

(2) Remove the rear brake adjusting hole cover plug (Fig. 194).

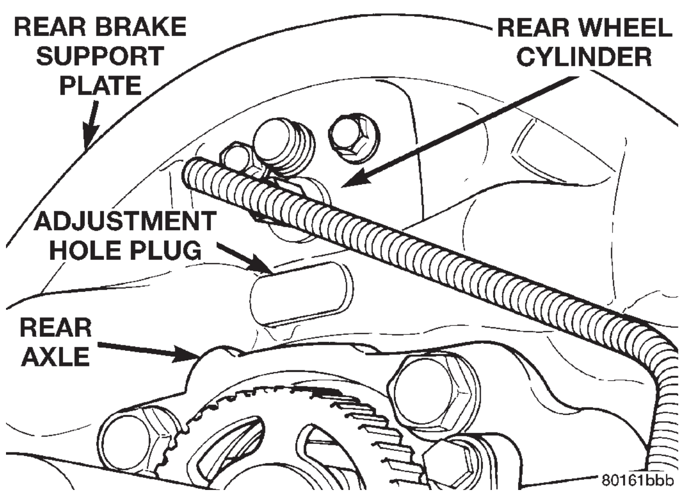


Fig. 194 Brake Adjustment Hole Rubber Plug

(3) Insert a thin screwdriver into brake adjusting hole to hold the adjusting lever away from the notches on the adjusting screw star wheel.

(4) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting screw star wheel. Release brake by prying down with adjusting tool.

(5) Remove the rear brake drum from the rear hub/bearing assembly.

(6) Inspect brake lining for wear, shoe alignment, and or contamination from grease or brake fluid.

CLEANING AND INSPECTION (Continued)

REAR DRUM BRAKE WHEEL CYLINDER

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

BRAKE HOSE AND BRAKE LINES INSPECTION

Flexible rubber hose is used at both front brakes and at the rear axle. Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for surface cracking, scuffing, or worn spots. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

The steel brake tubing should be inspected periodically for evidence of physical damage or contact with moving or hot components.

The flexible brake tube sections used on this vehicle in the primary and secondary tubes from the master cylinder to the ABS hydraulic control unit connections and the chassis brake tubes between the hydraulic control unit and the proportioning valve must also be inspected. This flexible tubing must be inspected for kinks, fraying and its contact with other components of the vehicle or contact with the body of the vehicle.

REAR WHEEL HUB AND BEARING ASSEMBLY

The rear hub and bearing assembly is designed for the life of the vehicle and should require no maintenance. The following procedure may be used for evaluation of bearing condition.

With wheel and brake drum removed, rotate flanged outer ring of hub. Excessive roughness, lateral play or resistance to rotation may indicate dirt intrusion or bearing failure. If the rear wheel bearings exhibit these conditions during inspection, the hub and bearing assembly should be replaced.

Damaged bearing seals and resulting excessive grease loss may also require bearing replacement. Moderate grease loss from bearing is considered normal and should not require replacement of the hub and bearing assembly.

ADJUSTMENTS

STOP LAMP SWITCH

(1) Remove stop lamp switch from its bracket by rotating it approximately 30° in a counter-clockwise direction.

(2) Disconnect wiring harness connector from stop lamp switch.

(3) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(4) Install the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then while keeping the brake pedal depressed, install the stop lamp switch into the bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in the square hole of the bracket, rotate switch clockwise approximately 30° to lock the switch into the bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If too much force is used, damage to the vacuum booster, stop lamp switch or striker (Fig. 195) can result.

(5) Connect the wiring harness connector to the stop lamp switch.

(6) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger (Fig. 195) to ratchet backward to the correct position.

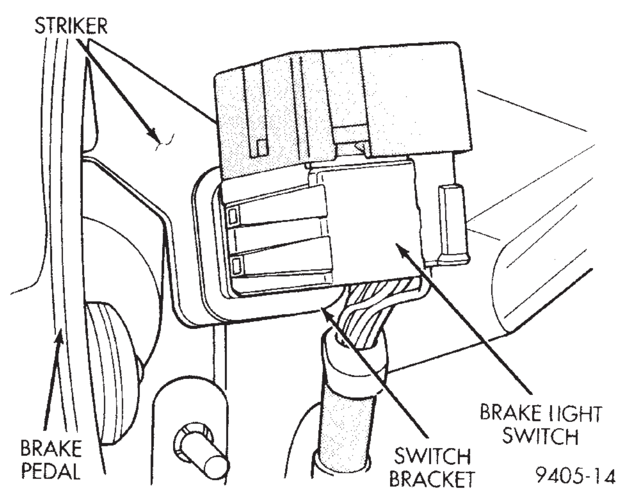


Fig. 195 Stop Light Switch Location In Vehicle

ADJUSTMENTS (Continued)

REAR DRUM BRAKE SHOE ADJUSTMENT

NOTE: Normally, self adjusting drum brakes will not require manual brake shoe adjustment. Although in the event of a brake reline it is advisable to make the initial adjustment manually to speed up the adjusting time.

(1) Raise the vehicle so that the rear wheels are free to turn. See Hoisting Recommendations in the Lubrication And Maintenance Section, at the front of this service manual.

Remove the park brake cable, for the wheel of the vehicle that is being worked on, from the park brake cable equalizer (Fig. 196). This is required to gain access to the star wheel. If the cable is not removed from the equalizer, the cable and spring inside of the brake drum is in the way of the star wheel.

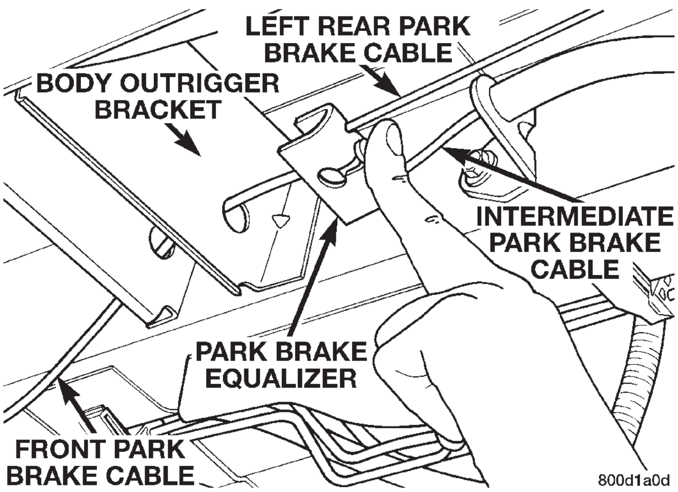


Fig. 196 Park Brake Cable Equlizer

(2) Remove rubber plug, from rear brake adjusting hole, in the rear brake support plate (Fig. 197).

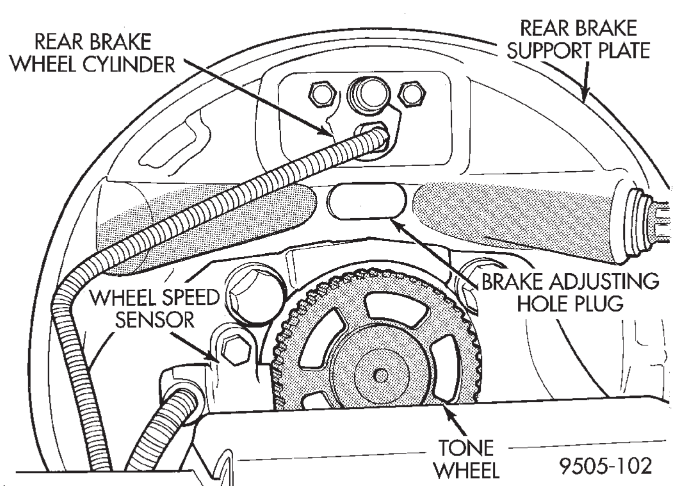


Fig. 197 Brake Adjusting Hole Plug

(3) **Be sure parking brake lever is fully released.**

(4) Insert Brake Adjusting, Special Tool C-3784 or equivalent through the adjusting hole in support plate and against star wheel of adjusting screw. Move handle of tool upward until a slight drag is felt when road wheel is rotated.

(5) Insert a thin screwdriver or piece of welding rod into brake adjusting hole. Push adjusting lever out of engagement with star wheel. **Care should be taken so as not to bend adjusting lever or distort lever spring.** While holding adjusting lever out of engagement, back off star wheel to ensure a free wheel with no brake shoe drag.

(6) Repeat above adjustment at the other rear wheel.

(7) Install adjusting hole rubber plug (Fig. 197) in rear brake support plates.

(8) Install park brake cables on park brake cable equalizer (Fig. 196).

PARK BRAKE SHOES (WITH REAR DISC BRAKES)

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.

(1) Raise vehicle.

(2) Remove tire and wheel.

(3) Remove disc brake caliper from caliper adapter (Fig. 198). If required, refer to Rear Disc Brake Caliper in the Removal And Installation Section in this group of the service manual for the removal procedure.

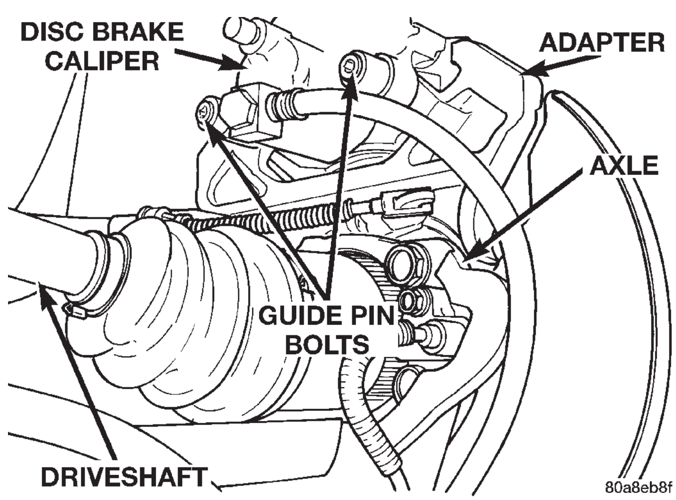


Fig. 198 Disc Brake Caliper

ADJUSTMENTS (Continued)

(4) Remove rotor from hub/bearing.

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 Gauge, Brake Shoe, Special Tool C-3919 or an equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor (Fig. 199).

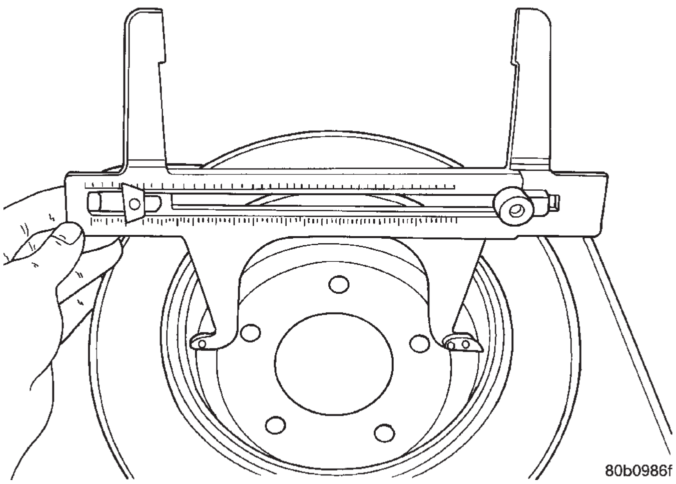


Fig. 199 Measuring Park Brake Drum Diameter

(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. 200).

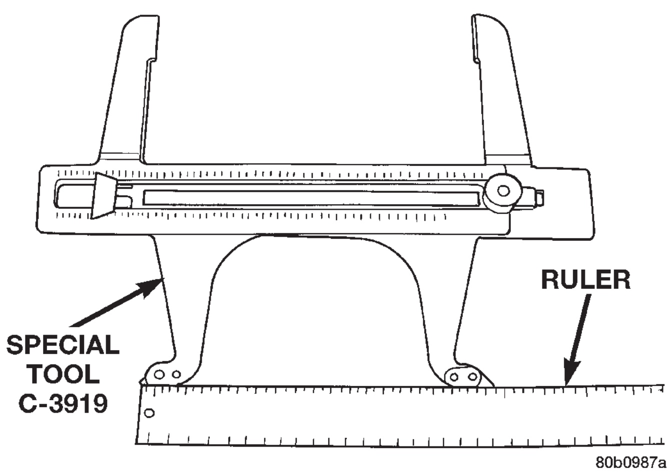


Fig. 200 Reading Park Brake Drum Diameter

(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. 201).

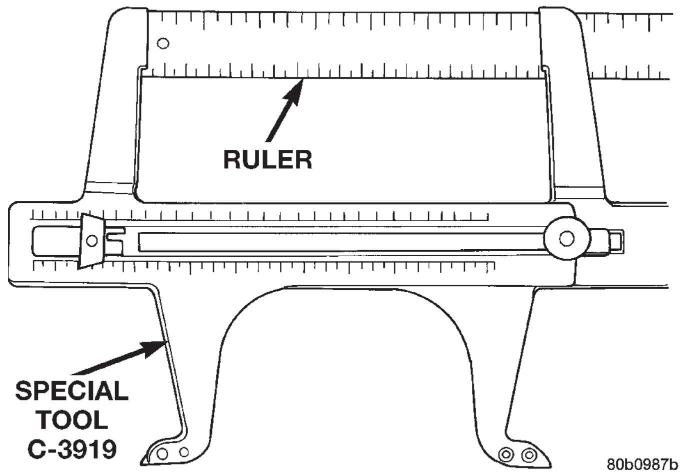


Fig. 201 Setting Gauge To Park Brake Shoe Measurement

(8) Place Gauge, Brake Shoe, Special Tool C-3919 or equivalent over the park brake shoes (Fig. 202). The special tool must be located straight across at the center (widest point) of the park brake shoes (Fig. 202).

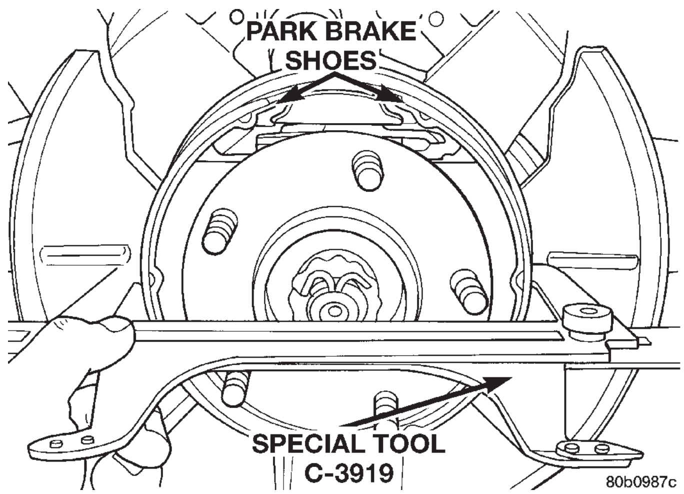


Fig. 202 Adjusting Park Brake Shoes

(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) Install rotor on hub/bearing.

(11) 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.

(12) Install disc brake caliper on caliper adapter (Fig. 198). If required, refer to Rear Disc Brake Caliper in the Removal And Installation Section in this

ADJUSTMENTS (Continued)

group of the service manual for the installation procedure.

(13) Install wheel and tire.

(14) 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.).

(15) Lower vehicle.

(16) Apply and release the park brake pedal one time. This will seat and correctly adjust the park brake cables.

CAUTION: Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.

(17) Road test the vehicle to ensure proper function of the vehicle's brake system.

PARK BRAKE CABLE ADJUSTMENT

The park brake cables on this vehicle have an automatic self adjuster built into the park brake pedal mechanism. When the foot operated park brake pedal is in its released (upward most) position, a clock spring automatically adjusts the park brake cables. The park brake cables are adjusted (tensioned) just enough to remove all the slack from the cables. The automatic adjuster system will not over adjust the cables causing rear brake drag.

Due to the automatic adjust feature of the park brake pedal, adjustment of the parking brake cables on these vehicles relies on proper drum brake and park brake shoe adjustment. See Rear Brake Adjustment and Park Brake Shoe Adjustment in the Service Adjustments Section in this group of the service manual.

When the park brake pedal is applied the self adjuster is by-passed and the pedal operates normally to engage the park brakes.

When a service procedure needs to be performed on the park brake pedal or the park brake cables, the automatic self adjuster can be manually locked out by the service technician.

PROPORTIONING VALVE (HEIGHT SENSING)

Proportioning valve actuator adjustment will be required if there is a complaint of premature rear wheel lockup and the front and rear brake shoe linings checked OK during inspection, the height sensing proportioning valve required replacement, or there is a complaint of excessive pedal effort and the vacuum booster and brake pedal checked OK. Make sure the proportioning valve and the mounting bracket are firmly attached to the vehicle. Then, proceed with the following procedure to perform the adjustment of the actuator.

(1) Raise vehicle. Vehicle is to be raised and supported on jackstands or with a frame contact type hoist so the rear suspension of the vehicle is hanging free. See hoisting in the Lubrication And Maintenance section of this service manual.

(2) Remove rear wheels/tires.

(3) Using an appropriate jack, support the rear axle prior to the removal of the track bar and shock absorber bolts from the rear axle.

(4) Unbolt the track bar from the rear axle.

(5) Unbolt both shock absorbers from the rear axle.

(6) Loosen (do not remove) both of the leaf spring to front spring hanger pivot bolts.

NOTE: When lowering the rear axle be sure that the leaf springs do not come in contact with the hoist limiting the downward movement of the axle. If this occurs an improper adjustment of the actuator may result.

(7) Lower the rear axle so it is at its farthest point of downward movement.

(8) Loosen the adjustment nut (Fig. 203) on the actuator.

(9) Be sure the hooked end of the actuator is correctly (fully) seated in the clip on the proportioning valve lever and that the clip is correctly positioned on the lever of the proportioning valve.

(10) Pull the housing of the proportioning valve actuator toward the spring hanger (Fig. 203) until the lever on the proportioning valve bottoms on the body of the proportioning valve. **Hold the proportioning valve actuator in this position while tightening the adjustment nut (Fig. 203) to a torque of 5 N·m (45 in. lbs.). Proportioning valve adjustment is now complete.**

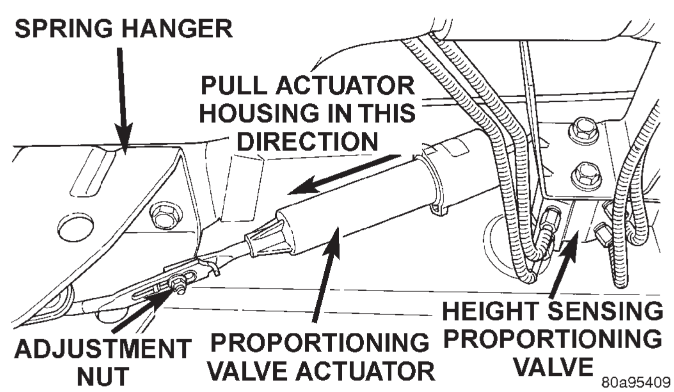


Fig. 203 Proportioning Valve Actuator Adjustment

(11) Install shock absorbers and track bar on rear axle. **Do not tighten the mounting bolts for any of the loosened suspension components at this time.**

(12) Install the wheel/tires.

ADJUSTMENTS (Continued)

(13) Lower the vehicle to the ground. **Be sure that the suspension is supporting the full weight of the vehicle.**

(14) Tighten the spring to front hanger pivot bolts to a torque of 156 N·m (115 ft. lbs.).

(15) Tighten the shock absorber mounting bolts to a torque of 101 N·m (75 ft. lbs.).

(16) Tighten the track bar mounting bolt to a torque of 95 N·m (70 ft. lbs.).

(17) Road test vehicle to ensure that the premature rear wheel lockup condition has been corrected.

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 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 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 ect.

VEHICLE BRAKE SYSTEM COMPONENT SPECIFICATIONS

BRAKE SYSTEM COMPONENTS

FRONT BRAKES—DISC	
Type	Single Piston-Pin Slider-Disc
Caliper Bore Diameter	60mm
Adjustment	Automatic
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press In EPDM Rubber
Disc Type All Bodies	Vented
Disc Diameter-Outside	260 mm or 283 mm
Runout - Maximum Allowable T.I.R.*	.13 mm (.005 in.)
Parallelism-Total Variation in Thickness in 360° of Rotation	.013 mm (.0005 in.)
Brake Shoes And Linings	Riveted

REAR BRAKES—DRUM	
Type	Leading-Trailing
Adjustment	Automatic
Drum Diameter	250 mm (9.84 in.)
Wheel Cylinder Diameter	19.0 mm (3/4 in.)
Brake Shoes And Linings	Riveted

*Measured On The Vehicle

8018347c

Brake System Component Specifications

SPECIFICATIONS (Continued)

BRAKE ACTUATION SYSTEM

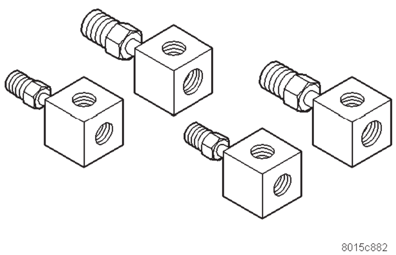
ACTUATION:
Vacuum Operated Power Brakes . . . . .Standard
Hydraulic System. . . . . .Dual-Diagonally Split
Antilock Brake Sytem (Teves Mark-20) . . . .
MASTER CYLINDER ASSEMBLY:
Supplier . . . . .Bosch
Type For Non-ABSAnd
ABS Brakes . . . .Conventional Compensating Port
Type For ABS Brakes
With Traction Control . . .Dual Center Port Design
Body Material. . . . . .Anodized Aluminum
Reservoir Material . . . . .Polypropelene
MASTER CYLINDER BORE / STROKE AND SPLIT:
ABS W/Disc/Drum Brakes . . . . . . 23.8 mm x 36 mm (.937 in. x 1.47 in.)
AWD W/Disc/Disc Brakes. . . . . . . .25.4 mm x 39 mm (1.00 in. x 1.50 in.)
Displacement Split . . . . .50 / 50
MASTER CYLINDER FLUID OUTLET PORTS:
Non-ABS And ABS . . .Primary 7/16–24 Secondary 7/16–24
ABS With Traction Control . . . . . . .Primary M12 x 1 Secondary M12 x 1
Outlet Fitting Type Non-ABS
And ABS . . . . .Double Wall Inverted Flare
Outlet Fitting Type ABS With
Traction Control . . . . .ISO Flare
ABS HYDRAULIC CONTROL UNIT:
Hydraulic Tube Fitting Type. . . . . .ISO Flare
BOOSTER:
Make/Type. . . . . .Bosch Vacuum Assist
Mounting Studs . . . . .M8 x 1.25
Type . . . . .270 ZLT RSMV
Boost At 20 inches Of
Manifold Vacuum. . . . . .3800 N·m (850 lbs.)
PROPORTIONING VALVE:
Material. . . . . .Aluminum
Function. . . . . .Hydraulic Pressure Proportioning To Rear Brakes
BRAKE PEDAL
Pedal Ratio 3.36

BRAKE FASTENER TORQUE SPECIFICATIONS

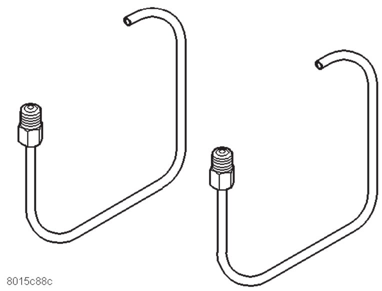
DESCRIPTION TORQUE
BRAKE TUBES:
Tube Nuts To Fittings And
Components . . . . .17 N·m (145 in. lbs.)
BRAKE HOSE:
To Caliper Banjo Bolt . . . . .48 N·m (35 ft. lbs.)
Intermediate Bracket . . . . .12 N·m (105 in. lbs.)
MASTER CYLINDER:
To Vacuum Booster
Mounting Nut . . . . .25 N·m (225 in. lbs.)
FIXED PROPORTIONING VALVE:
To Frame Rail Attaching
Bolts. . . . . .14 N·m (125 in. lbs.)
HEIGHT SENSING PROPORTIONING VALVE:
To Mounting Bracket
Attaching Bolts . . . . .23 N·m (200 in. lbs.)
Actuator Assembly
Adjustment Nut . . . . .5 N·m (45 in. lbs.)
Mounting Bracket To Frame
Rail Bolts . . . . .17 N·m (150 in. lbs.)
JUNCTION BLOCK (NON-ABS BRAKES)
To Suspension Cradle
Mounting Bolt . . . . .28 N·m (250 in. lbs.)
VACUUM BOOSTER:
To Dash Panel Mounting
Nuts . . . . .28 N·m (250 in. lbs.)
REAR WHEEL CYLINDER:
To Support Plate Mounting
Bolts .8 N·m (75 in. lbs.)
Bleeder Screw . . . . .10 N·m (80 in. lbs.)
BRAKE SUPPORT PLATE:
To Rear Axle Mounting Bolts . . .130 N·m (95 ft. lbs.)
DISC BRAKE CALIPER:
Guide Pin Bolts . . . . .41 N·m (30 ft. lbs.)
Bleeder Screw . . . . .15 N·m (125 in. lbs.)
ABS HYDRAULIC CONTROL UNIT:
Mounting Bracket To
Suspension Cradle Bolts. . . . .28 N·m (250 in. lbs.)
To Mounting Bracket Isolator
Attaching Bolts . . . . .11 N·m (97 in. lbs.)
CAB To HCU Mounting Screws . . .2 N·m (17 in. lbs.)
WHEEL SPEED SENSOR:
To Axle Or Steering Knuckle
Mounting Bolt . . . . .12 N·m (105 in. lbs.)
PARKING BRAKE:
Pedal Assembly Mounting
Bolts. . . . . .28 N·m (250 in. lbs.)
REAR HUB AND BEARING:
To Axle Mounting Bolts. . . . . . . .129 N·m (95 ft. lbs.)
WHEEL:
Stud Lug Nut . . . . .115–156 N·m (84-115 ft. lbs.)

SPECIAL TOOLS

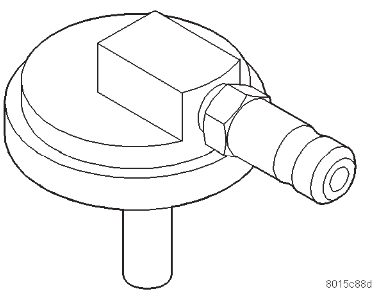
SPECIAL TOOLS—BASE BRAKES



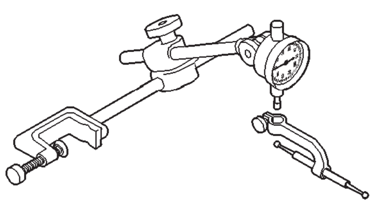
Fittings, Brake Proportioning Valve Testing 6833



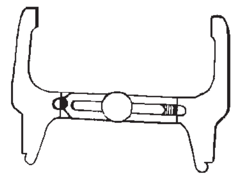
Tubes, Master Cylinder Bleeding 6920



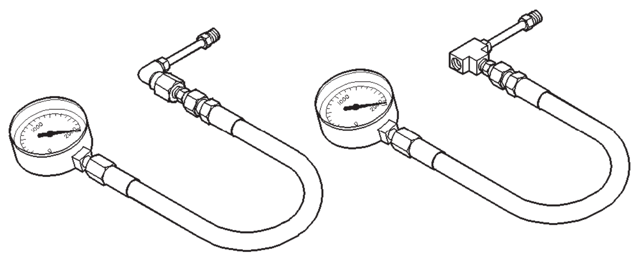
Adapter, Master Cylinder Pressure Bleed Cap 6921



Dial Indicator, C-3339



Gauge, Brake Safe-Set



Gauge Set, C-4007–A

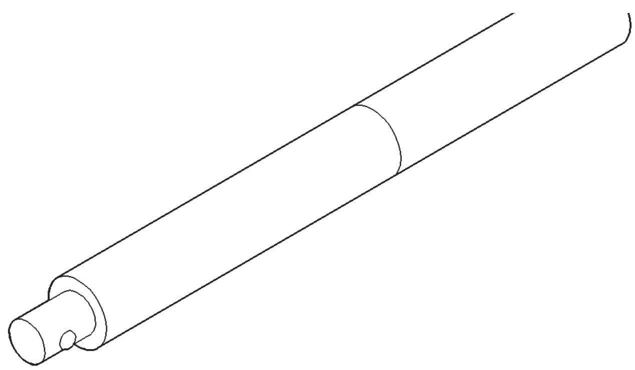


Fig. 204 Handle, Universal C–4171

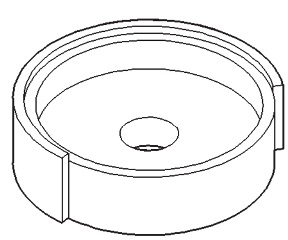


Fig. 205 Installer, Dust Boot C-4689

ANTILOCK BRAKE SYSTEM – TEVES MARK-20

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DESCRIPTION AND OPERATION

ANTILOCK BRAKES OPERATION DESCRIPTION

The purpose of an Antilock Brake System (ABS) is to prevent wheel lock-up under braking conditions on virtually any type of road surface. Antilock Braking is desirable because a vehicle which is stopped without locking the wheels will retain directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking.

This section of the service manual covers the description and on car service for the ITT Teves Mark 20 ABS Brake System and the ITT Teves Mark 20 ABS Brake System with Traction Control. If other service is required on the non ABS related components of the brake system, refer to the appropriate section in this group of the service manual for the specific service procedure required.

ABS BRAKES COMPONENT ABBREVIATION LIST

In this section of the service manual, several abbreviations are used for the components of the Teves Mark 20 ABS Brake System and the Teves Mark 20 ABS Brake System with Traction Control. They are listed below for your reference.

- CAB–Controller Antilock Brake
- ICU–Integrated Control Unit
- HCU–Hydraulic Control Unit
- TCS–Traction Control
- ABS–Antilock Brake System
- PSI–Pounds Per Square Inch (pressure)
- WSS–Wheel Speed Sensor
- FWD–Front Wheel Drive
- AWD–All Wheel Drive
- DTC–Diagnostic Trouble Code

DESCRIPTION AND OPERATION (Continued)

ABS BRAKES OPERATION AND VEHICLE PERFORMANCE

This ABS System represents the current state-of-the-art in vehicle braking systems and offers the driver increased safety and control during braking. This is accomplished by a sophisticated system of electrical and hydraulic components. As a result, there are a few performance characteristics that may at first seem different but should be considered normal. These characteristics are discussed below.

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions the same as a standard brake system with a diagonally split master cylinder and conventional vacuum assist.

ABS SYSTEM OPERATION

If a wheel locking tendency is detected during a brake application, the brake system will enter the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal.

During an ABS stop, the brakes hydraulic system is still diagonally split. However, the brake system pressure is further split into four control channels. During antilock operation of the vehicle's brake system the front wheels are controlled independently and are on two separate control channels and the rear wheels of the vehicle are controlled together.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller Antilock Brake (CAB).

ABS operation is available at all vehicle speeds above 3 to 5 mph. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

VEHICLE HANDLING PERFORMANCE DURING ABS BRAKING

It is important to remember that an antilock brake system does not shorten a vehicle's stopping distance under all driving conditions, but does provide improved control of the vehicle while stopping. Vehicle stopping distance is still dependent on vehicle speed, weight, tires, road surfaces and other factors.

Though ABS provides the driver with some steering control during hard braking, there are conditions however, where the system does not provide any benefit. In particular, hydroplaning is still possible when the tires ride on a film of water. This results in the vehicles tires leaving the road surface rendering the vehicle virtually uncontrollable. In addition, extreme steering maneuvers at high speed or high speed cornering beyond the limits of tire adhesion to the road surface may cause vehicle skidding, independent of vehicle braking. For this reason, the ABS system is termed Antilock instead of Anti-Skid.

NOISE AND BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping and/or groaning noises heard by the driver. This is normal due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS will be turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less then 3 mph or during an ABS stop where ABS is no longer required. These conditions will exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel or sand on it. Also stopping a vehicle on a bumpy road surface will activate ABS because of the wheel hop caused by the bumps.

TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows, 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25 to30%. This means that the wheel rolling velocity is 25 to 30% less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lock-up.

Complete wheel lock up normally leaves black tire marks on dry pavement. The ABS System will not leave dark black tire marks since the wheel never reaches a fully locked condition. Tire marks may however be noticeable as light patched marks.

START UP CYCLE

When the ignition is turned on, a popping sound and a slight brake pedal movement may be noticed. Additionally, when the vehicle is first driven off a humming may be heard and/or felt by the driver at approximately 20 to 40 kph (12 to 25 mph). The ABS warning lamp will also be on for up to 5 seconds after the ignition is turned on. All of these conditions are a normal function of ABS as the system is performing a diagnosis check.

DESCRIPTION AND OPERATION (Continued)

PREMATURE ABS CYCLING

NOTE: When working on a vehicle which has a complaint of premature ABS cycling it may be necessary to use a DRB Scan Tool to detect and verify the condition.

There is one complaint called Premature ABS Cycling in which neither the Red Brake Warning Lamp nor the Amber Antilock Lamp were illuminated and no fault codes were stored in the CAB. Symptoms of Premature ABS Cycling, include clicking sounds from the solenoids valves, pump motor running and pulsations in the brake pedal. This condition can occur at any braking rate of the vehicle and on any type of road surface. This creates an additional condition which needs to be correctly assessed when diagnosing problems with the antilock brake system.

The following conditions are common causes that need to be checked when diagnosing a condition of Premature ABS Cycling. Damaged tone wheels, incorrect tone wheels, damage to a wheel speed sensor mounting boss on a steering knuckle, a loose wheel speed sensor mounting bolt, and excessive tone wheel runout. Also, an excessively large tone wheel to wheel speed sensor air gap can lead to the condition of Premature ABS Cycling. Special attention is to be given to these components when diagnosing a vehicle exhibiting the condition of Premature ABS Cycling. After diagnosing the defective component, repair or replace as required.

When the component repair or replacement is completed, test drive the vehicle to verify the condition of Premature ABS Cycling has been corrected.

ABS BRAKE SYSTEM COMPONENTS

The following is a detailed description of the Teves Mark 20 ABS brake system components. For information on servicing the base brake system components, see the base Brake System section of this Service Manual.

ABS MASTER CYLINDER AND POWER BRAKE BOOSTER

A vehicle equipped with Teves Mark 20 ABS without optional traction control uses the same type of a master cylinder and power brake booster (Fig. 1) as a vehicle not equipped with antilock brakes.

A vehicle equipped with Teves Mark 20 ABS with Traction control uses a unique center port master cylinder. If the master cylinder is replaced on a vehicle equipped with traction control be sure the right type of master cylinder is installed.

A vehicle equipped with four wheel disc brakes (AWD applications) also have a unique master cylinder. The master cylinder used on these vehicles have a piston bore diameter which is larger then the master cylinder used on the other brake applications.

The primary and secondary outlet ports on the master cylinder go directly to the hydraulic control unit HCU.

Reference the appropriate section of this service manual for further information on the individual components.

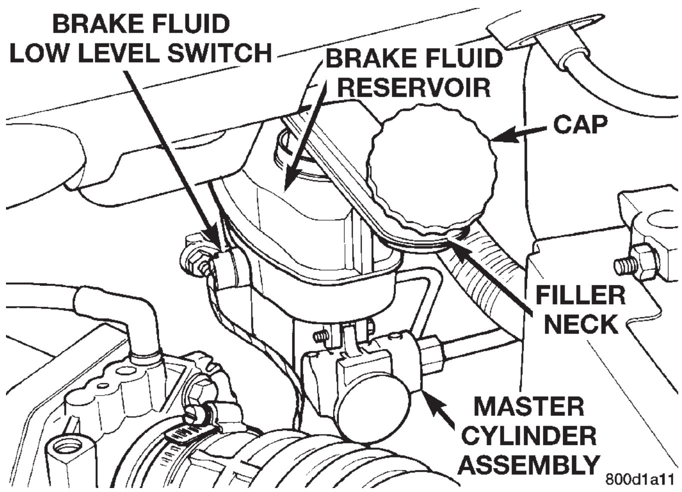

Fig. 1 Master Cylinder And Vacuum Booster

INTEGRATED CONTROL UNIT (ICU)

The hydraulic control unit (HCU) (Fig. 2) used with the Teves Mark 20 ABS is different from the HCU used on previous Chrysler products with ABS. The HCU used on this ABS system is part of the integrated contol unit (ICU). The HCU is part of what is referred to as the ICU because the HCU and the controller antilock brakes (CAB) are combined (integrated) into one unit. This differs from previous Chrysler products with ABS, where the HCU and the CAB were separate components located in different areas of the vehicle.

Teves Mark 20 ABS uses two different HCU's and CAB's depending on the type of ABS system the vehicle is equipped with. There is a unique HCU and CAB for a vehicle equipped with just ABS and a unique HCU and CAB for a vehicle equipped with ABS and traction control.

NOTE: The HCU and CAB used on a vehicle that is equipped with only ABS and on a vehicle that is equipped with ABS and traction control are different. The HCU on a vehicle equipped with ABS and traction control has a valve block housing (Fig. 2) that is approximately 1 inch longer on the low pressure fluid accumulators side than a HCU for a vehicle that is equipped with only ABS.

DESCRIPTION AND OPERATION (Continued)

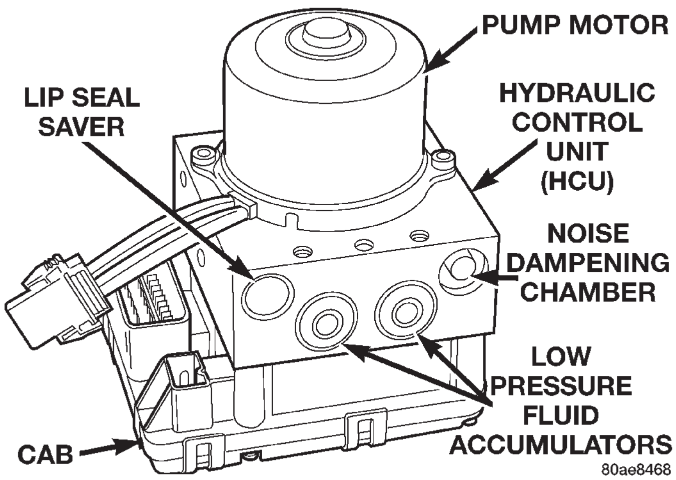

Fig. 2 Teves Mark 20 ICU

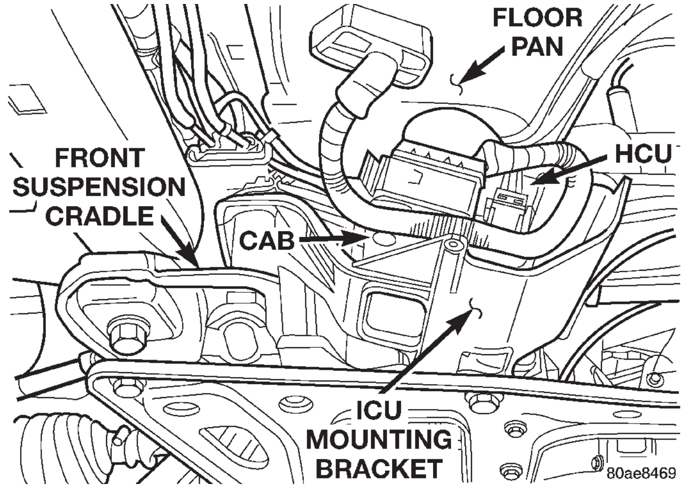

Fig. 3 ICU Mounting Location

The ICU is located on the driver's side of the vehicle, and is mounted to the front suspension cradle (Fig. 3). The **ABS only** ICU contains the following components for controlling the brake system hydraulic pressure during ABS braking: The CAB, eight valve solenoids, (four inlet valves and four outlet valves) fluid accumulators a pump, and an electric motor. The **ABS with traction control** ICU contains the following components for controlling the brake system hydraulic pressure during ABS braking and traction control operation: The CAB, four solenoid controlled inlet valves, four solenoid controlled outlet valves, two hydraulic shuttle valves, two ASR valves, fluid accumulators a pump and an electric motor. Also attached to the hydraulic control unit are the master cylinder primary and secondary brake tubes and the brake tubes going to each wheel of the vehicle. (Fig. 3).

CAUTION: No components of the ICU are serviceable. If any component that makes up the ICU is diagnosed as not functioning properly it MUST be replaced. The replaceable components of the ICU, are the HCU and the CAB (Fig. 2) and (Fig. 3). The mounting bracket is also replaceable as a separate component of the ICU. The remaining components of the ICU are not serviceable items. No attempt should ever be made to remove or service any individual components of the HCU. This is due to the concern of contamination entering the HCU while performing a service procedure. Also no attempt should ever be made to remove or service any individual components of the CAB.

CAUTION: At no time when servicing the ICU should a 12 volt power source be applied to any electrical connector of the HCU or the CAB.

INLET VALVES AND SOLENOIDS

There are four inlet solenoids, one for each wheel. In the released position they provide a fluid path from the master cylinder to the wheel brakes of the vehicle. When the ABS cycle has been completed the inlet solenoids will return to their released (open) position.

OUTLET VALVES AND SOLENOIDS

There are four outlet solenoids, one for each wheel. In the released position they are closed to allow for normal braking. In the actuated (open) position, they provide a fluid path from the wheel brakes of the vehicle to the hydraulic control unit HCU accumulators and pump motor. The outlet solenoids are spring loaded in the released (closed) position during normal braking.

ASR VALVE (ABS WITH TRACTION CONTROL ONLY)

On vehicles equipped with ABS having traction control, there are two special ASR valves located in the HCU portion of the ICU. The ASR valves are a normally open type valve and are solenoid actuated.

The special ASR valves are used to isolate the rear (non-driven) wheels of the vehicle from the hydraulic pressure that the HCU pump motor is sending to the front (driven) wheels, when the traction control system is in operation. The rear brakes need to be isolated from the master cylinder when traction control is in operation so that the HCU can build the required hydraulic pressure to the front brakes.

HCU BRAKE FLUID ACCUMULATORS AND NOISE DAMPING CHAMBER

There are two brake fluid accumulators in the HCU. There is one brake fluid accumlator for the primary and secondary hydraulic circuits. The brake

DESCRIPTION AND OPERATION (Continued)

fluid accumulators temporarily store brake fluid that is decayed from the wheel brakes during an ABS cycle. This stored brake fluid is then used by the pump in the HCU to provide build pressure for the brake hydraulic system.

Additionally on vehicles that are equipped with only ABS (non-traction control vehicles) there is a mini brake fluid accumulator on the secondary hydraulic circuit which protects the master cylinder's seals during an ABS stop. There is also a noise damping chamber on the primary hydraulic circuit.

On ABS equipped vehicles with traction control, in addition to the brake fluid accumulators there are also two noise damping chambers in the HCU.

HCU PUMP/MOTOR

The HCU (Fig. 4) contains 2 pump assemblies, one for the primary and one for the secondary hydraulic circuit of the brake system. Both pumps are driven by a common electric motor (Fig. 4) which is part of the HCU. The pumps draw brake fluid from the fluid accumulators to supply build pressure to the brakes during an ABS stop. The pump motor runs during the drive-off cycle as a check and during an ABS stop and is controlled by the CAB. The Pump/Motor Assembly is not a serviceable item. If the pump/motor requires replacement the complete HCU (Fig. 4) (minus the CAB) must be replaced.

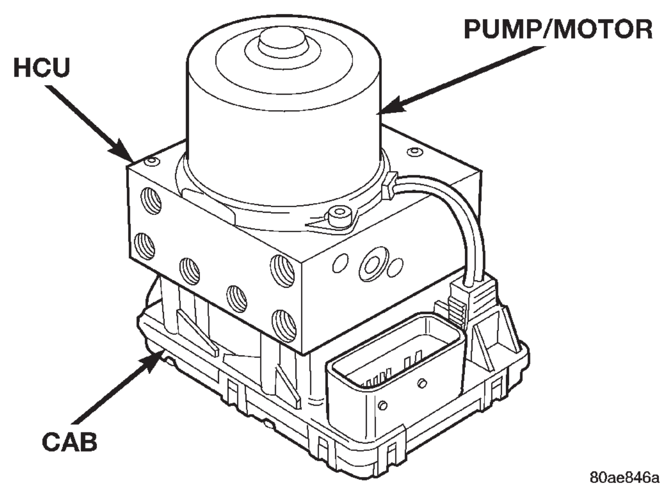

Fig. 4 Teves Mark 20 HCU Pump/Motor

ABS FUSES

The fuse for the ABS pump motor and the ABS system are located in the power distribution center (PDC) (Fig. 5). The PDC is located on the drivers side of the engine compartment forward of the strut tower. The fuse for the ABS warning lamp in the instrument panel message center is located in the junction block.

On vehicles equipped with traction control, the fuse for the traction control switch is also located in the junction block.

The junction block is located on the left hand front cowl panel on the vehicle.

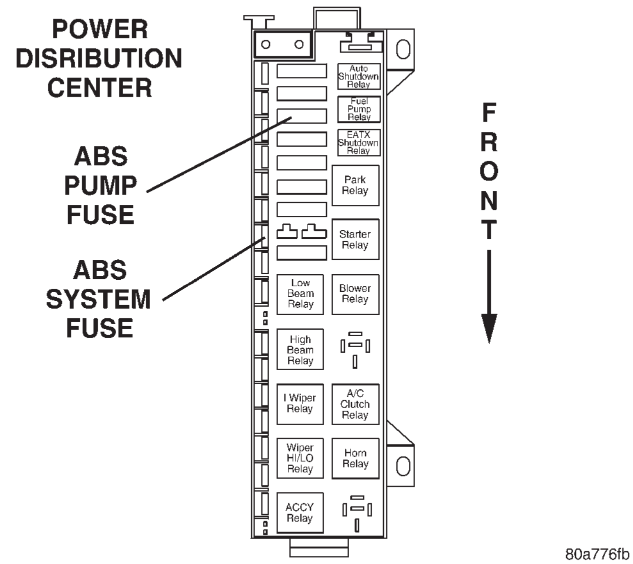

Fig. 5 Fuse Locations In Power Distribution Center

ABS RELAYS

On the Teves Mark 20 Antilock Brake System both the pump motor relay and the system relay are located in the CAB. If either of the relays is diagnosed as not functioning properly the CAB will need to be replaced. Refer to Controller Antilock Brakes in the Removal And Installation Section in this group of the service manual for the procedure.

PROPORTIONING VALVES

One assembly containing two proportioning valves are used in the system, one for each rear brake hydraulic circuit. The proportioning valve is located on the frame rail next to the fuel tank, forward of the right rear shock absorber (Fig. 6). Be sure replacement proportioning valve assemblies have the same split point and slope as the proportioning valve being replaced.

WHEEL SPEED SENSORS

One Wheel Speed Sensor WSS is located at each front and rear wheel of the vehicle (Fig. 7), (Fig. 8) and (Fig. 9). The wheel speed sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction created when a toothed sensor ring (tone wheel) (Fig. 7), (Fig. 8) and (Fig. 9) passes the stationary magnetic wheel speed sensor. The CAB converts the AC signal generated at each wheel into a digital signal. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

DESCRIPTION AND OPERATION (Continued)

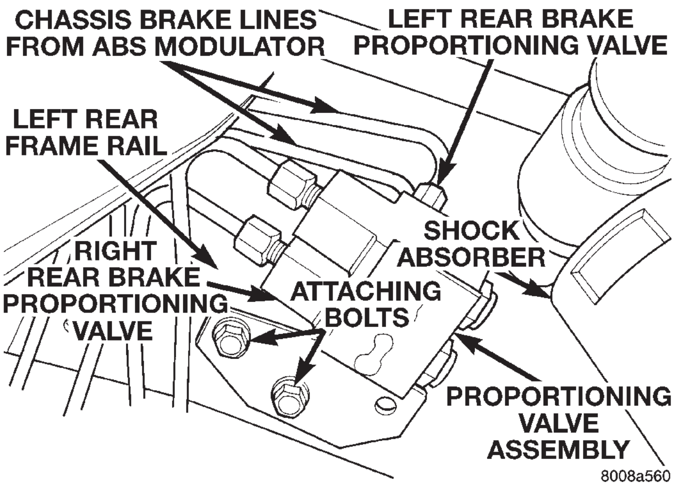

Fig. 6 Proportioning Valve Mounting Location

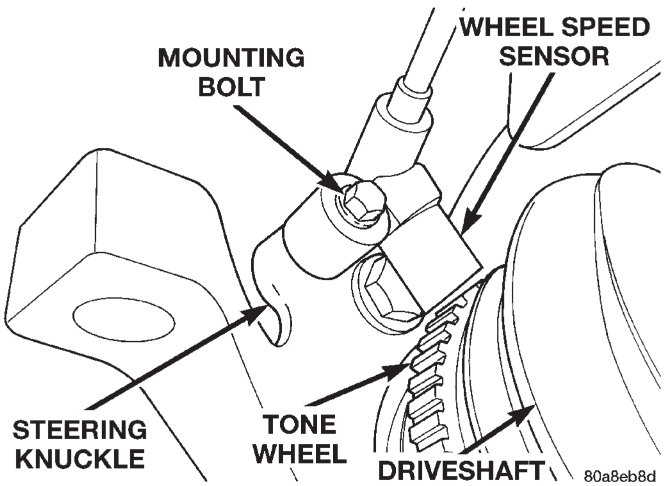

Fig. 7 Front Wheel Speed Sensor

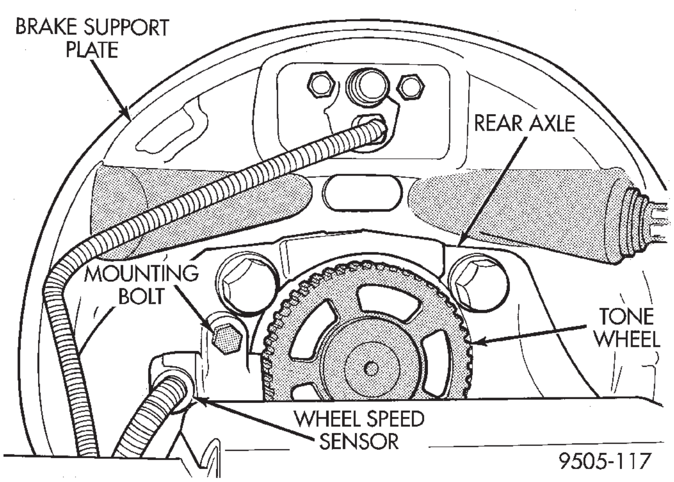

Fig. 8 Rear Wheel Speed Sensor (FWD)

The front wheel speed sensor is attached to a boss in the steering knuckle (Fig. 7). The front tone wheel (Fig. 7) is part of the driveshafts outboard constant velocity joint. The rear wheel speed sensor is

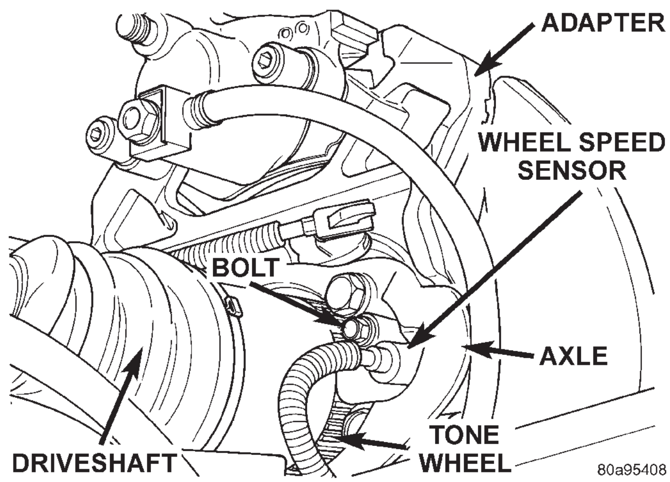

Fig. 9 Rear Wheel Speed Sensor (AWD)

mounted through the rear axle, rear brake support plate and directly to the rear bearing (Fig. 8) (Fig. 9). The rear tone wheel on a front wheel drive vehicle is an integral part of the rear wheel hub/bearing assembly. If damaged though, the rear tone wheel on a front wheel drive vehicle can be replaced as a individual component of the rear hub/bearing assembly. Refer to Rear Tone Wheel in the Remove And Install Section in this group of the service manual for the required procedure. The wheel speed sensor air gap is NOT adjustable.

The rear tone wheel on a all wheel drive vehicle, is part of the outboard constant velocity joint on the rear driveshaft (Fig. 9).

The four wheel speed sensors are all serviced individually, but the front tone wheel on all vehicles and the rear tone wheel on all wheel drive vehicles are serviced as part of the front or rear driveshaft outboard constant velocity joint (Fig. 7) and (Fig. 9).

Correct ABS system operation is dependent on accurate wheel speed signals. The vehicle's wheels and tires must all be the same size and type to generate accurate signals. Variations in wheel and tire size can produce inaccurate wheel speed signals, which can cause false ABS cycles to occur.

CONTROLLER ANTILOCK BRAKES (CAB)

The Controller Antilock Brakes (CAB) is a microprocessor based device which monitors the ABS system during normal braking and controls it when the vehicle is in an ABS stop. The CAB is mounted to the bottom of the HCU (Fig. 10). The CAB uses a 25 way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the Run or On position. **THE (CAB) IS ON THE CCD BUS**

DESCRIPTION AND OPERATION (Continued)

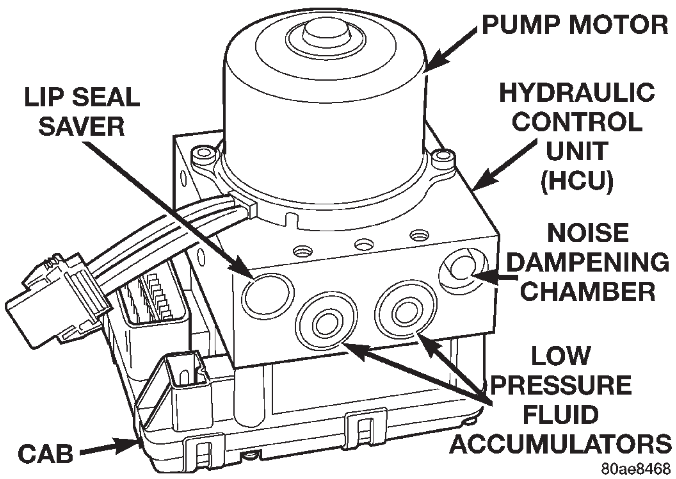

Fig. 10 Controller Antilock Brake (CAB)

The primary functions of the (CAB) are:

(1) Detect wheel locking or wheel slipping tendencies by monitoring the speed of all four wheels of the vehicle.

(2) Illuminate the TRAC lamp in the message center on the instrument panel when a traction control event is occurring.

(3) Control fluid modulation to the wheel brakes while the system is in an ABS mode or the traction control system is activated.

(4) Monitor the system for proper operation.

(5) Provide communication to the DRB Scan Tool while in diagnostic mode.

(6) Store diagnostic information.

(7) **The CAB continuously communicates with the body controller by sending out a message to the body controller on the CCD Bus. This message is used for illumination of the yellow antilock warning lamp. This is used if the ABS controller communication is lost in the hard wire between the body controller and the yellow antilock warning lamp. If the body controller does not receive this message from the CAB, the body controller will illuminate the antilock yellow warning lamp.**

The CAB continuously monitors the speed of each wheel through the signals generated by the wheel speed sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the CAB commands the CAB command coils to actuate. The CAB command coils then open and close the valves in the HCU which modulate brake fluid pressure in some or all of the hydraulic circuits. The CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The ABS system is constantly monitored by the CAB for proper operation. If the CAB detects a fault, it will turn on the Amber ABS Warning Lamp and disable the ABS braking system. The normal base braking system will remain operational.

The CAB contains a self-diagnostic program which will turn on the Amber ABS Warning Lamp when a ABS system fault is detected. Faults are then stored in a diagnostic program memory. There are multiple fault messages which may be stored in the CAB and displayed through the DRB Scan Tool. These fault messages will remain in the CAB memory even after the ignition has been turned off. The fault messages can be read and or cleared from the CAB memory by a technician using the DRB Scan Tool. The fault occurrence and the fault code will also be automatically cleared from the CAB memory after the identical fault has not been seen during the next 3500 miles of vehicle operation. Mileage though of the last fault occurrence will not be automatically cleared.

CONTROLLER ANTILOCK BRAKE INPUTS

- Four wheel speed sensors.
- Stop lamp switch.
- Ignition switch.
- System relay voltage.
- Ground.
- Traction Control Switch (If Equipped).
- Diagnostics Communications (CCD)

CONTROLLER ANTILOCK BRAKE OUTPUTS

- C2D Communication To Body Controller And Instrument Cluster
- ABS warning lamp actuation.
- Traction Control Light (If Equipped).
- Diagnostic communication. (CCD)

ABS WARNING LAMP (YELLOW)

The ABS system uses a yellow colored ABS Warning Lamp. The ABS warning lamp is located on the right side of the message center located at the top of the instrument panel. The purpose of the warning lamp is discussed in detail below.

The ABS warning lamp will turn on when the CAB detects a condition which results in a shutdown of ABS function or when the body controller does not receive C2D messages from the CAB. When the ignition key is turned to the on position, the ABS Warning Lamp is on until the CAB completes its self tests and turns the lamp off (approximately 4 seconds after the ignition switch is turned on). Under most conditions, when the ABS warning lamp is on, only the ABS function of the brake system is affected. The standard brake system and the ability to stop the car will not be affected when only the ABS warning lamp is on.

The ABS warning lamp is controlled by the CAB and the body controller through a diode located in the wiring harness junction block. The junction block is located under the instrument panel to the left of

DESCRIPTION AND OPERATION (Continued)

the steering column. The CAB and the body controller, controls the yellow ABS warning lamp by directly grounding the circuit.

HYDRAULIC CIRCUITS AND VALVE OPERATION

Through the following operation descriptions the function of the various hydraulic control valves in the ABS will be described. The fluid control valves mentioned below, control the flow of pressurized brake fluid to the wheel brakes during the different modes of ABS braking.

For explanation purposes, all wheel speed sensors except the right front are sending the same wheel speed information. The following diagrams show only the right front wheel in a antilock braking condition.

NORMAL BRAKING HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION

This condition is the normal operation of the vehicles base brake hydraulic system. The hydraulic system circuit diagram (Fig. 11) shows a situation where no wheel spin or slip is occurring relative to the speed of the vehicle. The driver is applying the brake pedal to build pressure in the brake hydraulic system to apply the brakes and stop the vehicle.

TEVES MARK 20 ABS CIRCUIT AND SOLENOID VALVE FUNCTION

This hydraulic circuit diagram (Fig. 12) shows the vehicle in the ABS braking mode. This hydraulic circuit (Fig. 12) shows a situation where one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than the surface the vehicle's tires are on will allow. The normally open and normally closed valves modulate the brake hydraulic pressure as required. The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits. The brake fluid will then be routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

TEVES MARK 20 SECONDARY ABS CIRCUIT AND SOLENOID VALVE FUNCTION

This hydraulic circuit diagram (Fig. 13) shows the vehicle in the ABS braking mode. This hydraulic circuit (Fig. 13) shows a situation where one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than the surface the vehicle's tires are on will allow. The normally open and normally closed valves modulate the brake hydraulic pressure as required. The pump/motor is switched on so that the brake fluid from the low pressure accu-

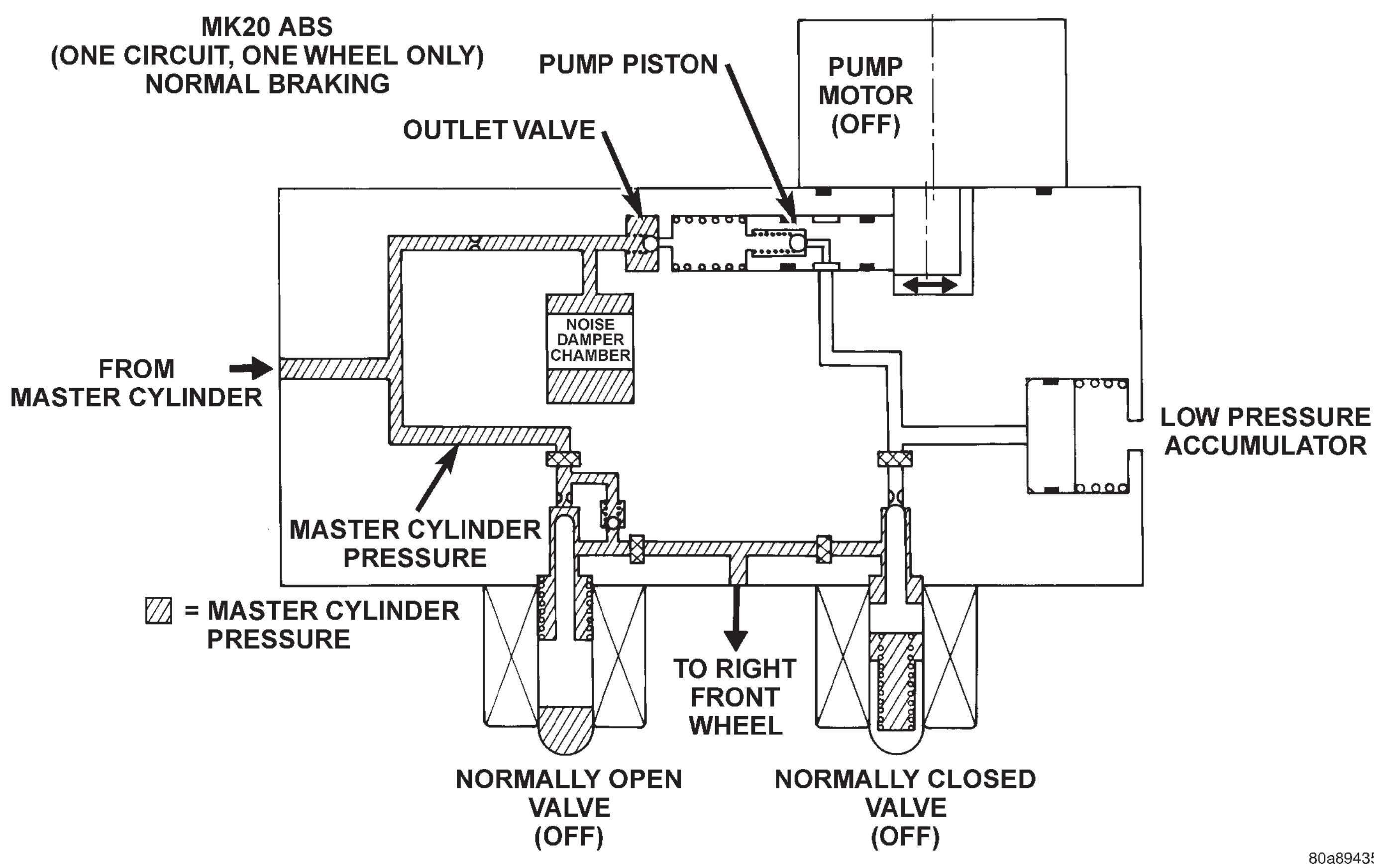

Fig. 11 Normal Braking Hydraulic Circuit

DESCRIPTION AND OPERATION (Continued)

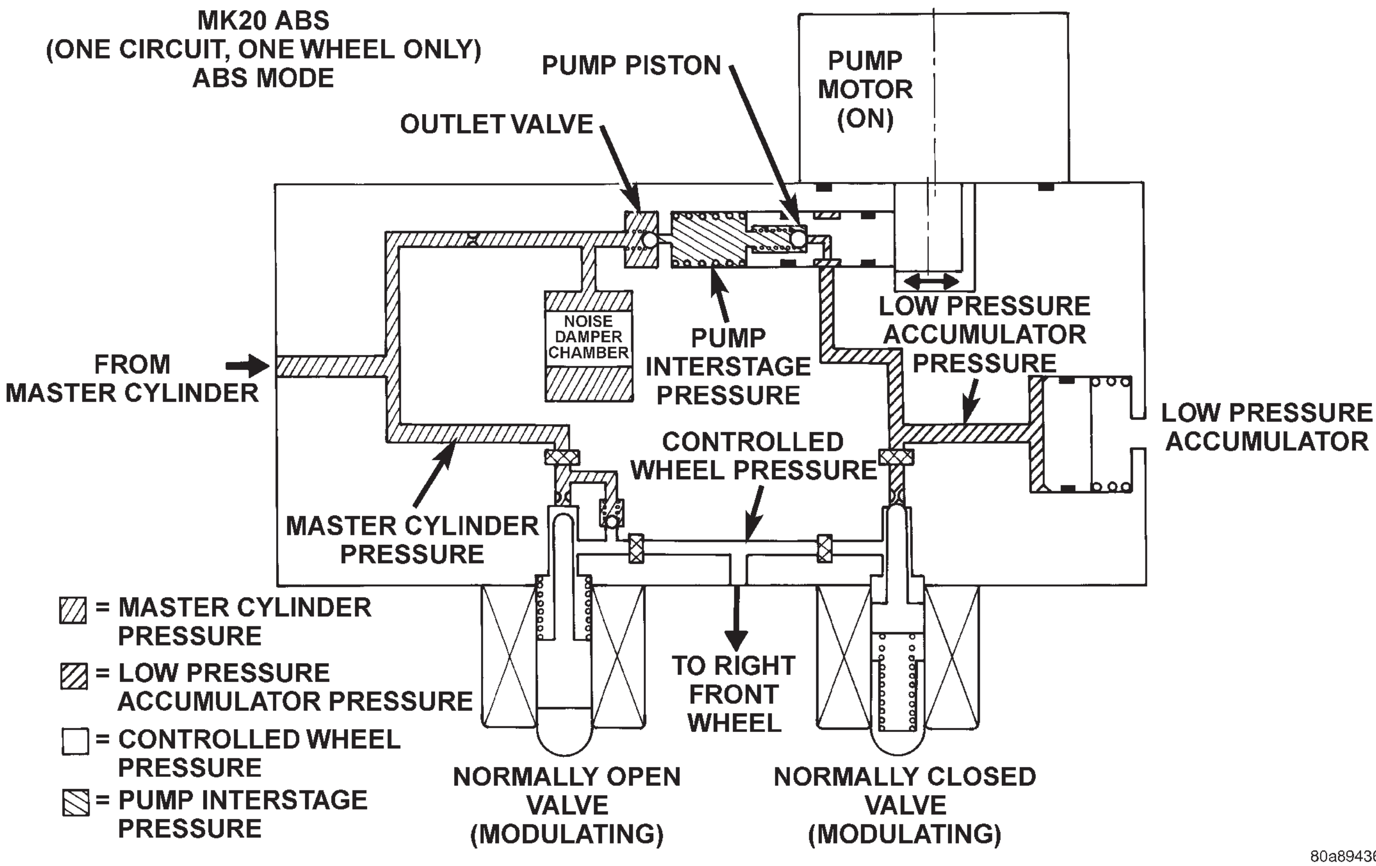

Fig. 12 ABS Mode Hydraulic Circuit

mulators is returned to the master cylinder circuits. The brake fluid will then be routed to either the master cylinder or the wheel brake depending on the position of the normally open valve. A volume of 1.2 cc's of brake fluid is taken in by the lip seal saver (Fig. 13) to protect the lip seals on the piston of the master cylinder.

TEVES MARK 20 ABS WITH TRACTION CONTROL NORMAL BRAKING HYDRAULIC CIRCUIT – SOLENOID AND SHUTTLE VALVE FUNCTION

This condition is the normal operation of the vehicles base brake hydraulic system when the vehicle is equipped with ABS and traction control. The hydraulic system circuit diagram (Fig. 14) shows a situation where no wheel spin or slip is occurring relative to the speed of the vehicle. The driver is applying the brake pedal to build pressure in the brake hydraulic system to apply the brakes and stop the vehicle. The hydraulic shuttle valve (Fig. 14) closes with every brake pedal application so pressure is not created at the inlet to the pump.

TEVES MARK 20 ABS WITH TRACTION CONTROL ABS BRAKING HYDRAULIC CIRCUIT – SOLENOID AND SHUTTLE VALVE FUNCTION

This hydraulic circuit diagram (Fig. 15) shows a vehicle equipped with ABS and traction control in the ABS braking mode. This hydraulic circuit (Fig. 15) shows a situation where one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than the surface the vehicle's tires are on will allow. The hydraulic shuttle valve (Fig. 15) closes upon brake application so that the pump can not suck brake fluid from the master cylinder. The normally open and normally closed valves modulate the brake hydraulic pressure as required. The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits. The brake fluid will then be routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

DESCRIPTION AND OPERATION (Continued)

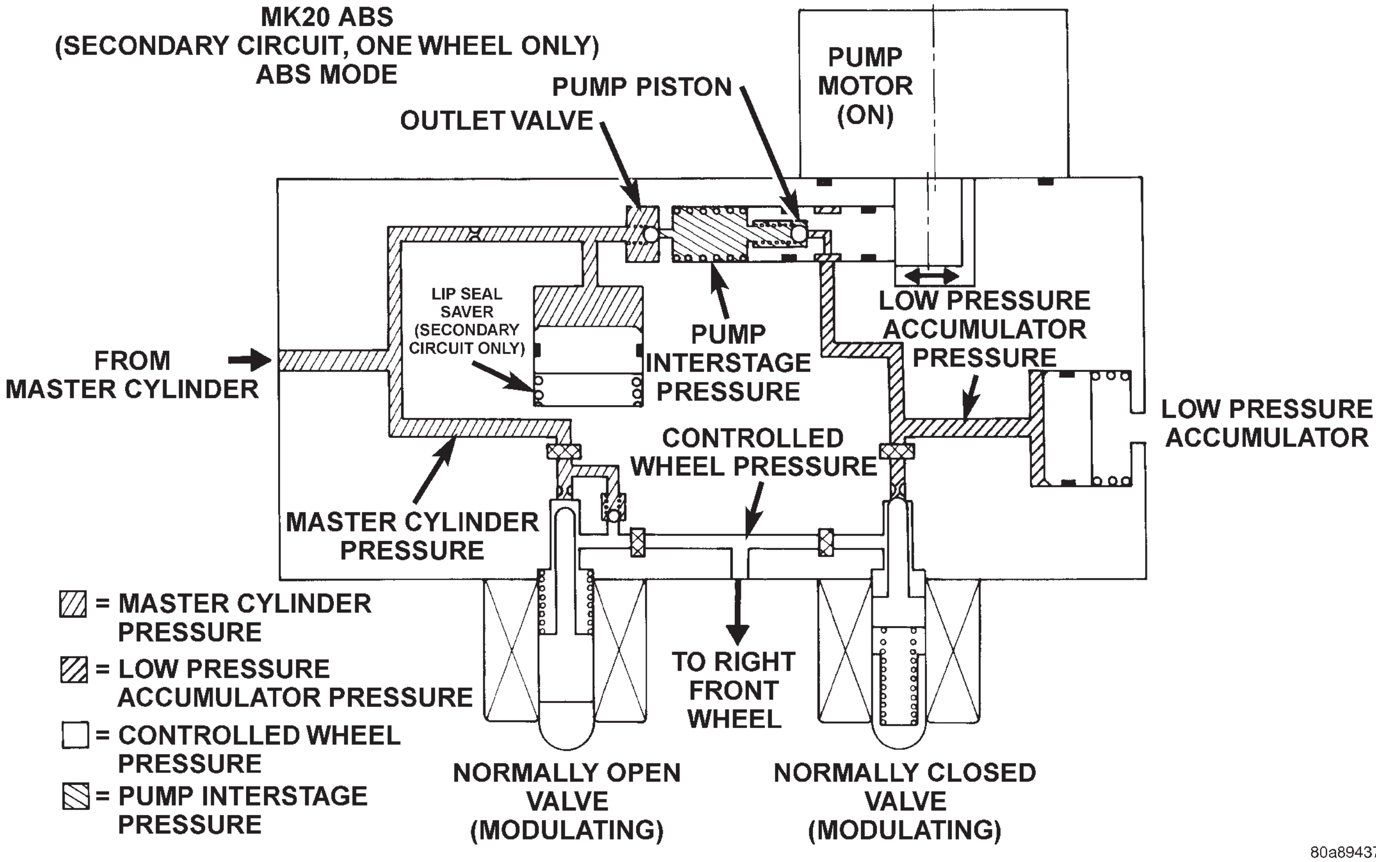

Fig. 13 ABS Mode Secondary Hydraulic Circuit

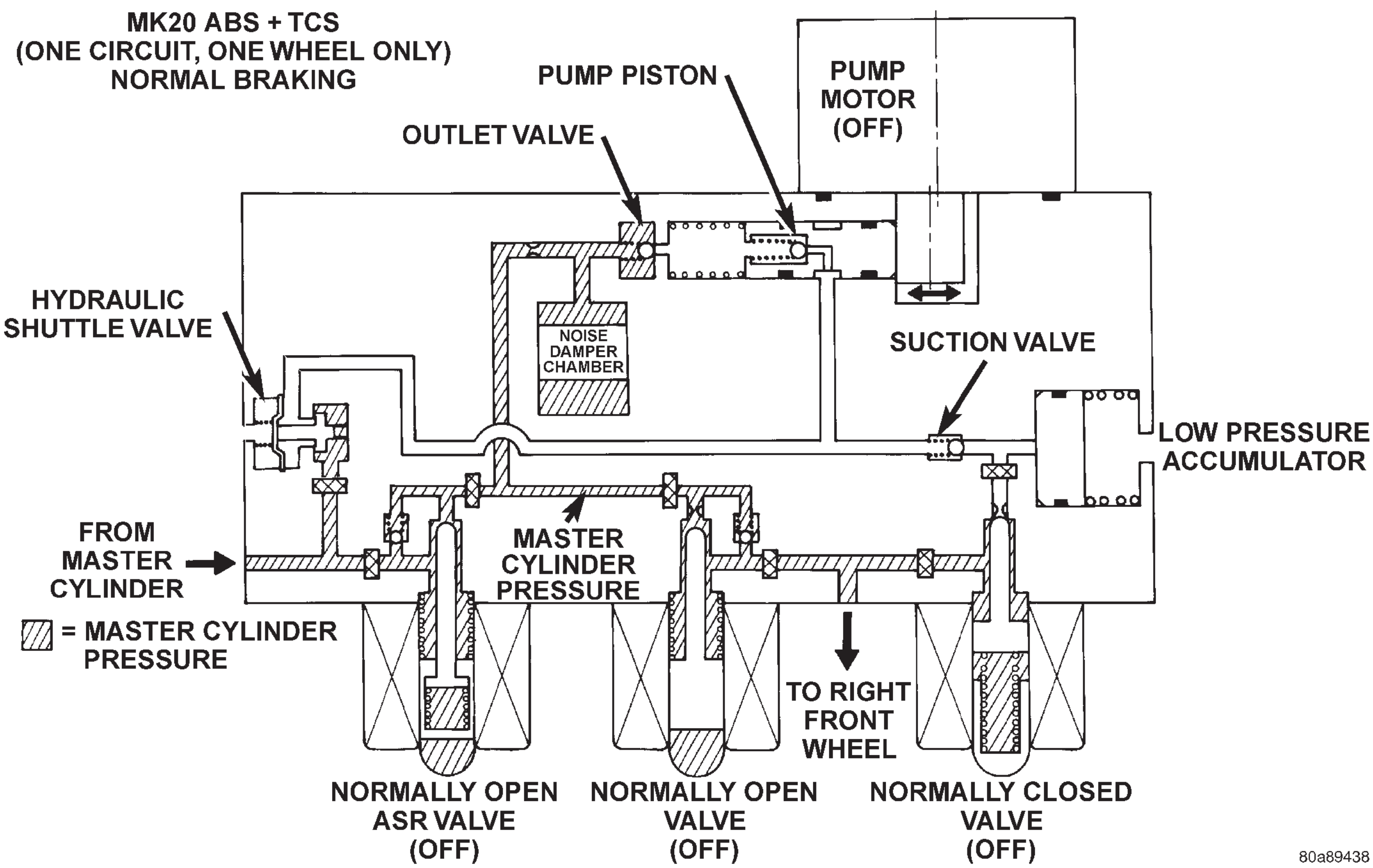

Fig. 14 ABS With Traction Control Normal Braking Hydraulic Circuit

DESCRIPTION AND OPERATION (Continued)

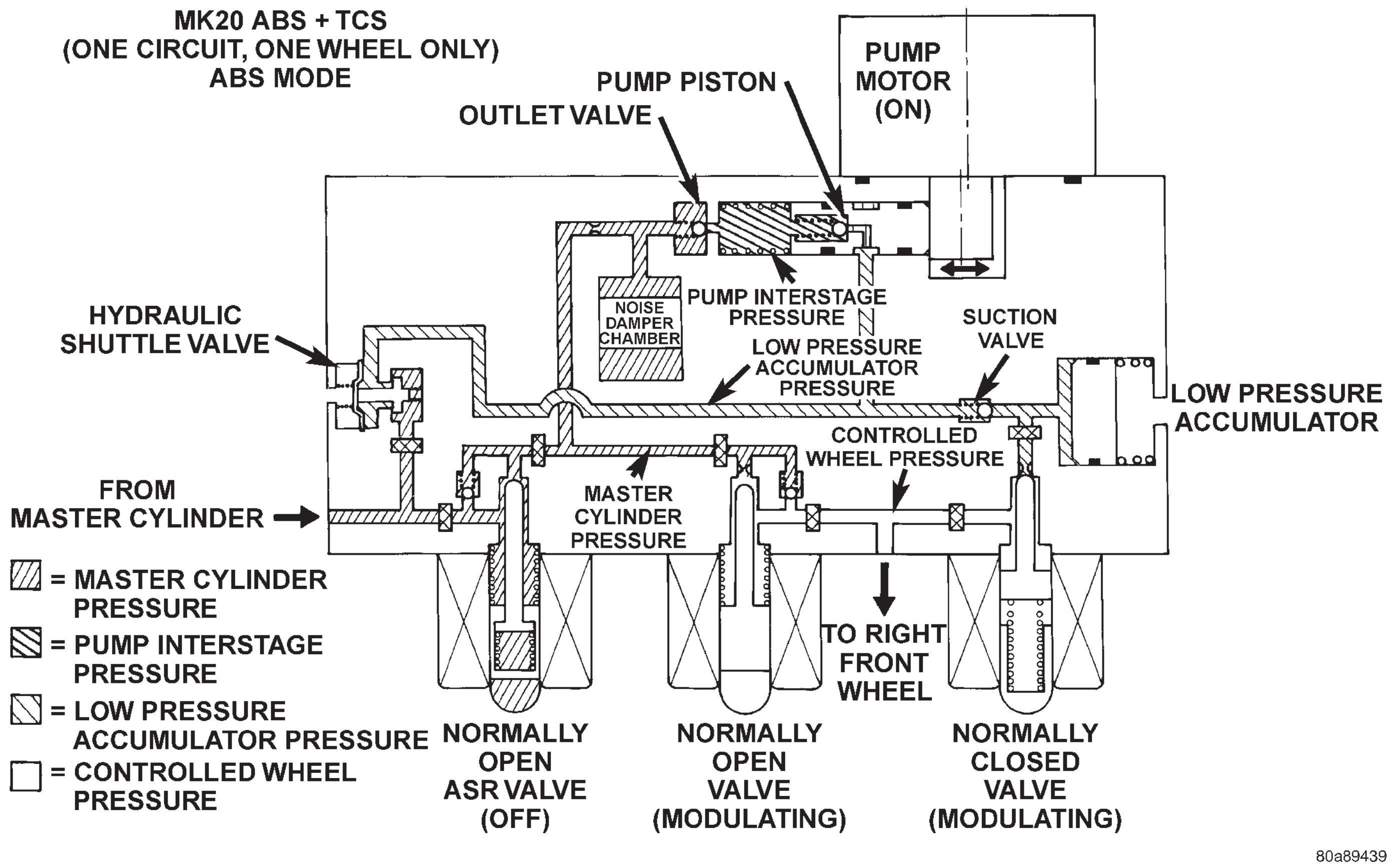

Fig. 15 ABS With Traction Control ABS Braking Hydraulic Circuit

TEVES MARK 20 ABS WITH TRACTION CONTROL– TRACTION CONTROL HYDRAULIC CIRCUIT – SOLENOID AND SHUTTLE VALVE FUNCTION

This hydraulic circuit diagram (Fig. 16) shows a vehicle equipped with ABS and traction control in the traction control mode. The hydraulic circuit (Fig. 16) shows a situation where a driven wheel is spinning and brake pressure is required to reduce its speed. The normally open ASR valve (Fig. 16) is energized to isolate the brake fluid being pumped from the master cylinder and to isolate the driven wheel. Also, the normally open ASR valve bypasses the pump output back to the master cylinder at a fixed pressure setting. The normally open and normally closed valves (Fig. 16) modulate the brake pressure as required to the spinning wheel.

DIAGNOSIS AND TESTING

ABS GENERAL DIAGNOSTICS INFORMATION

This section contains the information necessary to diagnose the ITT Teves Mark 20 ABS Brake System. Specifically, this section should be used to help diagnose conditions which result in any of the following:

(1) ABS Warning Lamp turned on.

(2) Brakes Lock-up on hard application

Diagnosis of base brake conditions which are obviously mechanical in nature should be directed to Group 5 Brakes in this service manual. This includes brake noise, brake pulsation, lack of power assist, parking brake, Red BRAKE Warning Lamp lighting, or vehicle vibration during normal braking.

Many conditions that generate customer complaints may be normal operating conditions, but are judged to be a problem due to not being familiar with the ABS system. These conditions can be recognized without performing extensive diagnostic work, given adequate understanding of the operating principles and performance characteristics of the ABS. See the ABS System Operation Section in this group of the service manual to familiarize yourself with the operating principles of the ABS system.

ABS WIRING DIAGRAM INFORMATION

During the diagnosis of the antilock brake system it may become necessary to reference the wiring diagrams covering the antilock brake system and its components. For wiring diagrams refer to Antilock Brakes in Group 8W of this service manual. This group will provide you with the wiring diagrams and the circuit description and operation information covering the antilock brake system.

DIAGNOSIS AND TESTING (Continued)

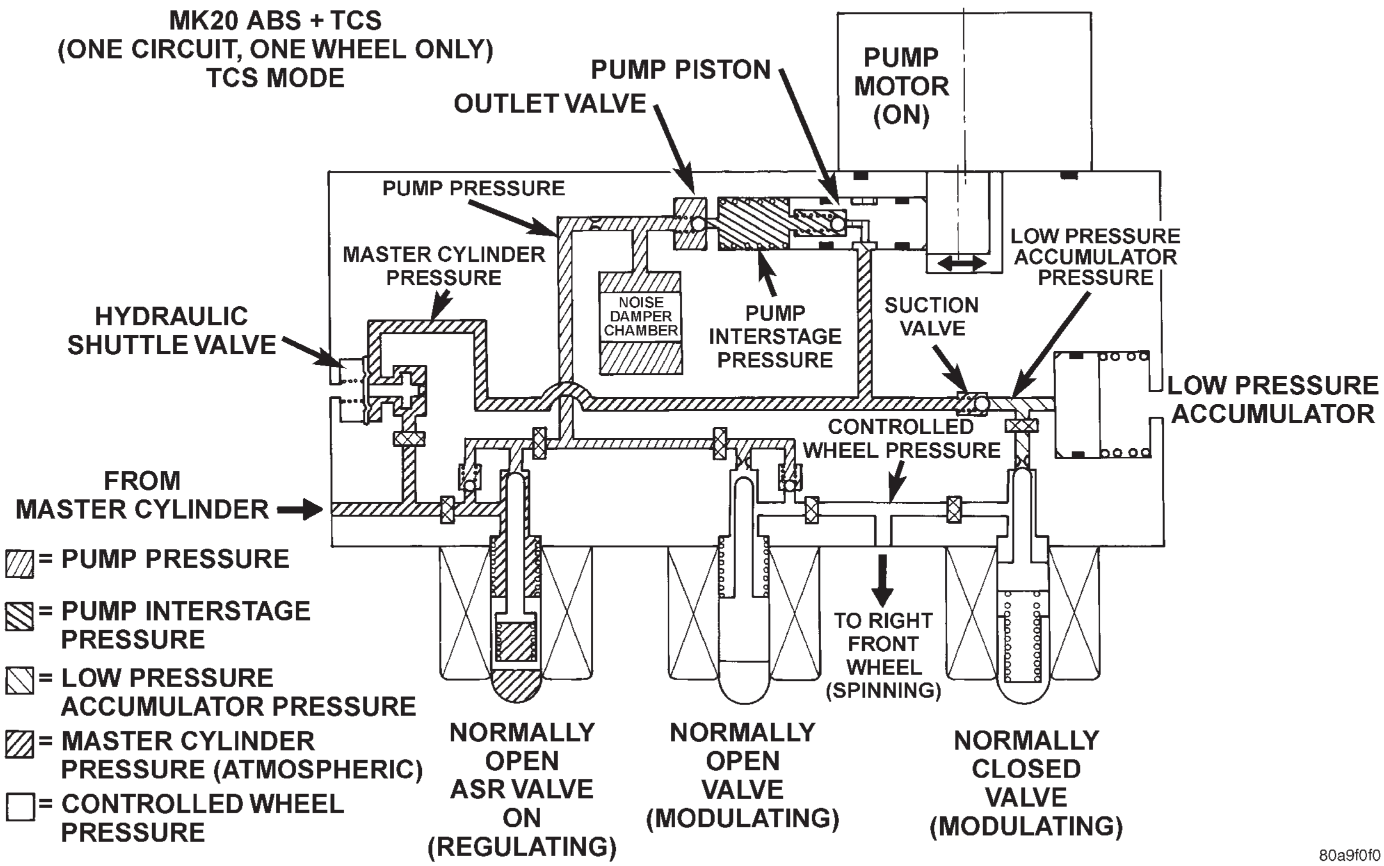

Fig. 16 Traction Control Hydraulic Circuit

ABS DIAGNOSTICS MANUAL

Detailed procedures for diagnosing specific ABS conditions are covered in the diagnostics manual covering the ITT Teves Mark 20 ABS system. The following information is presented to give the technician a general background on the diagnostic capabilities of the ITT Teves Mark 20 ABS system. Please refer to the above mentioned manual for any further electronic diagnostics and service procedures that are required.

DRB DIAGNOSTIC SCAN TOOL USAGE

The diagnostics of the ITT Teves Mark 20 ABS system is performed using the DRB scan tool. Refer to the diagnostics manual covering the ITT Teves Mark 20 ABS system for the required diagnostics and testing procedures and the DRB operators manual for its proper operational information.

ABS BRAKE DIAGNOSTIC TOOL CONNECTOR

On this vehicle, the diagnostic connector used for the diagnosis of the ITT Teves Mark 20 ABS system is located under the lower steering column cover, to the left side of the steering column, just below the hood release lever (Fig. 17). The ITT Teves Mark 20 ABS system uses the ISO 9141-K connector which is shared by other vehicle diagnostic systems such as the powertrain control module and air bag electronic control module.

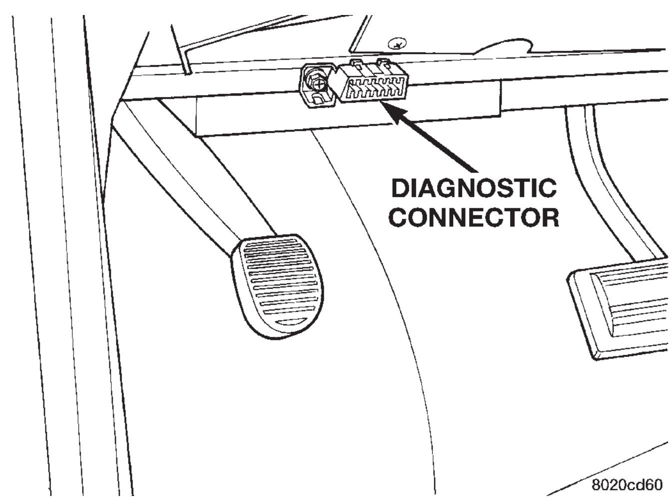

Fig. 17 Diagnostic Scan Tool Data Link Connector

ABS SYSTEM SELF DIAGNOSTICS

The ITT Teves Mark 20 ABS system is equipped with a self diagnostic capability which may be used to assist in the isolation of ABS faults. The features of the self diagnostics system are described below.

DIAGNOSIS AND TESTING (Continued)

START-UP CYCLE

The self diagnostic ABS start up cycle begins when the ignition switch is turned to the on position. Electrical checks are completed on ABS components, such as the Controller, solenoid continuity, and the system relay operation. During this check the Amber ABS Warning Light is turned on for approximately 4 seconds and the brake pedal may emit a popping sound and move slightly when the solenoid valves are checked.

DRIVE-OFF CYCLE

Further Functional testing is accomplished once the vehicle is set in motion and reaches a speed of about 20 kph (12 mph.). This cycle is performed only once after each ignition on/off cycle.

- The pump/motor is activated briefly to verify function. When the pump/motor is activated a whirling or buzzing sound may be heard by the driver, which is normal when the pump/motor is running.
- The wheel speed sensor output is verified to be within the correct operating range.

ONGOING TESTS

Other tests are performed on a continuous basis. These include checks for solenoid continuity, wheel speed sensor continuity and wheel speed sensor output.

ABS DIAGNOSTIC TROUBLE CODES

Diagnostic trouble codes (DTC) are kept in the controller's memory until either erased by the technician using the DRB or erased automatically after 3500 miles. DTC's are retained by the controller even if the ignition is turned off or the battery is disconnected. More than one DTC can be stored at a time. The mileage of the most recent occurrence, number of occurrences and the DTC that was stored is also displayed. Most functions of the CAB and the ABS system can be accessed by the technician for testing and diagnostic purposes by using the DRB.

LATCHING VERSUS NON-LATCHING DIAGNOSTIC TROUBLE CODES

Some DTC's detected by the CAB are latching; the DTC is latched and ABS braking is disabled until the ignition switch is reset. Thus ABS braking is non operational even if the original DTC has disappeared. Other DTC's are non-latching; any warning lights that are turned on, are only turned on as long as the DTC condition exists. As soon as the condition goes away, the ABS Warning Light is turned off, although a DTC will be set in most cases.

INTERMITTENT DIAGNOSTIC TROUBLE CODES

As with virtually any electronic system, intermittent electrical problems in the ABS system may be difficult to accurately diagnose.

Most intermittent electrical problems are caused by faulty electrical connections or wiring. When an intermittent fault is encountered, check suspect circuits for:

A visual inspection for loose, disconnected, or misrouted wires should be done before attempting to diagnose or service the ITT Teves Mark 20 antilock brake system. A visual inspection will eliminate unnecessary testing and diagnostics time. A thorough visual inspection will include the following components and areas of the vehicle.

(1) Inspect fuses in the power distribution center (PDC) and the wiring junction block. Verify that all fuses are fully inserted into the PDC and wring junction block. A label on the underside of the PDC cover identifies the locations of the ABS fuses in the PDC.

(2) Inspect the 25-way electrical connector at the CAB for damage, spread or backed-out wiring terminals. Verify that the 25-way connector is fully inserted in the socket on the CAB. Be sure that wires are not stretched tight or pulled out of the connector.

(3) Verify that all the wheel speed sensor connections are secure.

(4) Poor mating of connector halves or terminals not fully seated in the connector body.

(5) Improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(6) Poor terminal to wire connection. This requires removing the terminal from the connector body to inspect.

(7) Pin presence in the connector assembly

(8) Proper ground connections. Check all ground connections for signs of corrosion, tight fasteners, or other potential defects. Refer to wiring diagram manual for ground locations.

(9) Problems with main power sources of the vehicle. Inspect battery, generator, ignition circuits and other related relays and fuses.

(10) If a visual check does not find the cause of the problem, operate the car in an attempt to duplicate the condition and record the trouble code.

(11) Most failures of the ABS system will disable ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, which will allow ABS operation to resume during the ignition cycle in which a failure occurred if the failure conditions are no longer present. The following conditions may result in intermittent illumination of the ABS Warning Lamp. All other failures will cause the lamp to remain on until the ignition switch is turned off. Circuits involving

DIAGNOSIS AND TESTING (Continued)

these inputs to the CAB should be investigated if a complaint of intermittent warning system operation is encountered.

(12) Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

(13) High system voltage. If high system voltage is detected by the CAB, the CAB will turn on the Amber ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is again detected by the CAB, normal ABS operation will be resumed at the next key on cycle.

(14) Additionally, any condition which results in interruption of electrical current to the CAB or modulator assembly may cause the ABS Warning Lamp to turn on intermittently.

(15) The body controller can turn on the (yellow) ABS warning lamp if CCD communication between the body controller and the CAB is interupted.

TONEWHEEL INSPECTION

CAUTION: The tone wheels used on this vehicle equipped with the Teves Mark 20 Antilock Brake System are different then those used on past models of this vehicle equipped with antilock brakes. Reduced braking performance will result if this part is used on earlier model vehicles and an accident could result. Do not use on pre-1998 model year vehicles.

Carefully inspect tonewheel at the suspected faulty wheel speed sensor for missing, chipped or broken teeth, this can cause erratic speed sensor signals.

Tonewheels should show no evidence of contact with the wheel speed sensors. If contact was made, determine cause and correct before replacing the wheel speed sensor.

Excessive runout of the tonewheel can cause erratic wheel speed sensor signals. Refer to Tonewheel Runout in the Specification Section in this section of the service manual for the tonewheel runout specification. Replace drive shaft assembly or rear hub/bearing assembly if tonewheel runout exceeds the specification.

Inspect tonewheels for looseness on their mounting surfaces. Tonewheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface.

Check the wheel speed sensor head alignment to the tone wheel. Also check the gap between the speed sensor head and the tone wheel to ensure it is at specification. Refer to Wheel Speed Sensor Clearance in the Specification Section in this section of the service manual.

PROPORTIONING VALVE

CAUTION: Proportioning valves (Fig. 18) should never be disassembled.

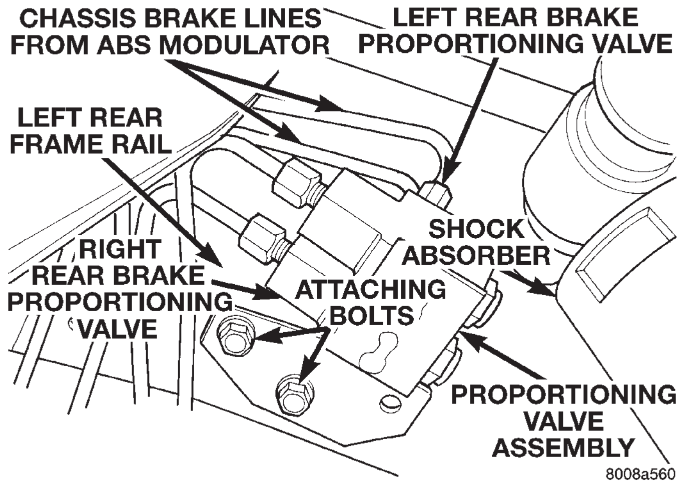

Fig. 18 Brake Proportioning Valve Identification

If premature rear wheel skid occurs on hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

If a malfunctioning proportioning valve is suspected on a vehicle, refer to Proportioning Valve Test in the Proportioning Valves Section in this group of the service manual for the required test procedure.

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.

TEST DRIVING ABS COMPLAINT VEHICLE

Most ABS complaints will require a test drive as a part of the diagnostic procedure. The purpose of the test drive is to duplicate the condition.

NOTE: Remember conditions that result in the turning on of the Red BRAKE Warning Lamp may indicate reduced braking ability. The following procedure should be used to test drive an ABS complaint vehicle.

DIAGNOSIS AND TESTING (Continued)

Before test driving a brake complaint vehicle, note whether the Red or Amber Brake Warning Lamp is turned on. If it is the Red Brake Warning Lamp, refer to the hydraulic system section in the brake group of this manual. If the ABS Warning lamp was/is on, test drive the vehicle as described below, to verify the complaint. While the ABS Warning Lamp is on, the ABS is not functional. The standard brake system and the ability to stop the car may not be affected if only the ABS Warning Lamp is on.

Discuss with the owner of the vehicle or note any other electrical problems or conditions that may be occurring on the vehicle. They may have an effect on the antilock brake system's function.

(1) Turn the key to the off position and then back to the on position. Note whether the ABS Warning Lamp continues to stay on. If it does, refer to the diagnostic manual covering the ITT Teves Mark 20 ABS system for the required test procedures.

(2) If the ABS Warning Lamp goes out, shift into gear and drive the car to a speed of 20 kph (12 mph) to complete the ABS start up cycle. If at this time the ABS Warning Lamp goes on refer to the ITT Teves Mark 20 Diagnostic Manual.

(3) If the ABS Warning Lamp remains OUT, drive the vehicle a short distance. During this test drive be sure that the vehicle achieves at least 40 mph. Brake to at least one complete stop in an ABS cycle, and again accelerate to 25 mph.

(4) If a functional problem with the ABS system is determined while test driving a vehicle, refer to the diagnostic manual covering the ITT Teves Mark 20 ABS system for the required test procedures and proper use of the DRB diagnostic scan tool.

ABS SERVICE PRECAUTIONS

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits. **In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter or the DRB tester as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, ect.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

SERVICE PROCEDURES

BRAKE FLUID LEVEL INSPECTION

CAUTION: Use only Mopar brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

For the specific procedure covering the inspection of the brake fluid level and adding brake fluid to the reservoir, refer to the Service Adjustments Section in this group of the service manual.

BLEEDING TEVES MARK 20 HYDRAULIC SYSTEM

The base brake system must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake lines, hoses or components. The ABS system, particularly the HCU, should only be bled when the HCU is replaced or removed from the vehicle, or if there is reason to believe the HCU has ingested air. Under most circumstances that would require brake bleeding, only the base brake system needs to be bled.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During bleeding operations, be sure that the brake fluid level remains close to the FULL level in the reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The Teves Mark 20 ABS hydraulic system and the base brake hydraulic system must be bled as two independent braking systems. The non ABS portion of the brake system is to be bled the same as any non ABS system. Refer to the Service Adjustments section in this manual for the proper bleeding procedure to be used. This brake system can be either pressure bled or manually bled.

The ABS portion of the brake system MUST be bled separately. This bleeding procedure requires the use of the DRB Diagnostic Tester and the bleeding sequence procedure outlined below.

ABS BLEEDING PROCEDURE

When bleeding the ABS system, the following bleeding sequence **MUST** be followed to insure complete and adequate bleeding. The ABS system can be bled using a manual bleeding procedure or standard pressure bleeding equipment.

SERVICE PROCEDURES (Continued)

If the brake system is to be bled using pressurized bleeding equipment, refer to Bleeding Brake System in the Service Adjustments section at the beginning of this group for proper equipment usage and procedures.

(1) Assemble and install all brake system components on the vehicle making sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB Diagnostics Tester to the diagnostics connector. The Teves Mark 20 ABS diagnostic connector is located under the instrument panel to the left of the steering column cover.

(3) Using the DRB, check to make sure the CAB does not have any fault codes stored. If it does, remove them using the DRB.

WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in the Service Adjustments section of this service manual.

(5) Using the DRB, go to the ″Bleed ABS″ routine. Apply the brake pedal firmly and initiate the ″Bleed ABS″ cycle one time. Release the brake pedal.

(6) Bleed the base brake system again, as in step Step 4 above.

(7) Repeat steps Step 5 and Step 6 above until brake fluid flows clear and is free of any air bubbles. Check brake fluid level in reservoir periodically to prevent reservoir from running low on brake fluid.

(8) Test drive the vehicle to be sure brakes are operating correctly and that brake pedal is solid.

REMOVAL AND INSTALLATION

ABS GENERAL SERVICE PRECAUTIONS

CAUTION: Review this entire section prior to performing any mechanical work on a vehicle equipped with the ITT Tevis Mark 20 ABS brake system. This section contains information on precautions pertaining to potential component damage, vehicle damage and personal injury which could result when servicing an ABS equipped vehicle.

CAUTION: Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

CAUTION: Certain components of the ABS System are not intended to be serviced individually. Attempting to remove or disconnect certain system components may result in improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

CAUTION: When performing any service procedure on a vehicle equipped with ABS do not apply a 12 volt power source to the ground circuit of the pump motor in the CAB. Doing this will damage the pump motor and will require replacement of the HCU.

The following are general cautions which should be observed when servicing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS System component damage.

If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

The CAB 25 way connector connector should never be connected or disconnected with the ignition switch in the ON position.

Many components of the ABS System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

HYDRAULIC CONTROL UNIT

REMOVE

(1) Disconnect the negative (ground) cable from the battery and isolate cable.

(2) Using a brake pedal depressor, move and lock the brake pedal to a position past the first inch of pedal travel. **This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the HCU.**

(3) Raise vehicle. Vehicle is to be raised and supported on jackstands or on a frame contact type

REMOVAL AND INSTALLATION (Continued)

hoist. See Hoisting in the Lubrication And Maintenance section of this service manual.

(4) Remove the routing clip attaching the HCU wiring harness to the HCU mounting bracket (Fig. 19).

CAUTION: Do not apply a 12 volt power source to any terminals of the 25 way HCU connector when disconnected.

(5) Remove the 25 way connector (Fig. 19) from the CAB. The 25 way connector is removed from the CAB using the following procedure. Grasp the lock on the 25 way connector (Fig. 19) and pull it as far out as possible (Fig. 20). This will raise and unlock the 25 way connector from the socket on the CAB.

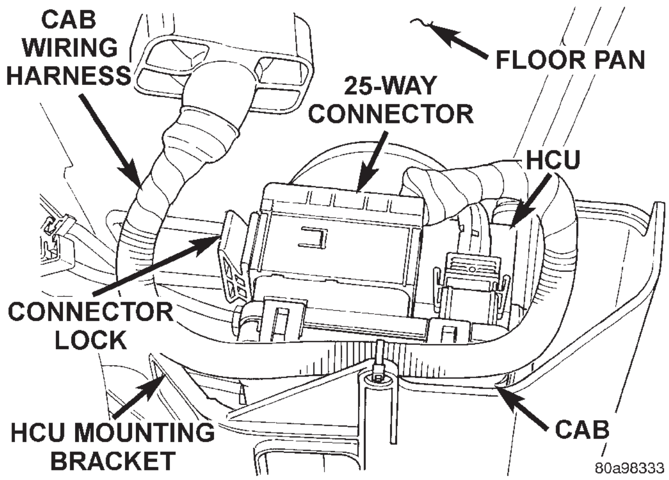

Fig. 19 CAB 25 Way Connector

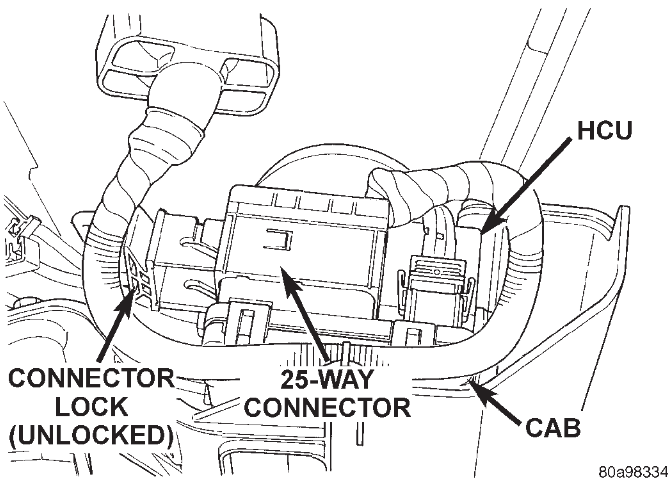

Fig. 20 Unlocked 25 Way CAB Connector

CAUTION: Before removing the brake tubes from the HCU, the HCU must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the ports of HCU or entering the brake tubes.

(6) Thoroughly clean all surfaces of the HCU, and all brake tube nuts located on the HCU. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent to clean the HCU.

(7) Remove the brake tubes (6) from the inlet and outlet ports on the HCU. (Fig. 21).

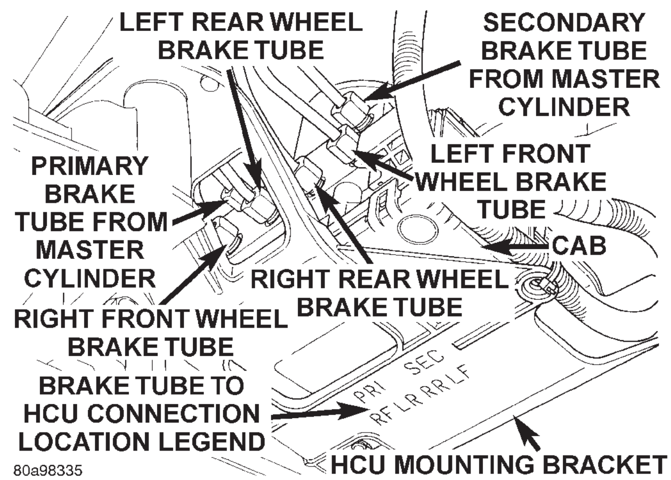

Fig. 21 Brake Tube Connections To HCU

(8) Remove the 3 bolts (Fig. 22) attaching the HCU mounting bracket to the front suspension crossmember.

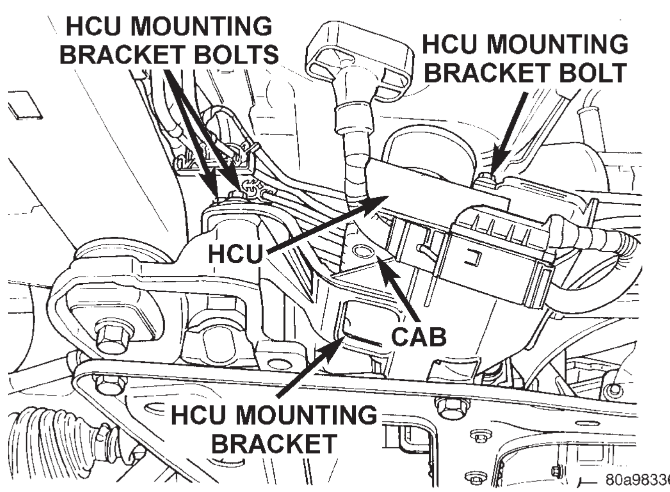

Fig. 22 HCU To Suspension Cradle Mounting Bolts

(9) Remove HCU and the mounting bracket as a unit from the vehicle.

(10) Remove the 3 bolts (Fig. 23) mounting the HCU to the mounting bracket. Separate the HCU from the mounting bracket.

(11) Remove the CAB (Fig. 19) from the bottom of the HCU for installation on the replacement HCU. Refer to Controller Antilock Brakes (CAB) in the Removal And Installation Section in this group of the service manual for the required procedure.

REMOVAL AND INSTALLATION (Continued)

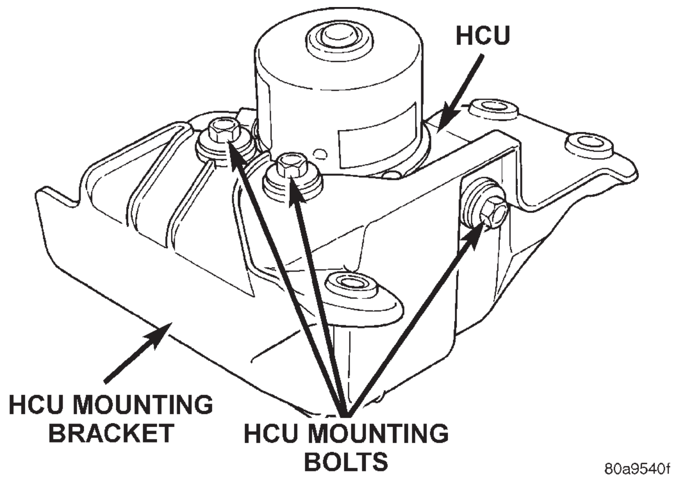

Fig. 23 HCU Mounting Bolts

INSTALL

(1) Install the CAB (Fig. 19) on the bottom of the HCU. Refer to Controller Antilock Brakes (CAB) in the Removal And Installation Section in this group of the service manual for the required procedure.

(2) Install the HCU on the mounting bracket (Fig. 23). Install the 3 bolts (Fig. 23) attaching the HCU to the mounting bracket. Tighten the 3 mounting bolts to a torque of 11 N·m (97 in. lbs.).

CAUTION: The HCU mounting bracket to front suspension cradle mounting bolts have a unique corrosion protection coating and a special aluminum washer. For this reason, only the original, or original equipment Mopar replacement bolts can be used to mount the HCU bracket to the front suspension crossmember.

(3) Install the HCU and its mounting bracket as an assembly on the front suspension crossmember. Install the 3 bolts attaching the HCU bracket to the crossmember (Fig. 22). Tighten the 3 mounting bolts to a torque of 28 N·m (250 in. lbs.).

CAUTION: Because of the flexible section in the primary and secondary brake tubes, and the brake tubes between the HCU and the proportioning valve, the brake tubes must be held in proper orientation when tightened and torqued. These tubes must not contact each other or other vehicle components when installed. Also, after the brake tubes are installed on the HCU, ensure all spacer clips are reinstalled on the brake tubes.

CAUTION: When installing the chassis brake tubes on the HCU valve block, they must be located correctly in the valve block to ensure proper ABS operation. Refer to (Fig. 21) for the correct chassis brake tube locations.

NOTE: The chassis brake tube attachment locations to the HCU, are marked on the bottom of the HCU mounting bracket.

(4) Install the 6 chassis brake tubes into their correct port locations on the HCU valve block as shown in (Fig. 21). Tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

NOTE: Before installing the 25 way connector in the CAB be sure the seal is properly installed in the connector.

(5) Install the 25 way connector (Fig. 19) on the CAB using the following procedure. Position the 25 way connector in the socket of the CAB and carefully push it down as far as possible. When connector is fully seated by hand into the CAB socket, push in the connector lock (Fig. 20). This will pull the connector into the socket of the CAB and lock it in the installed position.

NOTE: The CAB wiring harness must be clipped to the HCU mounting bracket. This will ensure the wiring harness is properly routed and does not contact the brake tubes or the body of the vehicle.

(6) Clip the cab wiring harness (Fig. 19) to the HCU mounting bracket.

(7) Install the routing clips (Fig. 24) on the brake tubes.

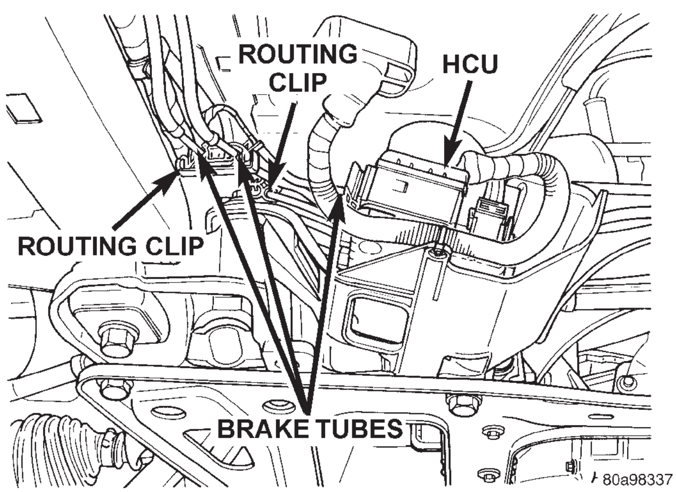

Fig. 24 Brake Tube Routing Clips

(8) Lower vehicle.

(9) Connect negative cable back on negative post of the battery.

(10) Bleed the base brakes and the ABS brakes hydraulic system. Refer to the Bleeding ABS System in this section of the manual for the proper bleeding procedure.

(11) Road test vehicle to ensure proper operation of the base and ABS systems.

REMOVAL AND INSTALLATION (Continued)

CONTROLLER ANTILOCK BRAKES (CAB)

REMOVE

(1) Disconnect the negative (ground) cable from the battery and isolate cable.

(2) Using a brake pedal depressor, move and lock the brake pedal to a position past the first inch of pedal travel. **This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the HCU.**

(3) Raise vehicle. Vehicle is to be raised and supported on jackstands or on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section of this service manual.

CAUTION: Do not apply a 12 volt power source to any terminals of the 25 way HCU connector when disconnected.

(4) Remove the 25 way connector (Fig. 25) from the CAB located on the bottom of the HCU. The 25 way connector is removed from the CAB using the following procedure. Grasp the lock on the 25 way connector (Fig. 25) and pull it as far out as possible (Fig. 26). This will unlock and raise the 25 way connector from the socket on the CAB.

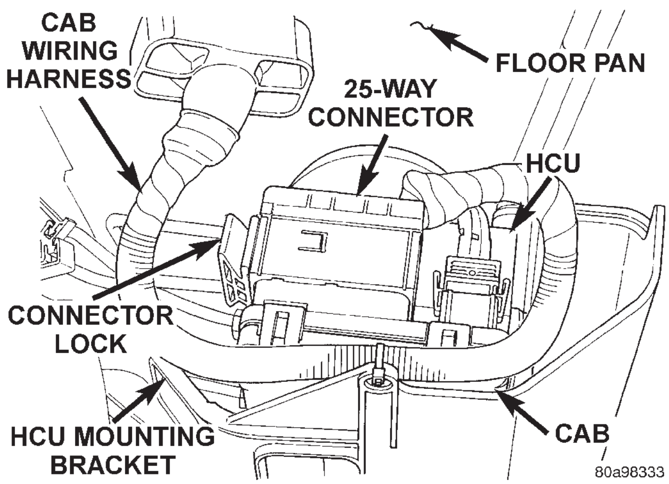

Fig. 25 CAB 25 Way Connector

CAUTION: Before removing the brake tubes from the HCU, the HCU must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the ports of HCU or entering the brake tubes.

(5) Thoroughly clean all surfaces of the HCU, and all brake tube nuts located on the HCU. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent to clean the HCU.

(6) Remove the brake tubes (6) from the inlet and outlet ports on the HCU. (Fig. 27).

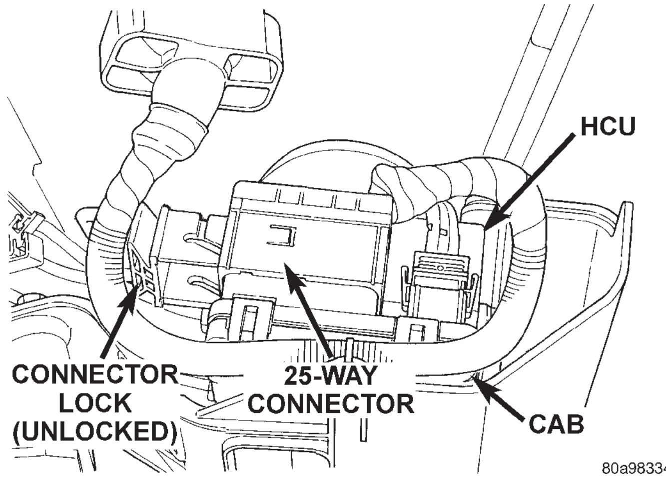

Fig. 26 Unlocking CAB 25 Way Connector

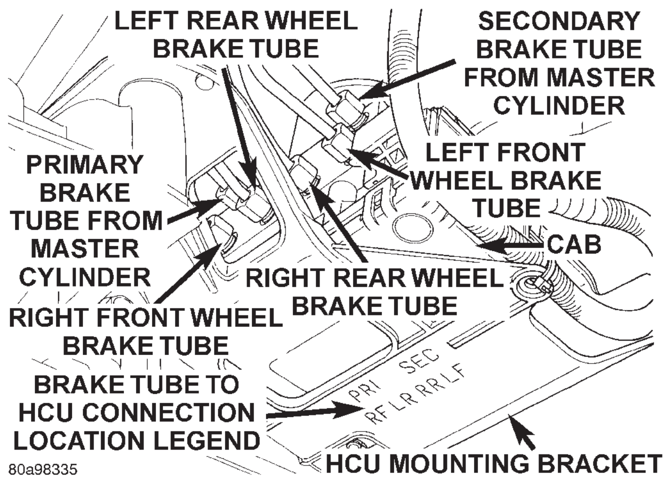

Fig. 27 Brake Tube Connections To HCU

(7) Remove the 3 bolts (Fig. 28) attaching the HCU mounting bracket to the front suspension crossmember.

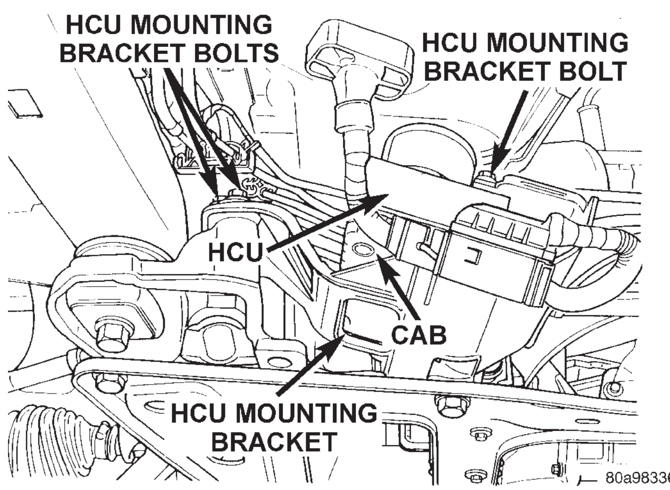

Fig. 28 HCU To Suspension Cradle Mounting Bolts

REMOVAL AND INSTALLATION (Continued)

(8) Remove HCU and the mounting bracket as a unit from the vehicle.

(9) Remove the 3 bolts (Fig. 29) mounting the HCU to the mounting bracket. Separate the HCU from the mounting bracket.

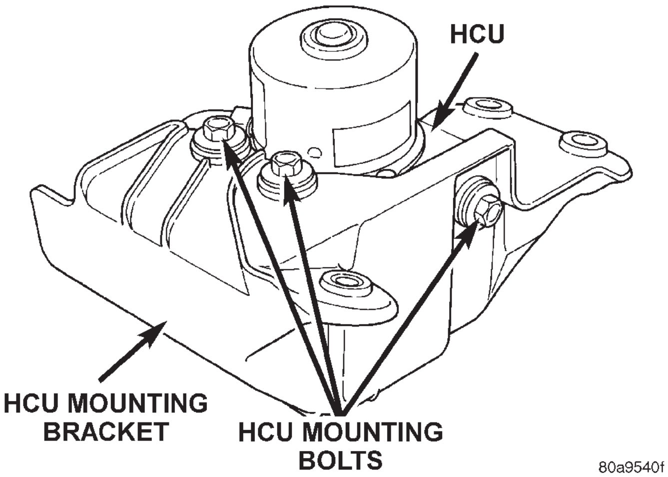

Fig. 29 HCU Mounting Bolts

(10) Unplug the pump motor wiring harness (Fig. 30) from the CAB.

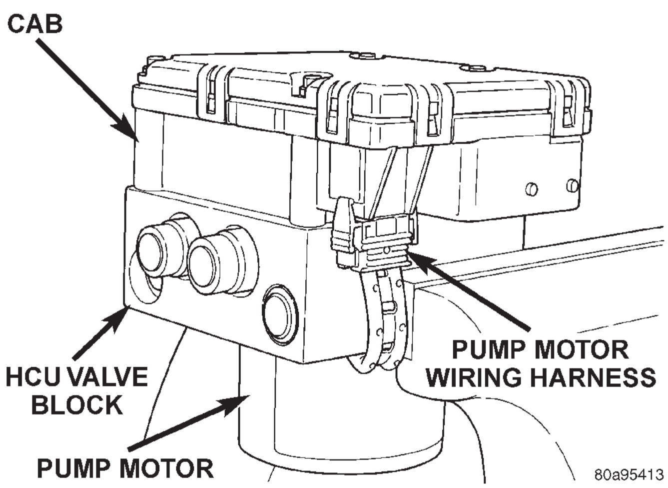

Fig. 30 Pump Motor To CAB Wiring Harness

(11) Remove the 4 bolts (Fig. 31) attaching the CAB to the valve block of the HCU.

(12) Remove the CAB from the valve block of the HCU (Fig. 32).

INSTALL

(1) Install the CAB (Fig. 32) on the valve block of the HCU.

(2) Install the 4 bolts mounting the CAB (Fig. 31) to the valve block of the HCU. Tighten the CAB mounting bolts to a torque of 2 N·m (17 in. lbs.).

(3) Plug the pump/motor wiring harness into the CAB (Fig. 30).

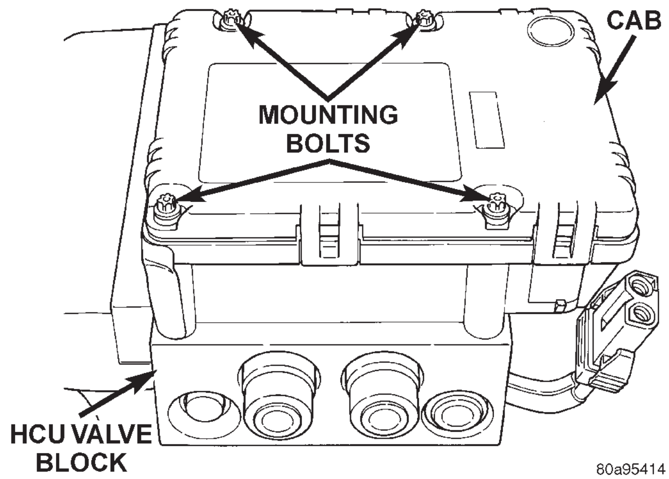

Fig. 31 CAB Attaching Bolts

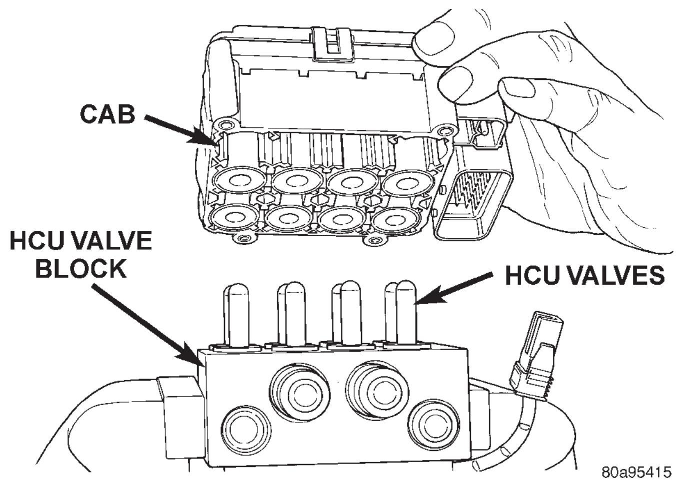

Fig. 32 Remove/Install CAB

(4) Install the HCU on the mounting bracket (Fig. 29). Install the 3 bolts (Fig. 29) attaching the HCU to the mounting bracket. Tighten the 3 mounting bolts to a torque of 11 N·m (97 in. lbs.).

CAUTION: The HCU mounting bracket to front suspension cradle mounting bolts have a unique corrosion protection coating and a special aluminum washer. For this reason, only the original, or original equipment Mopar replacement bolts can be used to mount the HCU bracket to the front suspension crossmember.

(5) Install the HCU and its mounting bracket as an assembly on the front suspension crossmember. Install the 3 bolts attaching the HCU bracket to the crossmember (Fig. 28). Tighten the 3 mounting bolts to a torque of 28 N·m (250 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

CAUTION: Because of the flexible section in the primary and secondary brake tubes, and the brake tubes between the HCU and the proportioning valve, the brake tubes must be held in proper orientation when tightened and torqued. These tubes must not contact each other or other vehicle components when installed.

CAUTION: When installing the chassis brake tubes on the HCU valve block, they must be located correctly in the valve block to ensure proper ABS operation. Refer to (Fig. 27) for the correct chassis brake tube locations.

NOTE: The chassis brake tube attachment locations to the HCU, are marked on the bottom of the HCU mounting bracket.

(6) Install the 6 chassis brake tubes into their correct port locations on the HCU valve block as shown in (Fig. 27). Tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

NOTE: Before installing the 25 way connector in the CAB be sure the seal is properly installed in the connector.

(7) Install the 25 way connector on the CAB using the following procedure. Position the 25 way connector in the socket of the CAB and carefully push it down as far as possible. When connector is fully seated by hand into the CAB socket, push in the connector lock (Fig. 26). This will pull the connector into the socket of the CAB and lock it in the installed position.

(8) Install the routing clips (Fig. 33) on the brake tubes.

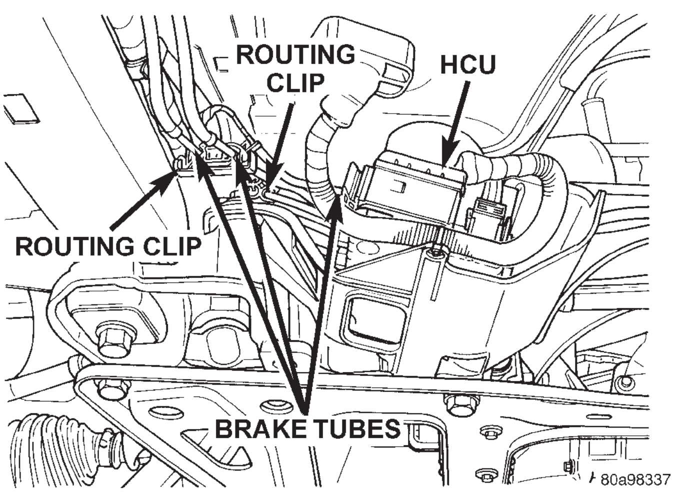

Fig. 33 Brake Tube Routing Clips

(9) Lower vehicle.

(10) Connect negative cable back on negative post of the battery.

(11) Bleed the base brakes and the ABS brakes hydraulic system. Refer to the Bleeding ABS System in this section of the manual for the proper bleeding procedure.

(12) Road test vehicle to ensure proper operation of the base and ABS brake systems.

WHEEL SPEED SENSOR (FRONT)

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) Remove the 2 screws (Fig. 34) attaching front channel bracket and grommet retainer to the outer frame rail.

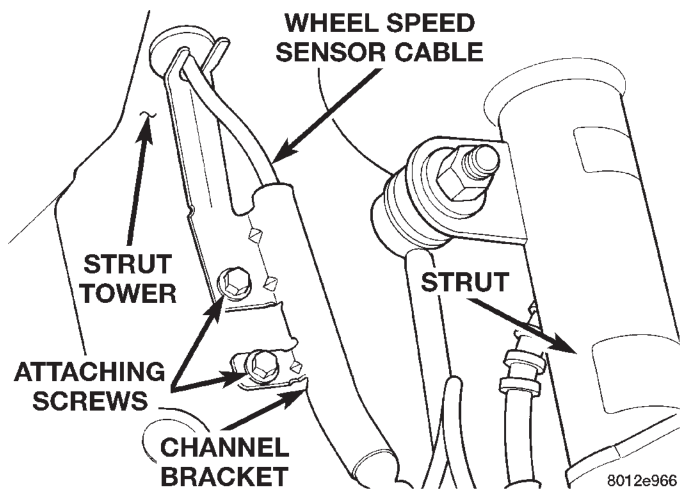

Fig. 34 Front Speed Sensor Cable Channel Bracket

CAUTION: When disconnecting the wheel speed sensor from vehicle wiring harness, be careful not to damage pins on connector

(4) Pull speed sensor cable grommet and connector through the hole in the strut tower (Fig. 35). Disconnect speed sensor cable from vehicle wiring harness (Fig. 35).

(5) Remove the wheel speed sensor head to steering knuckle attaching bolt (Fig. 36).

(6) Remove sensor head from steering knuckle. If the sensor has seized, due to corrosion, **DO NOT USE PLIERS ON SENSOR HEAD.** Use a hammer and a punch and tap edge of sensor ear, rocking the sensor side to side until free.

REMOVAL AND INSTALLATION (Continued)

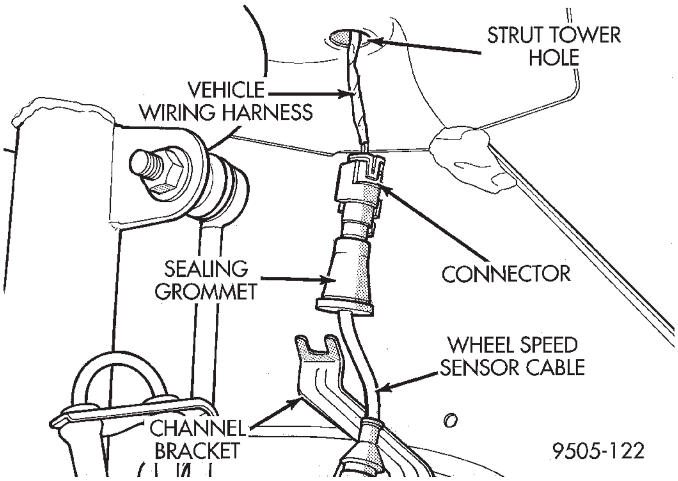

Fig. 35 Speed Sensor Cable To Vehicle Wiring Harness

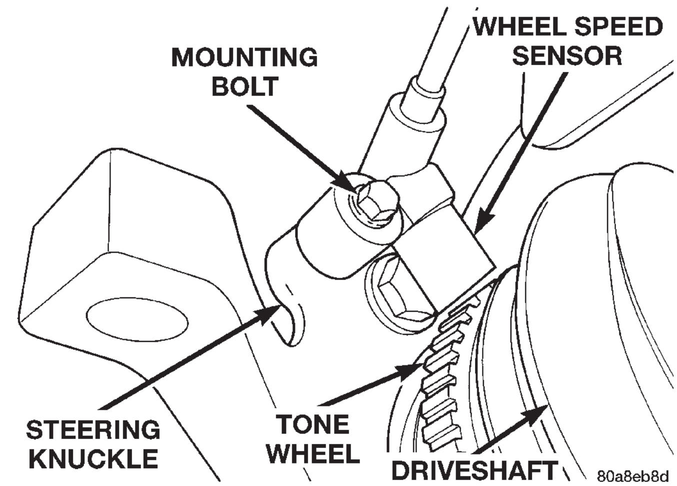

Fig. 36 Front Wheel Speed Sensor Attaching Bolt

(7) Remove the wheel speed sensor cable grommets from the retaining bracket (Fig. 37).

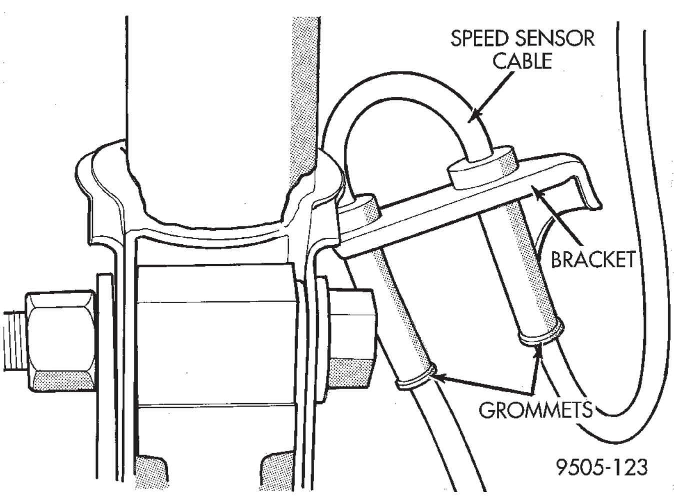

Fig. 37 Front Wheel Speed Sensor Cable Routing

(8) Remove front wheel speed sensor assembly from the vehicle.

INSTALL

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Connect the front wheel speed sensor cable to the vehicle wiring harness connector (Fig. 35). Be sure speed sensor cable connector is fully seated and locked into vehicle wiring harness connector, then insert cable and grommet into hole in strut tower (Fig. 35).

CAUTION: When installing channel bracket, do not pinch the speed sensor cable under the channel bracket.

(2) Install the channel bracket and grommet retainer on the frame rail (Fig. 34).

(3) Install the 2 bolts (Fig. 34) attaching the channel bracket to frame. Tighten the 2 attaching bolts to a torque of 11 N·m (95 in. lbs.).

(4) Insert speed sensor cable grommets into intermediate bracket on strut (Fig. 37). Route cable from strut to steering knuckle on the rearward side of the stabilizer bar link.

(5) Install the wheel speed sensor to steering knuckle attaching bolt (Fig. 36). Tighten the speed sensor attaching bolt to a torque of 12 N·m (105 in. lbs.)

(6) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-wheel. Air gap must be less then the maximum allowable tolerance of 1.2 mm (.047 in.).

(7) Install the wheel and tire assembly on vehicle.

(8) Road test vehicle to ensure proper operation of the base and ABS brake systems.

WHEEL SPEED SENSOR (REAR FWD)

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

REMOVAL AND INSTALLATION (Continued)

CAUTION: When unplugging speed sensor cable from vehicle wiring harness be careful not to damage pins on the electrical connectors. Also inspect connectors for any signs of previous damage.

(3) Remove grommet from floor pan of vehicle and unplug speed sensor cable connector from vehicle wiring harness (Fig. 38).

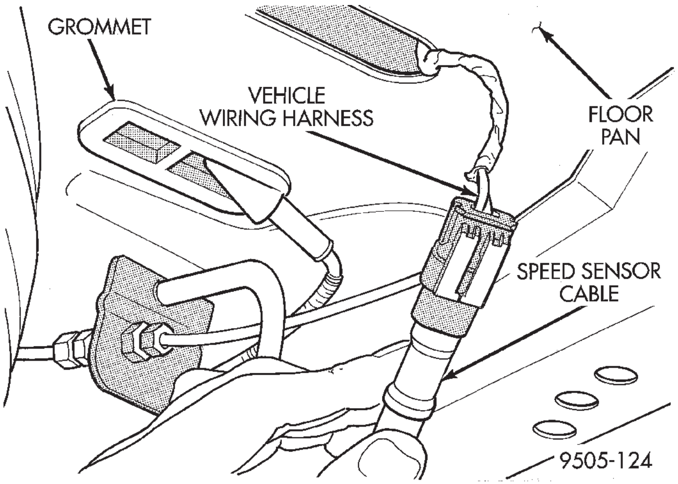

Fig. 38 Rear Speed Sensor Cable Connection To Vehicle Wiring Harness

CAUTION: When removing rear wheel speed sensor cable from routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during removal of the speed sensor cable.

(4) Carefully remove the speed sensor cable from the rear brake flex hose routing clips (Fig. 39).

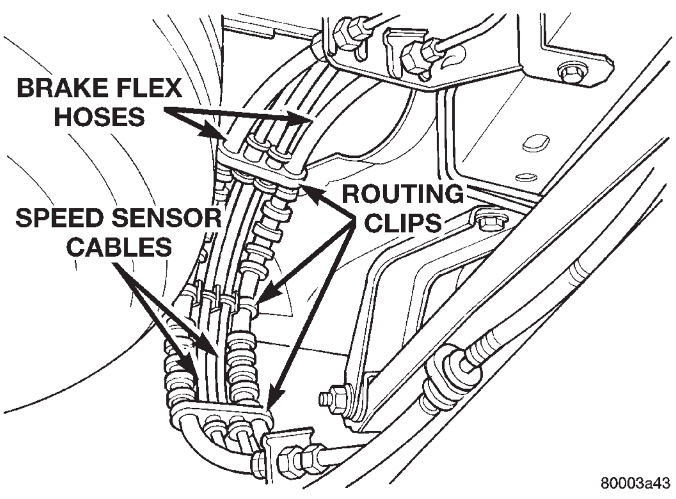

Fig. 39 Speed Sensor Cable Attachment To Brake Flex Hose

(5) If removing the right rear speed sensor cable, remove the speed sensor cable grommet from the axle flange, the brake tube clip and the routing clip from the track bar bracket on the axle (Fig. 40).

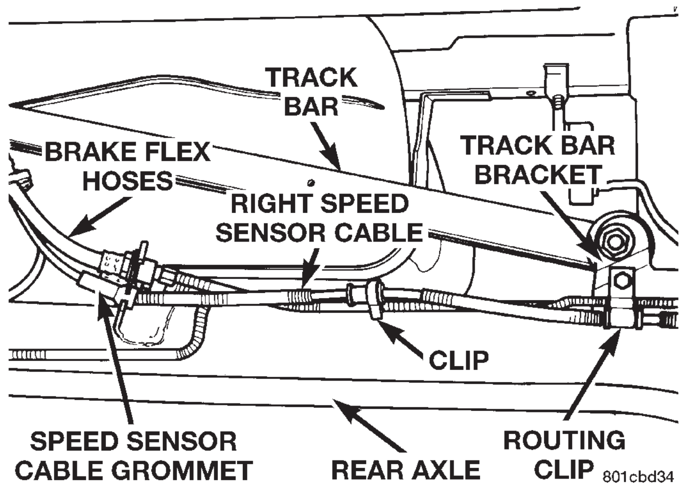

Fig. 40 Right Rear Speed Sensor Cable Routing

(6) Remove the 2 rear wheel speed sensor cable/brake tube routing clips (Fig. 41). Then un-clip the speed sensor cable from the routing clips on rear brake tube (Fig. 41).

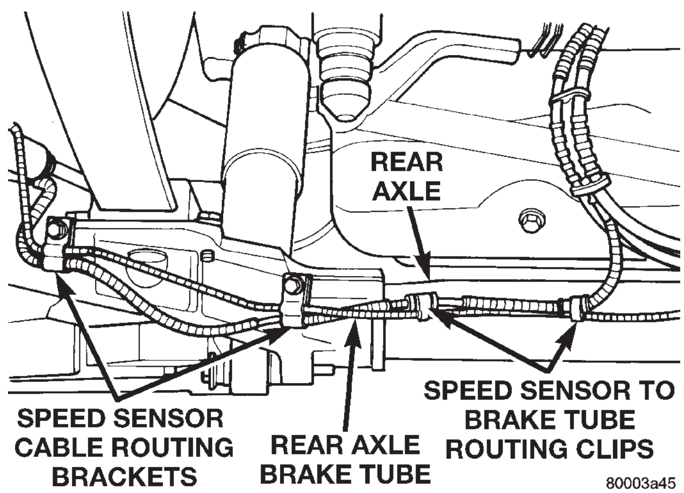

Fig. 41 Rear Speed Sensor Routing Brackets And Clips

CAUTION: If the speed sensor has seized, due to corrosion, do not use pliers on speed sensor head in a attempt to remove it. Use a hammer and a punch and tap edge of sensor, rocking the sensor from side to side until free.

(7) Remove the wheel speed sensor head to rear bearing attaching bolt (Fig. 42). If sensor head does not come loose, do not use pliers. Tap with screw driver and hammer.

(8) Remove the wheel speed sensor head from the rear bearing assembly.

(9) Remove speed sensor assembly from vehicle.

REMOVAL AND INSTALLATION (Continued)

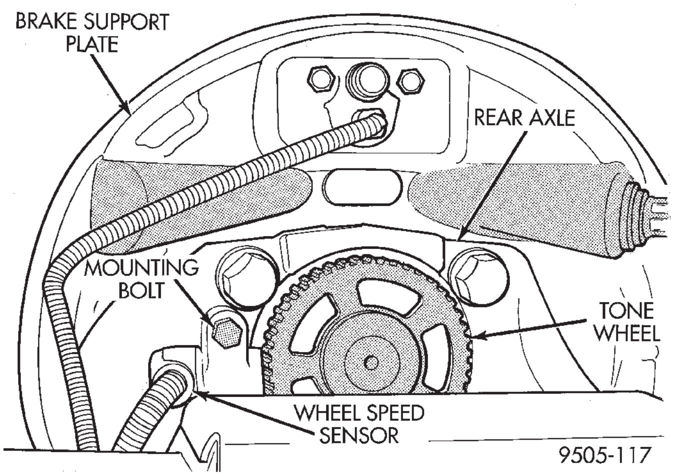

Fig. 42 Rear Wheel Speed Sensor Attaching Bolt

INSTALL

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Install wheel speed sensor head. Note, the plastic anti rotation pin must be fully seated prior to installing the attaching bolt.

CAUTION: Prior to installing the speed sensor head attaching bolt, the plastic anti-rotation pin must be fully seated into the bearing flange.

(2) Install the wheel speed sensor head to bearing flange attaching bolt (Fig. 42). Tighten the attaching bolt to a torque 12 N·m (105 in. lbs.)

(3) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-wheel. Air gap must be less then the maximum allowable tolerance of 1.2 mm (.047 in.).

(4) Install the 2 routing brackets attaching the speed sensor cable and brake tube to the rear axle (Fig. 41). **The rear wheel speed sensor cable should be routed under the rear brake tube (Fig. 41).**

CAUTION: When installing rear wheel speed sensor cable in the routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during installation of the wheel speed sensor cable.

(5) Install speed sensor cable into routing clips on rear brake flex hose (Fig. 41).

(6) If installing a right rear speed sensor cable, install the speed sensor cable grommet on the axle brake flex hose bracket (Fig. 40).

CAUTION: The wheel speed sensor cable connectors for the left and right rear wheel speed sensors are keyed differently. Therefore, when connecting a wheel speed sensor cable to the vehicle wiring harness, do not force the connectors together. If the connectors are forced together, damage to the connectors will occur.

(7) Plug speed sensor cable connector into vehicle wiring harness (Fig. 38). **Be sure speed sensor cable connector is fully seated and locked into vehicle wiring harness connector.**

(8) Install the speed sensor cable grommet into the body, being sure the grommet is fully seated into the body hole.

(9) Install the tire and wheel assembly on vehicle.

(10) Road test vehicle to ensure proper operation of the base and ABS braking systems.

WHEEL SPEED SENSOR (REAR AWD)

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

CAUTION: When unplugging speed sensor cable from vehicle wiring harness be careful not to damage pins on the electrical connectors. Also inspect connectors for any signs of previous damage.

(3) Remove grommet from floor pan of vehicle and unplug speed sensor cable connector from vehicle wiring harness (Fig. 43).

CAUTION: When removing rear wheel speed sensor cable from routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during removal of the speed sensor cable.

REMOVAL AND INSTALLATION (Continued)

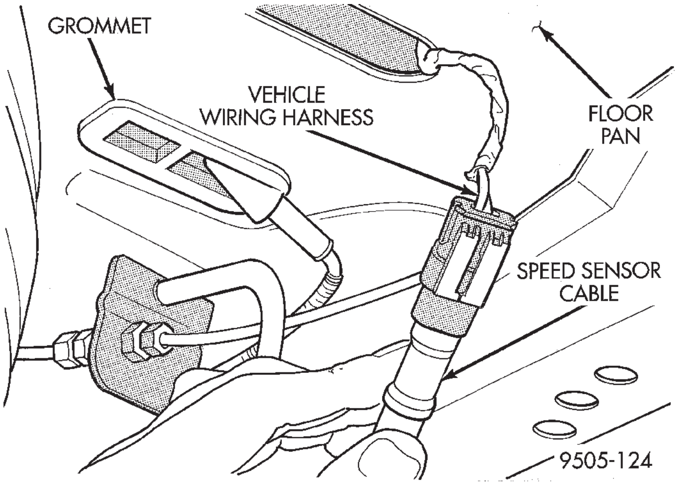

Fig. 43 Speed Sensor Cable Connection To Vehicle Wiring Harness

(4) Carefully remove the speed sensor cable from the rear brake flex hose routing clips (Fig. 44).

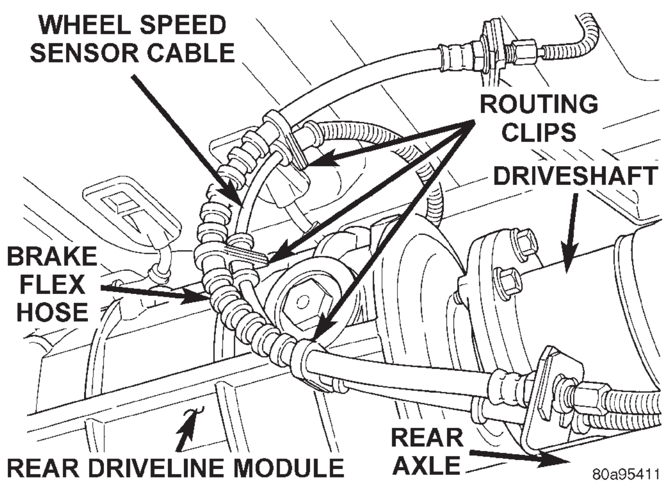

Fig. 44 Speed Sensor Cable Attachment To Brake Flex Hose

(5) Remove the rear wheel speed sensor cable/ brake tube routing clips (Fig. 45). Then un-clip the speed sensor cable from the routing clips on rear brake tube (Fig. 45).

CAUTION: If the speed sensor has seized, due to corrosion, do not use pliers on speed sensor head in a attempt to remove it. Use a hammer and a punch and tap edge of sensor, rocking the sensor from side to side until free.

(6) Remove the wheel speed sensor attaching bolt (Fig. 46). If sensor head does not come loose, do not use pliers on the sensor head to loosen. Tap sensor head from side to side to loosen.

(7) Remove the wheel speed sensor from the rear bearing assembly.

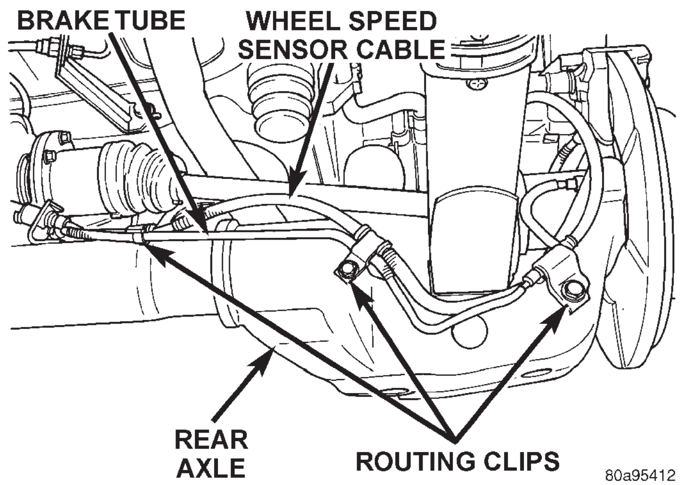

Fig. 45 Rear Speed Sensor Routing Brackets And Clips

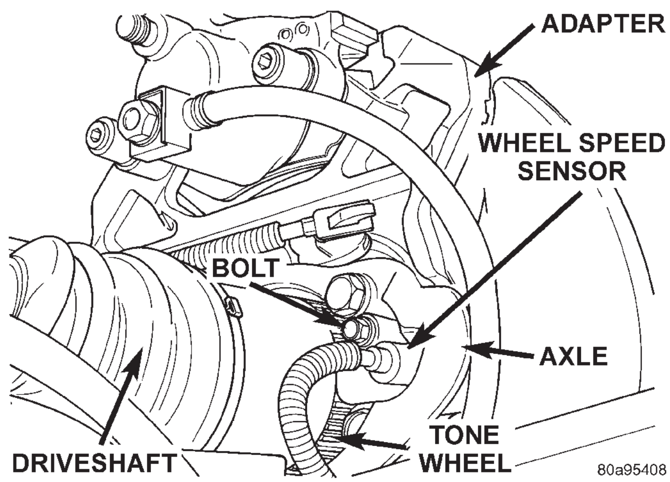

Fig. 46 Speed Sensor Attaching Bolt

(8) Remove the speed sensor assembly from the vehicle.

INSTALL

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Install wheel speed sensor head. Note, the plastic anti rotation pin must be fully seated prior to installing the attaching bolt.

CAUTION: Prior to installing the speed sensor head attaching bolt, the plastic anti-rotation pin must be fully seated into the bearing flange.

REMOVAL AND INSTALLATION (Continued)

(2) Install the wheel speed sensor head attaching bolt (Fig. 46). Tighten the attaching bolt to a torque 12 N·m (105 in. lbs.)

(3) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-wheel. Air gap must be less then the maximum allowable tolerance of 1.2 mm (.047 in.).

(4) Install the routing brackets attaching the speed sensor cable and brake tube to the rear axle (Fig. 45). **The rear wheel speed sensor cable should be routed under the rear brake tube (Fig. 45).**

CAUTION: When installing rear wheel speed sensor cable in the routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during installation of the wheel speed sensor cable.

(5) Install speed sensor cable into routing clips on rear brake flex hose (Fig. 44).

CAUTION: The wheel speed sensor cable connectors for the left and right rear wheel speed sensors are keyed differently. Therefore, when connecting a wheel speed sensor cable to the vehicle wiring harness, do not force the connectors together. If the connectors are forced together, damage to the connectors will occur.

(6) Plug speed sensor cable connector into vehicle wiring harness (Fig. 43). **Be sure speed sensor cable connector is fully seated and locked into vehicle wiring harness connector.**

(7) Install the speed sensor cable grommet into the body, being sure the grommet is fully seated into the body hole.

(8) Install the tire and wheel assembly on vehicle.

(9) Road test vehicle to ensure proper operation of the base and ABS braking systems.

TONE WHEEL (REAR FWD)

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual for required lifting procedure.

(2) Remove the wheel and tire assembly.

(3) Remove rear brake drum from the hub/bearing assembly.

(4) Remove the rear wheel speed sensor from the rear hub/bearing flange (Fig. 47). This will prevent damage to the speed sensor during removal and installation of the hub/bearing assembly.

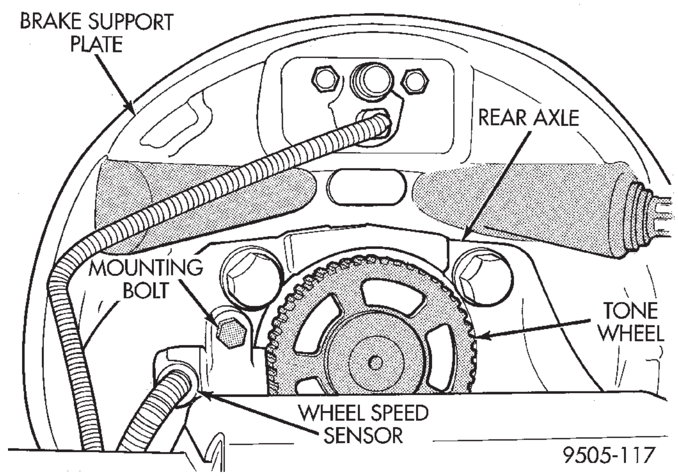

Fig. 47 Rear Wheel Speed Sensor

(5) Remove the 4 bolts (Fig. 48) attaching the hub/bearing assembly to the flange of the rear axle.

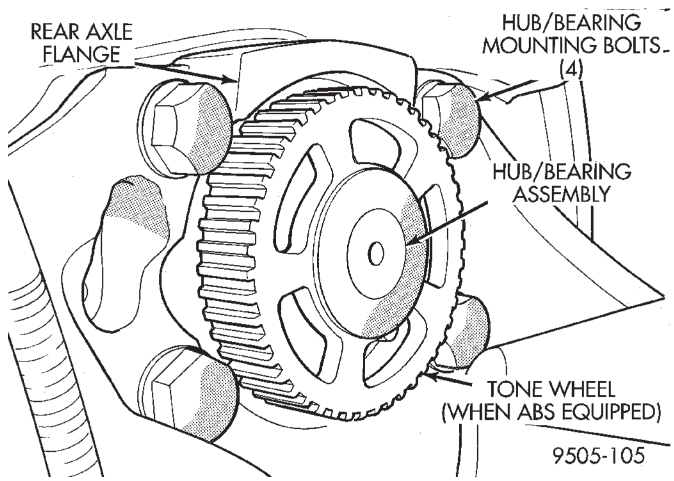

Fig. 48 Rear Hub/Bearing Mounting Bolts

(6) Remove the hub/bearing assembly from the rear axle and brake support plate (Fig. 49).

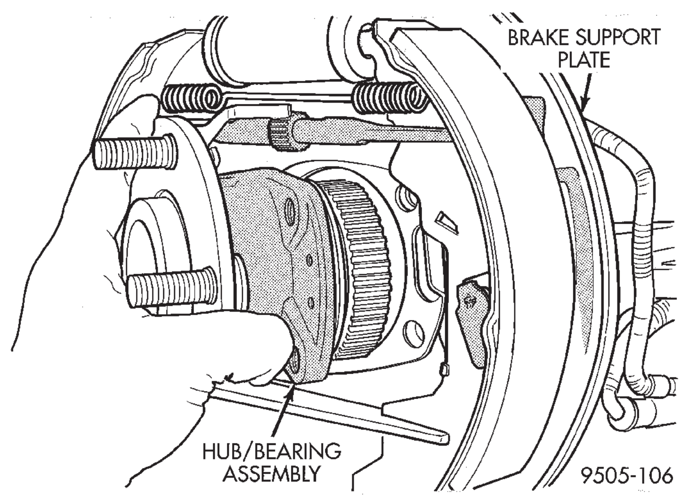

Fig. 49 Removing Rear Hub/Bearing From Axle

REMOVAL AND INSTALLATION (Continued)

(7) Install wheel lug nuts on 3 of the wheel mounting studs to protect the stud threads from damage by the vise jaws. Mount the hub/bearing assembly in a vise (Fig. 50). Using Puller, Special Tool C-4693 installed as shown in (Fig. 50) remove the tone wheel from the hub/bearing assembly.

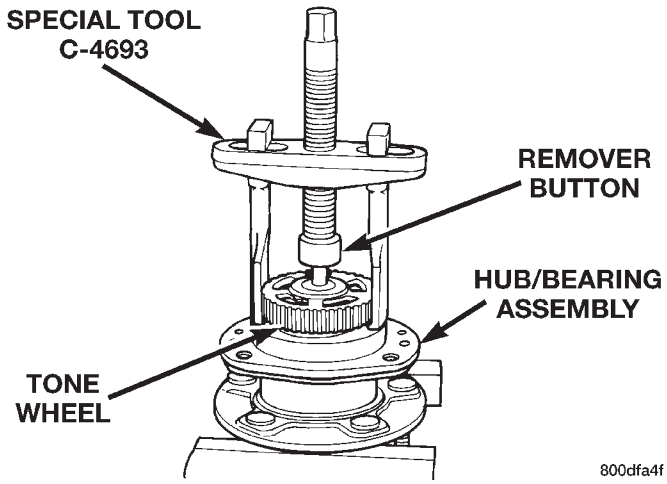

Fig. 50 Tone Wheel Removal From Hub/Bearing Assembly

INSTALL

(1) Place hub/bearing assembly in an arbor press supported by Receiver, Special Tool, 6062A–3 (Fig. 51). Position Driver, Special Tool 6908–1 with undercut side facing up (Fig. 51) on top of the tone wheel.

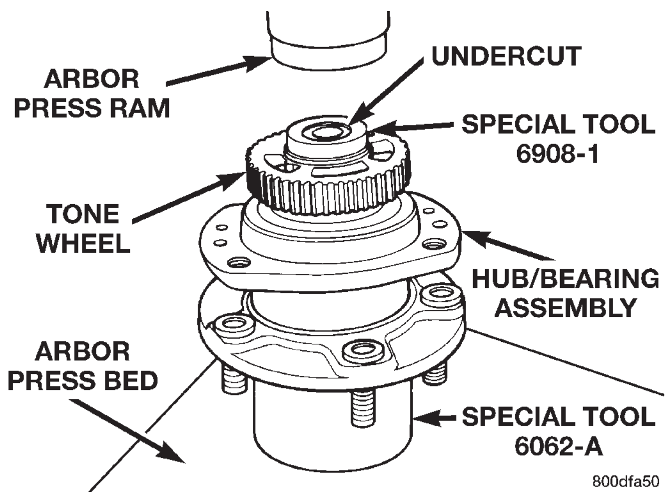

Fig. 51 Installing Tone Wheel On Hub/Bearing Assembly

(2) Press the tone wheel onto the hub/bearing assembly until it is flush with the end of hub shaft (Fig. 52).

(3) Install the 4 hub/bearing to axle flange mounting bolts into the 4 mounting holes in the flange of the rear axle.

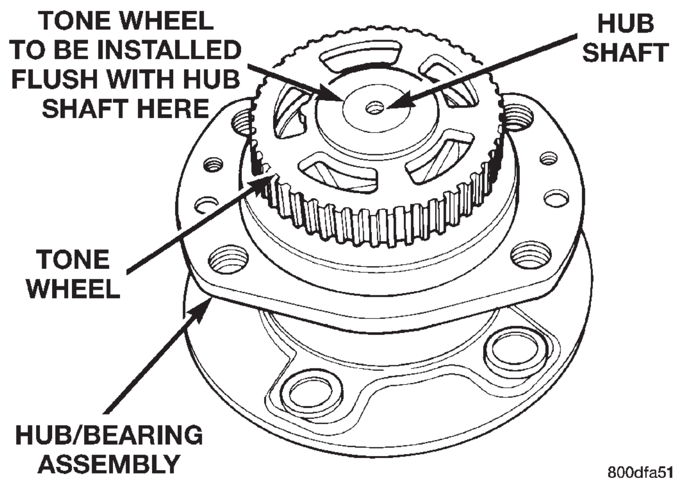

Fig. 52 Correctly Installed Tone Wheel

(4) Install the rear brake support plate on the 4 mounting bolts installed in the flange of the rear axle.

(5) Align the rear hub/bearing assembly with the 4 mounting bolts and start mounting bolts into hub/bearing assembly. Tighten the 4 bolts in a criss-cross pattern until the hub/bearing and brake support plate is fully and squarely seated onto flange of rear axle.

(6) Tighten the 4 hub/bearing mounting bolts (Fig. 48) to a torque of 129 N·m (95 ft. lbs.)

(7) Install the rear wheel speed sensor on the rear hub/bearing flange (Fig. 47). Install the speed sensor attaching bolt and tighten to a torque of 12 N·m (105 in. lbs.).

(8) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-wheel. Air gap must be less then the maximum allowable tolerance of 1.2 mm (.047 in.).

(9) Install the brake drum onto the rear hub/bearing assembly.

(10) Install rear wheel and tire assembly, tighten wheel stud nuts to 129 N·m (95 ft. lbs.).

(11) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

TONE WHEEL (REAR AWD)

The rear tone wheel on all wheel drive applications is an integral part of each rear axle outer C/V joint. If the rear tone wheel on an all wheel drive vehicle requires replacement it can not be replace as a separate component of the rear axle. Tone wheel replacement will require the replacement of the rear axle. Refer to Differential And Driveline in this service manual for the rear axle replacement procedure.

SPECIFICATIONS

SPEED SENSOR TONE WHEEL RUNOUT

The total indicator runout allowed for both the front and rear tone wheel measured using a dial indicator is 0.15 mm (.006 in.).

WHEEL SPEED SENSOR TO TONE WHEEL CLEARANCE

FRONT WHEEL

Minimum Clearance .35mm (.014 in.)
Maxamum Clearance 1.2 mm (.047 in.)

REAR WHEEL

Minimum Clearance .40mm (.016 in.)
Maxamum Clearance 1.2 mm (.047 in.)

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
BRAKE TUBES:	
Tube Nuts To Fittings And Components	17 N·m (145 in. lbs.)
BRAKE HOSE:	
To Caliper Banjo Bolt	48 N·m (35 ft. lbs.)
Intermediate Bracket	12 N·m (105 in. lbs.)
MASTER CYLINDER:	
To Vacuum Booster Mounting Nut	25 N·m (225 in. lbs.)
FIXED PROPORTIONING VALVE:	
To Frame Rail Attaching Bolts	14 N·m (125 in. lbs.)
HEIGHT SENSING PROPORTIONING VALVE:	
To Mounting Bracket Attaching Bolts	23 N·m (200 in. lbs.)
Actuator Assembly Adjustment Nut	5 N·m (45 in. lbs.)
Mounting Bracket To Frame Rail Bolts	17 N·m (150 in. lbs.)
JUNCTION BLOCK (NON-ABS BRAKES)	
To Suspension Cradle Mounting Bolt	28 N·m (250 in. lbs.)
VACUUM BOOSTER:	
To Dash Panel Mounting Nuts	28 N·m (250 in. lbs.)

DESCRIPTION	TORQUE
REAR WHEEL CYLINDER:	
To Support Plate Mounting Bolts	8 N·m (75 in. lbs.)
Bleeder Screw	10 N·m (80 in. lbs.)
BRAKE SUPPORT PLATE:	
To Rear Axle Mounting Bolts	130 N·m (95 ft. lbs.)
DISC BRAKE CALIPER:	
Guide Pin Bolts	41 N·m (30 ft. lbs.)
Bleeder Screw	15 N·m (125 in. lbs.)
ABS HYDRAULIC CONTROL UNIT:	
Mounting Bracket To Suspension Cradle Bolts	28 N·m (250 in. lbs.)
To Mounting Bracket Isolator Attaching Bolts	11 N·m (97 in. lbs.)
CAB To HCU Mounting Screws	2 N·m (17 in. lbs.)
WHEEL SPEED SENSOR:	
To Axle Or Steering Knuckle Mounting Bolt	12 N·m (105 in. lbs.)
PARKING BRAKE:	
Pedal Assembly Mounting Bolts	28 N·m (250 in. lbs.)
REAR HUB AND BEARING:	
To Axle Mounting Bolts	129 N·m (95 ft. lbs.)
WHEEL:	
Stud Lug Nut	115–156 N·m (84-115 ft. lbs.)

BRAKES

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GENERAL INFORMATION

BASE BRAKE SYSTEM COMPONENT DESCRIPTION

The standard brake system on this vehicle contains the same components as brake systems described in group 5 of the service manual, with the exception of the brake pedal system and master cylinder. These differences are mainly related to service procedures. The major differences are as follows:

- Use of a torque shaft assembly to transfer brake pedal travel to the power brake booster and master cylinder on the left side of the vehicle
- A unique power brake booster and master cylinder.

Refer to the Base Brake System Component Description in the General Information section of group 5 for more information on components used in the base brake system.

DESCRIPTION AND OPERATION

MASTER CYLINDER

The master cylinder used on this vehicle functions the same as master cylinders used in other brake systems. Refer to the Master Cylinder in the Description and Operation section of group 5 for more information.

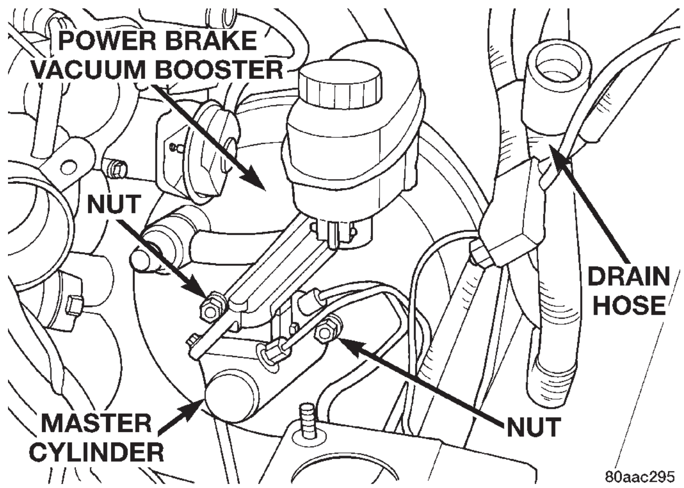

Fig. 1 Master Cylinder Assembly

DIAGNOSIS AND TESTING

REAR DRUM BRAKE ADJUSTMENT

The rear drum brakes on front wheel drive vehicles automatically adjust, when required, during the normal operation of the vehicle every time the brakes are applied. Use the following procedure to test the operation of the automatic adjuster.

Place the vehicle on a hoist with a helper in the driver's seat to apply the brakes. Remove the access plug from the adjustment slot in each brake support plate to provide visual access of brake adjuster star wheel. Disconnect parking brake cable from one side of the vehicle at the equalizer under the vehicle at the left frame rail. Working on the side of the vehicle that parking brake cable is connected to, hold the adjuster lever off the star wheel with a suitable tool, and loosen the star wheel approximately 30 notches in relation to the adjuster lever. This is to eliminate the possibility that the brake is already properly adjusted. Reconnect the parking brake cable and repeat the procedure for the other side of the vehicle.

DIAGNOSIS AND TESTING (Continued)

Upon application of the brake pedal, the lever should move down, turning the star wheel. A definite rotation of the star wheel should be seen if the automatic adjuster is working properly. If no rotation of the star wheel is observed when the pedal is consecutively pressed and released, the respective drum will have to be removed and the adjuster serviced.

MASTER CYLINDER FLUID LEVEL CHECK

The master cylinder used in this vehicle has the same fluid level markings as the master cylinders used in other brake systems on the side of the fluid resevoir. Refer to the Master Cylinder Fluid Level Check in the Diagnosis and Testing section of group 5 for more information

REMOVAL AND INSTALLATION

FRONT PARK BRAKE CABLE AND LEVER ASSEMBLY-RHD&LHD VEHICLES

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Remove the intermediate and left rear park brake cable from the park brake cable equalizer (Fig. 2).

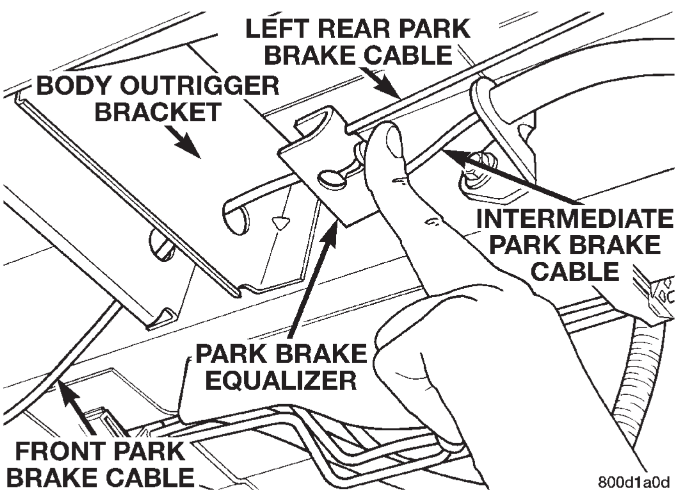

Fig. 2 Park Brake Cable Attachment To Equalizer

(3) Remove the front park cable housing retainer from body outrigger bracket (Fig. 3). Cable is removable by sliding a 14 mm box wrench over cable retainer and compressing the three retaining fingers. Alternate method is to use an aircraft type hose clamp and screwdriver.

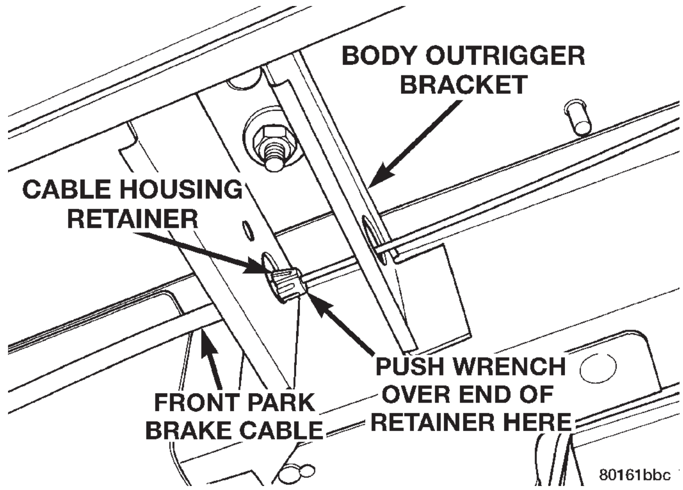

Fig. 3 Front Park Brake Cable Attachment To Body

(4) Remove the two (2) retaining nuts and (2) retaining bolts from the bottom of the parking brake/ gearshift lever bracket.

(5) Lower vehicle.

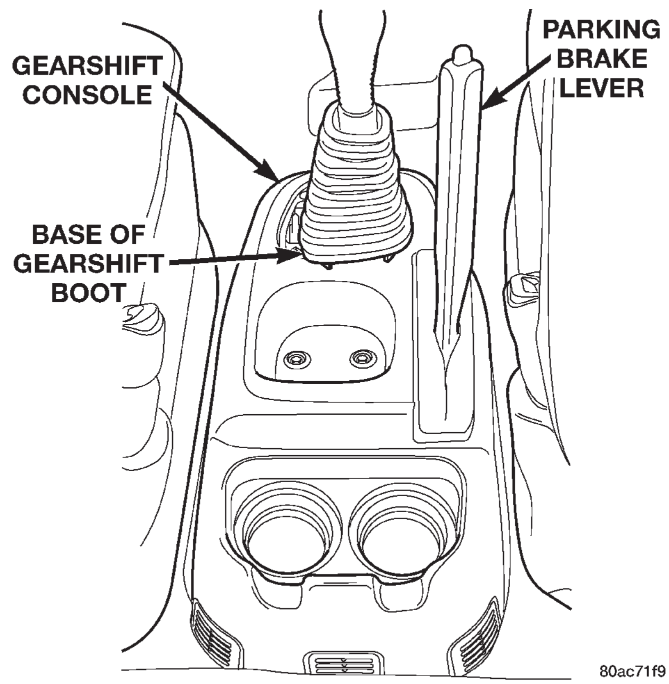

Fig. 4 Console and Gearshift boot

(6) Carefully lift the base of the gearshift boot from the gearshift console to access the screws (Fig. 4).

REMOVAL AND INSTALLATION (Continued)

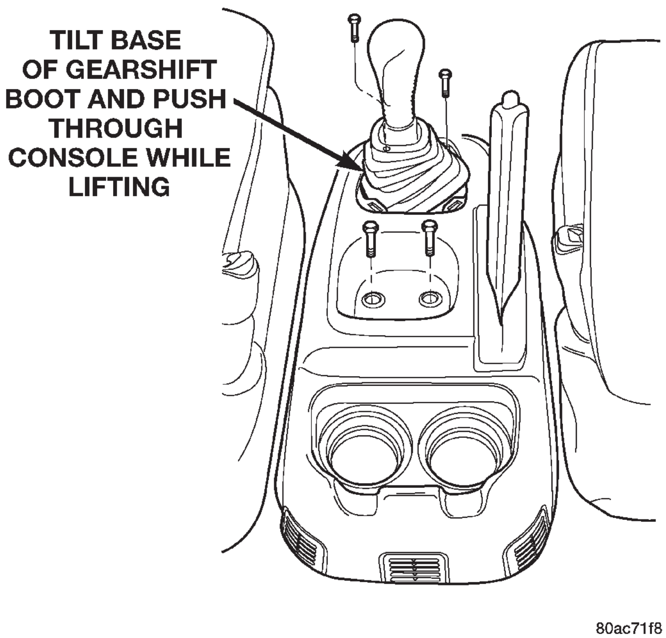

Fig. 5 Console Retaining Screws

(7) Remove the four (4) retaining screws (Fig. 5).

(8) Pull the parking brake lever to the "up" position and lift the console (Fig. 5).

(9) Tilt the base of the gearshift boot and carefully push through the opening in the console while lifting.

(10) Remove the three (3) nuts at the base of the parking brake assembly.

(11) Release the parking brake assembly and lift assembly off of the parking brake/gearshift lever bracket.

(12) Unhook the loop on the end of the parking brake from the equalizer bar on the parking brake/ gearshift lever bracket.

(13) Compress the parking brake cable retainer by sliding a 14 mm box wrench over the cable retainer and compress the three (3) retaining fingers.

(14) Remove the three (3) screws from the parking brake grommet on the floor pan of the passenger compartment.

(15) Lift the parking brake /gearshift lever bracket and slide the parking brake cable out.

(16) Pull the cable through the floor pan from inside the vehicle.

INSTALL

(1) Pass park brake cable assembly through hole in floor pan from the inside of the vehicle.

(2) Pass cable strand button through the hole in the pedal assembly bracket.

(3) Install parking brake cable to the brake/gearshift lever bracket by lifting the bracket and sliding the cable in.

(4) Install the three (3) screws to the parking brake grommet on the floor pan of the passenger compartment.

(5) Compress the parking brake cable retainer by sliding a 14 mm box wrench over the cable retainer and compress the three (3) retaining fingers.

(6) Hook the loop on the end of the parking brake to the equalizer bar on the parking brake/gearshift lever bracket.

(7) Attach the parking brake assembly and place assembly on the parking brake/gearshift lever bracket.

(8) Install the three (3) nuts at the base of the parking brake assembly.

(9) Pull the parking brake lever to the "up" position.

(10) Place the console over the parking brake/gearshift lever and tilt the base of the gearshift boot and carefully pull it through the opening in the console.

(11) Install the four (4) retaining screws (Fig. 5).

(12) Carefully press the three (3) clips at the base of the gearshift boot into the slots on the gearshift console.

(13) Raise the vehicle.

(14) install the two (2) retaining nuts and (2) retaining bolts to the bottom of the parking brake/ gearshift lever bracket.

(15) Install the front park cable housing retainer to the body outrigger bracket (Fig. 3). Cable is installed by sliding a 14 mm box wrench over cable retainer and compressing the three retaining fingers. Alternate method is to use an aircraft type hose clamp and screwdriver.

(16) Install the intermediate and left rear park brake cable to the park brake cable equalizer (Fig. 2).

(17) Lower the vehicle.

REMOVAL AND INSTALLATION (Continued)

BRAKE PEDAL TORQUE SHAFT ASSEMBLY

REMOVE

(1) Disconnect Brake Pedal Switch Electrical Connector

(2) Loosen the six (6) retaining nuts from the Brake Pedal Bracket. Do not remove nuts from studs. (Fig. 6)

(3) Remove steering column intermediate shaft. Loosen 72 and 36 way electrical connector brackets. Move components out of the way of the brake pedal bracket.

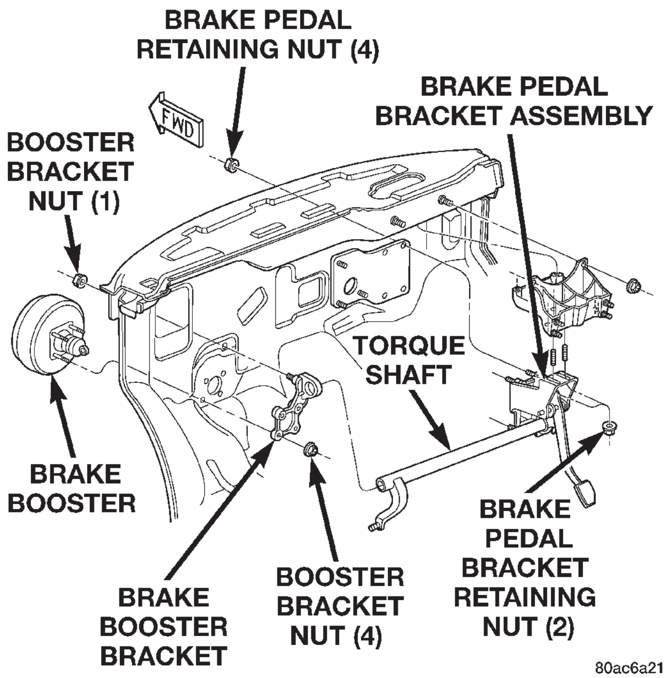

Fig. 6 Torque Shaft and Brake Pedal Assembly

(4) Access the brake booster bracket inside the passenger compartment. Remove the retaining clip from brake pedal torque shaft. **Discard retaining clip. It is not to be re-used. Replace only with a new clip when reassembled.** (Fig. 7)

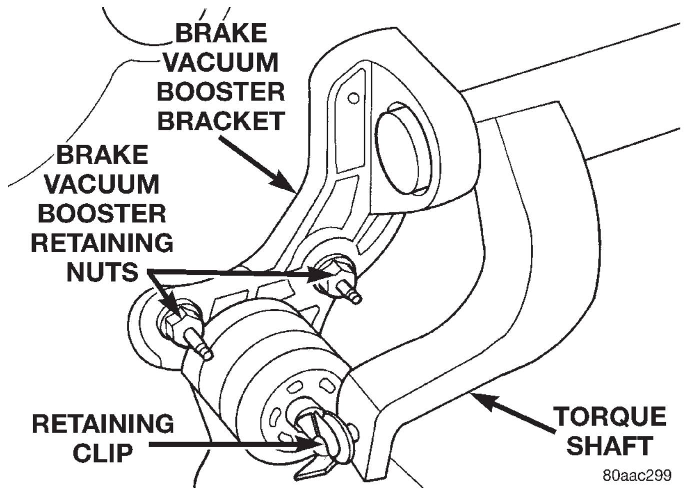

Fig. 7 Brake Vacuum Booster Bracket

(5) Loosen the retaining nut (1) from the Brake Booster Bracket in the engine compartment. Do not remove nut from stud. Loosen the four Brake Booster retaining nuts from inside the passenger compartment. Do not remove nuts from stud (Fig. 6)

(6) The pedal arm, link and pedal bracket can be disconnected from the torque shaft to make it easier to remove.

(7) Remove torque shaft from vehicle

INSTALL

(1) Install torque shaft. Reconnect pedal arm, link and pedal bracket assembly to torque shaft as necessary.

(2) Tighten the retaining nut (1) for the Brake Booster Bracket in the engine compartment. Tighten the four (4) Brake Booster retaining nuts from inside the passenger compartment.

(3) Install new retaining clip on torque shaft.

(4) Install steering column intermediate shaft. Install 72 and 36 way connector brackets.

(5) Tighten the six (6) retaining nuts for the Brake Pedal Bracket assembly.

(6) Connect the Brake Pedal Switch connector.

CLUTCH

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GENERAL INFORMATION

CLUTCH COMPONENTS

The clutch used in the 2.0 liter and 2.4 liter gasoline engine is a single, dry-disc modular clutch assembly. The modular clutch assembly combines the pressure plate cover, pressure plate, disc, and flywheel into one unit. The unit rides on the input shaft of the transmission and is bolted to the drive plate mounted on the rear of the crankshaft. The clutch used in the 2.5 liter diesel engine is a conventional clutch and pressure plate arrangement.

CLUTCH CABLE AND PEDAL — LHD

The clutch cable has a unique self-adjuster mechanism built into the cable which compensates for clutch disc wear. The cable requires no maintenance or lubrication. There are no serviceable components on the cable assembly.

The clutch pedal is connected to the cable through a plastic spacer (Fig. 1). The upper end of the clutch pedal pivots in the pedal bracket on two nylon bushings and a shaft (Fig. 2). These bushings are greased during assembly and do not require periodic lubrication.

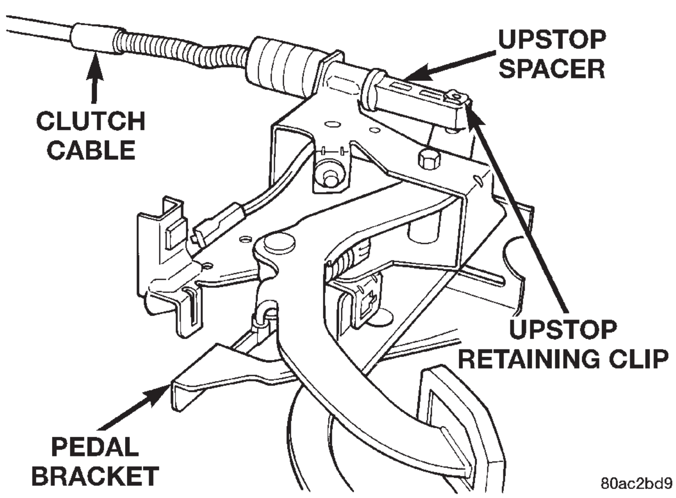

Fig. 1 Upstop/Spacer and Cable — LHD

GENERAL INFORMATION (Continued)

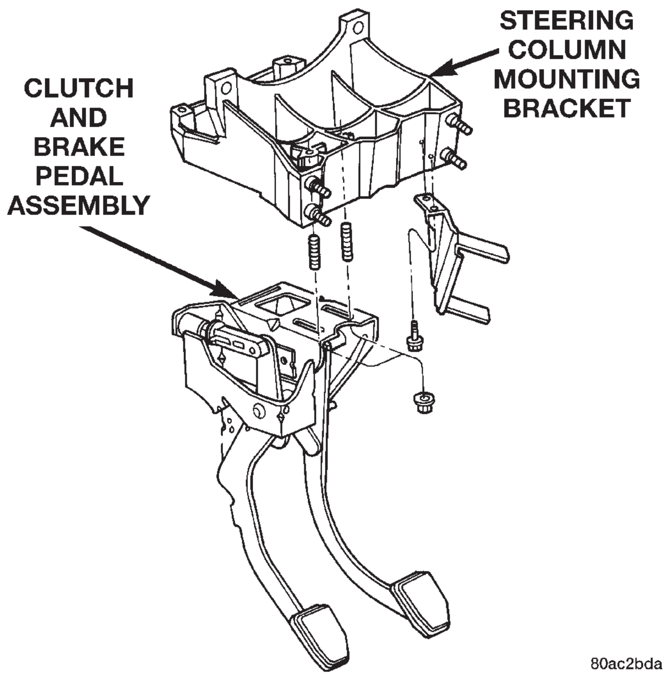

Fig. 2 Clutch Pedal Components — LHD

The clutch pedal on the 2.0L is fitted with a return spring (Fig. 3). The spring hook that attaches to the pedal is coated with nylon. Push the hook all the way through the hole in the pedal to prevent it from walking out. No service lubrication is required.

The clutch pedal on the 2.4L and 2.5L VM diesel is fitted with an assist spring (Fig. 4) to reduce clutch pedal effort. The assist spring has two plastic end fittings which locate to pins on the clutch pedal and bracket. The plastic which the fittings are made of includes PTFE lubricant. No service lubrication is required.

HYDRAULIC LINKAGE AND COMPONENTS — RHD

The hydraulic clutch linkage is a prefilled system free of air, contamination, and leaks. There is no routine maintenance required. The hydraulic clutch linkage is serviced as an assembly and the individual components cannot be overhauled or serviced separately. The hydraulic linkage consists of a clutch master cylinder with integral reservoir, a clutch slave cylinder and an interconnecting fluid line with quick disconnect coupling (Fig. 5).

The clutch master cylinder push rod is connected to the clutch pedal (Fig. 6). The clutch pedal is fitted with a return spring. The spring hook that attaches to the pedal is coated with nylon. No service lubrication is necessary. The slave cylinder push rod is connected to the clutch release fork (Fig. 5).

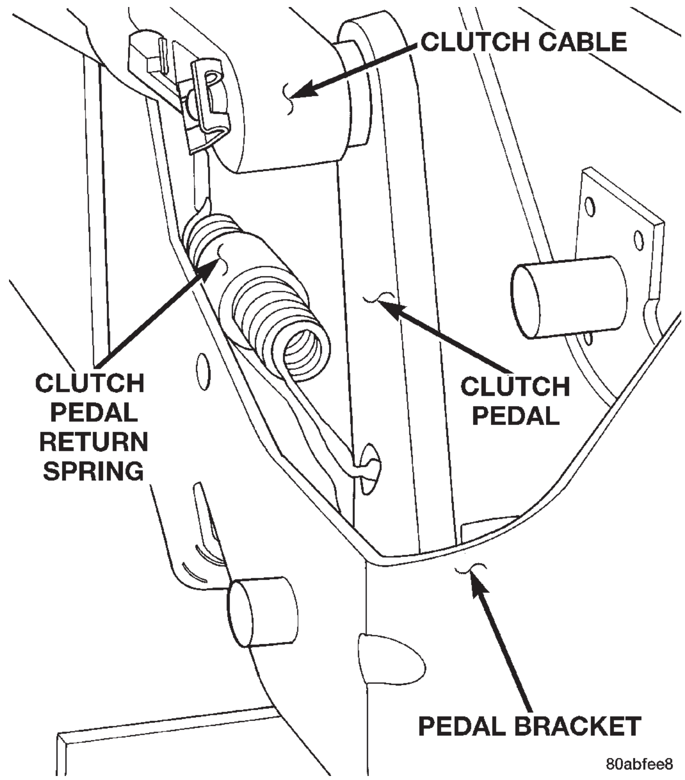

Fig. 3 Clutch Pedal Return Spring — 2.0L LHD

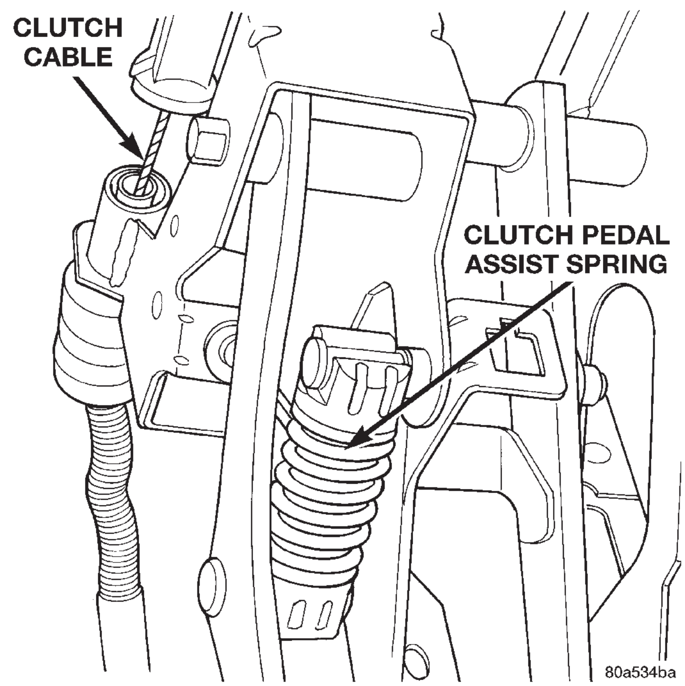

Fig. 4 Assist Spring — 2.4L and 2.5L VM Diesel LHD

GENERAL INFORMATION (Continued)

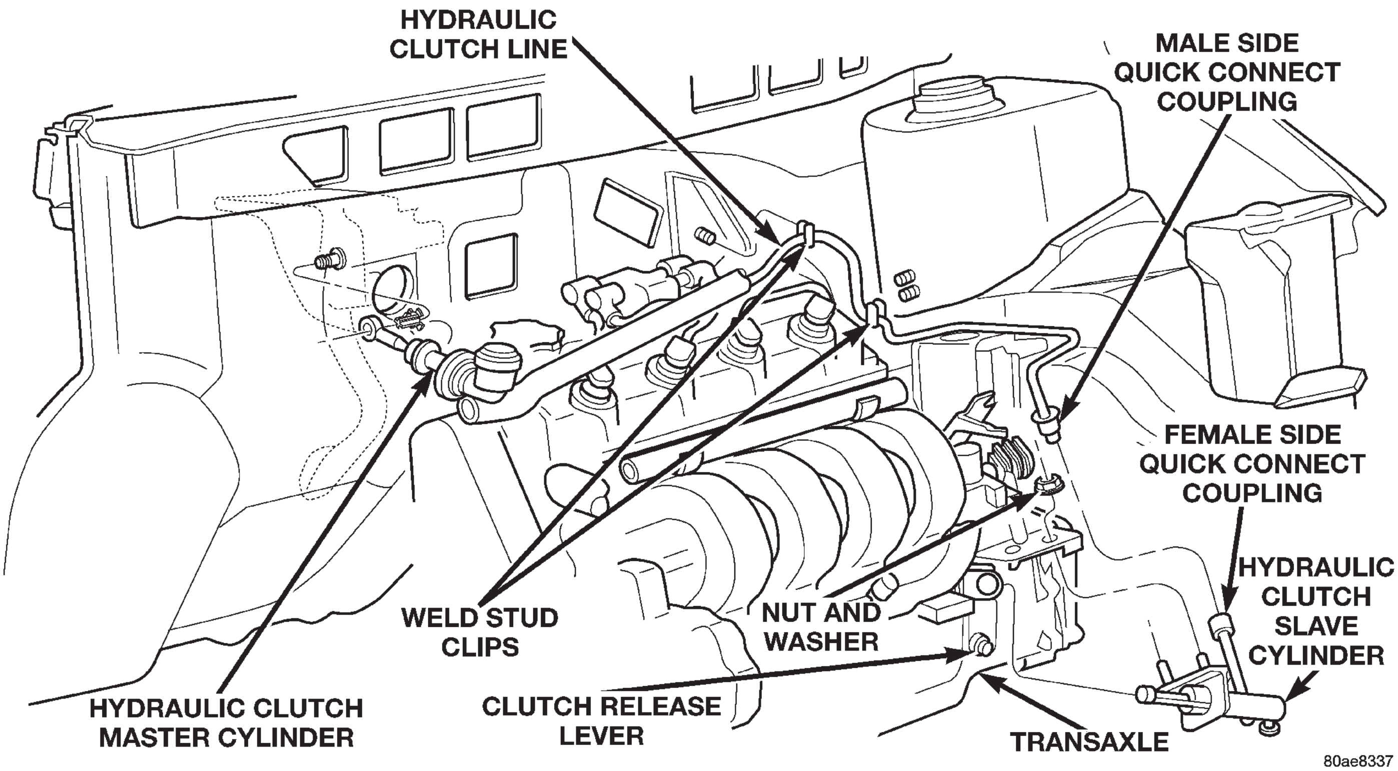

Fig. 5 Hydraulic Clutch Linkage System — RHD

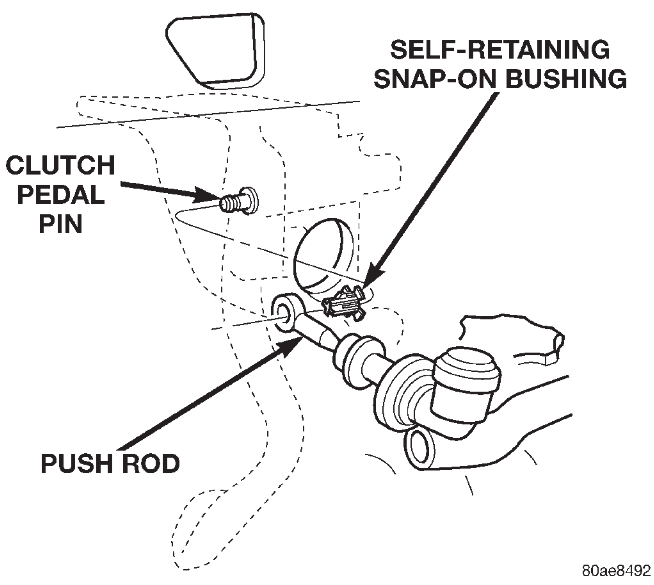

Fig. 6 Clutch Master Cylinder Mounting — RHD

CLUTCH DISC AND COVER APPLICATION

The 2.0 liter and 2.4 liter gasoline engines use a 240 mm (9.5 in.) modular clutch assembly. The 2.5 liter diesel engine uses a 240 mm (9.5 in.) standard clutch and pressure plate arrangement. Although the clutches are the same size they do not interchange.

CLUTCH REPLACEMENT

The transaxle must be removed to service the clutch assembly, fork, or bearing.

DESCRIPTION AND OPERATION

CLUTCH RELEASE SYSTEM

CLUTCH CABLE — LHD

The manual transaxle clutch release system has a unique self-adjusting mechanism to compensate for clutch disc wear (Fig. 7). This adjuster mechanism is located within the clutch cable assembly. The preload spring maintains tension on the cable. This tension keeps the clutch release bearing continuously loaded against the fingers of the clutch cover assembly.

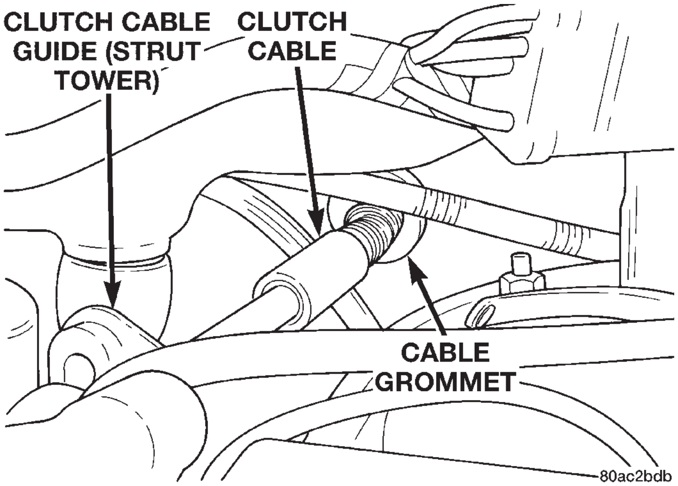

Fig. 7 Clutch Cable — LHD

HYDRAULIC CLUTCH — RHD

Leverage, clamping force, and friction are what make the clutch work. The disc serves as the friction element and a diaphragm spring and pressure plate provide the clamping force. The clutch pedal, hydraulic linkage, release lever and bearing provide the leverage to disengage and engage the modular clutch assembly.

The modular clutch assembly contains the cover, diaphragm spring, pressure plate, disc and flywheel in one unit. The modular clutch also uses a drive plate and is bolted to and driven by the drive plate.

The clutch linkage uses hydraulic pressure to operate the clutch. The clutch master cylinder push rod is connected to the clutch pedal and the slave cylinder push rod is connected to the release lever in the clutch housing.

Depressing the clutch pedal develops fluid pressure in the clutch master cylinder. This pressure is transmitted to the slave cylinder through a connecting line. In turn, the slave cylinder operates the clutch release lever.

The clutch release bearing is mounted on the transmission front bearing retainer. The bearing is attached to the release lever, which moves the bearing into contact with the clutch cover diaphragm spring.

Slave cylinder force causes the release lever to move the release bearing into contact with the diaphragm spring. As additional force is applied, the bearing presses the diaphragm spring fingers inward on the fulcrums. This action moves the pressure plate rearward relieving clamp force on the disc. The clutch disc is disengaged and not driven at this point.

The process of clutch engagement is simply the reverse of what occurs during disengagement. Releasing pedal pressure removes clutch linkage pressure. The release bearing moves away from the diaphragm spring which allows the pressure plate to exert clamping force on the clutch disc.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch functions as a safety interlock device. It prevents possible engine cranking with the clutch engaged.

The clutch pedal position switch is wired in series between the starter relay coil and the ignition switch.

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 8).

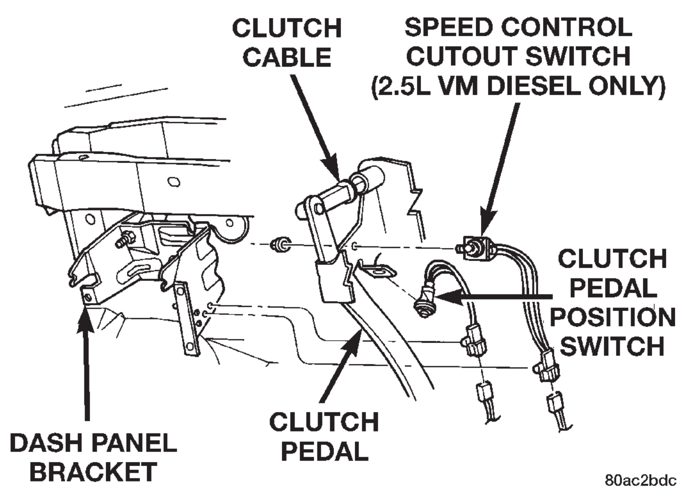

Fig. 8 Clutch Pedal Position Switch and Components — LHD Shown

DIAGNOSIS AND TESTING

CLUTCH PEDAL POSITION SWITCH

CLUTCH PEDAL POSITION SWITCH–ELECTRICAL TEST

Disconnect clutch pedal position switch harness from instrument panel wiring harness. Using an ohmmeter, check for continuity between the two terminals in the connector on the switch harness. There should be no continuity between the terminals when

DIAGNOSIS AND TESTING (Continued)

the switch is in its normal (fully extended) position. When the switch is depressed more than 1.25 mm (0.050), the ohmmeter should show continuity (zero ohms).

If ohmmeter readings do not fall within these ranges, the switch is defective, and must be replaced.

CLUTCH PEDAL POSITION SWITCH–MECHANICAL TEST

With the park brake set and the vehicle **IN NEUTRAL,** turn the key to the start position. The vehicle should not crank. If the vehicle cranks, the switch is defective (shorted out) and must be replaced. If the vehicle does not crank proceed to the next step.

WARNING: BEFORE PERFORMING THIS STEP, BE SURE THAT THE AREA IN FRONT OF THE VEHICLE IS CLEAR OF OBSTRUCTIONS AND PEOPLE. VEHICLE MAY MOVE WHEN PERFORMING THIS TEST.

With the park brake set and the vehicle **IN GEAR,** turn the key to the start position and hold it there.

Slowly depress the clutch pedal and feel for any vehicle motion when the starter is energized. If there is no motion the switch is working properly.

If motion is felt, check to see if the switch is making contact when the pedal is between 25 mm (1.0 in.) and 6 mm (0.25 in.) from the floor. If this condition is met, then the problem is either the clutch or the clutch actuation system (See “Clutch Will Not Disengage Properly”). If this condition is not met, then the switch mounting tab on the brake bracket is bent, and the brake bracket must be replaced.

If vehicle will not crank, even with clutch pedal pressed to the floor, refer to “Service Diagnosis-Clutch Pedal Position Switch” chart in this section.

SERVICE DIAGNOSIS–CLUTCH PEDAL POSITION SWITCH

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WON’T CRANK WHEN CLUTCH PEDAL IS PRESSED TO THE FLOOR	Switch does not have continuity when plunger is depressed 1.25 mm	Defective switch. Replace switch.
	Switch plunger is not depressed when clutch pedal is pushed to the floor	Floor mat interferes with clutch pedal movement. Move floor mat out of the way. Switch mounting bracket is bent. Replace brake bracket assembly
	Problem is related to other components in the starting circuit	Check other components in the starting circuit. Refer to Section 8A, Battery/Starting/Charging System.

DIAGNOSIS AND TESTING (Continued)

CLUTCH DIAGNOSIS

Problem diagnosis will generally require a road test to determine the type of fault. Component inspection will then determine the problem after road testing.

Drive the vehicle at normal speeds during road test. Shift the transaxle through all gear ranges and observe clutch action. If chatter, grab, slip, or improper release is experienced, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed. The transaxle or other driveline components may actually be at fault.

SERVICE DIAGNOSIS–CLUTCH GRAB/CHATTER

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC FACING COVERED WITH OIL OR GREASE	Oil leak at engine rear main or transaxle input shaft seal	Correct leak and replace clutch assembly
NO FAULT FOUND WITH CLUTCH COMPONENTS	Problem actually related to suspension or driveline component	Further diagnosis required. Check engine/transmission mounts, suspension attaching parts and other driveline components as needed.
	Engine related problems	Check EFI and ignition systems
PARTIAL ENGAGEMENT OF CLUTCH DISC	Clutch cover, spring, or release fingers bent, distorted (rough handling, improper assembly)	Replace clutch assembly
	Clutch disc damaged or distorted	Replace clutch assembly
	Clutch misalignment	Check alignment and runout of flywheel, disc, or cover. Check clutch housing to engine dowels and dowel holes for damage. Correct as necessary.

SERVICE DIAGNOSIS–CLUTCH SLIPS

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC FACING WORN OUT	Normal wear.	Replace clutch assembly.
	Driver frequently rides (slips) clutch, results in rapid wear overheating.	Replace clutch assembly
	Insufficient clutch cover diaphragm spring tension	Replace clutch assembly
CLUTCH DISC FACING CONTAMINATED WITH OIL OR GREASE	Leak at rear main oil seal or transaxle input shaft seal	Replace leaking seals. Replace clutch assembly.
	Road splash, water entering housing	Seal housing. Inspect clutch assembly.
CLUTCH IS RUNNING PARTIALLY DISENGAGED	Release bearing sticking or binding, does not return to normal running position.	Verify that bearing is actually binding. Then, replace bearing and transmission front bearing retainer if sleeve surface is damaged.
	Cable self-adjuster mechanism sticking or binding causing high preload (LHD Applications only)	Verify that self-adjuster is free to move (LHD Applications only)
CLUTCH DISC FACINGS HAVE FRACTURED INTO SMALL PIECES	Driver performs a 5-1 downshift at vehicle speed in excess of 60 miles per hour	Alert driver to problem cause. Replace clutch assembly.
	Excessive heat from slippage	Replace clutch assembly

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS–IMPROPER CLUTCH RELEASE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC BINDS ON INPUT SHAFT SPLINES	Clutch disc hub splines damaged during installation	Clean, smooth, and lubricate disc and shaft splines. Replace clutch assembly and/or input shaft if splines are severely damaged.
	Input shaft splines rough, damaged.	Clean input shaft splines. Then lube.
	Corrosion or rust formations on splines of input shaft and disc	Clean input shaft splines and disc splines, then lube
CLUTCH DISC RUSTED TO FLYWHEEL AND/OR PRESSURE PLATE	Occurs in vehicles stored or not driven for extended period of time. Also occurs after steam cleaning if vehicle is not used for extended period.	Replace clutch assembly
CLUTCH WILL NOT DISENGAGE PROPERLY	Disc bent, distorted during transaxle installation	Replace clutch assembly
	Clutch cover diaphragm spring damaged during transaxle installation	Replace clutch assembly
	Release fork and (or) bushings damaged	Replace fork and (or) bushings if worn or damaged
	Clutch cable binding or routed incorrectly	Check and correct cable routing
	Self-adjuster in cable not functioning properly, resulting in excess cable slack	Pull on cable conduit at transaxle (as if disconnecting cable) to check adjuster operation
	Clutch pedal travel restricted	Verify clutch pedal can travel all the way to the downstop on the bracket

SERVICE DIAGNOSIS–CLUTCH PEDAL NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH PEDAL MAKES REPEATED ″POP″ NOISE IN THE FIRST INCH OF TRAVEL	Self-adjusting mechanism in cable defective (LHD Applications)	Replace clutch cable (LHD Applications)
CLUTCH PEDAL SQUEAKS WHEN DEPRESSED TO FLOOR	Pedal bushings worn out or inadequate lubrication	Replace or lubricate bushings
	Clutch pedal assist spring fittings worn out	Replace assist spring fittings
	Clutch release shaft bushings in the bellhousing are worn out	Replace release shaft and bushings

DRIVE PLATE MISALIGNMENT

Common causes of misalignment are:

- Heat warping
- Mounting drive plate on a dirty crankshaft flange
- Incorrect bolt tightening
- Improper seating on the crankshaft shoulder
- Loose crankshaft bolts

Clean the crankshaft flange before mounting the drive plate. Dirt and grease on the flange surface may misalign the flywheel, causing excessive runout. Use new bolts when mounting drive plate to crankshaft. Tighten drive plate bolts to specified torque only. Over-tightening can distort the drive plate hub causing excessive runout.

DIAGNOSIS AND TESTING (Continued)

CLUTCH COVER AND DISC RUNOUT

Check condition of the clutch cover before installation. A warped cover or diaphragm spring will cause grab and/or incomplete release or engagement. Use care when handling the clutch assembly. Impact can distort the cover, diaphragm spring, and release fingers.

CLUTCH CHATTER COMPLAINTS

For all clutch chatter complaints, do the following:

(1) Check for loose, misaligned, or broken engine and transmission mounts. If present, they should be corrected at this time. Test vehicle for chatter. If chatter is gone, there is no need to go any further. If chatter persists:

(2) Check to see if clutch cable routing is correct and operates smoothly (LHD applications).

(3) Check for loose connections in drivetrain. Correct any problems and determine if clutch chatter complaints have been satisfied. If not:

(4) Remove transaxle. See Group 21, Manual Transaxle for procedure.

(5) Check to see if the release bearing is sticky or binding. Replace bearing, if needed.

(6) Check linkage for excessive wear on the pivot shaft, fork, and bushings. Replace all worn parts.

(7) Check clutch assembly for contamination (dirt, oil). Replace clutch assembly, if required.

(8) Check to see if the clutch disc hub splines are damaged. Replace with new clutch assembly, if necessary.

(9) Check input shaft splines for damage. Replace, if necessary.

(10) Check for uneven wear on clutch fingers.

(11) Check for broken clutch cover diaphragm spring fingers. Replace with new clutch assembly, if necessary.

CLASH–INTO–REVERSE COMPLAINTS

(1) Depress clutch pedal to floor and hold. After three seconds, shift to reverse. If clash is present, clutch has excessive spin time.

NOTE: Verify that nothing is obstructing pedal travel. Floormats or other articles located underneath the clutch pedal could prevent the clutch from disengaging fully.

(2) Remove transaxle. See Group 21, Manual Transaxle for procedure.

(3) Check the input shaft spline, clutch disc splines, and release bearing for dry rust. If present, clean rust off and apply a light coat of bearing grease to the input shaft splines. Apply grease on the input shaft splines only where the clutch disc slides. Verify that the clutch disc slides freely along the input shaft spline.

(4) Check to see if the clutch disc hub splines are damaged, and replace with new clutch assembly if required.

(5) Check the input shaft for damaged splines. Replace as necessary.

(6) Check for broken clutch cover diaphragm spring fingers.

(7) Install clutch assembly and transaxle.

REMOVAL AND INSTALLATION

CLUTCH CABLE SYSTEM — LHD

REMOVAL

(1) Hoist vehicle

(2) Using a pair of pliers, grasp end of clutch cable and pull downward.

(3) Remove clutch cable retaining clip from clutch release lever (Fig. 9).

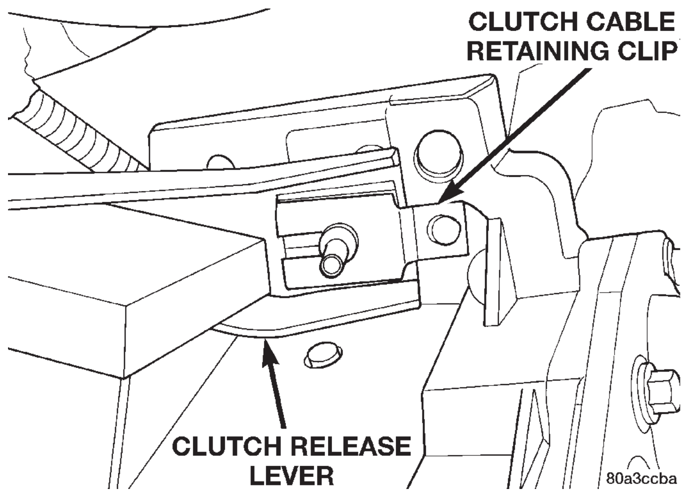

Fig. 9 Clutch Cable Retaining Clip — LHD

(4) Guide cable through slot in transaxle and disconnect (Fig. 10).

(5) Unsnap cable from the cable guide located at the left shock tower (Fig. 10).

(6) Inside the vehicle, remove the driver side lower dash cover and steel support plate. This provides access to the top of the clutch pedal.

(7) Disconnect clutch cable upstop/spacer with cable strand from clutch pedal (Fig. 11) (Fig. 12).

REMOVAL AND INSTALLATION (Continued)

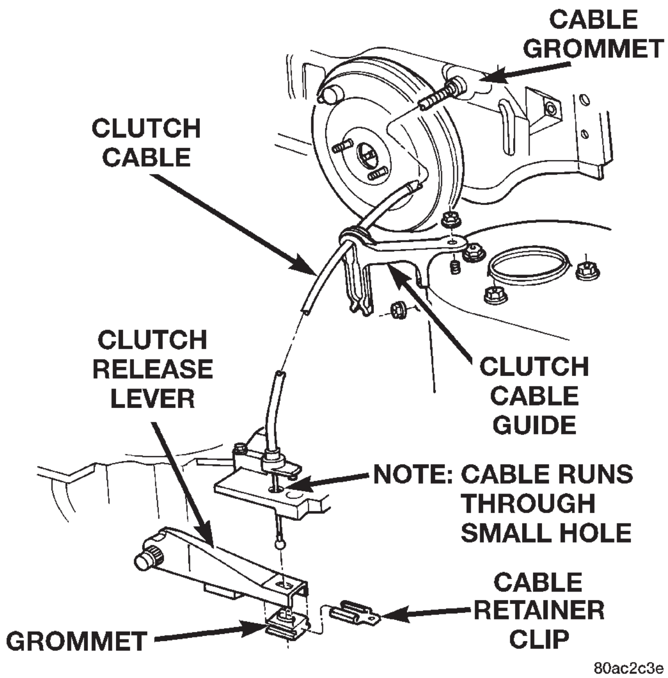

Fig. 10 Clutch Cable Routing — LHD

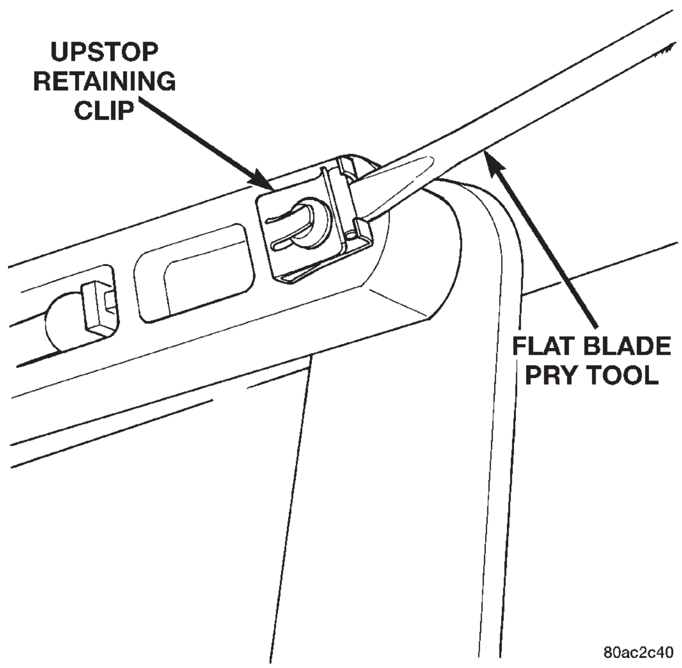

Fig. 11 Clutch Cable Retaining (Upstop) Clip — LHD

NOTE: Depressing the clutch pedal to the floor provides access to the clutch cable strand. Disconnect the cable upstop/spacer from the pedal pivot pin by removing the retaining clip at the top of the clutch pedal. Wedge a flat blade pry tool in the clip slot to remove the clip. Remove the clutch pedal upstop/ spacer from the pedal by wedging a flat blade pry tool between the spacer and pedal. It may be necessary to push the steel support bracket supporting the electrical junction block slightly to the left for clearance to remove the upstop/spacer from the pedal. Push the cable end fitting out of upstop/ spacer.

CAUTION: Use caution if lifting the clutch pedal once the clutch pedal/upstop spacer has been removed. The clutch pedal assist spring provides enough pedal force to cause an injury. Also, on 2.5L Turbo Diesel vehicles, lifting the clutch pedal with the upstop/spacer removed may bend the cruise control cutout switch bracket located near the top of the clutch pedal. This will result in non-operational cruise control.

CAUTION: Do not pull on the clutch cable to remove it from the dash panel. Damage to the cable self-adjuster may occur.

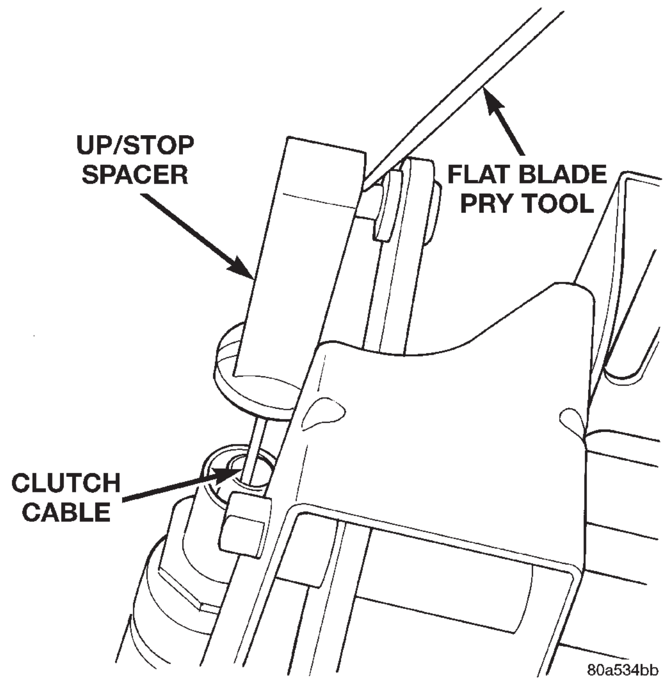

Fig. 12 Upstop/Spacer — LHD

NOTE: It may be helpful to remove the battery and clutch cable guide from the left shock tower to improve access to the clutch cable dash panel grommet.

REMOVAL AND INSTALLATION (Continued)

(8) Use a slight twisting motion while grasping the grommet and body to remove the cable from the dash panel and clutch bracket.

INSTALLATION

(1) Using a slight twisting motion, insert the self–adjuster mechanism end of the clutch cable through the dash panel hole and into the bracket.

NOTE: It may be helpful to lubricate the dash panel grommet using Mopar® Door-Ease or equivalent to aid installation.

(2) Seat the cylindrical part of the cable grommet in the dash panel. Be sure the self–adjuster is firmly seated against the clutch bracket to ensure proper adjuster mechanism function.

(3) Connect the clutch cable to the upstop/spacer.

(4) Connect the upstop/spacer to the clutch pedal.

(5) Replace the upstop/spacer retainer clip.

(6) Lift the clutch pedal and perform the Adjuster Mechanism Function Check before finishing installation.

NOTE: If the adjuster mechanism does not function properly, the most likely cause is that the cable is not properly seated in the bracket.

ADJUSTER MECHANISM FUNCTION CHECK — LHD

(1) With slight pressure, pull the clutch release lever end of the cable to draw the cable taut. Push the clutch cable housing toward the dash panel (With less than 20 lbs. of effort, the cable housing should move 30-50mm.). This indicates proper adjuster mechanism function. If the cable does not adjust, determine if the mechanism is properly seated on the bracket.

(2) If the adjust mechanism functions properly, route cable to the transaxle. Install battery and cable guide.

(3) Snap cable into cable guide located at the left shock tower.

(4) Insert cable into transaxle and through clutch release lever. Ensure the cable is routed through the smaller hole in the transaxle deck (Fig. 10).

(5) Pull down on cable and insert cable retaining clip onto clutch cable end.

(6) Check clutch pedal position switch operation.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 13).

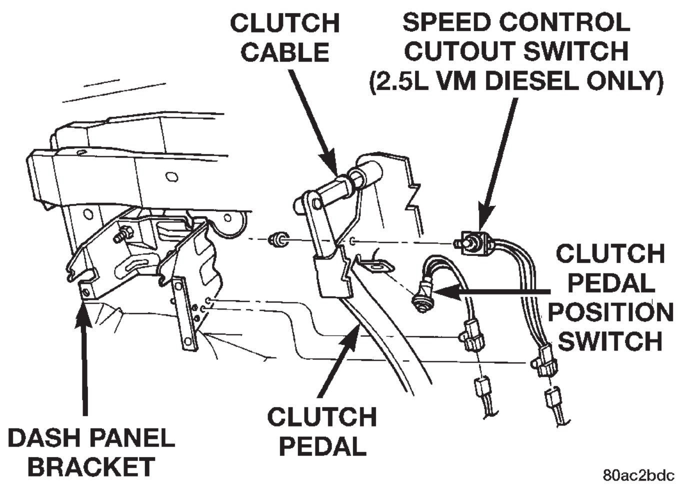

Fig. 13 Clutch Pedal Position Switch and Components (LHD Shown)

REMOVAL

(1) Disconnect electrical harness to switch connector.

(2) Depress wing tabs on switch and push switch out of mounting bracket. Then slide wires through slot in bracket.

INSTALLATION

(1) Slide switch wires through slot in switch bracket.

(2) Line up switch tab with slot in switch bracket and push switch into position. Do not pull on the switch wires to seat switch into bracket, switch damage may occur.

(3) Attach switch wiring harness to vehicle wiring harness. Attach switch panel to the dash panel bracket (Fig. 13).

(4) After installation, the switch must be checked for proper operation. Refer to Diagnosis and Testing section for proper testing procedures.

REMOVAL AND INSTALLATION (Continued)

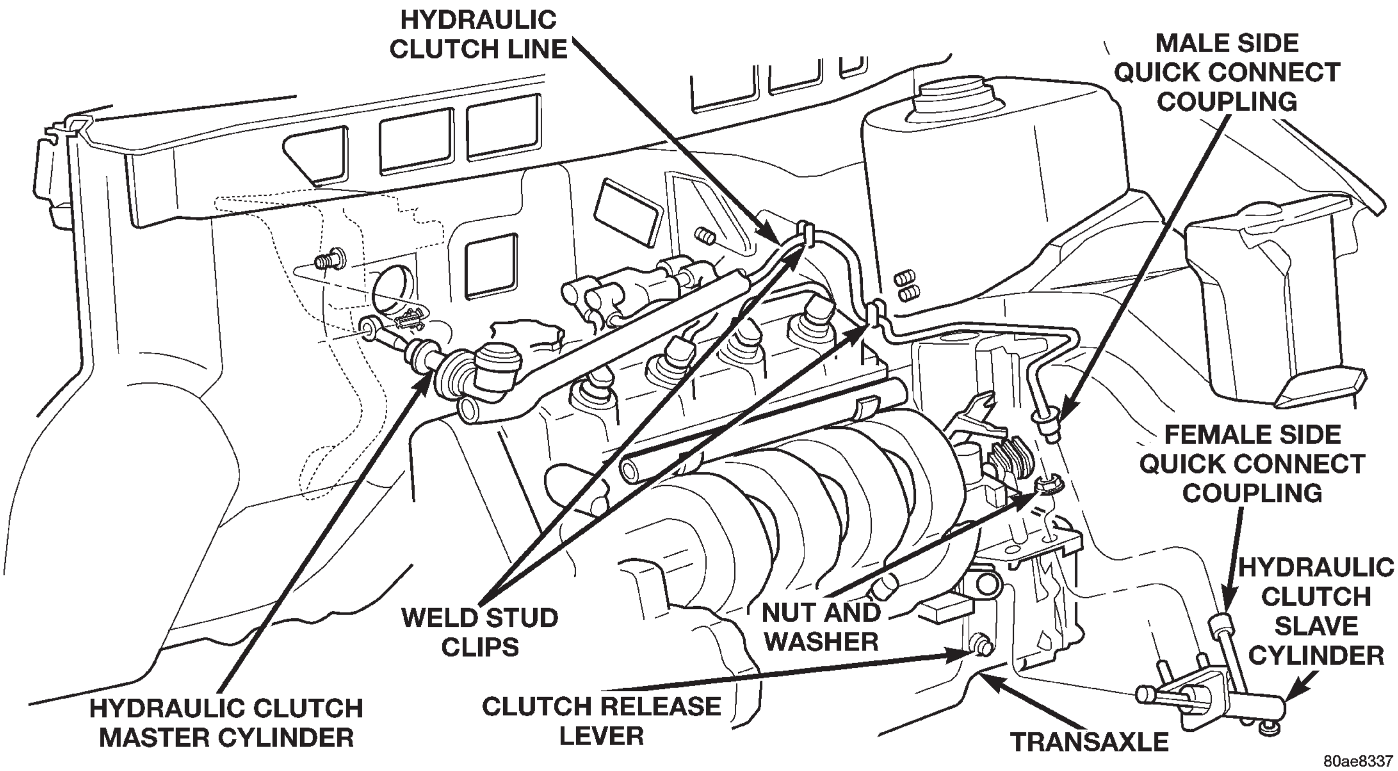

Fig. 14 Hydraulic Clutch Linkage System — RHD

HYDRAULIC CLUTCH LINKAGE SYSTEM — RHD

CAUTION: Do not actuate the master cylinder or step on the clutch pedal before the quick connect coupling is joined or an over pressure condition could result in damage to the master cylinder, the quick connect coupling, or the dash panel.

NOTE: The hydraulic clutch linkage system is pre-filled by the supplier who warrants the system to be free of air, contamination, and leaks. No routine maintenance is required. Except for the self-retaining snap-on master cylinder pushrod bushing, the hydraulic system is serviced only as a complete assembly and individual components cannot be overhauled or replaced.

REMOVAL

1. Disconnect the quick connect coupling to facilitate the removal of the master cylinder assembly and slave cylinder assembly separately (Fig. 14). Refer to the removal and installation procedure in this section for detailed instructions on disconnecting and connecting the quick connect coupling.

2. Remove the master cylinder assembly (Fig. 15). Refer to the master cylinder removal and installation procedure in this section for detailed instructions on removal of the master cylinder assembly.

3. Remove the slave cylinder assembly. Refer to the slave cylinder removal and installation procedure in this section for detailed instructions on removal and installation of the slave cylinder.

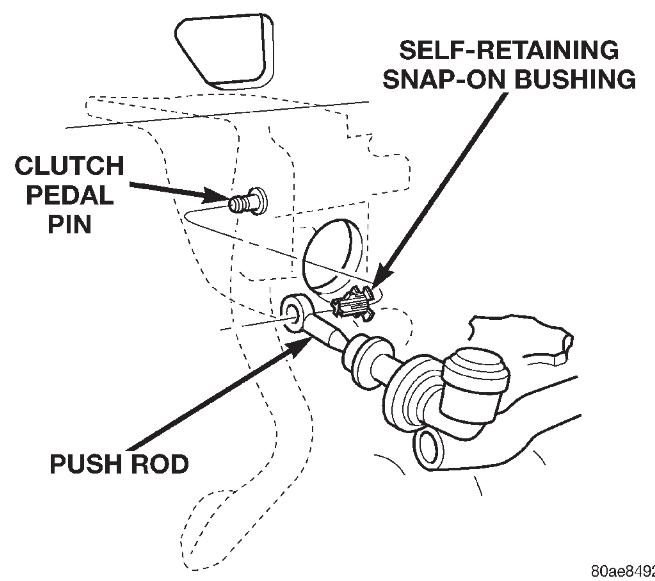

Fig. 15 Self-Retaining Snap-on Bushing — RHD

INSTALLATION

1. For installation of the hydraulic clutch linkage system, reverse the above procedure.

REMOVAL AND INSTALLATION (Continued)

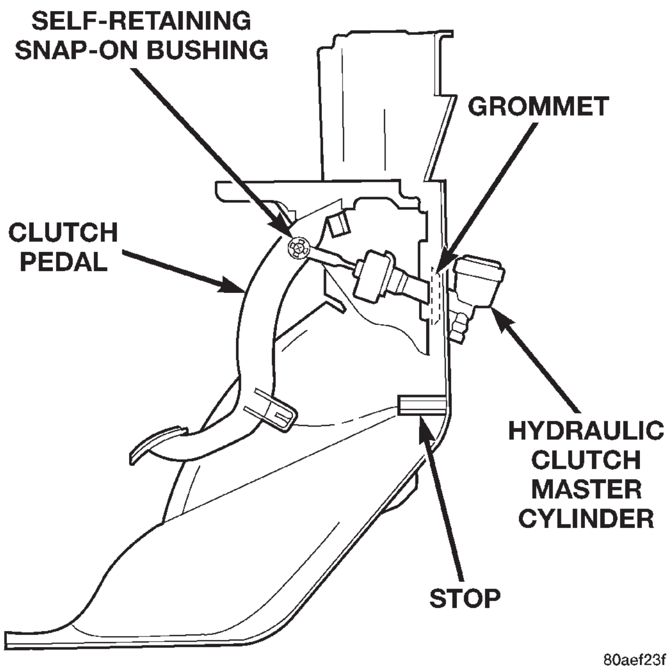

Fig. 16 Clutch Master Cylinder — RHD

QUICK CONNECT COUPLING — RHD

CAUTION: Do not actuate the master cylinder or step on the clutch pedal before the quick connect coupling is joined, or an over pressure condition could result in damage to the master cylinder, the quick connect coupling, or the dash panel.

REMOVAL

1. Disconnect the quick connect coupling by lightly pushing down on the black release collar on the male side of the quick connect coupling while separating it from the female side of the quick connect coupling (Fig. 14).

INSTALLATION

1. Connect the male side of the quick connect coupling (part of the master cylinder assembly) by holding the clutch tube at the rear and inserting it into the female side of the quick connect coupling (part of the slave cylinder assembly) until an audible click is heard (Fig. 14). **Do not push on the black release collar on the male side of the quick connect coupling while inserting it into the female side of the quick connect coupling.**
2. Confirm the connection by pulling firmly on the clutch tube.

MASTER CYLINDER SYSTEM — RHD

REMOVAL

(1) Disconnect the quick connect coupling. Refer to the “Quick Connect Coupling” removal and installation procedure in this section.

(2) Remove the master cylinder pushrod from the clutch pedal pin by prying between the self-retaining snap-on bushing, located in the master cylinder pushrod, and the clutch pedal pin (Fig. 15).

(3) Disconnect the hydraulic line from the weld stud clips (Fig. 14).

(4) Remove the rubber grommet at the master cylinder pass through in the dash panel (Fig. 16).

(5) Remove the master cylinder assembly from the engine compartment by rotating it clockwise from the 12 o’clock lock position to the 2 o’clock unlock position and pulling the master cylinder out tilted 20 degrees down. **NOTE: A “Twist and Lock” type mechanism is used to secure the master cylinder to the clutch pedal bracket which is attached to the dash panel.**

INSTALLATION

(1) Position the master cylinder assembly to the clutch pedal bracket by tilting it 20 degrees upward and at the 2 o’clock unlocked position.

(2) Rotate the master cylinder counterclockwise to the 12 o’clock locked position.

(3) Install the rubber grommet into the dash panel at the master cylinder pass through (Fig. 16).

(4) Connect the hydraulic line to the weld stud clips in the engine compartment (Fig. 14).

(5) Connect the quick connect coupling. Refer to the “Quick Connect Coupling” removal and installation procedure in this section.

(6) Install the self-retaining snap-on bushing into the master cylinder pushrod, if necessary.

(7) Install the master cylinder pushrod with self-retaining snap-on bushing onto the clutch pedal pin by pressing it onto the clutch pedal pin until seats in the groove of the clutch pedal pin.

SLAVE CYLINDER ASSEMBLY — RHD

REMOVAL

1. Disconnect the quick connect coupling. Refer to the “Quick Connect Coupling” removal and installation procedure in this section.
2. Remove the nut and washer assemblies (2) retaining the slave cylinder and mounting bracket assembly to the transaxle (Fig. 14).
3. Remove the slave cylinder assembly from the transaxle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

1. Position the slave cylinder assembly to the transaxle deck and secure with the nut and washer assemblies (2) and tighten to specifications (Fig. 14).
2. Make sure the slave cylinder pushrod is properly seated in the cup end of the clutch release lever.
3. Connect the quick connect coupling. Refer to the “Quick Connect Coupling” removal and installation procedure in this section.

MODULAR CLUTCH ASSEMBLY (2.0L AND 2.4L GASOLINE)

The transaxle must be removed to service the modular clutch assembly and components (Fig. 17). Refer to Group 21 for the “A-558 Manual Transaxle” removal procedure.

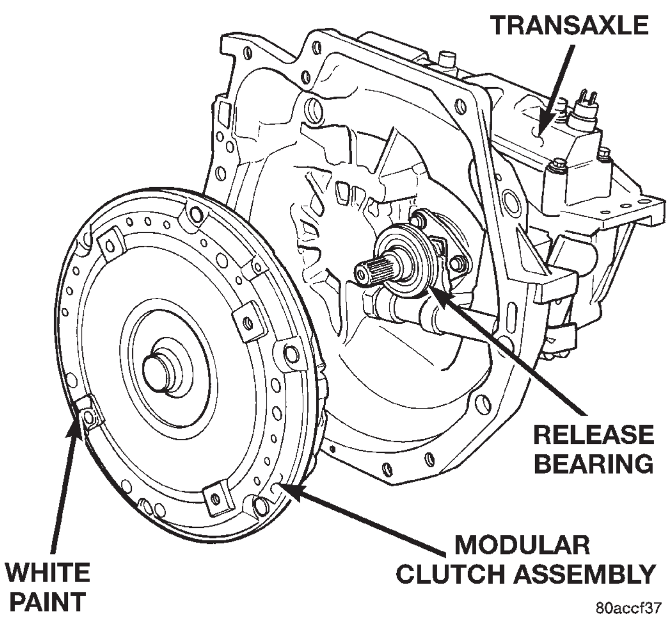

Fig. 17 Modular Clutch Assembly — 2.0L and 2.4L

CLUTCH ASSEMBLY (2.5L DIESEL)

The transaxle must be removed to service the clutch disc assembly and components.

REMOVAL

(1) Remove the transaxle, refer to Group 21, Transaxle.

(2) Install universal clutch alignment tool into the clutch assembly (this will prevent the clutch from inadvertently being dropped).

(3) To avoid distortion of the pressure plate, remove the clutch pressure plate bolts a few turns at a time. Use a crisscross pattern until all bolts are loosened.

(4) Carefully remove the clutch pressure plate and disc (Fig. 18).

To service the flywheel, refer to Group 9, Engine.

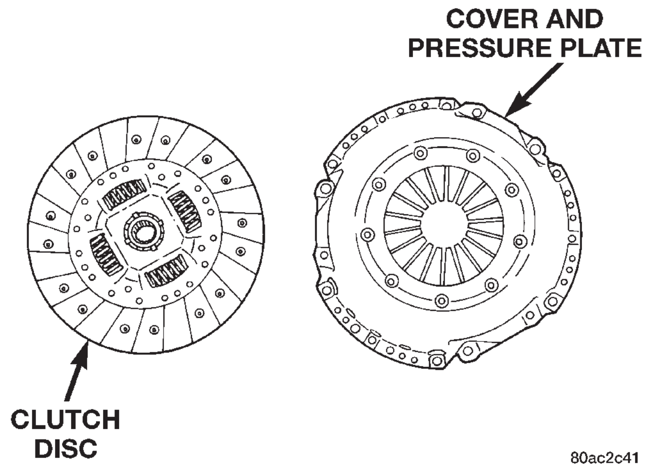

Fig. 18 Clutch Disc, Cover and Pressure Plate

INSPECTION

Inspect for oil leakage through engine rear main bearing oil seal and transaxle input shaft seal. If leakage is noted, it should be corrected at this time.

The friction faces of the flywheel and pressure plate should not have:

- Excessive discoloration
- Burned areas
- Small cracks
- Deep grooves
- Ridges

Replace parts as required.

CAUTION: Do not polish flywheel to a mirror like surface. Clean the flywheel face with medium sandpaper (80-160 grade), then wipe the surface with mineral spirits. If the surface is severely scored, heat checked, or warped, replace the flywheel.

CAUTION: Do not flat-machine the flywheel face. The surface profile is slightly tapered and has a 0.30 mm step.

The disc assembly should be handled without touching the facings. Replace disc if the facings show evidence of grease or oil soakage, or wear to within less than .38 mm (.015 inch) of the rivet heads. The splines on the disc hub and transaxle input shaft should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean, and not been discolored from excessive heat. Each of the arched springs between the facings should not be broken and all rivets should be tight.

Wipe the friction surface of the pressure plate with mineral spirits.

Using a straight edge, check clutch cover (pressure plate) for flatness. The clutch cover (pressure plate)

REMOVAL AND INSTALLATION (Continued)

friction area should be slightly concave, with the inner diameter 0.02 mm to 0.1 mm (.0008 in. to .0039 in.) below the outer diameter. It should also be free from discoloration, burned areas, cracks, grooves, or ridges.

Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch.

The cover should be a snug fit on flywheel dowels. If the clutch assembly does not meet these requirements, it should be replaced.

INSTALLATION

(1) Position the clutch and pressure plate onto the flywheel.

(2) Insert the universal clutch alignment tool into the clutch disc.

(3) To avoid distortion of the pressure plate, bolts should be tightened a few turns at a time (Fig. 19). Use a crisscross pattern until all bolts are seated. Tighten pressure plate bolts to 27 N·m (20 ft. lbs.).

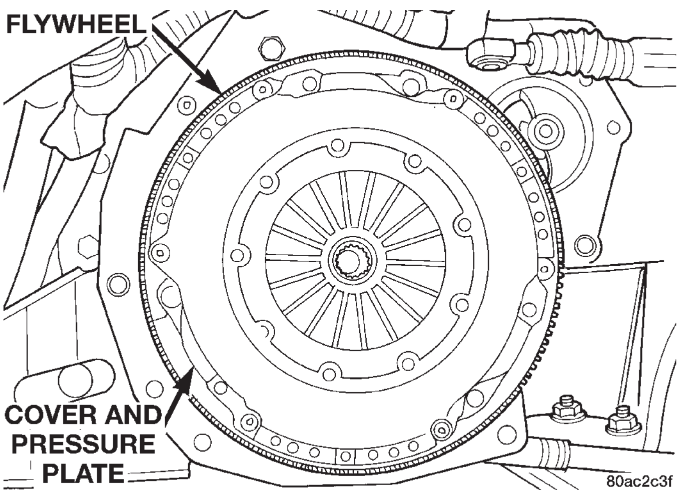

Fig. 19 2.5 Diesel Clutch Assembly

(4) Remove the universal clutch alignment tool.

(5) Install the transaxle, refer to Group 21, Transaxle.

(6) Fill transaxle to the proper level with the specified lubricant.

(7) While the vehicle is elevated slightly, run the transaxle through all the forward gears. Apply brakes and shift into reverse. Run the transaxle through reverse gear.

(8) Check the transaxle for leaks and recheck the level of the transaxle lubricant.

CLUTCH RELEASE BEARING AND FORK

Remove the transaxle from the vehicle. See Group 21, for removal and installation procedures.

REMOVAL

(1) Remove clutch release shaft E-clip (Fig. 20).

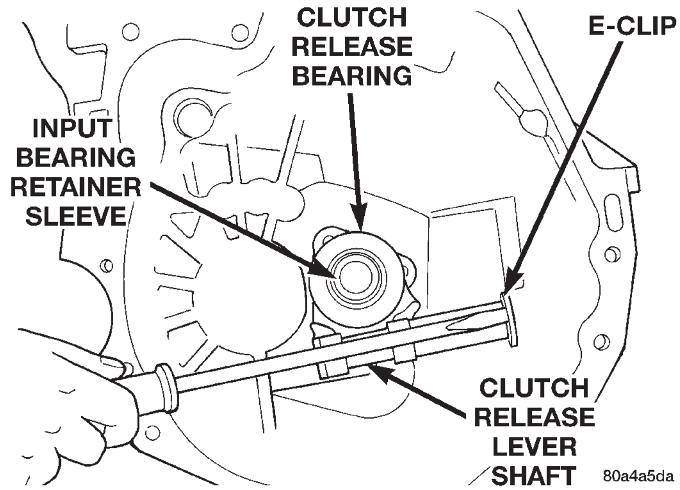

Fig. 20 E-clip at Clutch Release Lever Shaft

(2) Remove the clutch release shaft and then slide the fork and bearing assembly off the bearing pilot (Fig. 21).

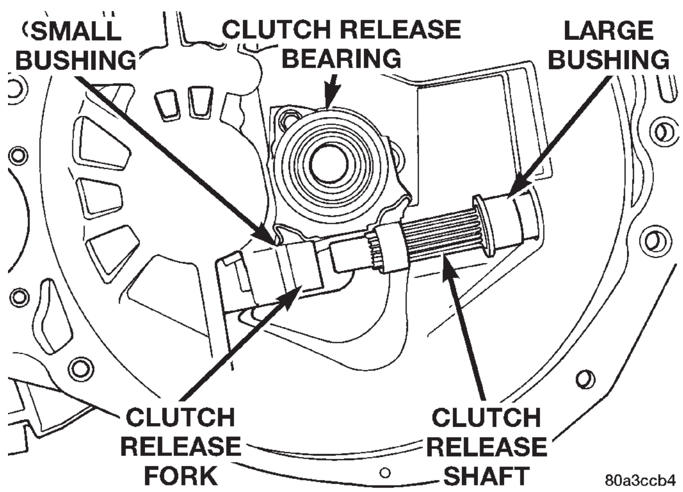

Fig. 21 Clutch Release Shaft

REMOVAL AND INSTALLATION (Continued)

(3) Remove the fork from the bearing thrust plate (Fig. 22).

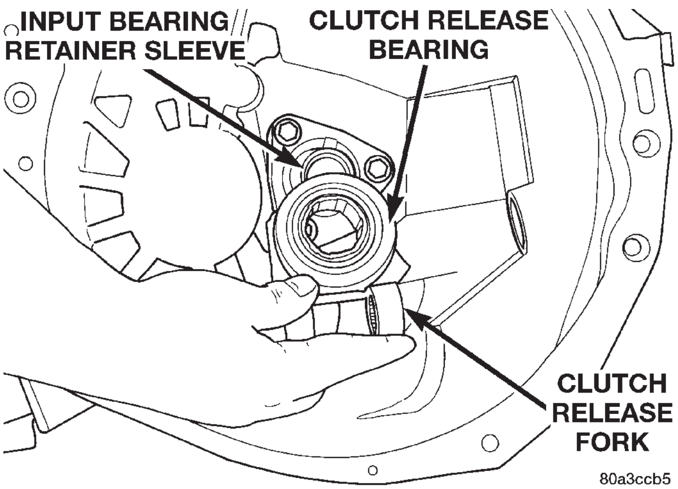

Fig. 22 Clutch Release Fork

(4) Examine the condition of the bearing. It is prelubricated and sealed and should not be immersed in oil or solvent.

(5) The bearing should turn smoothly when held in the hand under a light thrust load. A light drag caused by the lubricant fill is normal. If the bearing is noisy, rough, or dry, replace the complete bearing assembly with a new bearing.

(6) The bearing has a plastic sleeve pre-lubricated at assembly. Wipe out the old grease. Refill the sleeve cavities and coat the inner surface with multipurpose grease. If the liner is cracked or worn, replace the bearing assembly.

(7) Check the condition of the spring clips. If the clips are broken or distorted, replace the bearing assembly.

INSTALLATION

(1) Before assembling the fork, lubricate the rounded thrust pads and the spring clip cavities with multipurpose grease.

(2) Assemble the fork to the bearing by sliding the thrust pads under the spring clips. Be careful to avoid distorting the spring clips. These clips prevent the bearing thrust plate from rotating with the bearing.

(3) Slide the bearing and fork assembly onto the input shaft bearing retainer.

(4) Position the release shaft bushings in the housing and install the release shaft. A small amount of bearing grease between the release shaft bushing and the shaft is beneficial but not required. Install the retainer clip in the shaft groove near the large bushing.

(5) Install the release lever and retaining clip on the outer end of the release shaft.

CLEANING AND INSPECTION

CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, grease, water, or other fluids on the clutch contact surfaces will cause faulty operation.

During inspection, note if any components are contaminated. Look for evidence of oil, grease, or water/road splash on clutch components.

OIL CONTAMINATION

Oil contamination indicates a leak at the rear main seal and/or transaxle input shaft. Oil leaks produce a residue of oil on the transaxle housing interior, clutch cover and flywheel. Heat buildup caused by slippage can bake the oil residue onto the components. This glaze-like residue ranges in color from amber to black.

GREASE CONTAMINATION

Grease contamination is usually a product of overlubrication. During clutch service, apply only a small amount of grease to the input shaft splines. Excess grease may be thrown off during operation, contaminating the disc.

ROAD SPLASH/WATER CONTAMINATION

Road splash contamination is usually caused by driving the vehicle through deep water puddles. Water can be forced into the clutch housing, causing clutch components to become contaminated. Facing of disc will absorb moisture and bond to the flywheel and/or, pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, replacement of clutch assembly may be required. Drive the vehicle until normal clutch operating temperature has been obtained. This will dry off disc assembly, pressure plate, and flywheel.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. Facing of disc will absorb moisture and will bond to flywheel and/or pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, it may require replacement of clutch assembly. After cleaning, drive the vehicle to its normal clutch operating temperature. This will dry off disc assembly, pressure plate, and flywheel.

ADJUSTMENTS

CLUTCH CABLE — LHD

The manual transaxle clutch release system has a unique self-adjusting mechanism to compensate for clutch disc wear. This adjuster mechanism is located within the clutch cable assembly. The preload spring maintains tension on the cable. This tension keeps the clutch release bearing continuously loaded against the fingers of the clutch cover assembly.

ADJUSTER MECHANISM FUNCTION CHECK — LHD

(1) With slight pressure, pull the clutch release lever end of the cable to draw the cable taut. Push the clutch cable housing toward the dash panel (With less than 20 lbs. of effort, the cable housing should move 30-50mm.). This indicates proper adjuster mechanism function. If the cable does not adjust, determine if the mechanism is properly seated on the bracket.

(2) If the adjust mechanism functions properly, route cable to the transaxle.

(3) Insert cable into transaxle and through clutch release lever. Ensure the cable is routed through the smaller hole in the transaxle deck (Fig. 10).

(4) Pull down on cable and insert cable retaining clip onto clutch cable end.

(5) Check clutch pedal position switch operation.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position.

SPECIFICATIONS

CLUTCH TIGHTENING REFERENCE

2.0/2.4 LITER GASOLINE ENGINE

DESCRIPTION	TORQUE
Drive Plate Bolts	95 N·m (70 ft. lbs.)
Lower Trans. Cover	12 N·m (105 in. lbs.)
Modular Clutch Bolts	74 N·m (55 ft. lbs.)
Upper Trans. Cover	12 N·m (105 in. lbs.)

2.5 LITER DIESEL ENGINE

DESCRIPTION	TORQUE
Flywheel Bolts	95 N·m (70 ft. lbs.)
Lower Trans. Cover	12 N·m (105 in. lbs.)
Clutch Pressure Plate Bolts	27 N·m (20 ft. lbs.)
Upper Trans. Cover	12 N·m (105 in. lbs.)

COOLING SYSTEM

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GENERAL INFORMATION

ACCESSORY DRIVE BELTS

The accessory drive system utilizes two different style of drive belts. The conventional V-belt and the Poly-V belt are used to drive the generator, air conditioning compressor, power steering pump and water pump. Satisfactory performance of these belts depends on belt condition and proper belt tension. Belt tensioning should be performed with the aid of a Burroughs gauge Special Tool C-4162. Because of space limitations in the engine compartment, the use of the gauge may be restricted. Raise the vehicle on a hoist and then remove the splash shield to gain access to the drive belts.

GENERAL INFORMATION (Continued)

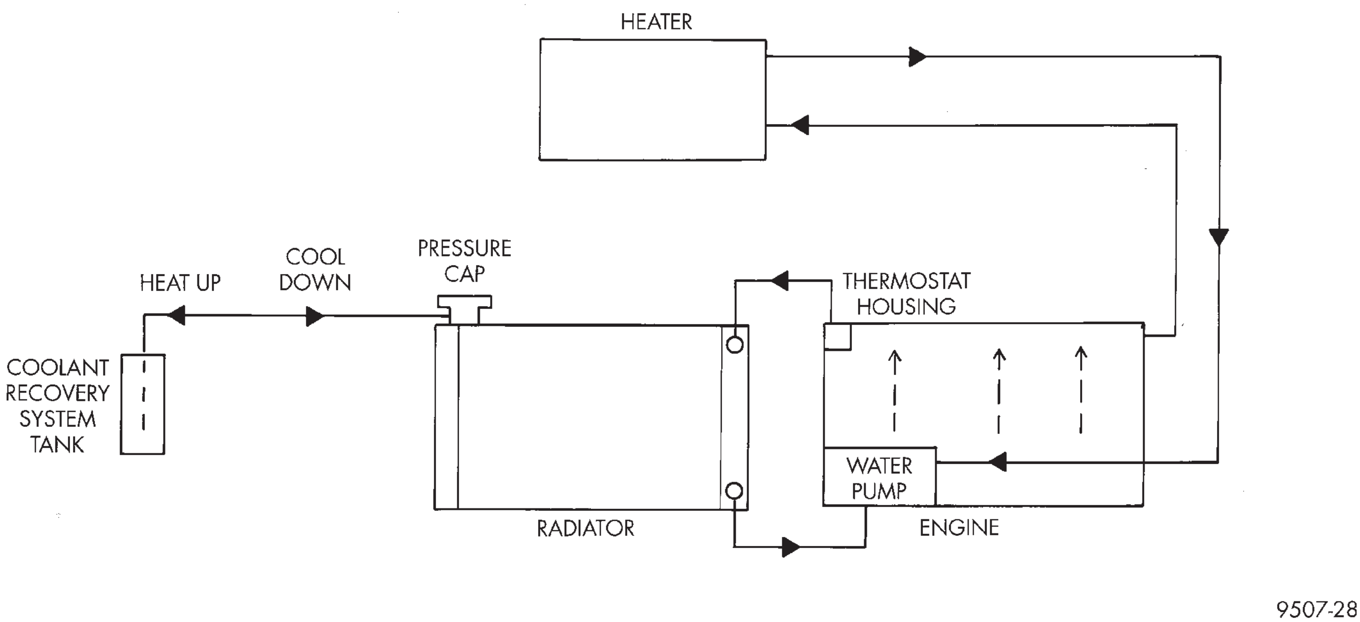

Fig. 1 Cooling System Operation 2.4L and 3.3/3.8L Engines

COOLING SYSTEM

The cooling system has a radiator, coolant, electric fan motor, shroud, pressure cap, thermostat, coolant reserve system, transmission oil cooler, a water pump to circulate the coolant, hoses, and clamps to complete the circuit.

• When Engine is cold: thermostat is closed, cooling system has no flow through the radiator. The coolant bypass flows through the engine only.

• When Engine is warm: thermostat is open, cooling system has bypass flow and coolant flow through radiator.

Its primary purpose is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also provides hot water (coolant) for heater performance and cooling for automatic transmission oil. It does this by transferring heat from engine metal to coolant, moving this heated coolant to the radiator, and then transferring this heat to the ambient air.

Coolant flow circuits for 2.4L and 3.3/3.8L engines are shown in (Fig. 1), and 3.0L engine coolant routing is shown in (Fig. 2)

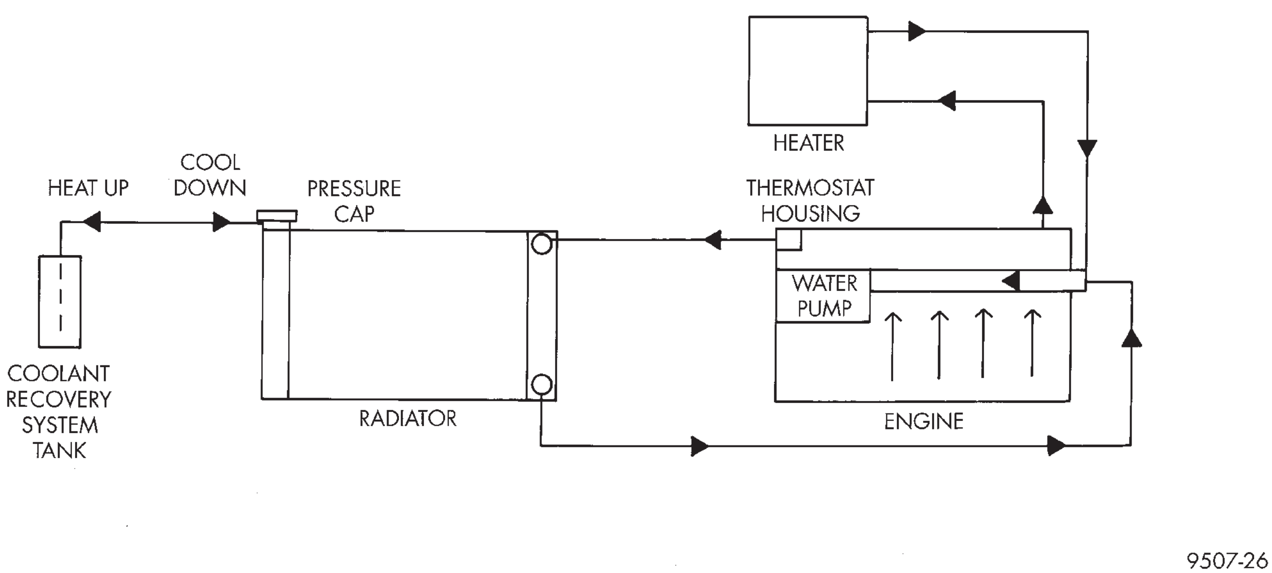

Fig. 2 Cooling System Operation 3.0L Engine

GENERAL INFORMATION (Continued)

COOLANT RECOVERY SYSTEM (CRS)

This system works with the radiator pressure cap to use thermal expansion and contraction of the coolant to keep the coolant free of trapped air. Provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure without removing the radiator pressure cap. It also provides some reserve coolant to cover deaeration and evaporation or boiling losses. All vehicles are equipped with this system and take various shapes and forms. (Fig. 3) shows a typical system in the typical location.

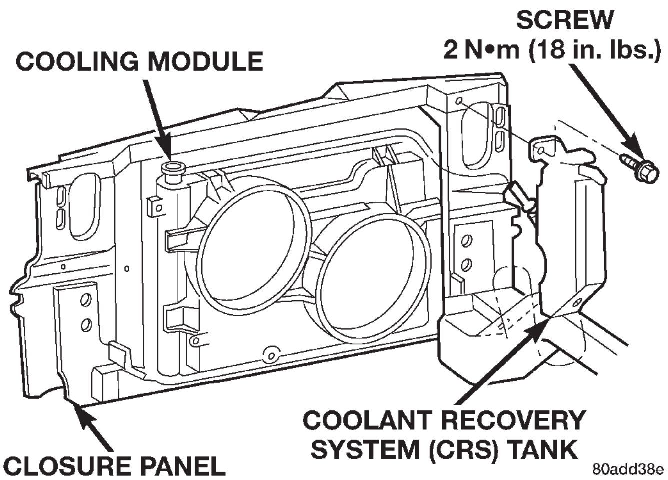

Fig. 3 Coolant Recovery System

See Coolant Level Service, and Deaeration, and Pressure Cap sections for operation and service.

AUTOMATIC TRANSMISSION OIL COOLER—2.4L

Oil cooler is internal oil to coolant type, mounted in the radiator left tank (Fig. 4). Rubber oil lines feed the oil cooler and the automatic transmission. Use only approved transmission oil cooler hose. Since these are molded to fit space available, molded hoses are recommended.

ENGINE THERMOSTAT

The engine cooling thermostats are a wax pellet driven, reverse poppet choke type. They are designed to provide the fastest warm up possible by preventing leakage through them and to guarantee a minimum engine operating temperature of 88 to 93°C (192 to 199°F). They also automatically reach wide open so they do not restrict flow to the radiator as temperature of the coolant rises in hot weather to around 104°C (220°F). Above this temperature the coolant temperature is controlled by the fan, the radiator, and the ambient temperature, not the thermostat.

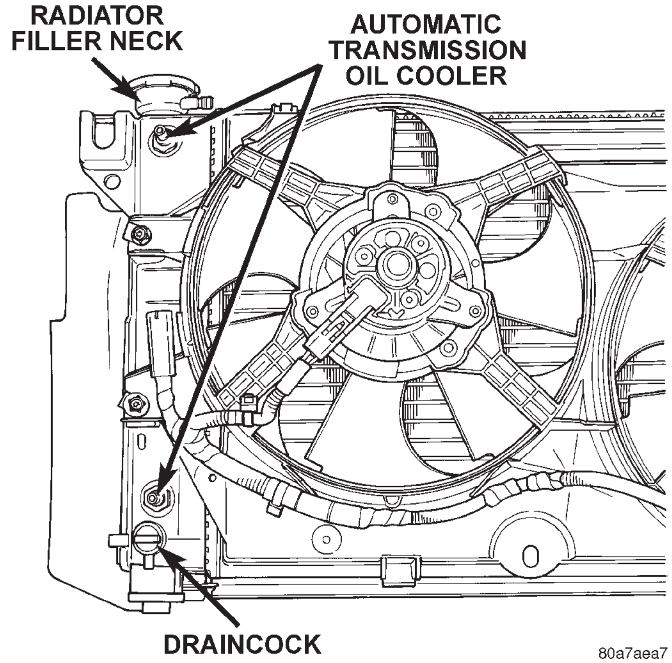

Fig. 4 Automatic Transmission Oil Cooler

WATER PUMPS

A quick test to tell whether the pump is working is to see if the heater warms properly. A defective pump can not circulate heated coolant through the long heater hose. **The water pump on all models can be replaced without discharging the air conditioning system.**

COOLANT

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. Coolant then carries this heat to the radiator, where the tube/fin assemblies of these components can give it up to the air.

The use of aluminum cylinder heads, intake manifolds, and water pumps requires special corrosion protection. Mopar® Antifreeze or the equivalent is recommended for best engine cooling without corrosion, when mixed only to a freeze point of -37°C (-35°F) to -59°C (-50°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed solution.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

RADIATOR

The radiators are cross-flow types (horizontal tubes) with design features that provide greater strength along with sufficient heat transfer capabili-

GENERAL INFORMATION (Continued)

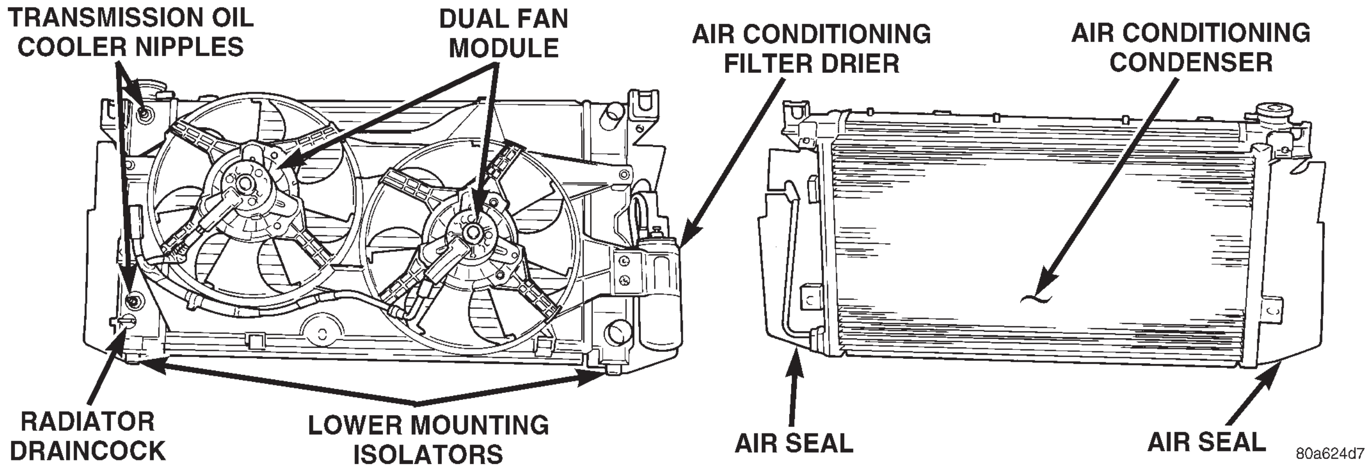

Fig. 5 Cooling Module—2.4L

ties to keep the engine satisfactorily cooled (Fig. 5), (Fig. 6), (Fig. 7) and (Fig. 8).

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches etc., or by excessive torque on hose clamps.

If the plastic tank is damaged, replace the radiator.

RADIATOR PRESSURE CAP

The radiator is equipped with a pressure cap that releases excessive cooling system pressure; maintaining a range of 97-124 kPa (14-18 psi).

The cooling system will operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point thus, allowing increased radiator cooling capacity.

There is also a vent valve in the center of the cap. This valve also opens when coolant is cooling and contracting allowing coolant to return to radiator from coolant reserve system tank by vacuum through connecting hose. **If valve is stuck shut, or the coolant recovery hose is pinched, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 9) and inspect coolant recovery hose routing, to ensure proper sealing when boiling point is reached.**

The gasket in the cap seals the filler neck, so that vacuum can be maintained, allowing coolant to be drawn back into the radiator from the reserve tank.

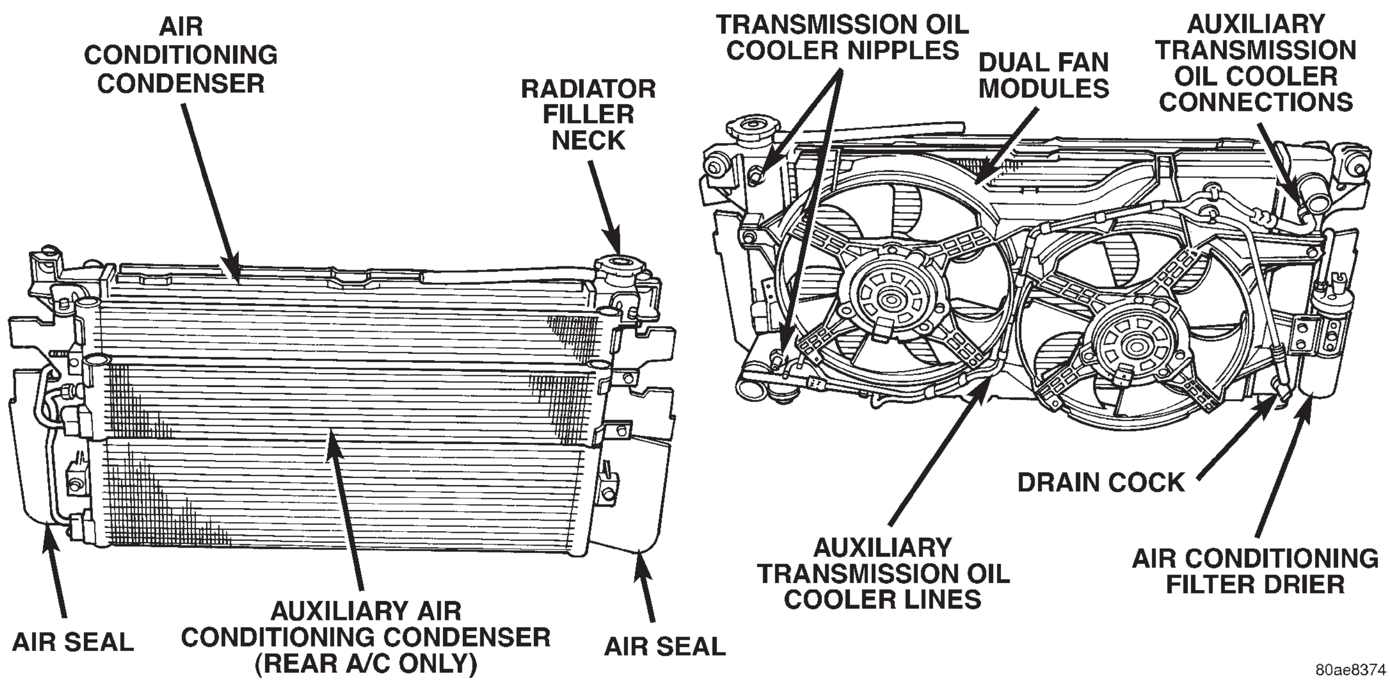

Fig. 6 Cooling Module—Trailer Tow (With Rear A/C)

GENERAL INFORMATION (Continued)

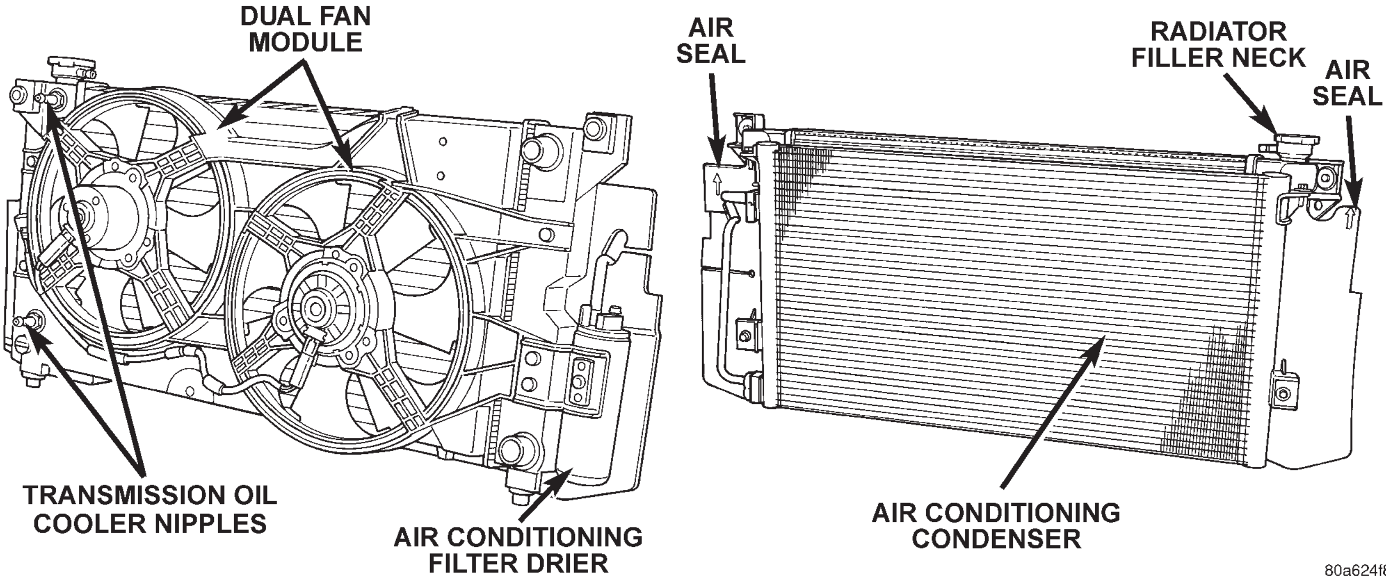

Fig. 7 Cooling Module—3.0L (Front A/C Only)

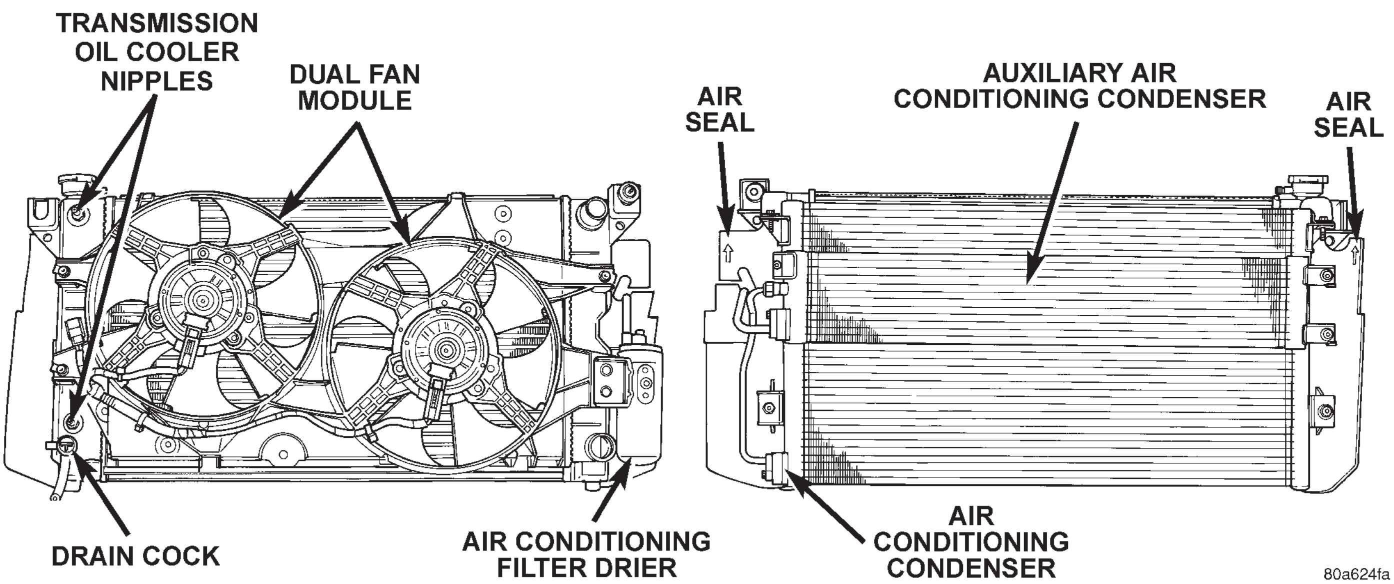

Fig. 8 Cooling Module—3.0/3.3/3.8L (With Rear A/C)

If the gasket is dirty or damaged, a vacuum may not be achieved, resulting is loss of coolant and eventual overheating due to low coolant level in radiator and engine.

ENGINE BLOCK HEATER

The engine block heater is available as an optional accessory on all models. The heater is operated by ordinary house current (110 Volt A.C.) through a power cord located behind the radiator grille. This provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant.

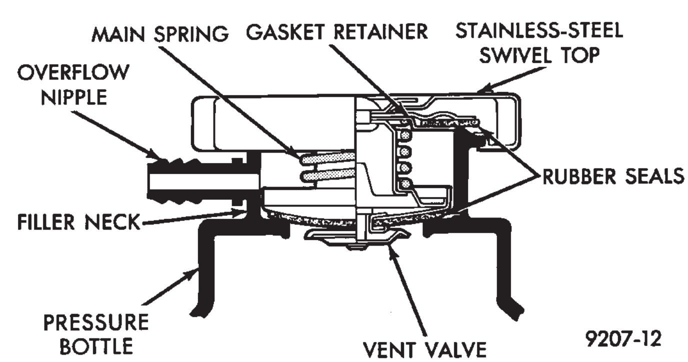

Fig. 9 Radiator Pressure Cap Filler Neck

DESCRIPTION AND OPERATION

WATER PIPES—3.0L ENGINE

The 3.0L engine uses metal piping beyond the lower radiator hose to route (suction) coolant to the water pump, which is located in the V of the cylinder banks (Fig. 10).

These pipes are provided with inlet nipples for thermostat bypass and heater return coolant hoses, and brackets for rigid engine attachment. The pipes employ O-rings for sealing at their interconnection and to the water pump (Fig. 10).

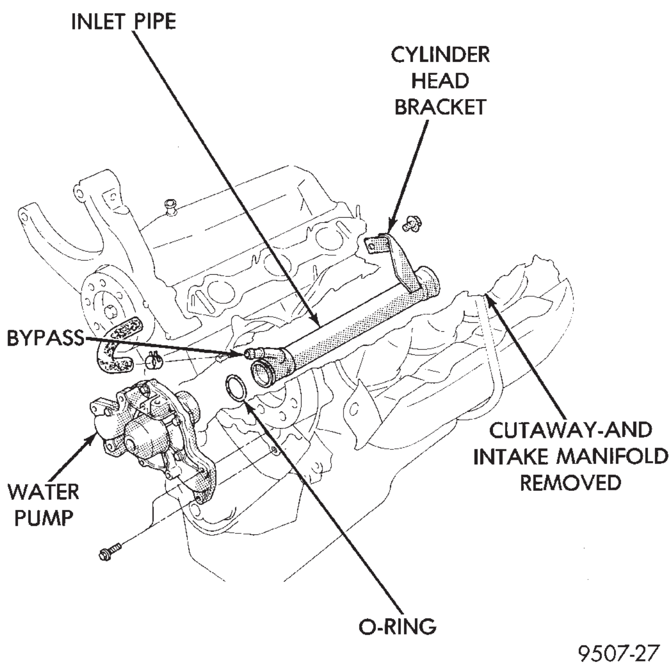

Fig. 10 Engine Inlet Coolant Pipes 3.0L Engine

COOLANT PERFORMANCE

Performance is measurable. For heat transfer pure water excels (Formula = 1 btu per minute for each degree of temperature rise for each pound of water). This formula is altered when necessary additives to control boiling, freezing, and corrosion are added as follows:

- Pure Water (1 btu) boils at 100°C (212°F) and freezes at 0°C (32°F)
- 100 percent Glycol (.7 btu) can cause a hot engine and detonation and will lower the freeze point to -22°C (-8°F).
- 50/50 Glycol and Water (.82 btu) is the recommended combination that provides a freeze point of -37°C (-35°F). The radiator, water pump, engine water jacket, radiator pressure cap, thermostat, temperature gauge, sending unit and heater are all designed for 50/50 glycol.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

Where required, a 56 percent glycol and 44 percent water mixture will provide a freeze point of -59°C (-50°F).

CAUTION: Richer mixtures cannot be measured with field equipment. This can lead to problems associated with 100 percent glycol.

RADIATOR HOSES AND CLAMPS

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE WORKING ON VEHICLE. RELIEVE PRESSURE BY PLACING A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE IT COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS AND STEAM TO ESCAPE THROUGH THE OVERFLOW TUBE. THIS WILL RELIEVE SYSTEM PRESSURE

The hoses are removed by using constant tension clamp pliers to compress the hose clamp.

A hardened, cracked, swollen or restricted hose should be replaced. Do not damage radiator inlet and outlet when loosening hoses.

Radiator hoses should be routed without any kinks and indexed as designed. The use of molded hoses is recommended.

Spring type hose clamps are used in all applications. If replacement is necessary replace with the original MOPAR® equipment spring type clamp.

WATER PUMP—2.4L ENGINE

The water pump has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block. Cylinder block to water pump sealing is provided by a rubber O-ring. The water pump is driven by the timing belt. Refer to Timing Belt in Group 9, Engine for component removal providing access to water pump.

WATER PUMP—3.0L ENGINE

The pump bolts directly to the engine block, using a gasket for pump to block sealing (Fig. 11). The pump is serviced as a unit.

The water pump is driven by the timing belt. See Timing Belt in Group 9, Engine for component removal providing access to water pump.

DESCRIPTION AND OPERATION (Continued)

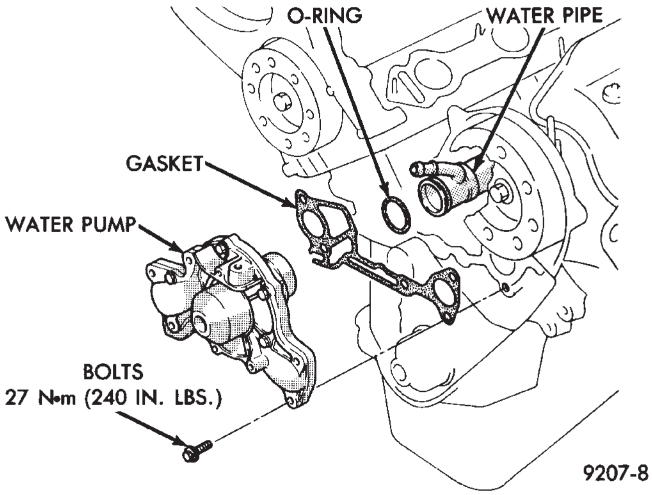

Fig. 11 Water Pump—3.0L Engine

WATER PUMP—3.3/3.8L ENGINES

The pump has a die cast aluminum body and a stamped steel impeller. It bolts directly to the chain case cover, using an O-ring for sealing. It is driven by the back surface of the Poly-V Drive Belt.

DIAGNOSIS AND TESTING

ACCESSORY DRIVE BELT

CONDITION	POSSIBLE CAUSES	CORRECTIONS
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	1. Belt too loose 2. Belt excessively glazed or worn	1. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 2. Replace and tighten as specified
BELT SQUEAL WHEN ACCELERATING ENGINE	1. Belts too loose 2. Belt glazed	1. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 2. Replace belts
BELT SQUEAK AT IDLE	1. Belts too loose 2. Dirt or paint imbedded in belt 3. Non-uniform belt 4. Misaligned pulleys 5. Non-uniform groove or eccentric pulley	1. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 2. Replace belt 3. Replace belt 4. Align accessories 5. Replace pulley
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt 2. Belt too loose, or too tight 3. Misaligned pulleys 4. Non-uniform groove or eccentric pulley	1. Replace belt 2. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 3. Align accessories 4. Replace pulley

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS

Establish what "driving" conditions caused this complaint. Abnormal loads on the cooling system, such as the following may be the problem:

1. Prolonged Idle, Very High Ambient Temperature, Slight Tail Wind at Idle, Slow Traffic, Traffic Jams, High Speed, Steep Grades:
Driving techniques that avoid overheating are:
(a) Idle with A/C off when temperature gauge is at end of normal range.
(b) Do not increase engine speed for more air flow and coolant flow because the electric motor fan systems are not responsive to engine RPM. The added cooling from higher coolant flow rate is more than offset by increased heat rejection (engine heat added to coolant).

2. Trailer Towing:
Consult owner's manual—Trailer Towing. Do not exceed limits.

3. Air Conditioning: Add-on or After Market:
If add-on or after market A/C is involved maximum cooling components should be installed for the model involved per manufacturer's specifications.
Further diagnostic checks should not be required.

4. Recent Service or Accident Repair:
Determine if any recent service has been performed on the vehicle that may affect the cooling system such as engine adjustment (wrong timing), loose or slipping water pump belt, brakes (possibly dragging), changed parts (possibly wrong), recored radiator or cooling system refilling (possibly under-filled or trapped air).
If investigation reveals none of the above as cause for overheating complaint refer to the following symptoms chart.

Symptom	Action
Blinking Engine Warning Light Or High Gauge Indication—Without Coolant Loss	Normal with temporary operation with heavy load, towing a light trailer, high outdoor temperatures, and/or on a steep grade.
Coolant Loss	Improper refilling procedures can result in trapped air in the system. As the cooling system operates the pressure cap and coolant recovery system will deaerate the cooling system. A low coolant level will result in the Coolant Reserve Tank. Add coolant. If condition persists see System Diagnosis.
Fan Never Runs	Refer to Powertrain Diagnostic Manual for test procedure.
Fan Always Runs	Normal with A/C compressor clutch engaged. Otherwise consult Electrical Group 8.
Hot Car (Not Engine) **Heat Damage** **Hot Carpet, Seat, Trunk** **Hot Catalytic Converter** **Smoke, Burnt Odor**	Check heat shielding, exhaust system, emission controls, ignition timing and fuel/air ratio misfiring.
Hot Engine **Crackling Sounds** **Hot Smell** **Severe Local Hot Spots**	A moderate amount of sound of heating metal can be expected with any vehicle. However, a crackling sound from the thermostat housing, a hot smell and/or severe local hot spots on an engine can indicate blocked coolant passages. Inspect for plugged water passages, bad casting, core sand and plugging, a cracked block or head, or a blown head gasket. Usually accompanied with coolant loss.
Coolant Color	Coolant color is not necessarily an indication of adequate temperature or corrosion protection.
Coolant Recovery Bottle **—Level Changes**	Level changes are to be expected as coolant volume changes with engine temperature. If the level in the bottle is between the Maximum and Minimum marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.
—Coolant NOT Returning	Coolant will not return to the radiator if the radiator cap vent valve does not function, if an air leak destroys vacuum, or if the overflow passage is blocked or restricted. Inspect all portions of the overflow passage, pressure cap, filler neck nipple, hose, and passageways within the bottle for vacuum leak only. Coolant return failure will be evident by a low level in the radiator. Bottle level should increase during heat-up.

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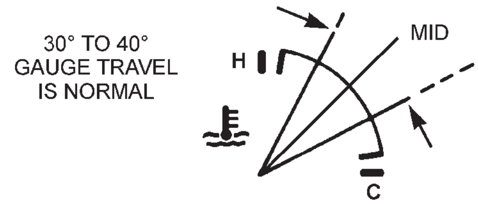
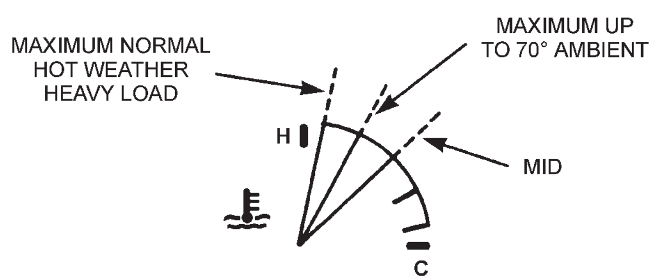
DIAGNOSIS AND TESTING (Continued)

CONDITION–AND CHECKS	DIAGNOSIS
MAGNETIC 90° GAUGE READS LOW	 **Fig. 1–Normal Gauge Travel**
(1) Verify gauge, (Fig. 1) is temperature really low?	(1) See Electrical, Group 8 and check temperature sending unit. Repair/Replace gauge.
(2) Is code 17 set in diagnostics?	(2) Yes—Thermostat, No—Other
(3) Does it read cold?	(3) Wiring disconnect wrong sending unit used, sending unit for HOT lite, not gauge.
(4) Coolant level low in cold ambient. (Also poor heater performance)	(4) Check radiator and CRS for level—inspect for leaks.
(5) Coolant level O.K.	(5) Check heater controls, doors—see Group 24, Heaters and Air Conditioning.
GAUGE READS HIGH–Without Pressure Cap Blow off without Coolant or Steam from CRS Tank and to Ground	 **Fig. 2—Gauge Reading—Hot Weather—Heavy Load**
(1) Is it really reading high?	(1) See Figure 2.
(2) If at “H” without other signs of boiling.	(2) Look for Grounded gauge, sending unit or wire. See Group 8, Electrical.
(3) Coolant level low in Radiator and CRS.	(3) a—Fill full remembering to vent air. b—Inspect for leaks, repair. c—Assure Pressure Cap was shut tight and seals at top and bottom of neck are functioning properly.
(4) Coolant level low in Radiator but not in CRS.	(4) a—Fill full remembering to vent air. b—Inspect for leaks and repair. c—Inspect for leaks in CRS to radiator connection. d—Inspect CRS hose for kinks. e—Assure cap seals at top and bottom.

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DIAGNOSIS AND TESTING (Continued)

CONDITION–AND CHECKS	DIAGNOSIS
(5) Check freeze point.	(5) a— Adjust to 50/50 Glycol and water. b— If no reading or below –59°C (–50°F), mixture is too rich clean system before refilling.
(6) Assure Coolant Flow.	(6) a— Look for flow through filler neck with some coolant removed and thermostat open. b— Repair water pump if necessary. See Water Pump Section.
(7) Other possible causes.	(7) a— **High Speed Only** — Radiator or Condenser air side plugged — Radiator core tubes plugged — Add on A/C without proper radiator — Engine out of tune (specifications) — Brakes dragging — Bug screen — Trailer towing or hill climbing b— **High and Low Speed** — Thermostat failed partially shut particularly if ambient temperature is below 21°C (70°F) and vehicle has high mileage. — Condenser or radiator air side plugged. — Add on A/C. c—**Low Speed—NOT high speed** — Fan not operating. — Check Diagnostics. — Check Fan Motor by wiring to battery, when disconnected from harness. — Check, Group 8, Electrical
Temperatue Gauge Reads Hot with Pressure Cap Blowoff and Steam and coolant to CRS and to Ground	
(1) Coolant Level Low in Radiator and CRS	(1) a— Fill Cooling System Full and Vent Air. b— Inspect for Leaks—repair. c— Assure Pressure cap was shut and seals. d— If low in radiator but not in CRS, also check connection to filler neck and pressure cap sealing. e— Inspect for CRS hose kinks.
(2) Check Coolant Freeze point.	(2) Adjust to 50/50 Glycol and water. –37°C (–35°F.)
(3) Assure Coolant flow.	(3) a— Look for flow through radiator filler neck with coolant lowered and thermostat open. b— When accompanied with “metal cracking sound”—consider core sand and/or bad head casting.
(4) Thermostat failed shut.	(4) Especially in cold to medium ambient temperatures.
(5) Head Gasket Leak.	(5) Use block leak checker.

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DIAGNOSIS AND TESTING (Continued)

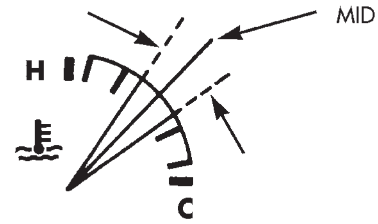
<table>
<tr><th>CONDITION—AND CHECKS</th><th>DIAGNOSIS</th></tr>
<tr><td>Temperature Gauge Is Inconsistent
Cycles—Erratic</td><td>

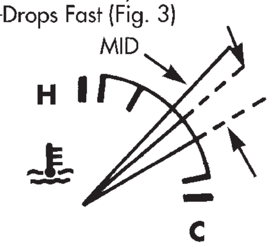
Fig. 3—Normal Reaction to Fan Cycle</td></tr>
<tr><td>(1) Is cycle normal?</td><td>(1) a—Normal Fan Cycle Due to Temperature. Raises Slowly—Drops Fast (Fig. 3)


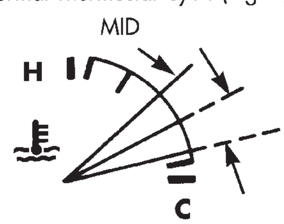
Fig. 4—Gauge Reaction to Thermostat
b—Normal Thermostat Cycle (Fig. 4)


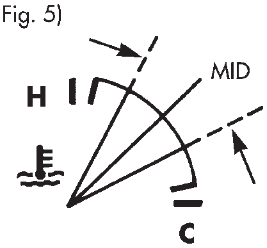
Fig. 5—Gauge Reaction—Winter, Idle, Heater On
c—Normal cycle at idle in winter with Heater on high. (Heater Heat Transfer exceeds engine Heat Rejection) drops lower with time. Sometimes noticed in winter between Drive and Idle (Fig. 5)


Fig. 6—Gauge Reaction—Stop after Heavy Use
d—Hot water normal build up at stop after heavy use (Fig. 6)</td></tr>
<tr><td>(2) Is coolant level low in radiator (Low level can trap air in system which can put thermostat pellet in air and it opens late).</td><td>(2) Fill system, vent air and inspect for leaks.</td></tr>
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DIAGNOSIS AND TESTING (Continued)

CONDITION—AND CHECKS	DIAGNOSIS
(3) Is there a head gasket leak that puts exhaust gas in system? (This acts like trapped air with same effect as 2 above.)	(3) a—Test with block leak checker and replace if necessary. b—Coolant in engine oil. c—White steam coming out of exhaust.
(4) Water pump impeller loose on shaft, slips sometimes.	(4) Replace.
(5) Air lead on suction side of water pump entraining air; see 2 above.	(5) Find leak and repair.
Warning Light Glows All the Time (No Gauge)	
(1) Check temperature sending unit. The sending unit for a light is a switch and has a screwdriver slot in the electrode that is used for calibration. The gauge sending units do NOT have a screwdriver slot.	(1) It is probably a sending unit for a gauge, NOT for a light.
Pressure Cap Blow-Off, With Steam to CRS and Coolant to Ground Without High Reading. Temperature Gauge Above Normal.	
(1) Check pressure cap relief pressure.	(1) Replace if lower than 14 psi.
Coolant Loss to Ground Without Pressure Cap Blow-Off	
(1) Leaks.	(1) a—Pressure test system while shaking hoses. b—Water pump seal. See "water pump," this Group.
Coolant Loss Past Pressure Cap Top Seal—Glycol Seen on Filler Neck	
(1) With normal gauge reading.	(1) a—Cap not on tight. b—Top seal leaking. c—Cap diaphragm "oil canned." d—Filler neck damaged. e—Rubber seal out of position.
(2) With high gauge reading or low gauge reading on new vehicle.	(2) a—CRS hose kinked. b—CRS tank and plastic tube plugged. c—Pressure cap rubber seal out of position.
Detonation or Pre-Ignition When Nothing to Cause It in Engine or Ignition	
(1) Check freeze point of coolant. If tester does not register reading or the reading is below −59°C (−50°F), be aware that 100% glycol makes engine metal run hotter even without a hot gauge reading.	(1) a—Adjust coolant to 50/50 glycol and water −37°C (−35°F). b—If 100% glycol has been found in the system, clean and flush the system before replacing with 50/50 glycol and water.
Hoses Observed Collapsing on Cool-Down	
(1) Check pressure cap vent valve.	(1) a—Must be free to move. Gasket swell can prevent valve from opening. b—Replace cap.
(2) Check CRS hose for kinking or plugging.	(2) Repair as required.
(3) Inside of cap plugged with stop leak pellet, green silica gel, or fiberglass.	(3) Clean cap.
Fan Runs All the Time	
(1) Check for relay.	(1) See Group 8, Electrical.
Fan Noisy	
(1) Check for loose fan. (2) Check for fan clearance to adjacent parts. (3) Check for loose mount fasteners. (4) Check for bent fan blades. (5) Check for fan blades spinning on hub. (6) Check for air obstructions on radiator or condenser.	(1) Repair as necessary.

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DIAGNOSIS AND TESTING (Continued)

CONDITION - AND CHECKS	DIAGNOSIS
Inadequate Air Conditioning Performance - Cooling System Suspected	
(1) Check for plugged air side of condenser and radiator front and rear.	(1) Wash out with low-velocity water.
(2) Assure fan runs whenever A/C head pressure exceeds 1724 kPa (250 psi).	(2) Repair as necessary.
(3) Check for missing air seals-recirculating air path.	
(4) Assure correct cooling system parts.	
Battery Dead - Suspect Fan Current Draw as Cause	
(1) With a good, fully charged battery.	(1) a - Assure fan control is operating properly. (1) b - See charging system in Electrical, Group 8B.
Hot Smell - Suspect Cooling System	
(1) Was temperature gauge high?	(1) a - Yes, See ″Gauge Reads High″ (1) b - No. See 2, 3, 4, and 5.
(2) Heat shields all in place?	(2) a - Yes, See 3, 4, and 5. (2) b - Repair or replace heat shields.
(3) Fan control operating properly?	(3) a - Yes, See 4 and 5. (3) b - No, See Radiator Fan Control this section.
(4) Heat exchanger air side plugged?	(4) Clean as required.
(5) Engine missing or running rich?	(5) Repair as required.
Poor Driveability - Suspect Failed Open Thermostat.	
(1) Check diagnostics - is code 17 set? (Engine too cold for too long)	(1) If yes, change thermostat.
Poor Heater Performance - Suspect Failed Open Thermostat	
(1) Does gauge read low?	(1) See 3
(2) Check coolant level.	(2) See 3
(3) Check diagnostics - is code 17 set? (Engine too cold for too long)	(3) If yes, change thermostat. If no, check heater bypass valve, which should be closed except in Max A/C or off mode; if not, see Heater and Air Conditioning Group, 24.
Steaming, Observe Water Vapor Through Grill or Head Gap at Standstill at Idle - In Wet Weather	
(1) This is normal. It is moisture, snow, or water on the outside of the radiator that evaporates when the thermostat opens to put hot coolant into the radiator. This usually occurs in cold weather with no fan or air flow to blow it away.	(1) Normal condition - no service required.

DIAGNOSIS AND TESTING (Continued)

RADIATOR COOLANT FLOW TEST

To determine whether coolant is flowing through the cooling system, use the following procedure:

(1) If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.

WARNING: DO NOT REMOVE RADIATOR PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Remove radiator pressure cap when engine is cold, idle engine until thermostat opens, you should observe coolant flow while looking down the filler neck. Once flow is detected install radiator pressure cap.

RADIATOR FAN CONTROL

Fan control is accomplished two ways. A pressure transducer on the compressor discharge line sends a signal to the Powertrain Control Module (PCM) which will activate the fan. In addition to this control, the fan is turned on by the temperature of the coolant which is sensed by the coolant temperature sensor which sends the message to the PCM. The fan will not run during cranking until the engine starts no matter what the coolant temperature is.

CAUTION: The solid state fan relay is attached to the left frame rail near the lower radiator support. The relay bracket, and fastener are used to dissipate heat from the relay. Ensure the relay is properly attached to prevent the following:

- Intermittent engine overheating.
- Relay "thermal" shutdown, or relay damage.

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

TESTING COOLING SYSTEM FOR LEAKS

With engine not running, wipe the radiator filler neck sealing seat clean. The radiator should be full.

Attach the Radiator Pressure Tool to the radiator, as shown in (Fig. 12) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 2 psi in 2 minutes, inspect all points for external leaks.

All radiator and heater hoses should be shaken while at 104 kPa (15 psi), since some leaks occur only while driving due to engine movement.

If there are no external leaks, after the gauge dial shows a drop in pressure, detach the tester. Start engine and run the engine up to normal operating temperature to open the thermostat and allow the coolant to expand. Reattach the tester. If the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

RADIATOR FAN OPERATION

Radiator Fan Control			A/C Pressure	
Fan Operation	Low Fan Speed 30%	High Fan Speed 100%	Low Fan Speed 30%	High Fan Speed 100%
On:	104°C (220°F)	110°C (230°F) Fan Speed Duty-Cycles (Ramps-up) from 31% to 99%	1,724 Kpa (250 psi)	2,068 Kpa (300 psi)Fan Speed Duty-Cycles (Ramps-up) from 31% to 99%
Off:	101°C (214°F)	Fan Speed Duty-Cycles (Ramps-down) from 99% to 31%	1,710 Kpa (248 psi)	Fan Speed Duty-Cycles (Ramps-down) from 99% to 31%

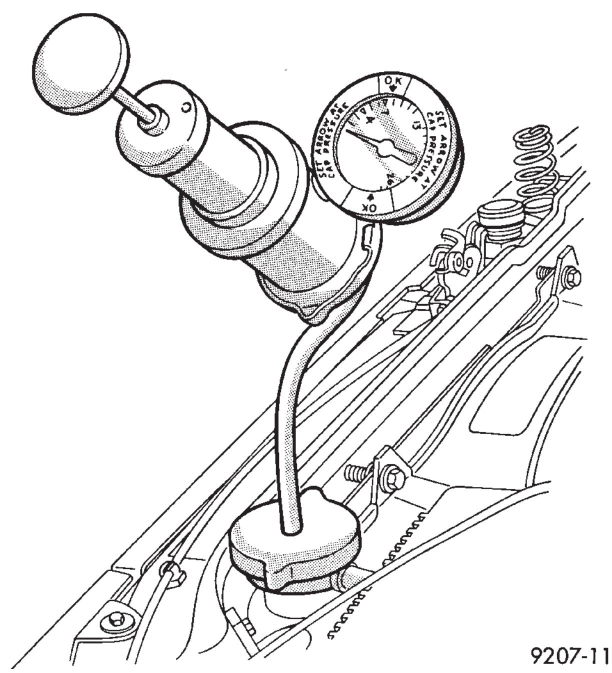


Fig. 12 Pressure Testing Cooling System

DIAGNOSIS AND TESTING (Continued)

WARNING: WITH TOOL 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).

If the needle on the dial does not fluctuate, race the engine a few times. If an abnormal amount of coolant or steam emits from the tail pipe, it may indicate a coolant leak caused by a faulty head gasket, cracked engine block, or cracked cylinder head.

There may be internal leaks that can be determined by removing the oil dipstick. If water globules appear intermixed with the oil it will indicate an internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

RADIATOR CAP TO FILLER NECK SEAL PRESSURE RELIEF CHECK

The pressure cap upper gasket (seal) pressure relief can be checked by removing the overflow hose at the radiator filler neck nipple (Fig. 13). Attach the Radiator Pressure Tool to the filler neck nipple and pump air into the radiator. Pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at 55 kPa (8 psi) minimum.

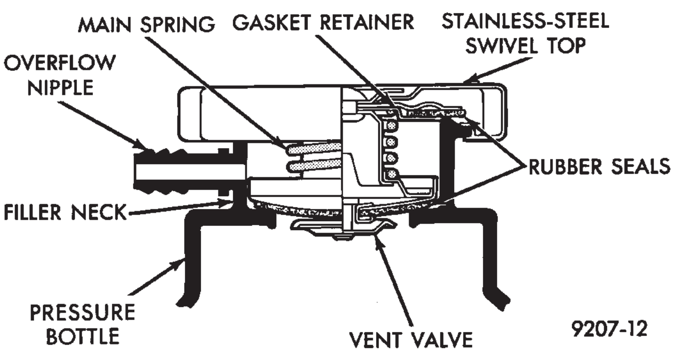


Fig. 13 Radiator Pressure Cap Filler Neck

WARNING: THE WARNING WORDS “DO NOT OPEN HOT” ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.

There is no need to remove the radiator cap at any time **except** for the following purposes:

(1) Check and adjust coolant freeze point. By adding or subtracting coolant through CRS bottle.

(2) Refill system with new coolant.

(3) Conducting service procedures.

(4) Checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. THEN PLACE A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS PUSH DOWN AND REMOVE THE CAP COMPLETELY. SQUEEZING THE RADIATOR INLET HOSE WITH A SHOP TOWEL (TO CHECK PRESSURE) BEFORE AND AFTER TURNING TO THE FIRST STOP IS RECOMMENDED.

PRESSURE TESTING RADIATOR CAP

Dip the pressure cap in water, clean any deposits off the vent valve or its seat and apply cap to end of Radiator Pressure Tool. Working the plunger, bring the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi) replace cap. See **CAUTION**.

If the pressure cap tests properly while positioned on Radiator Pressure Tool (Fig. 14), but will not hold pressure or vacuum when positioned on the radiator. Inspect the radiator filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

CAUTION: Radiator Pressure Tool is very sensitive to small air leaks that 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 the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.

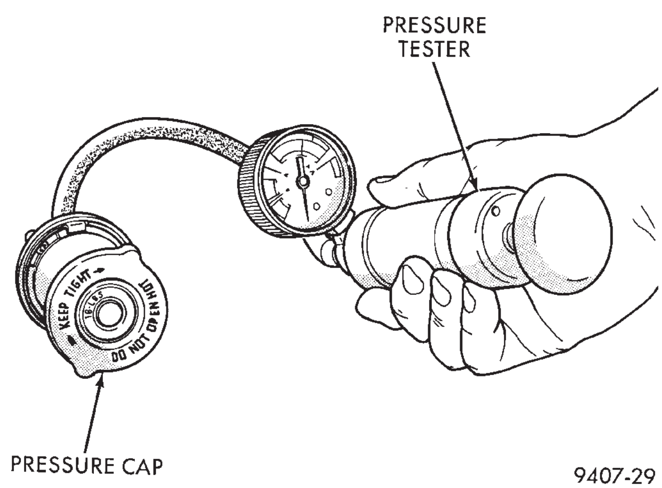


Fig. 14 Pressure Testing Radiator Cap

LOW COOLANT LEVEL AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine

DIAGNOSIS AND TESTING (Continued)

at running operating temperature the high pressure inlet tank runs full and the low pressure outlet tank drops:

- Transmission oil will become hotter.
- High reading shown on the temperature gauge.
- Air in the coolant can cause loss of flow through the heater.
- Exhaust gas leaks into the coolant also can cause the same problems.

DEAERATION

Air can only be removed from the system by gathering under the pressure cap. On the next heat up it will be pushed past the pressure cap into the CRS tank by thermal expansion of the coolant. It then escapes to the atmosphere in the CRS tank and is replaced with solid coolant on cool down.

TEMPERATURE GAUGE INDICATION

At idle with Air Conditioning off the temperature gauge will rise slowly to about 5/8 gauge travel, the fan will come on and the gauge will quickly drop to about 1/2 gauge travel. This is normal.

SERVICE PROCEDURES

COOLANT LEVEL CHECK—ROUTINE

Do not remove radiator cap for routine coolant level inspections.

The coolant reserve system provides a quick visual method for determining the coolant level without removing the radiator cap. **With the engine cold and not running,** simply observe the level of the coolant in the reserve tank (Fig. 3). The coolant level should be between the minimum and maximum marks.

COOLANT—ADDING ADDITIONAL

The radiator cap should not be removed. When additional coolant is needed to maintain this level, it should be added to the coolant reserve tank. Use only 50/50 mix of ethylene glycol type antifreeze and water.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

COOLANT LEVEL SERVICE

The cooling system is closed and designed to maintain coolant level to the top of the radiator.

When servicing requires a coolant level check in the radiator, the engine must be **off** and **not** under pressure. Drain several ounces of coolant from the radiator draincock while observing the Coolant Recovery System (CRS) Tank. Coolant level in the CRS tank should drop slightly. Then remove the radiator cap. The radiator should be full to the top. If not, and the coolant level in the CRS tank is at the MIN mark there is an air leak in the CRS system. Check hose or hose connections to the CRS tank, radiator filler neck or the pressure cap seal to the radiator filler neck for leaks.

COOLING SYSTEM—DRAINING

Without removing radiator pressure cap and with system not under pressure, shut engine off and open draincock. The coolant reserve tank should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks). To vent 2.4L engine remove the coolant temperature sensor located above water outlet housing (Fig. 15). The 3.0/3.3/3.8L engines have an air bleed vent on the thermostat.

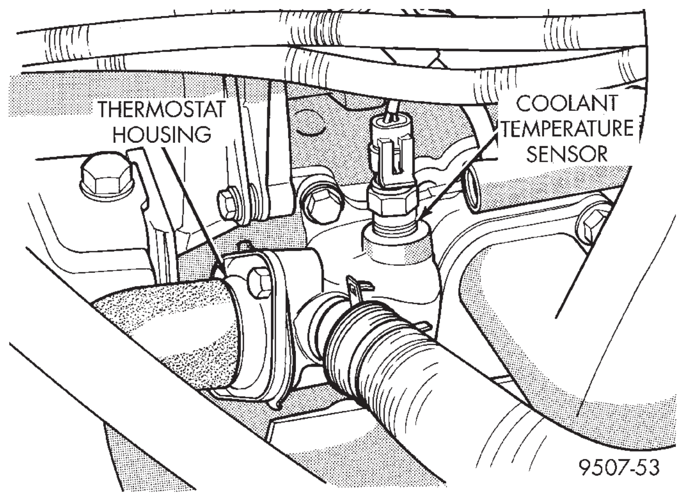


Fig. 15 Coolant Temperature Sensor—2.4L Engine Drain/Fill

Removal of a sensor is required because the thermostat does not have an air vent. Sensor removal allows an air bleed for coolant to drain from the engine block.

COOLING SYSTEM—REFILLING

First clean system to remove old coolant, see Cooling System Cleaning.

Fill the system, using the correct antifreeze as described in the Coolant Section. Fill the system to 50 percent of its capacity with 100 percent glycol. Then complete filling system with water. The 2.4L engine requires venting by removal of the coolant sensor on top of the water outlet connector (Fig. 15). When coolant reaches this hole:

- Install coolant sensor and tighten to 7 N·m (60 in. lbs.) for 2.4L Engines.

SERVICE PROCEDURES (Continued)

Continue filling system until full, this provides better heater performance. **Be careful not to spill coolant on drive belts or the generator.**

Fill coolant reserve system to at least the MAX mark with 50/50 solution. It may be necessary to add coolant to the reserve tank after three or four warm up/cool down cycles to maintain coolant level between the MAX and MIN mark. This will allow trapped air to be removed from the system.

REMOVAL AND INSTALLATION

WATER PUMP—2.4L ENGINE

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on a hoist. Remove right inner splash shield.

(3) Remove accessory drive belts. Refer to Accessory Drive Belt service in this section.

(4) Drain cooling system. Refer to Cooling System Draining in this section.

(5) Support engine from the bottom and remove right engine mount.

(6) Remove right engine mount bracket.

(7) Remove timing belt. Refer to Group 9, Engine for procedure.

(8) Remove timing belt idler pulley.

(9) Hold camshaft sprocket with Special tool C-4687 and adaptor C-4687-1 while removing bolt. Remove both cam sprockets.

(10) Remove rear timing belt cover.

(11) Remove water pump attaching screws to engine (Fig. 16).

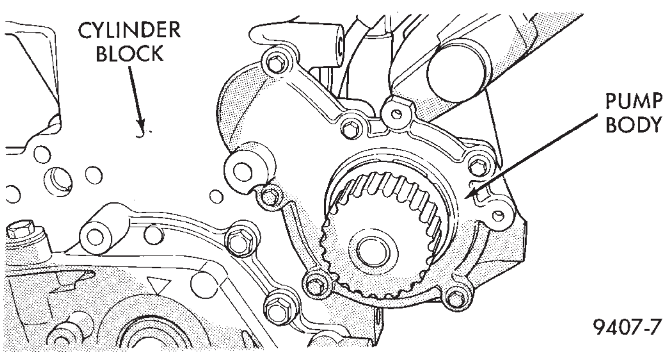


Fig. 16 Water Pump—2.4L Engine

INSTALLATION

(1) Install new O-ring gasket in water pump body O-ring groove (Fig. 17).

CAUTION: Make sure O-ring is properly seated in water pump groove before tightening screws. An improperly located O-ring may cause damage to the O-ring and cause a coolant leak.

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.) (Fig. 16). Pressurize cooling system to 15 psi with pressure tester and check water pump shaft seal and O-ring for leaks.

(3) Rotate pump by hand to check for freedom of movement.

(4) Install rear timing belt cover.

(5) Install camshaft sprockets and torque bolts to 101 N·m (75 ft. lbs.).

(6) Install timing belt idler pulley and torque mounting bolt to 61 N·m (45 ft. lbs.).

(7) Install timing belt. Refer to Group 9, Engine, 2.4L Timing Belt.

(8) Install right engine mount bracket and engine mount. Refer to Group 9 for procedure.

(9) Fill cooling system. See **Cooling System Filling.**

(10) Install accessory drive belts, Refer to Accessory Drive Belts, in this section.

(11) Lower vehicle and connect battery cable.

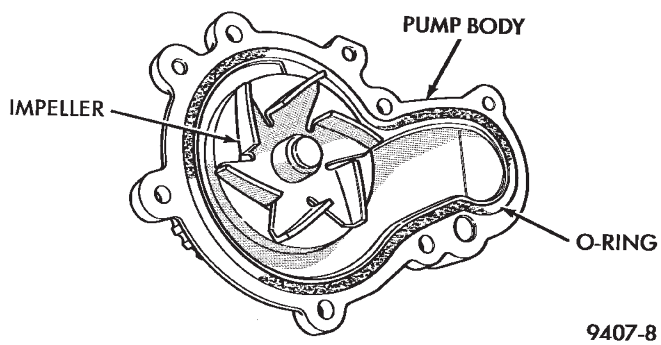


Fig. 17 Water Pump Body

WATER PUMP INLET TUBE—2.4L ENGINE

REMOVAL

(1) Drain cooling system. Refer to procedure outlined in this section.

(2) Remove upper radiator hose to access the hose connections at the inlet tube.

(3) Remove lower radiator hose and heater hose from the inlet tube (Fig. 18).

(4) Remove the 2 fasteners that hold the inlet tube to the block.

(5) Rotate tube while removing the tube from the engine block (Fig. 19).

INSTALLATION

(1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 19).

(2) Lube O-ring with coolant and install into the cylinder block opening.

(3) Install 2 fasteners and tighten to 12 N·m (105 in. lbs.).

(4) Connect lower radiator hose and heater hose to inlet tube (Fig. 18).

REMOVAL AND INSTALLATION (Continued)

(5) Install upper radiator hose.

(6) Fill cooling system. Refer to procedure outlined in this section.

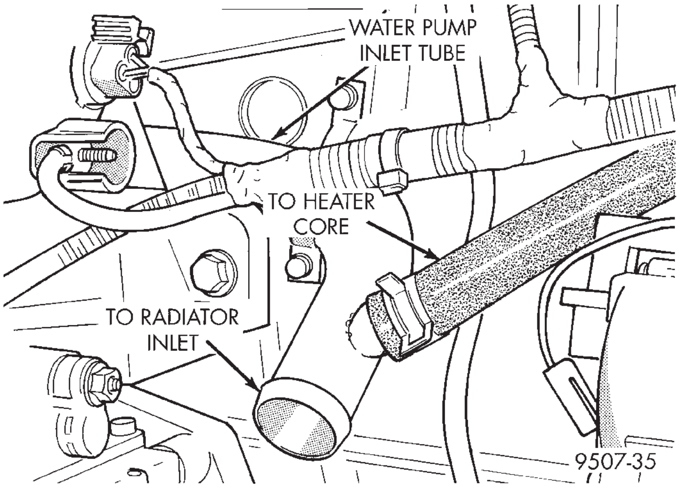


Fig. 18 Water Pump Inlet Tube Hose Connections

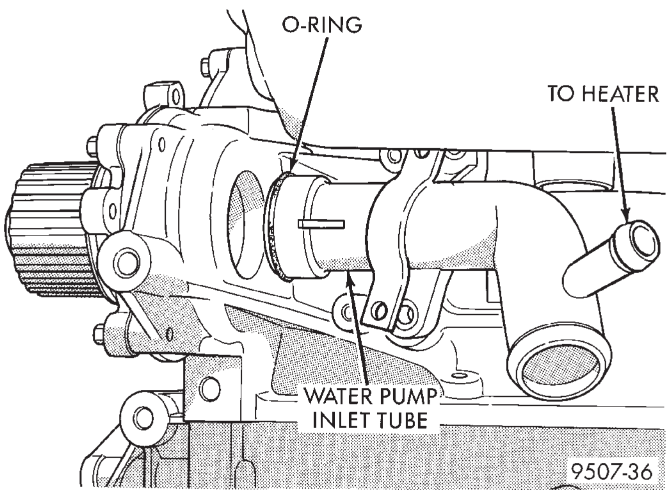


Fig. 19 Water Pump Inlet Tube —Service

WATER PUMP—3.0L ENGINE

REMOVAL

(1) Drain cooling system. Refer to Draining Cooling System in this group.

(2) To gain access to water pump refer to Group 9, Engine for Timing Belt Removal.

(3) Remove mounting bolts.

(4) Separate pump from water inlet pipe (Fig. 20) and (Fig. 21) and remove.

INSPECTION

Replace the water pump if it has any of the following defects.

(1) Damage or cracks on the pump body.

(2) Coolant leaks, if the shaft seal is leaking, evident by traces of coolant leaks from vent hole **A** in (Fig. 21).

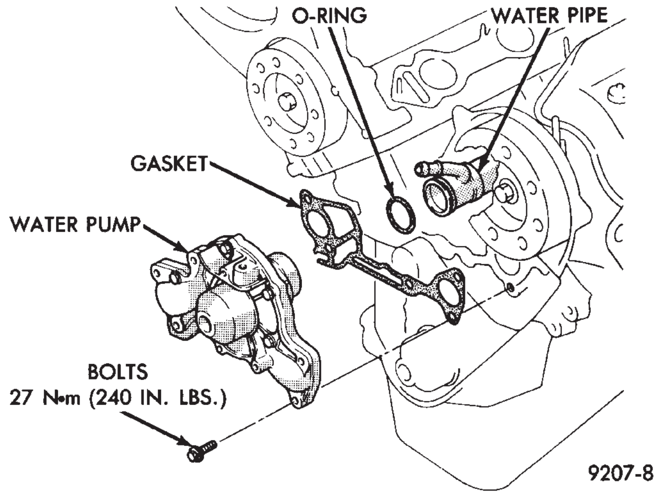


Fig. 20 Water Pump—3.0L Engine

(3) Impeller rubs the inside of pump.

(4) Loose or rough turning bearing.

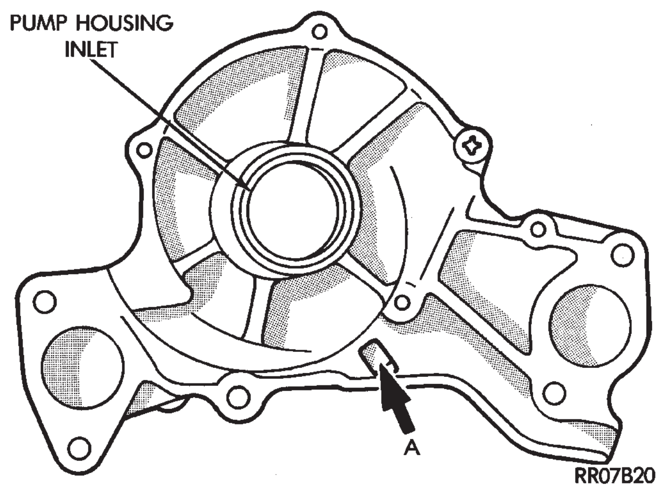


Fig. 21 Water Pump Inspection

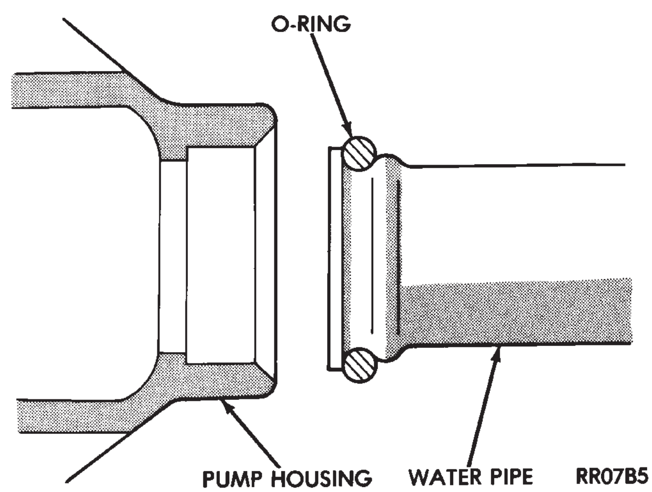


Fig. 22 Water Pipe O-Ring

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Clean all gasket and O-ring surfaces on pump and water pipe inlet tube.

(2) Install new O-ring on water inlet pipe (Fig. 22). Wet the O-ring (with water) to ease assembly.

CAUTION: Keep the O-ring free of oil or grease.

(3) Install new gasket on water pump and install pump inlet opening over water pipe, press assembly to cause water pipe insertion into pump housing.

(4) Install pump to block mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(5) See Timing Belt in Engine, Group 9 and install timing belt. Reassemble engine.

(6) Fill cooling system. See Refilling Cooling System.

WATER PUMP—3.3/3.8L ENGINES

REMOVAL

(1) Drain Cooling System. Refer to Draining Cooling System in this group.

(2) Remove Poly-V Drive Belt.

(3) Remove right front lower fender shield.

(4) Remove pump pulley bolts and remove pulley.

(5) Remove pump mounting screws (Fig. 23). Remove water pump.

(6) Remove and discard O-ring seal.

(7) Clean O-ring groove and O-ring surfaces on pump and chain case cover. Take care not to scratch or gouge sealing surface.

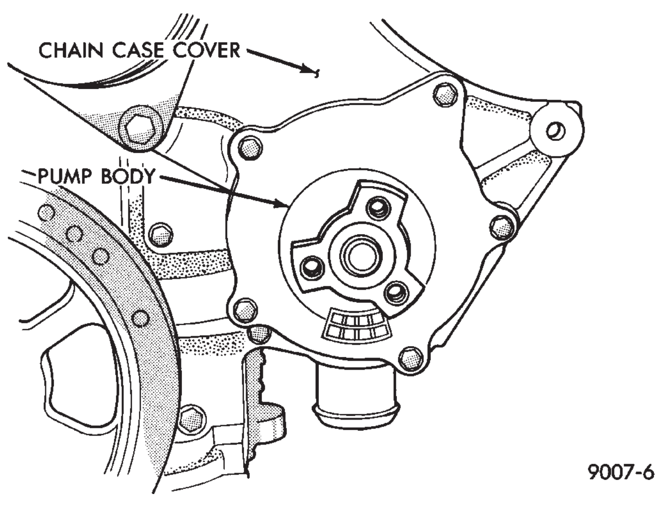


Fig. 23 Water Pump —3.3/3.8L Engines

INSTALLATION

(1) Install new O-ring into groove (Fig. 24).

(2) Install pump to chain case cover. Torque screws to 12 N·m (105 in. lbs.)

(3) Rotate pump by hand to check for freedom of movement.

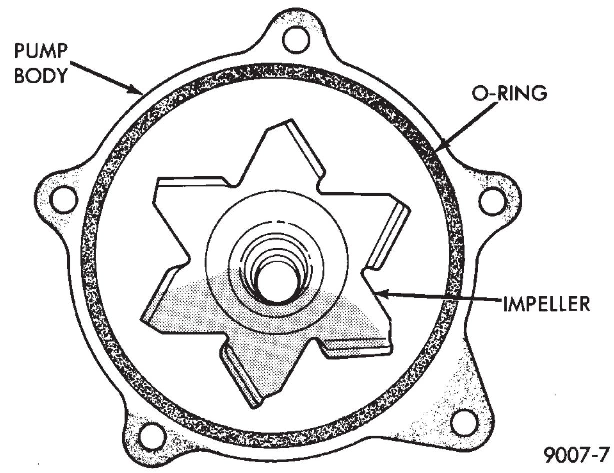


Fig. 24 Water Pump Body

(4) Position pulley on pump. Install screws and torque to 30 N·m (250 in. lbs.).

(5) Install drive belt. See Accessory Drive Belts in this group.

(6) Install right front lower fender shield.

(7) Refill Cooling System. See Refilling Cooling System.

THERMOSTAT—2.4L ENGINE

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Draining Cooling System in this group.

(2) Remove thermostat housing bolts and housing (Fig. 25).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

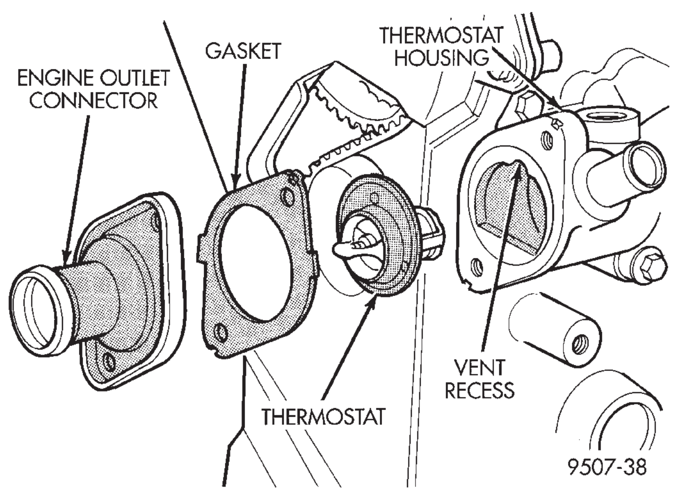


Fig. 25 Thermostat, Housing, and Outlet Connector—2.4L Engine

REMOVAL AND INSTALLATION (Continued)

INSTALLATION—2.4L ENGINE

(1) Place a new gasket (dipped in clean water) on the engine outlet connector surface. Center the thermostat in thermostat housing (Fig. 25).

(2) Place the engine outlet connector and gasket over the thermostat, making sure thermostat is seated in the thermostat housing.

(3) Bolt outlet connector to thermostat housing (Fig. 25). Tighten bolts to 28 N·m (250 in. lbs.).

(4) Refill the cooling system to the proper level. Refer to Cooling System Refilling outlined in this section for procedure

THERMOSTAT—3.0L ENGINE

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Draining Cooling System in this group.

(2) Remove thermostat housing bolts and housing (Fig. 26).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

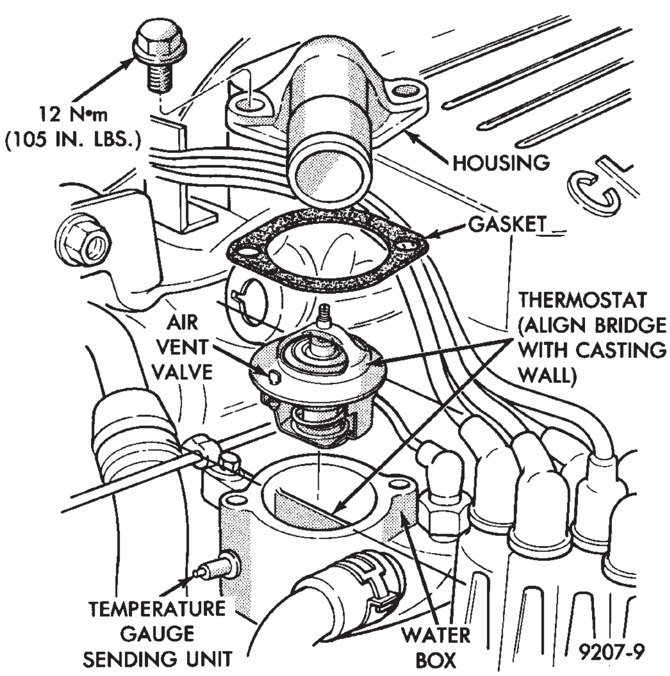


Fig. 26 Thermostat, Housing, and Water Box—3.0L Engine

INSTALLATION—3.0L ENGINE

(1) Center thermostat in water box pocket. Check that the flange is seated correctly in the countersunk portion of the intake manifold water box (Fig. 26) and (Fig. 27).

(2) Install new gasket on water box.

(3) Install housing over gasket and thermostat and tighten bolts to 12 N·m (105 in. lbs.).

(4) Refill the cooling system to the proper level. Refer to Cooling System Refilling outlined in this section for procedure.

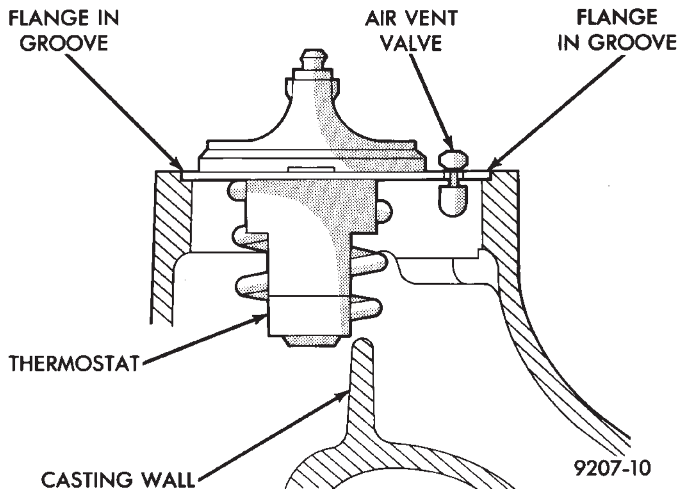


Fig. 27 Thermostat Installed—3.0L Engine

THERMOSTAT—3.3/3.8L ENGINES

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Cooling System Draining in this section.

(2) Remove thermostat housing bolts and housing (Fig. 28).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

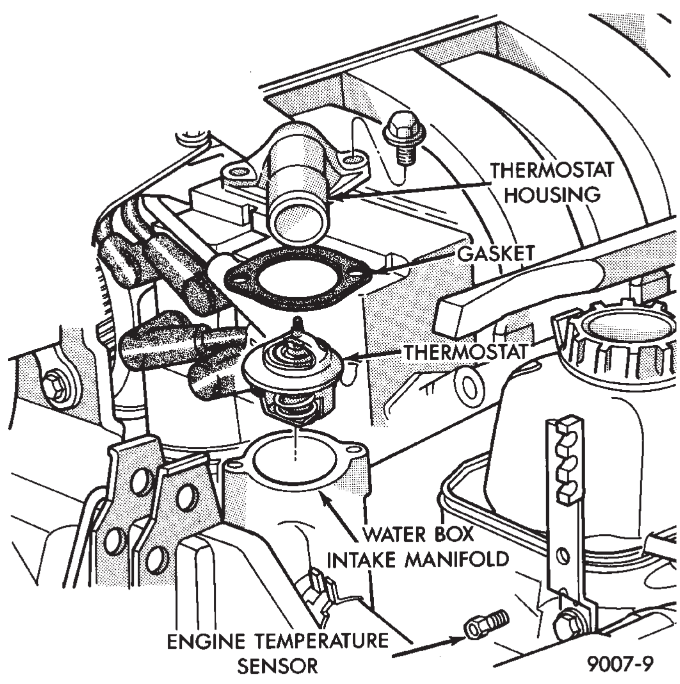


Fig. 28 Thermostat, Housing, and Water Box—3.3/3.8L Engines

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place a new gasket (dipped in water) on the thermostat housing surface, center thermostat into opening in the intake manifold water box.

(2) Place housing and gasket over the thermostat, making sure thermostat is in the recess provided (Fig. 28).

(3) Bolt housing to intake manifold, tighten bolts to 28 N·m (250 in. lbs.).

(4) Refill the cooling system to the proper level. Refer to Cooling System Refilling outlined in this section for procedure.

RADIATOR

REMOVAL

(1) Disconnect negative cable from battery.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK PLUG OR THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Drain cooling system. Refer to Draining Cooling System of this section.

(3) Remove air intake resonator.

(4) Remove coolant reserve system tank to filler neck tube hose.

(5) Disconnect fans from the connector located on the left side of the fan module.

(6) Remove the Coolant Recovery System (CRS) tank retaining screw from the upper radiator closure panel crossmember.

(7) Disconnect the upper radiator mounting screws from the crossmember. Disconnect the engine block heater wire if equipped.

(8) Remove the upper radiator closure panel crossmember. Refer to Group 23 Body for procedure.

(9) Remove air cleaner assembly.

(10) Disconnect automatic transmission oil cooler lines at radiator and plug.

(11) Disconnect inlet and outlet hoses from the radiator. Remove the lower hose clip from the fan module.

(12) Remove A/C condenser fasteners and separate the condenser from the radiator (Fig. 29). Verify the condenser is supported in position.

(13) Remove A/C filter/dryer mounting bracket, 2 bolts to the fan module, and 2 nuts to the filter/dryer.

(14) Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

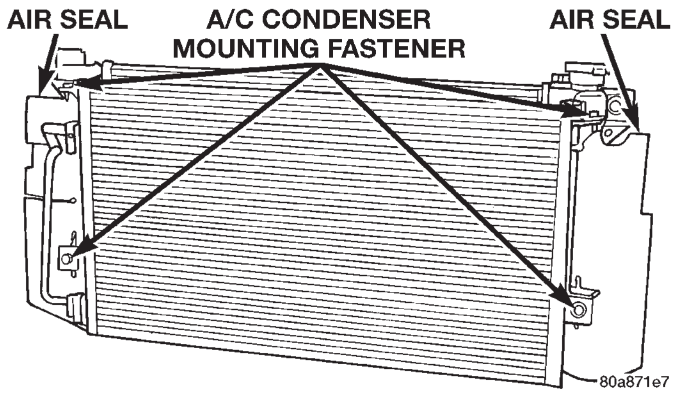


Fig. 29 Air Conditioning Condenser Mounting Fasteners

INSTALLATION

(1) **Be sure the air seals are in position before radiator is installed.** Slide radiator down into position behind closure panel. Seat the radiator with the rubber isolators into the mounting holes provided, with a 10 lbs. force.

(2) Install A/C filter/dryer and mounting bracket onto fan module.

(3) Install Air Conditioning Condenser onto the radiator (Fig. 29).

(4) Unplug and connect automatic transmission oil cooler lines to radiator.

(5) Install inlet and outlet radiator hoses (including coolant reserve hose) and connect the fan motor electrical connection.

(6) Install air cleaner assembly.

(7) Install the upper radiator closure panel crossmember. Refer to Group 23 Body for procedure.

(8) Install the upper radiator mounting screws. Tighten radiator mounting bolts to 12 N·m (105 in. lbs.). Connect the engine block heater wire if equipped.

(9) Install the Coolant Recovery System (CRS) tank retaining screw to the upper radiator closure panel crossmember.

(10) Install air intake resonator.

(11) Fill cooling system. Refer to Cooling System Filling in this section.

(12) Connect negative cable to battery.

RADIATOR DRAINCOCK

REMOVAL

CAUTION: Use of pliers on draincock is not recommended. Damage may occur to part. Draincock should not be removed unless leakage observed.

(1) Turn the draincock stem counterclockwise to unscrew the stem. When the stem is unscrewed to

REMOVAL AND INSTALLATION (Continued)

the end of the threads turn back 1/8 turn and, pull the stem (Fig. 30) from the radiator tank.

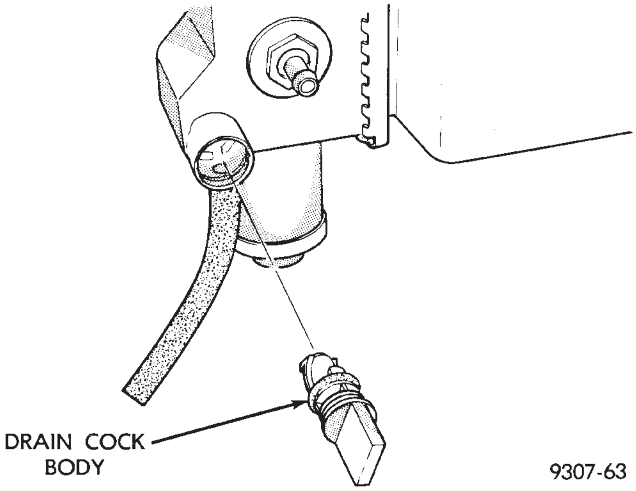


Fig. 30 Draincock Disassembled

INSTALLATION

(1) Push the draincock assembly body into the tank opening until it snaps into place.

(2) Tighten the draincock stem by turning clockwise until it stops.

FAN MODULE

REMOVAL

There are no repairs to be made to the fan or shroud assembly. If the fan is warped, cracked, or otherwise damaged, it must be replaced as a assembly (Fig. 31).

(1) Raise the vehicle on hoist.

(2) Remove the radiator outlet hose from hose retaining clip and remove clip from shroud.

(3) Remove lower auxiliary transmission cooler lines from retaining clips on the fan module shroud, if equipped.

(4) Lower the vehicle. Remove the air intake resonator from the throttle body and air cleaner assembly.

(5) Disconnect the fans electrical connector located on the left side of the fan module.

(6) Remove the Coolant Recovery System (CRS) attaching screw from the upper crossmember.

(7) Remove upper grill to crossmember valence panel.

(8) Disconnect the upper radiator mounts from the crossmember. Remove the upper crossmember. Refer to Group 23 Body for procedure.

(9) Remove the air cleaner assembly.

(10) Remove fan module retaining fasteners (Fig. 31).

(11) Remove upper auxiliary transmission cooler lines from retaining clips on the fan module shroud, if equipped.

(12) Disconnect and plug the transmission line from the radiator fitting on the lower left side.

(13) Raise vehicle on the hoist and remove the filter/drier, fan module and radiator mounting bolts located on the lower right of the module.

(14) Lower the vehicle on hoist and remove the upper fan module to radiator retaining clips.

(15) Remove the fan module from the vehicle.

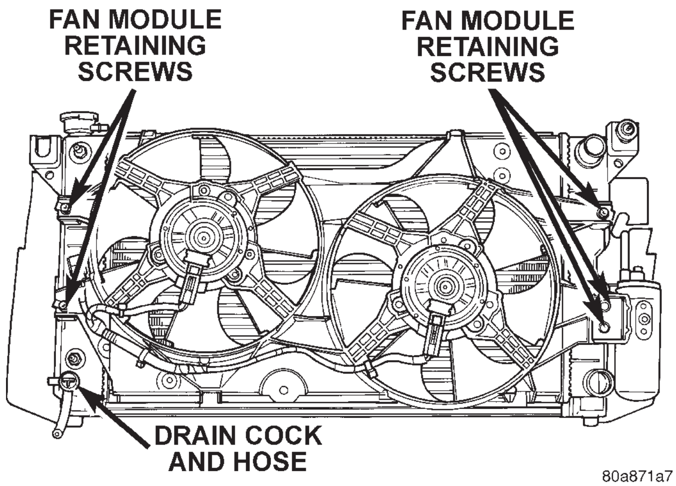


Fig. 31 Fan Module

INSTALLATION

(1) Install fan module assembly into attaching clips on the radiator.

(2) Install the upper fan module to radiator retaining clips.

(3) Raise vehicle on the hoist and install the filter/drier, fan module and radiator mounting fasteners located on the lower right of the module.

(4) Lower the vehicle. Connect the transmission line to the radiator fitting on the lower left side.

(5) Install the upper auxiliary transmission cooler lines to the retaining clips on the fan module shroud, if equipped.

(6) Install fan module retaining fasteners (Fig. 31). Tighten to 12 N·m (105 in. lbs.).

(7) Install the air cleaner assembly.

(8) Install the crossmember. Refer to Group 23 Body for procedure. Connect the upper radiator mounts to the crossmember. Tighten fasteners to 12 N·m (105 in. lbs.).

(9) Install the Coolant Recovery System (CRS) attaching screw to the upper crossmember. Tighten to 2 N·m (18 in. lbs.).

(10) Install upper grill to crossmember valence panel.

(11) Connect the fans to the connector located on the left side of the fan module.

(12) Install the air intake resonator to the throttle body and air cleaner assembly.

REMOVAL AND INSTALLATION (Continued)

(13) Raise the vehicle. Install the lower auxiliary transmission cooler lines to the retaining clips on the fan module shroud, if equipped.

(14) Install outlet hose retainer clip to the shroud. Install the radiator outlet hose to the retaining clip.

(15) Lower the vehicle.

ENGINE BLOCK HEATER

REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Drain, Clean, Flush and Refill of this section for procedure.

(2) Remove power cord plug from heater.

(3) Loosen screw in center of heater. Remove heater assembly.

INSTALLATION

(1) Thoroughly clean core hole and heater seat.

(2) Insert heater assembly with element loop positioned **upward.**

(3) With heater seated, tighten center screw securely to assure a positive seal.

(4) Fill cooling system with coolant to the proper level, vent air, and inspect for leaks. Pressurize system with Radiator Pressure Tool before looking for leaks.

(5) Install power cord plug to heater.

ACCESSORY DRIVE BELTS—2.4L

REMOVAL/INSTALLATION-ADJUST

GENERATOR AND AIR CONDITIONING

(1) Loosen lower generator pivot bolt and upper locking nut, then loosen adjusting bolt (Fig. 32) to remove belt tension.

CAUTION: Belt damage may occur if the following procedure is not performed.

(2) Tighten lock nut to 21 N·m (180 in. lbs.) and torque generator pivot bolt to 54 N·m (40 ft. lbs.). To assure proper alignment of generator assembly. Adjust belt tension by tightening the adjusting bolt until proper belt tension is obtained. Refer to tension specification in Belt Tension Chart.

(3) Torque lock nut to 54 N·m (40 ft. lbs.).

POWER STEERING PUMP

(1) From on top of the vehicle loosen locking nuts D and F (Fig. 33).

(2) From under the vehicle loosen the pivot bolt E. Loosen adjusting bolt G until belt can be removed.

(3) After installing a new belt, adjust belt tension by tightening the adjusting bolt until the proper tension obtained. Refer to tension specification in Belt Tension Chart.

(4) Tighten locking nuts D and F to 54 N·m (40 ft. lbs.).

(5) Tighten pivot bolt E to 54 N·m (40 ft. lbs.)

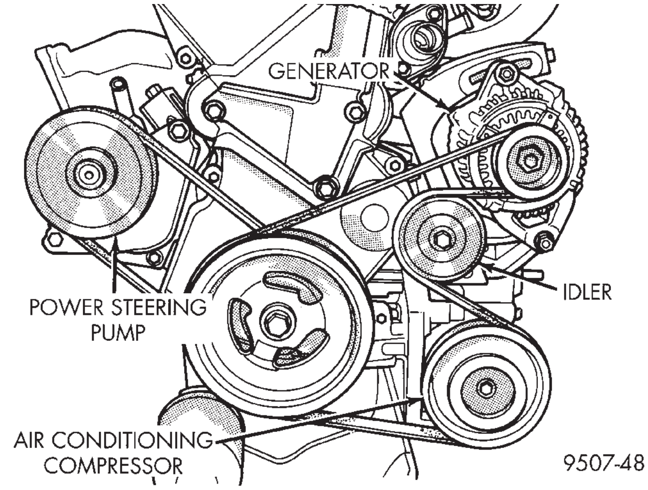


Fig. 32 Air Conditioning Compressor/Generator Belts—2.4L

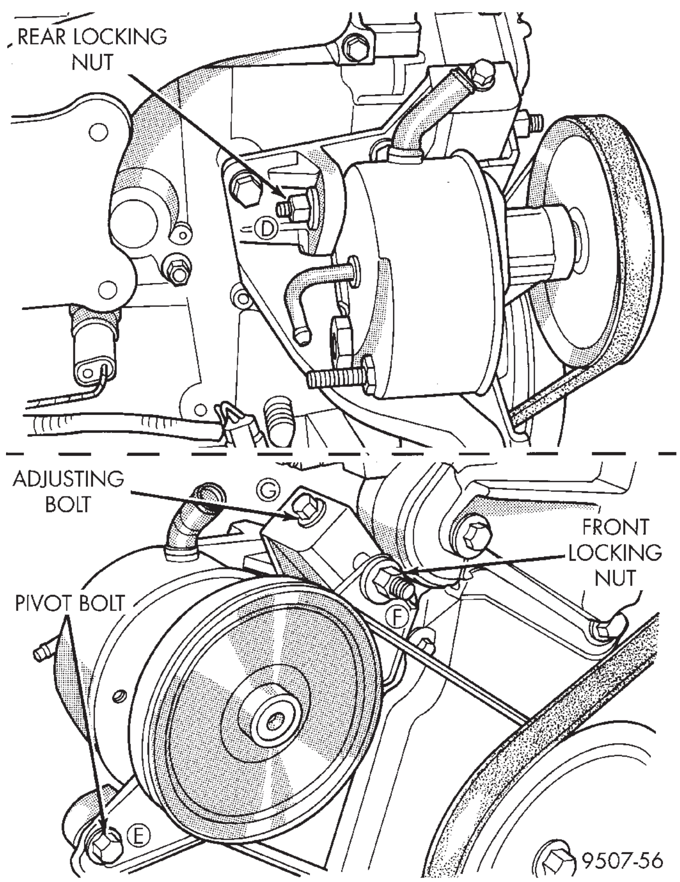


Fig. 33 Power Steering Pump Adjustment

REMOVAL AND INSTALLATION (Continued)

ACCESSORY DRIVE BELTS—3.0L

GENERATOR/POWER STEERING PUMP BELT

REMOVAL/INSTALLATION

The Poly-V generator/power steering pump belt is provided with a dynamic tensioner (Fig. 34) to maintain proper belt tension. To remove or install this belt, apply force in a clockwise direction to the tensioner pulley bolt (Fig. 34).

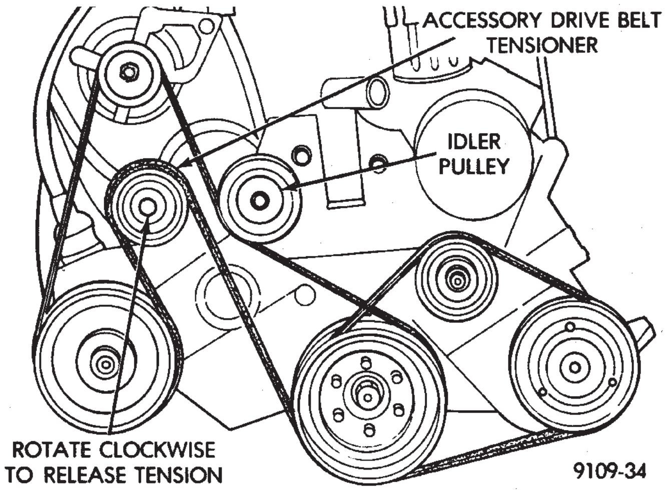


Fig. 34 Release Belt Tensioner—3.0L

AIR CONDITIONING BELT

REMOVAL

To remove the air conditioning compressor drive belt, first loosen the idler pulley lock nut, then turn the adjusting screw to lower the idler pulley (Fig. 35).

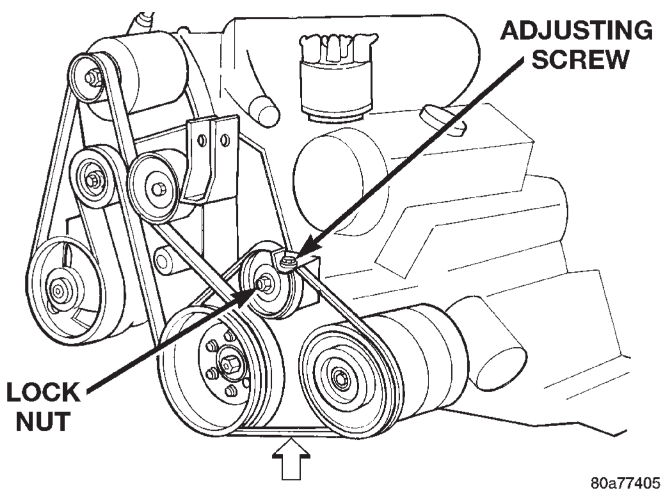


Fig. 35 Air Conditioning Drive Belt—3.0L Engine

INSTALLATION/ADJUSTMENT

To adjust the air conditioning drive belt, loosen the idler pulley lock nut (Fig. 35) and adjust belt tension by tightening adjusting screw. Refer to Proper Belt Tension and Belt Tension Chart in this Section for procedure. Tighten pulley lock nut to 54 N·m (40 ft. lbs.) after adjustment.

ACCESSORY DRIVE BELT—3.3/3.8L

REMOVE/INSTALL

GENERATOR, POWER STEERING PUMP, AIR CONDITIONING COMPRESSOR AND WATER PUMP DRIVE BELT

The Poly-V Drive belt is provided with a dynamic tensioner (Fig. 36) to maintain proper belt tension. To remove or install this belt.

(1) Raise vehicle on hoist.

(2) Remove right front splash shield.

(3) Release tension by rotating the tensioner clockwise (Fig. 36).

(4) Reverse above procedure to install.

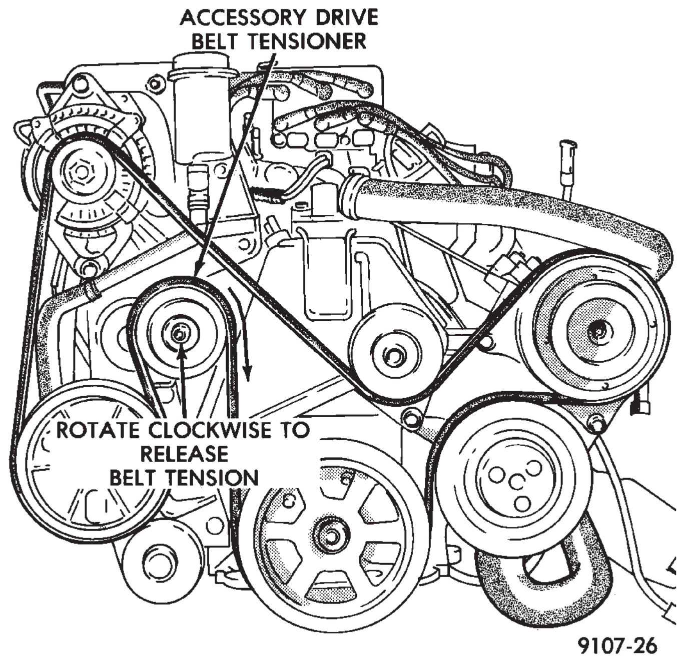


Fig. 36 Accessory Drive Belt—3.3/3.8L Engines

CLEANING AND INSPECTION

WATER PUMP

Replace the water pump if it has any of the following defects.

(1) Damage or cracks on the pump body.

(2) Coolant leaks; if the seal is leaking, this will be evident by traces of thick deposits of greenish-brown dried glycol running down the pump body and components below. A thin black stain below pump weep hole is considered normal operation.

(3) Impeller rubs inside of chain case cover 3.3/3.8L or cylinder block 2.4L engines.

(4) Excessively loose or rough turning bearing.

CLEANING AND INSPECTION (Continued)

NOTE: It is normal for the water pump to weep a small amount of coolant from the weep hole (black stain on water pump body). Do not replace the water pump if this condition exists. Replace the water pump if a heavy deposit or a steady flow of green/brown engine coolant is evident on water pump body from the weep hole (shaft seal failure). Be sure to perform a thorough analysis before replacing water pump.

ACCESSORY DRIVE BELT

When inspecting serpentine drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 37), are considered normal. these are not reasons to replace the belt. However, cracks running along the rib (not across) are not normal. Any belt with cracks running along the rib must be replaced (Fig. 37). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

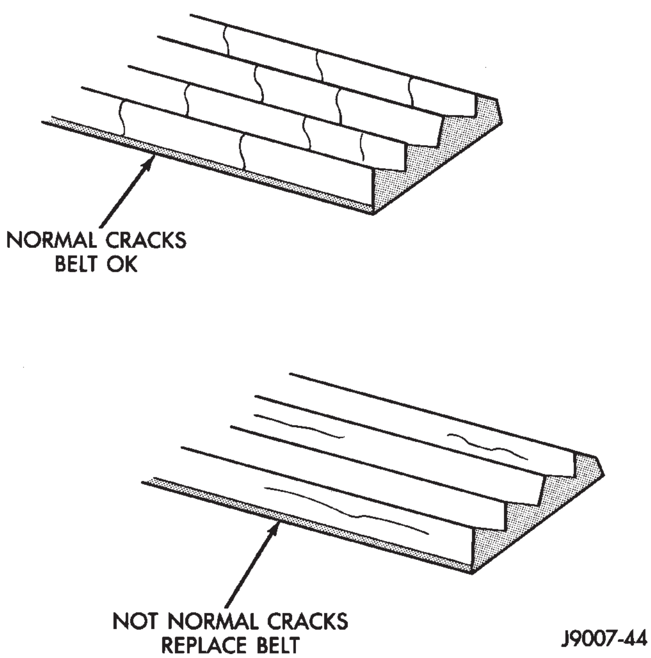


Fig. 37 Serpentine Drive Belt Wear Patterns

RADIATOR PRESSURE CAP

INSPECTION

Hold the cap in hand, **right side up**. The vent valve at the bottom of the cap should open. If the rubber gasket has swollen and prevents the valve from opening, replace the cap.

Hold the cleaned cap in hand **upside down.** If any light shows between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

Replacement cap must be of the type designed for coolant reserve system with a completely sealed diaphragm spring, and rubber gasket to seal to filler neck top surface. This design assures coolant return to radiator.

COOLING SYSTEM CLEANING

Drain cooling system (see: **Cooling System Draining**) and refill with clean water (see: **Cooling System Refilling**). Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty; fill, run, and drain system again, until water runs clear.

REVERSE FLUSHING THE RADIATOR

Drain cooling system and remove radiator hoses from engine. Install suitable flushing gun in radiator lower hose. Fill radiator with clean water and turn on air in short blasts.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result. Continue this procedure until water runs clear.

REVERSE FLUSHING THE ENGINE

Drain radiator (see: **Draining Cooling System**) and remove hoses from radiator. Remove engine thermostat and reinstall thermostat housing. Install suitable flushing gun to thermostat housing hose. Turn on water, and when engine is filled, turn on air, but no higher than 138 kPa (20 psi) in short blasts. Allow engine to fill between blasts of air. Continue this procedure until water runs clean. Reinstall thermostat using a new housing gasket. Fill cooling system (See **Refilling**).

CHEMICAL CLEANING

One type of corrosion encountered with aluminum cylinder heads is aluminum hydroxide deposits. Corrosion products are carried to the radiator and deposited when cooled off. They appear as dark grey when wet and white when dry. This corrosion can be removed with a two part cleaner (oxalic acid and neutralizer) available in auto parts outlets. Follow manufacturers directions for use.

ADJUSTMENTS

PROPER BELT TENSION

Satisfactory performance of the belt driven accessories depends on proper belt tension. Belt tensioning should be performed with the aid of a Burroughs gauge Special Tool C-4162. Because of space limitations in the engine compartment, the use of the gauge may be restricted. Raise the vehicle on a hoist

ADJUSTMENTS (Continued)

and the remove the splash shield to gain access to the drive belts.

BELT TENSION GAUGE METHOD

Use belt tensioning Special Tool Kit C-4162 for:

CAUTION: The Burroughs gauge for the Poly-V belt is not to be used on the V-belt. These gauges are not interchangeable.

- For conventional V-belts affix the Burroughs gauge (Special Tool C-4162) to the belt. Adjust the belt tension for New or Used belt as prescribed in the Belt Tension Chart.
- For a Poly-V belt affix the Poly-V Burroughs gauge to the belt and then apply specified tension to the belt as prescribed in the Belt Tension Chart

Adjust belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart.

BELT TENSION CHART

ACCESSORY DRIVE BELT	GAUGE
2.4L ENGINE	
A/C COMPRESSOR / GENERATOR	NEW 190 LB.
	USED 115 LB.
POWER STEERING	NEW 140 LB.
	USED 90 LB.
3.0L ENGINE	
A/C COMPRESSOR	NEW 150 LB.
	USED 80 LB.
GENERATOR / POWER STEERING	DYNAMIC TENSIONER
3.3/3.8L ENGINES	
A/C COMPRESSOR	DYNAMIC TENSIONER
GENERATOR / WATER PUMP / POWER STEERING	DYNAMIC TENSIONER

SPECIFICATIONS

COOLING SYSTEM CAPACITY

Engine	Standard Duty		Trailer Tow or Heavy Duty	
	Front Heater	Rear Heater	Front Heater	Rear Heater
2.4L	10.6 liters* (11.23 qts.)*	N/A	N/A	N/A
3.0L	12.3 liters* (13.0 qts.)*	N/A	N/A	15.0 liters* (15.9 qts.)*
3.3/3.8L	12.5 liters* (13.23 qts.)*	15.26 liters* (16.13 qts.)*	12.5 liters* (13.23 qts.)*	15.26 liters* (16.13 qts)*

*Includes Heater and Coolant Recovery Tank Filled to Max Level.

TORQUE CHART

DESCRIPTION **TORQUE**

Thermostat Housing
Bolts—2.4L & 3.3/3.8L . . . . . .28 N·m (250 in. lbs.)
Bolts—3.0L . . . . .12 N·m (105 in. lbs.)

Water Pump Mounting
Bolts—2.4L & 3.3/3.8L . . . . . .12 N·m (250 in. lbs.)
Bolts—3.0L . . . . .27 N·m (240 in. lbs.)

Water Pump Inlet Tube
Bolts—2.4L . . . . .12 N·m (250 in. lbs.)
Bolts—3.0L . . . . .11 N·m (94 in. lbs.)

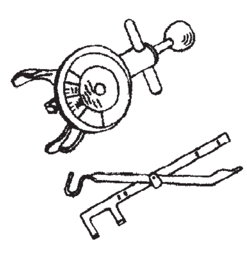
Water Pump Pulley
Bolts—3.3/3.8L . . . . .28 N·m (250 in. lbs.)

Transaxle Oil Cooler Hose
Clamps—All Engines . . . . .2 N·m (18 in. lbs.)

Radiator Mounting Upper Bracket
Nut—All Engines . . . . .12 N·m (105 in. lbs.)

SPECIAL TOOLS

COOLING



Belt Tension Gauge C-4162

COOLING SYSTEM

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GENERAL INFORMATION

COOLING SYSTEM — 2.0L GASOLINE

The 2.0L gasoline engine cooling system consists of an engine cooling module, thermostat, coolant, a water pump to circulate the coolant. The engine cooling module may consist of a radiator, electric fan motors, fan, shroud, coolant reserve system, hoses, clamps, air condition condenser.

• When the Engine is cold: The thermostat is closed; the cooling system has no flow through the radiator. The coolant flows through the engine, heater system and bypass.

• When the Engine is warm: Thermostat is open; the cooling system has flow through radiator, engine, heater system and bypass.

COOLING SYSTEM — 2.5L VM DIESEL

The cooling system has a radiator, coolant, electric fan motors, shroud, pressure cap, thermostat, coolant pressure bottle, hoses, a water pump to circulate the coolant, to complete the circuit. Coolant flow for the VM diesel engine is shown in (Fig. 1).

COOLANT PRESSURE BOTTLE

2.5L VM DIESEL

This system works with the pressure cap to use thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides some reserve coolant to cover minor leaks and evaporation or boiling losses. The coolant pressure bottle location for 2.5L diesel is above the cylinder head cover (Fig. 2).

LOW COOLANT LEVEL SENSOR

The low coolant level sensor checks for low coolant level in the coolant tank. A signal will be sent from this sensor to the Body Control Module (BCM). When the BCM determines low coolant level for 30 continuous seconds, the instrument panel mounted low coolant level warning lamp will be illuminated. The sensor is located on the front side of the coolant tank (Fig. 4). For information, refer to Group 8E, Instrument Panel and Gauges.

If this lamp is illuminated, it indicates the need to fill the coolant tank and check for leaks.

GENERAL INFORMATION (Continued)

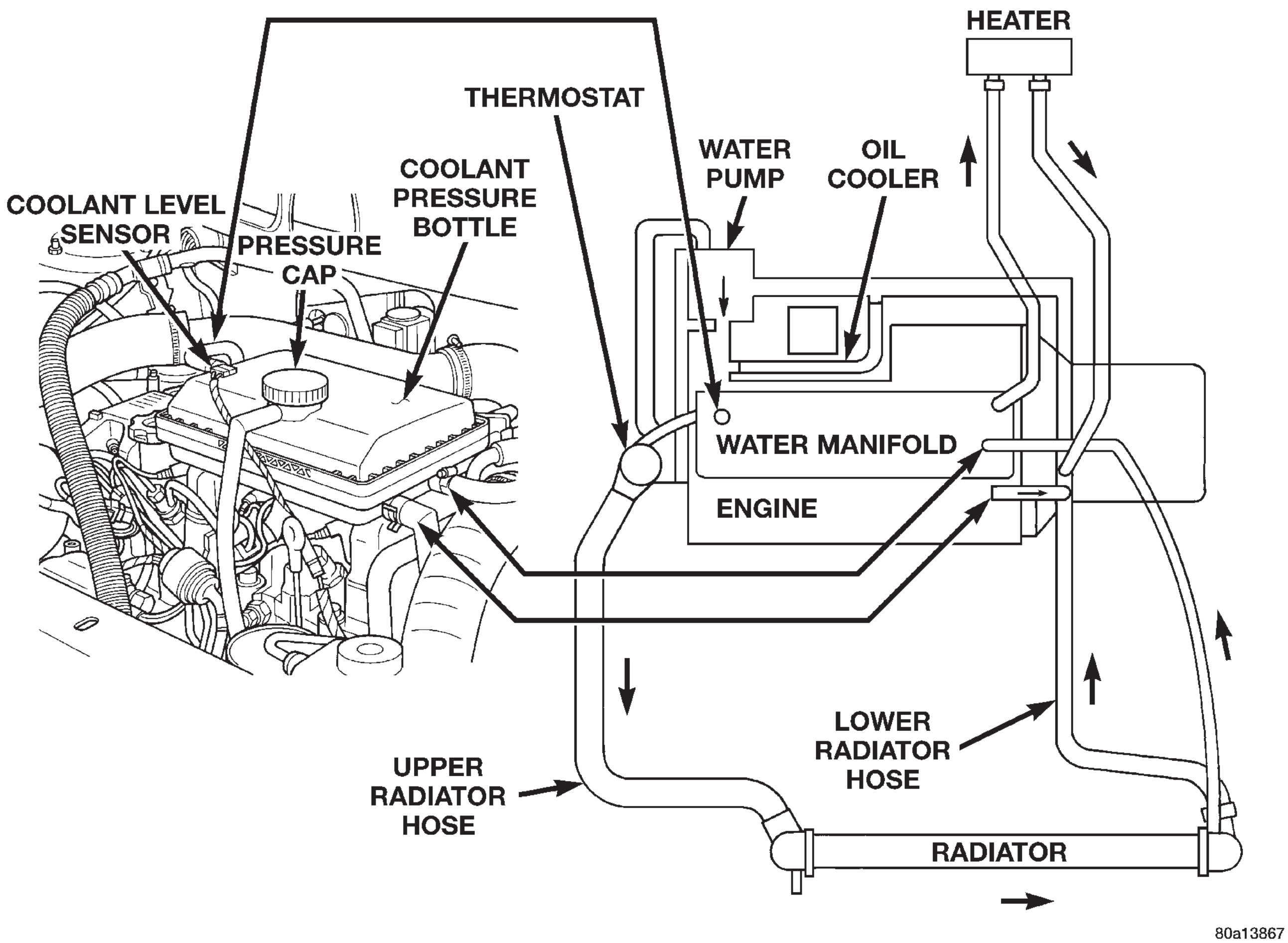


Fig. 1 Cooling System Operation – 2.5L VM Diesel

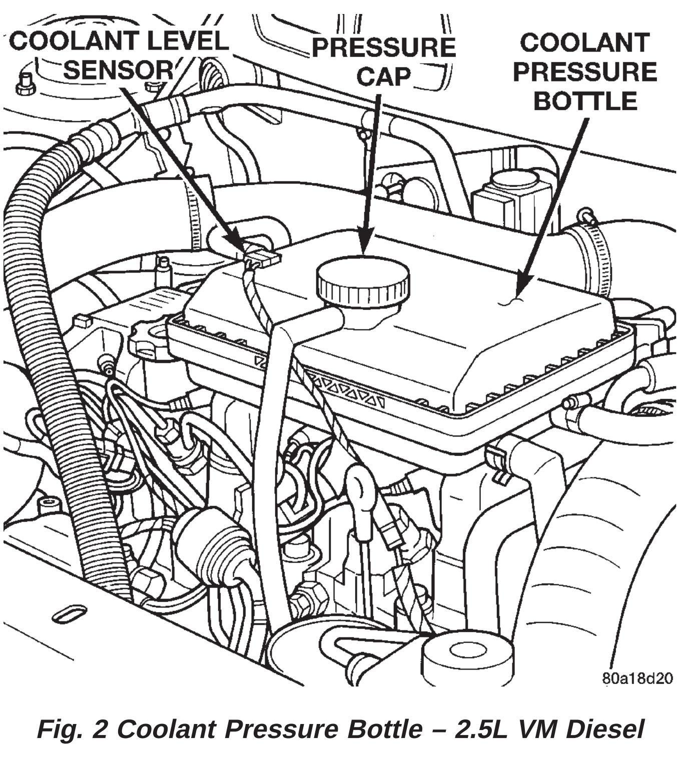


Fig. 2 Coolant Pressure Bottle – 2.5L VM Diesel

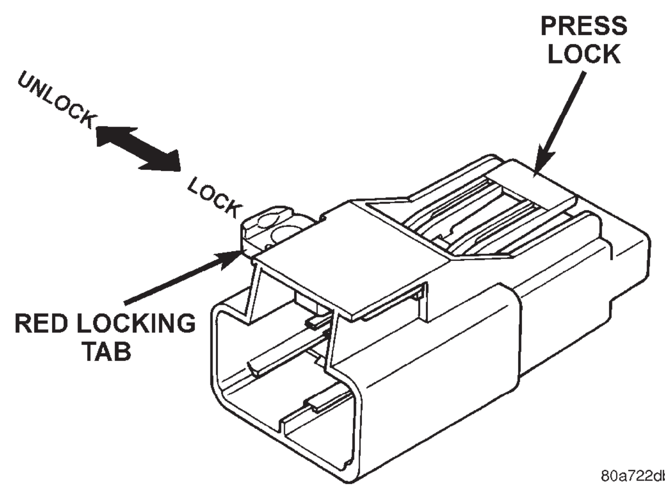


Fig. 3 Low Coolant Warning Sensor Connector – 2.5L VM Diesel

RADIATOR

The radiators are cross-flow types (horizontal tubes) with design features that provide greater strength along with sufficient heat transfer capabili-

GENERAL INFORMATION (Continued)

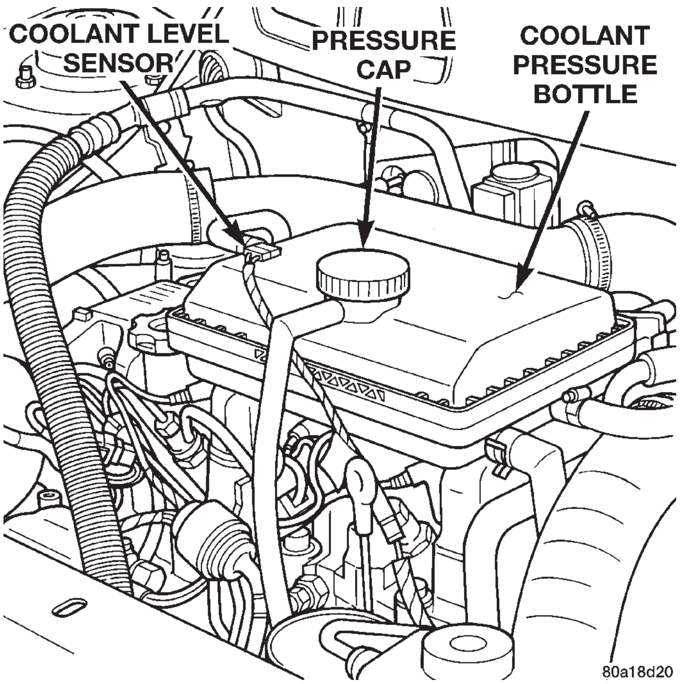


Fig. 4 Low Coolant Level Sensor

ties to keep the engine satisfactorily cooled (Fig. 5) and (Fig. 6).

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches etc., or by excessive torque on hose clamps.

If the plastic tank is damaged, replace the radiator.

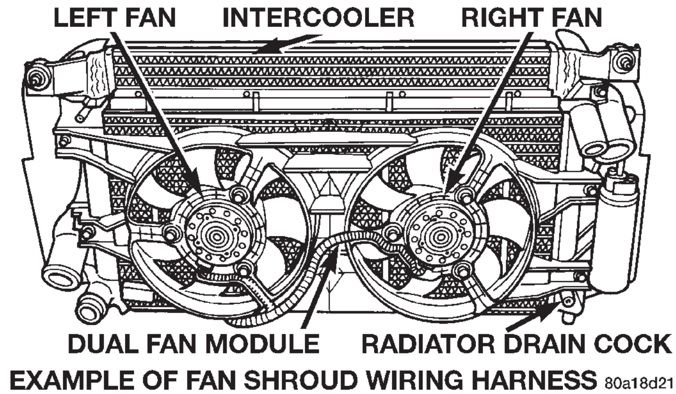


Fig. 6 Cooling Module —VM Diesel

bolts directly to the block (Fig. 7). Cylinder block to water pump sealing is provided by a rubber O-ring. The water pump is driven by the timing belt. Refer to Group 9, Engine section for component removal to access the water pump.

NOTE: The water pump on all models can be replaced without discharging the air conditioning system.

2.5L VM DIESEL

The Diesel engine water pump has an aluminum body and housing with a stamped steel impeller. The pump uses an O-ring gasket between body and housing. The water pump is driven by the accessory drive belt, and the pump housing is bolted to the cylinder block (Fig. 9).

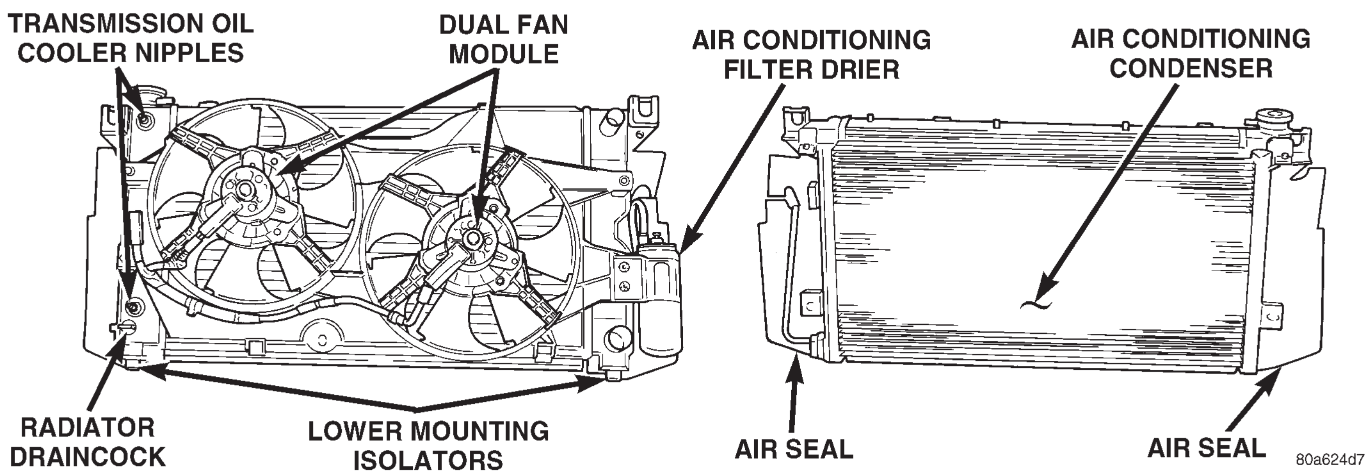


Fig. 5 Cooling Module —2.0LGasoline

DESCRIPTION AND OPERATION

WATER PUMP

2.0L GASOLINE

The water has a diecast aluminum body and housing with a stamped steel impeller. The water pump

NOTE: The water pump on all models can be replaced without discharging the air conditioning system.

DESCRIPTION AND OPERATION (Continued)

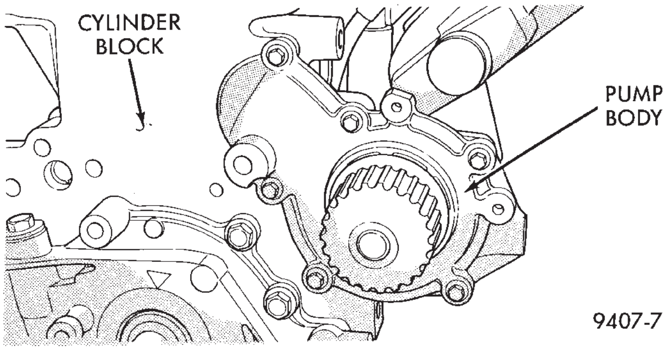


Fig. 7 Water Pump—2.0L Gasoline Engine

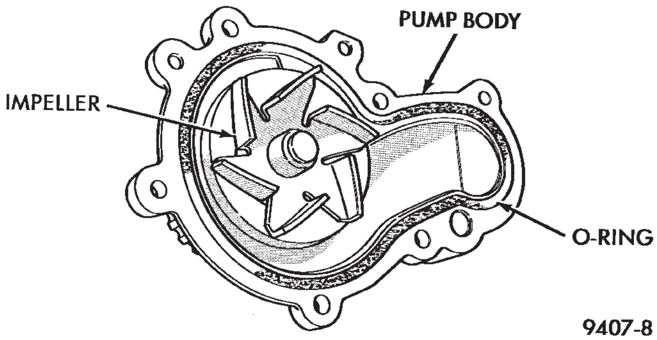


Fig. 8 Water Pump—2.0L Gasoline Engine

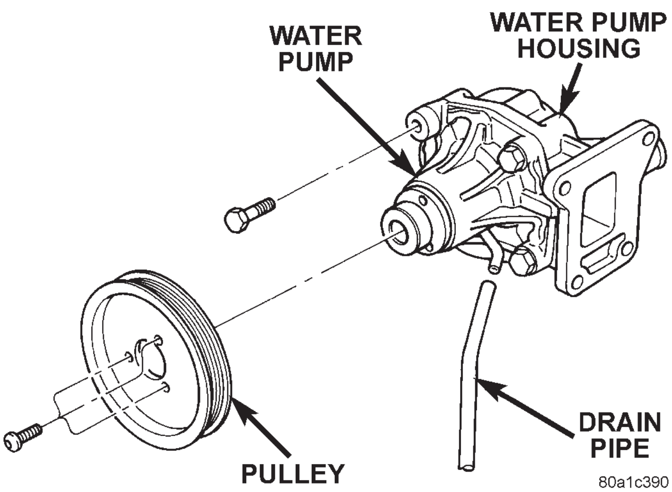


Fig. 9 Water Pump—2.5L VM Diesel

THERMOSTAT OPERATION

2.5 VM DIESEL

The engine cooling thermostats are wax pellet driven, reverse poppet choke type. They are designed to provide the fastest warm up possible by preventing leakage through them and to guarantee a minimum engine operating temperature (Fig. 10). The thermostat has a hole to bleed off air in the cooling system during engine warm up. The thermostat begins to open at 80° C ± 2° (176° F ± 4°).

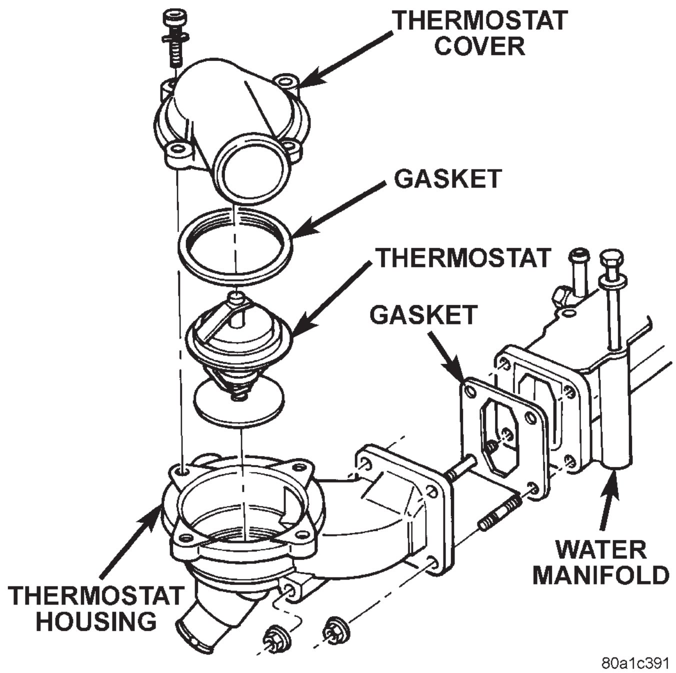


Fig. 10 Thermostat and Housing — 2.5L VM Diesel

PRESSURE/VENT CAP

WARNING: Engine coolant can reach temperatures of 200° fahrenheit or greater. If the cooling system is opened with coolant at a high temperature, hot coolant can be forced out of the system under high pressures, causing personal injury. Allow system to cool down prior to removing the pressure cap.

The pressure/vent cap is secured to the coolant tank neck by a means of a cam lock system. This cap releases excess pressure at some point within a range of 90-117 kPa (13- 17 psi) for gasoline engines, and 110–124 kPa (16–18 psi) for diesel engines. The actual pressure relief point (in pounds) is labeled on top of the cap (Fig. 11).

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 (Fig. 11) contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches approximately 103 kPa (15 psi).

When the engine is cooling down, vacuum is formed within the cooling system. To prevent collapse of the radiator and coolant hoses from this vacuum, a vacuum valve is used within the cap. This valve prevents excessive pressure differences from occurring between the closed cooling system and the atmosphere. If the vacuum valve is stuck shut, the radiator and/or cooling system hoses will collapse on cool-down.

DESCRIPTION AND OPERATION (Continued)

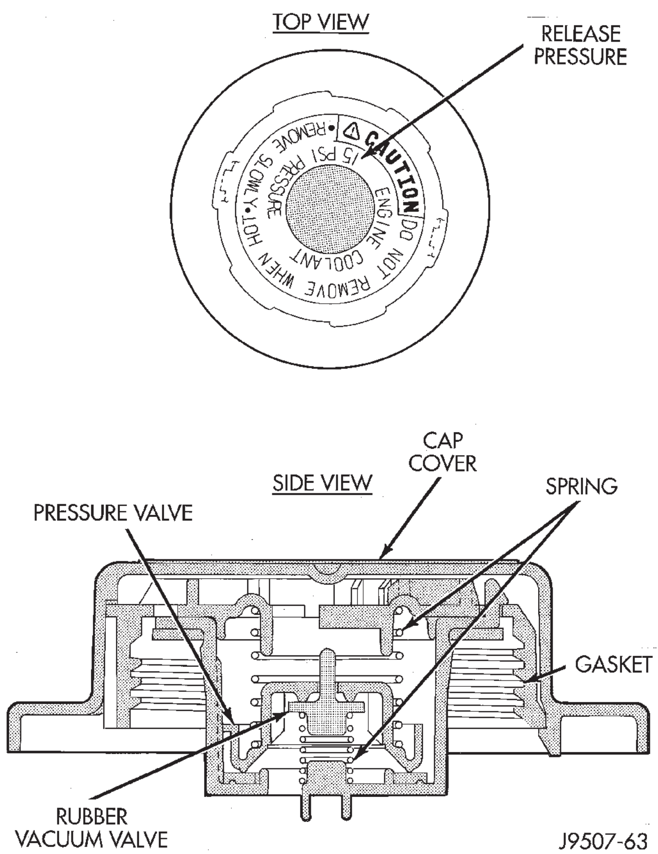


Fig. 11 Coolant Tank Pressure/Vent Cap

NOTE: Do not use any type of tool when tightening the cap. Hand tighten only (approximately 5 N·m or 44 in. lbs.) torque.

COOLANT PERFORMANCE

ETHYLENE-GLYCOL MIXTURES

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.

100 Percent Ethylene-Glycol—Should Not Be Used in Chrysler Vehicles

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 Formulations—Should Not Be Used in Chrysler Vehicles

Propylene-glycol formulations do not meet Chrysler coolant specifications. 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 in Chrysler vehicles, which are 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—Should Not Be Used in Chrysler Vehicles

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.

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

BELT TENSION

Correct accessory drive belt tension is required to be sure of optimum performance of belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate and greatly reduced belt life.

DESCRIPTION AND OPERATION (Continued)

Initial belt adjustment is done with a adjustable tensioner pulley. After the initial adjustment is performed, an automatic belt tensioner is used to maintain correct belt tension at all times. Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner. Refer to Automatic Belt Tensioner in this group.

AUTOMATIC BELT TENSIONER

Drive belt tension is controlled by a spring loaded automatic belt tensioner located below and to the front of the engine oil filter (Fig. 12). This tensioner is connected to a pivot bracket and a pulley (Fig. 12). The pivot bracket rotates on a pivot pin attached to the engine. Special machined washers with rubber o-rings (Fig. 12) are used at each side of the pivot bracket to help keep dirt and water away from the pivot pin.

If a defective belt tensioner is suspected, a check of this pivot bracket and pivot pin should be made. Corrosion may have formed at the pin and may cause the pivot bracket to stick. Belt slippage will result.

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE THE AUTOMATIC BELT TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY.

THERMOSTAT

DIAGNOSIS

Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. Because of this, lower temperature gauge readings for diesel versus gasoline engines may, at times be normal.

Typically, complaints of low engine coolant temperature are observed as low heater output when combined with cool or cold outside temperatures.

To help promote faster engine warm-up, an electric engine block heater must be used with cool or cold outside temperatures. This will help keep the engine coolant warm when the vehicle is parked. Use the block heater if the outside temperature is below 4°C (40°F). **Do not use the block heater if the outside temperature is above 4°C (40°F).**

TESTING

NOTE: The DRB scan tool shoud be used to monitor engine coolant temperature on the diesel engine. Refer to the 1998 GS Powertrain Diagnostic Manual for thermostat diagnosis procedure.

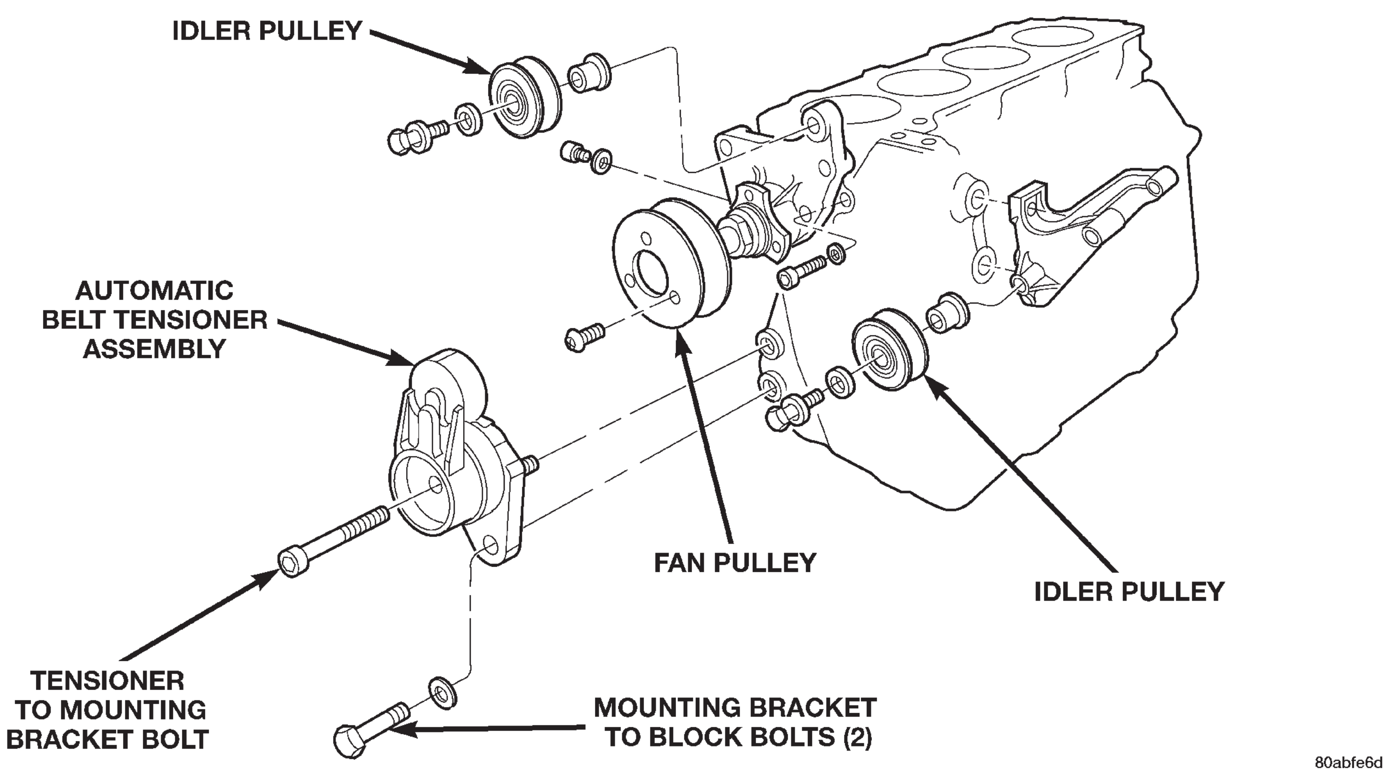


Fig. 12 Automatic Belt Tensioner Assembly

SERVICE PROCEDURES

ADDING ADDITIONAL COOLANT

2.5L VM DIESEL

Do not remove coolant bottle pressure cap when the engine is hot. Remove pressure cap and fill coolant bottle between Min and Max lines inside filler neck. Use only 50/50 mix of ethylene glycol type anti-freeze and water (Fig. 13). Squeezing radiator hoses may help purge air from the cooling system.

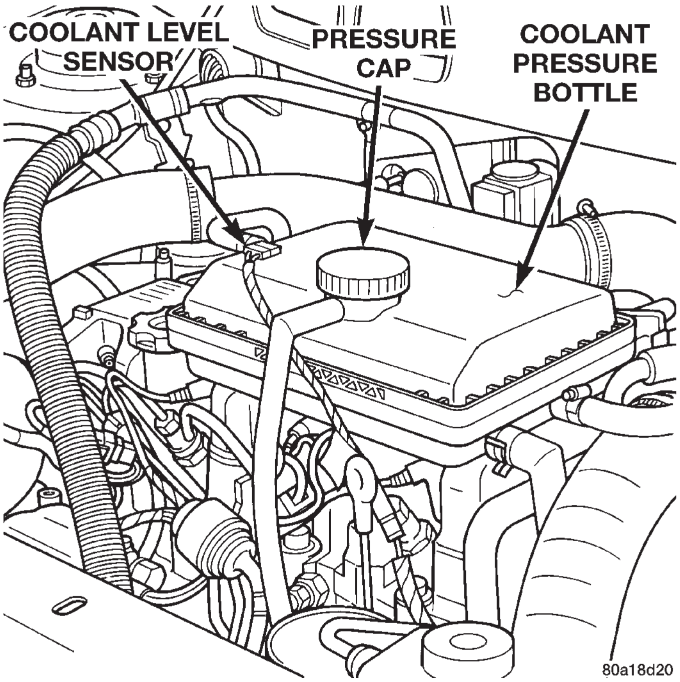


Fig. 13 Coolant Pressure Bottle—2.5L VM Diesel

DRAINING COOLING SYSTEM

2.0L GASOLINE

To drain cooling system move temperature selector for heater to full heat with engine running. **Without removing radiator pressure cap and with system not under pressure,** Shut engine off and open draincock. The coolant reserve tank should empty first, then remove radiator pressure cap and let the radiator drain (if not, see Testing Cooling System for leaks).

2.5L VM DIESEL

The cooling system does not have a radiator mounted pressure cap. Instead the pressure cap is mounted on the coolant pressure bottle (Fig. 14).

(1) Shut off engine.

(2) Remove radiator pressure cap.

(3) Open draincock and allow coolant to drain.

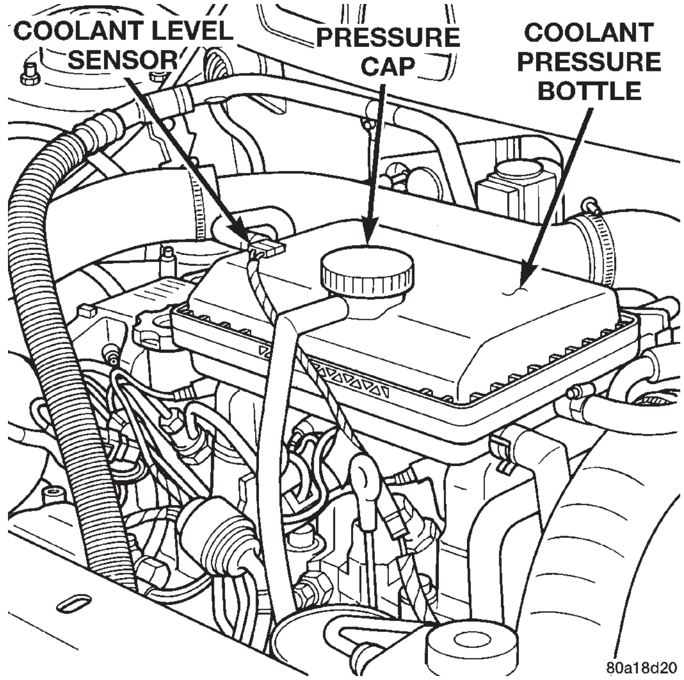


Fig. 14 Pressure Cap and Bottle—VM Diesel

REFILLING COOLING SYSTEM

2.0L GASOLINE

Refer to the gasoline engine cooling system information in this manual. Cooling system capacity is 6.0 liters (6.34 qts.) which includes the heater and coolant recovery tank.

2.5L VM DIESEL

First clean system to remove old glycol, see Cooling System Cleaning.

(1) Disconnect upper radiator hose at thermostat housing.

(2) Remove pressure cap from coolant expansion tank.

(3) Fill cooling system through upper radiator hose until coolant starts to leak out at the thermostat housing. Reconnect hose and re-install clamp.

(4) Fill expansion tank to top of bottle. Run engine at idle without pressure cap installed for 5 minutes. Squeeze upper radiator hose several times.

(5) Shut off engine. Top off coolant and install pressure cap.

(6) Inspect system for leaks.

REMOVAL AND INSTALLATION

WATER PUMP — 2.0L GASOLINE

REMOVAL

(1) Remove accessory drive belts and power steering pump.

(2) Drain cooling system.

REMOVAL AND INSTALLATION (Continued)

(3) Remove power steering pump bracket bolts and set pump and bracket assembly aside. Power steering lines do not need to be disconnected.

(4) Remove timing belt.

(5) Remove inner timing belt cover.

(6) Remove water pump attaching screws to engine (Fig. 15).

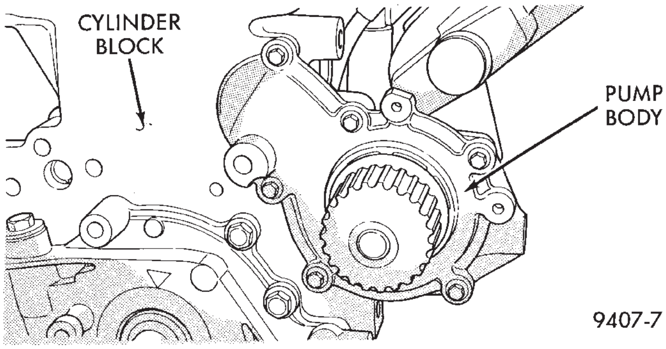


Fig. 15 Water Pump — 2.0L Gasoline

INSTALLATION

(1) Install new O-ring gasket in water pump body O-ring groove (Fig. 16). Use small dabs of Mopar Silicone Rubber Adhesive Sealant around the water pump body to secure O-ring in place during installation.

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 and cause a coolant leak.

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.). Pressurize cooling system to 15 psi with pressure tester and check water pump shaft seal and O-ring for leaks.

(3) Rotate pump by hand to check for freedom of movement.

(4) Install inner timing belt cover.

(5) Install timing belt.

(6) Fill cooling system. See **Filling Cooling System.**

(7) Install power steering pump and accessory drive belts.

WATER PUMP — 2.5L VM DIESEL

REMOVAL

(1) Drain cooling system. Refer to Draining Cooling System in this Group.

(2) Remove the right inner splash shield (Fig. 17).

(3) Loosen the water pump pulley attaching bolts (Fig. 18) before the accessory drive belt is removed.

(4) Loosen water pump accessory drive belts (Fig. 19). Remove water pump pulley.

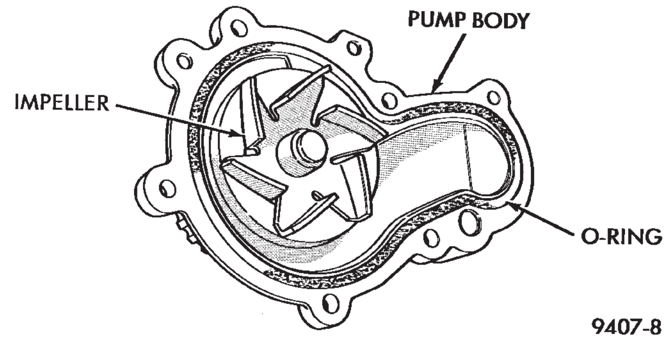


Fig. 16 Water Pump Body — 2.0L Gasoline

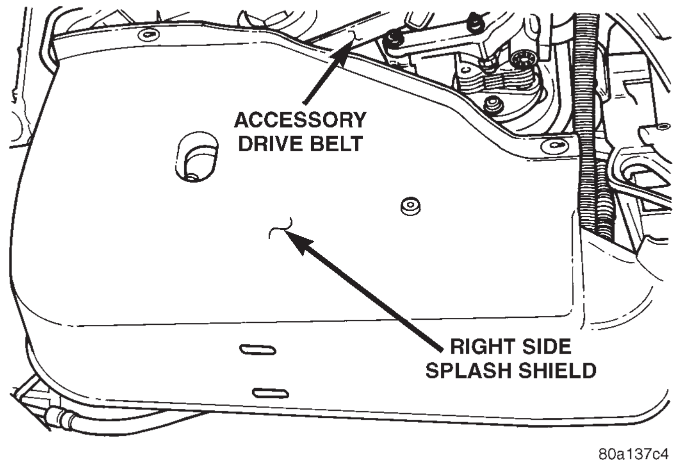


Fig. 17 Right Side Splash Shield

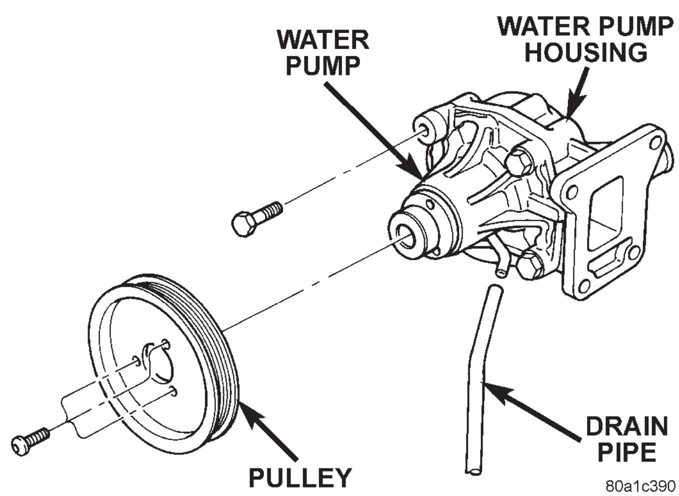


Fig. 18 Water Pump and Pulley — 2.5 L VM Diesel

(5) Remove water pump attaching bolts and remove pump.

INSTALLATION

(1) Install a new water pump to housing O-ring gasket. Install pump and tighten the attaching bolts to 22.6 N·m (205 in. lbs.)

REMOVAL AND INSTALLATION (Continued)

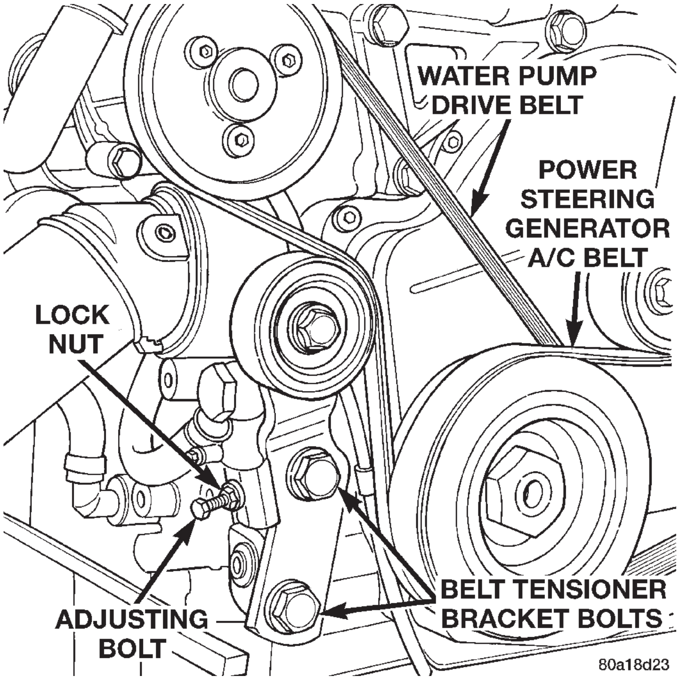


Fig. 19 Water Pump Drive Belt— 2.5 L VM Diesel

(2) Install water pump pulley.

(3) Install drive belt, Refer to Accessory Drive Belts, this Group. Tighten water pump pulley attaching bolts to 27.5 N·m (240 in. lbs.)

(4) Install right inner splash shield.

(5) Refill cooling system. Refer to Refilling Cooling System in this Group.

ENGINE THERMOSTAT— 2.0L GASOLINE

REMOVAL

(1) Drain cooling system to the thermostat level or below.

(2) Remove coolant recovery system (CRS) hose and thermostat/engine outlet connector bolts.

(3) Remove thermostat and seal, and clean sealing surfaces.

INSTALLATION

(1) Place the new thermostat assembly into the thermostat housing/outlet connector. Align air bleed vent with notch in cylinder head.

(2) Install thermostat housing/outlet connector onto cylinder head and tighten bolts to 12.5 N·m (110 in. lbs.). Connect the upper radiator hose.

(3) Refill cooling system (see **Refilling System**).

THERMOSTAT — 2.5L VM DIESEL

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Draining Cooling System in this section.

(2) Remove radiator hose at thermostat cover.

(3) Remove thermostat cover bolts (Fig. 20).

(4) Remove Thermostat.

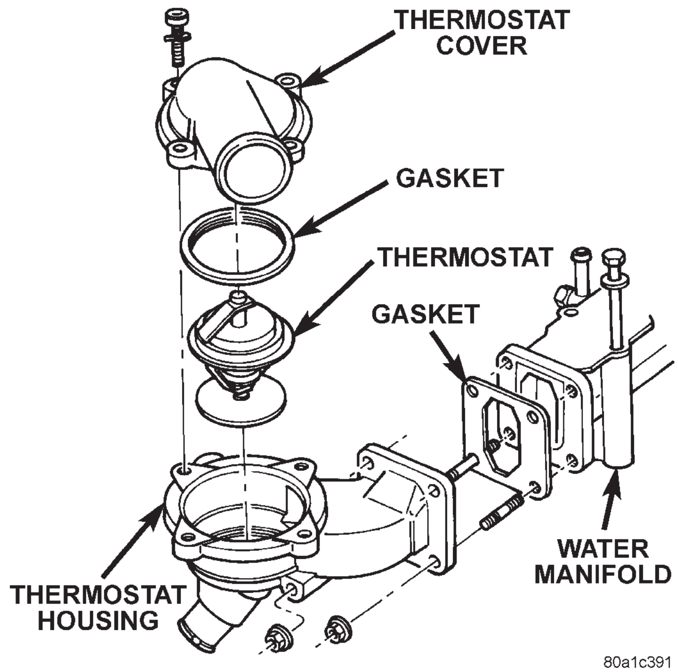


Fig. 20 Thermostat and Housing — 2.5L VM Diesel

INSTALLATION

(1) Remove old gasket material from thermostat housing and cover.

(2) Install new thermostat gasket.

(3) Install thermostat and tighten cover bolts to 10.8 N·m (96 in. lbs.).

(4) Install radiator hose.

(5) Refill cooling system. Refer to Refilling Cooling System in this section.

RADIATOR — 2.5L VM DIESEL

REMOVAL

(1) Disconnect battery.

(2) Remove power steering reservoir attaching bolts, and reposition reservoir.

(3) Remove radiator closure panel crossmember (Fig. 21).

(4) Remove air cleaner housing and intake hose.

(5) Unplug fan module 4 pin wiring connector.

(6) Drain cooling system. Refer to Draining cooling system in this section for procedure.

(7) Remove upper and lower Radiator Hoses.

(8) Remove radiator attaching bolts.

(9) Loosen A/C receiver/dryer lower bolt.

(10) Remove Radiator.

(11) Remove fan module from radiator.

REMOVAL AND INSTALLATION (Continued)

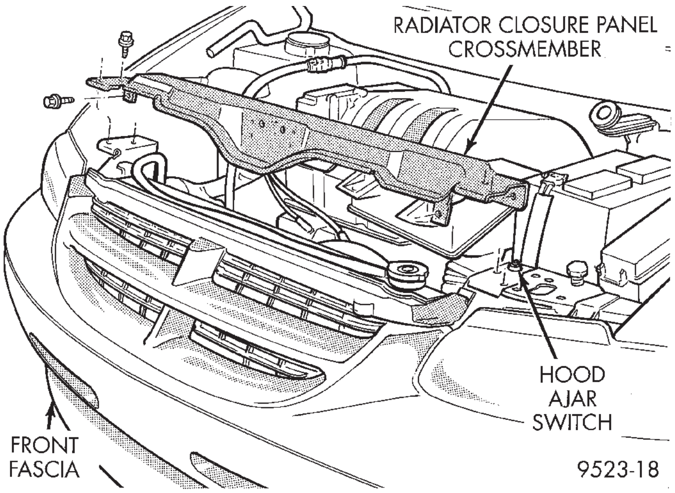


Fig. 21 Radiator Closure Panel Crossmember

INSTALLATION

(1) Install fan module on radiator.
(2) Install radiator.
(3) Tighten receiver/dryer lower bolt.
(4) Install radiator attaching bolts.
(5) Install lower and upper radiator hoses.
(6) Connect fan module.
(7) Install air cleaner housing and intake hose.
(8) Install radiator closure panel crossmember.
(9) Install power steering reservoir attaching bolts.
(10) Refill cooling system. Refer to Refilling cooling system in this section for procedure.
(11) Connect battery.

WATER PUMP BELT — 2.5L VM DIESEL

REMOVAL

(1) Remove generator/power steering belt. Refer to procedure in this section.
(2) Raise vehicle on hoist.
(3) Remove right side splash shield (Fig. 22).
(4) Loosen belt tensioner bracket bolts (Fig. 23).

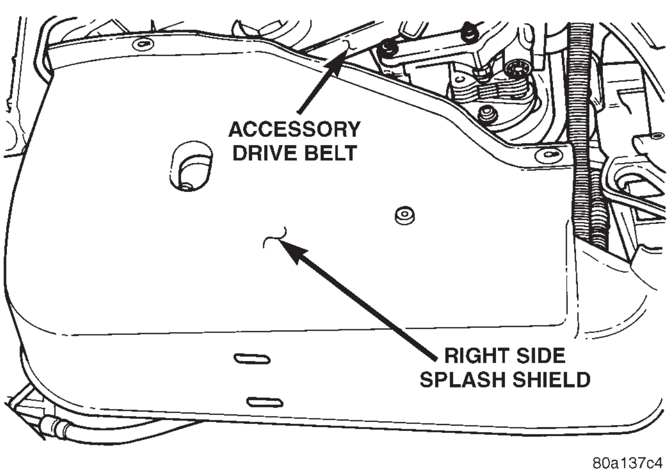


Fig. 22 Right Side Splash Shield

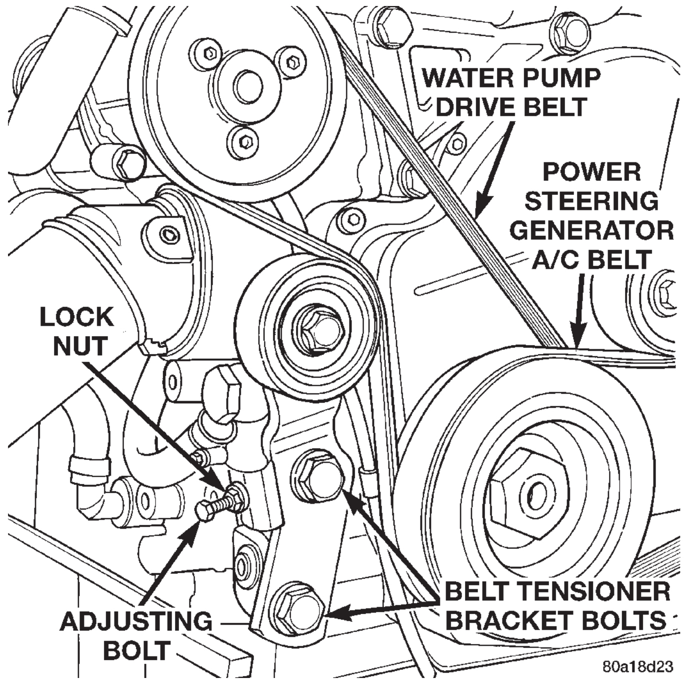


Fig. 23 Water Pump Belt Removal — 2.5L VM Diesel

(5) Loosen adjuster lock nut.
(6) Loosen adjusting bolt, and remove belt.

INSTALLATION

(1) Install water pump belt.
(2) Turn adjusting bolt clockwise to tighten belt.
(3) Tighten lock nut.
(4) Tighten belt tensioner bracket bolts
(5) Lower vehicle.
(6) Install generator/power steering belt. Refer to procedure in this section.

GENERATOR/POWER STEERING BELT — 2.5L VM DIESEL

REMOVAL

(1) Loosen generator pivot bolt (Fig. 24).
(2) Loosen adjusting bracket bolt.
(3) Loosen adjusting nut.
(4) Remove generator/power steering belt.

INSTALLATION

(1) Install generator/power steering belt.
(2) Tighten adjusting nut.
(3) Tighten adjusting bracket bolt.
(4) Tighten generator pivot bolt.

CLEANING AND INSPECTION

WATER PUMP

Replace the water pump if it has any of the following defects.
(1) Damage or cracks on the pump body.

CLEANING AND INSPECTION (Continued)

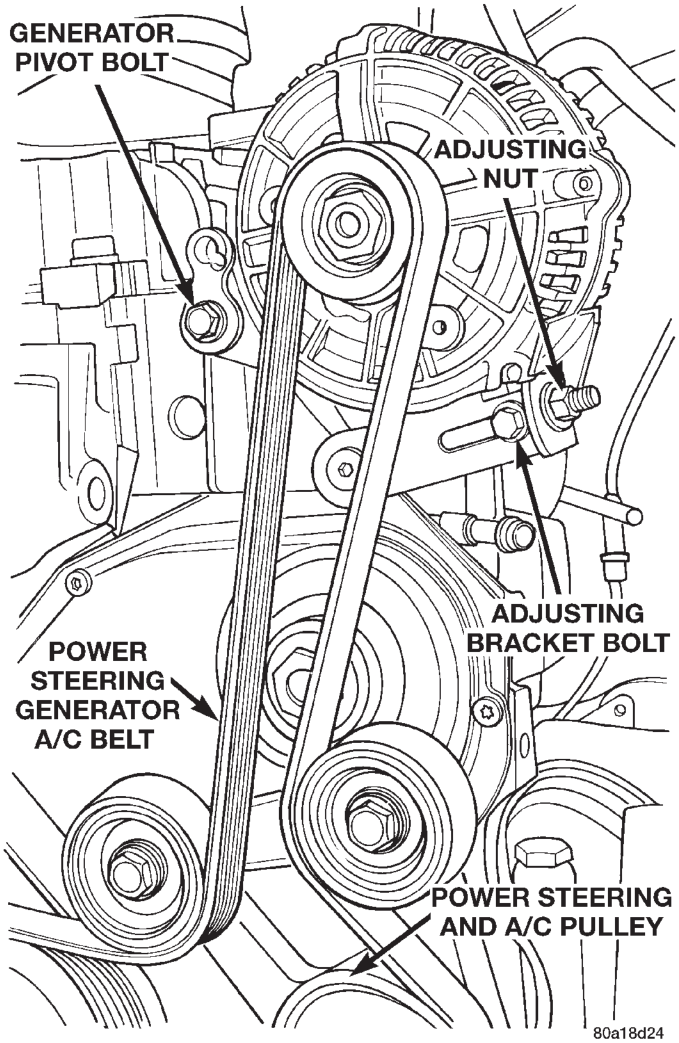


Fig. 24 Generator/Power Steering Removal – 2.5L VM Diesel

(2) Coolant leaks; if the seal is leaking, this will be evident by traces of thick deposits of greenish-brown dried glycol running down the pump body and components below. A thin black stain below pump weep hole is considered normal operation.

(3) Impeller rubs inside of the cylinder block 2.0L engine. Impeller rubs inside of the water pump housing 2.5L VM diesel engine.

(4) Excessively loose or rough turning bearing.

NOTE: It is normal for the water pump to weep a small amount of coolant from the weep hole (black stain on water pump body). Do not replace the water pump if this condition exists. Replace the water pump if a heavy deposit or a steady flow of green/brown engine coolant is evident on water pump body from the weep hole (shaft seal failure). Be sure to perform a thorough analysis before replacing water pump.

ADJUSTMENTS

BELT TENSION GAUGE METHOD

Use belt tensioning Special Tool Kit C-4162 for:

CAUTION: The Burroughs gauge for the Poly-V belt is not to be used on the V-belt. These gauges are not interchangeable.

- For conventional V-belts affix the Burroughs gauge (Special Tool C-4162) to the belt. Adjust the belt tension for New or Used belt as prescribed in the Belt Tension Chart. For a Poly-V belt affix the Poly-V Burroughs gauge to the belt and then apply specified tension to the belt as prescribed in the Belt Tension Chart

Adjust the belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart.

BELT TENSION CHART

ACCESSORY DRIVE BELT	GAUGE
2.0L GASOLINE ENGINE	
GENERATOR AND AIR CONDITIONING	NEW 667 ±44 N (150 ±10 LBS).
	USED 556 N (125 LBS.)
POWER STEERING	NEW 578 ±44 N (130 ±10 LBS).
	USED 489 N (110 LBS).
2.5L VM DIESEL	
WATER PUMP	NEW N/A LBS.
	USED N/A LBS.
GENERATOR /AIR CONDITIONING/ POWER STEERING	NEW 667 ± 44 N (150 ±10 LBS).
	USED 556 N (125 LBS).

SPECIFICATIONS

COOLING SYSTEM CAPACITY

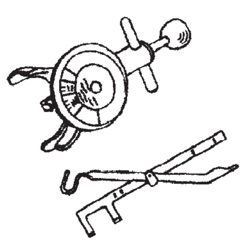
2.0L Gasoline	*10.6 liters (11 qts.)
2.5L VM Diesel	*10.0 liters (10.6 qts.)
*Includes Heater and Coolant recovery/pressure Tank.	

TORQUE CHART

COMPONENT	2.0L GASOLINE	2.5L VM
Thermostat Cover Bolts	105 in-lbs	10.8 N·m (96 in. lbs.)
Water Pump Mounting Bolts	12 N·m (105 in. lbs.)	22.6 N·m (204 in. lbs.)
Water Pump Pulley Bolts	N/A	27.5 N·m (240 in. lbs.)
Upper Radiator Mounting Bracket Bolts	12 N·m (105 in. lbs.)	12 N·m (105 in. lbs.)
Turbocharger Oil Supply Line	N/A	24.5 N·m (215 in. lbs.)
Turbocharger Oil Return Line	N/A	10.8 N·m (96 in. lbs.)
Water Pump Housing Nuts	N/A	9.5 N·m (84 in. lbs.)
Water Manifold Bolts	N/A	11.2 N·m (96 in. lbs.)
Coolant Bottle Bolts	2.0 N·m (18 in. lbs.)	10.8 N·m (96 in. lbs.)

SPECIAL TOOLS

COOLING



Belt Tension Gauge C-4162

BATTERY

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GENERAL INFORMATION

INTRODUCTION

The battery stores, stabilizes, and delivers electrical current to operate various electrical systems in the vehicle. The determination of whether a battery is good or bad is made by its ability to accept a charge. It also must supply high-amperage current for a long enough period to be able to start the vehicle. The capability of the battery to store electrical current comes from a chemical reaction. This reaction takes place between the sulfuric acid solution (electrolyte) and the lead +/- plates in each cell of the battery. As the battery discharges, the plates react with the acid from the electrolyte. When the charging system charges the battery, the water is converted to sulfuric acid in the battery. The concentration of acid in the electrolyte is measured as specific gravity using a hydrometer. The original equipment (OE) battery is equipped with a hydrometer (test indicator) built into the battery cover. The specific gravity indicates the battery's state-of-charge. The OE battery is sealed and water cannot be added.

The battery is vented to release gases that are created when the battery is being charged and discharged. The battery top, posts, and terminals should be cleaned when other under hood maintenance is performed.

When the electrolyte level is below the top of the plates, Clear in the test Indicator, the battery must be replaced. The battery must be completely charged, and the battery top, posts, and cable clamps must be cleaned before diagnostic procedures are performed.

SAFETY PRECAUTIONS AND WARNINGS

WARNING: 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 THE DISABLED VEHICLE'S BATTERY TO EXCEED 16 VOLTS. PERSONAL INJURY OR DAMAGE TO ELECTRICAL SYSTEM CAN RESULT.

TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

DESCRIPTION AND OPERATION

BATTERY IGNITION OFF DRAW (IOD)

A completely normal vehicle will have a small amount of current drain on the battery with the key out of the ignition. It can range from 5 to 25 milliamperes after all the modules time out. If a vehicle will not be operated for approximately a 20 days, the IOD fuse should be pulled to eliminate the vehicle electrical drain on the battery. The IOD fuse is

DESCRIPTION AND OPERATION (Continued)

located in the Power Distribution Center (PDC). Refer to the PDC cover for proper fuse.

CHARGING TIME REQUIRED

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD -1°C (30°F) BATTERY. PERSONAL INJURY MAY RESULT.

The time required to charge a battery will vary depending upon the following factors.

SIZE OF BATTERY

A completely discharged large heavy-duty battery may require more recharging time than a completely discharged small capacity battery, refer to the Battery Charging Timetable for charging times.

BATTERY CHARGING TIMETABLE

Charging Amperage	5 Amperes	10 Amperes	20 Amperes
Open Circuit Voltage	**Hours Charging at 21°C (70°F)**		
12.25 to 12.39	6 hours	3 hours	1.5 hours
12.00 to 12.24	8 hours	4 hours	2 hours
11.95 to 11.99	12 hours	6 hours	3 hours
10.00 to 11.94	14 hours	7 hours	3.5 hours
less than 10.00	See Charging Completely Discharged 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 charger is connected to a cold battery, current accepted by battery will be very low at first. In time, the battery will accept a higher rate as battery temperature warms.

CHARGER CAPACITY

A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 20 amperes or more.

STATE OF CHARGE

A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current amperage will be low. As water is converted back to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise, bringing the green ball (Fig. 1) into view at approximately 75 percent state-of-charge.

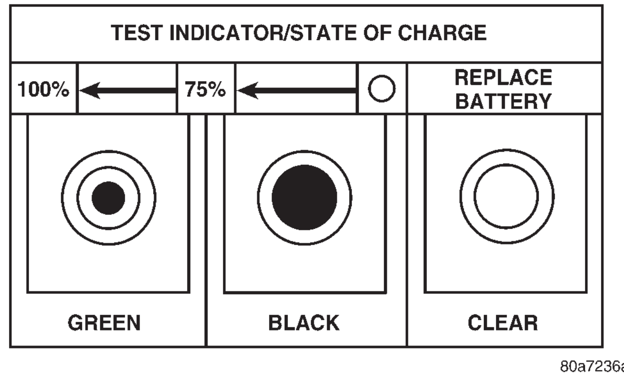

Fig. 1 Reading Test Indicator

DIAGNOSIS AND TESTING

BATTERY BUILT-IN TEST INDICATOR

USING TEST INDICATOR

The Test Indicator (Fig. 1), (Fig. 2) and (Fig. 3) measures the specific gravity of the electrolyte. Specific Gravity (SG) of the electrolyte will show state-of-charge (voltage). The test indicator WILL NOT show cranking capacity of the battery. Refer to Battery Load Test for more information. Look into the sight glass (Fig. 1), (Fig. 3) and note the color of the indicator. Refer to the following description of colors:

NOTE: GREEN = 75 to 100% state-of-charge

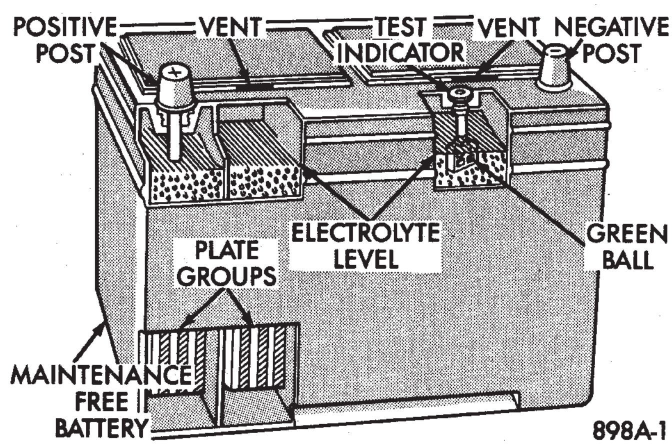

Fig. 2 Battery Construction and Test Indicator

The battery is adequately charged for further testing and may be returned to use. If the vehicle will not crank for a maximum 15 seconds, refer to BATTERY LOAD TEST in this Group for more information.

NOTE: BLACK OR DARK = 0 to 75% state-of-charge

The battery is INADEQUATELY charged and must be charged until green dot is visible, (12.4 volts or greater) before the battery is tested or returned to

DIAGNOSIS AND TESTING (Continued)

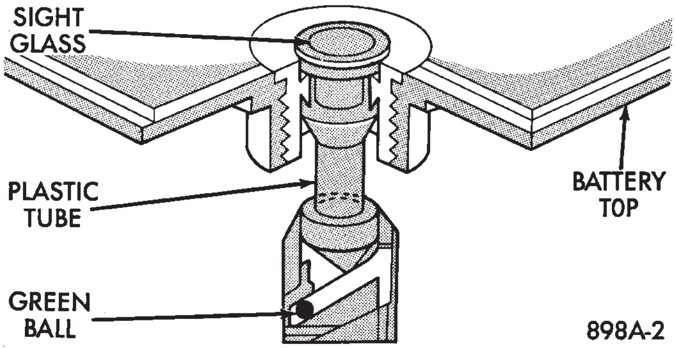

Fig. 3 Test Indicator

use. Refer to Causes of Battery Discharging in this Group for more information.

NOTE: CLEAR COLOR = Replace Battery

WARNING: DO NOT CHARGE, ASSIST BOOST, LOAD TEST, OR ADD WATER TO THE BATTERY WHEN CLEAR COLOR DOT IS VISIBLE. PERSONAL INJURY MAY OCCUR.

A clear color dot shows electrolyte level in battery is below the test indicator (Fig. 1). Water cannot be added to a maintenance free battery. The battery must be replaced. A low electrolyte level may be caused by an over charging condition. Refer to Generator Test Procedures on Vehicle.

CAUSES OF BATTERY DISCHARGING

It is normal to have a small 5 to 25 milliamperes continuous electrical draw from the battery. This draw will take place with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accessories that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period of approximately 20 days the IOD fuse should be pulled. The fuse is located in the power distribution center. Disconnection of this fuse will reduce the level of battery discharge. Refer to Battery Diagnosis and Testing table and to the proper procedures.

ABNORMAL BATTERY DISCHARGING

- Corroded battery posts, cables or terminals.
- Loose or worn generator drive belt.
- Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.
- Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.
- Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Battery Ignition Off Draw (IOD).
- Defective charging system.
- Defective battery.

BATTERY IGNITION OFF DRAW (IOD)

High current draw on the battery with the ignition OFF will discharge a battery. After a dead battery is serviced the vehicle Ignition Off Draw (IOD) should be checked. Determine if a high current draw condition exists first check the vehicle with a test lamp.

(1) Verify that all electrical accessories are OFF.

- Remove key from ignition switch
- Turn off all lights
- Liftgate and glove box door is closed
- Sun visor vanity lights are OFF
- All doors are closed
- Allow the Illuminated Entry System to time out in approximately 30 seconds, if equipped.
- During Transmission Control Module (TCM) power down there will be 500 milliamperes present for 20 minutes. Afterwards less than 1.0 milliampere.

(2) Disconnect battery negative cable (Fig. 4).

CAUTION: Always disconnect the meter before opening a door.

(3) Using an multimeter, that has least a milliampere range of 200 mA. Set meter to the highest mA range. Install meter between the battery negative cable and battery negative post (Fig. 5). Carefully remove the test lamp without disconnecting the meter. After all modules time-out the total vehicle IOD should be less than 25 milliamperes. If ignition off draw is more than 25 milliamperes go to Step 4.

(4) Each time the test lamp or milliampere meter is disconnected and connected, all electronic timer functions will be activated for approximately one minute. The Body Control Module (BCM) ignition off draw can reach 90 milliamperes.

(5) Remove the PDC fuses:

- Interior lamps
- Brake lamp
- IOD

(6) If there is any reading, with fuses removed there is a short circuit in the wiring. Refer to Group 8W, wiring diagrams. If reading is less than 25 mA go to Step 8.

(7) Install all fuses. After installing fuse, the current can reach 90 mA. After time-out the reading should not exceed 25 mA. If OK go to. If not, disconnect:

- Radio
- Body Control Module
- Remote Keyless Entry Module

DIAGNOSIS AND TESTING (Continued)

BATTERY DIAGNOSIS AND TESTING

STEPS	POSSIBLE CAUSE	CORRECTION
VISUAL INSPECTION Check for possible damage to battery and clean battery.	(1) Loose battery post, Cracked battery cover or case, Leaks or Any other physical (2) Battery OK.	(1) Replace Battery (2) Check state of charge. Refer to Test Indicator.
TEST INDICATOR Check Charge Eye Color	(1) GREEN (2) BLACK (3) CLEAR	(1) Battery is charged. Perform Battery 0pen Circuit Voltage Test (2) Perform Battery Charging procedure. (3) Replace Battery.
BATTERY OPEN CIRCUIT VOLTAGE TEST	(1) Battery is above 12.40 Volts (2) Battery is below 12.40 Volts.	(1) Perform the Battery Load Test. (2) Perform Battery Charging procedure.
BATTERY CHARGING	(1) Battery accepted Charge. (2) Battery will not accept charge	(1) Ensure that the indicator eye is GREEN and perform Battery 0pen Circuit Voltage Test (2) Perform Charging a Completely Discharged Battery.
BATTERY LOAD TEST	(1) Acceptable minimum voltage. (2) Unacceptable minimum voltage	(1) Battery is OK to put in use, perform Battery Ignition Off Draw Test. (2) Replace Battery and perform Battery Ignition Off Draw Test.
CHARGING A COMPLETELY DISCHARGED BATTERY	(1) Battery accepted charge. (2) Battery will not accept charge.	(1) Ensure that the indicator eye is GREEN and perform Battery 0pen Circuit Voltage Test. (2) Replace Battery.
IGNITION OFF DRAW TEST	(1) IOD is 5-25 Milliamperes. (2) IOD Exceeds 25 Milliamperes.	(1) Vehicle is normal. (2) Eliminate excess IOD draw.

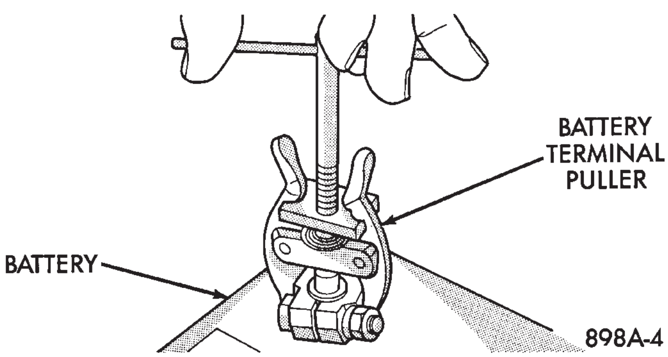

Fig. 4 Disconnect Battery Negative Cable

(8) Disconnect one component at time, to see if any component is at fault. If the high reading is not eliminated there is a short circuit in the wiring. Refer to Group 8W, wiring diagrams.

(9) Remove interior and brake lamp fuses. Install the fuses. The milliampere reading should be 2-4 mA. If reading is higher than 4 mA:

(a) Disconnect PCM.

(b) If reading is OK, replace PCM.

(c) If reading does not change, disconnect the TCM.

(d) If reading is OK, replace TCM.

(e) If reading stays, there is a short circuit to one of the modules. Refer to Group 8W, Wiring Diagrams.

BATTERY LOAD TEST

A fully charged battery must have cranking capacity, to provide the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking capability of the battery.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.

(1) Remove both battery cables, negative cable first. The battery top, cables and posts should be

DIAGNOSIS AND TESTING (Continued)

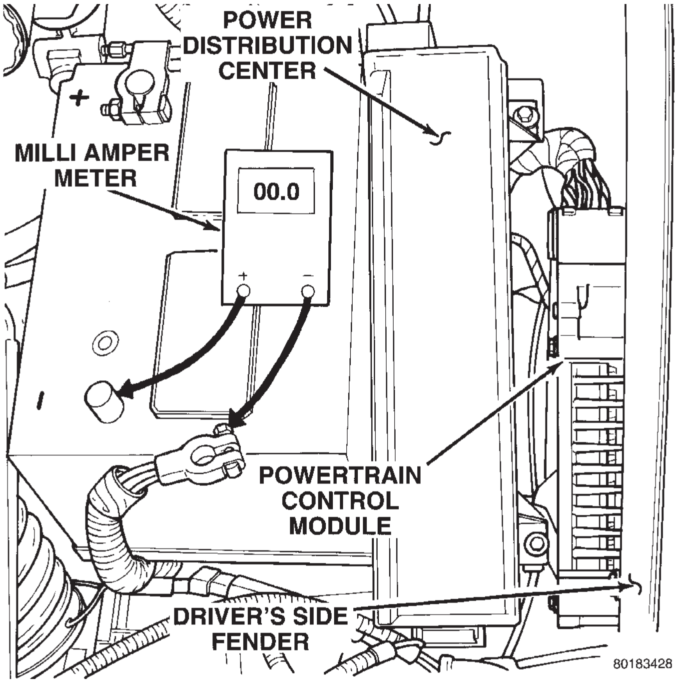

Fig. 5 Milliampere Meter Connection

clean. If green dot is not visible in indicator, charge the battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 6). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 7).

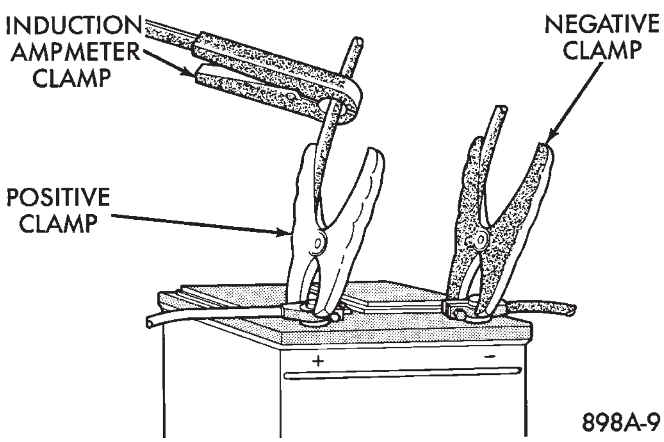

Fig. 6 Volt-Ammeter Load Tester Connections

(3) Allow the battery to stabilize for 2 minutes, and then verify open circuit voltage.

(4) Rotate the load control knob on the tester to maintain 50% of the battery cold crank rating for 15 seconds (Fig. 8). Record the loaded voltage reading and return the load control to off. Refer to the Battery Specifications at the rear of this Group.

(5) Voltage drop will vary according to battery temperature at the time of the load test. Battery

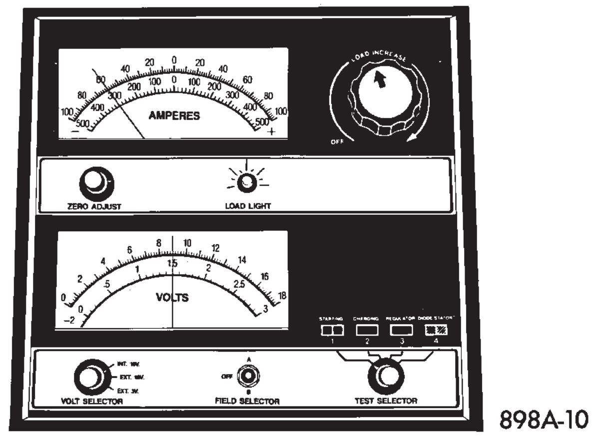

Fig. 7 Remove Surface Charge From Battery

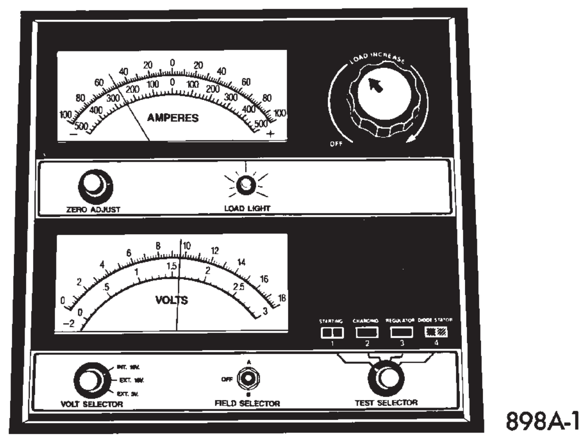

Fig. 8 Load 50% Cold Crank Rating

temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged or boosted a few minutes prior to the test, the battery would be slightly warmer. Refer to Battery Load Test Temperature Table:

BATTERY LOAD TEST TEMPERATURE

Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(6) If battery passes load test, it is in good condition and further tests are not necessary. If it fails load test, it should be replaced.

DIAGNOSIS AND TESTING (Continued)

BATTERY OPEN CIRCUIT VOLTAGE TEST

An open circuit voltage no load test shows the state of charge of a battery and whether it is ready for a load test at 50 percent of the battery's cold crank rating. Refer to Battery Load Test. If a battery has open circuit voltage reading of 12.4 volts or greater, and will not pass the load test, replace the battery because it is defective. To test open circuit voltage, perform the following operation.

(1) Remove both battery cables, negative cable first. Battery top, cables and posts should be clean. If green dot is not visible in indicator, charge the battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 6). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 7).

(3) Allow the battery to stabilize for 2 minutes, and then verify the open circuit voltage (Fig. 9).

(4) This voltage reading will approximate the state of charge of the battery. It will not reveal battery cranking capacity. Refer to Battery Open Circuit Voltage table.

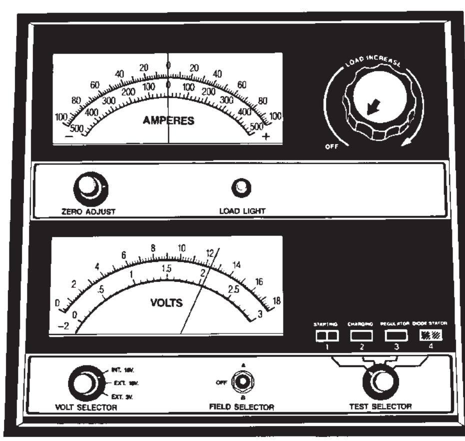

Fig. 9 Testing Open Circuit Voltage

BATTERY OPEN CIRCUIT VOLTAGE

Open Circuit Volts	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%

SERVICE PROCEDURES

BATTERY CHARGING

WARNING: DO NOT CHARGE A BATTERY THAT HAS EXCESSIVELY LOW ELECTROLYTE LEVEL. BATTERY MAY SPARK INTERNALLY AND EXPLODE. EXPLOSIVE GASES FORM OVER THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY. DO NOT ASSIST BOOST OR CHARGE A FROZEN BATTERY. BATTERY CASING MAY FRACTURE. BATTERY ACID IS POISON, AND MAY CAUSE SEVERE BURNS. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN.

CAUTION: Disconnect the battery NEGATIVE cable first. (Fig. 4) before charging battery to avoid damage to electrical systems. Do not exceed 16.0 volts while charging battery. Refer to the instructions supplied with charging equipment

NOTE: The battery cannot be refilled with water, it must be replaced.

A battery is considered fully charged when it will meet all the following requirements.

• It has an open circuit voltage charge of at least 12.4 volts.

• It passes the 15 second load test, refer to the Load Test Temperature chart.

• The built in test indicator dot is GREEN (Fig. 1).

Battery electrolyte will bubble inside of battery case while being charged properly. If the electrolyte boils violently, or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger. Evaluate battery condition. Battery damage may occur if charging is excessive.

Some battery chargers are equipped with polarity sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

CAUTION: Charge battery until test indicator appears green. Do not overcharge.

It may be necessary to jiggle the battery or vehicle to bring the green dot in the test indicator into view.

SERVICE PROCEDURES (Continued)

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. Refer to Battery Load Test in this Group. If the battery passes the load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service.

CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced. Refer to Battery Charging Rate table.

BATTERY CHARGING RATE

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

(1) Measure the voltage at battery posts with a voltmeter accurate to 1/10 volt (Fig. 10). If below 10 volts, charge current will be low, and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on amp meters built into many chargers.

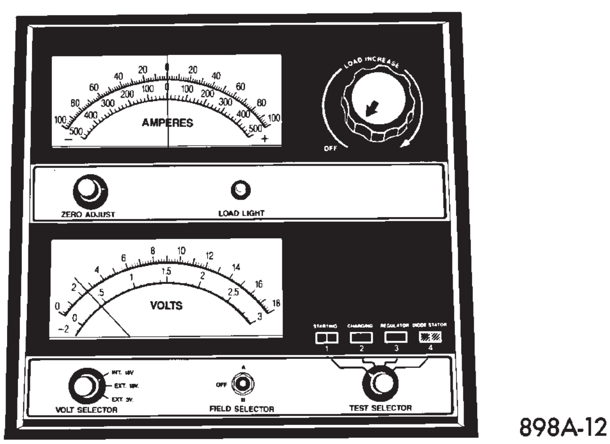

Fig. 10 Voltmeter Accurate to 1/10 Volt (Connected)

(2) Connect charger leads. Some chargers feature polarity protection circuitry that prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry. This may happen even though the leads are connected properly.

(3) Battery chargers vary in the amount of voltage and current they provide. For the time required for the battery to accept measurable charger current at various voltages, refer to Battery Charging Rate table. If charge current is still not measurable after charging times, the battery should be replaced. If charge current is measurable during charging time, the battery may be good, and charging should be completed in the normal manner.

VISUAL INSPECTION

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(1) Clean top of battery with a solution of warm water and baking soda.

(2) Apply soda solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 11).

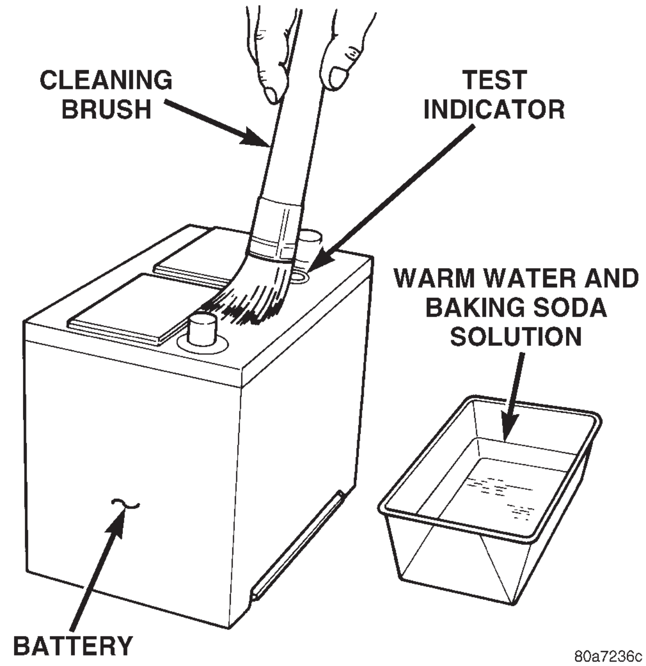

Fig. 11 Cleaning Battery

(3) Rinse soda solution from battery with clear water and blot battery dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.

(4) Inspect battery case and cover for cracks, leakage or damaged hold down ledge. If battery is damaged replace it.

(5) Inspect battery tray for damage caused by acid from battery. If acid is present, clean area with baking soda solution.

(6) Clean battery posts with a battery post cleaning tool (Fig. 12).

(7) Clean battery cable clamps with a battery terminal cleaning tool (Fig. 13). Replace cables that are frayed or have broken clamps.

SERVICE PROCEDURES (Continued)

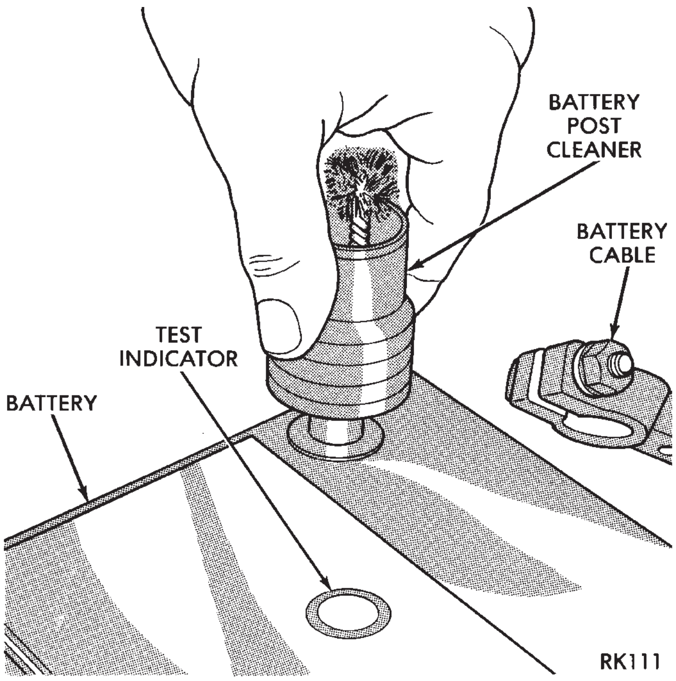

Fig. 12 Cleaning Battery Post

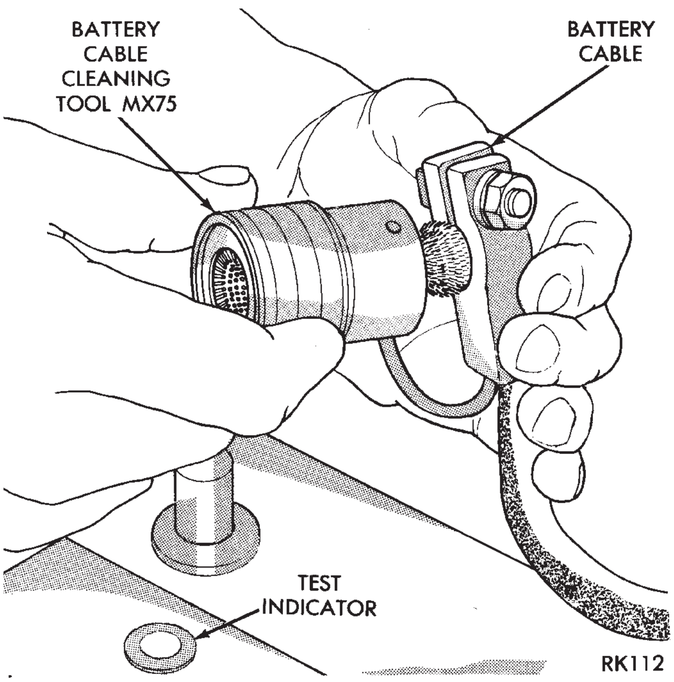

Fig. 13 Cleaning Battery Cable Terminal

REMOVAL AND INSTALLATION

BATTERY

WARNING: TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

REMOVAL

(1) Verify that the ignition switch and all accessories are OFF.

(2) Disconnect battery cable terminals from the battery posts, negative first (Fig. 14).

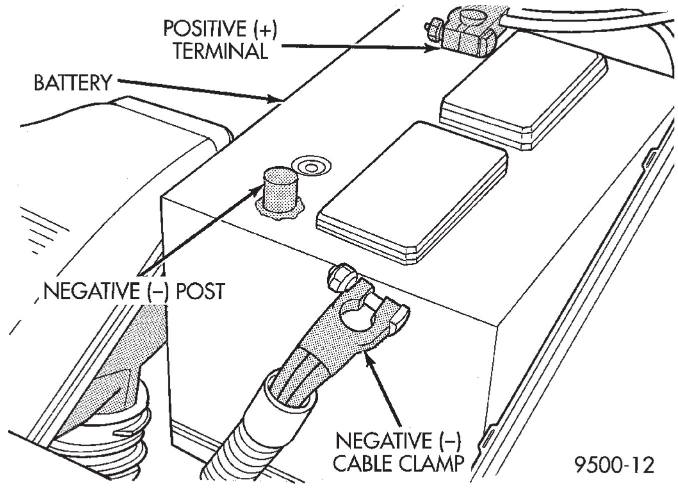

Fig. 14 Battery Cable Disconnected

(3) Remove battery heat shield (Fig. 15).

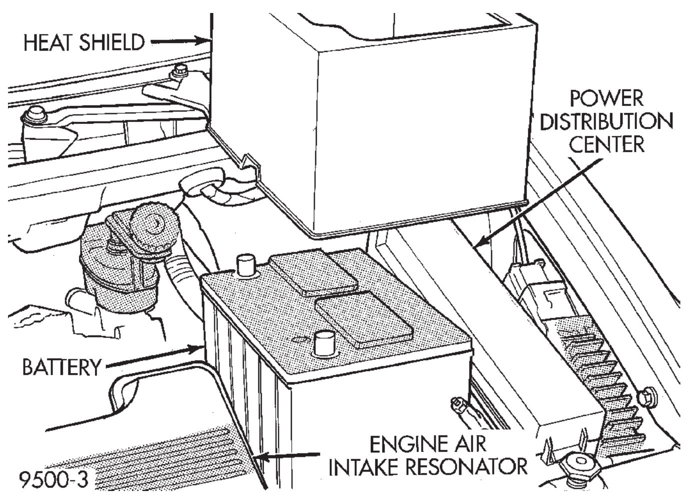

Fig. 15 Battery Heat Shield

(4) Remove battery hold down (Fig. 16).

(5) Remove battery from vehicle (Fig. 17).

INSTALLATION

Inspect and clean battery and attaching components before installation.

(1) Install battery in vehicle making sure that battery is properly positioned on battery tray.

(2) Install battery hold down.

REMOVAL AND INSTALLATION (Continued)

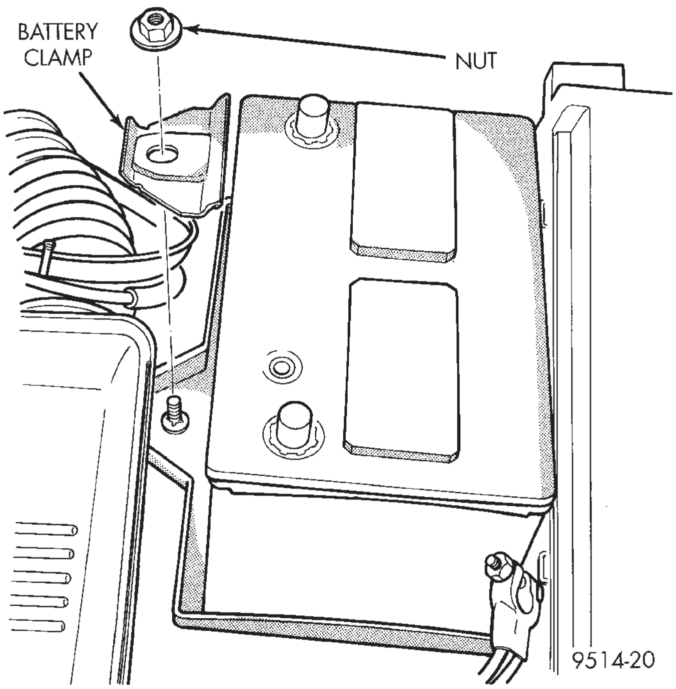

Fig. 16 Battery Hold Down

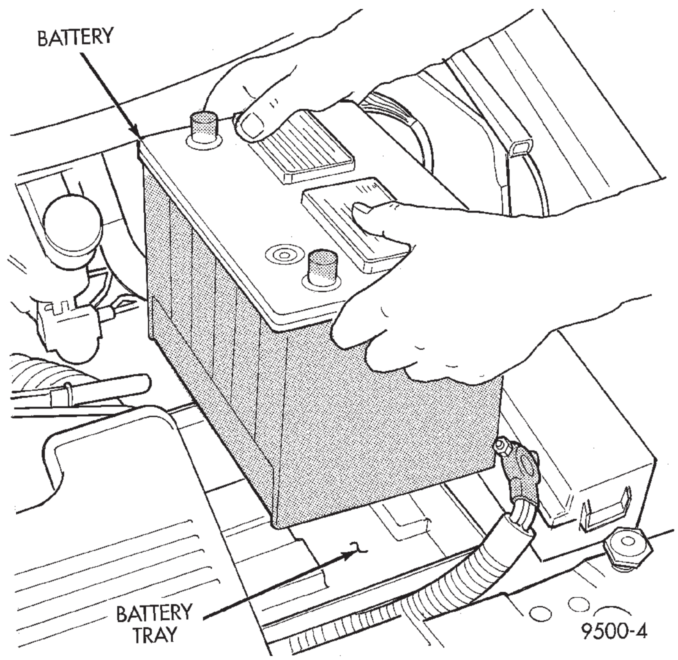

Fig. 17 Remove Battery

(3) Place battery heat shield over battery. The top inside surface of heat shield must be flush with top of battery.

(4) Connect battery cable terminals, positive cable first. Make sure the top of battery terminals are flush with top of posts.

WARNING: DO NOT OVER TIGHTEN BATTERY CABLE CLAMPS, DAMAGE TO CLAMPS CAN RESULT.

(5) Tighten terminal nuts to 8.5 N·m (75 in. lbs.).

BATTERY TRAY

REMOVAL

(1) Remove battery, refer to the above procedures.

(2) Remove nut and two bolts from battery tray (Fig. 18).

(3) Remove battery tray from vehicle.

(4) Remove speed control servo attaching bolt from battery tray (if equipped). Use care when disconnecting vacuum lines from reservoir (Fig. 19).

INSTALLATION

For installation, reverse the above procedures.

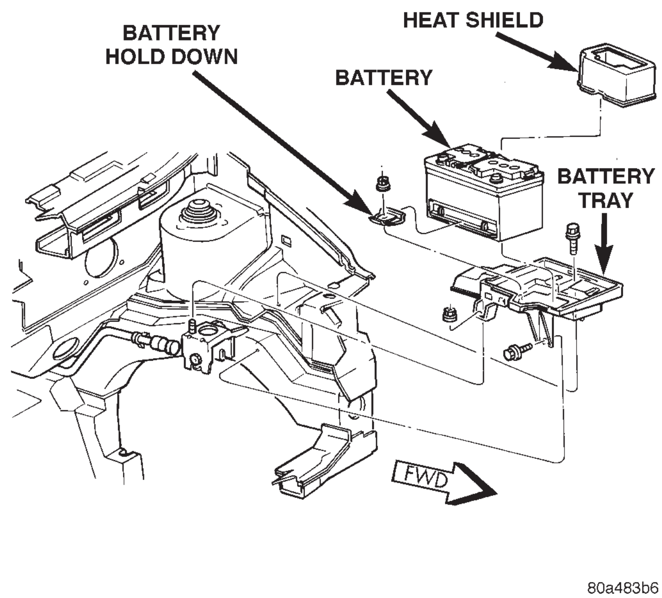

Fig. 18 Battery Tray Removal

REMOVAL AND INSTALLATION (Continued)

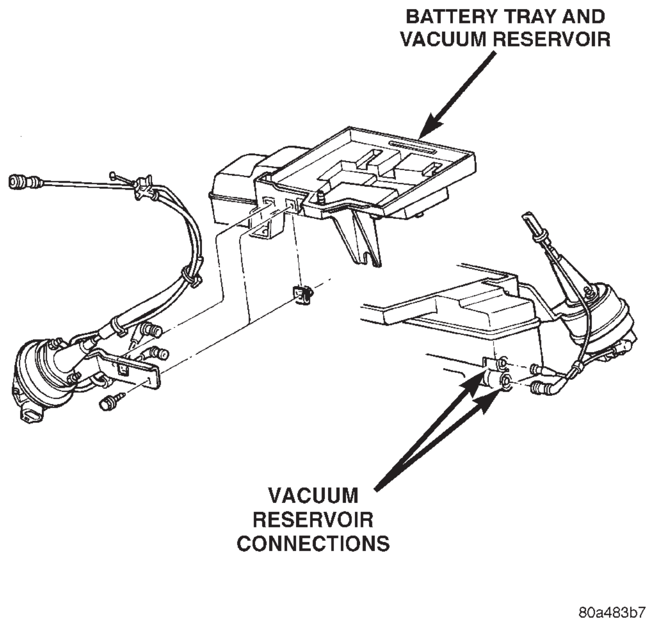

Fig. 19 Speed Control Servo Removal

SPECIFICATIONS

BATTERY SPECIFICATIONS

Load Test (Amps)	Cold Cranking Rating @ 0°F	Reserve Capacity
250 Amp	500 Amp	110 Minutes
300 Amp	600 Amp	120 Minutes
340 Amp	685 Amp	125 Minutes

CRANKING RATING

The current battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

RESERVE CAPACITY RATING

The length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27°C (80°F).

TORQUE

DESCRIPTION	TORQUE
Battery Hold Down Bolt Clamp Bolt	14 N·m (125 in. lbs.)

BATTERY

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GENERAL INFORMATION

INTRODUCTION

The battery stores, stabilizes, and delivers electrical current to operate various electrical systems in the vehicle (Fig. 1). The determination of whether a battery is good or bad is made by its ability to accept a charge. It also must supply high-amperage current for a long enough period to be able to start the vehicle. The capability of the battery to store electrical current comes from a chemical reaction. This reaction takes place between the sulfuric acid solution (electrolyte) and the lead +/- plates in each cell of the battery. As the battery discharges, the plates react with the acid from the electrolyte. When the charging system charges the battery, the water is converted to sulfuric acid in the battery. The concentration of acid in the electrolyte is measured as specific gravity using a hydrometer. The specific gravity indicates the battery's state-of-charge.

The battery is vented to release gases that are created when the battery is being charged and discharged.

The battery top, posts, and terminals should be cleaned when other under hood maintenance is performed.

The battery top, posts, cable clamps must be cleaned and battery must be completely charged before diagnostic procedures are performed.

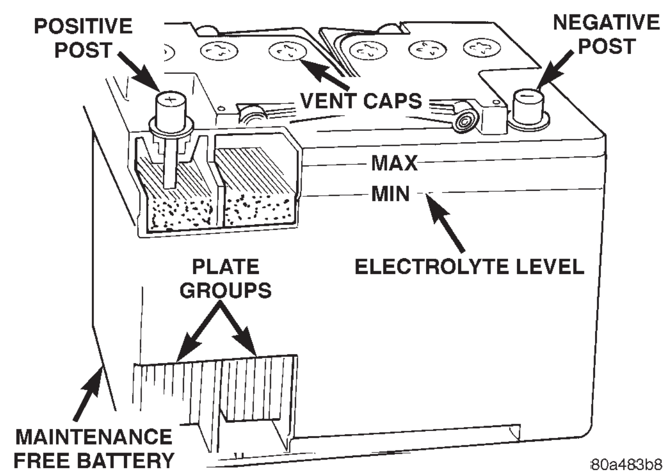

Fig. 1 Battery Construction

SAFETY PRECAUTIONS AND WARNINGS

WARNING:
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 THE DISABLED VEHICLE'S BATTERY TO EXCEED 16 VOLTS. PERSONAL INJURY OR DAMAGE TO ELECTRICAL SYSTEM CAN RESULT.

TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUB-

GENERAL INFORMATION (Continued)

BER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

DESCRIPTION AND OPERATION

BATTERY IGNITION OFF DRAW (IOD)

A completely normal vehicle will have a small amount of current drain on the battery with the key out of the ignition. It can range from 5 to 25 milliamperes after all the modules time out. If a vehicle will not be operated for approximately a 20 days, the IOD fuse should be pulled to eliminate the vehicle electrical drain on the battery. The IOD fuse is located in the Power Distribution Center (PDC). Refer to the PDC cover for proper fuse.

CHARGING TIME REQUIRED

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD -1°C (30°F) BATTERY. PERSONAL INJURY MAY RESULT.

The time required to charge a battery will vary depending upon the following factors.

SIZE OF BATTERY

A completely discharged large heavy-duty battery may require more recharging time than a completely discharged small capacity battery, refer to (Fig. 2) for charging times.

CHARGING AMPERAGE	5 AMPS	10 AMPS	15 AMPS	20 AMPS
OPEN CIRCUIT VOLTAGE	HOUR CHARGING AT 21°C (77°F)			
12.34 TO 12.52	4.6 HRS.	2.3 HRS.	1.5 HRS.	1.1 HRS.
12.16 TO 12.33	6.9 HRS.	3.4 HRS.	2.3 HRS.	1.8 HRS.
11.97 TO 12.15	9.2 HRS.	4.6 HRS.	3.0 HRS.	2.3 HRS.
10.00 TO 11.96	11.5 HRS.	5.8 HRS.	3.8 HRS.	2.9 HRS.
10.00 TO 0	SEE CHARGING COMPLETELY DISCHARGE BATTERY			

948A-48

Fig. 2 Battery Charging Time

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 charger is connected to a cold battery, current accepted by battery will be very low at first. In time, the battery will accept a higher rate as battery temperature warms.

CHARGER CAPACITY

A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 20 amperes or more.

STATE OF CHARGE

A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current amperage will be low. As water is converted back to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise. The electrolyte should be tested with a Hydrometer to check the specific gravity.

USING HYDROMETER

Before performing a hydrometer test, remove the battery caps and check the electrolyte level. Add distilled water as required.

NOTE: Periodically disassemble the hydrometer and wash components with soap and water. Inspect the float for possible leaks. If the paper inside has turned brown, the float is defective.

Before testing, visually inspect the battery for any damage:

- Cracked container or cover
- Loose post
- Corrosion

and any other thing that would cause the battery to be unserviceable. To interpret the hydrometer correctly, hold it with the top surface of the electrolyte in the hydrometer at eye level.

Disregard the curvature of the liquid where the surface rises against the float because of surface cohesion (Fig. 3). Remove only enough electrolyte from the battery to keep the float off the bottom of the hydrometer barrel with pressure on the bulb released. Keep the hydrometer in a vertical position while drawing the electrolyte into the hydrometer and observing the specific gravity. Exercise care when inserting the tip of the hydrometer into a cell to avoid damage to the separators. Damaged separators can cause premature battery failure.

Hydrometer floats are generally calibrated to indicate the specific gravity correctly only at one fixed temperature, 20°C (68°F). When testing the specific gravity at any other temperature, a correction factor is required, otherwise specific gravity readings will not indicate the true state of charge.

The correction factor is approximately a specific gravity value of 0.004, referred to as 4 points of specific gravity for every 5.5°C (10°F). If electrolyte temperature is below 20°C (68°F) you subtract. If the temperature is above 20°C (68°F) you add to the

DESCRIPTION AND OPERATION (Continued)

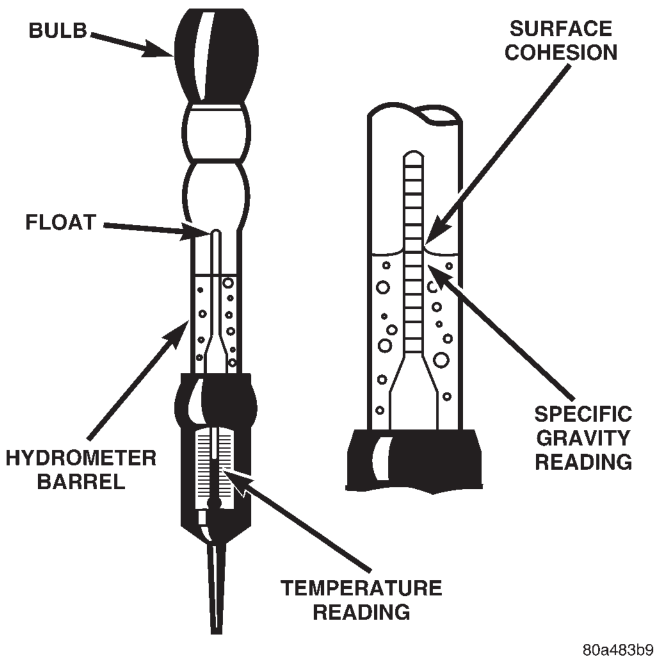

Fig. 3 Battery Hydrometer

hydrometer reading. Always correct the specific gravity for temperature variation. Test the specific gravity of the electrolyte in each battery cell. Refer to the information with the Hydrometer.

Example 1:

- Hydrometer reading: 1.260
- Electrolyte temperature: -7°C (20°F)
- Subtract specific gravity: -0.019
- Correction specific gravity: 1.241

Example 2:

- Hydrometer reading: 1.225
- Electrolyte temperature: -38°C (100°F)
- Add specific gravity: +0.013
- Correction specific gravity: 1.238

A fully charged relatively new battery has a specific gravity reading of 1.285 plus 0.015 or minus 0.010.

If the specific gravity of all cells is above 1.235, but variation between cells is more than 50 points (0.050), it is an indication that the battery is unserviceable.

If the specific gravity of one or more cells is less than 1.235, recharge the battery at a rate of approximately 5 amperes. Continue charging until three consecutive specific gravity tests, taken at one-hour intervals, are constant.

If the cell specific gravity variation is more than 50 points (0.050) at the end of the charge period, replace the battery.

When the specific gravity of all cells is above 1.235 and variation between cells is less than 50 points (0.050), the battery may be tested under heavy load.

DIAGNOSIS AND TESTING

BATTERY DISCHARGING

CAUSE OF BATTERY DISCHARGING

It is normal to have a small 5 to 25 milliamperes continuous electrical draw from the battery. This draw will take place with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accessories that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period of approximately 20 days the IOD fuse should be disconnected. The fuse is located in the power distribution center. Disconnection of this fuse will reduce the level of battery discharge. Refer to Battery Diagnosis and Testing Chart and to the proper procedures.

ABNORMAL BATTERY DISCHARGING

- Corroded battery posts, cables or terminals.
- Loose or worn generator drive belt.
- Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.
- Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.
- Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Battery Ignition Off Draw (IOD).
- Defective charging system.
- Defective battery.

BATTERY IGNITION OFF DRAW

High current draw on the battery with the ignition OFF will discharge a battery. After a dead battery is serviced the vehicle Ignition Off Draw (IOD) should be checked. Determine if a high current draw condition exists first check the vehicle with a test lamp.

(1) Verify that all electrical accessories are OFF.

- Remove key from ignition switch
- Turn off all lights
- Liftgate and glove box door is closed
- Sun visor vanity lights are OFF
- All doors are closed
- Allow the Illuminated Entry System to time out in approximately 30 seconds, if equipped.

(2) Disconnect battery negative cable (Fig. 4).

DIAGNOSIS AND TESTING (Continued)

BATTERY DIAGNOSIS AND TESTING		
STEPS	**POSSIBLE CAUSE**	**CORRECTION**
VISUAL INSPECTION Check for possible damage to battery and clean battery.	(1) Corroded post(s) or terminal(s) (2) Loose terminal(s) (3) Loose battery post, Cracked battery cover or case, Leaks or Any other physical (4) Battery OK.	(1) Clean post(s) or terminal(s) (2) Clean and tighten (3) Replace Battery (4) Check state of charge. Refer to Hydrometer Test
PERFORM BATTERY HYDROMETER TEST	(1) 1.285 (2) 1.235 (3) 1.175 or a variation between cells of 0.050 or greater	(1) Battery is charged. Perform Battery 0pen Circuit Voltage Test (2) Perform Battery Charging procedure. (3) Replace Battery.
BATTERY OPEN CIRCUIT VOLTAGE TEST	(1) Battery is above 12.40 Volts (2) Battery is below 12.40 Volts.	(1) Perform the Battery Load Test. (2) Perform Battery Charging procedure.
BATTERY CHARGING	(1) Battery accepted Charge. (2) Battery will not accept charge	(1) Pass Hydrometer Test and perform Battery 0pen Circuit Voltage Test (2) Perform Charging a Completely Discharged Battery.
BATTERY LOAD TEST	(1) Acceptable minimum voltage. (2) Unacceptable minimum voltage	(1) Battery is OK to put in use, perform Battery Ignition Off Draw Test. (2) Replace Battery and perform Battery Ignition Off Draw Test.
CHARGING A COMPLETELY DISCHARGED BATTERY	(1) Battery accepted charge. (2) Battery will not accept charge.	(1) Pass Hyrometer Test and perform Battery 0pen Circuit Voltage Test. (2) Replace Battery.
IGNITION OFF DRAW TEST	(1) IOD is 5-25 Milliamperes. (2) IOD Exceeds 25 Milliamperes.	(1) Vehicle is normal. (2) Eliminate excess IOD draw.

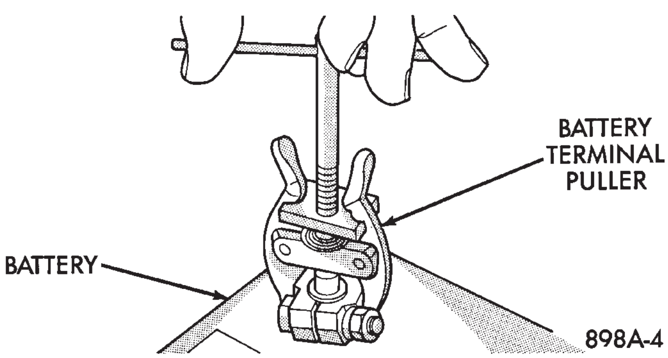

Fig. 4 Disconnect Battery Negative Cable

CAUTION: Always disconnect the meter before opening a door.

(3) Using an multimeter, that has least a milliampere range of 200 mA. Set meter to the highest mA range. Install meter between the battery negative cable and battery negative post (Fig. 5). Carefully remove the test lamp without disconnecting the meter. After all modules time-out the total vehicle IOD should be less than 25 milliamperes. If ignition off draw is more than 25 milliamperes go to Step 4.

(4) Each time the test lamp or milliampere meter is disconnected and connected, all electronic timer functions will be activated for approximately one minute. The Body Control Module (BCM) ignition off draw can reach 90 milliamperes.

(5) Remove the PDC fuses:

- Interior lamps
- Brake lamp
- IOD

(6) If there is any reading, with fuses removed there is a short circuit in the wiring. Refer to Group 8W, wiring diagrams. If reading is less than 25 mA go to Step 8.

(7) Install all fuses. After installing fuse, the current can reach 90 mA. After time-out the reading should not exceed 25 mA. If OK go to. If not, disconnect:

- Radio

DIAGNOSIS AND TESTING (Continued)

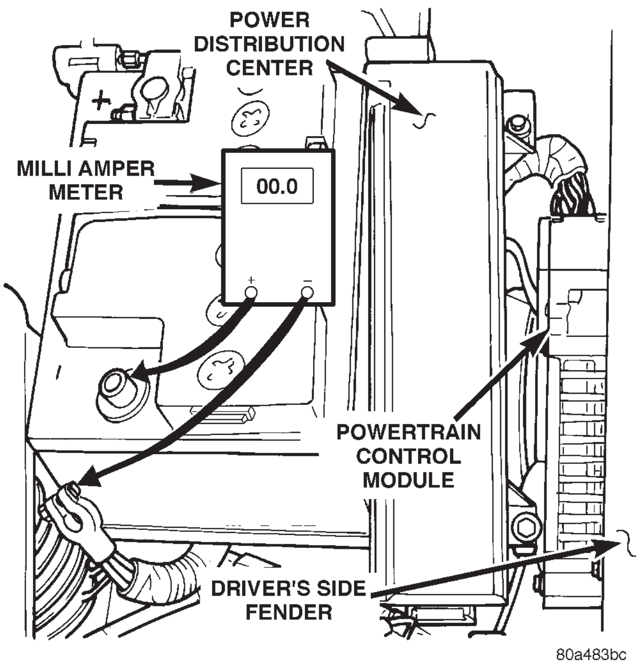

Fig. 5 Milliampere Meter Connection

- Body Control Module
- Remote Keyless Entry Module

(8) Disconnect one component at time, to see if any component is at fault. If the high reading is not eliminated there is a short circuit in the wiring. Refer to Group 8W, wiring diagrams.

(9) Remove interior and brake lamp fuses. Install the fuses. The milliampere reading should be 2-4 mA. If reading is higher than 4 mA:

(a) Disconnect PCM.

(b) If reading is OK, replace PCM.

(c) If reading does not change there is a short circuit to the PCM. Refer to Group 8W, Wiring Diagrams.

BATTERY LOAD TEST

A fully charged battery must have cranking capacity, to provide the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking capability of the battery.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.

(1) Remove both battery cables, negative cable first. The battery top, cables and posts should be clean. Test battery with a hydrometer. If battery charge is low the charge battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 6). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 7).

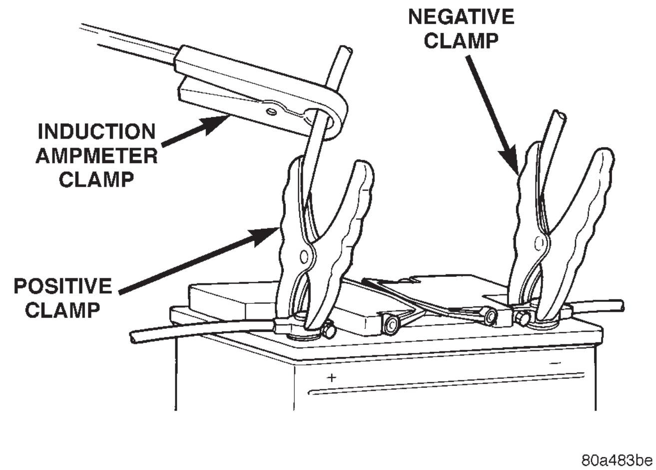

Fig. 6 Volt-Ammeter Load Tester Connections

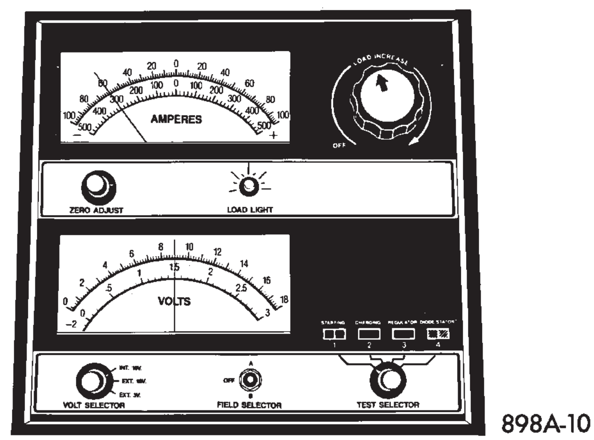

Fig. 7 Remove Surface Charge From Battery

(3) Allow the battery to stabilize for 2 minutes, and then verify open circuit voltage.

(4) Rotate the load control knob on the tester to maintain 50% of the battery cold crank rating for 15 seconds (Fig. 8). Record the loaded voltage reading and return the load control to off. Refer to the Battery Specifications at the rear of this Group.

(5) Voltage drop will vary according to battery temperature at the time of the load test. Battery temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged or boosted a few minutes prior to the test, the battery would be slightly warmer. Refer to Load Test Voltage Chart for proper loaded voltage reading.

DIAGNOSIS AND TESTING (Continued)

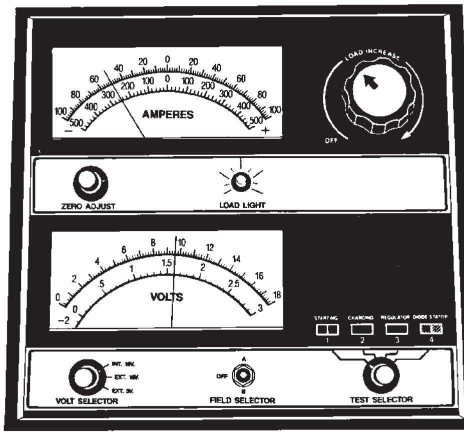

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Fig. 8 Load 50% Cold Crank Rating

Load Test Temperature		
Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(6) If battery passes load test, it is in good condition and further tests are not necessary. If it fails load test, it should be replaced.

BATTERY OPEN CIRCUIT VOLTAGE TEST

An open circuit voltage no load test shows the state of charge of a battery and whether it is ready for a load test at 50 percent of the battery's cold crank rating. Refer to Battery Load Test. If a battery has open circuit voltage reading of 12.4 volts or greater, and will not pass the load test, replace the battery because it is defective. To test open circuit voltage, perform the following operation.

(1) Remove both battery cables, negative cable first. Battery top, cables and posts should be clean. If green dot is not visible in indicator, charge the battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 6). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 7).

(3) Allow the battery to stabilize for 2 minutes, and then verify the open circuit voltage (Fig. 9).

(4) This voltage reading will approximate the state of charge of the battery. It will not reveal battery cranking capacity (Fig. 10).

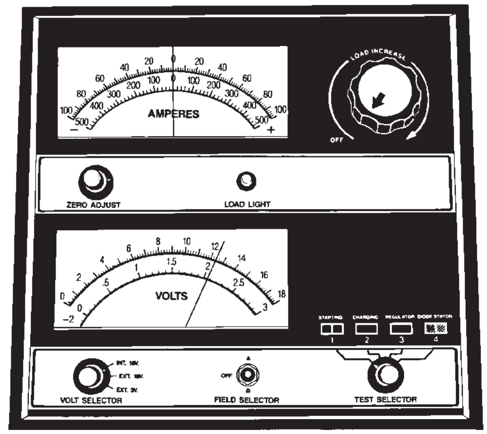

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Fig. 9 Testing Open Circuit Voltage

Open Circuit Volts	Percent Charge
11.7 volts or less	0%
12.0	25%
12.2	50%
12.4	75%
12.6 or more	100%

928A-3

Fig. 10 Battery Open Circuit Voltage

SERVICE PROCEDURES

BATTERY CHARGING

WARNING: DO NOT CHARGE A BATTERY THAT HAS EXCESSIVELY LOW ELECTROLYTE LEVEL. BATTERY MAY SPARK INTERNALLY AND EXPLODE. EXPLOSIVE GASES FORM OVER THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY. DO NOT ASSIST BOOST OR CHARGE A FROZEN BATTERY. BATTERY CASING MAY FRACTURE. BATTERY ACID IS POISON, AND MAY CAUSE SEVERE BURNS. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN.

SERVICE PROCEDURES (Continued)

CAUTION: Disconnect the battery NEGATIVE cable first (Fig. 4) before charging battery to avoid damage to electrical systems. Do not exceed 16.0 volts while charging battery. Refer to the instructions supplied with charging equipment

A battery is considered fully charged when it will meet all the following requirements.

• It has an open circuit voltage charge of at least 12.4 volts (Fig. 10).

• It passes the 15 second load test, refer to the Load Test Temperature chart.

• The specific gravity reading is 1.285 plus 0.015 or minus 0.010.

Battery electrolyte will bubble inside of battery case while being charged properly. If the electrolyte boils violently, or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger. Evaluate battery condition. Battery damage may occur if charging is excessive.

Some battery chargers are equipped with polarity sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

CAUTION: Do not overcharge Battery.

Test the battery until the specific gravity reading is 1.285 plus 0.015 or minus 0.010.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. Refer to Battery Load Test in this Group. If the battery passes the load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service.

CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced (Fig. 11).

(1) Measure the voltage at battery posts with a voltmeter accurate to 1/10 volt (Fig. 12). If below 10 volts, charge current will be low, and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on amp meters built into many chargers.

(2) Connect charger leads. Some chargers feature polarity protection circuitry that prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry. This may happen even though the leads are connected properly.

(3) Battery chargers vary in the amount of voltage and current they provide. For the time required for the battery to accept measurable charger current at various voltages, refer to (Fig. 11). If charge current is still not measurable after charging times, the battery should be replaced. If charge current is measurable during charging time, the battery may be good, and charging should be completed in the normal manner.

Voltage	Hours
16.0 volts or more	up to 4 hrs.
14.0 to 15.9 volts	up to 8 hrs.
13.9 volts or less	up to 16 hrs.

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Fig. 11 Charging Rate

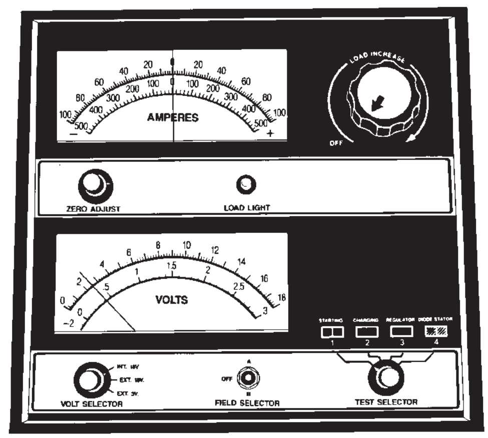

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Fig. 12 Voltmeter Accurate to 1/10 Volt (Connected)

VISUAL INSPECTION

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(1) Clean top of battery with a solution of warm water and baking soda.

(2) Apply soda solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 13).

(3) Rinse soda solution from battery with clear water and blot battery dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.

(4) Inspect battery case and cover for cracks, leakage or damaged hold down ledge. If battery is damaged replace it.

SERVICE PROCEDURES (Continued)

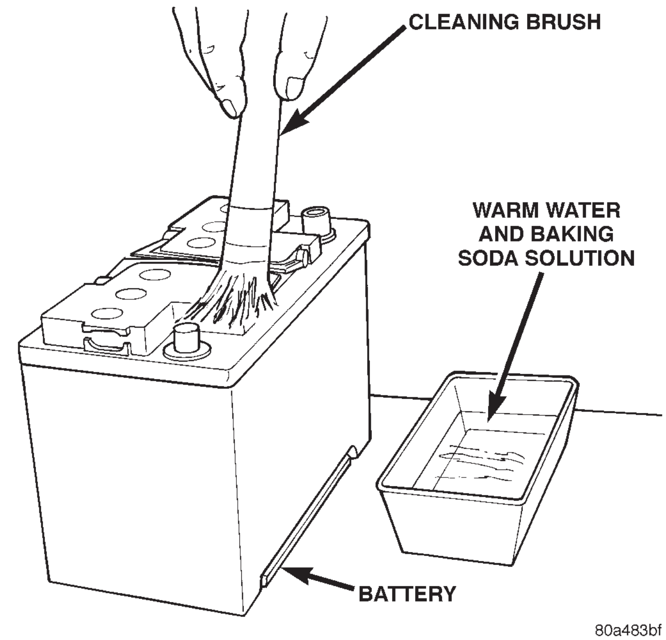

Fig. 13 Cleaning Battery

(5) Inspect battery tray for damage caused by acid from battery. If acid is present, clean area with baking soda solution.

(6) Clean battery posts with a battery post cleaning tool (Fig. 14).

(7) Clean battery cable clamps with a battery terminal cleaning tool (Fig. 15). Replace cables that are frayed or have broken clamps.

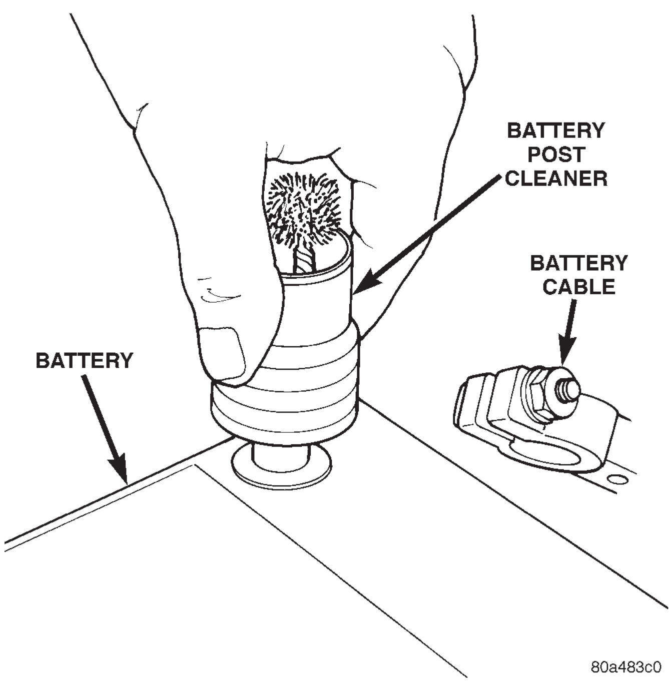

Fig. 14 Cleaning Battery Post

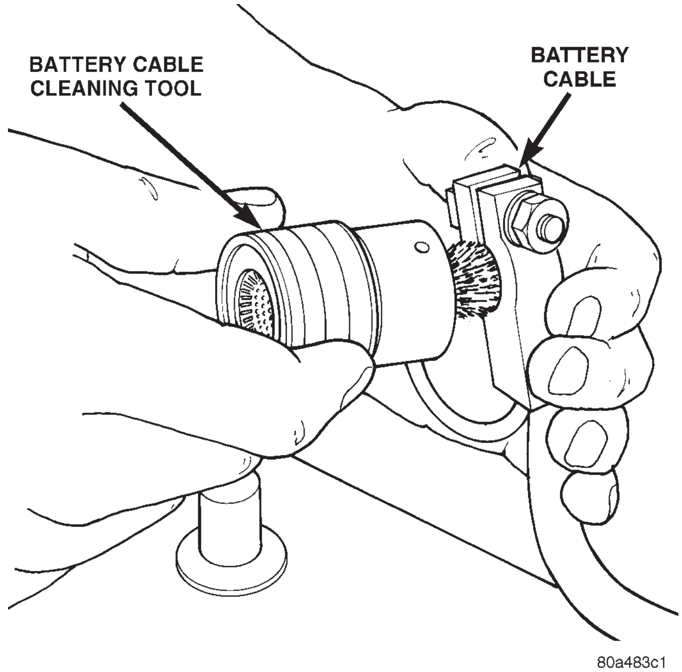

Fig. 15 Cleaning Battery Cable Terminal

REMOVAL AND INSTALLATION

BATTERY

WARNING: TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

REMOVAL

(1) Verify that the ignition switch and all accessories are OFF.

(2) Disconnect battery cable terminals from the battery posts, negative first (Fig. 16).

3

(3) Remove battery hold down (Fig. 17).

(4) Remove battery from vehicle (Fig. 18).

INSTALLATION

Inspect and clean battery and attaching components before installation.

(1) Install battery in vehicle making sure that battery is properly positioned on battery tray.

(2) Install battery hold down.

(3) Connect battery cable terminals, positive cable first. Make sure the top of battery terminals are flush with top of posts.

WARNING: DO NOT OVER TIGHTEN BATTERY CABLE CLAMPS, DAMAGE TO CLAMPS CAN RESULT.

REMOVAL AND INSTALLATION (Continued)

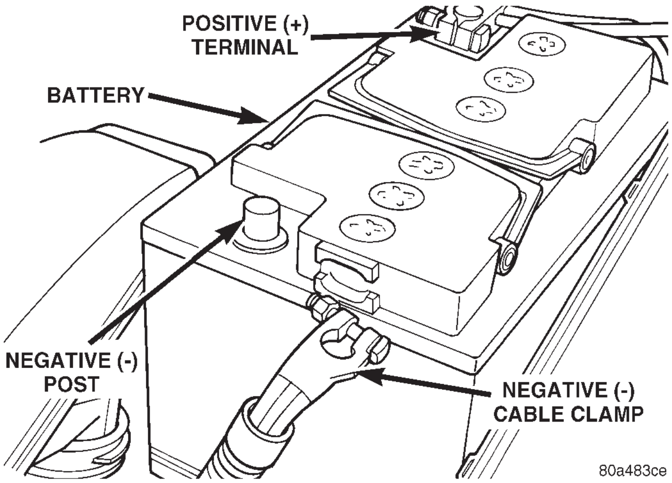

Fig. 16 Battery Cable Disconnected

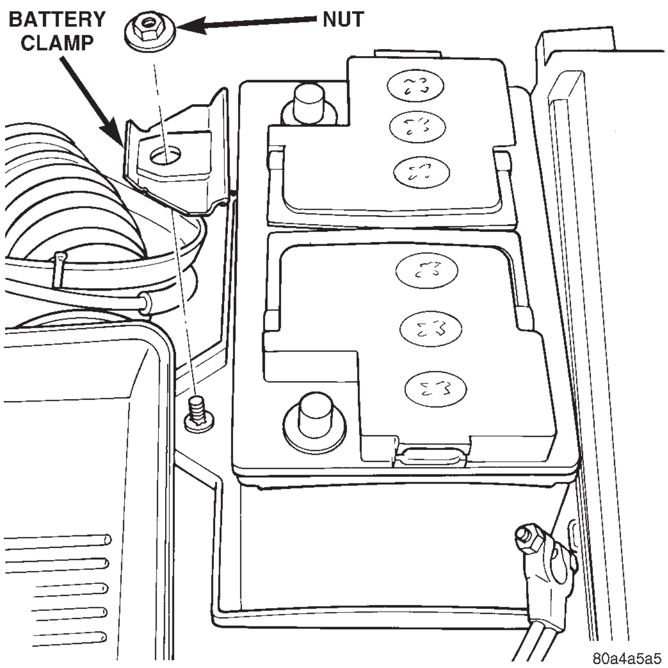

Fig. 17 Battery Hold Down

(4) Tighten terminal nuts to 8.5 N·m (75 in. lbs.).

BATTERY TRAY

REMOVAL

(1) Remove battery, refer to the above procedures.

(2) Remove nut and two bolts from battery tray (Fig. 19).

(3) Remove battery tray from vehicle.

(4) Remove speed control servo attaching bolt from battery tray (if equipped). Use care when disconnecting vacuum lines from reservoir (Fig. 20).

INSTALLATION

For installation, reverse the above procedures.

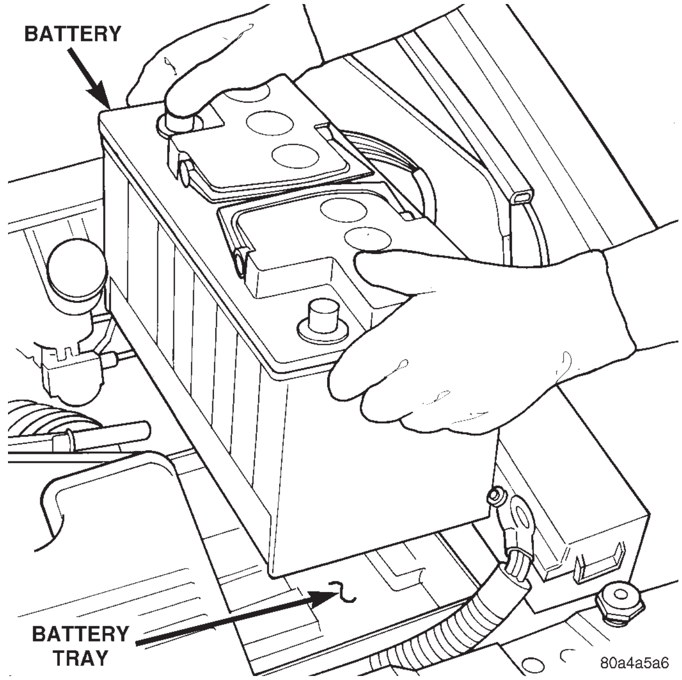

Fig. 18 Remove Battery

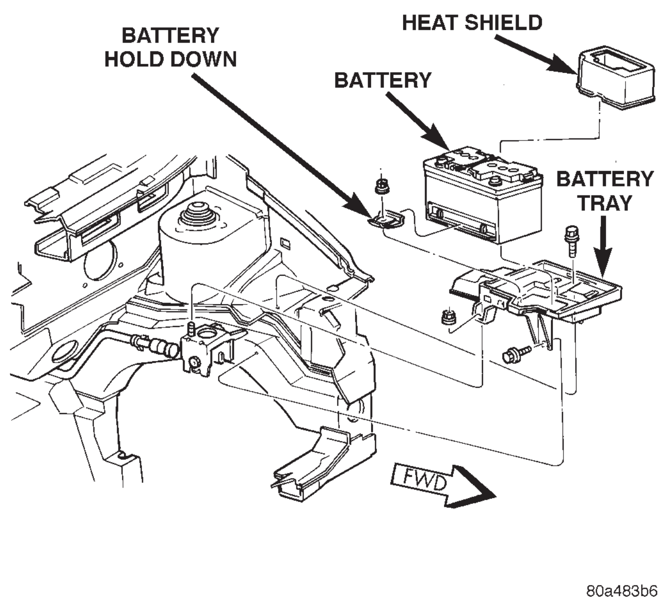

Fig. 19 Battery Tray Removal

SPECIFICATIONS

BATTERY SPECIFICATIONS

CRANKING RATING

The current battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

SPECIFICATIONS (Continued)

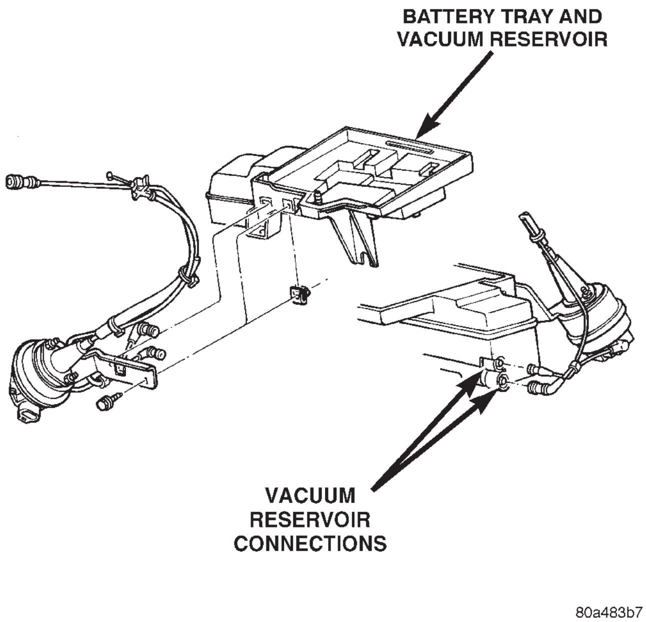

Fig. 20 Speed Control Servo Removal

Reserve (Amps)	Cold Cranking Rating @ -17.8C (0.0F) DIN/BCI	Reserve Capacity
200 Amp	500 Amp	110 Minutes
250 Amp	600 Amp	120 Minutes
315 Amp	685 Amp	125 Minutes

TORQUE

DESCRIPTION	TORQUE
Battery Hold Down Bolt Clamp Bolt	14 N·m (125 in. lbs.)

STARTER

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DIAGNOSIS AND TESTING		**SPECIFICATIONS**	
CONTROL CIRCUIT TEST	1	STARTER	7
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FEED CIRCUIT TEST	4		

GENERAL INFORMATION

INTRODUCTION

The starting system has (Fig. 1):

- Ignition switch
- Starter relay
- Powertrain Control Module (PCM) double start override
- Neutral starting and back up switch with automatic transmissions only
- Wiring harness
- Battery
- Starter motor with an integral solenoid
- Positive Temperature Coefficient (PTC) is the circuit protection for the ignition feed to the starter relay coil. The PTC is located in the Junction Block.

These components form two separate circuits. A high amperage circuit that feeds the starter motor up to 300+ amps, and a control circuit that operates on less than 20 amps.

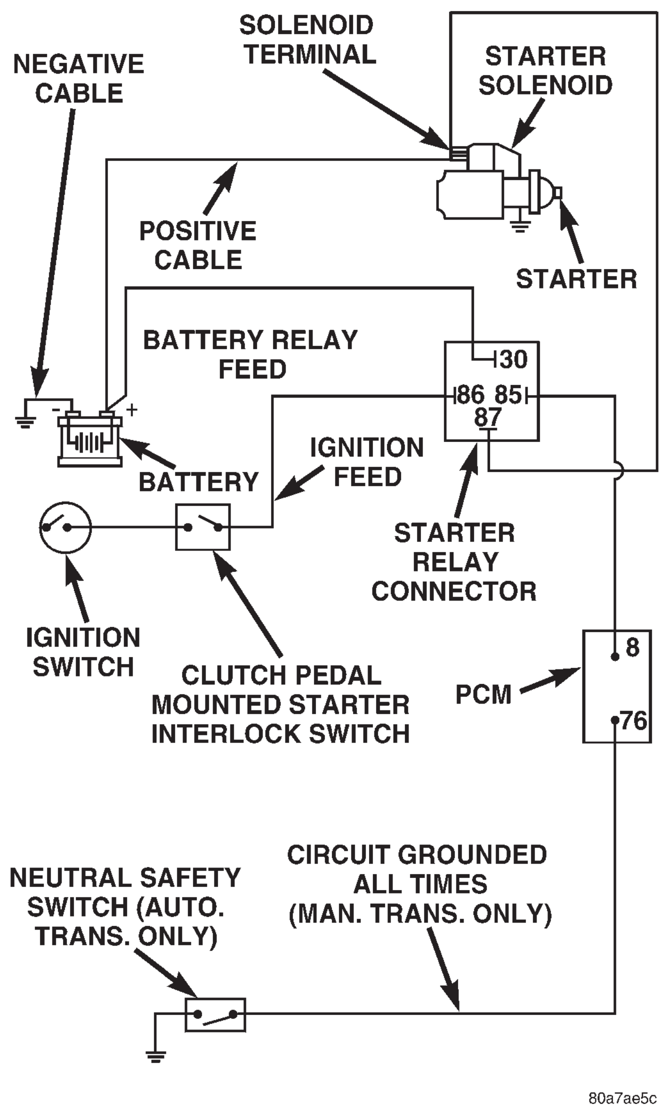


Fig. 1 Starting System Components

DESCRIPTION AND OPERATION

SUPPLY CIRCUIT AND CONTROL CIRCUIT

The starter system consists of two separate circuits:

- A high amperage supply to feed the starter motor.
- A low amperage circuit to control the starter solenoid.

DIAGNOSIS AND TESTING

CONTROL CIRCUIT TEST

The starter control circuit has:

- Starter solenoid
- Starter relay

DIAGNOSIS AND TESTING (Continued)

• Transmission range sensor, or Park/Neutral Position switch with automatic transmissions
• Clutch Pedal Position Switch with manual transmissions
• Ignition switch
• Battery
• All related wiring and connections

CAUTION: Before performing any starter tests, the ignition and fuel systems must be disabled.

• To disable ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the in the Power Distribution Center (PDC). Refer to the PDC cover for the proper relay location.

STARTER SOLENOID

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION WITH THE PARKING BRAKE APPLIED

(1) Verify battery condition. Battery must be in good condition with a full charge before performing any starter tests. Refer to Battery Tests.
(2) Perform Starter Solenoid test BEFORE performing the starter relay test.
(3) Raise the vehicle.
(4) Perform a visual inspection of the starter/starter solenoid for corrosion, loose connections or faulty wiring.
(5) Lower the vehicle.
(6) Locate and remove the starter relay from the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location.
(7) Connect a remote starter switch or a jumper wire between the remote battery positive post and terminal 87 of the starter relay connector.
(a) If engine cranks, starter/starter solenoid is good. Go to the Starter Relay Test.
(b) If engine does not or solenoid chatters, check wiring and connectors from starter relay to starter solenoid for loose or corroded connections. Particularly at starter terminals.
(c) Repeat test. If engine still fails to crank properly, trouble is within starter or starter mounted solenoid, and replace starter.

STARTER RELAY

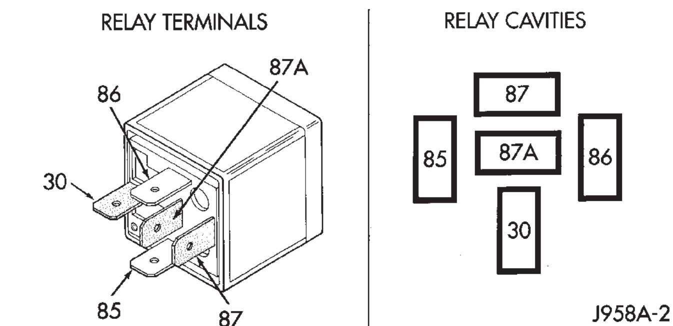
WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION/NEUTRAL WITH THE PARKING BRAKE APPLIED

RELAY TEST

The starter relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

Remove the starter relay from the PDC as described in this group to perform the following tests:

(1) 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 2. If not OK, replace the faulty relay.
(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ±5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.
(3) Connect a battery B+ lead to terminals 86 and a ground lead to terminal 85 to energize the relay. The relay should click. Also test for continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to Relay Circuit Test procedure. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Starter Relay

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 the open circuit to the 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 starter solenoid field coils. There should be continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open circuit to the starter solenoid as required.
(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. On

DIAGNOSIS AND TESTING (Continued)

vehicles with a manual transmission, the clutch pedal must be fully depressed for this test. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If not OK with an automatic transmission, check for an open or short circuit to the ignition switch and repair, if required. If the circuit to the ignition switch is OK, see the Ignition Switch Test procedure in this group. If not OK with a manual transmission, check the circuit between the relay and the clutch pedal position switch for an open or a short. If the circuit is OK, see the Clutch Pedal Position Switch Test procedure in this group.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. On vehicles with an automatic transmission, it is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. On vehicles with a manual transmission, it is grounded at all times. Check for continuity to ground at the cavity for relay terminal 85. If not OK with an automatic transmission, check for an open or short circuit to the park/neutral position switch and repair, if required. If the circuit is OK, see the Park/Neutral Position Switch Test procedure in this group. If not OK with a manual transmission, repair the circuit to ground as required.

SAFETY SWITCHES

For diagnostics,

- Clutch Pedal Position Switch, refer to Group 6, Clutch.
- Park/Neutral Position Switch, refer to Group 21, Transaxle

IGNITION SWITCH

After testing starter solenoid and relay, test ignition switch and wiring. Refer to Group 8D, Ignition Systems or Group 8W, Wiring Diagrams. Check all wiring for opens or shorts, and all connectors for being loose or corroded.

BATTERY

Refer to Group 8A, Battery for proper procedures.

ALL RELATED WIRING AND CONNECTORS

Refer to Group 8W, Wiring Diagrams,

FEED CIRCUIT RESISTANCE TEST

Before proceeding with this operation, review Diagnostic Preparation and Starter Feed Circuit Tests. The following operation will require a voltmeter, accurate to 1/10 of a volt.

CAUTION: Before performing any starter tests, the ignition and fuel systems must be disabled.

(1) To disable the ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for proper relay location.

(2) With all wiring harnesses and components properly connected, perform the following:

(a) Connect the negative lead of the voltmeter to the battery negative post, and positive lead to the battery negative cable clamp (Fig. 2). Rotate and hold the ignition switch in the START position. Observe the voltmeter. If voltage is detected, correct poor contact between cable clamp and post.

(b) Connect positive lead of the voltmeter to the battery positive post, and negative lead to the battery positive cable clamp. Rotate and hold the ignition switch key in the START position. Observe the voltmeter. If voltage is detected, correct poor contact between the cable clamp and post.

(c) Connect negative lead of voltmeter to battery negative terminal, and positive lead to engine

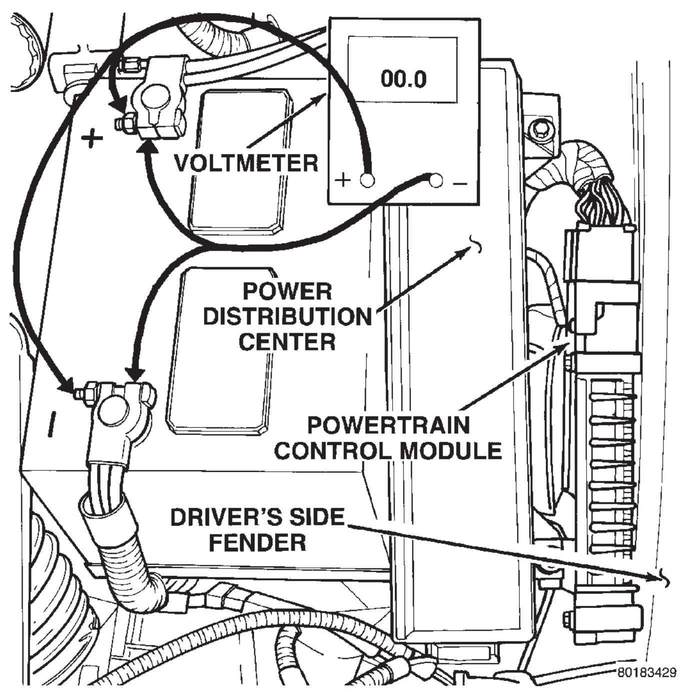


Fig. 2 Test Battery Connection Resistance

DIAGNOSIS AND TESTING (Continued)

block near the battery cable attaching point (Fig. 3). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, correct poor contact at ground cable attaching point. If voltage reading is still above 0.2 volt after correcting poor contacts, replace ground cable.

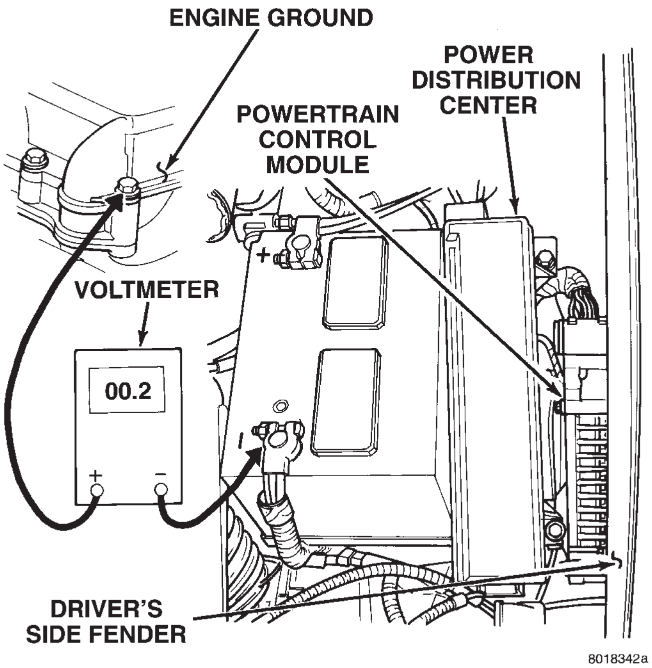


Fig. 3 Test Ground Circuit Resistance

(3) Connect positive voltmeter lead to the starter motor housing and the negative lead to the battery negative terminal (Fig. 4). Hold the ignition switch key in the START position. If voltage reads above 0.2 volt, correct poor starter to engine ground.

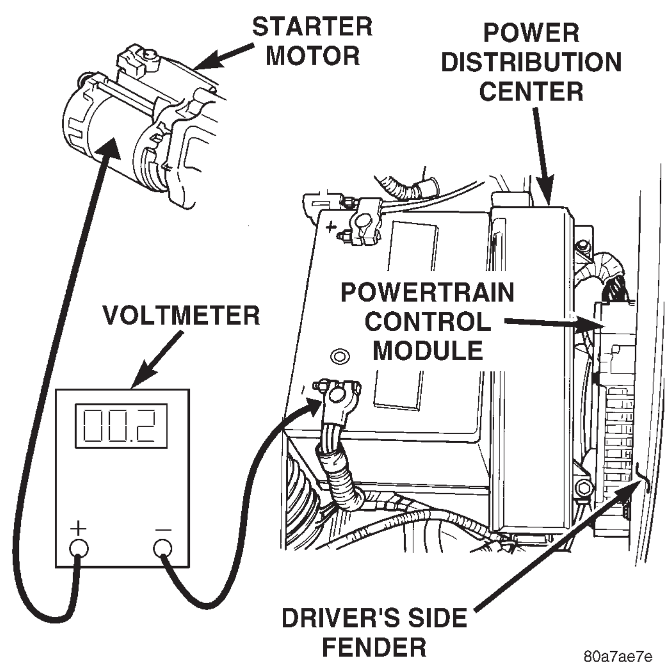


Fig. 4 Test Starter Motor Ground

(a) Connect the positive voltmeter lead to the battery positive terminal, and negative lead to battery cable terminal on starter solenoid (Fig. 5). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, correct poor contact at battery cable to solenoid connection. If reading is still above 0.2 volt after correcting poor contacts, replace battery positive cable.

(b) If resistance tests do not detect feed circuit failures, remove the starter motor and go to Starter Solenoid Test in this Group.

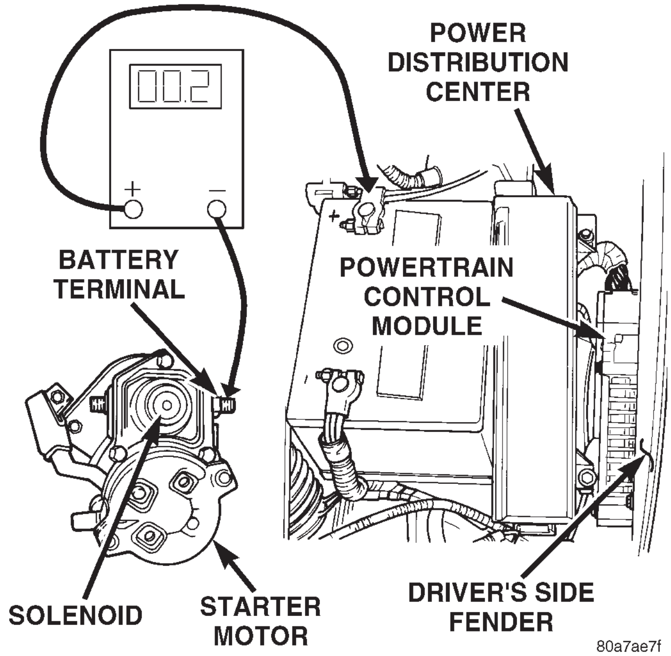


Fig. 5 Test Battery Positive Cable Resistance

FEED CIRCUIT TEST

The following procedure will require a suitable volt-ampere tester (Fig. 6).

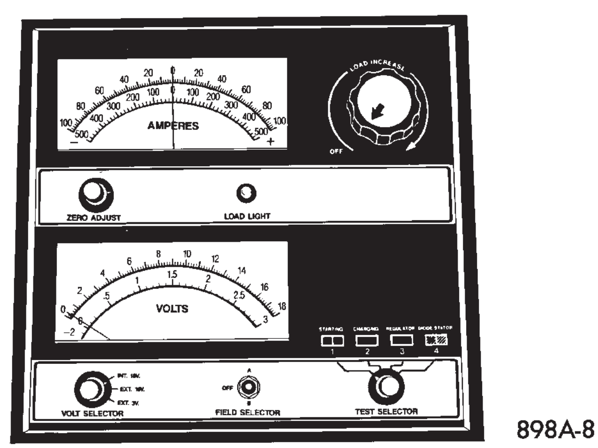


Fig. 6 Volt Ampere Tester

DIAGNOSIS AND TESTING (Continued)

CAUTION: Before performing any starter tests, the ignition and fuel systems must be disabled.

(1) Connect a volt-ampere tester to the battery terminals (Fig. 7). Refer to the operating instructions provided with the tester being used.

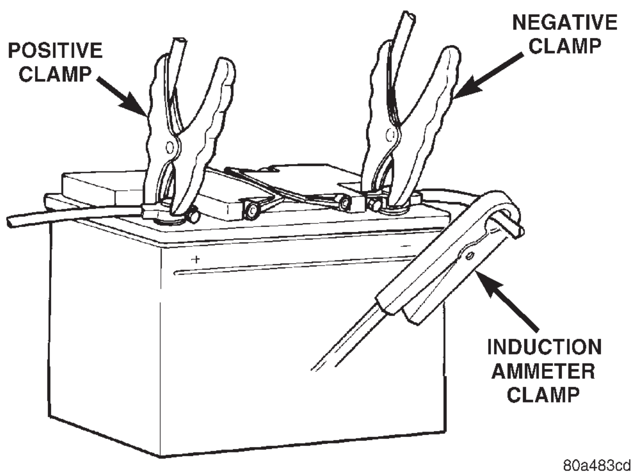


Fig. 7 Volt-Ampere Tester Connections

(2) To disable the ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for proper relay location. The 2.5L Diesel Engine, to disable the engine from starting, disconnect wire connector from the Fuel Solenoid.

(3) Verify that all lights and accessories are OFF, and the transmission shift selector is in the PARK position or with the clutch pedal depressed and SET parking brake.

CAUTION: Do not overheat the starter motor or draw the battery voltage below 9.6 volts during cranking operations.

(4) Rotate and hold the ignition switch in the START position. Observe the volt-ampere tester (Fig. 6).

- If voltage reads above 9.6 volts, and amperage draw reads above 280 amps or the Diesel engine above 450 amps, check for engine seizing or faulty starter.
- If voltage reads 12.4 volts or greater and amperage reads 0 to 10 amps, check for corroded cables and/or bad connections.
- Voltage below 9.6 volts and amperage draw above 300 amps or Diesel engine above 500 amps, the problem is the starter. Replace the starter refer to starter removal.

(5) After the starting system problems have been corrected, verify the battery state-of-charge and charge battery if necessary. Disconnect all testing equipment and connect ASD relay or the Fuel Solenoid. Start the vehicle several times to assure the problem has been corrected.

REMOVAL AND INSTALLATION

STARTER—2.4L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 8).

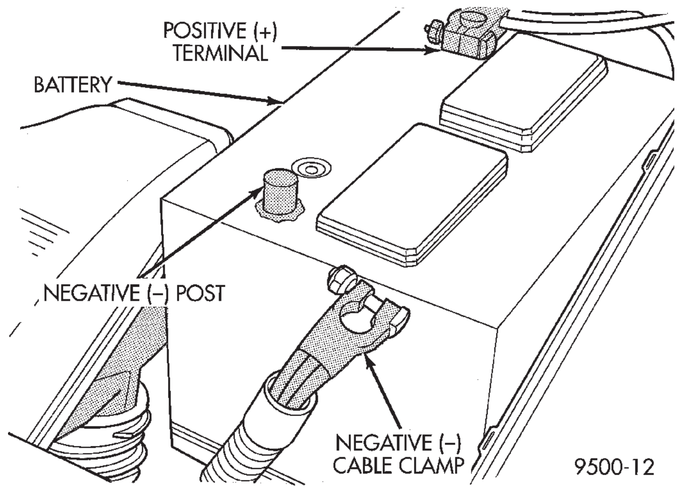


Fig. 8 Battery Negative Cable

(3) Hoist and support vehicle on safety stands.

(4) Disconnect solenoid wire connector from terminal.

(5) Remove nut holding B+ wire to terminal.

(6) Disconnect solenoid and B+ wires from starter terminals.

(7) Remove bolts holding starter to transaxle bellhousing (Fig. 9).

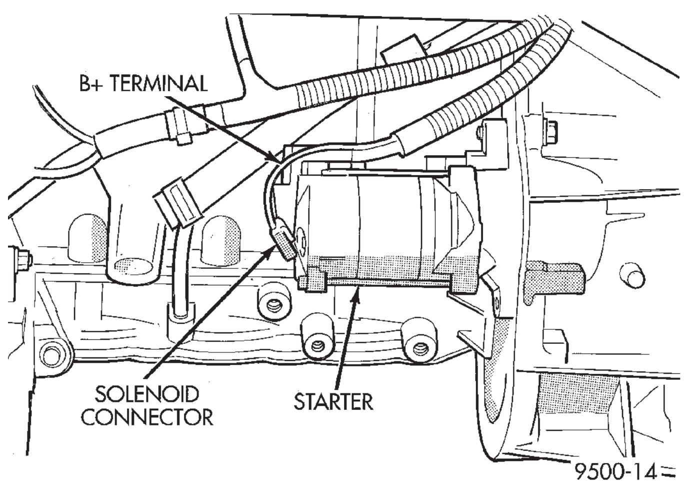


Fig. 9 Starter–2.4L Engine

(8) Remove starter.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place starter in position on vehicle.

(2) Install bolts to hold starter to transaxle bell-housing.

(3) Place solenoid and B+ wires in position on starter terminals.

(4) Install nut to hold B+ wire to terminal.

(5) Connect solenoid wire connector onto terminal.

(6) Lower vehicle.

(7) Connect battery negative cable.

(8) Verify starter operation.

STARTER—3.0L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 8).

(3) Hoist and support vehicle on safety stands.

(4) Remove nut holding solenoid wire to terminal (Fig. 10).

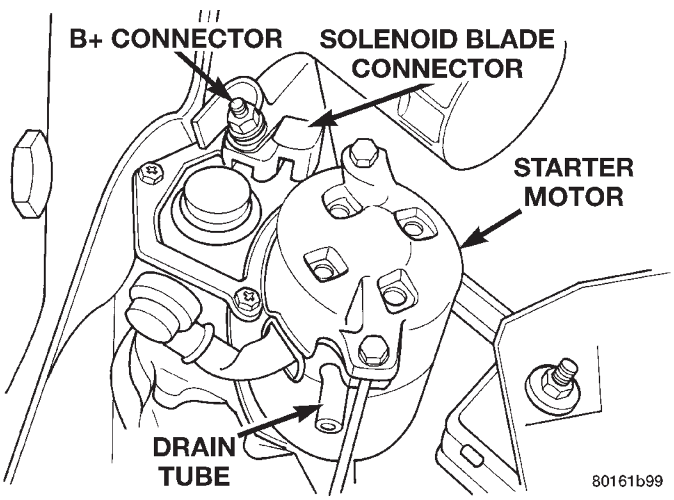


Fig. 10 Wire Connectors

(5) Remove nut holding B+ wire to terminal (Fig. 6)

(6) Disconnect solenoid and B+ wires from starter terminals.

(7) Remove bolts holding starter to transaxle bell-housing (Fig. 11).

(8) Remove starter.

INSTALLATION

(1) Place starter in position on vehicle.

(2) Install bolts to hold starter to transaxle bell-housing.

(3) Place solenoid and B+ wires in position on starter terminals.

(4) Install nut to hold B+ wire to terminal.

(5) Install nut to hold solenoid wire to terminal.

(6) Lower vehicle.

(7) Connect battery negative cable.

(8) Verify starter operation.

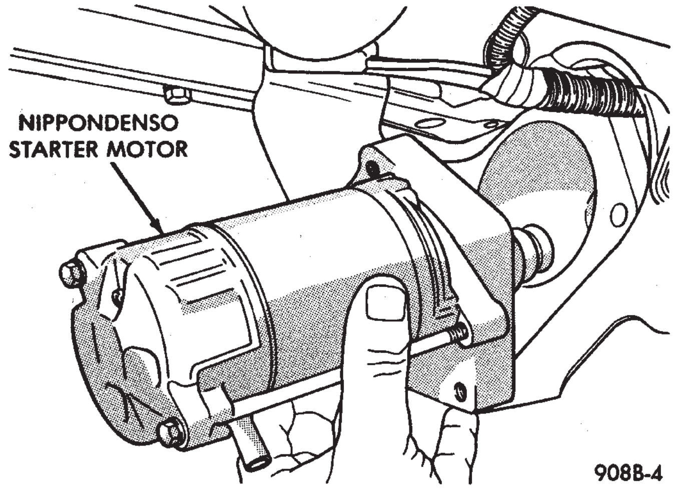


Fig. 11 Starter–3.0L Engine

STARTER—3.3/3.8L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 8).

(3) Hoist and support vehicle on safety stands.

(4) Remove nut holding B+ terminal to starter solenoid (Fig. 12).

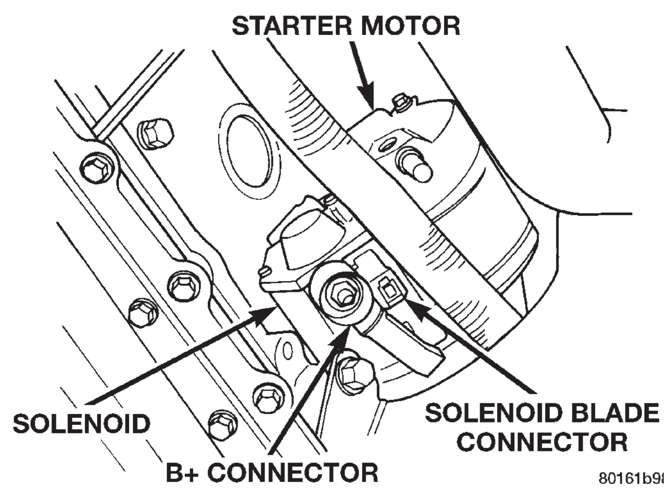


Fig. 12 Wire Connectors

(5) Disconnect solenoid connector from starter.

(6) Remove bolts holding starter to transaxle bell-housing (Fig. 13).

(7) Remove starter from bellhousing (Fig. 14).

(8) Separate starter spacer from transaxle bell-housing.

INSTALLATION

(1) Place starter spacer in position on transaxle bellhousing, flange toward flywheel.

(2) Place starter in position on bellhousing.

(3) Install bolts to hold starter to transaxle bell-housing.

REMOVAL AND INSTALLATION (Continued)

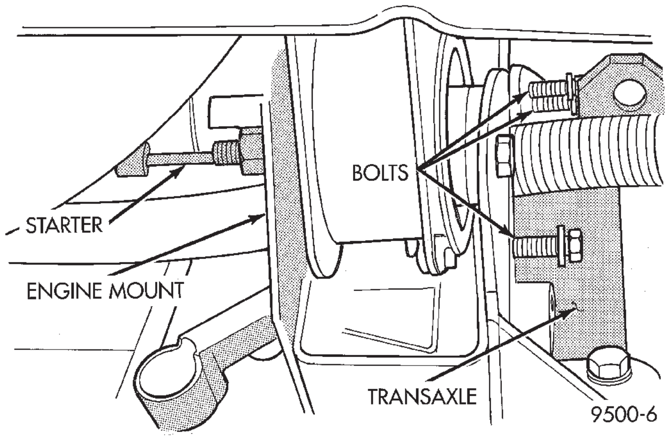


Fig. 13 Starter Bolts

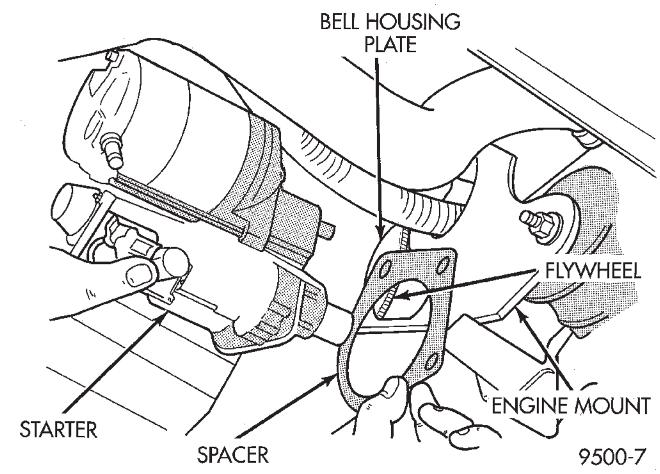


Fig. 14 Starter–3.3/3.8L Engine

(4) Connect solenoid connector into starter.

(5) Install nut to hold B+ terminal to starter solenoid.

(6) Lower vehicle.

(7) Connect battery negative cable.

(8) Verify starter operation.

SPECIFICATIONS

STARTER

MANUFACTURER	NIPPONDENSO
Engine Application	2.4L /3.0L /3.3/3.8L
Power rating	1.2 Kw
Voltage	12 VOLTS
No. of Fields	4
No. of Poles	4
Brushes	4
Drive	Conventional Gear Train
Free running Test Voltage Amperage Draw Minimum Speed	 11 73 Amp 3401 RPM
SolenoidClosing Voltage	7.5 Volts
Cranking Amperage Draw test	150 - 200 Amps.

Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

TORQUE

DESCRIPTION	TORQUE
Starter Mounting Bolts	54 N·m (40 ft. lbs.)
Starter Solenoid Battery Nut	10 N·m (90 in. lbs.)

STARTING SYSTEM

CONTENTS

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REMOVAL AND INSTALLATION
STARTER 1

REMOVAL AND INSTALLATION

STARTER

2.0L ENGINE

REMOVAL

(1) Disconnect battery negative cable (Fig. 1).

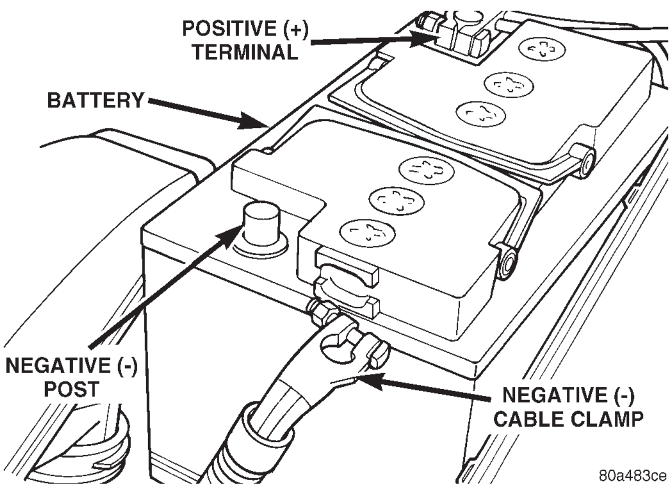

Fig. 1 Battery Negative Cable

(2) Raise vehicle.
(3) Disconnect solenoid wire connector from terminal.
(4) Remove nut holding B+ wire to terminal.
(5) Disconnect solenoid and B+ wires from starter terminals.
(6) Remove bolts holding starter to transaxle bell-housing (Fig. 2).
(7) Remove starter.

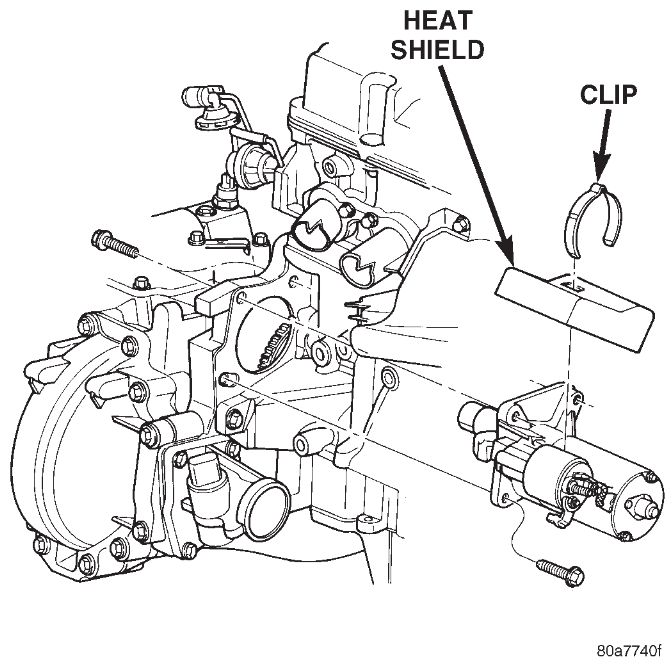

Fig. 2 Starter - 2.0L Engine

INSTALLATION

(1) Place starter in position on vehicle.
(2) Install starter attaching bolts to transaxle bell-housing and tighten to the proper torque.
(3) Place solenoid and B+ wires in position on starter terminals.
(4) Install nut to hold B+ wire to terminal.
(5) Connect solenoid wire connector onto terminal.
(6) Lower vehicle.
(7) Connect battery negative cable.
(8) Verify starter operation.

REMOVAL AND INSTALLATION (Continued)

2.4L ENGINE - With Manual Transaxle

REMOVAL

(1) Release hood latch and open hood.
(2) Disconnect battery negative cable (Fig. 1).
(3) Hoist and support vehicle on safety stands.
(4) Disconnect solenoid wire connector from terminal.
(5) Remove nut holding B+ wire to terminal.
(6) Disconnect solenoid and B+ wires from starter terminals.
(7) Remove bolts holding starter to transaxle bellhousing (Fig. 3).
(8) Remove starter.

INSTALLATION

(1) Place starter in position on vehicle.
(2) Install starter attaching bolts to transaxle bellhousing and tighten to the proper torque.
(3) Place solenoid and B+ wires in position on starter terminals.
(4) Install nut to hold B+ wire to terminal.
(5) Connect solenoid wire connector onto terminal.
(6) Lower vehicle.
(7) Connect battery negative cable.
(8) Verify starter operation.

2.4L ENGINE - With Automatic Transaxle

REMOVAL

(1) Release hood latch and open hood.
(2) Disconnect battery negative cable (Fig. 1).
(3) Hoist and support vehicle on safety stands.
(4) Disconnect solenoid wire connector from terminal.
(5) Remove nut holding B+ wire to terminal.
(6) Disconnect solenoid and B+ wires from starter terminals.

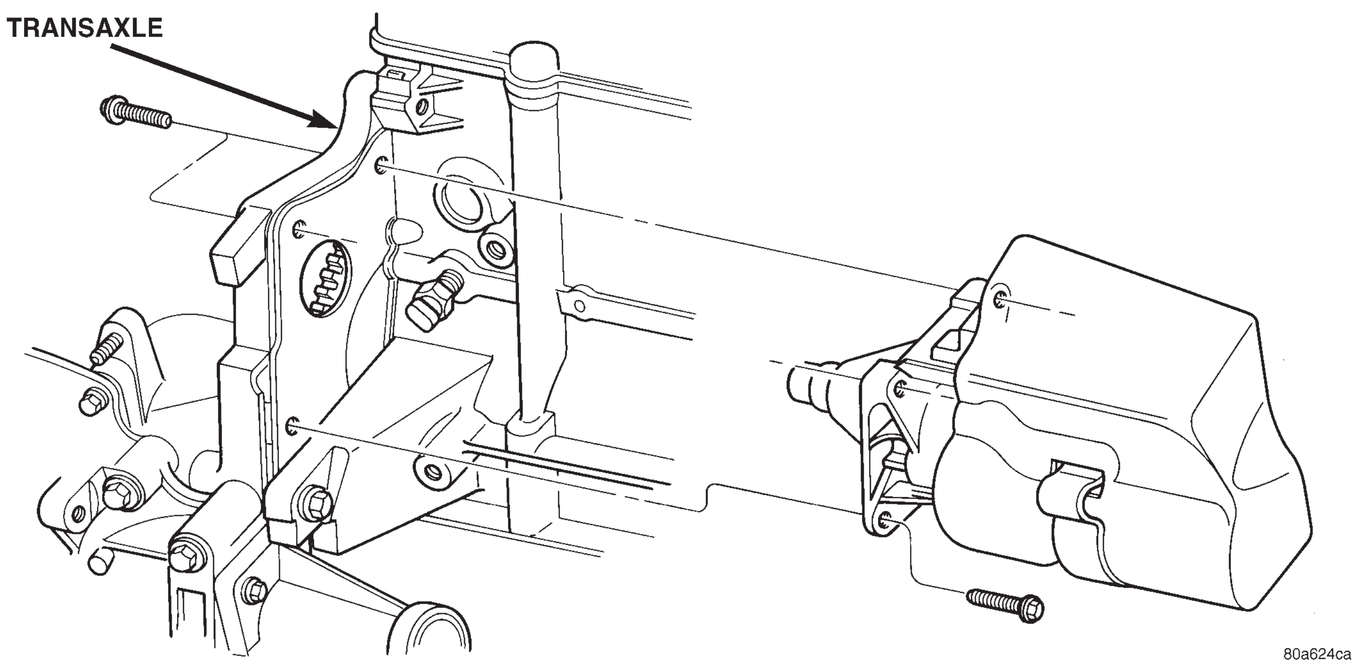

Fig. 3 Starter - 2.4L Engine with Manual Transaxle

REMOVAL AND INSTALLATION (Continued)

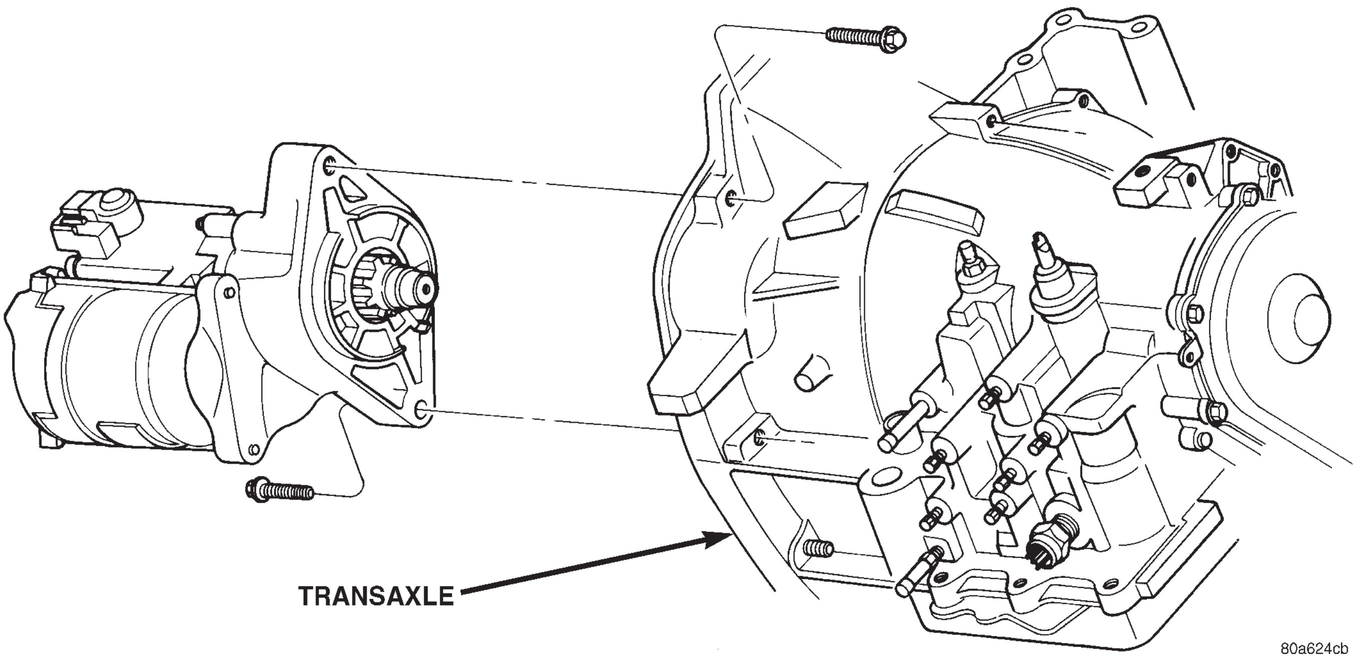

Fig. 4 Starter - 2.4L Engine with Automatic Transaxle

(7) Remove bolts holding starter to transaxle bell-housing (Fig. 4).

(8) Remove starter.

INSTALLATION

(1) Place starter in position on vehicle.

(2) Install starter attaching bolts to transaxle bell-housing and tighten to the proper torque

(3) Place solenoid and B+ wires in position on starter terminals.

(4) Install nut to hold B+ wire to terminal.

(5) Connect solenoid wire connector onto terminal.

(6) Lower vehicle.

(7) Connect battery negative cable.

(8) Verify starter operation.

3.0L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 1).

(3) Hoist and support vehicle on safety stands.

(4) Remove nut holding solenoid wire to terminal (Fig. 5).

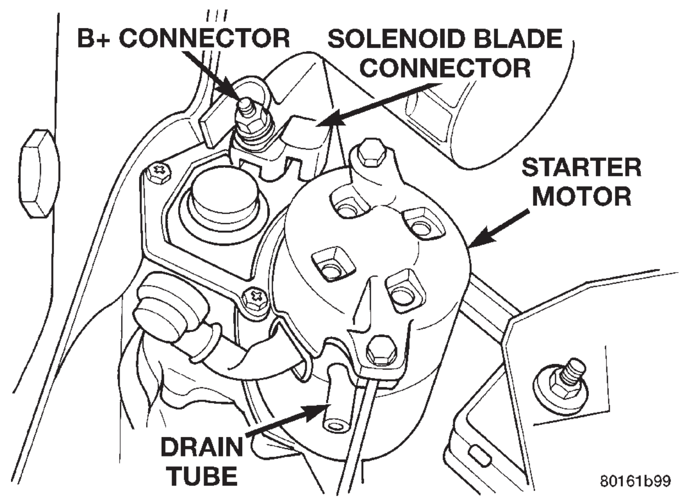

Fig. 5 Wire Connectors

(5) Remove nut holding B+ wire to terminal (Fig. 6)

(6) Disconnect solenoid and B+ wires from starter terminals.

REMOVAL AND INSTALLATION (Continued)

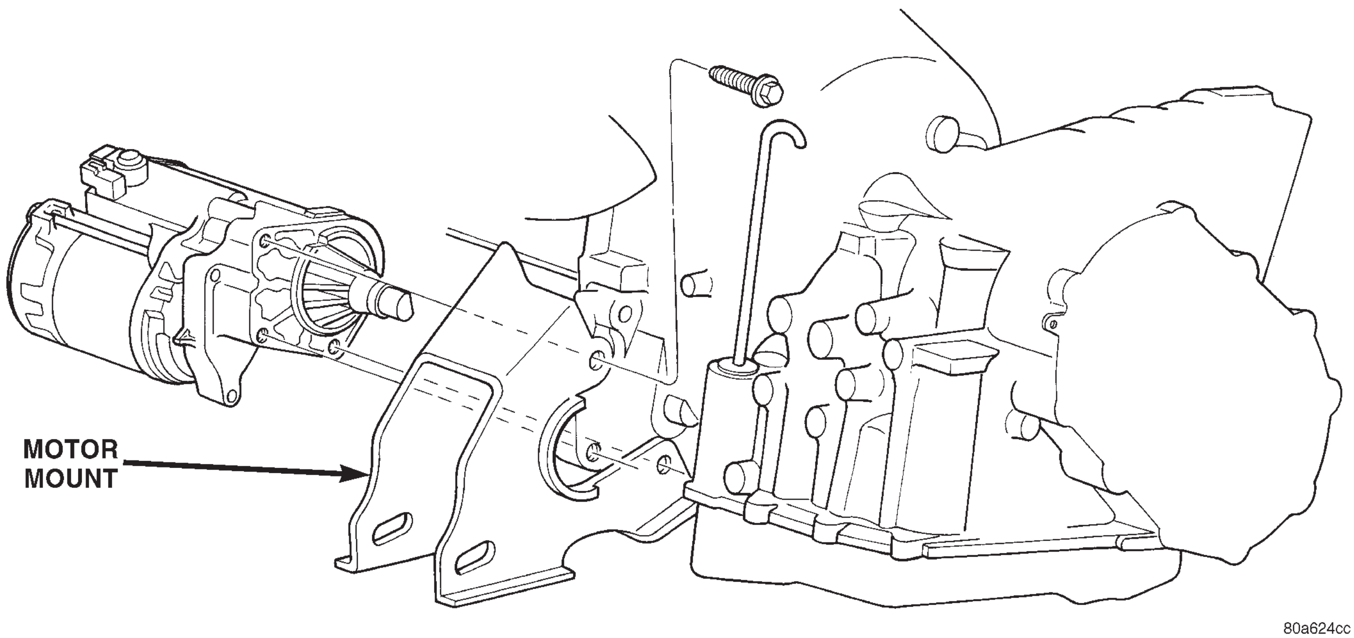

Fig. 6 Starter–3.0L Engine

(7) Remove bolts holding starter to transaxle bell-housing (Fig. 6).

(8) Remove starter.

INSTALLATION

(1) Place starter in position on vehicle.

(2) Install starter attaching bolts to transaxle bell-housing and tighten to the proper torque.

(3) Place solenoid and B+ wires in position on starter terminals.

(4) Install nut to hold B+ wire to terminal.

(5) Install nut to hold solenoid wire to terminal.

(6) Lower vehicle.

(7) Connect battery negative cable.

(8) Verify starter operation.

3.3/3.8L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 1).

(3) Hoist and support vehicle on safety stands.

(4) Remove nut holding B+ terminal to starter solenoid (Fig. 7).

(5) Disconnect solenoid connector from starter.

(6) Remove bolts holding starter to transaxle bell-housing.

(7) Remove starter from bellhousing (Fig. 8).

(8) Separate starter spacer from transaxle bell-housing.

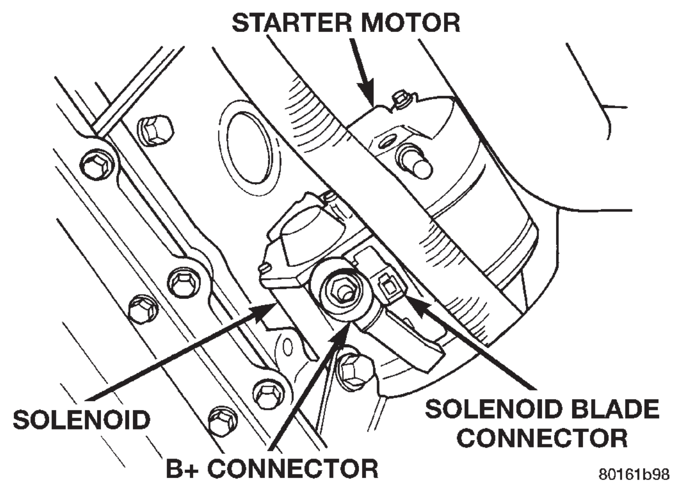

Fig. 7 Wire Connectors

INSTALLATION

(1) Place starter spacer in position on transaxle bellhousing, flange toward flywheel.

(2) Place starter in position on bellhousing.

(3) Install starter attaching bolts to transaxle bell-housing and tighten to the proper torque.

(4) Connect solenoid connector into starter.

(5) Install nut to hold B+ terminal to starter sole-noid.

(6) Lower vehicle.

(7) Connect battery negative cable.

(8) Verify starter operation.

REMOVAL AND INSTALLATION (Continued)

2.5L DIESEL ENGINE

REMOVAL

(1) Release hood latch and open hood.
(2) Disconnect battery negative cable (Fig. 1).
(3) Hoist and support vehicle on safety stands.
(4) Disconnect solenoid wire connector from terminal.
(5) Remove nut holding B+ wire to terminal.
(6) Disconnect solenoid and B+ wires from starter terminal.
(7) Remove three bolts holding starter to transaxle bellhousing (Fig. 9).
(8) Remove starter.

INSTALLATION

For installation, reverse the above procedures and verify the operation of the starter.

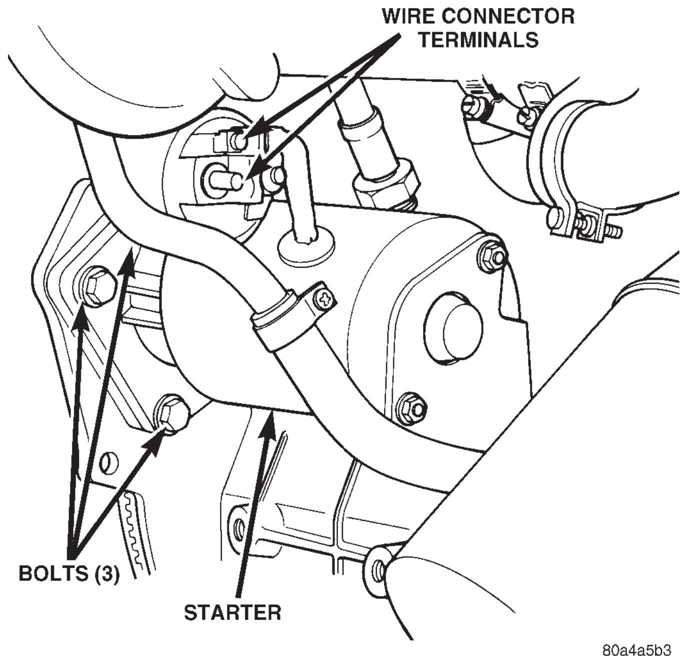

Fig. 9 Starter–2.5L Diesel Engine

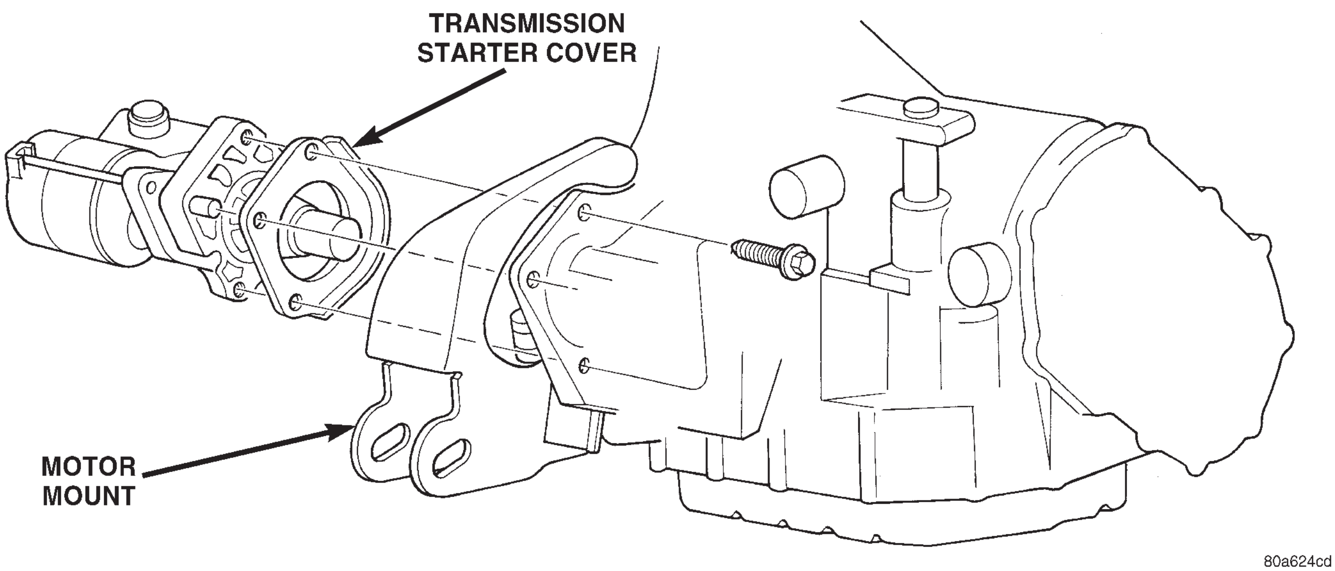

Fig. 8 Starter–3.3/3.8L Engine

CHARGING SYSTEM

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GENERAL INFORMATION

OVERVIEW

The battery, starting, and charging systems operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components involved in these systems must perform within specifications.

Group 8A covers the battery, Group 8B covers the starting system, and Group 8C covers the charging system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in 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 ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 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. See the On-Board Diagnostics Test in Group 8C - Charging System for more information.

DESCRIPTION AND OPERATION

CHARGING SYSTEM OPERATION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to Group 8D, Ignition System for information)
- Battery (refer to Group 8A, Battery for information)
- Temperature is measured by a sensor in the PCM circuitry
- Wiring harness and connections (refer to Group 8W, Wiring for information)

The charging system is turned on and off with the ignition switch. When the ignition switch is turned to the ON position, battery voltage is applied to the generator rotor through one of the two field terminals to produce a magnetic field. The generator is driven by the engine through a serpentine belt and pulley arrangement.

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.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including the 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 any failure it detects. See On-Board Diagnostic System Test in this group for more information.

DESCRIPTION AND OPERATION (Continued)

GENERATOR

The generator is belt-driven by the engine. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

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, and ground terminals.

Noise emitting from the generator may be caused by:

- Worn, loose or defective bearings
- Loose or defective drive pulley
- Incorrect, worn, damaged or misadjusted drive belt
- Loose mounting bolts
- Misaligned drive pulley
- Defective stator or diode

BATTERY TEMPERATURE SENSOR

The temperature sensor, in the PCM, is used to determine the battery temperature. 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.

ELECTRONIC VOLTAGE REGULATOR

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 and battery temperature (refer to Battery Temperature Sensor for more information). It then compensates and regulates generator current output accordingly. Also refer to Charging System Operation for additional information.

DIAGNOSIS AND TESTING

CHARGING SYSTEM

When the ignition switch is turned to the ON position, battery potential will register on the voltmeter. During engine cranking a lower voltage will appear on the meter. With the engine running, a voltage reading higher than the first reading (ignition in ON) should register.

The following are possible symptoms of a charging system fault:

- The voltmeter does not operate 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. See Ignition-Off Draw Test in Group 8A, Battery for more information.

The following procedures may be used to correct a problem diagnosed as a charging system fault.

INSPECTION

(1) 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.

(2) Inspect all fuses in the fuseblock module and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(3) Inspect the electrolyte level in the battery. Replace battery if electrolyte level is low.

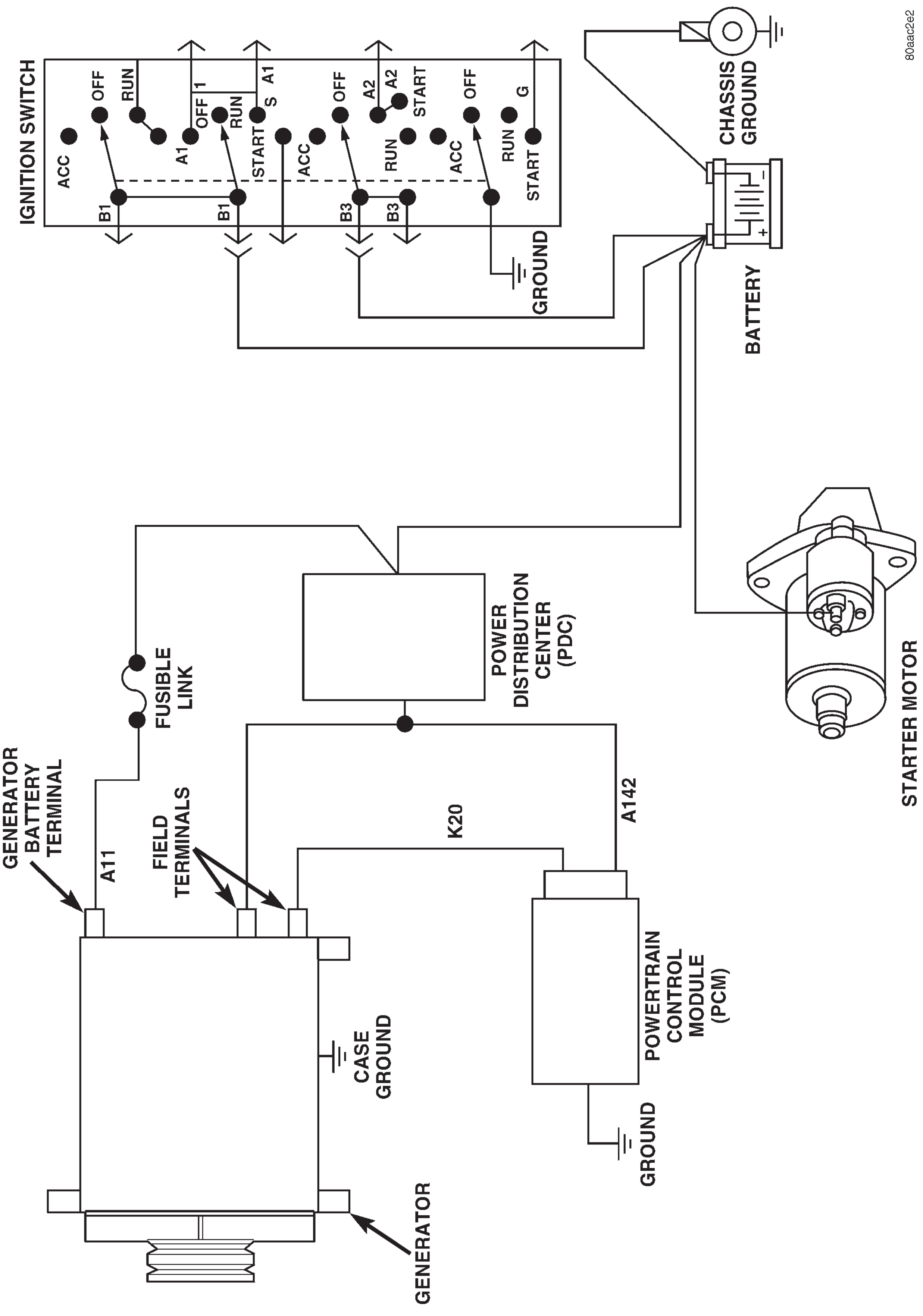
(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in Group 7, Cooling System.

(6) Inspect automatic belt tensioner (if equipped). Refer to Group 7, Cooling System for information.

(7) Inspect connections at generator field, battery output, and ground terminals. Also check ground connection at engine. They should all be clean and tight. Repair as required.

DIAGNOSIS AND TESTING (Continued)



CHARGING SYSTEM SCHEMATIC—TYPICAL

DIAGNOSIS AND TESTING (Continued)

CHARGING SYSTEM RESISTANCE TESTS

These tests will show the amount of voltage drop across the generator output wire from the generator output (B+) terminal to the battery positive post. They will also show the amount of voltage drop from the ground (-) terminal on the generator or case ground (Fig. 1) to the battery negative post.

A voltmeter with a 0–18 volt DC scale should be used for these tests. By repositioning the voltmeter test leads, the point of high resistance (voltage drop) can easily be found.

PREPARATION

(1) Before starting test, make sure battery is in good condition and is fully-charged. See Group 8A, Battery for more information.

(2) Check condition of battery cables at battery. Clean if necessary.

(3) Start the engine and allow it to reach normal operating temperature.

(4) Shut engine off.

(5) Connect an engine tachometer.

(6) Fully engage the parking brake.

TEST

(1) Start engine.

(2) Place heater blower in high position.

(3) Turn on headlamps and place in high-beam position.

(4) Turn rear window defogger on.

(5) Bring engine speed up to 2400 rpm and hold.

(6) Testing (+ positive) circuitry:

(a) Touch the negative lead of voltmeter directly to battery positive **POST** (Fig. 2).

(b) Touch the positive lead of voltmeter to the B+ output terminal stud on the generator (not the terminal mounting nut). Voltage should be no higher than 0.6 volts. If voltage is higher than 0.6 volts, touch test lead to terminal mounting stud nut and then to the wiring connector. If voltage is now below 0.6 volts, look for dirty, loose or poor connection at this point. Also check condition of the generator output wire-to-battery bullet connector. Refer to Group 8, Wiring for connector location. A voltage drop test may be performed at each (-ground) connection in this circuit to locate the excessive resistance.

(7) Testing (- ground) circuitry:

(a) Touch the positive lead of voltmeter directly to battery negative **POST**.

(b) Touch the negative lead of voltmeter to the generator case. Voltage should be no higher than 0.3 volts. If voltage is higher than 0.3 volts, touch test lead to generator case and then to the engine block. If voltage is now below 0.3 volts, look for dirty, loose or poor connection at this point. A voltage drop test may be performed at each connection in this circuit to locate the excessive resistance. This test can also be performed between the generator case and the engine. If test voltage is higher than 0.3 volts, check for corrosion at generator mounting points or loose generator mounting.

CURRENT OUTPUT TEST

The current output test will determine if the charging system can deliver its minimum test current (amperage) output. Refer to the Specifications section at the end of this group for minimum test current (amperage) requirements.

The first part of this test will determine the combined amperage output of both the generator and the Electronic Voltage Regulator (EVR) circuitry.

PREPARATION

(1) Determine if any Diagnostic Trouble Codes (DTC) exist. To determine a DTC, refer to On-Board Diagnostics in this group. For repair, refer to the appropriate Powertrain Diagnostic Procedures manual.

(2) Before starting test, make sure battery is in good condition and is fully-charged. See Group 8A, Battery for more information.

(3) Check condition of battery cables at battery. Clean if necessary.

(4) Perform the Voltage Drop Test. This will ensure clean and tight generator/battery electrical connections.

(5) Be sure the generator drive belt is properly tensioned. Refer to Group 7, Cooling System for information.

(6) A volt/amp tester equipped with both a battery load control (carbon pile rheostat) and an inductive-type pickup clamp (ammeter probe) will be used for this test. Refer to operating instructions supplied with tester. When using a tester equipped with an inductive-type clamp, removal of wiring at the generator will not be necessary.

(7) Start the engine and allow it to reach operating temperature.

(8) Shut engine off.

(9) Turn off all electrical accessories and all vehicle lighting.

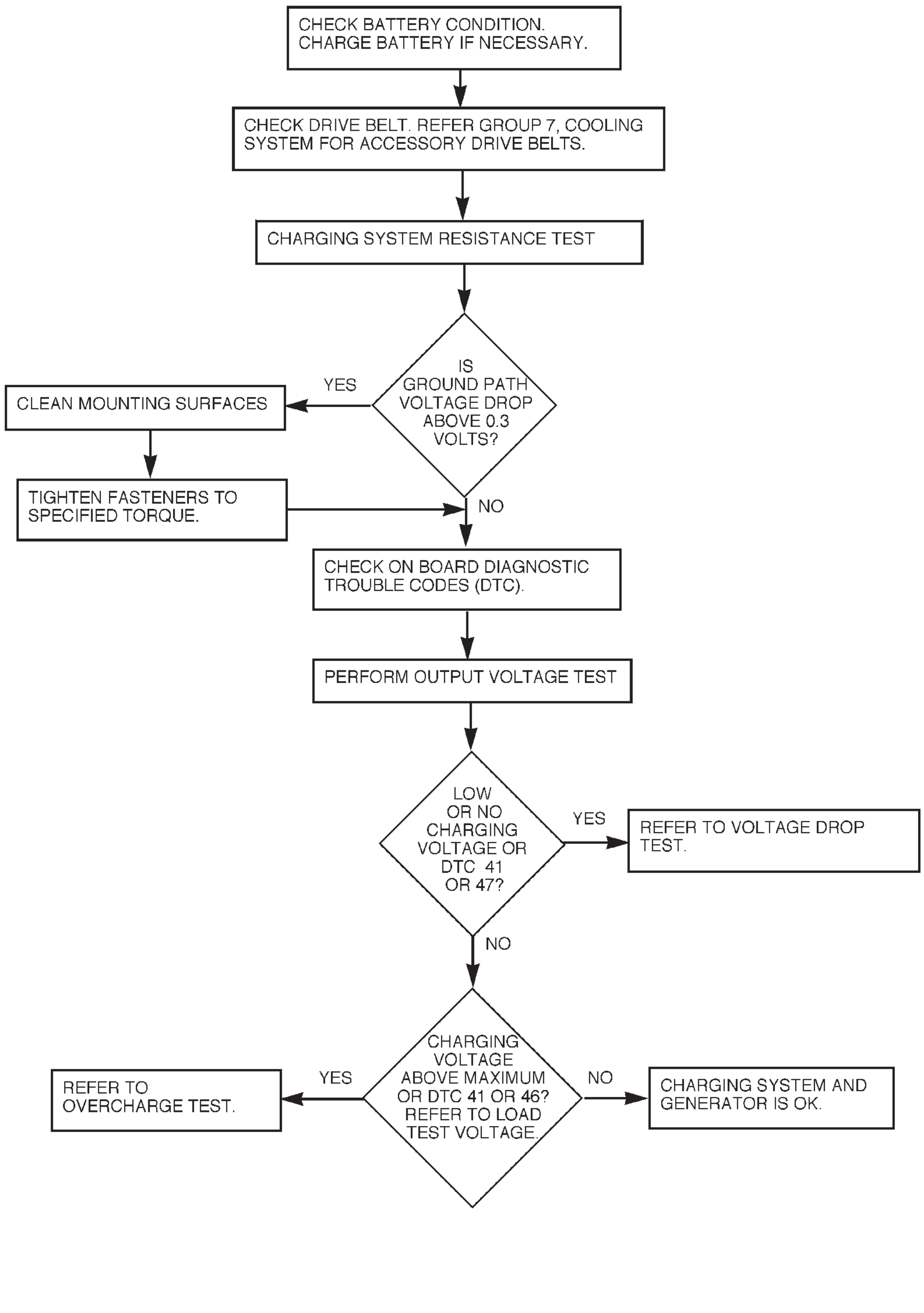
(10) Connect the volt/amp tester leads to the battery. Be sure the carbon pile rheostat control is in the OPEN or OFF position before connecting leads. See Load Test in Group 8A, Battery for more information. Also refer to the operating instructions supplied with test equipment.

(11) Connect the inductive clamp (ammeter probe). Refer to the operating instructions supplied with test equipment.

(12) If volt/amp tester is not equipped with an engine tachometer, connect a separate tachometer to the engine.

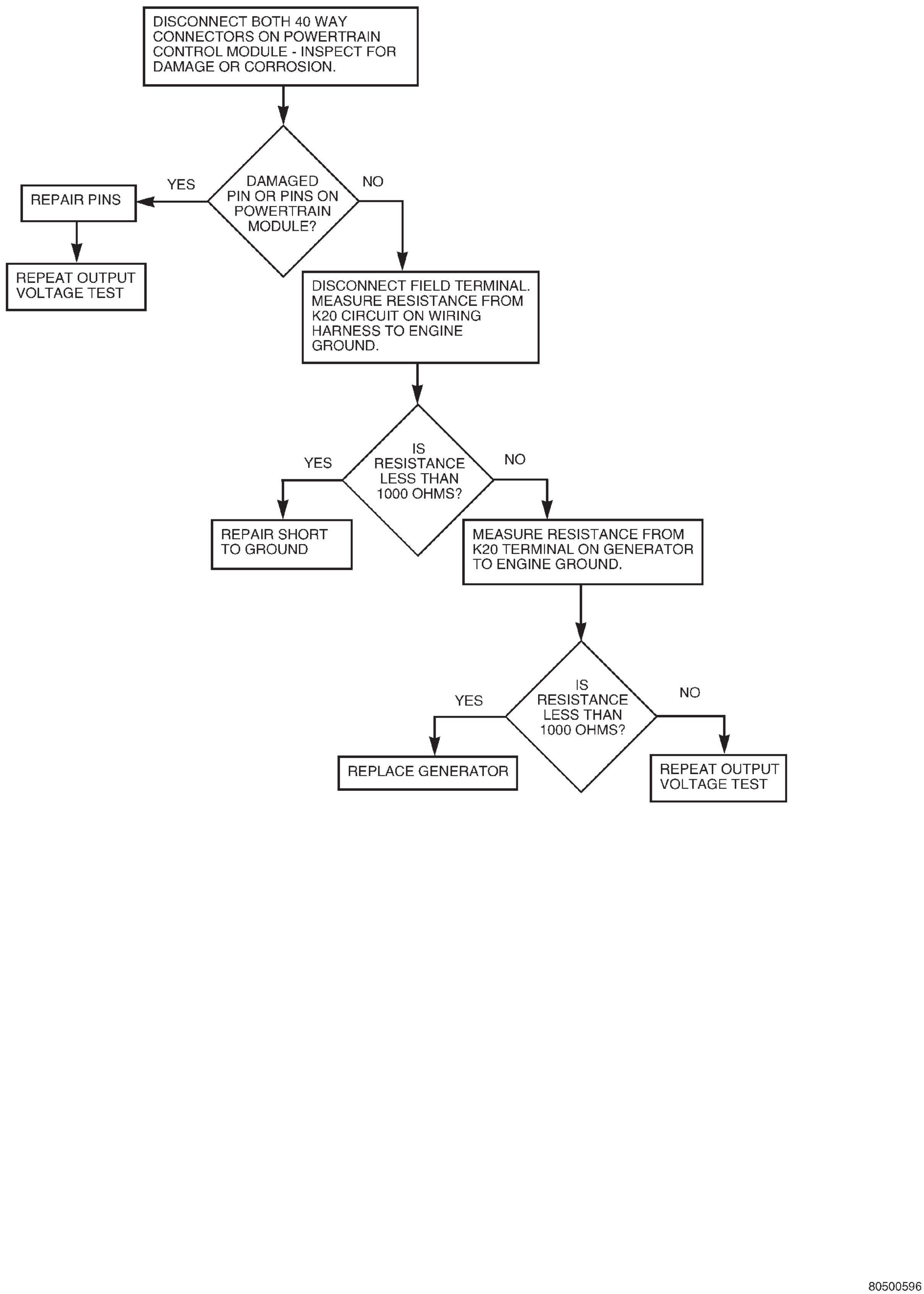
DIAGNOSIS AND TESTING (Continued)

CHARGING SYSTEM TEST



DIAGNOSIS AND TESTING (Continued)

OVERCHARGE TEST



DIAGNOSIS AND TESTING (Continued)

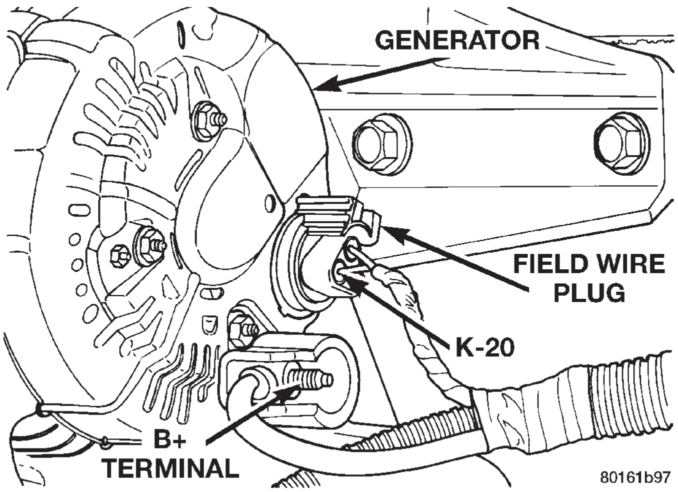


Fig. 1 Generator Terminals

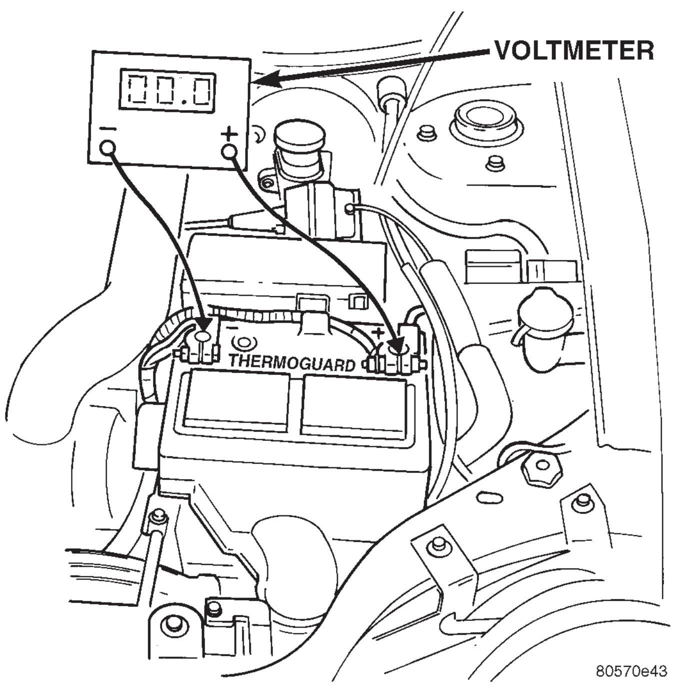


Fig. 2 Battery Voltage Test—Typical

TEST

(1) Perform the previous test Preparation.

(2) Fully engage the parking brake.

(3) Start engine.

(4) Bring engine speed to 2500 rpm.

(5) With engine speed held at 2500 rpm, slowly adjust the rheostat control (load) on the tester to obtain the highest amperage reading. Do not allow voltage to drop below 12 volts. Record the reading. **This load test must be performed within 15 seconds to prevent damage to test equipment.** On certain brands of test equipment, this load will be applied automatically. Refer to the operating manual supplied with test equipment.

(6) The ammeter reading must meet the Minimum Test Amps specifications as displayed in the Generator Ratings chart. This can be found in the Specifications section at the end of this group. A label stating a part reference number is attached to the generator case. On some engines this label may be located on the bottom of the case. Compare this reference number to the Generator Ratings chart.

(7) Rotate the load control to the OFF position.

(8) Continue holding engine speed at 2500. If EVR circuitry is OK, amperage should drop below 15–20 amps. With all electrical accessories and vehicle lighting off, this could take several minutes of engine operation. If amperage did not drop, refer to the appropriate Powertrain Diagnostic Procedures manual for testing.

(9) Remove volt/amp tester.

If minimum amperage could not be met, refer to the appropriate Powertrain Diagnostic Procedures manual for testing.

ON-BOARD DIAGNOSTIC SYSTEM TEST

GENERAL INFORMATION

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 OBD system. Some circuits are checked continuously and some are checked only under certain conditions.

If the OBD system senses that a monitored circuit is bad, it will put a DTC into electronic memory. The DTC will stay in electronic memory as long as the circuit continues to be bad. The PCM is programmed to clear the memory after 50 engine starts if the problem does not occur again.

DIAGNOSTIC TROUBLE CODES

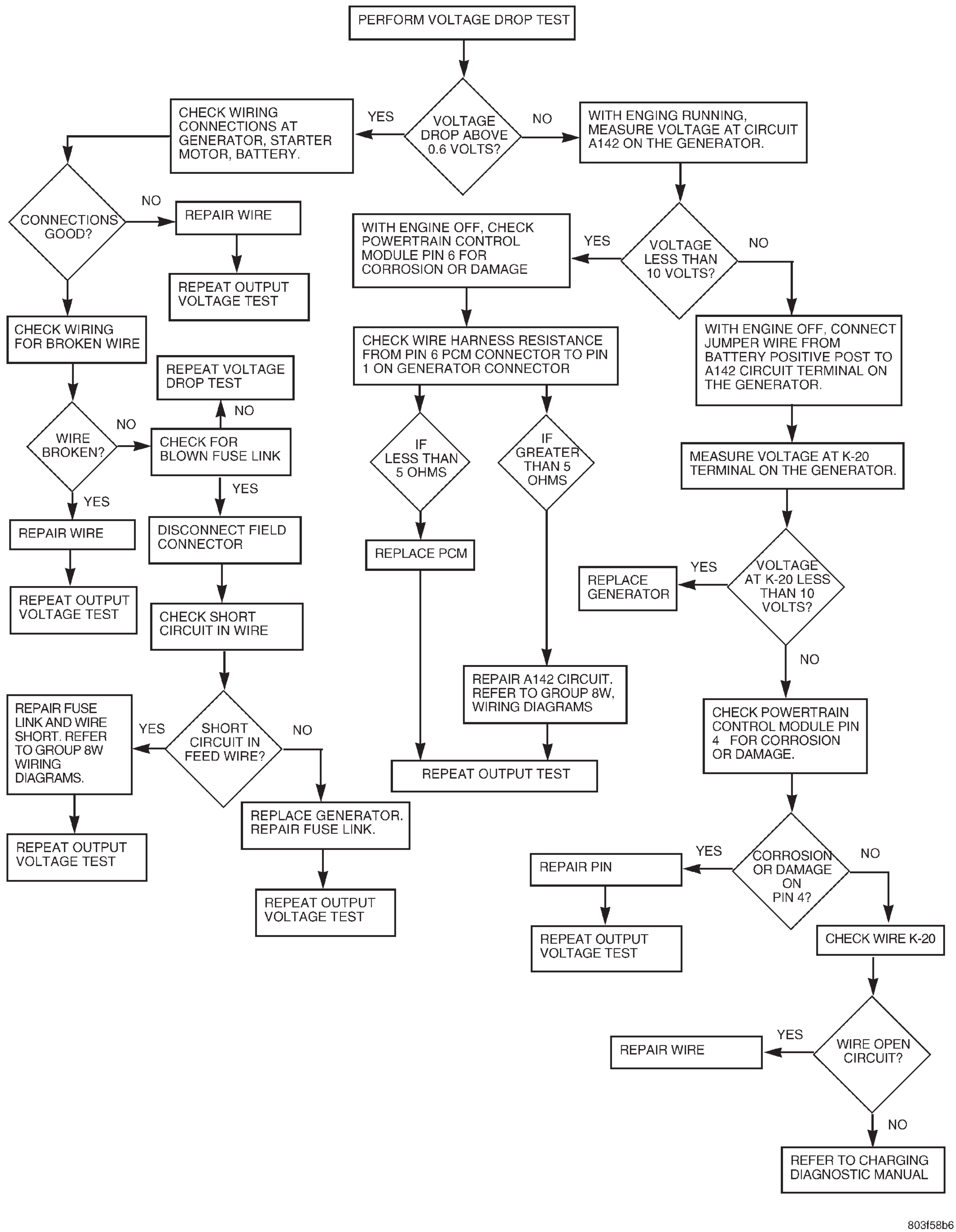
Refer to Group 25, On Board Diagnostic for more information. A DTC description can be read using the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for information.

A DTC does not identify which component in a circuit is bad. Thus, a DTC should be treated as a symptom, not as the cause for the problem. In some cases, because of the design of the diagnostic test procedure, a DTC can be the reason for another DTC to be set. Therefore, it is important that the test procedures be followed in sequence, to understand what caused a DTC to be set.

ERASING DIAGNOSTIC TROUBLE CODES

The DRB Scan Tool must be used to erase a DTC.

VOLTAGE DROP TEST



REMOVAL AND INSTALLATION

GENERATOR—2.4L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 3).

(3) Remove accessory drive belt, refer to Group 7, Cooling System for proper procedures.

(4) Disconnect the push-in field wire connector from back of generator (Fig. 4).

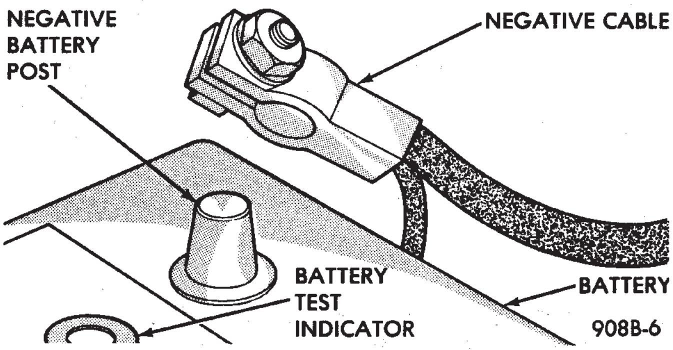


Fig. 3 Removal/Installation of Battery Cables

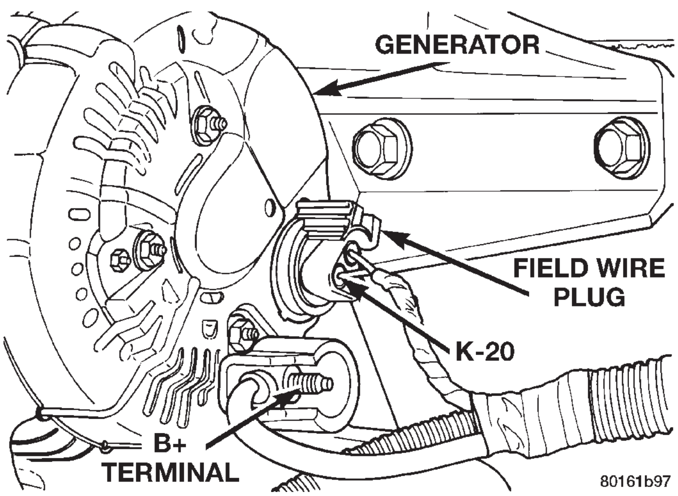


Fig. 4 Wire Connectors

(5) Remove nut holding B+ wire to terminal on back of generator.

(6) Separate B+ wire from generator terminal.

(7) Remove nut holding top of generator to adjustable T-bolt (Fig. 5).

(8) Remove bolt holding bottom generator pivot to lower mount.

(9) Remove generator.

INSTALLATION

(1) Place generator in position on vehicle.

(2) Install bolt to hold bottom generator pivot to lower mount.

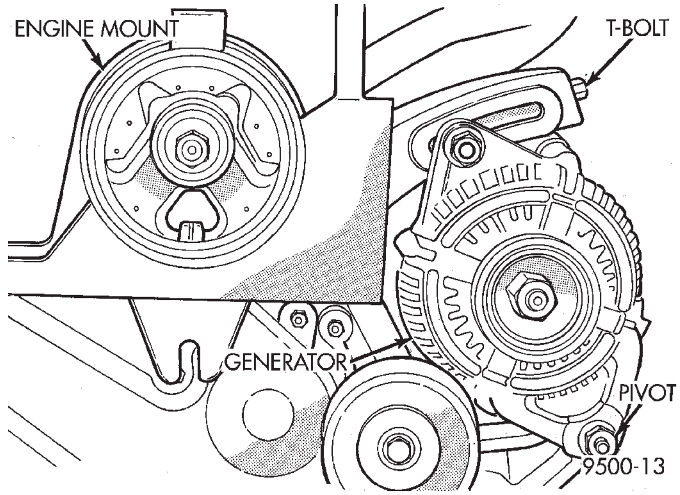


Fig. 5 Generator–2.4L Engine

(3) Install nut to hold top of generator to adjustable T-bolt.

(4) Place B+ wire in position on generator terminal.

(5) Install nut to hold B+ wire to terminal on back of generator.

(6) Connect the push-in field wire connector onto back of generator.

(7) Install accessory drive belt, refer to Group 7, Cooling System for proper procedures.

(8) Connect battery negative cable.

(9) Verify generator charge rate.

GENERATOR—3.0L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 3).

(3) Remove windshield wiper housing, refer to Group 8K, Windshield Wipers and Washers for proper procedures.

(4) Remove accessory drive belt, refer to Group 7, Cooling System for proper procedures.

(5) Remove bolt holding top of generator to mount bracket (Fig. 6).

(6) Remove bolt holding bottom of generator to lower pivot bracket (Fig. 4).

(7) Disengage push-in field wire connector from back of generator.

(8) Remove nut holding B+ wire terminal to back of generator.

(9) Remove B+ terminal from generator.

INSTALLATION

(1) Place B+ terminal in position on generator.

(2) Install nut to hold B+ wire terminal to back of generator

(3) Connect the push-in field wire connector into back of generator.

REMOVAL AND INSTALLATION (Continued)

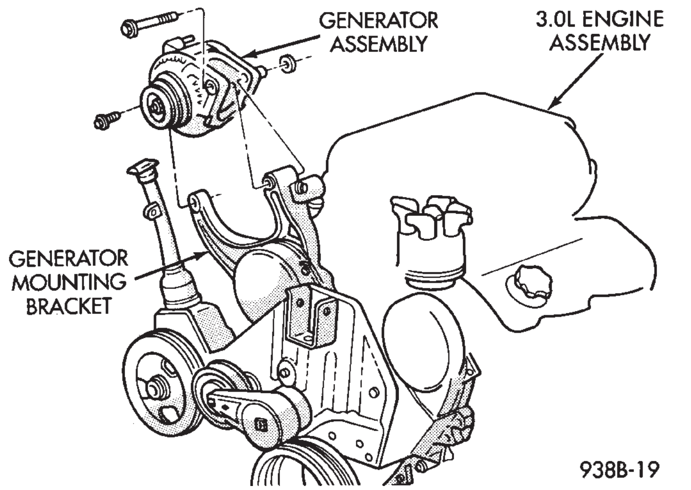


Fig. 6 Generator–3.0L Engine

(4) Install bolt to hold bottom of generator to lower pivot bracket.

(5) Install bolt to hold top of generator to mount bracket.

(6) Install accessory drive belt, refer to Group 7, Cooling System for proper procedures.

(7) Install windshield wiper housing, refer to Group 8K, Windshield Wipers and Washers for proper procedures.

(8) Connect battery negative cable.

(9) Verify generator charge rate.

GENERATOR—3.3/3.8 L ENGINE

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable (Fig. 3).

(3) Remove windshield wiper housing, refer to Group 8K, Windshield Wipers and Washers for proper procedures.

(4) Remove accessory drive belt, refer to Group 7, Cooling System for proper procedures.

(5) Remove bolt holding top of generator mount bracket to engine air intake plenum (Fig. 7).

(6) Remove bolts holding outside of generator mount bracket to generator mount plate.

(7) Remove bolt holding top of generator to mount bracket.

(8) Remove generator mount bracket from vehicle.

(9) Rotate generator toward rear dash panel.

(10) Disconnect the push-in field wire connector from back of generator (Fig. 6).

(11) Remove nut holding B+ wire terminal to back of generator.

(12) Separate B+ terminal from generator.

(13) Remove bolt holding bottom of generator to lower pivot bracket (Fig. 8).

(14) Remove generator from vehicle (Fig. 9).

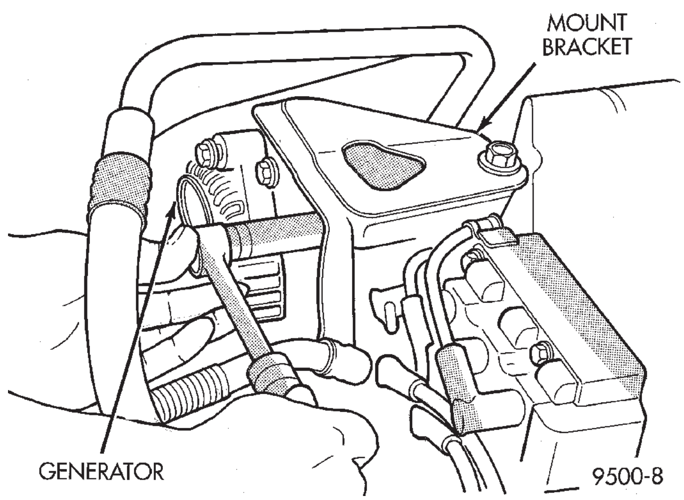


Fig. 7 Generator Mounting Bracket

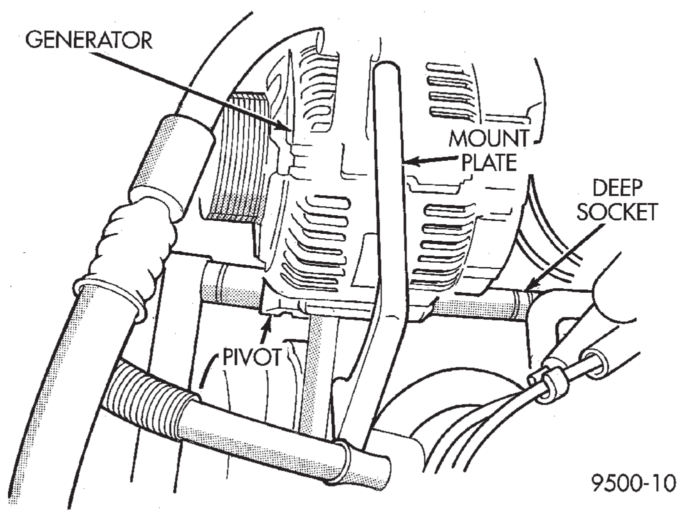


Fig. 8 Generator pivot Bolt

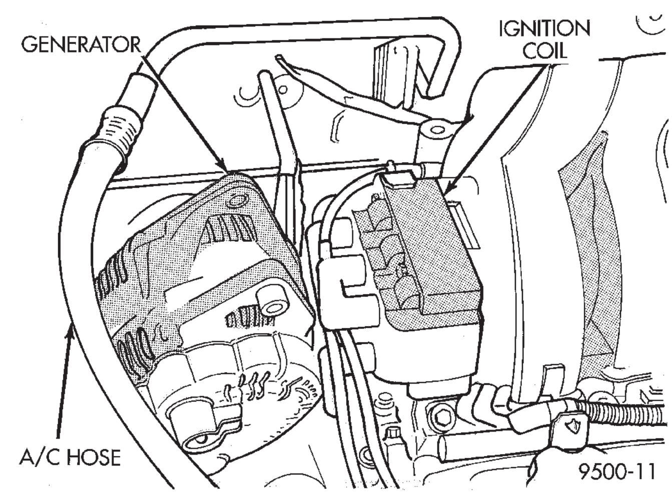


Fig. 9 Generator–3.3/3.8 L Engine

INSTALLATION

(1) Place generator in position on vehicle.

REMOVAL AND INSTALLATION (Continued)

(2) Install bolt to hold bottom of generator to lower pivot bracket.

(3) Place B+ terminal in position on generator.

(4) Install nut to hold B+ wire terminal to back of generator.

(5) Connect the push-in field wire connector into back of generator.

(6) Rotate generator forward away from dash panel.

(7) Place generator mount bracket in position on vehicle.

(8) Install bolt to hold top of generator to mount bracket.

(9) Install bolts to hold outside of generator mount bracket to generator mount plate.

(10) Install bolt to hold top of generator mount bracket to engine air intake plenum.

(11) Install accessory drive belt, refer to Group 7, Cooling System for proper procedures.

(12) Install windshield wiper housing, refer to Group 8K, Windshield Wipers and Washers for proper procedures.

(13) Connect battery negative cable.

(14) Verify generator charge rate.

SPECIFICATIONS

GENERATOR

Type	Part Number	Amperage output
Nippondenso 90 A HS	4727220	86 Amp
Nippondenso 120 A HS	4727221	98 Amp

Part number is located on the side of the generator.

TORQUE

DESCRIPTION	TORQUE
Battery Hold Down Bolt	14 N·m (125 in. lbs.)
Generator Mounting Bolts	54 N·m (40 ft. lbs.)
Generator B+ Terminal	9 N·m (75 in. lbs.)
Starter Mounting Bolts	54 N·m (40 ft. lbs.)
Starter Solenoid Battery Nut	10 N·m (90 in. lbs.)

IGNITION SYSTEM

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GENERAL INFORMATION

INTRODUCTION

This group describes the ignition systems for the 2.4, 3.0, and 3.3/3.8L engines.

On Board Diagnostics is described in Group 25 - Emission Control Systems.

Group 0 - Lubrication and Maintenance, contains general maintenance information for ignition related items. The Owner's Manual also contains maintenance information.

POWERTRAIN CONTROL MODULE

The ignition system is regulated by the Powertrain Control Module (PCM) (Fig. 1). The PCM supplies battery voltage to the ignition coil through the Auto Shutdown (ASD) Relay. The PCM also controls ground circuit for the ignition coil. By switching the ground path for the coil on and off, the PCM adjusts ignition timing to meet changing engine operating conditions.

During the crank-start period the PCM advances ignition timing a set amount. During engine operation, the amount of spark advance provided by the PCM is determined by the following input factors:

GENERAL INFORMATION (Continued)

- available manifold vacuum
- barometric pressure
- engine coolant temperature
- engine RPM
- intake air temperature (2.4L only)
- throttle position

The PCM also regulates the fuel injection system. Refer to the Fuel Injection sections of Group 14.

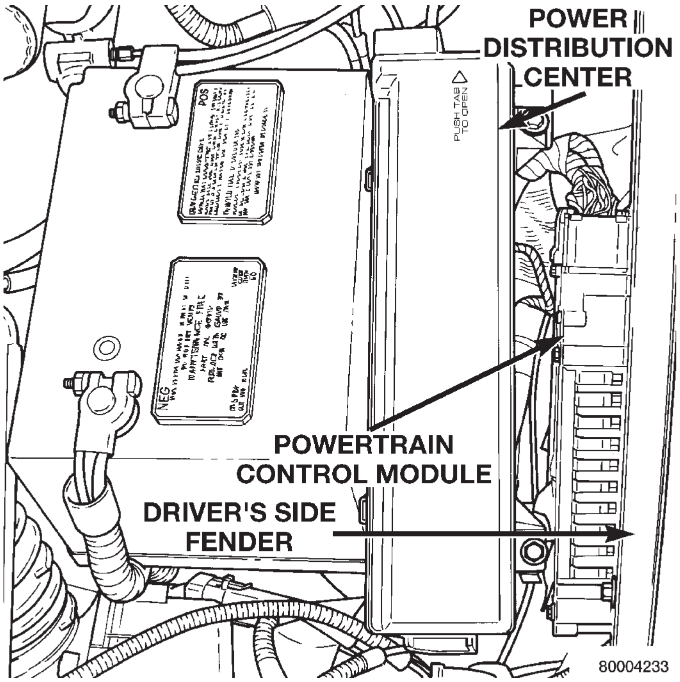

Fig. 1 Powertrain Control Module

IGNITION SYSTEM

NOTE: The 2.4, 3.0 and 3.3/3.8L engines use a fixed ignition timing system. Basic ignition timing is not adjustable. All spark advance is determined by the Powertrain Control Module (PCM).

The distributorless ignition system used on 2.4 and 3.3/3.8L engines is refered to as the Direct Ignition System (DIS). The system's three main components are the coil pack, crankshaft position sensor, and camshaft position sensor. The crankshaft position sensor and camshaft position sensor are hall effect devices.

The 3.0L engine uses a distributor, crankshaft sensor and ignition coil. The system's main components are the distributor, distributor pickup, camshaft signal, crankshaft signal and ignition coil.

SPARK PLUGS—2.4/3.0L

All engines use resistor spark plugs. They have resistance values ranging from 6,000 to 20,000 ohms when checked with at least a 1000 volt spark plug tester.

Do not use an ohm meter to check the resistance of the spark plugs. This will give an inaccurate reading.

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. An isolated 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. Refer to the Spark Plug Condition section of this group. After cleaning, file the center electrode flat with a small flat point file or jewelers file. Adjust the gap between the electrodes (Fig. 2) to the dimensions specified in the chart at the end of this section.

Special care should be used when installing spark plugs in the 2.4L cylinder head spark plug wells. Be sure the plugs do not drop into the wells, damage to the electrodes can occur.

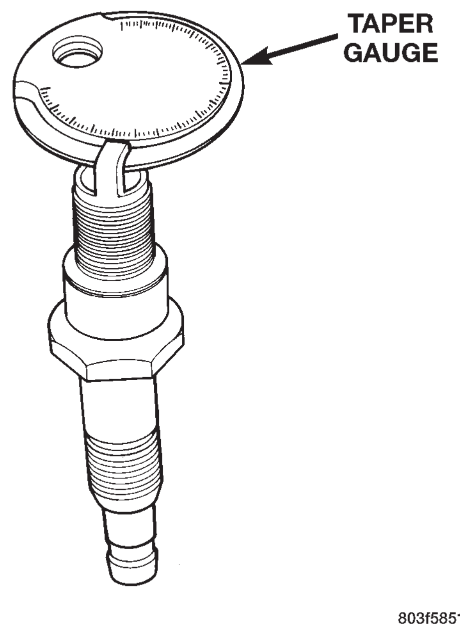

Fig. 2 Setting Spark Plug Electrode Gap

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap. Overtightening can also damage the cylinder head. Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

SPARK PLUGS—3.3/3.8L

The 3.3/3.8L engines utilize platinum spark plugs. Refer to the maintenance schedule in Group 0 of this service manual.

GENERAL INFORMATION (Continued)

All engines use resistor spark plugs. They have resistance values ranging from 6,000 to 20,000 ohms when checked with at least a 1000 volt spark plug tester.

Do not use an ohm meter to check the resistance of the spark plugs. This will give an inaccurate reading.

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. An isolated 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. Refer to the Spark Plug Condition section of this group.

The spark plugs are double platinum and have a recommended service life of 100,000 miles for normal driving conditions per schedule A in this manual. The spark plugs have a recommended service life of 75,000 miles for serve driving conditions per schedule B in this manual. A thin platinum pad is welded to both electrode ends as show in (Fig. 3). Extreme care must be used to prevent spark plug cross threading, mis-gaping and ceramic insulator damage during plug removal and installation.

CAUTION: Never attempt to file the electrodes or use a wire brush for cleaning platinum plugs. This would damage the platinum pads which would shorten spark plug life.

Apply a very small amount of anti-seize compound to the threads when reinstalling the vehicle's original spark plugs that have been determined good. **Do not apply anti-seize compound to new spark plugs.**

NOTE: Anti-seize compound is electrically conductive and can cause engine misfires if not applied correctly. It is extremely important that the anti-seize compound doesn't make contact with the spark plug electrodes or ceramic insulator.

Never force a gap gauge between the platinum electrodes or adjust the gap on platinum spark plugs without reading the 3.3/3.8L Spark Plug Gap Measurement procedures in this section.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap. Overtightening can also damage the cylinder head. Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

Due to the engine packaging environment for the 3.3/3.8L engines, extreme care should be used when installing the spark plugs to avoid cross threading problems.

3.3/3.8L SPARK PLUG GAP MEASUREMENT

CAUTION: The Platinum pads can be damaged during the measurement of checking the gap if extreme care is not used.

- **USE ONLY A TAPER GAP GAUGE (Fig. 2)**
- Never force the gap gauge through the platinum pads. Only apply enough force until resistance is felt.
- Never use a wire brush or spark plug cleaner machine to clean platinum spark plugs
- Use an OSHA approved air nozzle when drying gas fouled spark plugs.

If gap adjustment is required of platinum plug, bend only the ground electrode. DO NOT TOUCH the platinum pads. Use only a proper gapping tool and check with a taper gap gauge.

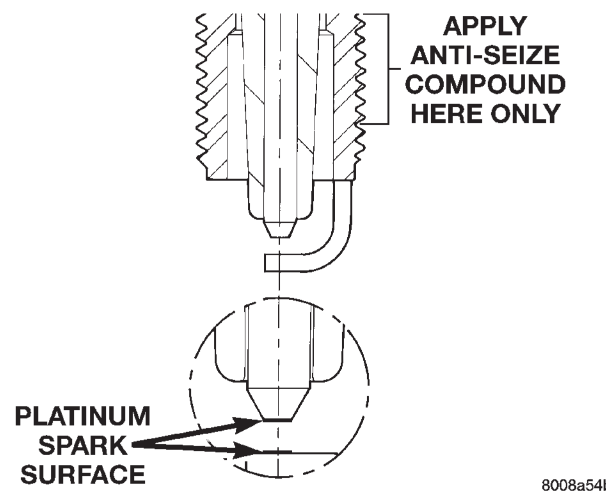

Fig. 3 Platinum Pads

CAUTION: Cleaning of the platinum plug may damage the platinum tip.

SPARK PLUG CABLE

Spark Plug cables are sometimes referred to as secondary ignition wires. The wires transfer electrical current from the ignition coil pack, distributor (3.0L), to individual spark plugs at each cylinder. The resistive spark plug cables are of nonmetallic construction. The cables provide suppression of radio frequency emissions from the ignition system.

Check the spark plug cable connections for good contact at the coil, distributor cap towers (3.0L), and spark plugs. Terminals should be fully seated. The insulators should be in good condition and should fit tightly on the coil, distributor (3.0L) and spark plugs. Spark plug cables with insulators that are cracked or torn must be replaced.

GENERAL INFORMATION (Continued)

Clean Spark Plug cables with a cloth moistened with a non-flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

SPARK PLUG CABLES—3.3/3.8L

The spark plug cables and spark plug boots are made from high temperature silicone materials. The spark plug boots utilize metal heat shields for thermal protection from the exhaust manifold. The heat shields slide over the spark plug boots. The notches on the heat shields ensure the spark plug boot and shield twist together during spark plug boot removal. They also identify proper heat shield installation on the boot for service. **Refer to 3.3/3.8L Spark Plug Cable removal and installation.** All spark plug cable leads are properly identified with cylinder numbers. The inside of the spark plug boot is coated with a special high temperature silicone grease for greater sealing and to minimize boot bonding to the spark plug insulator. The convoluted tubing on the rear plug cables are made of a high temperature plastic material. Under normal driving conditions, the spark plug cables have a recommended service life of a 100,000 miles. The spark plugs have a recommended service life of 75,000 miles for severe driving conditions per schedule B in this manual.

The spark plug heat shield can be reused if an ignition cable is replaced due to failure. Never reuse heat shield's that have heat shield anti-twist, side or spark plug attachment tabs bent or missing. Ensure that the heat shield is properly attached to the spark plug to avoid RFI problems. The bottom of the spark plug heat shield must make contact with the spark plug hex.

The front ignition cables must not make contact with the oil dip stick tube and #5 cable must not touch the coil mounting bolt to avoid abrasion/dielectric failures.

IGNITION COIL

WARNING: THE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The ignition coil assembly consists of 3 independent coils molded together (Fig. 4). The coil assembly is mounted on the intake manifold. Spark plug cables route to each cylinder from the coil. The coil fires two spark plugs every power stroke. One plug is the cylinder under compression, the other cylinder fires on the exhaust stroke. The Powertrain Control Module (PCM) determines which of the coils to charge and fire at the correct time.

Coil 1 fires cylinders 1 and 4, coil 2 fires cylinders 2 and 5, coil 3 fires cylinders 3 and 6.

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 primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs. Refer to Auto Shutdown (ASD) Relay—PCM Output, in this section for relay operation.

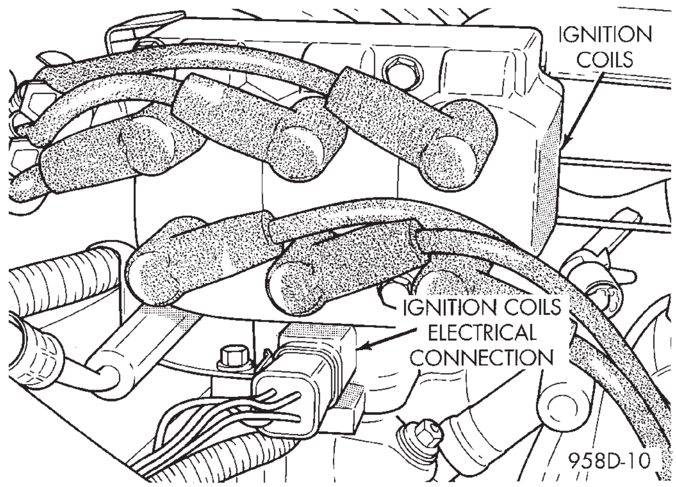

Fig. 4 Ignition Coil Pack

AUTOMATIC SHUTDOWN (ASD) RELAY

The Powertrain Control Module (PCM) operates the Auto Shutdown (ASD) relay by switching the ground path on and off.

The ASD relay supplies battery voltage to the fuel injectors, electronic ignition coil and the heating elements in the oxygen sensors.

The PCM controls the relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position unless the 02 Heater Monitor test is being run. Refer to Group 25, On-Board Diagnostics. When the ignition switch is in the On or Crank position, the PCM monitors the crankshaft position sensor and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive the crankshaft position sensor and camshaft position sensor signals when the ignition switch is in the Run position, it will de-energize the ASD relay.

The ASD relay is located in the Power Distribution Center (PDC). The PDC is located on the driver's side inner fender well (Fig. 5). A label on the underside of the PDC cover identifies the relays and fuses in the PDC.

GENERAL INFORMATION (Continued)

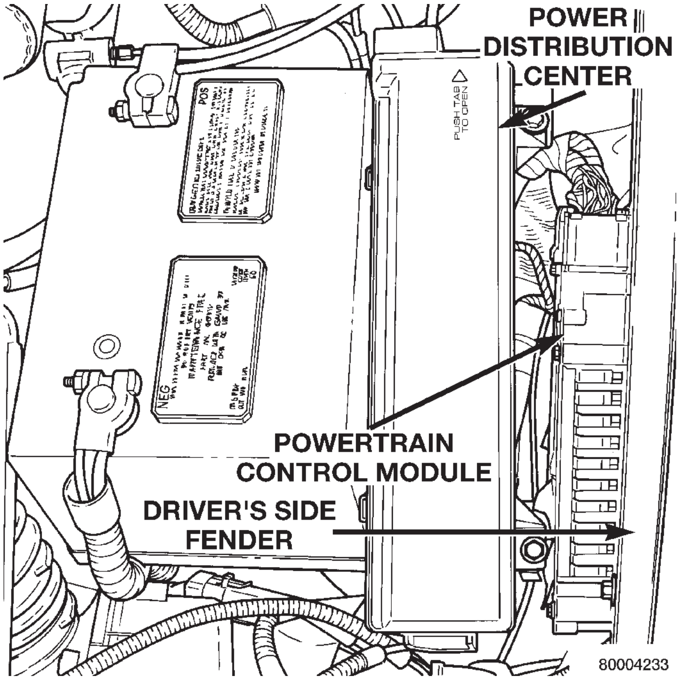

Fig. 5 Power Distribution Center

CRANKSHAFT POSITION SENSOR

The crankshaft position sensor detects slots cut into the transmission driveplate extension (Fig. 6). There are 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 7). Basic timing is set by the position of the last slot in each group. Once the Powertrain Control Module (PCM) senses the last slot, it determines crankshaft position (which piston will next be at TDC) from the camshaft position sensor input. The 4 pulses generated by the crankshaft position sensor represent the 69°, 49°, 29°, and 9° BTDC marks. It may take the PCM one engine revolution to determine crankshaft position.

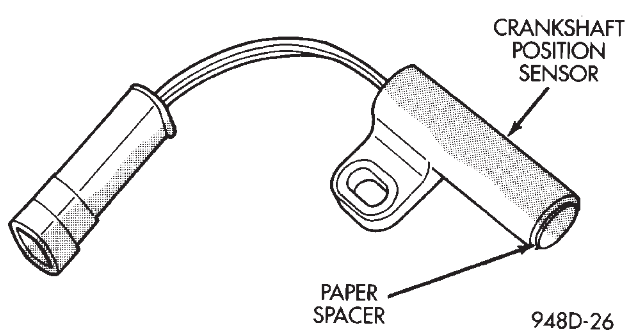

Fig. 6 Crankshaft Position Sensor

The PCM uses crankshaft position reference to determine injector sequence, ignition timing and the presence of misfire. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.

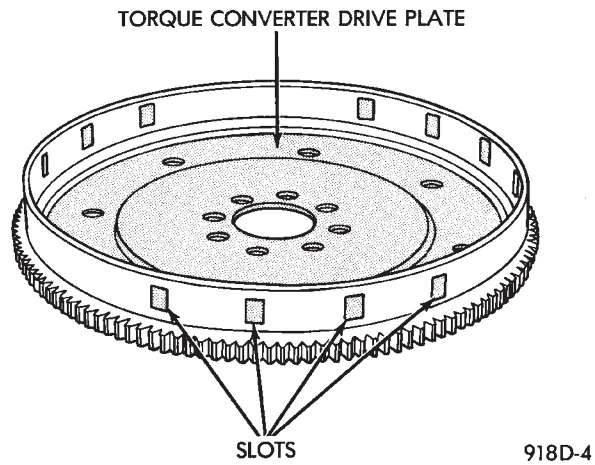

Fig. 7 Timing Slots

The crankshaft sensor is located on the passengers side of the transmission housing, above the differential housing (Fig. 8). The bottom of the sensor is positioned next to the drive plate.

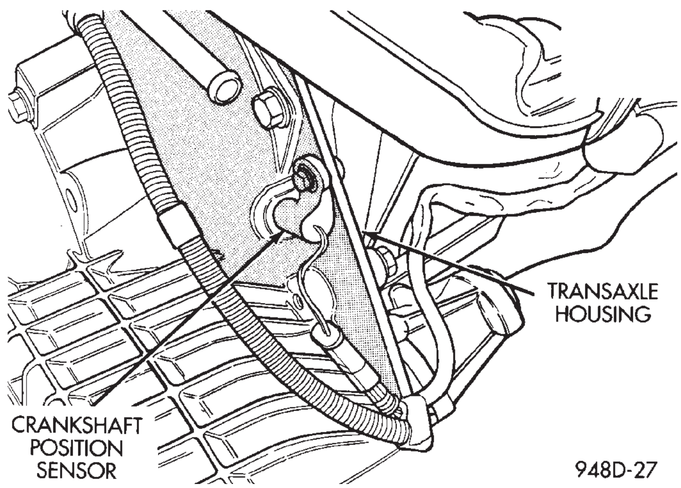

Fig. 8 Crankshaft Position Sensor Location

CAMSHAFT POSITION SENSOR

The camshaft position sensor provides cylinder identification to the Powertrain Control Module (PCM) (Fig. 9). The sensor generates pulses as groups of notches on the camshaft sprocket pass underneath it (Fig. 10). The PCM keeps track of crankshaft rotation and identifies each cylinder by the pulses generated by the notches on the camshaft sprocket. Four crankshaft pulses follow each group of camshaft pulses.

When the PCM receives 2 cam pulses followed by the long flat spot on the camshaft sprocket, it knows that the crankshaft timing marks for cylinder 1 are next (on driveplate). When the PCM receives one camshaft pulse after the long flat spot on the sprocket, cylinder number 2 crankshaft timing marks are next. After 3 camshaft pulses, the PCM knows

GENERAL INFORMATION (Continued)

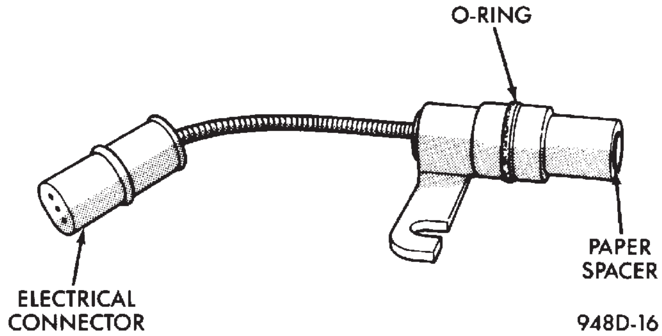

Fig. 9 Camshaft Position Sensor

cylinder 4 crankshaft timing marks follow. One camshaft pulse after the 3 pulses indicates cylinder 5. The 2 camshaft pulses after cylinder 5 signals cylinder 6 (Fig. 10). The PCM can synchronize on cylinders 1 or 4.

When metal aligns with the sensor, voltage goes low (less than 0.3 volts). When a notch aligns with the sensor, voltage switches high (5.0 volts). As a group of notches pass under the sensor, the voltage switches from low (metal) to high (notch) then back to low. The number of notches determine the amount of pulses. If available, an oscilloscope can display the square wave patterns of each timing event.

Top Dead Center (TDC) does not occur when notches on the camshaft sprocket pass below the cylinder. TDC occurs after the camshaft pulse (or pulses) and after the 4 crankshaft pulses associated with the particular cylinder. The arrows and cylinder call outs on Figure 4 represent which cylinder the flat spot and notches identify, they do not indicate TDC position.

The camshaft position sensor is mounted in the front of the timing case cover (Fig. 11).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The MAP sensor reacts to absolute pressure in the intake manifold and provides an input voltage to the Powertrain Control Module (PCM). As engine load changes, manifold pressure varies. The changes in engine load cause the MAP sensors resistance to change. The change in MAP sensor resistance results in a different input voltage to the PCM.

The input voltage level supplies the PCM with information relating to ambient barometric pressure during engine start-up (cranking) and engine load while its operating. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air-fuel mixture.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

The ECT sensor is located next to the thermostat housing (Fig. 12). The sensor provides an input voltage to the Powertrain Control Module (PCM). The

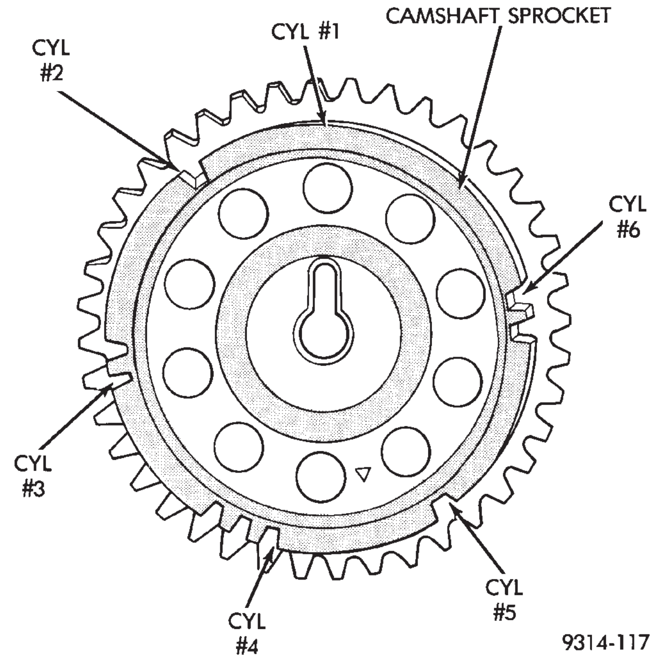

Fig. 10 Camshaft Sprocket

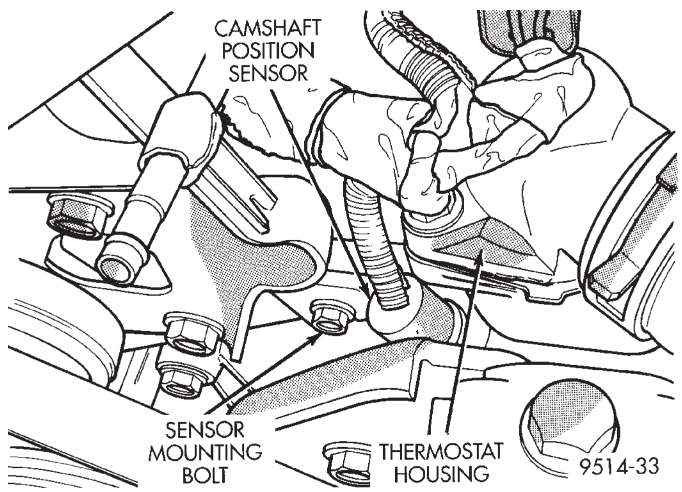

Fig. 11 Camshaft Position Sensor Location

sensor is a variable resistance (thermistor) with a range of -40°F to 265°F. As coolant temperature varies, the sensors resistance changes, resulting in a different input voltage to the PCM.

The PCM contains different spark advance schedules for cold and warm engine operation. The schedules reduce engine emission and improve driveability.

When the engine is cold, the PCM will demand slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached.

The ECT sensor input is also used for cooling fan control.

GENERAL INFORMATION (Continued)

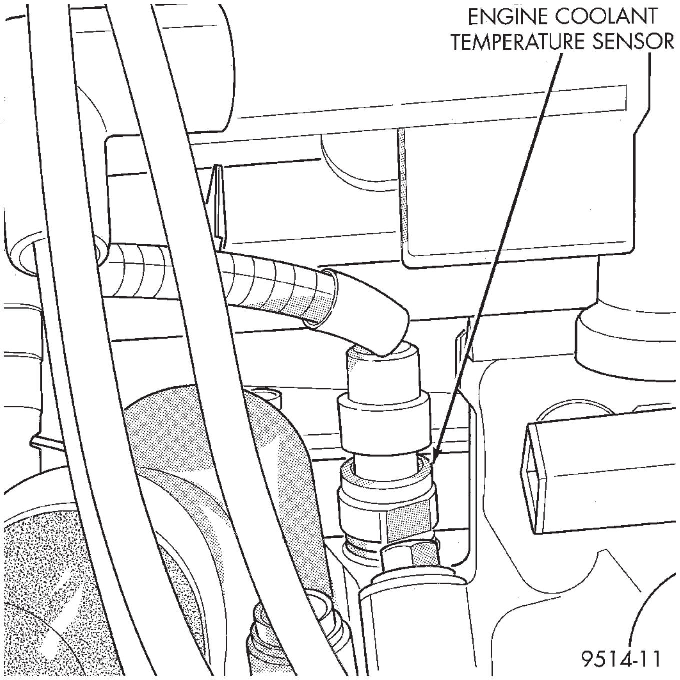

Fig. 12 Engine Coolant Temperature Sensor—3.3/3.8L

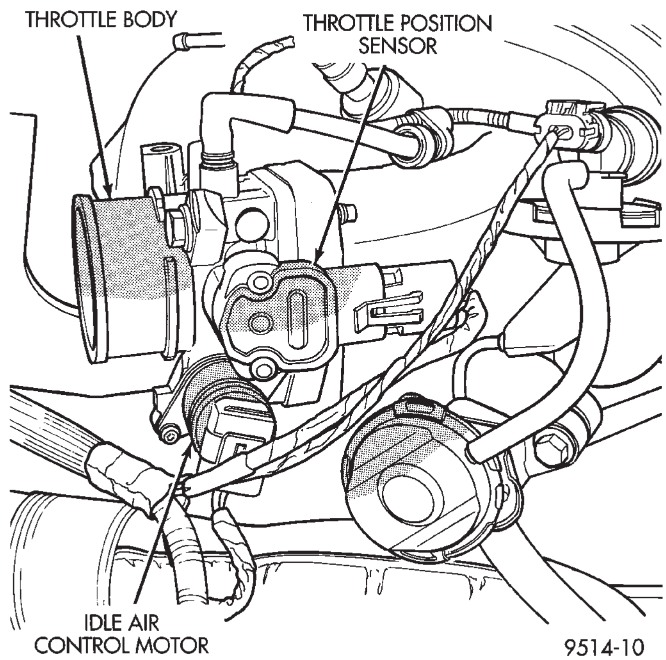

Fig. 13 Throttle Position Sensor and Idle Air Control Motor

THROTTLE POSITION SENSOR (TPS)

The TPS mounts to the side of the throttle body (Fig. 13).

The TPS connects to the throttle blade shaft. The TPS is a variable resistor that provides the Powertrain Control Module (PCM) with an input signal (voltage). The signal represents throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the powertrain control module) represents throttle blade position. The TPS output voltage to the PCM varies from approximately 0.40 volt at minimum throttle opening (idle) to a maximum of 3.80 volts at wide open throttle.

Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. The PCM also adjusts fuel injector pulse width and ignition timing based on these inputs.

LOCK KEY CYLINDER

The lock cylinder is inserted in the end of the housing opposite the ignition switch. The ignition key rotates the cylinder to 5 different detents (Fig. 14):

- Accessory
- Off (lock)
- Unlock
- On/Run
- Start

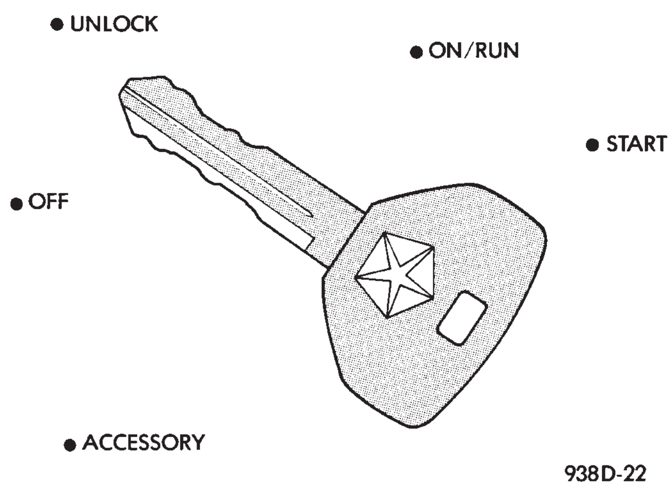

Fig. 14 Ignition Lock Cylinder Detents

KNOCK SENSOR

The knock sensor threads into the side of the cylinder block in front of the starter motor. When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increase, the knock sensor output voltage also increases.

GENERAL INFORMATION (Continued)

NOTE: Over or under tightening effects knock sensor performance, possibly causing improper spark control.

DIAGNOSIS AND TESTING

TESTING FOR SPARK AT COIL—2.4/3.3/3.8L ENGINES

WARNING: THE DIRECT IGNITION SYSTEMS GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The coil pack contains independent coils. Each coil must be checked individually.

CAUTION: Spark plug wire damage may occur if the spark plug is moved more than 1/4 inch away from the engine ground.

CAUTION: Do not leave any one spark plug cable disconnected any longer than 30 seconds or possible heat damage to catalytic converter will occur.

CAUTION: Test must be performed at idle and in park only with the parking brake on.

Use a new spark plug and spark plug cable for the following test.

(1) Insert a new spark plug into the new spark plug boot. Ground the plug to the engine (Fig. 15). Do not hold with your hand.

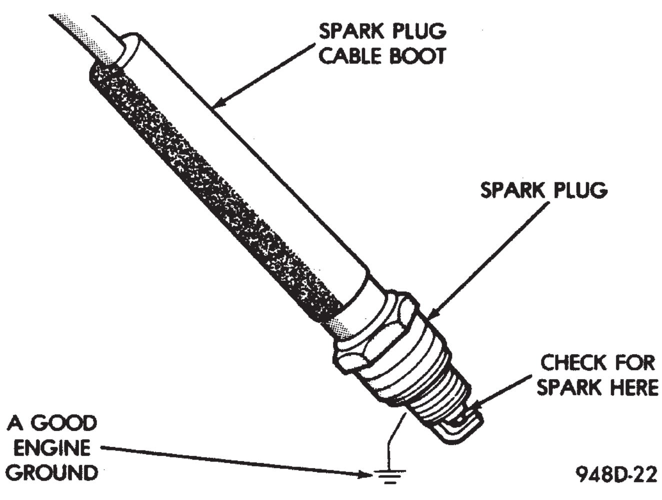

Fig. 15 Testing For Spark

(2) Starting with coil insulator #1, remove it from the DIS coil.

(3) Plug the test spark plug cable onto #1 coil tower. Make sure a good connection is made; there should be a click sound.

(4) Crank the engine and look for spark across the electrodes of the spark plug.

CAUTION: Always install the cable back on the coil tower after testing to avoid damage to the coil and catalytic converter.

(5) Repeat the above test for the remaining coils. If there is no spark during all cylinder tests, proceed to the Failure To Start Test.

(6) If one or more tests indicate irregular, weak, or no spark, proceed to Check Coil Test.

TESTING FOR SPARK AT COIL—3.0L

WARNING: APPLY PARKING BRAKE AND/OR BLOCK THE WHEELS BEFORE PERFORMING ANY TEST WITH THE ENGINE RUNNING.

CAUTION: Spark plug cables may be damaged if this test is performed with more than 1/4 inch clearance between the cable and engine ground.

Remove the coil secondary cable from the distributor cap. Hold the end of cable about 6 mm (1/4-inch) away from a good engine ground using non-conductive ignition pliers (Fig. 16). Crank the engine and inspect for spark at the coil secondary cable.

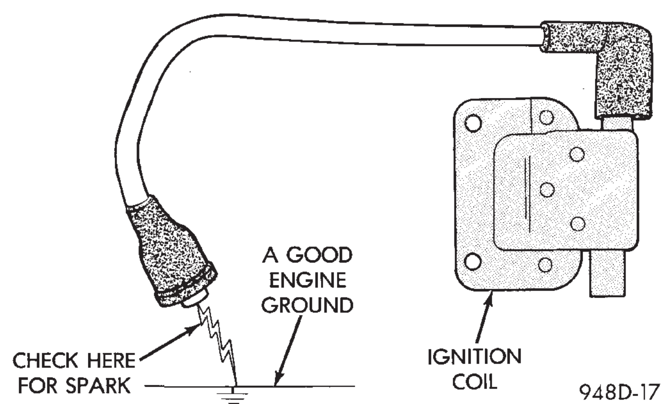

Fig. 16 Checking for Spark

There must be a constant spark at the coil secondary cable. If spark is not constant or there is no spark, proceed to the failure to start test. If the spark is constant, continue to crank engine and, while slowly moving coil secondary cable away from ground, look for arcing at the coil tower. If arcing occurs at the tower, replace the coil.

If a constant spark is present and no arcing occurs at the coil tower, the ignition system is producing the necessary high secondary voltage. However, make

DIAGNOSIS AND TESTING (Continued)

sure that the spark plugs are firing. Inspect the distributor rotor, cap, spark plug cables, and spark plugs. If they are in proper working order, the ignition system is not the reason why the engine will not start. Inspect the fuel system and engine for proper operation.

CHECK COIL TEST—2.4L

Coil one fires cylinders 1 and 4, coil two fires cylinders 2 and 3. Each coil tower is labeled with the number of the corresponding cylinder.

(1) Remove ignition cables and measure the resistance of the cables. Resistance must be within the range shown in the Cable Resistance Chart in Specifications. Replace any cable not within tolerance.

(2) Disconnect the electrical connector from the coil pack.

(3) Measure the primary resistance of each coil. At the coil, connect an ohmmeter between the B+ pin and the pin corresponding to the cylinders in question (Fig. 17). Resistance on the primary side of each coil should be 0.45 - 0.65 ohm at (70° to 80° F). Replace the coil if resistance is not within tolerance.

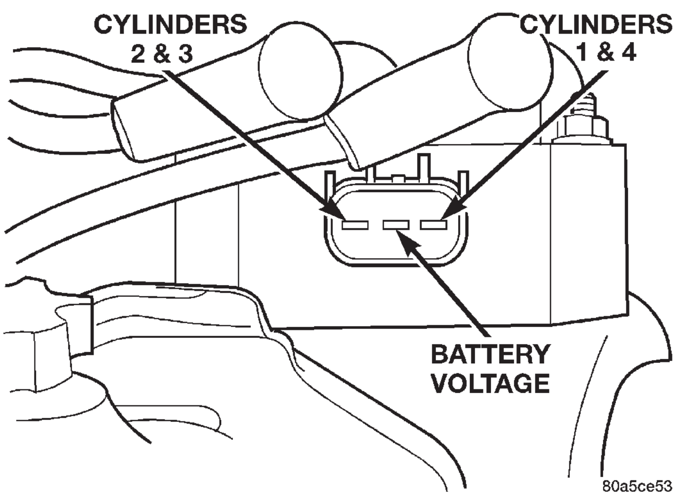

Fig. 17 Terminal Identification

(4) Remove ignition cables from the secondary towers of the coil. Measure the secondary resistance of the coil between the towers of each individual coil (Fig. 18). Secondary resistance should be 7,000 to 15,800 ohms. Replace the coil if resistance is not within tolerance.

CHECK COIL TEST—3.3/3.8L

Coil 1 fires cylinders 1 and 4, coil 2 fires cylinders 2 and 5, and coil 3 fires cylinders 3 and 6. Each coil tower is labeled with the number of the corresponding cylinder.

(1) Disconnect the electrical connector from the coil pack (Fig. 19).

(2) Measure the primary resistance of each coil. At the coil, connect an ohmmeter between the B+ pin and the pin corresponding to the cylinders in question (Fig. 20). Resistance on the primary side of each coil should be 0.45 - 0.65 ohm at 21° to 27°C (70° to 80°F). A coil that has not been allowed to cool off, would result in inaccurate measurement results. Replace the coil if resistance is not within tolerance.

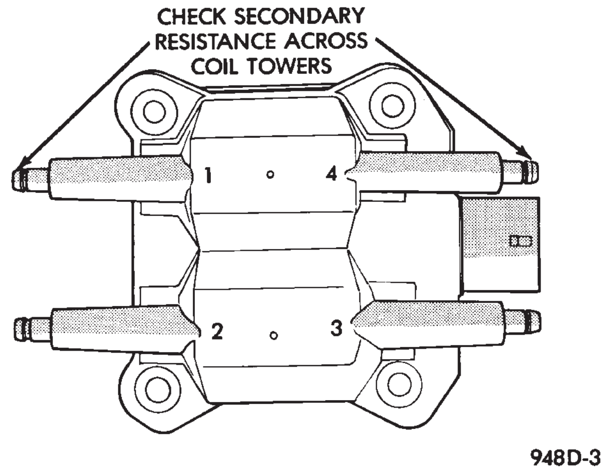

Fig. 18 Checking Ignition Coil Secondary Resistance

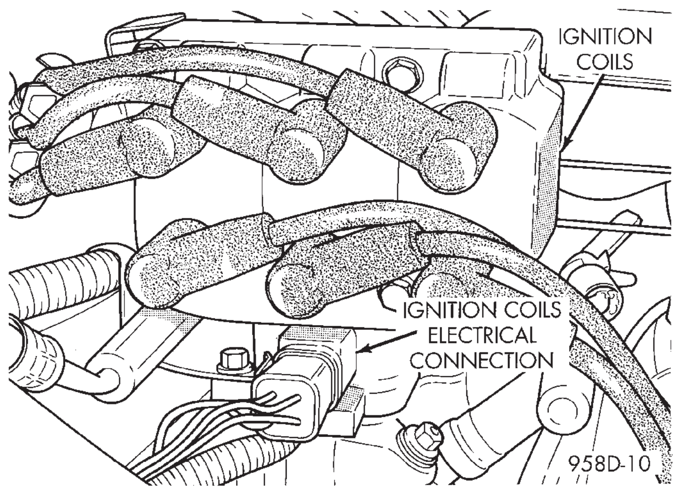

Fig. 19 Ignition Coil Electrical Connector

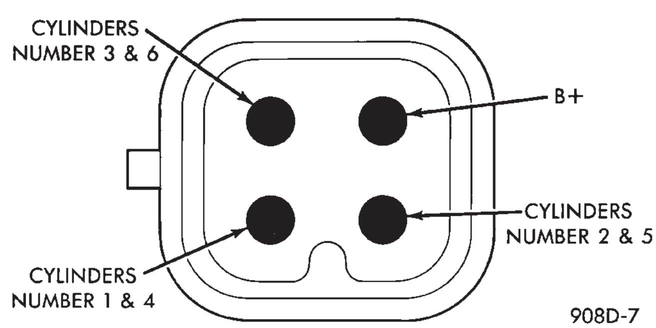

Fig. 20 Ignition Coil Terminal Identification

DIAGNOSIS AND TESTING (Continued)

(3) Remove ignition cables from the secondary towers of the coil. Measure the secondary resistance of the coil between the towers of each individual coil (Fig. 21). Secondary resistance should be 7,000 to 15,800 ohms. Replace the coil if resistance is not within tolerance.

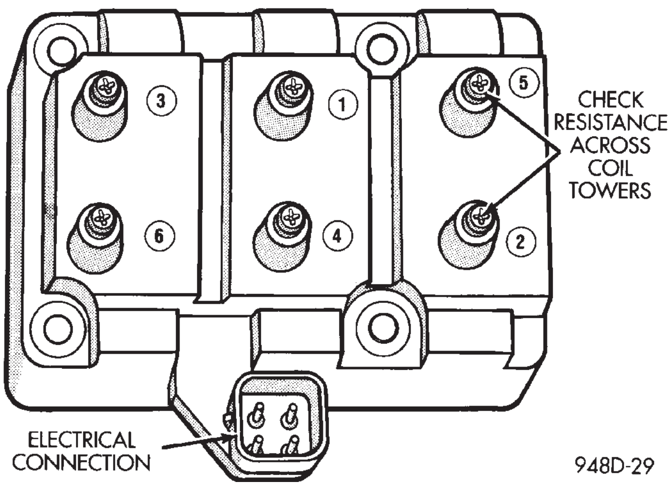

Fig. 21 Checking Ignition Coil Secondary Resistance

FAILURE TO START TEST

This no-start test checks the camshaft position sensor and crankshaft position sensor.

The Powertrain Control Module (PCM) supplies 8 volts to the camshaft position sensor and crankshaft position sensor through one circuit. If the 8 volt supply circuit shorts to ground, neither sensor will produce a signal (output voltage to the PCM).

When the ignition key is turned and left in the On position, the PCM automatically energizes the Auto Shutdown (ASD) relay. However, the controller de-energizes the relay within one second because it has not received a camshaft position sensor signal indicating engine rotation.

During cranking, the ASD relay will not energize until the PCM receives a camshaft position sensor signal. Secondly, the ASD relay remains energized only if the controller senses a crankshaft position sensor signal immediately after detecting the camshaft position sensor signal.

(1) Check battery voltage. Voltage should be approximately 12.66 volts or higher to perform failure to start test.

(2) Disconnect the harness connector from the coil pack.

(3) Connect a test light to the B+ (battery voltage) terminal of the coil electrical connector and ground as shown in (Fig. 22). The B+ wire for the DIS coil is dark green with an orange tracer. **Do not spread the terminal with the test light probe.**

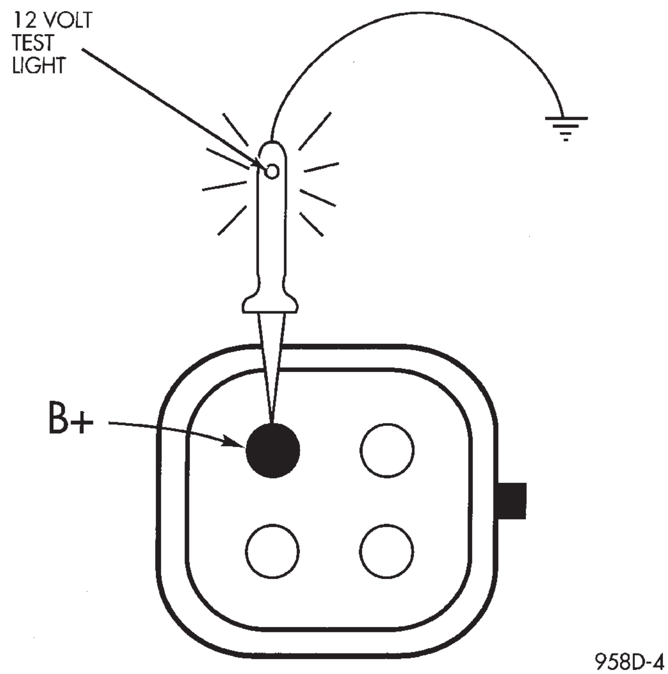

Fig. 22 Ignition Coil Engine Harness Connector

(4) Turn the ignition key to the **ON position.** The test light should flash On and then Off. **Do not turn the Key to off position, leave it in the On position**.

(a) If the test light flashes momentarily, the PCM grounded the Auto Shutdown (ASD) relay. Proceed to step 5.

(b) If the test light did not flash, the ASD relay did not energize. The cause is either the relay or one of the relay circuits. Use the DRB scan tool to test the ASD relay and circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

(5) Crank the engine. (If the key was placed in the off position after step 4, place the key in the On position before cranking. Wait for the test light to flash once, then crank the engine.)

(6) If the test light momentarily flashes during cranking, the PCM is not receiving a crankshaft position sensor signal. Use the DRB scan tool to test the crankshaft position sensor and sensor circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

(7) If the test light did not flash during cranking, unplug the crankshaft position sensor connector. Turn the ignition key to the off position. Turn the key to the On position, wait for the test light to momentarily flash once, then crank the engine. If the test light momentarily flashes, the crankshaft position sensor is shorted and must be replaced. If the light did not flash, the cause of the no-start is in

DIAGNOSIS AND TESTING (Continued)

either the crankshaft position sensor/camshaft position sensor 8 volt supply circuit, or the camshaft position sensor output or ground circuits. Use the DRB scan tool to test the camshaft position sensor and the sensor circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

IGNITION TIMING PROCEDURE

The engines for this vehicle, use a fixed ignition system. The PCM regulates ignition timing. Basic ignition timing is not adjustable.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

Refer to Group 14, Fuel System for Diagnosis and Testing.

CAMSHAFT POSITION SENSOR AND CRANKSHAFT POSITION SENSOR

The output voltage of a properly operating camshaft position sensor or crankshaft position sensor switches from high (5.0 volts) to low (0.3 volts). By connecting an Moper Diagonostic System (MDS) and engine analyzer to the vehicle, technicians can view the square wave pattern.

ENGINE COOLANT TEMPERATURE SENSOR

Refer to Group 14, Fuel System for Diagnosis and Testing.

INTAKE AIR TEMPERATURE SENSOR

Refer to Group 14, Fuel System, for Diagnosis and Testing.

SPARK PLUG CONDITION

NORMAL OPERATING CONDITIONS

The few deposits present will be probably light tan or slightly gray in color 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 1600 km (1000 miles) of operation for non platinum spark plugs. Non-platnium spark plugs that have normal wear can usually be cleaned, have the electrodes filed and regapped, and then reinstalled.

CAUTION: Never attempt to file the electrodes or use a wire brush for cleaning platinum spark plugs. This would damage the platinum pads which would shorten spark plug life.

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT may coat the entire tip of the spark plug with a rust colored deposit. The rust color deposits can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance is not affected by MMT deposits.

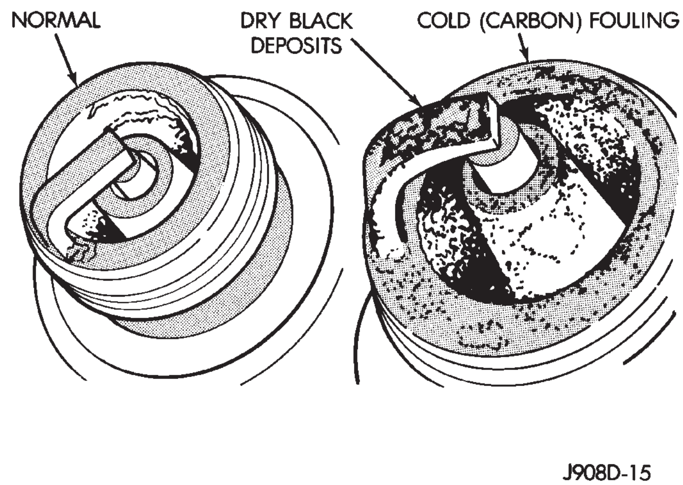

Fig. 23 Normal Operation and Cold (Carbon) Fouling

COLD FOULING (CARBON FOULING)

Cold fouling is sometimes referred to as carbon fouling because 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 misfire conditions. Cold (carbon) fouling of the entire set may be caused by a clogged air cleaner.

Cold fouling is normal after short operating periods. The spark plugs do not reach a high enough operating temperature during short operating periods. **Replace carbon fouled plugs with new spark plugs.**

FUEL FOULING

A spark plug that is coated with excessive wet fuel is called fuel fouled. This condition is normally observed during hard start periods. **Clean fuel fouled spark plugs with compressed air and reinstall them in the engine.**

OIL FOULING

A spark plug that is coated with excessive wet oil is oil fouled. In older engines, wet fouling can be caused by worn rings or excessive cylinder wear. Break-in fouling of new engines may occur before normal oil control is achieved. **Replace oil fouled spark plugs with new ones.**

OIL OR ASH ENCRUSTED

If one or more plugs are oil or ash encrusted, evaluate the engine for the cause of oil entering the combustion chambers (Fig. 24). Sometimes fuel additives can cause ash encrustation on an entire set of spark

DIAGNOSIS AND TESTING (Continued)

plugs. **Ash encrusted spark plugs can be cleaned and reused.**

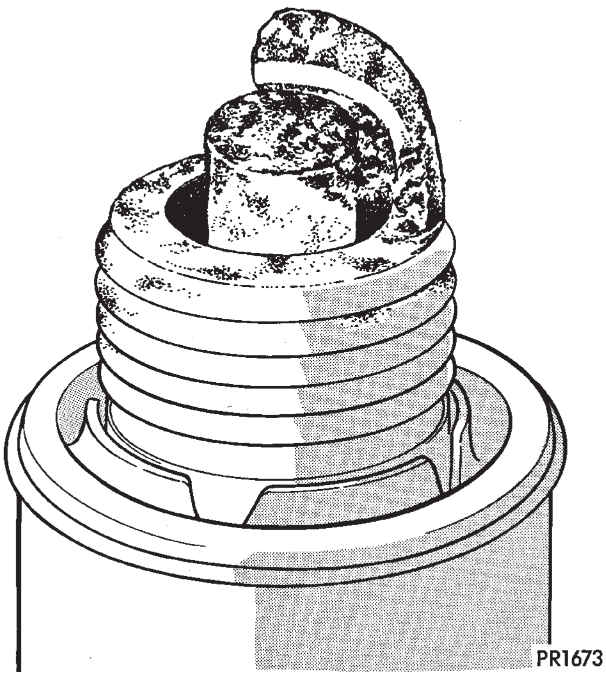

Fig. 24 Oil or Ash Encrusted

HIGH SPEED MISS

When replacing spark plugs because of a high speed miss condition; **wide open throttle operation should be avoided for approximately 80 km (50 miles) after installation of new plugs.** This will allow deposit shifting in the combustion chamber to take place gradually and avoid plug destroying splash fouling shortly after the plug change.

ELECTRODE GAP BRIDGING

Loose deposits in the combustion chamber can cause electrode gap bridging. The deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, the deposits partially liquefy and bridge the gap between the electrodes (Fig. 25). This short circuits the electrodes. **Spark plugs with electrode gap bridging can be cleaned and reused.**

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 26). They may appear to be harmful, but are 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, cleaned and reused.**

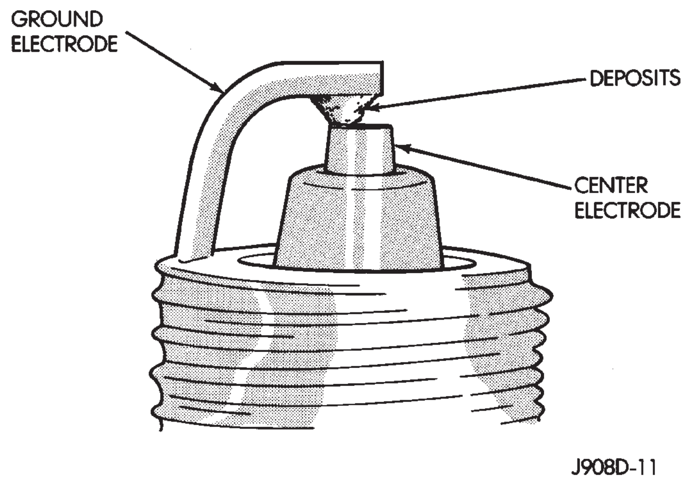

Fig. 25 Electrode Gap Bridging

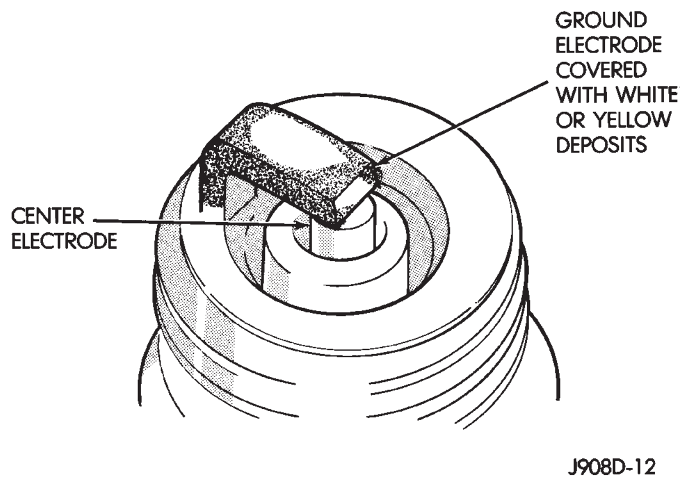

Fig. 26 Scavenger Deposits

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 also can separate the insulator from the center electrode (Fig. 27). **Spark plugs with chipped electrode insulators must be replaced.**

PREIGNITION DAMAGE

Excessive combustion chamber temperature can cause preignition damage. First, the center electrode dissolves and the ground electrode dissolves somewhat later (Fig. 28). Insulators appear relatively deposit free. Determine if the spark plugs are the correct type, as specified on the VECI label, or if other operating conditions are causing engine overheating.

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig.

DIAGNOSIS AND TESTING (Continued)

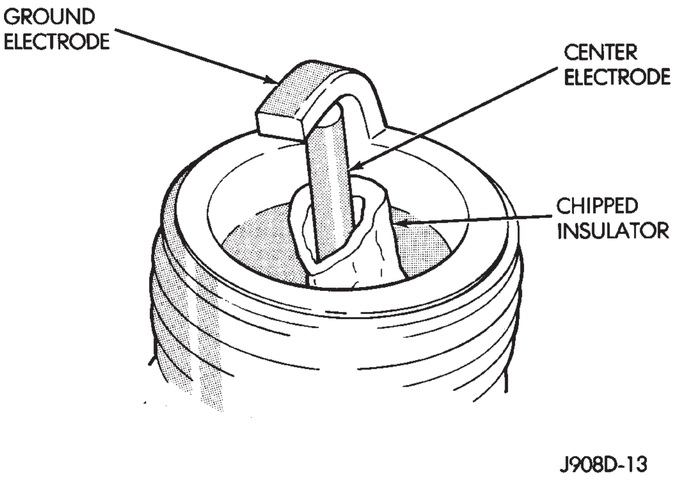

Fig. 27 Chipped Electrode Insulator

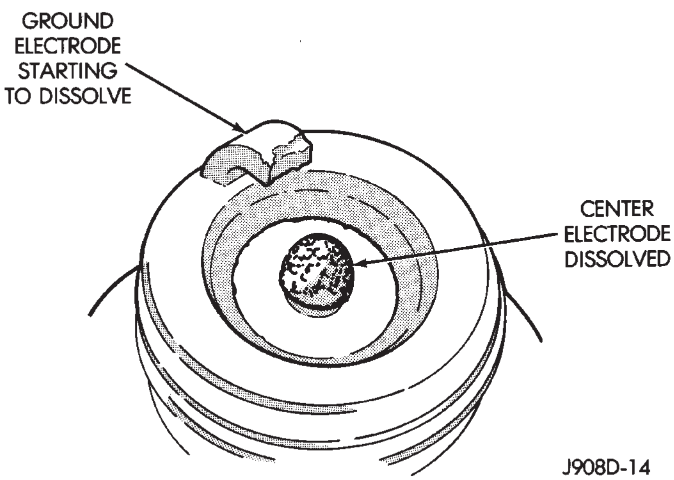

Fig. 28 Preignition Damage

29). The increase in electrode gap will be considerably in excess of 0.001 in per 1000 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 also can cause spark plug overheating.

THROTTLE POSITION SENSOR

To perform a complete test of the this sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the throttle position sensor only, refer to the following:

The Throttle Position Sensor (TPS) can be tested with a digital voltmeter (DVM). The center terminal of the sensor is the output terminal. One of the other terminals is a 5 volt supply and the remaining terminal is ground.

Connect the DVM between the center and sensor ground terminal. Refer to Group 8W - Wiring Diagrams for correct pinout.

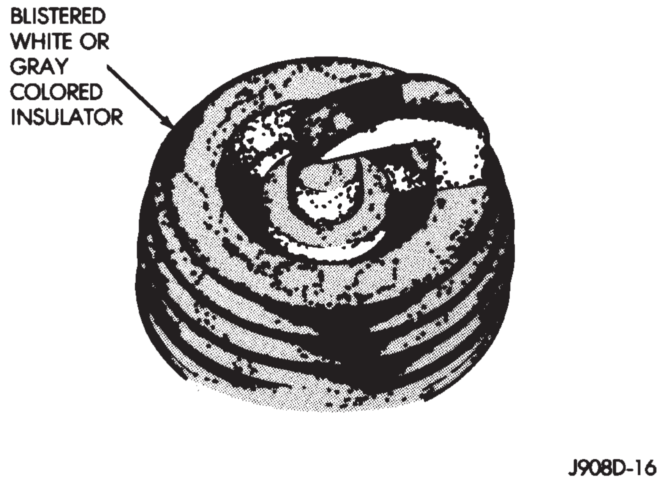

Fig. 29 Spark Plug Overheating

With the ignition switch in the ON position, check the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at Wide-Open-Throttle (WOT). At idle, TPS output voltage should be approximately 0.38 volts to 1.2 volts. At wide open throttle, TPS output voltage should be approximately 3.1 volts to 4.4 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

SERVICE PROCEDURES

SPARK PLUG GAP ADJUSTMENT

Check the spark plug gap with a gap gauge. If the gap is not correct, adjust it by bending the ground electrode (Fig. 30).

CAUTION: The Platinum pads can be damaged during the measurement of checking the gap if extreme care is not used.

Refer to 3.3/3.8L Spark Plug Gap Measurment in this section.

POWERTRAIN CONTROL MODULE

REMOVAL

(1) Disconnect both cables from battery, negative cable first.

(2) Remove 2 screws holding Power Distribution Center (PDC) to bracket (Fig. 31).

(3) Remove heat shield from battery (Fig. 32).

(4) Remove nut and clamp holding battery to battery tray (Fig. 33).

(5) Remove battery from vehicle.

(6) Rotate PDC toward center of vehicle to remove from rear bracket (Fig. 34).

SERVICE PROCEDURES (Continued)

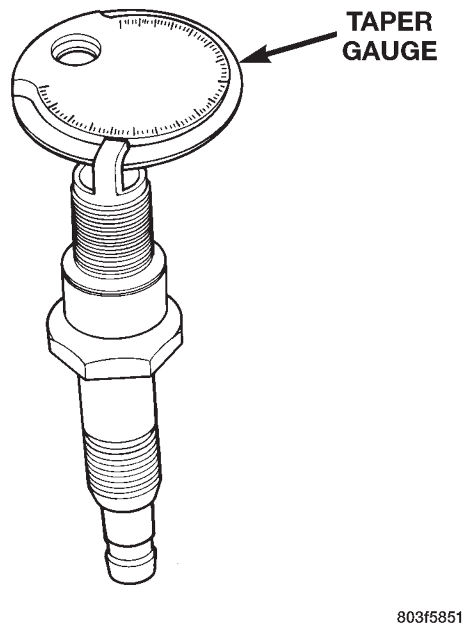

Fig. 30 Setting Spark Plug Electrode Gap—Typical

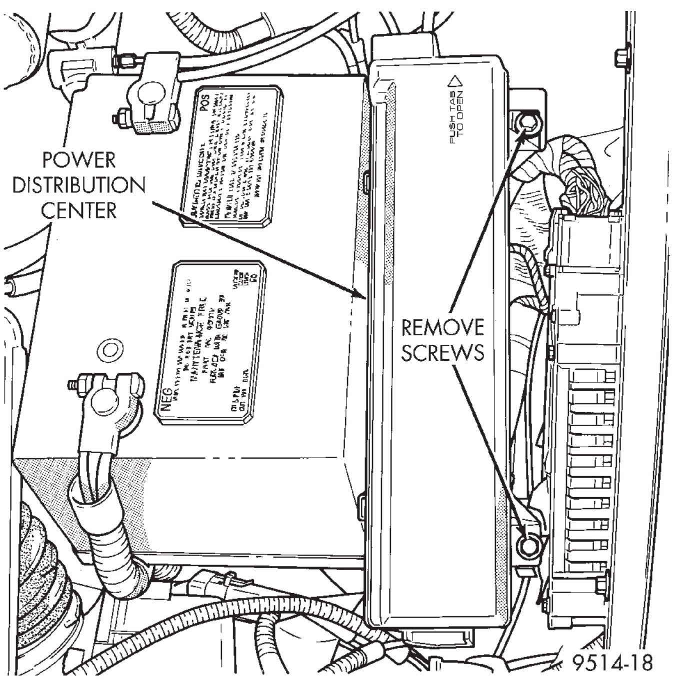

Fig. 31 Power Distribution Center Retaining Screws

(7) Pull PDC rearward to remove from front bracket. Lay PDC aside to allow access to Powertrain Control Module (PCM).

(8) Squeeze tabs on 40-way connector. Pull connector rearward to remove from PCM (Fig. 35). Remove both way connectors.

(9) Remove 3 screws holding PCM to fender (Fig. 36).

(10) Remove PCM from vehicle.

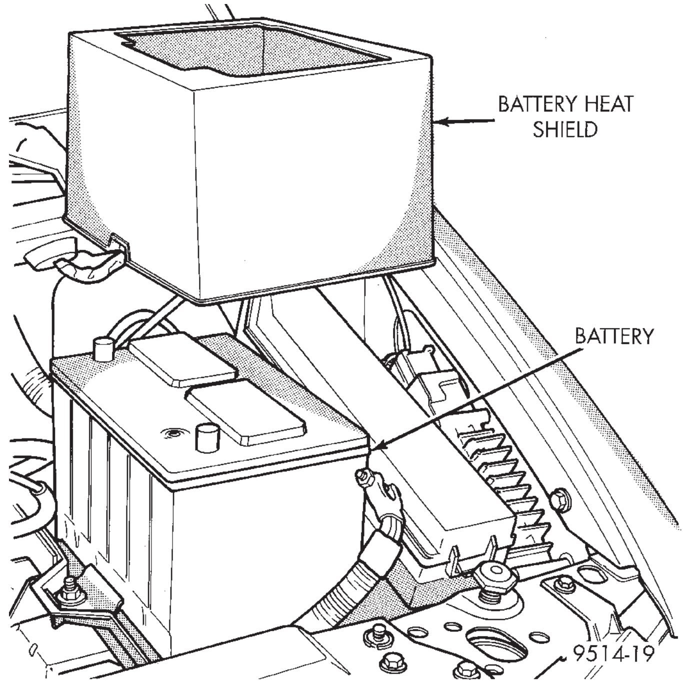

Fig. 32 Battery Heat Shield

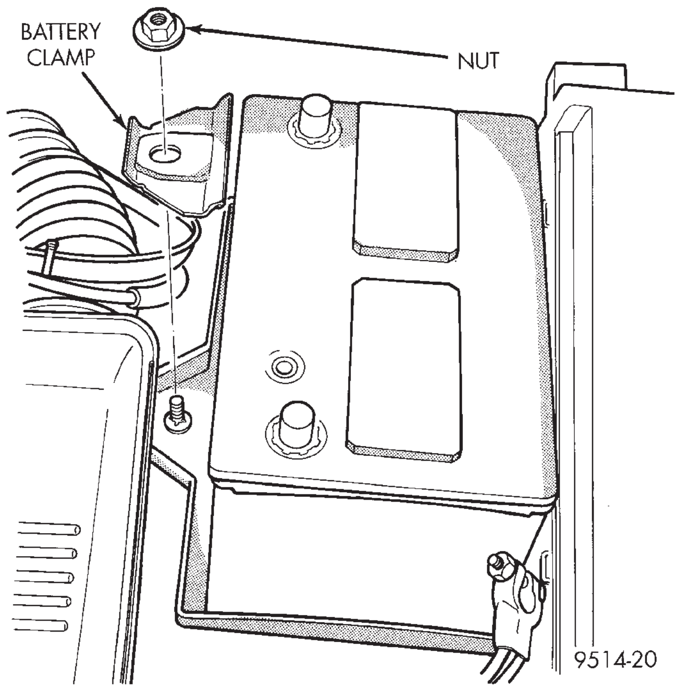

Fig. 33 Battery Clamp

INSTALLATION

(1) Connect 2 40-Way electrical connectors to PCM (Fig. 35).

(2) Install PCM. Tighten mounting screws.

(3) Install PDC bracket.

(4) Install battery.

SERVICE PROCEDURES (Continued)

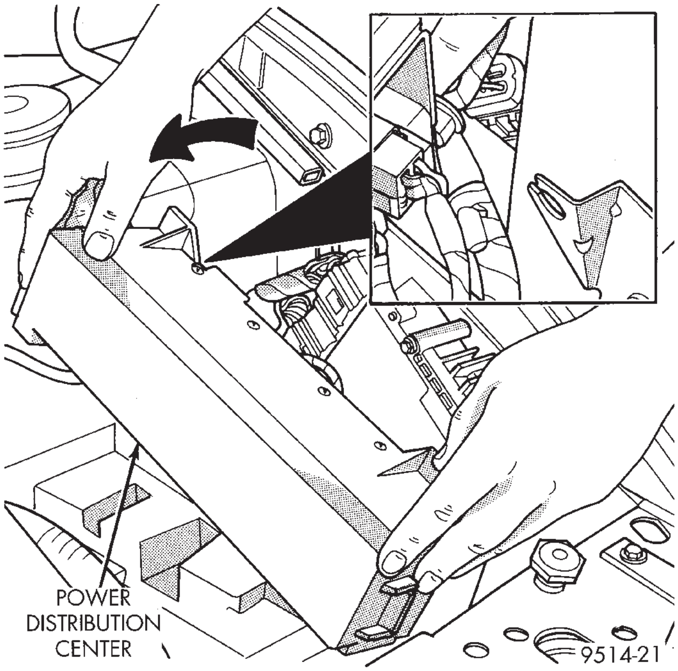

Fig. 34 PDC Rear Bracket

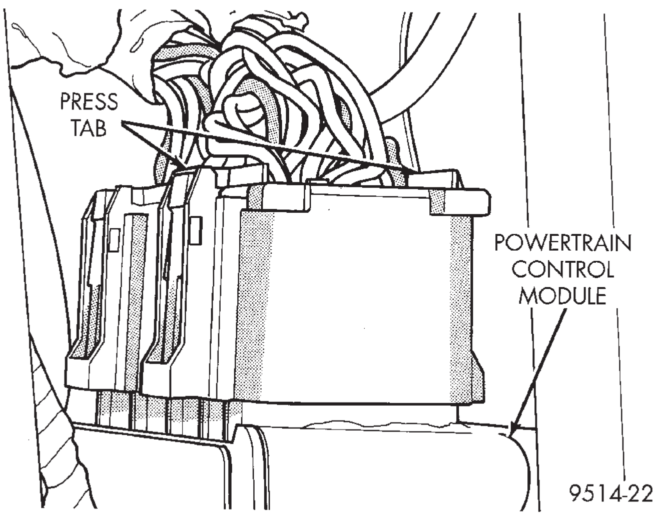

Fig. 35 PCM 40-Way Connectors

IGNITION TIMING PROCEDURE

The 2.4, 3.0, and 3.3/3.8L engines use a fixed ignition system. Basic ignition timing is not adjustable.

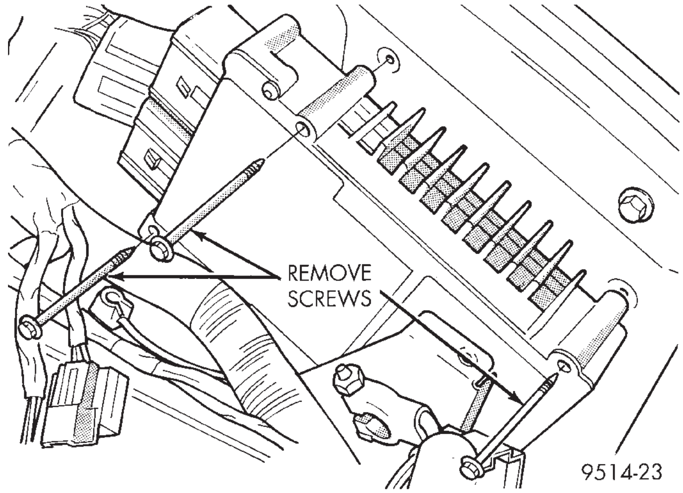

Fig. 36 PCM Removal/Installation

The Powertrain Control Module (PCM) regulates ignition timing.

2.4L ENGINE

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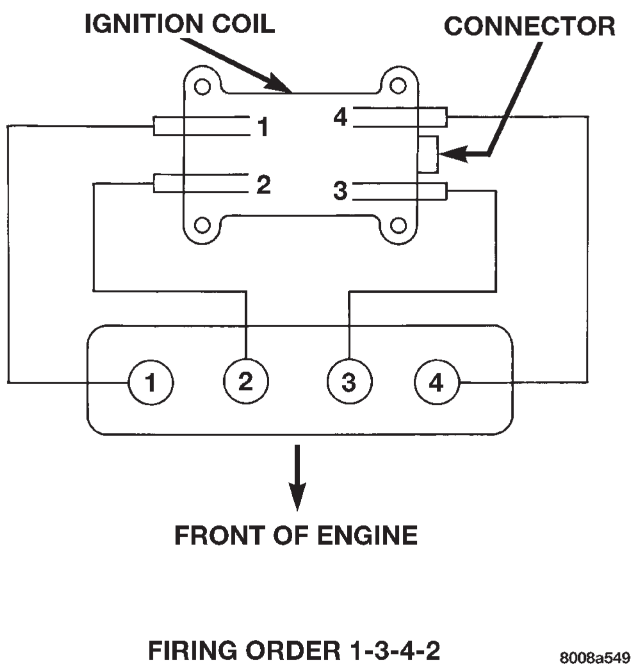
DESCRIPTION AND OPERATION

FIRING ORDER—2.4L



FIRING ORDER—2.4L

CRANKSHAFT POSITION SENSOR

The PCM determines what cylinder to fire from the crankshaft position sensor input and the camshaft position sensor input. The second crankshaft counterweight has machined into it two sets of four timing reference notches and a 60 degree signature notch (Fig. 1). From the crankshaft position sensor input the PCM determines engine speed and crankshaft angle (position).

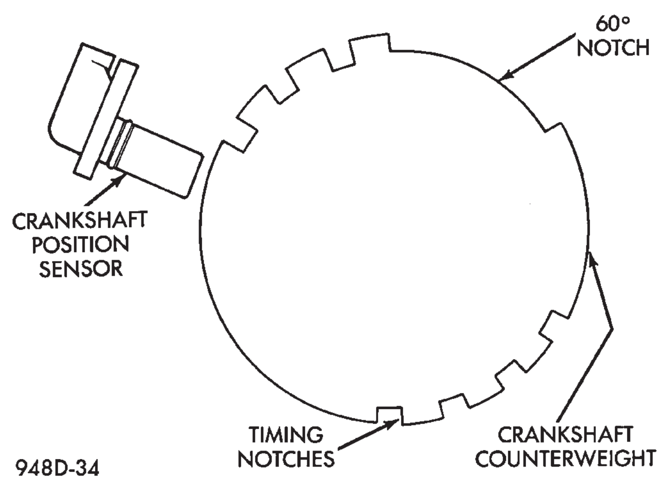


Fig. 1 Timing Reference Notches

The notches generate pulses from high to low in the crankshaft position sensor output voltage. When a metal portion of the counterweight aligns with the crankshaft position sensor, the sensor output voltage goes low (less than 0.3 volts). When a notch aligns with the sensor, voltage switches high (5.0 volts). As a group of notches pass under the sensor, the output voltage switches from low (metal) to high (notch) then back to low.

If available, an oscilloscope can display the square wave patterns of each voltage pulse. From the width of the output voltage pulses, the PCM calculates engine speed. The width of the pulses represent the amount of time the output voltage stays high before switching back to low. The period of time the sensor output voltage stays high before switching back to low is referred to as pulse width. The faster the

DESCRIPTION AND OPERATION (Continued)

engine is operating, the smaller the pulse width on the oscilloscope.

By counting the pulses and referencing the pulse from the 60 degree signature notch, the PCM calculates crankshaft angle (position). In each group of timing reference notches, the first notch represents 69 degrees before top dead center (BTDC). The second notch represents 49 degrees BTDC. The third notch represents 29 degrees. The last notch in each set represents 9 degrees before top dead center (TDC).

The timing reference notches are machined to a uniform width representing 13.6 degrees of crankshaft rotation. From the voltage pulse width the PCM tells the difference between the timing reference notches and the 60 degree signature notch. The 60 degree signature notch produces a longer pulse width than the smaller timing reference notches. If the camshaft position sensor input switches from high to low when the 60 degree signature notch passes under the crankshaft position sensor, the PCM knows cylinder number one is the next cylinder at TDC.

The crankshaft position sensor mounts to the engine block behind the generator, near the oil filter (Fig. 8).

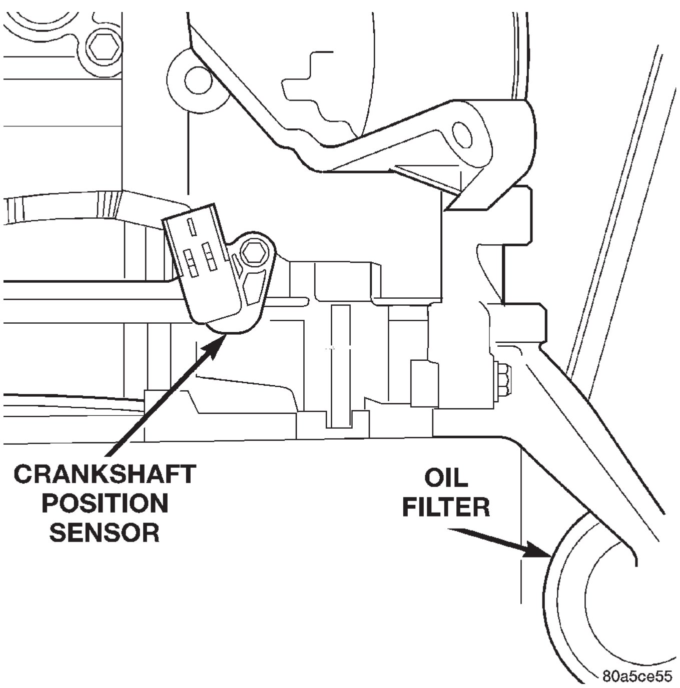


Fig. 2 Crankshaft Position Sensor

CAMSHAFT POSITION SENSOR

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

The camshaft position sensor attaches to the rear of the cylinder head (Fig. 2). A target magnet attaches to the rear of the camshaft and indexes to the correct position (Fig. 3). The target magnet has four different poles arranged in an asymmetrical pattern. As the target magnet rotates, the camshaft position sensor senses the change in polarity (Fig. 4). The sensor output switch switches from high (5.0 volts) to low (0.30 volts) as the target magnet rotates. When the north pole of the target magnet passes under the sensor, the output switches high. The sensor output switches low when the south pole of the target magnet passes underneath.

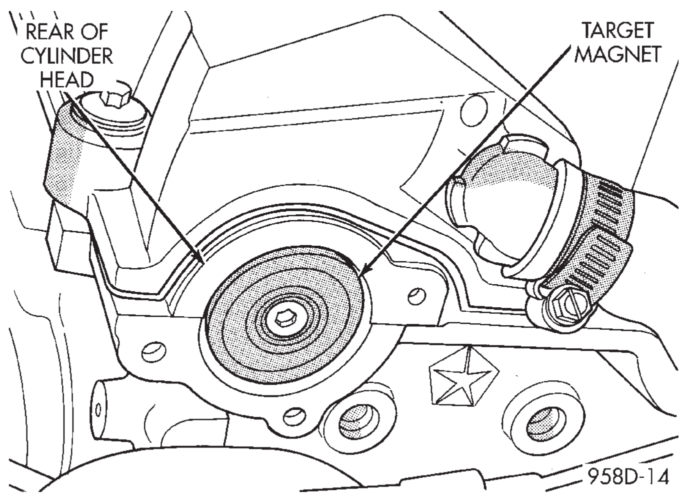


Fig. 3 Target Magnet

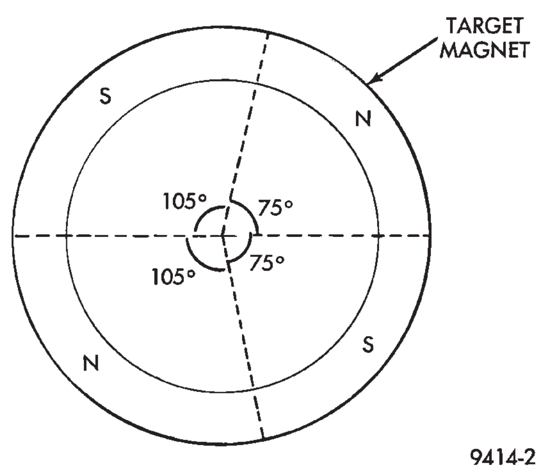


Fig. 4 Target Magnet Polarity

INTAKE AIR TEMPERATURE SENSOR—2.4L

The intake air temperature sensor measures the temperature of the air as it enters the engine. The sensor supplies one of the inputs the PCM uses to determine injector pulse width and spark advance.

The intake air temperature sensor threads into the intake manifold (Fig. 5).

DESCRIPTION AND OPERATION (Continued)

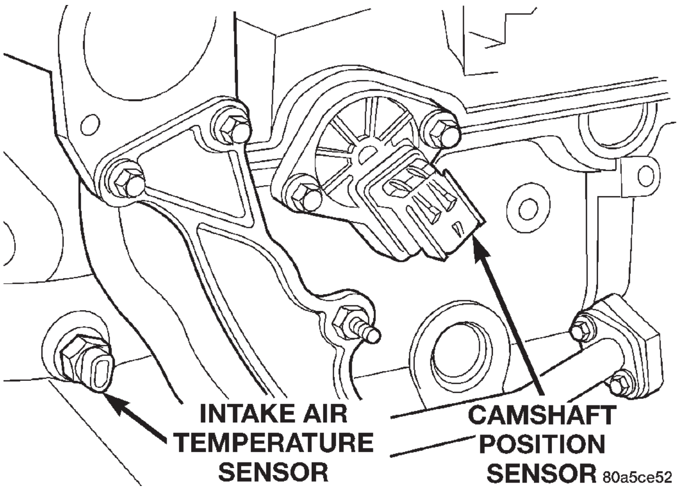


Fig. 5 Intake Air Temperature Sensor

REMOVAL AND INSTALLATION

SPARK PLUG CABLE SERVICE—2.4L

The cables insulate the spark plugs and covers the top of the spark plug tube (Fig. 6). To remove the cables, lightly grasp the top of the cable. Rotate the insulator 90° and pull straight up. To replace the cables, disconnect the cable from the ignition coil. **Ensure the #1 and #4 cables run under the #2 and #3 ignition coil towers. Keep #4 cable away from the oil fill cap.**

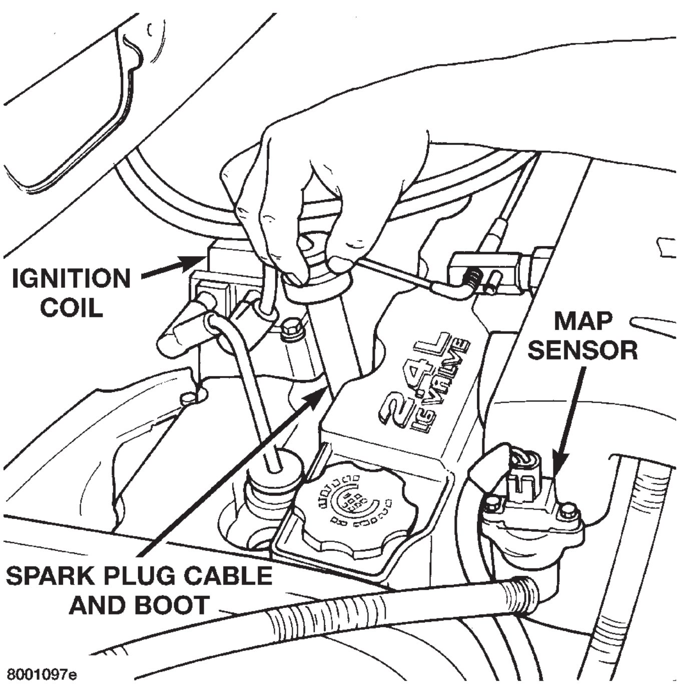


Fig. 6 Spark Plug Cables

SPARK PLUG SERVICE

When replacing the spark plugs and spark plug 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, cross ignition of the spark plugs or **short circuit the cables to ground.**

Never Wire Brush Spark Plugs. The spark plug insulator tip is harder than the bristles of wire brushes. Bristles of wire brushes can leave a conductive, metallic film on the insulator which could lead to conductive deposits. Conductive deposits can cause spark plug failure and engine misfire. Use a jewelers file to remove deposits from the electrode gap or use a spark plug cleaning machine to clean spark plugs.

REMOVAL

Always remove cables by grasping at the boot, rotating the boot 1/2 turn, and pulling straight back in a steady motion.

(1) Prior to removing the spark plug, spray compressed air around the spark plug hole and the area around the spark plug.

(2) Remove the spark plug using a quality socket with a foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

INSTALLATION

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install spark plug cables over spark plugs. A click will be heard and felt when the cable properly attaches to the spark plug.

IGNITION COIL—2.4L

REMOVAL

REMOVAL

(1) Remove spark plug cables from coil (Fig. 7). Always twist the coil boots to break the seal with the coil and pull straight back on the boot.

(2) Remove ignition coil electrical connector.

(3) Remove ignition coil mounting bolts, throttle cable bracket or clip.

(4) Remove ignition coil.

INSTALLATION

(1) Reverse the above procedure for installation. Tighten mounting screws to 12 N·m (105 in. lbs.) torque.

(2) Transfer ignition cables to new coil pack. The coil pack towers and cables are numbered with cylinder identification.

REMOVAL AND INSTALLATION (Continued)

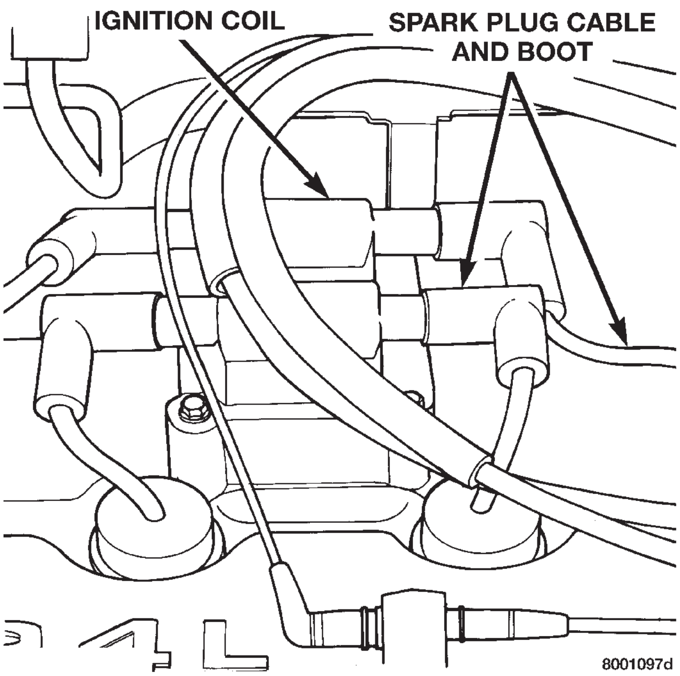


Fig. 7 Ignition Coil Removal

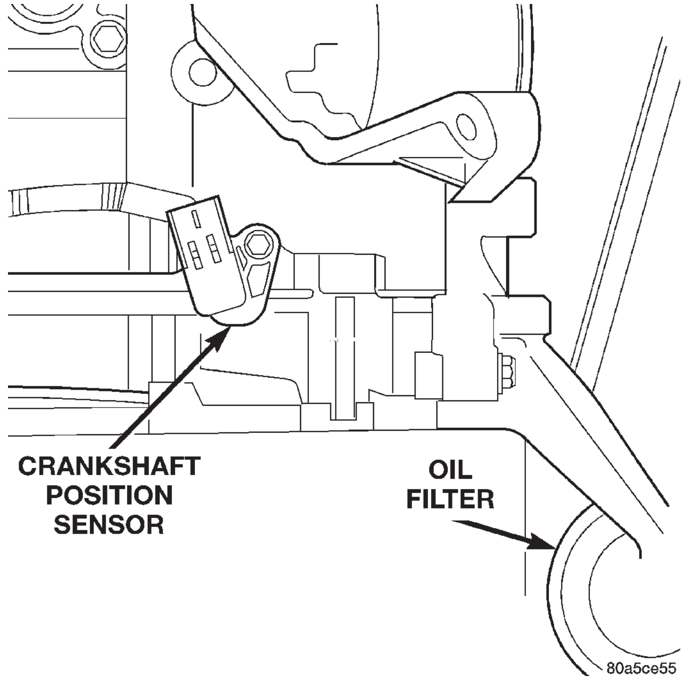


Fig. 8 Crankshaft Position Sensor

CRANKSHAFT POSITION SENSOR

The crankshaft position sensor mounts to the engine block behind the generator, just behind the oil filter (Fig. 8).

REMOVAL

(1) Raise and support vehicle.

(2) Disconnect electrical connector from crankshaft position sensor.

(3) Remove sensor mounting screw.

(4) Pull crankshaft position sensor straight out.

INSTALLATION

NOTE: If the removed sensor is to be reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the sensor face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face of the new sensor.

(1) Install sensor and push sensor down until contact is made. While holding the sensor in this position, and install and tighten the retaining bolt to 11.9 N·m (105 in. lbs.) torque.

CAMSHAFT POSITION SENSOR

The camshaft position sensor is mounted to the rear of the cylinder head (Fig. 9).

REMOVAL

(1) Disconnect the filtered air tube from the throttle body and air cleaner housing. Disconnect the air tube from the oil separator hose. Remove filtered air tube.

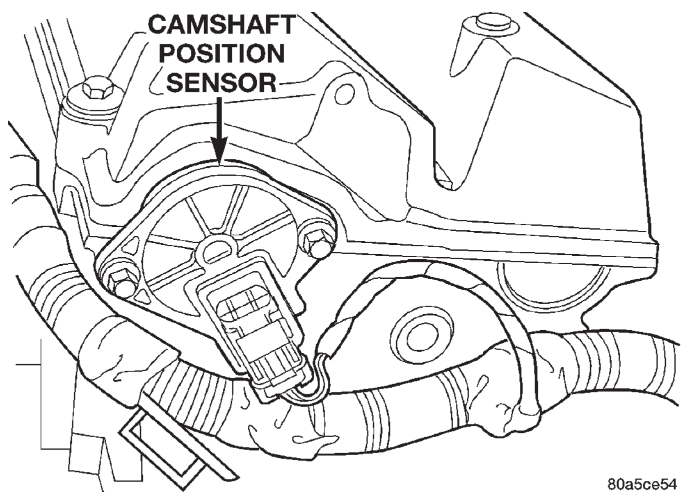


Fig. 9 Camshaft Position Sensor Location

(2) Remove the air cleaner inlet tube.

(3) Disconnect engine harness connector from camshaft position sensor.

(4) Remove camshaft position sensor mounting screws. Remove sensor.

(5) Loosen screw attaching target magnet to rear of camshaft (Fig. 10).

INSTALLATION

The target magnet has locating dowels that fit into off-set machined locating holes in end of the camshaft (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

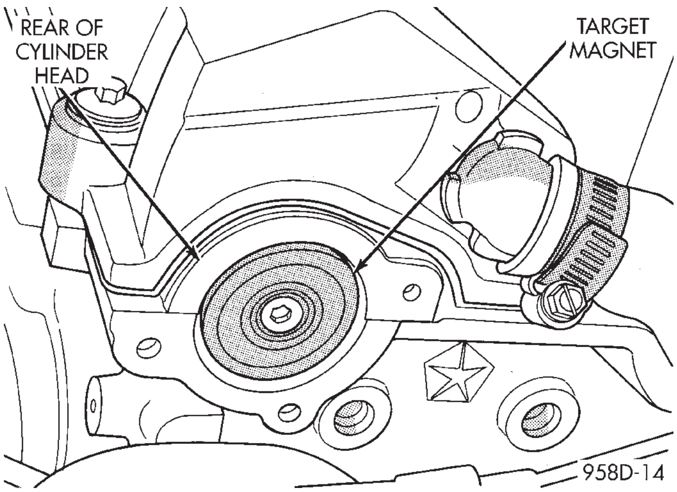


Fig. 10 Target Magnet

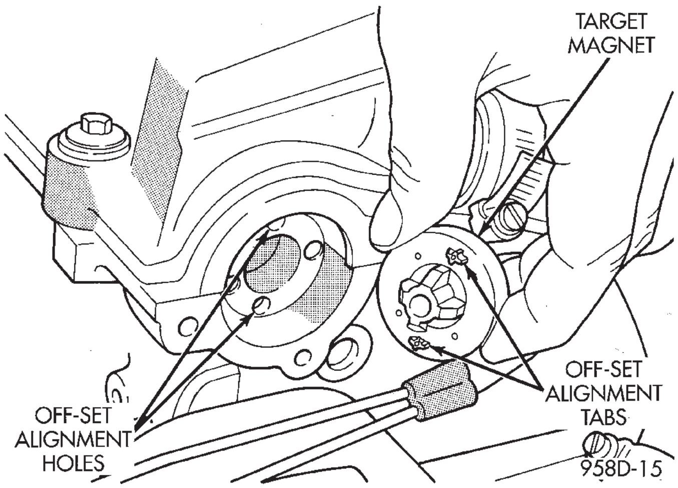


Fig. 11 Target Magnet Installation

(1) Install target magnet in end of camshaft. Tighten mounting screw to 5.65 N·m (50 in. lbs.) torque.

(2) Install a new O-ring on sensor.

(3) Install camshaft position sensor. Tighten sensor mounting screws to 9.6 N·m (85 in. lbs.) torque.

(4) Attach engine harness connector to camshaft position sensor.

(5) Install air cleaner inlet tube and filtered air tube.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.4/3.3/3.8L

REMOVAL

(1) Disconnect electrical connector from MAP sensor (Fig. 12).

(2) Remove two screws holding sensor to the intake manifold.

INSTALLATION

(1) Reverse the above procedure for installation.

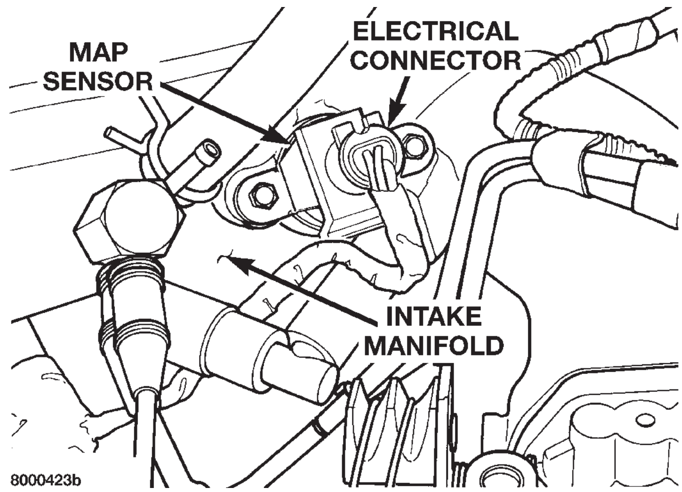


Fig. 12 Map Absolute Pressure Sensor

THROTTLE POSITION SENSOR

Refer to Group 14, Fuel Injection Section, for Removal/Installation.

ENGINE COOLANT TEMPERATURE SENSOR—2.4L

The coolant sensor threads into the top of the thermostat housing (Fig. 13). New sensors have sealant applied to the threads.

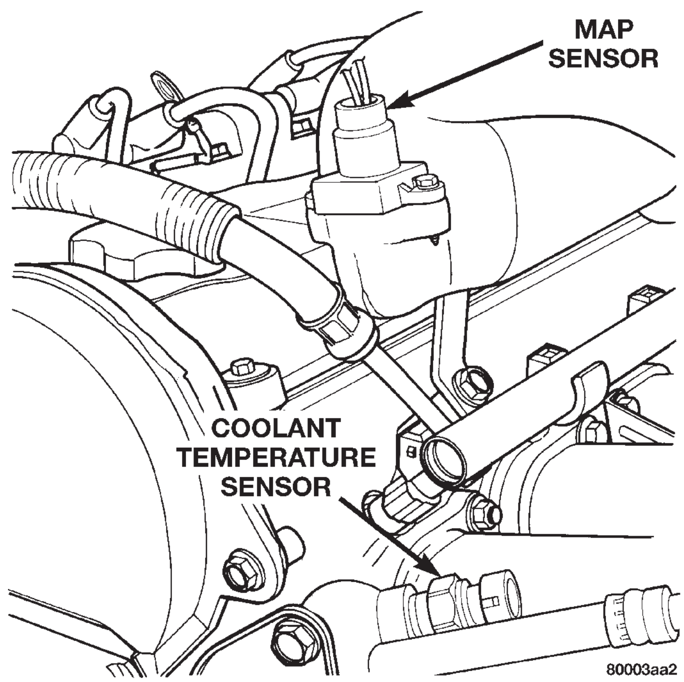


Fig. 13 Engine Coolant Temperature Sensor—2.4L

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7- COOLING.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 7 N·m (60 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

KNOCK SENSOR—2.4L

The knock sensor threads into the side of the cylinder block in front of the starter (Fig. 14).

REMOVAL

(1) Disconnect electrical connector from knock sensor.

(2) Use a crow foot socket to remove the knock sensors.

INSTALLATION

(1) Install knock sensor. Tighten knock sensor to 10 N·m (7 ft. lbs.) torque. **Over or under tightening effects knock sensor performance, possibly causing improper spark control.**

(2) Attach electrical connector to knock sensor.

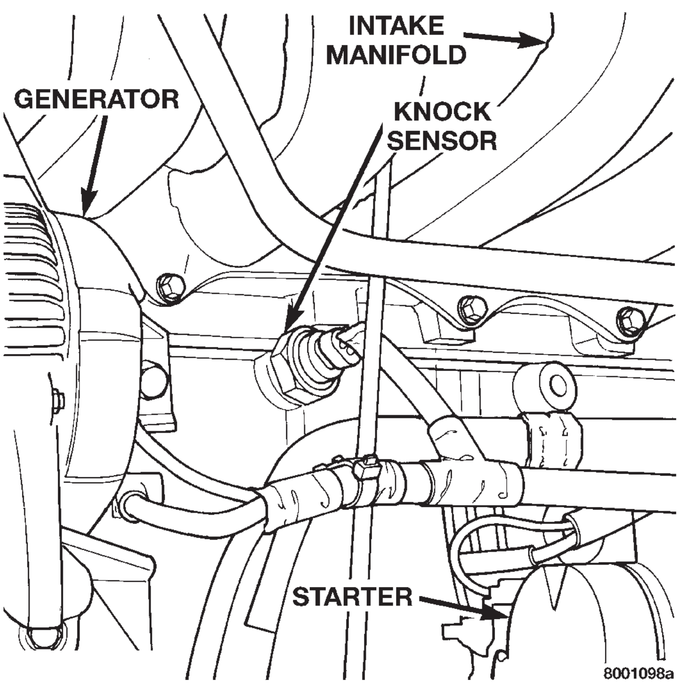


Fig. 14 Knock Sensor

INTAKE AIR TEMPERATURE SENSOR—2.4L

The intake air temperature sensor threads into the intake manifold plenum (Fig. 15).

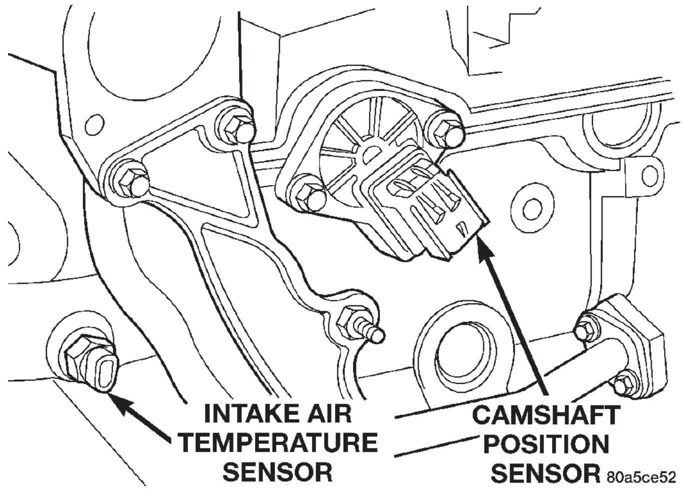


Fig. 15 Intake Air Temperature Sensor

REMOVAL

(1) Remove electrical connector from sensor.

(2) Remove sensor.

INSTALLATION

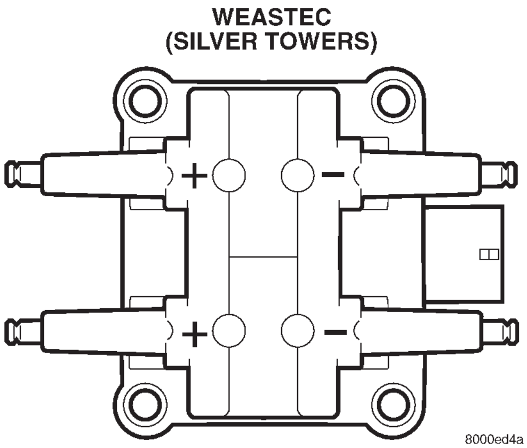
(1) Install sensor. Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Attach electrical connector to sensor.

SPECIFICATIONS

IGNITION COIL

Coil Manufacture	Primary Resistance at 21°C-27°C (70°F-80°F)	Secondary Resistance at 21°C-27°C (70°F-80°F)
Weastec (Steel Towers)	0.45 to 0.65 Ohms	7,000 to 15,800 Ohms



Coil Polarity

SPARK PLUG

Engine	Spark Plug	Gap	Thread Size
2.4L	RC12YC5	0.048 TO 0.053	14mm (3/4 in.) reach

TORQUE

DESCRIPTION . . . . .TORQUE
2.4L Target Magnet Screw . . . . . . .3 N·m (30 in. lbs.)
2.4L Camshaft Position Sensoe Screw . .9 N·m (80 in. lbs.)
Ignition Switch . . . . .2 N·m (17 in. lbs.)
Spark Plugs . . . . .28 N·m (60 in. lbs.)

SPARK PLUG CABLE RESISTANCE—2.4L

CABLE	Maximum Resistance
#1 & #4	4.2K ohms
#2 & #3	3.2K ohms

3.0L ENGINE

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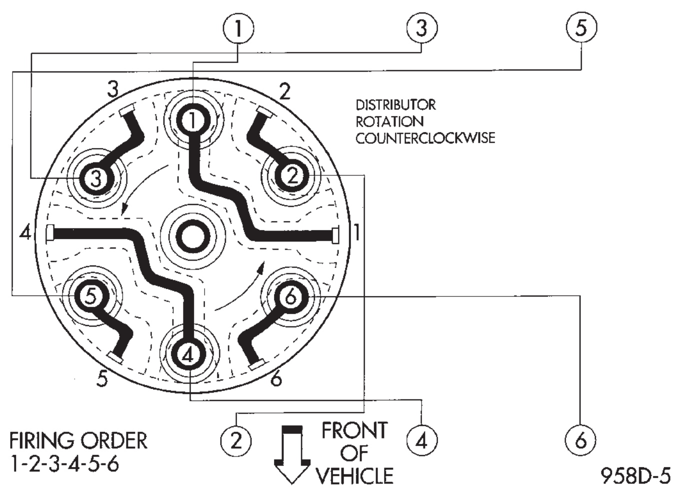
FIRING ORDER—3.0L



SPARK PLUG WIRE ROUTING—3.0L ENGINE

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The MAP sensor reacts to absolute pressure in the intake manifold and provides an input voltage to the Powertrain Control Module (PCM). As engine load changes, manifold pressure varies. The changes in engine load cause the MAP sensors resistance to change. The change in MAP sensor resistance results in a different input voltage to the PCM.

The input voltage level supplies the PCM with information relating to ambient barometric pressure during engine start-up (cranking) and engine load while its operating. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air-fuel mixture.

CAMSHAFT POSITION SENSOR

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

The 3.0L engine is equipped with a camshaft driven mechanical distributor, containing a shaft driven distributor rotor. The distributor is also equipped with an internal camshaft position (fuel sync) sensor (Fig. 1). This sensor provides fuel injection synchronization and cylinder identification to the PCM.

The camshaft position sensor contains a hall effect device callled a sync signal generator. This sync signal generator detects a rotating pulse ring (shutter) on the distributor shaft. The pulse ring rotates 180 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 used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the shutter enters the sync signal generator, the interruption of magnetic field causes the voltage to switch high. This causes a sync signal of approximately 5 volts.

When the trailing edge of the shutter leaves the sync signal generator, the change of magnetic field causes the sync signal voltage to switch low to 0 volts.

Since the shutter rotates at half crankshaft speed, it may take 1 engine revolution during cranking for the PCM to determine the position of piston number 6.

DESCRIPTION AND OPERATION (Continued)

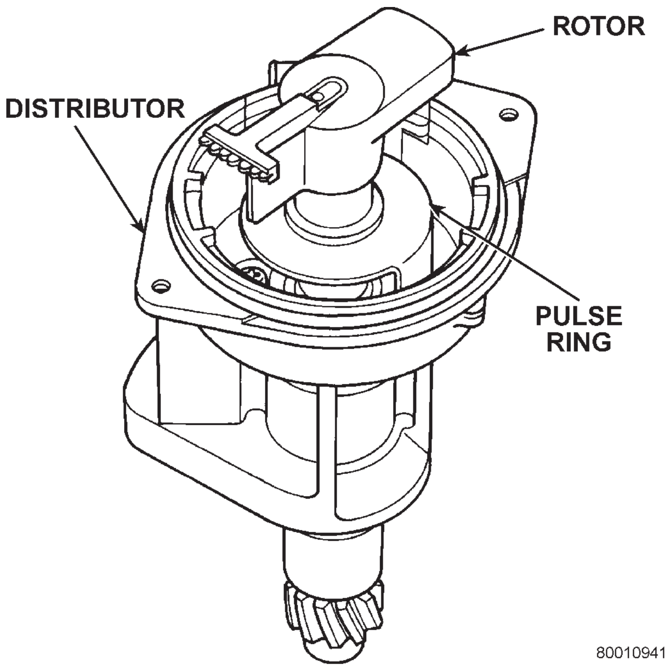


Fig. 1 Camshaft Position Sensor—3.0L Engine

REMOVAL AND INSTALLATION

SPARK PLUG SERVICE

When replacing the spark plugs and spark plug 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, cross ignition of the spark plugs or **short circuit the cables to ground.**

Never Wire Brush Spark Plugs. The spark plug insulator tip is harder than the bristles of wire brushes. Bristles of wire brushes can leave a conductive, metallic film on the insulator which could lead to conductive deposits. Conductive deposits can cause spark plug failure and engine misfire. Use a jewelers file to remove deposits from the electrode gap or use a spark plug cleaning machine to clean spark plugs.

REMOVAL

Always remove cables by grasping at the boot, rotating the boot 1/2 turn, and pulling straight back in a steady motion.

(1) Prior to removing the spark plug, spray compressed air around the spark plug hole and the area around the spark plug.

(2) Remove the spark plug using a quality socket with a foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

INSTALLATION

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install spark plug cables over spark plugs. A click will be heard and felt when the cable properly attaches to the spark plug.

IGNITION COIL—3.0L

The ignition coil is located at the back of the intake manifold (Fig. 2).

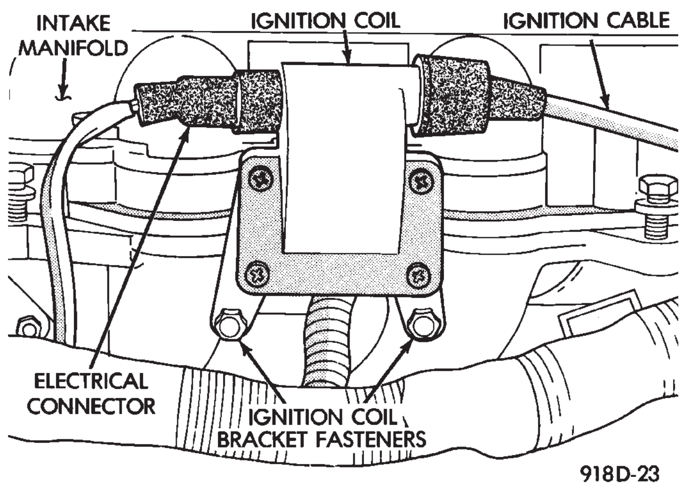


Fig. 2 Ignition Coil—3.0L Engine

REMOVAL

(1) Remove air cleaner assembly.

(2) Disconnect ignition cable from coil.

(3) Disconnect wiring harness connector from coil.

(4) Remove coil mounting screws.

INSTALLATION

(1) Loosely install ignition coil on intake manifold. Tighten the intake manifold fastener to 13 N·m (115 in. lbs.) torque. Tighten ignition coil bracket fasteners to 10 N·m (96 in. lbs.) torque.

(2) Connect the wiring harness connector.

(3) Connect the coil to distributor ignition cable.

(4) Install the air cleaner assembly. Tighten the air cleaner fasteners to 25 N·m (225 in. lbs.) torque.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.0L

REMOVAL

(1) Remove vacuum hose and mounting screws from manifold absolute pressure (MAP) sensor (Fig. 3).

(2) Disconnect electrical connector from sensor. Remove sensor.

REMOVAL AND INSTALLATION (Continued)

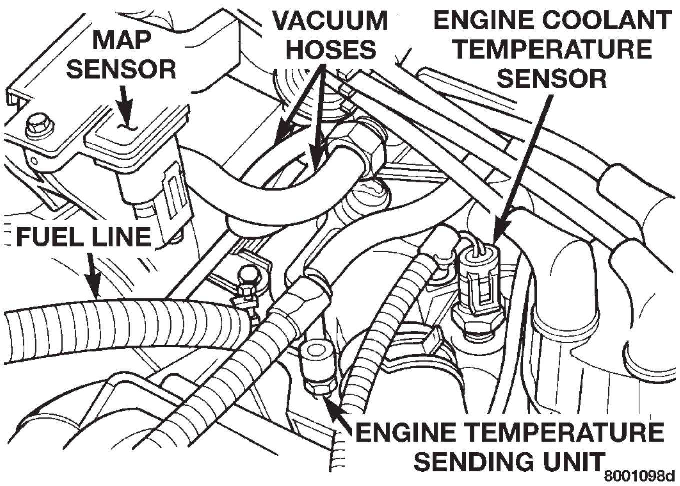


Fig. 3 Manifold Absolute Pressure Sensor

INSTALLATION

(1) Reverse the above procedure for installation.

ENGINE COOLANT TEMPERATURE SENSOR—3.0L

The sensor is installed next to the thermostat housing (Fig. 3).

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7- COOLING.

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 7 N·m (60 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

CRANKSHAFT POSITION SENSOR

REMOVAL

(1) Raise and support vehicle.

(2) Disconnect crankshaft position sensor electrical connector from the wiring harness connector (Fig. 4).

(3) Remove crankshaft position sensor retaining bolt.

(4) Pull crankshaft position sensor straight up out of the transaxle housing.

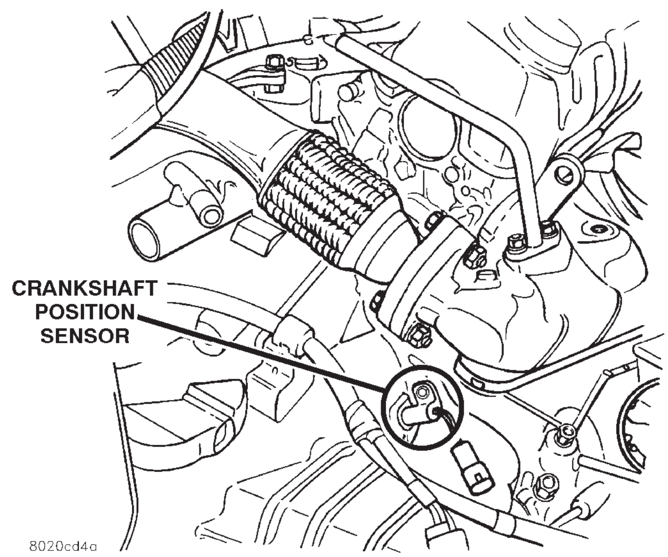


Fig. 4 Crankshaft Position Sensor Connector

INSTALLATION

NOTE: If the removed sensor is to be reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the sensor face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face of the new sensor (Fig. 5).

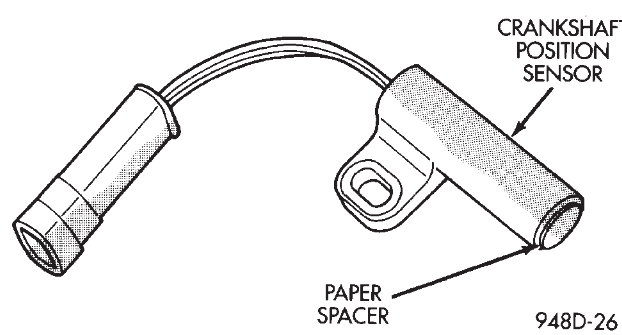


Fig. 5 Crankshaft Position Sensor and Spacer

(1) Install sensor in transaxle and push sensor down until contact is made with the drive plate. While holding the sensor in this position, and install and tighten the retaining bolt to 11.9 N·m (105 in. lbs.) torque.

(2) Raise and support vehicle.

(3) Connect crankshaft position sensor electrical connector to the wiring harness connector.

THROTTLE POSITION SENSOR

Refer to Group 14, Fuel Injection Section, for Removal/Installation.

DISASSEMBLY AND ASSEMBLY

DISTRIBUTOR—3.0L

REMOVAL

(1) Disconnect distributor connector from distributor (Fig. 6).

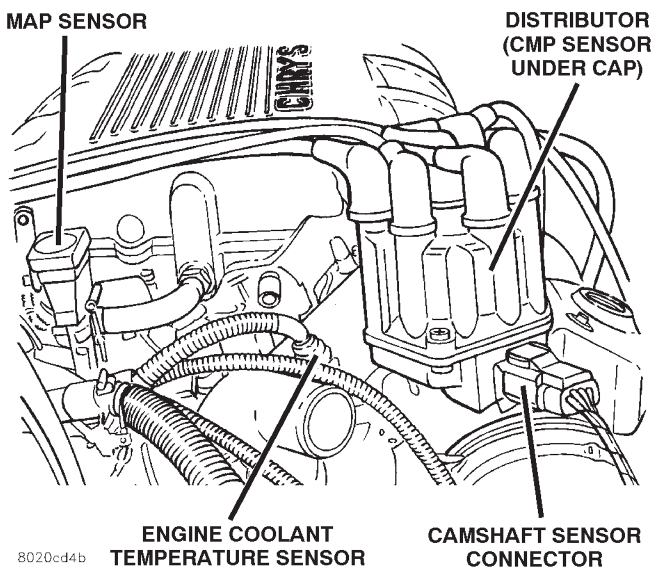


Fig. 6 Distributor Electrical Connector—3.0L Engine

(2) Loosen distributor cap retaining screws.
(3) Lift cap of off distributor.
(4) Rotate engine crankshaft until the distributor rotor points to the intake manifold plenum. Scribe a mark on the plenum in line with the rotor. The scribe line indicates where to position the rotor when reinstalling the distributor.
(5) Remove distributor hold down nut (Fig. 7).
(6) Carefully lift the distributor from the engine.

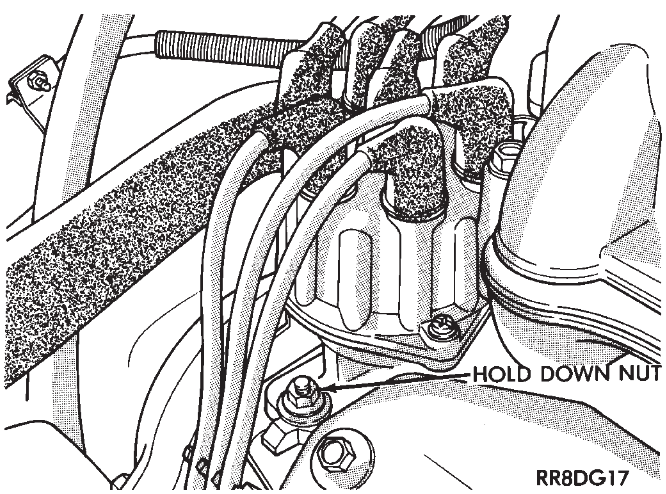


Fig. 7 Distributor Hold-Down

INSTALLATION

(1) Position distributor in engine. Make certain that the O-ring is properly seated on distributor. If O-ring is cracked or nicked replace with new one.
(2) Carefully engage distributor drive with gear on camshaft. When the distributor is installed properly, the rotor will be in line with previously scribe line on air intake plenum. **If engine was cranked while distributor was removed, it will be necessary to establish proper relationship between the distributor shaft and Number 1 piston position as follows:**

(a) Rotate the crankshaft until number one piston is at top of compression stroke.
(b) Rotate rotor to number one rotor terminal (Fig. 8).
(c) Lower the distributor into the opening, engaging distributor drive with drive on camshaft. With distributor fully seated on engine, rotor should be under the number 1 terminal.

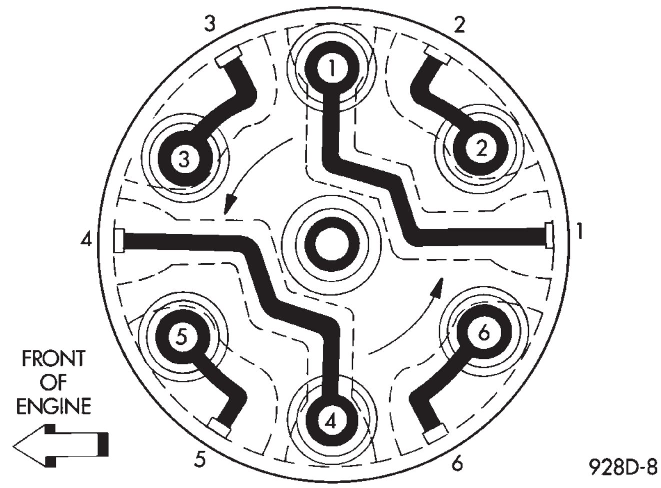


Fig. 8 Distributor Cap Terminal Routing, View from Top of Cap

(3) Install the distributor cap. Ensure sure all high tension wires are firmly in the cap towers.
(4) Install hold-down nut and tighten (Fig. 7).
(5) Connect distributor electrical connector to distributor (Fig. 6).

CLEANING AND INSPECTION

DISTRIBUTOR CAP

Remove the distributor cap and inspect the inside for flashover, cracking of carbon button, lack of spring tension on carbon button, cracking of cap, and burned, worn terminals (Fig. 9). Also check for broken distributor cap towers. If any of these conditions are present the distributor cap and/or cables should be replaced.

CLEANING AND INSPECTION (Continued)

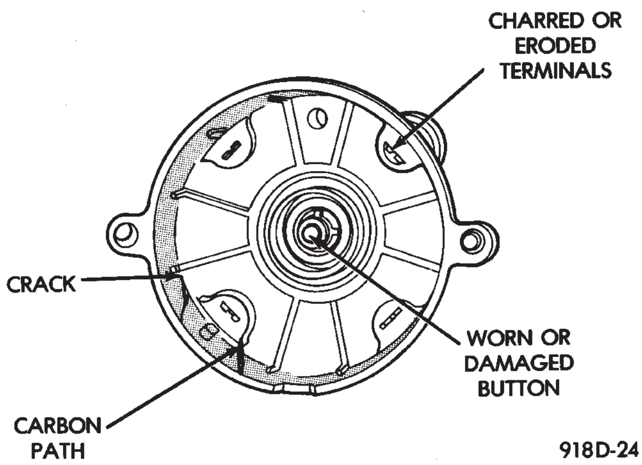


Fig. 9 Distributor Cap Inspection—Typical

When replacing the distributor cap, transfer spark plug wires from the original cap to the new cap one at a time. Ensure that each wire is installed into the tower of the new cap that corresponds to its tower position in the original cap. Fully seat the wires into the towers. If necessary, refer to the engine firing order diagram.

Light scaling of the terminals can be cleaned with a sharp knife. If the terminals are heavily scaled, replace the distributor cap.

A cap that is greasy, dirty or has a powder-like substance on the inside should be cleaned with a solution of warm water and a mild detergent. Scrub the cap with a soft brush. Thoroughly rinse the cap and dry it with a clean soft cloth.

DISTRIBUTOR ROTOR—3.0L

Replace the rotor if it is cracked, the tip is excessively burned or heavily scaled (Fig. 10).

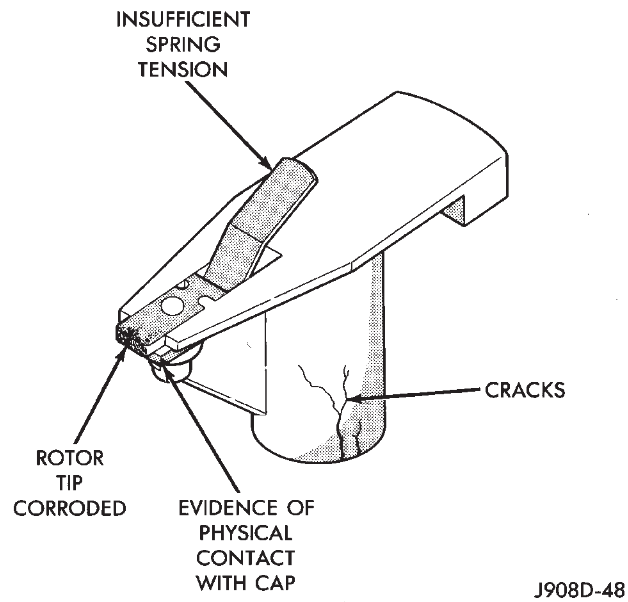


Fig. 10 Rotor Inspection—Typical

SPECIFICATIONS

SPARK PLUG

Engine	Spark Plug	Gap	Thread Size
3.0L	RN11YC4	0.039 TO 0.044	14mm (3/4 in.) reach

TORQUE

DESCRIPTION . . . . .TORQUE
Distributor Hold Down. . . . . .14 N·m (124 in. lbs.)
Ignition Coil Bracket . . . . .10 N·m (96 in. lbs.)
Ignition Switch . . . . .2 N·m (17 in. lbs.)
Spark Plugs . . . . .28 N·m (60 in. lbs.)

SPARK PLUG CABLE RESISTANCE—3.0L

CABLE	Maximum Resistance
#1	14.0K ohms
#2	10.4K ohms
#3	14.9K ohms
#4	11.5K ohms
#5	17.5K ohms
#6	10.3K ohms
Coil Lead	11.1K ohms

3.3/3.8L ENGINE

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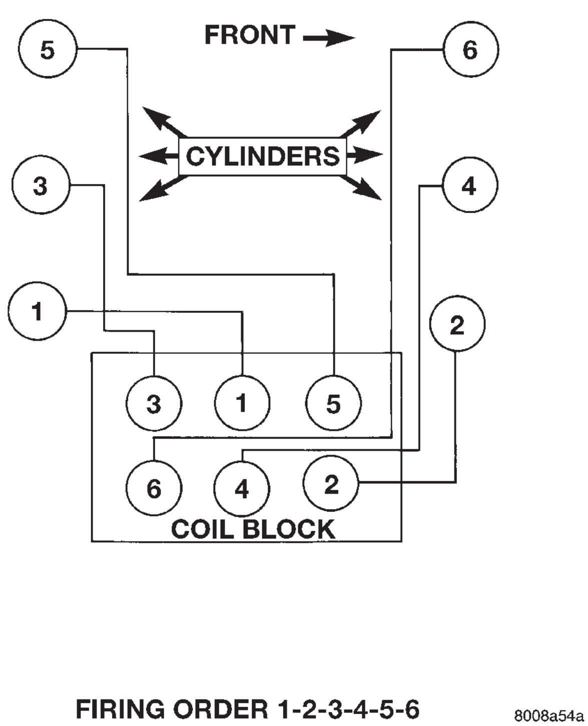
DESCRIPTION AND OPERATION

FIRING ORDER—3.3/3.8L

The firing order for 3.3L and 3.8L engines is 1-2-3-4-5-6.



Firing Order—3.3/3.8L

REMOVAL AND INSTALLATION

SPARK PLUG CABLE SERVICE—3.3/3.8L ENGINES

WARNING: The ignition cables should not be removed while the engine is hot. This could cause sever injury/burns and can cause damage to the ignition cables.

The spark plug boot heat shield needs to be installed correctly on the boot before being installed on the engine (Fig. 1). If it is not installed correctly engine misfire would occur.

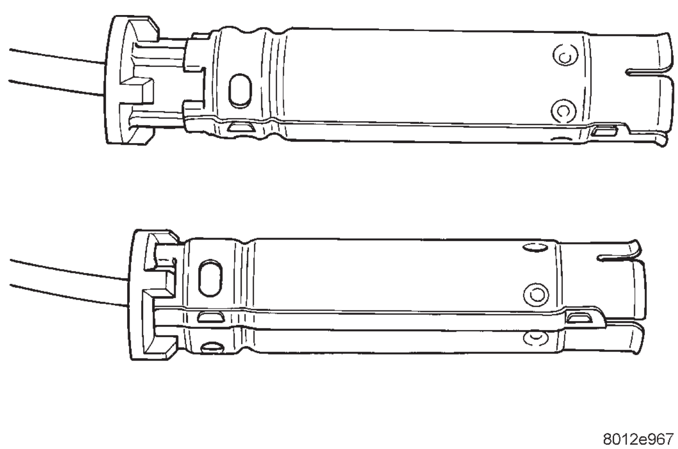


Fig. 1 Spark Plug Boot/Heat Shield Orientation

Do not use pliers to pull the boot/heat shield assembly from the spark plugs. This will damage the shield assembly.

Spark plug boot heat shields must be replaced if they are bent or damaged. It is extremely important the shield is reinstalled correctly as shown. The bottom of the spark plug heat shield must make contact with the spark plug socket hex.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Never coat the inside of spark plug boots with silicone grease. Some types of silicone grease can damage the ignition cable conductor.

SPARK PLUG CABLES #3 AND #5

REMOVAL

(1) Remove the resonator.

(2) Grasp the spark plug boot/heat shield as close as possible to the spark plug. **Twist the boot slightly to break its seal with the plug and pull straight back. Do not use pliers, pull on the ignition cable, or pull the spark plug boot at an angle.** This could damage the spark plug insulator, terminal, or the cable insulation. Wipe spark plug insulator clean with a dry cloth before installation.

(3) Remove the cable from the retaining bracket. Make sure that they are also detached from the rear retaining clip mounted on the rear of the intake manifold.

INSTALLATION

(1) When installing the spark plug cables, make sure the coil and spark plug insulator and terminals are fully seated. A **click sound should be heard or terminal engagement is felt when the terminals are properly attached.**

(2) Install the cable into the retaining bracket. Make sure that they are also attached to the rear retaining clip mounted on the rear of the intake manifold.

(3) Install the resonator.

SPARK PLUG CABLE #1

REMOVAL

(1) Remove the accessory drive belt, refer to Group 7, Cooling.

(2) Remove the four bolts from the upper half of the generator bracket.

(3) Push the Generator rearward.

(4) Grasp the spark plug boot/shield assembly as close as possible to the spark plug. **Twist the boot slightly to break its seal with the plug and pull straight back. Do not use pliers, pull on the ignition cable, or pull the spark plug boot at an angle.** This could damage the spark plug insulator, terminal, or the cable insulation. Wipe spark plug insulator clean with a dry cloth before installation.

(5) Remove the cable from the retaining bracket.

INSTALLATION

(1) When installing the spark plug cables, make sure the coil and spark plug insulator and terminals are fully seated. A **click sound should be heard or terminal engagement is felt when the terminals are properly attached.**

(2) Rotate Generator back into place.

(3) Install upper Generator bracket with the four bolts.

(4) Install the accessory drive belt, refer to Group 7, Cooling.

SPARK PLUG SERVICE—3.3/3.8L ENGINES

WARNING: The ignition cables should not be removed while the engine is hot. This could cause server injury/burns and can cause damage to the ignition cables.

Use extreme care when removing and installing the spark plug cables.

The spark plug boot heat shield needs to be installed correctly on the boot before being installed on the engine (Fig. 1). If it is not installed correctly engine misfire would occur.

Do not use pliers to pull the boot/heat shield assembly from the spark plugs. This will damage the shield assembly.

SPARK PLUG #3 AND #5

REMOVAL

(1) Remove the resonator.

(2) Remove intake strut to cylinder head bolt at cylinder head.

(3) Loosen bolt for intake strut at intake.

(4) Swing strut away.

(5) Grasp the spark plug boot/shield assembly as close as possible to the spark plug. **Twist the boot/shield assembly slightly to break the seal with the plug and pull straight out. Do not use pliers, pull on the ignition cable, or pull the spark plug boot at an angle.** This could damage the spark plug insulator, terminal, heat shield or the insulation. Wipe spark plug insulator clean with a dry cloth before installation.

(6) Remove spark plug

INSTALLATION

(1) Install spark plug and tighten to 28 N·m (20 ft. lbs.).

(2) When installing the spark plug cables, make sure spark plug insulator and terminals are fully seated. A **click sound should be heard or felt when the terminals are properly attached.**

(3) Install the cable into the retaining bracket. Make sure that they are also attached to the rear retaining clip mounted on the rear of the intake manifold.

(4) Swing strut back into place.

REMOVAL AND INSTALLATION (Continued)

(5) Install intake strut bolt to cylinder head at cylinder head.
(6) Tighten bolt to intake strut at intake.
(7) Tighten bolt at cylinder head.
(8) Install the resonator.

SPARK PLUG #1

REMOVAL

(1) Remove the accessory drive belt, refer to Group 7, Cooling.
(2) Remove the 4 bolts from the upper half of the generator bracket.
(3) Push the Generator rearward.
(4) Grasp the spark plug boot/shield assembly as close as possible to the spark plug. **Twist the boot/shield assembly slightly to break its seal with the plug and pull straight out. Do not use pliers, pull on the ignition cable, or pull the spark plug boot at an angle.** This could damage the spark plug insulator, terminal, or the insulation. Wipe spark plug insulator clean with a dry cloth before installation.
(5) Remove spark plug

INSTALLATION

(1) Install spark plug and tighten to 28 N·m (20 ft. lbs.).
(2) When installing the spark plug cables, make sure the coil or spark plug insulator and terminals are fully seated. A **click sound should be heard or felt when the terminals are properly attached.**
(3) Pull Generator back into place.
(4) Install upper Generator bracket with the 4 bolts.
(5) Install the accessory drive belt, refer to Group 7, Cooling.

IGNITION COIL

REMOVAL

(1) Remove spark plug cables from coil (Fig. 2). Always twist the spark plug boots to break the seal with the plug and pull straight back on the boot.
(2) Remove ignition coil electrical connector.
(3) Remove ignition coil mounting screws.
(4) Remove ignition coil.

INSTALLATION

(1) Reverse the above procedure for installation. Tighten mounting screws to 12 N·m (105 in. lbs.) torque.
(2) Transfer spark plug cables to new coil pack. The coil pack towers and cables are numbered with the cylinder identification.

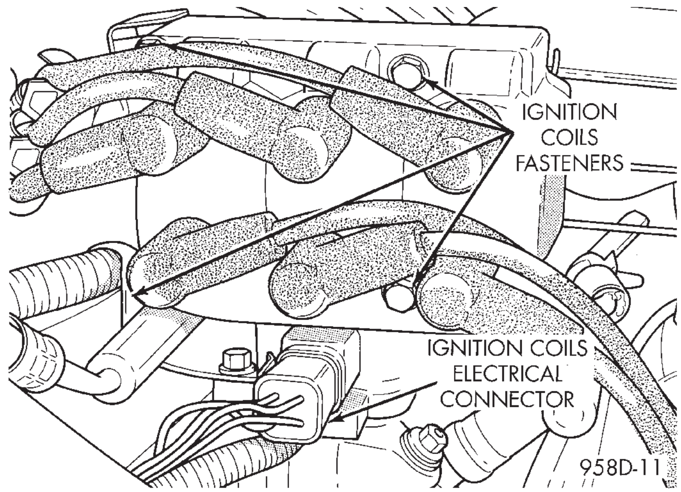


Fig. 2 Ignition Coil Removal

CRANKSHAFT POSITION SENSOR

REMOVAL

(1) Raise and support vehicle.
(2) Disconnect crankshaft position sensor electrical connector from the wiring harness connector (Fig. 3).

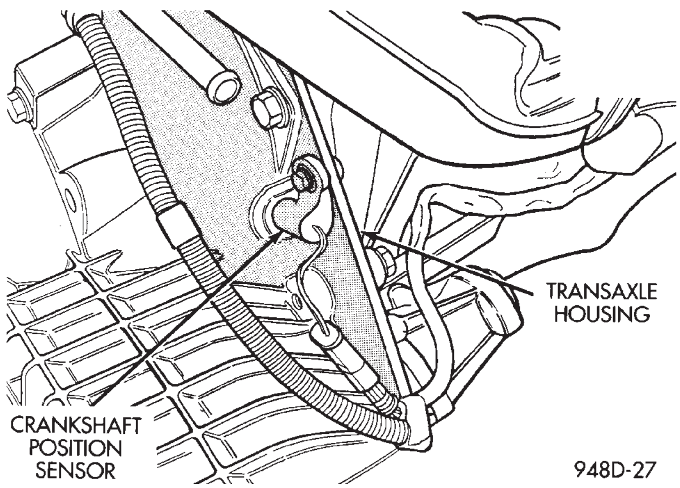


Fig. 3 Crankshaft Position Sensor Connector

(3) Remove crankshaft position sensor retaining bolt.
(4) Pull crankshaft position sensor straight up out of the transaxle housing.

INSTALLATION

NOTE: If the removed sensor is to be reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the sensor face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face of the new sensor (Fig. 4).

(1) Install sensor in transaxle and push sensor down until contact is made with the drive plate.

REMOVAL AND INSTALLATION (Continued)

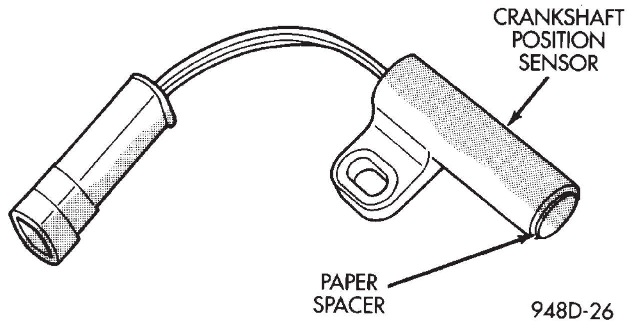


Fig. 4 Crankshaft Position Sensor and Spacer

While holding the sensor in this position, and install and tighten the retaining bolt to 11.9 N·m (105 in. lbs.) torque.

(2) Raise and support vehicle.

(3) Connect crankshaft position sensor electrical connector to the wiring harness connector.

CAMSHAFT POSITION SENSOR

REMOVAL

(1) Disconnect camshaft position sensor electrical connector from the wiring harness connector (Fig. 5).

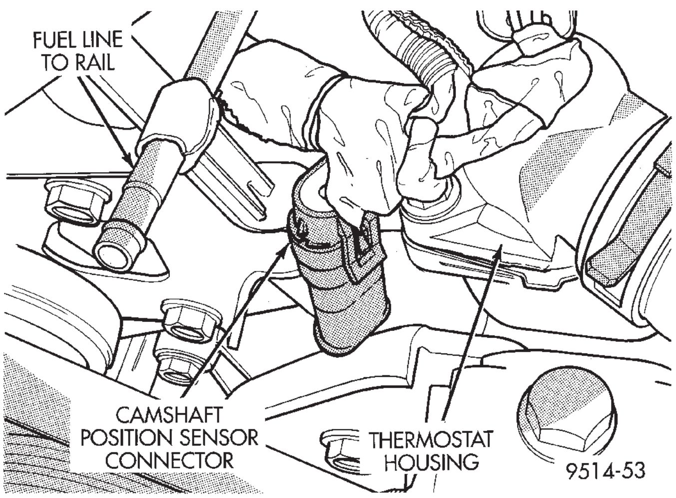


Fig. 5 Camshaft Position Sensor

(2) Remove bolt holding sensor (Fig. 6). **There is a hole in the bracket for tool access to the sensor bolt.**

(3) Rotate sensor away from block (Fig. 7).

(4) Pull sensor up out of the chain case cover. **Do not pull on the sensor lead.** There is an O-ring on the sensor case. The O-ring may make removal difficult. A light tap to top of sensor prior to removal may reduce force needed for removal.

INSTALLATION

If the removed sensor is reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the face before installation. Inspect O-ring for damage, replace if necessary. If the sensor is being replaced, confirm that the paper spacer is attached to the face and O-ring is positioned in groove of the new sensor (Fig. 8).

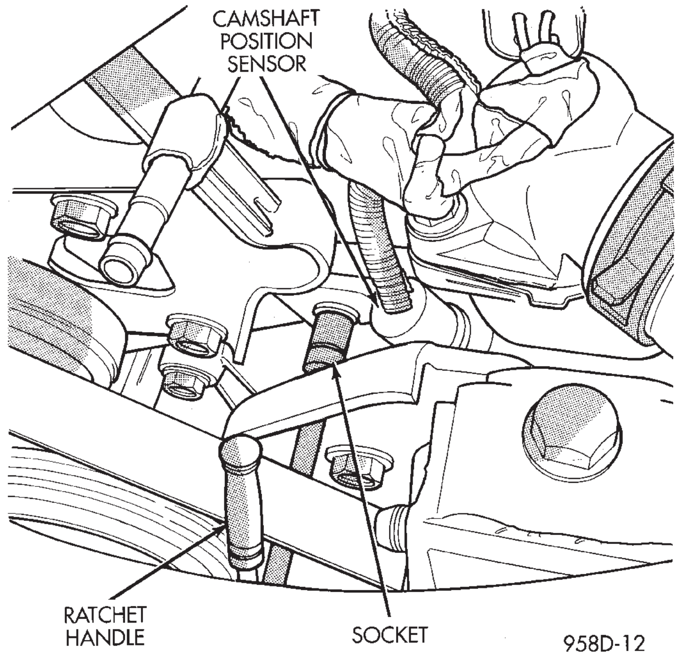


Fig. 6 Camshaft Sensor Bolt Removal/Installation

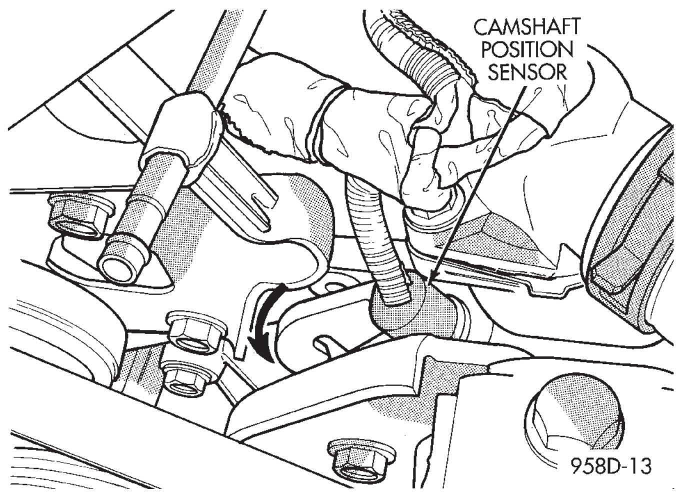


Fig. 7 Camshaft Sensor Removal/Installation

(1) Apply a couple drops of clean engine oil to the O-ring prior to installation.

(2) Install sensor in the chain case cover and rotate into position.

(3) Push sensor down until contact is made with the camshaft gear. While holding the sensor in this position, install and tighten the retaining bolt 14 N·m (125 in. lbs.) torque.

(4) Connect camshaft position sensor electrical connector to harness connector.

REMOVAL AND INSTALLATION (Continued)

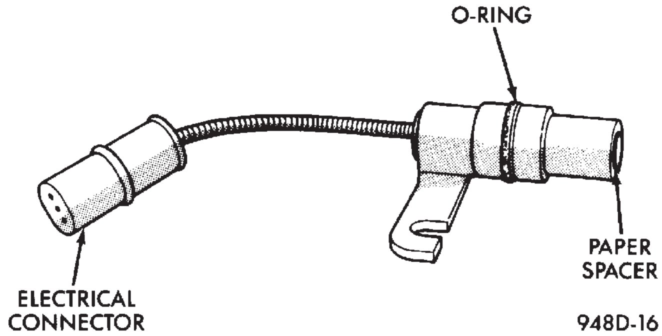


Fig. 8 Camshaft Position Sensor and Spacer

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

REMOVAL

(1) Disconnect electrical connector from MAP sensor.

(2) Remove 2 screws holding sensor to intake manifold (Fig. 9).

(3) Remove sensor from manifold.

INSTALLATION

Reverse the above procedure for installation.

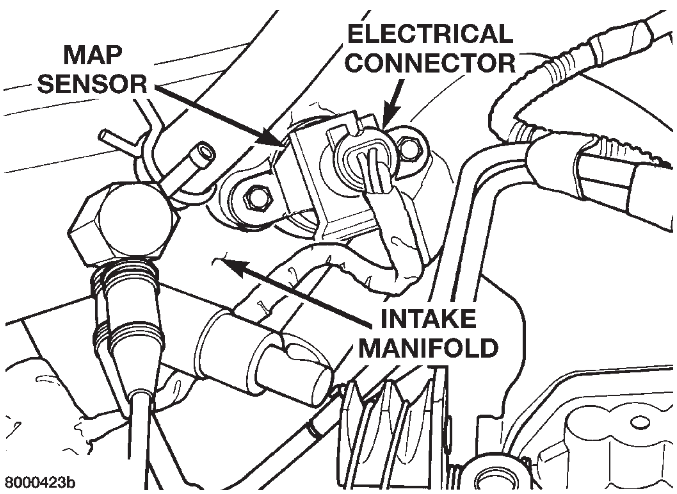


Fig. 9 Manifold Absolute Pressure Sensor

ENGINE COOLANT TEMPERATURE SENSOR

The Engine Coolant Temperature (ECT) sensor is located below the ignition coil (Fig. 10).

REMOVAL

(1) Drain cooling system until coolant level is below sensor. Refer to Group 7, Cooling System.

(2) Remove electrical connector from coil (Fig. 11).

(3) Remove coil mounting screws.

(4) Rotate coil away from engine coolant temperature sensor.

(5) Disconnect electrical connector from engine coolant temperature sensor.

(6) Remove sensor from engine.

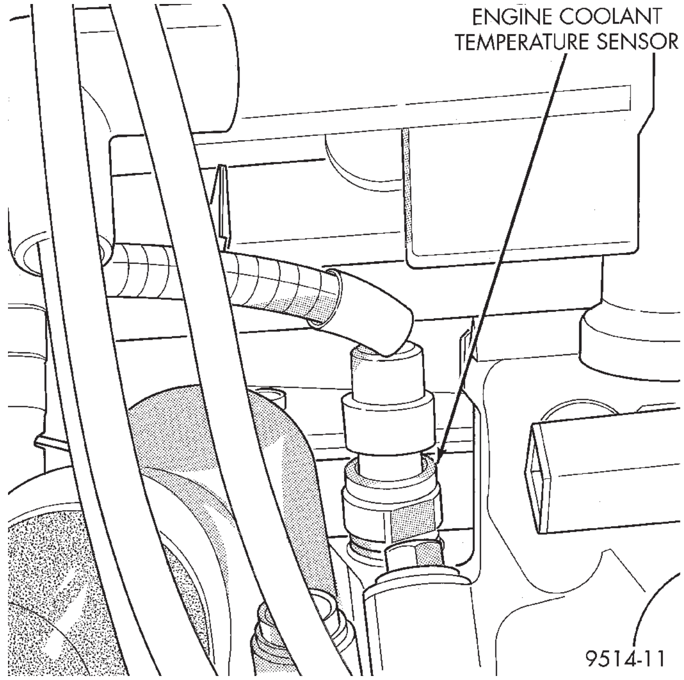


Fig. 10 Engine Coolant Temperature Sensor

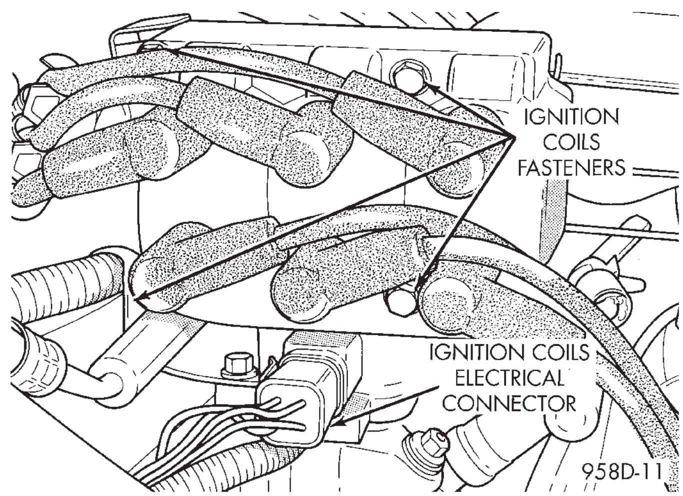


Fig. 11 Ignition Coil Removal

INSTALLATION

(1) Tighten the sensor to 7 N·m (60 in. lbs.) torque.

(2) Connect electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

(4) Install coil. Tighten coil mounting screws to 12 N·m (105 in. lbs.) torque.

(5) Connect electrical connector to coil.

THROTTLE POSITION SENSOR

Refer to Group 14, Fuel Injection Section, for Removal/Installation.

KNOCK SENSOR—3.3/3.8L

The knock sensor threads into the side of the cylinder block in front of the starter (Fig. 12).

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect electrical connector from knock sensor.

(2) Use a crow foot socket to remove the knock sensor.

INSTALLATION

(1) Install knock sensor. Tighten knock sensor to 10 N·m (7 ft. lbs.) torque. **Over or under tightening effects knock sensor performance, possibly causing improper spark control.**

(2) Attach electrical connector to knock sensor.

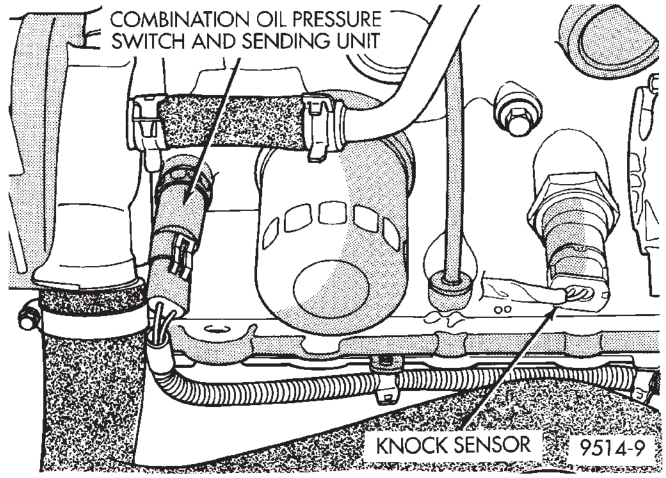
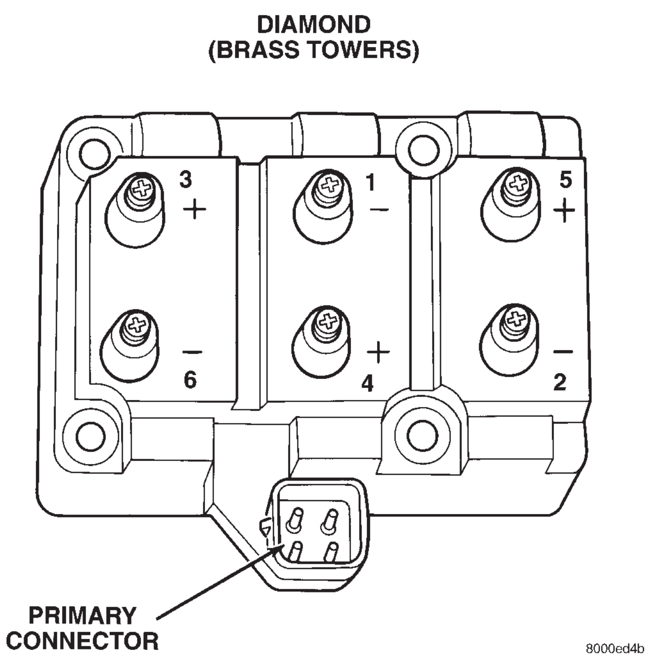


Fig. 12 Knock Sensor

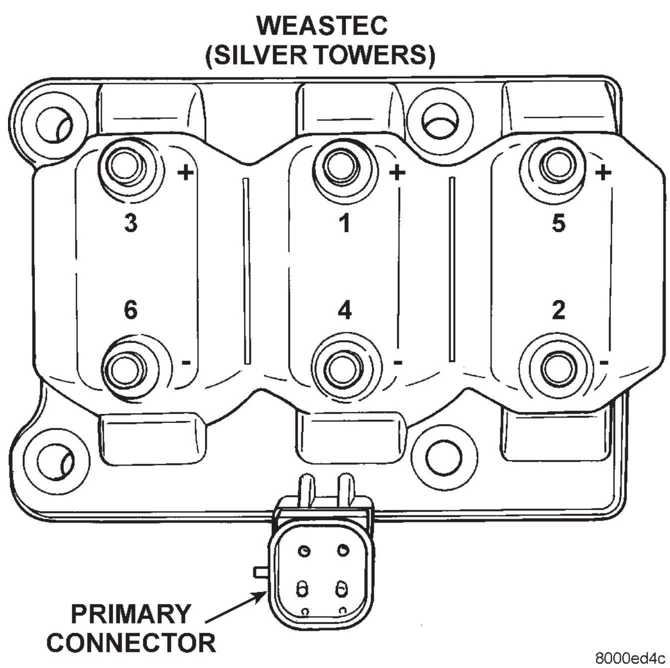
SPECIFICATIONS

IGNITION COIL

Coil Manufacture	Primary Resistance at 21°C-27°C (70°F-80°F)	Secondary Resistance at 21°C-27°C (70°F-80°F)
Weastec (Aluminum Towers)	0.45 TO 0.65 Ohms	7,000 to 15,800 Ohms
Diamond Electric (Brass Towers)	0.45 TO 0.65 Ohms	7,000 to 15,800 Ohms



Coil Polarity



Coil Polarity

SPECIFICATIONS (Continued)

SPARK PLUG

Engine	Spark Plug	Gap *	Thread Size
3.3L	RN14PMP5	0.048 TO 0.053	14mm (3/4 in.) reach
3.8L	RN14PMP5	0.048 TO 0.053	14mm (3/4 in.) reach

* New Spark Plug Gap

TORQUE

DESCRIPTION . . . . .TORQUE
3.3L Camshaft Position
Sensor Screw . . . . .12 N·m (105 in. lbs.)
3.3L Engine Coolant Sensor. . . . . .7 N·m (60 in. lbs.)
3.3L Crankshaft Position
Sensor Screw . . . . .12 N·m (105 in. lbs.)
3.3/3.8L Ignition Coil . . . . .12 N·m (105 in. lbs.)
Ignition Switch . . . . .2 N·m (17 in. lbs.)
Spark Plugs . . . . .28 N·m (20 ft. lbs.)

SPARK PLUG CABLE RESISTANCE—3.3/3.8L

CABLE	Maximum Resistance
#1	18.5K ohms
#2	15.5K ohms
#3	20.4K ohms
#4	21.2K ohms
#5	27.7K ohms
#6	26.7K ohms

IGNITION SWITCH AND LOCK CYLINDER

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DESCRIPTION AND OPERATION

IGNITION INTERLOCK

All vehicles equipped with automatic transaxles have an interlock system. The system prevents shifting the vehicle out of Park unless the ignition lock cylinder is in the Off, Run or Start position. In addition, the operator cannot rotate the key to the lock position unless the shifter is in the park position. On vehicles equipped with floor shift refer to Group 21 - Transaxle for Automatic Transmission Shifter/Ignition Interlock.

LOCK KEY CYLINDER

The lock cylinder is inserted in the end of the housing opposite the ignition switch. The ignition key rotates the cylinder to 5 different detents (Fig. 1):

- Accessory
- Off (lock)
- Unlock
- On/Run
- Start

REMOVAL AND INSTALLATION

IGNITION SWITCH

The ignition switch attaches to the lock cylinder housing on the end opposite the lock cylinder (Fig. 2). For ignition switch terminal and circuit identification, refer to Group 8W, Wiring Diagrams.

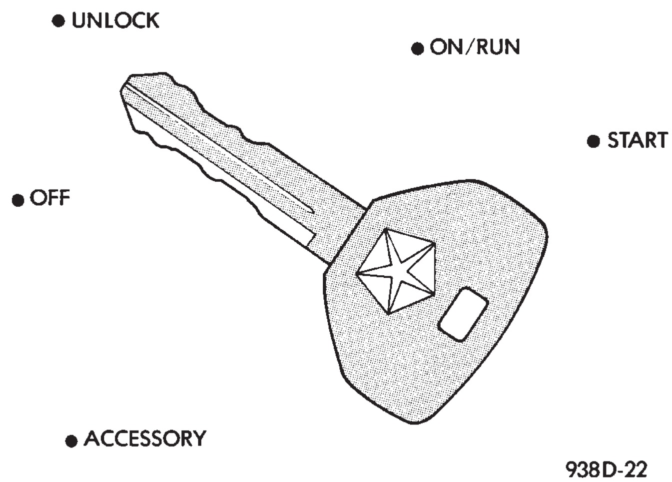

Fig. 1 Ignition Lock Cylinder Detents

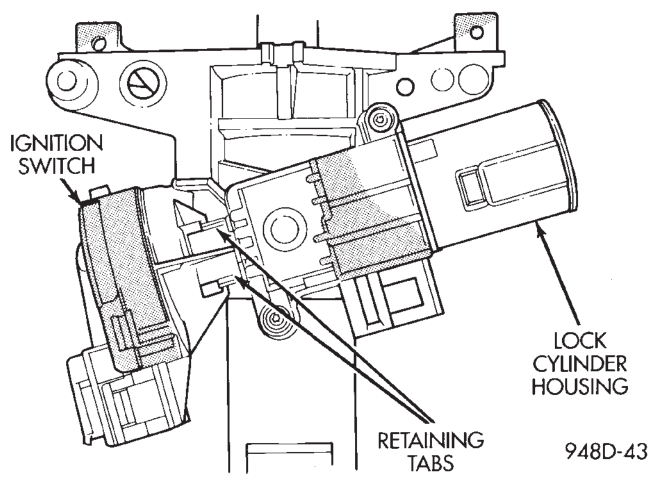

Fig. 2 Ignition Switch—Viewed From Below Column

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove steering column cover retaining screws (Fig. 3).

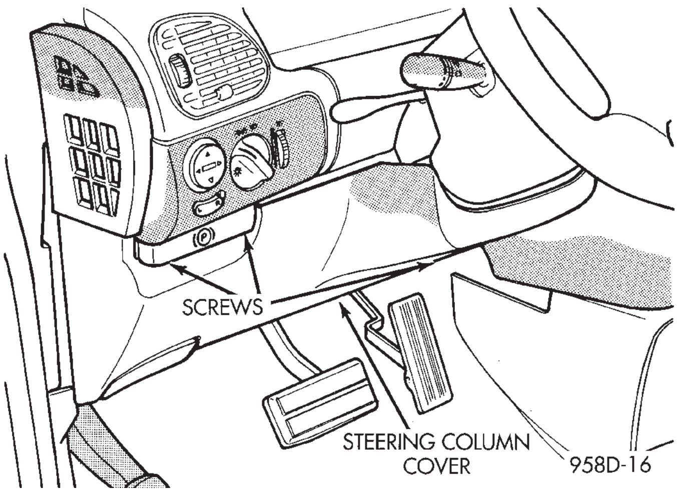

Fig. 3 Steering Column Cover

(3) Remove parking brake release cable from handle (Fig. 4).

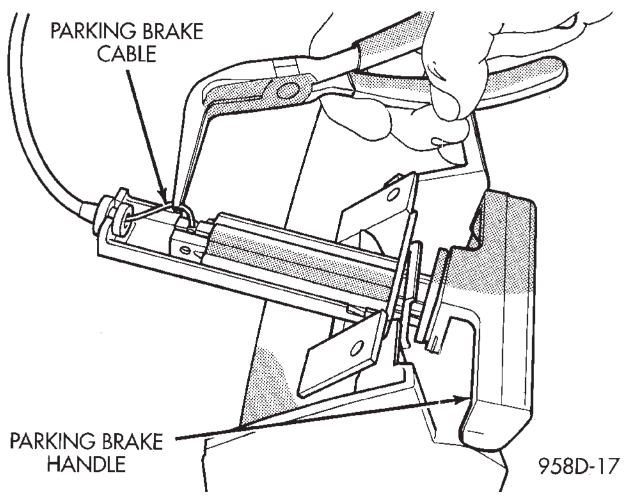

Fig. 4 Parking Brake Release Cable

(4) Remove screws holding steering column shrouds (Fig. 5) and remove lower shroud.

(5) Place key cylinder in RUN position. Depress lock cylinder retaining tab and remove key cylinder (Fig. 6).

(6) Remove ignition switch mounting screw (Fig. 7) with a #10 Torx® tamper proof bit.

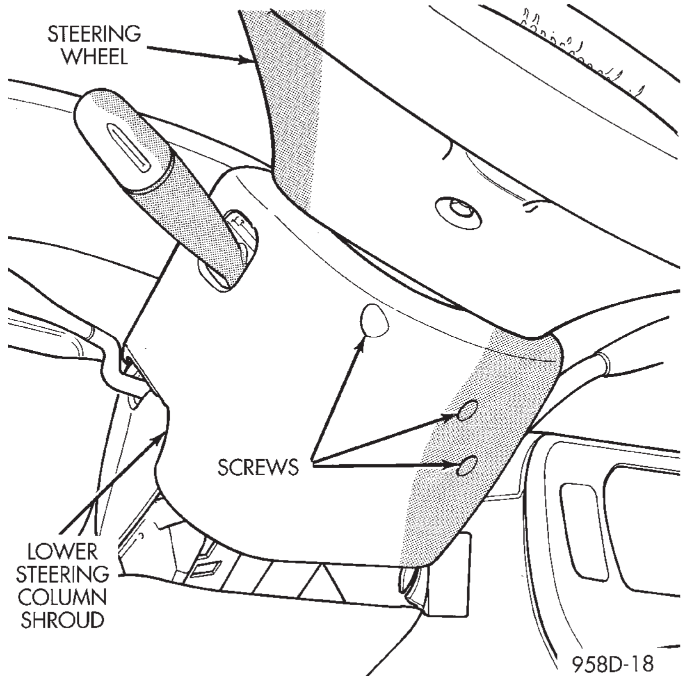

Fig. 5 Steering Column Shroud Screws

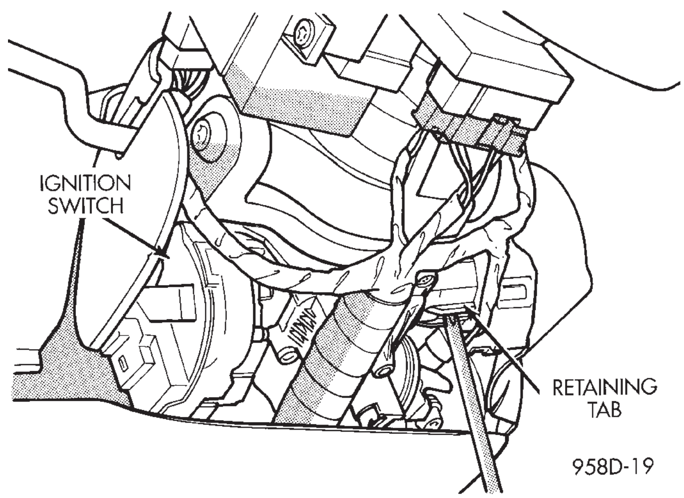

Fig. 6 Lock Cylinder Retaining Tab

(7) Depress retaining tab (Fig. 3) or (Fig. 8) and gently pry ignition switch from steering column (Fig. 9).

(8) Disconnect electrical connectors from ignition switch and remove switch (Fig. 10).

REMOVAL AND INSTALLATION (Continued)

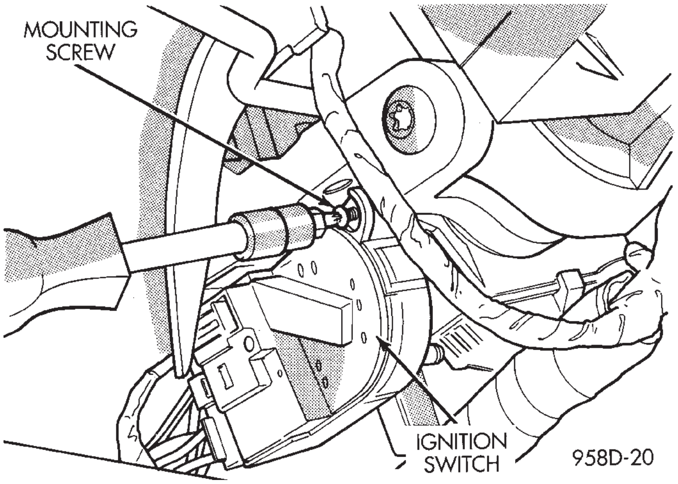

Fig. 7 Ignition Switch Mounting Screw

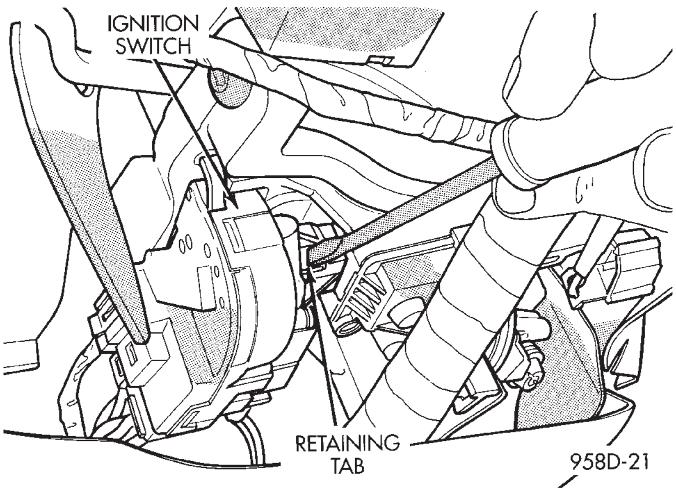

Fig. 8 Ignition Switch Retaining Tab

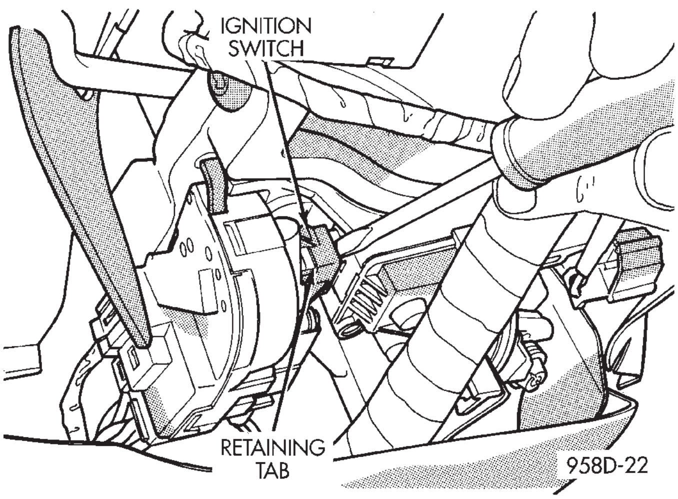

Fig. 9 Removing Ignition Switch

INSTALLATION

(1) Ensure the ignition switch is in the RUN position and the actuator shaft in the lock housing is in the RUN position.

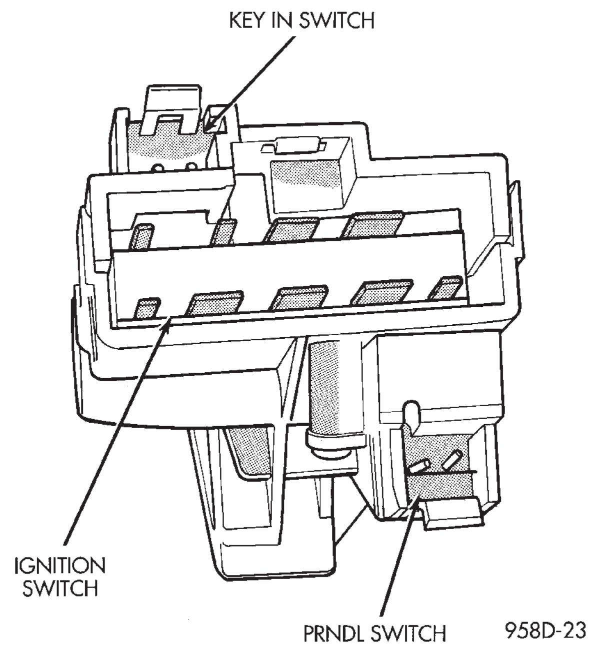

Fig. 10 Ignition Switch Connectors

(2) Install electrical connectors to ignition switch.

(3) Carefully install the ignition switch. The switch will snap over the retaining tabs (Fig. 11). Install mounting screw (Fig. 7).

(4) Install upper and lower shrouds.

(5) Install key cylinder (cylinder retaining tab will depress only in the RUN position).

(6) Connect negative cable to battery.

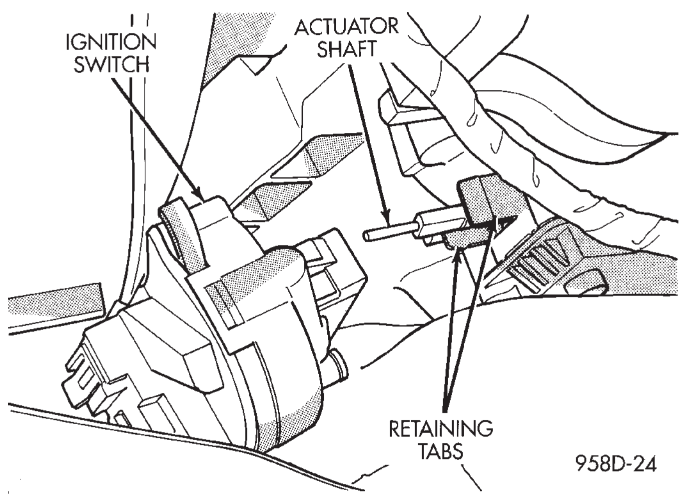

Fig. 11 Ignition Switch Installation

(7) Check for proper operation of ignition switch and key-in warning switch.

REMOVAL AND INSTALLATION (Continued)

LOCK KEY CYLINDER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove steering column cover retaining screws (Fig. 3).

(3) Remove screws holding steering column shrouds (Fig. 5) and remove lower shroud.

(4) Place key cylinder in RUN position. Depress lock cylinder retaining tab and remove key cylinder (Fig. 6).

INSTALLATION

(1) Install key in lock cylinder. Turn key to run position (retaining tab on lock cylinder can be depressed).

(2) The shaft at the end of the lock cylinder aligns with the socket in the end of the housing. To align the socket with the lock cylinder, ensure the socket is in the Run position (Fig. 12).

(3) Align the lock cylinder with the grooves in the housing. Slide the lock cylinder into the housing until the tab sticks through the opening in the housing.

(4) Turn the key to the Off position. Remove the key.

(5) Install lower steering column shroud.

(6) Install steering column cover.

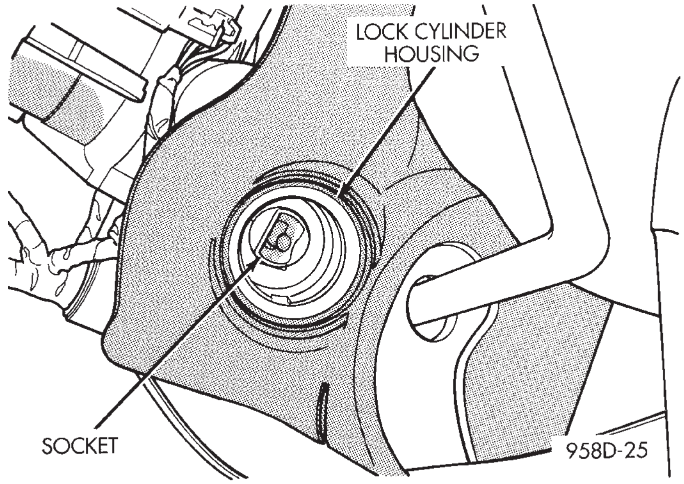

Fig. 12 Socket in Lock Cylinder Housing

(7) Connect negative cable to battery.

IGNITION INTERLOCK

Refer to Group 21, Transaxle for Shifter/Ignition Interlock Service.

LOCK CYLINDER HOUSING

Refer to Steering Column in Group 19, Steering, for Lock Cylinder Housing Service.

INSTRUMENT PANEL AND SYSTEMS

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GENERAL INFORMATION

INTRODUCTION

The instrumentation gauges on NS vehicles are contained in a subdial assemblies within the instrument cluster. The individual gauges are not serviced separately. If one of the cluster gauges becomes faulty the entire subdial would require replacement and all gauges will have to be calibrated. Refer to the proper Body Diagnostic Procedure Manual for calibration procedures.

DESCRIPTION AND OPERATION

INSTRUMENT CLUSTER

The mechanical instrument cluster with a tachometer is equipped with a electronic vacuum fluorescent transmission range indicator (PRND3L), odometer, and trip odometer display.

The mechanical instrument cluster without a tachometer is equipped with a cable operated transmission range indicator (PRND21).

DESCRIPTION AND OPERATION (Continued)

The instrument cluster is equipped with the following warning lamps.
- Lift Gate Ajar
- Low Fuel Level
- Low Windshield Washer Fluid Level
- Cruise
- Battery Voltage
- Fasten Seat Belt
- Door Ajar

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

NS vehicle instrument clusters are equipped with a self diagnostic test feature to help identify electronic problems. Prior to any test, perform Self Diagnostic Test. The self diagnostic system monitors the CCD bus messages. If an electronic problem occurs, a Diagnostic Trouble Code (DTC) will be displayed in the odometer window of the cluster.

The following CCD bus messages are continuously monitored by the diagnostic system:
- Body Control Module
- Powertrain Control Module
- Transmission Control Module, if equipped

HEADLAMP SWITCH

Using a Digital Multimeter, equipped with a diode test to perform the Headlamp Switch Test below (Fig. 1).

Switch position possibilities are open (no continuity), continuity, resistance value in ohms, or diode test. Use the values in the third column to determine meter setting. If Headlamp Switch is not within specifications replace as necessary.

The Chrysler Town and Country is available with optional Automatic Headlamps. For diagnosis, refer to the proper Body Diagnostic Procedures Manual.

SELF DIAGNOSTIC TEST

To activate self diagnostic program:

(1) With the ignition switch in the OFF position, depress the TRIP and RESET buttons.

(2) While holding the TRIP and RESET button turn the ignition switch to the ON position.

(3) Continue to hold the TRIP and RESET buttons until the word CODE appears in the odometer windows (about five seconds) then release the buttons. If a problem exists, the system will display Diagnostic Trouble Codes (DTC's). If no problem exists, the code 999 (End Test) will momentarily appear.

DIM TEST

When CHEC-0 is displayed in the odometer window, the cluster's vacuum fluorescent (VF) displays will dim down. If the VF display brightness does no change, a problem exists in the cluster.

HEADLAMP SWITCH POSITION	8-WAY CONNECTOR TERMINALS	RESISTANCE VALUE
OFF	2 to 1 2 to 5 2 to 6 2 to 7 2 to 8	5.2 OHMS (avg.) OPEN OPEN OPEN OPEN
PARKING LAMPS ON	2 to 3 2 to 5 2 to 6 2 to 7 2 to 8	OPEN OPEN OPEN OPEN CONTINUITY
HEADLAMPS ON	2 to 3 2 to 5 2 to 6 2 to 7 2 to 8	CONTINUITY OPEN OPEN OPEN CONTINUITY
FRONT FOG LAMPS ON (WITH PARKING LAMPS OR HEADLAMPS)	2 to 3 2 to 6 2 to 8 5 to 2 7 to 2	CONTINUITY CONTINUITY CONTINUITY DIODE CONTINUITY DIODE CONTINUITY

THUMBWHEEL	12-WAY CONNECTOR TERMINALS	RESISTANCE VALUE
DOME LAMPS ON	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	CONTINUITY OPEN 8k to 12k OHMS CONTINUITY OPEN
DAYTIME RUNNING MODE	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN CONTINUITY 8k to 12k OHMS CONTINUITY CONTINUITY
I/P LAMPS IN BRIGHT POSITION	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN OPEN 8k to 12k OHMS CONTINUITY CONTINUITY
I/P LAMPS IN DIM POSITION	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN OPEN 0 to 500 OHMS CONTINUITY CONTINUITY
COURTESY LAMPS DEFEAT	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN OPEN 0 to 500 OHMS OPEN CONTINUITY

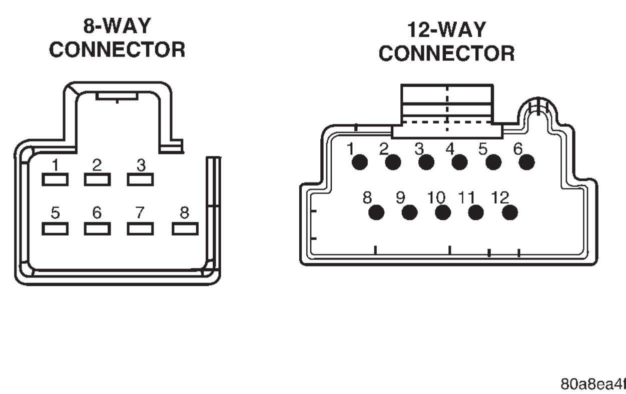

Fig. 1 Headlamp Switch Test

DIAGNOSIS AND TESTING (Continued)

INSTRUMENT CLUSTER DTC TABLE

DTC	DESCRIPTION
110	Memory Fault in cluster
111	Calibration fault in cluster
905	No CCD bus messages from TCM
921	Odometer fault from BCM
940	No CCD bus messages from PCM
999	End of Codes

CLUSTER CALIBRATION TABLE

Speedometer	Calibration Point
1	0 mph (0 Km/h)
2	20 mph (40 Km/h)
3	55 mph (80 Km/h)
4	75 mph (120 Km/h)

Tachometer	Calibration Point
1	0 rpm
2	1000 rpm
3	3000 rpm
4	6000 rpm

Fuel Gauge	Calibration Point
1	Empty (E)
2	1/8 Filled
3	1/4 Filled
4	Full (F)

Temperature Gauge	Calibration Point
1	Cold (C)
2	Low Normal
3	High Normal
4	Hot (H)

CALIBRATION TEST

When CHEC-1 is displayed in the odometer window, each of the cluster's gauge pointers will move sequentially through each calibration point. The Calibration Table contains the proper calibration points for each gauge. If the gauge pointers are not calibrated, a problem exists in the cluster. If any gauge is out of calibration it will have to be calibrated using a scan tool (DRB III). Refer to the proper Body Diagnostic Procedure Manual for calibration procedures.

ODOMETER SEGMENT TEST

When CHEC-2 is displayed in the odometer window, each digit of the odometer will illuminate sequentially. If a segment in the odometer does not illuminate normally, a problem exists in the display.

ELECTRONIC TRANSMISSION RANGE INDICATOR SEGMENT TEST

When CHEC-3 is displayed in the odometer window, each segment of the transmission range indicator will illuminate sequentially. If a segment in the transmission range indicator does not illuminate normally, a problem exists in the display board.

CONDITIONS

Refer to the following tables:
- Instrument Cluster
- Speedometer
- Tachometer
- Fuel Gauge
- Temperature Gauge
- Odometer
- Electronic Transmission Range Indicator (PRND3L)
- Mechanical Transmission Range Indicator (PRND21)

for possible/problems/causes and corrections.

INSTRUMENT CLUSTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
INSTRUMENT CLUSTER INOPERATIVE-NO RESPONSE	No CCD bus messages from the Body Control Module (BCM).	1. Use a scan tool to check the BCM. If OK, look for another possible cause for cluster failure. If not OK, refer to the proper Body Diagnostic Procedure Manual.
	Spread terminal(s) on wiring harness cluster connector.	1. Remove cluster from instrument panel and check wiring harness connector for spread terminal. If OK, look for another possible cause for the cluster failure. If not OK, repair connector.
	Body Control Module (BCM) is not receiving proper input from the ignition switch.	1. Use a scan tool to verify ignition switch status into the BCM. If not OK, go to Step (2). If OK, look at another possible cause of failure.
		2. Check ignition switch function and wiring.
	Internal cluster failure.	1. Replace main cluster pc board and use a scan tool to calibrate cluster.

DIAGNOSIS AND TESTING (Continued)

SPEEDOMETER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	1. Internal cluster failure.	1. (a) Perform cluster self diagnostic test and check for fault codes. • If speedometer pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If the pointer doesn't move during test, go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (b). • If fault code 111 is displayed in the odometer then go to Step (f). • If fault codes 905, 920, or 940 are displayed in the odometer display refer to the fault code chart to identify which module is causing the fault and repair module. (b) Replace main cluster pc board. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) Use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, complete installation. If not OK, go to Step (e). (e) Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the speedometer failure. (f) Use a scan tool to calibrate speedometer and perform Self Diagnostic Test. If OK, stop. If not OK, go to Step (b).
	2. No speed CCD Bus Message or Zero mph CCD Speed Bus Message.	2. (a) Check the Body Control Module (BCM) using a scan tool. If OK, go to Step (b). If not OK, refer to the BCM section of the service manual to repair the BCM. (b) Check the Powertrain Control Module (PCM) using a scan tool. If OK, go to Step (c). If not OK, refer to the PCM section of the service manual to repair the PCM. (c) Check the speed signal input into the PCM. The speed signal originates from one of the following sources: • A distance sensor for vehicles with 3 speed automatic transmission. Check continuity from distance sensor to PCM. If OK, replace distance sensor. If not OK, repair wiring. • The Electronic Transmission Control Module (TCM) for vehicles with the 4 speed electronic transmissions. Check continuity from TCM to PCM. If OK, use a scan tool to check TCM. Refer to the electronic TCM section of the service manual to repair the TCM. If not OK, repair wiring.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT	1. Erratic Message from another Module.	1. (a) Check the BCM using a scan tool If OK, go to Step (b). If not OK, refer to the BCM section of the service manual to repair the BCM. (b) Check the PCM using a scan tool. If OK, go to Step (c). If not OK, refer to the PCM section of the service manual to repair the PCM. (c) Check the speed signal input into the PCM. The speed signal originates from one of the following sources: • A distance sensor for vehicles with 3 speed automatic transmission. Check continuity from distance sensor to PCM. If OK, replace distance sensor. If not OK, repair wiring. • The Electronic Transmission Control Module (TCM) vehicles with the 4 speed electronic transmissions. Check continuity from TCM to engine controller. If OK, use a scan tool to check TCM. Refer to the electronic section of the service manual to repair the TCM. If not OK, repair wiring.
	2. Internal Cluster Failure.	2. (a) Perform cluster self diagnostic test and check for fault codes. • If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, then go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (e). • If fault code 111 appears in the odometer display go to Step (d). • If fault codes 905, 920, or 940 are displayed in the odometer display refer to the fault code chart to identify which module is causing the fault and repair module. (b) Replace cluster subdial assembly. To Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) Use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the speedometer failure.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SPEEDOMETER INACCURATE.	1. Speedometer Out of Calibration.	1. (a) Perform Cluster Self Diagnostic Test. • If speedometer is accurate to the calibration points then look for another possible cause of inaccuracy. • If speedometer is not accurate to the calibration points, go to Step (b). (b) Use a scan tool to calibrate speedometer.
	2. Wrong Speedometer Pinion Size For Tire Size.	2. (a) If vehicle has a 4 speed electronic transmission go to Step (c). Otherwise go to Step (b). (b) Check if correct speedometer pinion is being used with tires on vehicle. Refer to transmission section of manual for test and repair procedure. • If the incorrect pinion is in transmission then replace with correct pinion. • If the correct pinion is in the transmission calibrate speedometer using a scan tool to correct for the inaccuracy. (c) use a scan tool to check the TCM to see if the correct tire size has been programmed into the TCM. • If the incorrect tire size was selected, select the proper tire size. • If the correct tire size was selected, calibrate speedometer to correct for the inaccuracy.
	3. Bad Speed Sensor.	3. Refer to the proper section of the service manual for test and repair procedure.

DIAGNOSIS AND TESTING (Continued)

TACHOMETER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	1. Internal Cluster Failure.	1. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If tachometer pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If the pointer doesn't move during test, go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (b). • If fault code 111 is displayed in the odometer then go to Step (f). • If fault codes 920 or 940 are displayed in the odometer display refer to the fault code chart to identify which module is causing the fault an repair module. (b) Replace main cluster pc board. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). (e) Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the tachometer failure. (f) Use a scan tool to calibrate tachometer and perform Self Diagnostic Test. If OK, stop. If not OK, go to Step (b).
	2. No rpm CCD Bus Message or Zero rpm CCD Bus Message from Engine Controller.	2. Check the PCM using a scan tool. Refer to the PCM section of the manual to properly diagnose and repair.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT.	1. Bad CCD Bus Message from Engine Controller.	1. Check the PCM using a scan tool. Refer to the PCM section of the manual to properly diagnose and repair.
	2. Internal Cluster Failure.	2. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (e). • If fault code 111 appears in the odometer display go to Step (d). • If fault codes 920 or 940 are displayed in the odometer display refer to the fault code chart to identify which module is causing the fault and repair module. (b) Replace cluster subdial assembly. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) Use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). (e) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the tachometer failure.
TACHOMETER INACCURATE.	1. Tachometer out of calibration.	1. Calibrate tachometer using a scan tool.

DIAGNOSIS AND TESTING (Continued)

FUEL GAUGE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT.	1. Internal cluster failure.	1. (a) Perform Cluster Self Diagnostic Test and check for fault codes. •If fuel gauge pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. •If the pointer doesn't move during test, go to Step (b). •If fault code 110 is displayed in the odometer, go to Step (b). •If fault code 111 is displayed in the odometer then go to Step (f). •If fault code 920 is displayed in the odometer refer to the fault code chart to identify which module is causing the fault and repair module. (b) Replace main cluster pc board. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) Use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). (e) Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the fuel gauge failure. (f) Use a scan tool to calibrate fuel gauge and perform Self Diagnostic Test. If OK, stop. If not OK, go to Step (b).
	2. No CCD Fuel Message or Empty CCD Bus Message from Body Controller.	2. (a) Check the BCM using a scan tool. If OK, go to Step (b). If not OK, refer to the BCM section of the manual to properly diagnose and repair. (b) Refer to the Fuel section of the service manual for the fuel level sending unit test procedure. Test unit and repair as instructed.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT.	1. Bad CCD Fuel Message from the Body Controller.	1. (a) Use a scan tool to check the BCM. If OK, go to Step (b). If not OK, refer to the BCM section of the service manual to properly diagnose and repair. (b) Refer to the Fuel section of the service manual for the fuel level sending unit test procedure. Test unit. If OK, look for another possible cause for fuel gauge failure. If not OK, repair sending unit.
	2. Internal Cluster Failure.	2. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (e). • If fault code 111 appears in the odometer display to Step (d). • If fault code 920 is displayed in the odometer refer to the fault code chart to identify which module is causing the fault and repair module. (b) Replace cluster subdial assembly. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) Use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). (e) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the fuel gauge failure.
FUEL GAUGE INACCURATE.	1. Fuel Gauge Out of Calibration.	1. (a) Perform Cluster Self Diagnostic Test. If pointer is accurate to the calibration points look for another possible cause of failure. If pointer is inaccurate to the calibration points, to Step (b). (b) Use a scan tool to calibrate fuel gauge.
	2. Fuel Level Sending Unit is Out of Calibration.	2. (a) Refer to the Fuel section of the service manual for test and repair procedure.

DIAGNOSIS AND TESTING (Continued)

TEMPERATURE GAUGE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	1. Internal Cluster Failure.	1. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If temperature gauge pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If the pointer doesn't move during test, go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (b). • If fault code 111 is displayed in the odometer then go to Step (f). • If fault codes 920 or 940 are displayed refer to the fault code chart to identify which module is causing the fault and repair module. (b) Replace main cluster pc board. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). (e) Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the temperature gauge failure. (f) Use a scan tool to calibrate temperature gauge and perform Self Diagnostic Test. If OK, stop. If not OK, go to Step (b).
	2. No CCD Temperature Message or Cold CCD Bus Message from the Body Control Module.	2. (a) Check BCM fault codes using a scan tool. If there are not faults, go to Step (b). If there are faults, refer to the BCM section of the manual to properly diagnose and repair. (b) Check PCM fault codes using a scan tool. If there are no faults, go to Step (c). If there are faults, refer to the PCM section of the manual to properly diagnose and repair. (c) Refer to the coolant sensor section of the service manual for the coolant sensor test procedure. Repair sensor as needed.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT.	1. Bad CCD Bus Message from the Body Control Module.	1. (a) Check BCM fault codes using a scan tool. If there are no faults, go to Step (b). If there are faults, refer to the BCM section of the manual to properly diagnose and repair. (b) Check PCM fault codes using a scan tool. If there are no faults, go to Step (c). If there are faults, refer to the PCM section of the manual to properly diagnose and repair. (c) Refer to the coolant sensor section of the service manual for the coolant sensor test procedure. Repair sensor as needed.
	2. Internal Cluster Failure.	2. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (e). • If fault code 111 appears in the odometer display go to Step (d). • If fault code 920 or 940 is displayed refer to the fault code chart to identify which mode is causing the fault and repair module. (b) Replace cluster subdial assembly. Go to Step (c). (c) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to Step (d). (d) Use a scan tool to calibrate cluster and perform Self Diagnostic Test. If OK, continue installation. If not OK, go Step (e). (e) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the temperature gauge failure.
TEMPERATURE GAUGE INACCURATE.	1. Temperature Gauge Out of Calibration.	1. (a) Perform Cluster Self-Diagnostic Test. • If pointer is accurate to the calibration points look for another possible cause of failure. • If pointer is inaccurate to the calibration points, go the Step (b). (b) Use a scan tool to calibrate temperature gauge.
	2. Coolant Sensor Out of Calibration.	2. Refer to the Cooling section of the service manual for test and repair procedure.

DIAGNOSIS AND TESTING (Continued)

ODOMETER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DISPLAY	1. No CCD Odometer Bus Message from Body Control Module.	1. Use a scan tool to check the BCM. Refer to the BCM section of the manual to properly diagnose and repair.
	2. Internal Cluster Failure.	2. (a) Perform Cluster Self Diagnostic Test and check for fault codes. **• If odometer passes the dim test and segment check and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure.** **• If odometer doesn't work go to Step (b).** **•If fault code 110 is displayed in the odometer, go to Step (b).** **• If fault code 920 or 921 is displayed use a scan tool to check BCM.** **(b) Remove cluster from instrument panel and verify that odometer assembly is properly connected to main pc board. If OK, go to Step (c). If not OK, reconnect odometer assembly to main pc board.** **(c) Replace odometer assembly. Go to Step (d).** **(d) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS TESTED. Go to Step (e).** **(e) Perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (f).** **(f) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the odometer failure.**

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC DISPLAY	1. Internal Cluster Failure.	1. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If odometer passes the dim test and segment check and fault codes 110 or 111 don't appear in the odometer displayed then failure is not in the cluster. Look for another possible cause of failure. • If odometer doesn't work go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (b). • If fault code 920 or 921 is displayed use a scan tool to check BCM. (b) Remove cluster from instrument panel and verify that odometer assembly is properly connected to main pc board. If OK, go to Step (c). If not OK, reconnect odometer assembly to main pc board. (c) Replace odometer assembly. Go to Step (d). (d) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT TESTED. Go to Step (e). (e) Perform Self diagnostic Test. If OK, continue installation. If not OK, go to Step (f). (f) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the odometer failure.
	2. Bad CCD Bus Message from Body Controller Module.	2. Use a scan tool to check the BCM. Refer to the BCM section of the manual to properly diagnose and repair.
ODOMETER WON'T GO INTO TRIP MODE.	1. Trip Switch Doesn't Work.	1. Use a scan tool to perform trip switch activation test. If OK, look for another possible cause of failure. If not OK, replace odometer assembly.
TRIP ODOMETER WON'T RESET.	1. Reset Switch Doesn't Work.	1. Use a scan tool to perform reset switch activation test. If OK, look for another possible cause of failure. If not OK, replace odometer assembly.

DIAGNOSIS AND TESTING (Continued)

ELECTRONIC GEAR INDICATOR DISPLAY DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DISPLAY	1. Internal Cluster Failure.	1. (a) Perform Cluster Self Diagnostic Test and check for fault codes. **• If PRND3L passes the dim test and segment check and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure.** **• If PRND3L doesn't work go to Step (b).** **• If fault code 110 is displayed in the odometer, go to Step (b)** **• If fault code 905 is displayed use a scan tool to check electronic TCM.** **(b) Remove cluster from instrument panel and verify that PRND3L assembly is properly connected to main pc board. If OK, go to Step (c). If not OK, reconnect PRND3L assembly to main pc board.** **(c) Replace PRND3L assembly. Go to Step (d).** **(d) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS TESTED. Go to Step (e).** **(e) Perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (f).** **(f) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the PRND3L failure.**

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC DISPLAY	1. Internal Cluster Failure.	1. (a) Perform Cluster Self Diagnostic Test and check for fault codes. • If PRND3L passes the dim test and segment check and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If PRND3L doesn't work go to Step (b). • If fault code 110 is displayed in the odometer, go to Step (f). • If fault code 111 is displayed in the odometer display then use a scan tool to calibrate cluster. • If fault code 905 is displayed use a scan tool to check electronic TCM. (b) Remove cluster from instrument panel and verify that odometer assembly is properly connected to main pc board. If OK, go to Step (c). If not OK, reconnect PRND3L assembly to main pc board. (c) Replace PRND3L assembly. Go to Step (d). (d) Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS TESTED. Go to Step (e). (e) Perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (f). (f) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the PRND3L failure.
	2. Bad CCD Bus Message from the Electronic Transmission Control Module (TCM).	2. Use a scan tool to check the electronic TCM. Refer to the electronic TCM section of the manual to properly diagnose and repair.
ALL SEGMENTS ARE ON	1. No CCD bus message from the electronic Transmission Control Module (TCM).	1. (a) Perform Cluster Self Diagnostic test. If PRND3L passes test go to Step (b). If PRND3L fails test go to Step (c). (b) Check electronic TCM using a scan tool. Refer to the electronic TCM section of the manual to properly diagnose and repair. (c) Replace PRND3L assembly. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS TESTED. Go to Step (d). (d) Perform Self Diagnostic Test. If OK, continue installation. If not OK, go to Step (e). (e) Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the PRND3L failure.

DIAGNOSIS AND TESTING (Continued)

TRACTION CONTROL SWITCH

MECHANICAL TRANSMISSION RANGE INDICATOR (PRND21) DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
INDICATOR DOES NOT SHOW PROPER GEAR OR NO INDICATION.	Mis-adjusted.	1. (a) Verify transmission shift system correctly adjusted. (b) Verify correct routing and attachment of PRNDL cable and guide tube. (c) Re-adjust PRNDL indicator in Neutral using adjuster wheel below steering column.
INDICATOR DOES NOT FOLLOW GEAR SHIFT LEVER.	Not attached.	1. (a) Verify indicator cable connected to shift lever pin in the groove. (b) Verify indicator clip secure and attached to steering column/transmission shift cable bracket and clip not broken. If broken, replace clip on indicator.
INDICATOR DOES NOT MAKE FULL TRAVEL ("P" < > "1").	1. Cable dislodged from its path on the indicator base. 2. Incorrect attachment of cable to shift lever pin.	1. Verify correct attachment of indicator cable to shift lever pin (under hoop of trans. shift cable) and clip onto steering column/shift cable bracket. 2. Verify indicator travel by pulling on cable gently over full travel range. If still problem, remove cluster and lens to access indicator base and confirm cable path per attached sketch.

(1) Remove over steering column bezel. Refer to Over Steering Column Bezel. Removal procedures.

(2) Using an ohmmeter check for continuity reading between pins. Refer to Switch Continuity Table.

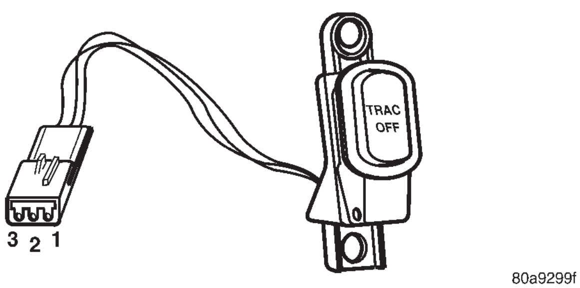

Fig. 2 Traction Control Switch Connector

SWITCH CONTINUITY TABLE

SWITCH POSITION	CONTINUITY BETWEEN
ACTUATED	PINS 1 AND 3
ILLUMINATION	PINS 2 AND 3

REMOVAL AND INSTALLATION

CONVENIENCE BIN - CUP HOLDER

REMOVAL

(1) Pull the convenience bin open (Fig. 3).

(2) Push lock tab at rear center downward.

(3) Pull the convenience bin - cup holder from track in instrument panel.

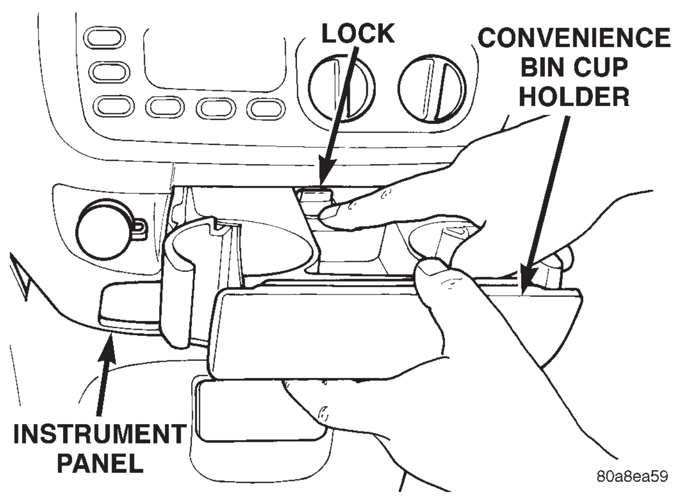

Fig. 3 Convenience Bin – Cup Holder

(4) Remove convenience bin - cup holder.

INSTALLATION

For installation, reverse the above procedures.

CONVENIENCE BIN LAMP

If the lamp is not used refer to (Fig. 4).

REMOVAL

(1) Pull out and remove the convenience bin - cup holder. Refer to Convenience Bin - Cup Holder removal in this section.

REMOVAL AND INSTALLATION (Continued)

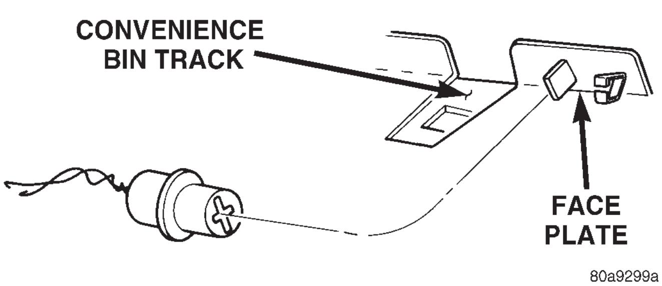

Fig. 4 Unused Convenience Bin Lamp Socket Location

(2) Insert the trim stick (special tool #C-4755) between access cover and radio bezel, above convenience bin - cup holder.

(3) Carefully pry the access cover from the instrument panel (Fig. 5).

(4) Separate the access cover from the vehicle.

(5) Using needle-nose pliers, carefully squeeze the vertical metal legs of the lamp hood.

(6) Lift the lamp hood upward from the cup holder tray.

(7) Carefully pull the lamp and wiring rearward from the instrument panel (Fig. 6).

(8) Pull the lamp hood from the lamp socket.

(9) Pull bulb from socket.

INSTALLATION

For installation, for reverse the above procedures.

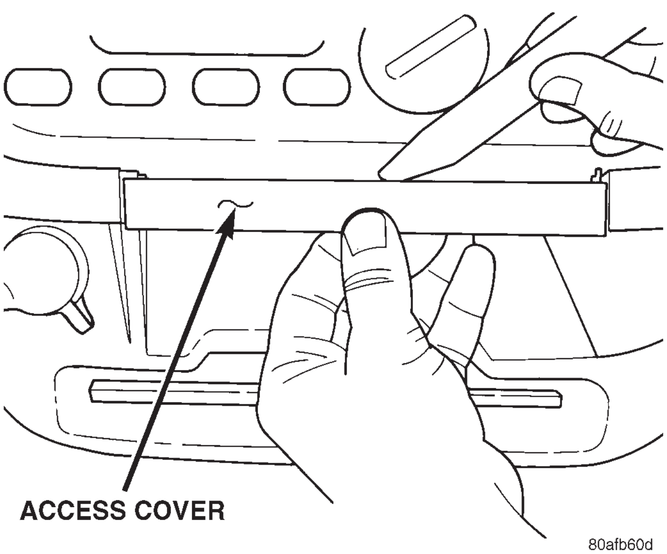

Fig. 5 Convenience Bin Access Cover

CONVENIENCE BIN TRACK

REMOVAL

(1) Remove the convenience bin - cup holder. Refer to Convenience Bin - Cup Holder Removal and Installation procedure in this section.

(2) Remove the screw access cover from the bottom of the radio bezel (Fig. 5).

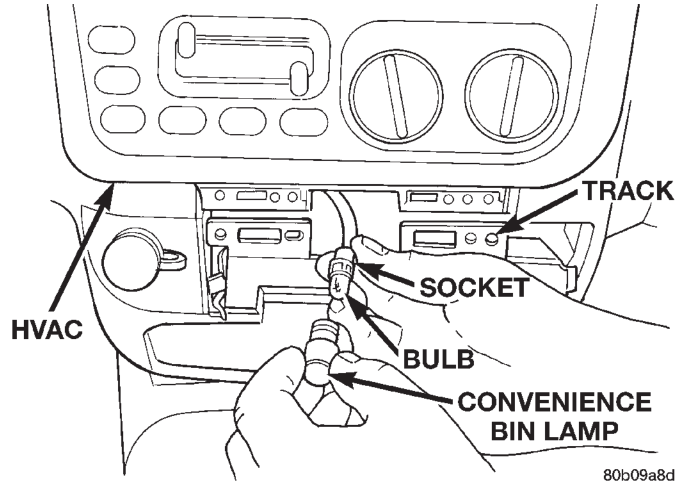

Fig. 6 Convenience Bin Lamp Bulb

(3) Remove the center bezel.

(4) Remove the convenience bin track attaching screws and pull the convenience bin track rearward to disengage the rear guide studs from instrument panel (Fig. 7).

(5) Disengage the clip holding convenience bin lamp to track.

(6) Remove the convenience bin track.

INSTALLATION

For installation, reverse the above procedures.

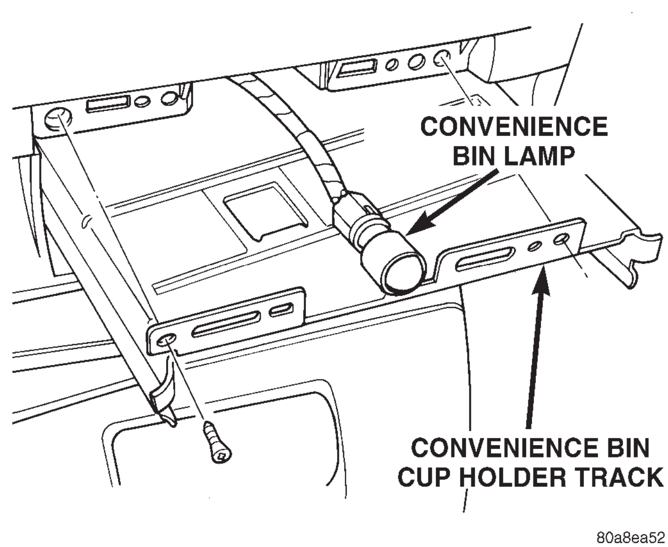

Fig. 7 Convenience Bin Track

BODY CONTROL MODULE (BCM)

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove lower steering column cover and knee blocker reinforcement.

REMOVAL AND INSTALLATION (Continued)

(3) Disconnect two wire connectors from bottom of Body Control Module (BCM)

(4) Remove bolts holding Junction Block to dash panel mounting bracket (Fig. 8).

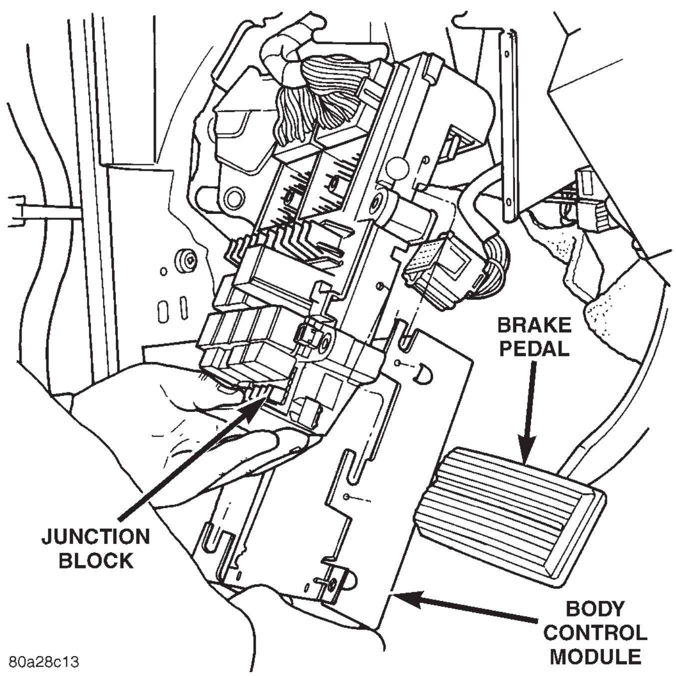

Fig. 8 Body Control Module Location

(5) Remove Junction Block from mounting bracket.

(6) Remove screws holding Body Control Module to Junction Block.

(7) Slide Body Control Module downward to disengage guide studs on Junction Block from channels on BCM mounting bracket.

(8) Remove Body Control Module from Junction Block.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER LENS - MECHANICAL TRANSMISSION RANGE INDICATOR (PRND21)

REMOVAL

(1) Remove the instrument cluster and disconnect the range indicator cable at both attaching points. Refer to Instrument Cluster with Mechanical Transmission Range Indicator Reval and Installation procedures.

(2) Remove the screws holding the cluster lens to the rear shell from around perimeter of lens.

(3) Remove the lens from the cluster, guide the shift indicator cable through cluster shell.

(4) Remove the screws holding the shift indicator to the lens.

INSTALLATION

(1) Install the shift indicator and screws to cluster lens.

(2) Position the lens on cluster and carefully guide the shift indicator cable and guide through cluster opening.

(3) Install the cluster lens and screws to the rear shell around perimeter of lens.

(4) Install the instrument cluster.

INSTRUMENT CLUSTER ELECTRONIC ODOMETER AND TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove instrument cluster.

(2) Remove cluster lens.

(3) Disconnect wire connector from odometer and transmission range indicator.

(4) Remove screws holding odometer and transmission range indicator to cluster shell.

(5) Remove odometer and transmission range indicator from cluster.

INSTALLATION

(1) Install odometer and transmission range indicator and attach to cluster shell.

(2) Connect wire connector into odometer and transmission range indicator.

(3) Install cluster lens.

(4) Install instrument cluster.

GLOVE BOX

REMOVAL (FIG. 4)

(1) Open glove box (Fig. 9).

(2) Disengage clip holding checkstraps to glove box door.

(3) Pivot glove box downward and disengage hinge hooks from instrument panel.

(4) Remove glove box.

INSTALLATION

(1) Place glove box in position.

(2) Engage hinge hooks into instrument panel and pivot glove box upward.

(3) Engage clip to hold checkstraps to glove box door.

(4) Close glove box door.

GLOVE BOX LAMP AND SWITCH

REMOVAL

(1) Open glove box door (Fig. 10).

(2) Using a trim stick, lightly pry glove box lamp/switch from instrument panel.

(3) Disengage wire connector from glove box lamp and switch.

REMOVAL AND INSTALLATION (Continued)

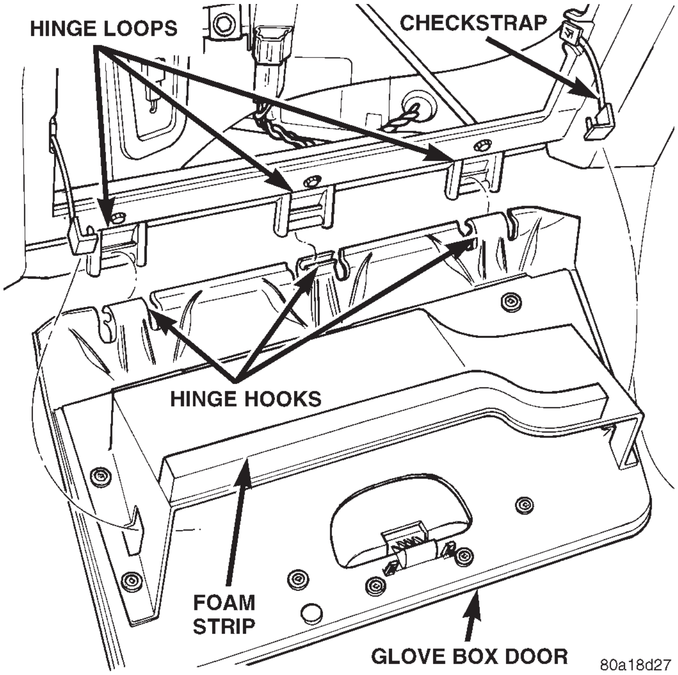

Fig. 9 Glove Box

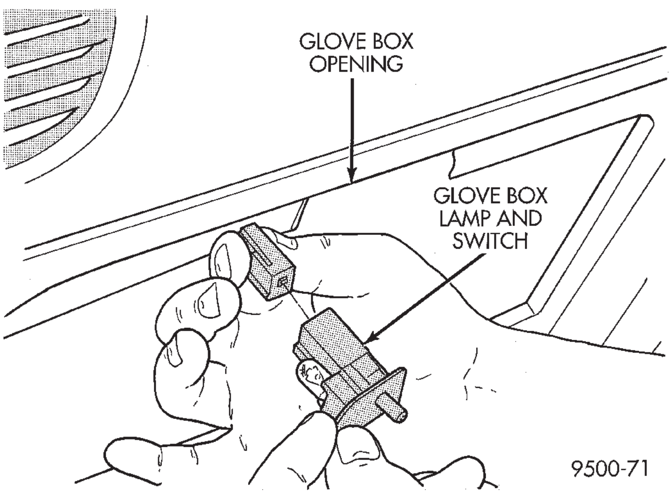

Fig. 10 Glove Box Lamp and Switch

(4) Remove glove box lamp and switch.
(5) Remove lamp (Fig. 11).

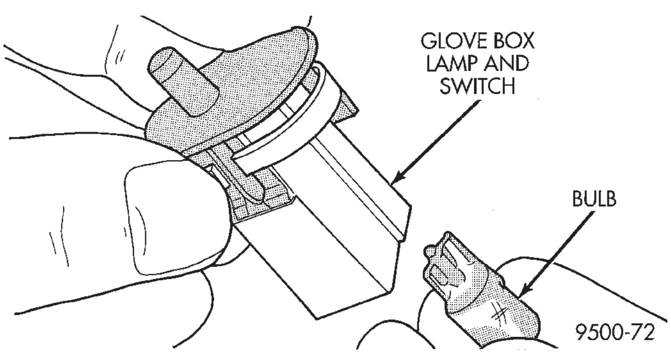

Fig. 11 Glove Box Lamp

INSTALLATION

For installation, reverse the above procedures.

GLOVE BOX LOCK STRIKER

REMOVAL

(1) Open glove box door (Fig. 12).

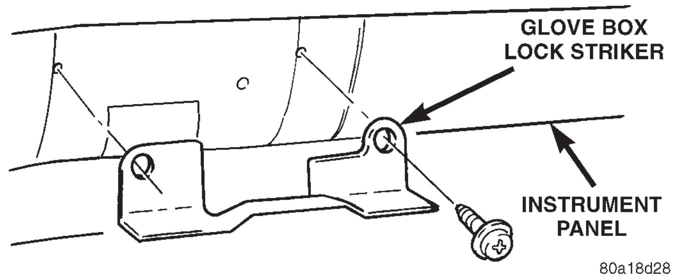

Fig. 12 Glove Box Lock Striker

(2) Disengage clip holding checkstraps to glove box door.
(3) Remove screws holding lock striker to instrument panel.
(4) Remove glove box lock striker.

INSTALLATION

For installation, reverse the above procedures.

HEADLAMP SWITCH

REMOVAL

(1) Remove instrument cluster bezel (Fig. 13).

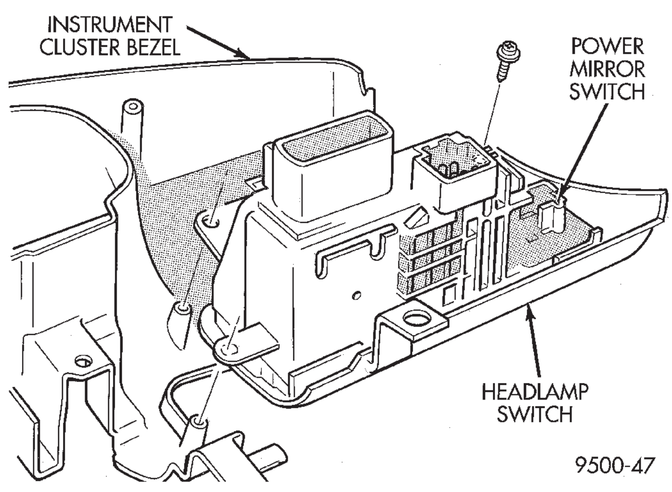

Fig. 13 Headlamp Switch

(2) Remove screws holding the headlamp switch bezel to cluster bezel.
(3) Disconnect the wire connectors from the headlamp switch and wire connector from the power mirror switch.
(4) Remove headlamp switch bezel from cluster bezel.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

HEADLAMP SWITCH LAMP(S)

REMOVAL

(1) Remove instrument cluster bezel.

(2) Disconnect wire connectors.

(3) Remove headlamp switch bezel from instrument cluster bezel.

(4) Rotate bulb socket counterclockwise one quarter turn (Fig. 14).

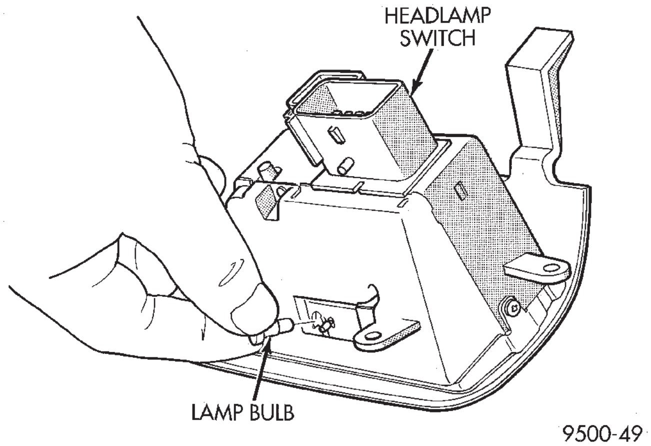

Fig. 14 Headlamp Switch Lamp

(5) Pull bulb socket from headlamp switch.

INSTALLATION

For installation, reverse the above procedures.

HVAC CONTROL LAMP

REMOVAL

(1) Remove radio bezel and HVAC Control (Fig. 15).

(2) Remove rear cover from HVAC control.

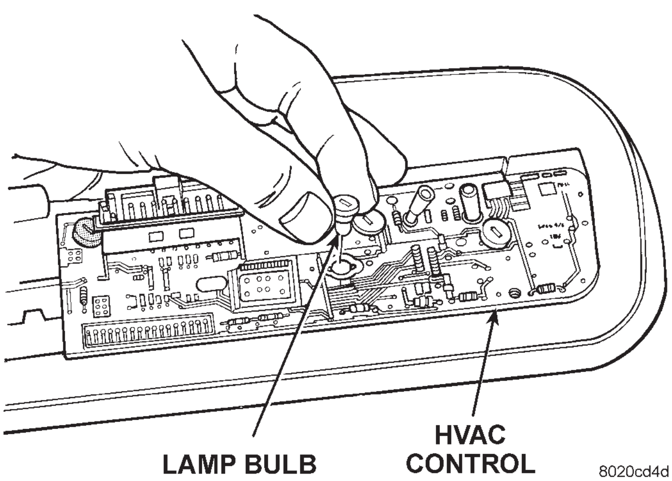

Fig. 15 HVAC Control Lamps

(3) Rotate bulb socket counterclockwise one quarter turn.

(4) Pull bulb socket from HVAC.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER BACK PANEL

REMOVAL

(1) Remove instrument cluster.

(2) Remove screws holding back panel to instrument cluster (Fig. 16).

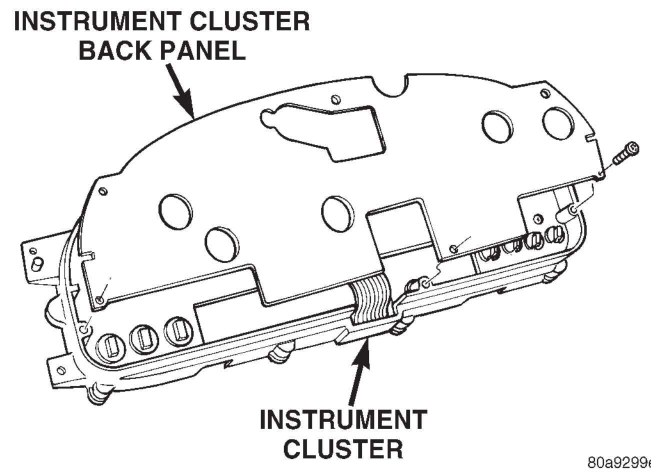

Fig. 16 Instrument Cluster Back Panel

(3) Remove back panel.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER BEZEL

REMOVAL

(1) Remove steering column cover.

(2) Remove over steering column bezel (Fig. 17).

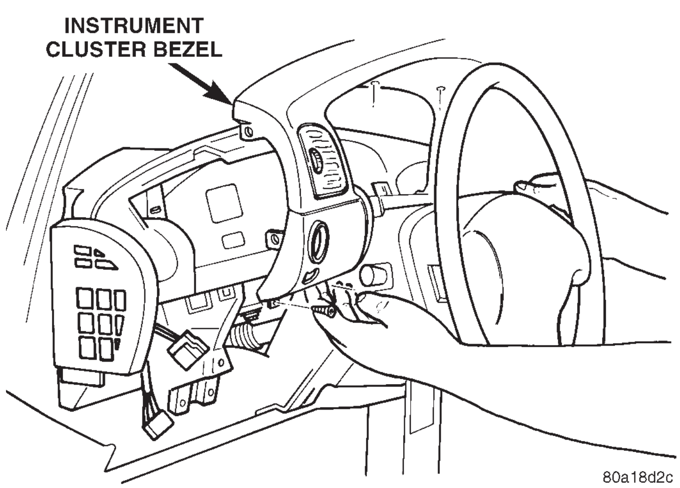

Fig. 17 Instrument Cluster Bezel

(3) Remove left end cover.

(4) Remove screw at left end of cluster bezel and headlamp switch.

REMOVAL AND INSTALLATION (Continued)

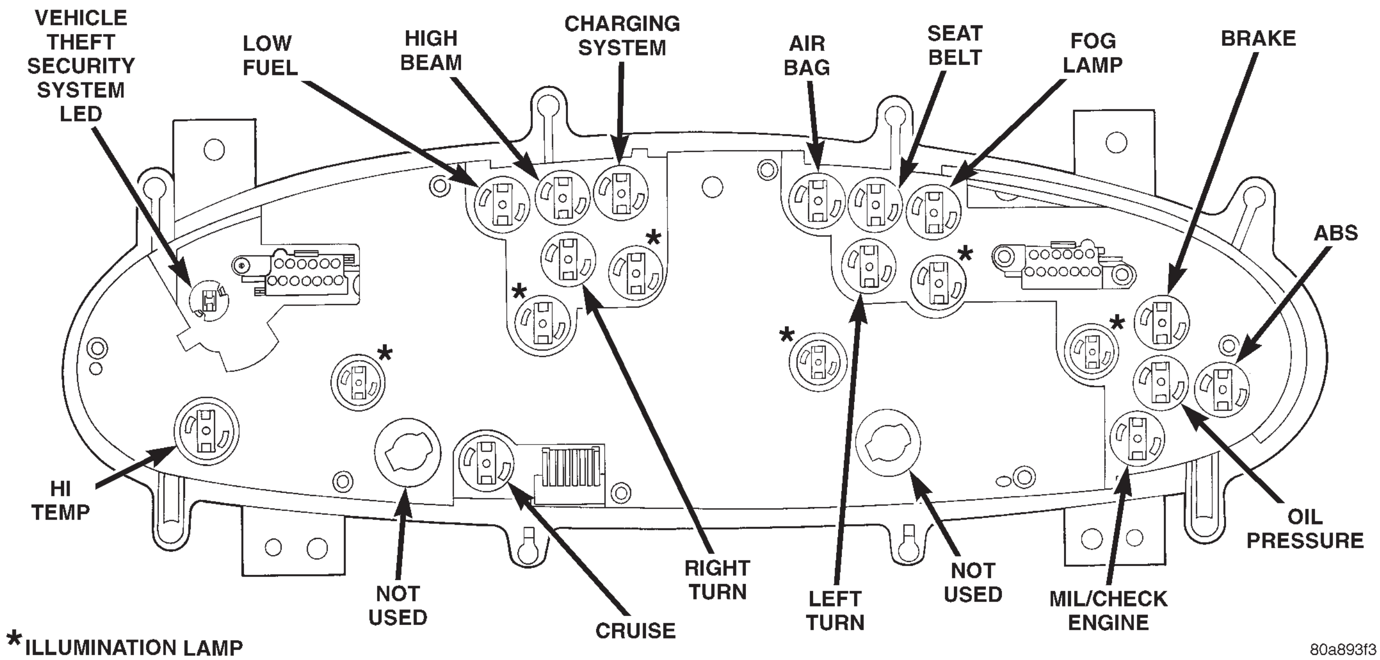

Fig. 18 Cluster Lamp Location

(5) Remove screws holding cluster bezel to instrument panel from each side of steering column.

(6) Disconnect clip holding cluster bezel to instrument panel from above right vent louver.

(7) Separate cluster bezel from instrument panel.

(8) Disconnect wire connectors from back of the bezel.

INSTALLATION

(1) Connect wire connectors into back of the bezel.

(2) Place cluster bezel in position on instrument panel. Use care not to place hands on louvers.

(3) Connect clips to hold cluster bezel to instrument panel. Use care not to add pressure on the A/C louvers to seat the cluster bezel clips.

(4) Install screws to hold cluster bezel to instrument panel on each side of steering column.

(5) Install screw at left end of cluster bezel and headlamp switch.

(6) Install left end cover.

(7) Install over steering column bezel.

(8) Install lower steering column cover.

INSTRUMENT CLUSTER LAMPS

REMOVAL

(1) Remove the instrument cluster. Refer to Instrument Cluster Removal procedure.

(2) Locate the lamp (Fig. 18).

(3) Remove the lamps from cluster with a 1/4 turn twist.

INSTALLATION

For installation, reverse the procedures.

INSTRUMENT CLUSTER LENS

REMOVAL

(1) Remove the instrument cluster.

(2) Remove the screws holding the lens to the instrument cluster (Fig. 19).

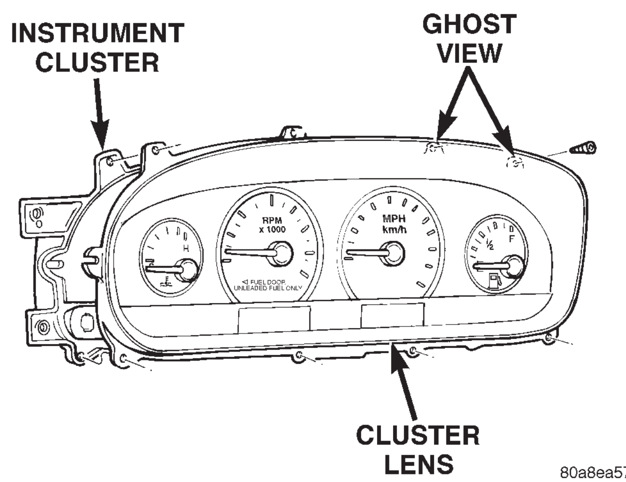

Fig. 19 Instrument Cluster Lens

(3) Remove the lens from cluster.

INSTALLATION

For installation, reverse the procedures.

REMOVAL AND INSTALLATION (Continued)

INSTRUMENT CLUSTER PRINTED CIRCUIT BOARD

REMOVAL

(1) Remove the instrument cluster.
(2) Remove the instrument cluster back panel.
(3) Disconnect the electronic cluster wire connector from the printed circuit board (Fig. 20).

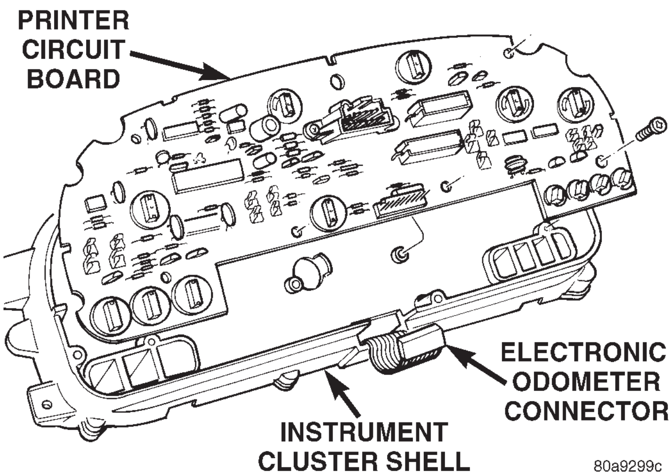

Fig. 20 Instrument Cluster Printed Circuit Board

(4) Remove the screws holding wire connector insulator to the instrument cluster shell and the printed circuit board.
(5) Remove the screws holding printed circuit board to the cluster shell.
(6) Remove the printed circuit board from the cluster.

INSTALLATION

For installation, reverse the above procedures. After installing the print circuit board it will have to be calibrated using a scan tool (DRB III). Refer to the proper Body Diagnostic Procedure Manual for calibration procedures.

NOTE: Speedometer and/or Tachometer will not operate properly until all gauges have been calibrated

INSTRUMENT CLUSTER SUBDIAL

REMOVAL

(1) Remove the instrument cluster.
(2) Remove the cluster lens.
(3) Disconnect the temperature/fuel gauge and the tachometer terminals from the connectors in cluster by pulling the subdial straight away from the cluster (Fig. 21).
(4) Remove the subdial from the cluster.

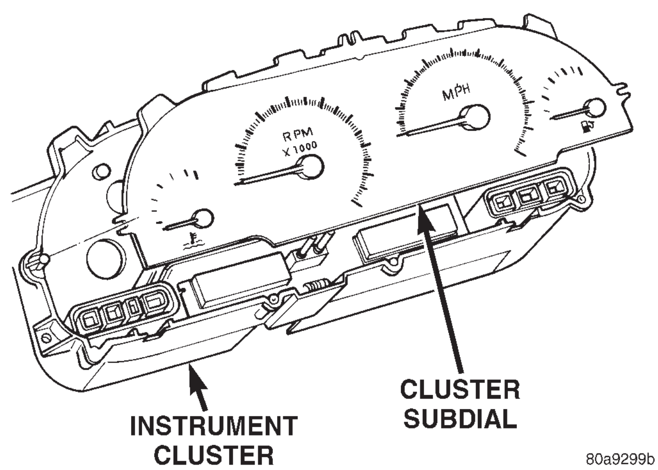

Fig. 21 Instrument Cluster Subdial

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER SUBDIAL—MECHANICAL TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove instrument cluster.
(2) Remove screws holding cluster lens to the rear shell from around perimeter of lens.
(3) Remove lens from cluster, guide shift indicator cable through cluster shell.
(4) Remove gauge subdial from cluster.

INSTALLATION

(1) Position gauge subdial on cluster.
(2) Position lens on cluster, guide shift indicator cable through cluster shell.
(3) Install cluster lens and screws to the rear shell around perimeter of lens.
(4) Install instrument cluster.

INSTRUMENT CLUSTER WITH ELECTRONIC TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove instrument cluster bezel (Fig. 22).
(2) Remove screws holding instrument cluster to instrument panel.
(3) Rotate top of cluster outward.
(4) Remove instrument cluster from instrument panel.
(5) Disconnect wire connector from back of instrument cluster.
(6) Remove instrument cluster.

INSTALLATION

(1) Place instrument cluster in instrument panel, bottom first.

REMOVAL AND INSTALLATION (Continued)

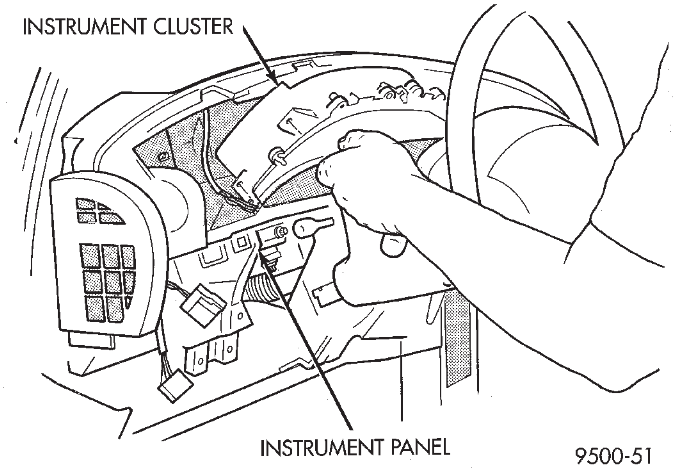

Fig. 22 Instrument Panel –Electronic Transmission Range Indicator

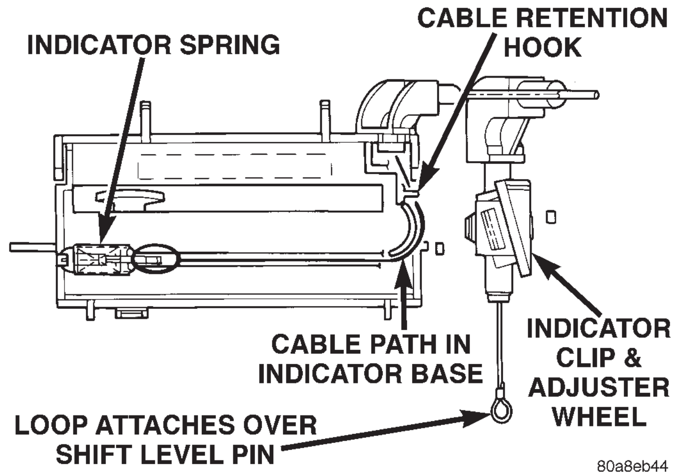

Fig. 23 Range Indicator

(2) Connect wire connector into back of instrument cluster.

(3) Position instrument cluster in instrument panel.

(4) Install instrument cluster mounting screws to instrument panel.

(5) Install instrument cluster bezel.

INSTRUMENT CLUSTER WITH MECHANICAL TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove the lower steering column cover.

(2) Remove the metal knee blocker panel.

(3) Disconnect the transmission range indicator cable end from shift lever by flexing the HOOP on the transmission shift cable rearward and slip the indicator cable loop off the lever pin (Fig. 23).

(4) Disconnect the clip holding the indicator cable to the steering column/transmission shift cable bracket.

(5) Remove the instrument cluster bezel.

(6) Rotate top of the cluster rearward.

(7) Disconnect the wire connector from back of the instrument cluster.

(8) Remove the instrument cluster carefully while guiding the range indicator cable and guide tube through the opening to avoid any damage (Fig. 24).

INSTALLATION

(1) Verify the free travel of the range indicator cable from P to 1 by gently pulling on the cable and relaxing the cable. DO NOT SNAP THE CABLE ONCE IT IS PULLED.

(2) Position the instrument cluster in instrument panel and route the indicator cable and guide tube through the opening in the instrument panel. Position the cluster by leading the bottom in first, connect the wire connector, and rotate upward.

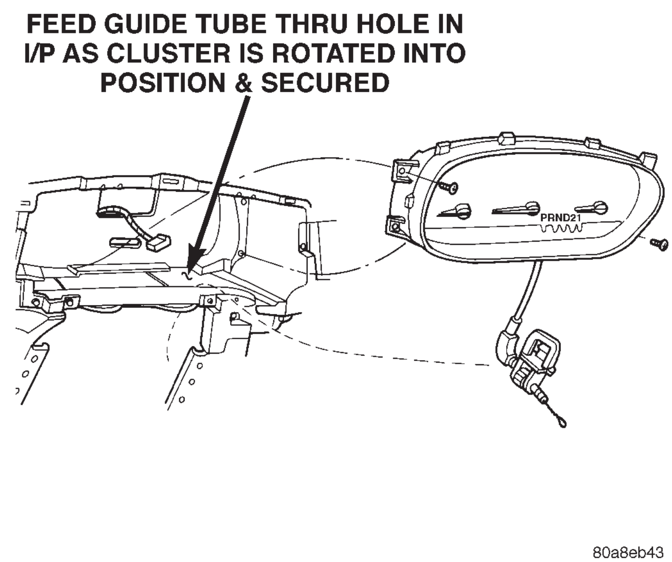

Fig. 24 Removing and Installing Cluster

(3) Install the screws to hold the instrument cluster to the instrument panel.

(4) Install the instrument cluster bezel.

(5) Connect the clip to hold the indicator cable to steering column/transmission shift cable bracket. The indicator cable and guide tube should BOW towards the passenger side of the vehicle (Fig. 25).

(6) Connect indicator cable loop end to shift lever by flexing the hoop on the transmission shift cable rearward, then slip the indicator cable loop over the shift lever pin and into the groove.

(7) Assuming the transmission shift system is properly adjusted, place the shift lever in neutral N position.

NOTE: The parking brake should have been engaged for safety purposes.

REMOVAL AND INSTALLATION (Continued)

(8) Using the indicator adjuster thumbwheel on the indicator clip below the steering column. Rotate the indicator thumbwheel to position the indicator calibration arrow to the center of the N slot on the instrument cluster mask.

(9) After the indicator has been properly adjusted, move the shift lever through each gear position to verify the appropriate gear position has been selected and the slot is fully covered by the indicator. The left edge of the indicator will just peek at the left edge of the P slot in Park.

(10) If the indicator is not covering each of the selected gear positions when selected, place the shift lever back into neutral N and readjust the indicator. Repeat the process until each gear is covered when selected.

(11) Install the metal knee blocker panel.

(12) Install the lower steering column cover.

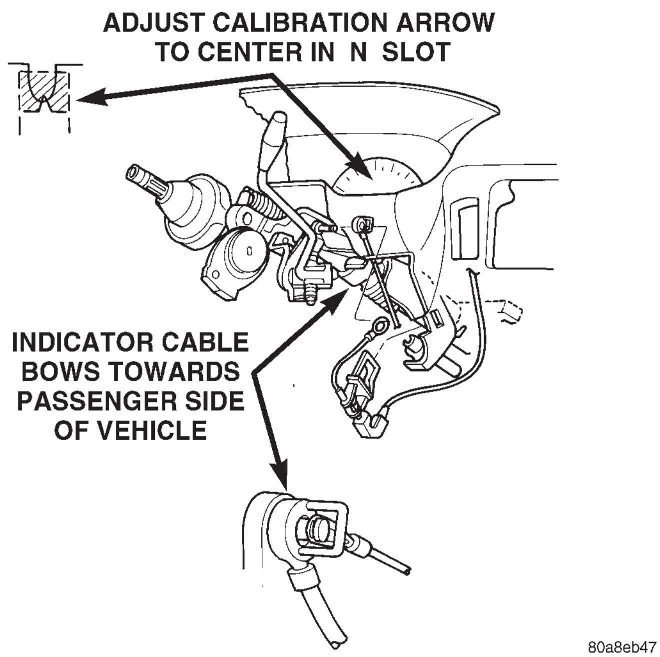

Fig. 25 Range Indicator Cable

INSTRUMENT PANEL

The instrument panel is removed as a unit. The steering column and wiring harnesses are assembled into the panel before installation. Service procedures for interior trim not related to the instrument panel can be found in Group 23, Body.

REMOVAL

(1) Disconnect the battery, negative cable first.

(2) Remove the lower console.

(3) Remove the screw holding the lower heat duct to the instrument panel support (Fig. 26).

(4) Disconnect the heat duct from the vehicle.

(5) Remove the bolts holding the lower supports to the instrument panel frame (Fig. 27).

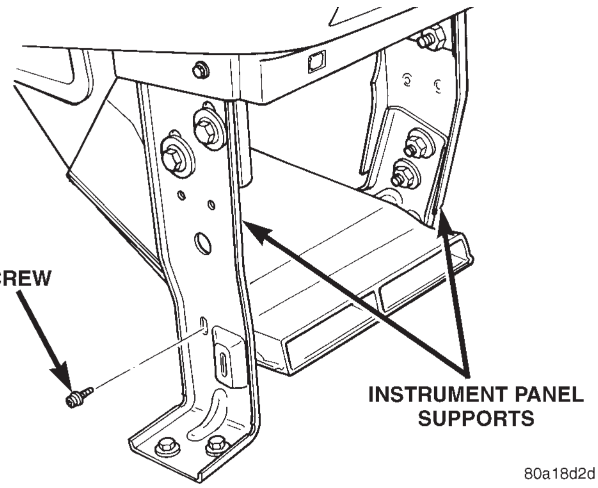

Fig. 26 Heat Duct

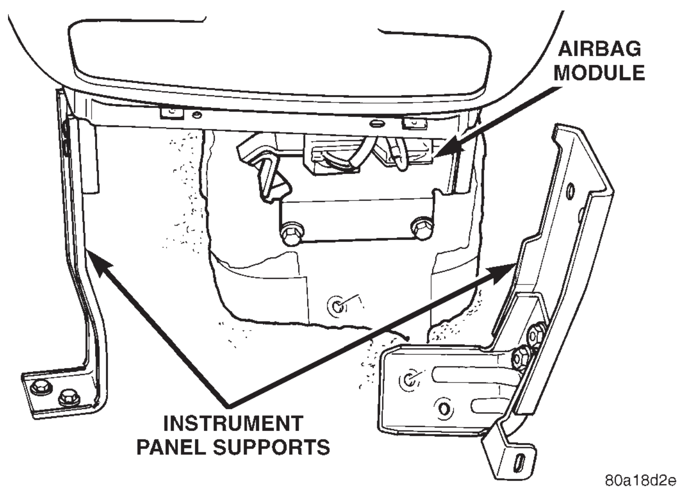

Fig. 27 Lower Supports

(6) Remove the bolts holding the lower supports to the floor pan.

(7) Remove the right and left end covers.

(8) Disconnect the wire connectors from the Passenger Airbag Module.

(9) Remove the front door sill trim covers.

(10) Remove the A-pillar trim covers.

(11) Remove the glove box.

(12) Disconnect the antenna lead connector from behind the glove box.

(13) Remove the lower steering column cover.

(14) Remove the knee blocker panel.

(15) Disconnect the lower two, forty pin wire harness connectors, from the main Junction Block near left cowl side panel (Fig. 28).

(16) Disconnect the instrument panel wire harness connector from the bottom of Body Control Module.

(17) Disconnect the two forty pin connectors from the right of the steering column (Fig. 29).

(18) Remove the clinch bolt holding upper the steering shaft to the lower steering shaft (Fig. 29).

REMOVAL AND INSTALLATION (Continued)

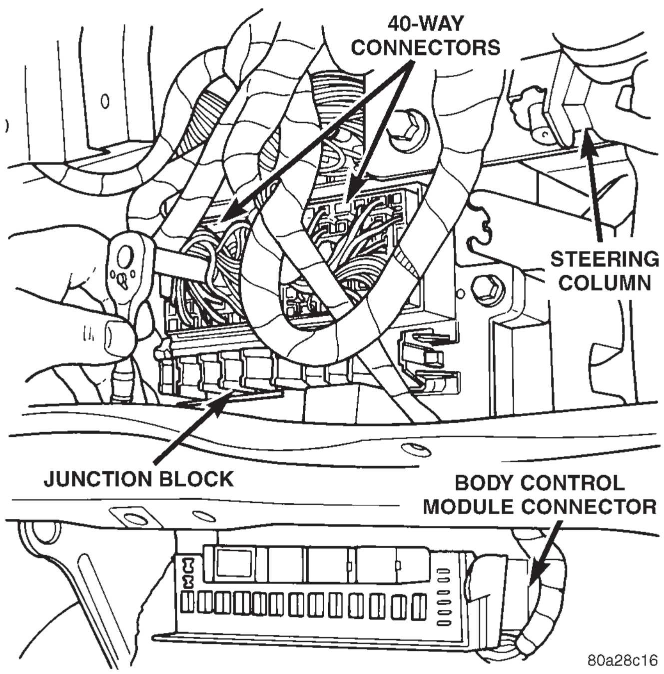

Fig. 28 Junction Block and Body Control Module Connectors

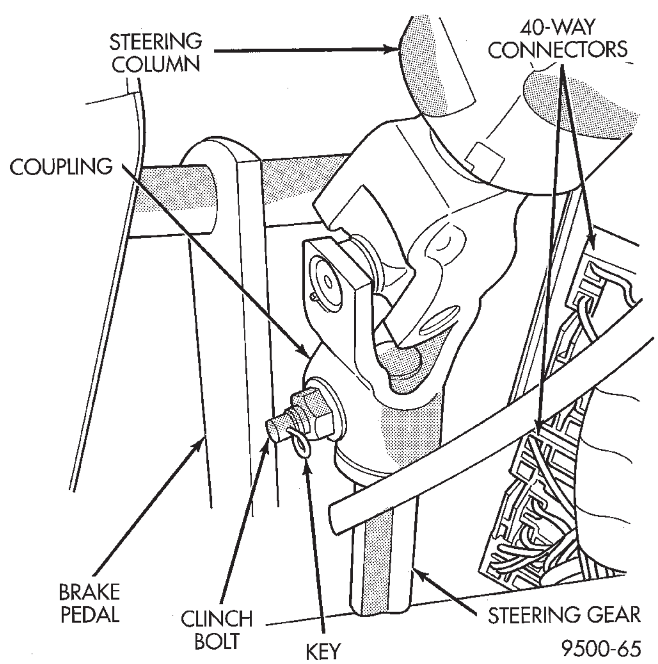

Fig. 29 40 Way Connectors Location

(19) Separate the upper steering shaft from the lower steering shaft.

(20) Remove the nuts holding the instrument panel frame to the die-cast brake pedal support on each side of the steering column.

(21) With mechanical transmission range indicator:

(a) Remove the indicator cable loop.

(b) Remove the clip holding gear shift cable end to the gear selector adapter.

(c) Pull the cable end from gear selector.

(d) Disconnect the clip for the indicator cable and guide tube from the shift cable bracket and move out of the way.

(22) Remove the nut holding gear shift cable bracket to the instrument panel frame.

(23) Remove the bracket from the instrument panel.

(24) Remove the screw holding hood release handle to the instrument panel.

(25) Remove the bolt holding the hood release handle to the instrument panel.

(26) Position the hood release handle out of the way.

(27) Remove the instrument panel top cover.

(28) Disconnect the wire connector from the HVAC wire harness behind the glove box area.

(29) Remove the bolts holding the instrument panel frame to the brackets on cowl side panels (Fig. 30) and (Fig. 31).

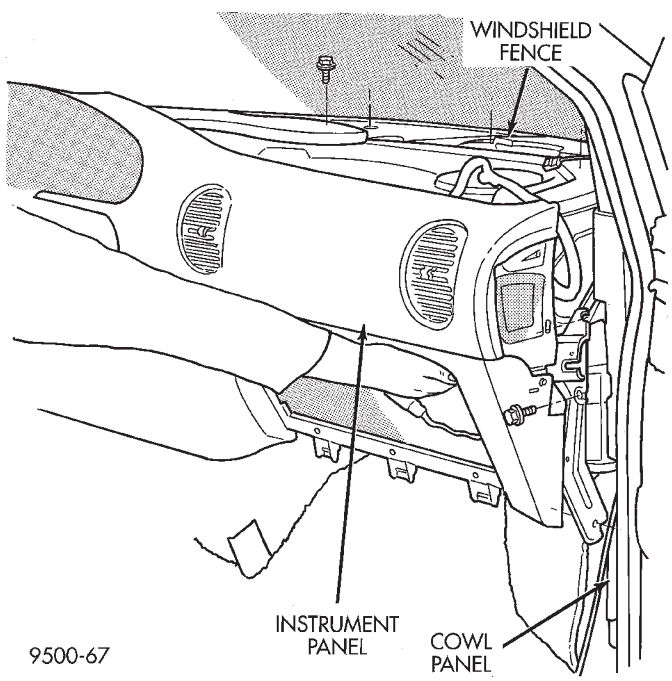

Fig. 30 Passenger Side Instrument Panel

(30) Loosen, but do not remove, the pivot bolts holding the instrument panel to the cowl panels.

(31) Remove the bolts holding the instrument panel frame to the dash panel below windshield opening.

(32) Remove the instrument panel from vehicle.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

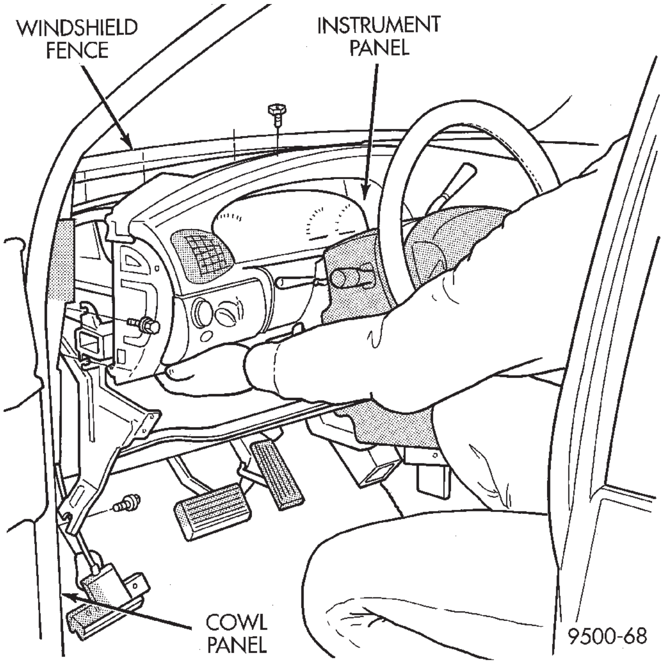

Fig. 31 Driver's Side instrument Panel

INSTRUMENT PANEL LEFT END COVER

REMOVAL

(1) Open driver side front door (Fig. 32).

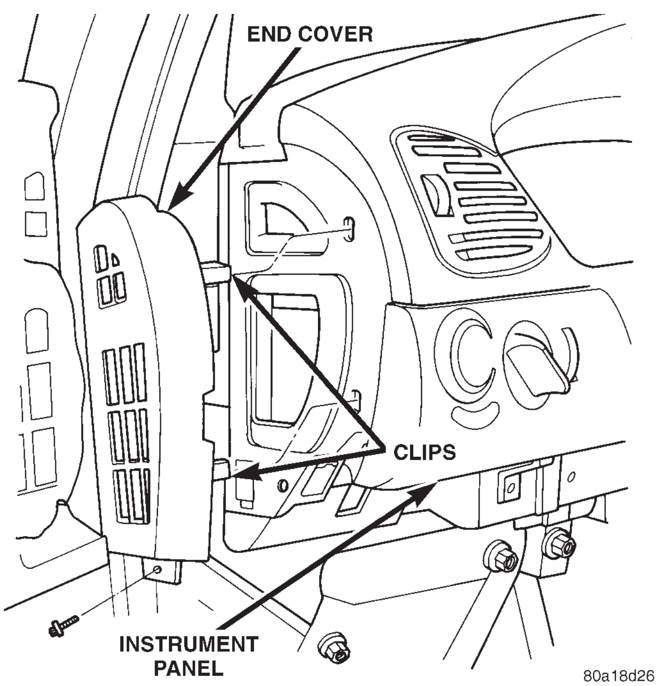

Fig. 32 Instrument Panel Left End Cover

(2) Remove lower steering column cover as necessary to gain clearance for end cover removal.

(3) Remove attaching screw

(4) Disengage clips holding end cover to instrument panel.

(5) Remove instrument panel end cover and foam pad covering the A/C inlet projection of the end cover if equipped.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT PANEL LOUVERS

CENTER LOUVER HOUSING

REMOVAL

(1) Remove the instrument cluster bezel. Refer to Instrument Cluster Bezel removal and installation procedures.

(2) Place cluster bezel on a clean surface face down with the head lamp switch to the right side (Fig. 33).

(3) Using a flat bladed tool, release the louver housing locks tabs (Fig. 34).

(4) Release the upper left lock tab first, then the two lower louver tabs.

(5) Applying pressure on the housing, release the upper right lock tab and the lower right.

(6) Push out the louver housing from the cluster bezel.

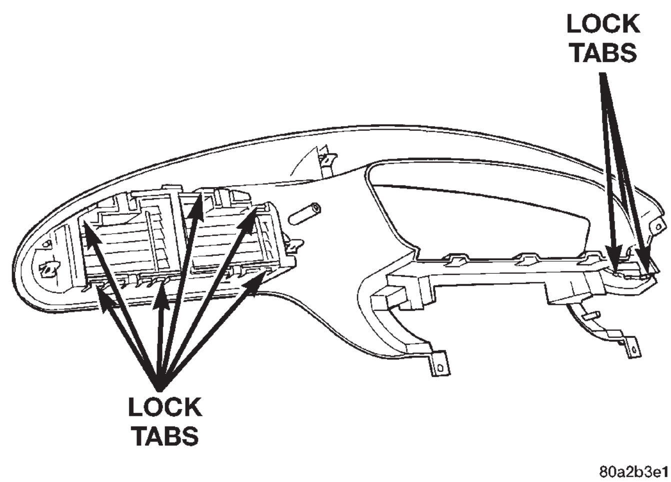

Fig. 33 Instrument Cluster Bezel

INSTALLATION

(1) Verify the function of the vanes.

(2) Set louver housing into the cluster bezel.

(3) Using care do not push on the vanes, apply pressure on outer edge of the housing and push louver housing into place.

(4) After in place check function of the vanes.

LEFT LOUVER HOUSING

REMOVAL

(1) Remove the instrument cluster bezel. Refer to Instrument Cluster Bezel Removal and Installation procedures.

REMOVAL AND INSTALLATION (Continued)

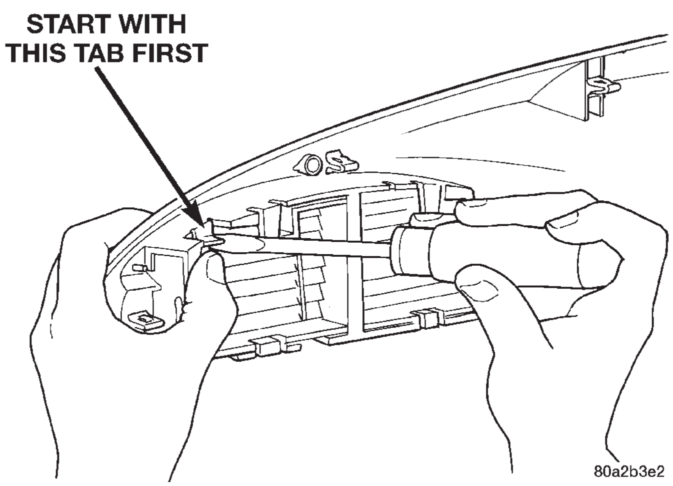

Fig. 34 Center Louver

(2) Place cluster bezel on a clean surface face down with the head lamp switch to the right side (Fig. 33).

(3) Using a flat bladed tool, release the louver housing locks tabs.

(4) Release the upper left lock tab first, then the other upper lock tab.

(5) Applying pressure on the housing, release the lower lock tabs.

(6) Push out the louver housing from the cluster bezel.

INSTALLATION

(1) Verify the function of the vanes.

(2) Set louver housing into the cluster bezel and align the slot of the housing with the T location pins.

(3) Using care do not push on the vanes, apply pressure on outer edge of the housing and push louver housing into place.

(4) After in place check function of the vanes.

PASSENGER SIDE LOUVERS

The inner, outer louver and inner, outer housing are serviceable.

REMOVAL

(1) Using medium flat blade tool, position it in between the right side of louver and the housing (Fig. 35).

(2) Twist the tool to release the pivot pin from the louver and pull outward till released from pin.

(3) Place tool on the other side of louver and release the other pivot pin and pull housing free from the instrument panel. Use the same procedure for either inner or outer louver.

INSTALLATION

The inner and outer louvers have different size pivot pins on the housing. The outer housing has a larger pin on the right side then the inner housing

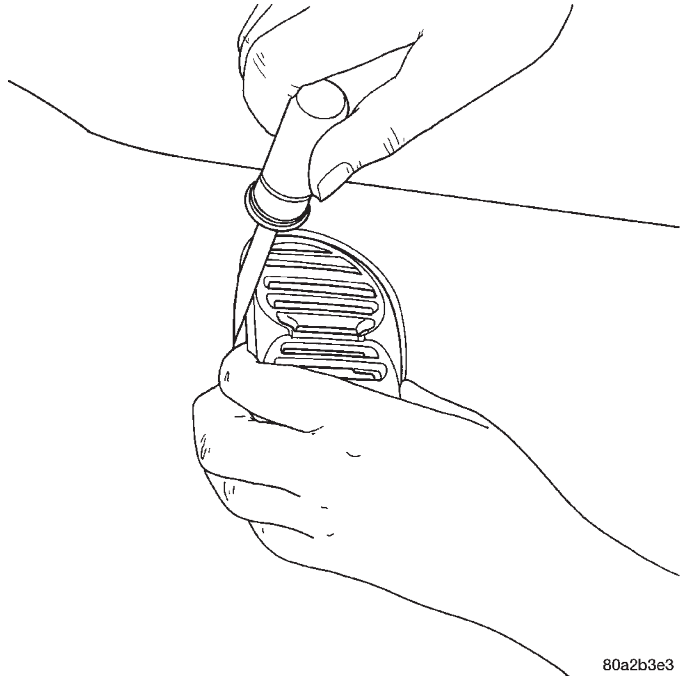

Fig. 35 Removing Passenger Louver

(Fig. 36). The louver have a surface cut out on the right side of the housings to note the proper side.

(1) The right pivot pin is slotted on both housings. So when aligning louver tab with the pin ensure that they are lined up.

(2) Using care, apply pressure on outer edge of the louver and push into place.

(3) Rotate louver to ensure proper engagement.

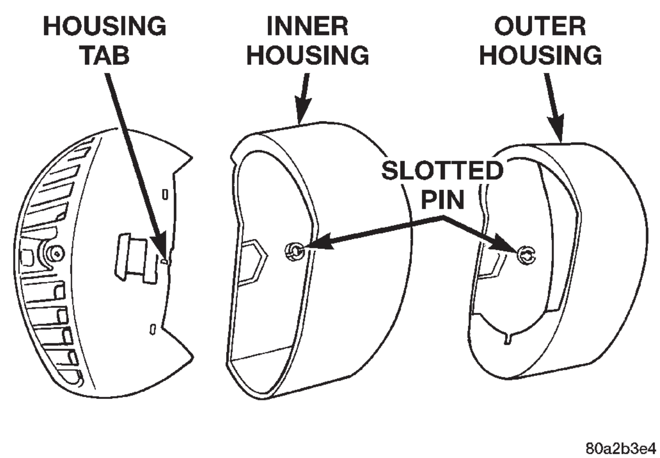

Fig. 36 Passenger Side Louver and Housings

PASSENGER SIDE LOUVER OUTER HOUSINGS

REMOVAL

(1) Using a trim stick, insert trim stick between the outer edge of the housing and the pad/panel vinyl covering (Fig. 37).

REMOVAL AND INSTALLATION (Continued)

(2) Lightly pry housing inward and by hand pull the housing free from panel (Fig. 38).

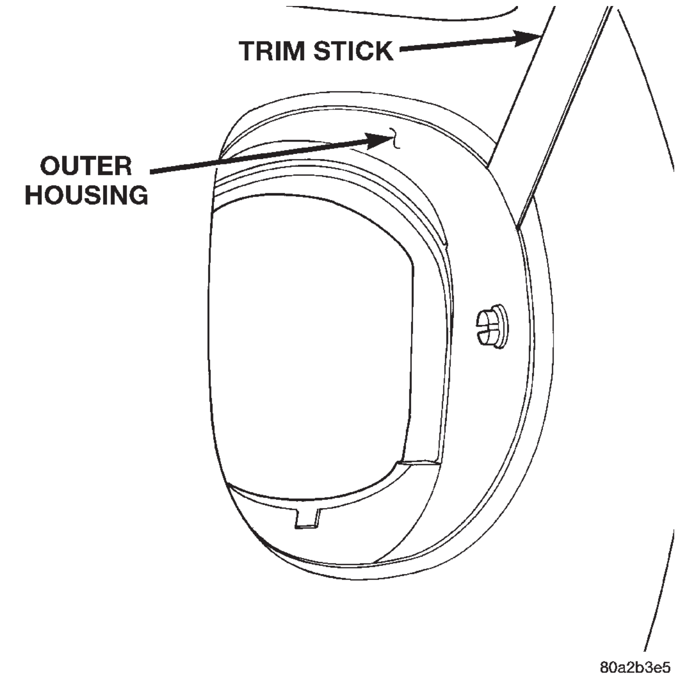

Fig. 37 Remove Housing

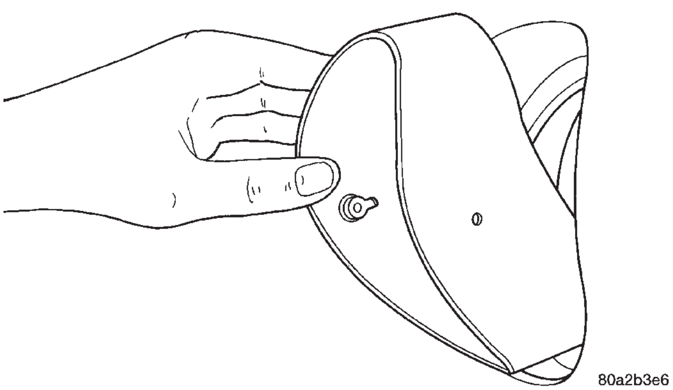

Fig. 38 Housing Being Removed

INSTALLATION

(1) Place the slotted pin on the right side of the opening.

(2) Set housing in to position and push into place. The housing may need to be rocked to get the best fit within the opening.

INSTRUMENT PANEL TOP COVER

REMOVAL

(1) Remove A-pillar trim.

(2) Using a trim stick, disengage clips holding rear edge of top cover to instrument panel (Fig. 39).

(3) Disconnect wire harness from message center.

(4) Pull top cover rearward to disengage hooks holding front of top cover to instrument panel.

(5) Remove top cover.

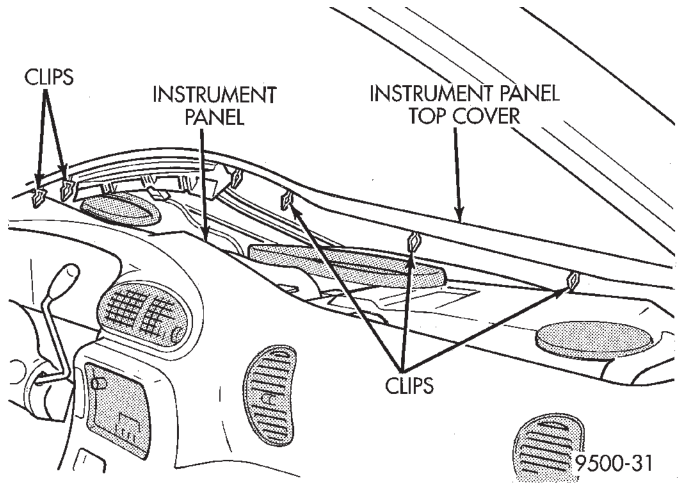

Fig. 39 Instrument Panel Top Cover

INSTALLATION

(1) Place instrument panel top cover in position on vehicle.

(2) Push top cover forward to engage hooks to hold front of top cover to instrument panel.

(3) Connect wire harness to message center.

(4) Engage clips to hold rear edge of top cover to instrument panel.

(5) Pull top cover rearward.

(6) Install A-pillar trim.

INSTRUMENT PANEL RIGHT END COVER

REMOVAL

(1) Open passenger side front door (Fig. 40).

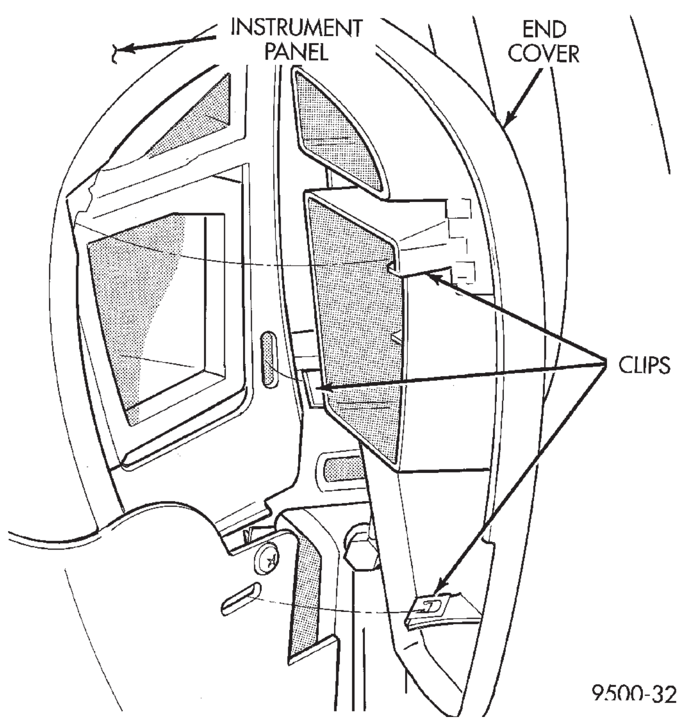

Fig. 40 Instrument Panel Right End Cover

REMOVAL AND INSTALLATION (Continued)

(2) Disengage clips holding right end cover to instrument panel.

(3) Remove instrument panel end cover and foam pad covering the A/C inlet projection of the end cover if equipped.

INSTALLATION

For installation, reverse the above procedures.

JUNCTION BLOCK

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove lower steering column cover and knee blocker reinforcement.

(3) Disconnect four, forty-way connectors from Junction Block (Fig. 41).

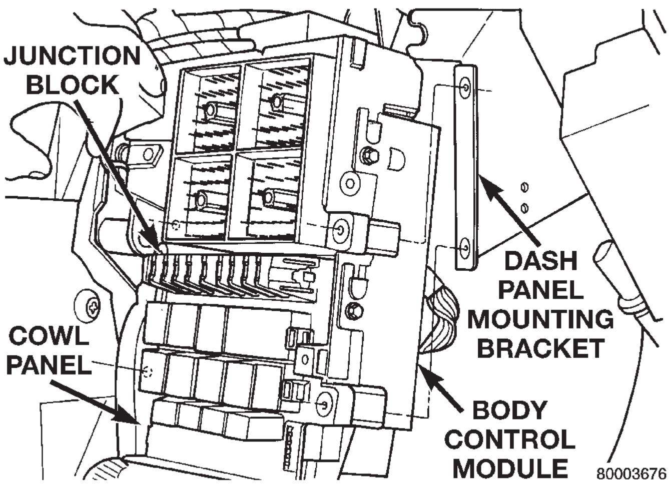

Fig. 41 Junction Block

(4) Disconnect two wire connectors from bottom of Body Control Module.

(5) Remove bolts holding Junction Block to dash panel mounting.

(6) Remove Junction Block from mounting bracket.

(7) Remove screws holding Body Control Module to Junction Block.

(8) Slide Body Control Module downward to disconnect guide studs on Junction Block from BCM ting bracket.

(9) Separate Junction Block from Body Control Module.

INSTALLATION

For installation, reverse the above procedures.

KNEE BLOCKER REINFORCEMENT

REMOVAL

(1) Remove lower steering column cover (Fig. 42).

(2) Remove screws holding knee blocker reinforcement to instrument panel.

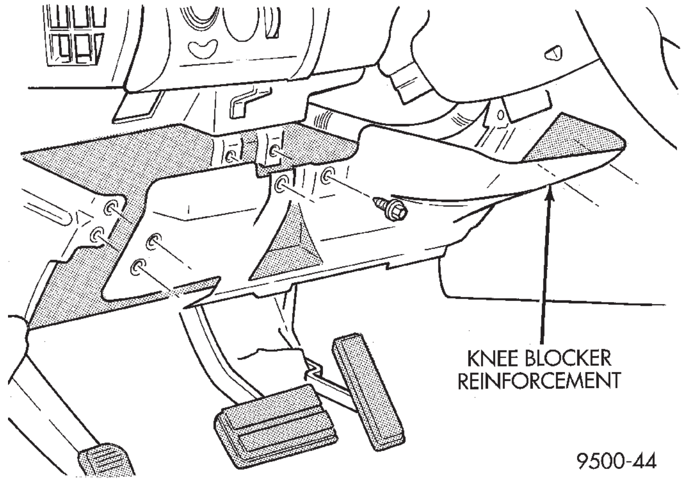

Fig. 42 Knee Blocker Reinforcement

(3) Remove reinforcement.

INSTALLATION

(1) Place reinforcement in position.

(2) Install screws to hold knee blocker reinforcement to instrument panel.

(3) Install lower steering column cover.

LOWER CONSOLE

REMOVAL

(1) Remove screws holding lower console to floor bracket and instrument panel (Fig. 43).

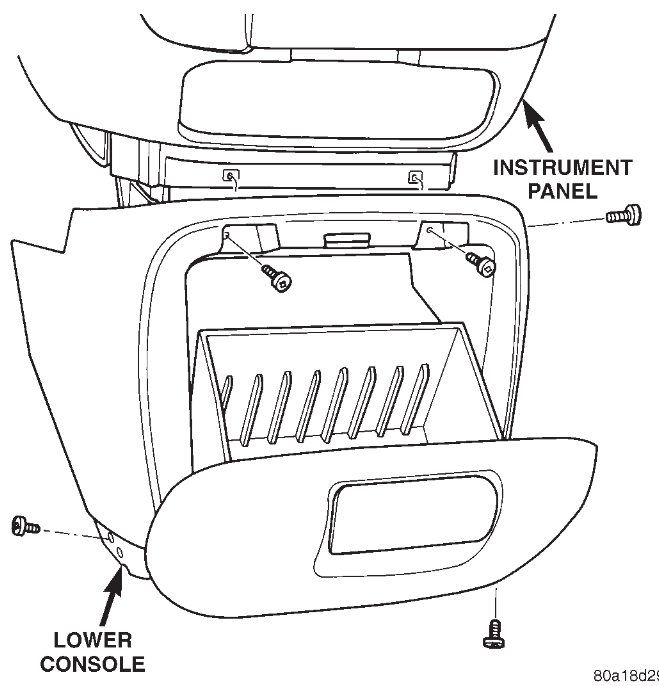

Fig. 43 Lower Console

(2) Slide console rearward from around instrument panel supports.

(3) Remove lower console.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place lower console in position.

(2) Slide console forward around instrument panel supports.

(3) Install screws to hold lower console to floor bracket and instrument panel.

LOWER INSTRUMENT PANEL

REMOVAL

(1) Remove the right end cover.

(2) Remove the steering column bezel.

(3) Remove the radio bezel and the HVAC control.

(4) Remove the lower console.

(5) Remove the convenience cup holder and track.

(6) Remove the glove box.

(7) Remove the glove box latch striker.

(8) Remove the glove box lamp.

(9) Disconnect the wire connector from glove box lamp.

(10) Remove the screws holding the lower instrument panel to the reinforcement frame around the glove box opening (Fig. 44).

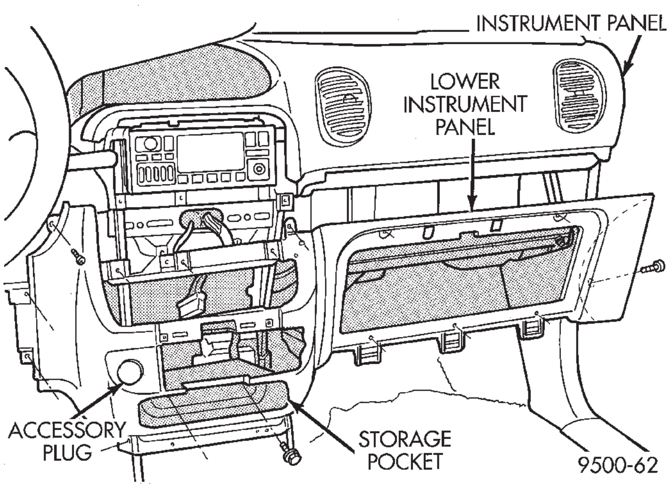

Fig. 44 Lower Instrument Panel

(11) Remove the screw holding the lower instrument panel to the right side of instrument panel.

(12) Remove the screw holding the lower instrument panel to the upper instrument panel at the left side panel above the accelerator pedal.

(13) Remove the instrument cluster bezel as necessary to gain access to the lower instrument panel screws.

(14) Remove the screw holding instrument panel to the upper panel below the instrument cluster.

(15) Remove the screws holding rear of storage pocket to the panel support frame.

(16) Remove the screws holding the lower instrument panel to the upper instrument panel from below radio.

(17) Remove the screws holding lower instrument panel to the support frame in floor console area.

(18) Separate the lower instrument from the upper instrument panel.

(19) Disconnect the wire connectors from back of the 12 volt outlet base.

(20) Remove the lower instrument from vehicle.

INSTALLATION

For installation, reverse the above procedures.

LOWER STEERING COLUMN COVER

REMOVAL

(1) Remove screws holding parking brake release handle to instrument panel (Fig. 45).

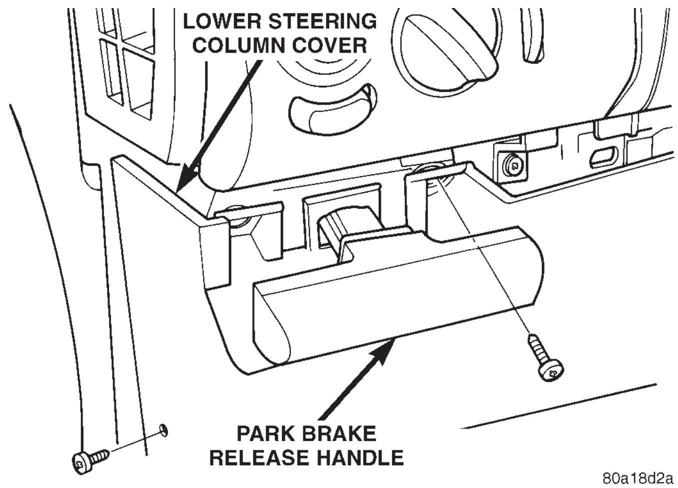

Fig. 45 Park Brake Release Handle

(2) Remove screws holding bottom of lower steering column cover to instrument panel (Fig. 46).

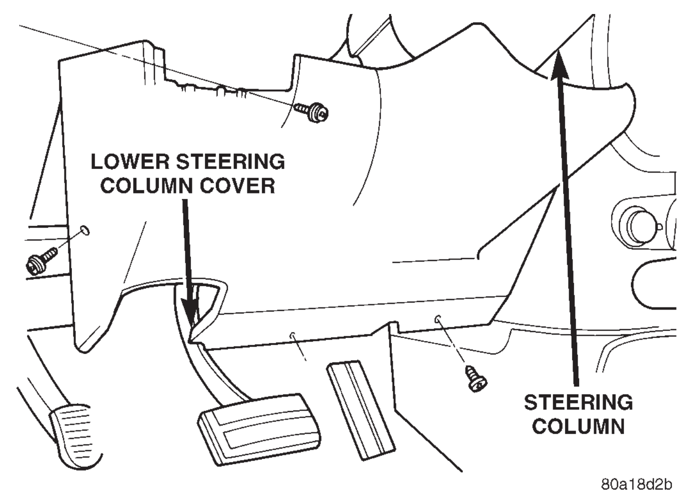

Fig. 46 Lower Steering Column Cover

(3) Remove screw holding right side of lower steering column cover to instrument panel.

REMOVAL AND INSTALLATION (Continued)

(4) Disengage park brake release cable case from groove on end of release handle (Fig. 47).

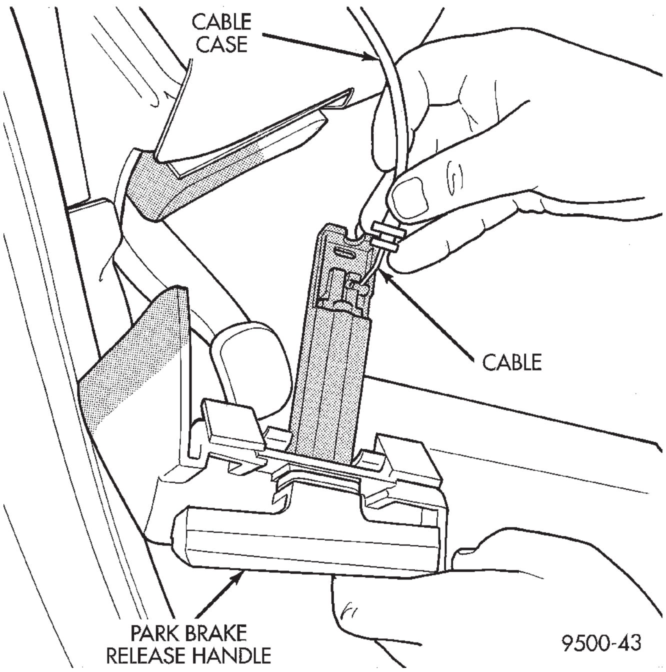

Fig. 47 Park Brake Release Handle

(5) Disengage cable end pivot from slot on release handle (Fig. 47).

INSTALLATION

For installation, reverse the above procedures,

MECHANICAL TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove instrument cluster.
(2) Remove cluster lens.
(3) Remove screws holding mechanical transmission range indicator to back of cluster lens.
(4) Remove mechanical transmission range indicator from cluster lens.

INSTALLATION

(1) Position transmission range indicator on cluster lens.
(2) Install mechanical range indicator and attaching screws to back of cluster lens.
(3) Install cluster lens.
(4) Install instrument cluster.

MESSAGE CENTER

REMOVAL

(1) Remove A-pillar trim.
(2) Remove instrument panel top cover. Refer to instrument panel top cover removal procedures.
(3) Disconnect the wire connector from back of message center.
(4) Remove screws holding message center to instrument panel top cover.
(5) Remove message center from instrument panel top cover.

INSTALLATION

(1) Place message center in position on top cover.
(2) Install screws to hold message center to instrument panel top cover.
(3) Connect wire connector into back of message center.
(4) Install instrument panel top cover.
(5) Install A-pillar trim.

MESSAGE CENTER LAMP

REMOVAL

(1) Remove instrument panel top cover. Refer to Instrument Panel Top Cover Removal procedures.
(2) Locate the lamp in question (Fig. 48).
(3) Remove lamp and check lamp. If lamp is good test the power supply to the lamp.

INSTALLATION

For installation, reverse the above procedures.

OUTLET (12 VOLT) BASE

REMOVAL

(1) Look inside and note position of the retaining bosses (Fig. 49).
(2) Using external snap ring pliers with 90 degree tips. Insert pliers with tips against bosses and squeeze forcing bosses out of base.
(3) Pull out the base through mounting ring by gently rocking pliers. A tool can be made to do the same. Refer to (Fig. 50).
(4) Disconnect the base wires.
(5) Set base aside. Remove light ring and disconnect wire.

INSTALLATION

(1) Position mount ring to the instrument panel and feed the wires through ring. Index the cap and the mount ring with the index tab at 9 o'clock to the key in the instrument panel. Install the ring.
(2) Connect wires to base. Orient base alignment rib at 11 o'clock to mate the groove in mount ring at the same location
(3) Push base into the bezel till it locks.
(4) Install 12 volt outlet cap and check operation of outlet or element.

OVER STEERING COLUMN BEZEL

REMOVAL

(1) Remove the lower steering column cover.

REMOVAL AND INSTALLATION (Continued)

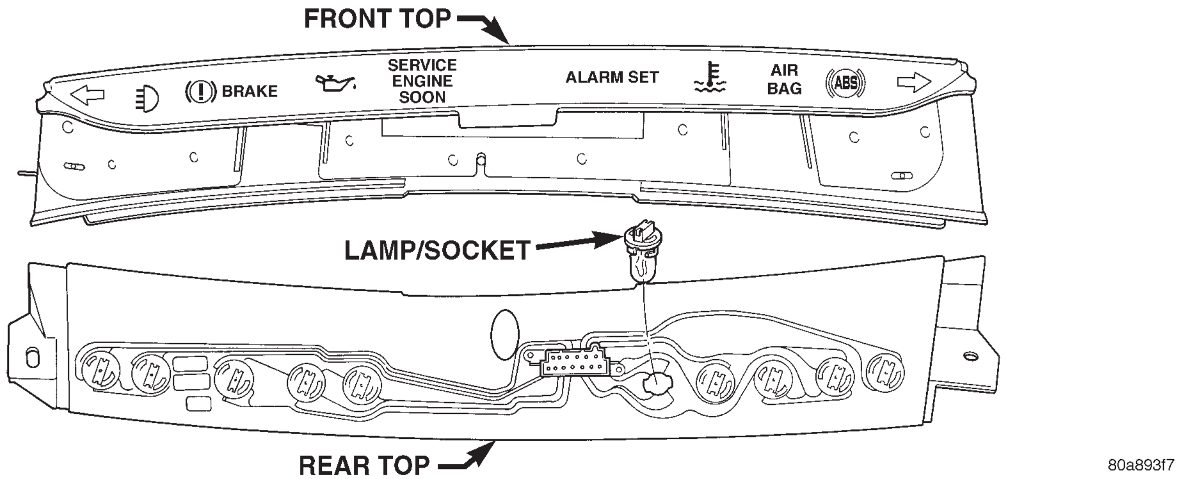

Fig. 48 Message Center Lamp Location

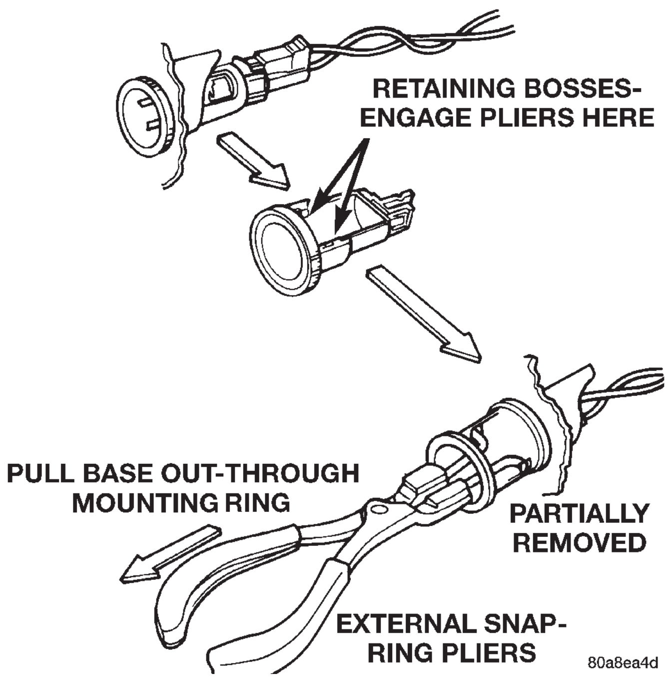

Fig. 49 Outlet Base Removal

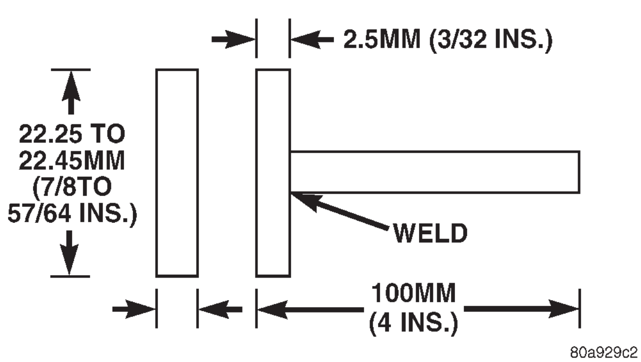

Fig. 50 Tool For Outlet Removal

(2) Remove the screws holding over steering column bezel to the cluster bezel (Fig. 51).

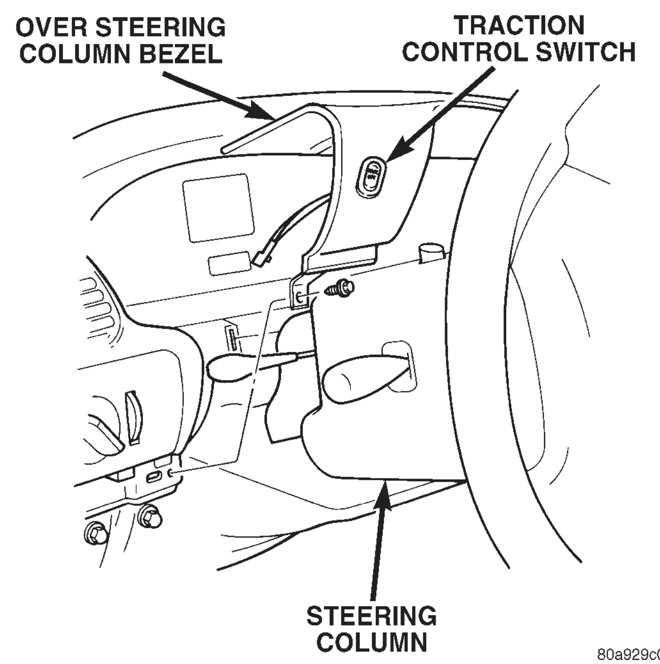

Fig. 51 Over Steering Column Bezel

(3) Remove over steering column bezel from vehicle.

(4) Disconnect the clips holding over column bezel to the cluster bezel.

(5) If equipped with traction control switch, disconnect the wire pigtail connector from the traction control switch.

(6) Remove the over steering column bezel.

INSTALLATION

(1) Place the over steering column bezel in position and engage clips to the cluster bezel. If equipped

REMOVAL AND INSTALLATION (Continued)

with traction control switch connect the wire pigtail before engaging clips.

(2) Install the screws to hold the over steering column bezel to the cluster bezel.

(3) Install the lower column cover.

POWER MIRROR SWITCH

REMOVAL

(1) Remove instrument cluster bezel (Fig. 52).

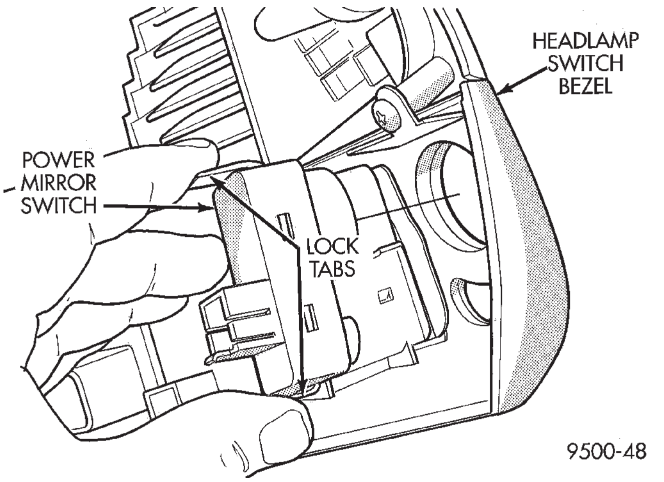

Fig. 52 Power Mirror Switch

(2) Disconnect wire connector from back of power mirror switch.

(3) Disengage lock tabs above and below the mirror switch.

(4) Pull power mirror switch from headlamp switch bezel.

(5) Remove power mirror switch.

INSTALLATION

For installation, reverse the above procedures.

POWER MIRROR SWITCH LAMP

REMOVAL

(1) Remove instrument cluster bezel (Fig. 53).

(2) Rotate bulb socket counterclockwise one quarter turn.

(3) Pull bulb socket from back of power mirror switch.

INSTALLATION

For installation, reverse the above procedures.

RADIO BEZEL AND HVAC CONTROL

REMOVAL

(1) Remove convenience bin - cup holder. Refer to Convenience Bin - Cup Holder Removal and Installation procedure in this section.

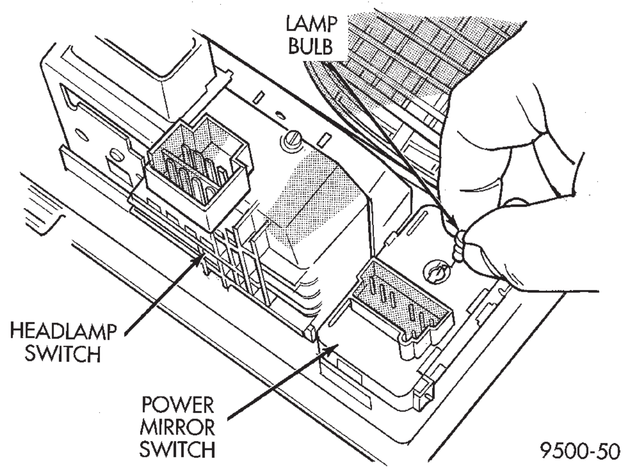

Fig. 53 Power Mirror Switch Lamp

(2) Insert the trim stick (special tool #C-4755) between access cover and radio bezel, above convenience bin - cup holder.

(3) Carefully pry the access cover from the instrument panel (Fig. 54).

(4) Separate the access cover from the vehicle.

(5) Remove convenience bin - cup holder track. Refer to Convenience Bin - Cup Holder Track Removal and Installation procedures in this section.

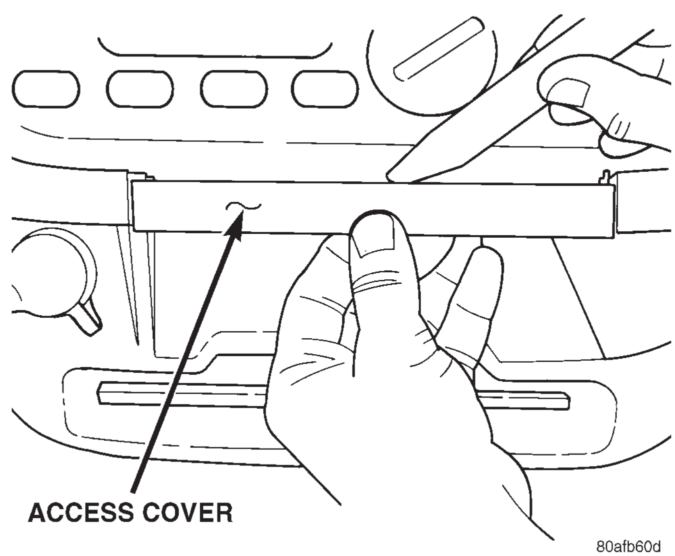

Fig. 54 Convenience Bin Access Cover

(6) Remove the attaching screws holding bottom of the bezel to instrument panel (Fig. 55).

(7) Remove the attaching screws holding top of the bezel to the instrument panel.

(8) Remove the bezel from the instrument panel.

(9) Disconnect the wire connector from back of the rear blower switch, if equipped.

(10) Disconnect the wire connector from the back of the HVAC Control.

(11) Remove the bezel.

REMOVAL AND INSTALLATION (Continued)

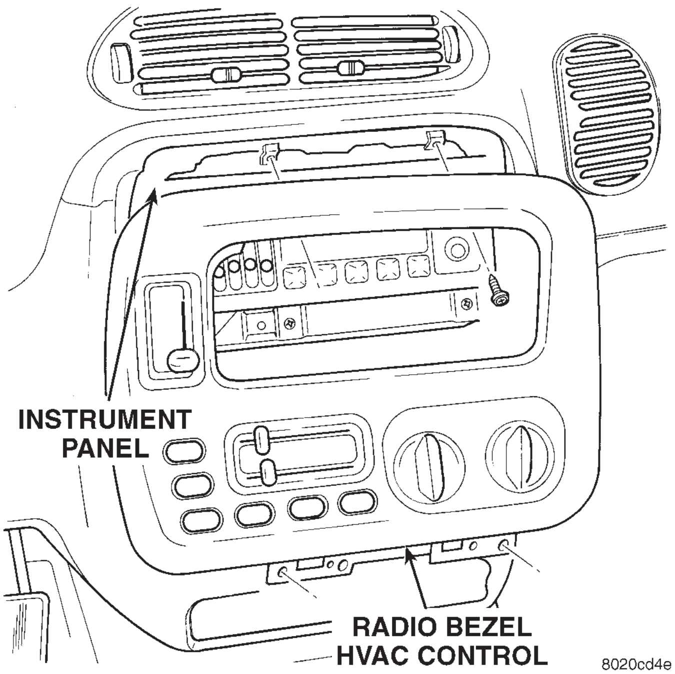

Fig. 55 Radio Bezel and HVAC Control

INSTALLATION

(1) Hold the radio bezel up and connect the wire connector into the back of the HVAC control.

(2) Connect the wire connector into back of the rear blower switch, if equipped.

(3) Place the radio bezel in position on the instrument panel.

(4) Install screws to hold the top of radio bezel to instrument panel.

(5) Install screws to the hold bottom of the radio bezel to the instrument panel.

(6) Install the access cover.

REAR HEATER-A/C SWITCH

REMOVAL

(1) Remove radio bezel and HVAC Control (Fig. 56).

(2) Remove screw holding rear heater-A/C switch to radio bezel HVAC Control.

(3) Disengage hook holding bottom of switch to radio bezel HVAC Control.

(4) Remove switch from radio bezel HVAC Control.

INSTALLATION

For instrument, reverse the above procedures.

REAR HEATER-A/C SWITCH LAMP

REMOVAL

(1) Remove radio bezel HVAC Control.

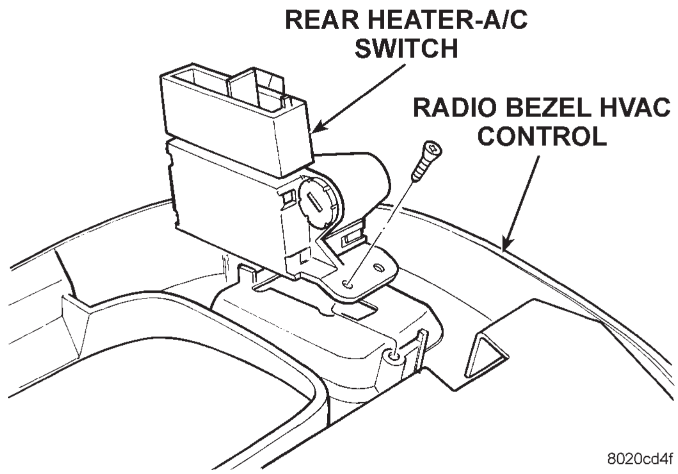

Fig. 56 Rear Heater – A/C Switch

(2) Rotate bulb socket counterclockwise one quarter (Fig. 57).

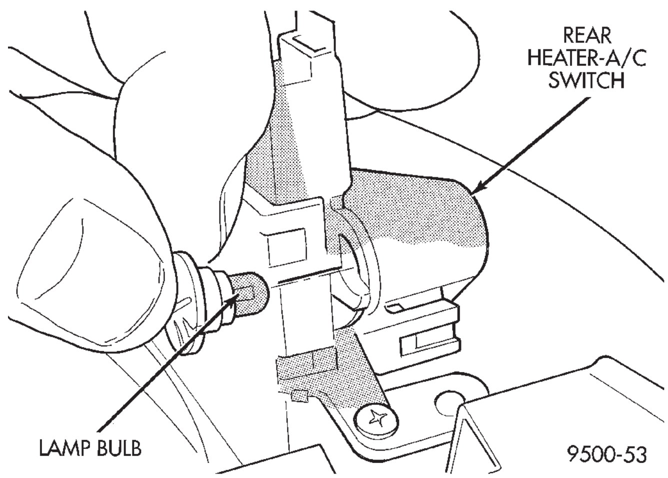

Fig. 57 Rear Heater-A/C Switch Lamp Bulb

(3) Pull bulb socket from switch.

INSTALLATION

For installation, reverse the above procedures.

TRACTION CONTROL SWITCH

REMOVAL

(1) Remove the over steering column bezel (Fig. 51). Refer to Over Steering Column Bezel Removal procedure.

(2) Remove the two screws attaching traction control switch to the bezel.

INSTALLATION

For installation, reverse the above procedure.

INSTRUMENT PANEL AND SYSTEMS

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GENERAL INFORMATION

INTRODUCTION

The instrumentation gauges on GS vehicles are contained in a subdial assemblies within the instrument cluster. The individual gauges are not serviced separately. If one of the cluster gauges becomes faulty the entire subdial would require replacement and all gauges will have to be calibrated. Refer to the proper Body Diagnostic Procedure Manual for calibration procedures.

DESCRIPTION AND OPERATION

HEADLAMP AND POWER MIRROR SWITCH LAMP(S)

The Headlamp Switch and Power Mirror Switch lamps are shown in (Fig. 1). For replacement of the lamp(s) refer to Headlamp Switch Lamp(s) Removal and Installation procedures below. Refer to Group 8T, Power Mirrors for mirror test procedures.

DESCRIPTION AND OPERATION (Continued)

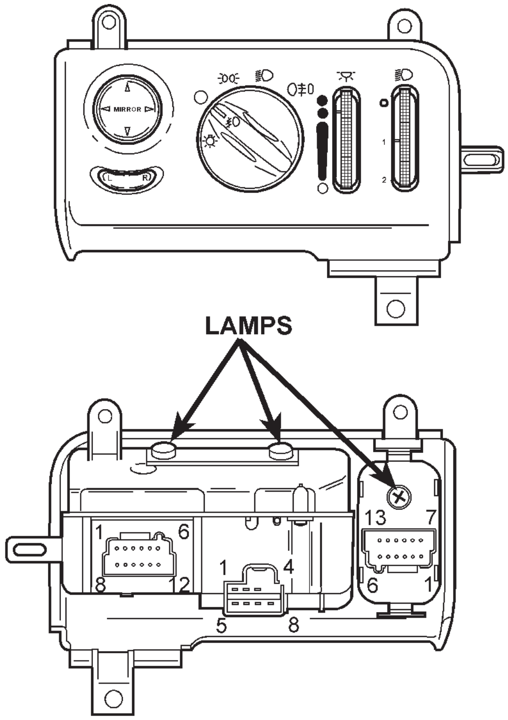

Fig. 1 Headlamp and Mirror Switch Lamps

INSTRUMENT CLUSTER

The mechanical instrument cluster with a tachometer is equipped with a electronic vacuum fluorescent odometer, and trip odometer display.

The instrument cluster is equipped with the following warning lamps (Fig. 2).

- Battery Voltage
- Lift Gate Ajar
- Low Coolant
- Low Windshield Washer Fluid Level
- Door Ajar
- Glow Plug Indicator
- Low Fuel Level

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

GS vehicle instrument clusters are equipped with a self diagnostic test feature to help identify electronic problems. Prior to any test, perform Self Diagnostic Test. The self diagnostic system monitors the CCD bus messages. If an electronic problem occurs, a Diagnostic Trouble Code (DTC) will be displayed in the odometer window of the cluster.

The following CCD bus messages are continuously monitored by the diagnostic system:

- Body Control Module
- Powertrain Control Module

HEADLAMP SWITCH

Using a Digital Multimeter, equipped with a diode test to perform the Headlamp Switch Test below (Fig. 3).

Switch position possibilities are open (no continuity), continuity, resistance value in ohms, or diode test. Use the values in the third column to determine meter setting. If Headlamp Switch is not within specifications replace as necessary.

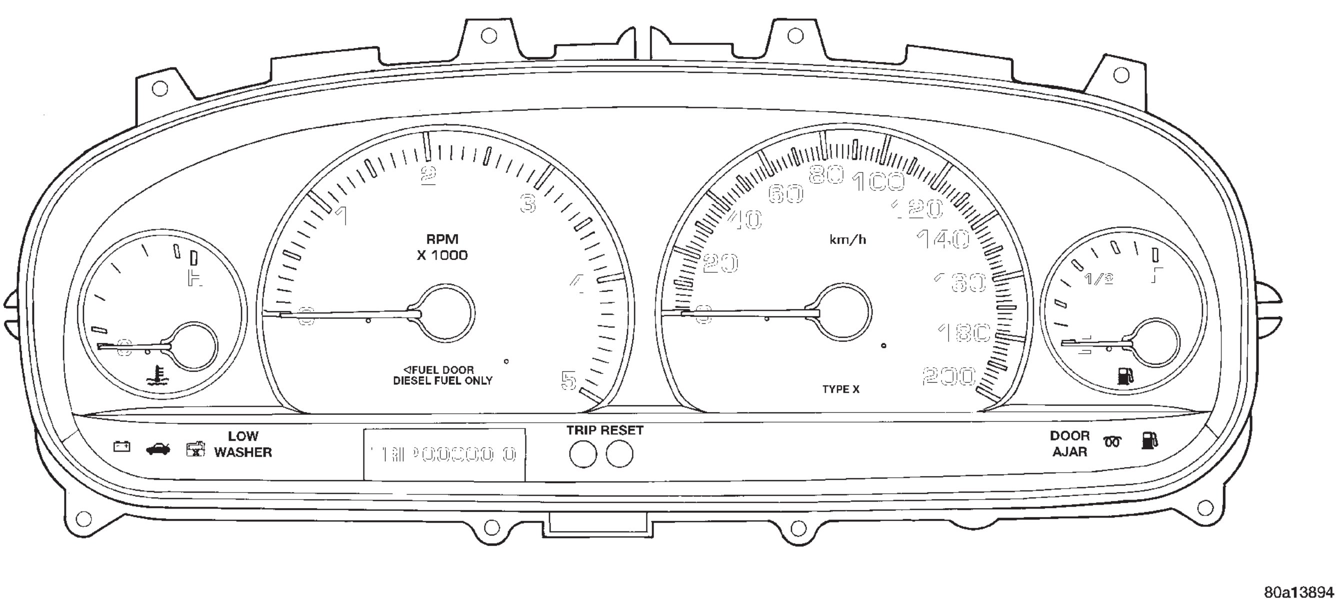

Fig. 2 Instrument Cluster

DIAGNOSIS AND TESTING (Continued)

HEADLAMP SWITCH POSITION	8-WAY CONNECTOR TERMINALS	RESISTANCE VALUE
OFF	2 to 1 2 to 5 2 to 6 2 to 7 2 to 8	5.2 OHMS (avg.) OPEN OPEN OPEN OPEN
PARKING LAMPS ON	2 to 3 2 to 5 2 to 6 2 to 7 2 to 8	OPEN OPEN OPEN OPEN CONTINUITY
HEADLAMPS ON	2 to 3 2 to 5 2 to 6 2 to 7 2 to 8	CONTINUITY OPEN OPEN OPEN CONTINUITY
FRONT FOG LAMPS ON (WITH PARKING LAMPS OR HEADLAMPS)	2 to 3 2 to 6 2 to 8 5 to 2 7 to 2	CONTINUITY CONTINUITY CONTINUITY DIODE CONTINUITY DIODE CONTINUITY

THUMBWHEEL	12-WAY CONNECTOR TERMINALS	RESISTANCE VALUE
DOME LAMPS ON	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	CONTINUITY OPEN 8k to 12k OHMS CONTINUITY OPEN
DAYTIME RUNNING MODE	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN CONTINUITY 8k to 12k OHMS CONTINUITY CONTINUITY
I/P LAMPS IN BRIGHT POSITION	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN OPEN 8k to 12k OHMS CONTINUITY CONTINUITY
I/P LAMPS IN DIM POSITION	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN OPEN 0 to 500 OHMS CONTINUITY CONTINUITY
COURTESY LAMPS DEFEAT	6 to 4 6 to 5 6 to 12 3 to 9 10 to 11	OPEN OPEN 0 to 500 OHMS OPEN CONTINUITY

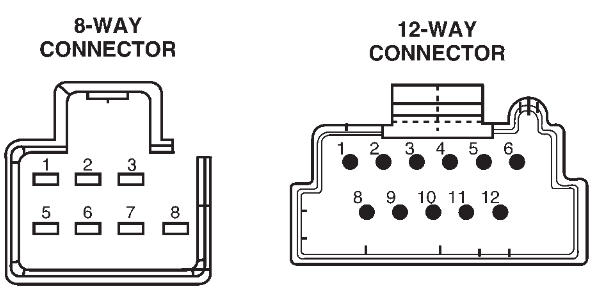

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Fig. 3 Headlamp Switch Test

SELF DIAGNOSTIC TEST

With the ignition switch in the OFF position, depress the TRIP and RESET buttons. While holding the TRIP and RESET button turn the ignition switch ON. Continue to hold the TRIP and RESET buttons until the word CODE appears in the odometer windows (about five seconds). If a problem exists, the system will display diagnostic trouble codes. If no problem exists the code 999 (End Test) will momentarily appear.

INSTRUMENT CLUSTER DTC CHART

DTC	DESCRIPTION
110	Memory Fault in cluster
111	Calibration fault in cluster
921	Odometer fault from BCM
940	No tachometer messages from BCM

DIM TEST

When CHEC-0 is displayed in the odometer window, the cluster's vacuum fluorescent (VF) displays will dim down. If the VF display brightness does not change, a problem exists in the cluster.

CLUSTER CALIBRATION TABLE

Speedometer	Calibration Point
1	0 Km/h (0 mph)
2	40 Km/h (20 mph)
3	80 Km/h (55 mph)
4	120 Km/h (75 mph)

Tachometer	Calibration Point
1	0 rpm
2	1000 rpm
3	3000 rpm
4	4000 rpm

Fuel Gauge	Calibration Point
1	Empty (E)
2	1/8 Filled
3	1/4 Filled
4	Full (F)

Temp Gauge	Calibration Point
1	Cold (C)
2	Low Normal
3	High Normal
4	Hot (H)

DIAGNOSIS AND TESTING (Continued)

CALIBRATION TEST

When CHEC-1 is displayed in the odometer window, each of the cluster's gauge pointers will move sequentially through each calibration point. The Calibration Table contains the proper calibration points for each gauge. If the gauge pointers are not calibrated, a problem exists in the cluster. If any gauge is out of calibration it will have to be calibrated using a scan tool (DRB III). Refer to the proper Body Diagnostic Procedure Manual for calibration procedures.

ODOMETER SEGMENT TEST

When CHEC-2 is displayed in the odometer window, each digit of the odometer will illuminate sequentially. If a segment in the odometer does not illuminate normally, a problem exists in the display.

CONDITIONS

Refer to the following charts for possible/problems/causes and corrections.

- Instrument Cluster
- Speedometer
- Tachometer
- Fuel Gauge
- Temperature Gauge
- Odometer

INSTRUMENT CLUSTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
INSTRUMENT CLUSTER INOPERATIVE - NO RESPONSE	No CCD bus messages from the body controller module (BCM).	1. Use a scan tool to check the BCM. If OK, look for another possible cause for cluster failure. If not OK, refer to the proper body diagnostic procedure manual.
	Spread terminal(s) on wiring harness cluster connector.	1. Remove cluster from instrument panel and check wiring harness connector for spread terminal. If OK, look for another possible cause for the cluster failure. If not OK, repair connector.
	Internal cluster failure.	1. Replace main cluster pc board and use a scan tool to calibrate cluster.

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DIAGNOSIS AND TESTING (Continued)

SPEEDOMETER

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. •If speedometer pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. •If the pointer doesn't move during test, go to step (2). •If fault code 110 is displayed in the odometer, go to step (2). •If fault code 111 is displayed in the odometer then go to step (6). •If fault code 920 is displayed in the odometer display, refer to the fault code chart to identify which module is causing the fault and repair module. 2. Replace main cluster pc board. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, complete installation. If not OK, go to step (5). 5. Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the speedometer failure. 6. Use a scan tool to calibrate speedometer and perform self diagnostic test. If OK, stop. If not OK, go to step (2).
	No Speed CCD bus message or zero mph CCD speed bus message.	1. Check the Body Control Module (BCM) using a scan tool. If OK, go to step (2). If not OK, refer to the proper body diagnostic procedure manual. 2. Check the speedometer pinion. If OK, check vehicle speed sensor wire harness connector. If not OK, refer to the proper powertrain diagnostic procedure manual.

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DIAGNOSIS AND TESTING (Continued)

SPEEDOMETER Continued

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT-(Binds or sticks)	Binding speedometer pinion	1. Check the BCM using a scan tool. If OK, go to step (2). If not OK, refer to the proper Body Diagnostic Procedure manual. 2. Check the speedometer pinion. If OK, check vehicle speed sensor wiring harness connector. If not OK, replace speedometer pinion.
	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. •If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, then go to step (2). •If fault code 110 is displayed in the odometer, go to step (5). •If fault code 111 appears in the odometer display, go to step (4) 2. Replace cluster subdial assembly. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, continue installation. If not OK, go to step (5). 5. Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the speedometer failure.
SPEEDOMETER INACCURATE	Speedometer out of calibration	1. Perform cluster self diagnostic test. •If speedometer is accurate to the calibration points, then look for another possible cause of inaccuracy. •If speedometer is not accurate to the calibration points, go to step (2). 2. Use a scan tool to calibrate speedometer.
	Wrong speedometer pinion and tire combination	1. Check if correct speedometer pinion is being used with tires on vehicle. Refer to the Transmission Powertrain Diagnostic Procedure manual. •If the incorrect pinion is in transmission, then replace with correct pinion. •If the correct pinion is in the transmission, calibrate speedometer using a scan tool to correct for the inaccuracy.

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DIAGNOSIS AND TESTING (Continued)

TACHOMETER

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. •If tachometer pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. •If the pointer doesn't move during test, go to step (2). •If fault code 110 is displayed in the odometer, go to step (2). •If fault code 111 is displayed in the odometer then go to step (6). •If fault code 920 is displayed in the odometer display, refer to the fault code chart to identify which module is causing the fault and repair module. 2. Replace main cluster pc board. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, continue installation. If not OK, go to step (5). 5. Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the tachometer failure. 6. Use a scan tool to calibrate tachometer and perform self diagnostic test. If OK, stop. If not OK, go to step (2).
	No rpm CCD bus message or zero rpm CCD bus message from BCM.	1. Check the Body Control Module (BCM) using a scan tool. Refer to the proper powertrain diagnostic procedure manual.

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DIAGNOSIS AND TESTING (Continued)

TACHOMETER Continued

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT- (Binds or sticks)	Bad CCD bus message from BCM.	1. Check the BCM using a scan tool. Refer to the proper powertrain diagnostic procedure manual.
	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. •If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, then go to step (2). •If fault code 110 is displayed in the odometer, go to step (5). •If fault code 111 appears in the odometer display, go to step (4). •If the fault code 920 is displayed in the odometer display, refer to the fault code chart to identify which module is causing the fault and repair module. 2. Replace cluster subdial assembly. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, continue installation. If not OK, go to step (5). 5. Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the tachometer failure.
TACHOMETER INACCURATE	Tachometer out of calibration	1. Calibrate tachometer using a scan tool.

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DIAGNOSIS AND TESTING (Continued)

FUEL GAUGE

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. • If fuel gauge pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If the pointer doesn't move during test, go to step (2). • If fault code 110 is displayed in the odometer, go to step (2). • If fault code 111 is displayed in the odometer then go to step (6). 2. Replace main cluster pc board. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, continue installation. If not OK, go to step (5). 5. Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the fuel gauge failure. 6. Use a scan tool to calibrate fuel gauge and perform self diagnostic test. If OK, stop. If not OK, go to step (2).
	No CCD fuel message or empty CCD bus message from BCM.	1. Check the BCM using a scan tool. If OK, go to step (2). If not OK, refer to the proper body diagnostic procedure manual. 2. Refer to the Fuel section of the service manual for the fuel level sending unit test procedure. Test unit and repair as instructed.

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DIAGNOSIS AND TESTING (Continued)

FUEL GAUGE Continued

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT	Bad CCD fuel message from the BCM.	1. Use a scan tool to check the BCM. If OK, go to step (2). If not OK, refer to the proper body diagnostic procedure manual. 2. Refer to Group 14, Fuel System for proper fuel level sending unit test procedure. Test unit. If OK, look for another possible cause for fuel gauge failure. If not OK, repair sending unit.
	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. • If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, go to step (2). • If fault code 110 is displayed in the odometer, go to step (5). • If fault code 111 appears in the odometer display go to step (4). 2. Replace cluster subdial assembly. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, continue installation. If not OK, go to step (5). 5. Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the fuel gauge failure.
FUEL GAUGE INACCURATE	Fuel gauge out of calibration.	1. Perform cluster self diagnostic test. If pointer is accurate to the calibration points look for another possible cause of failure. If pointer is inaccurate to the calibration points, go to step (2). 2. Use a scan tool to calibrate fuel gauge.
	Fuel level sending unit is out of calibration.	1. Refer to Group 14, Fuel System for test and repair procedure.

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DIAGNOSIS AND TESTING (Continued)

TEMPERATURE GAUGE

CONDITION	POSSIBLE CAUSES	CORRECTION
NO POINTER MOVEMENT	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. •If temperature gauge pointer moves to calibration points during test and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. •If the pointer doesn't move during test, go to step (2). •If fault code 110 is displayed in the odometer, go to step (2). •If fault code 111 is displayed in the odometer then go to step (6). •If fault code 920 is displayed in the odometer display, refer to the fault code chart to identify which module is causing the fault and repair module. 2. Replace main cluster pc board. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, complete installation. If not OK, go to step (5). 5. Replace subdial assembly and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the temperature failure. 6. Use a scan tool to calibrate speedomter and perform self diagnostic test. If OK, stop. If not OK, go to step (2).
	No CCD temperature message or cold CCD bus message from the BCM.	1. Check the body controller fault codes by using a scan tool. If there are no faults, go to step (2). If there are faults, refer to the Body Diagnostic Procedure manual. 2. Refer to the Group 14, Fuel Injection, General Diagnosis for the coolant sensor test procedure. Repair sensor as needed.

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DIAGNOSIS AND TESTING (Continued)

TEMPERATURE GAUGE Continued

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC POINTER MOVEMENT- (Binds or sticks)	Bad CCD bus message from BCM.	1. Check BCM fault codes using a scan tool. If there are no faults, got to step (2). If there are faults, refer to the proper body diagnostic procedure manual. 2. Refer to the Group 14, Fuel Injection, General Diagnosis for the coolant sensor test procedure. Repair sensor as needed.
	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. •If the pointer moves during test but still appears erratic and fault codes 110 or 111 don't appear in the odometer display, then go to step (2). •If fault code 110 is displayed in the odometer, go to step (5). •If fault code 111 appears in the odometer display, go to step (4). •If the fault code 920 is displayed in the odometer display, refer to the fault code chart to identify which module is causing the fault and repair module. 2. Replace cluster subdial assembly. Go to step (3). 3. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. Put in the top two mounting screws to hold the cluster in place. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS CALIBRATED AND TESTED. Go to step (4). 4. Use a scan tool to calibrate cluster and perform self diagnostic test. If OK, continue installation. If not OK, go to step (5). 5. Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the temperature gauge failure.

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DIAGNOSIS AND TESTING (Continued)

ODOMETER

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DISPLAY	No CCD odometer bus message from BCM.	1. Use a scan tool to check the BCM. Refer to the proper body diagnostic procedure manual.
	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. • If odometer passes the dim test and segment check and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If odometer doesn't work go to step (2). • If fault code 110 is displayed in the odometer, go to step (2). • If fault code 921 is displayed use a scan tool to check body controller. 2. Replace cluster from instrument panel and verify that odometer assembly is properly connected to main pc board. If OK, go to step (3). If not OK, reconnect odometer assembly to main pc board. 3. Replace odometer assembly. Go to step (4). 4. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS TESTED. Go to step (5). 5. Perform self diagnostic test. If OK, continue installation. If not OK, go to step (6). 6. Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the odometer failure.
ERRATIC DISPLAY	Internal cluster failure.	1. Perform cluster self diagnostic test and check for fault codes. • If odometer passes the dim test and segment check and fault codes 110 or 111 don't appear in the odometer display then failure is not in the cluster. Look for another possible cause of failure. • If odometer doesn't work go to step (2). • If fault code 110 is displayed in the odometer, go to step (b). • If fault code 921 is displayed use a scan tool to check body controller.

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DIAGNOSIS AND TESTING (Continued)

ODOMETER Continued

CONDITION	POSSIBLE CAUSES	CORRECTION
ERRATIC DISPLAY Cont.	Internal cluster failure, cont.	2. Remove cluster from instrument panel and verify that odometer assembly is properly connected to main pc board. If OK, go to step (3). If not OK, reconnect odometer assembly to main pc board. 3. Replace odometer assembly. Go to step (4). 4. Connect cluster into instrument panel wiring harness. Place it back into the proper position in the instrument panel. DO NOT COMPLETELY INSTALL CLUSTER TO INSTRUMENT PANEL UNTIL UNIT IS TESTED. Go to step (5). 5. Perform self diagnostic test. If OK, continue installation. If not OK, go to step (6). 6. Replace main cluster pc board and use a scan tool to calibrate cluster. If not OK, look at another possible cause for the odometer failure.
	Bad CCD bus message from BCM.	1. Use a scan tool to check the BCM. Refer to the proper body diagnostic procedure manual.
ODOMETER WON'T GO INTO TRIP MODE	Trip switch doesn't work.	1. Use a scan tool to perform trip switch activation test. If OK, look for another possible cause of failure. If not OK, replace odometer assembly.
TRIP ODOMETER WON'T RESET	Reset switch doesn't work.	1. Use a scan tool to perform reset switch activation test. If OK, look for another possible cause of failure. If not OK, replace odometer assembly.

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REMOVAL AND INSTALLATION

CONVENIENCE BIN - CUP HOLDER

REMOVAL

(1) Pull the convenience bin open (Fig. 4).

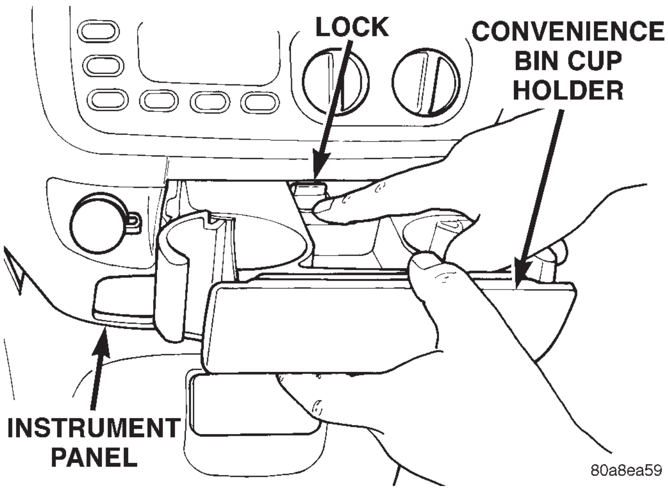

Fig. 4 Convenience Bin – Cup Holder

(2) Push lock tab at rear center downward.

(3) Pull the convenience bin - cup holder from track in instrument panel.

(4) Remove convenience bin - cup holder.

INSTALLATION

For installation, reverse the above procedures.

ASH RECEIVER – CONVENIENCE BIN LAMP MODULE

REMOVAL

(1) Pull out ash receiver/cup holder.

(2) Insert trim stick between access cover above cup holder and center console.

(3) Carefully pry access cover from center console (Fig. 5).

(4) Separate access cover from vehicle.

(5) Remove screw from ash receiver lamp module.

(6) Carefully pull lamp module and wiring rearward from instrument panel (Fig. 6).

(7) Disconnect lamp module from the wiring connector.

INSTALLATION

For installation, reverse the above procedures.

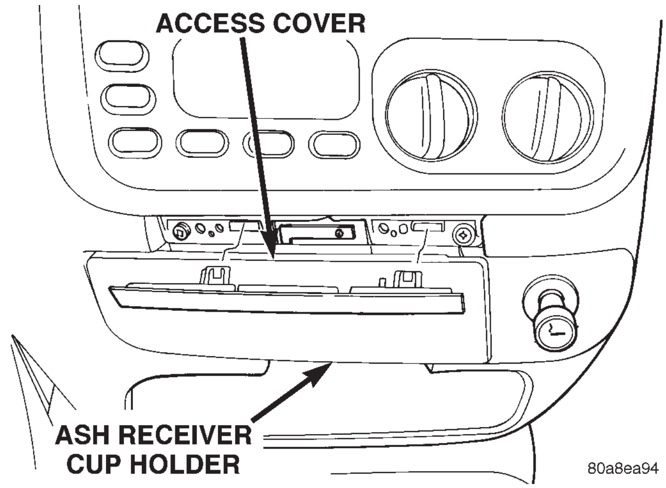

Fig. 5 Ash Receiver Access Cover

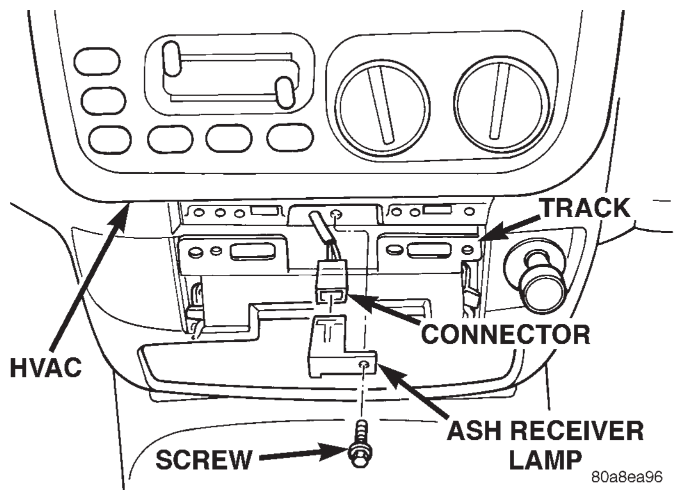

Fig. 6 Ash Reveiver Lamp Module

CONVENIENCE BIN

REMOVAL

(1) Remove the ash receiver/cup holder from the instrument panel.

(2) Remove the screw access cover from the bottom of the radio bezel (Fig. 5).

(3) Remove the center bezel.

(4) Remove the ash receiver/cup holder attaching screws and pull the ash receiver/cup holder track rearward to disengage the rear guide studs from instrument panel (Fig. 7).

(5) Remove the ash receiver/cup holder.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

For installation, reverse the above procedures.

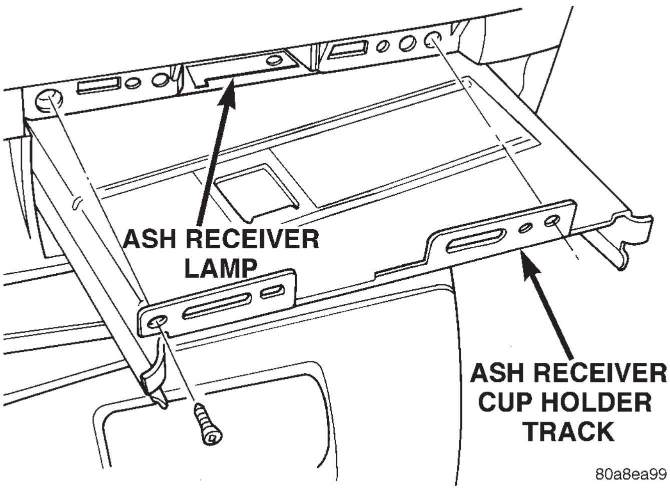

Fig. 7 Ash Receiver/Cup Holder Track RHD

BODY CONTROL MODULE (BCM)

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove lower steering column cover and knee blocker reinforcement.

(3) Disconnect two wire connectors from bottom of Body Control Module (BCM)

(4) Remove bolts holding Junction Block to dash panel mounting bracket (Fig. 8).

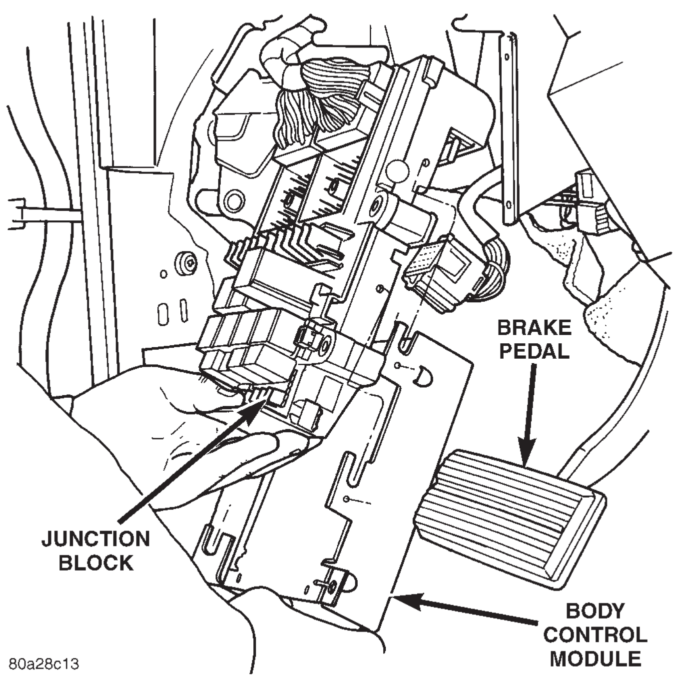

Fig. 8 Body Control Module Location

(5) Remove Junction Block from mounting bracket.

(6) Remove screws holding Body Control Module to Junction Block.

(7) Slide Body Control Module downward to disengage guide studs on Junction Block from channels on BCM mounting bracket.

(8) Remove Body Control Module from Junction Block.

INSTALLATION

For installation, reverse the above procedures.

CIGAR LIGHTER BASE

REMOVAL

(1) Look inside and note position of the retaining bosses (Fig. 9).

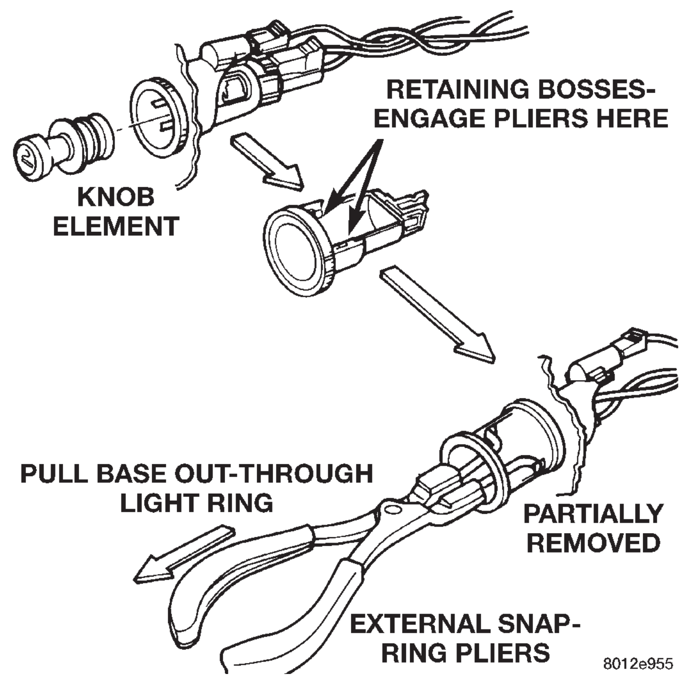

Fig. 9 Cigar Lighter Base Removal

(2) Using external snap ring pliers with 90 degree tips. Insert pliers with tips against bosses and squeeze forcing bosses out of base.

(3) Pull out base, through mounting ring, gently rocking pliers.

(4) Disconnect the base wires.

(5) Set base aside. Remove light ring and disconnect wire.

INSTALLATION

(1) Connect wire to light ring and install ring.

(2) Connect wires to base.

(3) Push base into the bezel till it locks.

(4) Install lighter element and check operation of element.

REMOVAL AND INSTALLATION (Continued)

GLOVE BOX

REMOVAL (FIG. 4)

(1) Open glove box (Fig. 10).

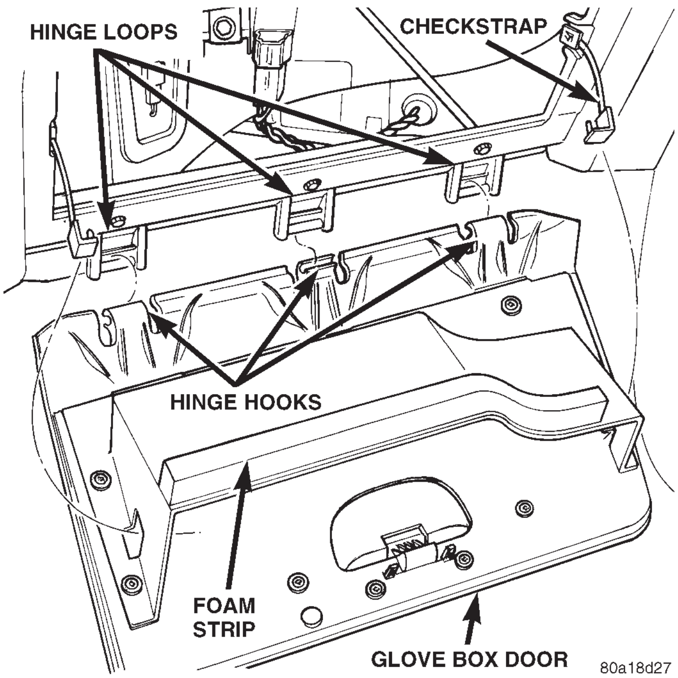

Fig. 10 Glove Box

(2) Disengage clip holding checkstraps to glove box door.

(3) Pivot glove box downward and disengage hinge hooks from instrument panel.

(4) Remove glove box.

INSTALLATION

(1) Place glove box in position.

(2) Engage hinge hooks into instrument panel and pivot glove box upward.

(3) Engage clip to hold checkstraps to glove box door.

(4) Close glove box door.

GLOVE BOX LAMP AND SWITCH

REMOVAL

(1) Open glove box door (Fig. 11).

(2) Using a trim stick, lightly pry glove box lamp/ switch from instrument panel.

(3) Disengage wire connector from glove box lamp and switch.

(4) Remove glove box lamp and switch.

(5) Remove lamp (Fig. 12).

INSTALLATION

For installation, reverse the above procedures.

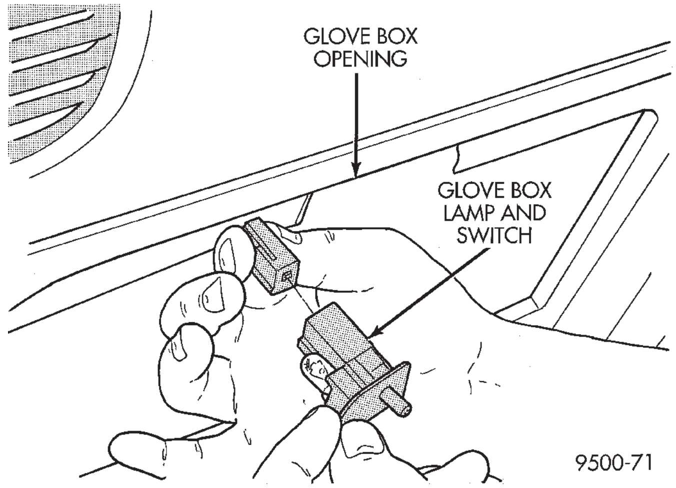

Fig. 11 Glove Box Lamp and Switch

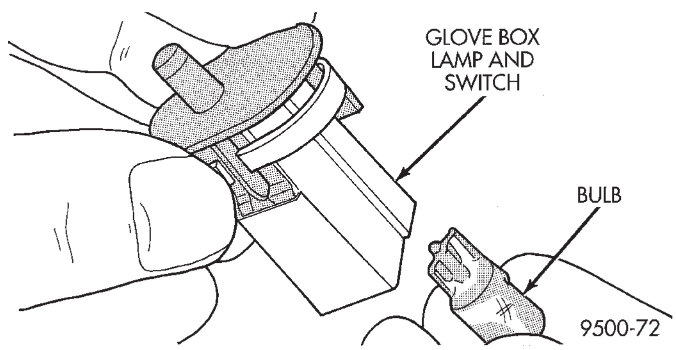

Fig. 12 Glove Box Lamp

GLOVE BOX LOCK STRIKER

REMOVAL

(1) Open glove box door (Fig. 13).

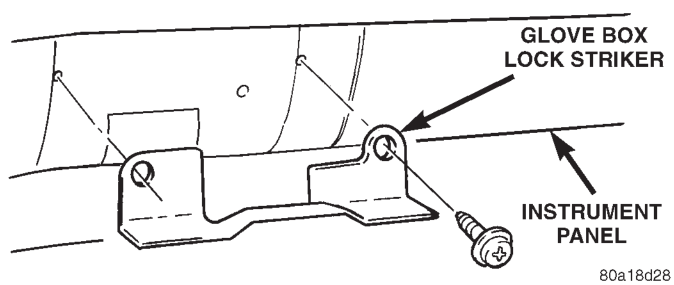

Fig. 13 Glove Box Lock Striker

(2) Disengage clip holding checkstraps to glove box door.

(3) Remove screws holding lock striker to instrument panel.

(4) Remove glove box lock striker.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

HEADLAMP SWITCH

REMOVAL

(1) Remove instrument cluster bezel (Fig. 14).

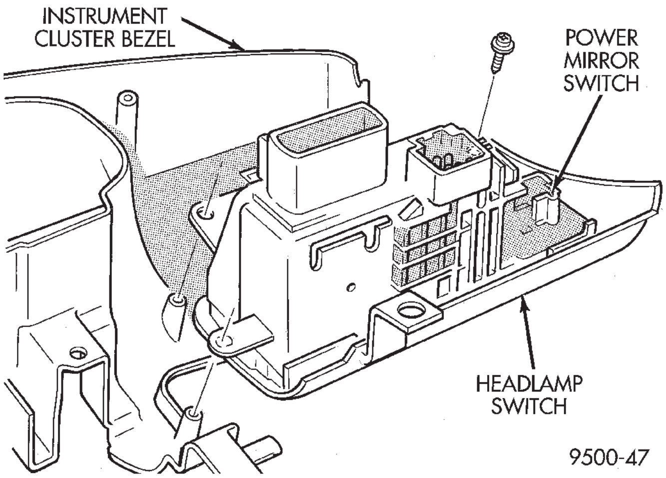

Fig. 14 Headlamp Switch

(2) Remove screws holding the headlamp switch bezel to cluster bezel.

(3) Disconnect the wire connectors from the headlamp switch and wire connector from the power mirror switch.

(4) Remove headlamp switch bezel from cluster bezel.

INSTALLATION

For installation, reverse the above procedures.

HEADLAMP SWITCH LAMP(S)

REMOVAL

(1) Remove instrument cluster bezel.

(2) Disconnect wire connectors.

(3) Remove headlamp switch bezel from instrument cluster bezel.

(4) Rotate bulb socket counterclockwise one quarter turn (Fig. 15).

(5) Pull bulb socket from headlamp switch.

INSTALLATION

For installation, reverse the above procedures.

HVAC CONTROL LAMP

REMOVAL

(1) Remove radio bezel and HVAC Control (Fig. 16).

(2) Remove rear cover from HVAC control.

(3) Rotate bulb socket counterclockwise one quarter turn.

(4) Pull bulb socket from HVAC.

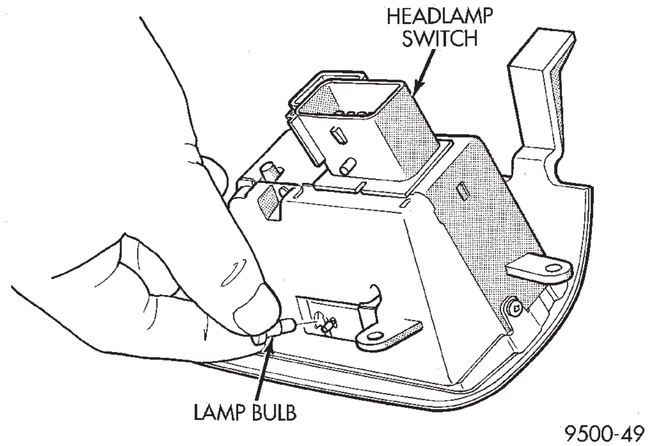

Fig. 15 Headlamp Switch Lamp

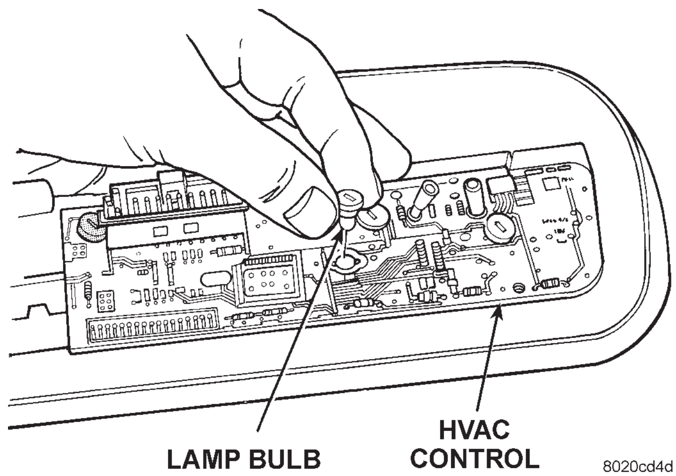

Fig. 16 HVAC Control Lamps

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER BACK PANEL

REMOVAL

(1) Remove instrument cluster.

(2) Remove screws holding back panel to instrument cluster (Fig. 17).

(3) Remove back panel.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER BEZEL

REMOVAL

(1) Remove steering column cover.

(2) Remove over steering column bezel (Fig. 18).

(3) Remove left end cover.

(4) Remove screw at left end of cluster bezel and headlamp switch.

REMOVAL AND INSTALLATION (Continued)

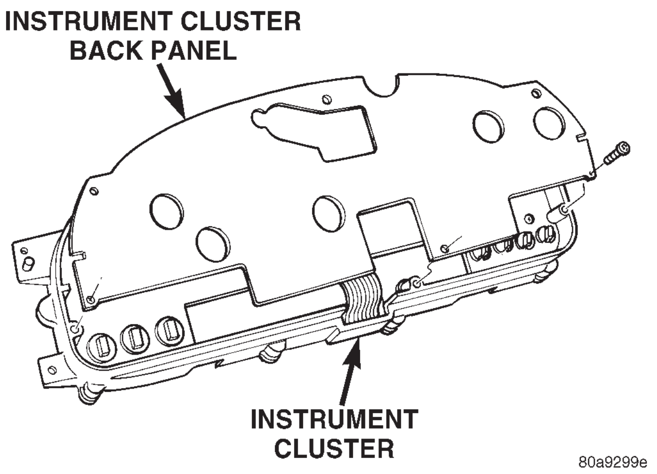

Fig. 17 Instrument Cluster Back Panel

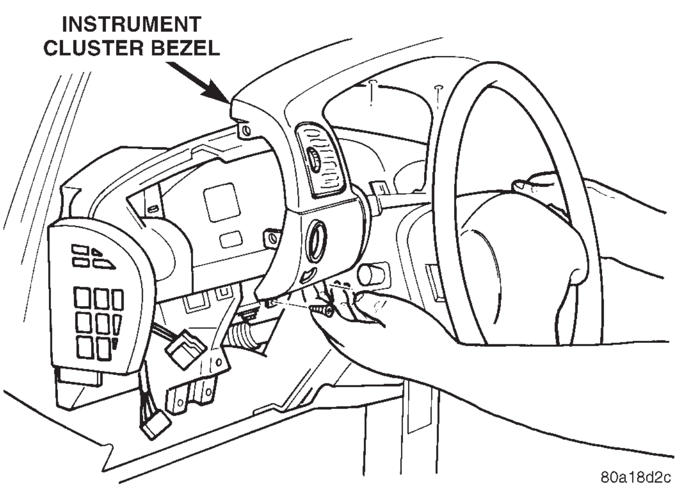

Fig. 18 Instrument Cluster Bezel

(5) Remove screws holding cluster bezel to instrument panel from each side of steering column.

(6) Disconnect clip holding cluster bezel to instrument panel from above right vent louver.

(7) Separate cluster bezel from instrument panel.

(8) Disconnect wire connectors from back of the bezel.

INSTALLATION

(1) Connect wire connectors into back of the bezel.

(2) Place cluster bezel in position on instrument panel. Use care not to place hands on louvers.

(3) Connect clips to hold cluster bezel to instrument panel. Use care not to add pressure on the A/C louvers to seat the cluster bezel clips.

(4) Install screws to hold cluster bezel to instrument panel on each side of steering column.

(5) Install screw at left end of cluster bezel and headlamp switch.

(6) Install left end cover.

(7) Install over steering column bezel.

(8) Install lower steering column cover.

INSTRUMENT CLUSTER LENS

REMOVAL

(1) Remove instrument cluster.

(2) Remove screws holding lens to instrument cluster (Fig. 19).

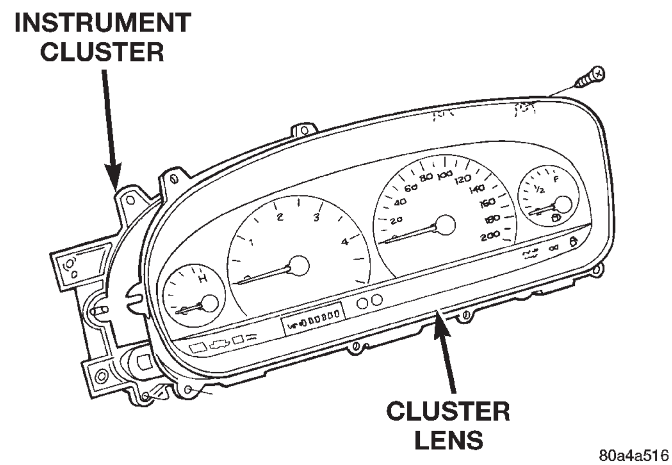

Fig. 19 Instrument Cluster Lens

(3) Remove lens from cluster.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER PRINTED CIRCUIT BOARD

REMOVAL

(1) Remove the instrument cluster.

(2) Remove the instrument cluster back panel.

(3) Disconnect the electronic cluster wire connector from the printed circuit board (Fig. 20).

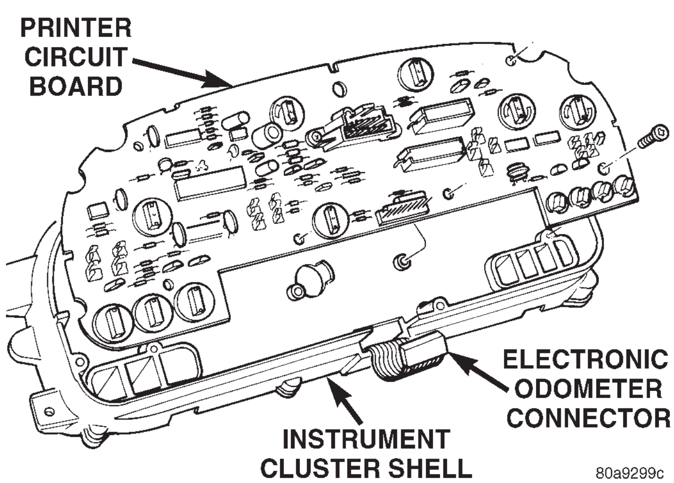

Fig. 20 Instrument Cluster Printed Circuit Board

(4) Remove the screws holding wire connector insulator to the instrument cluster shell and the printed circuit board.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the screws holding printed circuit board to the cluster shell.

(6) Remove the printed circuit board from the cluster.

INSTALLATION

For installation, reverse the above procedures. After installing the print circuit board it will have to be calibrated using a scan tool (DRB III). Refer to the proper Body Diagnostic Procedure Manual for calibration procedures.

NOTE: Speedometer and/or Tachometer will not operate properly until all gauges have been calibrated

INSTRUMENT CLUSTER SUBDIAL

REMOVAL

(1) Remove instrument cluster.

(2) Remove cluster lens.

(3) Disconnect temperature/fuel gauge and tachometer terminals from connectors in cluster by pulling subdial straight away from cluster (Fig. 21).

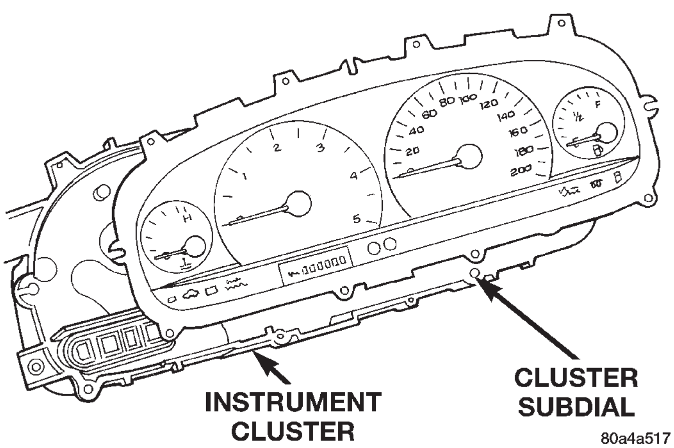

Fig. 21 Instrument Cluster Subdial

(4) Remove subdial from cluster.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT CLUSTER

REMOVAL

(1) Remove instrument cluster bezel (Fig. 22).

(2) Remove screws holding instrument cluster to instrument panel.

(3) Rotate top of cluster outward.

(4) Remove instrument cluster from instrument panel.

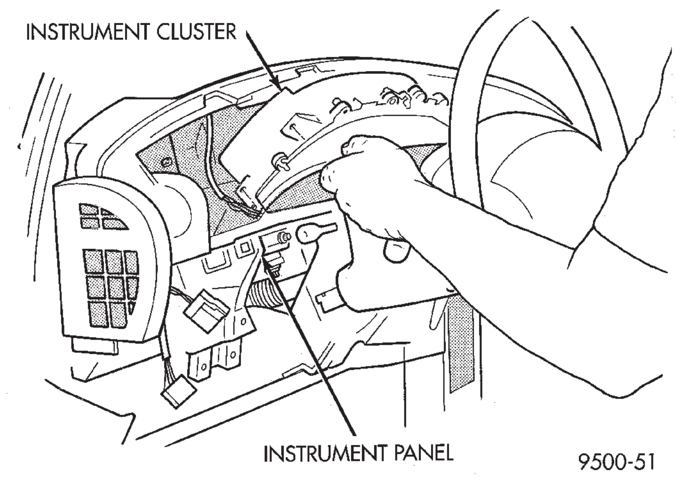

Fig. 22 Instrument Panel

(5) Disconnect wire connector from back of instrument cluster.

(6) Remove instrument cluster.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT PANEL

The instrument panel is removed as a unit. The steering column and wiring harnesses are assembled into the panel before installation. Service procedures for interior trim not related to the instrument panel can be found in Group 23, Body.

REMOVAL

(1) Disconnect the battery, negative cable first.

(2) Remove the lower console.

(3) Remove the screw holding the lower heat duct to the instrument panel support (Fig. 23).

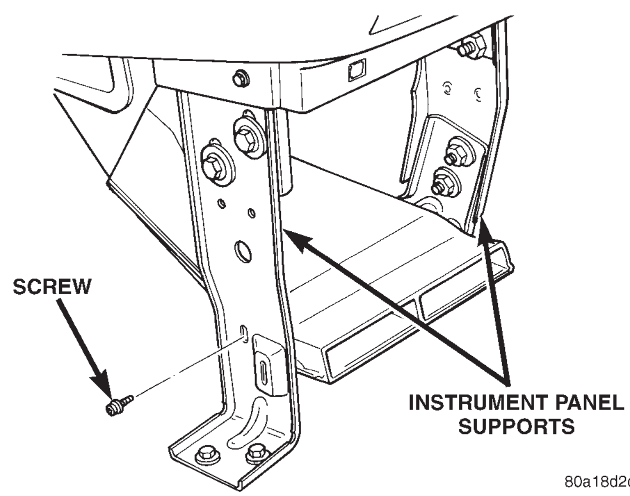

Fig. 23 Heat Duct

(4) Disconnect the heat duct from the vehicle.

(5) Remove the bolts holding the lower supports to the instrument panel frame (Fig. 24).

REMOVAL AND INSTALLATION (Continued)

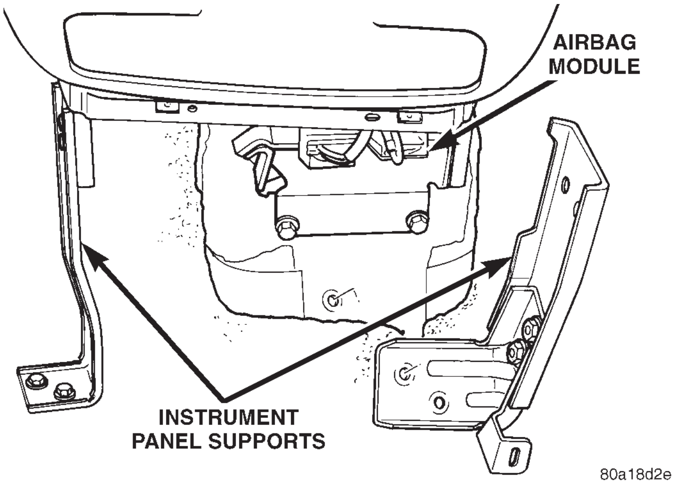

Fig. 24 Lower Supports

(6) Remove the bolts holding the lower supports to the floor pan.

(7) Remove the right and left end covers.

(8) Disconnect the wire connectors from the Passenger Airbag Module.

(9) Remove the front door sill trim covers.

(10) Remove the A-pillar trim covers.

(11) Remove the glove box.

(12) Disconnect the antenna lead connector from behind the glove box.

(13) Remove the lower steering column cover.

(14) Remove the knee blocker panel.

(15) Disconnect the lower two, forty pin wire harness connectors, from the main Junction Block near left cowl side panel (Fig. 25).

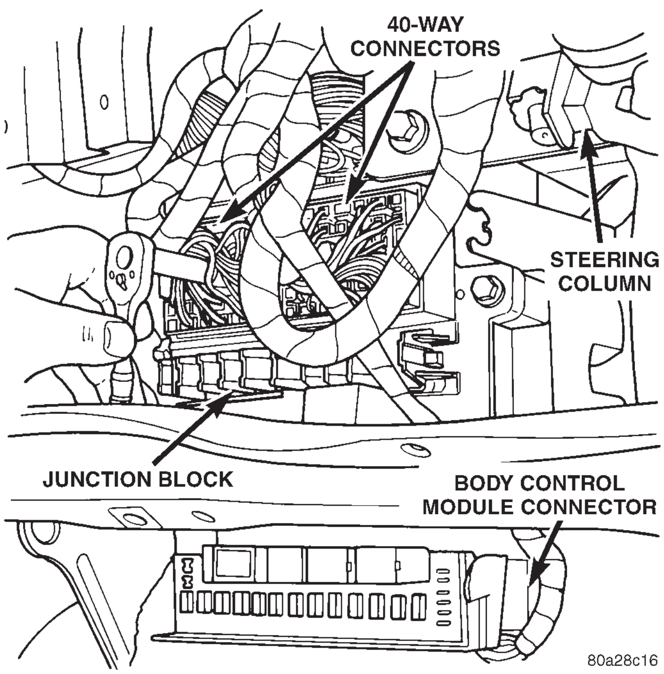

Fig. 25 Junction Block and Body Control Module Connectors

(16) Disconnect the instrument panel wire harness connector from the bottom of Body Control Module.

(17) Disconnect the two forty pin connectors from the right of the steering column (Fig. 26).

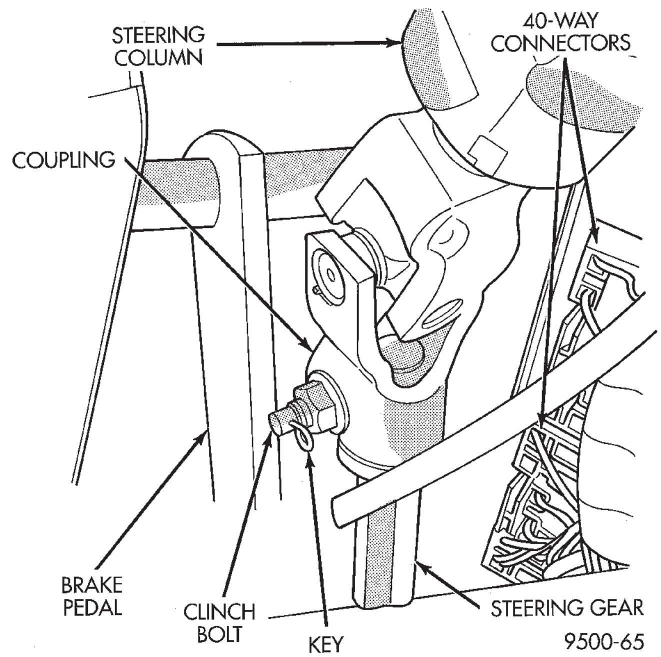

Fig. 26 40 Way Connectors Location

(18) Remove the clinch bolt holding upper the steering shaft to the lower steering shaft (Fig. 26).

(19) Separate the upper steering shaft from the lower steering shaft.

(20) Remove the nuts holding the instrument panel frame to the die-cast brake pedal support on each side of the steering column.

(21) With mechanical transmission range indicator:

(a) Remove the indicator cable loop.

(b) Remove the clip holding gear shift cable end to the gear selector adapter.

(c) Pull the cable end from gear selector.

(d) Disconnect the clip for the indicator cable and guide tube from the shift cable bracket and move out of the way.

(22) Remove the nut holding gear shift cable bracket to the instrument panel frame.

(23) Remove the bracket from the instrument panel.

(24) Remove the screw holding hood release handle to the instrument panel.

(25) Remove the bolt holding the hood release handle to the instrument panel.

(26) Position the hood release handle out of the way.

(27) Remove the instrument panel top cover.

(28) Disconnect the wire connector from the HVAC wire harness behind the glove box area.

REMOVAL AND INSTALLATION (Continued)

(29) Remove the bolts holding the instrument panel frame to the brackets on cowl side panels (Fig. 27) and (Fig. 28).

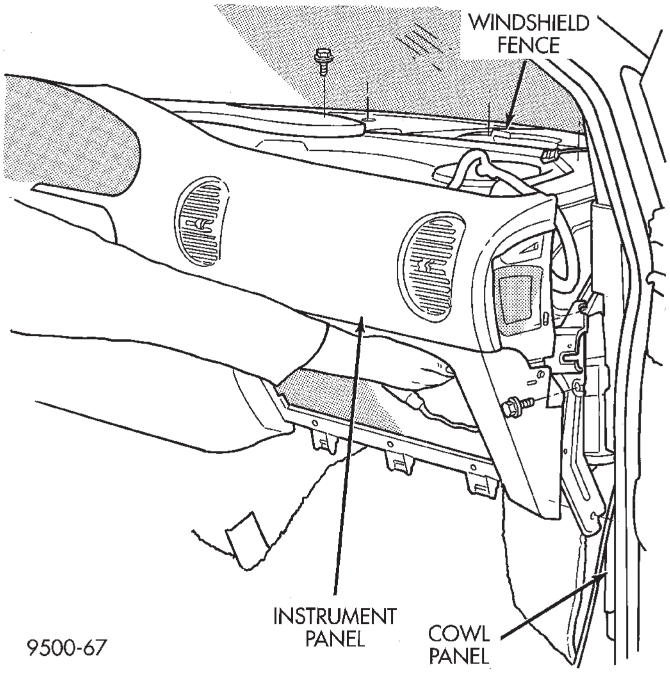

Fig. 27 Passenger Side Instrument Panel

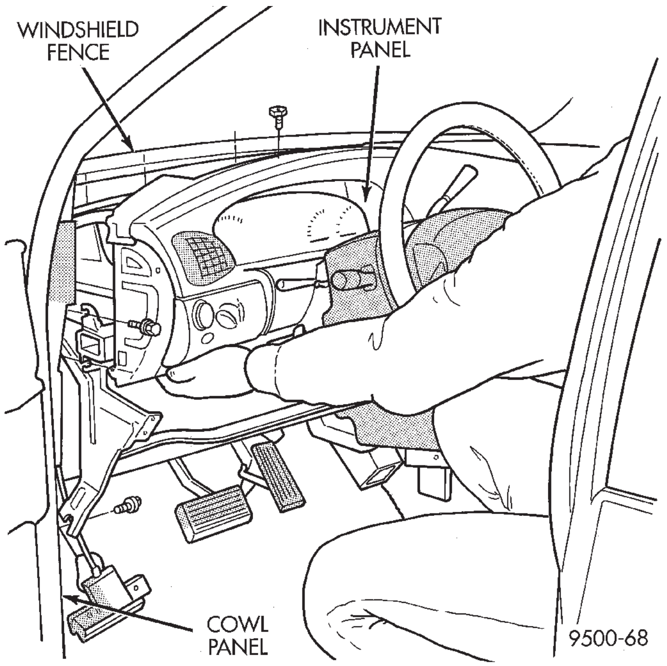

Fig. 28 Driver's Side instrument Panel

(30) Loosen, but do not remove, the pivot bolts holding the instrument panel to the cowl panels.

(31) Remove the bolts holding the instrument panel frame to the dash panel below windshield opening.

(32) Remove the instrument panel from vehicle.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT PANEL LEFT END COVER

REMOVAL

(1) Open driver side front door (Fig. 29).

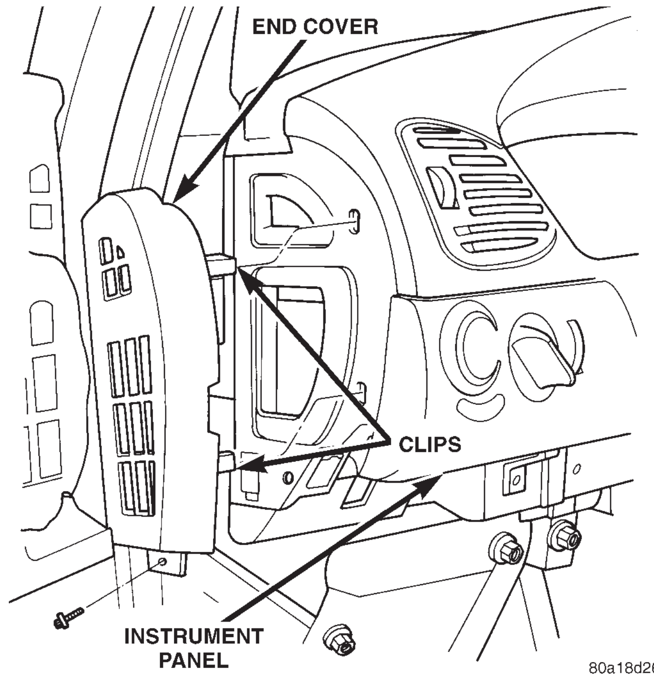

Fig. 29 Instrument Panel Left End Cover

(2) Remove lower steering column cover as necessary to gain clearance for end cover removal.

(3) Remove attaching screw

(4) Disengage clips holding end cover to instrument panel.

(5) Remove instrument panel end cover and foam pad covering the A/C inlet projection of the end cover if equipped.

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT PANEL LOUVERS

CENTER LOUVER HOUSING

REMOVAL

(1) Remove the instrument cluster bezel. Refer to Instrument Cluster Bezel removal and installation procedures.

(2) Place cluster bezel on a clean surface face down with the head lamp switch to the right side (Fig. 30).

(3) Using a flat bladed tool, release the louver housing locks tabs (Fig. 31).

(4) Release the upper left lock tab first, then the two lower louver tabs.

REMOVAL AND INSTALLATION (Continued)

(5) Applying pressure on the housing, release the upper right lock tab and the lower right.

(6) Push out the louver housing from the cluster bezel.

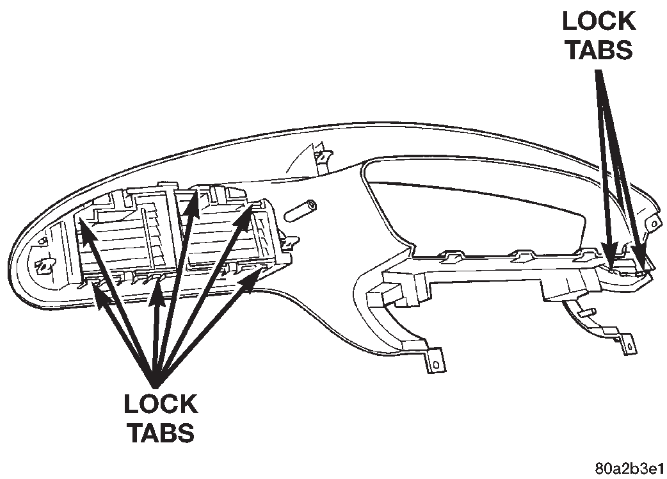

Fig. 30 Instrument Cluster Bezel

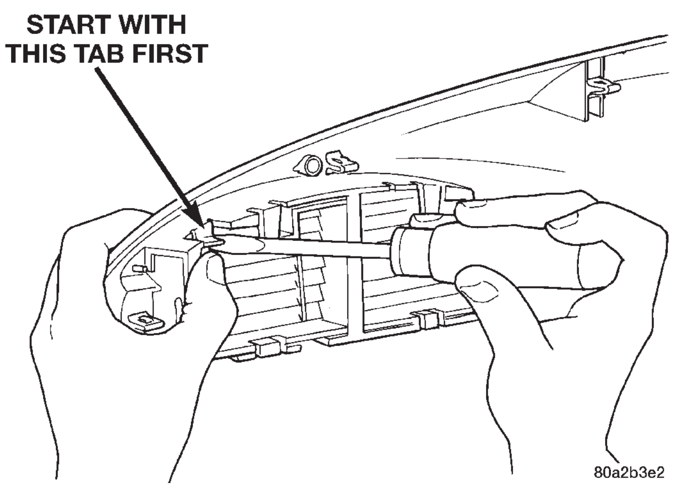

Fig. 31 Center Louver

INSTALLATION

(1) Verify the function of the vanes.

(2) Set louver housing into the cluster bezel.

(3) Using care do not push on the vanes, apply pressure on outer edge of the housing and push louver housing into place.

(4) After in place check function of the vanes.

LEFT LOUVER HOUSING

REMOVAL

(1) Remove the instrument cluster bezel. Refer to Instrument Cluster Bezel Removal and Installation procedures.

(2) Place cluster bezel on a clean surface face down with the head lamp switch to the right side (Fig. 30).

(3) Using a flat bladed tool, release the louver housing locks tabs.

(4) Release the upper left lock tab first, then the other upper lock tab.

(5) Applying pressure on the housing, release the lower lock tabs.

(6) Push out the louver housing from the cluster bezel.

INSTALLATION

(1) Verify the function of the vanes.

(2) Set louver housing into the cluster bezel and align the slot of the housing with the T location pins.

(3) Using care do not push on the vanes, apply pressure on outer edge of the housing and push louver housing into place.

(4) After in place check function of the vanes.

PASSENGER SIDE LOUVERS

The inner, outer louver and inner, outer housing are serviceable.

REMOVAL

(1) Using medium flat blade tool, position it in between the right side of louver and the housing (Fig. 32).

(2) Twist the tool to release the pivot pin from the louver and pull outward till released from pin.

(3) Place tool on the other side of louver and release the other pivot pin and pull housing free from the instrument panel. Use the same procedure for either inner or outer louver.

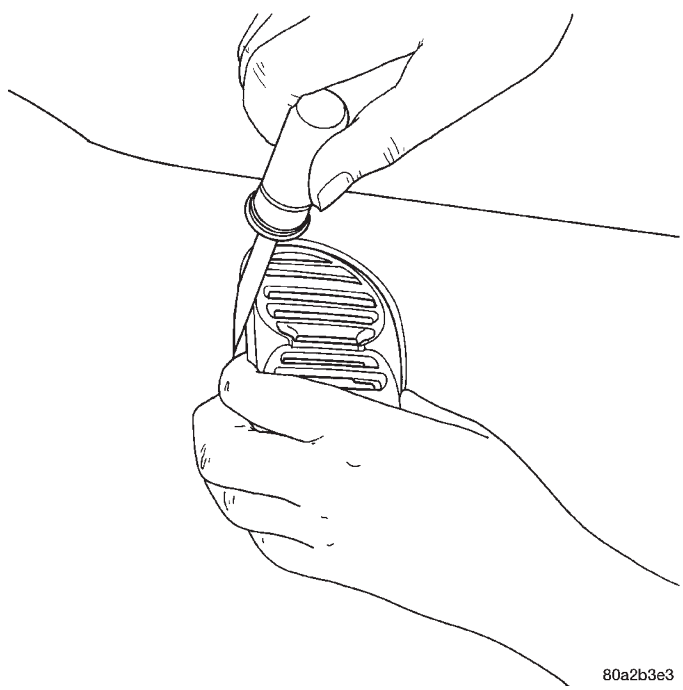

Fig. 32 Removing Passenger Louver

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

The inner and outer louvers have different size pivot pins on the housing. The outer housing has a larger pin on the right side then the inner housing (Fig. 33). The louver have a surface cut out on the right side of the housings to note the proper side.

(1) The right pivot pin is slotted on both housings. So when aligning louver tab with the pin ensure that they are lined up.

(2) Using care, apply pressure on outer edge of the louver and push into place.

(3) Rotate louver to ensure proper engagement.

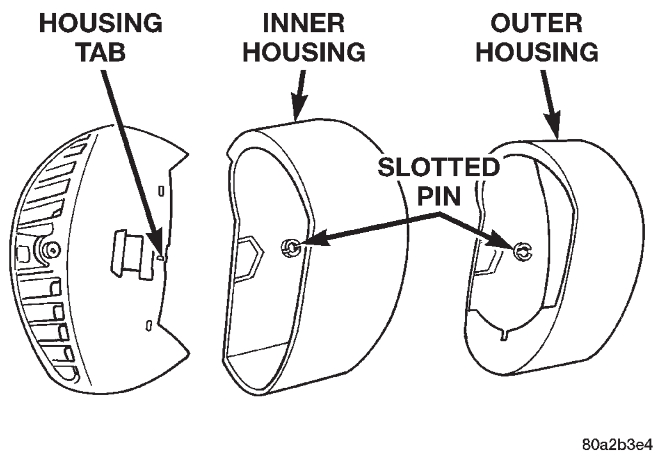

Fig. 33 Passenger Side Louver and Housings

PASSENGER SIDE LOUVER OUTER HOUSINGS

REMOVAL

(1) Using a trim stick, insert trim stick between the outer edge of the housing and the pad/panel vinyl covering (Fig. 34).

(2) Lightly pry housing inward and by hand pull the housing free from panel (Fig. 35).

INSTALLATION

(1) Place the slotted pin on the right side of the opening.

(2) Set housing in to position and push into place. The housing may need to be rocked to get the best fit within the opening.

INSTRUMENT PANEL TOP COVER

REMOVAL

(1) Remove A-pillar trim.

(2) Using a trim stick, disengage clips holding rear edge of top cover to instrument panel (Fig. 36).

(3) Disconnect wire harness from message center.

(4) Pull top cover rearward to disengage hooks holding front of top cover to instrument panel.

(5) Remove top cover.

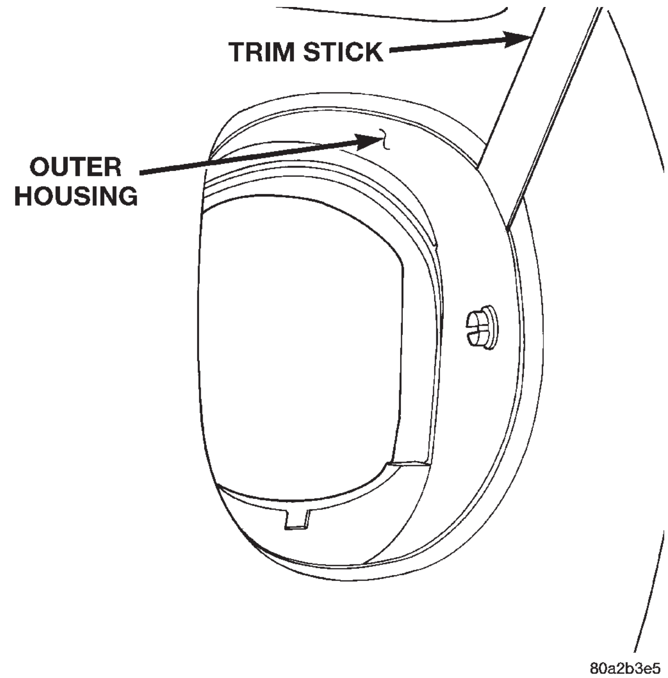

Fig. 34 Remove Housing

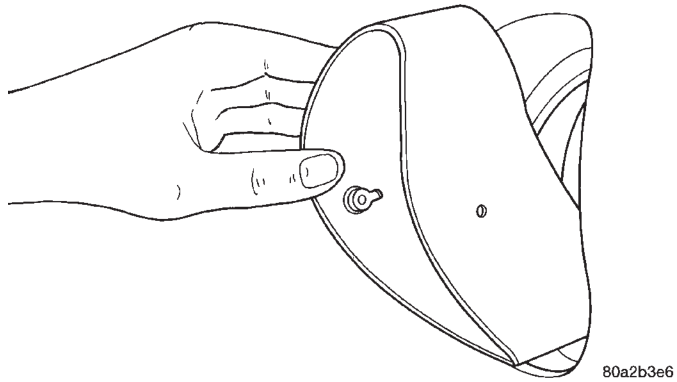

Fig. 35 Housing Being Removed

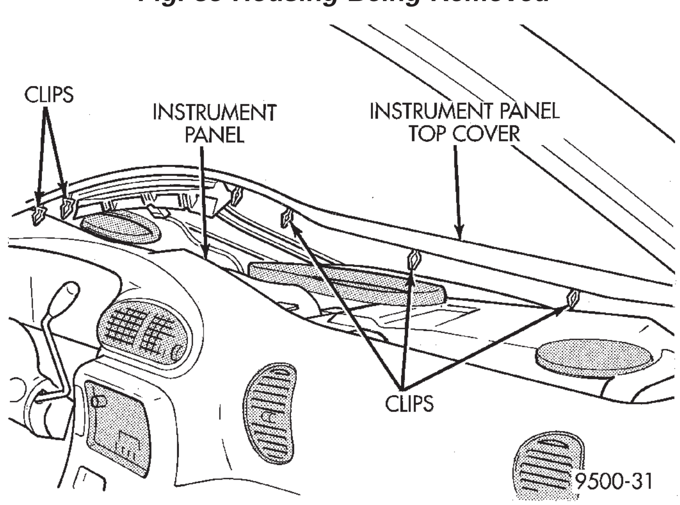

Fig. 36 Instrument Panel Top Cover

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place instrument panel top cover in position on vehicle.

(2) Push top cover forward to engage hooks to hold front of top cover to instrument panel.

(3) Connect wire harness to message center.

(4) Engage clips to hold rear edge of top cover to instrument panel.

(5) Pull top cover rearward.

(6) Install A-pillar trim.

INSTRUMENT PANEL RIGHT END COVER

REMOVAL

(1) Open passenger side front door (Fig. 37).

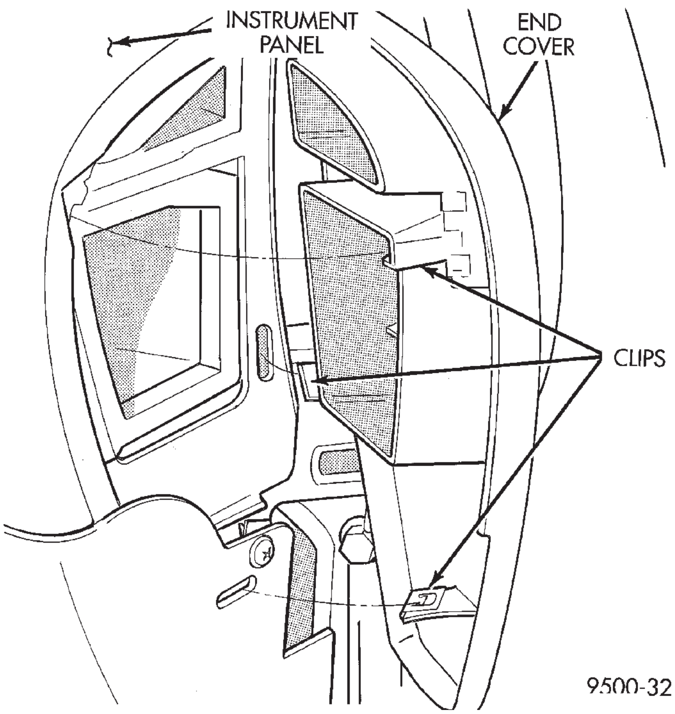

Fig. 37 Instrument Panel Right End Cover

(2) Disengage clips holding right end cover to instrument panel.

(3) Remove instrument panel end cover and foam pad covering the A/C inlet projection of the end cover if equipped.

INSTALLATION

For installation, reverse the above procedures.

JUNCTION BLOCK

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove lower steering column cover and knee blocker reinforcement.

(3) Disconnect four, forty-way connectors from Junction Block (Fig. 38).

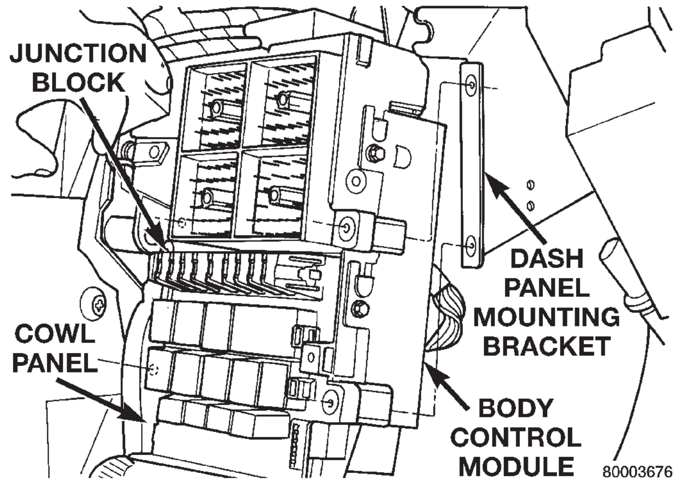

Fig. 38 Junction Block

(4) Disconnect two wire connectors from bottom of Body Control Module.

(5) Remove bolts holding Junction Block to dash panel mounting.

(6) Remove Junction Block from mounting bracket.

(7) Remove screws holding Body Control Module to Junction Block.

(8) Slide Body Control Module downward to disconnect guide studs on Junction Block from BCM ting bracket.

(9) Separate Junction Block from Body Control Module.

INSTALLATION

For installation, reverse the above procedures.

KNEE BLOCKER REINFORCEMENT

REMOVAL

(1) Remove lower steering column cover (Fig. 39).

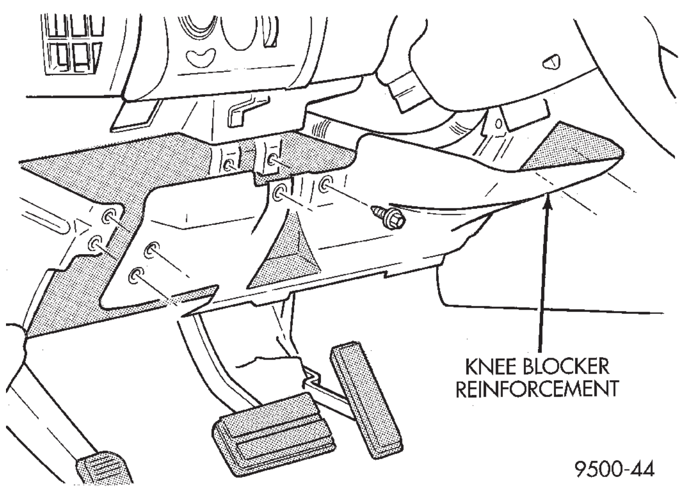

Fig. 39 Knee Blocker Reinforcement

(2) Remove screws holding knee blocker reinforcement to instrument panel.

REMOVAL AND INSTALLATION (Continued)

(3) Remove reinforcement.

INSTALLATION

(1) Place reinforcement in position.

(2) Install screws to hold knee blocker reinforcement to instrument panel.

(3) Install lower steering column cover.

LOWER CONSOLE

REMOVAL

(1) Remove screws holding lower console to floor bracket and instrument panel (Fig. 40).

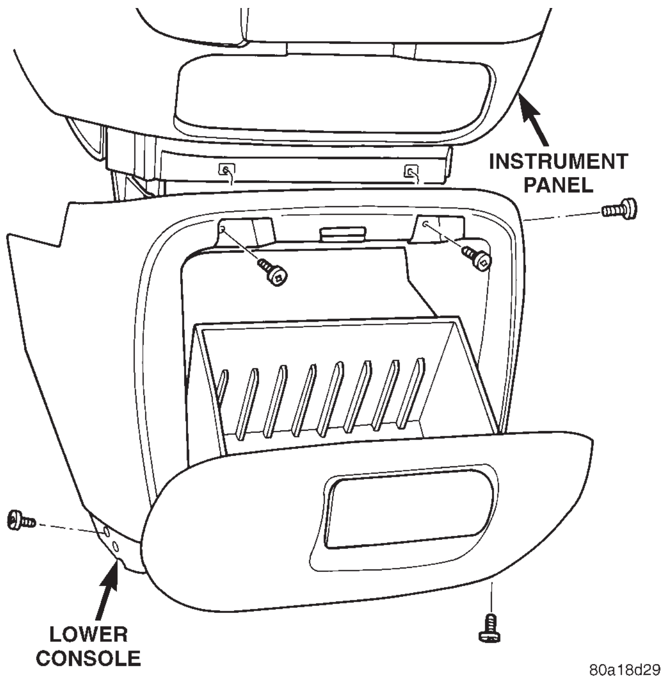

Fig. 40 Lower Console

(2) Slide console rearward from around instrument panel supports.

(3) Remove lower console.

INSTALLATION

(1) Place lower console in position.

(2) Slide console forward around instrument panel supports.

(3) Install screws to hold lower console to floor bracket and instrument panel.

LOWER INSTRUMENT PANEL

REMOVAL

(1) Remove right end cover.

(2) Remove steering column bezel.

(3) Remove radio bezel and HVAC control.

(4) Remove lower console.

(5) Remove ash receiver cup holder and track.

(6) Remove glove box.

(7) Remove glove box latch striker.

(8) Remove glove box lamp.

(9) Disconnect wire connector from glove box lamp.

(10) Remove screws holding lower instrument panel to reinforcement frame around glove box opening (Fig. 41).

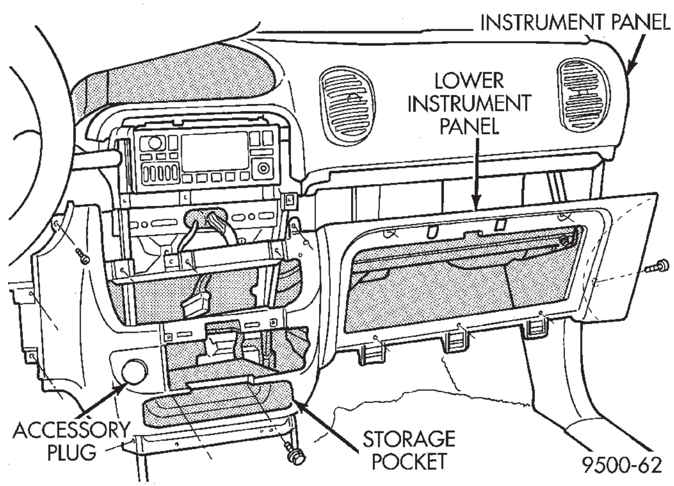

Fig. 41 Lower Instrument Panel

REMOVAL AND INSTALLATION (Continued)

(11) Remove screw holding lower instrument panel to right side of instrument panel.

(12) Remove screw holding lower instrument panel to upper instrument panel at left side panel above accelerator pedal.

(13) Remove instrument cluster bezel as necessary to gain access to lower instrument panel screws.

(14) Remove screw lower holding instrument panel to upper panel below instrument cluster.

(15) Remove screws holding rear of storage pocket to panel support frame.

(16) Remove screws holding lower instrument panel to upper instrument panel from below radio.

(17) Remove screws holding lower instrument panel to support frame in floor console area.

(18) Separate lower instrument from upper instrument panel.

(19) Disengage wire connectors from back of accessory plug.

(20) Separate lower instrument from vehicle.

INSTALLATION

For installation, reverse the above procedures.

LOWER STEERING COLUMN COVER

REMOVAL

(1) Remove screws holding parking brake release handle to instrument panel (Fig. 42).

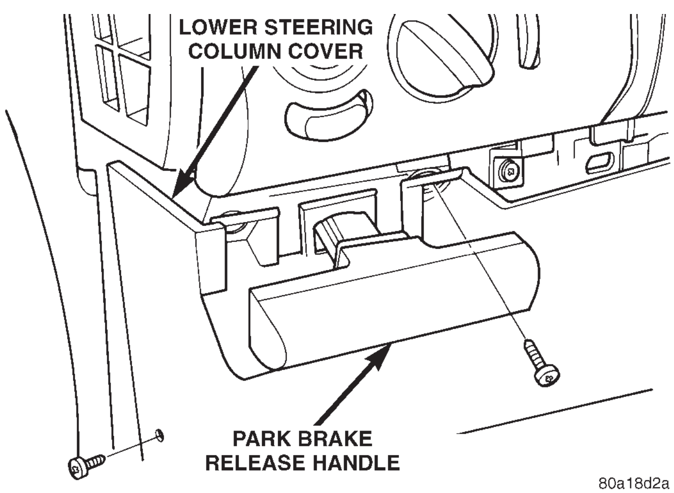

Fig. 42 Park Brake Release Handle

(2) Remove screws holding bottom of lower steering column cover to instrument panel (Fig. 43).

(3) Remove screw holding right side of lower steering column cover to instrument panel.

(4) Disengage park brake release cable case from groove on end of release handle (Fig. 44).

(5) Disengage cable end pivot from slot on release handle (Fig. 44).

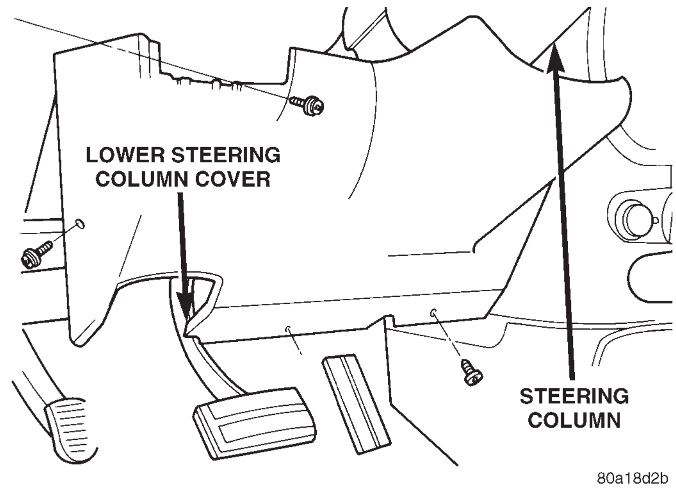

Fig. 43 Lower Steering Column Cover

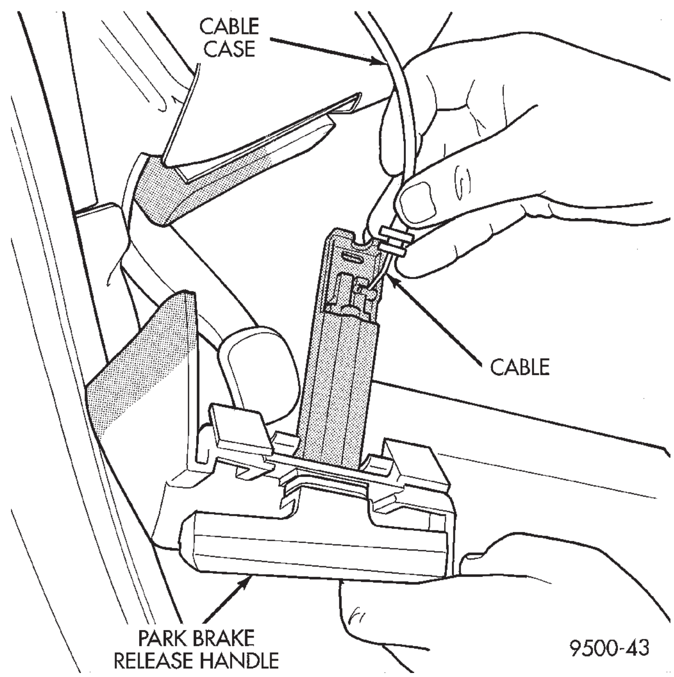

Fig. 44 Park Brake Release Handle

INSTALLATION

For installation, reverse the above procedures,

MESSAGE CENTER

REMOVAL

(1) Remove A-pillar trim.

(2) Remove instrument panel top cover. Refer to instrument panel top cover removal procedures.

(3) Disconnect the wire connector from back of message center.

(4) Remove screws holding message center to instrument panel top cover.

(5) Remove message center from instrument panel top cover.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place message center in position on top cover.
(2) Install screws to hold message center to instrument panel top cover.
(3) Connect wire connector into back of message center.
(4) Install instrument panel top cover.
(5) Install A-pillar trim.

OVER STEERING COLUMN BEZEL

REMOVAL

(1) Remove the lower steering column cover.
(2) Remove the screws holding over steering column bezel to the cluster bezel (Fig. 45).

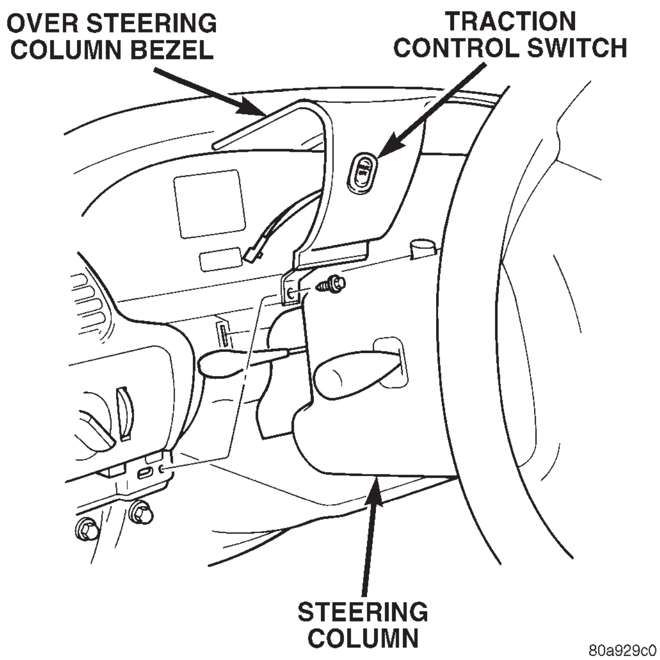

Fig. 45 Over Steering Column Bezel

(3) Remove over steering column bezel from vehicle.
(4) Disconnect the clips holding over column bezel to the cluster bezel.
(5) If equipped with traction control switch, disconnect the wire pigtail connector from the traction control switch.
(6) Remove the over steering column bezel.

INSTALLATION

(1) Place the over steering column bezel in position and engage clips to the cluster bezel. If equipped with traction control switch connect the wire pigtail before engaging clips.
(2) Install the screws to hold the over steering column bezel to the cluster bezel.
(3) Install the lower column cover.

POWER MIRROR SWITCH

REMOVAL

(1) Remove instrument cluster bezel (Fig. 46).

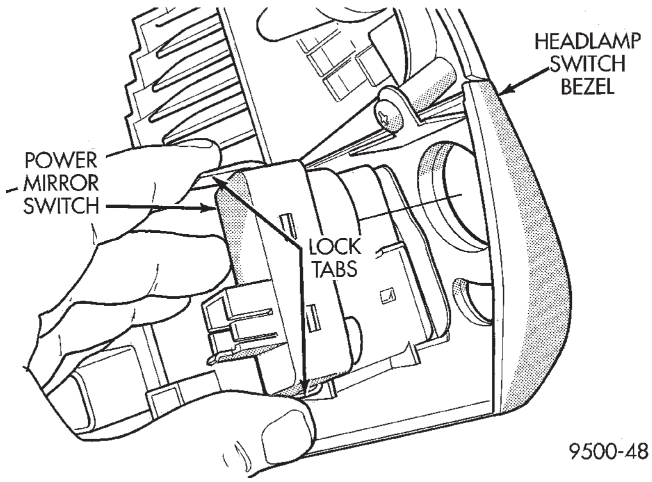

Fig. 46 Power Mirror Switch

(2) Disconnect wire connector from back of power mirror switch.
(3) Disengage lock tabs above and below the mirror switch.
(4) Pull power mirror switch from headlamp switch bezel.
(5) Remove power mirror switch.

INSTALLATION

For installation, reverse the above procedures.

POWER MIRROR SWITCH LAMP

REMOVAL

(1) Remove instrument cluster bezel (Fig. 47).

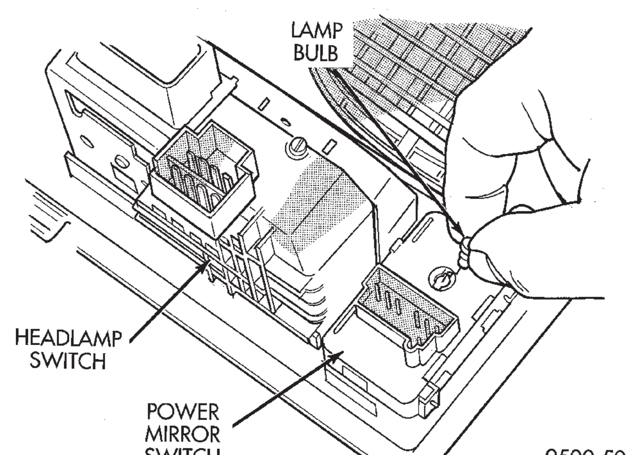

Fig. 47 Power Mirror Switch Lamp

(2) Rotate bulb socket counterclockwise one quarter turn.
(3) Pull bulb socket from back of power mirror switch.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

For installation, reverse the above procedures.

RADIO BEZEL AND HVAC CONTROL

REMOVAL

(1) Remove screw access cover (Fig. 48).

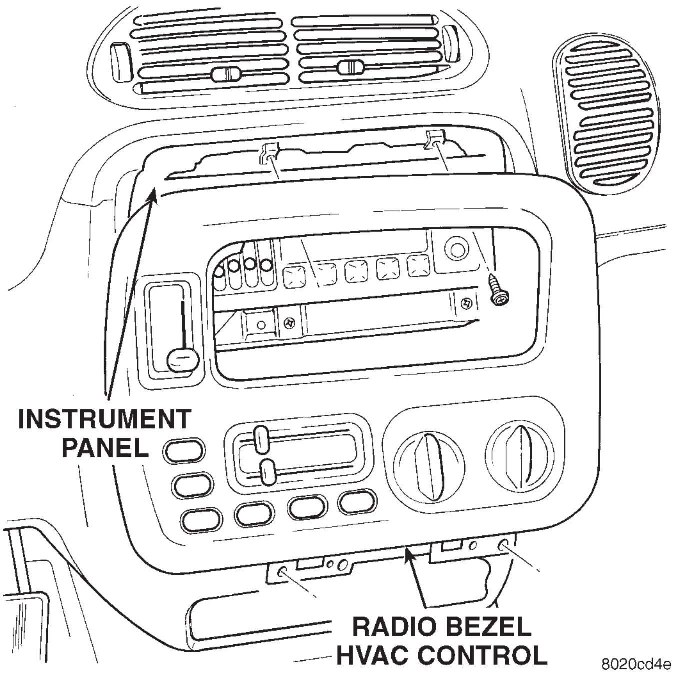

Fig. 48 Radio Bezel and HVAC Control

(2) Remove the attaching screws holding bottom of the bezel to instrument panel.

(3) Remove the attaching screws holding top of the bezel to the instrument panel.

(4) Remove the bezel from the instrument panel.

(5) Disconnect the wire connector from back of the rear blower switch, if equipped.

(6) Disconnect the wire connector from the back of the HVAC Control.

(7) Remove the bezel.

INSTALLATION

(1) Hold the radio bezel up and connect the wire connector into the back of the HVAC control.

(2) Connect the wire connector into back of the rear blower switch, if equipped.

(3) Place the radio bezel in position on the instrument panel.

(4) Install screws to hold the top of radio bezel to instrument panel.

(5) Install screws to the hold bottom of the radio bezel to the instrument panel.

(6) Install the access cover.

REAR HEATER-A/C SWITCH

REMOVAL

(1) Remove radio bezel and HVAC Control (Fig. 49).

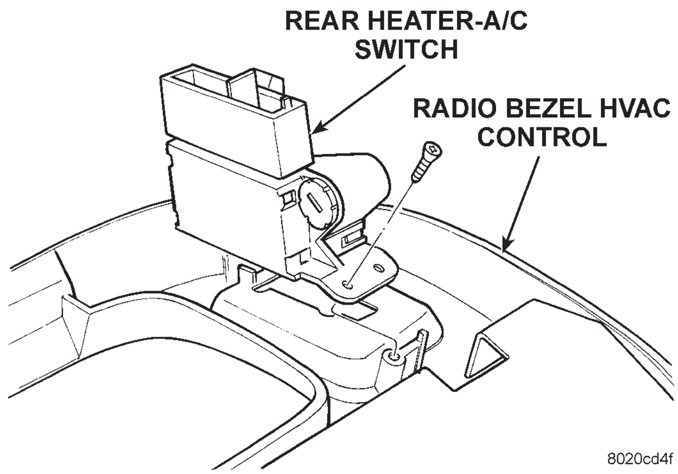

Fig. 49 Rear Heater – A/C Switch

(2) Remove screw holding rear heater-A/C switch to radio bezel HVAC Control.

(3) Disengage hook holding bottom of switch to radio bezel HVAC Control.

(4) Remove switch from radio bezel HVAC Control.

INSTALLATION

For instrument, reverse the above procedures.

REAR HEATER-A/C SWITCH LAMP

REMOVAL

(1) Remove radio bezel HVAC Control.

(2) Rotate bulb socket counterclockwise one quarter (Fig. 50).

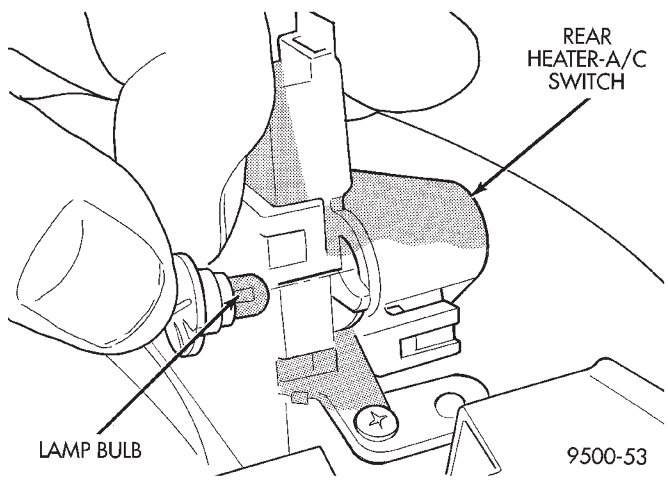

Fig. 50 Rear Heater-A/C Switch Lamp Bulb

(3) Pull bulb socket from switch.

INSTALLATION

For installation, reverse the above procedures.

AUDIO SYSTEMS

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GENERAL INFORMATION

INTRODUCTION

Operating instructions for the factory installed audio systems can be found in the Owner's Manual provided with the vehicle.

NS vehicles are equipped with an Ignition Off Draw (IOD) fuse in the power distribution center located in the engine compartment. After the IOD fuse or battery has been disconnected, the radio station sets and clock will require resetting.

DESCRIPTION AND OPERATION

ANTENNA

All models use a fixed-length stainless steel rod-type antenna mast, installed at the right front fender 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 coaxial antenna 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 near the right end of the instrument panel. This additional disconnect allows the instrument panel assembly to be removed and installed without removing the radio.

The factory-installed Electronically Tuned Radios (ETRs) automatically compensate for radio antenna trim. Therefore, no antenna trimmer adjustment is required or possible when replacing the receiver or the antenna.

INTERFERENCE ELIMINATION

Some components used on the vehicles are equipped with a capacitor to suppress radio frequency interference/static.

Capacitors are mounted in various locations internal to the generator, instrument cluster and windshield wiper motor.

To eliminate radio interference, ground straps are used in different areas of the vehicle. These ground circuits should be securely tightened to assure good metal to metal contact. The ground straps conduct very small high frequency electrical signals to ground and require clean surface contact area. The radio ground is supplied from the instrument panel harness and is attached to the rear of the radio. Some engines have other ground straps to eliminate further radio interference:

- Radio chassis to instrument panel structure
- Engine to dash panel
- Engine to chassis
- A/C h valve to dash panel

Radio resistance type spark plug cables in the high tension circuit of the ignition system complete the interference suppression. Faulty or deteriorated spark plug wires should be replaced.

RADIOS

Available factory-installed radio receivers for this model include an AM/FM/cassette (RAS sales code), an AM/FM/cassette/5-band graphic equalizer with CD changer control feature (RBN sales code), an AM/FM/

DESCRIPTION AND OPERATION (Continued)

CD/3-band graphic equalizer (RBR sales code), or an AM/FM/CD/cassette/3-band graphic equalizer (RAZ sales code).

All factory-installed radio receivers are stereo Electronically Tuned Radios (ETR) and include an electronic digital clock function.

All factory-installed radio receivers, except the RAS model, communicate on the Chrysler Collision Detection (CCD) data bus network through a separate two-way wire harness connector. The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

In addition, radios connected to the CCD data bus have several audio system functions that can be diagnosed using a DRB scan tool. Refer to the proper Diagnostic Procedures manual for more information on DRB testing of the audio systems.

The radio can only be serviced by an authorized radio repair station. Refer to the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

For more information on radio features, setting procedures, and control functions refer to the owner's manual in the vehicle glove box.

RADIO IGNITION INTERFERENCE

If receiving ignition/engine interference noise on the radio stations, check and clean all engine and body ground connections. Tighten properly after cleaning. Example (Fig. 1), (Fig. 2), (Fig. 3) and (Fig. 4).

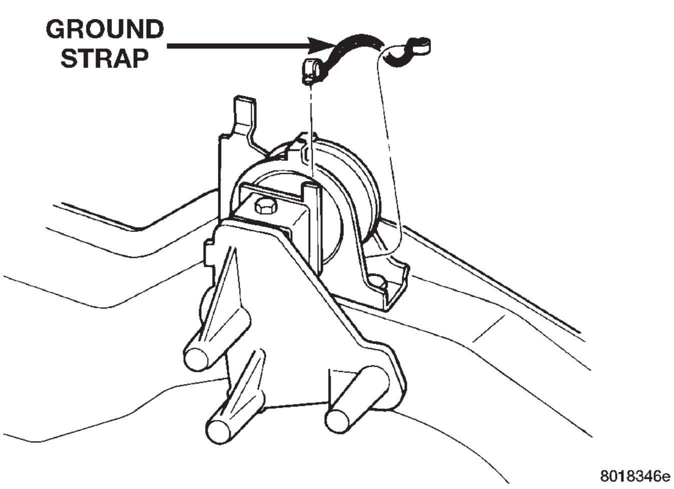

Fig. 1 Motor Mount to Frame Rail Ground

Ensure all ground connections are without corrosion.

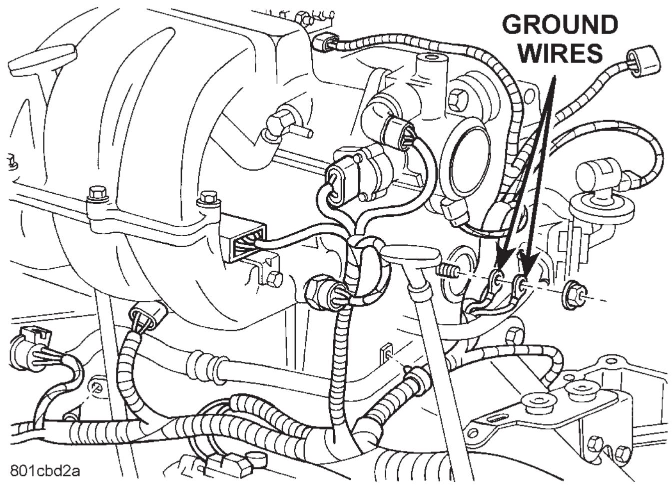

Fig. 2 2.4L Engine Block Ground

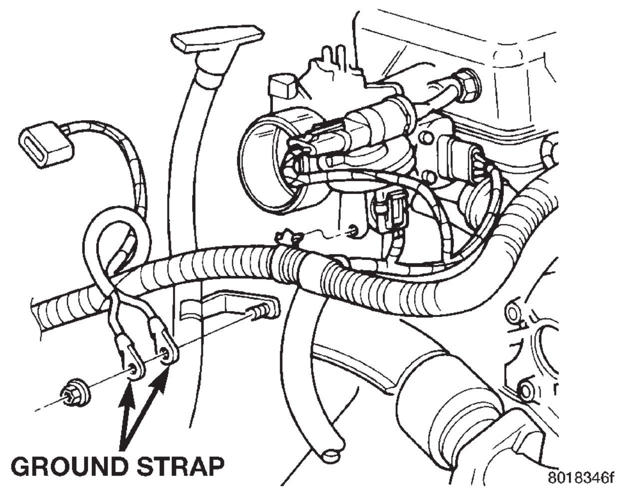

Fig. 3 3.0L Engine Block Ground

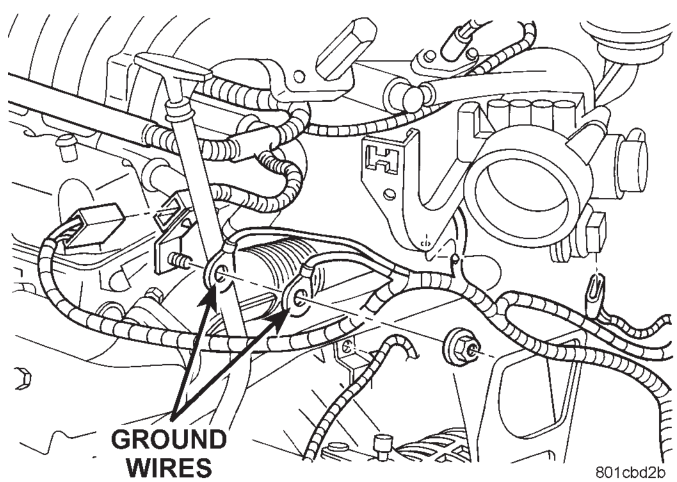

Fig. 4 3.3/3.8L Engine Block Ground

CHOKE—INFINITY SPEAKERS

If the audio system is lacking bass response, check for continuity across the choke connector. If no continuity Replace choke. The choke is located on the

DESCRIPTION AND OPERATION (Continued)

bracket behind the junction block/body control module (Fig. 5).

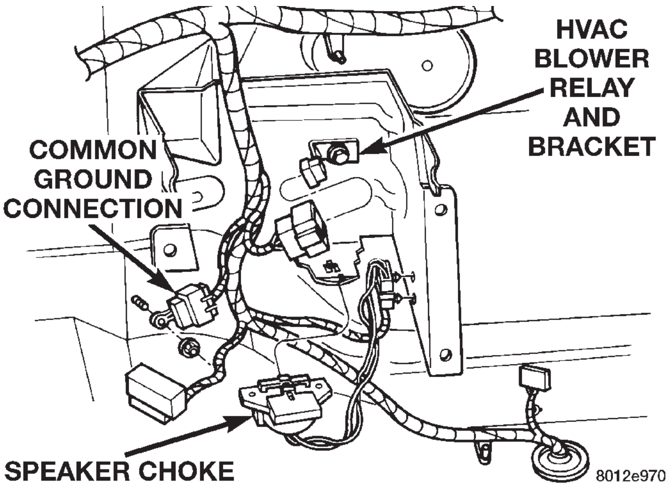

Fig. 5 Choke Location

REMOTE RADIO SWITCHES

A remote radio control switch option is available on LXI models sold in North America with the AM/FM/cassette/5-band graphic equalizer with CD changer control feature (RBN sales code), or the AM/FM/CD/cassette/3-band graphic equalizer (RAZ sales code) radio receivers. Two rocker-type switches are mounted on the back (instrument panel side) of the steering wheel spokes. The switch on the left spoke is the seek switch and has seek up, seek down, and preset station advance functions. The switch on the right spoke is the volume control switch and has volume up, and volume down functions (Fig. 6).

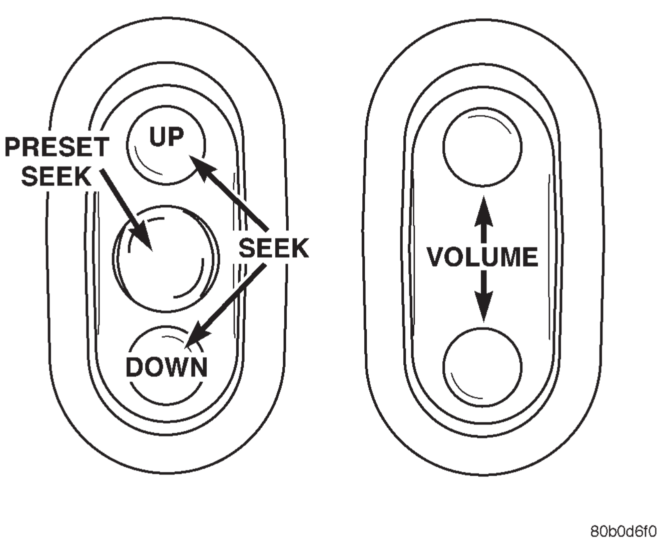

Fig. 6 Remote Radio Switch Operational View

These switches are resistor multiplexed units that are hard-wired to the Body Control Module (BCM) through the clockspring. The BCM sends the proper messages on the Chrysler Collision Detection (CCD) data bus network to the radio receiver. For diagnosis of the BCM or the CCD data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended. For more information on the operation of the remote radio switch controls, refer to the owner's manual in the vehicle glove box.

NAME BRAND SPEAKER RELAY

Relay is located in the junction block. To test relay refer to the Audio Diagnostic Test Procedures or use a known good relay.

DIAGNOSIS AND TESTING

ANTENNA

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.

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. 7).

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate a coaxial cable problem; from the coaxial cable connection under the right end of the instrument panel near the right cowl side panel to the antenna base, and then from the coaxial cable connection to the radio chassis connection.

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.

DIAGNOSIS AND TESTING (Continued)

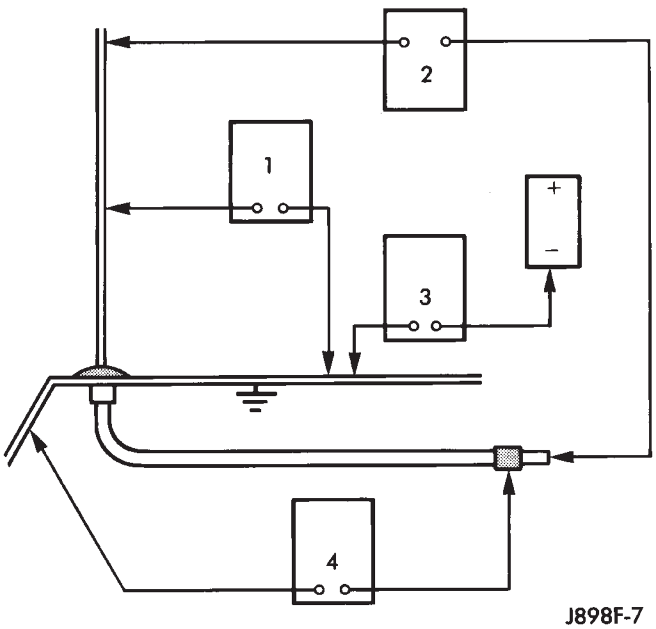

Fig. 7 Antenna Tests

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 battery. 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 (1) ohm.

(3) If the resistance is more than (1) ohm, check the braided ground strap connected to the engine and the vehicle body for being loose, corroded, or damaged. Repair 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 (1) ohm.

(3) If the resistance is more then (1) ohm, clean and/or tighten the antenna base to fender mounting hardware.

AUDIO SYSTEM

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.

RADIO

If the vehicle is equipped with remote radio switches located on the backs of the steering wheel spokes, and the problem being diagnosed is related to one of the symptoms listed below, be certain to check the remote radio switches and circuits as described in this group, prior to attempting radio diagnosis or repair.

- Stations changing with no remote radio switch input
- Radio memory presets not working properly
- Volume changes with no remote radio switch input
- Remote radio switch buttons taking on other functions
- CD player skipping tracks
- Remote radio switch inoperative.

For circuit descriptions and diagrams, refer to Group 8W - Wiring Diagrams.

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.

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.

DIAGNOSIS AND TESTING (Continued)

AUDIO SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
NO AUDIO.	1. FUSE FAULTY. 2. RADIO CONNECTOR FAULTY. 3. WIRING FAULTY. 4. GROUND FAULTY. 5. RADIO FAULTY. 6. SPEAKERS FAULTY.	1. CHECK RADIO FUSES IN FUSEBLOCK MODULE. REPLACE FUSES, IF REQUIRED. 2. CHECK FOR LOOSE OR CORRODED RADIO CONNECTOR. REPAIR, IF REQUIRED. 3. CHECK FOR BATTERY VOLTAGE AT RADIO CONNECTOR. REPAIR WIRING, IF REQUIRED. 4. CHECK FOR CONTINUITY BETWEEN RADIO CHASSIS AND A KNOWN GOOD GROUND. THERE SHOULD BE CONTINUITY. REPAIR GROUND, IF REQUIRED. 5. EXCHANGE OR REPLACE RADIO, IF REQUIRED. 6. SEE SPEAKER DIAGNOSIS, IN THIS GROUP.
NO DISPLAY.	1. FUSE FAULTY. 2. RADIO CONNECTOR FAULTY. 3. WIRING FAULTY. 4. GROUND FAULTY. 5. RADIO FAULTY.	1. CHECK RADIO FUSES IN FUSEBLOCK MODULE. REPLACE FUSES, IF REQUIRED. 2. CHECK FOR LOOSE OR CORRODED RADIO CONNECTOR. REPAIR, IF REQUIRED. 3. CHECK FOR BATTERY VOLTAGE AT RADIO CONNECTOR. REPAIR WIRING, IF REQUIRED. 4. CHECK FOR CONTINUITY BETWEEN RADIO CHASSIS AND A KNOWN GOOD GROUND. THERE SHOULD BE CONTINUITY. REPAIR GROUND, IF REQUIRED. 5. EXCHANGE OR REPLACE RADIO, IF REQUIRED.
NO MEMORY.	1. FUSE FAULTY. 2. RADIO CONNECTOR FAULTY. 3. WIRING FAULTY. 4. GROUND FAULTY. 5. RADIO FAULTY.	1. CHECK IGNITION-OFF DRAW FUSE. REPLACE FUSE, IF REQUIRED. 2. CHECK FOR LOOSE OR CORRODED RADIO CONNECTOR. REPAIR, IF REQUIRED. 3. CHECK FOR BATTERY VOLTAGE AT RADIO CONNECTOR. REPAIR WIRING, IF REQUIRED. 4. CHECK FOR CONTINUITY BETWEEN RADIO CHASSIS AND A KNOWN GOOD GROUND. THERE SHOULD BE CONTINUITY. REPAIR GROUND, IF REQUIRED. 5. EXCHANGE OR REPLACE RADIO, IF REQUIRED.
POOR RADIO RECEPTION.	1. ANTENNA FAULTY. 2. GROUND FAULTY. 3. RADIO FAULTY.	1. SEE ANTENNA DIAGNOSIS, IN THIS GROUP. REPAIR OR REPLACE ANTENNA, IF REQUIRED. 2. CHECK FOR CONTINUITY BETWEEN RADIO CHASSIS AND A KNOWN GOOD GROUND. THERE SHOULD BE CONTINUITY. REPAIR GROUND, IF REQUIRED.. 3. EXCHANGE OR REPLACE RADIO, IF REQUIRED.
NO/POOR TAPE OPERATION.	1. FAULTY TAPE. 2. FOREIGN OBJECTS BEHIND TAPE DOOR. 3. DIRTY CASSETTE TAPE HEAD. 4. FAULTY TAPE DECK.	1. INSERT KNOWN GOOD TAPE AND TEST OPERATION. 2. REMOVE FOREIGN OBJECTS AND TEST OPERATION. 3. CLEAN HEAD WITH MOPAR CASSETTE HEAD CLEANER. 4. EXCHANGE OR REPLACE RADIO, IF REQUIRED.
NO COMPACT DISC OPERATION	1. FAULTY CD. 2. FOREIGN MATERIAL ON CD. 3. CONDENSATION ON CD OR OPTICS. 4. FAULTY CD PLAYER.	1. INSERT KNOWN GOOD CD AND TEST OPERATION. 2. CLEAN CD AND TEST OPERATION. 3. ALLOW TEMPERATURE OF VEHICLE INTERIOR TO STABILIZE AND TEST OPERATION. 4. EXCHANGE OR REPLACE RADIO, IF REQUIRED.

DIAGNOSIS AND TESTING (Continued)

(1) Check the fuse(s) in the junction block and 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(s).

(2) Check for battery voltage at the fuse in the PDC. If OK, go to Step 3. If not OK, repair the open circuit to the battery as required.

(3) Turn the ignition switch to the ON position. Check for battery voltage at the fuse in the junction block. If OK, go to Step 4. If not OK, repair the open circuit to the ignition switch as required.

(4) Turn the ignition switch to the OFF position. Disconnect and isolate the battery negative cable. Remove the instrument cluster center bezel. Remove the radio, but do not unplug the wire harness connectors. Check for continuity between the radio chassis and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open radio chassis ground circuit as required.

(5) Connect the battery negative cable. Turn the ignition switch to the ON position. Check for battery voltage at the fused ignition switch output circuit cavity of the left (gray) radio 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. Check for battery voltage at the fused B(+) circuit cavity of the left (gray) radio wire harness connector. If OK, replace the faulty radio. If not OK, repair the open circuit to the Ignition-Off Draw (IOD) fuse as required.

REMOTE RADIO SWITCHES

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 and isolate the battery negative cable. Wait two minutes for the airbag system capacitor to discharge before further service.

(2) Remove the remote radio switch(es) from the steering wheel.

(3) Use an ohmmeter to check the switch resistance as shown in the Remote Radio Switch Test table (Fig. 8).

NOTE: The right remote radio switch back is white in color. The left switch back is black in color. The right/left remote radio switch orientation is with the steering wheel installed, and driver in drivers seat.

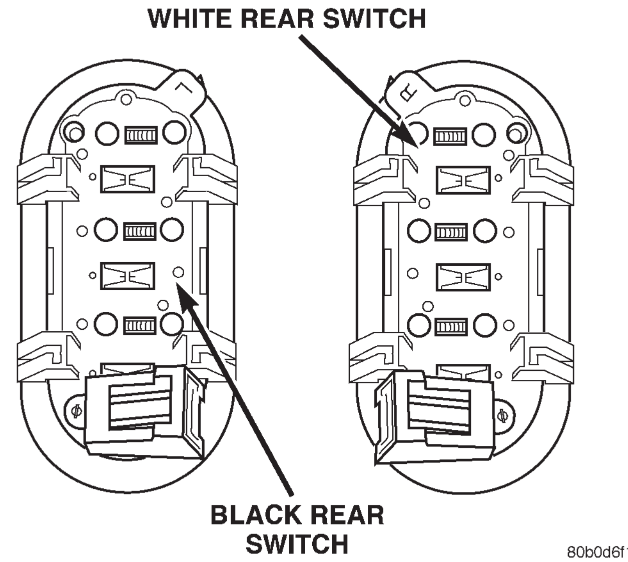

Fig. 8 Remote Radio Switches

REMOTE RADIO SWITCH TEST

SWITCH POSITION	RESISTANCE
VOLUME UP	7320 OHMS
VOLUME DOWN	1210 OHMS
SEEK UP	4530 OHMS
SEEK DOWN	2050 OHMS
PRE-SET STATION ADVANCE	10 OHMS

(4) If the switch resistance checks OK, go to Step 5. If not OK, replace the faulty switch.

(5) Check for continuity between the ground circuit cavity of the switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open circuit as required.

(6) Unplug the 24-way white wire harness connector from the Body Control Module (BCM). Check for continuity between the radio control circuit cavity of the remote radio switch wire harness connector and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the short circuit as required.

(7) Check for continuity between the radio control circuit cavities of the remote radio switch wire harness connector and the BCM wire harness connector. There should be continuity. If OK, refer to the proper Diagnostic Procedures manual to test the BCM and the CCD data bus. If not OK, repair the open circuit as required.

REMOVAL AND INSTALLATION

ANTENNA MAST AND CABLE LEAD

REMOVAL

(1) Remove glove box from instrument panel, refer to Group 8E, Instrument Panel and Systems for proper procedures.

(2) Disconnect antenna cable connector from extension cable (Fig. 9).

(3) Remove right kick trim panel.

(4) Disengage rubber grommet insulator from door hinge pillar.

(5) Pull antenna cable through hinge pillar into open between door hinges.

(6) Hoist and support vehicle on safety stands.

(7) Remove front wheel, refer to Group 22, Wheel and Tries for proper procedures and tightening references.

(8) Remove front wheelhouse splash shield, refer to Group 23, Body for proper procedures.

(9) Slide the plastic sleeve up on antenna mast for access to mast. Remove antenna mast from antenna base (Fig. 10).

(10) Remove plastic cap from the cap nut. Using cap nut tool, remove cap nut holding antenna base to front fender (Fig. 11).

(11) Remove antenna base from under front fender.

INSTALLATION

For installation, reverse the above procedure.

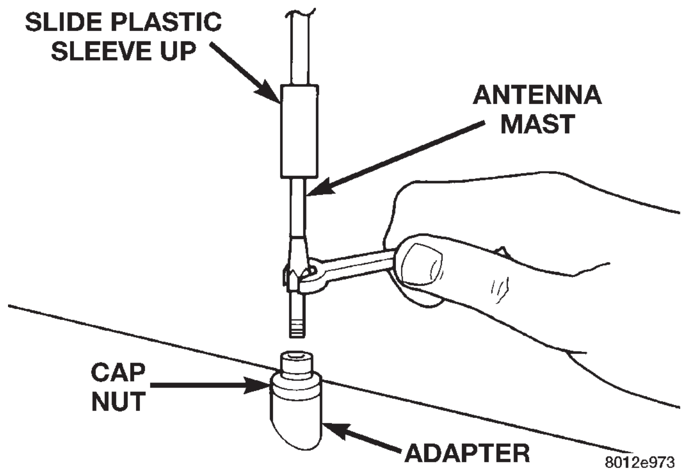

Fig. 10 Antenna Mast

ANTENNA EXTENSION CABLE

REMOVAL

(1) Remove glove box.

(2) Disconnect extension cable end from antenna cable end (Fig. 9).

(3) Disconnect cable hanger clip from HVAC unit.

(4) Remove radio as necessary to gain access to extension cable.

(5) Disconnect extension cable from back of radio.

(6) Remove extension cable from vehicle.

INSTALLATION

For installation, reverse the above procedure.

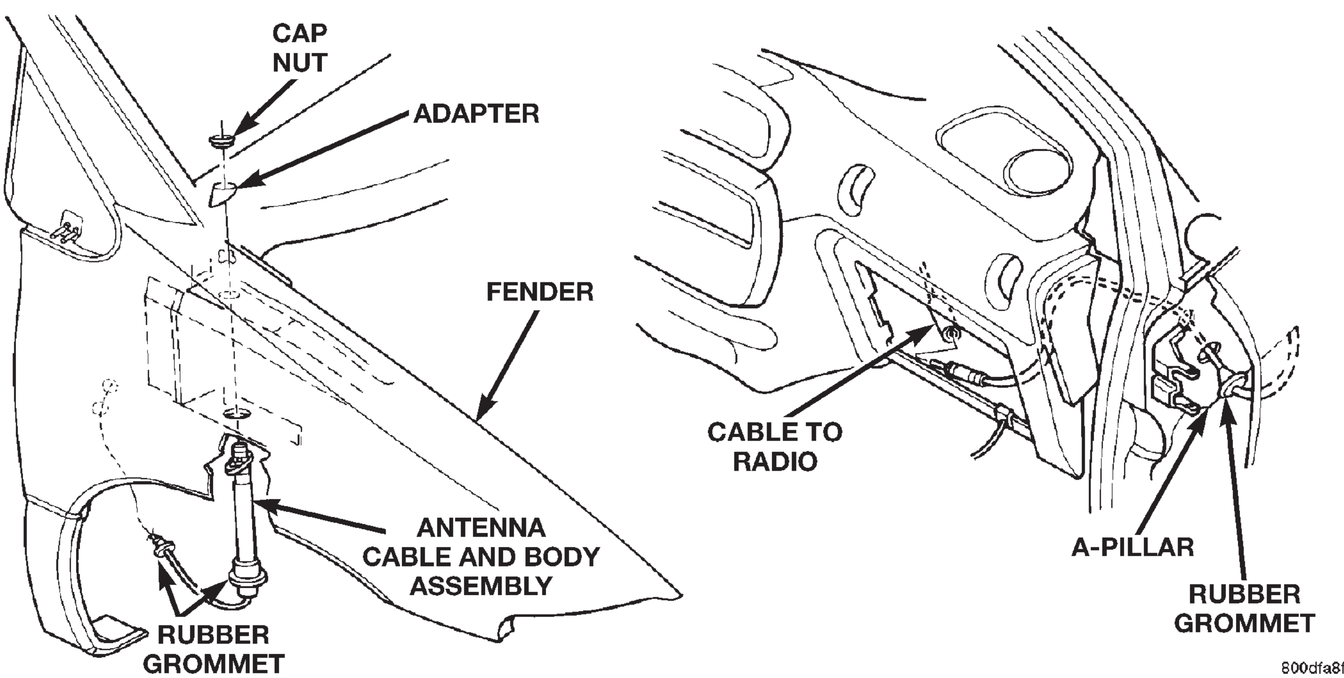

Fig. 9 Antenna Cable

REMOVAL AND INSTALLATION (Continued)

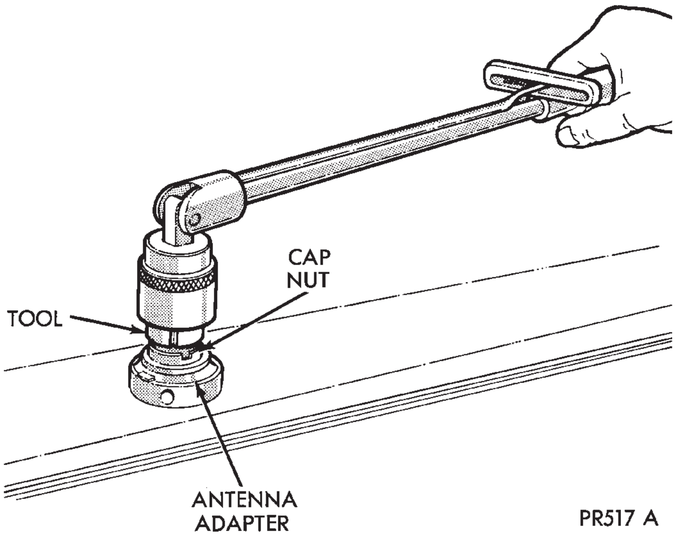

Fig. 11 Antenna Cap Nut

RADIO/TAPE/CD PLAYER

REMOVAL

(1) Remove HVAC switch bezel, refer to Group 8E, Instrument Panel and Systems for proper procedure.

(2) Remove screws holding radio to instrument panel (Fig. 12).

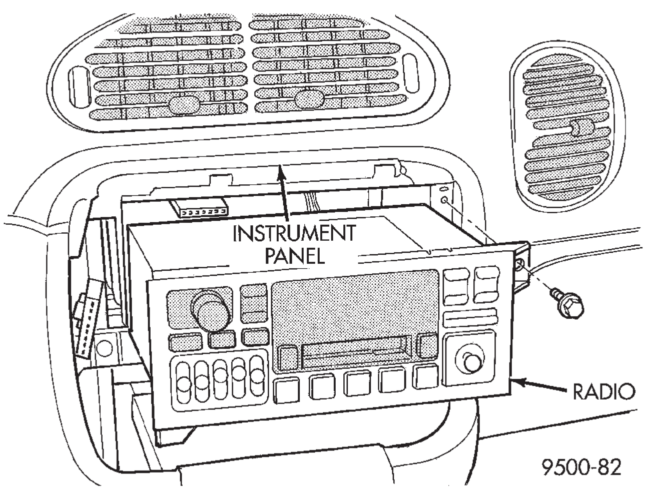

Fig. 12 Radio

(3) Pull radio rearward to gain access to back of radio (Fig. 13).

(4) Remove bolt holding ground strap to back of radio.

(5) Disconnect antenna cable from back of radio.

(6) Disconnect the wire connectors from back of radio.

(7) Remove radio from vehicle.

INSTALLATION

For installation, reverse the above procedure.

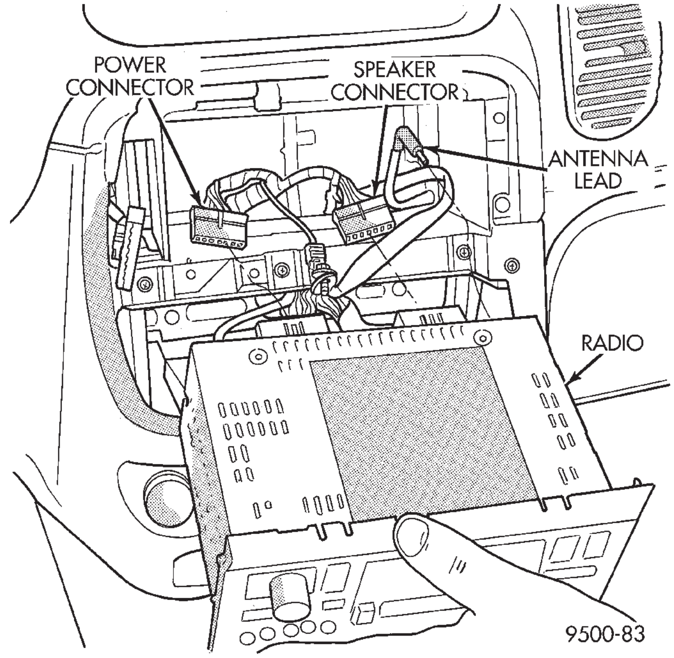

Fig. 13 Radio Connectors

INSTRUMENT PANEL SPEAKER

INSTALLATION

(1) Remove instrument panel top cover.

(2) Remove screws holding speaker to instrument panel and remove speaker (Fig. 14) or (Fig. 15).

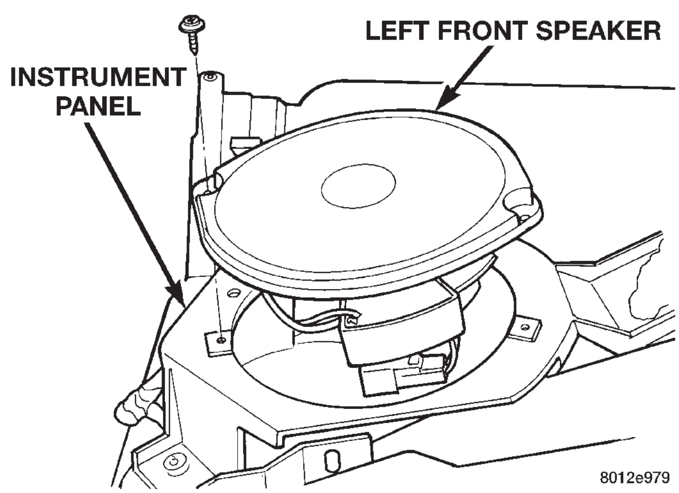

Fig. 14 Left Instrument Panel Speaker

(3) Remove anti rocking finger screw.

(4) Disconnect wire connector from speaker.

(5) Remove speaker.

INSTALLATION

For installation, reverse the above procedure.

REMOVAL AND INSTALLATION (Continued)

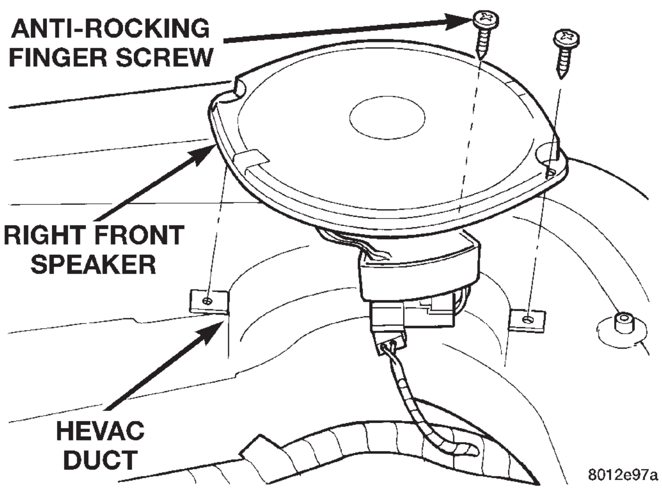

Fig. 15 Right Instrument Panel Speaker

FRONT DOOR SPEAKER

REMOVAL

(1) Remove front door trim panel as necessary to gain access to door speaker. Refer to Group 23, Body for proper procedures.

(2) Remove screws holding speaker to bracket (Fig. 16).

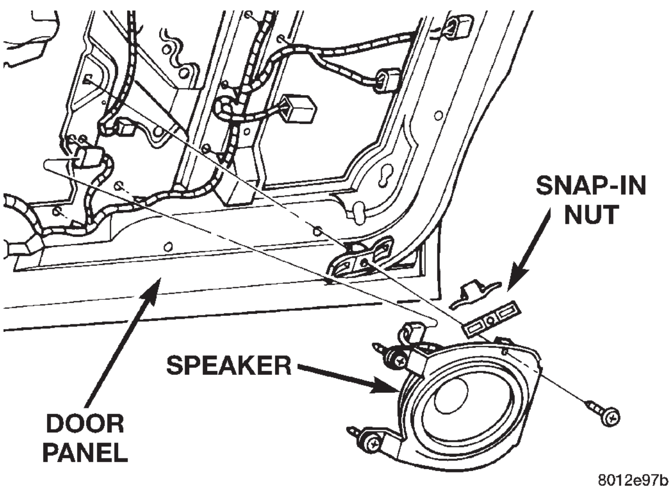

Fig. 16 Front Door Speaker

(3) Remove speaker from bracket.

(4) Disconnect wire connector from speaker.

(5) Remove speaker.

INSTALLATION

For installation, reverse the above procedure.

REMOTE RADIO SWITCHES

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.

REMOVAL

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the airbag system capacitor to discharge before further service.

(2) From the underside of the steering wheel, remove the (3) bolts that secure the driver side airbag module to the steering wheel.

(3) Pull the airbag module away from the steering wheel far enough to access the wire harness connectors on the back of the airbag module.

(4) Unplug the airbag module and horn switch wire harness connectors from the back of the airbag module.

(5) Remove the driver side airbag module from the vehicle.

(6) Remove the steering wheel from the steering column. Refer to Group 19–Steering, for service procedure.

(7) Unplug the wire harness connector from the remote radio switch (s).

(8) Remove three screws securing steering wheel rear cover. Refer to Group 19, Steering for serivce procedure.

(9) Remove the remote radio switch from the steering wheel by depressing tabs on each side of switch..

NOTE: The right remote radio switch back is white in color. The left switch back is black in color. The right/left remote radio switch orientation is with the steering wheel installed, and driver in drivers seat.

INSTALLATION

For installation, reverse the above procedure. The switches can only be installed one way. Be careful to index them correctly before pressing them into place.

Tighten the airbag module mounting screws to 10.2 N·m (90 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

QUARTER PANEL SPEAKER

REMOVAL

(1) Remove quarter trim bolster from quarter trim panel.

(2) Remove screws holding speaker to inner quarter panel (Fig. 17).

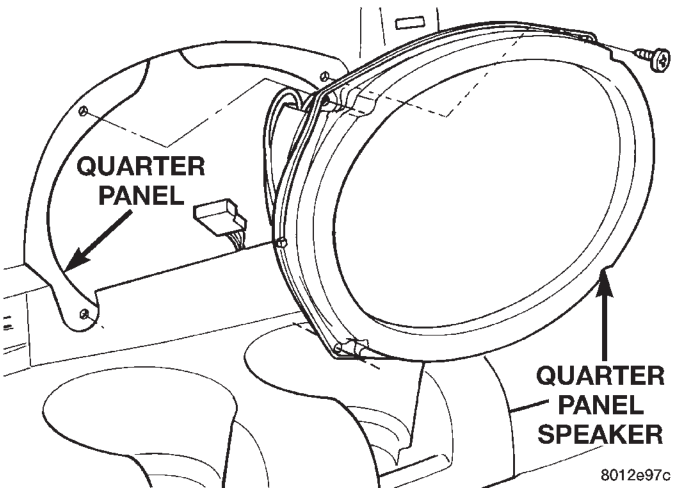

Fig. 17 Quarter Panel Speaker

(3) Separate speaker from quarter panel.

(4) Disconnect wire connector from speaker.

(5) Remove speaker.

INSTALLATION

For installation, reverse the above procedure.

D–PILLAR SPEAKER

REMOVAL

(1) Remove D-pillar trim panel as necessary to gain access to door speaker. Refer to Group 23, Body for proper procedures.

(2) Disconnect wire connector from speaker.

(3) Remove by sliding speaker out of bracket by pushing on magnet. The capacitor is wrapped with foam tape (Fig. 18).

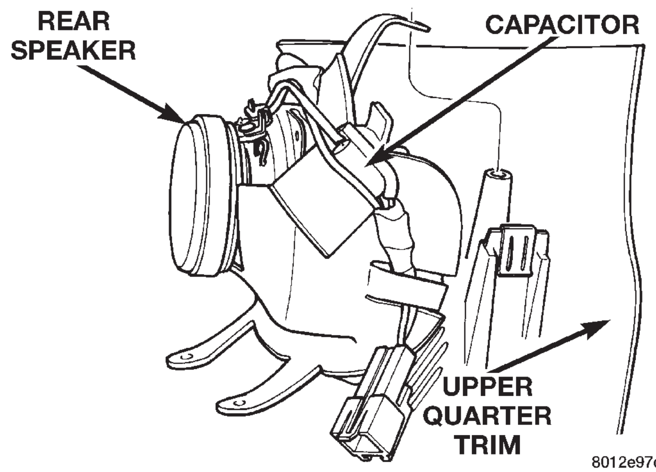

Fig. 18 D–Pillar Speaker

(4) Remove speaker.

INSTALLATION

For installation, reverse the above procedure.

HORNS

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DESCRIPTION AND OPERATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR SAFETY PRECAUTIONS. DISCONNECT THE NEGATIVE CABLE FROM THE BATTERY BEFORE SERVICING COMPONENTS INVOLVING THE AIRBAG SYSTEM. ACCIDENTAL DEPLOYMENT OF AIRBAG AND PERSONAL INJURY CAN RESULT.

The horn circuit consists of a horn switch, clockspring, horn relay, horns and Body Control Module (Fig. 1). The horn switch is a membrane switch located in the airbag cover. The horns are located forward of the left front wheel behind the bumper fascia. The horn relay plugs into the junction block. For circuit information and component locations refer to Group 8W, Wiring Diagrams.

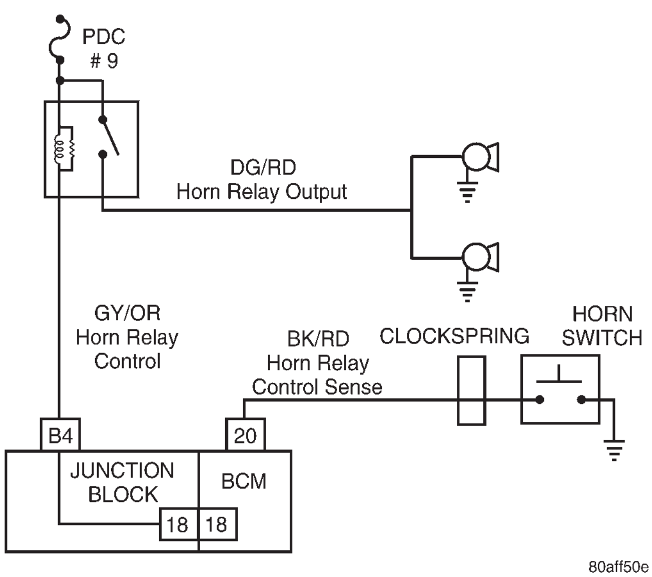

Fig. 1 Horn System

DIAGNOSIS AND TESTING

HORN

(1) Disconnect wire connector at horn.
(2) Using a voltmeter, connect one lead to ground terminal and the other lead to the positive wire terminal (Fig. 3).
(3) Depress the horn switch, battery voltage should be present.
(4) If no voltage, refer to Horn Will Not Sound. If voltage is OK, go to step Step 5.
(5) Using ohmmeter, test ground wire for continuity to ground.
(6) If no ground repair as necessary.
(7) If wires test OK and horn does not sound, replace horn.

HORN RELAY

(1) Remove horn relay.
(2) Using ohmmeter, test between relay connector terminals 85 to 86 for 70 to 75 ohms resistance (Fig. 2). If resistance not OK, replace relay.
(3) Test for continuity between ground and terminal 85 of horn relay.
(a) When the horn switch is not depressed, no continuity should be present.
(b) Continuity to ground when horn switch is depressed.
(c) If continuity is not correct repair horn switch or wiring as necessary, refer to Group 8W, Wiring Diagrams Group 8M Restraint System for Driver's Airbag Module removal procedures.
(4) Using voltmeter, test voltage at:
(a) Terminals 30 and 86 of the horn relay to body ground.
(b) If NO voltage check fuse 7 of the BCM.
(c) If incorrect voltage repair as necessary. Refer to Group 8W, Wiring Diagrams.
(5) Insert a jumper wire between terminal 30 and 87 of the power distribution center.
(a) If horn sounds replace relay.

DIAGNOSIS AND TESTING (Continued)

(b) If the horn does not sound, install horn relay and refer to Horn Test.

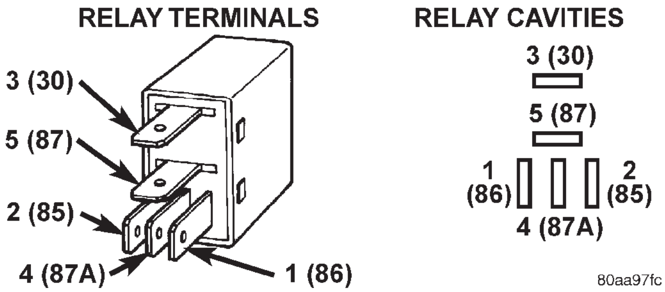

Fig. 2 Horn Relay

HORNS WILL NOT SOUND

Check horn fuse 6 in the Power Distribution Center and fuse 7 in the Junction Block. If fuse is blown refer to FUSE BLOWN section. If fuse is OK, refer to FUSE OK section.

FUSE BLOWN

(1) Verify condition of battery terminals and voltage, refer to Group 8A, Battery. If battery connections and battery charge is OK proceed to Step 2.

(2) Using a voltmeter, test for battery voltage at both sides of horn fuse 7. If voltage is OK, on both sides of fuse, proceed to Fuse OK. If voltage is OK, on one side of fuse, the fuse is blown, proceed to Step 3.

(3) Using a suitable ammeter in place of the fuse, test amperage draw of the horn circuit. If amperage draw is greater than 20 amps without the horn switch depressed, a grounded circuit exists between the fuse and the horn relay. Proceed to Step 4. If amperage draw is greater than 20 amps with the horn switch depressed, a grounded circuit exists between the horn relay and the horn. Proceed to step Step 5.

(4) Remove the horn relay from the Junction Block. If the amperage draw drops to 0 amps, the horn switch or circuit is shorted. Refer to group 8W, Wiring Diagrams for circuit information. If the amperage draw does not drop to 0 amps, repair short at the Junction Block.

(5) Disengage a wire connector from one of the horns. If amperage drops and the connected horn sounds, replace the faulty horn. If amperage does not drop with both horns disconnected and the horn switch depressed, proceed to Step 6.

(6) Using a continuity tester, with the horns disconnected test continuity of the X2 cavity of the horn relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information. If continuity is detected, the circuit is grounded between the Junction Block and the horns. Locate and repair pinched harness.

FUSE OK

(1) Remove the horn relay from the Junction Block.

(2) Using a continuity tester, Depress horn switch and test continuity from the X3 cavity of the horn relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information.

(a) If continuity is detected, proceed to Step 3.

(b) If NO continuity, proceed to Step 4.

(3) Using a suitable jumper wire, jump across the fuse F62 cavity and the X2 cavity of the horn relay in the Junction Block.

(a) If the horn sounds, replace the horn relay.

(b) If the horn does not sound, proceed to Step 4.

(4) Remove airbag/horn pad from steering wheel. Refer to Group 8M, Restraint Systems for proper procedures.

(5) Test continuity across horn switch connectors with horn switch depressed.

(a) If continuity is detected, repair open circuit between the relay and the horn switch.

(b) If NO continuity, replace airbag cover.

(6) Install horn relay into Junction Block.

(7) Disengage wire connectors from horns.

(8) Using a voltmeter, with the horn switch depressed test voltage across horn connector terminals of the wire harness (Fig. 3).

(a) If voltage is detected, replace horns.

(b) If NO voltage, proceed to step Step 9.

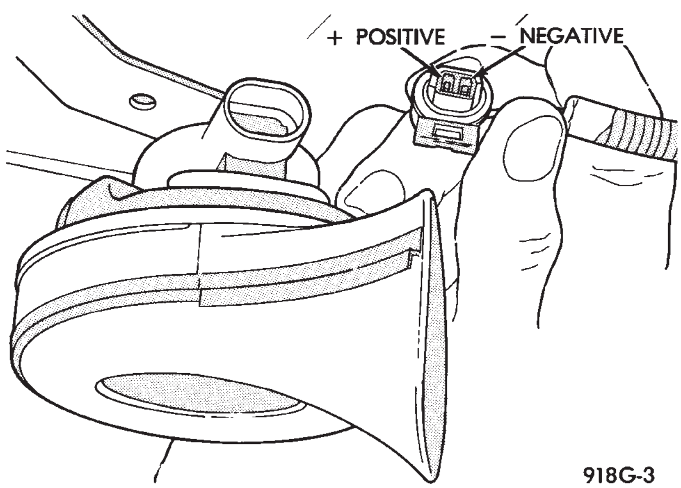

Fig. 3 Horn and Connector

(9) With the horn switch depressed, test for voltage between the X2 circuit and ground.

(a) If voltage OK, repair system ground at right cowl area. Refer to Group 8W, Wiring Diagrams.

(b) If NO voltage, repair open X2 circuit between the relay and the horns.

DIAGNOSIS AND TESTING (Continued)

HORNS SOUND CONTINUOUSLY

CAUTION: Continuous sounding of horns may cause relay to fail.

The horn switch (membrane) sometimes can be the cause without the switch being depressing.

(1) Remove the horn relay from the junction block.

(2) Using a continuity tester, test continuity from the X3 cavity of the horn relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information.

(a) If continuity is detected, proceed to step Step 3.

(b) If NO continuity, replace the horn relay.

(3) Remove the airbag/horn pad from the steering wheel and disengage horn connector.

(4) Install horn relay into junction block.

(a) If horn does not sound, replace airbag cover/ horn pad.

(b) If horn sounds, repair grounded X3 circuit from junction block to clockspring in steering in steering column. Refer to Group 8W, Wiring Diagrams.

HORN SYSTEM

Refer to Horn System Test below. If the horn does not sound, check horn fuse located in the Power Distribution Center. If the fuse is blown, replace with the correct fuse. If the horn fail to sound and the new fuse blows when depressing the horn switch, a short circuit in the horn or the horn wiring between the fuse terminal and the horn is responsible, or a defective horn switch allowed the horn to burn out is responsible.

If the fuse is OK, test horn relay refer to Horn Relay Test.

If the relay is OK, test horn. Refer to Horn System Test.

CAUTION: Continuous sounding of horn may cause horn relay to fail.

Should the horn sound continuously:

- Unplug the horn relay from Power Distribution Center.
- Refer to Horn Relay Test.

Refer to Group 8W, Wiring Diagrams for circuit and wiring information.

HORN SYSTEM TEST

CONDITION	POSSIBLE CAUSE	CORRECTION
Horn sounds continuously. NOTE: Immediately unplug horn relay in the Power Distribution Center (PDC)	(1) Faulty horn relay. (2) Horn control circuit to relay shorted to ground. (3) Pinched horn switch wire under Driver Airbag Module. (4) Defective horn switch	(1) Refer to horn relay test. (2) Check terminal 85 in Junction Block for continuity to ground. If continuity to ground indicates: (a) Steering Wheel horn switch/lead shorted to ground. (b) Wiring harness shorted to ground. Find the short and repair as necessary. (3) Replace Driver Airbag Module. (4) Replace Driver Airbag Module.
Horn sound intermittently as the steering wheel is turned.	(1) Horn relay control circuit X3 is shorted to ground inside steering column or wheel. (2) Pinched horn switch wire under Driver Airbag Module (3) Defective horn switch	(1) Remove Driver Airbag Module and/or wheel. Check for rubbing or loose wire/connector, repair as necessary. (2) Replace Driver Airbag Module. (3) Replace Driver Airbag Module.
Horn does not sound	(1) Check fuse 6 in PDC (2) No Voltage at horn relay terminals 30 & 86, and fuse is OK. (3) Open circuit from terminal 85 of the horn relay to horn switch, X3 circuit. (4) Defective or damaged horn. (5) Defective horn switch	(1) Replace fuse if blown repair as necessary. (2) No voltage, repair the A6 circuit as necessary. (3) Repair circuit as necessary. (4) Voltage at horn when horn switch is pressed, replace horn. (5) Replace Driver Airbag Module.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
Fuse blows when horn sounds	(1) Short circuit in horn or horn wiring	(1) Remove horn relay, check for shorted horn or horn wiring. Disconnect horn wire harness to isolate short and repair as necessary.
Fuse blows without blowing horn NOTE: For wiring repairs refer to Group 8W, Wire Diagrams.	(1) Short circuit	(1) Remove relay, install new fuse, if fuse does not blow replace horn relay. If fuse blows with relay removed, check for short to ground with ohmmeter on circuit between terminals 30 & 86 and the fuse terminal. Repair as necessary.

REMOVAL AND INSTALLATION

HORN SWITCH

The horn switch is molded into the airbag cover. The horn switch cannot be serviced separately. Refer to Group 8M, Restraint System for Driver Airbag Module Removal and Installation procedures.

HORNS

REMOVAL

(1) Hoist and support the front of the vehicle on safety stands.

(2) From behind the front fascia and forward of the left front wheel, disconnect the wire connectors from horn.

(3) Remove the mount bracket attaching nut from the bottom of radiator closure panel. Do not remove the horn from mounting bracket (Fig. 4).

(4) Separate the horn from vehicle.

INSTALLATION

For installation reverse the above procedures.

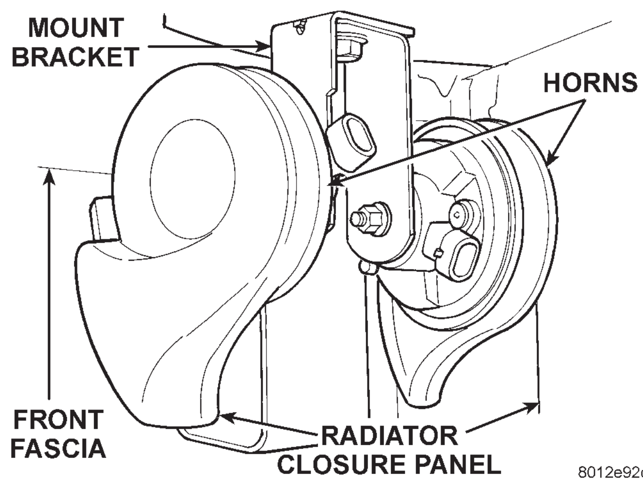

Fig. 4 Horn Removal/Installation

VEHICLE SPEED CONTROL SYSTEM

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GENERAL INFORMATION

INTRODUCTION

The speed control system is electronically controlled and vacuum operated. The electronic control is integrated into the powertrain control module, located next to battery. The controls are located on the steering wheel and consist of the ON/OFF, SET, RESUME/ACCEL, CANCEL and DECEL buttons (Fig. 1).

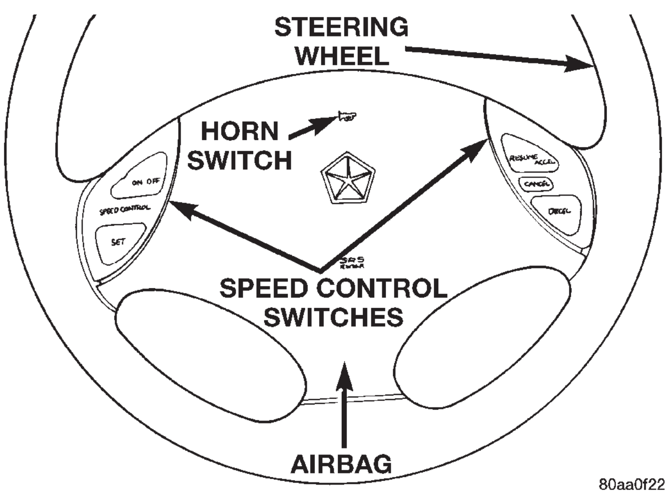

Fig. 1 Speed Control Switches

DESCRIPTION AND OPERATION

SPEED CONTROL SERVO

The servo unit consists of a solenoid valve body, and a vacuum chamber. The 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.

SPEED CONTROL SWITCHES

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.

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 30 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

DESCRIPTION AND OPERATION (Continued)

- Depressing the OFF switch
- Depressing the CANCEL switch.

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 disengaged for any of the following conditions:

- An indication of Park or Neutral
- An rpm increase without a VSS signal increase (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- 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)
- 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 when speed is greater than 25 mph restores the vehicle to the target speed that was stored in the PCM.

NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the ACCEL switch. The new target speed is stored in the PCM when the 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 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 individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

AUTOMATIC SPEED CONTROL OVERSPEED REDUCTION

Transmission control software includes an automatic speed control overspeed reduction feature. This maintains vehicle speed at the selected set point when descending a grade.

The Transmission Control Module (TCM) first senses that the speed control is set. If the set speed is exceeded by more than 4 mph (6.5 km/hr) and the throttle is closed, the TCM causes the transaxle to downshift to THIRD gear. After downshifting, the automatic speed control resumes normal operation. To ensure that an upshift is appropriate after the set speed is reached, the TCM waits until the speed control system opens the throttle at least 8 degrees before upshifting to OVERDRIVE again.

If the driver applies the brakes, canceling automatic speed control operation with the transaxle still in THIRD gear, the TCM maintains this gear until the driver opens the throttle at least 8 degrees to avoid an inappropriate upshift. The upshift is also delayed for 0.5 seconds after reaching the 8 degrees throttle opening in anticipation that the driver might open the throttle enough to require THIRD gear. This will avoid unnecessary and disturbing transmission cycling. If the automatic speed control RESUME feature is used after braking, the upshift is delayed until the set speed is achieved to reduce cycling and provide better response.

STOP LAMP SWITCH

Vehicles equipped with the speed control option use a dual function stop lamp switch. The switch is mounted on the brake pedal mounting bracket under the instrument panel. The PCM monitors the state of the dual function stop lamp switch. Refer to Group 5, Brakes for more information on stop lamp switch service and adjustment procedures.

SERVO CABLE

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage. This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

POWERTRAIN CONTROL MODULE

The speed control electronic control circuitry is integrated into the Powertrain Control Module (PCM). The PCM is located in the engine compartment. The PCM speed control functions are monitored by the On-Board Diagnostics (OBD). 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. See On-Board Diagnostic Tests in this group for more information. The PCM cannot be repaired and must be replaced if faulty.

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW PCM WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE ORGINAL VEHICLES MILAGE. IF THIS

DESCRIPTION AND OPERATION (Continued)

STEP IS NOT DONE A DIAGONSTIC TROUBLE CODE (DTC) MAY BE SET.

VACUUM RESERVOIR

The reservoir contains a one-way check valve to trap engine vacuum in the reservoir. When engine vacuum drops, as in climbing a grade while driving, the reservoir supplies the vacuum needed to maintain proper speed control operation. The vacuum reservoir cannot be repaired and must be replaced if faulty.

VEHICLE SPEED AND DISTANCE

The 4 speed automatic Transmission Control Module (TCM) supplies the speed input to the PCM. The PCM determines acceleration rates. The speed control software in the PCM uses vehicle speed and acceleration to control to the set speed.

Vehicles with a 3 speed automatic or manual transmission have a vehicle speed sensor (VSS) mounted to an adapter near the transmission output shaft. The sensor is driven through the adapter by a speedometer pinion gear. The VSS pulse signal is monitored by the PCM to determine vehicle speed and to maintain speed control set speed. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnosis and testing of this component. Refer to group 14, Fuel System for Removal/Installation

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 8E, Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies a surge following a set and the speedometer operates properly see “Overshoot/Undershoot on speed control set”.

If a road test verifies an inoperative system, 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 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 at both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Conduct electrical test at PCM.
- 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.

OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET

If the operator repeatedly presses and releases the set button with their foot off of the accelerator (a “lift foot set” to begin speed control operation), the vehicle may accelerate and exceed the desired set speed by up to 5 MPH (8 km/h) and then decelerate to less than the desired set speed before finally achieving the desired set speed.

The Speed Control 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. If the lift foot sets are continually used, the 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 with the accelerator pedal (not decelerating or accelerating), and then turn 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.

CHECKING FOR DIAGNOSTIC CODES

When trying to verify a speed control system electronic malfunction: Connect a DRB scan tool if available to the data link connector. The connector is located at left side of the steering column, and at lower edge of the panel.

(1) A speed control malfunction may occur without a diagnostic code being indicated.

DIAGNOSIS AND TESTING (Continued)

SPEED CONTROL DIAGNOSTIC TROUBLE CODES

Hex Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
23	No Vehicle Speed Sensor Signal	No vehicle distance (speed) sensor signal detected during road load conditions.
OF	Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
56	MUX S/C Switch High	Speed Control switch input above the maximum acceptable voltage.
57	MUX S/C Switch Low	Speed Control switch input below the minimum acceptable voltage.
52	S/C Power Relay Or 12V Driver Circuit	Malfunction detected with power feed to speed control servo solnoids.
Check Engine Lamp will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		

Refer to Group 25, for further information and useage of the DRB scan tool and a more complete list of Diagnostic Trouble Code.

SPEED CONTROL SLOWS DOWN BY ITSELF

Test vehicle speed sensor, refer to group 8E. If sensor fails replace sensor, if it passes perform the following test:

(1) Perform the speed control switch test on the DECEL switch, if it fails replace switch.

(2) If the switch passes, conduct the vacuum supply test.

(3) If it passes, conduct the servo vacuum test. If it fails replace servo.

(4) If continuity, replace the PCM.

SPEED CONTROL ELECTRICAL TEST

Electronic speed control systems may be tested using two different methods. One involves use of a DRB. If this test method is desired, refer to the Powertrain Diagnostic Test Procedures for charging and speed control system manual.

The other test method uses a volt/ohm meter. The volt/ohm meter method is described in the following tests.

If any information is needed concerning wiring, refer to Group 8W, Wiring Diagrams (Fig. 2).

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.

When electrical connections are removed, corrosion should be removed from electrical terminals and a light coating of Mopar Multi-Purpose Grease, or equivalent, applied. Inspect connectors for damage terminals.

A poor connection can cause a complete or intermittent malfunction and is also the only connection in the circuit, that can not be tested. For this reason, a loose connection may be misdiagnosed as a component malfunction.

DIAGNOSIS AND TESTING (Continued)

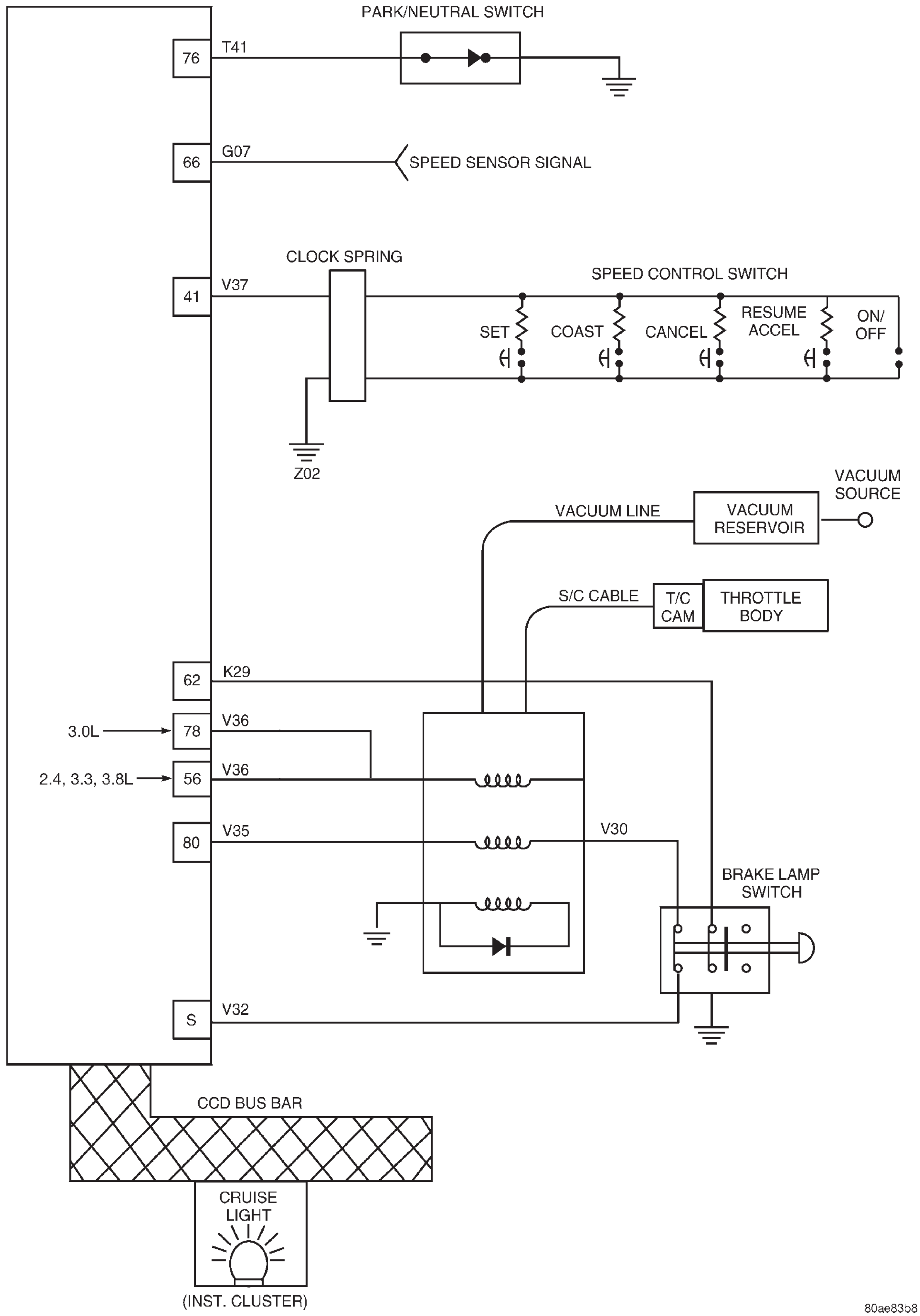

Fig. 2 Speed Control Circuit

DIAGNOSIS AND TESTING (Continued)

SERVO VACUUM TEST

(1) Turn ignition switch to the ON position without starting engine. Activate speed control ON switch.

(2) Disconnect the four-way electrical connector and the vacuum harness at the servo (Fig. 3).

(3) Connect a jumper wire from Pin 3 of the servo to Pin 3 of the wire connector.

(4) Ground Pins 2 and 4 in the servo. Do not connect pin 1.

(5) Connect a hand held vacuum pump to the vacuum nipple and apply 10 - 15 inches of vacuum.

(6) If servo pulls cable, replace servo.

(7) Ground Pin 1 on servo.

(8) Check that the throttle cable pulls in and holds as long as the vacuum pump is connected. After one minute, check if cable is still holding. If cable does not hold replace the servo.

(9) Disconnect jumper from pin 3. Cable should return to rest position. If not, replace servo.

(10) Connect 4 way electrical connector and vacuum harness to servo.

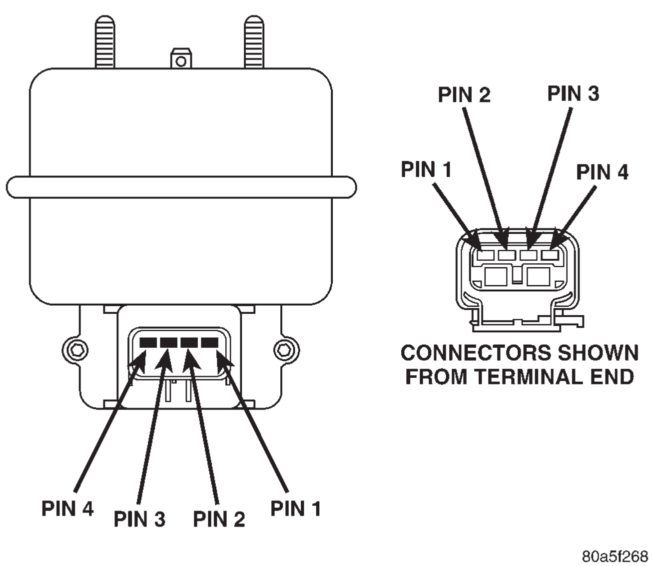

Fig. 3 Servo Harness Connector

SPEED CONTROL SWITCH TEST

Refer to the appropriate Powertrain Diagnostic Manual for switch test valves.

STOP LAMP SWITCH TEST

(1) Remove the stop lamp switch refer to Stop Switch Removal/Installation in this section. Disconnect connector from stop lamp switch (Fig. 4). Using an ohmmeter, switch continuity may be checked as follows:

(2) With switch plunger released, there should be continuity between Pin 5 and Pin 6.

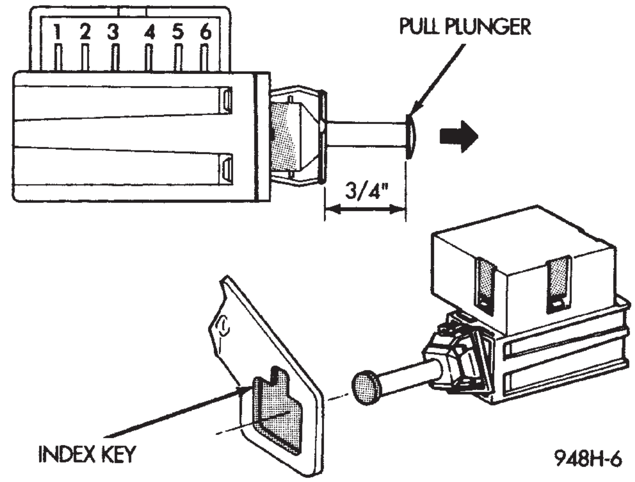

Fig. 4 Stop Lamp Wiring

(3) With switch plunger depressed, there should be continuity:

- Between Pin 1 and Pin 2.
- Between Pin 3 and Pin 4.

(4) If the above results are not obtained, the stop lamp switch is defective or out of adjustment.

(5) Stop lamp switch adjustment is detailed in Group 5, Brakes.

ELECTRICAL TESTS AT POWERTRAIN CONTROL MODULE

(1) Unplug the GRAY 40-way connector from the Powertrain Control Module (PCM), (Fig. 5).

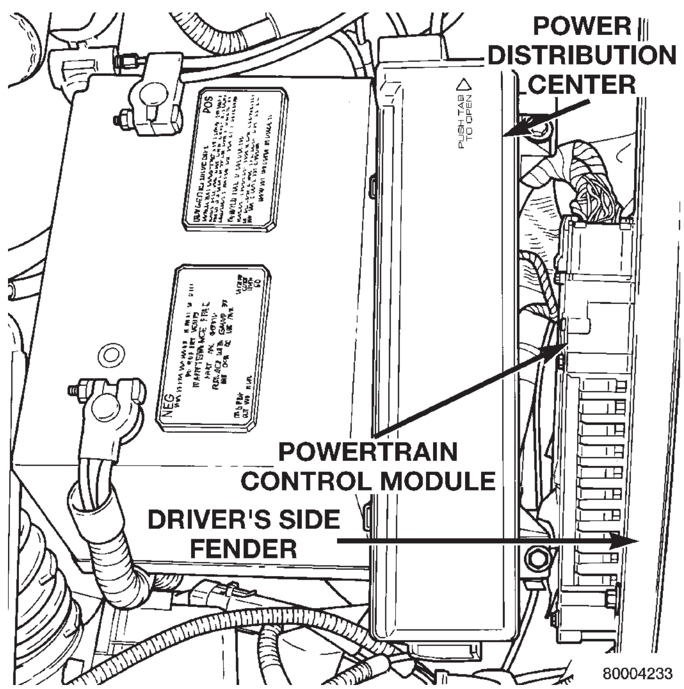

Fig. 5 Powertrain Control Module Location

(2) Remove both steering wheel speed control switches and disconnect the wire connectors.

DIAGNOSIS AND TESTING (Continued)

(a) Using an ohmmeter, check for continuity between cavity 41 of the PCM connector and cavity 1 of each speed control switch connector (Fig. 6).

(b) If no continuity, repair as necessary.

(c) Using an ohmmeter, check for continuity between cavity 41 of the PCM connector and ground.

(d) If continuity, repair as necessary.

(e) If no continuity, perform the Switch Test.

(f) Plug GRAY 40 way connector into PCM.

(g) Plug switch connectors back into switches.

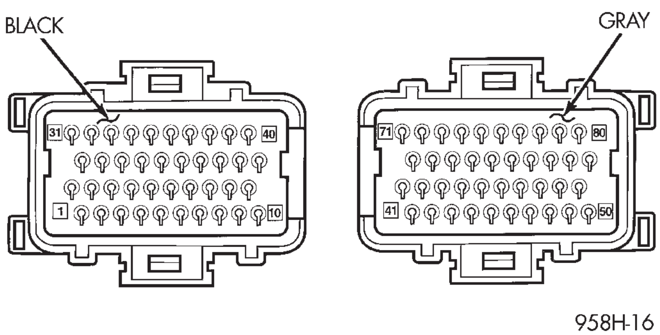

Fig. 6 PCM 40—Way Connectors

(3) Unplug speed control servo electrical connector.

(4) Place ignition switch in the ON position and turn on the speed control system, for the following tests.

(a) Using a voltmeter, measure voltage from cavity 3 of servo connector to ground. Voltmeter should read ignition voltage. If voltage is low, skip to Step 7.

(b) Turn speed control and ignition switch OFF. Using an ohmmeter, place positive lead on pin 3 and negative lead on pin 4 on the speed control servo. Check continuity from pin 3 to pin 4.

(c) If no continuity, replace the speed control servo. If continuity is greater than 49 ohms, clean terminals.

(d) Using an ohmmeter, place positive lead on pin 3 and negative lead on pin 2 on the speed control servo. Check continuity from pin 3 to pin 2.

(e) If no continuity, replace the speed control servo. If continuity is greater than 49 ohms, clean terminals.

(f) Using an ohmmeter, place positive lead on pin 3 and negative lead on pin 1 on the speed control servo. Check continuity from pin 3 to pin 1.

(g) If no continuity, replace the speed control servo. If continuity is greater than 49 ohms, clean terminals.

(h) Using an ohmmeter at the servo connector, place positive lead on cavity 4 and negative lead on ground. Check continuity from cavity 4 to ground. If no continuity, repair open circuit.

(i) Unplug 2 40-way PCM connectors.

(j) Using an ohmmeter, check continuity from cavity 1 of servo connector to cavity 56 (2.4, 3.3, 3.8L) or cavity 78 (3.0L) on PCM connector. If no continuity, repair open circuit.

(k) Using an ohmmeter, check continuity from cavity 1 of servo connector to ground. If continuity, repair as necessary.

(l) If continuity is OK, check continuity from cavity 2 of servo connector to cavity 80 of PCM connector. If no continuity, repair open circuit.

(m) Using an ohmmeter, check continuity from cavity 2 of servo connector to ground. If continuity, repair as necessary.

(n) Using an ohmmeter, check continuity from cavity 1 of servo connector to cavity 2 of servo connector. If continuity, repair as necessary.

(o) Reconnect the 4 way connector to servo.

(5) Using an ohmmeter, check continuity from cavity 62 of the PCM connector to ground. If continuity is OK with brake pedal in unpressed position, proceed to Step 6.

(a) If no continuity, perform the Stop Lamp switch test. Replace or adjust switch as required.

(b) If switch passes test, check continuity from cavity 62 of the PCM connector to cavity 1 of the stop lamp switch connector. Repair open circuit as required.

(c) If continuity is OK between cavity 62 and cavity 1, repair open circuit between cavity 2 of the stop lamp switch connector and ground.

(6) Using an ohmmeter, check continuity from cavity 76 on PCM connector to ground with the transmission in drive. If continuity, test TRS/ Park-Neutral switch and switch wiring.

(7) Turn speed control and ignition switch OFF.

(8) Unplug the BLACK 40-way connector from the Powertrain Control Module (PCM).

(9) Using an ohmmeter, check continuity from cavity 3 of servo connector to cavity 5 on the PCM connector.

(a) If no continuity, skip to Step 10.

(b) If continuity is OK, check continuity from pin 5 of PCM connector to ground. If continuity, repair short to ground. If no contunity, replace PCM. Jump to Step 11.

(10) Remove stop lamp switch and conduct Stop Lamp Switch Test. If test fails, adjust or replace as necessary.

(a) If switch passes, measure continuity from cavity 4 of stop lamp switch connector to cavity 3 of servo connector. Repair open circuit if necessary.

(b) If continuity is OK, measure continuity from cavity 3 of stop lamp switch to cavity 5 of PCM connector. Repair open circuit as necessary.

(11) Install PCM connectors onto PCM and speed control servo connector to servo.

DIAGNOSIS AND TESTING (Continued)

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at the servo and install a vacuum gauge in the hose (Fig. 7).

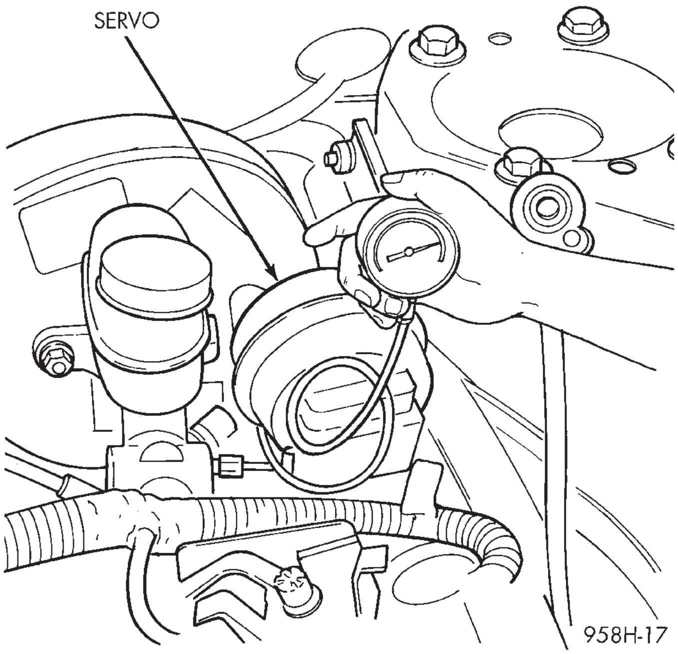

Fig. 7 Vacuum Gauge Test

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury. Shut off engine, the vacuum should continue to hold 10 inches of mercury.

(3) If vacuum does not meet this requirement, check and correct the following vacuum leaks in the vacuum lines, check valve, vacuum reservoir or poor engine performance.

VEHICLE SPEED SENSOR

For diagnosis and testing of the Vehicle Speed Sensor (VSS), refer to the appropriate Powertrain Diagnostic Procedures service manual. Also refer to the DRB scan tool.

REMOVAL AND INSTALLATION

SPEED CONTROL SERVO

REMOVAL

(1) Release hood latch and open hood.

(2) On vehicles with 3.3/3.8 L engine, remove air cleaner resonator. Refer to Group 14, Fuel System for proper procedure.

(3) Disconnect the throttle and speed control cable ends from throttle body (Fig. 8).

(4) Depress lock tabs holding speed control cable casing to cable mount bracket (Fig. 9).

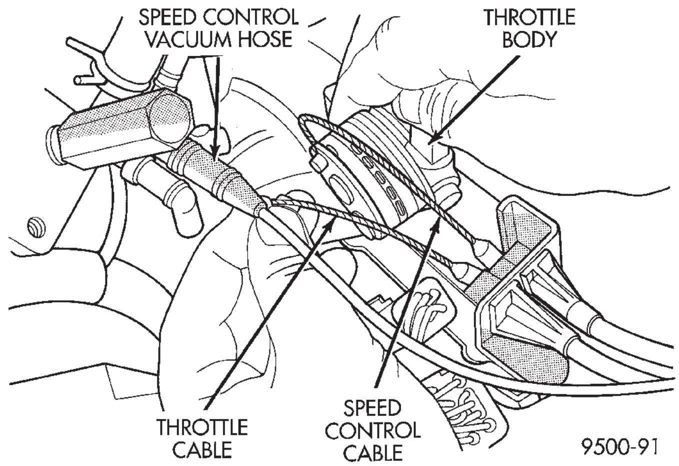

Fig. 8 Speed Control Cable End

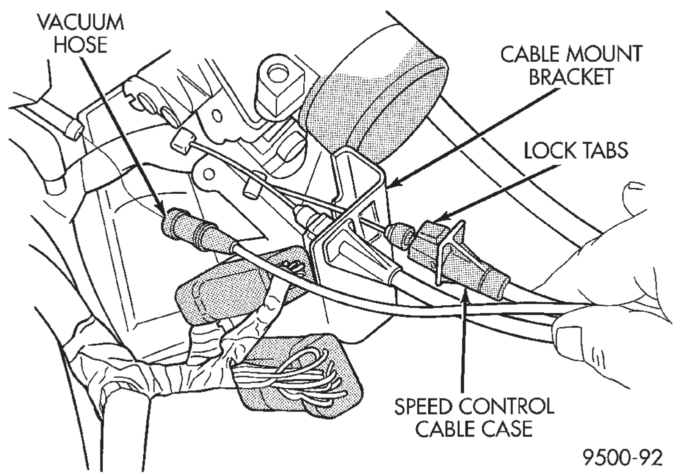

Fig. 9 Speed Control Cable Case and Vacuum Line—Typical

(5) Disconnect vacuum line from nipple on air intake plenum.

(6) Remove tie wrap holding vacuum line, throttle cable, and speed control cable together.

(7) Remove bolt holding speed control servo to side of battery tray/vacuum reservoir (Fig. 10).

(8) Remove speed control servo from battery tray.

(9) Disconnect wire connector from speed control servo.

(10) Disconnect vacuum line from speed control servo that leads to the battery tray/vacuum reservoir.

(11) Remove speed control servo.

REMOVAL AND INSTALLATION (Continued)

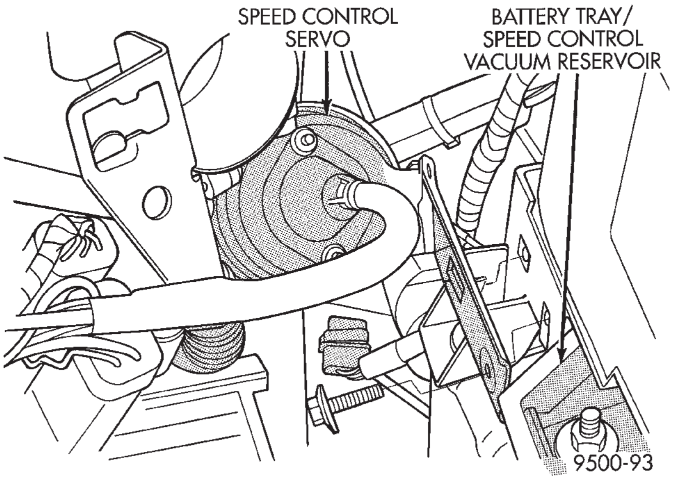

Fig. 10 Speed Control Servo

INSTALLATION

Transfer speed control cable to replacement speed control servo. Reverse the preceding operation.

SPEED CONTROL SWITCHES

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect battery negative cable.

(3) Remove airbag/horn pad from steering wheel, refer to Group 8M, Restraint Systems for proper procedures.

(4) Disconnect wire connector from horn switch, airbag, and speed control switches.

(5) Remove screws holding speed control switch to airbag/horn pad (Fig. 11).

(6) Separate speed control switch from airbag/horn pad.

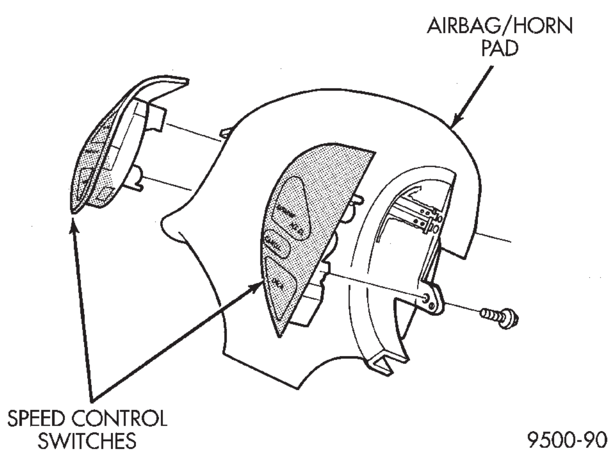

Fig. 11 Speed Control Switches

INSTALLATION

Reverse the preceding operation.

STOP LAMP SWITCH

REMOVAL

Remove the switch from the bracket by depressing the brake pedal and rotating the switch in a counter-clockwise direction approximately 30 degrees. Pull the switch rearward and remove from bracket. Disconnect wiring harness connector.

INSTALLATION

Before installing the switch, reset the adjustable switch plunger by pulling on the plunger head until the plunger reaches the end of its travel. A ratcheting sound will be heard during this procedure.

Connect the wiring harness to the switch. Mount the switch into the bracket by holding the switch with the plunger facing forward in car. There is an index key on the switch that mates with the bracket slot at the top of the square hole. Align key and push switch into square hole in bracket while depressing the brake pedal. Once the switch is seated in the hole, rotate clockwise approximately 30 degrees to lock into place. The switch will automatically adjust when the pedal is released. Pull back on the pedal to assure correct adjustment.

SPEED CONTROL CABLE

REMOVAL

(1) Release hood latch and open hood.

(2) On vehicles with 3.3/3.8 L engine, remove air cleaner resonator. Refer to Group 14, Fuel System for proper procedure.

(3) Disconnect throttle and speed control cable ends from throttle body (Fig. 8).

(4) Depress lock tabs holding speed control cable casing to cable mount bracket (Fig. 12).

(5) Remove tie wrap holding vacuum line, throttle cable, and speed control cable together.

(6) Remove nuts holding speed control cable case to servo.

(7) Remove cable case from servo.

(8) Remove hairpin clip holding cable end to servo diaphragm (Fig. 12).

(9) Remove speed control cable.

INSTALLATION

Reverse the preceding operation.

POWERTRAIN CONTROL MODULE

For Removal/Installation refer to Powertrain Control Module in Group 14, Fuel Injection System.

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW PCM WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE ORGINAL VEHICLES MILAGE. IF THIS

REMOVAL AND INSTALLATION (Continued)

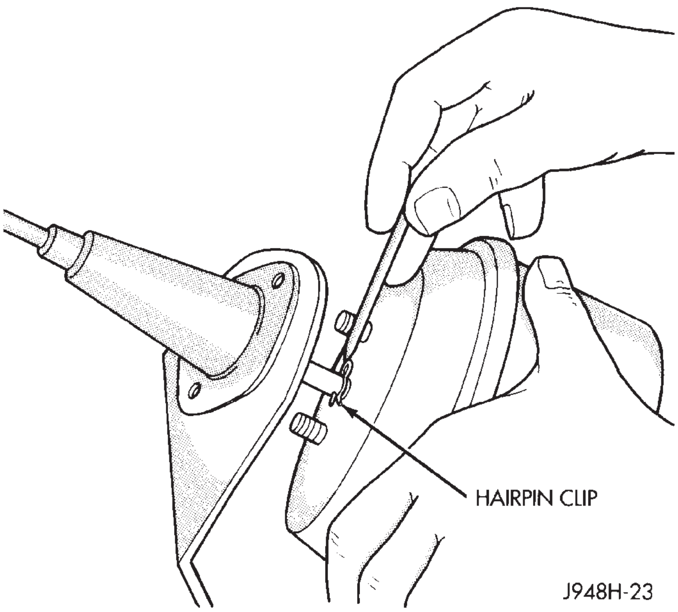

Fig. 12 Speed Control Cable

STEP IS NOT DONE A DIAGONSTIC TROUBLE CODE (DTC) MAY BE SET.

VACUUM RESEROIR

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove battery, Refer to Group 8B, for Battery Removal/Installation

(3) Remove battery tray.

(4) Disconnect vacuum hoses from vacuum reservoir

INSTALLATION

(1) Connect vacuum hoses to vacuum reservoir.

(2) Install battery tray

(3) Install battery, Refer to Group 8B, for Battery Removal/Installation.

(4) Connect negative cable to battery.

VEHICLE SPEED SENSOR

For Removal/Installation, refer to Vehicle Speed Sensor in Group 14, Fuel Injections.

VEHICLE SPEED CONTROL SYSTEM

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INTRODUCTION 1

GENERAL INFORMATION

INTRODUCTION

This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD or RHD, if a special illustration or procedure was/is required.

The speed control system used with the 2.5L diesel engine is basically identical to the system used with gasoline powered engines. Features unique to the diesel engine will be covered in this section.

- Models equipped with the 2.5L diesel engine do not use a vacuum reservoir to retain engine vacuum for speed control operation. There are no vaccum-operated speed control servos used in vehicles with the 2.5L diesel engine.
- The range of the speed control system operation is restricted to speeds between 56 km/h (35 MPH) to 145 km/h (90 MPH).
- Inputs to the MSA that allow speed control operation are from the vehicle speed sensor and the Speed Control Switch.
- Two separate speed control switch modules are mounted on the steering wheel to the left and right side of the driver's airbag module. Switch features are:

a. Within the two switch modules, five **momentary** contact switches, supporting seven different speed control functions are used.

b. The outputs from these switches are filtered into one input. The MSA determines which output has been applied through **resistive multiplexing.** The input circuit voltage is measured by the MSA to determine which switch function has been selected.

c. A speed control indicator lamp, located on the instrument panel cluster is energized by the MSA via the CCD Bus. This occurs when speed control system power has been turned ON, and the engine is running.

d. The two switch modules are labeled: ON/OFF, SET, RESUME/ACCEL, CANCEL and COAST. 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 individual switch fails, the switch module must be replaced.

TURN SIGNAL AND FLASHERS

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GENERAL INFORMATION

INTRODUCTION

The turn signals are actuated with a lever on the left side of the steering column just ahead of the steering wheel. The signals are automatically turned off by a canceling cam (two lobes molded to the clock-spring mechanism). The cam comes in contact with the cancel actuator on the turn signal (multi-function) switch assembly. Either cam lobe, pushing on the cancel actuator, returns the switch to the OFF position.

Lane change signaling is actuated by applying partial turn signal stalk movement toward the direction desired until the indicator lamps flashes in the instrument cluster. When the switch stalk is released the stalk will spring back into the neutral position turning OFF the turn signal.

With the ignition switch ON and the turn signal switch stalk actuated left or right, current flows through the:

- Combination flasher
- Multi-function switch
- Turn indicator lamp
- Front and rear turn signal bulbs.

A chime will sound after the vehicle has traveled a distance of approximately 0.5 mile with the turn signal ON.

COMBINATION FLASHER

The Turn Signal/Hazard Warning Flasher is a module providing the vehicle with turn signal and hazard warning functions and has been designed with internal relays to take advantage of low current switching requirements in the vehicle. It is plugged into the Junction Block at position 4 (Fig. 1), where all wiring associated with its operation is terminated. The Junction Block is adjacent to and left of the steering column of the vehicle.

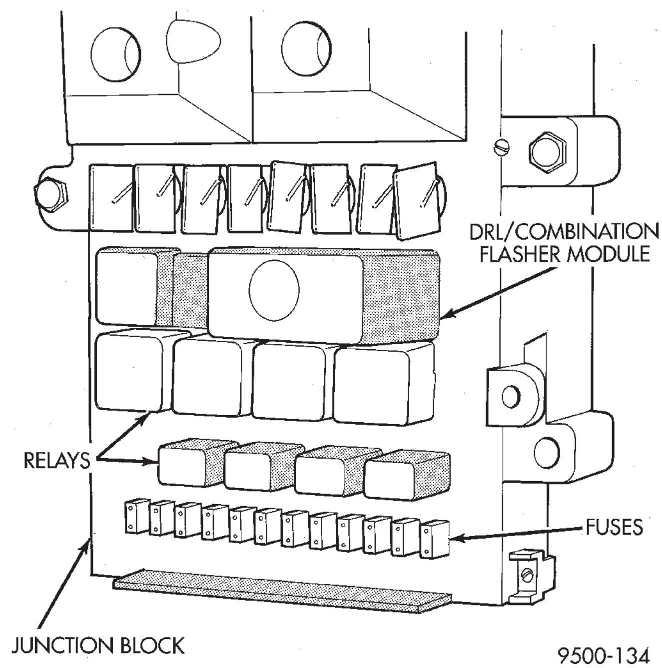

Fig. 1 Combination Flasher Location

To gain access to the flasher, remove the lower steering column cover and knee blocker. Refer to Group 8E, Instrument Panel and Systems for removal procedures.

DESCRIPTION AND OPERATION

COMBINATION FLASHER FUNCTION

The Turn Signal/Hazard Warning Flasher is a module providing turn signal, hazard warning functions and has been designed with internal relays to

DESCRIPTION AND OPERATION (Continued)

take advantage of low current switching requirements in the vehicle. It is plugged into the Junction Block at positions 4 (Fig. 1) where all wiring associated with its operation is terminated. The Junction Block is adjacent to and left of the steering column of the vehicle.

To gain access to the device, remove the lower steering column cover and knee blocker, refer to Group 8E, Instrument Panel and Systems.

The combination flasher may be operated in its hazard warning mode either with or without the ignition circuit being active. However, in order to operate in the turn signal mode, the ignition circuit must be completed to the module.

While the combination flasher is idle, there is no current drawn through the module. The device does not become active until a signal ground circuit is supplied to either of the turn signal inputs or the hazard warning input.

Typical flash rate for the flasher is 90 flashes per minute.

When a lamp is burnt out for a given side of the vehicle or a wire is open to a lamp, the flash rate will increase to 180 flashes per minute when in the turn signal mode. When in the hazard warning signal mode the flash rate remains at 90 flashes per minute.

Turn signal inputs that actuate the flasher are low current grounds, each drawing a maximum of 300 mA., and are provided to the flasher through the Junction Block from the multi-function switch that is mounted to the steering column. The hazard warning signal input is a low current ground drawing a maximum of 600 mA. through the multi-function switch.

COMBINATION FLASHER / DAYTIME RUNNING LAMPS (DRL) MODULE

The Combination Flasher/DRL is a module providing turn signal, hazard warning, and daytime running light functions, and has been designed with internal relays to take advantage of low current switching requirements in the vehicle. It is plugged into the junction block at positions 3 AND 4 (Fig. 2) where all wiring associated with its operation is terminated. The Junction Block is adjacent to and left of the steering column of the vehicle.

To gain access to the device, remove the lower steering column cover and knee blocker, refer to Group 8E, Instrument Panel and Gauges.

The combination flasher/DRL may be operated in its hazard warning mode either with or without the ignition circuit being active. However, in order to operate in the turn signal mode or the DRL mode, the ignition circuit must be completed to the module.

While the combination flasher portion is idle, there is no current drawn through the module. The device

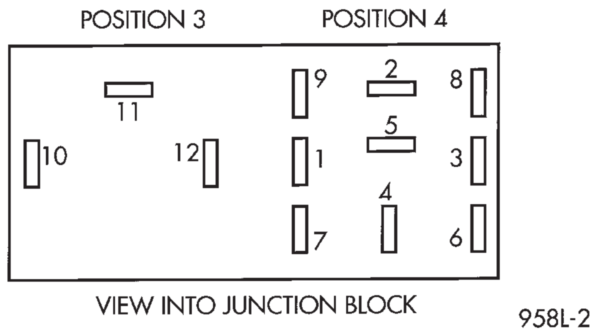

Fig. 2 Junction Block Terminal Pins

does not become active in the turn signal or hazard warning modes until a signal ground circuit is supplied to either of the turn signal inputs or the hazard warning input. With the ignition OFF, there is no current drawn through the module.

While the ignition is ON, the front turn signal filaments are illuminated steadily thus providing the DRL function. The DRL function may be inhibited by applying a signal ground input from either the park brake circuit or the headlamp relay activation circuit.

Typical flash rate for the flasher is 90 flashes per minute.

When a lamp is burnt out for a given side of the vehicle or a wire is open to a lamp, the flash rate will increase to 180 flashes per minute when in the turn signal mode. When in the hazard warning signal mode the flash rate remains at 90 flashes per minute.

Turn signal inputs that actuate the flasher are low current grounds, each could draw a maximum of 300 mA., and are provided to the flasher through the Junction Block from the multi-function switch that is mounted to the steering column. The hazard warning signal input is a low current ground that could draw a maximum of 600 mA. through the multi-function switch.

DIAGNOSIS AND TESTING

TURN SIGNAL MULTI-FUNCTION SWITCH

To test turn signal, headlamp beam select and optical horn portion of the multi-function switch:

(1) Remove the multi-function switch, refer to removal procedures.

(2) Using an ohmmeter check continuity reading between multi-function switch pins. Refer to (Fig. 3) for proper pin numbers and Turn Signal Multi-Function Switch Test chart.

DIAGNOSIS AND TESTING (Continued)

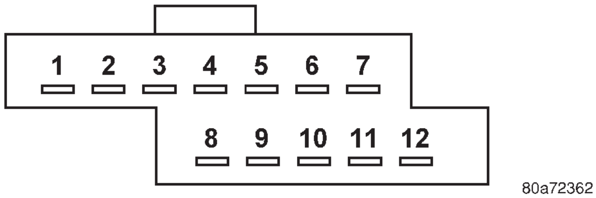

Fig. 3 Turn Signal–Multi-Function Switch Pin numbers

TURN SIGNAL MULTI-FUNCTION SWITCH TEST

SWITCH POSITION	CONTINUITY BETWEEN
LEFT	4 AND 8
RIGHT	3 AND 8
HAZARD	1 AND 8
LO BEAM	9 AND 10
HI BEAM	9 AND 121

COMBINATION FLASHER WITH / WITHOUT DAYTIME RUNNING LAMPS MODULE—CIRCUIT DIAGNOSTICS

The battery input (Pin 1), is brought into the Junction Block through the Electrical Distribution Wiring (EDW) harness (Fig. 4). It originates under the hood in the Power Distribution Center (PDC) through a 20 ampere fuse at position 10 (9th position from the upper end) and labeled HAZARD. This circuit (L09) is the only power feed to the combination-flasher/DRL.

The ignition input of Pin 6 (refer to Junction Block Terminal Call-Out and Junction Block Terminal Call-Out with DRL tables) only senses that the ignition circuit is ON and does not supply current to the module in a way that would power the system. This RUN/START circuit is brought into the junction block to a 10 ampere fuse labeled TS BU LMP at the bottom right side. The circuit designation out of the fuse is A22D. This circuit feeds the combo-flasher and the following systems with Ignition voltage if the vehicle is so equipped:

- Back-Up Lamps
- Electrochromic Inside Rear view Mirror
- A/C Control Head
- Mini-Trip Computer
- ABS Module
- Front Blower Relay Coil
- Rear Blower Relay Coil
- AWD Solenoids
- Rear Window Defogger (EBL) Relay Coil

The ignition input to the combo-flasher will draw typically 5 mA of current while active.

For diagnostic test procedures, refer to Combination Flasher Diagnosis tables.

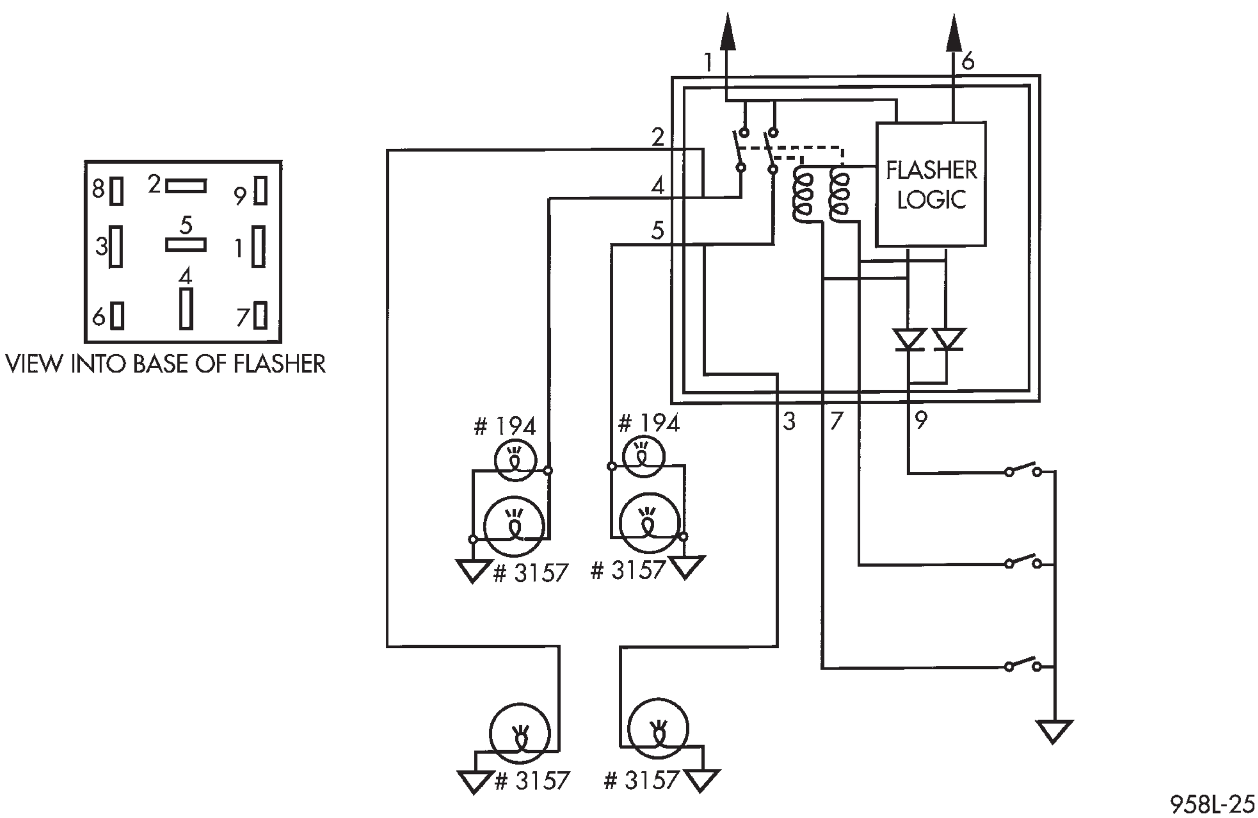

Fig. 4 Electronic Combination Flasher Circuit

DIAGNOSIS AND TESTING (Continued)

JUNCTION BLOCK TERMINAL CALL-OUT

CAV.	CKT.	WIRE GAUGE	COLOR	FUNCTION	
1	L09	18	BLK/WT	BATTERY INTPUT	MAIN FEED
2	L61	18	LG	LEFT FRONT T/S OUTPUT	TO LAMP
3	L60	18	TN	RIGHT FRONT T/S OUTPUT	TO LAMP
4	L63	18	DG/RD	LEFT REAR T/S OUTPUT	TO LAMP
5	L62	18	BR/RD	RIGHT REAR T/S OUTPUT	TO LAMP
6	A22D	20	BK/OR	IGNITION INPUT	SENSE ONLY
7	L305	22	LB/WT	LEFT T/S SWITCH INPUT	SENSE ONLY
8	L302	22	LB/YL	RIGHT T/S SWITCH INPUT	SENSE ONLY
9	L91	22	DB/PK	HAZARD SWITCH INPUT	SENSE ONLY

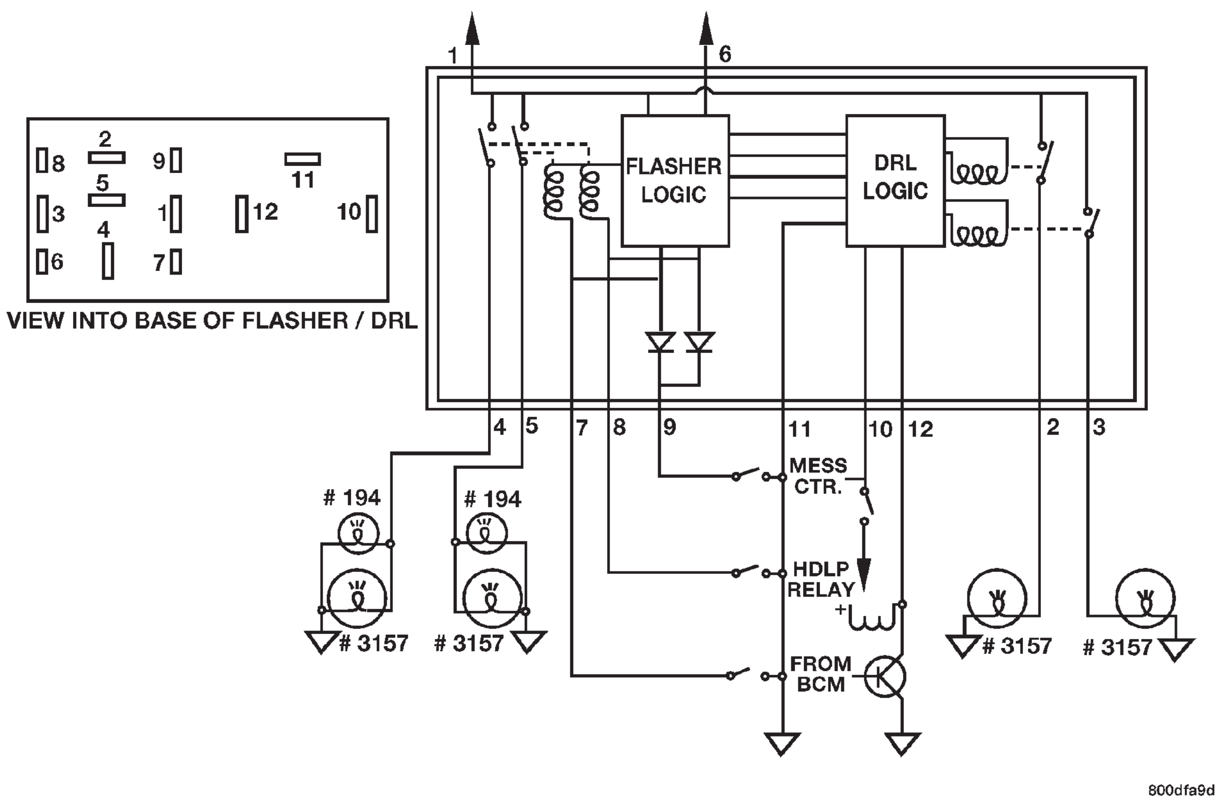

Fig. 5 Electronic Combination Flasher with DRL Circuit

DIAGNOSIS AND TESTING (Continued)

JUNCTION BLOCK TERMINAL CALL-OUT WITH DRL

CAV.	CKT.	WIRE GAUGE	COLOR	FUNCTION	
1	L09	18	BLK/WT	BATTERY INTPUT	MAIN FEED
2	L61	18	LG	LEFT FRONT T/S OUTPUT	TO LAMP
3	L60	18	TN	RIGHT FRONT T/S OUTPUT	TO LAMP
4	L63	18	DG/RD	LEFT REAR T/S OUTPUT	TO LAMP
5	L62	18	BR/RD	RIGHT REAR T/S OUTPUT	TO LAMP
6	A22D	20	BK/OR	IGNITION INPUT	SENSE ONLY
7	L305	22	LB/WT	LEFT T/S SWITCH INPUT	SENSE ONLY
8	L302	22	LB/YL	RIGHT T/S SWITCH INPUT	SENSE ONLY
9	L91	22	DB/PK	HAZARD SWITCH INPUT	SENSE ONLY
10	G09	22	GY/BK	PARK BRAKE SWITCH INPUT	SENSE ONLY
11	Z01	14	BK	GROUND	MAIN GRD.
12	L93	22	RD/YL	HEADLAMP RELAY SWITCH INPUT	SENSE ONLY

DIAGNOSIS AND TESTING (Continued)

COMBINATION FLASHER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
SYSTEM WILL NOT FLASH HAZARD WARNING LAMPS	1. FAULTY (20) AMP FUSE N POWER DISTRIBUTION CENTER (PDC). 2. FAULTY WIRING CONNECTION BETWEEN BOTTOM SIDE OF PDC AND JUNCTION BLOCK. 3. FAULTY GROUND FEED TO MULTI-FUNCTION SWITCH. 4. FAULTY HAZARD WARNING SWITCH CONTACT. 5. COMBINATION FLASHER NOT PLUGGED INTO JUNCTION BLOCK. 6. FAULTY COMBINATION FLASHER. 7. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE FAULTY FUSE IN PDC. 2. REPAIR FAULTY WIRING CONNECTION FROM PDC TO JUNCTION BLOCK. 3. REPAIR OR REPLACE FAULTY GROUND WIRE FEED TO MULTI-FUNCTION SWITCH. 4. REPLACE FAULTY MULTI-FUNCTION SWITCH. 5. PLUG COMBINATION FLASHER INTO JUNCTION BLOCK. 6. REPLACE FAULTY COMBINATION FLASHER. 7. REPLACE JUNCTION BLOCK.
SYSTEM WILL FLASH HAZARD WARNING LAMPS BUT WILL NOT FLASH RIGHT OR LEFT TURN SIGNAL LAMPS	1. FAULTY (10) AMP FUSE IN THE JUNCTION BLOCK. 2. FAULTY COMBINATION FLASHER. 3. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 4. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE FAULTY FUSE IN JUNCTION BLOCK. 2. REPLACE COMBINATION FLASHER. 3. REPLACE FAULTY MULTI-FUNCTION SWITCH. 4. REPLACE JUNCTION BLOCK.
SYSTEM WILL FLASH HAZARD WARNING LAMPS AND RIGHT TURN SIGNAL LAMPS, BUT WILL NOT FLASH LEFT TURN SIGNAL LAMPS	1. FAULTY LEFT TURN SIGNAL WIRING CONNECTION BETWEEN JUNCTION BLOCK AND MULTI-FUNCTION SWITCH. 2. FAULTY COMBINATION FLASHER. 3. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 4. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPAIR OR REPLACE FAULTY WIRING CONNECTION BETWEEN JUNCTION BLOCK AND MULTI-FUNCTION SWITCH. 2. REPLACE COMBINATION FLASHER. 3. REPLACE FAULTY MULTI-FUNCTION SWITCH. 4. REPLACE JUNCTION BLOCK.
RIGHT TURN SIGNAL OPERATES PROPERLY BUT LEFT TURN SIGNAL FLASHES FAST	1. FAULTY LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 2. FAULTY WIRING CONNECTION FROM JUNCTION BLOCK TO LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 3. FAULTY GROUND WIRING CONNECTION FROM LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 4. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 5. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 2. REPAIR OR REPLACE WIRING CONNECTION FROM JUNCTION BLOCK TO LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 3. REPAIR OR REPLACE FAULTY GROUND WIRING CONNECTION TO LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 4. REPLACE FAULTY MULTI-FUNCTION SWITCH. 5. REPLACE JUNCTION BLOCK.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
LEFT TURN SIGNAL OPERATES PROPERLY BUT RIGHT TURN SIGNAL FLASHES FAST	1. FAULTY RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 2. FAULTY WIRING CONNECTION FROM JUNCTION BLOCK TO RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 3. FAULTY GROUND WIRING CONNECTION FROM RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 4. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 5. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 2. REPAIR OR REPLACE WIRING CONNECTION FROM JUNCTION BLOCK TO RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 3. REPAIR OR REPLACE FAULTY GROUND WIRING CONNECTION TO RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 4. REPLACE FAULTY MULTI-FUNCTION SWITCH. 5. REPLACE JUNCTION BLOCK.
BOTH TURN SIGNAL INDICATORS IN MESSAGE CENTER DO NOT FLASH IN CONJUNCTION WITH OUTSIDE TURN SIGNAL LAMPS	1. FAULTY GROUND WIRING CONNECTION FROM COWL GROUND SPLICE.	1. REPAIR OR REPLACE WIRING CONNECTION FROM COWL GROUND SPLICE.
LEFT OR RIGHT TURN SIGNAL INDICATOR IN MESSAGE CENTER DOES NOT FLASH IN CONJUNCTION WITH OUTSIDE TURN SIGNAL LAMPS, BUT OTHER INDICATOR PERFORMS PROPERLY	1. FAULTY INDICATOR LAMP IN MESSAGE CENTER. 2. FAULTY WIRING CONNECTION BETWEEN MESSAGE CENTER AND JUNCTION BLOCK.	1. REPLACE FAULTY INDICATOR LAMP IN MESSAGE CENTER. 2. REPAIR OR REPLACE FAULTY WIRING CONNECTION BETWEEN MESSAGE CENTER AND JUNCTION BLOCK.

DIAGNOSIS AND TESTING (Continued)

COMBINATION FLASHER DIAGNOSIS WITH DRL

CONDITION	POSSIBLE CAUSES	CORRECTION
SYSTEM WILL NOT FLASH HAZARD WARNING LAMPS	1. FAULTY (20) AMP FUSE N POWER DISTRIBUTION CENTER (PDC). 2. FAULTY WIRING CONNECTION BETWEEN BOTTOM SIDE OF PDC AND JUNCTION BLOCK. 3. FAULTY GROUND FEED TO MULTI-FUNCTION SWITCH. 4. FAULTY HAZARD WARNING SWITCH CONTACT. 5. COMBINATION FLASHER/DRL MODULE NOT PLUGGED INTO JUNCTION BLOCK. 6. FAULTY COMBINATION FLASHER/DRL MODULE. 7. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE FAULTY FUSE IN PDC. 2. REPAIR FAULTY WIRING CONNECTION FROM PDC TO JUNCTION BLOCK. 3. REPAIR OR REPLACE FAULTY GROUND WIRE FEED TO MULTI-FUNCTION SWITCH. 4. REPLACE FAULTY MULTI-FUNCTION SWITCH. 5. PLUG COMBINATION FLASHER/ DRL MODULE INTO JUNCTION BLOCK. 6. REPLACE FAULTY COMBINATION FLASHER/DRL MODULE. 7. REPLACE JUNCTION BLOCK.
SYSTEM WILL FLASH HAZARD WARNING LAMPS BUT WILL NOT FLASH RIGHT OR LEFT TURN SIGNAL LAMPS	1. FAULTY (10) AMP FUSE IN THE JUNCTION BLOCK. 2. FAULTY COMBINATION FLASHER/DRL MODULE. 3. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 4. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE FAULTY FUSE IN JUNCTION BLOCK. 2. REPLACE COMBINATION FLASHER/DRL MODULE. 3. REPLACE FAULTY MULTI-FUNCTION SWITCH. 4. REPLACE JUNCTION BLOCK.
RIGHT TURN SIGNAL OPERATES PROPERLY BUT LEFT TURN SIGNAL FLASHES FAST (Hazard mode can be used for a system check)	1. FAULTY LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 2. FAULTY WIRING CONNECTION FROM JUNCTION BLOCK TO LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 3. FAULTY GROUND WIRING CONNECTION FROM LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 4. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 5. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 2. REPAIR OR REPLACE WIRING CONNECTION FROM JUNCTION BLOCK TO LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 3. REPAIR OR REPLACE FAULTY GROUND WIRING CONNECTION TO LEFT FRONT OR LEFT REAR TURN SIGNAL LAMP. 4. REPLACE FAULTY MULTI-FUNCTION SWITCH. 5. REPLACE JUNCTION BLOCK.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
LEFT TURN SIGNAL OPERATES PROPERLY BUT RIGHT TURN SIGNAL FLASHES FAST (Hazard mode can be used for a system check)	1. FAULTY RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 2. FAULTY WIRING CONNECTION FROM JUNCTION BLOCK TO RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 3. FAULTY GROUND WIRING CONNECTION FROM RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 4. FAULTY MULTI-FUNCTION SWITCH CONTACTS. 5. FAULTY TERMINALS IN JUNCTION BLOCK.	1. REPLACE RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 2. REPAIR OR REPLACE WIRING CONNECTION FROM JUNCTION BLOCK TO RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 3. REPAIR OR REPLACE FAULTY GROUND WIRING CONNECTION TO RIGHT FRONT OR RIGHT REAR TURN SIGNAL LAMP. 4. REPLACE FAULTY MULTI-FUNCTION SWITCH. 5. REPLACE JUNCTION BLOCK.
BOTH TURN SIGNAL INDICATORS IN MESSAGE CENTER DO NOT FLASH IN CONJUNCTION WITH OUTSIDE TURN SIGNAL LAMPS	1. FAULTY GROUND WIRING CONNECTION FROM COWL GROUND SPLICE.	1. REPAIR OR REPLACE WIRING CONNECTION FROM COWL GROUND SPLICE.
LEFT OR RIGHT TURN SIGNAL INDICATOR IN MESSAGE CENTER DOES NOT FLASH IN CONJUNCTION WITH OUTSIDE TURN SIGNAL LAMPS, BUT OTHER INDICATOR PERFORMS PROPERLY	1. FAULTY INDICATOR LAMP IN MESSAGE CENTER. 2. FAULTY WIRING CONNECTION BETWEEN MESSAGE CENTER AND JUNCTION BLOCK.	1. REPLACE FAULTY INDICATOR LAMP IN MESSAGE CENTER. 2. REPAIR OR REPLACE FAULTY WIRING CONNECTION BETWEEN MESSAGE CENTER AND JUNCTION BLOCK.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TURN SIGNAL AND HAZARD WARNING FLASHERS FUNCTION PROPERLY BUT DAYTIME RUNNING LIGHTS (DRL) DO NOT COME ON WHILE DRIVING (The brake lamp in the message center remains illuminated under the circumstances noted to the right in step #3.0 through 3.5 unless the lamp is burned out.) (Headlamps, either low or high beam, remain illuminated under the circumstances noted to the right in step #4.0 through 4.3 even though the headlamp switch is OFF.)	1. FAULTY GROUND FEED TO JUNCTION BLOCK FROM GROUND STUD CONNECTOR THROUGH I/P HARNESS. 2. FAULTY GROUND FEED THROUGH JUNCTION BLOCK TO CAVITY #11 IN POSITION #3 OF THE JUNCTION BLOCK. 3.0. FAULTY PARK BRAKE SWITCH. 3.1. PARK BRAKE INPUT CIRCUIT FALSELY GROUNDED. COULD BE THE G09 CIRCUIT WHICH IS A (20) GA. GY/BK WIRE BETWEEN THE MESSAGE CENTER AND THE JUNCTION BLOCK, 3.2. OR BETWEEN THE PARK BRAKE SWITCH AND THE JUNCTION BLOCK, 3.3. OR BETWEEN THE BRAKE PRESSURE SWITCH AND THE JUNCTION BLOCK, 3.4. OR BETWEEN THE IGNITION SWITCH AND THE JUNCTION BLOCK, 3.5. OR A SHORTED IGNITION SWITCH (CONTACT SHOULD ONLY BE MADE WHEN IN START POSITION). 4.0. L93 CIRCUIT FALSELY GROUNDED BETWEEN JUNCTION BLOCK AND MULTI-FUNCTION SWITCH. 4.1. L307 CIRCUIT FALSELY GROUNDED BETWEEN HEADLAMP SWITCH AND BODY CONTROL MODULE. 4.2. HEADLAMP SWITCH SHORTED. 4.3. HEADLAMP CONTROL OUTPUT FALSELY GROUNDED BY BODY CONTROL MODULE.	1. REPLACE GROUND CIRCUIT TO JUNCTION BLOCK. 2. REPLACE JUNCTION BLOCK. 3.0. REPLACE THE PARK BRAKE SWITCH. 3.1-3.4. REPAIR THE G09 CIRCUIT TO ELIMINATE THE FALSE GROUND SOURCE. 3.5. REPLACE IGNITION SWITCH. 4.0. REPAIR OR REPLACE FAULTY WIRING CONNECTION BETWEEN JUNCTION BLOCK AND MULTI-FUNCTION SWITCH. 4.1. REPAIR OR REPLACE FAULTY WIRING CONNECTION BETWEEN HEADLAMP SWITCH AND BODY CONTROL MODULE. 4.2. REPLACE SHORTED HEADLAMP SWITCH. 4.3. REPLACE BODY CONTROL MODULE.

REMOVAL AND INSTALLATION

MULTI-FUNCTION SWITCH

WARNING: BEFORE SERVICING A STEERING COLUMN EQUIPPED WITH AN AIRBAG REFER TO GROUP 8M, RESTRAINT SYSTEMS FOR PROPER AND SAFE SERVICE PROCEDURES.

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect and isolate battery negative cable.

(3) Remove upper and lower steering column shrouds, refer to Group 19, Steering for proper procedures.

(4) Disconnect wire connector from back of turn signal multi-function switch (Fig. 6).

(5) Remove screws holding turn signal switch to steering column adapter collar.

(6) Remove turn signal switch.

INSTALLATION

For installation, reverse the above procedures. Verify switch operation by placing the control stalk in either the right or left position and turning the steering wheel to ensure the automatic cancellation of the switch.

COMBINATION FLASHER WITH / WITHOUT DRL MODULE

REMOVAL

(1) Remove lower steering column cover.

(2) Remove knee blocker.

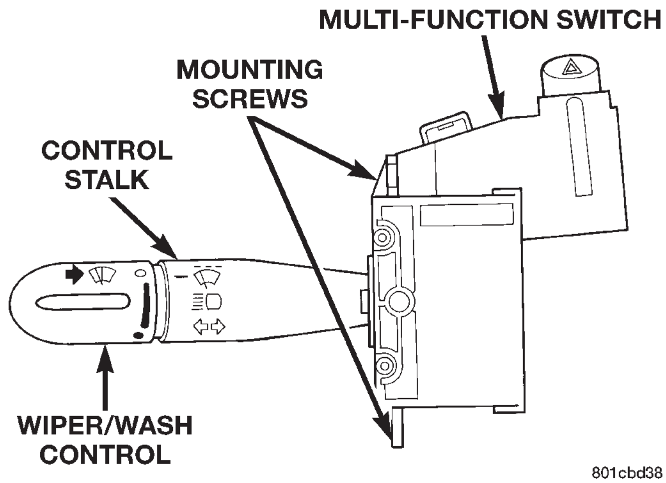

Fig. 6 Turn Signal Multi-Function Switch

(3) Pull combination flasher from junction block.

INSTALLATION

For installation, reverse the above procedures.

WINDSHIELD WIPERS AND WASHERS

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WINDSHIELD WIPERS AND WASHER

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GENERAL INFORMATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR SAFETY PRECAUTIONS. DISCONNECT THE NEGATIVE CABLE FROM THE BATTERY BEFORE SERVICING COMPONENTS INVOLVING THE AIRBAG SYSTEM. ACCIDENTAL DEPLOYMENT OF AIRBAG AND PERSONAL INJURY CAN RESULT.

The windshield wipers can be operated with the windshield wiper switch when the ignition switch is in the RUN or ACCESSORY positions. The windshield wiper system is protected by a 40 amp fuse (9) located in the Power Distribution Center (PDC) in the engine compartment. The windshield washer circuit is protected by a 6 amp fuse (9) located in the Junction Block. The wiper motor has permanent magnetic fields. The speeds are determined by current flow to the appropriate set of brushes inside the motor. The current flow is controlled by the multi-function switch stalk mounted wiper switch, high speed/low speed relays located in the PDC. The speed sensitive intermittent wiper is controlled by the Body Control Module (BCM). The intermittent mode, with the vehicle traveling greater than 10.4 mph, has a range of 0.5 to 18 seconds. With the vehicle traveling less than 10.4 mph, and the time delay is not adjusted, time delay doubles to a range of 1 to 36 seconds. The wiper arms will park at the base of the windshield just above the cowl cover after the wiper switch is turned OFF.

The windshield wiper motor and linkage is located in an integral wiper unit at the rear of the engine compartment. The wiper unit must be removed to gain access to the wiper motor.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

The windshield wiper system operates in several modes:

- Low and high speed normal wipe
- Speed sensitive intermittent wipe
- Wipe after wash
- Pulse wipe
- Park (switch OFF)

The windshield wiper circuits are continuously monitored and controlled by the Body Control Mod-

DIAGNOSIS AND TESTING (Continued)

ule (BCM). If a problem occurs in the electronic components, wiring, switch (except integral motor park switch) and wiper motor a Diagnostic Trouble Code (DTC) will be stored in the BCM memory. DTC's can be retrieved using a scan tool (DRB). Refer to proper Body Diagnostic Procedures manual for DTC descriptions and retrieval information.

The windshield wiper park switch and circuit is monitored by the BCM. The park switch and circuit can be tested using the Wiper System Diagnosis chart.

FAILED PARK SWITCH

If the wiper park switch has failed the windshield wipers will operate as follows:

SWITCH OFF—Wipers stop in current location regardless of the park signal.

INTERMITTENT MODE—Wipers operate at low speed for one or more extra wipes or continuously.

LOW SPEED—Wipers operate at low speed.

HIGH SPEED—Wipers operate at high speed.

PULSE WIPE—Wipers will not operate.

WIPE AFTER WASH—Wipers operate at low speed in any mode setting. Wipers operate only while wash button is depressed with switch in OFF mode, wipers stop in mid-cycle when button is released.

The windshield wiper park switch and circuit is monitored by the BCM. The park switch and circuit can be tested using the Wiper System Diagnosis table.

WIPER SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
WIPER BLADES DO NOT PARK PROPERLY	1. WIPER ARMS IMPROPERLY PARKED. 2. WIPER ARMS ARE LOOSE ON PIVOT SHAFT. 3. MOTOR CRANK LOOSE AT OUTPUT SHAFT.	1. REMOVE WIPER ARMS AND REPARK. REFER TO WIPER ARM REMOVAL AND INSTALLATION. 2. REMOVE WIPER ARM AND REPARK. REFER TO WIPER ARM REMOVAL AND INSTALLATION. 3. REMOVE WIPER ARM, RUN WIPER MOTOR TO PARK POSITION AND REMOVE THE MODULE. WITHOUT ROTATING THE MOTOR OUTPUT SHAFT, REMOVE THE CRANK AND CLEAN ANY FOREIGN MATTER FROM THE MOTOR SHAFT. INSTALL THE MOTOR CRANK IN ITS ORIGINAL POSITION.
MOTOR STOPS IN ANY POSITION WHEN THE SWITCH IS TURNED OFF	1. OPEN PARK CIRCUIT.	1. CHECK PARK SWITCH BY DISCONNECTING THE WIRE CONNECTOR AND APPLY BATTERY VOLTAGE TO PIN 4. PLACE A JUMPER WIRE FROM PIN 2 TO PIN 3 AND THEN TO AN EXTERNAL GROUND. REPLACE MOTOR IF IT DOES NOT PARK.
MOTOR WILL NOT STOP WHEN THE SWITCH IS TURNED OFF	1. FAULTY SWITCH. 2. LOCK OF DYNAMIC BRAKE ON WET GLASS.	1. CHECK SWITCH IN LOW, HIGH AND INTERMITTENT POSITION. 2. ENSURE PARK SWITCH HAS CLEAN GROUND.
WIPER BLADES SLAP AGAINST COWL SCREEN OR WINDOW MOLDINGS.	1. WIPER ARMS ARE PARKED INCORRECTLY.	1. PARK WIPER ARMS. REFER TO WIPER ARM ADJUSTMENT.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BLADES CHATTER	1. FOREIGN SUBSTANCE SUCH AS POLISH ON GLASS OR BLADES. 2. ARMS TWISTED, BLADE AT WRONG ANGLE ON GLASS. 3. BLADE STRUCTURE BENT. 4. BLADE ELEMENT HAS PERMANENT SET.	1. CLEAN GLASS AND BLADE ELEMENT WITH NON-ABRASIVE CLEANER. 2. REPLACE ARM. 3. REPLACE BLADE. 4. REPLACE BLADE ELEMENT.
WIPER KNOCK AT REVERSAL	1. LINKAGE BUSHINGS WORN. 2. ARMATURE ENDPLAY IN MOTOR.	1. REPLACE WORN LINK. REFER TO WIPER LINKAGE REMOVAL AND INSTALLATION. 2. REPLACE WIPER MOTOR. REFER TO WIPER MOTOR REMOVAL AND INSTALLATION.
WIPER MOTOR WILL NOT RUN	1. BLOWN FUSE. 2. NEW FUSE BLOWS. 3. NEW FUSE BLOWS. 4. NO VOLTAGE AT MOTOR. 5. POOR GROUND.	1. REPLACE FUSE, AND RUN SYSTEM. 2. CHECK FOR SHORT IN WIRING OR SWITCH. 3. REPLACE FUSE, REMOVE MOTOR CONNECTOR, TURN SWITCH ON, FUSE DOES NOT BLOW, REPLACE MOTOR. 4. CHECK SWITCH AND WIRING HARNESS. REFER TO GROUP 8W, WIRING DIAGRAMS. 5. REPAIR GROUND WIRE CONNECTION AS NECESSARY.

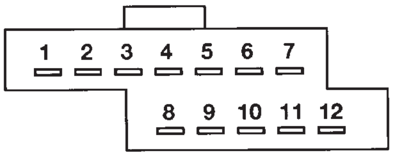
DIAGNOSIS AND TESTING (Continued)

MULTI-FUNCTION SWITCH

To test the windshield wiper and washer portion of the multi-function switch:

(1) Remove the multi-function switch, refer to removal procedures.

(2) Using an ohmmeter check continuity reading between switch pins, refer to (Fig. 1) for proper pin numbers.



SWITCH POSITION	RESISTANCE VALUE BETWEEN
OFF	6 AND 7 MAX. 1.0 Ω
DELAY POSITION	
1ST	6 AND 7 1.91 K Ω ± 5 Ω
2ND	6 AND 7 1.00 K Ω ± 5 Ω
3RD	6 AND 7 617 Ω ± 5 Ω
4TH	6 AND 7 389 Ω ± 2 Ω
5TH	6 AND 7 256 Ω ± 2 Ω
6TH	6 AND 7 156 Ω ± 1 Ω
LOW	6 AND 7 65.4 Ω ± 0.5 Ω
HIGH	5 AND 8 MAX. 1.0 Ω
WASH	8 AND 11 CONTINUITY

801cbd37

Fig. 1 Windshield Wiper and Washer–Multi-Function Switch Test

REMOVAL AND INSTALLATION

MULTI-FUNCTION SWITCH

WARNING: BEFORE SERVICING A STEERING COLUMN EQUIPPED WITH AN AIRBAG REFER TO GROUP 8M, RESTRAINT SYSTEMS FOR PROPER AND SAFE SERVICE PROCEDURES.

REMOVAL

(1) Release hood latch and open hood.

(2) Disconnect and isolate battery negative cable.

(3) Remove upper and lower steering column shrouds, refer to Group 19, Steering for proper procedures.

(4) Disconnect wire connector from back of turn signal multi-function switch (Fig. 2).

(5) Remove screws holding turn signal switch to steering column adapter collar.

(6) Remove turn signal switch.

INSTALLATION

For installation, reverse the above procedures. Verify switch operation by placing the control stalk in either the right or left position and turning the steering wheel to ensure the automatic cancellation of the switch.

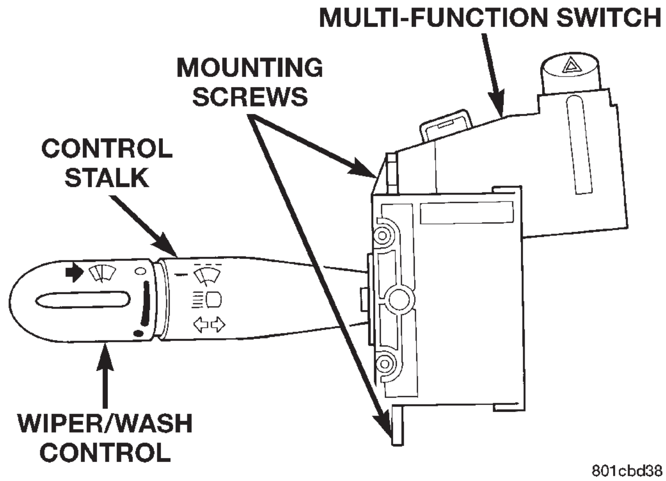


Fig. 2 Turn Signal Multi-Function Switch

WINDSHIELD WASHER BOTTLE

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove right front wheel, refer to Group 22, Wheels and Tires for proper procedures and tightening sequences.

(3) Remove front wheelhouse splash shield.

(4) Disconnect wire connectors from the windshield and rear window washer pumps (Fig. 3).

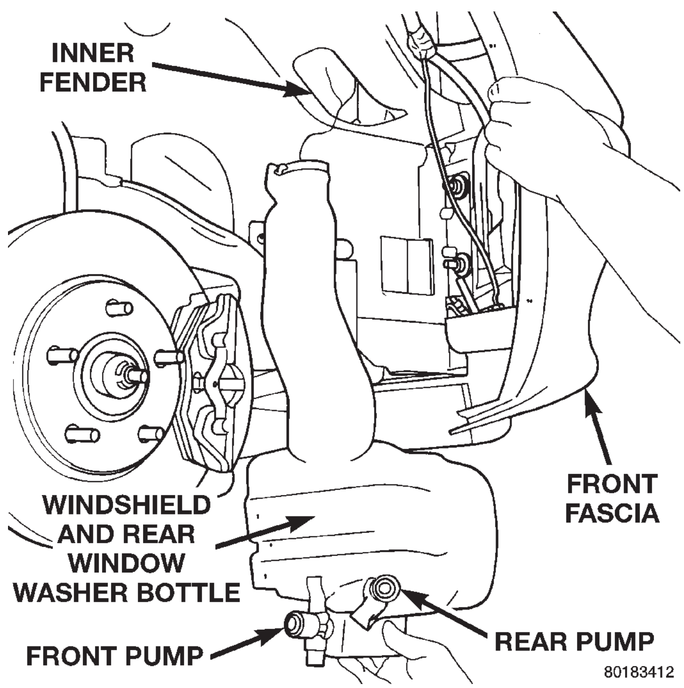


Fig. 3 Windshield Washer Bottle

(5) If washer bottle has fluid in it place a suitable drain pan under the hose connections.

REMOVAL AND INSTALLATION (Continued)

(6) Disconnect front washer hose at front wiper unit in the engine compartment (Fig. 4). The front hose will be removed with the bottle.

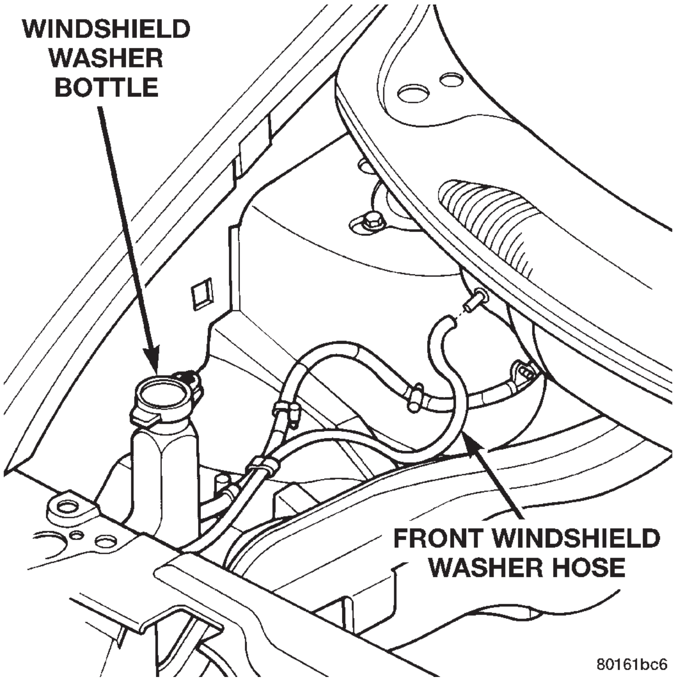


Fig. 4 Front Washer Hose

(7) Disconnect hose from rear washer pump nipple (Fig. 5).

(8) Allow washer bottle to drain.

(9) Remove screws holding washer bottle to front fender support and remove bottle.

INSTALLATION

For installation, reverse the above procedure.

WINDSHIELD WIPER BLADE

REMOVAL

(1) Lift the wiper arm away from windshield.

(2) Disengage the release tab holding the wiper blade to the wiper arm and remove the wiper blade from the wiper arm (Fig. 6).

(3) Remove the wiper blade from the wiper arm.

INSTALLATION

For installation, reverse the above procedure.

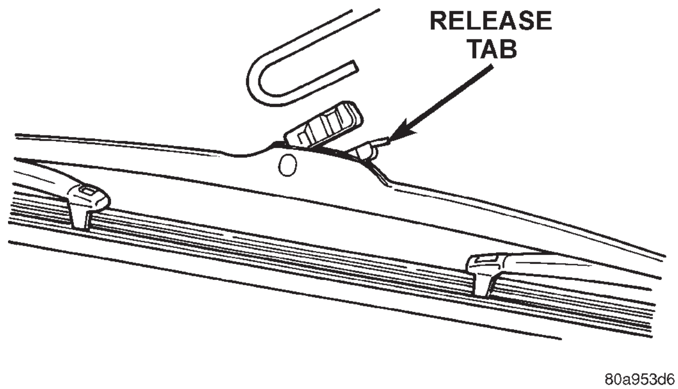


Fig. 6 Windshield Wiper Blade

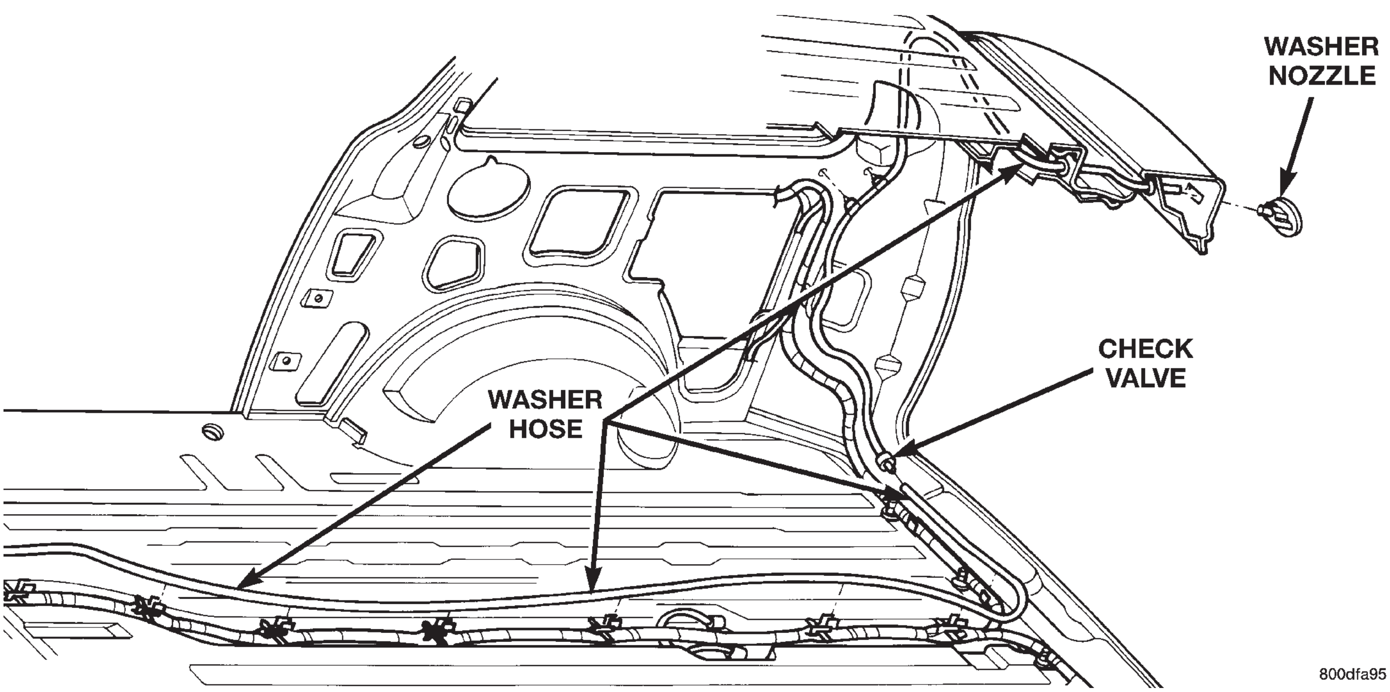


Fig. 5 Rear Washer Hose Routing

REMOVAL AND INSTALLATION (Continued)

WINDSHIELD WIPER BLADE ELEMENT

REMOVAL

(1) Disengage the release tab holding the wiper blade to the wiper arm and remove the wiper blade from the wiper arm (Fig. 6).

(2) Disengage clip holding the wiper element to wiper blade (Fig. 7).

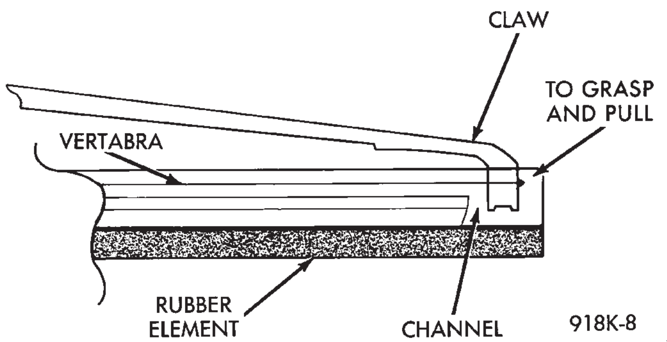


Fig. 7 Windshield Wiper Blade Element

(3) Pull the element from the claws on the wiper blade.

INSTALLATION

(1) Insert the element vertebra (Fig. 8) into claw at the open end of the wiper blade and through each claw location along the blade.

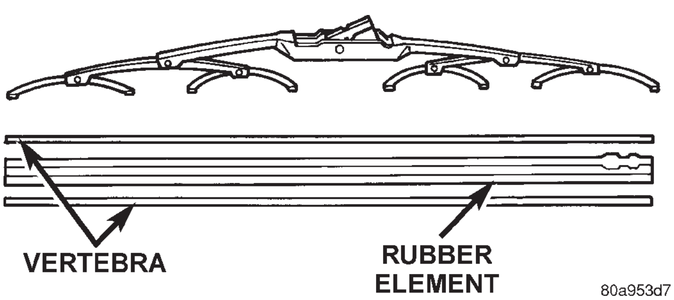


Fig. 8 Wiper Blade and Element

(2) Engage clip to hold wiper element to wiper blade.

(3) Test wiper effectiveness using washer mode and align if necessary.

WINDSHIELD WIPER MOTOR

REMOVAL

(1) Remove wiper unit from vehicle.

(2) Remove wiper linkage and motor mount plate from wiper unit.

(3) Disconnect wire connectors from back of wiper motor (Fig. 16).

(4) Remove wiper linkage from motor crank. Do NOT remove crank from motor.

(5) Remove bolts holding wiper motor to mount plate and remove motor (Fig. 9) and (Fig. 10).

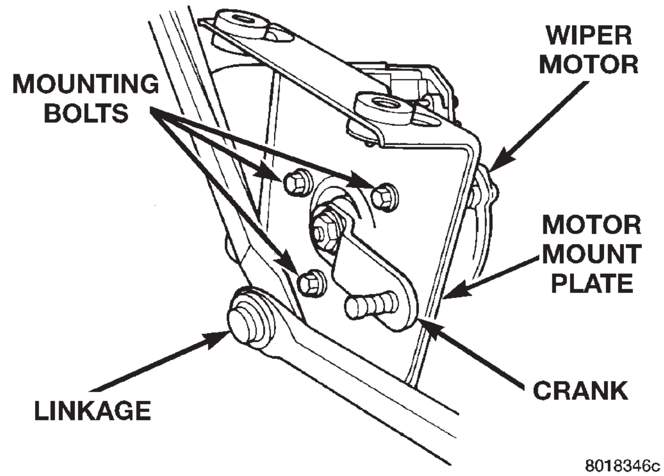


Fig. 9 Wiper Motor Crank

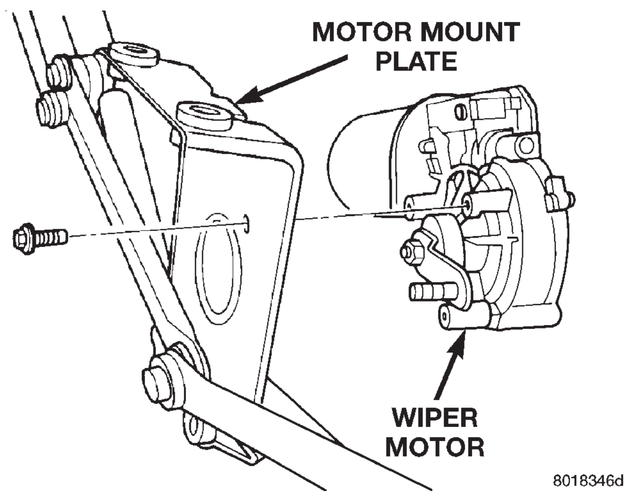


Fig. 10 Wiper Motor

INSTALLATION

(1) Place wiper unit on a suitable work surface.

(2) Place wiper motor in position on mount plate.

(3) Install bolts to hold wiper motor to mount plate.

(4) Install wiper linkage and motor mount plate into wiper unit.

(5) Connect wire connectors to wiper motor (Fig. 16).

(6) Place the wiper unit into engine compartment and connect wiper unit wire connector to engine wire harness (Fig. 13).

(7) Operate wiper motor and verify that the wiper motor parks when wiper switch is turned OFF.

REMOVAL AND INSTALLATION (Continued)

WIPER ARM

CAUTION: The Driver side wiper arm must be parked above the passenger side. Failure to do so will result in damage to the arms, blades, or system.

REMOVAL

(1) Disengage the clip holding outside end of the wiper arm pivot cover to the wiper arm.
(2) Lift the arm cap upward.
(3) Remove the nut holding wiper arm to the wiper pivot.
(4) Using a suitable two jaw puller, separate the wiper arm from the wiper pivot (Fig. 11).

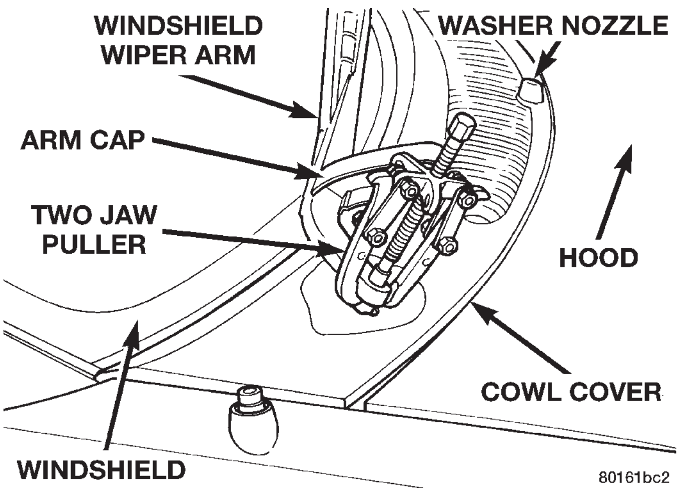


Fig. 11 Wiper Arm Removal

INSTALLATION

(1) Verify that the wiper motor and linkage are in the park position.
(2) Place the wiper arm in position over the wiper pivot (Fig. 12). Refer to Alignment.
(3) Install the nut to hold the wiper arm to the wiper pivot. Tighten nut to 35 N·m (26 ft. lbs.).
(4) Push the arm cap cover down.
(5) Engage clip to the hold outside end of wiper arm pivot cover to the wiper arm.

WIPER UNIT

REMOVAL

(1) Remove the wiper arms.
(2) Remove the cowl cover. Refer to Group 23 Body for proper procedure.
(3) Release the hood latch and open hood.
(4) Disconnect the positive lock on the wiper unit wire connector (Fig. 13).
(5) Disconnect the wiper unit wire connector from the engine compartment wire harness.
(6) Disconnect the windshield washer hose from coupling inside unit.

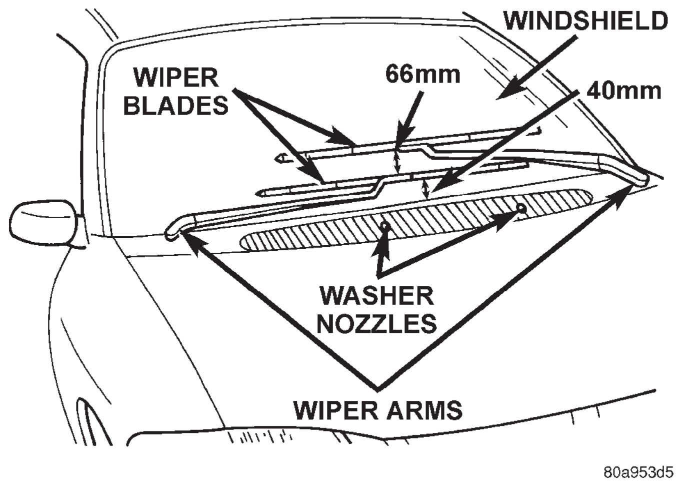


Fig. 12 Wiper Arm Adjustment

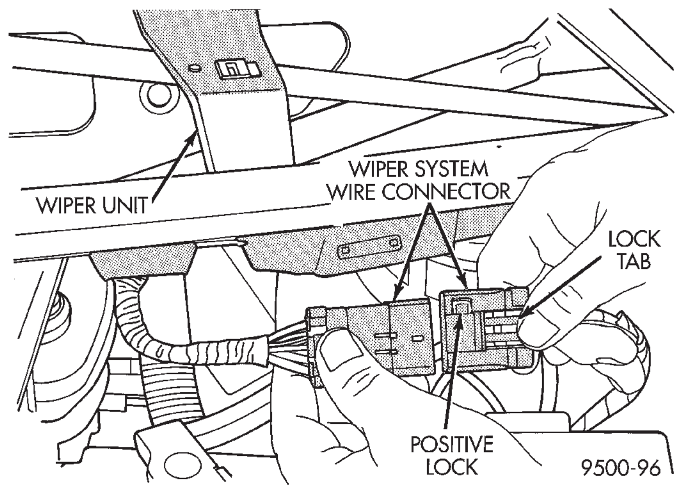


Fig. 13 Wiper Unit Wire Connector

(7) Disconnect the drain tubes from nipples on bottom of the wiper unit.
(8) Remove nuts holding wiper unit to lower windshield fence.
(9) Remove bolts holding the wiper unit to the dash panel (Fig. 14).
(10) Lift wiper unit from weld-studs on lower windshield fence.

CAUTION: Do not allow wiper unit to rest on brake master cylinder reservoir, damage to brake system can result.

(11) Remove wiper unit.

INSTALLATION

For installation, reverse the above procedure.

WIPER LINKAGE

REMOVAL

(1) Remove the windshield wiper unit from vehicle.

REMOVAL AND INSTALLATION (Continued)

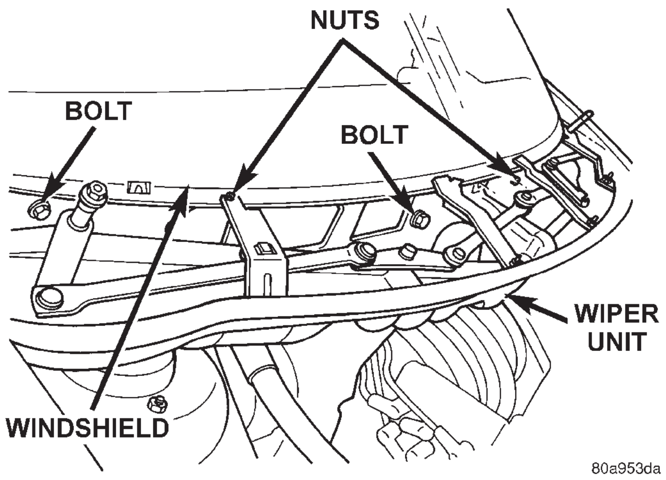


Fig. 14 Wiper Unit

(2) Place the wiper unit on a suitable work surface.

(3) Remove nuts holding the cowl cover brackets to the wiper unit.

(4) Remove cowl cover brackets from the wiper unit.

(5) Remove nuts holding linkage and motor mount plate to the wiper unit (Fig. 15).

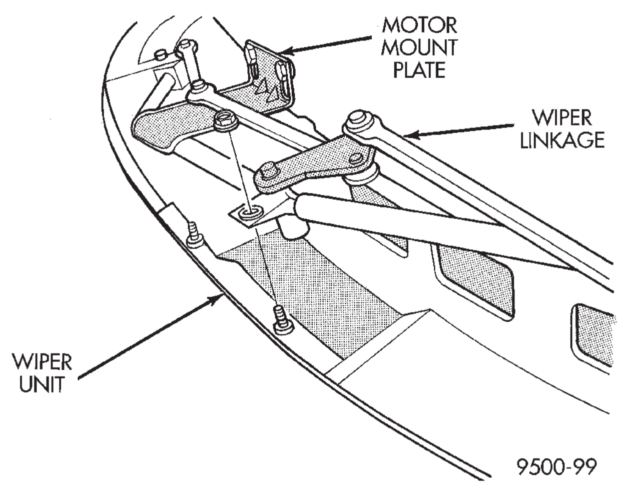


Fig. 15 Wiper Linkage

(6) Remove the wiper linkage from the wiper unit.

(7) Disconnect the wire connectors from back of the wiper motor (Fig. 16).

INSTALLATION

For installation, reverse the above procedure.

CLEANING AND INSPECTION

WIPER BLADES

Wiper blades exposed to the weather for a long period of time tend to lose their wiping effectiveness.

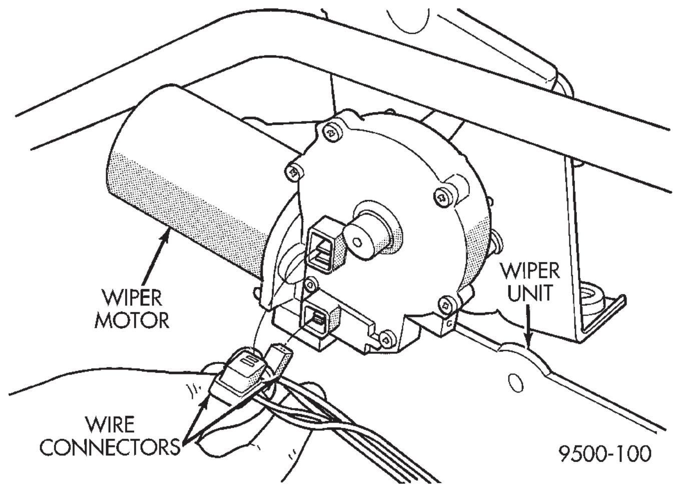


Fig. 16 Wiper Motor Connector

Periodic cleaning of the wiper blade is recommended to remove the accumulation of salt and road grime. The wiper blades, arms and windshield should be cleaned with a sponge or cloth and a mild detergent or nonabrasive cleaner. If the wiper blades continue to streak or smear, they should be replaced. The wiper blade should run smoothly across the windshield in both directions. The wiper blade should slightly roll over center when the blade reverses direction. A wiper blade insert that has lost flexibility or a wiper arm that has lost spring tension, will cause the blade to skip or chatter across the windshield. If the wiper blades are new and the wiper arm spring tension is OK and a chattering sound is emitted from the wiper(s), the wiper blade is not rolling over center. If this condition exists, refer to the Wiper Arm Alignment paragraph of this group.

ADJUSTMENTS

WIPER ARM ALIGNMENT

(1) Verify wiper blade element condition and wiper arm spring tension. Run wipers in low speed mode while applying water to the windshield. Observe the wiper blade that is chattering or skipping across the windshield. If the wiper element is not rolling over when the wiper direction reverses, align the wiper arm. The extension bar portion of the wiper arm must be twisted in the proper direction to allow the wiper element to roll over when the direction reverses.

(2) Place two small adjustable wrenches placed 50 mm (2 in.) apart on the wiper arm extension rod.

(3) Twist the extension rod slightly in the opposite direction that the element is laying on the windshield while holding the wrench closest to the pivot stationary.

(4) Repeat step Step 1, and align as necessary until wiper stops chattering and wipes the windshield clear.

REAR WIPER AND WASHER

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DESCRIPTION AND OPERATION

INTRODUCTION

When continuous rear wiper operation is required, the Body Control Module (BCM) will provide ignition ON voltage to the rear wiper motor. When the wiper switch is turned OFF, the BCM provides circuit ground to operate the motor until the wipe cycle is complete and the wiper arm returns to the base of the rear window.

When intermittent rear wiper mode is selected, the wiper motor will cycle every 7 seconds. The intermittent delay time is also adjusted based upon vehicle speed. With the vehicle traveling greater at 50 mph, the cycle changes to every 5 seconds.

REAR WINDOW WIPER/WASHER SWITCHES

The rear window wiper/washer switches are incorporated into the HVAC switch panel. Refer to Group 8E, Instrument Panel for proper service procedures.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

The rear window wiper system operates in several modes:

- Continuous wipe
- Intermittent wipe
- Wash
- Wipe after wash

The windshield wiper circuits are continuously monitored and controlled by the Body Control Module (BCM). If a problem occurs in the electronic components, wiring, switch (except integral motor park switch) and wiper motor a Diagnostic Trouble Code (DTC) will be stored in the BCM memory. The DTC(s) can be retrieved using a scan tool (DRB). Refer to proper Body Diagnostic Procedures manual for DTC descriptions and retrieval information.

REMOVAL AND INSTALLATION

REAR GLASS RUBBER GROMMET

REMOVAL

(1) Remove rear window wiper motor.
(2) Peel wiper pivot seal grommet from rear glass.
(3) Remove grommets from vehicle (Fig. 1).

INSTALLATION

For installation, reverse the above procedure.

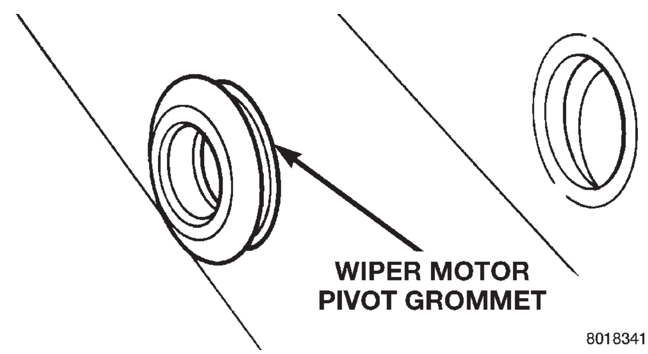

Fig. 1 Rear Glass Rubber Grommet

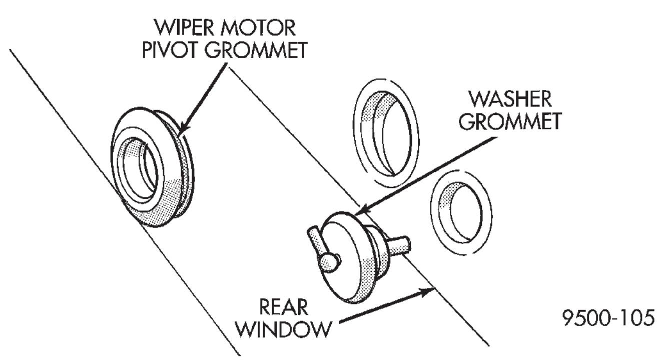

Fig. 2 Rear Glass Rubber Grommets

REMOVAL AND INSTALLATION (Continued)

REAR WINDOW WIPER MOTOR

REMOVAL

(1) Remove rear wiper arm.

(2) Open liftgate.

(3) Remove liftgate trim panel.

(4) Disconnect wire connector from rear wiper motor.

(5) Remove screws holding rear wiper motor to liftgate (Fig. 3).

(6) Remove wiper motor from liftgate.

INSTALLATION

For installation, reverse the above procedure.

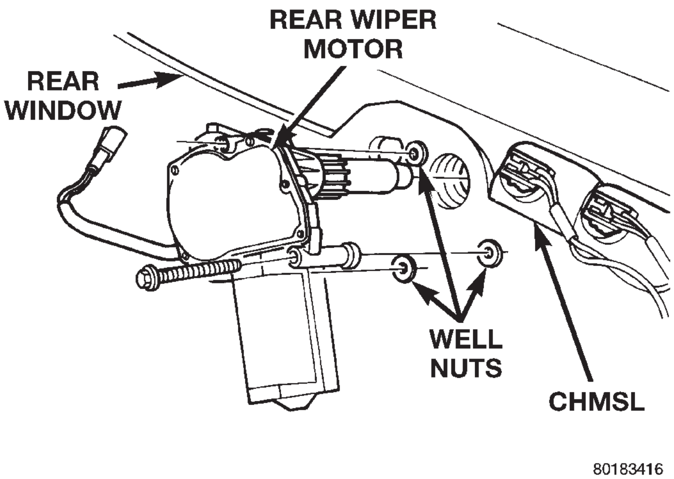

Fig. 3 Rear Window Wiper Motor

REAR WIPER ARM

REMOVAL

(1) Lift and hold wiper blade away from rear window.

(2) Lift lock holding wiper arm to wiper pivot upward.

(3) Allow wiper arm to rest against lock.

(4) Pull wiper from pivot (Fig. 4).

INSTALLATION

For installation, reverse the above procedure.

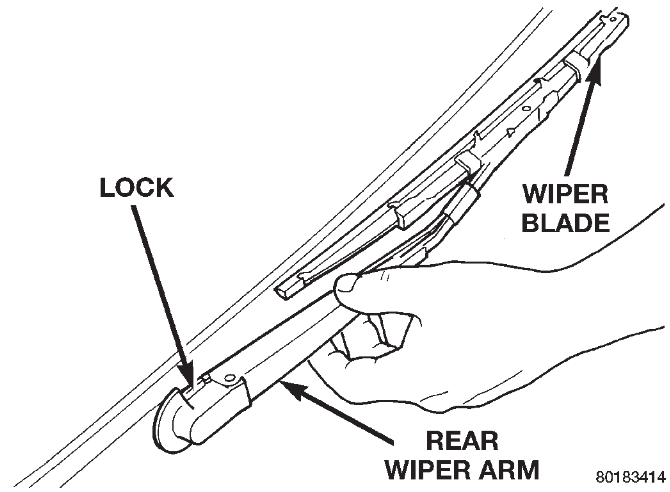

Fig. 4 Rear Wiper Arm

REAR WIPER BLADE

REMOVAL

(1) Lift wiper blade away from rear window.

(2) Release latch holding blade to wiper arm (Fig. 5).

(3) Remove blade from wiper arm.

INSTALLATION

For installation, reverse the above procedure.

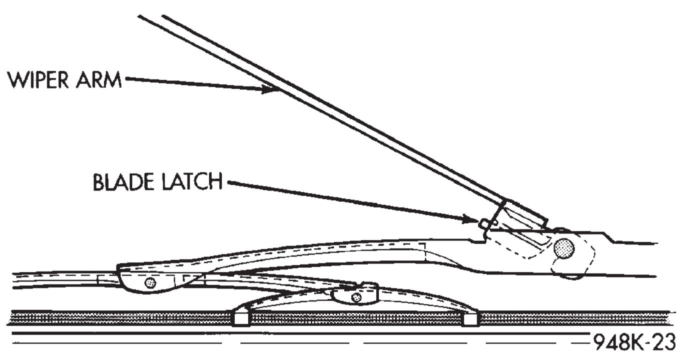

Fig. 5 Rear Wiper Arm

REAR WIPER BLADE ELEMENT

Refer to Windshield Wiper Blade Element in this section.

WIPER AND WASHER SYSTEMS

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HEADLAMP WASHERS

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WINDSHIELD/HEADLAMP WASHER
RESERVOIR 1

GENERAL INFORMATION

INTRODUCTION

Headlamp washers are available as a factory-installed option on this model. The headlamp washers on this vehicle work in conjunction with the windshield washers. The headlamp washers are enabled with the headlamps "ON" and the windshield washers activated. With the windshield washers activated the headlamp washers will spray for a preset amount of time controlled by a relay.

The headlamp washer system utilizes a separate pump that is attached to the windshield washer reservoir. The headlamp washer pump feeds two nozzles that are mounted in the front fascia of the vehicle. These nozzles spray the headlamps when the system is activated.

REMOVAL AND INSTALLATION

WINDSHIELD/HEADLAMP WASHER RESERVOIR

Removal

(1) Remove the right headlamp assembly. Refer to Group 8L, Lamps.

(2) Partially remove the inner fender well as needed to gain access to the reservoir.

(3) Disconnect the windshield washer pump, rear washer pump and headlamp washer pump electrical connectors.

(4) Disconnect the headlamp washer pump hose.

(5) Partially remove the front fascia to aid in the removal of the reservoir.

(6) Remove the reservoir mounting bolts. (Fig. 1)

(7) Slide the reservoir rearward and remove from the vehicle.

Installation

(1) For installation, reverse the above procedures

HEADLAMP WASHER NOZZLE

Removal

(1) Remove the headlamp assembly. Refer to Group 8L, Lamps.

(2) Disconnect the hose at the headlamp washer nozzle.

(3) Remove the headlamp washer nozzle retaining nuts and remove the nozzle from the front fascia.

REMOVAL AND INSTALLATION (Continued)

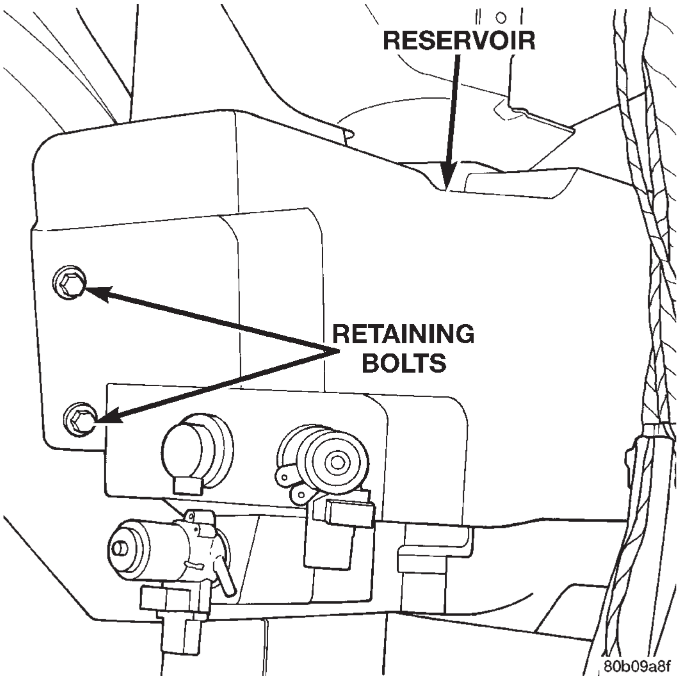

Fig. 1 Reservoir Removal

Installation

(1) For installation, reverse the above procedures.

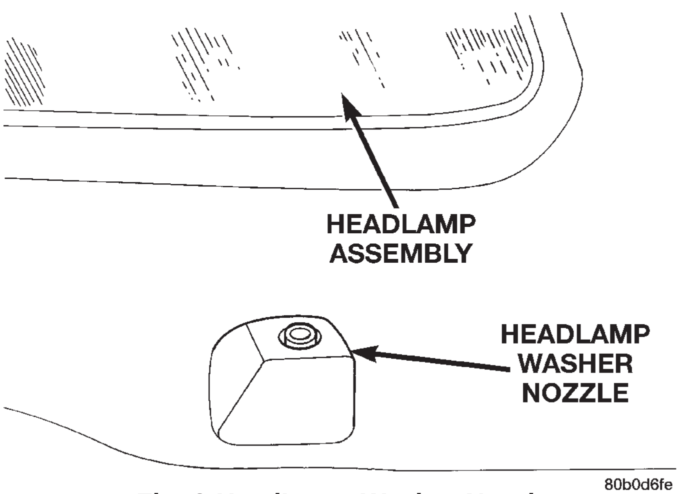

Fig. 2 HeadLamp Washer Nozzle

HEADLAMP WASHER PUMP

Removal

(1) Remove the right headlamp assembly. Refer to Group 8L, Lamps.

(2) Disconnect the headlamp washer pump electrical connector.

(3) Disconnect the headlamp washer pump hose.

(4) Remove the headlamp washer pump from the reservoir.

Installation

(1) For installation, reverse the above procedures.

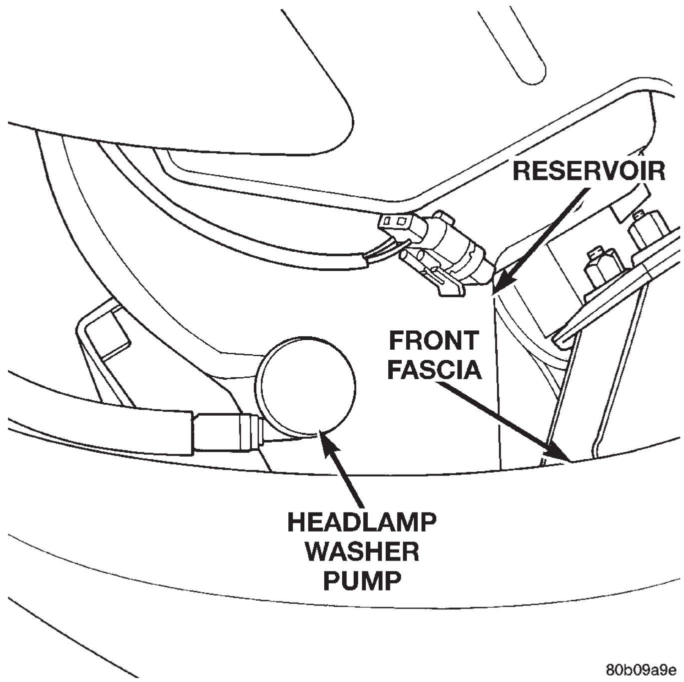

Fig. 3 Headlamp Washer Pump

LAMPS

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LAMP DIAGNOSIS

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GENERAL INFORMATION

GENERAL INFORMATION

NS vehicles use lighting on the interior and exterior of the vehicle for illuminating and indicating purposes. Lighting circuits are protected by fuses. Lighting circuits require an overload protected power source, on/off device, lamps and body ground to operate properly. Plastic lamps require a wire in the harness to supply body ground to the lamp socket. Replace sockets and bulbs that are corroded.

Some of the interior and exterior lighting functions are governed by the body controller. The headlamp, dome, and the door ajar switches provide signals to the body controller. The body controller in turn activates relay(s) in order to provide either a ground or feed line to the appropriate lamp(s).

Wire connectors can make intermittent contact or become corroded. Before coupling wire connectors, inspect the terminals inside the connector. Male terminals should not be bent or disengaged from the insulator. Female terminals should not be sprung open or disengaged from the insulator. Bent and sprung terminals can be repaired using needle nose pliers and pick tool. Corroded terminals appear chalky or green. Corroded terminals should be replaced to avoid recurrence of the problem symptoms.

Begin electrical system failure diagnosis by testing related fuses in the fuse block and power distribution center. Verify that bulbs are in good condition and test continuity of the circuit ground. Refer to Group 8W, Wiring Diagrams, for component location and circuit information.

SAFETY PRECAUTIONS

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.

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.

Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

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.

ELECTRONIC DAYTIME RUNNING LIGHT (DRL)

The Combination Flasher/DRL is a module providing turn signal, hazard warning, and daytime run-

GENERAL INFORMATION (Continued)

ning light functions (for Canadian vehicles), and has been designed with internal relays to take advantage of low current switching requirements in the vehicle. It is plugged into the junction block at positions three and four (Fig. 1), where all wiring associated with its operation is terminated. The junction block is adjacent to and left of the steering column of the vehicle. For diagnostic information refer to Group 8J, Turn Signal and Flashers.

On vehicles built for use in the United States, only position four is used. Vehicles built for use in Canada utilize both positions three and four.

To gain access to the device, remove the lower steering column cover and knee blocker. Refer to Group 8E, Instrument Panel and Gauges.

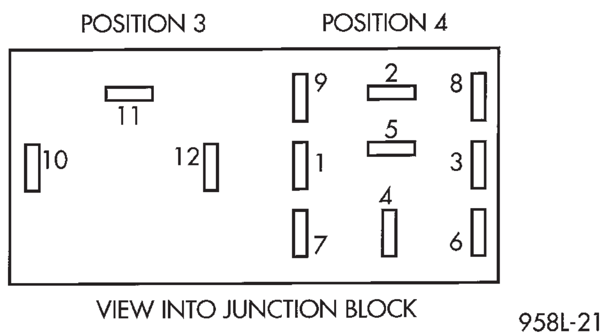

Fig. 1 Junction Block Terminal PINS

SYSTEM FUNCTION

The combination-flasher/DRL may be operated in its hazard warning mode either with or without the ignition circuit being active. However, in order to operate in the turn signal mode or the DRL mode, the ignition circuit must be completed to the module.

While the combination-flasher portion is idle, there is no current drawn through the module. The device does not become active in the turn signal or hazard warning modes until a signal ground circuit is supplied to either of the turn signal inputs or the hazard warning input. With the ignition OFF, there is no current drawn through the module.

While the ignition is ON, the front turn signal filaments are illuminated steadily thus providing the DRL function. The DRL function may be inhibited by applying a signal ground input from either the park brake circuit or the headlamp relay activation circuit.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

When a vehicle experiences problems with the headlamp system, verify the condition of the battery connections, charging system, headlamp bulbs, wire connectors, relay, high beam dimmer switch and headlamp switch. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.

DIAGNOSIS AND TESTING (Continued)

HEADLAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF	1. Loose or corroded battery cables. 2. Loose or worn generator drive belt. 3. Charging system output too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground. 7. Low beam headlamp / foglamp fuse blown.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace generator drive belt. 3. Test and repair charging system. Refer to Group 8A. 4. Test battery state-of -charge. Refer to Group 8A. 5. Load test battery. Refer to Group 8A. 6. Test for voltage drop across Z1-ground locations. Refer to Group 8W. 7. Locate cause of blown fuse and repair.
HEADLAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system. Refer to Group 8A. 2. Inspect and repair all connectors and splices. Refer to Group 8W.
HEADLAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low. 2. Poor lighting circuit Z1-ground. 3. High resistance in headlamp circuit. 4. Low beam headlamp / fog lamp fuse blown.	1. Test and repair charging system. Refer to Group 8A. 2. Test for voltage drop across Z1-ground locations. Refer to Group 8W. 3. Test amperage draw of headlamp circuit. 4. Locate cause of blown fuse and repair.
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground. 2. High resistance in headlamp circuit. 3. Loose or corroded terminals or splices in circuit.	1. Test for voltage drop across Z1-ground locations, refer to Group 8W. 2. Test amperage draw of headlamp circuit. 3. Inspect and repair all connectors and splices. Refer to Group 8W.
HEADLAMPS DO NOT ILLUMINATE	1. No voltage to headlamps. 2. No Z1-ground at headlamps. 3. Faulty headlamp switch. 4. Faulty headlamp dimmer (multi-function) switch. 5. Broken connector terminal or wire splice in headlamp circuit. 6. Defective or burned out bulb. 7. Body controller malfunction.	1. Repair open headlamp circuit. Refer to Group 8W. 2. Repair circuit ground. Refer to Group 8W. 3. Replace headlamp switch. 4. Replace multi-function switch. 5. Repair connector terminal or wire splice. 6. Replace bulb. 7. Refer to appropriate body controller diagnostics.

DIAGNOSIS AND TESTING (Continued)

FOG LAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables. 2. Loose or worn generator drive belt. 3. Charging system output too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace generator drive belt. 3. Test and repair charging system. Refer to Group 8A, 4. Test battery state-of -charge. Refer to Group 8A. 5. Load test battery. Refer to Group 8A. 6. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system. Refer to Group 8A. 2. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low. 2. Poor lighting circuit Z1-ground. 3. High resistance in fog lamp circuit.	1. Test and repair charging system. Refer to Group 8A. 2. Test for voltage drop across Z1-ground locations. Refer to Group 8W. 3. Test amperage draw of fog lamp circuit.
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground. 2. High resistance in fog lamp circuit. 3. Faulty fog lamp switch. 4. Loose or corroded terminals or splices in circuit.	1. Test for voltage drop across Z1-ground locations. Refer to Group 8W. 2. Test amperage draw of fog lamp circuit. 3. Replace fog lamp switch. 4. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamp. 2. No Z1-ground at fog lamps. 3. Faulty fog lamp switch. 4. Broken connector terminal or wire splice in fog lamp circuit. 5. Defective or burned out bulb.	1. Replace fuse. Refer to Group 8W. 2. Repair circuit ground. Refer to Group 8W. 3. Replace fog lamp switch. 4. Repair connector terminal or wire splice. 5. Replace bulb.

HEADLAMP ALIGNMENT

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GENERAL INFORMATION

HEADLAMP ALIGNMENT

The headlamps are equipped with a bubble level for up/down headlamp alignment. The bubble is centered with the vehicle on a level surface. A horizontal gauge and magnifying window is located next to the bubble level for left/right alignment (Fig. 1). Aim on every headlamp assembly is calibrated at the headlamp manufacturer. At the vehicle assembly plant, the vertical aim is set by centering the bubble with the vehicle on a level surface. Horizontal aim is controlled by the mounting pads on each headlamp mounting panel.

When the vehicle is to be used with a heavy load, the bubble level can be used to compensate for the altered ride height.

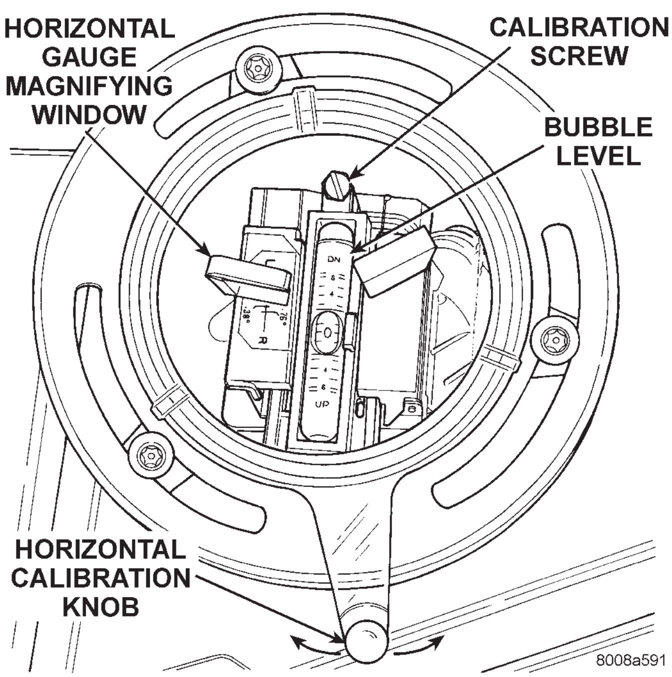

Fig. 1 Magnifying Window and Bubble Level

SERVICE PROCEDURES

HEADLAMP ALIGNMENT PREPARATION

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Inspect and correct damaged or defective components that could interfere with proper headlamp alignment.

(3) Verify proper tire inflation.

(4) Clean headlamp lenses.

(5) Verify that luggage area is loaded as the vehicle is routinely used.

(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.

ADJUSTMENTS

HEADLAMP/FOG LAMP ADJUSTMENT USING ALIGNMENT SCREEN

ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft.) away from front of headlamp lens (Fig. 2).

(2) If necessary, tape a line on the floor 7.62 meters (25 ft.) away from and parallel to the wall.

(3) From the floor up 1.27 meters (5 ft.), tape a line on the wall at the center line of the vehicle. Sight along the center line of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.

(4) Rock vehicle side-to-side three times and 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 line for up/down adjustment reference.

(7) Measure distance from the center line of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each

ADJUSTMENTS (Continued)

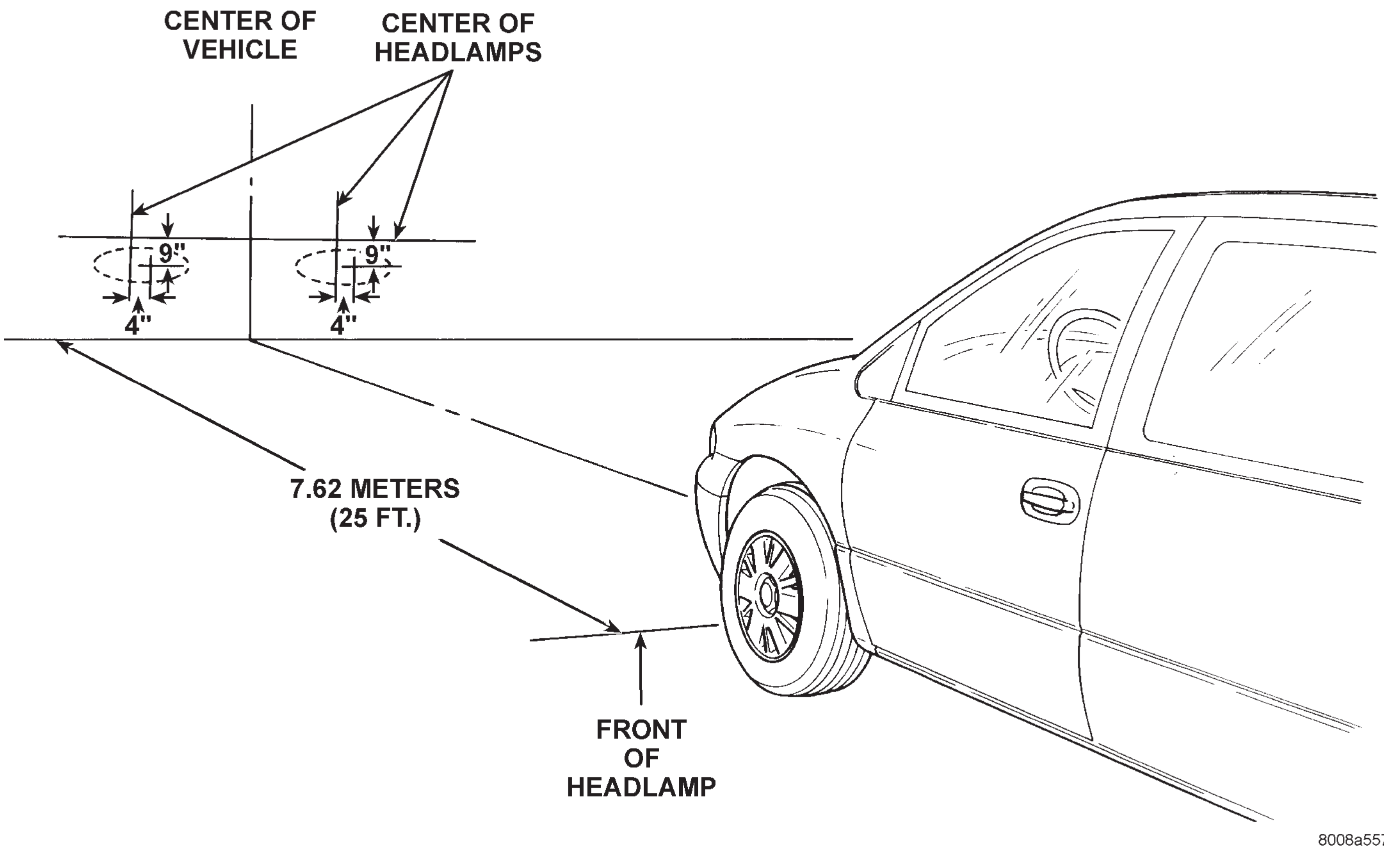

Fig. 2 Headlamp Alignment Screen

side of vehicle center line. Use these lines for left/right adjustment reference.

HEADLAMP ADJUSTMENT

A properly aimed low beam headlamp will project the center of the low beam hot spot on the alignment screen 229 mm (9 in.) ± 50 mm (2 in.) below the headlamp center line. The center of the hot spot should be 100 mm (4 in.) ± 50 mm (2 in.) right of the headlamp center line (Fig. 2). The high beams on a vehicle with aero headlamps cannot be aligned. The high beam pattern should be correct when the low beams are aligned properly.

To adjust headlamp alignment, rotate adjusting screws to achieve the specified low beam hot spot location (Fig. 3).

HEADLAMP ADJUSTMENT – TOWN AND COUNTRY

A properly aimed low beam headlamp will project the center of the low beam hot spot on the alignment screen 152 mm (6 in.) ± 50 mm (2 in.) below the headlamp center line. The center of the hot spot should be 254 mm (10 in.) ± 50 mm (2 in.) right of the headlamp center line (Fig. 4). The high beams on a vehicle with aero headlamps cannot be aligned. The high beam pattern should be correct when the low beams are aligned properly.

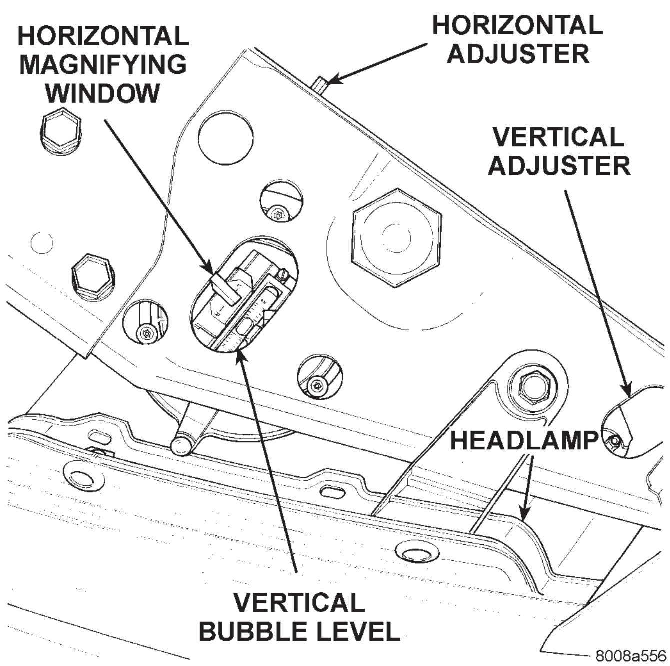

Fig. 3 Headlamp Bubble Level and Adjusters

ADJUSTMENTS (Continued)

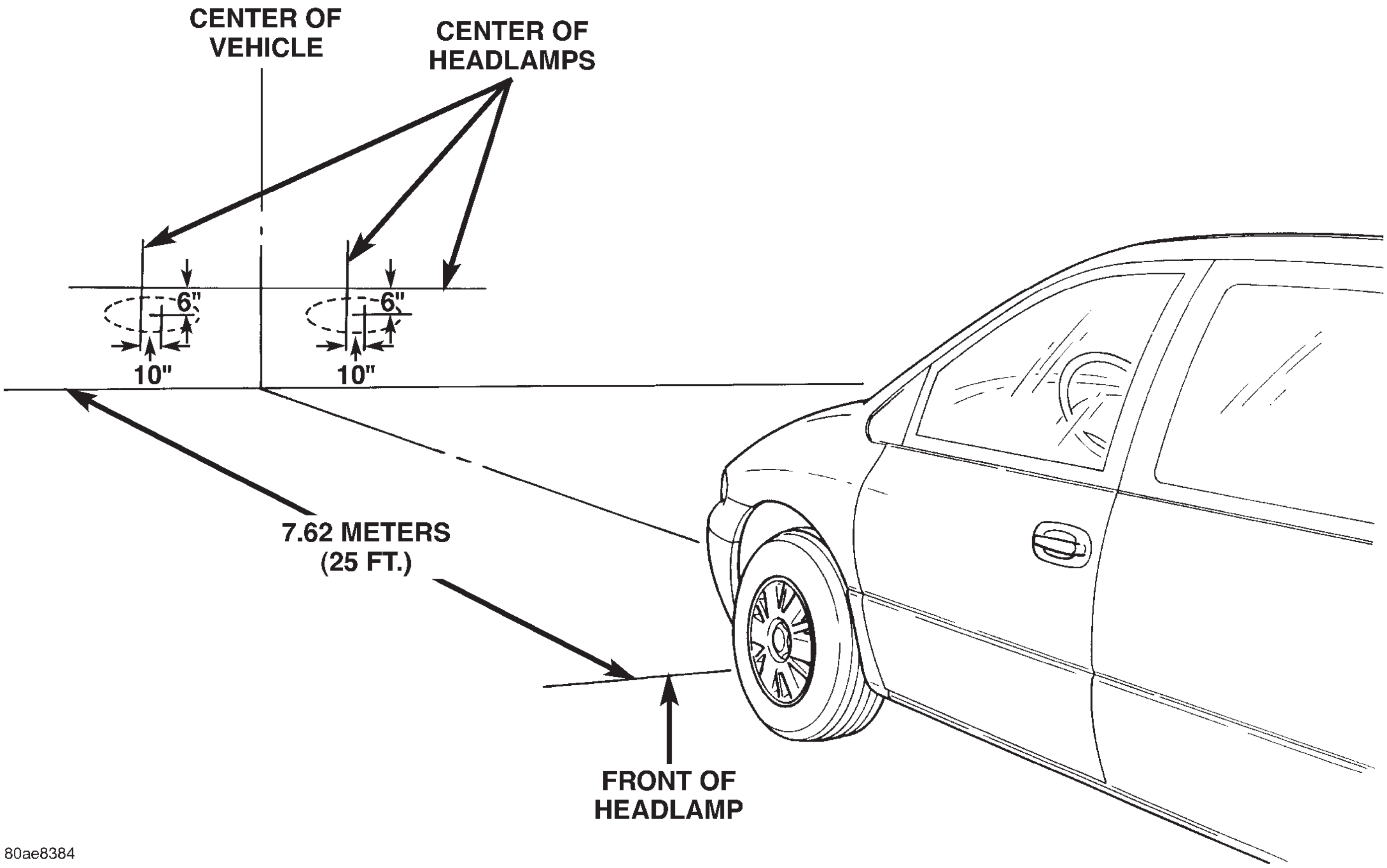

Fig. 4 Headlamp Alignment Screen – T&C

To adjust headlamp alignment, rotate adjusting screws to achieve the specified low beam hot spot location (Fig. 3).

BUBBLE LEVEL CALIBRATION (VERTICAL AIM)

After the headlamp alignment has been verified or set and the bubble level is not centered, calibrate the bubble level.

NOTE: Any calibration of the headlamp bubble level must be done on a level surface and the headlamp cool. Do not operate the headlamps for a minimum of 20 minutes prior to beginning adjustments.

(1) Remove screws holding magnifying window to top of headlamp module (Fig. 5).

(2) Position magnifying window to the side between headlamp module and radiator closure panel.

(3) Through slotted hole in magnifying window, insert small screw driver into bubble level calibration screw.

(4) Rotate calibration screw in proper direction until bubble is centered on the “O”.

(5) Install magnifying window, making sure O-ring seal is in place.

(6) If necessary, calibrate magnifying window.

MAGNIFYING WINDOW CALIBRATION (HORIZONTAL AIM)

After the headlamp alignment has been verified or set and the magnifying window is not centered, calibrate the magnifying window.

(1) Loosen screws holding magnifying window to top of headlamp module (Fig. 5).

(2) Using the calibration knob above headlamp lens, rotate magnifying window until window is centered over the “O” on the gauge below the window.

ADJUSTMENTS (Continued)

(3) Tighten screws to hold magnifying window to headlamp module. Do not over tighten.

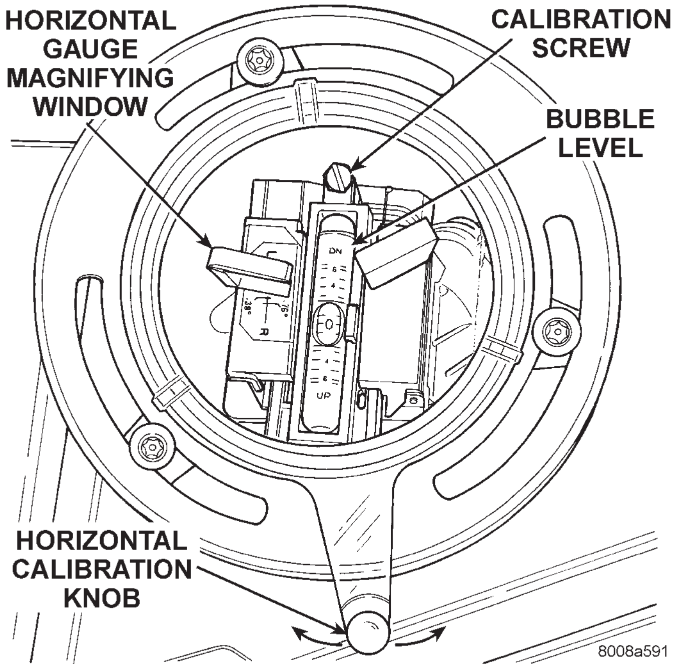

Fig. 5 Magnifying Window and Bubble Level Calibration

FOG LAMP ALIGNMENT

Prepare an alignment screen. Refer to the Alignment Screen Preparation paragraph in this section. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp center line and straight ahead (Fig. 6). To improve visual interpretation of the fog lamp pattern on the alignment screen, disable the headlamps by disengaging the wire connectors from the headlamp bulbs.

The Town and Country fog lamp adjustment screw is located through the lens (Fig. 7).

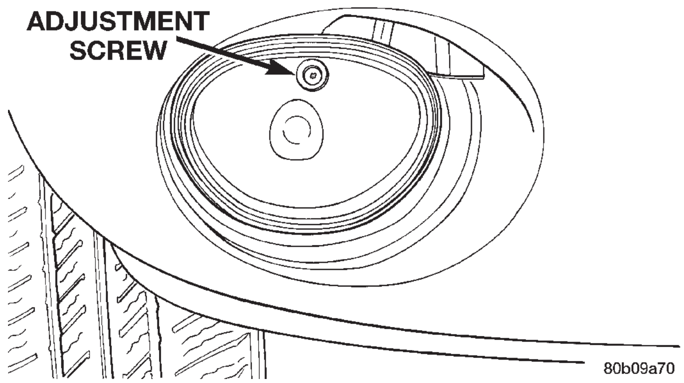

Fig. 7 Fog Lamp Adjustment Screw

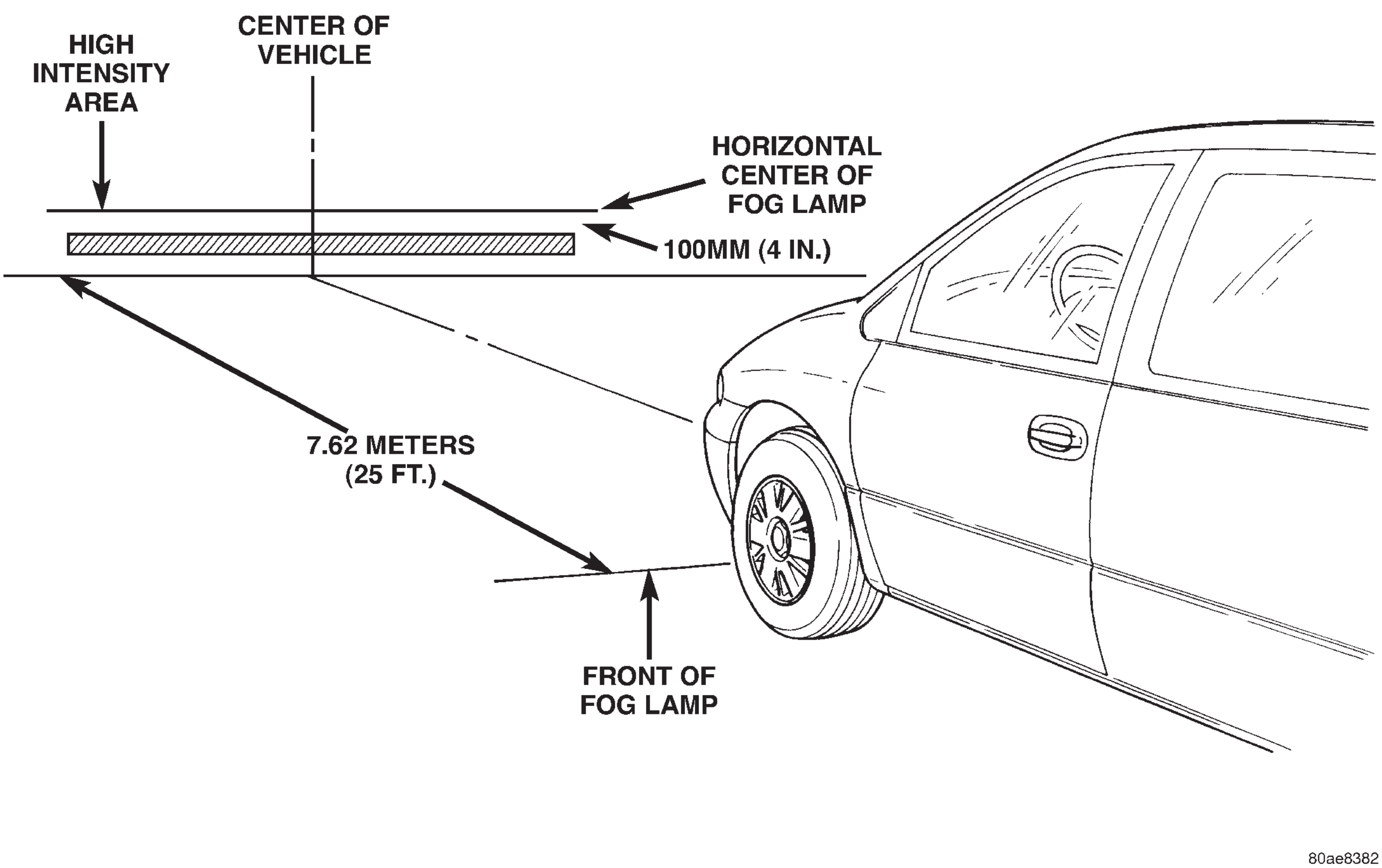

Fig. 6 Fog Lamp Alignment

EXTERIOR LAMP BULB SERVICE

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REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

(1) Release hood latch and open hood.
(2) From behind radiator closure panel, disconnect wire connector from back of headlamp bulb base.
(3) Rotate headlamp bulb retaining ring counter-clockwise.
(4) Remove retaining ring from headlamp (Fig. 1).
(5) Pull headlamp bulb from back of headlamp.

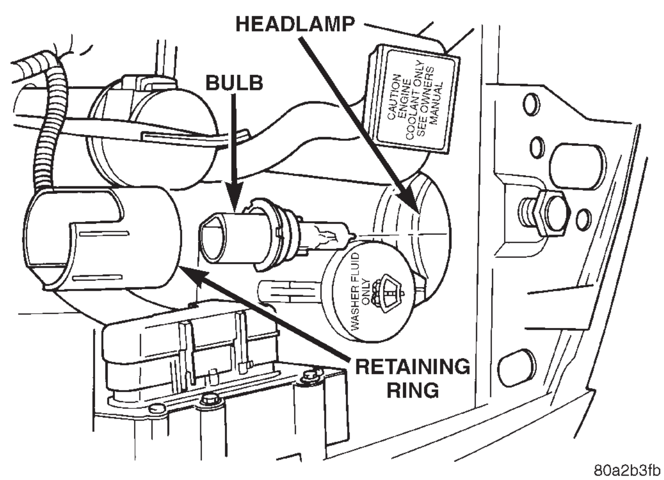

Fig. 1 Headlamp Bulb

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

(1) From behind radiator closure panel, insert headlamp bulb into back of headlamp.
(2) Engage retaining ring onto headlamp (Fig. 1).
(3) Rotate headlamp bulb retaining ring clockwise.
(4) Connect wire connector into headlamp bulb base.
(5) Verify headlamp alignment.

HEADLAMP BULB – TOWN & COUNTRY

HEADLAMP HIGH BEAM

REMOVAL

(1) Release hood latch and open hood.
(2) From behind radiator closure panel, disconnect wire connector from back of high headlamp bulb base.
(3) Rotate headlamp bulb counterclockwise and pull bulb from back of headlamp module (Fig. 2).

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

(1) Insert bulb into the back of the headlamp module.
(2) Rotate headlamp bulb clockwise to engage bulb.
(3) Connect wire connector to the low beam headlamp. Verify headlamp bulb operation
(4) Verify headlamp alignment.

HEADLAMP LOW BEAM

REMOVAL

(1) Release hood latch and open hood.
(2) Remove the three headlamp mounting nuts.
(3) Remove one attaching screw on top of the crossmember.
(4) Disconnect wire connector from the back of the low beam headlamp bulb base (Fig. 4).

REMOVAL AND INSTALLATION (Continued)

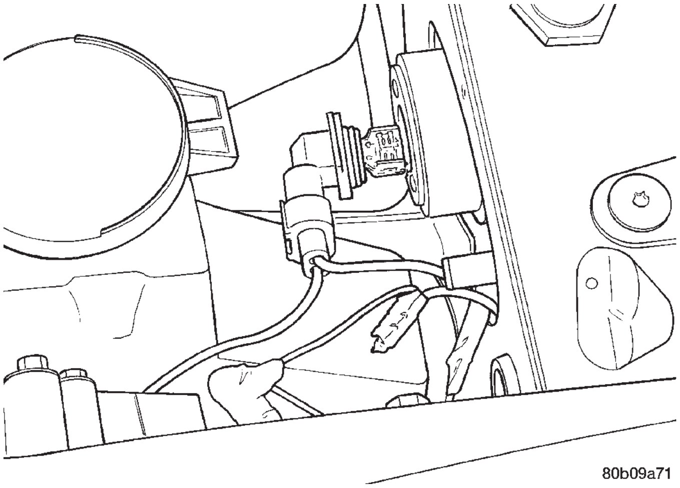

Fig. 2 Headlamp High Beam Bulb – T&C

(5) Rotate headlamp bulb retainer counterclockwise and disengage retainer from headlamp (Fig. 3).

(6) Pull headlamp bulb from back of the headlamp module.

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

(1) Place headlamp bulb into headlamp module.

(2) Rotate headlamp bulb retainer clockwise to engage retainer.

(3) Connect wire connector to the low beam headlamp. Verify headlamp bulb operation

(4) Install the headlamp module.

(5) Verify headlamp alignment.

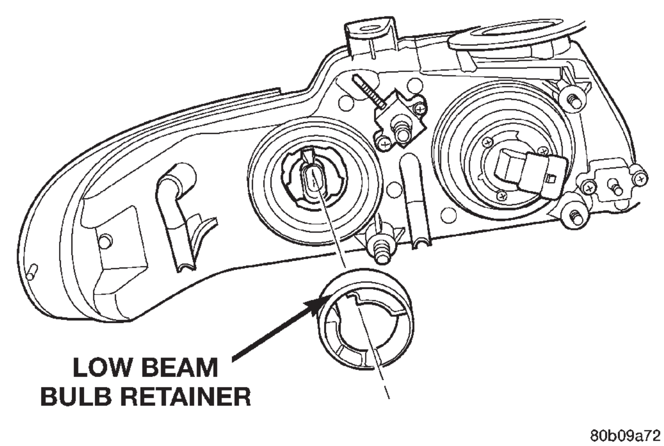

Fig. 3 Low Beam Headlamp Retainer

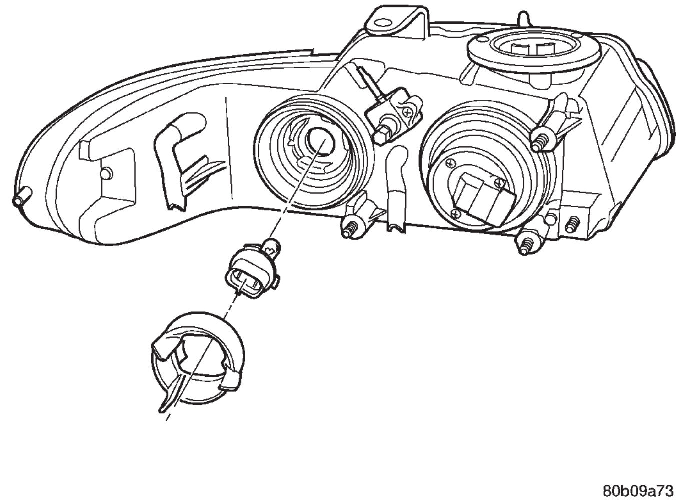

Fig. 4 Headlamp Low Beam Bulb – T&C

FOG LAMP BULB

REMOVAL

(1) Remove fog lamp from vehicle.

(2) Remove rear cover from fog lamp.

(3) Disengage wire clip holding bulb in fog lamp (Fig. 5).

(4) Hinge wire retainer clip out of bulb removal path.

(5) Pull bulb from lamp.

(6) Disconnect wire connector from fog lamp wire harness.

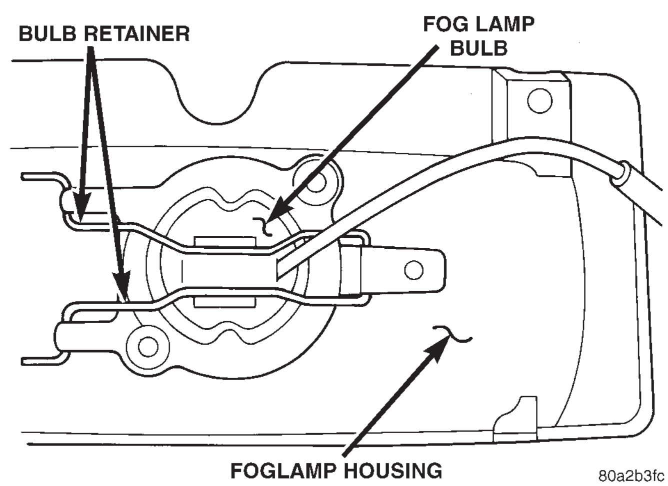

Fig. 5 Fog Lamp Bulb

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other oily surfaces, reduced bulb life will result.

REMOVAL AND INSTALLATION (Continued)

(1) Connect wire connector into fog lamp wire harness.

(2) Insert bulb into lamp so index notches on bulb engage with bosses in lamp (Fig. 5).

(3) Hinge wire retainer clip over bulb base.

(4) Engage wire clip to hold bulb into lamp.

(5) Install rear cover on fog lamp.

(6) Install fog lamp on vehicle.

FOG LAMP BULB – TOWN and COUNTRY

REMOVAL

(1) Reach behind fascia and remove bulb by rotating counterclockwise (Fig. 6).

(2) Rotate lamp bulb counterclockwise to disengage bulb.

(3) Disconnect the wire connector from fog lamp bulb base.

(4) Replace bulb.

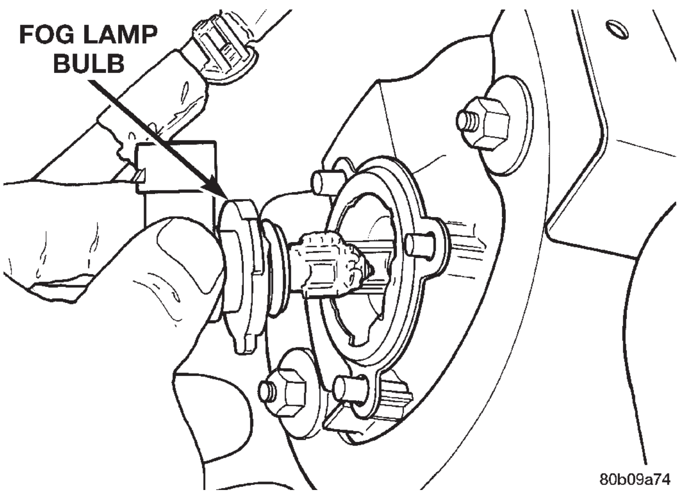

Fig. 6 Fog Lamp Bulb – T&C

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other oily surfaces, reduced bulb life will result.

(1) Connect wire connector into fog lamp bulb base.

(2) Insert bulb into fog lamp housing.

(3) Rotate lamp bulb clockwise to engage bulb.

(4) Verify bulb operation.

(5) Verify fog lamp alignment.

FRONT SIDE MARKER LAMP BULB TOWN and COUNTRY

REMOVAL

(1) Remove screw attaching side marker lamp to fascia.

(2) Remove housing by pulling rearward and away from fascia (Fig. 7).

(3) Rotate lamp socket counterclockwise one quarter turn.

(4) Pull bulb socket from the rear of lamp (Fig. 8).

(5) Pull bulb from socket.

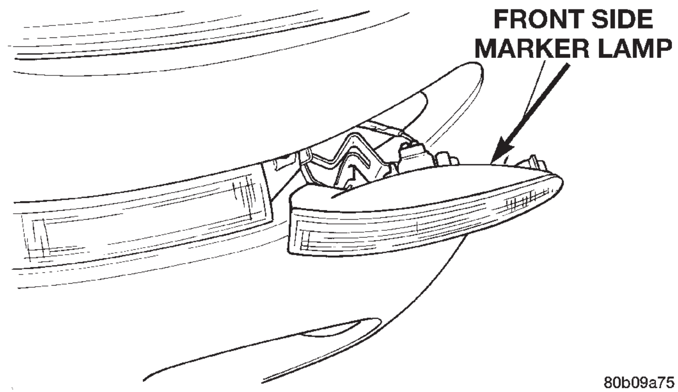

Fig. 7 Front Side Marker Lamp Bulb – T&C

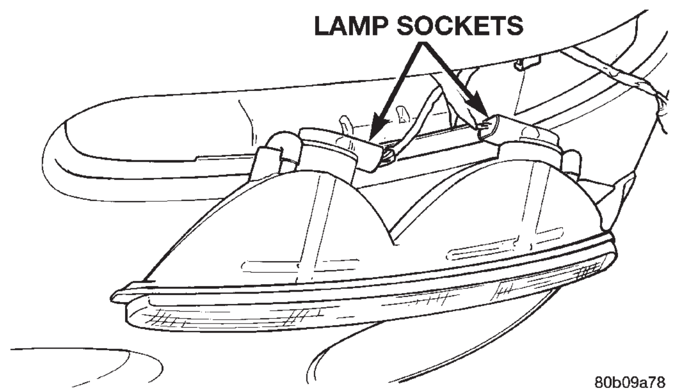

Fig. 8 Front Side Marker Lamp Sockets

INSTALLATION

(1) Insert bulb into socket.

(2) Insert bulb socket into rear of housing.

(3) Rotate park and turn signal socket clockwise one quarter turn.

(4) Verify bulb operation.

(5) Install screw attaching side marker lamp.

PARKING AND TURN SIGNAL BULB

REMOVAL

(1) From under front wheelhouse, remove access cover behind parking and turn signal lamp.

(2) Through access hole in wheelhouse, rotate parking and turn signal socket counterclockwise one quarter turn.

(3) Pull socket from back of lamp (Fig. 9).

(4) Pull bulb from socket.

INSTALLATION

(1) Align key on bulb base to groove in socket and insert bulb into socket.

REMOVAL AND INSTALLATION (Continued)

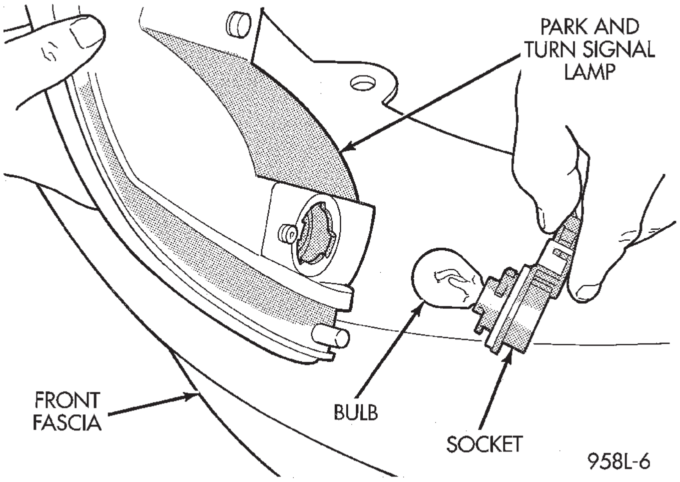

Fig. 9 Parking and Turn Signal Lamp Bulb

(2) Through access hole in wheelhouse, insert socket into back of lamp.

(3) Rotate parking and turn signal socket clockwise one quarter turn.

(4) Install access cover and verify lamp operation.

FRONT PARKING AND TURN SIGNAL LAMP BULB – TOWN and COUNTRY

REMOVAL

(1) Remove screw attaching side marker lamp to fascia.

(2) Remove housing by pulling outward and away from the fascia (Fig. 10).

(3) Remove screw attaching parking and turn signal lamp housing.

(4) Rotate lamp socket(s) counterclockwise one quarter turn (Fig. 11).

(5) Pull bulb socket(s).

(6) Pull bulb from socket(s).

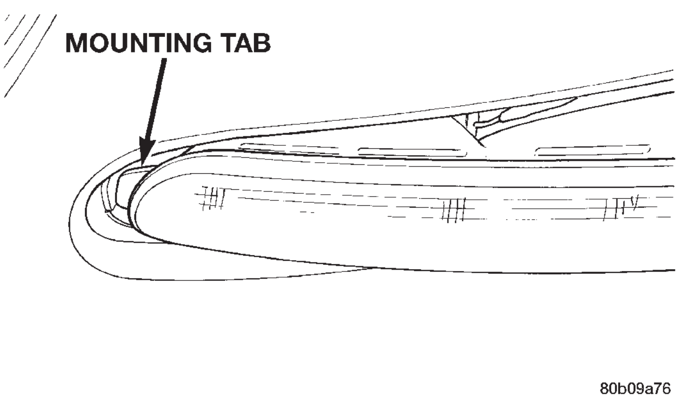

Fig. 10 Front Parking and Turn Signal Lamp – T&C

INSTALLATION

(1) Insert bulb into socket.

(2) Insert bulb socket into housing.

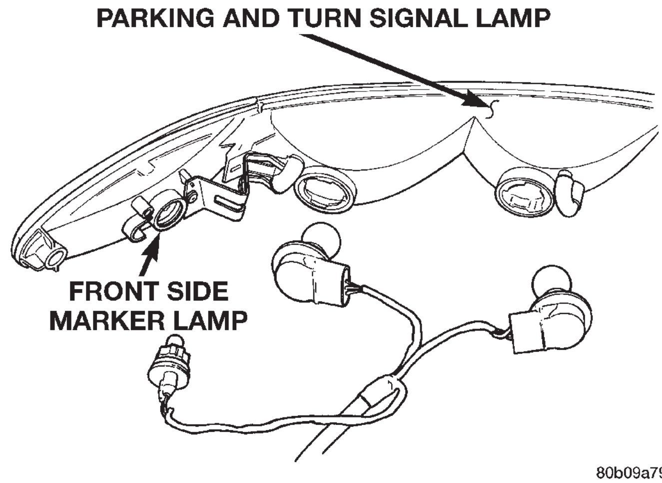

Fig. 11 Front Parking and Turn Signal Lamp Bulb(s) – T&C

(3) Rotate parking and turn signal socket clockwise one quarter turn.

(4) Verify bulb(s) operation.

(5) Install screw attaching parking and turn signal lamp housing.

(6) Install screw attaching side marker lamp.

TAIL, STOP, TURN SIGNAL AND BACK-UP LAMP BULB

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove screws holding tail, stop, turn signal and back-up lamp to rear door opening trough.

(3) Remove inner end of lamp from quarter panel.

(4) Disengage hook holding outer end of lamp to quarter panel opening.

(5) Remove lamp from quarter panel.

(6) Rotate lamp socket counterclockwise one quarter turn (Fig. 12).

(7) Pull socket from back of lamp.

(8) Pull bulb from socket (Fig. 13).

INSTALLATION

(1) Align key on bulb base to groove in socket and insert bulb into socket (Fig. 13).

(2) Insert socket into back of lamp.

(3) Rotate lamp socket clockwise one quarter turn.

(4) Engage hook to hold outer end of lamp to quarter panel opening.

(5) Place lamp in position on quarter panel.

(6) Install screws to hold lamp to rear door opening trough.

(7) Verify tail, stop, turn signal and back-up lamp operation.

REMOVAL AND INSTALLATION (Continued)

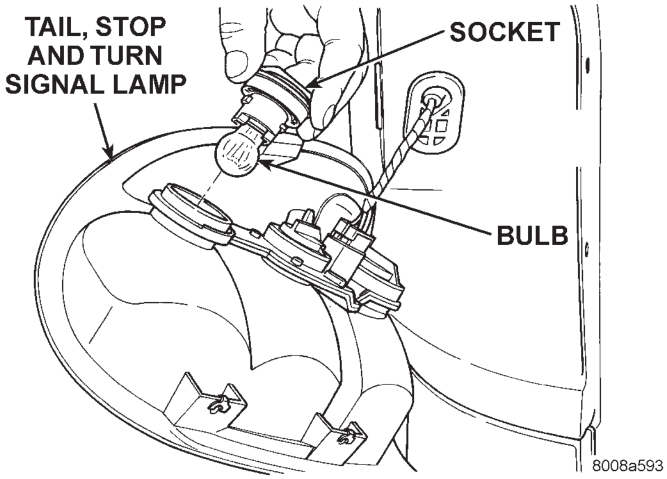

Fig. 12 Tail, Stop, Turn Signal and Back-up Lamp Bulb

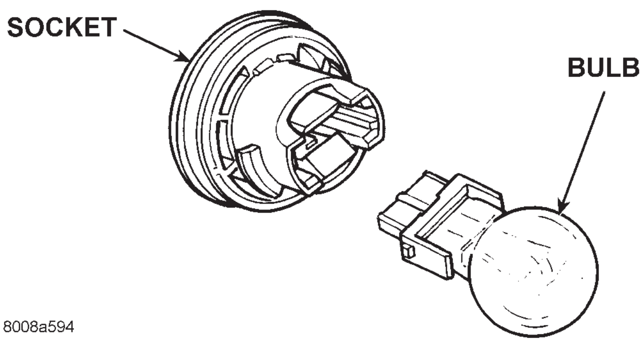

Fig. 13 Pull Bulb From Socket

LICENSE PLATE LAMP BULB

REMOVAL

(1) Remove screws attaching license plate lamp lens to liftgate.

(2) Remove license plate lamp lens from lamp.

(3) Rotate lamp socket counterclockwise one quarter turn.

(4) Pull socket from lens (Fig. 14).

(5) Pull bulb from socket.

INSTALLATION

(1) Install bulb into socket.

(2) Insert socket into lens.

(3) Rotate lamp socket clockwise one quarter turn.

(4) Place license plate lamp lens in position in lamp.

(5) Install screws attaching license plate lamp lens.

(6) Verify license plate lamp operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Release liftgate latch and open liftgate.

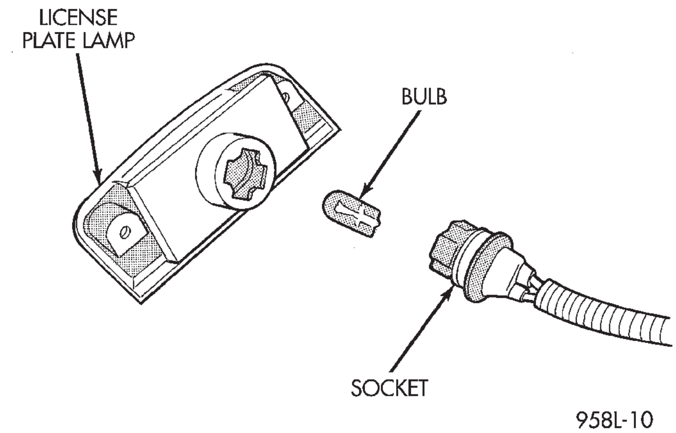

Fig. 14 License Plate Lamp Bulb

(2) Disengage clips holding CHMSL access trim cover to liftgate.

(3) Remove trim cover from liftgate.

(4) Rotate bulb socket counterclockwise one quarter turn.

(5) Pull socket from lamp (Fig. 15).

(6) Pull bulb from socket.

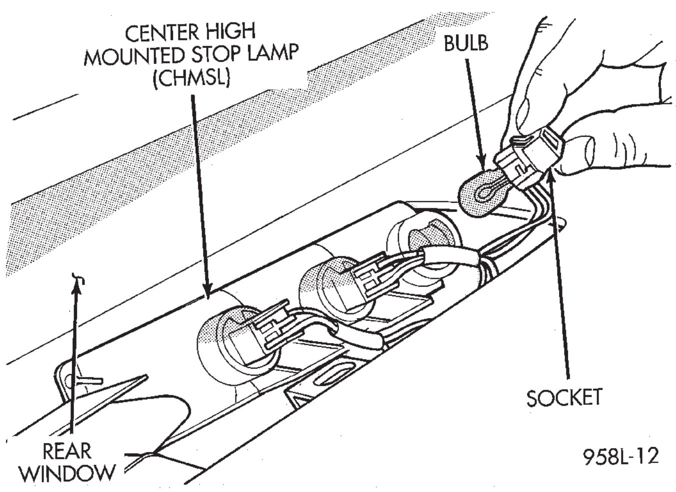

Fig. 15 CHMSL Bulb

INSTALLATION

(1) Insert bulb into socket.

(2) Insert socket into lamp.

(3) Rotate bulb socket clockwise one quarter turn.

(4) Place CHMSL access trim cover in position on liftgate.

(5) Engage clips to hold access cover to liftgate.

(6) Verify CHMSL operation.

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GENERAL INFORMATION

HEADLAMP MODULE

Minor amounts of fogging may occur around the edges of the headlamp lens when exposed to humid conditions. This is considered normal. The fogging will dissipate with increased ambient temperature or headlamp usage.

HEADLAMP SWITCH

Service procedures for the headlamp switch can be found in Group 8E, Instrument Panel and Gauges. More information can be found in Group 8W, Wiring Diagrams.

HEADLAMP DIMMER SWITCH

The headlamp dimmer switch is incorporated into the multi-function (turn signal) switch. Proper procedures can be found in Group 8J, Turn Signal and Flashers. More information can be found in Group 8W, Wiring Diagrams.

REMOVAL AND INSTALLATION

HEADLAMP MODULE

REMOVAL

(1) Release hood latch and open hood.
(2) From inside engine compartment, remove nuts holding headlamp module to radiator closure panel.
(3) Remove screw holding top of module to closure panel.
(4) Remove headlamp module from radiator closure panel (Fig. 1).
(5) Disconnect wire connectors from back of headlamp module.
(6) Separate headlamp module from vehicle.

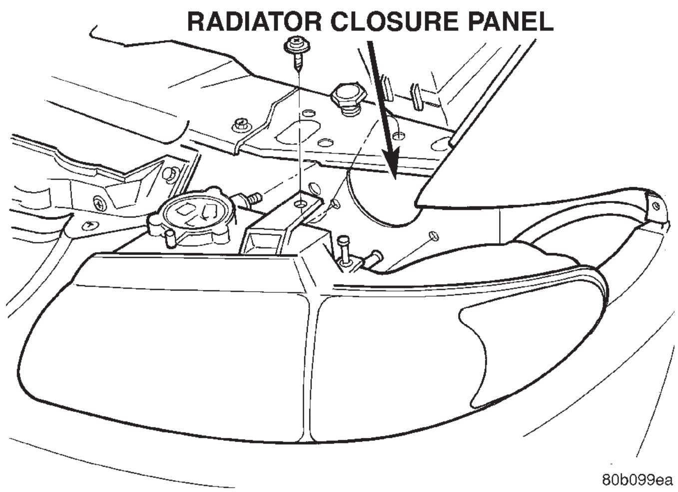

Fig. 1 Headlamp Module – Typical

INSTALLATION

(1) Place headlamp module in position on vehicle.
(2) Connect wire connectors into back of headlamp module.
(3) Place headlamp module in position on radiator closure panel.
(4) Install nuts to hold headlamp module to radiator closure panel.
(5) Install screw to hold top of module to closure panel.
(6) Verify headlamp operation and alignment.

FOG LAMP

REMOVAL

(1) Remove screws holding fog lamp to front bumper fascia (Fig. 2).
(2) Remove fog lamp from fascia.
(3) Disconnect wire connector from body wire harness.
(4) Remove fog lamp from vehicle.

REMOVAL AND INSTALLATION (Continued)

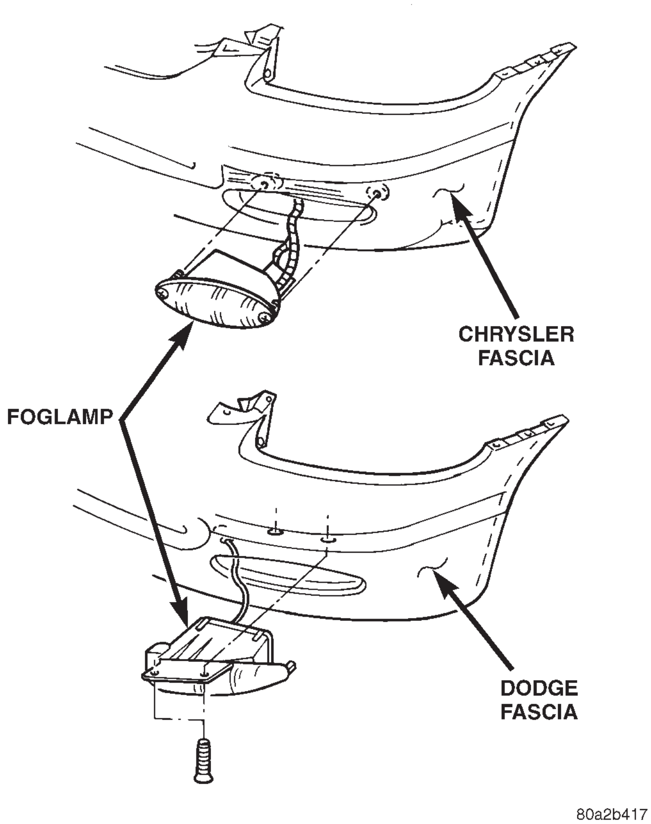

Fig. 2 Fog Lamp

INSTALLATION

(1) Position fog lamp on vehicle.
(2) Connect wire connector to body wire harness.
(3) Install fog lamp into bumper fascia.
(4) Install screws to hold fog lamp to front bumper fascia.

FOG LAMP – TOWN and COUNTRY

REMOVAL

(1) From behind fascia remove nuts attaching fog lamp housing to fascia (Fig. 3).
(2) Remove fog lamp from fascia.
(3) Disconnect wire connector from body wire harness.
(4) Remove fog lamp housing from vehicle.

INSTALLATION

(1) Connect wire connector to body wire harness.
(2) Position fog lamp on vehicle.
(3) Verify fog lamp operation.
(4) Insert fog lamp into bumper fascia.
(5) Install nuts attaching fog lamp to fascia.

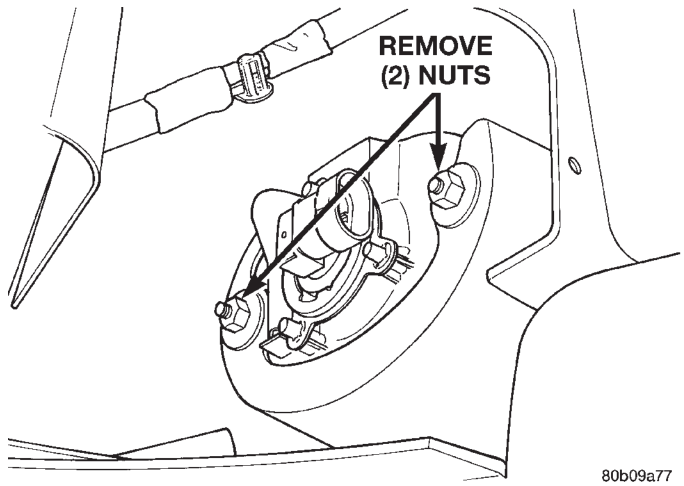

Fig. 3 Fog Lamp Bulb – T&C

FRONT SIDE MARKER LAMP TOWN and COUNTRY

REMOVAL

(1) Remove screw attaching side marker lamp.
(2) Remove housing by pulling rearward and away from fascia (Fig. 7).
(3) Rotate lamp socket counterclockwise one quarter turn.
(4) Pull bulb socket from the rear of lamp (Fig. 4).
(5) Remove side marker housing from vehicle.

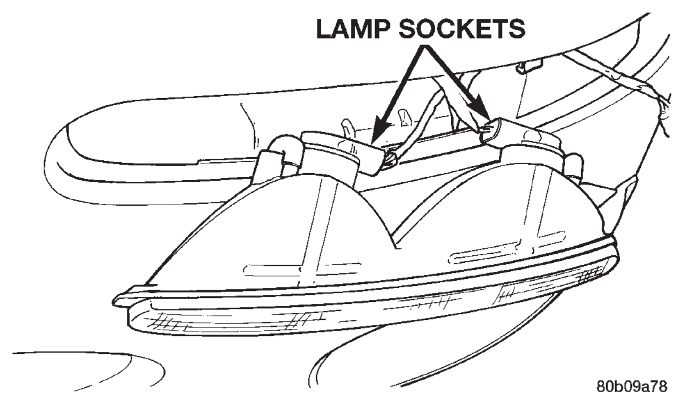

Fig. 4 Front Side Marker Lamp – T&C

INSTALLATION

(1) Insert bulb socket into rear of housing.
(2) Rotate park and turn signal socket clockwise one quarter turn.
(3) Verify bulb(s) operation.
(4) Install screw attaching side marker lamp.

FRONT PARKING AND TURN SIGNAL LAMP – TOWN and COUNTRY

REMOVAL

(1) Remove screw attaching side marker lamp.
(2) Remove housing by pulling outward and away from the fascia (Fig. 10).

REMOVAL AND INSTALLATION (Continued)

(3) Remove screw attaching parking and turn signal lamp housing to fascia.

(4) Rotate lamp socket(s) counterclockwise one quarter turn (Fig. 11).

(5) Pull bulb socket(s).

(6) Remove parking and turn signal lamp housing from vehicle (Fig. 5).

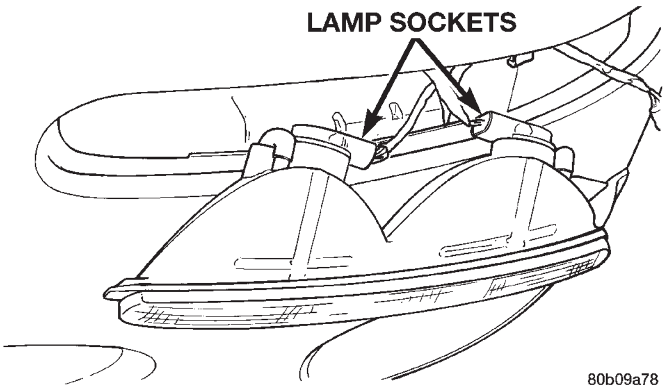

Fig. 5 Parking and Turn Signal Lamp Housing – T&C

INSTALLATION

(1) Insert bulb socket into housing.

(2) Rotate parking and turn signal socket clockwise one quarter turn.

(3) Verify bulb(s) operation.

(4) Install screw attaching parking and turn signal lamp housing.

(5) Install screw attaching side marker lamp.

TAIL, STOP, TURN SIGNAL AND BACK-UP LAMP

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove screws holding tail, stop, turn signal and back-up lamp to rear door opening trough.

(3) Remove inner end of lamp from quarter panel.

(4) Disengage hook holding outer end of lamp to quarter panel opening.

(5) Remove lamp from quarter panel (Fig. 6).

(6) Disconnect positive lock on wire connector (Fig. 7).

(7) Depress lock tab on the side of the body harness connector.

(8) Disconnect wire connector from tail lamp circuit board.

(9) Remove tail lamp from vehicle.

INSTALLATION

(1) Place tail lamp in position on vehicle.

(2) Connect wire connector into tail lamp circuit board.

(3) Connect positive lock on wire connector.

(4) Place lamp in position in position on quarter panel.

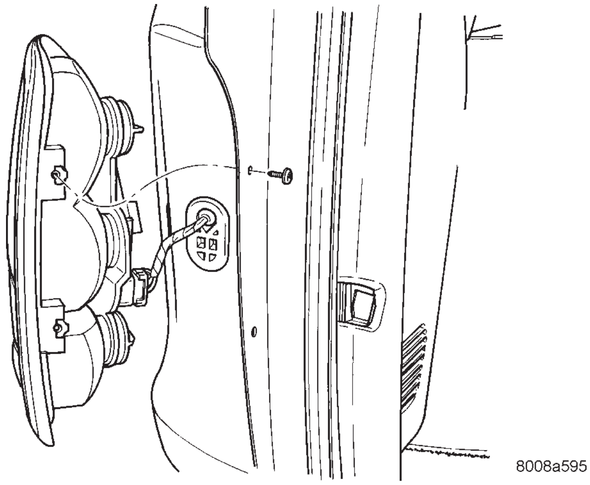

Fig. 6 Tail, Stop, Turn Signal and Back-up Lamp

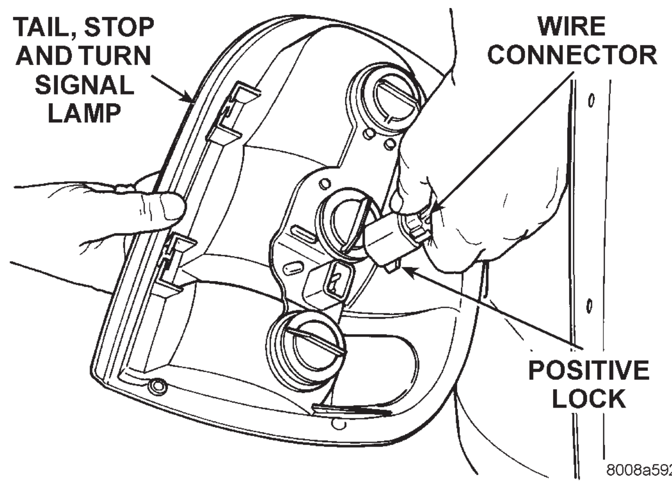

Fig. 7 Tail Lamp Connector

(5) Engage hook to hold outer end of lamp to quarter panel opening.

(6) Position inner end of lamp into quarter panel.

(7) Install screws to hold tail, stop, turn signal and back-up lamp to rear door opening trough.

(8) Verify tail lamp operation.

LICENSE PLATE LAMP

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove liftgate trim panel. Refer to Group 23, Body, for proper procedures.

(3) Remove water shield as necessary to gain access to back of license plate lamp bar.

(4) Disconnect wire connector from liftgate wire harness.

(5) Remove screws holding license plate lamp bar to liftgate.

(6) Remove license plate lamp bar from liftgate (Fig. 8).

(7) Remove license plate lamp bar from vehicle.

REMOVAL AND INSTALLATION (Continued)

NOTE: Wire connector may be disconnected at socket which eliminates removal of liftgate trim.

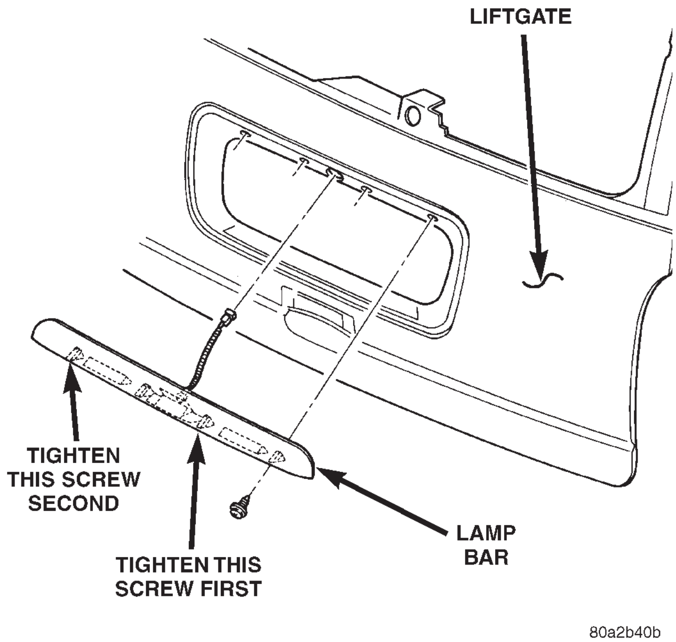

Fig. 8 License Plate Lamp

INSTALLATION

(1) Place license plate lamp bar in position on liftgate.

(2) Install screws to hold license plate lamp bar to liftgate.

(3) Connect wire connector into liftgate wire harness.

(4) Install water shield.

(5) Install liftgate trim panel.

(6) Verify license plate lamp operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Disengage clips holding CHMSL access cover to liftgate.

(3) Remove cover from liftgate.

(4) Rotate bulb sockets counterclockwise one quarter turn.

(5) Pull sockets from lamp.

(6) Remove screws holding CHMSL to liftgate.

(7) Remove CHMSL from vehicle (Fig. 9).

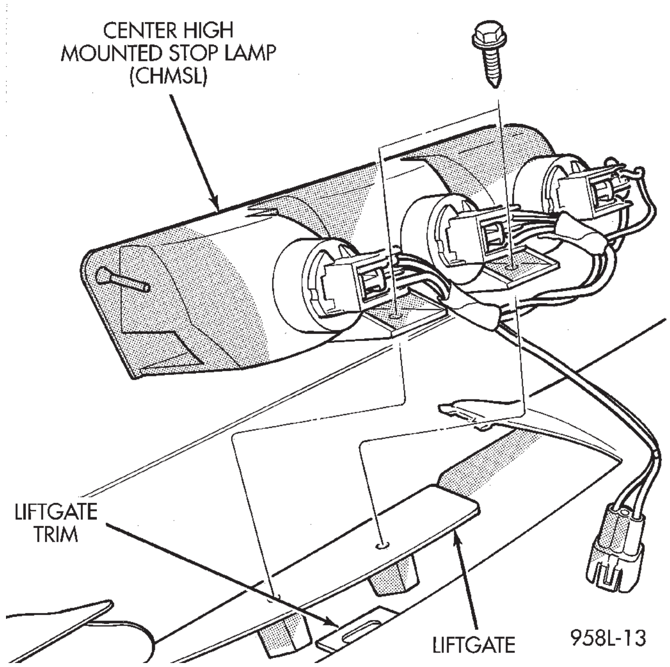

Fig. 9 CHMSL

INSTALLATION

(1) Place CHMSL in position on vehicle.

(2) Install screws to hold CHMSL to liftgate.

(3) Insert bulb into socket.

(4) Insert sockets into lamp.

(5) Rotate bulb sockets clockwise one quarter turn.

(6) Place CHMSL access cover in position on liftgate.

(7) Engage clips to hold access cover to liftgate.

(8) Verify CHMSL operation.

INTERIOR LAMPS

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REMOVAL AND INSTALLATION

OVERHEAD CONSOLE READING/COURTESY LAMP BULB

REMOVAL

(1) Using a trim stick, lightly pry outward the forward end of reading lamp lens.
(2) Rotate reading lamp bulb socket one quarter turn counterclockwise.
(3) Pull socket out of lamp (Fig. 1).
(4) Pull bulb from socket.

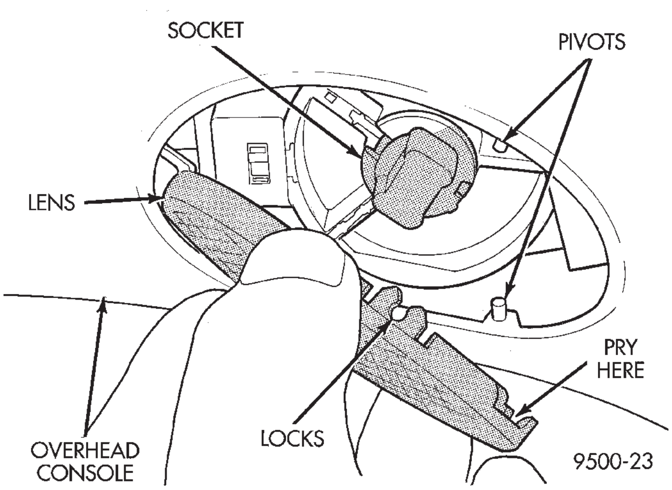

Fig. 1 Reading/Courtesy Lamp

INSTALLATION

(1) Push bulb into socket.
(2) Push socket into lamp.
(3) Rotate reading lamp bulb socket one quarter turn clockwise.
(4) Insert tab on lamp lens between lamp switch and overhead console.
(5) Snap lens onto lamp lens pivots.

HEADER READING/COURTESY LAMP

REMOVAL

(1) Grasp outer edges of header reading/courtesy lamp at headlining.
(2) Pull downward to disengage clips on reading/courtesy lamp from roof header panel (Fig. 2).
(3) Disconnect wire connector from reading/courtesy lamp.
(4) Remove lamp from vehicle.

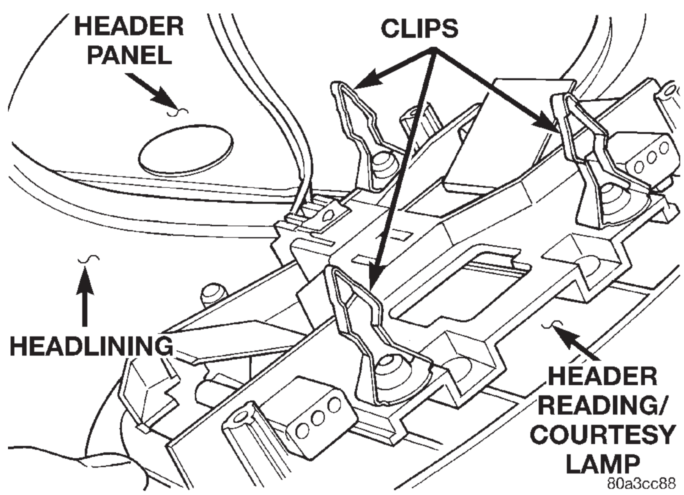

Fig. 2 Header Reading/Courtesy Lamp

INSTALLATION

(1) Position lamp on vehicle.
(2) Connect wire connector to reading/courtesy lamp.
(3) Align clips on reading/courtesy lamp to mating holes in roof header panel.
(4) Push upward to engage clips on reading/courtesy lamp to roof header panel.

REMOVAL AND INSTALLATION (Continued)

HEADER READING/COURTESY LAMP BULB

REMOVAL

(1) Insert a small, flat bladed pry tool at forward position between reading/courtesy lamp lens and lamp housing.

(2) Pry lamp lens from lamp housing (Fig. 3).

(3) Insert a small, flat bladed pry tool between lamp light shield and lamp housing at inboard rear corner of light shield.

(4) Pry light shield from housing (Fig. 4).

(5) Carefully press forward lamp bulb contact toward opposite contact and rotate.

(6) Remove bulb from lamp bulb contacts.

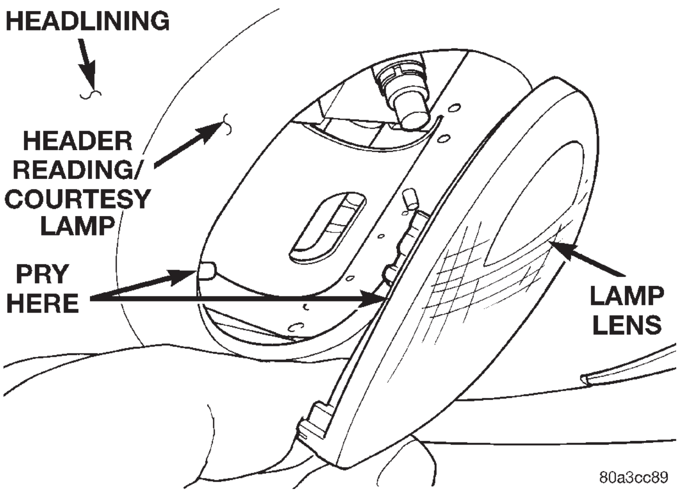

Fig. 3 Reading/Courtesy Lamp Lens

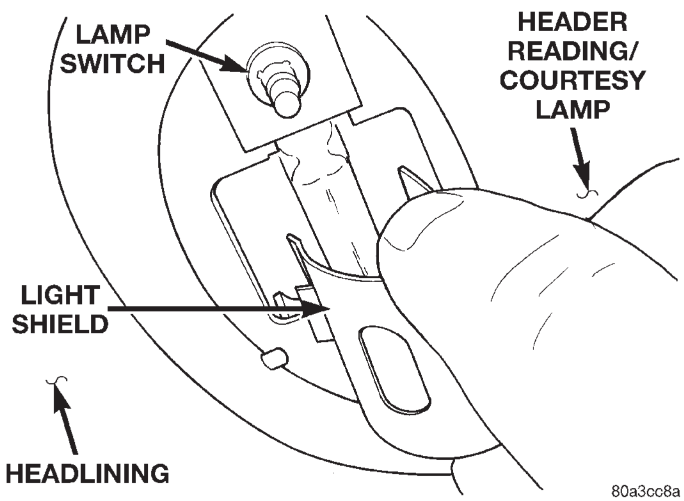

Fig. 4 Reading/Courtesy Lamp Light Shield

INSTALLATION

(1) Carefully press forward lamp bulb contact toward opposite contact and rotate bulb into position.

(2) Position bulb to lamp bulb contacts.

(3) Release lamp bulb contacts.

(4) Insert outer edge of light shield into lamp housing (Fig. 4).

(5) Rotate light shield upward and snap inboard edge into lamp housing.

(6) Position lens switch tab to lamp switch.

(7) Press lens pivots to tabs on lamp housing until both pivots are seated.

GLOVE BOX LAMP AND SWITCH

REMOVAL

(1) Open glove box door.

(2) Using a trim stick, lightly pry glove box lamp/switch from instrument panel.

(3) Disconnect wire connector from glove box lamp (Fig. 5).

(4) Remove glove box lamp from vehicle.

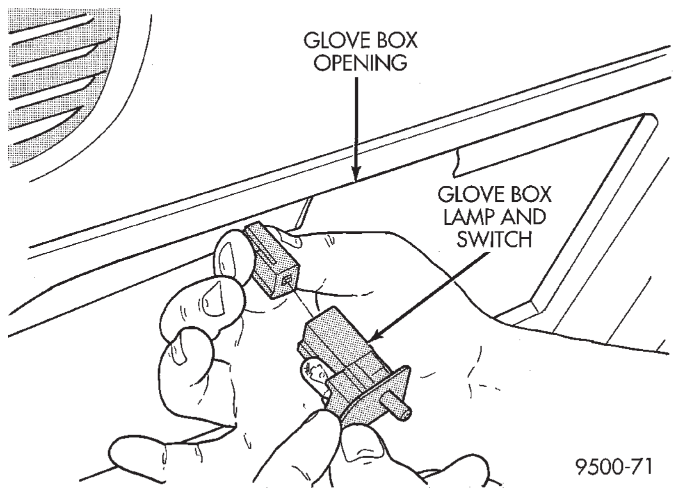

Fig. 5 Glove Box Lamp and Switch

INSTALLATION

(1) Position glove box lamp in vehicle.

(2) Connect wire connector from glove box lamp.

(3) Position glove box lamp in instrument panel.

(4) Press lamp into instrument panel until fully seated.

GLOVE BOX LAMP BULB

REMOVAL

(1) Remove glove box lamp/switch from instrument panel.

(2) Pull bulb from glove box lamp (Fig. 6).

INSTALLATION

(1) Push bulb into glove box lamp.

(2) Install glove box lamp/switch in instrument panel.

IGNITION HALO LAMP BULB

REMOVAL

(1) Remove steering column trim covers. Refer to Group 19, Steering, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

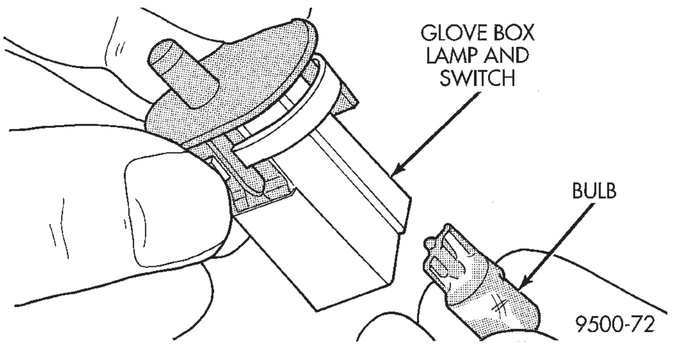

Fig. 6 Glove Box Lamp Bulb

(2) Rotate bulb socket counterclockwise one quarter turn (Fig. 7).

(3) Pull bulb socket from halo lamp.

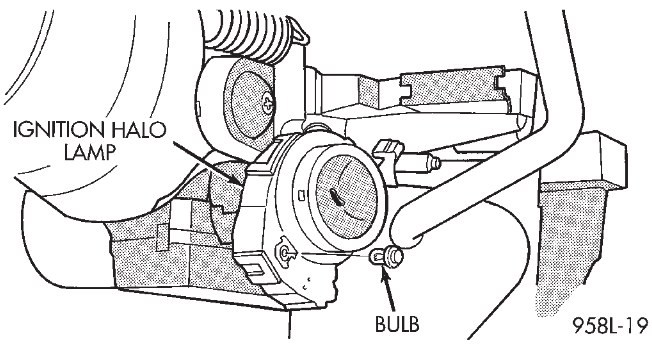

Fig. 7 Ignition Halo Lamp Bulb

INSTALLATION

(1) Push bulb socket into halo lamp.

(2) Rotate bulb socket clockwise one quarter turn.

(3) Install steering column trim covers. Refer to Group 19, Steering, for proper procedures.

CONVENIENCE BIN LAMP

If the lamp is not used refer to (Fig. 8).

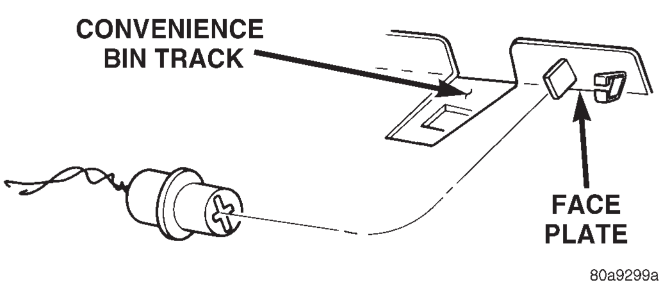

Fig. 8 Wiring for the Convenience Lamp

REMOVAL

(1) Pull out the convenience bin cup holder.

(2) Insert the trim stick between access cover above cup holder and center console.

(3) Carefully pry the access cover from the center console (Fig. 9).

(4) Remove the access cover from the vehicle.

(5) Using needle-nose pliers, carefully squeeze the vertical metal legs of the lamp hood.

(6) Lift the lamp hood upward from the cup holder tray.

(7) Carefully pull the lamp and wiring rearward from the instrument panel (Fig. 10).

(8) Pull the lamp hood from the lamp socket.

(9) Pull bulb from socket.

INSTALLATION

For installation, reverse the above procedures.

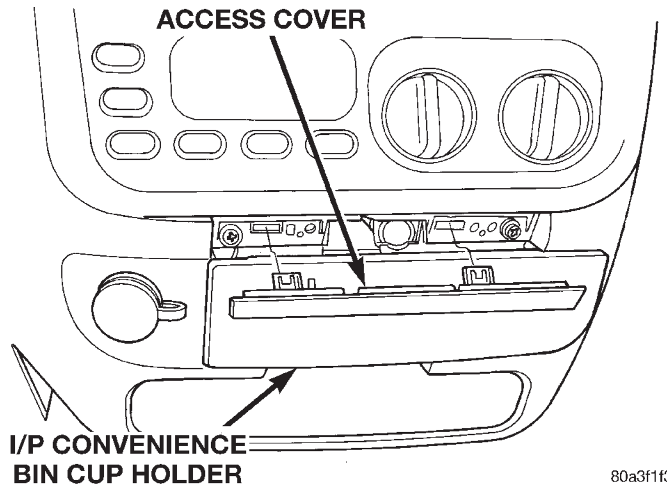

Fig. 9 Convenience Bin Access Cover

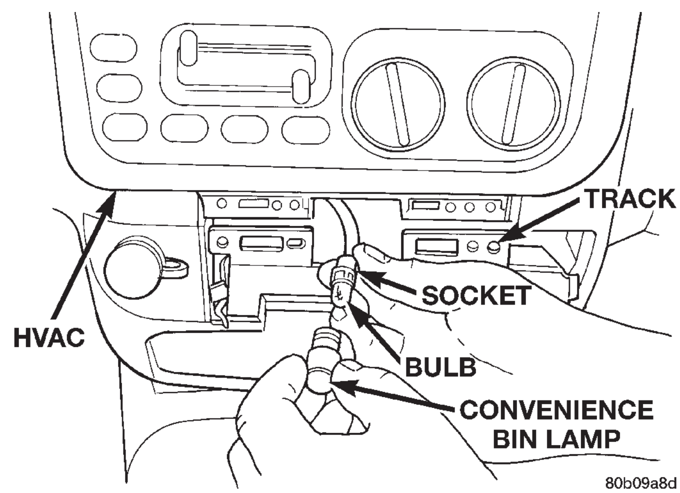

Fig. 10 Convenience Bin Lamp Bulb

INSTRUMENT PANEL LAMPS AND SWITCHES

For replacement of instrument panel lamps and switches, refer to Group 8E, Instrument Panel and Systems.

REMOVAL AND INSTALLATION (Continued)

DOME LAMP

REMOVAL

(1) Insert a small, flat bladed pry tool between dome lamp lens and dome lamp body on left side of dome lamp.

(2) Disengage left side of dome lamp lens from lamp body (Fig. 11).

(3) Pivot dome lamp lens downward until lens hook is clear of headlining.

(4) Slide dome lamp toward right side of vehicle until hook on dome lamp is clear of headlining (Fig. 12).

(5) Remove dome lamp from headlining.

(6) Disconnect wire connector from dome lamp.

(7) Remove dome lamp from vehicle.

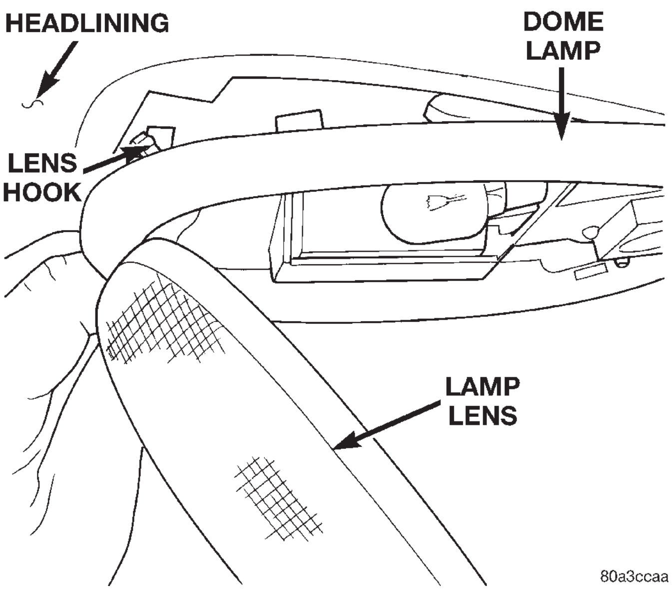

Fig. 11 Dome Lamp Lens

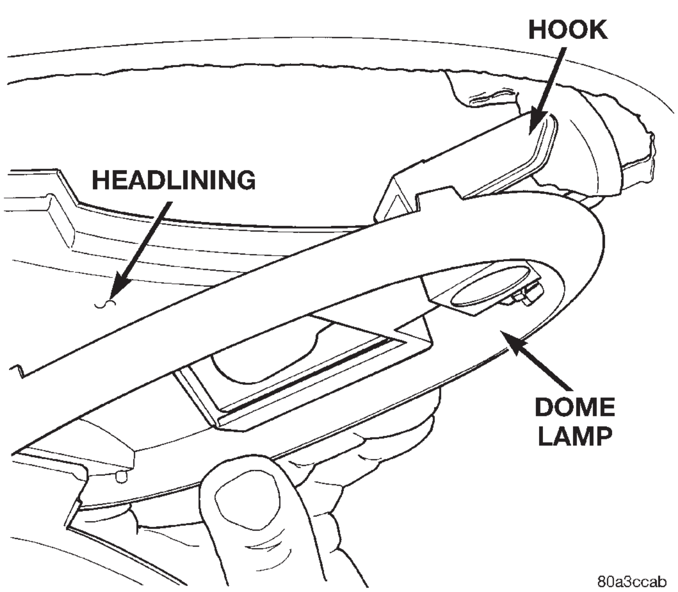

Fig. 12 Dome Lamp Hook

INSTALLATION

(1) Position dome lamp in vehicle.

(2) Connect wire connector to dome lamp.

(3) Position dome lamp to headlining.

(4) Position hook on dome lamp above headlining and slide lamp toward left side of vehicle until hook on dome lamp is fully engaged to headlining.

(5) Push upward on dome lamp until dome lamp is tight to headlining.

(6) Pivot dome lamp lens upward. Verify that lamp lens hook is above the headlining.

(7) Install left side of dome lamp lens to lamp body.

DOME LAMP BULB

REMOVAL

(1) Insert a small, flat bladed pry tool between dome lamp lens and dome lamp body on left side of dome lamp.

(2) Disengage left side of dome lamp lens from lamp body (Fig. 13).

(3) Pull bulb from lamp socket

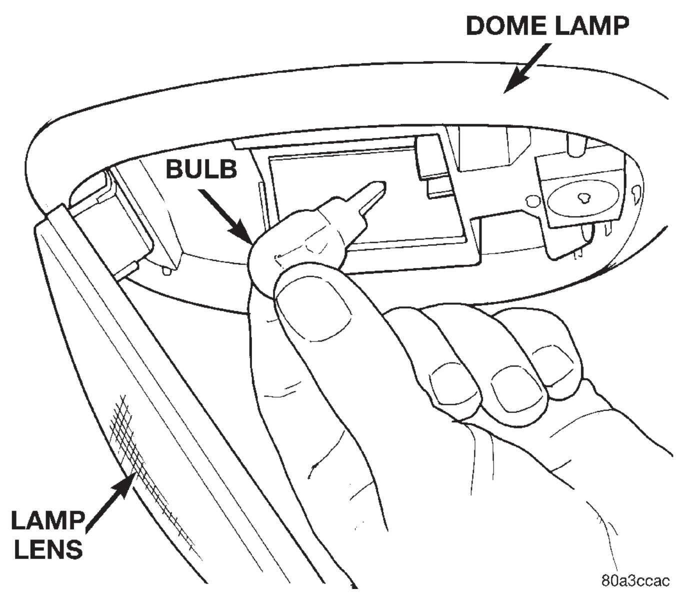

Fig. 13 Dome Lamp Bulb

INSTALLATION

(1) Push bulb into lamp socket.

(2) Pivot dome lamp lens upward. Verify that lamp lens hook is above the headlining.

(3) Engage left side of dome lamp lens to lamp body.

FRONT DOOR COURTESY LAMP

REMOVAL

(1) Insert a trimstick between courtesy lamp housing and door trim panel (Fig. 14).

(2) Pry rear edge of housing from trim panel.

REMOVAL AND INSTALLATION (Continued)

(3) Separate housing from trim panel.
(4) Disengage wire connector from lamp.
(5) Separate lamp housing from vehicle.

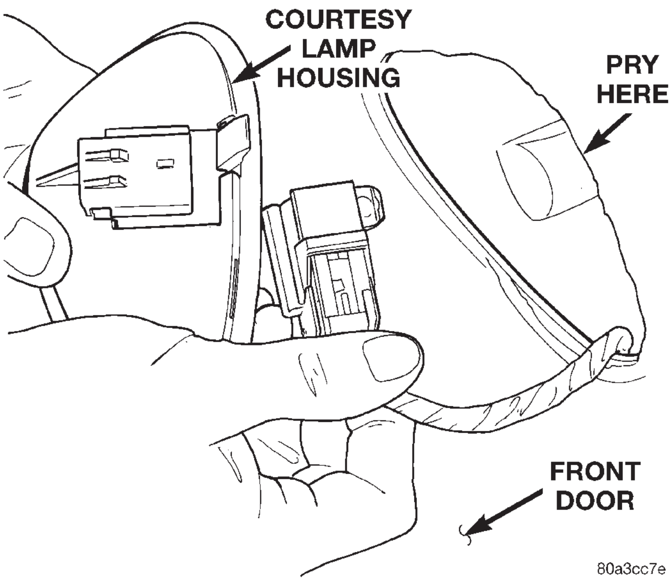

Fig. 14 Door Courtesy Lamp Housing

INSTALLATION

(1) Position lamp housing to vehicle.
(2) Engage wire connector to lamp.
(3) Slide tab on forward edge of housing behind trim panel.
(4) Snap rear edge of housing into trim panel.

FRONT DOOR COURTESY LAMP BULB

REMOVAL

(1) Using a small, flat bladed pry tool, pry rear edge of courtesy lamp lens from courtesy lamp (Fig. 15).
(2) Remove lens from lamp.
(3) Squeeze brass lamp bulb contacts together gently.
(4) Disengage bulb from lamp contacts (Fig. 16).
(5) Remove bulb from lamp.

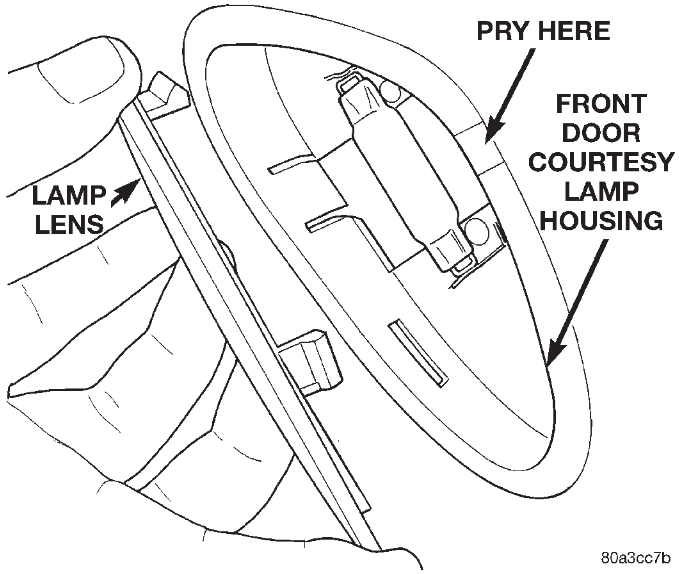

Fig. 15 Door Courtesy Lamp Lens

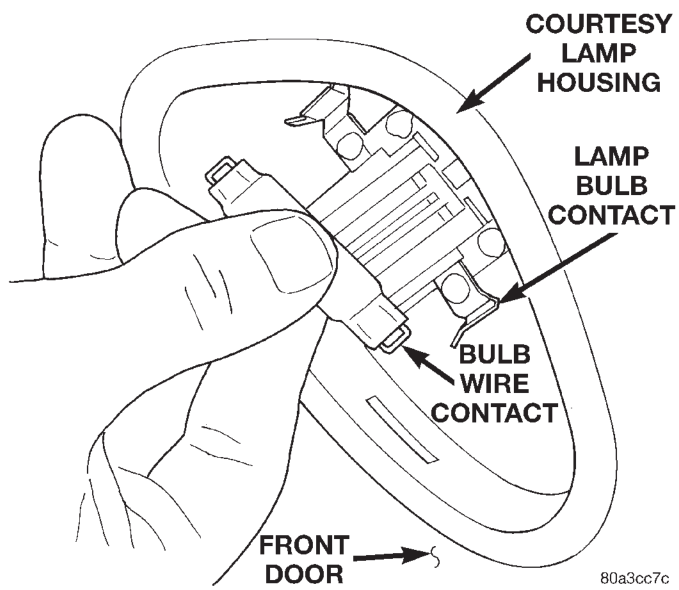

Fig. 16 Door Courtesy Lamp Bulb

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position bulb to lamp contacts.

(2) Engage bulb to lamp contacts.

(3) Insert long edge of lens into lamp housing.

(4) Press on center of lens to engage remainder of clips

RAIL LAMP MODULE BULB

REMOVAL

(1) Using a small screw driver, pry stationary end of rail lamp lens from rail lamp module (Fig. 17).

(2) Remove lens tab from between rail lamp module and rail lamp switch.

(3) Remove lens from lamp.

(4) Pull bulb from lamp (Fig. 18).

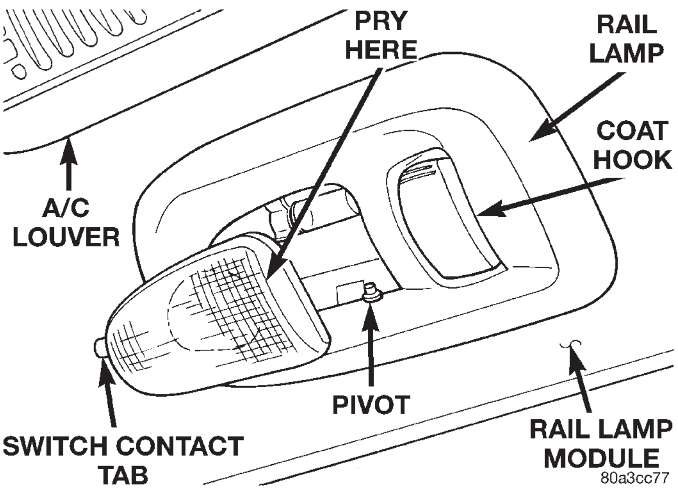

Fig. 17 Rail Lamp Module Lens

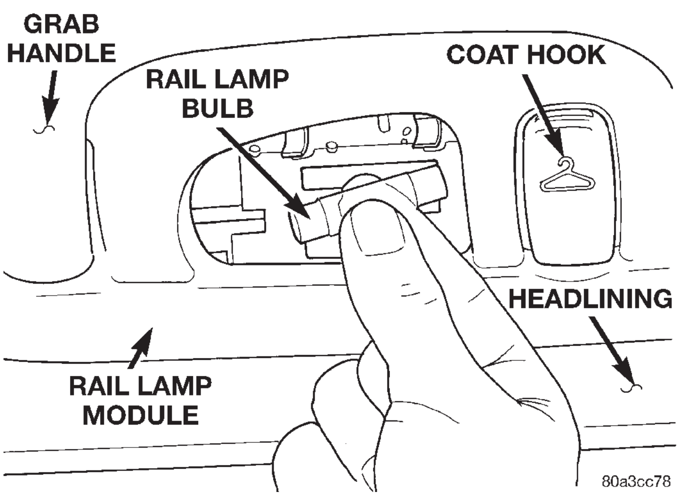

Fig. 18 Rail Lamp Module Bulb

INSTALLATION

(1) Push bulb into bulb contacts in rail lamp module.

(2) Insert tab on lamp lens between rail lamp module and rail lamp switch.

(3) Snap lens onto lens pivots on module.

LIFTGATE COURTESY LAMP

REMOVAL

(1) Insert trim stick between courtesy lamp and liftgate trim panel at upper inboard corner of courtesy lamp (Fig. 19).

(2) Disengage tabs holding courtesy lamp to liftgate trim panel (Fig. 20).

(3) Disconnect wire connector from courtesy lamp.

(4) Remove lamp from vehicle.

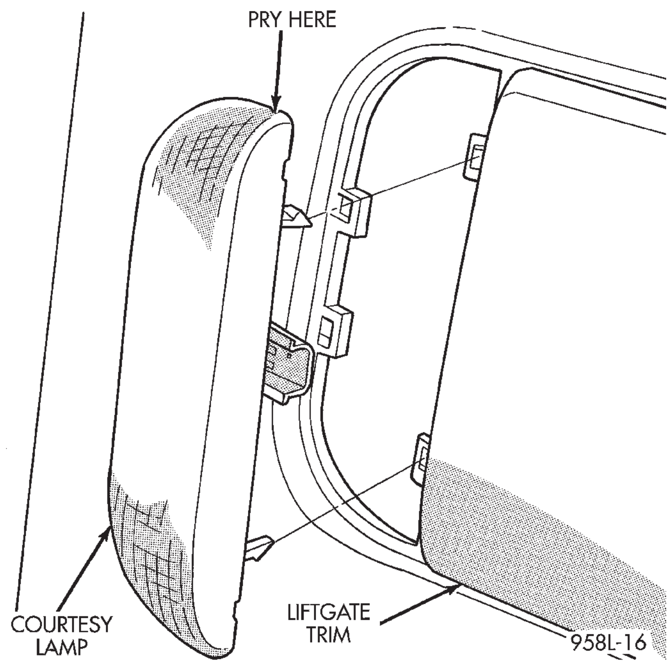

Fig. 19 Courtesy Lamp

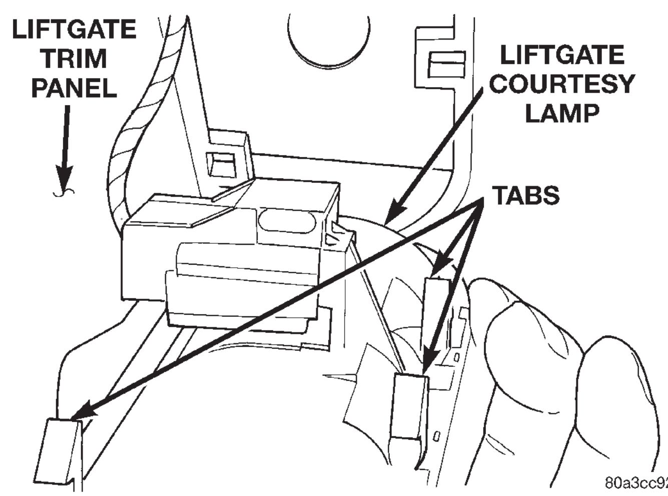

Fig. 20 Courtesy Lamp Tabs

INSTALLATION

(1) Position lamp to vehicle.

(2) Connect wire connector to courtesy lamp.

REMOVAL AND INSTALLATION (Continued)

(3) Position courtesy lamp to liftgate trim panel.

(4) Press courtesy lamp into trim panel until tabs engage fully to trim panel.

LIFTGATE COURTESY LAMP BULB

REMOVAL

(1) Remove liftgate courtesy lamp.

(2) Insert a small, flat bladed pry tool between courtesy lamp lens and courtesy lamp body.

(3) Carefully depress tabs holding lens to courtesy lamp body (Fig. 21).

(4) Remove lamp lens from lamp body.

(5) Carefully press lamp bulb contact toward opposite contact.

(6) Remove bulb from lamp body.

INSTALLATION

(1) Carefully press lamp bulb contact toward opposite contact.

(2) Position bulb to lamp bulb contacts.

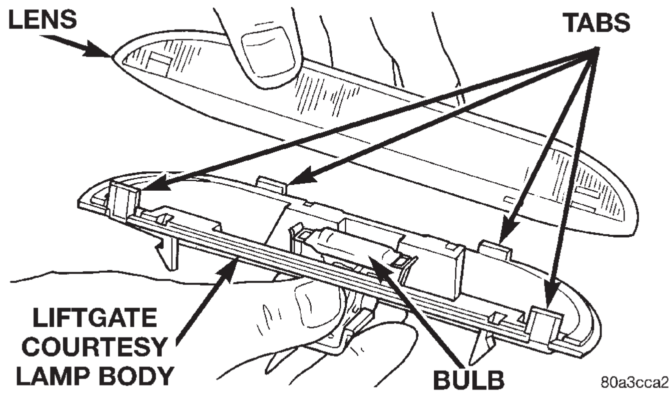

Fig. 21 Liftgate Courtesy Lamp Bulb

(3) Position long side of lamp lens to tabs on lamp body.

(4) Press on center of lens to engage tabs on opposite side of lamp body.

(5) Install liftgate courtesy lamp.

BULB APPLICATION

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GENERAL INFORMATION

INTRODUCTION

The following Bulb Application Tables list the lamp title on the left side of the column and trade number or part number on the right.

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 possibly oily surfaces. Bulb life will be reduced.

If a halogen bulb is contaminated with oil, clean bulb with denatured alcohol or ammonia based solvent.

SPECIFICATIONS

EXTERIOR LAMP BULBS

LAMP	BULB
Back-up	3057
CHMSL	921
Fog Lamp	H3
Fog Lamp – T&C	9040
Headlamp	9007
Headlamp high beam – T&C	9005
Headlamp low beam – T&C	9005 SLL
License Plate	168
Parking/Turn Signal/Front Side Marker	3157NA
Parking/Turn Signal – T&C	4157NAK
Tail, Stop, Turn Signal and Side Marker	3057
Front Side Marker	194NA

INTERIOR LAMP BULBS

LAMP	BULB
ABS	PC194
Air Bag	PC194
Alarm Set (Security)	PC194
Brake Warning	PC194
Center/Rear Reading Lamps	578
Center/Rear Dome Lamps	579
Check Engine Ind.	PC194
Front Door Courtesy	567
Door Ajar Ind.	PC194
Front Header Reading Lamp	567
Glove Box Lamp	194
High Beam Ind.	PC194
Instrument Cluster	PC194
IP Bin/Ash Tray	161
Liftgate Flood Lamps	567
Liftgate Ajar Ind.	PC74
Low Fuel Ind.	PC194
Oil Pressure Ind.	PC194
O/H Console Reading Lamps	579
Seat Belt Ind.	PC74
Engine Temp Ind.	PC194
Turn Signal	PC194
Engine Compartment Lamps	579
Visor Vanity Lamp	6501966
Low Washer Fluid	PC74
Low Volts Warning	PC74
Cruise Indicator	PC194

LAMPS

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LAMP DIAGNOSIS

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GENERAL INFORMATION

INTRODUCTION

GS vehicles use lighting on the interior and exterior of the vehicle for illuminating and indicating purposes. Lighting circuits are protected by fuses. Lighting circuits require an overload protected power source, on/off device, lamps and body ground to operate properly. Plastic lamps require a wire in the harness to supply body ground to the lamp socket. Replace sockets and bulbs that are corroded.

Some of the interior and exterior lighting functions are governed by the body controller. The headlamp, dome, and the door ajar switches provide signals to the body controller. The body controller in turn activates relay(s) in order to provide either a ground or feed line to the appropriate lamp(s).

Wire connectors can make intermittent contact or become corroded. Before coupling wire connectors, inspect the terminals inside the connector. Male terminals should not be bent or disengaged from the insulator. Female terminals should not be sprung open or disengaged from the insulator. Bent and sprung terminals can be repaired using needle nose pliers and pick tool. Corroded terminals appear chalky or green. Corroded terminals should be replaced to avoid recurrence of the problem symptoms.

Begin electrical system failure diagnosis by testing related fuses in the fuse block and power distribution center. Verify that bulbs are in good condition and test continuity of the circuit ground. Refer to Group 8W, Wiring Diagrams, for component location and circuit information.

SAFETY PRECAUTIONS

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.

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.

Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

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.

GENERAL INFORMATION (Continued)

HEADLAMP LEVELING MOTOR

This vehicle is equipped with a remote headlamp leveling system. This system allows the driver to adjust the vertical headlamp aim from the interior of the vehicle to compensate for passenger or cargo load. A headlamp leveling switch is located in the instrument panel and controls the headlamp leveling motor found on the back of the headlamp module.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

When a vehicle experiences problems with the headlamp system, verify the condition of the battery connections, charging system, headlamp bulbs, wire connectors, relay, high beam dimmer switch and headlamp switch. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.

HEADLAMP DIAGNOSIS

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 alternator drive belt.	2. Adjust or replace alternator drive belt.
	3. Charging system output too low.	3. Test and repair charging system. Refer to Group 8A.
	4. Battery has insufficient charge.	4. Test battery state-of -charge. Refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery. Refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
HEADLAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system. Refer to Group 8A.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices. Refer to Group 8W.
HEADLAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system. Refer to Group 8A.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
	3. High resistance in headlamp circuit.	3. Test amperage draw of headlamp circuit.
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	2. High resistance in headlamp circuit.	2. Test amperage draw of headlamp circuit.
	3. Loose or corroded terminals or splices in circuit.	3. Inspect and repair all connectors and splices. Refer to Group 8W.
HEADLAMPS DO NOT ILLUMINATE	1. No voltage to headlamps.	1. Repair open headlamp circuit. Refer to Group 8W.
	2. No Z1-ground at headlamps.	2. Repair circuit ground. Refer to Group 8W.
	3. Faulty headlamp switch.	3. Replace headlamp switch.
	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. Defective or burned out bulb.	6. Replace bulb.
	7. Body controller malfunction.	7. Refer to appropriate body controller diagnostics.

DIAGNOSIS AND TESTING (Continued)

FOG LAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables. 2. Loose or worn alternator drive belt. 3. Charging system output too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace alternator drive belt. 3. Test and repair charging system. Refer to Group 8A, 4. Test battery state-of -charge. Refer to Group 8A. 5. Load test battery. Refer to Group 8A. 6. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system. Refer to Group 8A. 2. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low. 2. Poor lighting circuit Z1-ground. 3. High resistance in fog lamp circuit.	1. Test and repair charging system. Refer to Group 8A. 2. Test for voltage drop across Z1-ground locations. Refer to Group 8W. 3. Test amperage draw of fog lamp circuit.
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground. 2. High resistance in fog lamp circuit. 3. Faulty fog lamp switch. 4. Loose or corroded terminals or splices in circuit.	1. Test for voltage drop across Z1-ground locations. Refer to Group 8W. 2. Test amperage draw of fog lamp circuit. 3. Replace fog lamp switch. 4. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamp. 2. No Z1-ground at fog lamps. 3. Faulty fog lamp switch. 4. Broken connector terminal or wire splice in fog lamp circuit. 5. Defective or burned out bulb.	1. Replace fuse. Refer to Group 8W. 2. Repair circuit ground. Refer to Group 8W. 3. Replace fog lamp switch. 4. Repair connector terminal or wire splice. 5. Replace bulb.

DIAGNOSIS AND TESTING (Continued)

HEADLAMP LEVELING MOTOR DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE MOTOR DOES NOT OPERATE	1. Poor connection at motor. 2. No voltage at motor. 3. Defective motor.	1. Secure connector on motor. 2. Repair circuit. Refer to Group 8W, Wiring. 3. Replace motor.
BOTH MOTORS DO NOT OPERATE	1. No voltage at headlamp leveling switch. 2. No voltage at both motors. 3. Poor connection at motors. 4. Both motors defective.	1. Repair circuit or replace fuse. Refer to Group 8W, Wiring. 2. Repair circuit or replace fuse. Refer to Group 8W, Wiring. 3. Secure connectors on motors. 4. Replace motors.

HEADLAMP ALIGNMENT

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ADJUSTMENTS
HEADLAMP/FOG LAMP ADJUSTMENT USING ALIGNMENT SCREEN 5

SERVICE PROCEDURES

HEADLAMP ALIGNMENT PREPARATION

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Verify that the headlamp leveling switch is in the "0" position.

(3) Inspect and correct damaged or defective components that could interfere with proper headlamp alignment.

(4) Verify proper tire inflation.

(5) Clean headlamp lenses.

(6) Verify that luggage area is loaded as the vehicle is routinely used.

(7) 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.

ADJUSTMENTS

HEADLAMP/FOG LAMP ADJUSTMENT USING ALIGNMENT SCREEN

ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 10 meters (32.8 ft.) away from front of headlamp lens (Fig. 1).

(2) Place 75 kg in the driver's seat to simulate the ride height of the vehicle when driven.

(3) If necessary, tape a line on the floor 10 meters (32.8 ft) away from and parallel to the wall.

(4) From the floor up 1.27 meters (5 ft), tape a 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.

ADJUSTMENTS (Continued)

(5) Rock vehicle side-to-side three times and allow suspension to stabilize.

(6) Jounce front suspension three times by pushing downward on front bumper and releasing.

(7) Measure the distance from the center of headlamp lens to the floor. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(8) Place a tape line 130 mm below and parallel to the center of headlamp line.

(9) 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.

HEADLAMP ADJUSTMENT

A properly aimed low beam headlamp will project a high intensity light pattern on the screen with the horizontal cut-off line aligned with the tape line 130 mm (5.12 in.) below the headlamp centerline (Fig. 1). The intersection of the horizontal and 15 degree cut-off lines in the projected pattern should align to the intersection of the headlamp centerline vertical tape line and the tape line 130 mm (5.12 in.) below the headlamp horizontal centerline. The high beams on a vehicle with aero headlamps cannot be aligned. The high beam pattern should be correct when the low beams are aligned properly.

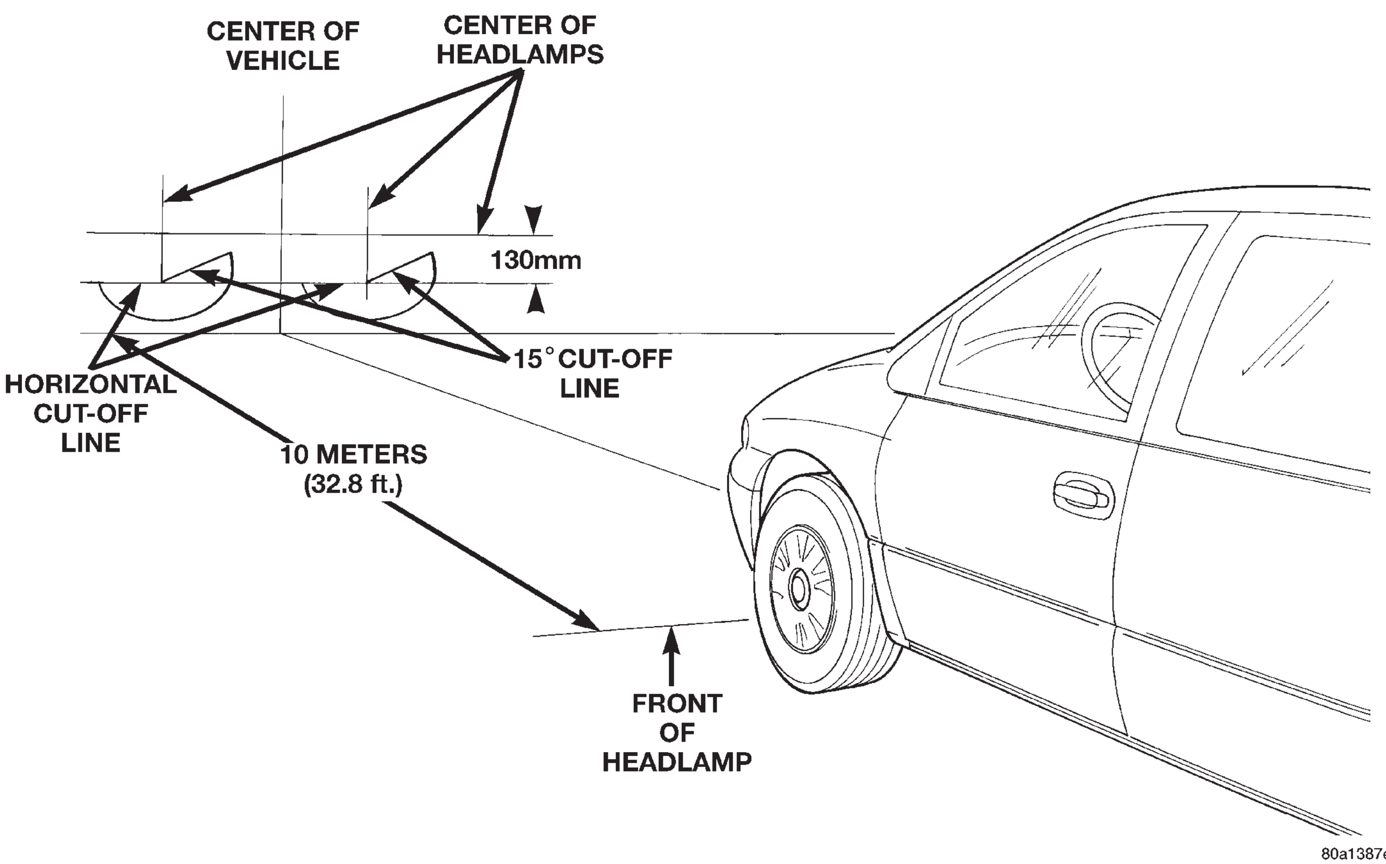

Fig. 1 Headlamp Alignment Screen

ADJUSTMENTS (Continued)

To adjust headlamp alignment, rotate alignment screws to achieve the specified low beam hot spot pattern (Fig. 2).

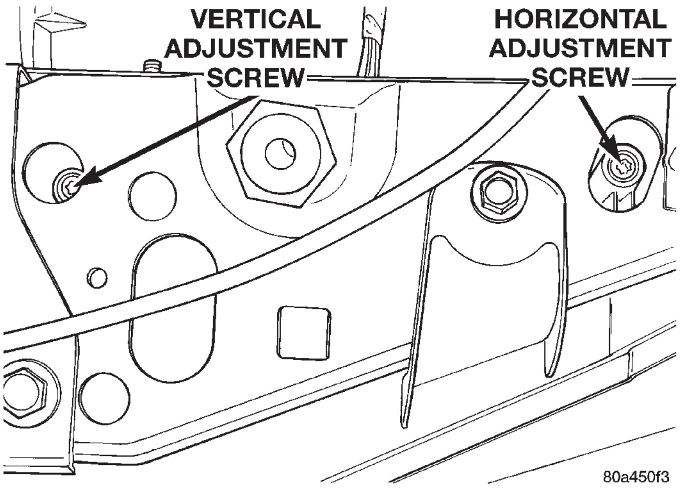

Fig. 2 Headlamp Adjusters—Left Side Shown

FOG LAMP ALIGNMENT

Prepare an alignment screen. Refer to the Alignment Screen Preparation paragraph in this section. A properly aligned fog lamp will project a pattern on the alignment screen 200 mm (8 in.) below the fog lamp centerline and straight ahead (Fig. 3). To improve visual interpretation of the fog lamp pattern on the alignment screen, disable the headlamps by disengaging the wire connectors from the headlamp bulbs.

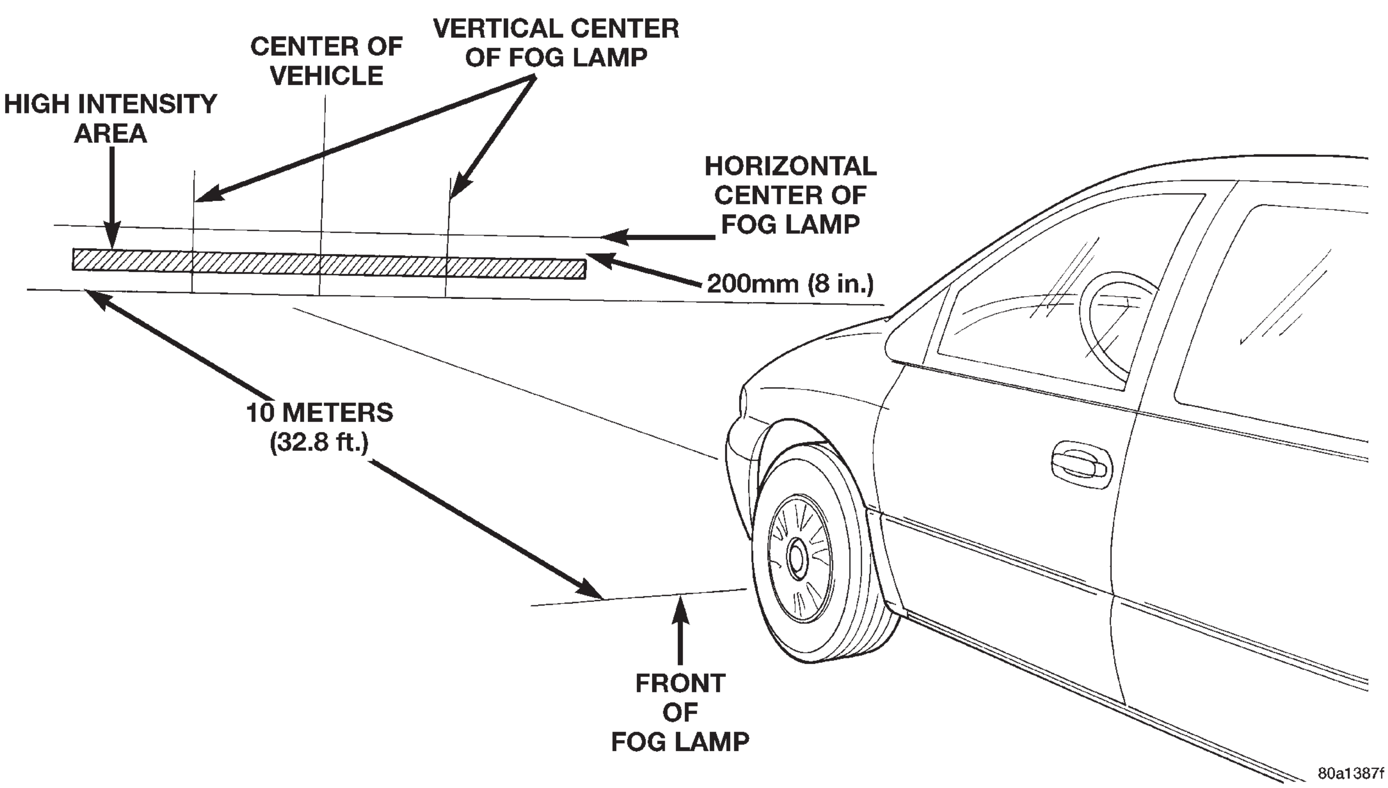

Fig. 3 Fog Lamp Alignment

LAMP BULB SERVICE

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REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

(1) Release hood latch and open hood.
(2) Remove headlamp module from vehicle.
(3) Remove rubber seal boot (Fig. 1).
(4) Disengage retaining spring clip from headlamp (Fig. 2).
(5) Pivot spring clip from headlamp bulb removal path.
(6) Pull headlamp bulb from back of headlamp (Fig. 3).

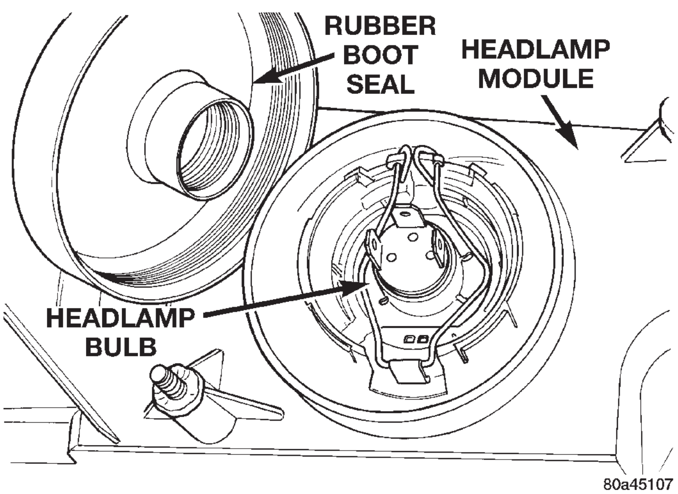

Fig. 1 Rubber Boot Seal

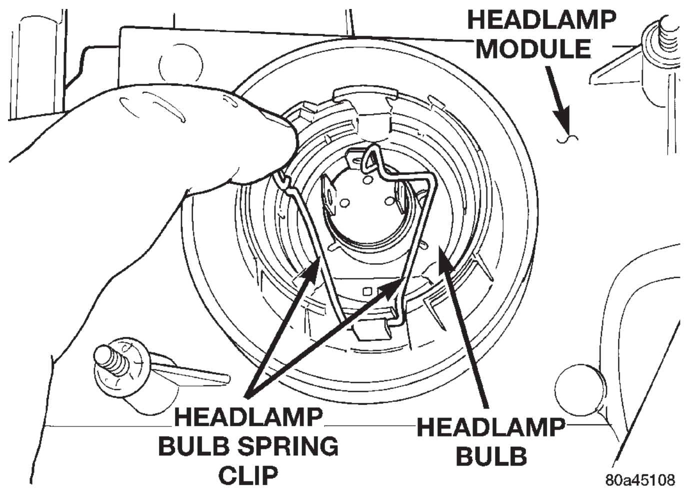

Fig. 2 Headlamp Bulb Spring Clip

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers of other possibly oily surface. Reduced bulb life will result.

(1) Insert headlamp bulb to headlamp.
(2) Pivot spring clip over headlamp bulb.
(3) Engage retaining spring clip to headlamp.
(4) Install rubber seal boot.

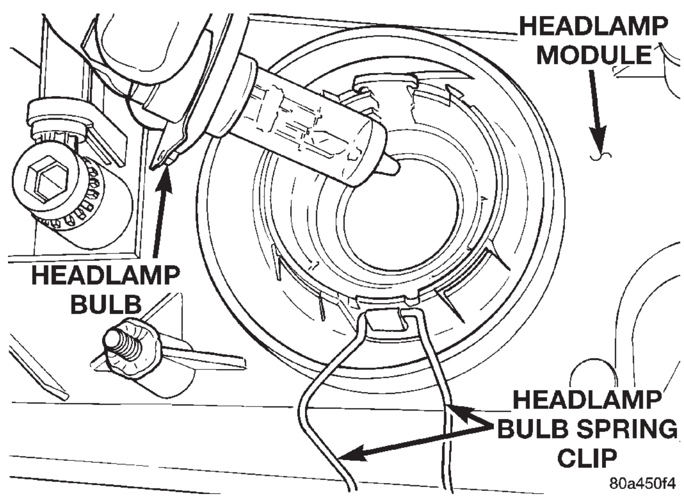

Fig. 3 Headlamp Bulb

(5) Engage wire connector to headlamp bulb base.
(6) Install headlamp module into vehicle
(7) Verify headlamp alignment.

FRONT TURN SIGNAL LAMP BULB

REMOVAL

(1) Remove headlamp module from vehicle

REMOVAL AND INSTALLATION (Continued)

(2) Rotate front turn signal lamp socket one quarter turn counterclockwise.

(3) Pull socket from back of lamp.

(4) Pull bulb from socket (Fig. 4).

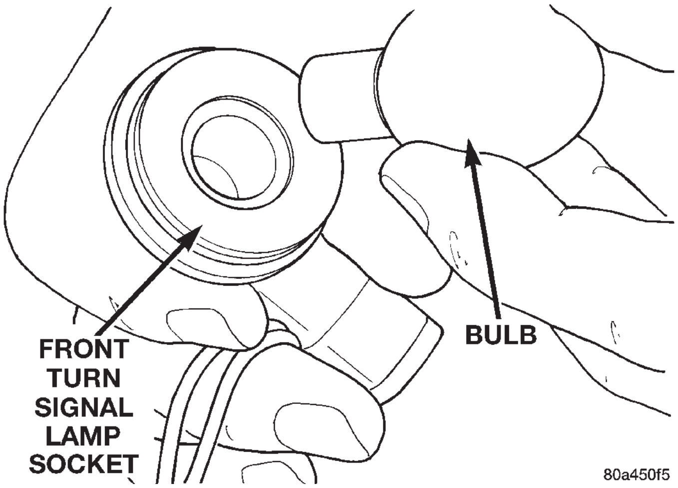

Fig. 4 Front Turn Signal Lamp Bulb

INSTALLATION

(1) Align key on bulb base to groove in socket and insert bulb into socket.

(2) Insert socket into back of headlamp.

(3) Rotate front turn signal socket clockwise one quarter turn.

(4) Install headlamp module into vehicle.

(5) Verify lamp operation.

CITYLIGHT LAMP BULB

REMOVAL

(1) Remove the headlamp module.

(2) Pull citylight lamp from rubber bushing in headlamp housing (Fig. 5).

(3) Pull bulb from socket (Fig. 6).

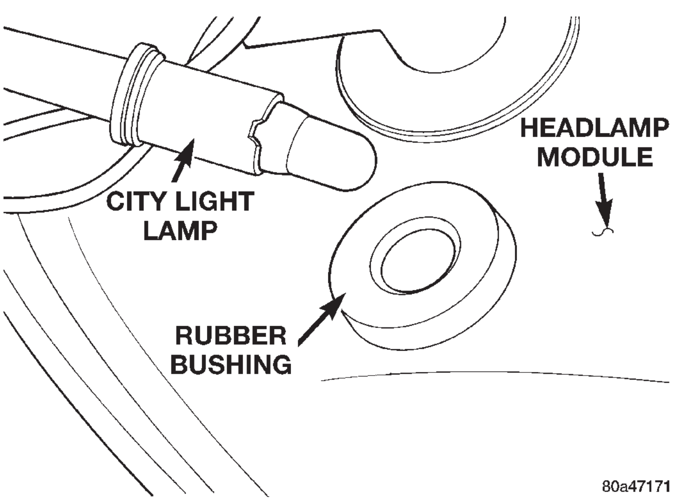

Fig. 5 Citylight Lamp Socket

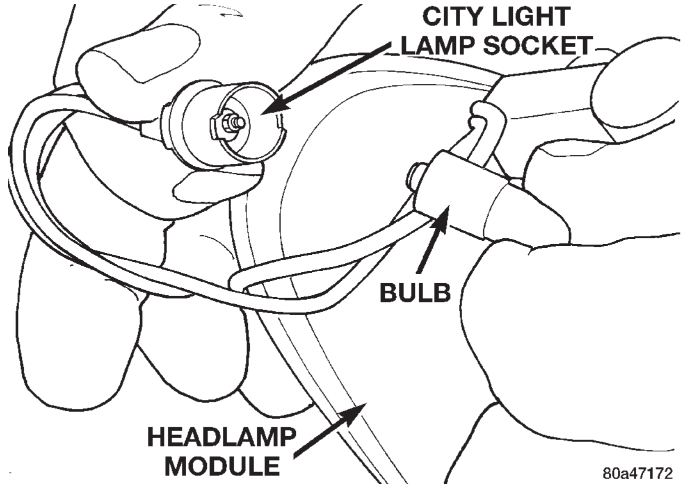

Fig. 6 Citylight Lamp Bulb

INSTALLATION

(1) Position citylight lamp bulb to lamp socket.

(2) Push bulb into socket.

(3) Push citylight lamp into bushing in headlamp housing.

(4) Install headlamp module to vehicle.

FOG LAMP BULB

REMOVAL

(1) Remove fog lamp from vehicle.

(2) Remove rear cover from fog lamp.

(3) Disengage wire clip holding bulb in fog lamp (Fig. 7).

(4) Hinge wire retainer clip out of bulb removal path.

(5) Pull bulb from lamp.

(6) Disengage wire connector from fog lamp wire harness.

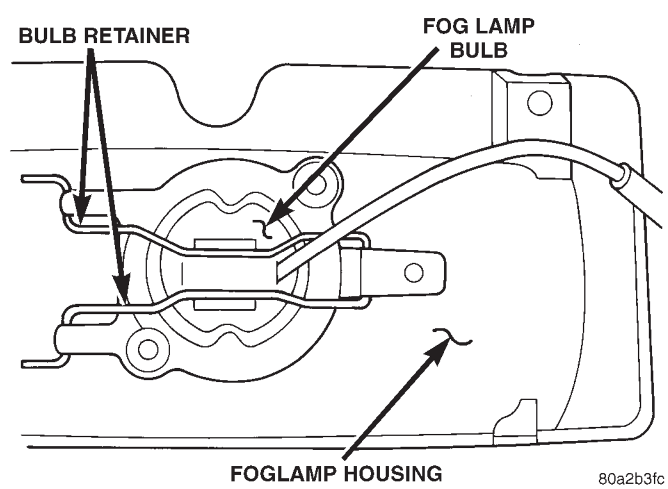

Fig. 7 Fog Lamp Bulb

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other oily surfaces, reduced bulb life will result.

(1) Engage wire connector into fog lamp wire harness.
(2) Insert bulb into lamp so index notches on bulb engage with bosses in lamp (Fig. 7).
(3) Hinge wire retainer clip over bulb base.
(4) Engage wire clip to hold bulb into lamp.
(5) Install rear cover on fog lamp.
(6) Install fog lamp on vehicle.

SIDE REPEATER LAMP BULB

REMOVAL

(1) Push side repeater lamp to one side and release retaining tab (Fig. 8).

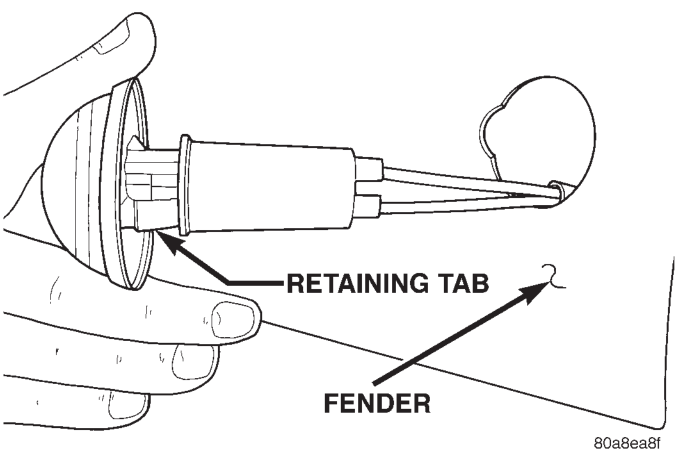

Fig. 8 Side Repeater Lamp

(2) Pull side repeater lamp out and disengage bulb socket from lamp (Fig. 9).

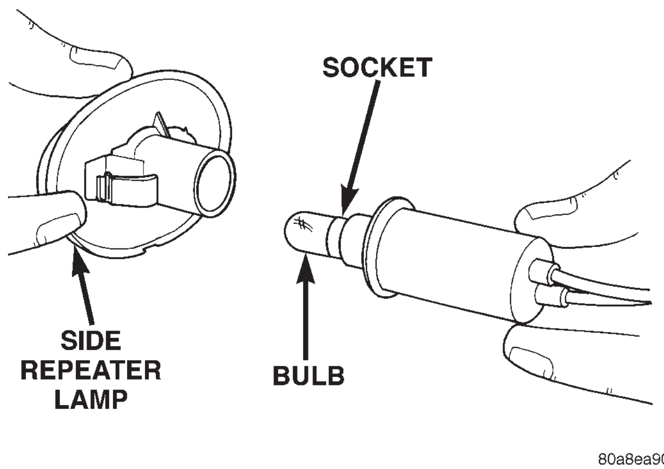

Fig. 9 Side Repeater Lamp Bulb

(3) Rotate and pull bulb from socket.

INSTALLATION

(1) Push and twist bulb into socket.
(2) Push side repeater lamp socket into side repeater lamp.
(3) Position side repeater lamp to hole in fender.
(4) Push side repeater lamp to one side and seat retaining tab into fender.
(5) Verify lamp operation.

TAIL LAMP BULB

The tail lamp houses the tail/stop lamp, rear turn signal lamp, back-up lamp, and rear fog lamp bulbs.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove screws holding tail lamp to rear door opening trough (Fig. 10).

(3) Separate inner end of lamp from quarter panel.

(4) Disengage hook holding outer end of lamp to quarter panel opening.

(5) Separate lamp from quarter panel.

(6) Remove screws holding bulb holder to lamp housing (Fig. 11).

(7) Separate bulb holder from lamp housing.

(8) Retrieve the rubber washers that seal the bulb holder to the lamp housing at the bulb holder screw locations.

(9) Pull bulb from bulb holder socket (Fig. 12).

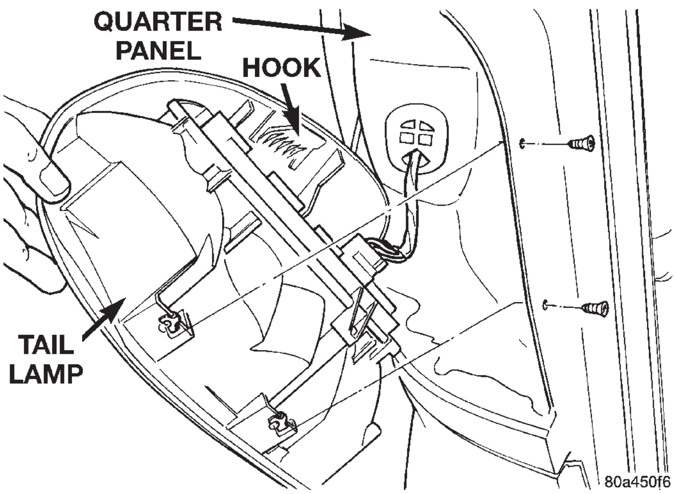

Fig. 10 Tail Lamp

INSTALLATION

(1) Align key on bulb base to groove in bulb holder socket and insert bulb into socket (Fig. 12).

(2) Position bulb holder to lamp housing.

(3) Verify that the rubber washers are properly positioned between the bulb holder and lamp housing at the screw locations.

(4) Install screws to hold bulb holder to lamp housing.

(5) Position lamp to quarter panel.

(6) Engage hook to hold outer end of lamp to quarter panel opening.

(7) Install screws to hold lamp to rear door opening trough.

(8) Verify tail lamp operation.

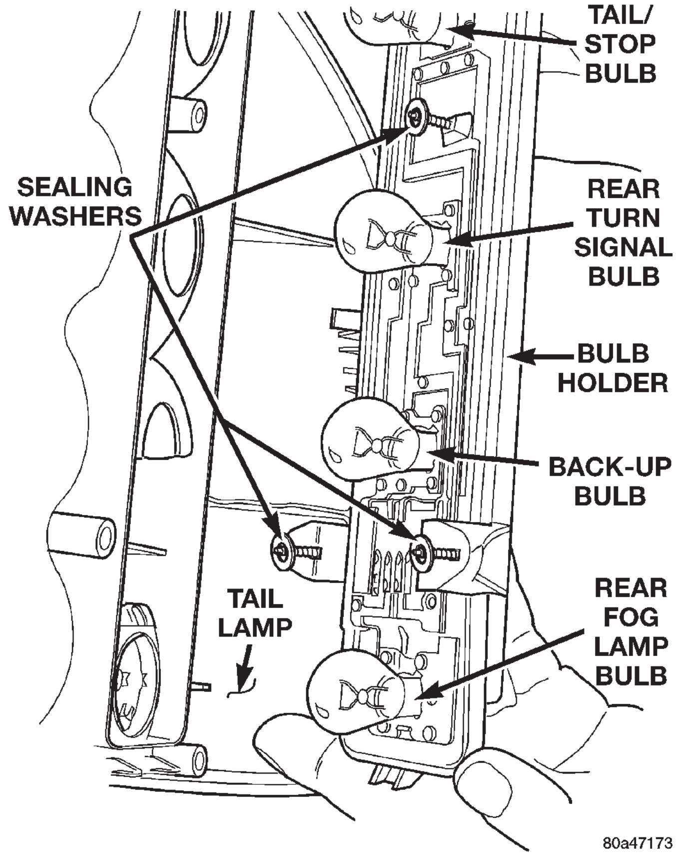

Fig. 11 Tail Lamp Bulb Holder

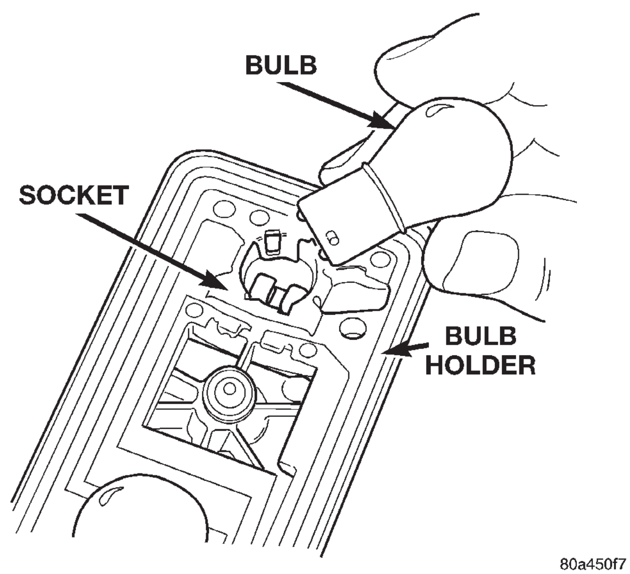

Fig. 12 Pull Bulb From Bulb Holder

REMOVAL AND INSTALLATION (Continued)

LICENSE PLATE LAMP BULB

REMOVAL

(1) Press one retaining tab on license plate lamp housing toward center of lens (Fig. 13).

(2) Separate lamp lens from lamp housing.

(3) Pull lamp bulb from socket.

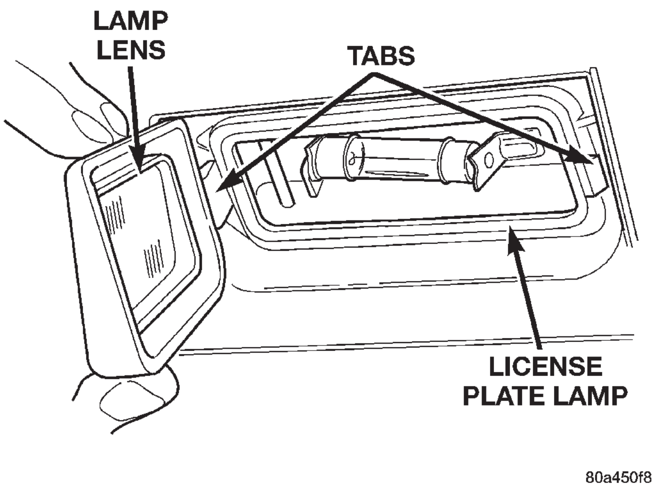

Fig. 13 License Plate Lamp Lens

INSTALLATION

(1) Align license plate lamp bulb to lamp socket.

(2) Push bulb into socket.

(3) Position lamp lens to lamp housing.

(4) Snap lamp lens onto tabs on lamp housing.

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Disengage clips holding CHMSL cover to liftgate trim panel (Fig. 14).

(3) Separate CHMSL cover from liftgate trim panel.

(4) Depress plastic tab holding bulb holder to lamp housing (Fig. 15).

(5) Separate bulb holder from lamp housing.

(6) Pull bulb or if equipped bulbs from lamp socket (Fig. 16).

INSTALLATION

(1) Align bulb to bulb holder socket.

(2) Push bulb into bulb holder socket.

(3) Position bulb holder to CHMSL housing.

(4) Snap bulb holder into CHMSL housing.

(5) Position CHMSL cover to liftgate trim panel.

(6) Engage clips to hold CHMSL cover to liftgate trim panel.

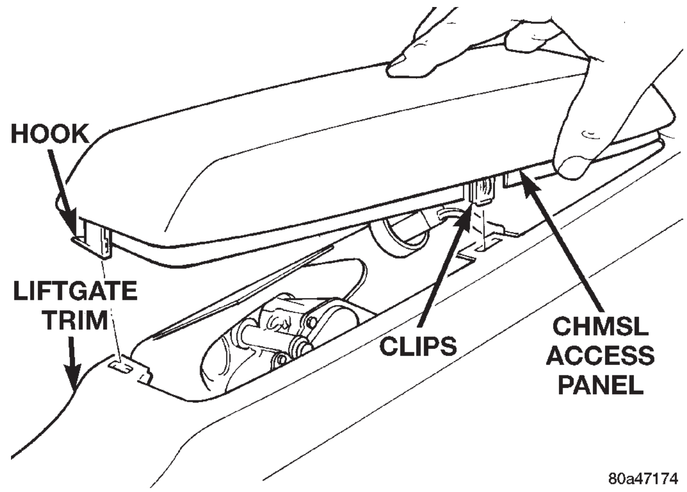

Fig. 14 CHMSL Cover

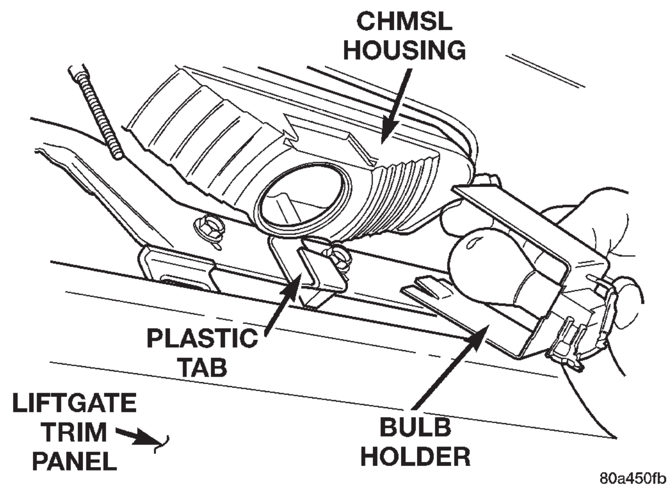

Fig. 15 CHMSL Bulb Holder

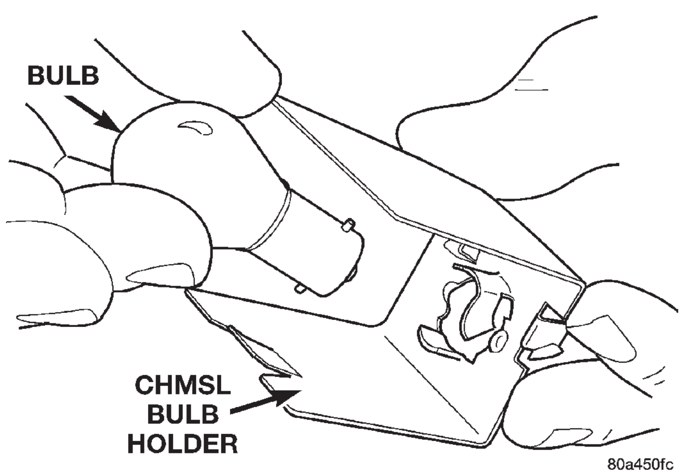

Fig. 16 CHMSL Bulb

LAMP SERVICE

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GENERAL INFORMATION

HEADLAMP SWITCH

Service procedures for the headlamp switch can be found in Group 8E, Instrument Panel and Gauges. More information can be found in Group 8W, Wiring Diagrams.

HEADLAMP DIMMER SWITCH

The headlamp dimmer switch is incorporated into the multi-function (turn signal) switch. Proper procedures can be found in Group 8J, Turn Signal and Flashers. More information can be found in Group 8W, Wiring Diagrams.

REMOVAL AND INSTALLATION

HEADLAMP MODULE

REMOVAL

(1) Release hood latch and open hood.
(2) Remove bolt holding headlamp module to radiator closure panel (Fig. 1).
(3) From behind the radiator closure panel, remove the nuts holding the headlamp module to the radiator closure panel.
(4) Separate headlamp module from radiator closure panel.
(5) Disengage wire connector from headlamp bulb.
(6) Disengage wire connector from headlamp leveling motor.
(7) Disengage wire connector for front turn signal and citylight lamps.
(8) Separate headlamp module from vehicle.

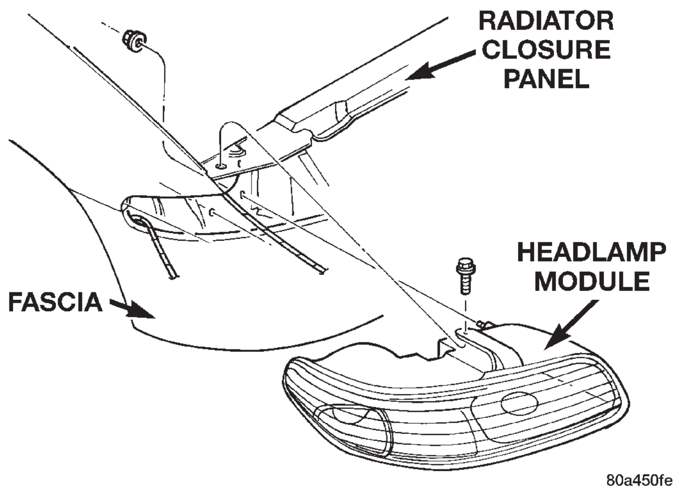

Fig. 1 Headlamp Module

INSTALLATION

(1) Position headlamp module to vehicle.
(2) Engage wire connector for front turn signal and citylight lamps.
(3) Engage wire connector to headlamp leveling motor.
(4) Engage wire connector to headlamp bulb.
(5) Position headlamp module to radiator closure panel.
(6) Press headlamp module rearward until module is fully seated onto mounting studs.
(7) Install nuts to hold headlamp module to radiator closure panel.
(8) Verify lamp operation.

REMOVAL AND INSTALLATION (Continued)

HEADLAMP LEVELING MOTOR

REMOVAL

(1) Remove headlamp module from vehicle.

(2) Rotate leveling motor one quarter turn counter-clockwise.

(3) Pull leveling motor from headlamp housing (Fig. 2).

NOTE: The headlamp leveling motor arm is snapped into the lens reflector mechanism very securely. Use a firm, steady pull to disengage motor arm from reflector mechanism.

(4) Separate leveling motor from headlamp housing.

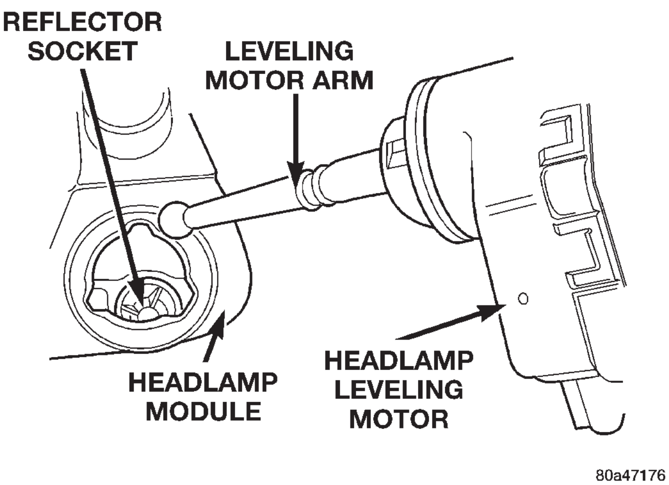

Fig. 2 Headlamp Leveling Motor

INSTALLATION

(1) Position headlamp leveling motor to headlamp housing.

(2) Insert leveling motor arm into hole in backside of headlamp housing.

(3) Push headlamp bulb toward top of headlamp housing (Fig. 3).

(4) Push leveling motor firmly into headlamp housing until leveling motor arm is fully seated into reflector mechanism.

(5) Rotate leveling motor one quarter turn clockwise.

(6) Install headlamp module to vehicle.

FOG LAMP

REMOVAL

(1) Remove screws holding fog lamp to front bumper fascia (Fig. 4).

(2) Separate fog lamp from fascia.

(3) Disengage wire connector from body wire harness.

(4) Separate fog lamp from vehicle.

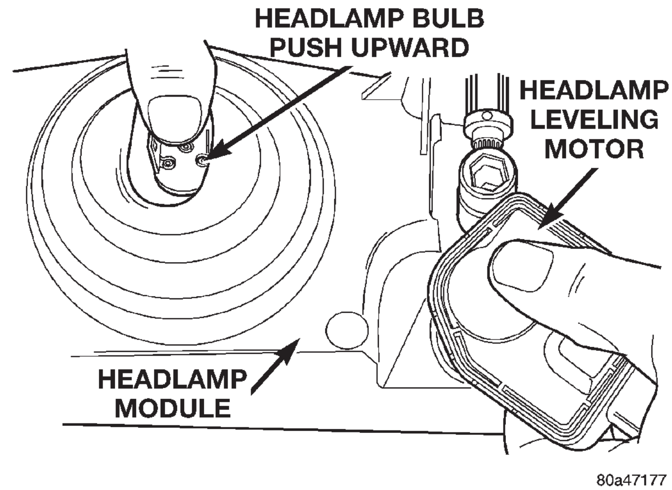

Fig. 3 Headlamp Leveling Motor Installation

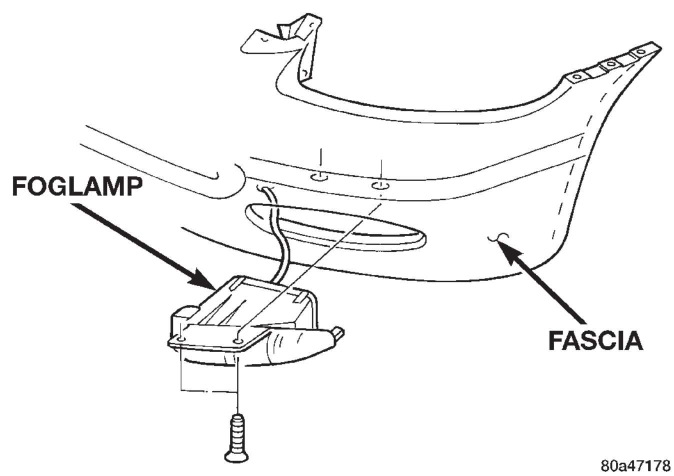

Fig. 4 Fog Lamp

INSTALLATION

(1) Position fog lamp on vehicle.

(2) Engage wire connector to body wire harness.

(3) Insert fog lamp into bumper fascia.

(4) Install screws to hold fog lamp to front bumper fascia.

SIDE REPEATER LAMP

REMOVAL

(1) Push side repeater lamp to one side and release retaining tab (Fig. 5).

(2) Pull side repeater lamp out and disengage bulb socket from lamp (Fig. 6).

(3) Separate side repeater lamp from vehicle.

INSTALLATION

(1) Push side repeater lamp socket into side repeater lamp.

(2) Position side repeater lamp to hole in fender.

(3) Push side repeater lamp to one side and seat retaining tab into fender.

REMOVAL AND INSTALLATION (Continued)

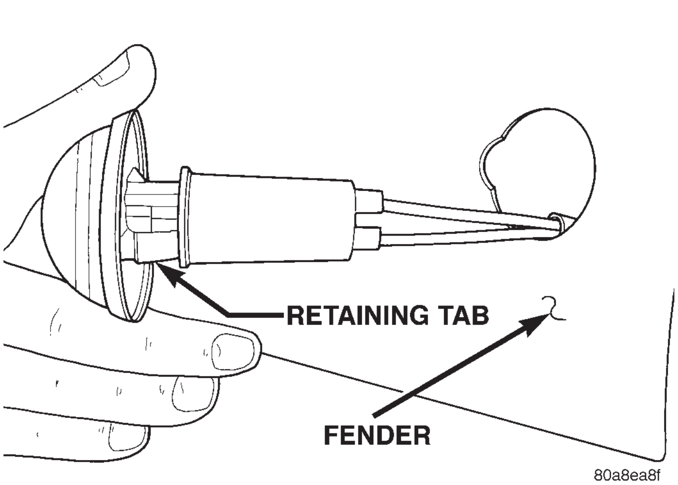

Fig. 5 Side Repeater Lamp

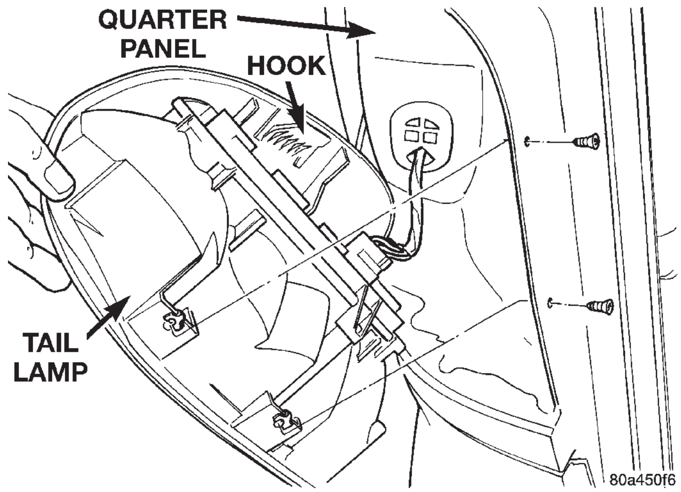

Fig. 7 Tail Lamp

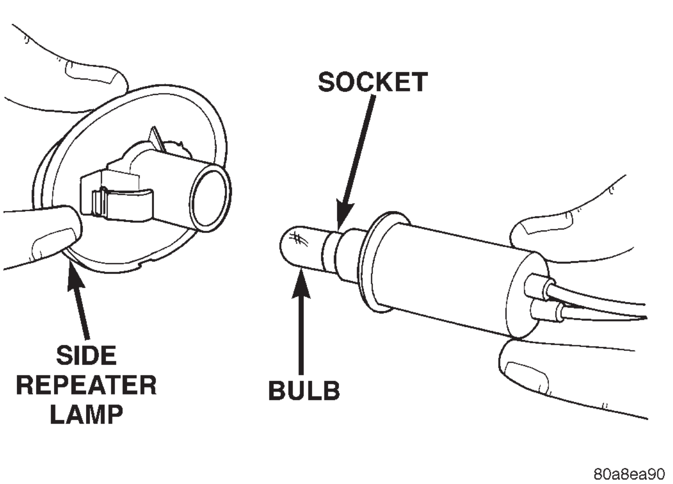

Fig. 6 Side Repeater Lamp Socket

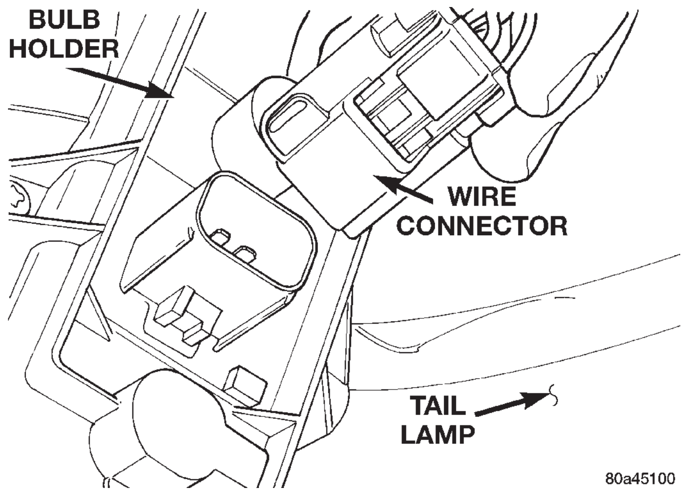

Fig. 8 Tail Lamp Connector

TAIL LAMP

The tail lamp houses the tail/stop lamp, rear turn signal lamp, back-up lamp, and rear fog lamp bulbs.

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove screws holding tail lamp to rear door opening trough.

(3) Separate inner end of lamp from quarter panel.

(4) Disengage hook holding outer end of lamp to quarter panel opening.

(5) Separate lamp from quarter panel (Fig. 7).

(6) Disengage positive lock on wire connector (Fig. 8).

(7) Depress lock tab on the side of the body harness connector.

(8) Disengage wire connector from bulb holder.

(9) Separate tail lamp from vehicle.

INSTALLATION

(1) Place tail lamp in position on vehicle.

(2) Engage wire connector into bulb holder.

(3) Engage positive lock on wire connector.

(4) Place lamp in position in position on quarter panel.

(5) Engage hook to hold outer end of lamp to quarter panel opening.

(6) Position inner end of lamp into quarter panel.

(7) Install screws to hold tail lamp to rear door opening trough.

(8) Verify tail lamp operation.

LICENSE PLATE LAMP

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove liftgate trim panel. Refer to Group 23, Body, for proper procedures.

(3) Remove water shield as necessary to gain access to wire connector.

(4) Disengage wire connector from liftgate wire harness.

(5) Remove screws holding license plate lamp bar to liftgate.

REMOVAL AND INSTALLATION (Continued)

(6) Separate license plate lamp bar from liftgate (Fig. 9).

(7) Separate license plate lamp bar grommet from vehicle.

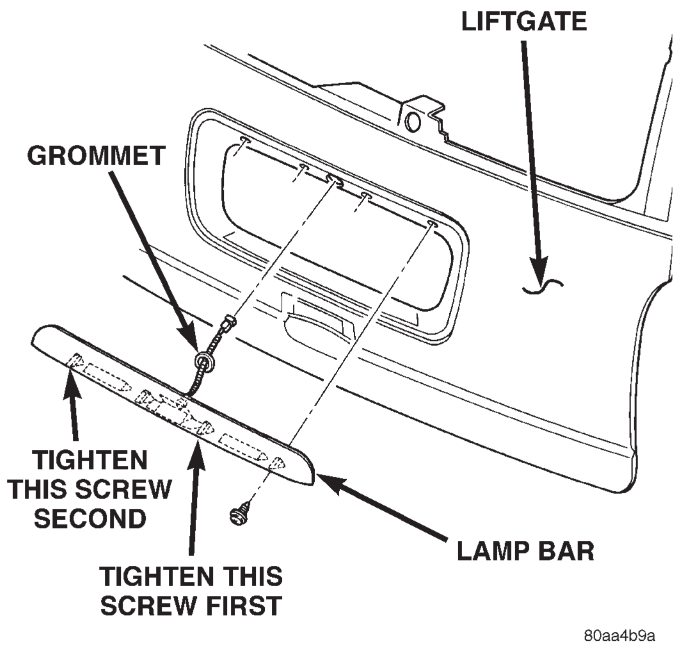

Fig. 9 License Plate Lamp

INSTALLATION

(1) Route wire connector through hole in liftgate.

(2) Install grommet to wiring harness hole in liftgate.

(3) Place license plate lamp bar in position on liftgate.

(4) Install screws to hold license plate lamp bar to liftgate.

(5) Engage wire connector into liftgate wire harness.

(6) Install water shield.

(7) Install liftgate trim panel.

(8) Verify license plate lamp operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Disengage clip holding CHMSL access cover to liftgate.

(3) Separate cover from liftgate.

(4) Depress plastic tab holding bulb holder to lamp housing (Fig. 10).

(5) Separate bulb holder from lamp housing.

(6) Remove screws holding CHMSL to liftgate.

(7) Separate CHMSL from vehicle.

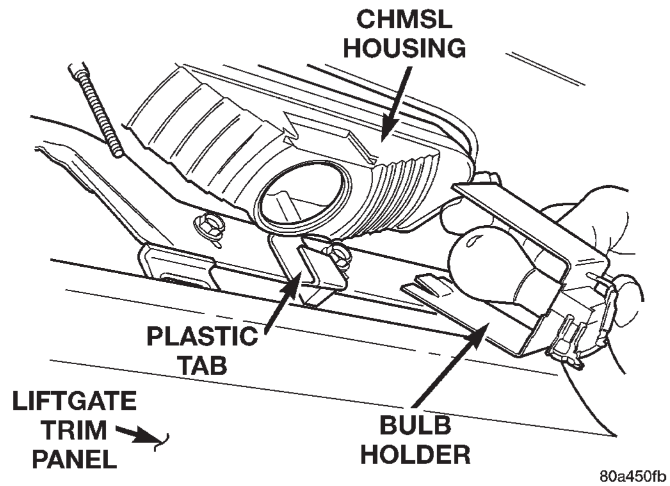

Fig. 10 CHMSL Bulb Holder

INSTALLATION

(1) Place CHMSL in position on vehicle.

(2) Install screws to hold CHMSL to liftgate.

(3) Position bulb holder to CHMSL housing.

(4) Snap bulb holder into CHMSL housing.

(5) Place CHMSL access cover in position on liftgate.

(6) Engage clip to hold access cover to liftgate.

(7) Verify CHMSL operation.

BULB APPLICATION

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HEADLAMP CLEANING	17		

GENERAL INFORMATION

INTRODUCTION

The following Bulb Application Tables list the lamp title on the left side of the column and trade number or part number on the right.

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 possibly oily surfaces. Bulb life will be reduced.

If a halogen bulb is contaminated with oil, clean bulb with denatured alcohol or ammonia based solvent.

CLEANING AND INSPECTION

HEADLAMP CLEANING

This vehicle is equipped with plastic headlights that are lighter and less susceptible to stone breakage than glass headlights.

This plastic is not as scratch resistant as glass and therefore a different lens cleaning procedures must be followed.

To minimize the possibility of scratching the lenses and reducing light output, avoid wiping with a dry cloth. To remove road dirt, wash with a mild soap solution followed by rinsing with water.

Do not use abrasive cleaning components, solvents, steel wool or other aggressive material to clean the lenses.

SPECIFICATIONS

EXTERIOR LAMP BULBS

LAMP	BULB
Back-up	P21W
CHMSL (Non-Solar Tint)	P21W
CHMSL (Solar Tint)	R10W
Fog Lamp	H3
Headlamp	H4
License Plate	C5W
Front Turn Signal	PY21W
Citylight	T4W
Front Side Repeater	T4W
Tail, Stop	P21/5W
Rear Turn Signal	P21W
Rear Fog Lamp	P21W

INTERIOR LAMP BULBS

LAMP	BULB
ABS	PC194
Air Bag	PC194
Alarm Set (Security/Immobilzer)	PC194
Brake Warning	PC194
Center/Rear Reading Lamps	578
Center/Rear Dome Lamps	579
Cruise Indicator	PC194
Door Ajar Indicator	PC194
Engine Compartment Lamps	579
Engine Temp Indicator	PC194
Front Door Courtesy	567
Glove Box Lamp	194
Glow Plug Indicator (Diesel Engine Only)	PC194
High Beam Indicator	PC194
Instrument Cluster	PC194
IP/Ash Tray (Left Hand Drive Only)	161
Liftgate Flood Lamps	567
Liftgate Ajar Indicator	PC74
Low Coolant Level (Diesel Engine Only)	PC74
Low Fuel Indicator	PC194
Low Volts Warning	PC74
Low Washer Fluid	PC74
Oil Pressure Indicator	PC194
O/H Console Reading Lamps	579
Seat Belt Indicator (Except Diesel)	PC74
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Turn Signal	PC194
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RESTRAINT SYSTEM

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GENERAL INFORMATION

WARNINGS AND PRECAUTIONS

WARNING: THIS SYSTEM IS A SENSITIVE, COMPLEX ELECTRO–MECHANICAL UNIT. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A SOLID SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED AND COULD RESULT IN PERSONAL INJURY. WHEN CARRYING OR HANDLING AN UNDEPLOYED AIRBAG MODULE, THE TRIM SIDE OF THE AIRBAG SHOULD BE POINTING AWAY FROM THE BODY TO MINIMIZE POSSIBILITY OF INJURY IF ACCIDENTAL DEPLOYMENT OCCURS.

REPLACE AIRBAG SYSTEM COMPONENTS WITH MOPAR® REPLACEMENT PARTS. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WEAR SAFETY GLASSES, RUBBER GLOVES, AND LONG SLEEVED CLOTHING WHEN CLEANING POWDER RESIDUE FROM VEHICLE AFTER AIRBAG DEPLOYMENT. SODIUM HYDROXIDE POWDER RESIDUE EMITTED FROM A DEPLOYED AIRBAG CAN CAUSE SKIN IRRITATION. FLUSH AFFECTED AREA WITH COOL WATER IF IRRITATION IS EXPERIENCED. IF NASAL OR THROAT IRRITATION IS EXPERIENCED, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

DO NOT USE A REPLACEMENT AIRBAG THAT IS NOT IN THE ORIGINAL PACKAGING, IMPROPER DEPLOYMENT AND PERSONAL INJURY CAN RESULT.

THE FACTORY INSTALLED FASTENERS, SCREWS AND BOLTS USED TO FASTEN AIRBAG COMPONENTS HAVE A SPECIAL COATING AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. DO NOT USE SUBSTITUTE FASTENERS, USE ONLY ORIGINAL EQUIPMENT FASTENERS LISTED IN THE PARTS CATALOG WHEN FASTENER REPLACEMENT IS REQUIRED.

NOTE: Airbags should be stored in a cool dry location away from excessive heat and static electrical activity with the fabric airbag facing UP, or a premature deployment can result.

If the Driver/Passenger Airbag Module is defective and not deployed, refer to Chrysler Corporation current return list for proper handling procedures.

DESCRIPTION AND OPERATION

AIRBAG CONTROL MODULE (ACM)

The Airbag Control Module (ACM) contains the impact sensor and energy reserve capacitor. The

DESCRIPTION AND OPERATION (Continued)

ACM monitors the system to determine the system readiness. The ACM contains on-board diagnostics and will light the AIRBAG warning lamp in the message center when a problem occurs.

The driver and passenger airbag system is a safety device designed to reduce the risk of fatality or serious injury, caused by a frontal impact of the vehicle.

The impact sensor provides verification of the direction and severity of the impact. One impact sensor is used. It is located inside the Airbag Control Module (ACM) which is mounted on a bracket, just forward of the center console. The impact sensor is an accelerometer that senses deceleration. The deceleration pulses are sent to a microprocessor which contains a decision algorithm. When an impact is severe enough to require airbag protection, the ACM micro processor sends a signal that completes the electrical circuit to the driver and passenger airbags. The sensor is calibrated for the specific vehicle and reacts to the severity and direction of the impact.

CLOCKSPRING

The clockspring is snapped into a plastic mounting platform on the steering column behind the steering wheel. The clockspring is used to maintain a continuous electrical circuit between the wiring harness and the driver's airbag module. This assembly consists of a flat ribbon like electrically conductive tape which winds and unwinds with the steering wheel rotation.

DRIVER AND PASSENGER AIRBAG MODULES

The Driver Airbag Module is located in the center of the steering wheel. The Passenger Airbag Module is located in the instrument panel above the glove box (Fig. 1). The Driver Airbag Module cover contains the horn switch, inflator device, and a fabric bag. The airbag cover/horn switch is serviced separately from the inflator and bag components. Refer to Group 8G, Horns for proper service procedure for horn switch. The Passenger Airbag Module is serviced as an assembly.

WARNING: WHEN THE AIRBAG SYSTEM IS DEPLOYED BECAUSE OF A COLLISION, THE FOLLOWING MUST BE REPLACED:

- **COMPLETE STEERING COLUMN ASSEMBLY**
- **LOWER STEERING COUPLER**
- **STEERING WHEEL**
- **STEERING COLUMN CLOCKSPRING**
- **DRIVER AIRBAG COVER/HORN SWITCH**
- **DRIVER AIRBAG MODULE**
- **PASSENGER AIRBAG MODULE**
- **UPPER INSTRUMENT PANEL WITH PAD**

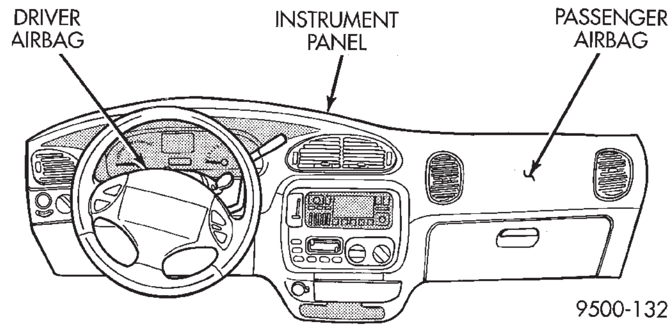

Fig. 1 Airbag Module Locations

DIAGNOSIS AND TESTING

AIRBAG SYSTEM TEST

(1) Disconnect and isolate the battery negative cable.

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT SERVICE PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

(2) Connect scan tool (DRB) to Data Link connector, located at left side of the steering column and at the lower edge of the lower instrument panel.

(3) Turn the ignition key to ON position. Exit vehicle with scan tool. Use the latest version of the proper cartridge.

(4) After checking that no one is inside the vehicle, connect the battery negative terminal.

(5) Using the scan tool, read and record active diagnostic code data.

(6) Read and record any stored diagnostic codes.

(7) Refer to the proper Body Diagnostic Procedures Manual if any diagnostic codes are found in Step 5 or Step 6.

(8) Erase stored diagnostic codes if there are no active diagnostic codes. If problems remain, diagnostic codes will not erase. Refer to the Passive Restraint Diagnostic Test Manual to diagnose the problem. **If airbag warning lamp either fails to light, or goes on and stays on, there is a system malfunction. Refer to the proper Body Diagnostic Procedures Manual to diagnose the problem.**

SERVICE PROCEDURES

CLEANUP PROCEDURE

Roll or fold the passenger airbag towards the instrument panel surface and close the door over the folded bag. Then tape the door shut.

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Work from the outside in to avoid kneeling or sitting in a contaminated area. Vacuum the heater and A/C outlets as well (Fig. 2). If HVAC was in RECIRC mode at time of airbag deployment, operate HVAC blower on low speed/heat and vacuum powder residue expelled from the heat outlets. Multiple vacuum cleaning may to necessary to decontaminate the interior of the vehicle.

NOTE: Dispose deployed airbag properly, contact dealer or government agency for disposal recommendations.

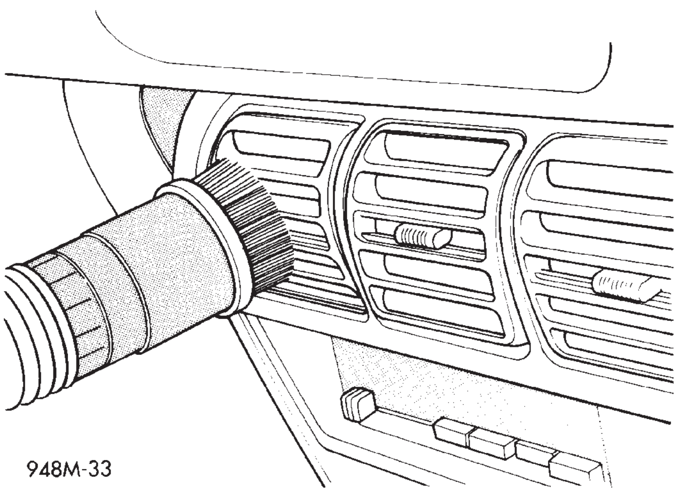

Fig. 2 Vacuum Heater and A/C Outlets

SERVICE OF DEPLOYED AIRBAG MODULE

DRIVER AIRBAG

If a Driver Airbag Module has been deployed, but not due to a collision, replace the following:

- Driver Airbag Module
- Clockspring assembly
- Driver airbag cover/horn switch

The components above must be replaced because they cannot be reused. Replace any other driver airbag system components if damaged.

PASSENGER AIRBAG

If a Passenger Airbag Module has been deployed, but not due to a collision, replace the following:

- Passenger Airbag Module
- Upper instrument panel with pad

The component above must be replaced because they cannot be reused. Inspect the heat duct near the passenger airbag for any damage replace as necessary. Replace any other passenger airbag system components if damaged.

HANDLING AIRBAG MODULE

DEPLOYED MODULE

The vehicle interior may contain a very small amount of sodium hydroxide powder, a by-product of airbag deployment. Sodium hydroxide powder can irritate the skin, eyes, nose and throat. Wear safety glasses, rubber gloves, and long sleeved clothing when cleaning any of the powder residue from the vehicle.

If you find that the cleanup is irritating your skin, run cool water over the affected area. Also, if you experience nasal or throat irritation, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

UNDEPLOYED

The airbag modules must be stored in its original special container until used for service. At no time should a source of electricity be permitted near the inflator on the back of an airbag module. When carrying or handling an undeployed airbag module, the trim side of the airbag should be pointing away from the body to minimize possibility of injury if accidental deployment occurs. Do not place undeployed airbag face down on a solid surface, the airbag will propel into the air if accidentally deployment occurs.

REMOVAL AND INSTALLATION

AIRBAG CONTROL MODULE

WARNING: THE ACM CONTAINS THE IMPACT SENSOR WHICH ENABLES THE SYSTEM TO DEPLOY THE AIRBAGS. TO AVOID ACCIDENTAL DEPLOYMENT, NEVER CONNECT ACM ELECTRICALLY TO THE SYSTEM WHILE VEHICLE BATTERY IS CONNECTED. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT SERVICE PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

REMOVAL

(1) Disconnect and isolate battery negative cable. Allow at least two minutes for the reserve capacitor in the Airbag Control Module (ACM) to discharge.

REMOVAL AND INSTALLATION (Continued)

(2) Remove forward lower console from instrument panel, refer to Group 8E, Instrument Panel and Systems for proper procedures.

(3) Remove screw holding lower heat duct to instrument panel support (Fig. 3).

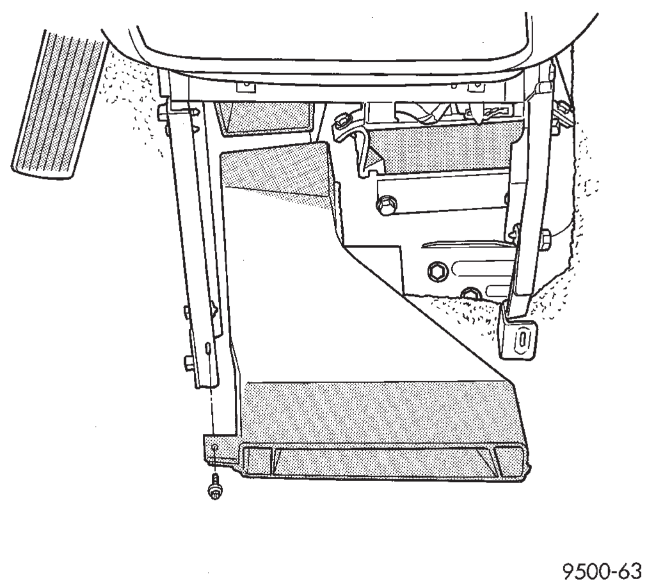

Fig. 3 Heat Duct

(4) Remove heat duct from instrument panel.

(5) Remove two bolts holding top of right support to instrument panel (Fig. 4).

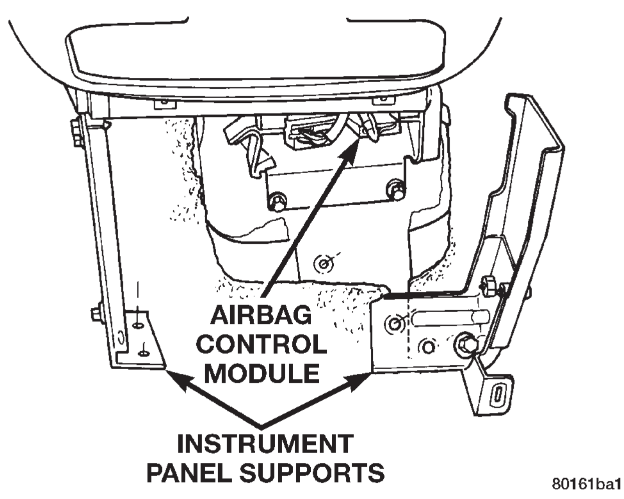

Fig. 4 Instrument Panel Supports

(6) Remove two bolts holding bottom of right support to floor pan.

(7) Separate right instrument panel support from vehicle.

(8) Disconnect two wire connectors from ACM (Fig. 5).

(9) Remove four bolts holding the ACM bracket assembly to floor (Fig. 6).

(10) Remove the ACM from vehicle.

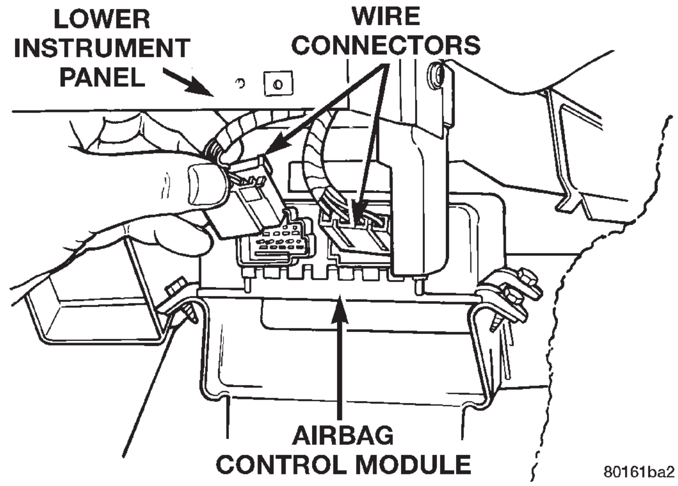

Fig. 5 ACM Connectors

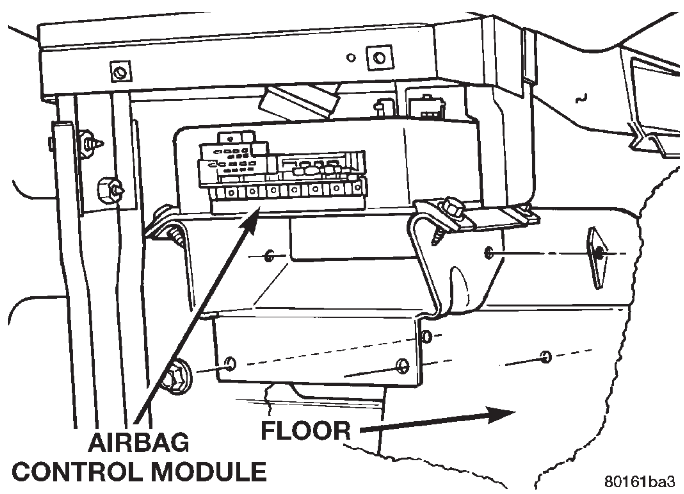

Fig. 6 ACM Bracket Assembly

INSTALLATION

WARNING: DO NOT REMOVE THE BOLTS HOLDING THE ACM TO THE ACM BRACKET. THESE BOLTS ARE SAFETY TORQUED AT THE MANUFACTURING FACILITY AND SHOULD NOT BE REMOVED FOR ANY REASON. THE NEW ACM WILL COME WITH A NEW BRACKET INSTALLED.

CAUTION: USE CORRECT SCREWS WHEN INSTALLING THE ACM

For installation, reverse the above procedures. Attach the ACM bracket assembly to vehicle with the proper screws and tighten to 805 to 11.9 N·m (75 to 105 in. lbs.) torque. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

REMOVAL AND INSTALLATION (Continued)

CLOCKSPRING

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT SERVICE PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

REMOVAL

(1) Position steering wheel and front wheels straight ahead.
(2) Release hood latch and open hood.
(3) Disconnect and isolate battery negative cable. Allow at least two minutes for the reserve capacitor in the ACM to discharge.
(4) Remove driver airbag from steering wheel (Fig. 7).
(5) Disconnect wire connectors from back of airbag module.
(6) Remove steering wheel (Fig. 8).
(7) Remove steering column shrouds (Fig. 9).

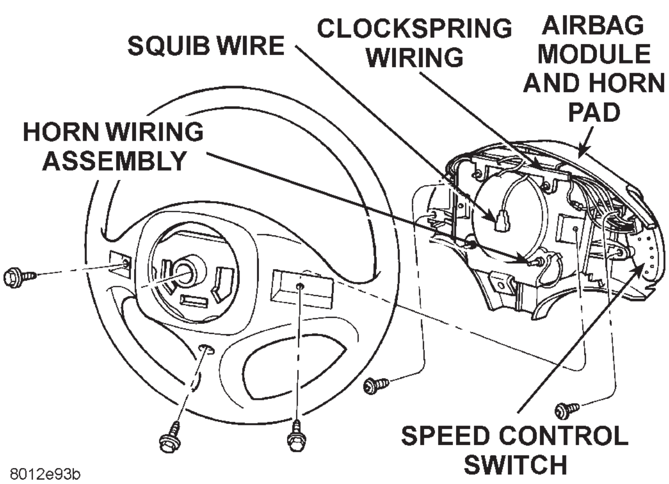

Fig. 7 Airbag/Horn Switch

(8) Disconnect 2-way and 4-way connectors between the clockspring and the instrument panel wiring harness.
(9) Remove clockspring from housing assembly by depressing the two tabs on the clockspring (Fig. 10)

INSTALLATION

For installation, reverse the above procedures. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

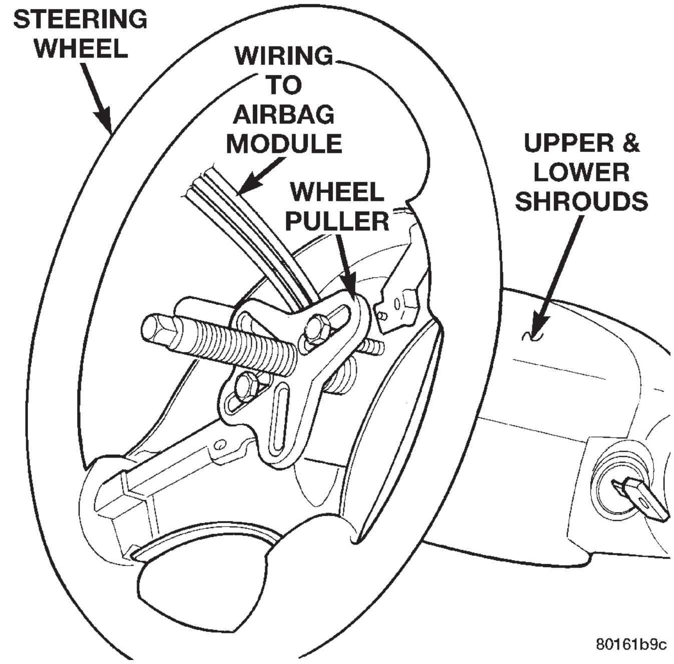

Fig. 8 Steering Wheel

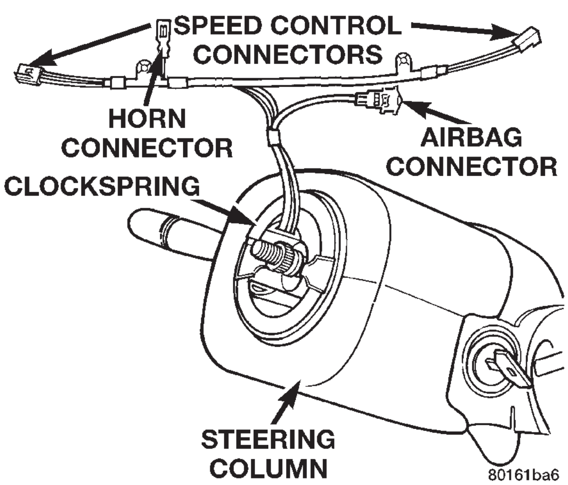

Fig. 9 Airbag Clockspring

DRIVER AIRBAG MODULE

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT SERVICE PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

REMOVAL AND INSTALLATION (Continued)

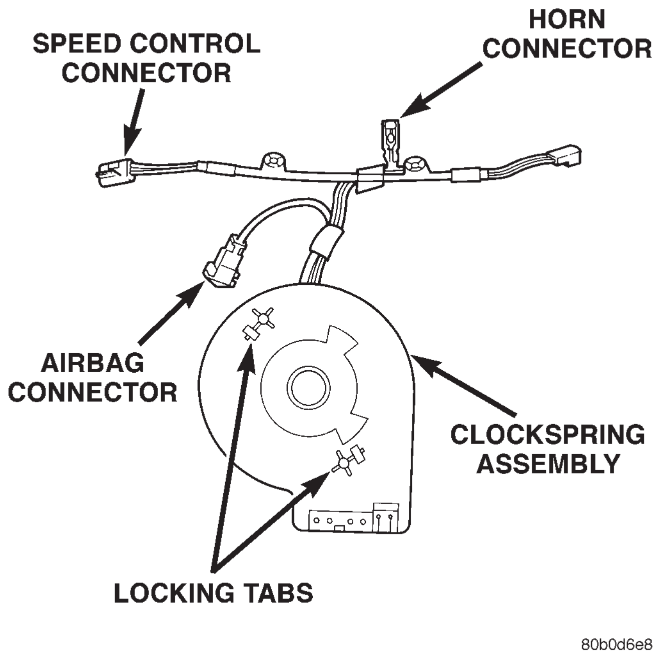

Fig. 10 Clockspring Locking Tabs

DEPLOYED MODULE

The Driver Airbag Module and Driver Airbag Cover/Horn Pad are serviced separately from eachother.

REMOVAL

(1) Disconnect battery negative cable. Allow at least two minutes for the reserve capacitor in the ACM to discharge.

(2) Clean powder residue from interior of vehicle, refer to Cleanup Procedure.

(3) Remove three screws attaching Driver Airbag Module to steering wheel (Fig. 7).

(4) Remove airbag module from steering wheel.

(5) Disconnect wire connectors from Airbag Module, horn switch, and speed control switches.

(6) Adjust the steering wheel so that the tires are in a straight ahead position. Remove steering wheel (Fig. 8), refer to Group 19, Steering for proper procedure.

(7) Disconnect the 2-way and 4-way connectors between the clockspring and the instrument panel wiring harness.

(8) Remove upper and lower steering column shrouds.

(9) Remove clockspring from the housing assembly by depressing the 2 tabs on the clockspring (Fig. 10).

(10) Remove screws holding speed control switches to airbag cover and remove, if equipped.

INSTALLATION

For installation, reverse the above procedures. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

UNDEPLOYED

REMOVAL

(1) Disconnect battery negative cable. Allow at least two minutes for the reserve capacitor in the Airbag Control Module (ACM) to discharge.

(2) Remove screws attaching airbag/horn switch to steering wheel (Fig. 7).

(3) Remove Driver Airbag Module from steering wheel.

(4) Disconnect wire connectors from airbag module, horn switch, and speed control switches, if equipped.

(5) Remove screws holding vehicle speed control switches to airbag cover and remove.

INSTALLATION

For installation, reverse the above procedures and do not connect battery negative cable. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

PASSENGER AIRBAG

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT SERVICE PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

DEPLOYED MODULE

REMOVAL

(1) Disconnect and isolate battery negative cable. Allow at least two minutes for the reserve capacitor in the Airbag Control Module to discharge.

(2) Clean powder residue from interior of vehicle, refer to Cleanup Procedure in this section.

(3) Remove instrument panel, refer to Group 8E, Instrument Panel and Systems for proper procedures.

(4) Remove all reusable components from the upper instrument panel.

INSTALLATION

Transfer all reusable components to the new the upper instrument panel.

(1) Install new Passenger Airbag Module into instrument panel.

(2) Install airbag module attaching screws to the instrument panel.

REMOVAL AND INSTALLATION (Continued)

(3) Install Instrument panel. Refer to Group 8E, Instrument Panel and Systems for installation procedures.

(4) Through access holes in instrument panel above glove box opening, install screws holding airbag to back of panel.

(5) Install the bolts attaching forward airbag mount to the instrument panel (Fig. 11).

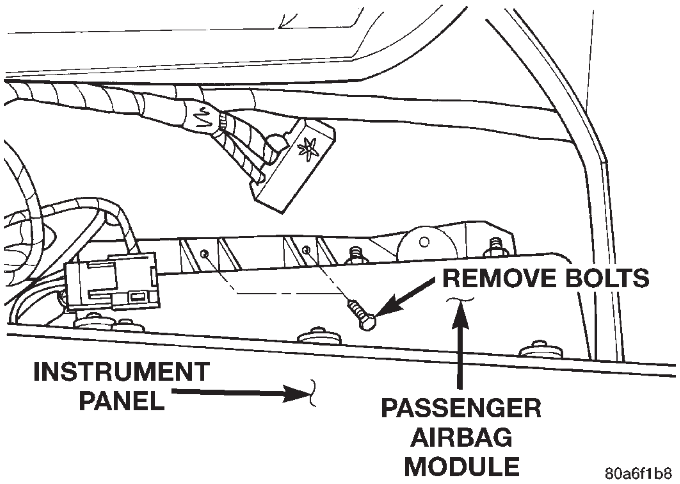

Fig. 11 Airbag Upper Attachment

(6) Connect yellow wire connector from passenger airbag.

(7) Install the glove box.

(8) Install right front instrument panel speaker.

(9) Install instrument panel top cover.

(10) Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

UNDEPLOYED

REMOVAL

(1) Disconnect battery negative cable. Allow at least two minutes for the reserve capacitor in the ACM to discharge.

(2) Remove instrument panel top cover.

(3) Remove right front instrument panel speaker.

(4) Remove glove box.

(5) Disconnect yellow wire connector from passenger airbag.

(6) Remove bolts attaching forward airbag mount to the instrument panel

(7) Through access holes in instrument panel above glove box opening, remove screws holding airbag to back of panel.

(8) Remove screws attaching airbag to upper instrument panel.

(9) Remove airbag from instrument panel through top of instrument panel.

INSTALLATION

For installation, reverse the above procedures. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

ADJUSTMENTS

CLOCKSPRING CENTERING PROCEDURE

If the rotating tape (wire coil) in the clockspring is not positioned properly with the steering wheel and the front wheels, the clockspring may fail. The following procedure MUST BE USED to center the clockspring if it is not known to be properly positioned, or if the front wheels were moved from the straight ahead position.

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT SERVICE PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

(1) Adjust the steering wheel so that the tires are in a straight ahead position.

(2) Disconnect and isolate battery negative cable. Allow at least two minutes for the reserve capacitor in the ACM to discharge.

(3) Remove Driver Airbag Module from steering wheel.

(4) Disconnect wire connectors from back of airbag module.

(5) Remove steering wheel.

(6) Depress the two plastic locking pins to disengage lock mechanism (Fig. 10).

(7) With lock mechanism disengaged, rotate the clockspring rotor clockwise until the rotor stops. Do not apply excessive force.

(8) From the end of travel, rotate the rotor three turns counterclockwise. The wires should end up at the top. Release locking pins to engage clockspring lock mechanism.

(9) Install steering wheel and airbag.

(10) Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

ELECTRICALLY HEATED SYSTEMS

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DESCRIPTION AND OPERATION

INTRODUCTION

The electrically heated Rear Window Defogger (Fig. 1), Heated Power Side View Mirrors, and Heated Windshield Wiper De-icer (Fig. 2) is available on NS vehicles.

The Rear Window Defogger system consists of two vertical bus bars linked by a series of grid lines on the inside surface of the rear window. The electrical circuit consists of the rear defogger switch in the HVAC and a relay with timer switch to turn OFF the system after ten minutes. The main feed circuit is protected by fuse one (40 amp) in the Junction Block. The rear defogger switch and relay also activates the heated power side view mirrors and heated windshield wiper de-icer. The HVAC rear defogger switch is protected by fuse ten (10 amp) in the Junction Block. The heated mirror circuit is protected by fuse 12 (10 amp) in the junction block. The heated windshield wiper de-icer circuit is protected by fuse 21 (25 amp) in the Junction Block.

The Heated Windshield Wiper Deicer is also activated when the DEFROST mode is selected on the HVAC. In the DEFROST mode the rear defogger relay/timer is bypassed, the heated windshield wiper de-icer will stay ON until the another mode is selected. For circuit information and component location refer to Group 8W, Wiring Diagrams.

CAUTION: Since grid lines can be damaged or scraped off with sharp instruments, care should be taken in cleaning the glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

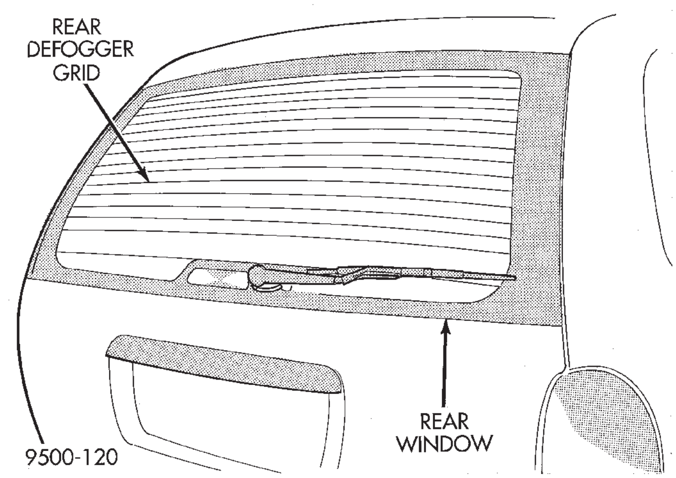

Fig. 1 Rear Window Defogger

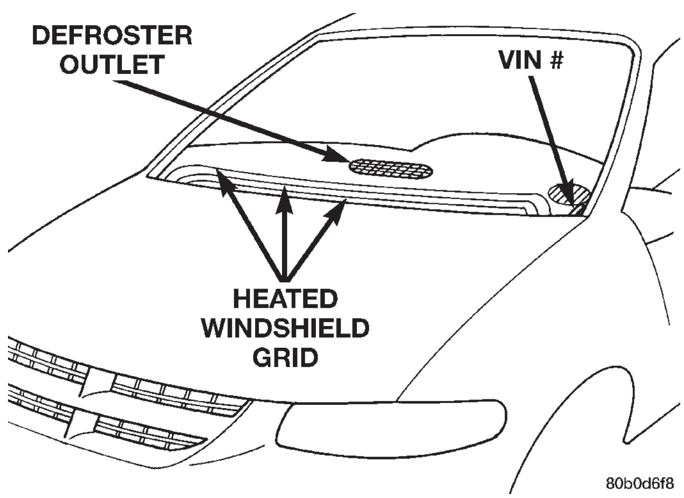

Fig. 2 Heated Windshield Wiper De-icer

HVAC MOUNTED SWITCH

The rear window defogger switch is integrated into the HVAC (Fig. 3). An LED indicator will illuminate when the switch is activated. The switch energizes the timing circuit and activates the rear window defogger relay. The relay controls the current to flow to the grids of the rear window defogger, heated power side view mirrors and the heated windshield wiper de-icer. The defogger relay will be on for approximately 10 minutes or until the control switch or ignition is turned off.

DIAGNOSIS AND TESTING (Continued)

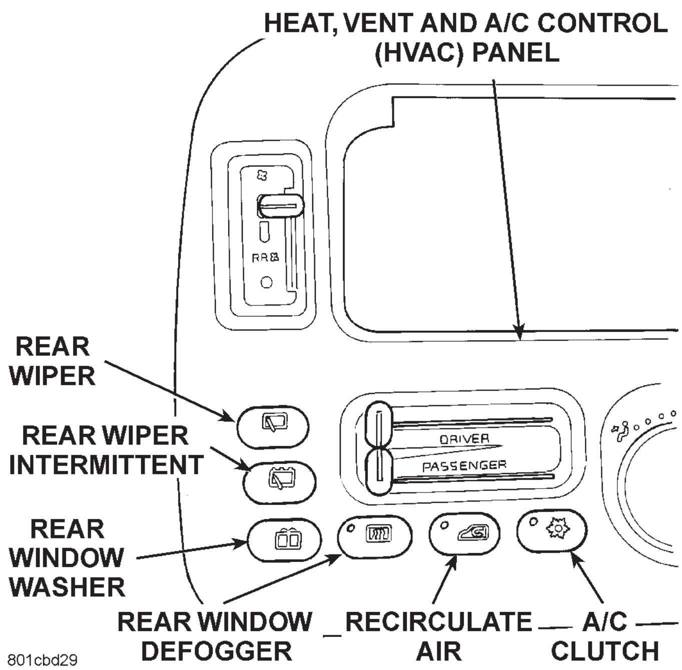

Fig. 3 HVAC Rear Window Defogger Switch

DIAGNOSIS AND TESTING

SYSTEM TEST

Electrically heated rear window defogger or the heated windshield wiper deicer operation can be checked on the vehicle in the following manner:

(1) Turn the ignition switch to the ON position.

(2) Using a ammeter on the battery, turn the rear defogger control switch to the ON position, a distinct increase in amperage draw should be noted.

(3) The rear window defogger or the heated windshield wiper deicer operation can be checked by feeling the glass. A distinct difference in temperature between the grid lines and adjacent clear glass can be detected in 3 to 4 minutes of operation.

(4) Using a DC voltmeter (Fig. 4) contact terminal B with the negative lead, and terminal A with the positive lead. The voltmeter should read 10-14 volts.

(5) Indicator light illumination means that there is power available at the switch only and does not necessarily verify system operation.

(6) If turning the defogger switch ON, no distinct current draw on the ammeter the problem should be isolated in the following manner:

- Confirm that ignition switch is ON.
- Ensure that the heated rear window or the heated windshield wiper deicer feed pigtail is connected to the wiring harness and that the ground pigtail is in fact grounded.
- Ensure that the proper fuse in the Junction Block is OK.

(7) When the above steps have been completed and the system is still inoperative, one or more of the following is defective:

- HVAC switch
- Rear window defogger relay in the relay bank.
- Check for loose connector or a wire pushed out of connector.
- Rear window or the windshield grid lines (all grid lines would have to be broken, or one of the feed pigtails not connected to the bus bar, for no ammeter deflection).

(8) If turning the switch ON produces severe voltmeter deflection, the circuit should be closely checked for a shorting condition.

(9) If the system operation has been verified but indicator LED does not light, replace switch.

(10) For detailed wiring information, refer to Group 8W, Wiring Diagrams.

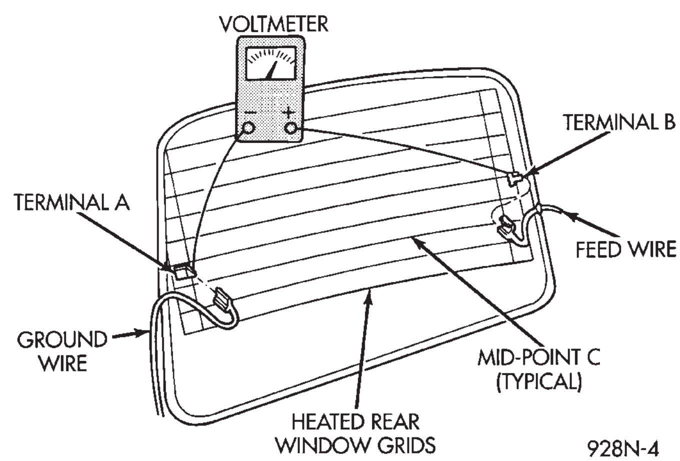

Fig. 4 Grid Line Test

GRID LINE TEST

The horizontal grid lines and vertical bus bar lines printed and baked on inside surface of the window glass makes up an electrical parallel circuit. The electrically conductive lines are composed of a silver ceramic material which when baked on glass becomes bonded to the glass and is highly resistant to abrasion. It is possible, however, that a break may exist or occur in an individual grid line resulting in no current flow through the line. To detect breaks in grid lines, the following procedure is required:

(1) Turn ignition and rear window defogger control switch ON. The indicator light should come on.

(2) Using a DC voltmeter with 0-15 volt range, contact vertical bus bar connecting grid lines on passenger side of vehicle at terminal A with negative lead of voltmeter (Fig. 4). With positive lead of voltmeter, contact vertical bus bar on driver side of vehicle at terminal B. The voltmeter should read 10-14 volts.

DIAGNOSIS AND TESTING (Continued)

(3) With negative lead of voltmeter, contact a good body ground point. The voltage reading should not change. A different reading indicates a poor ground connection.

(4) Connect negative lead of voltmeter to terminal A on passenger side bus bar and touch each grid line at Mid-Point with positive lead. A reading of approximately 6 volts indicates a line is good. A reading of 0 volts indicates a break in line between Mid-Point C and terminal B. A reading of 10-14 volts indicates a break between Mid-Point C and ground terminal A. Move toward break and voltage will change as soon as break is crossed.

SERVICE PROCEDURES

GRID LINE AND TERMINAL REPAIR

WARNING: REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION. CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, HARMFUL IF SWALLOWED. AVOID CONTACT WITH SKIN AND EYES. FOR SKIN, WASH AFFECTED AREAS WITH SOAP AND WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING; CALL A PHYSICIAN IMMEDIATELY. IF IN CONTACT WITH EYES, FLUSH WITH PLENTY OF WATER. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTENTS CONTAINS 3% FLAMMABLE SOLVENTS. KEEP OUT OF REACH OF CHILDREN.

The repair for the front windshield or the rear window grids are the same.

The repair of grid lines and replacement of the terminal is possible using the Mopar® Repair Package or equivalent.

(1) Clean area surrounding grid line or terminal by gently rubbing area with steel wool.

(2) Wipe area with clean cloth soaked in alcohol or similar solvent. It is necessary that all contaminants be removed from repair area.

(3) Remove package separator clamp and mix plastic conductive epoxy thoroughly.

(4) For grid line, mark off area to be repaired with masking tape (Fig. 5).

(5) Apply conductive epoxy through slit in masking tape. Overlap both ends of the break.

(6) For a terminal replacement, apply a thin layer of epoxy to area where terminal was fastened.

(7) Apply a thin layer of epoxy on terminal and place terminal on desired location. To prevent terminal from falling off use a wooden wedge to secure it.

(8) Carefully remove masking tape from grid line.

CAUTION: Do not allow the laminated windshield glass surface to exceed 82° C (180° F) or the glass may fracture. The rear window glass surface should not exceed 204° C (400° F).

(9) Allow epoxy to cure 24 hours at room temperature.

(10) After epoxy is properly cured remove wedge from terminal and check the operation of the rear window defogger.

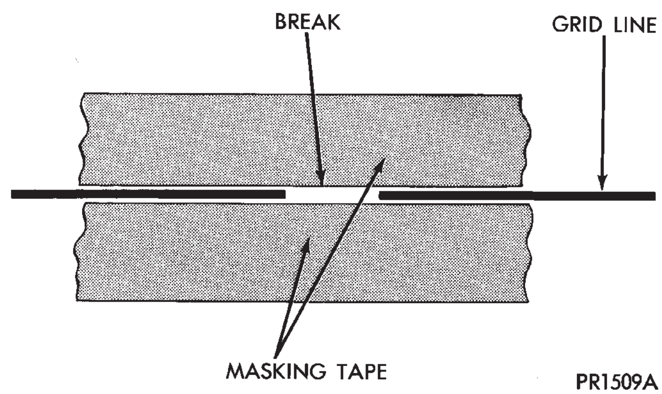

Fig. 5 Grid Line Repair

POWER DOOR LOCKS

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POWER DOOR LOCKS

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GENERAL INFORMATION

INTRODUCTION

The Body Control Module (BCM) locks or unlocks the doors when an actuation input signal from a door lock switch or Remote Keyless Entry Module (RKE) is received. The BCM signals lock and unlock relays in the Junction Block to actuate the door lock motors. The front doors, sliding door(s) and liftgate are equipped with actuator motors to lock or unlock the latch mechanisms. The front door lock actuator motor is not serviced separately from the door latch. The BCM locks the doors and liftgate automatically when the vehicle is driven beyond the speed of 25.7 Km/h (16 mph). The automatic door lock feature can be disabled if desired. All doors and liftgate can be locked or unlocked using mechanical button or key cylinder methods.

DESCRIPTION AND OPERATION

AUTOMATIC DOOR LOCK FEATURE

The vehicle comes with two options for power door locks:

- Rolling automatic lock (ENABLE), doors automatically lock at approximately at 25.7 Km/h (16 mph).
- No rolling automatic lock (DISABLE), doors do not automatically lock when the vehicle is moving.

The BCM is equipped with a disable feature to stop the speed sensitive automatic door locks from functioning. The DISABLE feature can be switched ON or OFF as desired. When the system is DISABLED the door locks will operate normally, but will not lock automatically when the vehicle is rolling. When the door locks are ENABLED the door locks will automatically lock when the vehicle is moving at about 25.7 Km/h (16 mph).

DOOR LOCK CIRCUIT PROTECTION

The BCM controls the door lock relay's operation. If the door lock switch is actuated continuously for more than one second the BCM will interrupt the relay circuit. The door lock system is protected by a 40 amp fuse located in the Power Distribution Center (PDC). The LOCK and UNLOCK relays are located in the Junction Block. The Power Distribution Center is located along side of the battery. The lock motors are protected with Positive Temperature Coefficient (PTC) device that prevents motor burn out.

DESCRIPTION AND OPERATION (Continued)

DOOR LOCK INHIBIT FEATURE

The BCM cancels out the door lock switch actuation, when the key is in the Ignition Switch and a door is open. After the key is removed from the Ignition Switch, or the doors are closed, the power door locks will operate normally.

SLIDING DOOR LOCK MEMORY FEATURE

The door locks on the sliding door(s) can be actuated when the door(s) are closed. If the sliding door(s) are open when the door locks are actuated, the BCM will hold the lock command in memory until the door(s) is closed. When the door is closed and the door jamb terminals make contact, signaling the BCM to lock the sliding door(s) automatically. Actuating the door lock switch to the unlock position before the sliding door(s) are closed will cancel the lock request.

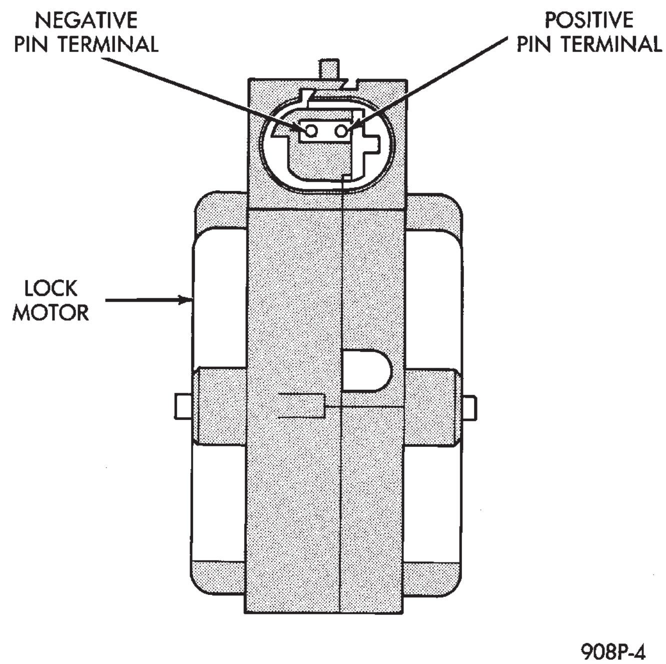

Fig. 1 Sliding Door Lock Motor–Typical

DIAGNOSIS AND TESTING

AUTOMATIC DOOR LOCK SYSTEM TEST

When using a scan tool (DRB) for testing the automatic door lock system, refer to the Body Diagnostic Procedures Manual. Refer to Group 8W, Wiring Diagrams for circuit information and component locations.

DOOR LOCK MOTOR

Verify battery condition before testing door lock motor(s), refer to Group 8A, Battery for proper diagnosis procedures.

To determine which motor is faulty, check each individual door for electrical lock and unlock or disconnect the motor connectors one at a time, while operating the door lock switch. In the event that none of the motors work, the problem may be caused by a shorted motor, a relay or a bad switch. Disconnecting the defective motor will allow the others to work.

To test an individual door lock motor, disconnect the electrical connector from the motor. To lock the door, connect a 12 volt power source to the positive pin of the lock motor and a ground wire to the other pin (Fig. 1), (Fig. 2), (Fig. 3) and refer to Group 8W, Wiring Diagrams for pin locations. To unlock the door reverse the wire connections at the motor pin terminals. If these results are NOT obtained, replace the motor.

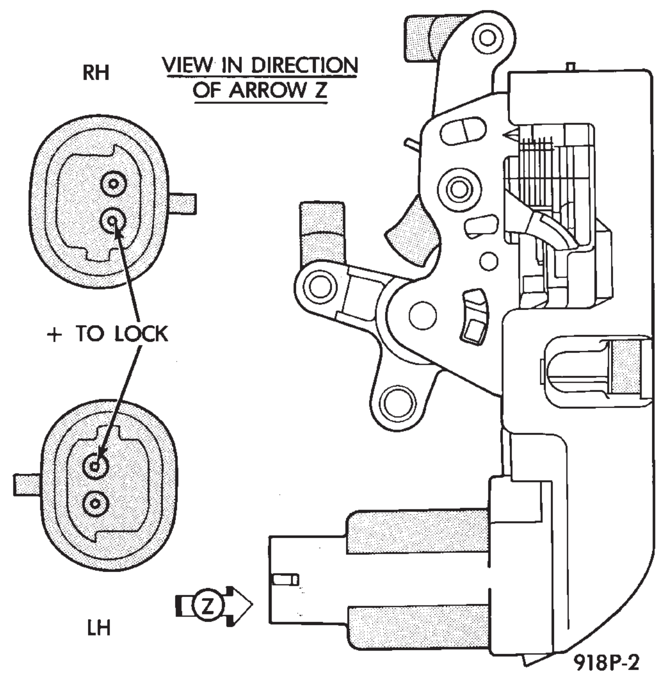

Fig. 2 Front Door Lock Motor

DOOR LOCK SWITCH TEST

(1) Remove door lock switch bezel assembly from door. Refer to Group 23, Body for removal procedures.

(2) Disconnect wire connector from back of door lock switch.

(3) Depress switch to LOCK position.

(4) Using an ohmmeter, test switch resistance between Pins 2 and 3. Refer to Door Lock Switch Test and (Fig. 4).

(5) Depress switch to UNLOCK position.

(6) Test resistance between Pins 2 and 3.

(7) If resistance values are not within the parameters shown replace the door lock switch.

SERVICE PROCEDURES (Continued)

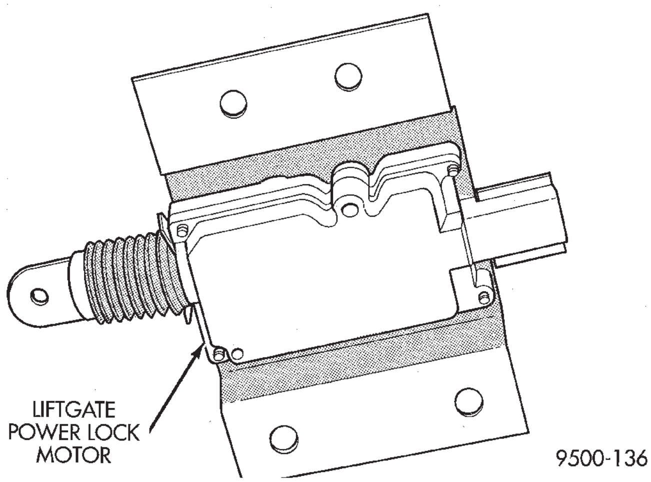

Fig. 3 Lift Gate Release Assembly

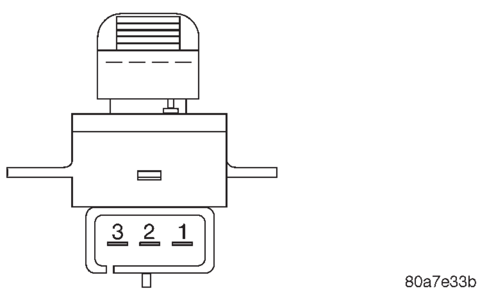

Fig. 4 Door Lock Switch

DOOR LOCK SWITCH TEST

SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE VALUE
LOCK	2 and 3	1.5K Ohm ± 1%
UNLOCK	2 and 3	249 Ohm ± 1%

SERVICE PROCEDURES

AUTOMATIC DOOR LOCKS DISABLE OR ENABLE

The vehicle comes with two options for power door locks:

- Rolling automatic lock, ENABLE approximately at 16 mph.
- No rolling automatic lock, DISABLE.

To change the automatic door lock selection, do the following:

(1) Close all doors.

(2) Place the ignition key in the OFF position for 20 seconds or more.

(3) Turn ignition key to the run position and to the OFF position without cranking the engine four times. The malfunction lamp will come on each time the key is in the run position.

(4) Press the door lock button to lock the doors. This procedure reverses the automatic door lock option, Enable to Disable, or Disable to Enable. If the present option is undesirable, repeat to arrive at the desired option.

REMOVAL AND INSTALLATION

FRONT DOOR LOCK MOTOR/LATCH

Refer to Group 23, Body for proper service procedures.

LIFTGATE LOCK MOTOR

REMOVAL

(1) Remove liftgate trim panel.

(2) Remove bolts holding liftgate lock motor to liftgate (Fig. 5).

(3) Disconnect the wire connector from power lock motor.

(4) Disconnect the liftgate lock motor from outside handle lock link.

(5) Remove the liftgate lock motor from vehicle.

INSTALLATION

For installation, reverse the above procedures.

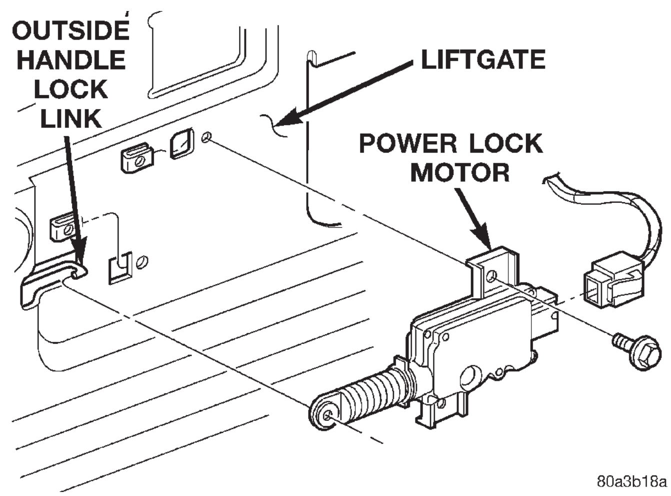

Fig. 5 Liftgate Lock Motor

SLIDING DOOR LOCK CONTACTS

REMOVAL

(1) Open the sliding door.

(2) Remove screw holding the lock contacts to B-pillar (Fig. 6).

(3) Disconnect the wire connector from the lock contacts.

(4) Remove the lock contacts from B-pillar.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

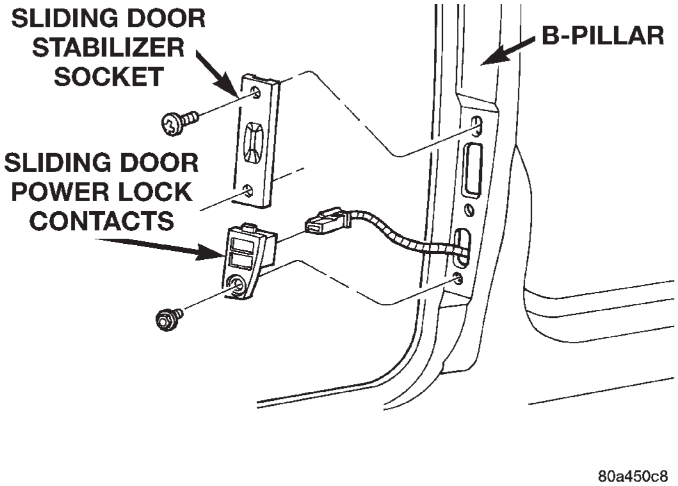

Fig. 6 Sliding Door Lock Contacts

SLIDING DOOR LOCK MOTOR

REMOVAL

(1) Remove sliding door trim panel.
(2) Remove watershield as necessary.
(3) Remove latch/lock control cover.
(4) Remove latch/lock control.
(5) Remove screws holding door lock motor to latch/lock control (Fig. 7).
(6) Remove lock motor from control.

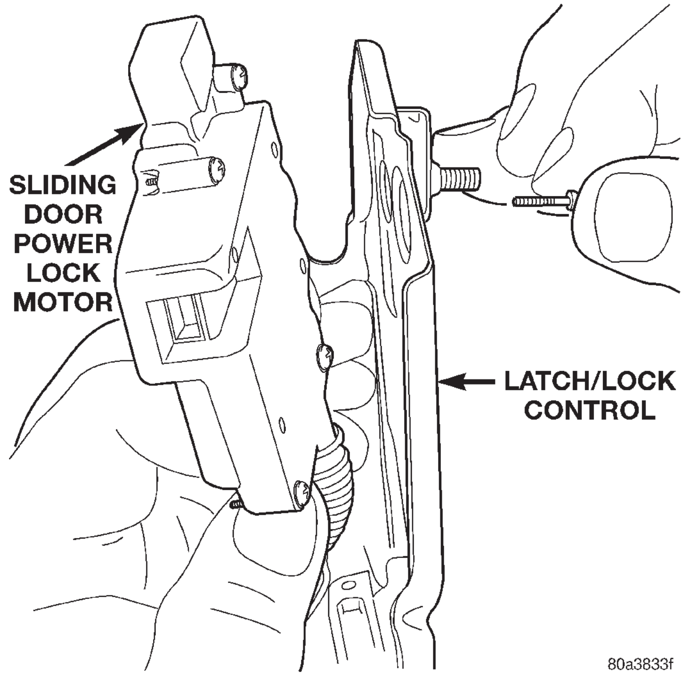

Fig. 7 Sliding Door Lock Motor

INSTALLATION

For installation, reverse the above procedures.

SLIDING DOOR LOCK PLUNGER

REMOVAL

(1) Remove sliding door trim panel.
(2) Remove watershield as necessary to gain access to push-in fasteners holding sliding door lock plunger wiring harness to inner door panel.
(3) Make note of wiring harness routing to aid installation (Fig. 8).
(4) Remove push-in fasteners holding lock plunger wiring harness to inner door panel.
(5) Disconnect plunger wiring harness from sliding door lock motor.
(6) Remove screw holding lock plunger to door frame (Fig. 8).
(7) Remove lock plunger from sliding door.

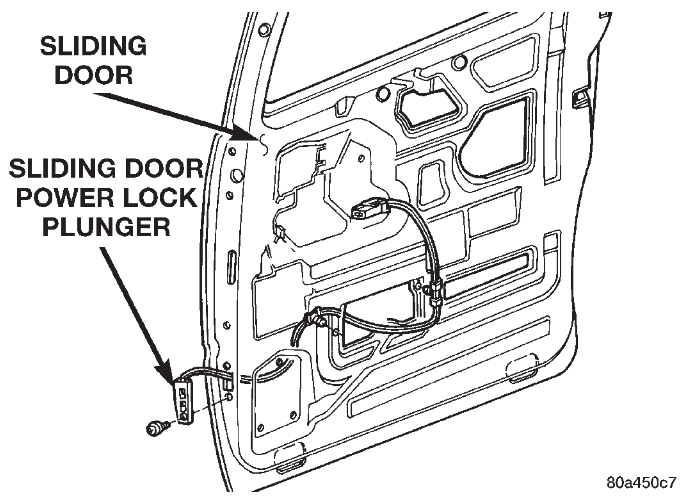

Fig. 8 Sliding Door Lock Plunger

INSTALLATION

For installation, reverse the above procedures.

REMOTE KEYLESS ENTRY

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DESCRIPTION AND OPERATION

INTRODUCTION

The key fob transmitter has three buttons to actuate and program the Remote Keyless Entry (RKE) system (Fig. 1).

- UNLOCK: Pressing the UNLOCK button once will unlock the driver door and activate the illuminated entry system and disarm Vehicle Theft Security System, if equipped. Pressing the UNLOCK button twice within five seconds will unlock all doors and activate the illuminated entry system.
- LOCK: Pressing the LOCK button locks all doors and sounds horn (chirp) and arm the Vehicle Theft Security System. The chirp verifies the door lock operation.
- PANIC: Pressing the PANIC button sounds the horns at half second intervals, flashes the exterior lamps, and turns ON the interior lamps. The panic alarm will remain on for three minutes, or until the PANIC button is actuated again or the ignition switch is turned to the RUN position.
- The Remote Keyless Entry Module is capable of retaining the transmitter Vehicle Access Code(s) (VAC) in its memory even after vehicle power has been interrupted.
- The RKE system activates the optional memory seat and mirror system, if equipped. Two primary key fob transmitters can be programmed to actuate memory seat and mirror setting 1 or 2. Two additional key fob transmitters can be added, but they will not be able to operate the memory seat and mirror system. Refer to Group 8R, Power Seats and Group 8T, Power Mirrors for memory system information.

VEHICLE ACCESS CODE (VAC) PROGRAMMING

The RKE module is capable of retaining up to four different Vehicle Access Codes. Whenever the vehicle battery power is interrupted the RKE Module will

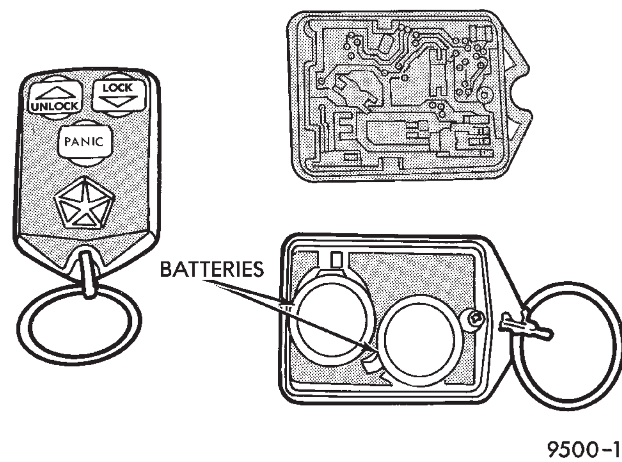

Fig. 1 Key Fob Transmitter

retain all vehicle access codes in its memory. When replacing or adding a key fob transmitter (maximum 4) a functional key fob transmitter is required to program the RKE Module to accept the new Vehicle Access Code. If a functional key fob transmitter is not available, a scan tool (DRB) can be used to program the RKE Module. Refer to the proper Body Diagnostic Procedures manual for Vehicle Access Code programming procedures using a scan tool.

DIAGNOSIS AND TESTING

RKE DIAGNOSTICS

Refer to Group 8W, Wiring Diagrams for circuit information and component locations. Refer to the proper Body Diagnostic Procedures manual for testing the Remote Keyless Entry system using a scan tool (DRB). Also refer to other interrelated systems groups within this manual:

- Group 8Q, Vehicle Theft Security System
- Group 8R, Power Seats
- Group 8T, Power Mirrors

SERVICE PROCEDURES

HORN CHIRP DISABLE OR ENABLE

The horn chirp can be DISABLED or ENABLED using the following procedure.

To DISABLE (cancelling) the horn chirp feature, press and hold the transmitter LOCK button for a minimum four seconds. While pressing LOCK button in, press the UNLOCK button. The horn chirp feature will not function until the above procedure is repeated. To ENABLE (reinstate) the horn chirp feature, use any one of the four key fob transmitters and reverse the above procedures. It will ENABLE the horn chirp feature for all transmitters.

REMOVAL AND INSTALLATION

RKE MODULE

REMOVAL

(1) Remove instrument panel top cover. Refer to Group 8E, Instrument Panel and Gauges for proper procedures.

(2) Remove screws holding RKE module to instrument panel.

(3) Disconnect wire connector from RKE module (Fig. 2).

(4) Remove the RKE module.

INSTALLATION

For installation, reverse the above procedures.

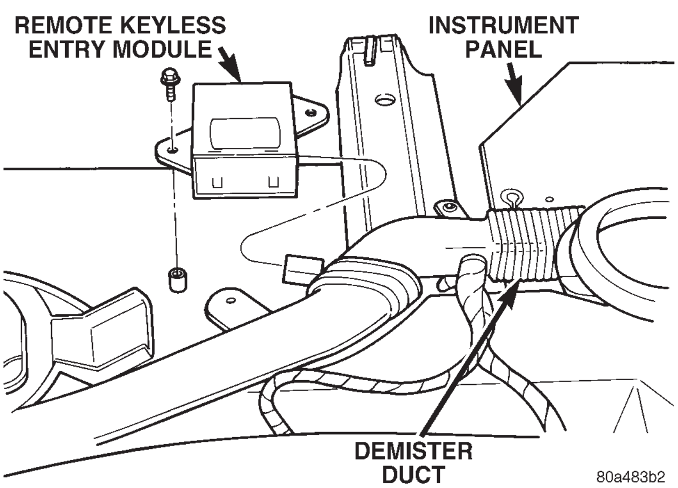

Fig. 2 RKE Module

ADJUSTMENTS

PROGRAMMING RKE MODULE

(1) Using a functional key fob transmitter, unlock the vehicle and disarm the Vehicle Theft Security System.

(2) Insert ignition key into the ignition switch.

(3) Turn the ignition switch to RUN position without starting engine.

(4) Using a functional key fob transmitter, press and hold the UNLOCK button for a minimum four seconds (maximum ten seconds).

(5) While holding UNLOCK button, and before ten seconds passes, press and release the PANIC button. A single chime will sound to verify that the RKE module is set to receive the new Vehicle Access Code(s).

(6) Within 30 seconds of the chime, press any button on each new key fob transmitter. After 30 seconds or when ignition switch is turned OFF, the RKE module will end the programming mode. A single chime will sound to verify that the RKE module will no longer receive additional Vehicle Access Code(s).

(7) When Vehicle Access Code(s) programming is complete, turn Ignition Switch to the OFF position and verify RKE system operation using each key fob.

NOTE: Only the primary (first two) key fob transmitters will operate the memory seat and mirror systems. If a primary key fob is being replaced, the memory seat and mirror module will require programming. Refer to Group 8R, Power Seats for proper (data link) programming procedure.

SPECIFICATIONS

RKE TRANSMITTER BATTERY

The batteries can be removed without special tools and are readily available at local retail stores. The recommended battery is Duracell DL 2016 or equivalent. Battery life is about one to two years.

CAUTION: Do not touch the battery terminals or handle the batteries any more than necessary. Hands must be clean and dry.

RKE TRANSMITTER RANGE

Normal operation range is up to about a distance of 7 meters (23 ft.) of the vehicle. Range may be better or worse depending on the environment around the vehicle. Closeness to a radio frequency transmitter such as a radio station tower may degrade operational range, while range in an open field will be enhanced.

VEHICLE THEFT SECURITY SYSTEM

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GENERAL INFORMATION

INTRODUCTION

Vehicles equipped with the Vehicle Theft Security System (VTSS) system, the doors, liftgate, hood and ignition circuit are monitored by the Body Control Module (BCM) when the system is armed. The VTSS will prevent the engine from starting until the BCM receives a disarm signal. If the VTSS is triggered, the horn will pulse, headlamps/marker lamps will flash, and the VTSS warning lamp will flash. If BCM determines the threat to be false and the VTSS is not triggered again, the system will shut down and rearm itself after three minutes. The VTSS monitoring portion of the system is split into two sections. The engine compartment section and the passenger compartment section. If a malfunction occurs in the engine compartment section, the passenger compartment section would still arm and function normally. If an electrical malfunction occurs in either section of the system a Diagnostic Trouble Code (DTC) would be stored the BCM memory to aid system repair. DTCs can be retrieved using scan tool (DRB) attached to the diagnostic connector above the accelerator pedal.

ENABLING

To initialize the VTSS feature the operator must, with the engine compartment hood open, cycle the key in the liftgate key cylinder to the unlock position giving the BCM a disarm signal. At this time the visual alarm outputs the headlamps and marker lamps will function. However the audio alarm output the horn and engine disable portion of the VTSS will not function until there has been twenty consecutive engine run cycles. When this has occurred the total VTSS will function.

If during alarm being set the BCM receives a request from the RKE module to enter PANIC mode the BCM will cancel the alarm, return VTSS armed state and then perform the RKE PANIC feature.

DESCRIPTION AND OPERATION

ARMING PROCEDURE

METHOD-A

(1) With the key removed from the ignition lock and any door open, actuate one of the following:
- Power door lock button to LOCK,
- Key fob LOCK button
- Door lock key cylinder to locked position.

(2) Close all opened doors.

(3) After the last door is closed, an arming time-out period of sixteen seconds will start, then the VTSS will become armed.

METHOD-B

Actuating the key fob transmitter LOCK button, key locking the front doors or liftgate with the doors closed and the ignition locked will begin the arming time-out period. If method-A, 16 second time-out sequence was in process when method-B was actuated, the 16 second time-out will restart from the time of the second actuation.

If the security lamp does not illuminate at all upon final door closure, it indicates that the system is not arming.

The current VTSS status armed or disarmed shall be maintained in memory to prevent battery disconnects from disarming the system.

DESCRIPTION AND OPERATION (Continued)

TIME-OUT PERIOD

The VTSS requires 16 consecutive seconds to time-out and arm the alarm. If a door is key unlocked, key fob unlocked. or the ignition is switched ON, the VTSS will cancel out. To reset the VTSS, perform methods A or B.

TRIGGERING THE VTSS

After the VTSS is armed, following actions will trigger the alarm:

- Opening any door.
- Opening the hood
- Turning the ignition to the ON or unlock position.
- The ignition switch can be turned to the accessory position without triggering alarm system.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

Refer to Group 8W, Wiring Diagrams for circuit information and component locations. Using a scan tool (DRB). Refer to the proper Body Diagnostic Procedures manual for test procedures.

REMOVAL AND INSTALLATION

BODY CONTROL MODULE

REMOVAL

(1) Disconnect the battery negative cable.

(2) Remove the lower steering column cover and the knee blocker reinforcement.

(3) Disconnect the two wire connectors from the bottom of the Body Control Module (BCM) (Fig. 1).

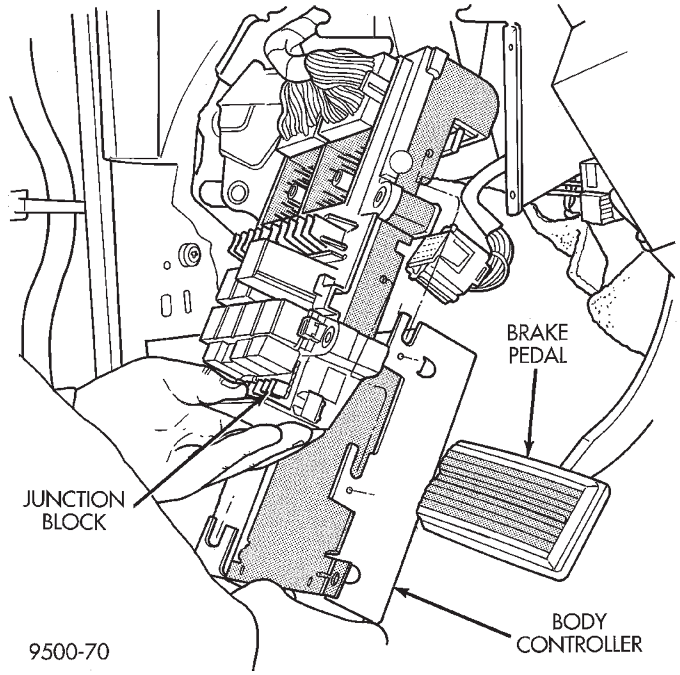

Fig. 1 Body Control Module

(4) Remove the bolts holding the Junction Block to the dash panel mounting bracket.

(5) Remove the Junction Block from the mounting bracket.

(6) Remove the screws holding BCM to Junction Block.

(7) Slide the BCM downward to disengage guide studs on Junction Block from the channels on the BCM mounting bracket.

(8) Remove the BCM from Junction Block.

INSTALLATION

For installation, reverse the above procedure.

DOOR LOCK CYLINDER SWITCH

REMOVAL

(1) Remove the door trim and water shield.

(2) Close the door window.

(3) Disconnect the door lock cylinder switch wire connector from the door harness and wiring clip from the impact beam.

(4) Remove the outer handle from the door.

(5) Disengage the lock tab holding switch to the back of the lock cylinder (Fig. 2).

(6) Remove the switch from the door handle.

INSTALLATION

For installation, reverse the above procedure.

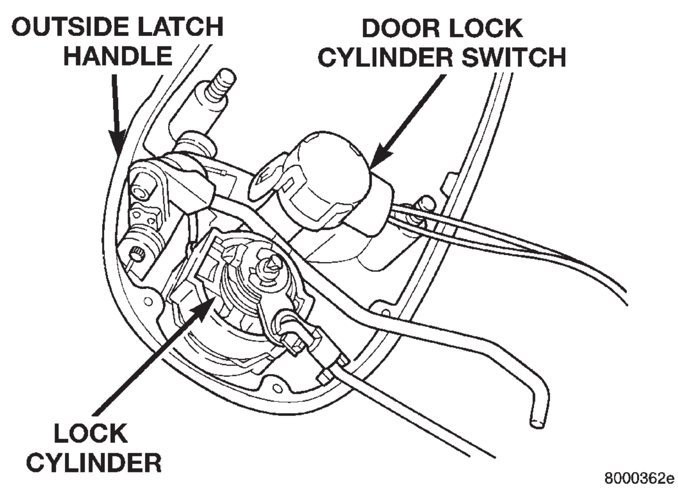

Fig. 2 Door Lock Cylinder Switch

FRONT DOOR AJAR (VTSS TRIGGER) SWITCH

REMOVAL

(1) Open the front door.

(2) Remove the screw holding the door ajar switch to the door B-pillar (Fig. 3).

(3) Remove the door ajar switch from the B-pillar.

REMOVAL AND INSTALLATION (Continued)

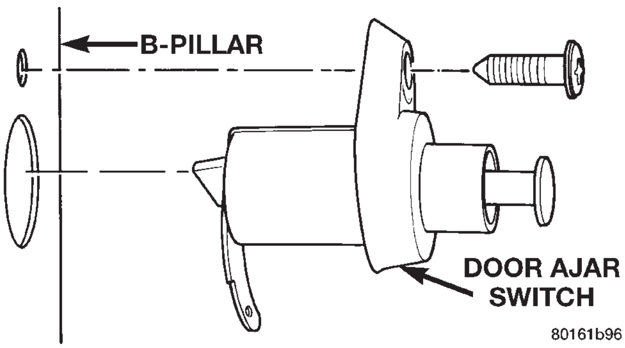

Fig. 3 Front Door Ajar Switch

(4) Disconnect the wire connector from the back of the ajar switch and remove the switch.

INSTALLATION

For installation, reverse the above procedure.

HOOD AJAR (VTSS TRIGGER) SWITCH

REMOVAL

(1) Release the hood latch and open the hood.

(2) Using a small flat blade screws driver, pry trigger switch from top of the radiator closure panel.

(3) Disconnect the trigger switch from the wire connector and remove the switch (Fig. 4).

INSTALLATION

For installation, reverse the above procedure.

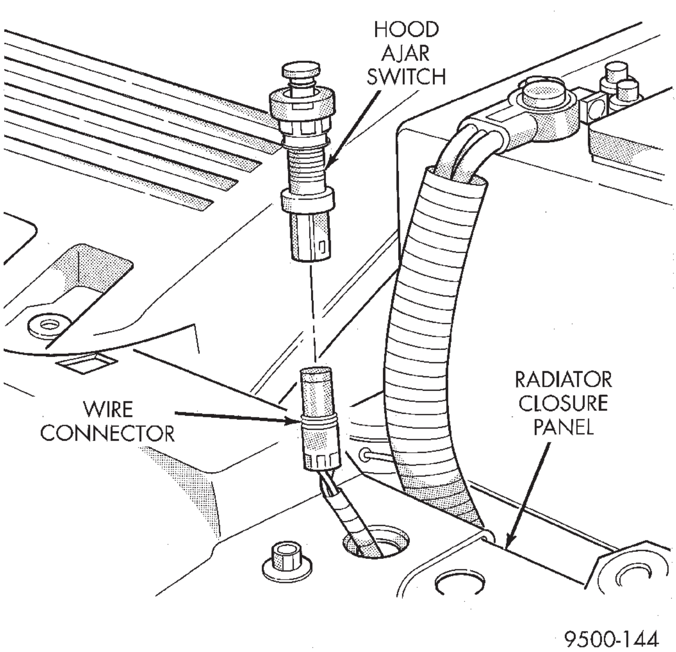

Fig. 4 Hood Ajar Switch

LIFTGATE AJAR (VTSS TRIGGER) SWITCH

REMOVAL

(1) Remove the liftgate latch from the vehicle. Refer to group 23, Body for proper procedures.

(2) Disconnect the wire connector from the liftgate ajar switch.

(3) Remove the screw holding the ajar switch to the liftgate latch and remove the switch (Fig. 5).

INSTALLATION

For installation, Reverse the above procedure.

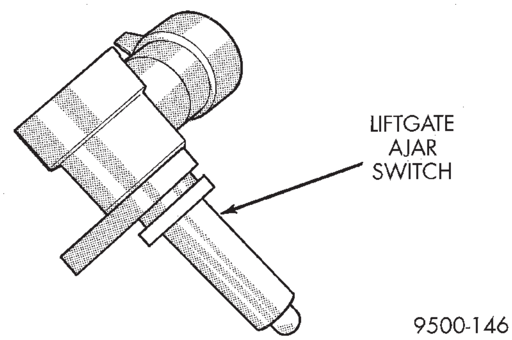

Fig. 5 Liftgate Ajar switch

LIFTGATE LOCK CYLINDER SWITCH

REMOVAL

(1) Remove the inner trim panel from the liftgate. Refer to Group 23, Body for proper procedure.

(2) Disconnect the door lock cylinder switch wire connector from the liftgate harness and clip from the liftgate inner panel.

(3) Remove the outside latch release handle.

(4) Disconnect the lock tab holding the switch to the back of lock cylinder and remove the switch (Fig. 6).

INSTALLATION

For installation, reverse the above procedure.

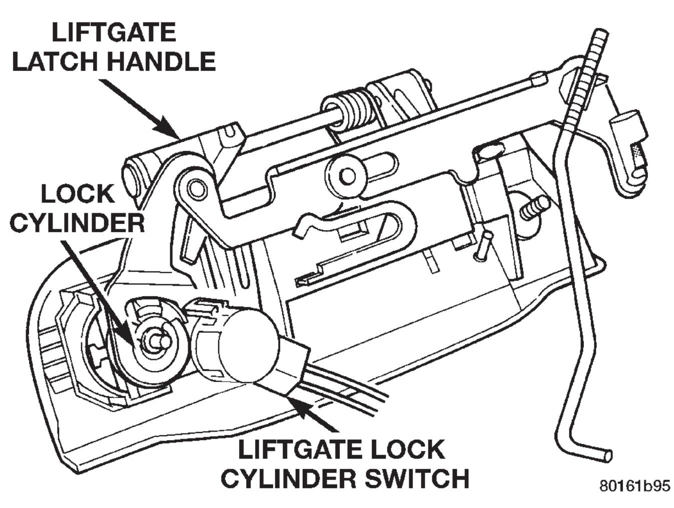

Fig. 6 Liftgate Lock Cylinder Switch

REMOVAL AND INSTALLATION (Continued)

SLIDING DOOR AJAR (VTSS TRIGGER) SWITCH

REMOVAL

(1) Release the sliding door latch and allow back of the door to pop open.

(2) Through opening at the rear edge of the sliding door on outside of the vehicle, pry door ajar switch from quarter panel opening (Fig. 7).

(3) Disconnect the wire connector from the back of the ajar switch.

(4) Remove the sliding door ajar switch.

INSTALLATION

For installation, reverse the above procedure.

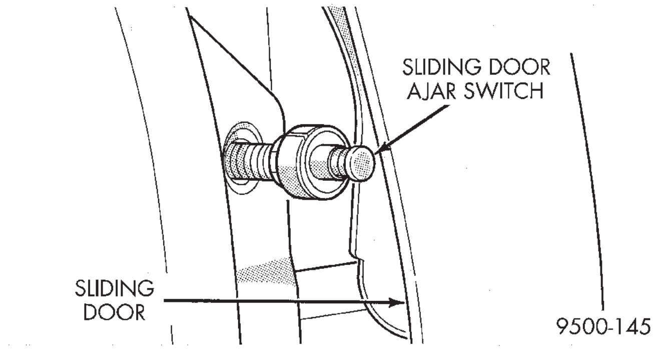

Fig. 7 Sliding Door Ajar Switch

VEHICLE THEFT/SECURITY SYSTEMS

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GENERAL INFORMATION

INTRODUCTION

The Smart Key Immobilizer System (SKIS) is available factory-installed optional equipment for this model. Following are some general descriptions of the features and components of the SKIS. Refer to the vehicle owner's manual for more information on the use and operation of the SKIS. Refer to 8W-30 - Fuel/Ignition System in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

SMART KEY IMMOBILIZER SYSTEM

The Smart Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by preventing the engine from operating while the system is armed. The primary components of this system are the Smart Key Immobilizer Module (SKIM), the Smart Key transponder, the SKIS indicator lamp, and the Powertrain Control Module (PCM), for gasoline engines, and the Body Control Module (BCM) for diesel engines.

The SKIM is installed on the steering column near the ignition lock cylinder. The transponder is located under the molded rubber cap on the head of the ignition key. The SKIS indicator lamp is located in the instrument cluster.

The SKIS includes two valid Smart Key transponders from the factory. If the customer wishes, additional non-coded blank Smart Keys are available. These blank keys can be cut to match a valid ignition key, but the engine will not start unless the key transponder is also programmed to the vehicle. The SKIS will recognize no more than eight valid Smart Key transponders at any one time.

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store Diagnostic Trouble Codes (DTCs) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a DRB scan tool as described in the proper Diagnostic Procedures manual.

DESCRIPTION AND OPERATION

SMART KEY IMMOBILIZER MODULE

The Smart Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a central processing unit, which includes the Smart Key Immobilizer System (SKIS) program logic. The SKIS programming enables the SKIM to program and retain in memory the codes of at least two, but no more than eight electronically coded Smart Key transponders. The SKIS programming also enables the SKIM to communicate over the Chrysler Collision Detection (CCD) data bus network with the Powertrain Control Module (PCM), the instrument cluster and/or the DRB scan tool.

The SKIM transmits and receives RF signals through a tuned antenna enclosed within a molded plastic ring formation that is integral to the SKIM housing. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing. This antenna ring must be located within eight millimeters (0.31 inches) of the Smart Key in order to ensure proper RF communication between the SKIM and the Smart Key transponder.

For added system security, each SKIM is programmed with a unique “Secret Key” code and a security code. The SKIM keeps the “Secret Key” code in memory and sends the code over the CCD data bus to the PCM, which also keeps this code in its memory. The SKIM also sends the “Secret Key” code to each of the programmed Smart Key transponders. The security code is used by the assembly plant to

DESCRIPTION AND OPERATION (Continued)

access the SKIS for initialization, or by the dealer technician to access the system for service. The SKIM also stores in its memory the Vehicle Identification Number (VIN), which it learns through a CCD data bus message from the PCM during initialization.

The SKIM and the PCM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized SKIS disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKIM or the PCM. However, the use of this strategy also means that replacement of either the SKIM or the PCM units will require a system initialization procedure to restore system operation.

When the ignition switch is turned to the On or Start positions, the SKIM transmits an RF signal to excite the Smart Key transponder. The SKIM then listens for a return RF signal from the transponder of the Smart Key that is inserted in the ignition lock cylinder. If the SKIM receives an RF signal with valid “Secret Key” and transponder identification codes, the SKIM sends a “valid key” message to the PCM over the CCD data bus. If the SKIM receives an invalid RF signal or no response, it sends “invalid key” messages to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages.

The SKIM also sends messages to the instrument cluster over the CCD data bus network to control the SKIS indicator lamp. The SKIM sends messages to the instrument cluster to turn the lamp on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the lamp off for a duration of about one second. Then the SKIM sends messages to turn the lamp on or off based upon the results of the SKIS self-tests. If the SKIS indicator lamp comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to the instrument cluster to flash the SKIS indicator lamp. The SKIM can also send messages to the instrument cluster to flash the lamp and to generate a single audible chime tone.

For diagnosis or initialization of the SKIM and the PCM, a DRB scan tool and the proper Diagnostic Procedures manual are required. The SKIM cannot be repaired and, if faulty or damaged, the unit must be replaced.

SMART KEY IMMOBILIZER TRANSPONDER

The Smart Key Immobilizer System (SKIS) uses a transponder that is integral to each of the two ignition keys that are supplied with the vehicle when it is shipped from the factory. The transponder chip is insulated within a nylon mount inserted in the head of the key, and invisible beneath a molded rubber cap (Fig. 1).

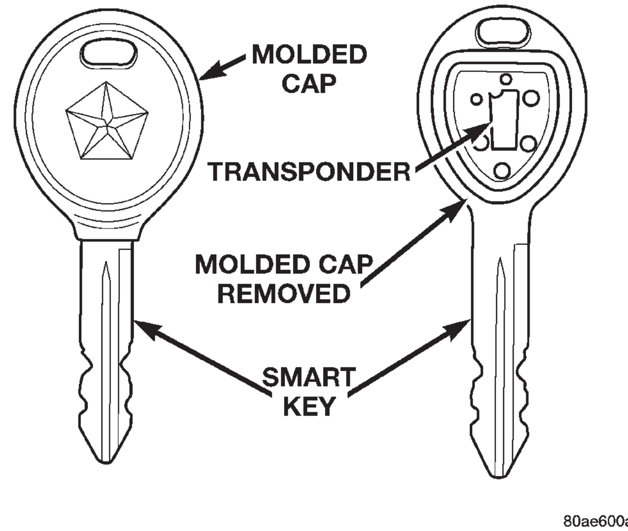

Fig. 1 Smart Key Immobilizer Transponder

Each Smart Key transponder has a unique transponder identification code programmed into it by the manufacturer. The Smart Key Immobilizer Module (SKIM) has a unique “Secret Key” code programmed into it by the manufacturer. When a Smart Key transponder is programmed into the memory of the SKIM, the SKIM learns the transponder identification code from the transponder, and the transponder learns the “Secret Key” code from the SKIM. Each of these codes is stored within the transponder and in the nonvolatile memory of the SKIM. Therefore, blank keys for the SKIS must be programmed by and into the SKIM, in addition to being cut to match the mechanical coding of the ignition lock cylinder. See Smart Key Immobilizer System Transponder Programming in this group for more information.

The Smart Key transponder is within the range of the SKIM transceiver antenna ring when it is inserted in the ignition lock cylinder. When the ignition switch is turned to the Start or On positions, the SKIM transceiver issues a Radio Frequency (RF) signal that excites the transponder chip. The transponder chip responds by issuing an RF signal containing its transponder identification code and the “Secret Key” code. The SKIM transceiver compares the transponder codes with the codes stored in its memory to

DESCRIPTION AND OPERATION (Continued)

determine whether a valid key is in the ignition lock cylinder.

The Smart Key transponder cannot be repaired and, if faulty or damaged, it must be replaced.

SMART KEY IMMOBILIZER SYSTEM INDICATOR LAMP

The Smart Key Immobilizer System (SKIS) indicator lamp gives an indication when the SKIS is faulty or when the vehicle has been immobilized due to the use of an invalid ignition key. The lamp is controlled by the instrument cluster circuitry based upon messages received from the Smart Key Immobilizer Module (SKIM) on the Chrysler Collision Detection (CCD) data bus.

The SKIM sends messages to the instrument cluster to turn the lamp on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the lamp off for a duration of about one second. Then the SKIM sends messages to the instrument cluster circuitry to turn the lamp on or off based upon the results of the SKIS self-tests. If the SKIS indicator lamp comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative. If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to the instrument cluster to flash the SKIS indicator lamp.

The SKIM can also send messages to the instrument cluster to flash the lamp and to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its “Customer Learn” programming mode. See Smart Key Immobilizer System Transponder Programming in this group for more information on the “Customer Learn” programming mode.

The SKIS indicator lamp uses a replaceable incandescent bulb and bulb holder on the instrument cluster electronic circuit board. Refer to Group 8E - Instrument Panel Systems for diagnosis and service of a faulty SKIS indicator lamp. If the SKIS indicator lamp comes on and stays on after the bulb test function, diagnosis of the SKIS should be performed with a DRB scan tool and the proper Diagnostic Procedures manual.

DIAGNOSIS AND TESTING

SMART KEY IMMOBILIZER SYSTEM

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.

NOTE: The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Smart Key Immobilizer System involves the use of a DRB scan tool. Refer to the proper Diagnostic Procedures manual for the procedures.

The Smart Key Immobilizer System (SKIS) and the Chrysler Collision Detection (CCD) data bus network should be diagnosed using a DRB scan tool. The DRB will allow confirmation that the CCD data bus is functional, that the Smart Key Immobilizer Module (SKIM) is placing the proper messages on the CCD data bus, and that the Powertrain Control Module (PCM) and the instrument cluster are receiving the CCD data bus messages. Refer to the proper Diagnostic Procedures manual for the procedures. Refer to 8W-30 - Fuel/Ignition System in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

(1) Check the fuses in the fuseblock module. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Disconnect and isolate the battery negative cable. Unplug the wire harness connector at the SKIM. Check for continuity between the ground circuit cavity of the SKIM 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.

(3) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the SKIM wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the fuse in the fuseblock module as required.

DIAGNOSIS AND TESTING (Continued)

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the SKIM wire harness connector. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to complete the diagnosis of the SKIS. If not OK, repair the open circuit to the fuse in the fuseblock module as required.

SERVICE PROCEDURES

SMART KEY IMMOBILIZER SYSTEM TRANSPONDER PROGRAMMING

Two programmed Smart Key transponders are included with the Smart Key Immobilizer System (SKIS) when it is shipped from the factory. The Smart Key Immobilizer Module (SKIM) can be programmed to recognize up to six additional transponders, for a total of eight Smart Keys. The following “Customer Learn” programming procedure for the programming of additional transponders requires access to at least two of the valid Smart Keys. If two valid Smart Keys are not available, Smart Key programming will require the use of a DRB scan tool and the proper Diagnostic Procedures manual.

PROGRAMMING THE SKIM MODULE WITH THE DRBIII

(1) Turn the ignition on. Transmission must be in park or neutral. Alarm set lamp will flash.

(2) Use the DRBIII and select “SKIM” under the “MISCELLANEOUS” menu.

(3) Select “PROGRAM PIN” and enter the customer 4–digit PIN number.

(4) Select “UPDATE VIN”. The SKIM module will learn the VIN from the PCM in gasoline engine vehicles, and from the BCM in diesel engine vehicles.

(5) Select “COUNTRY CODE” and enter the correct country.

(6) Select “PROGRAM NEW EMS”. The SKIM module will send the “secret key” data to the PCM.

(7) Program ignition keys to the SKIM module.

PROGRAMMING IGNITION KEYS WITH THE DRBIII

(1) Turn ignition on. Transmission must be in park or neutral. Alarm set lamp will flash.

(2) Use the DRBIII and select “SKIM” under the “MISCELLANEOUS” menu.

(3) Select “LEARN NEW KEY”. Alarm Set lamp will begin flashing.

NOTE: The PIN must be re-entered each time an additional key is learned.

(4) Insert key into ignition switch. Once the key has been learned, the Alarm Set lamp will turn off.

REMOVAL AND INSTALLATION

SMART KEY IMMOBILIZER MODULE

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 and isolate the battery negative cable.

(2) Remove the knee blocker from the instrument panel. See Knee Blocker in Group 8E - Instrument Panel Systems for the procedures.

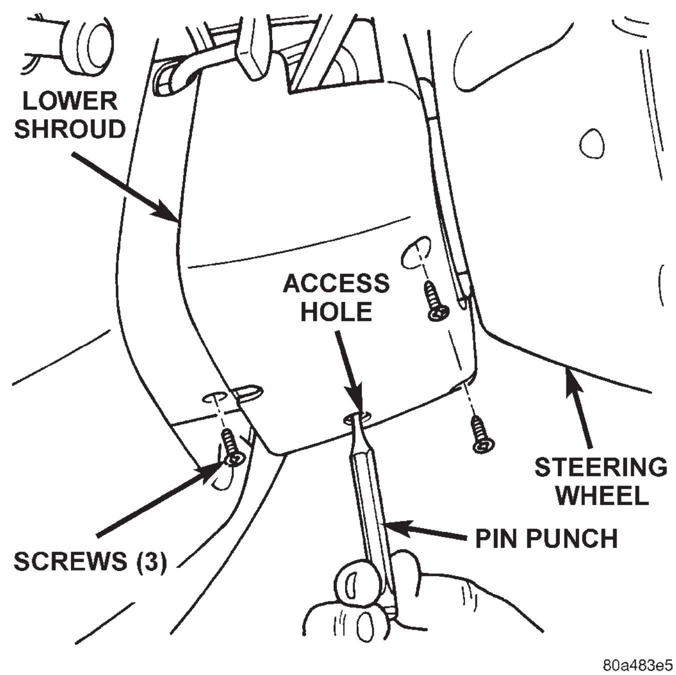

Fig. 2 Steering Column Shrouds Remove/Install

(3) Remove the three screws that secure the lower steering column shroud to the upper shroud.

(4) If the vehicle is so equipped, move the tilt steering column to the fully lowered position.

(5) If the vehicle is so equipped, loosen the two nuts that secure the non-tilt steering column upper mounting bracket to the dash panel steering column support bracket studs. Lower the column far enough to remove the upper steering column shroud.

(6) Remove both the upper and lower shrouds from the steering column.

REMOVAL AND INSTALLATION (Continued)

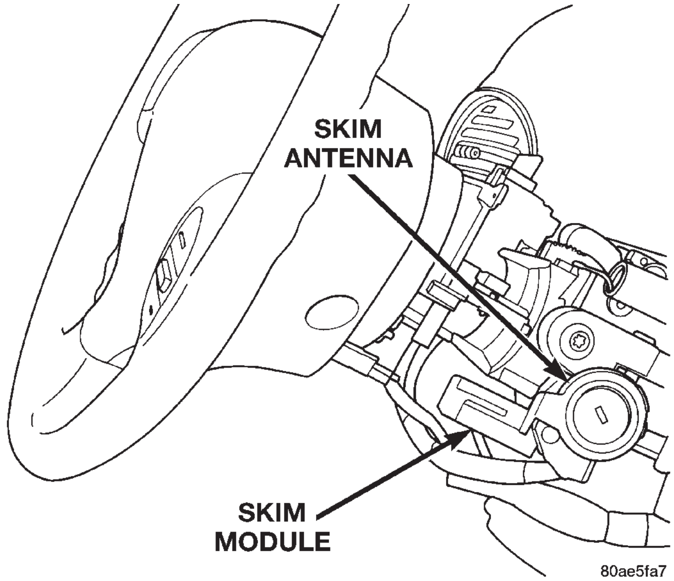

Fig. 3 Smart Key Immobilizer Module Remove/Install

(7) Unplug the wire harness connector from the SKIM receptacle.

(8) Remove the screw securing the SKIM module to the steering column.

(9) Release the clip holding the SKIM antenna to the ignition lock housing on the steering column.

(10) Remove the SKIM from the vehicle.

(11) Reverse the removal procedures to install. Tighten the non-tilt steering column mounting nuts to 22 N·m (200 in. lbs.) and the steering column shroud mounting screws to 2 N·m (18 in. lbs.).

(12) If the SKIM is replaced with a new unit, a DRB scan tool and the proper Diagnostic Procedures manual MUST be used to initialize the new SKIM and to program at least two Smart Key transponders.

POWER WINDOWS

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GENERAL INFORMATION

INTRODUCTION

Front door window lift motors use permanent type magnets. The B+ and ground applied at the motor terminal pins will cause the motor to rotate in one direction. Reversing current through the motor terminals will cause the motor to rotate in the opposite direction.

The power window motors ground through the master switch in the driver door (Fig. 1) by a black wire attached to the left cowl panel. Refer to Group 8W, Wiring Diagrams from circuit information and component locations.

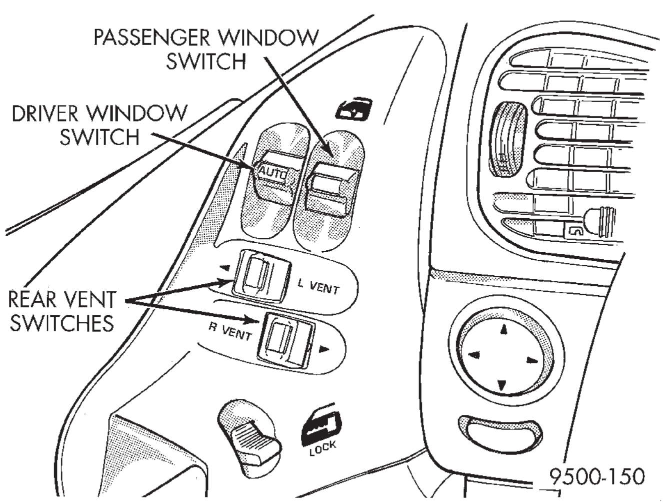


Fig. 1 Power Window Master Switch

The power rear vent windows, if equipped, are operated by switches mounted in the driver door switch bezel. A separate switch is used for each window. Permanent magnet type motors connected to a crank system are used to open and close the rear vent windows. A battery positive and negative connection to either of the two motor terminals will cause the motor to rotate in one direction. Reversing current through these same two connections will cause the motor to rotate in the opposite direction. Refer to Group 8W, Wiring Diagrams for circuit information and component locations.

DIAGNOSIS AND TESTING

POWER VENT WINDOW MOTOR TEST

If the power vent window motor is receiving proper current and ground and does not operate proceed with motor test. Refer to Group 8W, Wiring Diagrams for circuit information and component locations.

(1) Remove D-pillar trim panel necessary to gain access to power vent window motor wire connector, refer to Group 23, Body for proper procedures.

(2) Disconnect power vent window motor wire connector from body harness.

(3) Using two jumper wires, connect one to a battery (+) source and the other to a good ground (-).

(4) Connect the Negative (-) jumper probe to one of the motor connector terminals.

(5) Momentarily touch the Positive (+) jumper probe to the other motor connector terminal.

When positive probe is connected the motor should rotate in one direction to either move window open or closed. If window is all the way open or closed the motor will grunt and the crank system will flex when actuated in that one direction.

Reverse jumper probes at the motor connector terminals and window should now move in opposite direction. If window does not move or grunt, replace the motor.

If window moved completely open or closed, reverse the jumper probes and cycle window to the opposite position to verify full operation.

If motor grunts and does not move, verify that crank system is not binding.

DIAGNOSIS AND TESTING (Continued)

POWER WINDOW AND VENT SWITCH TEST

(1) Remove the driver or passenger door power window switch and bezel assembly from door trim panel. Refer to group 23, Body for proper procedures.

(2) Using an ohmmeter, Test driver door switch for continuity as described in (Fig. 2).

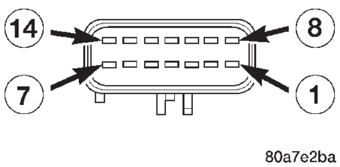


Fig. 2 Driver Side Power Window Switch Connector

DRIVER DOOR POWER WINDOW SWITCH TEST

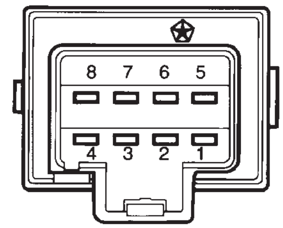
SWITCH POSITION	CONTINUITY BETWEEN
OFF	13 and 1
	13 and 2
	13 and 3
	13 and 4
	13 and 5
	13 and 6
	13 and 7
	13 and 8
UP DRIVER	11 and 8
*DOWN DRIVER	11 and 6
*X DOWN DRIVER	11and 6
UP PASSENGER	9 and 4
DOWN PASSENGER	9 and 2
LEFT VENT OPEN	11 and 7
LEFT VENT CLOSE	9 and 3
RIGHT VENT OPEN	9 and 1
RIGHT VENT CLOSE	11 and 5

* MUST TEST WITH B+ ON PIN 9 AND GROUND ON PIN 13 FOR CONTINUITY BETWEEN PINS 11 AND 6

(3) Test passenger door switch for continuity as described in (Fig. 3).

(4) If the results are not OK, replace the switch.

The driver door power window switch has a Auto-Down feature. The switch is equipped with two detent positions when actuating the power window OPEN. The first detent position allows the window to roll down and stop when the switch is released. The second detent position actuates an integral express roll down relay that rolls the window down after the switch is released. When the express down relay senses an amperage spike (motor pushing against down stop) in the feed circuit, current is turned off to the motor. The AUTO feature can be cancelled by actuating the switch UP or DOWN while window is in motion. Failure of the electronic switch to detect an amperage spike will cause the switch to disconnect after approximately 11 seconds.



SWITCH POSITION	CONTINUITY BETWEEN
OFF	3 AND 8
OFF	2 AND 5
UP	4 AND 8
DOWN	4 AND 5

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Fig. 3 Passenger Door Power Window Switch

POWER WINDOW MOTOR TEST

If the power window motor is receiving proper current and ground and does not operate proceed with motor test. Refer to Group 8W, Wiring Diagrams for circuit information and component locations.

(1) Remove front door trim panel and water shield as necessary to gain access to power window motor wire connector, refer to Group 23, Body for proper procedures.

(2) Disconnect power window motor wire connector from door harness.

(3) Using two jumper wires, connect one to a battery (+) source and the other to a good ground (-).

(4) Connect the Negative (-) jumper probe to one of the motor connector terminals.

(5) Momentarily touch the Positive (+) jumper probe to the other motor connector terminal.

When positive probe is connected the motor should rotate in one direction to either move window up or down. If window is all the way up or down the motor will grunt and the inner door panel will flex when actuated in that one direction.

(6) Reverse jumper probes at the motor connector terminals and window should now move in opposite direction. If window does not move or grunt, replace the motor.

If window moved completely up or down, reverse the jumper probes and cycle window to the opposite position to verify full operation.

DIAGNOSIS AND TESTING (Continued)

If motor grunts and does not move, verify that regulator is not binding.

WIRING VOLTAGE TEST

The following wiring test determines whether or not voltage is continuous through the body harness to switch.

(1) Remove the master power window switch and bezel assembly from the driver door. Refer to Group 23, Body for proper procedures.

(2) Disconnect wire connector from back of power window switch.

(3) Switch ignition ON position.

(4) Connect the clip end of a 12 volt test light to Pin 13 in door harness connector at the window switch. Touch the test light probe to Pin 9 and then to Pin 11.

- If the test light illuminates, the wiring circuit between the battery and switch is OK.
- If light does not illuminate, check the 40 amp fuse in the Power Distribution Center or for a broken wire.
- The power window motors are protected with Positive Temperature Coefficient (PTC) device that prevents motor burn out. Check Junction Block.
- Refer to Group 8W, Wiring Diagrams for circuit information and component locations.

REMOVAL AND INSTALLATION

POWER VENT WINDOW MOTOR

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove D-pillar trim panel.

(3) Disconnect wire connector from power vent motor.

(4) Remove nut holding crank to vent glass.

(5) Remove bolts holding power vent motor to D-pillar (Fig. 4).

(6) Remove power vent motor.

(7) Pull the crank system from the motor.

INSTALLATION

Before installing crank, cycle replacement motor to the open position. Install crank hinge in extended position to the motor and for installation, reverse the above procedures.

POWER WINDOW SWITCH

To remove power window switches refer to Group 23, Body for proper procedures.

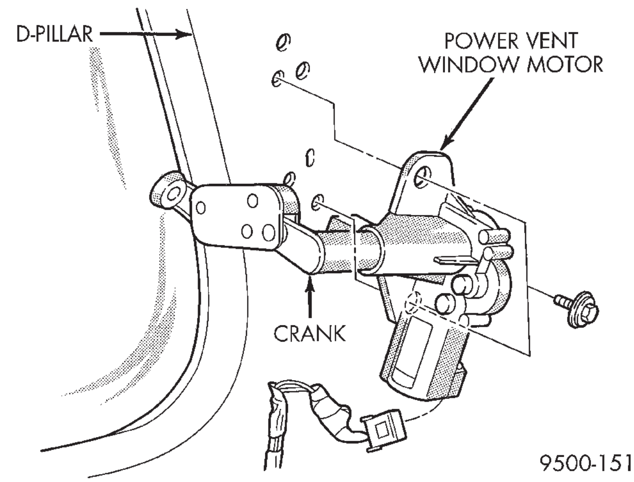

Fig. 4 Vent Window Motor

POWER WINDOW MOTOR

WARNING: DO NOT HAVE ANY HANDS OR FINGERS IN SECTOR GEAR AREA WHERE THEY CAN BE PINCHED BY SMALL MOVEMENTS OF REGULATOR LINKAGE.

REMOVAL

(1) Tape the window in its existing position to remove its weight from the regulator system.

(2) Cut and remove the tie wrap at the window motor. Its no longer required.

(3) Disconnect window motor wire connector from door harness.

(4) Remove screws and nuts holding window motor to the inner panel.

(5) Remove the motor from the door inner panel, let it hang from the cables.

(6) With the cables still attached to the failed motor, Install the replacement motor to the door inner panel. Tighten down the screws and nuts to 3.4 to 4.5 N·m (30 to 40 in. lbs.) of torque.

(7) Separate the failed motor from regulator by:

- Removing the drum cover plate.
- Lift the cable guide off the motor, the drum with cables, will be lifted off simultaneously (Fig. 5).

CAUTION: Do not allow the drum to separate from the cable guide, by dropping drum or letting the cables unwind.

INSTALLATION

(1) Install the cable guide and drum into the replacement motor.

REMOVAL AND INSTALLATION (Continued)

CAUTION: The drum may require a slight rotation to install onto the motor drive shaft. Rotate the drum with the use of needle nose pliers or a similar tool. If, the drum does not align with the motor shaft by a slight rotation, then, the glass should be lowered a small amount approximately 1 to 2 inches. The drum will rotate when the glass is lowered. Lowering the glass will require assistance of a second person.

(2) install the replacement cover plate onto the replacement motor. Crimp toy tabs.

(3) Connect the wiring harness to the window motor connector.

(4) Remove the tape holding the window in place and test window operation.

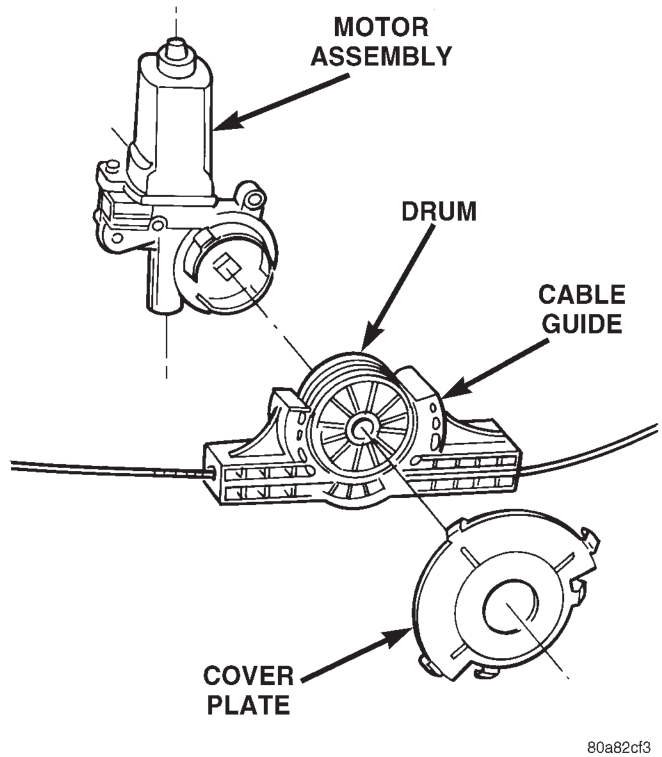

Fig. 5 Power Window Motor Removal

POWER SEATS

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POWER SEATS

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GENERAL INFORMATION

INTRODUCTION

Power seats can be adjusted in eight directions; up, down, forward, back, tilt forward, or tilt rearward. Four reversible motors and a transmission located on the seat tracks provide the various seat movements. The electrical circuit is protected by a 40 amp fuse in the Power Distribution Center (PDC) and a 30 amp circuit breaker located in the wire harness under the driver's seat.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

Before testing the seat functions, verify that the battery is fully charged and the terminals cleaned and tightened to ensure proper connections. If the battery is not fully charged, refer to Group 8A Battery for proper testing procedures.

The following test will determine if the circuit is complete through the body harness to the switch:

Using a voltmeter, verify the condition of the power seat circuit breaker located under the driver's seat. The circuit breaker also protects the passenger side power seat track circuit. Check both sides of the circuit breaker connector for voltage, on the wire side.

- If not OK replace circuit breaker.
- If battery voltage is detected on both sides of the circuit breaker. Refer to Seat Motor in the Diagnostic and Testing in this section.
- If seat motors test OK, refer to the Seat Switch in the Diagnostic and Testing in this section.
- Refer to Group 8W Wiring Diagrams for wire circuit information.

SEAT MOTORS

(1) Remove power seat switch from seat. Refer to Group 23 Body for procedures.

(2) Disconnect wire connector.

(3) Using a voltmeter check for battery voltage at Pin 5. Using an ohmmeter, check Pin 1 for ground.

(4) To test the seat motors, refer to (Fig. 1) and verify proper seat responses. Using two jumper wires, connect one to a battery supply and the other to a ground. Connect the other ends to the seat wire harness connector as described in (Fig. 1). If any motor fails to operate, check wire connectors to the motor. If not OK, repair as necessary. If OK, replace seat motor/track assembly.

POWER SEAT SWITCH

(1) Remove power seat switch from seat. Refer to Group 23 Body for procedures.

(2) Using an ohmmeter, perform the switch continuity tests in (Fig. 2). If there is no continuity at any of the switch positions, replace switch.

DIAGNOSIS AND TESTING (Continued)

SEAT CONNECTOR			
Connect Jumper		SEAT ACTION	
Battery	Ground	DRIVER SIDE	PASSENGER SIDE
PIN 7	PIN 10	Front Riser Up	Front Riser Down
PIN 10	PIN 7	Front Riser Down	Front Riser Up
PIN 6	PIN 3	Forward	Forward
PIN 3	PIN 6	Backward	Backward
PIN 8	PIN 9	Rear Riser Up	Rear Riser Down
PIN 9	PIN 8	Rear Riser Down	Rear Riser Up
PIN 2	PIN 4	Recliner Up	Recliner Up
PIN 4	PIN 2	Recliner Down	Recliner Down

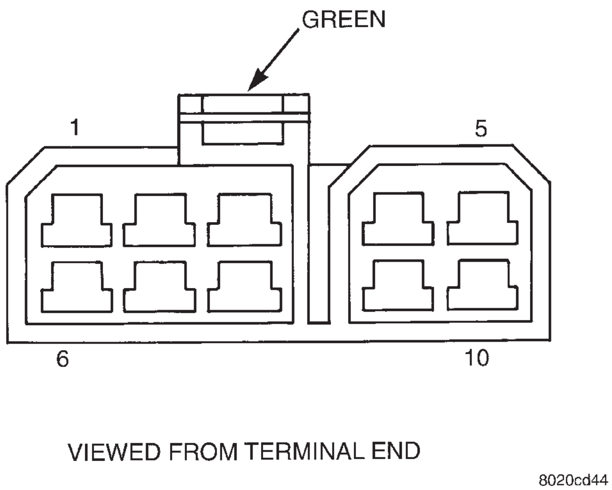

Fig. 1 Seat Motor Test

SWITCH POSITION	CONTINUITY BETWEEN PINS	
	DRIVER	PASSENGER
OFF	PIN 1 to 2 PIN 1 to 3 PIN 1 to 4 PIN 1 to 6 PIN 1 to 7 PIN 1 to 8 PIN 1 to 9 PIN 1 to 10	PIN 1 to 2 PIN 1 to 3 PIN 1 to 4 PIN 1 to 6 PIN 1 to 7 PIN 1 to 8 PIN 1 to 9 PIN 1 to 10
FRONT RISER UP	PIN 1 to 10 PIN 5 to 7	PIN 1 to 7 PIN 5 to 10
FRONT RISER DOWN	PIN 1 to 7 PIN 5 to 10	PIN 1 to 10 PIN 5 to 7
CENTER SWITCH FORWARD	PIN 1 to 3 PIN 5 to 6	PIN 1 to 3 PIN 5 to 6
CENTER SWITCH REARWARD	PIN 1 to 6 PIN 3 to 5	PIN 1 to 6 PIN 3 to 5
REAR RISER UP	PIN 1 to 9 PIN 5 to 8	PIN 1 to 8 PIN 5 to 9
REAR RISER DOWN	PIN 1 to 8 PIN 5 to 9	PIN 1 to 9 PIN 5 to 8
RECLINER UP	PIN 1 to 4 PIN 2 to 5	PIN 1 to 4 PIN 2 to 5
RECLINER DOWN	PIN 1 to 2 PIN 4 to 5	PIN 1 to 2 PIN 4 to 5

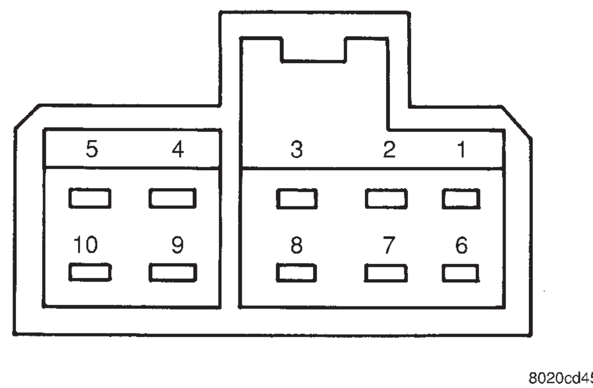

Fig. 2 Power Seat Switch Test

MEMORY SEAT AND MIRROR SYSTEM

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GENERAL INFORMATION

INTRODUCTION

Memory Seat and Mirrors system is available only on Town and Country (Luxury Class) vehicles.

Refer to Group 8W, Wiring Diagrams for circuit information and component locations. Refer to the proper Body Diagnostic Procedures manual for additional diagnostic information.

The Memory Seat/Mirror Module (MSM Module) is mounted under the driver's seat, on the inboard upper track with Torx head screws. The MSM Module provides the driver with an adjustable seat, recliner, and power side view mirror positioning controller that remembers stored positions and will recall those positions on command.

The Memory Seat/Mirror Module reads all seat and recliner switch inputs and operates the seat and recliner motors in response to switch actuation. The MSM Module monitors position sensing potentiometers (mounted on the motors) for seat and recliner positioning.

The MSM Module operates the power side view mirror motors through solid state drivers (electronic switches) in the recall mode only, and follows the glass face position by means of rheostats built into the motor pack assembly of the mirrors. Normal electrical operation of the mirrors is accomplished by actuation of the power mirror switch.

The Memory Seat/Mirror Module monitors the memory switches and has the capability to store desired positions in non-volatile memory in response to a valid input sequence. Refer to Memory Selector Switches (1, 2, and S) and Remote Keyless Entry (RKE) Data Link. The memory seat/mirror module also can activate the previously described motors in response to a recall request from an individual memory switch.

The Memory Seat/Mirror Module monitors a data link between the RKE receiver and the Body Control Module (BCM) and will respond to stored information or modify stored information when requested by a valid data stream.

The Memory Seat/Mirror Module is connected to the system through a seat wiring harness that interfaces will all of the components within the seat structure, and with electrical distribution wiring harness connections to the non-seat mounted components. The module operates the seat and recliner motors through relays: four dedicated to track forward/rearward, track front up/down, track rear up/down, and recliner forward/rearward. A fifth relay controls the direction of operation of those motors.

DESCRIPTION AND OPERATION

POWER SIDE VIEW MIRROR POSITION SENSING

The mirror switch on the instrument panel operates the outside rear view mirrors independently of the memory seat/mirror module. The module activates the mirror motors only when in its recall mode.

The side view mirrors have position sensing rheostats built into each side view mirror vertical and horizontal motor assembly. These rheostats provide a sense voltage to the memory seat/mirror module that indicates where the mirror is moving to or where its position is at when the module is activated but the mirror motor is not moving.

MEMORY SELECTOR SWITCHES

The memory selector switches are mounted on the driver's door trim panel within easy reach of the driver. They provide a means to set or recall either of

DESCRIPTION AND OPERATION (Continued)

two positions of seat and recliner, and the side view mirrors as chosen by the driver.

The inputs from these switches to the memory seat/mirror module is a ground level signal.

(1) Adjust the seat, recliner and side view mirrors to the desired position.

(2) Press momentarily and release memory switch S.

(3) Press momentarily and release memory switch 1 or 2. Do NOT press any switches for 10 seconds.

(4) To program the second driver's position, follow the above sequence.

(5) To recall either of the programmed positions momentarily press and release either memory selector switch 1 or 2.

DEFINITION OF: MOMENTARILY AND RELEASE

The memory seat/mirror module has switch input timing requirements of a minimum press momentarily time of 250 milliseconds followed by a maximum hold time of 5 seconds, followed by a maximum release time between steps of 5 seconds that must be met for proper operation of the system.

SEAT AND RECLINER SWITCHES

The seat and recliner switch assembly is mounted outboard on the seat side-shield. Press and hold the desired seat or recliner switch to effect movement. The Memory Seat/Mirror Module (MSM Module) will drive a maximum of 2 motors at a time in a given direction. If conflicting directions are requested, the priority for response will be as follows:

- Seat Track Rearward
- Seat Front Down
- Seat Rear Down
- Recliner Rearward
- Seat Track Forward
- Seat Front Up
- Seat Rear Up
- Recliner Forward

The inputs from these switches to the MSM Module is a current limited battery source fed by the MSM Module. This protects the MSM Module printed circuit board traces from acting as fuses. All of these switch contact inputs to the module are normally closed to ground, except when actuated.

POSITION SENSING SEAT AND RECLINER POTENTIOMETERS

A potentiometer is mounted to each seat track and recliner motor end-bell to provide a sense voltage to the Memory Seat/Mirror Module that will indicate to the module where the seat track or recliner is positioned.

This sense voltage is derived from a 5 volt source provided by the module to the potentiometer. The sense voltage is input into the module and stored by the Memory Seat/Mirror Module.

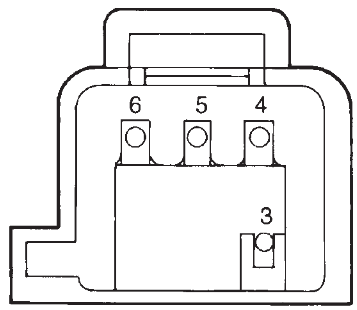
DIAGNOSIS AND TESTING

MEMORY SELECTOR SWITCHES

To test the memory selector switch:

(1) Remove the memory selector switch. Refer to removal procedure.

(2) Using an ohmmeter check continuity reading between switch pins. Refer to (Fig. 1) for proper Pin numbers.



MEMORY SELECTOR SWITCH CONTINUITY	
BUTTON	Continuity Between
Depressing "1"	PIN 6 - PIN 3
Depressing "2"	PIN 4 - PIN 3
Depressing "S"	PIN 5 - PIN 3
Normal Position - ALL	All Circuits OPEN

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Fig. 1 Memory Selector Switch Continuity

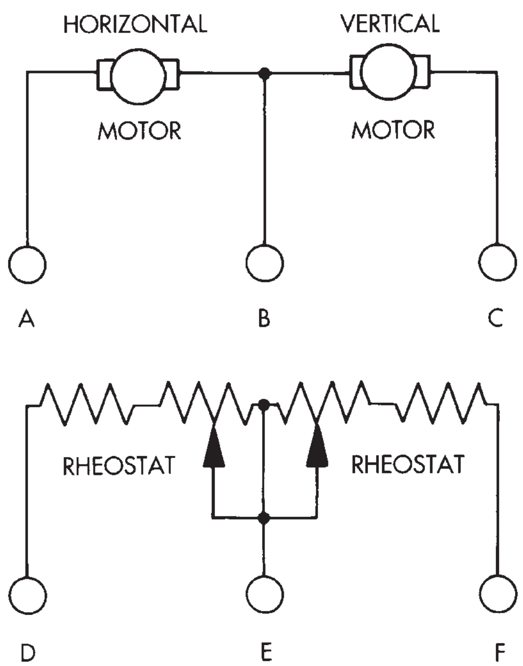
SIDE VIEW MIRROR SWITCH STUCK

The mirror switches in the instrument panel have normally open contacts when in their inactive state. The left/right rocker switch has a center-off detent. If this switch is actuated to either side, it then becomes connected to the P73/P70, circuits which are the mirror motor common connections. No faults will result from this action by itself. If one of the other switch contacts from the round portion of the switch becomes accidentally closed, **It can cause problems such as both mirrors operating at the same time in the vertical or horizontal modes**.

• Turn ignition switch ON: If two mirror switch contacts, from the round portion, are stuck in the closed position, and the left/right portion is actuated to either side, a mirror motor will become actuated. This will drive the motor to its stop, where it will keep ratcheting until a switch contact is released or the ignition is turned to OFF. Replace the mirror switch assembly to correct this condition.

• With the ignition switch in the ON or the OFF position: If only one mirror switch contact is stuck in the closed position, the mirror motor will not become actuated. During an ignition switch recall of a driv-

DIAGNOSIS AND TESTING (Continued)



25-way Wiring Harness at the CM.

TERMINAL	LH MIR. CAV. #	RH MIR. CAV. #
A	12	25
B	10	23
C	11	24
D	3	15
E	1	13
F	2	14

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Fig. 2 Mirror Mechanization

er's chosen position, the Memory Seat/Mirror Module will attempt to drive the mirror motor only if:

- The closed switch contact was the same as the desired direction
- Until the lack of a signal seen by the module shuts off the drive to the motor

The Memory Seat/Mirror Module will shut off the drive to the desired motor. It is possible that a single stuck contact could place an opposite mirror or direction into a series connection. This would run the connected motors at approximately half speed. Replace the mirror switch assembly to correct this condition.

The 25-way connector at the Memory Seat/Mirror Module (under the driver's seat) and the mirror mechanization show that both mirrors use the same functions. The rheostat for position sensing utilizes the wire from the module to the mirror as both feed and sense line on the same wires, D and F. The ground return wire, E, stands alone. Refer to (Fig. 2) and the Mirror Mechanization Table.

The mirror motors for each side use a common connection, B, which becomes automatically connected to the proper polarity power connection during either manual (through the mirror switch) or recall (through the Memory Seat/Mirror Module) modes of operation.

DIAGNOSTIC MODE

MODE 1

Diagnostic Mode 1 clears soft limits and sets memory selector switches (1 and 2) to predetermined values.

MIRROR MECHANIZATION TABLE

MIRROR PLANE MOTION	RESISTANCE	APPLIED POTENTIAL		
		A	B	C
UP	E-F INCREASE	OPEN	–	–
DOWN	E-F DECREASE	OPEN	–	–
RIGHT	D-E INCREASE	–	–	OPEN
LEFT	D-E DECREASE	–	–	OPEN

DIAGNOSIS AND TESTING (Continued)

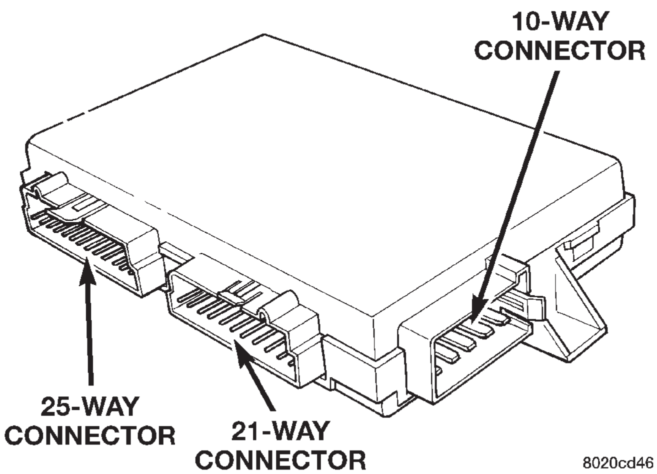


Fig. 3 Memory Seat/Mirror Module

ACTIVATION- Press and hold the S and 1 buttons for 5 seconds to enter diagnostic mode 1. This mode is exited at the completion of the mode 1 tasks or upon grounding the RKE input to the Memory Seat/ Mirror Module.

Mode 1 will:

• Clear all soft limits to their default hard limit values

• Load memory 1 with default settings corresponding to horizontal rearward, front down, rear down, and recliner rearward positions

• Load memory 2 with default settings corresponding to horizontal forward, front up, rear up, and recliner forward positions

MODE 2

Diagnostic mode 2 provides a way to determine if the seat/mirror motors and position sensors are connected properly.

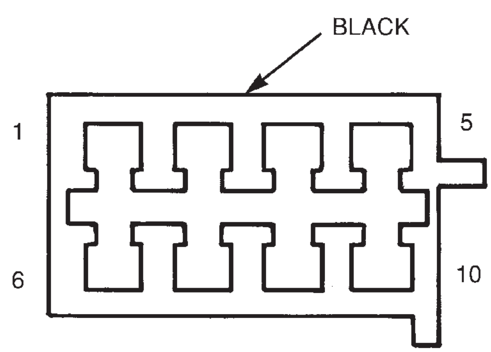
ACTIVATION- Press and hold the S and 2 buttons for 5 seconds to enter diagnostic mode 2. This mode is exited after 5 seconds of switch inactivity or upon grounding the RKE input by moving the transmission out of the PARK position.

Mode 2 will:

• Place the seat and mirror motors at their midpoint

• When a single axis of seat or mirror motion is requested by pressing a switch, the corresponding motor is energized. This tests switch input and motor output

• When the switch is released, the motor will automatically return to its original position. If the corresponding sensor is out of range, then the motor will not return to its original position. This tests the integrity of the sensors and motor outputs. Refer to (Fig. 3), (Fig. 4), (Fig. 5) and (Fig. 6) for module connector call outs.



CAV	CIRC	GA	COLOR	FUNCTION
1	P117	14	RD/LB	POWER SEAT B+ = HORIZONTAL REARWARD
2	P115	14	YL/DB	POWER SEAT B+ = HORIZONTAL FORWARD
3	P111	14	YL/WT	POWER SEAT B+ = REAR RISER UP
4	P43	14	GY/LB	POWER RECLINER B+ = SEAT BACK FORWARD
5	P119	14	YL/LG	POWER SEAT B+ = FRONT RISER UP
6	P113	14	RD/WT	POWER SEAT B+ = REAR RISER DOWN
7	Z1	14	BK	GROUND FEED TO MODULE
8	F35	14	RD	BATTERY FEED TO MODULE
9	P41	14	GY/WT	POWER RECLINER B+ = SEAT BACK REARWARD
10	P121	14	RD/LG	POWER SEAT B+ = FRONT RISER DOWN

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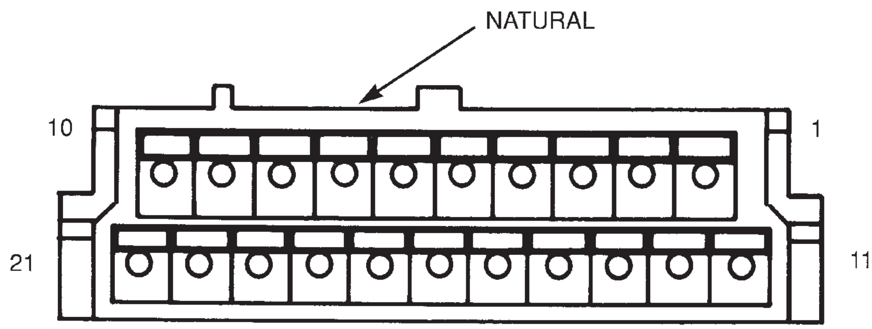
Fig. 4 Memory Seat/Mirror Module 10-Way Connector

DIAGNOSIS AND TESTING (Continued)



CAV	CIRC	GA	COLOR	FUNCTION
1	P21	22	RD/LG	SEAT FRONT RISER DOWN SWITCH INPUT
2	P13	22	RD/WT	SEAT REAR RISER DOWN SWITCH INPUT
3	P17	22	RD/LB	SEAT HORIZ. REARWARD SWITCH INPUT
4	P48	22	GY/WT	RECLINER REARWARD SWITCH INPUT
7	P27	22	LB/RD	SEAT REAR POSITION SENSE (UP/DOWN)
8	P26	22	BR	SEAT FRONT POSITION SENSE (UP/DOWN)
10	P28	22	BR/RD	SEAT & RECLINER POSITION SENSE GROUND
11	P09	20	RD	SEAT & RECL. SWITCH PTC RESISTIVE FEED
12	P19	22	YL/LG	SEAT FRONT RISER UP SWITCH INPUT
13	P11	22	YL/WT	SEAT REAR RISER UP SWITCH INPUT
14	P15	22	YL/LB	SEAT HORIZ. FORWARD SWITCH INPUT
15	P40	22	GY/LB	RECLINER FORWARD SWITCH INPUT
17	P47	22	LB	RECLINER POSITION SENSE (FOR/AFT)
18	P25	22	VT/RD	SEAT HORIZ. POSITION SENSE (FOR/AFT)
20	P29	22	BR/WT	SEAT & RECLINER POSITION SENSE + FEED

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Fig. 5 Memory Seat/Mirror Module 21-Way Connector

CIRCUIT DESCRIPTION

Power to both driver and passenger seats, as well as power door locks, rear blower, and front fog lamps (if so equipped), is provided by the A3 circuit through a 40 amp MAXI-fuse in the Power Distribution Center (PDC) under the hood. If all of these devices are nonfunctional, replace the MAXI-fuse. If the new MAXI-fuse blows immediately, correct the wiring short to Ground that could be on any of those aforementioned loads before proceeding further.

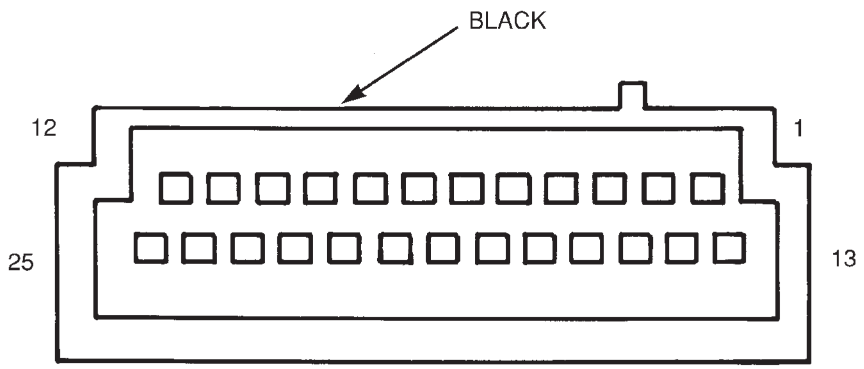
Once the power is back ON, if the power seats still do not work, check the 30 amp circuit breaker that is located in the driver's seat wiring harness approximately 10 inches from the 4-way connector. The power feed circuit to the 30 amp circuit breaker is 14 ga. A3 RD/WT.

Following the 30 amp circuit breaker is a 14 ga. wire designated as F35 RD that provides power into the Memory Seat/Mirror Module and is double crimped with a 14 ga. F35A RD that provides power to the passenger seat through the 4-way connector.

If the power door locks, rear blower, and front fog lamps (if so equipped) are functional and the seats are both nonfunctional, repair/replace the open wiring and/or circuit breaker in the driver's seat harness to correct the condition.

Ensure that the 12 ga. ground wire Z1 BK from the electrical distribution wiring ground splice into the 4-way connector is providing ground. The Z1 BK is double crimped at the seat harness side of the 4-way connector taking a 14 ga. Z1 BK into the 10-way connector (cavity 7) 14 ga. This double crimp carries a 20 ga. Z1A BK to cavity 3 of the power seat switch 10-way. If the passenger power seat is functional, and the driver's seat is nonfunctional examine the circuit F35 RD from the double crimped circuit breaker connector into the 10-way connector cavity 8 of the control module for continuity. Repair or replace as necessary. If the driver's seat is still nonfunctional, use a multi-function meter to check the P9 RD 20 ga. circuit from the control module 21-way connector (cavity 11) to the power seat switch 10-way con-

DIAGNOSIS AND TESTING (Continued)



CAV	CIRC	GA	COLOR	FUNCTION
1	P69	22	WT/RD	LEFT MIRROR RHEOSTAT SENSE GROUND
2	P64	22	YL/OR	LEFT MIRROR RHEOSTAT SENSE VERTICAL
3	P65	22	DB/YL	LEFT MIRROR RHEOSTAT SENSE HORIZONTAL
8	P22	20	PK/BK	MEMORY “SET” SWITCH INPUT
10	P73	22	YL/PK	LEFT COMMON MIRROR OUTPUT
11	P71	22	YL	LEFT VERTICAL MIRROR OUTPUT
12	P75	22	DB/WT	LEFT HORIZONTAL MIRROR OUTPUT
13	P66	22	WT/BK	RIGHT MIRROR RHEOSTAT SENSE GROUND
14	P67	22	YL/RD	RIGHT MIRROR RHEOSTAT SENSE VERTICAL
15	P68	22	DG/RD	RIGHT MIRROR RHEOSTAT SENSE HORIZONTAL
16	M1	22	PK	BATTERY FEED FOR “WAKEUPS & RECALLS”
19	G96	22	LG/RD	RKE DATA LINK INPUT
20	P23	20	PK/RD	MEMORY “1” SWITCH INPUT
21	P24	20	PK/WT	MEMORY “2” SWITCH INPUT
23	P70	22	WT	RIGHT COMMON MIRROR OUTPUT
24	P72	22	YL/BK	RIGHT VERTICAL MIRROR OUTPUT
25	P75	22	DB	RIGHT HORIZONTAL MIRROR OUTPUT

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Fig. 6 Memory Seat/Mirror Module 25-Way Connector

nector (cavity 5) **This is a low current battery feed from the control module that will not illuminate a test lamp.**

During shipping of the vehicle, an M1 circuit 10 amp fuse (labeled IOD) is temporarily removed from the PDC in the engine compartment to eliminate unnecessary battery depletion. However, this fused circuit being open (that feeds through the electrical distribution wiring to cavity 16 of the 25-way connector) will not stop manual seat actuations from taking place (only recall mode requests) during shipping.

(1) If the memory seat/mirror module does not respond with a relay click to any seat switch input (as well as the desired motion) when actuated, proceed with the following analysis:

• Verify power ON F35 and ground Z1 into the system as indicated above.

• Verify all connectors are mated with the memory seat/mirror module.

• Place the vehicle gear shift lever in any position except PARK (causes the Memory Seat/Mirror Module to wake-up and provide a position sense voltage to the seat motor potentiometers and the mirror rheostat(s). This voltage can be checked at the appropriate cavities of the 21 and 25-way connectors.

• Verify the switch connector is mated with the seat switch on the inside of the outboard side-shield.

• Verify battery voltage at the P9 circuit referenced to the Z1A ground reference (cavity 1) of the seat switch. If P9 low current battery is not available

DIAGNOSIS AND TESTING (Continued)

coming from the module, replace the Memory Seat/ Mirror Module.

• If P9 low current battery is present at (cavity 5) referenced to ground Z1 (cavity 1) of the seat switch, verify the presence of the P9 voltage at the switch outputs. If there is no output voltage from the switch, replace the switch.

• If P9 voltage is present at the output of the switch, but there is no reaction from the memory seat/mirror module, verify that the P9 voltage is present at the appropriate 21-way connector pins into the module. If the P9 voltage is not present at the 21-way connector, repair or replace the seat wiring harness. If the verification check of the seat wiring harness is correct, replace the control module.

(2) If the control module does not respond with a relay click to a specific seat switch when actuated, verify the continuity of the particular circuit between the seat switch and the Memory Seat/Mirror Module. If the P9 voltage is present at the correct input of the 21-way connector of the module when the switch is actuated, but there is no response by the module, replace the Memory Seat/Mirror Module.

(3) If the Memory Seat/Mirror Module responds with a relay click when a seat switch is actuated for a given direction, but there is no reaction from a seat or recliner motor relating to that switch input, disconnect the 10-way connector from the control module. Jumper the battery and ground from cavities 8 and 7 of the seat harness 10-way connector to the proper cavities for the seat or recliner motor in question and direction of travel desired. If the motor operates, replace the control module. If the motor does not operate, verify continuity of the wiring into the motor 2-way connector. Repair or replace the wiring as necessary. If the wiring has continuity, and the motor will not operate when fed directly, replace the track assembly, since the motor/transmission combinations are not designed to be serviced on an individual basis.

SEAT AND RECLINER POSITION SENSING

Seat and recliner position sense ground reference circuit P28 BR/RD feed is from the memory seat/mirror module (cavity 10) 21-way connector to each of the position sense connectors.

Seat and recliner position sense +5 volt feed circuit P29 BR/WT feed is from the memory seat/mirror module (cavity 20) 21-way connector to each of the position sense connectors.

To test for the presence of a sense voltage, a volt meter must be used as follows:

• Connect the negative probe to the P28 circuit (cavity 10) of the 21-way connector.

• Connect the positive probe to the P29 circuit (cavity 20) of the 21-way connector and verify a voltage reading between 3.5 and 5 volts when a seat or recliner switch is activated. **An internal timer in the Memory Seat/Mirror Module (MSM Module) regulates the length of time this voltage stays active i.e., 3 seconds from the time that the switch was activated, unless the switch is held or while the transmission is out of PARK.** If the voltage is less than 3.5, there is a fault in the system that is drawing it down. To troubleshoot this circuit, disconnect the 25-way connector from the MSM Module (this removes all of the vehicle mirror circuitry). If the voltage is still less than 3.5, disconnect each of the position sense connectors from each of the motors. If the voltage remains less than 3.5, replace the MSM Module. If the voltage increases when a motor is disconnected from the system, determine if the fault is in the wiring or the motor assembly. Repair or replace the wire harness assembly as needed. If the fault is in the motor position sensing potentiometer, replace the track assembly.

• The potentiometers built onto the motor end-bell provide voltages to the MSM Module through the 21-way connector, which change as follows, corresponding to the given seat actuations. Refer to Seat Actuations Table.

SERVICE PROCEDURES

REMOTE KEYLESS ENTRY (RKE) DATA LINK

The memory seat/mirror module interfaces with the RKE via a serial data link (single wire). The programming sequence to relate an RKE transmitter to the chosen seat, recliner and side view mirror positions consists of the following steps:

(1) Adjust the seat, recliner and side view mirrors to the desired position.

(2) Press momentarily and release memory switch S.

(3) Press momentarily and release memory switch 1 or 2.

(4) Press momentarily and release a LOCK button on an RKE transmitter.

(5) To program the second driver's position, follow the previous sequence with a second transmitter.

(6) To recall either of the programmed positions with an RKE transmitter, press momentarily and release an UNLOCK button on one of the programmed RKE transmitters. **An unprogrammed RKE transmitter will have no effect on the system.**

(7) The RKE receiver uses the serial data link to notify the module of a request from a programmed transmitter, that an UNLOCK button has been pressed. This UNLOCK request (from a transmitter associated with either switch 1 or 2) will activate the

SERVICE PROCEDURES (Continued)

SEAT ACTUATIONS TABLE

LOCATION	POSITION	VOLTAGE READING
CAVITY #8 CIRCUIT P26	SEAT TRACK FRONT UP SEAT TRACK FRONT DOWN	VOLTAGE INCREASES VOLTAGE DECREASES
CAVITY #7 CIRCUIT P27	SEAT TRACK REAR UP SEAT TRACK REAR DOWN	VOLTAGE INCREASES VOLTAGE DECREASES
CAVITY #18 CIRCUIT P25	TRACK HORIZONTAL FORWARD TRACK HORIZONTAL REARWARD	VOLTAGE INCREASES VOLTAGE DECREASES
CAVITY #17 CIRCUIT P47	RECLINER FORWARD RECLINER REARWARD	VOLTAGE INCREASES VOLTAGE DECREASES

Memory Seat/Mirror Module in the recall mode to the values that are stored in the module's memory.

(8) Whenever the module receives a specific data stream from the RKE receiver that involves the programming of a new transmitter into the RKE receiver, the module will clear its nonvolatile memory seat and recliner values for both memory 1 and 2 and will default to a location consisting of seat track rearward, seat vertical risers down, and recliner forward in both memory 1 and 2. After this has occurred, the customer must reprogram their desired seat and mirror positions.

(9) A recall is possible any time that the vehicle transmission is in PARK. This condition is monitored by the Body Control Module (BCM).

(10) A ground placed on the serial data link by the BCM whenever that the transmission is not in PARK, will inhibit a recall request from the door mounted memory switch 1 or 2 or the RKE receiver that was initiated by either of the validly programmed transmitters.

NOTE: The module will abort a recall if the transmission is moved out of the PARK position or if any seat, recliner or memory switch is pressed.

REMOVAL AND INSTALLATION

MEMORY SWITCHES

REMOVAL

(1) Insert a proper tool through the access slot located at the front forward edge of the switch bezel.

(2) Pry the switch out from the door trim panel opening.

(3) Disconnect wire connector from back of switch.

INSTALLATION

For installation. reverse the above procedures.

SEAT TRACK ASSEMBLY

Refer to Group 23, Body for Removal and Installation procedures.

POWER MIRRORS

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GENERAL INFORMATION

INTRODUCTION

Electrically-operated remote control mirrors are controlled by a switch assembly located on the headlamp switch bezel in the instrument panel.

The vehicle uses a rocker switch for right or left side mirror selection and a single platform button for mirror UP, DOWN, RIGHT, or LEFT movement.

The motors which operate the mirrors are part of the mirror assembly and cannot be serviced separately.

HEATED MIRROR

Heated mirrors are available on models with Power Mirrors and Rear Window Defogger only. The heated mirror is controlled by the rear window defogger switch. The heated mirror is ON when the rear window defogger is ON.

MEMORY MIRRORS

For memory mirrors refer to Group 8R, Power Seats section Memory Seat/Mirror system.

DIAGNOSIS AND TESTING

MIRROR MOTOR TEST

(1) Remove headlamp switch bezel. Refer to Group 8E, Instrument Panel and Gauges.

(2) Disconnect wiring harness connector to the power mirror switch and headlamp switch.

(3) Using two jumper wires:
- Connect one to a 12-volt source
- Connect the other to a good body ground
- Refer to the Mirror Test Chart for wire hookups at the switch connector (Fig. 1).

(4) If results shown in chart are not obtained, check for broken or shorted circuit, or replace mirror assembly as necessary.

MIRROR SWITCH TEST

(1) Remove power mirror switch from mounting position.

(2) Disconnect wiring harness at switch connector.

(3) Using a ohmmeter, test for continuity between the terminals of the switch as shown in the Mirror Switch Continuity Chart (Fig. 2).

(4) If results shown in the chart are not obtained, replace the switch.

HEATED MIRROR TEST

Heated mirrors are available on models with Power Mirrors and Rear Window Defogger only. The heated mirror is controlled by the rear window defogger switch. The heated mirror is ON when the rear window defogger is ON.

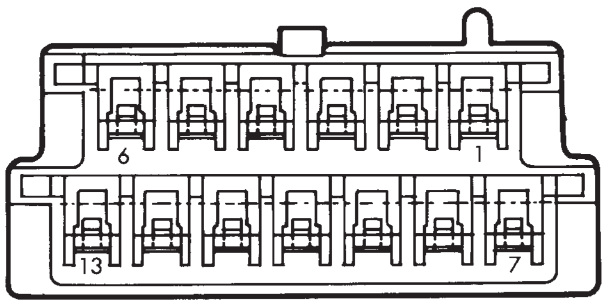
TEST PROCEDURE

(1) The mirror should be warm to the touch.

(2) If not, check the 10 amp fuse (12) in the junction block behind the instrument panel to the left of the steering column.

(3) Test voltage at rear window defogger switch.
- If no voltage repair wire.
- Apply voltage to one wire and ground the other, refer to (Fig. 1) for pin numbers. Mirror should become warm to the touch.
- If not remove mirror glass and test the wires for continuity. If no continuity repair wires.
- If wires are OK, replace mirror glass.
- To test defogger switch refer to Group 8N, Electrically Heated Systems.

DIAGNOSIS AND TESTING (Continued)



MIRROR TEST			
SWITCH CONNECTOR			
12 Volts	Ground	MIRROR REACTION Right	MIRROR REACTION Left
PIN 12	PIN 6	—	UP
PIN 7	PIN 6	—	LEFT
PIN 6	PIN 12	—	DOWN
PIN 6	PIN 7	—	RIGHT
PIN 13	PIN 1	UP	—
PIN 8	PIN 1	LEFT	—
PIN 1	PIN 13	DOWN	—
PIN 1	PIN 8	RIGHT	—
PIN 5	PIN 11	LAMP	LAMP

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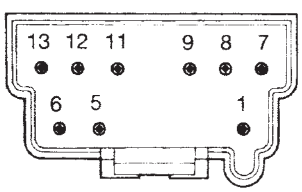
Fig. 1 Power Mirror Test



MIRROR SWITCH CONTINUITY			
MIRROR SELECT KNOB IN "LEFT" POSITION			
Move Lever	Continuity Between		
UP	PIN 9 - PIN 12,	PIN 6 - PIN 11,	PIN 9 - PIN 13
LEFT	PIN 9 - PIN 7,	PIN 6 - PIN 11,	PIN 9 - PIN 8
DOWN	PIN 9 - PIN 6,	PIN 12 - PIN 11,	PIN 13 - PIN 11
RIGHT	PIN 9 - PIN 6,	PIN 7 - PIN 11,	PIN 8 - PIN 11
MIRROR SELECT KNOB IN "RIGHT" POSITION			
Move Lever	Continuity Between		
UP	PIN 9 - PIN 13,	PIN 1 - PIN 11,	PIN 9 - PIN 12
LEFT	PIN 9 - PIN 8,	PIN 1 - PIN 11,	PIN 9 - PIN 7
DOWN	PIN 9 - PIN 1,	PIN 13 - PIN 11,	PIN 12 - PIN 11
RIGHT	PIN 9 - PIN 1,	PIN 8 - PIN 11,	PIN 7 - PIN 11
LAMP	PIN 5 - PIN 11		

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Fig. 2 Mirror Switch Test

REMOVAL AND INSTALLATION

POWER MIRROR

REMOVAL

(1) Remove front cover, refer to (Fig. 3).
(2) Remove attaching screws.
(3) Disconnect wire connector(s).
(4) Remove mirror from vehicle.

INSTALLATION

For installation, reverse the above procedures.

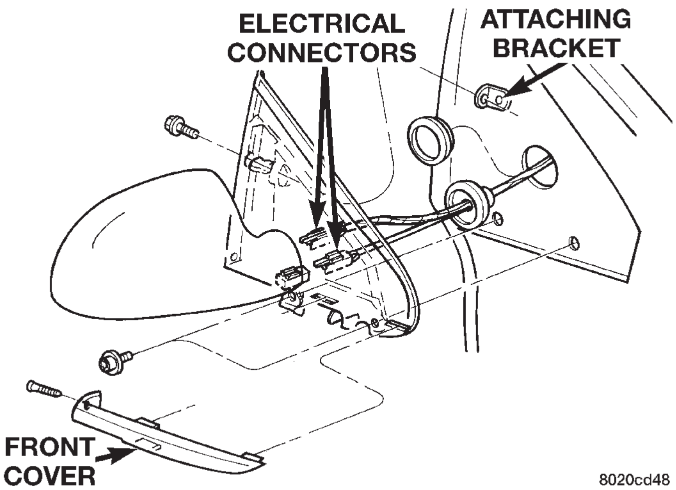

Fig. 3 Power Side View Mirror

POWER MIRROR SWITCH

Refer to Group 8E, Instrument Panel and Systems for service procedure (Fig. 4).

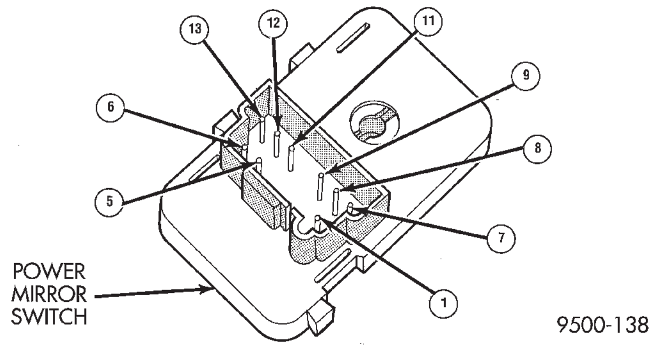

Fig. 4 Power Mirror/Window Switch

CHIME WARNING/REMINDER SYSTEM

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GENERAL INFORMATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M, RESTRAINT SYSTEMS FOR SAFETY PRECAUTIONS AND WARNINGS TO OBSERVE WHEN SERVICING AIRBAG RELATED COMPONENTS.

The chime system provides the driver with warning chimes for:

- Seat Belt
- Exterior Lamps ON
- Key-In Ignition
- Engine Temperature Critical
- Turn Signals ON
- Dome Lamp ON
- Low Oil Pressure
- High Speed Warning
- Warning Lamp Announcement

The Chime Warning/Reminder System is diagnosed using a scan tool (DRB). Refer to the proper Body Diagnostic Procedures manual for testing procedures and scan tool usage instructions.

DIAGNOSIS AND TESTING

CHIME SYSTEM DIAGNOSIS

NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVER'S SEAT BELT IS NOT BUCKLED.

(1) Using a scan tool (DRB), check for tone in any other function.

(2) Using a voltmeter, check for voltage:

(a) Pin 9 of the internal 32 way connector of the BCM for battery feed.

(b) Pin 8 of the internal 32 way connector of the BCM for ignition feed.

(c) If voltage OK, go to step Step 3

(d) If NO voltage repair as necessary. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

(3) Check driver's seat belt buckle switch input for a closed circuit when not buckled. If input not seen, look for open in wiring or switch. The switch is grounded when belt is not buckled.

(4) Repair as necessary.

NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON.

(1) Check for burned out lamp.

(2) Using a voltmeter check for voltage:

(a) Pin 2 of the mechanical instrument cluster for battery feed.

(b) Pin 11 of the mechanical instrument cluster for ignition voltage.

(3) Repair as necessary.

FASTEN SEAT BELT LAMP OR TONE CONTINUES FOR MORE THAN 10 SECONDS AFTER SEAT BELTS ARE FASTENED AND DRIVER'S DOOR IS CLOSED.

(1) Check left door ajar switch for no ground when switch is depressed.

(a) If continuity replace door ajar switch.

(b) If NO continuity replace BCM for tone condition, or replace mechanical instrument panel for lamp condition.

(c) Replace BCM for tone condition.

(d) Replace mechanical instrument cluster for lamp condition.

NO TONE WHEN PARK OR HEADLAMPS ARE ON AND DRIVER'S DOOR IS OPEN.

(1) Check left door ajar switch for good ground when driver's door is open. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

(2) Inspect BCM connectors and wires for proper connection. If OK, replace BCM for tone condition.

DOME LAMP ON CHIME

The dome lamp on chime will warn the driver that the dome lamps have been left on.

With the ignition is OFF:

• Driver's door OPEN (door ajar switch is closed to ground)

• Dome lamps are ON (dome lamp switch is closed to ground),

The chime will sound continuously until driver's door is closed, dome lamps tuned OFF or until the battery protection time out of 15 minutes has expired. Refer Group 8L, Lamps proper procedures. Chime rate: 168 to 192 chimes per minute.

ENGINE TEMPERATURE CRITICAL CHIME

The engine temperature critical chime will warn the driver that the vehicle's engine is overheating. While monitoring the coolant temperature, the Powertrain Control Module (PCM) will send on the CCD bus as engine temperature every 1.376 seconds to the Body Control Module (BCM). The BCM calculates engine temperature and determines if a warning should occur. This feature is functional only with the Ignition Switch in the Run/Start position.

When the engine temperature reaches 122°C (252°F) the BCM will chime one tone and the engine temperature lamp comes ON. The BCM turns OFF the lamp when the engine temperature reaches 117°C (242°F). The BCM will chime continuously when the engine temperature reaches 125°C (257°F). The chime will turn OFF after four minutes or when the temperature reaches 117°C (242°F), which ever occurs first.

EXTERIOR LAMPS ON CHIME

The exterior lamp on chime will warn the driver that the exterior lights have been left on.

With the ignition switch OFF:

• Driver's door is open (door ajar switch is closed to ground)

• Parking lamps or headlamps ON (parking lamp switch is closed to ground)

The chime will sound until lights are turned OFF, driver's door closed or until the battery protection time out of 3 minutes has expired.

Refer to Group 8L, Lamps, for proper service procedures. Chime rate: 168 to 192 chimes per minute.

To test the exterior lamps left on function:

• Turn ignition off

• Remove ignition key

• Turn exterior lamps on with driver's door open. Chime should sound until lamps are turned off or driver's door is closed.

KEY-IN IGNITION CHIME

The key-in ignition chime will act as a warning to the driver that the ignition key has been left in the ignition switch.

With the ignition switch is in OFF position ONLY:

• Driver's door is open/ajar (door ajar switch is closed to ground)

• Key is in the ignition switch (key-in ignition switch is closed to ground)

The chime will sound until one of the above conditions is removed. Chime rate: 168 to 192 chimes per minute.

To test the key-in ignition function, insert key into the ignition and open driver's door. Do not turn ignition ON. Chime should sound until key is removed from ignition or driver's door is closed.

LOW OIL PRESSURE CHIME OPERATION

The low oil pressure chime will warn the driver that the engine oil pressure is low. The oil pressure switch, will close to ground during a low oil pressure condition. The oil pressure lamp will illuminate in the message center. The body control module will monitor the oil pressure switch and signal a low oil pressure condition. A continuous four minute warning chime will sound and the oil pressure lamp will come ON when the following conditions are met:

• Ignition on and engine not cranking

• Engine running at 420 to 480 rpm for 10 seconds

• Oil pressure switch closed to ground for (1 second minimum, 2 seconds maximum)

Chime rate: 168 to 192 chimes per minute.

SEAT BELT CHIME

The seat belt chime will sound for 4 to 8 seconds, when the ignition is turned on and the driver's seat belt is not buckled (seat belt switch is closed to ground). This is a reminder to the driver to buckle the seat belt. The seat belt lamp is controlled by the mechanical instrument cluster. The cluster will also illuminate the seat belt warning lamp for 6 seconds. Buckling the driver's seat belt before the time out has expired will cause the chime to stop immediately. Chime rate: 38 to 62 chimes per minute.

To test the seat belt warning system, the ignition switch must be in the OFF position for 1 minute before starting the test. Turn the ignition switch to the on position with the driver's seat belt not buckled. The seat belt warning lamp should light and the chime should sound 4 to 8 seconds.

SEAT BELT LAMP

The seat belt lamp in the instrument cluster signals the vehicle passengers to fasten their seat belts. The seat belt lamp is illuminated directly by the

DIAGNOSIS AND TESTING (Continued)

instrument cluster for 6 seconds after the instrument cluster receives the message from the Body Control Module. The seat belt lamp is therefore illuminated for 6 seconds whenever the ignition switch is moved to run/start position.

(1) While ignition is off, the seat belt lamp will not be illuminated.

(2) The ignition power feed status will be updated every 250 milliseconds or on change.

(3) This lamp will be checked by the instrument cluster for 6 seconds with every run/start cycle of the ignition switch.

TURN SIGNAL ON CHIME

The turn signal on chime will warn the driver that the turn signals have been left on. When the body control module receives a turn signal input for 6.4 km (4.0 miles), vehicle speed is greater than 24 km/h (15 mph), the chime will sound continuously until the turn signal is turned OFF. If vehicle speed drops below 24 km/h (15 mph) prior to the warning being activated, the accumulated distance traveled will be reset. The turn signal chime is not activated when the emergency flashers are turned on. This feature can also be disabled in EEPROM. Chime rate: 50 chimes per minute.

For the turn signal warning system to operate:

- Must have input from either the right or left turn signal lamps. Creates a voltage change between 0 and battery voltage.
- The vehicle speed sensor sends a message to the Powertrain Control Module that vehicle has exceeded 24 km/h (15 mph) for 6.4 km (4.0 miles).
- When the above two conditions are met, the chime will sound. The chime will stop when no further voltage change is detected.
- If hazard warning signals are pulsing, no chime will sound.
- If speed drops below 24 km/h (15 mph) before the warning is issued, the warning will not be issued and the distance counter will be reset.
- If turn signal lamps are not working properly, the chime will not sound.
- When using the scan tool, refer to the proper Body Diagnostic Manual for the procedure.

WARNING LAMP ANNOUNCEMENT CHIME

The warning lamp announcement chime will warn the driver to scan the instrument cluster to observe which warning lamp is illuminated. Whenever the volts, low fuel, low washer/coolant level, door ajar or gate ajar lamps are first illuminated, the chime will sound one tone. The door/liftgate ajar warning lamp announcement chime sounds only if the vehicle speed is above 2 m.p.h.

Two seconds after ignition switch is turned ON or until the seat belt warning chime ends, all warning announcement chimes will be consolidated into one warning announcement. This will occur 2 seconds after the seat belt warning chime ends. If a warning announcement should occur while another warning chime in progress (turn signal, low oil pressure or high speed warnings), no additional chimes will sound after the chime in progress ends. All associated lamps will be illuminated, and the active chime will be the warning announcement.

CHIME WARNING/REMINDER SYSTEM

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GENERAL INFORMATION

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The chime system provides the driver with warning chimes for:

- Seat Belt
- Exterior Lamps ON
- Key-In Ignition
- Engine Temperature Critical
- Turn Signals ON
- Dome Lamp ON
- Low Oil Pressure
- High Speed Warning
- Warning Lamp Announcement
- Catalyst Overheating

The Chime Warning/Reminder System is diagnosed using a scan tool (DRB). Refer to the proper Body Diagnostic Procedures manual for testing procedures and scan tool usage instructions.

DIAGNOSIS AND TESTING

CATALYST OVERHEAT WARNING CHIME

The Catalyst Overheat Warning Chime will act as a warning to the driver that the vehicle's catalyst has entered an overheat condition. The Powertrain Control Module (PCM) will enable or disable this feature for the appropriate vehicles. Right hand drive gas vehicles only. The Body Control Module (BCM) will monitor the CCD bus for status and signal a catalyst overheat condition with continuous warning chime when the following conditions are met:

- Ignition switch in the ON position
- Engine running at 420 to 480 rpm for 10 seconds
- CCD status and with a chime rate of one chime per second.

CHIME SYSTEM DIAGNOSIS

NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVER'S SEAT BELT IS NOT BUCKLED.

(1) Using a scan tool (DRB), check for tone in any other function.

(2) Using a voltmeter, check for voltage:

(a) Pin 9 of the internal 32 way connector of the BCM for battery feed.

(b) Pin 8 of the internal 32 way connector of the BCM for ignition feed.

(c) If voltage OK, go to step Step 3

(d) If NO voltage repair as necessary. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

(3) Check driver's seat belt buckle switch input for a closed circuit when not buckled. If input not seen, look for open in wiring or switch. The switch is grounded when belt is not buckled.

(4) Repair as necessary.

NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON.

(1) Check for burned out lamp.

(2) Using a voltmeter check for voltage:

(a) Pin 2 of the mechanical instrument cluster for battery feed.

(b) Pin 11 of the mechanical instrument cluster for ignition voltage.

(3) Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

FASTEN SEAT BELT LAMP OR TONE CONTINUES FOR MORE THAN 10 SECONDS AFTER SEAT BELTS ARE FASTENED AND DRIVER'S DOOR IS CLOSED.

(1) Check left door ajar switch for no ground when switch is depressed.

(a) If continuity replace door ajar switch.

(b) If NO continuity replace BCM for tone condition, or replace mechanical instrument panel for lamp condition.

(c) Replace BCM for tone condition.

(d) Replace mechanical instrument cluster for lamp condition.

NO TONE WHEN PARK OR HEADLAMPS ARE ON AND DRIVER'S DOOR IS OPEN.

(1) Check left door ajar switch for good ground when driver's door is open. Repair as necessary.

(2) Inspect BCM connectors and wires for proper connection. If OK, replace BCM for tone condition.

DOME LAMP ON CHIME

The dome lamp on chime will warn the driver that the dome lamps have been left on.

With the ignition is OFF:

• Driver's door OPEN (door ajar switch is closed to ground)

• Dome lamps are ON (dome lamp switch is closed to ground),

The chime will sound continuously until driver's door is closed, dome lamps tuned OFF or until the battery protection time out of 15 minutes has expired. Refer Group 8L, Lamps proper procedures. Chime rate: 168 to 192 chimes per minute.

ENGINE TEMPERATURE CRITICAL CHIME

The engine temperature critical chime will warn the driver that the vehicle's engine is overheating. While monitoring the coolant temperature, the Powertrain Control Module (PCM) will send on the CCD bus as engine temperature every 1.376 seconds to the Body Control Module (BCM). The BCM calculates engine temperature and determines if a warning should occur. This feature is functional only with the Ignition Switch in the Run/Start position. On the Diesel vehicles, the coolant temperature sensor is read directly by the BCM.

When the engine temperature reaches 122°C (252°F) or the diesel engine 112°C (234°F), the BCM will chime one tone and the engine temperature lamp comes ON. The BCM turns OFF the lamp when the engine temperature reaches 117°C (242°F) or the diesel engine 108°C (226°F). The BCM will chime continuously when the engine temperature reaches 125°C (257°F) or diesel engine 116°C (241°F). The chime will turn OFF after four minutes or when the temperature reaches 117°C (242°F) or diesel engine 108°C (226°F), which ever occurs first.

EXTERIOR LAMPS ON CHIME

The exterior lamp on chime will warn the driver that the exterior lights have been left on.

With the ignition switch OFF:

• Driver's door is open (door ajar switch is closed to ground)

• Parking lamps or headlamps ON (parking lamp switch is closed to ground)

The chime will sound until lights are turned OFF, driver's door closed or until the battery protection time out of 3 minutes has expired.

Refer to Group 8L, Lamps, for proper service procedures. Chime rate: 168 to 192 chimes per minute.

To test the exterior lamps left on function:

• Turn ignition off

• Remove ignition key

• Turn exterior lamps on with driver's door open. Chime should sound until lamps are turned off or driver's door is closed.

KEY-IN IGNITION CHIME

The key-in ignition chime will act as a warning to the driver that the ignition key has been left in the ignition switch.

With the ignition switch is in OFF position ONLY:

• Driver's door is open/ajar (door ajar switch is closed to ground)

• Key is in the ignition switch (key-in ignition switch is closed to ground)

The chime will sound until one of the above conditions is removed. Chime rate: 168 to 192 chimes per minute.

To test the key-in ignition function, insert key into the ignition and open driver's door. Do not turn ignition ON. Chime should sound until key is removed from ignition or driver's door is closed.

LOW OIL PRESSURE CHIME OPERATION

The low oil pressure chime will warn the driver that the engine oil pressure is low. The oil pressure switch, will close to ground during a low oil pressure condition. The oil pressure lamp will illuminate in the message center. The body control module will monitor the oil pressure switch and signal a low oil pressure condition. A continuous four minute warning chime will sound and the oil pressure lamp will come ON when the following conditions are met:

• Ignition on and engine not cranking

• Engine running at 420 to 480 rpm for 10 seconds

• Oil pressure switch closed to ground for (1 second minimum, 2 seconds maximum)

Chime rate: 168 to 192 chimes per minute.

DIAGNOSIS AND TESTING (Continued)

SEAT BELT CHIME

The seat belt chime will sound for 4 to 8 seconds, when the ignition is turned on and the driver's seat belt is not buckled (seat belt switch is closed to ground). This is a reminder to the driver to buckle the seat belt. The seat belt lamp is controlled by the mechanical instrument cluster. The cluster will also illuminate the seat belt warning lamp for 6 seconds. Buckling the driver's seat belt before the time out has expired will cause the chime to stop immediately. Chime rate: 38 to 62 chimes per minute.

To test the seat belt warning system, the ignition switch must be in the OFF position for 1 minute before starting the test. Turn the ignition switch to the on position with the driver's seat belt not buckled. The seat belt warning lamp should light and the chime should sound 4 to 8 seconds.

SEAT BELT LAMP

The seat belt lamp in the instrument cluster signals the vehicle passengers to fasten their seat belts. The seat belt lamp is illuminated directly by the instrument cluster for 6 seconds after the instrument cluster receives the message from the Body Control Module. The seat belt lamp is therefore illuminated for 6 seconds whenever the ignition switch is moved to run/start position.

(1) While ignition is off, the seat belt lamp will not be illuminated.

(2) The ignition power feed status will be updated every 250 milliseconds or on change.

(3) This lamp will be checked by the instrument cluster for 6 seconds with every run/start cycle of the ignition switch.

TURN SIGNAL ON CHIME

The turn signal on chime will warn the driver that the turn signals have been left on. When the Body Control Module receives a turn signal input for 1.6 km (1.0 miles), vehicle speed is greater than 24 km/h (15 mph), the chime will sound continuously until the turn signal is turned OFF. If vehicle speed drops below 24 km/h (15 mph) prior to the warning being activated, the accumulated distance traveled will be reset. The turn signal chime is not activated when the emergency flashers are turned on. This feature can also be disabled in EEPROM. Chime rate: 38 to 62 chimes per minute.

For the turn signal warning system to operate:

- Must have input from either the right or left turn signal lamps. Creates a voltage change between 0 and battery voltage.
- The vehicle speed sensor sends a message to the Powertrain Control Module that vehicle has exceeded 24 km/h (15 mph) for 1.6 km (1.0 miles).
- When the above two conditions are met, the chime will sound. The chime will stop when no further voltage change is detected.
- If hazard warning signals are pulsing, no chime will sound.
- If speed drops below 24 km/h (15 mph) before the warning is issued, the warning will not be issued and the distance counter will be reset.
- If turn signal lamps are not working properly, the chime will not sound.
- When using the scan tool, refer to the proper Body Diagnostic Manual for the procedure.

WARNING LAMP ANNOUNCEMENT CHIME

The warning lamp announcement chime will warn the driver to scan the instrument cluster to observe which warning lamp is illuminated. Whenever the volts, low fuel, low washer fluid, coolant level (gas/diesel), low coolant level, engine temperature high (diesel only), door ajar or gate ajar lamps are first illuminated, the chime will sound one tone. The door/liftgate ajar warning lamp announcement chime sounds only if the vehicle speed is above 2 m.p.h.

Two seconds after ignition switch is turned ON or until the seat belt warning chime ends, all warning announcement chimes will be consolidated into one warning announcement. This will occur 2 seconds after the seat belt warning chime ends. If a warning announcement should occur while another warning chime in progress (turn signal, low oil pressure or high speed warnings), no additional chimes will sound after the chime in progress ends. All associated lamps will be illuminated, and the active chime will be the warning announcement.

OVERHEAD CONSOLE

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DESCRIPTION AND OPERATION

COMPASS/TEMPERATURE MINI TRIP COMPUTER SELF-DIAGNOSTIC TEST

The CMTC is capable of performing a diagnostic self check on many of its internal functions. CMTC diagnostics may be performed using a scan tool (DRB) and the proper Body Diagnostic Procedures manual or by the following procedure.

(1) With the ignition switch in the OFF position, press both the US/M and STEP button.

(2) Turn ignition switch to the ON position.

The CMTC will perform internal checks while lighting all segments of the vacuum florescent display. Upon completion of the internal check, the CMTC will display.

- PASS
- FAIL
- CCd

If any segment of the CMTC fails to light replace the module.

If FAIL is displayed, replace the module.

If CCd is displayed, check the CCD and Body Control Module (BCM) for proper operation, refer to the appropriate diagnostic test procedures manual If the CCD and the BCM are OK, replace the CMTC module.

For additional diagnostic information on the CMTC and for identifying CMTC problems, refer to the proper Body Diagnostic Procedures manual.

COMPASS MINI-TRIP COMPUTER (CMTC)

The Compass Mini-Trip Computer (CMTC) system is located in the overhead console. CMTC consists of a electronic control module with a vacuum fluorescent display (VFD) and function switches. The CMTC consists of a electronic module that displays compass, trip computer, and temperature features. Actuating the STEP switch will cause the CMTC to change mode of operation when ignition is ON. Example:

- Compass/Temperature
- Trip odometer (ODO)
- Average miles per gallon (ECO)
- Instant miles per gallon (ECO)
- Distance to empty (DTE)
- Elapsed time (ET)
- Off

The CMTC module in the overhead console has three buttons used to select various functions. The CMTC selector buttons will not operate until the ignition is in the RUN position (Fig. 1).

When the ignition switch is first turned to the RUN position the CMTC display;

- Blanks momentarily
- All segments of the VFD will light for one second
- Blanks momentarily
- Returns to the last mode setting selected before the ignition was last switched OFF.

DESCRIPTION AND OPERATION (Continued)

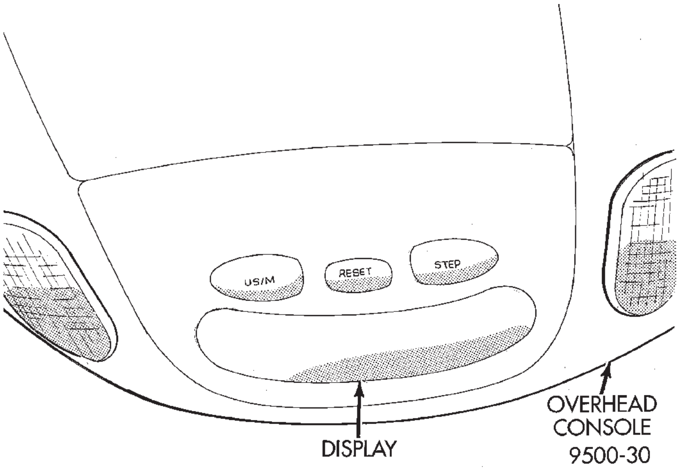


Fig. 1 Compass Mini-Trip Computer (CMTC) Switches and Display

THERMOMETER AND COMPASS

THERMOMETER

Engine temperature can increase the displayed temperature. The CMTC is designed to dampen temperature readings when the vehicle is moving at a rate slower than 18 miles per hour.

The outside temperature is measured from a sensor mounted in the front of the vehicle. If the temperature is more than 55°C (131°F) or the temperature sending line is shorted to ground, the temperature display should read SC. If the temperature is less than -40°C (-40°F), or the sending line is an open circuit, the display should read OC.

The CMTC will not allow the temperature reading to increase when the vehicle is not moving.

COMPASS

The CMTC is self calibrating and usually requires no adjustment. The compass will continuously perform a slow calibration to compensate for small magnetic variations common to any automobile. Uncommon magnetic shifts may be caused by items such as magnetic base antennas, which can permanently alter the magnetic field of the vehicle roof panel. If excessive magnetic field continues for 5 minutes, the compass heading will go blank and only the CAL symbol will illuminate. When this occurs, the vehicle roof panel may require demagnetizing. Refer to the demagnetizing procedure in this section.

Moderate magnetic shifts may, on very rare occasions, cause the compass heading to display only one or two of the eight possible headings. Although the compass will eventually compensate for this shift, it could take several ignition cycles. The compensation process can be expedited by manually activating the fast calibration routine. Refer to the fast calibrating procedure in this section. This procedure may be performed anytime that the compass appears to be inaccurate.

If the calibration data stored in the body control module is not received, the compass will read only NE North-East. The CMTC is self calibrating and requires no adjusting. The word CAL is displayed to show that the compass is in calibration mode. CAL will turn off after the vehicle has gone through three complete circles without stopping, in an area free of magnetic disturbance. If module displays temperature while the compass is blank, turn off ignition and run self diagnostics then demagnetize the vehicle. After demagnetizing, check compass calibration number, refer to Self Diagnostic Test. If greater than 15, demagnetize again until reading is less than 15. If compass still goes blank after demagnetizing then check internal diagnostics and demagnetize.

UNIVERSAL TRANSMITTER

The Universal Transmitter, replaces the hand held remote controls that open the garage door, motorized gates, or home lighting in/outside the home. This device memorizes the activator codes for up to three remote controlled devices. It triggers those devices at the push of a button, located in a unit permanently mounted in your overhead console (if equipped).

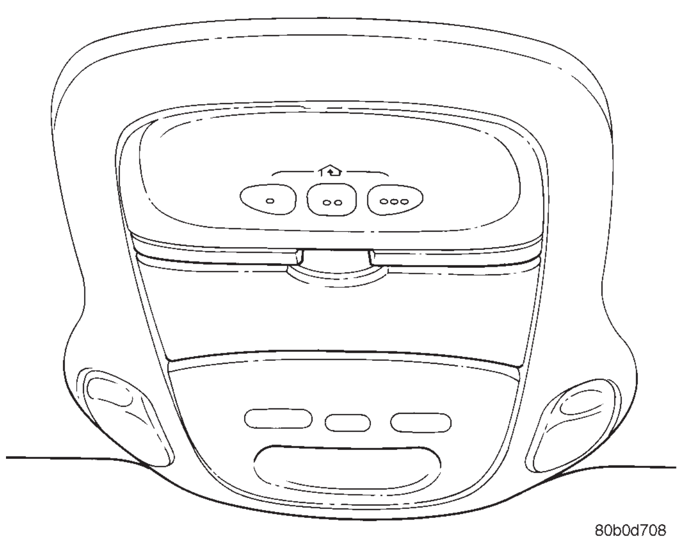


Fig. 2 Universal Transmitter Location

The transmitter operates off your vehicle's battery and charging system; no batteries are needed.

The Universal Transmitter incorporates a Rolling Code technology (random digital code signals from the remote transmitter) within the transmitter module. This is done so, as an added security measure.

Features of the Universal Transmitter are:

• Can be used with most other Radio Frequency (RF) activated devices.

• Individual channels can be trained.

DESCRIPTION AND OPERATION (Continued)

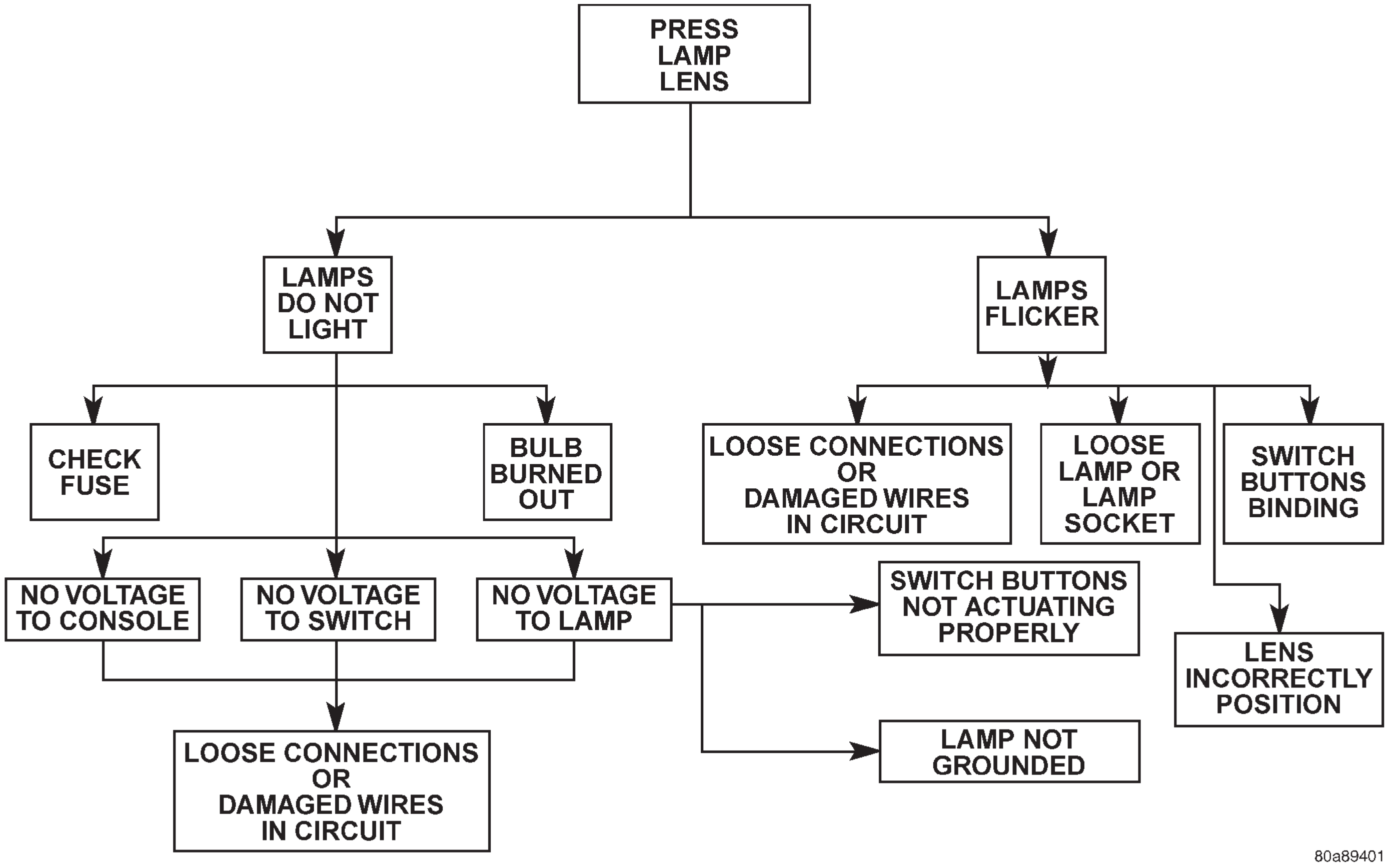


Fig. 3 Reading/Dome Lamp Diagnosis

• Stores transmitter data in permanent memory - retraining is not required even if the battery dies or is disconnected.

To operate, simply press the appropriate button on the Universal Transmitter. The red LED will light up while the signal is being transmitted.

NOTE: For security reasons, you are able to erase the trained frequencies.

DIAGNOSIS AND TESTING

READING/DOME LAMP DIAGNOSIS

The dome lamps operate in conjunction with the Remote Keyless Entry system. Refer to the Wiring Diagrams group of this manual for component locations and circuit information. For additional diagnostic information on lamp operation controlled by Body Control Module (BCM) refer to the Body Diagnostic Procedures Manual. For diagnosis of the reading lamps and switches refer to (Fig. 3).

TRAVELER MESSAGES

Traveler data is obtained from the Body Control Module (BCM) on the CCD bus wires. The CMTC will not display information for any of the screens for which it did not receive the bus messages. The label corresponding to the missing information will be lit. If no traveler data is displayed, check the CCD communications and the BCM. If the brightness level is improper check the CCD bus. One general method for checking the CCD bus communications between CMTC and the BCM is refer to the following procedure.

(1) STEP the CMTC to the Elapsed Time (ET).

(2) Press and release the reset button to reset the module.

(3) If the elapsed time clock does not reset, or fails to update, check the CCD wires and the BCM. The DRB is recommended for checking the CCD and the BCM.

(4) Perform the CMTC self diagnosis before replacing the module.

UNIVERSAL TRANSMITTER

Before proceeding in diagnosis, check the transmitter for battery voltage and a good ground at the transmitter harness connector.

• The unit may not have been trained correctly, try retraining the transmitter.

• The batteries in the hand-held transmitter may be dead.

DIAGNOSIS AND TESTING (Continued)

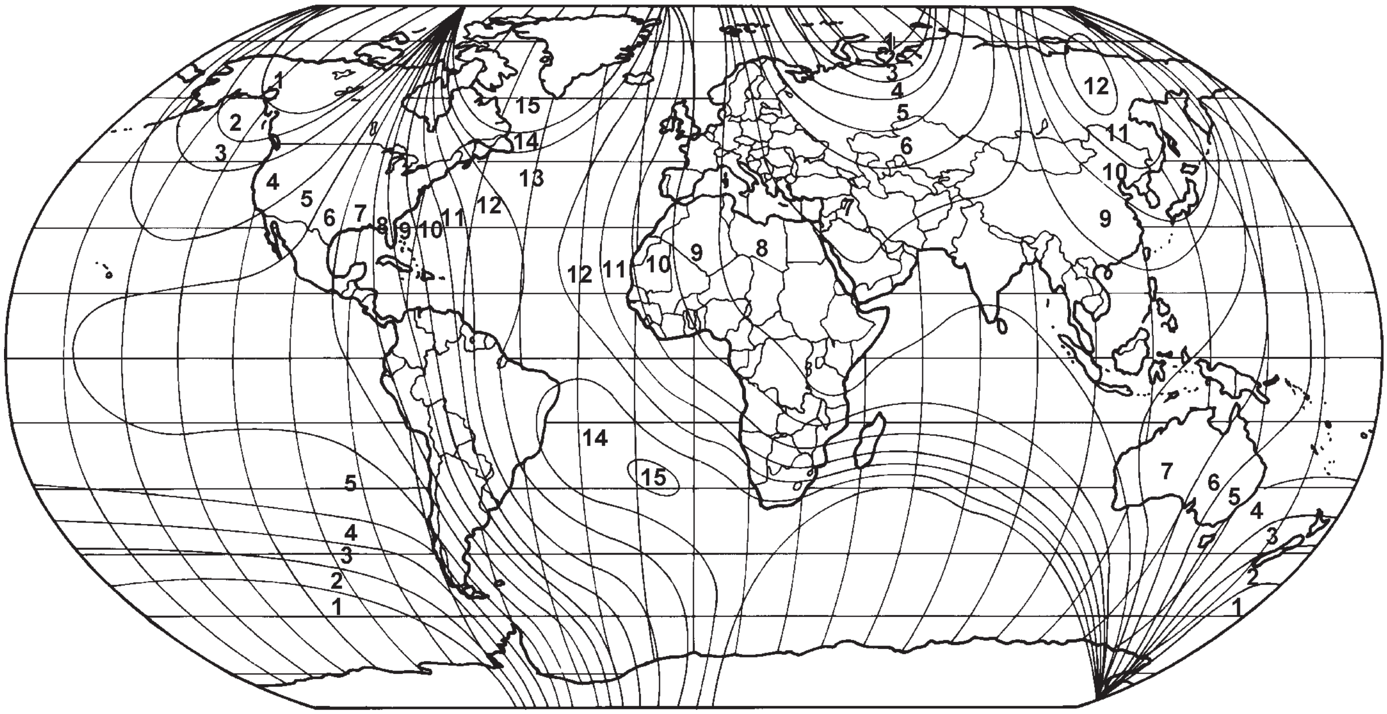


Fig. 4 Variance Settings

• Rotate your hand-held transmitter end-over-end and train again. For best results, place the end opposite from the battery compartment against the universal transmitter while training.

• The frequency of the hand-held transmitter may not be in the desired frequencies between 286MHz and 399MHz set by FCC.

SERVICE PROCEDURES

COMPASS CALIBRATION PROCEDURE

Variance is the difference between magnetic North and geographic North (Fig. 4). To adjust the compass variance set the CMTC to Compass/Temperature mode and press RESET buttons for 5 seconds. The symbol VAR and the current variance zone number will be displayed. Press the STEP button to select the proper variance zone as shown in (Fig. 4). Press the US/Metric button to save the new variance zone and normal CMTC operation. If both buttons are held for 10 seconds instead 5 seconds the CMTC will set variance to 8 and enter the fast calibration mode.

COMPASS CALIBRATION PROCEDURE (FAST METHOD)

When the compass is subjected to excessive magnetic fields, the CMTC automatically enters a fast calibration mode where is tries to compensate for the large magnetic shifts.

If the compass is inaccurate, appears to be inaccurate and the CAL is not illuminated the fast calibration mode may be manually entered by using the following procedure.

(1) Set the CMTC to Compass/Temperature mode and press the reset button for 10 continuous seconds. Manual activation of the fast calibration is generally not required.

(2) Compass variance sets to the default of 8 after the fast calibration is manually activated.

(3) Complete the compass variance setting procedure by referring to the Compass Variance Procedure in this section

(4) Drive the vehicle in three 360° turns in an area free from large metal objects. If the CAL symbol remains lit after completing this step, the roof panel may need demagnetizing

DEMAGNETIZING PROCEDURE

A magnetic field can adversely affect the compass. Magnetic interference can magnetize the roof panel. Magnetizing can be caused by placing a permanent magnet in contact with the roof panel. Example:

- Magnetic Base Antenna
- Magnetic screwdriver
- Audio speakers
- Refrigerator magnets.
- Pizza Signs
- Bubble gum flasher lights

SERVICE PROCEDURES (Continued)

Removing magnetic interfering objects will usually restore normal compass operation. If the compass display remains blank while the CAL label is illuminated, then the roof panel requires demagnetizing. To demagnetize use Special Tool 6029 for demagnetizing the roof panel. The demagnetizing procedure will demagnetize the roof and mounting screws in the overhead console. It is important that you follow the instructions below exactly. The mounting screws and the mounting brackets around the compass area are steel, and therefore aid in the demagnetizing of the roof panel.

(1) Be sure the ignition switch is in the OFF position before you begin the demagnetize procedure.

(2) Plug the demagnetizing tool into a standard 110/115 volt AC outlet, keeping the demagnetizing tool at least 12 inches away from the compass area when plugging it in.

(3) Slowly approach and contact the console mounting screw with the plastic coated tip of the tool for at least two seconds.

(4) With the demagnetizing tool still energized, slowly back it away from the screw until the tip is at least 12 inches from the screw head.

(5) Repeat the last step with all the console mounting screws.

(6) After you have pulled at least 12 inches from the last screw, remove the demagnetizing tool from inside vehicle and disconnect it from the electrical outlet.

(7) Place an 8 1/2 X 11 inch piece of paper lengthwise on the roof of vehicle directly above compass. The purpose of the paper is to protect the roof panel from scratches and define the area to be demagnetized.

(8) Plug in the demagnetizing tool, keeping it at least two feet away from the compass unit.

(9) Slowly approach the center of the roof panel at the windshield with the demagnetizing tool plugged in.

(10) Contact the roof panel with the tip of the tool. Using slow sweeping motions of 1/2 inch between sweeps. Move the tool approximately four inches either side of the center line and at least 11 inches back from the windshield.

(11) With the demagnetizing tool still energized, slowly back away from the roof panel until the tip is at least two feet from the roof before unplugging the tool.

(12) Recalibrate compass, refer to the compass calibration procedure in this section.

UNIVERSAL TRANSMITTER

TRAINING

(1) Turn off the engine.

(2) Erase the factory test codes by pressing the two outside buttons. Release the buttons when the red light begins to flash (about 20 seconds).

(3) Choose one of the three buttons to train. Place the hand-held transmitter within one inch of the universal transmitter and push the buttons on both transmitters. The red light on the universal transmitter will begin to flash slowly.

(4) When the red light on the universal transmitter begins to flash rapidly (this may take as long as 60 seconds), release both buttons. Your universal transmitter is now “trained”. To train the other buttons, repeat Step 3 and Step 4. Be sure to keep your hand-held transmitter in case you need to retrain the universal transmitter.

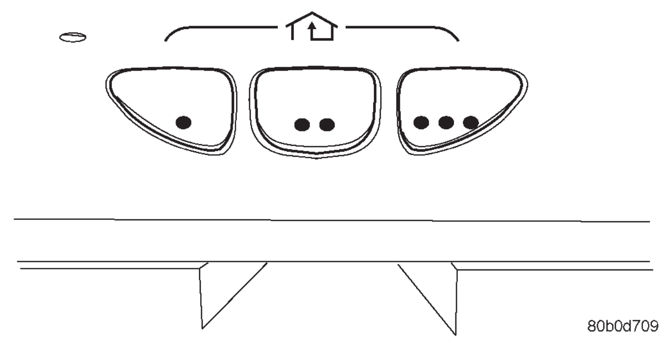


Fig. 5 Universal Transmitter

ERASING

To erase the universal transmitter codes, simply hold down the two outside buttons until the red LED begins to flash.

NOTE: Individual channels cannot be erased. Erasing the transmitter codes will erase ALL programmed codes.

REMOVAL AND INSTALLATION

AMBIENT TEMPERATURE SENSOR

REMOVAL

(1) Raise and support vehicle on safety stands.

(2) From behind front bumper fascia, remove screw holding sensor to radiator closure panel.

(3) Remove sensor from vehicle.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

COMPASS MINI-TRIP COMPUTER (CMTC) MODULE

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove overhead console.

(3) Remove the six screws holding CMTC module to overhead console (Fig. 6).

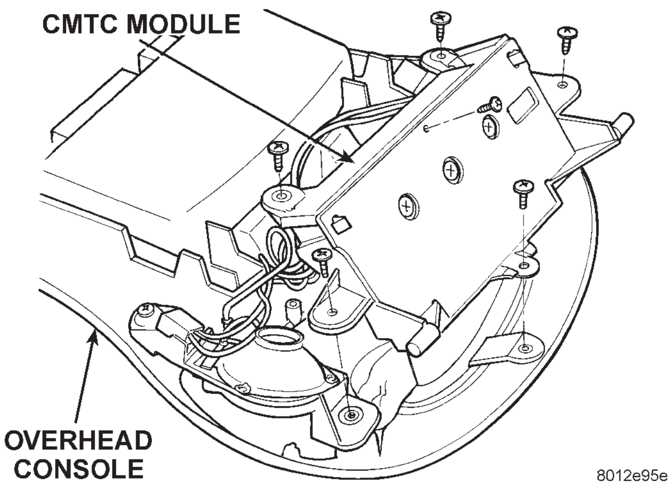


Fig. 6 Compass Mini-Trip Computer

(4) Remove CMTC module from console.

INSTALLATION

For installation, reverse the above procedures.

COMPASS MINI-TRIP COMPUTER (CMTC) LAMP BULBS

REMOVAL

(1) Remove overhead console.

(2) Rotate bulb socket counterclockwise one quarter turn (Fig. 7).

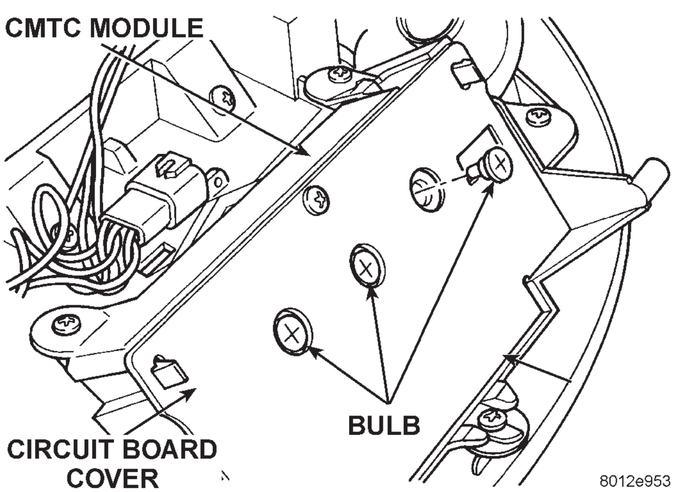


Fig. 7 CMTC Lamp Bulbs

(3) Pull bulb socket from CMTC module.

INSTALLATION

For installation, reverse the above procedures.

FRONT HEADER READING/COURTESY LAMP

REMOVAL

(1) Place a small flat tool in the slot at the forward edge of the lamp lens and twist (Fig. 8).

(2) Remove lens.

(3) Insert the tip of the tool under the inside, rear edge of the reflector/light shield. Carefully pry reflector/light shield out.

(4) Remove the lamp by pressing forward the brass terminal and rotating the lamp clockwise to remove.

INSTALLATION

For installation, reverse the above procedures. When installing the lamp lens, first guide the switch contact tab on the lens between the lamp switch plunger and the lamp bezel. Then snap lens onto the two lens pivots on the bezel.

OVERHEAD CONSOLE

REMOVAL

(1) Open the transmitter bin door (Fig. 9).

(2) Remove screw holding the overhead console to the headliner. With the screw removed the console is retained by one engagement tab located inside the eyeglass storage bin.

(3) Open the eyeglass bin door.

(4) Press the retaining tab which is located directly above the door latch.

(5) Lower rear of console away from headliner.

(6) Pull console rearward to disengage clips holding front of console to roof armature and lower console.

(7) Disconnect wire connectors from back of CMTC and reading lamps. Ensure the connectors lock tabs are fully depressed before disconnecting.

(8) Remove overhead console.

INSTALLATION

For installation, reverse the above procedures.

READING/COURTESY LAMP

Removal

(1) Using a trim stick, lightly pry outward the forward end of reading lamp lens (Fig. 10).

(2) Rotate reading/courtesy lamp socket one quarter turn counterclockwise.

(3) Pull socket out of lamp (Fig. 11).

(4) Pull lamp from socket.

REMOVAL AND INSTALLATION (Continued)

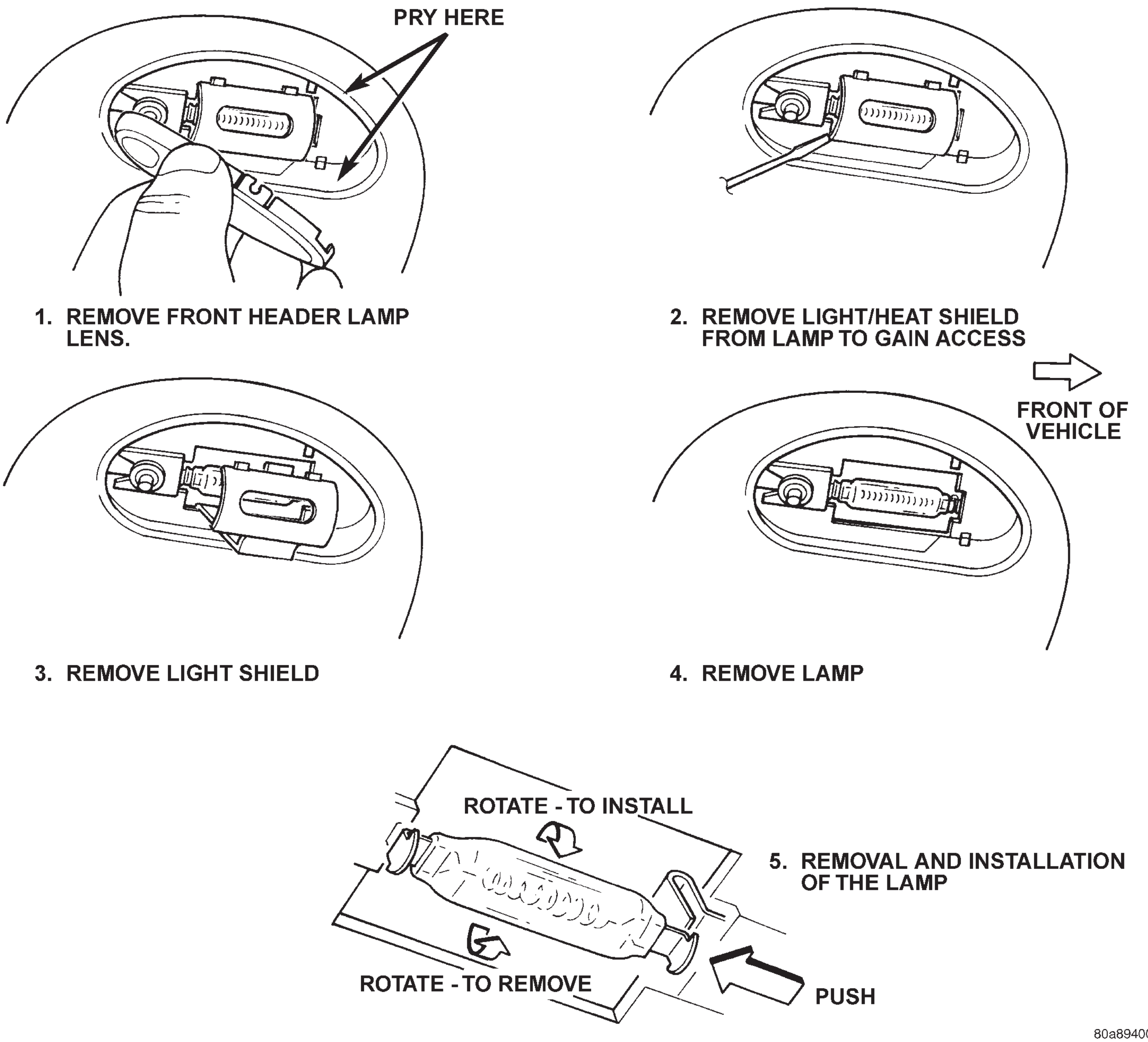


Fig. 8 Lamp and Lens Removal

Installation

For installation, reverse the above procedures. When installing the lamp lens, first guide the switch contact tab on the lens between the lamp switch plunger and the lamp bezel. Then snap lens onto the two lens pivots on the bezel.

READING/COURTESY LAMP ASSEMBLY

Removal

(1) Disconnect the battery negative cable.

(2) Remove the overhead console.

(3) Remove the screws holding the reading lamp to the overhead console (Fig. 12).

(4) Remove the lamp from the overhead console.

(5) Disconnect the wire connectors from the back of the reading lamp (Fig. 13).

(6) Disconnect the reading lamp switch from the keyhole slot in the reading lamp.

(7) Remove the reading lamp from the overhead console.

Installation

For installation, reverse the above procedures.

UNIVERSAL TRANSMITTER

REMOVAL

The Universal Transmitter is serviced with the transmitter bin door, in the overhead console.

REMOVAL AND INSTALLATION (Continued)

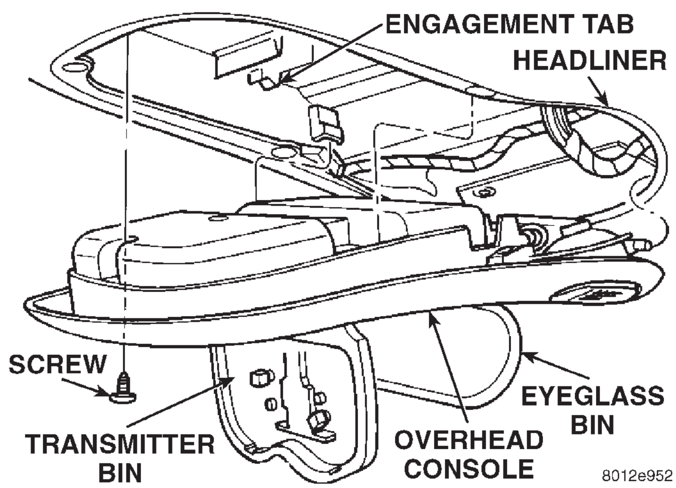


Fig. 9 Overhead Console

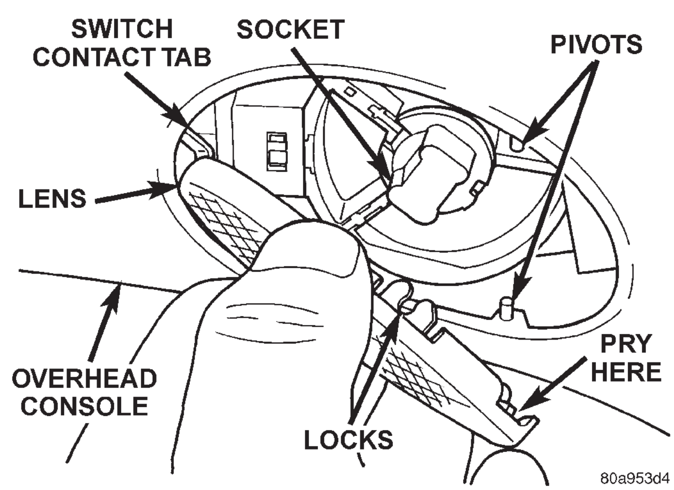


Fig. 10 Reading/Courtesy lamp lens

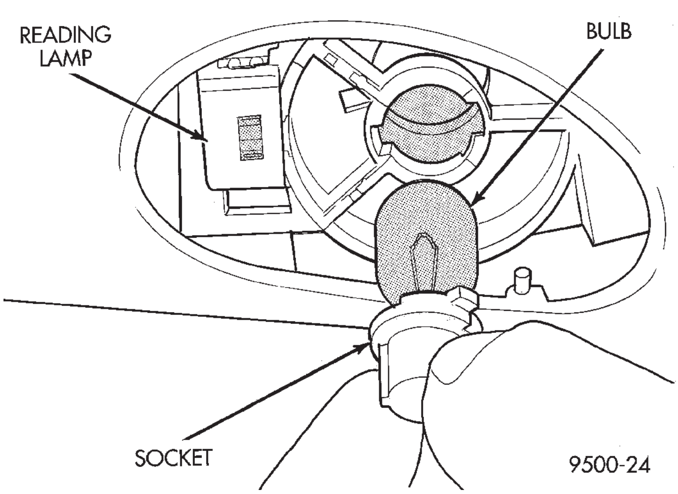


Fig. 11 Socket and Lamp

(1) Disconnect and isolate negative battery cable.

(2) Open transmitter bin door in rear of overhead console.

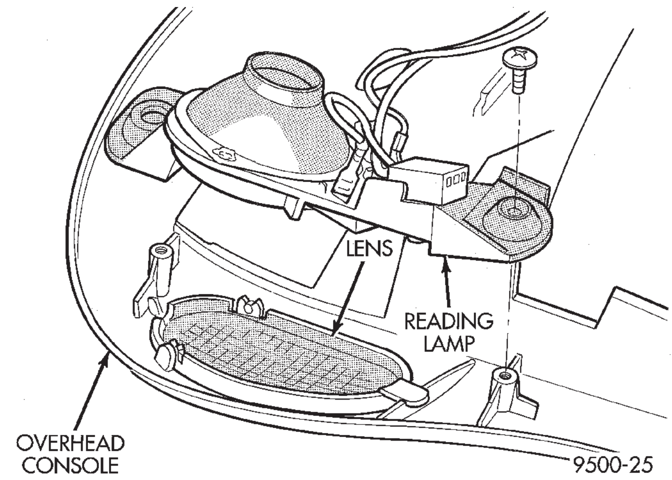


Fig. 12 Reading/Courtesy Lamp

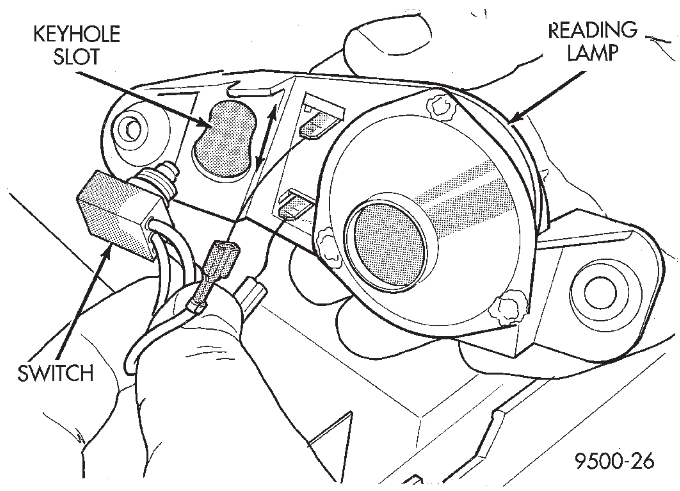


Fig. 13 Connector and Switch

(3) Gently pull towards rear of vehicle, releasing transmitter bin door.

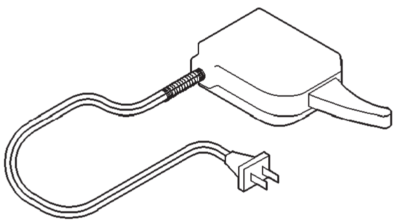
(4) Disconnect harness connector from Universal Transmitter and remove bin door from vehicle.

INSTALLATION

For installation, reverse the above procedures. The Universal Transmitter will need to be retrained. Refer to SERVICE PROCEDURES in this section.

SPECIAL TOOLS

SPECIAL TOOL



Degausser 6029

WIRING DIAGRAMS

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DESCRIPTION AND OPERATION

INTRODUCTION

Chrysler wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use Chrysler wiring diagrams to diagnose and repair a Chrysler vehicle, it is important to understand all of their features and characteristics.

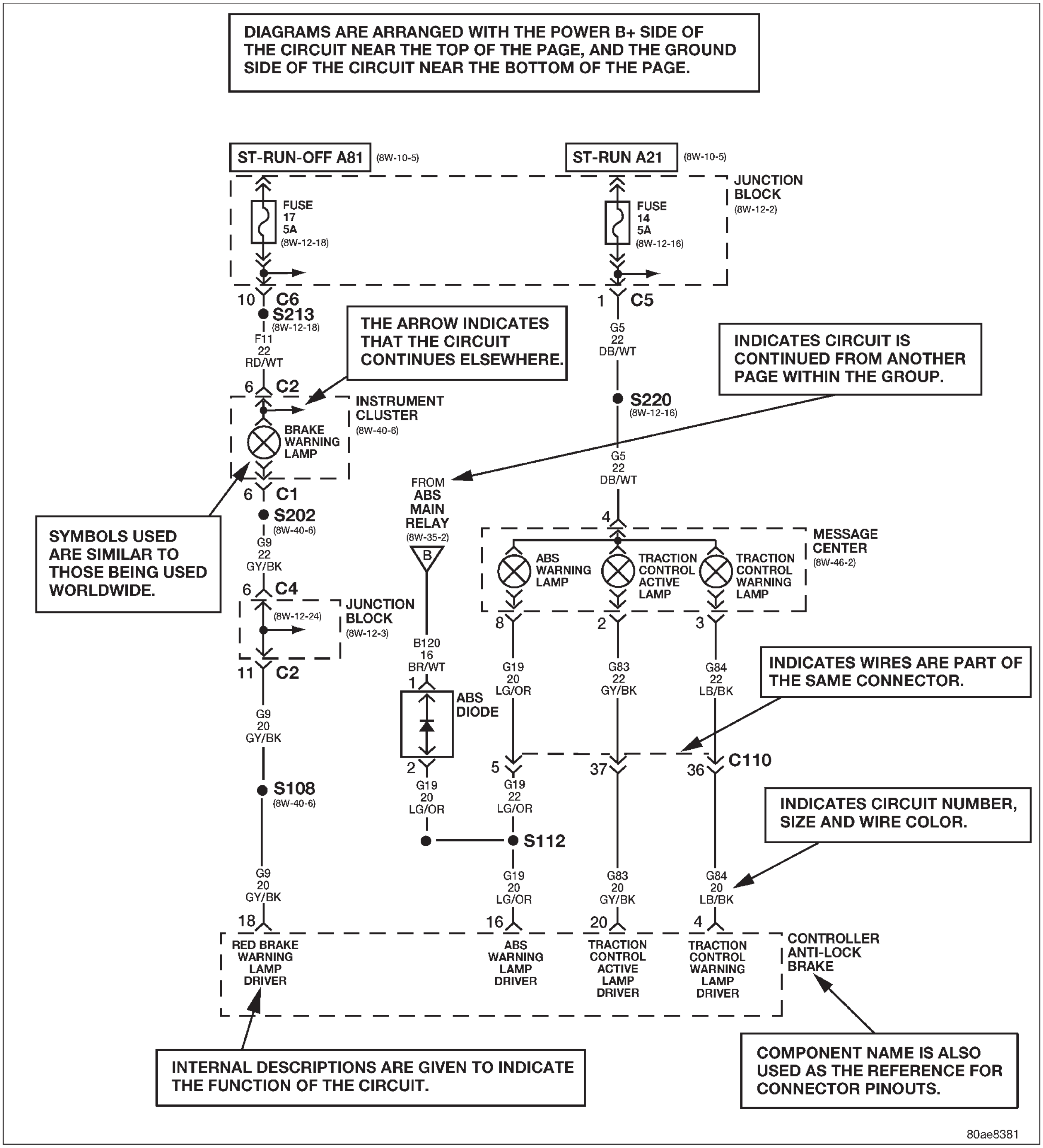
Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

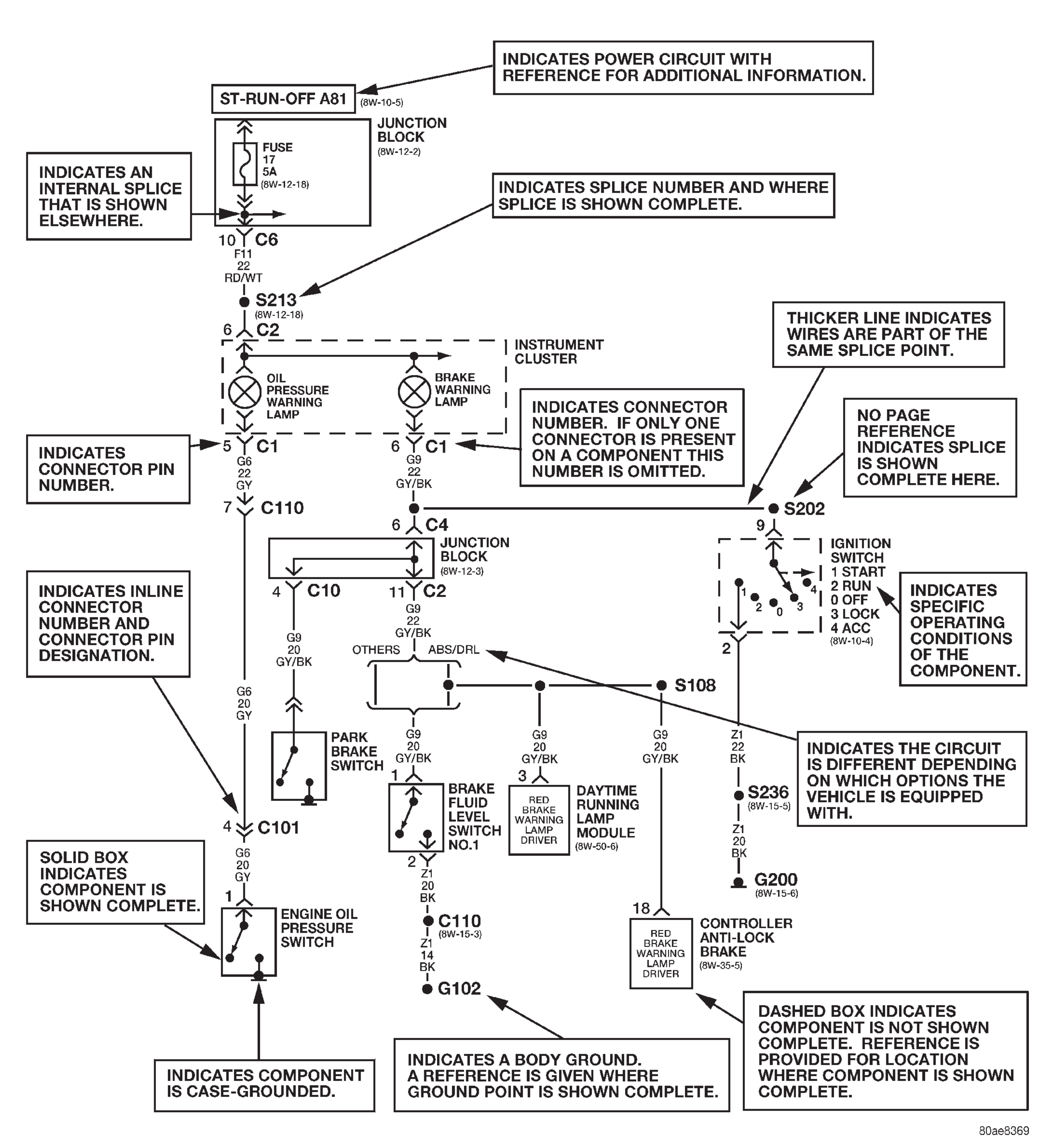
Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around a component indicates that the component being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

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.

DESCRIPTION AND OPERATION (Continued)



DESCRIPTION AND OPERATION (Continued)



DESCRIPTION AND OPERATION (Continued)

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. 1).

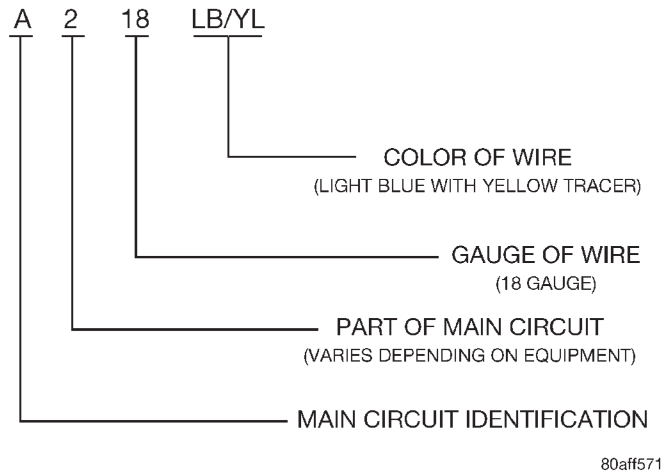


Fig. 1 Wire Code Identification

COLOR CODE	COLOR	STANDARD TRACER COLOR
BL	BLUE	WT
BK	BLACK	WT
BR	BROWN	WT
DB	DARK BLUE	WT
DG	DARK GREEN	WT
GY	GRAY	BK
LB	LIGHT BLUE	BK
LG	LIGHT GREEN	BK
OR	ORANGE	BK
PK	PINK	BK or WT
RD	RED	WT
TN	TAN	WT
VT	VIOLET	WT
WT	WHITE	BK
YL	YELLOW	BK
*	WITH TRACER	

CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and its 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	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 AND OPERATION (Continued)

SECTION IDENTIFICATION

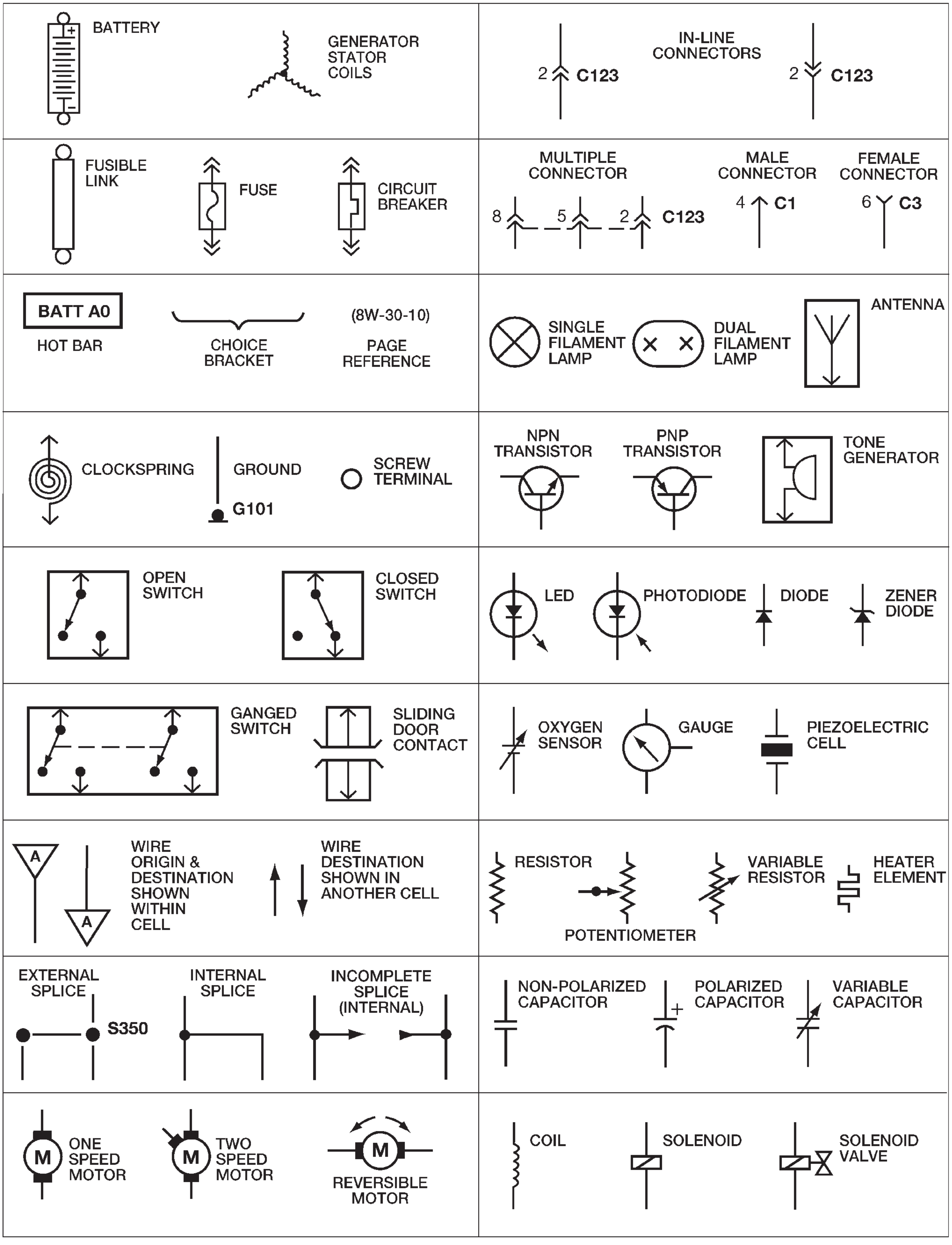
The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world.

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-90	Connector Locations (including grounds)
8W-95	Splice Locations

DESCRIPTION AND OPERATION (Continued)



Wiring Diagram Symbols

DESCRIPTION AND OPERATION (Continued)

TERMINOLOGY

This a list of terms with there definitions used in the wiring diagrams.

Built-Up-Export . . . . .Vehicles Built For Sale In Markets Other Than North America
Except-Built-Up-Export . . . . .Vehicles Built For Sale In North America
LHD . . . . .Left Hand Drive Vehicles
RHD . . . . .Right Hand Drive Vehicles
ATX . . . .Automatic Transmission-Front Wheel Drive
MTX. . . . . .Manual Transmission-Front Wheel Drive
AT . . . . . .Automatic Transmission-Rear Wheel Drive
MT . . . . . . .Manual Transmission-Rear Wheel Drive
SOHC. . . . . .Single Over Head Cam Engine
DOHC . . . . .Dual Over Head Cam Engine

CONNECTOR 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 on the **engine compartment harness** are **C100** series numbers.
- Connectors located on the **instrument panel harness** are **C200** series numbers.
- Connectors located on the **body harness** 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 connector.

Component connectors are identified by the component name instead of a number (Fig. 2). Multiple connectors on a component use a C1, C2, etc. identifier (Fig. 3).

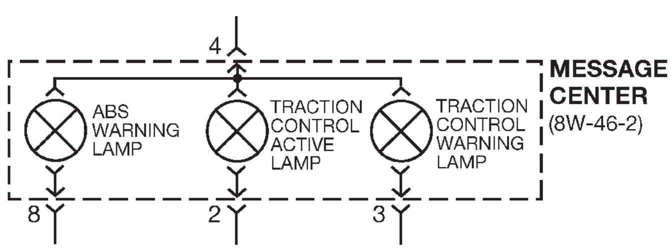


Fig. 2 Component Identification

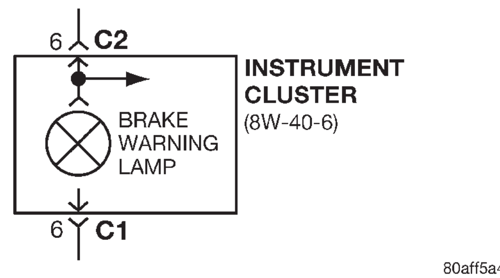


Fig. 3 Connector Identification

LOCATIONS

Section 8W-90 contains connector/ground location illustrations. The illustrations contain the connector name (or number)/ground number and component identification. Connector/ground location charts in Section 8W-90 reference the illustration number for components and connectors.

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.

SPLICE LOCATIONS

Splice Location charts in Section 8W-70 show the entire splice, and provide references to other sections the splice serves.

Section 8W-95 contains illustrations that show the general location of the splices in each harness. The illustrations show the splice by number, and provide a written location.

NOTES, CAUTIONS, and WARNINGS

Throughout this group additional important information is presented in three ways; Notes, Cautions, and Warnings.

NOTES are used to help describe how switches or components operate to complete a particular circuit. They are also used to indicate different conditions that may appear on the vehicle. For example, an up-to and after condition.

CAUTIONS are used to indicate information that could prevent making an error that may damage the vehicle.

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.

DESCRIPTION AND OPERATION (Continued)

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 LOOSE CLOTHING.

TAKE OUTS

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.

ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 4) 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 from its protective packing until it is time to install the part.

(5) Before removing the part from its package, ground the package to a known good ground on the vehicle.

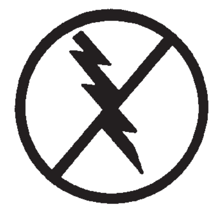


Fig. 4 Electrostatic Discharge Symbol

POSITIVE TEMPERATURE COEFFICIENT

Positive Temperature Coefficient (PTC) devices are being used for circuit protection. These PTC's act like a solid state fuse. They are located in the junction block, and are used to protect such items as: power door lock motors, power windows, and various engine solenoids.

A special symbol is used to identify these in the wiring diagrams (Fig. 5).

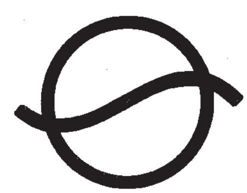


Fig. 5 Positive Temperature Coefficient Symbol

DIAGNOSIS AND TESTING

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.

DIAGNOSIS AND TESTING (Continued)

• 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 vehicle are solid state. When checking voltages in these circuits use a meter with a 10-megohm or greater impedance rating.

• 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 vehicle 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 electrical system can cause damage to the equipment and provide false readings.

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 6). 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.

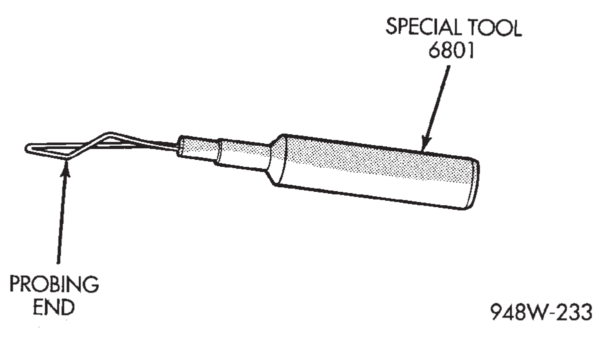


Fig. 6 Probing Tool

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 in 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 and moisture
• Wire insulation that has rubbed through causing a short to ground
• Some or all of the wiring strands broken inside of the insulation covering.
• Wiring broken inside of the insulation

TROUBLESHOOTING TESTS

Before beginning any tests on a vehicles electrical system use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems in this section.

TESTING FOR 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.

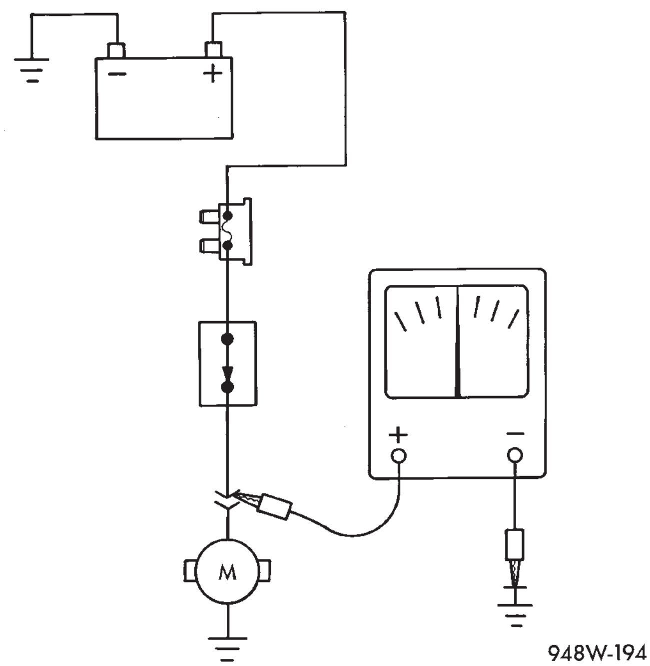


Fig. 7 Testing for Voltage Potential

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.

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.

DIAGNOSIS AND TESTING (Continued)

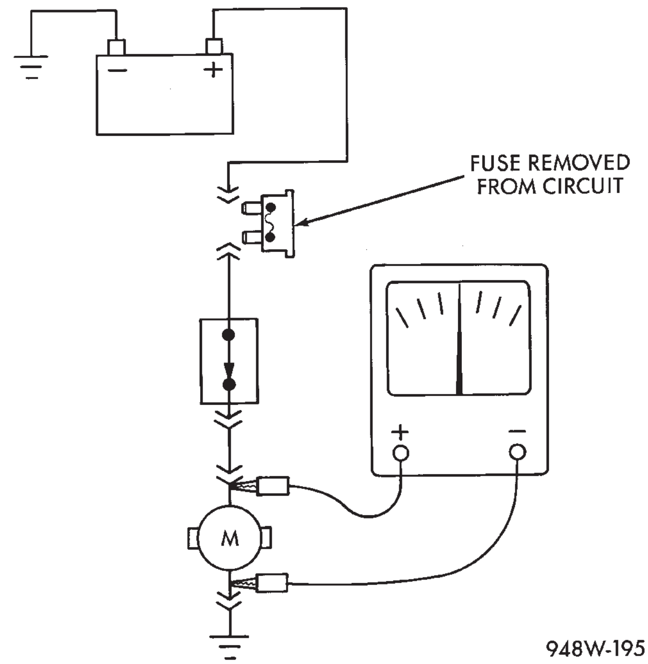


Fig. 8 Testing for Continuity

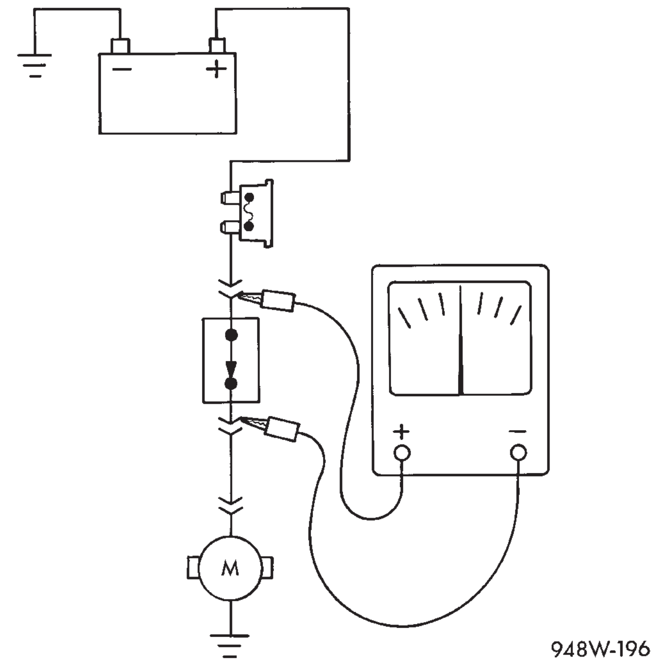


Fig. 9 Testing for Voltage Drop

(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.

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 the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

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 or component.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

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.

(6) Verify proper operation. For this step check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

SERVICE PROCEDURES

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gage be used as shown in the wiring diagrams. The wires must also be held securely in place to prevent damage to the insulation.

(1) Disconnect battery negative cable

(2) Remove 1 inch of insulation from each end of the wire.

(3) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(4) Spread the strands of the wire apart on each part of the exposed wire (example 1). (Fig. 10)

SERVICE PROCEDURES (Continued)

(5) Push the two ends of wire together until the strands of wire are close to the insulation (example 2) (Fig. 10)

(6) Twist the wires together (example 3) (Fig. 10)

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(8) 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.

(9) Secure the wire to the existing ones to prevent chafing or damage to the insulation

(10) Connect battery and test all affected systems.

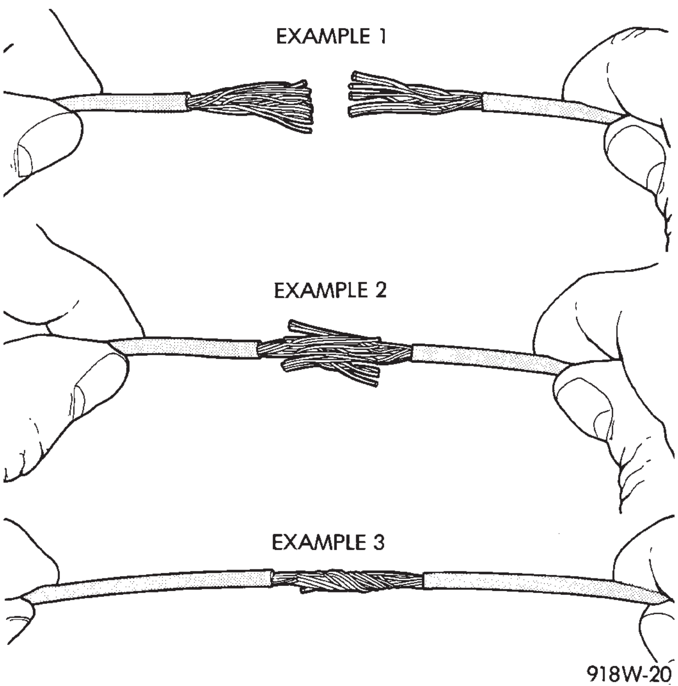


Fig. 10 Wire Repair

TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/ component.

(3) Insert the terminal releasing special tool 6742 into the terminal end of the connector (Fig. 11).

(4) Using special tool 6742 release the locking fingers on the terminal (Fig. 12).

(5) Pull on the wire to remove it from the connector.

(6) Repair or replace the connector or terminal, as necessary.

CONNECTOR REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector that is to be repaired from its mating half/component

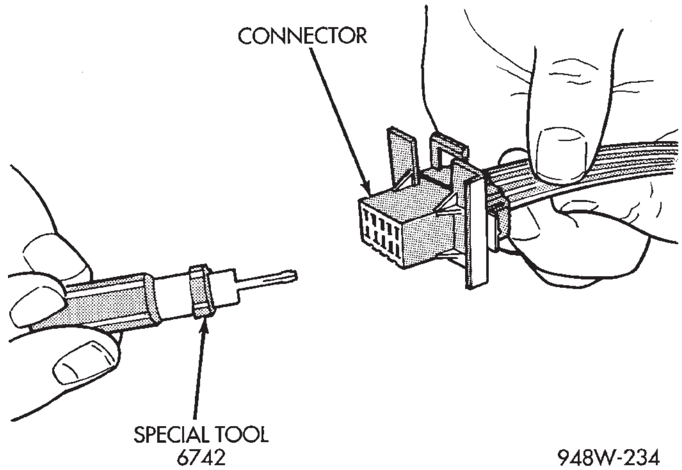


Fig. 11 Molex Connector Repair

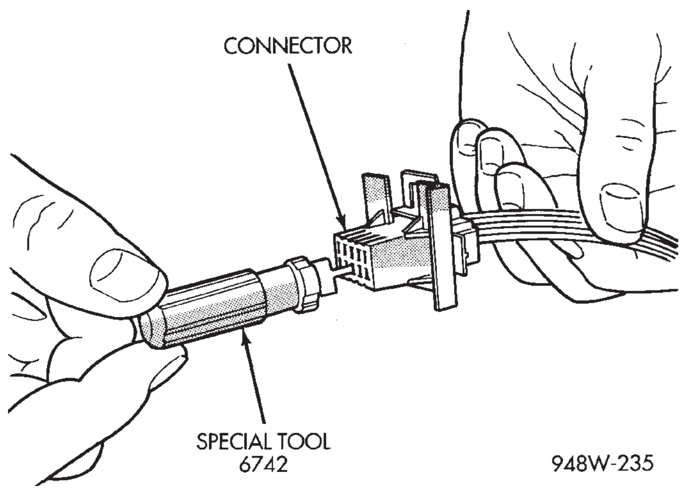


Fig. 12 Using Special Tool 6742

(3) Remove the connector locking wedge, if required (Fig. 13)

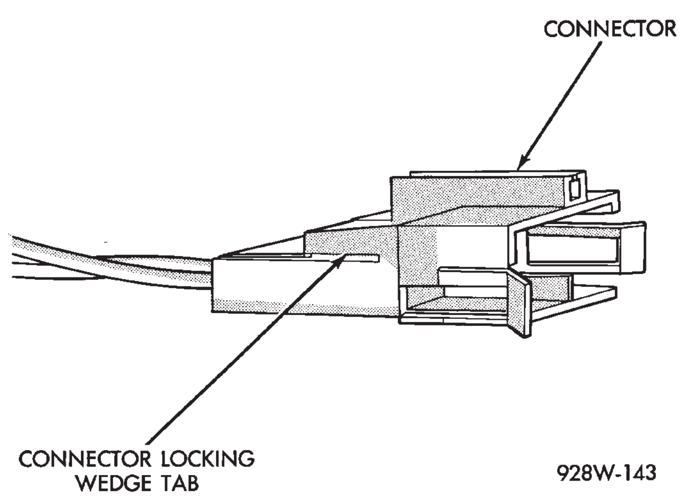


Fig. 13 Connector Locking Wedge

(4) Position the connector locking finger away from the terminal using the proper pick from special tool

SERVICE PROCEDURES (Continued)

kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 14) (Fig. 15).

(5) Reset the terminal locking tang, if it has one.

(6) Insert the removed wire in the same cavity on the repair connector.

(7) Repeat steps four through six for each wire 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.

(8) Insert the connector locking wedge into the repaired connector, if required.

(9) Connect connector to its mating half/component.

(10) Connect battery and test all affected systems.

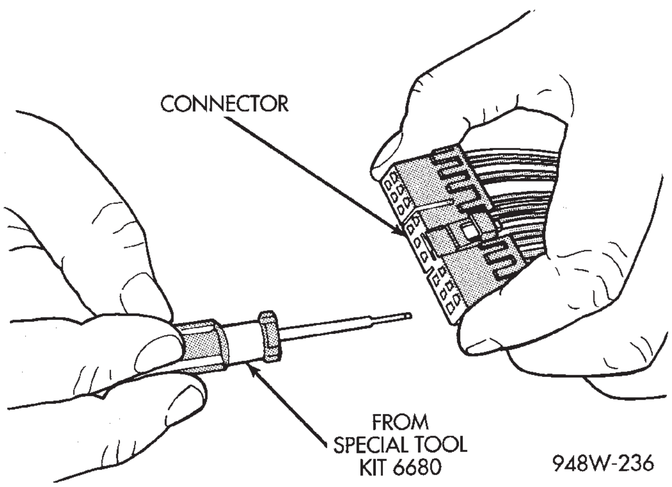


Fig. 14 Terminal Removal

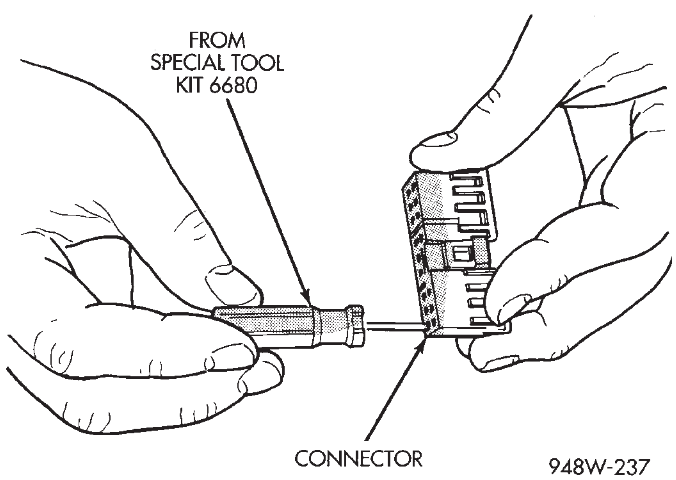


Fig. 15 Terminal Removal Using Special Tool

CONNECTOR AND TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector (that is to be repaired) from its mating half/component.

(3) Cut off the existing wire connector directly behind the insulator. Remove six inches of tape from the harness.

(4) Stagger cut all wires on the harness side at 1/2 inch intervals (Fig. 16).

(5) Remove 1 inch of insulation from each wire on the harness side.

(6) Stagger cut the matching wires on the repair connector assembly in the opposite order as was done on the harness side of the repair. Allow extra length for soldered connections. Check that the overall length is the same as the original (Fig. 16).

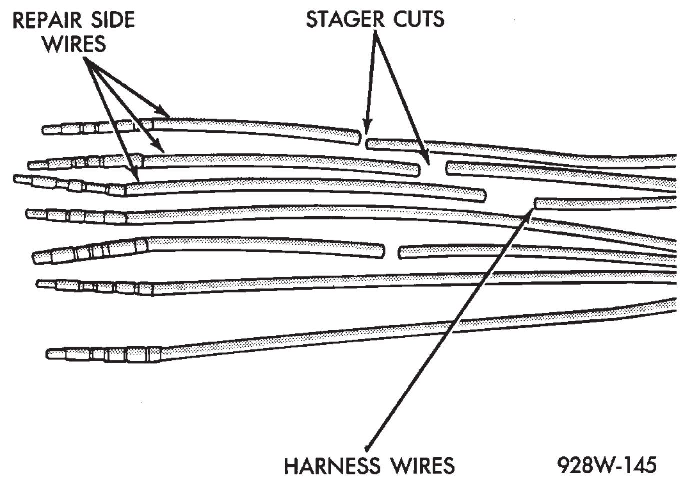


Fig. 16 Stagger Cutting Wires

(7) Remove 1 inch of insulation from each wire.

(8) Place a piece of heat shrink tubing over one side of the wire. Be sure the tubing will be long enough to cover and seal the entire repair area.

(9) Spread the strands of the wire apart on each part of the exposed wires.

(10) Push the two ends of wire together until the strands of wire are close to the insulation.

(11) Twist the wires together.

(12) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(13) 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

(14) Repeat steps 8 through 13 for each wire.

(15) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(16) Re-connect the repaired connector.

(17) Connect the battery, and test all affected systems.

TERMINAL/CONNECTOR REPAIR- AUGAT CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

(3) Push down on the yellow connector locking tab to release the terminals (Fig. 17).

(4) Using special tool 6932, push the terminal to remove it from the connector (Fig. 18).

SERVICE PROCEDURES (Continued)

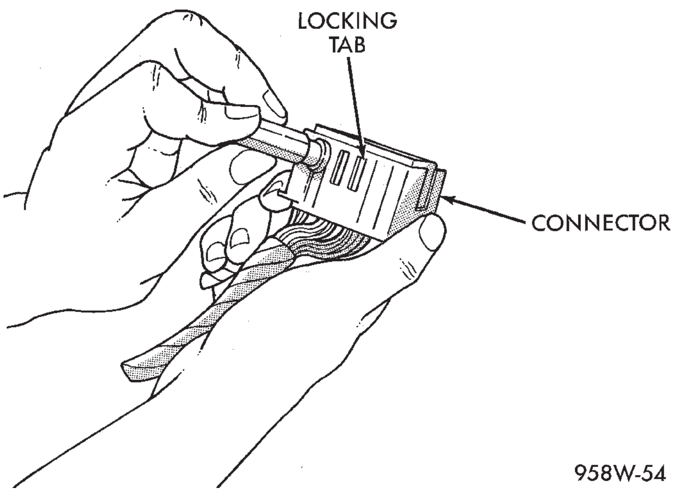


Fig. 17 Augat Connector Repair

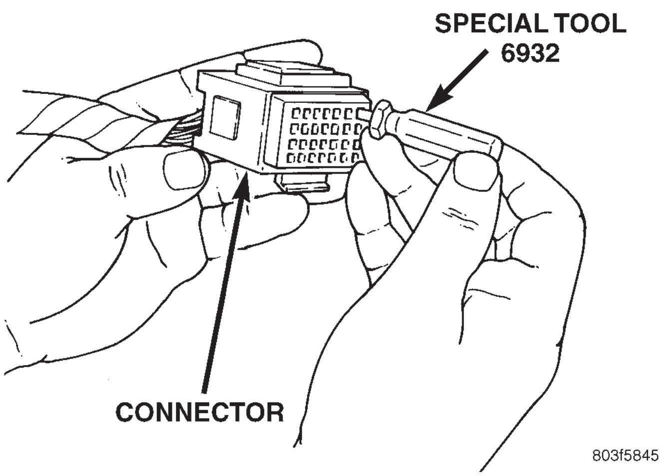


Fig. 18 Using Special Tool 6932

(5) Repair or replace the connector or terminal as necessary.

(6) When re-assembling the connector, the locking wedge must be placed in the locked position to prevent terminal push out.

TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector being repaired from its mating half. Remove connector locking wedge, if required (Fig. 19).

(3) Remove connector locking wedge, if required (Fig. 19).

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 20) (Fig. 21).

(5) Cut the wire 6 inches from the back of the connector.

(6) Remove 1 inch of insulation from the wire on the harness side.

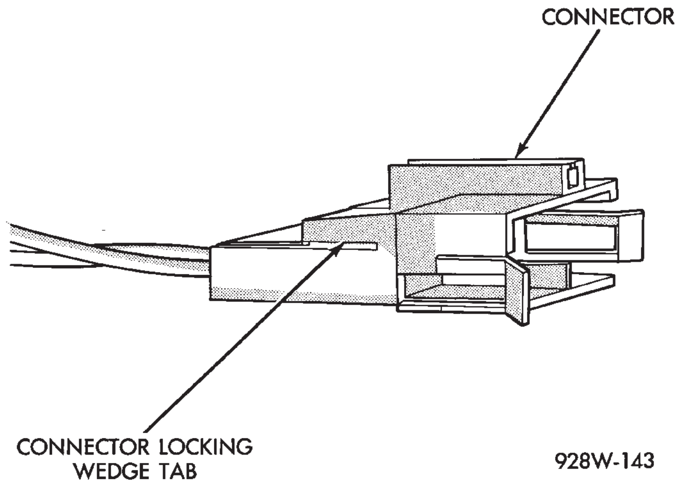


Fig. 19 Connector Locking Wedge Tab (Typical)

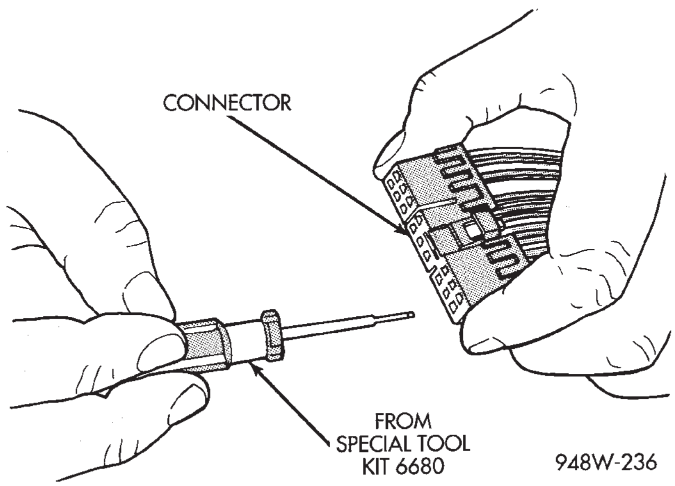


Fig. 20 Terminal Removal

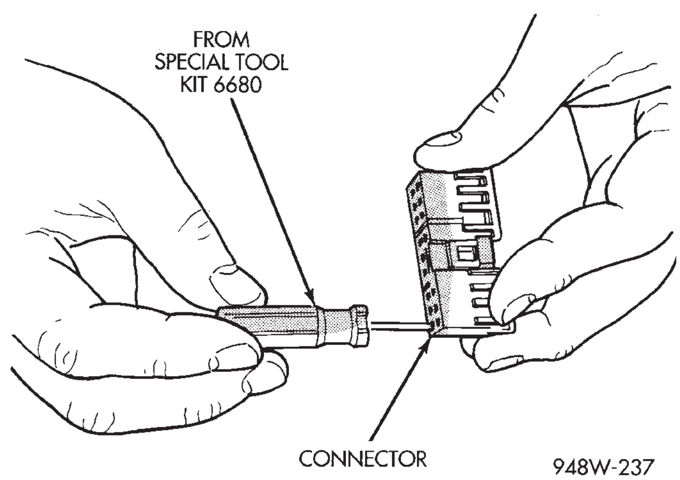


Fig. 21 Terminal Removal Using Special Tool

(7) Select a wire from the terminal repair assembly that best matches the color wire being repaired.

(8) Cut the repair wire to the proper length and remove 1 inch of insulation.

SERVICE PROCEDURES (Continued)

(9) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(10) Spread the strands of the wire apart on each part of the exposed wires.

(11) Push the two ends of wire together until the strands of wire are close to the insulation.

(12) Twist the wires together.

(13) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(14) 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.

(15) Insert the repaired wire into the connector.

(16) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(17) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(18) Connect battery, and test all affected systems.

DIODE REPLACEMENT

(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. 22).

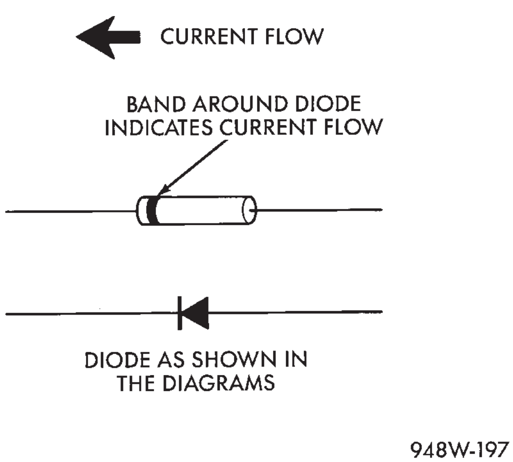


Fig. 22 Diode Identification

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

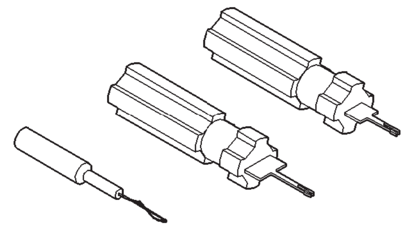
(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

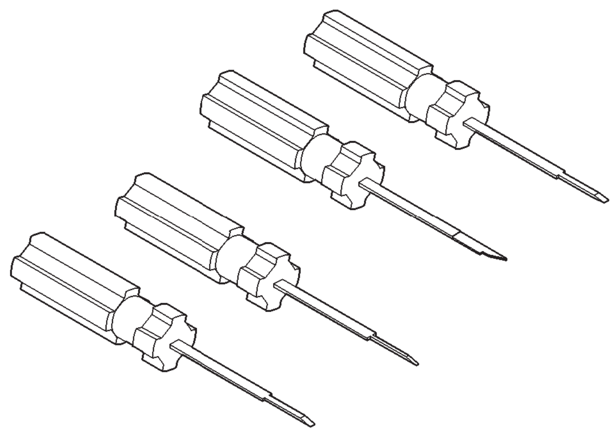
(8) Re-connect the battery, and test affected systems.

SPECIAL TOOLS

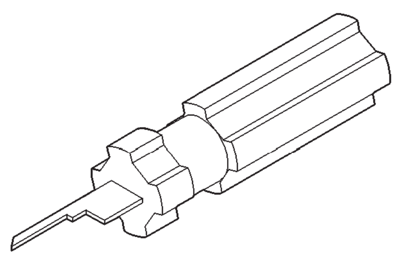
WIRING/TERMINAL



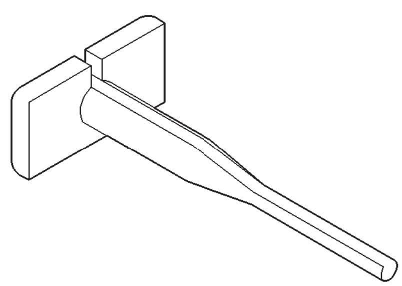
Probing Tool Package 6807



Terminal Pick 6680



Terminal Removing Tool 6932



Terminal Removing Tool 6934

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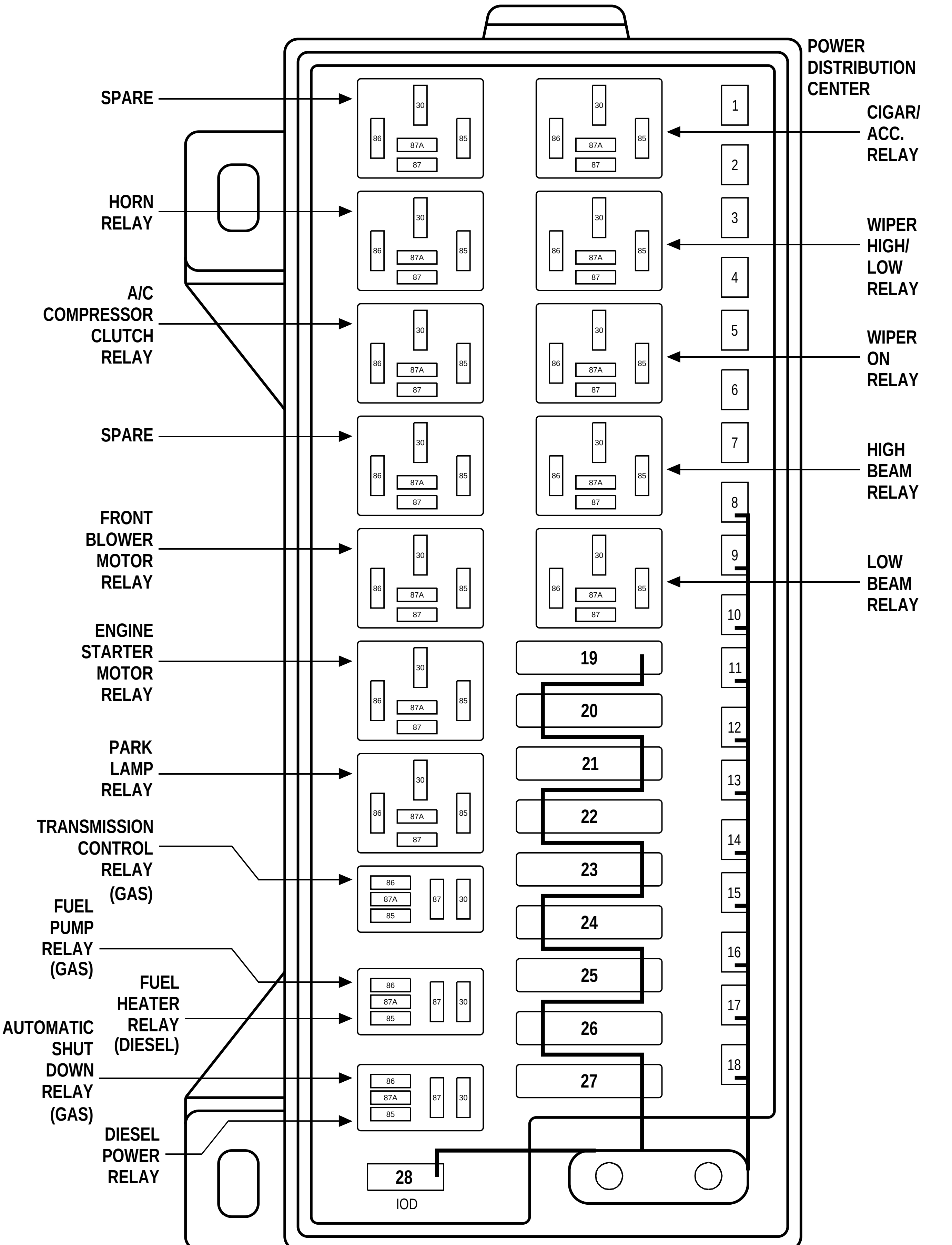

J988W-1 GS001002

FUSES

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2	10A	F14 18LG/YL ● F14 20LG/YL ● ●	F87 18WT/BK
3	-	SPARE	A0 6RD
4	10A	L33 20RD	INTERNAL
5	10A	L34 20RD/OR L34 20RD/OR	INTERNAL
6	20A	L43 18VT	INTERNAL
7	15A	L44 20VT/RD	INTERNAL
8	20A	INTERNAL	A0 6RD
9	20A	INTERNAL	A0 6RD
10	20A	L9 18BK/WT	A0 6RD
11	15A	INTERNAL	A0 6RD
12	25A	A20 12RD/DB	A0 6RD
13	20A	F32 18PK/DB	A0 6RD
14	-	SPARE	A0 6RD
15*	20A	A5 18RD/DB INTERNAL	A0 6RD
16	20A	A14 18RD/WT* INTERNAL	A0 6RD
17	20A	INTERNAL	A0 6RD
18	15A	F41 20PK/VT	A0 6RD
19	30A	INTERNAL	A0 6RD
20**	40A	A17 12RD/BK	A0 6RD
21	40A	INTERNAL	A0 6RD
22	40A	INTERNAL	A0 6RD
23	40A	A1 12RD INTERNAL	A0 6RD
24	40A	A16 12GY	A0 6RD
25	40A	A10 12RD/DG	A0 6RD
26	40A	A2 12PK/BK	A0 6RD
27	40A	A4 12BK/RD	A0 6RD
28	10A	M1 20PK	A0 6RD

* GAS
** DIESEL
● BUILT-UP-EXPORT
● ● EXCEPT BUILT-UP-EXPORT

A/C COMPRESSOR CLUTCH RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	C13 18DB/OR*	A/C COMPRESSOR CLUTCH RELAY CONTROL
85	C13 20DB/OR**	A/C COMPRESSOR CLUTCH RELAY CONTROL
86	F87 18WT/BK*	FUSED IGNITION (ST-RUN)
86	A142 18DG/OR**	FUSED IGNITION (ST-RUN)
87	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

AUTOMATIC SHUT DOWN RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	K51 18DB/YL	AUTOMATIC SHUTDOWN RELAY CONTROL
86	A0 6RD	B (+)
87	A142 18DG/OR	ASD RELAY OUTPUT
87A	-	-

CIGAR/ACCESSORY RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	Z1 18BK	GROUND
86	F1 20DB	FUSED IGNITION (RUN-ACC)
87	F30 16RD	CIGAR/ACCESSORY RELAY OUTPUT
87A	-	-

DIESEL POWER RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	K51 20DB/YL	DIESEL POWER RELAY CONTROL
86	A0 6RD	B (+)
87	A142 18DG/OR	DIESEL POWER RELAY OUTPUT
87A	-	-

*GAS
**DIESEL

ENGINE STARTER MOTOR RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	K90 18TN	ENGINE STARTER MOTOR RELAY CONTROL
86	F45 18YL/RD ■	FUSED IGNITION (ST)
86	T141 20YL/RD ■■	FUSED IGNITION (ST)
87	T40 12BR	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

FRONT BLOWER MOTOR RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	Z1 18BK	GROUND
86	F20 20WT	FUSED IGNITION (RUN)
87	C71 12DB	FRONT BLOWER MOTOR RELAY OUTPUT
87A	-	-

FUEL HEATER RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	Z1 20BK	GROUND
86	INTERNAL	FUSED IGNITION (ST-RUN)
87	A141 16DG/WT	FUEL HEATER RELAY OUTPUT
87A	-	-

FUEL PUMP RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	K31 18BR	FUEL PUMP RELAY CONTROL
86	F87 18 WT/BK	FUSED IGNITION (ST-RUN)
87	A141 16DG/WT	FUEL PUMP RELAY OUTPUT
87A	-	-

■ EATX
■■ MTX

HIGH BEAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	A0 6RD	B (+)
85	L324 20WT/LG	HIGH BEAM RELAY CONTROL
86	A0 6RD	B (+)
87	INTERNAL	HIGH BEAM RELAY OUTPUT
87A	-	-

HORN RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	X4 20GY/OR	HORN RELAY CONTROL
86	A0 6RD	B (+)
87	X2 18DG/RD	HORN RELAY OUTPUT
87A	-	-

LOW BEAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	A0 6RD	B (+)
85	L94 20OR/WT	LOW BEAM RELAY CONTROL
85	L193 20OR/WT *	LOW BEAM RELAY CONTROL
86	A0 6RD	B (+)
87	INTERNAL	LOW BEAM RELAY OUTPUT
87A	-	-

PARK LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	L97 18PK/DB	PARK LAMP RELAY CONTROL
86	INTERNAL	FUSED B (+)
87	L7 12BK/YL	PARK LAMP RELAY OUTPUT
87A	-	-

* CHRYSLER

TRANSMISSION CONTROL RELAY (GAS)

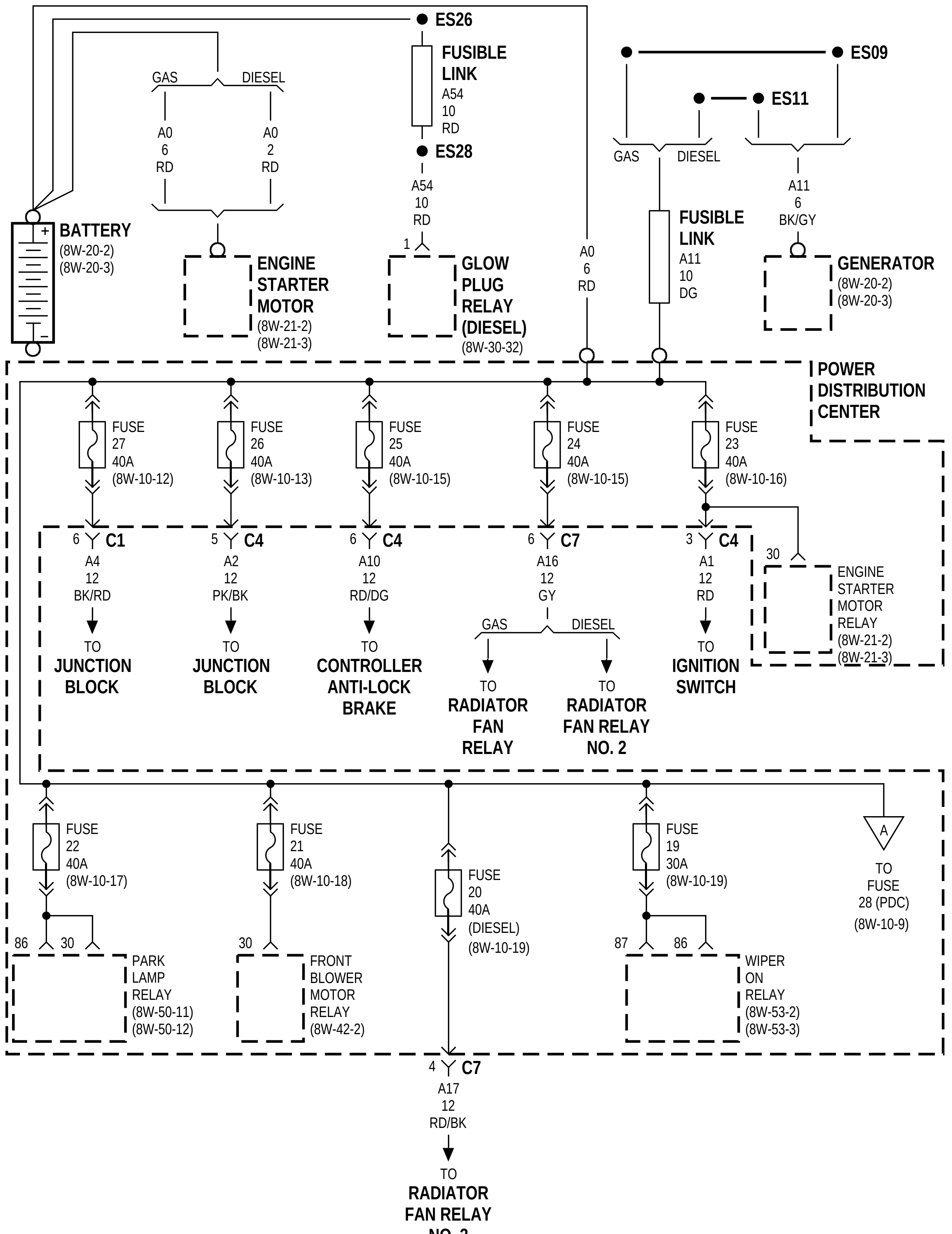
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	Z16 18BK	GROUND
86	T15 18LG	12 V SUPPLY
87	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
87A	-	-

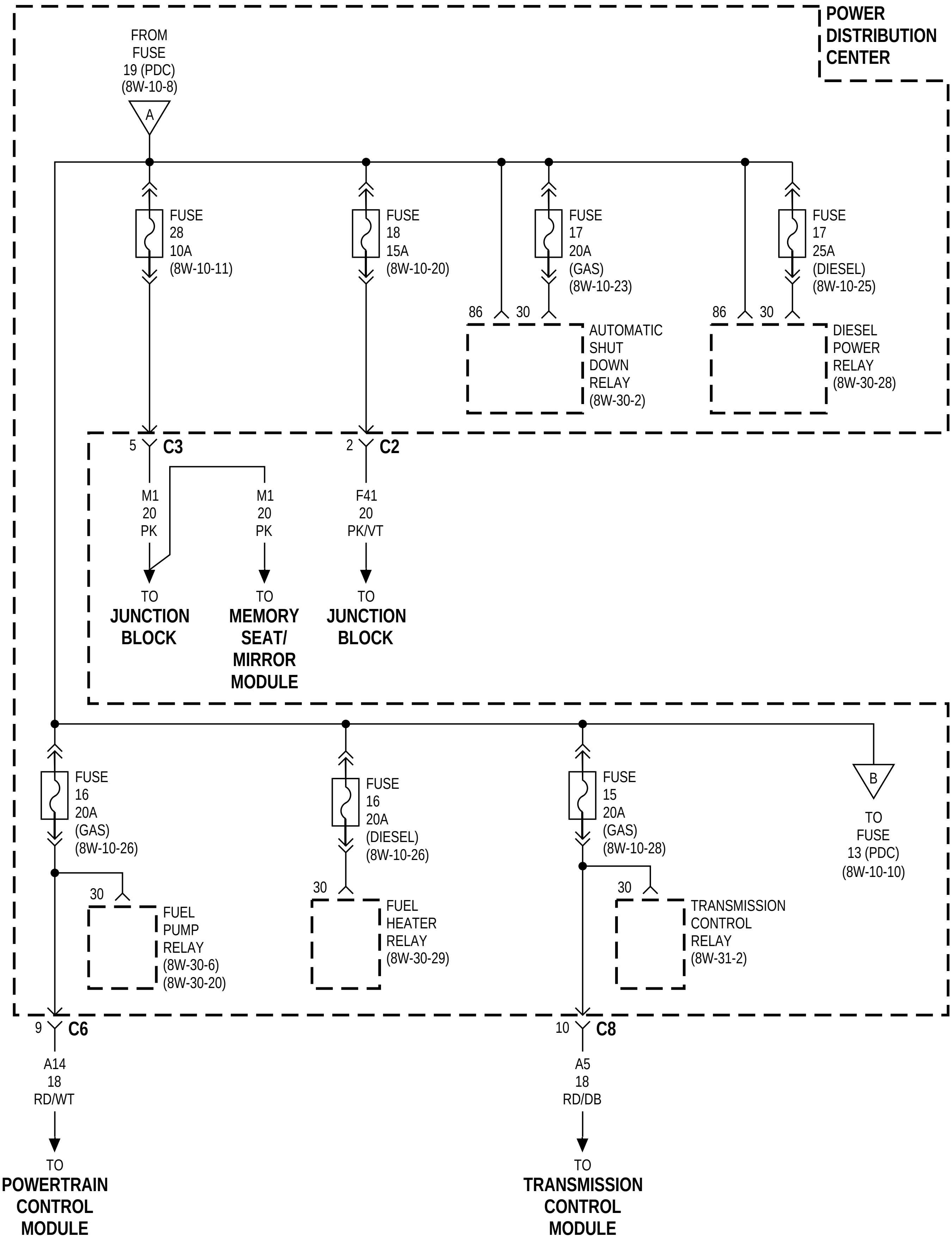
WIPER HIGH/LOW RELAY

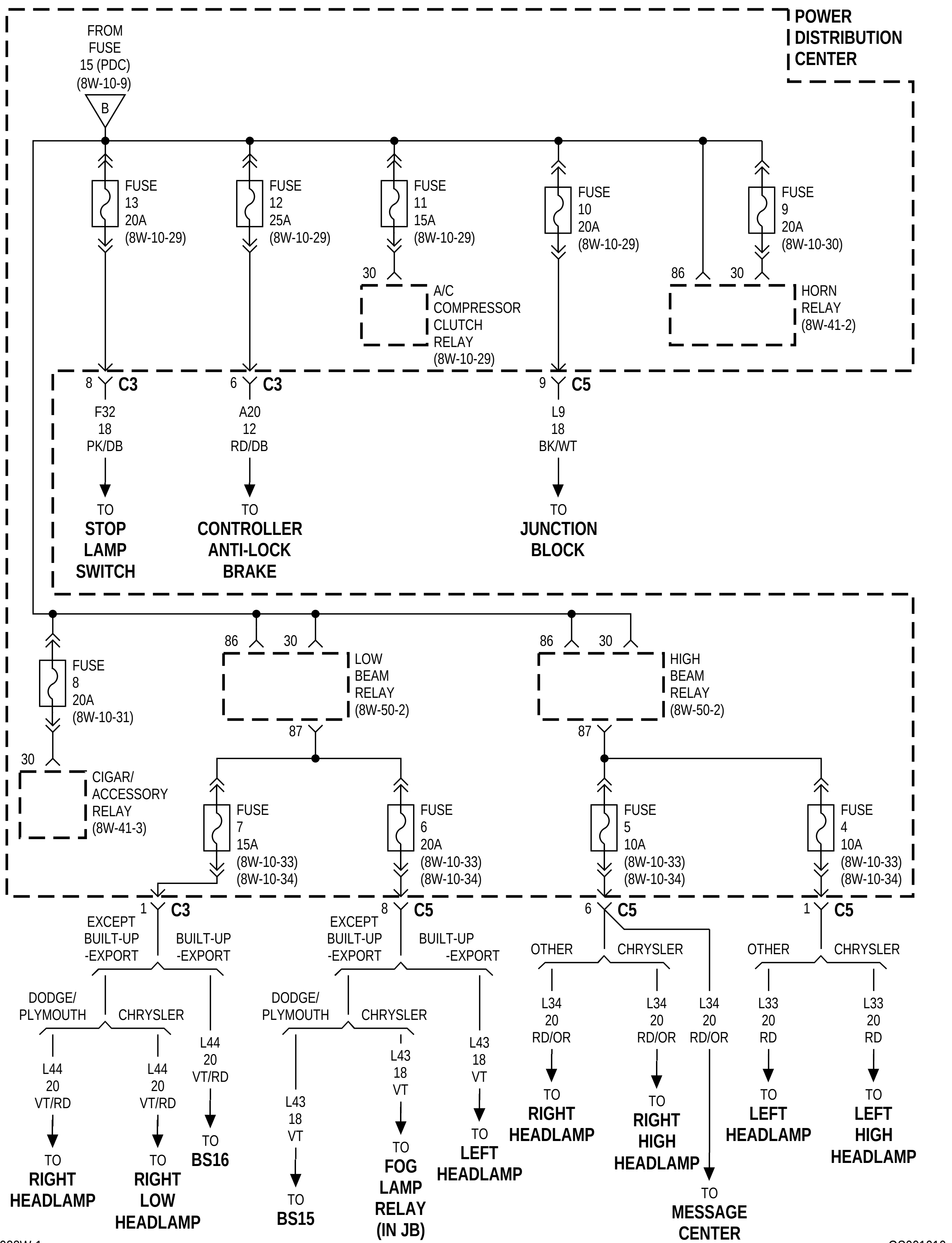
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	WIPER ON RELAY OUTPUT
85	V16 20WT	WIPER HIGH/LOW RELAY CONTROL
86	INTERNAL	WIPER ON RELAY OUTPUT
87	V4 12RD/YL	WIPER HIGH/LOW RELAY OUTPUT (HIGH)
87A	V3 12BR/WT	WIPER HIGH/LOW RELAY OUTPUT (LOW)

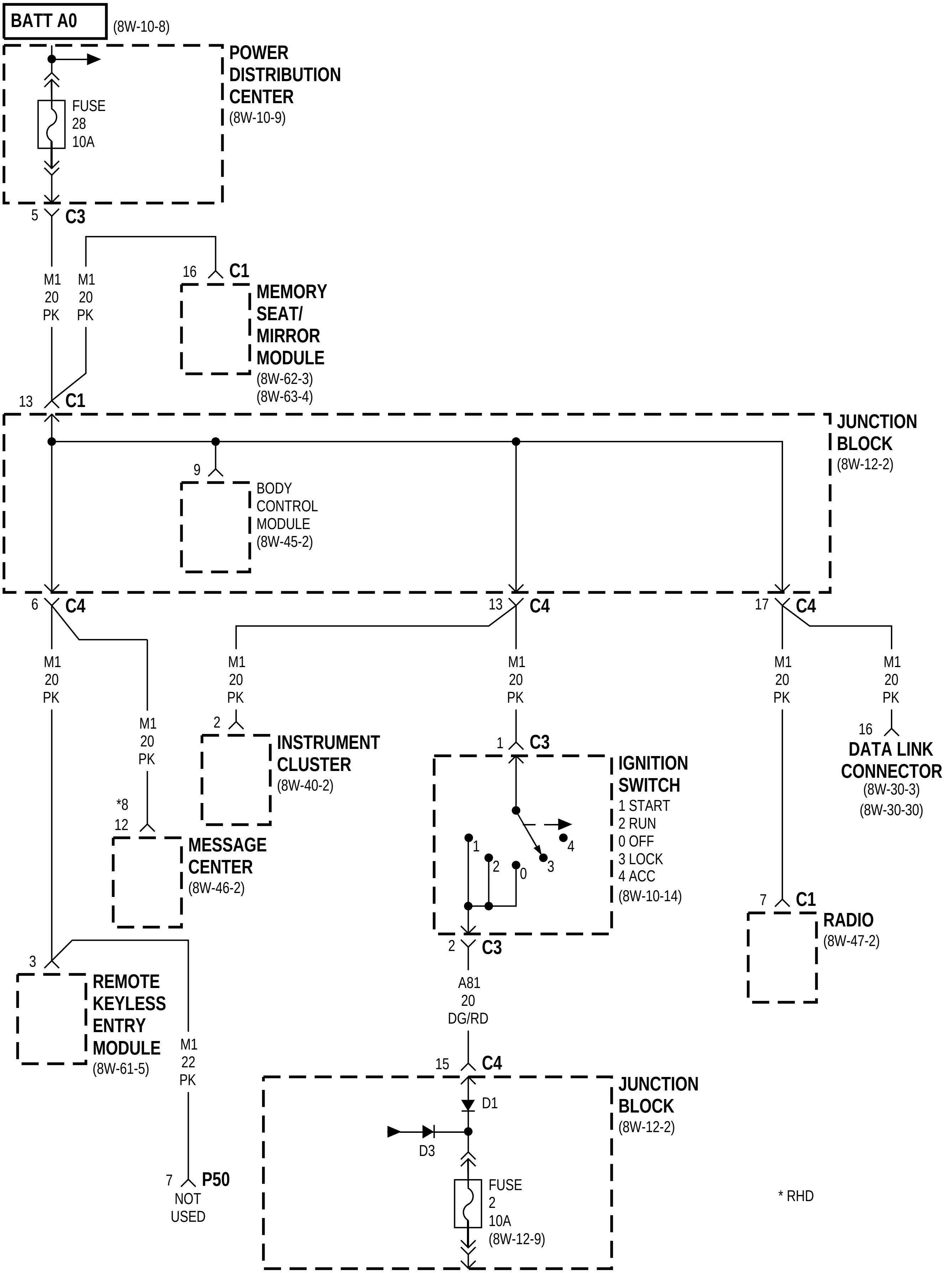
WIPER ON RELAY

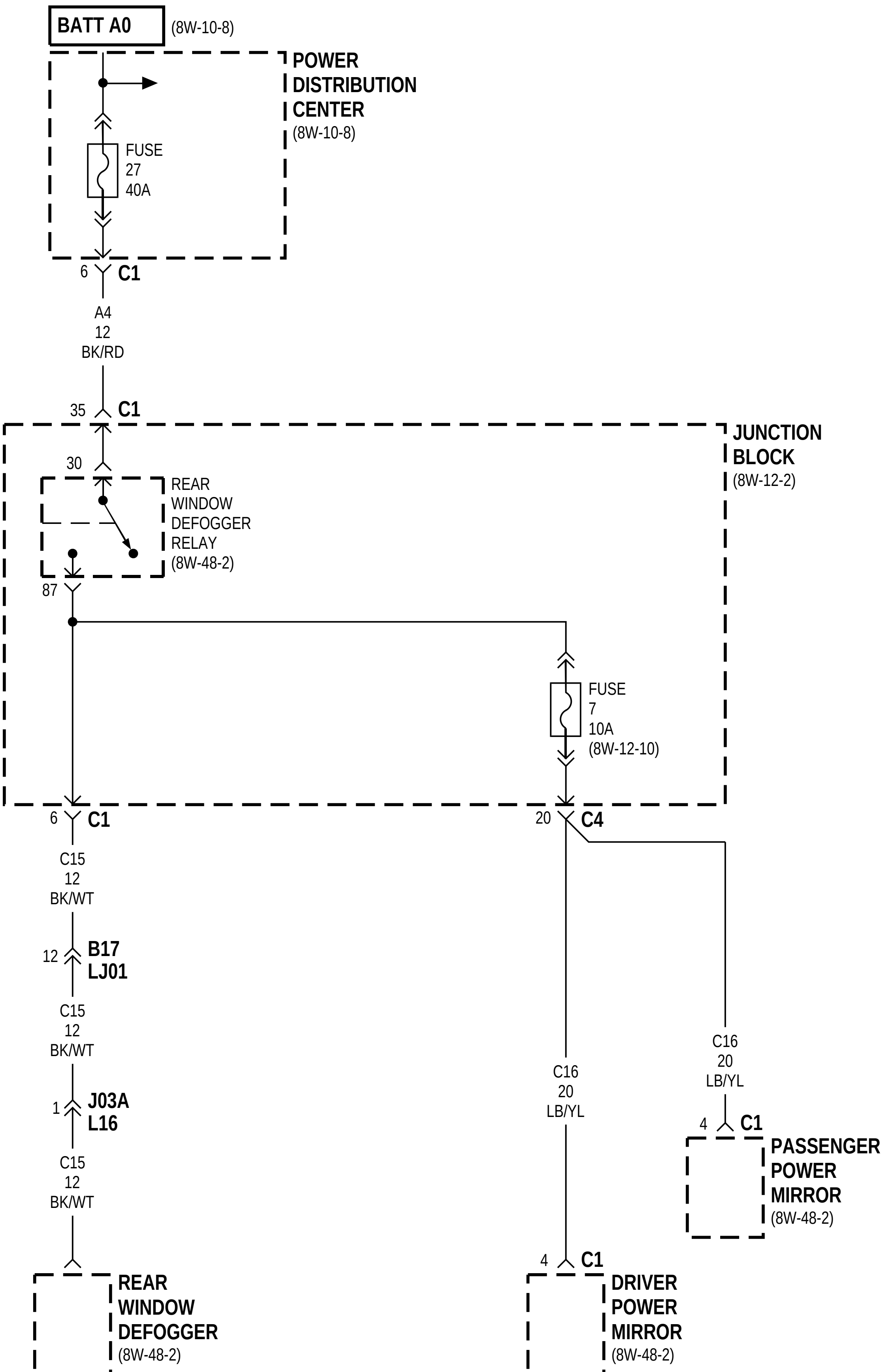
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	WIPER ON RELAY OUTPUT
85	V14 18RD/VT	WIPER ON RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	FUSED B(+)
87A	Z1 18BK	GROUND

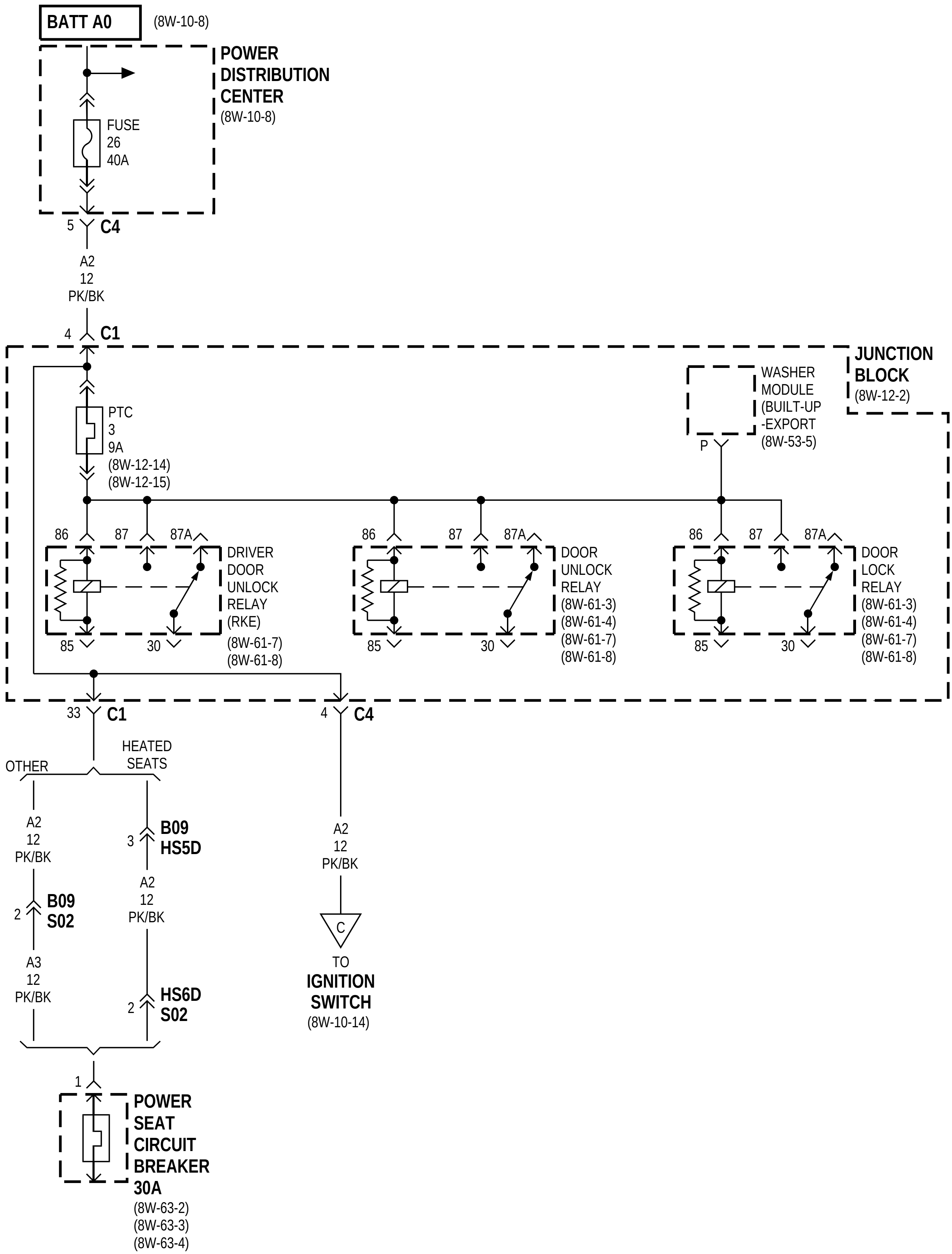

ES26
FUSIBLE LINK
A54
10
RD
ES28
A54
10
RD
1
GLOW PLUG RELAY (DIESEL)
(8W-30-32)
GAS
DIESEL
A0
6
RD
A0
2
RD
BATTERY
(8W-20-2)
(8W-20-3)
ENGINE STARTER MOTOR
(8W-21-2)
(8W-21-3)
A0
6
RD
ES09
ES11
GAS
DIESEL
FUSIBLE LINK
A11
10
DG
A11
6
BK/GY
GENERATOR
(8W-20-2)
(8W-20-3)
POWER DISTRIBUTION CENTER
FUSE 27 40A (8W-10-12)
FUSE 26 40A (8W-10-13)
FUSE 25 40A (8W-10-15)
FUSE 24 40A (8W-10-15)
FUSE 23 40A (8W-10-16)
6 C1
A4
12
BK/RD
TO JUNCTION BLOCK
5 C4
A2
12
PK/BK
TO JUNCTION BLOCK
6 C4
A10
12
RD/DG
TO CONTROLLER ANTI-LOCK BRAKE
6 C7
A16
12
GY
GAS
DIESEL
TO RADIATOR FAN RELAY
TO RADIATOR FAN RELAY NO. 2
3 C4
A1
12
RD
TO IGNITION SWITCH
30
ENGINE STARTER MOTOR RELAY
(8W-21-2)
(8W-21-3)
FUSE 22 40A (8W-10-17)
86
30
PARK LAMP RELAY
(8W-50-11)
(8W-50-12)
FUSE 21 40A (8W-10-18)
30
FRONT BLOWER MOTOR RELAY
(8W-42-2)
FUSE 20 40A (DIESEL) (8W-10-19)
FUSE 19 30A (8W-10-19)
87
86
WIPER ON RELAY
(8W-53-2)
(8W-53-3)
A
TO FUSE 28 (PDC)
(8W-10-9)
4 C7
A17
12
RD/BK
TO RADIATOR FAN RELAY NO. 3

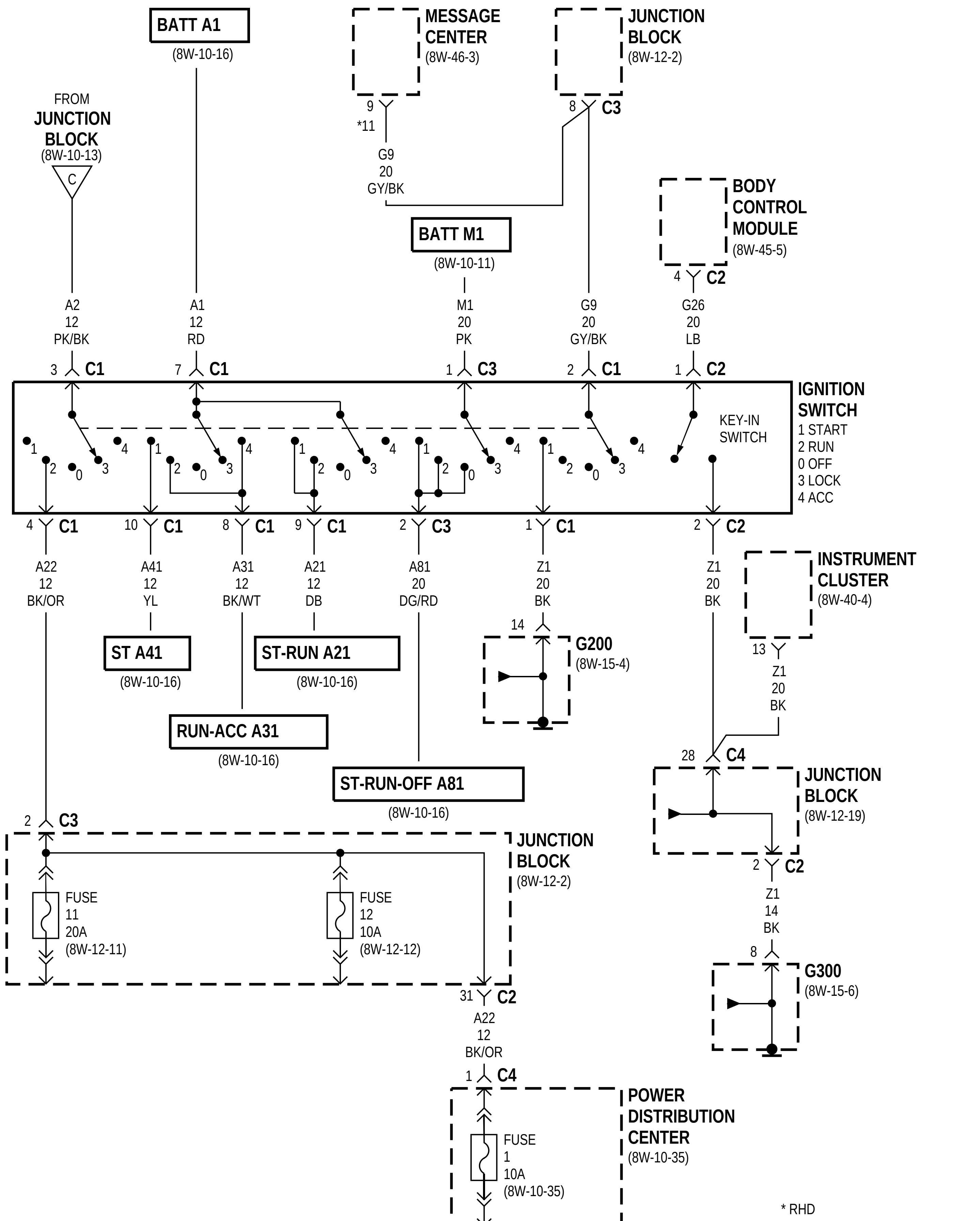

POWER DISTRIBUTION CENTER
FROM FUSE 19 (PDC) (8W-10-8)
A
FUSE 28 10A (8W-10-11)
FUSE 18 15A (8W-10-20)
FUSE 17 20A (GAS) (8W-10-23)
FUSE 17 25A (DIESEL) (8W-10-25)
86 30
AUTOMATIC SHUT DOWN RELAY (8W-30-2)
86 30
DIESEL POWER RELAY (8W-30-28)
5 C3
2 C2
M1 20 PK
M1 20 PK
F41 20 PK/VT
TO JUNCTION BLOCK
TO MEMORY SEAT/ MIRROR MODULE
TO JUNCTION BLOCK
FUSE 16 20A (GAS) (8W-10-26)
FUSE 16 20A (DIESEL) (8W-10-26)
FUSE 15 20A (GAS) (8W-10-28)
B
TO FUSE 13 (PDC) (8W-10-10)
30
FUEL PUMP RELAY (8W-30-6) (8W-30-20)
30
FUEL HEATER RELAY (8W-30-29)
30
TRANSMISSION CONTROL RELAY (8W-31-2)
9 C6
10 C8
A14 18 RD/WT
A5 18 RD/DB
TO POWERTRAIN CONTROL MODULE
TO TRANSMISSION CONTROL MODULE

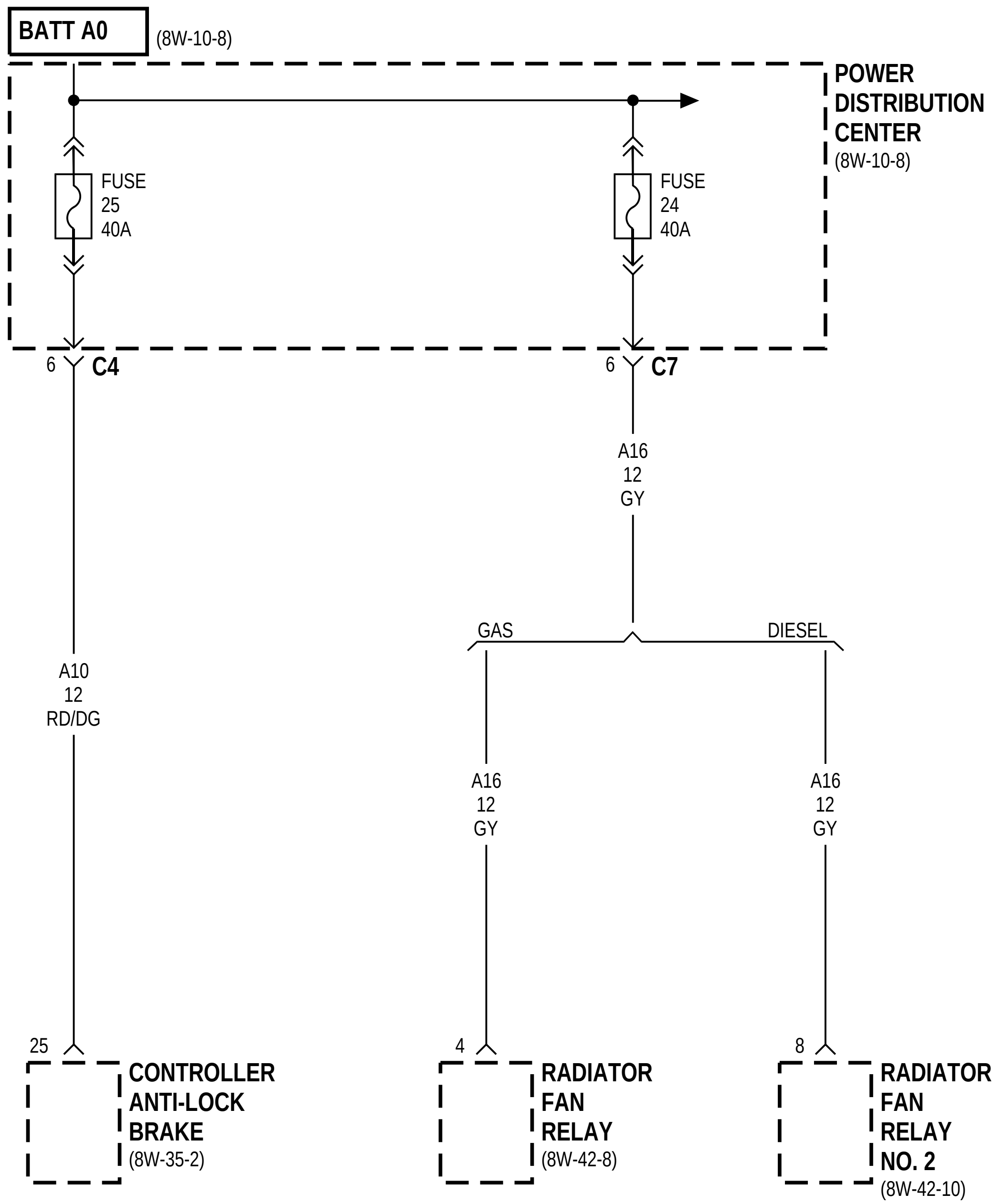

POWER DISTRIBUTION CENTER
FROM FUSE 15 (PDC) (8W-10-9)
B
FUSE 13 20A (8W-10-29)
FUSE 12 25A (8W-10-29)
FUSE 11 15A (8W-10-29)
FUSE 10 20A (8W-10-29)
FUSE 9 20A (8W-10-30)
30
A/C COMPRESSOR CLUTCH RELAY (8W-10-29)
86
30
HORN RELAY (8W-41-2)
8 C3
F32 18 PK/DB
TO STOP LAMP SWITCH
6 C3
A20 12 RD/DB
TO CONTROLLER ANTI-LOCK BRAKE
9 C5
L9 18 BK/WT
TO JUNCTION BLOCK
FUSE 8 20A (8W-10-31)
30
CIGAR/ ACCESSORY RELAY (8W-41-3)
86 30
LOW BEAM RELAY (8W-50-2)
87
86 30
HIGH BEAM RELAY (8W-50-2)
87
FUSE 7 15A (8W-10-33) (8W-10-34)
FUSE 6 20A (8W-10-33) (8W-10-34)
FUSE 5 10A (8W-10-33) (8W-10-34)
FUSE 4 10A (8W-10-33) (8W-10-34)
1 C3
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
DODGE/ PLYMOUTH
CHRYSLER
L44 20 VT/RD
TO RIGHT HEADLAMP
L44 20 VT/RD
TO RIGHT LOW HEADLAMP
L44 20 VT/RD
TO BS16
8 C5
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
DODGE/ PLYMOUTH
CHRYSLER
L43 18 VT
TO BS15
L43 18 VT
TO FOG LAMP RELAY (IN JB)
L43 18 VT
TO LEFT HEADLAMP
6 C5
OTHER
CHRYSLER
L34 20 RD/OR
TO RIGHT HEADLAMP
L34 20 RD/OR
TO RIGHT HIGH HEADLAMP
L34 20 RD/OR
TO MESSAGE CENTER
1 C5
OTHER
CHRYSLER
L33 20 RD
TO LEFT HEADLAMP
L33 20 RD
TO LEFT HIGH HEADLAMP

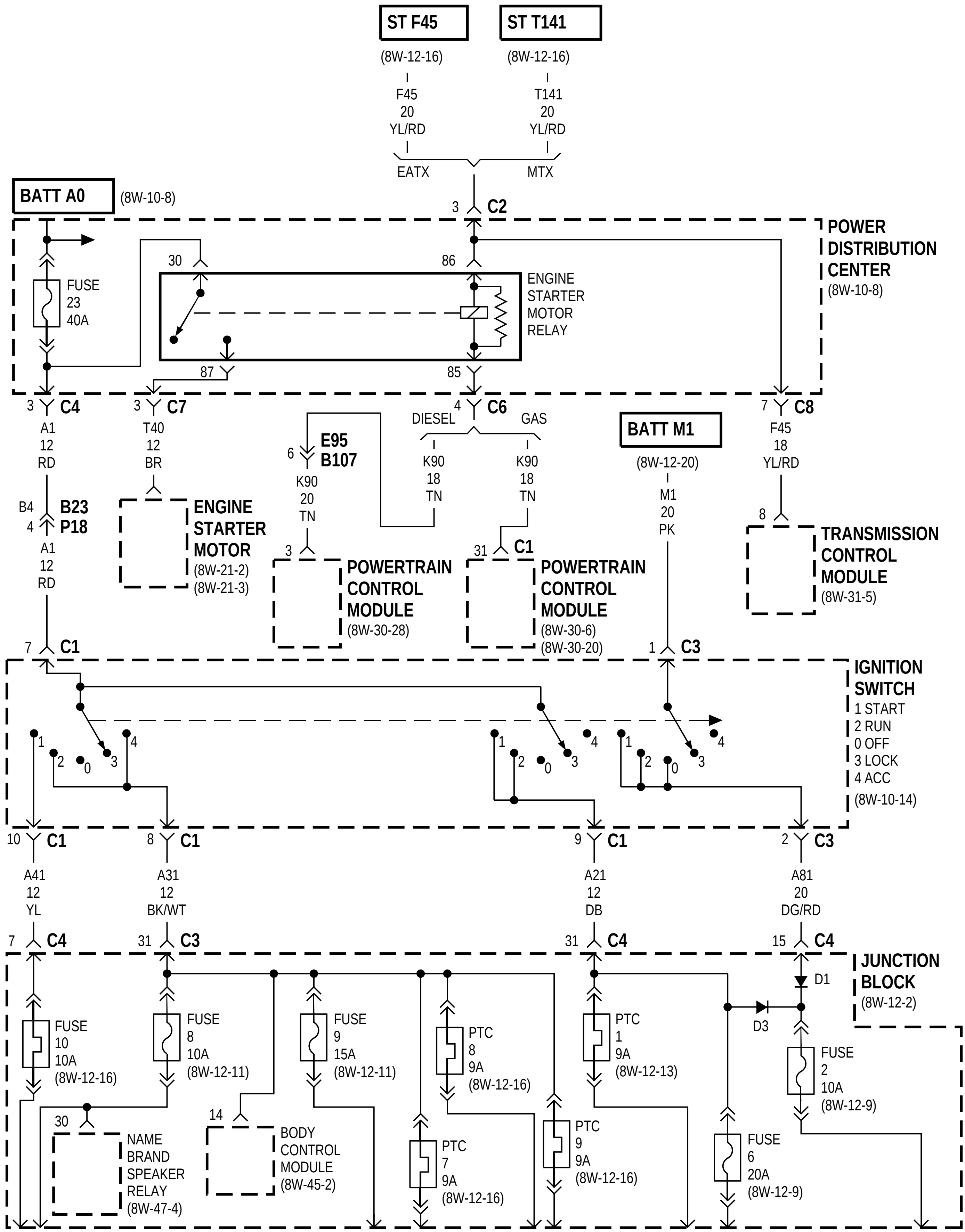

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A
5 C3
M1 20 PK
M1 20 PK
16 C1
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
(8W-63-4)
13 C1
JUNCTION BLOCK
(8W-12-2)
9
BODY CONTROL MODULE
(8W-45-2)
6 C4
13 C4
17 C4
M1 20 PK
M1 20 PK
M1 20 PK
M1 20 PK
M1 20 PK
M1 20 PK
2
INSTRUMENT CLUSTER
(8W-40-2)
1 C3
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-14)
16
DATA LINK CONNECTOR
(8W-30-3)
(8W-30-30)
*8
12
MESSAGE CENTER
(8W-46-2)
2 C3
A81 20 DG/RD
7 C1
RADIO
(8W-47-2)
3
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
M1 22 PK
15 C4
JUNCTION BLOCK
(8W-12-2)
D1
D3
FUSE 2 10A (8W-12-9)
7 P50
NOT USED
* RHD

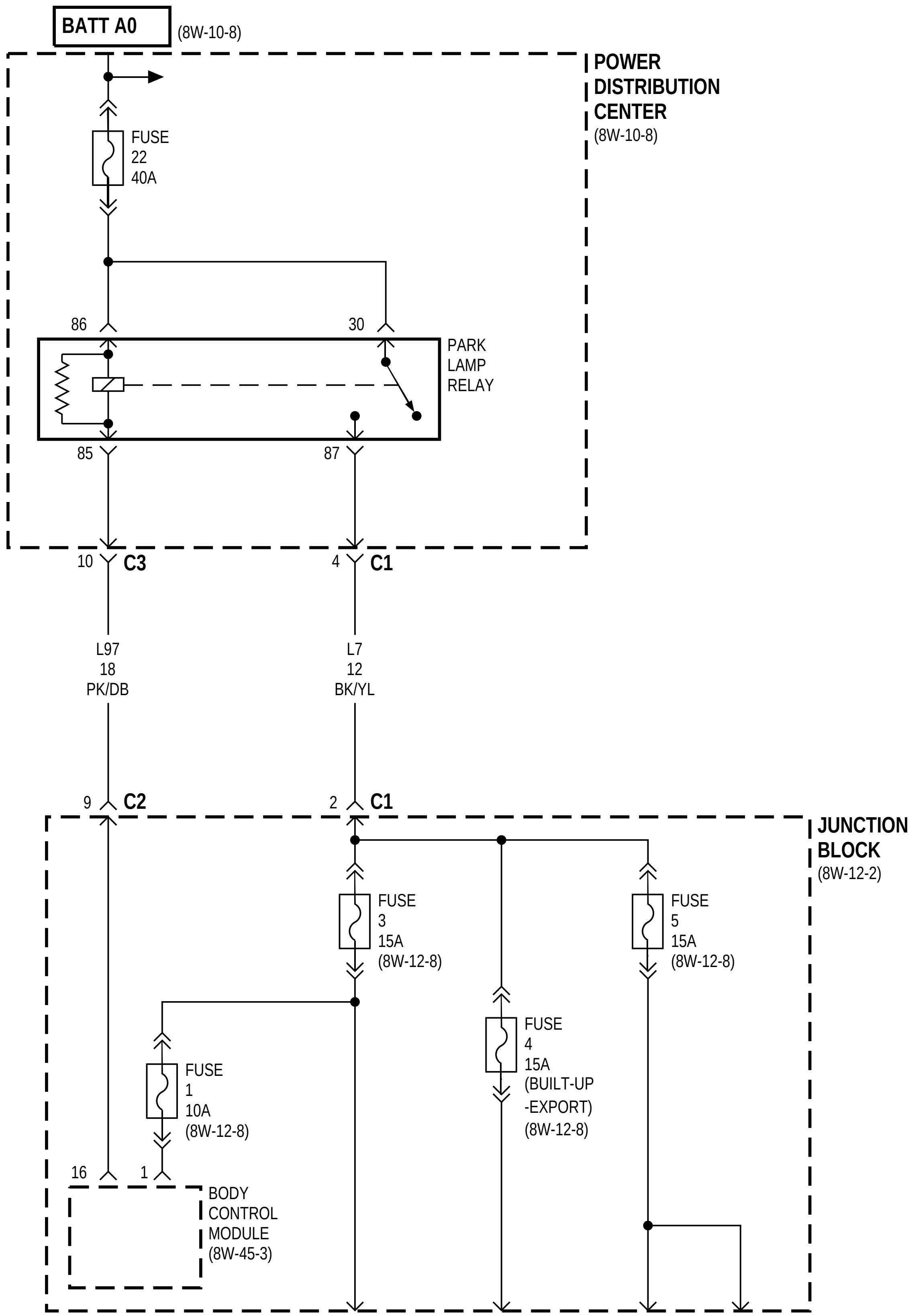

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
27
40A
6
C1
A4
12
BK/RD
35
C1
JUNCTION
BLOCK
(8W-12-2)
30
REAR
WINDOW
DEFOGGER
RELAY
(8W-48-2)
87
FUSE
7
10A
(8W-12-10)
6
C1
20
C4
C15
12
BK/WT
12
B17
LJ01
C15
12
BK/WT
1
J03A
L16
C15
12
BK/WT
REAR
WINDOW
DEFOGGER
(8W-48-2)
C16
20
LB/YL
4
C1
DRIVER
POWER
MIRROR
(8W-48-2)
C16
20
LB/YL
4
C1
PASSENGER
POWER
MIRROR
(8W-48-2)

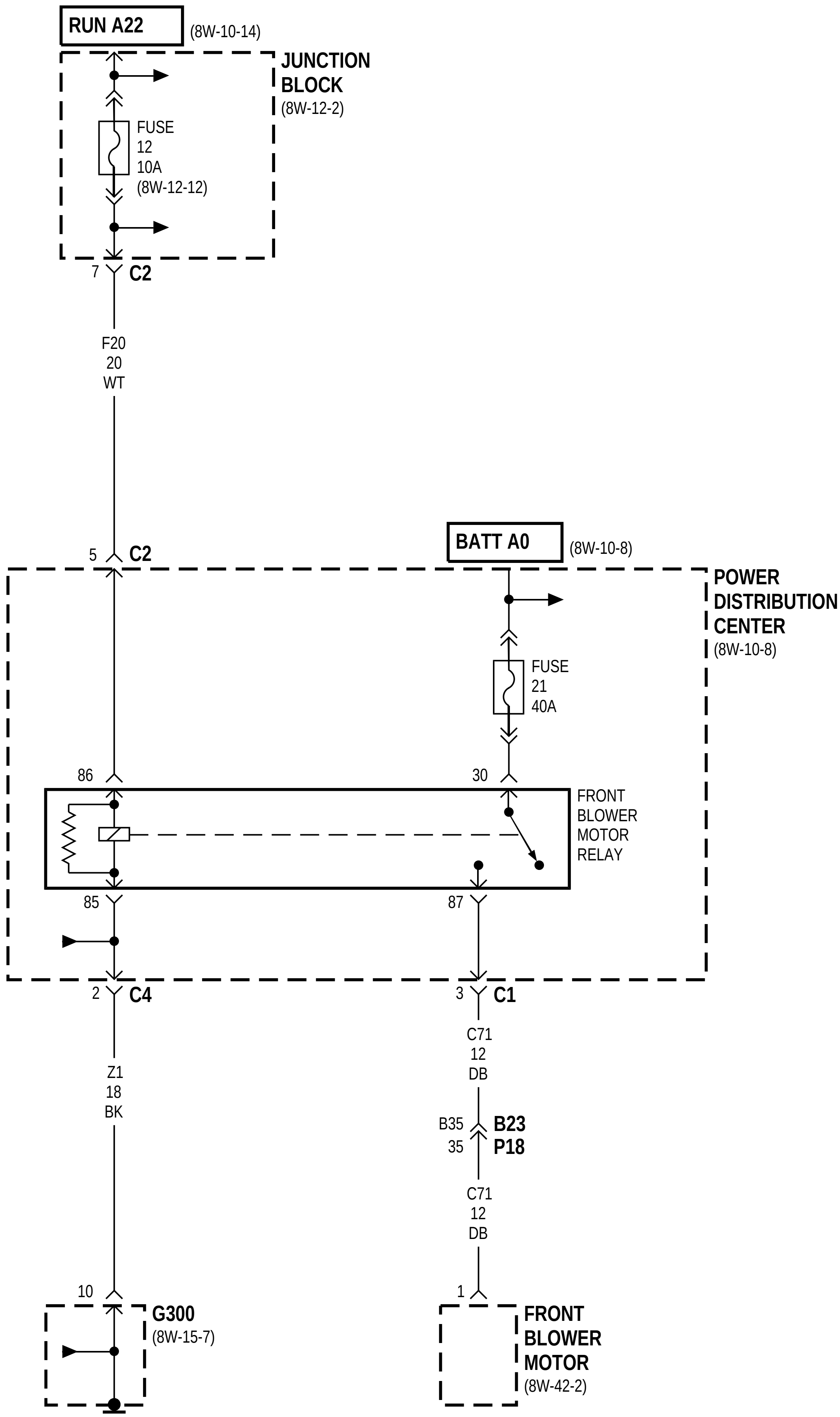

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
26
40A
5
C4
A2
12
PK/BK
4
C1
JUNCTION
BLOCK
(8W-12-2)
WASHER
MODULE
(BUILT-UP
-EXPORT
(8W-53-5)
P
PTC
3
9A
(8W-12-14)
(8W-12-15)
86
87
87A
DRIVER
DOOR
UNLOCK
RELAY
(RKE)
(8W-61-7)
(8W-61-8)
85
30
DOOR
UNLOCK
RELAY
(8W-61-3)
(8W-61-4)
(8W-61-7)
(8W-61-8)
DOOR
LOCK
RELAY
(8W-61-3)
(8W-61-4)
(8W-61-7)
(8W-61-8)
33
C1
4
C4
OTHER
HEATED
SEATS
A2
12
PK/BK
3
B09
HS5D
2
B09
S02
A3
12
PK/BK
2
HS6D
S02
C
TO
IGNITION
SWITCH
(8W-10-14)
1
POWER
SEAT
CIRCUIT
BREAKER
30A
(8W-63-2)
(8W-63-3)
(8W-63-4)

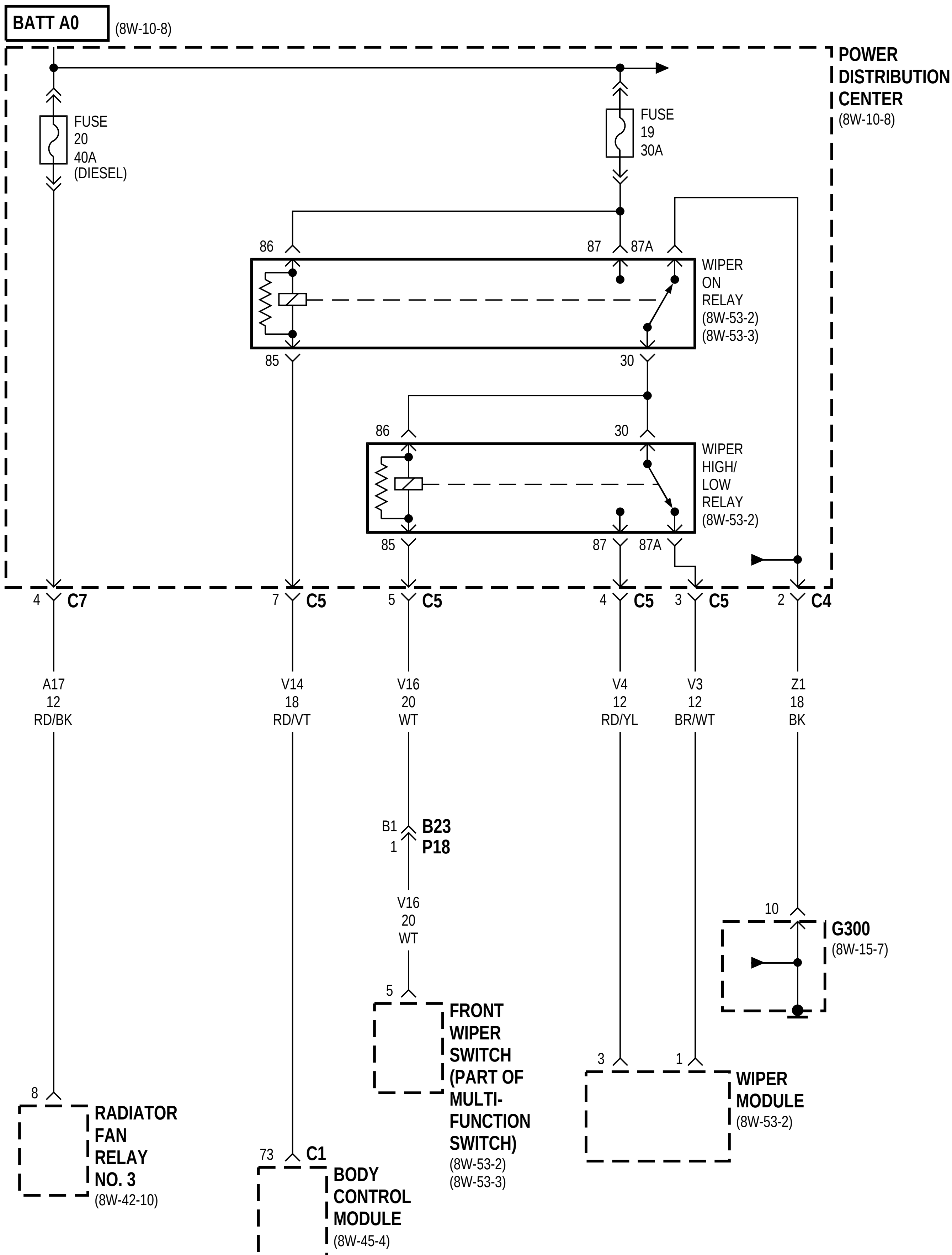

BATT A1
(8W-10-16)
MESSAGE CENTER
(8W-46-3)
JUNCTION BLOCK
(8W-12-2)
FROM JUNCTION BLOCK
(8W-10-13)
C
9
*11
G9
20
GY/BK
8
C3
BODY CONTROL MODULE
(8W-45-5)
BATT M1
(8W-10-11)
4
C2
A2
12
PK/BK
A1
12
RD
M1
20
PK
G9
20
GY/BK
G26
20
LB
3 C1
7 C1
1 C3
2 C1
1 C2
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
KEY-IN SWITCH
4 C1
10 C1
8 C1
9 C1
2 C3
1 C1
2 C2
A22
12
BK/OR
A41
12
YL
A31
12
BK/WT
A21
12
DB
A81
20
DG/RD
Z1
20
BK
Z1
20
BK
INSTRUMENT CLUSTER
(8W-40-4)
ST A41
(8W-10-16)
ST-RUN A21
(8W-10-16)
14
G200
(8W-15-4)
13
Z1
20
BK
RUN-ACC A31
(8W-10-16)
ST-RUN-OFF A81
(8W-10-16)
28
C4
JUNCTION BLOCK
(8W-12-19)
2 C3
JUNCTION BLOCK
(8W-12-2)
FUSE
11
20A
(8W-12-11)
FUSE
12
10A
(8W-12-12)
2
C2
Z1
14
BK
8
G300
(8W-15-6)
31
C2
A22
12
BK/OR
1
C4
POWER DISTRIBUTION CENTER
(8W-10-35)
FUSE
1
10A
(8W-10-35)
* RHD

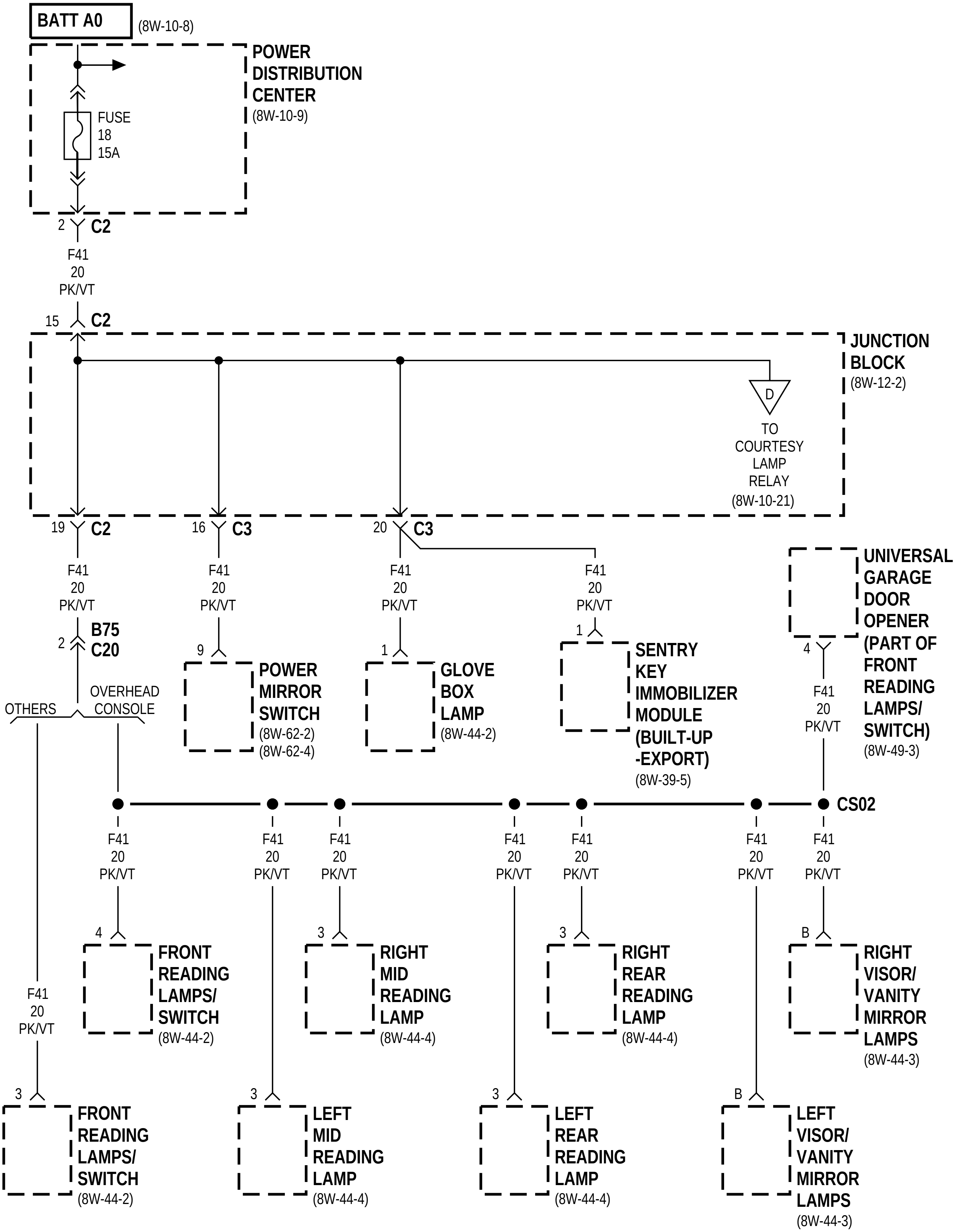

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 25 40A
FUSE 24 40A
6 C4
6 C7
A16 12 GY
GAS
DIESEL
A10 12 RD/DG
A16 12 GY
A16 12 GY
25
4
8
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
RADIATOR FAN RELAY
(8W-42-8)
RADIATOR FAN RELAY NO. 2
(8W-42-10)


ST F45
(8W-12-16)
F45
20
YL/RD
ST T141
(8W-12-16)
T141
20
YL/RD
EATX
MTX
BATT A0
(8W-10-8)
3 C2
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE
23
40A
30
86
ENGINE STARTER MOTOR RELAY
87
85
3 C4
3 C7
4 C6
7 C8
A1
12
RD
T40
12
BR
DIESEL
GAS
E95
B107
6
K90
20
TN
K90
18
TN
K90
18
TN
BATT M1
(8W-12-20)
M1
20
PK
F45
18
YL/RD
B4
4
B23
P18
A1
12
RD
ENGINE STARTER MOTOR
(8W-21-2)
(8W-21-3)
3
POWERTRAIN CONTROL MODULE
(8W-30-28)
31 C1
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-20)
8
TRANSMISSION CONTROL MODULE
(8W-31-5)
7 C1
1 C3
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-14)
10 C1
8 C1
9 C1
2 C3
A41
12
YL
A31
12
BK/WT
A21
12
DB
A81
20
DG/RD
7 C4
31 C3
31 C4
15 C4
JUNCTION BLOCK
(8W-12-2)
D1
D3
FUSE
10
10A
(8W-12-16)
FUSE
8
10A
(8W-12-11)
FUSE
9
15A
(8W-12-11)
PTC
8
9A
(8W-12-16)
PTC
1
9A
(8W-12-13)
FUSE
2
10A
(8W-12-9)
30
NAME BRAND SPEAKER RELAY
(8W-47-4)
14
BODY CONTROL MODULE
(8W-45-2)
PTC
7
9A
(8W-12-16)
PTC
9
9A
(8W-12-16)
FUSE
6
20A
(8W-12-9)

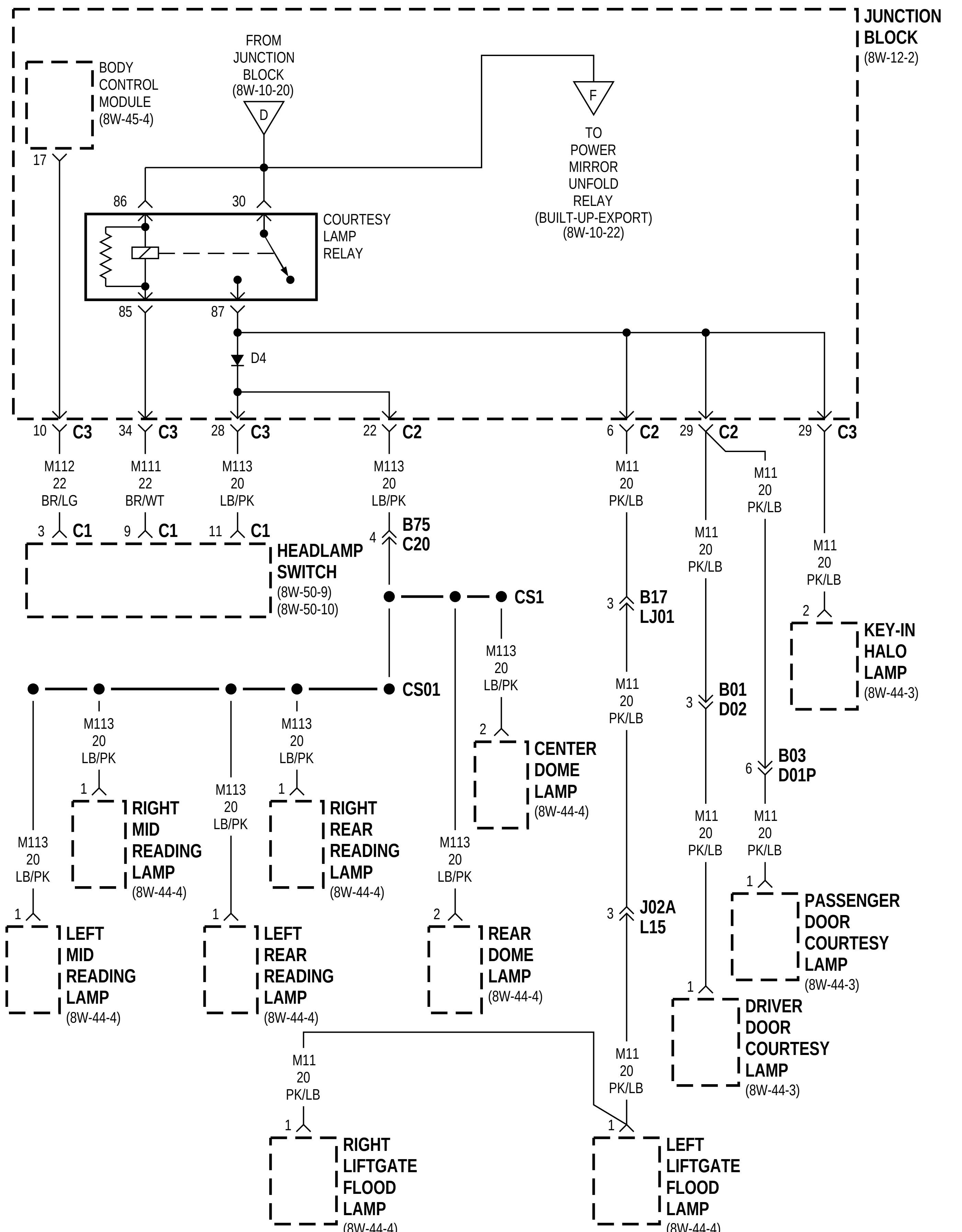

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
22
40A
86
30
PARK
LAMP
RELAY
85
87
10
C3
4
C1
L97
18
PK/DB
L7
12
BK/YL
9
C2
2
C1
JUNCTION
BLOCK
(8W-12-2)
FUSE
3
15A
(8W-12-8)
FUSE
5
15A
(8W-12-8)
FUSE
4
15A
(BUILT-UP
-EXPORT)
(8W-12-8)
FUSE
1
10A
(8W-12-8)
16
1
BODY
CONTROL
MODULE
(8W-45-3)

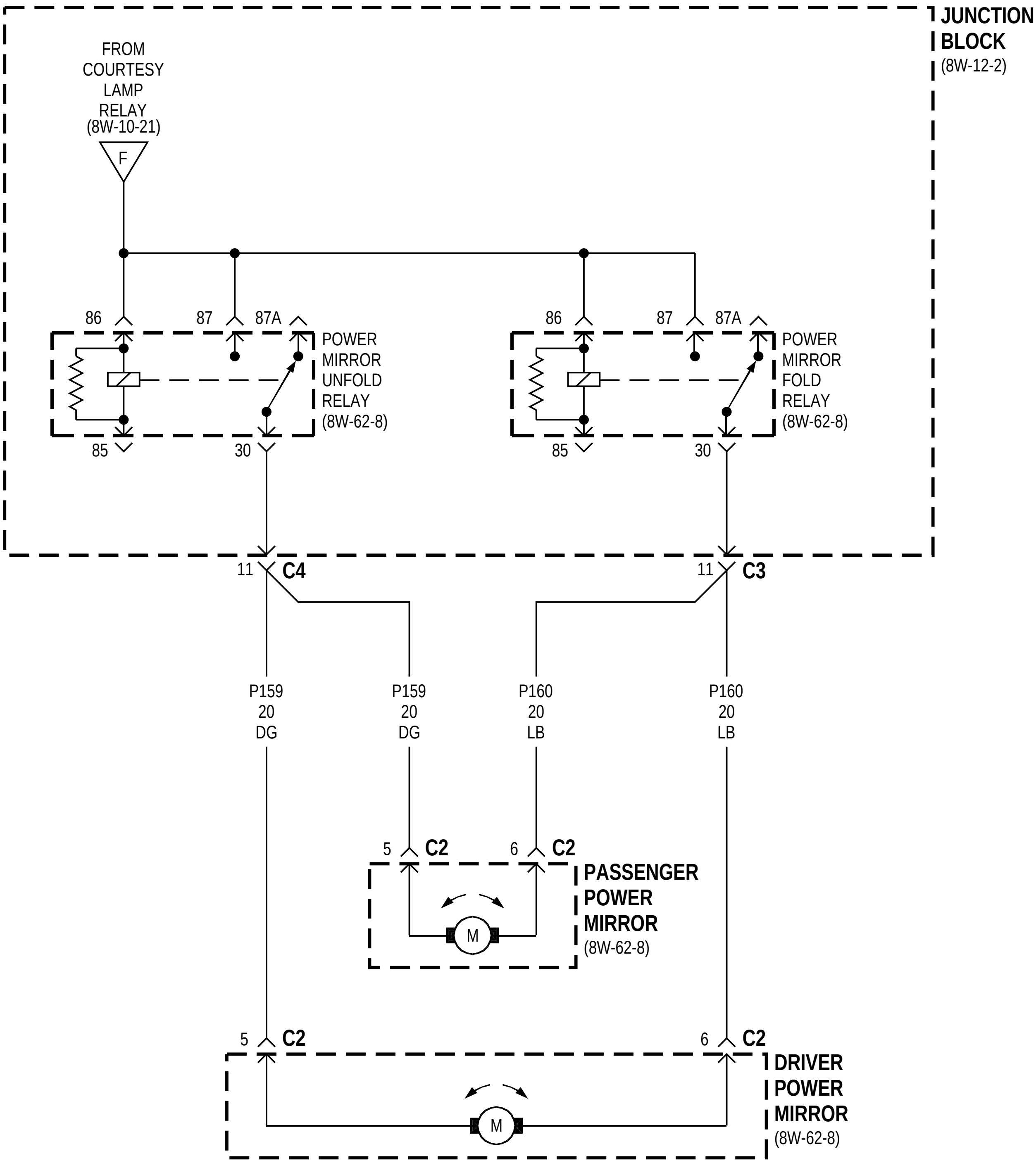

RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
7
C2
F20
20
WT
5
C2
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE
21
40A
86
30
FRONT BLOWER MOTOR RELAY
85
87
2
C4
3
C1
C71
12
DB
Z1
18
BK
B35
35
B23
P18
C71
12
DB
10
G300
(8W-15-7)
1
FRONT BLOWER MOTOR
(8W-42-2)

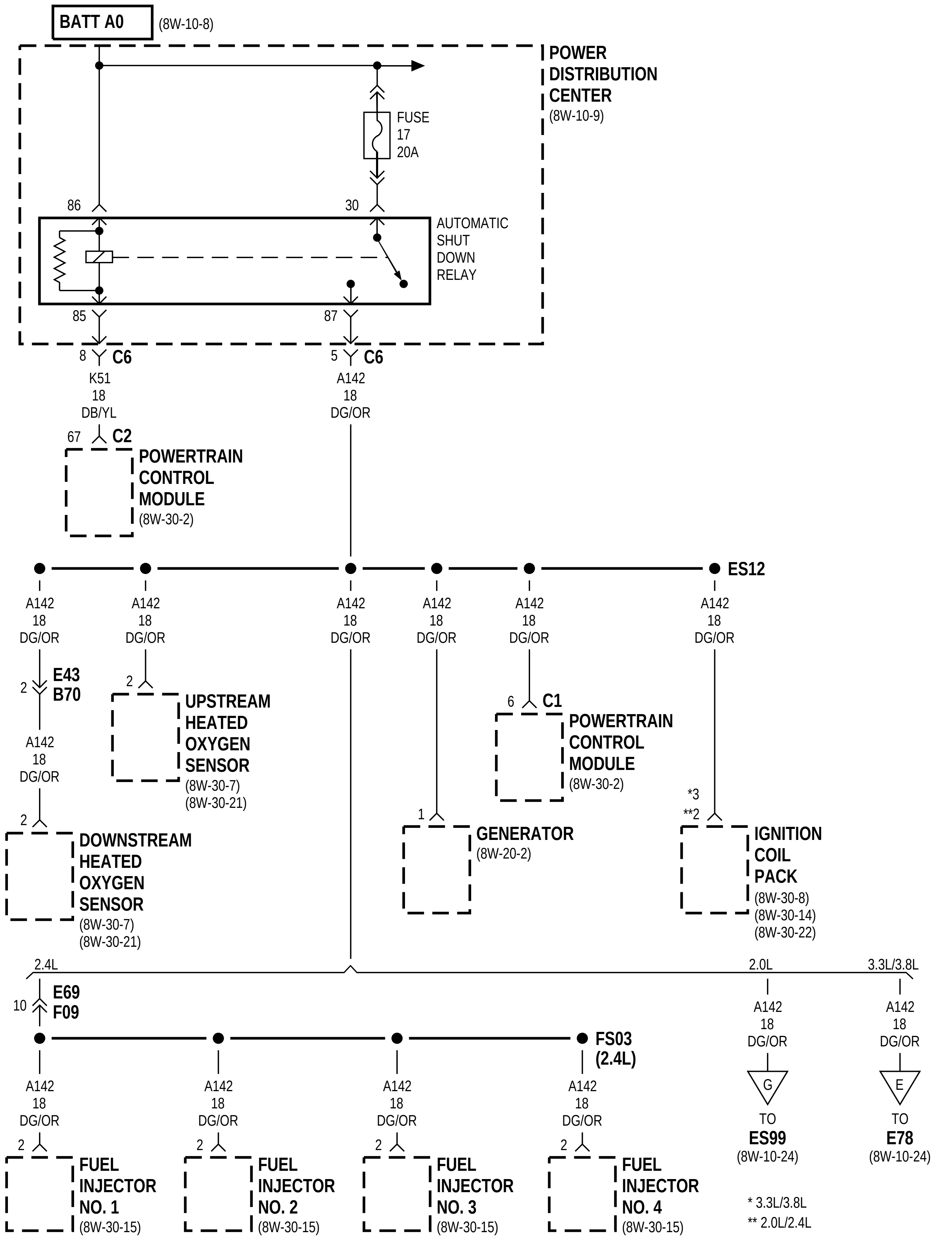

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 20 40A (DIESEL)
FUSE 19 30A
86
87
87A
WIPER ON RELAY
(8W-53-2)
(8W-53-3)
85
30
86
30
WIPER HIGH/ LOW RELAY
(8W-53-2)
85
87
87A
4 C7
7 C5
5 C5
4 C5
3 C5
2 C4
A17 12 RD/BK
V14 18 RD/VT
V16 20 WT
V4 12 RD/YL
V3 12 BR/WT
Z1 18 BK
B1 B23
1 P18
V16 20 WT
10
G300
(8W-15-7)
5
FRONT WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-53-2)
(8W-53-3)
3
1
WIPER MODULE
(8W-53-2)
8
RADIATOR FAN RELAY NO. 3
(8W-42-10)
73 C1
BODY CONTROL MODULE
(8W-45-4)

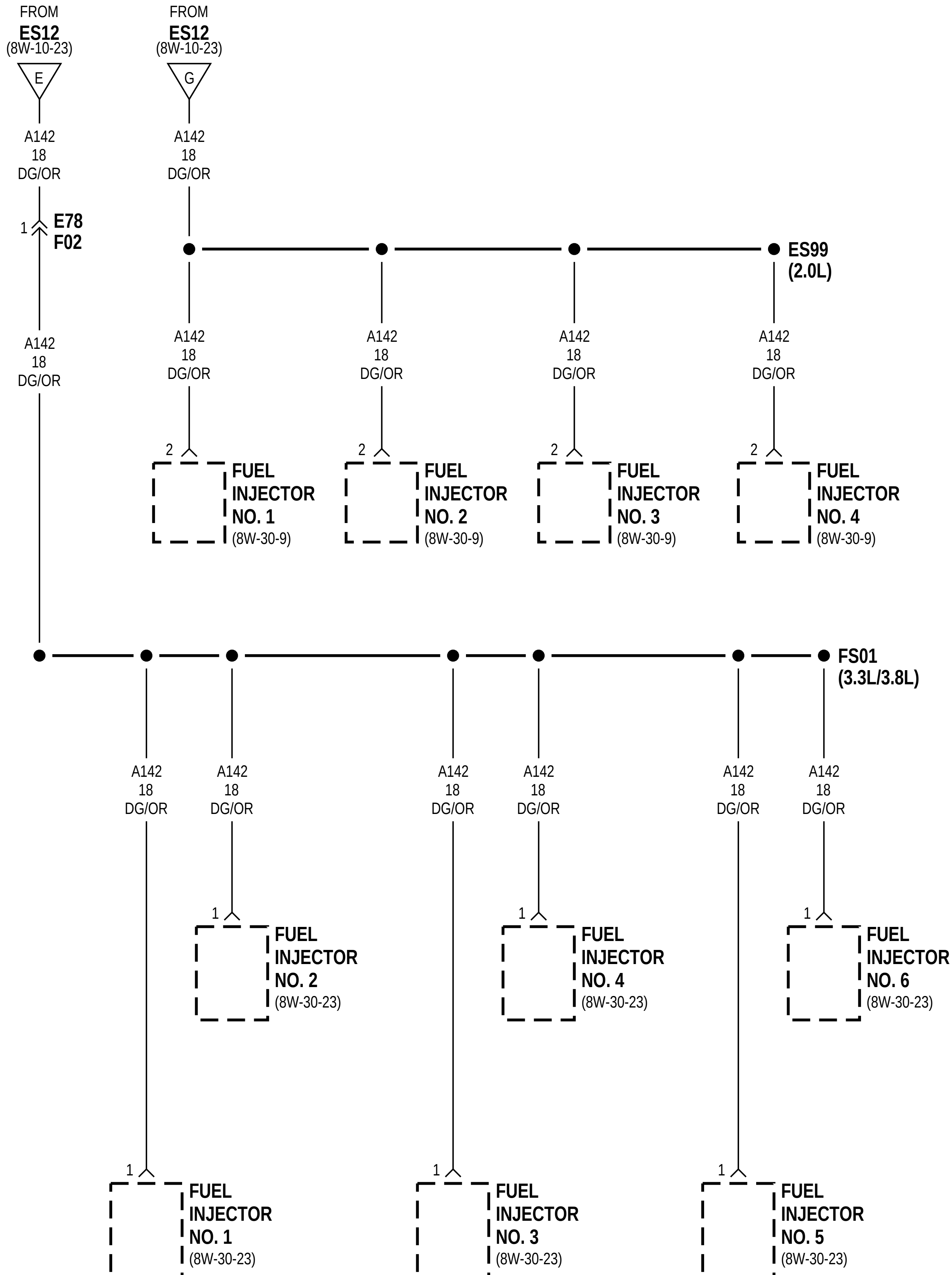


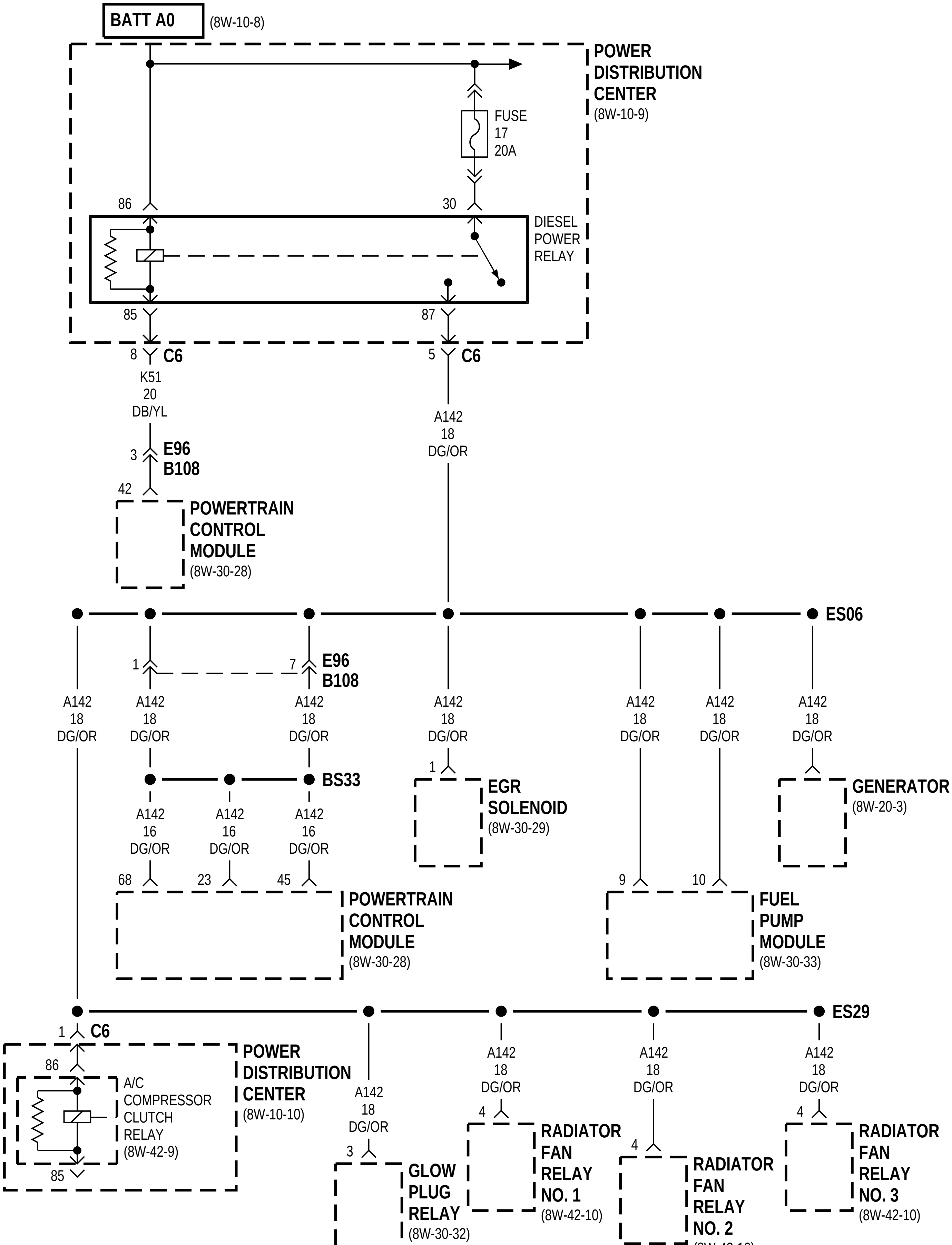
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
18
15A
2 C2
F41
20
PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
D
TO COURTESY LAMP RELAY
(8W-10-21)
19 C2
16 C3
20 C3
F41
20
PK/VT
2 B75
C20
OTHERS
OVERHEAD CONSOLE
9
POWER MIRROR SWITCH
(8W-62-2)
(8W-62-4)
1
GLOVE BOX LAMP
(8W-44-2)
1
SENTRY KEY IMMOBILIZER MODULE (BUILT-UP -EXPORT)
(8W-39-5)
UNIVERSAL GARAGE DOOR OPENER (PART OF FRONT READING LAMPS/ SWITCH)
(8W-49-3)
4
CS02
4
FRONT READING LAMPS/ SWITCH
(8W-44-2)
3
RIGHT MID READING LAMP
(8W-44-4)
3
RIGHT REAR READING LAMP
(8W-44-4)
B
RIGHT VISOR/ VANITY MIRROR LAMPS
(8W-44-3)
3
FRONT READING LAMPS/ SWITCH
(8W-44-2)
3
LEFT MID READING LAMP
(8W-44-4)
3
LEFT REAR READING LAMP
(8W-44-4)
B
LEFT VISOR/ VANITY MIRROR LAMPS
(8W-44-3)

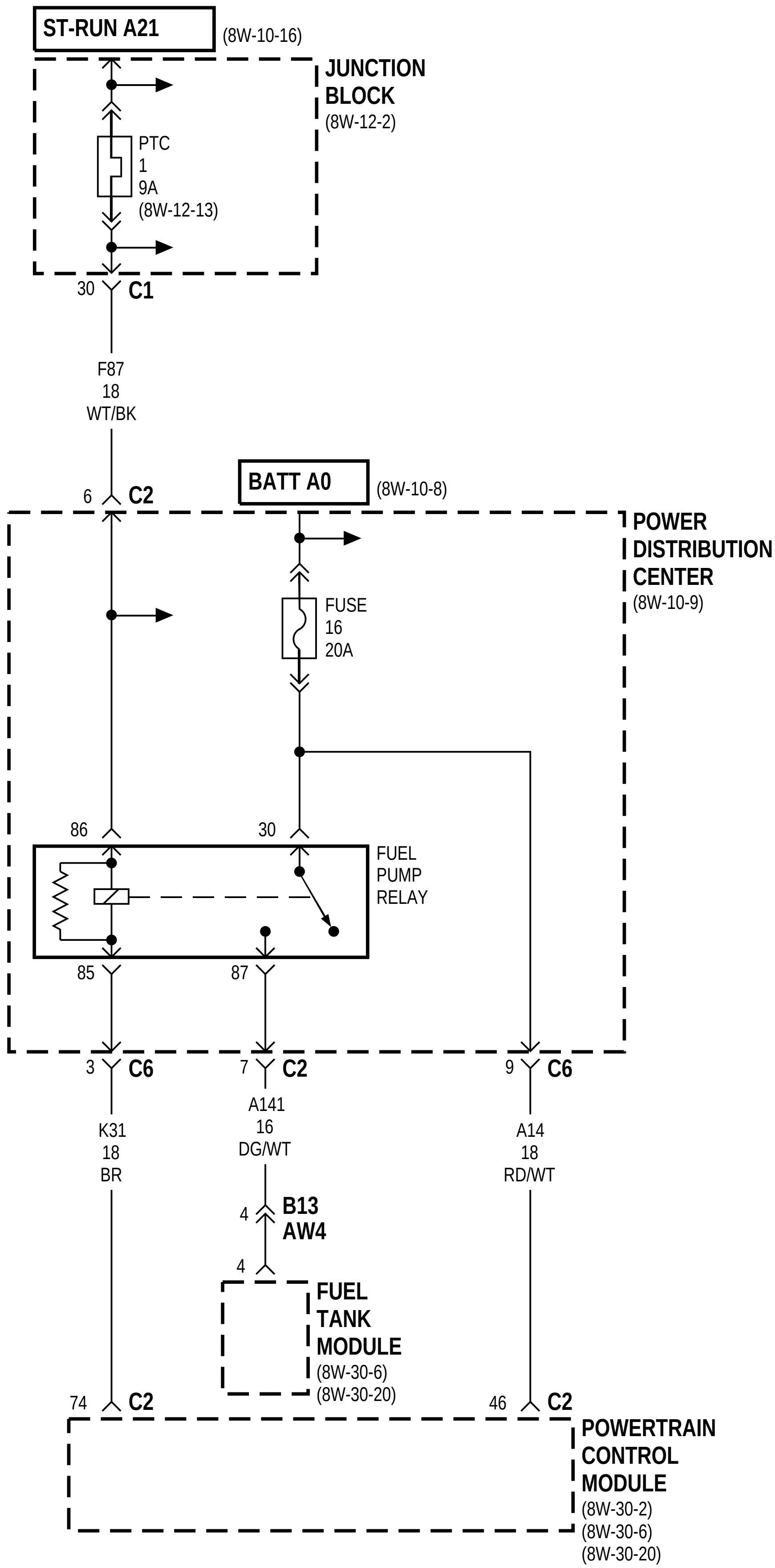

JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-4)
FROM JUNCTION BLOCK
(8W-10-20)
D
F
TO POWER MIRROR UNFOLD RELAY
(BUILT-UP-EXPORT)
(8W-10-22)
COURTESY LAMP RELAY
17
86
30
85
87
D4
10 C3
34 C3
28 C3
22 C2
6 C2
29 C2
29 C3
M112
22
BR/LG
M111
22
BR/WT
M113
20
LB/PK
M11
20
PK/LB
3 C1
9 C1
11 C1
HEADLAMP SWITCH
(8W-50-9)
(8W-50-10)
4 B75 C20
CS1
CS01
3 B17 LJ01
3 B01 D02
6 B03 D01P
KEY-IN HALO LAMP
(8W-44-3)
CENTER DOME LAMP
(8W-44-4)
RIGHT MID READING LAMP
(8W-44-4)
RIGHT REAR READING LAMP
(8W-44-4)
LEFT MID READING LAMP
(8W-44-4)
LEFT REAR READING LAMP
(8W-44-4)
REAR DOME LAMP
(8W-44-4)
3 J02A L15
PASSENGER DOOR COURTESY LAMP
(8W-44-3)
DRIVER DOOR COURTESY LAMP
(8W-44-3)
RIGHT LIFTGATE FLOOD LAMP
(8W-44-4)
LEFT LIFTGATE FLOOD LAMP
(8W-44-4)


JUNCTION
BLOCK
(8W-12-2)
FROM
COURTESY
LAMP
RELAY
(8W-10-21)
F
86
87
87A
POWER
MIRROR
UNFOLD
RELAY
(8W-62-8)
85
30
86
87
87A
POWER
MIRROR
FOLD
RELAY
(8W-62-8)
85
30
11
C4
11
C3
P159
20
DG
P159
20
DG
P160
20
LB
P160
20
LB
5
C2
6
C2
PASSENGER
POWER
MIRROR
(8W-62-8)
M
5
C2
6
C2
DRIVER
POWER
MIRROR
(8W-62-8)
M

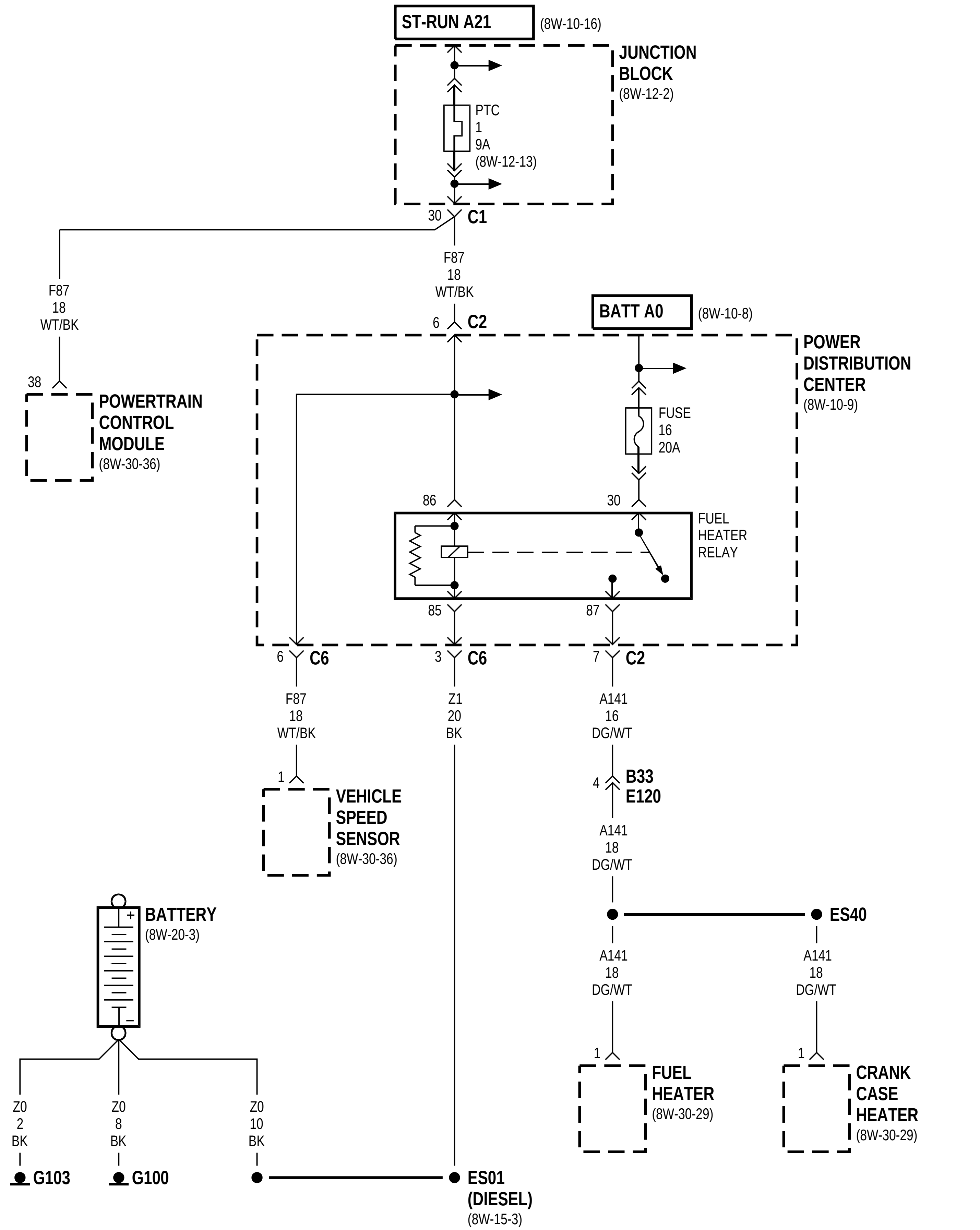

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 17 20A
86
30
AUTOMATIC SHUT DOWN RELAY
85
87
8 C6
5 C6
K51 18 DB/YL
A142 18 DG/OR
67 C2
POWERTRAIN CONTROL MODULE
(8W-30-2)
ES12
A142 18 DG/OR
2 E43 B70
2
UPSTREAM HEATED OXYGEN SENSOR
(8W-30-7)
(8W-30-21)
6 C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
2
DOWNSTREAM HEATED OXYGEN SENSOR
(8W-30-7)
(8W-30-21)
1
GENERATOR
(8W-20-2)
*3
**2
IGNITION COIL PACK
(8W-30-8)
(8W-30-14)
(8W-30-22)
2.4L
2.0L
3.3L/3.8L
10 E69 F09
FS03 (2.4L)
G
TO ES99
(8W-10-24)
E
TO E78
(8W-10-24)
FUEL INJECTOR NO. 1
(8W-30-15)
FUEL INJECTOR NO. 2
(8W-30-15)
FUEL INJECTOR NO. 3
(8W-30-15)
FUEL INJECTOR NO. 4
(8W-30-15)
* 3.3L/3.8L
** 2.0L/2.4L

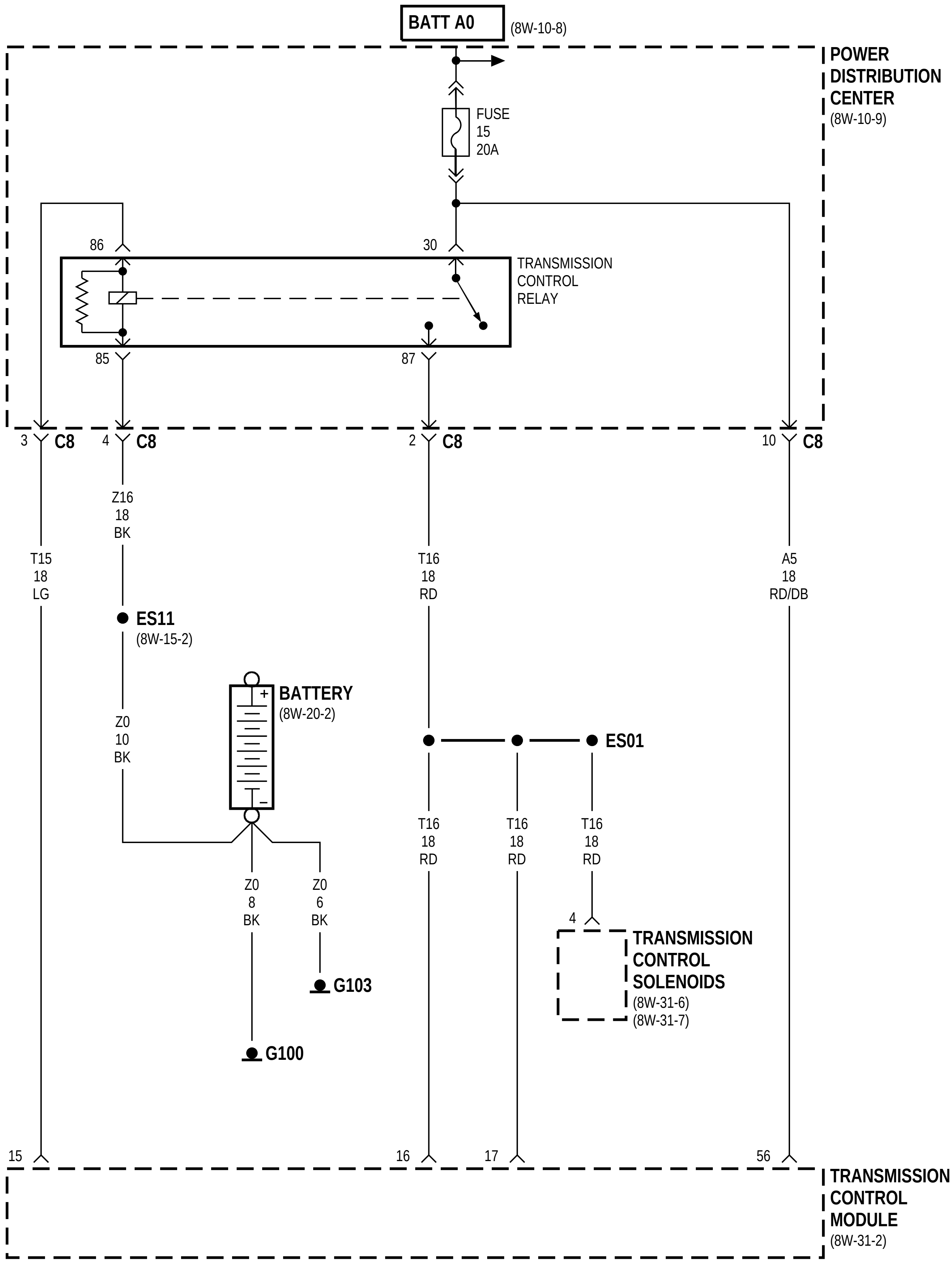

FROM
ES12
(8W-10-23)
E
FROM
ES12
(8W-10-23)
G
A142
18
DG/OR
1
E78
F02
ES99
(2.0L)
2
FUEL
INJECTOR
NO. 1
(8W-30-9)
FUEL
INJECTOR
NO. 2
(8W-30-9)
FUEL
INJECTOR
NO. 3
(8W-30-9)
FUEL
INJECTOR
NO. 4
(8W-30-9)
FS01
(3.3L/3.8L)
FUEL
INJECTOR
NO. 2
(8W-30-23)
FUEL
INJECTOR
NO. 4
(8W-30-23)
FUEL
INJECTOR
NO. 6
(8W-30-23)
FUEL
INJECTOR
NO. 1
(8W-30-23)
FUEL
INJECTOR
NO. 3
(8W-30-23)
FUEL
INJECTOR
NO. 5
(8W-30-23)

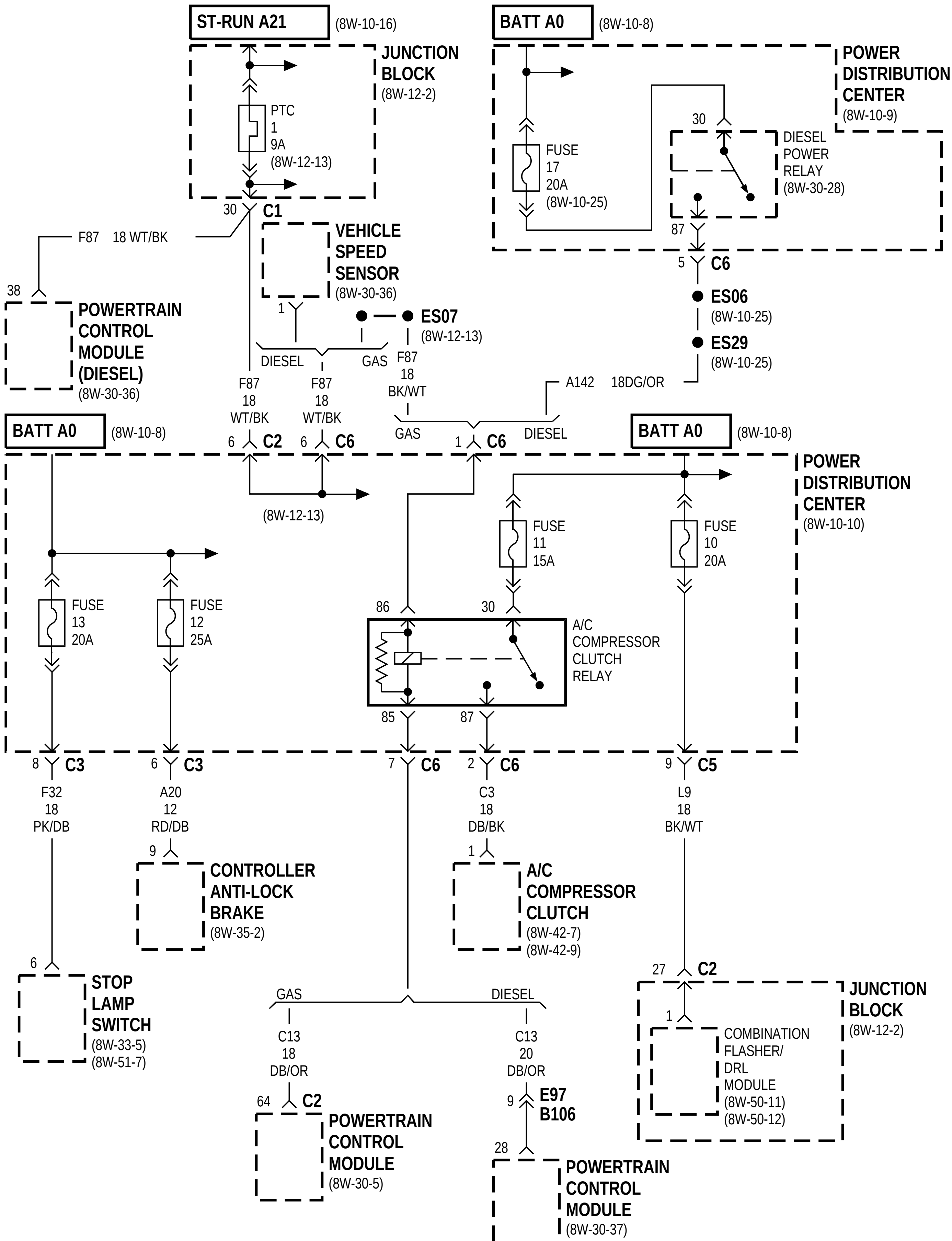

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
17
20A
86
30
DIESEL
POWER
RELAY
85
87
8
C6
5
C6
K51
20
DB/YL
A142
18
DG/OR
3
E96
B108
42
POWERTRAIN
CONTROL
MODULE
(8W-30-28)
ES06
1
7
E96
B108
A142
18
DG/OR
BS33
A142
16
DG/OR
1
EGR
SOLENOID
(8W-30-29)
GENERATOR
(8W-20-3)
68
23
45
POWERTRAIN
CONTROL
MODULE
(8W-30-28)
9
10
FUEL
PUMP
MODULE
(8W-30-33)
ES29
1
C6
86
A/C
COMPRESSOR
CLUTCH
RELAY
(8W-42-9)
85
POWER
DISTRIBUTION
CENTER
(8W-10-10)
3
GLOW
PLUG
RELAY
(8W-30-32)
4
RADIATOR
FAN
RELAY
NO. 1
(8W-42-10)
RADIATOR
FAN
RELAY
NO. 2
(8W-42-10)
RADIATOR
FAN
RELAY
NO. 3
(8W-42-10)

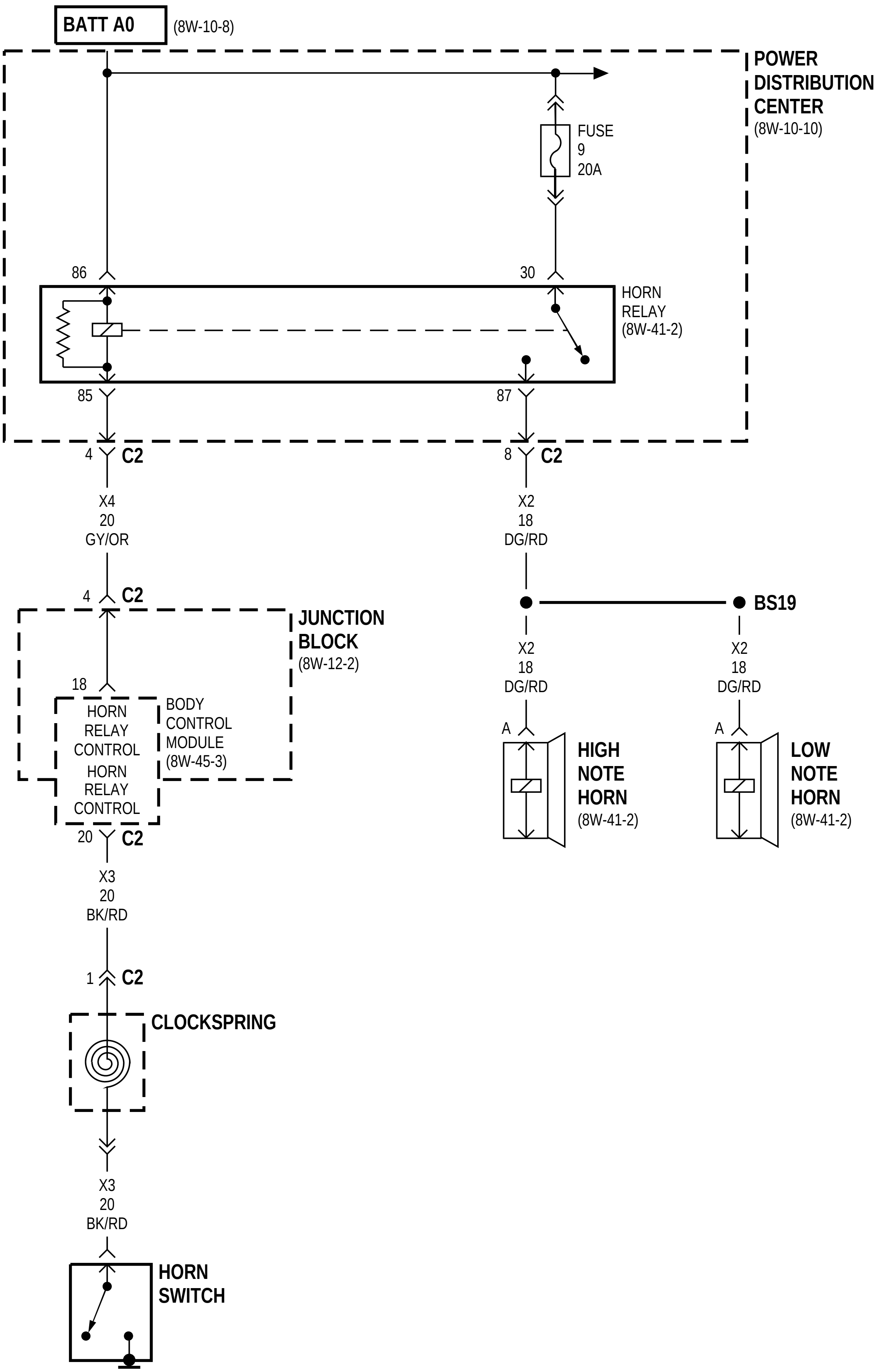


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30
C1
F87
18
WT/BK
6
C2
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
16
20A
86
30
FUEL PUMP RELAY
85
87
3
C6
7
C2
9
C6
K31
18
BR
A141
16
DG/WT
A14
18
RD/WT
4
B13
AW4
4
FUEL TANK MODULE
(8W-30-6)
(8W-30-20)
74
C2
46
C2
POWERTRAIN CONTROL MODULE
(8W-30-2)
(8W-30-6)
(8W-30-20)

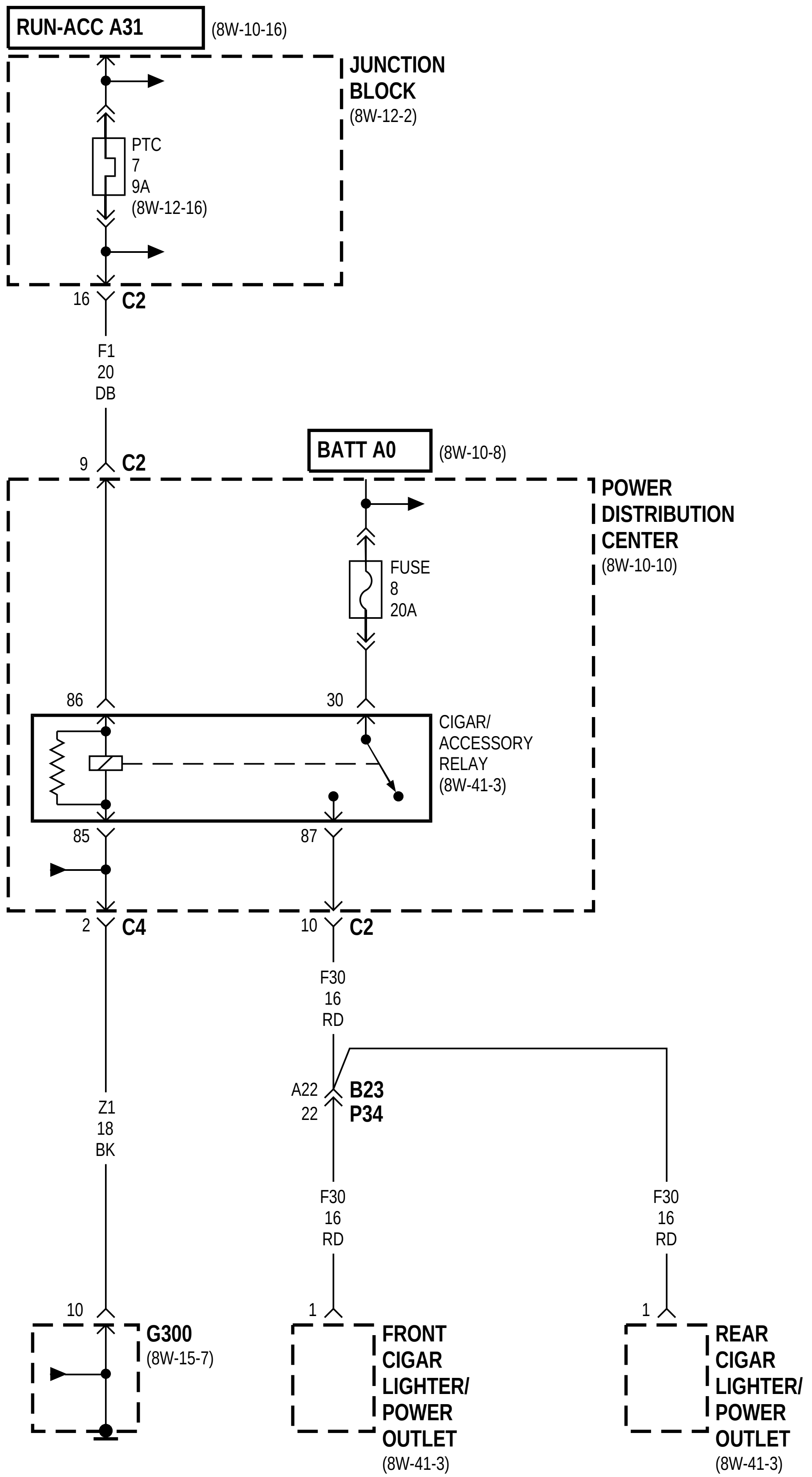

ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30
C1
F87
18
WT/BK
F87
18
WT/BK
6
C2
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
38
POWERTRAIN CONTROL MODULE
(8W-30-36)
FUSE
16
20A
86
30
FUEL HEATER RELAY
85
87
6
C6
3
C6
7
C2
F87
18
WT/BK
Z1
20
BK
A141
16
DG/WT
1
VEHICLE SPEED SENSOR
(8W-30-36)
4
B33
E120
A141
18
DG/WT
BATTERY
(8W-20-3)
ES40
A141
18
DG/WT
A141
18
DG/WT
1
FUEL HEATER
(8W-30-29)
1
CRANK CASE HEATER
(8W-30-29)
Z0
2
BK
Z0
8
BK
Z0
10
BK
G103
G100
ES01
(DIESEL)
(8W-15-3)

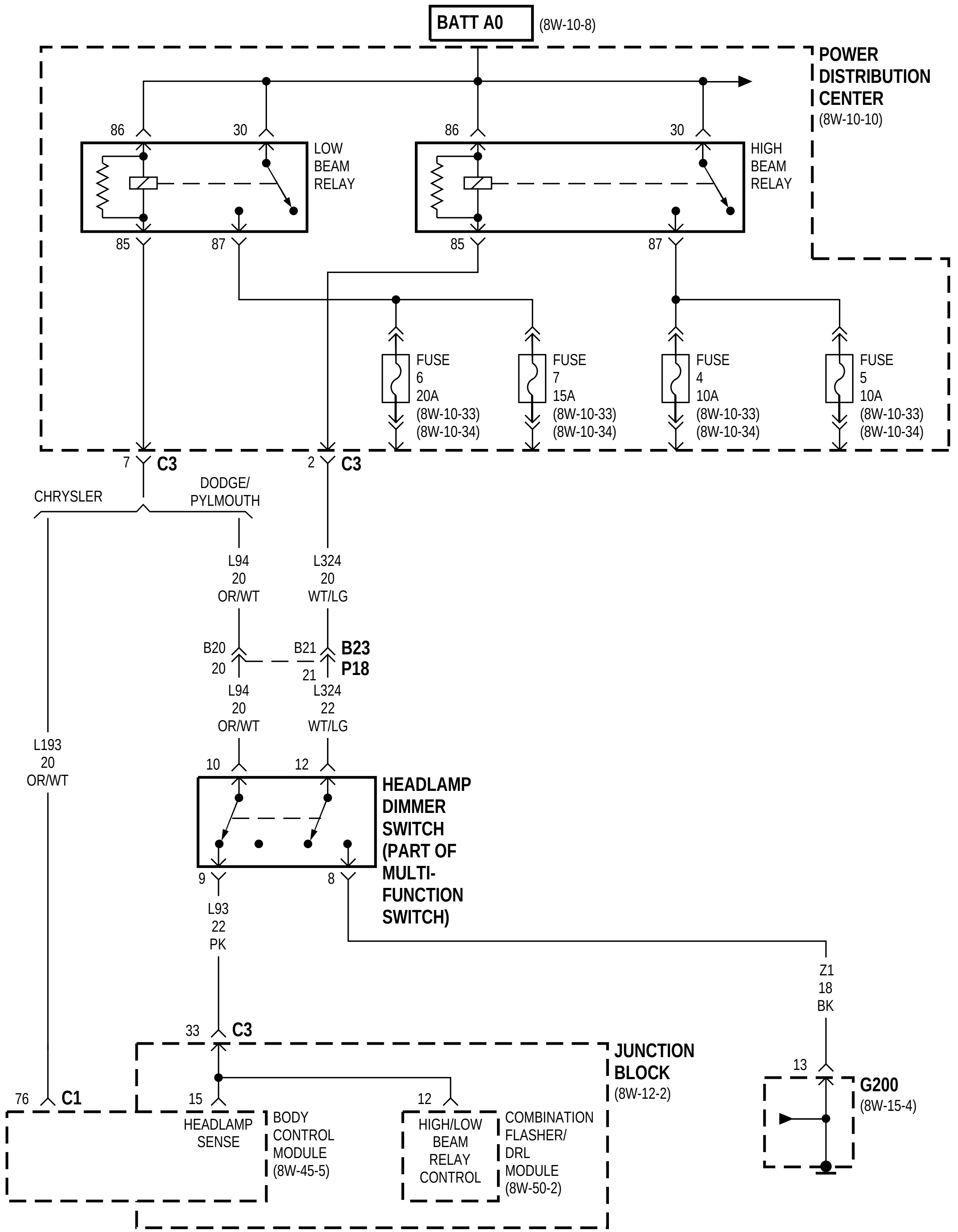

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
15
20A
86
30
TRANSMISSION CONTROL RELAY
85
87
3 C8
4 C8
2 C8
10 C8
Z16
18
BK
T15
18
LG
T16
18
RD
A5
18
RD/DB
ES11
(8W-15-2)
BATTERY
(8W-20-2)
Z0
10
BK
ES01
T16
18
RD
T16
18
RD
T16
18
RD
Z0
8
BK
Z0
6
BK
4
TRANSMISSION CONTROL SOLENOIDS
(8W-31-6)
(8W-31-7)
G103
G100
15
16
17
56
TRANSMISSION CONTROL MODULE
(8W-31-2)

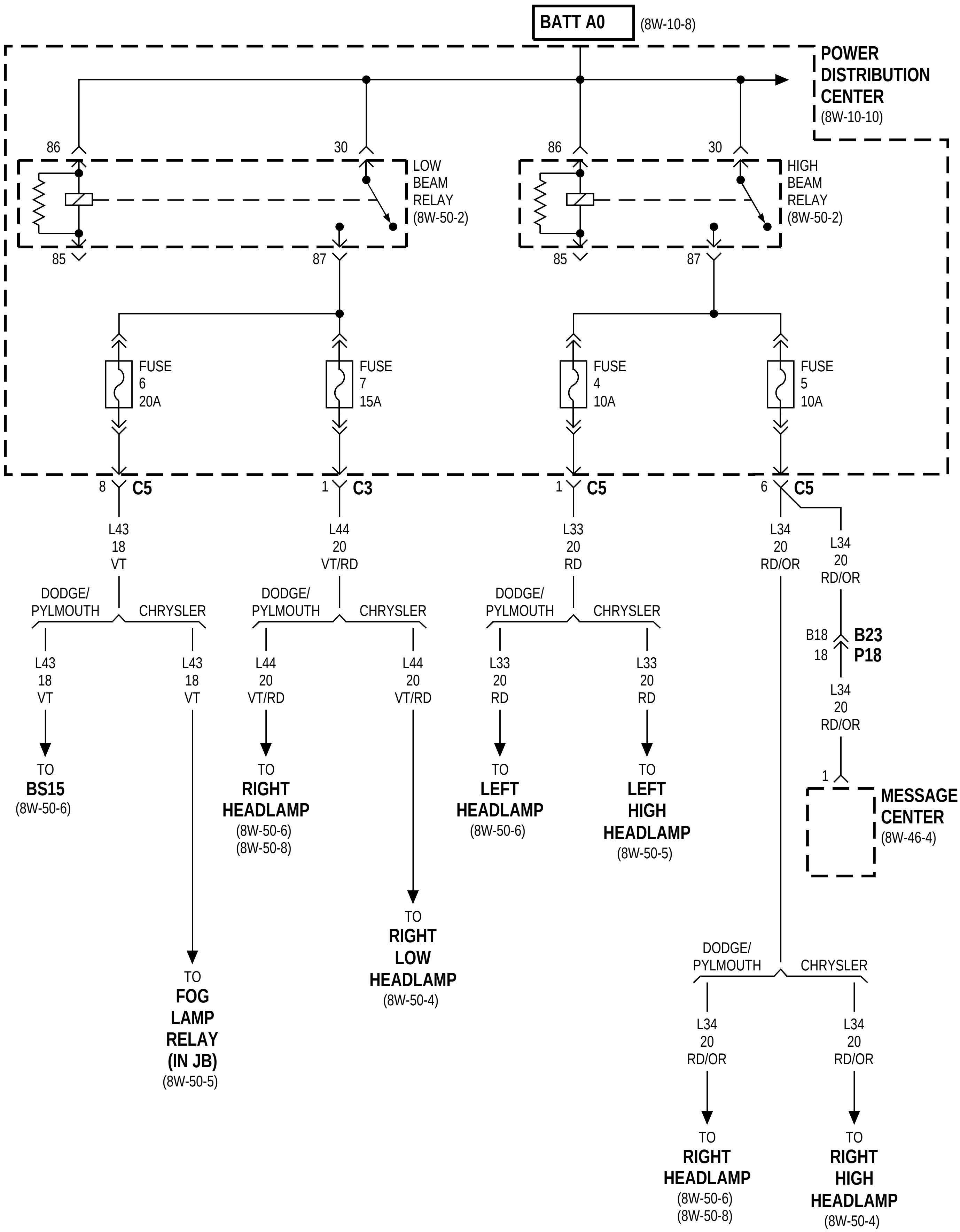

ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-25)
DIESEL POWER RELAY
(8W-30-28)
30
87
5
C6
ES06
(8W-10-25)
ES29
(8W-10-25)
30
C1
F87 18 WT/BK
38
POWERTRAIN CONTROL MODULE (DIESEL)
(8W-30-36)
VEHICLE SPEED SENSOR
(8W-30-36)
1
ES07
(8W-12-13)
DIESEL
GAS
F87
18
BK/WT
A142 18DG/OR
F87
18
WT/BK
F87
18
WT/BK
GAS
DIESEL
BATT A0
(8W-10-8)
6
C2
6
C6
1
C6
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
(8W-12-13)
FUSE
11
15A
FUSE
10
20A
FUSE
13
20A
FUSE
12
25A
86
30
A/C COMPRESSOR CLUTCH RELAY
85
87
8
C3
6
C3
7
C6
2
C6
9
C5
F32
18
PK/DB
A20
12
RD/DB
C3
18
DB/BK
L9
18
BK/WT
9
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
1
A/C COMPRESSOR CLUTCH
(8W-42-7)
(8W-42-9)
6
STOP LAMP SWITCH
(8W-33-5)
(8W-51-7)
GAS
DIESEL
C13
18
DB/OR
C13
20
DB/OR
64
C2
POWERTRAIN CONTROL MODULE
(8W-30-5)
9
E97
B106
28
POWERTRAIN CONTROL MODULE
(8W-30-37)
27
C2
JUNCTION BLOCK
(8W-12-2)
1
COMBINATION FLASHER/ DRL MODULE
(8W-50-11)
(8W-50-12)



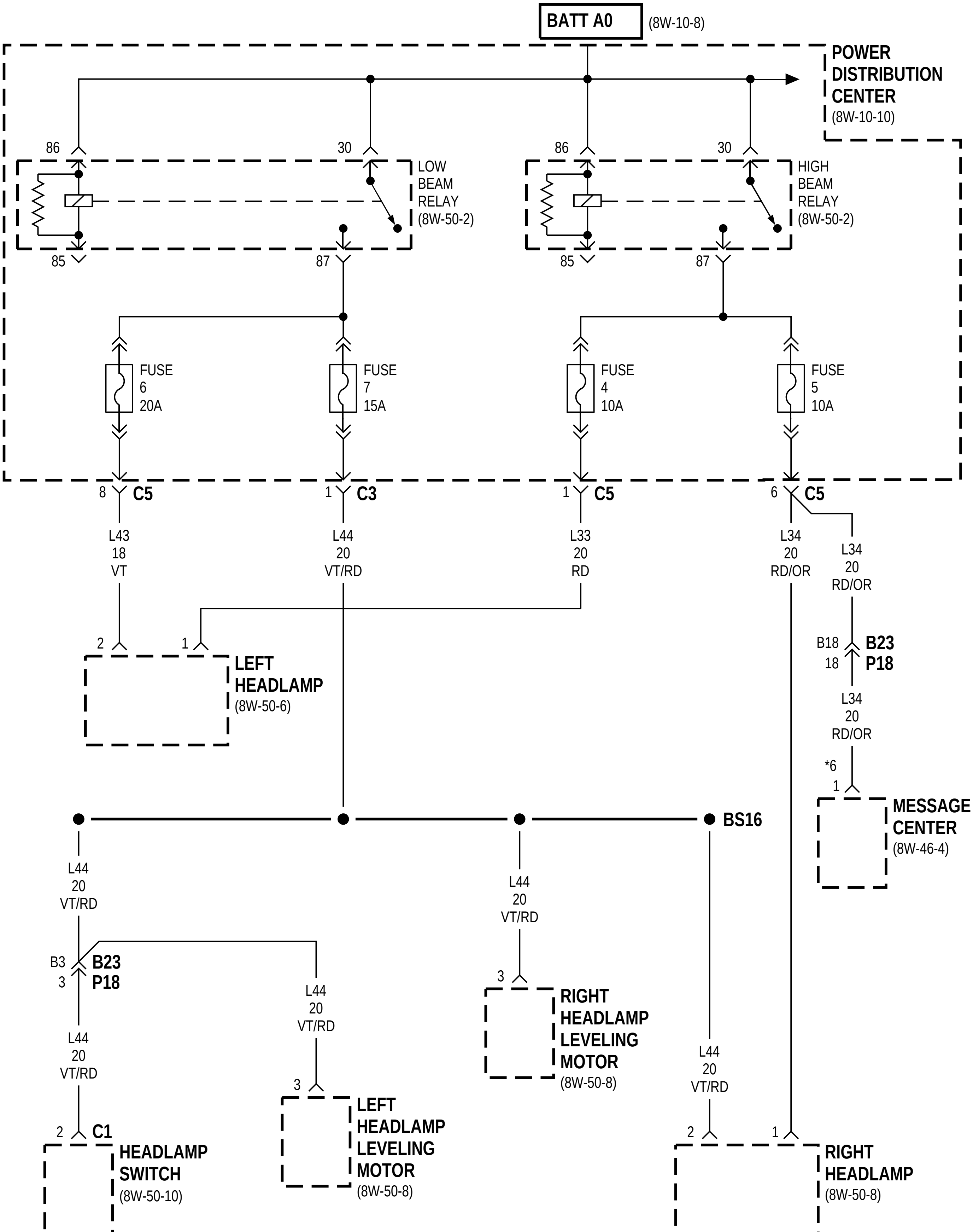
J988W-3 GS001030

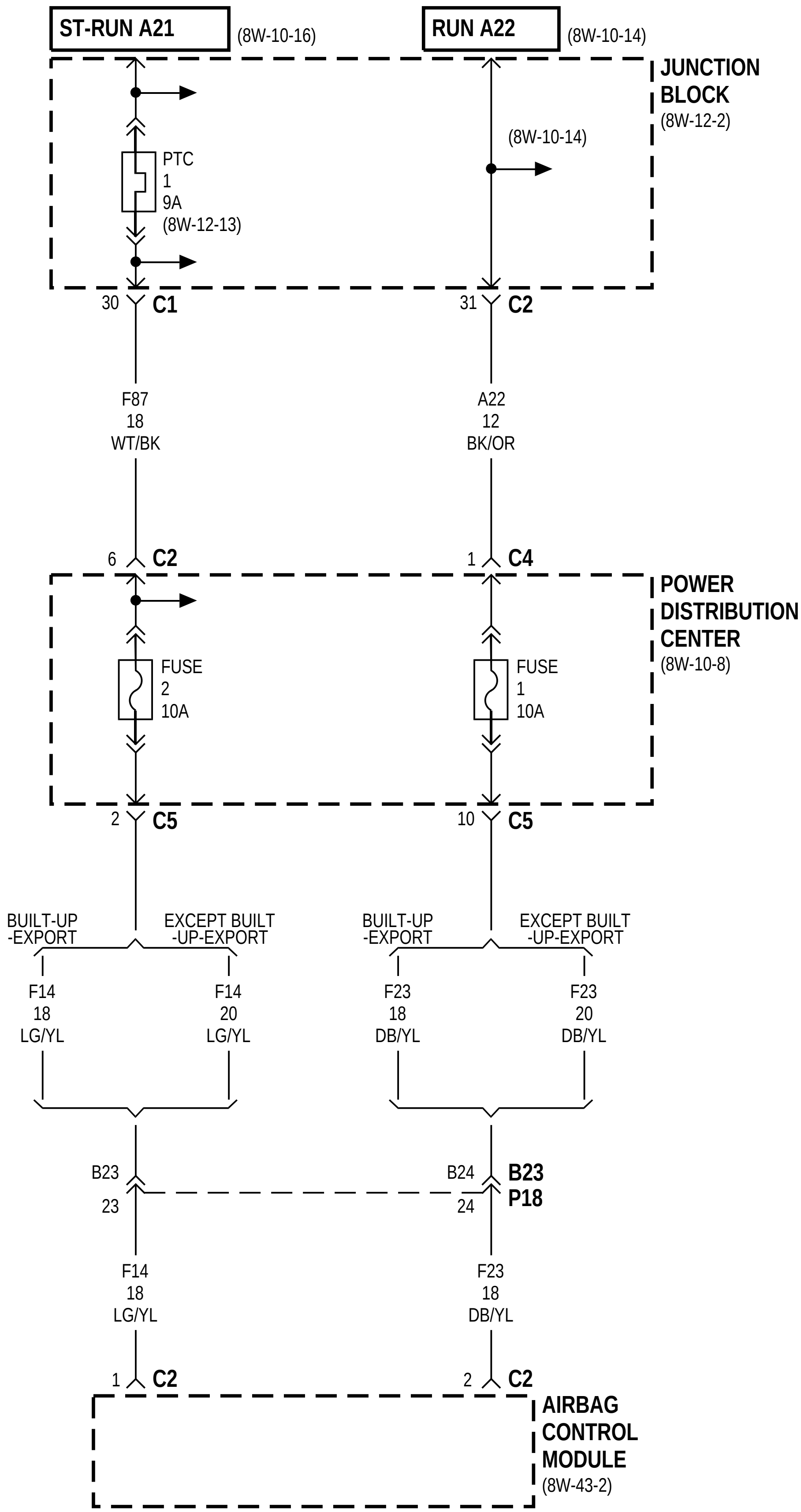

RUN-ACC A31
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
PTC
7
9A
(8W-12-16)
16
C2
F1
20
DB
9
C2
BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-10)
FUSE
8
20A
86
30
CIGAR/
ACCESSORY
RELAY
(8W-41-3)
85
87
2
C4
10
C2
F30
16
RD
A22
22
B23
P34
Z1
18
BK
F30
16
RD
F30
16
RD
10
G300
(8W-15-7)
1
FRONT
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-3)
1
REAR
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-3)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
86
30
LOW BEAM RELAY
86
30
HIGH BEAM RELAY
85
87
85
87
FUSE 6 20A (8W-10-33) (8W-10-34)
FUSE 7 15A (8W-10-33) (8W-10-34)
FUSE 4 10A (8W-10-33) (8W-10-34)
FUSE 5 10A (8W-10-33) (8W-10-34)
7 C3
2 C3
CHRYSLER
DODGE/ PYLMOUTH
L94 20 OR/WT
L324 20 WT/LG
B20 20
B21 21
B23 P18
L94 20 OR/WT
L324 22 WT/LG
L193 20 OR/WT
10
12
HEADLAMP DIMMER SWITCH (PART OF MULTI-FUNCTION SWITCH)
9
8
L93 22 PK
Z1 18 BK
33 C3
JUNCTION BLOCK
(8W-12-2)
76 C1
15
HEADLAMP SENSE
BODY CONTROL MODULE (8W-45-5)
12
HIGH/LOW BEAM RELAY CONTROL
COMBINATION FLASHER/ DRL MODULE (8W-50-2)
13
G200
(8W-15-4)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
86
30
LOW BEAM RELAY
(8W-50-2)
85
87
86
30
HIGH BEAM RELAY
(8W-50-2)
85
87
FUSE 6 20A
FUSE 7 15A
FUSE 4 10A
FUSE 5 10A
8 C5
1 C3
1 C5
6 C5
L43 18 VT
L44 20 VT/RD
L33 20 RD
L34 20 RD/OR
L34 20 RD/OR
DODGE/ PYLMOUTH
CHRYSLER
L43 18 VT
L43 18 VT
L44 20 VT/RD
L44 20 VT/RD
L33 20 RD
L33 20 RD
B18 18
B23 P18
L34 20 RD/OR
1
TO BS15
(8W-50-6)
TO RIGHT HEADLAMP
(8W-50-6)
(8W-50-8)
TO LEFT HEADLAMP
(8W-50-6)
TO LEFT HIGH HEADLAMP
(8W-50-5)
MESSAGE CENTER
(8W-46-4)
TO RIGHT LOW HEADLAMP
(8W-50-4)
TO FOG LAMP RELAY (IN JB)
(8W-50-5)
DODGE/ PYLMOUTH
CHRYSLER
L34 20 RD/OR
L34 20 RD/OR
TO RIGHT HEADLAMP
(8W-50-6)
(8W-50-8)
TO RIGHT HIGH HEADLAMP
(8W-50-4)

BUILT-UP-EXPORT




ST-RUN A21
(8W-10-16)
RUN A22
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
(8W-10-14)
PTC
1
9A
(8W-12-13)
30
C1
31
C2
F87
18
WT/BK
A22
12
BK/OR
6
C2
1
C4
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
2
10A
FUSE
1
10A
2
C5
10
C5
BUILT-UP
-EXPORT
EXCEPT BUILT
-UP-EXPORT
BUILT-UP
-EXPORT
EXCEPT BUILT
-UP-EXPORT
F14
18
LG/YL
F14
20
LG/YL
F23
18
DB/YL
F23
20
DB/YL
B23
23
B24
24
B23
P18
F14
18
LG/YL
F23
18
DB/YL
1
C2
2
C2
AIRBAG
CONTROL
MODULE
(8W-43-2)

8W-12 JUNCTION BLOCK

Component	Page
A/C Compressor Clutch Relay	8W-12-13
A/C Heater Control	8W-12-9, 12, 23
Airbag Control Module	8W-12-13
Ash Receiver Lamp	8W-12-19, 23
Automatic Day/Night Mirror	8W-12-9
Back-Up Switch	8W-12-12
Body Control Module	8W-12-8, 9, 14, 15, 17, 18, 19, 20, 22, 23, 24, 26
Brake Pressure Switch	8W-12-17
Cigar/Accessory Relay	8W-12-16
Clutch Interlock Switch	8W-12-16
Clutch Interlock Switch Jumper	8W-12-16
Combination Flasher/DRL Module	8W-12-12, 17, 18, 19
Controller Anti-Lock Brake	8W-12-12
Courtesy Lamp Relay	8W-12-22
CS01	8W-12-22
CS02	8W-12-21
CS04	8W-12-9
CS1	8W-12-22
Data Link Connector	8W-12-20
Door Lock Relay	8W-12-15, 19
Door Unlock Relay	8W-12-14, 19
Driver Door Courtesy Lamp	8W-12-22
Driver Door Lock Motor	8W-12-14, 15
Driver Door Lock Switch	8W-12-23
Driver Door Unlock Relay	8W-12-14, 19
Driver Heated Seat Switch	8W-12-12
Driver Power Mirror	8W-12-10, 26
Driver Power Window Switch	8W-12-16, 23
EGR Solenoid	8W-12-13
Electric Wiper De-Icer	8W-12-11
Engine Starter Motor Relay	8W-12-16
ES07	8W-12-13
ES29	8W-12-13
Evap Leak Detection Pump	8W-12-13
Fog Lamp Relay	8W-12-25
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Fuse 1 (JB)	8W-12-8
Fuse 2 (JB)	8W-12-9, 20
Fuse 2 (PDC)	8W-12-13
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Fuse 6 (JB)	8W-12-9
Fuse 6 (PDC)	8W-12-25
Fuse 7 (JB)	8W-12-10
Fuse 8 (JB)	8W-12-11
Fuse 9 (JB)	8W-12-11
Fuse 10 (JB)	8W-12-16
Fuse 11 (JB)	8W-12-11
Fuse 12 (JB)	8W-12-12
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G300	8W-12-11, 19, 26
Glove Box Lamp	8W-12-21
Headlamp Dimmer Switch	8W-12-18, 25
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Headlamp Washer	8W-12-24
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HS2	8W-12-12
HS4	8W-12-12
Ignition Switch	8W-12-17, 19, 20
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Key-In Halo Lamp	8W-12-19, 22, 26
Left Combination Relay	8W-12-18
Left Fog Lamp	8W-12-8, 25
Left Front Park/Turn Signal Lamp	8W-12-8, 18
Left Liftgate Flood Lamp	8W-12-22
Left Low Headlamp	8W-12-25
Left Rear Lamp Assembly	8W-12-8, 18
Left Rear Sliding Door Contact	8W-12-14, 15
Left Repeater Lamp	8W-12-18
Left Stop/Turn Signal Relay	8W-12-18
License Lamp	8W-12-8
Liftgate Lock Motor	8W-12-14, 15
Low Beam Relay	8W-12-25
Message Center	8W-12-9, 17, 18, 19, 20
Name Brand Speaker Relay	8W-12-11, 19
Overhead Console	8W-12-9
Park Brake Switch	8W-12-17
Park Lamp Relay	8W-12-8, 24
Passenger Door Courtesy Lamp	8W-12-22
Passenger Door Lock Motor	8W-12-14, 15
Passenger Door Lock Switch	8W-12-23
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Passenger Power Mirror	8W-12-10, 26
Passenger Power Window Switch	8W-12-16, 23
Power Distribution Center	8W-8, 12-12, 13, 16, 17, 24, 25, 26
Power Folding Mirror Switch	8W-12-19, 26
Power Mirror Fold Relay	8W-12-26
Power Mirror Switch	8W-12-19, 21, 23
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Powertrain Control Module	8W-12-13
PTC 1 (JB)	8W-12-13
PTC 3 (JB)	8W-12-14, 15, 24
PTC 7 (JB)	8W-12-16, 24
PTC 8 (JB)	8W-12-16
PTC 9 (JB)	8W-12-16
Radio	8W-12-11, 20, 23
Radio Choke	8W-12-11
Rear A/C Heater Unit	8W-12-11
Rear Blower Front Control Switch	8W-12-23
Rear Blower Rear Control Switch	8W-12-23
Rear Washer Motor	8W-12-16
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Rear Wiper Motor	8W-12-9
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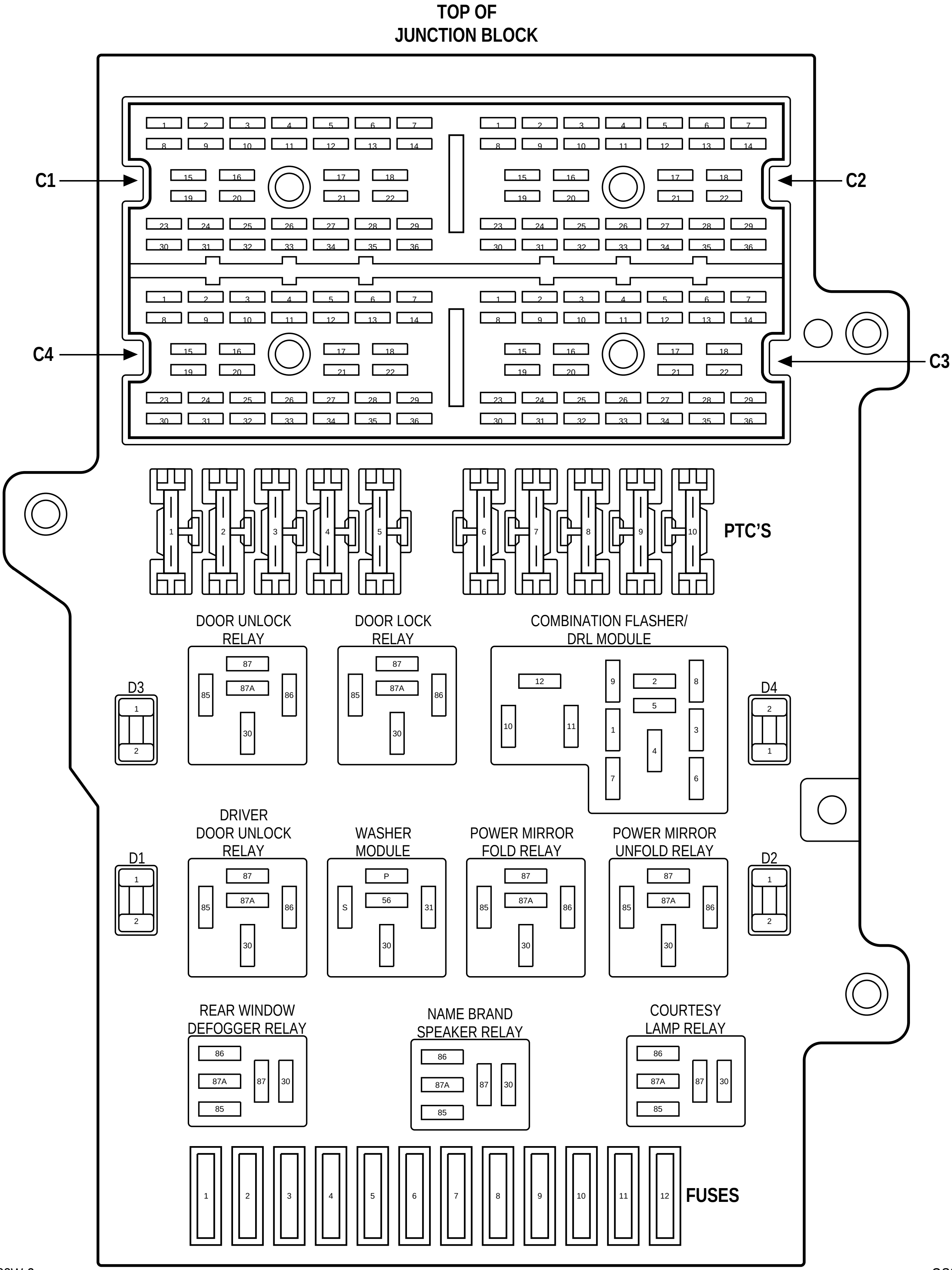
Right Combination Relay	8W-12-18
Right Fog Lamp	8W-12-8, 25
Right Front Park/Turn Signal Lamp	8W-12-8, 18
Right Liftgate Flood Lamp	8W-12-22
Right Rear Lamp Assembly	8W-12-8, 18
Right Rear Sliding Door Contact	8W-12-14, 15
Right Repeater Lamp	8W-12-18
Right Stop/Turn Signal Relay	8W-12-18
Sentry Key Immobilizer Module	8W-12-13, 21
Stop Lamp Switch	8W-12-19
Traction Control Switch	8W-12-19, 23
Trailer Tow Connector	8W-12-8
Transmission Control Module	8W-12-9, 16
Transmission Range Sensor	8W-12-12
Turn Signal/Hazard Switch	8W-12-17
Universal Garage Door Opener	8W-12-23
Washer Module	8W-12-8, 15, 16, 23


TOP OF
JUNCTION BLOCK
C1
C2
C3
C4
PTC'S
DOOR UNLOCK
RELAY
DOOR LOCK
RELAY
COMBINATION FLASHER/
DRL MODULE
D3
D4
DRIVER
DOOR UNLOCK
RELAY
WASHER
MODULE
POWER MIRROR
FOLD RELAY
POWER MIRROR
UNFOLD RELAY
D1
D2
REAR WINDOW
DEFOGGER RELAY
NAME BRAND
SPEAKER RELAY
COURTESY
LAMP RELAY
FUSES

FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	10A	INTERNAL	L78 20DG/YL L78 20DG/YL
2	10A	F11 20RD/WT	A81 20DG/RD A21 12DB
3	15A	L78 20DG/YL L78 20DG/YL	L7 12BK/YL
4 ■	15A	F39 18PK/LG F39 18PK/LG	L7 12BK/YL
5	15A	INTERNAL	L7 12BK/YL
6	20A	INTERNAL	A21 12DB
7	10A	C16 20LB/YL C16 20LB/YL	INTERNAL
8	10A	INTERNAL	INTERNAL
9	15A	V20 18RD	INTERNAL
10	10A	F45 20YL/RD	A41 12YL
11	20A	C40 12BR/WT	A22 12BK/OR
12	10A	INTERNAL	A22 12BK/OR

PTC'S
(POSITIVE TEMPERATURE COEFFICIENT)

PTC NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	9A	INTERNAL	INTERNAL
2	-	-	-
3	9A	INTERNAL	INTERNAL
4	-	-	-
5	-	-	-
6	-	-	-
7	9A	INTERNAL	INTERNAL
8	9A	INTERNAL	INTERNAL
9	9A	F21 12TN	INTERNAL
10	-	-	-

■ FOG LAMPS

COMBINATION FLASHER/DRL MODULE

CAVITY	CIRCUIT	FUNCTION
1	L9 18BK/WT	FUSED B (+)
2	L61 18LG	LEFT FRONT TURN SIGNAL
3	L60 18TN	RIGHT FRONT TURN SIGNAL
4	INTERNAL	LEFT REAR TURN SIGNAL
5	INTERNAL	RIGHT REAR TURN SIGNAL
6	INTERNAL	FUSED IGNITION (RUN)
7	L305 22LB/WT	LEFT TURN SIGNAL SENSE
8	L302 22LB/YL	RIGHT TURN SIGNAL SENSE
9	L91 20DB/PK L91 22DB/PK	COMBINATION FLASHER SWITCHED GROUND
10	INTERNAL	RED BRAKE WARNING LAMP SENSE
11	INTERNAL	GROUND
12	INTERNAL	HIGH/LOW BEAM RELY CONTROL

COURTESY LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B (+)
85	M111 22BR/WT	COURTESY LAMP RELAY CONTROL
86	INTERNAL	FUSED B (+)
87	INTERNAL	COURTESY LAMP RELAY OUTPUT
-	-	-

DOOR LOCK RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	DOOR LOCK RELAY OUTPUT
85	INTERNAL	DOOR LOCK RELAY CONTROL
86	INTERNAL	FUSED B (+)
87	INTERNAL	FUSED B (+)
87A	INTERNAL	GROUND

DOOR UNLOCK RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	DOOR UNLOCK RELAY OUTPUT
85	INTERNAL	DOOR UNLOCK RELAY CONTROL
86	INTERNAL	FUSED B (+)
87	INTERNAL	FUSED B (+)
87A	INTERNAL	GROUND

DRIVER DOOR UNLOCK RELAY

CAVITY	CIRCUIT	FUNCTION
30	F131 20BK/PK	LEFT FRONT DOOR UNLOCK RELAY OUTPUT
85	INTERNAL	LEFT FRONT DOOR UNLOCK RELAY CONTROL
86	INTERNAL	FUSED B (+)
87	INTERNAL	FUSED B (+)
87A	INTERNAL	GROUND

FOG LAMP RELAY*

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED LOW BEAM RELAY OUTPUT
85	L94 20OR/WT	FOG LAMP RELAYCONTROL
86	INTERNAL	FUSED LOW BEAM RELAY OUTPUT
87	INTERNAL	FOG LAMP RELAY OUTPUT
87A	-	-

NAME BRAND SPEAKER RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED IGNITION (RUN-ACC)
85	INTERNAL	GROUND
86	X60 20RD/DG	NAME BRAND SPEAKER RELAY DRIVER
87	X1 16DG/RD	NAME BRAND SPEAKER RELAY OUTPUT
-	-	-

* CHRYSLER

POWER MIRROR FOLD RELAY (BUILT-UP-EXPORT)

CAVITY	CIRCUIT	FUNCTION
30	P160 20LB P160 20LB	POWER MIRROR FOLD OUTPUT
85	P171 20VT/WT	POWER MIRROR FOLD OUTPUT
86	INTERNAL	FUSED B (+)
87	INTERNAL	FUSED B (+)
87A	INTERNAL	GROUND

POWER MIRROR UNFOLD RELAY (BUILT-UP-EXPORT)

CAVITY	CIRCUIT	FUNCTION
30	P159 20DG P159 20DG	POWER MIRROR UNFOLD OUTPUT
85	P174 20YL/RD	POWER MIRROR UNFOLD OUTPUT
86	INTERNAL	FUSED B (+)
87	INTERNAL	FUSED B (+)
87A	INTERNAL	GROUND

REAR WINDOW DEFOGGER RELAY

CAVITY	CIRCUIT	FUNCTION
30	A4 12BK/RD	FUSED B (+)
85	C14 22WT/RD	REAR WINDOW DEFOGGER RELAY CONTROL
86	INTERNAL	FUSED IGNITION (RUN)
87	INTERNAL	REAR WINDOW DEFOGGER RELAY OUTPUT
-	-	-

WASHER MODULE
(BUILT-UP-EXPORT)

CAVITY	CIRCUIT	FUNCTION
30	V53 18RD/YL	WASHER MODULE OUTPUT
31	INTERNAL	WASHER MODULE CONTROL
56	INTERNAL	FUSED PARK LAMP RELAY OUTPUT
P	INTERNAL	FUSED B(+)
S	INTERNAL	FUSED IGNITION (RUN-ACC)

DIODES

D1

CAVITY	CIRCUIT	ORIENTATION
1	INTERNAL	ANODE (+)
2	INTERNAL	CATHODE

D2
(NOT USED)

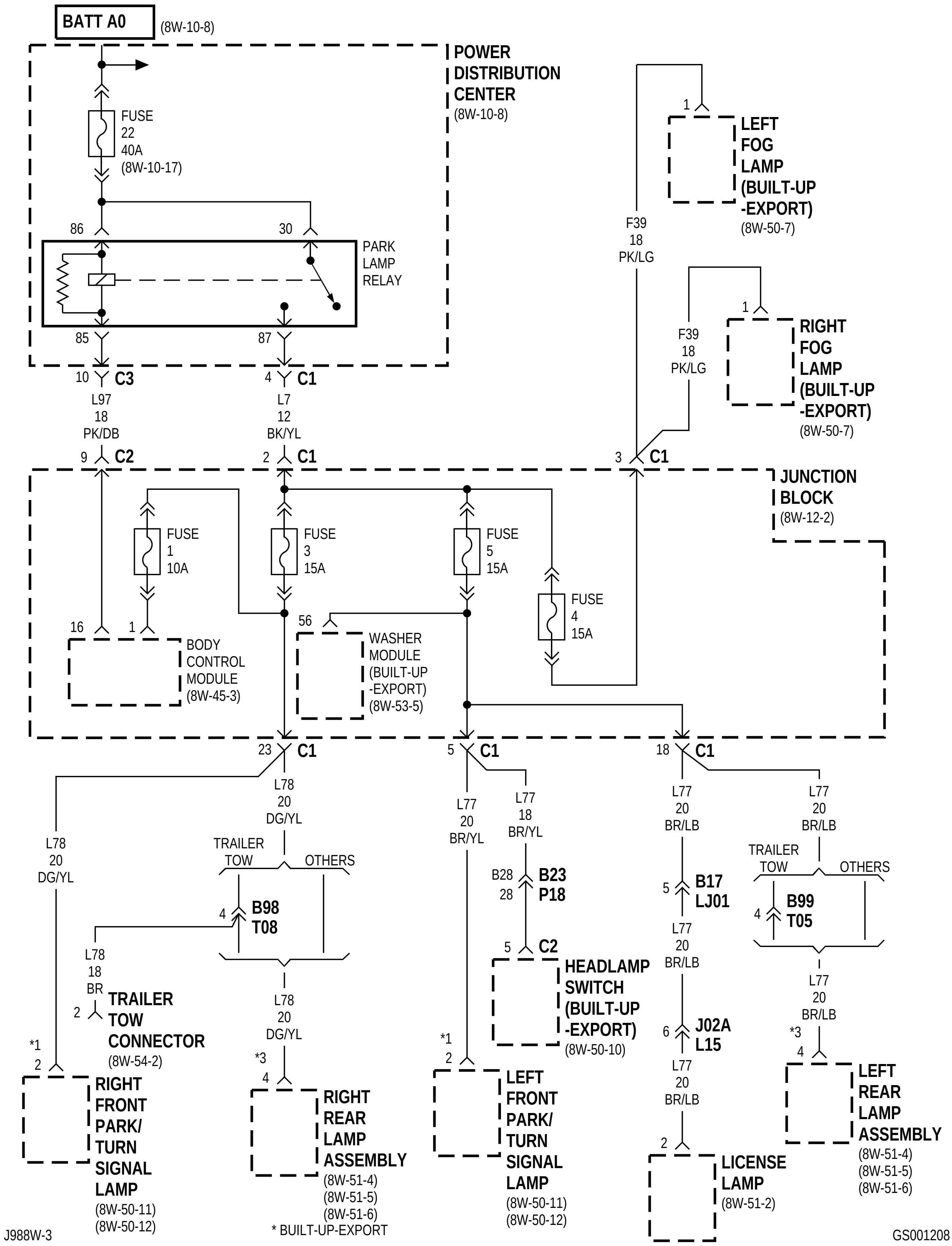
CAVITY	CIRCUIT	ORIENTATION
1	-	ANODE (+)
2	-	CATHODE

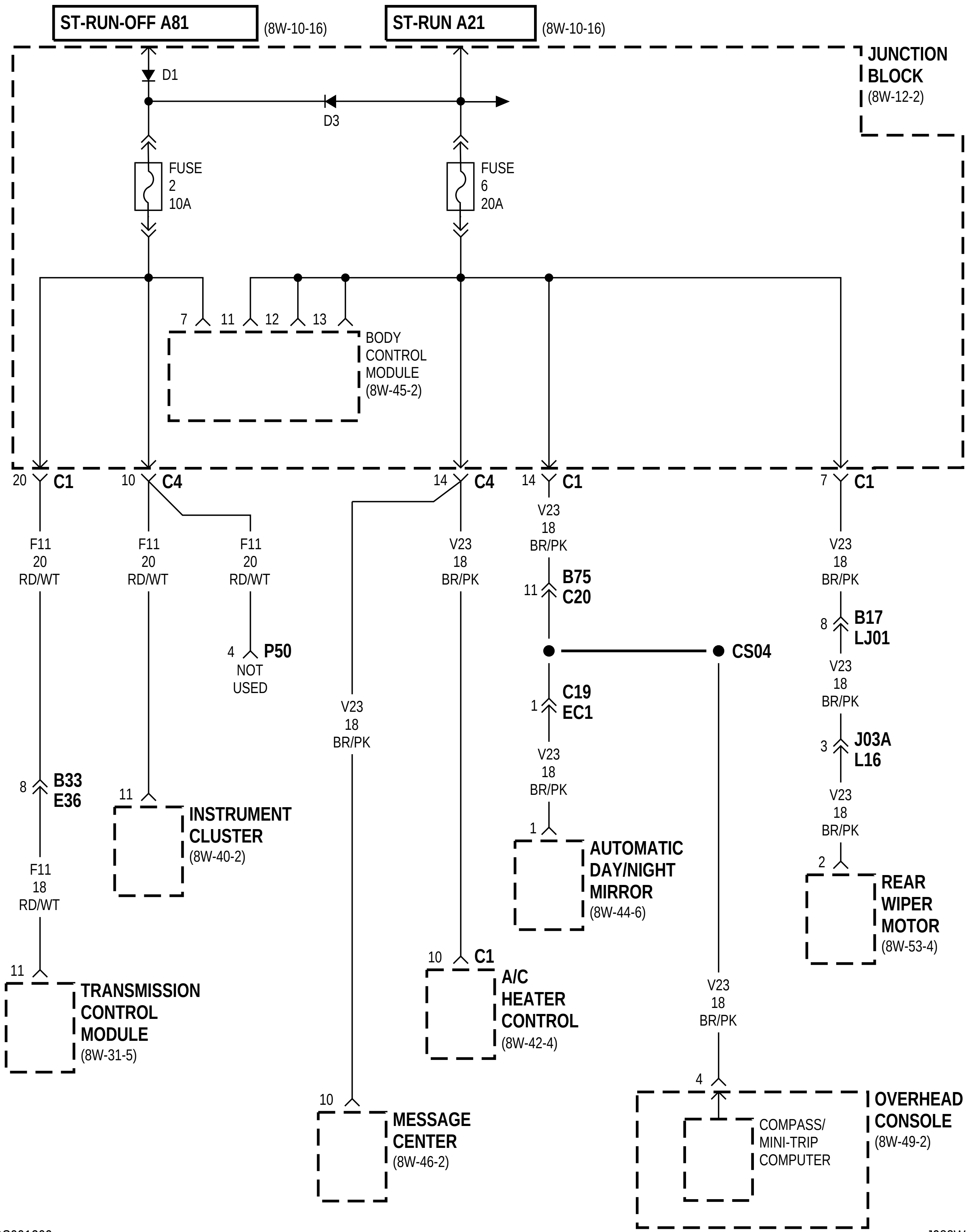
D3

CAVITY	CIRCUIT	ORIENTATION
1	INTERNAL	ANODE (+)
2	INTERNAL	CATHODE

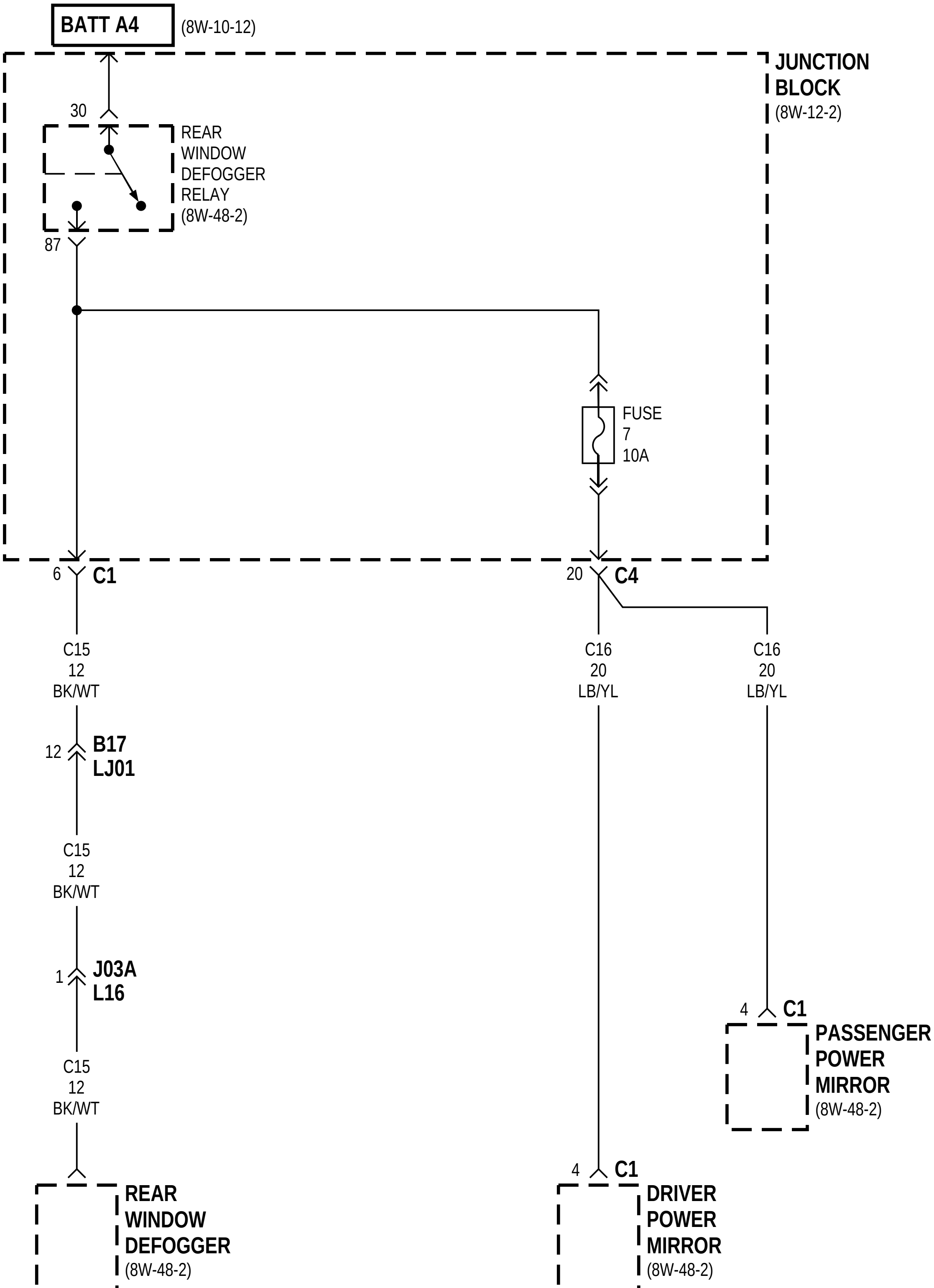
D4

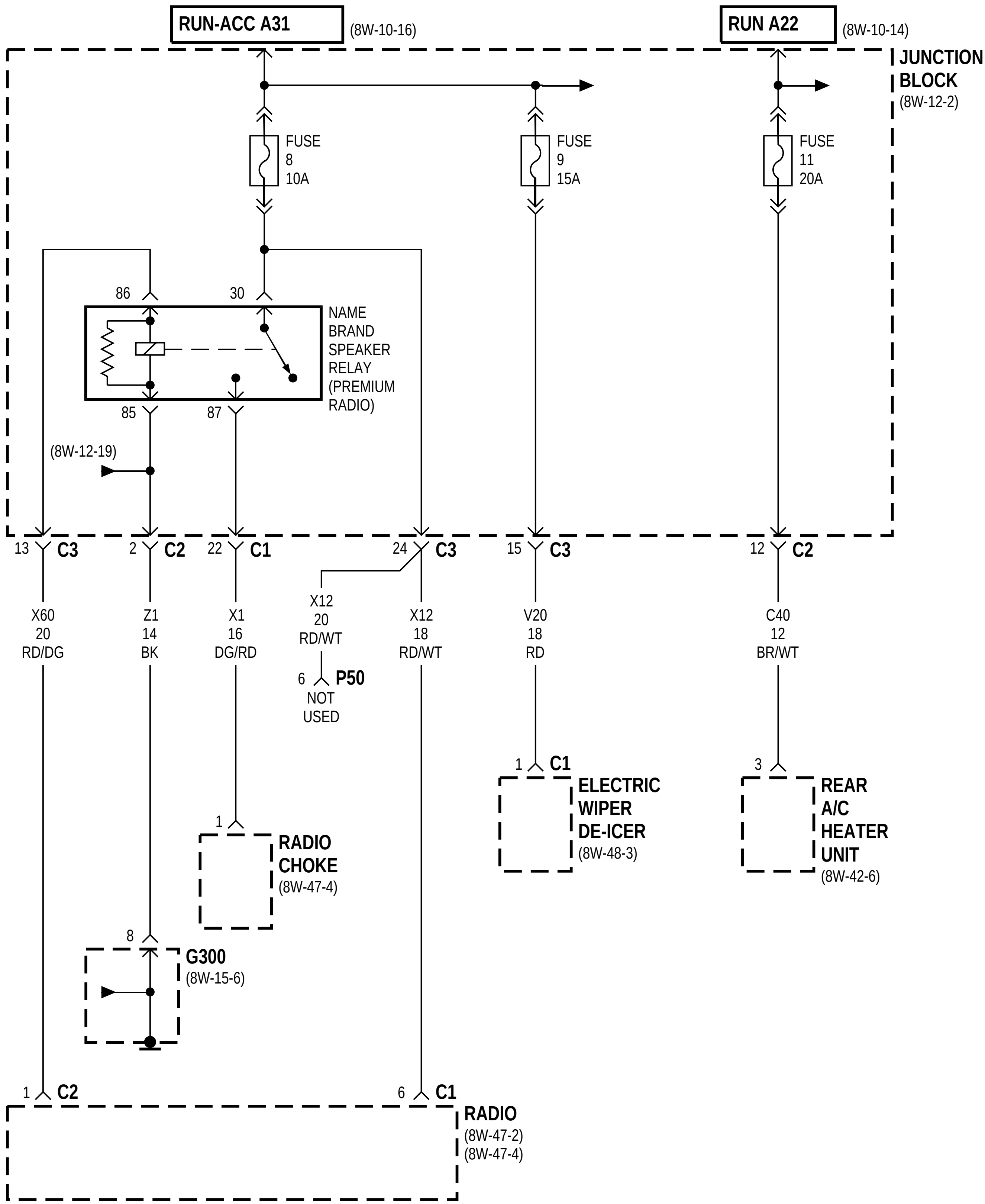
CAVITY	CIRCUIT	ORIENTATION
1	INTERNAL	ANODE (+)
2	INTERNAL	CATHODE

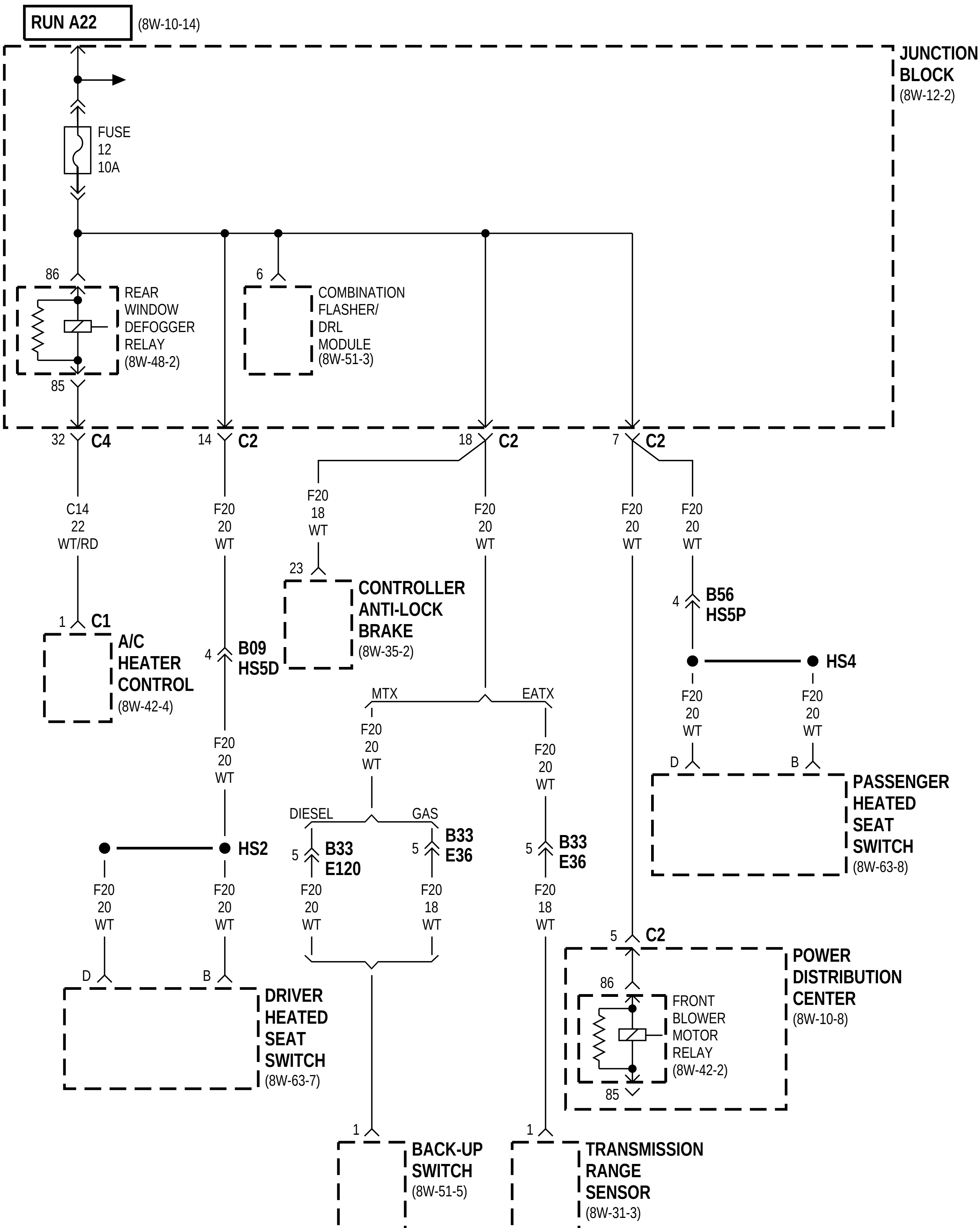

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 22 40A
(8W-10-17)
86
30
PARK LAMP RELAY
85
87
10 C3
4 C1
L97 18 PK/DB
L7 12 BK/YL
9 C2
2 C1
3 C1
F39 18 PK/LG
1
LEFT FOG LAMP (BUILT-UP -EXPORT)
(8W-50-7)
RIGHT FOG LAMP (BUILT-UP -EXPORT)
(8W-50-7)
JUNCTION BLOCK
(8W-12-2)
FUSE 1 10A
FUSE 3 15A
FUSE 5 15A
FUSE 4 15A
16
56
BODY CONTROL MODULE
(8W-45-3)
WASHER MODULE (BUILT-UP -EXPORT)
(8W-53-5)
23 C1
5 C1
18 C1
L78 20 DG/YL
L78 18 BR
L77 20 BR/YL
L77 18 BR/YL
L77 20 BR/LB
TRAILER TOW
OTHERS
4 B98 T08
B28 28 B23 P18
5 B17 LJ01
4 B99 T05
5 C2
6 J02A L15
2
TRAILER TOW CONNECTOR
(8W-54-2)
HEADLAMP SWITCH (BUILT-UP -EXPORT)
(8W-50-10)
*1
*3
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
(8W-50-12)
RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
(8W-51-6)
LEFT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
(8W-50-12)
LICENSE LAMP
(8W-51-2)
LEFT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
(8W-51-6)
J988W-3
* BUILT-UP-EXPORT
GS001208

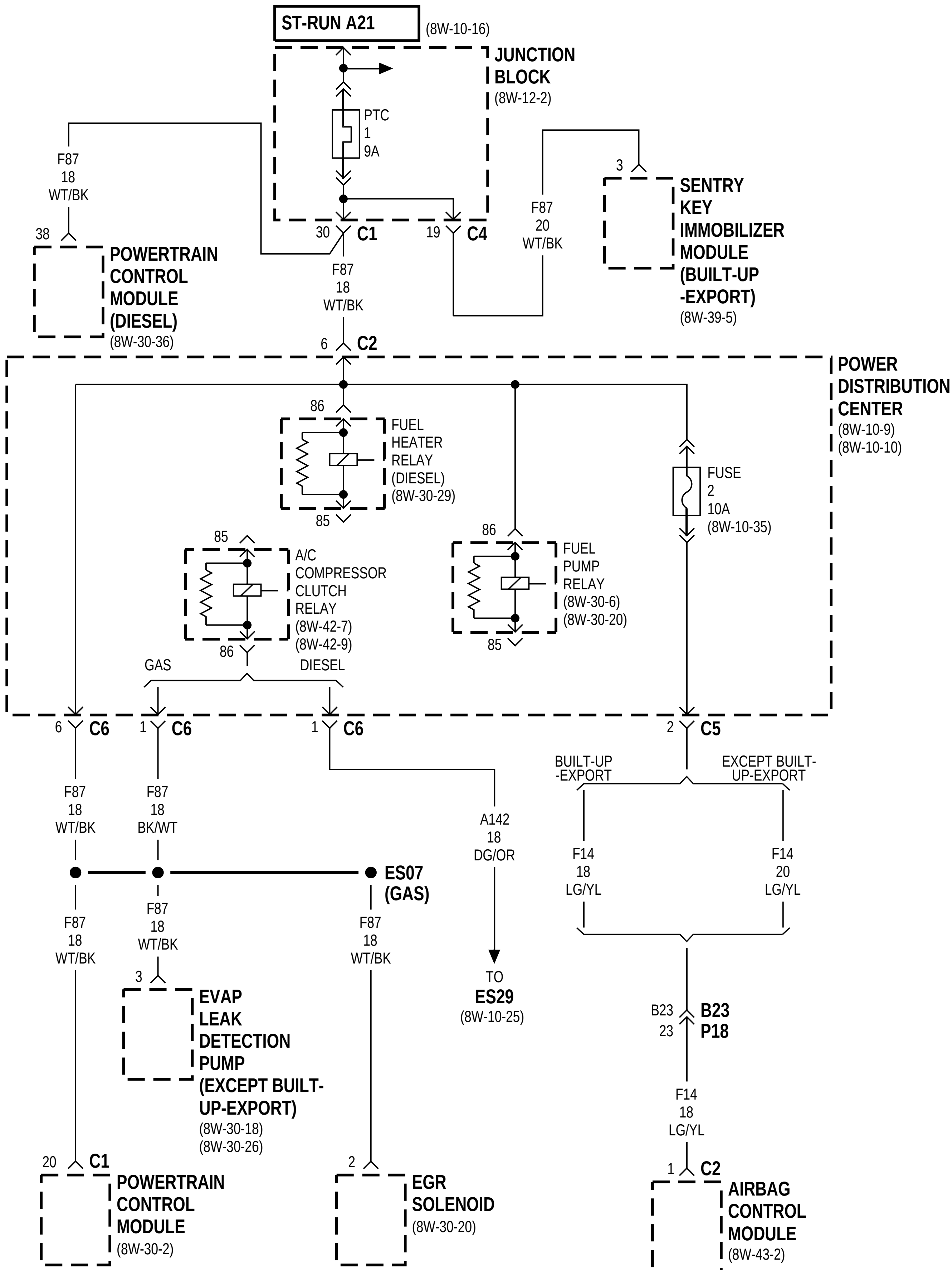


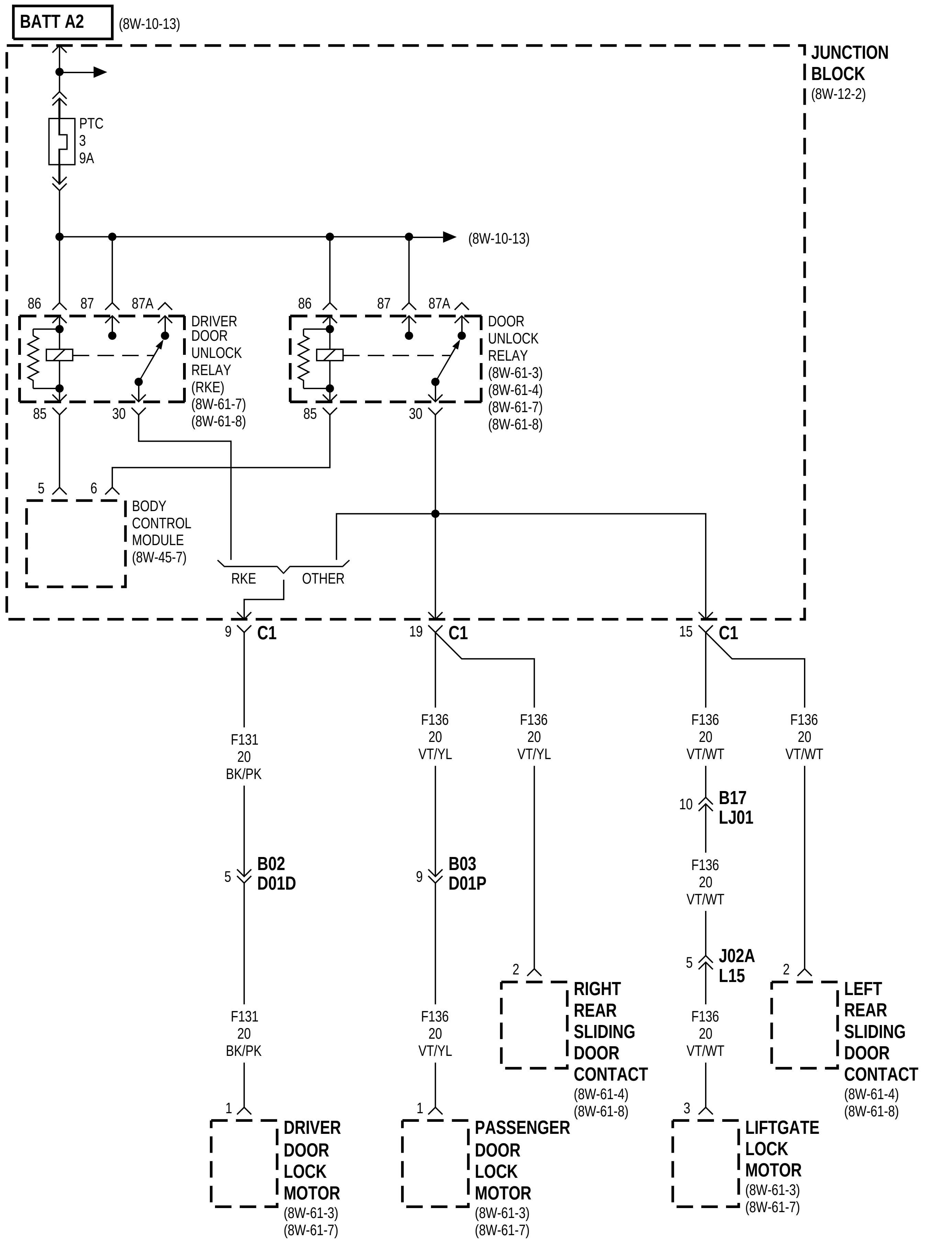
ST-RUN-OFF A81
(8W-10-16)
ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
D3
FUSE 2 10A
FUSE 6 20A
7 11 12 13
BODY CONTROL MODULE
(8W-45-2)
20 C1
10 C4
14 C4
14 C1
7 C1
F11 20 RD/WT
F11 20 RD/WT
F11 20 RD/WT
V23 18 BR/PK
V23 18 BR/PK
V23 18 BR/PK
4 P50
NOT USED
11 B75 C20
CS04
1 C19 EC1
8 B17 LJ01
3 J03A L16
8 B33 E36
F11 18 RD/WT
11
INSTRUMENT CLUSTER
(8W-40-2)
1
AUTOMATIC DAY/NIGHT MIRROR
(8W-44-6)
2
REAR WIPER MOTOR
(8W-53-4)
11
TRANSMISSION CONTROL MODULE
(8W-31-5)
10 C1
A/C HEATER CONTROL
(8W-42-4)
10
MESSAGE CENTER
(8W-46-2)
4
OVERHEAD CONSOLE
(8W-49-2)
COMPASS/ MINI-TRIP COMPUTER

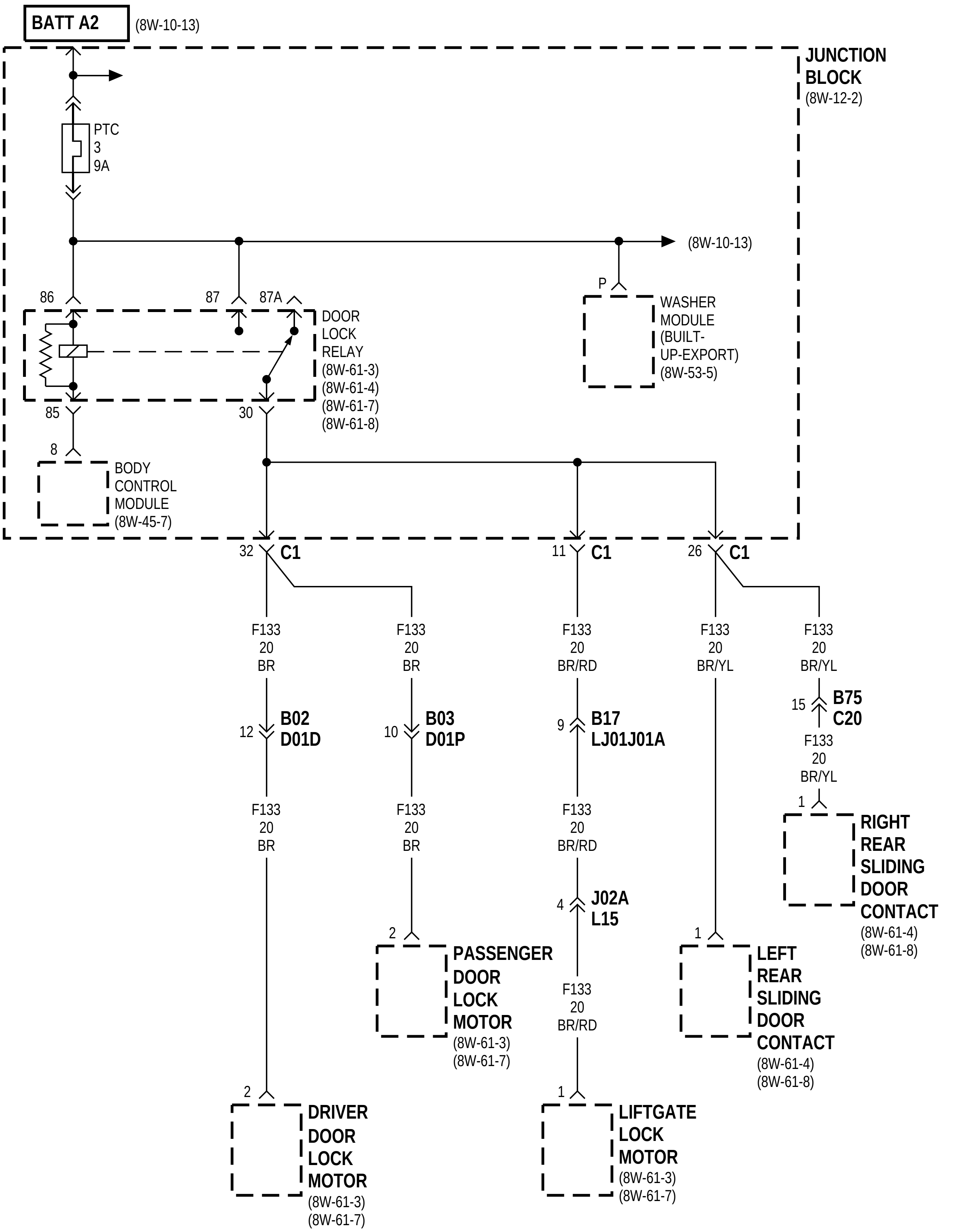

BATT A4
(8W-10-12)
JUNCTION
BLOCK
(8W-12-2)
30
REAR
WINDOW
DEFOGGER
RELAY
(8W-48-2)
87
FUSE
7
10A
6
C1
20
C4
C15
12
BK/WT
C16
20
LB/YL
C16
20
LB/YL
12
B17
LJ01
C15
12
BK/WT
1
J03A
L16
C15
12
BK/WT
4
C1
PASSENGER
POWER
MIRROR
(8W-48-2)
REAR
WINDOW
DEFOGGER
(8W-48-2)
4
C1
DRIVER
POWER
MIRROR
(8W-48-2)

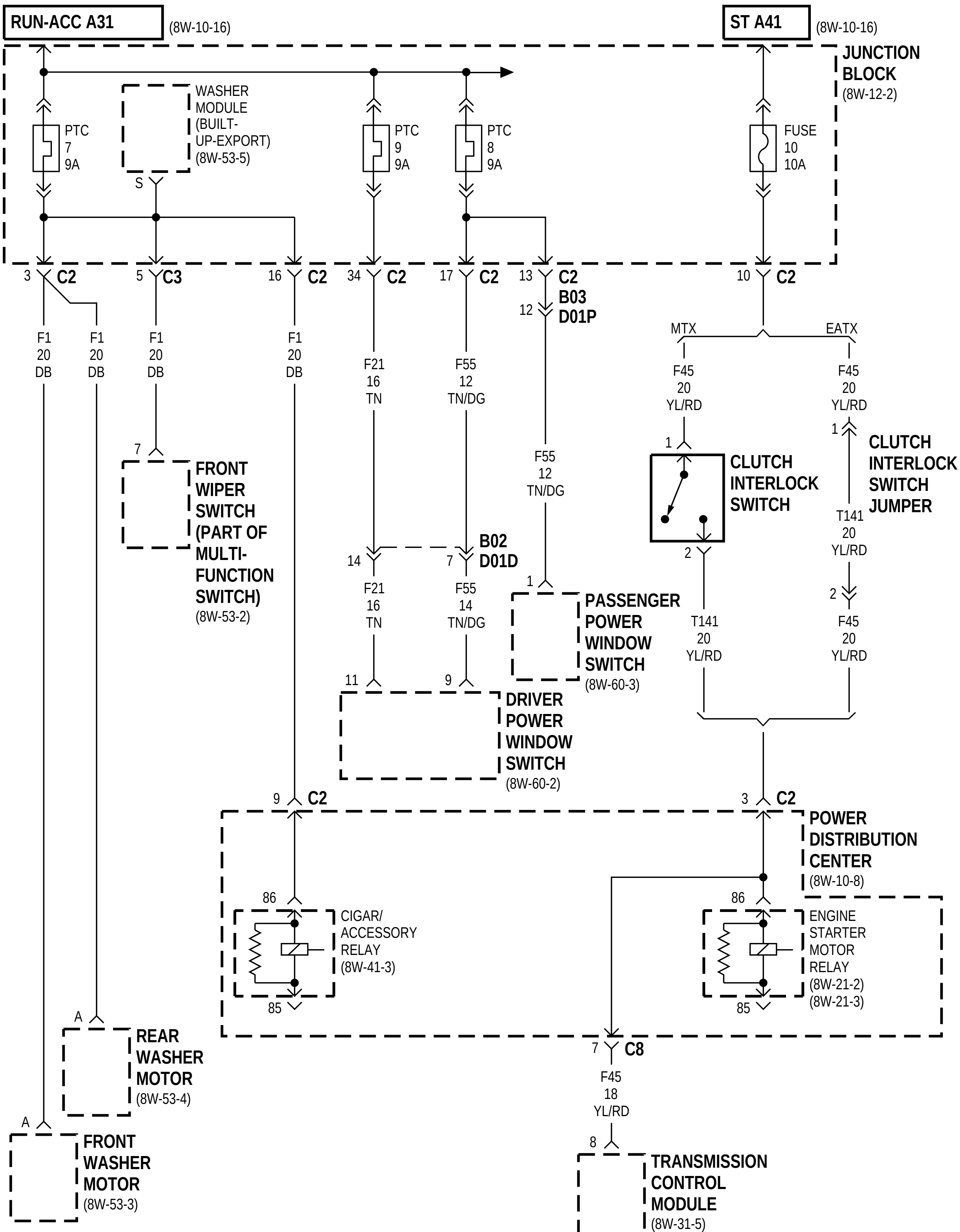

RUN-ACC A31
(8W-10-16)
RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 8 10A
FUSE 9 15A
FUSE 11 20A
86
30
85
87
NAME BRAND SPEAKER RELAY (PREMIUM RADIO)
(8W-12-19)
13 C3
2 C2
22 C1
24 C3
15 C3
12 C2
X60 20 RD/DG
Z1 14 BK
X1 16 DG/RD
X12 20 RD/WT
X12 18 RD/WT
V20 18 RD
C40 12 BR/WT
6 P50
NOT USED
1 C1
ELECTRIC WIPER DE-ICER
(8W-48-3)
3
REAR A/C HEATER UNIT
(8W-42-6)
1
RADIO CHOKE
(8W-47-4)
8
G300
(8W-15-6)
1 C2
6 C1
RADIO
(8W-47-2)
(8W-47-4)


RUN A22
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
FUSE
12
10A
86
REAR
WINDOW
DEFOGGER
RELAY
(8W-48-2)
85
6
COMBINATION
FLASHER/
DRL
MODULE
(8W-51-3)
32
C4
14
C2
18
C2
7
C2
C14
22
WT/RD
F20
20
WT
F20
18
WT
23
CONTROLLER
ANTI-LOCK
BRAKE
(8W-35-2)
1
C1
A/C
HEATER
CONTROL
(8W-42-4)
4
B09
HS5D
4
B56
HS5P
HS4
MTX
EATX
D
B
PASSENGER
HEATED
SEAT
SWITCH
(8W-63-8)
DIESEL
GAS
5
B33
E120
5
B33
E36
HS2
F20
18
WT
5
C2
86
FRONT
BLOWER
MOTOR
RELAY
(8W-42-2)
85
POWER
DISTRIBUTION
CENTER
(8W-10-8)
DRIVER
HEATED
SEAT
SWITCH
(8W-63-7)
1
BACK-UP
SWITCH
(8W-51-5)
1
TRANSMISSION
RANGE
SENSOR
(8W-31-3)


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC 1 9A
F87 18 WT/BK
38
POWERTRAIN CONTROL MODULE (DIESEL)
(8W-30-36)
30 C1
19 C4
F87 20 WT/BK
3
SENTRY KEY IMMOBILIZER MODULE (BUILT-UP -EXPORT)
(8W-39-5)
F87 18 WT/BK
6 C2
POWER DISTRIBUTION CENTER
(8W-10-9)
(8W-10-10)
86
FUEL HEATER RELAY (DIESEL)
(8W-30-29)
85
FUSE 2 10A
(8W-10-35)
85
A/C COMPRESSOR CLUTCH RELAY
(8W-42-7)
(8W-42-9)
86
86
FUEL PUMP RELAY
(8W-30-6)
(8W-30-20)
85
GAS
DIESEL
6 C6
1 C6
1 C6
2 C5
BUILT-UP -EXPORT
EXCEPT BUILT-UP-EXPORT
F87 18 WT/BK
F87 18 BK/WT
A142 18 DG/OR
F14 18 LG/YL
F14 20 LG/YL
ES07 (GAS)
F87 18 WT/BK
F87 18 WT/BK
F87 18 WT/BK
TO ES29
(8W-10-25)
B23 23
B23 P18
3
EVAP LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)
(8W-30-18)
(8W-30-26)
F14 18 LG/YL
20 C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
2
EGR SOLENOID
(8W-30-20)
1 C2
AIRBAG CONTROL MODULE
(8W-43-2)


BATT A2
(8W-10-13)
JUNCTION
BLOCK
(8W-12-2)
PTC
3
9A
(8W-10-13)
86
87
87A
DRIVER
DOOR
UNLOCK
RELAY
(RKE)
(8W-61-7)
(8W-61-8)
85
30
86
87
87A
DOOR
UNLOCK
RELAY
(8W-61-3)
(8W-61-4)
(8W-61-7)
(8W-61-8)
85
30
5
6
BODY
CONTROL
MODULE
(8W-45-7)
RKE
OTHER
9
C1
19
C1
15
C1
F131
20
BK/PK
F136
20
VT/YL
F136
20
VT/YL
F136
20
VT/WT
F136
20
VT/WT
10
B17
LJ01
5
B02
D01D
9
B03
D01P
F136
20
VT/WT
5
J02A
L15
2
RIGHT
REAR
SLIDING
DOOR
CONTACT
(8W-61-4)
(8W-61-8)
2
LEFT
REAR
SLIDING
DOOR
CONTACT
(8W-61-4)
(8W-61-8)
F131
20
BK/PK
F136
20
VT/YL
F136
20
VT/WT
1
DRIVER
DOOR
LOCK
MOTOR
(8W-61-3)
(8W-61-7)
1
PASSENGER
DOOR
LOCK
MOTOR
(8W-61-3)
(8W-61-7)
3
LIFTGATE
LOCK
MOTOR
(8W-61-3)
(8W-61-7)


BATT A2
(8W-10-13)
JUNCTION BLOCK
(8W-12-2)
PTC
3
9A
(8W-10-13)
86
87
87A
DOOR LOCK RELAY
(8W-61-3)
(8W-61-4)
(8W-61-7)
(8W-61-8)
85
30
P
WASHER MODULE (BUILT-UP-EXPORT)
(8W-53-5)
8
BODY CONTROL MODULE
(8W-45-7)
32 C1
11 C1
26 C1
F133
20
BR
F133
20
BR/RD
F133
20
BR/YL
12 B02 D01D
10 B03 D01P
9 B17 LJ01J01A
15 B75 C20
4 J02A L15
2
PASSENGER DOOR LOCK MOTOR
(8W-61-3)
(8W-61-7)
1
LEFT REAR SLIDING DOOR CONTACT
(8W-61-4)
(8W-61-8)
1
RIGHT REAR SLIDING DOOR CONTACT
(8W-61-4)
(8W-61-8)
2
DRIVER DOOR LOCK MOTOR
(8W-61-3)
(8W-61-7)
1
LIFTGATE LOCK MOTOR
(8W-61-3)
(8W-61-7)



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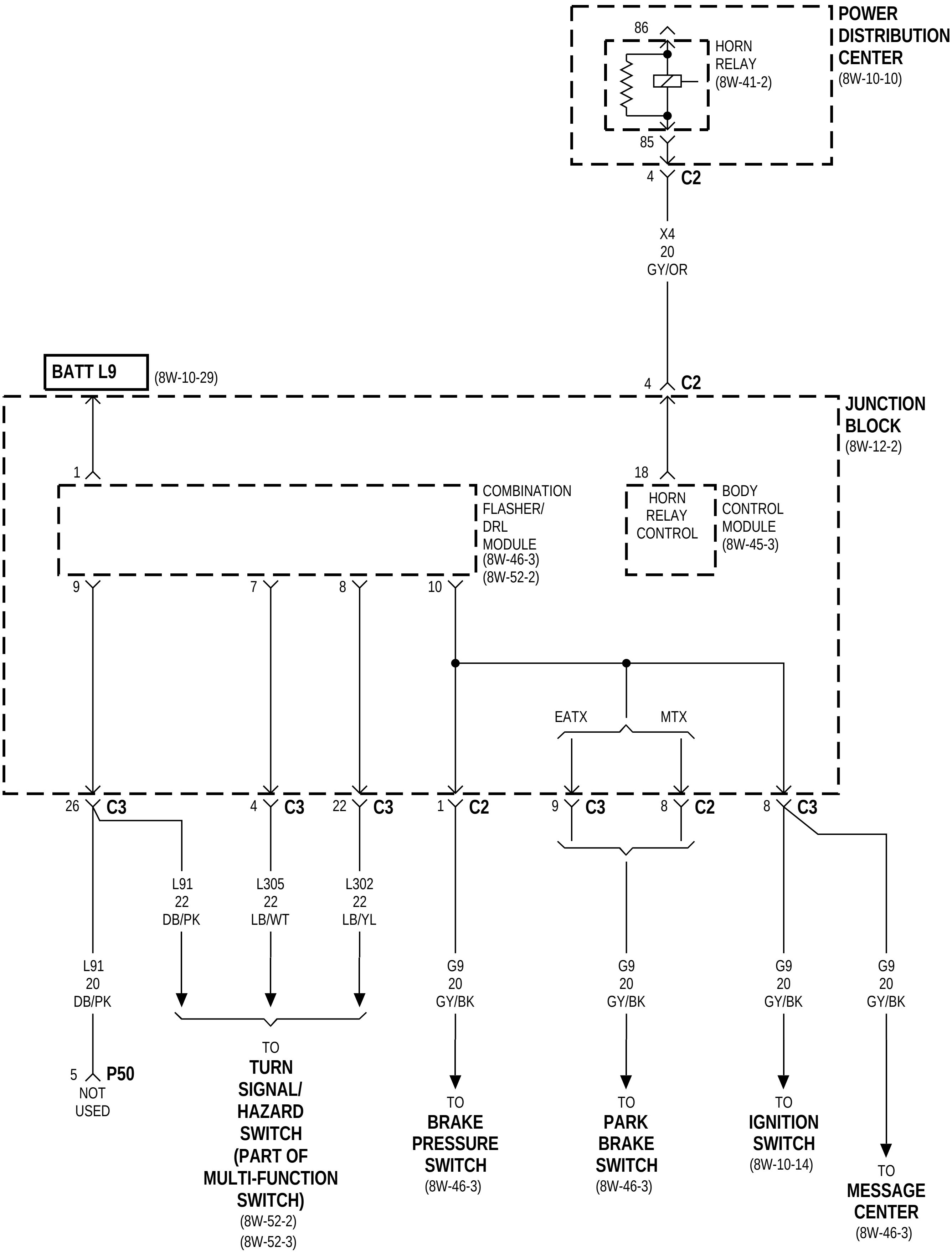
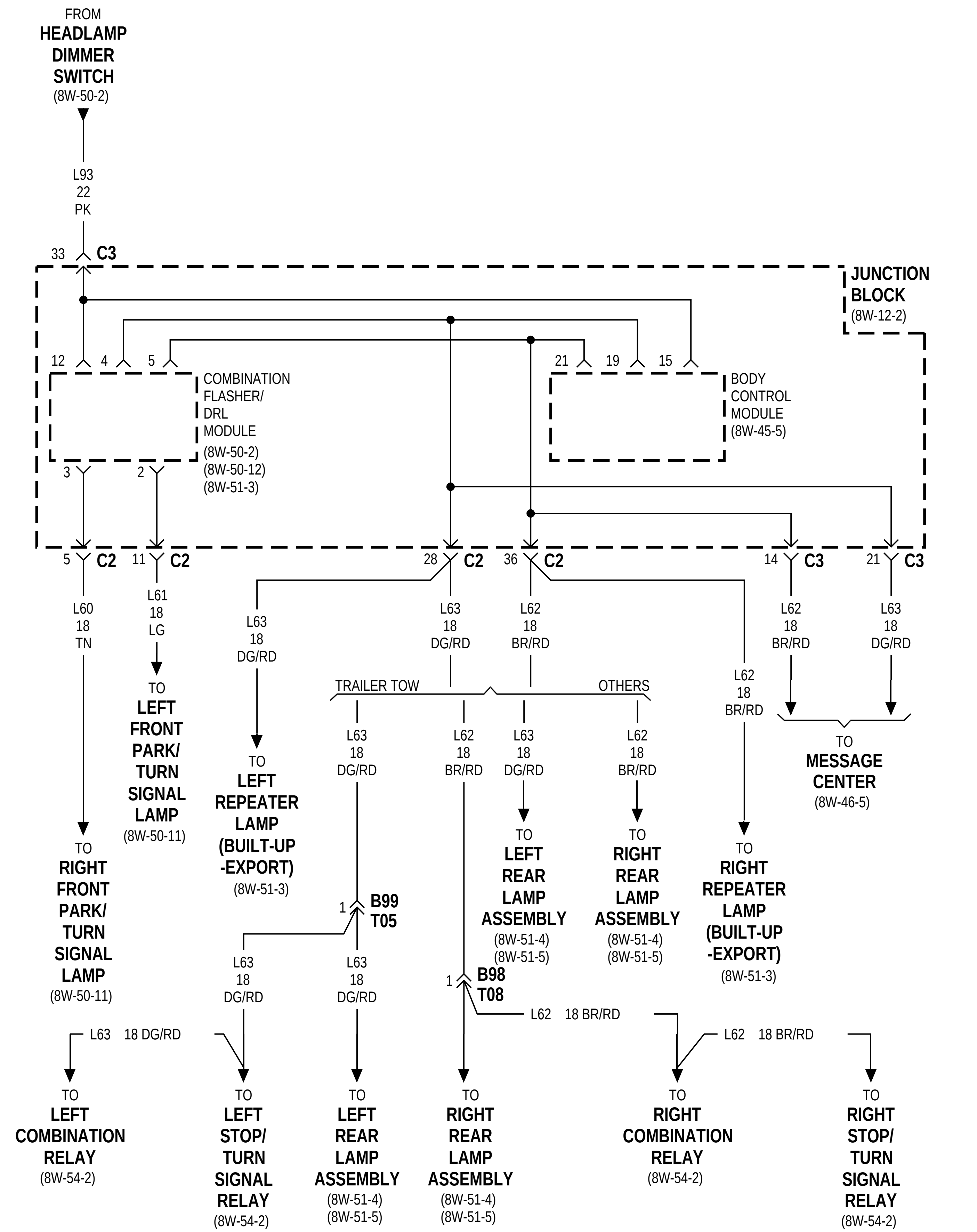
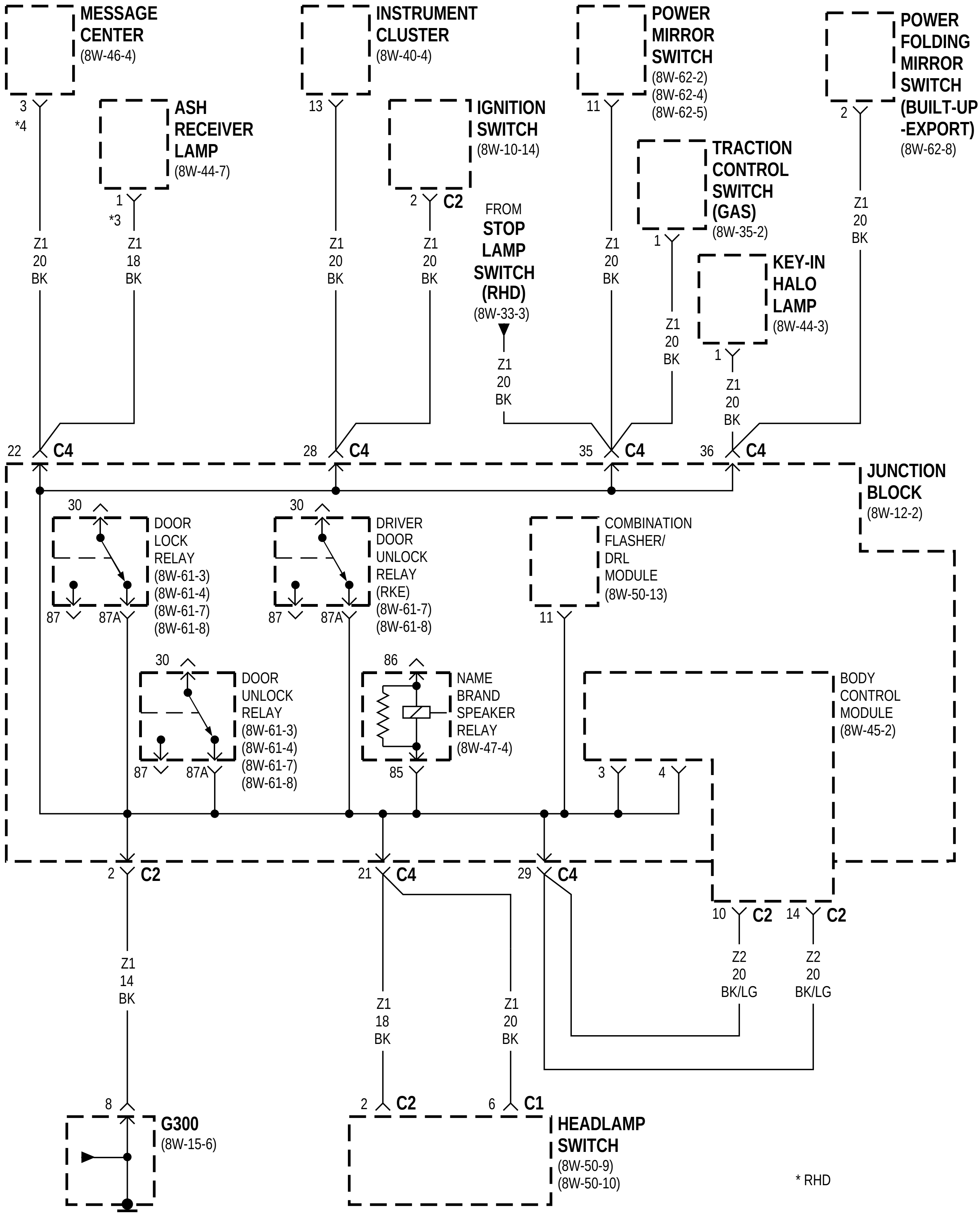
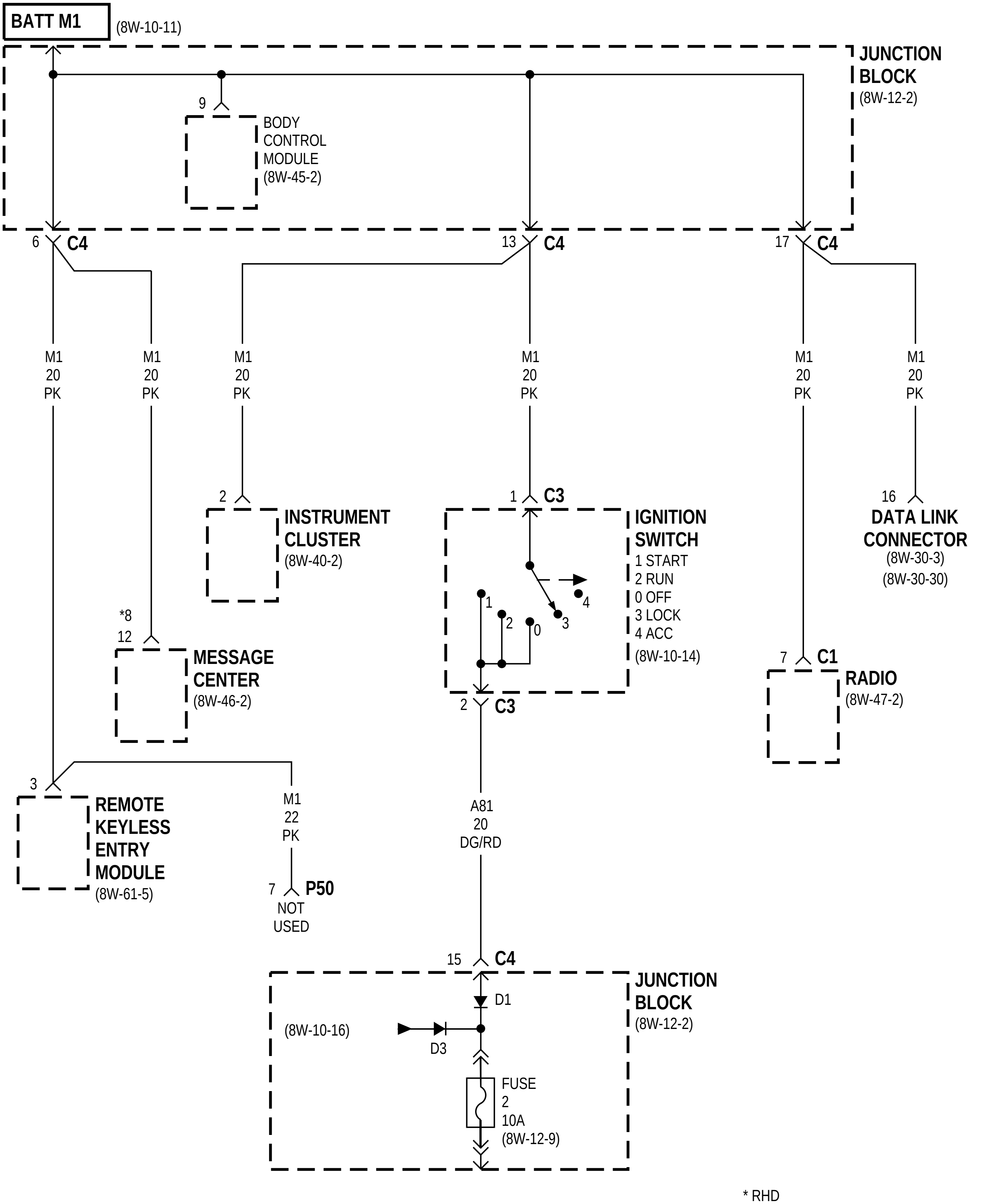
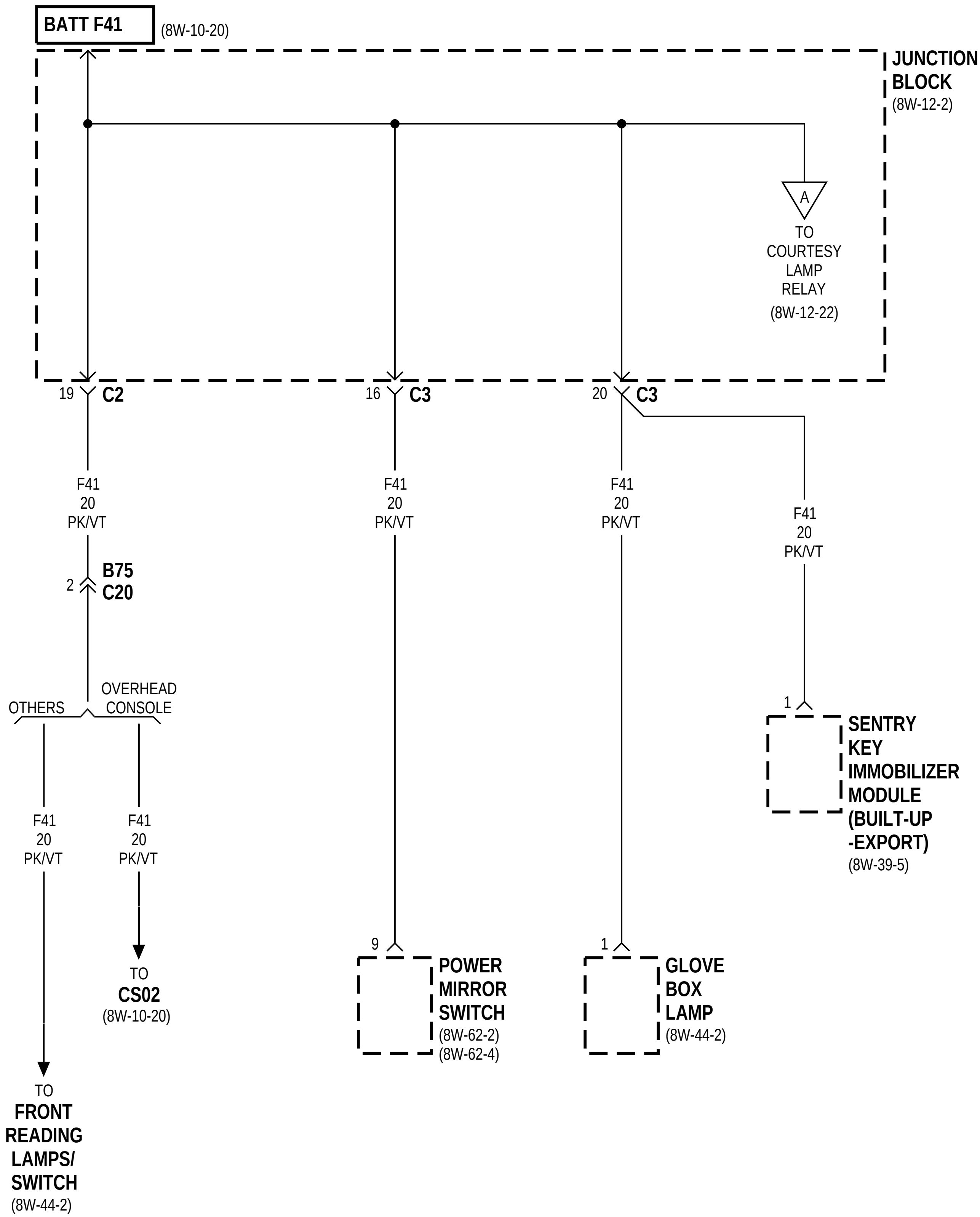
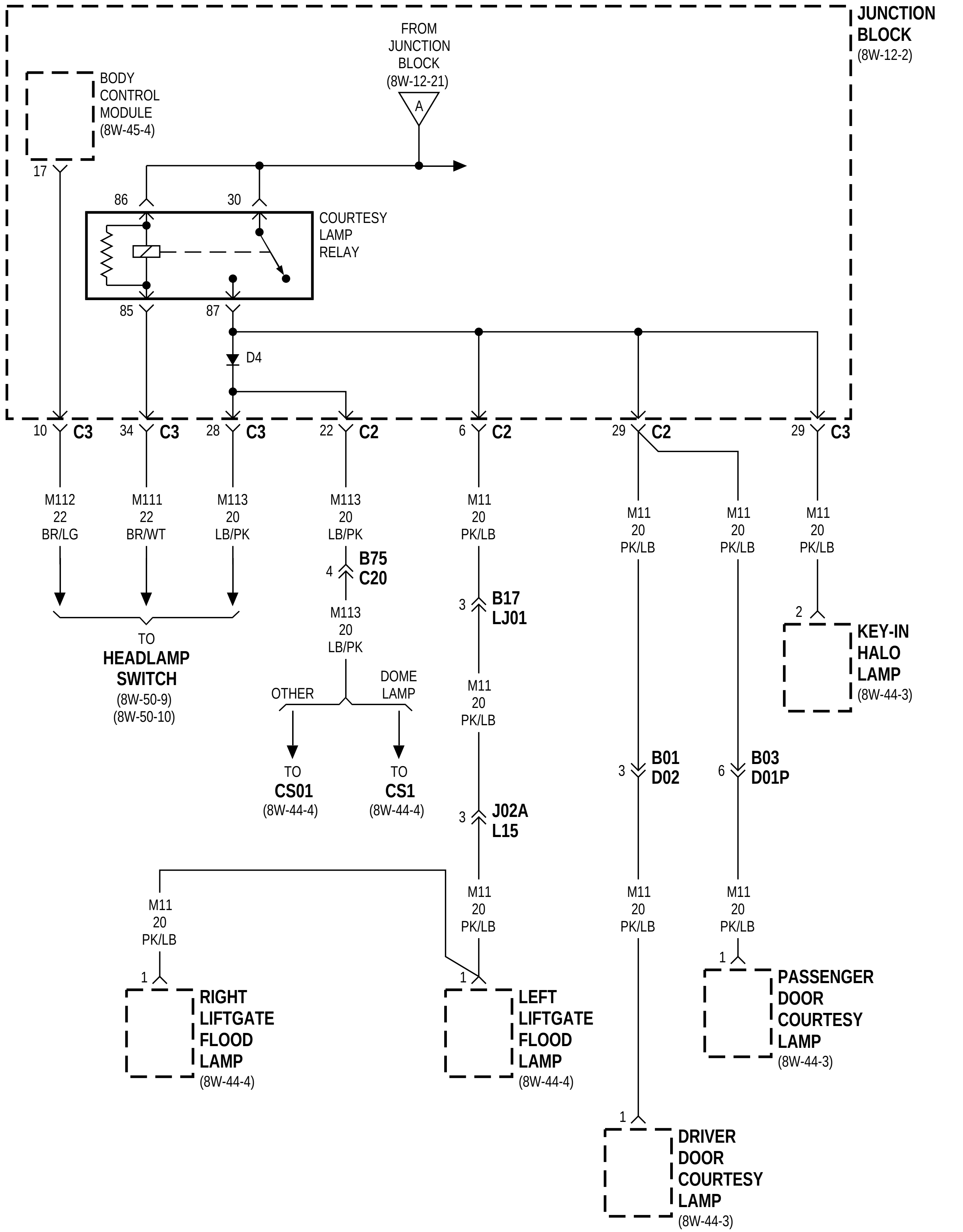

POWER DISTRIBUTION CENTER
(8W-10-10)
86
HORN RELAY
(8W-41-2)
85
4 C2
X4
20
GY/OR
BATT L9
(8W-10-29)
4 C2
JUNCTION BLOCK
(8W-12-2)
1
18
COMBINATION FLASHER/ DRL MODULE
(8W-46-3)
(8W-52-2)
HORN RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
9
7
8
10
EATX
MTX
26 C3
4 C3
22 C3
1 C2
9 C3
8 C2
8 C3
L91
22
DB/PK
L305
22
LB/WT
L302
22
LB/YL
L91
20
DB/PK
G9
20
GY/BK
G9
20
GY/BK
G9
20
GY/BK
G9
20
GY/BK
5 P50
NOT USED
TO TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
(8W-52-3)
TO BRAKE PRESSURE SWITCH
(8W-46-3)
TO PARK BRAKE SWITCH
(8W-46-3)
TO IGNITION SWITCH
(8W-10-14)
TO MESSAGE CENTER
(8W-46-3)

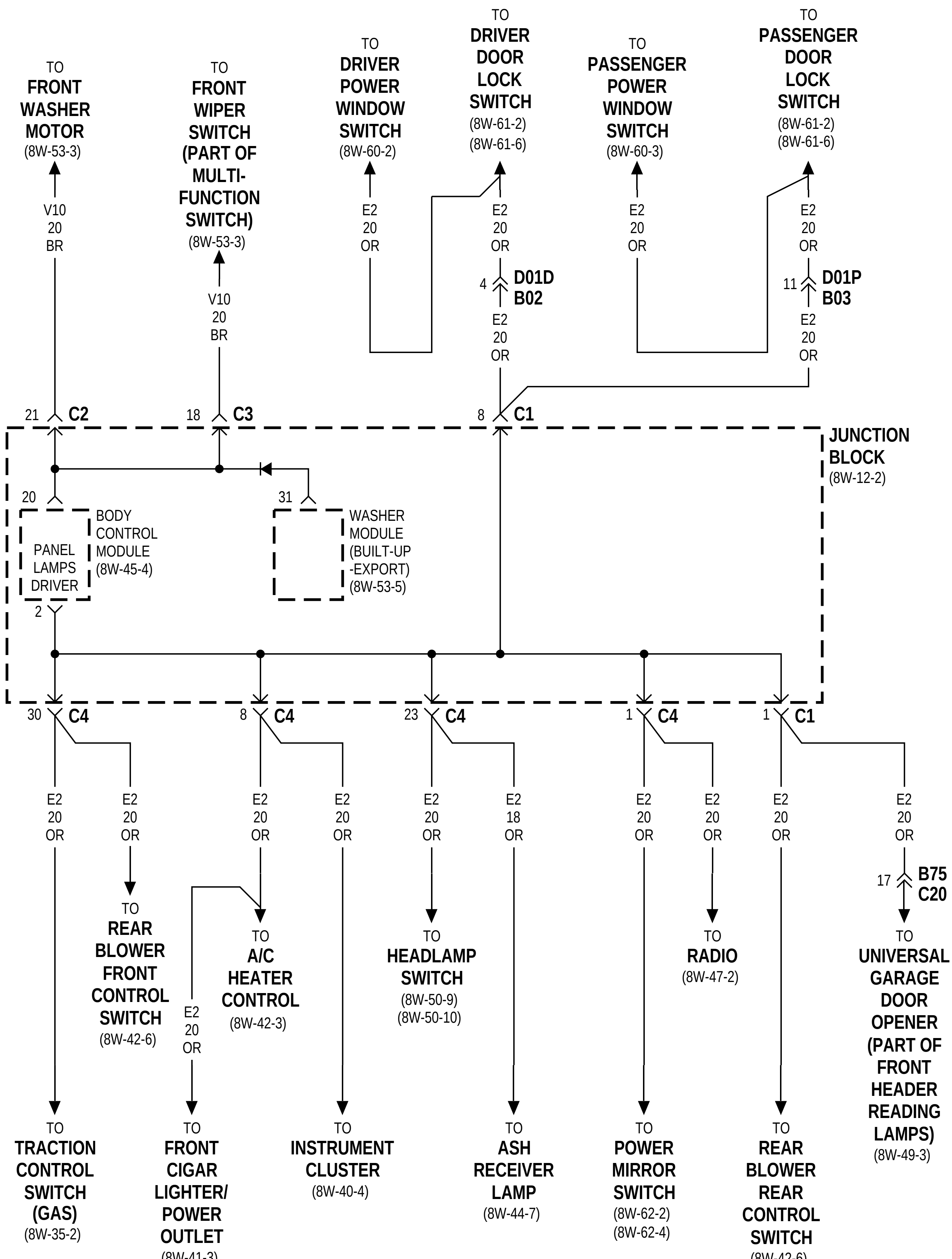

FROM
HEADLAMP DIMMER SWITCH
(8W-50-2)
L93 22 PK
33 C3
JUNCTION BLOCK
(8W-12-2)
12 4 5
COMBINATION FLASHER/ DRL MODULE
(8W-50-2)
(8W-50-12)
(8W-51-3)
3 2
21 19 15
BODY CONTROL MODULE
(8W-45-5)
5 C2
11 C2
28 C2
36 C2
14 C3
21 C3
L60 18 TN
L61 18 LG
L63 18 DG/RD
L63 18 DG/RD
L62 18 BR/RD
L62 18 BR/RD
L62 18 BR/RD
L63 18 DG/RD
TO LEFT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
TO LEFT REPEATER LAMP (BUILT-UP -EXPORT)
(8W-51-3)
TRAILER TOW
OTHERS
L63 18 DG/RD
L62 18 BR/RD
L63 18 DG/RD
L62 18 BR/RD
TO MESSAGE CENTER
(8W-46-5)
TO LEFT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
TO RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
TO RIGHT REPEATER LAMP (BUILT-UP -EXPORT)
(8W-51-3)
TO RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
1 B99 T05
L63 18 DG/RD
L63 18 DG/RD
1 B98 T08
L62 18 BR/RD
L63 18 DG/RD
L62 18 BR/RD
TO LEFT COMBINATION RELAY
(8W-54-2)
TO LEFT STOP/ TURN SIGNAL RELAY
(8W-54-2)
TO LEFT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
TO RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
TO RIGHT COMBINATION RELAY
(8W-54-2)
TO RIGHT STOP/ TURN SIGNAL RELAY
(8W-54-2)

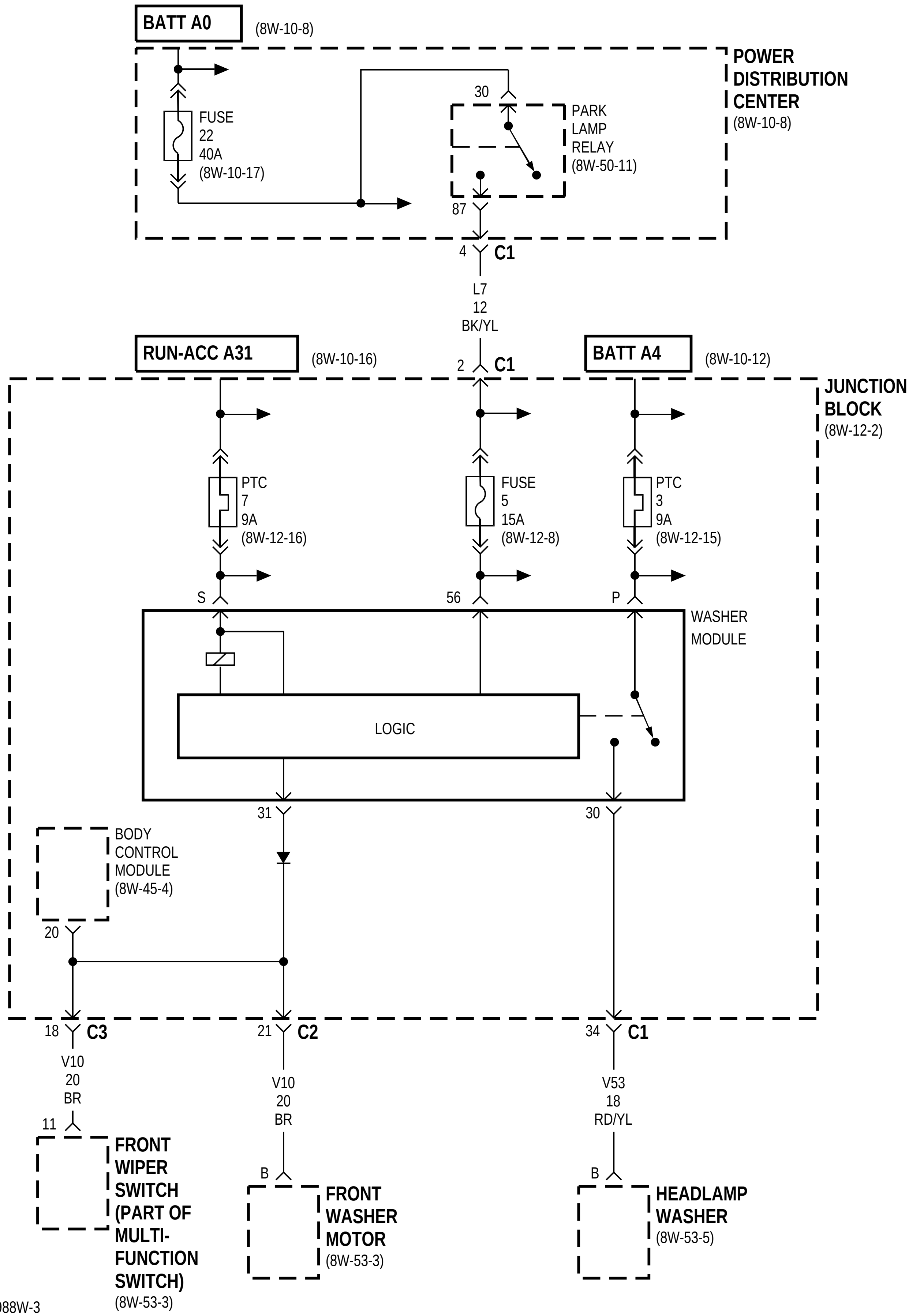

MESSAGE CENTER (8W-46-4)
3 *4
ASH RECEIVER LAMP (8W-44-7)
1 *3
Z1 20 BK
Z1 18 BK
INSTRUMENT CLUSTER (8W-40-4)
13
IGNITION SWITCH (8W-10-14)
2 C2
Z1 20 BK
FROM STOP LAMP SWITCH (RHD) (8W-33-3)
POWER MIRROR SWITCH (8W-62-2) (8W-62-4) (8W-62-5)
11
TRACTION CONTROL SWITCH (GAS) (8W-35-2)
1
KEY-IN HALO LAMP (8W-44-3)
1
POWER FOLDING MIRROR SWITCH (BUILT-UP -EXPORT) (8W-62-8)
2
22 C4
28 C4
35 C4
36 C4
JUNCTION BLOCK (8W-12-2)
30
DOOR LOCK RELAY (8W-61-3) (8W-61-4) (8W-61-7) (8W-61-8)
87 87A
DRIVER DOOR UNLOCK RELAY (RKE) (8W-61-7) (8W-61-8)
COMBINATION FLASHER/ DRL MODULE (8W-50-13)
11
DOOR UNLOCK RELAY (8W-61-3) (8W-61-4) (8W-61-7) (8W-61-8)
86
NAME BRAND SPEAKER RELAY (8W-47-4)
85
BODY CONTROL MODULE (8W-45-2)
3 4
2 C2
21 C4
29 C4
10 C2
14 C2
Z1 14 BK
Z1 18 BK
Z1 20 BK
Z2 20 BK/LG
8
G300 (8W-15-6)
2 C2
6 C1
HEADLAMP SWITCH (8W-50-9) (8W-50-10)
* RHD


BATT M1
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
9
BODY CONTROL MODULE
(8W-45-2)
6 C4
13 C4
17 C4
M1 20 PK
M1 20 PK
M1 20 PK
M1 20 PK
M1 20 PK
M1 20 PK
2
INSTRUMENT CLUSTER
(8W-40-2)
1 C3
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-14)
1
2
0
3
4
2 C3
16
DATA LINK CONNECTOR
(8W-30-3)
(8W-30-30)
*8
12
MESSAGE CENTER
(8W-46-2)
7 C1
RADIO
(8W-47-2)
3
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
M1 22 PK
7 P50
NOT USED
A81 20 DG/RD
15 C4
JUNCTION BLOCK
(8W-12-2)
D1
(8W-10-16)
D3
FUSE
2
10A
(8W-12-9)
* RHD

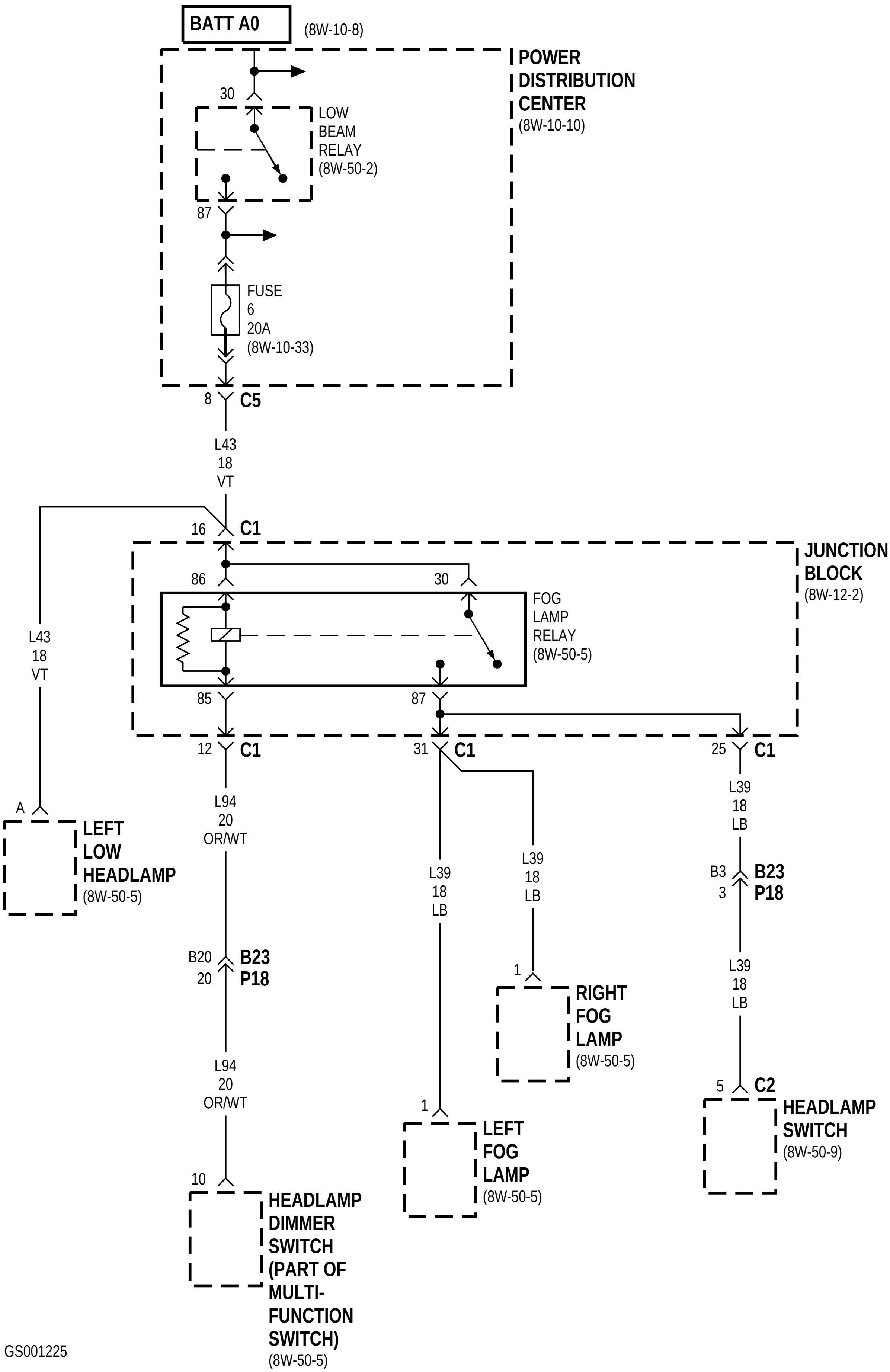

BATT F41
(8W-10-20)
JUNCTION
BLOCK
(8W-12-2)
A
TO
COURTESY
LAMP
RELAY
(8W-12-22)
19
C2
16
C3
20
C3
F41
20
PK/VT
F41
20
PK/VT
F41
20
PK/VT
F41
20
PK/VT
2
B75
C20
OTHERS
OVERHEAD
CONSOLE
F41
20
PK/VT
F41
20
PK/VT
1
SENTRY
KEY
IMMOBILIZER
MODULE
(BUILT-UP
-EXPORT)
(8W-39-5)
TO
CS02
(8W-10-20)
9
POWER
MIRROR
SWITCH
(8W-62-2)
(8W-62-4)
1
GLOVE
BOX
LAMP
(8W-44-2)
TO
FRONT
READING
LAMPS/
SWITCH
(8W-44-2)

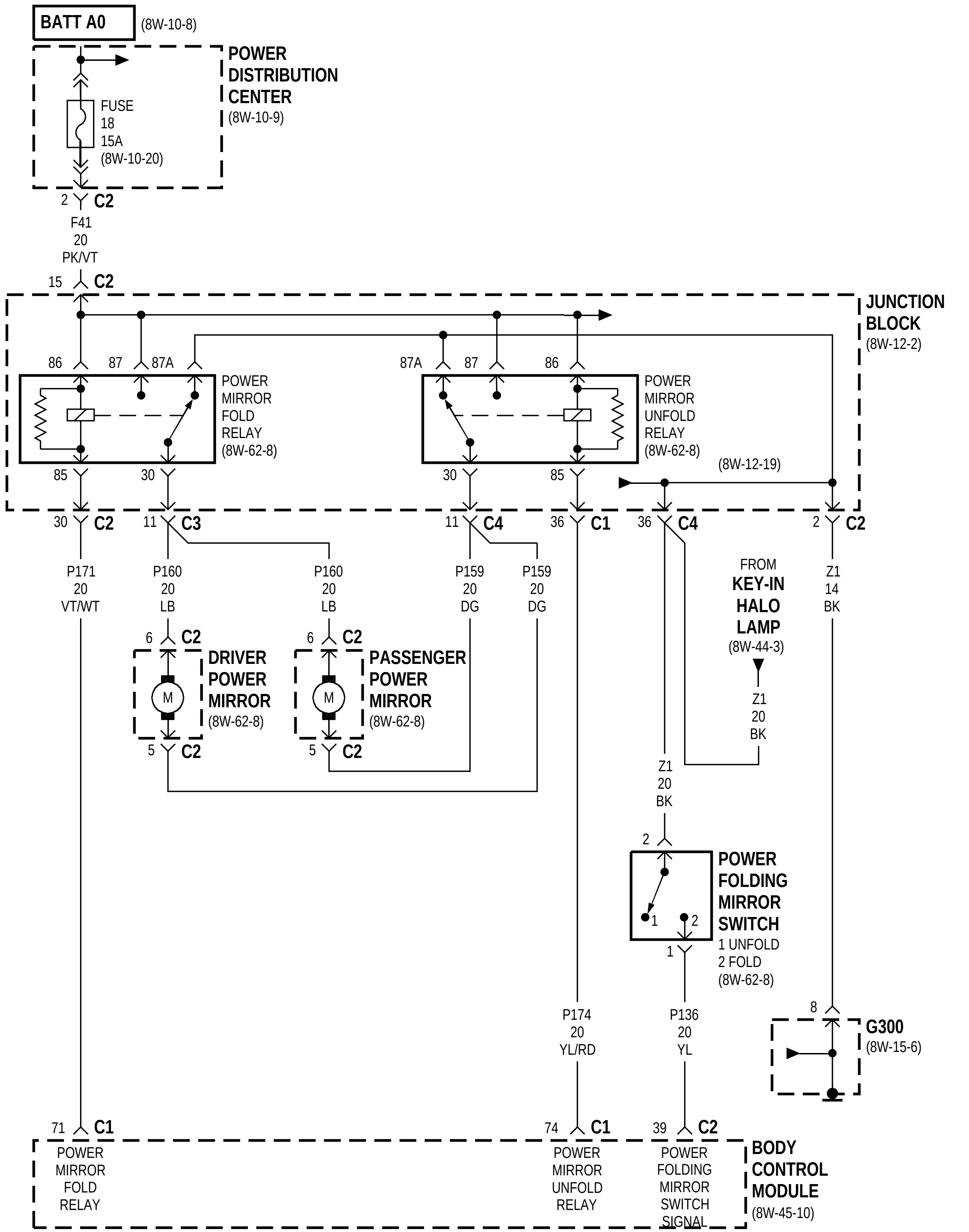

JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-4)
FROM JUNCTION BLOCK
(8W-12-21)
A
17
86
30
COURTESY LAMP RELAY
85
87
D4
10 C3
34 C3
28 C3
22 C2
6 C2
29 C2
29 C3
M112
22
BR/LG
M111
22
BR/WT
M113
20
LB/PK
M113
20
LB/PK
M11
20
PK/LB
4 B75 C20
3 B17 LJ01
TO HEADLAMP SWITCH
(8W-50-9)
(8W-50-10)
OTHER
DOME LAMP
TO CS01
(8W-44-4)
TO CS1
(8W-44-4)
3 J02A L15
3 B01 D02
6 B03 D01P
2
KEY-IN HALO LAMP
(8W-44-3)
1
RIGHT LIFTGATE FLOOD LAMP
(8W-44-4)
LEFT LIFTGATE FLOOD LAMP
(8W-44-4)
PASSENGER DOOR COURTESY LAMP
(8W-44-3)
DRIVER DOOR COURTESY LAMP
(8W-44-3)


TO
FRONT
WASHER
MOTOR
(8W-53-3)
V10
20
BR
TO
FRONT
WIPER
SWITCH
(PART OF
MULTI-
FUNCTION
SWITCH)
(8W-53-3)
TO
DRIVER
POWER
WINDOW
SWITCH
(8W-60-2)
TO
DRIVER
DOOR
LOCK
SWITCH
(8W-61-2)
(8W-61-6)
TO
PASSENGER
POWER
WINDOW
SWITCH
(8W-60-3)
TO
PASSENGER
DOOR
LOCK
SWITCH
(8W-61-2)
(8W-61-6)
E2
20
OR
D01D
B02
D01P
B03
C2
C3
C1
JUNCTION
BLOCK
(8W-12-2)
BODY
CONTROL
MODULE
(8W-45-4)
PANEL
LAMPS
DRIVER
WASHER
MODULE
(BUILT-UP
-EXPORT)
(8W-53-5)
C4
E2
18
OR
B75
C20
TO
REAR
BLOWER
FRONT
CONTROL
SWITCH
(8W-42-6)
TO
A/C
HEATER
CONTROL
(8W-42-3)
TO
HEADLAMP
SWITCH
(8W-50-9)
(8W-50-10)
TO
RADIO
(8W-47-2)
TO
UNIVERSAL
GARAGE
DOOR
OPENER
(PART OF
FRONT
HEADER
READING
LAMPS)
(8W-49-3)
TO
TRACTION
CONTROL
SWITCH
(GAS)
(8W-35-2)
TO
FRONT
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-3)
TO
INSTRUMENT
CLUSTER
(8W-40-4)
TO
ASH
RECEIVER
LAMP
(8W-44-7)
TO
POWER
MIRROR
SWITCH
(8W-62-2)
(8W-62-4)
TO
REAR
BLOWER
REAR
CONTROL
SWITCH
(8W-42-6)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
22
40A
(8W-10-17)
30
PARK
LAMP
RELAY
(8W-50-11)
87
4
C1
L7
12
BK/YL
RUN-ACC A31
(8W-10-16)
2
C1
BATT A4
(8W-10-12)
JUNCTION
BLOCK
(8W-12-2)
PTC
7
9A
(8W-12-16)
FUSE
5
15A
(8W-12-8)
PTC
3
9A
(8W-12-15)
S
56
P
WASHER
MODULE
LOGIC
31
30
BODY
CONTROL
MODULE
(8W-45-4)
20
18
C3
21
C2
34
C1
V10
20
BR
V10
20
BR
V53
18
RD/YL
11
B
B
FRONT
WIPER
SWITCH
(PART OF
MULTI-
FUNCTION
SWITCH)
(8W-53-3)
FRONT
WASHER
MOTOR
(8W-53-3)
HEADLAMP
WASHER
(8W-53-5)

EXCEPT BUILT-UP-EXPORT/CHRYSLER




BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
18
15A
(8W-10-20)
2 C2
F41
20
PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
86 87 87A
POWER MIRROR FOLD RELAY
(8W-62-8)
87A 87 86
POWER MIRROR UNFOLD RELAY
(8W-62-8)
85 30
30 85
(8W-12-19)
30 C2
11 C3
11 C4
36 C1
36 C4
2 C2
P171
20
VT/WT
P160
20
LB
P160
20
LB
P159
20
DG
P159
20
DG
FROM
KEY-IN HALO LAMP
(8W-44-3)
Z1
14
BK
6 C2
DRIVER POWER MIRROR
(8W-62-8)
M
5 C2
6 C2
PASSENGER POWER MIRROR
(8W-62-8)
M
5 C2
Z1
20
BK
Z1
20
BK
2
POWER FOLDING MIRROR SWITCH
1 UNFOLD
2 FOLD
(8W-62-8)
1 2
1
P174
20
YL/RD
P136
20
YL
8
G300
(8W-15-6)
71 C1
74 C1
39 C2
POWER MIRROR FOLD RELAY
POWER MIRROR UNFOLD RELAY
POWER FOLDING MIRROR SWITCH SIGNAL
BODY CONTROL MODULE
(8W-45-10)

8W-15 GROUND DISTRIBUTION

Component	Page
A/C Compressor Clutch	8W-15-2, 3
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BS31	8W-15-3
BS40	8W-15-3
BS41	8W-15-3
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Driver Door Arm/Disarm Switch	8W-15-11, 12
Driver Door Courtesy Lamp	8W-15-7
Driver Door Lock Switch	8W-15-11, 12
Driver Door Unlock Relay	8W-15-6
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Driver Heated Seat Cushion	8W-15-9
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Driver Power Mirror	8W-15-4
Driver Power Seat Switch	8W-15-5
Driver Power Window Switch	8W-15-7
DS01	8W-15-7
EC1 C19	8W-15-5
Engine Speed Sensor	8W-15-3
ES01	8W-15-3
ES02	8W-15-3
ES11	8W-15-2
ES12	8W-15-3
ES18	8W-15-2
ES23	8W-15-2
ES30	8W-15-3
ES31	8W-15-3
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G100	8W-15-2, 3
G101	8W-15-2
G102	8W-15-2, 3
G103	8W-15-2, 3
G104	8W-15-4
G200	8W-15-4
G201	8W-15-4
G202	8W-15-5
G204	8W-15-4
G300	8W-15-5, 6, 7, 8, 9
G301	8W-15-10, 11, 12
G302	8W-15-13
G400	8W-15-14
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Hood Ajar Switch	8W-15-10
HS1	8W-15-9
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Junction Block	8W-15-6
Key-In Halo Lamp	8W-15-6
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Left Door Speaker	8W-15-5
Left Front Park/Turn Signal Lamp	8W-15-7
Left Headlamp	8W-15-8
Left Headlamp Leveling Motor	8W-15-8
Left High Headlamp	8W-15-8
Left Liftgate Flood Lamp	8W-15-14
Left Low Headlamp	8W-15-8
Left Rear Door Ajar Switch	8W-15-13
Left Rear Lamp Assembly	8W-15-13
Left Rear Speaker	8W-15-5
Left Repeater Lamp	8W-15-5
Left Speed Control Switch	8W-15-4
Left Stop/Turn Signal Relay	8W-15-13
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Passenger Door Lock Switch	8W-15-10
Passenger Heated Seat Back	8W-15-9
Passenger Heated Seat Cushion	8W-15-9
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Passenger Heated Seat Switch	8W-15-9
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Power Mirror Switch	8W-15-6
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Radiator Fan No. 2	8W-15-2
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Radiator Fan Relay No. 1	8W-15-3
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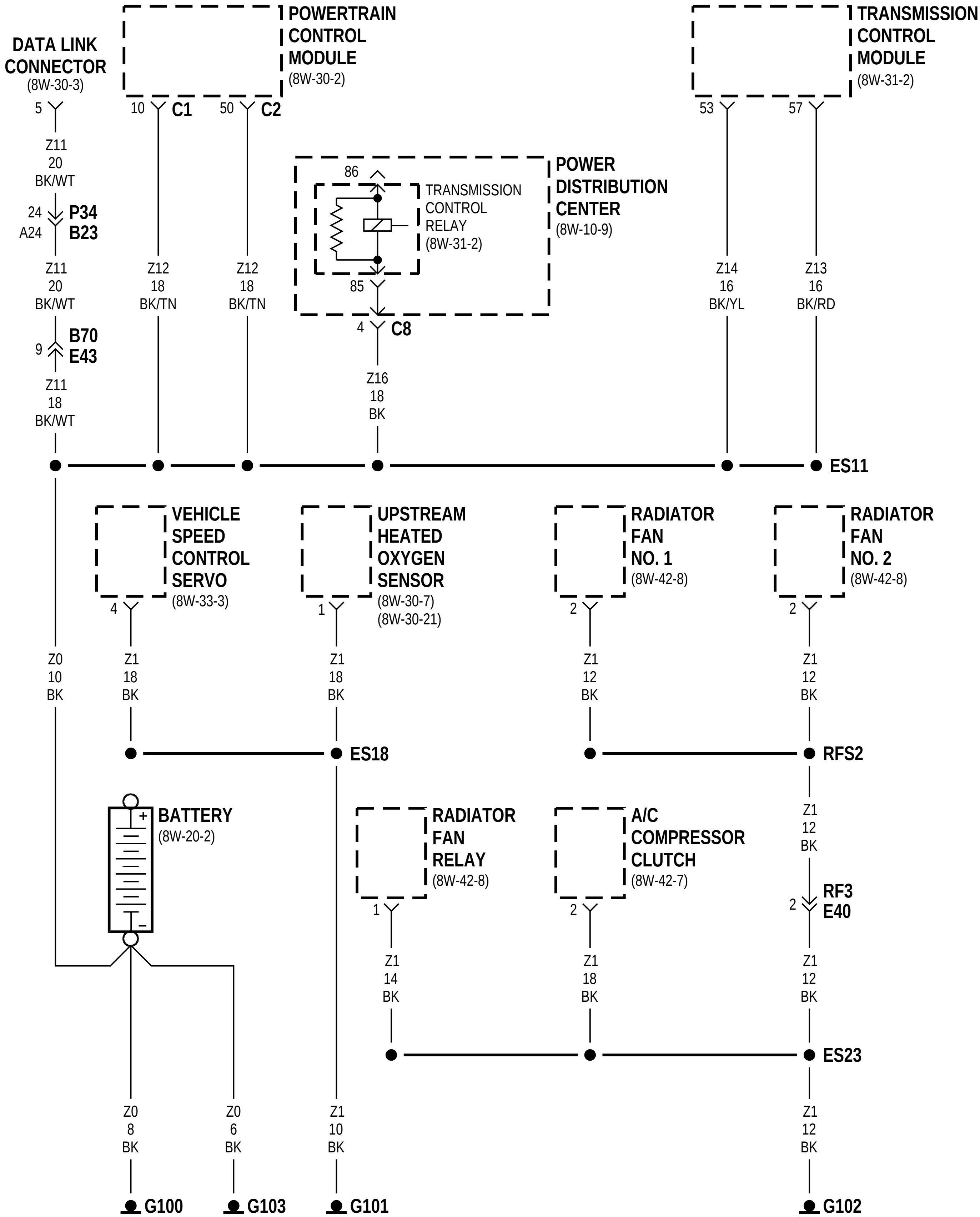
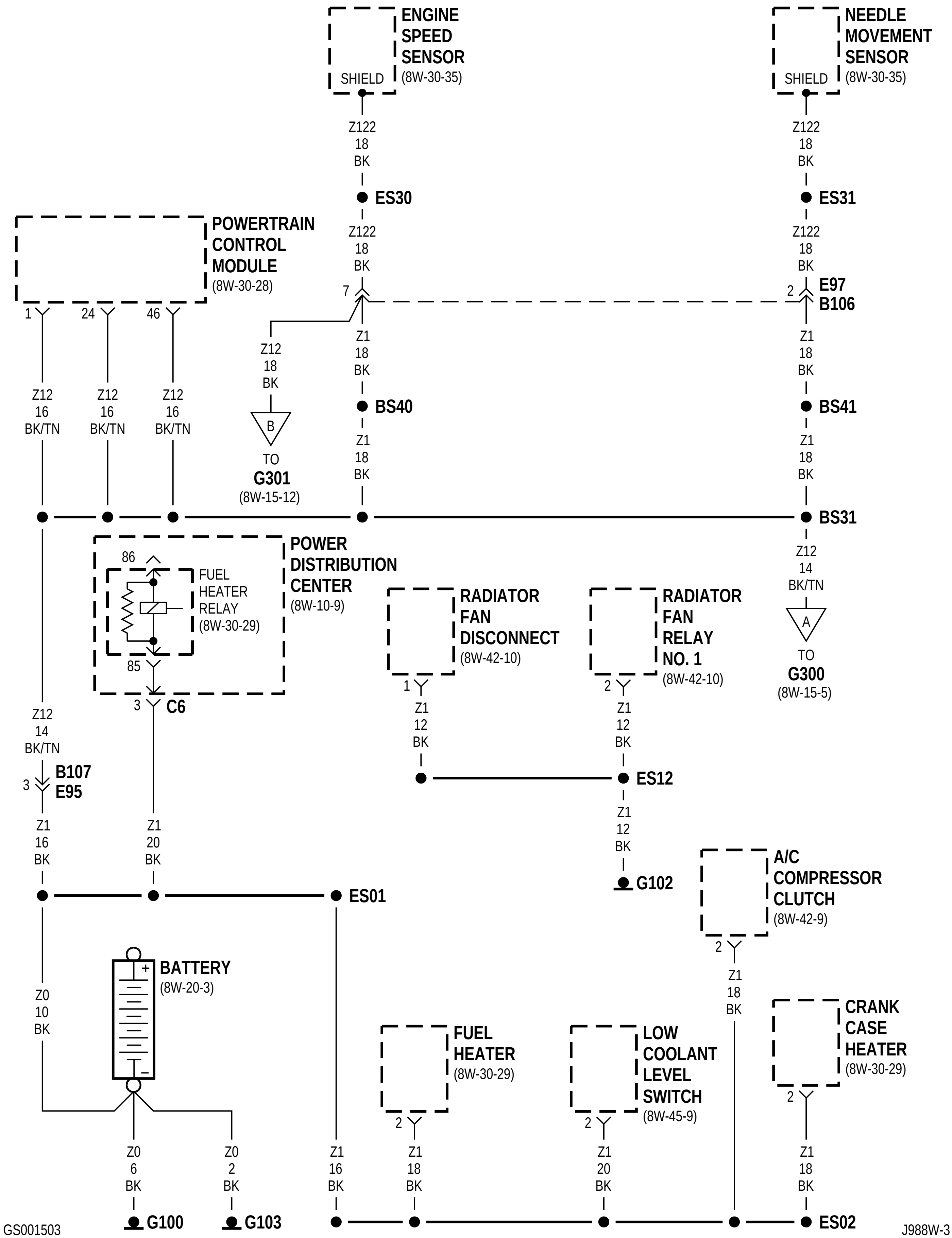
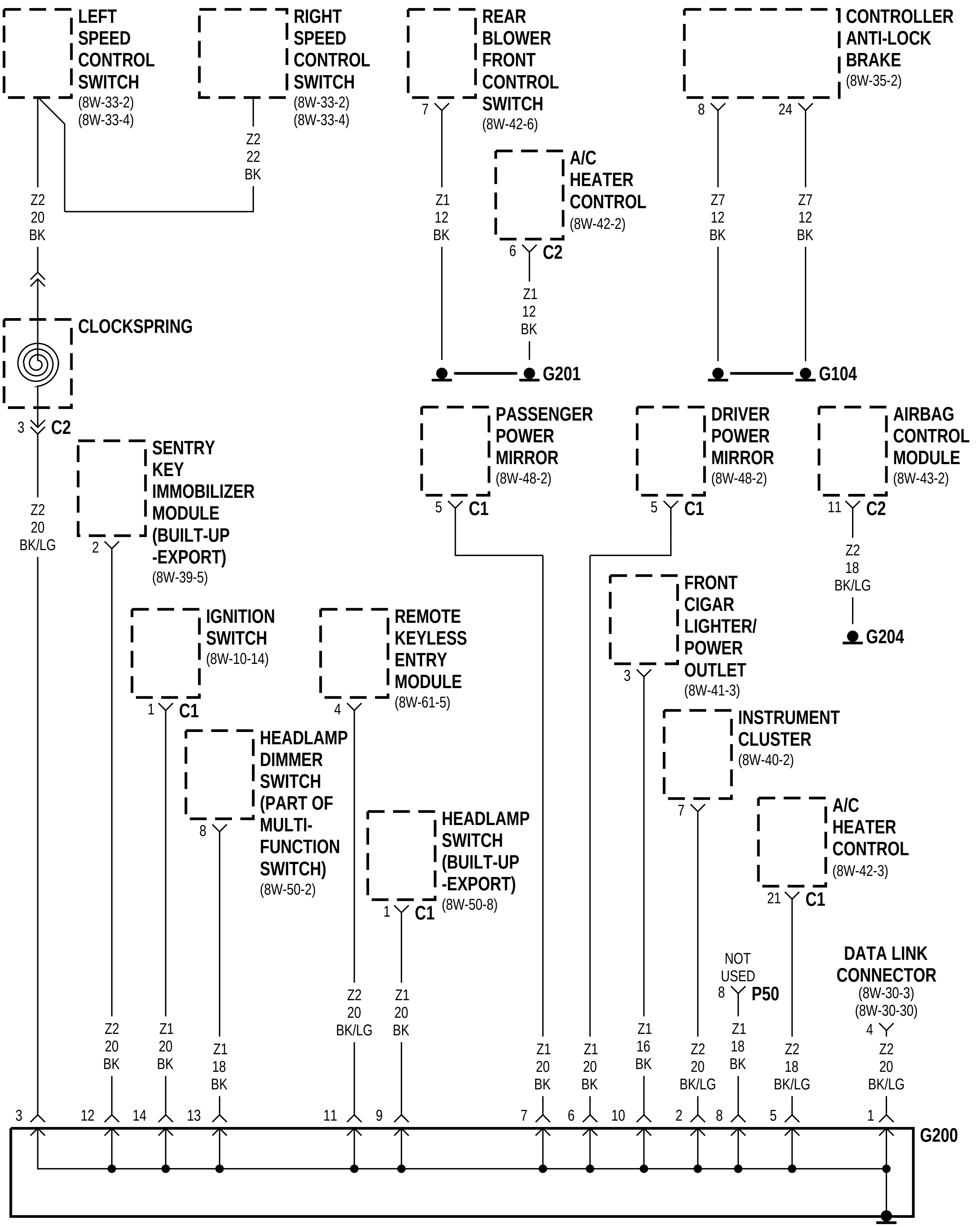
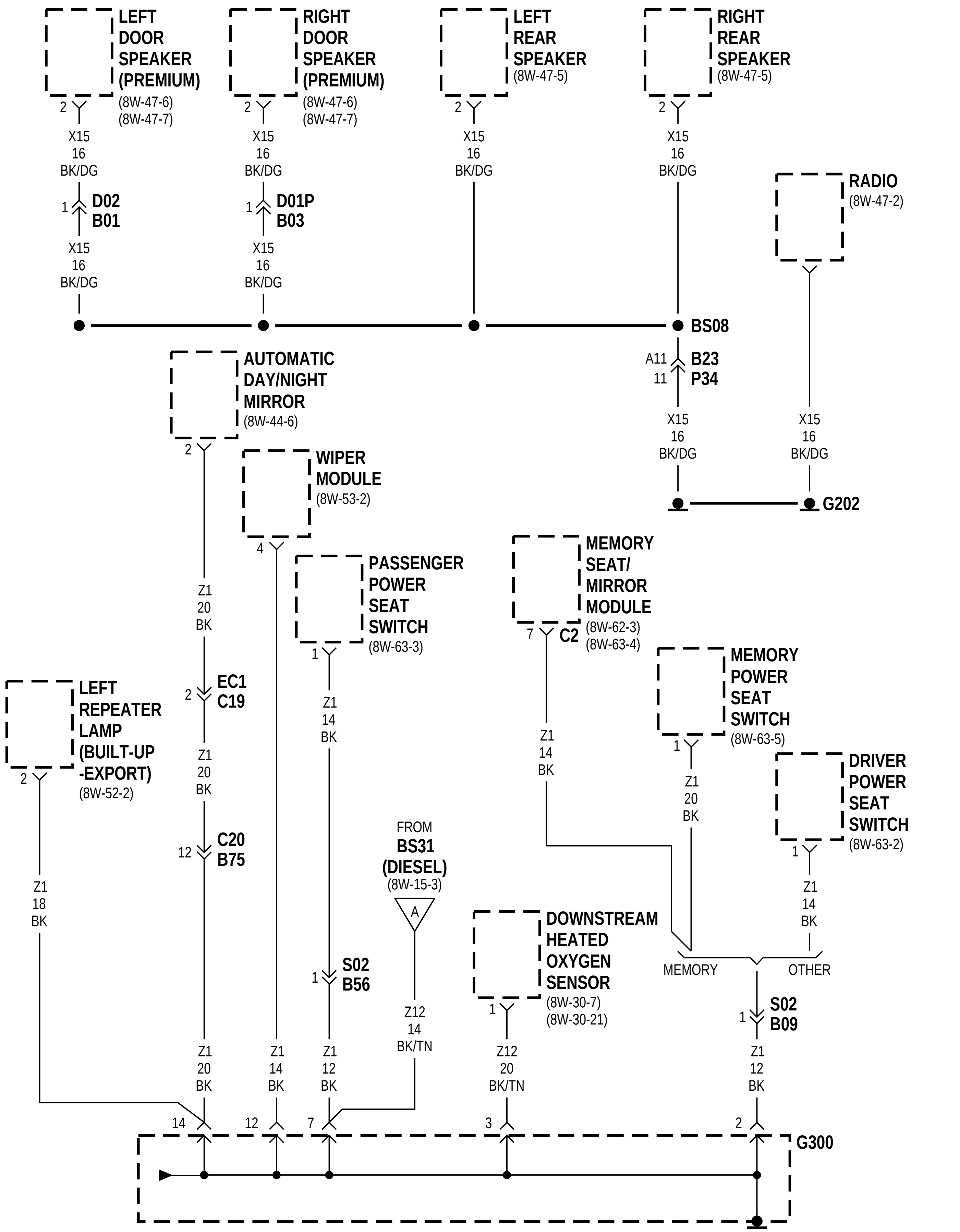
Right Combination Relay	8W-15-13
Right Door Speaker	8W-15-5
Right Front Park/Turn Signal Lamp	8W-15-10
Right Headlamp	8W-15-10
Right Headlamp Leveling Motor	8W-15-10
Right High Headlamp	8W-15-10
Right Liftgate Flood Lamp	8W-15-14
Right Low Headlamp	8W-15-10
Right Rear Door Ajar Switch	8W-15-13
Right Rear Lamp Assembly	8W-15-13
Right Rear Speaker	8W-15-5
Right Repeater Lamp	8W-15-10
Right Speed Control Switch	8W-15-4
Right Stop/Turn Signal Relay	8W-15-13
Seat Belt Switch	8W-15-8
Sentry Key Immobilizer Module	8W-15-4
Stop Lamp Switch	8W-15-6, 7
Traction Control Switch	8W-15-6
Trailer Tow Connector	8W-15-13
Transmission Control Module	8W-15-2
Transmission Control Relay	8W-15-2
Universal Garage Door Opener	8W-15-11, 12
Upstream Heated Oxygen Sensor	8W-15-2
Vehicle Speed Control Servo	8W-15-2
Wiper Module	8W-15-5
Wiper On Relay	8W-15-7

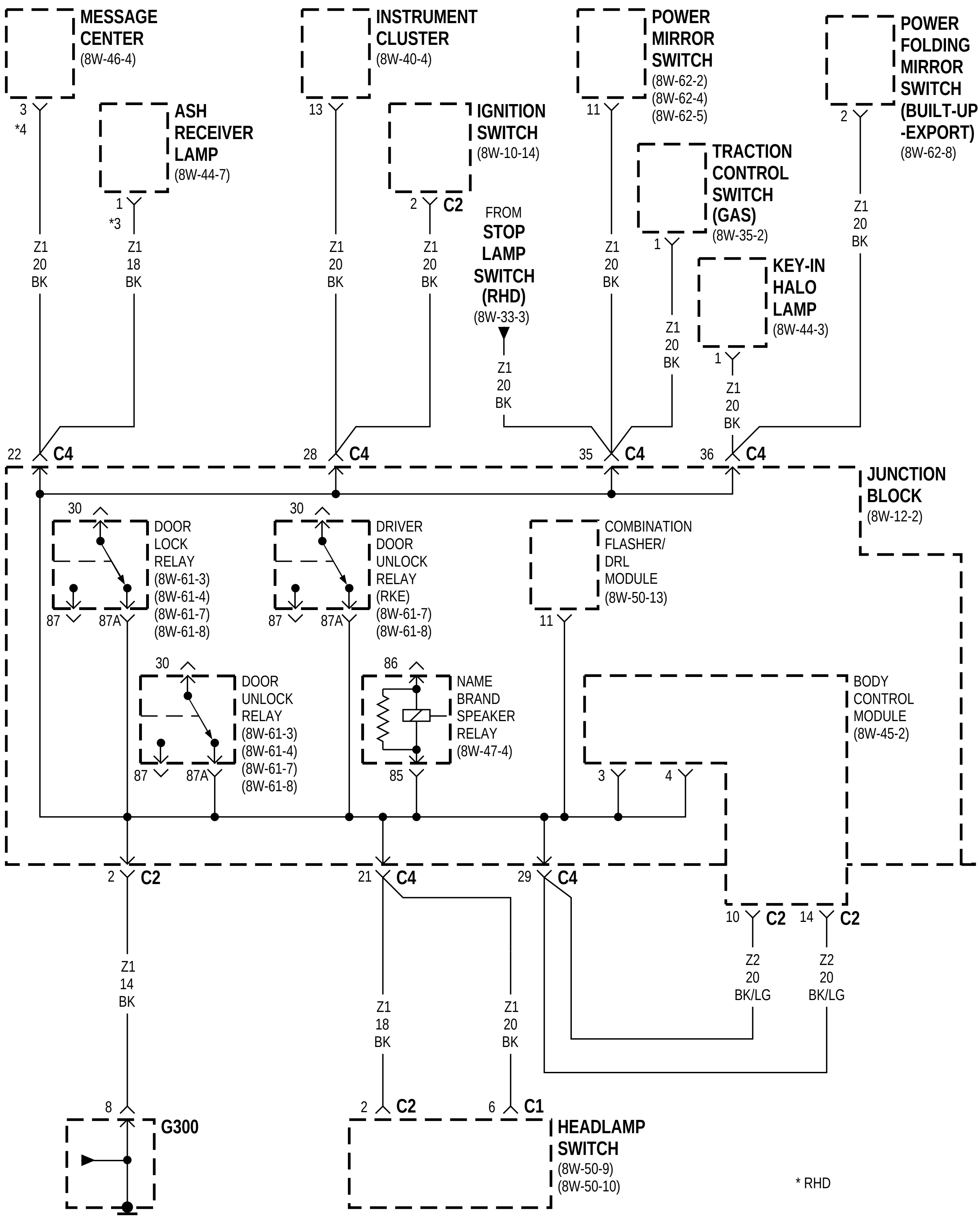

DATA LINK CONNECTOR
(8W-30-3)
POWERTRAIN CONTROL MODULE
(8W-30-2)
TRANSMISSION CONTROL MODULE
(8W-31-2)
C1
C2
POWER DISTRIBUTION CENTER
(8W-10-9)
TRANSMISSION CONTROL RELAY
(8W-31-2)
86
85
C8
P34
B23
B70
E43
Z11 20 BK/WT
Z11 18 BK/WT
Z12 18 BK/TN
Z16 18 BK
Z14 16 BK/YL
Z13 16 BK/RD
ES11
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
UPSTREAM HEATED OXYGEN SENSOR
(8W-30-7)
(8W-30-21)
RADIATOR FAN NO. 1
(8W-42-8)
RADIATOR FAN NO. 2
(8W-42-8)
Z0 10 BK
Z1 18 BK
Z1 12 BK
ES18
RFS2
BATTERY
(8W-20-2)
RADIATOR FAN RELAY
(8W-42-8)
A/C COMPRESSOR CLUTCH
(8W-42-7)
RF3
E40
Z1 14 BK
ES23
Z0 8 BK
Z0 6 BK
Z1 10 BK
G100
G103
G101
G102

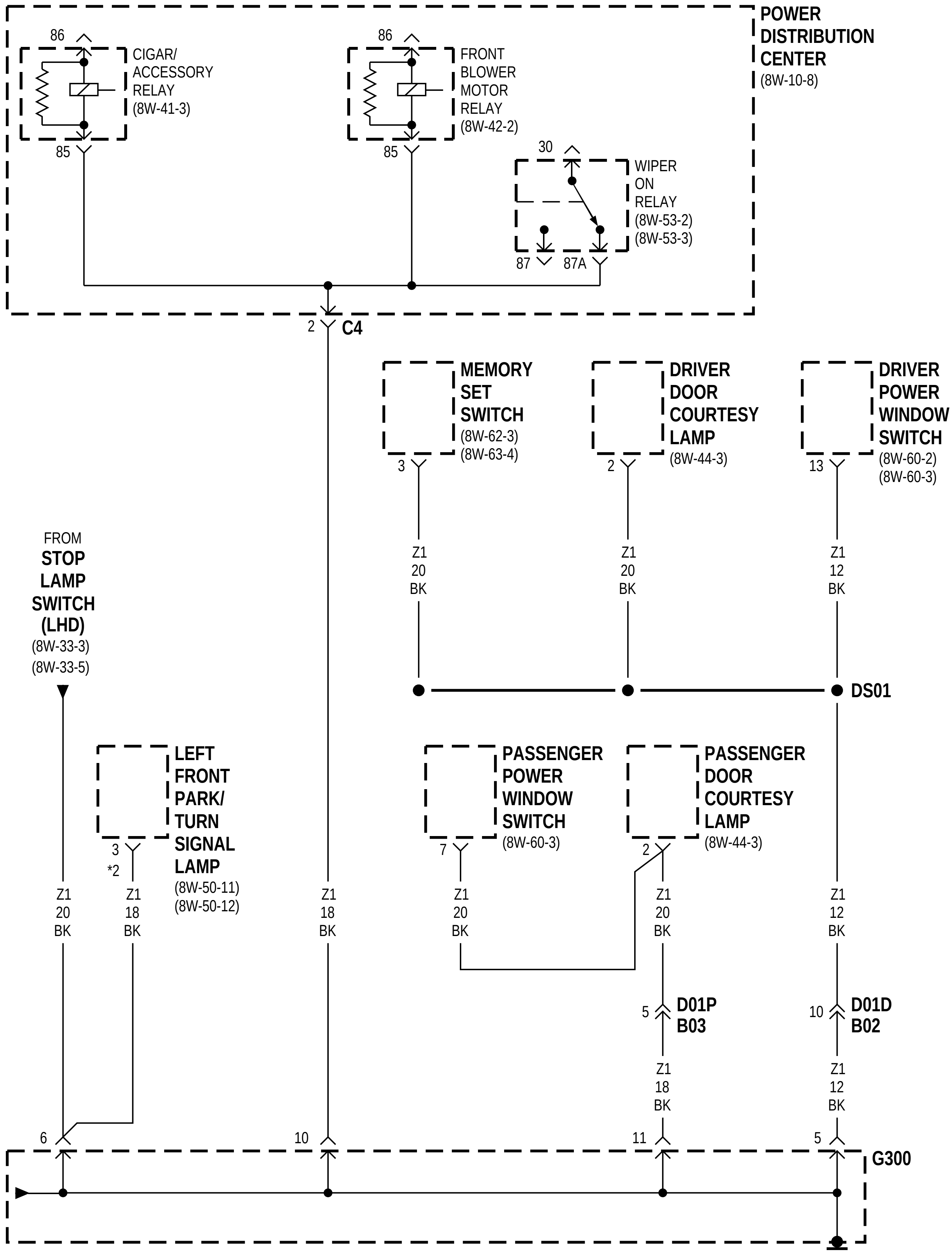
DIESEL


ENGINE SPEED SENSOR
SHIELD
(8W-30-35)
NEEDLE MOVEMENT SENSOR
SHIELD
(8W-30-35)
Z122 18 BK
ES30
ES31
Z122 18 BK
POWERTRAIN CONTROL MODULE
(8W-30-28)
1
24
46
7
2
E97
B106
Z12 18 BK
Z1 18 BK
B
TO
G301
(8W-15-12)
BS40
BS41
Z12 16 BK/TN
BS31
POWER DISTRIBUTION CENTER
(8W-10-9)
86
FUEL HEATER RELAY
(8W-30-29)
85
3
C6
RADIATOR FAN DISCONNECT
(8W-42-10)
RADIATOR FAN RELAY NO. 1
(8W-42-10)
Z12 14 BK/TN
A
TO
G300
(8W-15-5)
Z1 12 BK
ES12
G102
B107
E95
Z1 16 BK
Z1 20 BK
ES01
A/C COMPRESSOR CLUTCH
(8W-42-9)
BATTERY
(8W-20-3)
Z0 10 BK
Z1 18 BK
CRANK CASE HEATER
(8W-30-29)
FUEL HEATER
(8W-30-29)
LOW COOLANT LEVEL SWITCH
(8W-45-9)
Z0 6 BK
Z0 2 BK
Z1 16 BK
Z1 18 BK
Z1 20 BK
G100
G103
ES02
GS001503
J988W-3

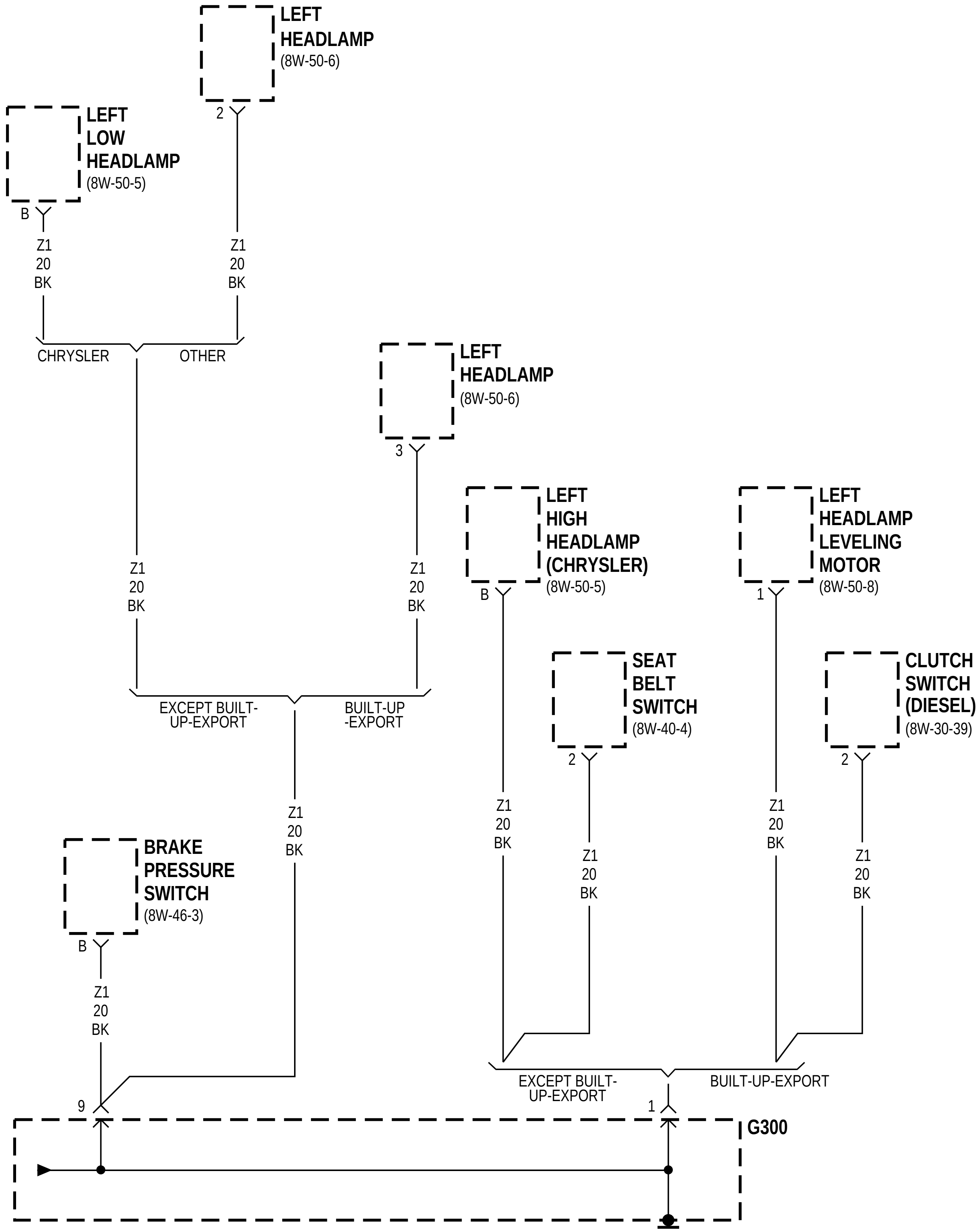

LEFT SPEED CONTROL SWITCH
(8W-33-2)
(8W-33-4)
RIGHT SPEED CONTROL SWITCH
(8W-33-2)
(8W-33-4)
REAR BLOWER FRONT CONTROL SWITCH
(8W-42-6)
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
A/C HEATER CONTROL
(8W-42-2)
C2
G201
G104
Z2 22 BK
Z2 20 BK
Z1 12 BK
Z7 12 BK
CLOCKSPRING
C2
Z2 20 BK/LG
SENTRY KEY IMMOBILIZER MODULE (BUILT-UP -EXPORT)
(8W-39-5)
PASSENGER POWER MIRROR
(8W-48-2)
C1
DRIVER POWER MIRROR
(8W-48-2)
C1
AIRBAG CONTROL MODULE
(8W-43-2)
C2
Z2 18 BK/LG
G204
IGNITION SWITCH
(8W-10-14)
C1
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
FRONT CIGAR LIGHTER/ POWER OUTLET
(8W-41-3)
HEADLAMP DIMMER SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-50-2)
INSTRUMENT CLUSTER
(8W-40-2)
HEADLAMP SWITCH (BUILT-UP -EXPORT)
(8W-50-8)
C1
A/C HEATER CONTROL
(8W-42-3)
C1
NOT USED
P50
DATA LINK CONNECTOR
(8W-30-3)
(8W-30-30)
Z2 20 BK
Z1 20 BK
Z1 18 BK
Z2 20 BK/LG
Z1 16 BK
Z2 20 BK/LG
Z2 18 BK/LG
G200


LEFT DOOR SPEAKER (PREMIUM)
(8W-47-6)
(8W-47-7)
RIGHT DOOR SPEAKER (PREMIUM)
(8W-47-6)
(8W-47-7)
LEFT REAR SPEAKER
(8W-47-5)
RIGHT REAR SPEAKER
(8W-47-5)
RADIO
(8W-47-2)
X15
16
BK/DG
D02
B01
D01P
B03
BS08
A11
11
B23
P34
G202
AUTOMATIC DAY/NIGHT MIRROR
(8W-44-6)
WIPER MODULE
(8W-53-2)
PASSENGER POWER SEAT SWITCH
(8W-63-3)
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
(8W-63-4)
C2
MEMORY POWER SEAT SWITCH
(8W-63-5)
DRIVER POWER SEAT SWITCH
(8W-63-2)
LEFT REPEATER LAMP (BUILT-UP -EXPORT)
(8W-52-2)
Z1
20
BK
EC1
C19
C20
B75
Z1
14
BK
Z1
18
BK
FROM
BS31
(DIESEL)
(8W-15-3)
A
Z12
14
BK/TN
S02
B56
DOWNSTREAM HEATED OXYGEN SENSOR
(8W-30-7)
(8W-30-21)
Z12
20
BK/TN
MEMORY
OTHER
S02
B09
Z1
12
BK
G300

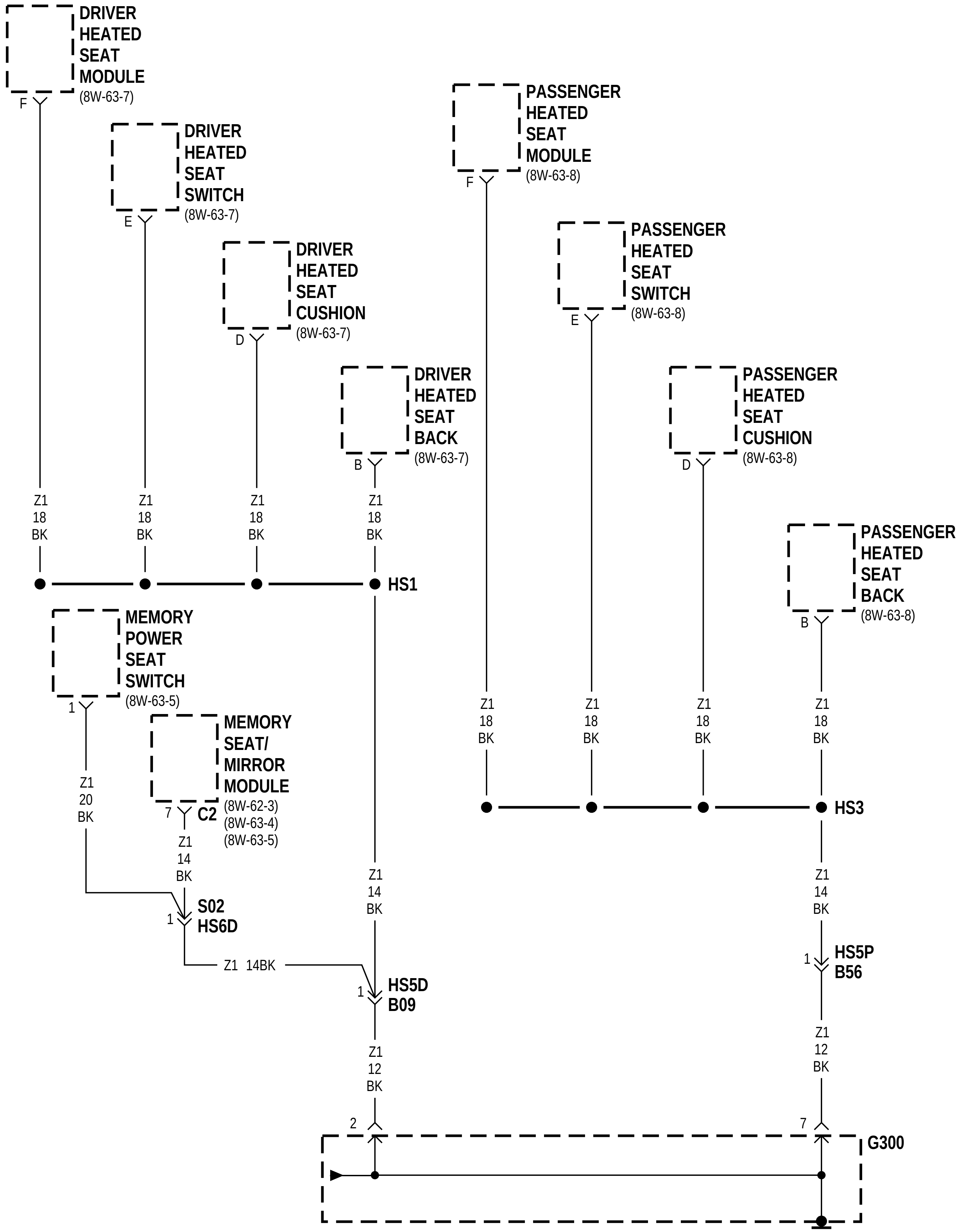

MESSAGE CENTER (8W-46-4)
3 *4
ASH RECEIVER LAMP (8W-44-7)
1 *3
Z1 20 BK
Z1 18 BK
INSTRUMENT CLUSTER (8W-40-4)
13
IGNITION SWITCH (8W-10-14)
2 C2
Z1 20 BK
Z1 20 BK
FROM STOP LAMP SWITCH (RHD) (8W-33-3)
Z1 20 BK
POWER MIRROR SWITCH (8W-62-2) (8W-62-4) (8W-62-5)
11
Z1 20 BK
TRACTION CONTROL SWITCH (GAS) (8W-35-2)
1
Z1 20 BK
KEY-IN HALO LAMP (8W-44-3)
1
Z1 20 BK
POWER FOLDING MIRROR SWITCH (BUILT-UP -EXPORT) (8W-62-8)
2
Z1 20 BK
22 C4
28 C4
35 C4
36 C4
JUNCTION BLOCK (8W-12-2)
30
DOOR LOCK RELAY (8W-61-3) (8W-61-4) (8W-61-7) (8W-61-8)
87 87A
30
DRIVER DOOR UNLOCK RELAY (RKE) (8W-61-7) (8W-61-8)
87 87A
COMBINATION FLASHER/ DRL MODULE (8W-50-13)
11
30
DOOR UNLOCK RELAY (8W-61-3) (8W-61-4) (8W-61-7) (8W-61-8)
87 87A
86
NAME BRAND SPEAKER RELAY (8W-47-4)
85
BODY CONTROL MODULE (8W-45-2)
3 4
2 C2
21 C4
29 C4
10 C2
14 C2
Z1 14 BK
Z1 18 BK
Z1 20 BK
Z2 20 BK/LG
Z2 20 BK/LG
8
G300
2 C2
6 C1
HEADLAMP SWITCH (8W-50-9) (8W-50-10)
* RHD



* BUILT-UP-EXPORT


LEFT
HEADLAMP
(8W-50-6)
LEFT
LOW
HEADLAMP
(8W-50-5)
B
2
Z1
20
BK
Z1
20
BK
CHRYSLER
OTHER
LEFT
HEADLAMP
(8W-50-6)
3
Z1
20
BK
Z1
20
BK
LEFT
HIGH
HEADLAMP
(CHRYSLER)
(8W-50-5)
B
LEFT
HEADLAMP
LEVELING
MOTOR
(8W-50-8)
1
EXCEPT BUILT-
UP-EXPORT
BUILT-UP
-EXPORT
SEAT
BELT
SWITCH
(8W-40-4)
2
CLUTCH
SWITCH
(DIESEL)
(8W-30-39)
2
Z1
20
BK
BRAKE
PRESSURE
SWITCH
(8W-46-3)
B
Z1
20
BK
EXCEPT BUILT-
UP-EXPORT
BUILT-UP-EXPORT
9
1
G300

HEATED SEATS



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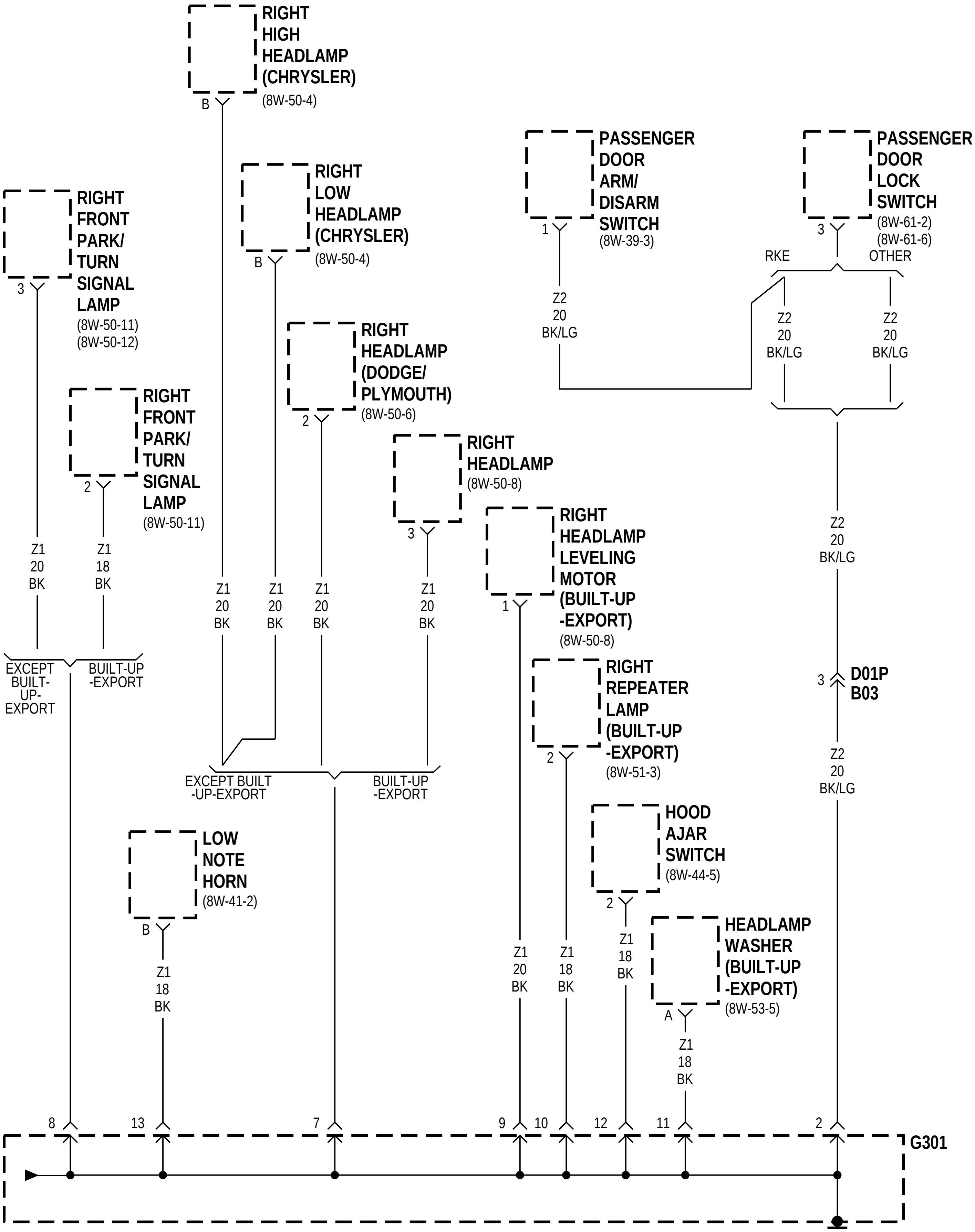
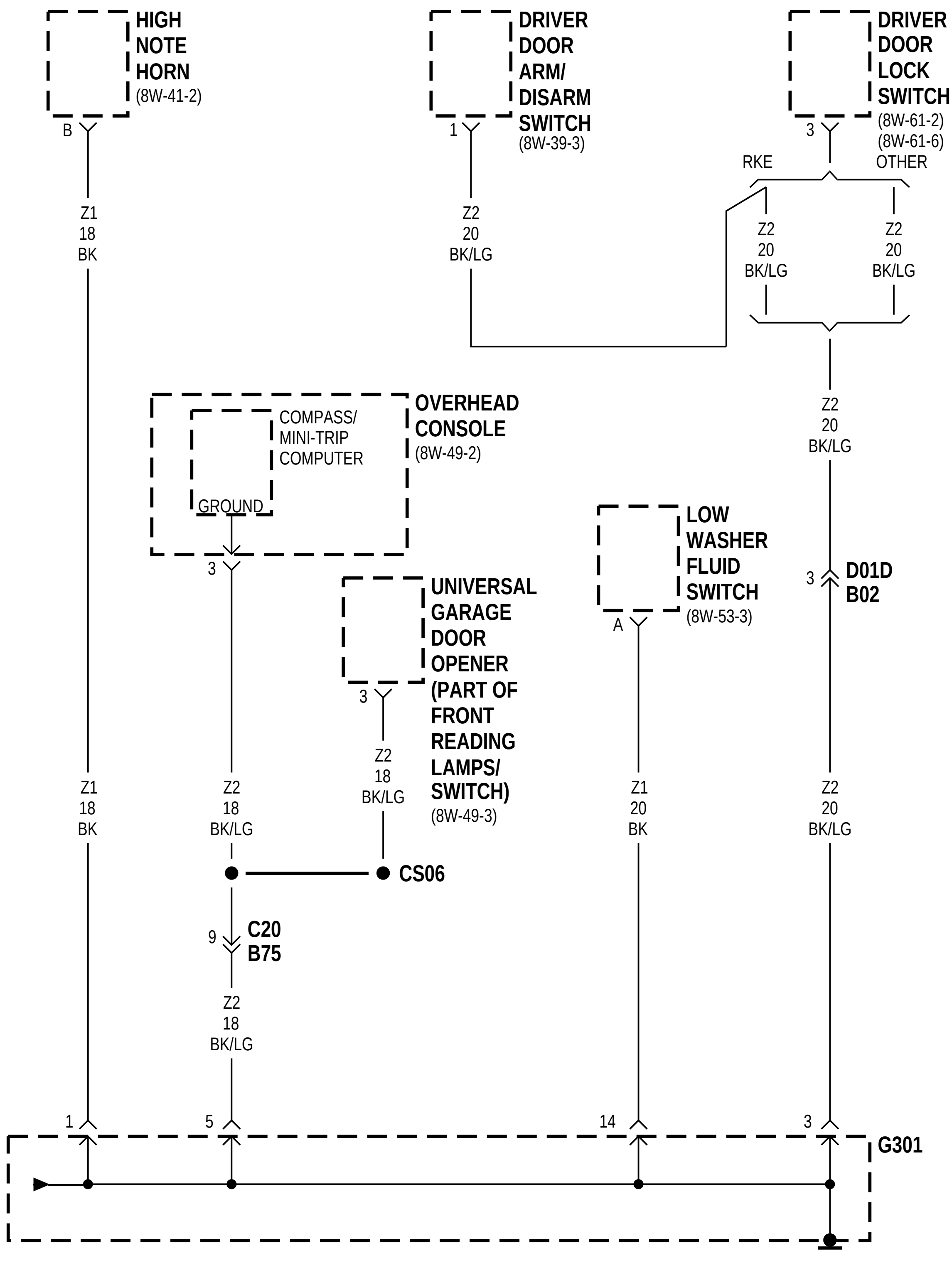
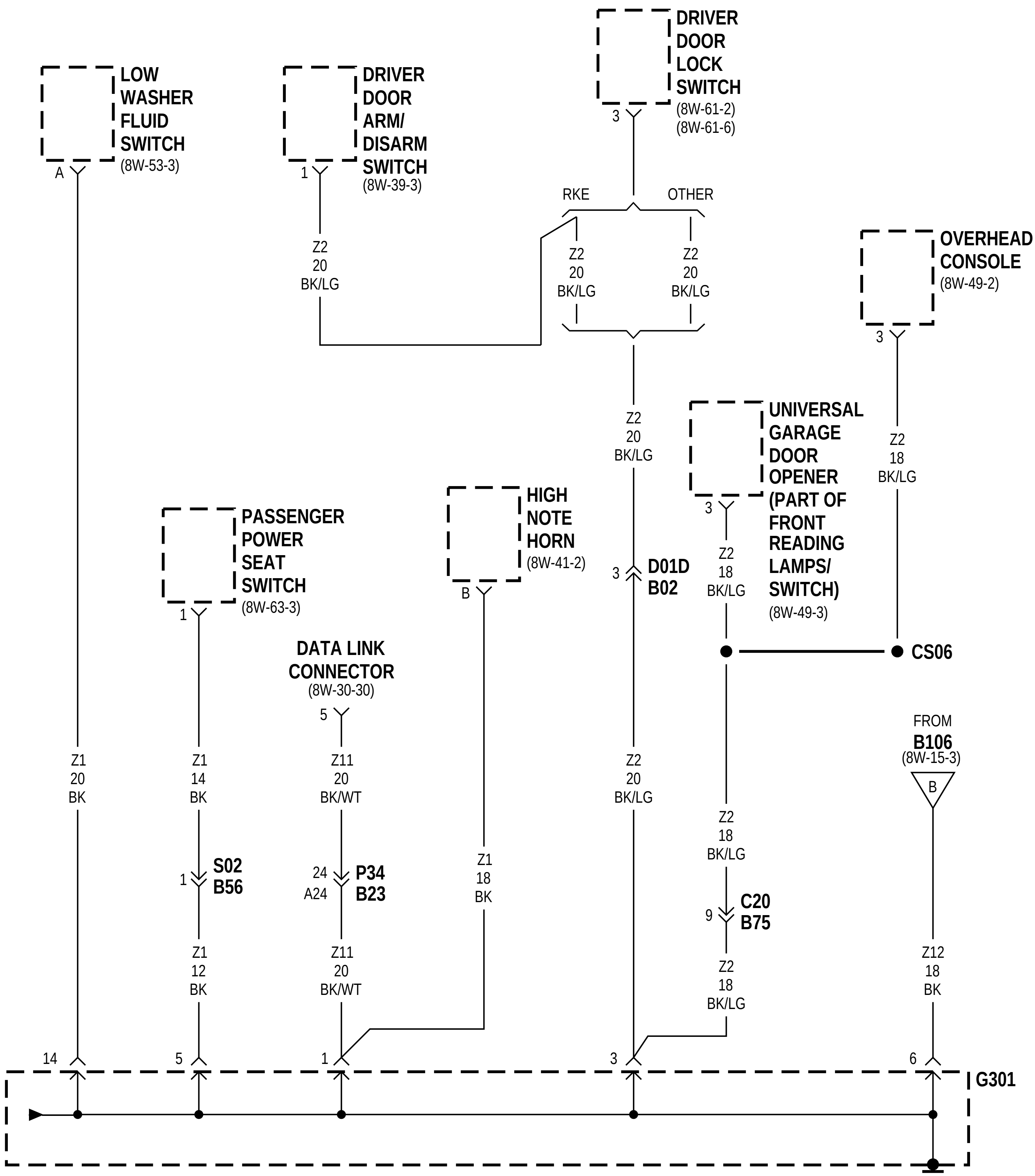
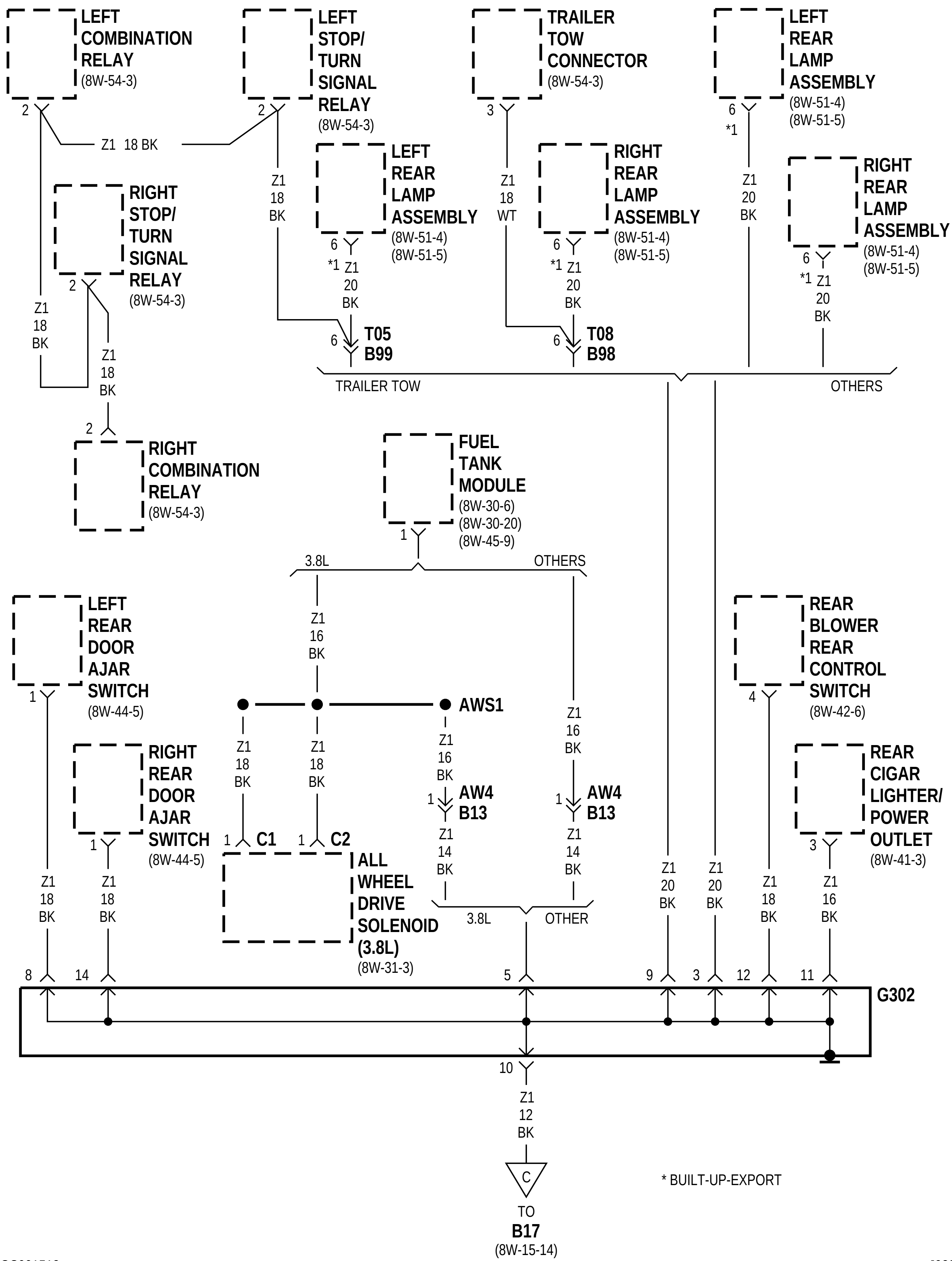
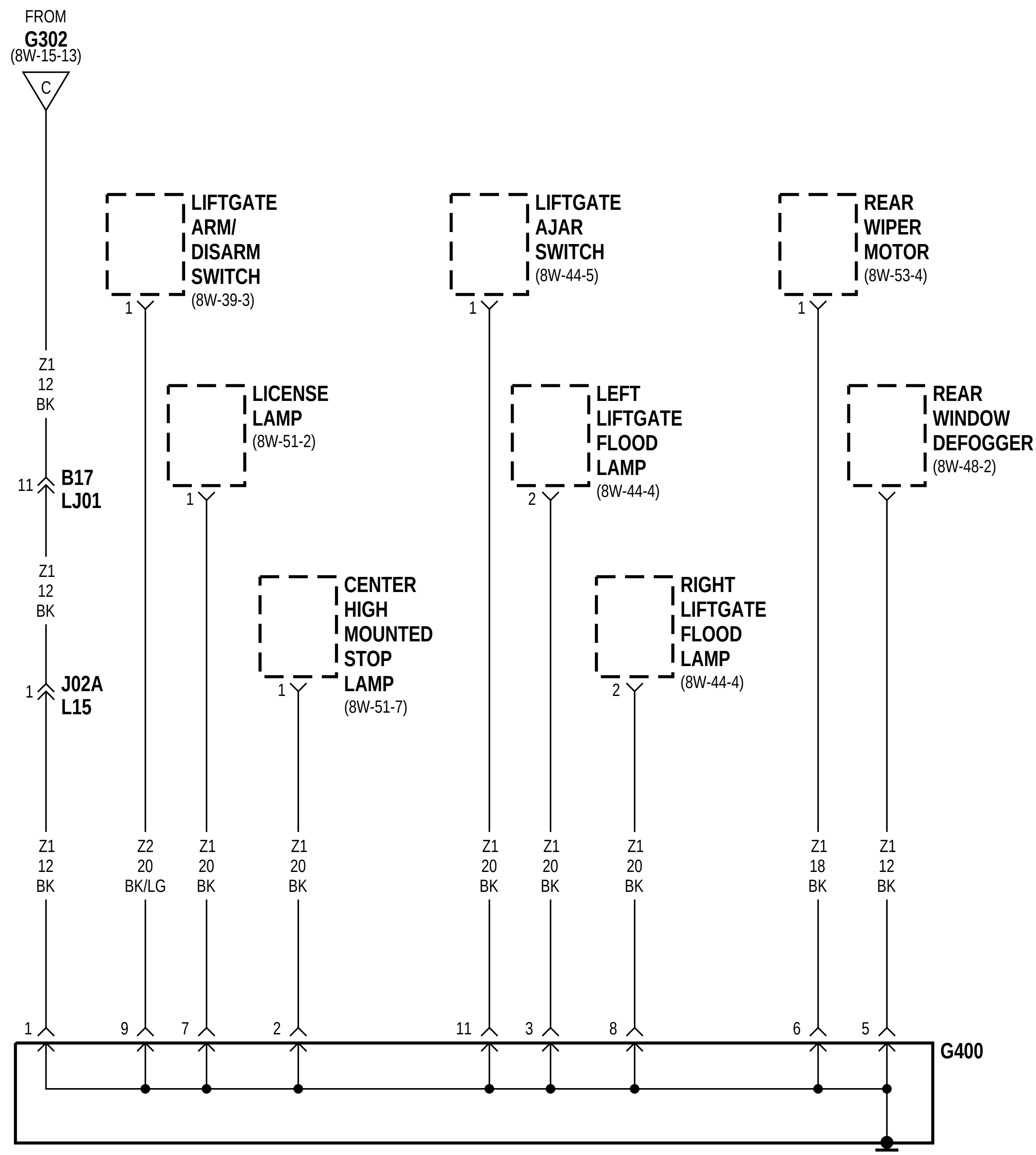

RIGHT HIGH HEADLAMP (CHRYSLER)
(8W-50-4)
B
RIGHT LOW HEADLAMP (CHRYSLER)
(8W-50-4)
B
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
(8W-50-12)
3
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
2
RIGHT HEADLAMP (DODGE/ PLYMOUTH)
(8W-50-6)
2
RIGHT HEADLAMP
(8W-50-8)
3
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP -EXPORT)
(8W-50-8)
1
RIGHT REPEATER LAMP (BUILT-UP -EXPORT)
(8W-51-3)
2
HOOD AJAR SWITCH
(8W-44-5)
2
HEADLAMP WASHER (BUILT-UP -EXPORT)
(8W-53-5)
A
LOW NOTE HORN
(8W-41-2)
B
PASSENGER DOOR ARM/ DISARM SWITCH
(8W-39-3)
1
PASSENGER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
3
RKE
OTHER
Z2 20 BK/LG
Z1 20 BK
Z1 18 BK
EXCEPT BUILT-UP-EXPORT
BUILT-UP -EXPORT
EXCEPT BUILT -UP-EXPORT
D01P
B03
8
13
7
9
10
12
11
2
G301


HIGH NOTE HORN
(8W-41-2)
B
Z1
18
BK
DRIVER DOOR ARM/ DISARM SWITCH
(8W-39-3)
1
Z2
20
BK/LG
DRIVER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
3
RKE
OTHER
Z2
20
BK/LG
Z2
20
BK/LG
Z2
20
BK/LG
OVERHEAD CONSOLE
(8W-49-2)
COMPASS/ MINI-TRIP COMPUTER
GROUND
3
LOW WASHER FLUID SWITCH
(8W-53-3)
A
D01D
B02
3
UNIVERSAL GARAGE DOOR OPENER (PART OF FRONT READING LAMPS/ SWITCH)
(8W-49-3)
3
Z2
18
BK/LG
Z1
18
BK
Z2
18
BK/LG
Z1
20
BK
Z2
20
BK/LG
CS06
9
C20
B75
Z2
18
BK/LG
1
5
14
3
G301

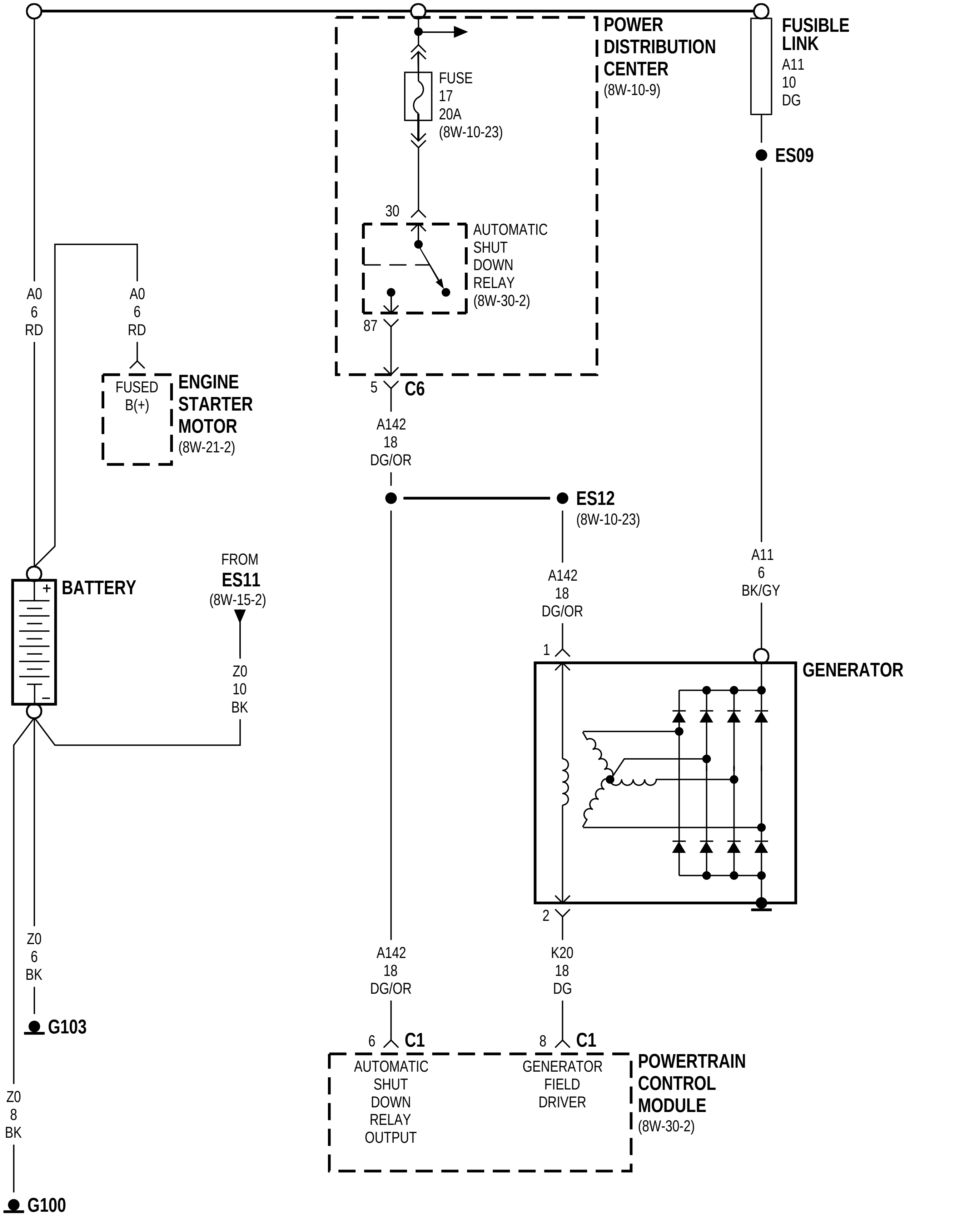

LOW WASHER FLUID SWITCH
(8W-53-3)
A
DRIVER DOOR ARM/ DISARM SWITCH
(8W-39-3)
1
DRIVER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
3
RKE
OTHER
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
OVERHEAD CONSOLE
(8W-49-2)
3
Z2 20 BK/LG
UNIVERSAL GARAGE DOOR OPENER (PART OF FRONT READING LAMPS/ SWITCH)
(8W-49-3)
3
Z2 18 BK/LG
Z2 18 BK/LG
HIGH NOTE HORN
(8W-41-2)
B
PASSENGER POWER SEAT SWITCH
(8W-63-3)
1
3
D01D
B02
CS06
DATA LINK CONNECTOR
(8W-30-30)
5
FROM
B106
(8W-15-3)
B
Z1 20 BK
Z1 14 BK
Z11 20 BK/WT
Z2 20 BK/LG
Z2 18 BK/LG
1
S02
B56
24
A24
P34
B23
Z1 18 BK
9
C20
B75
Z1 12 BK
Z11 20 BK/WT
Z2 18 BK/LG
Z12 18 BK
14
5
1
3
6
G301

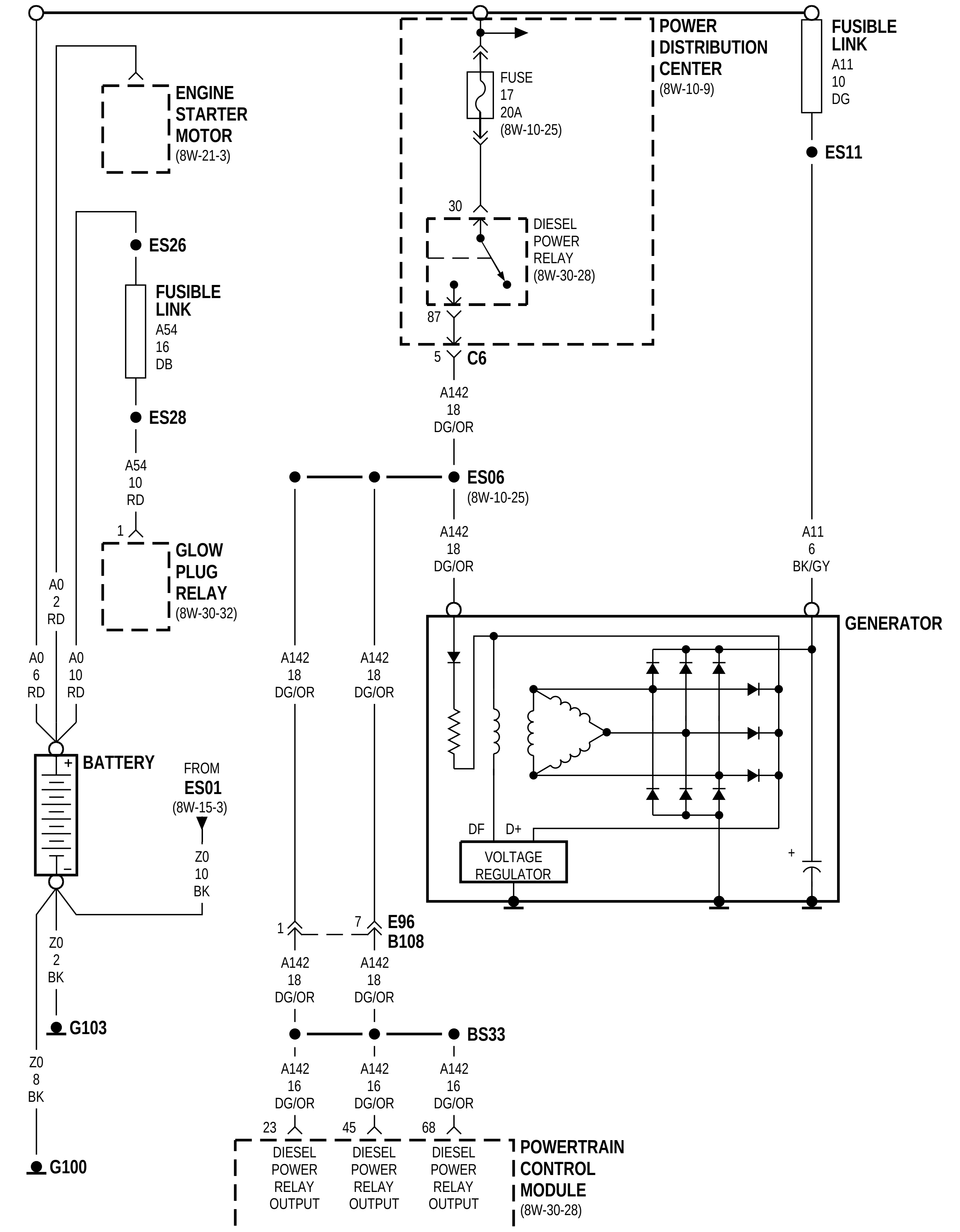

LEFT COMBINATION RELAY (8W-54-3)
LEFT STOP/ TURN SIGNAL RELAY (8W-54-3)
TRAILER TOW CONNECTOR (8W-54-3)
LEFT REAR LAMP ASSEMBLY (8W-51-4) (8W-51-5)
Z1 18 BK
RIGHT STOP/ TURN SIGNAL RELAY (8W-54-3)
LEFT REAR LAMP ASSEMBLY (8W-51-4) (8W-51-5)
RIGHT REAR LAMP ASSEMBLY (8W-51-4) (8W-51-5)
RIGHT REAR LAMP ASSEMBLY (8W-51-4) (8W-51-5)
*1
Z1 20 BK
Z1 18 WT
T05 B99
T08 B98
TRAILER TOW
OTHERS
RIGHT COMBINATION RELAY (8W-54-3)
FUEL TANK MODULE (8W-30-6) (8W-30-20) (8W-45-9)
3.8L
OTHERS
LEFT REAR DOOR AJAR SWITCH (8W-44-5)
Z1 16 BK
AWS1
RIGHT REAR DOOR AJAR SWITCH (8W-44-5)
AW4 B13
C1
C2
ALL WHEEL DRIVE SOLENOID (3.8L) (8W-31-3)
Z1 14 BK
3.8L
OTHER
REAR BLOWER REAR CONTROL SWITCH (8W-42-6)
REAR CIGAR LIGHTER/ POWER OUTLET (8W-41-3)
Z1 12 BK
G302
C
TO B17 (8W-15-14)
* BUILT-UP-EXPORT


FROM
G302
(8W-15-13)
C
LIFTGATE ARM/ DISARM SWITCH
(8W-39-3)
LIFTGATE AJAR SWITCH
(8W-44-5)
REAR WIPER MOTOR
(8W-53-4)
LICENSE LAMP
(8W-51-2)
LEFT LIFTGATE FLOOD LAMP
(8W-44-4)
REAR WINDOW DEFOGGER
(8W-48-2)
CENTER HIGH MOUNTED STOP LAMP
(8W-51-7)
RIGHT LIFTGATE FLOOD LAMP
(8W-44-4)
B17
LJ01
J02A
L15
Z1 12 BK
Z2 20 BK/LG
Z1 20 BK
Z1 18 BK
G400

8W-20 CHARGING SYSTEM

Component	Page
Automatic Shut Down Relay	8W-20-2
Battery	8W-20-2, 3
BS33	8W-20-3
Diesel Power Relay	8W-20-3
Engine Starter Motor	8W-20-2, 3
ES01	8W-20-3
ES06	8W-20-3
ES09	8W-20-2
ES11	8W-20-2, 3
ES12	8W-20-2
ES26	8W-20-3
ES28	8W-20-3
Fuse 17 (PDC)	8W-20-2, 3
Fusible Link	8W-20-2, 3
G100	8W-20-2, 3
G103	8W-20-2, 3
Generator	8W-20-2, 3
Glow Plug Relay	8W-20-3
Power Distribution Center	8W-20-2, 3
Powertrain Control Module	8W-20-2, 3
Voltage Regulator	8W-20-3


POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSIBLE
LINK
A11
10
DG
FUSE
17
20A
(8W-10-23)
ES09
30
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
87
A0
6
RD
A0
6
RD
FUSED
B(+)
ENGINE
STARTER
MOTOR
(8W-21-2)
5
C6
A142
18
DG/OR
ES12
(8W-10-23)
FROM
ES11
(8W-15-2)
BATTERY
A142
18
DG/OR
A11
6
BK/GY
1
GENERATOR
Z0
10
BK
2
Z0
6
BK
A142
18
DG/OR
K20
18
DG
G103
6
C1
8
C1
AUTOMATIC
SHUT
DOWN
RELAY
OUTPUT
GENERATOR
FIELD
DRIVER
POWERTRAIN
CONTROL
MODULE
(8W-30-2)
Z0
8
BK
G100



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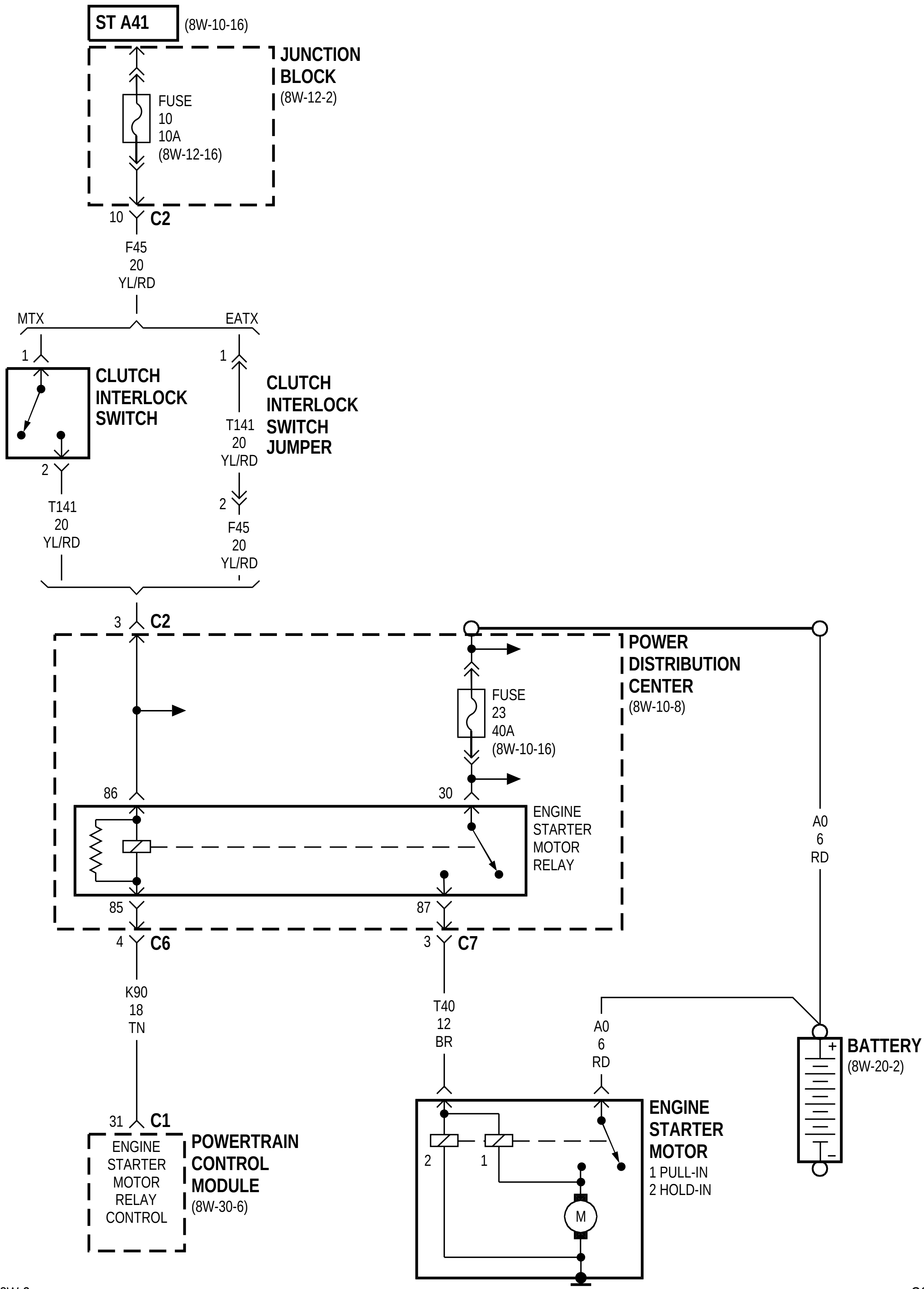
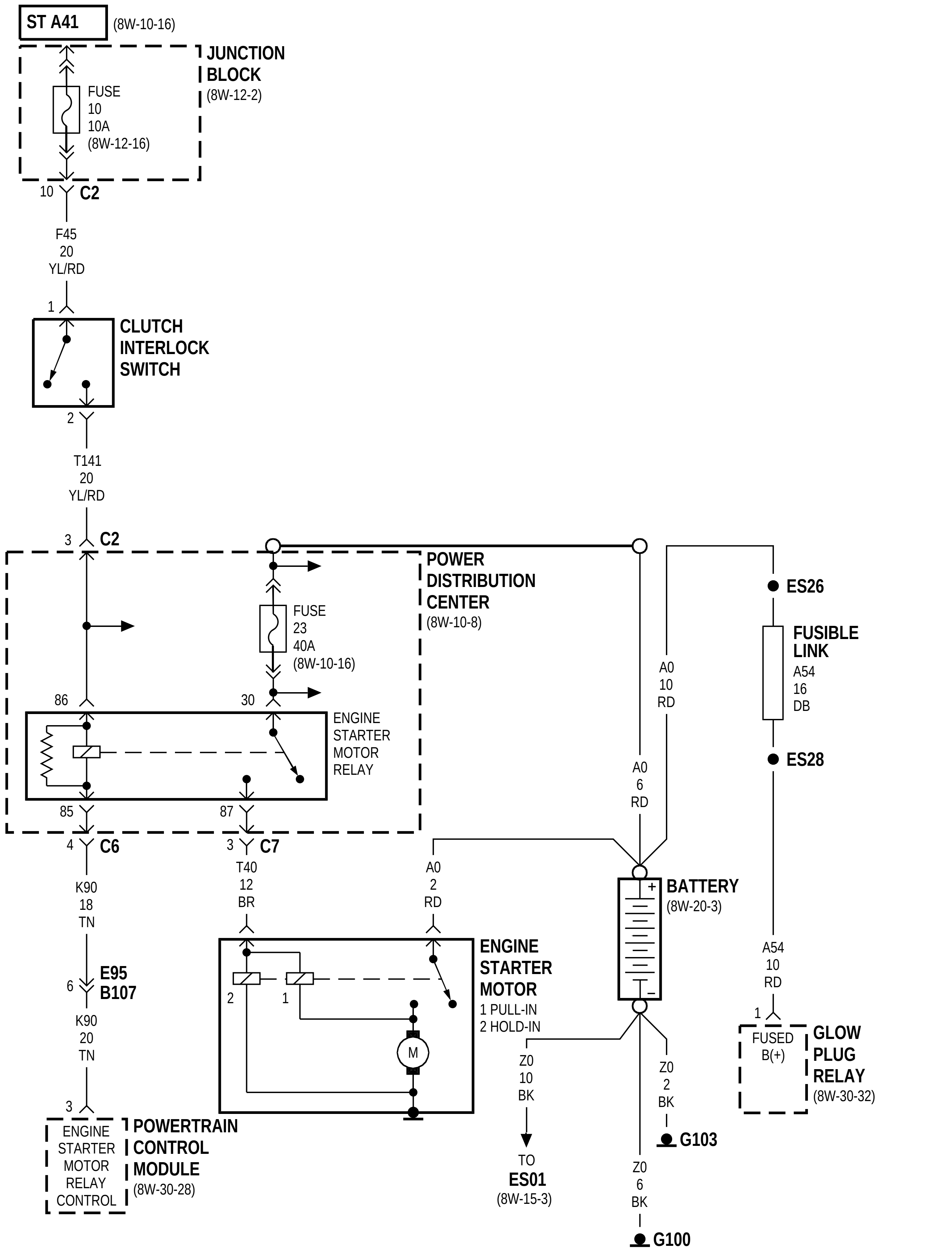
8W-21 STARTING SYSTEM

Component	Page
Battery	8W-21-2, 3
Clutch Interlock Switch	8W-21-2, 3
Clutch Interlock Switch Jumper	8W-21-2
Engine Starter Motor	8W-21-2, 3
Engine Starter Motor Relay	8W-21-2, 3
ES01	8W-21-3
ES26	8W-21-3
ES28	8W-21-3
Fuse 10 (JB)	8W-21-2, 3
Fuse 23 (PDC)	8W-21-2, 3
Fusible Link	8W-21-3
G100	8W-21-3
G103	8W-21-3
Glow Plug Relay	8W-21-3
Junction Block	8W-21-2, 3
Power Distribution Center	8W-21-2, 3
Powertrain Control Module	8W-21-2, 3


ST A41
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
FUSE
10
10A
(8W-12-16)
10
C2
F45
20
YL/RD
MTX
EATX
1
1
CLUTCH INTERLOCK SWITCH
CLUTCH INTERLOCK SWITCH JUMPER
T141
20
YL/RD
2
2
T141
20
YL/RD
F45
20
YL/RD
3
C2
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE
23
40A
(8W-10-16)
86
30
ENGINE STARTER MOTOR RELAY
85
87
4
C6
3
C7
A0
6
RD
K90
18
TN
T40
12
BR
A0
6
RD
BATTERY
(8W-20-2)
+
−
31
C1
ENGINE STARTER MOTOR RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-6)
2
1
M
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN


ST A41
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
FUSE
10
10A
(8W-12-16)
10
C2
F45
20
YL/RD
1
CLUTCH INTERLOCK SWITCH
2
T141
20
YL/RD
3
C2
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE
23
40A
(8W-10-16)
86
30
ENGINE STARTER MOTOR RELAY
85
87
4
C6
3
C7
K90
18
TN
T40
12
BR
A0
2
RD
A0
10
RD
A0
6
RD
ES26
FUSIBLE LINK
A54
16
DB
ES28
BATTERY
(8W-20-3)
+
−
E95
B107
6
K90
20
TN
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN
2
1
M
A54
10
RD
1
FUSED B(+)
GLOW PLUG RELAY
(8W-30-32)
Z0
10
BK
Z0
2
BK
G103
TO
ES01
(8W-15-3)
Z0
6
BK
G100
3
ENGINE STARTER MOTOR RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-28)

8W-30 FUEL/IGNITION SYSTEM

Component	Page
A/C Compressor Clutch Relay	8W-30-5, 37
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AW4 B13	8W-30-20
AWS1	8W-30-20
AWS2	8W-30-20
Back-Up Switch	8W-30-6, 20
Battery	8W-30-2, 3, 29, 32
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BS02	8W-30-6, 20
BS05	8W-30-4, 31
BS06	8W-30-4, 31
BS30	8W-30-36
BS31	8W-30-28, 35
BS32	8W-30-33
BS33	8W-30-28
BS34	8W-30-33, 34, 36, 38
BS40	8W-30-35
BS41	8W-30-35
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Control Sleeve Sensor	8W-30-34
Controller Anti-Lock Brake	8W-30-4, 31
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Diesel Power Relay	8W-30-28, 29, 32, 33
Downstream Heated Oxygen Sensor	8W-30-7, 21
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ES07	8W-30-2, 18, 20, 26
ES08	8W-30-17, 19, 25
ES09	8W-30-37
ES11	8W-30-2, 3
ES12	8W-30-2, 7, 8, 9, 14, 15, 21, 22, 23
ES13	8W-30-4
ES14	8W-30-4
ES17	8W-30-8, 11, 14, 17, 22
ES18	8W-30-7, 21
ES21	8W-30-7, 8, 10, 11, 14, 16, 17, 24
ES24	8W-30-3
ES26	8W-30-32
ES28	8W-30-32
ES29	8W-30-32
ES30	8W-30-35
ES31	8W-30-35
ES37	8W-30-32
ES40	8W-30-29
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FS02	8W-30-16, 22, 24
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Fuel Injector No. 2	8W-30-9, 15, 23
Fuel Injector No. 3	8W-30-9, 15, 23
Fuel Injector No. 4	8W-30-9, 15, 23
Fuel Injector No. 5	8W-30-23
Fuel Injector No. 6	8W-30-23
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Fuel Pump Relay	8W-30-6, 20
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Fuel Shutdown Solenoid	8W-30-33
Fuel Tank Module	8W-30-6, 20
Fuel Temperature Sensor	8W-30-33
Fuel Timing Solenoid	8W-30-33
Fuse 6 (JB)	8W-30-32
Fuse 13 (PDC)	8W-30-39
Fuse 16 (PDC)	8W-30-2, 6, 20, 29
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G101	8W-30-7, 21
G103	8W-30-2, 3, 29
G200	8W-30-3, 5, 30
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G301	8W-30-30, 35
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Glow Plug No. 3	8W-30-32
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Junction Block	8W-30-2, 3, 6, 13, 18, 19, 20, 26, 27, 28, 29, 30, 32, 36
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Powertrain Control Module	8W-30-11
Powertrain Control Module	8W-30-12
Powertrain Control Module	8W-30-13
Powertrain Control Module	8W-30-8
Powertrain Control Module	8W-30-9
Powertrain Control Module	8W-30-2, 3, 4, 5, 6, 7, 8, 9, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39
PS01	8W-30-4, 31
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Radiator Fan Relay	8W-30-5
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Radiator Fan Relay No. 2	8W-30-37
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Transmission Range Sensor	8W-30-6, 19, 20, 27, 34
Turbo Boost Pressure Sensor	8W-30-34
Upstream Heated Oxygen Sensor	8W-30-7, 21
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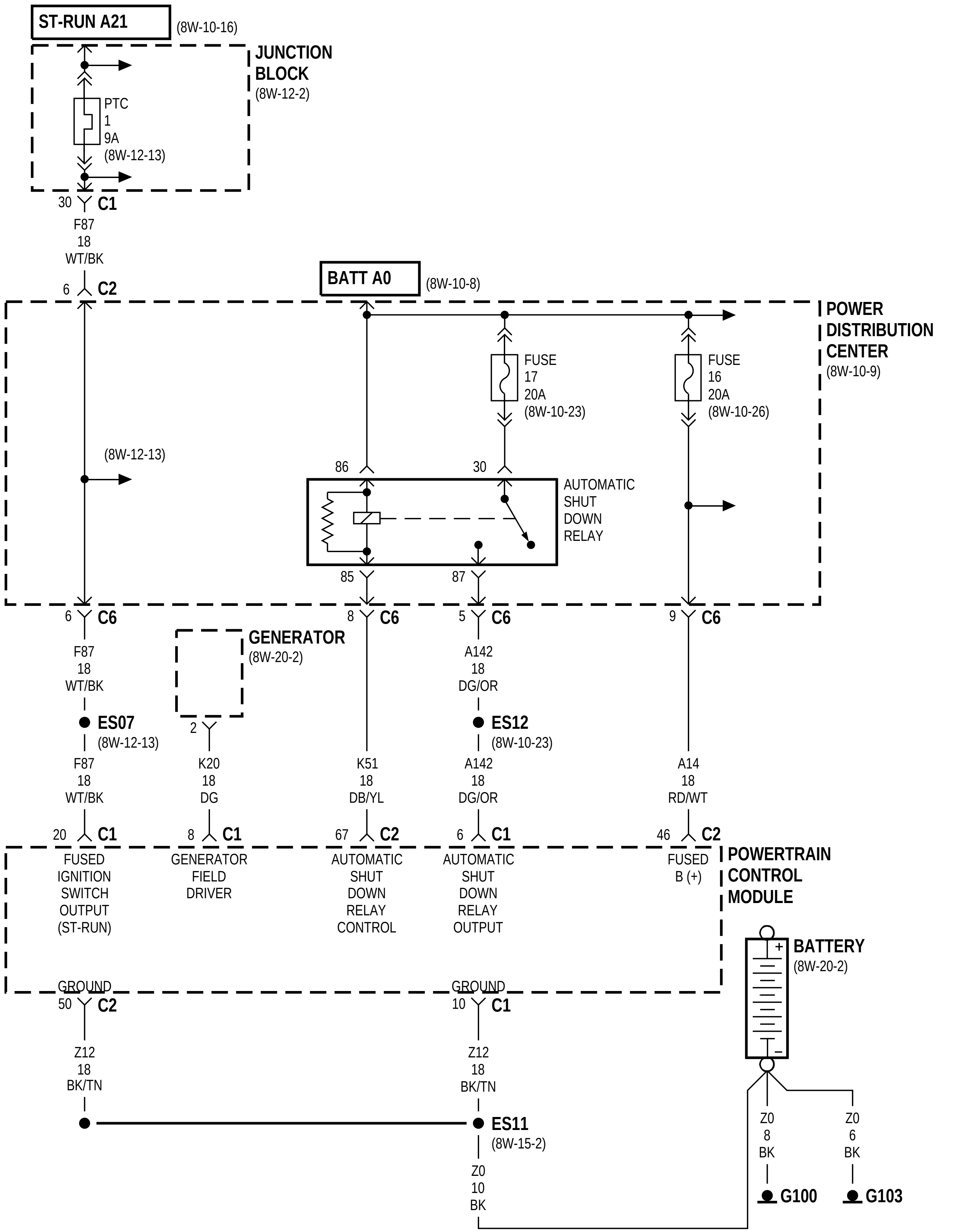
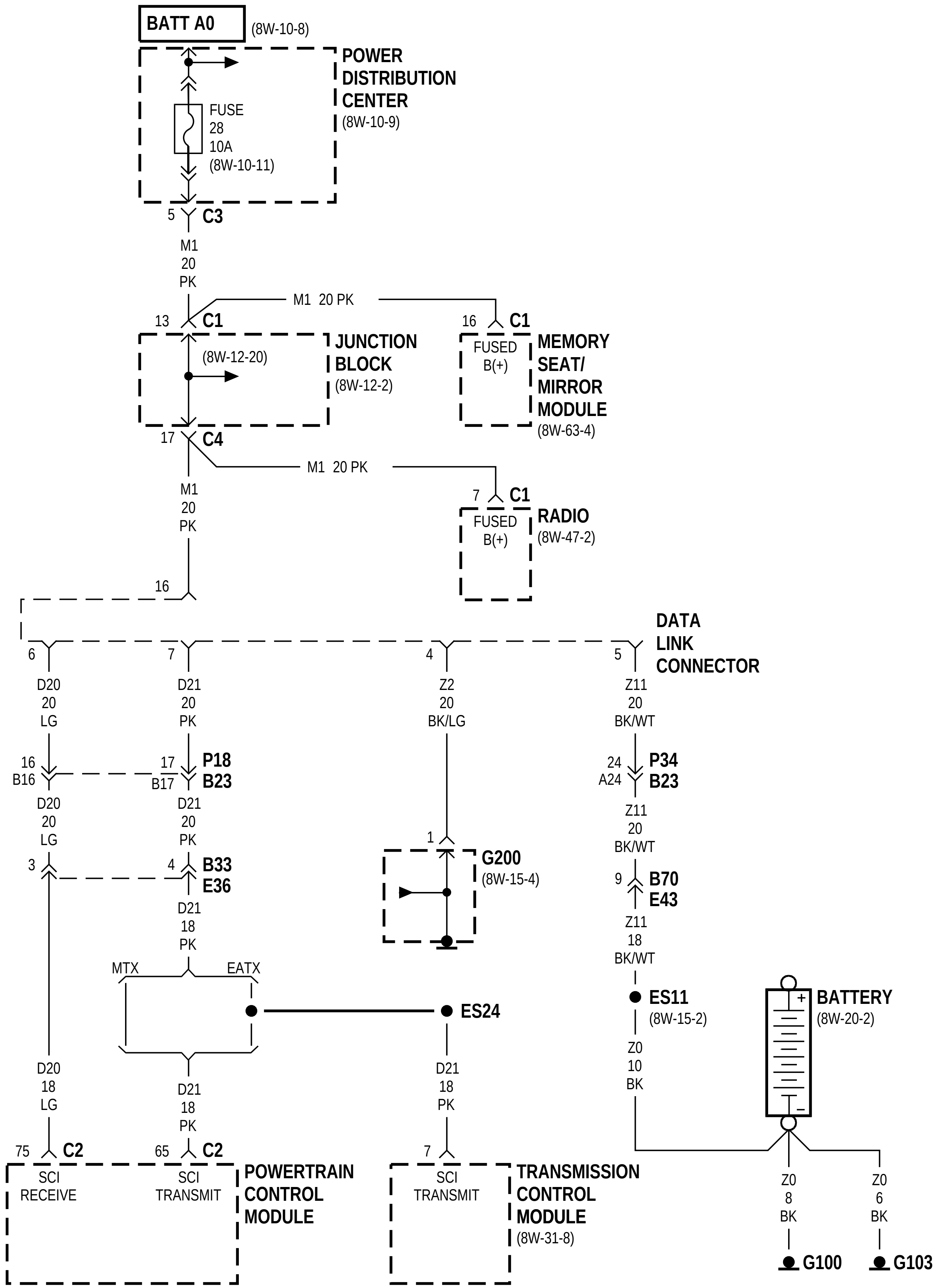
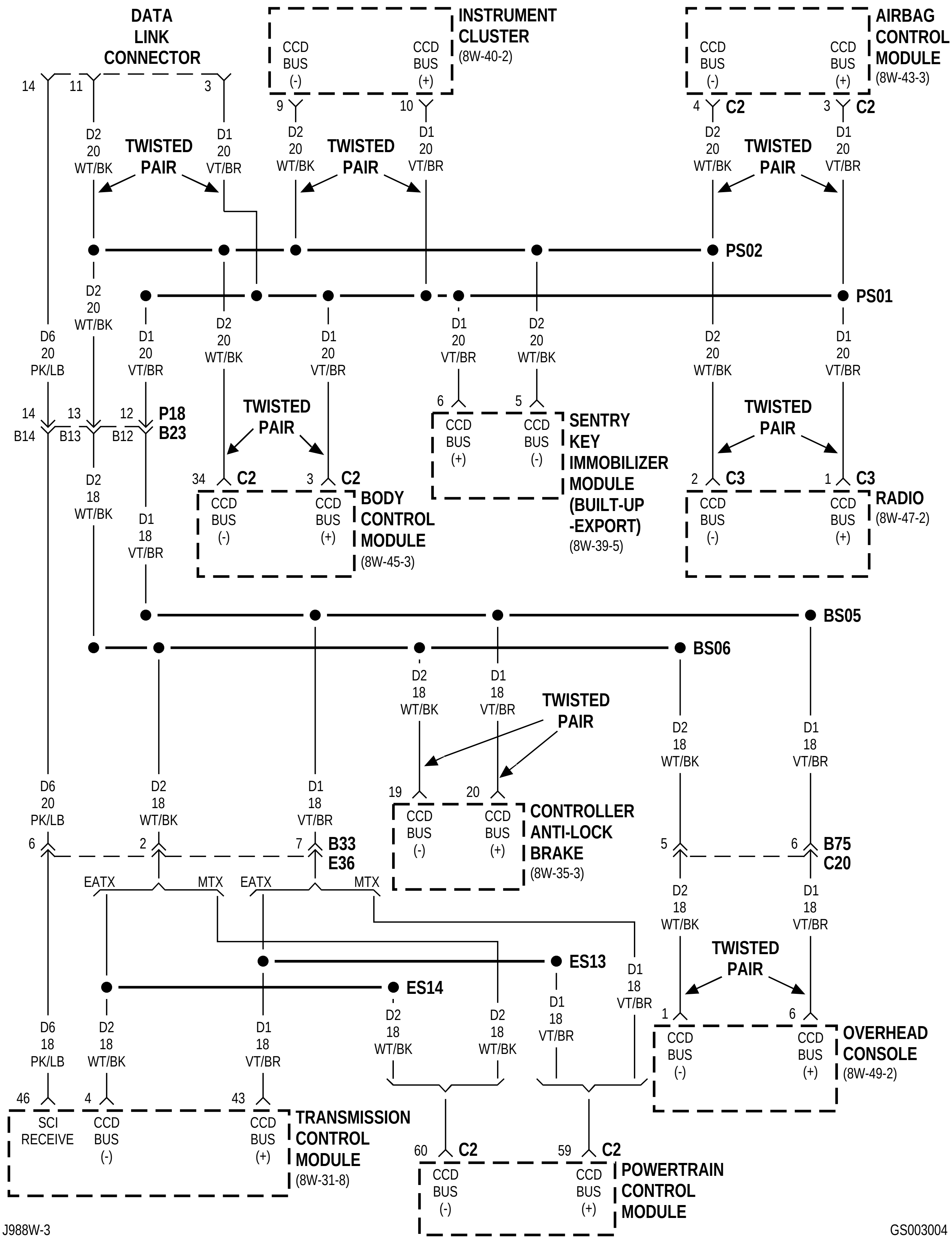
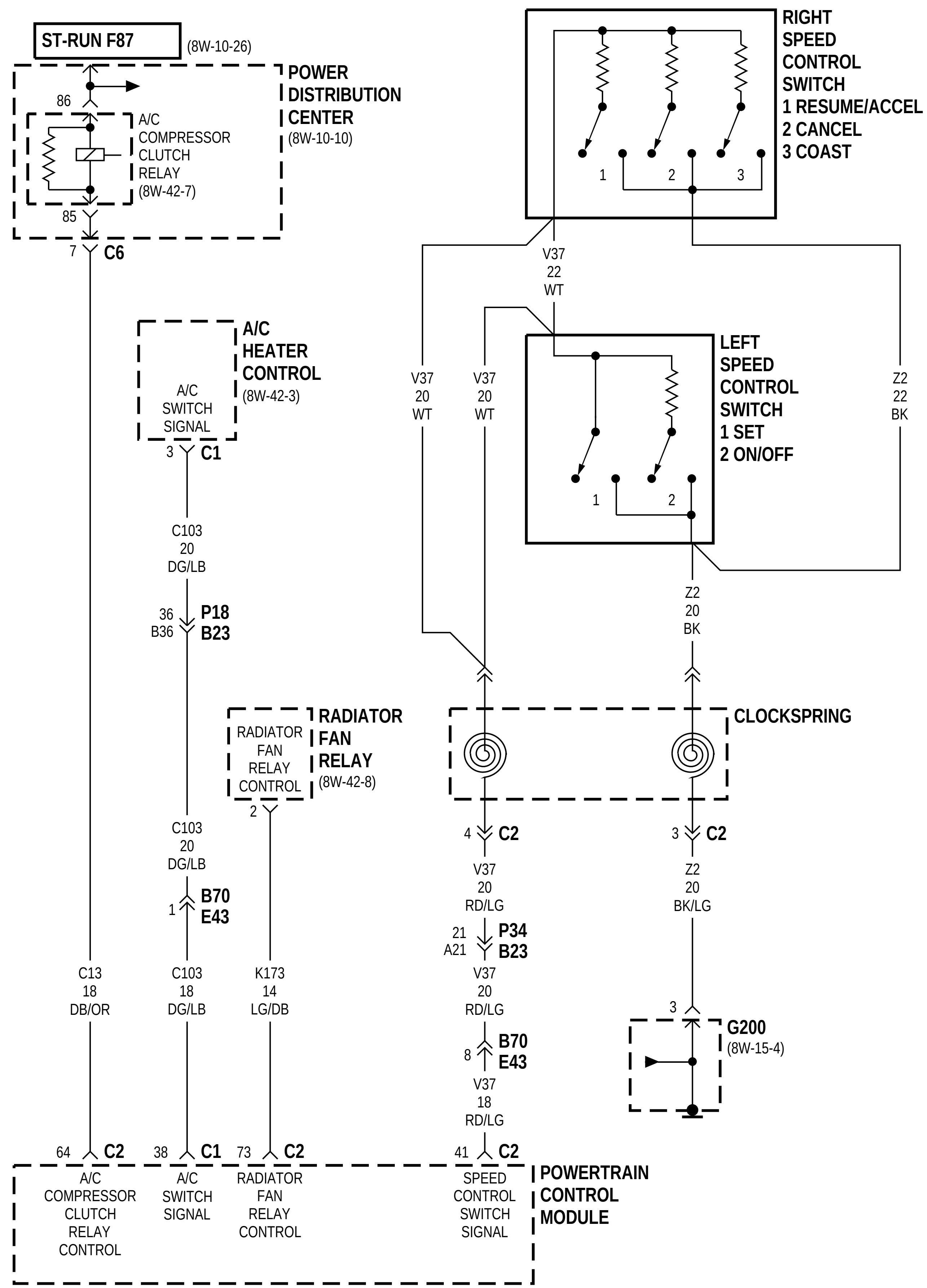
Vehicle Speed Control Servo	8W-30-13, 19, 27
Vehicle Speed Sensor	8W-30-11, 17, 36
Vent Solenoid	8W-30-27

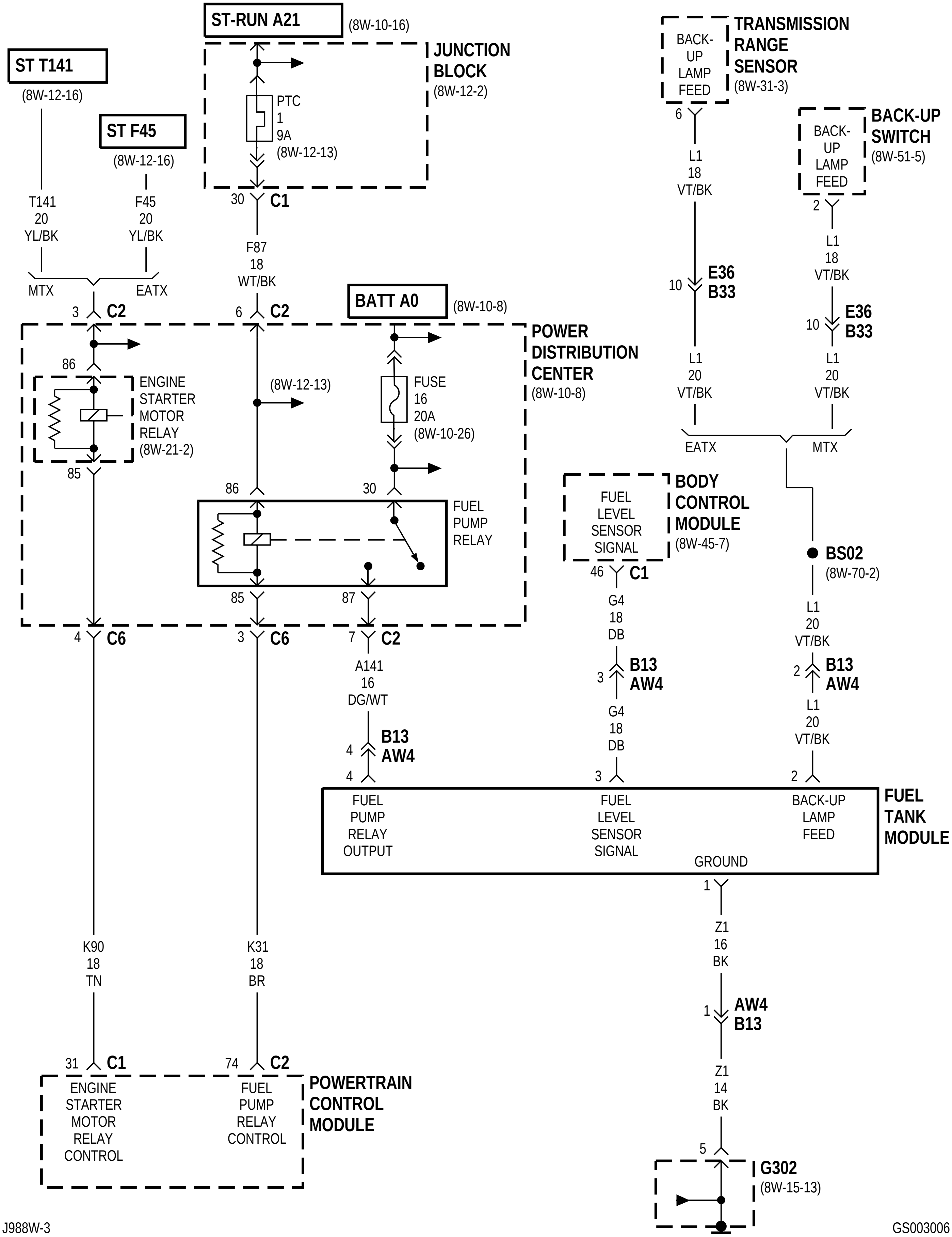

ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30
C1
F87
18
WT/BK
6
C2
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
FUSE
16
20A
(8W-10-26)
(8W-12-13)
86
30
AUTOMATIC SHUT DOWN RELAY
85
87
6
C6
8
C6
5
C6
9
C6
F87
18
WT/BK
GENERATOR
(8W-20-2)
A142
18
DG/OR
ES07
(8W-12-13)
2
ES12
(8W-10-23)
F87
18
WT/BK
K20
18
DG
K51
18
DB/YL
A142
18
DG/OR
A14
18
RD/WT
20
C1
8
C1
67
C2
6
C1
46
C2
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
GENERATOR FIELD DRIVER
AUTOMATIC SHUT DOWN RELAY CONTROL
AUTOMATIC SHUT DOWN RELAY OUTPUT
FUSED B (+)
POWERTRAIN CONTROL MODULE
BATTERY
(8W-20-2)
GROUND
50
C2
GROUND
10
C1
Z12
18
BK/TN
Z12
18
BK/TN
ES11
(8W-15-2)
Z0
10
BK
Z0
8
BK
Z0
6
BK
G100
G103


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A
(8W-10-11)
5 C3
M1 20 PK
M1 20 PK
13 C1
16 C1
JUNCTION BLOCK
(8W-12-2)
(8W-12-20)
FUSED B(+)
MEMORY SEAT/ MIRROR MODULE
(8W-63-4)
17 C4
M1 20 PK
7 C1
FUSED B(+)
RADIO
(8W-47-2)
M1 20 PK
16
DATA LINK CONNECTOR
6
7
4
5
D20 20 LG
D21 20 PK
Z2 20 BK/LG
Z11 20 BK/WT
16 B16
17 B17
P18 B23
24 A24
P34 B23
D20 20 LG
D21 20 PK
Z11 20 BK/WT
1
G200
(8W-15-4)
3
4
B33 E36
9
B70 E43
D21 18 PK
Z11 18 BK/WT
MTX
EATX
ES24
ES11
(8W-15-2)
BATTERY
(8W-20-2)
D20 18 LG
D21 18 PK
D21 18 PK
Z0 10 BK
75 C2
65 C2
7
SCI RECEIVE
SCI TRANSMIT
POWERTRAIN CONTROL MODULE
SCI TRANSMIT
TRANSMISSION CONTROL MODULE
(8W-31-8)
Z0 8 BK
Z0 6 BK
G100
G103

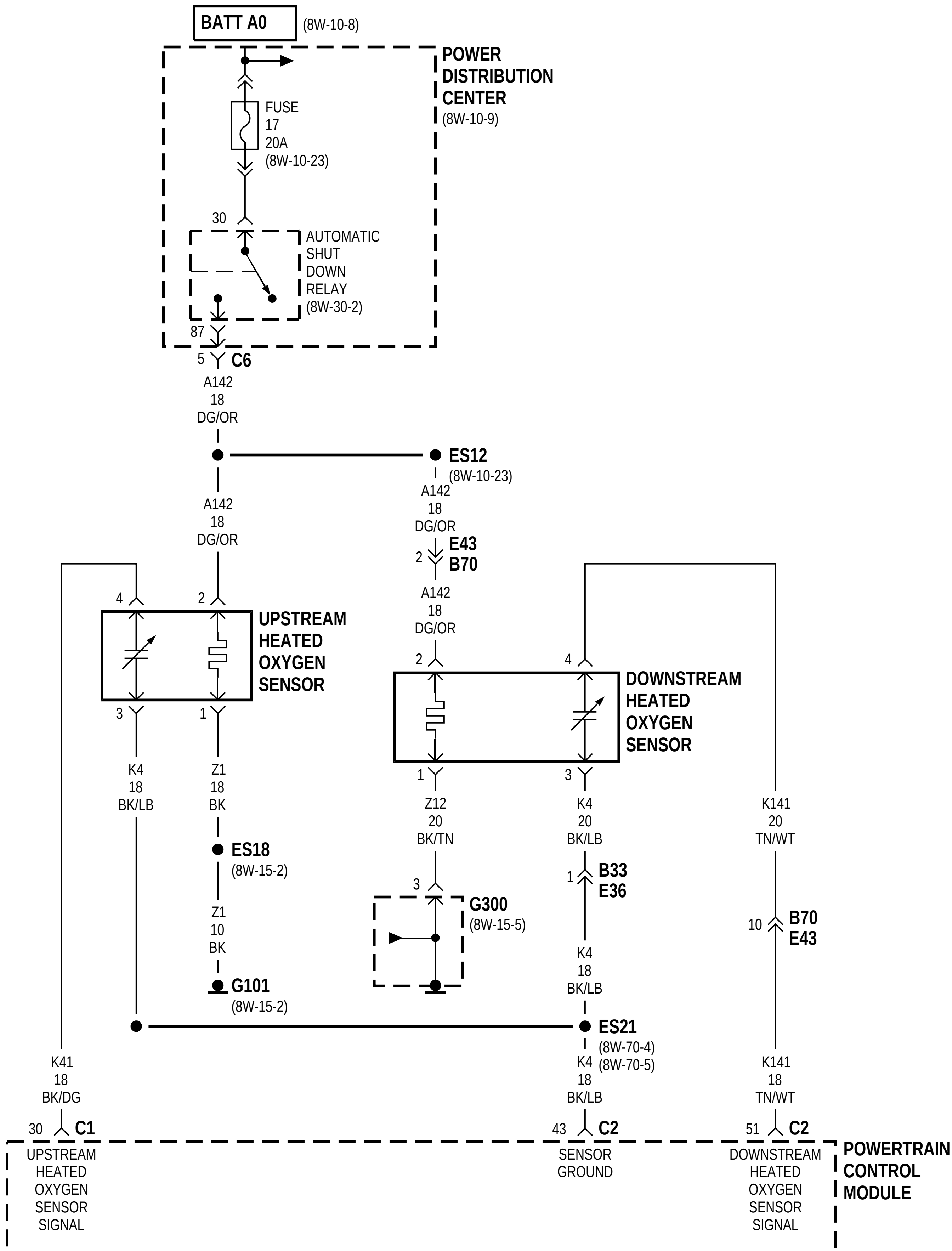


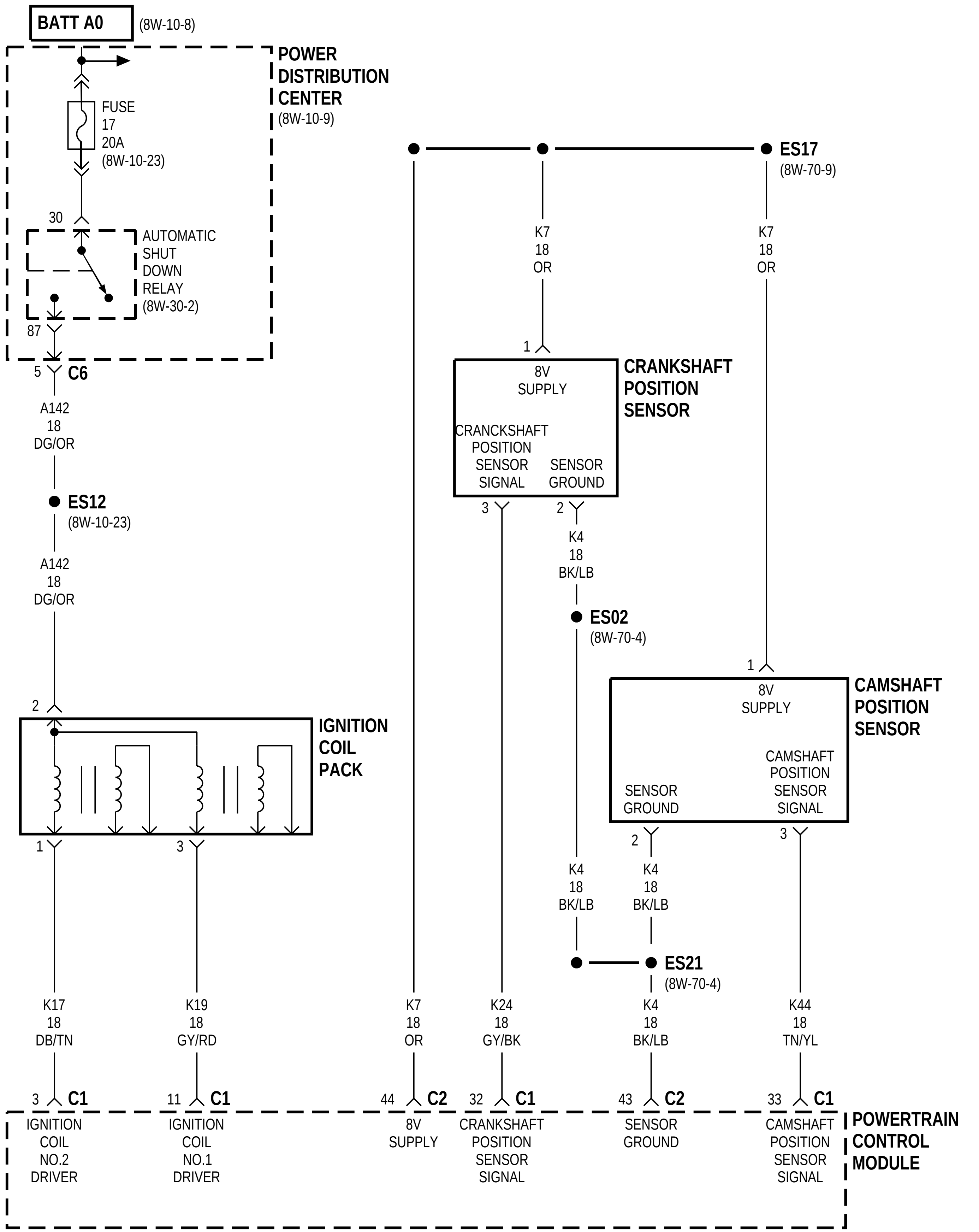
DATA LINK CONNECTOR
14
11
3
INSTRUMENT CLUSTER
(8W-40-2)
CCD BUS (-)
CCD BUS (+)
9
10
AIRBAG CONTROL MODULE
(8W-43-3)
CCD BUS (-)
CCD BUS (+)
4 C2
3 C2
D2 20 WT/BK
D1 20 VT/BR
TWISTED PAIR
PS02
PS01
D6 20 PK/LB
P18 B23
14 B14
13 B13
12 B12
D2 18 WT/BK
D1 18 VT/BR
34 C2
3 C2
BODY CONTROL MODULE
(8W-45-3)
6
5
SENTRY KEY IMMOBILIZER MODULE (BUILT-UP -EXPORT)
(8W-39-5)
CCD BUS (+)
CCD BUS (-)
2 C3
1 C3
RADIO
(8W-47-2)
BS05
BS06
19
20
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
B33 E36
6
2
7
EATX
MTX
B75 C20
5
6
ES13
ES14
D6 18 PK/LB
46
4
43
SCI RECEIVE
TRANSMISSION CONTROL MODULE
(8W-31-8)
60 C2
59 C2
POWERTRAIN CONTROL MODULE
1
6
OVERHEAD CONSOLE
(8W-49-2)
J988W-3
GS003004

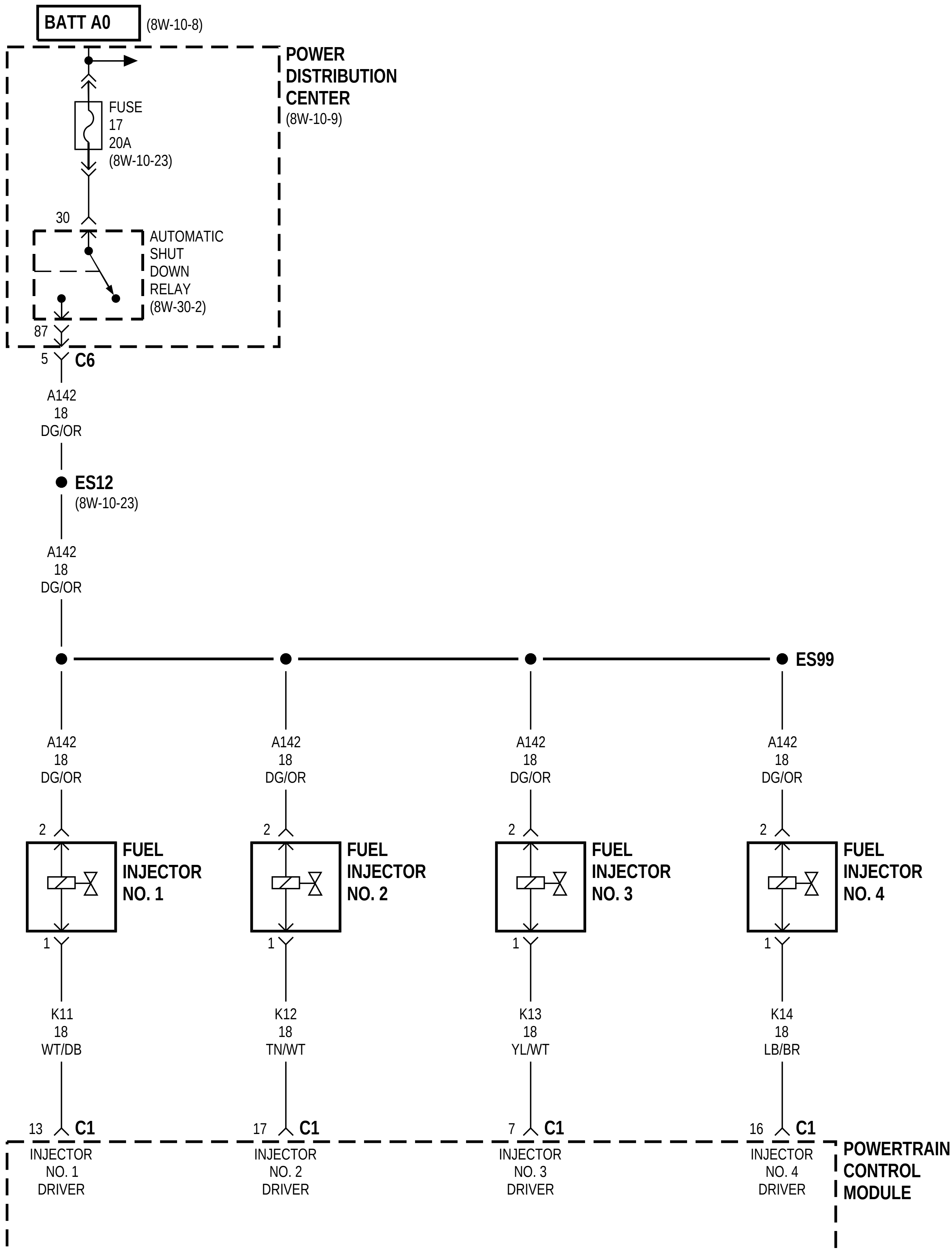

ST-RUN F87
(8W-10-26)
POWER DISTRIBUTION CENTER
(8W-10-10)
86
A/C COMPRESSOR CLUTCH RELAY
(8W-42-7)
85
7 C6
A/C HEATER CONTROL
(8W-42-3)
A/C SWITCH SIGNAL
3 C1
C103 20 DG/LB
36 P18
B36 B23
C103 20 DG/LB
1 B70 E43
RADIATOR FAN RELAY
(8W-42-8)
RADIATOR FAN RELAY CONTROL
2
C13 18 DB/OR
C103 18 DG/LB
K173 14 LG/DB
RIGHT SPEED CONTROL SWITCH
1 RESUME/ACCEL
2 CANCEL
3 COAST
1 2 3
V37 22 WT
LEFT SPEED CONTROL SWITCH
1 SET
2 ON/OFF
1 2
V37 20 WT
V37 20 WT
Z2 22 BK
Z2 20 BK
CLOCKSPRING
4 C2
3 C2
V37 20 RD/LG
Z2 20 BK/LG
21 P34
A21 B23
V37 20 RD/LG
8 B70 E43
V37 18 RD/LG
3
G200
(8W-15-4)
64 C2
38 C1
73 C2
41 C2
A/C COMPRESSOR CLUTCH RELAY CONTROL
A/C SWITCH SIGNAL
RADIATOR FAN RELAY CONTROL
SPEED CONTROL SWITCH SIGNAL
POWERTRAIN CONTROL MODULE

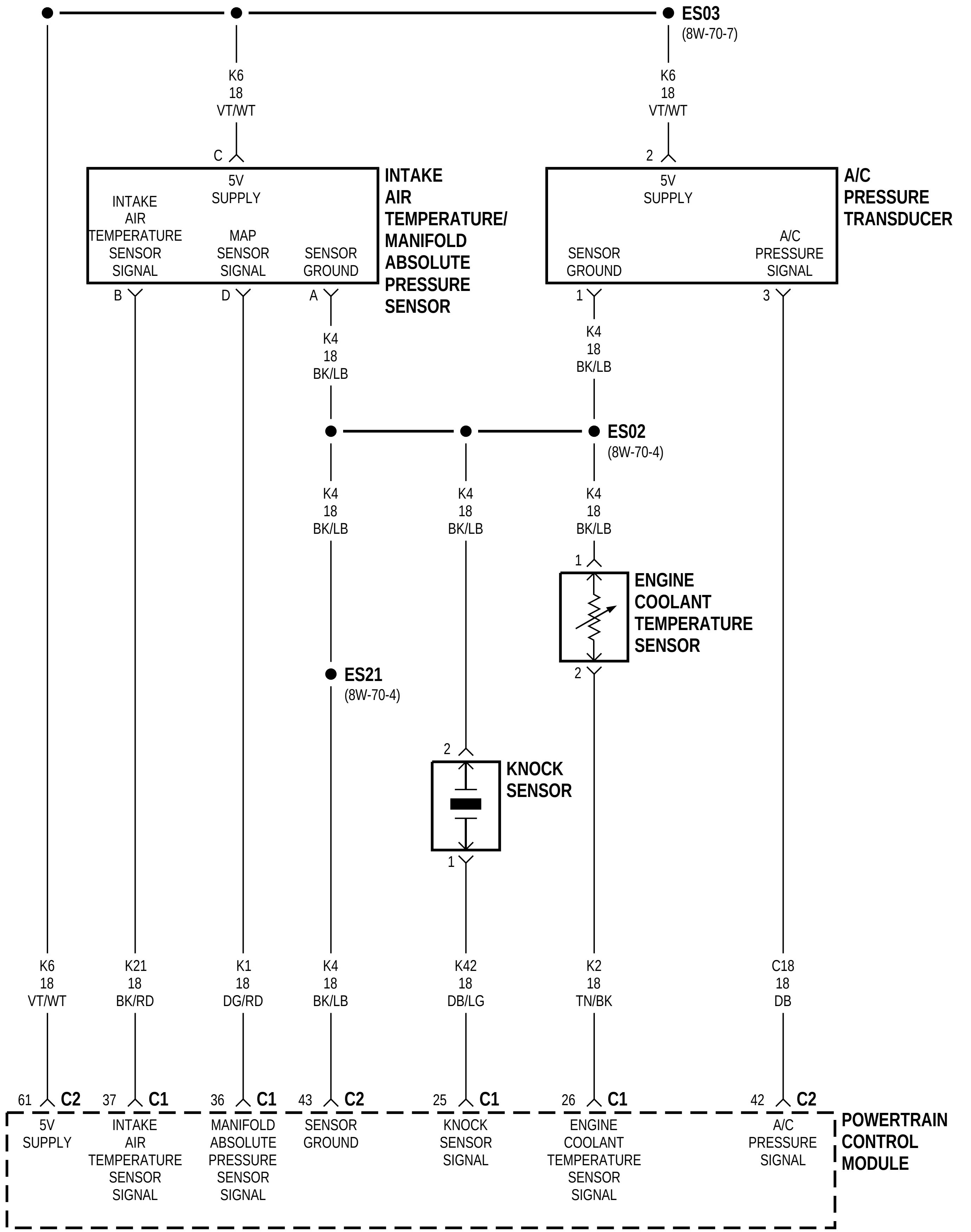


J988W-3 GS003006

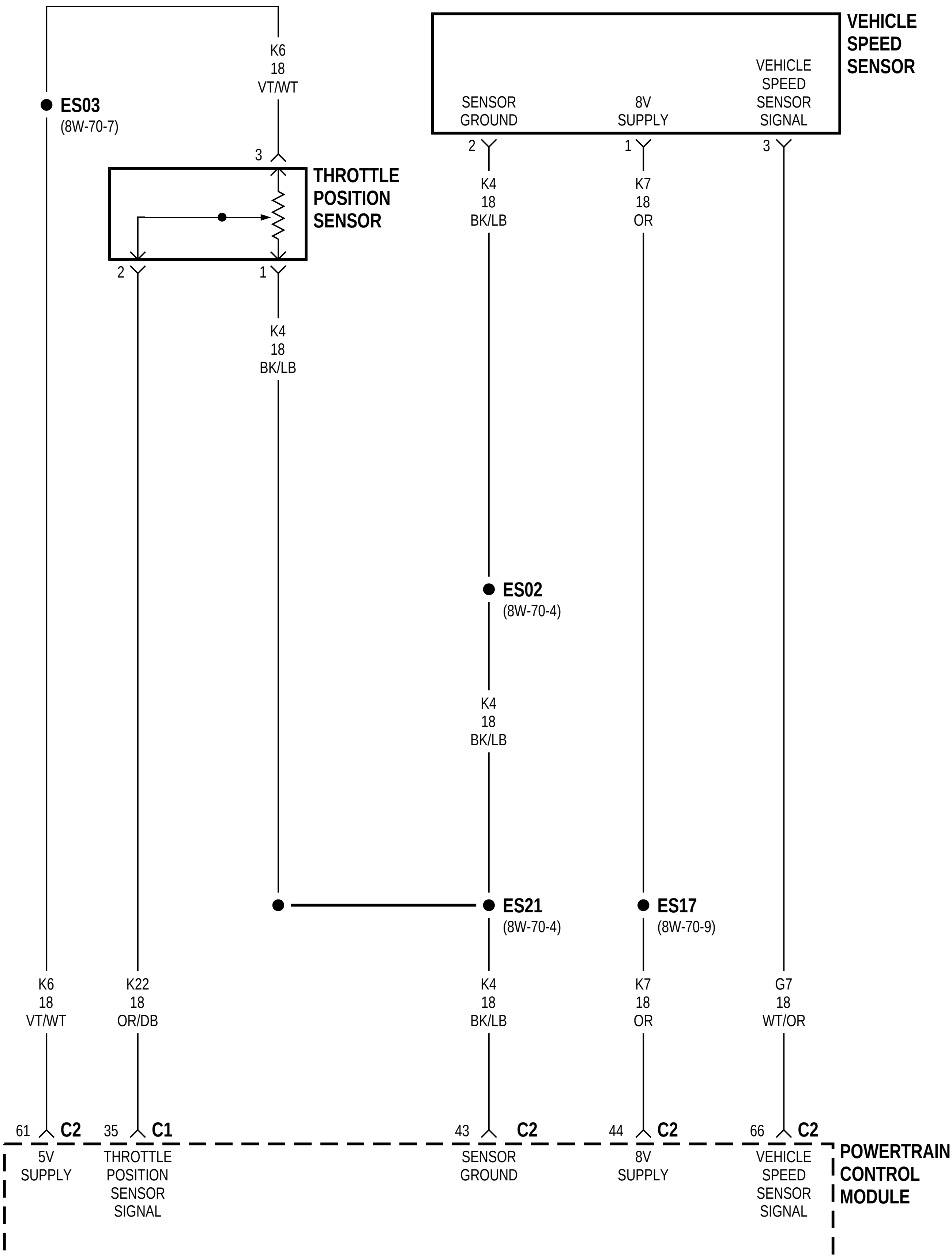

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
30
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
87
5
C6
A142
18
DG/OR
ES12
(8W-10-23)
A142
18
DG/OR
2
E43
B70
A142
18
DG/OR
4
2
UPSTREAM HEATED OXYGEN SENSOR
3
1
K4
18
BK/LB
Z1
18
BK
ES18
(8W-15-2)
Z1
10
BK
G101
(8W-15-2)
2
4
DOWNSTREAM HEATED OXYGEN SENSOR
1
3
Z12
20
BK/TN
K4
20
BK/LB
K141
20
TN/WT
3
G300
(8W-15-5)
1
B33
E36
10
B70
E43
K4
18
BK/LB
ES21
(8W-70-4)
(8W-70-5)
K41
18
BK/DG
K4
18
BK/LB
K141
18
TN/WT
30
C1
43
C2
51
C2
UPSTREAM HEATED OXYGEN SENSOR SIGNAL
SENSOR GROUND
DOWNSTREAM HEATED OXYGEN SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

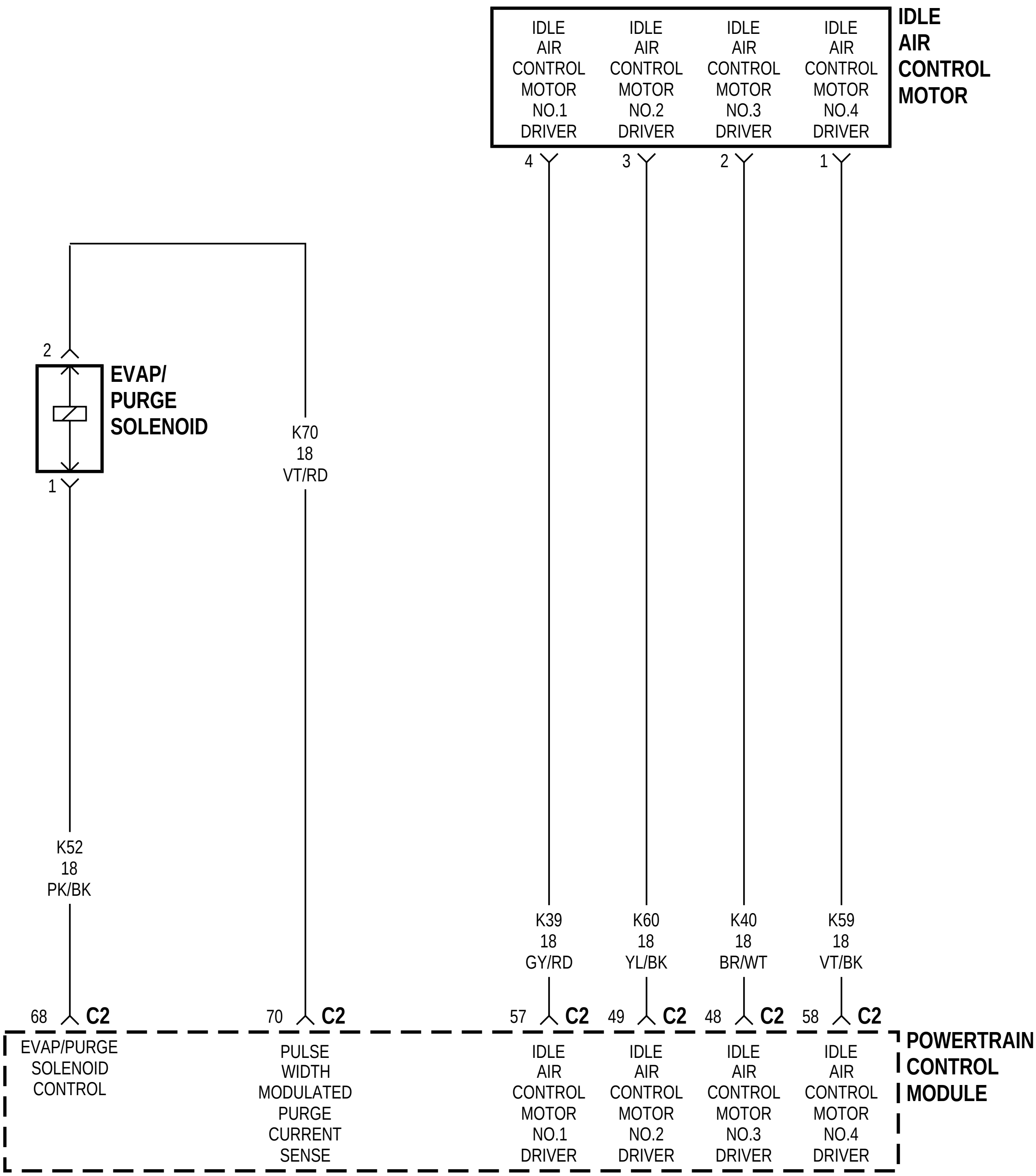

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
30
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
87
5
C6
A142
18
DG/OR
ES12
(8W-10-23)
A142
18
DG/OR
2
IGNITION COIL PACK
1
3
K17
18
DB/TN
K19
18
GY/RD
ES17
(8W-70-9)
K7
18
OR
K7
18
OR
1
8V SUPPLY
CRANCKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CRANKSHAFT POSITION SENSOR
3
2
K4
18
BK/LB
ES02
(8W-70-4)
1
8V SUPPLY
CAMSHAFT POSITION SENSOR
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
2
3
K4
18
BK/LB
K4
18
BK/LB
ES21
(8W-70-4)
K7
18
OR
K24
18
GY/BK
K4
18
BK/LB
K44
18
TN/YL
3 C1
11 C1
44 C2
32 C1
43 C2
33 C1
IGNITION COIL NO.2 DRIVER
IGNITION COIL NO.1 DRIVER
8V SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

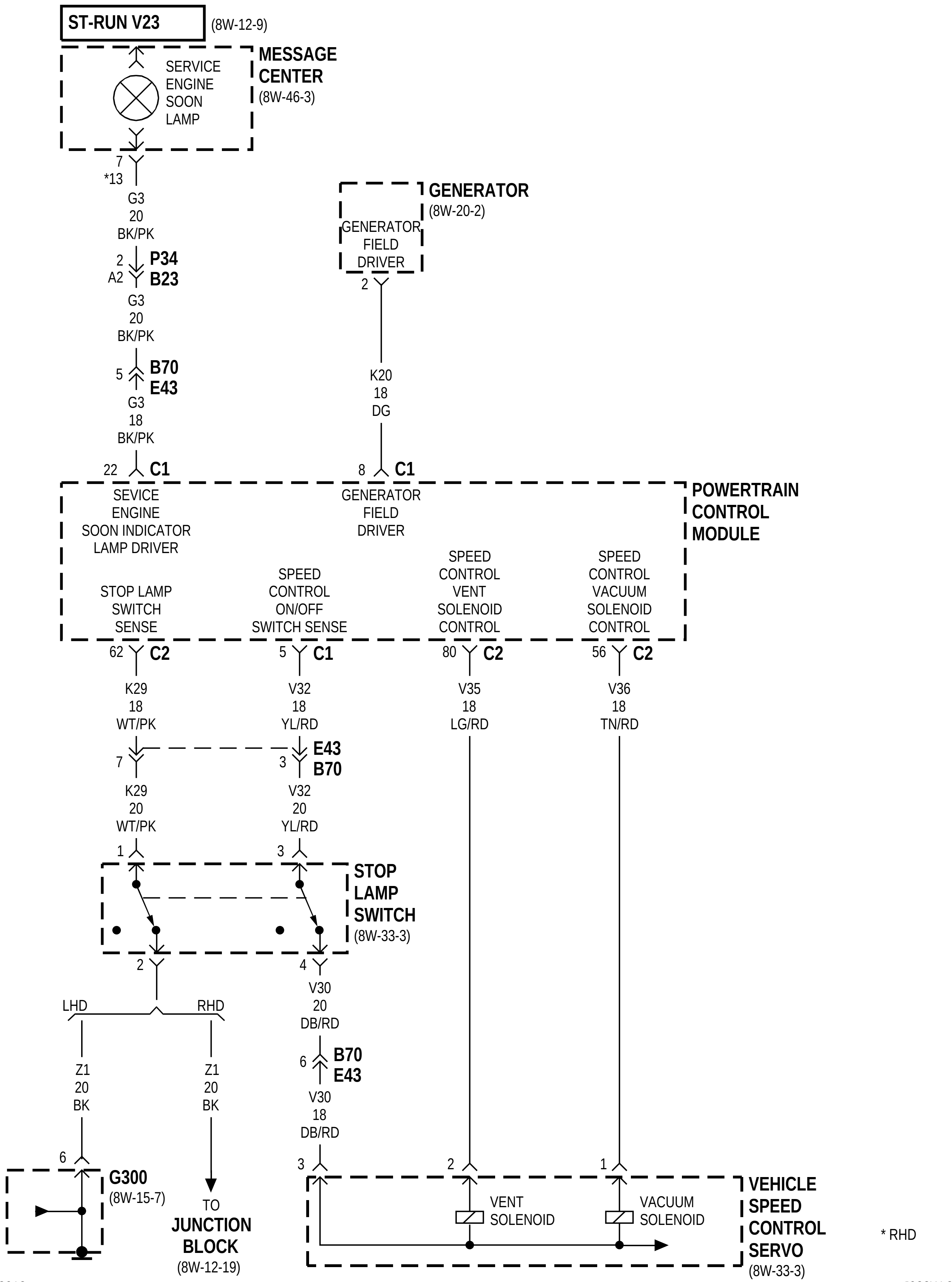

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
30
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
87
5
C6
A142
18
DG/OR
ES12
(8W-10-23)
A142
18
DG/OR
ES99
A142
18
DG/OR
2
FUEL
INJECTOR
NO. 1
1
K11
18
WT/DB
13
C1
INJECTOR
NO. 1
DRIVER
A142
18
DG/OR
2
FUEL
INJECTOR
NO. 2
1
K12
18
TN/WT
17
C1
INJECTOR
NO. 2
DRIVER
A142
18
DG/OR
2
FUEL
INJECTOR
NO. 3
1
K13
18
YL/WT
7
C1
INJECTOR
NO. 3
DRIVER
A142
18
DG/OR
2
FUEL
INJECTOR
NO. 4
1
K14
18
LB/BR
16
C1
INJECTOR
NO. 4
DRIVER
POWERTRAIN
CONTROL
MODULE

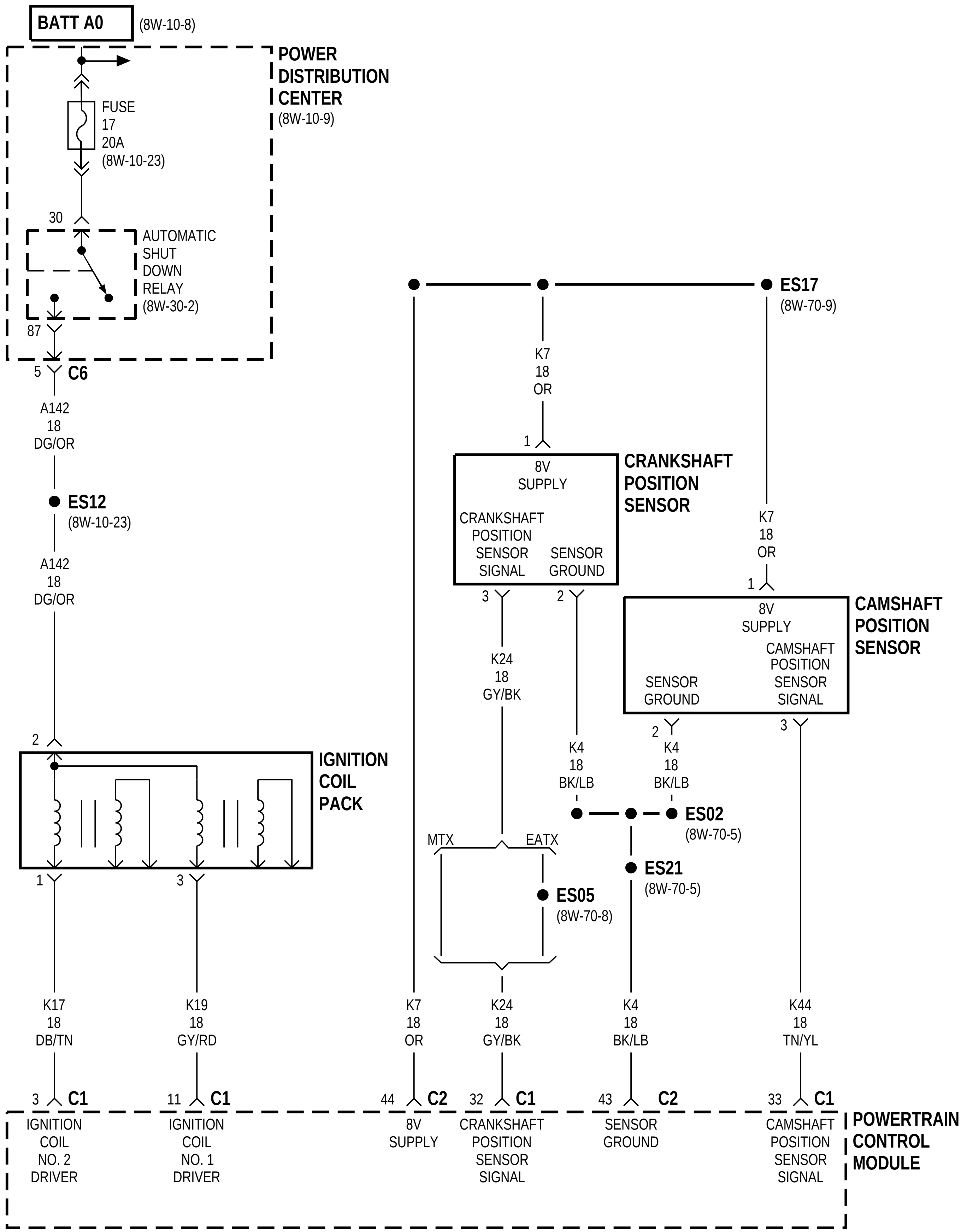


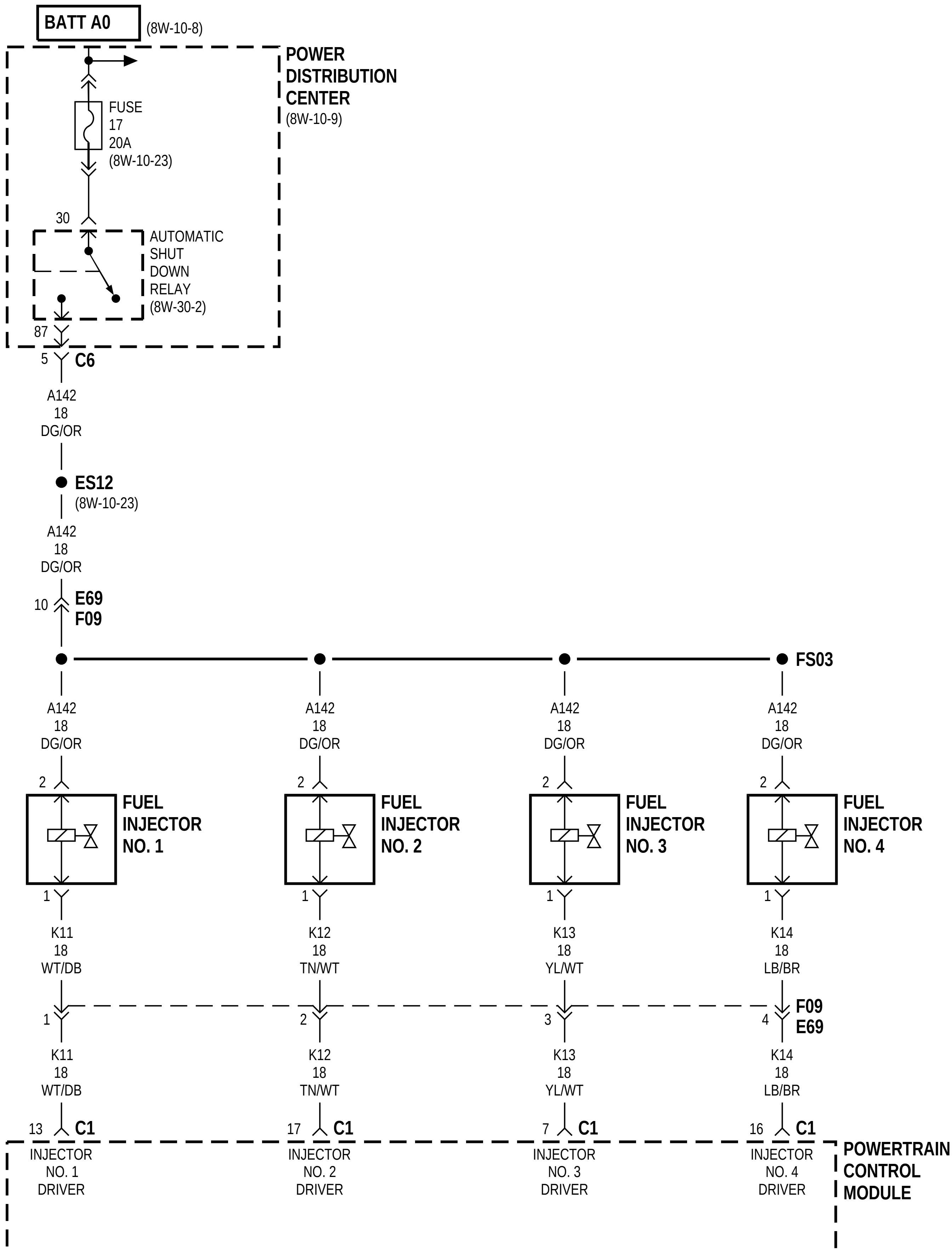
ES03
(8W-70-7)
K6
18
VT/WT
C
2
5V
SUPPLY
INTAKE
AIR
TEMPERATURE
SENSOR
SIGNAL
MAP
SENSOR
SIGNAL
SENSOR
GROUND
INTAKE
AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
A/C
PRESSURE
SIGNAL
A/C
PRESSURE
TRANSDUCER
B
D
A
1
3
K4
18
BK/LB
ES02
(8W-70-4)
ENGINE
COOLANT
TEMPERATURE
SENSOR
ES21
(8W-70-4)
KNOCK
SENSOR
K6 18 VT/WT
K21 18 BK/RD
K1 18 DG/RD
K4 18 BK/LB
K42 18 DB/LG
K2 18 TN/BK
C18 18 DB
61 C2
37 C1
36 C1
43 C2
25 C1
26 C1
42 C2
5V SUPPLY
INTAKE AIR TEMPERATURE SENSOR SIGNAL
MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
SENSOR GROUND
KNOCK SENSOR SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
A/C PRESSURE SIGNAL
POWERTRAIN
CONTROL
MODULE

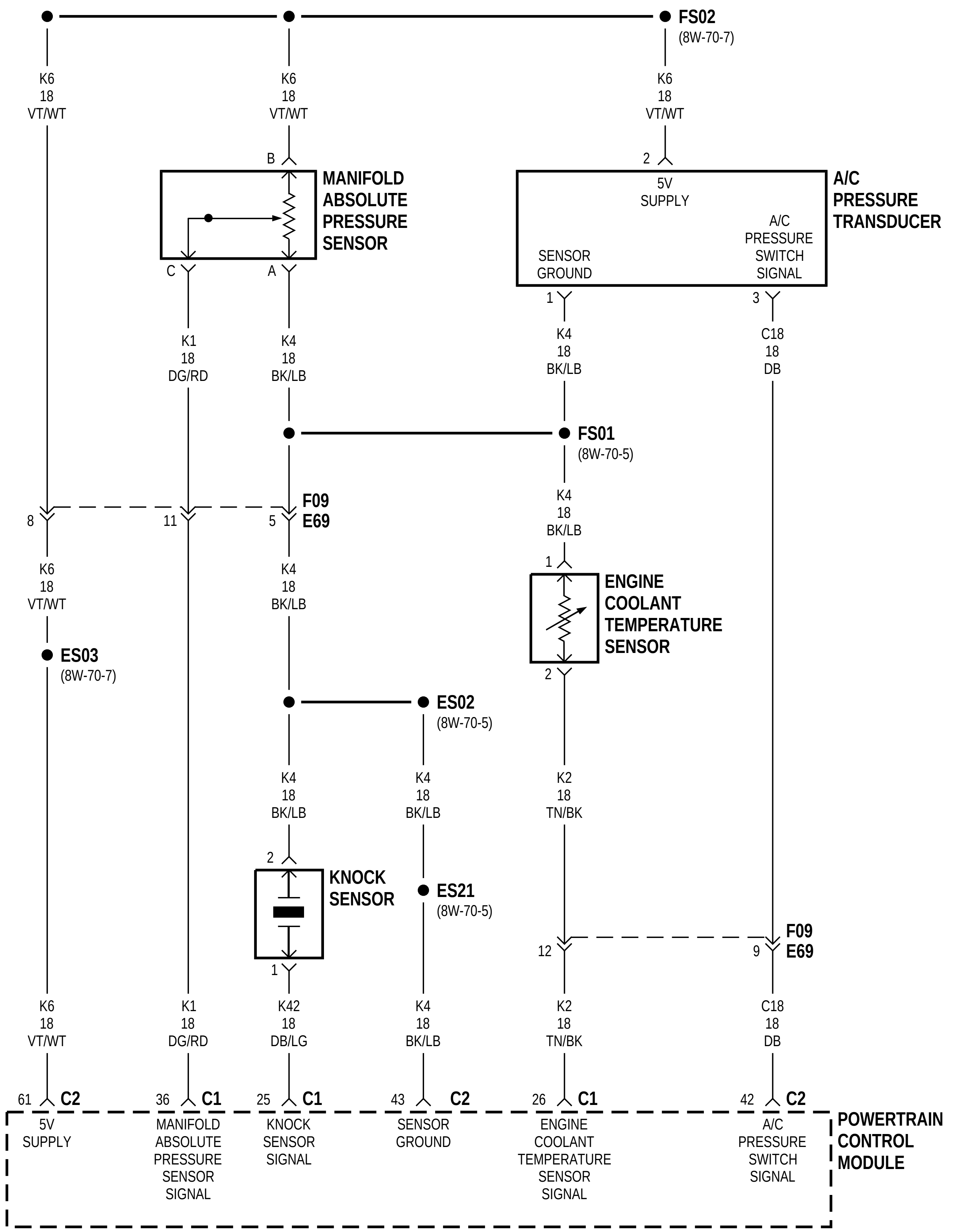

K6
18
VT/WT
ES03
(8W-70-7)
3
THROTTLE
POSITION
SENSOR
2
1
K4
18
BK/LB
VEHICLE
SPEED
SENSOR
SENSOR
GROUND
8V
SUPPLY
VEHICLE
SPEED
SENSOR
SIGNAL
2
1
3
K4
18
BK/LB
K7
18
OR
ES02
(8W-70-4)
K4
18
BK/LB
ES21
(8W-70-4)
ES17
(8W-70-9)
K6
18
VT/WT
K22
18
OR/DB
K4
18
BK/LB
K7
18
OR
G7
18
WT/OR
61 C2
35 C1
43 C2
44 C2
66 C2
5V
SUPPLY
THROTTLE
POSITION
SENSOR
SIGNAL
SENSOR
GROUND
8V
SUPPLY
VEHICLE
SPEED
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE

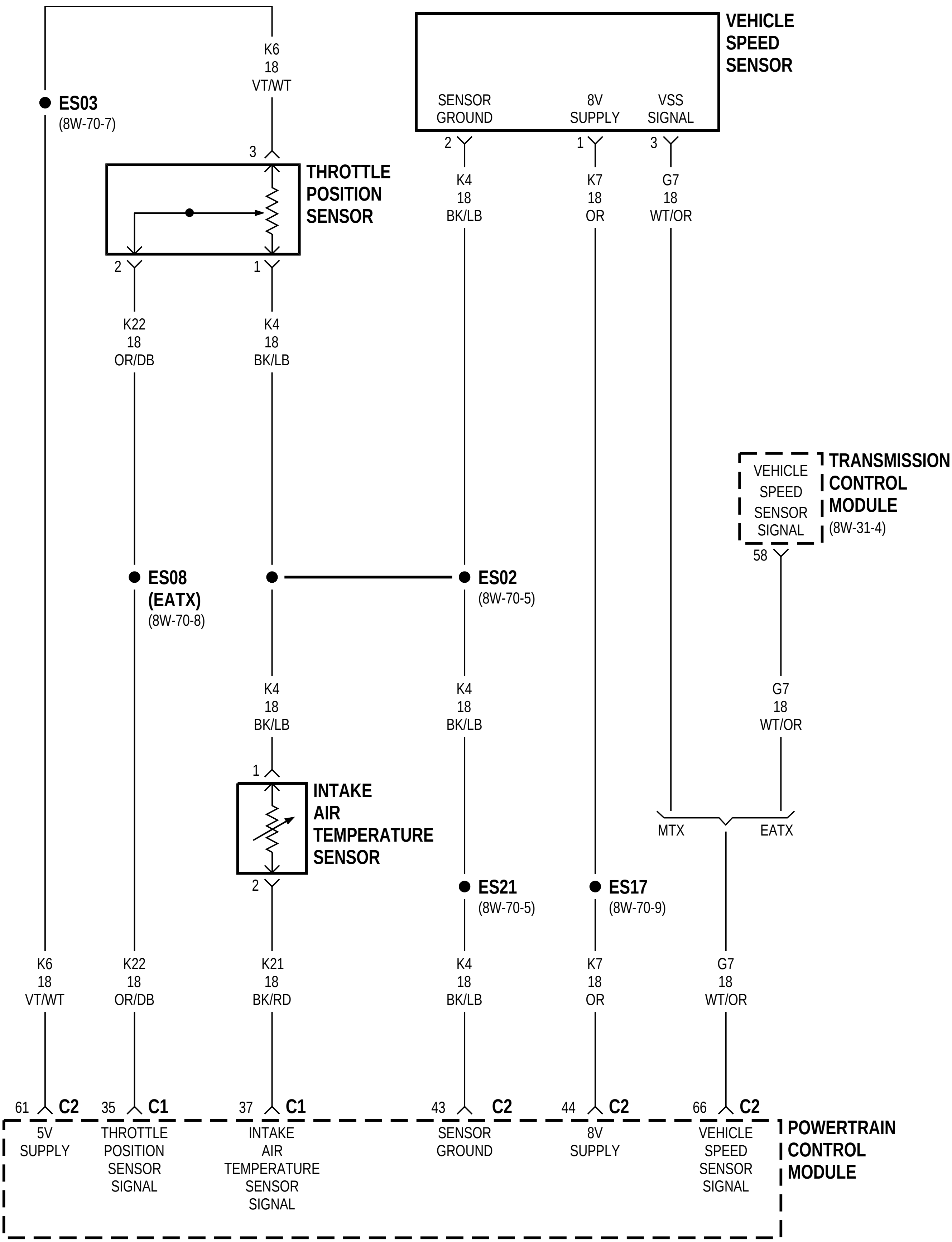

IDLE AIR CONTROL MOTOR NO.1 DRIVER
IDLE AIR CONTROL MOTOR NO.2 DRIVER
IDLE AIR CONTROL MOTOR NO.3 DRIVER
IDLE AIR CONTROL MOTOR NO.4 DRIVER
IDLE AIR CONTROL MOTOR
4
3
2
1
2
EVAP/ PURGE SOLENOID
1
K70 18 VT/RD
K52 18 PK/BK
K39 18 GY/RD
K60 18 YL/BK
K40 18 BR/WT
K59 18 VT/BK
68 C2
70 C2
57 C2
49 C2
48 C2
58 C2
EVAP/PURGE SOLENOID CONTROL
PULSE WIDTH MODULATED PURGE CURRENT SENSE
IDLE AIR CONTROL MOTOR NO.1 DRIVER
IDLE AIR CONTROL MOTOR NO.2 DRIVER
IDLE AIR CONTROL MOTOR NO.3 DRIVER
IDLE AIR CONTROL MOTOR NO.4 DRIVER
POWERTRAIN CONTROL MODULE

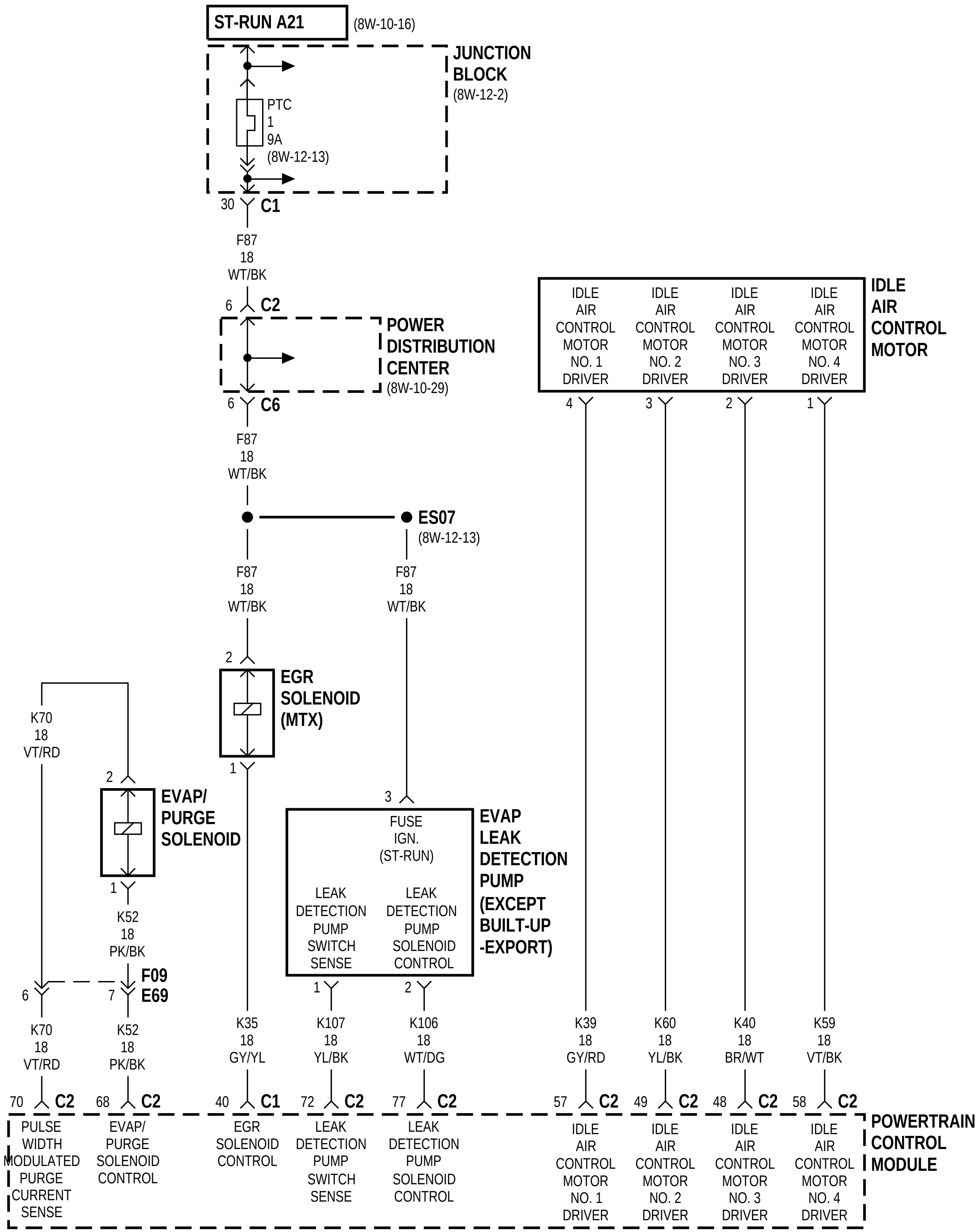

ST-RUN V23
(8W-12-9)
MESSAGE CENTER
(8W-46-3)
SERVICE ENGINE SOON LAMP
7
*13
G3 20 BK/PK
2
A2
P34
B23
G3 20 BK/PK
5
B70
E43
G3 18 BK/PK
22
C1
GENERATOR
(8W-20-2)
GENERATOR FIELD DRIVER
2
K20 18 DG
8
C1
POWERTRAIN CONTROL MODULE
SEVICE ENGINE SOON INDICATOR LAMP DRIVER
GENERATOR FIELD DRIVER
STOP LAMP SWITCH SENSE
SPEED CONTROL ON/OFF SWITCH SENSE
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL VACUUM SOLENOID CONTROL
62
C2
5
C1
80
C2
56
C2
K29 18 WT/PK
V32 18 YL/RD
V35 18 LG/RD
V36 18 TN/RD
7
3
E43
B70
K29 20 WT/PK
V32 20 YL/RD
1
3
STOP LAMP SWITCH
(8W-33-3)
2
4
LHD
RHD
V30 20 DB/RD
6
B70
E43
V30 18 DB/RD
Z1 20 BK
Z1 20 BK
6
G300
(8W-15-7)
TO JUNCTION BLOCK
(8W-12-19)
3
2
1
VENT SOLENOID
VACUUM SOLENOID
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
* RHD


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 17 20A (8W-10-23)
30
AUTOMATIC SHUT DOWN RELAY (8W-30-2)
87
5 C6
A142 18 DG/OR
ES12 (8W-10-23)
A142 18 DG/OR
2
IGNITION COIL PACK
1
3
K17 18 DB/TN
K19 18 GY/RD
ES17 (8W-70-9)
K7 18 OR
1
CRANKSHAFT POSITION SENSOR
8V SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
3
2
K24 18 GY/BK
K4 18 BK/LB
K7 18 OR
1
CAMSHAFT POSITION SENSOR
8V SUPPLY
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
2
3
K4 18 BK/LB
ES02 (8W-70-5)
ES21 (8W-70-5)
MTX
EATX
ES05 (8W-70-8)
K7 18 OR
K24 18 GY/BK
K4 18 BK/LB
K44 18 TN/YL
3 C1
11 C1
44 C2
32 C1
43 C2
33 C1
POWERTRAIN CONTROL MODULE
IGNITION COIL NO. 2 DRIVER
IGNITION COIL NO. 1 DRIVER
8V SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL

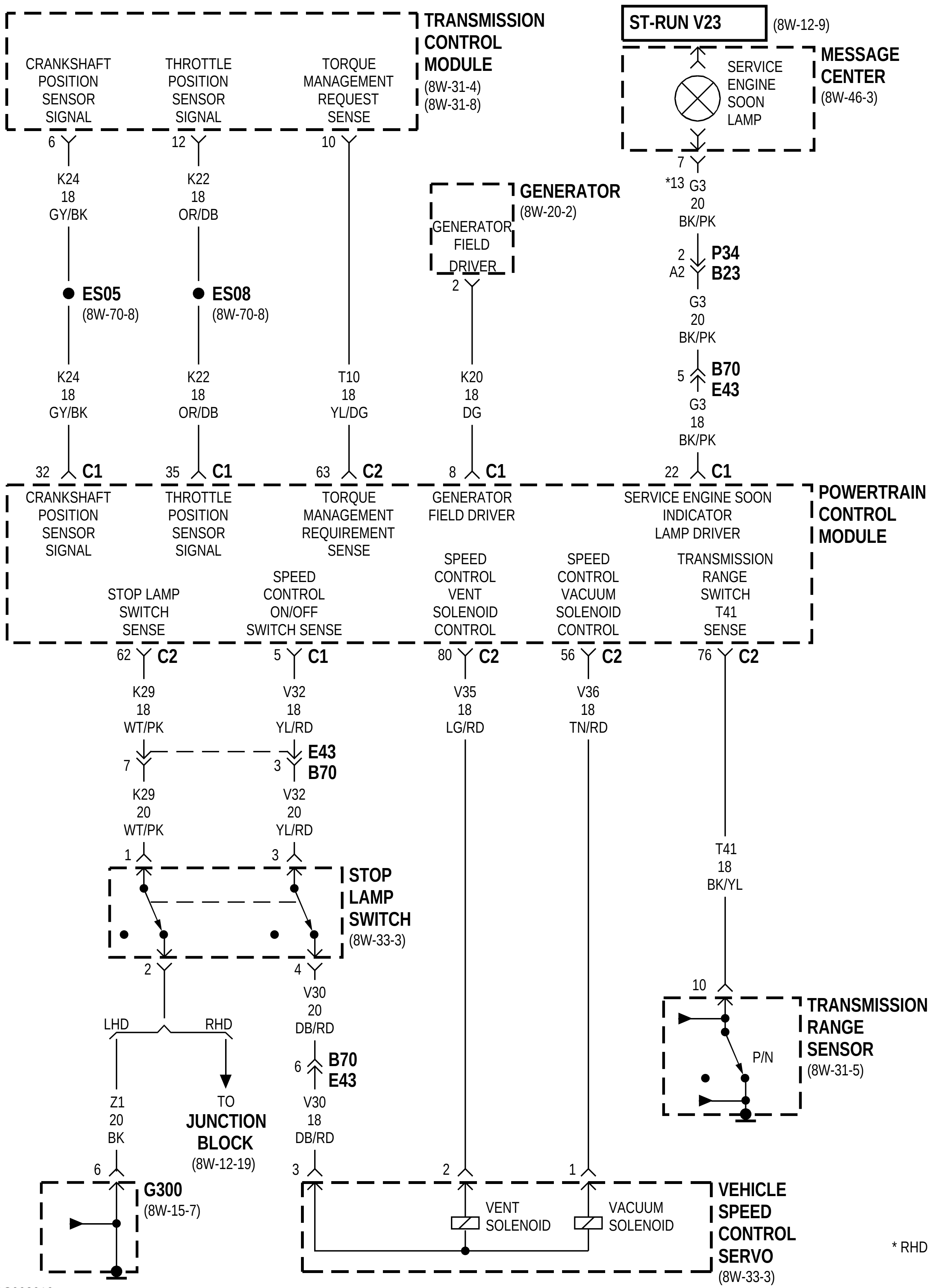

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
30
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
87
5
C6
A142
18
DG/OR
ES12
(8W-10-23)
A142
18
DG/OR
10
E69
F09
FS03
A142
18
DG/OR
2
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 4
1
K11
18
WT/DB
K12
18
TN/WT
K13
18
YL/WT
K14
18
LB/BR
F09
E69
13
C1
17
C1
7
C1
16
C1
INJECTOR
NO. 1
DRIVER
INJECTOR
NO. 2
DRIVER
INJECTOR
NO. 3
DRIVER
INJECTOR
NO. 4
DRIVER
POWERTRAIN
CONTROL
MODULE


FS02
(8W-70-7)
K6
18
VT/WT
B
2
MANIFOLD ABSOLUTE PRESSURE SENSOR
5V SUPPLY
A/C PRESSURE SWITCH SIGNAL
SENSOR GROUND
A/C PRESSURE TRANSDUCER
C
A
1
3
K1
18
DG/RD
K4
18
BK/LB
C18
18
DB
FS01
(8W-70-5)
8
11
5
F09
E69
ENGINE COOLANT TEMPERATURE SENSOR
ES03
(8W-70-7)
ES02
(8W-70-5)
K2
18
TN/BK
KNOCK SENSOR
ES21
(8W-70-5)
12
9
K42
18
DB/LG
61 C2
36 C1
25 C1
43 C2
26 C1
42 C2
5V SUPPLY
MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
KNOCK SENSOR SIGNAL
SENSOR GROUND
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
A/C PRESSURE SWITCH SIGNAL
POWERTRAIN CONTROL MODULE

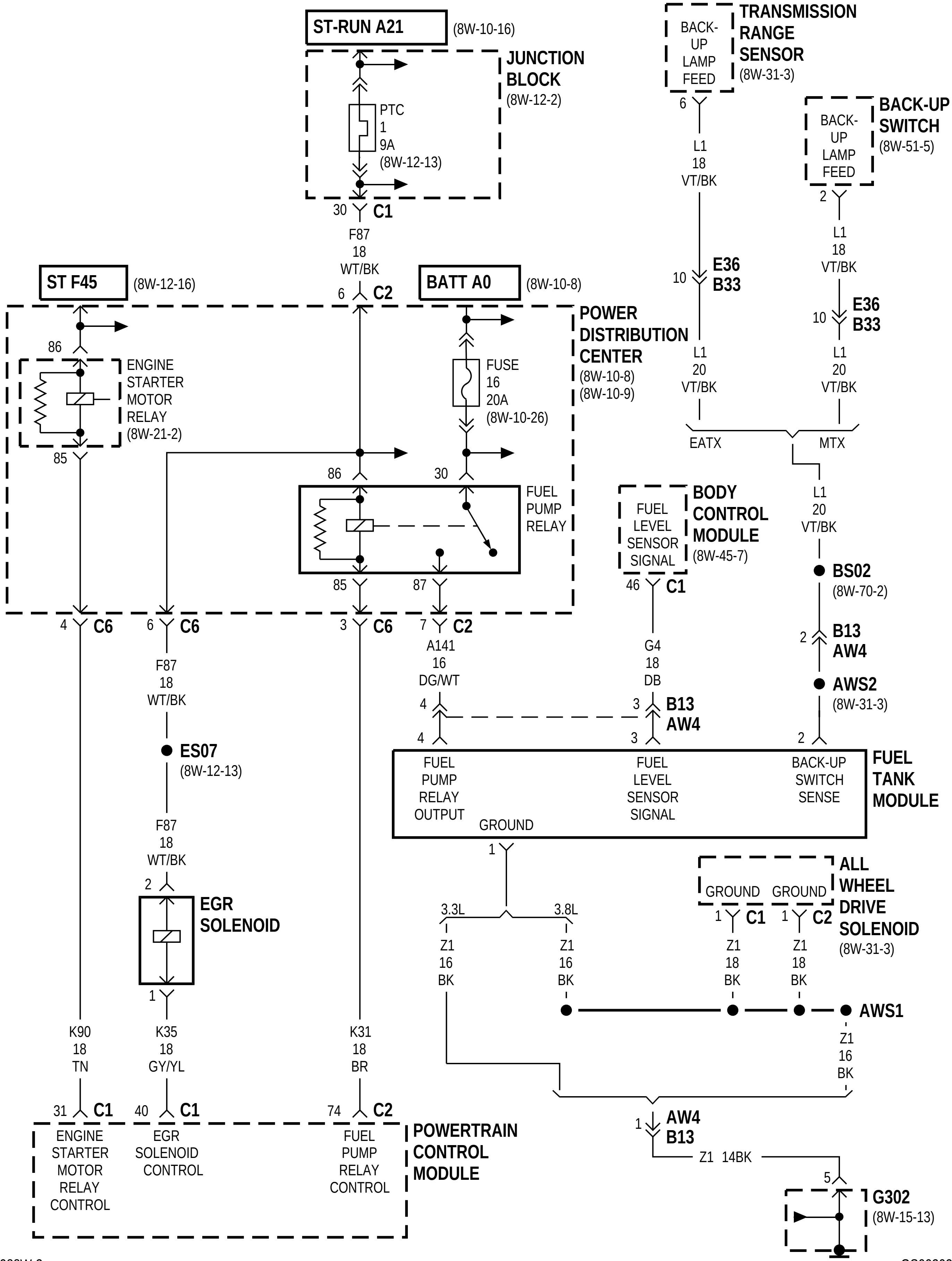

VEHICLE SPEED SENSOR
SENSOR GROUND
8V SUPPLY
VSS SIGNAL
K6 18 VT/WT
ES03
(8W-70-7)
THROTTLE POSITION SENSOR
K22 18 OR/DB
K4 18 BK/LB
K7 18 OR
G7 18 WT/OR
TRANSMISSION CONTROL MODULE
(8W-31-4)
VEHICLE SPEED SENSOR SIGNAL
58
ES08 (EATX)
(8W-70-8)
ES02
(8W-70-5)
INTAKE AIR TEMPERATURE SENSOR
MTX
EATX
ES21
(8W-70-5)
ES17
(8W-70-9)
K21 18 BK/RD
61 C2
35 C1
37 C1
43 C2
44 C2
66 C2
5V SUPPLY
THROTTLE POSITION SENSOR SIGNAL
INTAKE AIR TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
8V SUPPLY
VEHICLE SPEED SENSOR SIGNAL
POWERTRAIN CONTROL MODULE


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30
C1
F87
18
WT/BK
6
C2
POWER DISTRIBUTION CENTER
(8W-10-29)
6
C6
F87
18
WT/BK
ES07
(8W-12-13)
F87
18
WT/BK
F87
18
WT/BK
2
EGR SOLENOID (MTX)
1
K70
18
VT/RD
2
EVAP/ PURGE SOLENOID
1
K52
18
PK/BK
F09
E69
6
7
K70
18
VT/RD
K52
18
PK/BK
3
FUSE IGN. (ST-RUN)
LEAK DETECTION PUMP SWITCH SENSE
LEAK DETECTION PUMP SOLENOID CONTROL
EVAP LEAK DETECTION PUMP (EXCEPT BUILT-UP -EXPORT)
1
2
K35
18
GY/YL
K107
18
YL/BK
K106
18
WT/DG
IDLE AIR CONTROL MOTOR NO. 1 DRIVER
IDLE AIR CONTROL MOTOR NO. 2 DRIVER
IDLE AIR CONTROL MOTOR NO. 3 DRIVER
IDLE AIR CONTROL MOTOR NO. 4 DRIVER
IDLE AIR CONTROL MOTOR
4
3
2
1
K39
18
GY/RD
K60
18
YL/BK
K40
18
BR/WT
K59
18
VT/BK
70 C2
68 C2
40 C1
72 C2
77 C2
57 C2
49 C2
48 C2
58 C2
PULSE WIDTH MODULATED PURGE CURRENT SENSE
EVAP/ PURGE SOLENOID CONTROL
EGR SOLENOID CONTROL
LEAK DETECTION PUMP SWITCH SENSE
LEAK DETECTION PUMP SOLENOID CONTROL
IDLE AIR CONTROL MOTOR NO. 1 DRIVER
IDLE AIR CONTROL MOTOR NO. 2 DRIVER
IDLE AIR CONTROL MOTOR NO. 3 DRIVER
IDLE AIR CONTROL MOTOR NO. 4 DRIVER
POWERTRAIN CONTROL MODULE

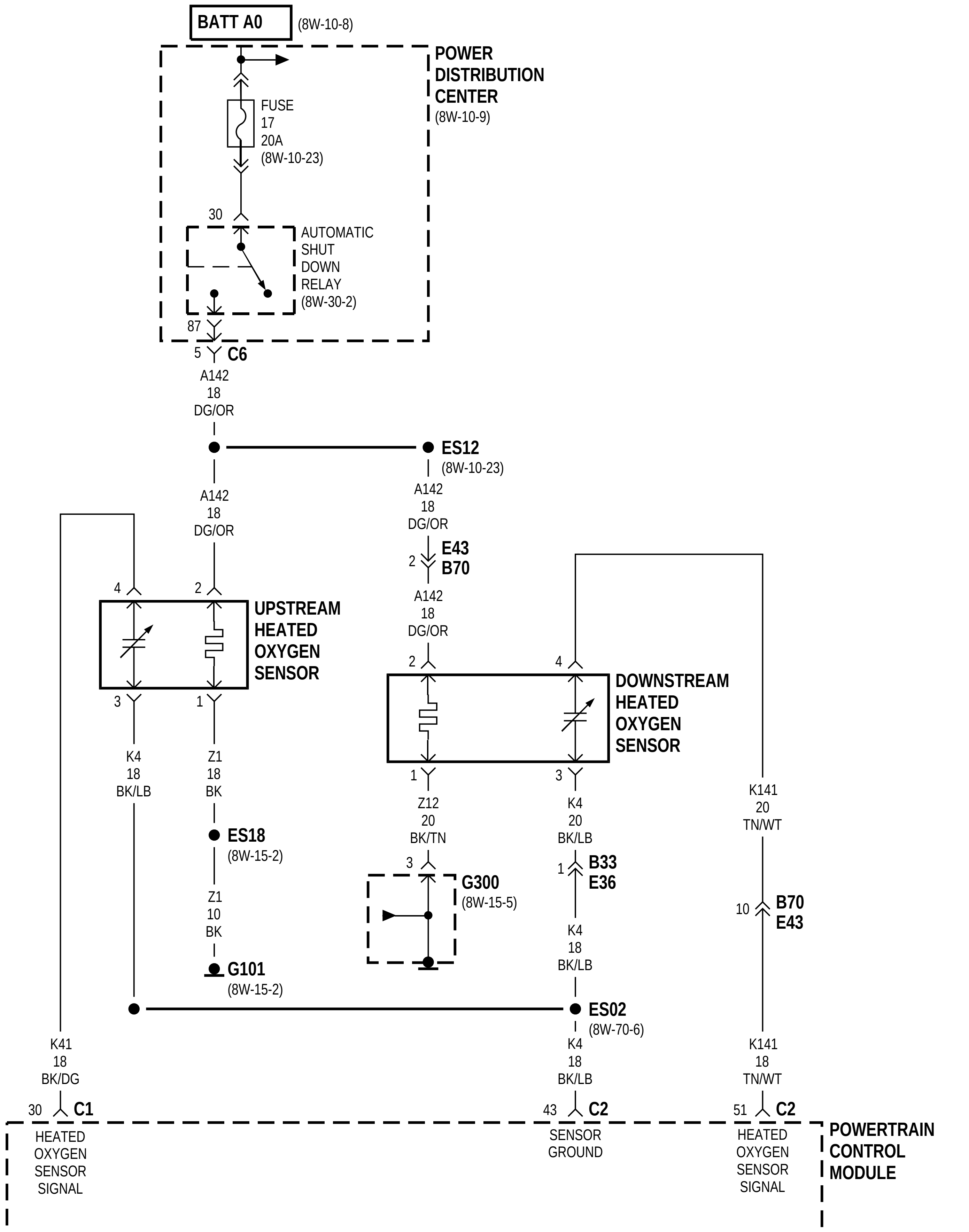
2.4L


TRANSMISSION CONTROL MODULE
(8W-31-4)
(8W-31-8)
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
TORQUE MANAGEMENT REQUEST SENSE
6
12
10
K24 18 GY/BK
K22 18 OR/DB
ES05 (8W-70-8)
ES08 (8W-70-8)
T10 18 YL/DG
ST-RUN V23 (8W-12-9)
MESSAGE CENTER (8W-46-3)
SERVICE ENGINE SOON LAMP
7
*13
G3 20 BK/PK
2
A2
P34
B23
G3 20 BK/PK
5
B70
E43
G3 18 BK/PK
GENERATOR (8W-20-2)
GENERATOR FIELD DRIVER
2
K20 18 DG
32 C1
35 C1
63 C2
8 C1
22 C1
POWERTRAIN CONTROL MODULE
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
TORQUE MANAGEMENT REQUIREMENT SENSE
GENERATOR FIELD DRIVER
SERVICE ENGINE SOON INDICATOR LAMP DRIVER
STOP LAMP SWITCH SENSE
SPEED CONTROL ON/OFF SWITCH SENSE
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL VACUUM SOLENOID CONTROL
TRANSMISSION RANGE SWITCH T41 SENSE
62 C2
5 C1
80 C2
56 C2
76 C2
K29 18 WT/PK
V32 18 YL/RD
V35 18 LG/RD
V36 18 TN/RD
7
3
E43
B70
K29 20 WT/PK
V32 20 YL/RD
T41 18 BK/YL
1
3
STOP LAMP SWITCH (8W-33-3)
2
4
V30 20 DB/RD
LHD
RHD
6
B70
E43
10
TRANSMISSION RANGE SENSOR (8W-31-5)
P/N
Z1 20 BK
TO JUNCTION BLOCK (8W-12-19)
V30 18 DB/RD
6
G300 (8W-15-7)
3
2
1
VENT SOLENOID
VACUUM SOLENOID
VEHICLE SPEED CONTROL SERVO (8W-33-3)
* RHD

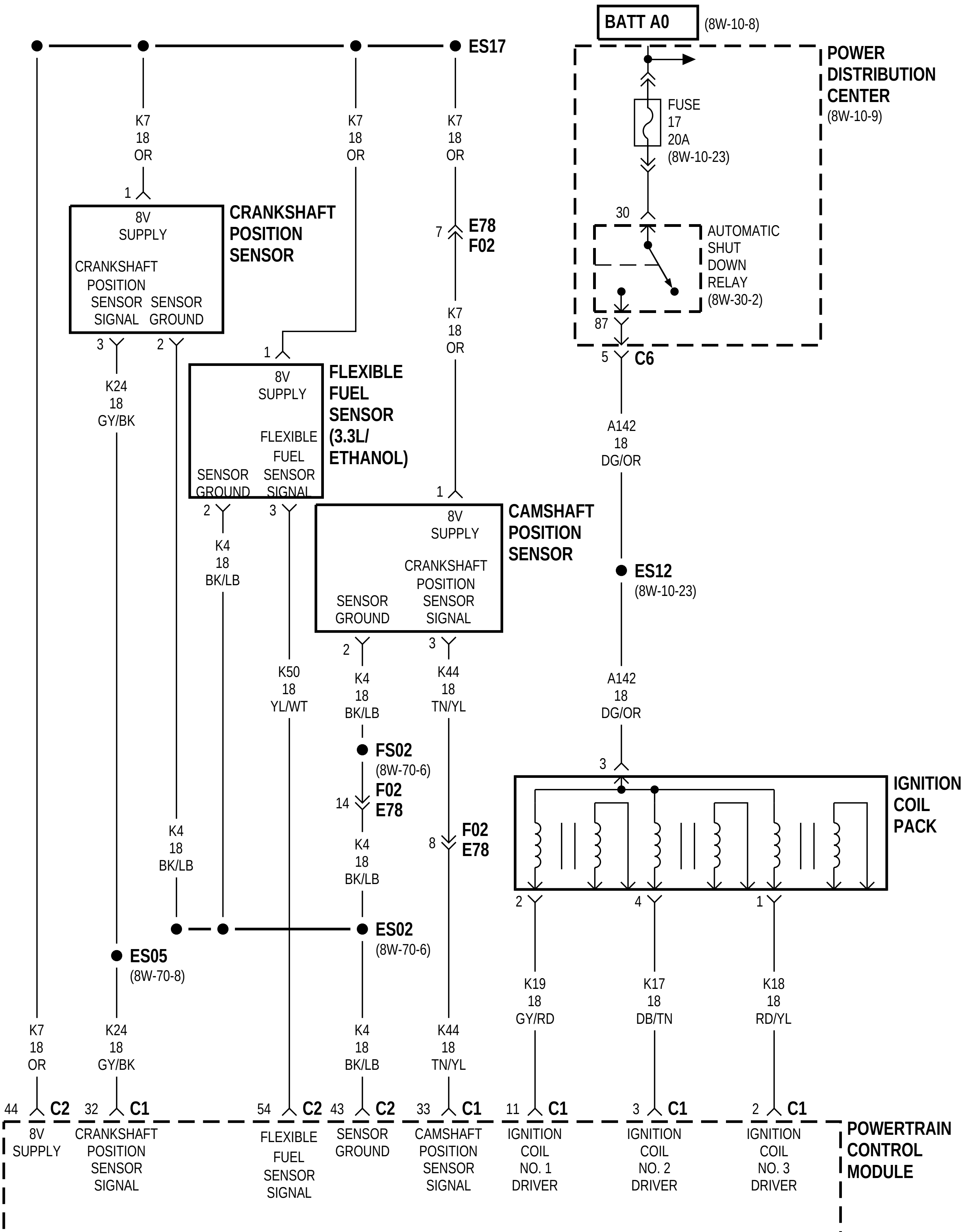
3.3L/3.8L

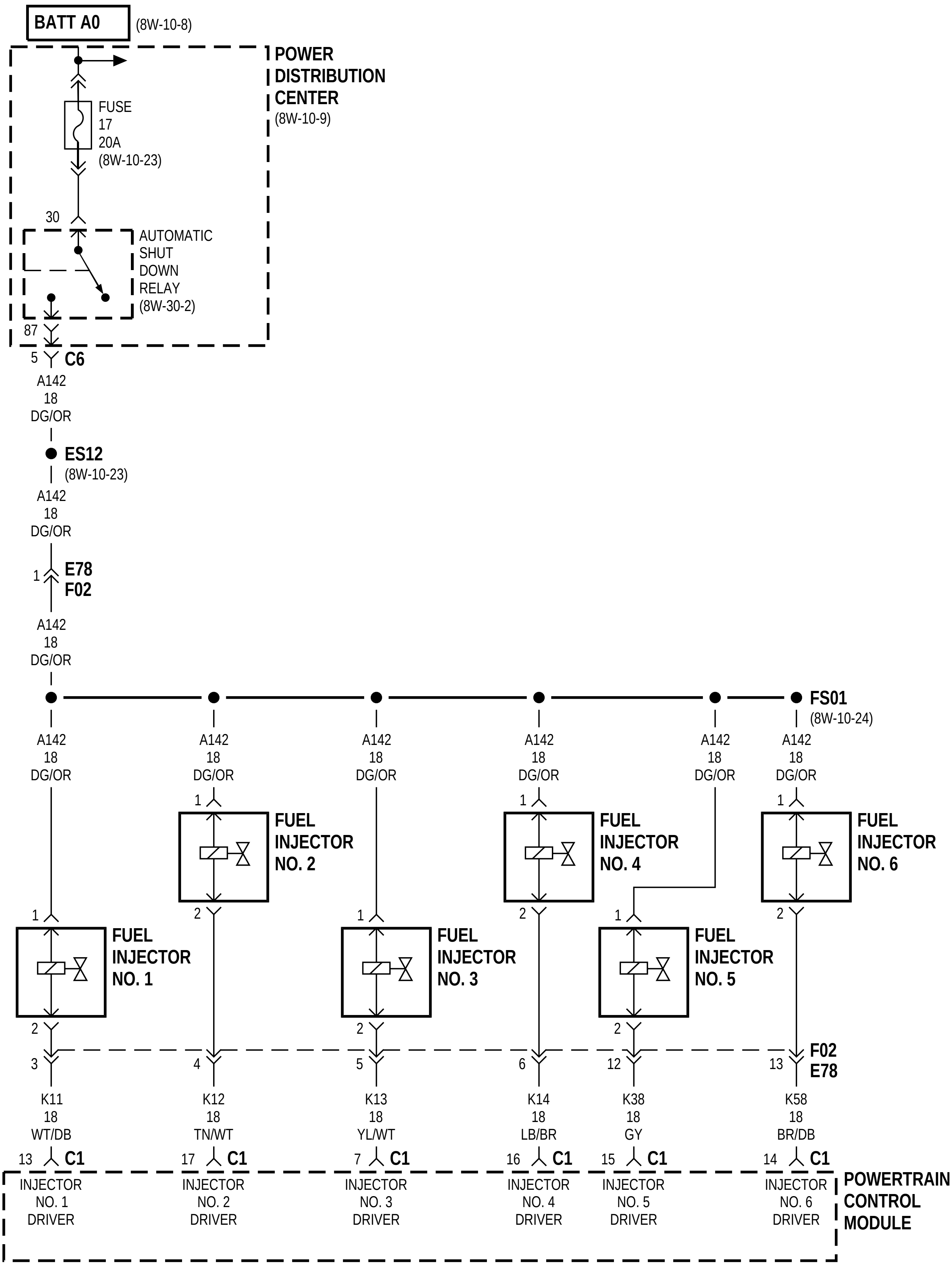


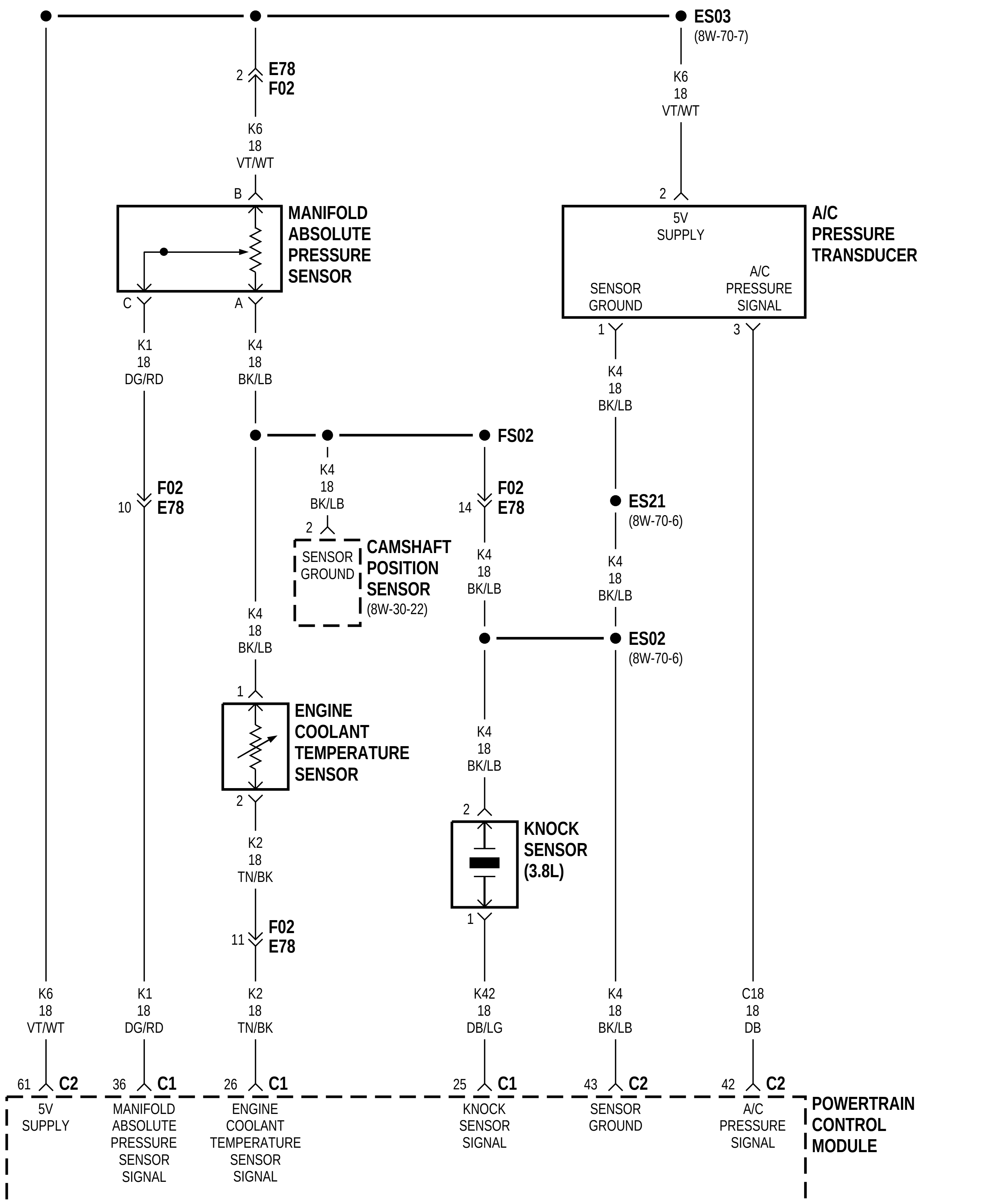
ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30 C1
F87
18
WT/BK
6 C2
ST F45
(8W-12-16)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
(8W-10-9)
86
ENGINE STARTER MOTOR RELAY
(8W-21-2)
85
FUSE
16
20A
(8W-10-26)
86
30
FUEL PUMP RELAY
85
87
4 C6
6 C6
3 C6
7 C2
F87
18
WT/BK
ES07
(8W-12-13)
F87
18
WT/BK
2
EGR SOLENOID
1
K90
18
TN
K35
18
GY/YL
K31
18
BR
31 C1
40 C1
74 C2
ENGINE STARTER MOTOR RELAY CONTROL
EGR SOLENOID CONTROL
FUEL PUMP RELAY CONTROL
POWERTRAIN CONTROL MODULE
TRANSMISSION RANGE SENSOR
BACK-UP LAMP FEED
(8W-31-3)
6
L1
18
VT/BK
10
E36
B33
L1
20
VT/BK
BACK-UP SWITCH
BACK-UP LAMP FEED
(8W-51-5)
2
L1
18
VT/BK
10
E36
B33
L1
20
VT/BK
EATX
MTX
L1
20
VT/BK
BS02
(8W-70-2)
2
B13
AW4
AWS2
(8W-31-3)
BODY CONTROL MODULE
FUEL LEVEL SENSOR SIGNAL
(8W-45-7)
46 C1
G4
18
DB
A141
16
DG/WT
4
3
B13
AW4
4
3
2
FUEL PUMP RELAY OUTPUT
GROUND
FUEL LEVEL SENSOR SIGNAL
BACK-UP SWITCH SENSE
FUEL TANK MODULE
1
3.3L
3.8L
Z1
16
BK
Z1
16
BK
ALL WHEEL DRIVE SOLENOID
GROUND
GROUND
1 C1
1 C2
(8W-31-3)
Z1
18
BK
Z1
18
BK
AWS1
Z1
16
BK
1
AW4
B13
Z1 14BK
5
G302
(8W-15-13)

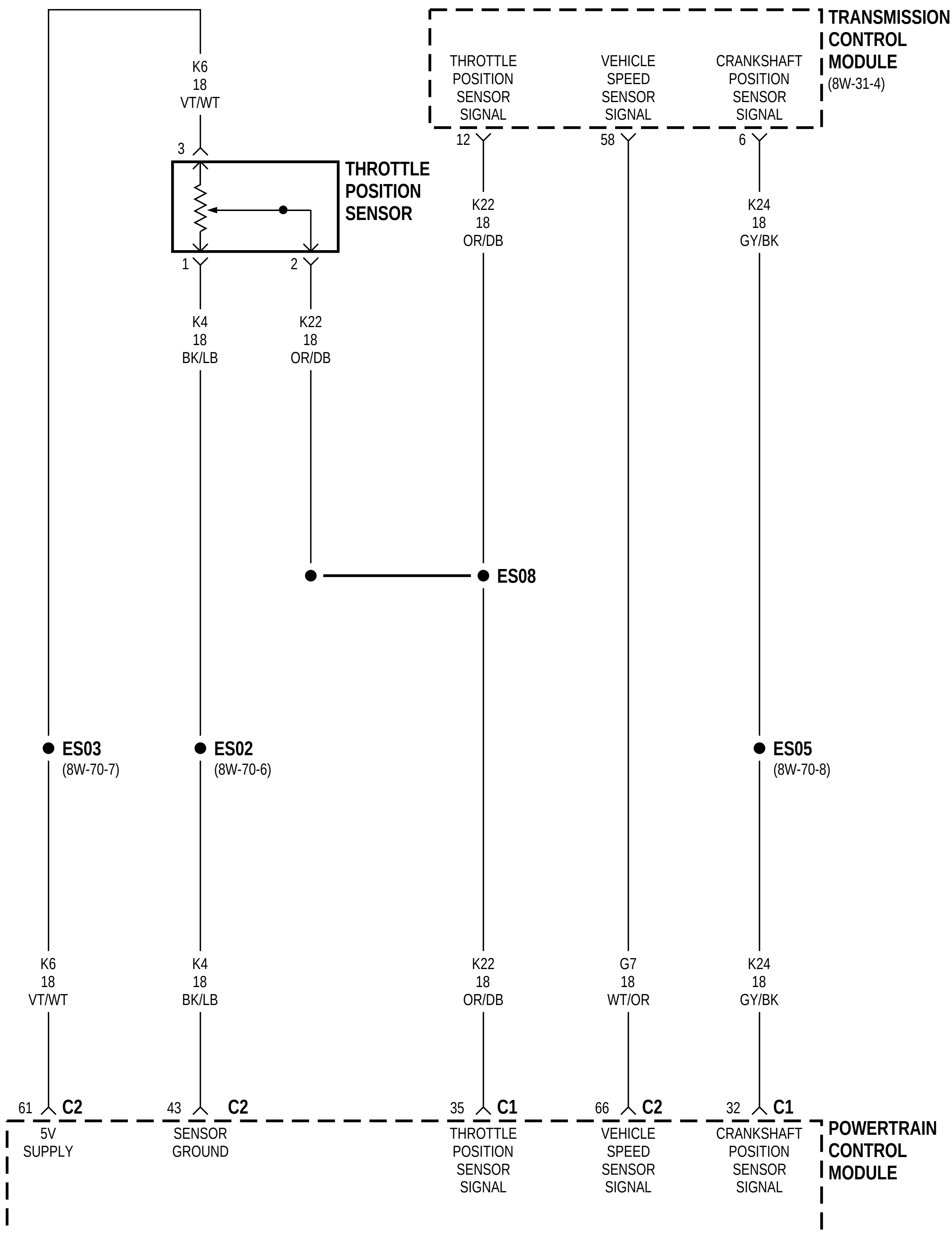


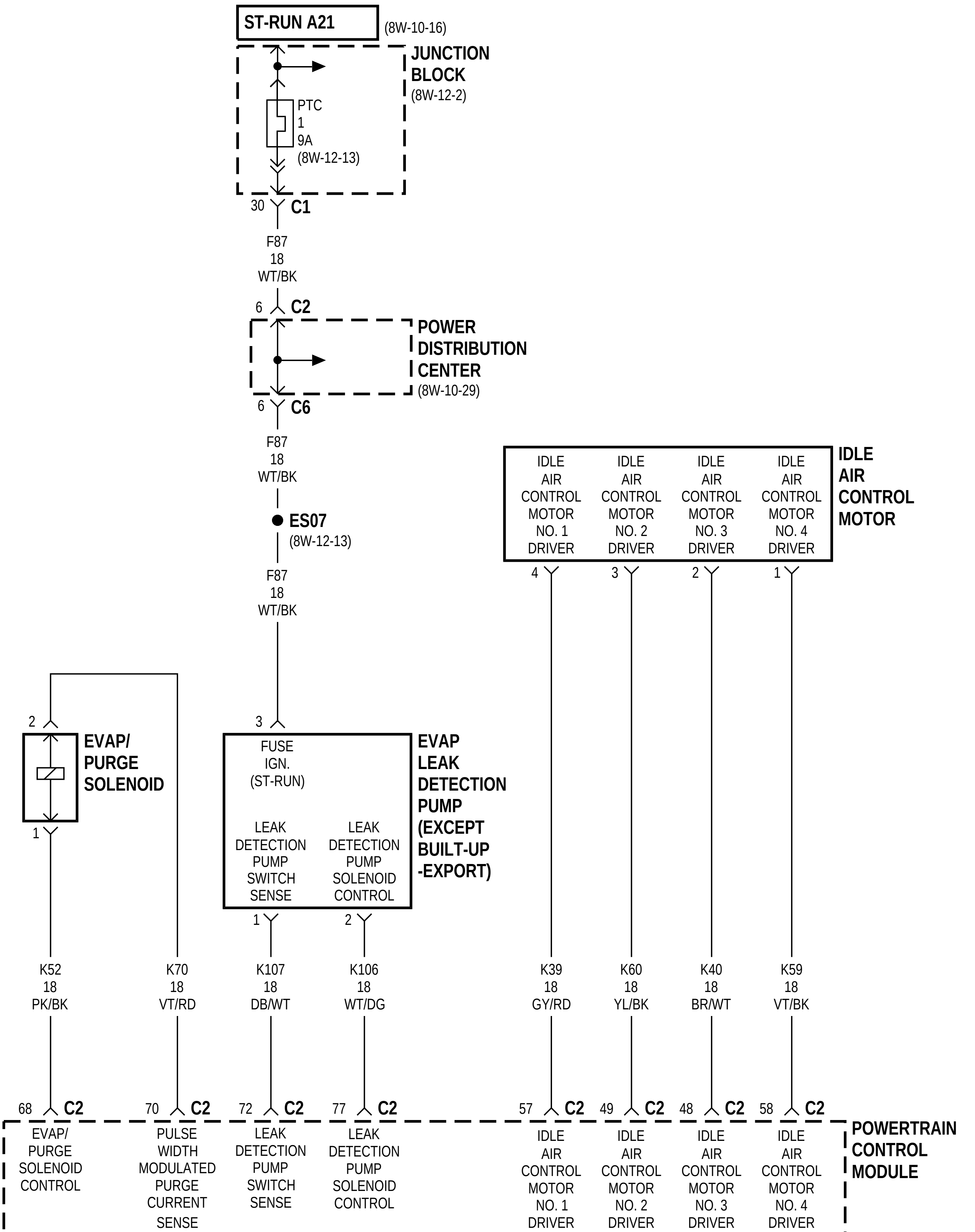
BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
30
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
87
5
C6
A142
18
DG/OR
ES12
(8W-10-23)
A142
18
DG/OR
A142
18
DG/OR
2
E43
B70
A142
18
DG/OR
4
2
UPSTREAM
HEATED
OXYGEN
SENSOR
3
1
2
4
DOWNSTREAM
HEATED
OXYGEN
SENSOR
1
3
K4
18
BK/LB
Z1
18
BK
ES18
(8W-15-2)
Z1
10
BK
G101
(8W-15-2)
Z12
20
BK/TN
3
G300
(8W-15-5)
K4
20
BK/LB
1
B33
E36
K4
18
BK/LB
K141
20
TN/WT
10
B70
E43
ES02
(8W-70-6)
K41
18
BK/DG
K4
18
BK/LB
K141
18
TN/WT
30
C1
43
C2
51
C2
HEATED
OXYGEN
SENSOR
SIGNAL
SENSOR
GROUND
HEATED
OXYGEN
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE


ES17
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-23)
30
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
87
5 C6
A142
18
DG/OR
ES12
(8W-10-23)
K7
18
OR
CRANKSHAFT POSITION SENSOR
8V SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
K24
18
GY/BK
FLEXIBLE FUEL SENSOR (3.3L/ ETHANOL)
FLEXIBLE FUEL SENSOR SIGNAL
E78
F02
CAMSHAFT POSITION SENSOR
K4
18
BK/LB
K50
18
YL/WT
K44
18
TN/YL
FS02
(8W-70-6)
ES02
(8W-70-6)
ES05
(8W-70-8)
IGNITION COIL PACK
K19
18
GY/RD
K17
18
DB/TN
K18
18
RD/YL
44 C2
32 C1
54 C2
43 C2
33 C1
11 C1
3 C1
2 C1
POWERTRAIN CONTROL MODULE
8V SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
FLEXIBLE FUEL SENSOR SIGNAL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
IGNITION COIL NO. 1 DRIVER
IGNITION COIL NO. 2 DRIVER
IGNITION COIL NO. 3 DRIVER

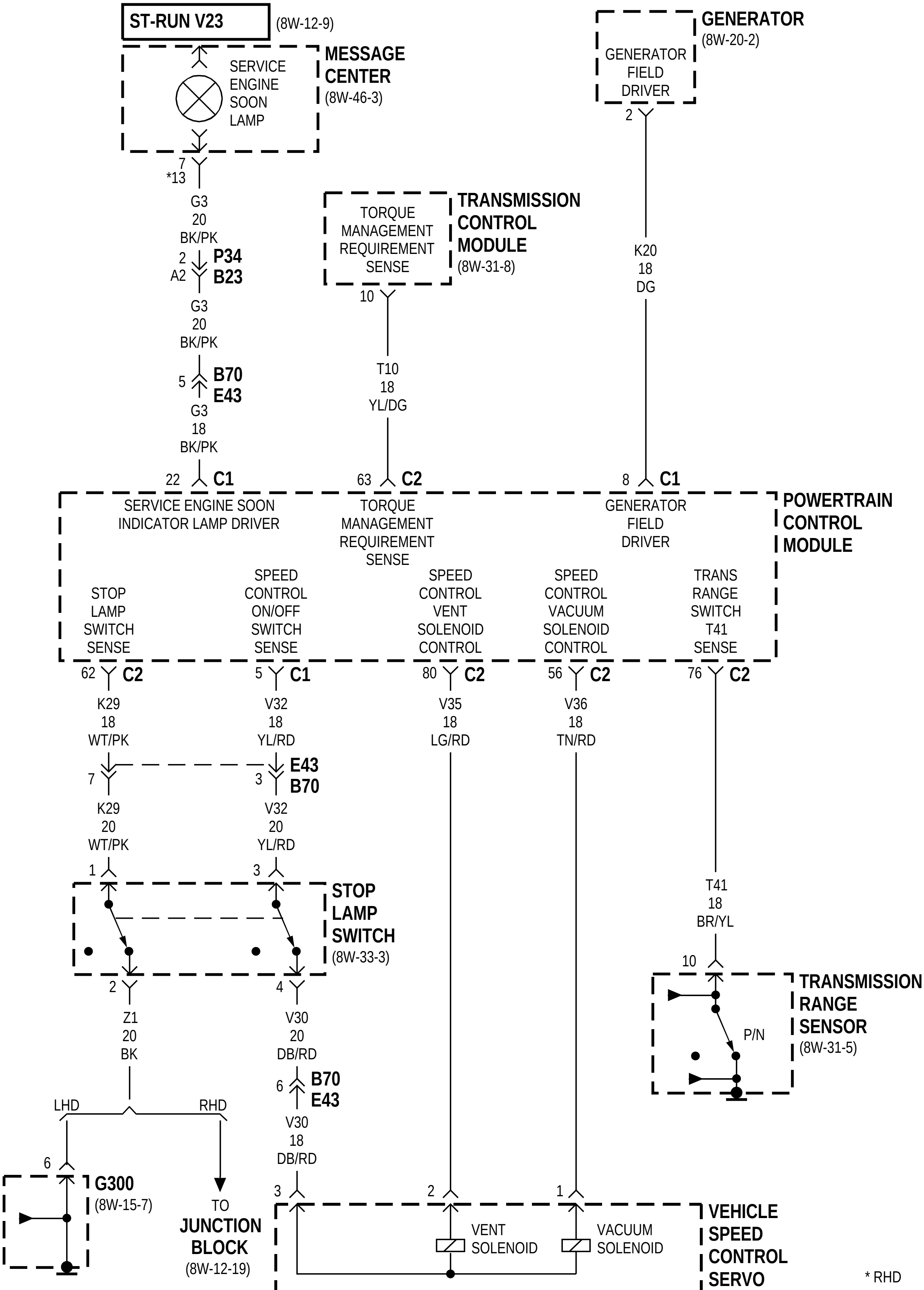

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 17 20A
(8W-10-23)
30
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
87
5 C6
A142 18 DG/OR
ES12
(8W-10-23)
A142 18 DG/OR
1 E78 F02
A142 18 DG/OR
FS01
(8W-10-24)
A142 18 DG/OR
FUEL INJECTOR NO. 1
FUEL INJECTOR NO. 2
FUEL INJECTOR NO. 3
FUEL INJECTOR NO. 4
FUEL INJECTOR NO. 5
FUEL INJECTOR NO. 6
F02 E78
K11 18 WT/DB
K12 18 TN/WT
K13 18 YL/WT
K14 18 LB/BR
K38 18 GY
K58 18 BR/DB
13 C1
17 C1
7 C1
16 C1
15 C1
14 C1
INJECTOR NO. 1 DRIVER
INJECTOR NO. 2 DRIVER
INJECTOR NO. 3 DRIVER
INJECTOR NO. 4 DRIVER
INJECTOR NO. 5 DRIVER
INJECTOR NO. 6 DRIVER
POWERTRAIN CONTROL MODULE


ES03
(8W-70-7)
2 E78
F02
K6
18
VT/WT
B
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
C
A
K1
18
DG/RD
K4
18
BK/LB
2
5V
SUPPLY
A/C
PRESSURE
TRANSDUCER
SENSOR
GROUND
A/C
PRESSURE
SIGNAL
1
3
FS02
10 F02
E78
2
SENSOR
GROUND
CAMSHAFT
POSITION
SENSOR
(8W-30-22)
14 F02
E78
ES21
(8W-70-6)
ES02
(8W-70-6)
1
ENGINE
COOLANT
TEMPERATURE
SENSOR
2
K2
18
TN/BK
11 F02
E78
KNOCK
SENSOR
(3.8L)
K42
18
DB/LG
C18
18
DB
61 C2
36 C1
26 C1
25 C1
43 C2
42 C2
5V
SUPPLY
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
SIGNAL
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
KNOCK
SENSOR
SIGNAL
SENSOR
GROUND
A/C
PRESSURE
SIGNAL
POWERTRAIN
CONTROL
MODULE

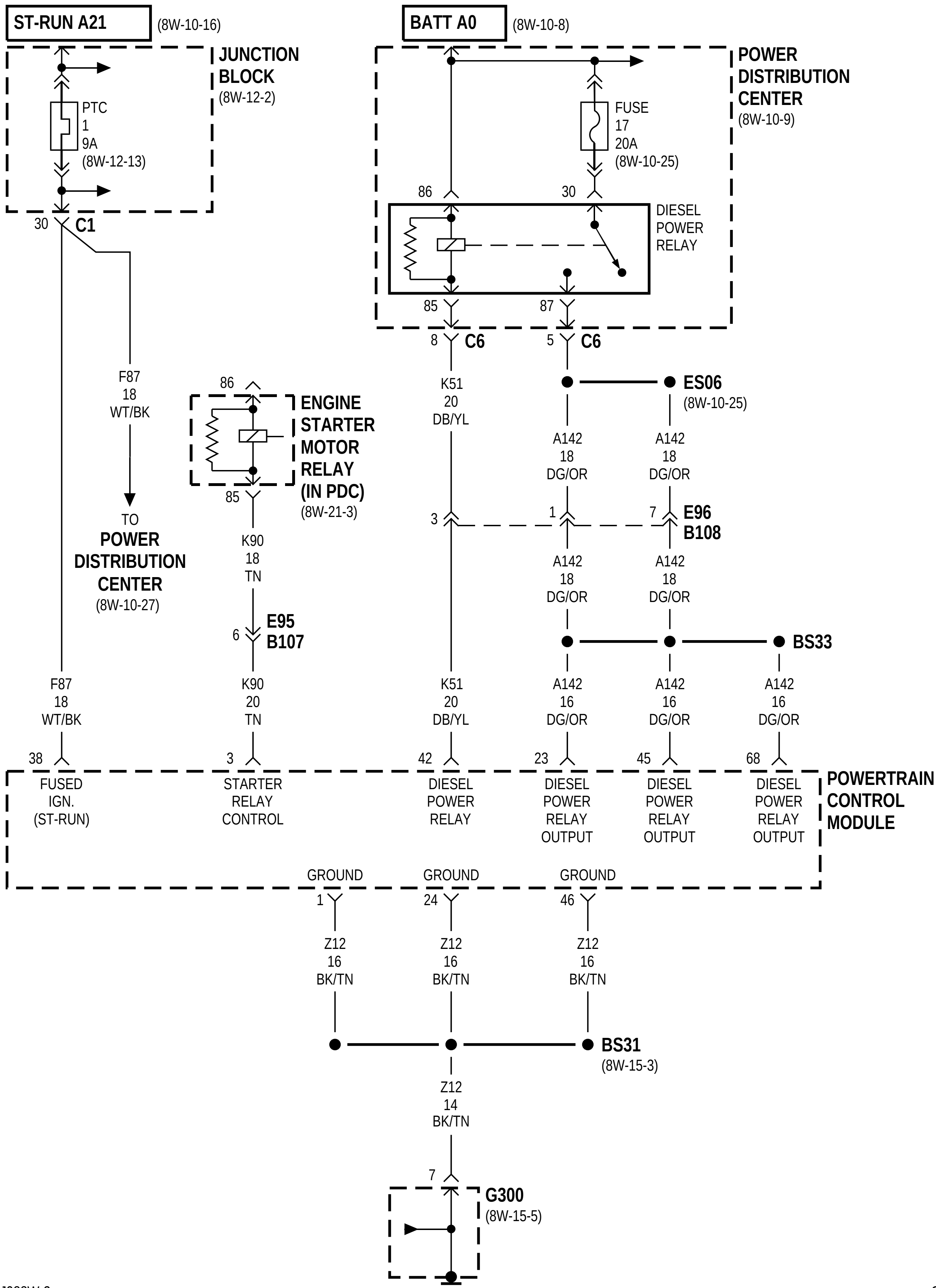

TRANSMISSION CONTROL MODULE
(8W-31-4)
THROTTLE POSITION SENSOR SIGNAL
VEHICLE SPEED SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR SIGNAL
12
58
6
K6 18 VT/WT
3
THROTTLE POSITION SENSOR
1
2
K22 18 OR/DB
K24 18 GY/BK
K4 18 BK/LB
K22 18 OR/DB
ES08
ES03 (8W-70-7)
ES02 (8W-70-6)
ES05 (8W-70-8)
K6 18 VT/WT
K4 18 BK/LB
K22 18 OR/DB
G7 18 WT/OR
K24 18 GY/BK
61 C2
43 C2
35 C1
66 C2
32 C1
5V SUPPLY
SENSOR GROUND
THROTTLE POSITION SENSOR SIGNAL
VEHICLE SPEED SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

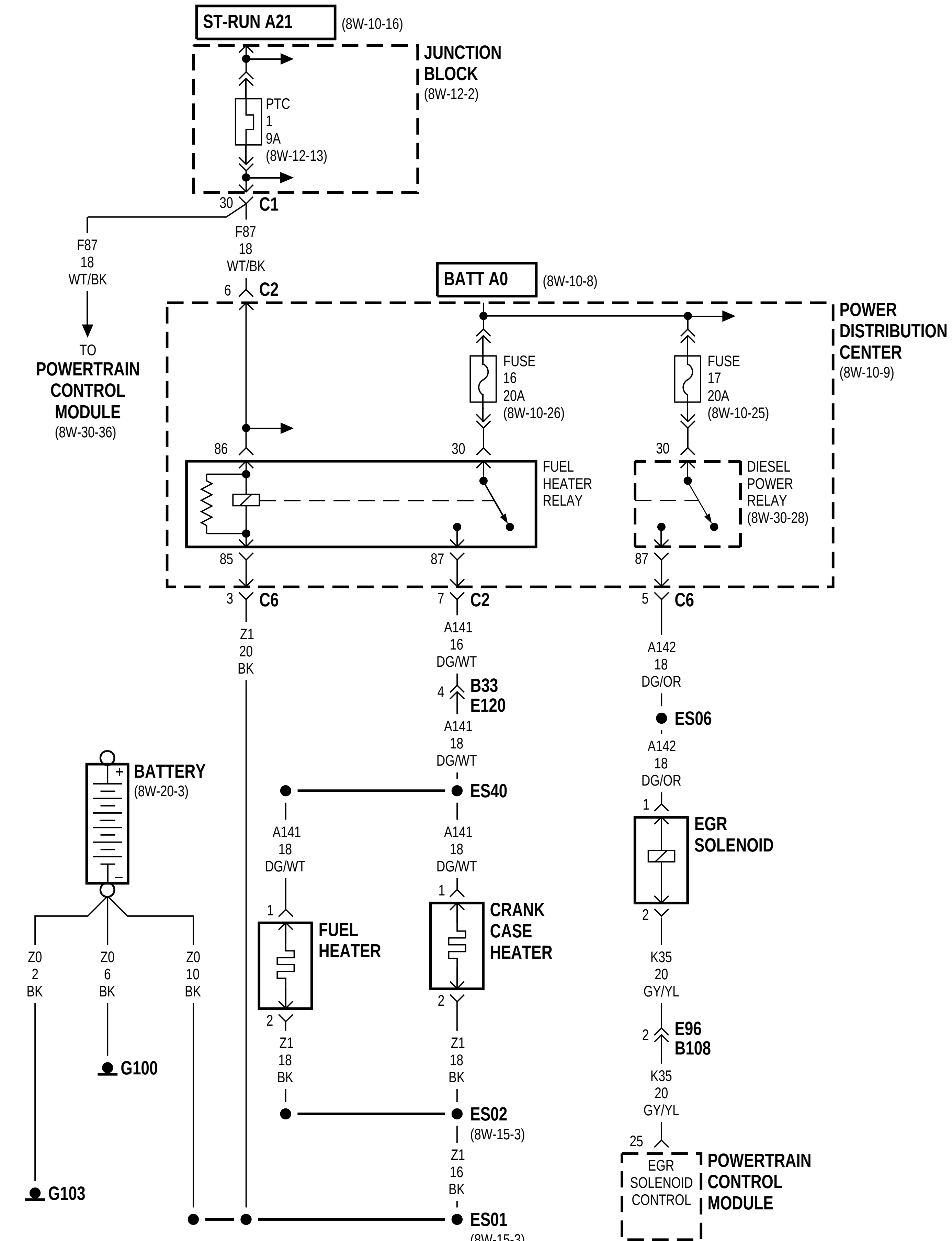


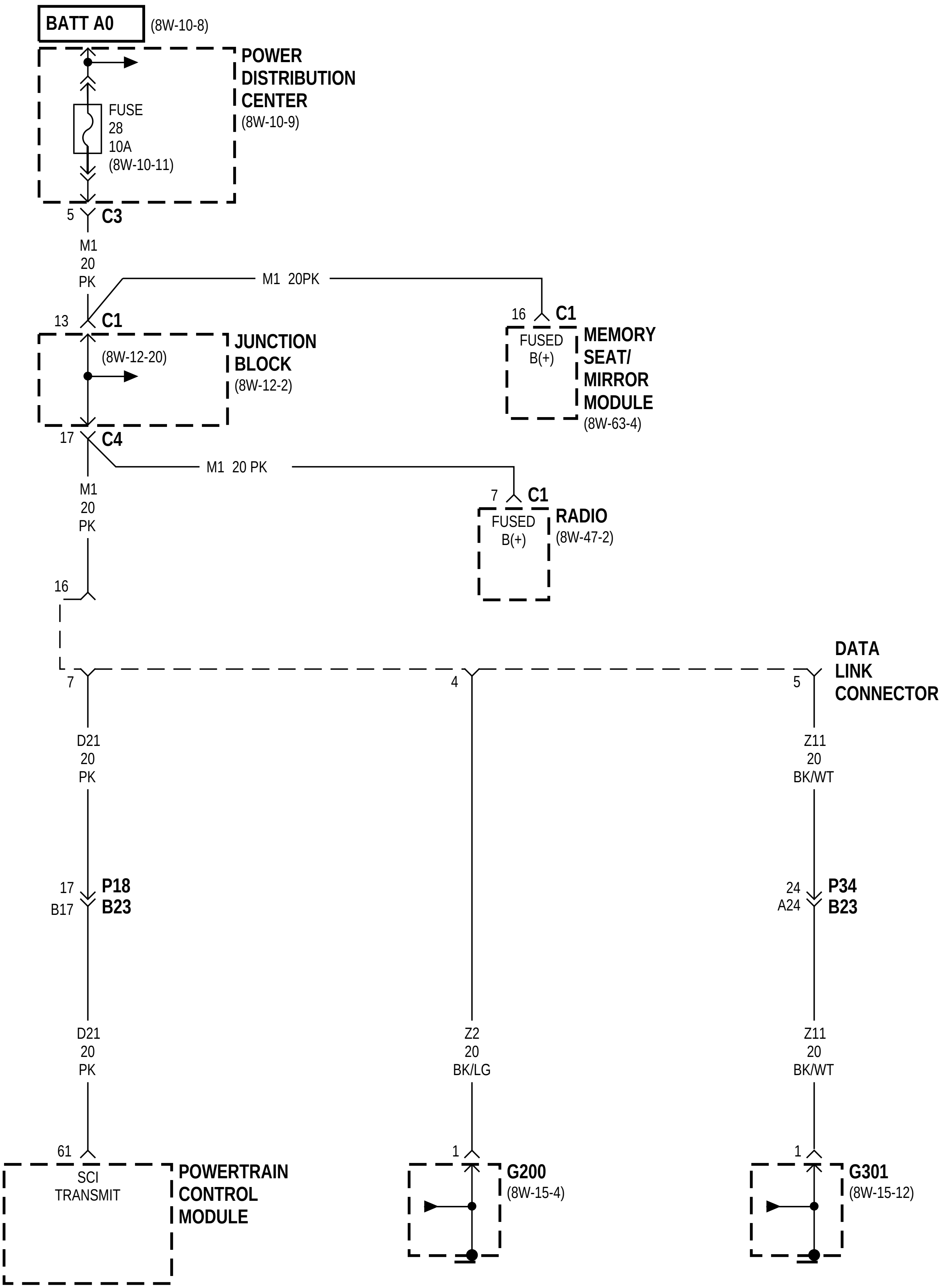
J988W-3 GS003026

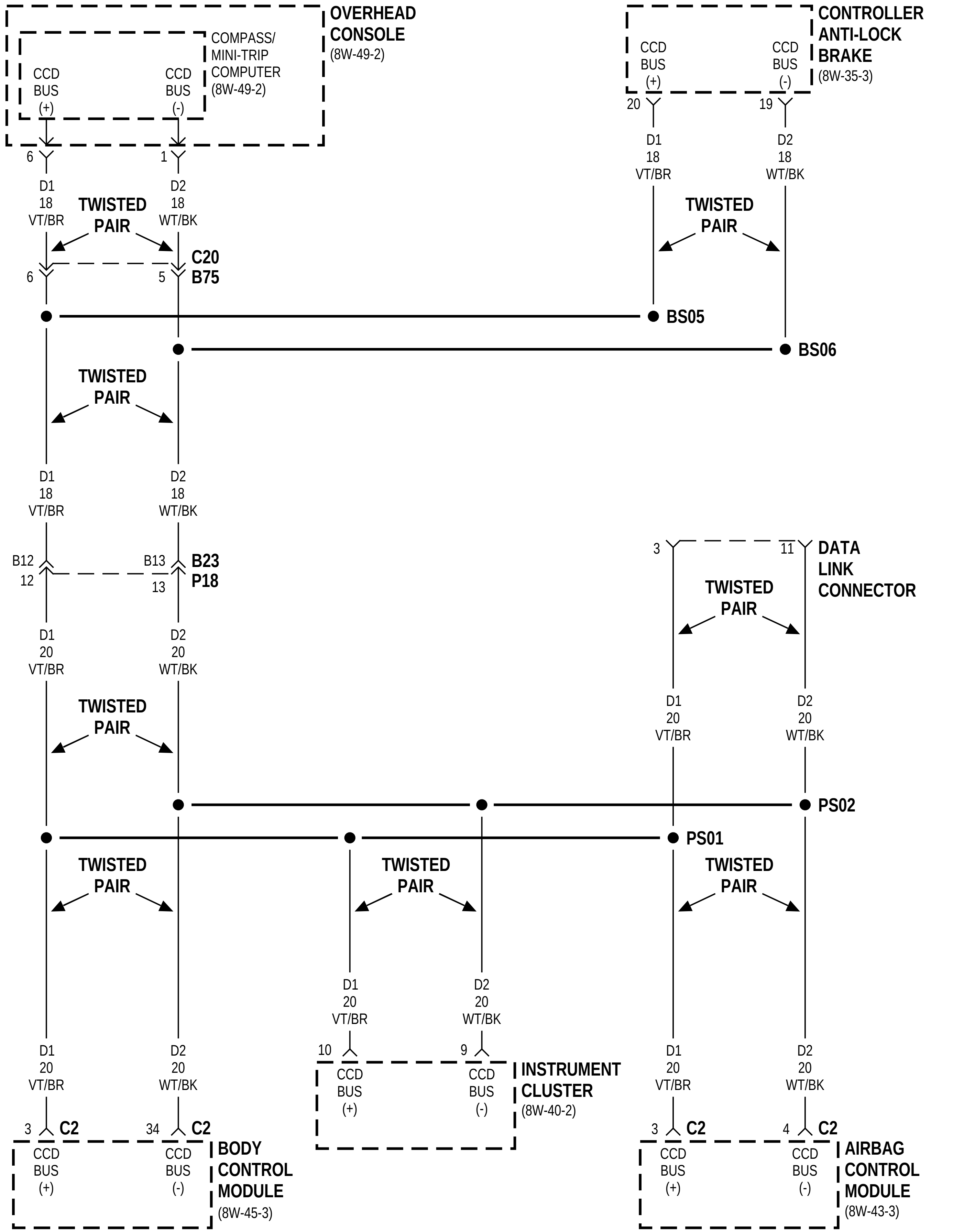

ST-RUN V23
(8W-12-9)
SERVICE ENGINE SOON LAMP
MESSAGE CENTER
(8W-46-3)
7
*13
G3 20 BK/PK
2
A2
P34
B23
G3 20 BK/PK
5
B70
E43
G3 18 BK/PK
TORQUE MANAGEMENT REQUIREMENT SENSE
TRANSMISSION CONTROL MODULE
(8W-31-8)
10
T10 18 YL/DG
GENERATOR FIELD DRIVER
GENERATOR
(8W-20-2)
2
K20 18 DG
22 C1
63 C2
8 C1
SERVICE ENGINE SOON INDICATOR LAMP DRIVER
TORQUE MANAGEMENT REQUIREMENT SENSE
GENERATOR FIELD DRIVER
POWERTRAIN CONTROL MODULE
STOP LAMP SWITCH SENSE
SPEED CONTROL ON/OFF SWITCH SENSE
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL VACUUM SOLENOID CONTROL
TRANS RANGE SWITCH T41 SENSE
62 C2
5 C1
80 C2
56 C2
76 C2
K29 18 WT/PK
V32 18 YL/RD
V35 18 LG/RD
V36 18 TN/RD
7
3
E43
B70
K29 20 WT/PK
V32 20 YL/RD
1
3
STOP LAMP SWITCH
(8W-33-3)
2
4
Z1 20 BK
V30 20 DB/RD
6
B70
E43
V30 18 DB/RD
LHD
RHD
6
G300
(8W-15-7)
TO JUNCTION BLOCK
(8W-12-19)
T41 18 BR/YL
10
TRANSMISSION RANGE SENSOR
(8W-31-5)
P/N
3
2
1
VENT SOLENOID
VACUUM SOLENOID
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
* RHD

DIESEL


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC 1 9A
(8W-12-13)
30 C1
F87 18 WT/BK
TO POWER DISTRIBUTION CENTER
(8W-10-27)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 17 20A
(8W-10-25)
86
30
DIESEL POWER RELAY
85
87
8 C6
5 C6
K51 20 DB/YL
ES06
(8W-10-25)
A142 18 DG/OR
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-3)
86
85
K90 18 TN
3
1
7
E96 B108
E95 B107
6
BS33
F87 18 WT/BK
K90 20 TN
K51 20 DB/YL
A142 16 DG/OR
38
3
42
23
45
68
FUSED IGN. (ST-RUN)
STARTER RELAY CONTROL
DIESEL POWER RELAY
DIESEL POWER RELAY OUTPUT
POWERTRAIN CONTROL MODULE
GROUND
1
24
46
Z12 16 BK/TN
BS31
(8W-15-3)
Z12 14 BK/TN
7
G300
(8W-15-5)


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30
C1
F87
18
WT/BK
F87
18
WT/BK
6
C2
TO
POWERTRAIN CONTROL MODULE
(8W-30-36)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
16
20A
(8W-10-26)
FUSE
17
20A
(8W-10-25)
86
30
30
FUEL HEATER RELAY
DIESEL POWER RELAY
(8W-30-28)
85
87
87
3
C6
7
C2
5
C6
Z1
20
BK
A141
16
DG/WT
4
B33
E120
A141
18
DG/WT
ES40
A142
18
DG/OR
ES06
A142
18
DG/OR
1
EGR SOLENOID
2
K35
20
GY/YL
2
E96
B108
K35
20
GY/YL
25
EGR SOLENOID CONTROL
POWERTRAIN CONTROL MODULE
BATTERY
(8W-20-3)
Z0
2
BK
Z0
6
BK
Z0
10
BK
G100
G103
A141
18
DG/WT
1
FUEL HEATER
2
Z1
18
BK
A141
18
DG/WT
1
CRANK CASE HEATER
2
Z1
18
BK
ES02
(8W-15-3)
Z1
16
BK
ES01
(8W-15-3)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A
(8W-10-11)
5 C3
M1 20 PK
M1 20PK
13 C1
16 C1
FUSED B(+)
MEMORY SEAT/ MIRROR MODULE
(8W-63-4)
JUNCTION BLOCK
(8W-12-2)
(8W-12-20)
17 C4
M1 20 PK
7 C1
FUSED B(+)
RADIO
(8W-47-2)
M1 20 PK
16
DATA LINK CONNECTOR
7
4
5
D21 20 PK
Z11 20 BK/WT
17 B17 P18 B23
24 A24 P34 B23
D21 20 PK
Z2 20 BK/LG
Z11 20 BK/WT
61
SCI TRANSMIT
POWERTRAIN CONTROL MODULE
1
G200
(8W-15-4)
1
G301
(8W-15-12)



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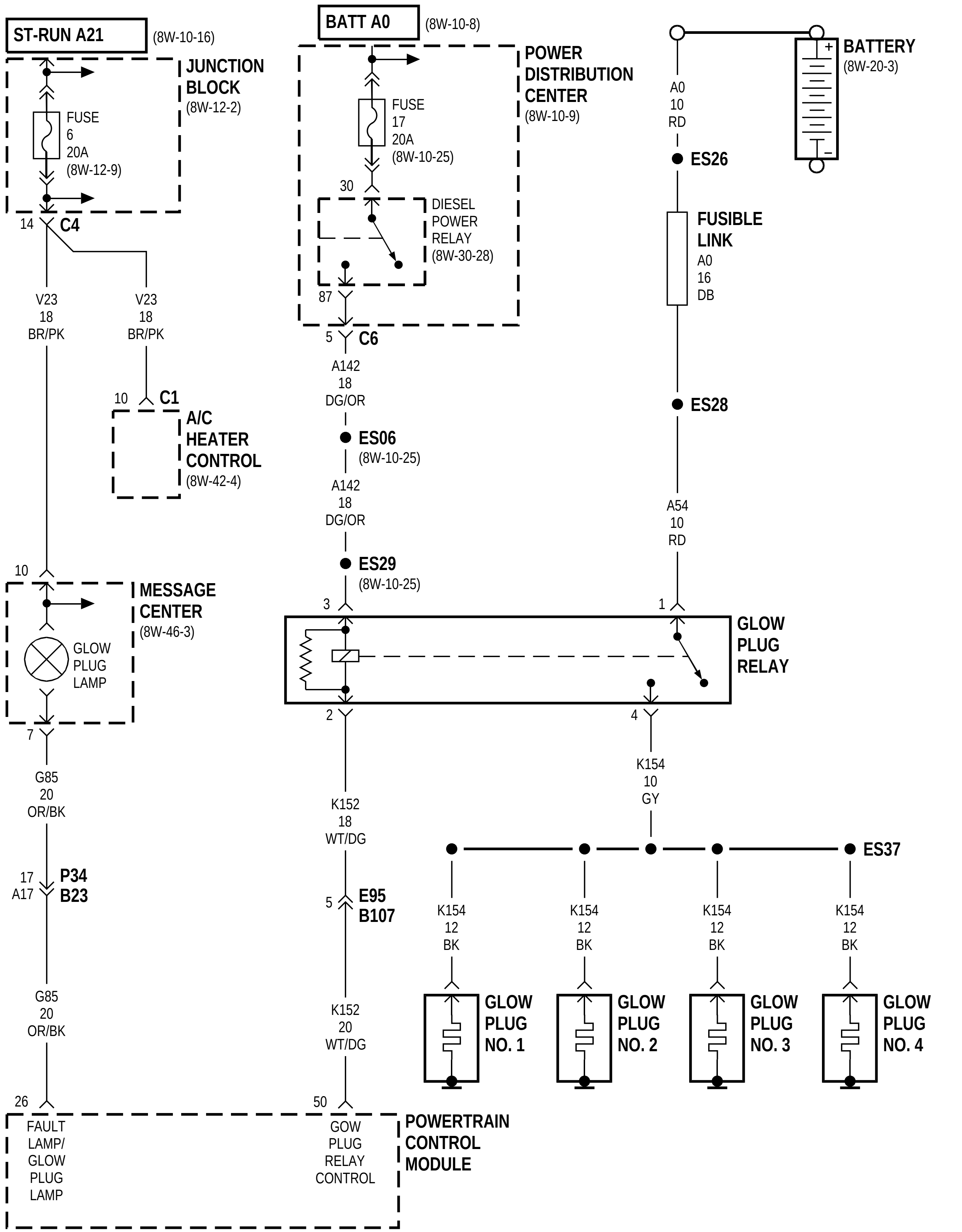
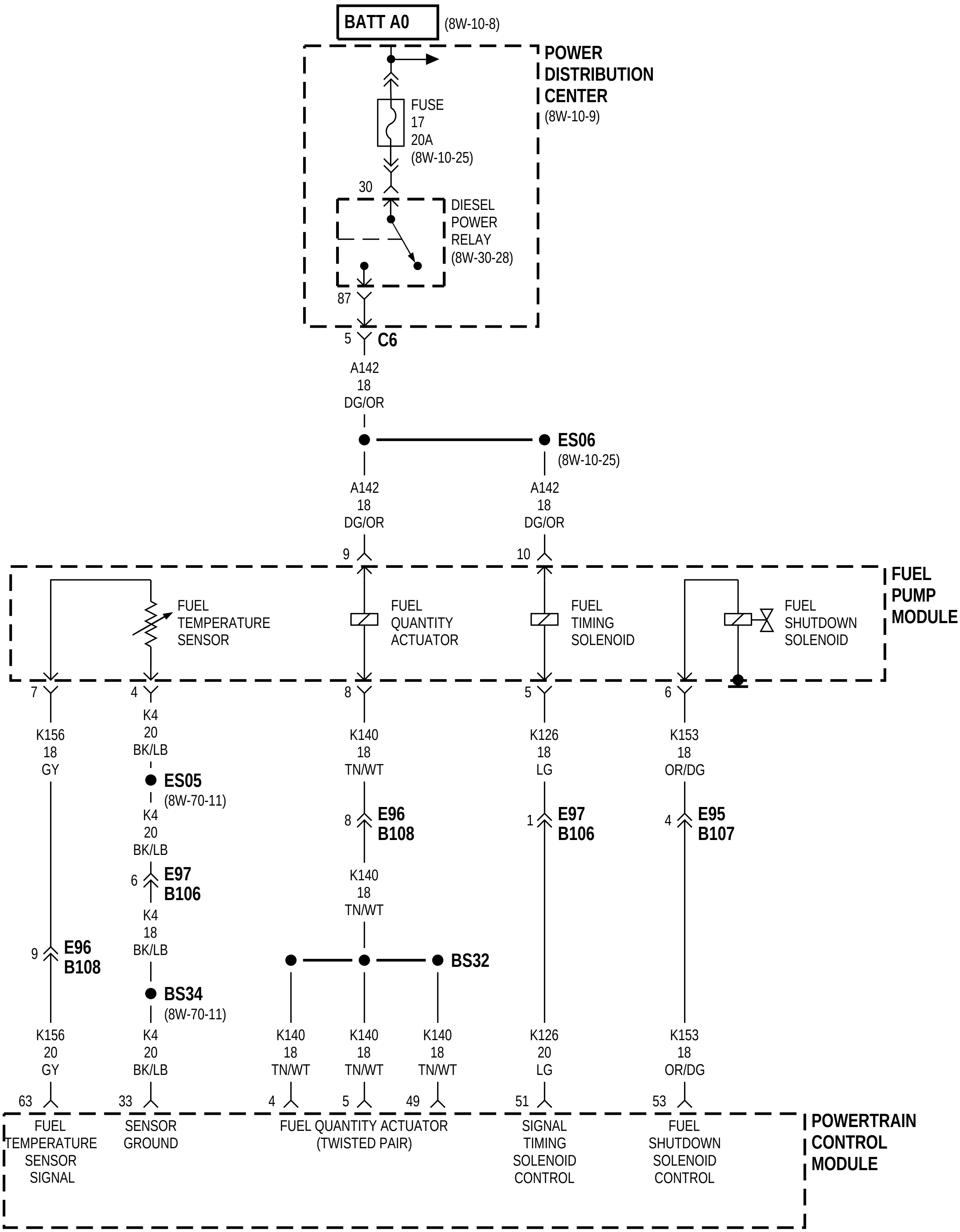
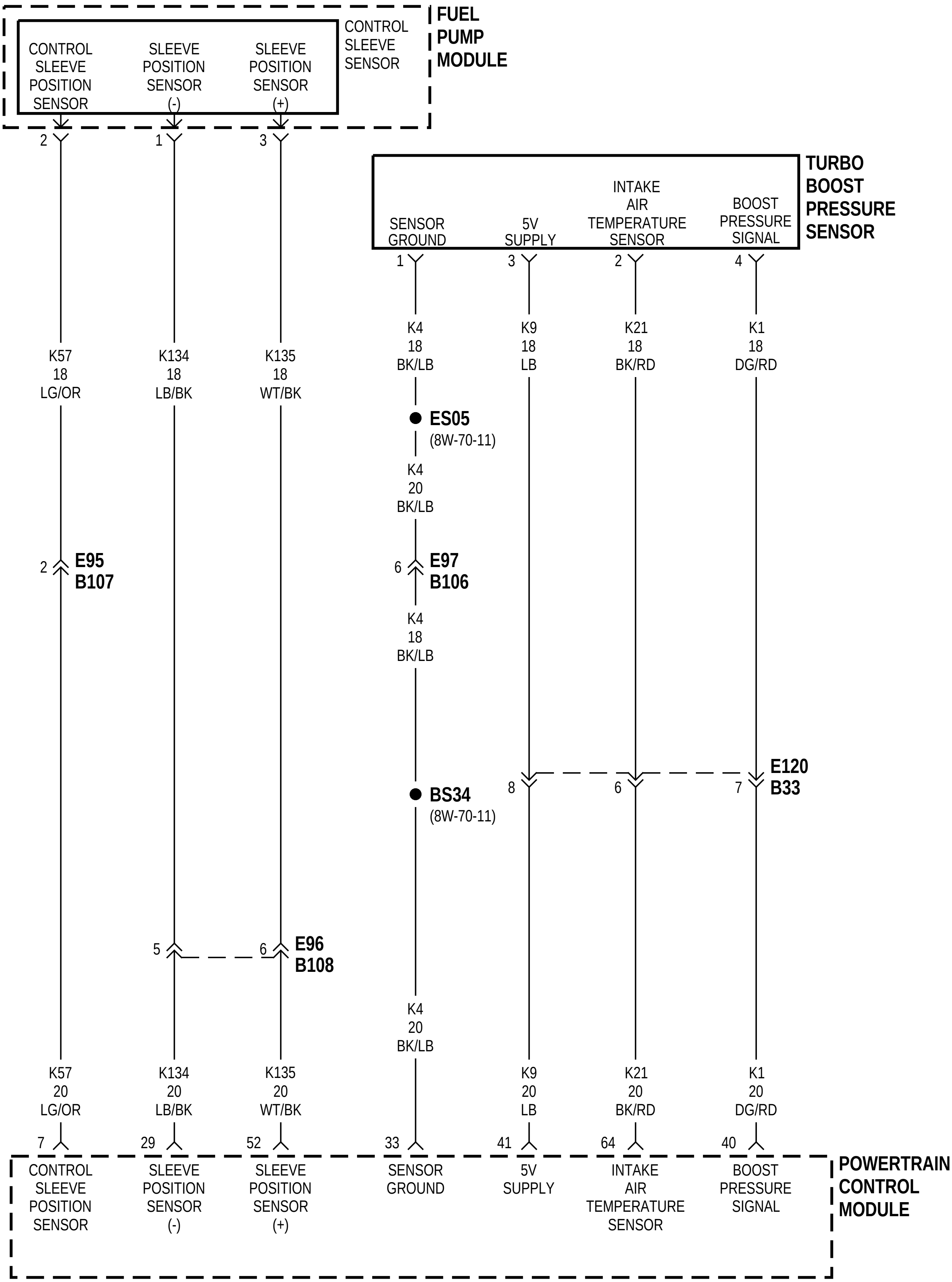
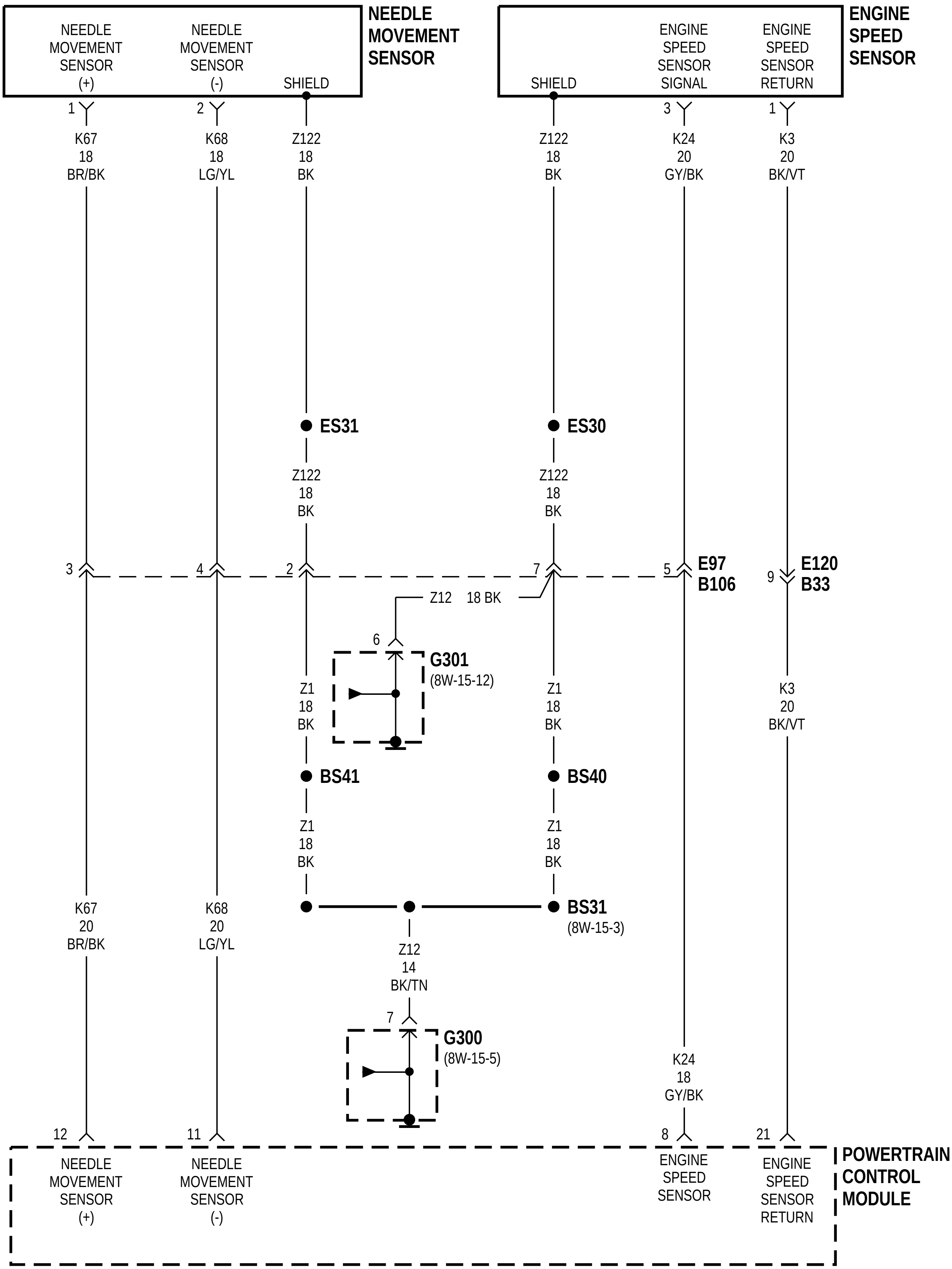
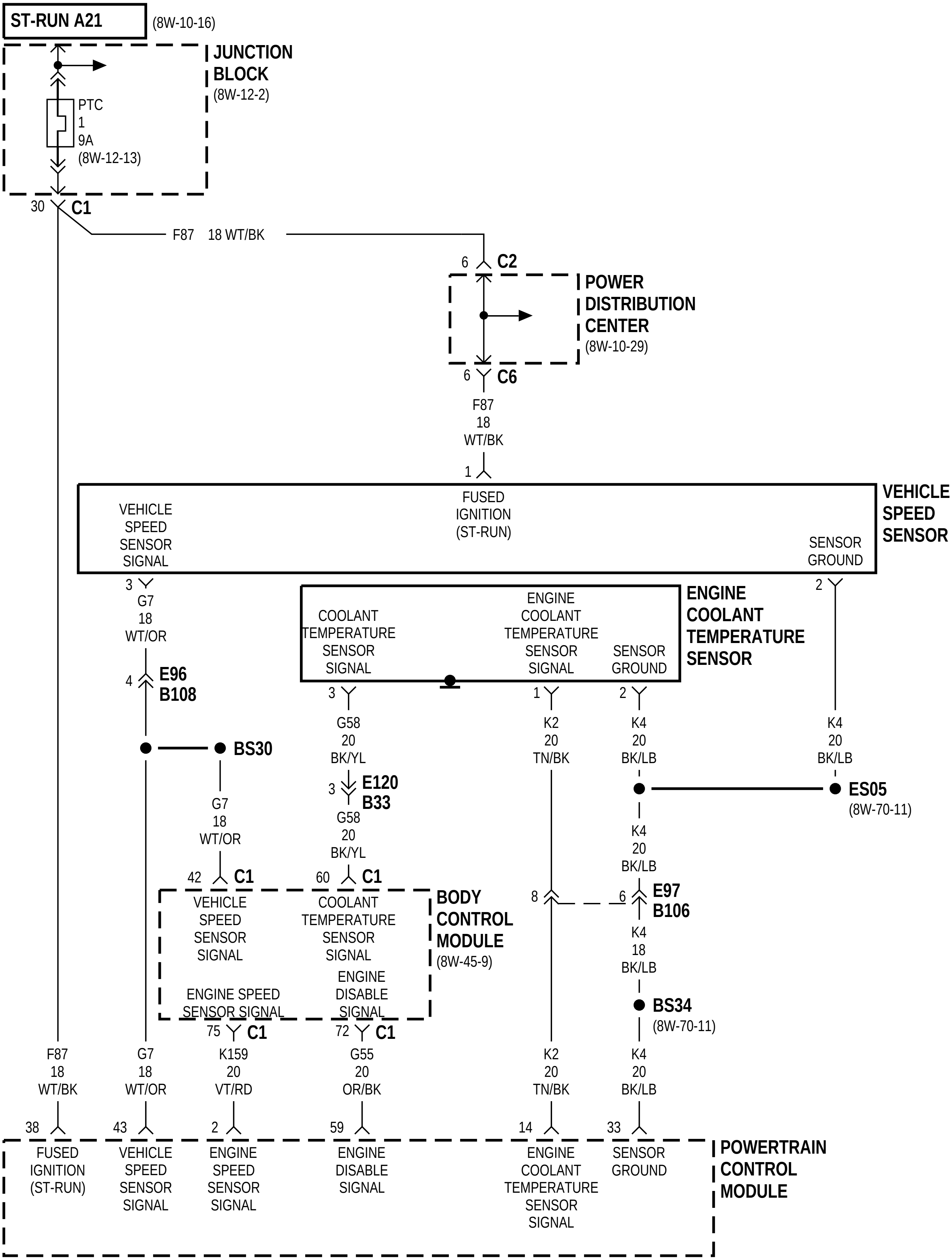
J988W-3

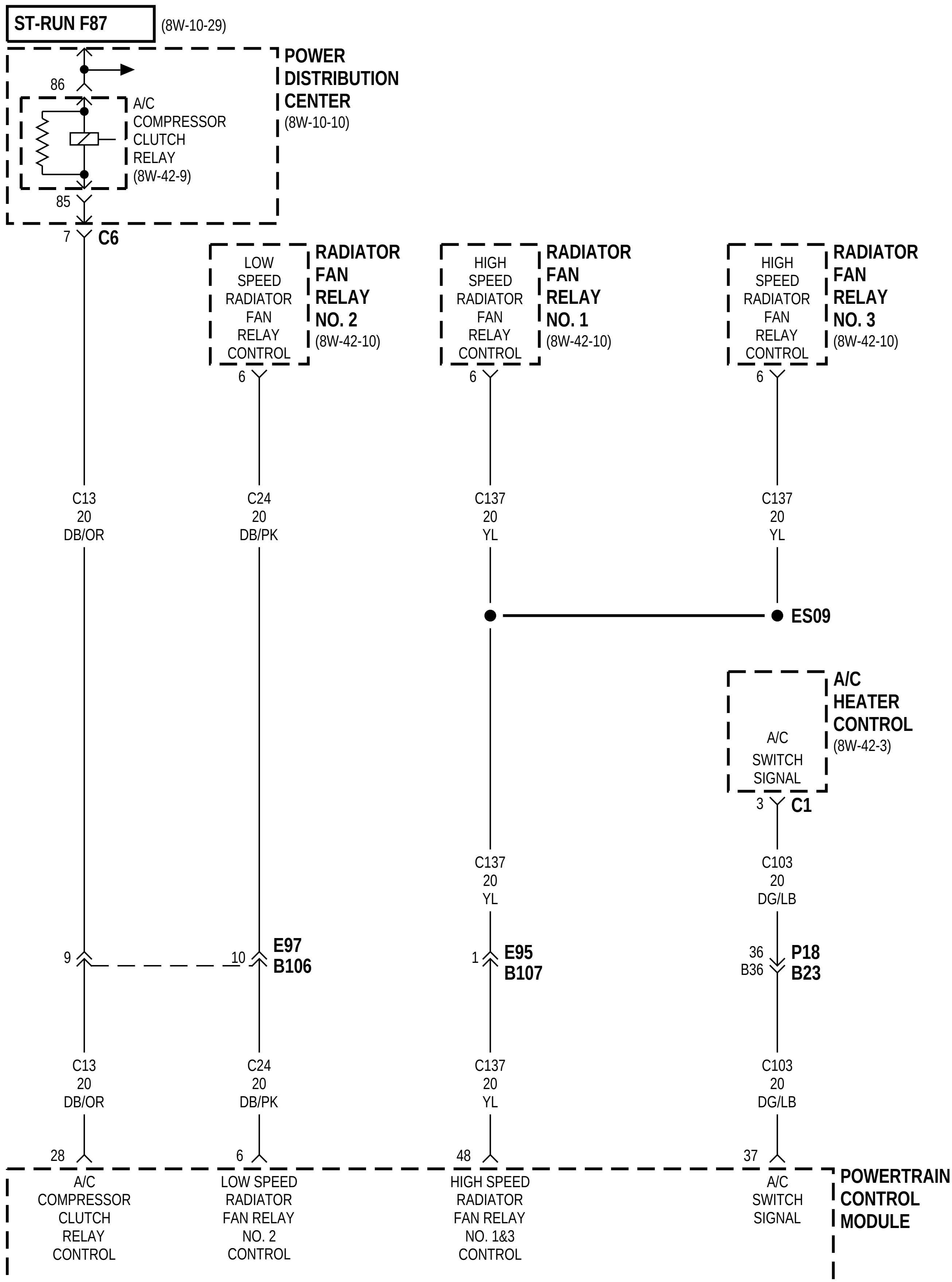

ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
FUSE
6
20A
(8W-12-9)
14
C4
V23
18
BR/PK
V23
18
BR/PK
10
C1
A/C HEATER CONTROL
(8W-42-4)
10
MESSAGE CENTER
(8W-46-3)
GLOW PLUG LAMP
7
G85
20
OR/BK
17
A17
P34
B23
G85
20
OR/BK
26
FAULT LAMP/ GLOW PLUG LAMP
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-25)
30
DIESEL POWER RELAY
(8W-30-28)
87
5
C6
A142
18
DG/OR
ES06
(8W-10-25)
A142
18
DG/OR
ES29
(8W-10-25)
3
2
K152
18
WT/DG
5
E95
B107
K152
20
WT/DG
50
GOW PLUG RELAY CONTROL
POWERTRAIN CONTROL MODULE
BATTERY
(8W-20-3)
A0
10
RD
ES26
FUSIBLE LINK
A0
16
DB
ES28
A54
10
RD
1
GLOW PLUG RELAY
4
K154
10
GY
ES37
K154
12
BK
GLOW PLUG NO. 1
K154
12
BK
GLOW PLUG NO. 2
K154
12
BK
GLOW PLUG NO. 3
K154
12
BK
GLOW PLUG NO. 4

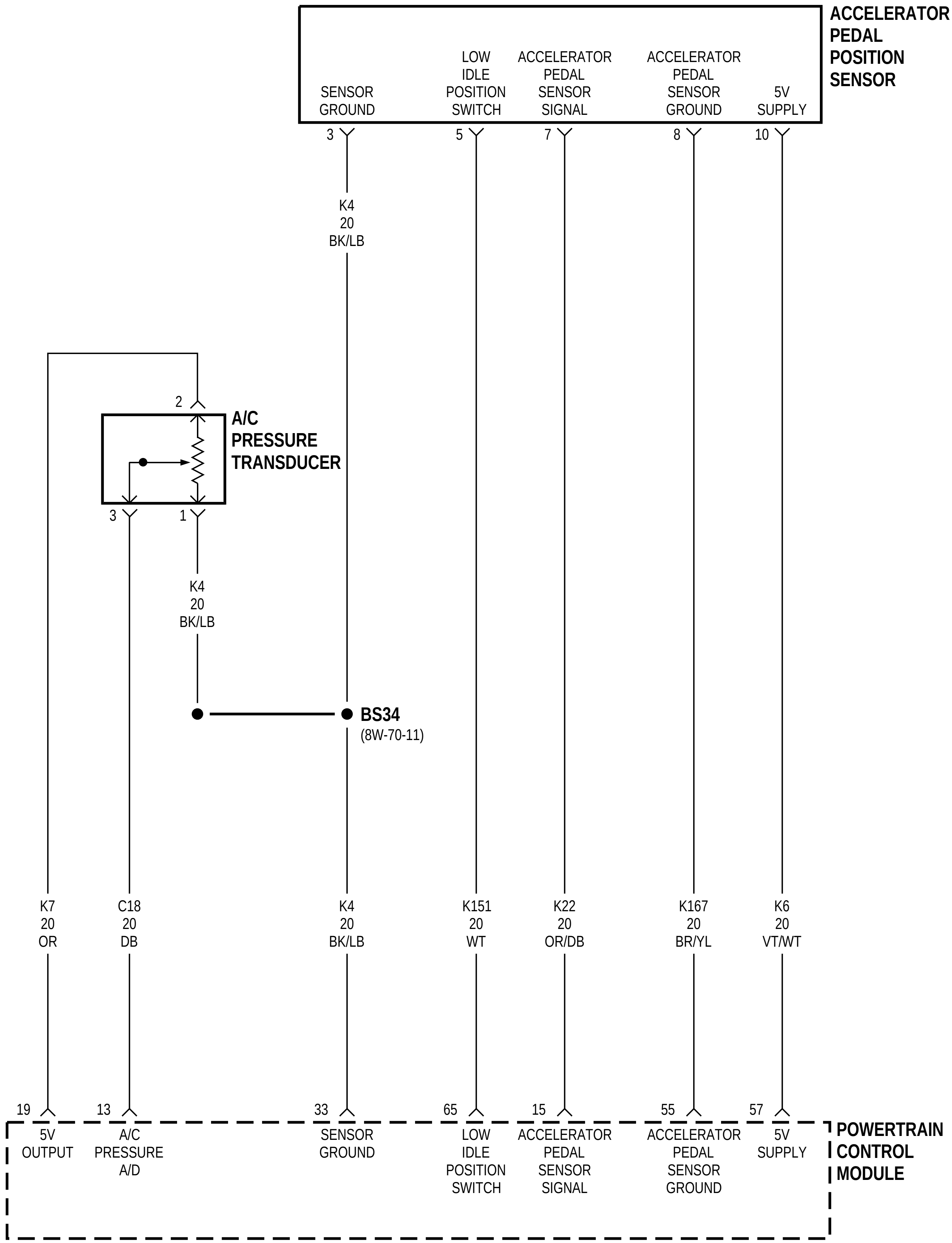

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
17
20A
(8W-10-25)
30
DIESEL POWER RELAY
(8W-30-28)
87
5
C6
A142
18
DG/OR
ES06
(8W-10-25)
9
10
FUEL PUMP MODULE
FUEL TEMPERATURE SENSOR
FUEL QUANTITY ACTUATOR
FUEL TIMING SOLENOID
FUEL SHUTDOWN SOLENOID
7
4
8
5
6
K156
18
GY
K4
20
BK/LB
ES05
(8W-70-11)
K140
18
TN/WT
K126
18
LG
K153
18
OR/DG
E96
B108
E97
B106
E95
B107
K4
18
BK/LB
BS32
BS34
(8W-70-11)
K156
20
GY
K126
20
LG
63
33
4
5
49
51
53
POWERTRAIN CONTROL MODULE
FUEL TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
FUEL QUANTITY ACTUATOR (TWISTED PAIR)
SIGNAL TIMING SOLENOID CONTROL
FUEL SHUTDOWN SOLENOID CONTROL

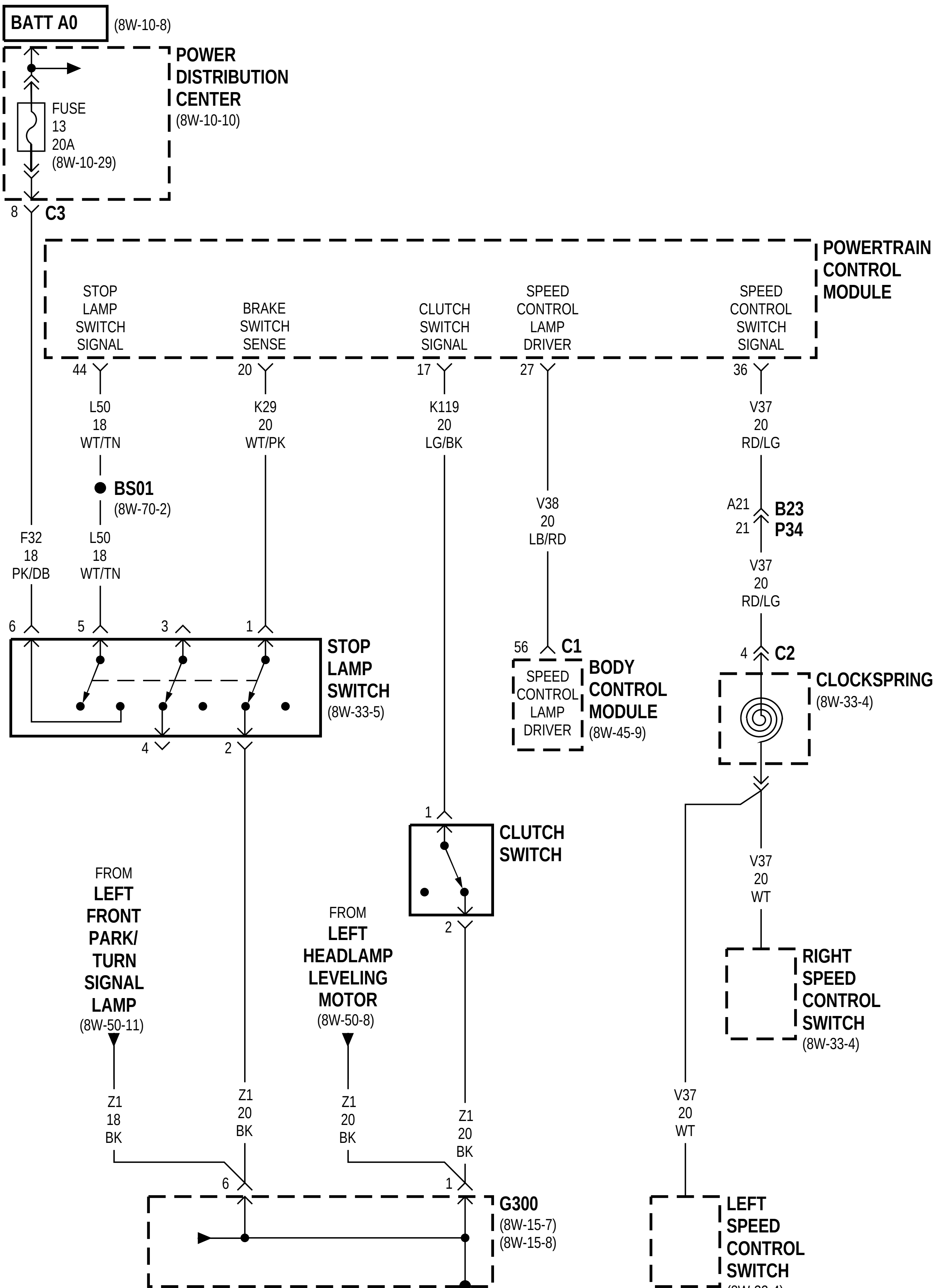

FUEL PUMP MODULE
CONTROL SLEEVE SENSOR
CONTROL SLEEVE POSITION SENSOR
SLEEVE POSITION SENSOR (-)
SLEEVE POSITION SENSOR (+)
2
1
3
K57 18 LG/OR
K134 18 LB/BK
K135 18 WT/BK
2
E95
B107
5
6
E96
B108
K57 20 LG/OR
K134 20 LB/BK
K135 20 WT/BK
TURBO BOOST PRESSURE SENSOR
SENSOR GROUND
5V SUPPLY
INTAKE AIR TEMPERATURE SENSOR
BOOST PRESSURE SIGNAL
1
3
2
4
K4 18 BK/LB
K9 18 LB
K21 18 BK/RD
K1 18 DG/RD
ES05
(8W-70-11)
K4 20 BK/LB
6
E97
B106
K4 18 BK/LB
BS34
(8W-70-11)
8
6
7
E120
B33
K4 20 BK/LB
K9 20 LB
K21 20 BK/RD
K1 20 DG/RD
7
29
52
33
41
64
40
POWERTRAIN CONTROL MODULE
CONTROL SLEEVE POSITION SENSOR
SLEEVE POSITION SENSOR (-)
SLEEVE POSITION SENSOR (+)
SENSOR GROUND
5V SUPPLY
INTAKE AIR TEMPERATURE SENSOR
BOOST PRESSURE SIGNAL


NEEDLE MOVEMENT SENSOR
NEEDLE MOVEMENT SENSOR (+)
NEEDLE MOVEMENT SENSOR (-)
SHIELD
ENGINE SPEED SENSOR
SHIELD
ENGINE SPEED SENSOR SIGNAL
ENGINE SPEED SENSOR RETURN
K67 18 BR/BK
K68 18 LG/YL
Z122 18 BK
Z122 18 BK
K24 20 GY/BK
K3 20 BK/VT
ES31
ES30
Z122 18 BK
Z122 18 BK
E97
B106
E120
B33
Z12 18 BK
G301
(8W-15-12)
Z1 18 BK
Z1 18 BK
K3 20 BK/VT
BS41
BS40
Z1 18 BK
Z1 18 BK
K67 20 BR/BK
K68 20 LG/YL
BS31
(8W-15-3)
Z12 14 BK/TN
G300
(8W-15-5)
K24 18 GY/BK
POWERTRAIN CONTROL MODULE
NEEDLE MOVEMENT SENSOR (+)
NEEDLE MOVEMENT SENSOR (-)
ENGINE SPEED SENSOR
ENGINE SPEED SENSOR RETURN


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30 C1
F87 18 WT/BK
6 C2
POWER DISTRIBUTION CENTER
(8W-10-29)
6 C6
F87
18
WT/BK
1
FUSED IGNITION (ST-RUN)
VEHICLE SPEED SENSOR SIGNAL
SENSOR GROUND
VEHICLE SPEED SENSOR
3
G7
18
WT/OR
4 E96 B108
BS30
G7
18
WT/OR
ENGINE COOLANT TEMPERATURE SENSOR
COOLANT TEMPERATURE SENSOR SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
3
G58
20
BK/YL
3 E120 B33
G58
20
BK/YL
1
K2
20
TN/BK
2
K4
20
BK/LB
2
K4
20
BK/LB
ES05
(8W-70-11)
K4
20
BK/LB
8
6 E97 B106
K4
18
BK/LB
BS34
(8W-70-11)
42 C1
60 C1
BODY CONTROL MODULE
(8W-45-9)
VEHICLE SPEED SENSOR SIGNAL
COOLANT TEMPERATURE SENSOR SIGNAL
ENGINE SPEED SENSOR SIGNAL
ENGINE DISABLE SIGNAL
75 C1
72 C1
F87
18
WT/BK
G7
18
WT/OR
K159
20
VT/RD
G55
20
OR/BK
K2
20
TN/BK
K4
20
BK/LB
38
43
2
59
14
33
FUSED IGNITION (ST-RUN)
VEHICLE SPEED SENSOR SIGNAL
ENGINE SPEED SENSOR SIGNAL
ENGINE DISABLE SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
POWERTRAIN CONTROL MODULE


ST-RUN F87
(8W-10-29)
POWER DISTRIBUTION CENTER
(8W-10-10)
86
A/C COMPRESSOR CLUTCH RELAY
(8W-42-9)
85
7 C6
LOW SPEED RADIATOR FAN RELAY CONTROL
RADIATOR FAN RELAY NO. 2
(8W-42-10)
6
HIGH SPEED RADIATOR FAN RELAY CONTROL
RADIATOR FAN RELAY NO. 1
(8W-42-10)
6
HIGH SPEED RADIATOR FAN RELAY CONTROL
RADIATOR FAN RELAY NO. 3
(8W-42-10)
6
C13 20 DB/OR
C24 20 DB/PK
C137 20 YL
C137 20 YL
ES09
A/C HEATER CONTROL
(8W-42-3)
A/C SWITCH SIGNAL
3 C1
C137 20 YL
C103 20 DG/LB
9
10 E97 B106
1 E95 B107
36 B36 P18 B23
C13 20 DB/OR
C24 20 DB/PK
C137 20 YL
C103 20 DG/LB
28
6
48
37
A/C COMPRESSOR CLUTCH RELAY CONTROL
LOW SPEED RADIATOR FAN RELAY NO. 2 CONTROL
HIGH SPEED RADIATOR FAN RELAY NO. 1&3 CONTROL
A/C SWITCH SIGNAL
POWERTRAIN CONTROL MODULE


ACCELERATOR PEDAL POSITION SENSOR
SENSOR GROUND
LOW IDLE POSITION SWITCH
ACCELERATOR PEDAL SENSOR SIGNAL
ACCELERATOR PEDAL SENSOR GROUND
5V SUPPLY
3
5
7
8
10
K4 20 BK/LB
2
A/C PRESSURE TRANSDUCER
3
1
K4 20 BK/LB
BS34
(8W-70-11)
K7 20 OR
C18 20 DB
K4 20 BK/LB
K151 20 WT
K22 20 OR/DB
K167 20 BR/YL
K6 20 VT/WT
19
13
33
65
15
55
57
5V OUTPUT
A/C PRESSURE A/D
SENSOR GROUND
LOW IDLE POSITION SWITCH
ACCELERATOR PEDAL SENSOR SIGNAL
ACCELERATOR PEDAL SENSOR GROUND
5V SUPPLY
POWERTRAIN CONTROL MODULE



BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 13 20A (8W-10-29)
8 C3
POWERTRAIN CONTROL MODULE
STOP LAMP SWITCH SIGNAL
BRAKE SWITCH SENSE
CLUTCH SWITCH SIGNAL
SPEED CONTROL LAMP DRIVER
SPEED CONTROL SWITCH SIGNAL
44
20
17
27
36
L50 18 WT/TN
K29 20 WT/PK
K119 20 LG/BK
V37 20 RD/LG
BS01
(8W-70-2)
V38 20 LB/RD
A21 B23
21 P34
F32 18 PK/DB
L50 18 WT/TN
V37 20 RD/LG
6 5 3 1
STOP LAMP SWITCH
(8W-33-5)
4 2
56 C1
SPEED CONTROL LAMP DRIVER
BODY CONTROL MODULE
(8W-45-9)
4 C2
CLOCKSPRING
(8W-33-4)
1
CLUTCH SWITCH
2
V37 20 WT
RIGHT SPEED CONTROL SWITCH
(8W-33-4)
FROM LEFT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
FROM LEFT HEADLAMP LEVELING MOTOR
(8W-50-8)
Z1 18 BK
Z1 20 BK
Z1 20 BK
Z1 20 BK
V37 20 WT
6
1
G300
(8W-15-7)
(8W-15-8)
LEFT SPEED CONTROL SWITCH
(8W-33-4)

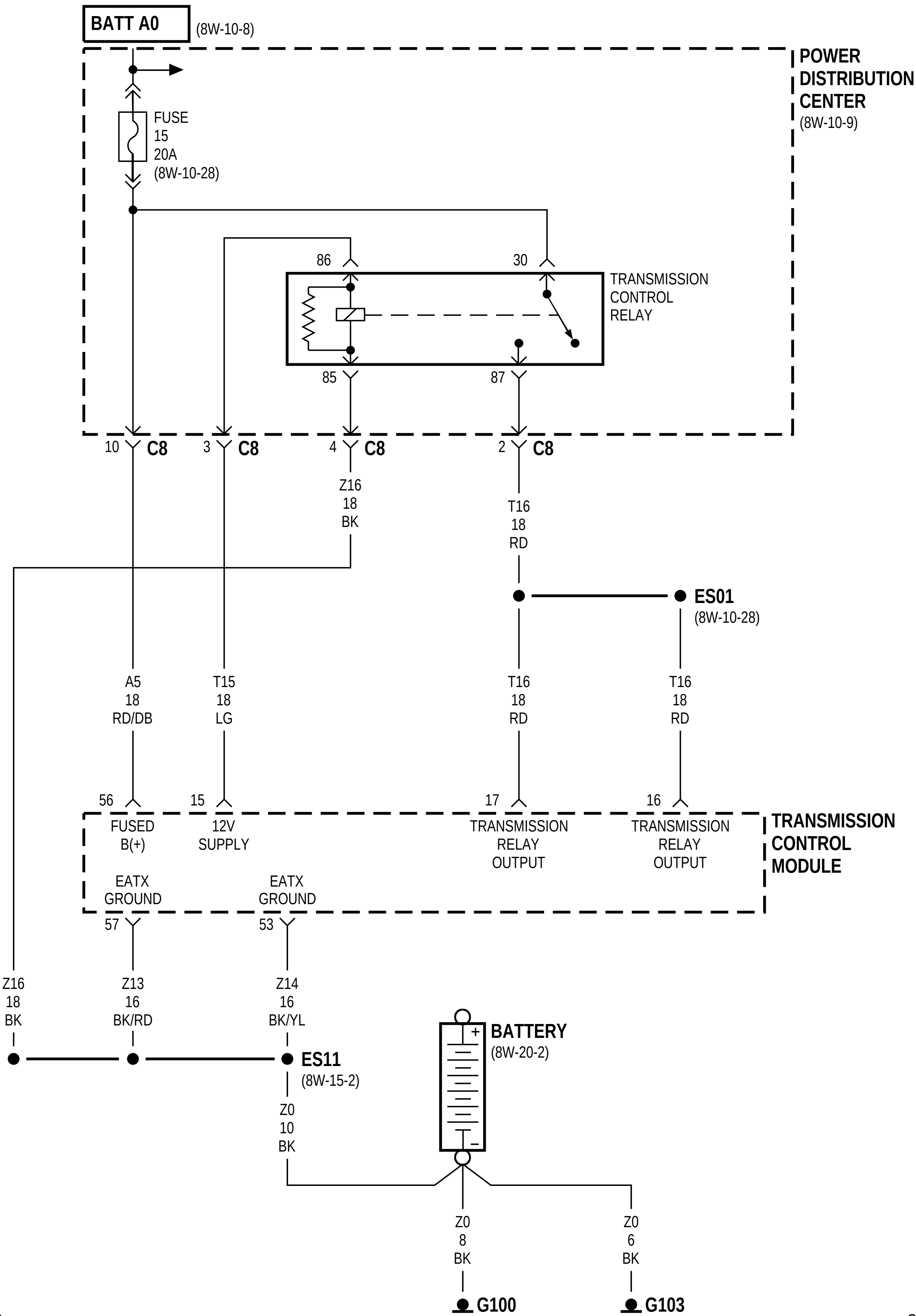
8W-31 TRANSMISSION CONTROL SYSTEM

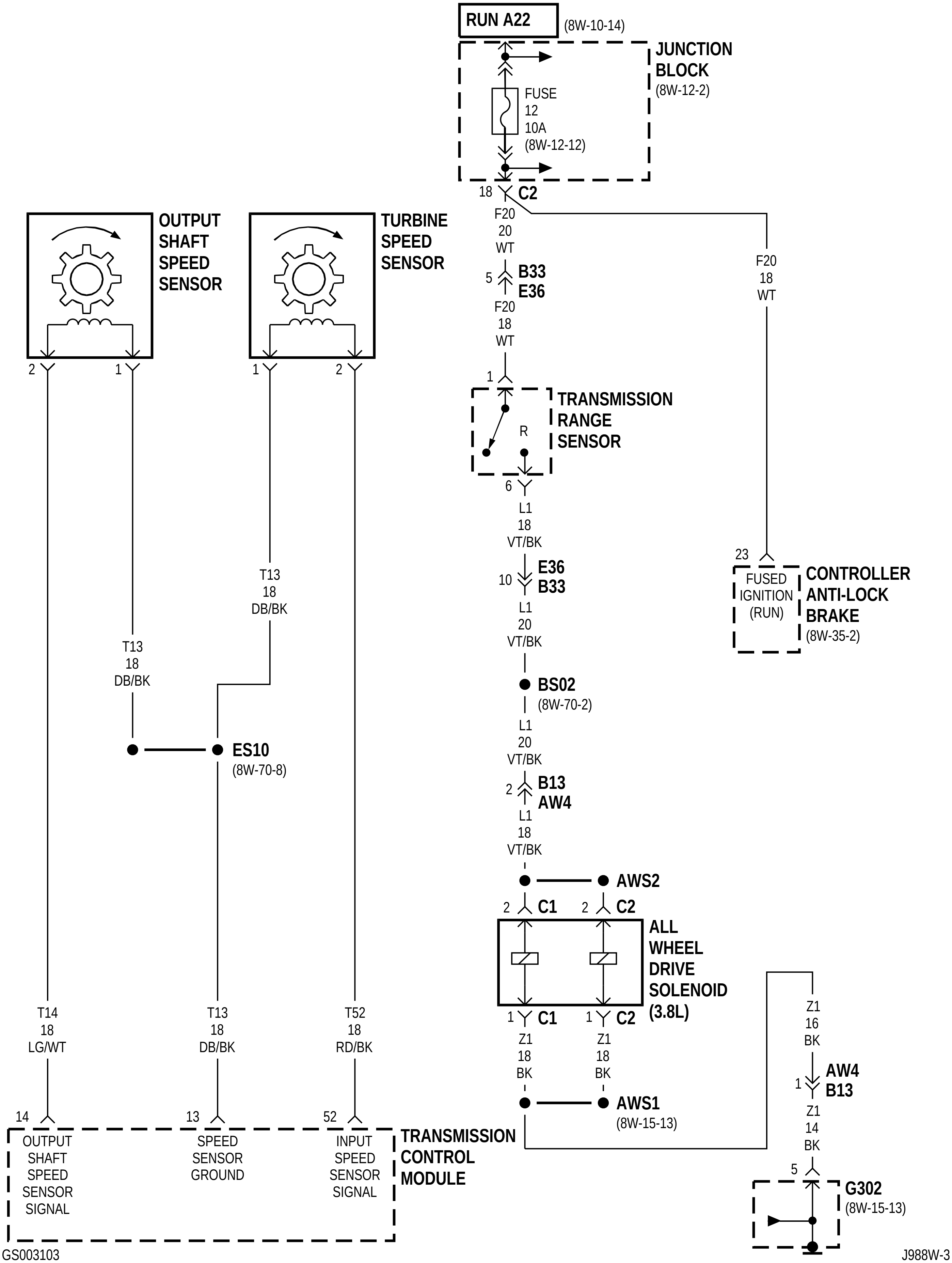
Component **Page**

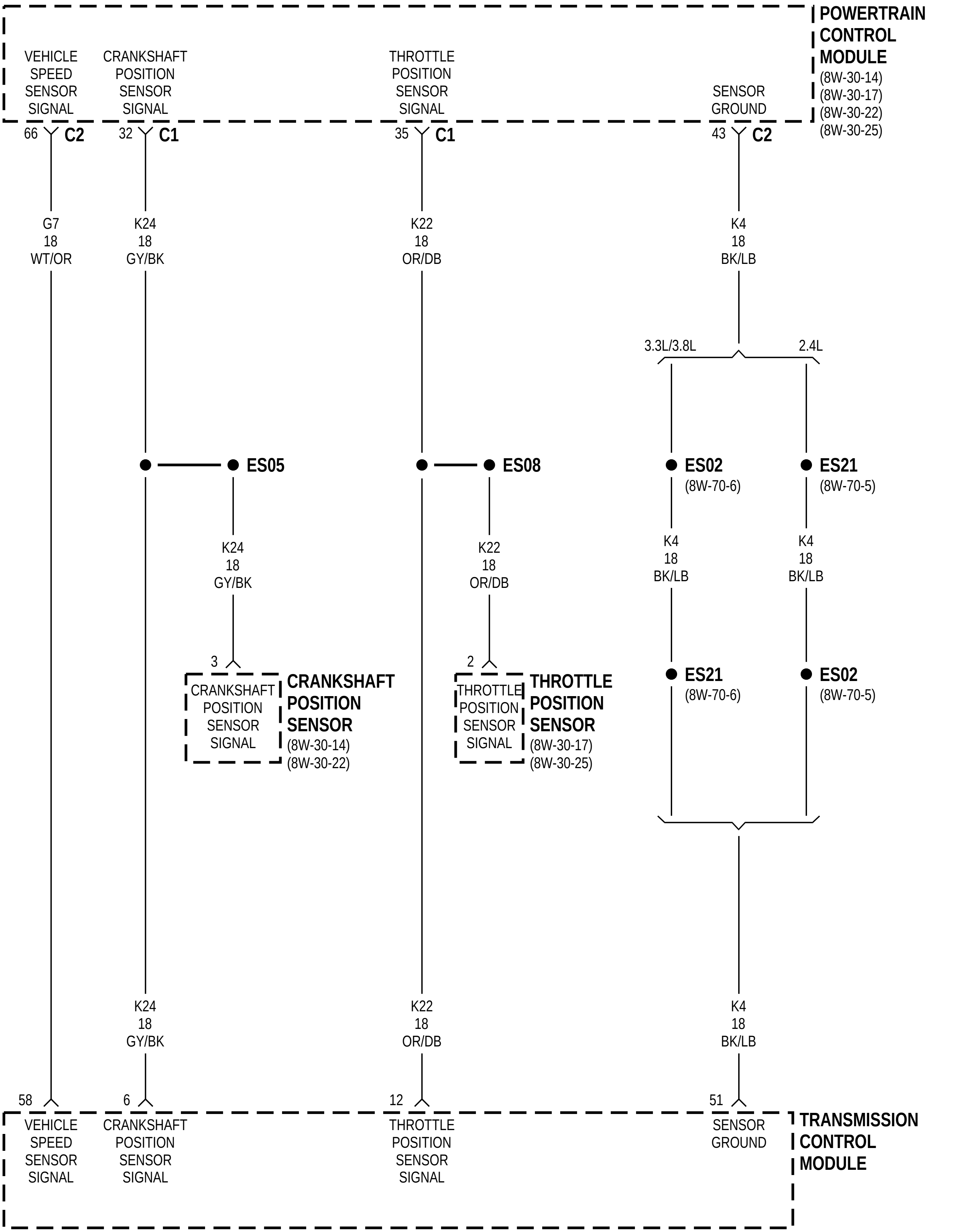
All Wheel Drive Solenoid. 8W-31-3
AW4 B13 . . . . .8W-31-3
AWS1 . . . . .8W-31-3
AWS2 . . . . .8W-31-3
Battery 8W-31-2
BS02 . . . . .8W-31-3
BS05 . . . . .8W-31-8
BS06 . . . . .8W-31-8
Clutch Interlock Switch Jumper 8W-31-5
Controller Anti-Lock Brake 8W-31-3
Crankshaft Position Sensor 8W-31-4
Data Link Connector 8W-31-8
ES01 . . . . .8W-31-2, 6, 7
ES02 . . . . .8W-31-4
ES05 . . . . .8W-31-4
ES08 . . . . .8W-31-4
ES10 . . . . .8W-31-3, 5
ES11 . . . . .8W-31-2
ES13 . . . . .8W-31-8
ES14 . . . . .8W-31-8
ES21 . . . . .8W-31-4
ES24 . . . . .8W-31-8
Fuse 2 (JB) 8W-31-5
Fuse 10 (JB) 8W-31-5

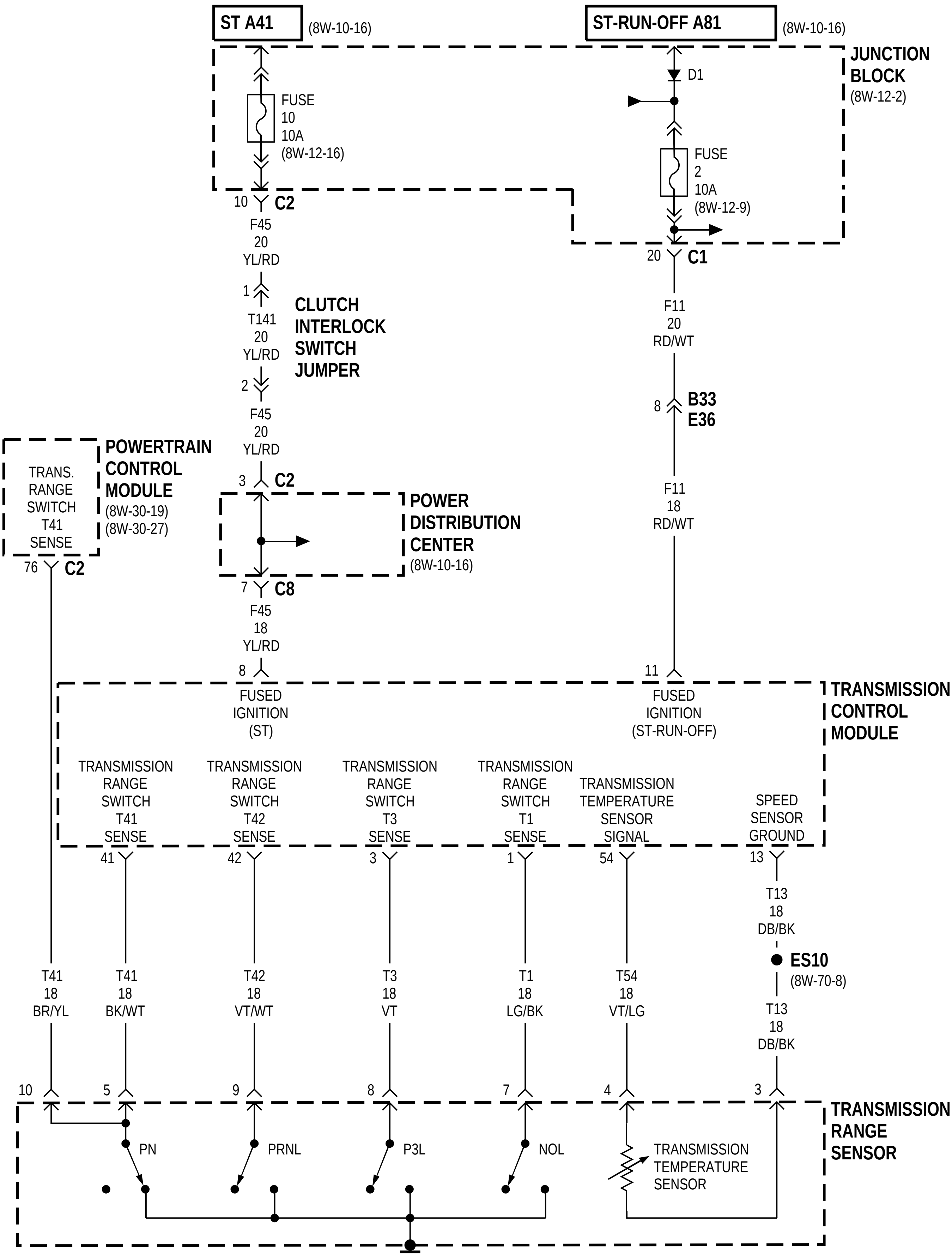
Component **Page**

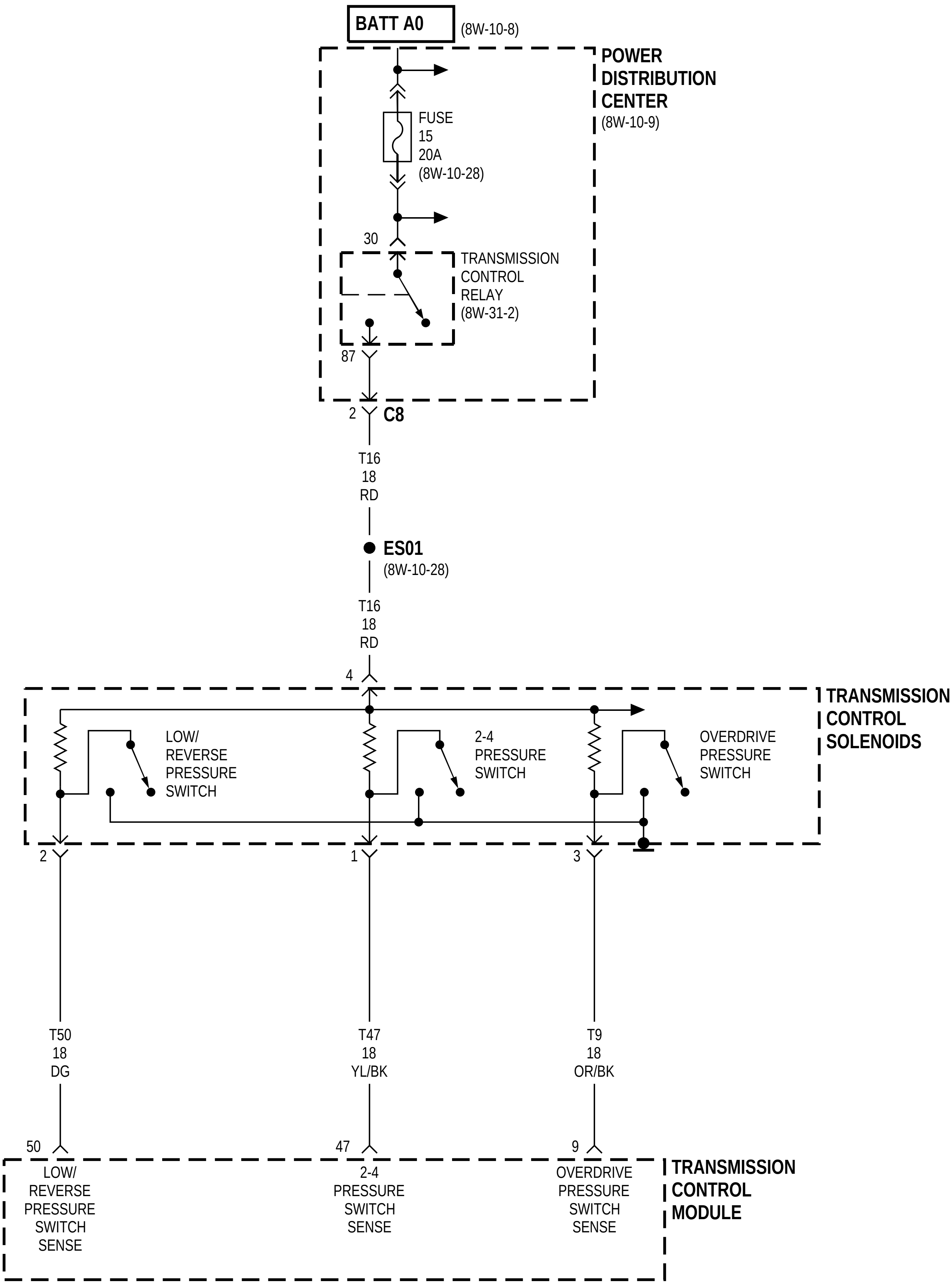
Fuse 12 (JB) 8W-31-3
Fuse 15 (PDC) .8W-31-2, 6, 7
G100 . . . . .8W-31-2
G103 . . . . .8W-31-2
G302 . . . . .8W-31-3
Junction Block. 8W-31-3, 5
Low/Reverse Pressure Switch 8W-31-6
Low/Reverse Solenoid 8W-31-7
Output Shaft Speed Sensor 8W-31-3
Overdrive Pressure Switch 8W-31-6
Overdrive Solenoid .8W-31-7
Power Distribution Center. 8W-31-2, 5, 6, 7
Powertrain Control Module 8W-31-4, 5, 6
PS01 . . . . .8W-31-8
PS02 . . . . .8W-31-8
Throttle Position Sensor 8W-31-4
Transmission Control
Module. 8W-31-2, 3, 4, 5, 6, 7, 8
Transmission Control Relay. 8W-31-2, 6, 7
Transmission Control Solenoids. 8W-31-6, 7
Transmission Range Sensor. 8W-31-3, 5
Turbine Speed Sensor 8W-31-3
Underdrive Solenoid 8W-31-7

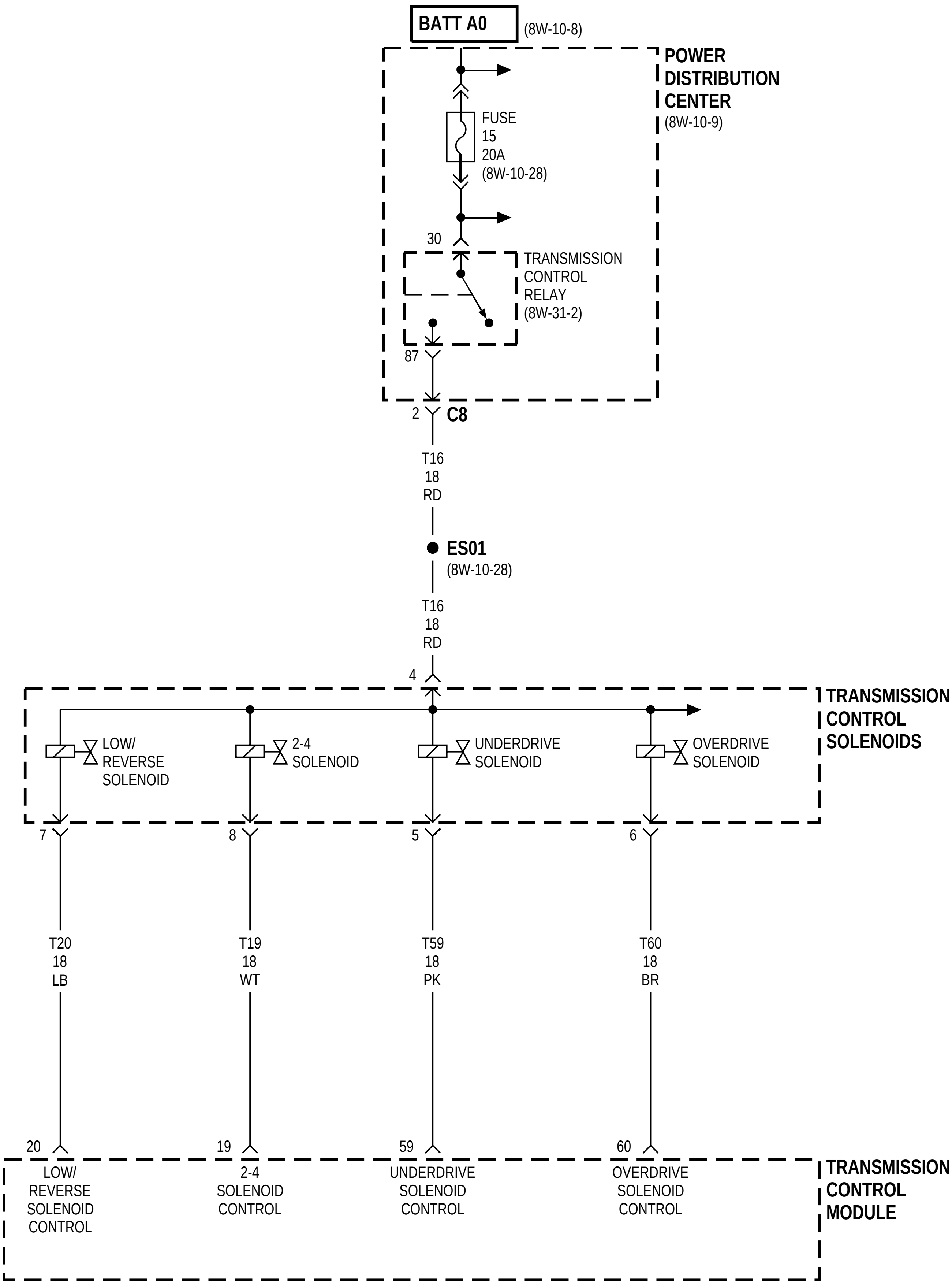

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
15
20A
(8W-10-28)
86
30
TRANSMISSION
CONTROL
RELAY
85
87
10 C8
3 C8
4 C8
2 C8
Z16
18
BK
T16
18
RD
ES01
(8W-10-28)
A5
18
RD/DB
T15
18
LG
T16
18
RD
T16
18
RD
56
15
17
16
FUSED
B(+)
12V
SUPPLY
TRANSMISSION
RELAY
OUTPUT
TRANSMISSION
RELAY
OUTPUT
TRANSMISSION
CONTROL
MODULE
EATX
GROUND
EATX
GROUND
57
53
Z16
18
BK
Z13
16
BK/RD
Z14
16
BK/YL
ES11
(8W-15-2)
BATTERY
(8W-20-2)
Z0
10
BK
Z0
8
BK
Z0
6
BK
G100
G103

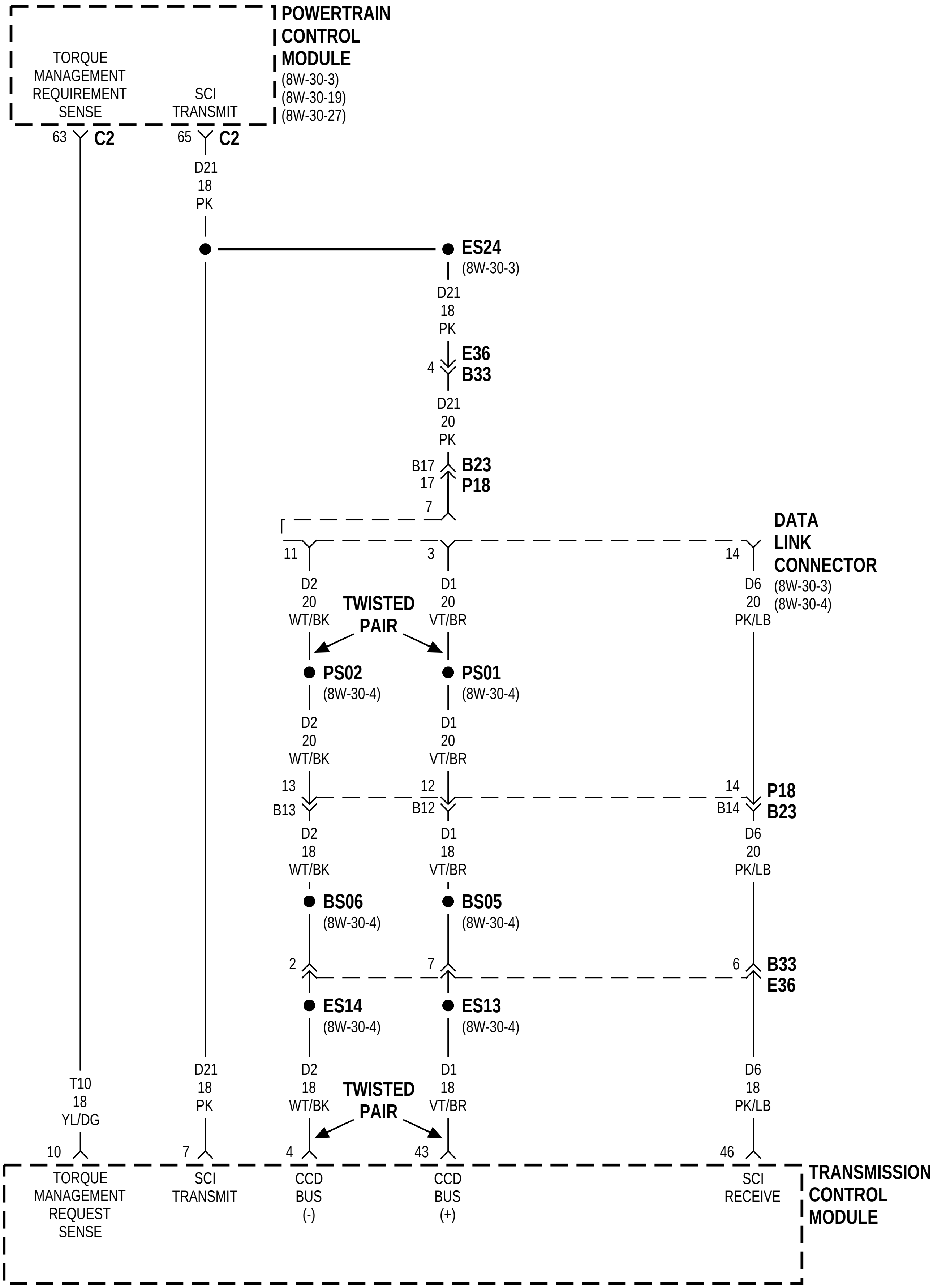

RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
18
C2
F20
20
WT
5
B33
E36
F20
18
WT
F20
18
WT
OUTPUT SHAFT SPEED SENSOR
TURBINE SPEED SENSOR
2
1
1
2
1
TRANSMISSION RANGE SENSOR
R
6
L1
18
VT/BK
10
E36
B33
L1
20
VT/BK
BS02
(8W-70-2)
L1
20
VT/BK
2
B13
AW4
L1
18
VT/BK
23
FUSED IGNITION (RUN)
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
T13
18
DB/BK
T13
18
DB/BK
ES10
(8W-70-8)
AWS2
2
C1
2
C2
ALL WHEEL DRIVE SOLENOID (3.8L)
1
C1
1
C2
Z1
18
BK
Z1
18
BK
AWS1
(8W-15-13)
Z1
16
BK
1
AW4
B13
Z1
14
BK
5
G302
(8W-15-13)
T14
18
LG/WT
T13
18
DB/BK
T52
18
RD/BK
14
13
52
OUTPUT SHAFT SPEED SENSOR SIGNAL
SPEED SENSOR GROUND
INPUT SPEED SENSOR SIGNAL
TRANSMISSION CONTROL MODULE


POWERTRAIN CONTROL MODULE
(8W-30-14)
(8W-30-17)
(8W-30-22)
(8W-30-25)
VEHICLE SPEED SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
66 C2
32 C1
35 C1
43 C2
G7 18 WT/OR
K24 18 GY/BK
K22 18 OR/DB
K4 18 BK/LB
3.3L/3.8L
2.4L
ES05
ES08
ES02 (8W-70-6)
ES21 (8W-70-5)
K24 18 GY/BK
K22 18 OR/DB
K4 18 BK/LB
K4 18 BK/LB
3
2
CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR
(8W-30-14)
(8W-30-22)
THROTTLE POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR
(8W-30-17)
(8W-30-25)
ES21 (8W-70-6)
ES02 (8W-70-5)
K24 18 GY/BK
K22 18 OR/DB
K4 18 BK/LB
58
6
12
51
VEHICLE SPEED SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
TRANSMISSION CONTROL MODULE


ST A41
(8W-10-16)
ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
10
10A
(8W-12-16)
FUSE
2
10A
(8W-12-9)
10
C2
20
C1
F45
20
YL/RD
1
T141
20
YL/RD
2
CLUTCH INTERLOCK SWITCH JUMPER
F45
20
YL/RD
F11
20
RD/WT
8
B33
E36
F11
18
RD/WT
POWERTRAIN CONTROL MODULE
(8W-30-19)
(8W-30-27)
TRANS. RANGE SWITCH T41 SENSE
76
C2
3
C2
POWER DISTRIBUTION CENTER
(8W-10-16)
7
C8
F45
18
YL/RD
8
11
FUSED IGNITION (ST)
FUSED IGNITION (ST-RUN-OFF)
TRANSMISSION CONTROL MODULE
TRANSMISSION RANGE SWITCH T41 SENSE
TRANSMISSION RANGE SWITCH T42 SENSE
TRANSMISSION RANGE SWITCH T3 SENSE
TRANSMISSION RANGE SWITCH T1 SENSE
TRANSMISSION TEMPERATURE SENSOR SIGNAL
SPEED SENSOR GROUND
41
42
3
1
54
13
T13
18
DB/BK
ES10
(8W-70-8)
T41
18
BR/YL
T41
18
BK/WT
T42
18
VT/WT
T3
18
VT
T1
18
LG/BK
T54
18
VT/LG
T13
18
DB/BK
10
5
9
8
7
4
3
TRANSMISSION RANGE SENSOR
PN
PRNL
P3L
NOL
TRANSMISSION TEMPERATURE SENSOR


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
15
20A
(8W-10-28)
30
TRANSMISSION
CONTROL
RELAY
(8W-31-2)
87
2
C8
T16
18
RD
ES01
(8W-10-28)
T16
18
RD
4
TRANSMISSION
CONTROL
SOLENOIDS
LOW/
REVERSE
PRESSURE
SWITCH
2-4
PRESSURE
SWITCH
OVERDRIVE
PRESSURE
SWITCH
2
1
3
T50
18
DG
T47
18
YL/BK
T9
18
OR/BK
50
47
9
LOW/
REVERSE
PRESSURE
SWITCH
SENSE
2-4
PRESSURE
SWITCH
SENSE
OVERDRIVE
PRESSURE
SWITCH
SENSE
TRANSMISSION
CONTROL
MODULE

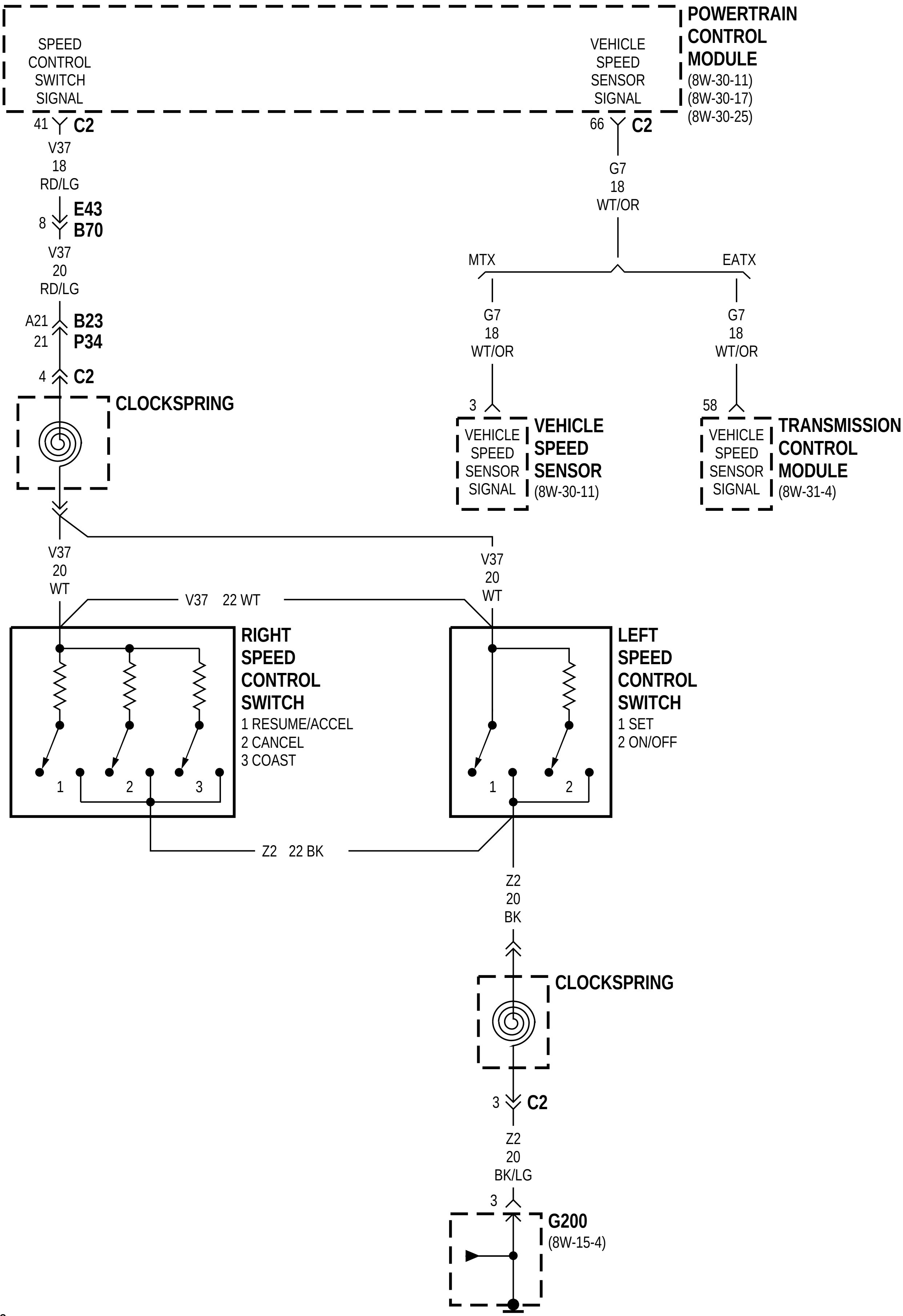

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
15
20A
(8W-10-28)
30
TRANSMISSION
CONTROL
RELAY
(8W-31-2)
87
2
C8
T16
18
RD
ES01
(8W-10-28)
T16
18
RD
4
TRANSMISSION
CONTROL
SOLENOIDS
LOW/
REVERSE
SOLENOID
2-4
SOLENOID
UNDERDRIVE
SOLENOID
OVERDRIVE
SOLENOID
7
8
5
6
T20
18
LB
T19
18
WT
T59
18
PK
T60
18
BR
20
19
59
60
LOW/
REVERSE
SOLENOID
CONTROL
2-4
SOLENOID
CONTROL
UNDERDRIVE
SOLENOID
CONTROL
OVERDRIVE
SOLENOID
CONTROL
TRANSMISSION
CONTROL
MODULE

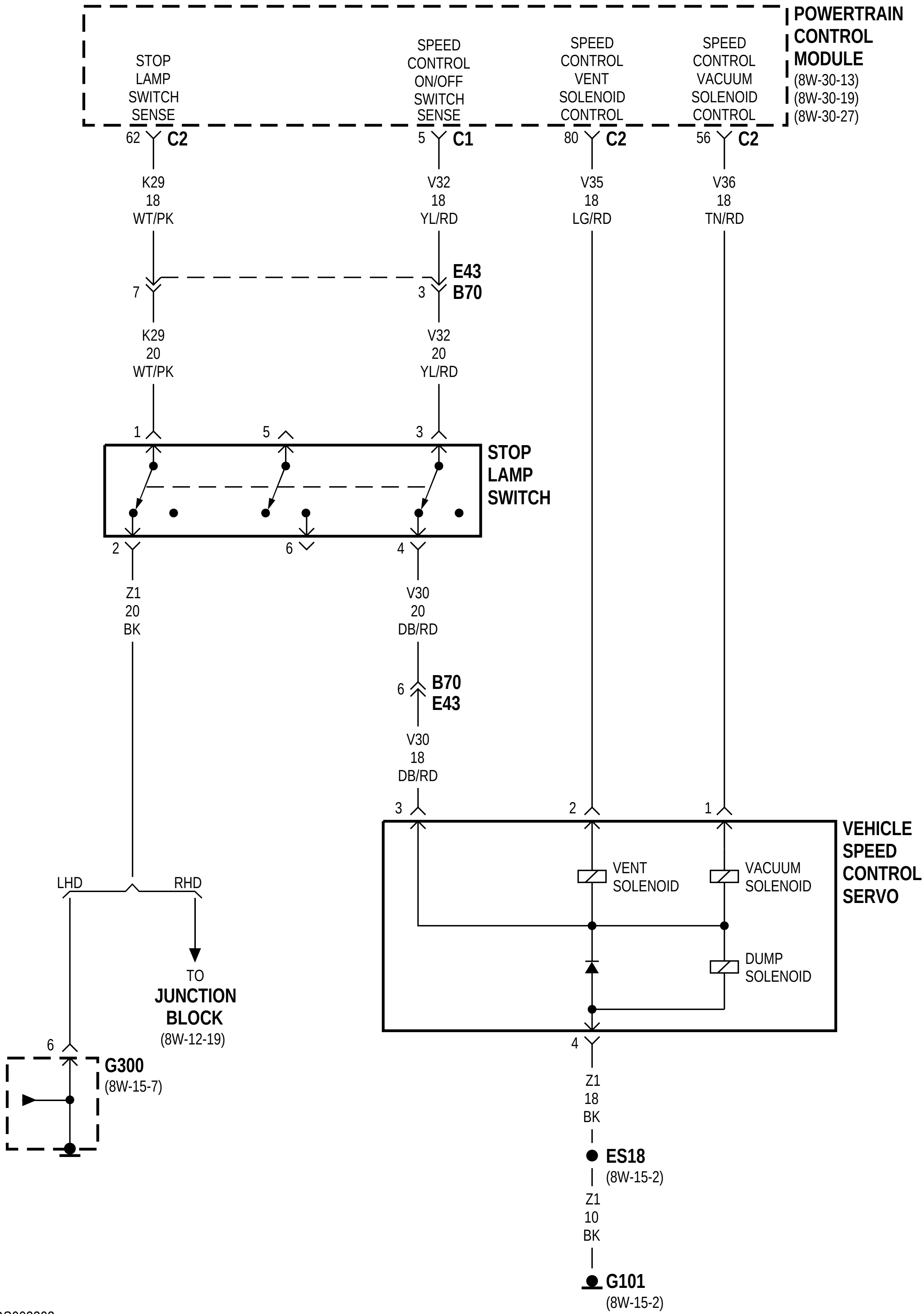

POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-19)
(8W-30-27)
TORQUE MANAGEMENT REQUIREMENT SENSE
SCI TRANSMIT
63
C2
65
C2
D21
18
PK
ES24
(8W-30-3)
D21
18
PK
4
E36
B33
D21
20
PK
B17
17
B23
P18
7
11
3
14
DATA LINK CONNECTOR
(8W-30-3)
(8W-30-4)
D2
20
WT/BK
TWISTED PAIR
D1
20
VT/BR
D6
20
PK/LB
PS02
(8W-30-4)
PS01
(8W-30-4)
D2
20
WT/BK
D1
20
VT/BR
13
12
14
P18
B23
B13
B12
B14
D2
18
WT/BK
D1
18
VT/BR
D6
20
PK/LB
BS06
(8W-30-4)
BS05
(8W-30-4)
2
7
6
B33
E36
ES14
(8W-30-4)
ES13
(8W-30-4)
T10
18
YL/DG
D21
18
PK
D2
18
WT/BK
TWISTED PAIR
D1
18
VT/BR
D6
18
PK/LB
10
7
4
43
46
TORQUE MANAGEMENT REQUEST SENSE
SCI TRANSMIT
CCD BUS (-)
CCD BUS (+)
SCI RECEIVE
TRANSMISSION CONTROL MODULE

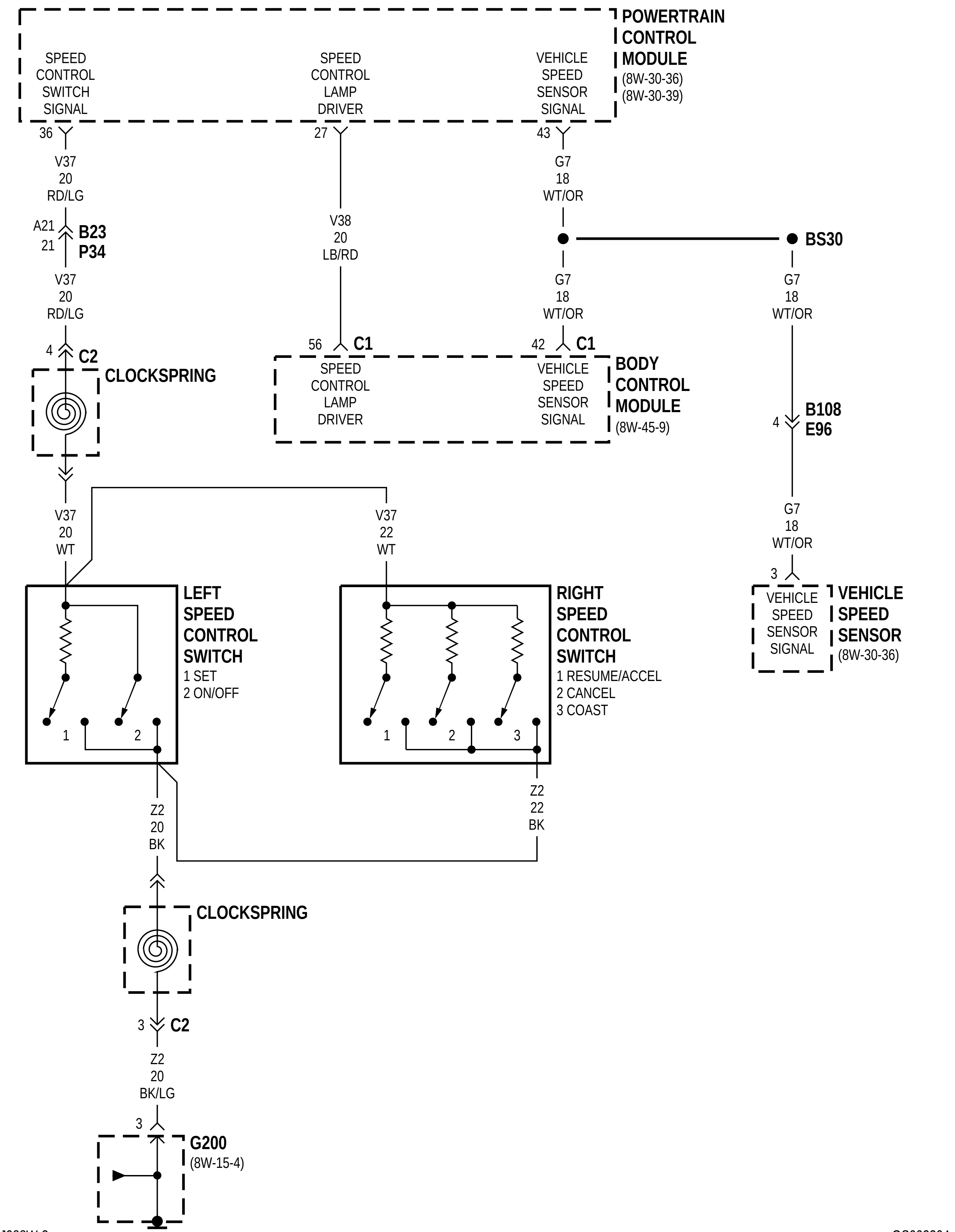
8W-33 VEHICLE SPEED CONTROL

Component	Page
Accelerator Pedal Position Sensor	8W-33-5
Body Control Module	8W-33-4
BS01	8W-33-5
BS30	8W-33-4
BS32	8W-33-5
Clockspring	8W-33-2, 4
Clutch Switch	8W-33-5
Dump Solenoid	8W-33-3
ES18	8W-33-3
Fuel Pump Module	8W-33-5
Fuse 13 (PDC)	8W-33-5
G101	8W-33-3
G200	8W-33-2, 4
G300	8W-33-3, 5
Junction Block	8W-33-3
Left Headlamp Leveling Motor	8W-33-5
Left Speed Control Switch	8W-33-2, 4
Power Distribution Center	8W-33-5
Powertrain Control Module	8W-33-2, 3, 4, 5
Right Speed Control Switch	8W-33-2, 4
Stop Lamp Switch	8W-33-3, 5
Transmission Control Module	8W-33-2
Vacuum Solenoid	8W-33-3
Vehicle Speed Control Servo	8W-33-3
Vehicle Speed Sensor	8W-33-2, 4
Vent Solenoid	8W-33-3

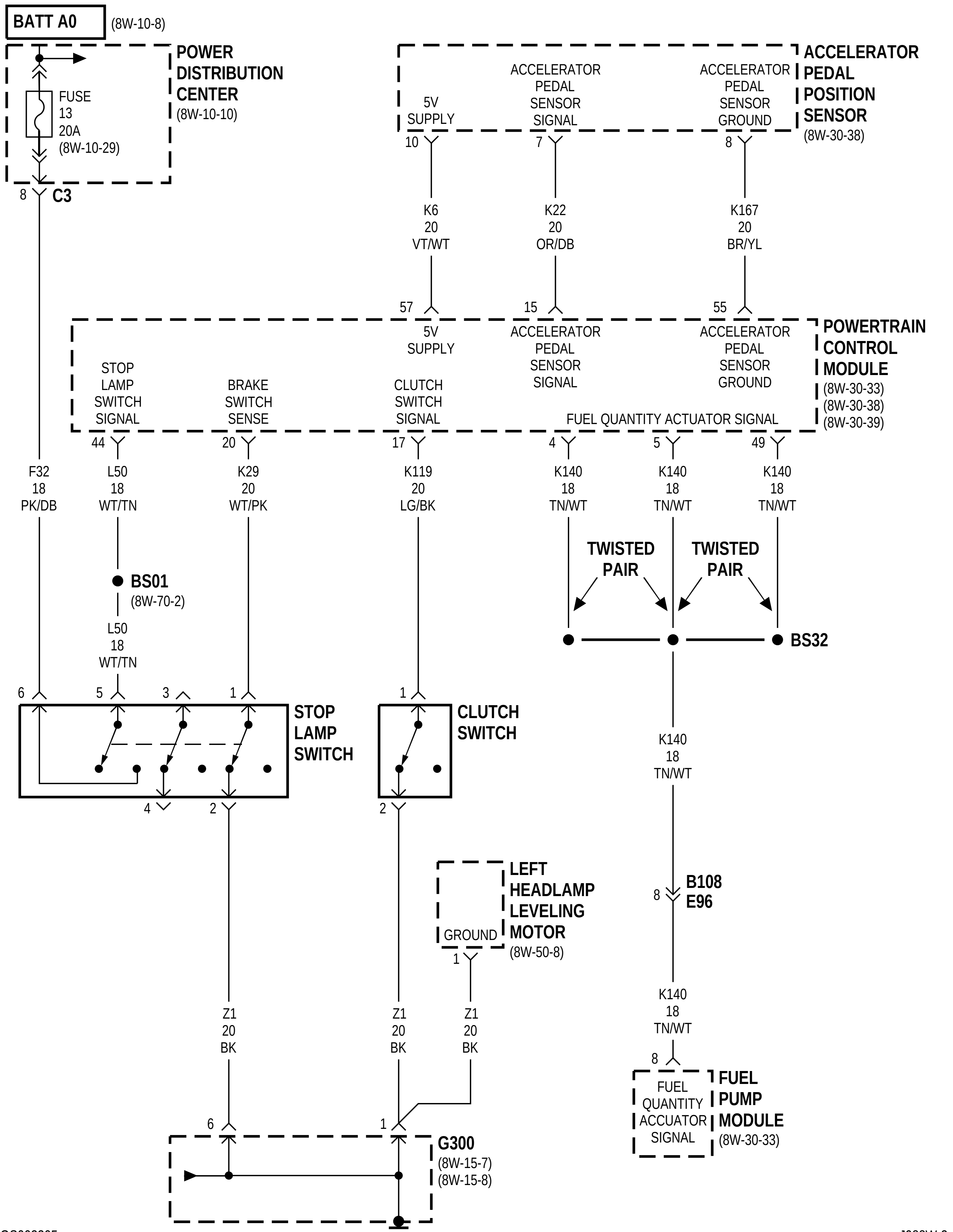
GAS


SPEED
CONTROL
SWITCH
SIGNAL
VEHICLE
SPEED
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE
(8W-30-11)
(8W-30-17)
(8W-30-25)
41 C2
66 C2
V37
18
RD/LG
8 E43
B70
V37
20
RD/LG
A21 B23
21 P34
4 C2
CLOCKSPRING
G7
18
WT/OR
MTX
EATX
G7
18
WT/OR
3
VEHICLE
SPEED
SENSOR
SIGNAL
VEHICLE
SPEED
SENSOR
(8W-30-11)
58
VEHICLE
SPEED
SENSOR
SIGNAL
TRANSMISSION
CONTROL
MODULE
(8W-31-4)
V37
20
WT
V37 22 WT
RIGHT
SPEED
CONTROL
SWITCH
1 RESUME/ACCEL
2 CANCEL
3 COAST
1 2 3
LEFT
SPEED
CONTROL
SWITCH
1 SET
2 ON/OFF
1 2
Z2 22 BK
Z2
20
BK
CLOCKSPRING
3 C2
Z2
20
BK/LG
3
G200
(8W-15-4)


POWERTRAIN
CONTROL
MODULE
(8W-30-13)
(8W-30-19)
(8W-30-27)
STOP
LAMP
SWITCH
SENSE
SPEED
CONTROL
ON/OFF
SWITCH
SENSE
SPEED
CONTROL
VENT
SOLENOID
CONTROL
SPEED
CONTROL
VACUUM
SOLENOID
CONTROL
62 C2
5 C1
80 C2
56 C2
K29
18
WT/PK
V32
18
YL/RD
V35
18
LG/RD
V36
18
TN/RD
E43
B70
7
3
K29
20
WT/PK
V32
20
YL/RD
1
5
3
STOP
LAMP
SWITCH
2
6
4
Z1
20
BK
V30
20
DB/RD
6
B70
E43
V30
18
DB/RD
3
2
1
VEHICLE
SPEED
CONTROL
SERVO
VENT
SOLENOID
VACUUM
SOLENOID
DUMP
SOLENOID
4
LHD
RHD
TO
JUNCTION
BLOCK
(8W-12-19)
6
G300
(8W-15-7)
Z1
18
BK
ES18
(8W-15-2)
Z1
10
BK
G101
(8W-15-2)

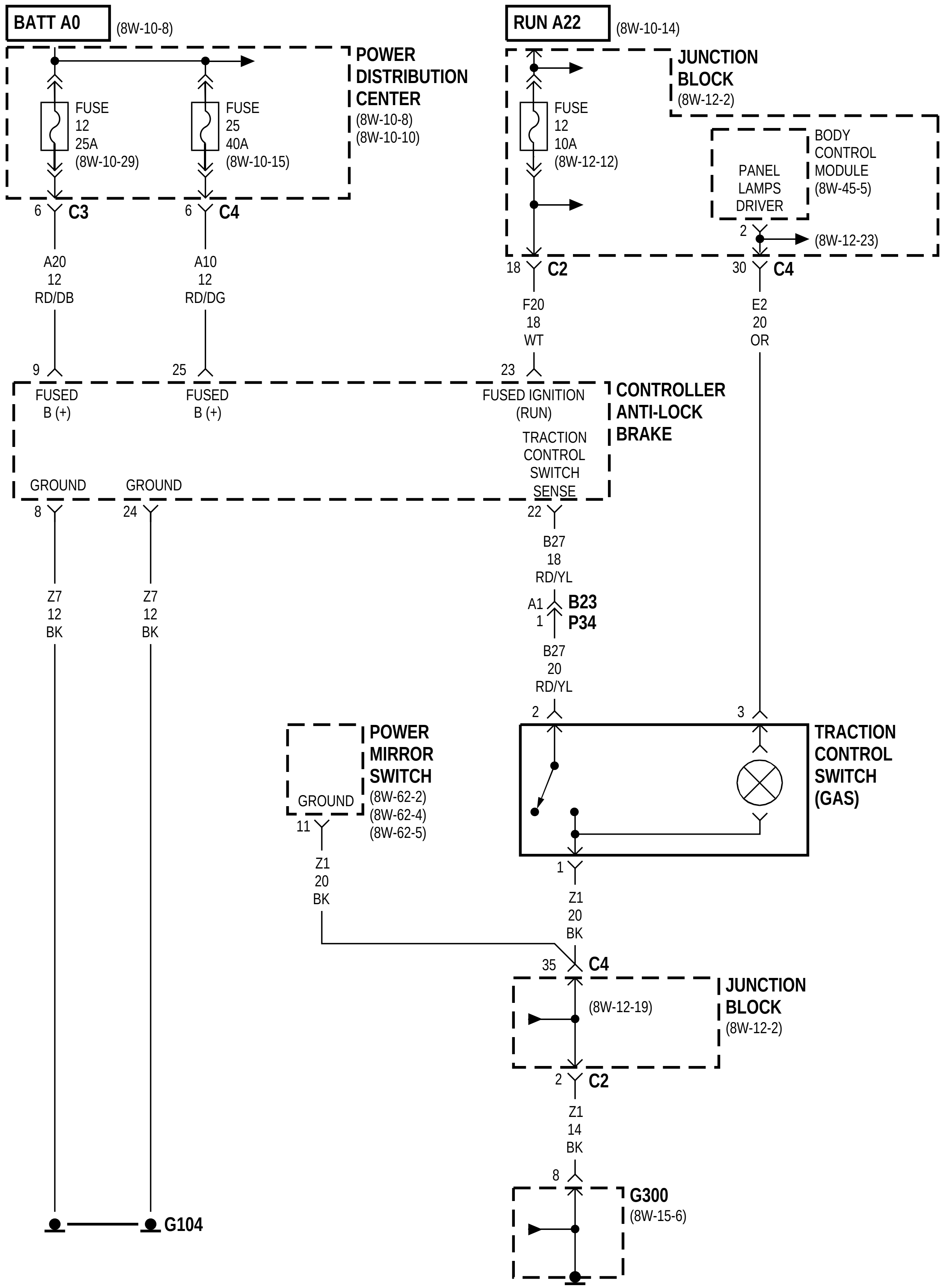

POWERTRAIN CONTROL MODULE
(8W-30-36)
(8W-30-39)
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL LAMP DRIVER
VEHICLE SPEED SENSOR SIGNAL
36
27
43
V37 20 RD/LG
A21
21
B23
P34
V37 20 RD/LG
V38 20 LB/RD
G7 18 WT/OR
BS30
G7 18 WT/OR
G7 18 WT/OR
4
C2
CLOCKSPRING
56
C1
42
C1
BODY CONTROL MODULE
(8W-45-9)
SPEED CONTROL LAMP DRIVER
VEHICLE SPEED SENSOR SIGNAL
4
B108
E96
V37 20 WT
V37 22 WT
G7 18 WT/OR
3
VEHICLE SPEED SENSOR
(8W-30-36)
VEHICLE SPEED SENSOR SIGNAL
LEFT SPEED CONTROL SWITCH
1 SET
2 ON/OFF
1
2
RIGHT SPEED CONTROL SWITCH
1 RESUME/ACCEL
2 CANCEL
3 COAST
1
2
3
Z2 20 BK
Z2 22 BK
CLOCKSPRING
3
C2
Z2 20 BK/LG
3
G200
(8W-15-4)

DIESEL

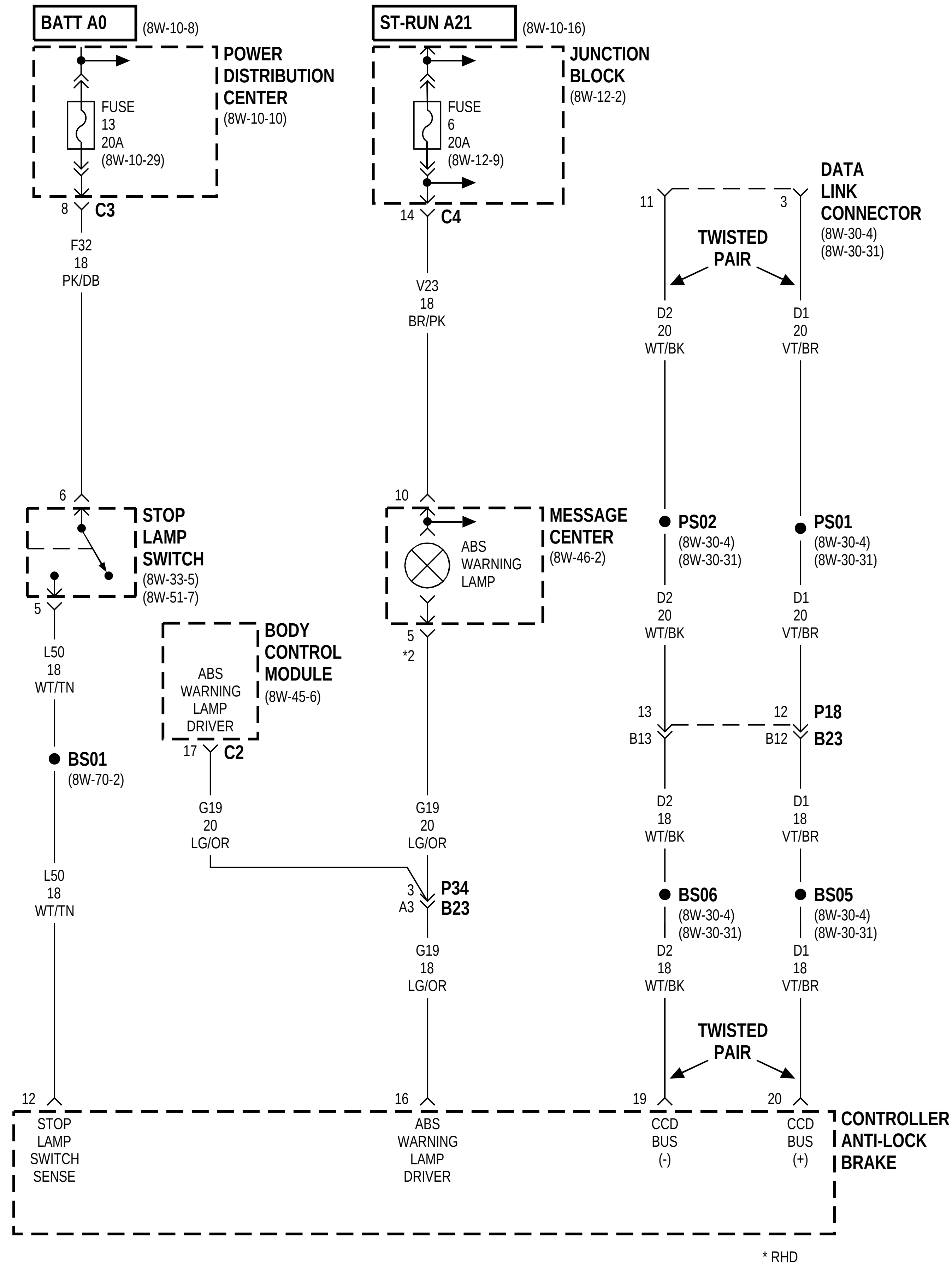

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 13 20A
(8W-10-29)
8 C3
ACCELERATOR PEDAL POSITION SENSOR
(8W-30-38)
5V SUPPLY
ACCELERATOR PEDAL SENSOR SIGNAL
ACCELERATOR PEDAL SENSOR GROUND
10 7 8
K6 20 VT/WT
K22 20 OR/DB
K167 20 BR/YL
57 15 55
POWERTRAIN CONTROL MODULE
(8W-30-33)
(8W-30-38)
(8W-30-39)
STOP LAMP SWITCH SIGNAL
BRAKE SWITCH SENSE
CLUTCH SWITCH SIGNAL
FUEL QUANTITY ACTUATOR SIGNAL
44 20 17 4 5 49
F32 18 PK/DB
L50 18 WT/TN
K29 20 WT/PK
K119 20 LG/BK
K140 18 TN/WT
K140 18 TN/WT
K140 18 TN/WT
TWISTED PAIR
TWISTED PAIR
BS01
(8W-70-2)
L50 18 WT/TN
BS32
6 5 3 1
STOP LAMP SWITCH
4 2
1
CLUTCH SWITCH
2
K140 18 TN/WT
LEFT HEADLAMP LEVELING MOTOR
GROUND
(8W-50-8)
1
B108 E96
8
K140 18 TN/WT
Z1 20 BK
Z1 20 BK
Z1 20 BK
8
FUEL PUMP MODULE
FUEL QUANTITY ACCUATOR SIGNAL
(8W-30-33)
6 1
G300
(8W-15-7)
(8W-15-8)

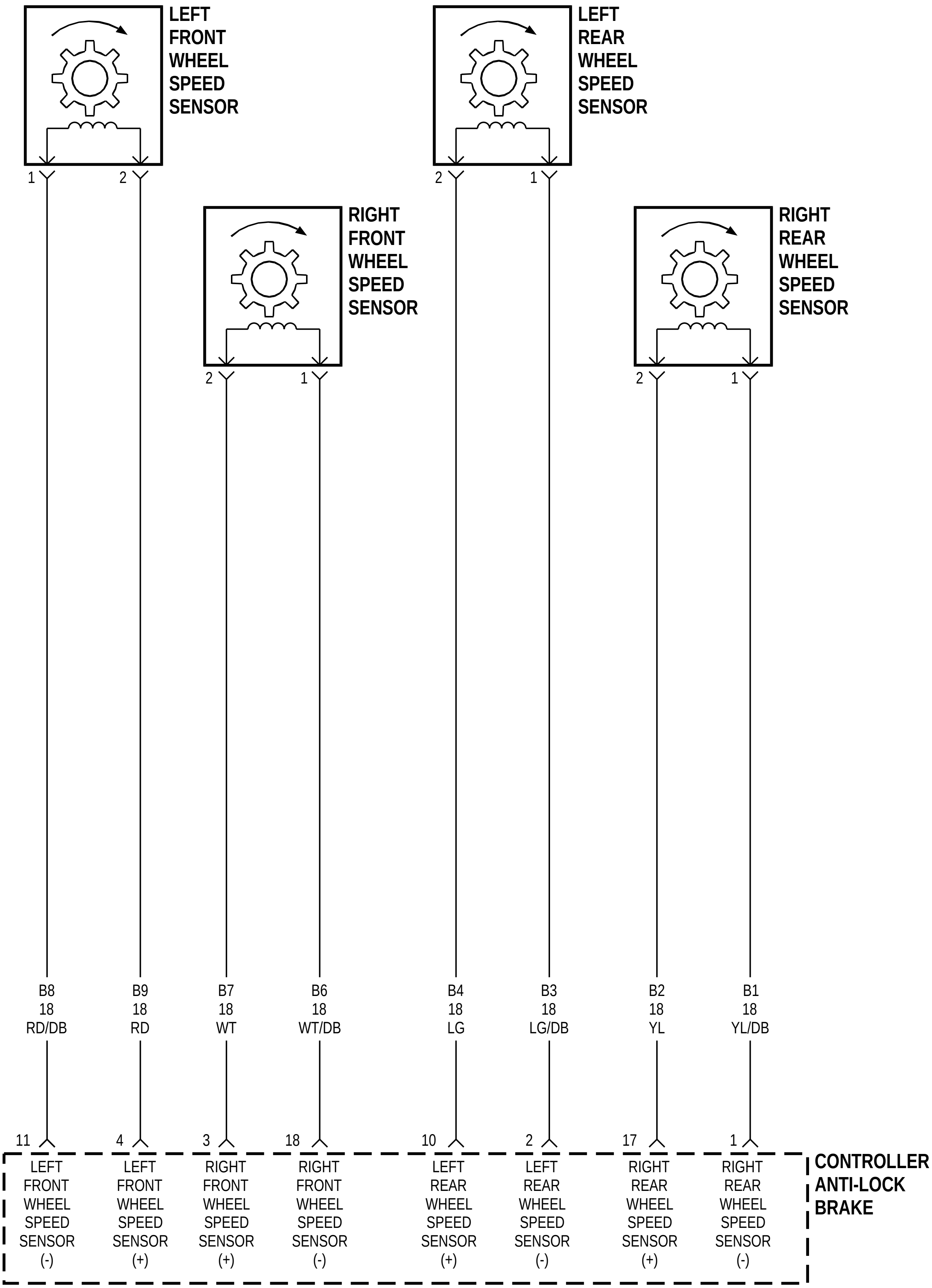
8W-35 ANTI-LOCK BRAKES

Component	Page
ABS Warning Lamp	8W-35-3
Body Control Module	8W-35-2, 3
BS01	8W-35-3
BS05	8W-35-3
BS06	8W-35-3
Controller Anti-Lock Brake	8W-35-2, 3, 4
Data Link Connector	8W-35-3
Fuse 6 (JB)	8W-35-3
Fuse 12 (JB)	8W-35-2
Fuse 12 (PDC)	8W-35-2
Fuse 13 (PDC)	8W-35-3
Fuse 25 (PDC)	8W-35-2
G104	8W-35-2
G300	8W-35-2
Junction Block	8W-35-2, 3
Left Front Wheel Speed Sensor	8W-35-4
Left Rear Wheel Speed Sensor	8W-35-4
Message Center	8W-35-3
Power Distribution Center	8W-35-2, 3
Power Mirror Switch	8W-35-2
PS01	8W-35-3
PS02	8W-35-3
Right Front Wheel Speed Sensor	8W-35-4
Right Rear Wheel Speed Sensor	8W-35-4
Stop Lamp Switch	8W-35-3
Traction Control Switch	8W-35-2



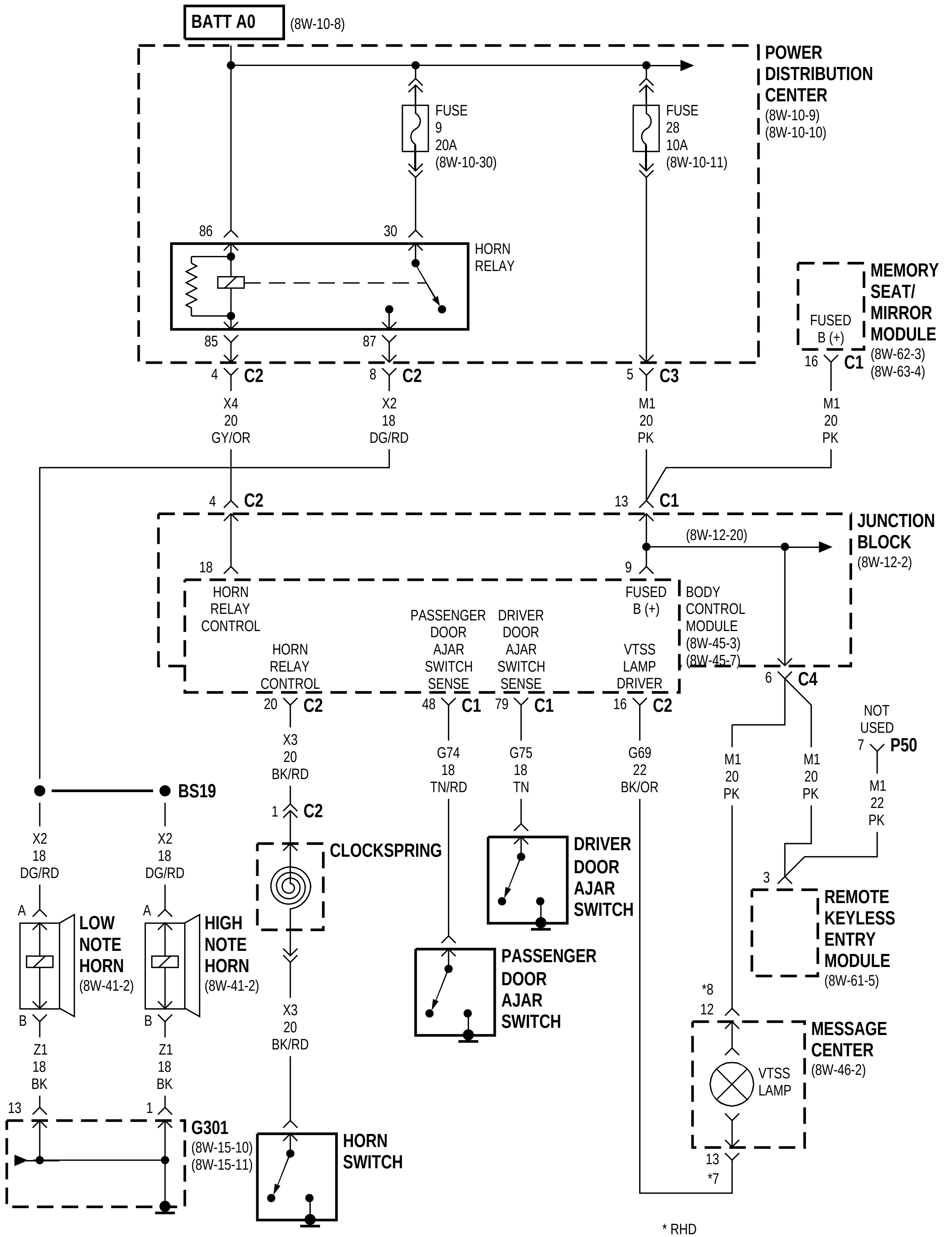
BATT A0
(8W-10-8)
FUSE
12
25A
(8W-10-29)
FUSE
25
40A
(8W-10-15)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
(8W-10-10)
6 C3
6 C4
A20
12
RD/DB
A10
12
RD/DG
RUN A22
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
PANEL
LAMPS
DRIVER
BODY
CONTROL
MODULE
(8W-45-5)
2
(8W-12-23)
18 C2
30 C4
F20
18
WT
E2
20
OR
9
25
23
FUSED
B (+)
FUSED
B (+)
FUSED IGNITION
(RUN)
TRACTION
CONTROL
SWITCH
SENSE
CONTROLLER
ANTI-LOCK
BRAKE
GROUND
GROUND
8
24
22
Z7
12
BK
Z7
12
BK
B27
18
RD/YL
A1 B23
1 P34
B27
20
RD/YL
2
3
POWER
MIRROR
SWITCH
(8W-62-2)
(8W-62-4)
(8W-62-5)
GROUND
11
TRACTION
CONTROL
SWITCH
(GAS)
1
Z1
20
BK
Z1
20
BK
35 C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-19)
2 C2
Z1
14
BK
8
G300
(8W-15-6)
G104


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-10)
FUSE
13
20A
(8W-10-29)
8
C3
F32
18
PK/DB
ST-RUN A21
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
FUSE
6
20A
(8W-12-9)
14
C4
V23
18
BR/PK
DATA
LINK
CONNECTOR
(8W-30-4)
(8W-30-31)
11
3
TWISTED
PAIR
D2
20
WT/BK
D1
20
VT/BR
6
STOP
LAMP
SWITCH
(8W-33-5)
(8W-51-7)
5
L50
18
WT/TN
10
MESSAGE
CENTER
(8W-46-2)
ABS
WARNING
LAMP
5
*2
PS02
(8W-30-4)
(8W-30-31)
PS01
(8W-30-4)
(8W-30-31)
BODY
CONTROL
MODULE
(8W-45-6)
ABS
WARNING
LAMP
DRIVER
17
C2
13
12
P18
B13
B12
B23
BS01
(8W-70-2)
G19
20
LG/OR
D2
18
WT/BK
D1
18
VT/BR
3
A3
P34
B23
BS06
(8W-30-4)
(8W-30-31)
BS05
(8W-30-4)
(8W-30-31)
G19
18
LG/OR
12
16
19
20
STOP
LAMP
SWITCH
SENSE
ABS
WARNING
LAMP
DRIVER
CCD
BUS
(-)
CCD
BUS
(+)
CONTROLLER
ANTI-LOCK
BRAKE
* RHD

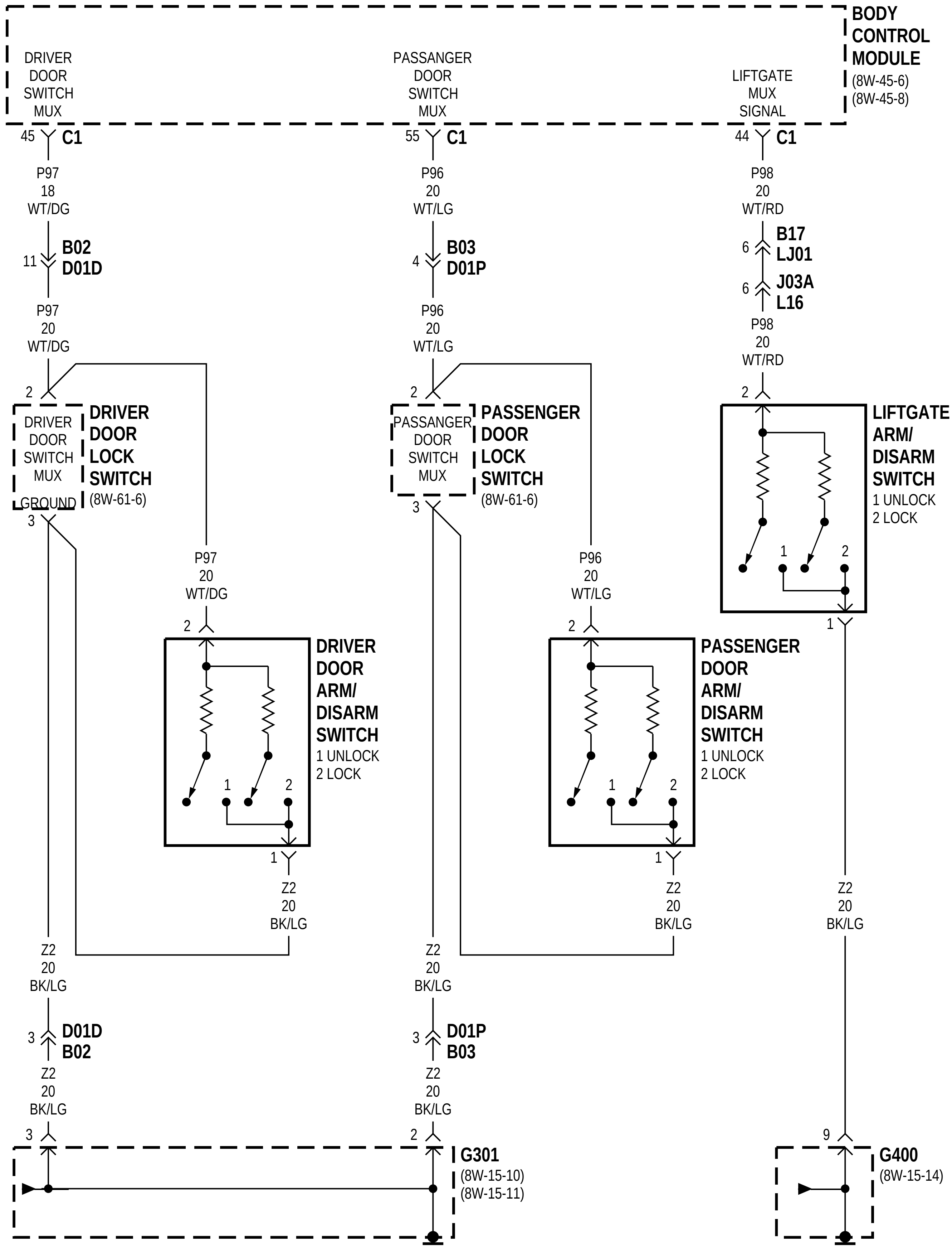

LEFT
FRONT
WHEEL
SPEED
SENSOR
LEFT
REAR
WHEEL
SPEED
SENSOR
RIGHT
FRONT
WHEEL
SPEED
SENSOR
RIGHT
REAR
WHEEL
SPEED
SENSOR
1
2
2
1
2
1
2
1
B8
18
RD/DB
B9
18
RD
B7
18
WT
B6
18
WT/DB
B4
18
LG
B3
18
LG/DB
B2
18
YL
B1
18
YL/DB
11
4
3
18
10
2
17
1
LEFT FRONT WHEEL SPEED SENSOR (-)
LEFT FRONT WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (-)
LEFT REAR WHEEL SPEED SENSOR (+)
LEFT REAR WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (+)
RIGHT REAR WHEEL SPEED SENSOR (-)
CONTROLLER
ANTI-LOCK
BRAKE

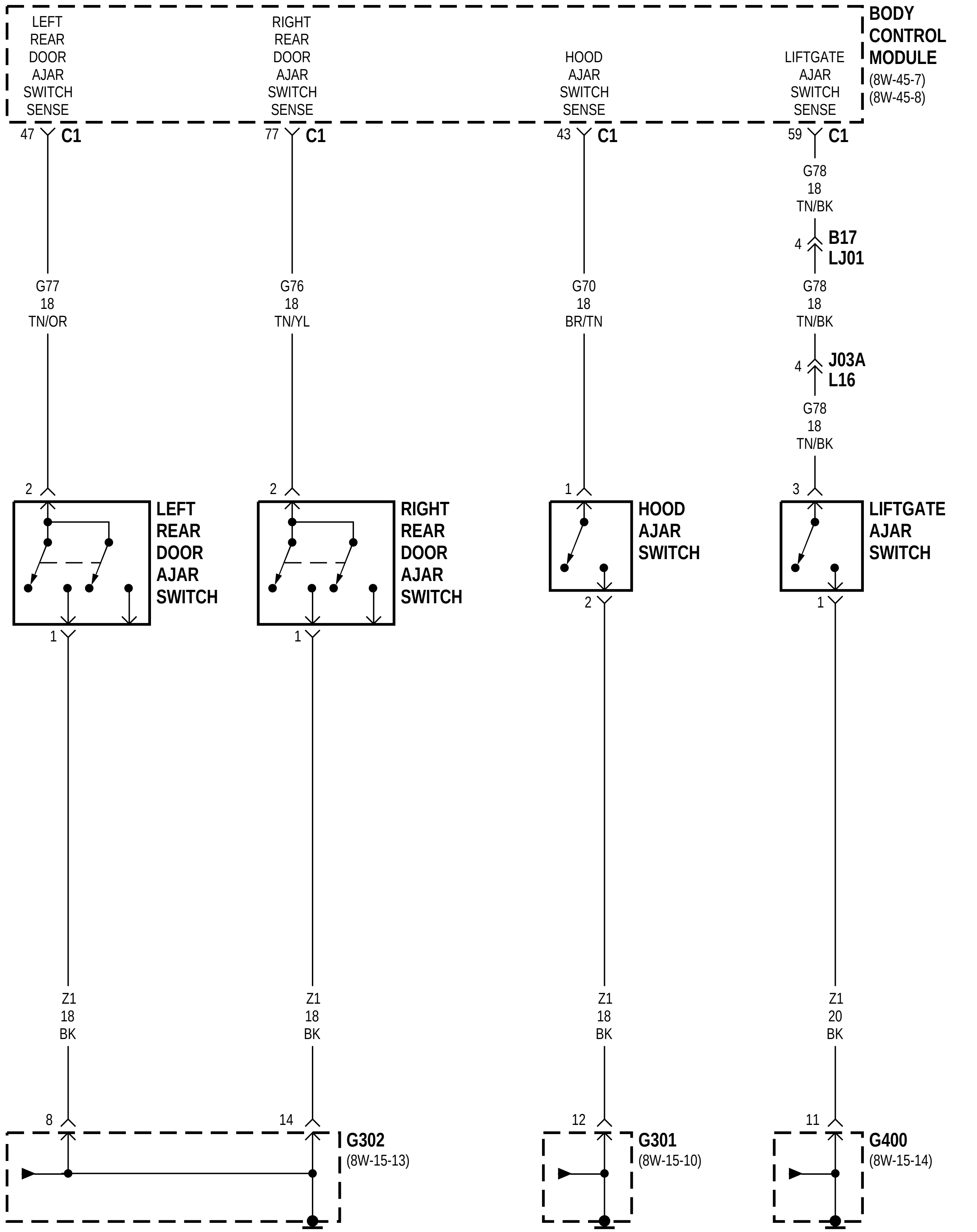
8W-39 VEHICLE THEFT SECURITY SYSTEM

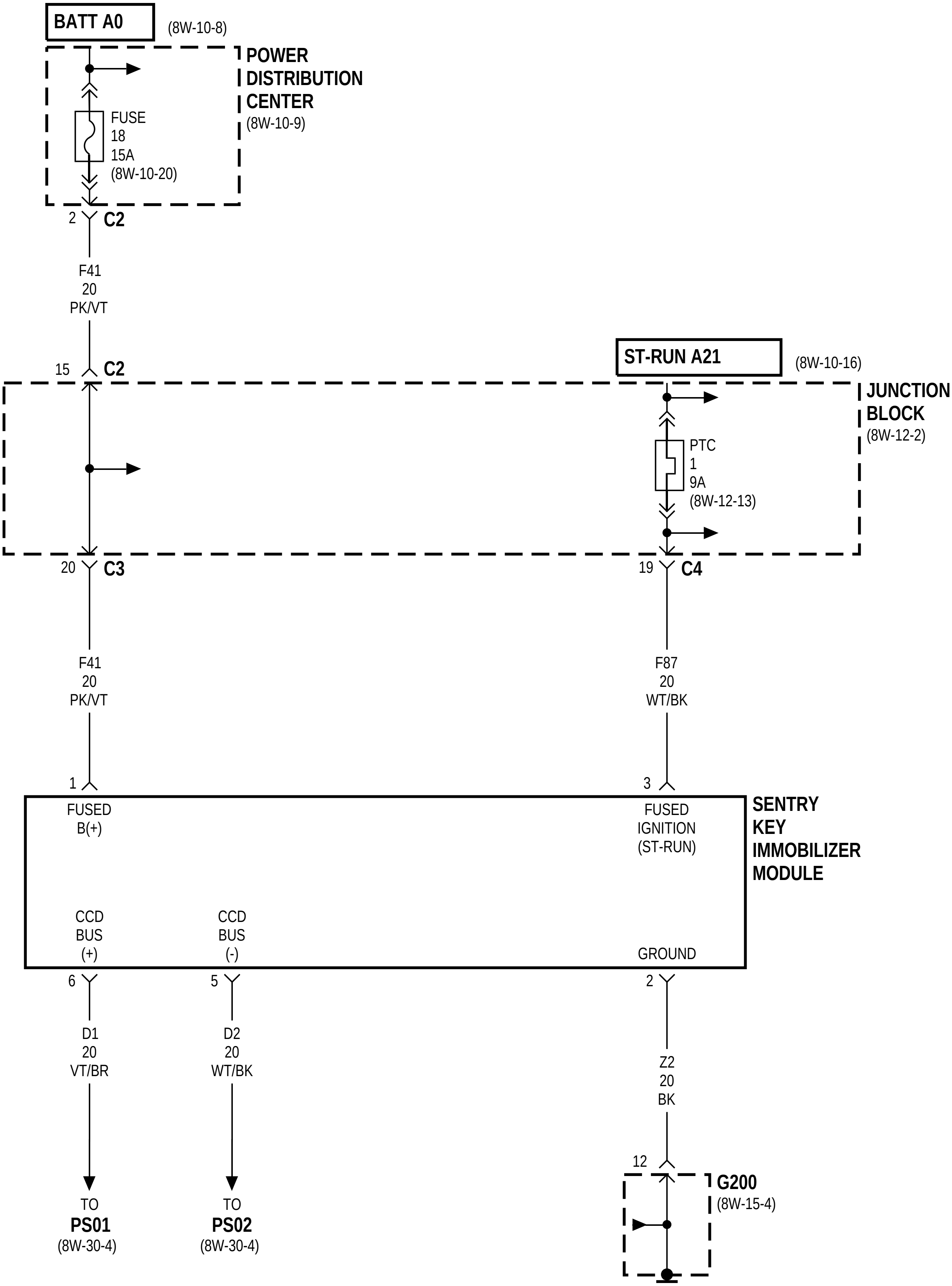
Component	Page
Body Control Module	8W-39-2, 3, 4
BS19	8W-39-2
Clockspring	8W-39-2
Driver Door Ajar Switch	8W-39-2
Driver Door Arm/Disarm Switch	8W-39-3
Driver Door Lock Switch	8W-39-3
Fuse 9 (PDC)	8W-39-2
Fuse 18 (PDC)	8W-39-5
Fuse 28 (PDC)	8W-39-2
G200	8W-39-5
G301	8W-39-2, 3, 4
G302	8W-39-4
G400	8W-39-3, 4
High Note Horn	8W-39-2
Hood Ajar Switch	8W-39-4
Horn Relay	8W-39-2
Horn Switch	8W-39-2
Junction Block	8W-39-2, 5
Left Rear Door Ajar Switch	8W-39-4
Liftgate Ajar Switch	8W-39-4
Liftgate Arm/Disarm Switch	8W-39-3
Low Note Horn	8W-39-2
Memory Seat/Mirror Module	8W-39-2
Message Center	8W-39-2
Passenger Door Ajar Switch	8W-39-2
Passenger Door Arm/Disarm Switch	8W-39-3
Passenger Door Lock Switch	8W-39-3
Power Distribution Center	8W-39-2, 5
PS01	8W-39-5
PS02	8W-39-5
PTC 1 (JB)	8W-39-5
Remote Keyless Entry Module	8W-39-2
Right Rear Door Ajar Switch	8W-39-4
Sentry Key Immobilizer Module	8W-39-5
VTSS Lamp	8W-39-2



BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
(8W-10-10)
FUSE
9
20A
(8W-10-30)
FUSE
28
10A
(8W-10-11)
86
30
HORN RELAY
85
87
4 C2
8 C2
5 C3
MEMORY SEAT/ MIRROR MODULE
FUSED B (+)
16 C1
(8W-62-3)
(8W-63-4)
X4
20
GY/OR
X2
18
DG/RD
M1
20
PK
M1
20
PK
4 C2
13 C1
JUNCTION BLOCK
(8W-12-2)
(8W-12-20)
18
9
HORN RELAY CONTROL
FUSED B (+)
BODY CONTROL MODULE
(8W-45-3)
(8W-45-7)
HORN RELAY CONTROL
PASSENGER DOOR AJAR SWITCH SENSE
DRIVER DOOR AJAR SWITCH SENSE
VTSS LAMP DRIVER
20 C2
48 C1
79 C1
16 C2
6 C4
X3
20
BK/RD
G74
18
TN/RD
G75
18
TN
G69
22
BK/OR
M1
20
PK
M1
20
PK
NOT USED
7 P50
M1
22
PK
BS19
1 C2
CLOCKSPRING
X2
18
DG/RD
X2
18
DG/RD
A
A
LOW NOTE HORN
(8W-41-2)
HIGH NOTE HORN
(8W-41-2)
B
B
DRIVER DOOR AJAR SWITCH
3
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
PASSENGER DOOR AJAR SWITCH
X3
20
BK/RD
Z1
18
BK
Z1
18
BK
*8
12
MESSAGE CENTER
(8W-46-2)
VTSS LAMP
13
1
G301
(8W-15-10)
(8W-15-11)
HORN SWITCH
13
*7
* RHD

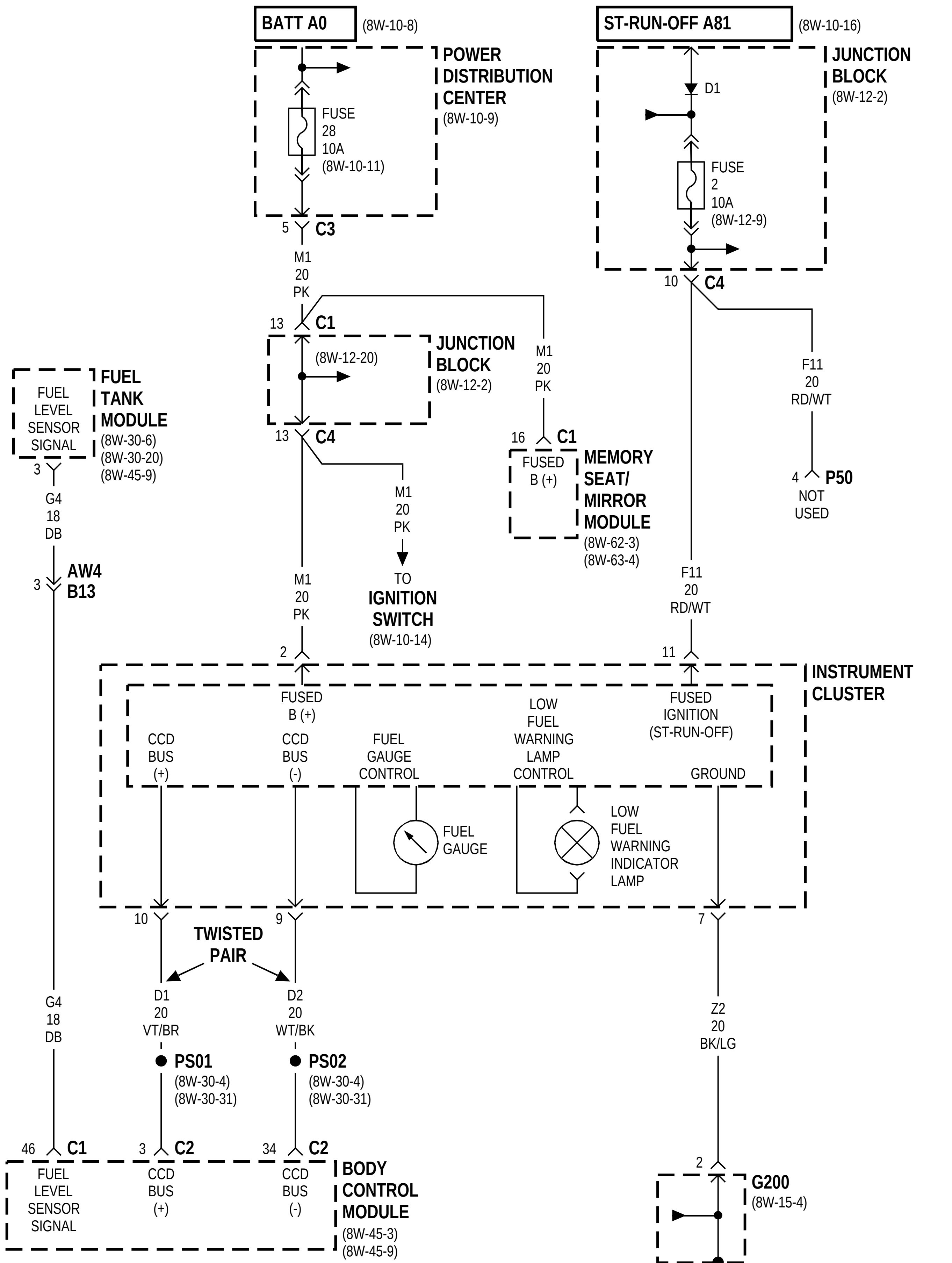

BODY
CONTROL
MODULE
(8W-45-6)
(8W-45-8)
DRIVER DOOR SWITCH MUX
PASSANGER DOOR SWITCH MUX
LIFTGATE MUX SIGNAL
45 C1
55 C1
44 C1
P97 18 WT/DG
P96 20 WT/LG
P98 20 WT/RD
11 B02 D01D
4 B03 D01P
6 B17 LJ01
6 J03A L16
P97 20 WT/DG
P96 20 WT/LG
P98 20 WT/RD
DRIVER DOOR SWITCH MUX
GROUND
DRIVER DOOR LOCK SWITCH (8W-61-6)
PASSANGER DOOR SWITCH MUX
PASSENGER DOOR LOCK SWITCH (8W-61-6)
LIFTGATE ARM/ DISARM SWITCH
1 UNLOCK
2 LOCK
DRIVER DOOR ARM/ DISARM SWITCH
1 UNLOCK
2 LOCK
PASSENGER DOOR ARM/ DISARM SWITCH
1 UNLOCK
2 LOCK
Z2 20 BK/LG
3 D01D B02
3 D01P B03
G301 (8W-15-10) (8W-15-11)
G400 (8W-15-14)

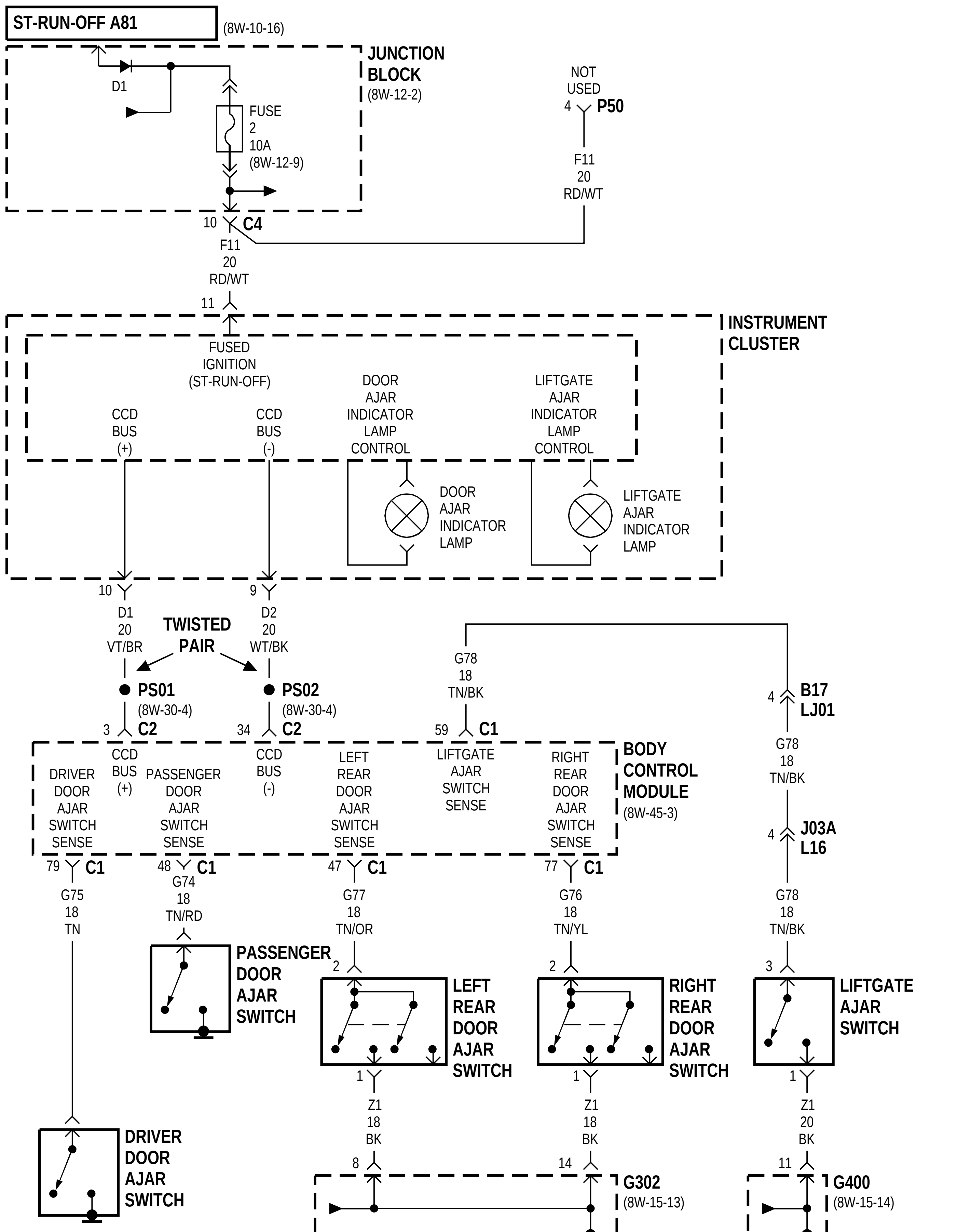

LEFT REAR DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
HOOD AJAR SWITCH SENSE
LIFTGATE AJAR SWITCH SENSE
BODY CONTROL MODULE
(8W-45-7)
(8W-45-8)
47 C1
77 C1
43 C1
59 C1
G78 18 TN/BK
4 B17 LJ01
G77 18 TN/OR
G76 18 TN/YL
G70 18 BR/TN
G78 18 TN/BK
4 J03A L16
G78 18 TN/BK
2
2
1
3
LEFT REAR DOOR AJAR SWITCH
RIGHT REAR DOOR AJAR SWITCH
HOOD AJAR SWITCH
LIFTGATE AJAR SWITCH
1
1
2
1
Z1 18 BK
Z1 18 BK
Z1 18 BK
Z1 20 BK
8
14
12
11
G302
(8W-15-13)
G301
(8W-15-10)
G400
(8W-15-14)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
18
15A
(8W-10-20)
2 C2
F41
20
PK/VT
15 C2
ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
20 C3
19 C4
F41
20
PK/VT
F87
20
WT/BK
1
3
FUSED B(+)
FUSED IGNITION (ST-RUN)
SENTRY KEY IMMOBILIZER MODULE
CCD BUS (+)
CCD BUS (-)
GROUND
6
5
2
D1
20
VT/BR
D2
20
WT/BK
Z2
20
BK
12
G200
(8W-15-4)
TO PS01
(8W-30-4)
TO PS02
(8W-30-4)

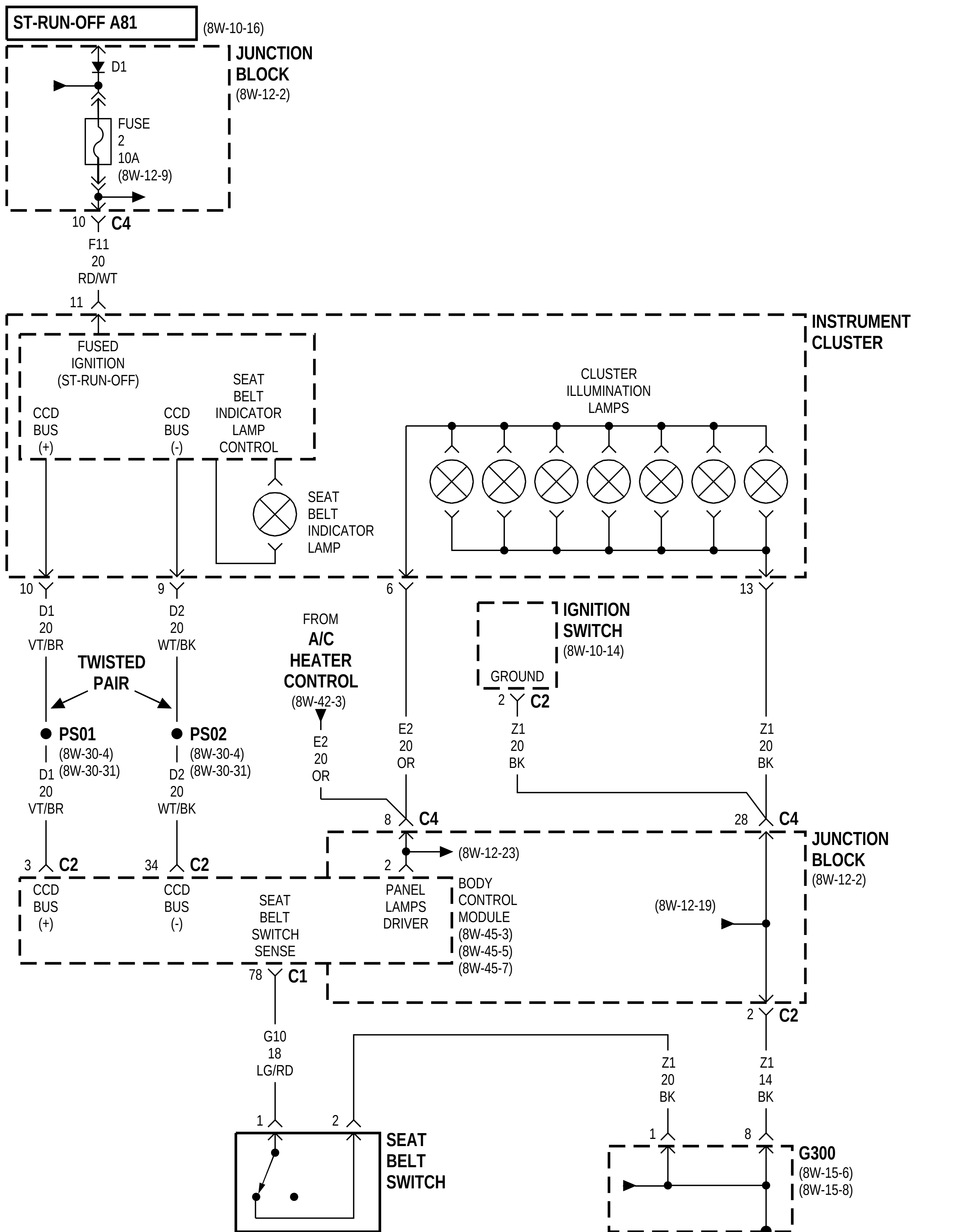
8W-40 INSTRUMENT CLUSTER

Component	Page
A/C Heater Control	8W-40-4
AW4 B13	8W-40-2
Body Control Module	8W-40-2, 3, 4, 5, 6, 7, 8, 9, 10, 11
BS05	8W-40-5, 6, 8, 10
BS06	8W-40-5, 6, 8, 10
BS30	8W-40-7
BS40	8W-40-7
Clockspring	8W-40-10, 11
Cluster Illumination Lamps	8W-40-4
Cruise Indicator Lamp	8W-40-10, 11
Data Link Connector	8W-40-9
Door Ajar Indicator Lamp	8W-40-3
Driver Door Ajar Switch	8W-40-3
Electronic PRNDL Indicator	8W-40-5
Engine Coolant Temperature Gauge	8W-40-8, 9
Engine Coolant Temperature Sensor	8W-40-8, 9
Engine Speed Sensor	8W-40-7
ES13	8W-40-5, 6, 8, 10
ES14	8W-40-5, 6, 8, 10
ES30	8W-40-7
Fuel Gauge	8W-40-2
Fuel Tank Module	8W-40-2
Fuse 2 (JB)	8W-40-2, 3, 4, 5, 6, 8, 10
Fuse 28 (PDC)	8W-40-2
G200	8W-40-2
G300	8W-40-4
G301	8W-40-7
G302	8W-40-3
G400	8W-40-3
Ignition Switch	8W-40-2, 4
Instrument Cluster	8W-40-2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Junction Block	8W-40-2, 3, 4, 5, 6, 8, 10
Left Rear Door Ajar Switch	8W-40-3
Left Speed Control Switch	8W-40-10, 11
Liftgate Ajar Indicator Lamp	8W-40-3
Liftgate Ajar Switch	8W-40-3
Low Fuel Warning Indicator Lamp	8W-40-2
Low Washer Fluid Level Indicator Lamp	8W-40-10, 11
Low Washer Fluid Switch	8W-40-10, 11
Memory Seat/Mirror Module	8W-40-2
Odometer	8W-40-5
Passenger Door Ajar Switch	8W-40-3
Power Distribution Center	8W-40-2
Powertrain Control Module	8W-40-5, 6, 7, 8, 9, 10, 11
PS01	8W-40-2, 3, 4, 5, 6, 7, 8, 9, 10, 11
PS02	8W-40-2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Right Rear Door Ajar Switch	8W-40-3
Right Speed Control Switch	8W-40-10, 11
Seat Belt Indicator Lamp	8W-40-4
Seat Belt Switch	8W-40-4
Speedometer	8W-40-6, 7
Tachometer	8W-40-6, 7
Transmission Control Module	8W-40-5, 6
Trip Odometer	8W-40-5
Vehicle Speed Sensor	8W-40-6, 7
Voltage Indicator Lamp	8W-40-8, 9

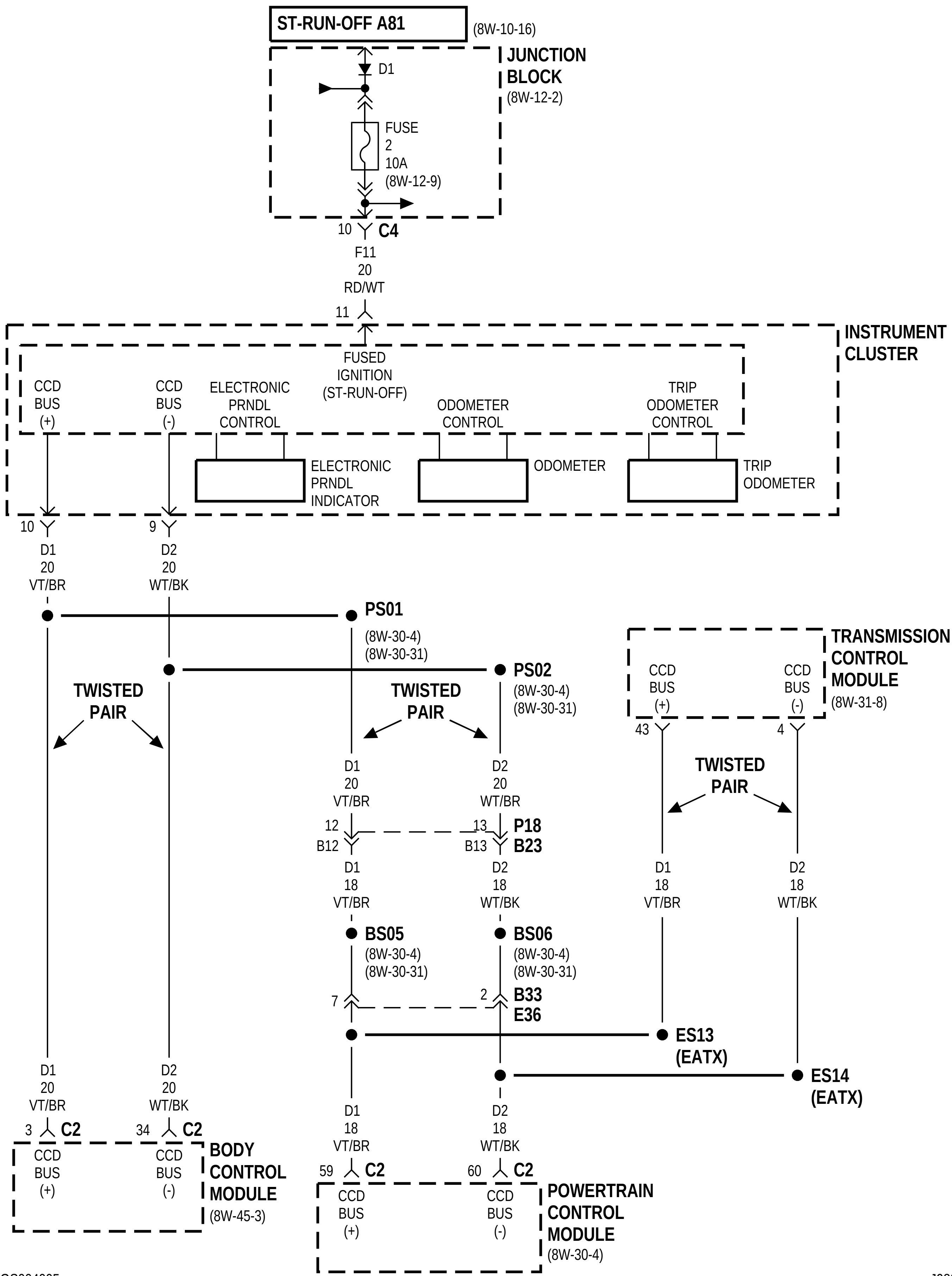

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A (8W-10-11)
5 C3
M1 20 PK
ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE 2 10A (8W-12-9)
10 C4
13 C1
JUNCTION BLOCK
(8W-12-20)
(8W-12-2)
13 C4
M1 20 PK
16 C1
FUSED B (+)
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
(8W-63-4)
F11 20 RD/WT
4 P50
NOT USED
FUEL LEVEL SENSOR SIGNAL
FUEL TANK MODULE
(8W-30-6)
(8W-30-20)
(8W-45-9)
3
G4 18 DB
3 AW4 B13
M1 20 PK
TO IGNITION SWITCH
(8W-10-14)
F11 20 RD/WT
2
11
INSTRUMENT CLUSTER
FUSED B (+)
LOW FUEL WARNING LAMP CONTROL
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
FUEL GAUGE CONTROL
GROUND
FUEL GAUGE
LOW FUEL WARNING INDICATOR LAMP
10
9
7
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
Z2 20 BK/LG
G4 18 DB
PS01
(8W-30-4)
(8W-30-31)
PS02
(8W-30-4)
(8W-30-31)
46 C1
3 C2
34 C2
FUEL LEVEL SENSOR SIGNAL
CCD BUS (+)
CCD BUS (-)
BODY CONTROL MODULE
(8W-45-3)
(8W-45-9)
2
G200
(8W-15-4)



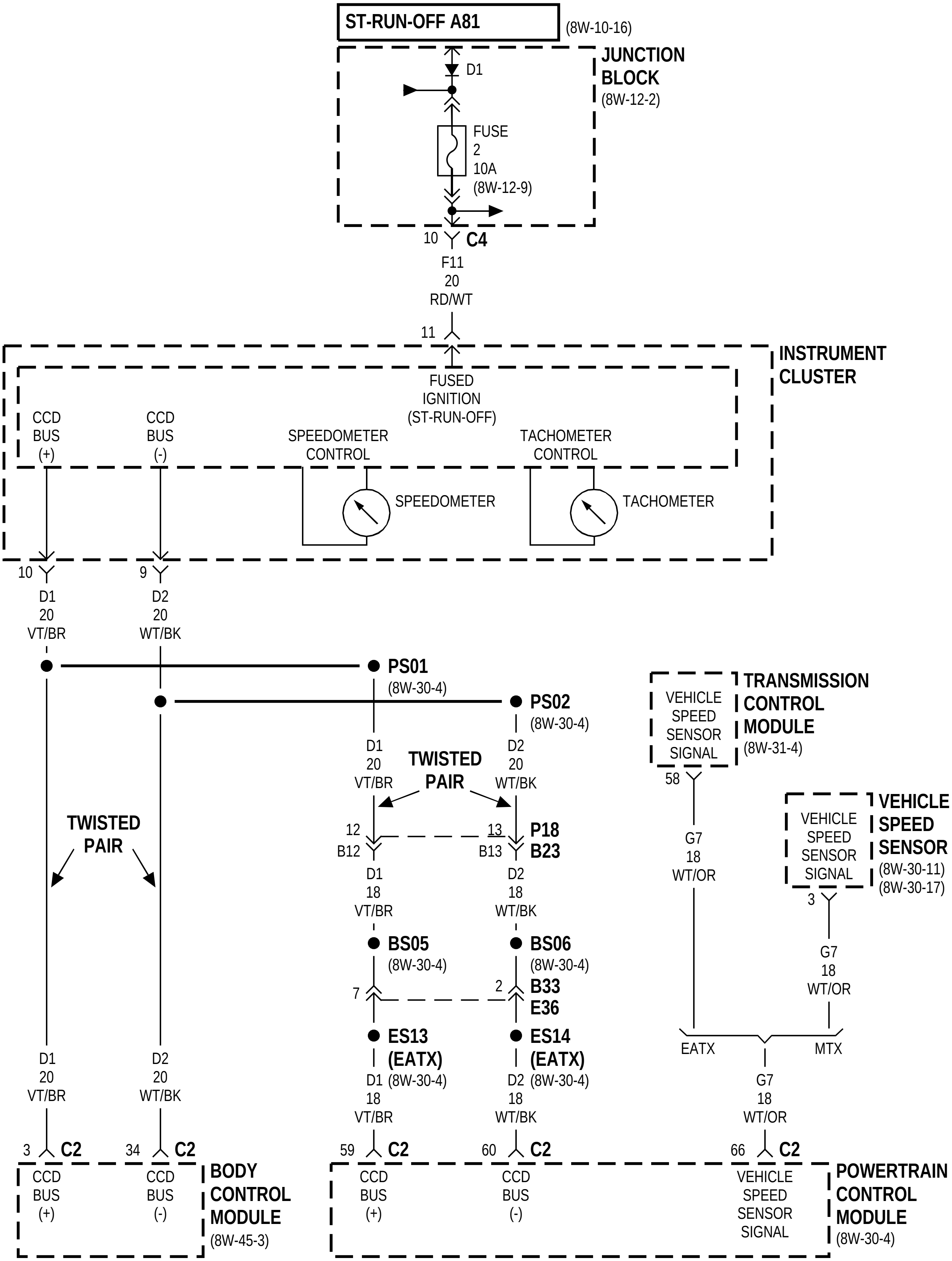
ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
2
10A
(8W-12-9)
NOT USED
4
P50
F11
20
RD/WT
10
C4
F11
20
RD/WT
11
INSTRUMENT CLUSTER
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
DOOR AJAR INDICATOR LAMP CONTROL
LIFTGATE AJAR INDICATOR LAMP CONTROL
DOOR AJAR INDICATOR LAMP
LIFTGATE AJAR INDICATOR LAMP
10
9
D1
20
VT/BR
TWISTED PAIR
D2
20
WT/BK
G78
18
TN/BK
PS01
(8W-30-4)
PS02
(8W-30-4)
4
B17
LJ01
3
C2
34
C2
59
C1
BODY CONTROL MODULE
(8W-45-3)
DRIVER DOOR AJAR SWITCH SENSE
CCD BUS (+)
PASSENGER DOOR AJAR SWITCH SENSE
CCD BUS (-)
LEFT REAR DOOR AJAR SWITCH SENSE
LIFTGATE AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
G78
18
TN/BK
4
J03A
L16
79
C1
48
C1
47
C1
77
C1
G75
18
TN
G74
18
TN/RD
G77
18
TN/OR
G76
18
TN/YL
G78
18
TN/BK
PASSENGER DOOR AJAR SWITCH
2
LEFT REAR DOOR AJAR SWITCH
2
RIGHT REAR DOOR AJAR SWITCH
3
LIFTGATE AJAR SWITCH
1
1
1
Z1
18
BK
Z1
18
BK
Z1
20
BK
DRIVER DOOR AJAR SWITCH
8
14
G302
(8W-15-13)
11
G400
(8W-15-14)



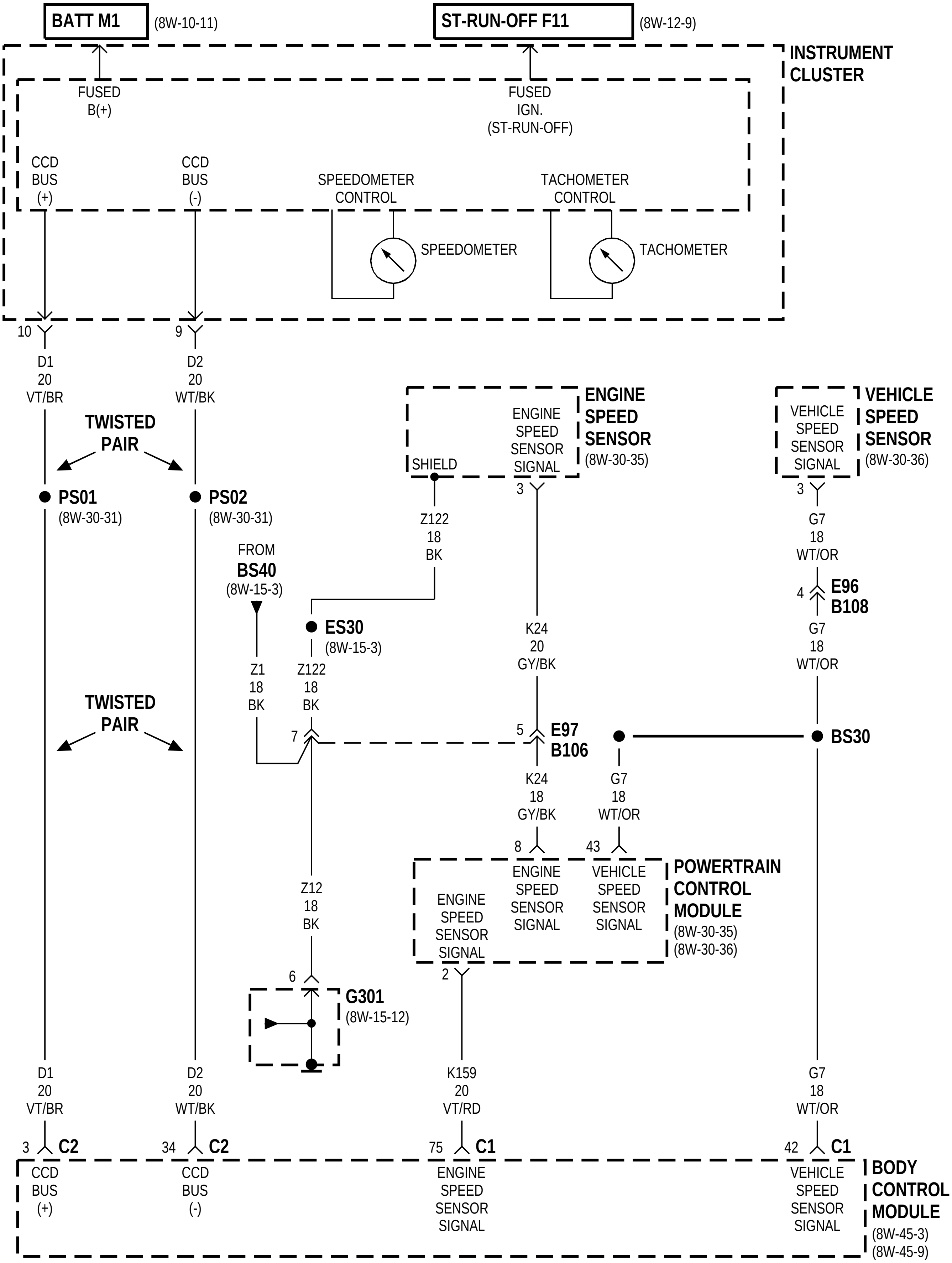
ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
2
10A
(8W-12-9)
10 C4
F11
20
RD/WT
11
INSTRUMENT CLUSTER
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
SEAT BELT INDICATOR LAMP CONTROL
SEAT BELT INDICATOR LAMP
CLUSTER ILLUMINATION LAMPS
10
9
6
13
D1
20
VT/BR
D2
20
WT/BK
TWISTED PAIR
PS01
(8W-30-4)
(8W-30-31)
PS02
(8W-30-4)
(8W-30-31)
D1
20
VT/BR
D2
20
WT/BK
FROM
A/C HEATER CONTROL
(8W-42-3)
E2
20
OR
E2
20
OR
IGNITION SWITCH
(8W-10-14)
GROUND
2 C2
Z1
20
BK
Z1
20
BK
8 C4
28 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-23)
2
3 C2
34 C2
CCD BUS (+)
CCD BUS (-)
SEAT BELT SWITCH SENSE
PANEL LAMPS DRIVER
BODY CONTROL MODULE
(8W-45-3)
(8W-45-5)
(8W-45-7)
(8W-12-19)
78 C1
2 C2
G10
18
LG/RD
Z1
20
BK
Z1
14
BK
1
2
SEAT BELT SWITCH
1
8
G300
(8W-15-6)
(8W-15-8)

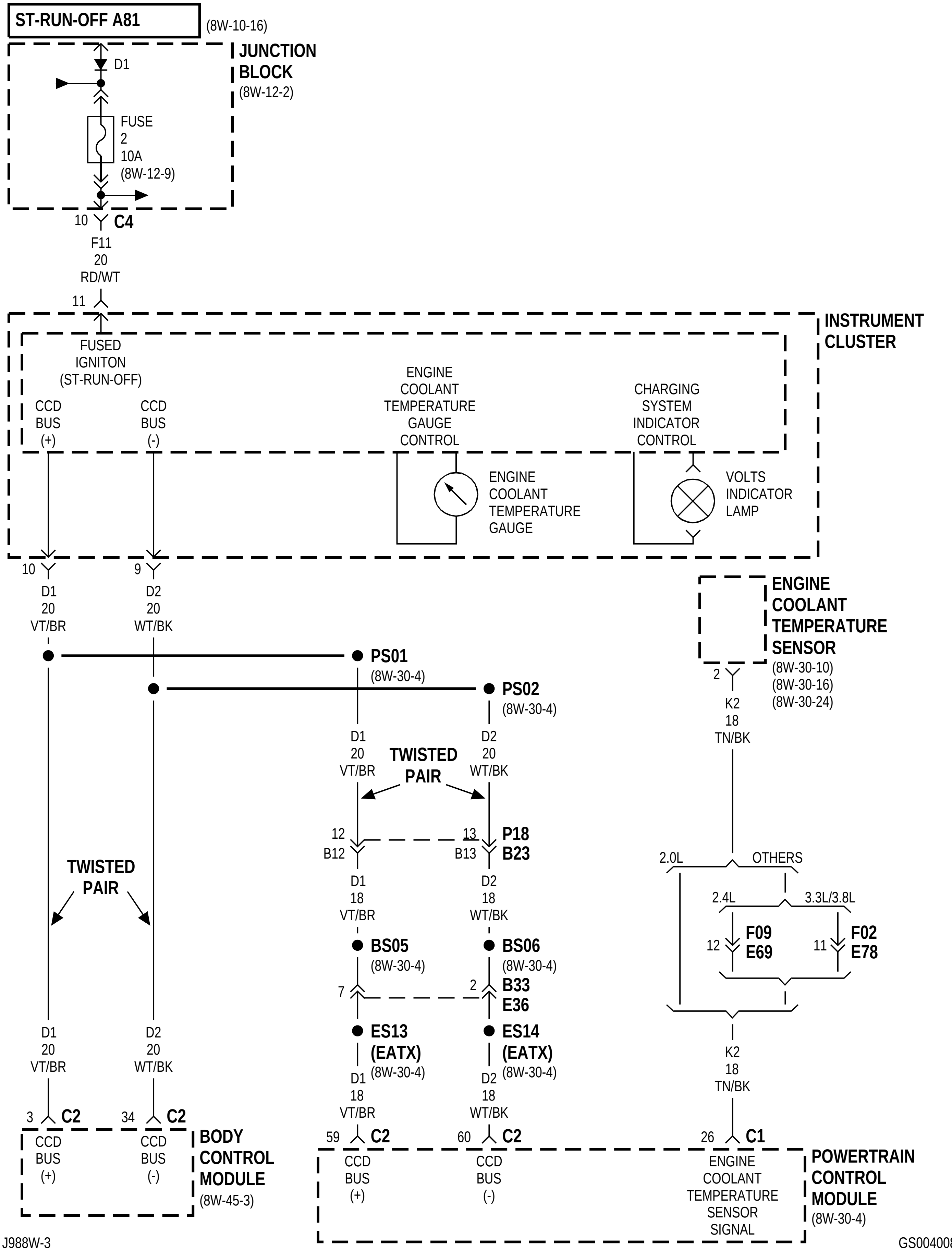

ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
2
10A
(8W-12-9)
10 C4
F11
20
RD/WT
11
INSTRUMENT CLUSTER
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
ELECTRONIC PRNDL CONTROL
ODOMETER CONTROL
TRIP ODOMETER CONTROL
ELECTRONIC PRNDL INDICATOR
ODOMETER
TRIP ODOMETER
10
9
D1
20
VT/BR
D2
20
WT/BK
PS01
(8W-30-4)
(8W-30-31)
PS02
(8W-30-4)
(8W-30-31)
TWISTED PAIR
TWISTED PAIR
TRANSMISSION CONTROL MODULE
(8W-31-8)
CCD BUS (+)
CCD BUS (-)
43
4
TWISTED PAIR
D1
20
VT/BR
D2
20
WT/BR
12
B12
13
B13
P18
B23
D1
18
VT/BR
D2
18
WT/BK
D1
18
VT/BR
D2
18
WT/BK
BS05
(8W-30-4)
(8W-30-31)
BS06
(8W-30-4)
(8W-30-31)
7
2
B33
E36
ES13 (EATX)
ES14 (EATX)
D1
20
VT/BR
D2
20
WT/BK
3 C2
34 C2
BODY CONTROL MODULE
(8W-45-3)
CCD BUS (+)
CCD BUS (-)
D1
18
VT/BR
D2
18
WT/BK
59 C2
60 C2
POWERTRAIN CONTROL MODULE
(8W-30-4)
CCD BUS (+)
CCD BUS (-)

GAS

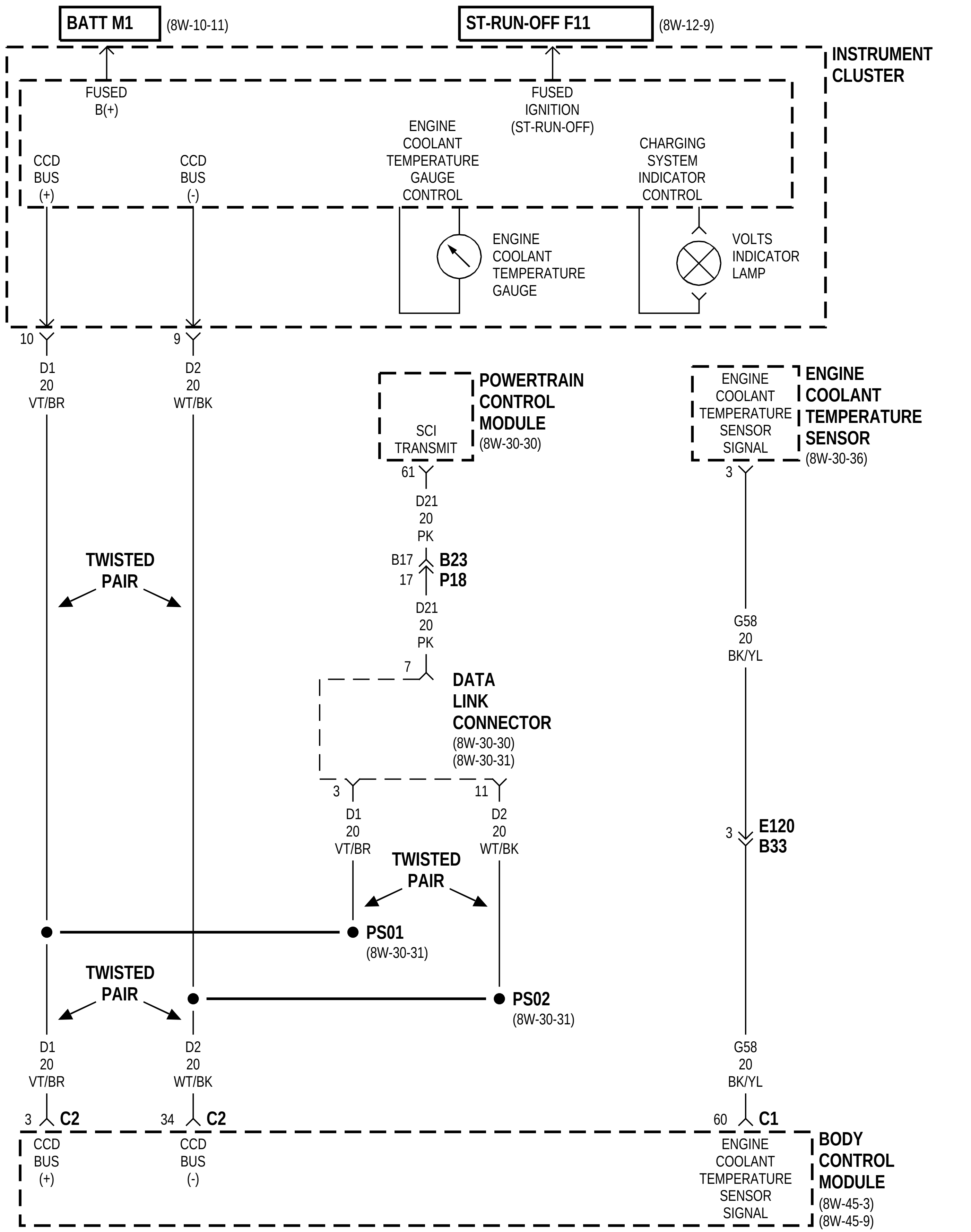

ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
2
10A
(8W-12-9)
10
C4
F11
20
RD/WT
11
INSTRUMENT CLUSTER
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
SPEEDOMETER CONTROL
TACHOMETER CONTROL
SPEEDOMETER
TACHOMETER
10
9
D1
20
VT/BR
D2
20
WT/BK
PS01
(8W-30-4)
PS02
(8W-30-4)
TWISTED PAIR
TWISTED PAIR
12
13
P18
B12
B13
B23
D1
18
VT/BR
D2
18
WT/BK
BS05
(8W-30-4)
BS06
(8W-30-4)
7
2
B33
E36
ES13
(EATX)
ES14
(EATX)
(8W-30-4)
(8W-30-4)
TRANSMISSION CONTROL MODULE
(8W-31-4)
VEHICLE SPEED SENSOR SIGNAL
58
G7
18
WT/OR
VEHICLE SPEED SENSOR
(8W-30-11)
(8W-30-17)
3
EATX
MTX
3
C2
34
C2
59
C2
60
C2
66
C2
BODY CONTROL MODULE
(8W-45-3)
POWERTRAIN CONTROL MODULE
(8W-30-4)

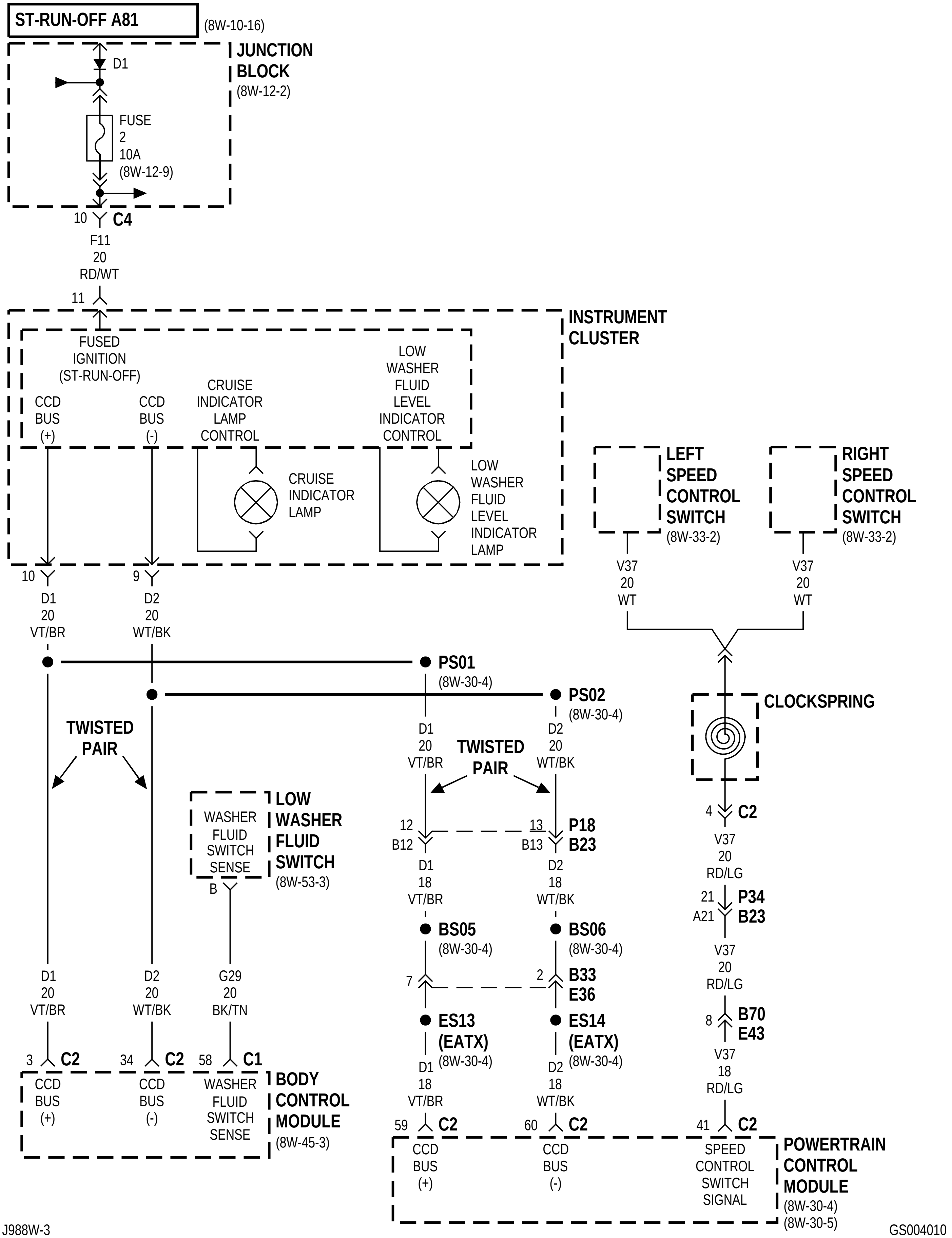
DIESEL

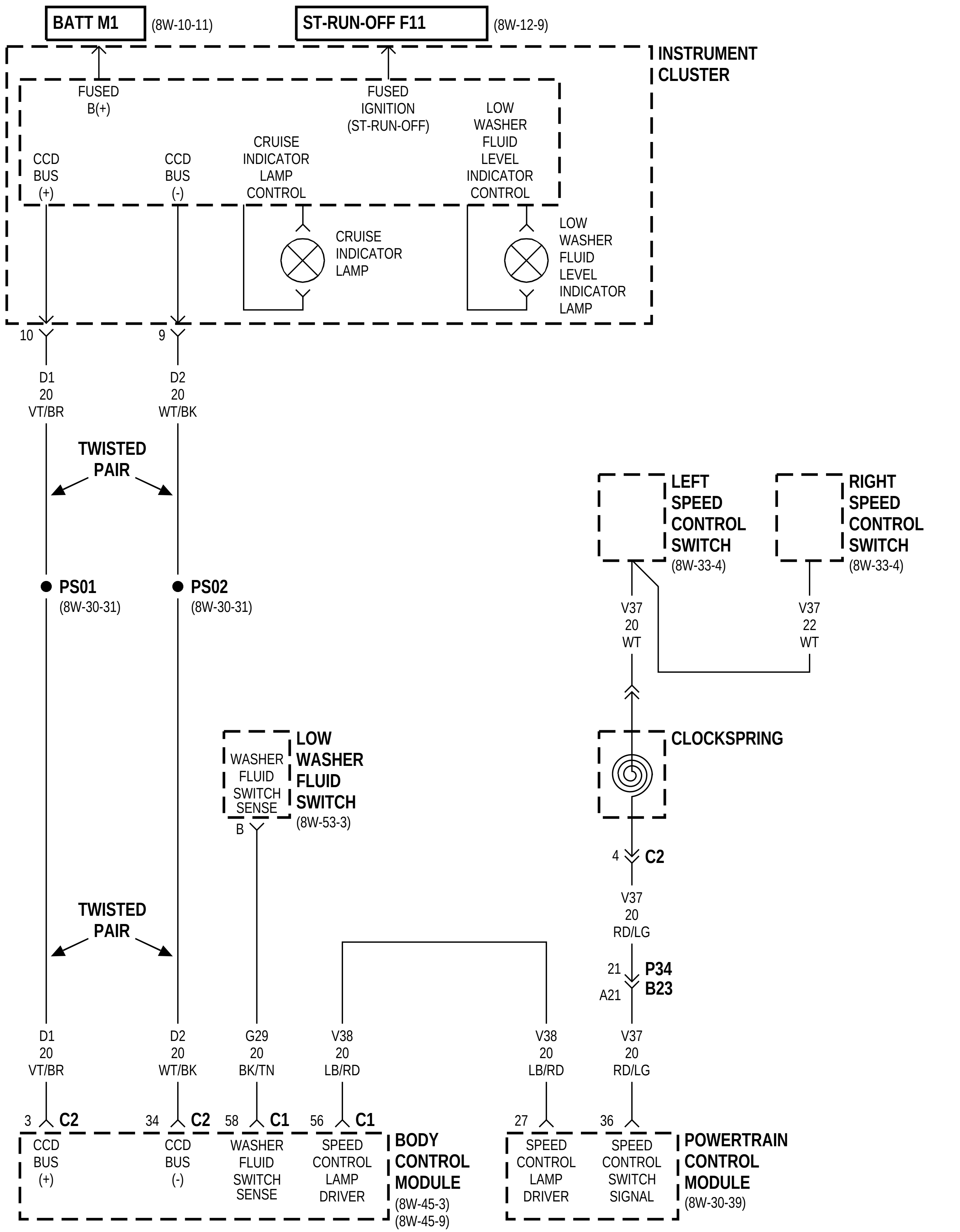

BATT M1
(8W-10-11)
ST-RUN-OFF F11
(8W-12-9)
INSTRUMENT CLUSTER
FUSED B(+)
FUSED IGN. (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
SPEEDOMETER CONTROL
TACHOMETER CONTROL
SPEEDOMETER
TACHOMETER
10
9
D1 20 VT/BR
D2 20 WT/BK
TWISTED PAIR
PS01 (8W-30-31)
PS02 (8W-30-31)
ENGINE SPEED SENSOR (8W-30-35)
ENGINE SPEED SENSOR SIGNAL
SHIELD
3
Z122 18 BK
VEHICLE SPEED SENSOR (8W-30-36)
VEHICLE SPEED SENSOR SIGNAL
3
G7 18 WT/OR
4
E96 B108
G7 18 WT/OR
FROM BS40 (8W-15-3)
ES30 (8W-15-3)
Z1 18 BK
Z122 18 BK
K24 20 GY/BK
TWISTED PAIR
7
5
E97 B106
BS30
K24 18 GY/BK
G7 18 WT/OR
8
43
POWERTRAIN CONTROL MODULE (8W-30-35) (8W-30-36)
ENGINE SPEED SENSOR SIGNAL
ENGINE SPEED SENSOR SIGNAL
VEHICLE SPEED SENSOR SIGNAL
Z12 18 BK
6
2
G301 (8W-15-12)
D1 20 VT/BR
D2 20 WT/BK
K159 20 VT/RD
G7 18 WT/OR
3 C2
34 C2
75 C1
42 C1
BODY CONTROL MODULE (8W-45-3) (8W-45-9)
CCD BUS (+)
CCD BUS (-)
ENGINE SPEED SENSOR SIGNAL
VEHICLE SPEED SENSOR SIGNAL



ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
2
10A
(8W-12-9)
10 C4
F11
20
RD/WT
11
INSTRUMENT CLUSTER
FUSED IGNITON (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
ENGINE COOLANT TEMPERATURE GAUGE CONTROL
CHARGING SYSTEM INDICATOR CONTROL
ENGINE COOLANT TEMPERATURE GAUGE
VOLTS INDICATOR LAMP
10
9
D1
20
VT/BR
D2
20
WT/BK
ENGINE COOLANT TEMPERATURE SENSOR
PS01
(8W-30-4)
PS02
(8W-30-4)
2
(8W-30-10)
(8W-30-16)
(8W-30-24)
K2
18
TN/BK
D1
20
VT/BR
TWISTED PAIR
D2
20
WT/BK
12
B12
13
B13
P18
B23
2.0L
OTHERS
TWISTED PAIR
D1
18
VT/BR
D2
18
WT/BK
2.4L
3.3L/3.8L
12
F09
E69
11
F02
E78
BS05
(8W-30-4)
BS06
(8W-30-4)
7
2
B33
E36
ES13 (EATX)
(8W-30-4)
ES14 (EATX)
(8W-30-4)
D1
20
VT/BR
D2
20
WT/BK
K2
18
TN/BK
D1
18
VT/BR
D2
18
WT/BK
3 C2
34 C2
CCD BUS (+)
CCD BUS (-)
BODY CONTROL MODULE
(8W-45-3)
59 C2
60 C2
26 C1
CCD BUS (+)
CCD BUS (-)
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-4)

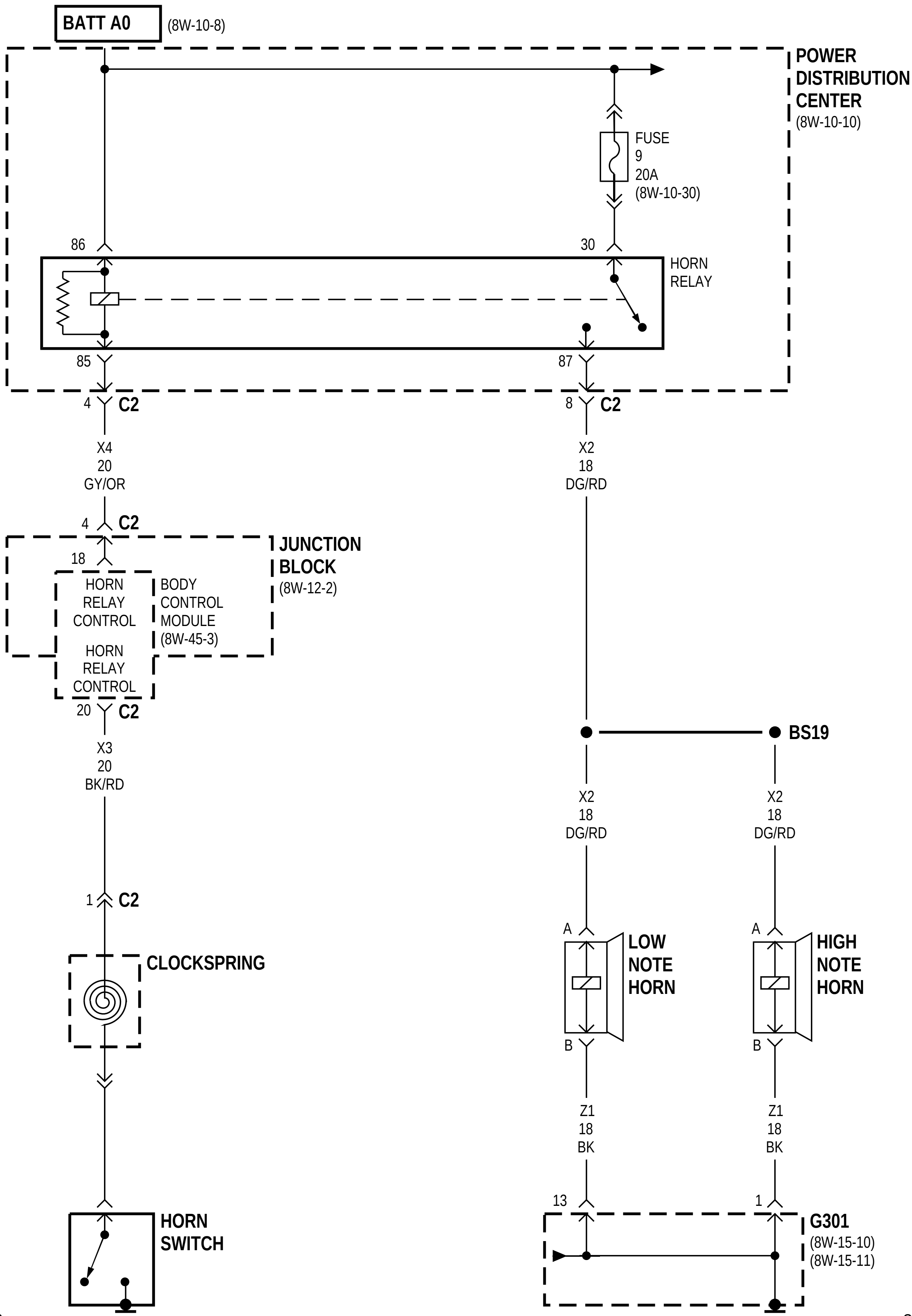

BATT M1
(8W-10-11)
ST-RUN-OFF F11
(8W-12-9)
INSTRUMENT CLUSTER
FUSED B(+)
FUSED IGNITION (ST-RUN-OFF)
ENGINE COOLANT TEMPERATURE GAUGE CONTROL
CHARGING SYSTEM INDICATOR CONTROL
CCD BUS (+)
CCD BUS (-)
ENGINE COOLANT TEMPERATURE GAUGE
VOLTS INDICATOR LAMP
10
9
D1 20 VT/BR
D2 20 WT/BK
POWERTRAIN CONTROL MODULE
(8W-30-30)
SCI TRANSMIT
61
D21 20 PK
B17
17
B23
P18
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-36)
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
3
G58 20 BK/YL
TWISTED PAIR
7
DATA LINK CONNECTOR
(8W-30-30)
(8W-30-31)
3
11
D1 20 VT/BR
D2 20 WT/BK
E120
B33
PS01
(8W-30-31)
PS02
(8W-30-31)
34
C2
60
C1
BODY CONTROL MODULE
(8W-45-3)
(8W-45-9)

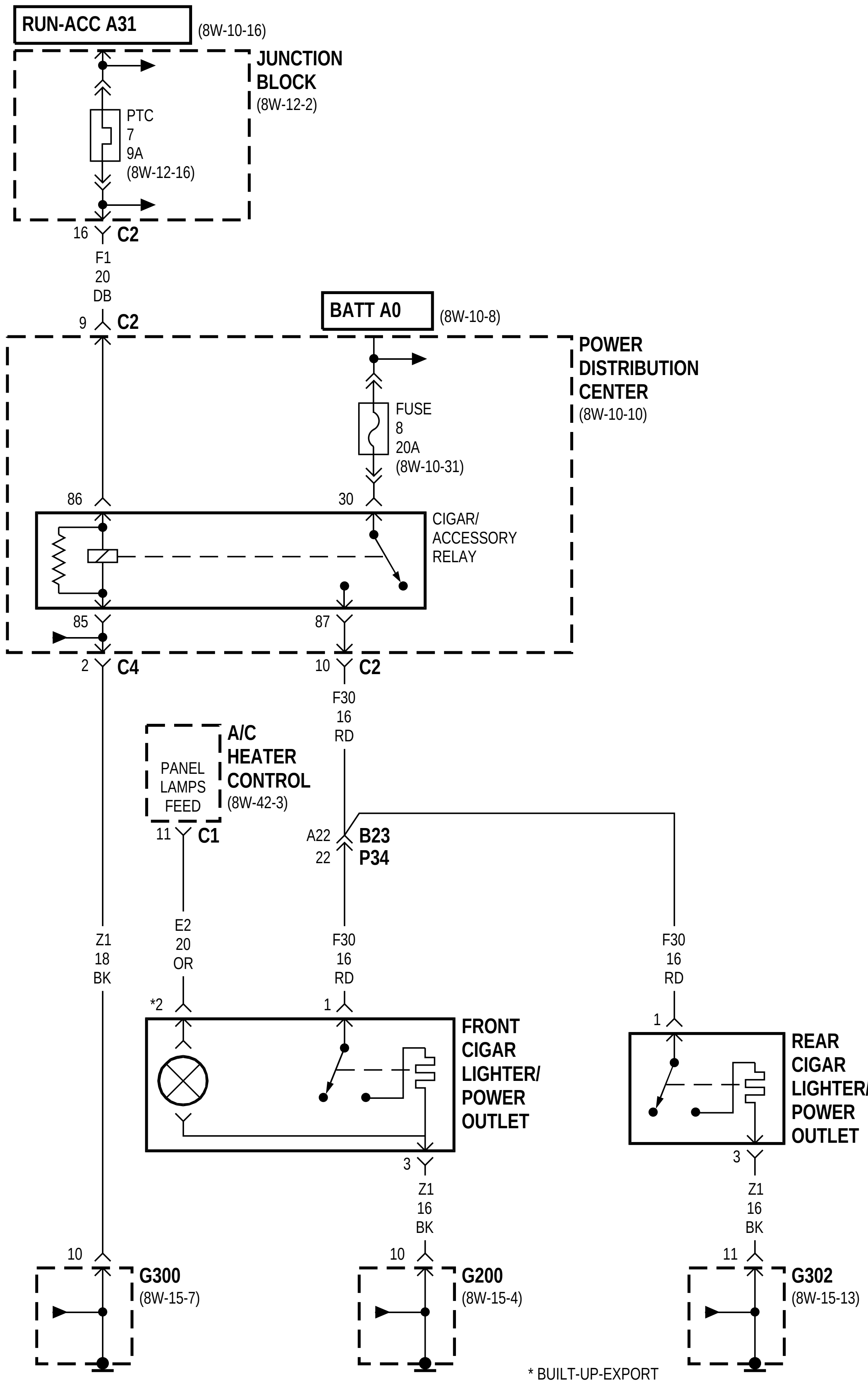

ST-RUN-OFF A81
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
D1
FUSE
2
10A
(8W-12-9)
10 C4
F11
20
RD/WT
11
INSTRUMENT CLUSTER
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
CRUISE INDICATOR LAMP CONTROL
LOW WASHER FLUID LEVEL INDICATOR CONTROL
CRUISE INDICATOR LAMP
LOW WASHER FLUID LEVEL INDICATOR LAMP
LEFT SPEED CONTROL SWITCH
(8W-33-2)
RIGHT SPEED CONTROL SWITCH
(8W-33-2)
V37
20
WT
V37
20
WT
10
D1
20
VT/BR
9
D2
20
WT/BK
PS01
(8W-30-4)
PS02
(8W-30-4)
CLOCKSPRING
TWISTED PAIR
D1
20
VT/BR
D2
20
WT/BK
TWISTED PAIR
4 C2
V37
20
RD/LG
LOW WASHER FLUID SWITCH
(8W-53-3)
WASHER FLUID SWITCH SENSE
B
12
B12
13
B13
P18
B23
D1
18
VT/BR
D2
18
WT/BK
21
A21
P34
B23
V37
20
RD/LG
BS05
(8W-30-4)
BS06
(8W-30-4)
7
2
B33
E36
D1
20
VT/BR
D2
20
WT/BK
G29
20
BK/TN
ES13 (EATX)
(8W-30-4)
ES14 (EATX)
(8W-30-4)
8
B70
E43
V37
18
RD/LG
D1
18
VT/BR
D2
18
WT/BK
3 C2
34 C2
58 C1
BODY CONTROL MODULE
(8W-45-3)
CCD BUS (+)
CCD BUS (-)
WASHER FLUID SWITCH SENSE
59 C2
60 C2
41 C2
CCD BUS (+)
CCD BUS (-)
SPEED CONTROL SWITCH SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-5)


BATT M1
(8W-10-11)
ST-RUN-OFF F11
(8W-12-9)
INSTRUMENT CLUSTER
FUSED B(+)
FUSED IGNITION (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
CRUISE INDICATOR LAMP CONTROL
LOW WASHER FLUID LEVEL INDICATOR CONTROL
CRUISE INDICATOR LAMP
LOW WASHER FLUID LEVEL INDICATOR LAMP
10
9
D1 20 VT/BR
D2 20 WT/BK
TWISTED PAIR
PS01 (8W-30-31)
PS02 (8W-30-31)
LEFT SPEED CONTROL SWITCH (8W-33-4)
RIGHT SPEED CONTROL SWITCH (8W-33-4)
V37 20 WT
V37 22 WT
CLOCKSPRING
LOW WASHER FLUID SWITCH (8W-53-3)
WASHER FLUID SWITCH SENSE
B
4 C2
V37 20 RD/LG
21 P34
A21 B23
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
G29 20 BK/TN
V38 20 LB/RD
V38 20 LB/RD
V37 20 RD/LG
3 C2
34 C2
58 C1
56 C1
27
36
CCD BUS (+)
CCD BUS (-)
WASHER FLUID SWITCH SENSE
SPEED CONTROL LAMP DRIVER
BODY CONTROL MODULE (8W-45-3) (8W-45-9)
SPEED CONTROL LAMP DRIVER
SPEED CONTROL SWITCH SIGNAL
POWERTRAIN CONTROL MODULE (8W-30-39)

8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

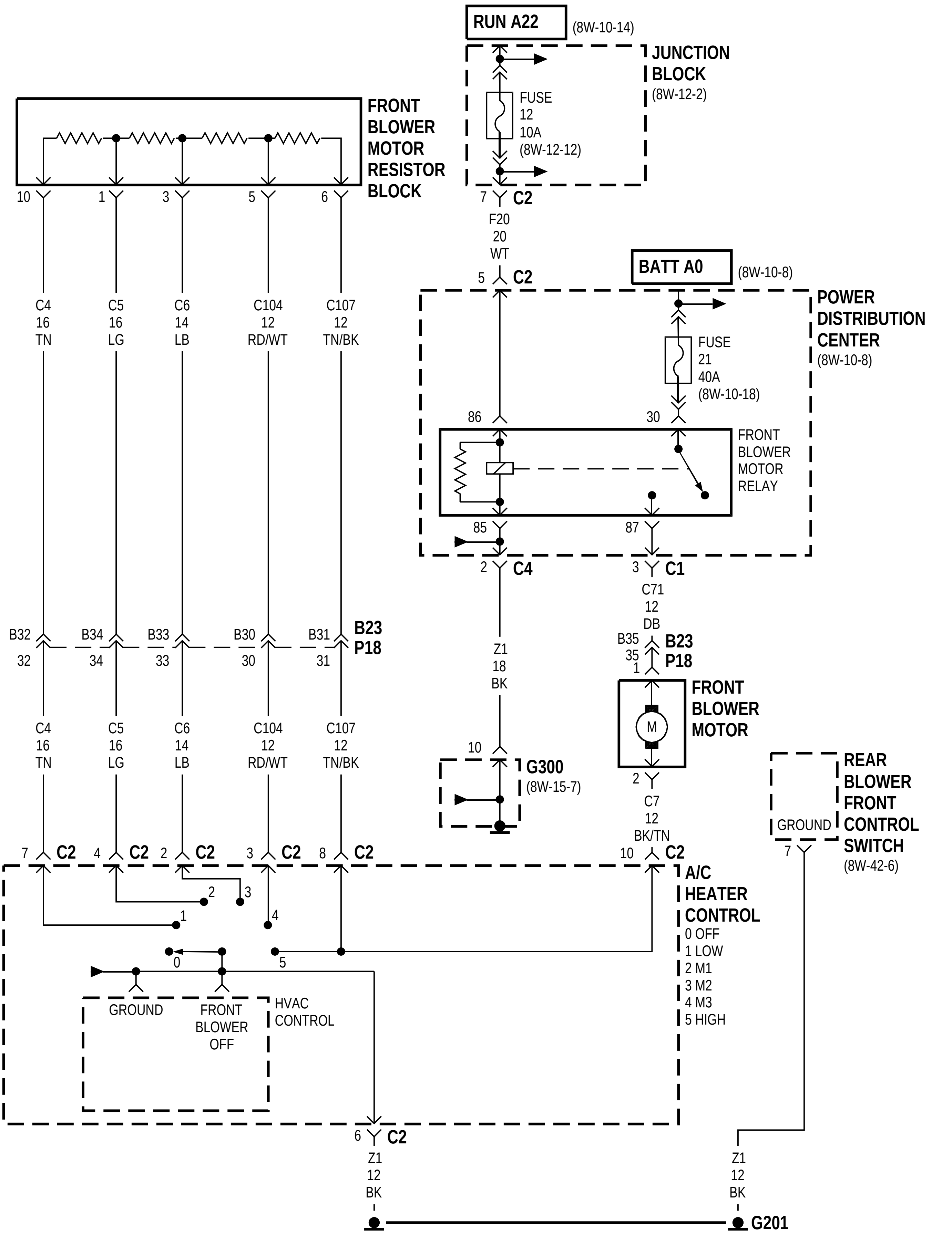
Component	Page
A/C Heater Control	8W-41-3
Body Control Module	8W-41-2
BS19	8W-41-2
Cigar/Accessory Relay	8W-41-3
Clockspring	8W-41-2
Front Cigar Lighter/Power Outlet	8W-41-3
Fuse 8 (PDC)	8W-41-3
Fuse 9 (PDC)	8W-41-2
G200	8W-41-3
G300	8W-41-3
G301	8W-41-2
G302	8W-41-3
High Note Horn	8W-41-2
Horn Relay	8W-41-2
Horn Switch	8W-41-2
Junction Block	8W-41-2, 3
Low Note Horn	8W-41-2
Power Distribution Center	8W-41-2, 3
PTC 7 (JB)	8W-41-3
Rear Cigar Lighter/Power Outlet	8W-41-3

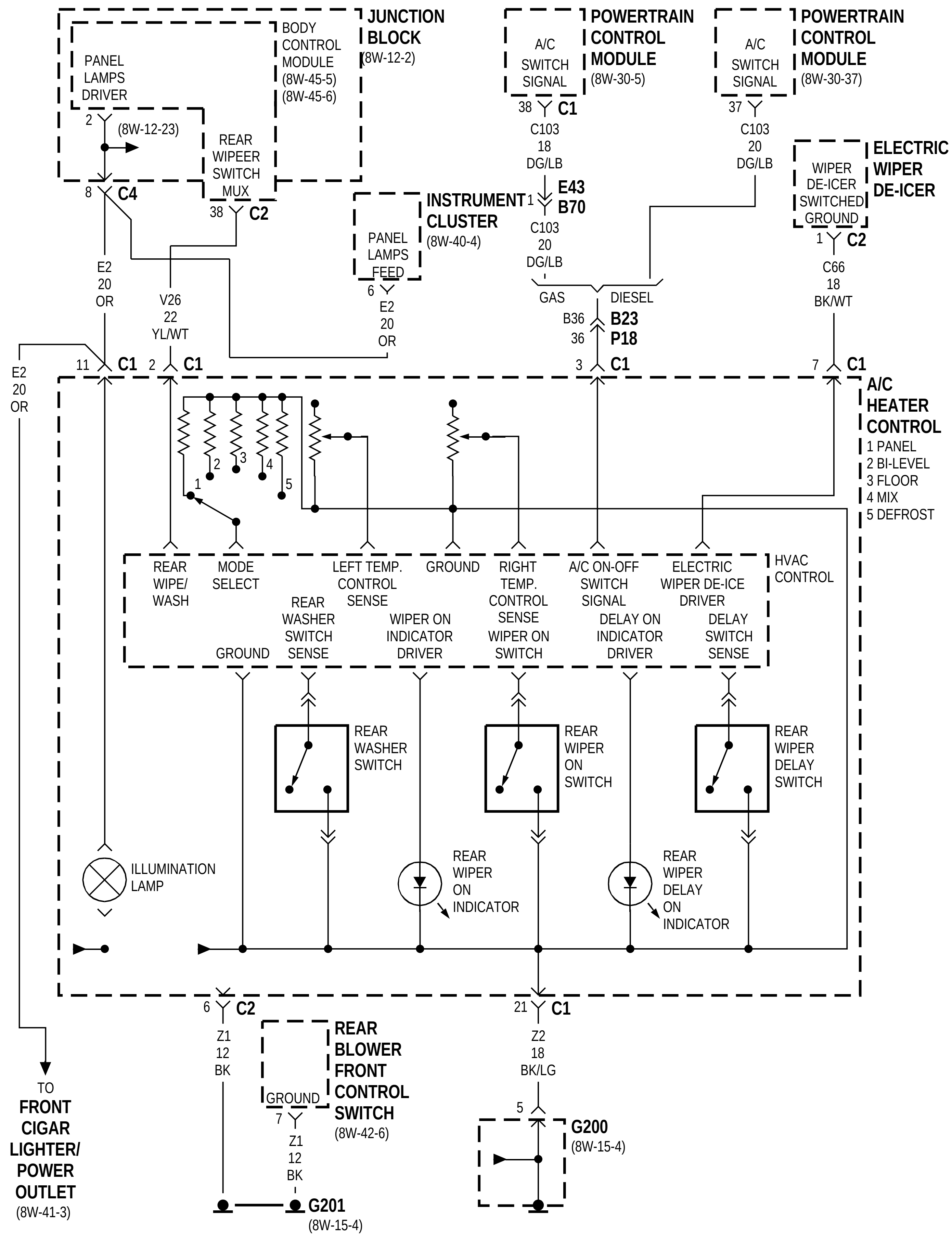

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE
9
20A
(8W-10-30)
86
30
HORN RELAY
85
87
4 C2
8 C2
X4
20
GY/OR
X2
18
DG/RD
4 C2
18
JUNCTION BLOCK
(8W-12-2)
HORN RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
HORN RELAY CONTROL
20 C2
X3
20
BK/RD
BS19
X2
18
DG/RD
X2
18
DG/RD
1 C2
CLOCKSPRING
A
LOW NOTE HORN
A
HIGH NOTE HORN
B
B
Z1
18
BK
Z1
18
BK
13
1
HORN SWITCH
G301
(8W-15-10)
(8W-15-11)

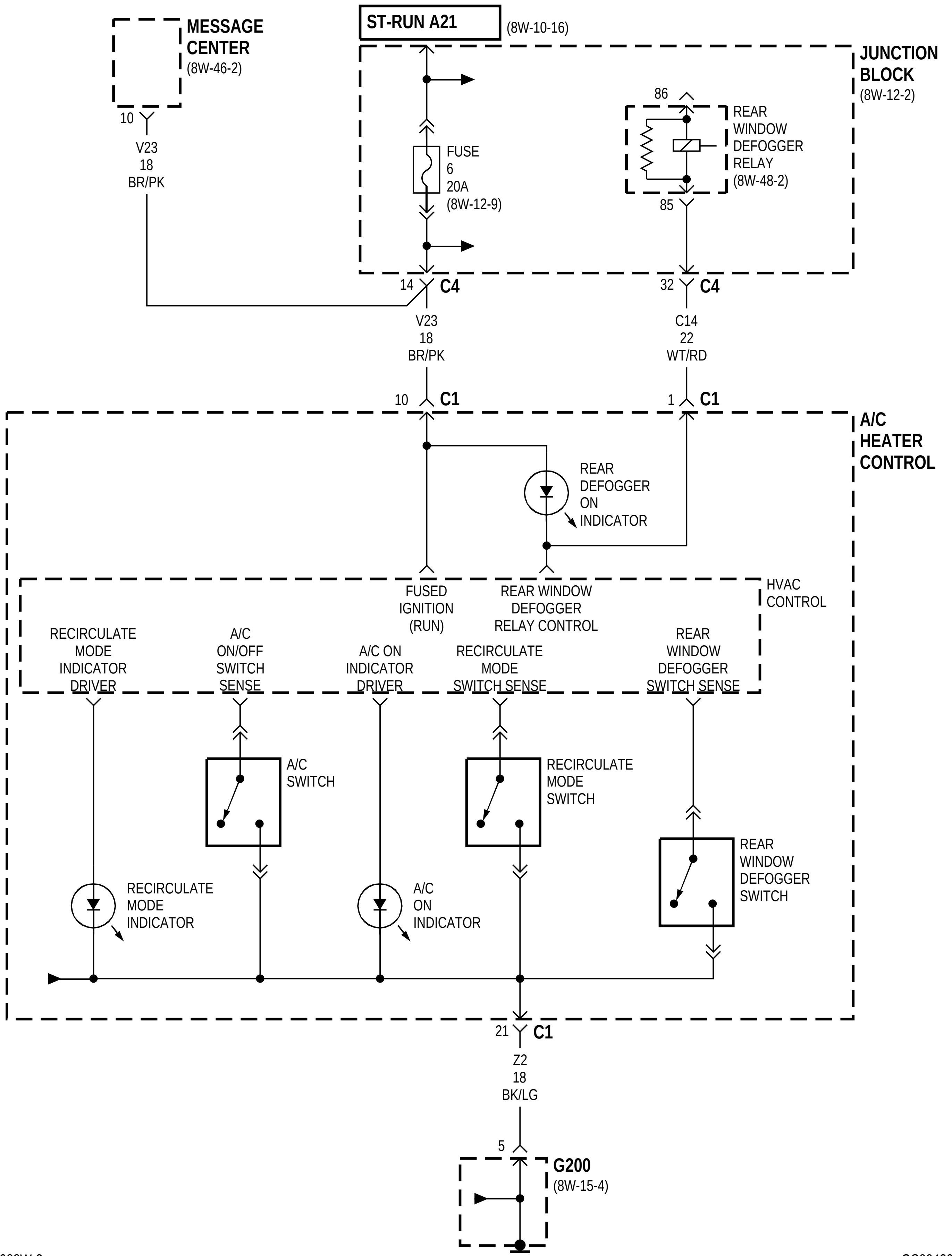

RUN-ACC A31
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
7
9A
(8W-12-16)
16 C2
F1
20
DB
9 C2
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE
8
20A
(8W-10-31)
86
30
CIGAR/ ACCESSORY RELAY
85
87
2 C4
10 C2
F30
16
RD
A/C HEATER CONTROL
(8W-42-3)
PANEL LAMPS FEED
11 C1
A22 B23
22 P34
Z1
18
BK
E2
20
OR
F30
16
RD
F30
16
RD
*2
1
FRONT CIGAR LIGHTER/ POWER OUTLET
1
REAR CIGAR LIGHTER/ POWER OUTLET
3
Z1
16
BK
3
Z1
16
BK
10
G300
(8W-15-7)
10
G200
(8W-15-4)
11
G302
(8W-15-13)
* BUILT-UP-EXPORT

8W-42 AIR CONDITIONING-HEATER

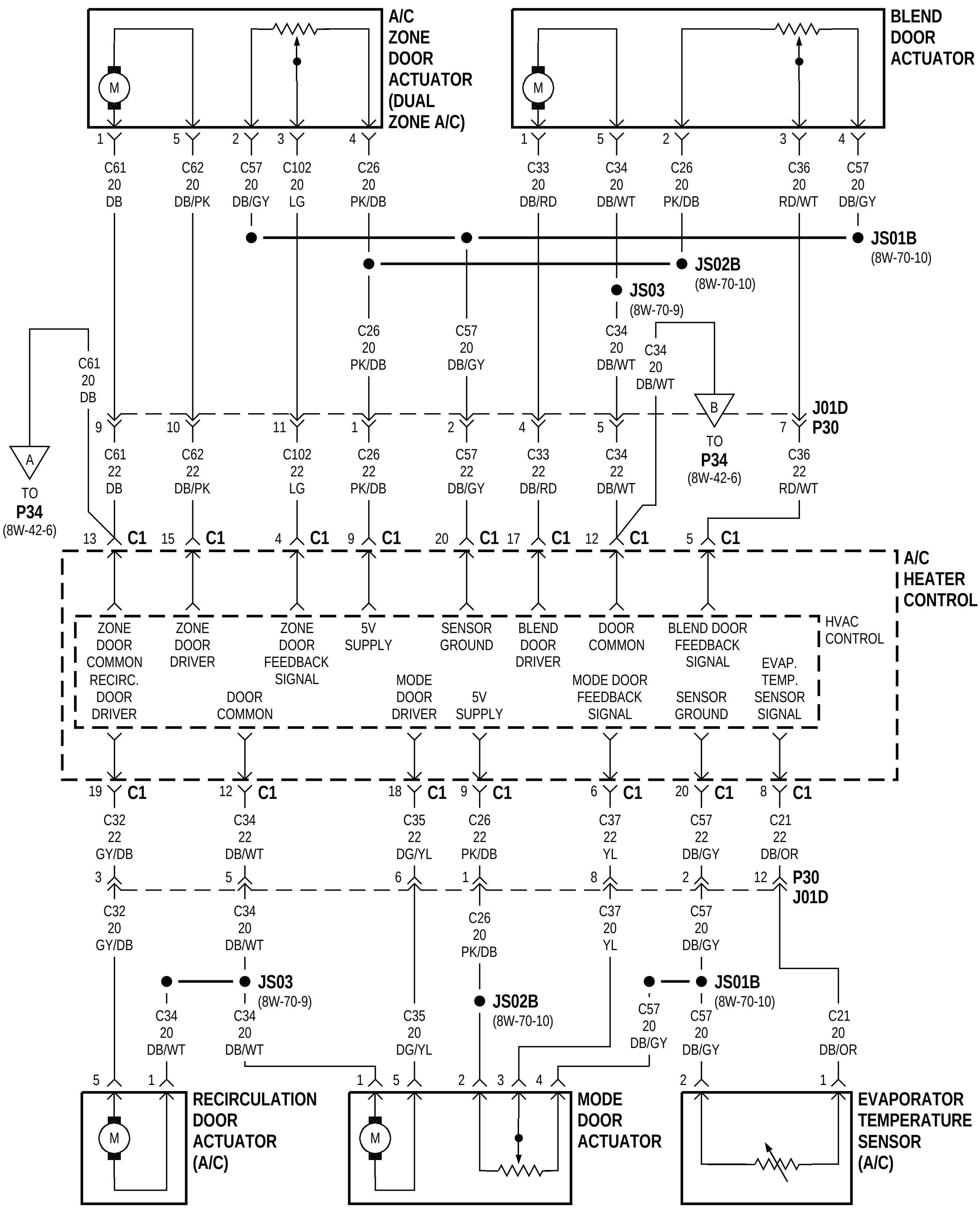
Component	Page
A/C Compressor Clutch	8W-42-7, 9
A/C Compressor Clutch Relay	8W-42-7, 9
A/C Heater Control	8W-42-2, 3, 4, 5, 6
A/C On Indicator	8W-42-4
A/C Pressure Transducer	8W-42-7, 9
A/C Switch	8W-42-4
A/C Zone Door Actuator	8W-42-5
Battery	8W-42-9
Blend Door Actuator	8W-42-5
Body Control Module	8W-42-3, 6
BS17	8W-42-6
BS34	8W-42-9
Diesel Power Relay	8W-42-9
Driver's Side Radiator Fan	8W-42-10
Electric Wiper De-Icer	8W-42-3
ES01	8W-42-9
ES02	8W-42-7, 9
ES03	8W-42-7
ES06	8W-42-9
ES07	8W-42-7, 10
ES09	8W-42-10
ES12	8W-42-10
ES21	8W-42-7
ES23	8W-42-7, 8
ES29	8W-42-9, 10
Evaporator Temperature Sensor	8W-42-5
Front Blower Motor	8W-42-2
Front Blower Motor Relay	8W-42-2
Front Blower Motor Resistor Block	8W-42-2
Front Cigar Lighter/Power Outlet	8W-42-3
FS01	8W-42-7
Fuse 6 (JB)	8W-42-4
Fuse 11 (JB)	8W-42-6
Fuse 11 (PDC)	8W-42-7, 9
Fuse 12 (JB)	8W-42-2
Fuse 17 (PDC)	8W-42-9
Fuse 21 (PDC)	8W-42-2
Fuse 24 (PDC)	8W-42-8, 10
G100	8W-42-9
G102	8W-42-7, 8, 10
G103	8W-42-9
G200	8W-42-3, 4
G201	8W-42-2, 3, 6
G300	8W-42-2
G302	8W-42-6
HVAC Control	8W-42-2, 3, 4, 5
Illumination Lamp	8W-42-3
Instrument Cluster	8W-42-3
JS01b	8W-42-5
JS02b	8W-42-5
JS03	8W-42-5
Junction Block	8W-42-2, 3, 4, 6, 7
Message Center	8W-42-4
Mode Door Actuator	8W-42-5
Passenger's Side Radiator Fan	8W-42-10
Power Distribution Center	8W-42-2, 7, 8, 9, 10
Powertrain Control Module	8W-42-3, 7, 8, 9, 10
PTC 1 (JB)	8W-42-7
Radiator Fan Disconnect	8W-42-10
Radiator Fan No. 1	8W-42-8
Radiator Fan No. 2	8W-42-8
Radiator Fan Relay	8W-42-8
Radiator Fan Relay No. 1	8W-42-10
Radiator Fan Relay No. 2	8W-42-10
Radiator Fan Relay No. 3	8W-42-10
Rear A/C Heater Unit	8W-42-6
Rear Blower Front Control Switch	8W-42-2, 3, 6
Rear Blower Rear Control Switch	8W-42-6
Rear Defogger On Indicator	8W-42-4
Rear Washer Switch	8W-42-3
Rear Window Defogger Relay	8W-42-4
Rear Window Defogger Switch	8W-42-4
Rear Wiper Delay On Indicator	8W-42-3
Rear Wiper Delay Switch	8W-42-3
Rear Wiper On Indicator	8W-42-3
Rear Wiper On Switch	8W-42-3
Recirculate Mode Indicator	8W-42-4
Recirculate Mode Switch	8W-42-4
Recirculation Door Actuator	8W-42-5
RF3 E40	8W-42-8
RFS1	8W-42-8
RFS2	8W-42-8

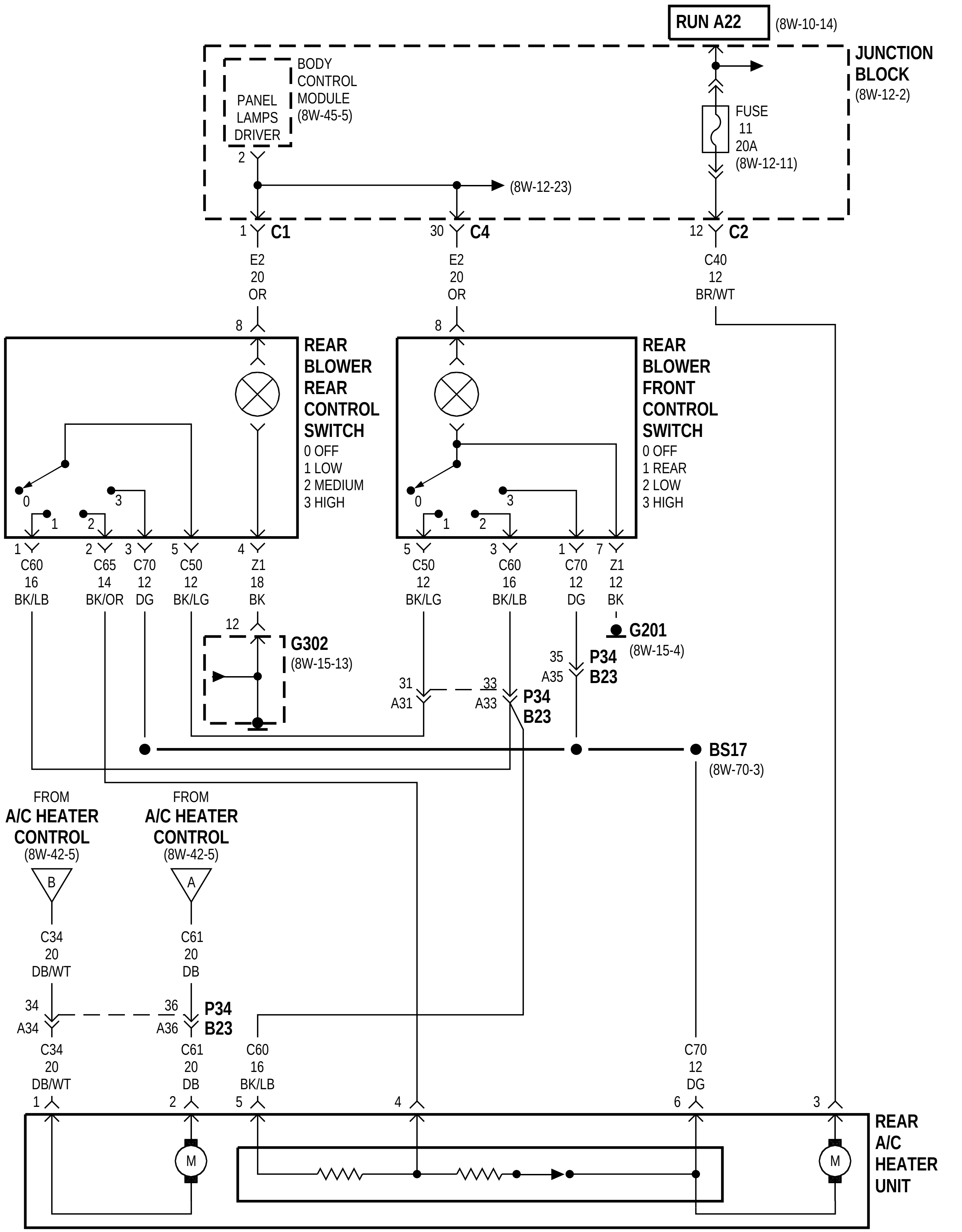

RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
C2
F20
20
WT
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE
21
40A
(8W-10-18)
FRONT BLOWER MOTOR RELAY
C4
C1
C71
12
DB
B23
P18
FRONT BLOWER MOTOR
M
C7
12
BK/TN
Z1
18
BK
G300
(8W-15-7)
FRONT BLOWER MOTOR RESISTOR BLOCK
C4
16
TN
C5
16
LG
C6
14
LB
C104
12
RD/WT
C107
12
TN/BK
REAR BLOWER FRONT CONTROL SWITCH
GROUND
(8W-42-6)
A/C HEATER CONTROL
0 OFF
1 LOW
2 M1
3 M2
4 M3
5 HIGH
GROUND
FRONT BLOWER OFF
HVAC CONTROL
Z1
12
BK
G201
(8W-15-4)

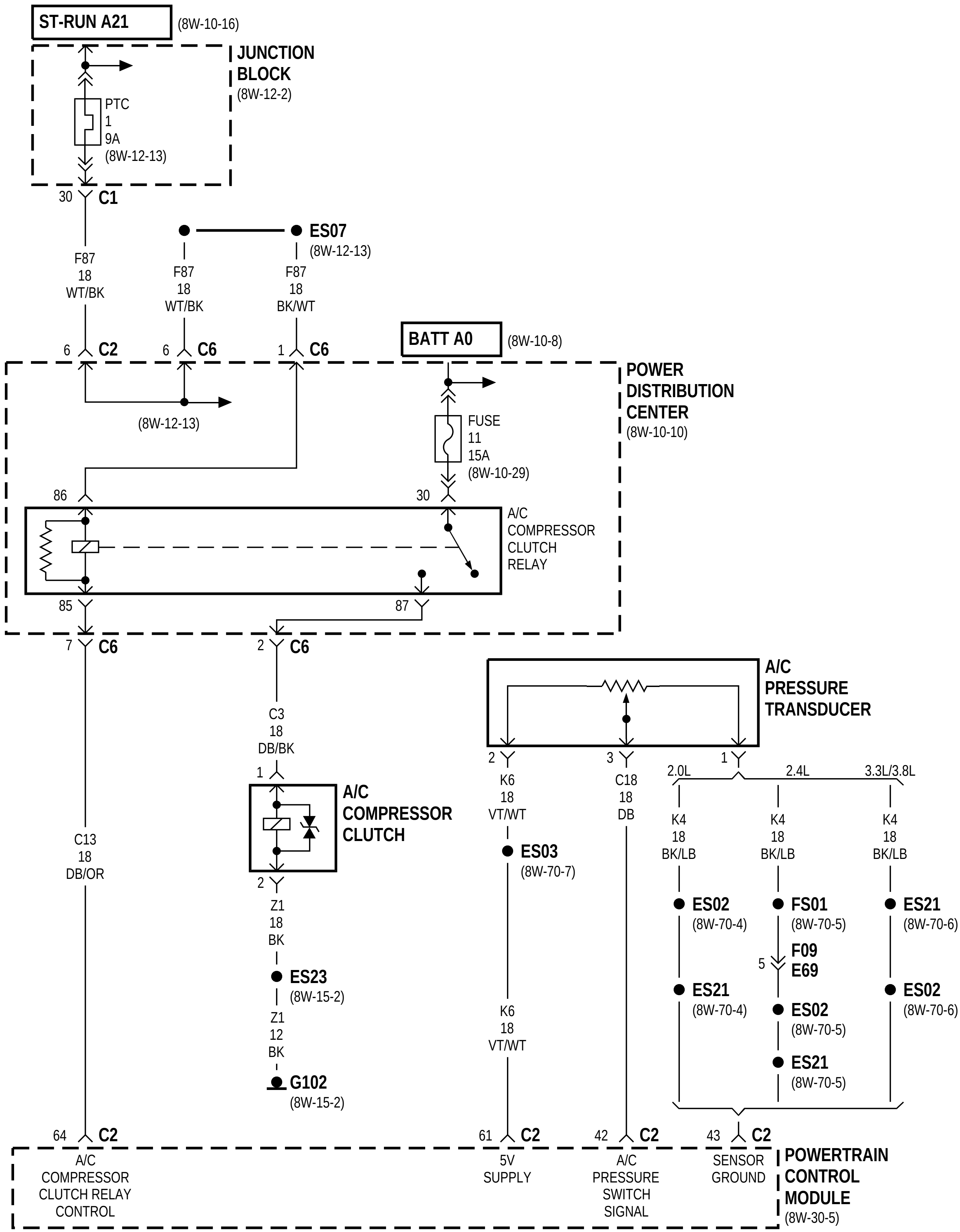

JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
PANEL LAMPS DRIVER
(8W-12-23)
REAR WIPEER SWITCH MUX
C4
C2
POWERTRAIN CONTROL MODULE
(8W-30-5)
A/C SWITCH SIGNAL
C1
POWERTRAIN CONTROL MODULE
(8W-30-37)
C103
18
DG/LB
20
E43
B70
INSTRUMENT CLUSTER
(8W-40-4)
PANEL LAMPS FEED
E2
20
OR
V26
22
YL/WT
GAS
DIESEL
B36
36
B23
P18
ELECTRIC WIPER DE-ICER
WIPER DE-ICER SWITCHED GROUND
C66
BK/WT
A/C HEATER CONTROL
1 PANEL
2 BI-LEVEL
3 FLOOR
4 MIX
5 DEFROST
HVAC CONTROL
REAR WIPE/ WASH
MODE SELECT
LEFT TEMP. CONTROL SENSE
GROUND
RIGHT TEMP. CONTROL SENSE
A/C ON-OFF SWITCH SIGNAL
ELECTRIC WIPER DE-ICE DRIVER
REAR WASHER SWITCH SENSE
WIPER ON INDICATOR DRIVER
WIPER ON SWITCH
DELAY ON INDICATOR DRIVER
DELAY SWITCH SENSE
REAR WASHER SWITCH
REAR WIPER ON SWITCH
REAR WIPER DELAY SWITCH
ILLUMINATION LAMP
REAR WIPER ON INDICATOR
REAR WIPER DELAY ON INDICATOR
Z1
12
BK
REAR BLOWER FRONT CONTROL SWITCH
(8W-42-6)
Z2
BK/LG
G200
(8W-15-4)
G201
(8W-15-4)
TO FRONT CIGAR LIGHTER/ POWER OUTLET
(8W-41-3)

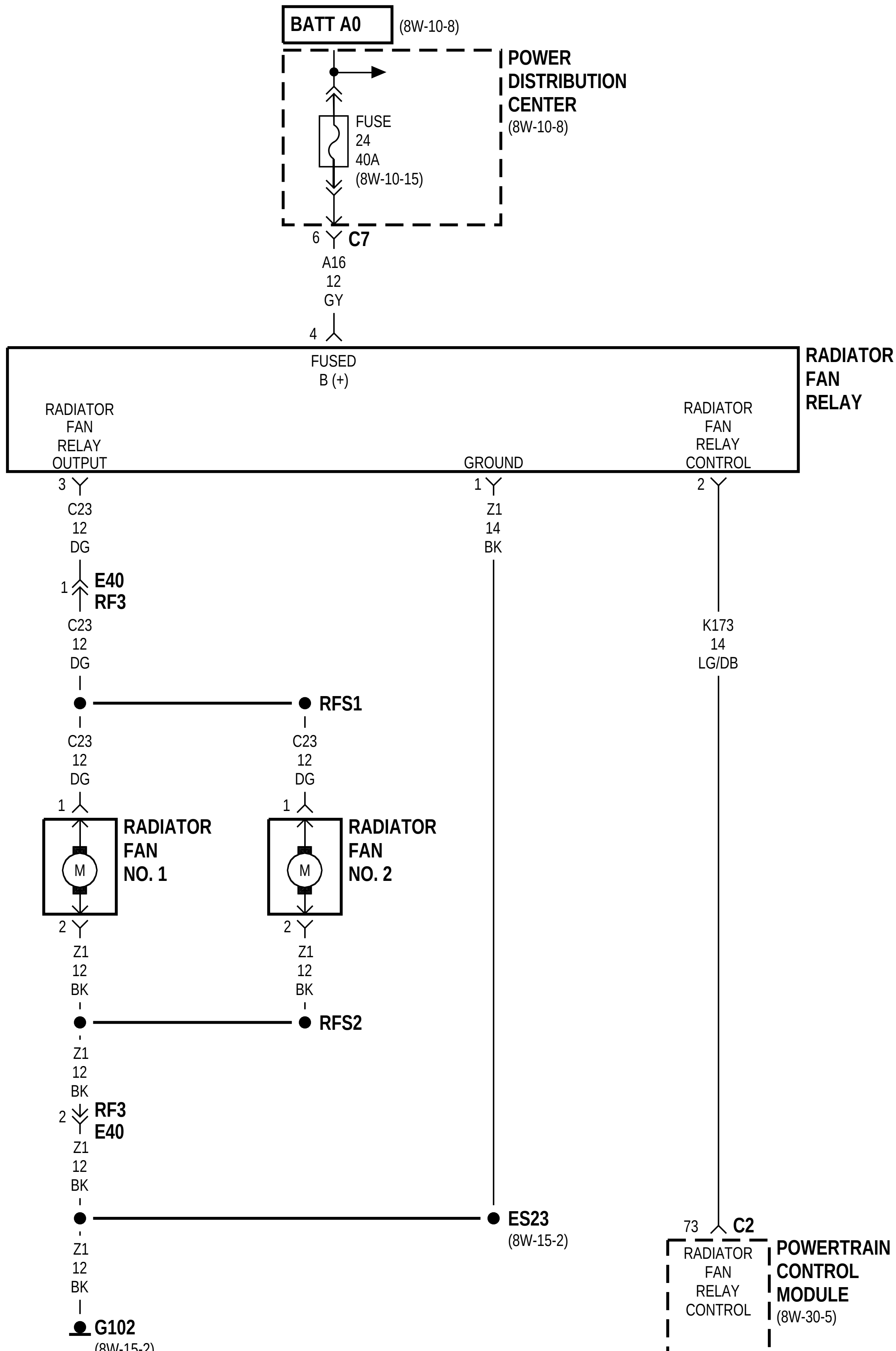


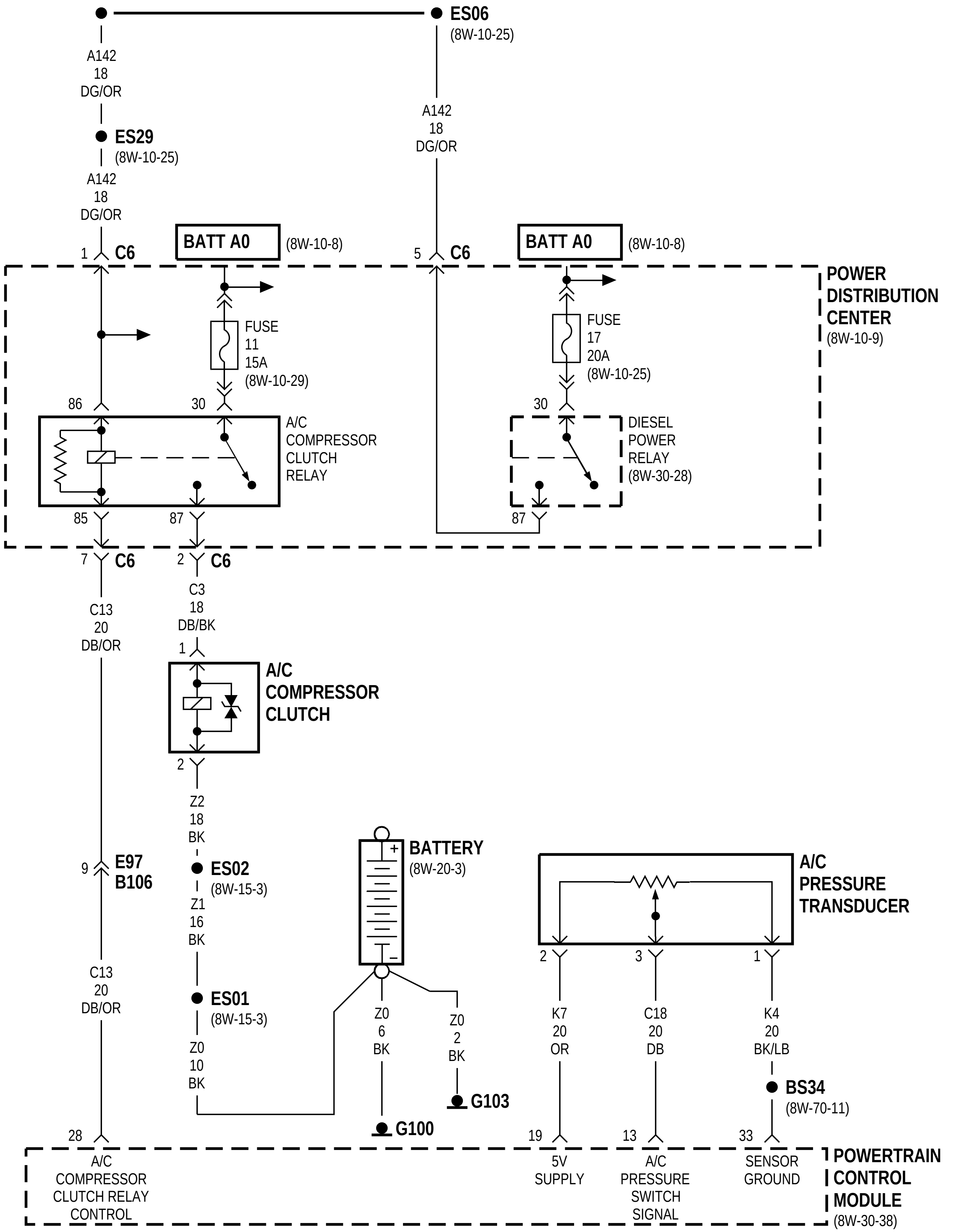
MESSAGE CENTER
(8W-46-2)
10
V23
18
BR/PK
ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
FUSE
6
20A
(8W-12-9)
86
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
85
14
C4
32
C4
V23
18
BR/PK
C14
22
WT/RD
10
C1
1
C1
A/C HEATER CONTROL
REAR DEFOGGER ON INDICATOR
HVAC CONTROL
FUSED IGNITION (RUN)
REAR WINDOW DEFOGGER RELAY CONTROL
RECIRCULATE MODE INDICATOR DRIVER
A/C ON/OFF SWITCH SENSE
A/C ON INDICATOR DRIVER
RECIRCULATE MODE SWITCH SENSE
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH
RECIRCULATE MODE SWITCH
REAR WINDOW DEFOGGER SWITCH
RECIRCULATE MODE INDICATOR
A/C ON INDICATOR
21
C1
Z2
18
BK/LG
5
G200
(8W-15-4)


A/C ZONE DOOR ACTUATOR (DUAL ZONE A/C)
BLEND DOOR ACTUATOR
C61 20 DB
C62 20 DB/PK
C57 20 DB/GY
C102 20 LG
C26 20 PK/DB
C33 20 DB/RD
C34 20 DB/WT
C36 20 RD/WT
JS01B (8W-70-10)
JS02B (8W-70-10)
JS03 (8W-70-9)
TO P34 (8W-42-6)
J01D P30
C61 22 DB
C62 22 DB/PK
C102 22 LG
C26 22 PK/DB
C57 22 DB/GY
C33 22 DB/RD
C34 22 DB/WT
C36 22 RD/WT
C1
A/C HEATER CONTROL
HVAC CONTROL
ZONE DOOR COMMON
ZONE DOOR DRIVER
ZONE DOOR FEEDBACK SIGNAL
5V SUPPLY
SENSOR GROUND
BLEND DOOR DRIVER
DOOR COMMON
BLEND DOOR FEEDBACK SIGNAL
RECIRC. DOOR DRIVER
DOOR COMMON
MODE DOOR DRIVER
5V SUPPLY
MODE DOOR FEEDBACK SIGNAL
SENSOR GROUND
EVAP. TEMP. SENSOR SIGNAL
C32 22 GY/DB
C34 22 DB/WT
C35 22 DG/YL
C26 22 PK/DB
C37 22 YL
C57 22 DB/GY
C21 22 DB/OR
P30 J01D
C32 20 GY/DB
C34 20 DB/WT
C26 20 PK/DB
C37 20 YL
C57 20 DB/GY
C35 20 DG/YL
C21 20 DB/OR
RECIRCULATION DOOR ACTUATOR (A/C)
MODE DOOR ACTUATOR
EVAPORATOR TEMPERATURE SENSOR (A/C)

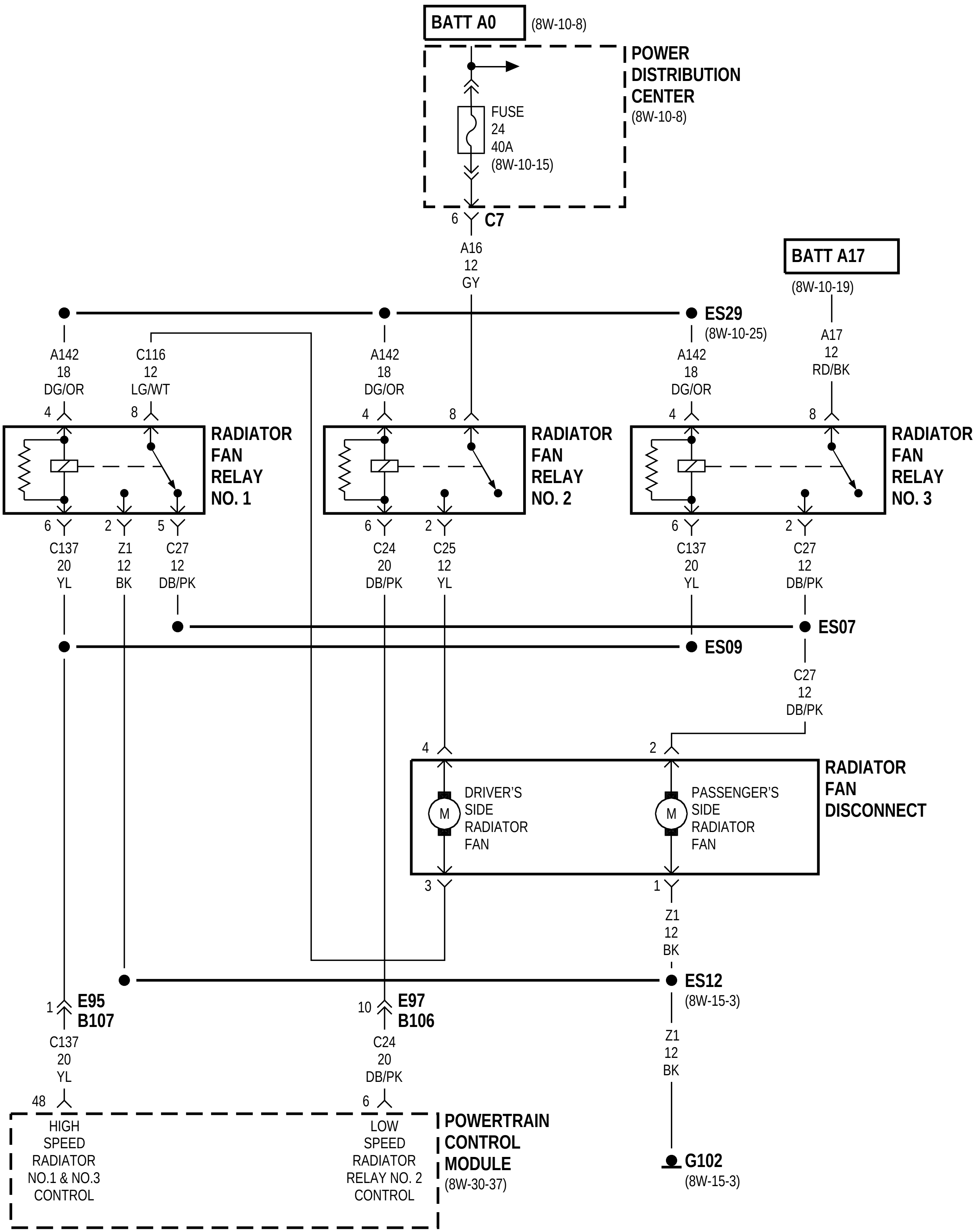

RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-5)
PANEL LAMPS DRIVER
FUSE 11 20A
(8W-12-11)
(8W-12-23)
C1
C4
C2
E2 20 OR
E2 20 OR
C40 12 BR/WT
REAR BLOWER REAR CONTROL SWITCH
0 OFF
1 LOW
2 MEDIUM
3 HIGH
REAR BLOWER FRONT CONTROL SWITCH
0 OFF
1 REAR
2 LOW
3 HIGH
C60 16 BK/LB
C65 14 BK/OR
C70 12 DG
C50 12 BK/LG
Z1 18 BK
C50 12 BK/LG
C60 16 BK/LB
C70 12 DG
Z1 12 BK
G302
(8W-15-13)
G201
(8W-15-4)
P34
B23
BS17
(8W-70-3)
FROM A/C HEATER CONTROL
(8W-42-5)
FROM A/C HEATER CONTROL
(8W-42-5)
C34 20 DB/WT
C61 20 DB
C60 16 BK/LB
C70 12 DG
REAR A/C HEATER UNIT
M


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
1
9A
(8W-12-13)
30 C1
F87
18
WT/BK
ES07
(8W-12-13)
F87
18
WT/BK
F87
18
BK/WT
6 C2
6 C6
1 C6
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
(8W-12-13)
FUSE
11
15A
(8W-10-29)
86
30
A/C COMPRESSOR CLUTCH RELAY
85
87
7 C6
2 C6
A/C PRESSURE TRANSDUCER
C3
18
DB/BK
1
A/C COMPRESSOR CLUTCH
2
Z1
18
BK
ES23
(8W-15-2)
Z1
12
BK
G102
(8W-15-2)
C13
18
DB/OR
2
3
1
K6
18
VT/WT
ES03
(8W-70-7)
K6
18
VT/WT
C18
18
DB
2.0L
2.4L
3.3L/3.8L
K4
18
BK/LB
ES02
(8W-70-4)
ES21
(8W-70-4)
FS01
(8W-70-5)
5
F09
E69
ES02
(8W-70-5)
ES21
(8W-70-5)
ES21
(8W-70-6)
ES02
(8W-70-6)
64 C2
61 C2
42 C2
43 C2
A/C COMPRESSOR CLUTCH RELAY CONTROL
5V SUPPLY
A/C PRESSURE SWITCH SIGNAL
SENSOR GROUND
POWERTRAIN CONTROL MODULE
(8W-30-5)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
24
40A
(8W-10-15)
6
C7
A16
12
GY
4
FUSED
B (+)
RADIATOR
FAN
RELAY
RADIATOR
FAN
RELAY
OUTPUT
GROUND
RADIATOR
FAN
RELAY
CONTROL
3
1
2
C23
12
DG
Z1
14
BK
1
E40
RF3
C23
12
DG
K173
14
LG/DB
RFS1
C23
12
DG
C23
12
DG
1
1
M
M
RADIATOR
FAN
NO. 1
RADIATOR
FAN
NO. 2
2
2
Z1
12
BK
Z1
12
BK
RFS2
Z1
12
BK
2
RF3
E40
Z1
12
BK
ES23
(8W-15-2)
73
C2
RADIATOR
FAN
RELAY
CONTROL
POWERTRAIN
CONTROL
MODULE
(8W-30-5)
Z1
12
BK
G102
(8W-15-2)

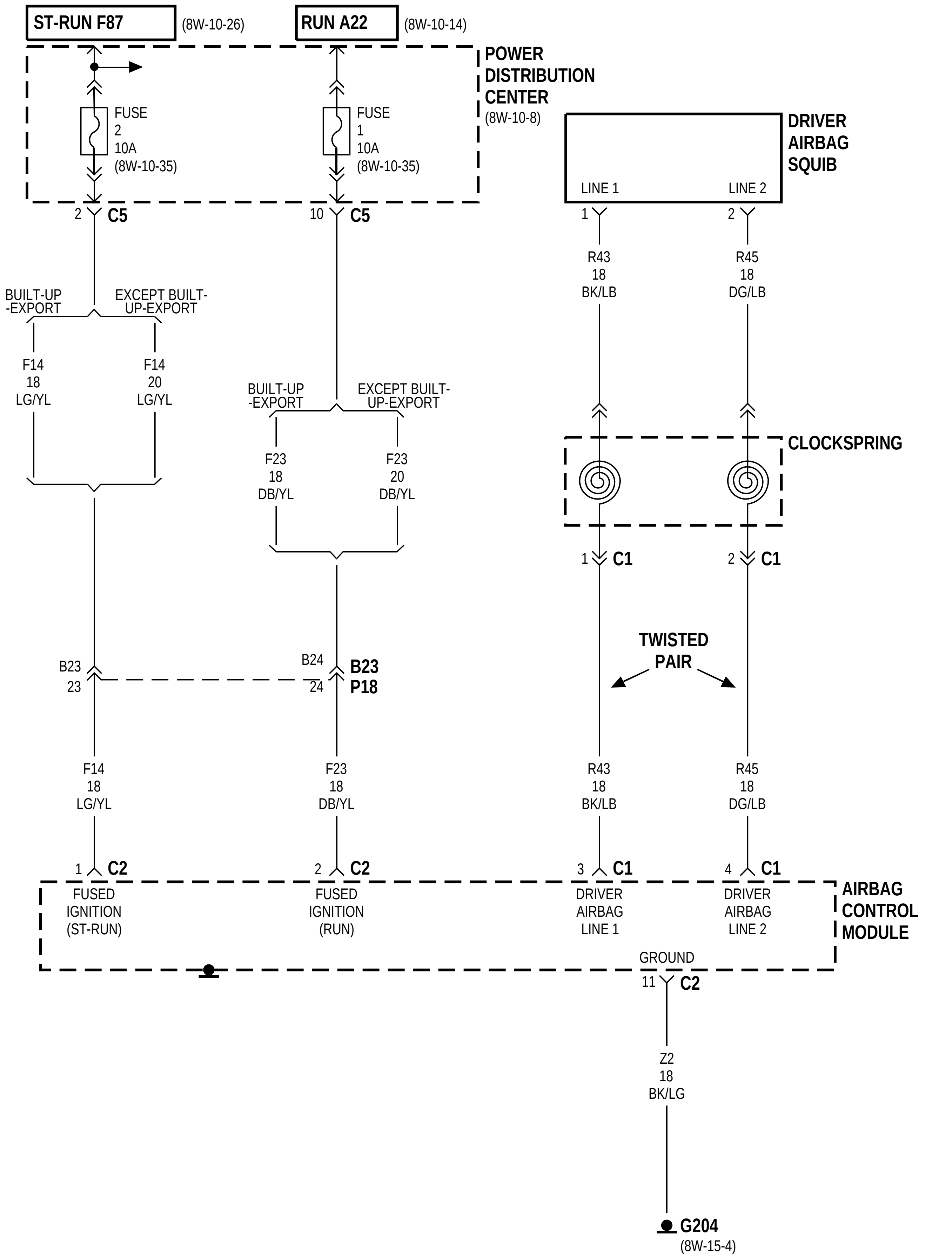

ES06
(8W-10-25)
A142
18
DG/OR
ES29
(8W-10-25)
A142
18
DG/OR
A142
18
DG/OR
BATT A0
(8W-10-8)
BATT A0
(8W-10-8)
1 C6
5 C6
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
11
15A
(8W-10-29)
FUSE
17
20A
(8W-10-25)
86
30
30
A/C
COMPRESSOR
CLUTCH
RELAY
DIESEL
POWER
RELAY
(8W-30-28)
85
87
87
7 C6
2 C6
C3
18
DB/BK
C13
20
DB/OR
1
A/C
COMPRESSOR
CLUTCH
2
Z2
18
BK
9 E97
B106
ES02
(8W-15-3)
Z1
16
BK
ES01
(8W-15-3)
Z0
10
BK
C13
20
DB/OR
BATTERY
(8W-20-3)
Z0
6
BK
Z0
2
BK
G103
G100
A/C
PRESSURE
TRANSDUCER
2
3
1
K7
20
OR
C18
20
DB
K4
20
BK/LB
BS34
(8W-70-11)
28
19
13
33
A/C
COMPRESSOR
CLUTCH RELAY
CONTROL
5V
SUPPLY
A/C
PRESSURE
SWITCH
SIGNAL
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE
(8W-30-38)

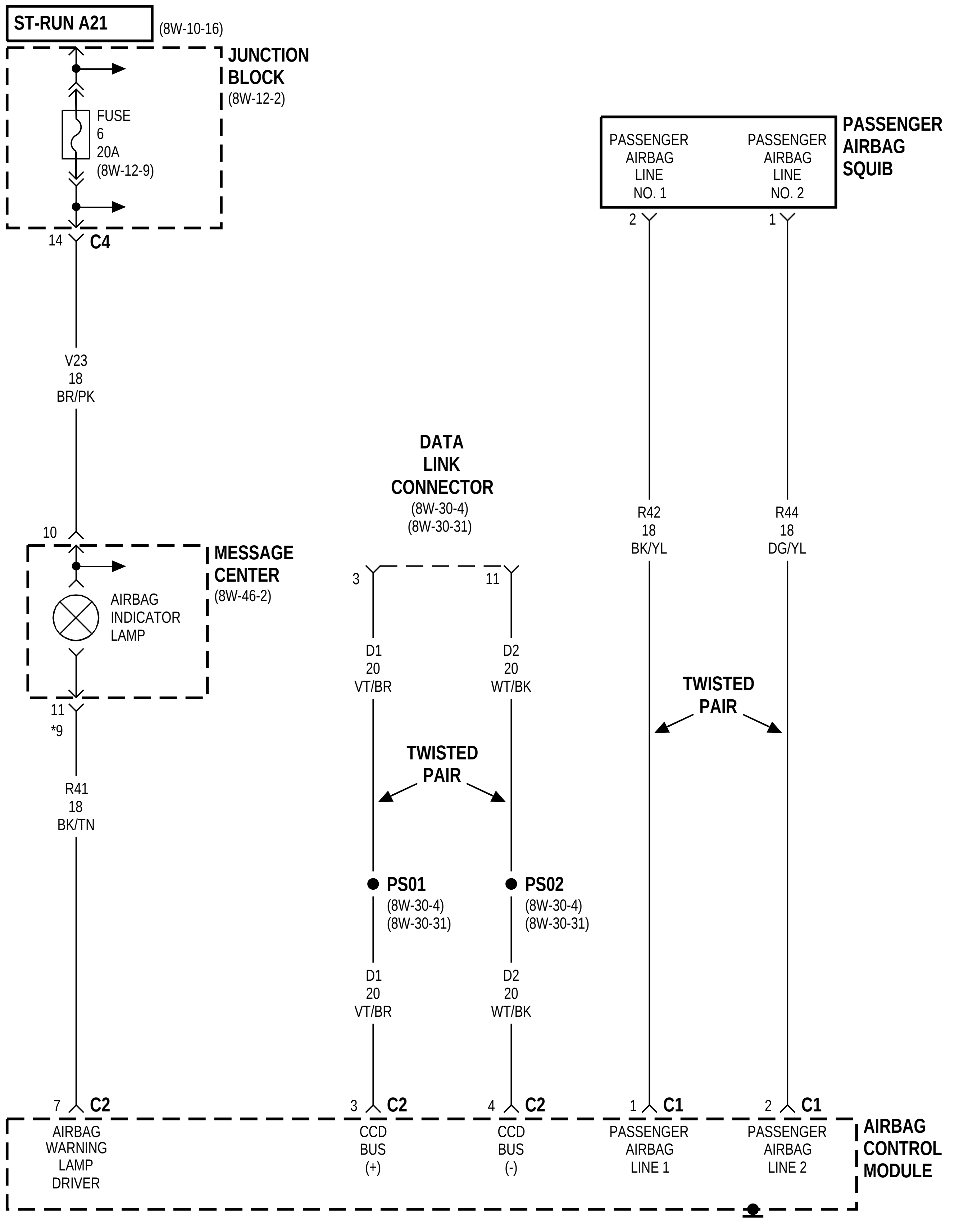
DIESEL


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE
24
40A
(8W-10-15)
6
C7
A16
12
GY
BATT A17
(8W-10-19)
ES29
(8W-10-25)
A142
18
DG/OR
C116
12
LG/WT
A17
12
RD/BK
RADIATOR FAN RELAY NO. 1
RADIATOR FAN RELAY NO. 2
RADIATOR FAN RELAY NO. 3
C137
20
YL
Z1
12
BK
C27
12
DB/PK
C24
20
DB/PK
C25
12
YL
ES07
ES09
RADIATOR FAN DISCONNECT
DRIVER'S SIDE RADIATOR FAN
PASSENGER'S SIDE RADIATOR FAN
M
ES12
(8W-15-3)
E95
B107
E97
B106
G102
(8W-15-3)
HIGH SPEED RADIATOR NO.1 & NO.3 CONTROL
LOW SPEED RADIATOR RELAY NO. 2 CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-37)

8W-43 AIRBAG SYSTEM

Component	Page
Airbag Control Module	8W-43-2, 3
Airbag Indicator Lamp	8W-43-3
Clockspring	8W-43-2
Data Link Connector	8W-43-3
Driver Airbag Squib	8W-43-2
Fuse 1 (PDC)	8W-43-2
Fuse 2 (PDC)	8W-43-2
Fuse 6 (JB)	8W-43-3
G204	8W-43-2
Junction Block	8W-43-3
Message Center	8W-43-3
Passenger Airbag Squib	8W-43-3
Power Distribution Center	8W-43-2
PS01	8W-43-3
PS02	8W-43-3


ST-RUN F87
(8W-10-26)
RUN A22
(8W-10-14)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
2
10A
(8W-10-35)
FUSE
1
10A
(8W-10-35)
DRIVER
AIRBAG
SQUIB
LINE 1
LINE 2
2
C5
10
C5
1
2
R43
18
BK/LB
R45
18
DG/LB
BUILT-UP
-EXPORT
EXCEPT BUILT-
UP-EXPORT
F14
18
LG/YL
F14
20
LG/YL
BUILT-UP
-EXPORT
EXCEPT BUILT-
UP-EXPORT
F23
18
DB/YL
F23
20
DB/YL
CLOCKSPRING
1
C1
2
C1
TWISTED
PAIR
B23
23
B24
24
B23
P18
F14
18
LG/YL
F23
18
DB/YL
R43
18
BK/LB
R45
18
DG/LB
1
C2
2
C2
3
C1
4
C1
FUSED
IGNITION
(ST-RUN)
FUSED
IGNITION
(RUN)
DRIVER
AIRBAG
LINE 1
DRIVER
AIRBAG
LINE 2
AIRBAG
CONTROL
MODULE
GROUND
11
C2
Z2
18
BK/LG
G204
(8W-15-4)



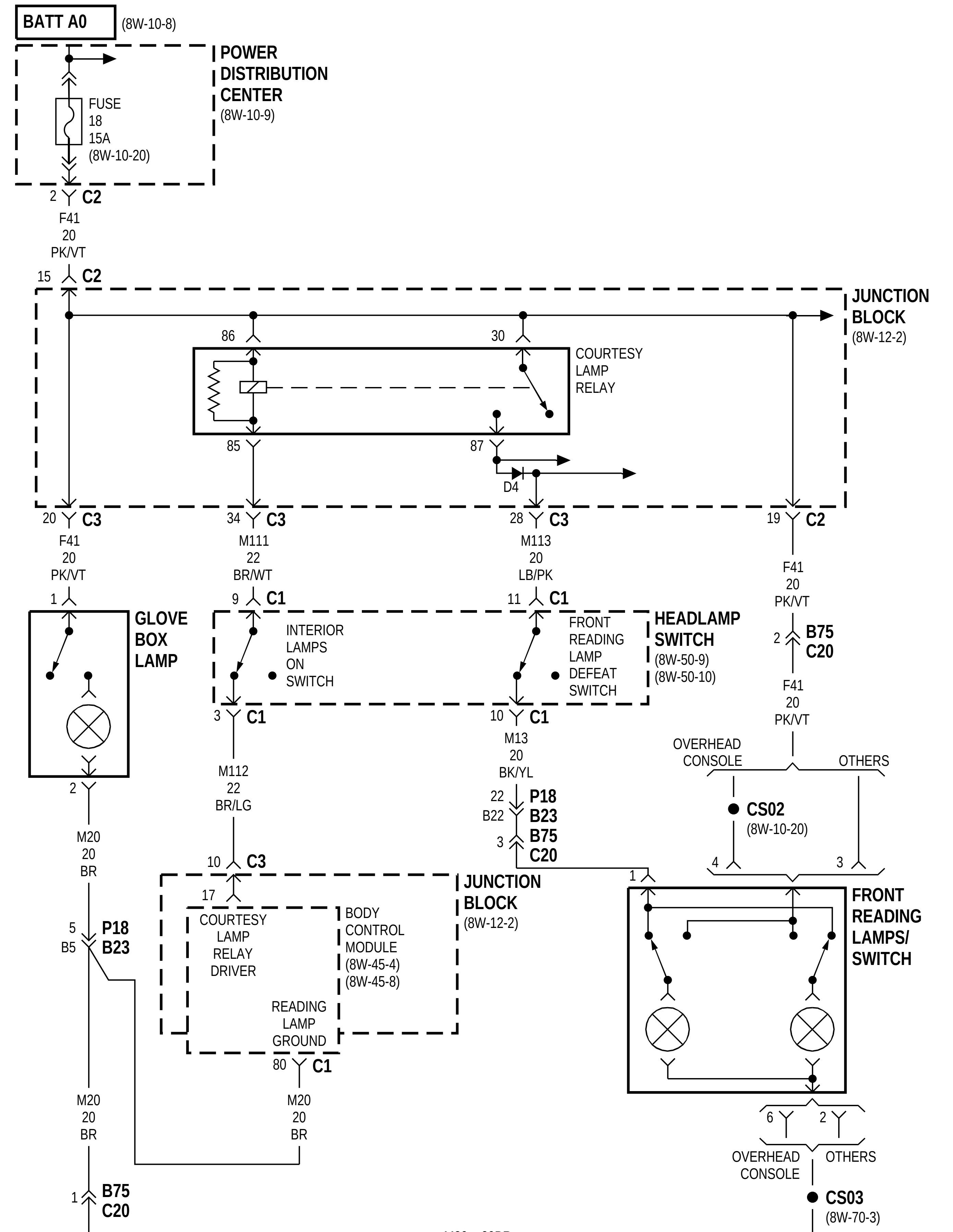
* RHD

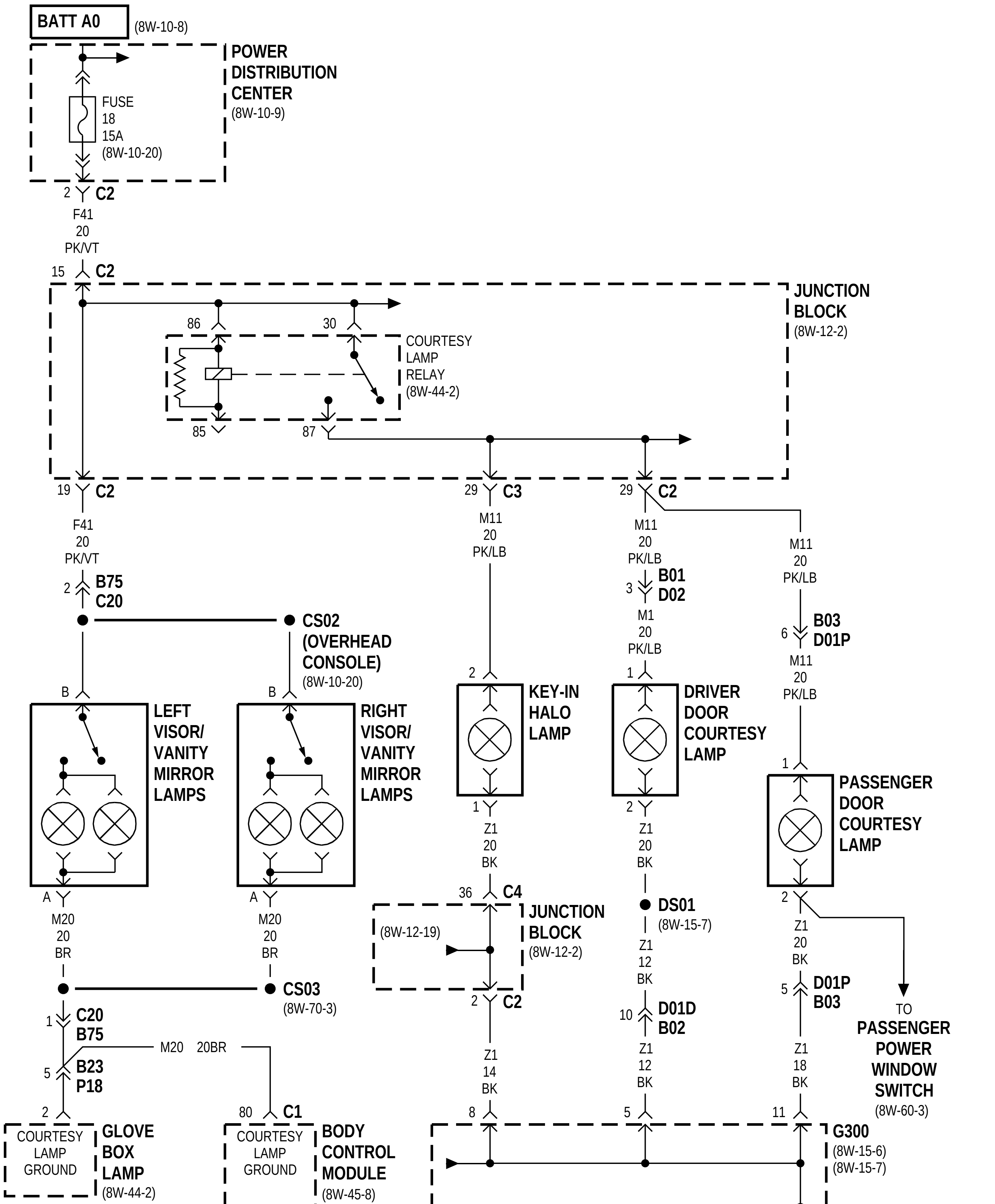
GS004303

J988W-3

8W-44 INTERIOR LIGHTING

Component	Page
A/C Heater Control	8W-44-8
Ash Receiver Lamp	8W-44-7
Automatic Day/Night Mirror	8W-44-6
Back-Up Switch	8W-44-6
Body Control Module	8W-44-2, 3, 4, 5, 6, 7, 8, 9
BS02	8W-44-6
Center Dome Lamp	8W-44-4
Courtesy Lamp Relay	8W-44-2, 3, 4
CS01	8W-44-4
CS02	8W-44-2, 3, 4
CS03	8W-44-2, 3, 4
CS04	8W-44-6
CS06	8W-44-8
CS1	8W-44-4
Driver Door Ajar Switch	8W-44-5
Driver Door Courtesy Lamp	8W-44-3
Driver Door Lock Switch	8W-44-9
Driver Power Mirror	8W-44-6
Driver Power Window Switch	8W-44-9
DS01	8W-44-3, 9
EC1 C19	8W-44-6
Front Cigar Lighter/Power Outlet	8W-44-8
Front Reading Lamp Defeat Switch	8W-44-2
Front Reading Lamps/Switch	8W-44-2
Fuse 1 (JB)	8W-44-7
Fuse 3 (JB)	8W-44-7
Fuse 6 (JB)	8W-44-6
Fuse 12 (JB)	8W-44-6
Fuse 18 (PDC)	8W-44-2, 3, 4
Fuse 22 (PDC)	8W-44-7
G200	8W-44-8
G201	8W-44-8
G300	8W-44-3, 6, 7, 8, 9
G301	8W-44-5, 8, 9
G302	8W-44-5, 8
G400	8W-44-4, 5
Glove Box Lamp	8W-44-2, 3, 4
Headlamp Switch	8W-44-2, 7
Hood Ajar Switch	8W-44-5
Ignition Switch	8W-44-8
Instrument Cluster	8W-44-8
Interior Lamps On Switch	8W-44-2
Junction Block	8W-44-2, 3, 4, 6, 7, 8, 9
Key-In Halo Lamp	8W-44-3
Left Liftgate Flood Lamp	8W-44-4
Left Mid Reading Lamp	8W-44-4
Left Rear Door Ajar Switch	8W-44-5
Left Rear Reading Lamp	8W-44-4
Left Visor/Vanity Mirror Lamps	8W-44-3
Liftgate Ajar Switch	8W-44-5
Message Center	8W-44-7
Park Lamp Relay	8W-44-7
Passenger Door Ajar Switch	8W-44-5
Passenger Door Courtesy Lamp	8W-44-3, 9
Passenger Door Lock Switch	8W-44-9
Passenger Power Window Switch	8W-44-3, 9
Power Distribution Center	8W-44-2, 3, 4, 7
Power Mirror Switch	8W-44-8
Radio	8W-44-7, 8
Rear Blower Front Control Switch	8W-44-8
Rear Blower Rear Control Switch	8W-44-8
Rear Dome Lamp	8W-44-4
Right Liftgate Flood Lamp	8W-44-4
Right Mid Reading Lamp	8W-44-4
Right Rear Door Ajar Switch	8W-44-5
Right Rear Reading Lamp	8W-44-4
Right Visor/Vanity Mirror Lamps	8W-44-3
Traction Control Switch	8W-44-8
Transmission Range Sensor	8W-44-6
Universal Garage Door Opener	8W-44-8


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
18
15A
(8W-10-20)
2 C2
F41
20
PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
86
30
COURTESY LAMP RELAY
85
87
D4
20 C3
34 C3
28 C3
19 C2
F41
20
PK/VT
M111
22
BR/WT
M113
20
LB/PK
1
9 C1
11 C1
GLOVE BOX LAMP
INTERIOR LAMPS ON SWITCH
FRONT READING LAMP DEFEAT SWITCH
HEADLAMP SWITCH
(8W-50-9)
(8W-50-10)
2 B75
C20
2
3 C1
10 C1
M112
22
BR/LG
M13
20
BK/YL
OVERHEAD CONSOLE
OTHERS
22 P18
B22 B23
3 B75
C20
CS02
(8W-10-20)
M20
20
BR
10 C3
4
3
1
17
JUNCTION BLOCK
(8W-12-2)
COURTESY LAMP RELAY DRIVER
BODY CONTROL MODULE
(8W-45-4)
(8W-45-8)
READING LAMP GROUND
FRONT READING LAMPS/ SWITCH
5 P18
B5 B23
80 C1
M20
20
BR
6
2
OVERHEAD CONSOLE
OTHERS
1 B75
C20
CS03
(8W-70-3)
M20 20BR



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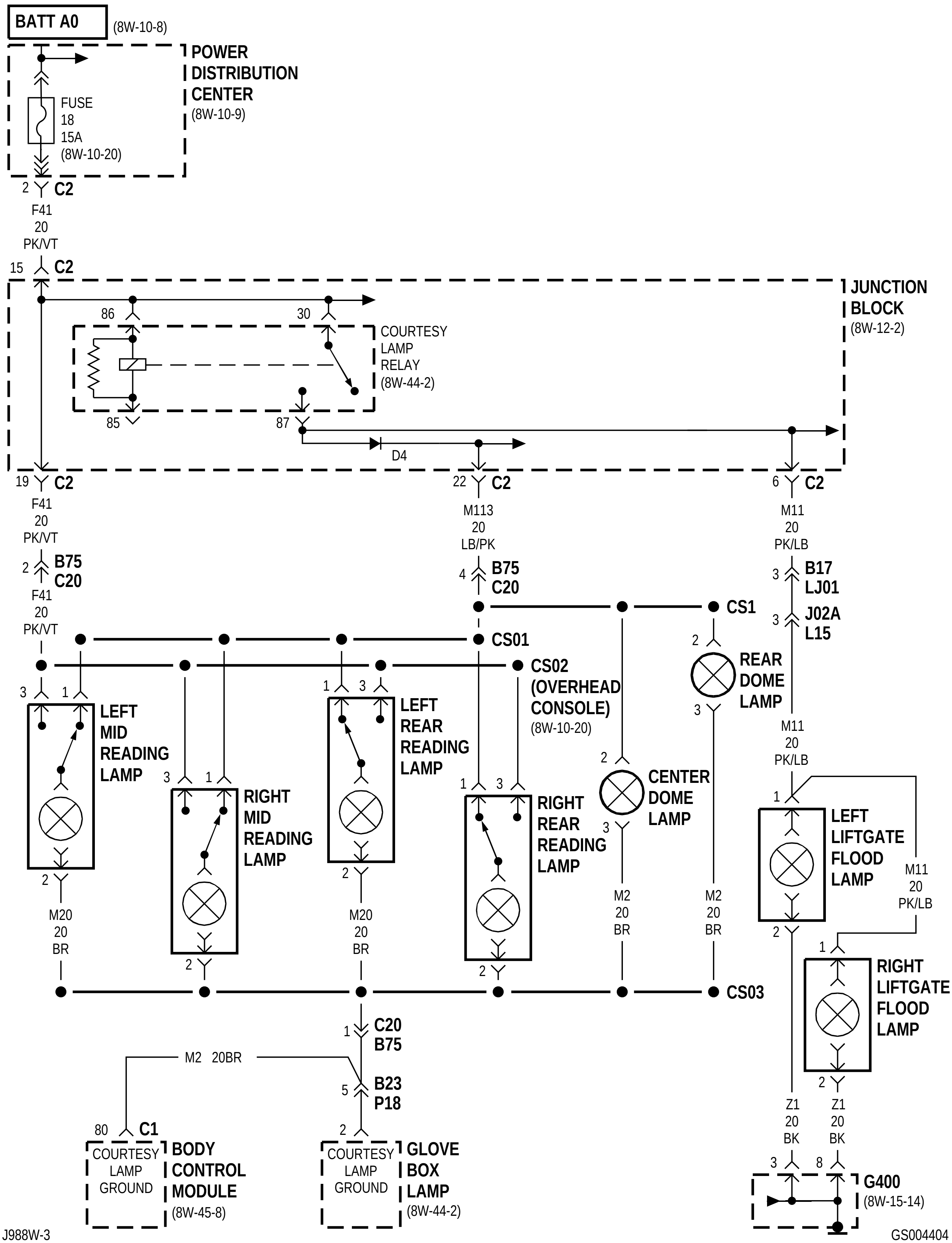
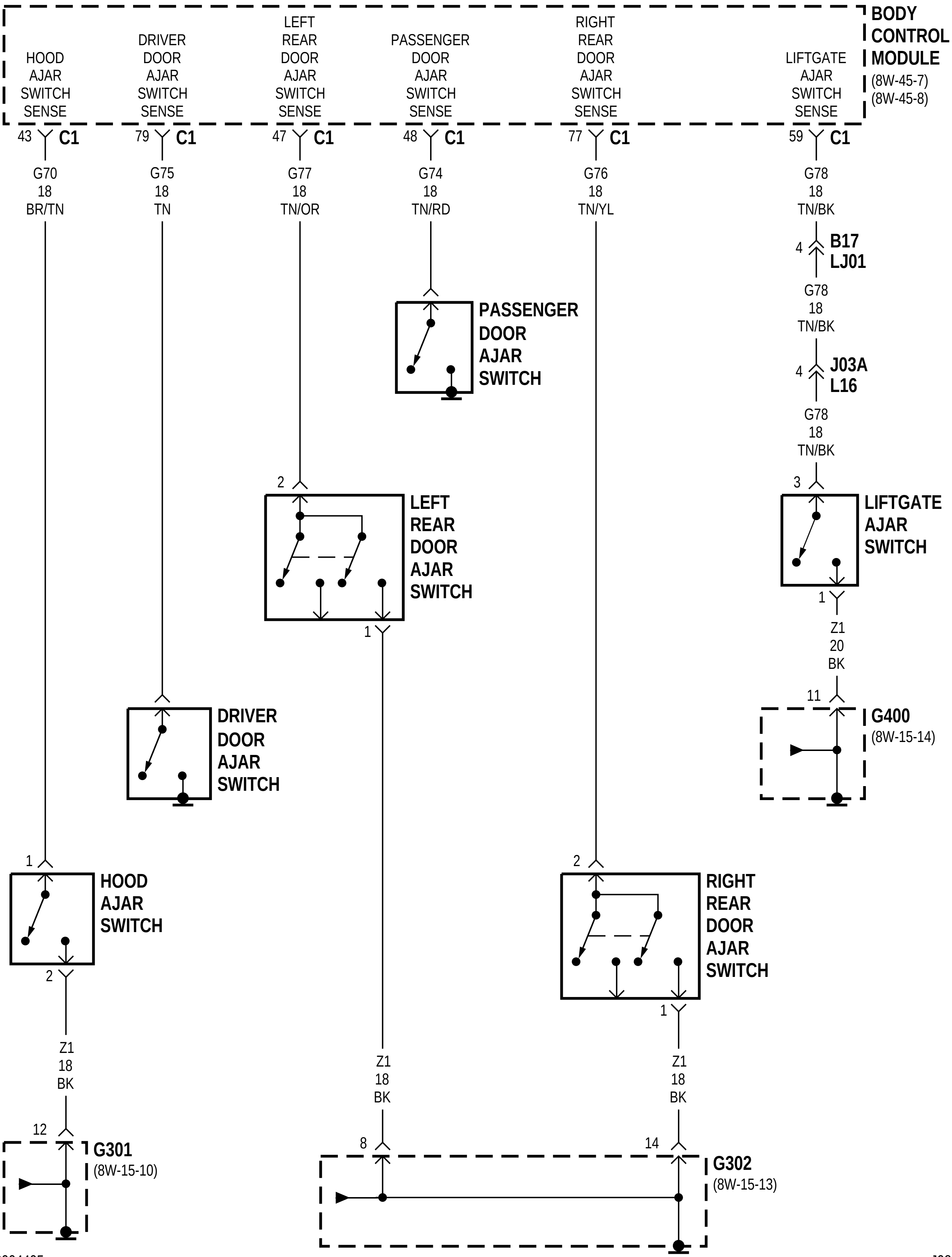
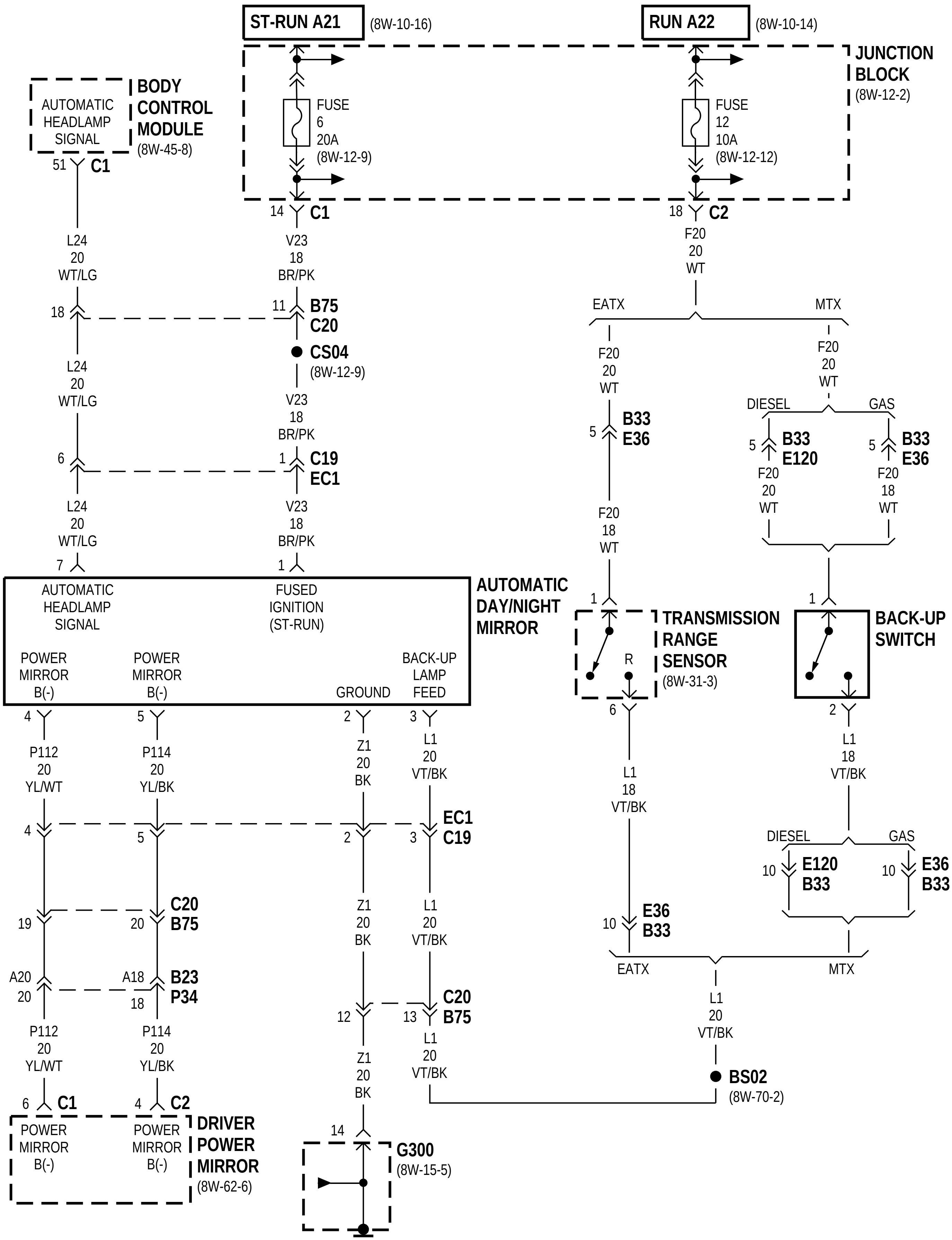
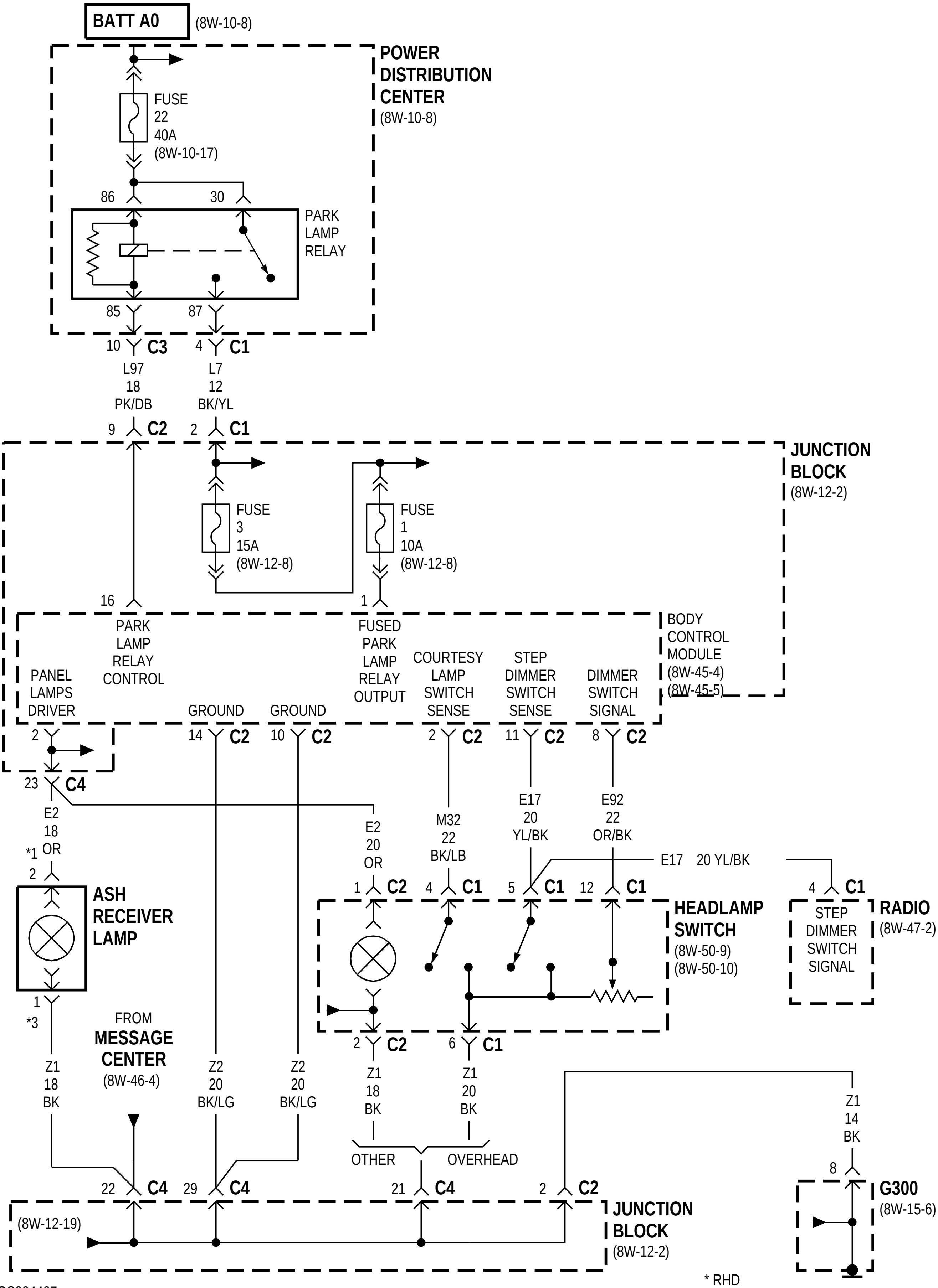
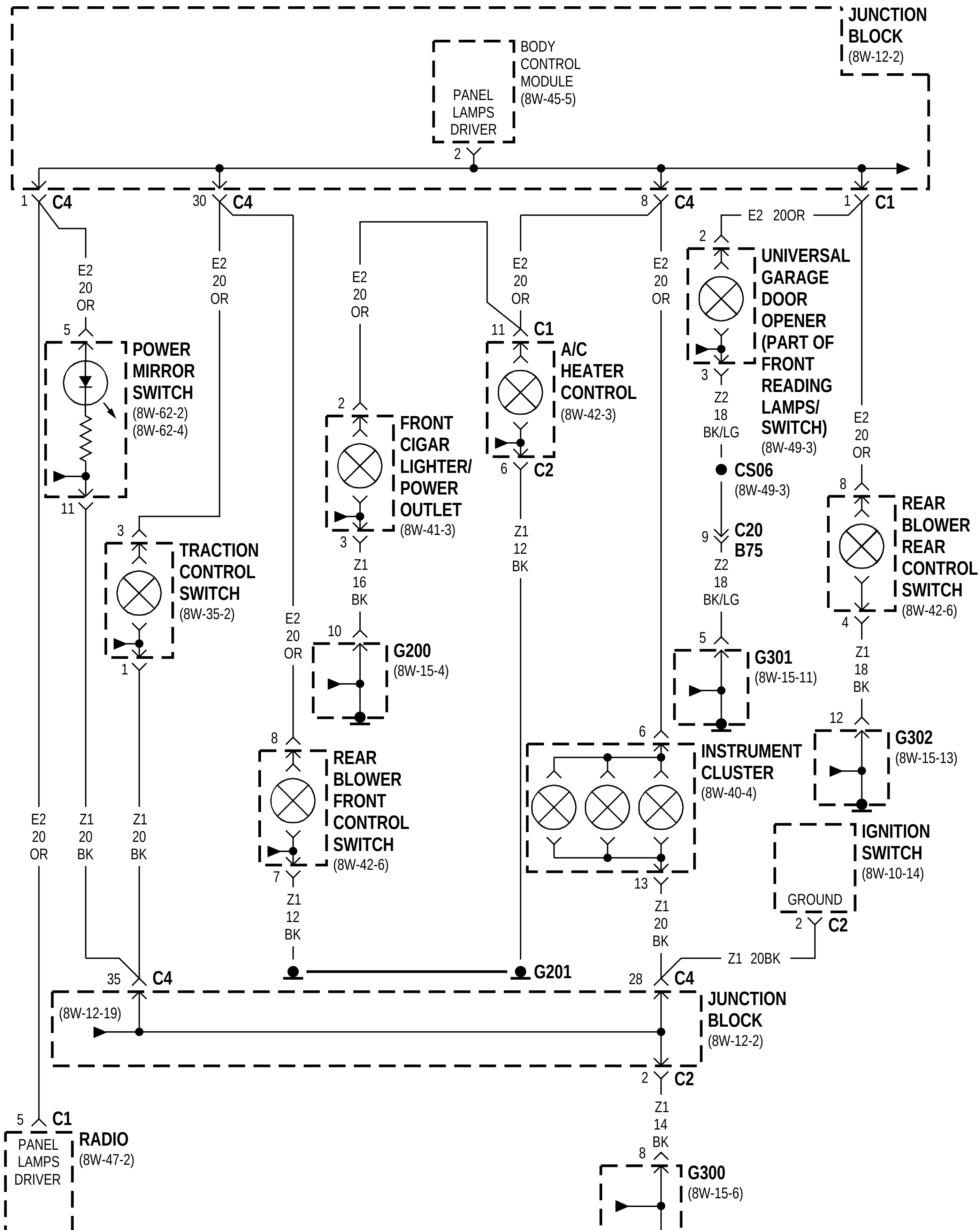

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 18 15A
(8W-10-20)
2 C2
F41 20 PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
86
30
COURTESY LAMP RELAY
(8W-44-2)
85
87
D4
19 C2
F41 20 PK/VT
2 B75 C20
F41 20 PK/VT
22 C2
M113 20 LB/PK
4 B75 C20
6 C2
M11 20 PK/LB
3 B17 LJ01
3 J02A L15
CS1
CS01
CS02 (OVERHEAD CONSOLE)
(8W-10-20)
LEFT MID READING LAMP
RIGHT MID READING LAMP
LEFT REAR READING LAMP
RIGHT REAR READING LAMP
REAR DOME LAMP
CENTER DOME LAMP
LEFT LIFTGATE FLOOD LAMP
RIGHT LIFTGATE FLOOD LAMP
M11 20 PK/LB
M20 20 BR
M2 20 BR
CS03
1 C20 B75
M2 20BR
5 B23 P18
80 C1
COURTESY LAMP GROUND
BODY CONTROL MODULE
(8W-45-8)
2
GLOVE BOX LAMP
(8W-44-2)
Z1 20 BK
G400
(8W-15-14)
J988W-3
GS004404

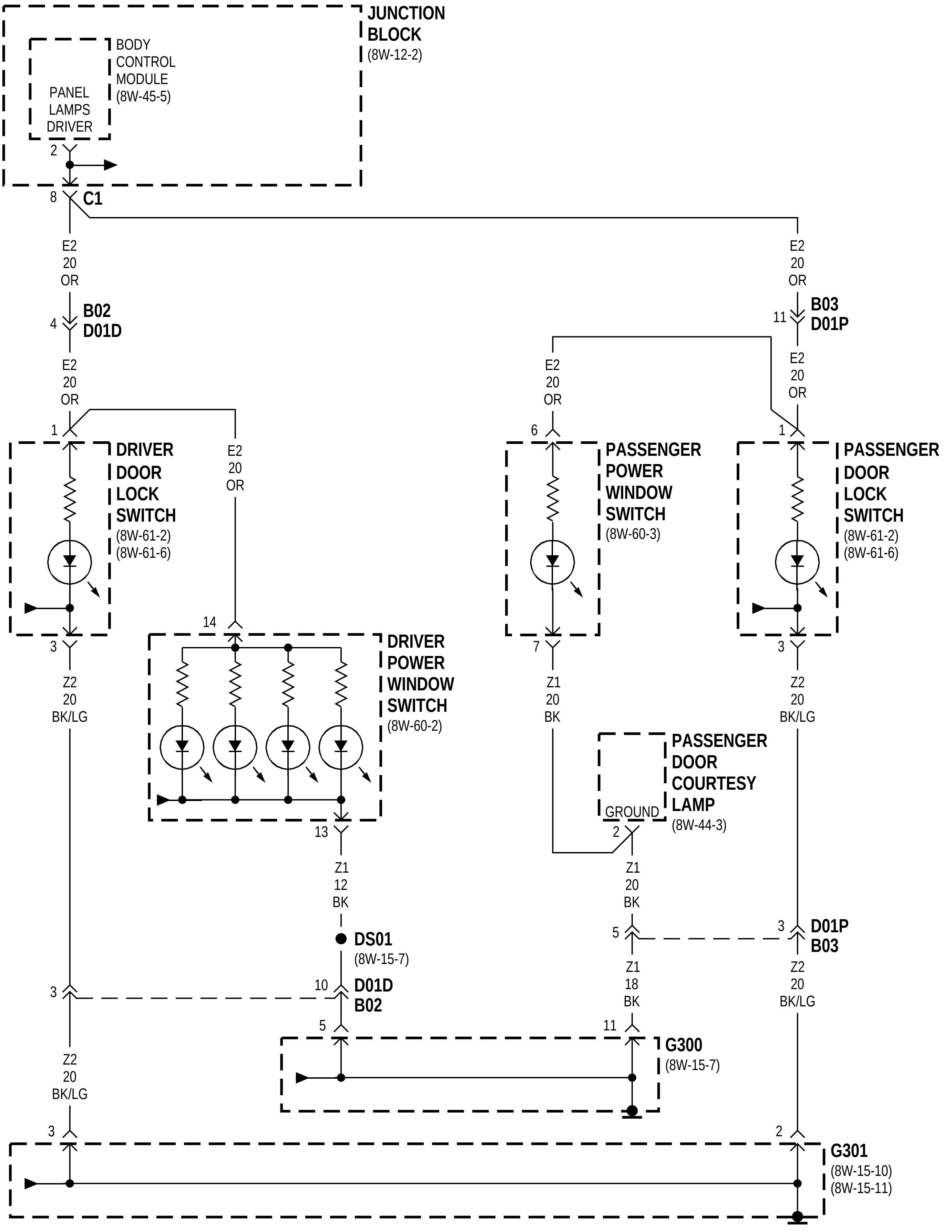

BODY CONTROL MODULE
(8W-45-7)
(8W-45-8)
HOOD AJAR SWITCH SENSE
DRIVER DOOR AJAR SWITCH SENSE
LEFT REAR DOOR AJAR SWITCH SENSE
PASSENGER DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
LIFTGATE AJAR SWITCH SENSE
43 C1
79 C1
47 C1
48 C1
77 C1
59 C1
G70 18 BR/TN
G75 18 TN
G77 18 TN/OR
G74 18 TN/RD
G76 18 TN/YL
G78 18 TN/BK
4 B17 LJ01
G78 18 TN/BK
4 J03A L16
G78 18 TN/BK
PASSENGER DOOR AJAR SWITCH
2
LEFT REAR DOOR AJAR SWITCH
1
3
LIFTGATE AJAR SWITCH
1
Z1 20 BK
11
G400
(8W-15-14)
DRIVER DOOR AJAR SWITCH
1
HOOD AJAR SWITCH
2
2
RIGHT REAR DOOR AJAR SWITCH
1
Z1 18 BK
Z1 18 BK
Z1 18 BK
12
G301
(8W-15-10)
8
14
G302
(8W-15-13)


ST-RUN A21
(8W-10-16)
RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE
6
20A
(8W-12-9)
FUSE
12
10A
(8W-12-12)
AUTOMATIC HEADLAMP SIGNAL
BODY CONTROL MODULE
(8W-45-8)
51 C1
14 C1
18 C2
L24
20
WT/LG
V23
18
BR/PK
F20
20
WT
EATX
MTX
18
11 B75
C20
CS04
(8W-12-9)
F20
20
WT
DIESEL
GAS
5 B33
E36
5 B33
E120
5 B33
E36
F20
18
WT
6
1 C19
EC1
7
1
AUTOMATIC HEADLAMP SIGNAL
FUSED IGNITION (ST-RUN)
AUTOMATIC DAY/NIGHT MIRROR
POWER MIRROR B(-)
POWER MIRROR B(-)
GROUND
BACK-UP LAMP FEED
TRANSMISSION RANGE SENSOR
(8W-31-3)
R
BACK-UP SWITCH
4
5
2
3
6
2
P112
20
YL/WT
P114
20
YL/BK
Z1
20
BK
L1
20
VT/BK
L1
18
VT/BK
EC1
C19
10 E120
B33
10 E36
B33
19
20 C20
B75
10 E36
B33
A20
20
A18
18
B23
P34
12
13 C20
B75
L1
20
VT/BK
BS02
(8W-70-2)
6 C1
4 C2
POWER MIRROR B(-)
DRIVER POWER MIRROR
(8W-62-6)
14
G300
(8W-15-5)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
22
40A
(8W-10-17)
86
30
PARK
LAMP
RELAY
85
87
10 C3
4 C1
L97
18
PK/DB
L7
12
BK/YL
9 C2
2 C1
JUNCTION
BLOCK
(8W-12-2)
FUSE
3
15A
(8W-12-8)
FUSE
1
10A
(8W-12-8)
16
1
PARK
LAMP
RELAY
CONTROL
FUSED
PARK
LAMP
RELAY
OUTPUT
BODY
CONTROL
MODULE
(8W-45-4)
(8W-45-5)
PANEL
LAMPS
DRIVER
GROUND
GROUND
COURTESY
LAMP
SWITCH
SENSE
STEP
DIMMER
SWITCH
SENSE
DIMMER
SWITCH
SIGNAL
2
14 C2
10 C2
2 C2
11 C2
8 C2
23 C4
E2
18
OR
*1
2
E2
20
OR
M32
22
BK/LB
E17
20
YL/BK
E92
22
OR/BK
E17 20 YL/BK
1 C2
4 C1
5 C1
12 C1
4 C1
ASH
RECEIVER
LAMP
HEADLAMP
SWITCH
(8W-50-9)
(8W-50-10)
STEP
DIMMER
SWITCH
SIGNAL
RADIO
(8W-47-2)
1
*3
FROM
MESSAGE
CENTER
(8W-46-4)
2 C2
6 C1
Z1
18
BK
Z2
20
BK/LG
Z2
20
BK/LG
Z1
18
BK
Z1
20
BK
Z1
14
BK
OTHER
OVERHEAD
8
22 C4
29 C4
21 C4
2 C2
G300
(8W-15-6)
(8W-12-19)
JUNCTION
BLOCK
(8W-12-2)
* RHD



JUNCTION BLOCK (8W-12-2)
BODY CONTROL MODULE (8W-45-5)
PANEL LAMPS DRIVER
2
1 C4
30 C4
8 C4
1 C1
E2 20OR
E2 20 OR
5
POWER MIRROR SWITCH (8W-62-2) (8W-62-4)
11
3
TRACTION CONTROL SWITCH (8W-35-2)
1
2
FRONT CIGAR LIGHTER/ POWER OUTLET (8W-41-3)
3
Z1 16 BK
10
G200 (8W-15-4)
11 C1
A/C HEATER CONTROL (8W-42-3)
6 C2
Z1 12 BK
UNIVERSAL GARAGE DOOR OPENER (PART OF FRONT READING LAMPS/ SWITCH) (8W-49-3)
Z2 18 BK/LG
CS06 (8W-49-3)
9 C20 B75
5
G301 (8W-15-11)
8
REAR BLOWER REAR CONTROL SWITCH (8W-42-6)
4
Z1 18 BK
12
G302 (8W-15-13)
8
REAR BLOWER FRONT CONTROL SWITCH (8W-42-6)
7
Z1 12 BK
6
INSTRUMENT CLUSTER (8W-40-4)
13
Z1 20 BK
IGNITION SWITCH (8W-10-14)
GROUND
2 C2
Z1 20BK
G201
35 C4
28 C4
(8W-12-19)
JUNCTION BLOCK (8W-12-2)
2 C2
Z1 14 BK
8
G300 (8W-15-6)
5 C1
RADIO (8W-47-2)
PANEL LAMPS DRIVER


JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-5)
PANEL LAMPS DRIVER
2
8
C1
E2
20
OR
4
B02
D01D
E2
20
OR
11
B03
D01P
1
DRIVER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
E2
20
OR
6
PASSENGER POWER WINDOW SWITCH
(8W-60-3)
1
PASSENGER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
14
DRIVER POWER WINDOW SWITCH
(8W-60-2)
3
Z2
20
BK/LG
7
Z1
20
BK
PASSENGER DOOR COURTESY LAMP
(8W-44-3)
GROUND
2
13
Z1
12
BK
DS01
(8W-15-7)
Z1
20
BK
5
3
D01P
B03
Z1
18
BK
3
10
D01D
B02
5
11
G300
(8W-15-7)
Z2
20
BK/LG
3
2
G301
(8W-15-10)
(8W-15-11)

8W-45 BODY CONTROL MODULE

Component **Page**

A/C Heater Control 8W-45-5, 6
Ash Receiver Lamp .8W-45-5
Automatic Day/Night Mirror 8W-45-8
Back-Up Switch. 8W-45-9
Battery 8W-45-9
Body Control Module . .8W-45-2, 3, 4, 5, 6, 7, 8, 9, 10
BS02 . . . . .8W-45-9
BS10 . . . . .8W-45-8
BS30 . . . . .8W-45-9
Clockspring 8W-45-3
Combination Flasher/DRL Module 8W-45-5
Controller Anti-Lock Brake 8W-45-6
CS03 . . . . .8W-45-8
Data Link Connector 8W-45-3
Door Lock Relay 8W-45-7
Door Unlock Relay .8W-45-7
Driver Door Ajar Switch 8W-45-7
Driver Door Arm/Disarm Switch 8W-45-8
Driver Door Lock Switch 8W-45-6, 8
Driver Door Unlock Relay 8W-45-7
Driver Power Mirror 8W-45-10
Driver Power Window Switch 8W-45-6
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Engine Oil Pressure Switch. 8W-45-7
ES01 . . . . .8W-45-9
ES02 . . . . .8W-45-9
Front Cigar Lighter/Power Outlet 8W-45-5
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Fuel Tank Module 8W-45-7, 9
Fuse 1 (JB) 8W-45-3
Fuse 2 (JB) 8W-45-2
Fuse 3 (JB) 8W-45-3
Fuse 6 (JB) 8W-45-2
Fuse 19 (PDC). 8W-45-4
Fuse 22 (PDC). 8W-45-3
Fuse 28 (PDC). 8W-45-2
G100 . . . . .8W-45-9
G103 . . . . .8W-45-9
G300 . . . . .8W-45-2, 10
G302 . . . . .8W-45-9
Glove Box Lamp 8W-45-8
Headlamp Dimmer Switch 8W-45-5
Headlamp Switch 8W-45-2, 3, 4, 5
Hood Ajar Switch 8W-45-7
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HVAC Control 8W-45-6
Ignition Switch 8W-45-2, 5
Instrument Cluster .8W-45-5
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Key-In Halo Lamp. 8W-45-10

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Left Mid Reading Lamp 8W-45-8
Left Rear Door Ajar Switch 8W-45-8
Left Rear Reading Lamp 8W-45-8
Left Visor/Vanity Mirror Lamps 8W-45-8
Liftgate Ajar Switch 8W-45-7
Liftgate Arm/Disarm Switch 8W-45-6
LJ01 B17. . . . . .8W-45-4, 6
Low Beam Relay 8W-45-5
Low Coolant Level Switch 8W-45-9
Low Washer Fluid Switch 8W-45-3
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Message Center .8W-45-5, 6
Park Lamp Relay 8W-45-3
Passenger Door Ajar Switch 8W-45-7
Passenger Door Arm/Disarm Switch 8W-45-8
Passenger Door Lock Switch 8W-45-6, 8
Passenger Power Mirror 8W-45-10
Passenger Power Window Switch 8W-45-6
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Power Mirror Switch 8W-45-5
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PS02 . . . . .8W-45-3
PTC 3 (JB) 8W-45-7
Radio. 8W-45-4, 5
Rear Blower Front Control Switch 8W-45-5
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Rear Washer Motor .8W-45-4
Rear Wiper Motor 8W-45-4
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Right Rear Reading Lamp. 8W-45-8
Right Visor/Vanity Mirror Lamps 8W-45-8
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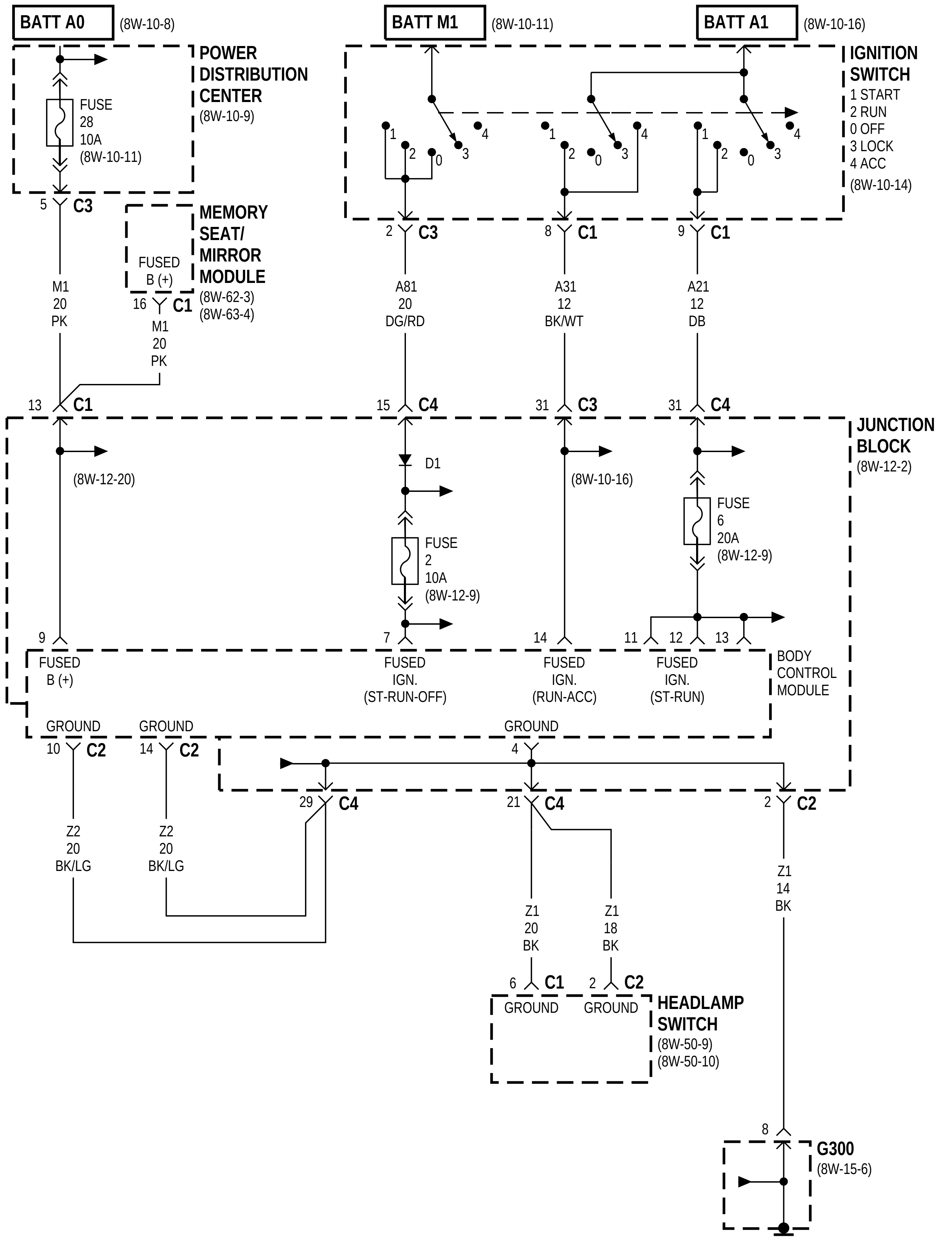
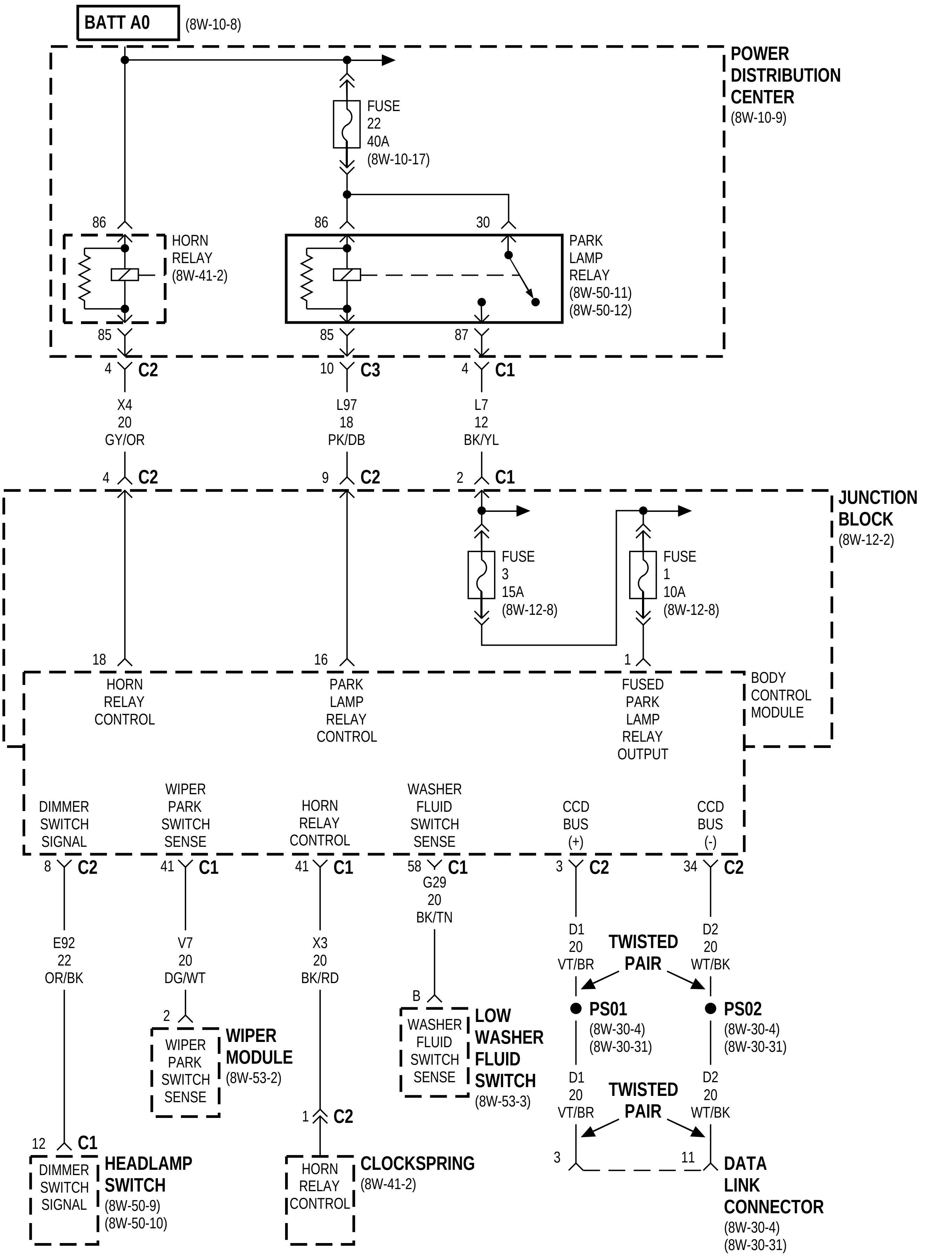
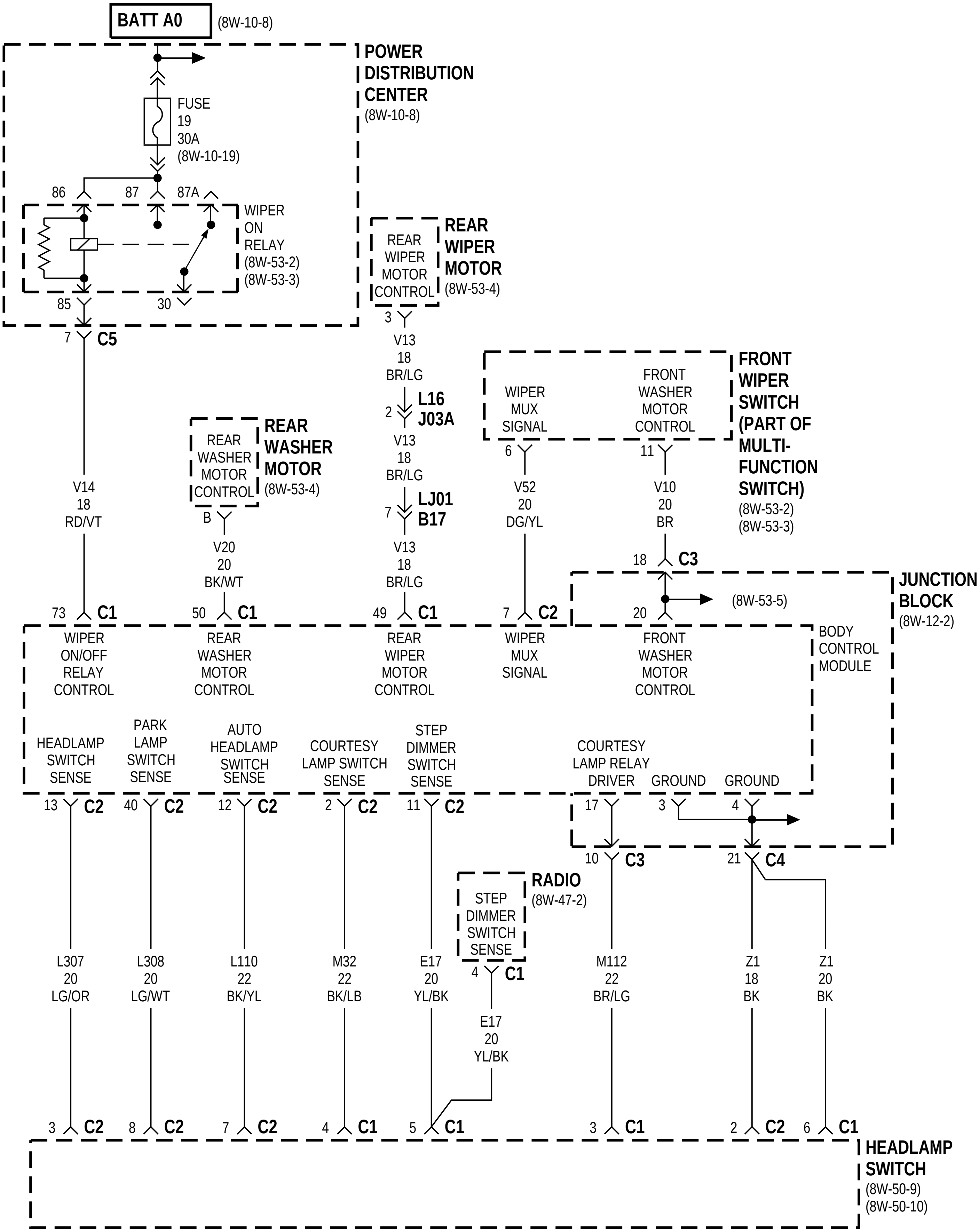
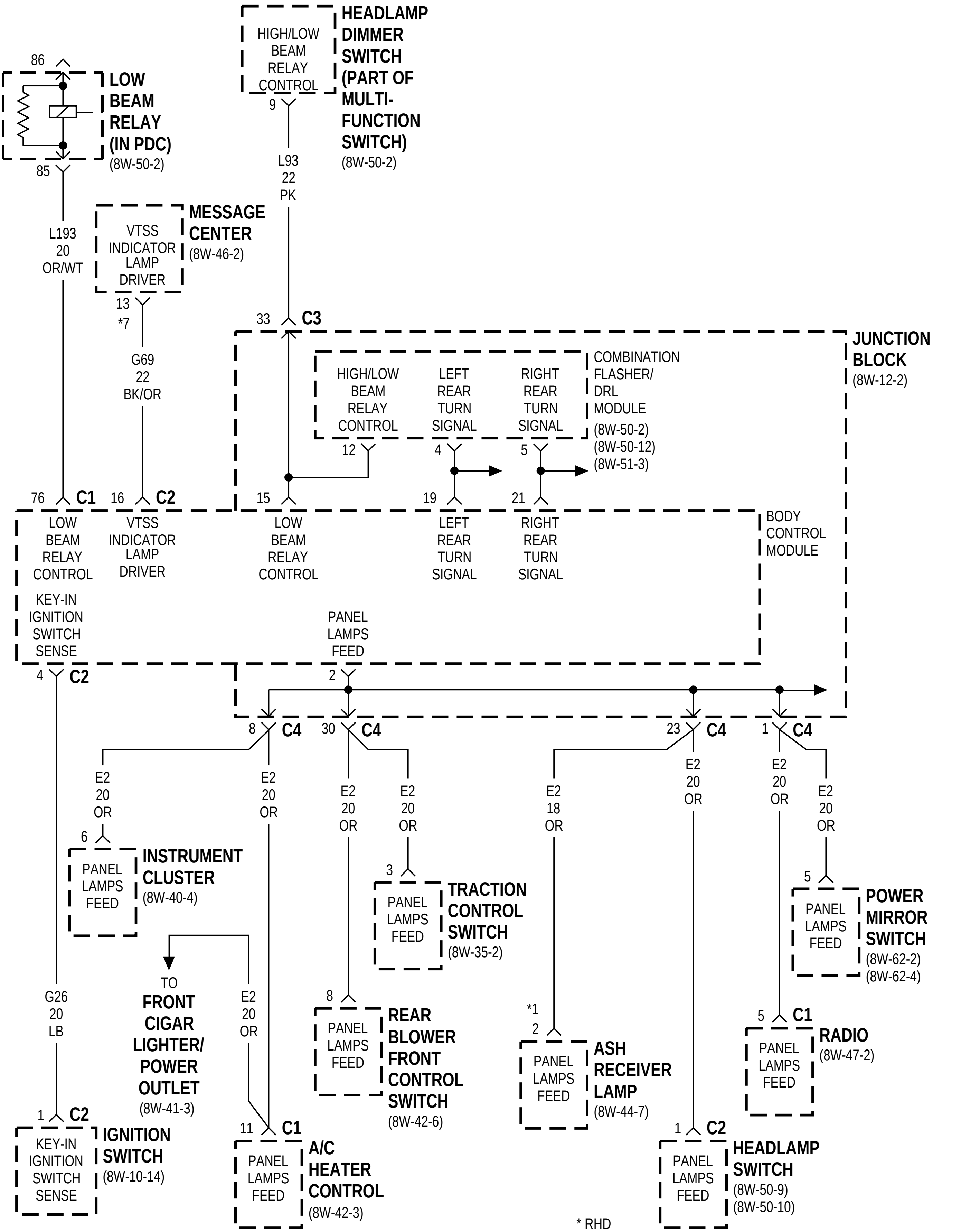
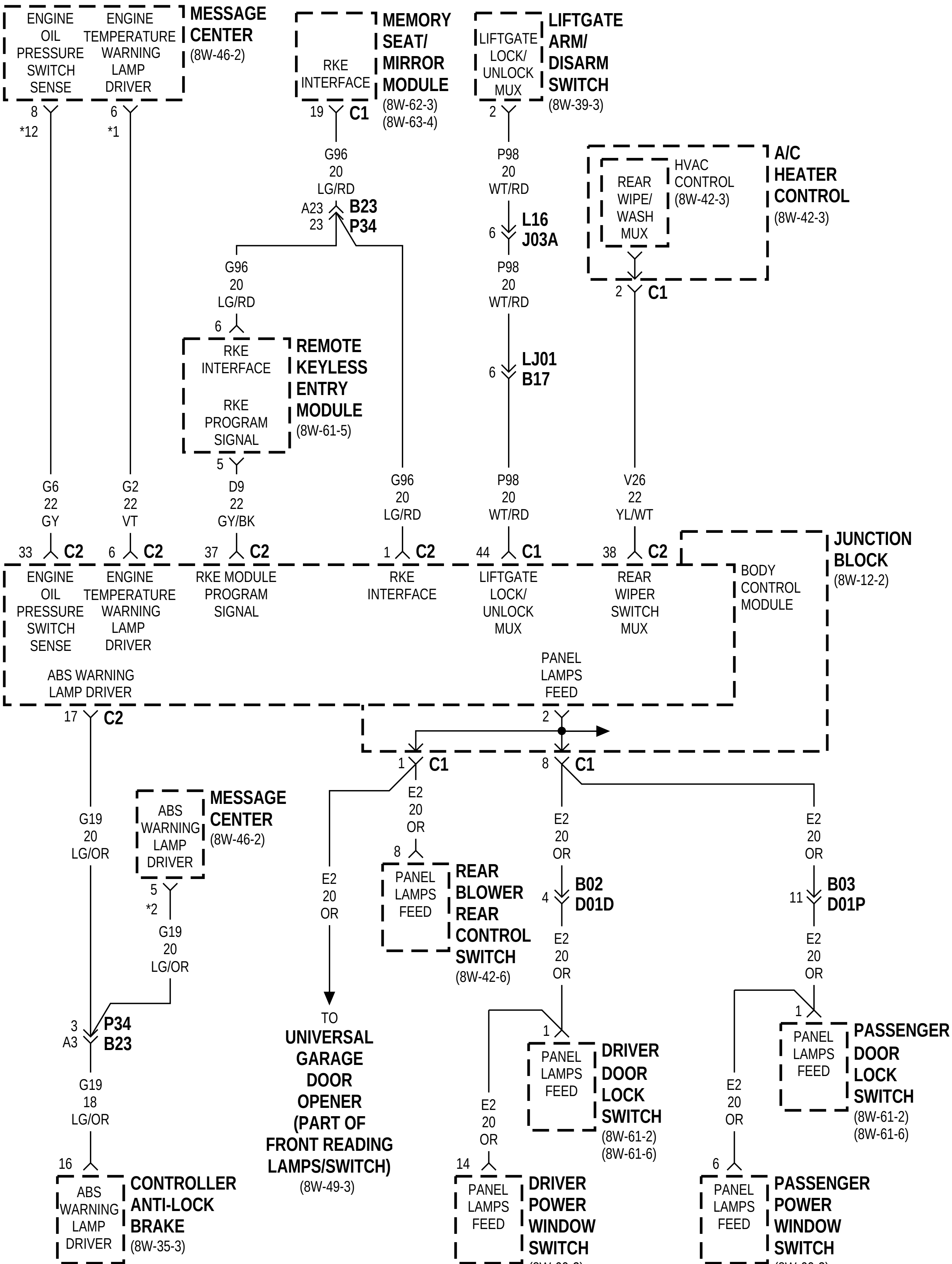
Traction Control Switch. 8W-45-5
Universal Garage Door Opener 8W-45-6
Wiper Module 8W-45-3
Wiper On Relay. 8W-45-4


BATT A0
(8W-10-8)
BATT M1
(8W-10-11)
BATT A1
(8W-10-16)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
28
10A
(8W-10-11)
IGNITION
SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-14)
5 C3
MEMORY
SEAT/
MIRROR
MODULE
(8W-62-3)
(8W-63-4)
FUSED
B (+)
16 C1
2 C3
8 C1
9 C1
M1
20
PK
A81
20
DG/RD
A31
12
BK/WT
A21
12
DB
13 C1
15 C4
31 C3
31 C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-20)
D1
(8W-10-16)
FUSE
6
20A
(8W-12-9)
FUSE
2
10A
(8W-12-9)
9
7
14
11
12
13
FUSED
B (+)
FUSED
IGN.
(ST-RUN-OFF)
FUSED
IGN.
(RUN-ACC)
FUSED
IGN.
(ST-RUN)
BODY
CONTROL
MODULE
GROUND
GROUND
GROUND
10 C2
14 C2
4
29 C4
21 C4
2 C2
Z2
20
BK/LG
Z1
14
BK
Z1
20
BK
Z1
18
BK
6 C1
2 C2
HEADLAMP
SWITCH
(8W-50-9)
(8W-50-10)
8
G300
(8W-15-6)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
22
40A
(8W-10-17)
86
30
HORN
RELAY
(8W-41-2)
PARK
LAMP
RELAY
(8W-50-11)
(8W-50-12)
85
87
4 C2
10 C3
4 C1
X4
20
GY/OR
L97
18
PK/DB
L7
12
BK/YL
4 C2
9 C2
2 C1
JUNCTION
BLOCK
(8W-12-2)
FUSE
3
15A
(8W-12-8)
FUSE
1
10A
(8W-12-8)
18
16
1
HORN
RELAY
CONTROL
PARK
LAMP
RELAY
CONTROL
FUSED
PARK
LAMP
RELAY
OUTPUT
BODY
CONTROL
MODULE
DIMMER
SWITCH
SIGNAL
WIPER
PARK
SWITCH
SENSE
HORN
RELAY
CONTROL
WASHER
FLUID
SWITCH
SENSE
CCD
BUS
(+)
CCD
BUS
(-)
8 C2
41 C1
41 C1
58 C1
3 C2
34 C2
G29
20
BK/TN
E92
22
OR/BK
V7
20
DG/WT
X3
20
BK/RD
D1
20
VT/BR
TWISTED
PAIR
D2
20
WT/BK
B
2
WIPER
PARK
SWITCH
SENSE
WIPER
MODULE
(8W-53-2)
WASHER
FLUID
SWITCH
SENSE
LOW
WASHER
FLUID
SWITCH
(8W-53-3)
PS01
(8W-30-4)
(8W-30-31)
PS02
(8W-30-4)
(8W-30-31)
D1
20
VT/BR
TWISTED
PAIR
D2
20
WT/BK
1 C2
12 C1
DIMMER
SWITCH
SIGNAL
HEADLAMP
SWITCH
(8W-50-9)
(8W-50-10)
HORN
RELAY
CONTROL
CLOCKSPRING
(8W-41-2)
3
11
DATA
LINK
CONNECTOR
(8W-30-4)
(8W-30-31)

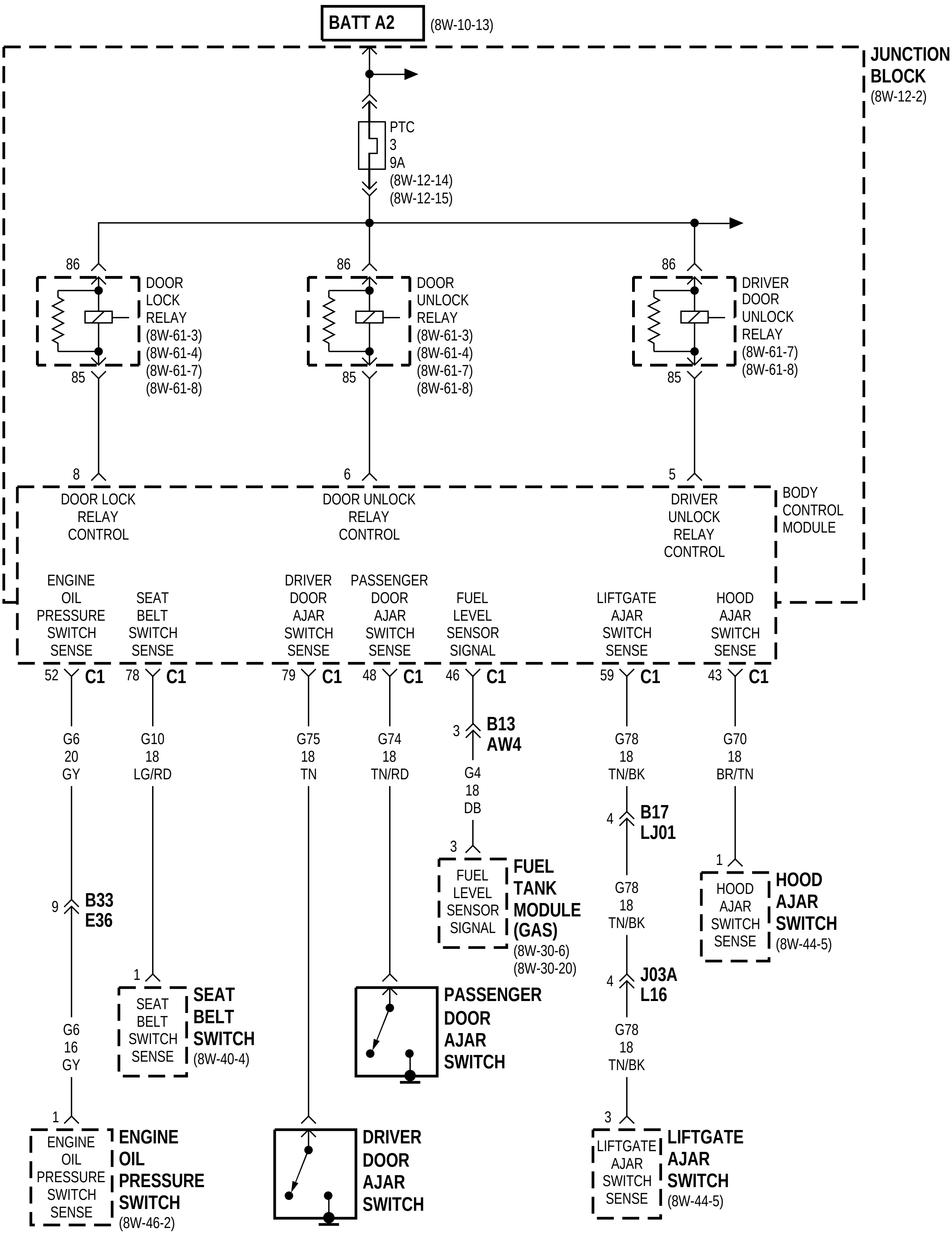

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 19 30A
(8W-10-19)
86
87
87A
WIPER ON RELAY
(8W-53-2)
(8W-53-3)
85
30
7 C5
REAR WIPER MOTOR CONTROL
REAR WIPER MOTOR
(8W-53-4)
3
V13 18 BR/LG
2 L16 J03A
V13 18 BR/LG
7 LJ01 B17
V13 18 BR/LG
WIPER MUX SIGNAL
FRONT WASHER MOTOR CONTROL
FRONT WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-53-2)
(8W-53-3)
6
11
V52 20 DG/YL
V10 20 BR
18 C3
REAR WASHER MOTOR CONTROL
REAR WASHER MOTOR
(8W-53-4)
B
V20 20 BK/WT
V14 18 RD/VT
JUNCTION BLOCK
(8W-12-2)
(8W-53-5)
73 C1
50 C1
49 C1
7 C2
20
WIPER ON/OFF RELAY CONTROL
REAR WASHER MOTOR CONTROL
REAR WIPER MOTOR CONTROL
WIPER MUX SIGNAL
FRONT WASHER MOTOR CONTROL
BODY CONTROL MODULE
HEADLAMP SWITCH SENSE
PARK LAMP SWITCH SENSE
AUTO HEADLAMP SWITCH SENSE
COURTESY LAMP SWITCH SENSE
STEP DIMMER SWITCH SENSE
COURTESY LAMP RELAY DRIVER
GROUND
GROUND
13 C2
40 C2
12 C2
2 C2
11 C2
17
3
4
10 C3
21 C4
STEP DIMMER SWITCH SENSE
RADIO
(8W-47-2)
4 C1
L307 20 LG/OR
L308 20 LG/WT
L110 22 BK/YL
M32 22 BK/LB
E17 20 YL/BK
E17 20 YL/BK
M112 22 BR/LG
Z1 18 BK
Z1 20 BK
3 C2
8 C2
7 C2
4 C1
5 C1
3 C1
2 C2
6 C1
HEADLAMP SWITCH
(8W-50-9)
(8W-50-10)

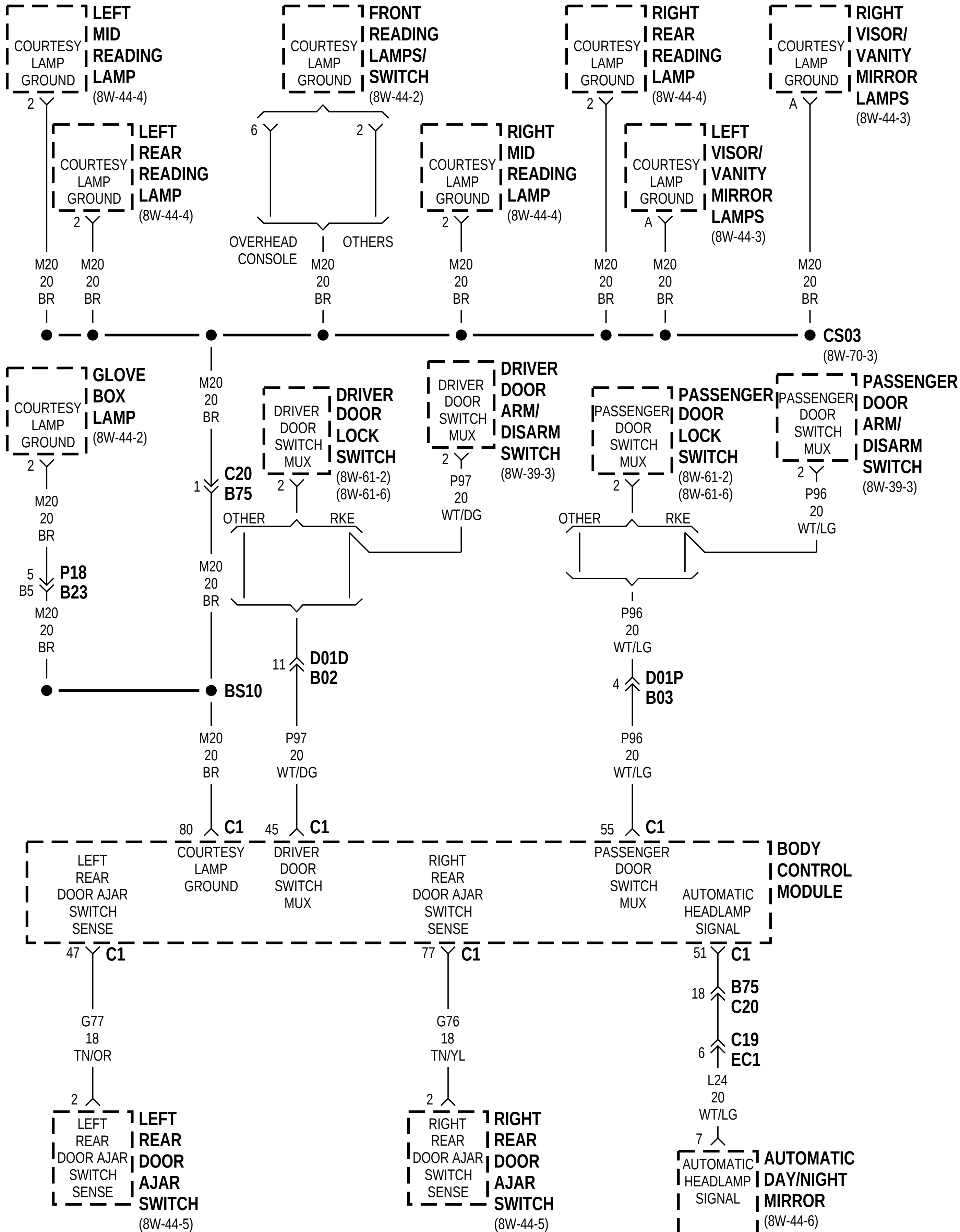

HEADLAMP DIMMER SWITCH (PART OF MULTI-FUNCTION SWITCH) (8W-50-2)
HIGH/LOW BEAM RELAY CONTROL
LOW BEAM RELAY (IN PDC) (8W-50-2)
86
85
9
L93 22 PK
L193 20 OR/WT
MESSAGE CENTER (8W-46-2)
VTSS INDICATOR LAMP DRIVER
13
*7
G69 22 BK/OR
33 C3
JUNCTION BLOCK (8W-12-2)
COMBINATION FLASHER/ DRL MODULE (8W-50-2) (8W-50-12) (8W-51-3)
HIGH/LOW BEAM RELAY CONTROL
LEFT REAR TURN SIGNAL
RIGHT REAR TURN SIGNAL
12
4
5
76 C1
16 C2
15
19
21
BODY CONTROL MODULE
LOW BEAM RELAY CONTROL
VTSS INDICATOR LAMP DRIVER
KEY-IN IGNITION SWITCH SENSE
PANEL LAMPS FEED
4 C2
2
8 C4
30 C4
23 C4
1 C4
E2 20 OR
E2 18 OR
6
INSTRUMENT CLUSTER (8W-40-4)
3
TRACTION CONTROL SWITCH (8W-35-2)
5
POWER MIRROR SWITCH (8W-62-2) (8W-62-4)
G26 20 LB
TO FRONT CIGAR LIGHTER/ POWER OUTLET (8W-41-3)
8
REAR BLOWER FRONT CONTROL SWITCH (8W-42-6)
*1
2
ASH RECEIVER LAMP (8W-44-7)
5 C1
RADIO (8W-47-2)
1 C2
IGNITION SWITCH (8W-10-14)
11 C1
A/C HEATER CONTROL (8W-42-3)
HEADLAMP SWITCH (8W-50-9) (8W-50-10)
* RHD

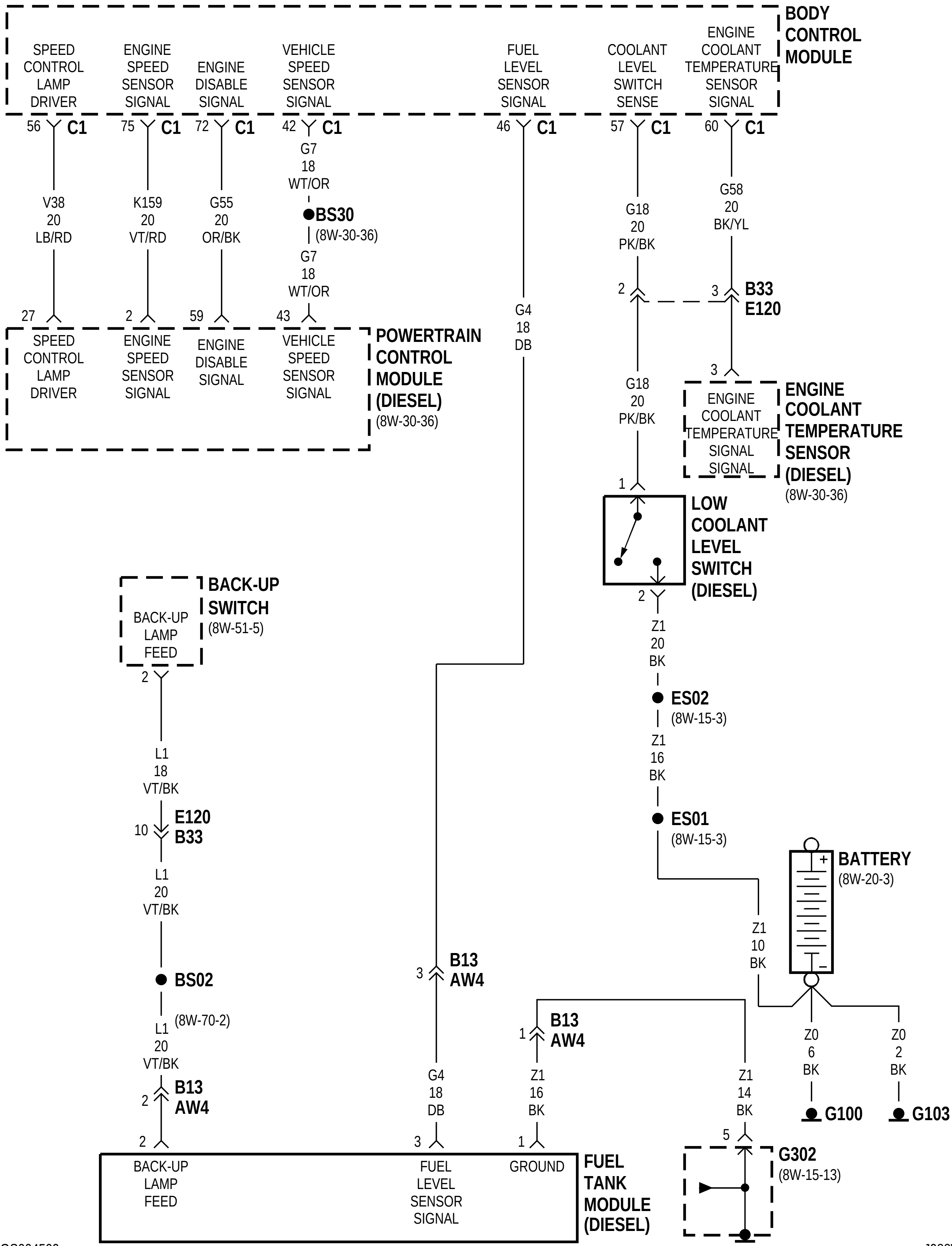


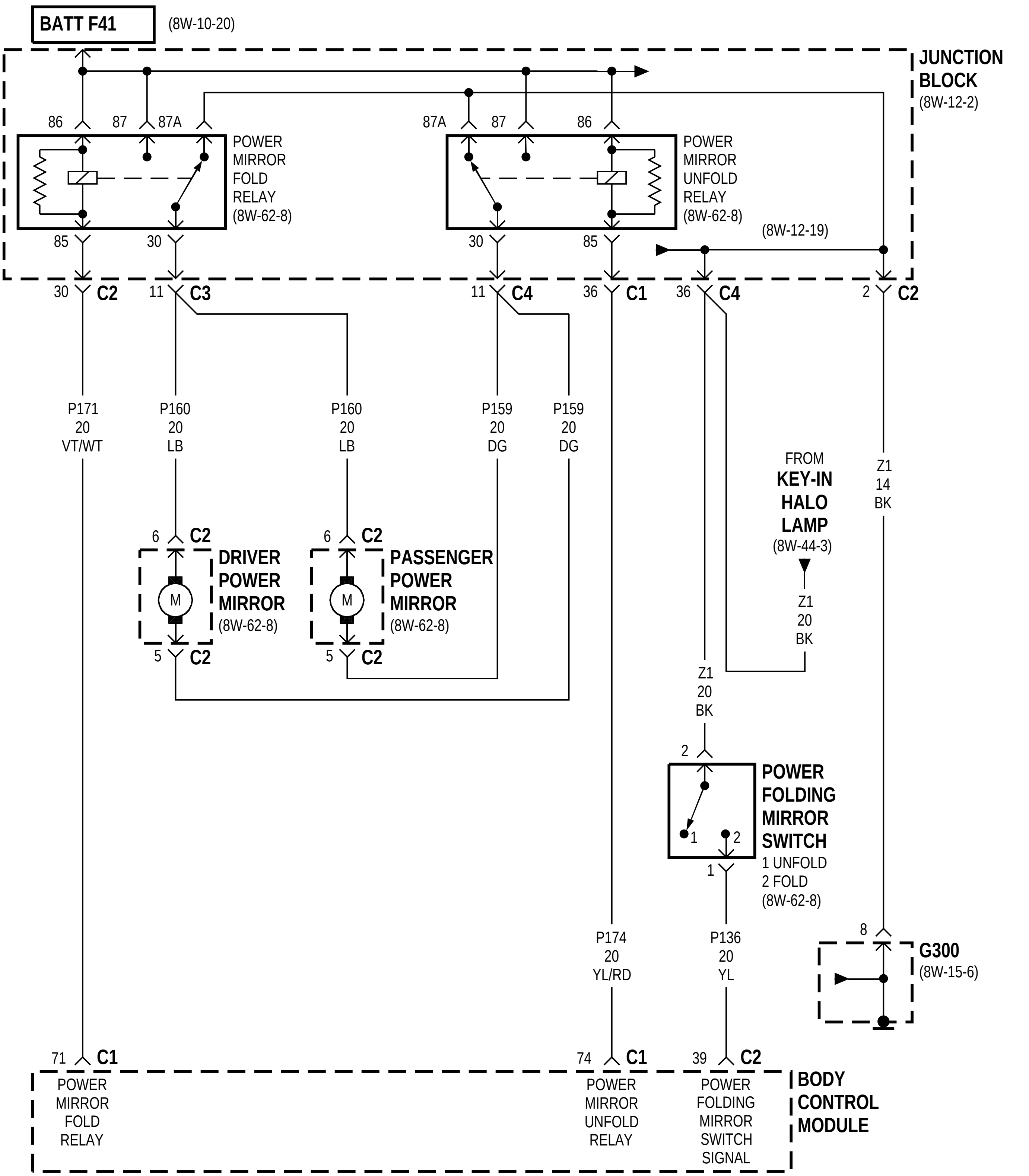
ENGINE OIL PRESSURE SWITCH SENSE
ENGINE TEMPERATURE WARNING LAMP DRIVER
MESSAGE CENTER
(8W-46-2)
8
*12
6
*1
RKE INTERFACE
19
C1
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
(8W-63-4)
LIFTGATE LOCK/ UNLOCK MUX
2
LIFTGATE ARM/ DISARM SWITCH
(8W-39-3)
G96 20 LG/RD
A23 23
B23 P34
P98 20 WT/RD
L16 J03A
6
A/C HEATER CONTROL
(8W-42-3)
REAR WIPE/ WASH MUX
HVAC CONTROL
(8W-42-3)
2
C1
G96 20 LG/RD
6
RKE INTERFACE
RKE PROGRAM SIGNAL
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
5
LJ01 B17
G6 22 GY
G2 22 VT
D9 22 GY/BK
G96 20 LG/RD
P98 20 WT/RD
V26 22 YL/WT
33 C2
6 C2
37 C2
1 C2
44 C1
38 C2
JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
ENGINE OIL PRESSURE SWITCH SENSE
ENGINE TEMPERATURE WARNING LAMP DRIVER
RKE MODULE PROGRAM SIGNAL
RKE INTERFACE
LIFTGATE LOCK/ UNLOCK MUX
REAR WIPER SWITCH MUX
ABS WARNING LAMP DRIVER
PANEL LAMPS FEED
17 C2
2
1 C1
8 C1
G19 20 LG/OR
ABS WARNING LAMP DRIVER
MESSAGE CENTER
(8W-46-2)
5
*2
G19 20 LG/OR
E2 20 OR
8
PANEL LAMPS FEED
REAR BLOWER REAR CONTROL SWITCH
(8W-42-6)
B02 D01D
4
B03 D01P
11
3
A3
P34 B23
G19 18 LG/OR
TO UNIVERSAL GARAGE DOOR OPENER (PART OF FRONT READING LAMPS/SWITCH)
(8W-49-3)
1
PANEL LAMPS FEED
DRIVER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
PASSENGER DOOR LOCK SWITCH
(8W-61-2)
(8W-61-6)
16
ABS WARNING LAMP DRIVER
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
14
DRIVER POWER WINDOW SWITCH
(8W-60-2)
6
PASSENGER POWER WINDOW SWITCH
(8W-60-3)

* RHD


BATT A2
(8W-10-13)
JUNCTION
BLOCK
(8W-12-2)
PTC
3
9A
(8W-12-14)
(8W-12-15)
86
DOOR
LOCK
RELAY
(8W-61-3)
(8W-61-4)
(8W-61-7)
(8W-61-8)
85
86
DOOR
UNLOCK
RELAY
(8W-61-3)
(8W-61-4)
(8W-61-7)
(8W-61-8)
85
86
DRIVER
DOOR
UNLOCK
RELAY
(8W-61-7)
(8W-61-8)
85
8
DOOR LOCK
RELAY
CONTROL
6
DOOR UNLOCK
RELAY
CONTROL
5
DRIVER
UNLOCK
RELAY
CONTROL
BODY
CONTROL
MODULE
ENGINE
OIL
PRESSURE
SWITCH
SENSE
SEAT
BELT
SWITCH
SENSE
DRIVER
DOOR
AJAR
SWITCH
SENSE
PASSENGER
DOOR
AJAR
SWITCH
SENSE
FUEL
LEVEL
SENSOR
SIGNAL
LIFTGATE
AJAR
SWITCH
SENSE
HOOD
AJAR
SWITCH
SENSE
52 C1
78 C1
79 C1
48 C1
46 C1
59 C1
43 C1
G6
20
GY
G10
18
LG/RD
G75
18
TN
G74
18
TN/RD
3
B13
AW4
G4
18
DB
G78
18
TN/BK
G70
18
BR/TN
4
B17
LJ01
3
FUEL
LEVEL
SENSOR
SIGNAL
FUEL
TANK
MODULE
(GAS)
(8W-30-6)
(8W-30-20)
1
HOOD
AJAR
SWITCH
SENSE
HOOD
AJAR
SWITCH
(8W-44-5)
9
B33
E36
G78
18
TN/BK
1
SEAT
BELT
SWITCH
SENSE
SEAT
BELT
SWITCH
(8W-40-4)
PASSENGER
DOOR
AJAR
SWITCH
4
J03A
L16
G6
16
GY
G78
18
TN/BK
1
ENGINE
OIL
PRESSURE
SWITCH
SENSE
ENGINE
OIL
PRESSURE
SWITCH
(8W-46-2)
DRIVER
DOOR
AJAR
SWITCH
3
LIFTGATE
AJAR
SWITCH
SENSE
LIFTGATE
AJAR
SWITCH
(8W-44-5)


LEFT MID READING LAMP (8W-44-4)
COURTESY LAMP GROUND
FRONT READING LAMPS/ SWITCH (8W-44-2)
RIGHT REAR READING LAMP (8W-44-4)
RIGHT VISOR/ VANITY MIRROR LAMPS (8W-44-3)
LEFT REAR READING LAMP (8W-44-4)
RIGHT MID READING LAMP (8W-44-4)
LEFT VISOR/ VANITY MIRROR LAMPS (8W-44-3)
OVERHEAD CONSOLE
OTHERS
M20 20 BR
CS03 (8W-70-3)
GLOVE BOX LAMP (8W-44-2)
C20 B75
DRIVER DOOR SWITCH MUX
DRIVER DOOR LOCK SWITCH (8W-61-2) (8W-61-6)
DRIVER DOOR ARM/ DISARM SWITCH (8W-39-3)
PASSENGER DOOR SWITCH MUX
PASSENGER DOOR LOCK SWITCH (8W-61-2) (8W-61-6)
PASSENGER DOOR ARM/ DISARM SWITCH (8W-39-3)
P97 20 WT/DG
P96 20 WT/LG
OTHER
RKE
P18 B23
D01D B02
D01P B03
BS10
C1
BODY CONTROL MODULE
LEFT REAR DOOR AJAR SWITCH SENSE
COURTESY LAMP GROUND
DRIVER DOOR SWITCH MUX
RIGHT REAR DOOR AJAR SWITCH SENSE
PASSENGER DOOR SWITCH MUX
AUTOMATIC HEADLAMP SIGNAL
G77 18 TN/OR
G76 18 TN/YL
B75 C20
C19 EC1
L24 20 WT/LG
LEFT REAR DOOR AJAR SWITCH (8W-44-5)
RIGHT REAR DOOR AJAR SWITCH (8W-44-5)
AUTOMATIC DAY/NIGHT MIRROR (8W-44-6)


BODY CONTROL MODULE
SPEED CONTROL LAMP DRIVER
ENGINE SPEED SENSOR SIGNAL
ENGINE DISABLE SIGNAL
VEHICLE SPEED SENSOR SIGNAL
FUEL LEVEL SENSOR SIGNAL
COOLANT LEVEL SWITCH SENSE
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
56 C1
75 C1
72 C1
42 C1
46 C1
57 C1
60 C1
V38 20 LB/RD
K159 20 VT/RD
G55 20 OR/BK
G7 18 WT/OR
BS30 (8W-30-36)
G18 20 PK/BK
G58 20 BK/YL
B33 E120
G4 18 DB
27
2
59
43
POWERTRAIN CONTROL MODULE (DIESEL) (8W-30-36)
ENGINE COOLANT TEMPERATURE SENSOR (DIESEL) (8W-30-36)
ENGINE COOLANT TEMPERATURE SIGNAL SIGNAL
LOW COOLANT LEVEL SWITCH (DIESEL)
BACK-UP SWITCH (8W-51-5)
BACK-UP LAMP FEED
Z1 20 BK
ES02 (8W-15-3)
Z1 16 BK
ES01 (8W-15-3)
L1 18 VT/BK
E120 B33
L1 20 VT/BK
BS02 (8W-70-2)
B13 AW4
BATTERY (8W-20-3)
Z1 10 BK
Z1 16 BK
Z1 14 BK
Z0 6 BK
Z0 2 BK
G100
G103
G302 (8W-15-13)
BACK-UP LAMP FEED
FUEL LEVEL SENSOR SIGNAL
GROUND
FUEL TANK MODULE (DIESEL)


BATT F41
(8W-10-20)
JUNCTION
BLOCK
(8W-12-2)
86
87
87A
POWER
MIRROR
FOLD
RELAY
(8W-62-8)
85
30
87A
87
86
POWER
MIRROR
UNFOLD
RELAY
(8W-62-8)
30
85
(8W-12-19)
30 C2
11 C3
11 C4
36 C1
36 C4
2 C2
P171
20
VT/WT
P160
20
LB
P160
20
LB
P159
20
DG
P159
20
DG
FROM
KEY-IN
HALO
LAMP
(8W-44-3)
Z1
14
BK
6 C2
DRIVER
POWER
MIRROR
(8W-62-8)
5 C2
6 C2
PASSENGER
POWER
MIRROR
(8W-62-8)
5 C2
Z1
20
BK
Z1
20
BK
2
POWER
FOLDING
MIRROR
SWITCH
1 UNFOLD
2 FOLD
(8W-62-8)
1
P174
20
YL/RD
P136
20
YL
8
G300
(8W-15-6)
71 C1
74 C1
39 C2
POWER
MIRROR
FOLD
RELAY
POWER
MIRROR
UNFOLD
RELAY
POWER
FOLDING
MIRROR
SWITCH
SIGNAL
BODY
CONTROL
MODULE

8W-46 MESSAGE CENTER

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Airbag Control Module	8W-46-2
Airbag Warning Lamp	8W-46-2
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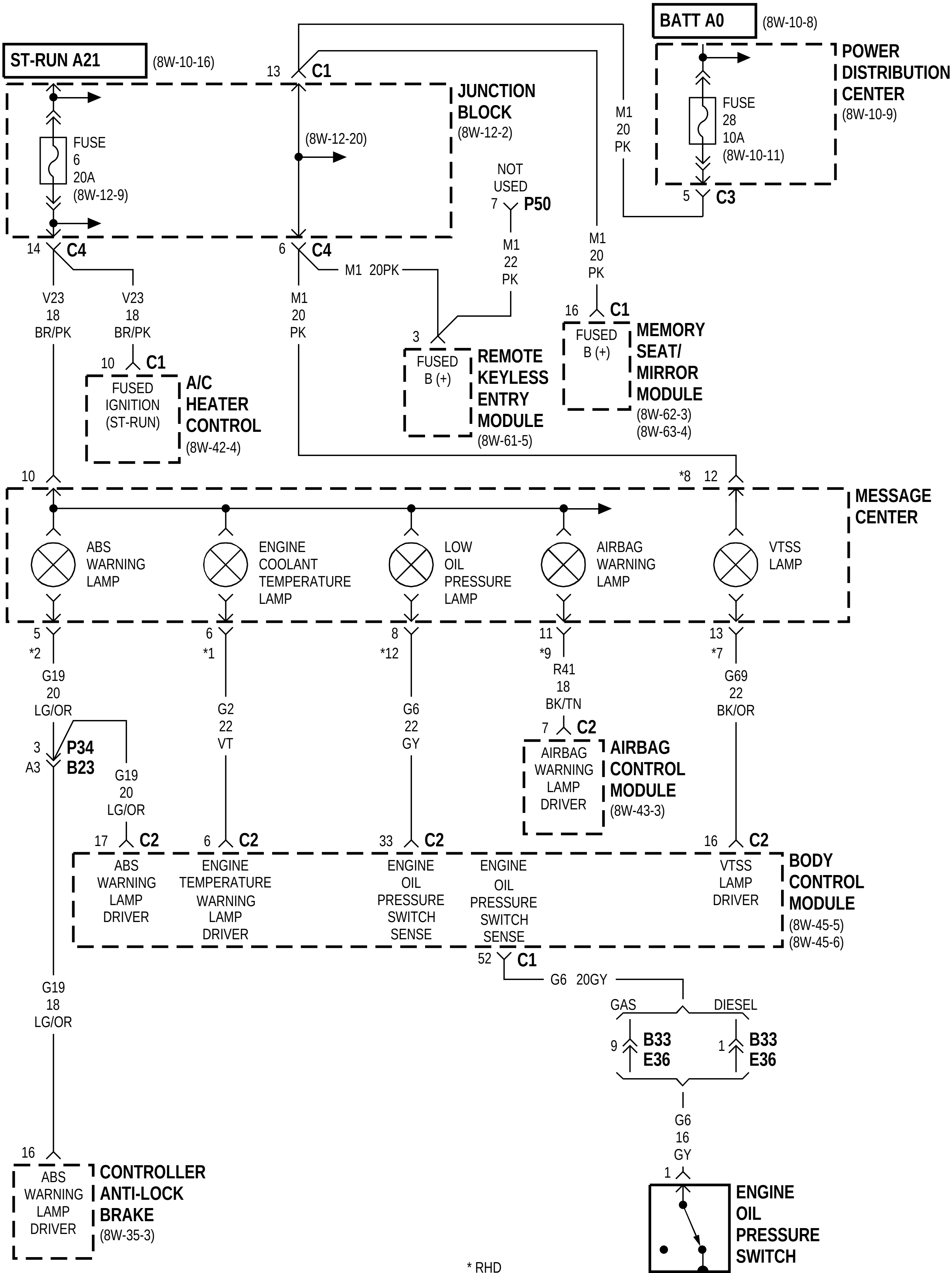
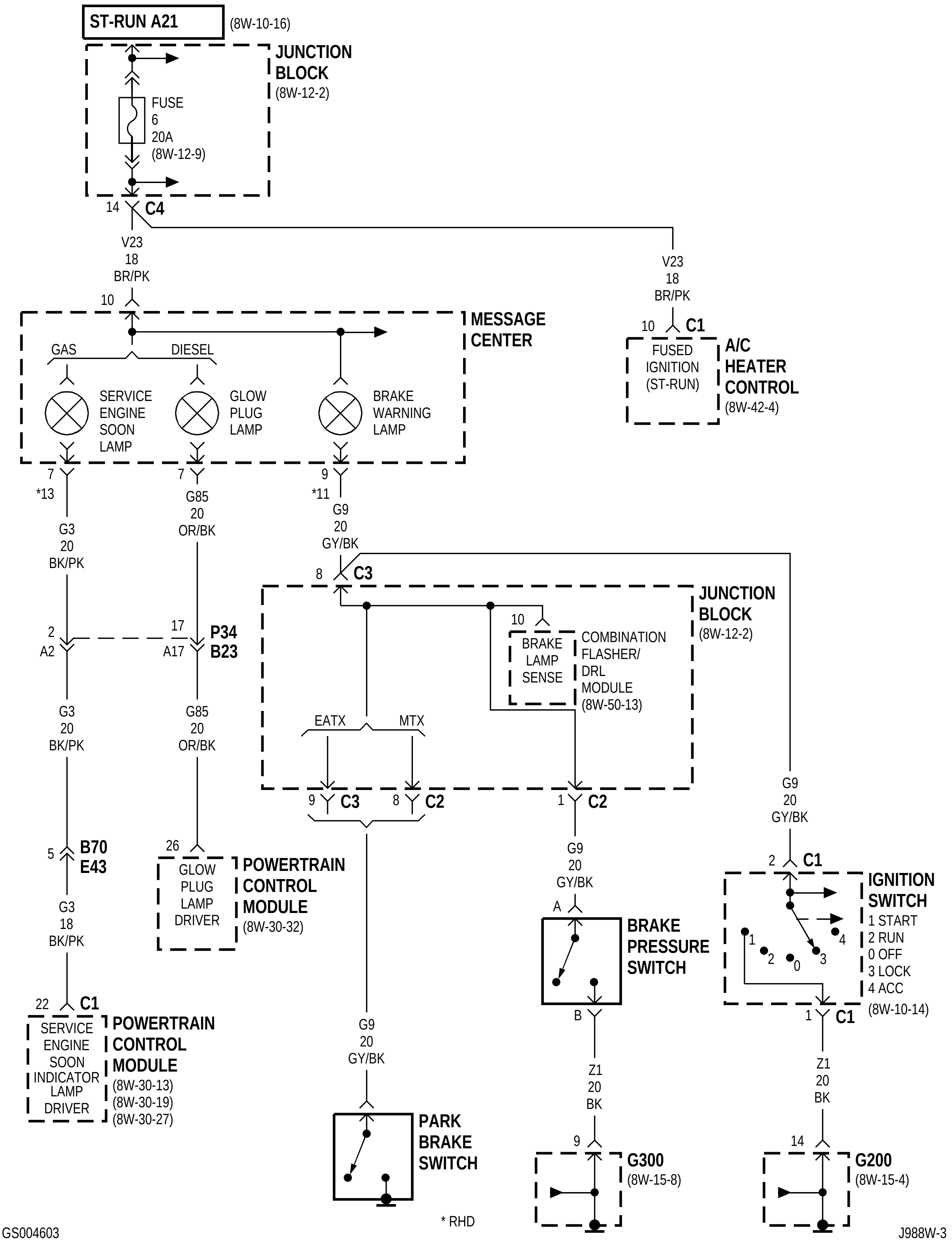
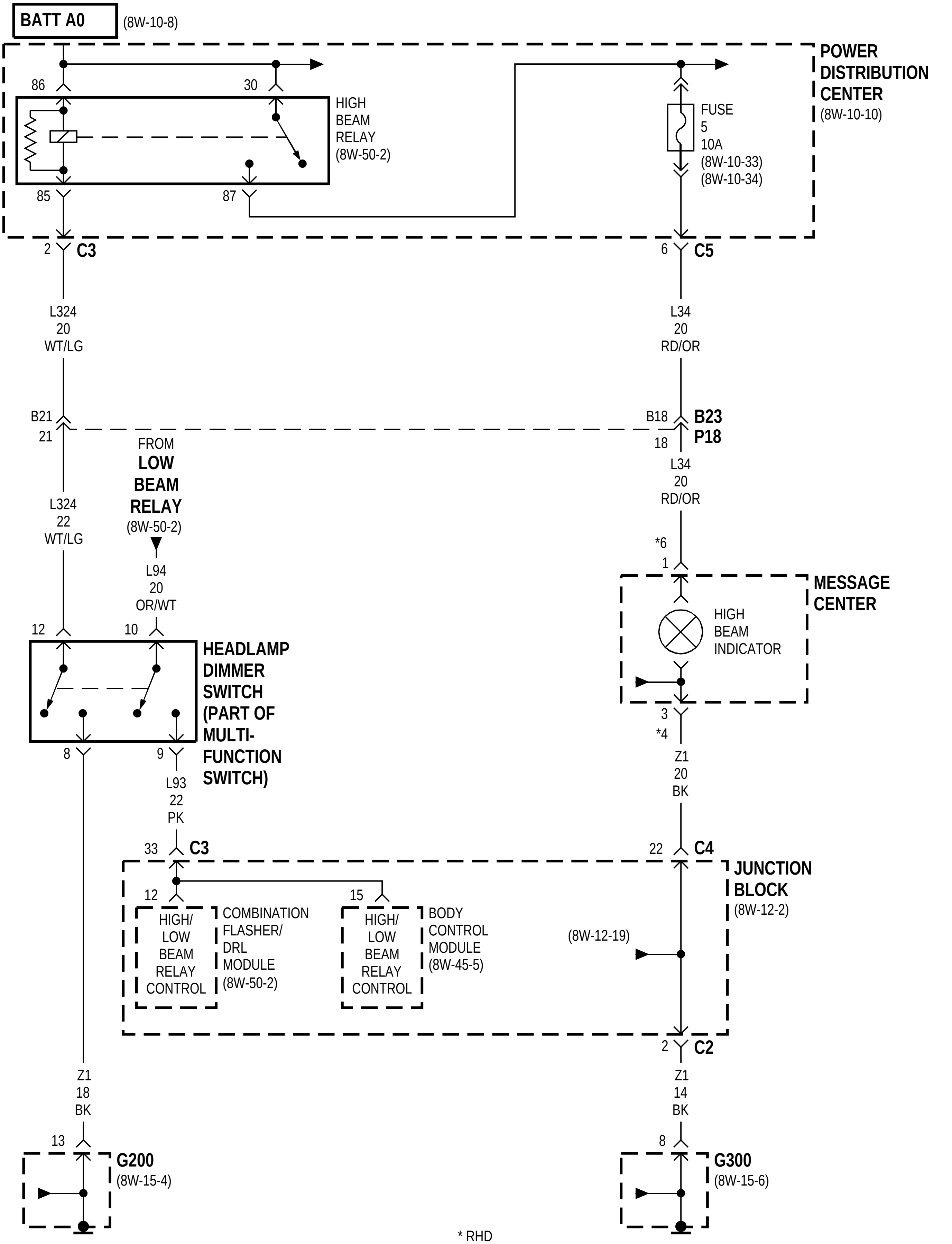
Controller Anti-Lock Brake	8W-46-2
Engine Coolant Temperature Lamp	8W-46-2
Engine Oil Pressure Switch	8W-46-2
Fuse 5 (PDC)	8W-46-4
Fuse 6 (JB)	8W-46-2, 3
Fuse 28 (PDC)	8W-46-2
G200	8W-46-3, 4, 5
G300	8W-46-3, 4, 5
Glow Plug Lamp	8W-46-3
Headlamp Dimmer Switch	8W-46-4
High Beam Indicator	8W-46-4
High Beam Relay	8W-46-4
Ignition Switch	8W-46-3
Junction Block	8W-46-2, 3, 4, 5
Left Rear Lamp Assembly	8W-46-5
Left Repeater Lamp	8W-46-5
Left Turn Indicator	8W-46-5
Low Beam Relay	8W-46-4
Low Oil Pressure Lamp	8W-46-2
Memory Seat/Mirror Module	8W-46-2
Message Center	8W-46-2, 3, 4, 5
Park Brake Switch	8W-46-3
Power Distribution Center	8W-46-2, 4
Powertrain Control Module	8W-46-3
Remote Keyless Entry Module	8W-46-2
Right Rear Lamp Assembly	8W-46-5
Right Repeater Lamp	8W-46-5
Right Turn Indicator	8W-46-5
Service Engine Soon Lamp	8W-46-3
Turn Signal/Hazard Switch	8W-46-5
VTSS Lamp	8W-46-2

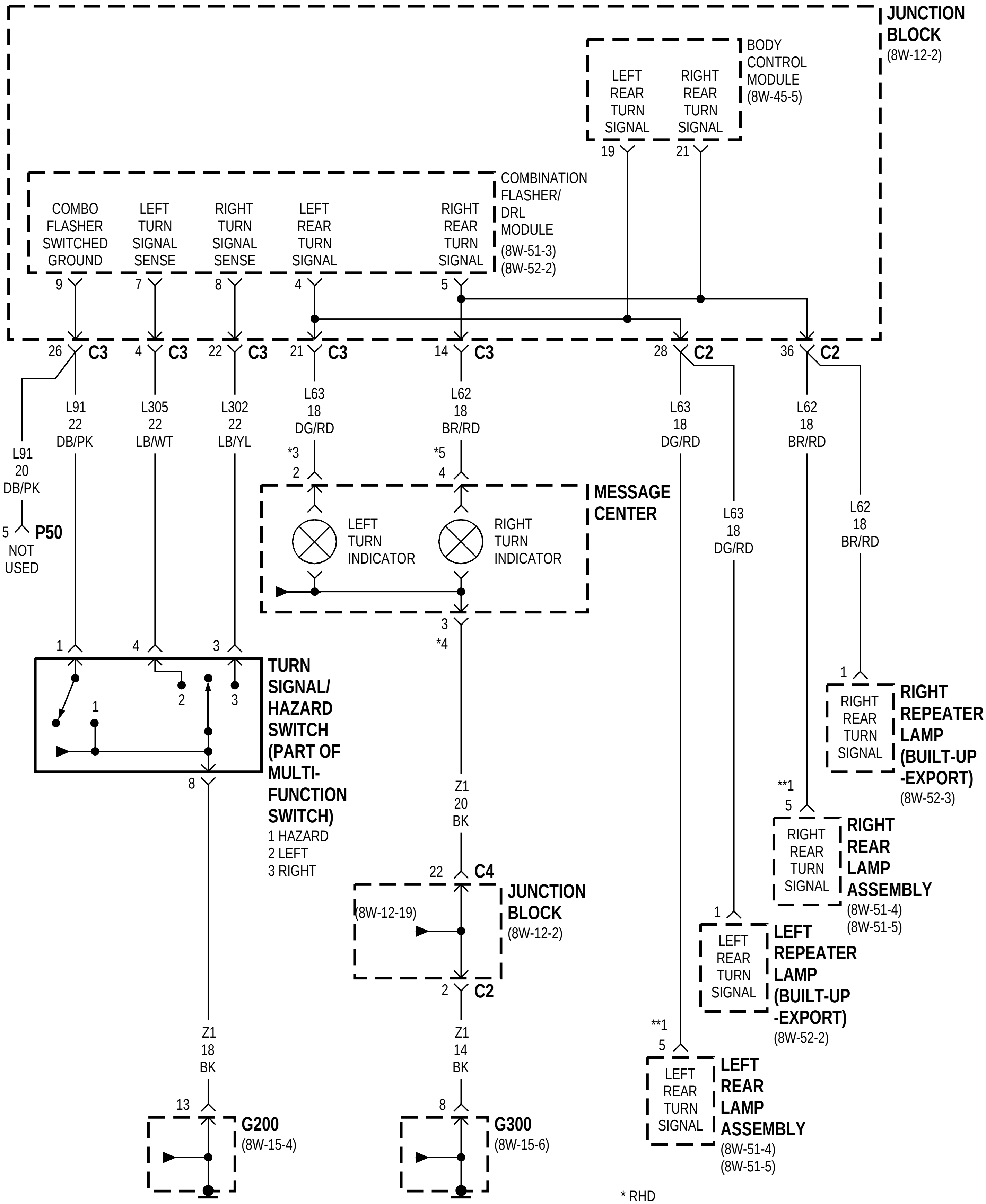


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A (8W-10-11)
5 C3
ST-RUN A21
(8W-10-16)
13 C1
JUNCTION BLOCK
(8W-12-2)
FUSE 6 20A (8W-12-9)
(8W-12-20)
M1 20 PK
NOT USED
7 P50
M1 22 PK
14 C4
6 C4
M1 20PK
V23 18 BR/PK
M1 20 PK
10 C1
FUSED IGNITION (ST-RUN)
A/C HEATER CONTROL
(8W-42-4)
3
FUSED B (+)
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
16 C1
FUSED B (+)
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
(8W-63-4)
10
*8 12
MESSAGE CENTER
ABS WARNING LAMP
ENGINE COOLANT TEMPERATURE LAMP
LOW OIL PRESSURE LAMP
AIRBAG WARNING LAMP
VTSS LAMP
5 *2
6 *1
8 *12
11 *9
13 *7
G19 20 LG/OR
G2 22 VT
G6 22 GY
R41 18 BK/TN
G69 22 BK/OR
3 P34
A3 B23
G19 20 LG/OR
7 C2
AIRBAG WARNING LAMP DRIVER
AIRBAG CONTROL MODULE
(8W-43-3)
17 C2
6 C2
33 C2
16 C2
ABS WARNING LAMP DRIVER
ENGINE TEMPERATURE WARNING LAMP DRIVER
ENGINE OIL PRESSURE SWITCH SENSE
ENGINE OIL PRESSURE SWITCH SENSE
VTSS LAMP DRIVER
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
52 C1
G6 20GY
GAS
DIESEL
9 B33 E36
1 B33 E36
G19 18 LG/OR
G6 16 GY
16
ABS WARNING LAMP DRIVER
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
1
ENGINE OIL PRESSURE SWITCH
* RHD


ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
FUSE 6 20A (8W-12-9)
14 C4
V23 18 BR/PK
10
MESSAGE CENTER
GAS
DIESEL
SERVICE ENGINE SOON LAMP
GLOW PLUG LAMP
BRAKE WARNING LAMP
V23 18 BR/PK
10 C1
FUSED IGNITION (ST-RUN)
A/C HEATER CONTROL
(8W-42-4)
7 *13
G3 20 BK/PK
7
G85 20 OR/BK
9 *11
G9 20 GY/BK
8 C3
JUNCTION BLOCK
(8W-12-2)
10
BRAKE LAMP SENSE
COMBINATION FLASHER/ DRL MODULE
(8W-50-13)
2 A2
17 A17
P34 B23
G3 20 BK/PK
G85 20 OR/BK
EATX
MTX
9 C3
8 C2
1 C2
G9 20 GY/BK
5 B70 E43
G3 18 BK/PK
26
GLOW PLUG LAMP DRIVER
POWERTRAIN CONTROL MODULE
(8W-30-32)
G9 20 GY/BK
A
BRAKE PRESSURE SWITCH
B
2 C1
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-14)
1 C1
22 C1
SERVICE ENGINE SOON INDICATOR LAMP DRIVER
POWERTRAIN CONTROL MODULE
(8W-30-13)
(8W-30-19)
(8W-30-27)
G9 20 GY/BK
PARK BRAKE SWITCH
Z1 20 BK
9
G300
(8W-15-8)
Z1 20 BK
14
G200
(8W-15-4)
* RHD


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
86
30
85
87
HIGH BEAM RELAY
(8W-50-2)
FUSE
5
10A
(8W-10-33)
(8W-10-34)
2 C3
6 C5
L324
20
WT/LG
L34
20
RD/OR
B21
21
B18
18
B23
P18
FROM
LOW BEAM RELAY
(8W-50-2)
L324
22
WT/LG
L34
20
RD/OR
L94
20
OR/WT
*6
1
MESSAGE CENTER
HIGH BEAM INDICATOR
12
10
HEADLAMP DIMMER SWITCH (PART OF MULTI-FUNCTION SWITCH)
8
9
3
*4
Z1
20
BK
L93
22
PK
33 C3
22 C4
JUNCTION BLOCK
(8W-12-2)
12
15
HIGH/ LOW BEAM RELAY CONTROL
COMBINATION FLASHER/ DRL MODULE
(8W-50-2)
HIGH/ LOW BEAM RELAY CONTROL
BODY CONTROL MODULE
(8W-45-5)
(8W-12-19)
2 C2
Z1
18
BK
Z1
14
BK
13
8
G200
(8W-15-4)
G300
(8W-15-6)

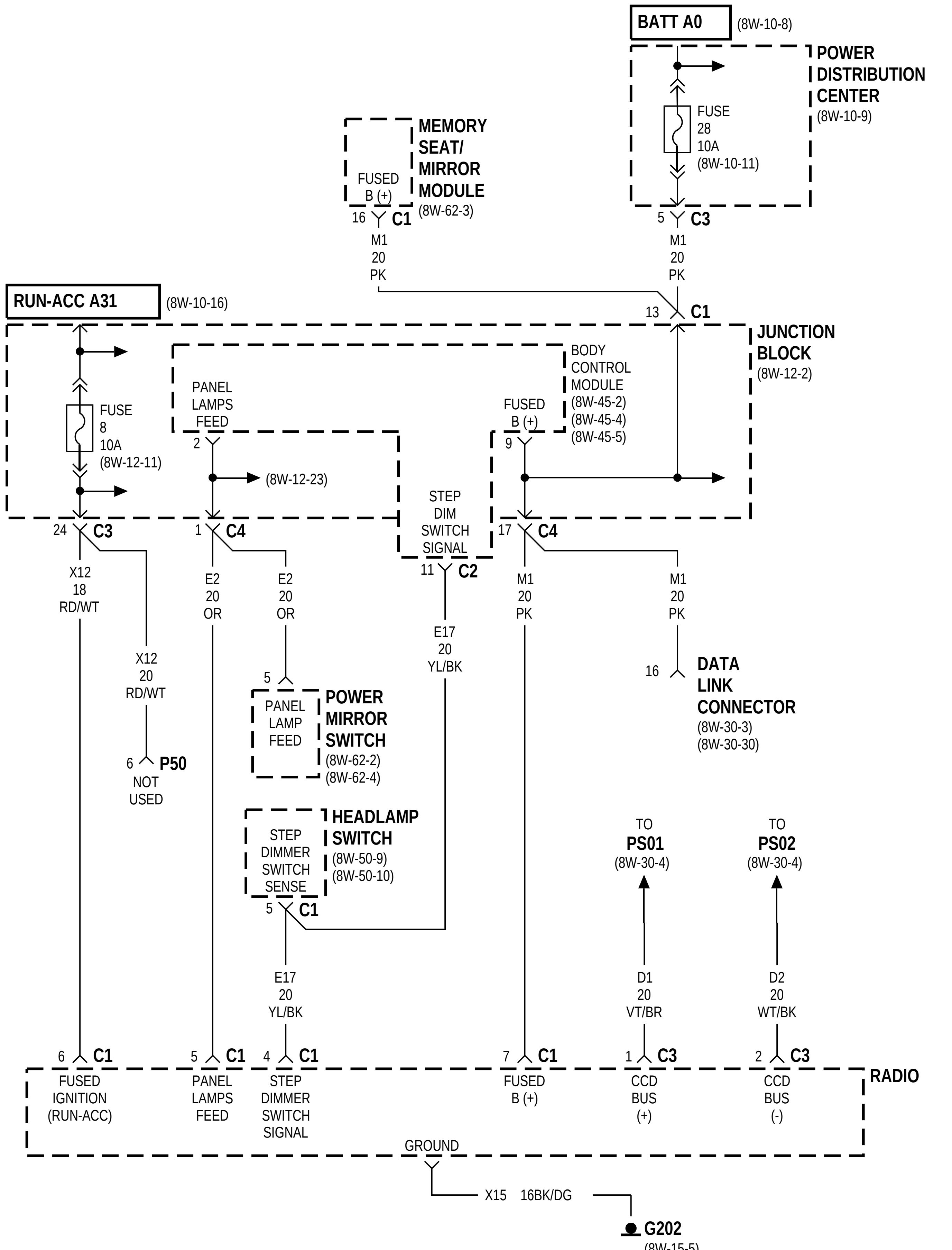
* RHD

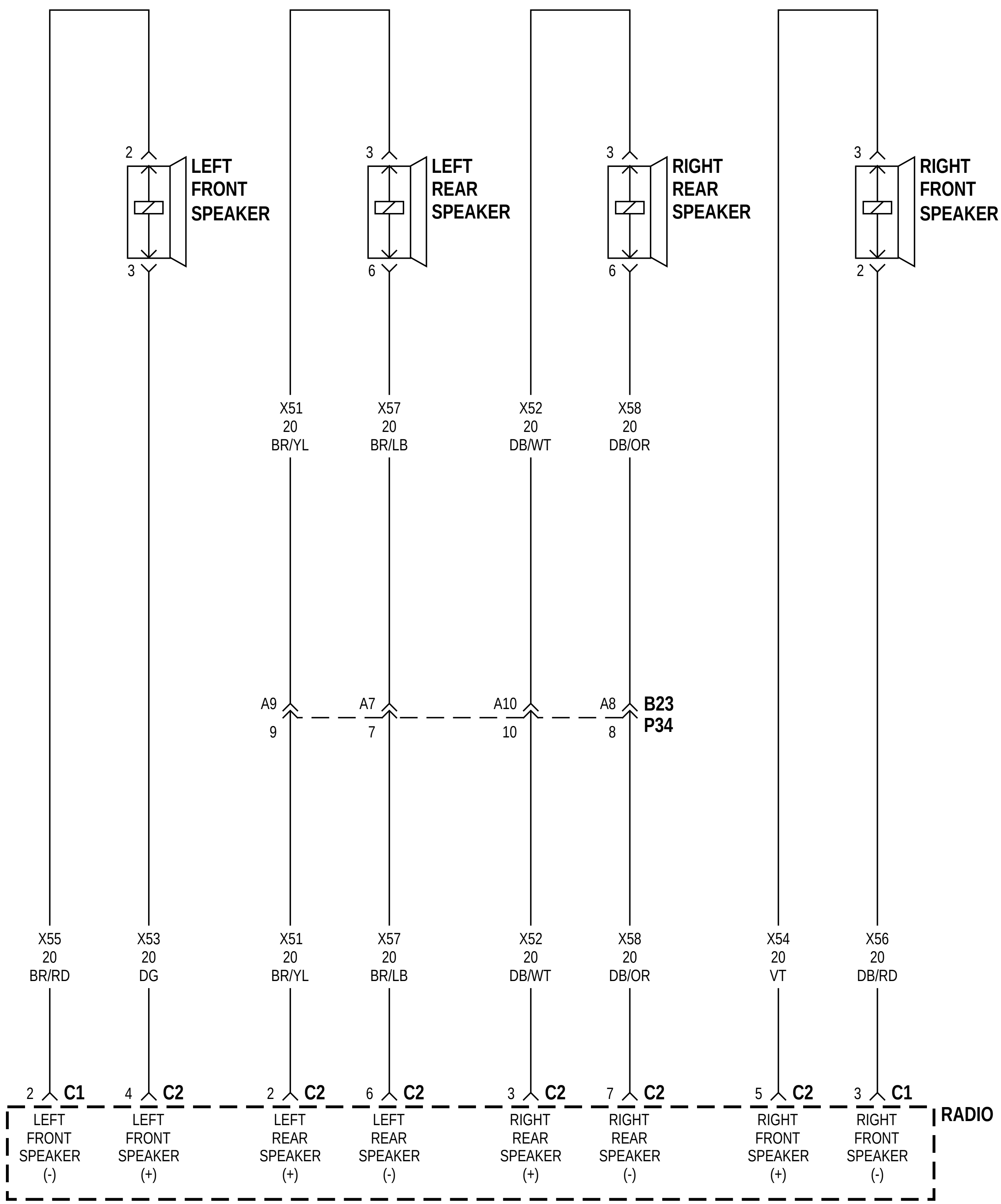


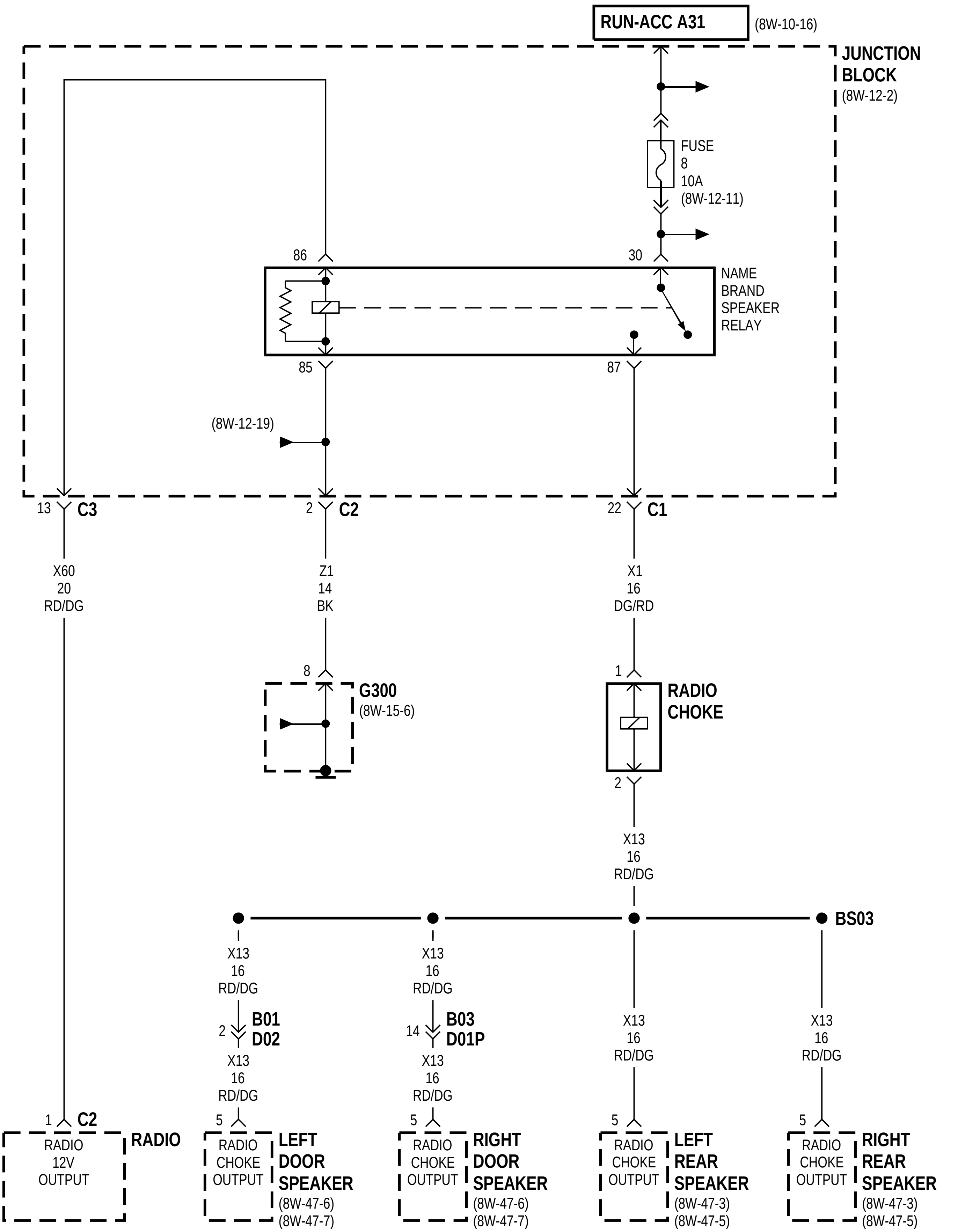
* RHD
** EXCEPT BUILT-UP-EXPORT

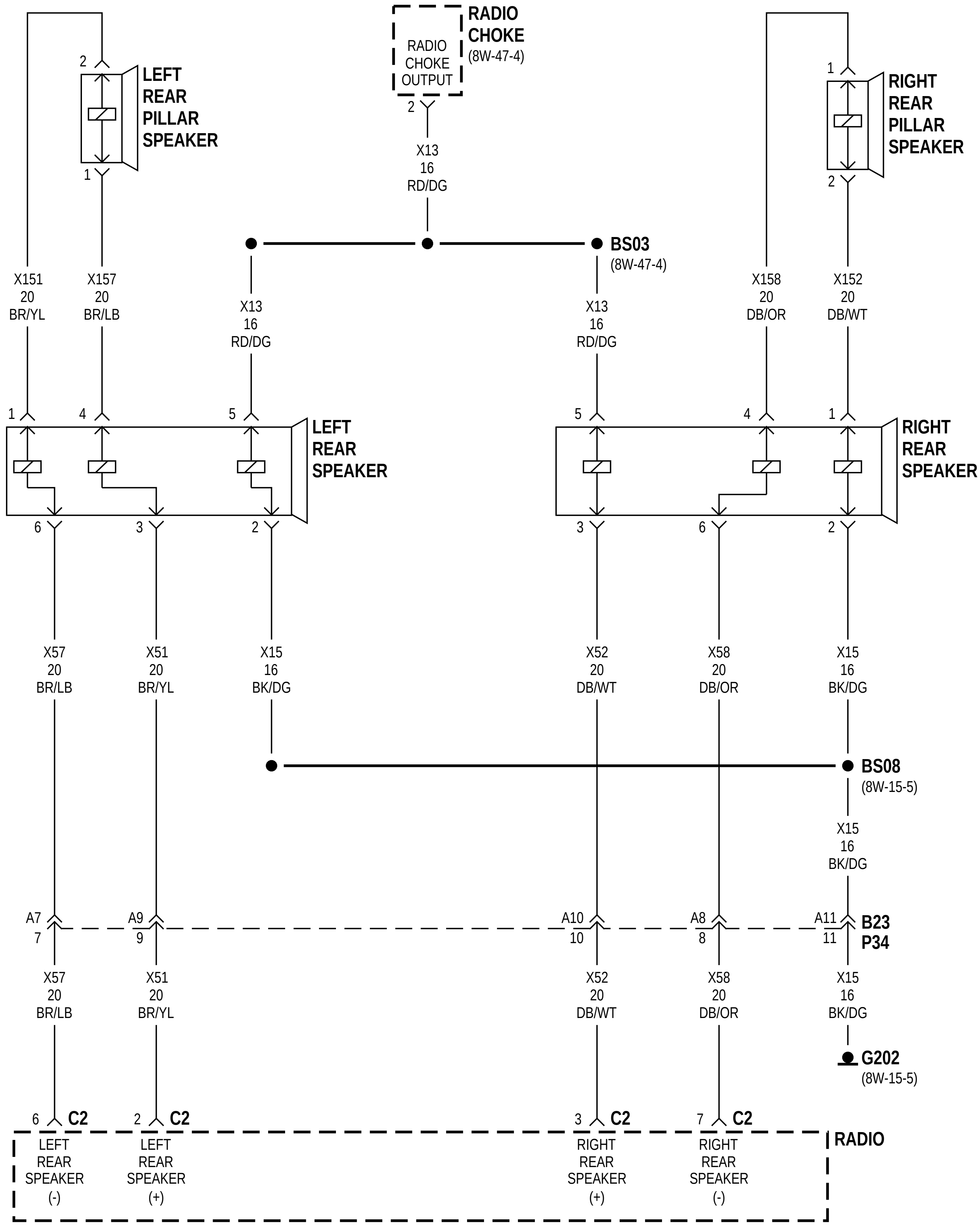
8W-47 AUDIO SYSTEM

Component	Page
Body Control Module	8W-47-2
BS03	8W-47-4, 5, 6, 7
Bs08	8W-47-5, 6, 7
Data Link Connector	8W-47-2
Fuse 8 (JB)	8W-47-2, 4
Fuse 28 (PDC)	8W-47-2
G202	8W-47-2, 5, 6, 7
G300	8W-47-4
Headlamp Switch	8W-47-2
Junction Block	8W-47-2, 4
Left Door Speaker	8W-47-4, 6, 7
Left Front Panel Speaker	8W-47-6, 7
Left Front Speaker	8W-47-3
Left Rear Pillar Speaker	8W-47-5
Left Rear Speaker	8W-47-3, 4, 5
Memory Seat/Mirror Module	8W-47-2
Name Brand Speaker Relay	8W-47-4
Power Distribution Center	8W-47-2
Power Mirror Switch	8W-47-2
PS01	8W-47-2
PS02	8W-47-2
Radio	8W-47-2, 3, 4, 5, 6, 7
Radio Choke	8W-47-4, 5, 6, 7
Right Door Speaker	8W-47-4, 6, 7
Right Front Panel Speaker	8W-47-6, 7
Right Front Speaker	8W-47-3
Right Rear Pillar Speaker	8W-47-5
Right Rear Speaker	8W-47-3, 4, 5

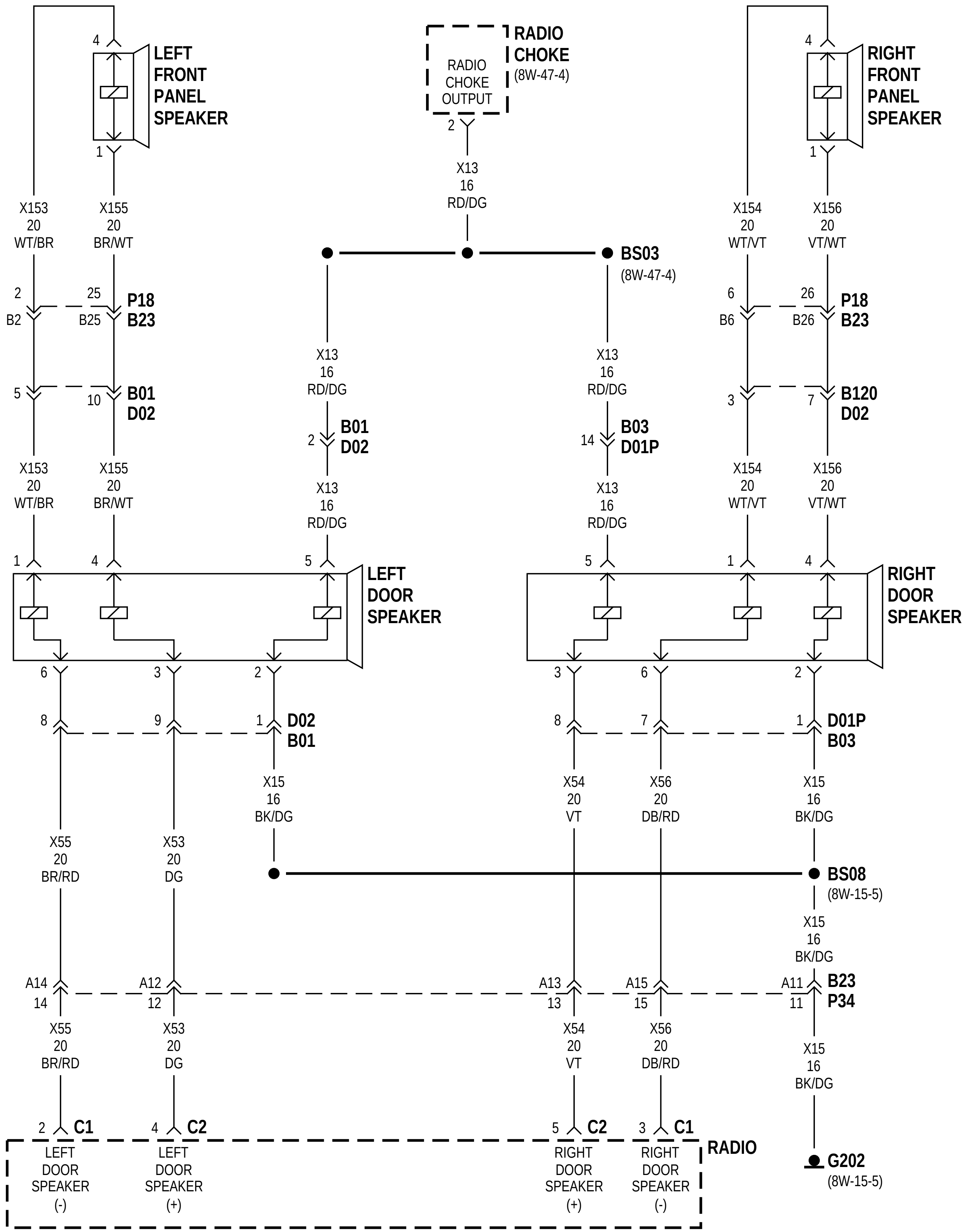

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A (8W-10-11)
5 C3
M1 20 PK
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
FUSED B (+)
16 C1
M1 20 PK
RUN-ACC A31
(8W-10-16)
13 C1
JUNCTION BLOCK
(8W-12-2)
FUSE 8 10A (8W-12-11)
PANEL LAMPS FEED
2
(8W-12-23)
BODY CONTROL MODULE
(8W-45-2)
(8W-45-4)
(8W-45-5)
FUSED B (+)
9
STEP DIM SWITCH SIGNAL
24 C3
1 C4
17 C4
11 C2
X12 18 RD/WT
X12 20 RD/WT
6 P50
NOT USED
E2 20 OR
E2 20 OR
5
PANEL LAMP FEED
POWER MIRROR SWITCH
(8W-62-2)
(8W-62-4)
E17 20 YL/BK
M1 20 PK
M1 20 PK
16
DATA LINK CONNECTOR
(8W-30-3)
(8W-30-30)
STEP DIMMER SWITCH SENSE
HEADLAMP SWITCH
(8W-50-9)
(8W-50-10)
5 C1
E17 20 YL/BK
TO PS01 (8W-30-4)
TO PS02 (8W-30-4)
D1 20 VT/BR
D2 20 WT/BK
6 C1
5 C1
4 C1
7 C1
1 C3
2 C3
RADIO
FUSED IGNITION (RUN-ACC)
PANEL LAMPS FEED
STEP DIMMER SWITCH SIGNAL
FUSED B (+)
CCD BUS (+)
CCD BUS (-)
GROUND
X15 16BK/DG
G202
(8W-15-5)

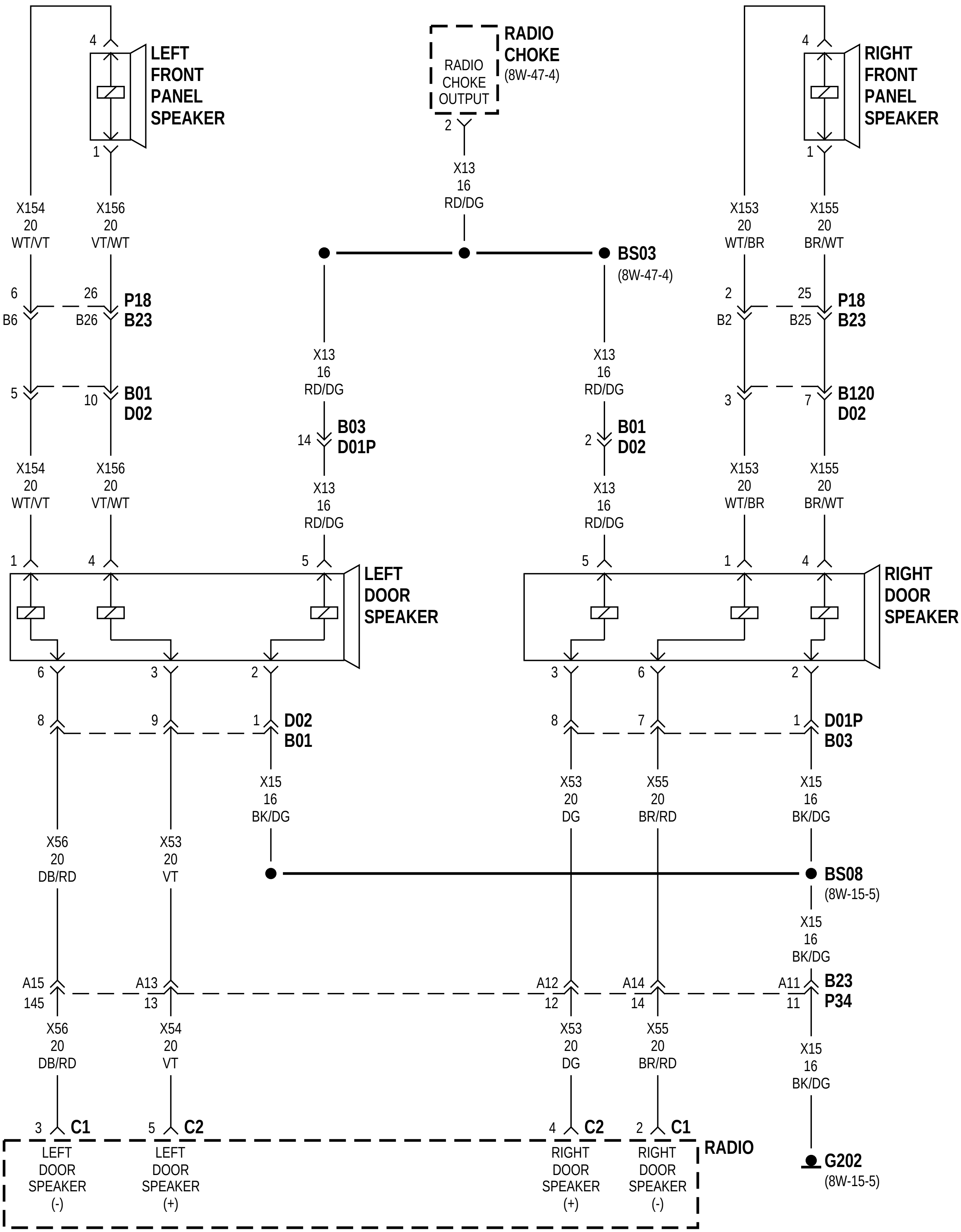

LEFT
FRONT
SPEAKER
LEFT
REAR
SPEAKER
RIGHT
REAR
SPEAKER
RIGHT
FRONT
SPEAKER
2
3
3
6
3
6
3
2
X51
20
BR/YL
X57
20
BR/LB
X52
20
DB/WT
X58
20
DB/OR
A9
A7
A10
A8
9
7
10
8
B23
P34
X55
20
BR/RD
X53
20
DG
X51
20
BR/YL
X57
20
BR/LB
X52
20
DB/WT
X58
20
DB/OR
X54
20
VT
X56
20
DB/RD
2 C1
4 C2
2 C2
6 C2
3 C2
7 C2
5 C2
3 C1
RADIO
LEFT
FRONT
SPEAKER
(-)
LEFT
FRONT
SPEAKER
(+)
LEFT
REAR
SPEAKER
(+)
LEFT
REAR
SPEAKER
(-)
RIGHT
REAR
SPEAKER
(+)
RIGHT
REAR
SPEAKER
(-)
RIGHT
FRONT
SPEAKER
(+)
RIGHT
FRONT
SPEAKER
(-)


RUN-ACC A31
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
FUSE
8
10A
(8W-12-11)
86
30
NAME BRAND SPEAKER RELAY
85
87
(8W-12-19)
13 C3
2 C2
22 C1
X60
20
RD/DG
Z1
14
BK
X1
16
DG/RD
8
G300
(8W-15-6)
1
RADIO CHOKE
2
X13
16
RD/DG
BS03
B01
D02
2
B03
D01P
14
1 C2
RADIO 12V OUTPUT
RADIO
5
RADIO CHOKE OUTPUT
LEFT DOOR SPEAKER
(8W-47-6)
(8W-47-7)
RIGHT DOOR SPEAKER
(8W-47-6)
(8W-47-7)
LEFT REAR SPEAKER
(8W-47-3)
(8W-47-5)
RIGHT REAR SPEAKER
(8W-47-3)
(8W-47-5)


RADIO CHOKE
(8W-47-4)
RADIO CHOKE OUTPUT
X13 16 RD/DG
BS03
(8W-47-4)
LEFT REAR PILLAR SPEAKER
RIGHT REAR PILLAR SPEAKER
X151 20 BR/YL
X157 20 BR/LB
X13 16 RD/DG
X13 16 RD/DG
X158 20 DB/OR
X152 20 DB/WT
LEFT REAR SPEAKER
RIGHT REAR SPEAKER
X57 20 BR/LB
X51 20 BR/YL
X15 16 BK/DG
X52 20 DB/WT
X58 20 DB/OR
X15 16 BK/DG
BS08
(8W-15-5)
X15 16 BK/DG
B23
P34
A7 7
A9 9
A10 10
A8 8
A11 11
X57 20 BR/LB
X51 20 BR/YL
X52 20 DB/WT
X58 20 DB/OR
X15 16 BK/DG
G202
(8W-15-5)
C2
RADIO
LEFT REAR SPEAKER (-)
LEFT REAR SPEAKER (+)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)

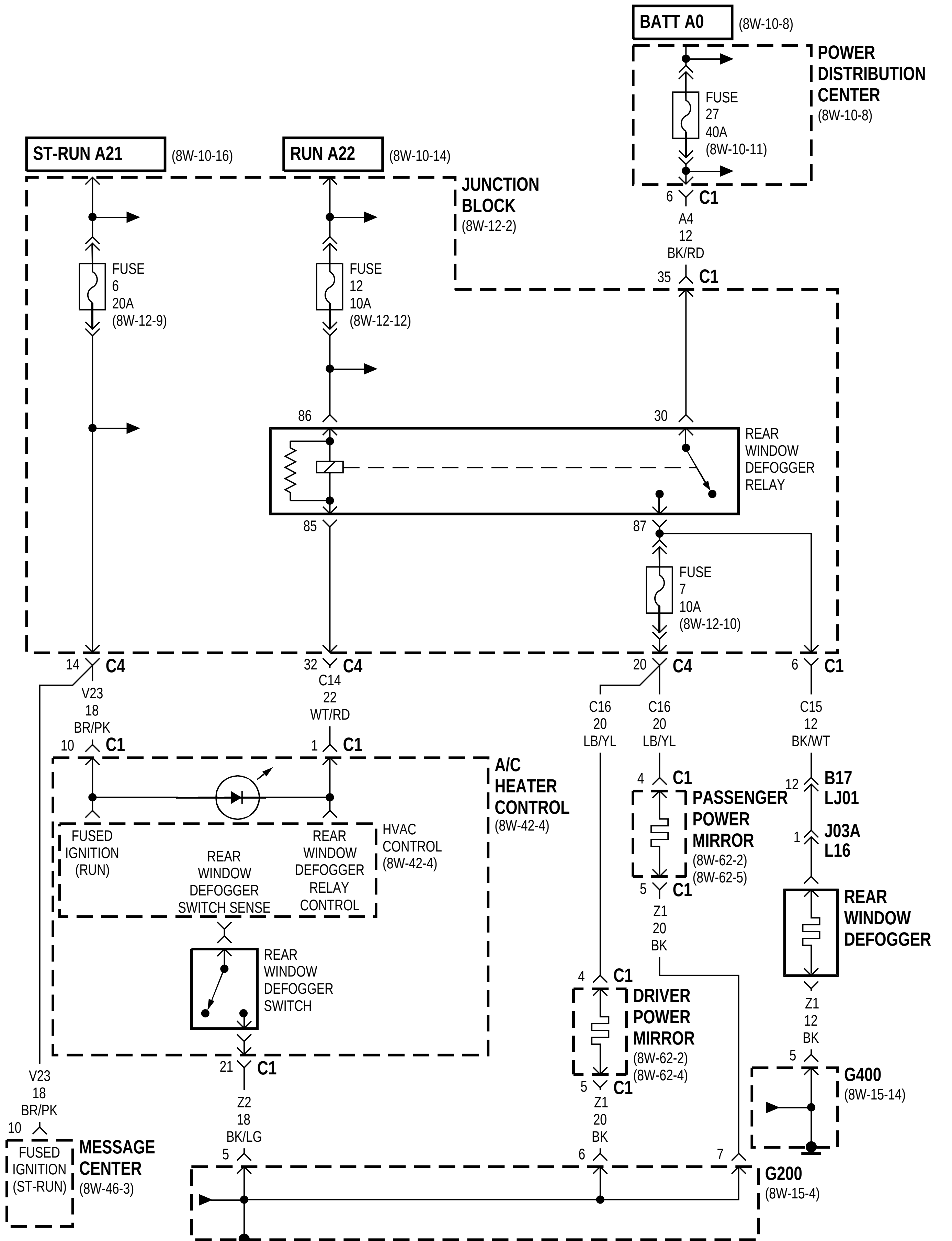
PREMIUM LHD

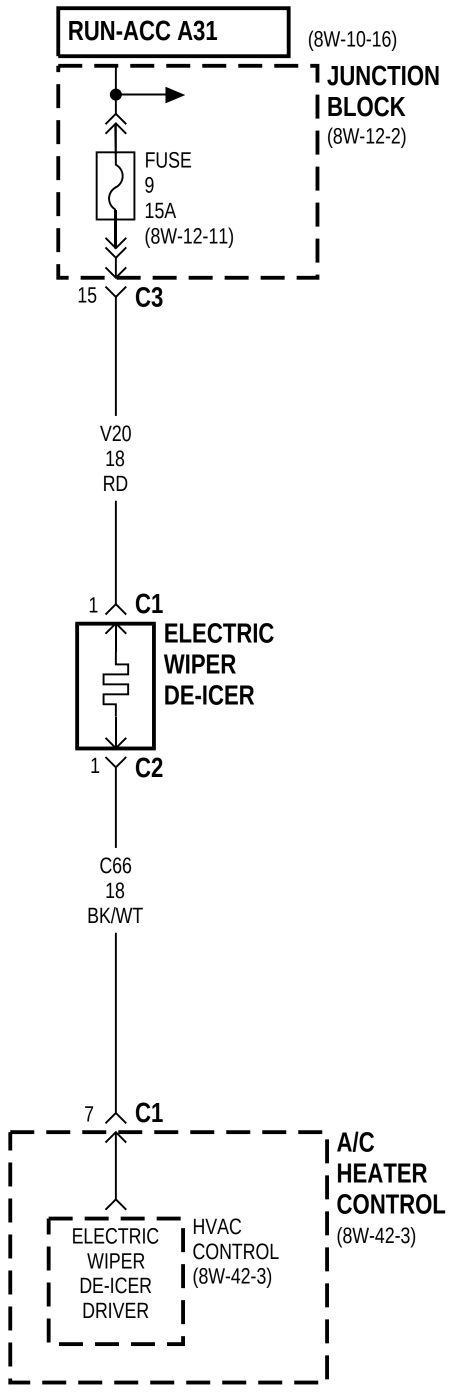

LEFT FRONT PANEL SPEAKER
RADIO CHOKE (8W-47-4)
RADIO CHOKE OUTPUT
RIGHT FRONT PANEL SPEAKER
X153 20 WT/BR
X155 20 BR/WT
X13 16 RD/DG
X154 20 WT/VT
X156 20 VT/WT
BS03 (8W-47-4)
P18 B23
B01 D02
B120 D02
B03 D01P
LEFT DOOR SPEAKER
RIGHT DOOR SPEAKER
D02 B01
D01P B03
X15 16 BK/DG
X55 20 BR/RD
X53 20 DG
X54 20 VT
X56 20 DB/RD
BS08 (8W-15-5)
B23 P34
C1
C2
RADIO
LEFT DOOR SPEAKER (-)
LEFT DOOR SPEAKER (+)
RIGHT DOOR SPEAKER (+)
RIGHT DOOR SPEAKER (-)
G202 (8W-15-5)


LEFT FRONT PANEL SPEAKER
RADIO CHOKE (8W-47-4)
RADIO CHOKE OUTPUT
RIGHT FRONT PANEL SPEAKER
X154 20 WT/VT
X156 20 VT/WT
X13 16 RD/DG
X153 20 WT/BR
X155 20 BR/WT
BS03 (8W-47-4)
P18 B23
B01 D02
B03 D01P
B120 D02
LEFT DOOR SPEAKER
RIGHT DOOR SPEAKER
D02 B01
D01P B03
X15 16 BK/DG
X53 20 DG
X55 20 BR/RD
X56 20 DB/RD
X53 20 VT
X54 20 VT
BS08 (8W-15-5)
B23 P34
C1
C2
RADIO
LEFT DOOR SPEAKER (-)
LEFT DOOR SPEAKER (+)
RIGHT DOOR SPEAKER (+)
RIGHT DOOR SPEAKER (-)
G202 (8W-15-5)

8W-48 WINDOW DEFOGGERS

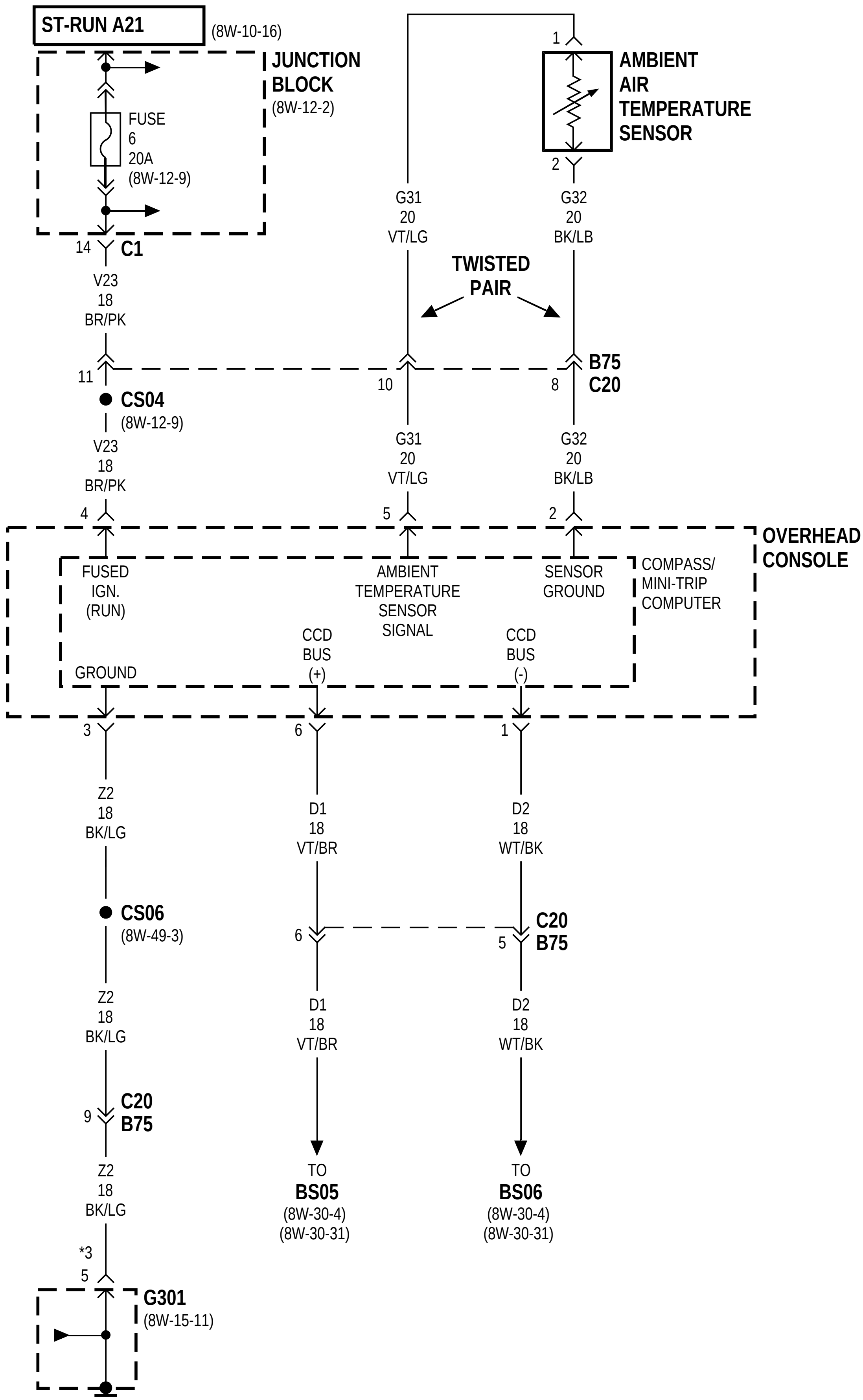
Component	Page
A/C Heater Control	8W-48-2, 3
Driver Power Mirror	8W-48-2
Electric Wiper De-Icer	8W-48-3
Fuse 6 (JB)	8W-48-2
Fuse 7 (JB)	8W-48-2
Fuse 9 (JB)	8W-48-3
Fuse 12 (JB)	8W-48-2
Fuse 27 (PDC)	8W-48-2
G200	8W-48-2
G400	8W-48-2
HVAC Control	8W-48-2, 3
Junction Block	8W-48-2, 3
Message Center	8W-48-2
Passenger Power Mirror	8W-48-2
Power Distribution Center	8W-48-2
Rear Window Defogger	8W-48-2
Rear Window Defogger Relay	8W-48-2
Rear Window Defogger Switch	8W-48-2


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 27 40A (8W-10-11)
ST-RUN A21
(8W-10-16)
RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 6 20A (8W-12-9)
FUSE 12 10A (8W-12-12)
6 C1
A4 12 BK/RD
35 C1
86
30
85
87
REAR WINDOW DEFOGGER RELAY
FUSE 7 10A (8W-12-10)
14 C4
32 C4
20 C4
6 C1
V23 18 BR/PK
C14 22 WT/RD
C16 20 LB/YL
C16 20 LB/YL
C15 12 BK/WT
10 C1
1 C1
A/C HEATER CONTROL
(8W-42-4)
FUSED IGNITION (RUN)
REAR WINDOW DEFOGGER SWITCH SENSE
REAR WINDOW DEFOGGER RELAY CONTROL
HVAC CONTROL
(8W-42-4)
REAR WINDOW DEFOGGER SWITCH
21 C1
Z2 18 BK/LG
4 C1
PASSENGER POWER MIRROR
(8W-62-2)
(8W-62-5)
5 C1
Z1 20 BK
12 B17 LJ01
1 J03A L16
REAR WINDOW DEFOGGER
Z1 12 BK
5
G400
(8W-15-14)
4 C1
DRIVER POWER MIRROR
(8W-62-2)
(8W-62-4)
5 C1
Z1 20 BK
V23 18 BR/PK
10
FUSED IGNITION (ST-RUN)
MESSAGE CENTER
(8W-46-3)
5
6
7
G200
(8W-15-4)

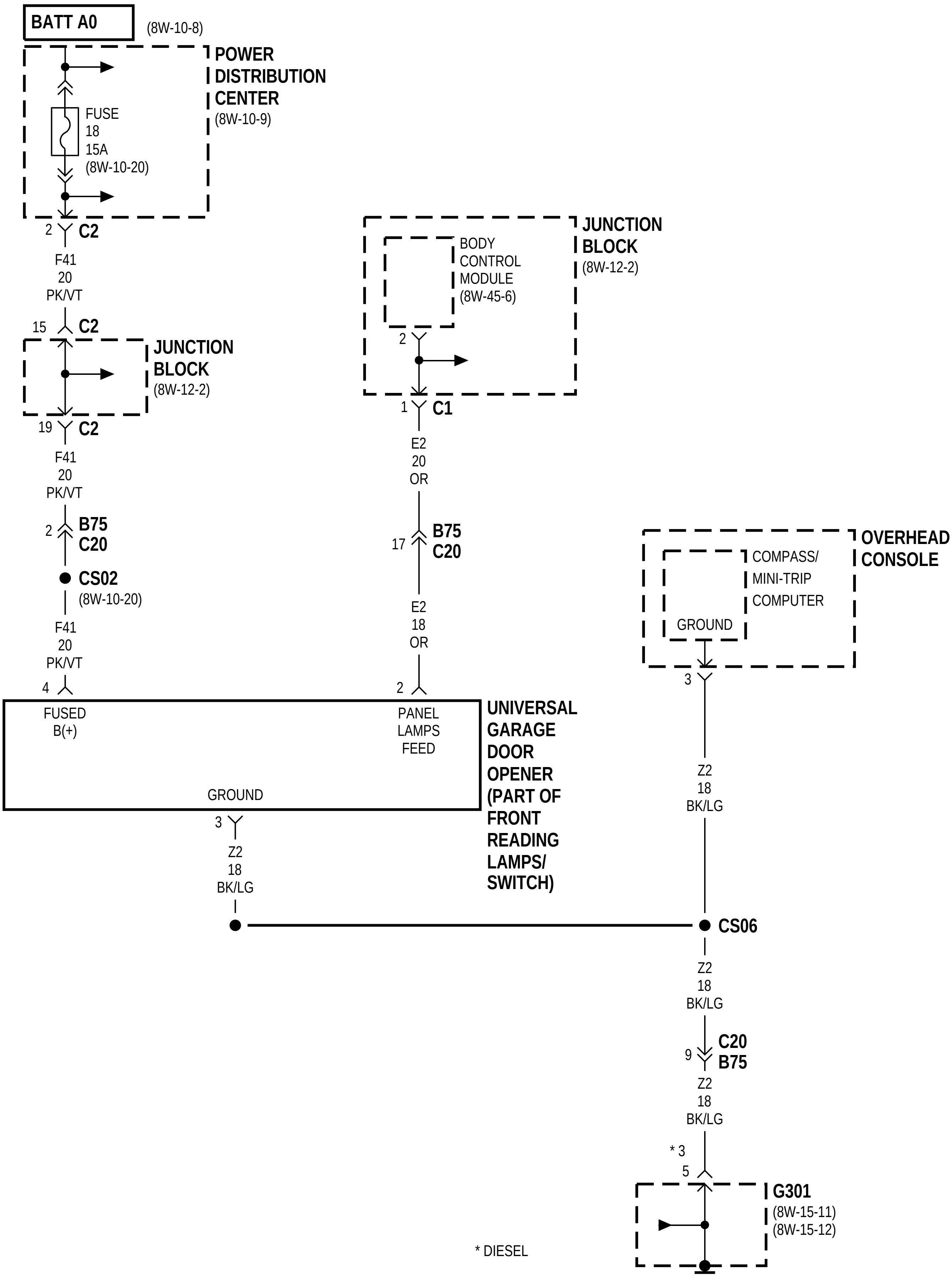

RUN-ACC A31
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
FUSE
9
15A
(8W-12-11)
15
C3
V20
18
RD
1
C1
ELECTRIC
WIPER
DE-ICER
1
C2
C66
18
BK/WT
7
C1
A/C
HEATER
CONTROL
(8W-42-3)
ELECTRIC
WIPER
DE-ICER
DRIVER
HVAC
CONTROL
(8W-42-3)

8W-49 OVERHEAD CONSOLE

Component	Page
Ambient Air Temperature Sensor	8W-49-2
Body Control Module	8W-49-3
BS05	8W-49-2
BS06	8W-49-2
Compass/Mini-Trip Computer	8W-49-2
CS02	8W-49-3
CS04	8W-49-2
CS06	8W-49-2, 3
Fuse 6 (JB)	8W-49-2
Fuse 18 (PDC)	8W-49-3
G301	8W-49-2, 3
Junction Block	8W-49-2, 3
Overhead Console	8W-49-2, 3
Power Distribution Center	8W-49-3
Universal Garage Door Opener	8W-49-3

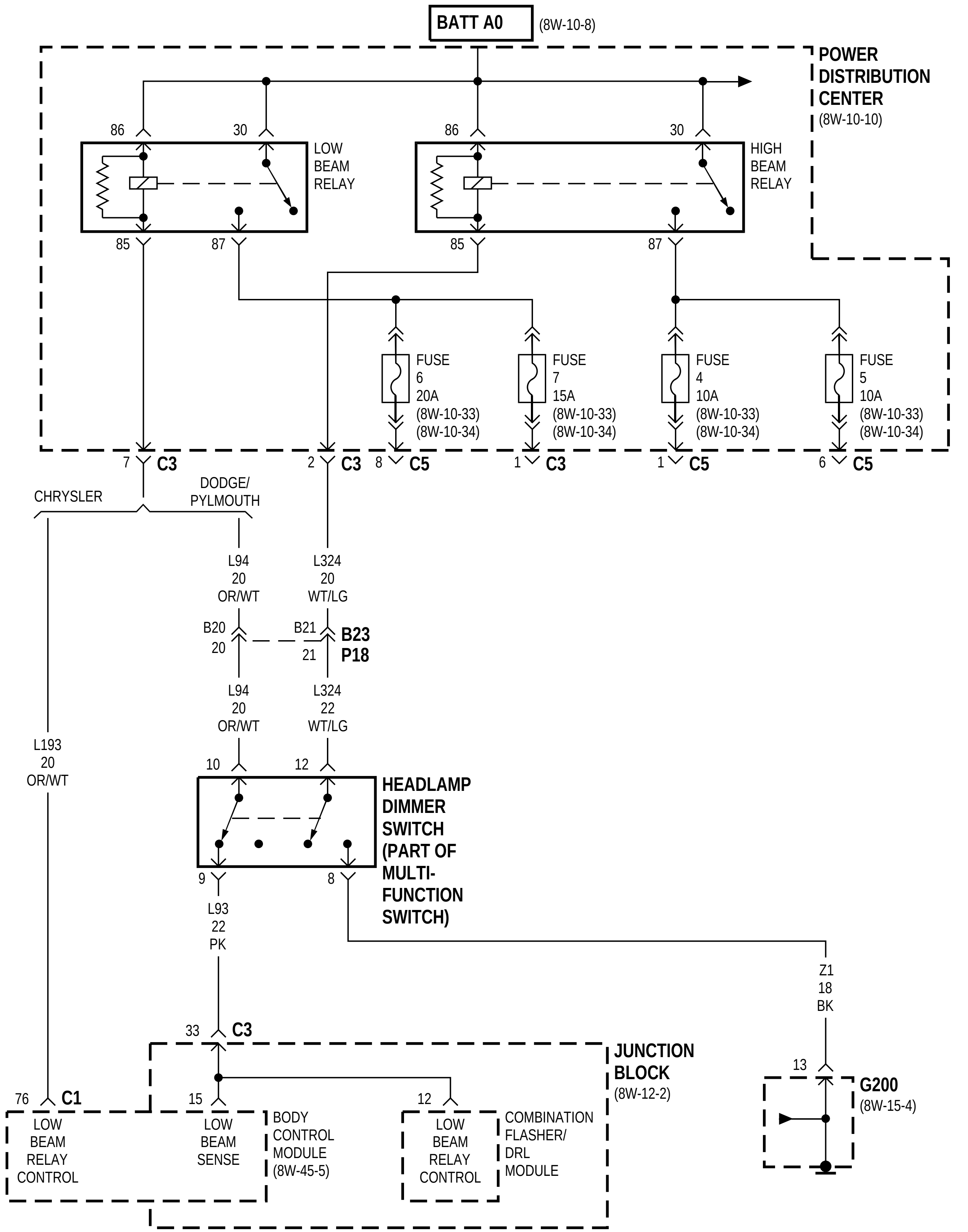

ST-RUN A21
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
FUSE
6
20A
(8W-12-9)
14
C1
V23
18
BR/PK
11
CS04
(8W-12-9)
V23
18
BR/PK
1
AMBIENT
AIR
TEMPERATURE
SENSOR
2
G31
20
VT/LG
G32
20
BK/LB
TWISTED
PAIR
10
8
B75
C20
G31
20
VT/LG
G32
20
BK/LB
4
5
2
OVERHEAD
CONSOLE
FUSED
IGN.
(RUN)
AMBIENT
TEMPERATURE
SENSOR
SIGNAL
SENSOR
GROUND
COMPASS/
MINI-TRIP
COMPUTER
CCD
BUS
(+)
CCD
BUS
(-)
GROUND
3
6
1
Z2
18
BK/LG
D1
18
VT/BR
D2
18
WT/BK
CS06
(8W-49-3)
6
5
C20
B75
Z2
18
BK/LG
D1
18
VT/BR
D2
18
WT/BK
9
C20
B75
Z2
18
BK/LG
TO
BS05
(8W-30-4)
(8W-30-31)
TO
BS06
(8W-30-4)
(8W-30-31)
*3
5
G301
(8W-15-11)

*DIESEL

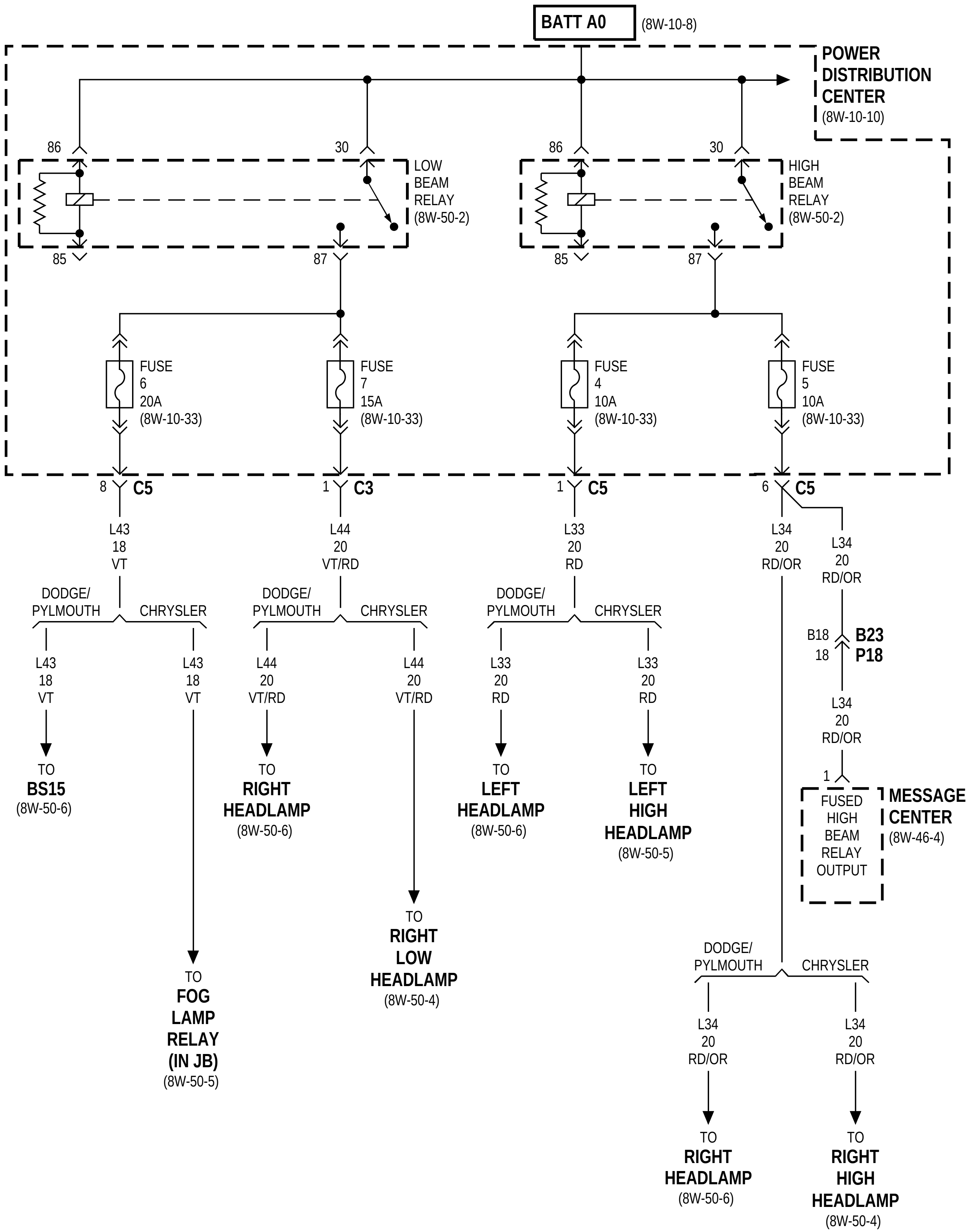

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
18
15A
(8W-10-20)
2 C2
F41
20
PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
19 C2
F41
20
PK/VT
2 B75 C20
CS02
(8W-10-20)
F41
20
PK/VT
4
FUSED B(+)
JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-6)
2
1 C1
E2
20
OR
17 B75 C20
E2
18
OR
2
PANEL LAMPS FEED
GROUND
3
Z2
18
BK/LG
UNIVERSAL GARAGE DOOR OPENER (PART OF FRONT READING LAMPS/ SWITCH)
OVERHEAD CONSOLE
COMPASS/ MINI-TRIP COMPUTER
GROUND
3
Z2
18
BK/LG
CS06
Z2
18
BK/LG
9 C20 B75
Z2
18
BK/LG
* 3
5
G301
(8W-15-11)
(8W-15-12)
* DIESEL

8W-50 FRONT LIGHTING

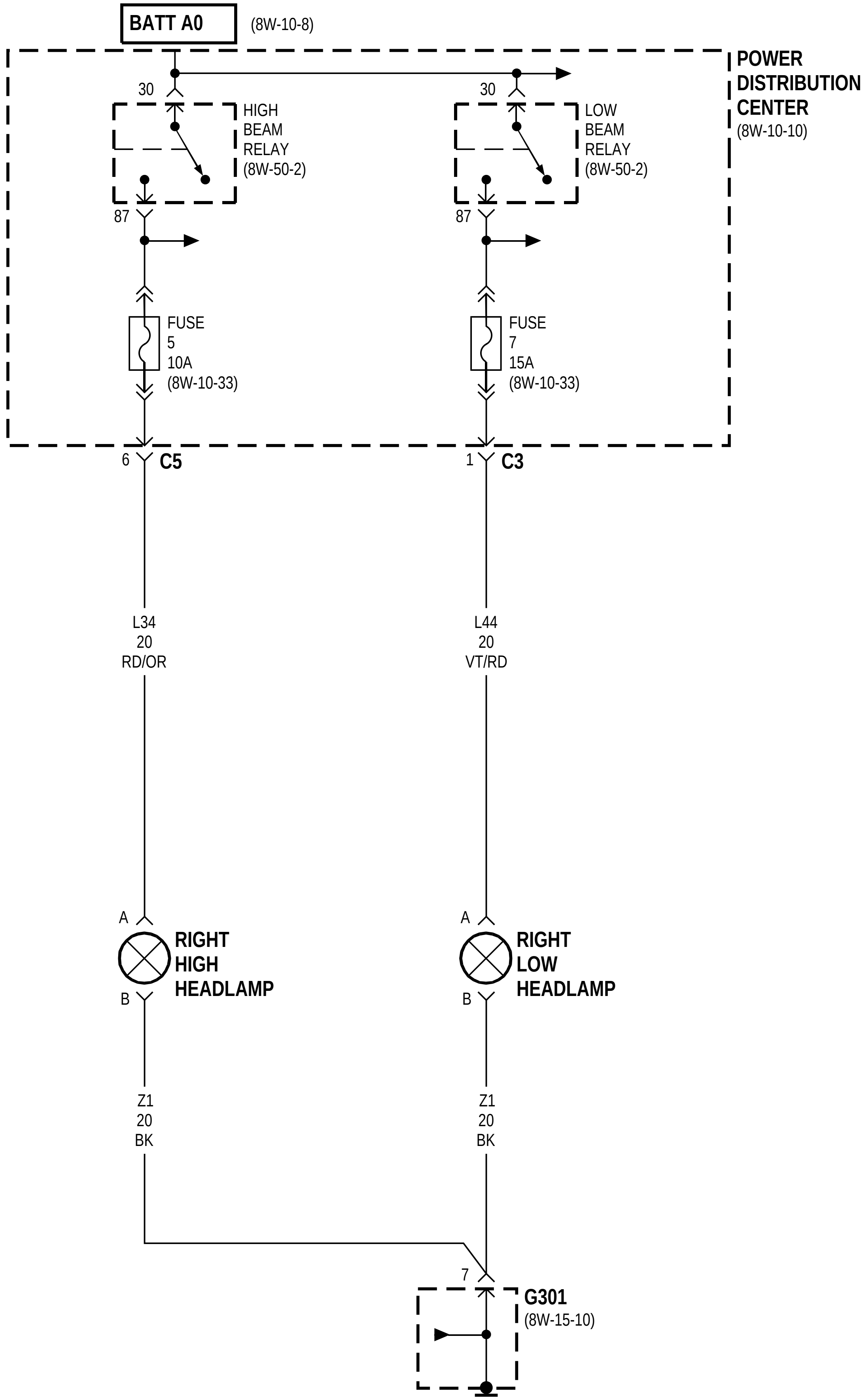
Component	Page
Body Control Module	8W-50-2, 9, 10, 11, 12, 13
BS15	8W-50-3, 6
BS16	8W-50-8
Combination Flasher/DRL Module	8W-50-2, 11, 12, 13
Courtesy Lamp Relay	8W-50-9, 10
Dome Lamp Switch	8W-50-9, 10
Fog Lamp Indicator	8W-50-9, 10
Fog Lamp Relay	8W-50-3, 5
Front Reading Lamps/Switch	8W-50-9, 10
Fuse 1 (JB)	8W-50-11, 12
Fuse 3 (JB)	8W-50-11, 12
Fuse 4 (JB)	8W-50-7
Fuse 4 (PDC)	8W-50-2, 3, 5, 6
Fuse 5 (JB)	8W-50-11, 12
Fuse 5 (PDC)	8W-50-2, 3, 4, 6
Fuse 6 (PDC)	8W-50-2, 3, 5, 6
Fuse 7 (PDC)	8W-50-2, 3, 4, 6
Fuse 10 (PDC)	8W-50-11, 12
Fuse 12 (JB)	8W-50-13
Fuse 22 (PDC)	8W-50-7, 11, 12
G200	8W-50-2, 8, 13
G300	8W-50-5, 6, 8, 9, 10, 11, 12, 13
G301	8W-50-4, 6, 8, 11, 12
Headlamp Dimmer Switch	8W-50-2, 5, 13
Headlamp Switch	8W-50-7, 8, 9, 10
High Beam Relay	8W-50-2, 3, 4, 5, 6
Ignition Switch	8W-50-13
Illumination Lamp	8W-50-9, 10
Junction Block	8W-50-2, 5, 7, 9, 10, 11, 12, 13
Left Fog Lamp	8W-50-5, 6, 7
Left Front Park/Turn Signal Lamp	8W-50-11, 12
Left Headlamp	8W-50-3, 6
Left Headlamp Leveling Motor	8W-50-8
Left High Headlamp	8W-50-3, 5
Left Low Headlamp	8W-50-5
Low Beam Relay	8W-50-2, 3, 4, 5, 6
Message Center	8W-50-3, 13
Park Brake Switch	8W-50-13
Park Lamp Relay	8W-50-7, 11, 12
Power Distribution Center	8W-50-2, 3, 4, 5, 6, 7, 11, 12
Radio	8W-50-10
Rear Fog Lamp Indicator	8W-50-10
Right Fog Lamp	8W-50-5, 6, 7
Right Front Park/Turn Signal Lamp	8W-50-11, 12
Right Headlamp	8W-50-3, 6, 8
Right Headlamp Leveling Motor	8W-50-8
Right High Headlamp	8W-50-3, 4
Right Low Headlamp	8W-50-3, 4
Right Rear Lamp Assembly	8W-50-11


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-10)
86
30
LOW
BEAM
RELAY
86
30
HIGH
BEAM
RELAY
85
87
85
87
FUSE
6
20A
(8W-10-33)
(8W-10-34)
FUSE
7
15A
(8W-10-33)
(8W-10-34)
FUSE
4
10A
(8W-10-33)
(8W-10-34)
FUSE
5
10A
(8W-10-33)
(8W-10-34)
7 C3
2 C3
8 C5
1 C3
1 C5
6 C5
CHRYSLER
DODGE/
PYLMOUTH
L94
20
OR/WT
L324
20
WT/LG
B20
20
B21
21
B23
P18
L94
20
OR/WT
L324
22
WT/LG
L193
20
OR/WT
10
12
HEADLAMP
DIMMER
SWITCH
(PART OF
MULTI-
FUNCTION
SWITCH)
9
8
L93
22
PK
Z1
18
BK
33 C3
JUNCTION
BLOCK
(8W-12-2)
76 C1
LOW
BEAM
RELAY
CONTROL
15
LOW
BEAM
SENSE
BODY
CONTROL
MODULE
(8W-45-5)
12
LOW
BEAM
RELAY
CONTROL
COMBINATION
FLASHER/
DRL
MODULE
13
G200
(8W-15-4)

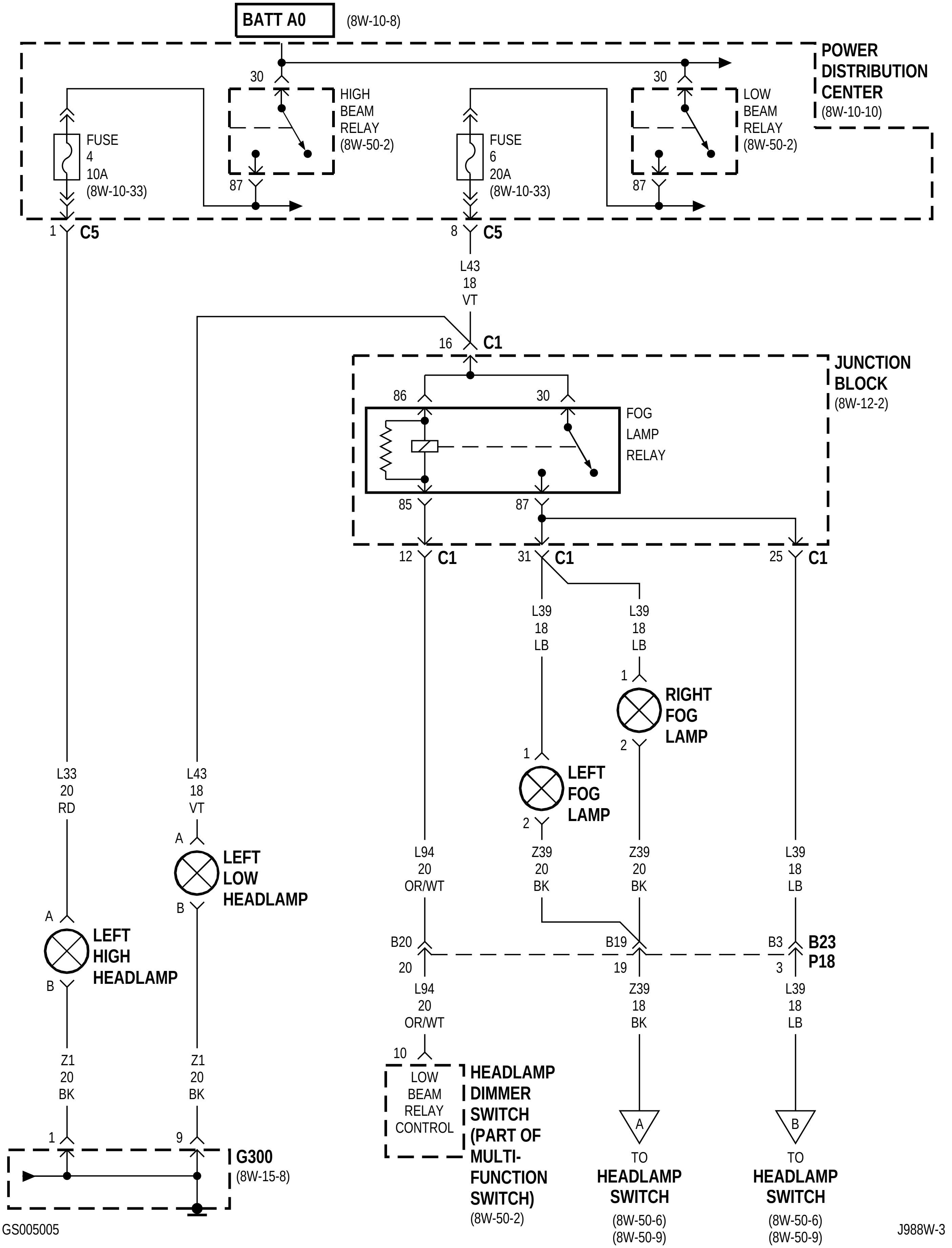
EXCEPT BUILT-UP-EXPORT

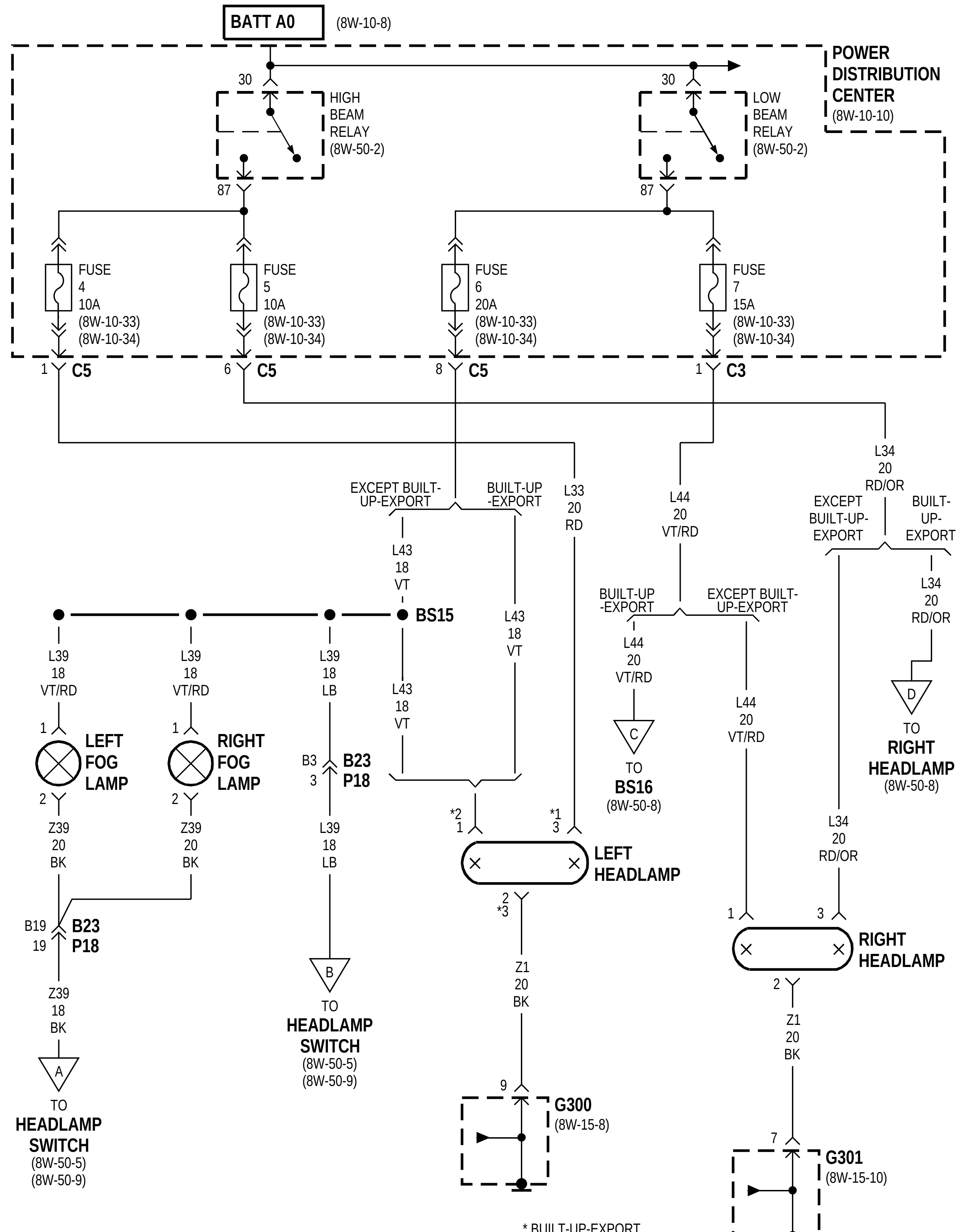


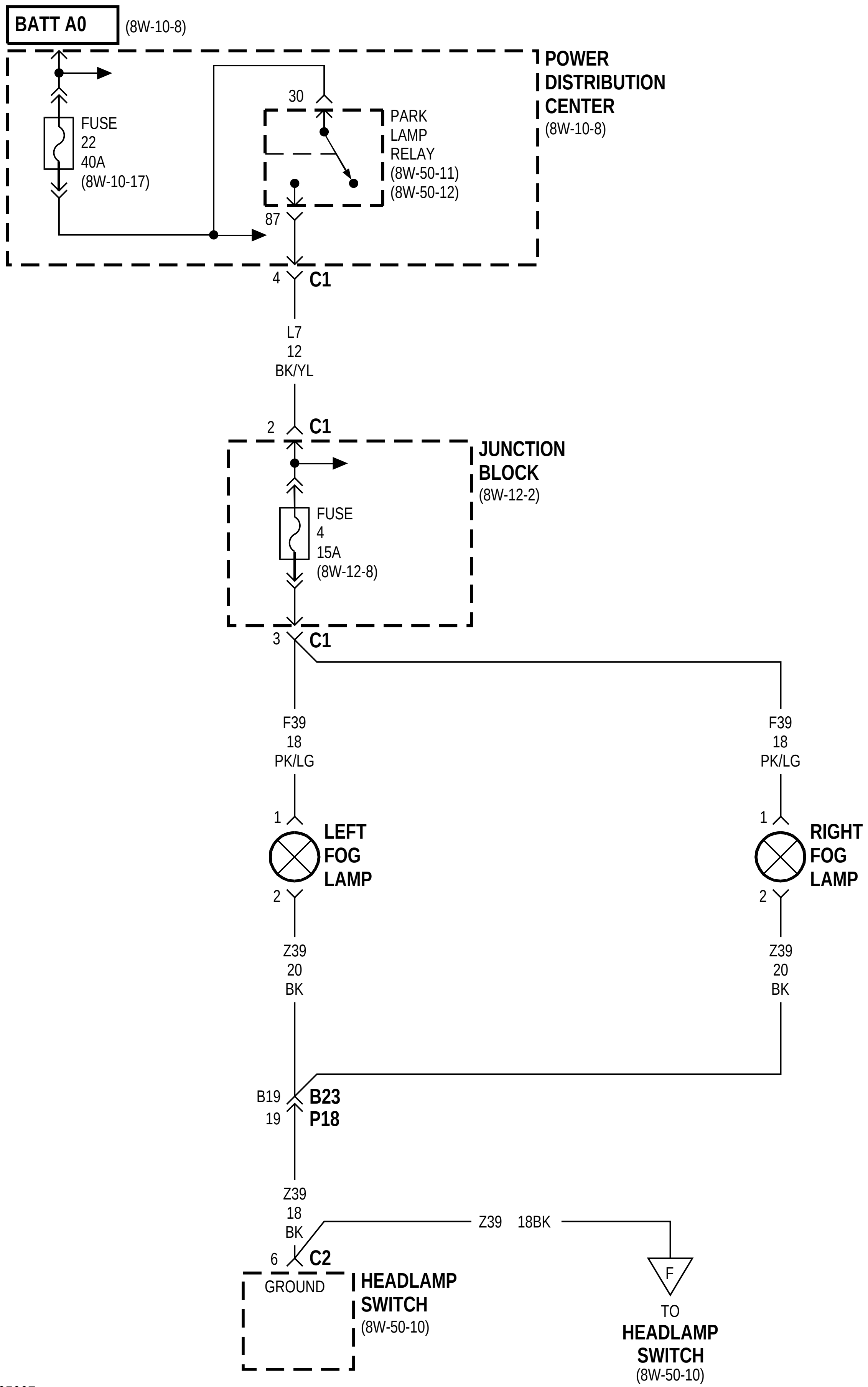
EXCEPT BUILT-UP-EXPORT/CHRYSLER



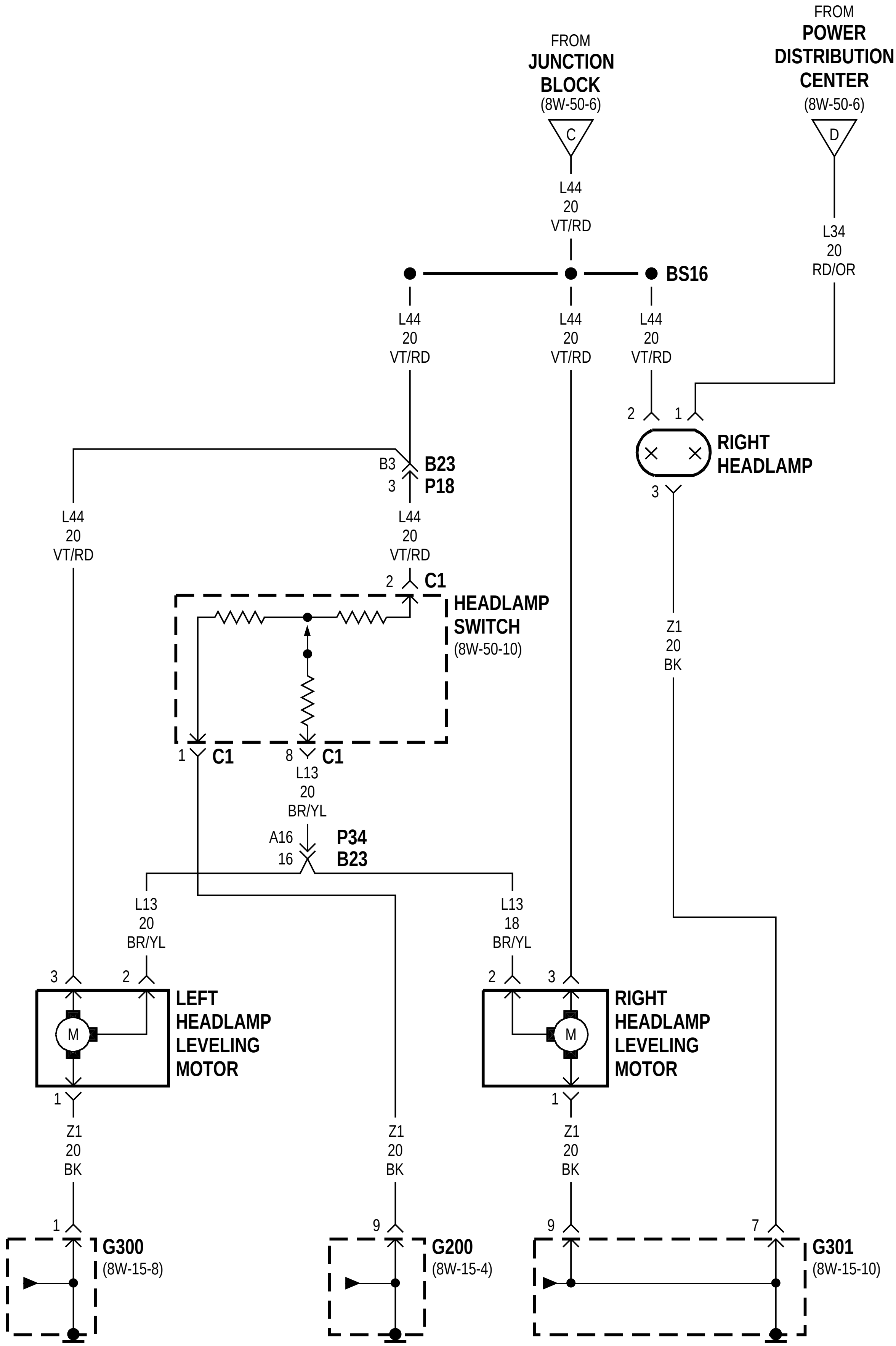
EXCEPT BUILT-UP-EXPORT/CHRYSLER



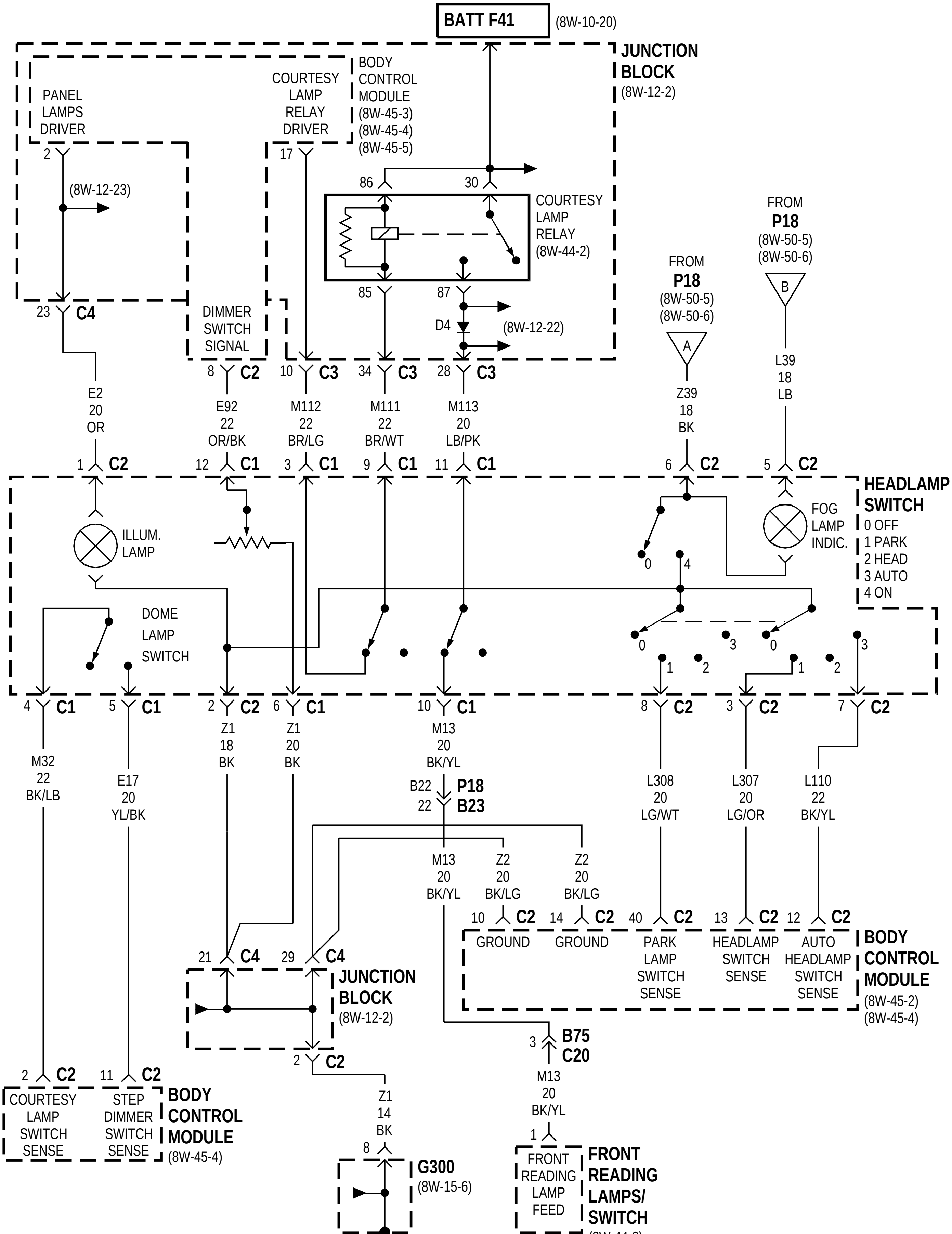

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-10)
30
HIGH
BEAM
RELAY
(8W-50-2)
87
30
LOW
BEAM
RELAY
(8W-50-2)
87
FUSE
4
10A
(8W-10-33)
(8W-10-34)
FUSE
5
10A
(8W-10-33)
(8W-10-34)
FUSE
6
20A
(8W-10-33)
(8W-10-34)
FUSE
7
15A
(8W-10-33)
(8W-10-34)
1 C5
6 C5
8 C5
1 C3
L34
20
RD/OR
EXCEPT BUILT-
UP-EXPORT
BUILT-UP
-EXPORT
L33
20
RD
L44
20
VT/RD
EXCEPT
BUILT-UP-
EXPORT
BUILT-
UP-
EXPORT
L43
18
VT
BS15
L43
18
VT
BUILT-UP
-EXPORT
EXCEPT BUILT-
UP-EXPORT
L34
20
RD/OR
L39
18
VT/RD
L39
18
VT/RD
L39
18
LB
L43
18
VT
L44
20
VT/RD
L44
20
VT/RD
D
TO
RIGHT
HEADLAMP
(8W-50-8)
1
LEFT
FOG
LAMP
2
1
RIGHT
FOG
LAMP
2
B3
3
B23
P18
C
TO
BS16
(8W-50-8)
*2
1
*1
3
LEFT
HEADLAMP
L34
20
RD/OR
Z39
20
BK
Z39
20
BK
L39
18
LB
2
*3
1
3
RIGHT
HEADLAMP
B19
19
B23
P18
B
TO
HEADLAMP
SWITCH
(8W-50-5)
(8W-50-9)
Z1
20
BK
2
Z1
20
BK
Z39
18
BK
9
G300
(8W-15-8)
7
G301
(8W-15-10)
A
TO
HEADLAMP
SWITCH
(8W-50-5)
(8W-50-9)
* BUILT-UP-EXPORT

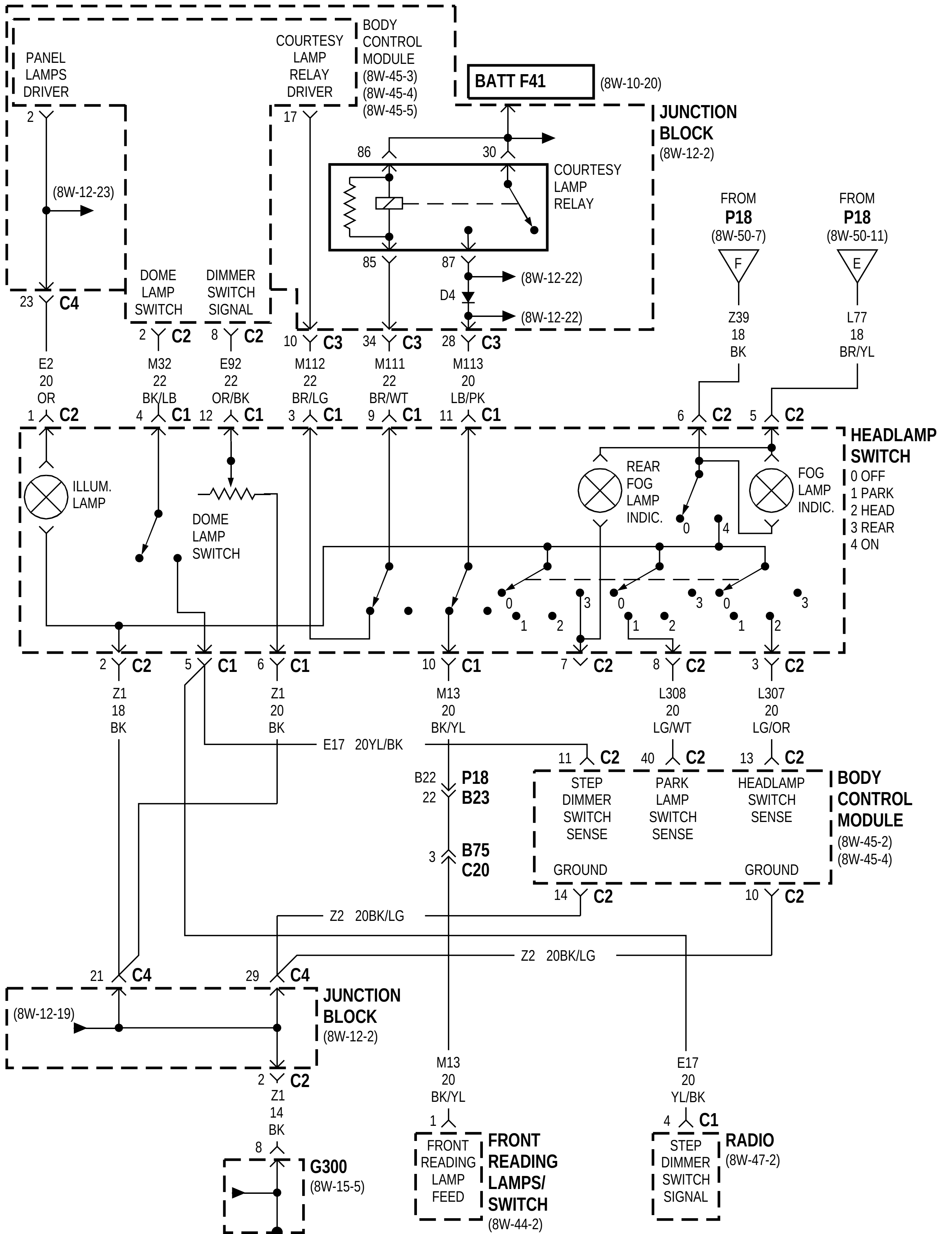

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
22
40A
(8W-10-17)
30
PARK
LAMP
RELAY
(8W-50-11)
(8W-50-12)
87
4
C1
L7
12
BK/YL
2
C1
JUNCTION
BLOCK
(8W-12-2)
FUSE
4
15A
(8W-12-8)
3
C1
F39
18
PK/LG
F39
18
PK/LG
1
LEFT
FOG
LAMP
2
1
RIGHT
FOG
LAMP
2
Z39
20
BK
Z39
20
BK
B19
19
B23
P18
Z39
18
BK
Z39 18BK
6
C2
GROUND
HEADLAMP
SWITCH
(8W-50-10)
F
TO
HEADLAMP
SWITCH
(8W-50-10)

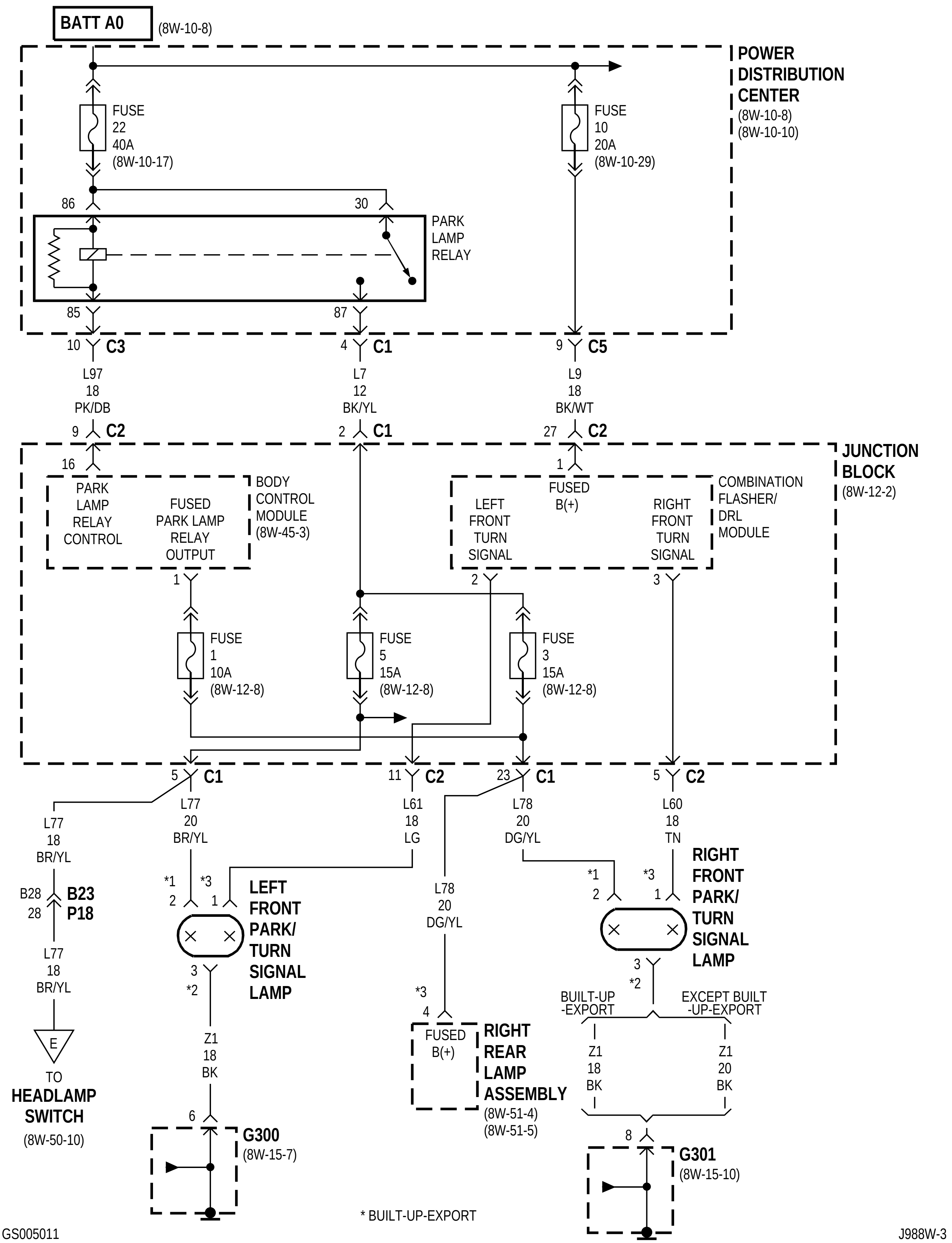
BUILT-UP-EXPORT



EXCEPT BUILT-UP-EXPORT



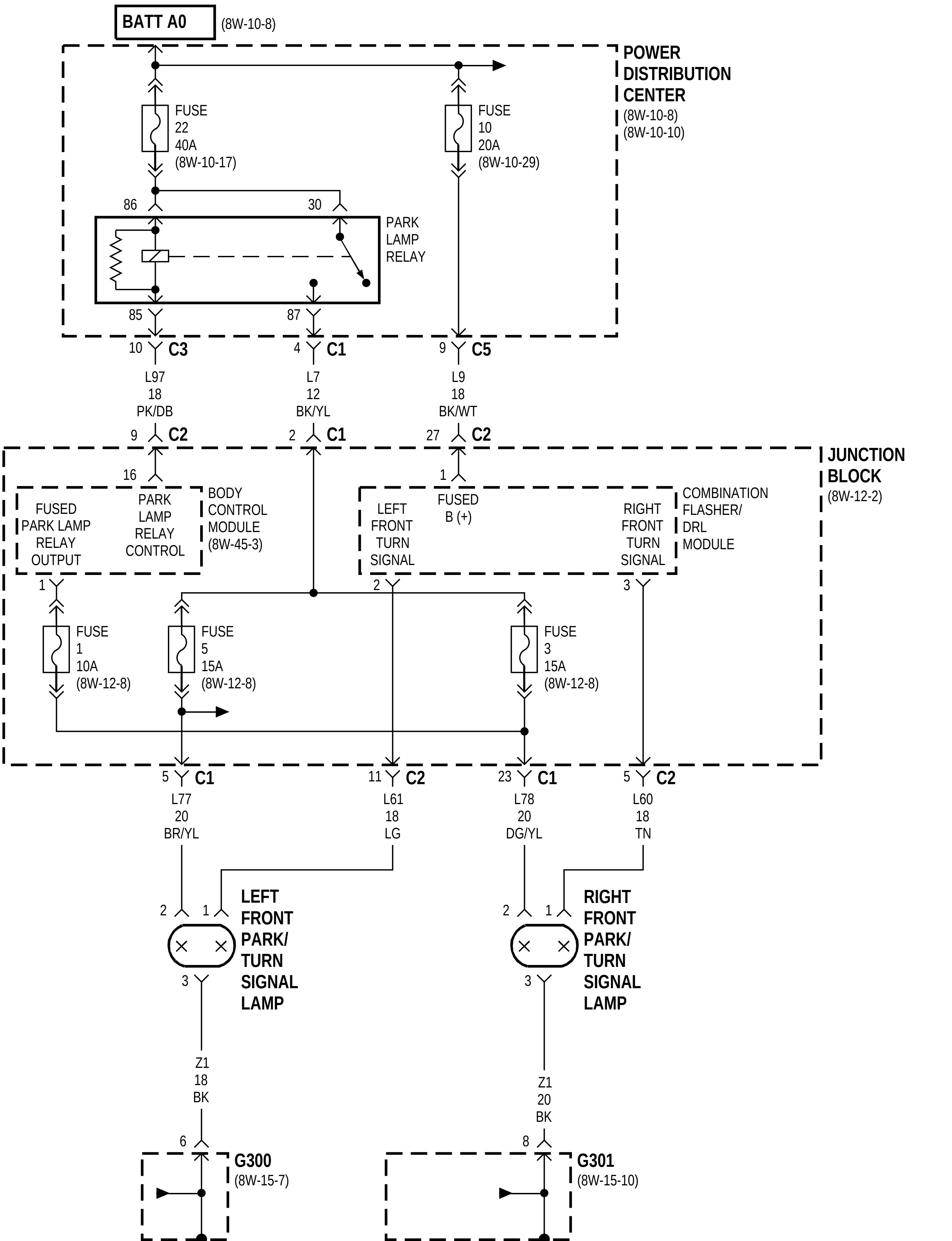

PANEL LAMPS DRIVER
COURTESY LAMP RELAY DRIVER
BODY CONTROL MODULE (8W-45-3) (8W-45-4) (8W-45-5)
BATT F41
(8W-10-20)
JUNCTION BLOCK (8W-12-2)
(8W-12-23)
COURTESY LAMP RELAY
86 30 85 87
(8W-12-22)
D4
(8W-12-22)
FROM P18 (8W-50-7)
FROM P18 (8W-50-11)
F
E
23 C4
DOME LAMP SWITCH
DIMMER SWITCH SIGNAL
2 C2
8 C2
10 C3
34 C3
28 C3
Z39 18 BK
L77 18 BR/YL
E2 20 OR
M32 22 BK/LB
E92 22 OR/BK
M112 22 BR/LG
M111 22 BR/WT
M113 20 LB/PK
1 C2
4 C1
12 C1
3 C1
9 C1
11 C1
6 C2
5 C2
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
3 REAR
4 ON
ILLUM. LAMP
DOME LAMP SWITCH
REAR FOG LAMP INDIC.
FOG LAMP INDIC.
2 C2
5 C1
6 C1
10 C1
7 C2
8 C2
3 C2
Z1 18 BK
Z1 20 BK
M13 20 BK/YL
L308 20 LG/WT
L307 20 LG/OR
E17 20YL/BK
11 C2
40 C2
13 C2
B22 22 P18 B23
3 B75 C20
STEP DIMMER SWITCH SENSE
PARK LAMP SWITCH SENSE
HEADLAMP SWITCH SENSE
GROUND
GROUND
BODY CONTROL MODULE (8W-45-2) (8W-45-4)
14 C2
10 C2
Z2 20BK/LG
Z2 20BK/LG
21 C4
29 C4
JUNCTION BLOCK (8W-12-2)
(8W-12-19)
2 C2
Z1 14 BK
8
G300 (8W-15-5)
M13 20 BK/YL
1
FRONT READING LAMP FEED
FRONT READING LAMPS/ SWITCH (8W-44-2)
E17 20 YL/BK
4 C1
STEP DIMMER SWITCH SIGNAL
RADIO (8W-47-2)



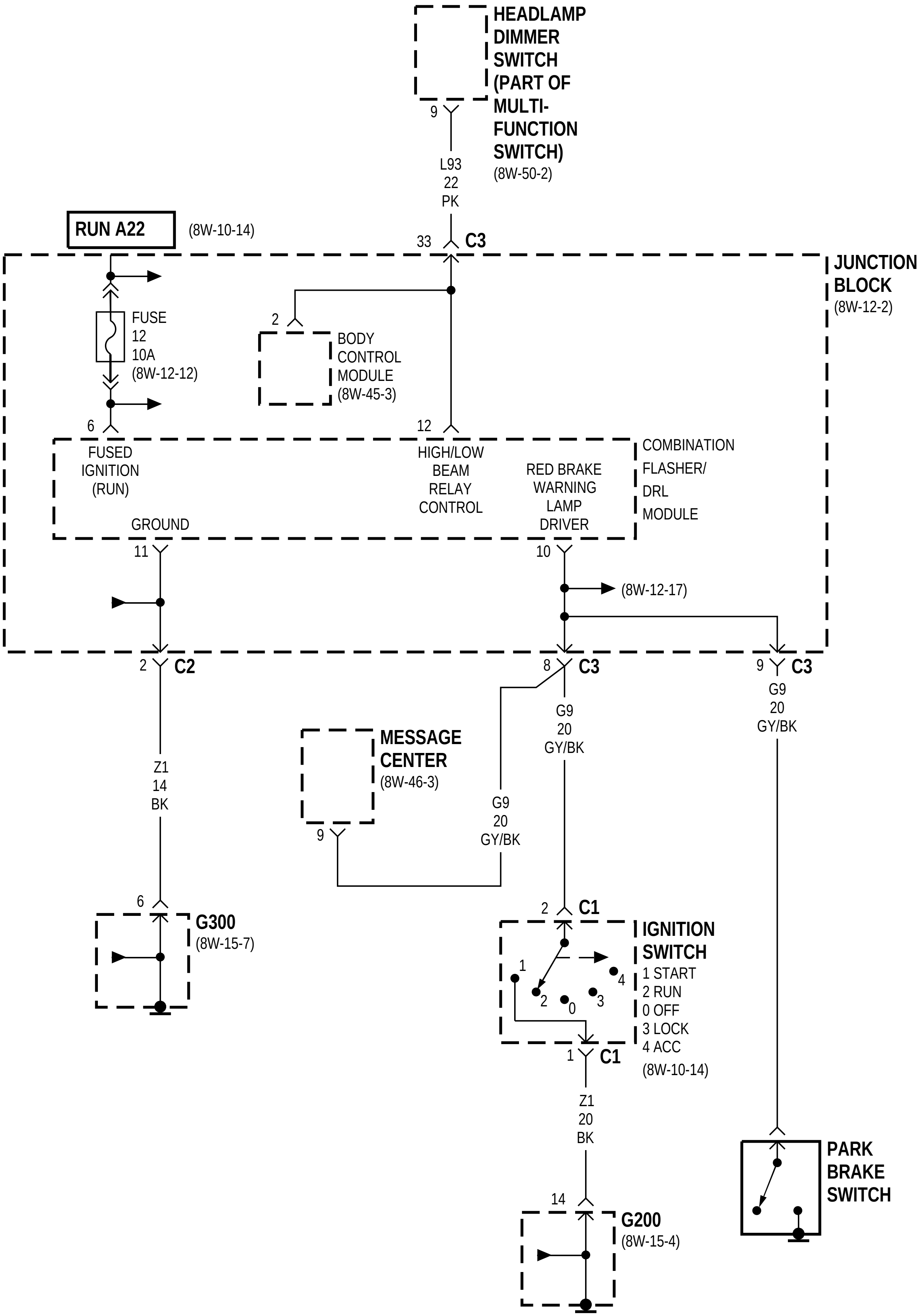
* BUILT-UP-EXPORT

GS005011 J988W-3

DRL


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
(8W-10-10)
FUSE 22 40A
(8W-10-17)
FUSE 10 20A
(8W-10-29)
86
30
PARK LAMP RELAY
85
87
10 C3
4 C1
9 C5
L97 18 PK/DB
L7 12 BK/YL
L9 18 BK/WT
9 C2
2 C1
27 C2
JUNCTION BLOCK
(8W-12-2)
16
1
FUSED PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
LEFT FRONT TURN SIGNAL
FUSED B (+)
RIGHT FRONT TURN SIGNAL
COMBINATION FLASHER/ DRL MODULE
1
2
3
FUSE 1 10A
(8W-12-8)
FUSE 5 15A
(8W-12-8)
FUSE 3 15A
(8W-12-8)
5 C1
11 C2
23 C1
5 C2
L77 20 BR/YL
L61 18 LG
L78 20 DG/YL
L60 18 TN
2
1
LEFT FRONT PARK/ TURN SIGNAL LAMP
2
1
RIGHT FRONT PARK/ TURN SIGNAL LAMP
3
3
Z1 18 BK
Z1 20 BK
6
8
G300
(8W-15-7)
G301
(8W-15-10)

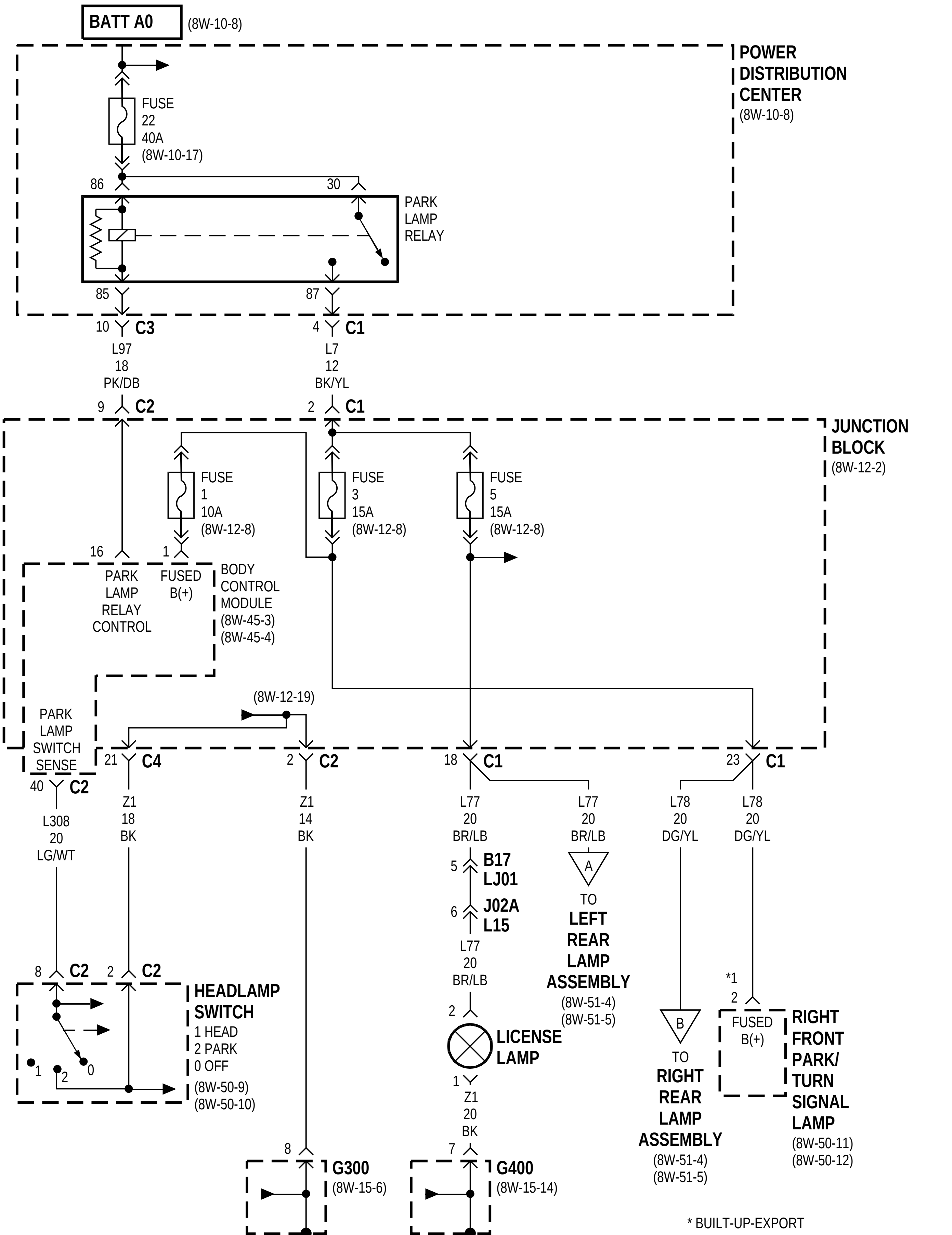
DRL

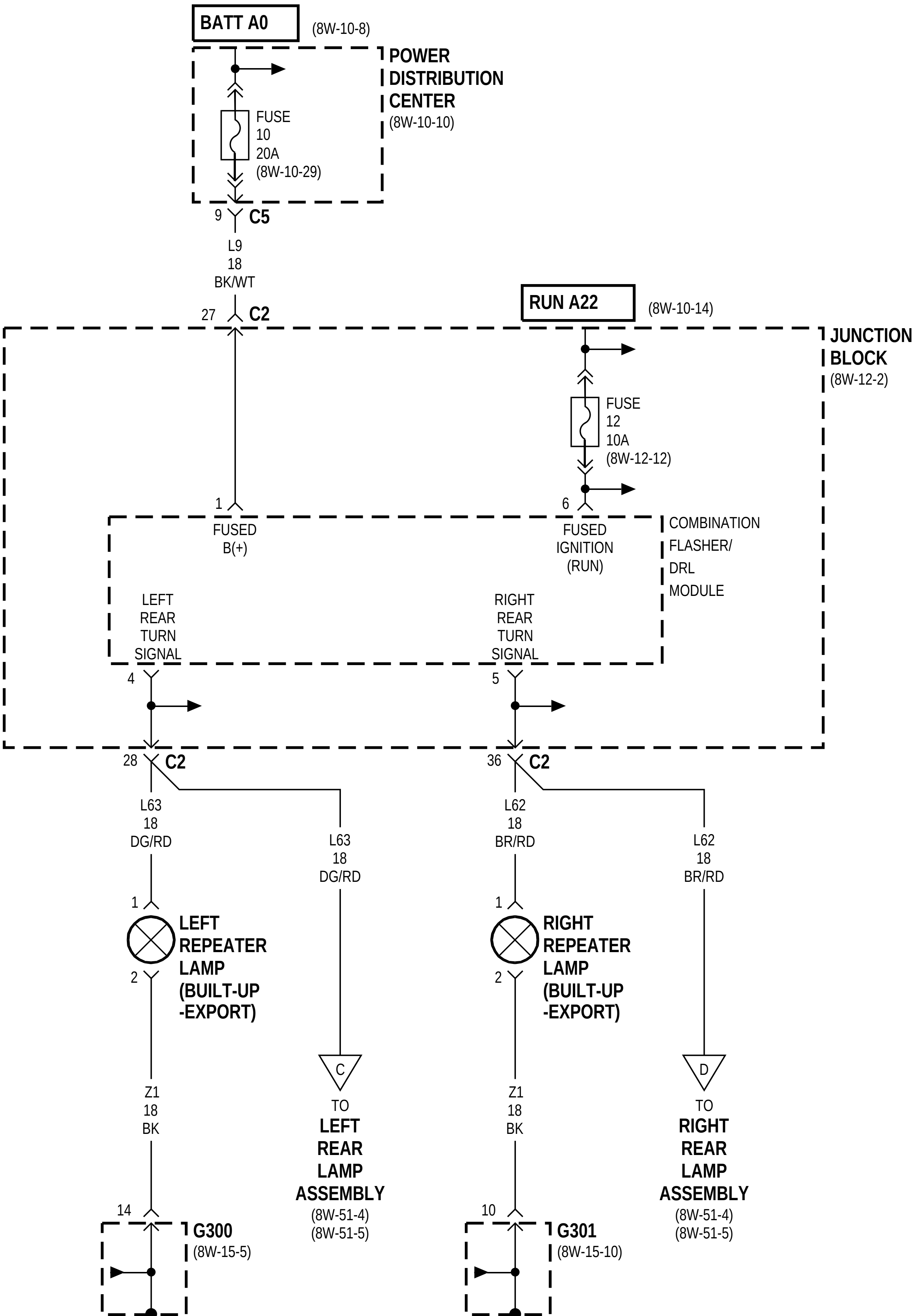

HEADLAMP DIMMER SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-50-2)
9
L93
22
PK
RUN A22
(8W-10-14)
33
C3
JUNCTION BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
2
BODY CONTROL MODULE
(8W-45-3)
6
12
FUSED IGNITION (RUN)
HIGH/LOW BEAM RELAY CONTROL
RED BRAKE WARNING LAMP DRIVER
COMBINATION FLASHER/ DRL MODULE
GROUND
11
10
(8W-12-17)
2
C2
8
C3
9
C3
G9
20
GY/BK
MESSAGE CENTER
(8W-46-3)
Z1
14
BK
9
G9
20
GY/BK
G9
20
GY/BK
6
G300
(8W-15-7)
2
C1
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
C1
(8W-10-14)
Z1
20
BK
14
G200
(8W-15-4)
PARK BRAKE SWITCH

8W-51 REAR LIGHTING

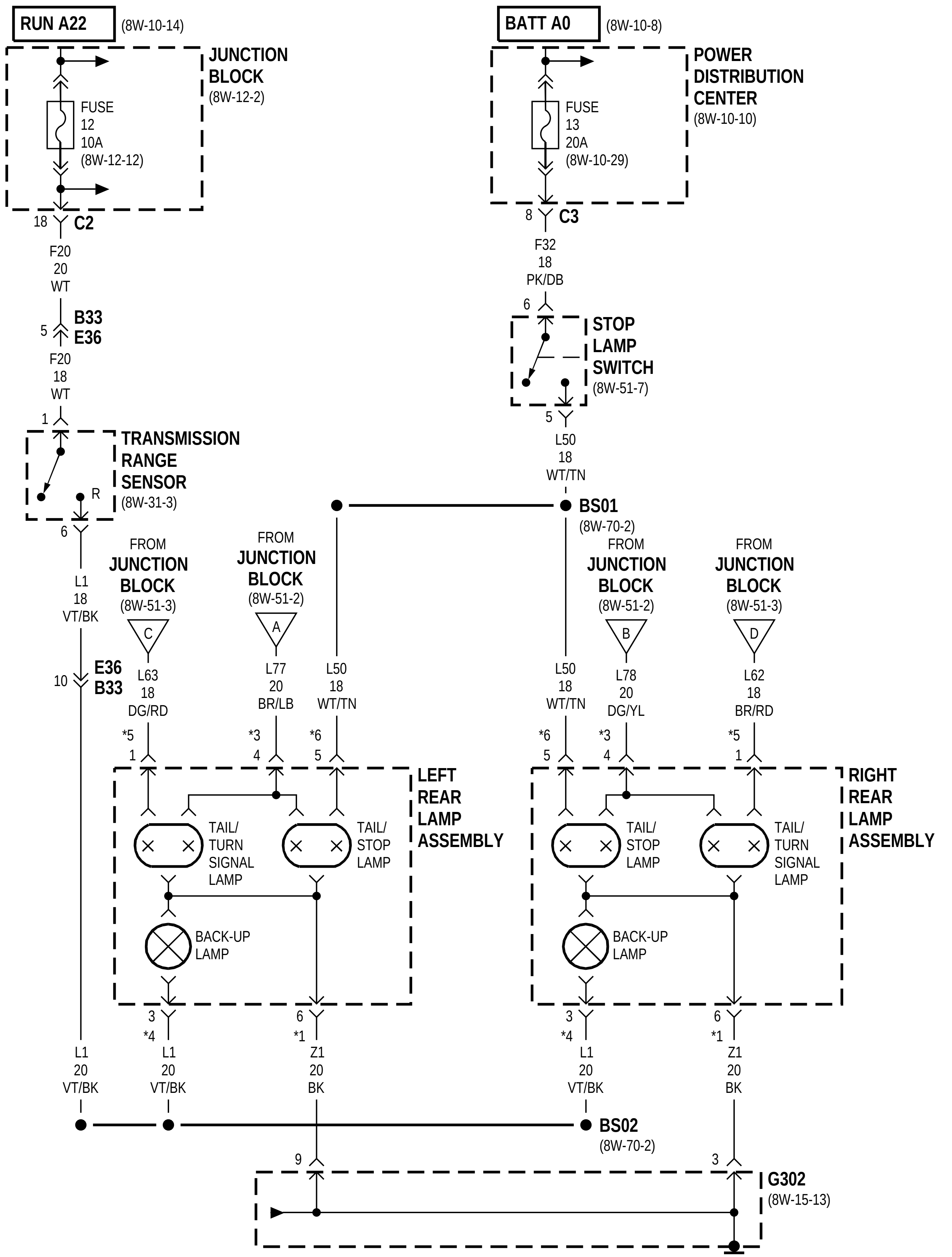
Component	Page
Back-Up Lamp	8W-51-4, 5
Back-Up Switch	8W-51-5
Body Control Module	8W-51-2, 6
BS01	8W-51-4, 5, 7
BS02	8W-51-4, 5
Center High Mounted Stop Lamp	8W-51-7
Combination Flasher/DRL Module	8W-51-3
Fuse 1 (JB)	8W-51-2
Fuse 3 (JB)	8W-51-2, 6
Fuse 5 (JB)	8W-51-2, 6
Fuse 10 (PDC)	8W-51-3
Fuse 12 (JB)	8W-51-3, 4, 5
Fuse 13 (PDC)	8W-51-4, 5, 7
Fuse 22 (PDC)	8W-51-2, 6
G300	8W-51-2, 3
G301	8W-51-3
G302	8W-51-4, 5
G400	8W-51-2, 7

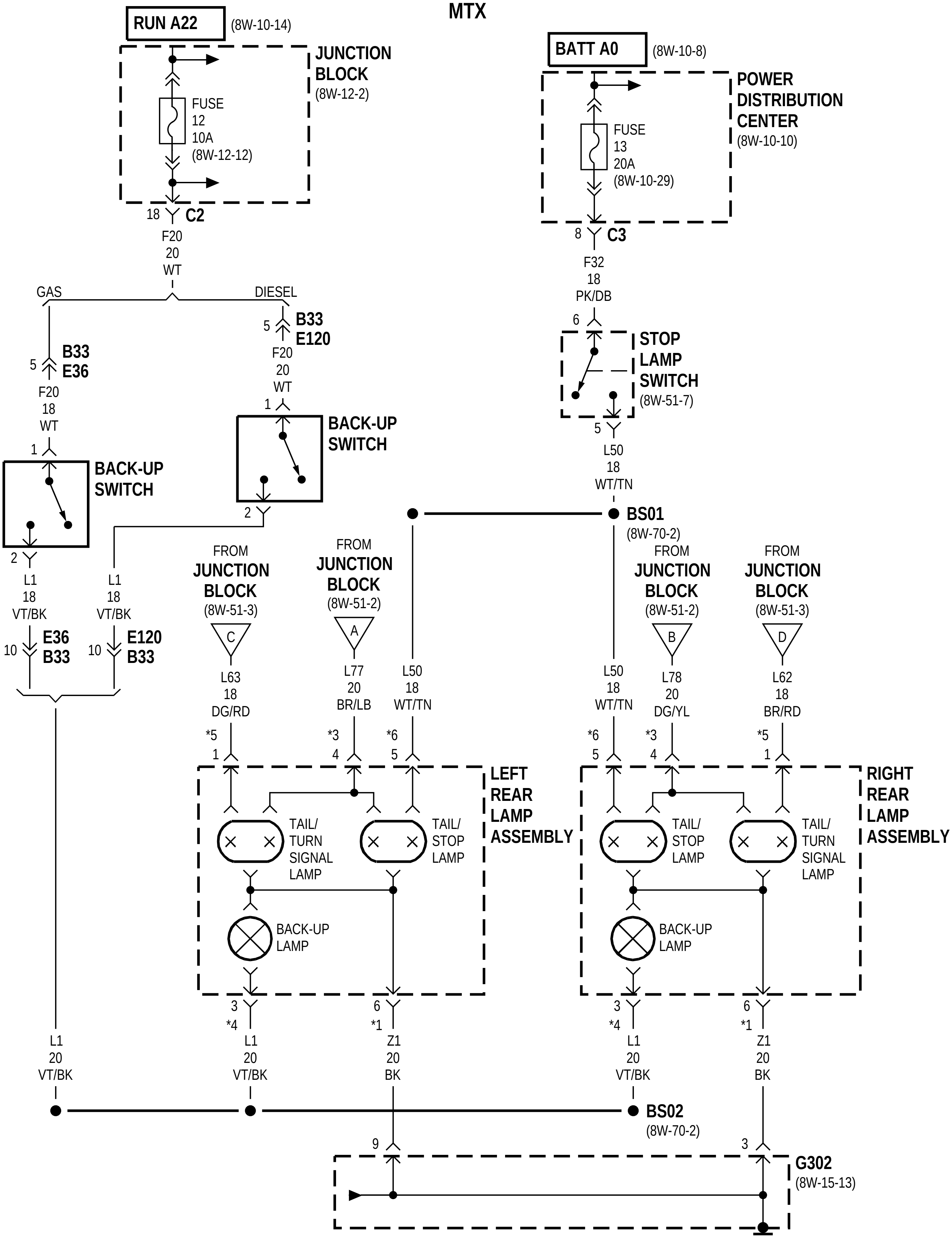
Component	Page
Headlamp Switch	8W-51-2, 6
Junction Block	8W-51-2, 3, 4, 5, 6
Left Rear Lamp Assembly	8W-51-4, 5, 6
Left Repeater Lamp	8W-51-3
License Lamp	8W-51-2
Park Lamp Relay	8W-51-2, 6
Power Distribution Center	8W-51-2, 3, 4, 5, 6, 7
Rear Fog Lamp	8W-51-6
Rear Fog Lamp Indicator	8W-51-6
Right Front Park/Turn Signal Lamp	8W-51-2
Right Rear Lamp Assembly	8W-51-4, 5, 6
Right Repeater Lamp	8W-51-3
Stop Lamp Switch	8W-51-4, 5, 7
Tail/Stop Lamp	8W-51-4, 5
Tail/Turn Signal Lamp	8W-51-4, 5
Transmission Range Sensor	8W-51-4

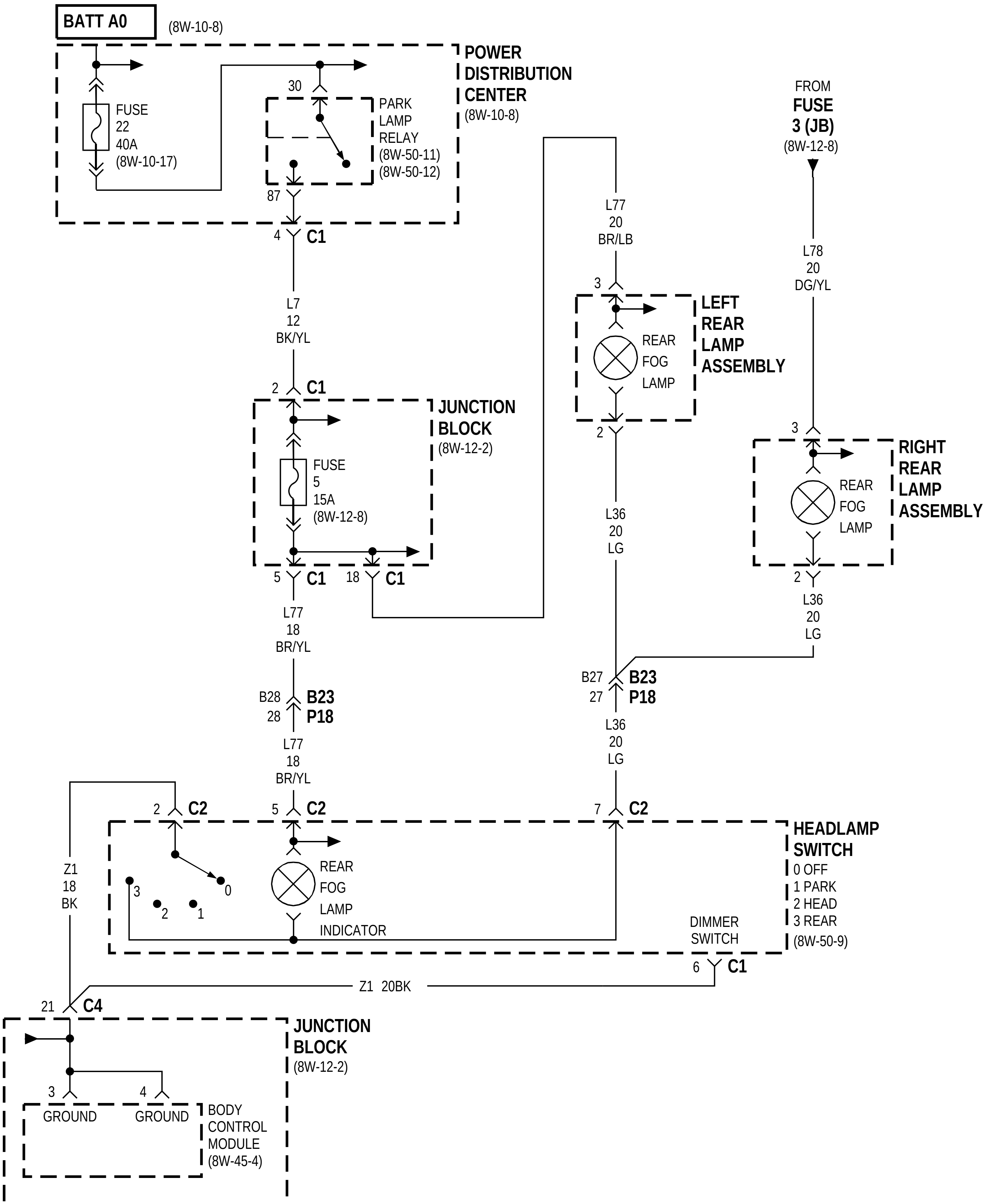

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 22 40A
(8W-10-17)
86
30
PARK LAMP RELAY
85
87
10 C3
4 C1
L97 18 PK/DB
L7 12 BK/YL
9 C2
2 C1
JUNCTION BLOCK
(8W-12-2)
FUSE 1 10A
(8W-12-8)
FUSE 3 15A
(8W-12-8)
FUSE 5 15A
(8W-12-8)
16
1
PARK LAMP RELAY CONTROL
FUSED B(+)
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
(8W-12-19)
PARK LAMP SWITCH SENSE
21 C4
2 C2
18 C1
23 C1
40 C2
L308 20 LG/WT
Z1 18 BK
Z1 14 BK
L77 20 BR/LB
L77 20 BR/LB
L78 20 DG/YL
L78 20 DG/YL
5 B17 LJ01
6 J02A L15
L77 20 BR/LB
A
TO LEFT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
8 C2
2 C2
HEADLAMP SWITCH
1 HEAD
2 PARK
0 OFF
(8W-50-9)
(8W-50-10)
1 2 0
2
LICENSE LAMP
1
Z1 20 BK
B
TO RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
*1
2
FUSED B(+)
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
(8W-50-12)
8
G300
(8W-15-6)
7
G400
(8W-15-14)
* BUILT-UP-EXPORT

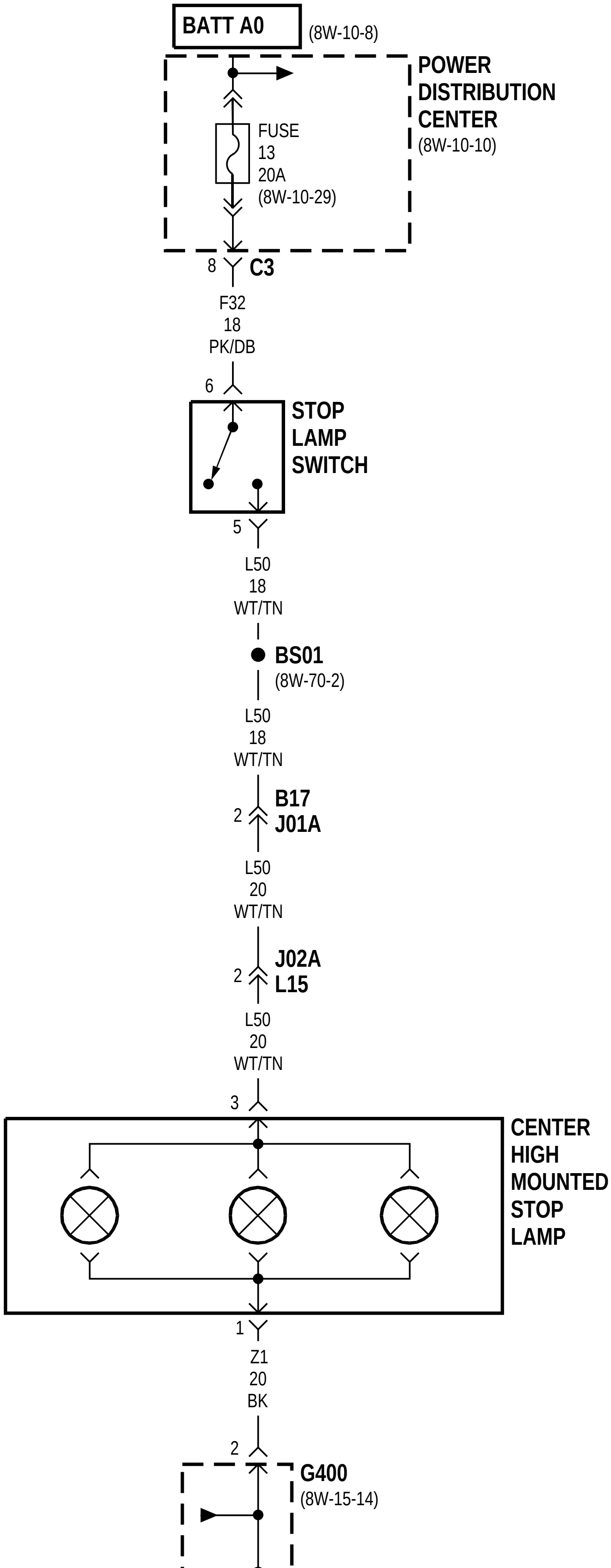

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 10 20A
(8W-10-29)
9
C5
L9 18 BK/WT
27
C2
RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 12 10A
(8W-12-12)
1
6
FUSED B(+)
FUSED IGNITION (RUN)
COMBINATION FLASHER/ DRL MODULE
LEFT REAR TURN SIGNAL
RIGHT REAR TURN SIGNAL
4
5
28
C2
36
C2
L63 18 DG/RD
L63 18 DG/RD
L62 18 BR/RD
L62 18 BR/RD
1
LEFT REPEATER LAMP (BUILT-UP -EXPORT)
2
1
RIGHT REPEATER LAMP (BUILT-UP -EXPORT)
2
C
TO LEFT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
D
TO RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
Z1 18 BK
Z1 18 BK
14
G300
(8W-15-5)
10
G301
(8W-15-10)

EATX


RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 12 10A (8W-12-12)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 13 20A (8W-10-29)
18 C2
8 C3
F20 20 WT
F32 18 PK/DB
5 B33 E36
F20 18 WT
STOP LAMP SWITCH
(8W-51-7)
TRANSMISSION RANGE SENSOR
(8W-31-3)
R
L50 18 WT/TN
BS01
(8W-70-2)
L1 18 VT/BK
FROM JUNCTION BLOCK (8W-51-3) C
FROM JUNCTION BLOCK (8W-51-2) A
FROM JUNCTION BLOCK (8W-51-2) B
FROM JUNCTION BLOCK (8W-51-3) D
10 E36 B33
L63 18 DG/RD
L77 20 BR/LB
L50 18 WT/TN
L78 20 DG/YL
L62 18 BR/RD
*5 *3 *6
LEFT REAR LAMP ASSEMBLY
RIGHT REAR LAMP ASSEMBLY
TAIL/ TURN SIGNAL LAMP
TAIL/ STOP LAMP
BACK-UP LAMP
*4 *1
L1 20 VT/BK
Z1 20 BK
BS02
(8W-70-2)
G302
(8W-15-13)

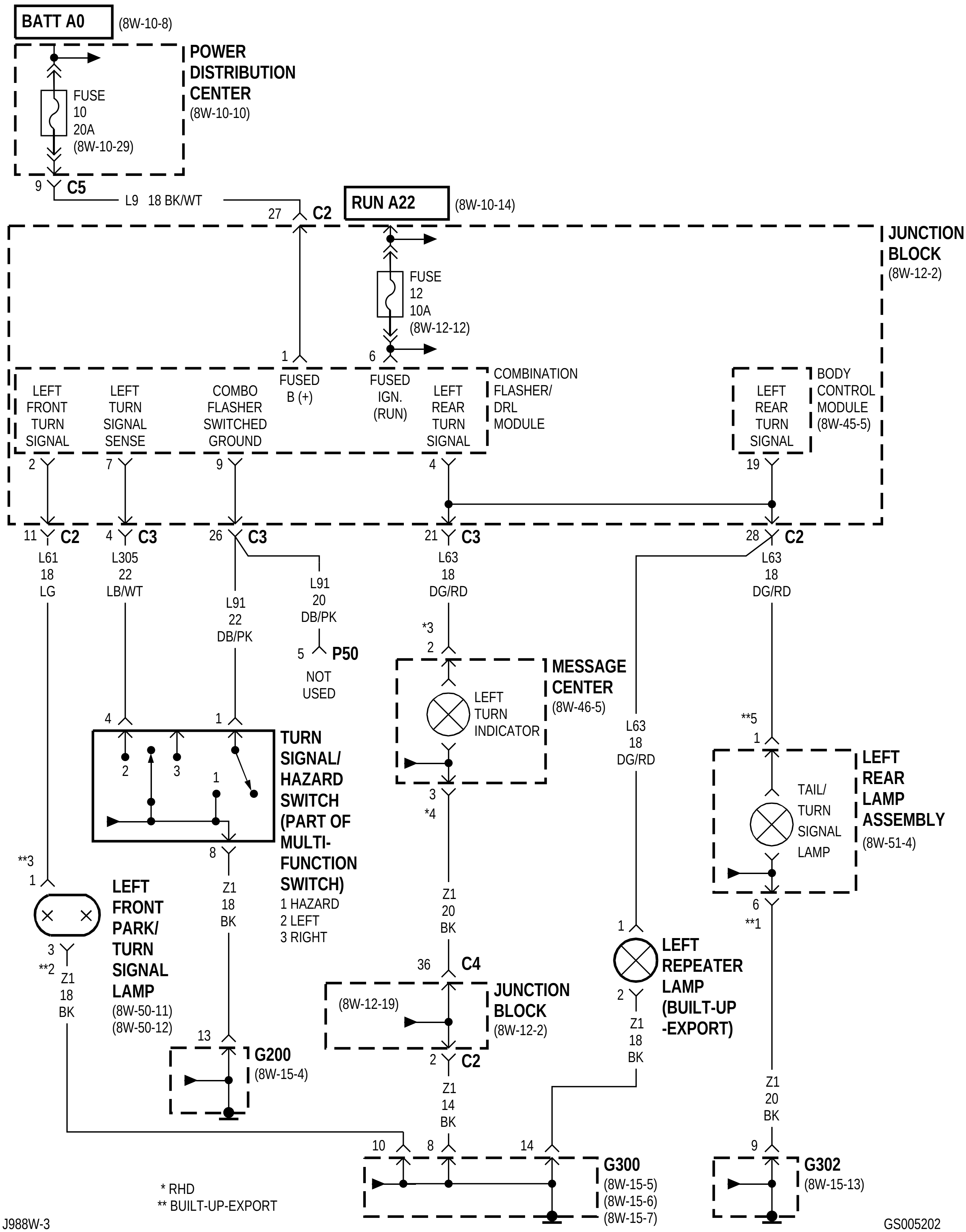

RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 12 10A (8W-12-12)
18 C2
F20 20 WT
GAS
DIESEL
5 B33 E36
F20 18 WT
1
BACK-UP SWITCH
2
L1 18 VT/BK
10 E36 B33
5 B33 E120
F20 20 WT
1
BACK-UP SWITCH
2
L1 18 VT/BK
10 E120 B33
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 13 20A (8W-10-29)
8 C3
F32 18 PK/DB
6
STOP LAMP SWITCH
(8W-51-7)
5
L50 18 WT/TN
BS01
(8W-70-2)
FROM JUNCTION BLOCK (8W-51-3)
C
L63 18 DG/RD
FROM JUNCTION BLOCK (8W-51-2)
A
L77 20 BR/LB
L50 18 WT/TN
*5 1
*3 4
*6 5
LEFT REAR LAMP ASSEMBLY
TAIL/ TURN SIGNAL LAMP
TAIL/ STOP LAMP
BACK-UP LAMP
3 *4
6 *1
FROM JUNCTION BLOCK (8W-51-2)
B
L78 20 DG/YL
FROM JUNCTION BLOCK (8W-51-3)
D
L62 18 BR/RD
L50 18 WT/TN
*6 5
*3 4
*5 1
RIGHT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
TAIL/ TURN SIGNAL LAMP
BACK-UP LAMP
3 *4
6 *1
L1 20 VT/BK
L1 20 VT/BK
Z1 20 BK
L1 20 VT/BK
Z1 20 BK
BS02
(8W-70-2)
9
3
G302
(8W-15-13)

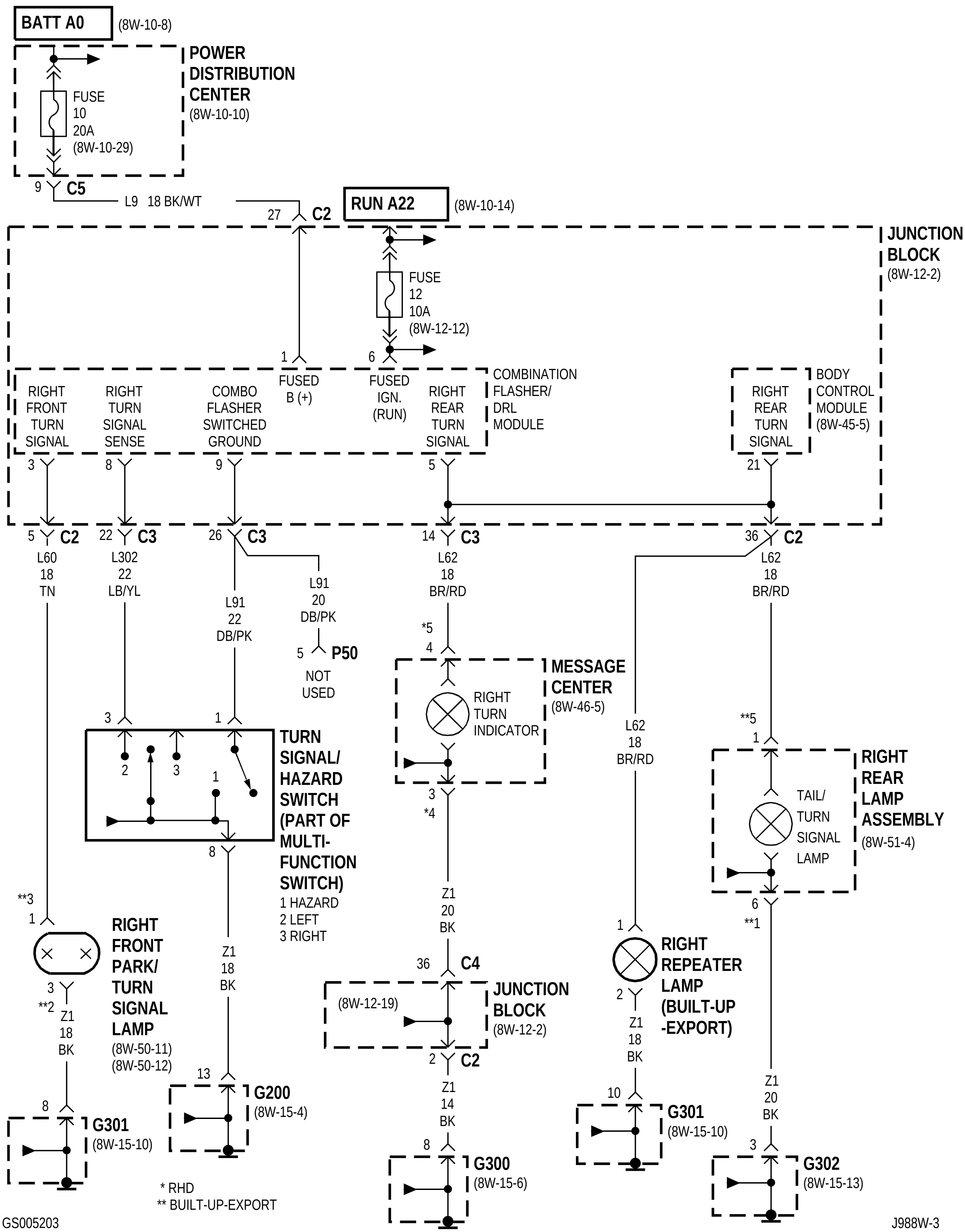

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 22 40A (8W-10-17)
30
PARK LAMP RELAY (8W-50-11) (8W-50-12)
87
4 C1
L7 12 BK/YL
2 C1
JUNCTION BLOCK
(8W-12-2)
FUSE 5 15A (8W-12-8)
5 C1
18 C1
L77 18 BR/YL
B28 28 B23 P18
L77 18 BR/YL
L77 20 BR/LB
3
LEFT REAR LAMP ASSEMBLY
REAR FOG LAMP
2
L36 20 LG
FROM FUSE 3 (JB) (8W-12-8)
L78 20 DG/YL
3
RIGHT REAR LAMP ASSEMBLY
REAR FOG LAMP
2
L36 20 LG
B27 27 B23 P18
L36 20 LG
2 C2
5 C2
7 C2
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
3 REAR
(8W-50-9)
3 2 1 0
REAR FOG LAMP INDICATOR
DIMMER SWITCH
6 C1
Z1 18 BK
Z1 20BK
21 C4
JUNCTION BLOCK
(8W-12-2)
3 4
GROUND GROUND
BODY CONTROL MODULE (8W-45-4)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-10)
FUSE
13
20A
(8W-10-29)
8
C3
F32
18
PK/DB
6
STOP
LAMP
SWITCH
5
L50
18
WT/TN
BS01
(8W-70-2)
L50
18
WT/TN
2
B17
J01A
L50
20
WT/TN
2
J02A
L15
L50
20
WT/TN
3
CENTER
HIGH
MOUNTED
STOP
LAMP
1
Z1
20
BK
2
G400
(8W-15-14)

8W-52 TURN SIGNALS

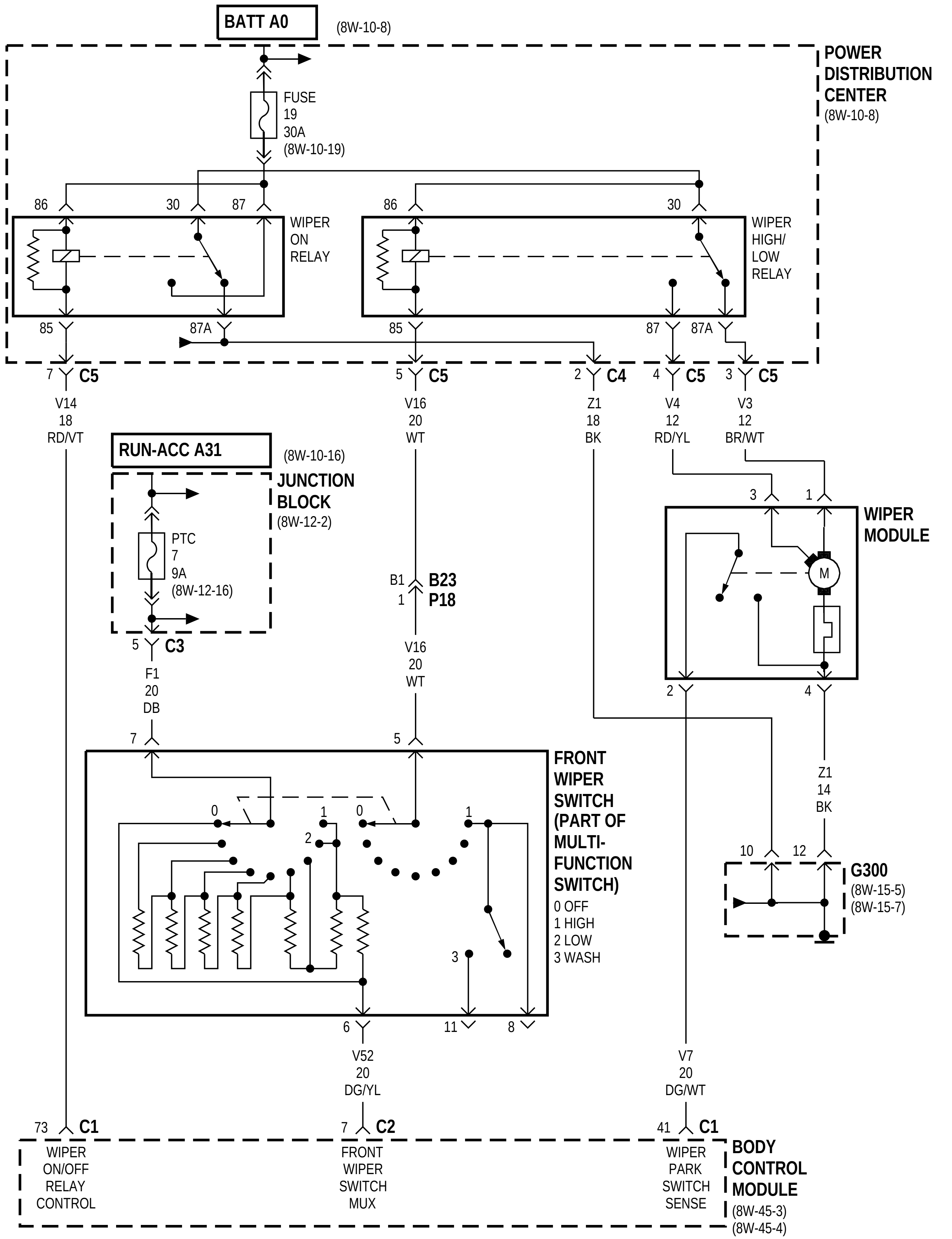
Component	Page
Body Control Module	8W-52-2, 3
Combination Flasher/DRL Module	8W-52-2, 3
Fuse 10 (PDC)	8W-52-2, 3
Fuse 12 (JB)	8W-52-2, 3
G200	8W-52-2, 3
G300	8W-52-2, 3
G301	8W-52-3
G302	8W-52-2, 3
Junction Block	8W-52-2, 3
Left Front Park/Turn Signal Lamp	8W-52-2
Left Rear Lamp Assembly	8W-52-2
Left Repeater Lamp	8W-52-2
Left Turn Indicator	8W-52-2
Message Center	8W-52-2, 3
Power Distribution Center	8W-52-2, 3
Right Front Park/Turn Signal Lamp	8W-52-3
Right Rear Lamp Assembly	8W-52-3
Right Repeater Lamp	8W-52-3
Right Turn Indicator	8W-52-3
Tail/Turn Signal Lamp	8W-52-2, 3
Turn Signal/Hazard Switch	8W-52-2, 3

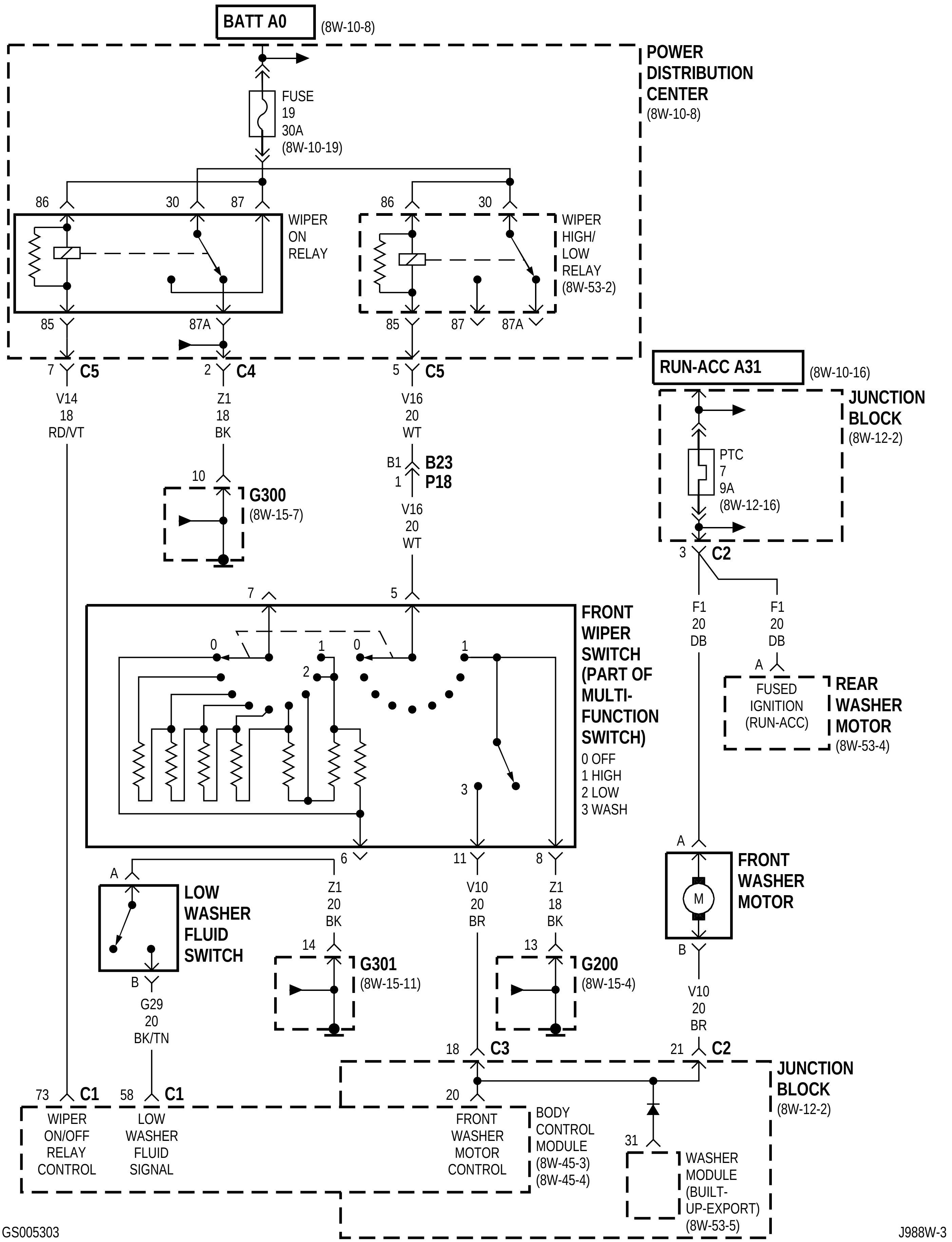

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 10 20A (8W-10-29)
9 C5
L9 18 BK/WT
27 C2
RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 12 10A (8W-12-12)
1
6
LEFT FRONT TURN SIGNAL
LEFT TURN SIGNAL SENSE
COMBO FLASHER SWITCHED GROUND
FUSED B (+)
FUSED IGN. (RUN)
LEFT REAR TURN SIGNAL
COMBINATION FLASHER/ DRL MODULE
LEFT REAR TURN SIGNAL
BODY CONTROL MODULE (8W-45-5)
2
7
9
4
19
11 C2
4 C3
26 C3
21 C3
28 C2
L61 18 LG
L305 22 LB/WT
L91 22 DB/PK
L91 20 DB/PK
L63 18 DG/RD
L63 18 DG/RD
5 P50
NOT USED
*3
2
MESSAGE CENTER
(8W-46-5)
LEFT TURN INDICATOR
3
*4
4
1
2
3
1
TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI- FUNCTION SWITCH)
1 HAZARD
2 LEFT
3 RIGHT
8
Z1 18 BK
**3
1
LEFT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
(8W-50-12)
3
**2
Z1 18 BK
L63 18 DG/RD
**5
1
LEFT REAR LAMP ASSEMBLY
(8W-51-4)
TAIL/ TURN SIGNAL LAMP
6
**1
Z1 20 BK
36 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-19)
2 C2
Z1 14 BK
1
LEFT REPEATER LAMP (BUILT-UP -EXPORT)
2
Z1 18 BK
Z1 20 BK
13
G200
(8W-15-4)
10
8
14
G300
(8W-15-5)
(8W-15-6)
(8W-15-7)
9
G302
(8W-15-13)
* RHD
** BUILT-UP-EXPORT


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-10)
FUSE 10 20A
(8W-10-29)
9 C5
L9 18 BK/WT
27 C2
RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE 12 10A
(8W-12-12)
1
6
FUSED B (+)
FUSED IGN. (RUN)
COMBINATION FLASHER/ DRL MODULE
RIGHT FRONT TURN SIGNAL
RIGHT TURN SIGNAL SENSE
COMBO FLASHER SWITCHED GROUND
RIGHT REAR TURN SIGNAL
RIGHT REAR TURN SIGNAL
BODY CONTROL MODULE
(8W-45-5)
3
8
9
5
21
5 C2
22 C3
26 C3
14 C3
36 C2
L60 18 TN
L302 22 LB/YL
L91 22 DB/PK
L91 20 DB/PK
5 P50
NOT USED
L62 18 BR/RD
L62 18 BR/RD
L62 18 BR/RD
*5
4
MESSAGE CENTER
(8W-46-5)
RIGHT TURN INDICATOR
3
*4
3
1
2
3
1
TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI-FUNCTION SWITCH)
1 HAZARD
2 LEFT
3 RIGHT
8
**5
1
RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
TAIL/ TURN SIGNAL LAMP
6
**1
**3
1
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
(8W-50-12)
3
**2
Z1 18 BK
Z1 18 BK
Z1 20 BK
36 C4
JUNCTION BLOCK
(8W-12-19)
(8W-12-2)
2 C2
Z1 14 BK
1
RIGHT REPEATER LAMP (BUILT-UP -EXPORT)
2
Z1 18 BK
Z1 20 BK
8
G301
(8W-15-10)
13
G200
(8W-15-4)
8
G300
(8W-15-6)
10
G301
(8W-15-10)
3
G302
(8W-15-13)
* RHD
** BUILT-UP-EXPORT

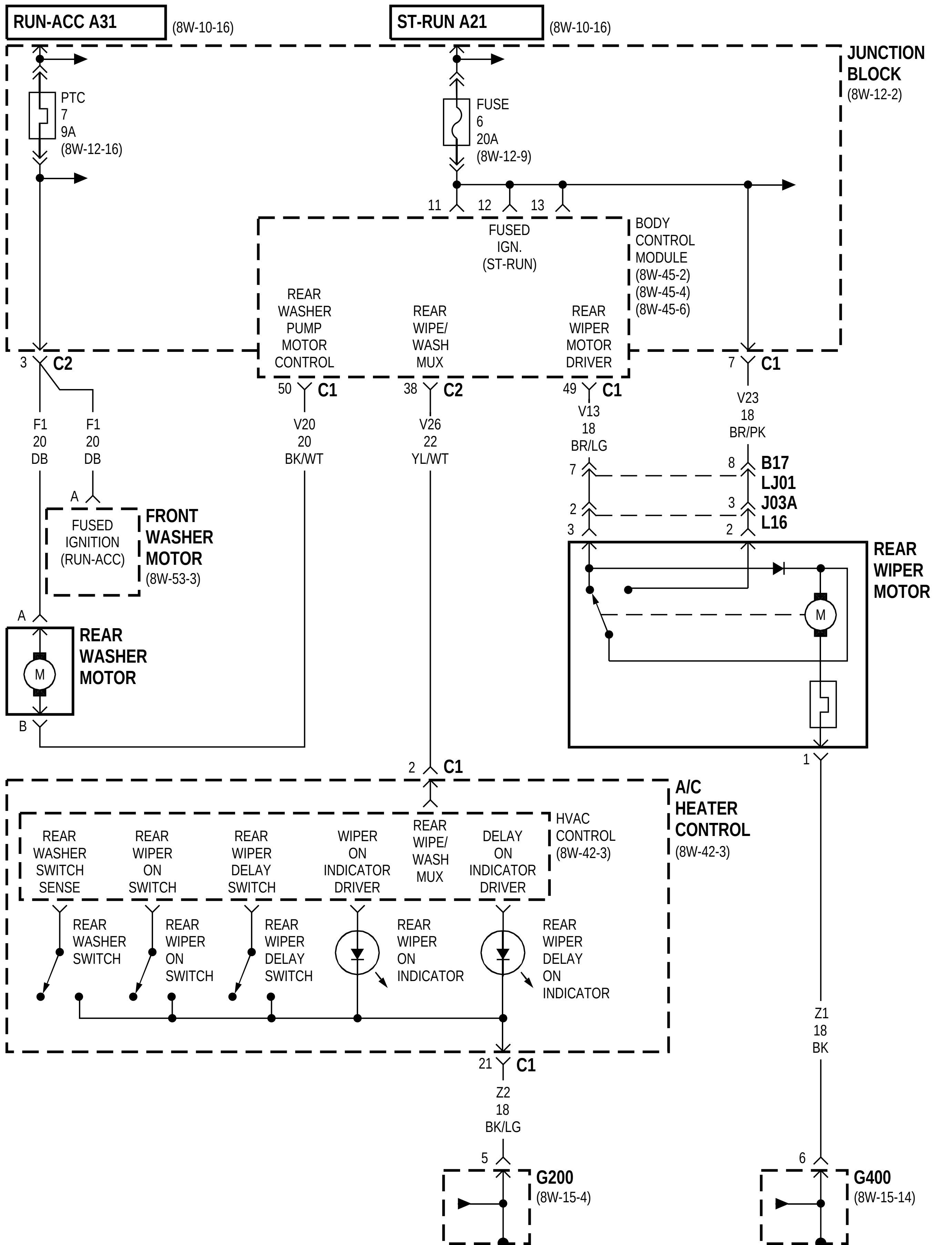
8W-53 WIPERS

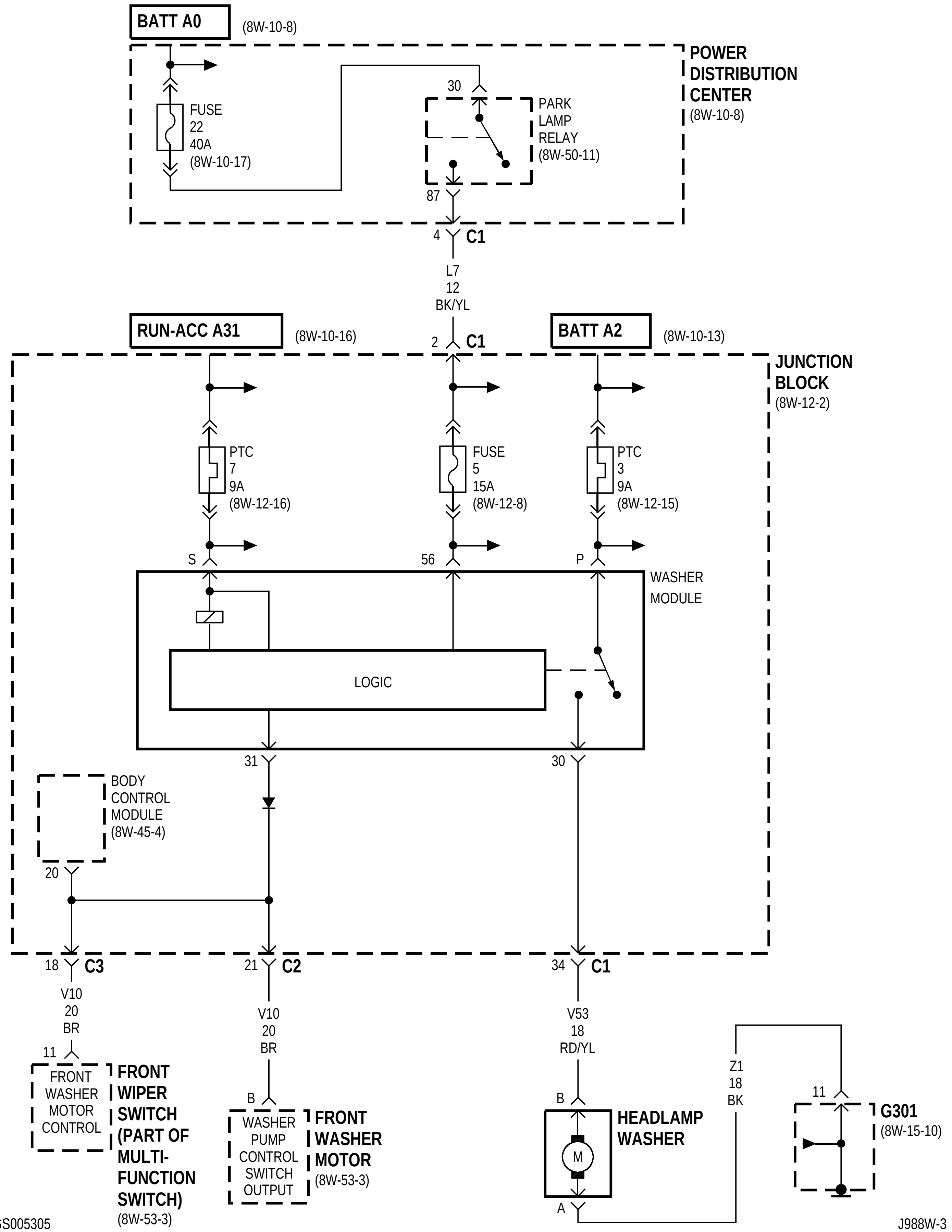
Component	Page
A/C Heater Control	8W-53-4
Body Control Module	8W-53-2, 3, 4, 5
Front Washer Motor	8W-53-3, 4, 5
Front Wiper Switch	8W-53-2, 3, 5
Fuse 5 (JB)	8W-53-5
Fuse 6 (JB)	8W-53-4
Fuse 19 (PDC)	8W-53-2, 3
Fuse 22 (PDC)	8W-53-5
G200	8W-53-3, 4
G300	8W-53-2, 3
G301	8W-53-3, 5
G400	8W-53-4
Headlamp Washer	8W-53-5
HVAC Control	8W-53-4
Junction Block	8W-53-2, 3, 4, 5
Low Washer Fluid Switch	8W-53-3
Park Lamp Relay	8W-53-5
Power Distribution Center	8W-53-2, 3, 5
PTC 3 (JB)	8W-53-5
PTC 7 (JB)	8W-53-2, 3, 4, 5
Rear Washer Motor	8W-53-3, 4
Rear Washer Switch	8W-53-4
Rear Wiper Delay On Indicator	8W-53-4
Rear Wiper Delay Switch	8W-53-4
Rear Wiper Motor	8W-53-4
Rear Wiper On Indicator	8W-53-4
Rear Wiper On Switch	8W-53-4
Washer Module	8W-53-3, 5
Wiper High/Low Relay	8W-53-2, 3
Wiper Module	8W-53-2
Wiper On Relay	8W-53-2, 3


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
19
30A
(8W-10-19)
86
30
87
WIPER
ON
RELAY
85
87A
WIPER
HIGH/
LOW
RELAY
7 C5
5 C5
2 C4
4 C5
3 C5
V14
18
RD/VT
V16
20
WT
Z1
18
BK
V4
12
RD/YL
V3
12
BR/WT
RUN-ACC A31
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
PTC
7
9A
(8W-12-16)
5 C3
F1
20
DB
B1 B23
1 P18
WIPER
MODULE
M
FRONT
WIPER
SWITCH
(PART OF
MULTI-
FUNCTION
SWITCH)
0 OFF
1 HIGH
2 LOW
3 WASH
Z1
14
BK
G300
(8W-15-5)
(8W-15-7)
V52
20
DG/YL
V7
20
DG/WT
73 C1
7 C2
41 C1
WIPER
ON/OFF
RELAY
CONTROL
FRONT
WIPER
SWITCH
MUX
WIPER
PARK
SWITCH
SENSE
BODY
CONTROL
MODULE
(8W-45-3)
(8W-45-4)



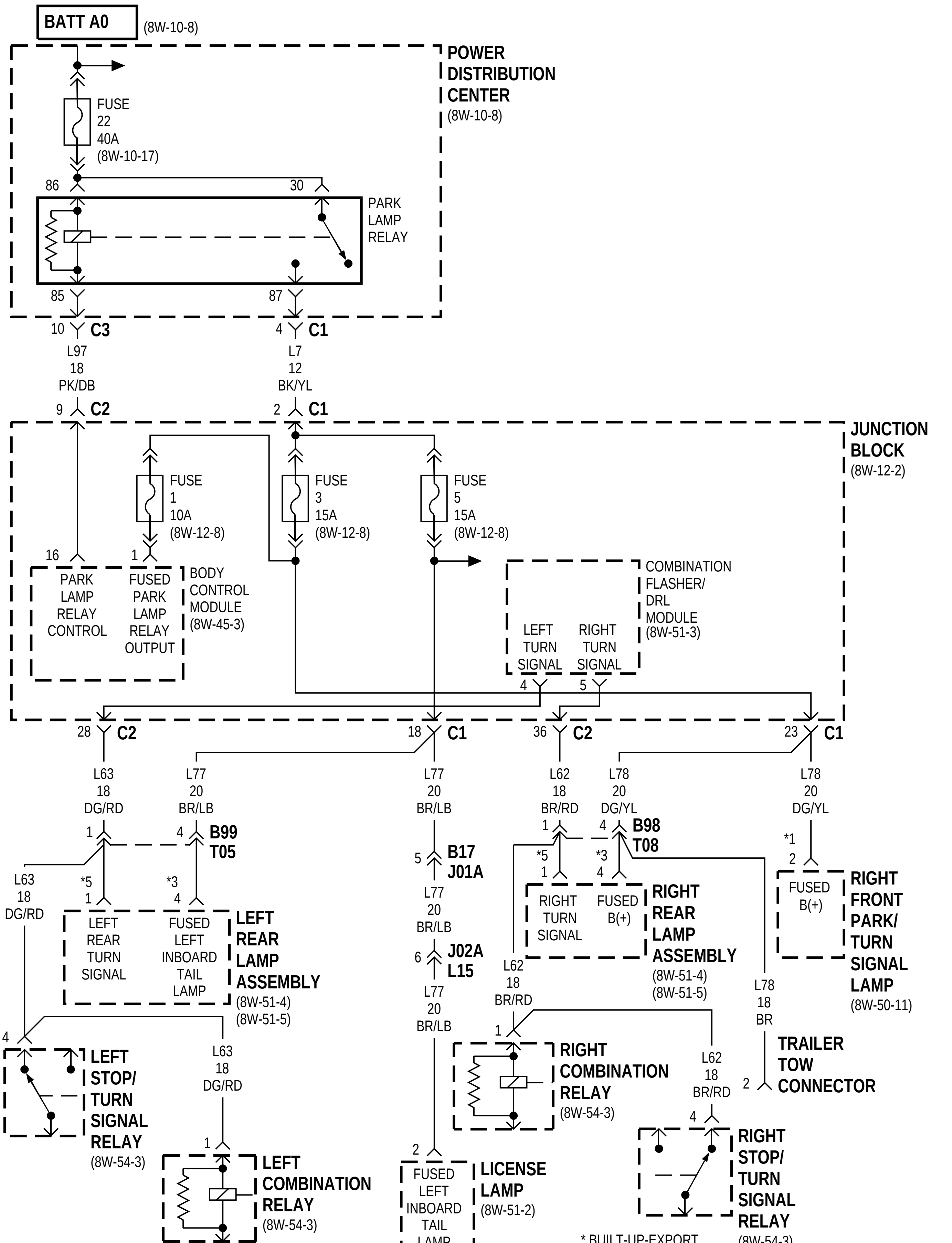
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 19 30A (8W-10-19)
86 30 87
WIPER ON RELAY
86 30
WIPER HIGH/ LOW RELAY (8W-53-2)
85 87A 85 87 87A
7 C5
2 C4
5 C5
V14 18 RD/VT
Z1 18 BK
V16 20 WT
RUN-ACC A31
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC 7 9A (8W-12-16)
B1 B23
1 P18
10
G300
(8W-15-7)
V16 20 WT
3 C2
F1 20 DB
F1 20 DB
7 5
FRONT WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 HIGH
2 LOW
3 WASH
0 1 0 1 2 3
A
FUSED IGNITION (RUN-ACC)
REAR WASHER MOTOR
(8W-53-4)
6 11 8
A
LOW WASHER FLUID SWITCH
B
Z1 20 BK
V10 20 BR
Z1 18 BK
14
G301
(8W-15-11)
13
G200
(8W-15-4)
A
FRONT WASHER MOTOR
M
B
V10 20 BR
G29 20 BK/TN
18 C3
21 C2
73 C1
58 C1
20
JUNCTION BLOCK
(8W-12-2)
WIPER ON/OFF RELAY CONTROL
LOW WASHER FLUID SIGNAL
FRONT WASHER MOTOR CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
31
WASHER MODULE (BUILT-UP-EXPORT)
(8W-53-5)

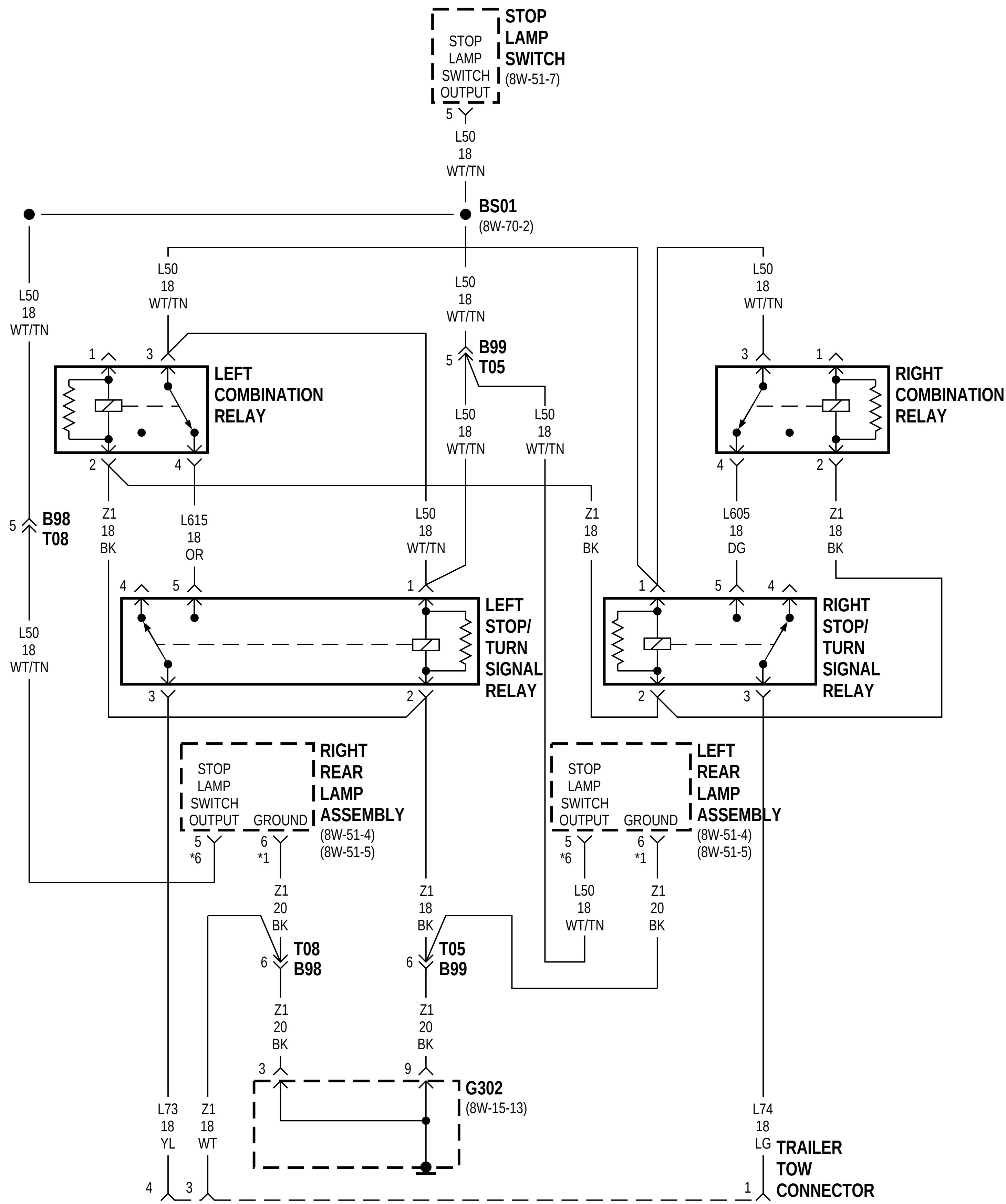

RUN-ACC A31
(8W-10-16)
ST-RUN A21
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC 7 9A (8W-12-16)
FUSE 6 20A (8W-12-9)
11 12 13
FUSED IGN. (ST-RUN)
BODY CONTROL MODULE
(8W-45-2)
(8W-45-4)
(8W-45-6)
REAR WASHER PUMP MOTOR CONTROL
REAR WIPE/ WASH MUX
REAR WIPER MOTOR DRIVER
3 C2
50 C1
38 C2
49 C1
7 C1
F1 20 DB
F1 20 DB
V20 20 BK/WT
V26 22 YL/WT
V13 18 BR/LG
V23 18 BR/PK
A
FUSED IGNITION (RUN-ACC)
FRONT WASHER MOTOR
(8W-53-3)
7 8 B17
LJ01
2 3 J03A
3 2 L16
REAR WIPER MOTOR
M
A
REAR WASHER MOTOR
B
2 C1
1
A/C HEATER CONTROL
(8W-42-3)
HVAC CONTROL
(8W-42-3)
REAR WASHER SWITCH SENSE
REAR WIPER ON SWITCH
REAR WIPER DELAY SWITCH
WIPER ON INDICATOR DRIVER
REAR WIPE/ WASH MUX
DELAY ON INDICATOR DRIVER
REAR WASHER SWITCH
REAR WIPER ON SWITCH
REAR WIPER DELAY SWITCH
REAR WIPER ON INDICATOR
REAR WIPER DELAY ON INDICATOR
21 C1
Z2 18 BK/LG
Z1 18 BK
5
6
G200
(8W-15-4)
G400
(8W-15-14)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-8)
FUSE
22
40A
(8W-10-17)
30
PARK
LAMP
RELAY
(8W-50-11)
87
4
C1
L7
12
BK/YL
RUN-ACC A31
(8W-10-16)
2
C1
BATT A2
(8W-10-13)
JUNCTION
BLOCK
(8W-12-2)
PTC
7
9A
(8W-12-16)
FUSE
5
15A
(8W-12-8)
PTC
3
9A
(8W-12-15)
S
56
P
WASHER
MODULE
LOGIC
31
30
BODY
CONTROL
MODULE
(8W-45-4)
20
18
C3
21
C2
34
C1
V10
20
BR
V10
20
BR
V53
18
RD/YL
11
FRONT
WASHER
MOTOR
CONTROL
FRONT
WIPER
SWITCH
(PART OF
MULTI-
FUNCTION
SWITCH)
(8W-53-3)
B
WASHER
PUMP
CONTROL
SWITCH
OUTPUT
FRONT
WASHER
MOTOR
(8W-53-3)
B
M
A
HEADLAMP
WASHER
Z1
18
BK
11
G301
(8W-15-10)

8W-54 TRAILER TOW

Component	Page
Body Control Module	8W-54-2
BS01	8W-54-3
Combination Flasher/DRL Module	8W-54-2
Fuse 1 (JB)	8W-54-2
Fuse 3 (JB)	8W-54-2
Fuse 5 (JB)	8W-54-2
Fuse 22 (PDC)	8W-54-2
G302	8W-54-3
Junction Block	8W-54-2
Left Combination Relay	8W-54-2, 3
Left Rear Lamp Assembly	8W-54-2, 3
Left Stop/Turn Signal Relay	8W-54-2, 3
License Lamp	8W-54-2
Park Lamp Relay	8W-54-2
Power Distribution Center	8W-54-2
Right Combination Relay	8W-54-2, 3
Right Front Park/Turn Signal Lamp	8W-54-2
Right Rear Lamp Assembly	8W-54-2, 3
Right Stop/Turn Signal Relay	8W-54-2, 3
Stop Lamp Switch	8W-54-3
Trailer Tow Connector	8W-54-2, 3

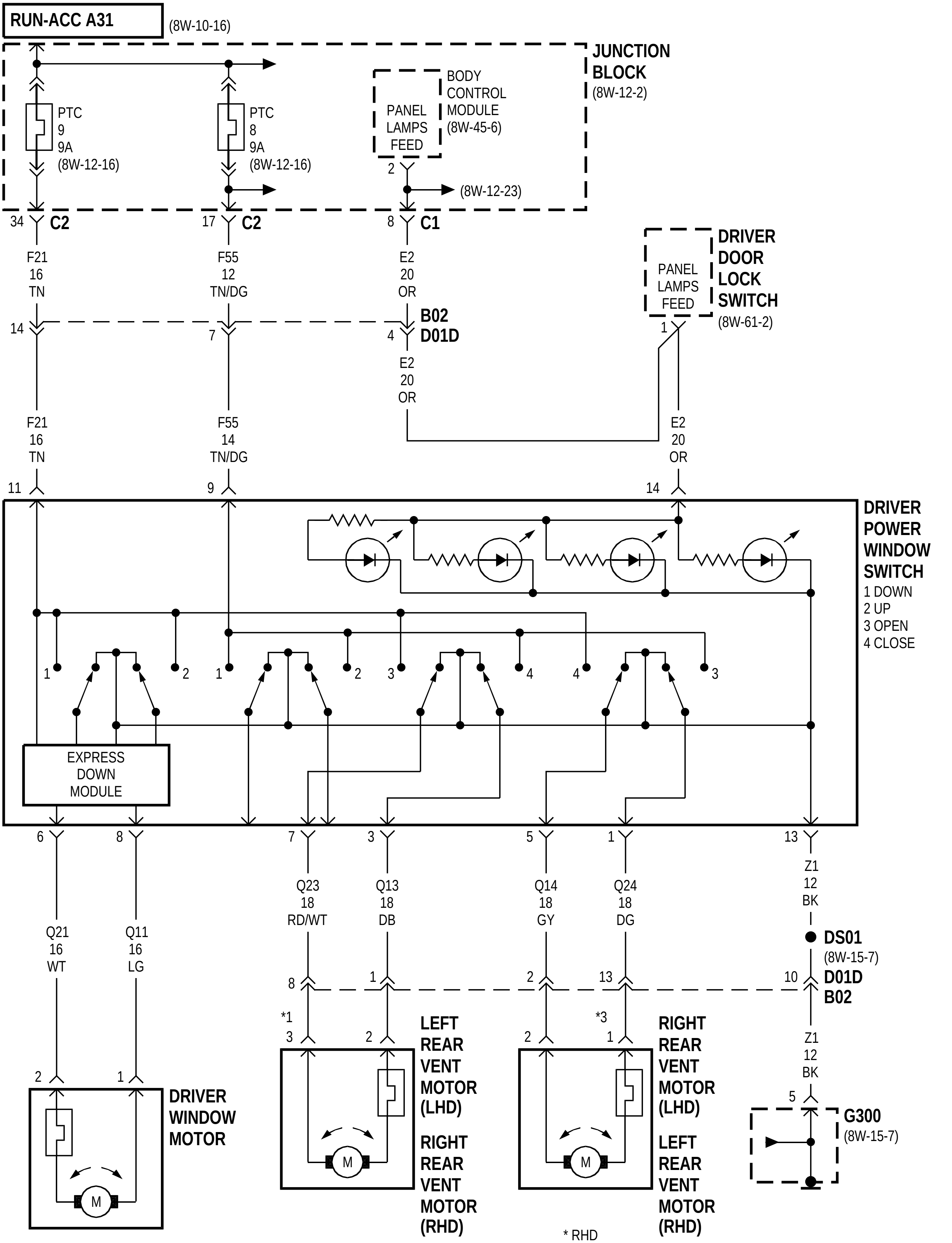

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-8)
FUSE 22 40A (8W-10-17)
86
30
PARK LAMP RELAY
85
87
10 C3
4 C1
L97 18 PK/DB
L7 12 BK/YL
9 C2
2 C1
JUNCTION BLOCK
(8W-12-2)
FUSE 1 10A (8W-12-8)
FUSE 3 15A (8W-12-8)
FUSE 5 15A (8W-12-8)
16
1
PARK LAMP RELAY CONTROL
FUSED PARK LAMP RELAY OUTPUT
BODY CONTROL MODULE
(8W-45-3)
COMBINATION FLASHER/ DRL MODULE
(8W-51-3)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
4
5
28 C2
18 C1
36 C2
23 C1
L63 18 DG/RD
L77 20 BR/LB
L77 20 BR/LB
L62 18 BR/RD
L78 20 DG/YL
L78 20 DG/YL
1
4 B99 T05
L63 18 DG/RD
*5 1
*3 4
LEFT REAR TURN SIGNAL
FUSED LEFT INBOARD TAIL LAMP
LEFT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
5 B17 J01A
L77 20 BR/LB
6 J02A L15
L77 20 BR/LB
1
4 B98 T08
*5 1
*3 4
RIGHT TURN SIGNAL
FUSED B(+)
RIGHT REAR LAMP ASSEMBLY
(8W-51-4)
(8W-51-5)
*1 2
FUSED B(+)
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-11)
L62 18 BR/RD
L78 18 BR
4
LEFT STOP/ TURN SIGNAL RELAY
(8W-54-3)
L63 18 DG/RD
1
LEFT COMBINATION RELAY
(8W-54-3)
2
FUSED LEFT INBOARD TAIL LAMP
LICENSE LAMP
(8W-51-2)
1
RIGHT COMBINATION RELAY
(8W-54-3)
L62 18 BR/RD
4
RIGHT STOP/ TURN SIGNAL RELAY
(8W-54-3)
TRAILER TOW CONNECTOR
2
* BUILT-UP-EXPORT

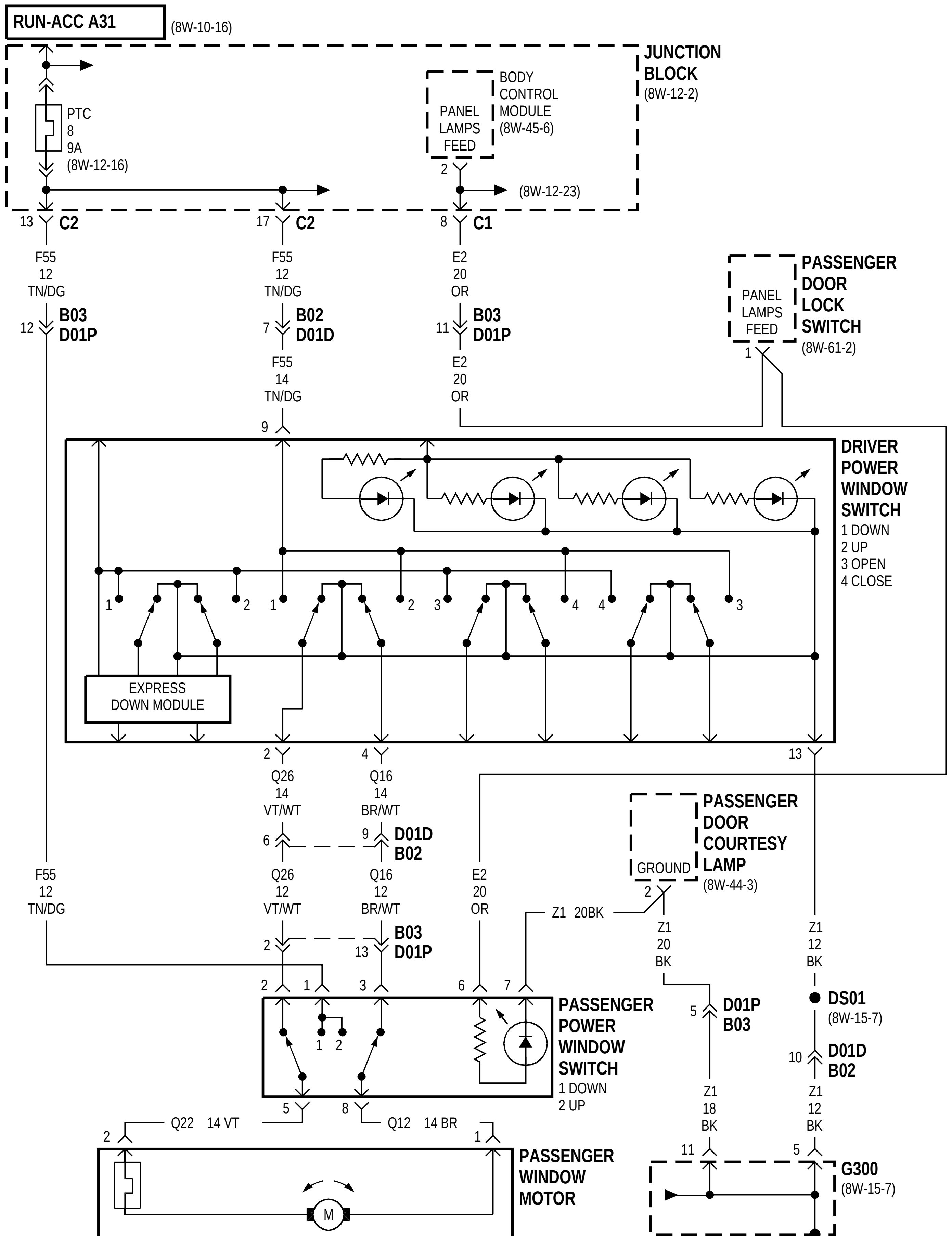


* BUILT-UP-EXPORT

8W-60 POWER WINDOWS

Component	Page
Body Control Module	8W-60-2, 3
Driver Door Lock Switch	8W-60-2
Driver Power Window Switch	8W-60-2, 3
Driver Window Motor	8W-60-2
DS01	8W-60-2, 3
Express Down Module	8W-60-2
G300	8W-60-2, 3
Junction Block	8W-60-2, 3
Left Rear Vent Motor	8W-60-2
Passenger Door Courtesy Lamp	8W-60-3
Passenger Door Lock Switch	8W-60-3
Passenger Power Window Switch	8W-60-3
Passenger Window Motor	8W-60-3
PTC 8 (JB)	8W-60-2, 3
PTC 9 (JB)	8W-60-2
Right Rear Vent Motor	8W-60-2


RUN-ACC A31
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
PTC
9
9A
(8W-12-16)
PTC
8
9A
(8W-12-16)
PANEL LAMPS FEED
BODY CONTROL MODULE
(8W-45-6)
2
(8W-12-23)
34
C2
17
C2
8
C1
F21
16
TN
F55
12
TN/DG
E2
20
OR
PANEL LAMPS FEED
DRIVER DOOR LOCK SWITCH
(8W-61-2)
14
7
4
B02
D01D
1
E2
20
OR
F21
16
TN
F55
14
TN/DG
E2
20
OR
11
9
14
DRIVER POWER WINDOW SWITCH
1 DOWN
2 UP
3 OPEN
4 CLOSE
EXPRESS DOWN MODULE
6
8
7
3
5
1
13
Q21
16
WT
Q11
16
LG
Q23
18
RD/WT
Q13
18
DB
Q14
18
GY
Q24
18
DG
Z1
12
BK
DS01
(8W-15-7)
10
D01D
B02
*1
*3
LEFT REAR VENT MOTOR (LHD)
RIGHT REAR VENT MOTOR (RHD)
RIGHT REAR VENT MOTOR (LHD)
LEFT REAR VENT MOTOR (RHD)
M
DRIVER WINDOW MOTOR
Z1
12
BK
5
G300
(8W-15-7)
* RHD

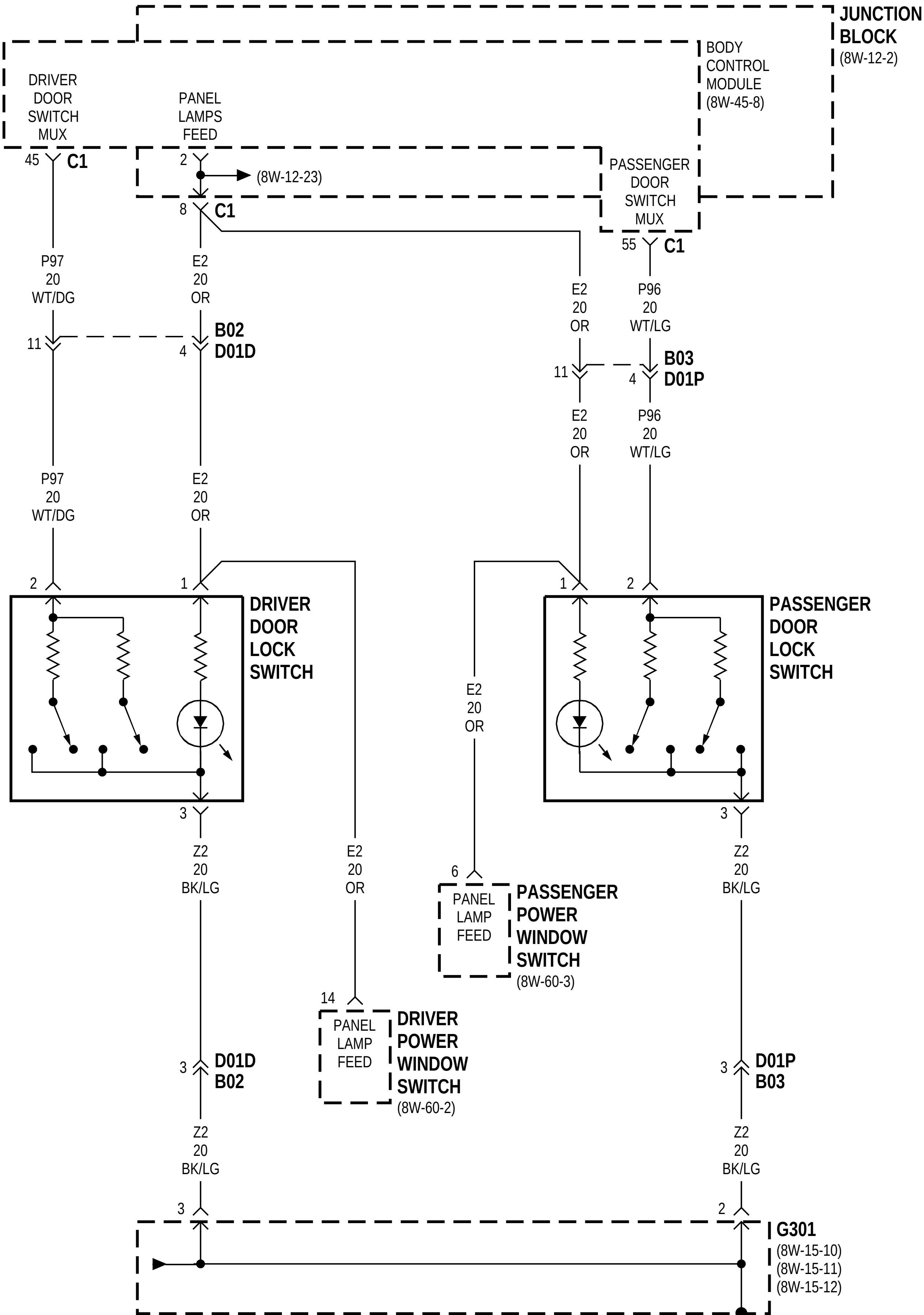


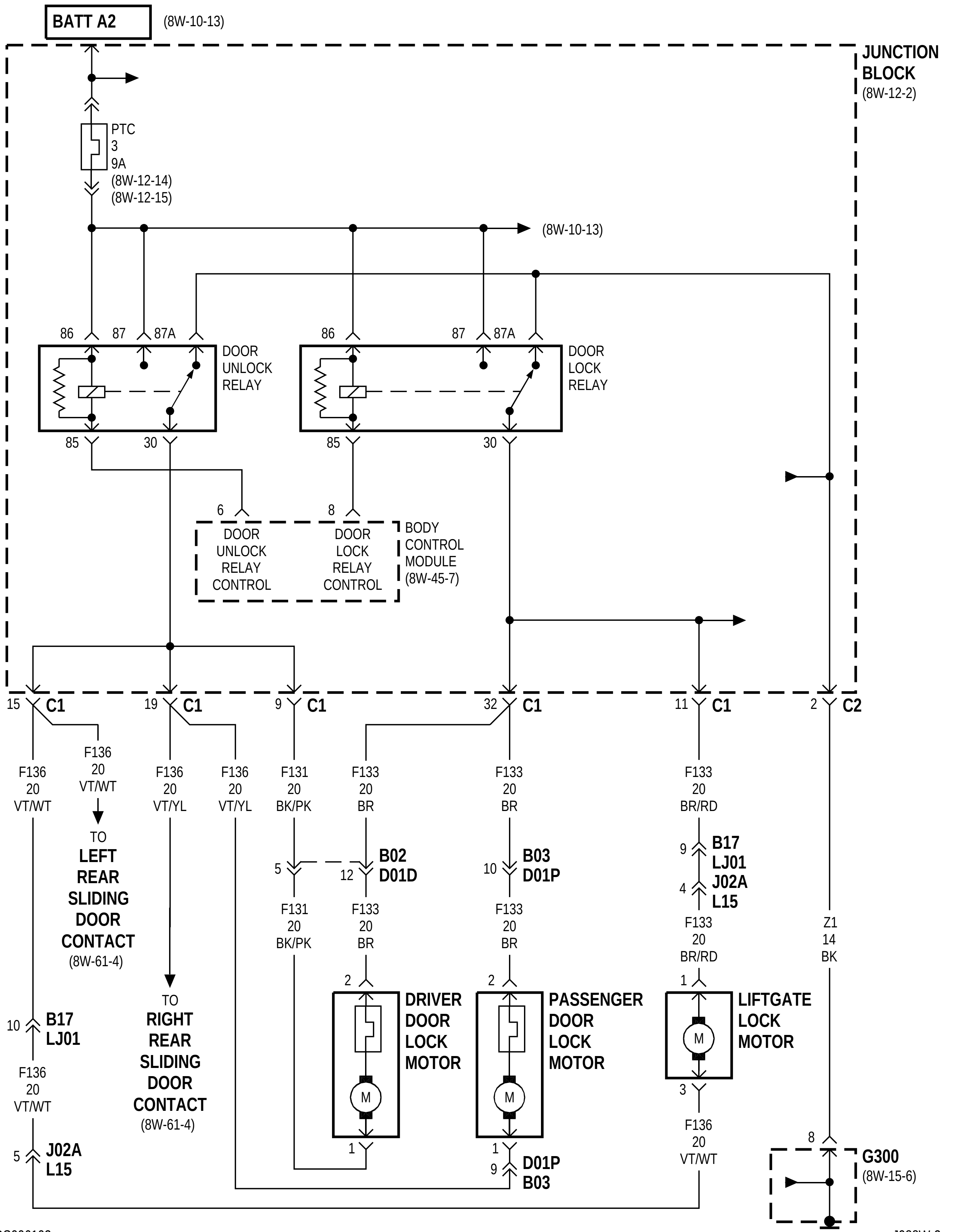
GS006003

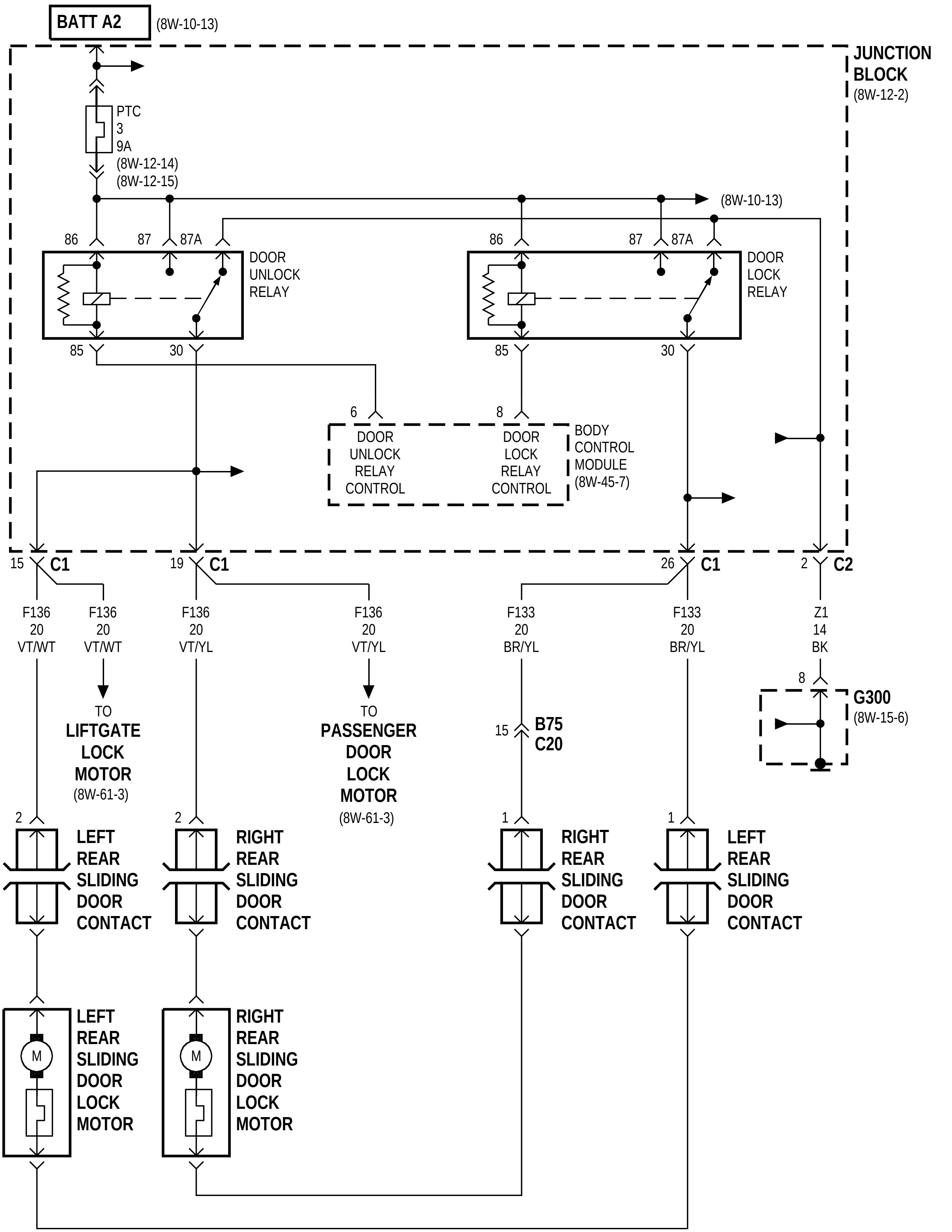
J988W-3

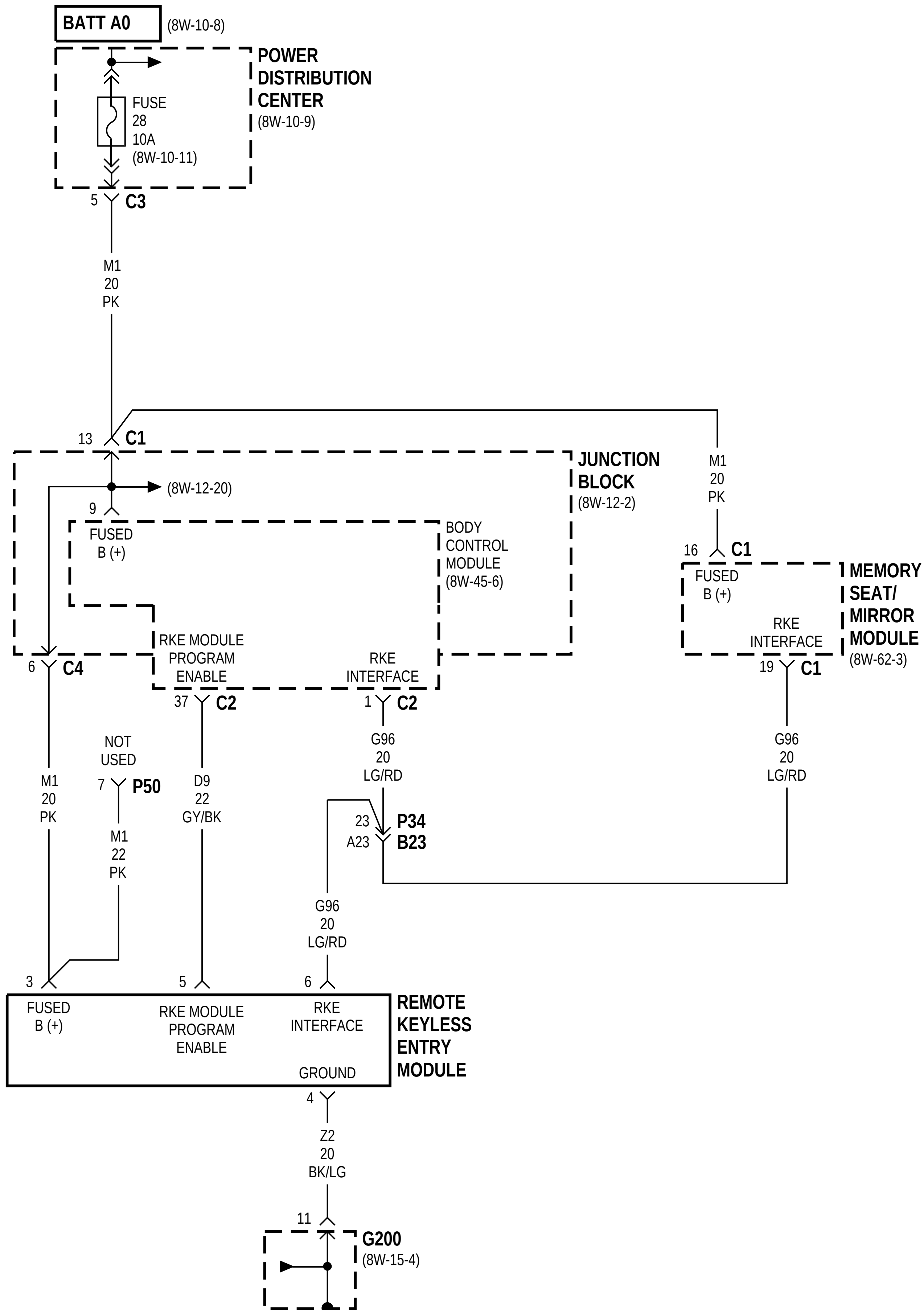
8W-61 POWER DOOR LOCKS

Component	Page
Body Control Module	8W-61-2, 3, 4, 5, 6, 7, 8
Door Lock Relay	8W-61-3, 4, 7, 8
Door Unlock Relay	8W-61-3, 4, 7, 8
Driver Door Arm/Disarm Switch	8W-61-6
Driver Door Lock Motor	8W-61-3, 7
Driver Door Lock Switch	8W-61-2, 6
Driver Door Unlock Relay	8W-61-7, 8
Driver Power Window Switch	8W-61-2, 6
Fuse 28 (PDC)	8W-61-5
G200	8W-61-5
G300	8W-61-3, 4, 7, 8
G301	8W-61-2, 6
G400	8W-61-6
Junction Block	8W-61-2, 3, 4, 5, 6, 7, 8
Left Rear Sliding Door Contact	8W-61-3, 4, 7, 8
Left Rear Sliding Door Lock Motor	8W-61-4, 8
Liftgate Arm/Disarm Switch	8W-61-6
Liftgate Lock Motor	8W-61-3, 4, 7, 8
Memory Seat/Mirror Module	8W-61-5
Passenger Door Arm/Disarm Switch	8W-61-6
Passenger Door Lock Motor	8W-61-3, 4, 7, 8
Passenger Door Lock Switch	8W-61-2, 6
Passenger Power Window Switch	8W-61-2, 6
Power Distribution Center	8W-61-5
PTC 3 (JB)	8W-61-3, 4, 7, 8
Remote Keyless Entry Module	8W-61-5
Right Rear Sliding Door Contact	8W-61-3, 4, 7, 8
Right Rear Sliding Door Lock Motor	8W-61-4, 8

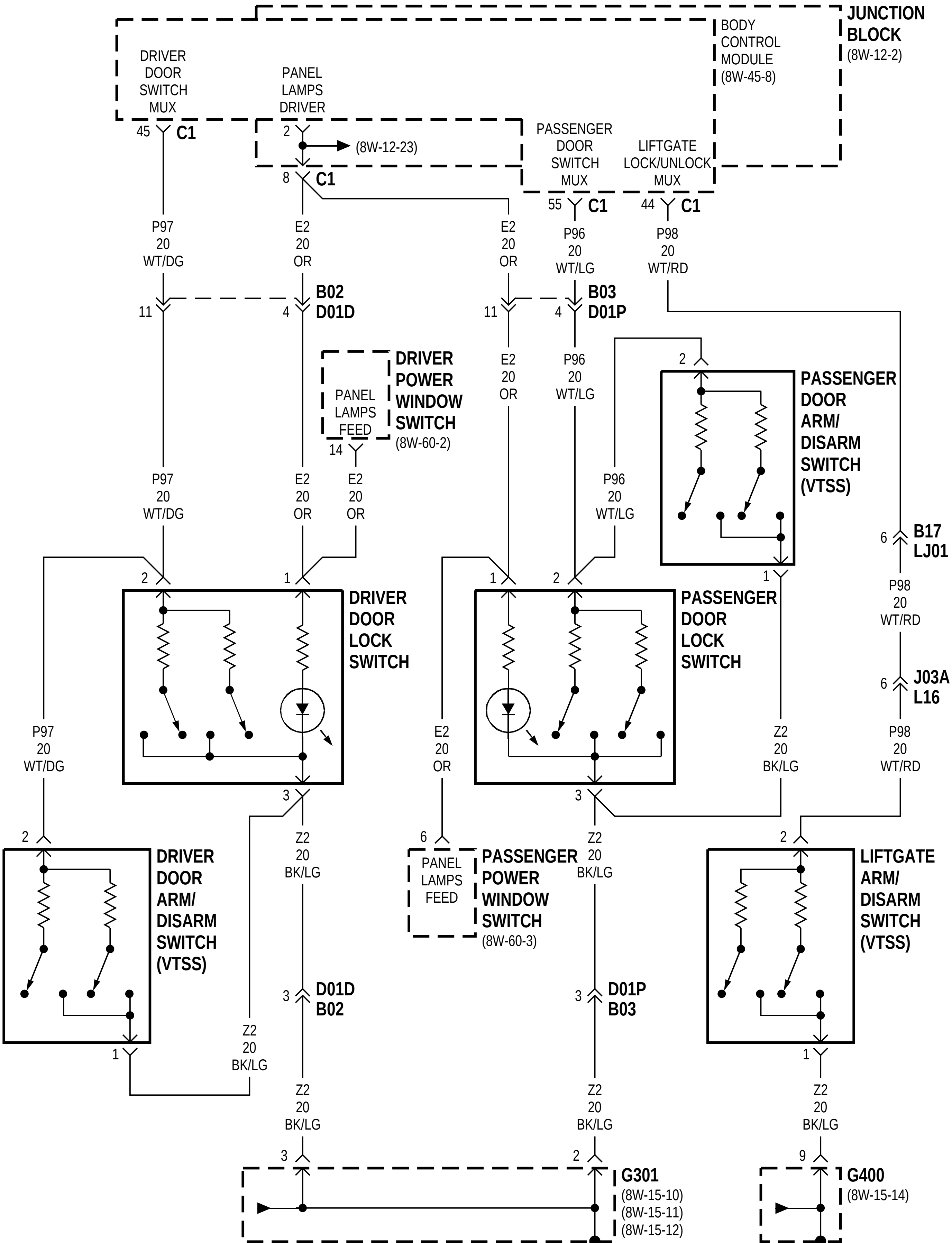

JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-8)
DRIVER DOOR SWITCH MUX
PANEL LAMPS FEED
PASSENGER DOOR SWITCH MUX
45
C1
2
(8W-12-23)
8
C1
55
C1
P97
20
WT/DG
E2
20
OR
P96
20
WT/LG
11
4
B02
D01D
B03
D01P
1
2
DRIVER DOOR LOCK SWITCH
PASSENGER DOOR LOCK SWITCH
3
Z2
20
BK/LG
6
PANEL LAMP FEED
PASSENGER POWER WINDOW SWITCH
(8W-60-3)
14
DRIVER POWER WINDOW SWITCH
(8W-60-2)
D01D
B02
D01P
B03
G301
(8W-15-10)
(8W-15-11)
(8W-15-12)


BATT A2
(8W-10-13)
JUNCTION
BLOCK
(8W-12-2)
PTC
3
9A
(8W-12-14)
(8W-12-15)
(8W-10-13)
86
87
87A
DOOR
UNLOCK
RELAY
85
30
DOOR
LOCK
RELAY
6
8
DOOR
UNLOCK
RELAY
CONTROL
DOOR
LOCK
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
15 C1
19 C1
9 C1
32 C1
11 C1
2 C2
F136
20
VT/WT
F136
20
VT/YL
F131
20
BK/PK
F133
20
BR
F133
20
BR/RD
TO
LEFT
REAR
SLIDING
DOOR
CONTACT
(8W-61-4)
TO
RIGHT
REAR
SLIDING
DOOR
CONTACT
(8W-61-4)
B02
D01D
B03
D01P
B17
LJ01
J02A
L15
Z1
14
BK
DRIVER
DOOR
LOCK
MOTOR
PASSENGER
DOOR
LOCK
MOTOR
LIFTGATE
LOCK
MOTOR
M
G300
(8W-15-6)

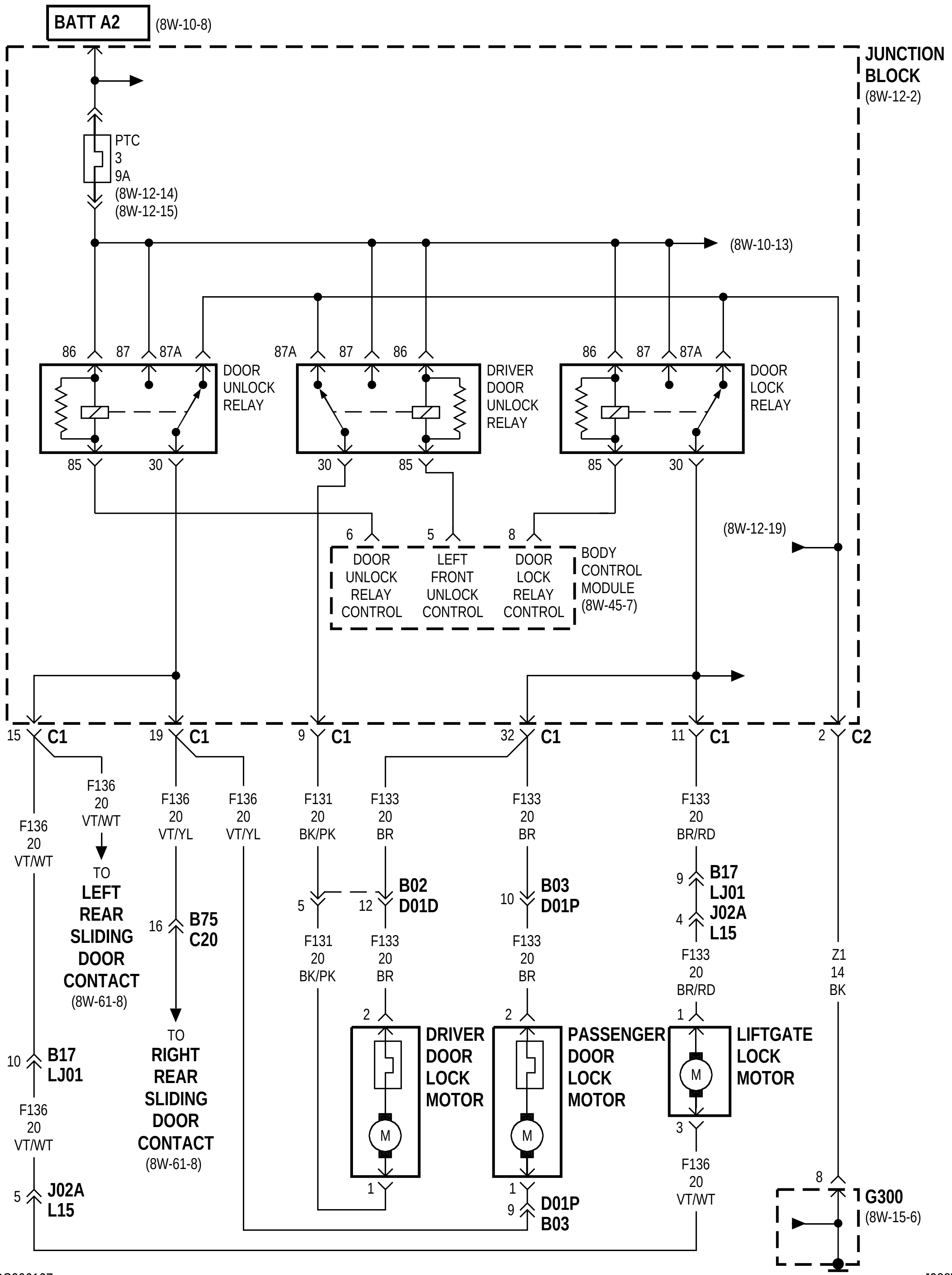

BATT A2
(8W-10-13)
JUNCTION BLOCK
(8W-12-2)
PTC
3
9A
(8W-12-14)
(8W-12-15)
(8W-10-13)
86
87
87A
DOOR UNLOCK RELAY
86
87
87A
DOOR LOCK RELAY
85
30
85
30
6
8
DOOR UNLOCK RELAY CONTROL
DOOR LOCK RELAY CONTROL
BODY CONTROL MODULE
(8W-45-7)
15 C1
19 C1
26 C1
2 C2
F136 20 VT/WT
F136 20 VT/WT
F136 20 VT/YL
F136 20 VT/YL
F133 20 BR/YL
F133 20 BR/YL
Z1 14 BK
TO LIFTGATE LOCK MOTOR
(8W-61-3)
TO PASSENGER DOOR LOCK MOTOR
(8W-61-3)
8
G300
(8W-15-6)
15
B75
C20
2
2
1
1
LEFT REAR SLIDING DOOR CONTACT
RIGHT REAR SLIDING DOOR CONTACT
RIGHT REAR SLIDING DOOR CONTACT
LEFT REAR SLIDING DOOR CONTACT
M
LEFT REAR SLIDING DOOR LOCK MOTOR
M
RIGHT REAR SLIDING DOOR LOCK MOTOR

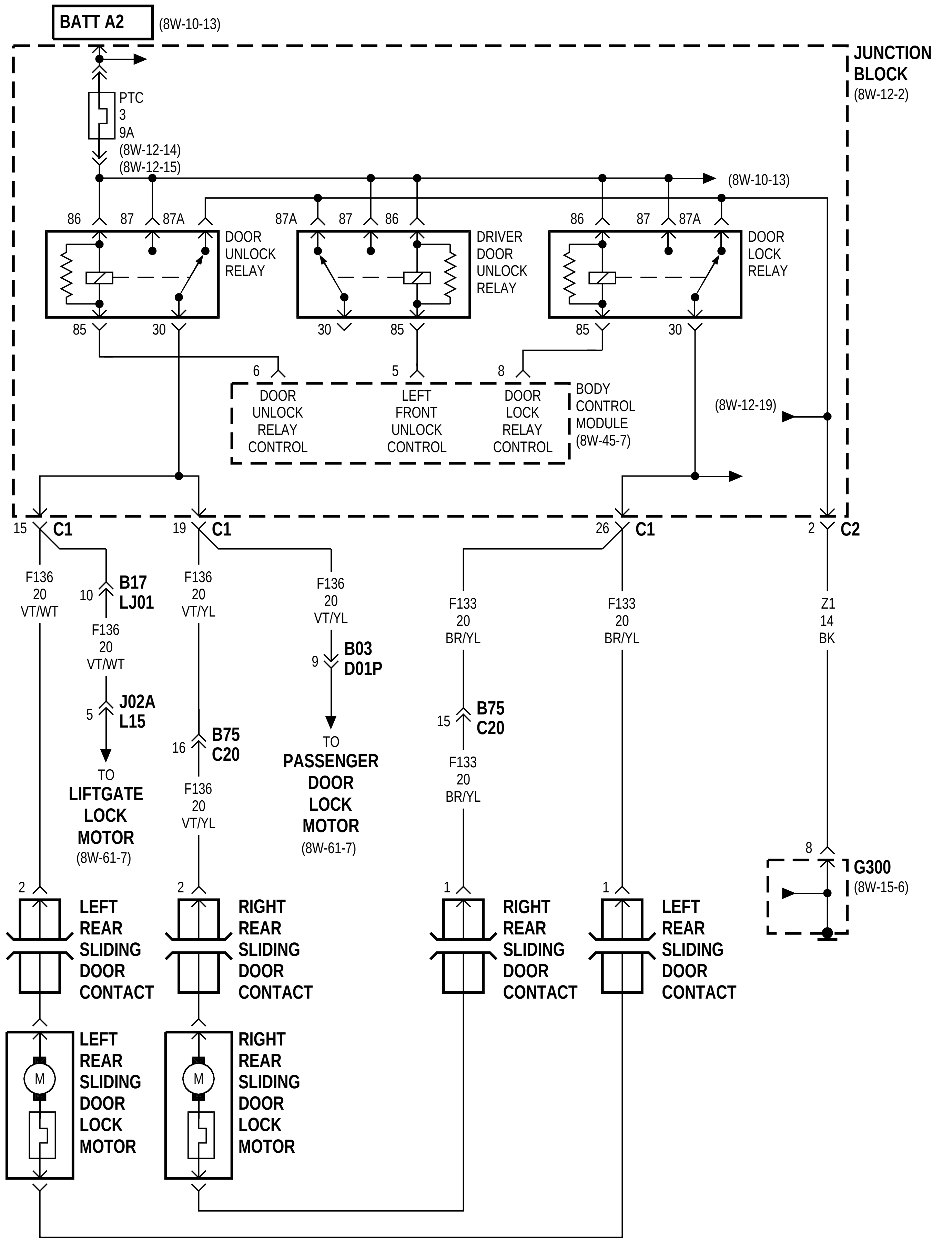

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-9)
FUSE
28
10A
(8W-10-11)
5
C3
M1
20
PK
13
C1
JUNCTION
BLOCK
(8W-12-2)
(8W-12-20)
9
FUSED
B (+)
BODY
CONTROL
MODULE
(8W-45-6)
M1
20
PK
16
C1
FUSED
B (+)
MEMORY
SEAT/
MIRROR
MODULE
(8W-62-3)
RKE
INTERFACE
19
C1
RKE MODULE
PROGRAM
ENABLE
RKE
INTERFACE
6
C4
37
C2
1
C2
NOT
USED
7
P50
M1
20
PK
M1
22
PK
D9
22
GY/BK
G96
20
LG/RD
G96
20
LG/RD
23
A23
P34
B23
G96
20
LG/RD
3
5
6
FUSED
B (+)
RKE MODULE
PROGRAM
ENABLE
RKE
INTERFACE
GROUND
REMOTE
KEYLESS
ENTRY
MODULE
4
Z2
20
BK/LG
11
G200
(8W-15-4)

RKE


JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-8)
DRIVER DOOR SWITCH MUX
PANEL LAMPS DRIVER
PASSENGER DOOR SWITCH MUX
LIFTGATE LOCK/UNLOCK MUX
45 C1
2
(8W-12-23)
8 C1
55 C1
44 C1
P97 20 WT/DG
E2 20 OR
P96 20 WT/LG
P98 20 WT/RD
11
4
B02 D01D
B03 D01P
DRIVER POWER WINDOW SWITCH
PANEL LAMPS FEED
(8W-60-2)
14
PASSENGER DOOR ARM/ DISARM SWITCH (VTSS)
B17 LJ01
6
1
DRIVER DOOR LOCK SWITCH
PASSENGER DOOR LOCK SWITCH
J03A L16
Z2 20 BK/LG
3
DRIVER DOOR ARM/ DISARM SWITCH (VTSS)
PASSENGER POWER WINDOW SWITCH
(8W-60-3)
LIFTGATE ARM/ DISARM SWITCH (VTSS)
D01D B02
D01P B03
9
G301
(8W-15-10)
(8W-15-11)
(8W-15-12)
G400
(8W-15-14)

RKE

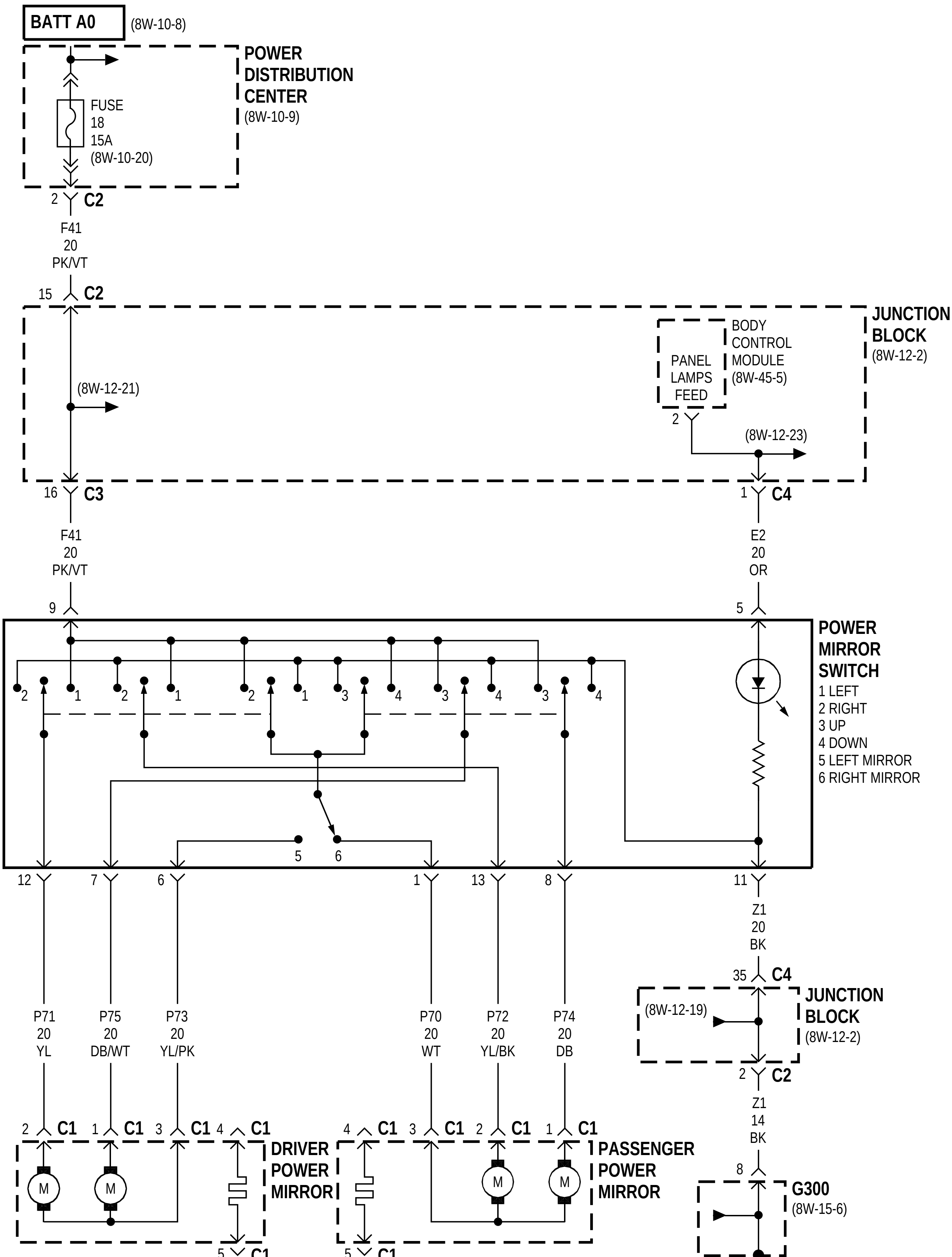

BATT A2
(8W-10-8)
JUNCTION BLOCK
(8W-12-2)
PTC
3
9A
(8W-12-14)
(8W-12-15)
(8W-10-13)
86
87
87A
DOOR UNLOCK RELAY
DRIVER DOOR UNLOCK RELAY
DOOR LOCK RELAY
85
30
6
5
8
DOOR UNLOCK RELAY CONTROL
LEFT FRONT UNLOCK CONTROL
DOOR LOCK RELAY CONTROL
BODY CONTROL MODULE
(8W-45-7)
(8W-12-19)
C1
C2
F136 20 VT/WT
F136 20 VT/YL
F131 20 BK/PK
F133 20 BR
F133 20 BR/RD
TO LEFT REAR SLIDING DOOR CONTACT
(8W-61-8)
TO RIGHT REAR SLIDING DOOR CONTACT
(8W-61-8)
B75
C20
B02
D01D
B03
D01P
B17
LJ01
J02A
L15
DRIVER DOOR LOCK MOTOR
PASSENGER DOOR LOCK MOTOR
LIFTGATE LOCK MOTOR
M
Z1 14 BK
G300
(8W-15-6)


BATT A2
(8W-10-13)
JUNCTION
BLOCK
(8W-12-2)
PTC
3
9A
(8W-12-14)
(8W-12-15)
(8W-10-13)
86
87
87A
DOOR
UNLOCK
RELAY
87A
87
86
DRIVER
DOOR
UNLOCK
RELAY
86
87
87A
DOOR
LOCK
RELAY
85
30
30
85
85
30
6
5
8
DOOR
UNLOCK
RELAY
CONTROL
LEFT
FRONT
UNLOCK
CONTROL
DOOR
LOCK
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
(8W-12-19)
15
C1
19
C1
26
C1
2
C2
F136
20
VT/WT
10
B17
LJ01
F136
20
VT/WT
5
J02A
L15
TO
LIFTGATE
LOCK
MOTOR
(8W-61-7)
F136
20
VT/YL
16
B75
C20
F136
20
VT/YL
F136
20
VT/YL
9
B03
D01P
TO
PASSENGER
DOOR
LOCK
MOTOR
(8W-61-7)
F133
20
BR/YL
15
B75
C20
F133
20
BR/YL
F133
20
BR/YL
Z1
14
BK
8
G300
(8W-15-6)
2
LEFT
REAR
SLIDING
DOOR
CONTACT
2
RIGHT
REAR
SLIDING
DOOR
CONTACT
1
RIGHT
REAR
SLIDING
DOOR
CONTACT
1
LEFT
REAR
SLIDING
DOOR
CONTACT
M
LEFT
REAR
SLIDING
DOOR
LOCK
MOTOR
M
RIGHT
REAR
SLIDING
DOOR
LOCK
MOTOR

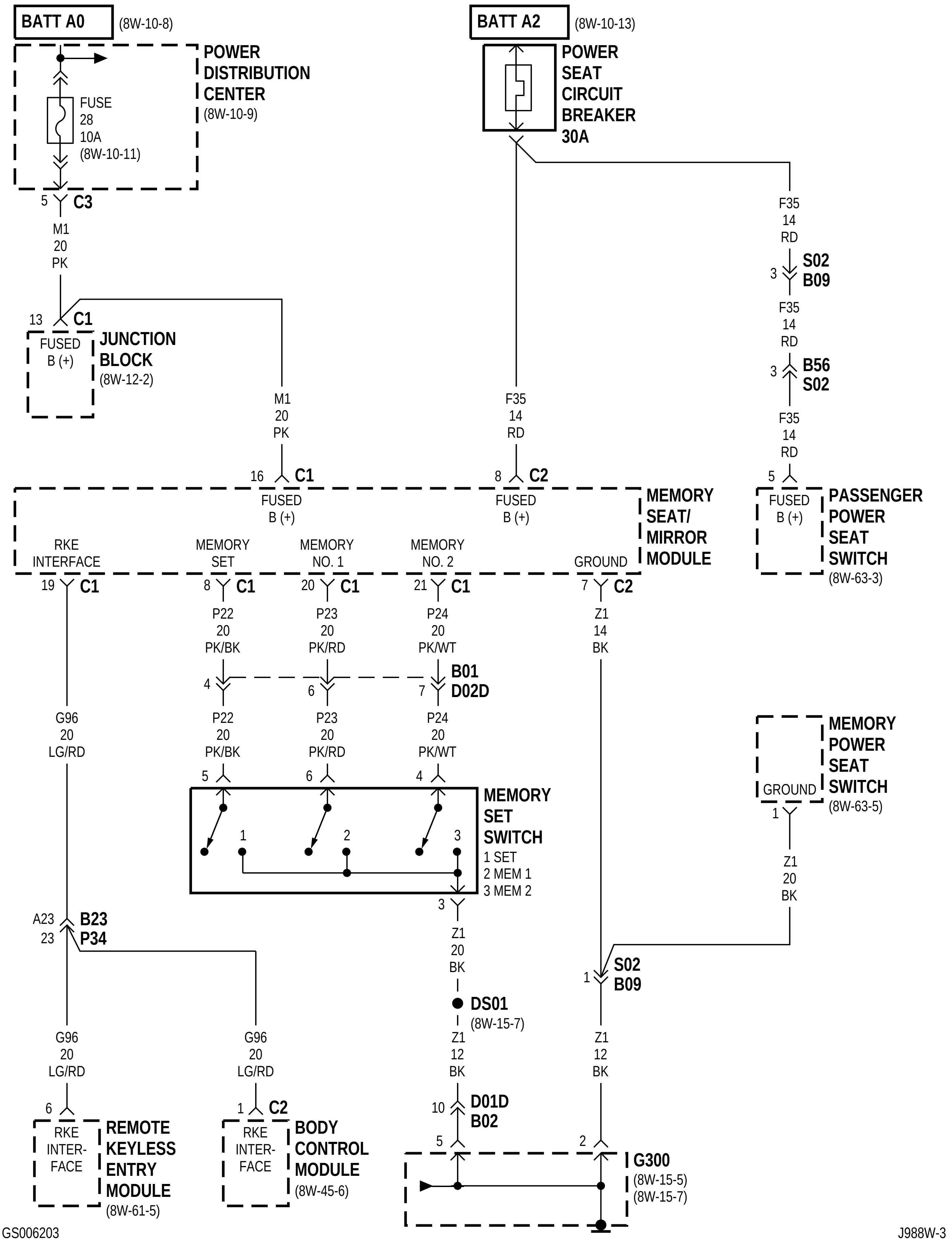
8W-62 POWER MIRRORS

Component	Page
Automatic Day/Night Mirror	8W-62-6
Body Control Module	8W-62-2, 3, 4, 5, 8
Driver Power Mirror	8W-62-2, 4, 6, 7, 8
DS01	8W-62-3
Fuse 18 (PDC)	8W-62-2, 4, 8
Fuse 28 (PDC)	8W-62-3
G300	8W-62-2, 3, 4, 5, 8
Junction Block	8W-62-2, 3, 4, 5, 8
Memory Power Seat Switch	8W-62-3
Memory Seat/Mirror Module	8W-62-3, 4, 5, 6, 7
Memory Set Switch	8W-62-3
Passenger Power Mirror	8W-62-2, 5, 8
Passenger Power Seat Switch	8W-62-3
Power Distribution Center	8W-62-2, 3, 4, 8
Power Folding Mirror Switch	8W-62-8
Power Mirror Fold Relay	8W-62-8
Power Mirror Switch	8W-62-2, 4, 5
Power Mirror Unfold Relay	8W-62-8
Power Seat Circuit Breaker	8W-62-3
Remote Keyless Entry Module	8W-62-3

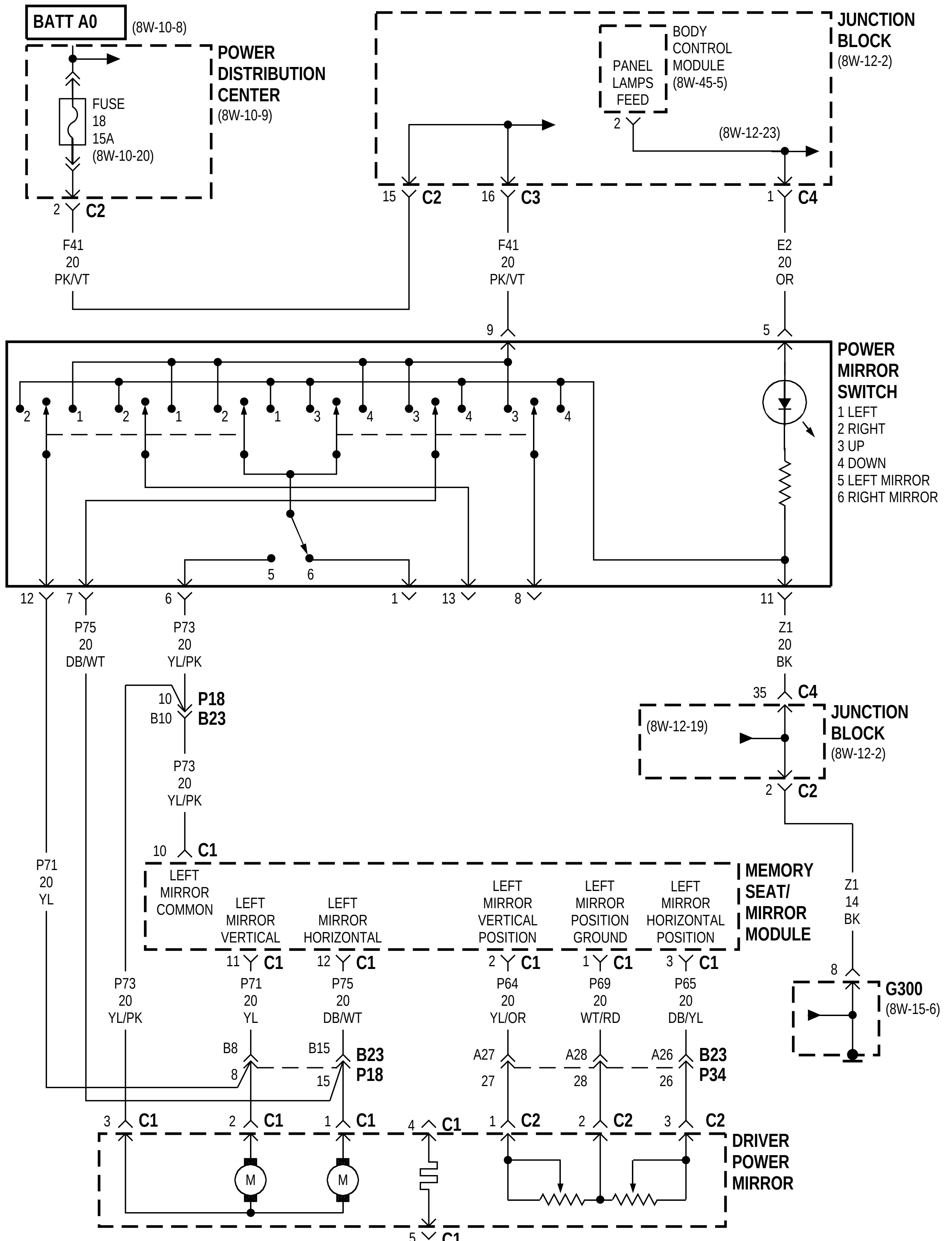
STANDARD


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 18 15A (8W-10-20)
2 C2
F41 20 PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-21)
PANEL LAMPS FEED
BODY CONTROL MODULE (8W-45-5)
2
(8W-12-23)
16 C3
1 C4
F41 20 PK/VT
E2 20 OR
9
5
POWER MIRROR SWITCH
1 LEFT
2 RIGHT
3 UP
4 DOWN
5 LEFT MIRROR
6 RIGHT MIRROR
12 7 6 1 13 8 11
Z1 20 BK
35 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-19)
2 C2
Z1 14 BK
8
G300
(8W-15-6)
P71 20 YL
P75 20 DB/WT
P73 20 YL/PK
P70 20 WT
P72 20 YL/BK
P74 20 DB
2 C1
1 C1
3 C1
4 C1
DRIVER POWER MIRROR
5 C1
4 C1
3 C1
2 C1
1 C1
PASSENGER POWER MIRROR
5 C1
M

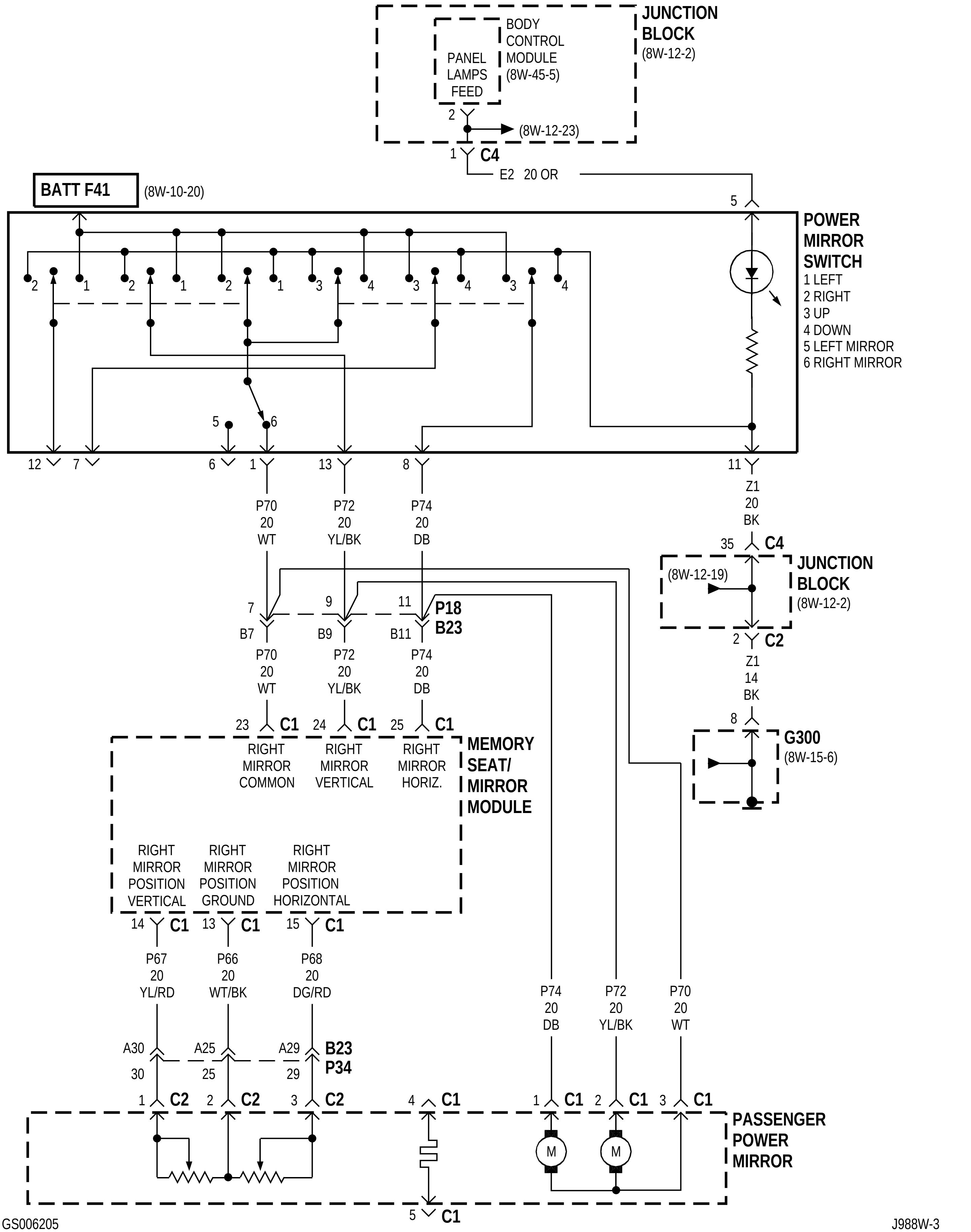
MEMORY


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A
(8W-10-11)
5 C3
M1 20 PK
13 C1
FUSED B (+)
JUNCTION BLOCK
(8W-12-2)
BATT A2
(8W-10-13)
POWER SEAT CIRCUIT BREAKER 30A
F35 14 RD
3 S02 B09
3 B56 S02
5
FUSED B (+)
PASSENGER POWER SEAT SWITCH
(8W-63-3)
16 C1
8 C2
FUSED B (+)
RKE INTERFACE
MEMORY SET
MEMORY NO. 1
MEMORY NO. 2
GROUND
MEMORY SEAT/ MIRROR MODULE
19 C1
8 C1
20 C1
21 C1
7 C2
P22 20 PK/BK
P23 20 PK/RD
P24 20 PK/WT
Z1 14 BK
4
6
7 B01 D02D
G96 20 LG/RD
5
6
4
MEMORY SET SWITCH
1 SET
2 MEM 1
3 MEM 2
MEMORY POWER SEAT SWITCH
(8W-63-5)
1
Z1 20 BK
A23 23 B23 P34
3
1 S02 B09
DS01
(8W-15-7)
Z1 12 BK
6
1 C2
RKE INTER-FACE
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
BODY CONTROL MODULE
(8W-45-6)
10 D01D B02
5
2
G300
(8W-15-5)
(8W-15-7)

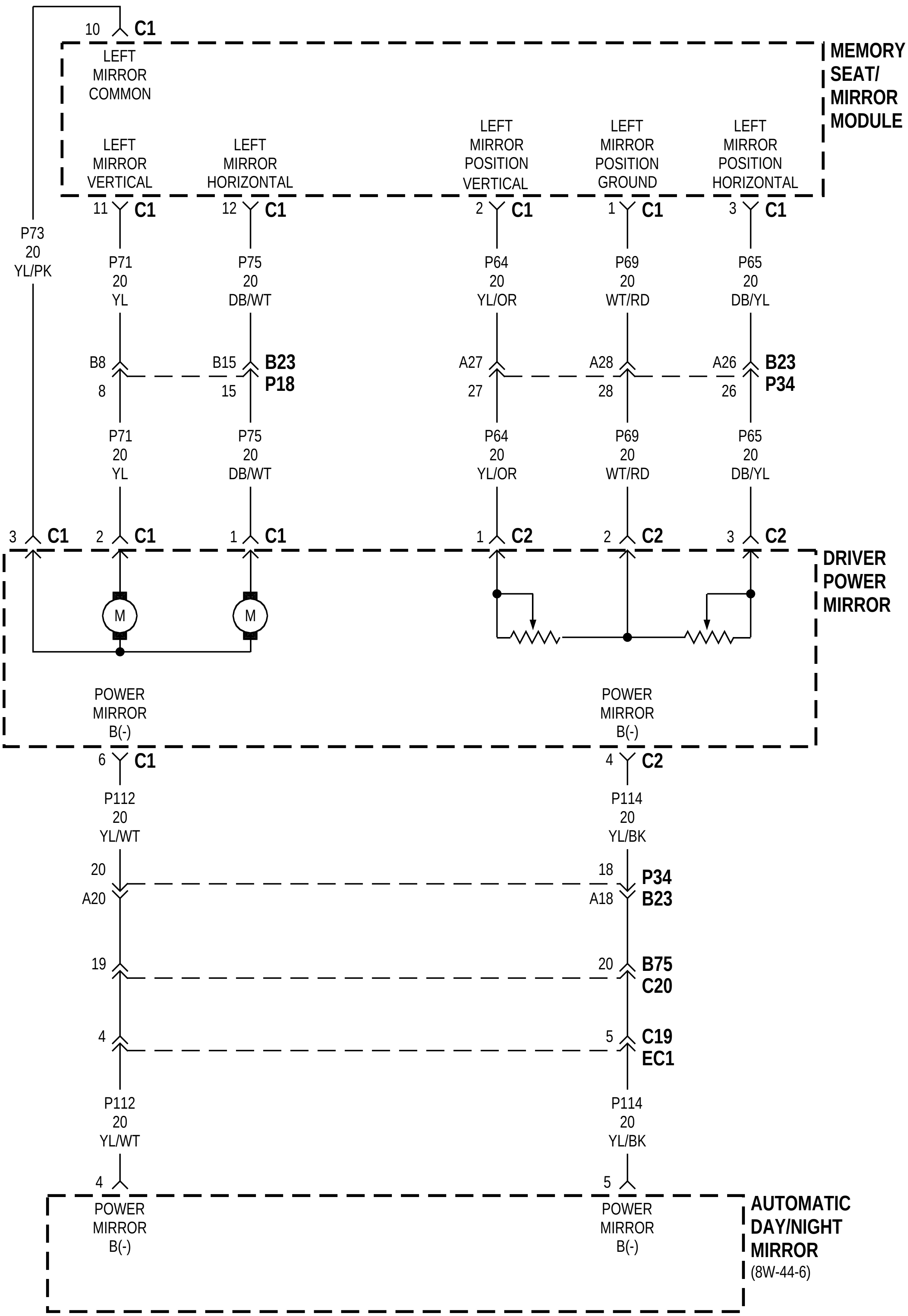
MEMORY

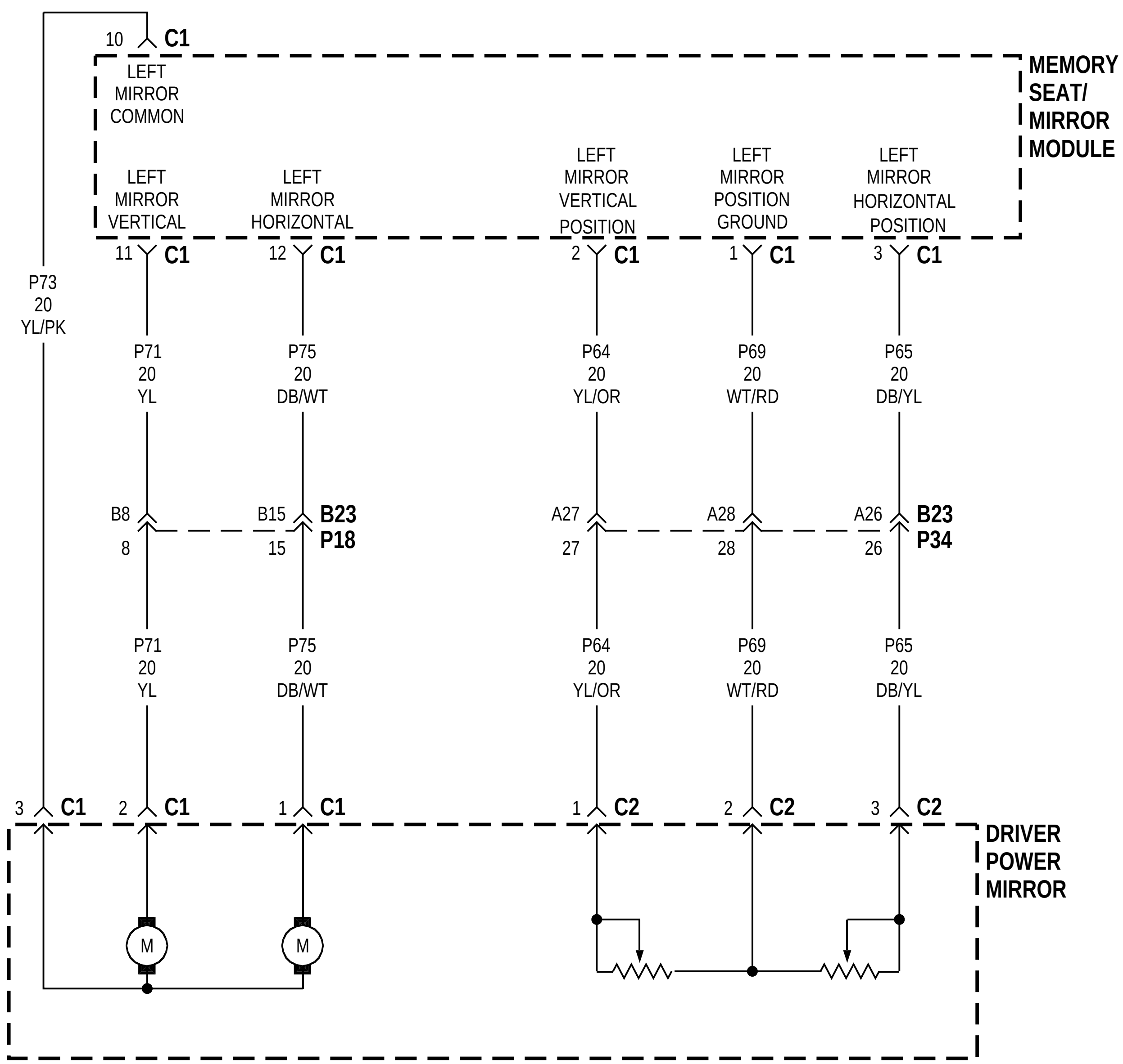

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE
18
15A
(8W-10-20)
JUNCTION BLOCK
(8W-12-2)
BODY CONTROL MODULE
(8W-45-5)
PANEL LAMPS FEED
(8W-12-23)
C2
C3
C4
F41
20
PK/VT
E2
20
OR
POWER MIRROR SWITCH
1 LEFT
2 RIGHT
3 UP
4 DOWN
5 LEFT MIRROR
6 RIGHT MIRROR
P75
20
DB/WT
P73
20
YL/PK
P18
B23
Z1
20
BK
(8W-12-19)
P71
20
YL
C1
LEFT MIRROR COMMON
LEFT MIRROR VERTICAL
LEFT MIRROR HORIZONTAL
LEFT MIRROR VERTICAL POSITION
LEFT MIRROR POSITION GROUND
LEFT MIRROR HORIZONTAL POSITION
MEMORY SEAT/ MIRROR MODULE
Z1
14
BK
G300
(8W-15-6)
P64
20
YL/OR
P69
20
WT/RD
P65
20
DB/YL
B23
P34
DRIVER POWER MIRROR

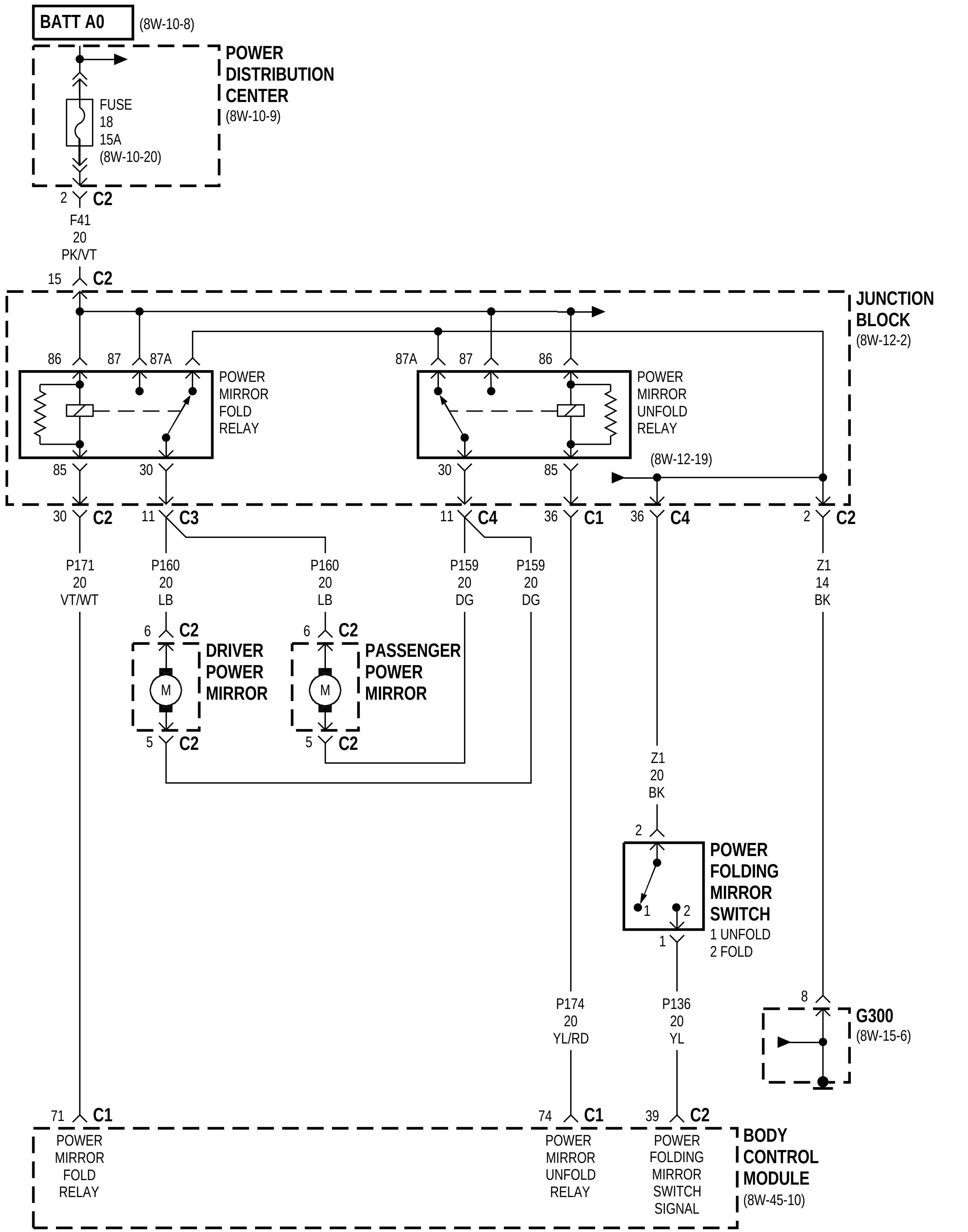
MEMORY


JUNCTION BLOCK (8W-12-2)
BODY CONTROL MODULE (8W-45-5)
PANEL LAMPS FEED
2
(8W-12-23)
1
C4
E2 20 OR
BATT F41
(8W-10-20)
5
POWER MIRROR SWITCH
1 LEFT
2 RIGHT
3 UP
4 DOWN
5 LEFT MIRROR
6 RIGHT MIRROR
12
7
6
1
13
8
11
P70 20 WT
P72 20 YL/BK
P74 20 DB
Z1 20 BK
35
C4
JUNCTION BLOCK
(8W-12-19)
(8W-12-2)
2
C2
Z1 14 BK
7
9
11
P18
B23
B7
B9
B11
8
G300
(8W-15-6)
23 C1
24 C1
25 C1
MEMORY SEAT/ MIRROR MODULE
RIGHT MIRROR COMMON
RIGHT MIRROR VERTICAL
RIGHT MIRROR HORIZ.
RIGHT MIRROR POSITION VERTICAL
RIGHT MIRROR POSITION GROUND
RIGHT MIRROR POSITION HORIZONTAL
14 C1
13 C1
15 C1
P67 20 YL/RD
P66 20 WT/BK
P68 20 DG/RD
P74 20 DB
P72 20 YL/BK
P70 20 WT
A30
A25
A29
B23
P34
30
25
29
1 C2
2 C2
3 C2
4 C1
1 C1
2 C1
3 C1
M
M
PASSENGER POWER MIRROR
5 C1

MEMORY/EXCEPT BUILT-UP-EXPORT




10 C1
LEFT MIRROR COMMON
MEMORY SEAT/ MIRROR MODULE
LEFT MIRROR VERTICAL
LEFT MIRROR HORIZONTAL
LEFT MIRROR VERTICAL POSITION
LEFT MIRROR POSITION GROUND
LEFT MIRROR HORIZONTAL POSITION
11 C1
12 C1
2 C1
1 C1
3 C1
P73 20 YL/PK
P71 20 YL
P75 20 DB/WT
P64 20 YL/OR
P69 20 WT/RD
P65 20 DB/YL
B8 8
B15 15
B23 P18
A27 27
A28 28
A26 26
B23 P34
P71 20 YL
P75 20 DB/WT
P64 20 YL/OR
P69 20 WT/RD
P65 20 DB/YL
3 C1
2 C1
1 C1
1 C2
2 C2
3 C2
DRIVER POWER MIRROR
M
M


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 18 15A
(8W-10-20)
2 C2
F41 20 PK/VT
15 C2
JUNCTION BLOCK
(8W-12-2)
86 87 87A
POWER MIRROR FOLD RELAY
85 30
87A 87 86
POWER MIRROR UNFOLD RELAY
30 85
(8W-12-19)
30 C2
11 C3
11 C4
36 C1
36 C4
2 C2
P171 20 VT/WT
P160 20 LB
P160 20 LB
P159 20 DG
P159 20 DG
Z1 14 BK
6 C2
DRIVER POWER MIRROR
M
5 C2
6 C2
PASSENGER POWER MIRROR
M
5 C2
Z1 20 BK
2
POWER FOLDING MIRROR SWITCH
1 2
1 UNFOLD
2 FOLD
1
P174 20 YL/RD
P136 20 YL
8
G300
(8W-15-6)
71 C1
74 C1
39 C2
POWER MIRROR FOLD RELAY
POWER MIRROR UNFOLD RELAY
POWER FOLDING MIRROR SWITCH SIGNAL
BODY CONTROL MODULE
(8W-45-10)

8W-63 POWER SEAT

Component	Page
Body Control Module	8W-63-4
Driver Heated Seat Back	8W-63-7
Driver Heated Seat Cushion	8W-63-7
Driver Heated Seat Module	8W-63-7
Driver Heated Seat Switch	8W-63-7
Driver Power Seat Switch	8W-63-2
Driver Seat Front Vertical Motor	8W-63-2
Driver Seat Horizontal Motor	8W-63-2
Driver Seat Rear Vertical Motor	8W-63-2
Driver Seat Recliner Motor	8W-63-2
DS01	8W-63-4
Fuse 12 (JB)	8W-63-7, 8
Fuse 28 (PDC)	8W-63-4
Fusible Link	8W-63-2, 3
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HS1	8W-63-7
HS2	8W-63-7
HS3	8W-63-8
HS4	8W-63-8
HS5D B09	8W-63-2, 7
HS5P B56	8W-63-3, 8
Junction Block	8W-63-4, 7, 8
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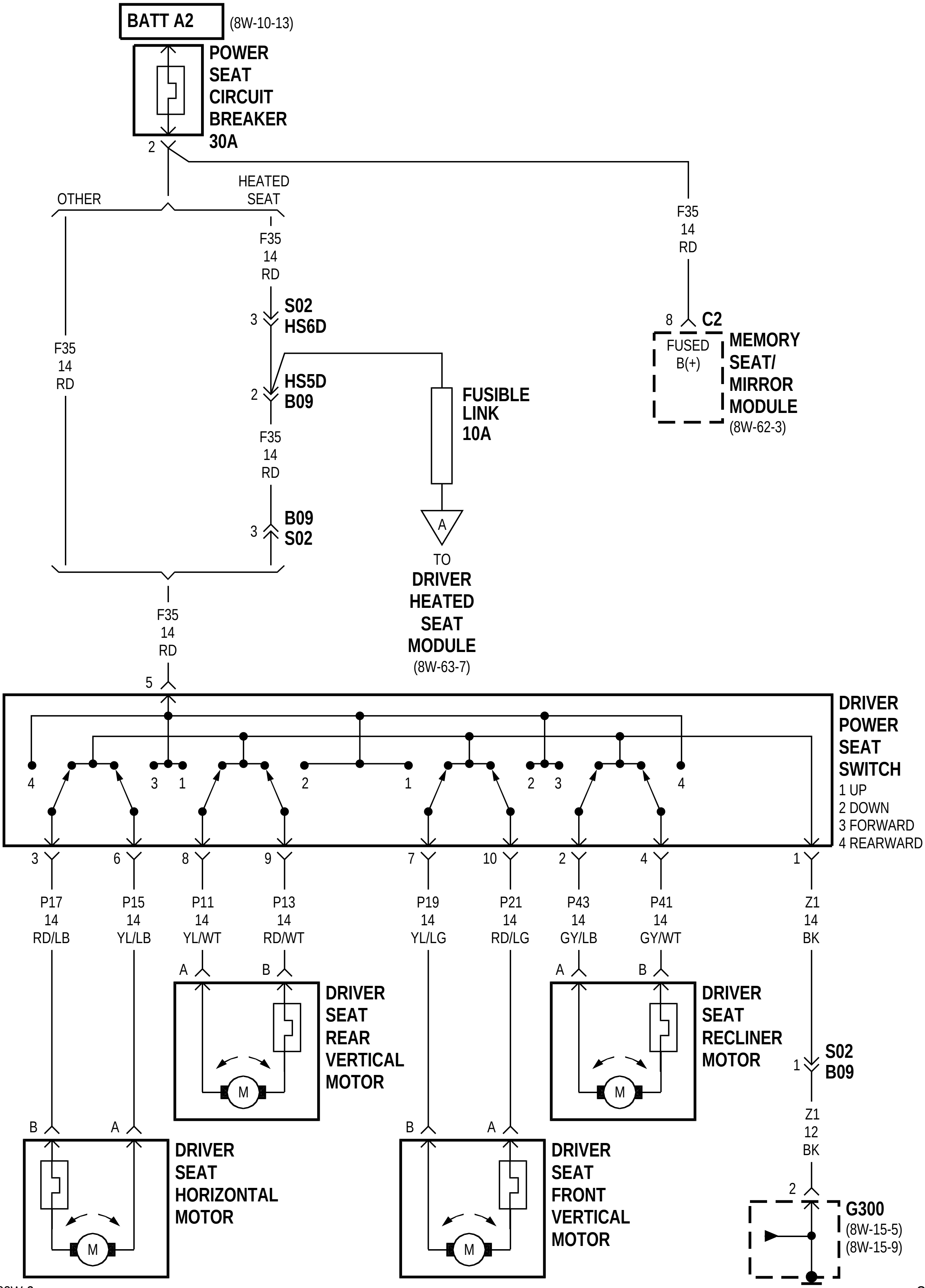
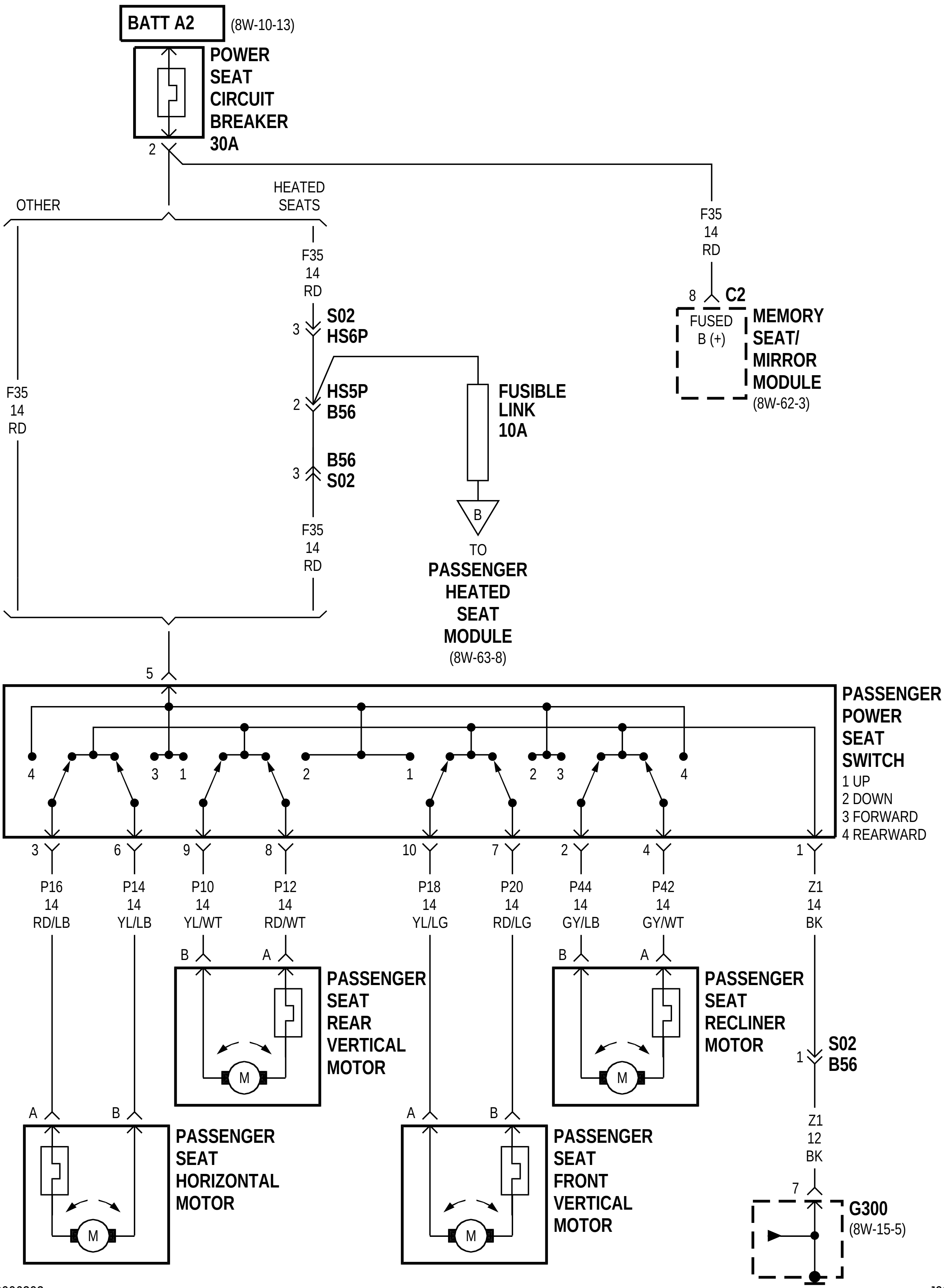
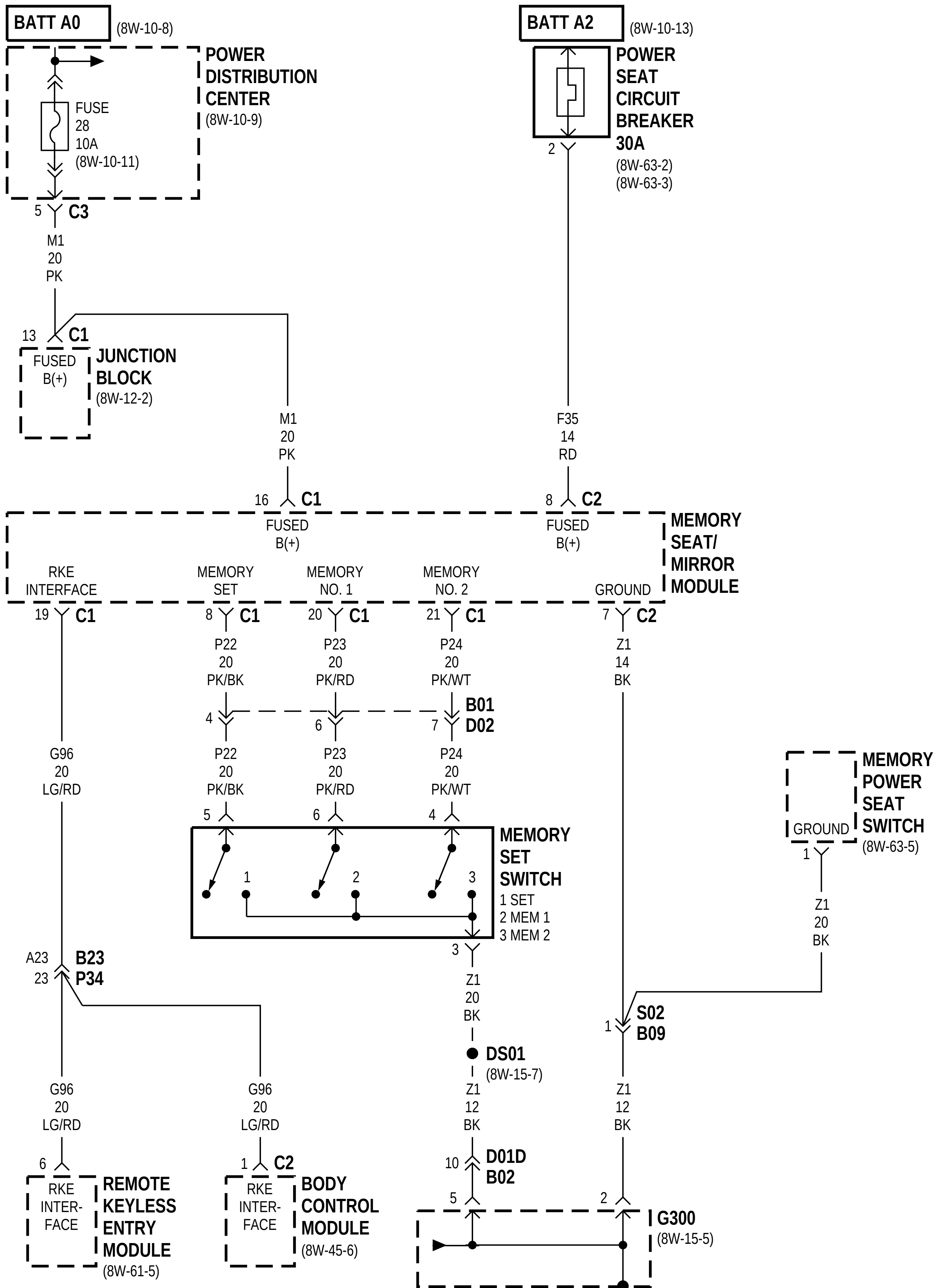
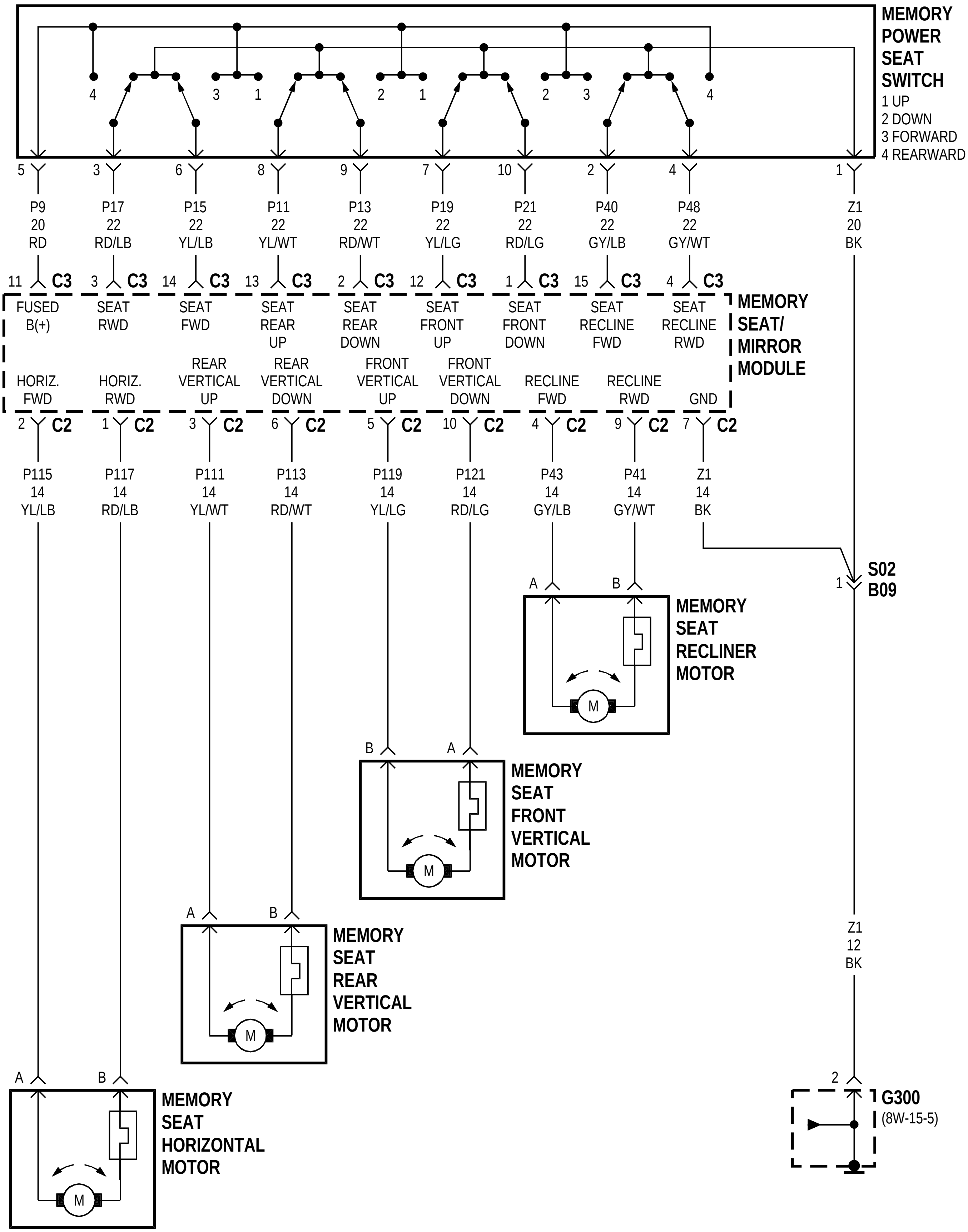
Memory Seat Front Vertical Motor	8W-63-5
Memory Seat Front Vertical Position Sensor	8W-63-6
Memory Seat Horizontal Motor	8W-63-5
Memory Seat Horizontal Position Sensor	8W-63-6
Memory Seat Rear Vertical Motor	8W-63-5
Memory Seat Rear Vertical Position Sensor	8W-63-6
Memory Seat Recline Position Sensor	8W-63-6
Memory Seat Recliner Motor	8W-63-5
Memory Seat/Mirror Module	8W-63-2, 3, 4, 5, 6, 7
Memory Set Switch	8W-63-4
Passenger Heated Seat Back	8W-63-8
Passenger Heated Seat Cushion	8W-63-8
Passenger Heated Seat Module	8W-63-8
Passenger Heated Seat Switch	8W-63-8
Passenger Power Seat Switch	8W-63-3
Passenger Seat Front Vertical Motor	8W-63-3
Passenger Seat Horizontal Motor	8W-63-3
Passenger Seat Rear Vertical Motor	8W-63-3
Passenger Seat Recliner Motor	8W-63-3
Power Distribution Center	8W-63-4
Power Seat Circuit Breaker	8W-63-2, 3, 4
Remote Keyless Entry Module	8W-63-4
SS01	8W-63-6
SS02	8W-63-6

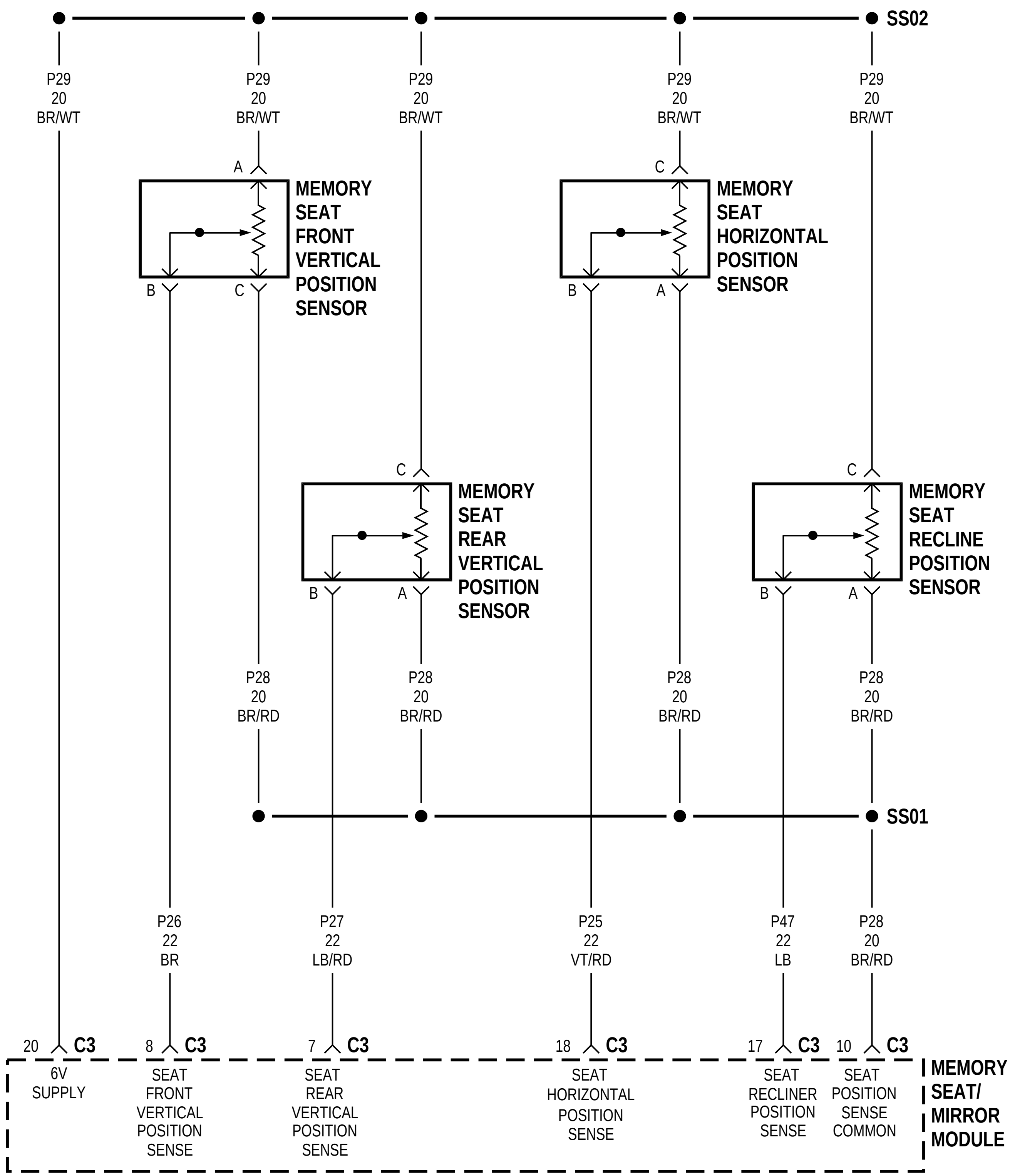

BATT A2
(8W-10-13)
POWER SEAT CIRCUIT BREAKER 30A
2
OTHER
HEATED SEAT
F35 14 RD
S02 HS6D
3
HS5D B09
2
FUSIBLE LINK 10A
B09 S02
A
TO DRIVER HEATED SEAT MODULE
(8W-63-7)
8
C2
FUSED B(+)
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
5
DRIVER POWER SEAT SWITCH
1 UP
2 DOWN
3 FORWARD
4 REARWARD
P17 14 RD/LB
P15 14 YL/LB
P11 14 YL/WT
P13 14 RD/WT
P19 14 YL/LG
P21 14 RD/LG
P43 14 GY/LB
P41 14 GY/WT
Z1 14 BK
DRIVER SEAT REAR VERTICAL MOTOR
DRIVER SEAT RECLINER MOTOR
S02 B09
Z1 12 BK
DRIVER SEAT HORIZONTAL MOTOR
DRIVER SEAT FRONT VERTICAL MOTOR
G300
(8W-15-5)
(8W-15-9)
M


BATT A2
(8W-10-13)
POWER SEAT CIRCUIT BREAKER 30A
2
OTHER
HEATED SEATS
F35 14 RD
3 S02 HS6P
2 HS5P B56
3 B56 S02
FUSIBLE LINK 10A
B
TO PASSENGER HEATED SEAT MODULE
(8W-63-8)
F35 14 RD
8 C2
FUSED B (+)
MEMORY SEAT/ MIRROR MODULE
(8W-62-3)
5
PASSENGER POWER SEAT SWITCH
1 UP
2 DOWN
3 FORWARD
4 REARWARD
4 3 1 2 1 2 3 4
3 6 9 8 10 7 2 4 1
P16 14 RD/LB
P14 14 YL/LB
P10 14 YL/WT
P12 14 RD/WT
P18 14 YL/LG
P20 14 RD/LG
P44 14 GY/LB
P42 14 GY/WT
Z1 14 BK
B A
PASSENGER SEAT REAR VERTICAL MOTOR
M
PASSENGER SEAT RECLINER MOTOR
1 S02 B56
Z1 12 BK
A B
PASSENGER SEAT HORIZONTAL MOTOR
PASSENGER SEAT FRONT VERTICAL MOTOR
7
G300
(8W-15-5)

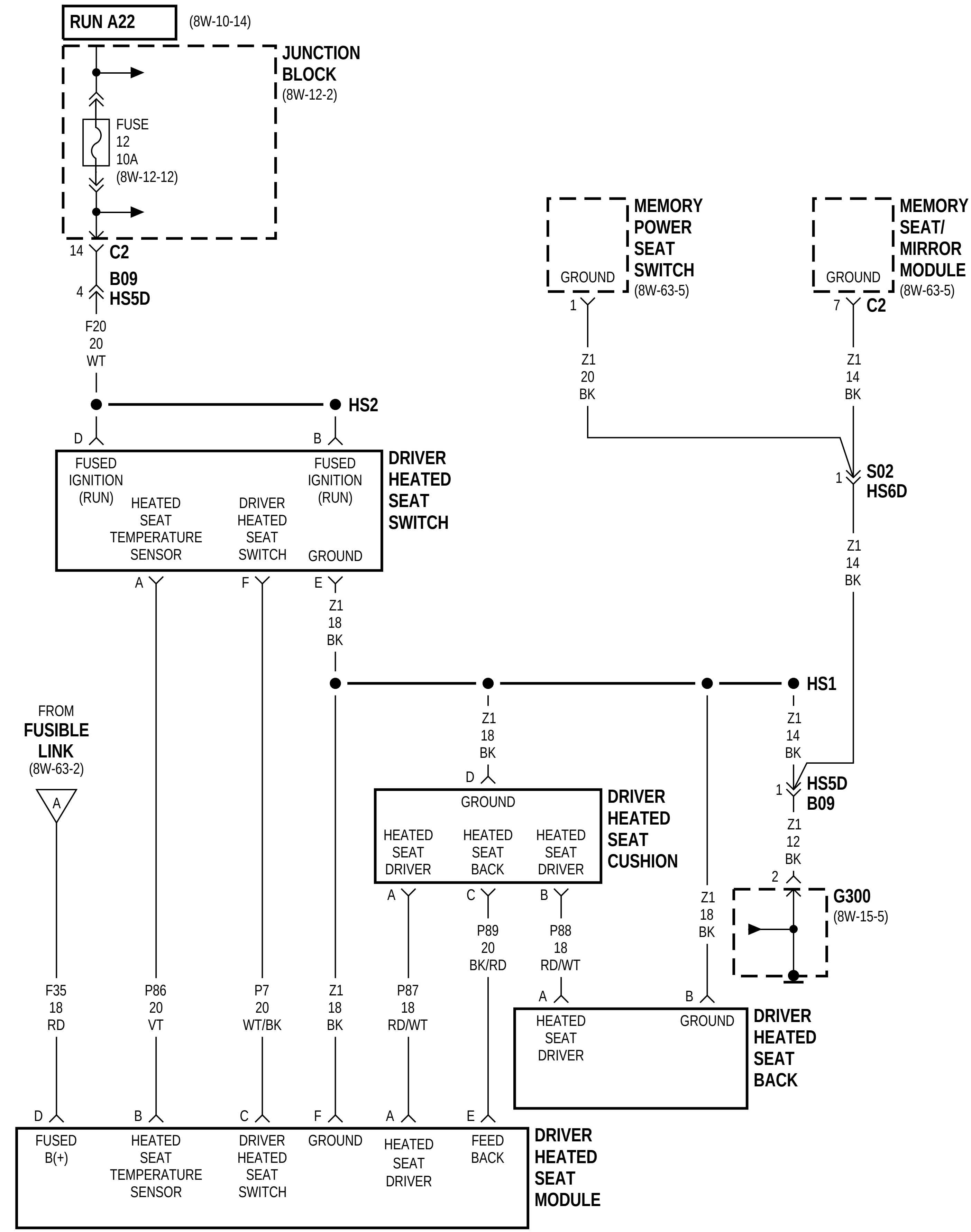
MEMORY

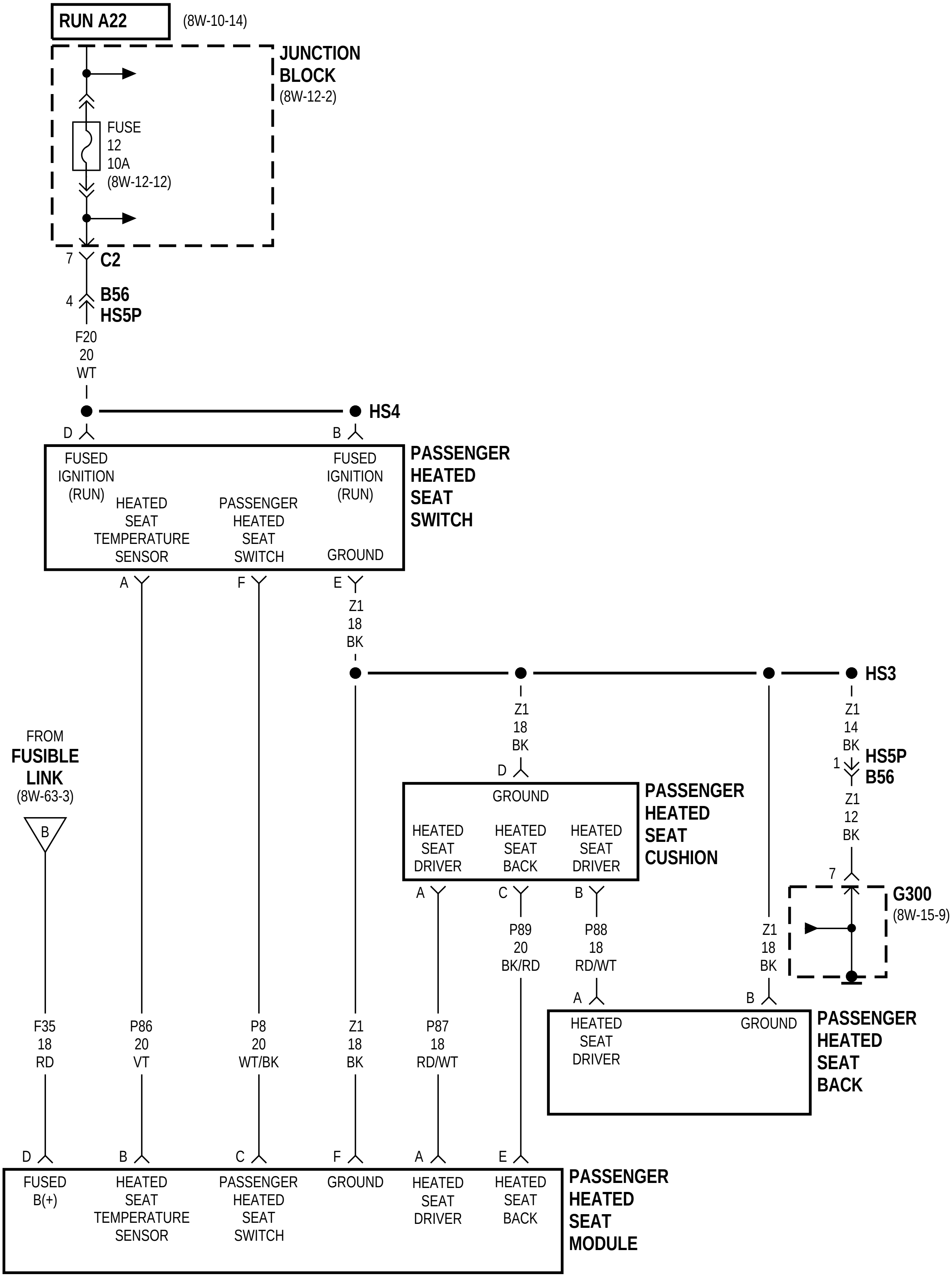

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-9)
FUSE 28 10A
(8W-10-11)
5 C3
M1 20 PK
13 C1
FUSED B(+)
JUNCTION BLOCK
(8W-12-2)
BATT A2
(8W-10-13)
POWER SEAT CIRCUIT BREAKER 30A
(8W-63-2)
(8W-63-3)
2
M1 20 PK
F35 14 RD
16 C1
8 C2
FUSED B(+)
FUSED B(+)
MEMORY SEAT/ MIRROR MODULE
RKE INTERFACE
MEMORY SET
MEMORY NO. 1
MEMORY NO. 2
GROUND
19 C1
8 C1
20 C1
21 C1
7 C2
P22 20 PK/BK
P23 20 PK/RD
P24 20 PK/WT
Z1 14 BK
4
6
7
B01
D02
G96 20 LG/RD
P22 20 PK/BK
P23 20 PK/RD
P24 20 PK/WT
5
6
4
MEMORY SET SWITCH
1 SET
2 MEM 1
3 MEM 2
1
2
3
3
MEMORY POWER SEAT SWITCH
GROUND
(8W-63-5)
1
Z1 20 BK
A23
23
B23
P34
Z1 20 BK
DS01
(8W-15-7)
1
S02
B09
G96 20 LG/RD
G96 20 LG/RD
Z1 12 BK
Z1 12 BK
6
1 C2
10
D01D
B02
RKE INTER-FACE
REMOTE KEYLESS ENTRY MODULE
(8W-61-5)
RKE INTER-FACE
BODY CONTROL MODULE
(8W-45-6)
5
2
G300
(8W-15-5)


MEMORY POWER SEAT SWITCH
1 UP
2 DOWN
3 FORWARD
4 REARWARD
P9 20 RD
P17 22 RD/LB
P15 22 YL/LB
P11 22 YL/WT
P13 22 RD/WT
P19 22 YL/LG
P21 22 RD/LG
P40 22 GY/LB
P48 22 GY/WT
Z1 20 BK
C3
MEMORY SEAT/ MIRROR MODULE
FUSED B(+)
SEAT RWD
SEAT FWD
SEAT REAR UP
SEAT REAR DOWN
SEAT FRONT UP
SEAT FRONT DOWN
SEAT RECLINE FWD
SEAT RECLINE RWD
HORIZ. FWD
HORIZ. RWD
REAR VERTICAL UP
REAR VERTICAL DOWN
FRONT VERTICAL UP
FRONT VERTICAL DOWN
RECLINE FWD
RECLINE RWD
GND
C2
P115 14 YL/LB
P117 14 RD/LB
P111 14 YL/WT
P113 14 RD/WT
P119 14 YL/LG
P121 14 RD/LG
P43 14 GY/LB
P41 14 GY/WT
Z1 14 BK
S02
B09
MEMORY SEAT RECLINER MOTOR
MEMORY SEAT FRONT VERTICAL MOTOR
MEMORY SEAT REAR VERTICAL MOTOR
MEMORY SEAT HORIZONTAL MOTOR
M
Z1 12 BK
G300
(8W-15-5)


SS02
P29
20
BR/WT
A
C
B
MEMORY
SEAT
FRONT
VERTICAL
POSITION
SENSOR
MEMORY
SEAT
HORIZONTAL
POSITION
SENSOR
MEMORY
SEAT
REAR
VERTICAL
POSITION
SENSOR
MEMORY
SEAT
RECLINE
POSITION
SENSOR
P28
20
BR/RD
SS01
P26
22
BR
P27
22
LB/RD
P25
22
VT/RD
P47
22
LB
20 C3
8 C3
7 C3
18 C3
17 C3
10 C3
6V
SUPPLY
SEAT
FRONT
VERTICAL
POSITION
SENSE
SEAT
REAR
VERTICAL
POSITION
SENSE
SEAT
HORIZONTAL
POSITION
SENSE
SEAT
RECLINER
POSITION
SENSE
SEAT
POSITION
SENSE
COMMON
MEMORY
SEAT/
MIRROR
MODULE

HEATED


RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
14
C2
4
B09
HS5D
F20
20
WT
HS2
D
B
FUSED IGNITION (RUN)
HEATED SEAT TEMPERATURE SENSOR
DRIVER HEATED SEAT SWITCH
FUSED IGNITION (RUN)
GROUND
DRIVER HEATED SEAT SWITCH
A
F
E
Z1
18
BK
MEMORY POWER SEAT SWITCH
(8W-63-5)
GROUND
1
Z1
20
BK
MEMORY SEAT/ MIRROR MODULE
(8W-63-5)
GROUND
7
C2
Z1
14
BK
1
S02
HS6D
Z1
14
BK
HS1
Z1
18
BK
Z1
14
BK
1
HS5D
B09
Z1
12
BK
2
G300
(8W-15-5)
FROM FUSIBLE LINK
(8W-63-2)
A
D
GROUND
HEATED SEAT DRIVER
HEATED SEAT BACK
HEATED SEAT DRIVER
DRIVER HEATED SEAT CUSHION
A
C
B
P89
20
BK/RD
P88
18
RD/WT
Z1
18
BK
A
B
HEATED SEAT DRIVER
GROUND
DRIVER HEATED SEAT BACK
F35
18
RD
P86
20
VT
P7
20
WT/BK
Z1
18
BK
P87
18
RD/WT
D
B
C
F
A
E
FUSED B(+)
HEATED SEAT TEMPERATURE SENSOR
DRIVER HEATED SEAT SWITCH
GROUND
HEATED SEAT DRIVER
FEED BACK
DRIVER HEATED SEAT MODULE


RUN A22
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
FUSE
12
10A
(8W-12-12)
7
C2
4
B56
HS5P
F20
20
WT
HS4
D
B
FUSED IGNITION (RUN)
HEATED SEAT TEMPERATURE SENSOR
PASSENGER HEATED SEAT SWITCH
FUSED IGNITION (RUN)
GROUND
PASSENGER HEATED SEAT SWITCH
A
F
E
Z1
18
BK
HS3
Z1
18
BK
Z1
14
BK
1
HS5P
B56
Z1
12
BK
7
G300
(8W-15-9)
FROM
FUSIBLE LINK
(8W-63-3)
B
D
GROUND
HEATED SEAT DRIVER
HEATED SEAT BACK
HEATED SEAT DRIVER
PASSENGER HEATED SEAT CUSHION
A
C
B
P89
20
BK/RD
P88
18
RD/WT
Z1
18
BK
A
B
HEATED SEAT DRIVER
GROUND
PASSENGER HEATED SEAT BACK
F35
18
RD
P86
20
VT
P8
20
WT/BK
Z1
18
BK
P87
18
RD/WT
D
B
C
F
A
E
FUSED B(+)
HEATED SEAT TEMPERATURE SENSOR
PASSENGER HEATED SEAT SWITCH
GROUND
HEATED SEAT DRIVER
HEATED SEAT BACK
PASSENGER HEATED SEAT MODULE

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BS33	8W-10-25
BS40	8W-15-3
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ES06	8W-10-25
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ES07 (GAS)	8W-12-13
ES08	8W-30-25
ES08	8W-70-8
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Component	Page
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ES13	8W-40-5
ES14	8W-30-4
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ES24	8W-30-3
ES26	8W-20-3
ES28	8W-20-3
ES29	8W-10-25
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ES37	8W-30-32
ES40	8W-10-27
ES99 (2.0L)	8W-10-24
FS01 (2.4L)	8W-70-5
FS01 (3.3L/3.8L)	8W-10-24
FS02 (2.4L)	8W-70-7
FS02 (3.3L/3.8L)	8W-70-6
FS03	8W-10-23
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HS2	8W-63-7
HS3	8W-63-8
HS4	8W-63-8
JS01B	8W-70-10
JS02B	8W-70-10
JS03	8W-70-9
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PS02	8W-30-4, 31
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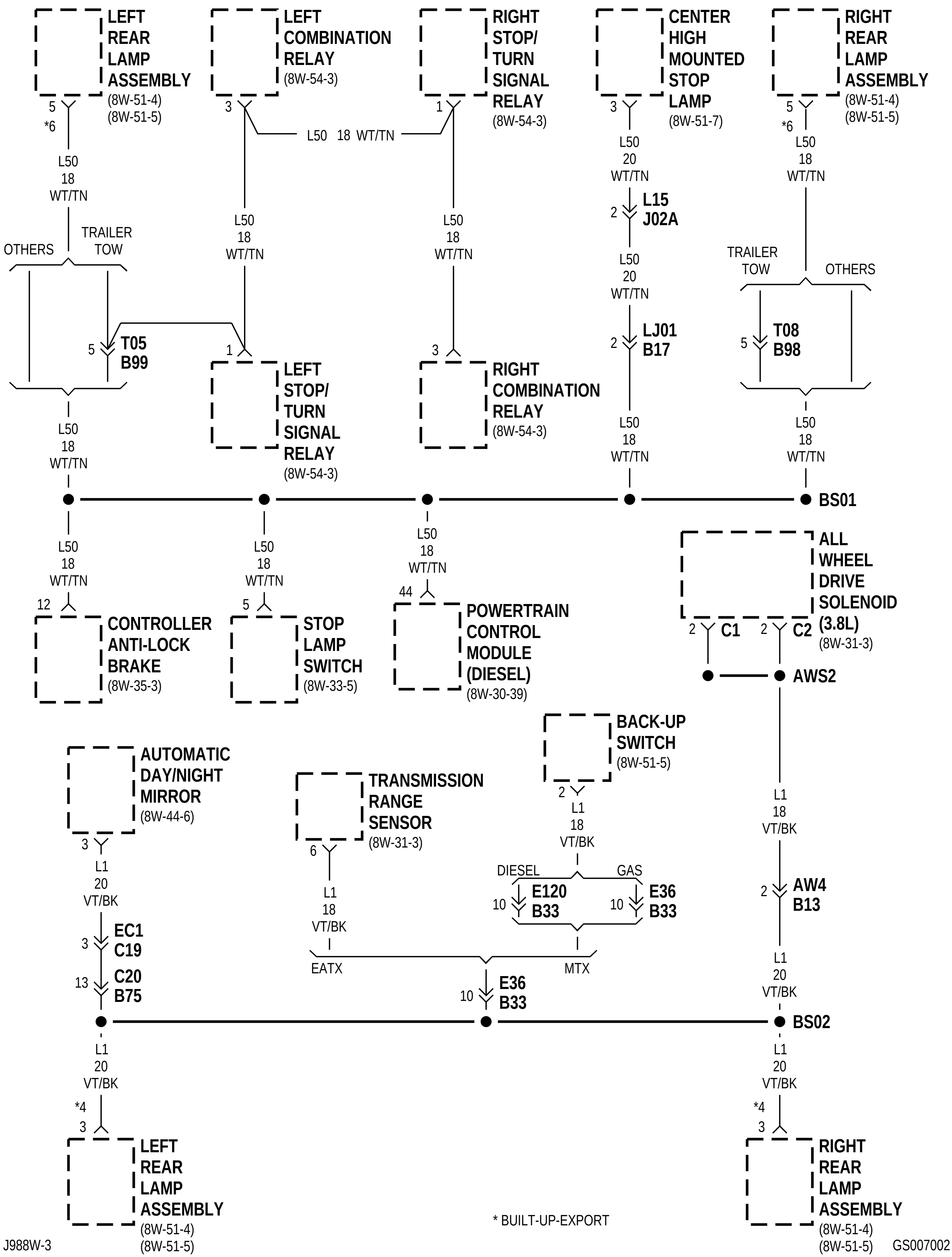
RFS2	8W-15-2
RFS2	8W-42-8
SS01	8W-63-6
SS02	8W-63-6



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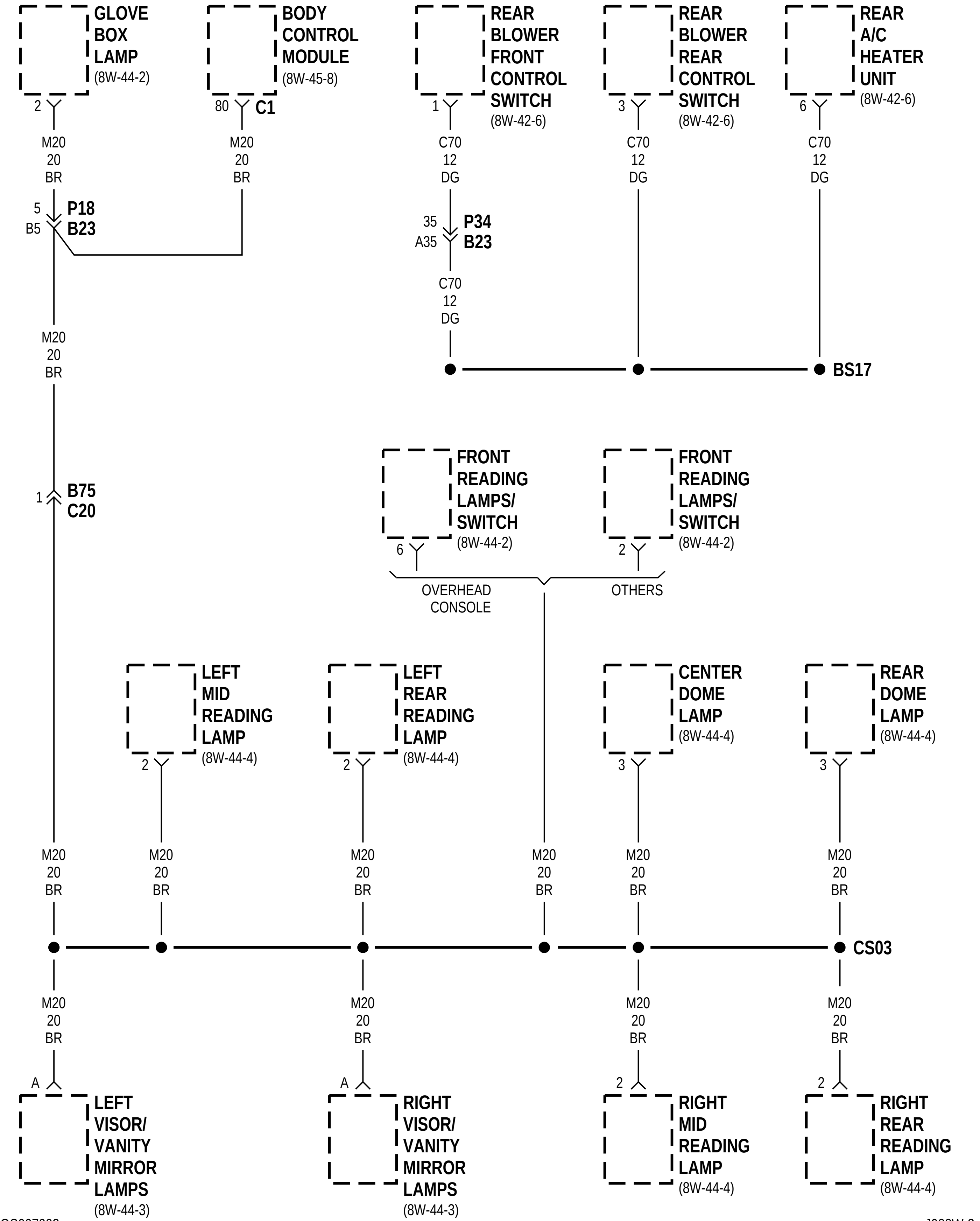
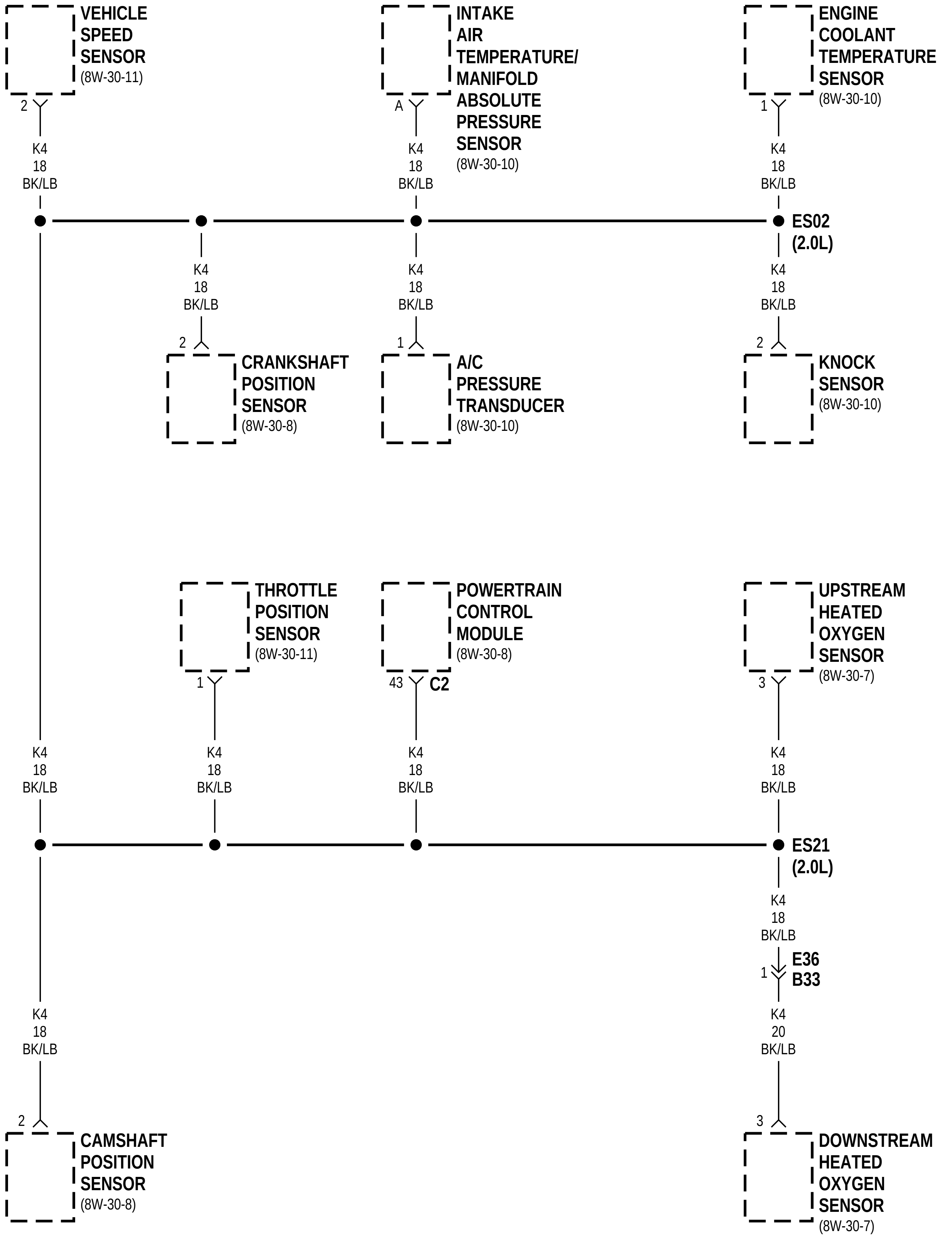
J988W-3

GS007002

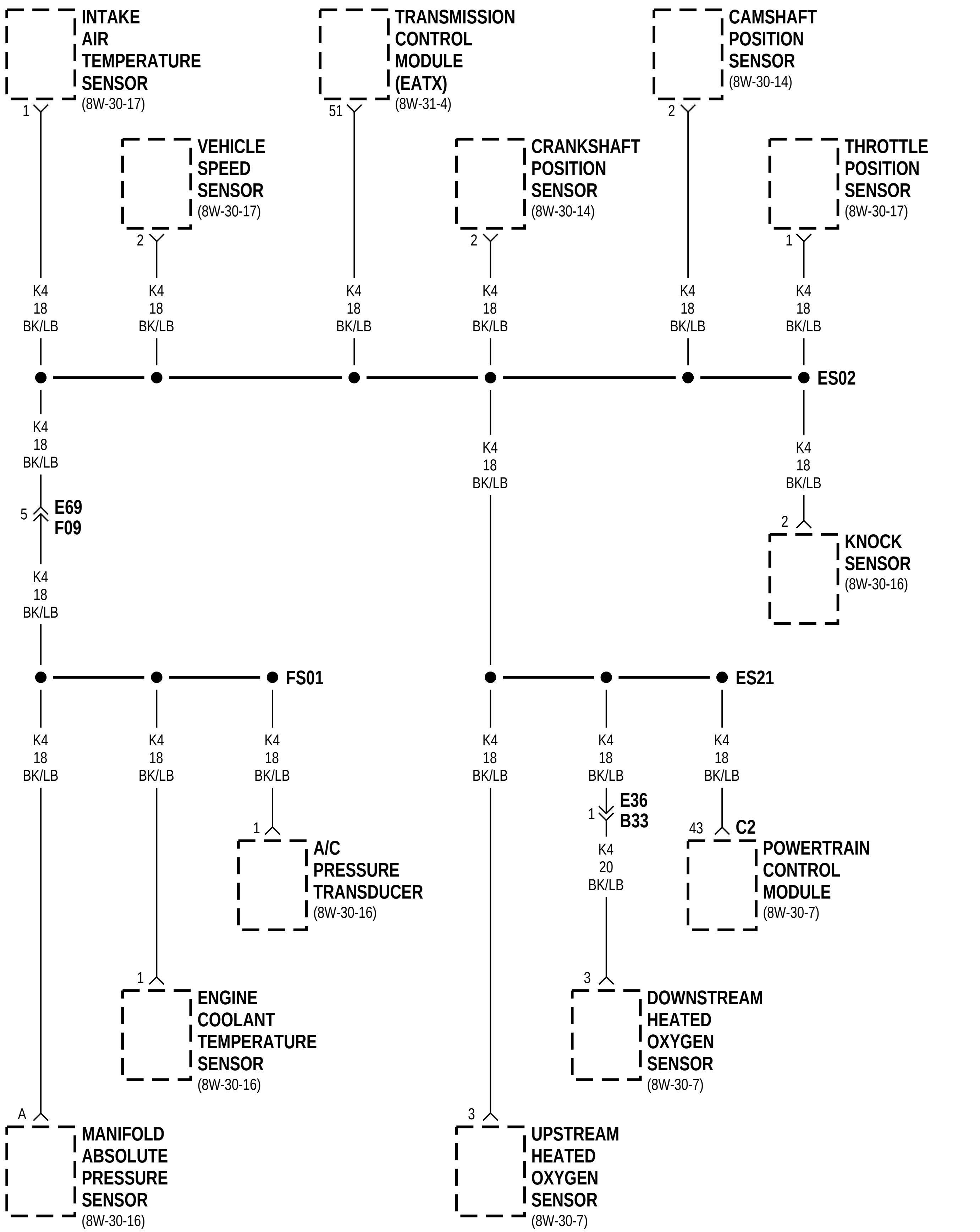


GS007003 J988W-3

2.0L

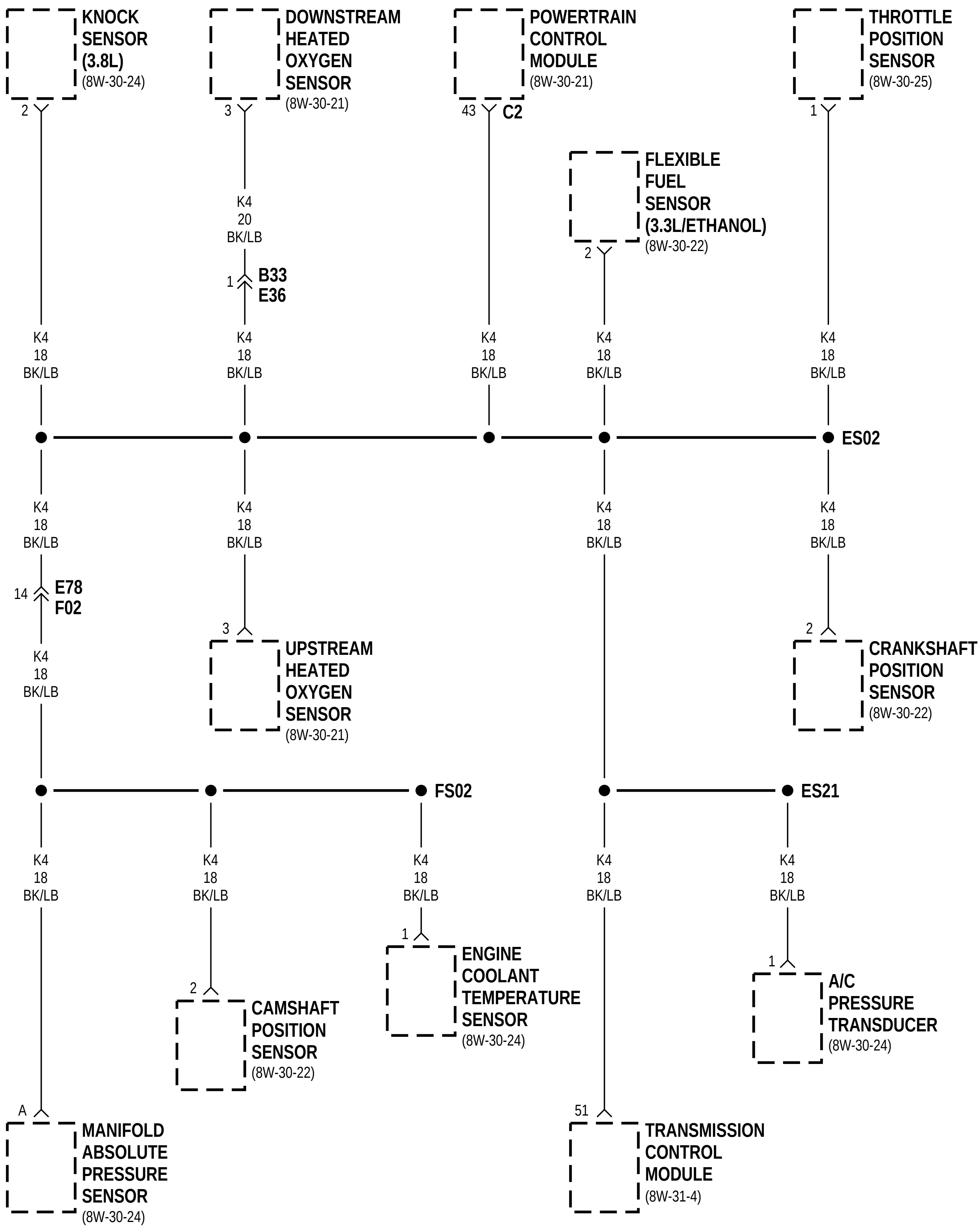

VEHICLE SPEED SENSOR (8W-30-11)
2
K4 18 BK/LB
INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE SENSOR (8W-30-10)
A
K4 18 BK/LB
ENGINE COOLANT TEMPERATURE SENSOR (8W-30-10)
1
K4 18 BK/LB
ES02 (2.0L)
K4 18 BK/LB
2
CRANKSHAFT POSITION SENSOR (8W-30-8)
K4 18 BK/LB
1
A/C PRESSURE TRANSDUCER (8W-30-10)
K4 18 BK/LB
2
KNOCK SENSOR (8W-30-10)
THROTTLE POSITION SENSOR (8W-30-11)
1
POWERTRAIN CONTROL MODULE (8W-30-8)
43 C2
UPSTREAM HEATED OXYGEN SENSOR (8W-30-7)
3
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
ES21 (2.0L)
K4 18 BK/LB
E36 B33
1
K4 20 BK/LB
3
DOWNSTREAM HEATED OXYGEN SENSOR (8W-30-7)
K4 18 BK/LB
2
CAMSHAFT POSITION SENSOR (8W-30-8)

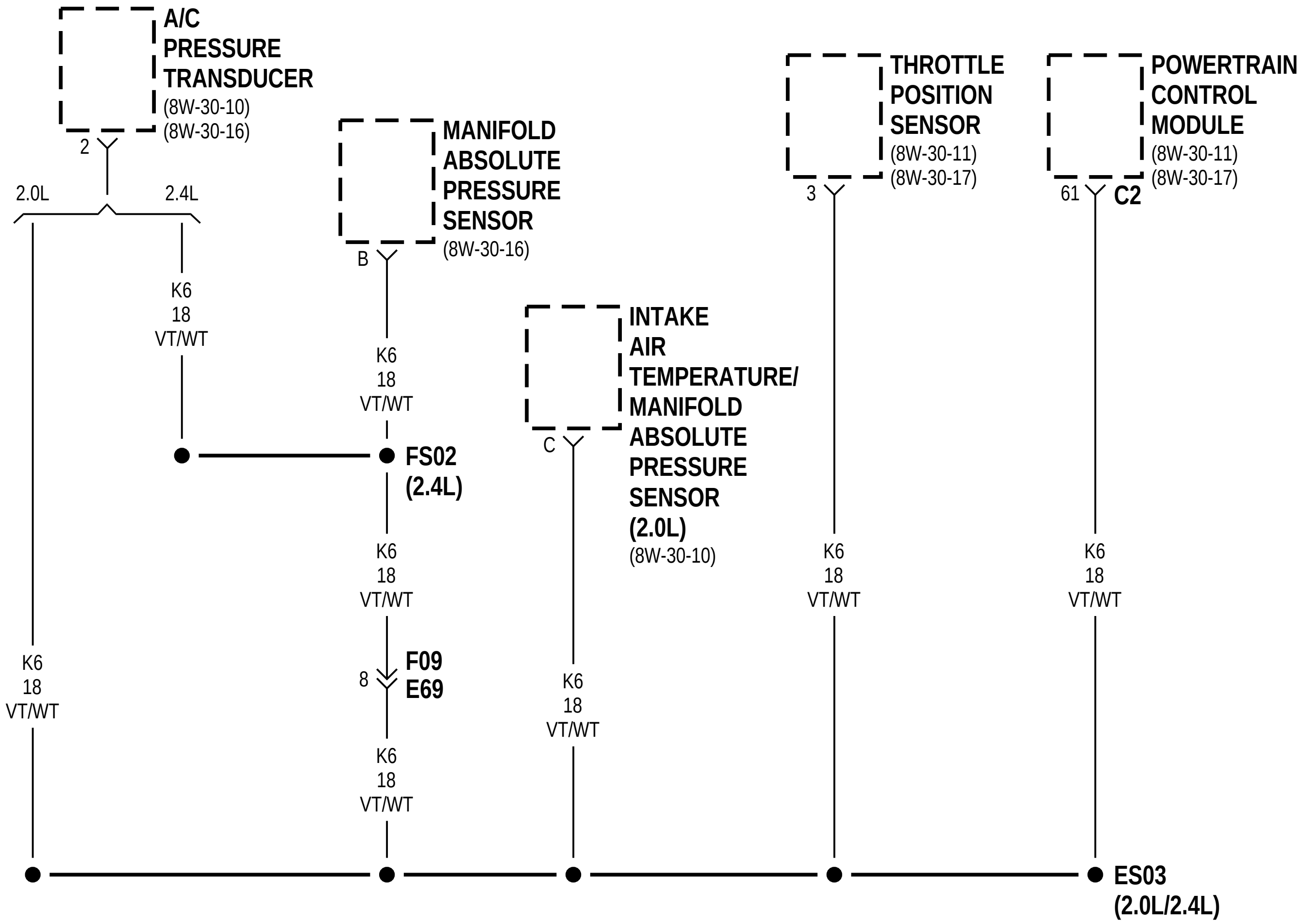
2.4L

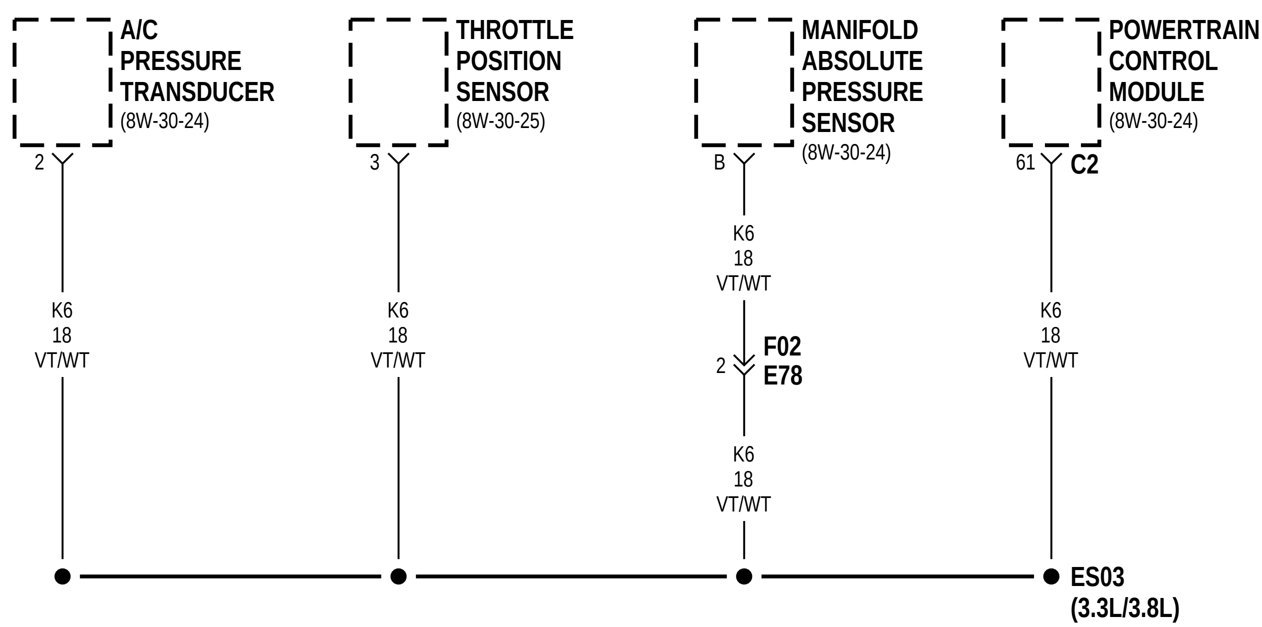


INTAKE AIR TEMPERATURE SENSOR (8W-30-17)
1
VEHICLE SPEED SENSOR (8W-30-17)
2
TRANSMISSION CONTROL MODULE (EATX) (8W-31-4)
51
CRANKSHAFT POSITION SENSOR (8W-30-14)
2
CAMSHAFT POSITION SENSOR (8W-30-14)
2
THROTTLE POSITION SENSOR (8W-30-17)
1
K4 18 BK/LB
ES02
5
E69
F09
2
KNOCK SENSOR (8W-30-16)
FS01
ES21
1
E36
B33
K4 20 BK/LB
1
A/C PRESSURE TRANSDUCER (8W-30-16)
43
C2
POWERTRAIN CONTROL MODULE (8W-30-7)
1
ENGINE COOLANT TEMPERATURE SENSOR (8W-30-16)
3
DOWNSTREAM HEATED OXYGEN SENSOR (8W-30-7)
A
MANIFOLD ABSOLUTE PRESSURE SENSOR (8W-30-16)
3
UPSTREAM HEATED OXYGEN SENSOR (8W-30-7)

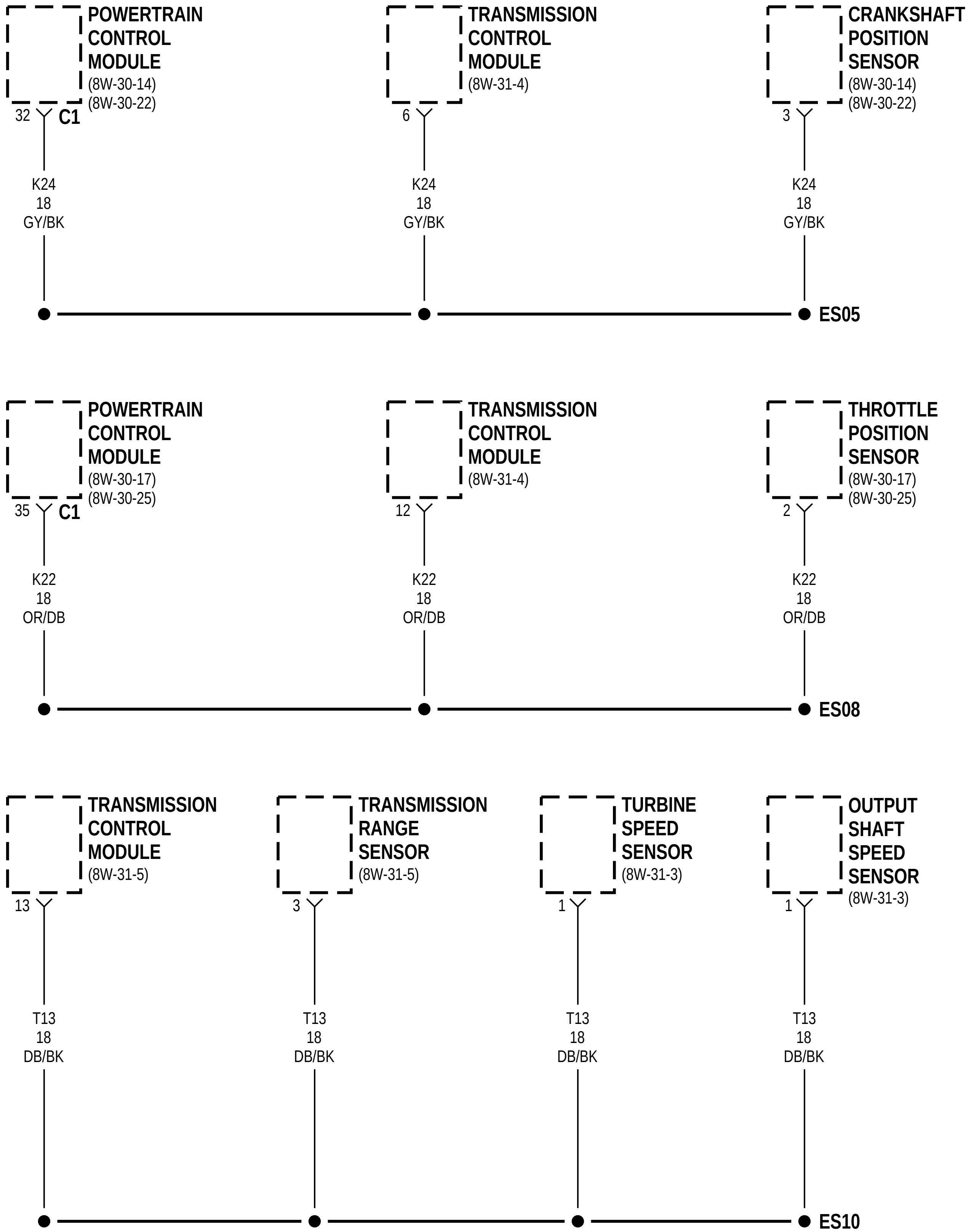
3.3L/3.8L


KNOCK
SENSOR
(3.8L)
(8W-30-24)
2
DOWNSTREAM
HEATED
OXYGEN
SENSOR
(8W-30-21)
3
K4
20
BK/LB
1
B33
E36
POWERTRAIN
CONTROL
MODULE
(8W-30-21)
43
C2
THROTTLE
POSITION
SENSOR
(8W-30-25)
1
FLEXIBLE
FUEL
SENSOR
(3.3L/ETHANOL)
(8W-30-22)
2
K4
18
BK/LB
ES02
14
E78
F02
3
UPSTREAM
HEATED
OXYGEN
SENSOR
(8W-30-21)
2
CRANKSHAFT
POSITION
SENSOR
(8W-30-22)
FS02
ES21
1
ENGINE
COOLANT
TEMPERATURE
SENSOR
(8W-30-24)
1
A/C
PRESSURE
TRANSDUCER
(8W-30-24)
2
CAMSHAFT
POSITION
SENSOR
(8W-30-22)
A
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
(8W-30-24)
51
TRANSMISSION
CONTROL
MODULE
(8W-31-4)


A/C PRESSURE TRANSDUCER
(8W-30-10)
(8W-30-16)
2
2.0L
2.4L
K6
18
VT/WT
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-16)
B
FS02
(2.4L)
F09
E69
8
INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE SENSOR (2.0L)
(8W-30-10)
C
THROTTLE POSITION SENSOR
(8W-30-11)
(8W-30-17)
3
POWERTRAIN CONTROL MODULE
(8W-30-11)
(8W-30-17)
61
C2
ES03
(2.0L/2.4L)


A/C PRESSURE TRANSDUCER
(8W-30-24)
2
THROTTLE POSITION SENSOR
(8W-30-25)
3
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-24)
B
F02
E78
2
POWERTRAIN CONTROL MODULE
(8W-30-24)
61
C2
K6
18
VT/WT
ES03
(3.3L/3.8L)

EATX


POWERTRAIN CONTROL MODULE
(8W-30-14)
(8W-30-22)
32
C1
K24
18
GY/BK
TRANSMISSION CONTROL MODULE
(8W-31-4)
6
K24
18
GY/BK
CRANKSHAFT POSITION SENSOR
(8W-30-14)
(8W-30-22)
3
K24
18
GY/BK
ES05
POWERTRAIN CONTROL MODULE
(8W-30-17)
(8W-30-25)
35
C1
K22
18
OR/DB
TRANSMISSION CONTROL MODULE
(8W-31-4)
12
K22
18
OR/DB
THROTTLE POSITION SENSOR
(8W-30-17)
(8W-30-25)
2
K22
18
OR/DB
ES08
TRANSMISSION CONTROL MODULE
(8W-31-5)
13
T13
18
DB/BK
TRANSMISSION RANGE SENSOR
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T13
18
DB/BK
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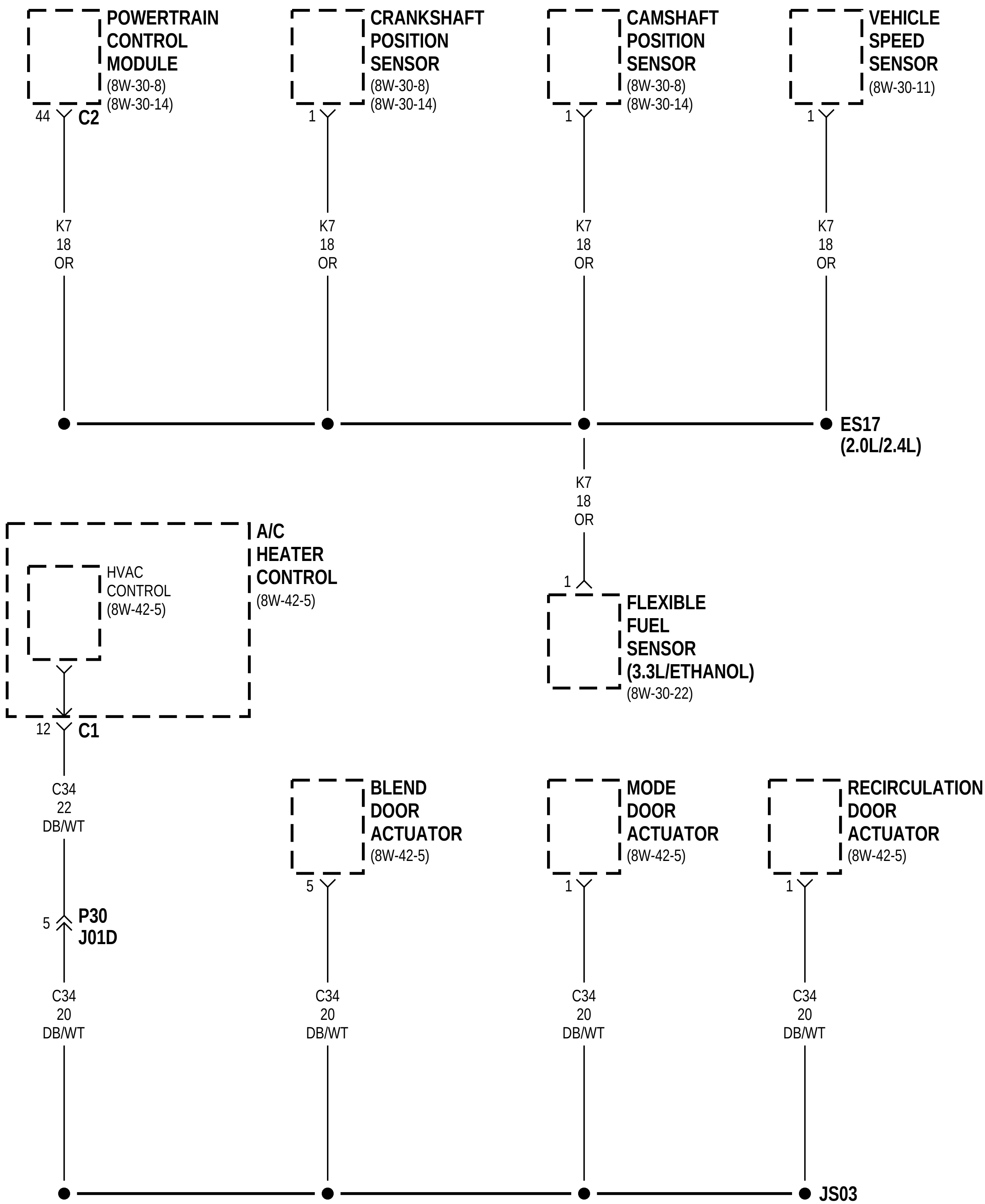
1
T13
18
DB/BK
OUTPUT SHAFT SPEED SENSOR
(8W-31-3)
1
T13
18
DB/BK
ES10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1
K7 18 OR
K7 18 OR
K7 18 OR
K7 18 OR
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1
5
P30
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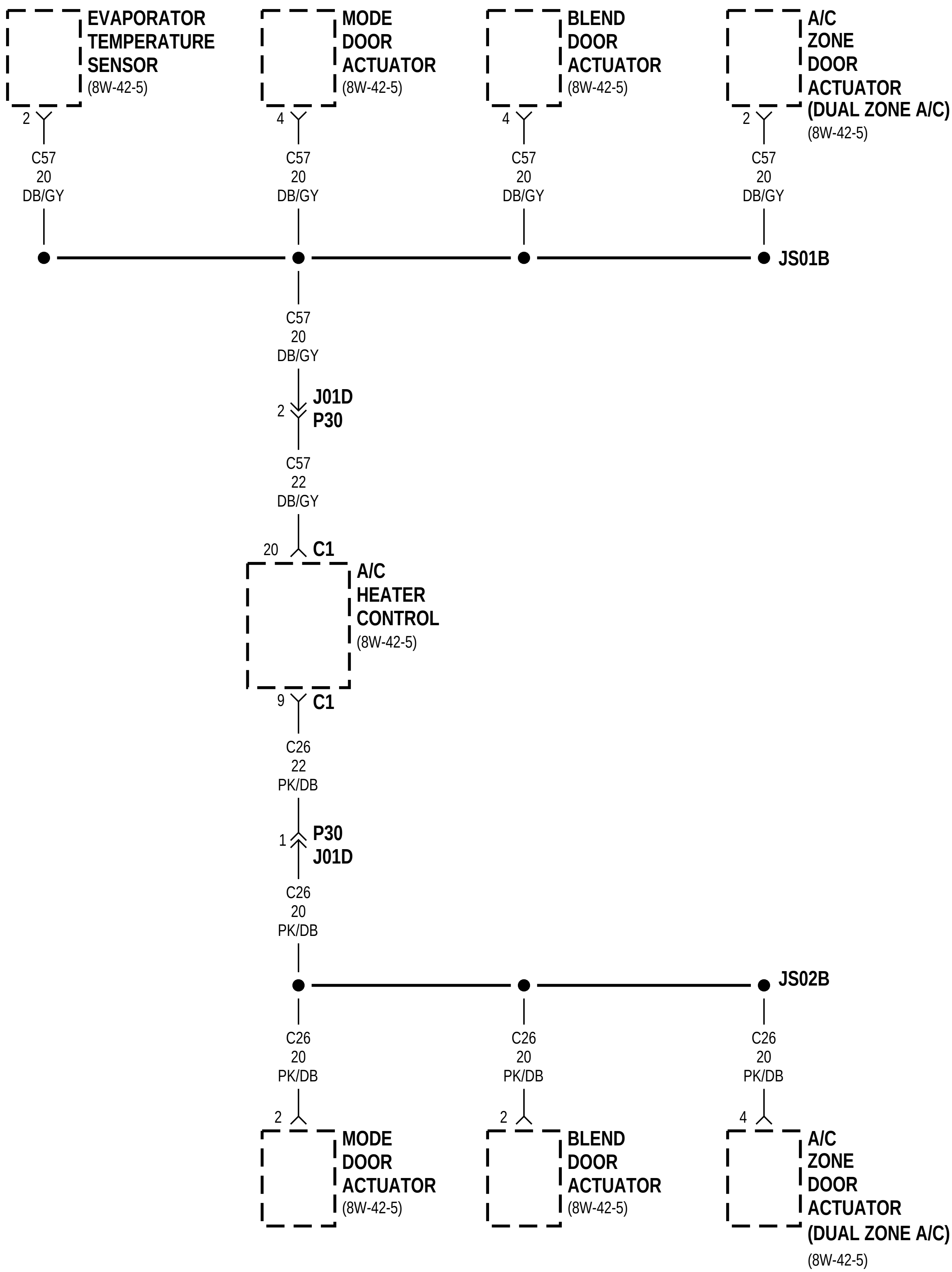
C34 20 DB/WT
C34 20 DB/WT
C34 20 DB/WT
C34 20 DB/WT
JS03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4
2
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20
DB/GY
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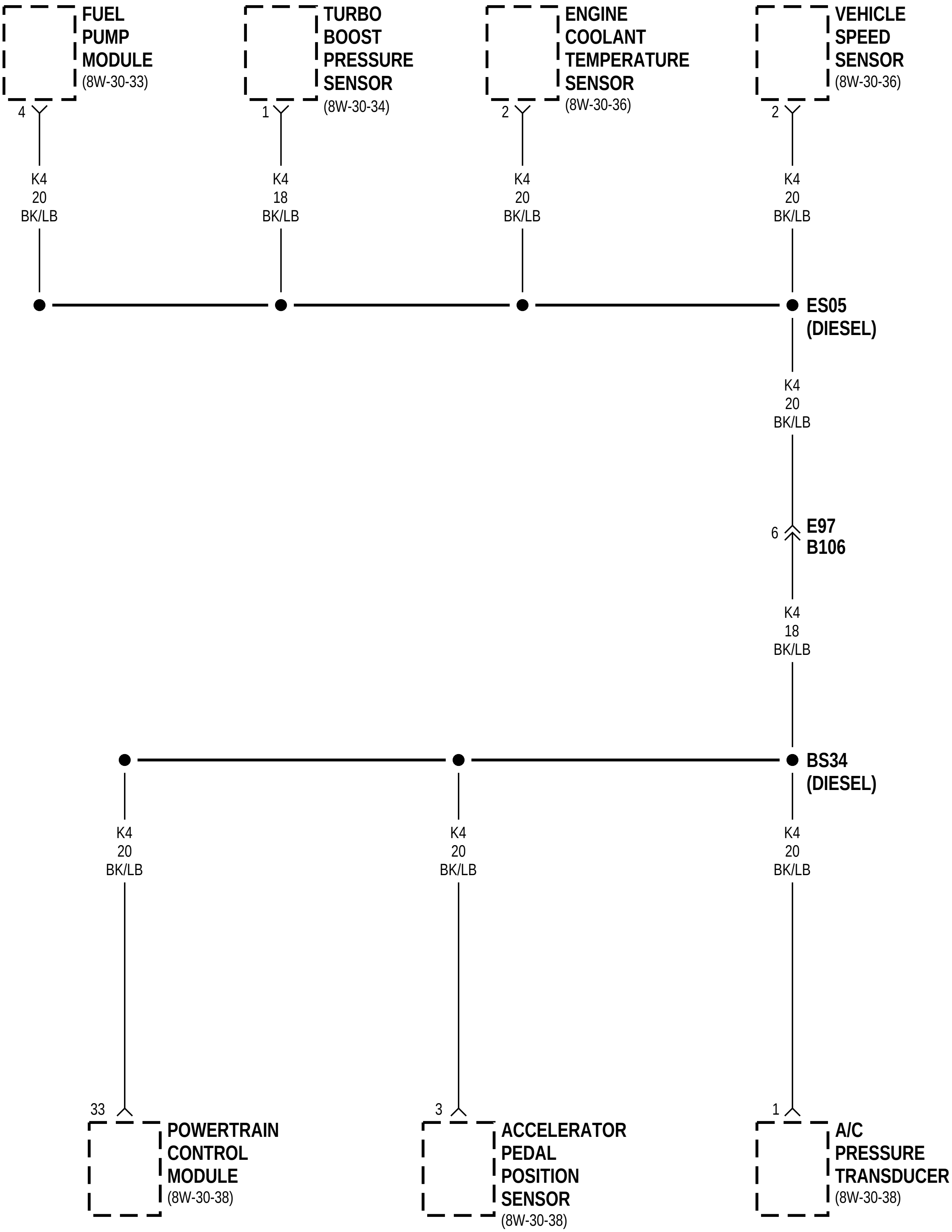
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BK/LB
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BK/LB
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K4
20
BK/LB
6
E97
B106
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18
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BK/LB
K4
20
BK/LB
K4
20
BK/LB
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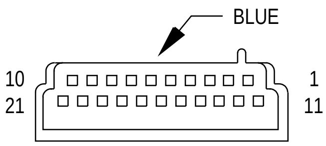
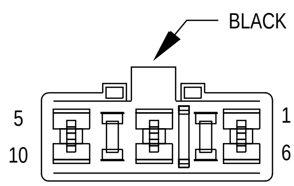


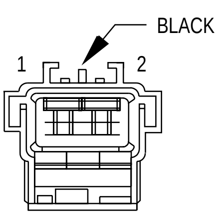
A/C HEATER CONTROL - C1

CAV	CIRCUIT	FUNCTION
1	C14 22WT/RD	REAR DEFOGGER RELAY CONTROL
2	V26 22YL/WT	REAR WIPER SWITCH MUX
3	C103 20DG/LB	A/C SWITCH SIGNAL
4	C102 22LG	ZONE DOOR FEEDBACK SIGNAL
5	C36 22RD/WT	BLEND DOOR FEEDBACK SIGNAL
6	C37 22YL	MODE DOOR FEEDBACK SIGNAL
7	C66 18BK/WT	WIPER DE-ICE SWITCHED GROUND
8	C21 22DB/OR	A/C SWITCH SENSE
9	C26 22PK/DB	5 VOLT SUPPLY
10	V23 18BR/PK	FUSED IGNITION (ST-RUN)
11	E2 20OR	PANEL LAMPS FEED
	E2 20OR*	PANEL LAMPS FEED
12	C34 22DB/WT	COMMON DOOR DRIVER
	C34 20DB/WT	COMMON DOOR DRIVER
13	C61 22DB	DUAL ZONE A/C ACTUATOR (+/-)
	C61 20DB	DUAL ZONE A/C ACTUATOR (+/-)
14	D1 20VT/BR	CCD(+)
15	C62 22DB/PK	DUAL ZONE A/C ACTUATOR (+/-)
16	D2 20WT/BK	CCD(-)
17	C33 22DB/RD	BLEND DOOR DRIVER
18	C35 22DG/YL	MODE DOOR DRIVER
19	C32 22GY/DB	RECIRCULATION DOOR DRIVER
20	C57 22DB/GY	SENSOR GROUND
21	Z2 18BK/LG	GROUND



A/C HEATER CONTROL -C2

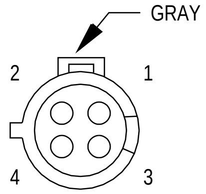
CAV	CIRCUIT	FUNCTION
1	-	-
2	C6 14LB	M2 SPEED BLOWER MOTOR
3	C104 12RD/WT	M3 SPEED BLOWER MOTOR
4	C5 16LG	M1 SPEED BLOWER MOTOR
5	-	-
6	Z1 12BK	GROUND
7	C4 16TN	LOW SPEED BLOWER MOTOR
8	C107 12TN/BK	HIGH SPEED BLOWER MOTOR
9	-	-
10	C7 12BK/TN	HIGH SPEED BLOWER MOTOR



A/C COMPRESSOR CLUTCH

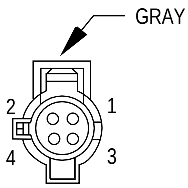
CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z1 18BK	GROUND

* BUILT-UP-EXPORT



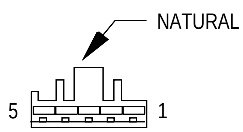
A/C PRESSURE TRANSDUCER (GAS)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K6 18VT/WT	5 VOLT SUPPLY
3	C18 18DB	AC PRESSURE SIGNAL
4	-	-



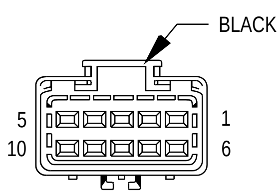
A/C PRESSURE TRANSDUCER (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K7 20OR	5 VOLT SUPPLY
3	C18 20DB	A/C PRESSURE SIGNAL
4	-	-



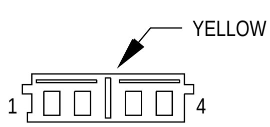
A/C ZONE DOOR ACTUATOR (DUAL ZONE A/C)

CAV	CIRCUIT	FUNCTION
1	C61 20DB	DUAL ZONE A/C ACTUATOR (+/-)
2	C57 20DB/GY	SENSOR GROUND
3	C102 20LG	ZONE DOOR FEEDBACK SIGNAL
4	C26 20PK/DB	5 VOLT SUPPLY
5	C62 20DB/PK	DUAL ZONE A/C ACTUATOR (+/-)



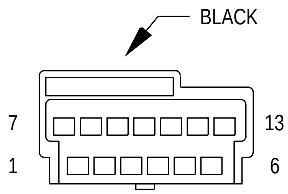
ACCELERATOR PEDAL POSITION SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	K4 20BK/LB	SENSOR GROUND
4	-	-
5	K151 20WT	LOW IDLE POSITION SWITCH
6	-	-
7	K22 20OR/DB	ACCELERATOR PEDAL SENSOR SIGNAL
8	K167 20BR/YL	ACCELERATOR PEDAL SENSOR GROUND
9	-	-
10	K6 20VT/WT	5 VOLT SUPPLY



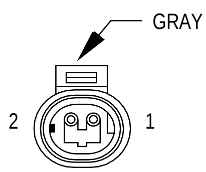
AIRBAG CONTROL MODULE - C1

CAV	CIRCUIT	FUNCTION
1	R42 18BK/YL	PASSENGER AIRBAG LINE NO. 1
2	R44 18DG/YL	PASSENGER AIRBAG LINE NO. 2
3	R43 18BK/LB	DRIVER AIRBAG LINE NO. 1
4	R45 18DG/LB	DRIVER AIRBAG LINE NO. 2



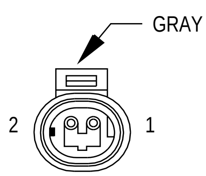
AIRBAG CONTROL MODULE - C2

CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION (ST-RUN)
2	F23 18 DB/YL	FUSED IGNITION (RUN)
3	D1 20VT/BR	CCD BUS(+)
4	D2 20WT/BK	CCD BUS(-)
5	-	-
6	-	-
7	R41 18BK/TN	AIRBAG WARNING LAMP DRIVER
8	-	-
9	-	-
10	-	-
11	Z2 18BK/LG	GROUND
12	-	-
13	-	-



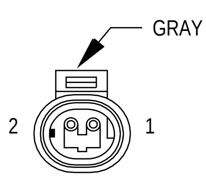
ALL WHEEL DRIVE SOLENOID - C1 (3.8L ONLY)

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L1 18VT/BK	BACK-UP LAMP FEED



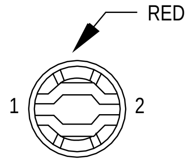
ALL WHEEL DRIVE SOLENOID - C2 (3.8L ONLY)

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L1 18VT/BK	BACK-UP LAMP FEED



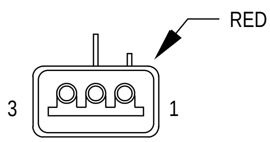
AMBIENT AIR TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
2	G32 20BK/LB	SENSOR GROUND



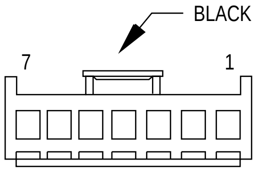
ASH RECEIVER LAMP (LHD)

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	E2 18OR	PANEL LAMPS FEED



ASH RECEIVER LAMP (RHD)

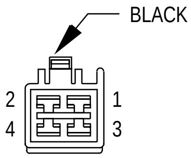
CAV	CIRCUIT	FUNCTION
1	E2 18OR	PANEL LAMPS FEED
2	-	-
3	Z1 18BK	GROUND



AUTOMATIC DAY/NIGHT MIRROR

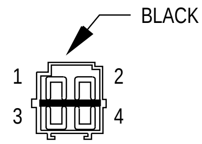
CAV	CIRCUIT	FUNCTION
1	V23 18BR/PK	FUSED IGNITION (ST-RUN)
2	Z1 20BK	GROUND
3	L1 20VT/BK	BACK-UP LAMP FEED
4	P112 20YL/WT*	POWER MIRROR B(-)
5	P114 20YL/BK*	POWER MIRROR B(-)
6	-	-
7	L24 20WT/LG*	AUTOMATIC HEADLAMP SIGNAL

* EXCEPT BUILT-UP-EXPORT



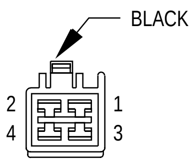
B09

CAV	CIRCUIT
1	Z1 12BK
2	F35 14RD
3	A2 12PK/BK
4	F20 20WT



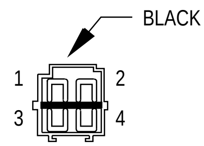
HS5D

CAV	CIRCUIT
1	Z1 14BK
	Z1 14BK
2	F35 14RD
	F35 14RD
3	A2 12PK/BK
4	F20 20WT



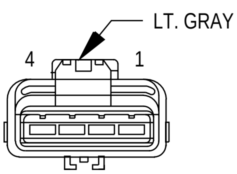
B09

CAV	CIRCUIT
1	Z1 12BK
2	A2 12PK/BK
3	F35 14RD
4	F20 20WT



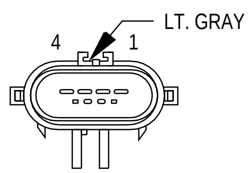
S02

CAV	CIRCUIT
1	Z1 14BK
	Z1 20BK
2	A2 12PK/BK
3	F35 14RD
4	-



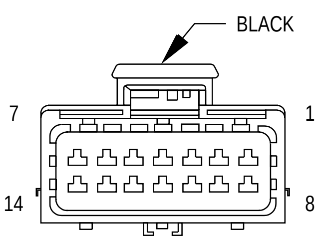
B13

CAV	CIRCUIT
1	Z1 14BK
2	L1 20VT/BK
3	G4 18DB
4	A141 16DG/WT



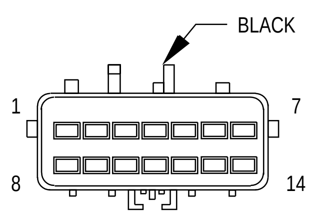
AW4

CAV	CIRCUIT
1	Z1 16BK
2	L1 20VT/BK
3	G4 18DB
4	A141 16DG/WT



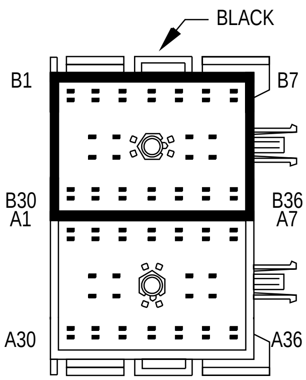
B17

CAV	CIRCUIT
1	-
2	L50 18WT/TN
3	M11 20PK/LB
4	G78 18TN/BK
5	L77 20BR/LB
6	P98 20WT/RD
7	V13 18BR/LG
8	V23 18BR/PK
9	F133 20BR/RD
10	F136 20VT/WT
11	Z1 12BK
12	C15 12BK/WT



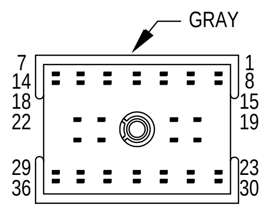
LJ01

CAV	CIRCUIT
1	-
2	L50 20WT/TN
3	M11 20PK/LB
4	G78 18TN/BK
5	L77 20BR/LB
6	P98 20WT/RD
7	V13 18BR/LG
8	V23 18BR/PK
9	F133 20BR/RD
10	F136 20VT/WT
11	Z1 12BK
12	C15 12BK/WT



B23

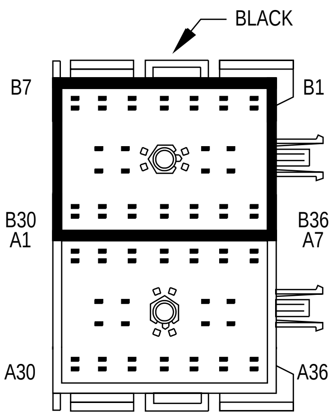
CAV	CIRCUIT
B1	V16 20WT
B2	X153 20WT/BR
B3	L39 18LB ●
B3	L44 20VT/RD ●●
	L44 20VT/RD ●●
B4	A1 12RD
B5	M20 20BR
	M20 20BR
B6	X154 20WT/VT
B7	P70 20WT*
B8	P71 20YL*
B9	P72 20YL/BK*
B10	P73 20YL/PK*
B11	P74 20DB*
B12	D1 18VT/BR
B13	D2 18WT/BK
B14	D6 20PK/LB*
B15	P75 20DB/WT*
B16	D20 20LG*
B17	D21 20PK
B18	L34 20RD/OR
B19	Z39 20BK
	Z39 20BK ●●
B20	L94 20OR/WT
B21	L324 20WT/LG
B22	M13 20BK/YL
B23	F14 18LG/YL ●●
	F14 20LG/YL ●
B24	F23 18DB/YL ●●
	F23 20DB/YL ●
B25	X155 20BR/WT
B26	X156 20VT/WT
B27	L36 20LG ●●
	L36 20LG ●●
B28	L77 18BR/YL ●●
B29	F39 18PK/LG*
	F39 18PK/LG*
B30	C104 12RD/WT
B31	C107 12TN/BK
B32	C4 16TN
B33	C6 14LB
B34	C5 16LG
B35	C71 12DB
B36	C103 20DG/LB



P18

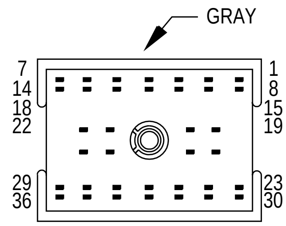
CAV	CIRCUIT
1	V16 20WT
2	X153 20WT/BR
3	L39 18LB ●
3	L44 20VT/RD ●●
4	A1 12RD
5	M20 20BR
6	X154 20WT/VT
7	P70 20WT*
	P70 20WT**
8	P71 20YL*
	P71 20YL**
9	P72 20YL/BK*
	P72 20YL/BK**
10	P73 20YL/PK*
	P73 20YL/PK**
11	P74 20DB*
	P74 20DB**
12	D1 20VT/BR
13	D2 20WT/BK
14	D6 20PK/LB*
15	P75 20DB/WT*
	P75 20DB/WT**
16	D20 20LG*
17	D21 20PK
18	L34 20RD/OR
19	Z39 18BK
20	L94 20OR/WT
21	L324 22WT/LG
22	M13 20BK/YL
23	F14 18LG/YL
24	F23 18DB/YL
25	X155 20BR/WT
26	X156 20VT/WT
27	L36 20LG ●●
28	L77 18BR/YL ●●
29	-
30	C104 12RD/WT
31	C107 12TN/BK
32	C4 16TN
33	C6 14LB
34	C5 16LG
35	C71 12DB
36	C103 20DG/LB

* GAS
** GAS/MEMORY OPTIONS
● GAS, EXCEPT BUILT-UP-EXPORT
●● BUILT-UP-EXPORT



B23

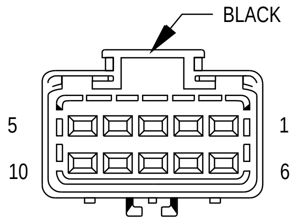
CAV	CIRCUIT
A1	B27 20RD/YL ●
A1	B27 18RD/YL ●●
A2	G3 20BK/PK ●
A2	G3 18BK/PK ■■
A3	G19 18LG/OR
A4	K29 20WT/PK ▲
A5	-
A6	-
A7	X57 20BR/LB
A8	X58 20DB/OR
A9	X51 20BR/YL
A10	X52 20DB/WT
A11	X15 16BK/DG
A12	X53 20DG
A13	X54 20VT
A14	X55 20BR/RD
A15	X56 20DB/RD
A16	L13 20BR/YL ●●
	L13 18BR/YL ●●
A17	V32 20YL/RD ▲
A17	G85 20OR/BK ▲▲
A18	V30 20DB/RD ▲
A18	P114 20YL/BK ●
A19	L50 18WT/TN ▲
A20	F32 18PK/DB ▲
A20	P112 20YL/WT ●
A21	V37 20RD/LG
A22	F30 16RD
	F30 16RD
A23	G96 20LG/RD** ●
	G96 20LG/RD** ●
A23	G96 20LG/RD** ▲
A24	Z11 20BK/WT
A25	P66 20WT/BK** ■
A26	P65 20DB/YL** ■
A27	P64 20YL/OR** ■
A28	P69 20WT/RD** ■
A29	P68 20DG/RD** ■
A30	P67 20YL/RD** ■
A31	C50 12BK/LG*
A32	-
A33	C60 16BK/LB*
	C60 16BK/LB*
A34	C34 20DB/WT*
A34	C63 20LB* ●
A35	C70 12DG*
A36	C61 20DB*



P34

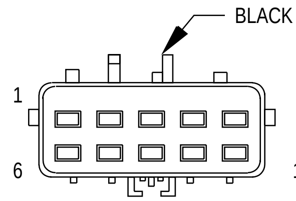
CAV	CIRCUIT
1	B27 20RD/YL
2	G3 20BK/PK
3	G19 20LG/OR
	G19 20LG/OR
4	K29 20WT/PK ▲
5	-
6	-
7	X57 20BR/LB
8	X58 20DB/OR
9	X51 20BR/YL
10	X52 20DB/WT
11	X15 16BK/DG
12	X53 20DG
	X53 20DG*
13	X54 20VT
	X54 20VT*
14	X55 20BR/RD
	X55 20BR/RD*
15	X56 20DB/RD
	X56 20DB/RD*
16	L13 20BR/YL ●●
17	V32 20YL/RD ▲
17	G85 20OR/BK ▲▲
18	V30 20DB/RD ▲
18	P114 20YL/BK ●
19	L50 18WT/TN ▲
20	F32 18PK/DB ▲
20	P112 20YL/WT ●
21	V37 20RD/LG
22	F30 16RD
23	G96 20LG/RD ●
	G96 20LG/RD ●
24	Z11 20BK/WT
25	P66 20WT/BK ■
26	P65 20DB/YL ■
27	P64 20YL/OR ■
28	P69 20WT/RD ■
29	P68 20DG/RD ■
30	P67 20YL/RD ■
31	C50 12BK/LG*
32	- ■
33	C60 16BK/LB*
34	C34 20DB/WT*
34	C63 22LB ●
35	C70 12DG*
36	C61 20DB*

* REAR A/C HEATER
** MEMORY SEAT
● EXCEPT BUILT-UP-EXPORT
●● BUILT-UP-EXPORT
▲ RHD
▲▲ DIESEL
■ GAS
■■ GAS,BUILT-UP-EXPORT



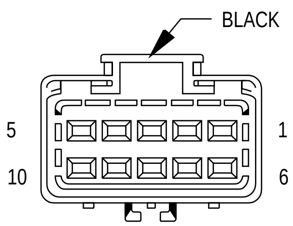
B33
(DIESEL)

CAV	CIRCUIT
1	G6 20GY
2	G18 20PK/BK
3	G58 20BK/YL
4	A141 16DG/WT
5	F20 20WT
6	K21 20BK/RD
7	K1 20DG/RD
8	K9 20LB
9	K3 20BK/VT
10	L1 20VT/BK



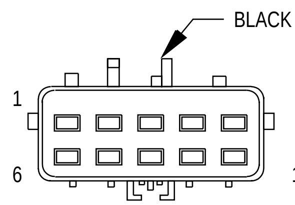
E120
(DIESEL)

CAV	CIRCUIT
1	G6 16GY
2	G18 20BK/PK
3	G58 20BK/YL
4	A141 18DG/WT
5	F20 20WT
6	K21 18BK/RD
7	K1 18DG/RD
8	K9 18LB
9	K3 20BK/VT
10	L1 18VT/BK



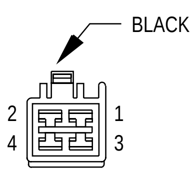
B33
(GAS)

CAV	CIRCUIT
1	K4 20BK/LB
2	D2 18WT/BK
3	D20 20LG
4	D21 20PK
5	F20 20WT
6	D6 20PK/LB
7	D1 18VT/BR
8	F11 20RD/WT
9	G6 20GY
10	L1 20VT/BK



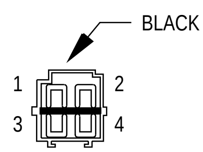
E36
(GAS)

CAV	CIRCUIT
1	K4 18BK/LB
2	D2 18WT/BK
3	D20 18LG
4	D21 18PK
5	F20 18WT
6	D6 18PK/LB
7	D1 18VT/BR
8	F11 18RD/WT
9	G6 16GY
10	L1 18VT/BK



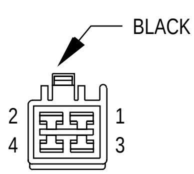
B56

CAV	CIRCUIT
1	Z1 12BK
2	F35 14RD
3	-
4	F20 20WT



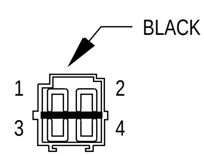
HS5P

CAV	CIRCUIT
1	Z1 14BK
2	F35 14RD
	F35 14RD
3	-
4	F20 20WT



B56

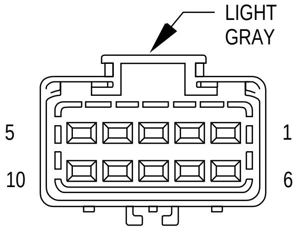
CAV	CIRCUIT
1	Z1 12BK
2	A2 12PK/BK
3	F35 14RD
4	F20 20WT



S02

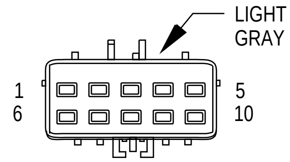
CAV	CIRCUIT
1	Z1 14BK
	Z1 20BK*
2	A2 12PK/BK
3	F35 14RD
4	F20 20WT

* MEMORY



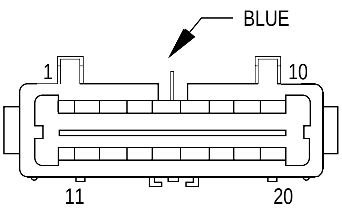
B70

CAV	CIRCUIT
1	C103 20DG/LB
2	A142 18DG/OR
3	V32 20YL/RD
4	-
5	G3 20BK/PK
6	V30 20DB/RD
7	K29 20WT/PK
8	V37 20RD/LG
9	Z11 20BK/WT
10	K141 20TN/WT



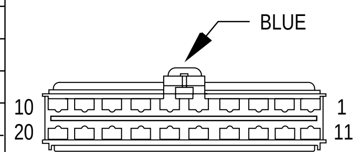
E43

CAV	CIRCUIT
1	C103 18DG/LB
2	A142 18DG/OR
3	V32 18YL/RD
4	-
5	G3 18BK/PK
6	V30 18DB/RD
7	K29 18WT/PK
8	V37 18RD/LG
9	Z11 18BK/WT
10	K141 18TN/WT



B75

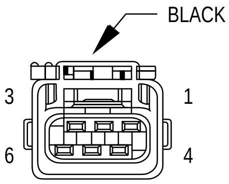
CAV	CIRCUIT
1	M20 20BR
2	F41 20PK/VT
3	M13 20BK/YL
4	M113 20LB/PK
5	D2 18WT/BK
6	D1 18VT/BR
7	G10 18LG/RD*
8	G32 20BK/LB
9	Z2 18BK/LG
10	G31 20VT/LG
11	V23 18BR/PK
12	Z1 20BK
13	L1 20VT/BK
14	G74 18TN/RD
14	G75 18TN*
15	F133 20BR/YL
16	F136 20VT/YL
17	E2 20OR
18	L24 20WT/LG**
19	P112 20YL/WT**
20	P114 20YL/BK**



C20

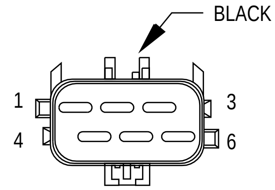
CAV	CIRCUIT
1	M20 20BR
2	F41 20PK/VT
3	M13 20BK/YL
4	M113 20LB/PK
5	D2 18WT/BK
6	D1 18VT/BR
7	G10 18LG/RD*
8	G32 20BK/LB
9	Z2 18BK/LG
10	G31 20VT/LG
11	V23 18BR/PK
12	Z1 20BK
13	L1 20VT/BK
14	G74 18TN/RD
15	F133 20BR/YL
16	F136 20VT/YL
17	E2 18OR
18	L24 20WT/LG**
19	P112 20YL/WT**
20	P114 20YL/BK**

* RHD
** EXCEPT BUILT-UP-EXPORT



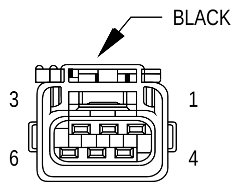
B98
(TRAILER TOW)

CAV	CIRCUIT
1	L62 18BR/RD
2	-
3	L1 20VT/BK
4	L78 20DG/YL
5	L50 18WT/TN
6	Z1 20BK



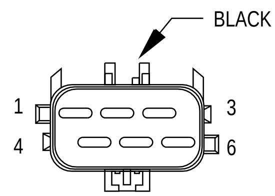
T08

CAV	CIRCUIT
1	L62 18BR/RD
	L62 18BR/RD
2	-
3	L1 20VT/BK
4	L78 20DG/YL
	L78 18BR
5	L50 18WT/TN
6	Z1 20BK
	Z1 18WT



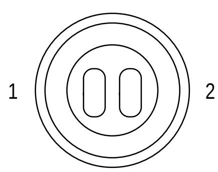
B99
(TRAILER TOW)

CAV	CIRCUIT
1	L63 18DG/RD
2	-
3	L1 20VT/BK
4	L77 20BR/LB
5	L50 18WT/TN
6	Z1 20BK



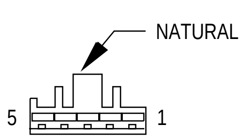
T05

CAV	CIRCUIT
1	L63 18DG/RD
	L63 18DG/RD
2	-
3	L1 20VT/BK
4	L77 20BR/LB
5	L50 18WT/TN
	L50 18WT/TN
6	Z1 20BK
	Z1 18BK



BACK-UP
SWITCH

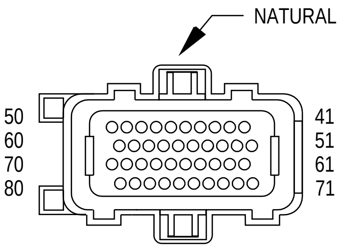
CAV	CIRCUIT	FUNCTION
1	F20 18WT	FUSED IGNITION SWITCH OUTPUT
1	F20 20WT*	FUSED IGNITION SWITCH OUTPUT
2	L1 18VT/BK	BACK-UP LAMP FEED



BLEND
DOOR ACTUATOR

CAV	CIRCUIT	FUNCTION
1	C33 20DB/RD	BLEND AIR DOOR DRIVER
2	C26 20PK/DB	5 VOLT SUPPLY
3	C36 20RD/WT	BLEND DOOR FEEDBACK SIGNAL
4	C57 20DB/GY	SENSOR GROUND
5	C34 20DB/WT	BLEND AIR DOOR DRIVER

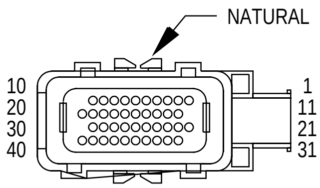
* DIESEL



BODY CONTROL MODULE - C1

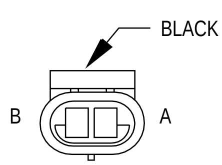
CAV	CIRCUIT	FUNCTION
41	V7 20DG/WT	WIPER PARK SWITCH SENSE
42	G7 18WT/OR*	VEHICLE SPEED SENSOR SIGNAL
43	G70 18BR/TN	HOOD AJAR SWITCH SENSE
44	P98 20WT/RD	LIFTGATE LOCK/UNLOCK MUX
45	P97 20WT/DG	DRIVER DOOR SWITCH MUX
46	G4 18DB	FUEL LEVEL SENSOR SIGNAL
47	G77 18TN/OR	LEFT REAR DOOR AJAR SWITCH SENSE
48	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
49	V13 18BR/LG	REAR WIPER MOTOR CONTROL
50	V20 20BK/WT	REAR WASHER MOTOR CONTROL
51	L24 20WT/LG**	AUTOMATIC HEADLAMP SIGNAL
52	G6 20GY	ENGINE OIL PRESSURE SWITCH SENSE
53	-	-
54	-	-
55	P96 20WT/LG	PASSENGER DOOR SWITCH MUX
56	V38 20LB/RD*	SPEED CONTROL LAMP DRIVER
57	G18 20PK/BK*	COOLANT LEVEL SWITCH SENSE
58	G29 20BK/TN	WASHER FLUID SWITCH SENSE
59	G78 18TN/BK	LIFTGATE AJAR SWITCH SENSE
60	G58 20BK/YL*	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
61	-	-
62	-	-
63	-	-
64	-	-
65	-	-
66	-	-
67	-	-
68	-	-
69	-	-
70	-	-
71	P171 20VT/WT ●	POWER MIRROR FOLD RELAY
72	G55 20OR/BK*	ENGINE DISABLE SIGNAL
73	V14 18RD/VT	WIPER ON/OFF RELAY CONTROL
74	P174 20YL/RD ●	POWER MIRROR UNFOLD RELAY
75	K159 20VT/RD*	ENGINE SPEED SENSOR SIGNAL
76	L193 20OR/WT**	LOW BEAM RELAY CONTROL
77	G76 18TN/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
78	G10 18LG/RD	SEAT BELT SWITCH SENSE
79	G75 18TN	DRIVER DOOR AJAR SWITCH SENSE
80	M20 20BR	COURTESY LAMP GROUND

* DIESEL
** GAS
● BUILT-UP-EXPORT



BODY CONTROL MODULE - C2

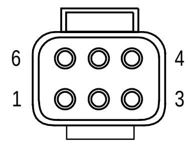
CAV	CIRCUIT	FUNCTION
1	G96 20LG/RD	RKE INTERFACE
2	M32 22BK/LB	COURTESY LAMP SWITCH SENSE
3	D1 20VT/BR	CCD BUS(+)
4	G26 20LB	KEY-IN IGNITION SWITCH SENSE
5	-	-
6	G2 22VT	ENGINE TEMPERATURE WARNING LAMP DRIVER
7	V52 20DG/YL	FRONT WIPER SWITCH MUX
8	E92 22OR/BK	DIMMER SWITCH SIGNAL
9	Z20 20BK/WT**	GROUND
10	Z2 20BK/LG	GROUND
11	E17 20YL/BK	STEP DIMMER SWITCH SENSE
12	L110 22BK/YL •	AUTO HEADLAMP SWITCH SENSE
13	L307 20LG/OR	HEADLAMP SWITCH SENSE
14	Z2 20BK/LG	GROUND
15	-	-
16	G69 22BK/OR	VTSS LAMP DRIVER
17	G19 20LG/OR	ABS WARNING LAMP DRIVER
18	-	-
19	-	-
20	X3 20BK/RD	HORN RELAY CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	G6 22GY	ENGINE OIL PRESSURE SWITCH SENSE
34	D2 20WT/BK	CCD BUS(-)
35	-	-
36	-	-
37	D9 22GY/BK	RKE MODULE PROGRAM ENABLE
38	V26 22YL/WT	REAR WIPER SWITCH MUX
39	P136 20YL	POWER FOLDING MIRROR SWITCH SIGNAL
40	L308 20LG/WT	PARK LAMP SWITCH SENSE



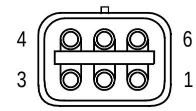
BRAKE PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
A	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
B	Z1 20BK	GROUND

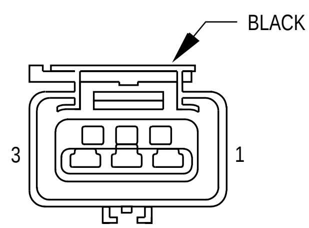
* BUILT-UP-EXPORT
** EXCEPT BUILT-UP-EXPORT
• GAS



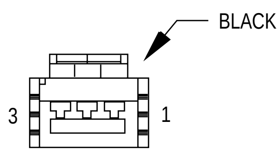
CAV	CIRCUIT
1	V23 18BRPK
2	Z1 20BK
3	L1 20VT/BK
4	P112 20YL/WT*
5	P114 20YL/BK*
6	L24 20WT/LG*



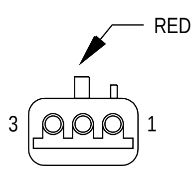
CAV	CIRCUIT
1	V23 18BRPK
2	Z1 20BK
3	L1 20VT/BK
4	P112 20YL/WT*
5	P114 20YL/BK*
6	L24 20WT/LG*



CAV	CIRCUIT	FUNCTION
1	K7 18OR	8 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL

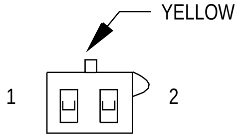


CAV	CIRCUIT	FUNCTION
1	-	-
2	M113 20LB/PK	CENTER DOME LAMP FEED
3	M20 20BR	CENTER DOME LAMP GROUND



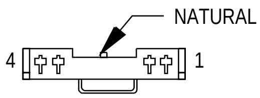
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	-	-
3	L50 20WT/TN	STOP LAMP SWITCH OUTPUT

* EXCEPT BUILT-UP-EXPORT



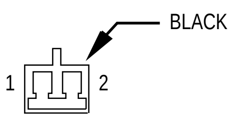
CLOCKSPRING - C1

CAV	CIRCUIT	FUNCTION
1	R43 18BK/LB	DRIVER AIRBAG LINE NO.1
2	R45 18DG/LB	DRIVER AIRBAG LINE NO.2



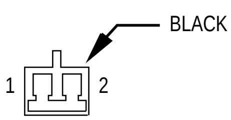
CLOCKSPRING - C2

CAV	CIRCUIT	FUNCTION
1	X3 20BK/RD	HORN RELAY DRIVER
2	-	-
3	Z2 20BK/LG	GROUND
4	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL



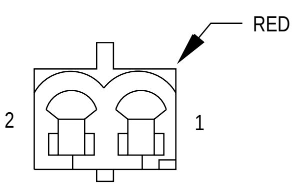
CLUTCH INTERLOCK SWITCH (MTX)

CAV	CIRCUIT	FUNCTION
1	F45 20YL/RD	FUSED B(+) ENGINE STARTER MOTOR RELAY
2	T141 20YL/RD	IGNITION SWITCH OUTPUT (START)



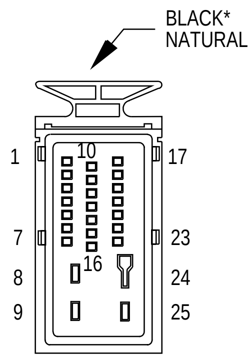
CLUTCH INTERLOCK SWITCH JUMPER (EATX)

CAV	CIRCUIT	FUNCTION
1	T141 20YL/RD	IGNITION SWITCH OUTPUT (START)
2	T141 20YL/RD	IGNITION SWITCH OUTPUT (START)



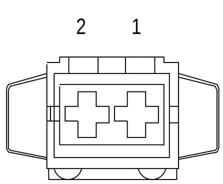
CLUTCH SWITCH (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K119 20LG/BK	CLUTCH SWITCH
2	Z1 20BK	GROUND



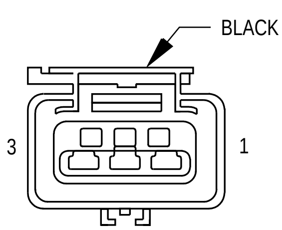
CONTROLLER
ANTI-LOCK
BRAKE

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	-	-
7	-	-
8	Z7 12BK	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	STOP LAMP SWITCH SENSE
13	-	-
14	-	-
15	-	-
16	G19 18LG/OR	ABS WARNING LAMP DRIVER
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	D2 18WT/BK	CCD BUS (-)
20	D1 18VT/BR	CCD BUS (+)
21	-	-
22	B27 18RD/YL	TRACTION CONTROL SWITCH SENSE
23	F20 18WT	FUSED IGNITION (RUN)
24	Z7 12BK	GROUND
25	A10 12RD/DG	FUSED B(+)



CRANK CASE
HEATER
(DIESEL)

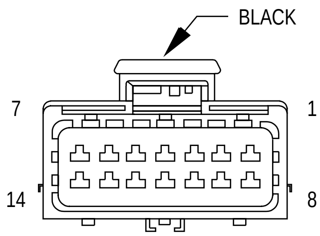
CAV	CIRCUIT	FUNCTION
1	A141 18DG/WT	FUEL PUMP RELAY OUTPUT
2	Z1 18BK	GROUND



CRANKSHAFT
POSITION
SENSOR

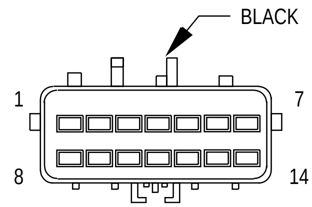
CAV	CIRCUIT	FUNCTION
1	K7 18OR	8 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL

* DIESEL



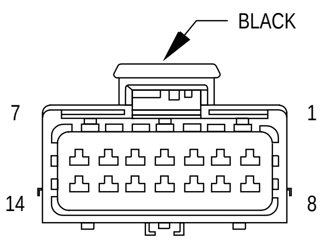
D01D

CAV	CIRCUIT
1	Q13 18DB
2	Q14 18GY
3	Z2 20BK/LG
4	E2 20OR
5	F131 20BK/PK
6	Q26 14VT/RD
7	F55 14TN/DG
8	Q23 18RD/WT
9	Q16 14BR/WT
10	Z1 12BK
11	P97 20WT/DG
12	F133 20BR
13	Q24 18DG
14	F21 16TN



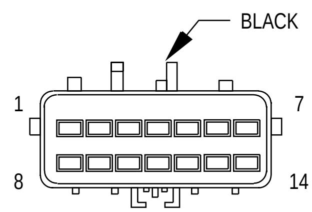
B02

CAV	CIRCUIT
1	Q13 18DB
2	Q14 18GY
3	Z2 20BK/LG
4	E2 20OR
5	F131 20BK/PK
6	Q26 12VT/RD
7	F55 12TN/DG
8	Q23 18RD/WT
9	Q16 12BR/WT
10	Z1 12BK
11	P97 20WT/DG
12	F133 20BR
13	Q24 18DG
14	F21 16TN



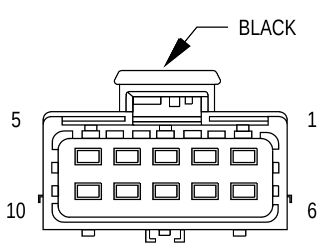
D01P

CAV	CIRCUIT
1	X15 16BK/DG
2	Q26 12VT/RD
3	Z2 20BK/LG
4	P96 20WT/LG
5	Z1 20BK
6	M11 20PK/LB
7	X56 20DB/RD*
7	X55 20BR/RD**
8	X54 20VT*
8	X53 20DG**
9	F136 20VT/YL
10	F133 20BR
11	E2 20OR
12	F55 12TN/DG
13	Q16 12BR/WT
14	X13 16RD/DG



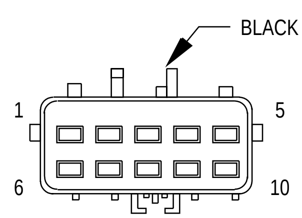
B03

CAV	CIRCUIT
1	X15 16BK/DG
2	Q26 12VT/RD
3	Z2 20BK/LG
4	P96 20WT/LG
5	Z1 18BK
6	M11 20PK/LB
7	X56 20DB/RD*
7	X55 20BR/RD**
8	X54 20VT*
8	X53 20DG**
9	F136 20VT/YL
10	F133 20BR
11	E2 20OR
12	F55 12TN/DG
13	Q16 12BR/WT
14	X13 16RD/DG



D02

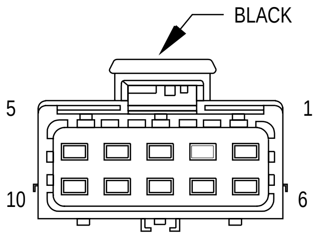
CAV	CIRCUIT
1	X15 16BK/DG
2	X13 16RD/DG
3	M11 20PK/LB
4	P22 20PK/BK
5	X153 20WT/BR*
5	X154 20WT/VT**
6	P23 20PK/RD
7	P24 20PK/WT
8	X55 20BR/RD*
8	X56 20DB/RD**
9	X53 20DG*
9	X54 20VT**
10	X155 20BR/WT*
10	X156 20VT/WT**



B01

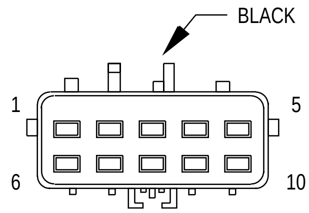
CAV	CIRCUIT
1	X15 16BK/DG
2	X13 16RD/DG
3	M11 20PK/LB
4	P22 20PK/BK
5	X153 20WT/BR*
5	X154 20WT/VT**
6	P23 20PK/RD
7	P24 20PK/WT
8	X55 20BR/RD*
8	X56 20DB/RD**
9	X53 20DG*
9	X54 20VT**
10	X155 20BR/WT*
10	X156 20VT/WT**

* LHD
** RHD



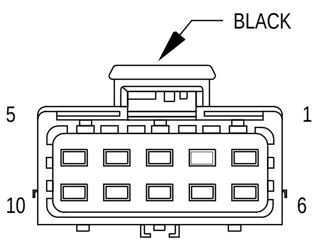
D02
(LHD)

CAV	CIRCUIT
1	-
2	-
3	X154 20WT/VT
4	-
5	-
6	-
7	X156 20VT/WT
8	-
9	-
10	-



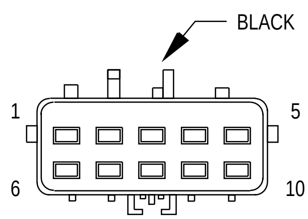
B120
(LHD)

CAV	CIRCUIT
1	-
2	-
3	X154 20WT/VT
4	-
5	-
6	-
7	X156 20VT/WT
8	-
9	-
10	-



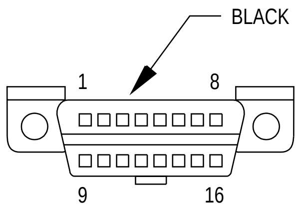
D02
(RHD)

CAV	CIRCUIT
1	-
2	-
3	X153 20WT/BR
4	-
5	-
6	-
7	X155 20BR/WT
8	-
9	-
10	-



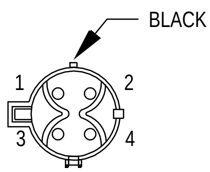
B120
(RHD)

CAV	CIRCUIT
1	-
2	-
3	X153 20WT/BR
4	-
5	-
6	-
7	X155 20BR/WT
8	-
9	-
10	-



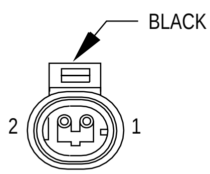
DATA LINK CONNECTOR

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	D1 20VT/BR	CCD BUS(+)
4	Z2 20BK/LG	GROUND
5	Z11 20BK/WT	GROUND
6	D20 20LG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	-	-
10	-	-
11	D2 20WT/BK	CCD BUS(-)
12	-	-
13	-	-
14	D6 20PK/LB	SCI RECEIVE (EATX)
15	-	-
16	M1 20PK	FUSED B(+)



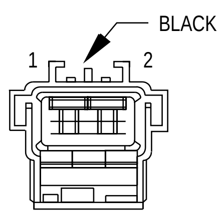
DOWNSTREAM HEATED OXYGEN SENSOR

CAV	CIRCUIT	FUNCTION
1	Z12 20BK/TN	GROUND
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K4 20BK/LB	SENSOR GROUND
4	K141 20TN/WT	HEATED OXYGEN SENSOR 1/2 SIGNAL



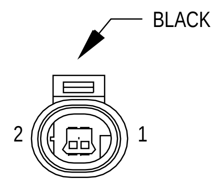
DRIVER DOOR ARM/DISARM SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG	GROUND
2	P97 20WT/DG	DRIVER DOOR SWITCH MUX



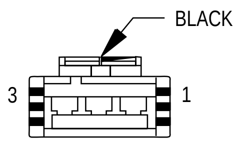
DRIVER DOOR COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



DRIVER DOOR LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	F131 20BK/PK	LEFT FRONT UNLOCK RELAY OUTPUT
2	F133 20BR	LOCK RELAY OUTPUT



DRIVER DOOR LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS FEED
	E2 20OR	
2	P97 20WT/DG	DRIVER DOOR SWITCH MUX
	P97 20WT/DG*	
3	Z2 20BK/LG	GROUND
	Z2 20BK/LG*	

DRIVER HEATED SEAT BACK

CAV	CIRCUIT	FUNCTION
A	P88 18RD/WT	HEATED SEAT DRIVER
B	Z1 18BK	GROUND

DRIVER HEATED SEAT CUSHION

CAV	CIRCUIT	FUNCTION
A	P87 18RD/WT	HEATED SEAT DRIVER
B	P88 18RD/WT	HEATED SEAT DRIVER
C	P89 20BK/RD	HEATED SEAT BACK
D	Z1 18BK	GROUND

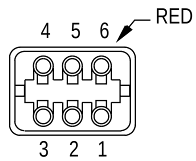
DRIVER HEATED SEAT MODULE

CAV	CIRCUIT	FUNCTION
A	P87 18RD/WT	DRIVER HEATED SEAT SWITCH
B	P86 20VT	HEATED SEAT TEMPERATURE SENSOR
C	P7 20WT/BK	DRIVER HEATED SEAT SWITCH
D	F35 18RD	FUSED B(+)
E	P89 20BK/RD	HEATED SEAT BACK
F	Z1 18BK	GROUND

* RKE

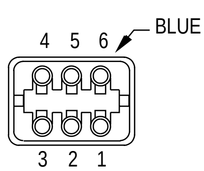
DRIVER HEATED SEAT SWITCH

CAV	CIRCUIT	FUNCTION
A	P86 20VT	HEATED SEAT TEMPERATURE SENSOR
B	F20 20WT	FUSED IGNITION (RUN)
C	-	-
D	F20 20WT	FUSED IGNITION (RUN)
E	Z1 18BK	GROUND
F	P7 20WT/BK	DRIVER HEATED SEAT BACK



DRIVER POWER MIRROR - C1

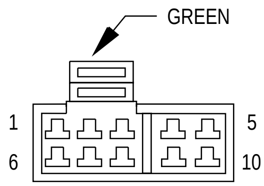
CAV	CIRCUIT	FUNCTION
1	P75 20DB/WT	DRIVER POWER MIRROR UP
2	P71 20YL	DRIVER POWER MIRROR LEFT
3	P73 20YL/PK	DRIVER POWER MIRROR RIGHT/DOWN
4	C16 20LB/YL	REAR DEFOGGER LAMP DRIVER
5	Z1 20BK	GROUND
6	P112 20YL/WT	POWER MIRROR B(-)



DRIVER POWER MIRROR - C2

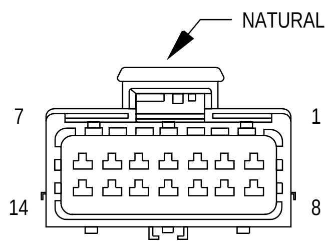
CAV	CIRCUIT	FUNCTION
1	P64 20YL/OR	DRIVER POWER MIRROR UP/DOWN
2	P69 20WT/RD	DRIVER POWER MIRROR RETURN
3	P65 20DB/YL	DRIVER POWER MIRROR LEFT/RIGHT
4	P114 20YL/BK**	POWER MIRROR B(-)
5	P159 20DG*	DRIVER POWER MIRROR UNFOLD
6	P160 20LB*	DRIVER POWER MIRROR FOLD

* BUILT-UP-EXPORT
** EXCEPT BUILT-UP-EXPORT



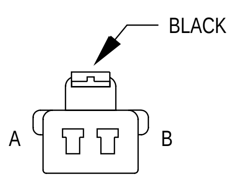
DRIVER POWER SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 14BK	GROUND
2	P43 14GY/LB	DRIVER SEAT RECLINER SWITCH DOWN
3	P17 14RD/LB	DRIVER POWER SEAT HORIZONTAL REARWARD
4	P41 14GY/WT	DRIVER SEAT RECLINER SWITCH UP
5	F35 14RD	FUSED B(+)
6	P15 14YL/LB	DRIVER POWER SEAT HORIZONTAL FORWARD
7	P19 14YL/LG	DRIVER POWER SEAT FRONT UP
8	P11 14YL/WT	DRIVER POWER SEAT REAR UP
9	P13 14RD/WT	DRIVER POWER SEAT REAR DOWN
10	P21 14RD/LG	DRIVER POWER SEAT FRONT DOWN



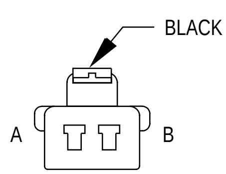
DRIVER POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q24 18DG	POWER WINDOW RIGHT REAR B(+) DOWN
2	Q26 14VT/WT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
3	Q13 18DB	POWER WINDOW LEFT REAR B(+) UP
4	Q16 14BR/WT	MASTER WINDOW SWITCH RIGHT FRONT UP
5	Q14 18GY	POWER WINDOW RIGHT REAR B(+) UP
6	Q21 16WT	LEFT FRONT WINDOW DRIVER (DOWN)
7	Q23 18RD/WT	POWER WINDOW LEFT REAR B(+) DOWN
8	Q11 16LG	LEFT WINDOW DRIVER (UP)
9	F55 14TN/DG	FUSED B(+)
10	-	-
11	F21 16TN	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
12	-	-
13	Z1 12BK	GROUND
14	E2 20OR	PANEL LAMPS FEED



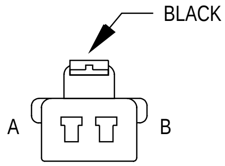
DRIVER SEAT FRONT VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P21 14RD/LG	DRIVER POWER SEAT FRONT DOWN
B	P19 14YL/LG	DRIVER POWER SEAT FRONT UP



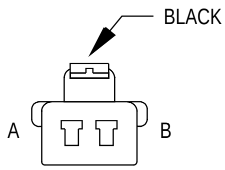
DRIVER SEAT HORIZONTAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P15 14YL/LB	DRIVER POWER SEAT HORIZONTAL FORWARD
B	P17 14RD/LB	DRIVER POWER SEAT HORIZONTAL REARWARD



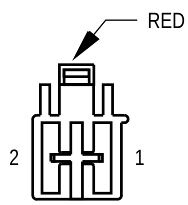
DRIVER SEAT
REAR VERTICAL
MOTOR

CAV	CIRCUIT	FUNCTION
A	P11 14YL/WT	DRIVER POWER SEAT REAR UP
B	P13 14RD/WT	DRIVER POWER SEAT REAR DOWN



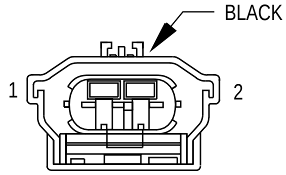
DRIVER SEAT
RECLINER MOTOR

CAV	CIRCUIT	FUNCTION
A	P43 14GY/LB	DRIVER SEAT RECLINER SWITCH DOWN
B	P41 14GY/WT	DRIVER SEAT RECLINER SWITCH UP



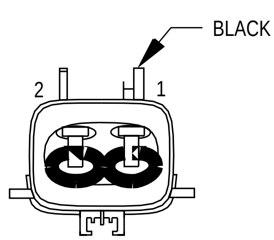
DRIVER
WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q11 16LG	DRIVER WINDOW (UP)
2	Q21 16WT	DRIVER WINDOW (DOWN)



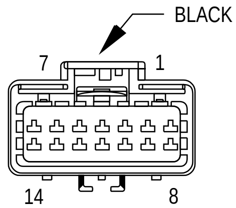
E40

CAV	CIRCUIT
1	C23 12DG
2	Z1 12BK



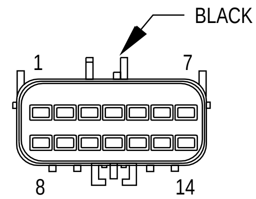
RF3

CAV	CIRCUIT
1	C23 12DG
2	Z1 12BK



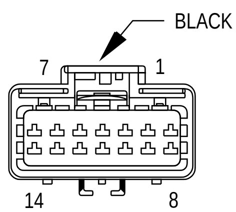
E69
(2.4L)

CAV	CIRCUIT
1	K11 18WT/DB
2	K12 18TN/WT
3	K13 18YL/WT
4	K14 18LB/BR
5	K4 18BK/LB
6	K70 18VT/RD
7	K52 18PK/BK
8	K6 18VT/WT
9	C18 18DB
10	A142 18DG/OR
11	K1 18DG/RD
12	K2 18TN/BK
13	-
14	-



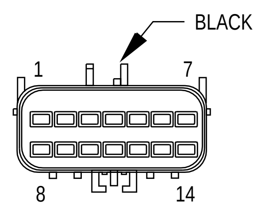
F09
(2.4L)

CAV	CIRCUIT
1	K11 18WT/DB
2	K12 18TN/WT
3	K13 18YL/WT
4	K14 18LB/BR
5	K4 18BK/LB
6	K70 18VT/RD
7	K52 18PK/BK
8	K6 18VT/WT
9	C18 18DB
10	A142 18DG/OR
11	K1 18DG/RD
12	K2 18TN/BK
13	-
14	-



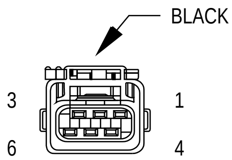
E78
(3.3L/3.8L)

CAV	CIRCUIT
1	A142 18DG/OR
2	K6 18VT/WT
3	K11 18WT/DB
4	K12 18TN/WT
5	K13 18YL/WT
6	K14 18LB/BR
7	K7 18OR
8	K44 18TN/YL
9	-
10	K1 18DG/RD
11	K2 18TN/BK
12	K38 18GY
13	K58 18BR/DB
14	K4 18BK/LB



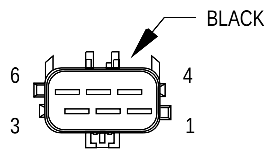
F02
(3.3L/3.8L)

CAV	CIRCUIT
1	A142 18DG/OR
2	K6 18VT/WT
3	K11 18WT/DB
4	K12 18TN/WT
5	K13 18YL/WT
6	K14 18LB/BR
7	K7 18OR
8	K44 18TN/YL
9	-
10	K1 18DG/RD
11	K2 18TN/BK
12	K38 18GY
13	K58 18BR/DB
14	K4 18BK/LB



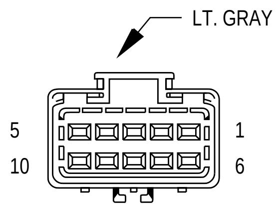
E95
(DIESEL)

CAV	CIRCUIT
1	C137 20YL
2	K57 20LG/OR
3	Z1 16BK
4	K153 18OR/DG
5	K152 20WT/DG
6	K90 18TN



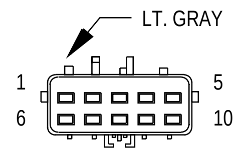
B107
(DIESEL)

CAV	CIRCUIT
1	C137 20YL
2	K57 20LG/OR
3	Z12 14BK/TN
4	K153 18OR/DG
5	K152 20WT/DG
6	K90 20OR/VT



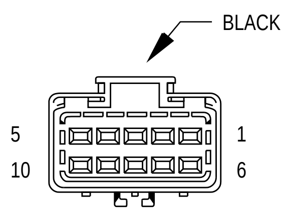
E96
(DIESEL)

CAV	CIRCUIT
1	A142 18DG/OR
2	K35 20GY/YL
3	K51 20DB/YL
4	G7 18WT/OR
5	K134 18LB/BK
6	K135 18WT/BK
7	A142 18DG/OR
8	K140 18TN/WT
9	K156 18GY
10	-



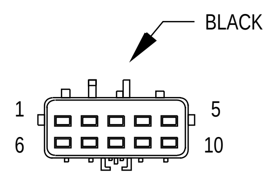
B108
(DIESEL)

CAV	CIRCUIT
1	A142 18DG/OR
2	K35 20GY/YL
3	K51 20DB/YL
4	G7 18WT/OR
5	K134 20LB/BK
6	K135 20WT/BK
7	A142 18DG/OR
8	K140 18TN/WT
9	K156 20GY
10	-



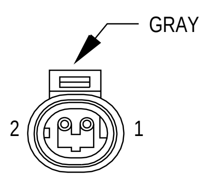
E97
(DIESEL)

CAV	CIRCUIT
1	K126 18LG
2	Z122 18BK
3	K67 18BR/BK
4	K68 18LG/YL
5	K24 20GY/BK
6	K4 20BK/LB
7	Z122 18BK
8	K2 20TN/BK
9	C13 20DB/OR
10	C24 20DB/PK



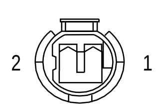
B106
(DIESEL)

CAV	CIRCUIT
1	K126 20LG
2	Z1 18BK
3	K67 20BR/BK
4	K68 20LG/YL
5	K24 18GY/BK
6	K4 18BK/LB
7	Z12 18BK
	Z1 18BK
8	K2 20TN/BK
9	C13 20DB/OR
10	C24 20DB/PK



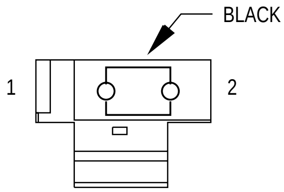
EGR SOLENOID
(2.4L MTX/3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	K35 18GY/YL	EGR SOLENOID CONTROL
2	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT



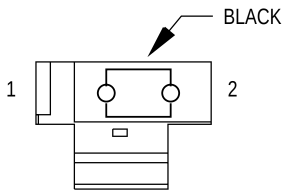
EGR SOLENOID
(DIESEL)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT
2	K35 20GY/YL	EGR SOLENOID CONTROL



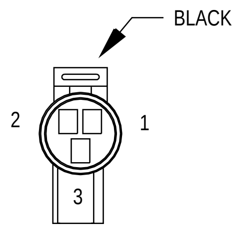
ELECTRIC
WIPER DE-ICER-C1

CAV	CIRCUIT	FUNCTION
1	V20 18RD	REAR WASHER MOTOR CONTROL
2	-	-



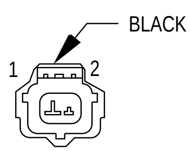
ELECTRIC
WIPER DE-ICER-C2

CAV	CIRCUIT	FUNCTION
1	C66 18BK/WT	WIPER DE-ICE SWITCHED GROUND
2	-	-



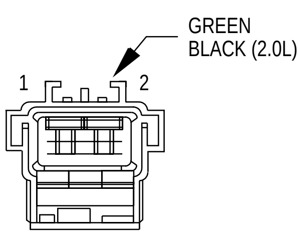
ENGINE COOLANT
TEMPERATURE SENSOR
(DIESEL)

CAV	CIRCUIT	FUNCTION
1	K2 20TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
2	K4 20BK/LB	SENSOR GROUND
3	G58 20BK/YL	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



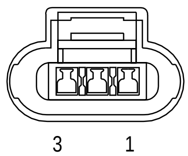
ENGINE COOLANT
TEMPERATURE SENSOR
(GAS)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



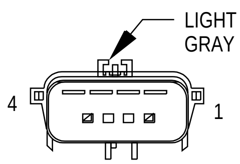
ENGINE OIL
PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	G6 16GY	ENGINE OIL PRESSURE SWITCH SENSE
2	-	-



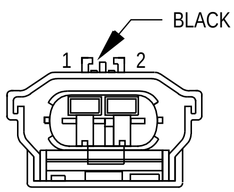
ENGINE SPEED SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K3 20BK/VT	ENGINE SPEED RETURN
2	-	-
3	K24 20GY/BK	ENGINE SPEED SENSOR SIGNAL



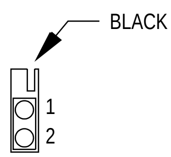
EVAP LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	K107 18DB/WT*	LEAK DETECTION PUMP SWITCH SENSE
1	K107 18YL/BK**	LEAK DETECTION PUMP SWITCH SENSE
2	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
3	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT
4	-	-



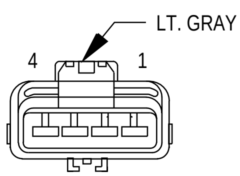
EVAP/PURGE SOLENOID

CAV	CIRCUIT	FUNCTION
1	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
2	K70 18VT/RD	EVAP/PURGE CURRENT SENSE



EVAPORATOR TEMPERATURE SENSOR

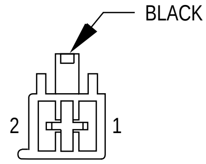
CAV	CIRCUIT	FUNCTION
1	C21 20DB/OR	A/C SWITCH SENSE
2	C57 20DB/GY	SENSOR GROUND



FLEXIBLE FUEL SENSOR (3.3L/ETHANOL)

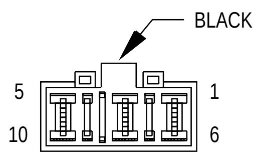
CAV	CIRCUIT	FUNCTION
1	K7 18OR	8V SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K50 18YL/WT	FLEXIBLE FUEL SENSOR SIGNAL
4	-	-

* 3.3L/3.8L
** 2.4L



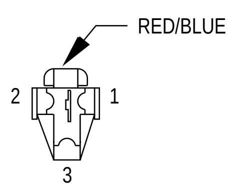
FRONT BLOWER MOTOR

CAV	CIRCUIT	FUNCTION
1	C71 12DB	BLOWER MOTOR DRIVER
2	C7 12BK/TN	HIGH SPEED BLOWER MOTOR



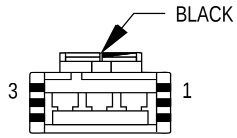
FRONT BLOWER MOTOR RESISTOR BLOCK

CAV	CIRCUIT	FUNCTION
1	C5 16LG	M1 SPEED BLOWER MOTOR
2	-	-
3	C6 14LB	M2 SPEED BLOWER MOTOR
4	-	-
5	C104 12RD/WT	M3 SPEED BLOWER MOTOR
6	C107 12TN/BK	HIGH SPEED BLOWER MOTOR
7	-	-
8	-	-
9	-	-
10	C4 16TN	LOW SPEED BLOWER MOTOR



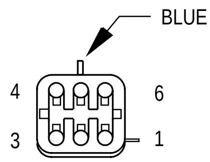
FRONT CIGAR LIGHTER POWER OUTLET

CAV	CIRCUIT	FUNCTION
1	F30 16RD	FUSED B(+)
2	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
3	Z1 16BK	GROUND



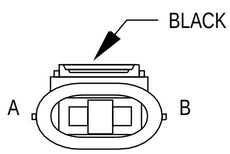
FRONT READING LAMPS/ SWITCH

CAV	CIRCUIT	FUNCTION
1	M13 20BK/YL	FRONT READING LAMP FEED
2	M20 20BR	COURTESY LAMP GROUND
3	F41 20PK/VT	FUSED B(+)



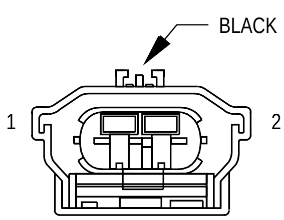
FRONT READING LAMPS/ SWITCH (OVERHEAD CONSOLE)

CAV	CIRCUIT	FUNCTION
1	M13 20BK/YL	FRONT READING LAMP FEED
2	E2 18OR	PANEL LAMPS FEED
3	Z2 18BK/LG	GROUND
4	F41 20PK/VT	FUSED (B+)
5	-	-
6	M20 20BR	COURTESY LAMP GROUND



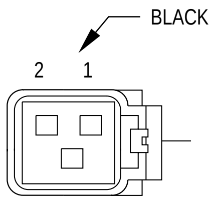
FRONT WASHER MOTOR

CAV	CIRCUIT	FUNCTION
A	F1 20DB	FUSED IGNITION (RUN-ACC)
B	V10 20BR	WASHER PUMP CONTROL SWITCH OUTPUT



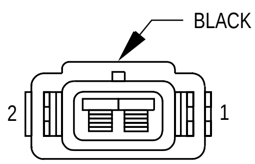
FUEL HEATER (DIESEL)

CAV	CIRCUIT	FUNCTION
1	A141 18DG/WT	FUEL PUMP RELAY OUTPUT
2	Z1 18BK	GROUND



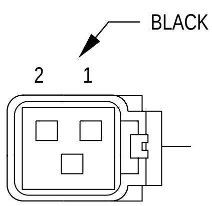
FUEL INJECTOR NO. 1 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	INJECTOR NO. 1 DRIVER
2	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT



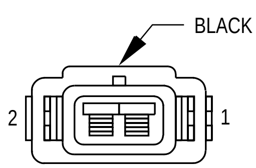
FUEL INJECTOR NO. 1 (3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K11 18WT/DB	INJECTOR NO. 1 DRIVER



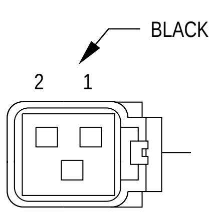
FUEL INJECTOR NO. 2 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K12 18TN/WT	INJECTOR NO. 2 DRIVER
2	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT



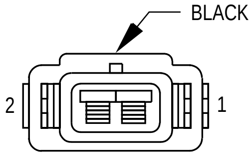
FUEL INJECTOR NO. 2 (3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K12 18TN/WT	INJECTOR NO. 2 DRIVER



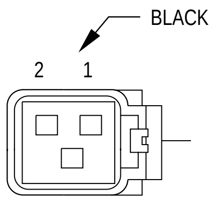
FUEL INJECTOR NO. 3 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	INJECTOR NO. 3 DRIVER
2	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT



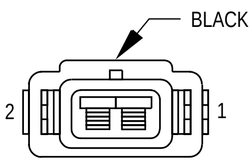
FUEL INJECTOR
NO. 3
(3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K13 18YL/WT	INJECTOR NO. 3 DRIVER



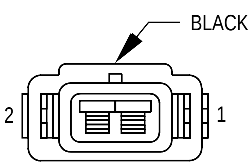
FUEL INJECTOR
NO. 4
(2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	INJECTOR NO. 4 DRIVER
2	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT



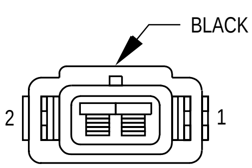
FUEL INJECTOR
NO. 4
(3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K14 18LB/BR	INJECTOR NO. 4 DRIVER



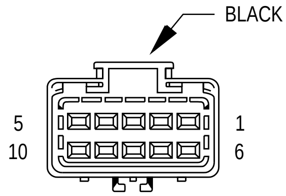
FUEL INJECTOR
NO. 5
(3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K38 18GY	INJECTOR NO. 5 DRIVER



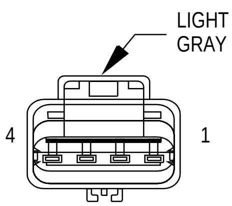
FUEL INJECTOR
NO. 6
(3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K58 18BR/DB	INJECTOR NO. 6 DRIVER



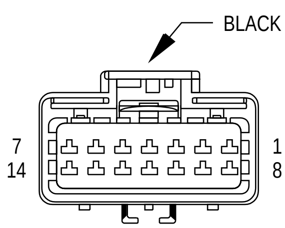
FUEL PUMP MODULE (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K134 18LB/BK	SLEEVE POSITION SENSOR (-)
2	K57 18LG/OR	CONTROL SLEEVE POSTION SENSOR
3	K135 18WT/BK	SLEEVE POSTION SENSOR (+)
4	K4 20BK/LB	SENSOR GROUND
5	K126 18LG	SOLENOID CONTROL
6	K153 18OR/DG	SHUT OFF FEED
7	K156 18GY	FUEL TEMPERATURE SENSOR SIGNAL
8	K140 18TN/WT	FUEL QUANTITY ACTUATOR SIGNAL
9	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT
10	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT



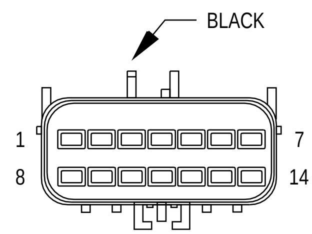
FUEL TANK MODULE

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	L1 20VT/BK	BACK-UP LAMP FEED
3	G4 18DB	FUEL LEVEL SENSOR SIGNAL
4	A141 16DG/WT*	FUEL PUMP RELAY OUTPUT



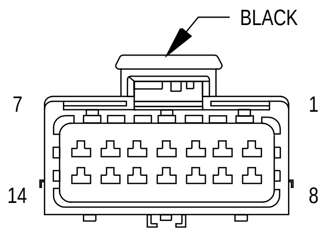
G200

CAV	CIRCUIT
1	Z2 20BK/LG
2	Z2 20BK/LG
3	Z2 20BK/LG
4	-
5	Z2 18BK/LG
6	Z1 20BK
7	Z1 20BK
8	Z1 18BK**
9	Z1 20BK
10	Z1 16BK
11	Z2 20BK/LG
12	Z2 20BK
13	Z1 18BK
14	Z1 20BK



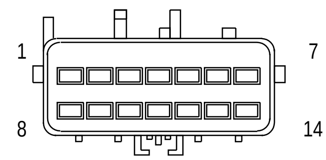
CAV	CIRCUIT
1	GROUND BUS BAR
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

* GAS
** RHD



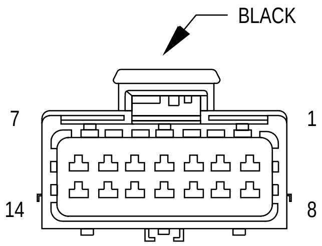
G300

CAV	CIRCUIT
1	Z1 20BK
	Z1 20BK
2	Z1 12BK
3	Z12 20BK/TN*
4	-
5	Z1 12BK
6	Z1 20BK***
	Z1 18BK
7	Z1 12BK*
	Z12 14BK/TN**
8	Z1 14BK
9	Z1 20BK
	Z1 20BK
10	Z1 18BK
11	Z1 18BK
12	Z1 14BK
13	-
14	Z1 20BK
	Z1 18BK ●●



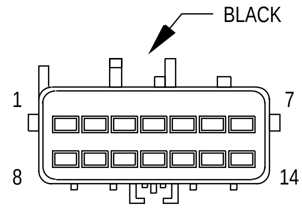
CAV	CIRCUIT
1	Z1 BUS BAR
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

* GAS
** DIESEL
*** LHD
● EXCEPT BUILT-UP-EXPORT
●● BUILT-UP-EXPORT



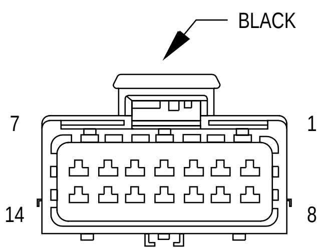
**G301
(DIESEL)**

CAV	CIRCUIT
1	Z11 20BK/WT
	Z1 18BK
2	Z2 20BK/LG
3	Z2 18BK/LG
	Z2 20BK/LG
4	-
5	Z1 12BK
6	Z12 18BK
7	Z1 20BK
8	Z1 18BK
9	Z1 20BK
10	Z1 18BK
11	Z1 18BK
12	Z1 18BK
13	Z1 18BK
14	Z1 20BK



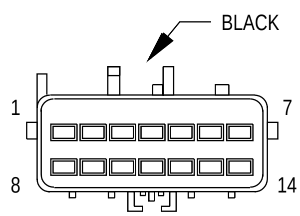
(DIESEL)

CAV	CIRCUIT
1	
1	
2	
3	
3	
4	
5	Z1 BUS BAR
6	
7	
8	
9	
10	
11	
12	
13	
14	



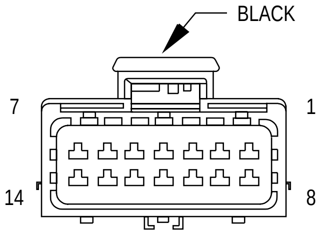
**G301
(GAS)**

CAV	CIRCUIT
1	Z1 18BK
2	Z2 20BK/LG
3	Z2 20BK/LG
4	-
5	Z2 18BK/LG
6	-
7	Z1 20BK*
	Z1 20BK*
7	Z1 20BK** ▲
8	Z1 20BK
9	Z1 20BK ▲
10	Z1 18BK ▲
11	Z1 18BK ▲
12	Z1 18BK
13	Z1 18BK
14	Z1 20BK



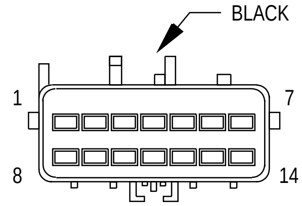
CAV	CIRCUIT
1	
2	
3	
4	
5	
6	
7	Z1 BUS BAR
7	
8	
9	
10	
11	
12	
13	
14	

* EXCEPT BUILT-UP-EXPORT/CHRYSLER
** EXCEPT BUILT-UP-EXPORT/PLYMOUTH, DODGE
▲ BUILT-UP-EXPORT

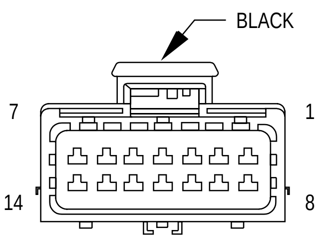


G302

CAV	CIRCUIT
1	-
2	-
3	Z1 20BK
4	-
5	Z1 14BK
6	-
7	-
8	Z1 18BK
9	Z1 20BK
10	Z1 12BK
11	Z1 16BK
12	Z1 18BK*
13	-
14	Z1 18BK

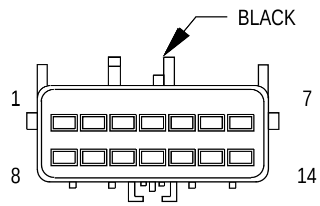


CAV	CIRCUIT
1	
2	
3	
4	
5	
6	
7	Z1 BUS BAR
8	
9	
10	
11	
12	
13	
14	

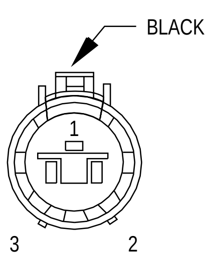


G400

CAV	CIRCUIT
1	Z1 12BK
2	Z1 20BK
3	Z1 20BK
4	-
5	Z1 12BK
6	Z1 18BK
7	Z1 20BK
8	Z1 20BK
9	Z2 20BK/LG
10	-
11	Z1 20BK
12	-
13	-
14	-



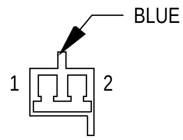
CAV	CIRCUIT
1	
2	
3	
4	
5	
6	
7	Z1 BUS BAR
8	
9	
10	
11	
12	
13	
14	



GENERATOR
(GAS)

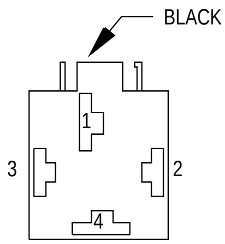
CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	ASD RELAY OUTPUT
2	K20 18DG	GENERATOR FIELD DRIVER
3	-	-

* REAR A/C-HEATER



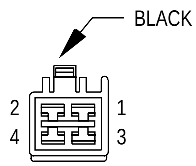
GLOVE BOX LAMP

CAV	CIRCUIT	FUNCTION
1	F41 20PK/VT	FUSED B(+)
2	M20 20BR	COURTESY LAMP GROUND



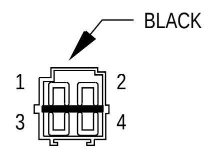
GLOW PLUG RELAY (DIESEL)

CAV	CIRCUIT	FUNCTION
1	A54 10RD	FUSED B(+)
2	K152 18WT/DG	GLOW PLUG RELAY CONTROL SENSE
3	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT
4	K154 10GY	GLOW PLUG RELAY CONTROL



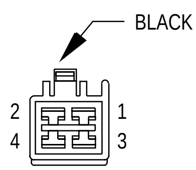
HS6D (HEATED SEAT)

CAV	CIRCUIT
1	Z1 14BK
2	A2 12PK/BK
3	F35 14RD
4	-



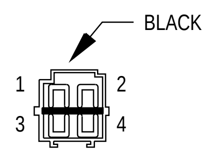
S02

CAV	CIRCUIT
1	Z1 14BK
	Z1 20BK
2	A2 12PK/BK
3	F35 14RD
4	-



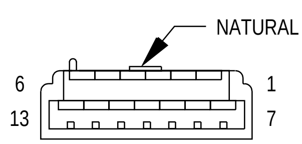
HS6P

CAV	CIRCUIT
1	-
2	-
3	F35 14RD
4	-



S02

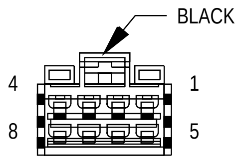
CAV	CIRCUIT
1	-
2	-
3	F35 14RD
4	-



HEADLAMP SWITCH - C1

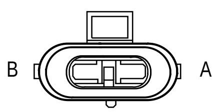
CAV	CIRCUIT	FUNCTION
1	Z1 20BK*	GROUND
2	L44 20VT/RD*	FUSED RIGHT LOW BEAM OUTPUT
3	M112 22BR/LG	COURTESY LAMP RELAY CONTROL
4	M32 22BK/LB	COURTESY LAMP SWITCH SENSE
5	E17 20YL/BK	STEP DIMMER SWITCH SENSE
	E17 20YL/BK	STEP DIMMER SWITCH SENSE
6	Z1 20BK	GROUND
7	-	-
8	L13 20BR/YL*	HEADLAMP LEVELING SIGNAL
9	M111 22BR/WT	COURTESY LAMP RELAY CONTROL
10	M13 20BK/YL	COURTESY LAMP RELAY OUTPUT
11	M113 20LB/PK	READING LAMP FEED
12	E92 22OR/BK	DIMMER SWITCH SIGNAL
13	-	-

* BUILT-UP-EXPORT



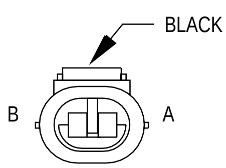
HEADLAMP SWITCH - C2

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS FEED
2	Z1 18BK	GROUND
3	L307 20LG/OR	HEADLAMP SWITCH SENSE
4	-	-
5	L77 18BR/YL	FUSED LEFT INBOARD TAIL LAMP
5	L39 18LB*	FOG LAMP SWITCH OUTPUT
6	Z39 18BK	GROUND
7	L36 20LG	REAR FOG LAMP
7	L110 22BK/YL*	SENSOR SIGNAL
8	L308 20LG/WT	PARK LAMP SWITCH SENSE



HEADLAMP WASHER (BUILT-UP-EXPORT)

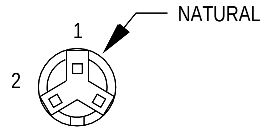
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	V53 18RD/YL	WASHER RELAY OUTPUT



HIGH NOTE HORN

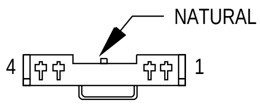
CAV	CIRCUIT	FUNCTION
A	X2 18DG/RD	HORN RELAY OUTPUT
B	Z1 18BK	GROUND

* EXCEPT BUILT-UP-EXPORT



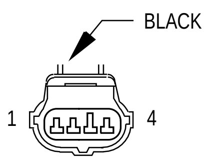
HOOD AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G70 18BR/TN	HOOD AJAR SWITCH SENSE
2	Z1 18BK	GROUND



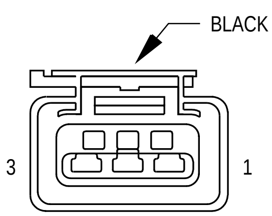
HORN/SPEED CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	X3 20BK/RD	HORN RELAY DRIVER
2	-	-
3	Z2 20BK/LG	GROUND
4	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL



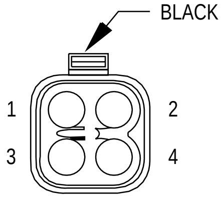
IDLE AIR CONTROL MOTOR

CAV	CIRCUIT	FUNCTION
1	K59 18VT/BK	IDLE AIR CONTROL MOTOR NO.4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL MOTOR NO.3 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL MOTOR NO.2 DRIVER
4	K39 18GY/RD	IDLE AIR CONTROL MOTOR NO.1 DRIVER



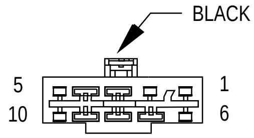
IGNITION COIL PACK (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
2	A142 18DG/OR	ASD RELAY OUTPUT
3	K19 18GY/RD	IGNITION COIL NO. 1 DRIVER



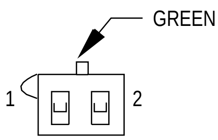
IGNITION COIL PACK (3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	K18 18RD/YL	IGNITION COIL DRIVER NO. 3, 6
2	K19 18GY/RD	IGNITION COIL DRIVER NO. 1, 4
3	A142 18DG/OR	ASD RELAY OUTPUT
4	K17 18DB/TN	IGNITION COIL DRIVER NO. 2, 5



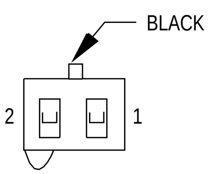
IGNITION SWITCH - C1

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
3	A2 12PK/BK	FUSED B(+)
4	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
5	-	-
6	-	-
7	A1 12RD	FUSED B(+)
8	A31 12BK/WT	IGNITION SWITCH OUTPUT (RUN-ACC)
9	A21 12DB	IGNITION SWITCH OUTPUT (ST-RUN)
10	A41 12YL	IGNITION SWITCH OUTPUT (START)



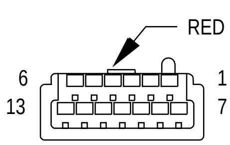
IGNITION SWITCH - C2

CAV	CIRCUIT	FUNCTION
1	G26 20LB	KEY-IN IGNITION SWITCH SENSE
2	Z1 20BK	GROUND



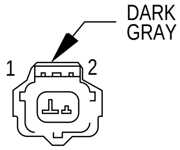
IGNITION SWITCH - C3

CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	A81 20DG/RD	IGNITION SWITCH OUTPUT (OFF/RUN/START)



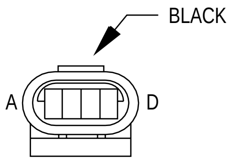
INSTRUMENT CLUSTER

CAV	CIRCUIT	FUNCTION
1	-	-
2	M1 20PK	FUSED B(+)
3	-	-
4	-	-
5	-	-
6	E2 20OR	PANEL LAMPS FEED
7	Z2 20BK/LG	GROUND
8	-	-
9	D2 20WT/BK	CCD BUS (-)
10	D1 20VT/BR	CCD BUS (+)
11	F11 20RD/WT	FUSED IGNITION (ST-RUN-OFF)
12	-	-
13	Z1 20BK	GROUND



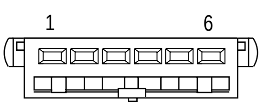
INTAKE AIR TEMPERATURE SENSOR (2.4L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL



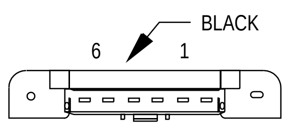
INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE SENSOR (2.0L)

CAV	CIRCUIT	FUNCTION
A	K4 18BK/LB	SENSOR GROUND
B	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL
C	K6 18VT/WT	5 VOLT SUPPLY
D	K1 18DG/RD	MAP SENSOR SIGNAL



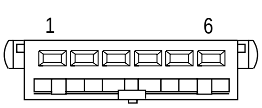
J02A

CAV	CIRCUIT
1	Z1 12BK
2	L50 20WT/TN
3	M11 20PK/LB
4	F133 20BR/RD
5	F136 20VT/WT
6	L77 20BR/LB



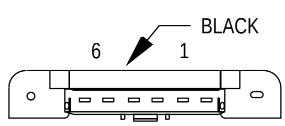
L15

CAV	CIRCUIT
1	Z1 12BK
2	L50 20WT/TN
3	M11 20PK/LB
4	F133 20BR/RD
5	F136 20VT/WT
6	L77 20BR/LB



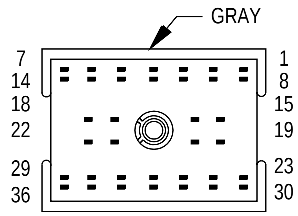
J03A

CAV	CIRCUIT
1	C15 12BK/WT
2	V13 18BR/LG
3	V23 18BR/PK
4	G78 18TN/BK
5	-
6	P98 20WT/RD



L16

CAV	CIRCUIT
1	C15 12BK/WT
2	V13 18BR/LG
3	V23 18BR/PK
4	G78 18TN/BK
5	-
6	P98 20WT/RD

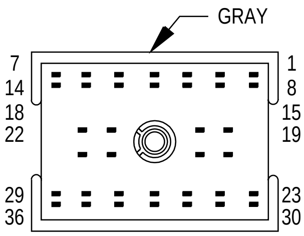


JUNCTION BLOCK - C1

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS FEED
	E2 20OR**	PANEL LAMPS FEED
2	L7 12BK/YL	PARK LAMP RELAY OUTPUT
3	F39 18PK/LG ▲	FUSED B(+)
	F39 18PK/LG ▲	FUSED B(+)
4	A2 12PK/BK	FUSED B(+)
5	L77 20BR/YL ▲▲	FUSED LEFT INBOARD TAIL LAMP
5	L77 20BR/YL	FUSED LEFT INBOARD TAIL LAMP
	L77 18BR/YL ▲	FUSED LEFT INBOARD TAIL LAMP
6	C15 12BK/WT	REAR DEFOGGER RELAY OUTPUT
7	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT
8	E2 20OR	PANEL LAMPS FEED
	E2 20OR	PANEL LAMPS FEED
9	F131 20BK/PK	DRIVER UNLOCK RELAY OUTPUT
10	-	-
11	F133 20BR/RD	LOCK RELAY OUTPUT
12	L94 20OR/WT ▲▲	LOW BEAM RELAY CONTROL
13	M1 20PK	FUSED B (+)
	M1 20PK ●	FUSED B (+)
14	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT
15	F136 20VT/WT	UNLOCK RELAY OUTPUT
	F136 20VT/WT	UNLOCK RELAY OUTPUT
16	L43 18VT* ▲▲	FUSED LEFT LOW BEAM OUTPUT
	L43 18VT* ▲▲	FUSED LEFT LOW BEAM OUTPUT
17	-	-
18	L77 20BR/LB	FUSED LEFT INBOARD TAIL LAMP
	L77 20BR/LB	FUSED LEFT INBOARD TAIL LAMP
19	F136 20VT/YL	UNLOCK RELAY OUTPUT
	F136 20VT/YL	UNLOCK RELAY OUTPUT
20	F11 20RD/WT ■	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
21	-	-
22	X1 16DG/RD	NAME BRAND SPEAKER RELAY OUTPUT
23	L78 20DG/YL	FUSED B(+)
	L78 20DG/YL	FUSED B(+)
24	-	-
25	L39 18LB ▲▲	FOG LAMP RELAY OUTPUT
26	F133 20BR/YL	LOCK RELAY OUTPUT
	F133 20BR/YL	LOCK RELAY OUTPUT
27	-	-
28	-	-
29	-	-
30	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT
	F87 18WT/BK ■■	FUSED IGNITION SWITCH OUTPUT
31	L39 18LB* ▲▲	FOG LAMP SWITCH OUTPUT
	L39 18LB* ▲▲	FOG LAMP SWITCH OUTPUT
32	F133 20BR	LOCK RELAY OUTPUT
	F133 20BR	LOCK RELAY OUTPUT
33	A2 12PK/BK	FUSED B(+)
34	V53 18RD/YL ▲	WASHER RELAY OUTPUT
35	A4 12BK/RD	FUSED B(+)
36	P174 20YL/RD ▲	POWER MIRROR UNFOLD RELAY

* CHRYSLER
** REAR A/C-HEATER
● MEMORY SEAT
▲ BUILT-UP-EXPORT
▲▲ EXCEPT BUILT-UP-EXPORT
■ EATX
■■ DIESEL

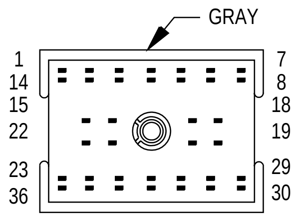
J988W-3



JUNCTION BLOCK - C2

CAV	CIRCUIT	FUNCTION
1	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
2	Z1 14BK	GROUND
3	F1 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	F1 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	X4 20GY/OR	HORN RELAY CONTROL
5	L60 18TN	RIGHT TURN SIGNAL
6	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
7	F20 20WT	FUSED IGNITION SWITCH OUTPUT
	F20 20WT	FUSED IGNITION SWITCH OUTPUT
8	G9 20GY/BK ●	RED BRAKE WARNING LAMP DRIVER
9	L97 18PK/DB	PARK LAMP RELAY CONTROL
10	F45 20YL/RD	FUSED B(+) ENGINE STARTER MOTOR RELAY
11	L61 18LG	LEFT TURN SIGNAL
12	C40 12BR/WT*	5-VOLT SUPPLY
13	F55 12TN/DG	FUSED IGNITION SWITCH OUTPUT
14	F20 20WT	FUSED IGNITION SWITCH OUTPUT
15	F41 20PK/VT	FUSED B(+)
16	F1 20DB	FUSED B(+)
17	F55 12TN/DG	FUSED IGNITION SWITCH OUTPUT
18	F20 20WT	FUSED B(+)
	F20 18WT	FUSED B(+)
19	F41 20PK/VT	FUSED B(+)
20	-	-
21	V10 20BR	WASHER PUMP CONTROL SWITCH OUTPUT
22	M113 20LB/PK	DOME LAMP FEED
23	F133 20BR/YL**	LOCK RELAY OUTPUT
	F133 20BR/YL**	LOCK RELAY OUTPUT
24	-	-
25	-	-
26	-	-
27	L9 18BK/WT	FUSED FLASHER FEED
28	L63 18DG/RD	LEFT TURN SIGNAL
	L63 18DG/RD ●	LEFT TURN SIGNAL
29	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
30	P171 20VT/WT ●	POWER MIRROR FOLD RELAY
31	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
32	-	-
33	-	-
34	F21 16TN	FUSED IGNITION SWITCH OUTPUT
35	-	-
36	L62 18BR/RD	RIGHT TURN SIGNAL
	L62 18BR/RD ●	RIGHT TURN SIGNAL

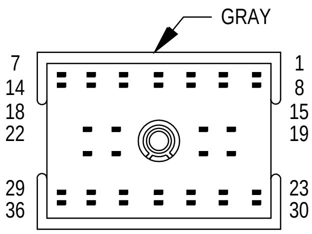
* REAR A/C
** GAS, EXCEPT BUILT-UP-EXPORT
● BUILT-UP-EXPORT



JUNCTION BLOCK - C3

CAV	CIRCUIT	FUNCTION
1	-	-
2	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
3	-	-
4	L305 22LB/WT	LEFT TURN SWITCH SENSE
5	F1 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
6	-	-
7	-	-
8	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
9	G9 20GY/BK* ●	RED BRAKE WARNING LAMP DRIVER
10	M112 22BR/LG	COURTESY LAMP RELAY CONTROL
11	P160 20LB**	POWER MIRROR FOLD
	P160 20LB**	POWER MIRROR FOLD
12	-	-
13	X60 20RD/DG	NAME BRAND SPEAKER RELAY DRIVER
14	L62 18BR/RD	RIGHT TURN SIGNAL
15	V20 18RD	REAR WASHER MOTOR CONTROL
16	F41 20PK/VT	FUSED B (+)
17	L63 18DG/RD ●●	LEFT TURN SIGNAL
18	V10 20BR	WASHER PUMP CONTROL SWITCH OUTPUT
19	G9 20GY/BK ●●	RED BRAKE WARNING LAMP DRIVER
20	F41 20PK/VT	FUSED B(+)
	F41 20PK/VT**	FUSED B(+)
21	L63 18DG/RD	LEFT TURN SIGNAL
22	L302 22LB/YL	RIGHT TURN SWITCH SENSE
23	-	-
24	X12 18RD/WT	FUSED IGNITION SWITCH OUTPUT
	X12 20RD/WT ■	FUSED IGNITION SWITCH OUTPUT
25	-	-
26	L91 22DB/PK	COMBINATION FLASHER SWITCHES GROUND
	L91 20DB/PK ■	COMBINATION FLASHER SWITCHES GROUND
27	-	
28	M113 20LB/PK	READING LAMP FEED
29	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
30	-	-
31	A31 12BK/WT	IGNITION SWITCH OUTPUT (RUN-ACC)
32	-	-
33	L93 22PK	HIGH BEAM RELAY CONTROL
34	M111 22BR/WT	SWITCHED COURTESY LAMP RELAY CONTROL
35	-	-
36	-	-

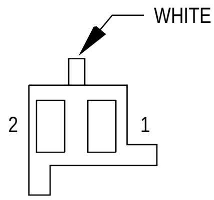
* LHD
** BUILT-UP-EXPORT
● GAS
●● GAS, EXCEPT BUILT-UP-EXPORT
■ RHD



JUNCTION BLOCK - C4

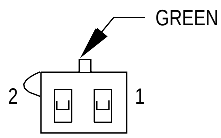
CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS FEED
	E2 20OR	PANEL LAMPS FEED
2	-	-
3	-	-
4	A2 12PK/BK	FUSED B(+)
5	-	-
6	M1 20PK	FUSED B (+)
	M1 20PK	FUSED B (+)
7	A41 12YL	IGNITION SWITCH OUTPUT (START)
8	E2 20OR	PANEL LAMPS FEED
	E2 20OR	PANEL LAMPS FEED
9	-	-
10	F11 20RD/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
	F11 20RD/WT** ●●	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
11	P159 20DG ■	POWER MIRROR UNFOLD
	P159 20DG ■	POWER MIRROR UNFOLD
12	-	-
13	M1 20PK	FUSED B (+)
	M1 20PK	FUSED B (+)
14	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT
	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT
15	A81 20DG/RD	IGNITION SWITCH OUTPUT (ST-RUN-OFF)
16	E2 22OR ▲	PANEL LAMPS FEED
17	M1 20PK	FUSED B (+)
	M1 20PK	FUSED B (+)
18	-	-
19	F87 20WT/BK	FUSED IGNITION SWITCH OUTPUT
20	C16 20LB/YL	REAR DEFOGGER LAMP DRIVER
	C16 20LB/YL	REAR DEFOGGER LAMP DRIVER
21	Z1 20BK	GROUND
	Z1 18BK	GROUND
22	Z1 20BK	GROUND
	Z1 18BK	GROUND
23	E2 18OR	PANEL LAMPS FEED
	E2 20OR	PANEL LAMPS FEED
24	-	-
25	-	-
26	-	-
27	-	-
28	Z1 20BK	GROUND
	Z1 20BK	GROUND
29	Z2 20BK/LG	GROUND
	Z2 20BK/LG	GROUND
30	E2 20OR ●	PANEL LAMPS FEED
	E2 20OR*	PANEL LAMPS FEED
31	A21 12DB	IGNITION SWITCH OUTPUT (ST-RUN)
32	C14 22WT/RD	REAR DEFOGGER RELAY CONTROL
33	-	-
34	-	-
35	Z1 20BK	GROUND
	Z1 20BK	GROUND
	Z1 20BK*	GROUND
36	Z1 20BK	GROUND
	Z1 20BK ■	GROUND

* GAS
** RHD
● REAR A/C
●● GAS, BUILT-UP-EXPORT
▲ GAS, EXCEPT BUILT-UP-EXPORT
■ BUILT-UP-EXPORT



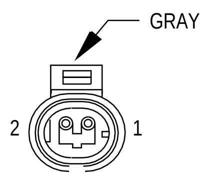
KEY-IN HALO LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M11 20PK/LB	COURTESY LAMP SWITCH OUTPUT



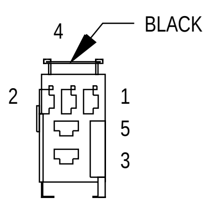
KEY-IN SWITCH

CAV	CIRCUIT	FUNCTION
1	G26 20LB	KEY-IN IGNITION SWITCH SENSE
2	Z1 20BK	GROUND



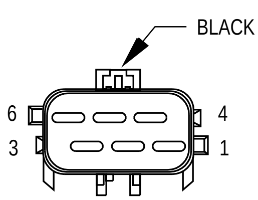
KNOCK SENSOR (2.0L/2.4L/3.8L)

CAV	CIRCUIT	FUNCTION
1	K42 18DB/LG	KNOCK SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND



LEFT COMBINATION RELAY (TRAILER TOW)

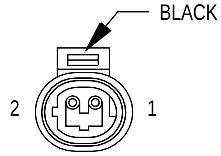
CAV	CIRCUIT	FUNCTION
1	L63 18DG/RD	LEFT TURN SIGNAL
2	Z1 18BK	GROUND
	Z1 18BK	
3	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
4	L615 18OR	LEFT COMBINATION RELAY OUTPUT
5	-	-



LEFT DOOR SPEAKER (PREMIUM)

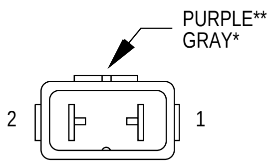
CAV	CIRCUIT	FUNCTION
1	X154 20WT/VT*	LEFT INSTRUMENT PANEL SPEAKER (+)
	X153 20WT/BR**	LEFT INSTRUMENT PANEL SPEAKER (+)
2	X15 16BK/DG	AMPLIFIED SPEAKER GROUND
3	X53 20DG	LEFT FRONT SPEAKER (+)
4	X156 20VT/WT*	LEFT INSTRUMENT PANEL SPEAKER (-)
	X155 20BR/WT**	LEFT INSTRUMENT PANEL SPEAKER (-)
5	X13 16RD/DG	RADIO CHOKE OUTPUT
6	X55 20BR/RD	LEFT FRONT SPEAKER (-)

* RHD
** LHD



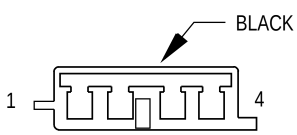
LEFT
FOG LAMP
(BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	F39 18PK/LG	FUSED PARK LAMP RELAY OUTPUT
2	Z39 20BK	FOG LAMP SWITCHED GROUND



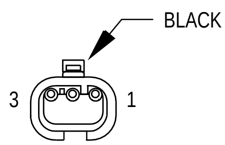
LEFT
FOG LAMP
(EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L39 18VT/RD*	FOG LAMP RELAY OUTPUT
	L39 18LB**	FOG LAMP RELAY OUTPUT
2	Z39 20BK	FOG LAMP SWITCHED GROUND



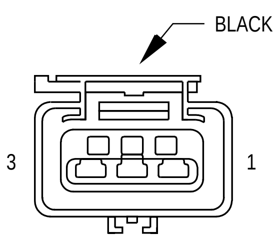
LEFT FRONT
PANEL SPEAKER
(PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X156 20VT/WT •	LEFT INSTRUMENT PANEL SPEAKER (-)
	X155 20BR/WT ••	LEFT INSTRUMENT PANEL SPEAKER (-)
2	-	-
3	-	-
4	X154 20WT/VT •	LEFT INSTRUMENT PANEL SPEAKER (+)
	X153 20WT/BR ••	LEFT INSTRUMENT PANEL SPEAKER (+)



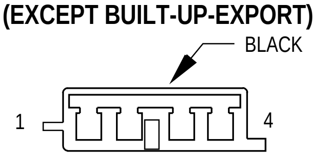
LEFT FRONT PARK/
TURN SIGNAL LAMP
(BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L77 20BR/YL	FUSED LEFT INBOARD TAIL LAMP
2	Z1 18BK	GROUND
3	L61 18LG	LEFT TURN SIGNAL



LEFT FRONT
PARK/TURN
SIGNAL LAMP
(EXCEPT BUILT-UP-EXPORT)

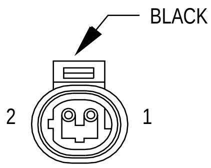
CAV	CIRCUIT	FUNCTION
1	L61 18LG	LEFT TURN SIGNAL
2	L77 20BR/YL	FUSED LEFT INBOARD TAIL LAMP
3	Z1 18BK	GROUND



LEFT FRONT
SPEAKER
(BASE)

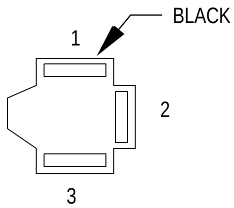
CAV	CIRCUIT	FUNCTION
1	-	-
2	X55 20BR/RD	LEFT FRONT SPEAKER (-)
3	X53 20DG	LEFT FRONT SPEAKER (+)
4	-	-

•RHD * DODGE/PLYMOUTH
••LHD ** CHRYSLER



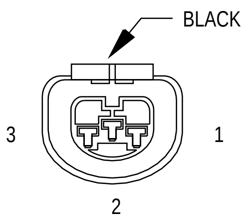
LEFT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)



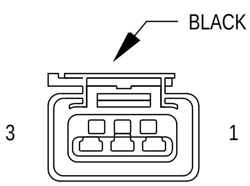
LEFT HEADLAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L33 20RD	FUSED LEFT HIGH BEAM OUTPUT
2	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
3	Z1 20BK	GROUND



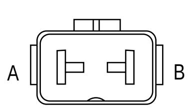
LEFT HEADLAMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
2	Z1 20BK	GROUND
3	L33 20RD	FUSED LEFT HIGH BEAM OUTPUT



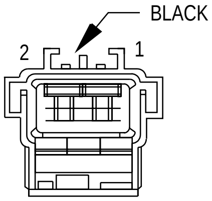
LEFT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L13 20BR/YL	HEADLAMP ADJUST SIGNAL
3	L44 20VT/RD	FUSED RIGHT LOW BEAM OUTPUT



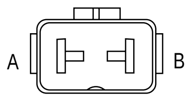
LEFT HIGH HEADLAMP (CHRYSLER) (EXCEPT-BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	L33 20RD	FUSED LEFT HIGH BEAM OUTPUT
B	Z1 20BK	GROUND



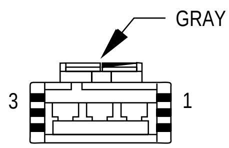
LEFT LIFTGATE FLOOD LAMP

CAV	CIRCUIT	FUNCTION
1	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



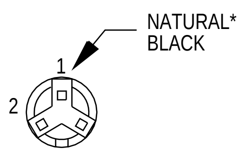
LEFT LOW HEADLAMP (CHRYSLER) (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
B	Z1 20BK	GROUND



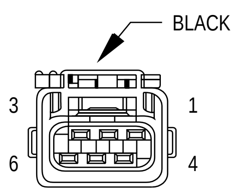
LEFT MID READING LAMP

CAV	CIRCUIT	FUNCTION
1	M113 20LB/PK	READING LAMP FEED
2	M20 20BR	COURTESY LAMP GROUND
3	F41 20PK/VT	FUSED B (+)



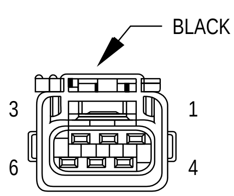
LEFT REAR DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	G77 18TN/OR	LEFT REAR DOOR AJAR SWITCH SENSE
3	-	-



LEFT REAR LAMP ASSEMBLY (BUILT-UP-EXPORT)

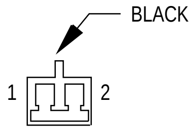
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L36 20LG	REAR FOG LAMP SWITCH OUTPUT
3	L77 20BR/LB	FUSED LEFT INBOARD TAIL LAMP
4	L1 20VT/BK	BACK-UP SWITCH OUTPUT
5	L63 18DG/RD	LEFT TURN SIGNAL
6	L50 18WT/TN	STOP LAMP SWITCH OUTPUT



LEFT REAR LAMP ASSEMBLY (EXCEPT BUILT-UP-EXPORT)

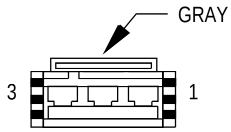
CAV	CIRCUIT	FUNCTION
1	L63 18DG/RD	LEFT TURN SIGNAL
2	-	-
3	L1 20VT/BK	BACK-UP SWITCH OUTPUT
4	L77 20BR/YL	FUSED LEFT INBOARD TAIL LAMP
5	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
6	Z1 20BK	GROUND

* DIESEL



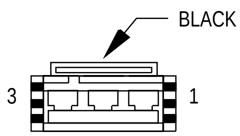
LEFT REAR PILLAR SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X157 20BR/LB	LEFT REAR PILLAR (-)
2	X151 20BR/YL	LEFT REAR PILLAR (+)



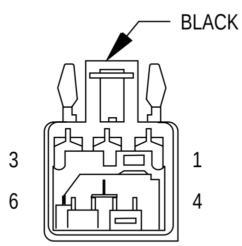
LEFT REAR READING LAMP

CAV	CIRCUIT	FUNCTION
1	M113 20LB/PK	COURTESY LAMP RELAY OUTPUT
2	M20 20BR	COURTESY LAMP GROUND
3	F41 20PK/VT	FUSED B (+)



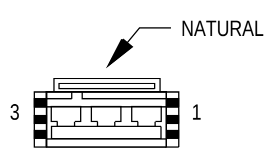
LEFT REAR SLIDING DOOR CONTACTS

CAV	CIRCUIT	FUNCTION
1	F133 20BR/YL	FUSED DOOR LOCK RELAY OUTPUT
2	F136 20VT/WT	FUSED DOOR UNLOCK RELAY OUTPUT
3	-	-



LEFT REAR SPEAKER

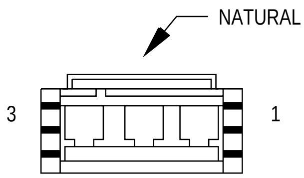
CAV	CIRCUIT	FUNCTION
1	X151 20BR/YL*	LEFT REAR SPEAKER (+)
2	X15 16BK/DG*	AMPLIFIER SPEAKER GROUND
3	X51 20BR/YL	LEFT REAR SPEAKER (+)
4	X157 20BR/LB*	LEFT REAR SPEAKER (-)
5	X13 16RD/DG*	RADIO CHOKE OUTPUT
6	X57 20BR/LB	LEFT REAR SPEAKER (-)



LEFT REAR VENT MOTOR (LHD)

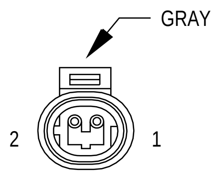
CAV	CIRCUIT	FUNCTION
1	-	-
2	Q13 18DB	LEFT REAR VENT MOTOR (CLOSE)
3	Q23 18RD/WT	LEFT REAR VENT MOTOR (OPEN)

* PREMIUM



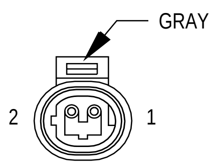
LEFT REAR VENT MOTOR (RHD)

CAV	CIRCUIT	FUNCTION
1	-	-
2	Q14 18GY	LEFT REAR VENT MOTOR (CLOSE)
3	Q24 18DG	LEFT REAR VENT MOTOR (OPEN)



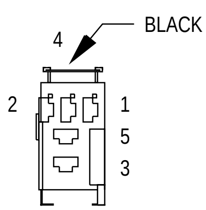
LEFT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)



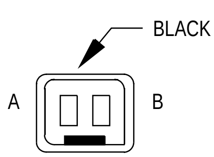
LEFT REPEATER LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L63 18DG/RD	LEFT REPEATER LAMP SIGNAL
2	Z1 18BK	GROUND



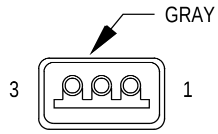
LEFT STOP/TURN SIGNAL RELAY (TRAILER TOW)

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	
2	Z1 18BK	GROUND
	Z1 18BK	
3	L73 18YL	LEFT STOP/TURN SIGNAL OUTPUT
4	L63 18DG/RD	LEFT REAR TURN SIGNAL
	L63 18DG/RD	
5	L615 18OR	LEFT COMBINATION RELAY OUTPUT



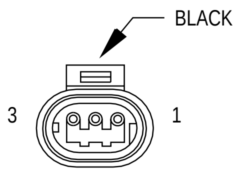
LEFT VISOR/VANITY MIRROR LAMPS

CAV	CIRCUIT	FUNCTION
A	M20 20BR	COURTESY LAMP GROUND
B	F41 20PK/VT	FUSED B (+)



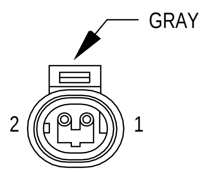
LICENSE LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L77 20BR/LB	FUSED LEFT INBOARD TAIL LAMP
3	-	-



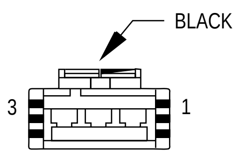
LIFTGATE AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	-	-
3	G78 18TN/BK	LIFTGATE AJAR SWITCH SENSE



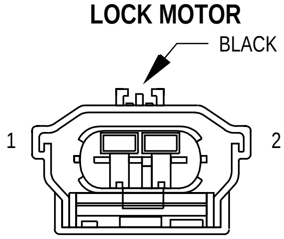
LIFTGATE ARM/ DISARM SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG	GROUND
2	P98 20WT/RD	LIFTGATE LOCK/UNLOCK MUX



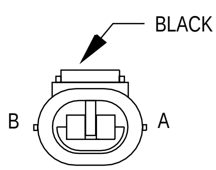
LIFTGATE LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	F133 20BR/RD	UNLOCK RELAY OUTPUT
2	-	-
3	F136 20VT/WT	LOCK RELAY OUTPUT



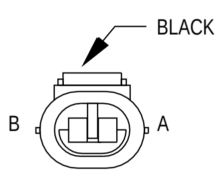
LOW COOLANT LEVEL SWITCH (DIESEL)

CAV	CIRCUIT	FUNCTION
1	G18 20BK/PK	COOLANT LEVEL SWITCH SENSE
2	Z1 20BK	GROUND



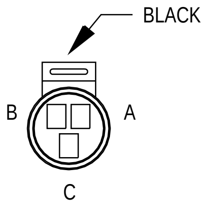
LOW NOTE HORN

CAV	CIRCUIT	FUNCTION
A	X2 18DG/RD	GROUND
B	Z1 18BK	HORN RELAY OUTPUT



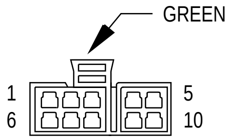
LOW WASHER FLUID SWITCH

CAV	CIRCUIT	FUNCTION
A	Z1 20BK	GROUND
B	G29 20BK/TN	WASHER FLUID SWITCH SENSE



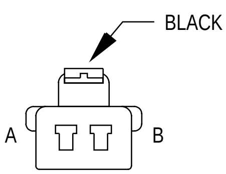
MANIFOLD ABSOLUTE PRESSURE SENSOR (2.4L/3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
A	K4 18BK/LB	SENSOR GROUND
B	K6 18VT/WT	5 VOLT SUPPLY
C	K1 18DG/RD	MAP SENSOR SIGNAL



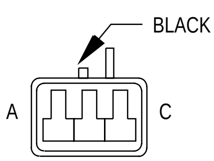
MEMORY POWER SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	P40 22GY/LB	RECLINER SWITCH TO MEMORY MODULE (SEAT BACK UP)
3	P17 22RD/LB	SEAT HORIZONTAL (REARWARD)
4	P48 22GY/WT	SEAT RECLINER (REARWARD)
5	P9 20RD	FUSED B (+)
6	P15 22YL/LB	SEAT HORIZONTAL (FORWARD)
7	P19 22YL/LG	SEAT FRONT VERTICAL (UP)
8	P11 22YL/WT	SEAT REAR VERTICAL (UP)
9	P13 22RD/WT	SEAT REAR VERTICAL (DOWN)
10	P21 22RD/LG	SEAT FRONT VERTICAL (DOWN)



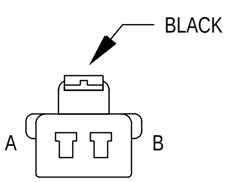
MEMORY SEAT FRONT VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P121 14RD/LG	SEAT FRONT VERTICAL (DOWN)
B	P119 14YL/LG	SEAT FRONT VERTICAL (UP)



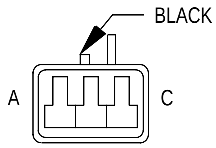
MEMORY SEAT FRONT VERTICAL POSITION SENSOR

CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	5 VOLT SUPPLY
B	P26 22BR	SEAT FRONT VERTICAL POSITION SENSE
C	P28 20BR/RD	SEAT POSITION SENSE COMMON



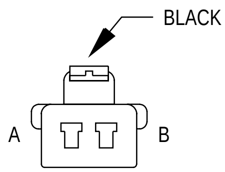
MEMORY SEAT HORIZONTAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P115 14YL/LB	SEAT HORIZONTAL (FORWARD)
B	P117 14RD/LB	SEAT HORIZONTAL (REARWARD)



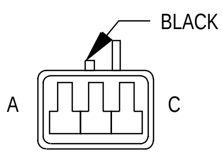
MEMORY SEAT HORIZONTAL POSITION SENSOR

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSE COMMON
B	P25 22VT/RD	SEAT HORIZONTAL POSITION SENSE
C	P29 20BR/WT	5 VOLT SUPPLY



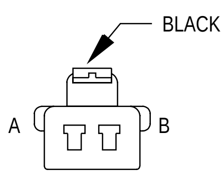
MEMORY SEAT REAR VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P111 14YL/WT	SEAT REAR VERTICAL (UP)
B	P113 14RD/WT	SEAT REAR VERTICAL (DOWN)



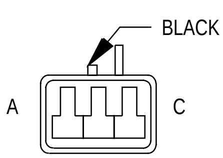
MEMORY SEAT REAR VERTICAL POSITION SENSOR

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSE COMMON
B	P27 22LB/RD	SEAT REAR VERTICAL POSITION SENSE
C	P29 20BR/WT	5 VOLT SUPPLY



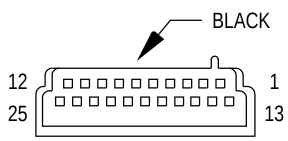
MEMORY SEAT RECLINER MOTOR

CAV	CIRCUIT	FUNCTION
A	P43 14GY/LB	SEAT RECLINER (REARWARD)
B	P41 14GY/WT	SEAT RECLINER (FORWARD)



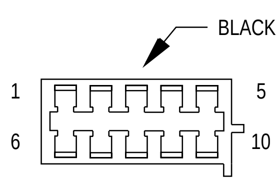
MEMORY SEAT RECLINER POSITION SENSOR

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSE COMMON
B	P47 22LB	SEAT RECLINER POSITION SENSE
C	P29 20BR/WT	5 VOLT SUPPLY



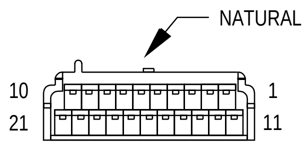
MEMORY SEAT/MIRROR MODULE - C1

CAV	CIRCUIT	FUNCTION
1	P69 20WT/RD	LEFT MIRROR POSITION (GROUND)
2	P64 20YL/OR	LEFT MIRROR POSITION (VERTICAL)
3	P65 20DB/YL	LEFT MIRROR POSITION (HORIZONTAL)
4	-	-
5	-	-
6	-	-
7	-	-
8	P22 20PK/BK	MEMORY SET
9	-	-
10	P73 20YL/PK	LEFT MIRROR (COMMON)
11	P71 20YL	LEFT MIRROR (VERTICAL)
12	P75 20DB/WT	LEFT MIRROR (HORIZONTAL)
13	P66 20WT/BK	RIGHT MIRROR POSITION (GROUND)
14	P67 20YL/RD	RIGHT MIRROR POSITION (VERTICAL)
15	P68 20DG/RD	RIGHT MIRROR POSITION (HORIZONTAL)
16	M1 20PK	FUSED B (+)
17	-	-
18	-	-
19	G96 20LG/RD	RKE INTERFACE
20	P23 20PK/RD	MEMORY NO. 1
21	P24 20PK/WT	MEMORY NO. 2
22	-	-
23	P70 20WT	RIGHT MIRROR (COMMON)
24	P72 20YL/BK	RIGHT MIRROR (VERTICAL)
25	P74 20DB	RIGHT MIRROR (HORIZONTAL)



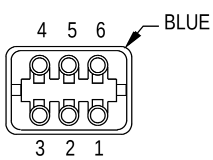
MEMORY SEAT/MIRROR MODULE - C2

CAV	CIRCUIT	FUNCTION
1	P117 14RD/LB	SEAT HORIZONTAL (REARWARD)
2	P115 14YL/LB	SEAT HORIZONTAL (FORWARD)
3	P111 14YL/WT	SEAT REAR VERTICAL (UP)
4	P43 14GY/LB	SEAT RECLINER (REARWARD)
5	P119 14YL/LG	SEAT FRONT VERTICAL (UP)
6	P113 14RD/WT	SEAT REAR VERTICAL (DOWN)
7	Z1 14BK	GROUND
8	F35 14RD	FUSED B (+)
9	P41 14GY/WT	SEAT RECLINER (FORWARD)
10	P121 14RD/LG	SEAT FRONT VERTICAL (DOWN)



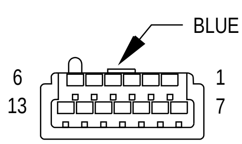
MEMORY SEAT/MIRROR MODULE - C3

CAV	CIRCUIT	FUNCTION
1	P21 22RD/LG	SEAT FRONT VERTICAL (DOWN)
2	P13 22RD/WT	SEAT REAR VERTICAL (DOWN)
3	P17 22RD/LB	SEAT HORIZONTAL (REARWARD)
4	P48 22GY/WT	SEAT RECLINER (REARWARD)
5	-	-
6	-	-
7	P27 22LB/RD	SEAT REAR VERTICAL POSITION SENSE
8	P26 22BR	SEAT FRONT VERTICAL POSITION SENSE
9	-	-
10	P28 20BR/RD	SEAT POSITION SENSE COMMON
11	P9 20RD	FUSED B (+) -
12	P19 22YL/LG	SEAT FRONT VERTICAL (UP)
13	P11 22YL/WT	SEAT REAR VERTICAL (UP)
14	P15 22YL/LB	SEAT HORIZONTAL (FORWARD)
15	P40 22GY/LB	SEAT RECLINER (FORWARD)
16	-	-
17	P47 22LB	SEAT RECLINER POSITION SENSE
18	P25 22VT/RD	SEAT HORIZONTAL POSITION SENSE
19	-	-
20	P29 20BR/WT	6 VOLT SUPPLY
21	-	-



MEMORY SET SWITCH

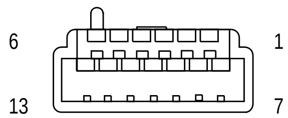
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	Z1 20BK	GROUND
4	P24 20PK/WT	MEMORY NO. 1
5	P22 20PK/BK	MEMORY SET
6	P23 20PK/RD	MEMORY NO. 2



MESSAGE CENTER (LHD)

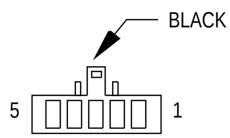
CAV	CIRCUIT	FUNCTION
1	L34 20RD/OR	FUSED HIGH BEAM RELAY OUTPUT
2	L63 18DG/RD	LEFT TURN SIGNAL
3	Z1 20BK	GROUND
4	L62 18BR/RD	RIGHT TURN SIGNAL
5	G19 20LG/OR	ABS WARNING LAMP DRIVER
6	G2 22VT	ENGINE TEMPERATURE WARNING LAMP DRIVER
7	G3 20BK/PK	SERVICE ENGINE SOON INDICATOR LAMP DRIVER
7	G85 20OR/BK *	WAIT-TO START WARNING LAMP DRIVER
8	G6 22GY	ENGINE OIL PRESSURE SWITCH SENSE
9	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
10	V23 18BR/PK	FUSED IGNITION (ST-RUN)
11	R41 18BK/TN	AIRBAG WARNING LAMP DRIVER
12	M1 20PK	FUSED B (+)
13	G69 22BK/OR	VTSS INDICATOR LAMP DRIVER

* DIESEL



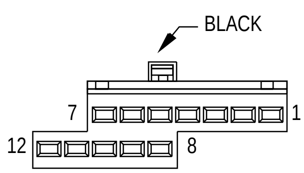
MESSAGE CENTER (RHD)

CAV	CIRCUIT	FUNCTION
1	G2 22VT	ENGINE TEMPERATURE WARNING LAMP DRIVER
2	G19 20LG/OR	ABS WARNING LAMP DRIVER
3	L63 18DG/RD	LEFT TURN SIGNAL
4	Z1 20BK	GROUND
5	L62 18BR/RD	RIGHT TURN SIGNALS
6	L34 20RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
7	G69 22BK/OR	VTSS INDICATOR LAMP DRIVER
8	M1 20PK	FUSED B(+)
9	R41 18BK/OR	AIRBAG WARNING LAMP DRIVER
10	V23 18BR/PK	FUSED IGNITION (ST-RUN)
11	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
12	G6 22GY	ENGINE OIL PRESSURE SWITCH SENSE
13	G3 20BK/PK	SERVICE ENGINE SOON INDICATOR LAMP DRIVER



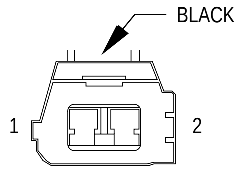
MODE DOOR ACTUATOR

CAV	CIRCUIT	FUNCTION
1	C34 20DB/WT	DOOR COMMON
2	C26 20PK/DB	5 VOLT SUPPLY
3	C37 20YL	MODE DOOR FEEDBACK SIGNAL
4	C57 20DB/GY	SENSOR GROUND
5	C35 20DG/YL	MODE DOOR DRIVER



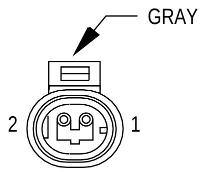
MULTI-FUNCTION SWITCH

CAV	CIRCUIT	FUNCTION
1	L91 22DB/PK	COMBO FLASHER SWITCHED GROUND
2	-	-
3	L302 22LB/YL	LEFT TURN SIGNAL SENSE
4	L305 22LB/WT	RIGHT TURN SIGNAL SENSE
5	V16 20WT	HIGH SPEED RELAY DRIVER
6	V52 20DG//YL	WIPER MUX SIGNAL
7	F1 20DB	FUSED B(+)
8	Z1 18BK	GROUND
9	L93 22PK	HIGH/LOW BEAM RELAY CONTROL
10	L94 20OR/WT	LOW BEAM RELAY CONTROL
11	V10 20BR	FRONT WASHER MOTOR CONTROL
12	L324 22WT/LG	HIGH BEAM RELAY CONTROL



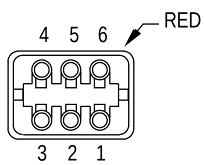
NEEDLE MOVEMENT SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K67 18BR/BK	NEEDLE MOVEMENT SENSOR (+)
2	K68 18LG/YL	NEEDLE MOVEMENT SENSOR (-)



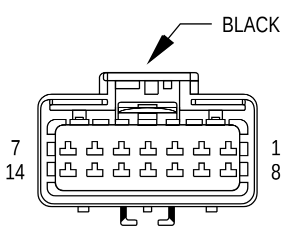
OUTPUT SHAFT SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SHAFT SPEED SIGNAL (+)



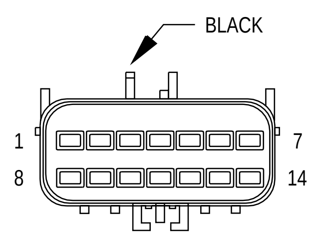
OVERHEAD CONSOLE

CAV	CIRCUIT	FUNCTION
1	D2 18WT/BK	CCD BUS(-)
2	G32 20BK/LB	SENSOR GROUND
3	Z2 18BK/LG	GROUND
4	V23 18BR/PK	FUSED IGN. (ST-RUN)
5	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
6	D1 18VT/BR	CCD BUS(+)



P30

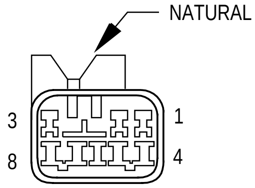
CAV	CIRCUIT
1	C26 22PK/DB
2	C57 22DB/GY
3	C32 22GY/DB
4	C33 22DB/RD
5	C34 22DB/WT
6	C35 22DG/YL
7	C36 22RD/WT
8	C37 22YL
9	C61 22DB
10	C62 22DB/PK
11	C102 22LG
12	C21 22DB/OR
13	-
14	-



J01D

CAV	CIRCUIT
1	C26 20PK/DB
2	C57 20DB/GY
3	C32 20GY/DB
4	C33 20DB/RD
5	C34 20DB/WT
6	C35 20DG/YL
7	C36 20RD/WT
8	C37 20YL
9	C61 20DB*
10	C62 20DB/PK*
11	C102 20LG*
12	C21 20DB/OR
13	-
14	-

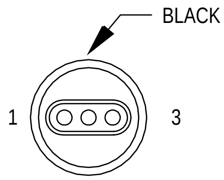
* REAR A/C



P50
(RHD)

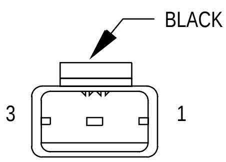
CAV	CIRCUIT
1	D1 20VT/BR
2	G96 22LG/RD
3	D2 20WT/BK
4	F11 20RD/WT
5	L91 20DB/PK
6	X12 20RD/WT
7	M1 22PK
8	Z1 18BK

CAV	CIRCUIT
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-



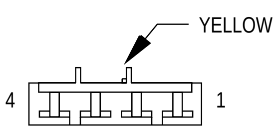
PARK/NEUTRAL
POSITION SWITCH
(EATX)

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP RELAY OUTPUT
2	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
3	F20 18WT	FUSED IGNITION (RUN)



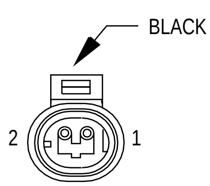
PARK/NEUTRAL
POSITION SWITCH
(MTX)

CAV	CIRCUIT	FUNCTION
1	T3 18VT	PARK/NEUTRAL POSITION SWITCH OUTPUT
2	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
3	F11 18RD/WT	FUSED IGNITION (ST-RUN-OFF)



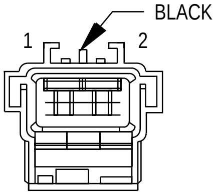
PASSENGER
AIRBAG SQUIB

CAV	CIRCUIT	FUNCTION
1	R44 18DG/YL	PASSENGER AIRBAG LINE NO. 2
2	R42 18BK/YL	PASSENGER AIRBAG LINE NO. 1
3	-	-
4	-	-



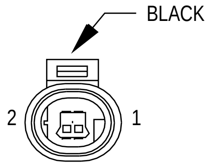
PASSENGER DOOR
ARM/DISARM SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG	GROUND
2	P96 20WT/LG	PASSENGER DOOR SWITCH MUX



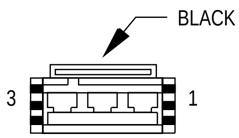
PASSENGER DOOR COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
2	Z1 20BK	GROUND
	Z1 20BK	



PASSENGER DOOR LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	F136 20VT/YL	FUSED DOOR UNLOCK RELAY OUTPUT
2	F133 20BR	FUSED DOOR LOCK RELAY OUTPUT



PASSENGER DOOR LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS FEED
	E2 20OR	
2	P96 20WT/LG	PASSENGER DOOR SWITCH MUX
	P96 20WT/LG*	
3	Z2 20BK/LG	GROUND
	Z2 20BK/LG*	

PASSENGER HEATED SEAT BACK

CAV	CIRCUIT	FUNCTION
A	P88 18RD/WT	HEATED SEAT DRIVER
B	Z1 18BK	GROUND

PASSENGER HEATED SEAT CUSHION

CAV	CIRCUIT	FUNCTION
A	P87 18RD/WT	HEATED SEAT DRIVER
B	P88 18RD/WT	HEATED SEAT DRIVER
C	P89 20BK/RD	HEATED SEAT BACK
D	Z1 18BK	GROUND

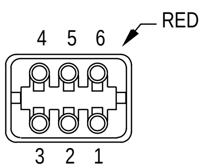
PASSENGER HEATED SEAT MODULE

CAV	CIRCUIT	FUNCTION
A	P87 18RD/WT	HEATED SEAT DRIVER
B	P86 20VT	HEATED SEAT TEMPERATURE SENSOR
C	P8 20WT/BK	PASSENGER HEATED SEAT SWITCH
D	F35 18RD	FUSED B(+)
E	P89 20BK/RD	HEATED SEAT BACK
F	Z1 18BK	GROUND

* RKE

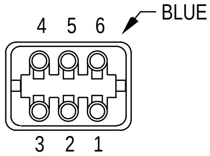
PASSENGER HEATED SEAT SWITCH

CAV	CIRCUIT	FUNCTION
A	P86 20VT	HEATED SEAT TEMPERATURE SENSOR
B	F20 20WT	FUSED IGNITION (RUN)
C	-	-
D	F20 20WT	FUSED IGNITION (RUN)
E	Z1 18BK	GROUND
F	P8 20WT/BK	PASSENGER HEATED SEAT SWITCH



PASSENGER POWER MIRROR - C1

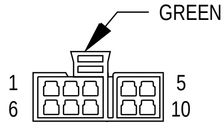
CAV	CIRCUIT	FUNCTION
1	P74 20DB	MIRROR SWITCH OUTPUT (HORIZONTAL)
2	P72 20YL/BK	MIRROR SWITCH OUTPUT (VERTICAL)
3	P70 20WT	MIRROR SWITCH COMMON
4	C16 20LB/YL	FUSED B(+)
5	Z1 20BK	GROUND
6	-	-



PASSENGER POWER MIRROR - C2

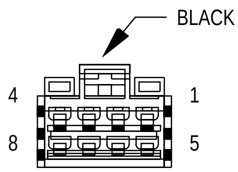
CAV	CIRCUIT	FUNCTION
1	P67 20YL/RD	PASSENGER MIRROR POSITION (VERTICAL)
2	P66 20WT/BK	PASSENGER MIRROR POSITION COMMON
3	P68 20DG/RD	PASSENGER MIRROR POSITION (HORIZONTAL)
4	-	-
5	P159 20DG*	PASSENGER MIRROR UNFOLD SIGNAL
6	P160 20LB*	PASSENGER MIRROR FOLD SIGNAL

* BUILT-UP-EXPORT
** RKE



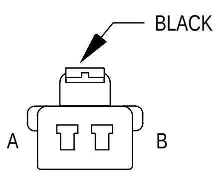
PASSENGER POWER SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 14BK	GROUND
2	P44 14GY/LB	SEAT RECLINER (FORWARD)
3	P16 14RD/LB	SEAT HORIZONTAL (REARWARD)
4	P42 14GY/WT	SEAT RECLINER (REARWARD)
5	F35 14RD	FUSED (B+)
6	P14 14YL/LB	SEAT HORIZONTAL (FORWARD)
7	P20 14RD/LG	SEAT FRONT VERTICAL (DOWN)
8	P12 14RD/WT	SEAT REAR VERTICAL (DOWN)
9	P10 14YL/WT	SEAT REAR VERTICAL (UP)
10	P18 14YL/LG	SEAT FRONT VERTICAL (UP)



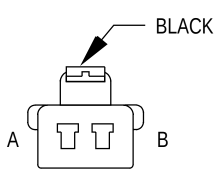
PASSENGER POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	F55 12TN/DG	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
2	Q26 12VT/WT	RIGHT FRONT WINDOW (DOWN)
3	Q16 12BR/WT	RIGHT FRONT WINDOW (UP)
4	-	-
5	Q22 14VT	RIGHT FRONT WINDOW (DOWN)
6	E2 20OR	PANEL LAMPS FEED
7	Z1 20BK	GROUND
8	Q12 14BR	RIGHT FRONT WINDOW (UP)



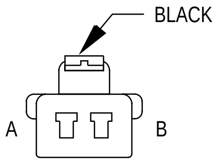
PASSENGER SEAT FRONT VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P18 14YL/LG	SEAT FRONT VERTICAL (UP)
B	P20 14RD/LG	SEAT FRONT VERTICAL (DOWN)



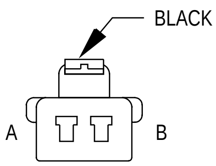
PASSENGER SEAT HORIZONTAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P16 14RD/LB	SEAT HORIZONTAL (REARWARD)
B	P14 14YL/LB	SEAT HORIZONTAL (FORWARD)



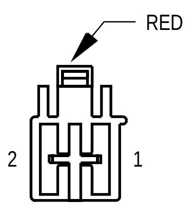
PASSENGER SEAT REAR VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
A	P12 14RD/WT	SEAT REAR VERTICAL (DOWN)
B	P10 14YL/WT	SEAT REAR VERTICAL (UP)



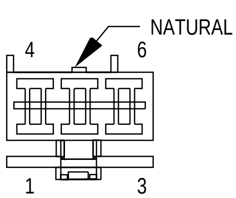
PASSENGER SEAT RECLINER MOTOR

CAV	CIRCUIT	FUNCTION
A	P42 14GY/WT	SEAT RECLINER (REARWARD)
B	P44 14GY/LB	SEAT RECLINER (FORWARD)



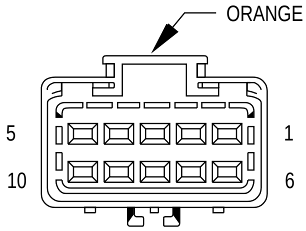
PASSENGER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q11 16LG	DRIVER WINDOW (UP)
2	Q21 16WT	DRIVER WINDOW (DOWN)



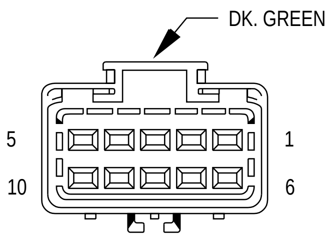
POWER DISTRIBUTION CENTER - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	C71 12DB	BLOWER MOTOR FEED FROM ATC/RELAY
4	L7 12BK/YL	TAIL, LICENSE, SIDE MARKER LAMP, PARK LAMP FEED
5	-	-
6	A4 12BK/RD	FUSED B (+)



POWER DISTRIBUTION CENTER - C2

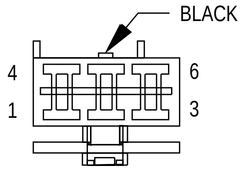
CAV	CIRCUIT	FUNCTION
1	-	-
2	F41 20PK/VT	FUSED B (+)
3	F45 20YL/RD ●	FUSED IGNITION SWITCH OUTPUT (START)
3	T141 20YL/RD ●●	CLUTCH INTERLOCK SWITCH
4	X4 20GY/OR	HORN RELAY CONTROL
5	F20 20WT	IGNITION FEED FOR EVIC
6	F87 18WT/BK	FUSED IGN. (ST-RUN)
7	A141 16DG/WT	FUEL PUMP RELAY OUTPUT
8	X2 18DG/RD	HORN RELAY OUTPUT
9	F1 20DB	WIPE FEED
10	F30 16RD	CIGAR AND ACCESSORY RELAY OUTPUT



POWER DISTRIBUTION CENTER - C3

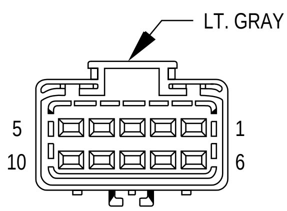
CAV	CIRCUIT	FUNCTION
1	L44 20VT/RD	FUSED LOW BEAM RELAY OUTPUT
2	L324 20WT/LG	HIGH BEAM RELAY DRIVER
3	-	-
4	-	-
5	M1 20PK	FUSED B (+)
6	A20 12RD/DB	FUSED B (+)
7	L94 20OR/WT*	LOW BEAM RELAY DRIVER
7	L193 20OR/WT**	LOW BEAM RELAY DRIVER
8	F32 18PK/DB	FUSED B (+)
9	-	-
10	L97 18PK/DB	PARK LAMP RELAY CONTROL

● EATX
●● MTX
* DODGE/PLYMOUTH OR BUILT-UP-EXPORT
** CHRYSLER (PREMIUM)



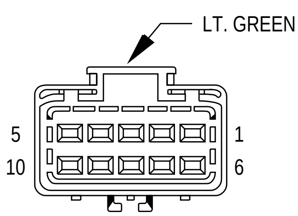
POWER DISTRIBUTION CENTER - C4

CAV	CIRCUIT	FUNCTION
1	A22 12BK/OR	IGNITION SWITCH RUN ONLY FEED
2	Z1 18BK	GROUND
3	A1 12RD	FUSED B (+)
4	-	-
5	A2 12PK/BK	BATTERY FEED TO IGNITION SWITCH
6	A10 12RD/DG	FUSED LINK TO ABS PUMP MOTOR RELAY



POWER DISTRIBUTION CENTER - C5

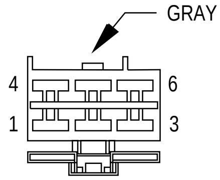
CAV	CIRCUIT	FUNCTION
1	L33 20RD	HIGH BEAM RELAY OUTPUT
2	F14 20LG/YL*	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	F14 18LG/YL**	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
3	V3 12BR/WT	WIPER HIGH/LOW RELAY OUTPUT (LOW)
4	V4 12RD/YL	WIPER HIGH/LOW RELAY OUTPUT (HIGH)
5	V16 20WT	WIPER HIGH/LOW RELAY DRIVER
6	L34 20RD/OR	HIGH BEAM RELAY OUTPUT
	L34 20RD/OR	HIGH BEAM RELAY OUTPUT
7	V14 18RD/VT	WIPER ON RELAY DRIVER
8	L43 18VT	LOW BEAM RELAY OUTPUT
9	L9 18BK/WT	FUSED HAZARD FLASHER FEED (DEDICATED)
10	F23 20DB/YL*	FUSED IGNITION SWITCH OUTPUT (RUN)
	F23 18DB/YL**	FUSED IGNITION SWITCH OUTPUT (RUN)



POWER DISTRIBUTION CENTER - C6

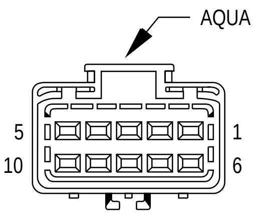
CAV	CIRCUIT	FUNCTION
1	F87 18BK/WT ••	FUSED IGNITION "C" (7.5A)
1	A142 18DG/OR •	FUSED IGNITION "C" (7.5A)
2	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
3	K31 18BR	FUEL PUMP RELAY CONTROL
3	Z1 20BK •	GROUND
4	K90 18TN	ENGINE STARTER MOTOR RELAY CONTROL
5	A142 18DG/OR	ASD RELAY OUTPUT
6	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT (RUN/START)
7	C13 18DB/OR ••	A/C COMPRESSOR CLUTCH RELAY CONTROL
7	C13 20DB/OR •	A/C COMPRESSOR CLUTCH RELAY CONTROL
8	K51 18DB/YL ••	ASD RELAY CONTROL
8	K51 20DB/YL •	ASD RELAY CONTROL
9	A14 18RD/WT ••	FUSED B(+)
10	-	-

* EXCEPT BUILT-UP-EXPORT
** BUILT-UP-EXPORT
•DIESEL
••GAS



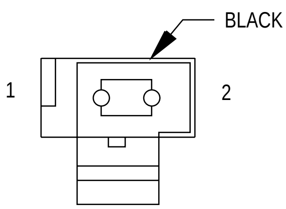
POWER DISTRIBUTION CENTER - C7

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	T40 12BR	STARTER MOTOR RELAY OUTPUT
4	A17 12RD/BK*	FUSED B(+)
5	-	-
6	A16 12GY	FUSED B(+)



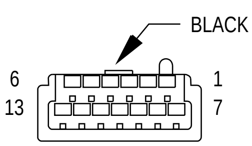
POWER DISTRIBUTION CENTER - C8

CAV	CIRCUIT	FUNCTION
1	-	-
2	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
3	T15 18LG	TRANSMISSION CONTROL RELAY CONTROL
4	Z16 18BK	GROUND
5	-	-
6	-	-
7	F45 18YL/RD	FUSED B(+)
8	-	-
9	-	-
10	A5 18RD/DB	FUSED B(+)



POWER FOLDING MIRROR SWITCH (BUILT-UP-EXPORT)

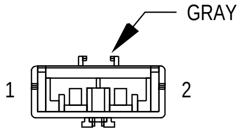
CAV	CIRCUIT	FUNCTION
1	P136 20YL	POWER FOLDING MIRROR INPUT
2	Z1 20BK	GROUND



POWER MIRROR SWITCH

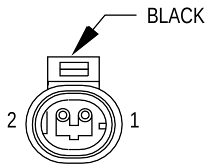
CAV	CIRCUIT	FUNCTION
1	P70 20WT	RIGHT COMMON
2	-	-
3	-	-
4	-	-
5	E2 20OR	PANEL LAMPS FEED
6	P73 20YL/PK	LEFT COMMON
7	P75 20DB/WT	LEFT HORIZONTAL
8	P74 20DB	RIGHT HORIZONTAL
9	F41 20PK/VT	FUSED B (+)
10	-	-
11	Z1 20BK	GROUND
12	P71 20YL	LEFT VERTICAL
13	P72 20YL/BK	RIGHT VERTICAL

* DIESEL



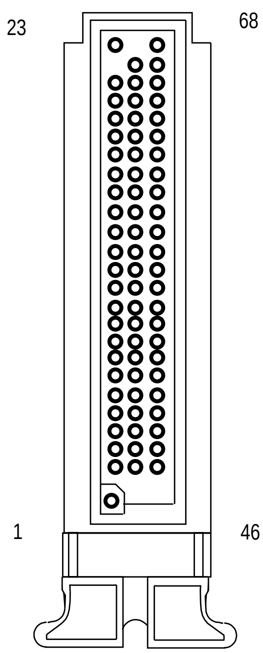
POWER SEAT CIRCUIT BREAKER

CAV	CIRCUIT	FUNCTION
1	A3 12PK/BK	FUSED B(+)
2	F35 14RD	FUSED B(+)
	F35 14RD*	



POWER STEERING PRESSURE SWITCH (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K10 18DB/OR	POWER STEERING PRESSURE SWITCH SENSE
2	Z1 18BK	GROUND



POWERTRAIN CONTROL MODULE (DIESEL)

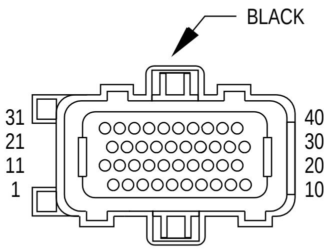
CAV	CIRCUIT	FUNCTION
1	Z12 16BK/TN	GROUND
2	K159 20VT/RD	ENGINE SPEED SENSOR SIGNAL
3	K90 20TN	ENGINE STARTER MOTOR RELAY CONTROL
4	K140 18TN/WT	FUEL QUANTITY ACTUATOR SIGNAL
5	K140 18TN/WT	FUEL QUANTITY ACTUATOR SIGNAL
6	C24 20DB/PK	LOW SPEED RADIATOR FAN RELAY NO. 2 CONTROL
7	K57 20LG/OR	CONTROL SLEEVE POSITION SENSOR
8	K24 18GY/BK	ENGINE SPEED SENSOR FEED
9	-	-
10	-	-
11	K68 20LG/YL	NEEDLE MOVEMENT SENSOR RETURN
12	K67 20BR/BK	NEEDLE MOVEMENT SENSOR SIGNAL
13	C18 20DB	A/C PRESSURE SWITCH SIGNAL
14	K2 20TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
15	K22 20OR/DB	ACCELERATOR PEDAL SENSOR SIGNAL
16	-	-
17	K119 20LG/BK	CLUTCH SWITCH SIGNAL
18	-	-
19	K7 20OR	5 VOLT SUPPLY
20	K29 20WT/PK	BRAKE SWITCH SENSE
21	K3 20BK/VT	ENGINE SPEED SENSOR RETURN
22	-	-
23	A142 16DG/OR	DIESEL POWER RELAY OUTPUT
24	Z12 16BK/TN	GROUND
25	K35 20GY/YL	EGR SOLENOID CONTROL
26	G85 20OR/BK	GLOW PLUG LAMP DRIVER
27	V38 20LB/RD	SPEED CONTROL LAMP DRIVER
28	C13 20DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
29	K134 20LB/BK	SLEEVE POSITION SENSOR
30	-	-
31	-	-
32	-	-
33	K4 20BK/LB	SENSOR GROUND
34	-	-
35	-	-
36	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
37	C103 20DG/LB	A/C SWITCH SIGNAL
38	F87 18WT/BK	FUSED IGNITION (ST-RUN)
39	-	-
40	K1 20DG/RD	BOOST PRESSURE SENSOR SIGNAL

* MEMORY SEAT

CONTINUED ON NEXT PAGE

(CONTINUED)

CAV	CIRCUIT	FUNCTION
41	K9 20LB	5 VOLT SUPPLY
42	K51 20DB/YL	DIESEL POWER RELAY
43	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
44	L50 18WT/TN	STOP LAMP SWITCH SIGNAL
45	A142 16DG/OR	DIESEL POWER RELAY OUTPUT
46	Z12 16BK/TN	GROUND
47	-	-
48	C137 20YL	HIGH SPEED RADIATOR FAN RELAY NO. 1 AND 3 CONTROL
49	K140 18TN/WT	SLEEVE POSITION SENSOR (+)
50	K152 20WT/DG	FUEL TIMING SOLENOID CONTROL
51	K126 20LG	SLEEVE POSITION SENSOR (+)
52	K135 20WT/BK	SHUT DOWN SOLENOID CONTROL
53	K153 18OR/DG	FUEL SHUT OFF SIGNAL
54	-	-
55	K167 20BR/YL	ACCELERATOR PEDAL SENSOR GROUND
56	-	-
57	K6 20VT/WT	5 VOLT SUPPLY
58	-	-
59	G55 20OR/BK	ENGINE DISABLE SIGNAL
60	-	-
61	D21 20PK	SCI TRANSMIT
62	-	-
63	K156 20GY	FUEL TEMPERATURE SENSOR SIGNAL
64	K21 20BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
65	K151 20WT	LOW IDLE POSITION SWITCH SIGNAL
66	-	-
67	-	-
68	A142 16DG/OR	DIESEL POWER RELAY OUTPUT



POWERTRAIN CONTROL MODULE - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	K18 18RD/YL	IGNITION COIL NO. 3 DRIVER (3.3L/3.8L)
3	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
4	-	-
5	V32 18YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
6	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
7	K13 18YL/WT	INJECTOR NO. 3 DRIVER
8	K20 18DG	GENERATOR FIELD DRIVER
9	-	-
10	Z12 18BK/TN	GROUND
11	K19 18GY/RD	IGNITION COIL NO. 1 DRIVER
12	-	-
13	K11 18WT/DB	INJECTOR NO. 1 DRIVER
14	K58 18BR/DB	INJECTOR NO. 6 DRIVER (3.3L/3.8L)
15	K38 18GY	INJECTOR NO. 5 DRIVER (3.3L/3.8L)
16	K14 18LB/BR	INJECTOR NO. 4 DRIVER
17	K12 18TN/WT	INJECTOR NO. 2 DRIVER
18	-	-
19	-	-
20	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
21	-	-
22	G3 18BK/PK	SERVICE ENGINE SOON INDICATOR LAMP DRIVER
23	-	-
24	-	-
25	K42 18DB/LG	KNOCK SENSOR SIGNAL
26	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
27	-	-
28	-	-
29	-	-
30	K41 18BK/DG	HEATED OXYGEN SENSOR SIGNAL
31	K90 18TN	ENGINE STARTER MOTOR RELAY CONTROL
32	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
33	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
34	-	-
35	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
36	K1 18DG/RD	MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
37	K21 18BK/RD*	INTAKE AIR TEMPERATURE SENSOR SIGNAL
38	C103 18DG/LB	A/C SWITCH SIGNAL
39	-	-
40	K35 18GY/YL	EGR SOLENOID CONTROL

* 2.0L

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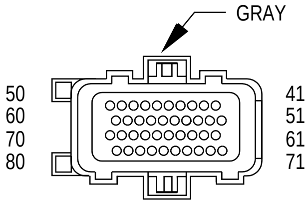
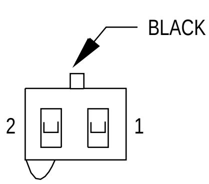


POWERTRAIN CONTROL MODULE - C2

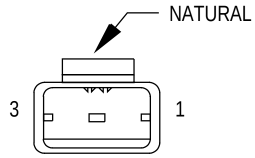
CAV	CIRCUIT	FUNCTION
41	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL
42	C18 18DB	A/C PRESSURE SWITCH SIGNAL
43	K4 18BK/LB	SENSOR GROUND
44	K7 18OR	8 VOLT SUPPLY
45	-	-
46	A14 18RD/WT	FUSED B(+)
47	-	-
48	K40 18BR/WT	IDLE AIR CONTROL MOTOR NO. 3 DRIVER
49	K60 18YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
50	Z12 18BK/TN	GROUND
51	K141 18TN/WT	HEATED OXYGEN SENSOR SIGNAL
52	-	-
53	-	-
54	K50 18YL/WT*	FLEXIBLE FUEL SENSOR SIGNAL
55	-	-
56	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
57	K39 18GY/RD	IDLE AIR CONTROL MOTOR NO. 1 DRIVER
58	K59 18VT/BK	IDLE AIR CONTROL MOTOR NO. 4 DRIVER
59	D1 18VT/BR	CCD BUS (+)
60	D2 18WT/BK	CCD BUS (-)
61	K6 18VT/WT	5 VOLT SUPPLY
62	K29 18WT/PK	STOP LAMP SWITCH SENSE
63	T10 18YL/DG ●	TORQUE MANAGEMENT REQUEST SENSE
64	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
65	D21 18PK	SCI TRANSMIT
66	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
67	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
68	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
69	-	-
70	K70 18VT/RD	PULSE WIDTH MODULATED PURGE CURRENT SENSE
71	-	-
72	K107 18YL/BK	EVAP LEAK DETECTION PUMP STROKE SENSE
73	K173 14LG/DB	RADIATOR FAN RELAY CONTROL
74	K31 18BR	FUEL PUMP RELAY CONTROL
75	D20 18LG	SCI RECEIVE
76	T41 18BR/YL ●	TRANSMISSION RANGE SWITCH T41 SENSE
77	K106 18WT/DG	EVAP LEAK DETECTION PUMP SOLENOID CONTROL
78	-	-
79	-	-
80	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL



PRNDL FEED

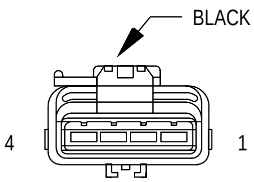
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	A81 20DG/RD	IGNITION SWITCH OUTPUT (OFF/RUN/START)

* 3.3L/3.8L ENGINE
● EATX



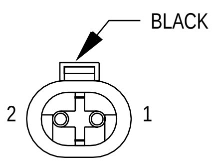
PRNDL SWITCH

CAV	CIRCUIT	FUNCTION
1	Z13 18BK/RD	GROUND
2	T42 18VT/WT	PRNDL SWITCH GROUND
3	T1 18LG/BK	PRNDL SWITCH SENSE



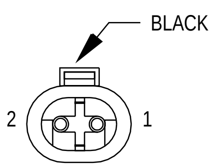
RADIATOR FAN DISCONNECT (DIESEL)

CAV	CIRCUIT	FUNCTION
1	Z1 12BK	GROUND
2	C27 12DB/PK	RADIATOR FAN RELAY CONTROL
3	C116 12LG/WT	HIGH SPEED RELAY OUTPUT
4	C25 12YL	RADIATOR FAN RELAY OUTPUT



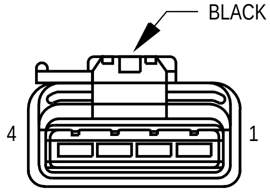
RADIATOR FAN NO. 1

CAV	CIRCUIT	FUNCTION
1	C23 12DG	LOW SPEED RADIATOR FAN RELAY OUTPUT
2	Z1 12BK	GROUND



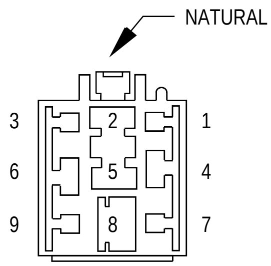
RADIATOR FAN NO.2

CAV	CIRCUIT	FUNCTION
1	C23 12DG	LOW SPEED RADIATOR FAN RELAY OUTPUT
2	Z1 12BK	GROUND



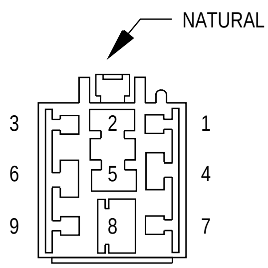
RADIATOR FAN RELAY (GAS)

CAV	CIRCUIT	FUNCTION
1	Z1 14BK	GROUND
2	K173 14LG/DB	RADIATOR FAN RELAY CONTROL
3	C23 12DG	LOW SPEED RADIATOR FAN RELAY OUTPUT
4	A16 12GY	FUSED B(+)



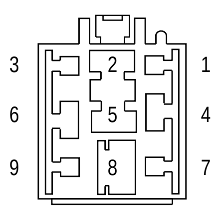
RADIATOR FAN RELAY NO. 1 (DIESEL)

CAV	CIRCUIT	FUNCTION
2	Z1 12BK	GROUND
4	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT
5	C27 12DB/PK	HIGH SPEED RADIATOR FAN RELAY CONTROL
6	C137 20YL	HIGH SPEED RADIATOR FAN RELAY CONTROL
8	C116 12LG/WT	HIGH SPEED RELAY OUTPUT



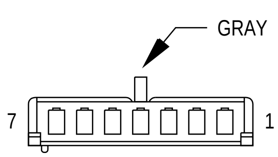
RADIATOR FAN RELAY NO. 2 (DIESEL)

CAV	CIRCUIT	FUNCTION
2	C25 12YL	RADIATOR FAN RELAY OUTPUT
4	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT
6	C24 20DB/PK	LOW SPEED RADIATOR FAN RELAY CONTROL
8	A16 12GY	FUSED B(+)



RADIATOR FAN RELAY NO. 3 (DIESEL)

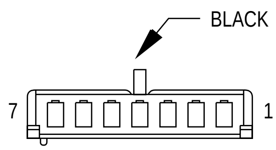
CAV	CIRCUIT	FUNCTION
2	C27 12DB/PK	RADIATOR FAN RELAY CONTROL
4	A142 18DG/OR	AUTO SHUTDOWN RELAY OUTPUT
6	C137 20YL	HIGH SPEED RADIATOR FAN RELAY CONTROL
8	A17 12RD/BK	FUSED B(+)



RADIO - C1

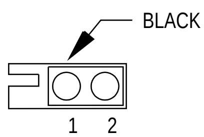
CAV	CIRCUIT	FUNCTION
1	-	-
2	X55 20BR/RD	LEFT DOOR SPEAKER (-)
	X55 20BR/RD*	LEFT DOOR SPEAKER (-)
3	X56 20DB/RD	RIGHT DOOR SPEAKER (-)
	X56 20DB/RD*	RIGHT DOOR SPEAKER (-)
4	E17 20YL/BK	STEP DIMMER SWITCH SENSE
5	E2 20OR	PANEL LAMPS FEED
6	X12 18RD/WT	FUSED IGNITION (RUN-ACC)
7	M1 20PK	FUSED B(+)

* PREMIUM



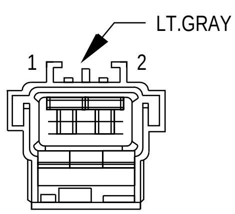
RADIO - C2

CAV	CIRCUIT	FUNCTION
1	X60 20RD/DG	RADIO 12 VOLT OUTPUT
2	X51 20BR/YL	LEFT REAR SPEAKER (+)
3	X52 20DB/WT	RIGHT REAR SPEAKER (+)
4	X53 20DG	LEFT DOOR SPEAKER (+)
	X53 20DG*	LEFT DOOR SPEAKER (+)
5	X54 20VT	RIGHT DOOR SPEAKER (+)
	X54 20VT*	RIGHT DOOR SPEAKER (+)
6	X57 20BR/LB	LEFT REAR SPEAKER (-)
7	X58 20DB/OR	RIGHT REAR SPEAKER (-)



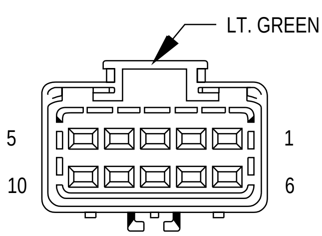
RADIO - C3
(EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	D1 20VT/BR	CCD BUS(+)
2	D2 20WT/BK	CCD BUS(-)



RADIO CHOKE

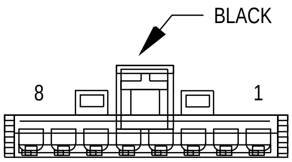
CAV	CIRCUIT	FUNCTION
1	X1 16DG/RD	NAME BRAND SPEAKER RELAY OUTPUT
2	X13 16RD/DG	RADIO CHOKE OUTPUT



REAR A/C-HEATER UNIT

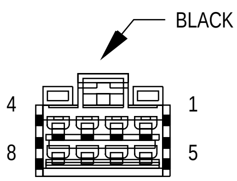
CAV	CIRCUIT	FUNCTION
1	C34 20DB/WT	A/C MODE DOOR DRIVER (A)
2	C61 20DB	DUAL ZONE A/C ACTUATOR
3	C40 12BR/WT	REAR BLOWER RELAY OUTPUT
4	C65 14BK/OR	REAR BLOWER MEDIUM SPEED
5	C60 16BK/LB	REAR BLOWER MEDIUM SPEED
6	C70 12DG	REAR BLOWER HIGH SPEED
7	-	-
8	-	-
9	-	-
10	-	-

* PREMIUM



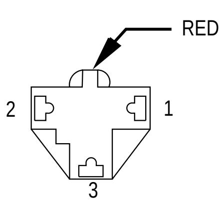
REAR BLOWER FRONT CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	C70 12DG	REAR BLOWER HIGH SPEED
2	-	-
3	C60 16BK/LB	REAR BLOWER MEDIUM SPEED
4	-	-
5	C50 12BK/LG	REAR BLOWER LOW SPEED
6	-	-
7	Z1 12BK	GROUND
8	E2 20OR	PANEL LAMPS FEED



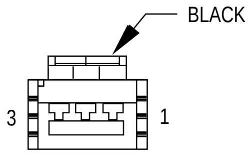
REAR BLOWER REAR CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	C60 16BK/LB	REAR BLOWER MEDIUM SPEED
2	C65 14BK/OR	REAR BLOWER MEDIUM SPEED
3	C70 12DG	REAR BLOWER HIGH SPEED
4	Z1 18BK	GROUND
5	C50 12BK/LG	REAR BLOWER LOW SPEED
6	-	-
7	-	-
8	E2 20OR	PANEL LAMPS FEED



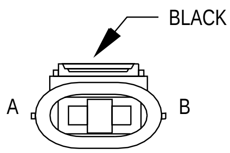
REAR CIGAR LIGHTER/POWER OUTLET

CAV	CIRCUIT	FUNCTION
1	F30 16RD	FUSED B(+)
2	-	-
3	Z1 16BK	GROUND



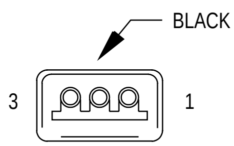
REAR DOME LAMP

CAV	CIRCUIT	
1	-	-
2	M113 20LB/PK	READING LAMP FEED
3	M20 20BR	COURTESY LAMP GROUND



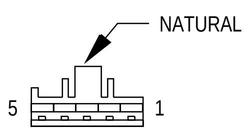
REAR WASHER MOTOR

CAV	CIRCUIT	FUNCTION
A	F1 20DB	FUSED IGNITION (RUN-ACC)
B	V20 20BK/WT	REAR WASHER MOTOR CONTROL



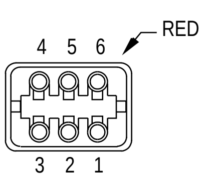
REAR WIPER MOTOR

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT
3	V13 18BR/LG	REAR WIPER MOTOR CONTROL



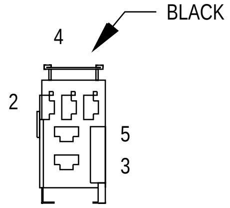
RECIRCULATION DOOR ACTUATOR

CAV	CIRCUIT	FUNCTION
1	C34 20DB/WT	COMMON DOOR DRIVER
2	-	-
3	-	-
4	-	-
5	C32 20GY/DB	RECIRCULATION DOOR DRIVER



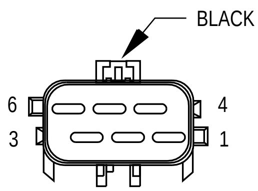
REMOTE KEYLESS ENTRY MODULE

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	M1 20PK	FUSED B(+)
4	Z2 20BK/LG	GROUND
5	D9 22GY/BK	RKE MODULE PROGRAM ENABLE
6	G96 20LG/RD	RKE INTERFACE



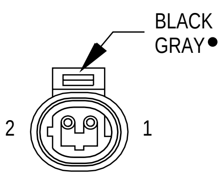
RIGHT COMBINATION RELAY (TRAILER TOW)

CAV	CIRCUIT	FUNCTION
1	L62 18BR/RD	RIGHT TURN SIGNAL
	L62 18BR/RD	
2	Z1 18BK	GROUND
3	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
4	L605 18DG	RIGHT TURN SIGNAL
5	-	-



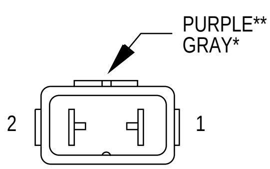
RIGHT DOOR SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X153 20WT/BR •	RIGHT I/P SPEAKER (+)
	X154 20WT/VT ••	RIGHT I/P SPEAKER (+)
2	X15 16BK/DG	AMPLIFIED SPEAKER GROUND
3	X54 20VT	RIGHT FRONT SPEAKER (+)
4	X155 20BR/WT •	RIGHT FRONT I/P SPEAKER (-)
	X156 20VT/WT ••	RIGHT FRONT I/P SPEAKER (-)
5	X13 16RD/DG	RADIO CHOKE OUTPUT
6	X56 20DB/RD	RIGHT FRONT SPEAKER (-)



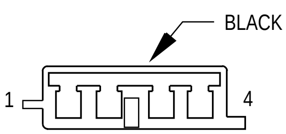
RIGHT FOG LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	F39 18PK/LG	FUSED PARK LAMP RELAY OUTPUT
2	Z39 20BK	FOG LAMP SWITCHED GROUND



RIGHT FOG LAMP (EXCEPT BUILT-UP-EXPORT)

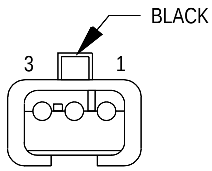
CAV	CIRCUIT	FUNCTION
1	L39 18VT/RD*	FOG LAMP RELAY OUTPUT
	L39 18LB**	FOG LAMP RELAY OUTPUT
2	Z39 20BK	FOG LAMP SWITCHED GROUND



RIGHT FRONT PANEL SPEAKER (PREMIUM)

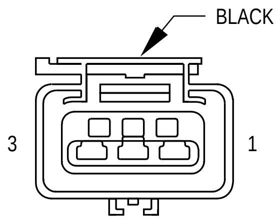
CAV	CIRCUIT	FUNCTION
1	X155 20BR/WT •	RIGHT FRONT I/P SPEAKER (-)
	X156 20VT/WT ••	RIGHT FRONT I/P SPEAKER (-)
2	-	-
3	-	-
4	X153 20WT/BR •	RIGHT FRONT I/P SPEAKER (+)
	X154 20WT/VT ••	RIGHT FRONT I/P SPEAKER (+)

* DODGE/PLYMOUTH
** CHRYSLER
• RHD
•• LHD
▲ DIESEL



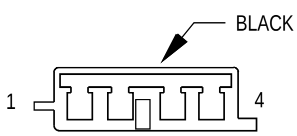
RIGHT FRONT PARK/ TURN SIGNAL LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L78 20DG/YL	FUSED B(+)
2	Z1 18BK	GROUND
3	L60 18TN	RIGHT TURN SIGNAL



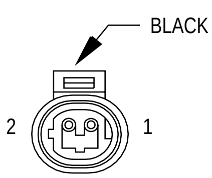
RIGHT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	L78 20DG/YL	FUSED B(+)
3	Z1 20BK	GROUND



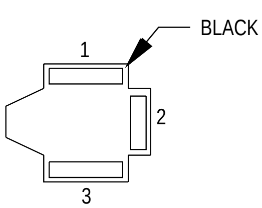
RIGHT FRONT SPEAKER (BASE)

CAV	CIRCUIT	FUNCTION
1	-	-
2	X56 20DB/RD	RIGHT FRONT SPEAKER (-)
3	X54 20VT	RIGHT FRONT SPEAKER (+)
4	-	-



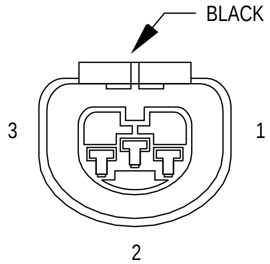
RIGHT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



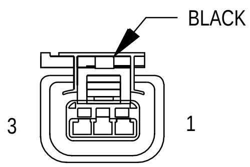
RIGHT HEADLAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L34 20RD/OR	FUSED RIGHT HIGH BEAM RELAY OUTPUT
2	L44 20VT/RD	FUSED RIGHT LOW BEAM OUTPUT
3	Z1 20BK	GROUND



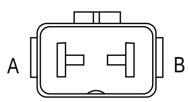
RIGHT HEADLAMP
(EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L44 20VT/RD	FUSED RIGHT LOW BEAM OUTPUT
2	Z1 20BK	GROUND
3	L34 20RD/OR	FUSED RIGHT HIGH BEAM OUTPUT



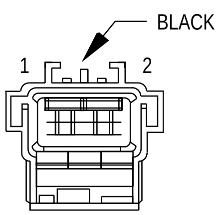
RIGHT HEADLAMP
LEVELING MOTOR
(BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L13 18BR/YL	HEADLAMP ADJUST SIGNAL
3	L44 20VT/RD	FUSED RIGHT LOW BEAM OUTPUT



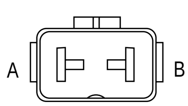
RIGHT HIGH
HEADLAMP (CHRYSLER)
(EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	L34 20RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
B	Z1 20BK	GROUND



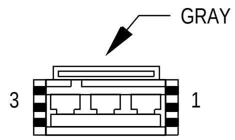
RIGHT LIFTGATE
FLOOD LAMP

CAV	CIRCUIT	FUNCTION
1	M11 20PK/LB	COURTESY LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



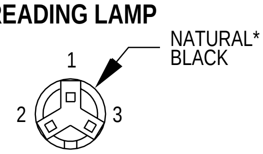
RIGHT LOW
HEADLAMP (CHRYSLER)
(EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	L44 20VT/RD	FUSED RIGHT LOW BEAM OUTPUT
B	Z1 20BK	GROUND



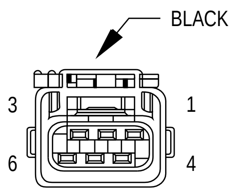
RIGHT MID READING LAMP

CAV	CIRCUIT	FUNCTION
1	M113 20LB/PK	READING LAMP FEED
2	M20 20BR	COURTESY LAMP GROUND
3	F41 20PK/VT	FUSED B(+)



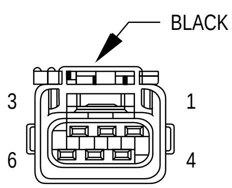
RIGHT REAR DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	G76 18TN/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
3	-	-



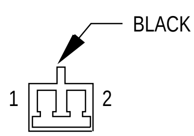
RIGHT REAR LAMP ASSEMBLY (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L36 20LG	REAR FOG LAMP
3	L78 20DG/YL	FUSED B(+)
4	L1 20VT/BK	BACK-UP LAMP FEED
5	L62 18BR/RD	RIGHT TURN SIGNAL
6	L50 18WT/TN	STOP LAMP SWITCH OUTPUT



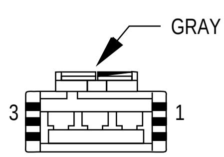
RIGHT REAR LAMP ASSEMBLY (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L62 18BR/RD	RIGHT TURN SIGNAL
2	-	-
3	L1 20VT/BK	BACK-UP LAMP FEED
4	L78 20DG/YL	FUSED B(+)
5	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
6	Z1 20BK	GROUND



RIGHT REAR PILLAR SPEAKER (PREMIUM)

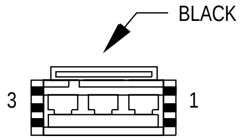
CAV	CIRCUIT	FUNCTION
1	X158 20DB/OR	RIGHT REAR PILLAR SPEAKER (+)
2	X152 20DB/WT	RIGHT REAR PILLAR SPEAKER (-)



RIGHT REAR READING LAMP

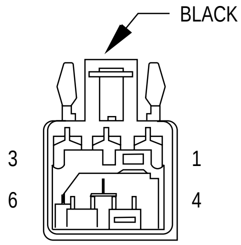
CAV	CIRCUIT	FUNCTION
1	M113 20LB/PK	READING LAMP FEED
2	M20 20BR	COURTESY LAMP GROUND
3	F41 20PK/VT	FUSED B(+)

* DIESEL



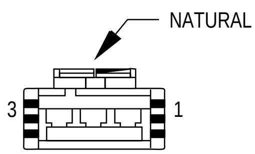
RIGHT REAR
SLIDING DOOR
CONTACTS

CAV	CIRCUIT	FUNCTION
1	F133 20BR/YL	LOCK RELAY OUTPUT
2	F136 20VT/YL	UNLOCK RELAY OUTPUT
3	-	-



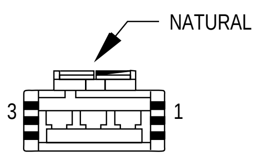
RIGHT REAR
SPEAKER

CAV	CIRCUIT	FUNCTION
1	X152 20DB/WT*	RIGHT REAR SPEAKER (-)
2	X15 16BK/DG*	AMPLIFIED SPEAKER GROUND
3	X52 20DB/WT	RIGHT REAR SPEAKER (+)
4	X158 20DB/OR*	RIGHT REAR SPEAKER (+)
5	X13 16RD/DG*	RADIO CHOKE OUTPUT
6	X58 20DB/OR	RIGHT REAR SPEAKER (-)



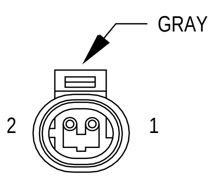
RIGHT REAR
VENT MOTOR
(LHD)

CAV	CIRCUIT	FUNCTION
1	Q24 18DG	RIGHT REAR VENT MOTOR (OPEN)
2	Q14 18GY	RIGHT REAR VENT MOTOR (CLOSE)
3	-	-



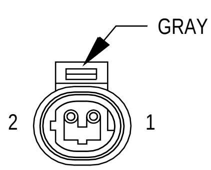
RIGHT REAR
VENT MOTOR
(RHD)

CAV	CIRCUIT	FUNCTION
1	Q23 18RD/WT	RIGHT REAR VENT MOTOR (OPEN)
2	Q13 18DB	RIGHT REAR VENT MOTOR (CLOSE)
3	-	-



RIGHT REAR
WHEEL SPEED
SENSOR

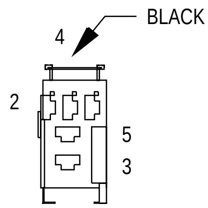
CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)



RIGHT REPEATER
LAMP
(BUILT-UP-EXPORT)

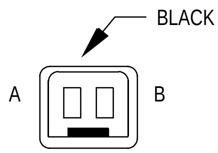
CAV	CIRCUIT	FUNCTION
1	L62 18BR/RD	RIGHT TURN SIGNAL
2	Z1 18BK	GROUND

* PREMIUM



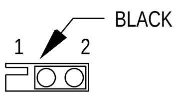
RIGHT STOP/TURN SIGNAL RELAY (TRAILER TOW)

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	
2	Z1 18BK	GROUND
	Z1 18BK	
3	L74 18LG	STOP LAMP SWITCH OUTPUT
4	L62 18BR/RD	RIGHT TURN SIGNAL
5	L605 18DG	RIGHT COMBINATION RELAY OUTPUT



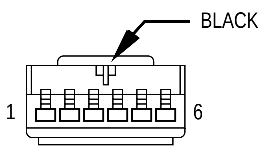
RIGHT VISOR/ VANITY MIRROR LAMPS

CAV	CIRCUIT	FUNCTION
A	M20 20BR	COURTESY LAMP GROUND
B	F41 20PK/VT	FUSED B(+)



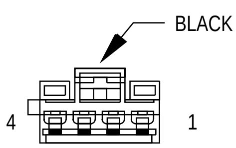
SEAT BELT SWITCH

CAV	CIRCUIT	FUNCTION
1	G10 18LG/RD	SEAT BELT SWITCH SENSE
2	Z1 20BK	GROUND



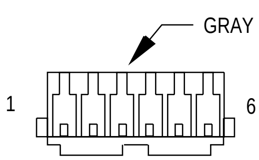
SENTRY KEY IMMOBILIZER MODULE (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	F41 20PK/VT	FUSED B(+)
2	Z2 20BK	GROUND
3	F87 20WT/BK	FUSED IGNITION (ST-RUN)
4	-	-
5	D2 20WT/BK	CCD BUS (-)
6	D1 20VT/BR	CCD BUS (+)



SPEED CONTROL DIMMING MODULE

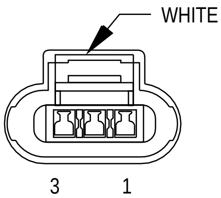
CAV	CIRCUIT	FUNCTION
1	L97 29PK/DB	PARK LAMP RELAY CONTROL
2	-	-
3	V38 20LB/RD	SPEED CONTROL RELAY CONTROL
4	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE



STOP LAMP SWITCH

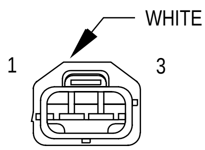
CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	STOP LAMP SWITCH SENSE
2	Z1 20BK	GROUND
3	V32 20YL/RD*	SPEED CONTROL ON/OFF SWITCH SENSE
4	V30 20DB/RD*	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
6	F32 18PK/DB	FUSED B(+)

* GAS



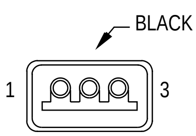
THROTTLE POSITION SENSOR (2.0L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	CRANK POSITION SENSOR
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K6 18VT/WT	5V SUPPLY



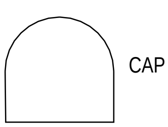
THROTTLE POSITION SENSOR (EXCEPT 2.0L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K6 18VT/WT	5 VOLT SUPPLY



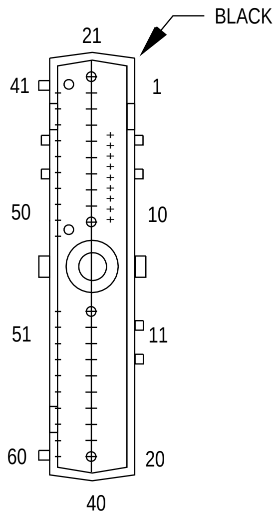
TRACTION CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	B27 20RD/YL	TRACTION CONTROL SWITCH SENSE
3	E2 20OR	PANEL LAMP FEED



TRAILER TOW CONNECTOR

CAV	CIRCUIT	FUNCTION
1	L74 18LG	STOP LAMP SWITCH OUTPUT
2	L78 18BR	FUSED B(+)
3	Z1 18WT	GROUND
4	L73 18YL	STOP LAMP SWITCH OUTPUT



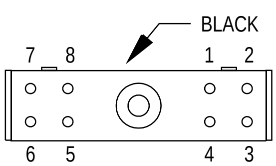
TRANSMISSION CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRANSMISSION RANGE SWITCH T1 SENSE
2	-	-
3	T3 18VT	TRANSMISSION RANGE SWITCH T3 SENSE
4	D2 18WT/BK	CCD BUS(-)
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	F45 18YL/RD	FUSED IGNITION (ST)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F11 18RD/WT	FUSED IGNITION (ST-RUN-OFF)
12	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SHAFT SPEED SENSOR SIGNAL
15	T15 18LG	12 VOLT SUPPLY
16	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
18	-	-
19	T19 18WT	2-4 SOLENOID CONTROL
20	T20 18LB	LOW/REVERSE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-

(CONTINUED ON NEXT PAGE)

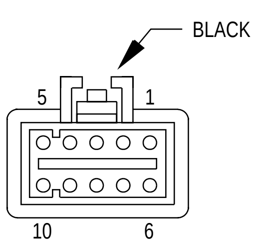
(CONTINUED)

CAV	CIRCUIT	FUNCTION
41	T41 18BK/WT	TRANSMISSION RANGE SWITCH T41 SENSE
42	T42 18VT/WT	TRANSMISSION RANGE SWITCH T42 SENSE
43	D1 18VT/BR	CCD BUS(+)
44	-	-
45	-	-
46	D6 18PK/LB	SCI RECEIVE
47	T47 18YL/BK	2/4 PRESSURE SWITCH SENSE
48	-	-
49	-	-
50	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z14 16BK/YL	EATX GROUND
54	T54 18VT/LG	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	-	-
56	A5 18RD/DB	FUSED B(+)
57	Z13 16BK/RD	EATX GROUND
58	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
59	T59 18PK	UNDERDRIVE SOLENOID CONTROL
60	T60 18BR	OVERDRIVE SOLENOID CONTROL



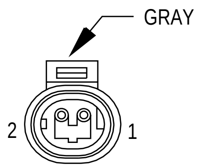
TRANSMISSION CONTROL SOLENOIDS

CAV	CIRCUIT	FUNCTION
1	T47 18YL/BK	2/4 PRESSURE SWITCH SENSE
2	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE
3	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
4	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
5	T59 18PK	UNDERDRIVE PRESSURE SWITCH SENSE
6	T60 18BR	OVERDRIVE SOLENOID CONTROL
7	T20 18LB	LOW/REVERSE SOLENOID CONTROL
8	T19 18WT	2/4 SOLENOID CONTROL



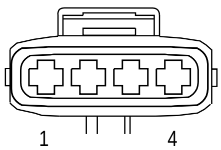
TRANSMISSION RANGE SENSOR

CAV	CIRCUIT	FUNCTION
1	F20 18WT	FUSED IGNITION SWITCH OUTPUT
2	-	-
3	T13 18DB/BK	SPEED SENSOR GROUND
4	T54 18VT/LG	TRANSMISSION TEMPERATURE SENSOR SIGNAL
5	T41 18BK/WT	TRANSMISSION RANGE SENSOR T41 SENSE
6	L1 18VT/BK	BACK-UP LAMP FEED
7	T1 18LG/BK	TRANSMISSION RANGE SENSOR T1 SENSE
8	T3 18VT	TRANSMISSION RANGE SENSOR T3 SENSE
9	T42 18VT/WT	TRANSMISSION RANGE SENSOR T42 SENSE
10	T41 18BR/YL	TRANSMISSION RANGE SENSOR T41 SENSE



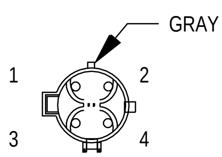
TURBINE SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL



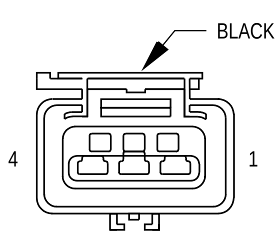
TURBO BOOST PRESSURE SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL
3	K9 18LB	5 VOLT SUPPLY
4	K1 18DG/RD	BOOST PRESSURE SIGNAL



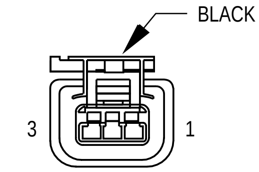
UPSTREAM HEATED OXYGEN SENSOR

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	A142 18DG/OR	ASD RELAY OUTPUT
3	K4 18BK/LB	SENSOR GROUND
4	K41 18BK/DG	UPSTREAM HEATED OXYGEN SENSOR SIGNAL



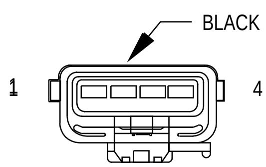
VEHICLE SPEED CONTROL SERVO

CAV	CIRCUIT	FUNCTION
1	V36 18TN/RD	SPEED CONTROL VACUM SOLENOID CONTROL
2	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 18DB/RD	STOP LAMP SWITCH OUTPUT
4	Z1 18BK	GROUND



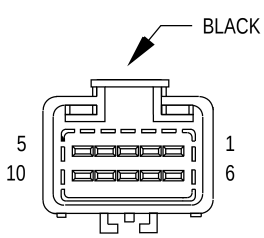
VEHICLE SPEED SENSOR (EXCEPT 3.3L/3.8L)

CAV	CIRCUIT	FUNCTION
1	K7 18OR	8 VOLT SUPPLY
1	F87 18WT/BK*	FUSED IGNITION (ST-RUN)
2	K4 18BK/LB	SENSOR GROUND
2	K4 20BK/LB*	SENSOR GROUND
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL



WIPER MODULE (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	V3 12BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
2	V7 20DG/WT	WIPER PARK SWITCH SENSE
3	V4 12RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
4	Z1 14BK	GROUND



WIPER MODULE (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	V3 12BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
2	V7 20DG/WT	WIPER PARK SWITCH SENSE
3	V4 12RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
4	Z1 14BK	GROUND
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-

* DIESEL

J988W-3 NSGS8088

8W-90 CONNECTOR/GROUND LOCATIONS

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DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of components, grounds, and connectors in the vehicle. A index is provided. Use the wiring diagrams in each section for connector/ground number identification. Refer to the index for the proper figure number.

CONNECTOR/GROUND LOCATIONS

For items not shown in this section a N/S is placed in the Fig. column.

Component/ Ground	Color	Location	Fig.
A/C Compressor Clutch	BK	Top of A/C Compressor	5, 6, 7, 8, 9
A/C-Heater Control Module C1	NAT	Rear of Control	11
A/C-Heater Control Module C2	BK	Rear of Control	11
A/C Pressure Transducer	GY	RT Side Cowl	3
A/C Zone Door Actuator	NAT	LT Side of HVAC	15
Airbag Control Module C1	YL	Rear of I.P. Center Stack	12
Airbag Contol Module C2	BK	Rear of I.P. Center Stack	12
All Wheel Drive Solenoid	BK	Near Fuel Tank	20
Ambient Temperature Sensor	BK	On Radiator Closure Panel	4
Ash Receiver Lamp	RD	At Lamp	10
Automatic Day/Night Mirror	BK	At Mirror	15
B01	BK	LT Kick Panel	18
B02	BK	LT Kick Panel	18
B03	BK	RT Kick Panel	18

Component/ Ground	Color	Location	Fig.
B09	BK	Under Seat	16
B17	BK	LT Quarter Panel	21
B23	BK	RT of Steering Column	13
B33	BK	LT Frame Rail	2
B56	RD	Under Seat	16
B70	LT/GY	LT Frame Rail	2
B75	BL	Bottom of RT B-Pillar	12
B98	BK	Rear of RT Tail	N/S
B99	BK	Rear of LT Tail Lamp	N/S
B120	BK	LT Kick Panel	N/S
Backup Lamp Switch (M/T)	BK	On Transmission	5, 6, 8
Blend Door Actuator	NAT	LT Side of HVAC	15
Body Control Module C1	NAT	On Junction Block	12, 13
Brake Pressure Switch	BK	On Master Cylinder	2
C19		Above RT Vanity Mirror	17
Camshaft Position Sensor 2.4L	BK	Rear of Cylinder Head	6, 7

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Camshaft Position Sensor 3.3L, 3.8L	BK	RT Side of Engine	9
Center Dome Lamp	BK	At Lamp	N/S
CHMSL	RD	Rear of CHMSL	21
Cigar Lighter	BK	Rear of Lighter	9
Clockspring C1	YL	Rear of Clockspring	11
Clockspring C2	NAT	Rear of Clockspring	11
Clutch Interlock Switch	BK	Top of Clutch Pedal	13
Controller Anti-Lock Brake	BK	RT Side of Engine Compartment	N/S
Crankcase Vent Heater		At Heater	N/S
Crankshaft Position Sensor	BK	Rear of Engine	5, 6, 7, 9
D01	BK	On Kick Panel	18
D02	BK	On Kick Panel	18
Data Link Connector	BK	LT of Steering Column	12
Downstream Heated Oxygen Sensor	BK	Front Center of Floor Pan	16
Driver Airbag	YL	Rear of Airbag	11
E36	BK	LT Frame Rail	2
E40	BK	At Radiator Fan Module	N/S
E43	LT/GY	LT Frame Rail	2
E69	BK	LT Side of Intake	6, 7
E78	BK	Near Throttle Body	9
EC1		Above RT Vanity Mirror	17
EGR Solenoid	BK	LT Rear of Engine	6, 9
Electric Wiper De-Icer C1	BK	At Left Base of Windshield	11
Electric Wiper De-Icer C2	BK	At Right Base of Windshield	11

Component/ Ground	Color	Location	Fig.
Engine Coolant Temp Sensor 2.4L	BK	On Cylinder Block	N/S
Engine Coolant Temp Sensor 2.5	BK	On Cylinder Head	8
Engine Coolant Temp Sensor 3.3L, 3.8L	BK	On Cylinder Block	N/S
Engine Oil Pressure Switch	GN	On Cylinder Block	5, 6, 7, 8, 9
Engine Starter Motor		Rear of Starter	5, 6, 7, 8, 9
EVAP/Purge Solenoid	BK	RT Motor Mount	3
Evaporator Temperature Sensor	BK	RT Side of HVAC	N/S
F02	BK	Near Throttle Body	9
F09	BK	LT Side of Intake	6, 7
Front Blower Motor	BK	At Motor	10
Front Blower Motor Resistor Block	BK	RT Side Cowl	4
Front Cigar Lighter	BK	Rear of Lighter	9
Front Reading Lamps/Switch	RD	At Lamp	15
Front Washer Motor	BK	Bottom of Reservior	4
Fuel Injection Pump	BK	Near Pump	8
Fuel Injector #1	BK	At Injector	N/S
Fuel Injector #2	BK	At Injector	N/S
Fuel Injector #3	BK	At Injector	N/S
Fuel Injector #4	BK	At Injector	N/S
Fuel Injector #5	BK	At injector	N/S
Fuel Injector #6	BK	At Injector	N/S
Fuel Injectors (2.0L)	BK	At Injectors	5
Fuel Pump Heater	BK	At Heater	N/S
Fuel Pump Module	LT/GY	Side of Fuel Tank	20

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
G100		LT Frame Rail	3
G101 2.4L		Rear of Cylinder Head	6, 7
G101 3.3L, 3.8L		Rear of Cylinder Block	9
G102		LT Frame Rail	3
G103 2.4L		Rear of Cylinder Head	6, 7
G103 3.3L, 3.8L		Rear of Cylinder Block	9
G104		Rear of Right Headlamp	4
G200		Right of I.P. Center Stack	10
G201		I.P. Center Support	10
G202		I.P. Center Support	10
G204		I.P. Center Support	10
G300		LT Kick Panel	13
G301		RT Kick Panel	14
G302		LT Quarter Panel	21
G400		In Liftgate	23
Generator	BK	Rear of Generator	5, 6, 7, 8, 9
Glove Box Lamp	BL	Rear of Glove Box	11
Glow #1	BK	At Glow Plug	8
Glow #2	BK	At Glow Plug	8
Glow #3	BK	At Glow Plug	8
Glow #4	BK	At Glow Plug	8
Headlamp Dimmer Switch	BK	Part of Multifunction Switch	11
Headlamp Switch C1	NAT	Rear of Switch	11
Headlamp Switch C2	BK	Rear of Switch	11
Headlamp Washer Pump	BK	At Pump	N/S
High Note Horn	BK	LT Frame Rail	4
Hood Ajar Switch	NAT	LT Fender	2

Component/ Ground	Color	Location	Fig.
Horn Switch		Rear of Driver Airbag	11
Idle Air Control Motor	BK	On Throttle Body	5, 6, 7, 8, 9
Ignition Coil Pack 2.0L	BK	Top of Valve Cover	5
Ignition Coil Pack 2.4L	BK	Top of Valve Cover	6, 7
Ignition Coil Pack 3.3L, 3.8L	BK	RT Side of Engine	9
Ignition Switch C1	GY	Rear of Switch	11
Ignition Switch C2	GN	Rear of Switch	11
Ignition Switch C3	BK	Rear of Switch	11
Instrument Cluster	RD	Rear of Cluster	11
Intake Air Temp Sensor	GY	On Intake	6, 7
J01D	BK	RT Side of HVAC	15
J02A	BK	Top of Liftgate	23
JO3A	BK	Top of Liftgate	23
Junction Block C1	GY	On Junction Block	13
Junction Block C2	GY	On Junction Block	13
Junction Block C3	GY	On Junction Block	12
Junction Block C4	GY	On Junction Block	12
Key-In Halo Lamp	WT	Rear of Lamp	11
Knock Sensor 2.0L	GY	Front of Cylinder Block	5
Knock Sensor 2.4L	GY	Front of Cylinder Block	6, 7
Knock Sensor 3.3L, 3.8L	GY	Front of Cylinder Block	N/S
L15	BK	Top of Liftgate	23
L16	BK	Top of Liftgate	23
Left Flasher Relay	BK	LT Rear Quarter Panel	N/S
Left Door Ajar Switch	BK	LT B-PIllar	14

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Left Door Arm/Disarm Switch	BK	At Switch	19
Left Door Courtesy Lamp	BK	At Lamp	19
Left Door Speaker	BK	At Speaker	19
Left Front Fog Lamp	BK	At Lamp	4
Left Front Door Lock Motor	BK	At Motor	19
Left Front Panel Speaker	BK	At Speaker	11
Left Front Park/Turn Signal Lamp	BK	At Lamp	4
Left Front Wheel Speed Sensor	BK	LT Fender Side Shield	2
Left Front Window Motor	RD	At Motor	19
Left Headlamp	BK	At Lamp	2
Left Headlamp Leveling Motor	BK	At Motor	N/S
Left Liftgate Flood Lamp	BK	At Lamp	21
Left Mid Reading Lamp	GY	At Lamp	15
Left Power Door Lock Switch	BK	At Switch	19
Left Power Mirror C1	RD	At Mirror	11
Left Power Mirror C2	BL	At Mirror	11
Left Power Window Switch	BK	At Switch	19
Left Rear Door Ajar Switch	BK	LT C-Pillar	21
Left Rear Lamp Assembly	BK	At Lamp	21
Left Rear Pillar Speaker	BK	At Speaker	21
Left Rear Reading Lamp	BK	At Lamp	15
Left Rear Sliding Door Contacts	BK	LT B-Pillar	14

Component/ Ground	Color	Location	Fig.
Left Rear Sliding Door Lock Motor	BK	At Motor	N/S
Left Rear Speaker	BK	At Speaker	21
Left Rear Vent Motor	NAT	At Motor	21
Left Rear Wheel Speed Sensor	BK	Center Rear of Floor Pan	16
Left Repeater Lamp	GY	At Lamp	N/S
Left Speed Control Switch		Left Side of Steering Wheel Pad	11
Left Stop/Turn Signal Relay	BK	LT Quarter Panel	N/S
Left Visor/Vanity Lamp	BK	At Lamp	15
License Lamp	GY	At Lamps	21
Liftgate Ajar Switch	BK	At Latch	21
Liftgate Arm/Disarm Switch	BK	At Key Cylinder	21
Liftgate Door Lock Motor	BK	At Motor	21
LJ01	BK	LT Quarter Panel	21
Low Coolant Switch	BK	At Reservior	8
Low Note Horn	BK	LT Frame Rail	4
Low Washer Fluid Level Switch	BK	Bottom of Reservior	N/S
MAP Sensor 2.0L	BK	On Intake	5
MAP Sensor 2.4L	BK	On Intake	N/S
MAP Sensor 3.3L, 3.8L	BK	Near Throttle Body	9
Memory Seat/Mirror Module	BK	Under Seat	16
Memory Set Switch	BL	At Switch	19

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Message Center	BL	Rear of Message Center	11
Mode Door Actuator	BK	LT Side of HVAC	15
Multi Function Switch	BK	Rear of Switch	11
Name Brand Speaker Relay	LT/GY	LT of Steering Column	11
Needle Movement Sensor	BK	Back of Generator	8
Output Shaft Speed Sensor	GY	Front of Transmission	7, 9
Overhead Console	RD	Front of Console	15
P18	GY	RT of Steering Column	12
P25	BK	RT of I.P Center Stack	10
P30	BK	RT Side of HVAC	10
P34	GY	RT of Steering Column	12
P50	NAT	Right Side of HVAC Unit Taped to Harness	10
Park Brake Switch	BK	Top of Park Brake	13
Park/Neutral Positon Switch	BK	Front of Transmission	N/S
Passenger Airbag	YL	Rear of Airbag	11
PDC C1	NAT	Bottom of PDC	2
PDC C2	OR	Bottom of PDC	2
PDC C3	DK/ GN	Bottom of PDC	2
PDC C4	BK	Bottom of PDC	2
PDC C5	LT/GY	Bottom of PDC	2
PDC C6	LT/GN	Bottom of PDC	3
PDC C7	LT/GY	Bottom of PDC	3
PDC C8	BL	Bottom of PDC	3
Power Folding Mirror Switch	BK	At Switch	N/S

Component/ Ground	Color	Location	Fig.
Power Mirror Switch	BK	Rear of Switch	11
Power Steering Pressure Switch	BK	RT Side of Engine Compartment	N/S
Powertrain Control Module C1	BK	LT Fender Side Shield	3
Powertrain Control Module C2	BK	LT Fender Side Shield	3
Radiator Fan No.1	BK	At Motor	N/S
Radiator Fan No.2	BK	At Motor	N/S
Radiator Fan Solid State Relay	BK	LT Front Frame Rail	3
Radio C1	GY	Rear of Radio	11
Radio C2	BK	Rear of Radio	11
Radio C3	BK	Rear of Radio	11
Radio Choke	LT/GY	Rear of Radio	N/S
Rear A/C-Heater Unit	LT/GN	RT Quarter Panel	22
Rear Blower Front Control Switch	BK	Rear of Switch	11
Rear Blower Rear Control Switch	BK	At Switch	N/S
Rear Cigar Lighter/Power Outlet	BK	LT Quarter Panel	21
Rear Dome Lamp	BK	At Lamp	N/S
Rear Washer Motor	BK	Bottom of Reservior	4
Rear Window Defogger	BK	On Liftgate	21
Rear Wiper Motor	BK	At Motor	21
Recirculation Door Actuator	NAT	RT Side of HVAC	15
Remote Keyless Entry Module	RD	Top Left of I.P.	11
RF3	BK	At Radiator Fan	N/S

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Right Door Arm/Disarm Switch	BK	At Switch	17
Right Door Courtesy Lamp	BK	At Lamp	17
Right Door Speaker	BK	At Speaker	17
Right Flasher Relay	BK	LT Quarter Panel	N/S
Right Front Fog Lamp	BK	At Lamp	4
Right Front Door Ajar Switch	BK	RT B-Pillar	12
Right Front Door Lock Motor	BK	At Motor	17
Right Front Panel Speaker	BK	At Speaker	11
Right Front Park/Turn Signal Lamp	BK	At Lamp	4
Right Front Wheel Speed Sensor	BK	Right Fender Side Shield	4
Right Front Window Motor	RD	At Motor	19
Right Headlamp	BK	At Lamp	4
Right Headlamp Leveling Motor	BK	At Motor	N/S
Right Liftgate Flood Lamp	BK	At Lamp	23
Right Mid Reading Lamp	GY	At Lamp	17
Right Power Door Lock Switch	BK	At Switch	19
Right Power Mirror C1	RD	At Mirror	11
Right Power Mirror C2	BL	At Mirror	11
Right Power Window Switch	BK	At Switch	19
Right Rear Lamp Assembly	BK	At Lamp	22
Right Rear Door Ajar Switch	BK	RT C-Pillar	22

Component/ Ground	Color	Location	Fig.
Right Rear Pillar Speaker	BK	At Speaker	22
Right Rear Reading Lamp	GY	At Lamp	17
Right Rear Sliding Door Contact	BK	RT B-Pillar	14
Right Rear Sliding Door Lock Motor	BK	At Motor	N/S
Right Rear Speaker	BK	At Speaker	22
Right Rear Vent Motor	NAT	At Motor	22
Right Rear Wheel Speed Sensor	BK	Center Rear of Floor Pan	16
Right Repeater Lamp	GY	At Lamp	N/S
Right Speed Control Switch		Right Side of Steering Wheel Pad	11
Right Stop/Turn Signal Relay	BK	LT Quarter Panel	N/S
Right Visor/ Vanity Lamp	BK	At Lamp	17
S02	BK	Under Seat	N/S
Seat Belt Switch	BK	LT B-Pillar	N/S
Sentry Key Immobilizer Module	BK	Near Steering at Module	11
Stop Lamp Switch	GY	Top of Brake Pedal	13
T05	BK	LT Quarter Panel	N/S
T08	BK	LT Quarter Panel	N/S
Throttle Position Sensor	NAT	On Throttle Body	5, 6, 7, 8, 9
Trailer Tow Connector	BK	LT Quarter Panel	N/S
Transmission Control Module	BK	RT Fender Side Shield	3
Transmission Range Sensor	BK	Top of Transmission	7, 9

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Transmission Control Solenoids	BK	Front of Transmission	7, 9
Turbine Speed Sensor	GY	Front of Transmission	7, 9
Turn Signal/ Hazard Switch	BK	Part of Multifunction Switch	11
Upstream Heated Oxygen Sensor	GY	Rear of Engine	5, 6, 7, 8, 9
Vehicle Speed Control Servo	BK	LT Rear of Engine Compartment	5, 6, 7, 8, 9
Vehicle Speed Sensor	BK	Rear of Transmission	5, 6, 8
Windshield Wiper Switch	BK	Part of Multifunction Switch	11
Wiper Module	BK	LT Side of Engine	2

DESCRIPTION AND OPERATION (Continued)

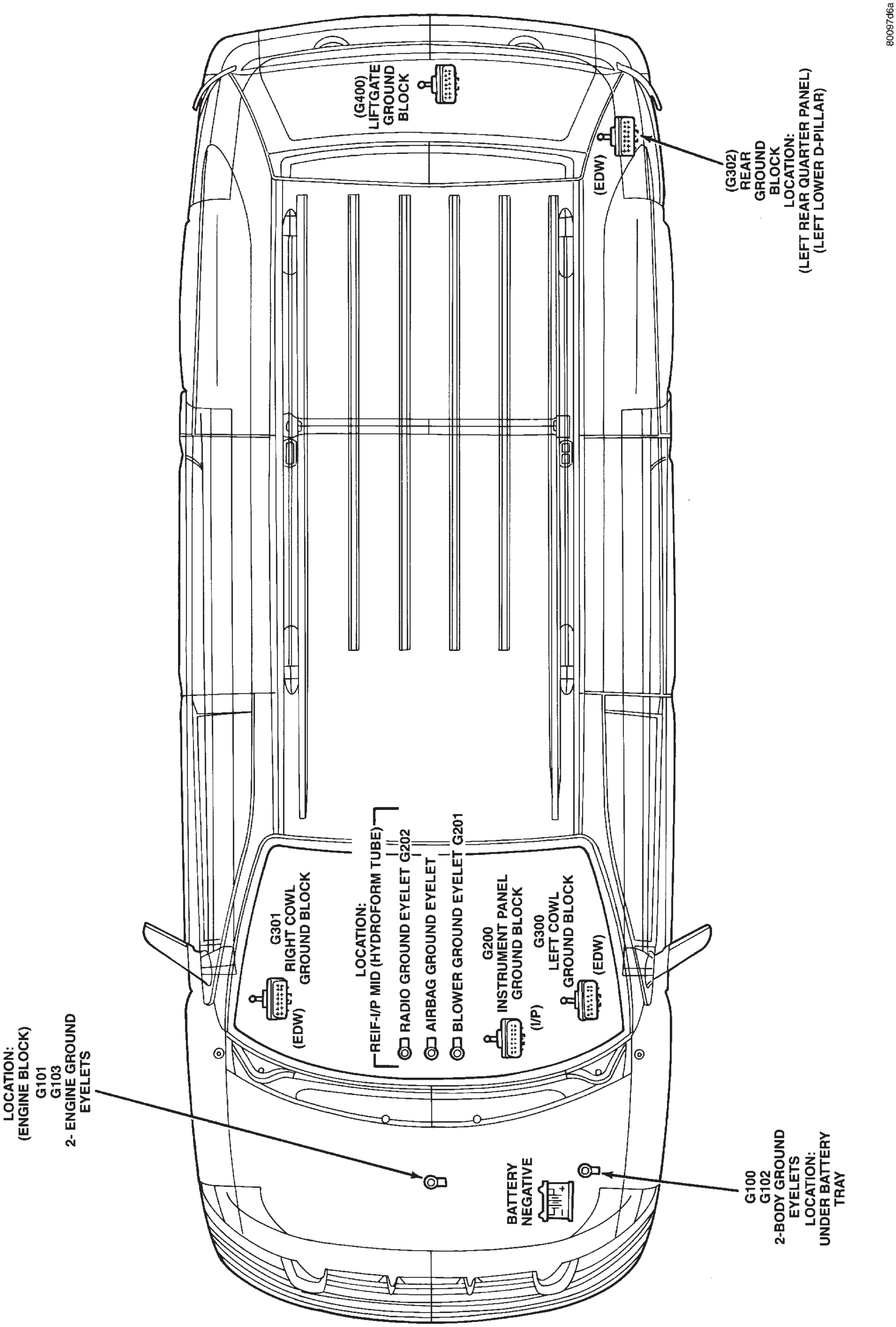

Fig. 1 Ground Locations—LHD

DESCRIPTION AND OPERATION (Continued)

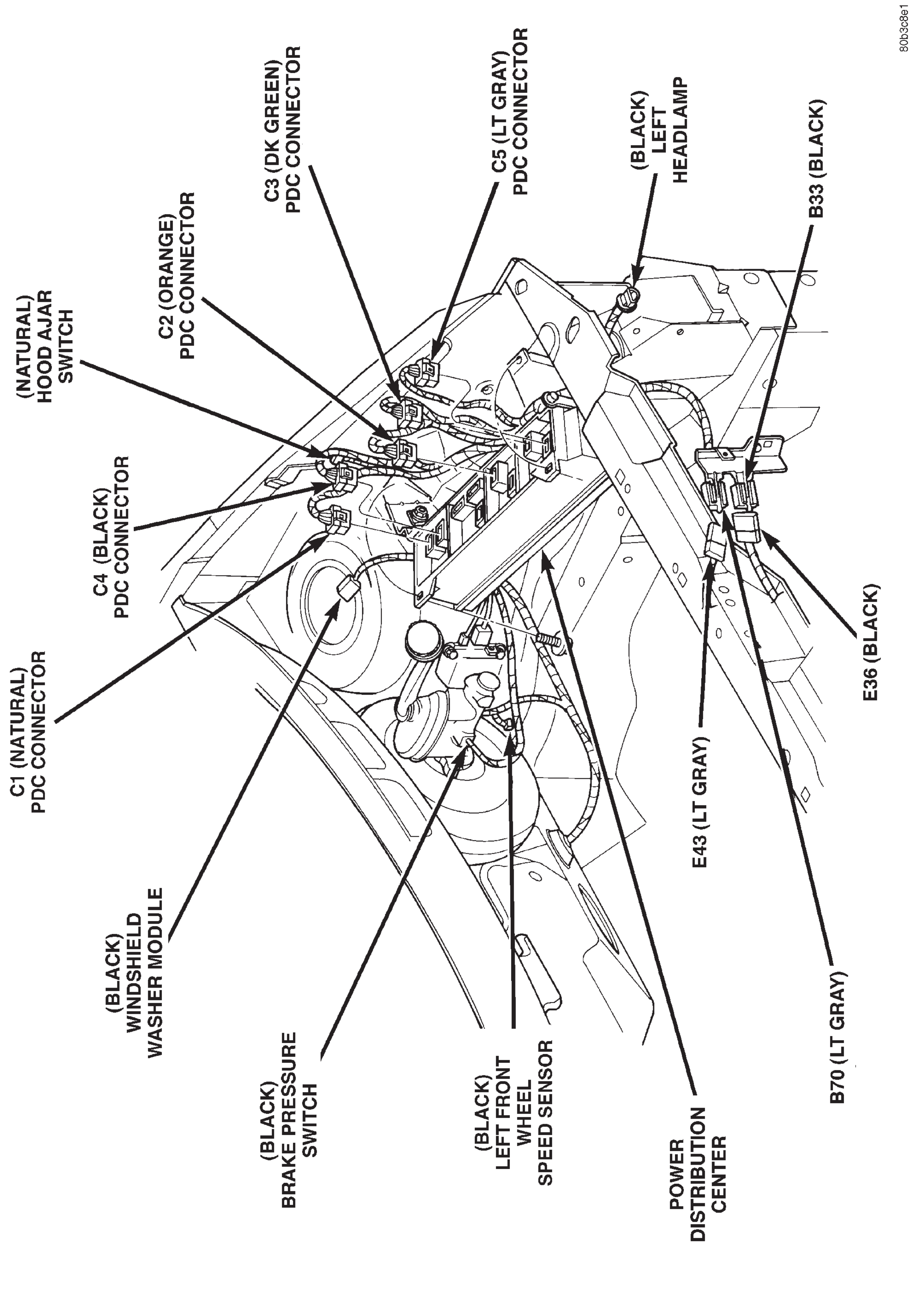

Fig. 2 Engine Compartment Connetions—LHD

DESCRIPTION AND OPERATION (Continued)

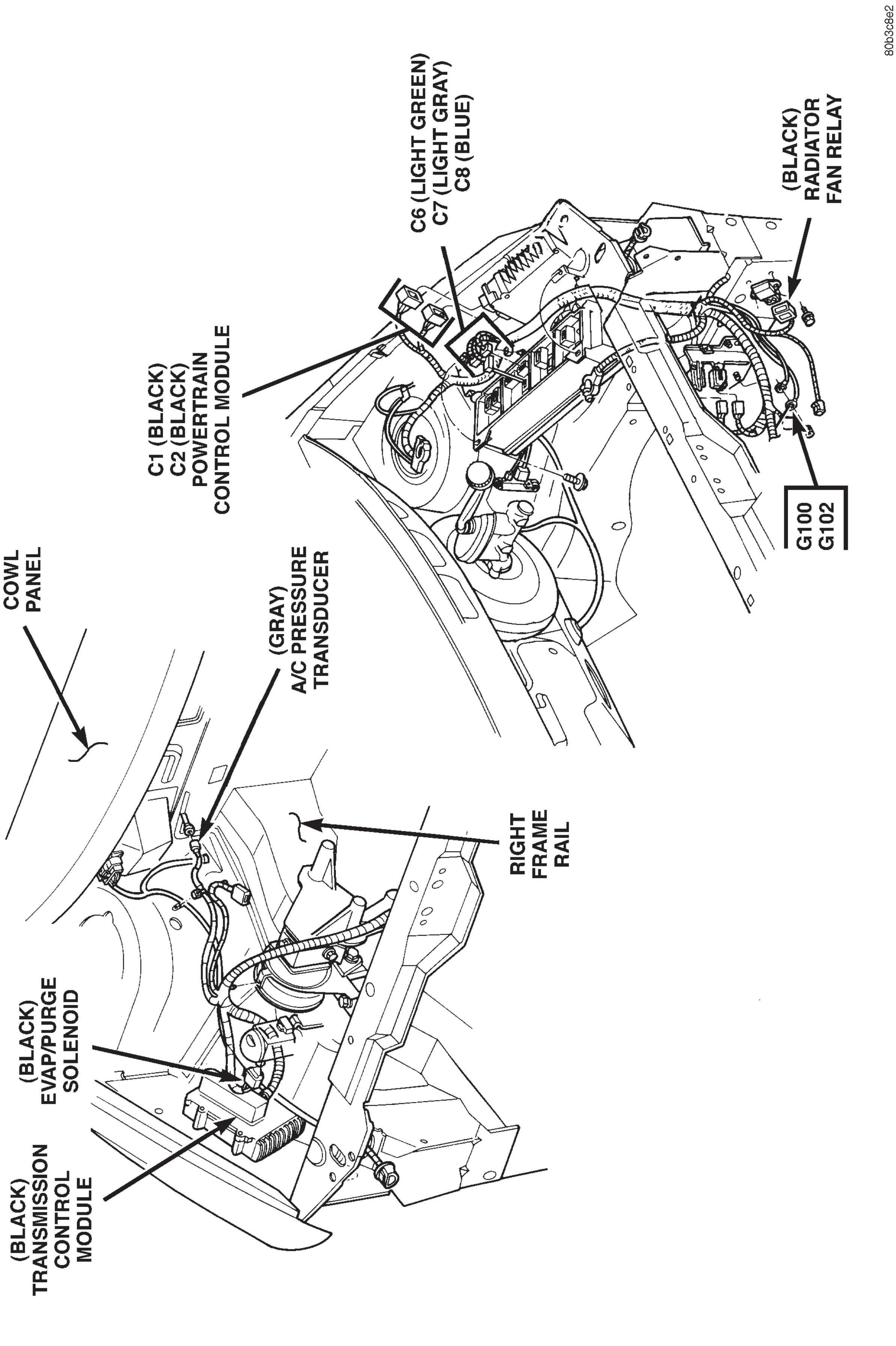

Fig. 3 Engine Compartment Connections—LHD

DESCRIPTION AND OPERATION (Continued)

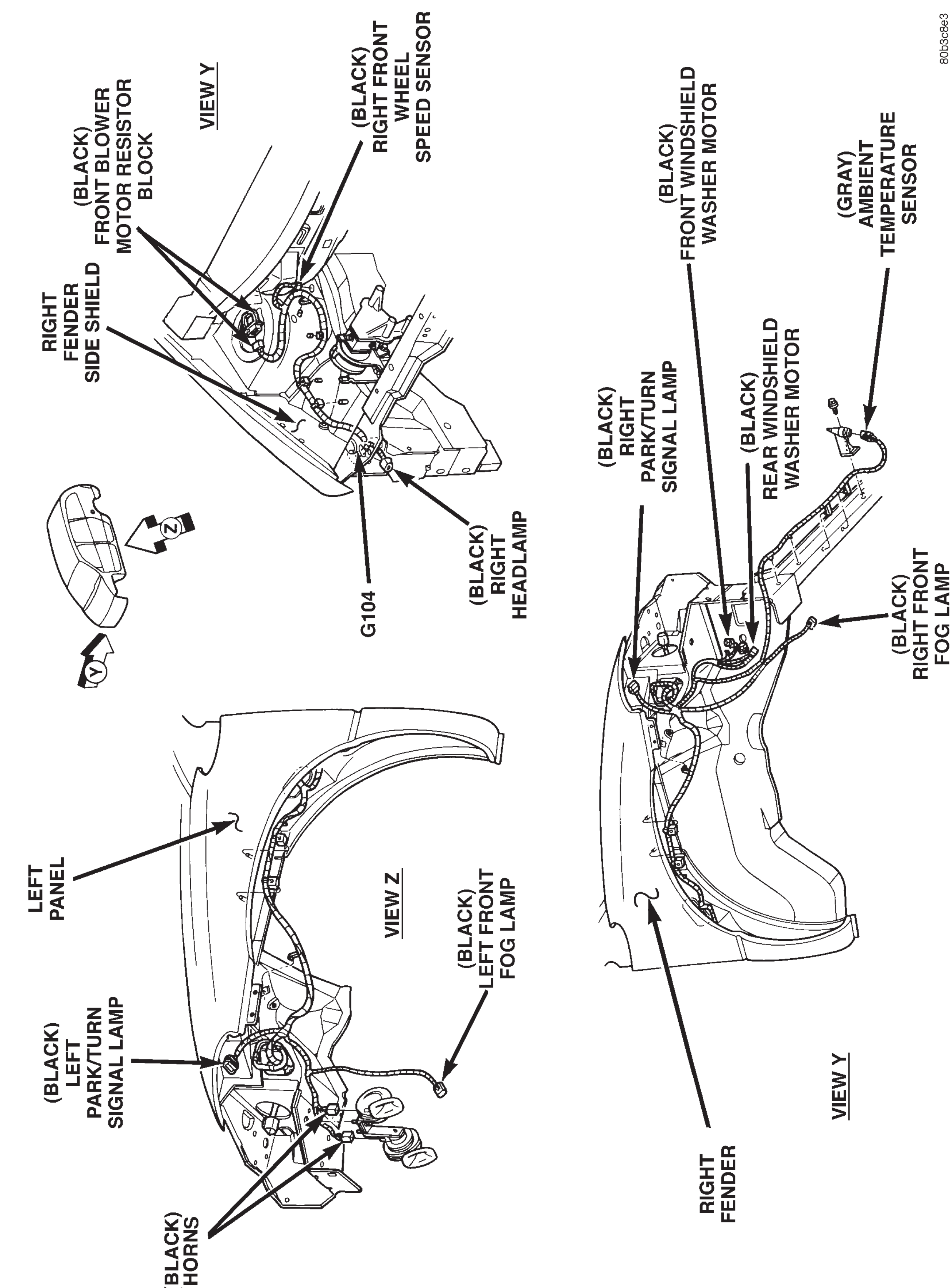

Fig. 4 Engine Compartment Connections—LHD

DESCRIPTION AND OPERATION (Continued)

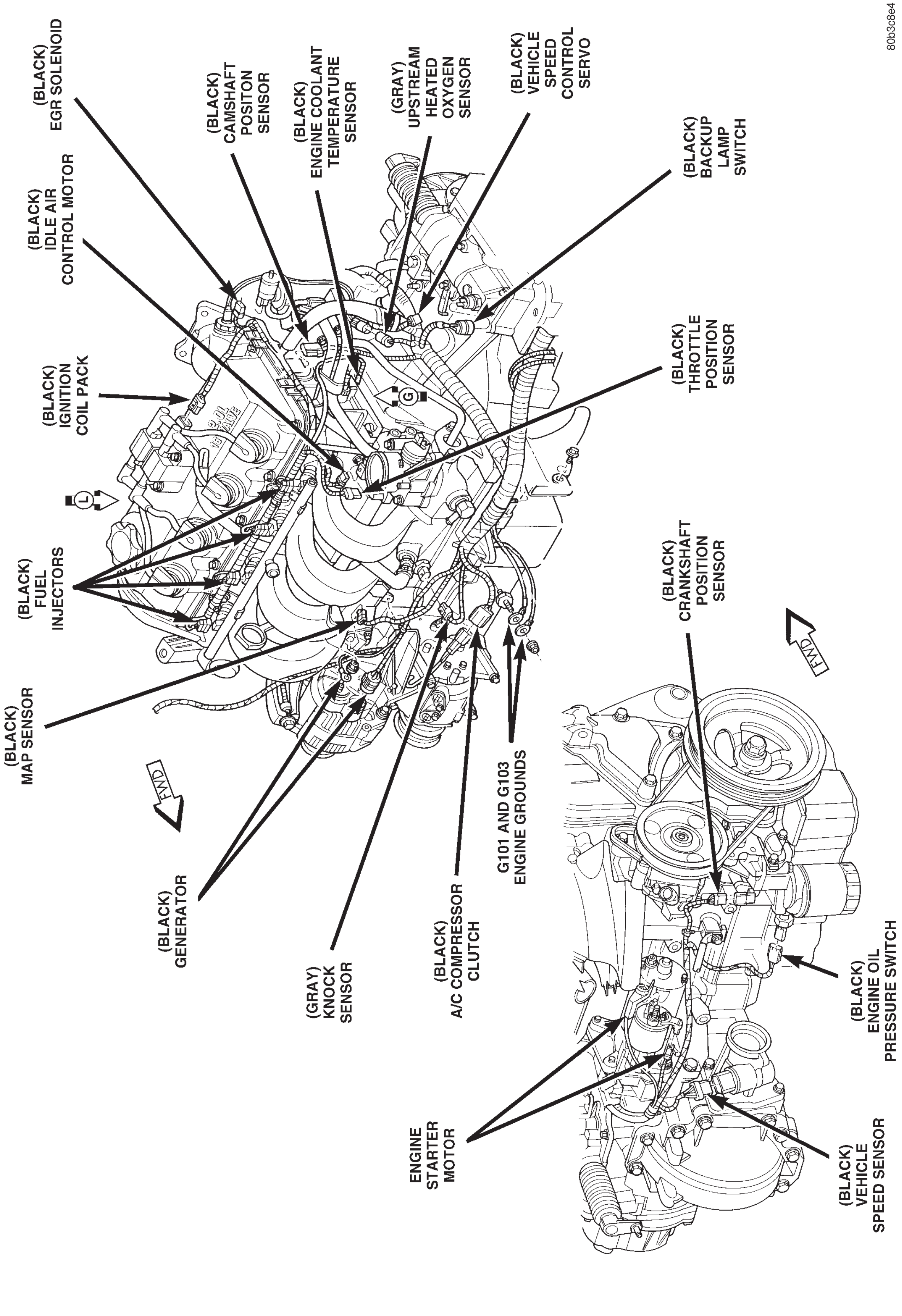

Fig. 5 Engine Connections—2.0L, LHD

DESCRIPTION AND OPERATION (Continued)

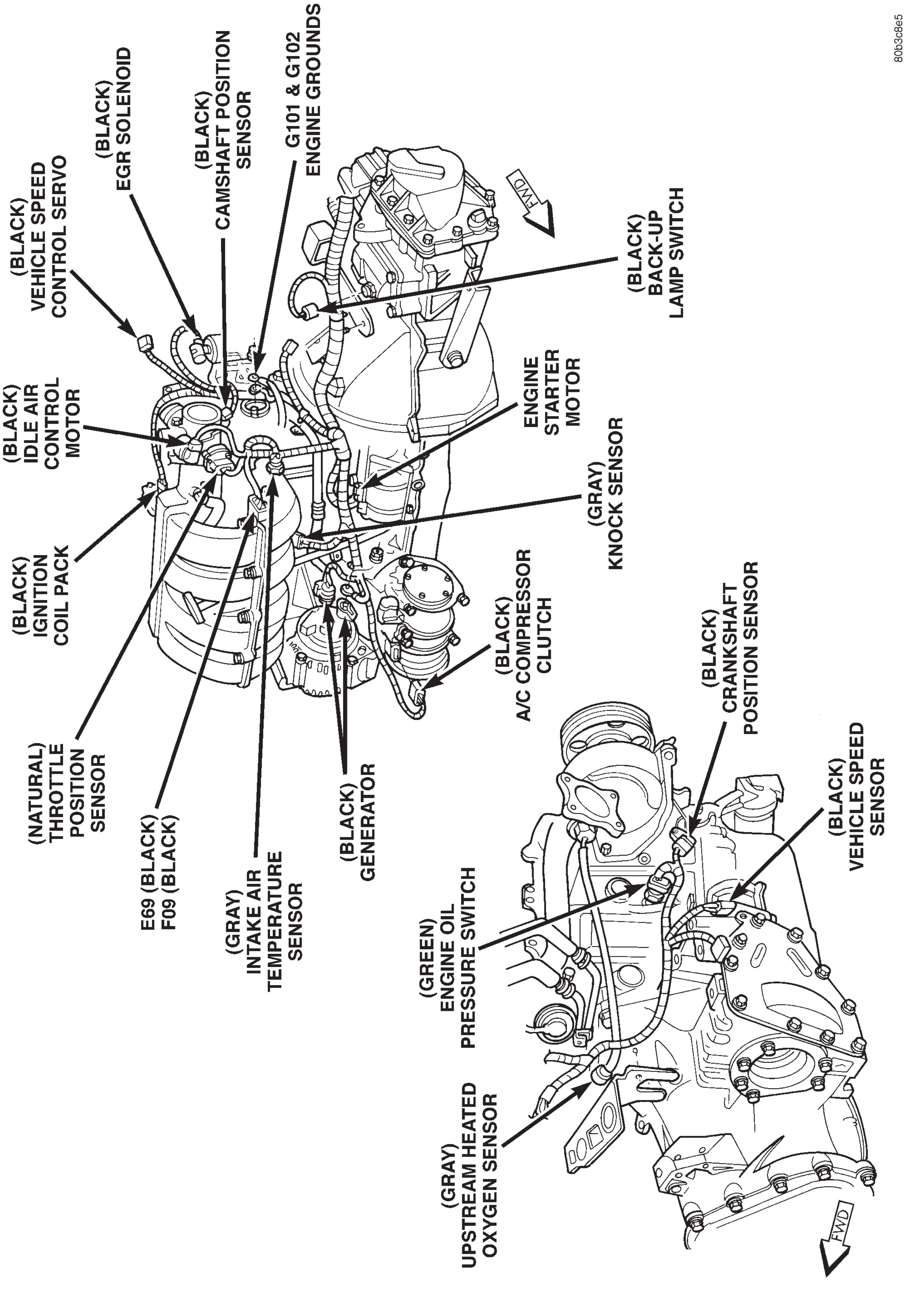

Fig. 6 Engine Connections—2.4L (M/T), LHD

DESCRIPTION AND OPERATION (Continued)

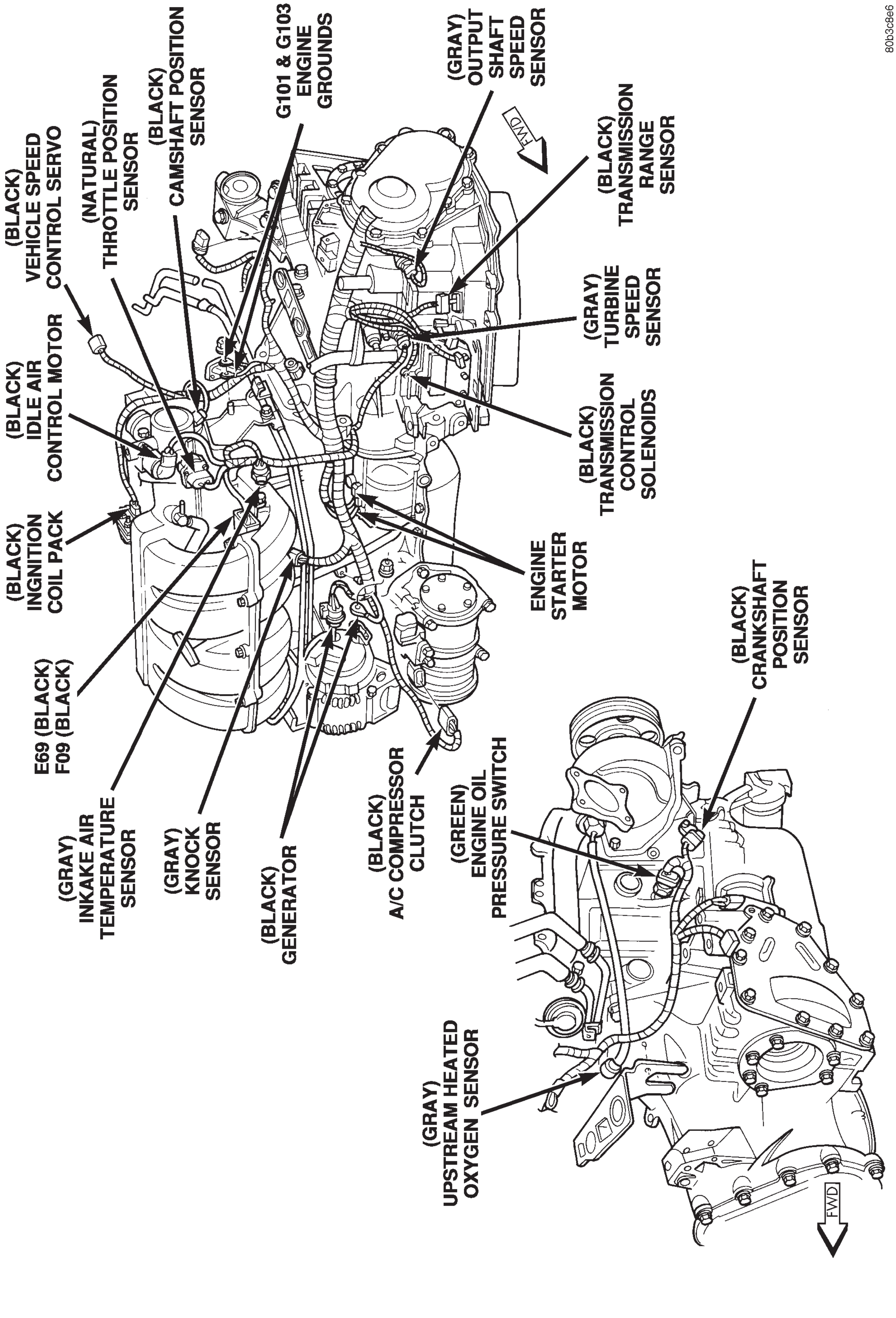

Fig. 7 Engine Connections—2.4L (A/T), LHD

DESCRIPTION AND OPERATION (Continued)

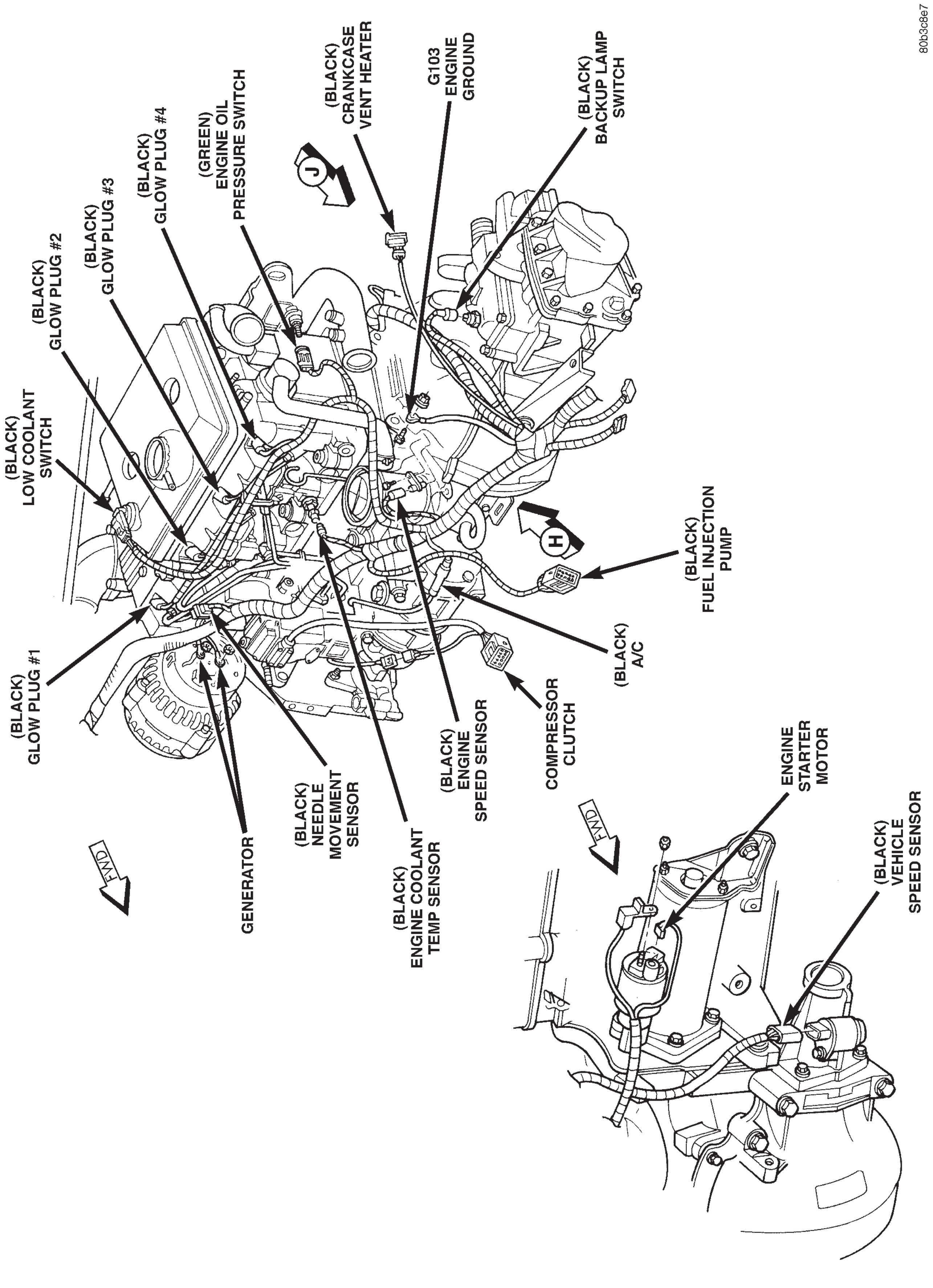

Fig. 8 Engine Connections—2.5L, LHD

DESCRIPTION AND OPERATION (Continued)

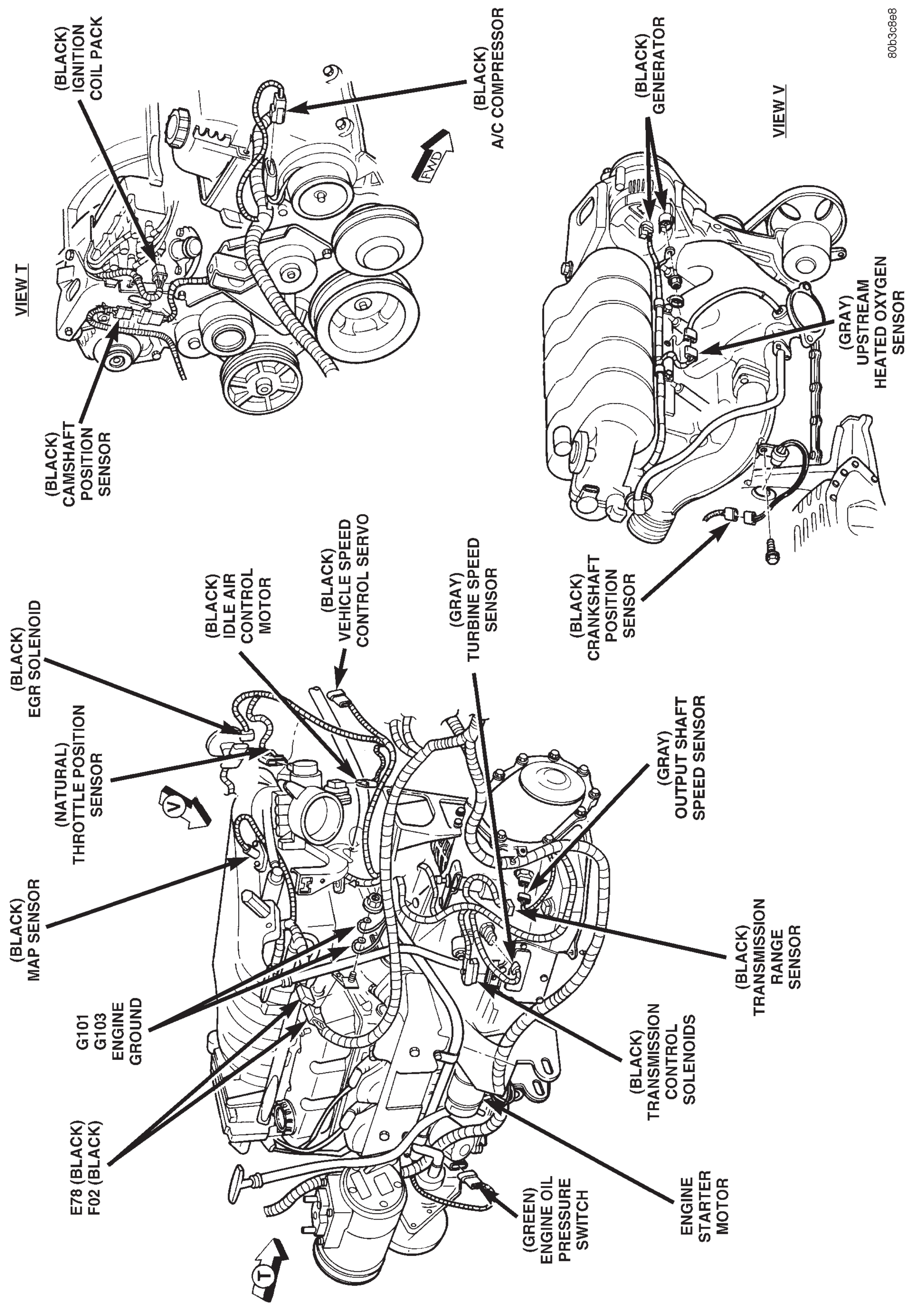

Fig. 9 Engine Connections—3.3L, 3.8L, LHD

DESCRIPTION AND OPERATION (Continued)

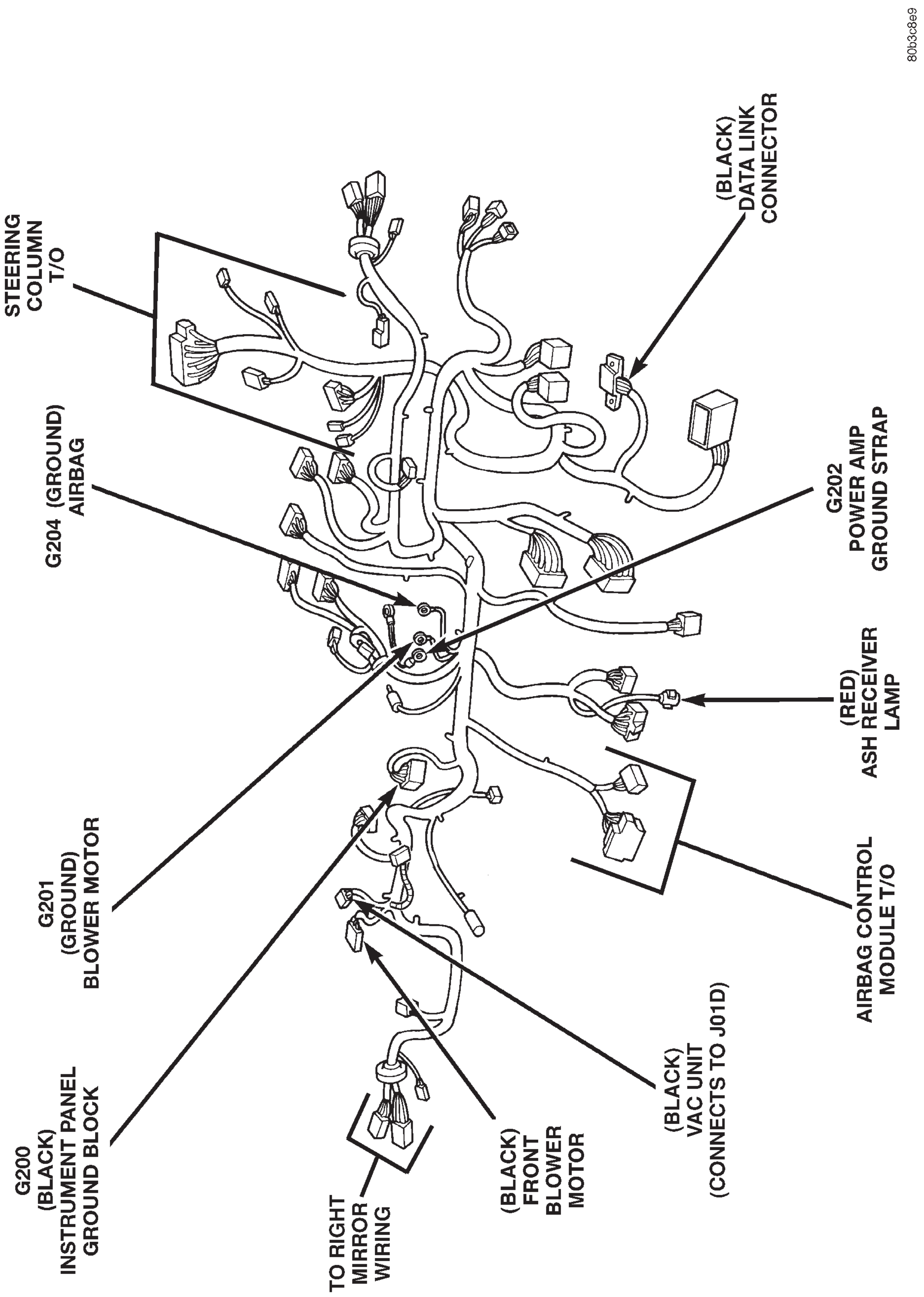

Fig. 10 Instrument Panel Connections—LHD

DESCRIPTION AND OPERATION (Continued)

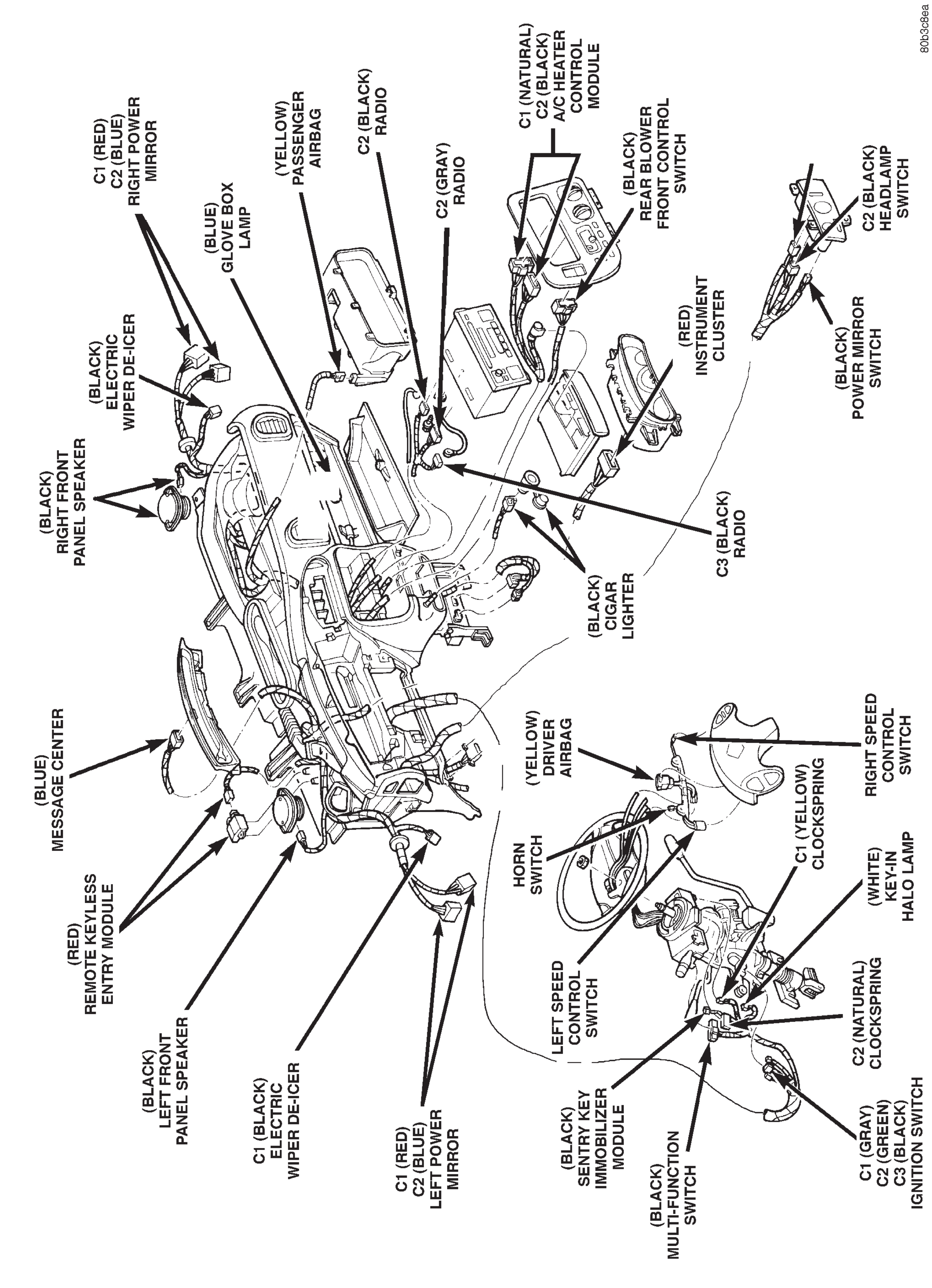

Fig. 11 Instrument Panel Connections—LHD

DESCRIPTION AND OPERATION (Continued)

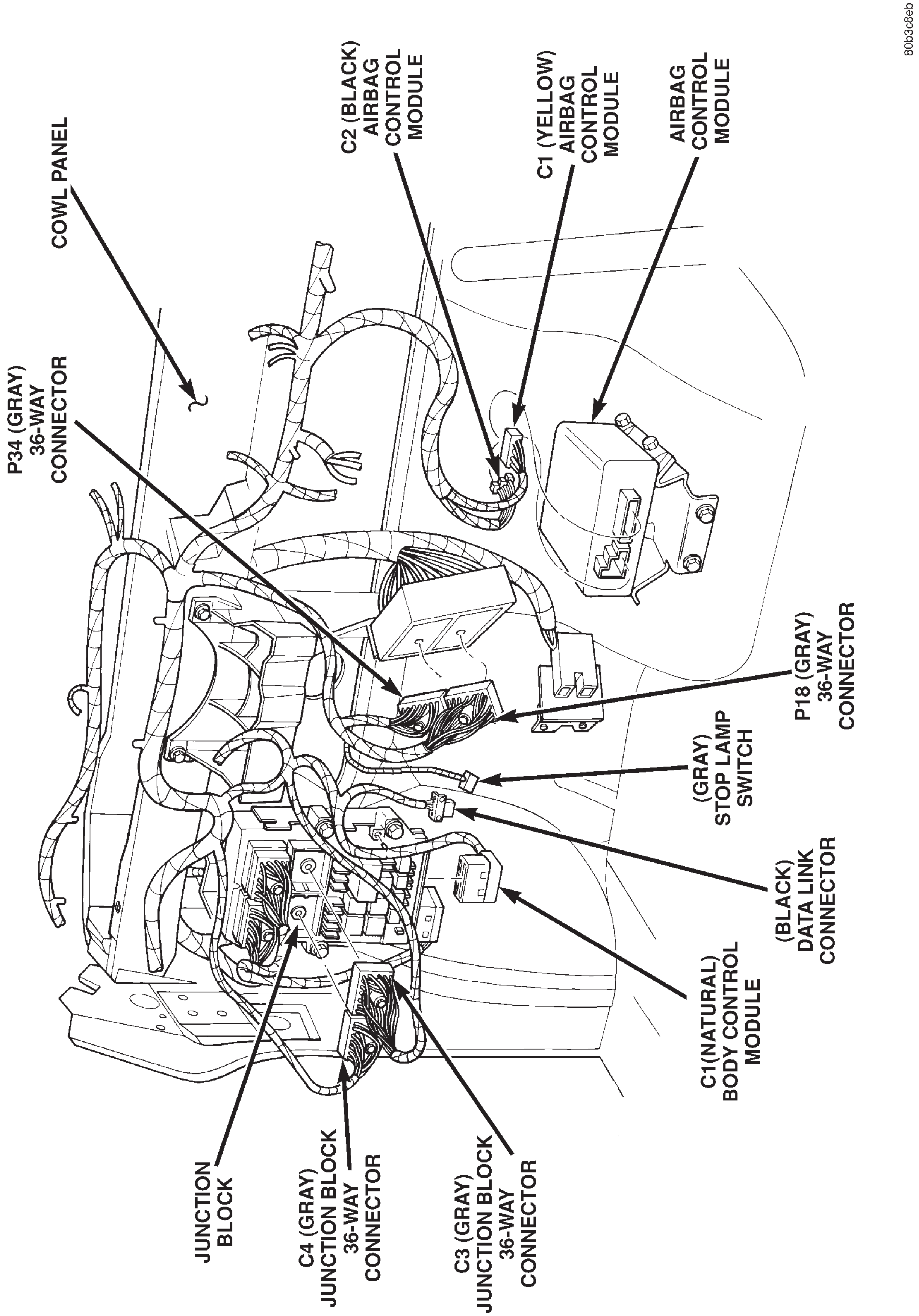

Fig. 12 Instrument Panel Connections—LHD

DESCRIPTION AND OPERATION (Continued)

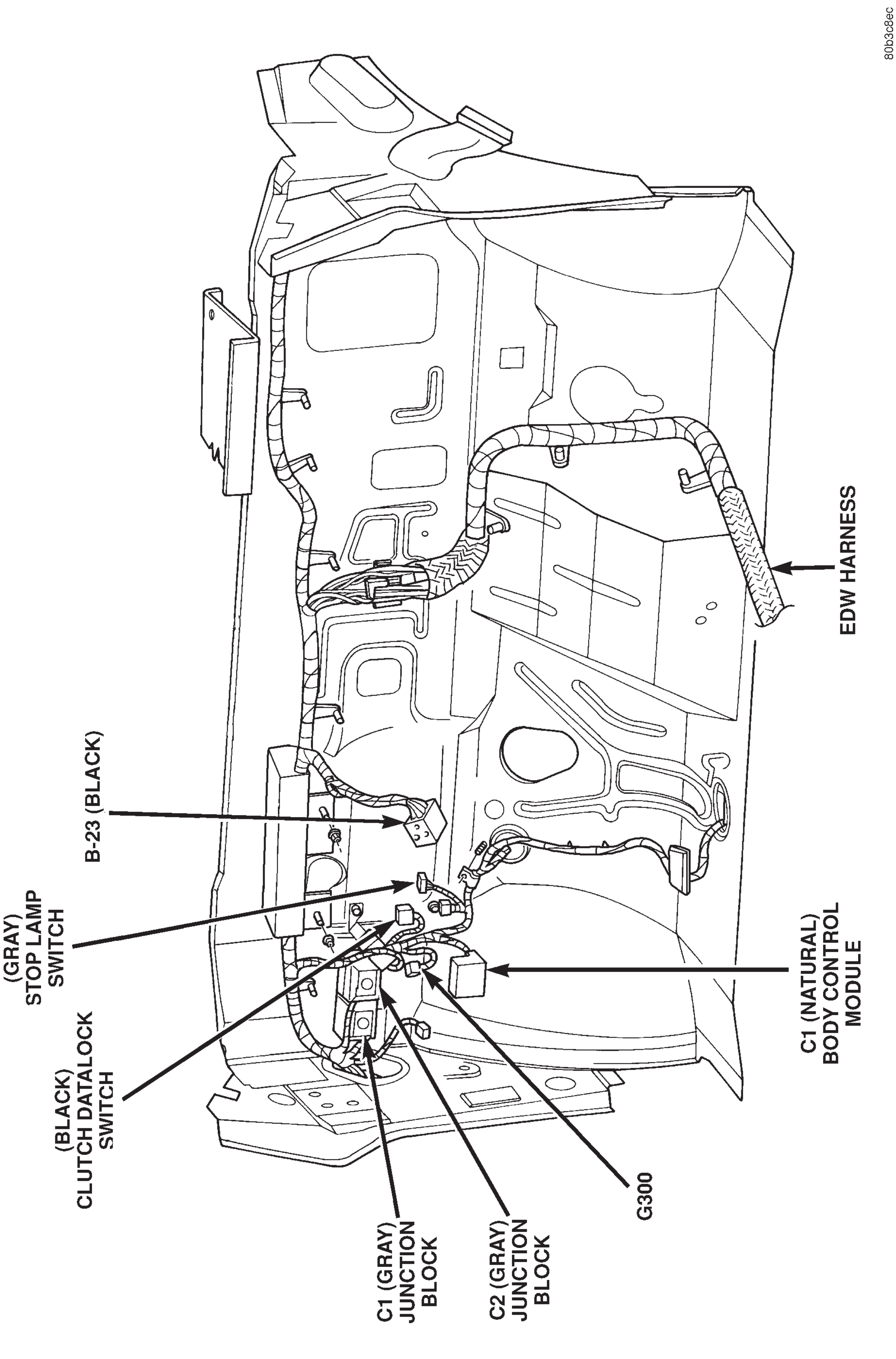

Fig. 13 Cowl Panel Connections—LHD

DESCRIPTION AND OPERATION (Continued)

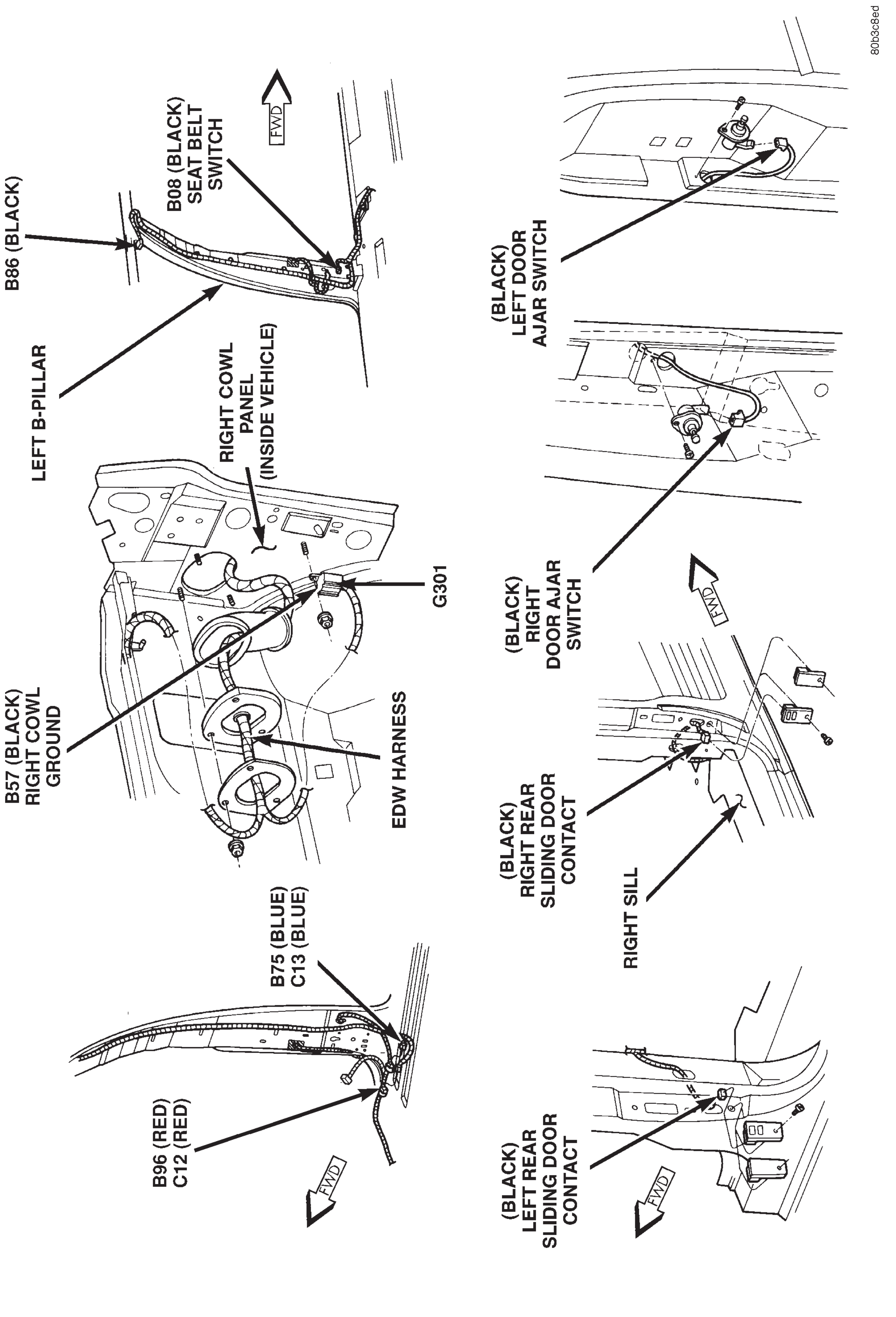

Fig. 14 Body Connections—LHD

DESCRIPTION AND OPERATION (Continued)

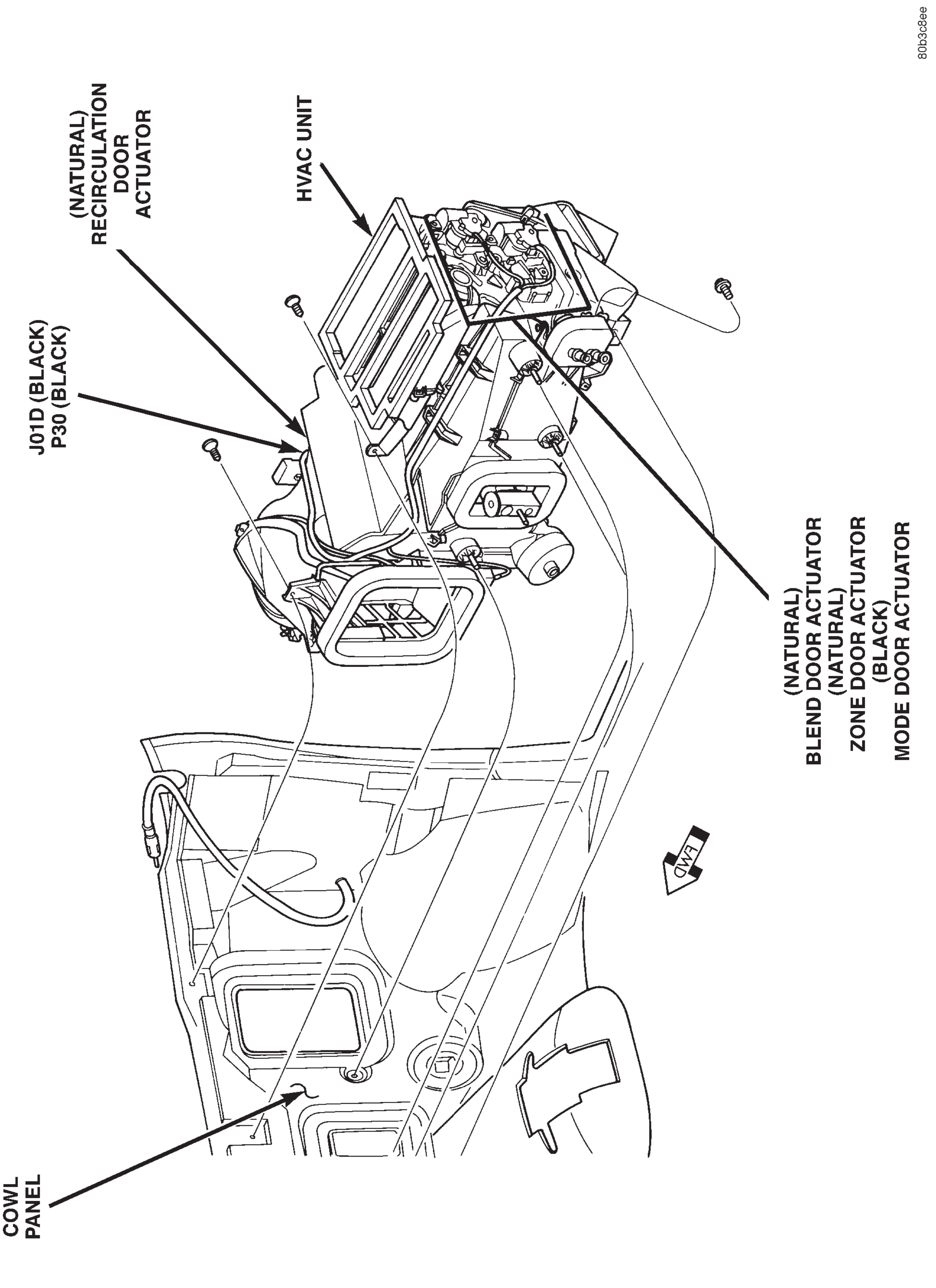

Fig. 15 HVAC Connections—LHD

DESCRIPTION AND OPERATION (Continued)

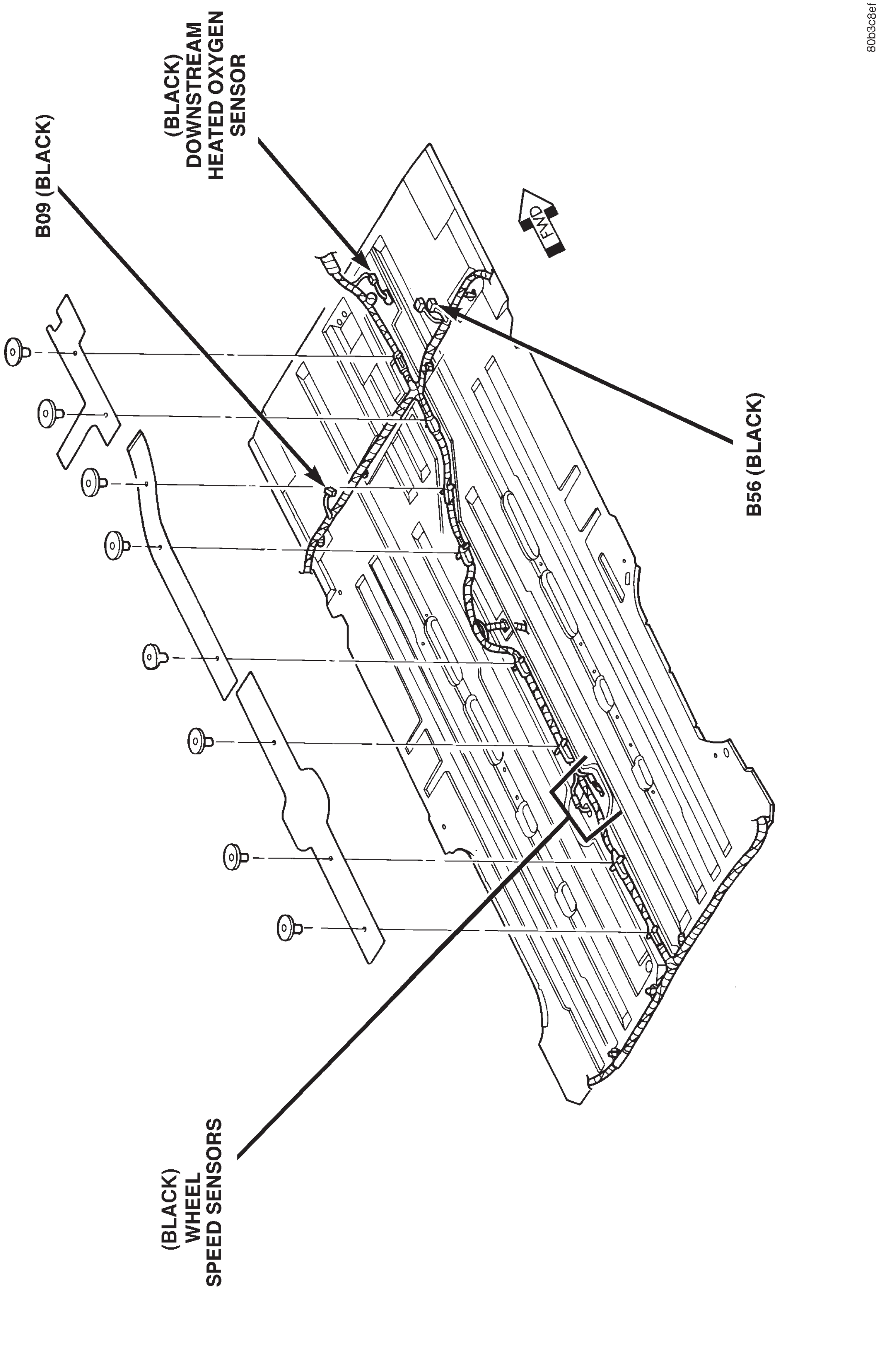

Fig. 16 Body Connections—LHD

DESCRIPTION AND OPERATION (Continued)

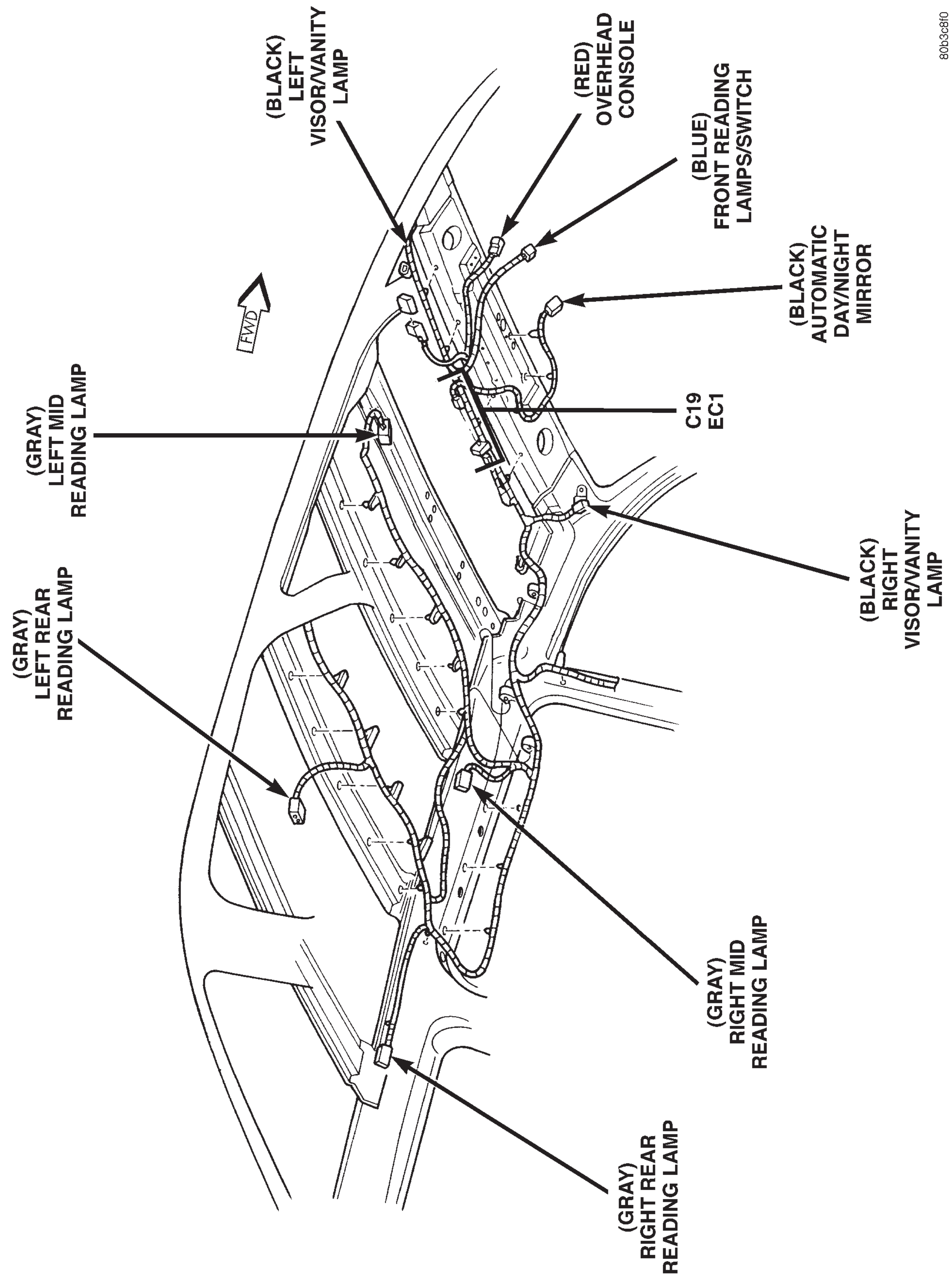

Fig. 17 Roof Panel Connections—LHD

DESCRIPTION AND OPERATION (Continued)

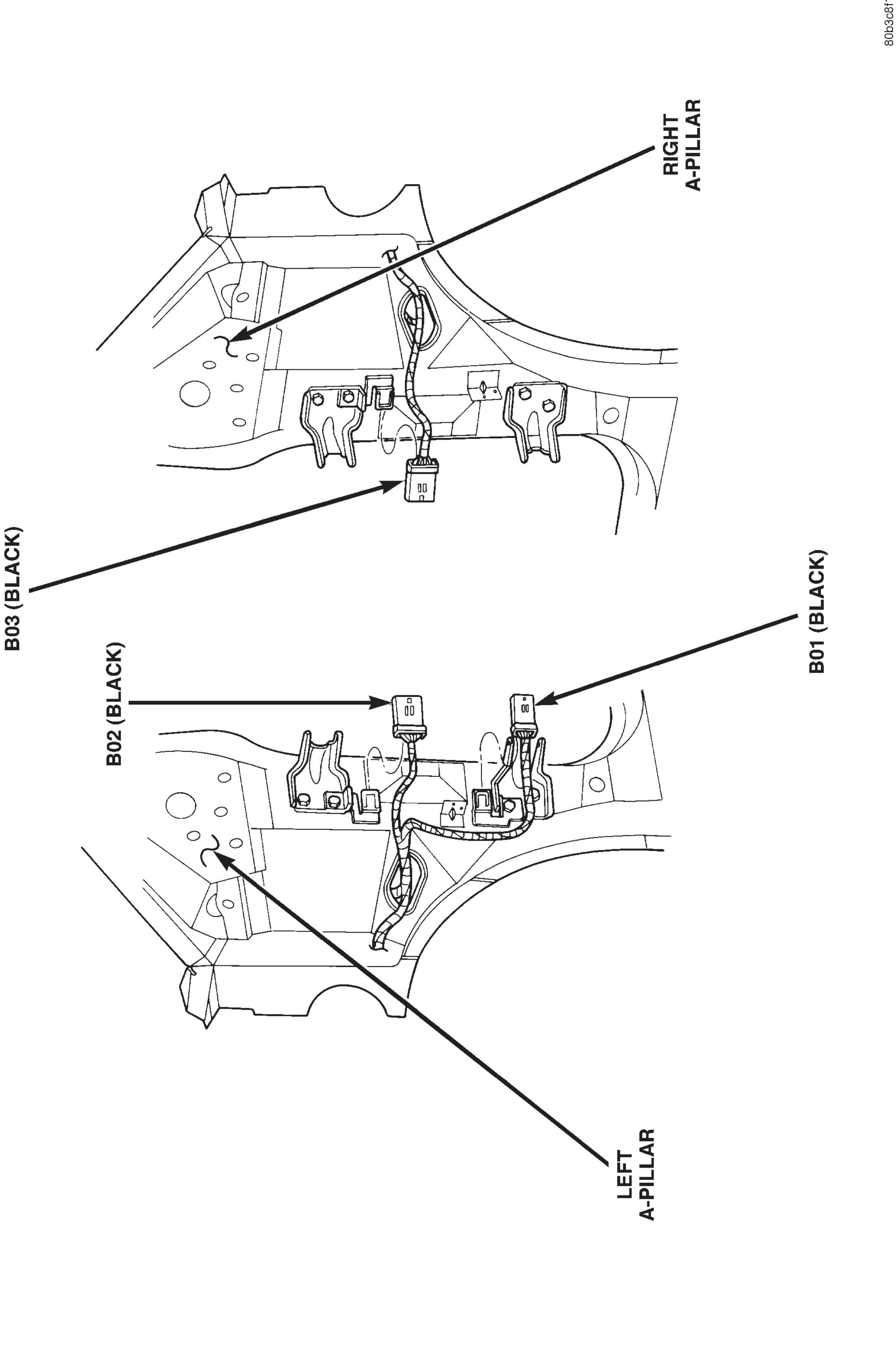

Fig. 18 Body to Door Connections—LHD

DESCRIPTION AND OPERATION (Continued)

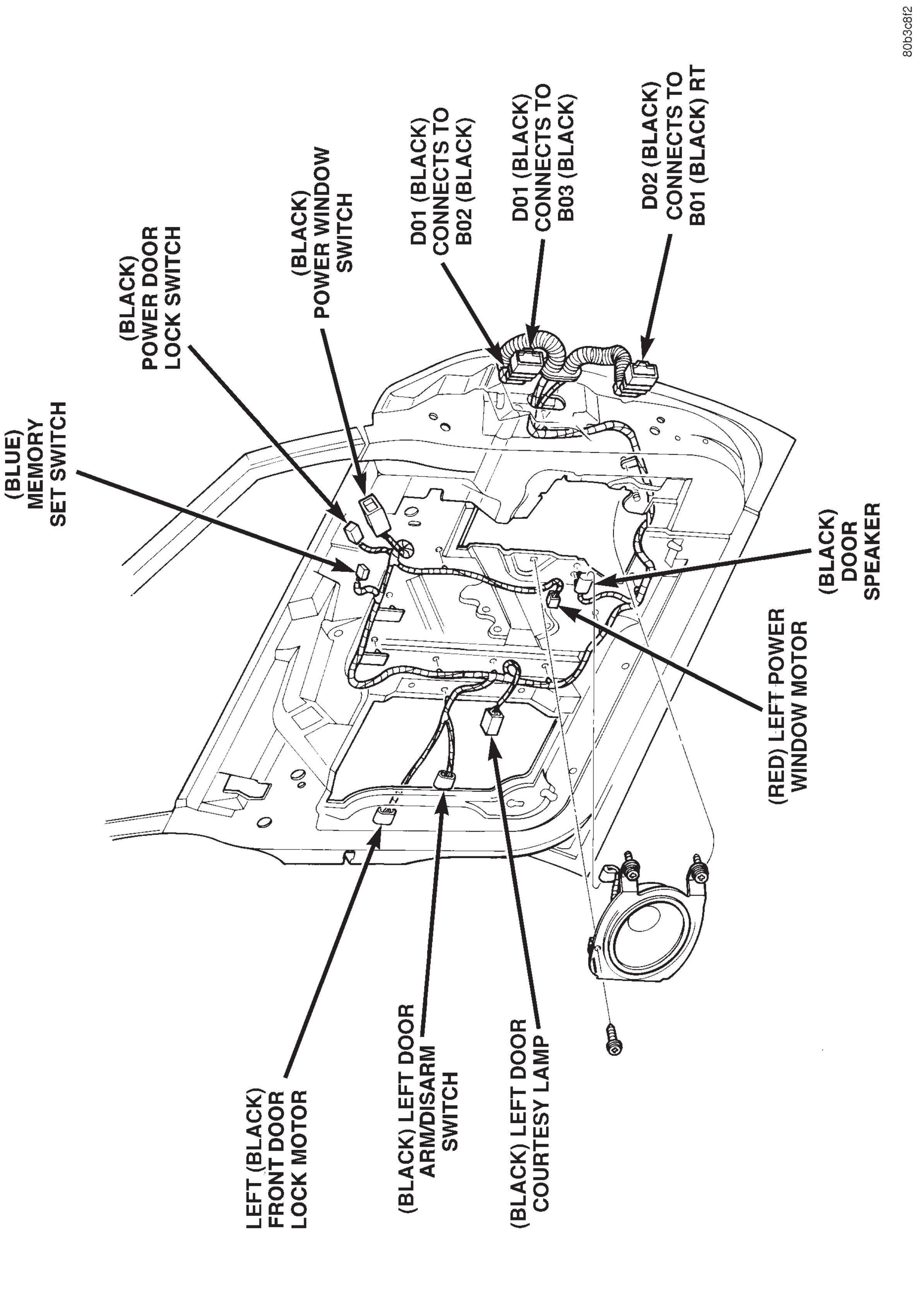

Fig. 19 Door Connections—LHD

DESCRIPTION AND OPERATION (Continued)

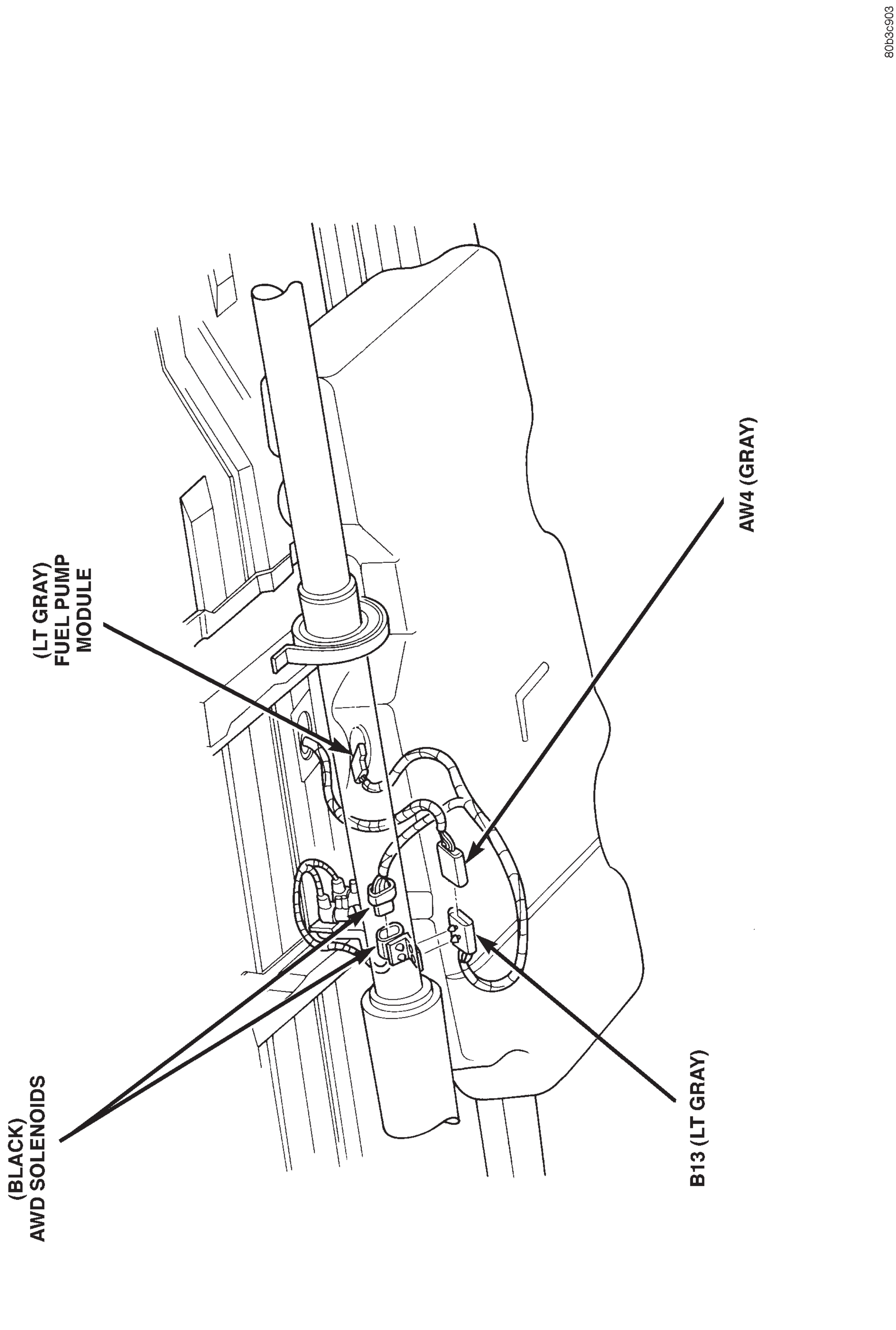

Fig. 20 Underbody Connections—LHD

DESCRIPTION AND OPERATION (Continued)

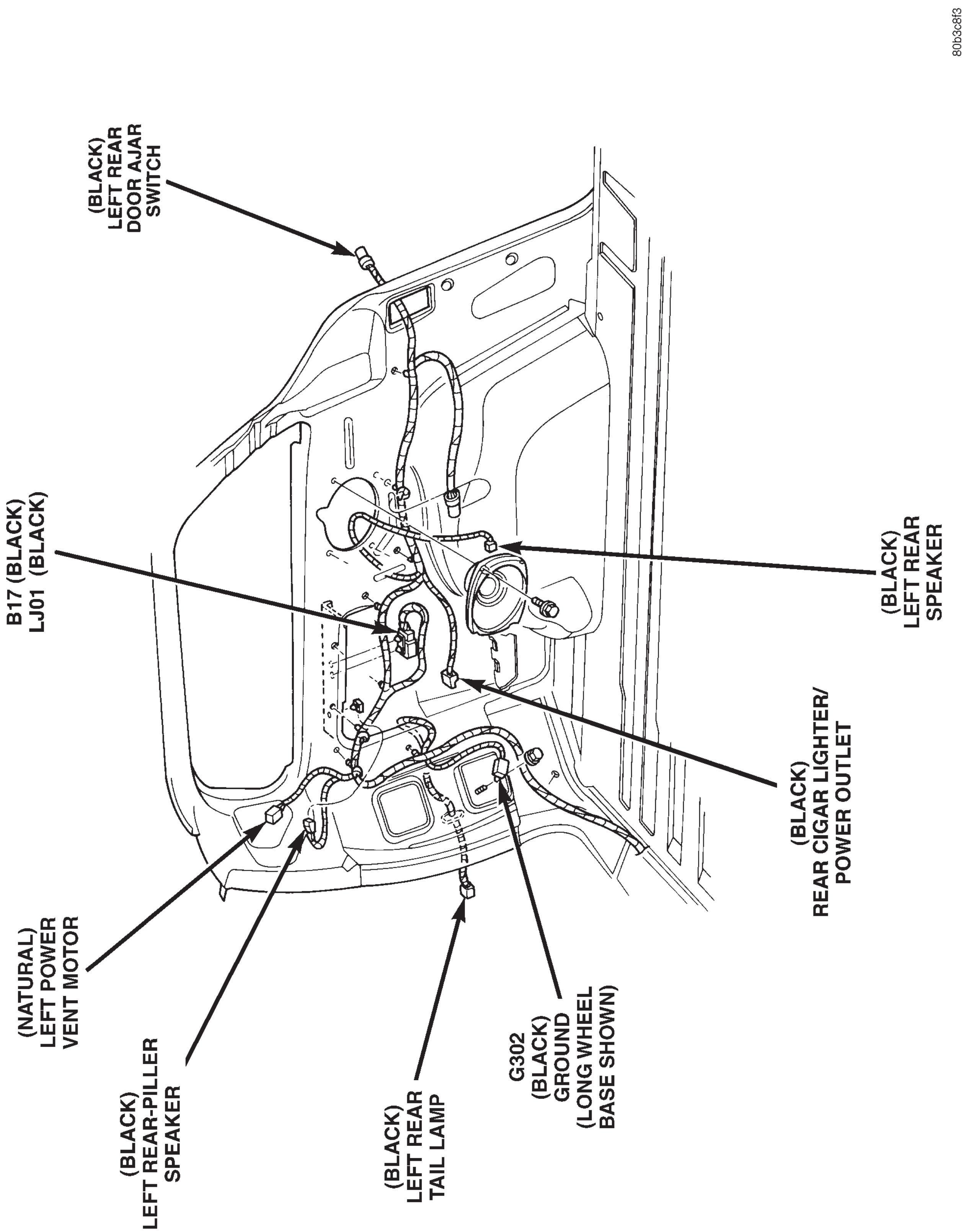

Fig. 21 Left Rear Quarter Connections—LHD

DESCRIPTION AND OPERATION (Continued)

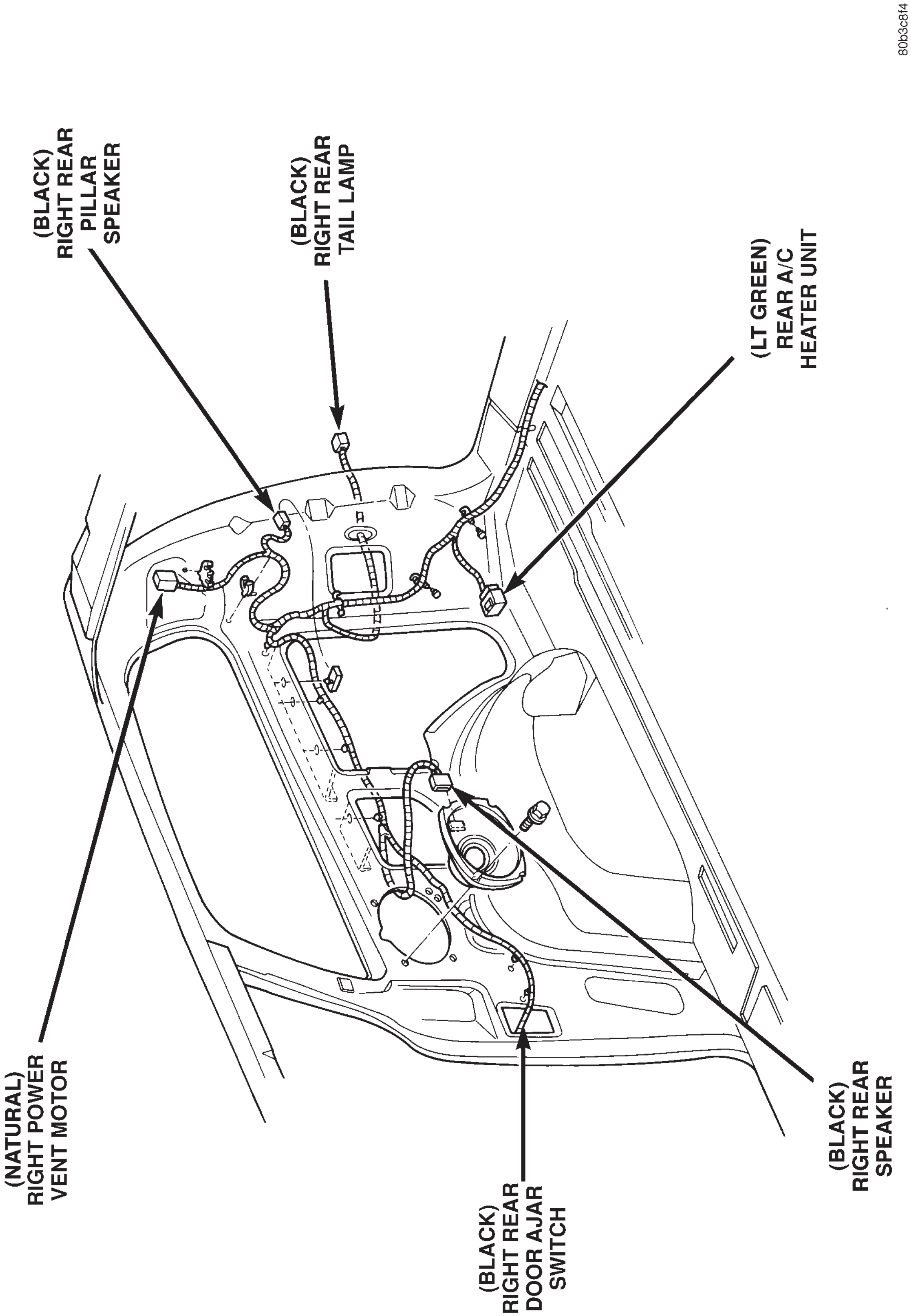

Fig. 22 Right Rear Quarter Connections—LHD

DESCRIPTION AND OPERATION (Continued)

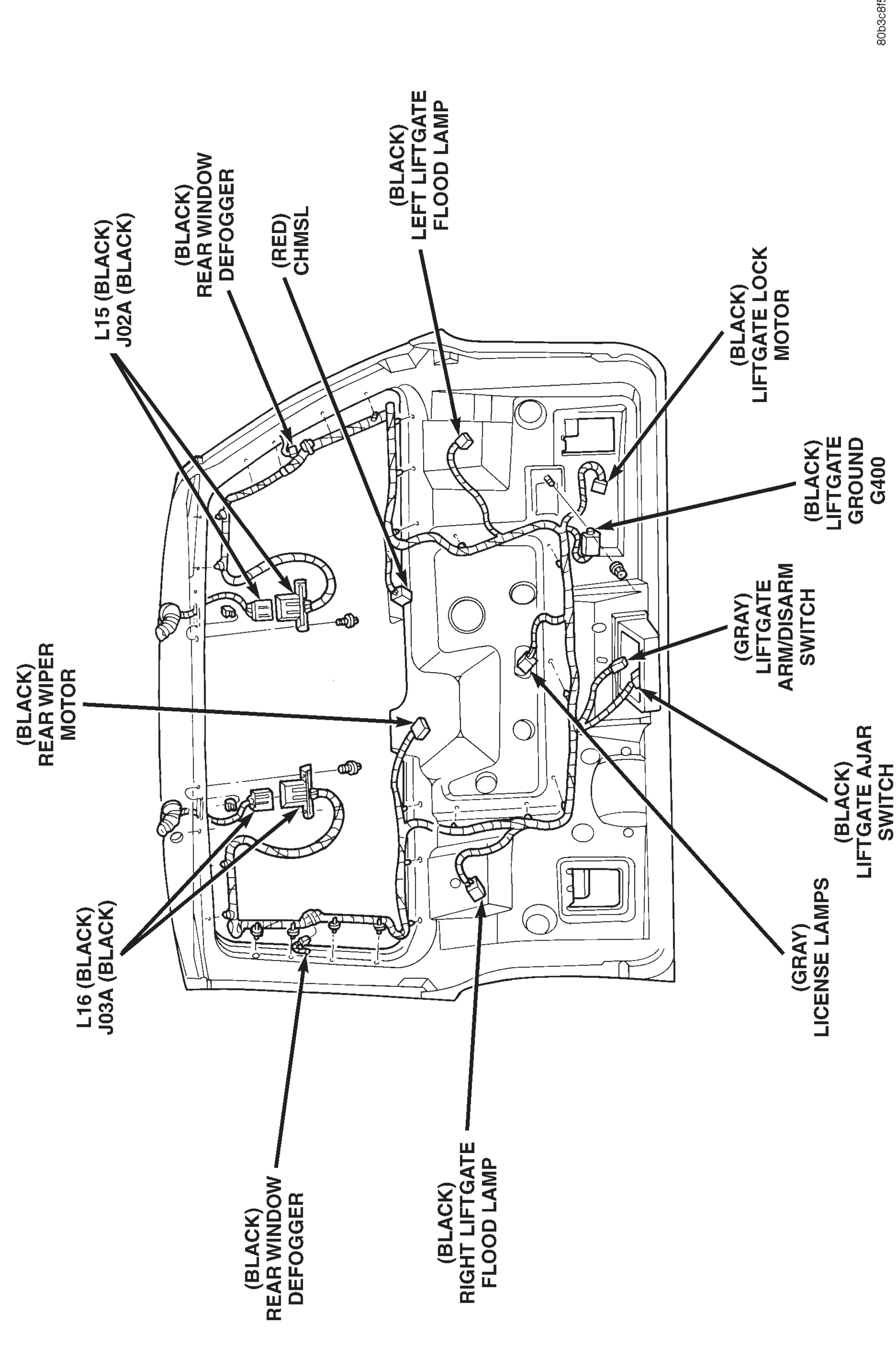

Fig. 23 Liftgate Connections—LHD

DESCRIPTION AND OPERATION (Continued)

CONNECTOR/GROUND LOCATIONS

For items not shown in this section a N/S is placed in the Fig. column.

Component/ Ground	Color	Location	Fig.
A/C Compressor Clutch	BK	Top of A/C Compressor	5, 6, 7, 8, 9
A/C-Heater Control Module C1	NAT	Rear of Control	11
A/C-Heater Control Module C2	BK	Rear of Control	11
A/C Pressure Transducer	GY	RT Side Cowl	3
A/C Zone Door Actuator	NAT	LT Side of HVAC	15
Airbag Control Module C1	YL	Rear of I.P. Center Stack	12
Airbag Contol Module C2	BK	Rear of I.P. Center Stack	12
All Wheel Drive Solenoid	BK	Near Fuel Tank	20
Ambient Temperature Sensor	GY	On Radiator Closure Panel	4
Ash Receiver Lamp	RD	At Lamp	10
Automatic Day/Night Mirror	BK	At Mirror	17
B01	BK	RT Kick Panel	18
B02	BK	RT Kick Panel	18
B03	BK	LT Kick Panel	18
B09	BK	Under Seat	16
B17	BK	LT Quarter Panel	21
B23	BK	RT of Steering Column	13
B33	BK	LT Frame Rail	2
B56	BK	Under Seat	16
B70	LT/GY	LT Frame Rail	2
B75	BL	Bottom of RT B-Pillar	14
B98	BK	Rear of RT Tail Lamp	N/S

Component/ Ground	Color	Location	Fig.
B99	BK	Rear of LT Tail Lamp	N/S
B120	BK	LT Kick Panel	N/S
Backup Lamp Switch (M/T)	BK	On Transmission	5, 6, 8
Blend Door Actuator	NAT	LT Side of HVAC	15
Body Control Module C1	NAT	On Junction Block	12
Body Control Module C2	NAT	On Junction Block	12
Brake Pressure Switch	BK	On Master Cylinder	2
C19		At Top Center of Windshield	17
C20		Bottom of RT B-Pillar	N/S
Camshaft Position Sensor 2.4L	BK	Rear of Cylinder Head	6, 7
Camshaft Position Sensor 3.3L, 3.8L	BK	RT Side of Engine	9
Center Dome Lamp	BK	At Lamp	N/S
CHMSL	RD	Rear of CHMSL	23
Clockspring C1	YL	Rear of Clockspring	11
Clockspring C2	NAT	Rear of Clockspring	11
Clutch Switch	BK	Top of Clutch Pedal	13
Controller Anti-Lock Brake	BK	LT Side of Engine Compartment	N/S
Crankshaft Position Sensor	BK	Rear of Engine	5, 6, 7, 9
D01	BK	On Kick Panel	19
D02	BK	On Kick Panel	19
Data Link Connector	BK	LT of Steering Column	12

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Downstream Heated Oxygen Sensor	BK	Front Center of Floor Pan	16
Driver Airbag	YL	Rear of Airbag	11
E36	BK	LT Frame Rail	2
E40	BK	At Radiator Fan Module	N/S
E43	LT/GY	LT Frame Rail	2
E69	BK	LT Side of Intake	6, 7
E78	BK	Near Throttle Body	9
EC1		At Top Center of Windshield	17
EGR Solenoid	BK	LT Rear of Engine	6, 9
Electric Wiper De-Icer C1	BK	At Right Base of Windshield	11
Electric Wiper De-Icer C2	BK	At Left Base of Windshield	11
Engine Coolant Temp Sensor 2.4L	BK	On Cylinder Block	N/S
Engine Coolant Temp Sensor 3.3L, 3.8L	BK	On Cylinder Block	N/S
Engine Oil Pressure Switch	GN	On Cylinder Block	5, 6, 7, 8, 9
Engine Starter Motor		Rear of Starter	5, 6, 7, 8, 9
EVAP/Purge Solenoid	BK	RT Motor Mount	3
Evaporator Temperature Sensor	BK	RT Side of HVAC	N/S
F02	BK	Near Throttle Body	9
F09	BK	LT Side of Intake	6, 7
Front Blower Motor	BK	At Motor	10
Front Blower Motor Resistor Block	BK	LT Side of Engine	2
Front Cigar Lighter	BK	Rear of Lighter	11

Component/ Ground	Color	Location	Fig.
Front Reading Lamps/Switch	BL	At Lamp	17
Front Washer Motor	BK	Bottom of Reservior	4
Fuel Injector #1	BK	At Injector	N/S
Fuel Injector #2	BK	At Injector	N/S
Fuel Injector #3	BK	At Injector	N/S
Fuel Injector #4	BK	At Injector	N/S
Fuel Injector #5	BK	At Injector	N/S
Fuel Injector #6	BK	At Injector	N/S
Fuel Pump Module	GY	Side of Fuel Tank	20
G100		LT Frame Rail	3
G101 2.4L		Rear of Cylinder Head	6, 7
G101 3.3L, 3.8L		Rear of Cylinder Block	9
G102		LT Frame Rail	3
G103 2.4L		Rear of Cylinder Head	6, 7
G103 3.3L, 3.8L		Rear of Cylinder Block	9
G104		Near T/O for RT Headlamp	N/S
G200		Left of I.P. Center Stack	10
G201		I.P. Center Support	10
G202		I.P. Center Support	10
G204		I.P. Center Support	10
G300	BK	LT Kick Panel	13
G301		RT Kick Panel	13, 14
G302	BK	LT Quarter Panel	21
G400	BK	In Liftgate	23
Generator	BK	Rear of Generator	5, 6, 7, 8, 9
Glove Box Lamp	BL	Rear of Glove Box	11
Headlamp Dimmer Switch	BK	Part of Multifunction Switch	11

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Headlamp Switch C1	NAT	Rear of Switch	11
Headlamp Switch C2	BK	Rear of Switch	11
Headlamp Washer Motor		Bottom of Reservior	N/S
High Note Horn	BK	LT Frame Rail	4
Hood Ajar Switch	NAT	LT Fender	2
Horn Switch		Rear of Driver Airbag	11
Idle Air Control Motor	BK	On Throttle Body	5, 6, 7, 8, 9
Ignition Coil Pack 2.4L	BK	Top of Valve Cover	6, 7
Ignition Coil Pack 3.3L, 3.8L	BK	RT Side of Engine	9
Ignition Switch C1	GY	Rear of Switch	11
Ignition Switch C2	GN	Rear of Switch	11
Ignition Switch C3	BK	Rear of Switch	11
Instrument Cluster	RD	Rear of Cluster	11
Intake Air Temp Sensor	GY	On Intake	6, 7
J01D	BK	RT Side of HVAC	15
J02A	BK	Top of Liftgate	23
JO3A	BK	Top of Liftgate	23
Junction Block C1	GY	On Junction Block	12, 13
Junction Block C2	GY	On Junction Block	12, 13
Junction Block C3	GY	On Junction Block	12
Junction Block C4	GY	On Junction Block	12
Key-In Halo Lamp	WT	Rear of Lamp	11
Knock Sensor 2.4L	GY	Front of Cylinder Block	6, 7
Knock Sensor 3.3L, 3.8L	GY	Front of Cylinder Block	N/S
L15	BK	Top of Liftgate	23

Component/ Ground	Color	Location	Fig.
L16	BK	Top of Liftgate	23
Left Combination Relay	BK	LT Rear Quarter Panel	N/S
Left Door Ajar Switch	BK	LT B-PIllar	12
Left Door Arm/Disarm Switch	BK	At Switch	19
Left Door Courtesy Lamp	BK	At Lamp	19
Left Door Speaker	BK	At Speaker	19
Left Fog Lamp	GY	At Lamp	4
Left Front Door Lock Motor	BK	At Motor	19
Left Front Panel Speaker	BK	At Speaker	11
Left Front Park/Turn Signal Lamp	BK	At Lamp	4
Left Front Wheel Speed Sensor	BK	LT Fender Side Shield	2
Left Front Window Motor	RD	At Motor	19
Left Headlamp	BK	At Lamp	2
Left Headlamp Leveling Motor	BK	At Motor	N/S
Left Liftgate Flood Lamp	BK	At Lamp	23
Left Mid Reading Lamp	GY	At Lamp	17
Left Power Door Lock Switch	BK	At Switch	19
Left Power Mirror C1	RD	At Mirror	11
Left Power Mirror C2	BL	At Mirror	11
Left Power Window Switch	OR	At Switch	19
Left Rear Lamp Assembly	BK	At Lamp	21
Left Rear Door Ajar Switch	BK	LT C-Pillar	21
Left Rear Pillar Speaker	BK	At Speaker	21

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Left Rear Reading Lamp	GY	At Lamp	17
Left Rear Sliding Door Contact	BK	LT B-Pillar	14
Left Rear Sliding Door Lock Motor	BK	At Motor	N/S
Left Rear Speaker	BK	At Speaker	21
Left Rear Vent Motor	NAT	At Motor	21
Left Rear Wheel Speed Sensor	GY	Center Rear of Floor Pan	16
Left Repeater Lamp	GY	At Lamp	N/S
Left Speed Control Switch		Left Side of Steering Wheel Pad	11
Left Stop/Turn Signal Relay	BK	LT Quarter Panel	N/S
Left Visor/Vanity Lamp	BK	At Lamp	17
License Lamp	GY	At Lamps	23
Liftgate Ajar Switch	BK	At Latch	23
Liftgate Arm/Disarm Switch	GY	At Key Cylinder	23
Liftgate Lock Motor	BK	At Motor	23
LJ01	BK	LT Quarter Panel	21
Low Note Horn	BK	LT Frame Rail	4
Low Washer Fluid Level Sensor	BK	Bottom of Reservior	4
MAP Sensor 2.4L	BK	On Intake	N/S
MAP Sensor 3.3L, 3.8L	BK	Near Throttle Body	9
Memort Seat/Mirror Module	BK	RT Front of Floor Pan	16
Memory Set Switch	BL	At Switch	19

Component/ Ground	Color	Location	Fig.
Message Center	BL	Rear of Message Center	11
Mode Door Actuator	BK	LT Side of HVAC	15
Multi Function Switch	BK	Rear of Switch	11
Name Brand Speaker Relay	LT/GY	LT of Steering Column	N/S
Output Shaft Speed Sensor	GY	Front of Transmission	7, 9
Overhead Console	RD	Front of Console	17
P18	GY	RT of Steering Column	12
P30	BK	RT Side of HVAC	10
P34	GY	RT of Steering Column	12
P50	NAT	Right Side of HVAC Taped to Harness	10
Park Brake Switch	NAT	Top of Park Brake	N/S
Park/Neutral Positon Switch	BK	Front of Transmission	N/S
Passenger Airbag	YL	Rear of Airbag	11
PDC C1	NAT	Bottom of PDC	2
PDC C2	OR	Bottom of PDC	2
PDC C3	DK/ GN	Bottom of PDC	2
PDC C4	BK	Bottom of PDC	2
PDC C5	LT/GY	Bottom of PDC	2
PDC C6	LT/GN	Bottom of PDC	3
PDC C7	LT/GY	Bottom of PDC	3
PDC C8	BL	Bottom of PDC	3
Power Folding Mirror Switch	BK	At Switch	N/S
Power Mirror Switch	BK	Rear of Switch	11
Power Steering Pressure Switch	BK	RT Side of Engine Compartment	N/S

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Powertrain Control Module C1	BK	LT Fender Side Shield	3
Powertrain Control Module C2	BK	LT Fender Side Shield	3
Radiator Fan No.1	BK	At Motor	N/S
Radiator Fan No.2	BK	At Motor	N/S
Radiator Fan Relay	BK	LT Front Frame Rail	3
Radio C1	GY	Rear of Radio	11
Radio C2	BK	Rear of Radio	11
Radio C3	BK	Rear of Radio	11
Radio Choke	LT/GY	Rear of Radio	N/S
Rear A/C-Heater Unit	LT/GN	RT Quarter Panel	22
Rear Blower Front Control Switch	BK	Rear of Switch	11
Rear Blower Rear Control Switch	BK	At Switch	N/S
Rear Cigar Lighter/Power Outlet	BK	LT Quarter Panel	21
Rear Dome Lamp	BK	At Lamp	N/S
Rear Washer Motor	BK	Bottom of Reservior	4
Rear Window Defogger	BK	On Liftgate	23
Rear Wiper Motor	BK	At Motor	23
Recirculation Door Actuator	NAT	RT Side of HVAC	15
Remote Keyless Entry Module	RD	Top RT of I.P.	11
Right Combination Relay	BK	LT Quarter Panel	N/S
Right Door Arm/Disarm Switch	BK	At Switch	19
Right Door Courtesy Lamp	BK	At Lamp	19

Component/ Ground	Color	Location	Fig.
Right Door Speaker	BK	At Speaker	19
RF3	BK	At Radiator Fan Module	N/S
Right Fog Lamp	GY	At Lamp	4
Right Front Door Ajar Switch	BK	RT B-Pillar	12
Right Front Door Lock Motor	BK	At Motor	19
Right Front Panel Speaker	BK	At Speaker	11
Right Front Park/Turn Signal Lamp	BK	At Lamp	4
Right Front Wheel Speed Sensor	BK	Right Fender Side Shield	4
Right Front Window Motor	RD	At Motor	19
Right Headlamp	BK	At Lamp	4
Right Headlamp Leveling Motor	BK	At Motor	N/S
Right Liftgate Flood Lamp	BK	At Lamp	23
Right Mid Reading Lamp	GY	At Lamp	17
Right Power Door Lock Switch	BK	At Switch	19
Right Power Mirror C1	RD	At Mirror	11
Right Power Mirror C2	BL	At Mirror	11
Right Power Window Switch	BK	At Switch	19
Right Rear Lamp Assembly	BK	At Lamp	22
Right Rear Door Ajar Switch	BK	RT C-Pillar	N/S
Right Rear Pillar Speaker	BK	At Speaker	22
Right Rear Reading Lamp	GY	At Lamp	17

DESCRIPTION AND OPERATION (Continued)

Component/ Ground	Color	Location	Fig.
Right Rear Sliding Door Contact	BK	RT B-Pillar	14
Right Rear Sliding Door Lock Motor	BK	At Motor	N/S
Right Rear Speaker	BK	At Speaker	22
Right Rear Vent Motor	NAT	At Motor	22
Right Rear Wheel Speed Sensor	GY	Center Rear of Floor Pan	16
Right Repeater Lamp	GY	At Lamp	N/S
Right Speed Control Switch		Right Side of Steering Wheel Pad	11
Right Stop/Turn Signal Relay	BK	LT Quarter Panel	N/S
Right Visor/ Vanity Lamp	BK	At Lamp	17
S02	BK	Under Seat	N/S
Seat Belt Switch	BK	RT B-Pillar	N/S
Sentry Key Immobilizer Module	BK	Near Steering Column at Module	11
Stop Lamp Switch	GY	Top of Brake Pedal	12
T05	BK	LT Quarter Panel	N/S
T08	BK	RT Quarter Panel	N/S

Component/ Ground	Color	Location	Fig.
Throttle Position Sensor	NAT	On Throttle Body	5, 6, 7, 8, 9
Trailer Tow Connector	BK	LT Quarter Panel	N/S
Transmission Control Module	BK	RT Fender Side Shield	3
Transmission Range Sensor	BK	Top of Transmission	7. 9
Transmission Control Solenoids	BK	Front of Transmission	7, 9
Turbine Speed Sensor	GY	Front of Transmission	7, 9
Turn Signal/ Hazard Switch	BK	Part of Multifunction Switch	11
Upstream Heated Oxygen Sensor	GY	Rear of Engine	5, 6, 7, 8, 9
Vehicle Speed Control Servo	BK	LT Rear of Engine Compartment	5, 6, 7, 8, 9
Vehicle Speed Sensor	BK	Rear of Transmission	5, 6, 8
Windshield Wiper Switch	BK	Part of Multifunction Switch	11
Wiper Module	BK	LT Side of Engine	2

DESCRIPTION AND OPERATION (Continued)

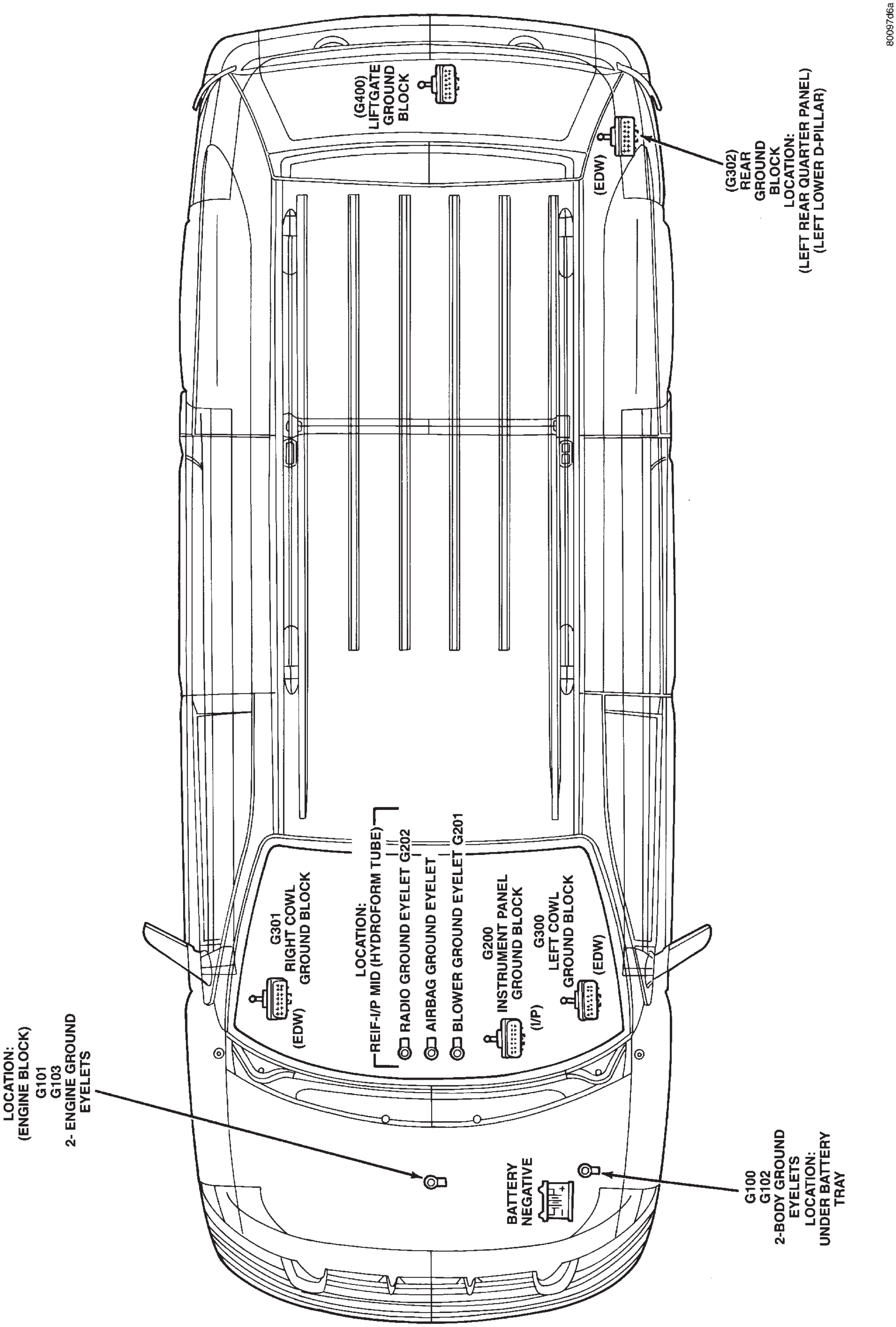

Fig. 1 Ground Locations—RHD

DESCRIPTION AND OPERATION (Continued)

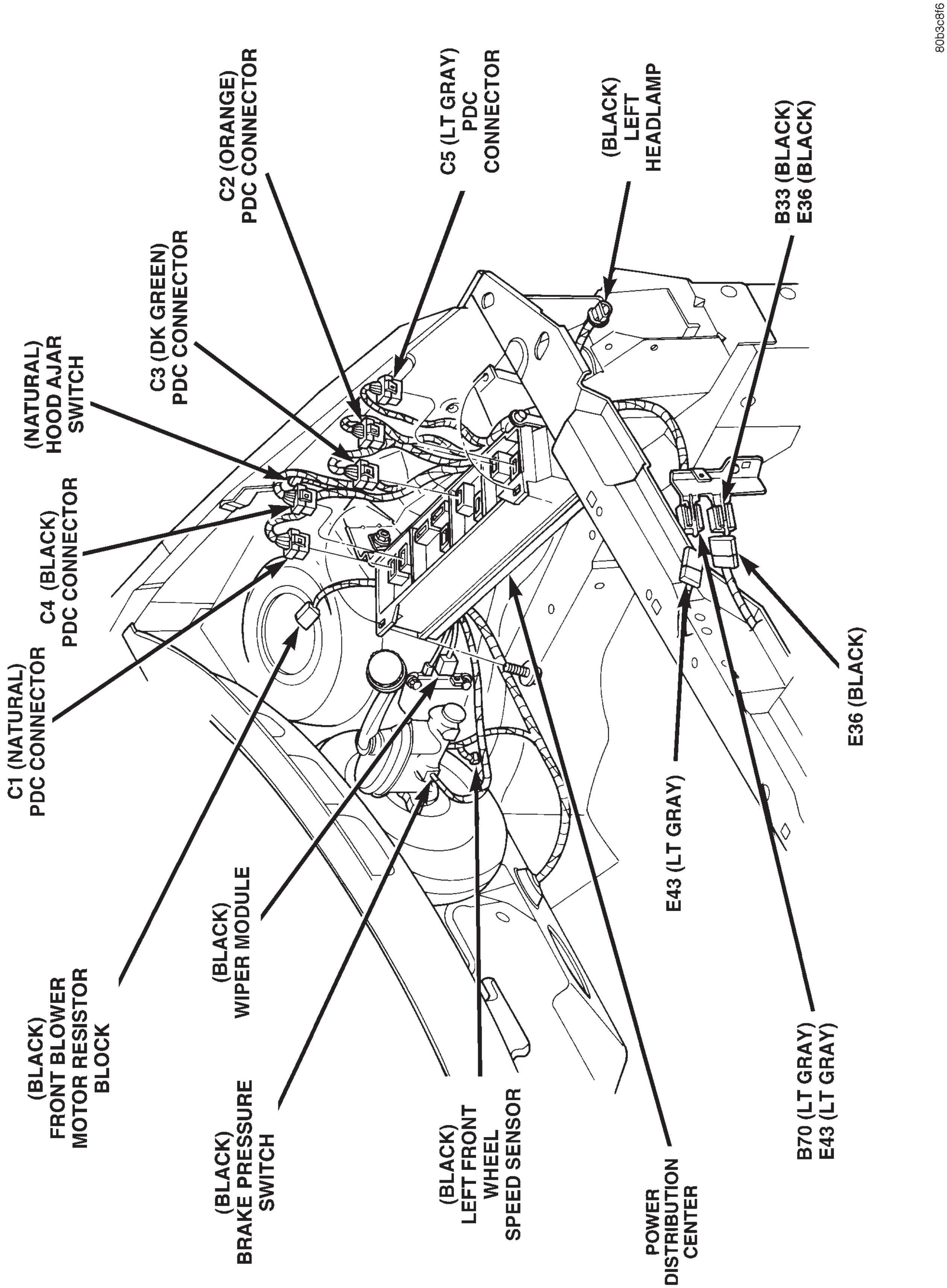

Fig. 2 Engine Compartment Connetions—RHD

DESCRIPTION AND OPERATION (Continued)

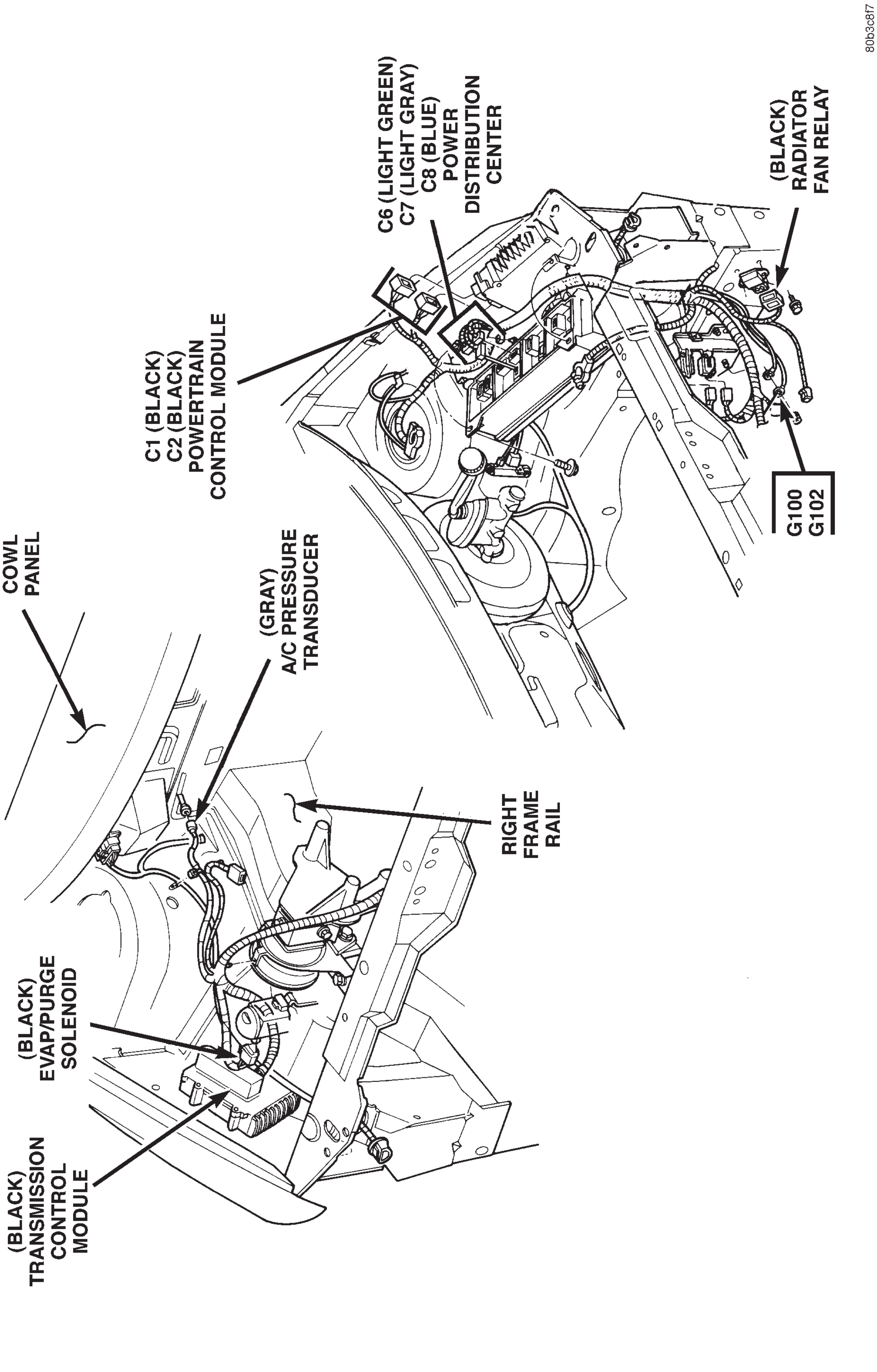

Fig. 3 Engine Compartment Connections—RHD

DESCRIPTION AND OPERATION (Continued)

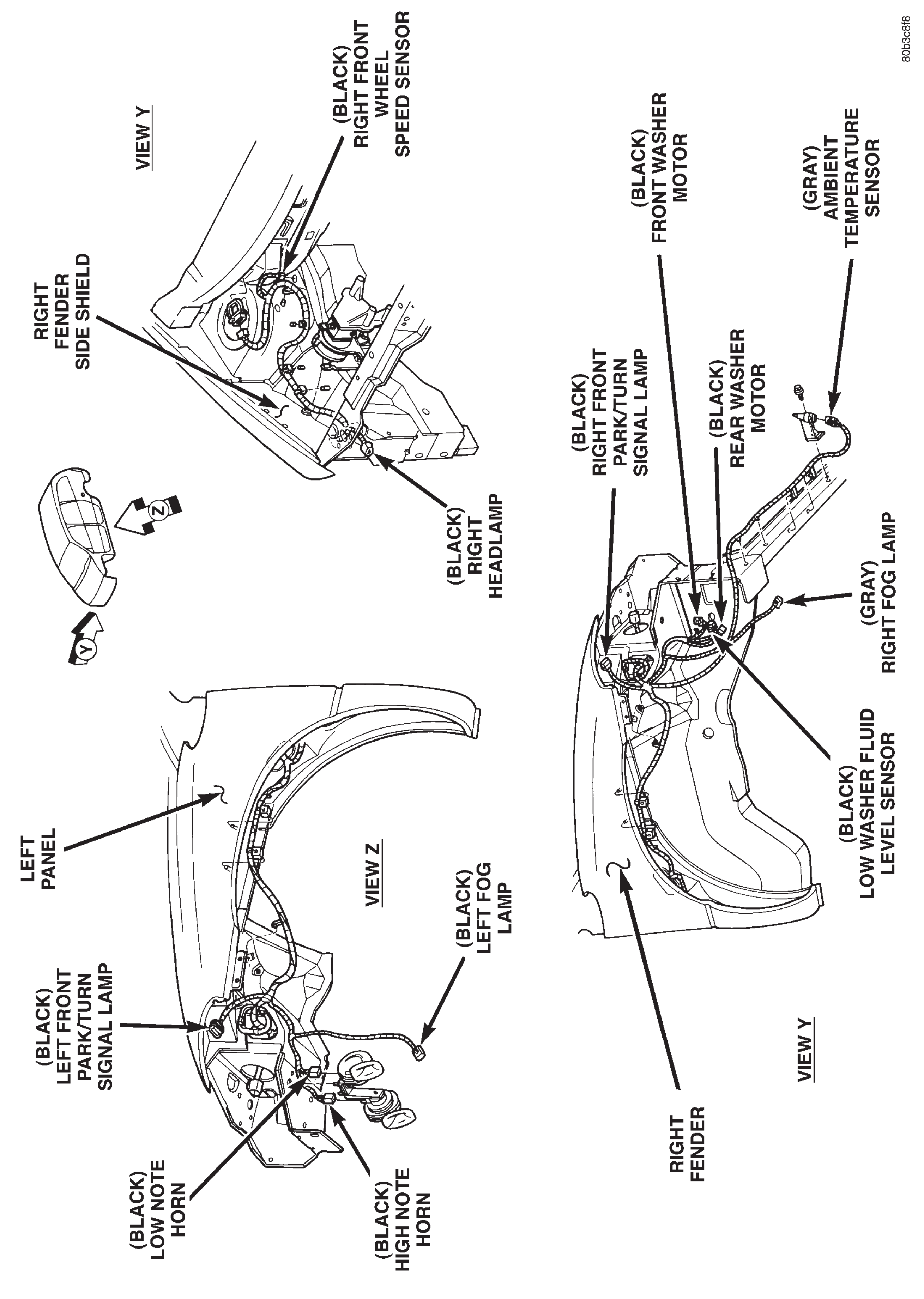

Fig. 4 Engine Compartment Connections—RHD

DESCRIPTION AND OPERATION (Continued)

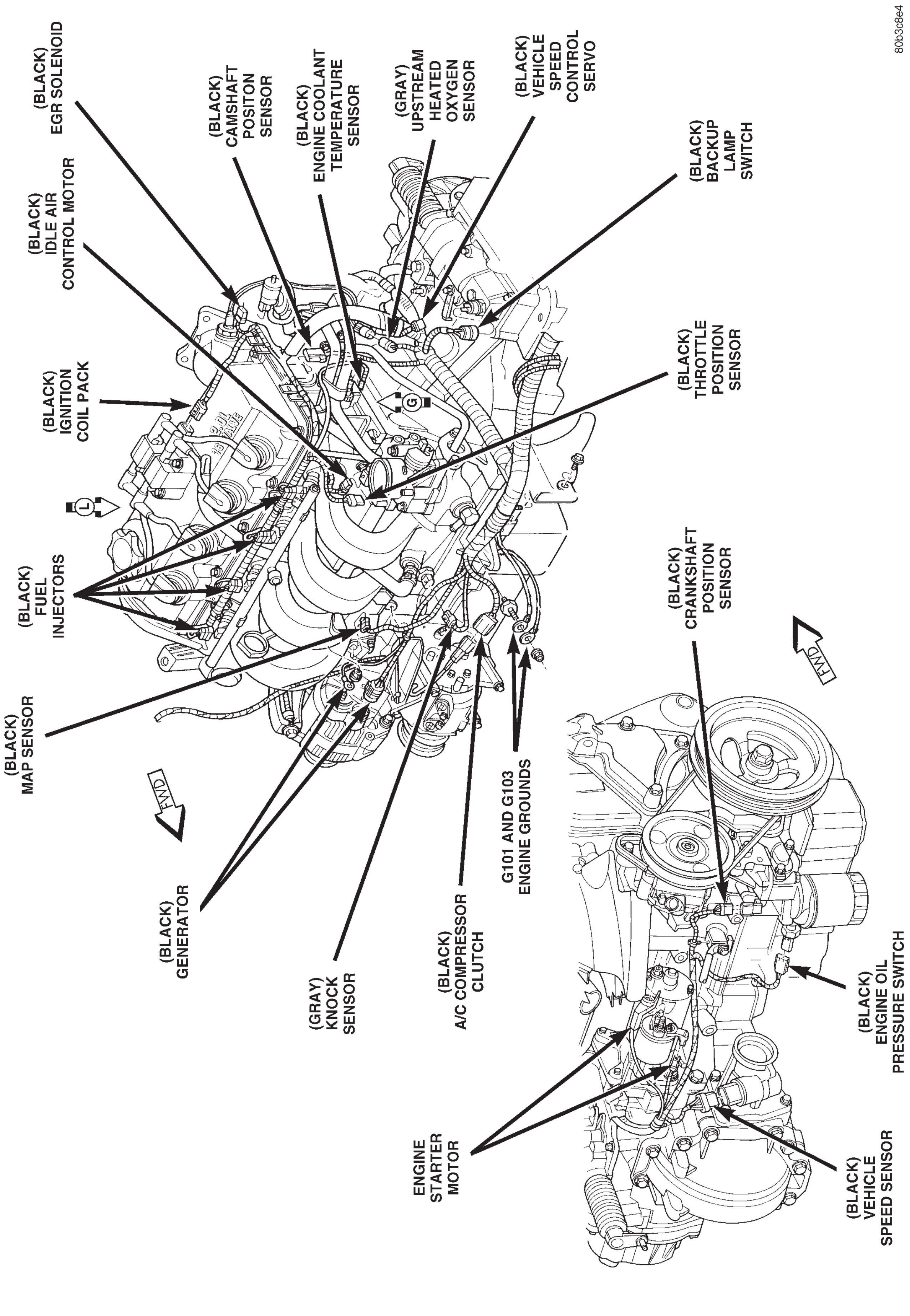

Fig. 5 Engine Connections—2.0L, RHD

DESCRIPTION AND OPERATION (Continued)

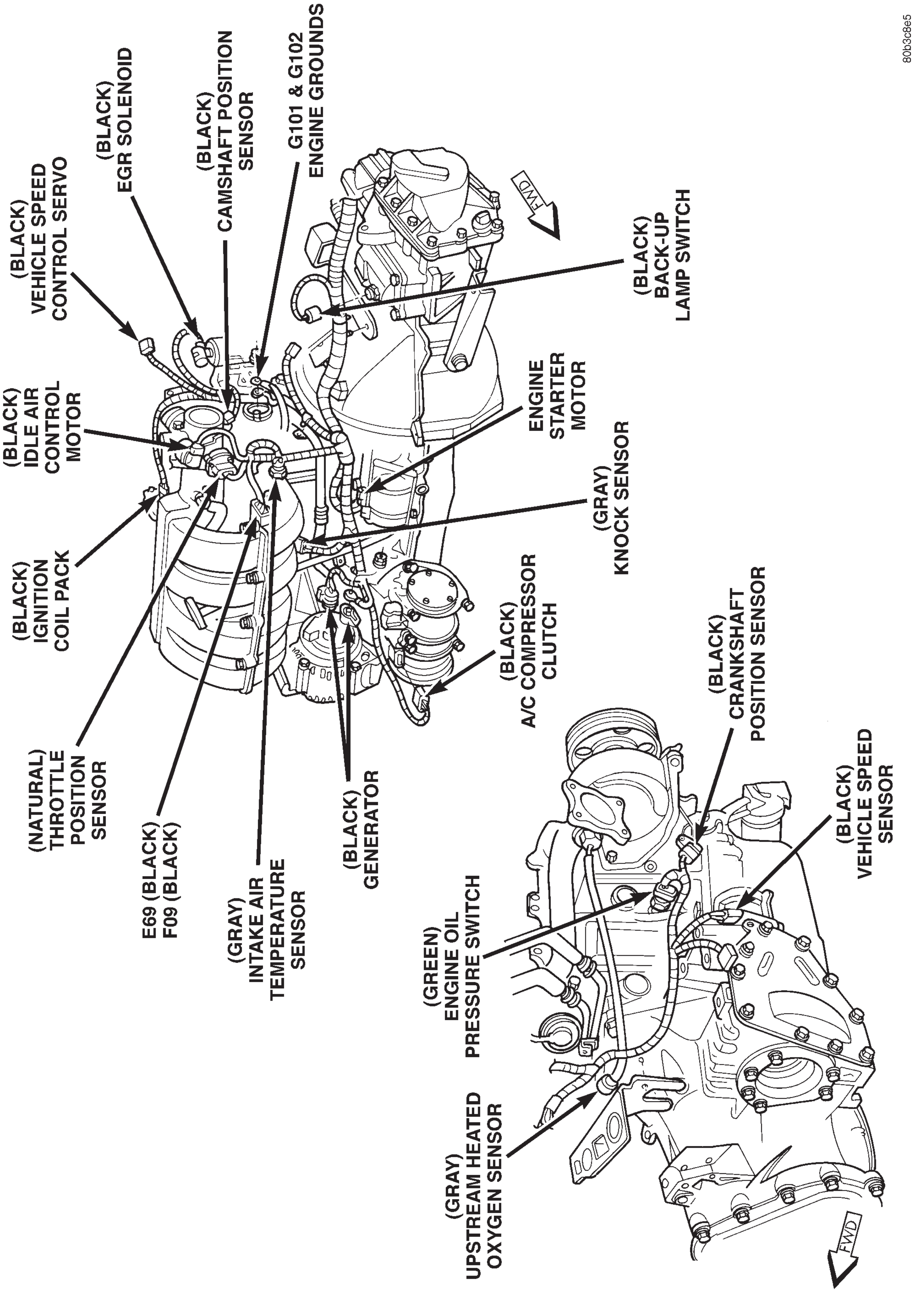

Fig. 6 Engine Connections—2.4L (M/T), RHD

DESCRIPTION AND OPERATION (Continued)

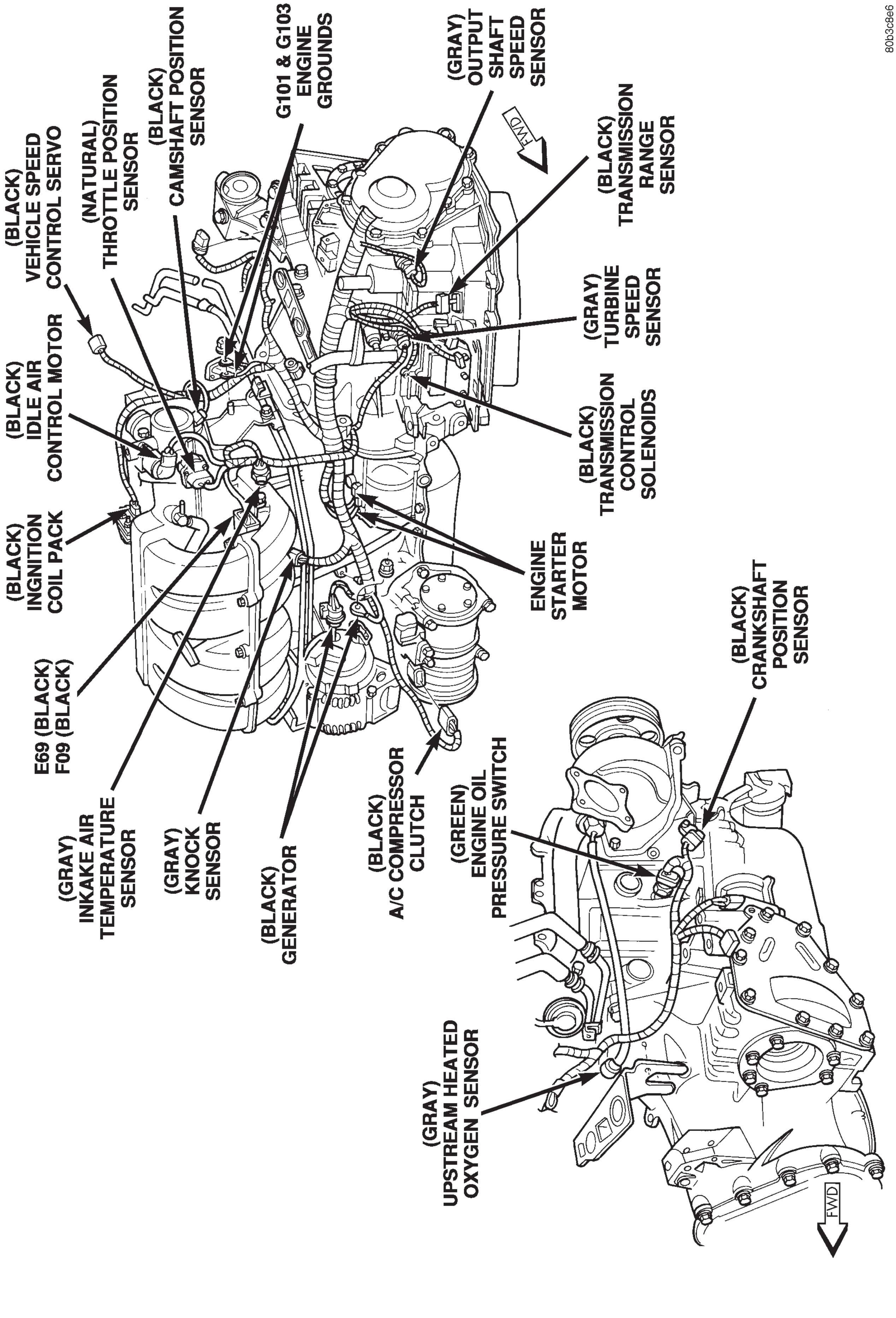

Fig. 7 Engine Connections—2.4L (A/T), RHD

DESCRIPTION AND OPERATION (Continued)

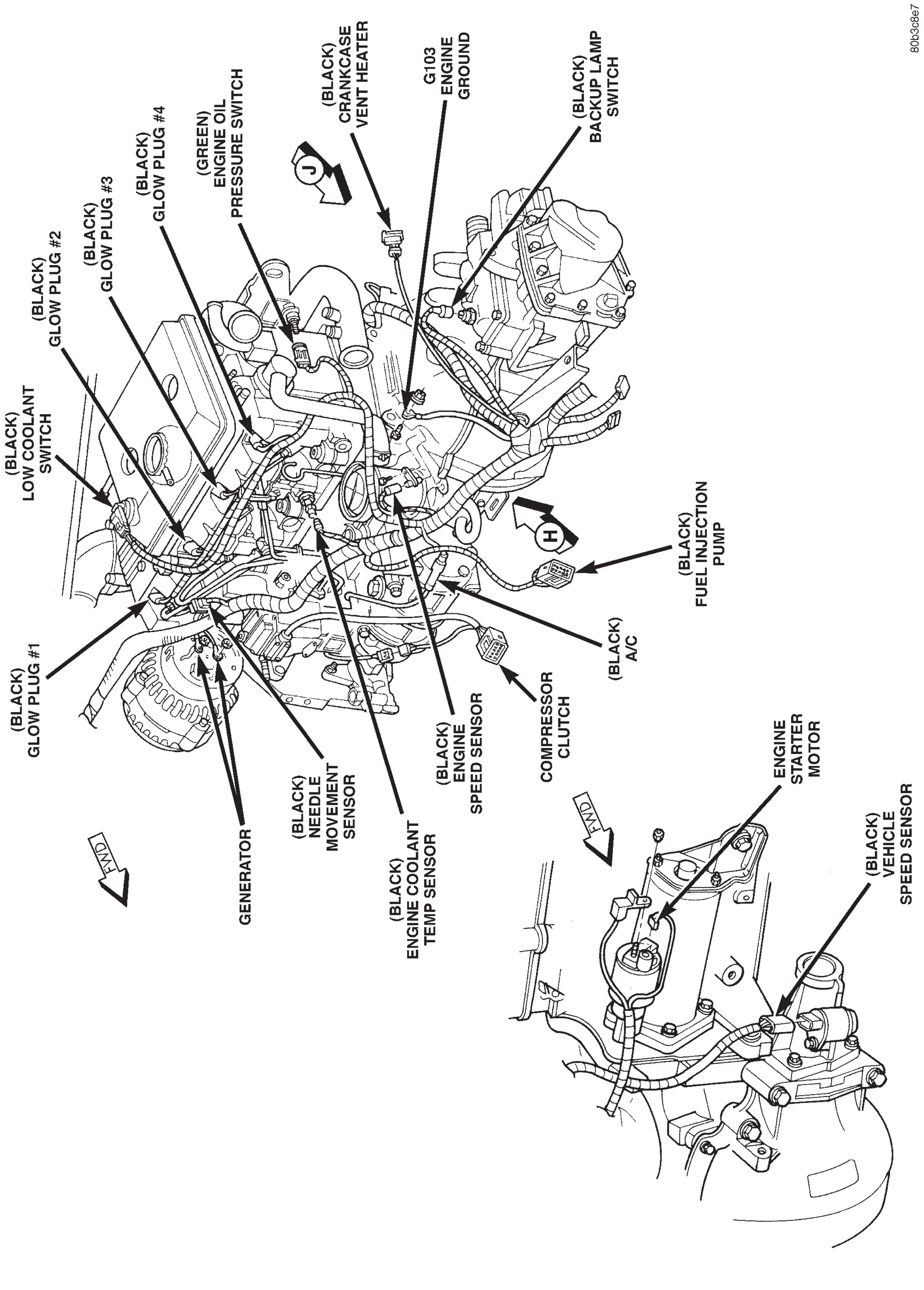

Fig. 8 Engine Connections—2.5L, RHD

DESCRIPTION AND OPERATION (Continued)

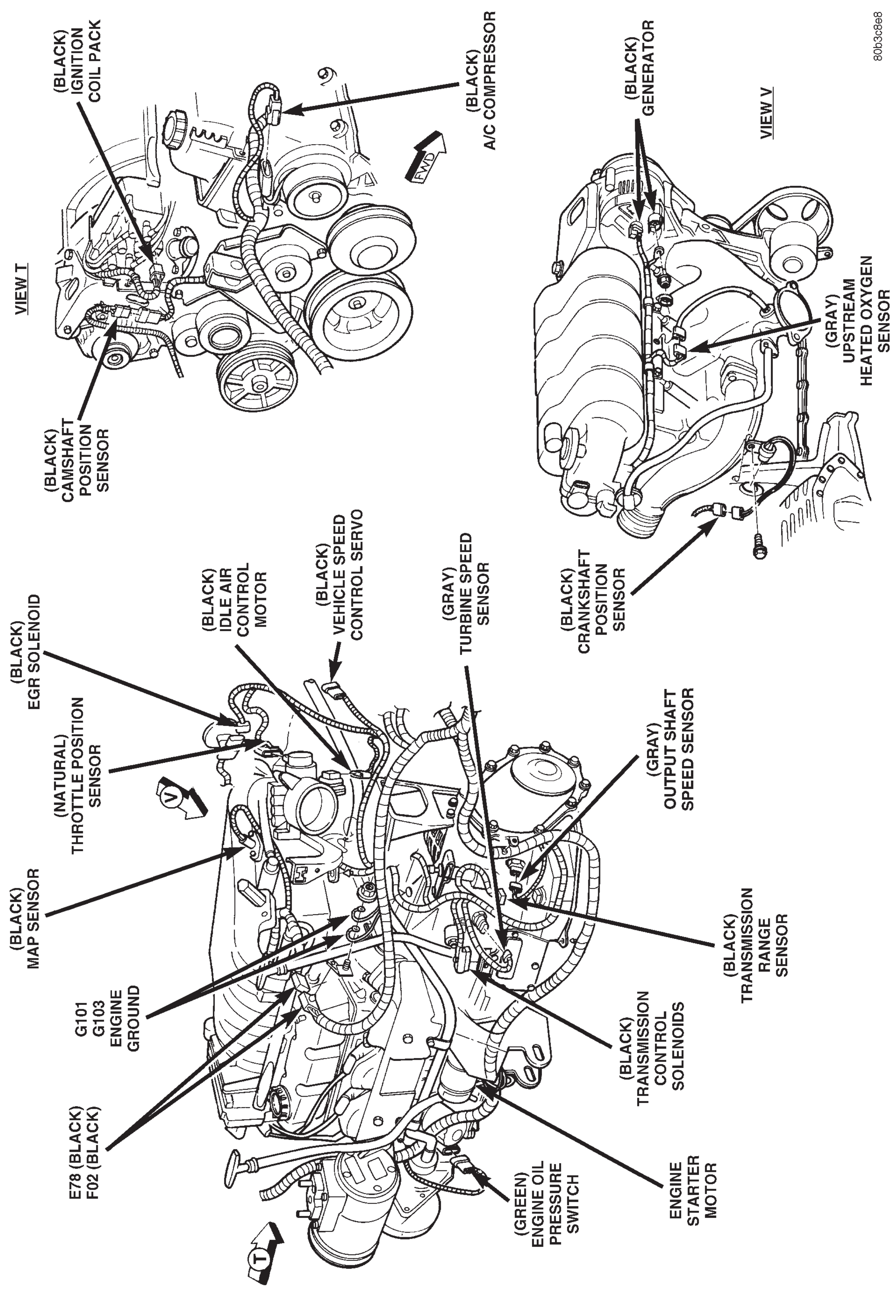

Fig. 9 Engine Connections—3.3L, 3.8L, RHD

DESCRIPTION AND OPERATION (Continued)

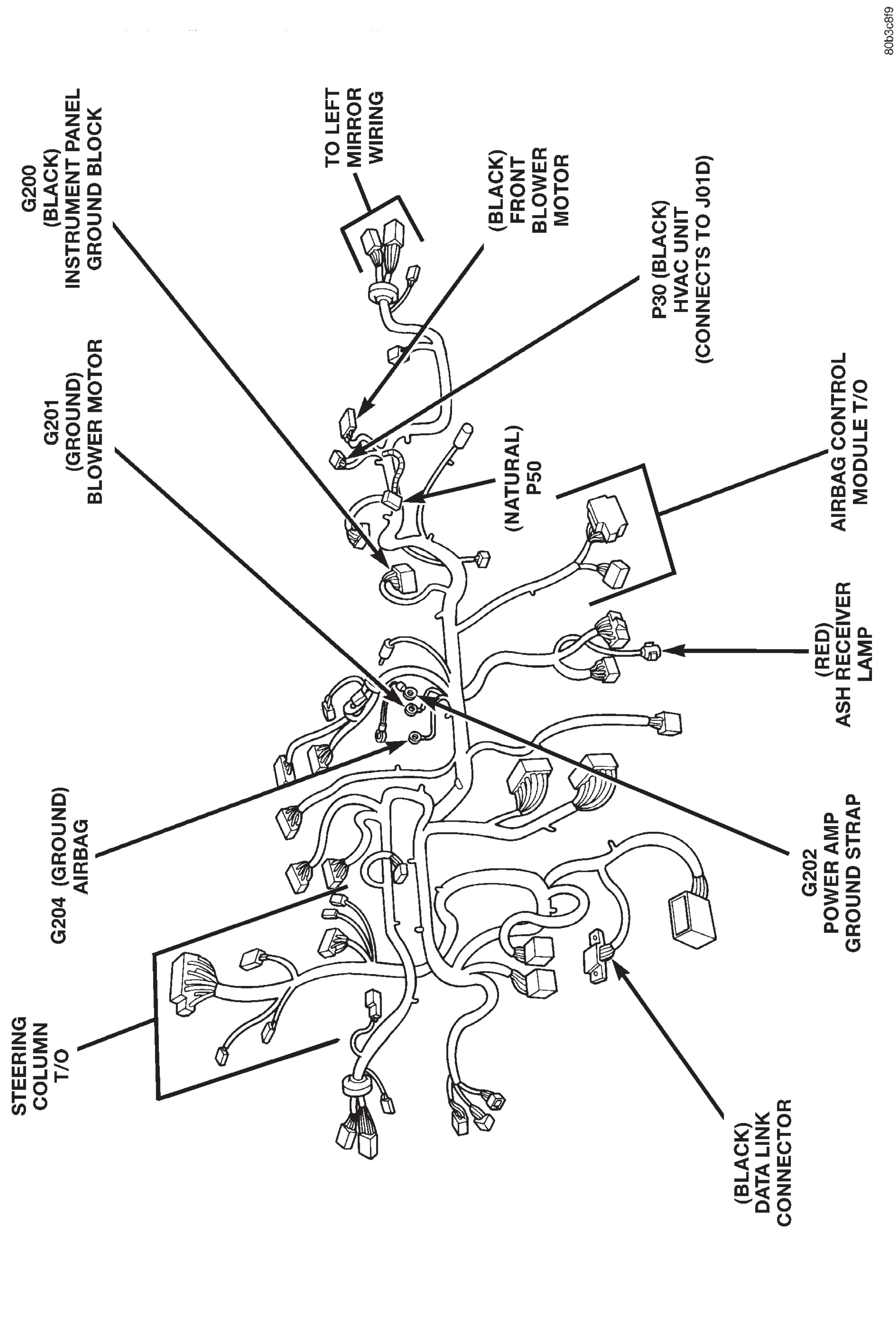

Fig. 10 Instrument Panel Connections—RHD

DESCRIPTION AND OPERATION (Continued)

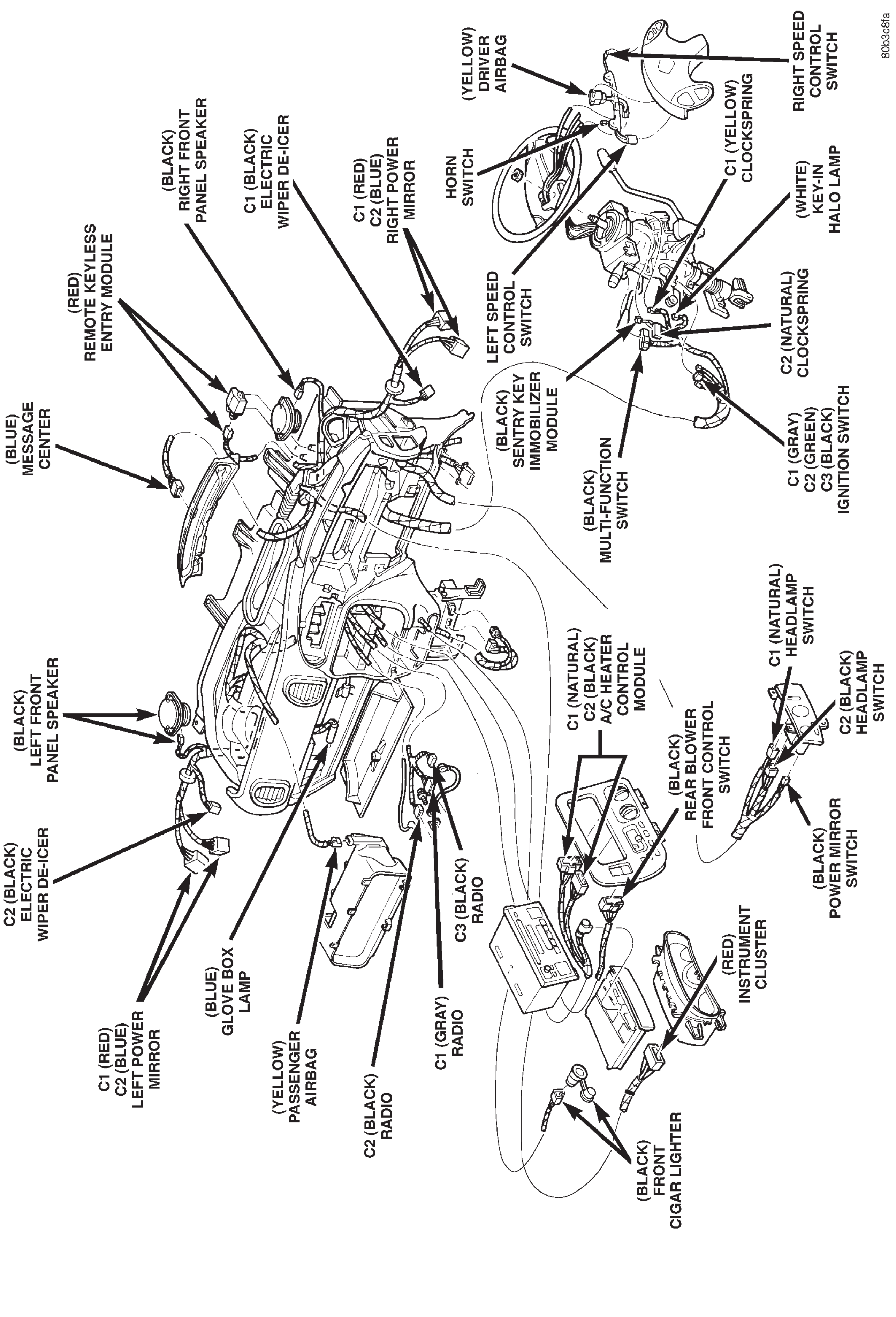

Fig. 11 Instrument Panel Connections—RHD

DESCRIPTION AND OPERATION (Continued)

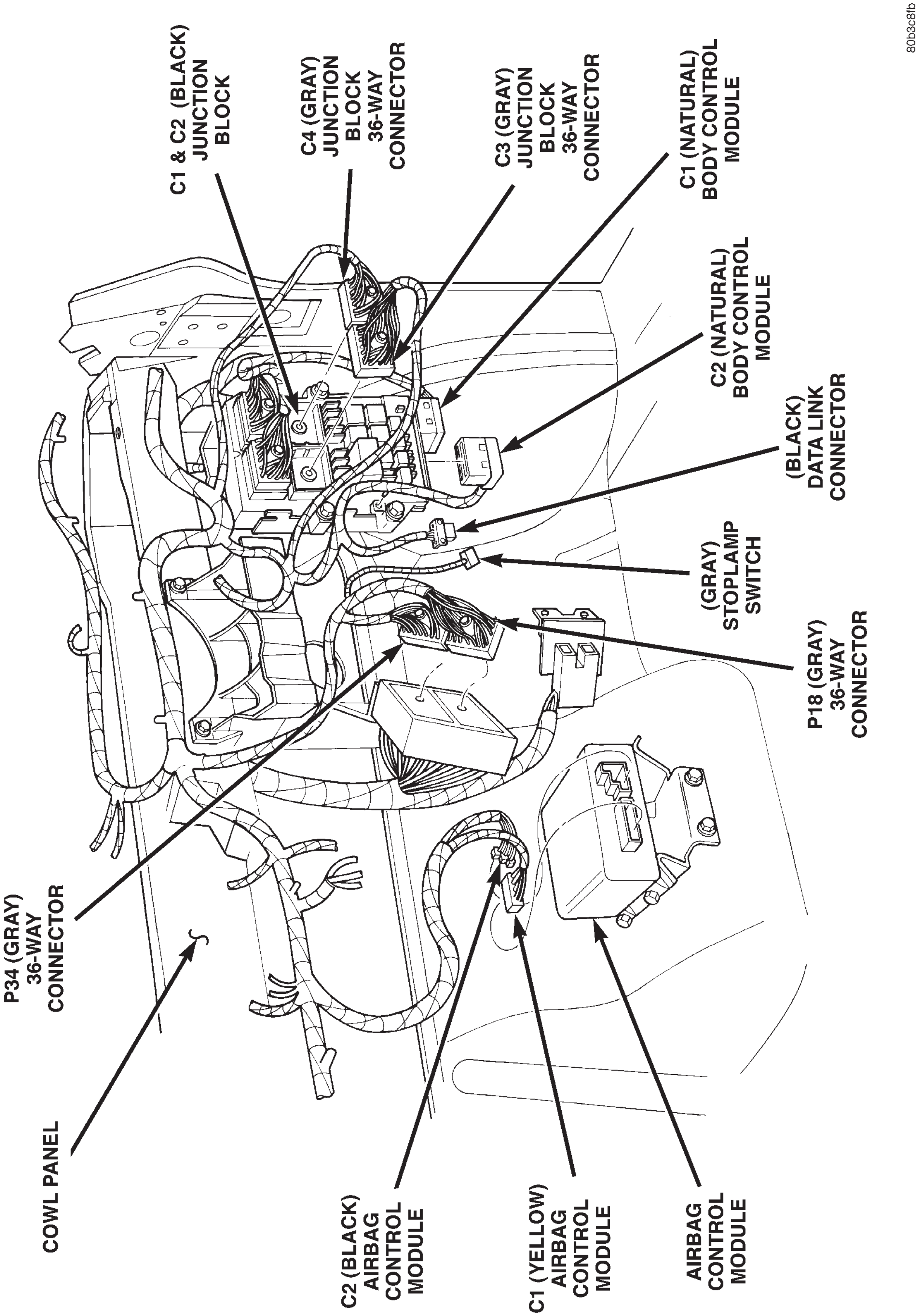

Fig. 12 Instrument Panel Connections—RHD

DESCRIPTION AND OPERATION (Continued)

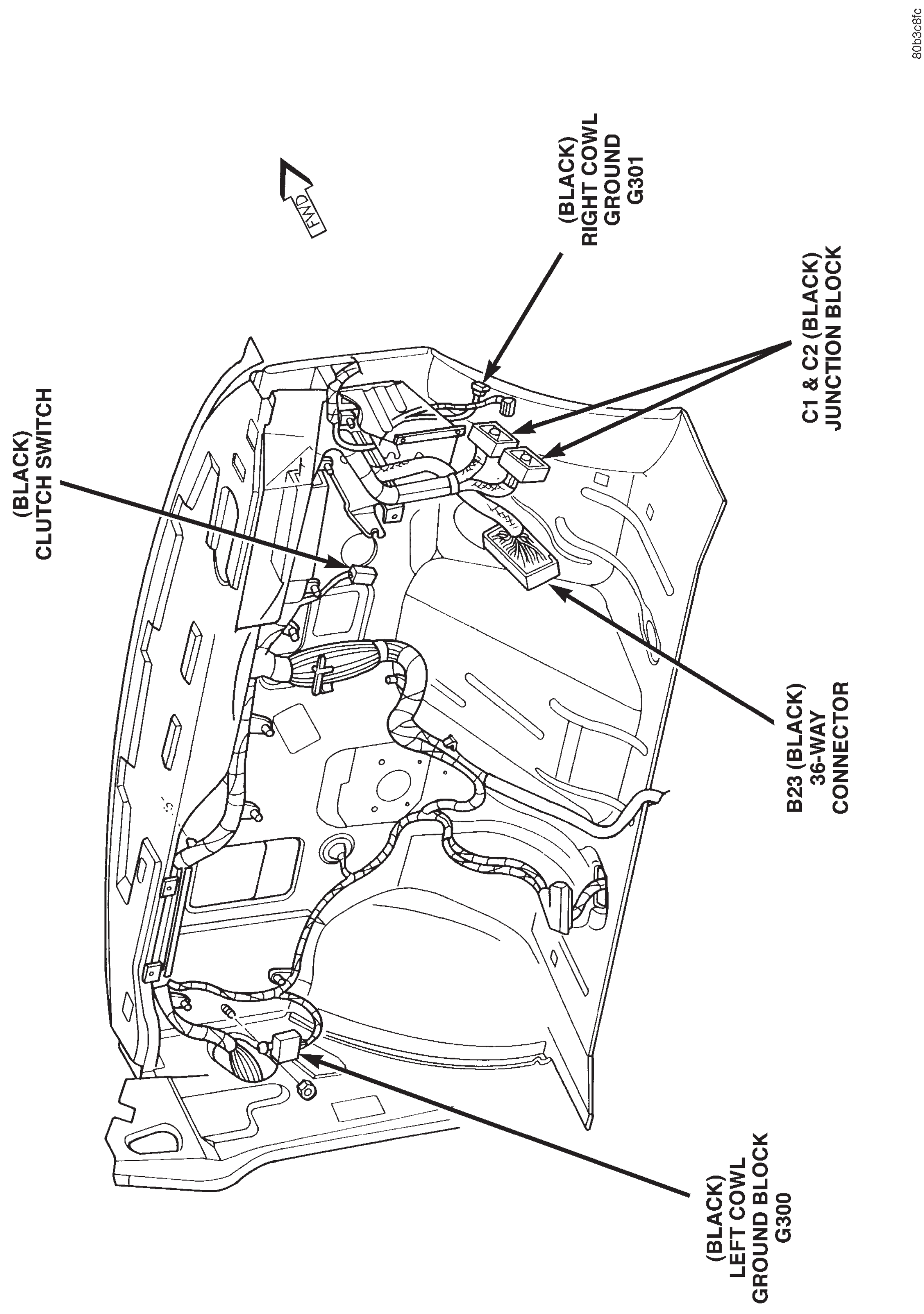

Fig. 13 Cowl Panel Connections—RHD

DESCRIPTION AND OPERATION (Continued)

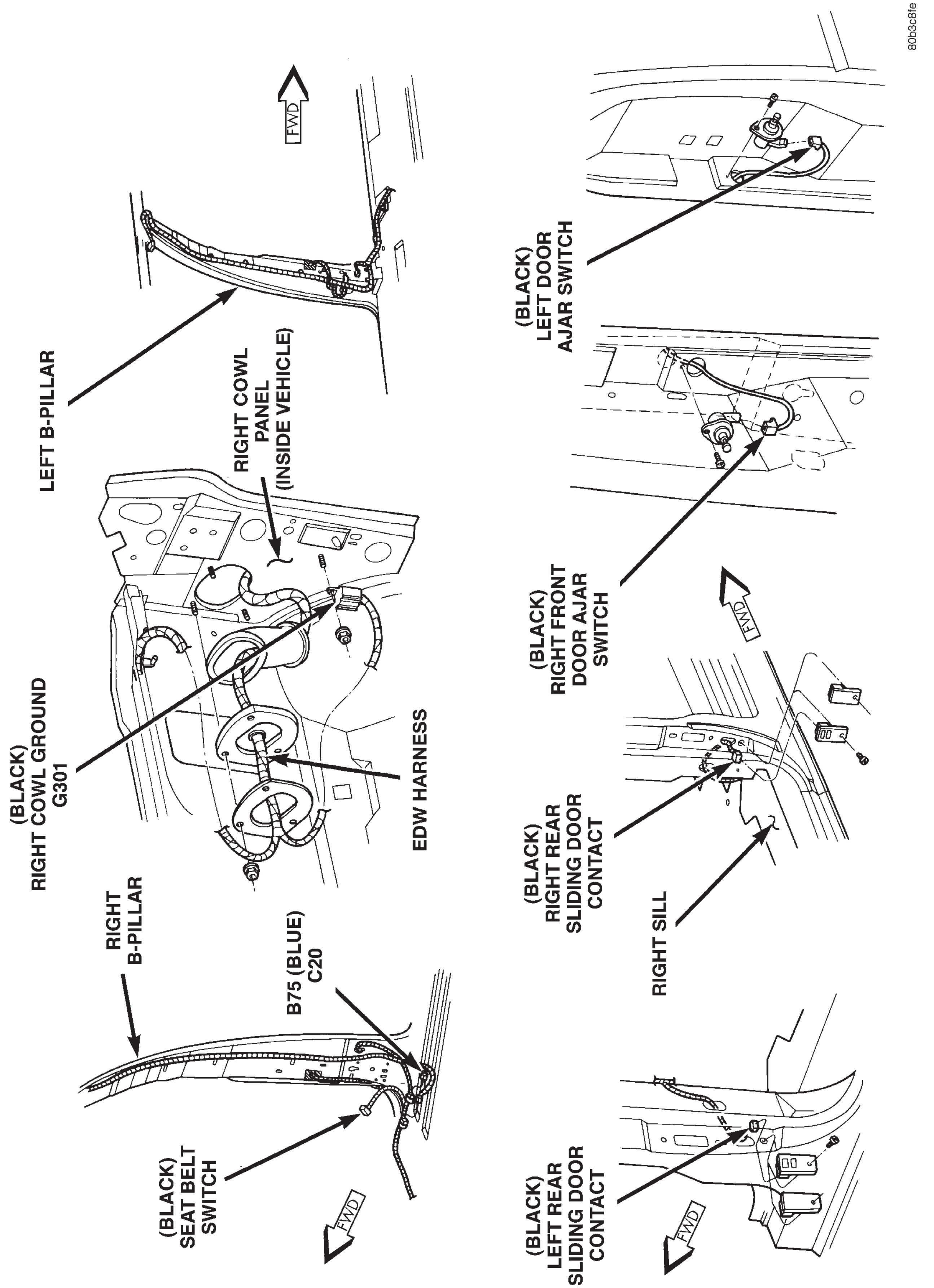

Fig. 14 Body Connections—RHD

DESCRIPTION AND OPERATION (Continued)

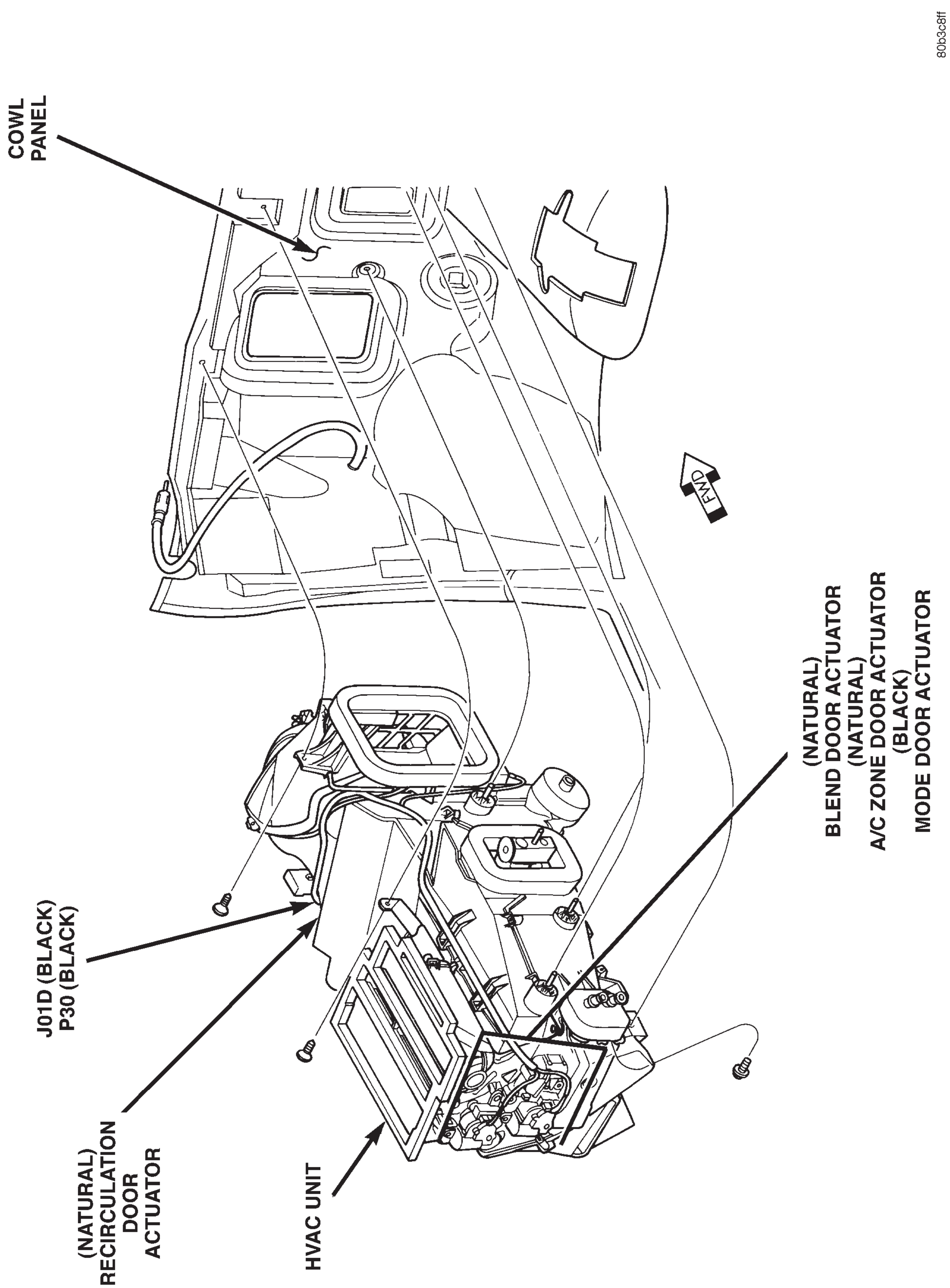

Fig. 15 HVAC Connections—RHD

DESCRIPTION AND OPERATION (Continued)

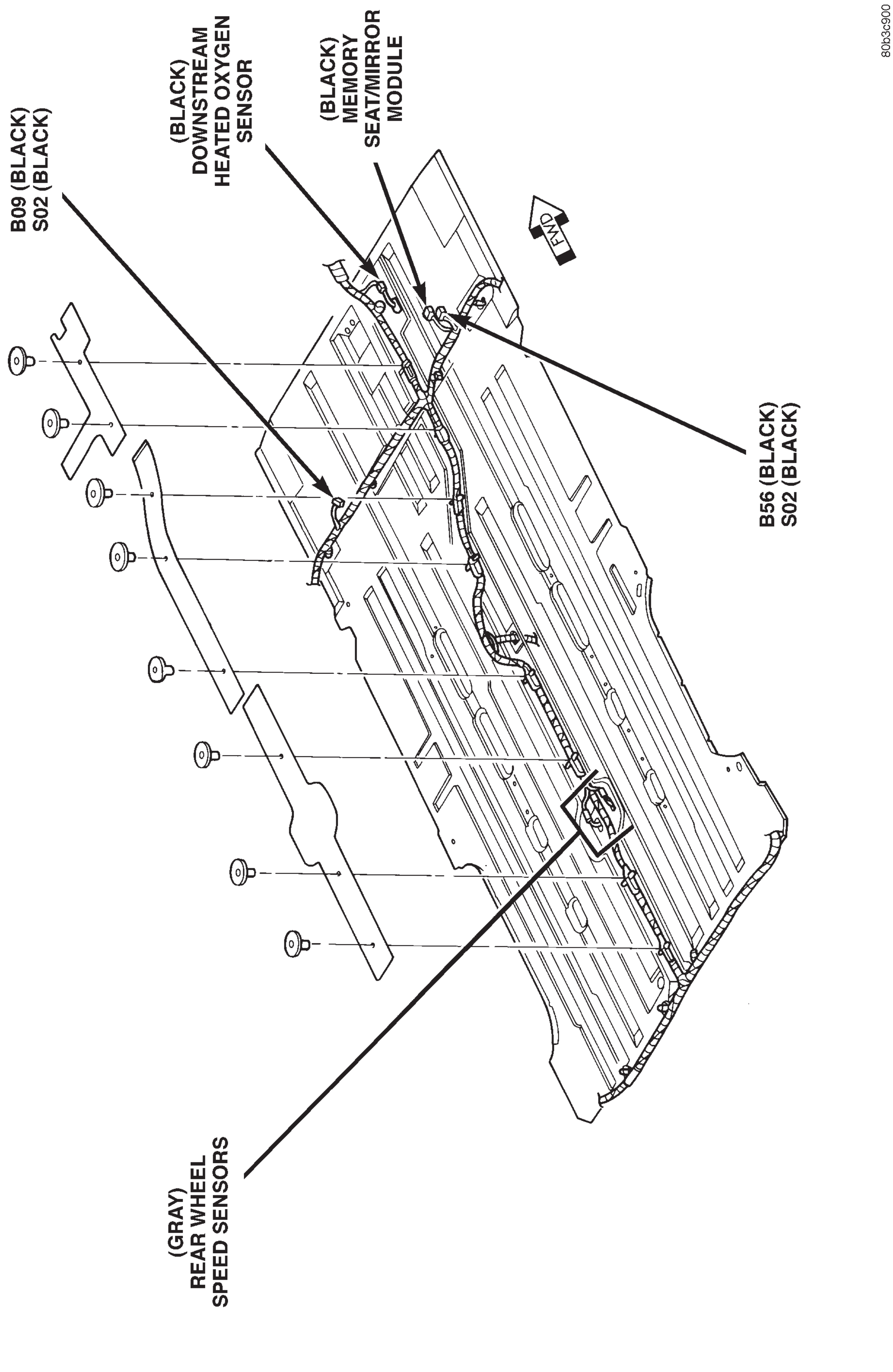

Fig. 16 Body Connections—RHD

DESCRIPTION AND OPERATION (Continued)

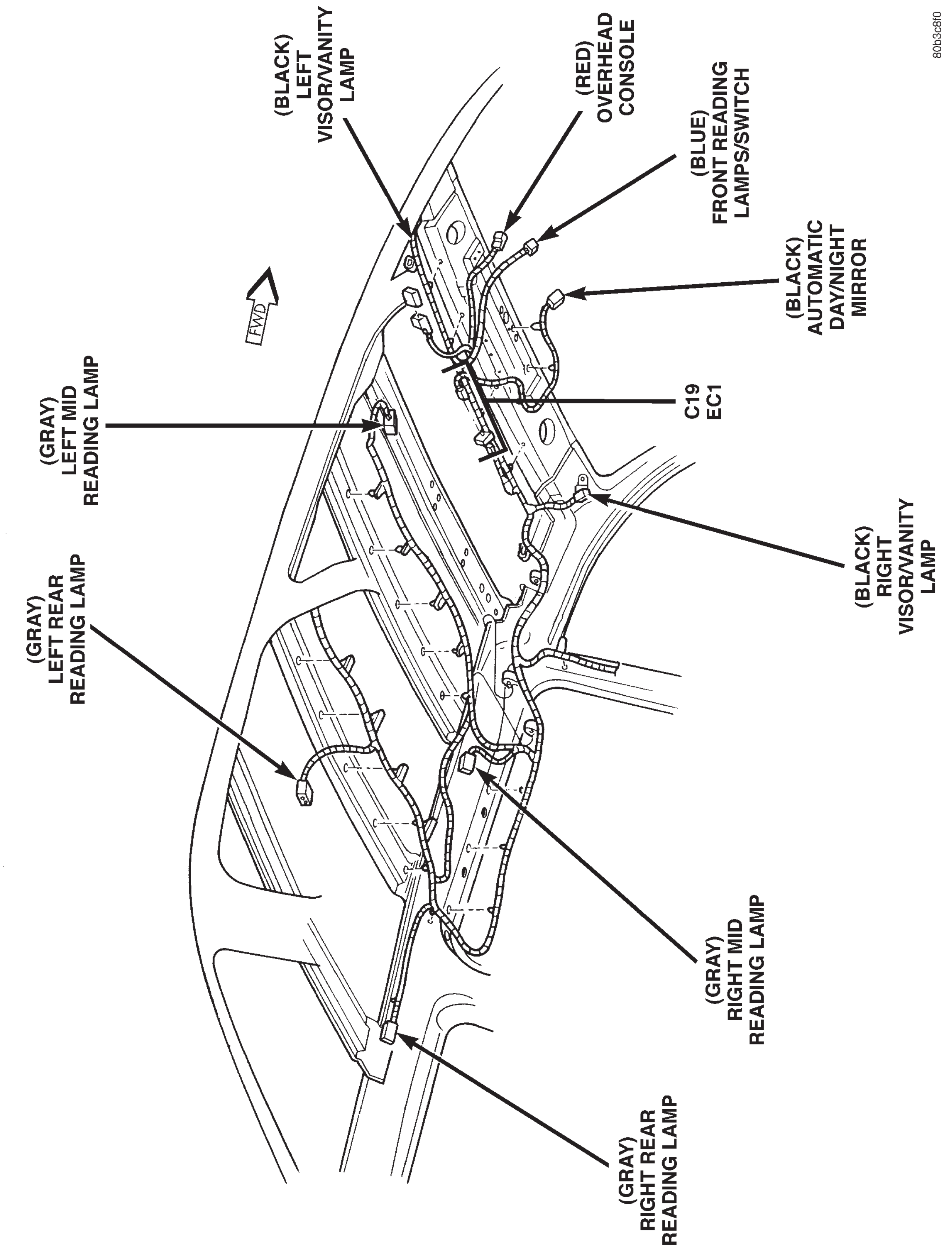

Fig. 17 Roof Panel Connections—RHD

DESCRIPTION AND OPERATION (Continued)

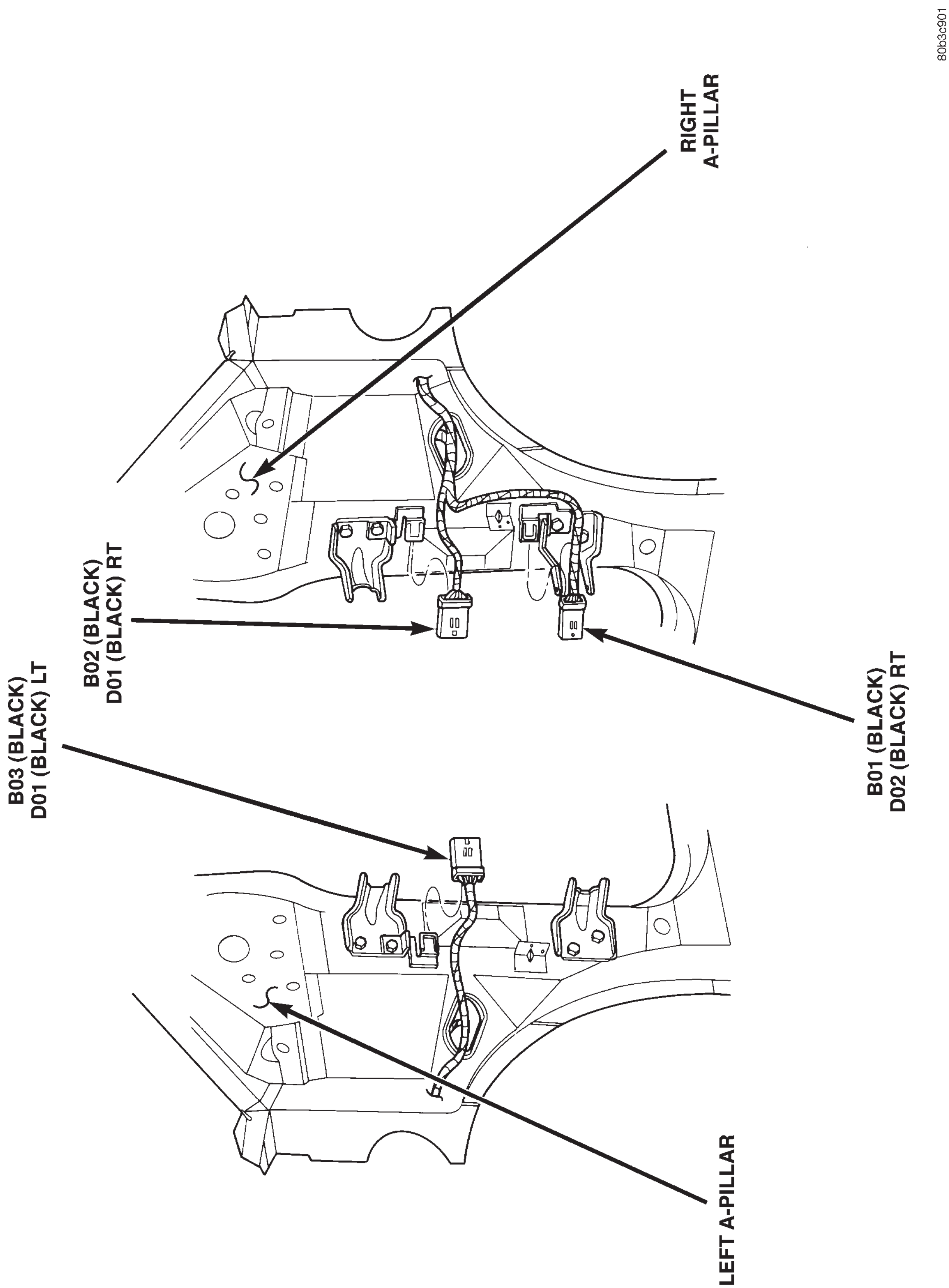

Fig. 18 Body to Door Connections—RHD

DESCRIPTION AND OPERATION (Continued)

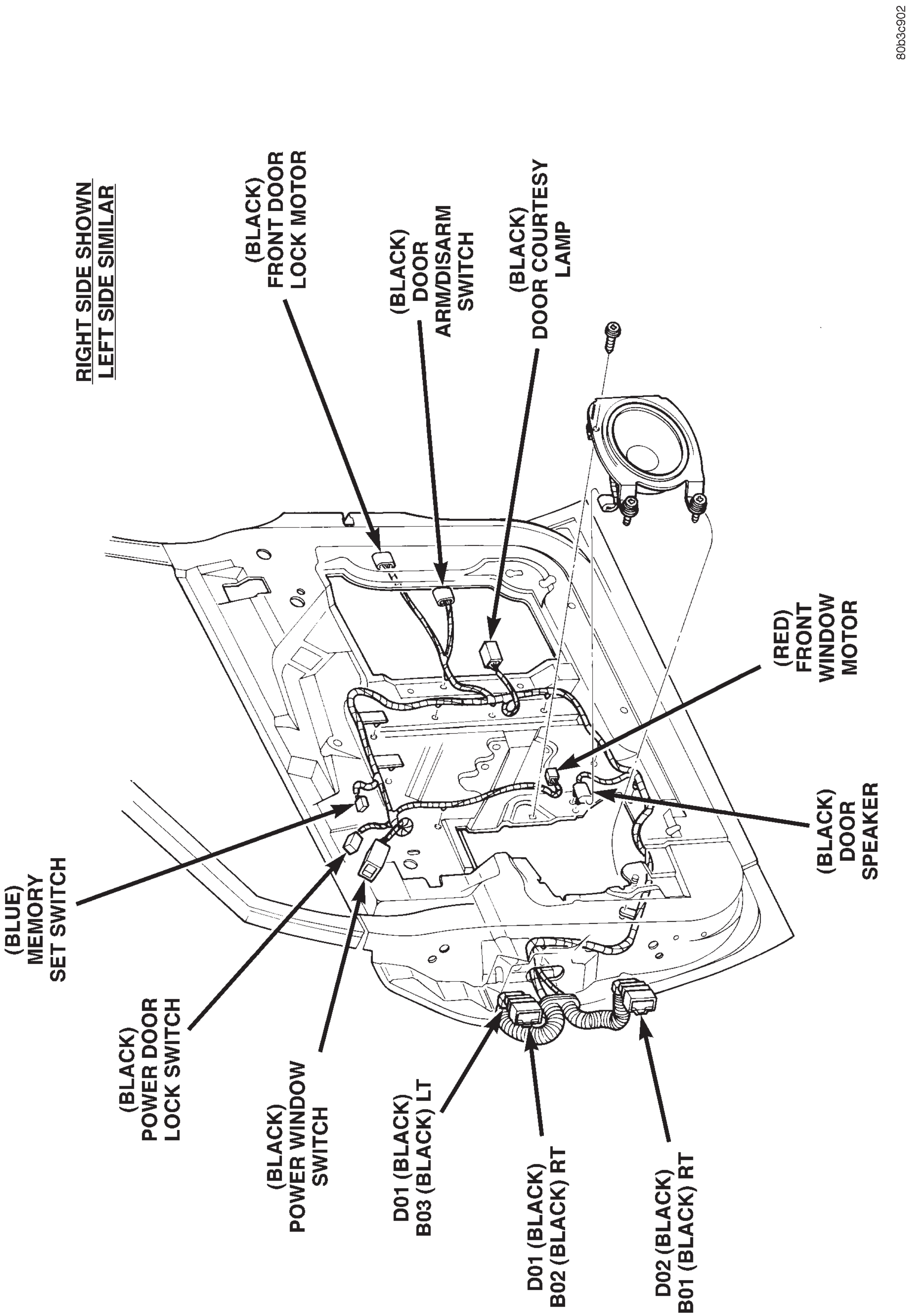

Fig. 19 Door Connections—RHD

DESCRIPTION AND OPERATION (Continued)

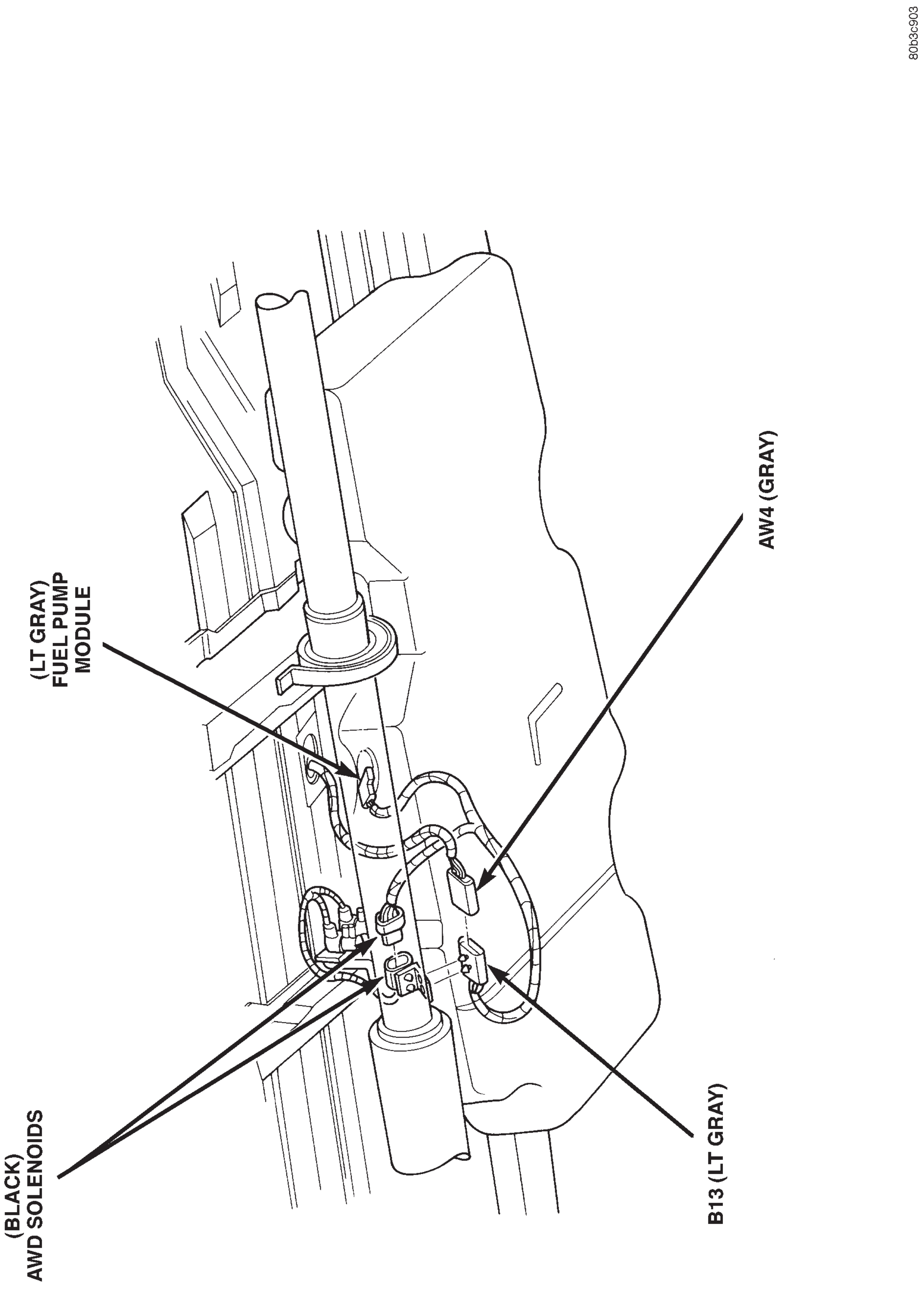

Fig. 20 Underbody Connections—RHD

DESCRIPTION AND OPERATION (Continued)

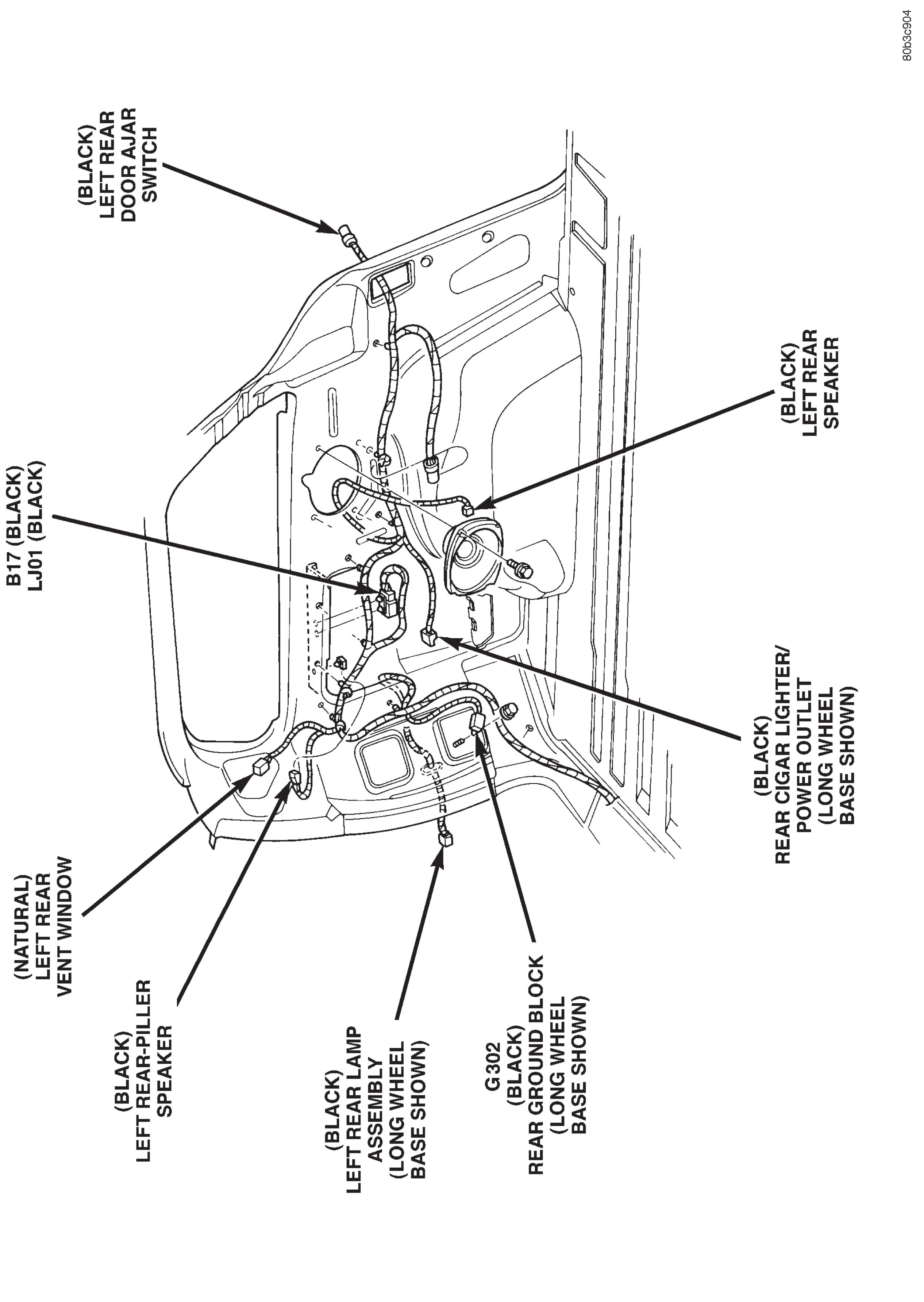

Fig. 21 Left Rear Quarter Connections—RHD

DESCRIPTION AND OPERATION (Continued)

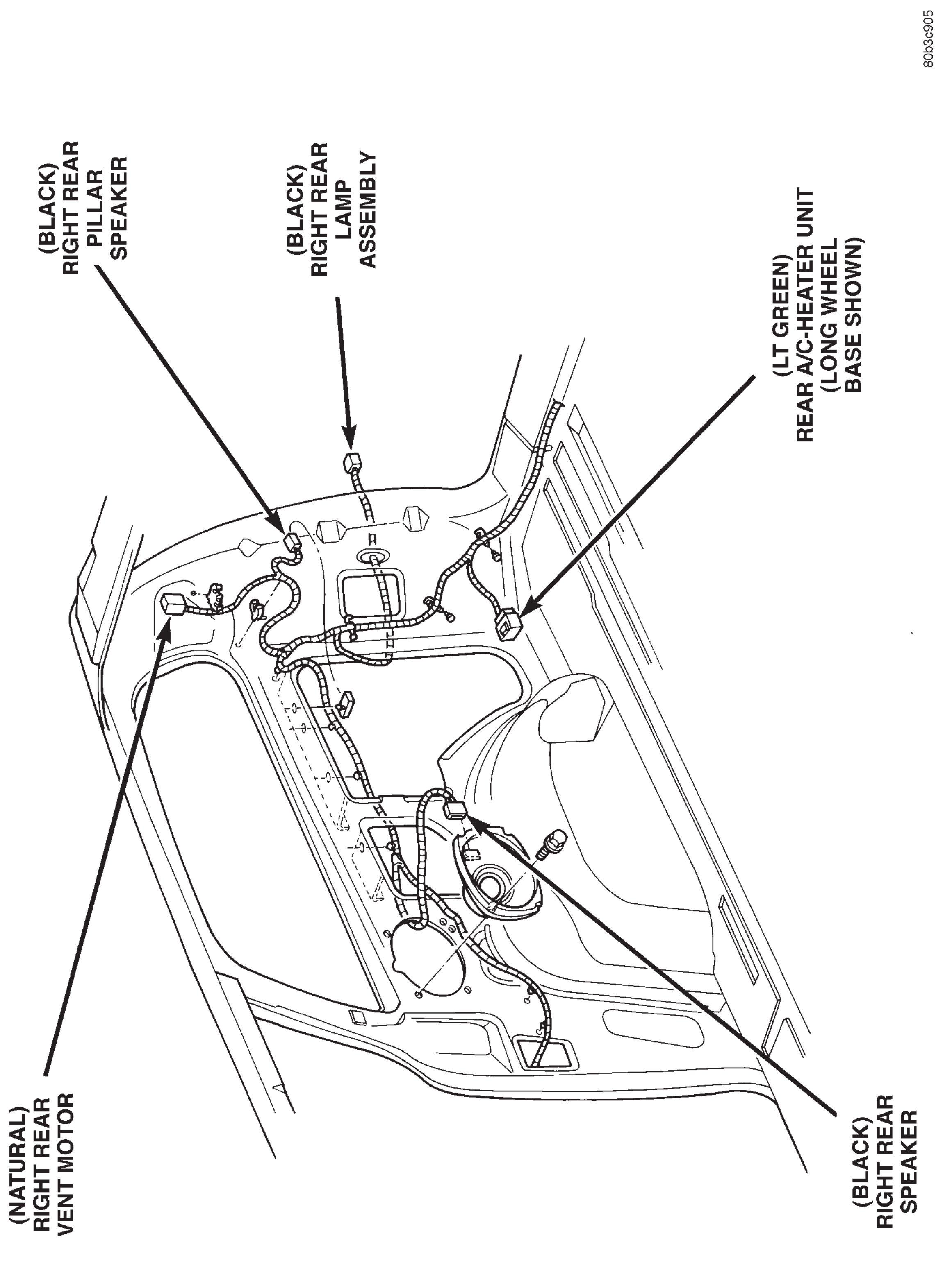

Fig. 22 Right Rear Quarter Connections—RHD

DESCRIPTION AND OPERATION (Continued)

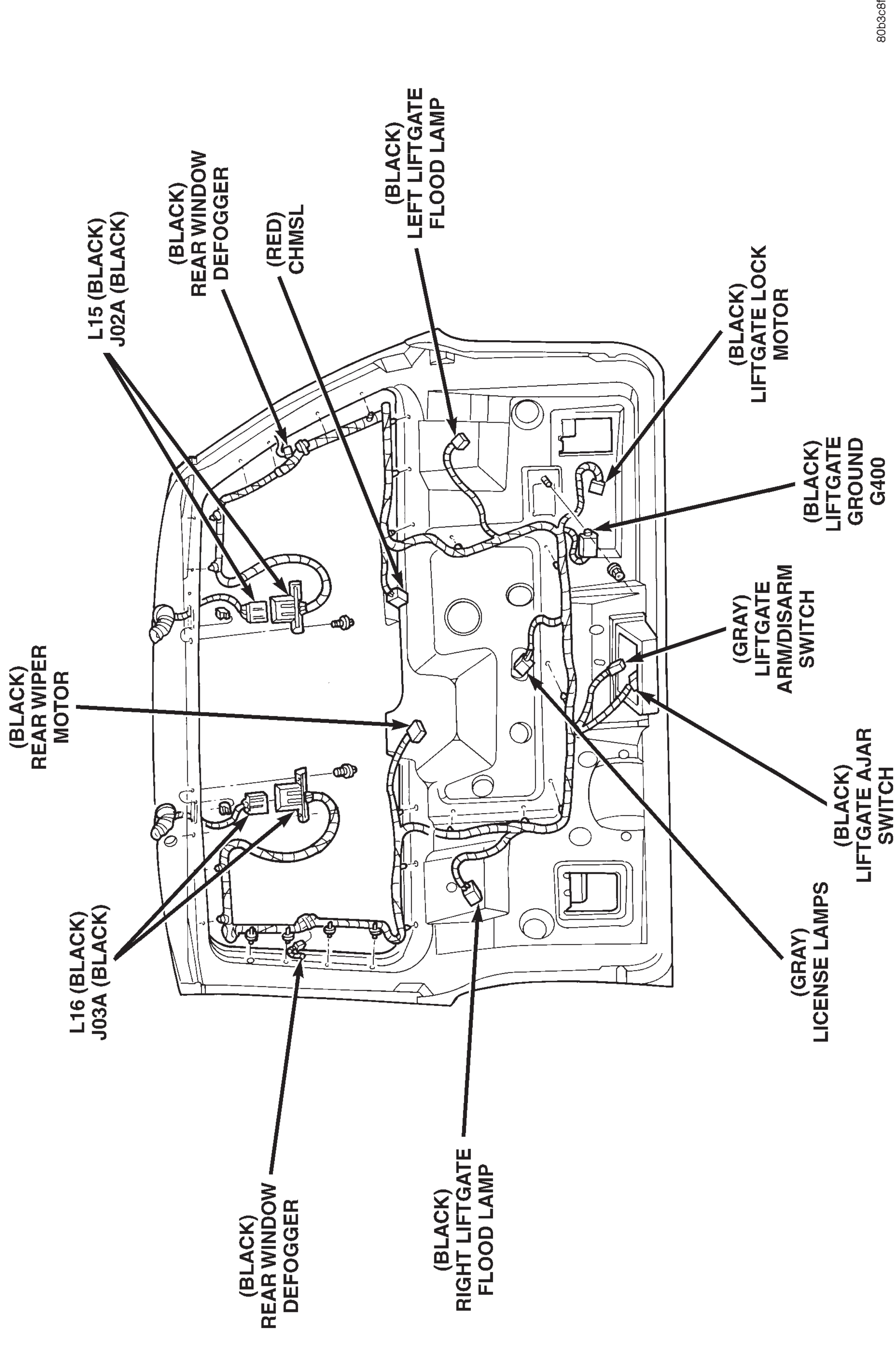

Fig. 23 Liftgate Connections—RHD

8W-95 SPLICE LOCATIONS

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DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of the splices in this vehicle. A splice index is provided. Use the wiring diagrams in each section for splice number identification. Refer to the index for the proper splice number.

SPLICE LOCATION INDEX

Splice Number	Location	Fig.
BS01	Near Split for Tail Lamps	12
BS02	Near Fuel Tank T/O	12
BS03	Near Instrument Panel T/O	9
BS05	Near Instrument Panel T/O	9
BS05 (2.5L)	Near MSA Controller T/O	N/S
BS06	Near Instrument Panel T/O	9
BS06 (2.5L)	Near MSA Controller T/O	N/S
BS08	Near Instrument Panel T/O	9
BS16	Near Right Park Lamp T/O	1
BS17	Near Split for Tail Lamps	12
BS19	Near Horn T/O	1
BS30 (2.5L)	Near Generator T/O	5
BS31	Near Left Headlamp Leveling Motor T/O	1
BS31 (2.5L)	In BCM T/O	5
BS32 (2.5L)	In BCM T/O	N/S
BS33 (2.5L)	In BCM T/O	N/S
BS34 (2.5L)	In BCM T/O	N/S
BS40 (2.5L)	In Engine Harness T/O	5
BS41 (2.5L)	In Engine Harness T/O	N/S
CS01	Above Right Rear Door	11
CS02	Above Right Rear Door	11
CS03	Right B-Pillar	11
CS04	Right B-Pillar	11
DS01	Near LT Power WDO T/O	10
ES01	In TCM T/O	7
ES01 (2.5L)	Near Battery Positive Terminal T/O	N/S
ES02 (2.0L)	Near Camshaft Position Sensor T/O	3
ES02 (2.4L)	Near Fuel Rail T/O	4
ES02 (2.5L)	Near Engine Speed Sensor T/O	5
ES02 (3.3L,3.8L)	Near Transmission T/O	6
ES03 (2.0L)	Near Distributor Coil T/O	2
ES03 (2.4L)	Near PDC T/O	4
ES03 (3.3L,3.8L)	Near Body Ground T/O	7
ES05 (2.4L)	Near Knock Sensor T/O	4
ES05 (2.5L)	In Fuel Injection Pump T/O	5
ES05 (3.3L,3.8L)	Near Transmission T/O	6
ES06 (2.5L)	Near Needle Movement Sensor T/O	5
ES06 (3.3L,3.8L)	Near Transmission T/O	N/S
ES07 (2.0L)	Near Engine Ground T/O	2
ES07 (2.5L)	Near Battery Negative Terminal T/O	N/S
ES07 (2.4L)	Near Body Ground T/O	4, 7
ES07 (3.3L,3.8L)	Near Battery Negative Terminal T/O	6
ES08 (3.3L,3.8L)	Near Transmission T/O	6
ES09 (2.0L)	In Battery Positive Terminal T/O	7
ES09 (2.4L)	Near Battery Positive Terminal	4

DESCRIPTION AND OPERATION (Continued)

Splice Number	Location	Fig.
ES09 (2.5L)	In Battery Positive Terminal T/O	N/S
ES09 (3.3L,3.8L)	In Battery Positive Terminal T/O	7
ES10	Near Knock Sensor T/O	6
ES10 (3.3L,3.8L)	Near Transmission T/O	7
ES11 (2.0L)	Near Battery Positive Terminal T/O	7
ES11 (2.4L)	Near Battery Negative Terminal T/O	4
ES11 (2.5L)	In Generator T/O	N/S
ES11 (3.3L,3.8L)	Near Battery Negative Terminal	7
ES12 (2.4L)	Near Throttle Body T/O	4
ES12 (2.5L)	Near Battery Negative Terminal T/O	N/S
ES12 (3.3L,3.8L)	Near Battery Positive Terminal T/O	7
ES13 (2.4L)	Near Generator T/O	4
ES13 (3.3L,3.8L)	Near Battery Negative Terminal T/O	7
ES14 (2.4L)	Near Generator T/O	4,7
ES14 (3.3L,3.8L)	Near Battery Negative Terminal T/O	7
ES17 (2.0L)	Near Camshaft Position Sensor T/O	3
ES17 (2.4L)	Near Engine Ground T/O	4
ES17 (3.3L,3.8L)	Near Battery Negative Terminal T/O	7
ES18 (2.0L)	Near Camshaft Position Sensor T/O	3
ES18 (2.4L)	Near Engine Ground T/O	4
ES18 (3.3L,3.8L)	Near Engine Ground T/O	7

Splice Number	Location	Fig.
ES21 (2.0L)	Near Body Ground T/O	N/S
ES21 (2.4L)	Near Engine Ground T/O	4
ES21 (3.3L,3.8L)	Near A/C Clutch T/O	6
ES23 (2.0L)	Near Radiator Fan T/O	N/S
ES23 (2.4L)	Near Radiator Fan T/O	4
ES23 (3.3L,3.8L)	Near Engine ground T/O	7
ES24 (2.4L)	Near Transmission T/O	4
ES24 (3.3L,3.8L)	Near Transmission T/O	7
ES26 (2.5L)	In Battery Positive Terminal T/O	N/S
ES28 (2.5L)	In Battery Positive Terminal T/O	N/S
ES29 (2.5L)	Near Glow Plug Relay T/O	N/S
ES30 (2.5L)	Near Fuel Heater T/O	5
ES31 (2.5L)	Near Fuel Heater T/O	5
ES37 (2.5L)	Near Oil Pressure Switch T/O	5
ES40 (2.5L)	Near Fuel Injection Pump T/O	5
ES99 (2.0L)	Near Knock Sensor T/O	2
FS01 (2.4L)	Near ECT Sensor T/O	N/S
FS01 (3.3L,3.8L)	Near Injector #5 T/O	N/S
FS02 (2.4L)	Near Inj #2 T/O	N/S
FS02 (3.3L,3.8L)	Between Inj’s 4 and 6	N/S
FS03 (2.4L)	Between Inj #2 and #3	N/S
PS01	Near Steering Column T/O	8
PS02	Near Steering Column T/O	8
RFS01	Near Radiator Fan #2	N/S
RFS02	Near Radiator Fan #1	N/S

DESCRIPTION AND OPERATION (Continued)

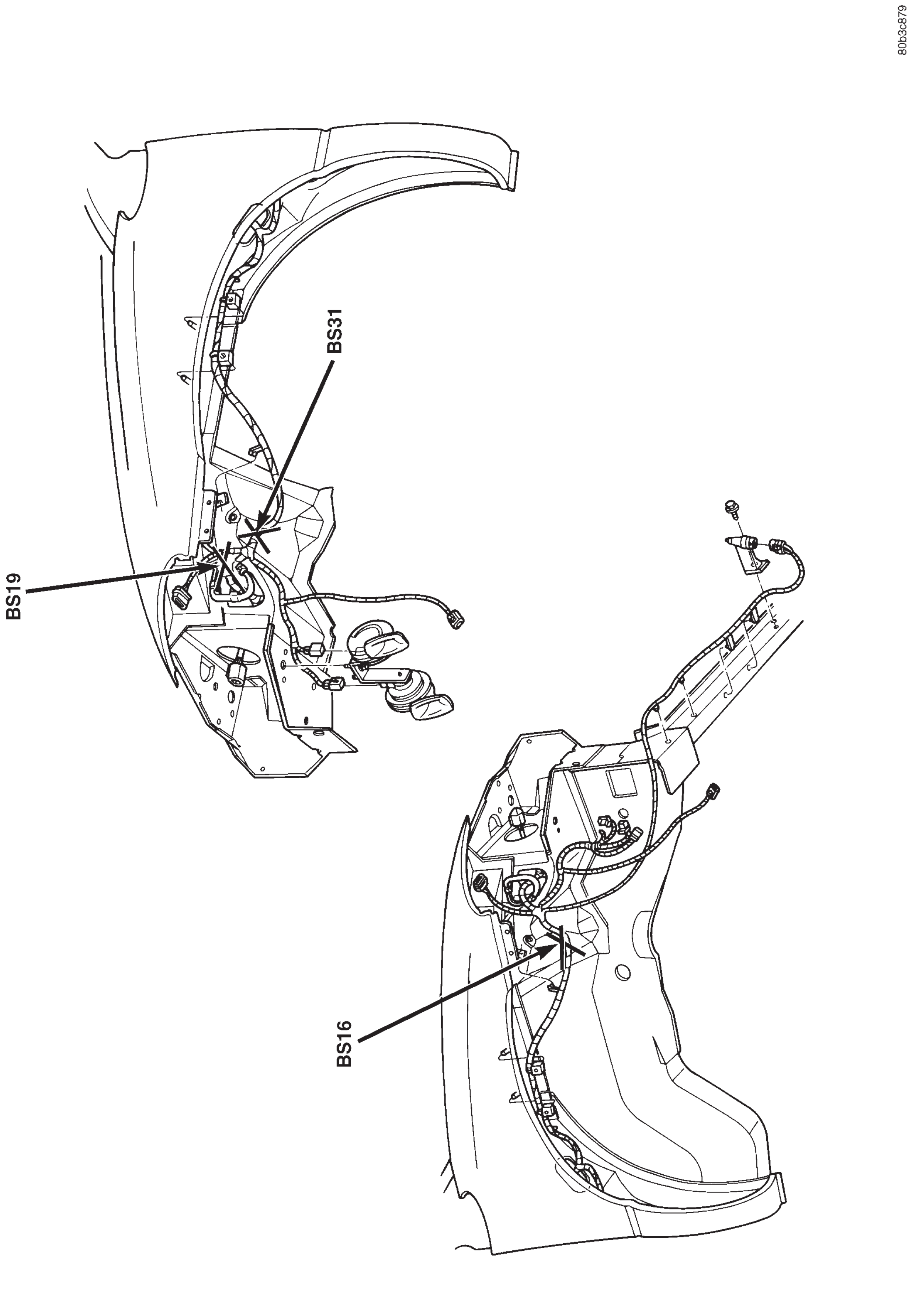

Fig. 1 Front End Splices—LHD

DESCRIPTION AND OPERATION (Continued)

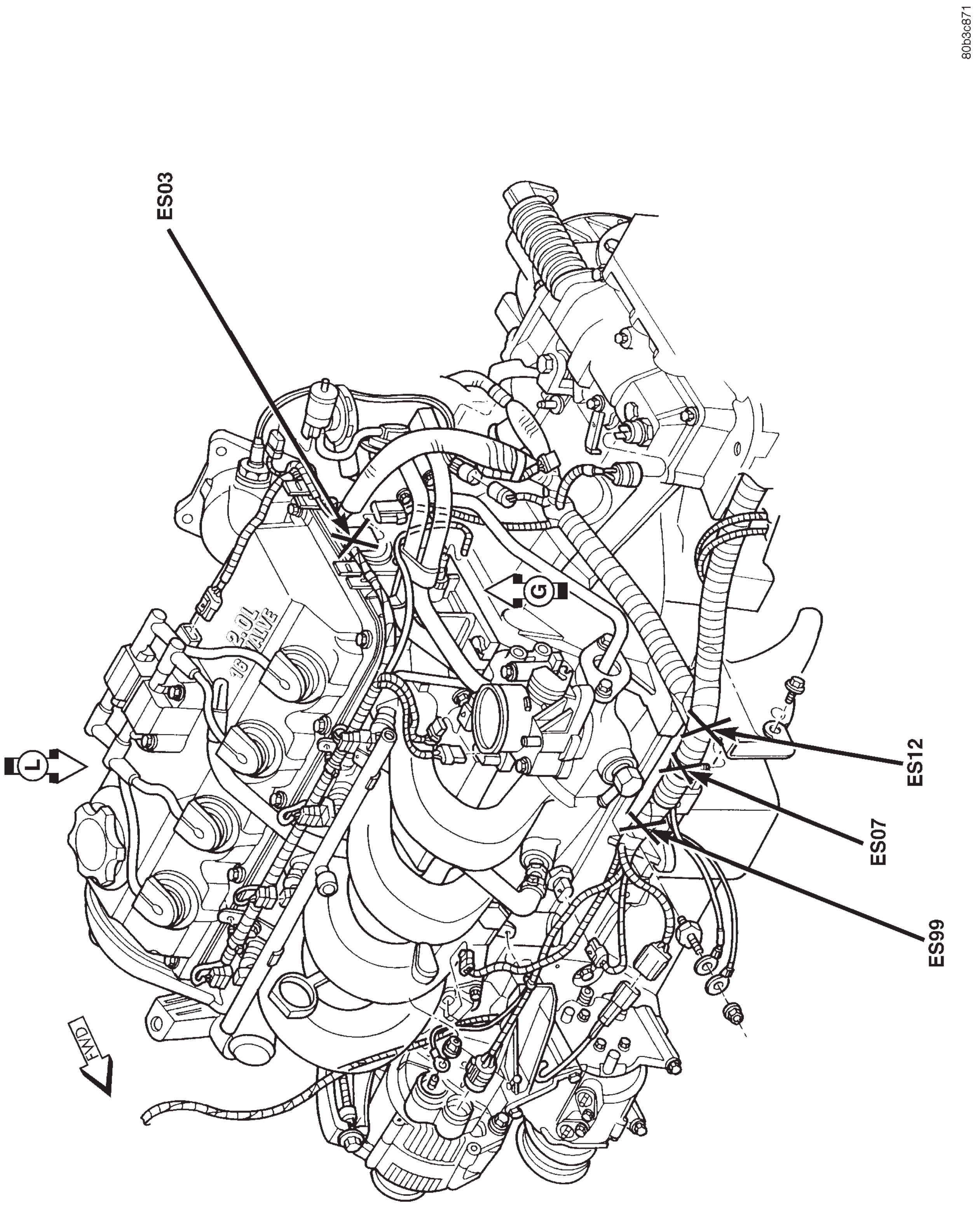

Fig. 2 Engine Splices—2.0L, LHD

DESCRIPTION AND OPERATION (Continued)

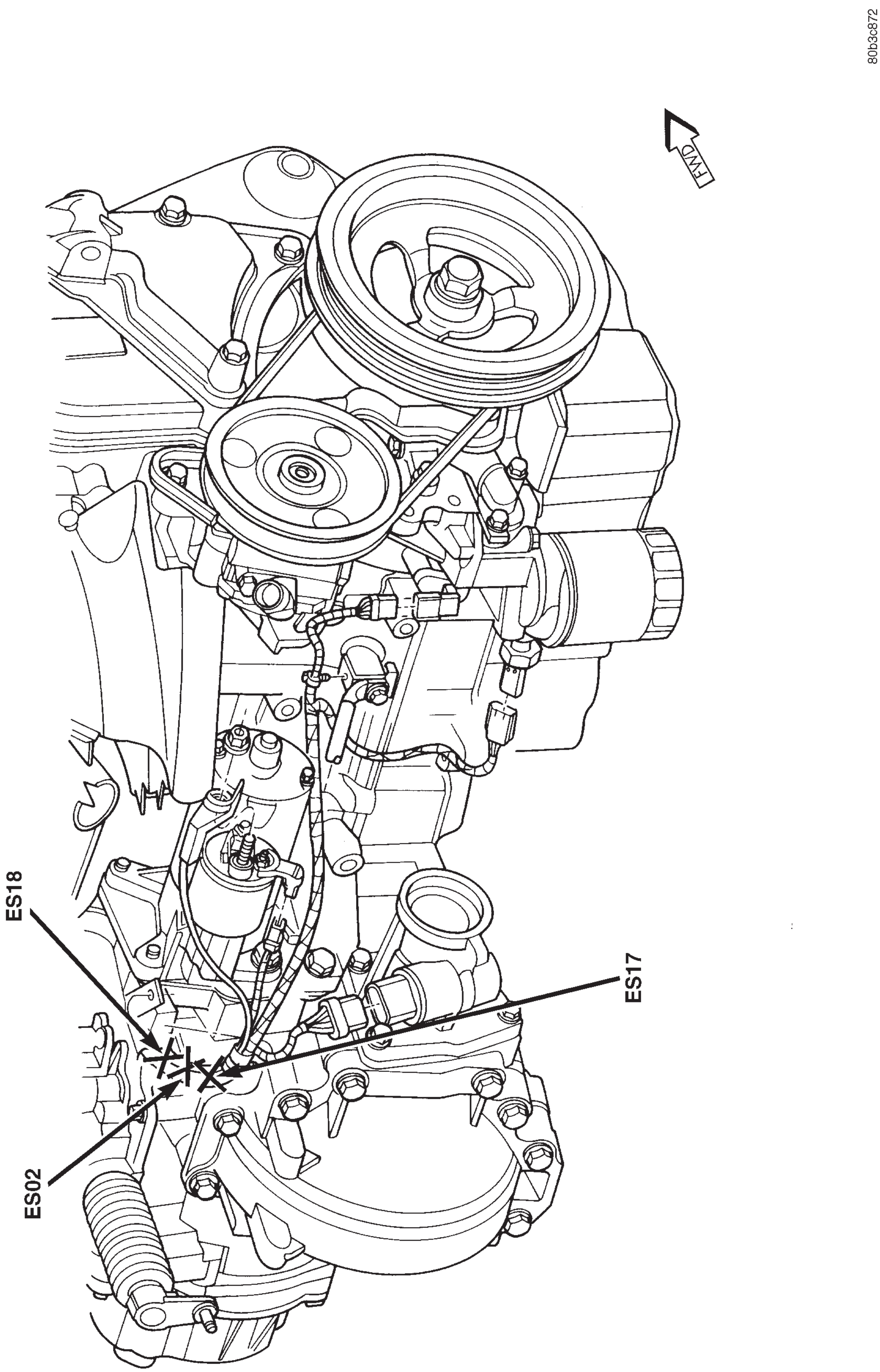

Fig. 3 Engine Splices—2.0L, LHD

DESCRIPTION AND OPERATION (Continued)

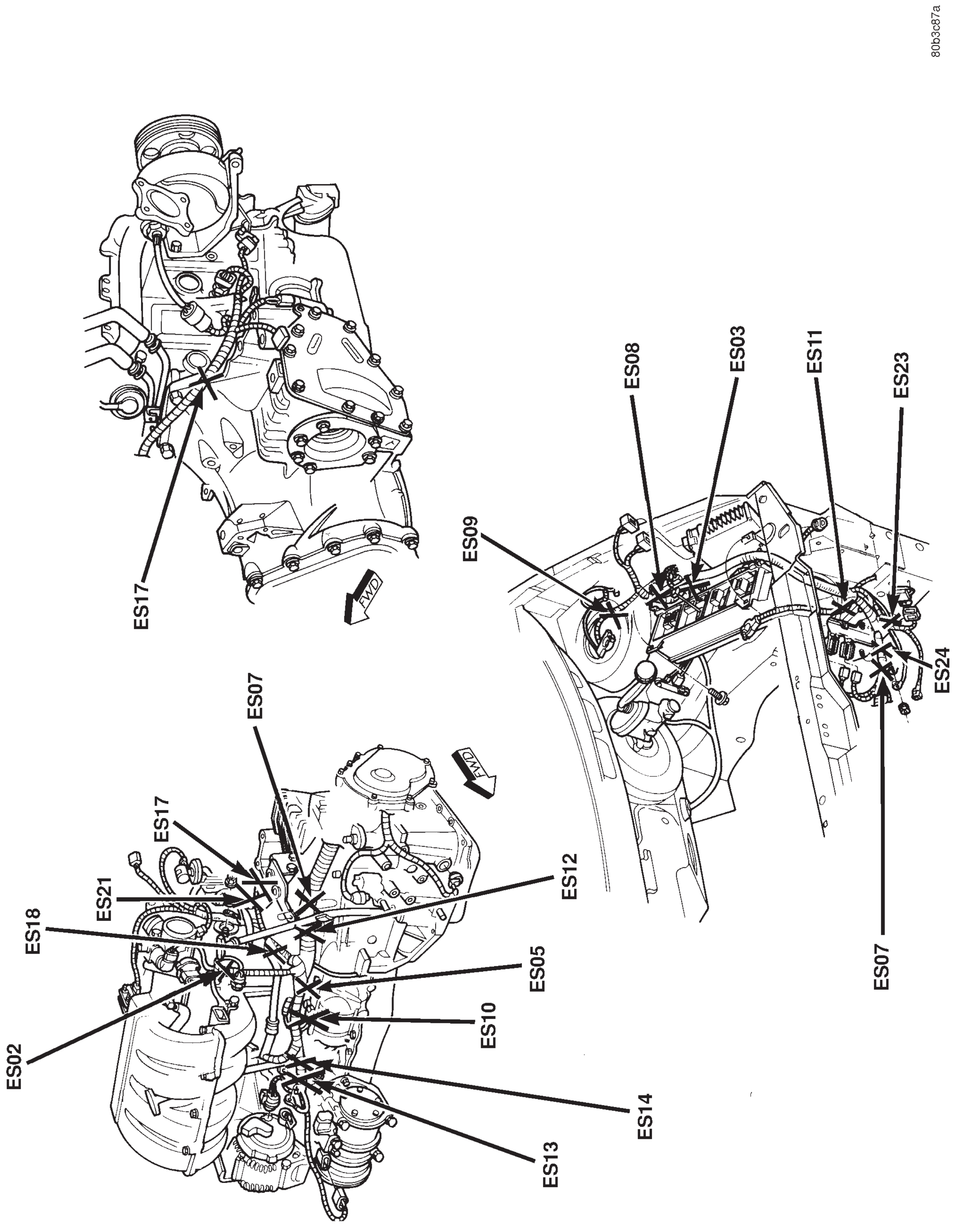

Fig. 4 Engine Splices—2.4L, LHD

DESCRIPTION AND OPERATION (Continued)

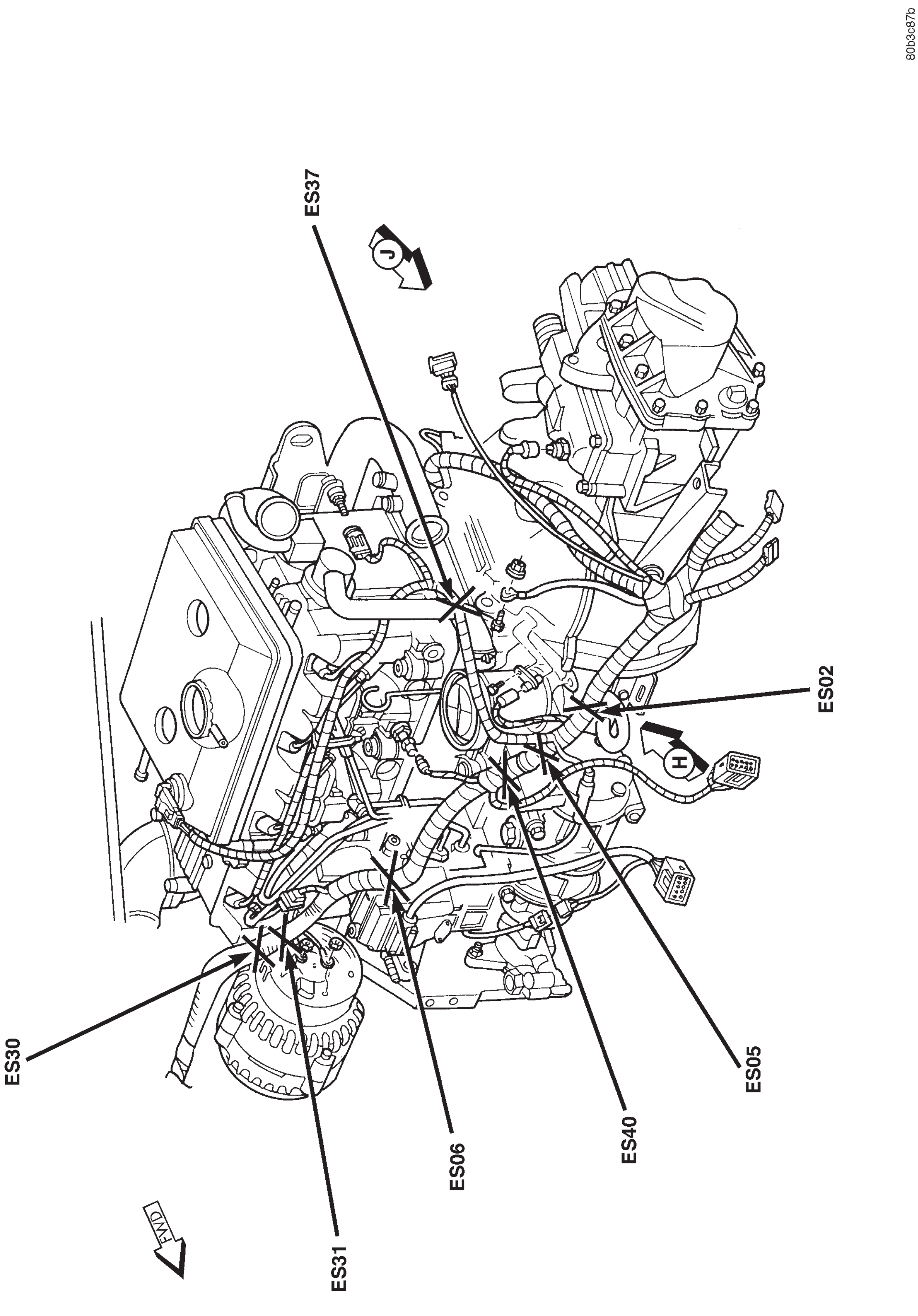

Fig. 5 Engine Splices—2.5L, LHD

DESCRIPTION AND OPERATION (Continued)

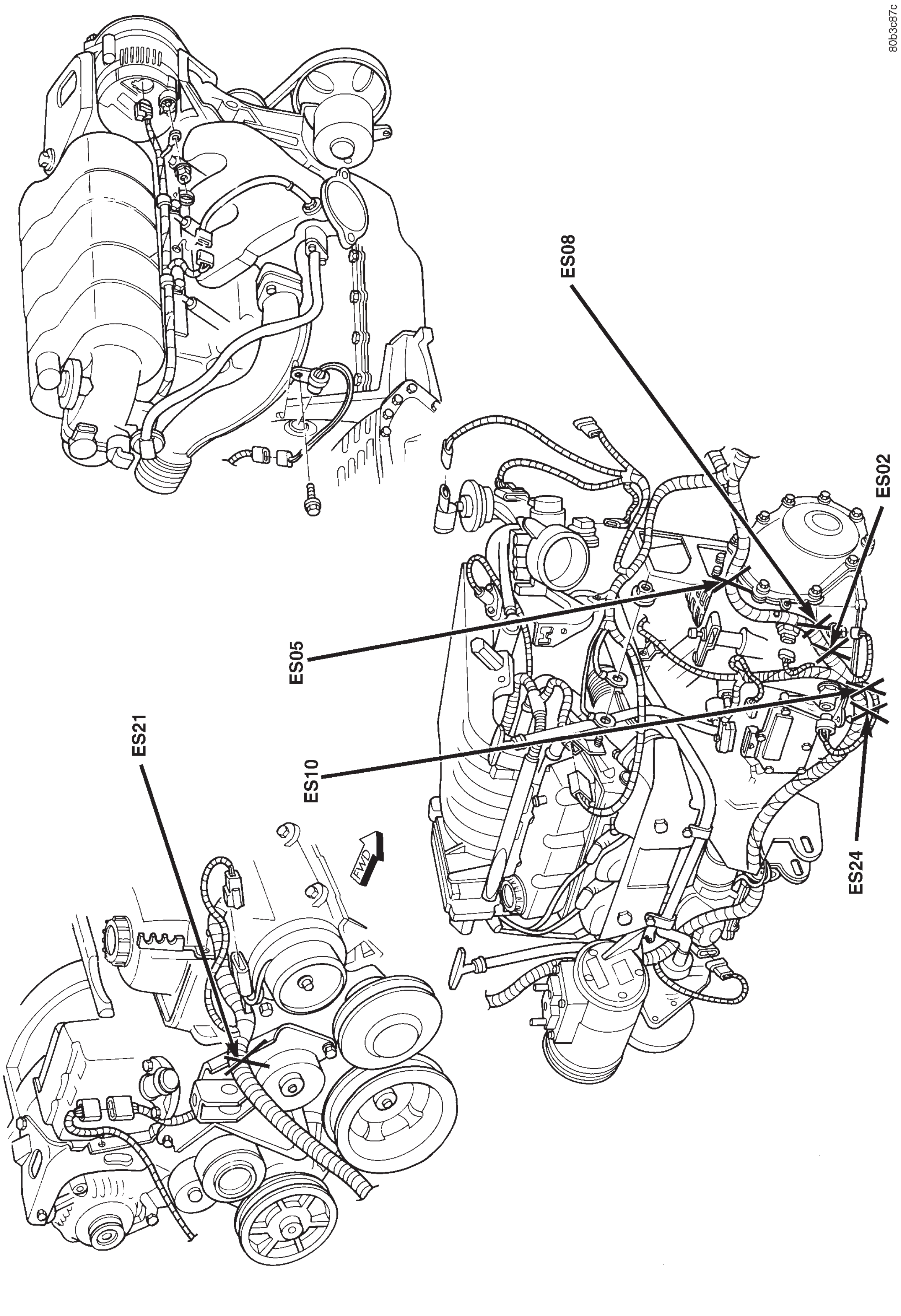

Fig. 6 Engine Splices—3.3L, 3.8L, LHD

DESCRIPTION AND OPERATION (Continued)

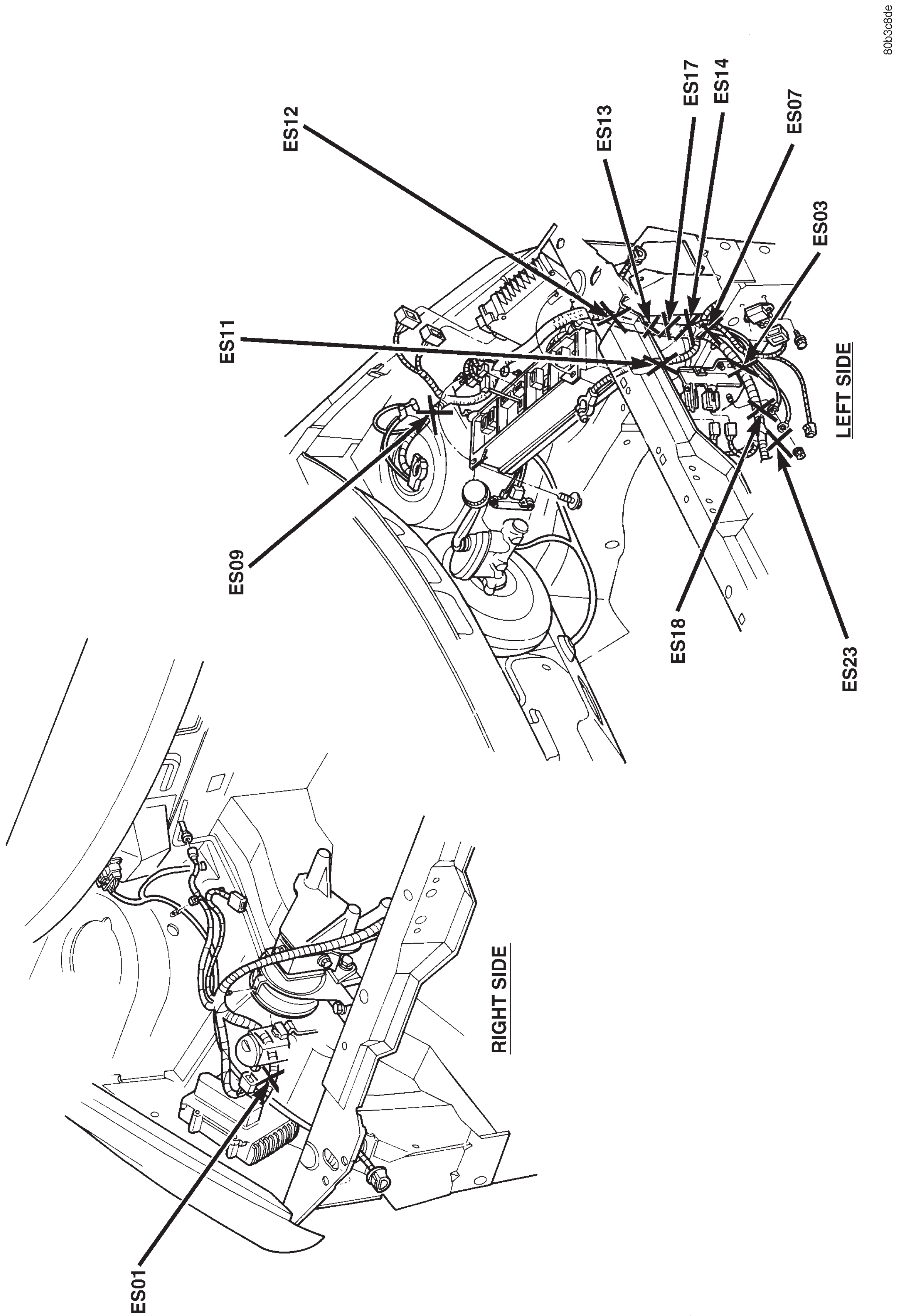

Fig. 7 Engine Compartment Splices—3.3L, 3.8L, LHD

DESCRIPTION AND OPERATION (Continued)

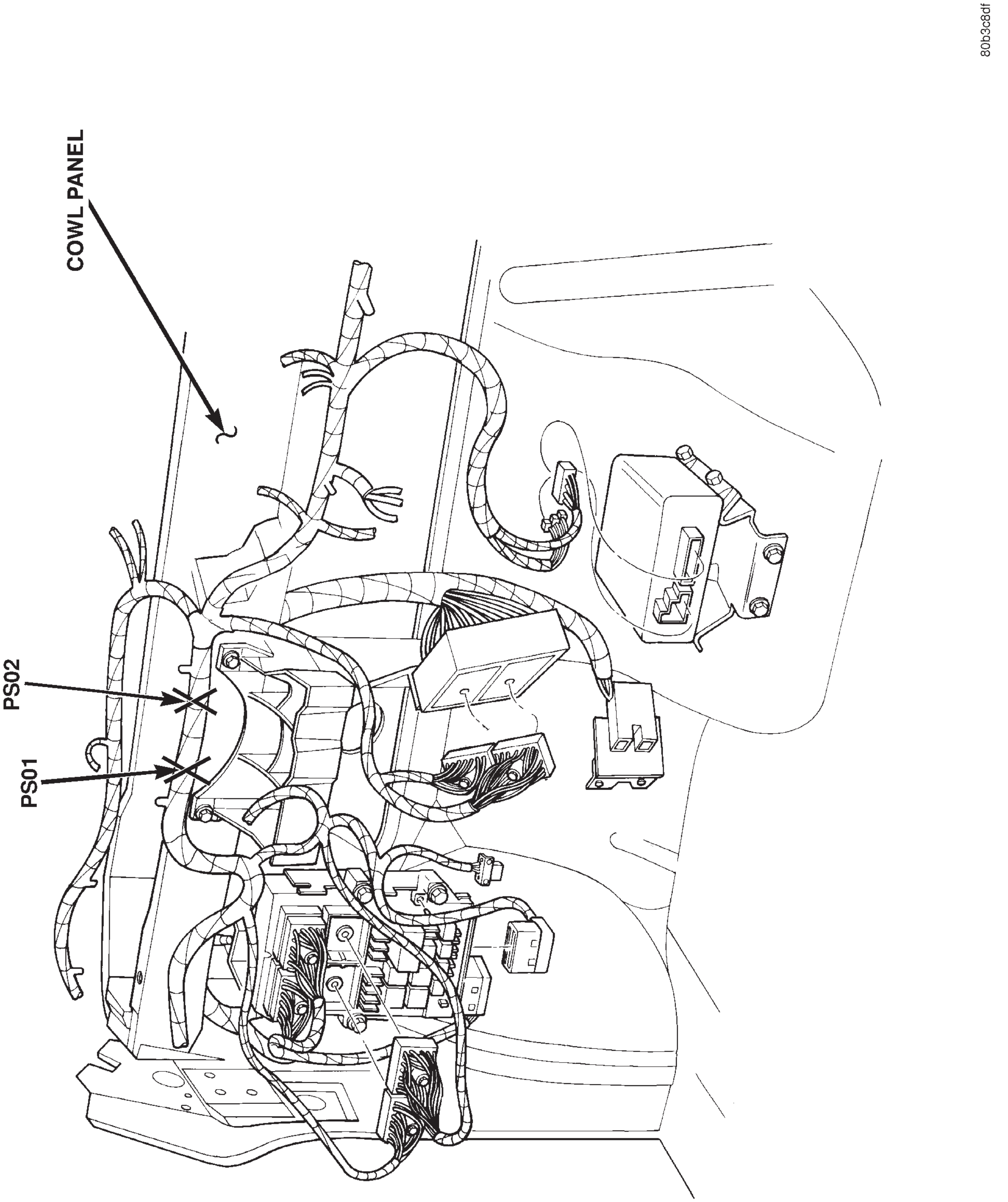

Fig. 8 Instrument Panel Splices—LHD

DESCRIPTION AND OPERATION (Continued)

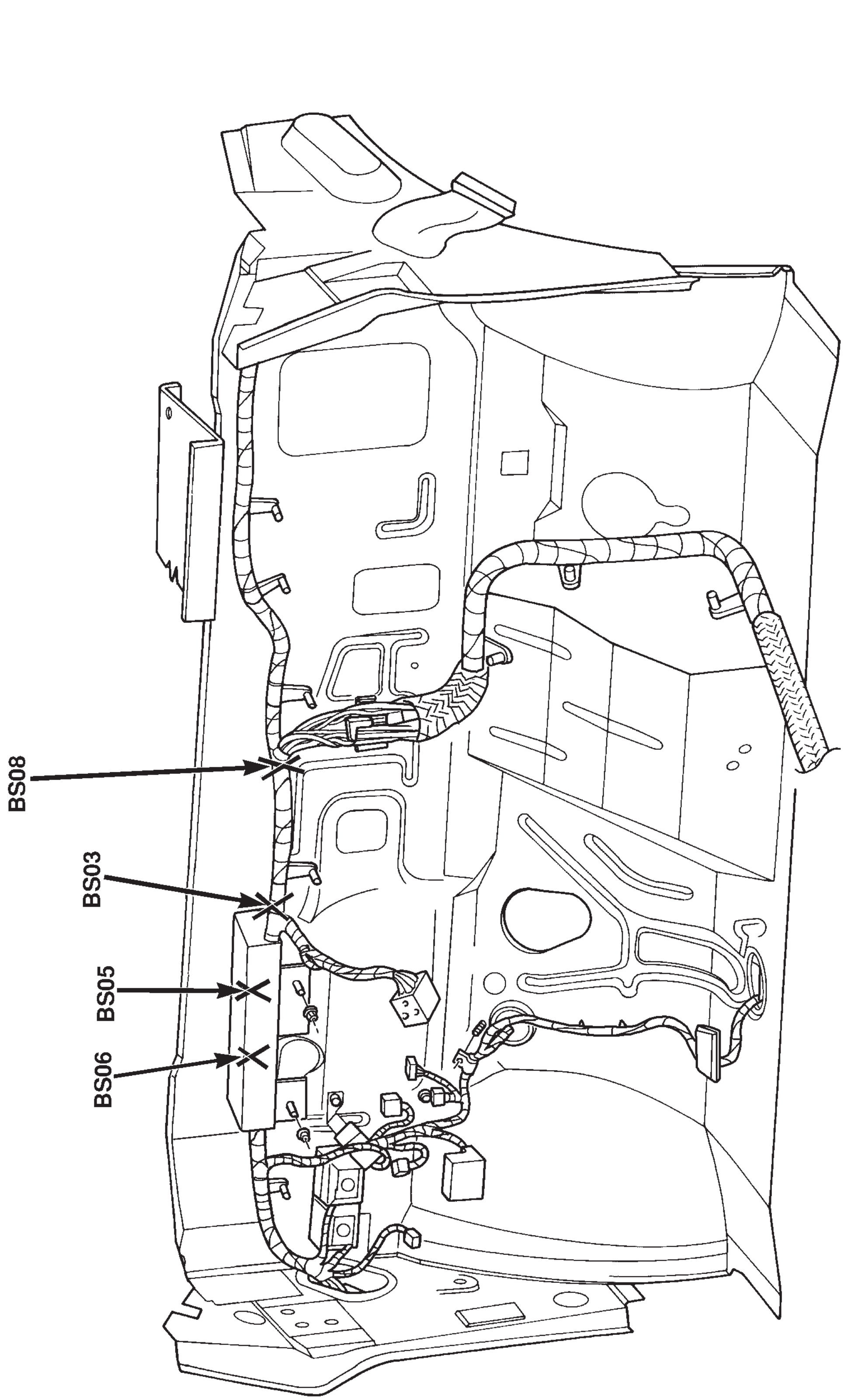

Fig. 9 Cowl Panel Splices—LHD

DESCRIPTION AND OPERATION (Continued)

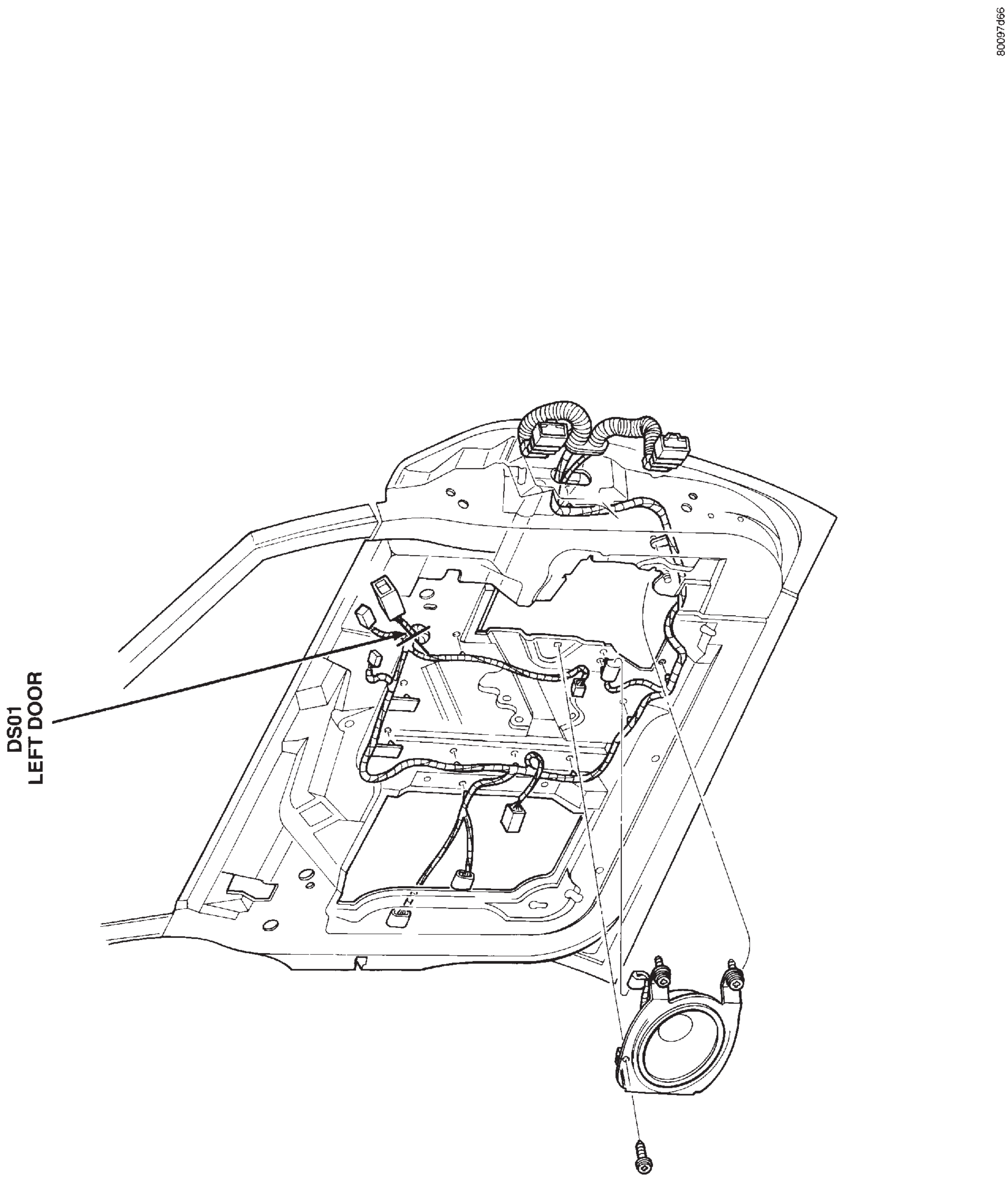

Fig. 10 Left Door Splice—LHD

DESCRIPTION AND OPERATION (Continued)

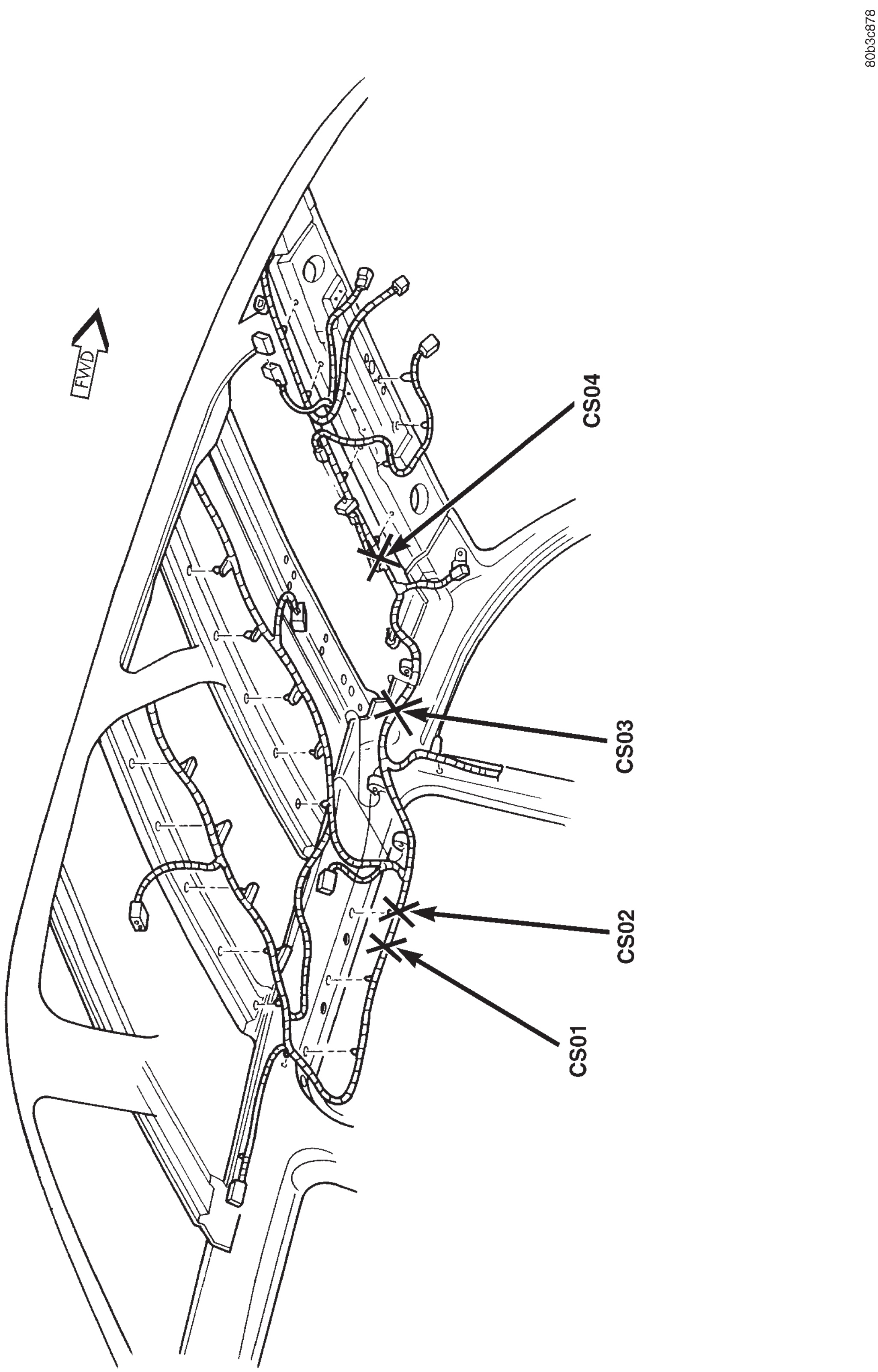

Fig. 11 Dome Harness Splices—LHD

DESCRIPTION AND OPERATION (Continued)

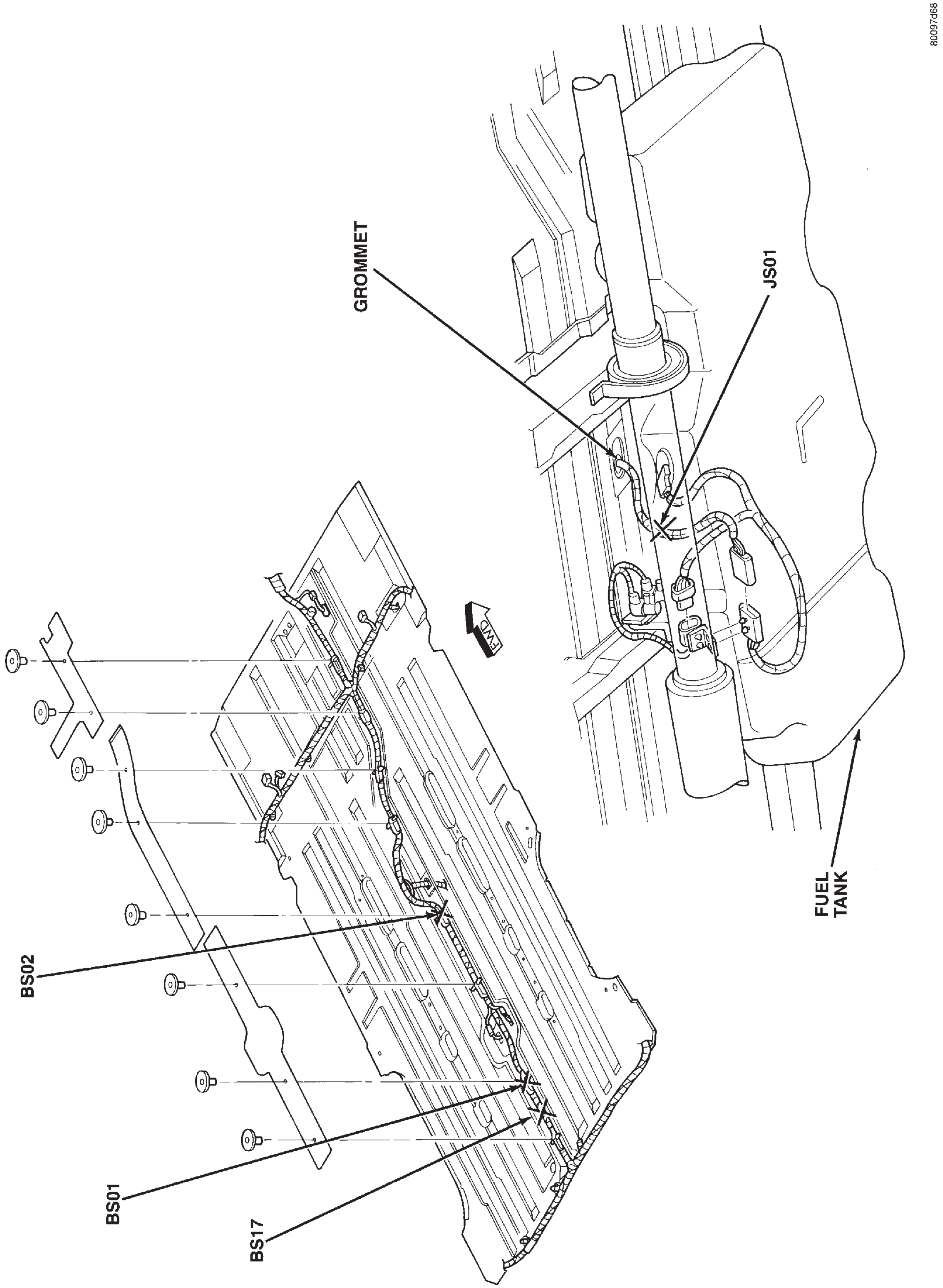

Fig. 12 Floor Pan and Underbody Splices—LHD

DESCRIPTION AND OPERATION (Continued)

SPLICE LOCATIONS (RHD)

Splice Number	Location	Fig.
BS01	Near Split for Tail Lamps	11
BS02	Near Fuel Tank T/O	11
BS03	Near I/P Bulkhead Connector T/O	8
BS05	Near Left Door T/O	N/S
BS06	Near Left Door T/O	N/S
BS08	Near Clutch Interlock switch T/O	8
BS16	Near RT Park Lamp T/O	1
BS17	Near Split for Tail Lamps	11
BS31	Near Left Headlamp Leveling Motor T/O	1
CS01	Above Right Rear Door	10
CS02	Above Right Rear Door	10
CS03	Right B-Pillar	10
CS04	Right B-Pillar	10
DS01	Near LT Power WDO T/O	9
ES01	In TCM T/O	6
ES02 (2.0L)	Near Camshaft Position Sensor T/O	3
ES02 (2.4L)	In Throttle Body T/O	4
ES02 (3.3L, 3.8L)	Near Transmission T/O	5
ES03 (2.0L)	Near Distributor Coil T/O	2
ES03 (2.4L)	Near PDC T/O	4
ES03 (3.3L, 3.8L)	Near Body Ground T/O	6
ES05 (2.4L)	Near Knock Sensor T/O	4
ES05 (3.3L, 3.8L)	Near Transmission T/O	5
ES06	Near Transmission T/O	N/S
ES07 (2.0L)	Near Engine Ground T/O	2
ES07 (2.4L)	Near Body Ground T/O	4
ES07 (3.3L, 3.8L)	Near Battery Negative Terminal T/O	6
ES08 (2.4L)	Near Transmission T/O	4,6
ES09 (2.0L)	Near Battery Positive Terminal	N/S
ES09 (2.4L)	Near Battery Positive Terminal	4
ES09 (3.3L, 3.8L)	Near Battery Positive Terminal	6
ES10 (2.4L)	Near Knock Sensor T/O	6
ES10 (3.3L, 3.8L)	Near Transmission T/O	5
ES11 (2.0L)	Near Battery Positive Terminal	N/S
ES11 (2.4L)	Near Battery Negative Terminal T/O	4
ES11 (3.3L, 3.8L)	Near Battery Negative Terminal	5,6
ES12 (2.0L)	Near Engine Ground T/O	2
ES12 (2.4L)	Near Throttle Body T/O	4
ES12 (3.3L, 3.8L)	Near Battery Positive Terminal T/O	6
ES13 (2.4L)	Near Generator T/O	4
ES13 (3.3L, 3.8L)	Near Battery Negative Terminal	4
ES14 (2.4L)	Near Generator Field T/O	4
ES14 (3.3L, 3.8L)	Near Battery Negative Terminal	4
ES17 (2.0L)	Near Camshaft Position Sensor T/O	3
ES17 (2.4L)	Near Engine Ground T/O	4
ES17 (3.3L, 3,8L)	Near Battery Negative Terminal	4
ES18 (2.0L)	Near Camshaft Position Sensor T/O	3
ES18 (2.4L)	Near Engine Ground T/O	4
ES18 (3.3L, 3.8L)	Near Engine Ground T/O	6
ES21 (2.0L)	Near Body Ground T/O	N/S
ES21 (2.4L)	Near Back Up Lamp Switch T/O	4
ES21 (3.3L, 3.8L)	Near A/C Clutch T/O	5
ES23 (2.0L)	Near Radiator Fan T/O	N/S
ES23 (2.4L)	Near Radiator Fan T/O	4
ES23 (3.3L, 3.8L)	Near Body Ground T/O	6
ES24	Near Transmission T/O	4,6
ES24 (3.3L, 3.8L)	Near Transmission T/O	5
ES99 (2.0L)	Near Knock Sensor T/O	2
FS01 (2.4L)	Near ECT Sensor T/O	N/S
FS01 (3.3L, 3.8L)	Near Injector #5 T/O	N/S
FS02 (2.4L)	Near Inj #2 T/O	N/S
FS02 (3.3L, 3.8L)	Between Inj's 4 and 6	N/S
FS03 (2.4L)	Between Inj #2 and #3	N/S
PS01	Near Steering Column T/O	7
PS02	Near Steering Column T/O	7
RFS01	Near Radiator Fan #2	N/S
RFS02	Near Radiator Fan #1	N/S

DESCRIPTION AND OPERATION (Continued)

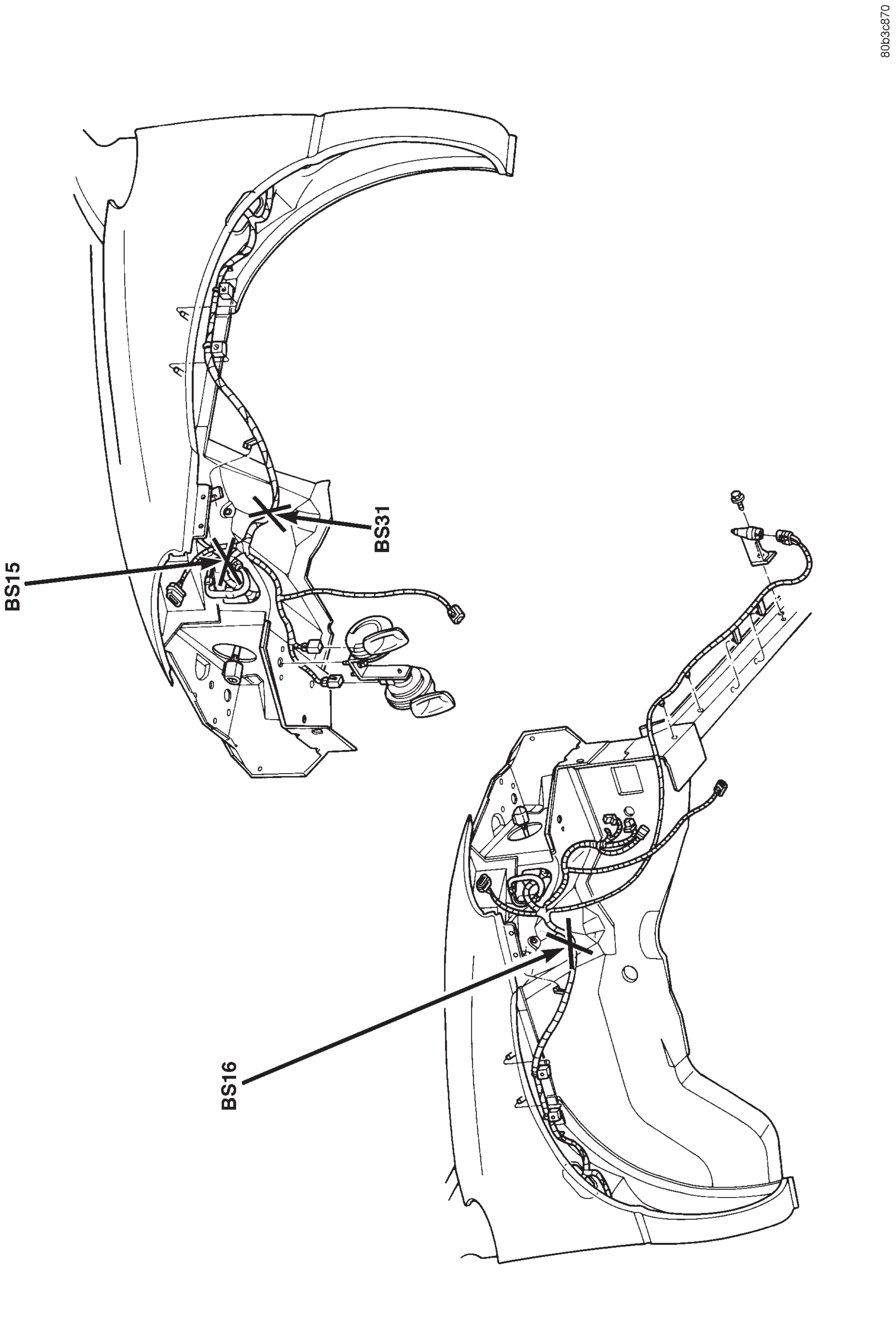

Fig. 1 Front End Splices—RHD

DESCRIPTION AND OPERATION (Continued)

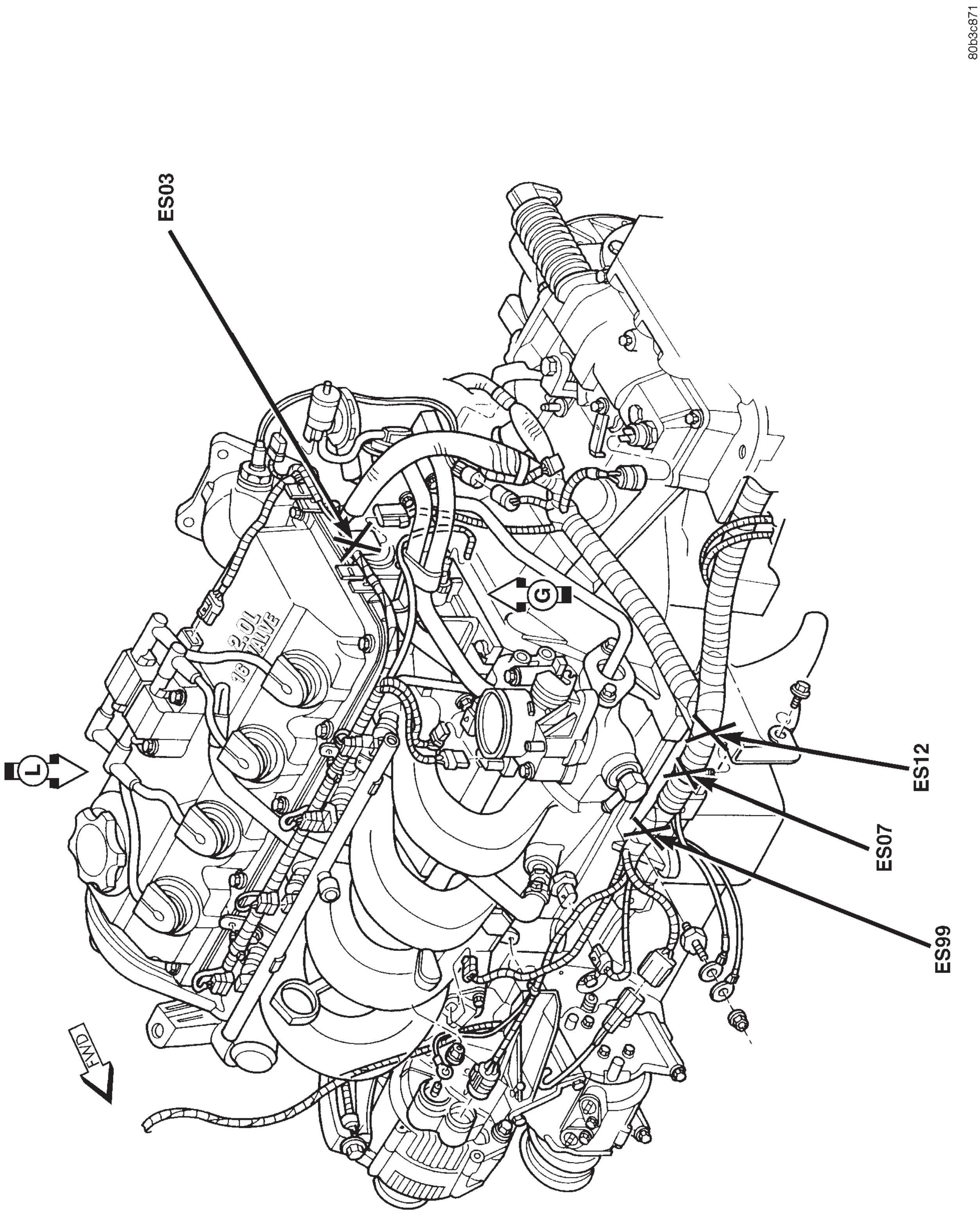

Fig. 2 Engine Splices—2.0L, RHD

DESCRIPTION AND OPERATION (Continued)

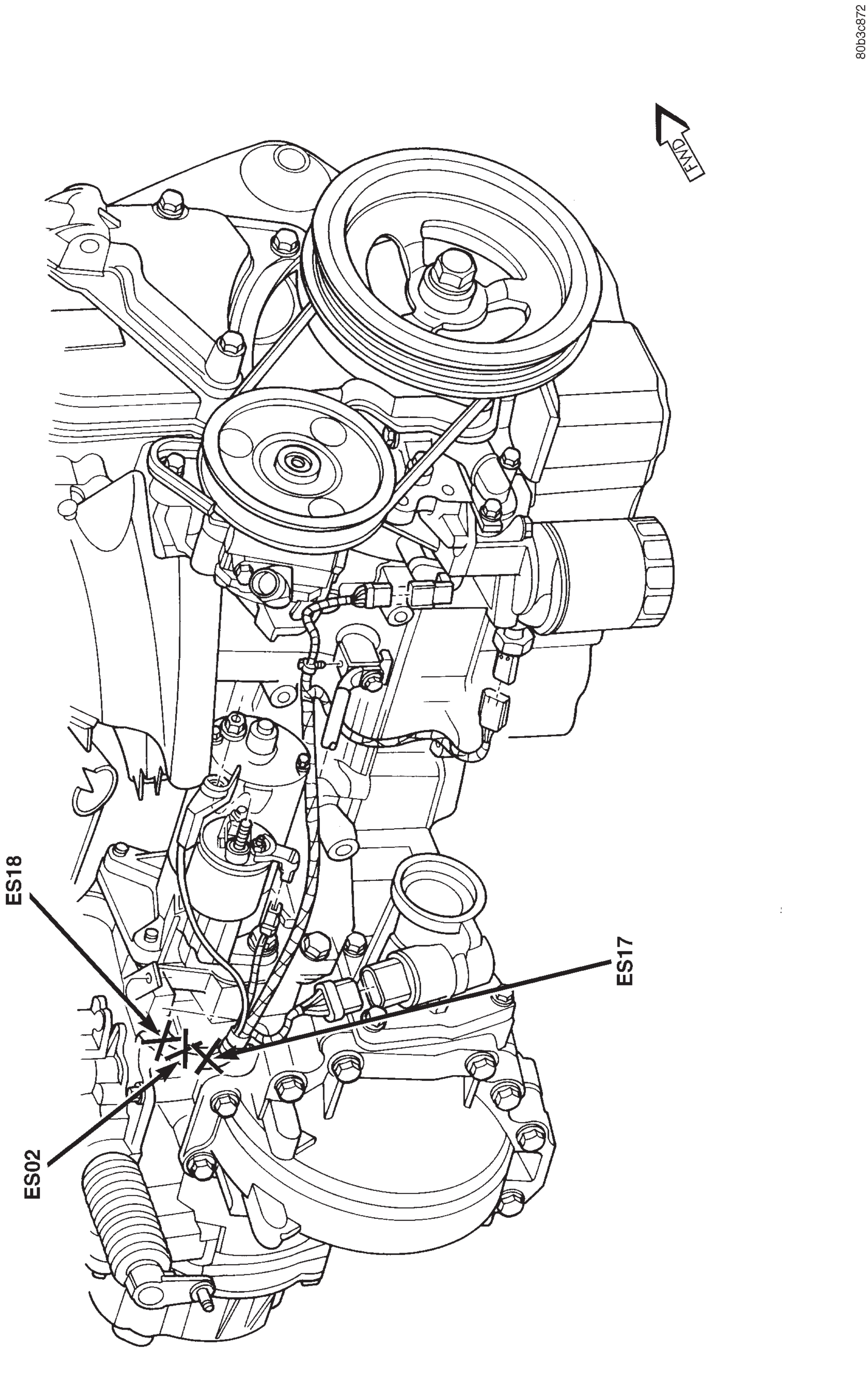

Fig. 3 Engine Splices—2.0L, RHD

DESCRIPTION AND OPERATION (Continued)

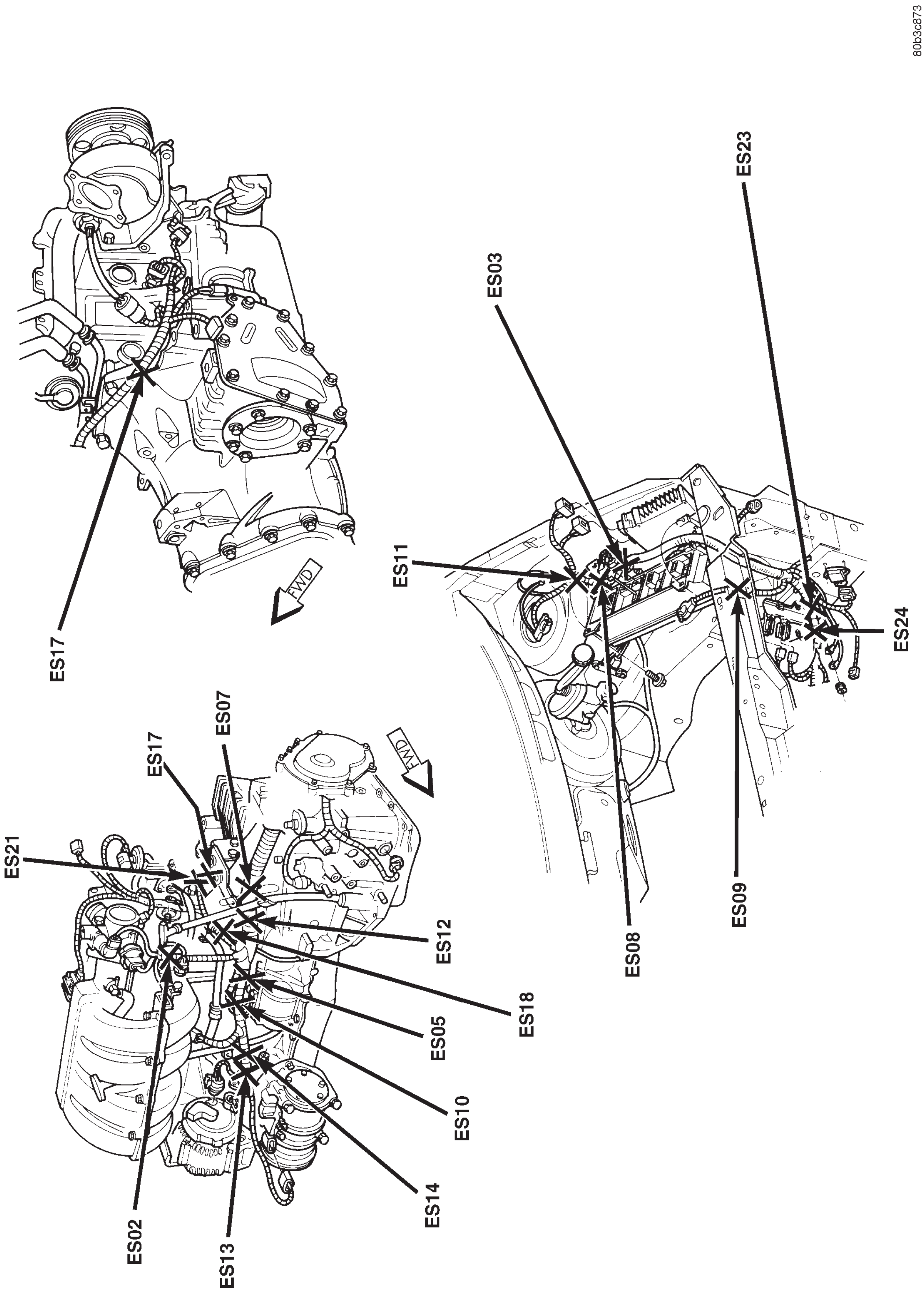

Fig. 4 Engine Splices—2.4L, RHD

DESCRIPTION AND OPERATION (Continued)

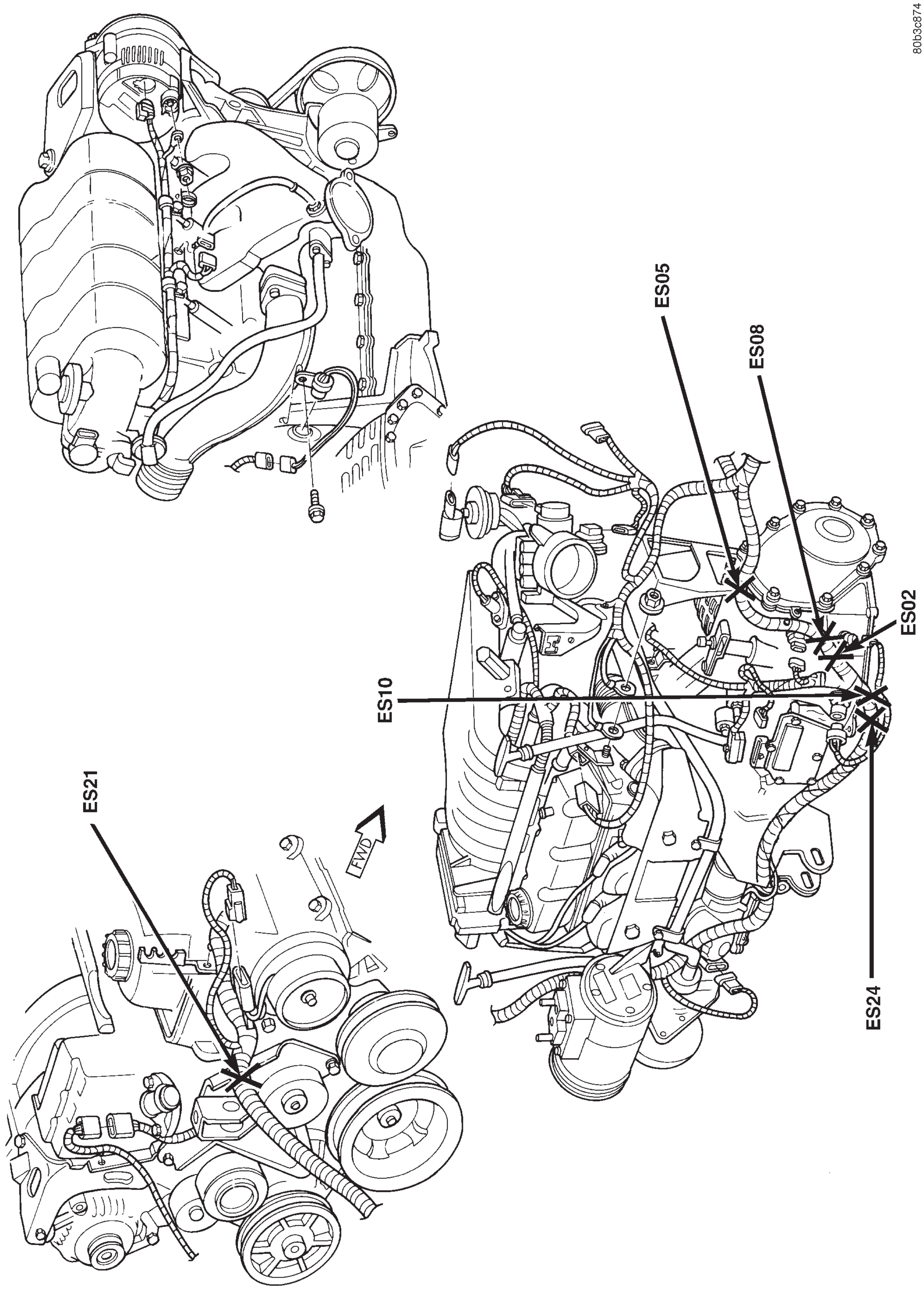

Fig. 5 Engine Splices—3.3L, 3.8L, RHD

DESCRIPTION AND OPERATION (Continued)

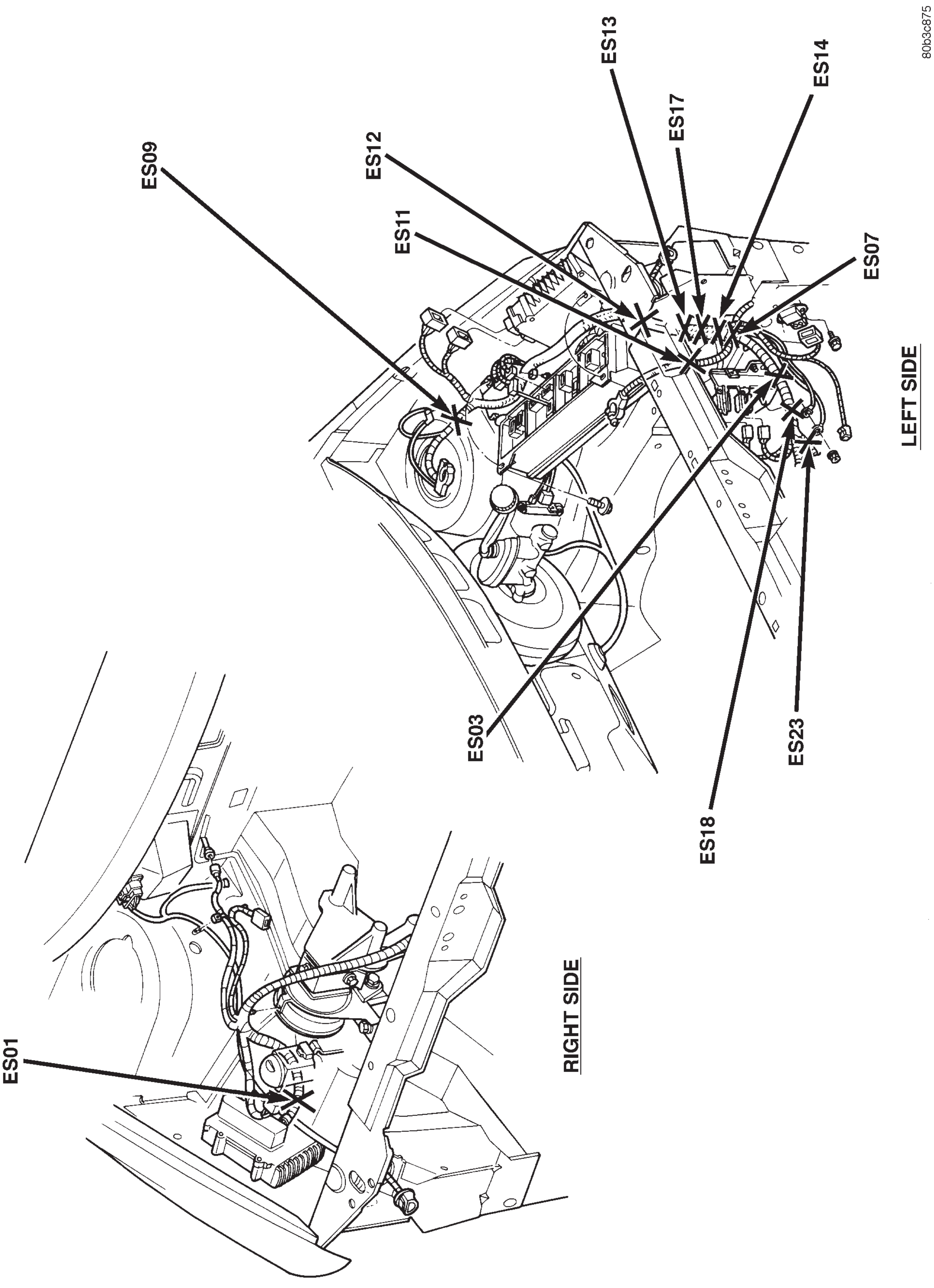

Fig. 6 Engine Compartment Splices—3.3L, 3.8L, RHD

DESCRIPTION AND OPERATION (Continued)

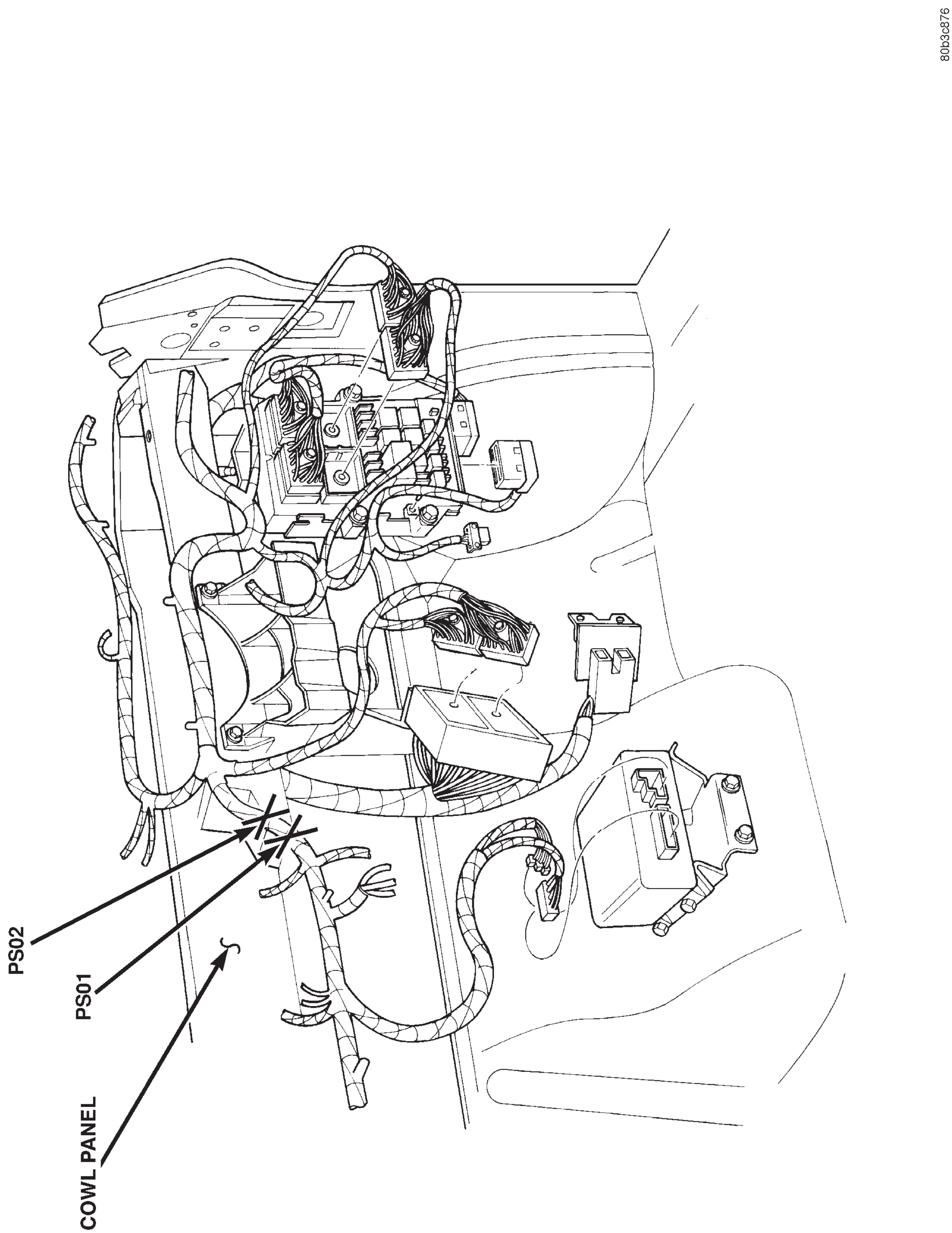

Fig. 7 Instrument Panel Splices—RHD

DESCRIPTION AND OPERATION (Continued)

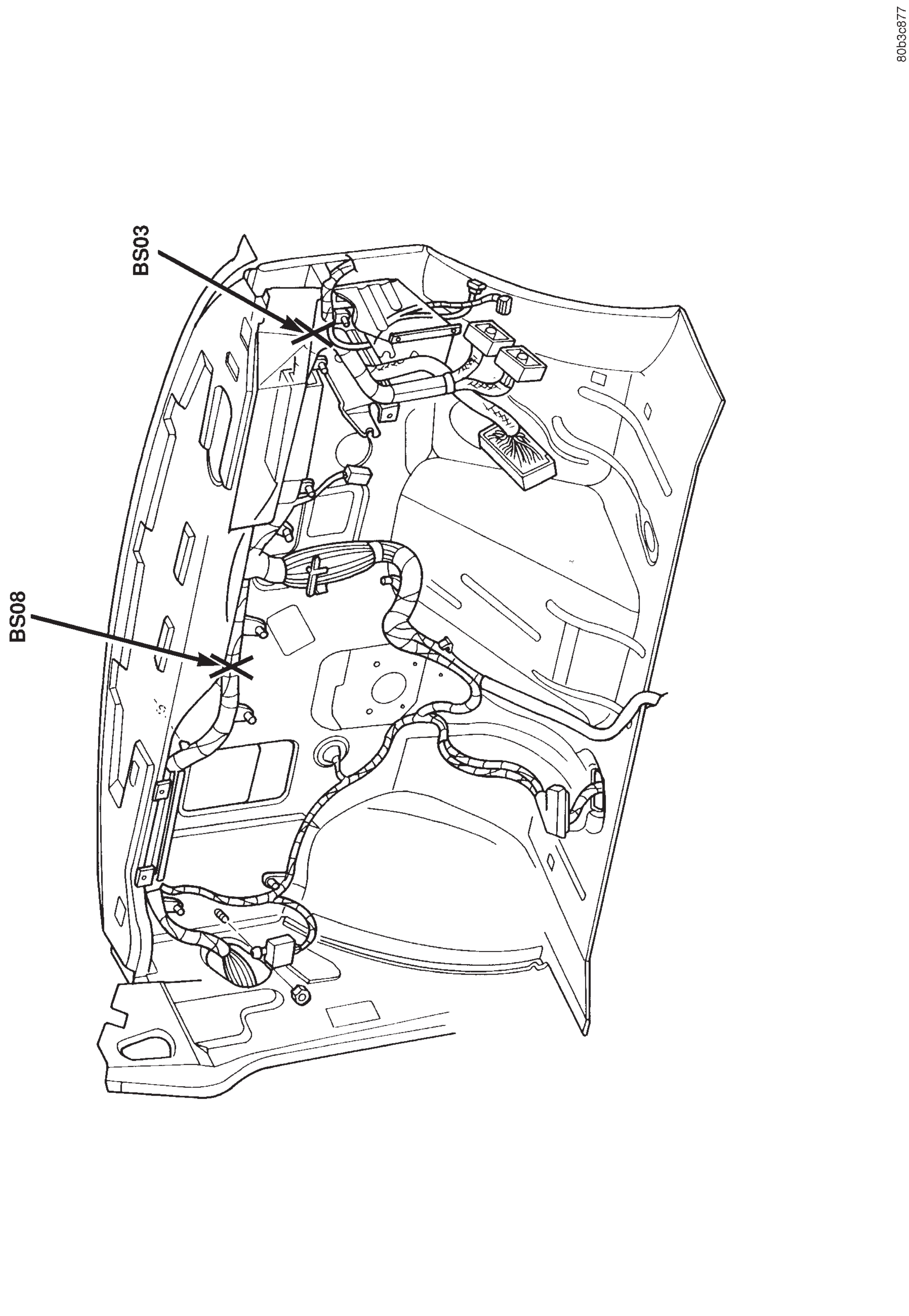

Fig. 8 Cowl Panel Splices—RHD

DESCRIPTION AND OPERATION (Continued)

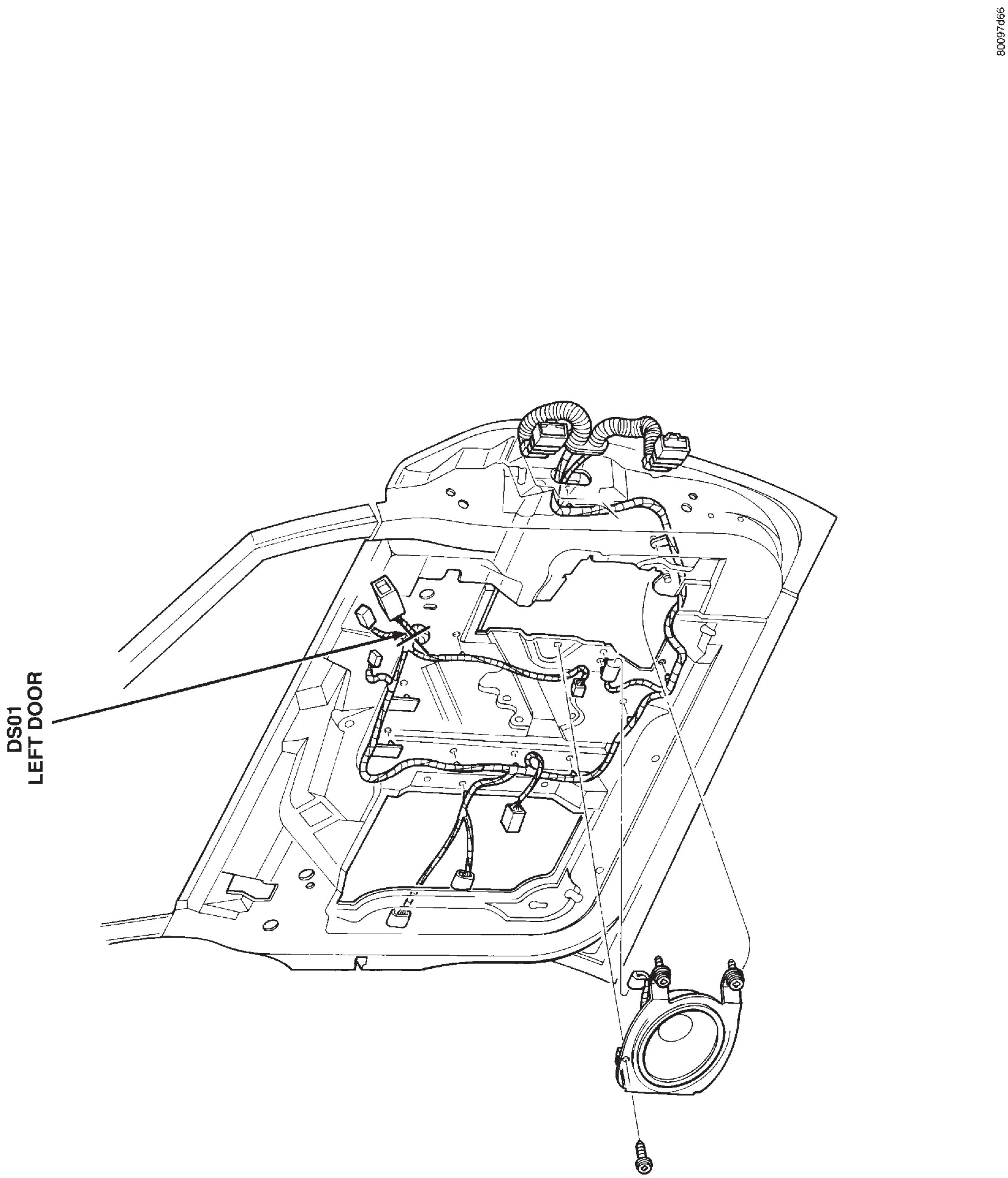

Fig. 9 Left Door Splice—RHD

DESCRIPTION AND OPERATION (Continued)

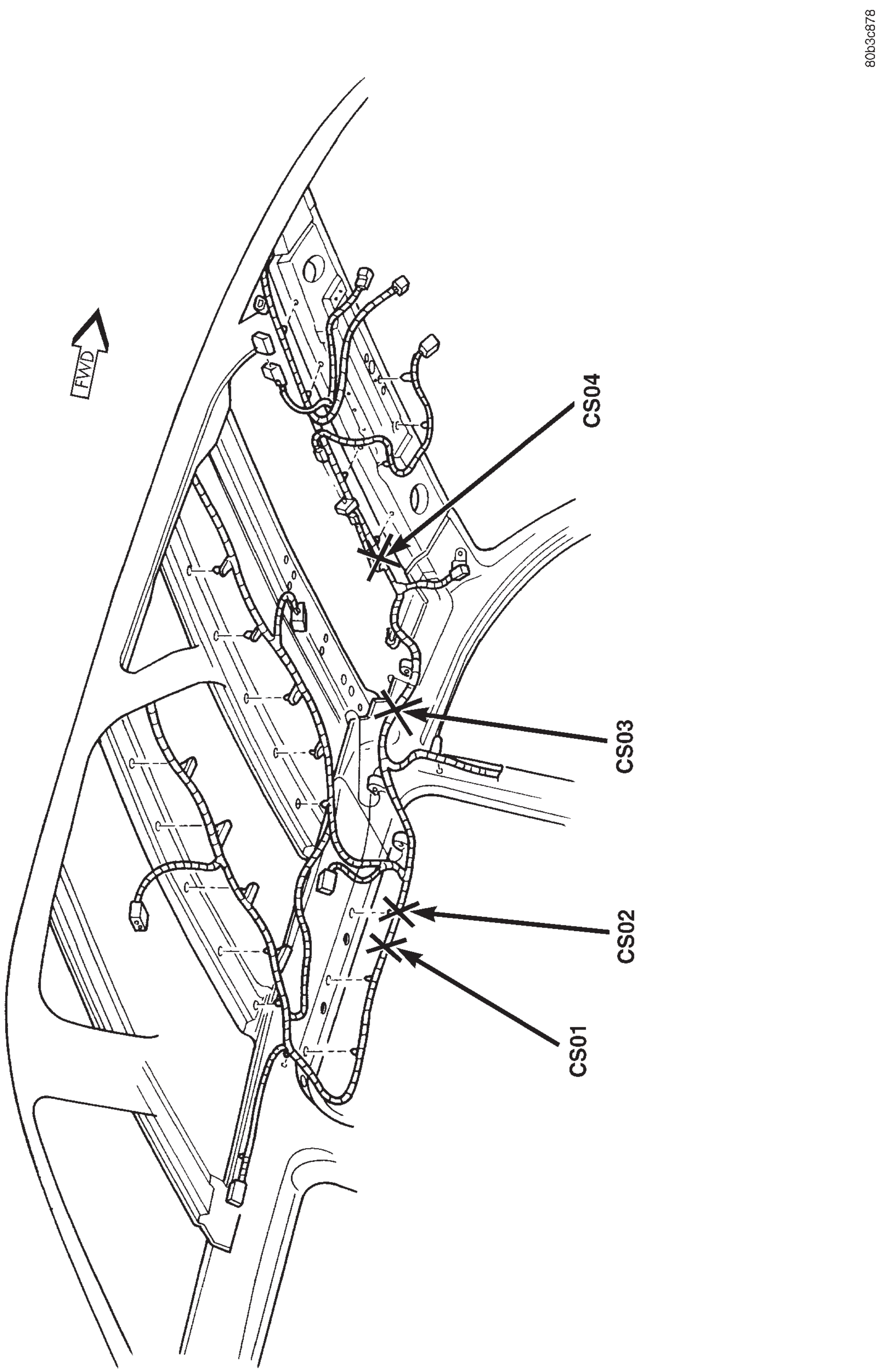

Fig. 10 Dome Harness Splices—RHD

DESCRIPTION AND OPERATION (Continued)

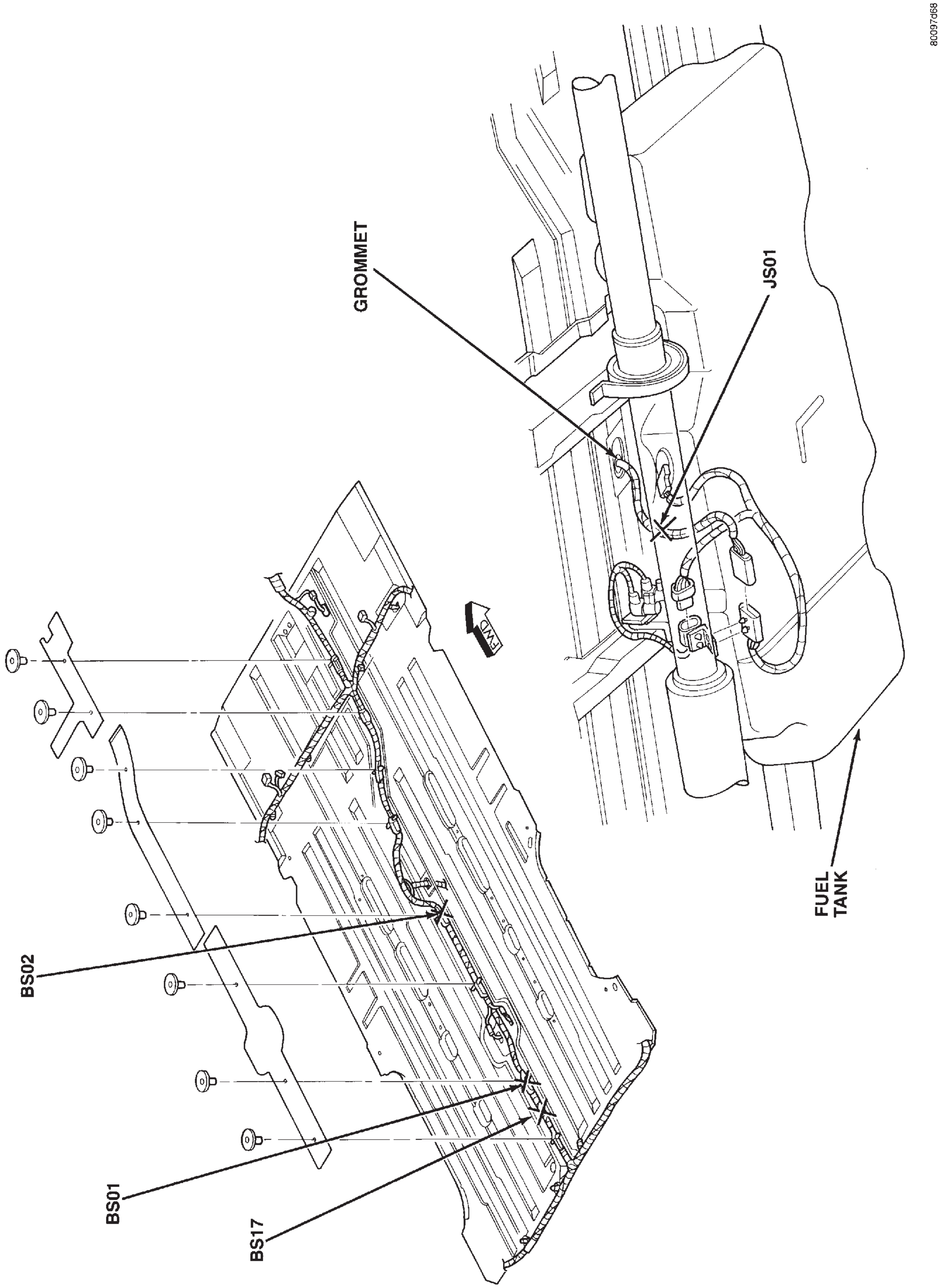

Fig. 11 Floor Pan and Underbody Splices—RHD

ENGINE

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STANDARD SERVICE PROCEDURES

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GENERAL INFORMATION

FORM-IN-PLACE GASKETS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets. **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, 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. **Mopar**® Silicone Rubber Adhesive Sealant and **Mopar**® Gasket Maker, (anaerobic) each have different properties and cannot be used interchangeably.

CAUTION: Silicone sealer and anaerobic sealers each will inhibit the cure of the other and care should be taken to keep usages separated as much as possible.

MOPAR® SILICONE RUBBER ADHESIVE SEALANT

Mopar® Silicone Rubber Adhesive Sealant or equivalent, normally black in color, is available in three ounce tubes. Moisture in the air causes the **Mopar**® Silicone Rubber Adhesive Sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of one year and will not properly cure if over age. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material normally red in color. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. It is normally red in color. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® TORQUE CURE GASKET MAKER

Mopar® Torque Cure Gasket Maker is a unique anaerobic type gasket material to be used **ONLY** between the bedplate and engine block. The material cures in the absence of air when torqued between two metallic surfaces. It will not cure if left in the uncovered tube. This anaerobic material is specially

GENERAL INFORMATION (Continued)

made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components.

GASKET DISASSEMBLY

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.

SURFACE PREPARATION

Scrape clean or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Gasket surfaces must be free of oil and dirt. Make sure old gasket material is removed from blind attaching holes.

FORM-IN-PLACE GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier then using precut gaskets.

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 the material off location.

The **Mopar**® Silicone Rubber Adhesive Sealant gasket material or equivalent 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 towels. 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 of material off location.

CRANKSHAFT SPROCKET BOLT ACCESS PLUG

An Access plug is located in the right inner fender shield. Remove the plug and insert the proper size socket, extension and ratchet, when crankshaft rotation is necessary.

ENGINE CORE PLUGS

REMOVAL

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 1). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 1).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

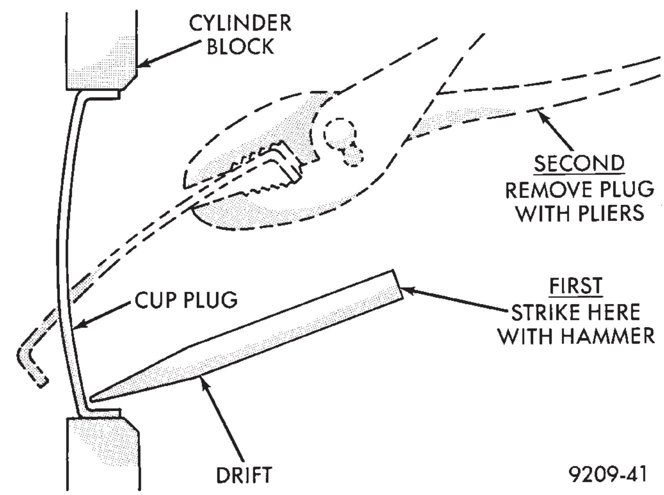


Fig. 1 Core Hole Plug Removal

INSTALLATION

Thoroughly remove all rust and 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 sealer. 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 inch.) inside the lead in chamfer (Fig. 1).

It is in not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

ENGINE PERFORMANCE

If a loss of performance is noticed, timing belt or chain may have skipped one or two teeth. Camshaft and crankshaft timing should be checked. Refer to Group 9, Engine Timing belt or chain installation.

It is important that the vehicle is operating to its optimum performance level to maintain fuel economy and lowest vehicle emissions. If vehicle is not operating to these standards, refer to Engine Diagnosis outlined is this section. The following procedures can assist in achieving the proper engine diagnosis.

(1) Test cranking amperage draw. Refer to Group 8B, Starting.

(2) Check intake manifold for vacuum leaks.

(3) Perform cylinder compression pressure test. Refer to Engine Diagnosis, outlined in this section.

(4) Clean or replace spark plugs as necessary and adjust gap as specified in Group 8D, Ignition System. Tighten to specifications.

GENERAL INFORMATION (Continued)

(5) Test resistance of spark plug cables. Refer to Group 8D, Ignition System.

(6) Test ignition coils primary and secondary resistance. Replace parts as necessary. Refer to Group 8D, Ignition System.

(7) Check fuel pump pressure at idle and different RPM ranges. Refer to Group 14, Fuel System for Specifications.

(8) The air filter elements should be replaced as specified in Group 0, Lubrication and Maintenance.

(9) Inspect crankcase ventilation system as outlined in Group 25, Emission Control Systems.

(10) Road test vehicle as a final test.

HONING CYLINDER BORES

(1) Used carefully, the cylinder bore resizing hone C-823 equipped with 220 grit stones, is the best tool for this job. 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.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, Tool C-3501, 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. Inspect cylinder walls after each 20 strokes, using a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.**

(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 50-60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 2).

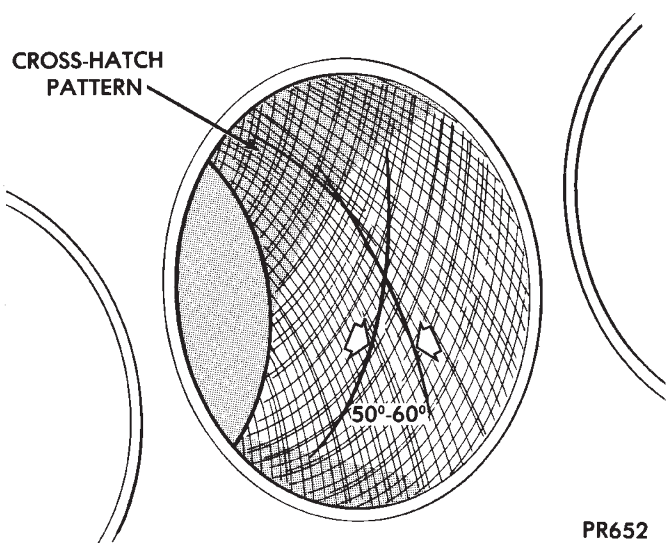


Fig. 2 Cylinder Bore Cross-Hatch Pattern

(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 50-60 degree angle. Faster up and down strokes increase the cross-hatch angle.

(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.

MEASURING MAIN BEARING AND CONNECTING ROD BEARING CLEARANCES

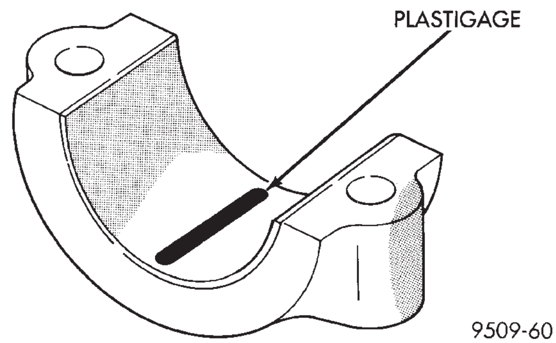


Fig. 3 Plastigage Placed in Lower Shell

PLASTIGAGE METHOD

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

NOTE: The total clearance of the main bearings can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

PREFERRED METHOD

Shimming the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (0.010 in.) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tightening bolts to 14-20 N·m (10-15 ft. lbs.). The number of main bearing will vary from engine to engine.

GENERAL INFORMATION (Continued)

ENGINE WITH 5 MAIN BEARINGS

- When checking #1 main bearing shim #2 main bearing.
- When checking #2 main bearing shim #1 & 3 main bearing.
- When checking #3 main bearing shim #2 & 4 main bearing.
- When checking #4 main bearing shim #3 & 5 main bearing.
- When checking #5 main bearing shim #4 main bearing.

ENGINE WITH 4 MAIN BEARING

- When checking #1 main bearing shim # 2 main bearing.
- When checking #2 main bearing shim #1 & #3 main bearing.
- When checking #3 main bearing shim #2 & #4 main bearing.
- When checking #4 main bearing shim #3 main bearing.

NOTE: REMOVE ALL SHIMS BEFORE REASSEMBLING ENGINE

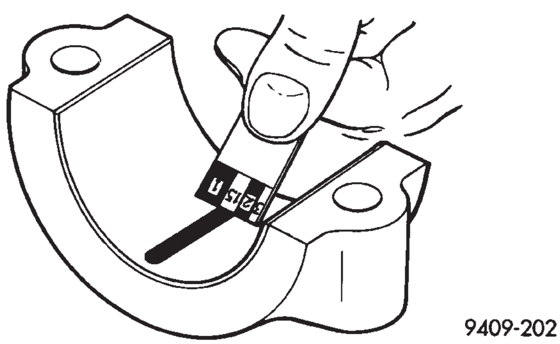


Fig. 4 Clearance Measurement

ALTERNATIVE METHOD

The weight of the crankshaft can be supported by a jack under the counterweight adjacent to the bearing being checked.

PLASTIGAGE PROCEDURE

(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. 3). (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 (Fig. 4) with the metric scale provided on the package. Locate the band closest 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. Refer to 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.

CONNECTING ROD BEARING CLEARANCE

Engine connecting rod bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.

(2) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from the oil hole (Fig. 3). In addition, suspect areas can be checked by placing plastigage in the suspect area.

(4) Assemble the rod cap with Plastigage in place. Tighten the rod cap to the specified torque. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

(5) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 4) with the scale provided on the package. Locate the band closest to the same width. This band indicates the amount of oil clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. If the bearing clearance exceeds 0.076 mm (0.003 in.) replace bearing.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (including aluminum head spark plug 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.

GENERAL INFORMATION (Continued)

CAUTION: Be sure that the tapped holes maintain the original centerline.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, these steps should be used.

CAUTION: Do Not Use Starter Motor To Rotate 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 occurring again.

CAUTION: Squirt approximately 1 teaspoon of oil into 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) Fill engine with specified amount of approved oil and install new oil filter.
(11) Connect negative battery cable.
(12) Start engine and check for any leaks.

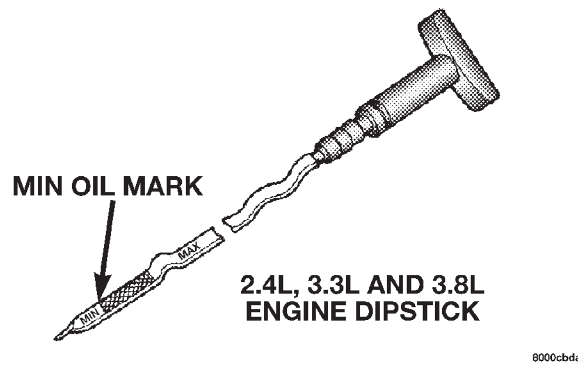
ENGINE OIL

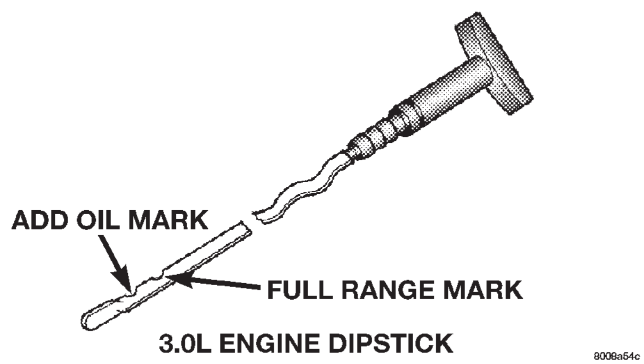
Checking Oil Level

To assure proper engine lubrication, the engine oil must be maintained at the correct level. Check the oil level at regular intervals, such as every fuel stop.

The best time to check the oil level is about 5 minutes after a fully warmed-up engine is shut off, or before starting the vehicle after it has sat overnight.

Checking the oil while the vehicle is on level ground, will improve the accuracy of the oil level readings. For 2.4L, 3.3L and 3.8L engines, maintain the oil level between the MIN and MAX markings on the dipstick. Adding one quart of oil when the reading is at the MIN mark will result in a MAX reading on these engines. For the 3.0L engine, add one full quart when the level on the dipstick is at or below the ADD mark.





ENGINE OIL SERVICE

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.

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

GENERAL INFORMATION (Continued)

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conforms to this service grade.

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. 5).

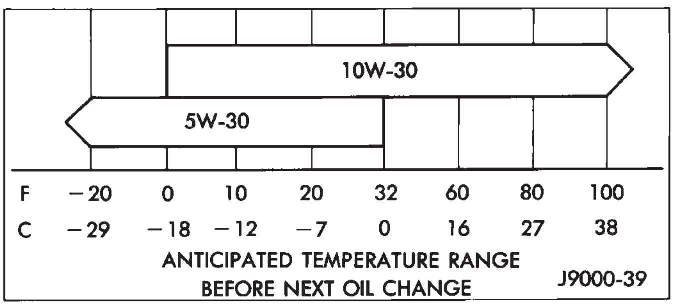


Fig. 5 Temperature/Engine Oil Viscosity

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. They are designated as either ENERGY CONSERVING or ENERGY CONSERVING II.

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 label of engine oil plastic bottles and the top of engine oil cans (Fig. 6).

Fig. 6 Engine Oil Container Standard Notations

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule.

TO CHANGE ENGINE OIL

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.

(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) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE DIAGNOSIS

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DIAGNOSIS AND TESTING

GENERAL INFORMATION

Engine diagnosis is helpful in determining the causes of malfunctions.

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 Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer to Group 14, Fuel System, for the fuel system diagnosis.

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

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

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 a change in RPM'S, the area of the suspected leak has been found.

(4) Repair as required.

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) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire (Conventional Ignition System). For Direct Ignition System DIS disconnect the coil connector.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gage adaptor into the #1 spark plug hole in cylinder head. Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(7) Repeat the previous step for all remaining cylinders.

(8) Compression should not be less than (689kPa) 100 psi and not vary more than 25 percent from cylinder to cylinder.

(9) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(10) 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**

DIAGNOSIS AND TESTING (Continued)

cause of low compression unless some malfunction is present.

(11) Clean or replace spark plugs as necessary and adjust gap as specified in Group 8, Electrical. Tighten to specifications.

(12) Test resistance of spark plug cables. Refer to Group 8, Electrical Ignition System Secondary Circuit Inspection.

(13) Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to Group 8, Electrical Ignition System.

(14) Check fuel pump pressure at idle and different RPM ranges. Refer to Group 14, Fuel System for Specifications.

(15) The air filter elements should be replaced as specified in Group 0, Lubrication and Maintenance,.

(16) Inspect crankcase ventilation system as out lined in Group 0, Lubrication and Maintenance. For emission controls see Group 25, Emission Controls for service procedures.

(17) Inspect and adjust accessory belt drives referring to Group 7, Cooling System, Accessory Drive Belts for proper adjustments.

(18) Road test vehicle as a final test.

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 RADIATOR 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 radiator 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 and 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 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.

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.

(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 pressed into 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 disassemble **Do not reuse retainer caps**. Do not interchange parts and make sure that care and cleanliness is exercised in the handling of parts.

c. Clean out dirt and varnish with solvent.

d. Reassemble with engine oil.

e. Check for sponginess.

f. If still spongy, replace with new adjuster.

INSPECTION (ENGINE OIL LEAKS IN GENERAL)

Begin with a through 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.

DIAGNOSIS AND TESTING (Continued)

(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.

(5) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:

(6) Disconnect the fresh air hose (makeup air) at the cylinder head cover and plug or cap the nipple on the cover.

(7) Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.

(8) 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.

(9) 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 manual procedures.

(10) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(11) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose. Proceed to next step.

(12) 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. 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 galley cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

(4) If no leaks are detected, pressurized 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.

(7) After the oil leak root cause and appropriate corrective action have been identified. Refer to Rear Crankshaft Seals, for proper replacement procedures.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Moisture on ignition wires. 5. Faulty ignition cables. 6. Faulty coil or control unit. 7. Incorrect spark plug gap. 8. Contamination in fuel system. 9. Faulty fuel pump.	1. Test battery. Charge or replace as necessary.Refer to Group 8A, Battery. 2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals. Test starting system. Refer to Group 8B, Starting. 4. Remove moisture from wires. 5. Replace any cracked or shorted cables. 6. Test and replace as needed. Refer to Group 8D, Ignition System 7. Set gap. Refer to Group 8D, Ignition System. 8. Clean system and replace fuel filter. 9. Test fuel pump and replace as needed. Refer to Group 14, Fuel System.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low. 2. Incorrect fuel mixture. 3. Intake manifold leakage. 4. Incorrect ignition wiring. 5. Faulty coil(s)	1. Test minimum air flow. Refer to Group 14, Fuel System. 2. Refer to Group 14, Fuel System. 3. Inspect intake manifold, manifold gasket, and vacuum hoses. Refer to Group 11, Exhaust System and Intake Manifold. 4. Install correct wiring. 5. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs. 2. Contamination in fuel system. 3. Faulty fuel pump. 4. Incorrect valve timing. 5. Leaking cylinder head gasket. 6. Low compression. 7. Burned, warped, or pitted valves. 8. Plugged or restricted exhaust system. 9. Faulty ignition cables. 10. Faulty coil(s).	1. Clean plugs and set gap. Refer to Group 8D, Ignition System. 2. Clean system and replace fuel filter. 3. Test and replace as necessary. Refer to Group 14, Fuel System. 4. Correct valve timing. 5. Replace cylinder head gasket. 6. Test compression of each cylinder. 7. Replace valves. 8. Install new parts, as necessary. 9. Replace any cracked or shorted cables. 10. Test and replace as necessary. Refer to Group 8D, Ignition System.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs. 2. Contamination in Fuel System. 3. Burned, warped, or pitted valves. 4. Faulty coil(s).	1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System. 2. Clean fuel system and replace fuel filter. 3. Replace valves. 4. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap. 2. Faulty coil(s). 3. Dirty fuel injector(s). 4. Contamination in fuel system.	1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System. 2. Test and replace as necessary. Refer to Group 8D, Ignition System. Test and replace as necessary. Refer to Group 14, Fuel System. 4. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase. 2. Thin or diluted oil. 3. Low oil pressure. 4. Dirt in tappets/lash adjusters. 5. Worn rocker arms. 6. Worn tappets/lash adjusters. 7. Worn valve guides. 8. Excessive runout of valve seats on valve faces. 9. Missing adjuster pivot.	1. Check for correct oil level. 2. Change oil to correct viscosity. 3. Check engine oil level. 4. Replace rocker arm/hydraulic lash adjuster assembly. 5. Inspect oil supply to rocker arms. 6. Install new rocker arm/hydraulic lash adjuster assembly. 7. Ream and install new valves with oversize stems. 8. Grind valve seats and valves. 9. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insuffient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Excessive bearing clearance. 5. Connecting rod journal out-of-round. 6. Misaligned connecting rods.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. Measure bearings for correct clearance. Repair as necessary. 5. Replace crankshaft or grind surface. 6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Excessive bearing clearance. 5. Excessive end play. 6. Crankshaft journal out-of-round or worn. 7. Loose flywheel or torque converter.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. Measure bearings for correct clearance. Repair as necessary. 5. Check thrust bearing for wear on flanges. 6. Replace crankshaft or grind journals. 7. Tighten to correct torque.
OIL PRESSURE DROP	1. Low oil level. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn parts in oil pump. 6. Thin or diluted oil. 7. Excessive bearing clearance. 8. Oil pump relief valve stuck. 9. Oil pump suction tube loose. 10. Oil pump cover warped or cracked.	1. Check engine oil level. 2. Install new sending unit. 3. Check sending unit and main bearing oil clearance. 4. Install new oil filter. 5. Replace worn parts or pump. 6. Change oil to correct viscosity. 7. Measure bearings for correct clearance. 8. Remove valve and inspect, clean, or replace. 9. Remove oil pan and install new tube or clean, if necessary. 10. Install new oil pump.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Misaligned or deteriorated gaskets. 2. Loose fastener, broken or porous metal part. 3. Misaligned or deteriorated cup or threaded plug.	1. Replace gasket(s). 2. Tighten, repair or replace the part. 3. Replace as necessary.
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction. 2. Worn, scuffed or broken rings. 3. Carbon in oil ring slots. 4. Rings fitted too tightly in grooves. 5. Worn valve guides. 6. Valve stem seal unseated or faulty.	1. Check system and repair as necessary. Refer to Group 25, Emission Control Systems. 2. Hone cyinder bores. Install new rings. 3. Install new rings. 4. Remove rings and check grooves. If groove is not proper width, replace piston. 5. Ream guides and replace valves with oversize valves and seals. 6. Repair or replace seal.

2.4L ENGINE

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DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION

The engine identification number is located on the rear of the cylinder block (Fig. 1).

ENGINE LUBRICATION SYSTEM

OIL PAN

A structural die cast aluminum oil pan provides lower engine protection as well as serving as the engine oil reservoir. Oil pan is attached to block and sealed with a gasket. The oil pickup tube has a strainer and cover.

PRESSURE LUBRICATION

Oil drawn up through the pickup tube is pressurized by the pump and routed through the full flow filter to the main oil gallery running the length of the cylinder block. Oil pickup, pump and check valve provide oil flow to the main oil gallery.

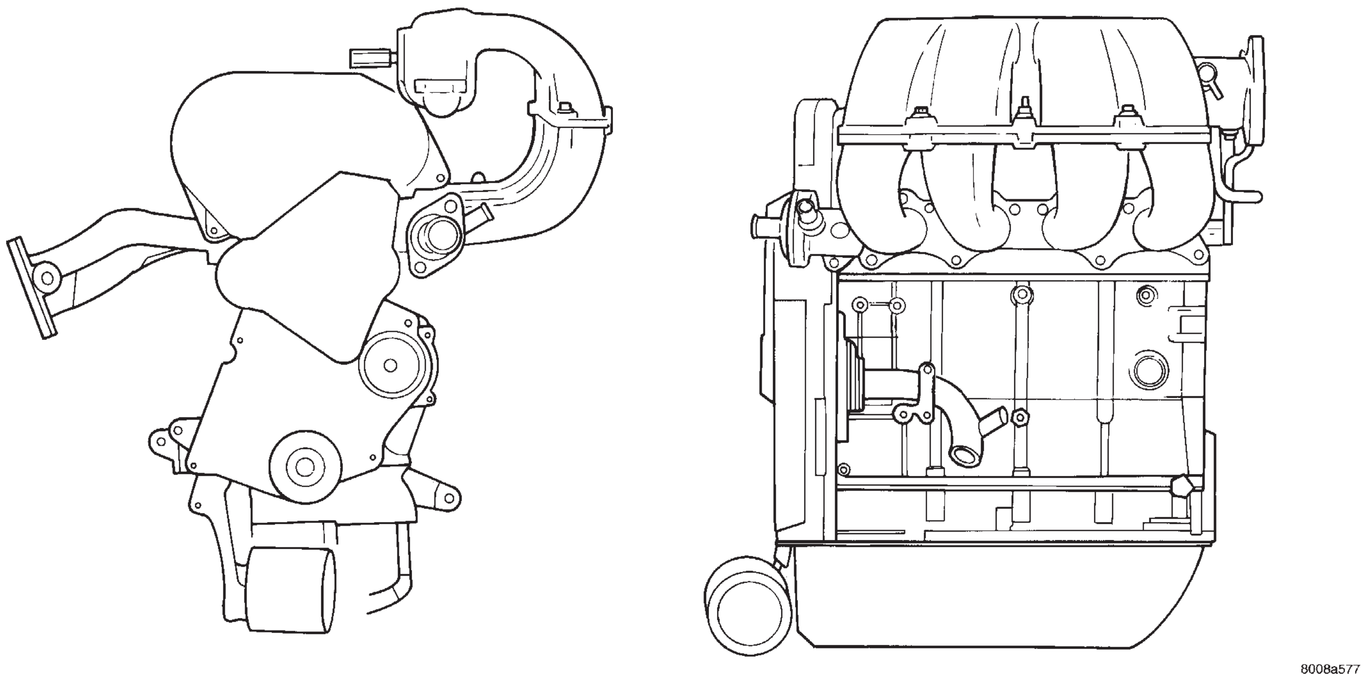
MAIN/ROD BEARINGS

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.

CAMSHAFT/HYDRAULIC LASH ADJUSTERS

A vertical hole at the number five bulkhead routes pressurized oil through a restrictor 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 with small holes directed to spray lubricate the camshaft lobes.

DESCRIPTION AND OPERATION (Continued)



Engine—2.4L

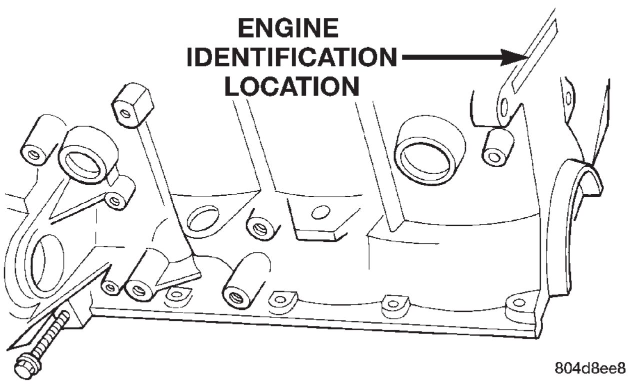


Fig. 1 Engine Identification

BALANCE SHAFTS

Balance shaft lubrication is provided through an oil passage from the number 1 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 rear shaft bearing journals

SPLASH LUBRICATION

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.

ENGINE COMPONENTS

BALANCE SHAFTS: 2.4L engines are equipped with two balance shafts installed in a carrier attached to the lower crankcase. The shafts interconnect through gears to rotate in opposite directions. These gears are driven by a short chain from the crankshaft, to rotate at two times crankshaft speed. This counterbalances certain engine reciprocating masses.

CYLINDER BLOCK AND BEDPLATE ASSEMBLY: A closed deck design is used for cooling and weight reduction with water pump molded into the block. Nominal wall thickness is 4.5 mm. The bedplate incorporates main bearing caps. Rear seal retainer is integral with the block.

CRANKSHAFT: A nodular cast iron crankshaft is used. The engine has 5 main bearings, with number 3 flanged to control thrust. The 60 mm diameter main and 50 mm diameter crank pin journals (all) have undercut fillets that are deep rolled for added strength. To evenly distribute bearing loads and minimize internal stress, 8 counterweights are used. Hydrodynamic seals provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for parting line sealing in the block. A sintered powder metal timing belt sprocket is mounted on the crankshaft nose. This sprocket provides motive power; via timing belt to the camshaft sprockets (providing timed valve actuation) and to the water pump.

PISTONS: There is provisions for free wheeling valve train. Piston has a unique height. All engines use pressed in piston pins to attach forged powder metal connecting rods. Incorporate hex head cap screw threaded into the connecting rod. Piston and Rods are serviced as a assembly.

PISTONS RINGS: The piston rings include a molybdenum faced top ring for reliable compression

DESCRIPTION AND OPERATION (Continued)

sealing and a chrome plated taper faced intermediate ring for additional cylinder pressure control. There are also standard oil control rings.

CYLINDER HEAD: Features a Dual Over Head Camshaft (DOHC) 4 valves per cylinder cross flow design. The valves are arranged in two inline banks, with the ports of the bank of two intake valves per cylinder facing toward the radiator side of engine and ports of the bank of two exhaust valves per cylinder facing toward the dash panel. Incorporates powder metal valve guides and seats. Integral oil galleys within the cylinder head supplies oil to the hydraulic lash adjusters, camshaft and valve mechanisms.

CAMSHAFTS: The nodular iron camshafts have six bearing journals and 2 cam lobes per cylinder. Flanges at the rear journals control camshaft end play. Provision for cam position sensor is located on the intake camshaft at the rear of cylinder head. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

VALVES: 4 valves per cylinder are actuated by roller cam followers which pivot on stationary hydraulic lash adjusters. All valves have 6 mm diameter chrome plated valve stems. The valve sizes are 34.8 mm (1.370 inch.) diameter intake valves and 30.5 mm (1.20 inch.) diameter exhaust valves. Viton rubber valve stem seals are integral with the spring seats. Valve springs, spring retainers, and locks are conventional.

INTAKE MANIFOLD: The intake manifold is a two piece aluminum casting, attached to the cylinder head with ten screws. This long branch fan design enhances low and midspeed torque, while minimizing undesirable inlet noise.

EXHAUST MANIFOLD: The exhaust manifold is made of cast iron for strength and high temperatures.

ENGINE LUBRICATION: Refer to Group 0 Lubrication and Maintenance for recommended oil to be used in various engine application. System is full flow filtration, pressure feed type. The oil pump is mounted in the front engine cover and driven by the crankshaft. Pressurized oil is then routed through the main oil gallery, running the length of the cylinder block, supplying main and rod bearings with further routing. Pistons are lubricated from rod bearing throw off and lubricating slots on the connecting rod assemblies. Camshaft and valve mechanisms are lubricated from a full length cylinder head oil gallery supplied from the crankcase main oil gallery.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit and install gauge assembly C-3292.

(2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170/550 kPa (25/80 psi).

(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open or a clogged oil pickup screen.

SERVICE PROCEDURES

FITTING PISTONS

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. 3). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 2). Refer to Cylinder Bore and Piston Specification Chart.

Correct piston to bore clearance must be established in order to assure quiet and economical operation.

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).

FITTING PISTON RINGS

(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. 4). Refer to specification in Piston Ring Specification Chart.

(2) Check piston ring to groove side clearance (Fig. 5). Refer to specification in Piston Ring Specification Chart.

SERVICE PROCEDURES (Continued)

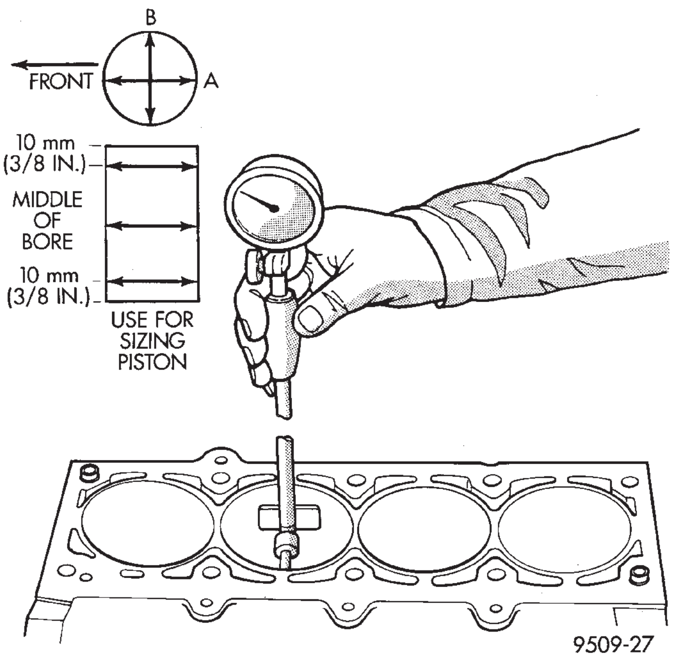


Fig. 2 Checking Cylinder Bore Size

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Maximum Out-Of-Round	Maximum Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size 87.450 - 87.468 mm (3.4434 - 3.4441 in.)		
Piston To Bore Clearance 0.024 - 0.057 mm (0.0009 - 0.0022 in.)		
Note: Measurements taken at Piston Size Location.		

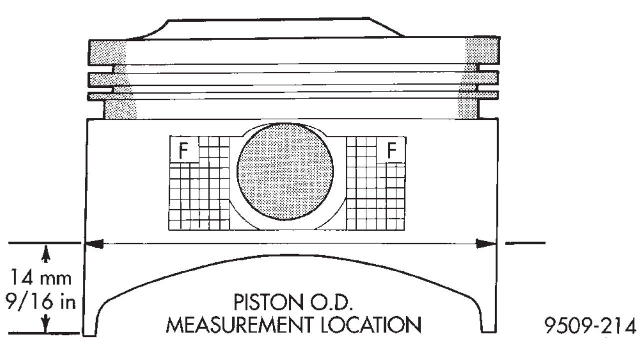


Fig. 3 Piston Measurement

PISTON RINGS—INSTALLATION

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 6).

CAUTION: Install piston rings in the following order:

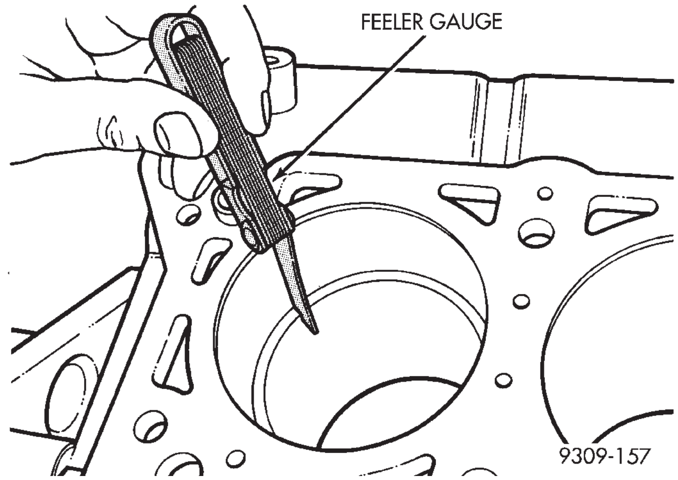


Fig. 4 Piston Ring Gap

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Wear Limit
Upper Ring	0.025 to 0.51 mm (0.0098 to 0.020 in.)	0.8 mm (0.031 in.)
Intermediate Ring	0.23 to 0.48 mm (0.009 to 0.018 in.)	0.8 mm (0.031 in.)
Oil Control Ring	0.25 to 0.64 mm (0.0098 to 0.025 in.)	1.0 mm (0.039 in.)
Ring Position	**Groove Clearance**	**Max. Clearance**
Upper Ring	0.030 to 0.080 mm (0.0011 to 0.0031 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.025 to 0.065 mm (0.0010 to 0.0026 in.)	0.10 mm (0.004 in.)
Oil Control Ring - Three Piece. Oil Ring Side Rails Must Be Free To Rotate After Assembly.		

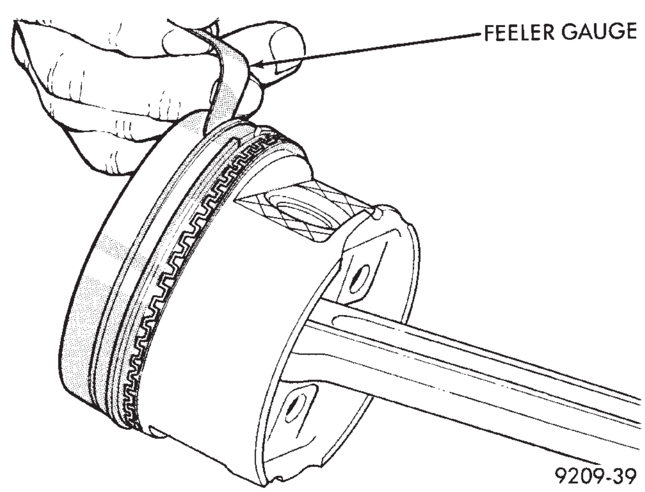


Fig. 5 Piston Ring Side Clearance

SERVICE PROCEDURES (Continued)

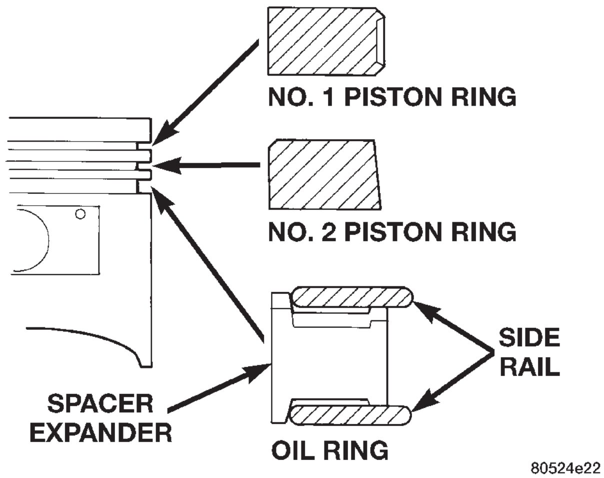


Fig. 6 Piston Ring Installation

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. 7).

(3) Install upper side rail first and then the lower side rail.

(4) Install No. 2 piston ring and then No. 1 piston ring.

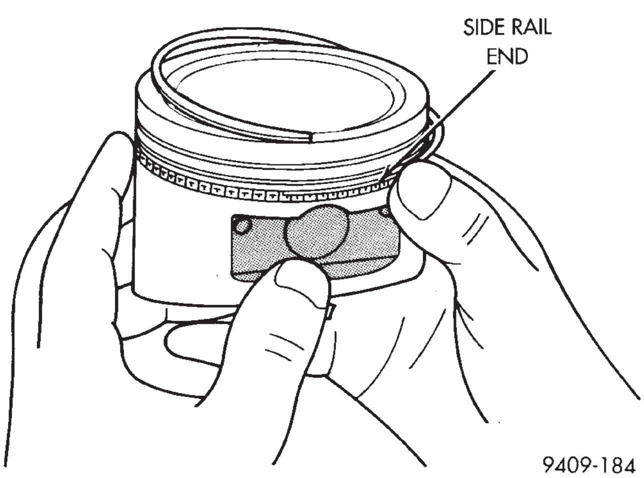


Fig. 7 Installing Side Rail

(5) Position piston ring end gaps as shown in (Fig. 8).

(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.

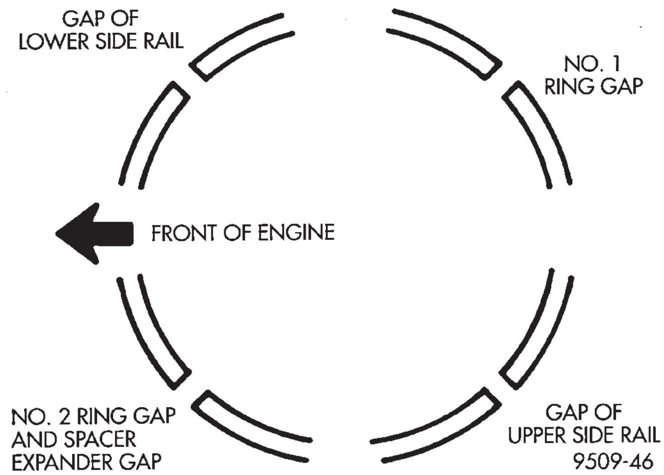


Fig. 8 Piston Ring End Gap Position

FITTING CONNECTING ROD BEARINGS

Engine connecting rod bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.

(2) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from the oil hole (Fig. 9). In addition, suspect areas can be checked by placing plastigage in the suspect area.

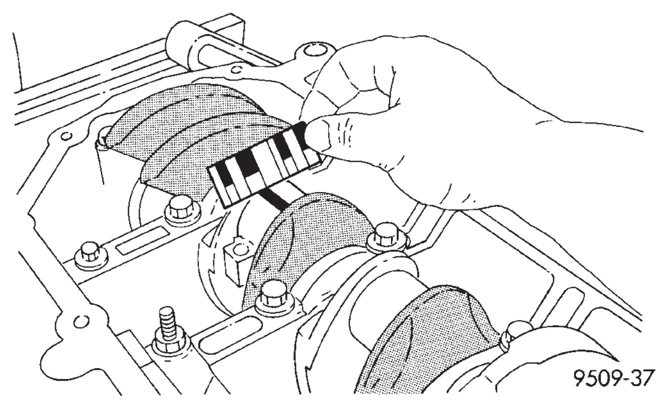


Fig. 9 Measuring Plastigage Width

(4) Before assembling the rod cap with Plastigage in place, the crankshaft must be rotated until the connecting rod being checked starts moving toward the top of the engine. Only then should the cap be assembled and torqued to specifications. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

(5) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 9) with the metric

SERVICE PROCEDURES (Continued)

scale provided on the package. Locate the band closest 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. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

(6) Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (.001-.003 in.) is usually the most appropriate for checking engine bearing proper specifications.

FITTING MAIN BEARINGS

Refer to the Engine General Information Section for Measuring Main Bearings. For Crankshaft specifications refer to Crankshaft Specification Chart.

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play New Part: 0.09 - 0.24 mm (0.0035 - 0.0094 in.) Wear Limit: 0.37 mm (0.015 in.)
Main Bearing Clearance New Part: 0.018 - 0.058 mm (0.0007 - 0.0023 in.)
Connecting Rod Bearing Clearance New Part: 0.025 - 0.071 mm (0.001 - 0.003 in.) Wear Limit: 0.075 mm (0.003 in.)
Crankshaft Journal Sizes Main Bearing Journal Diameter Standard 60.000 ± 0.008 mm (2.3622 ± 0.0003 in.) 1 st Undersize 59.975 ± 0.008 mm (2.361 ± 0.0003 in.)
Connecting Rod Journals Standard 49.992 ± 0.008 mm (1.968 ± 0.0003 in.) 1 st Undersize 49.967 ± 0.008 mm (1.967 ± 0.0003 in.)

CRANKSHAFT MAIN BEARINGS

The crankshaft is supported in five main bearings. All upper and lower bearing shells in the crankcase have oil grooves. The number three lower main thrust bearing is plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 10).

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. 10). 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.

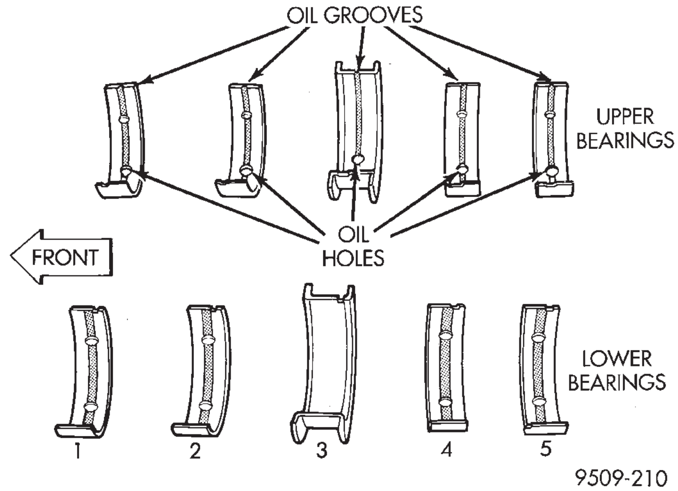


Fig. 10 Main Bearing Identification

MAIN BEARING INSTALLATION

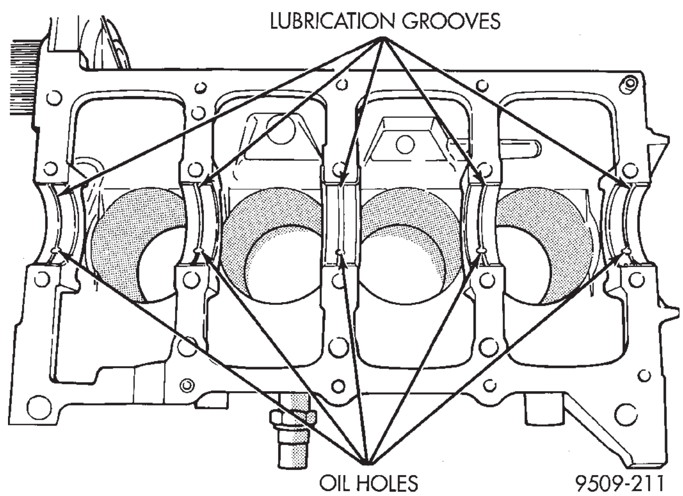


Fig. 11 Installing Main Bearing Upper Shell

(1) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 11).

(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.

SERVICE PROCEDURES (Continued)

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of anaerobic sealer Mopar® Torque Cure Gasket Maker to cylinder block as shown in (Fig. 12).

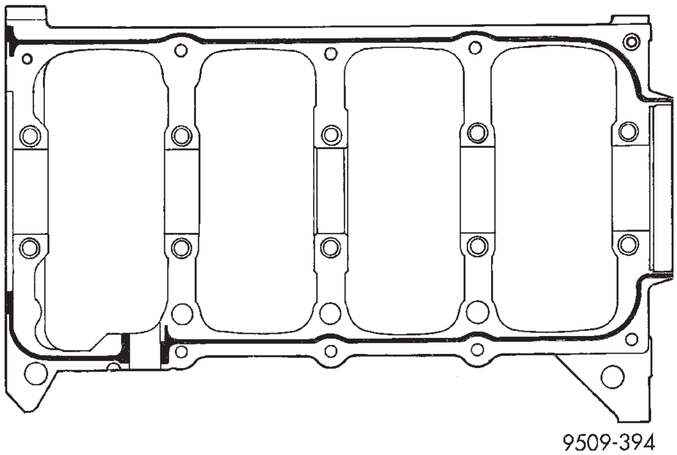


Fig. 12 Main Bearing Caps/Bedplate Sealing

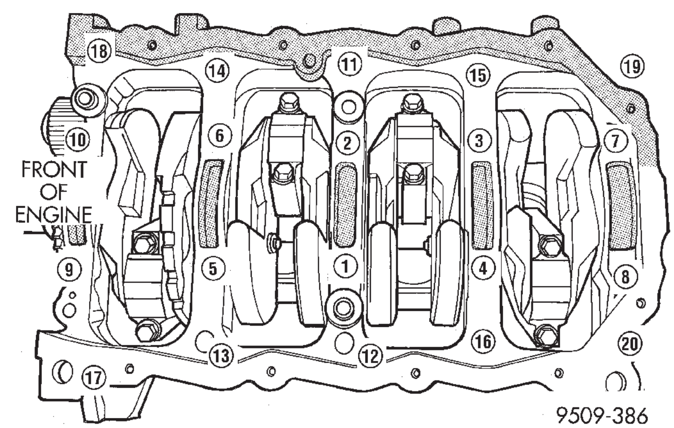


Fig. 13 Main Bearing Caps/Bedplate Torque Sequence

(5) 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.

(6) Before installing bolts, lubricate the threads with clean engine oil, wipe off any excess oil.

(7) 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.

(8) 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. 13) to 41 N·m (30 ft. lbs.).

• Step 6: Remove wedge tool used to hold crankshaft.

(9) Tighten bolts (1 – 10) again to 41 N·m (30 ft. lbs.) + 1/4 turn in sequence shown in (Fig. 13).

(10) Install main bearing bedplate to engine block bolts (11 through 20), and torque each bolt to 28 N·m (20 ft. lbs.) in sequence shown in (Fig. 13).

(11) 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 END PLAY

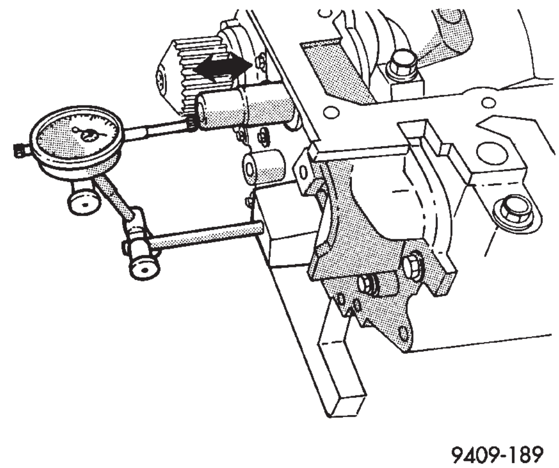


Fig. 14 Checking Crankshaft End Play—Typical

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 14).

(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 Crankshaft Specification Chart for end-play specification.

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.09 - 0.24mm (0.0035 - 0.0094 in.)
Wear Limit:	0.37 mm (0.015 in.)

SERVICE PROCEDURES (Continued)

OPTIONAL CRANKSHAFT END PLAY CHECK

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. **DO NOT** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

VALVE SERVICE RECONDITION

VALVE REMOVAL

(1) With cylinder head removed, compress valve springs using Special Tool C-3422-B or equivalent.

(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 to insure installation in original location.

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

(3) If valve stems are worn more than 0.05 mm (0.002 in.), replace valve.

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 15). Refer to Valve Guide Specification Chart. Replace guides if they are not within specification.

(3) Check valve guide height (Fig. 16).

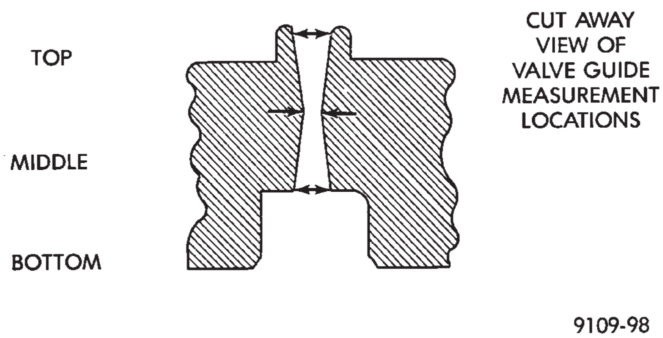


Fig. 15 Checking Wear on Valve Guide—Typical

TESTING VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. As an example, the compression length of the spring to be tested is 33.34 mm (1 5/16 inches). Turn tool table until surface is in line with the 33.34 mm (1 5/16 in.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device (Fig. 17). Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Discard the springs that do not meet specifications. The Following specifications apply to both intake and exhaust valve 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.

REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and valve face have a 45 and a 45 1/2 degree angles.

VALVE GUIDE SPECIFICATION CHART

Valve Guide Diameter		
Intake and Exhaust Valve:	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	
Valve Guide Clearance	New	Service Limit
Intake Valve:	0.048 - 0.066 mm (0.0018 - 0.0025 in.)	0.25 mm (0.010 in.)
Exhaust Valve:	0.0736 - 0.094 mm (0.0029 - 0.0037 in.)	

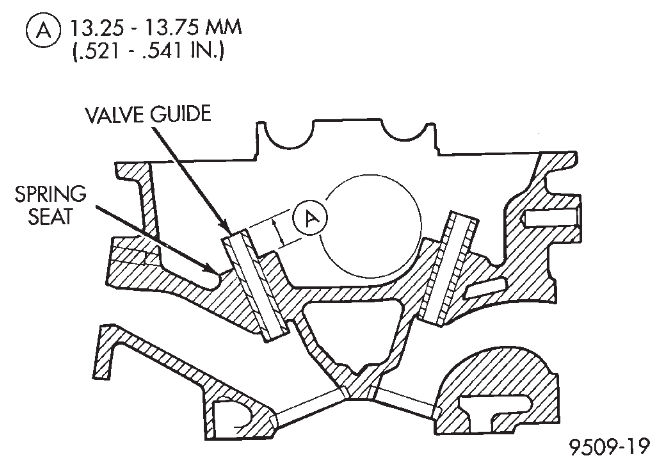


Fig. 16 Valve Guide Height

SERVICE PROCEDURES (Continued)

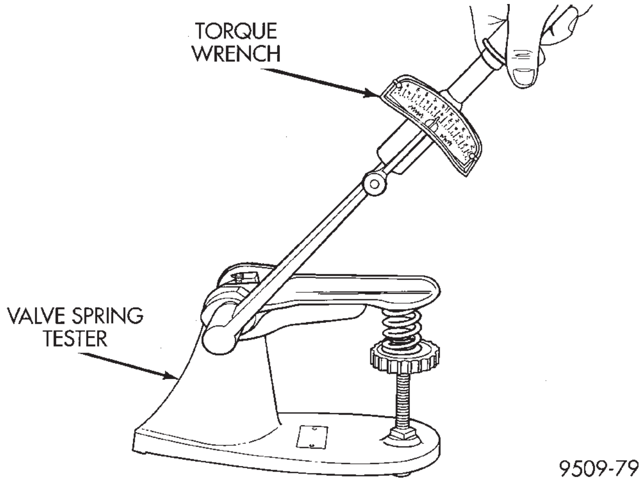
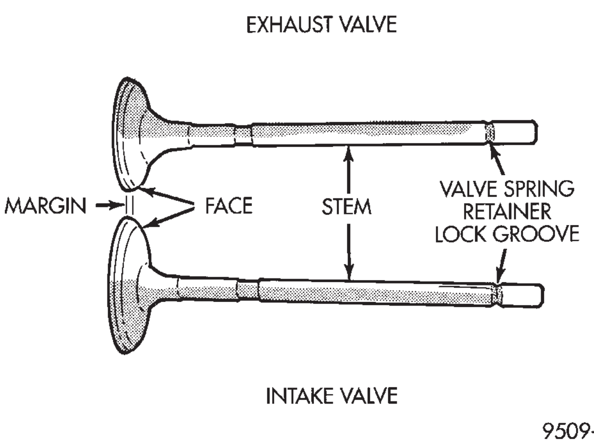


Fig. 17 Testing Valve Springs



Intake and Exhaust Valves

(2) Inspect the remaining margin after the valves are refaced (Fig. 18). Intake valves with less than 1.2 mm (3/64 inch.) margin and Exhaust valves with less than 0.9 mm (1/32 inch.) margin should be discarded.

(3) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(4) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator. Total runout should not exceed. 0.051 mm (0.002 inch.) (total indicator reading).

(5) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

VALVE SPECIFICATION CHART

Face Angle	
Intake and Exhaust:	44.5°-45°
Head Diameter	
Intake:	34.67 - 34.93 mm (1.364 - 1.375 in.)
Exhaust:	30.37 - 30.63 mm (1.195 - 1.205 in.)
Length (Overall)	
Intake:	112.76 - 113.32 mm (4.439 - 4.461 in.)
Exhaust:	109.59 - 110.09 mm (4.314 - 4.334 in.)
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	
Intake:	1.285 - 1.615 mm (0.050 - 0.063 in.)
Exhaust:	0.985 - 1.315 mm (0.038 - 0.051 in.)

- Intake valve seat diameter is 34.37 34.63 mm (1.158 1.363 inch.)
- Exhaust valve seat diameter is 29.37 29.63 mm (1.156 1.166 inch.)

(6) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

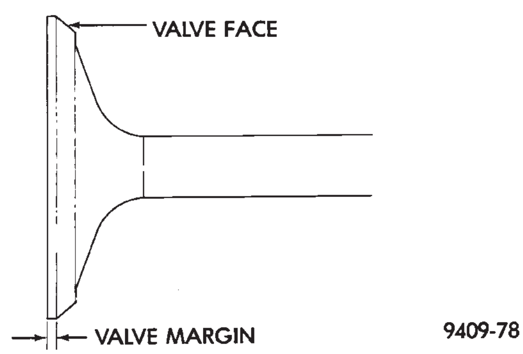


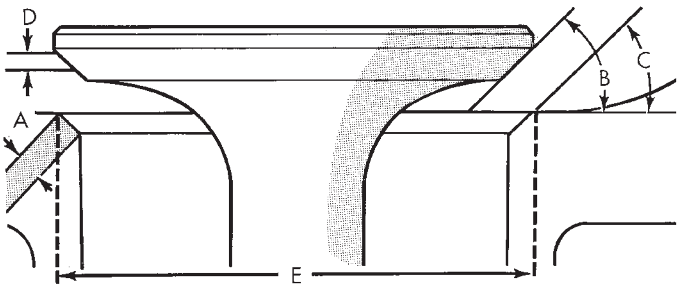
Fig. 18 Refacing Intake and Exhaust Valves

(7) When seat is properly positioned the width of intake and exhaust seats should be 0.9 to 1.3 mm (0.35 to 0.051 inch.) (Fig. 19).

(8) Check valve tip height dimensions A after grinding the valve seats or faces (Fig. 20). Grind valve tip to 47.99 mm (1.889 in.) for exhaust valve and 48.04 mm (1.891 in.) for intake valve when installed in the head. The valve tip chamfer may

SERVICE PROCEDURES (Continued)

need to be reground to prevent seal damage when the valve is installed.



A – SEAT WIDTH (INTAKE AND EXHAUST 0.9 TO 1.3 mm (.035 TO .051 IN.)
B – FACE ANGLE (INTAKE & EXHAUST: 44½°-45°)
C – SEAT ANGLE (INTAKE & EXHAUST: 45°-45½°)
D – SEAT CONTACT AREA
E – SEAT DIAMETER

9509-207

Fig. 19 Refacing Valve Seats

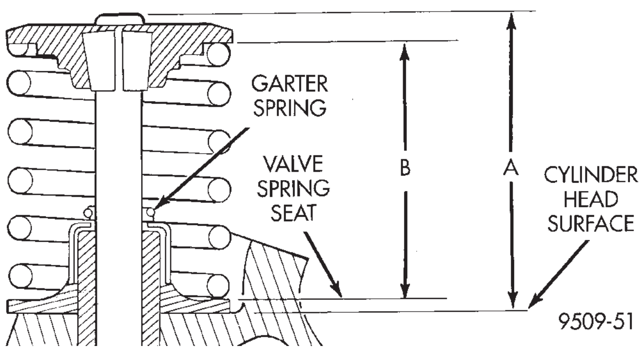


Fig. 20 Checking Spring Installed Height and Valve Tip Height Dimensions

VALVE INSTALLATION

(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. 21). The valve stem seals should be pushed firmly and squarely over valve guide.

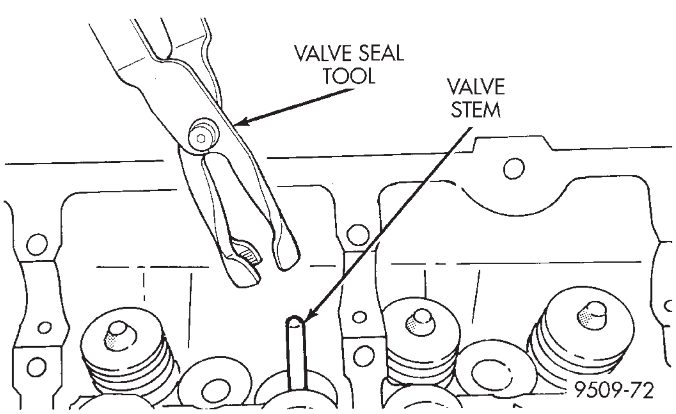


Fig. 21 Valve Stem Oil Seal Special Tool C4745

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. Check to make sure both locks are in their correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 20). 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 .762 mm (0.030 inch.) spacer under the valve spring seat to bring spring height back within specification.

(5) Install rocker arm shafts as previously described in this section.

(6) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.17 mm (0.046 in.) for intake and 1.28 mm (0.050 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster/s to bleed down before rotating cam.

REMOVAL AND INSTALLATION

ENGINE MOUNT—FRONT

REMOVAL

(1) Support the engine and transaxle assembly with a floor jack so it will not rotate.

(2) Remove the front engine mount through bolt from the insulator and front crossmember mounting bracket (Fig. 22).

(3) Remove six screws from air dam to allow access to the front mount screws.

(4) Remove the front engine mount screws and remove the insulator assembly.

(5) Remove the front mounting bracket, if necessary (Fig. 22).

INSTALLATION

(1) Reverse removal procedure for installation and tighten fasteners in this order. For engine mount

REMOVAL AND INSTALLATION (Continued)

adjustment procedure, refer to Adjustments, Engine Mounts in this Section.

(a) Tighten bolts 2, 3 and 4 to 108 N·m (80 ft. lbs.)

(b) Tighten bolts 1 and 5 to 54 N·m (40 ft. lbs.).

(2) Install six screws to air dam and tighten to 12 N·m (105 in. lbs.).

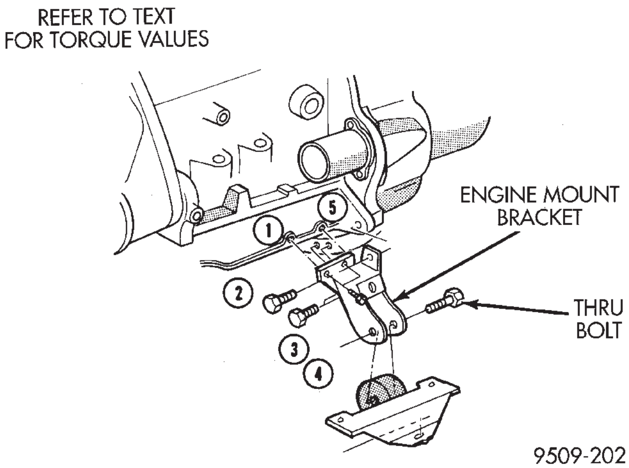


Fig. 22 Engine Mounting-Front

ENGINE MOUNT—LEFT

REMOVAL

(1) Raise vehicle on hoist and remove left front wheel.

(2) Support the transaxle with a jack.

(3) Remove the insulator through bolt from the mount.

(4) Remove the transaxle mount fasteners and remove mount (Fig. 23).

INSTALLATION

(1) Reverse removal procedure for installation.

(2) Tighten mount to transaxle bolts to 55 N·m (40 ft. lbs.)

(3) Tighten through bolt to 75 N·m (55 ft. lbs.) (Fig. 23).

(4) Engine mount adjustment, Refer to Engine Mount Adjustment in this section.

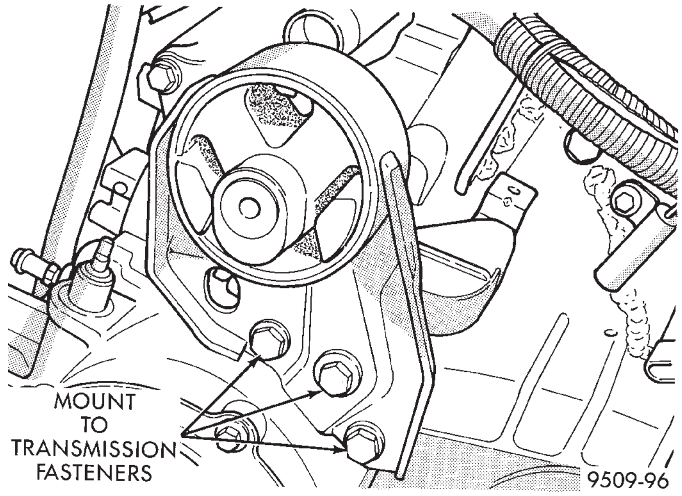


Fig. 23 Typical Engine Mounting—Left

ENGINE MOUNT—RIGHT

REMOVAL

NOTE: Right mount should only be serviced as an assembly to prevent noise, vibration and harshness concerns.

(1) Remove the purge duty solenoid and wiring harness from engine mount bracket.

(2) Remove the two right engine mount insulator vertical fasteners from frame rail and loosen the one horizontal fastener. **Do not remove the large nut located at the end of the core (Fig. 24).**

(3) Remove the load on the engine mounts by carefully supporting the engine and transaxle assembly with a floor jack.

(4) Remove the vertical and horizontal fasteners from the engine side bracket. Remove the mount assembly.

INSTALLATION

(1) Reverse removal procedure for installation. Tighten assembly in the following order:

a. Engine mount to rail fasteners to 68 N·m (50 ft. lbs.).

b. The vertical engine fastener to 102 N·m (75 ft. lbs.).

c. The horizontal fastener to 150 N·m (111 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

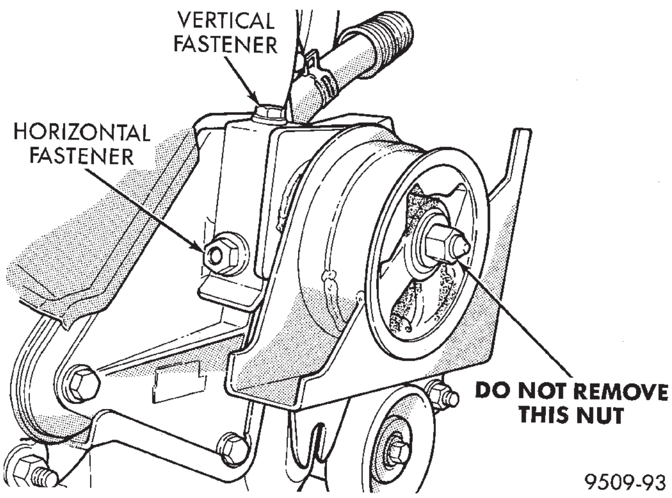


Fig. 24 Engine Mounting—Right Side

ENGINE MOUNT—REAR

REMOVAL

(1) Raise vehicle on hoist and remove the left front wheel.

(2) Support the transaxle with a jack so it will not rotate.

(3) Remove the insulator thru bolt from the mount and rear suspension crossmember.

(4) Remove the four mount fasteners and remove the mount.

INSTALLATION

(1) Reverse the removal procedure for installation. Refer to (Fig. 25).

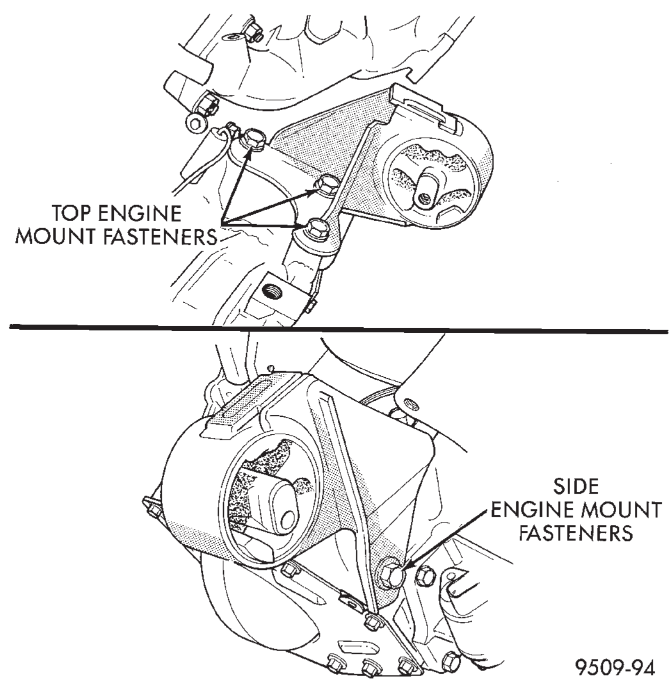


Fig. 25 Engine Mounting—Rear

STRUCTURAL COLLAR

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove front engine mounting bracket from bending strut and front insulator mount.

(3) Remove bolts attaching bending strut to engine and transaxle.

(4) Remove bolts attaching collar and strut to engine, oil pan, and transaxle. Remove strut and collar.

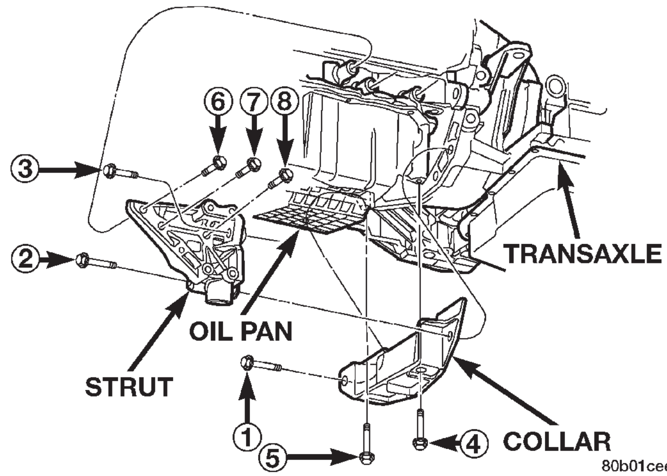


Fig. 26 Structural Collar and Bending Strut—Removal and Installation

INSTALLATION

CAUTION: Torque procedure for the structural collar and bending strut must be followed or damage could occur to oil pan, collar, and/or bending strut.

(1) Perform the following steps for installing structural collar and bending strut. Refer to (Fig. 26):

- Step 1: Place collar into position between transaxle and oil pan. Hand start only, collar to transaxle bolt 1.
- Step 2: Install bolt 4, collar to oil pan, **hand tight only.**
- Step 3: Position bending strut in place and hand start bolt 3 into the upper transaxle hole.
- Step 4: Install bolt 2, through strut and collar. Hand starting only.
- Step 5: Install bolt 6, strut to cylinder block, **hand tight only.**
- Step 6: Install the remaining collar to oil pan bolt 5, **hand tight only.**
- Step 7: Final torque collar to transaxle bolts 1 – 3, to 101 N·m (75 ft. lbs.)
- Step 8: Install bolts 7 and 8, through strut and into cylinder block.
- Step 9: Final torque bolts 4 – 8 to 61 N·m (45 ft. lbs.).

(2) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect battery.

(3) Remove Air cleaner and hoses.

(4) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(5) Remove upper radiator hose and remove radiator fans. Refer to Group 7, Cooling System for procedure.

(6) Remove lower radiator hose.

(7) Disconnect automatic transmission cooler lines and plug, if equipped.

(8) Disconnect transmission shift linkage.

(9) Disconnect throttle body linkage.

(10) Disconnect engine wiring harness.

(11) Disconnect heater hoses.

(12) Discharge Air Conditioning System. Refer to Group 24, Air Conditioning for procedure.

(13) Hoist vehicle and remove right inner splash shield. Remove wheels and tires.

(14) Loosen power steering belt for pump removal. Refer to Group 7, Cooling System for procedure.

(15) Remove axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(16) Disconnect exhaust pipe from manifold.

(17) Remove front and rear engine mount brackets from the body.

(18) Remove bending braces and front engine mount bracket. Remove transmission inspection cover.

(19) Mark flexplate to torque converter and remove torque converter bolts.

(20) Install front engine mount bracket.

(21) Lower vehicle.

(22) Remove power steering pump. Set pump aside.

(23) Remove A/C lines at compressor and cap.

(24) Remove ground straps to body.

(25) Raise vehicle enough to allow engine dolly Special Tool 6135, cradle Special Tool 6710 with Posts Special Tool 6848 and Adaptor Special Tool 8130 to be installed under vehicle (Fig. 27).

(26) Loosen cradle posts to allow movement for proper positioning. Locate two rear posts (right side of engine) into the holes on the engine bedplate. Locate the two front posts (left side of engine) on the front engine bracket and A/C compressor bracket (Fig. 27). Lower vehicle and position cradle mounts until the engine is resting on mounts. Tighten mounts to cradle frame. This will keep mounts from moving when removing or installing engine and transmission.

(27) Lower vehicle so the weight of **ONLY THE ENGINE AND TRANSMISSION** are on the cradle.

(28) Remove engine and transmission mount bolts.

(29) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly on the cradle to allow for removal around the body.

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right engine and left transmission mounts. Refer to procedures outlined in this section.

(3) Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135 and 6710.

(4) Install axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(5) Install transmission and engine braces and splash shields.

(6) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(7) Install power steering pump. Refer to Cooling System Group 7, Accessory Drive Section for belt tension adjustment.

(8) Install A/C compressor hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(9) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(10) Install front and rear engine mounts. Refer to this section for procedure.

(11) Install inner splash shield. Install wheels and tires.

(12) Connect automatic transmission cooler lines, and shift linkage. Refer to Group 21, Transmission for procedures.

(13) Connect fuel line and heater hoses.

(14) Install ground straps. Connect engine and throttle body connections and harnesses. Refer to Group 8, Electrical for procedure.

(15) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(16) Install radiator fans. Install radiator hoses. Fill cooling system. Refer to Group 7, Cooling System for filling procedure.

(17) Connect battery.

(18) Install air cleaner and hoses.

(19) Install oil filter. Fill engine crankcase with proper oil to correct level.

(20) Start engine and run until operating temperature is reached.

(21) Adjust transmission linkage, if necessary.

REMOVAL AND INSTALLATION (Continued)

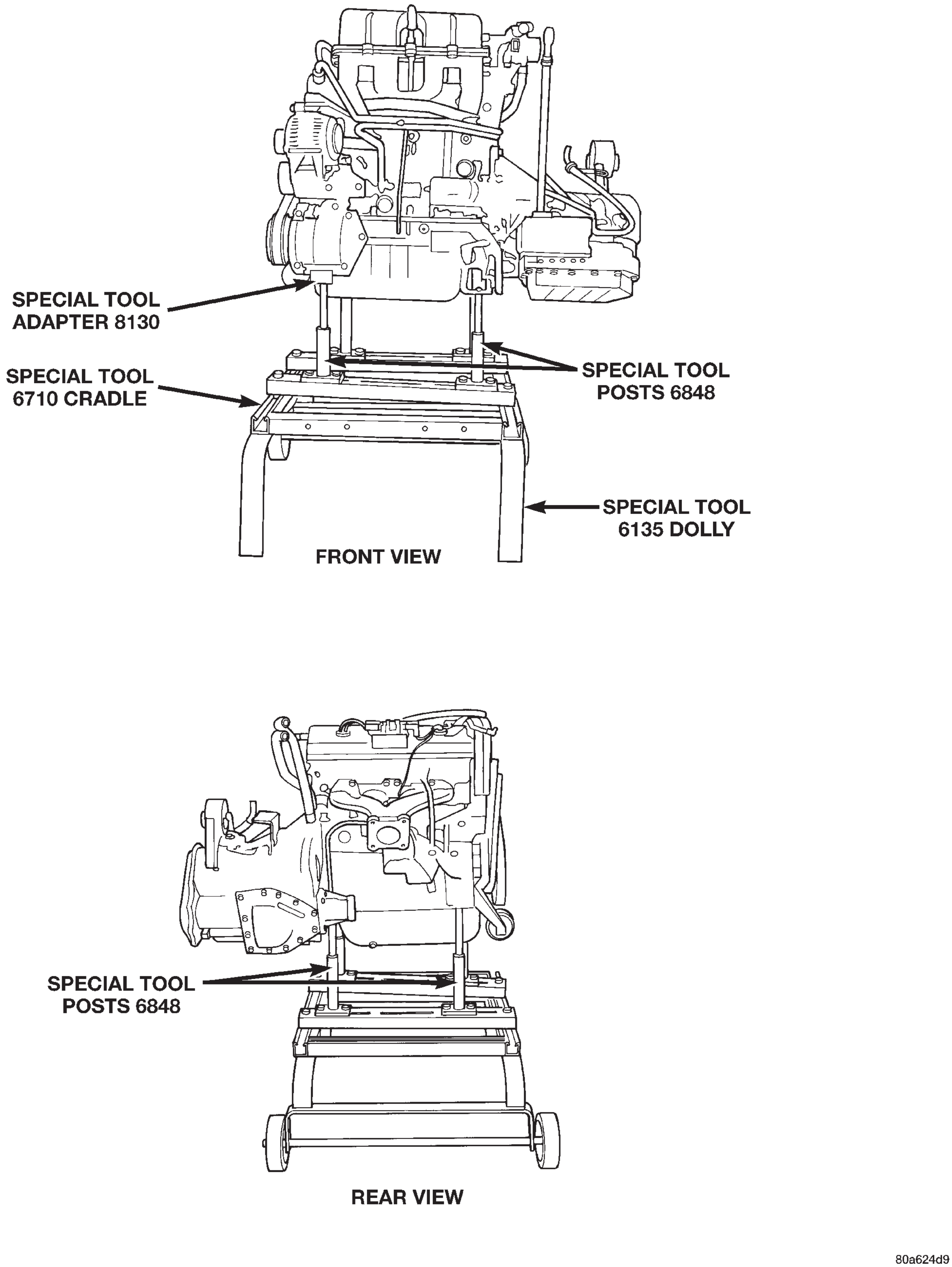


Fig. 27 Positioning Engine Cradle Support Post Mounts—Typical

REMOVAL AND INSTALLATION (Continued)

CYLINDER HEAD COVER

REMOVAL

(1) Remove upper intake manifold. Refer to Group 11, Exhaust System and Intake Manifold.

(2) Remove nuts attaching front and rear intake manifold supports from cylinder head cover attaching studs.

(3) Remove ignition coil pack and plug wires (Fig. 28). Remove ground strap.

(4) Remove the cylinder head cover fasteners.

(5) Remove cylinder head cover from cylinder head.

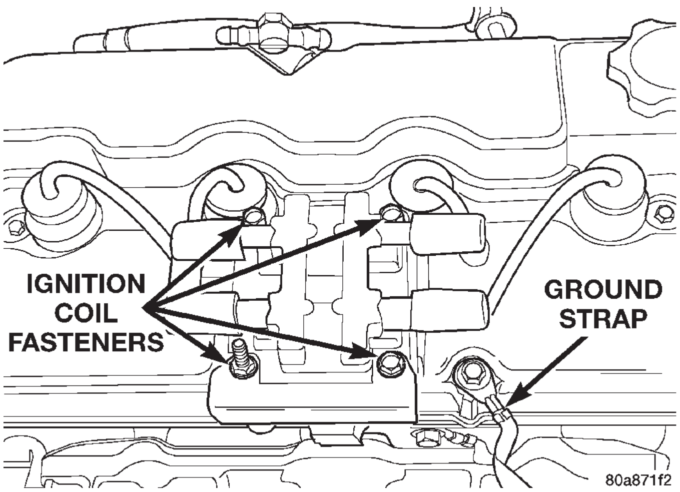


Fig. 28 Ignition Coil Pack and Ground Strap

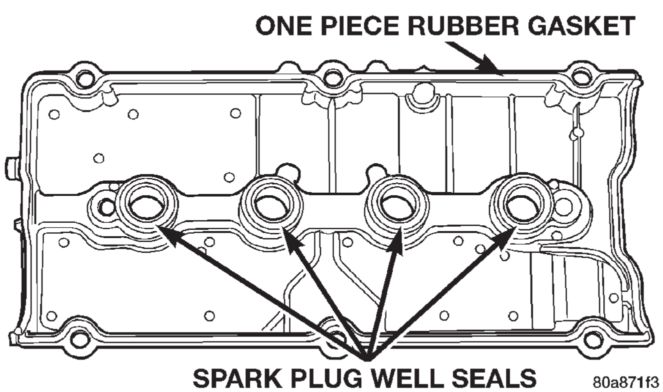


Fig. 29 Cylinder Head Cover Gasket and Spark Plug Seals

INSTALLATION

NOTE: Replace spark plug well seals when installing a new cylinder head cover gasket.

(1) Clean all sealing surfaces.

(2) Install new cylinder head cover gaskets and spark plug seals (Fig. 29).

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® Silicone Rubber Adhesive Sealant at the camshaft cap corners and at the top edge of the 1/2 round seal.

(4) Install cylinder head cover assembly to head and tighten fasteners in sequence shown in (Fig. 30). Using the 3 step torque method:

(a) Tighten all fasteners to 4.5 N·m (40 in. lbs.)

(b) Tighten all fasteners to 9.0 N·m (80 in. lbs.)

(c) Tighten all fasteners to 12 N·m (105 in. lbs.)

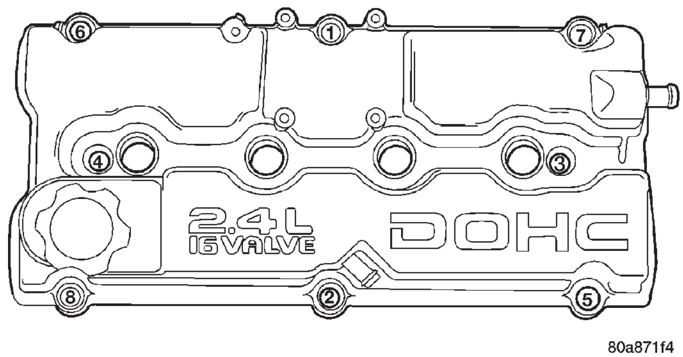


Fig. 30 Cylinder Head Cover Tightening Sequence

(5) Install ignition coil pack and plug wires. Tighten fasteners to 12 N·m (105 in. lbs.).

(6) Install ground strap.

(7) Install front and rear intake manifold support brackets and attaching nuts, but do not tighten at this time.

(8) Install upper intake manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure.

(9) Final torque intake manifold support nuts to 28 N·m (250 in. lbs.).

CAMSHAFT

REMOVAL

(1) Remove cylinder head cover using procedure outlined in this section.

(2) Remove timing belt, sprockets and covers. Refer to Timing Belt Service outlined in this section.

(3) Bearing caps are identified for location. Remove the outside bearing caps first (Fig. 31).

(4) Loosen the camshaft bearing cap attaching fasteners in sequence shown (Fig. 32) one camshaft at a time.

CAUTION: Camshafts are not interchangeable. The intake cam number 6 thrust bearing face spacing is wider.

REMOVAL AND INSTALLATION (Continued)

(5) Identify the camshafts before removing from the head. The camshafts are not interchangeable.

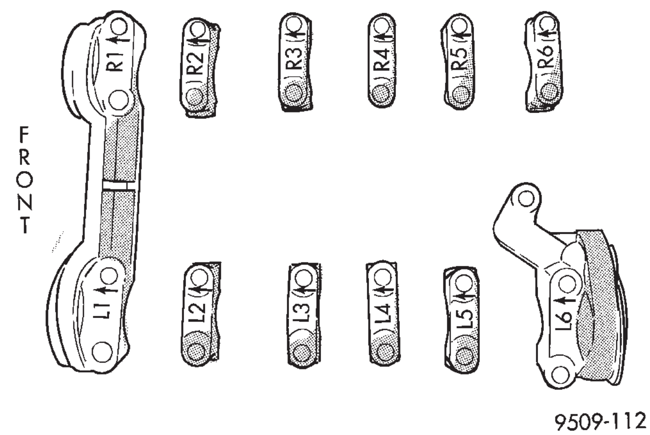


Fig. 31 Camshaft Bearing Cap Identification

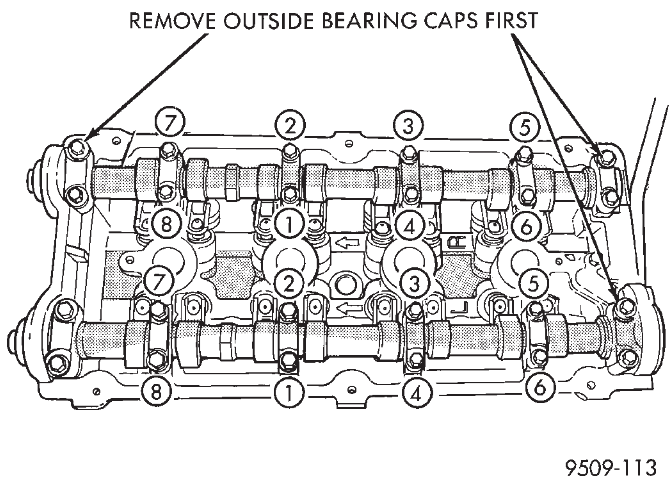


Fig. 32 Camshaft Bearing Cap— Removal

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.

(3) Zero dial indicator (Fig. 33).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.05–0.15 mm (0.002–0.010 in.).

(6) If end play is excessive check cylinder head and camshaft for wear; replace as necessary.

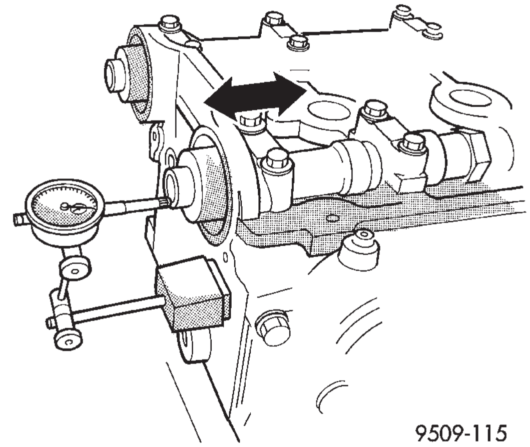


Fig. 33 Camshaft End Play

INSTALLATION

CAUTION: Ensure that NONE of the pistons are at top dead center when installing the camshafts.

(1) Remove camshaft retaining caps and lubricate bearing journals. Install cam followers and camshafts with clean oil. Install right and left camshaft bearing caps #2 thru #5 and right #6. Tighten M6 fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 34).

(2) Apply Mopar® Gasket Maker to No. 1 and No. 6 bearing caps (Fig. 35). Install bearing caps and tighten M8 fasteners to 28 N·m (250 in. lbs.).

(3) Bearing end caps must be installed before seals can be installed.

(4) Install timing belt, sprockets and covers. Refer to timing belt service outlined in this section.

(5) Install cylinder head cover using procedure outlined in this section.

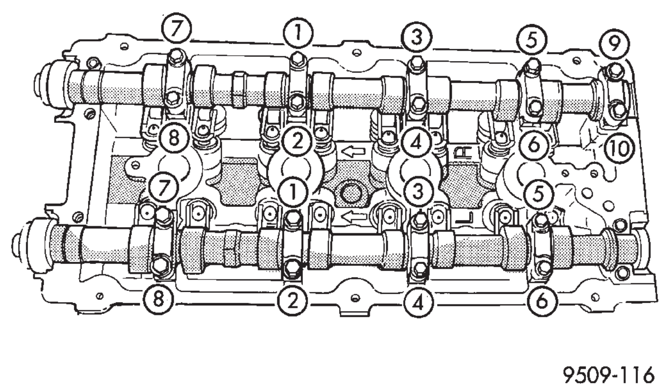


Fig. 34 Camshaft Bearing Cap Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

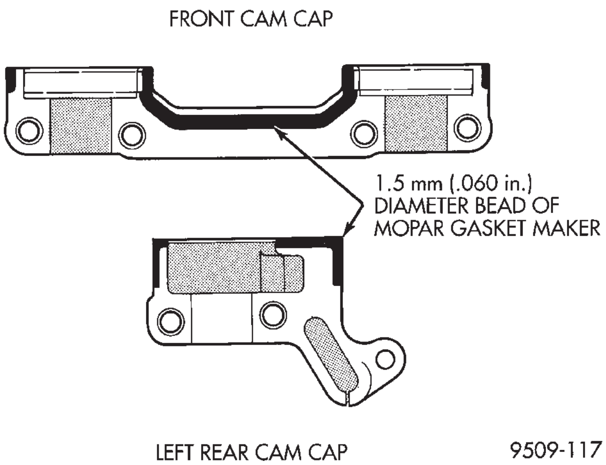


Fig. 35 Camshaft Bearing Cap Sealing

CAMSHAFT FOLLOWER

REMOVAL

(1) Remove cylinder head cover using procedure outlined in this section.

(2) Remove timing belt, sprockets and covers using procedure outlined in this section.

(3) Remove camshaft. Refer to procedure previously outline this section.

(4) Remove cam follower assemblies from cylinder head. Keep the cam followers in the order they have been removed from the head for reassembly.

INSPECTION

Inspect the cam follower assembly for wear or damage (Fig. 36). Replace as necessary.

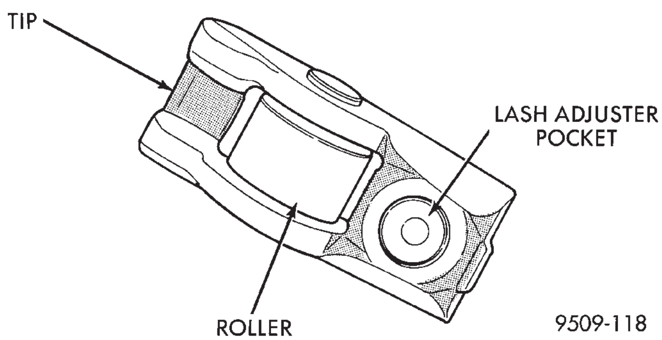


Fig. 36 Cam Follower Assembly

INSTALLATION

(1) Lubricate with clean oil and install cam follower assemblies in their original position on the hydraulic adjuster and valve stem (Fig. 37).

(2) Install the camshafts. Refer to procedure previously outlined in this section.

(3) Install timing belt, sprockets and covers using procedure outlined in this section.

(4) Install cylinder head cover using procedure outlined in this section.

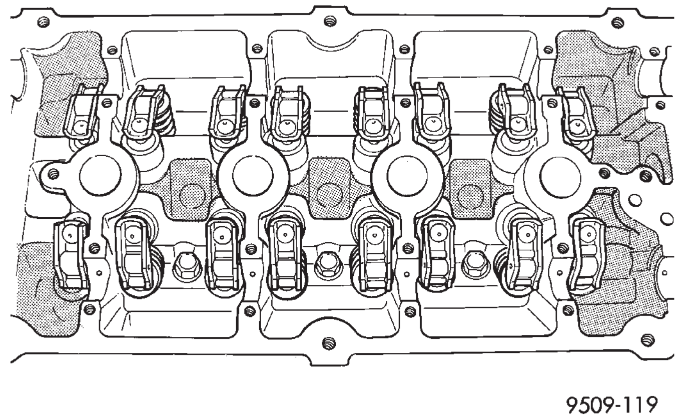


Fig. 37 Cam Follower Assemblies—Installation

BALANCE SHAFTS CARRIER ASSEMBLY

BALANCE SHAFTS

REMOVAL

Refer to Timing Belt Cover, and Timing Belt removal procedure in this section. To repair balance shafts carrier assembly.

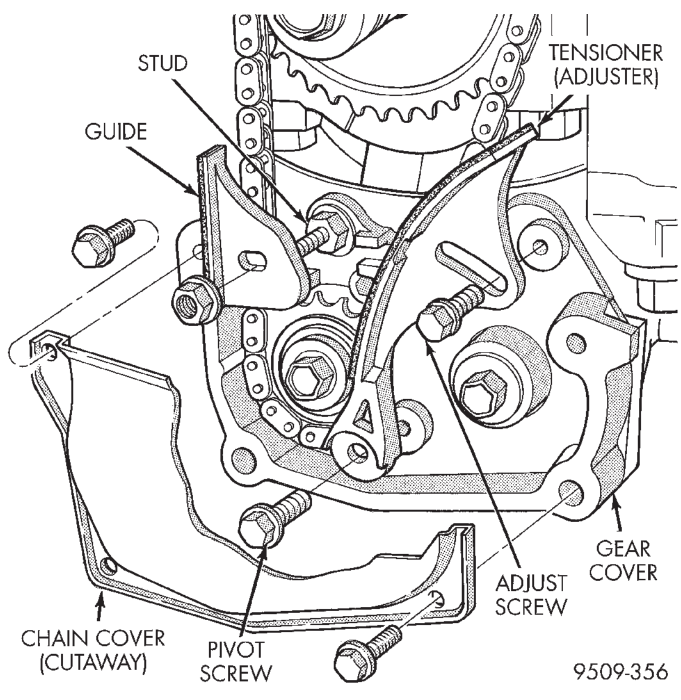


Fig. 38 Chain Cover, Guide and Tensioner

(1) Remove chain cover, guide and tensioner (Fig. 38). Also see Carrier Assembly Removal for service procedures requiring only temporary relocation of assembly.

(2) Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears (Fig. 38).

REMOVAL AND INSTALLATION (Continued)

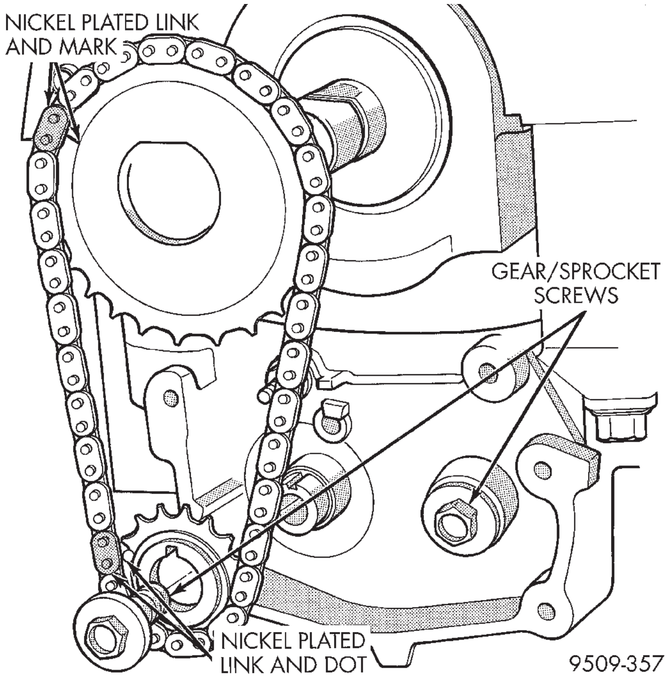


Fig. 39 Drive Chain and Sprockets

(3) Remove balance shaft gear and chain sprocket retaining screws and crankshaft chain sprocket. Remove chain and sprocket assembly (Fig. 39). Using two wide pry bars, work the sprocket back and forth until it is off the shaft.

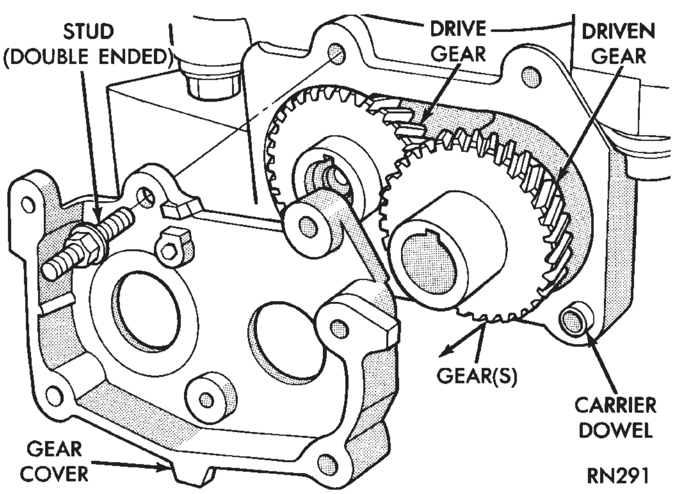


Fig. 40 Gear Cover and Gears

(4) Remove carrier gear cover and balance shafts (Fig. 40).

(5) Remove four carrier to crankcase attaching bolts to separate carrier from engine bedplate.

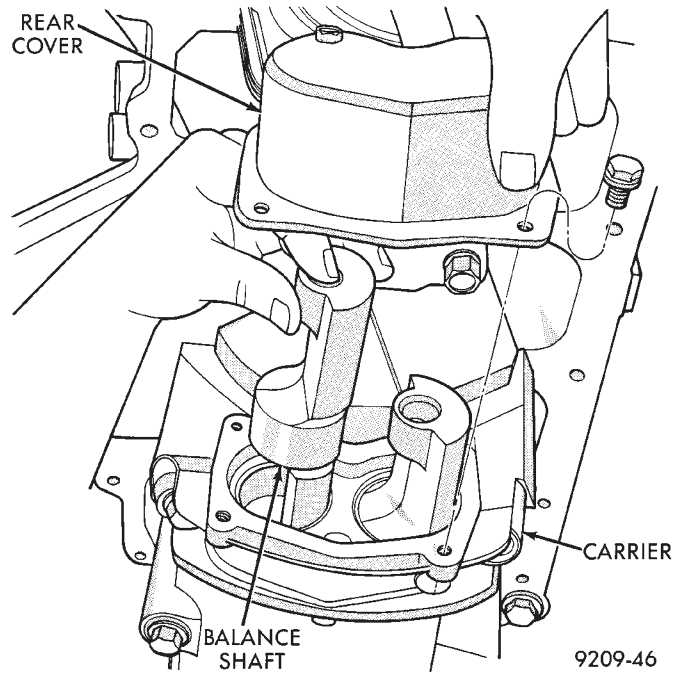


Fig. 41 Balance Shaft(s)—Removal/Installation

BALANCE SHAFT CARRIER

REMOVAL

The following components will remain intact during carrier removal. Gear cover, gears, balance shafts and the rear cover (Fig. 41).

(1) Remove chain cover and driven balance shaft chain sprocket screw.

(2) Loosen tensioner pivot and adjusting screws, move driven balance shaft inboard through driven chain sprocket. Sprocket will hang in lower chain loop.

(3) Remove carrier to crankcase attaching bolts to remove carrier.

BALANCE SHAFT INSTALLATION

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 outlined in this section.**

BALANCE SHAFT TIMING

(1) With balance shafts installed in carrier (Fig. 42) 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. 43).

REMOVAL AND INSTALLATION (Continued)

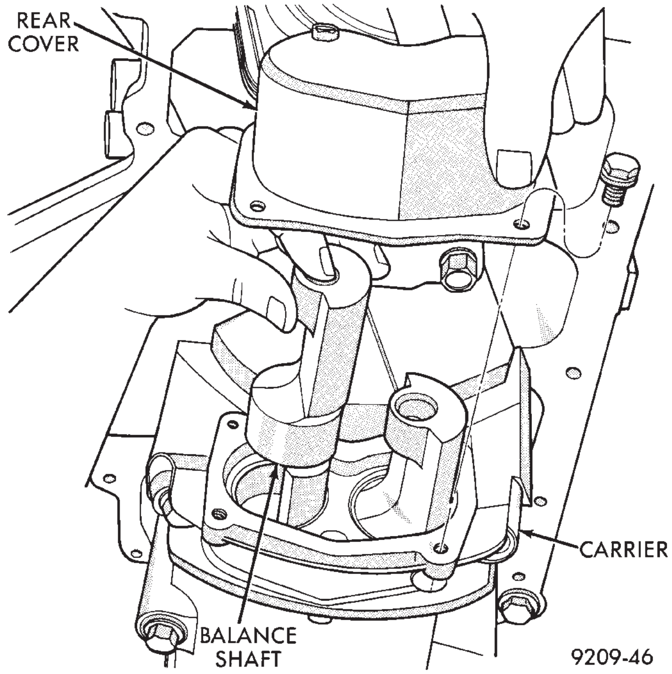


Fig. 42 Balance Shaft(s)—Removal/Installation

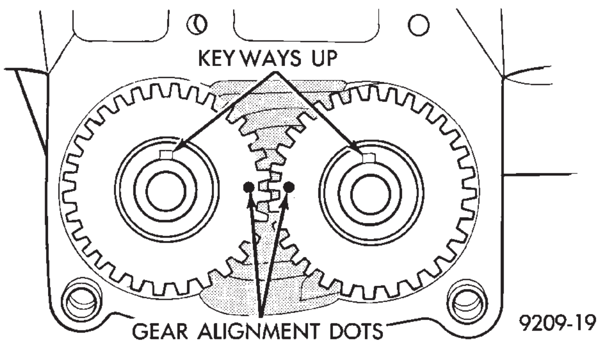


Fig. 43 Gear Timing

(3) Install gear cover and tighten double ended stud/washer fastener to 12 N·m (105 in. lbs.).

(4) Install crankshaft sprocket using Special Tool 6052 (Fig. 44).

(5) Turn crankshaft until number one 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. 45).

(6) Place chain over crankshaft sprocket so that the nickel plated link of the chain is over the number 1 cylinder timing mark on the crankshaft sprocket (Fig. 45).

(7) Place balance shaft sprocket into the timing chain (Fig. 45) so that the timing mark on the sprocket (yellow dot) mates with the (lower) nickel plated link on the chain

(8) With balance shaft keyways pointing up (12 o'clock) slide the balance shaft sprocket onto the nose

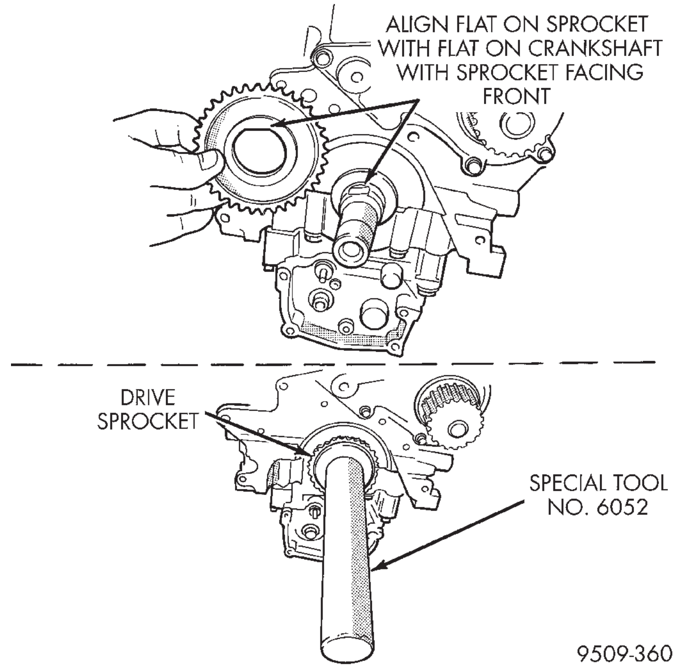


Fig. 44 Crankshaft Sprocket—Installation

of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance.

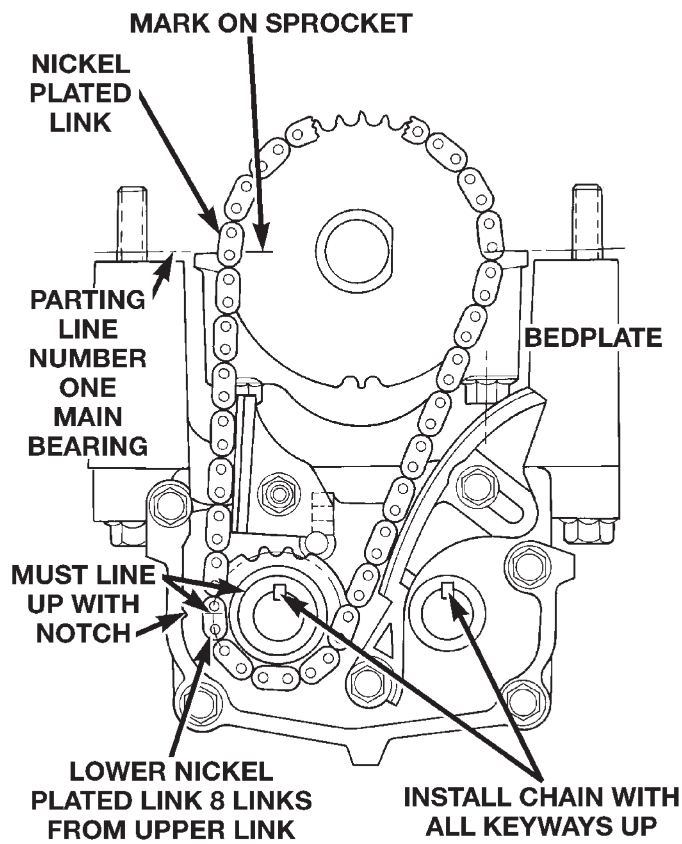


Fig. 45 Balance Shaft Timing

REMOVAL AND INSTALLATION (Continued)

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.

(9) 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.

CHAIN TENSIONING

(1) Install chain tensioner loosely assembled.

(2) 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.).

(3) Place a shim 1 mm (0.039 in.) thick x 70 mm (2.75 in.) long or between tensioner and chain. Push tensioner and shim up against the chain. **Apply firm pressure (5.5 to 6.6 lbs.) directly behind the adjustment slot to take up all slack.** Chain must have shoe radius contact as shown in (Fig. 46).

(4) With the load applied, tighten top tensioner bolt first, then bottom pivot bolt. Tighten bolts to 12 N·m (105 in. lbs.). Remove shim.

(5) Install carrier covers and tighten screws to 12 N·m (105 in. lbs.).

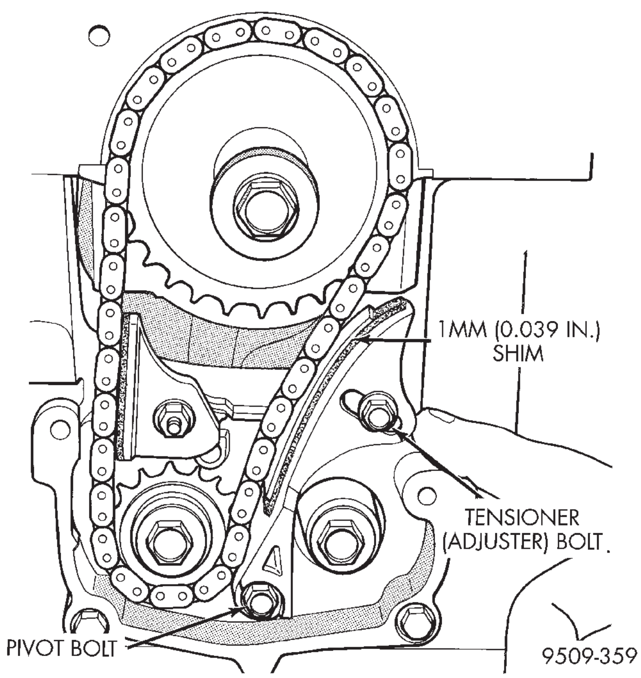


Fig. 46 Chain Tension Adjustment

HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove cylinder head cover. Refer to procedure outlined in this section.

(2) Remove cam follower assembly. Refer to camshaft removal procedure outlined in this section to gain access to cam followers and lash adjusters.

(3) Mark hydraulic lash adjusters for reassembly in their original position. Lash adjusters are serviced as an assembly.

INSTALLATION

(1) Install hydraulic lash adjuster assembly making sure adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed.

(2) Install cam follower assembly as previously outlined in this section.

(3) Install camshaft as previously outlined in this section.

(4) Install cylinder head cover as previously outlined in this section.

VALVE SPRINGS AND VALVE SEALS IN VEHICLE

REMOVAL

(1) Remove camshafts as previously outlined in this section.

(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. 47) compress valve springs and remove valve locks.

(5) Remove valve spring.

(6) Remove valve stem seal by a using valve stem seal tool.

INSTALLATION

(1) Install valve seal/valve spring seat assembly (Fig. 48). 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 (Fig. 47). Correct alignment of tool is necessary to avoid nicking valve stems.

(3) Remove air hose and install spark plugs.

(4) Install camshafts as previously outlined in this section.

(5) Install cylinder head cover as previously outlined in this section.

REMOVAL AND INSTALLATION (Continued)

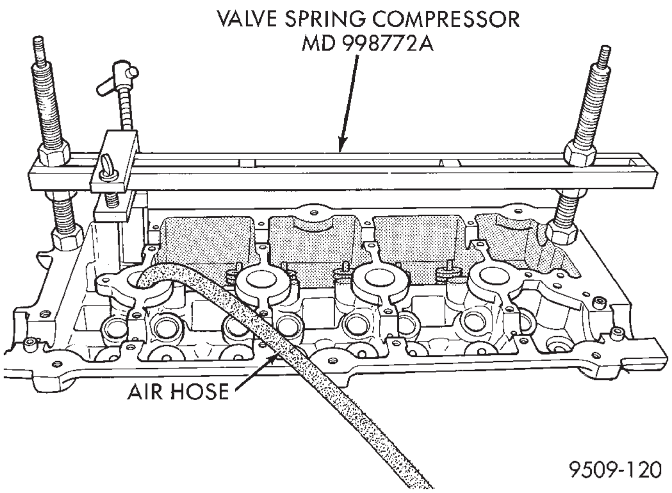


Fig. 47 Valve Spring—Removal/Installation

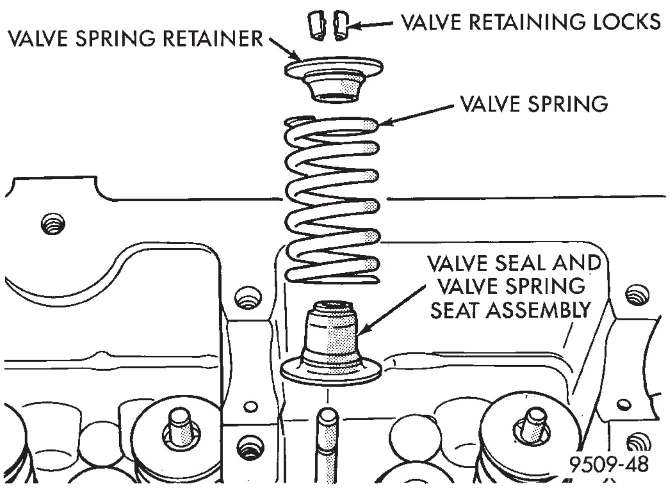


Fig. 48 Valve Stem Seal/Valve Spring Seat

CYLINDER HEAD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System for procedure.

(2) Disconnect negative battery cable. Drain cooling system. Refer to Group 7, Cooling System for procedure.

(3) Remove air cleaner and disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.

(4) Remove throttle linkage. Refer to Group 14, Fuel System for procedures

(5) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(6) Remove power brake vacuum hose from intake manifold.

(7) Raise vehicle and remove exhaust pipe from manifold.

(8) Remove power steering pump assembly and set aside.

(9) Disconnect coil pack wiring connector and remove coil pack and plug wires from engine.

(10) Remove cam sensor and fuel injectors wiring connectors.

(11) Remove timing belt and camshaft sprocket. Refer to procedure outlined in this section.

(12) Remove timing belt idler pulley and rear timing belt cover.

(13) Remove cylinder head cover using procedure outlined in this section.

(14) Remove camshafts and cam followers. Refer to procedures outlined in this section for procedures.

(15) Remove cylinder head bolts and remove cylinder head from engine block.

(16) Inspect and clean cylinder head. Refer to Cleaning and Inspection outlined in this section for procedures.

INSTALLATION

NOTE: The Cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts should be replaced (Fig. 49).

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.

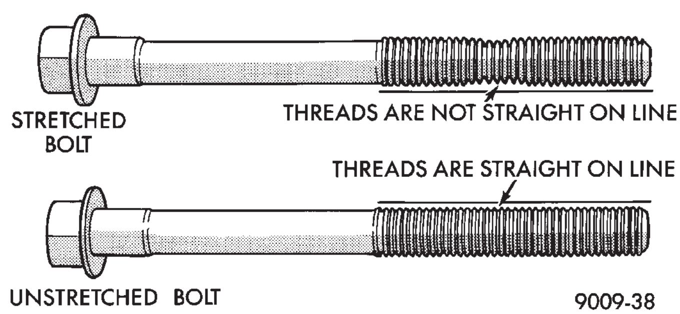


Fig. 49 Checking Bolts for Stretching (Necking)

(1) Before installing the bolts, the threads should be coated with engine oil.

(2) Tighten the cylinder head bolts in the sequence shown in (Fig. 50). 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.)
- Third All to 68 N·m (50 ft. lbs.)

CAUTION: Do not use a torque wrench for the following step.

- Fourth Turn an additional 1/4 Turn,

(3) Install camshafts and cam followers. Refer to procedures outlined in this section for procedures.

REMOVAL AND INSTALLATION (Continued)

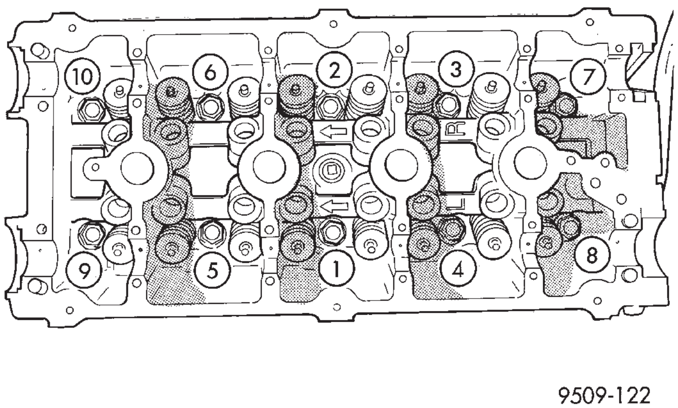


Fig. 50 Cylinder Head Tightening Sequence

(4) Install cylinder head cover using procedure outlined in this section.

(5) Install rear timing belt cover and timing belt idler pulley.

(6) Install timing belt and camshaft sprocket. Refer to procedure outlined in this section.

(7) Install cam sensor and fuel injectors wiring connectors.

(8) Install coil pack and plug wires onto the engine. Connect coil pack wiring connector.

(9) Install power steering pump assembly.

(10) Raise vehicle and install the exhaust pipe to the manifold.

(11) Install power brake vacuum hose to the intake manifold.

(12) Install accessory drive belts. Refer to Group 7, Cooling System for procedure.

(13) Install throttle linkage. Refer to Group 14, Fuel System for procedures.

(14) Install air cleaner and connect all vacuum lines, electrical wiring and fuel lines to the throttle body.

(15) Fill cooling system. Refer to Group 7, Cooling System for procedure. Connect negative battery cable.

VALVES AND VALVE SPRINGS

REMOVAL

(1) With cylinder head removed, 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 to insure installation in original location.

(4) Inspect and clean the valves. Refer to Cleaning and Inspection outlined in this section for procedure.

INSTALLATION

(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. 51). 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.

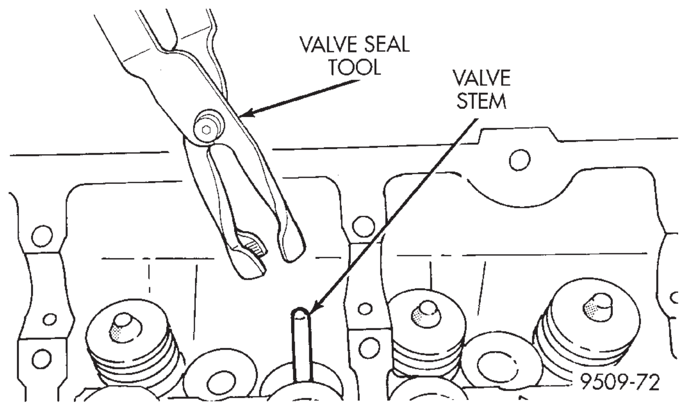


Fig. 51 Valve Stem Oil Seal Tool

(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.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 52). 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 .762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

REMOVAL AND INSTALLATION (Continued)

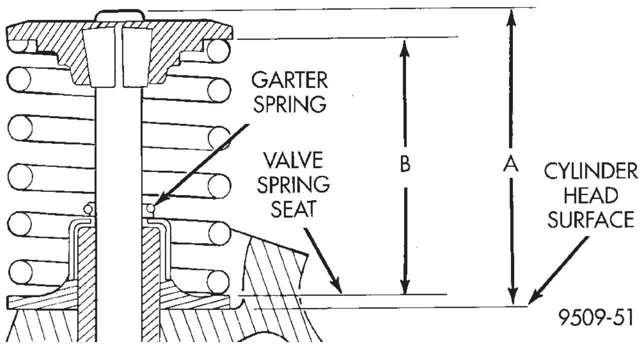


Fig. 52 Checking Spring Installed Height and Valve Tip Height Dimensions

VIBRATION DAMPER

REMOVAL

Remove crankshaft vibration damper bolt. Remove damper by using Special Tool 1026 and Insert 6827–A (Fig. 53).

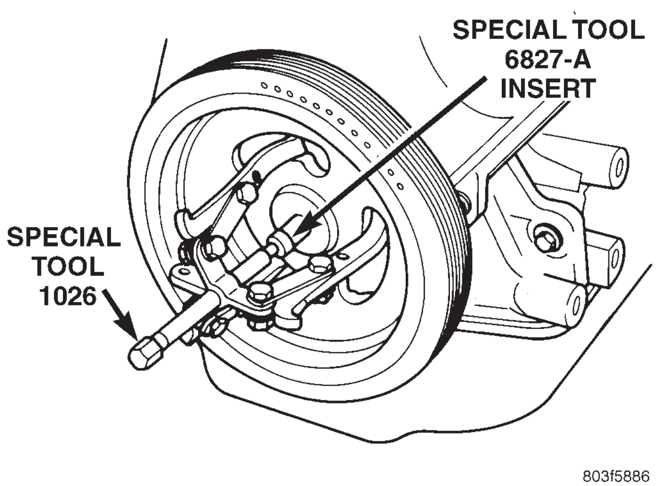


Fig. 53 Crankshaft Vibration Damper—Removal

INSTALLATION

Install crankshaft vibration damper using M12 1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft vibration damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 54).

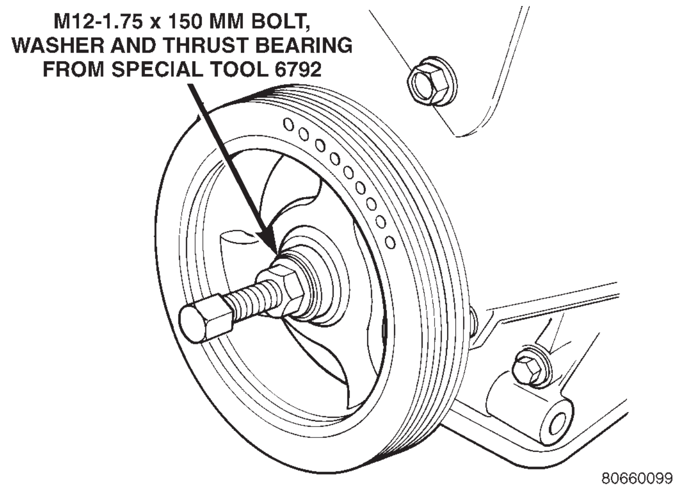


Fig. 54 Crankshaft Vibration Damper—Installation

REMOVAL AND INSTALLATION (Continued)

TIMING BELT COVER

FRONT COVER

REMOVAL

(1) Remove crankshaft damper. Refer to crankshaft damper removal for procedure.

(2) Remove front timing belt cover fasteners (Fig. 55) and remove covers.

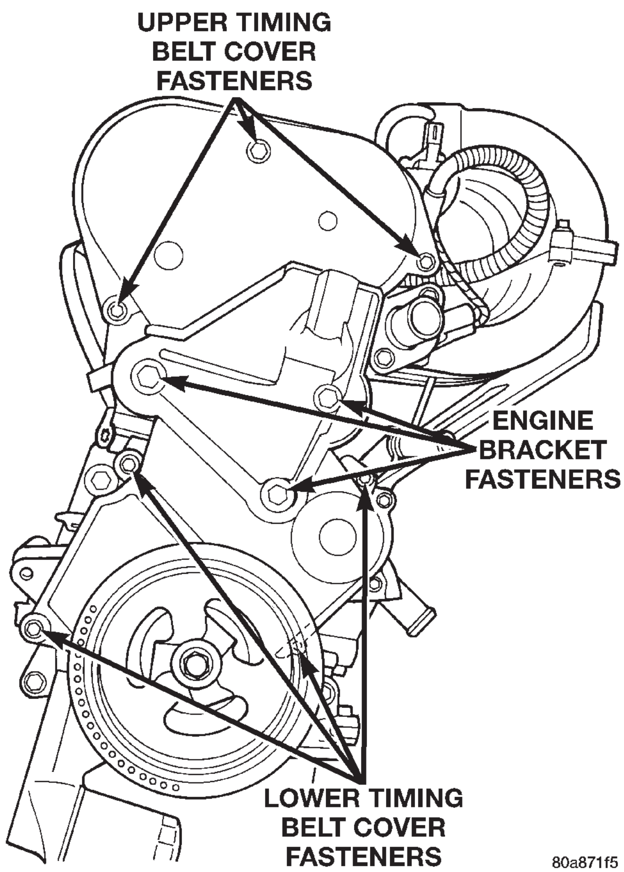


Fig. 55 Front Timing Belt Cover

INSTALLATION

(1) Install front timing belt covers (Fig. 55). Tighten bolts to 4.5 N·m (40 in. lbs.).

(2) Install crankshaft damper. Refer to crankshaft damper installation for procedure.

REAR COVER

REMOVAL

(1) Remove front covers.

(2) Remove engine mount bracket (Fig. 55).

(3) Remove Timing Belt, Idler Pulley, and Camshaft Sprockets. Refer to procedure outlined in this section.

(4) Remove rear cover fasteners and remove cover from engine (Fig. 56).

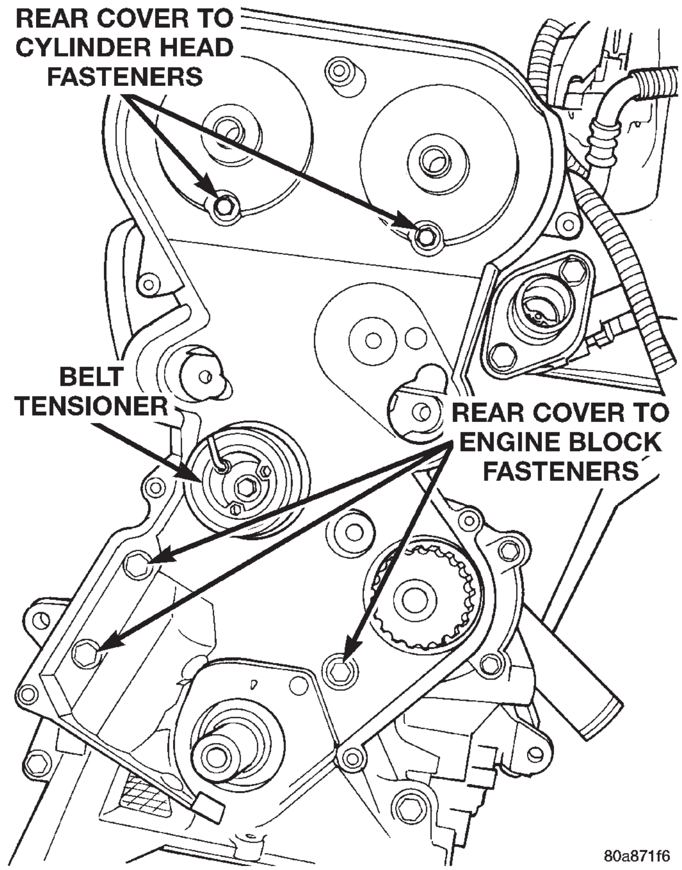


Fig. 56 Rear Timing Belt Cover Fasteners

INSTALLATION

(1) Install rear timing belt cover and fasteners (Fig. 56).

(2) Install camshaft sprockets. While holding sprocket with Special Tools C-4687 and C-4687-1, 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 procedure outlined in this section.

(5) Install engine mount bracket and tighten bolts to 61 N·m (45 ft. lbs.).

(6) Install front covers.

TIMING BELT

REMOVAL

(1) Raise vehicle on hoist. Remove right front wheel.

(2) Remove right inner splash shield.

(3) Remove accessory drive belts. Refer to Group 7, Cooling System.

(4) Remove crankshaft damper bolt, and remove damper. Refer to Removal and Installation procedure in this section.

(5) Remove lower timing belt cover fasteners and remove cover (Fig. 57).

REMOVAL AND INSTALLATION (Continued)

(6) Lower vehicle and remove upper timing belt cover fasteners and remove cover.

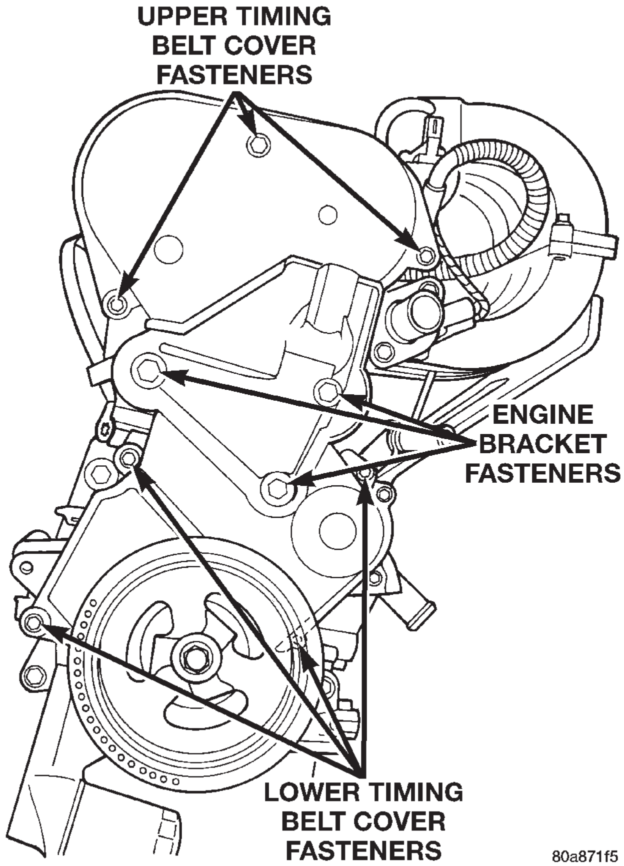


Fig. 57 Timing Belt Covers

(7) Remove right engine mount and support bracket. Refer to Removal and Installation procedure in this section.

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.

(8) Before the removal of the timing belt, rotate crankshaft until TDC mark on oil pump housing aligns with TDC mark on crankshaft sprocket (trailing edge of sprocket tooth) (Fig. 58).

NOTE: The crankshaft sprocket mark is located on the trailing edge of the sprocket tooth. Failure to align trailing edge of sprocket tooth to mark on oil pump housing will cause the camshaft marks to be misaligned (Fig. 58).

(9) 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. 59). While rotating the tensioner counterclockwise push in lightly on the 1/8” or 3 mm Allen wrench, until it slides into the locking hole.

(10) Remove timing belt.

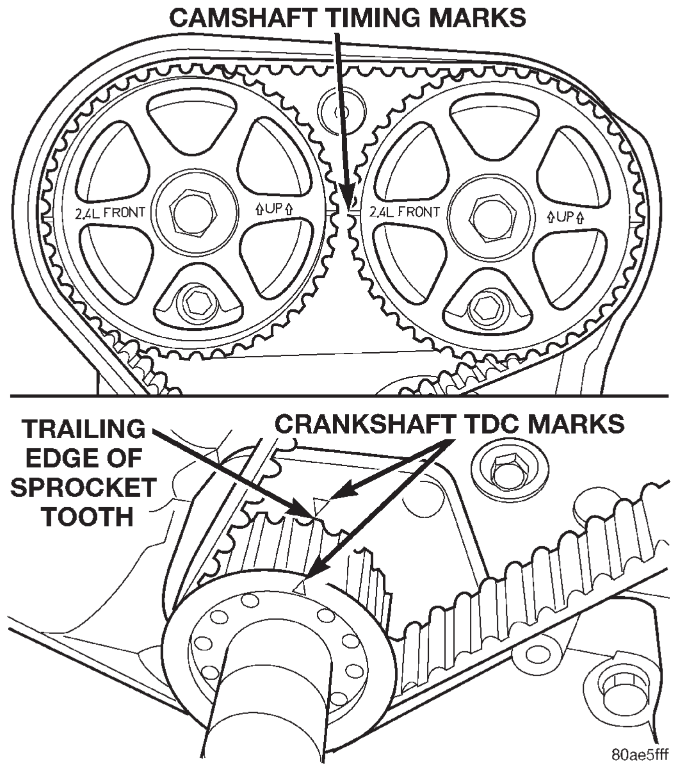


Fig. 58 Crankshaft and Camshaft Timing

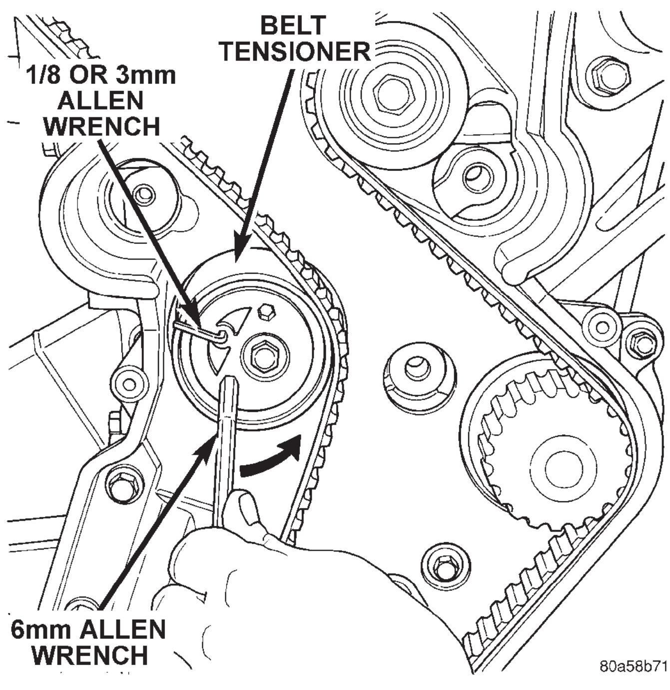


Fig. 59 Locking Timing Belt Tensioner

REMOVAL AND INSTALLATION (Continued)

CAUTION: If timing belt was damaged due to incorrect tracking (alignment), the belt tensioner assembly must be replace. Refer to Timing Belt Tensioner Assembly Removal and Installation procedure outlined in this section.

INSTALLATION

(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. 61).

CAUTION: Ensure that the arrows on both camshaft sprockets are facing up.

(3) Install timing belt. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner (Fig. 62).

(4) Move the exhaust camshaft sprocket counterclockwise (Fig. 62) to align marks and take up belt slack.

NOTE: A new tensioner is held in the wound position by a pull pin.

(5) Remove the pull pin or Allen wrench from the belt tensioner.

(6) Once timing belt has been installed and tensioner released, rotate crankshaft two (2) complete revolutions. Verify that the TDC marks on crankshaft and timing marks on the camshafts are aligned as shown in (Fig. 60).

(7) Install right engine mount and support bracket. Refer to Removal and Installation procedure in this section.

(8) Install upper timing belt cover bolts 4.5 N·m (40 in. lbs.).

(9) Install the lower timing belt cover bolts 4.5 N·m (40 in. lbs.).

(10) Install crankshaft damper. Refer to procedure outlined in this section.

(11) Install accessory drive belts. Refer to Group 7, Cooling System.

(12) Install right inner splash shield.

(13) Install right front wheel.

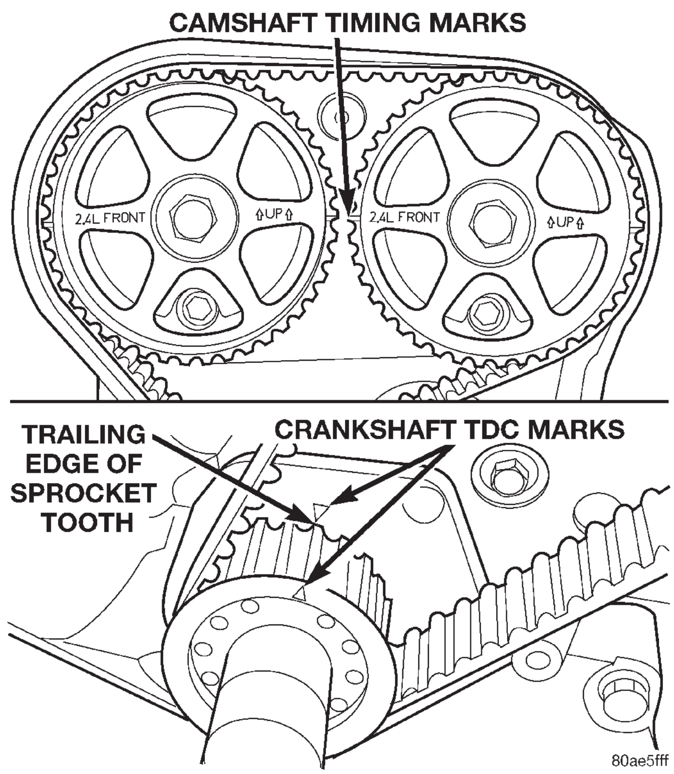


Fig. 60 Crankshaft and Camshaft Timing

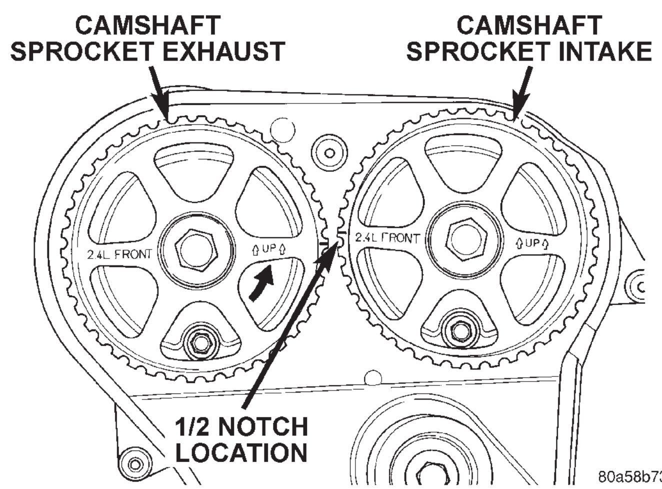


Fig. 61 Camshaft Sprocket Alignment

REMOVAL AND INSTALLATION (Continued)

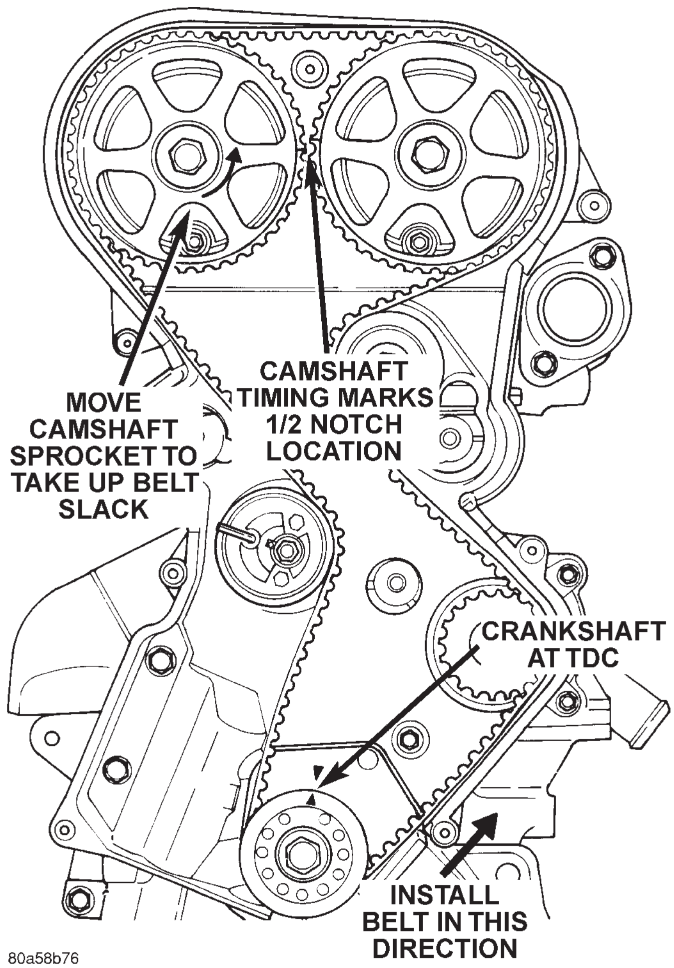


Fig. 62 Timing Belt—Installation

TIMING BELT TENSIONER ASSEMBLY

REMOVAL

(1) Remove timing belt. Refer to Removal and Installation procedure in this section.

(2) Remove timing belt idler pulley.

(3) Hold camshaft sprocket with Special Tools C-4687 and C-4687-1 Adapter, while removing bolt (Fig. 63). Remove both cam sprockets.

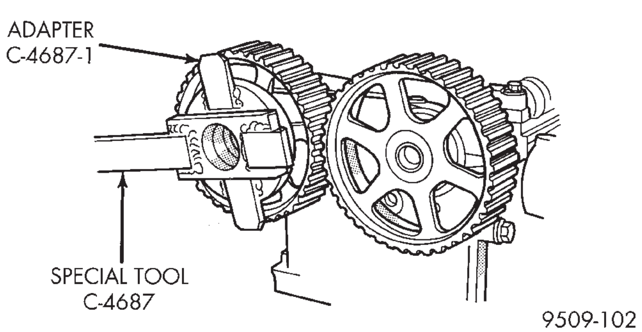


Fig. 63 Camshaft Sprockets—Removal/Installation

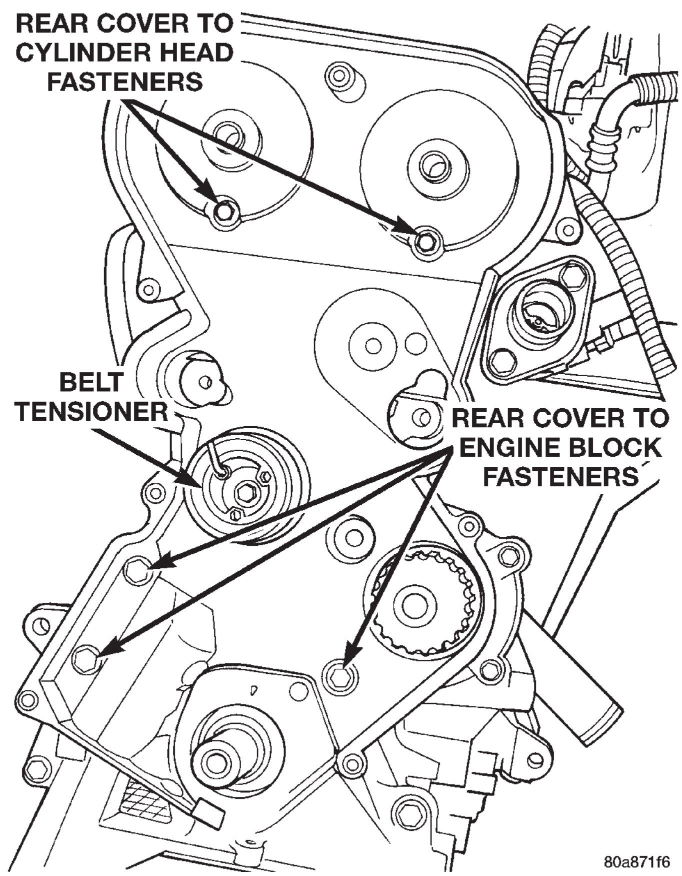


Fig. 64 Rear Timing Belt Cover Fasteners

(4) Remove rear timing belt cover fasteners and remove cover from engine (Fig. 64).

(5) Remove lower bolt attaching timing belt tensioner assembly to engine and remove tensioner **as an assembly** (Fig. 65).

INSTALLATION

(1) Align timing belt tensioner assembly to engine and install lower mounting bolt **but do not tighten** (Fig. 65). 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. 65).

(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 tighten mounting bolt to 61 N·m (45 ft. lbs.).

(5) Install camshaft sprockets. Use Special Tools C-4687 and C-4687-1 Adapter to hold camshaft sprockets (Fig. 63) and tighten attaching bolts to 101 N·m (75 ft. lbs.).

(6) Install timing belt. Refer to procedure outlined in this section.

REMOVAL AND INSTALLATION (Continued)

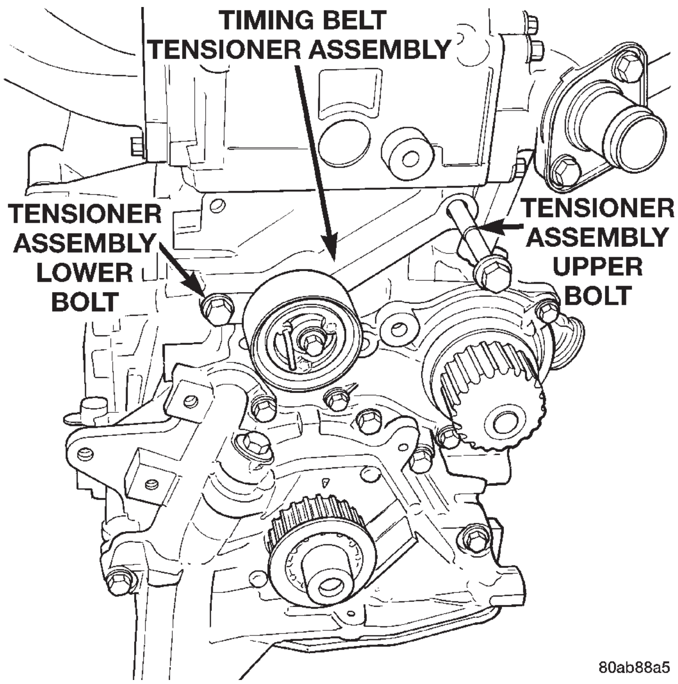


Fig. 65 Timing Belt Tensioner Assembly—Removal/Installation

CAMSHAFT OIL SEAL—FRONT

REMOVAL

(1) Remove front timing belt covers and timing belt. Refer to procedures outlined in this section.

(2) Hold camshaft sprocket with Special Tools C-4687 and 4687-1 while removing center bolt (Fig. 66).

(3) Remove camshaft seal using Special Tool C-4679-A (Fig. 67).

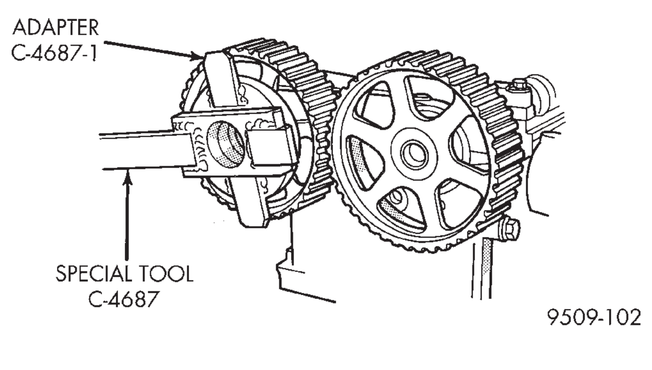


Fig. 66 Camshaft Sprocket—Removal/Installation

CAUTION: Do not nick shaft seal surface or seal bore

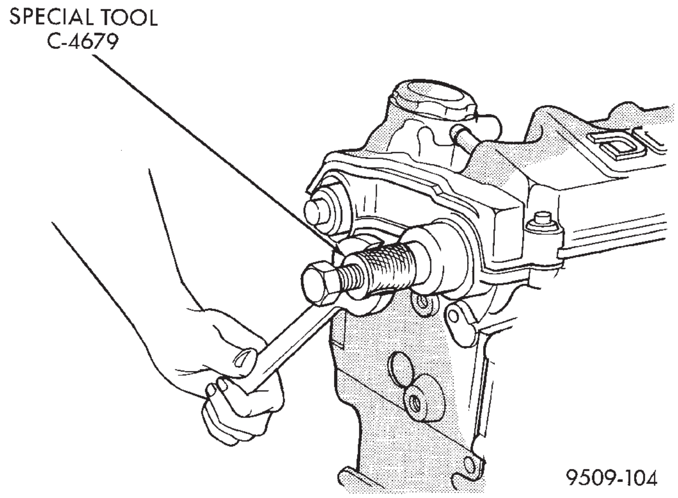


Fig. 67 Camshaft Oil Seal—Removal With C-4679–A

INSTALLATION

(1) Shaft seal surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

(2) Install camshaft seal into cylinder head using Special Tool MD-998306 until flush with head (Fig. 68).

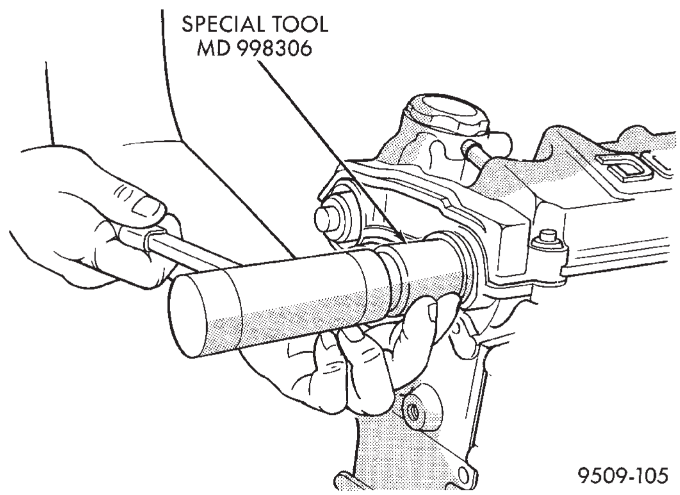


Fig. 68 Camshaft Seal—Installation

(3) Install camshaft sprocket. While holding sprocket with Special Tools C-4687 and 4687-1, tighten center bolt to 101 N·m (75 ft. lbs.) (Fig. 66).

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Using Special Tool 1026 and Insert 6827-A, remove crankshaft damper (Fig. 69).

(2) Remove outer timing belt cover and timing belt. Refer to procedures outlined in this section.

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 70).

CAUTION: Do not nick shaft seal surface or seal bore.

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 71). Be careful not to damage the seal surface of cover.

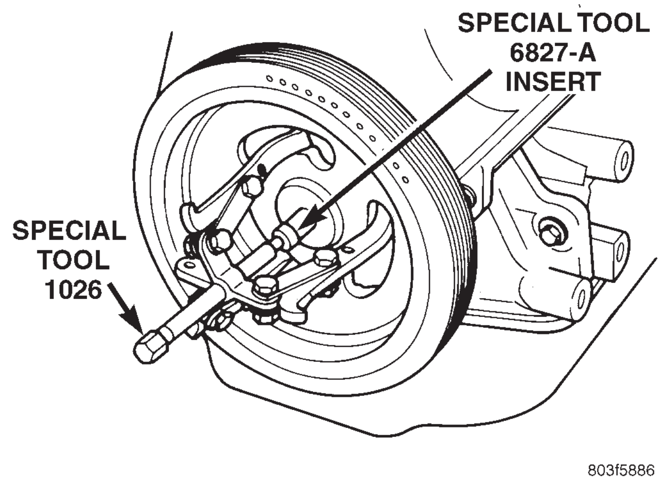


Fig. 69 Crankshaft Damper—Removal

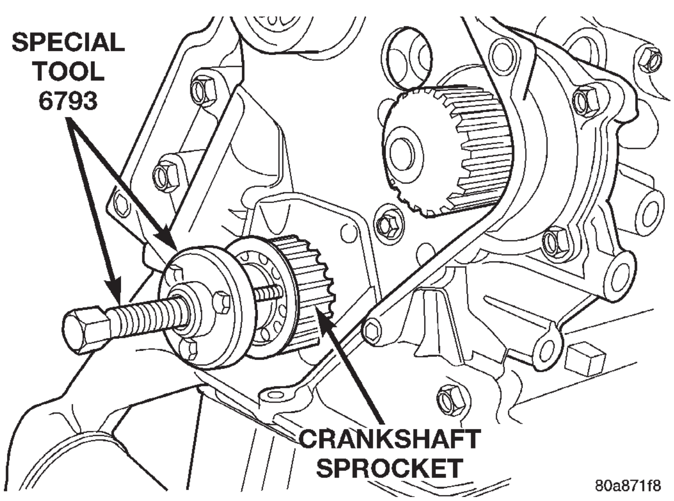


Fig. 70 Crankshaft Sprocket—Removal

INSTALLATION

(1) Install new seal by using Tool 6780 (Fig. 72).

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

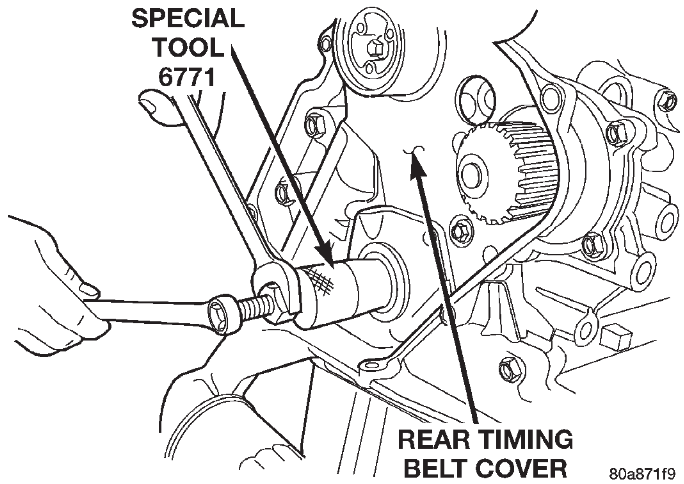


Fig. 71 Front Crankshaft Oil Seal—Removal

(3) Install crankshaft sprocket (Fig. 73). Using Special Tool 6792.

(4) Install timing belt and timing belt covers. Refer to Timing System Section for timing belt covers and belt.

(5) Install crankshaft damper (Fig. 74). Use thrust bearing/washer and 12M 1.75 x 150 mm bolt from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.)

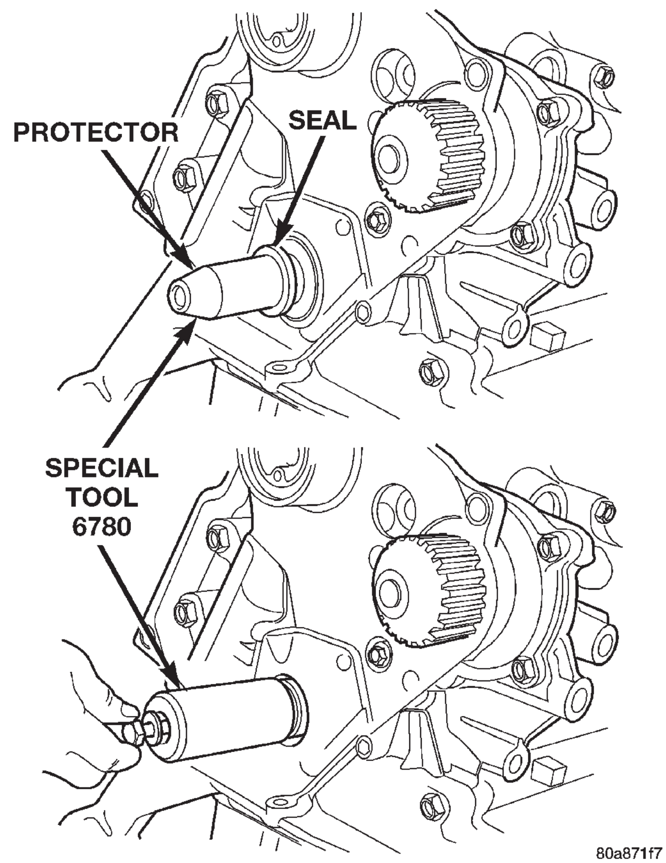


Fig. 72 Front Crankshaft Oil Seal—Installation

REMOVAL AND INSTALLATION (Continued)

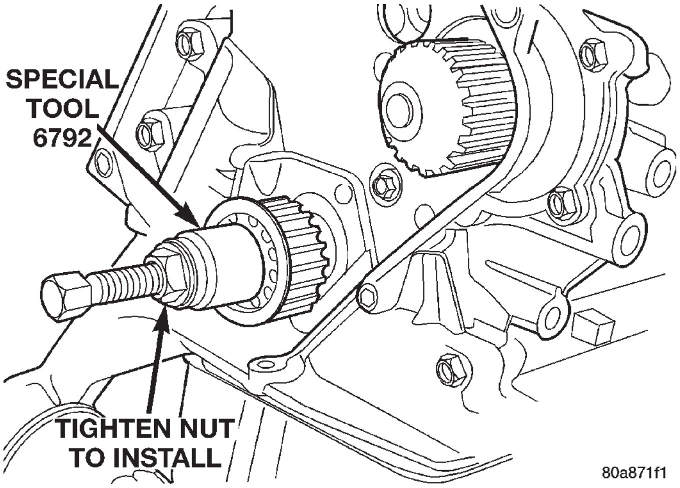


Fig. 73 Crankshaft Sprocket—Installation

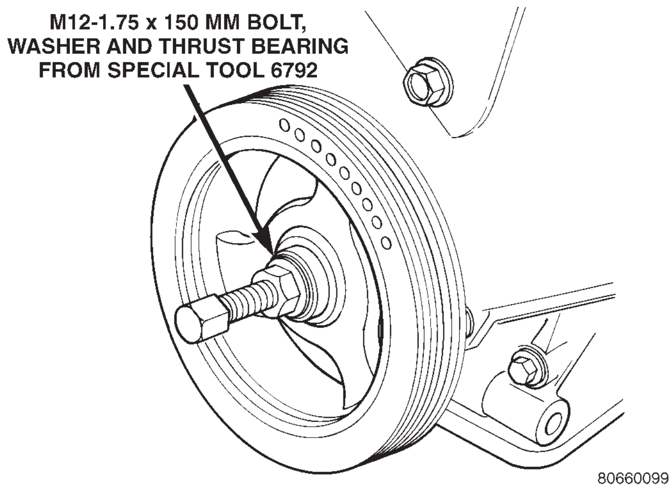


Fig. 74 Crankshaft Damper—Installation

CRANKSHAFT OIL SEAL—REAR

REMOVAL

(1) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 75) 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.

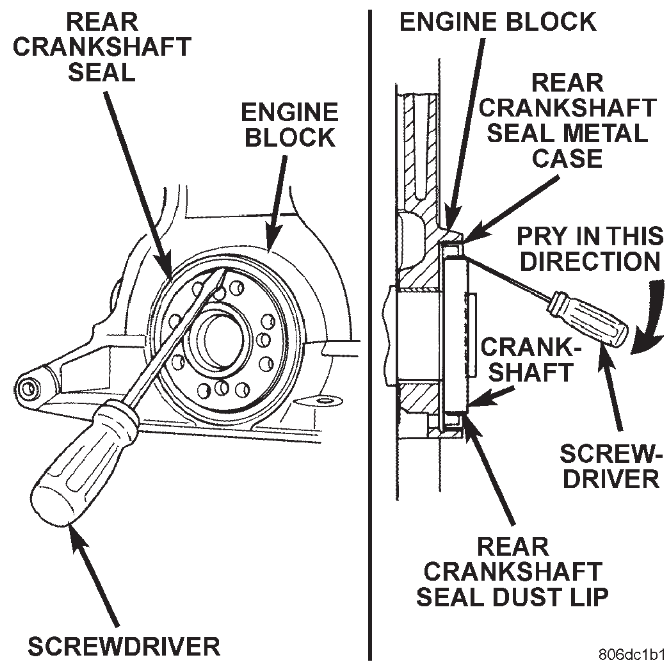


Fig. 75 Rear Crankshaft Oil Seal—Removal

REMOVAL AND INSTALLATION (Continued)

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.

NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 76).

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 76). Pilot 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.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 77) until the tool bottoms out against the block (Fig. 78).

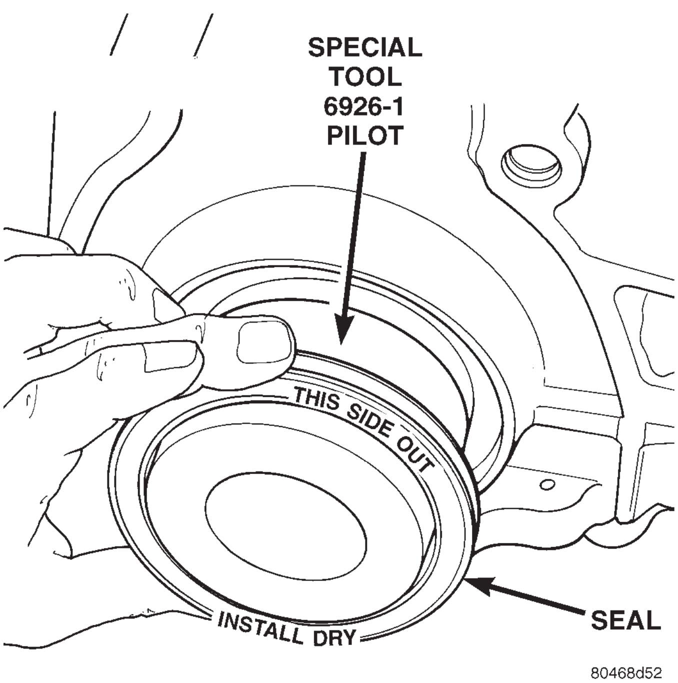


Fig. 76 Rear Crankshaft Seal and Special Tool 6926-1

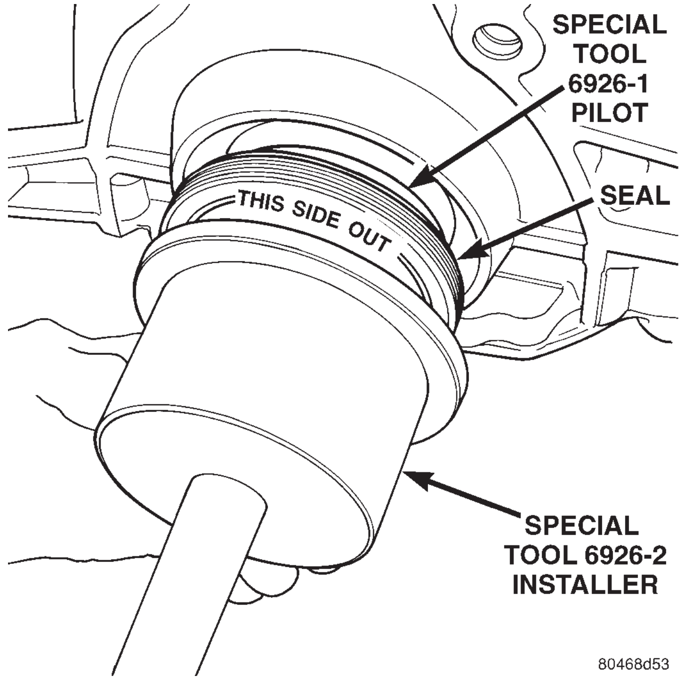


Fig. 77 Crankshaft Seal Special Tool 6926-2

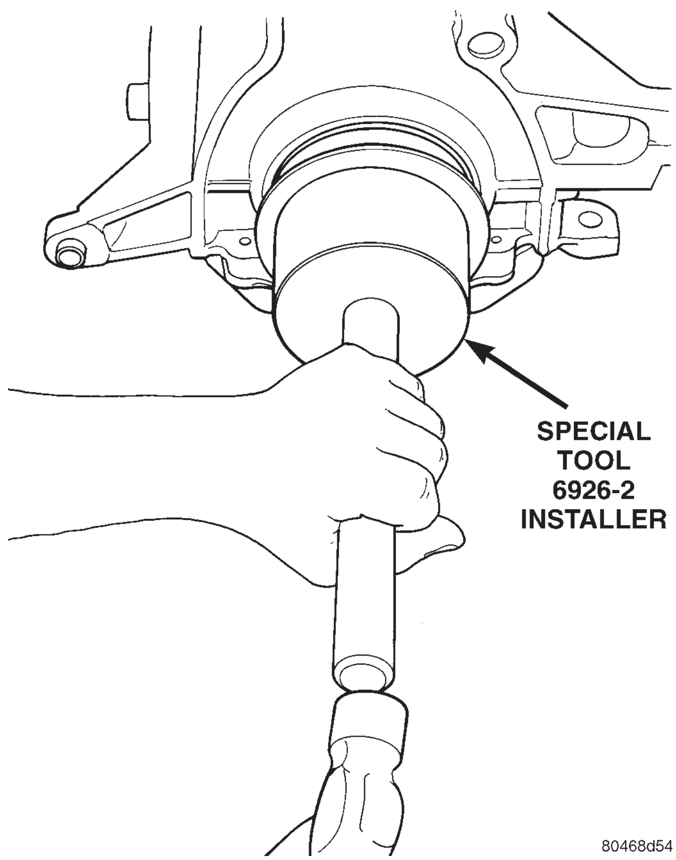


Fig. 78 Rear Crankshaft Seal—Installation

REMOVAL AND INSTALLATION (Continued)

OIL PAN

REMOVAL

(1) Raise vehicle on hoist and drain engine oil.

(2) Remove front engine mount bracket from engine and insulator mount.

(3) Remove bolts attaching bending strut to engine and transaxle.

(4) Remove bolts attaching collar and bending strut to engine, oil pan, and transaxle (Fig. 79). Remove strut and collar.

(5) Remove oil pan.

(6) Clean oil pan and all gasket surfaces.

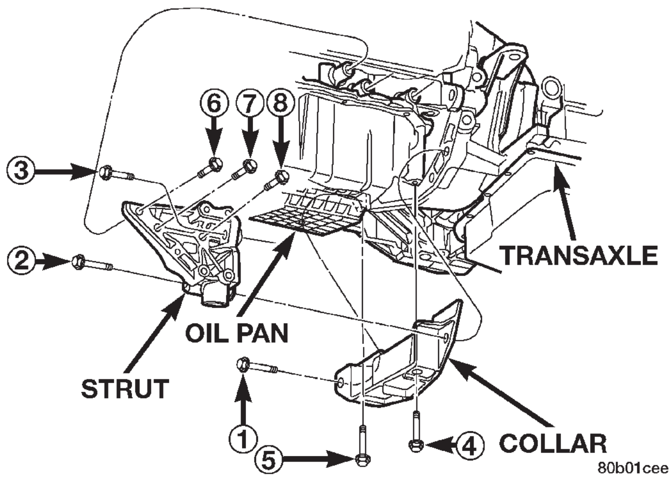


Fig. 79 Structural Collar and Bending Strut—Removal and Installation

INSTALLATION

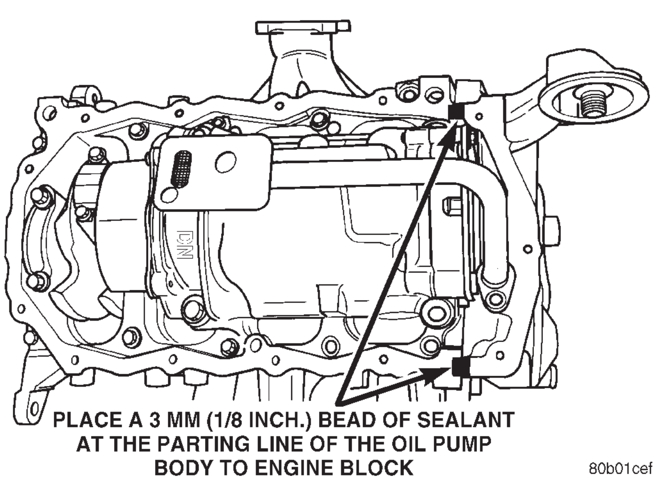


Fig. 80 Oil Pan Sealing

(1) Apply Mopar® Silicone Rubber Adhesive Sealant or equivalent at the oil pump to engine block parting line (Fig. 80).

(2) Install the oil pan gasket to the block (Fig. 81).

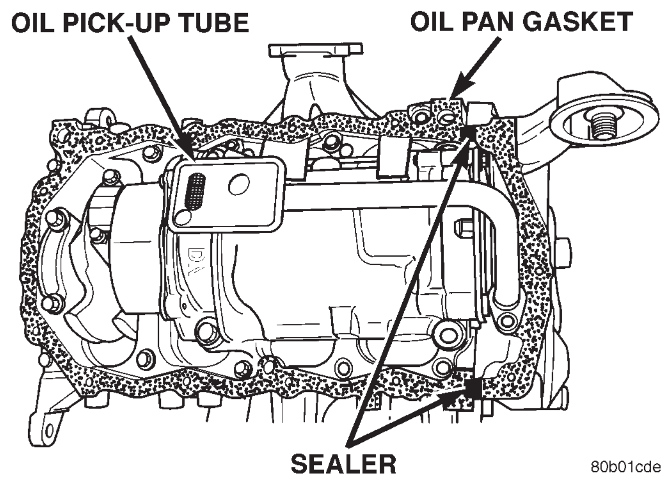


Fig. 81 Oil Pan Gasket Installation

(3) Install pan and tighten the screws to 12 N·m (105 in. lbs.).

CAUTION: Torque procedure for the structural collar and bending strut must be followed or damage could occur to oil pan, collar, and/or bending strut.

(4) Perform the following steps for installing structural collar and bending strut. Refer to (Fig. 79):

- Step 1: Place collar into position between transaxle and oil pan. Hand start only, collar to transaxle bolt 1.
- Step 2: Install bolt 4, collar to oil pan, **hand tight only.**
- Step 3: Position bending strut in place and hand start bolt 3 into the upper transaxle hole.
- Step 4: Install bolt 2, through strut and collar. Hand starting only.
- Step 5: Install bolt 6, strut to cylinder block, **hand tight only.**
- Step 6: Install the remaining collar to oil pan bolt 5, **hand tight only.**
- Step 7: Final torque collar to transaxle bolts 1 – 3, to 101 N·m (75 ft. lbs.)
- Step 8: Install bolts 7 and 8, through strut and into cylinder block.
- Step 9: Final torque bolts 4 – 8 to 61 N·m (45 ft. lbs.).

(5) Install front mount bracket to engine and front insulator. Refer to procedure in the section.

(6) Lower vehicle and fill engine crankcase with proper oil to correct level.

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT

REMOVAL

NOTE: Crankshaft can not be removed when engine is in vehicle.

(1) Remove oil filter and oil pan. Refer to procedure outlined in this section.
(2) Remove Timing Belt Cover, Timing Belt and Oil Pump. Refer to procedure outlined in this section.
(3) Remove Balance Shafts Assembly. Refer to procedure outlined in this section.
(4) Remove all main bearing cap bedplate bolts from the engine block. Refer to procedure outlined in this section.
(5) 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.

(6) Bedplate should be removed evenly from the cylinder block dowel pins to prevent damage to the dowel pins and thrust bearing.
(7) Lift out crankshaft from cylinder block. Do not damage the main bearings or journals when removing the crankshaft.

INSTALLATION

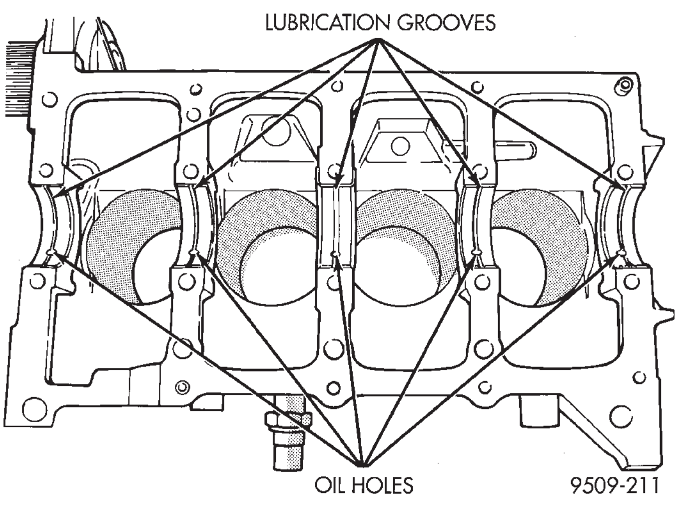


Fig. 82 Installing Main Bearing Upper Shell

(1) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 82).
(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs 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. Install crankshaft.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar Torque Cure Gasket Maker to cylinder block as shown in (Fig. 83).

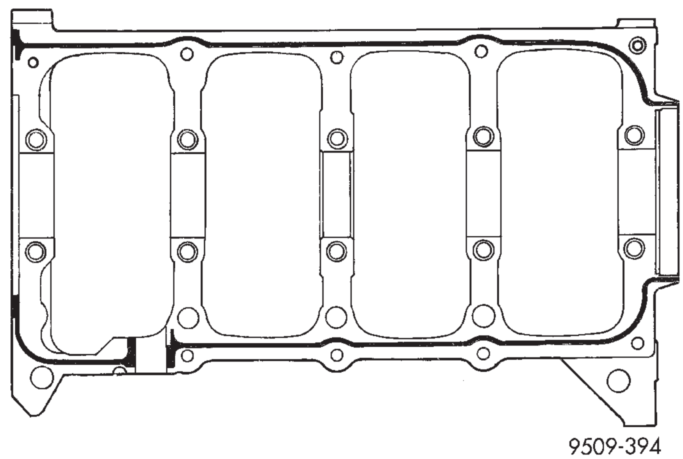


Fig. 83 Main Bearing Caps/Bedplate Sealing

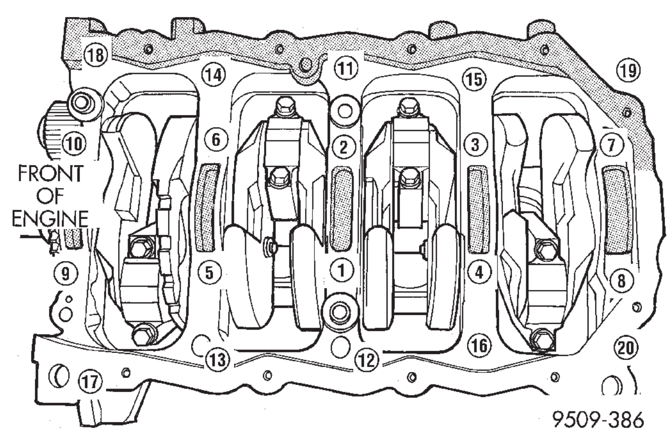


Fig. 84 Main Bearing Caps/Bedplate Torque Sequence

(5) 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.
(6) Before installing the bolts the threads should be oiled with clean engine oil, wipe off any excess oil.

REMOVAL AND INSTALLATION (Continued)

(7) 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.

(8) 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 appropraite 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. 84) to 41 N·m (30 ft. lbs.).
- Step 6: Remove wedge tool used to hold crankshaft.

(9) Tighten bolts (1-10) again to 41 N·m (30 ft. lbs) + 1/4 turn in sequence shown in (Fig. 84).

(10) 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. 84).

(11) 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.).

OIL FILTER

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.

(1) Turn counterclockwise to remove.

(2) To install, lubricate new filter gasket. Check filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber. Screw filter on until the gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

OIL PUMP

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove Timing Belt. Refer to procedure outlined in this section.

(3) Remove Oil Pan. Refer to procedure outlined in this section.

(4) Remove Crankshaft Sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 85).

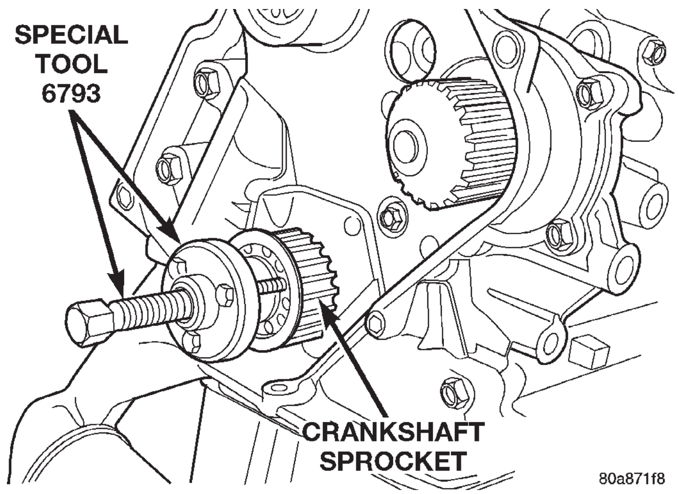


Fig. 85 Crankshaft Sprocket—Removal

(5) Remove oil pick-up tube.

(6) Remove oil pump, (Fig. 86) and front crankshaft seal.

REMOVAL AND INSTALLATION (Continued)

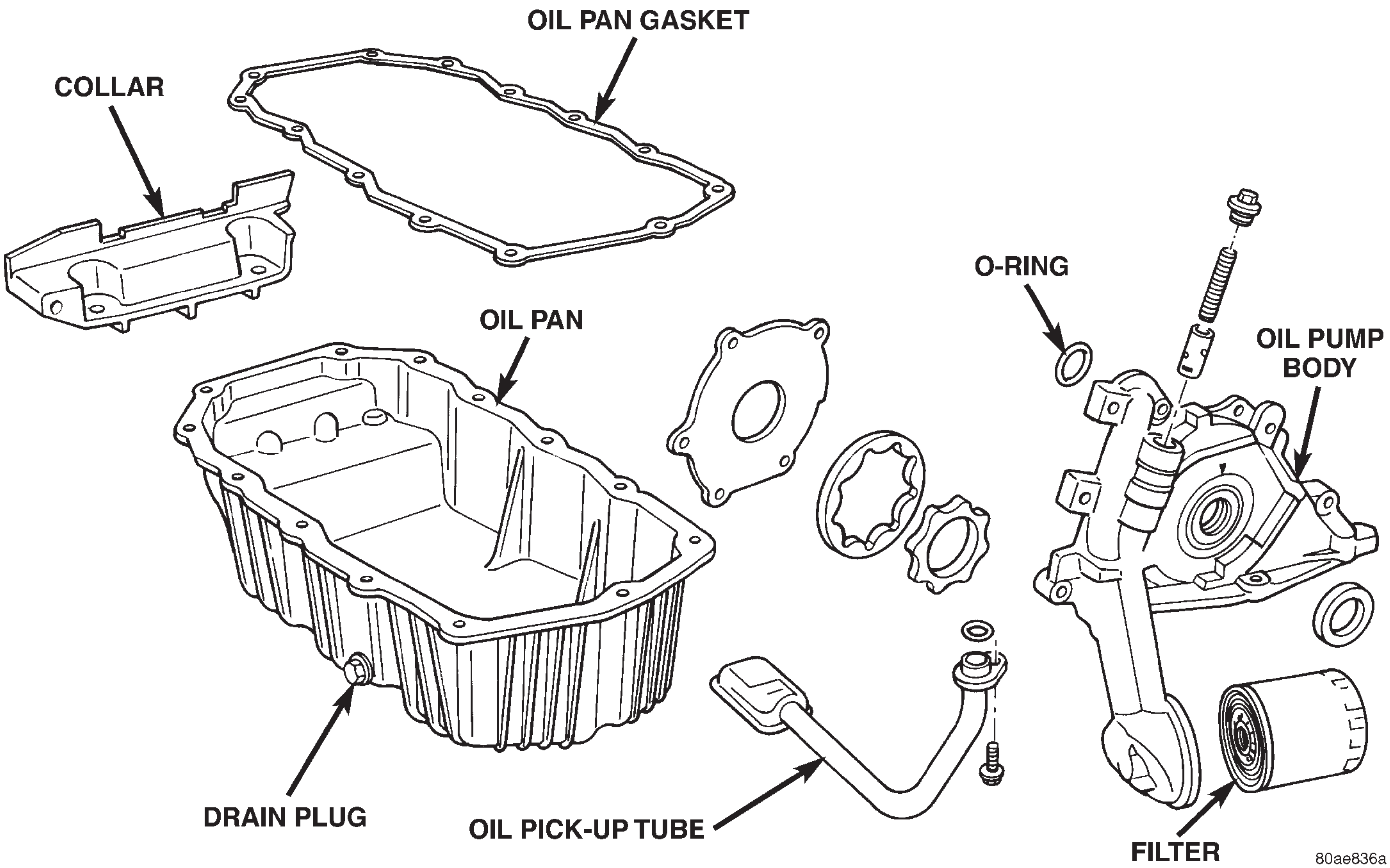


Fig. 86 Oil Pump and Pick-up Tube

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. 87). Install oil ring into oil pump body discharge passage.

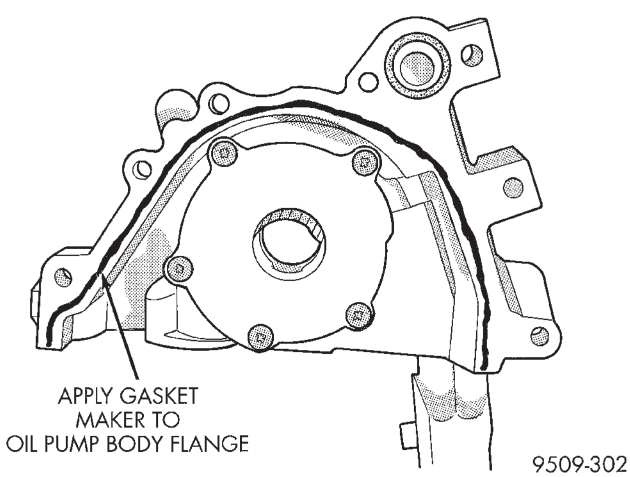


Fig. 87 Oil Pump Sealing

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

(5) Install new front crankshaft seal using Special Tool 6780 (Fig. 88).

(6) Install crankshaft sprocket, using Special Tool 6792 (Fig. 89).

(7) Install oil pump pick-up tube.

CAUTION: Installation and torque procedure for the collar must be followed or damage could occur to oil pan or collar.

(8) Install oil pan and collar. Refer to procedure outlined in this section.

(9) Install Timing Belt. Refer to procedure outlined in this section.

REMOVAL AND INSTALLATION (Continued)

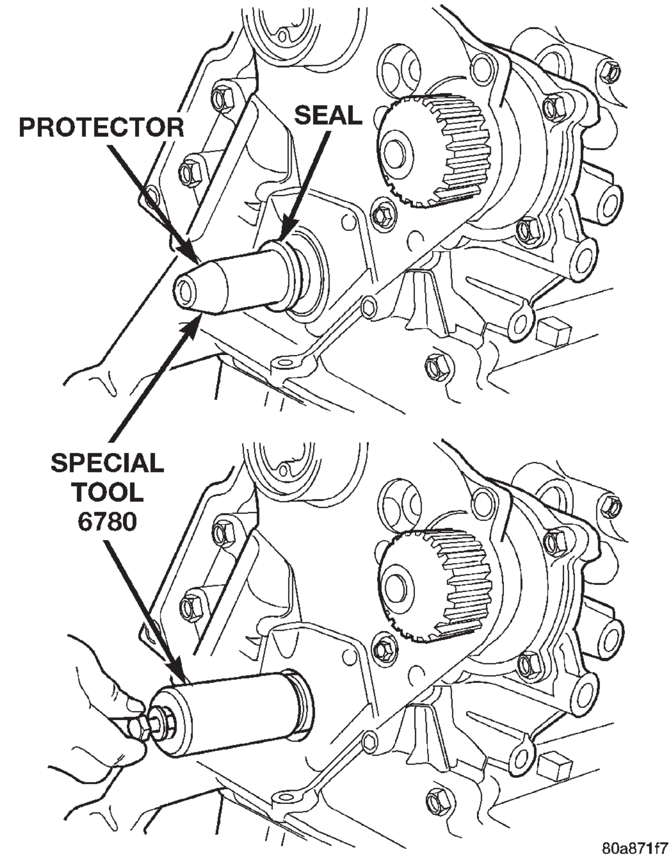


Fig. 88 Front Crankshaft Seal—Installation

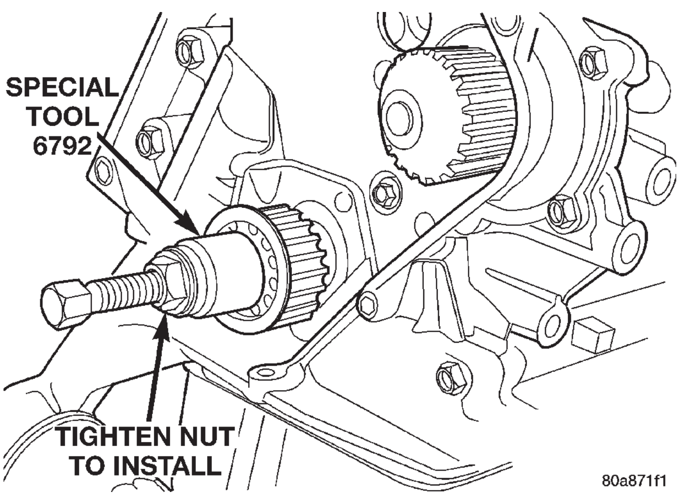


Fig. 89 Crankshaft Sprocket—Installation

PISTON AND CONNECTING ROD

REMOVAL

NOTE: Cylinder Head must be removed before Pistons and Rods. Refer to Cylinder Head Removal in this section.

(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. 90).

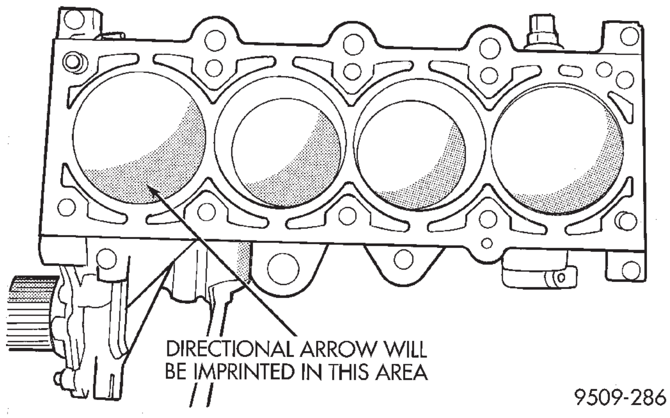


Fig. 90 Piston Markings

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 91) 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.

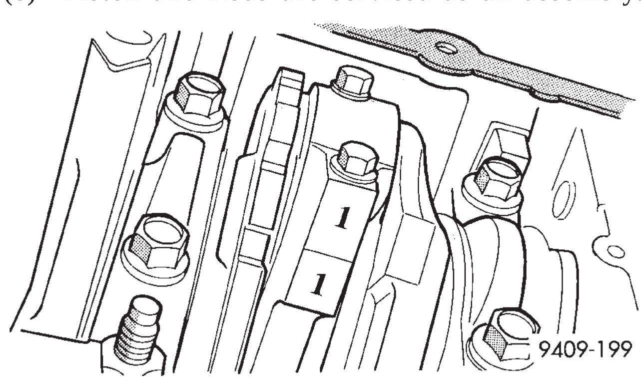


Fig. 91 Identify Connecting Rod to Cylinder

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.

REMOVAL AND INSTALLATION (Continued)

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 92). As viewed from top.

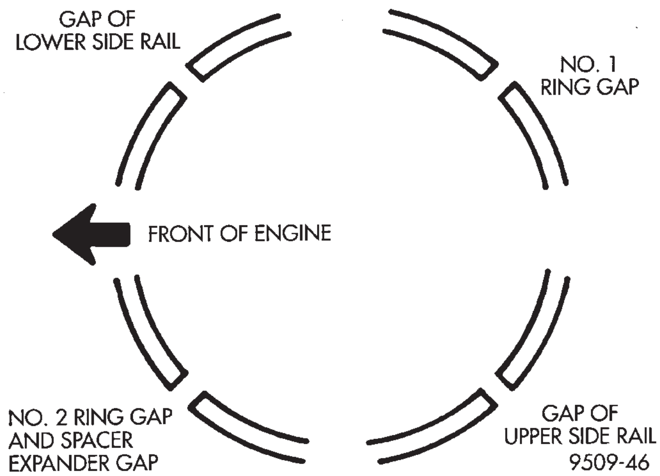


Fig. 92 Piston Ring End Gap Position

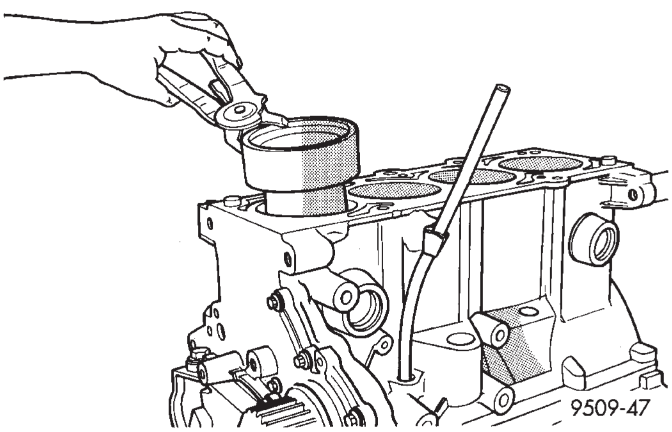


Fig. 93 Piston—Installation

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 93). **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 (Fig. 90).

(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.

NOTE: The rod bearing 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 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn).

(10) Using a feeler gauge, check connecting rod side clearance (Fig. 94).

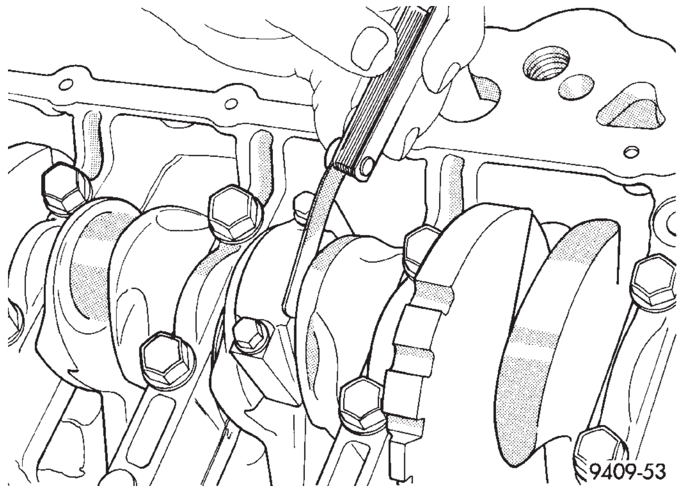


Fig. 94 Checking Connecting Rod Side Clearance

DISASSEMBLY AND ASSEMBLY

OIL PUMP

DISASSEMBLY

(1) To remove the relief valve, proceed as follows:

(a) Remove the threaded plug and gasket from the oil pump (Fig. 95).

(b) Remove spring and relief valve.

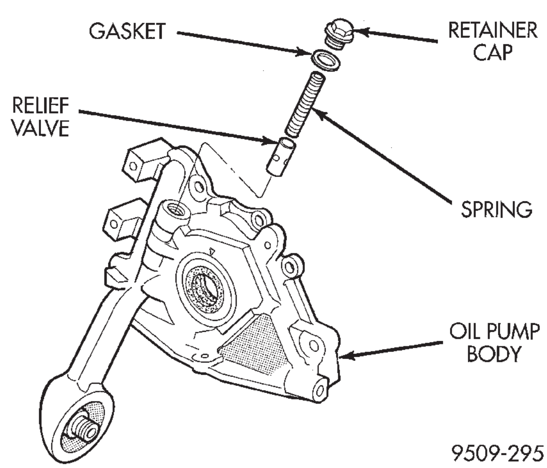


Fig. 95 Oil Pressure Relief Valve

(2) Remove oil pump cover screws, and lift off cover.

(3) Remove pump rotors.

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

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 screws to 12 N·m (105 in. lbs.).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 95) or serious damage may occur.

(4) Install relief valve, spring, gasket and cap as shown in (Fig. 95). Tighten cap to 41 N·m (30 ft. lbs.)

CLEANING AND INSPECTION

CYLINDER HEAD

CLEANING

Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

INSPECTION

(1) Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 96).

(2) Inspect camshaft bearing journals for scoring.

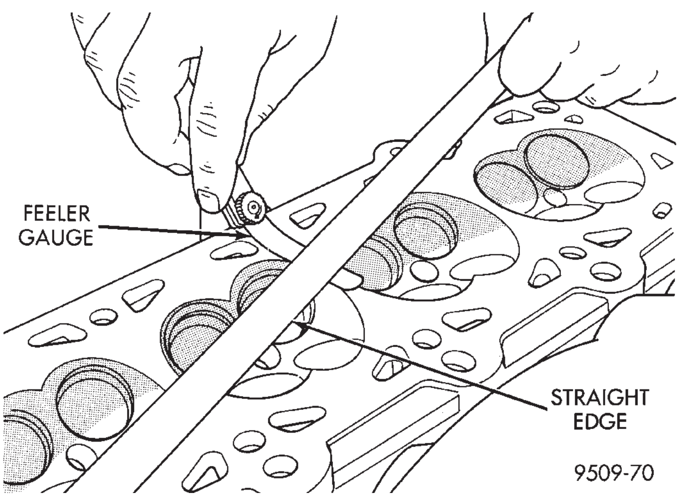


Fig. 96 Checking Cylinder Head Flatness

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 97). Refer to Valve Guide Specification Chart. Replace guides if they are not within specification.

(3) Check valve guide height (Fig. 98).

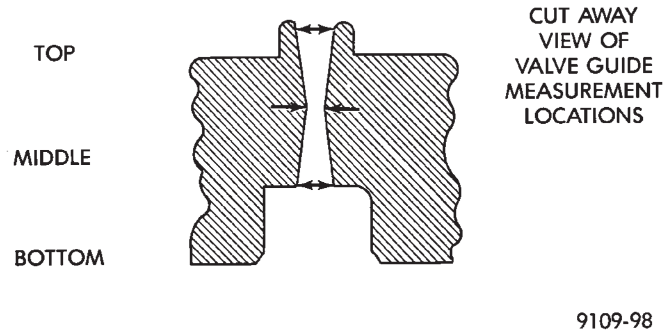


Fig. 97 Checking Wear on Valve Guide—Typical

VALVE GUIDE SPECIFICATION CHART

Valve Guide Diameter		
Intake and Exhaust Valve:	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	
Valve Guide Clearance	**New**	**Service Limit**
Intake Valve:	0.048 - 0.066 mm (0.0018 - 0.0025 in.)	0.25 mm (0.010 in.)
Exhaust Valve:	0.0736 - 0.094 mm (0.0029 - 0.0037 in.)	

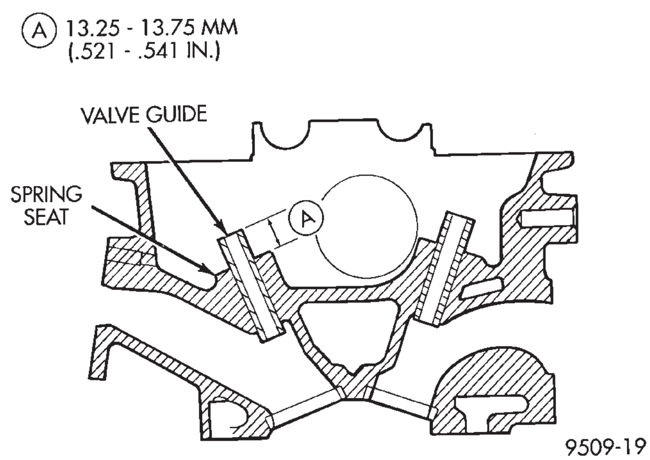


Fig. 98 Valve Guide Height

VALVE AND VALVE SPRING

VALVES

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

CLEANING AND INSPECTION (Continued)

(3) If valve stems are worn more than 0.05 mm (.002 in.), replace valve.

VALVE SPRINGS

(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.

CRANKSHAFT

The crankshaft journals should be checked for excessive wear, taper and scoring (Fig. 99). Limits of taper or out-of-round on any crankshaft journals should be held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. **DO NOT** grind thrust faces of Number 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 used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

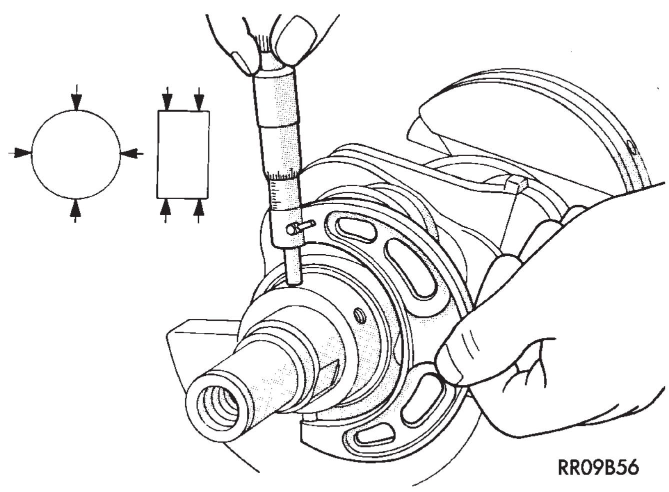


Fig. 99 Crankshaft Journal Measurements

OIL PUMP

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth (Fig. 100). Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 101). 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. 102), 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. 103).

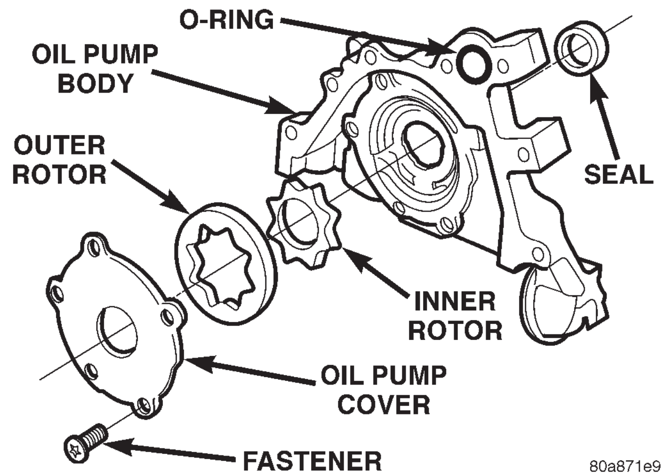


Fig. 100 Oil Pump

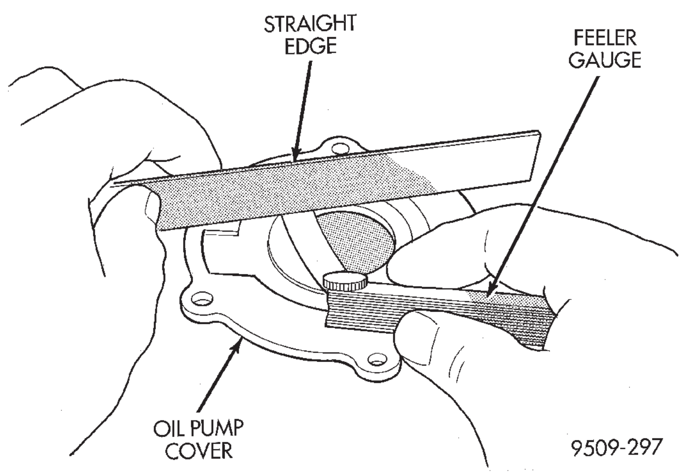


Fig. 101 Checking Oil Pump Cover Flatness

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 104). If measurement is 0.39 mm (0.015 in.) or more, replace housing only if outer rotor is in specification.

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 105) is 0.203 mm (0.008 in.) or more, replace both rotors.

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of 0.102 mm (0.004 in.), or more can be inserted

CLEANING AND INSPECTION (Continued)

between rotors and the straightedge, replace pump assembly (Fig. 106), **ONLY** if rotors are in specs.

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400 grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

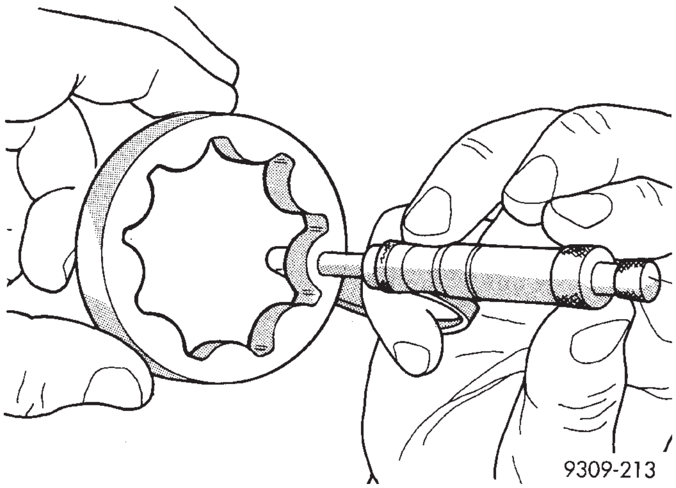


Fig. 102 Measuring Outer Rotor Thickness

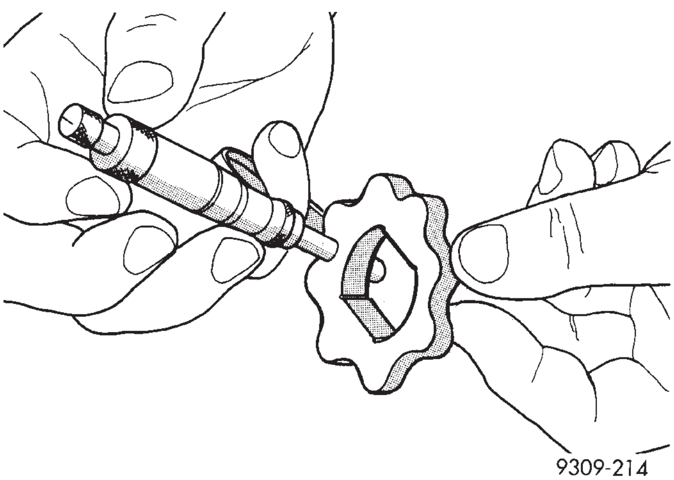


Fig. 103 Measuring Inner Rotor Thickness

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

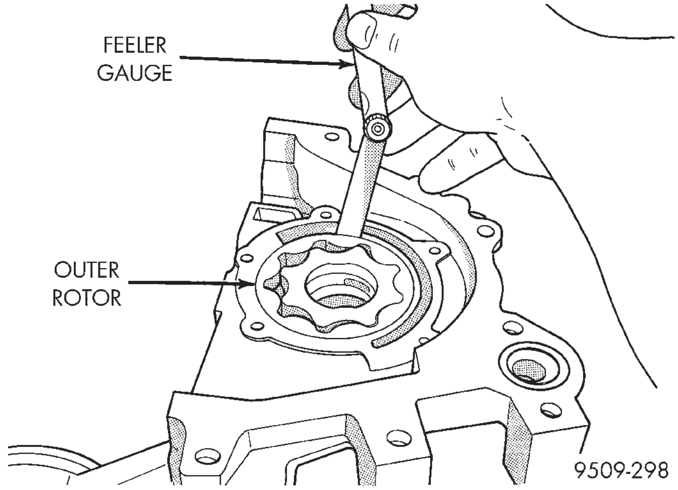


Fig. 104 Measuring Outer Rotor Clearance in Housing

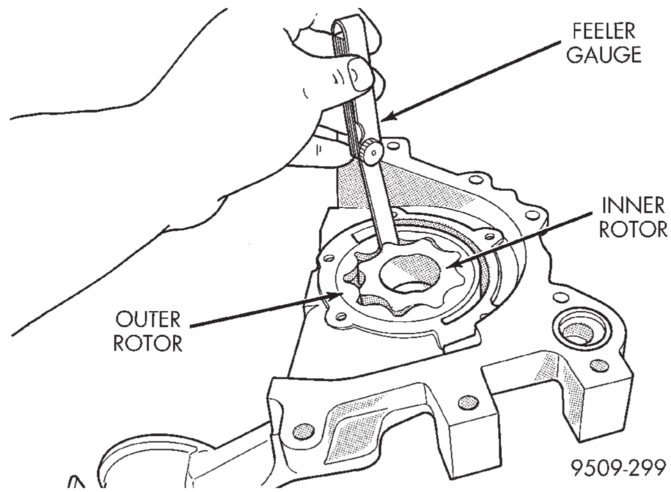


Fig. 105 Measuring Clearance Between Rotors

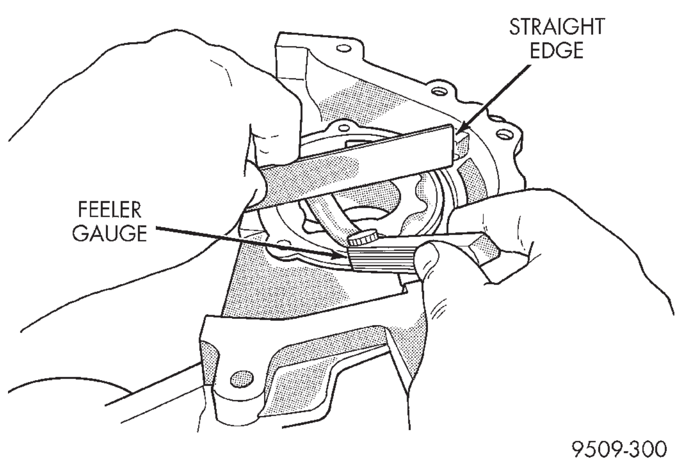


Fig. 106 Measuring Clearance Over Rotors

CLEANING AND INSPECTION (Continued)

CYLINDER BLOCK

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, refer to Engine Core Plugs outlined in this section.

(3) Examine block and cylinder bores for cracks or fractures.

CYLINDER BORE INSPECTION

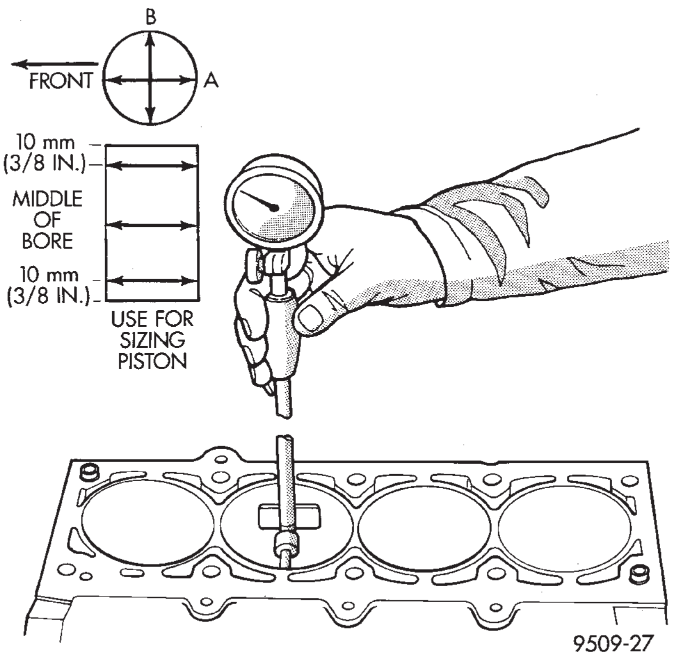


Fig. 107 Checking Cylinder Bore Size

The cylinder walls should be checked for out-of-round and taper with Tool C119 (Fig. 107). The cylinder bore out-of-round is 0.050 mm (0.002 in.) maximum and cylinder bore taper is 0.051 mm (0.002 in.) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B (Fig. 107). 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 Cylinder Bore and Piston Specification Chart.

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Maximum Out-Of-Round	Maximum-Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
87.450 - 87.468 mm (3.4434 - 3.4441 in.)		
Piston To Bore Clearance		
0.024 - 0.057 mm (0.0009 - 0.0022 in.)		
Measurements taken at Piston Size Location.		

ADJUSTMENTS

ENGINE MOUNTS

ENGINE MOUNT INSULATOR ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine mount insulator vertical fastener and the fore and aft fasteners, and the front engine mount bracket to front crossmember screws.

(3) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshafts for driveshaft identification and related assembly length measuring.

(4) Tighten engine mounts and fasteners in the following order:

(a) Right engine mount insulator vertical bolts to 102 N·m (75 ft. lbs.) and the fore and aft bolts to 150 N·m (110 ft. lbs.).

(b) Front engine mount screws to 54 N·m (40 ft. lbs.) the clearance between the snubbers and the engine should be 2 mm (0.078 inch.) each side.

(c) Left engine mount through bolt to 75 N·m (55 ft. lbs.).

(5) Recheck driveshaft length.

SPECIFICATIONS

2.4L ENGINE

Type .In-Line OHV, DOHC
Number of Cylinder 4
Bore . . . . .87.5 mm (3.445 in.)
Stroke .101 mm (3.976 in.)
Compression Ratio. 9.4:1
Displacement . . . . . . .2.4 Liters (148 Cubic Inches)
Firing Order 1, 3, 4, 2
Compression Pressure . . . . .1172-1551 kPa (170-225 psi)
Maximum Variation Between Cylinder . . . . . .25 %
Lubrication. . . .Pressure Feed-Full Flow Filtration (Direct Crankshaft Driven Pump)

Cylinder Block

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

Clearance at 14 mm (9/16 in.) From Bottom of Skirt . . . . .0.024 - 0.057 mm (0.0009 - 0.0022 in.)
Weight . . . . .332 - 346 grams (11.85 - 12.20 oz.)
Top Land Clearance (Diametrical). . . . . .0.614 - 0.664 mm (0.024 - 0.026 in.)
Piston Length . . . . .60.30 mm (2.374 in.)

Piston Ring Groove Depth

No. 1 . . . . .4.640 - 4.784 mm (0.182 - 0.188 in.)
No. 2 . . . . .4.575 - 4.719 mm (0.180 - 0.185 in.)
No. 3 . . . . .4.097 - 4.236 mm (0.161 - 0.166 in.)

Piston Pins

Clearance in Piston . . . . .0.005 - 0.018 mm
In Rod (Interference) . . . . .0.018 - 0.043 mm (0.0007 - 0.0017 in.)
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 Ring Gap

Top Compression Ring. . . . . .0.25 - 0.51 mm (0.0098 - 0.020 in.)
2nd Compression Ring. . . . . .0.23 - 0.48 mm (0.009 - 0.018 in.)
Oil Control (Steel Rails) . . . . .0.25 - 0.64 mm (0.0098 - 0.025 in.)

Piston Ring Side Clearance

Top and Second Compression Rings . . . . .0.030 - 0.080 mm (0.0011 - 0.0031 in.)
Oil Ring (Pack) . . . . .0.012 - 0.178 mm (0.0004 - 0.0070 in.)

Piston Ring Width

Compression Rings . . . . .1.47 - 1.50 mm (0.057 - 0.059 in.)
Oil Ring (Pack) . . . . .2.72 - 2.88 mm (0.107 - 0.1133 in.)

Connecting Rod

Bearing Clearance . . . . .0.025 - 0.071 mm (0.0009 - 0.0027 in.)
Piston Pin Bore Diameter . . . . . .20.96 - 20.98 mm (0.8252 - 0.8260 in.)
Large End Bore Diameter . . . .53.007 - 52.993 mm (2.0868 - 2.0863)
Side Clearance. . . . . .0.013 - 0.0150 mm (0.0051 - 0.0150 in.)
Total Weight (Less Bearing). . . . . .565.8 grams (19.96 oz.)

Crankshaft

Connecting Rod Journal Diameter . . . . .49.984 - 50.000 mm (1.967 - 1.9685 in.)
Out-of-Round (Max.) . . . . . .0.0035 mm (0.0001 in.)
Taper (Max.) . . . . .0.0038 mm (0.0001 in.)
Main Bearing Diametrical Clearance No. 1 - 5 . . . . .0.018 - 0.058 mm (0.0007 - 0.0023 in.)
End Play .0.09 - 0.24 mm (0.0035 - 0.0094 in.)

Main Bearing Journals

Diameter . . . . .59.992 - 60.008 mm (2.361 - 2.3625 in.)
Out-of-Round (Max.) . . . . . .0.0035 mm (0.0001 in.)
Taper (Max.) . . . . .0.0038 (0.0001 in.)

Hydraulic Lash Adjusters

Body Diameter. . . . . .15.901 - 15.913 mm (0.626 - 0.6264 in.)
Plunger Travel Minimum (Dry). . . . . .3.0 mm (0.118 in.)

Camshaft

Bearing Bore Diameters No. 1–6. . . . . .26.020 - 26.041 mm (1.024 - 1.025 in.)
Diametrical Bearing Clearance . .0.069 - 0.071 mm (0.0027 - 0.003 in.)
End Play . . . . .0.050 - 0.170 mm (0.0019 - 0.0066 in.)
Bearing Journal Diameter No. 1–6 . . . . .25.951 - 25.970 mm (1.021 - 1.022 in.)
Lift (Zero Lash) Intake . . . . . . .8.25 mm (0.324 in.)
Lift (Zero Lash) Exhaust . . . . .6.52 mm (0.256 in.)

Valve Timing – Intake Valve

Closes (ABDC) . . . . .51°
Opens (BTDC) . . . . .1°

SPECIFICATIONS (Continued)

Duration . . . . .232°

Valve Timing – Exhaust Valve

Closes (ATDC) . . . . .8°
Opens (BBDC) . . . . .52°
Duration . . . . .240°

Valve Timing

Valve Overlap . . . . .9°

Cylinder Head

Material . . . . .Cast Aluminum
Gasket Thickness (Compressed) . . . . .1.15 mm (0.045 in.)

Cylinder Head Valve Seat

Angle . . . . .45°
Runout (Max.). . . . . .0.050 mm (0.002 in.)
Width (Finish) Intake and Exhaust. . .0.9 - 1.3 mm (0.035 - 0.051 in.)
Guide Bore Diameter (Std). . . . . . .11.0 - 11.02 mm (0.4330 - 0.4338 in.)
Finish Guide Bore ID. . . . . .5.975 - 6.000 mm (0.235 - 0.236 in.)

Valves

Face Angle . . . . .44-1/2° - 45°
Head Diameter Intake . . . . .34.67 - 34.93 mm (1.364 - 1.375 in.)
Head Diameter Exhaust . . . . . . .30.37 - 30.63 mm (1.195 - 1.205 in.)
Length–Intake (Overall). . . . . .112.76 - 113.32 mm (4.439 - 4.461 in.)
Length–Exhaust (Overall) . . . .109.59 - 110.09 mm (4.314 - 4.334 in.)
Valve Margin–Intake . . . . .1.285 - 1.615 mm (0.050 - 0.063 in.)
Valve Margin–Exhaust . . . . .0.985 - 1.315 mm (0.038 - 0.051 in.)
Valve Stem Tip Height–Intake . . . . .48.04 mm (1.891 in.)

Valves

Valve Stem Tip Height–Exhaust . . . . . . .47.99 mm (1.889 in.)
Stem Diameter–Intake . . . . .5.934 - 5.952 mm (0.234 - 0.234 in.)
Stem Diameter–Exhaust . . . . . . .5.906 - 5.924 mm (0.233 - 0.233 in.)
Stem-to-Guide Clearance–Intake . . . . .0.048 - 0.066 mm (0.0018 - 0.0025 in.)
Stem-to-Guide Clearance–Exhaust . . . . .0.0736 - 0.094 mm (0.0029 - 0.0037 in.)
Max. Allowable Stem-to-Guide Clearance–Intake and Exhaust . . . . . . .0.025 mm (0.010 in.)

Valve Springs

Free Length (Approx.) . . . . . . .48.4 mm (1.905 in.)
Spring Tension (Valve Closed) . . . . .338 N ±20 N @ 38.0 mm (75.98 lbs. ±4.5 lbs. @ 1.496 in.)
Spring Tension (Valve Open) . . . . .607 N ±30 N @ 29.75 mm (136 lbs. ±7 @ 1.172 in.)
Number of Coils 7.82
Wire Diameter . . . . .3.86 mm (0.151 in.)
Installed Spring Height . . . . .38.00 mm (1.496 in.)

Oil Pump

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 (Oil Pump)

Clearance (Max.) . . . . .0.39 mm (0.015 in.)
Diameter (Min.) . . . . .79.95 mm (3.148 in.)
Thickness (Min.). . . . . .9.40 mm (0.370 in.)
Tip Clearance Between Rotors (Max.) . . . .0.20 mm (0.008 in.)

Oil Pressure

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 3,000 rpm.

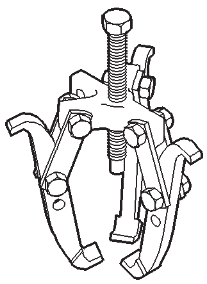
SPECIFICATIONS (Continued)

TORQUE CHART 2.4L

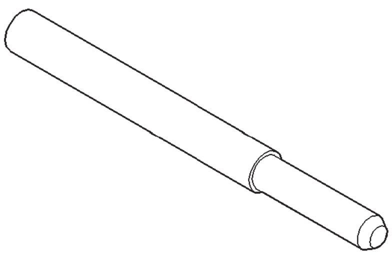
DESCRIPTION	TORQUE
Balance Shaft Carrier to Block	
Bolts	54 N·m (40 ft. lbs.)
Balance Shaft Gear Cover	
Double Ended Fastener	12 N·m (105 in. lbs.)
Balance Shaft Sprockets	
Bolts	28 N·m (250 in. lbs.)
Balance Shaft Chain Tensioner	
Bolts	12 N·m (105 in. lbs.)
Balance Shaft Carrier Cover	
Fasteners	12 N·m (105 in. lbs.)
Camshaft Sensor Pick Up	
Bolts	27 N·m (20 ft. lbs.)
Timing Belt Cover	
Outer to Inner Attaching Bolts M6	4.5 N·m (40 in. lbs.)
Inner Cover to Head/Oil Pump Bolts M6	12 N·m (105 in. lbs.)
Camshaft Sprocket	
Bolt	101 N·m (75 ft. lbs.)
Connecting Rod Cap	
Bolts	27 N·m (20 ft. lbs.) Plus 1/4 Turn
Crankshaft Main Bearing Cap/Bedplate	
M8 Bedplate Bolts	34 N·m (250 in. lbs.)
Main Cap Bolts M11	41 N·m (30 ft. lbs.) Plus 1/4 Turn
Crankshaft Damper	
Bolt	135 N·m (100 ft. lbs.)
Cylinder Head	
Bolts	Refer To Cylinder Head Installation
Cylinder Head Cover	
Bolts	12 N·m (105 in. lbs.)
Engine Mount Bracket	
Bolts	61 N·m (45 ft. lbs.)
Engine Mount—Front and Rear	
Through Bolt	61 N·m (45 ft. lbs.)
Exhaust Manifold to Cylinder Head	
Bolts	23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield	
Bolts	12 N·m (105 in. lbs.)
Front Torque Bracket—2.0/2.4L Engine	
Bolts	33 N·m (24 ft. lbs.)
Front Torque Bracket Strut—2.0/2.4L Engine	
Long Bolts	110 N·m (80 ft. lbs.)
Short Bolt	61 N·m (45 ft. lbs.)
Intake Manifold	
Bolts	27 N·m (20 ft. lbs.)
Oil Filter	
Filter	20 N·m (15 ft. lbs.)
Oil Pan	
Oil Pan Bolts	12 N·m (105 in. lbs.)
Drain Plug	27 N·m (20 ft. lbs.)
Oil Pump Attaching	
Bolts	28 N·m (250 in. lbs.)
Oil Pump Cover Fastener	12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Bolt	28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap	41 N·m (30 ft. lbs.)
Rear Torque Bracket	
Bolts	110 N·m (80 ft. lbs.)
Spark Plugs	
Plugs	28 N·m (20 ft. lbs.)
Thermostat Housing	
Bolts	23 N·m (200 in lbs.)
Timing Belt Tensioner Assembly	
Bolts	61 N·m (45 ft. lbs.)
Water Pump Mounting	
Bolts	12 N·m (105 in. lbs.)

SPECIAL TOOLS

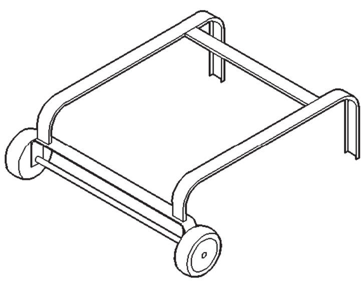
2.4L ENGINE



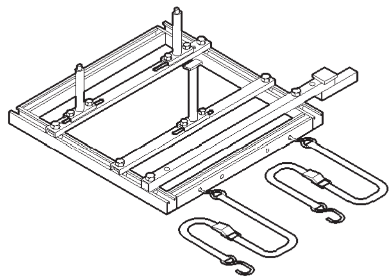
Puller 1026



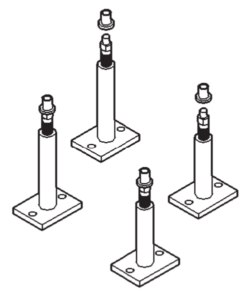
Crankshaft Damper Removal Insert 6827-A



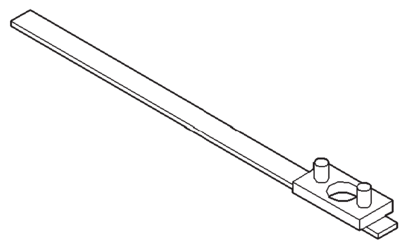
Dolly 6135



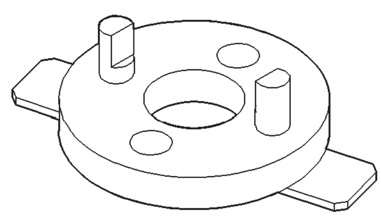
Cradle 6710



Post Kit Engine Cradle 6848

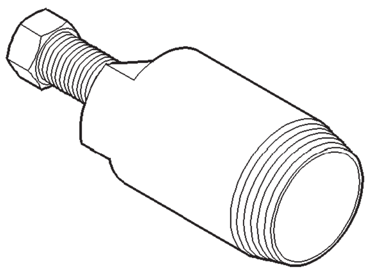


Camshaft Sprocket Remover/Installer C-4687

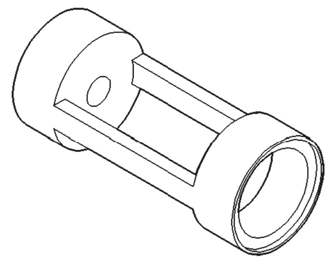


Camshaft Sprocket Remover/Installer Adapter C-4687-1

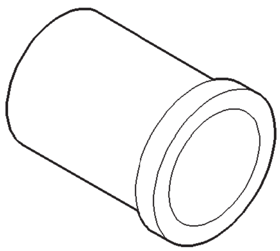
SPECIAL TOOLS (Continued)



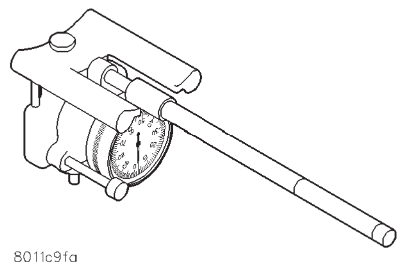
Camshaft Seal Remover C-4679-A



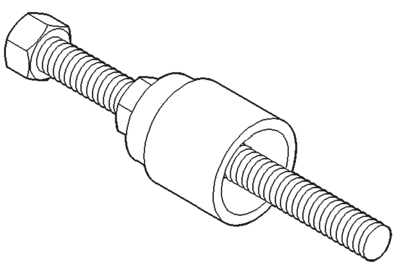
Valve Spring Compressor Adapter 6779



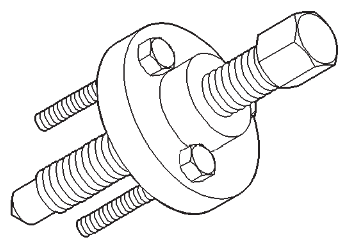
Camshaft Seal Installer MD-998306



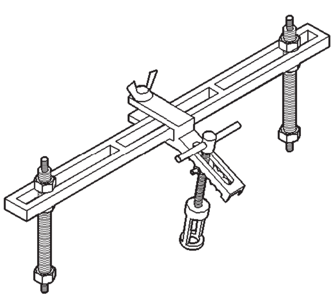
Cylinder Bore Gage C-119



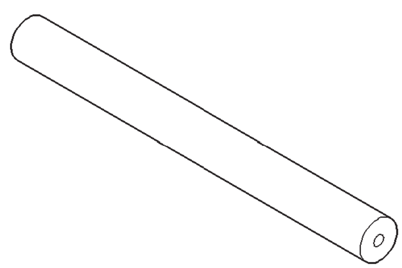
Crankshaft Damper Installer 6792



Crankshaft Sprocket Remover 6793

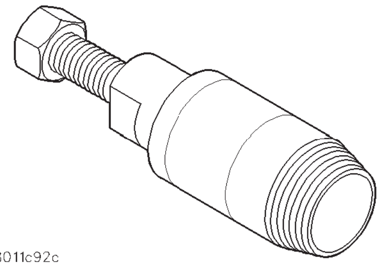


Valve Spring Compressor MD-998772-A



Crankshaft Sprocket Remover Insert C-4685-C2

SPECIAL TOOLS (Continued)



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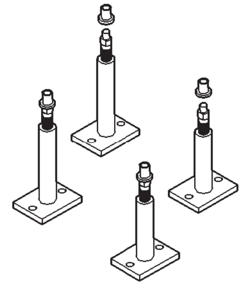
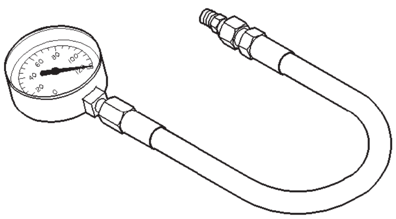
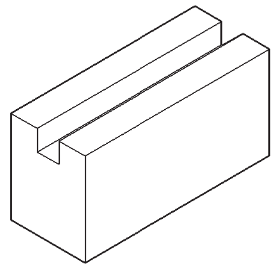
Crankshaft Seal Remover 6771



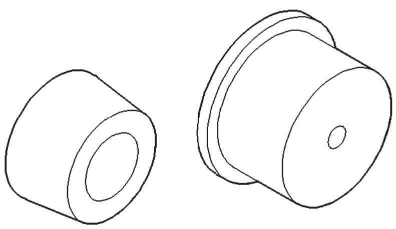
Post Kit Engine Cradle 6848



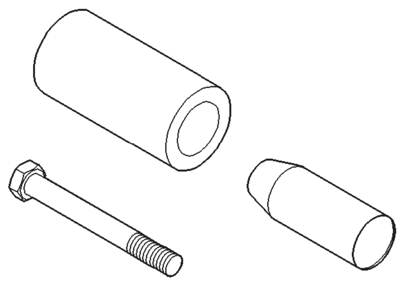
Oil Pressure Gage C-3292



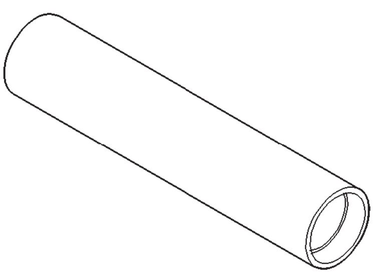
Post Adapter 8130



Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



Front Crankshaft Oil Seal Installer 6780



Balance Shaft Sprocket Installer 6052

3.0L ENGINE

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DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION NUMBER

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 1).

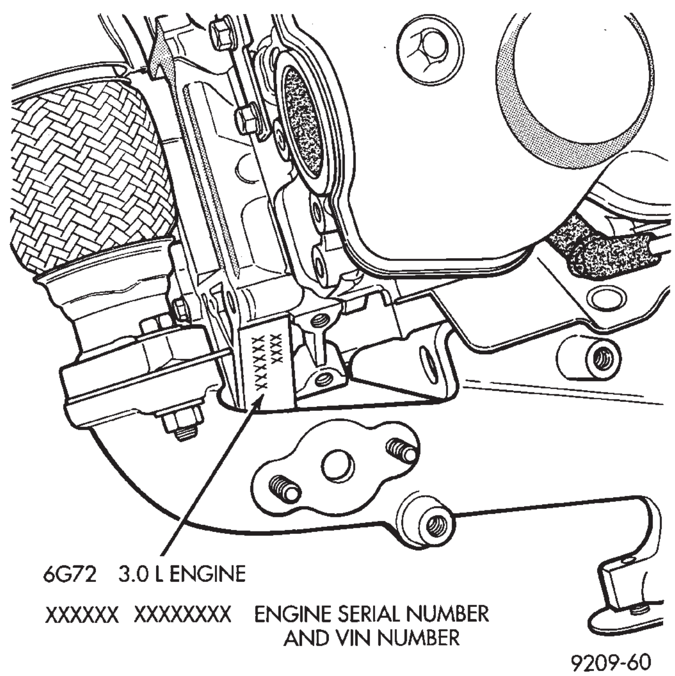


Fig. 1 Engine Identification

ENGINE LUBRICATION

System is a full flow filtration, pressure feed type. The oil pump is mounted behind the timing belt cover. The pump inner rotor is driven by the crankshaft. The engine oil pan contains a baffle plate to control oil level fluctuation during engine operation.

ENGINE COMPONENTS

BLOCK: The cylinder block is a light weight design created by reducing thickness in many parts and a short 10 mm (3/8 in.) block skirt. High rigidity is provided with ribs cast in the outer wall, a full length water jacket, and a mono-block or beam type, main bearing cap. This single unit four bearing cap is designed to control vibration of the cylinder block partition walls.

CRANKSHAFT: A six throw, five weight crankshaft is supported by four main bearings with number three being the thrust bearing. The six separate connecting rod throws pins reduce torque fluctuations while a torsional vibration damper is used to control torsion caused vibration of the crankshaft. Rubber lipped seals are used at front and rear. The

DESCRIPTION AND OPERATION (Continued)

front seal is retained in the oil pump case and the rear is retained in a block-mounted housing.

PISTONS: Are aluminum alloy with a steel strut, short height, and thin wall so as to be autothermic and light weight. The piston head with valve recesses, in combination with the cylinder head, forms a compact spherical head with clearance for total valve lift with pistons at top dead center. The piston skirt, top and second ring lands are finished to a tapered roughness for oil retention and high resistance to scuffing. Piston pins, pressed into place, join the pistons to the connecting rods.

CYLINDER HEAD: The alloy cylinder heads feature cross-flow type intake and exhaust ports. Valve guides and inserts are hardened cast iron. Valves of heat resistance steel are arranged in a V with each camshaft on center. To improve combustion speed the chambers are a compact spherical design with a squish area of approximately 30 percent of the piston top area. The cylinder heads are common to either cylinder bank by reversing the direction of installation.

CAMSHAFTS: Two overhead camshafts provide valve actuation, one front (radiator side of cylinder bank) and one rear. The front camshaft is provided with a distributor drive and is longer. Both camshafts are supported by four bearing journals, thrust for the front camshaft is taken at journal two and the rear at journal three. Front and rear camshaft driving sprockets are interchangeable. The sprockets and the engine water pump are driven by a single notched timing belt.

ROCKER ARM SHAFTS: The shafts are retained by the camshaft bearing journal caps. Four shafts are used, one for each intake and exhaust rocker arm assembly on each cylinder head. The hollow shafts provide a duct for lubricating oil flow from the cylinder head to the valve mechanisms.

ROCKER ARMS: Are of light weight die-cast with roller type follower operating against the cam shaft. The valve actuating end of the rocker arms are machined to retain hydraulic lash adjusters, eliminating valve lash adjustment.

VALVES: Are made of heat resistant steel, valve springs are especially designed to be short. The valve spring wire cross-section is oval shaped and provides the same spring tension as longer springs. Valve spring retainers, locks and seals are conventional.

INTAKE MANIFOLD: The aluminum alloy manifold is a cross type with long runners to improve inertia. The runners, attaching below at the cylinder head, also attach above and support an air plenum. The air plenum chamber absorbs air pulsations created during the suction phase of each cylinder.

EXHAUST MANIFOLDS: Both manifolds are a log style made of ductile cast iron. Exhaust gasses, collected from the front cylinder bank, leave the front manifold through an end outlet and are fed through an upper crossover tube to the rear manifold. The collected exhaust from both manifolds are combined, and exit to the exhaust pipe through an articulated joint.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

Check oil pressure using gauge at oil pressure switch location. Oil pressure should be 41 kPa (6 psi.) at idle or 241 to 517 kPa (35 to 75 psi.) at 3000 RPM.

(1) Remove pressure sending unit and install oil pressure gauge. (Fig. 2).

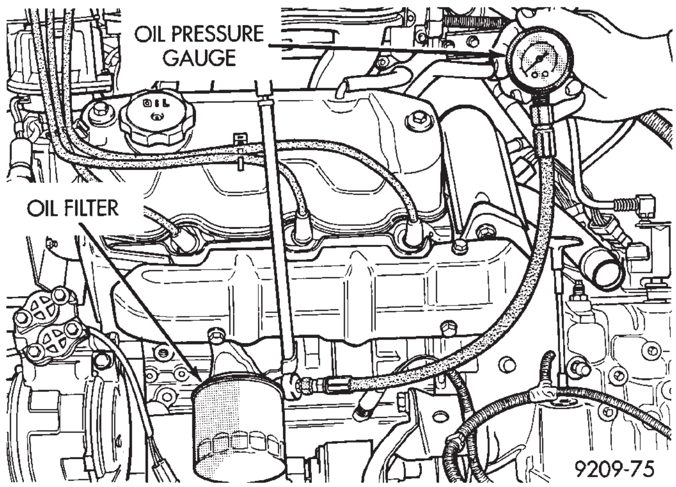


Fig. 2 Checking Engine Oil Pressure

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

(2) Warm engine at high idle until thermostat opens.

SERVICE PROCEDURES

AUTO LASH ADJUSTER

The automatic lash adjusters are precision units installed in machined openings in the valve actuating ends of the rocker arms. Do not disassemble the auto lash adjuster.

FUNCTION CHECK

Check auto adjusters for free play by inserting a small wire through the air bleed hole in the rocker arm and **very lightly** pushing the auto adjuster ball check down (Fig. 3). While lightly holding the check ball down move the rocker up and down to check for free play. If there is no play replace the adjuster.

SERVICE PROCEDURES (Continued)

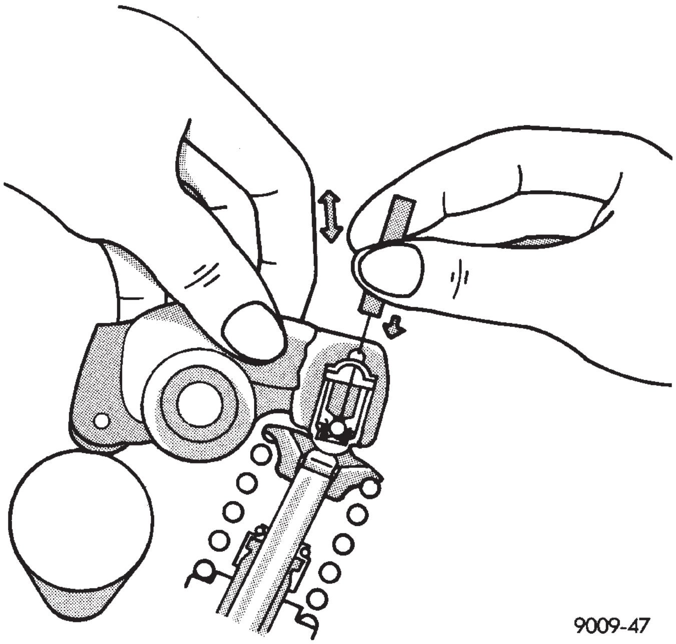


Fig. 3 Auto Lash Adjuster—Function Check

FITTING CONNECTING ROD BEARINGS

CONNECTING ROD CLEARANCE

(1) Following procedures specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 4). Refer to Connecting Rod Specification Chart.

(2) Tighten nuts to 52 N·m (38 ft. lbs.).

(3) Remove connecting rod cap and measure Plastigage (Fig. 4).

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

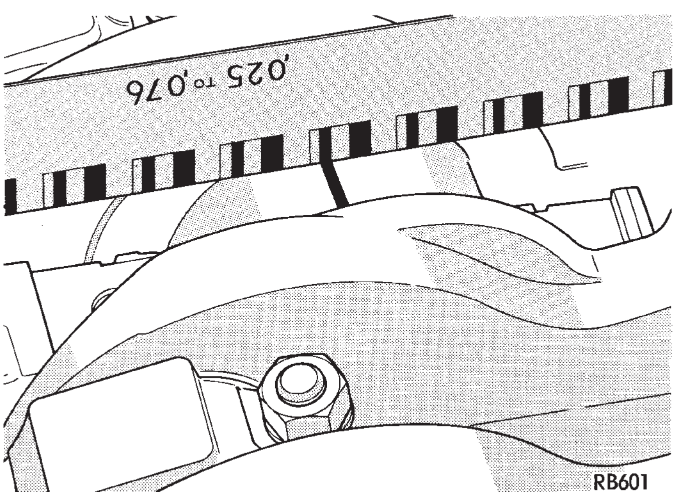


Fig. 4 Connecting Rod—Checking Bearing Clearance

CONNECTING ROD SIDE CLEARANCE

Using a feeler gauge, check connecting rod side clearance (Fig. 5). Refer to Connecting Rod Specification Chart.

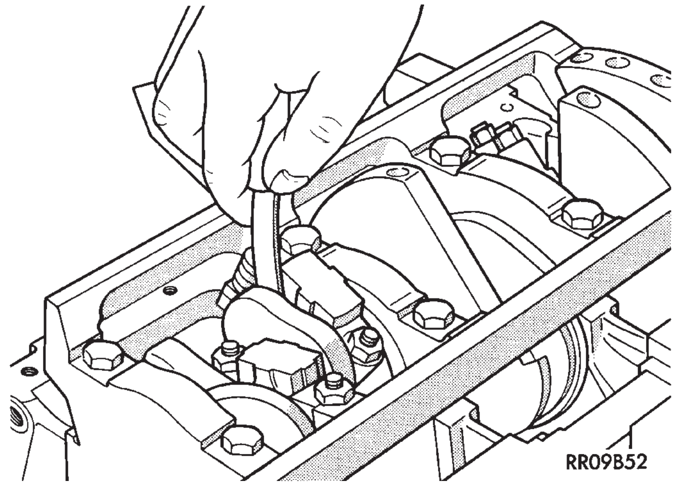


Fig. 5 Checking Connecting Rod Side Clearance

CONNECTING ROD SPECIFICATION CHART

Connecting Rod Bearing Oil Clearance	
New Part:	0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Connecting Rod Side Clearance	
New Part:	0.10 - 0.25 mm (0.004 - 0.010 in.)
Wear Limit:	0.4 mm (0.015 in.)

FITTING MAIN BEARING

INSPECTION

Visually check the main and connecting rod bearing journals for wear, scuffs or scoring and replace if necessary.

CRANKSHAFT OIL CLEARANCE—MECHANICAL MEASUREMENT

Measure the journal outside diameter and the main bearing inside diameter (Fig. 6) & (Fig. 7). If the clearance exceeds the specifications limit, replace the main bearing(s) and if necessary replace the crankshaft. Refer to Crankshaft Clearance Specification Chart.

PLASTIGAGE MEASUREMENT

(1) Remove oil from journal and bearing shell.

(2) Install crankshaft.

(3) Cut plastigage to same length as width of the bearing and place it in parallel with the journal axis (Fig. 8).

SERVICE PROCEDURES (Continued)

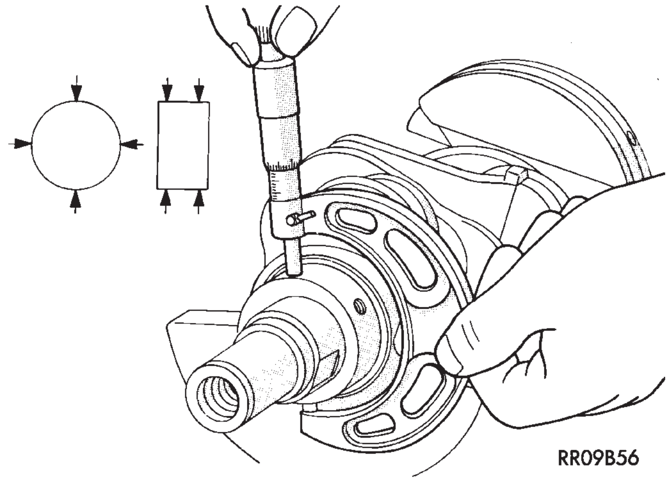


Fig. 6 Measure Crankshaft Journal O.D.

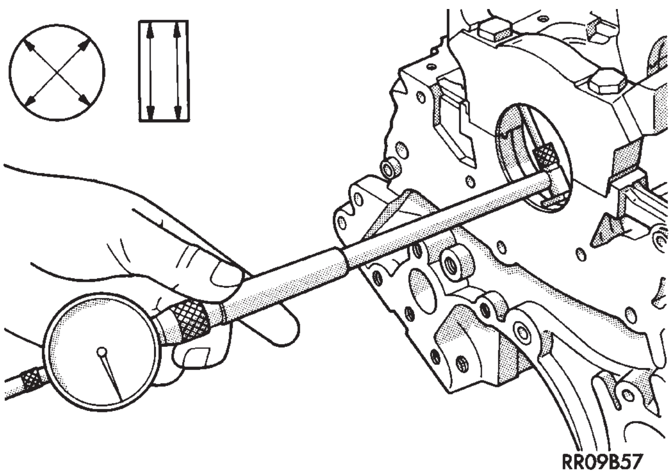


Fig. 7 Measure Main Bearing I.D.

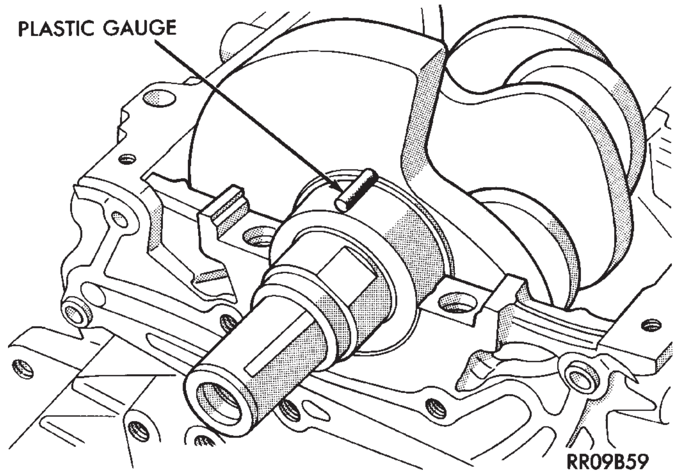


Fig. 8 Measure Oil Clearance with Plastigage

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.05 - 0.25 mm (0.002 - 0.001 in.)
Wear Limit:	0.30 mm (0.012 in.)
Main Bearing Oil Clearance	
New Part:	0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Wear Part:	0.10 mm (0.0039 in.)
Crankshaft Main Bearing Journal	
Standard Diameter:	59.980 mm (2.361 in.)
Crankshaft Connecting Rod Journal	
Standard Diameter:	50.00 mm (1.968 in.)

CAUTION: Do not rotate crankshaft or the plastigage will be smeared.

(4) Install the main bearing cap carefully and tighten the bolts to specified torque.

(5) Carefully remove the bearing cap and measure the width of the plastigage at the widest part using the scale on the plastigage package (Fig. 9). Refer to Crankshaft Clearance Specification Chart for proper clearances. Also see Measuring Main and Connecting Rod Bearing Clearance in Standard Service Procedures.

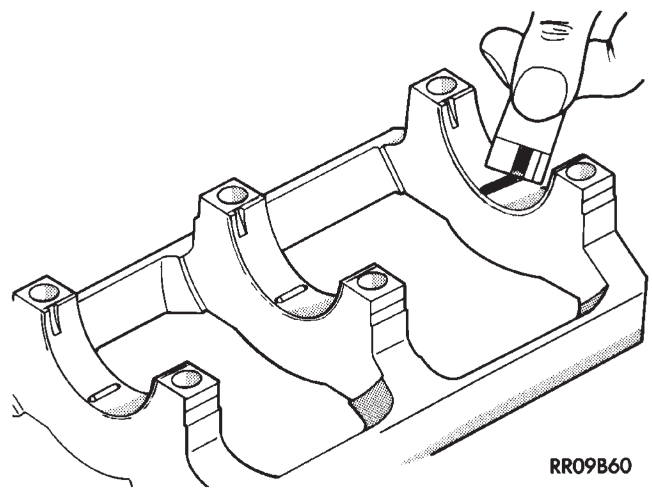


Fig. 9 Measuring Clearance

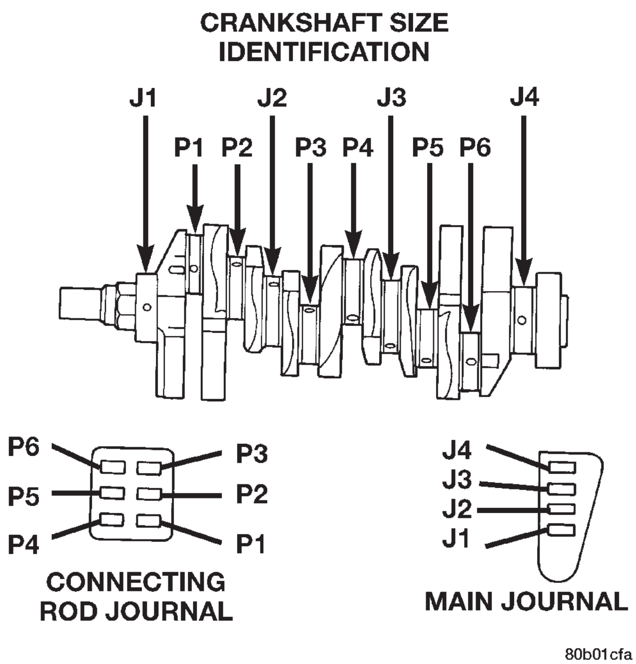
CRANKSHAFT BEARING INSTALLATION

When the bearings need replacing, select and install the proper bearing by the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the following. In the case of a bearing supplied as a service part, its identification color is painted at the position show in (Fig. 10).

NOTE: Service replacement parts have identification marks, but factory-assembled parts have no identification marks. Service crankshaft identification may have marks or paint at counterweights. Refer to Crankshaft Size Classification Chart.

SERVICE PROCEDURES (Continued)



CRANKSHAFT SIZE CLASSIFICATION CHART

SIZE	NEW	CURRENT
MAIN JOURNAL		
59.982 - 59.988 mm (2.3615 - 2.3617 in.)	2	WHITE ENAMEL
59.988 - 59.994 mm (2.3617 - 2.3620 in.)	1	NONE
59.994 - 60.000 mm (2.3620 - 2.3622 in.)	0	YELLOW ENAMEL
CONNECTING ROD JOURNAL		
49.980 - 49.985 mm (1.9677 - 1.9679 in.)	III	WHITE ENAMEL
49.985 - 49.995 mm (1.9679 - 1.9683 in.)	II	NONE
49.995 - 50.000 mm (1.9683 - 1.9685 in.)	I	YELLOW ENAMEL

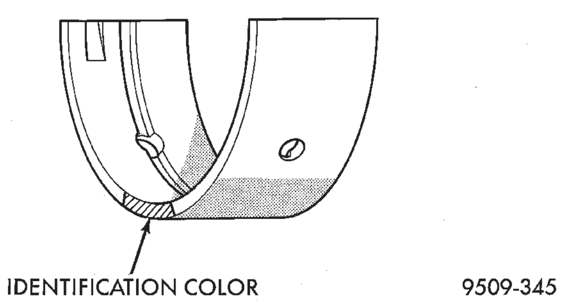


Fig. 10 Bearing Identification

CHECKING CRANKSHAFT END PLAY

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 11).

(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 Crankshaft Specification Chart.

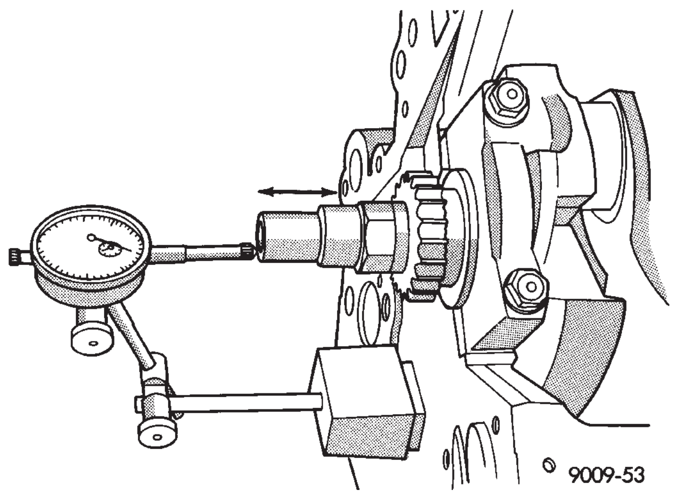


Fig. 11 Checking Crankshaft End Play

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.05 - 0.25 mm 0.002 - 0.001 in.)
Wear Limit:	0.30 mm (0.012 in.)
Main Bearing Oil Clearance	
New Part:	0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Wear Part:	0.10 mm (0.0039 in.)
Crankshaft Main Bearing Journal	
Standard Diameter:	59.980 mm (2.361 in.)
Crankshaft Connecting Rod Journal	
Standard Diameter:	50.00 mm (1.968 in.)

SERVICE PROCEDURES (Continued)

VALVE SERVICE RECONDITION

(1) With suitable valve spring compressor, remove spring retainer locks, retainer, valve spring, spring seat and valve (Fig. 12).

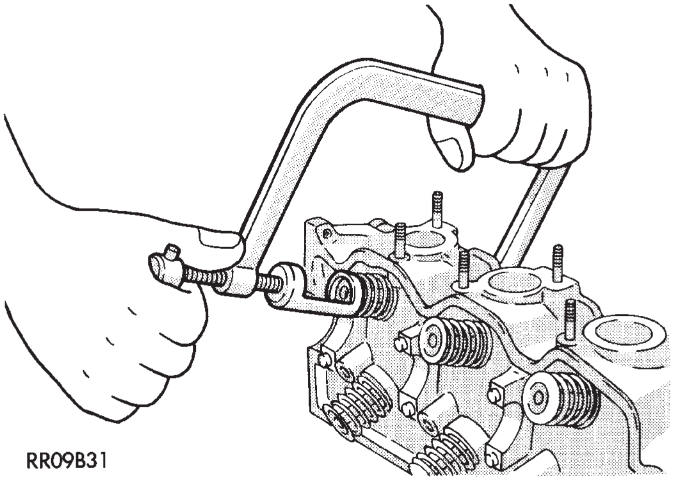


Fig. 12 Remove Valves

(2) Remove valve stem seals with suitable tool (Fig. 13). Do not reuse valve stem seals.

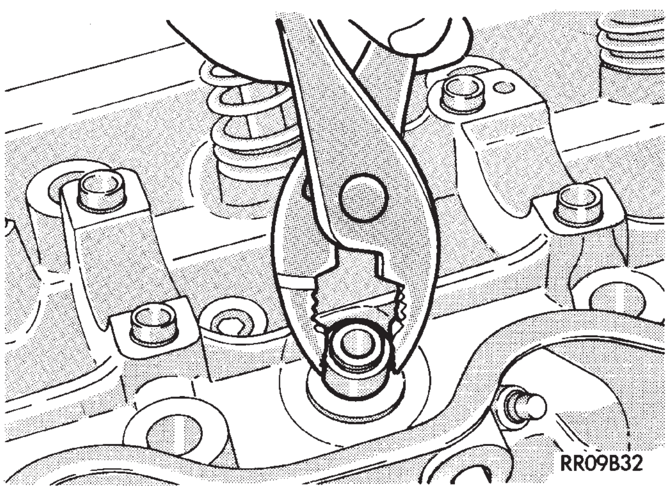


Fig. 13 Remove Valve Stem Seals

VALVES

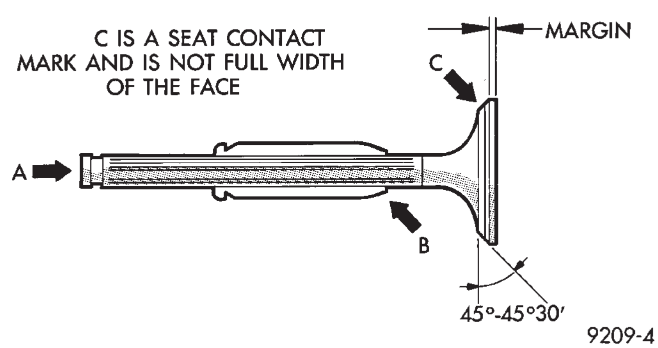


Fig. 14 Valve Inspection

(1) Check valve stem tip for pitting or depression at point A (Fig. 14).

(2) Check for wear and ridge wear at Point B.

(3) Check for even contact (at face center) with valve seat, Point C.

(4) Check margin (Fig. 14). Replace valve if margin is out of specification. Refer to Valve Specification Chart.

(5) Check valve guide height (Fig. 15).

(6) Measure valve stem to guide clearance. Refer to Valve Specification Chart.

(7) Measure Valve spring free length and squareness (Fig. 16). Refer to Valve Specification Chart.

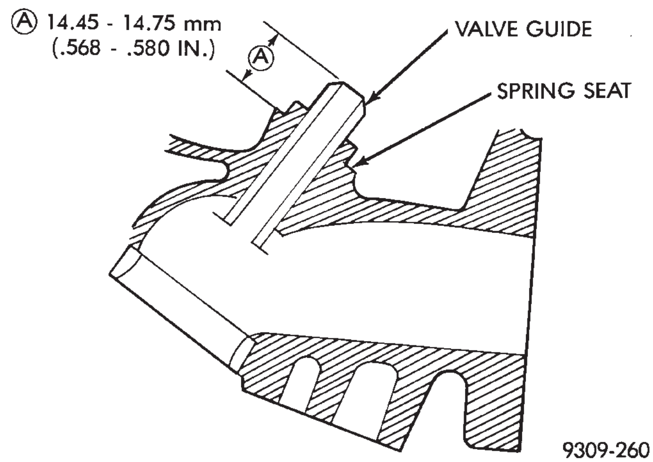


Fig. 15 Valve Guide Height

SERVICE PROCEDURES (Continued)

VALVE SPECIFICATION CHART

Valve Dimensions		
INTAKE VALVE (MINIMUM)		
Stem Diameter:	7.960 mm (0.313 in.)	
Face Angle:	45°	
Valve Margin:	0.700 mm (0.028 in.)	
Length:	103.0 mm (4.055 in.)	
EXHAUST VALVE (MINIMUM)		
Stem Diameter:	7.930 mm (0.312)	
Face Angle:	45°	
Valve Margin:	1.50 mm (0.059 in.)	
Length:	102.70 mm (4.043 in.)	
Valve Guide Clearance	**New**	**Service Limit**
Intake:	0.03 - 0.06 mm (0.001 - 0.002 in.)	0.10 mm (0.004 in.)
Exhaust:	0.05 - 0.09 mm (0.002 - 0.0035 in.)	0.15 mm (0.006 in.)
Valve Springs	**New**	**Service Limit**
Free Length:	49.8 mm (1.960 in.)	48.8 mm (1.921 in.)
Squarness:	2° Maximum	4° Maximum
Spring Tension:	33 Kg @ 40.4 mm (73 lbs. @ 1.59 in.)	

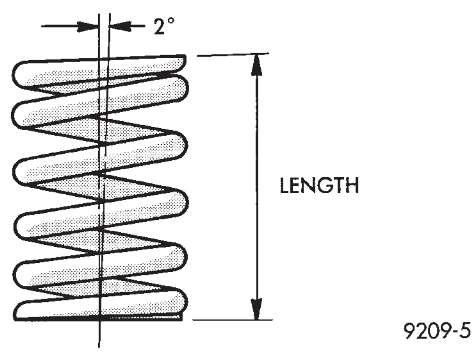


Fig. 16 Valve Spring

VALVE SEAT

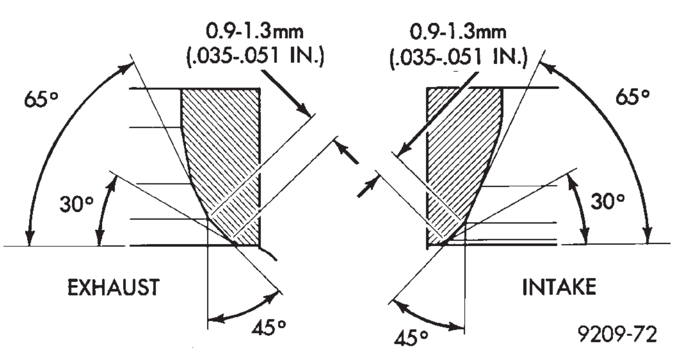


Fig. 17 Valve Seat Reconditioning

Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degree stone (Fig. 17).

INSTALLATION

(1) Install valve spring seat.

(2) Using suitable tool install seal by tapping lightly until seal is in place (Fig. 18).

(3) Install valve spring with the enamelled ends facing the rocker arms (Fig. 19).

CAUTION: During reassembly, compressing the valve spring more than necessary to install valve spring retainer locks can cause the retainer to be forced against the stem seal and damaging it.

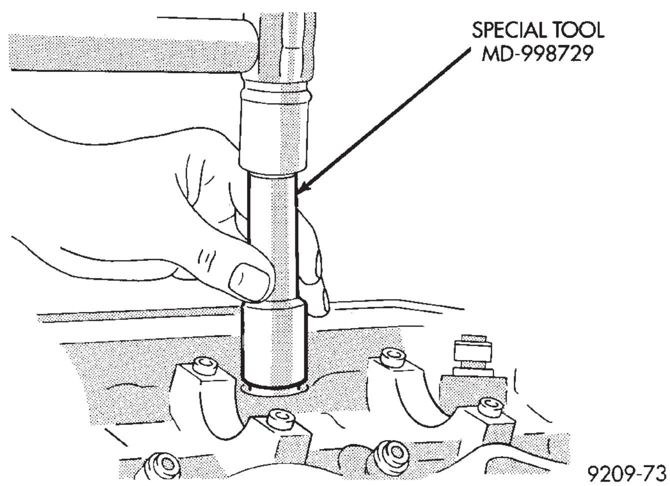


Fig. 18 Install Valve Stem Seals

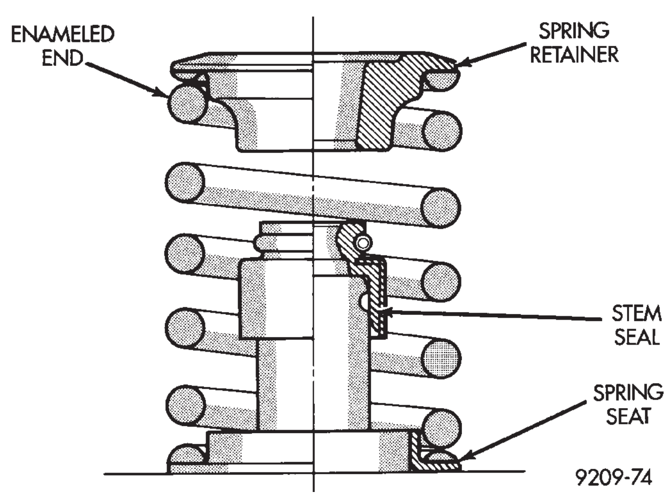


Fig. 19 Installed Valve Spring Position

REMOVAL AND INSTALLATION

ENGINE MOUNTS

RIGHT SIDE MOUNT

REMOVAL

NOTE: Right mount should only be serviced as an assembly to prevent noise, vibration and harshness concerns.

(1) Remove the purge duty solenoid and wiring harness from engine mount.

(2) Remove the two right engine mount insulator vertical fasteners and loosen the horizontal fastener. **Do Not remove the large nut on the end of the core from the frame rail (Fig. 20).**

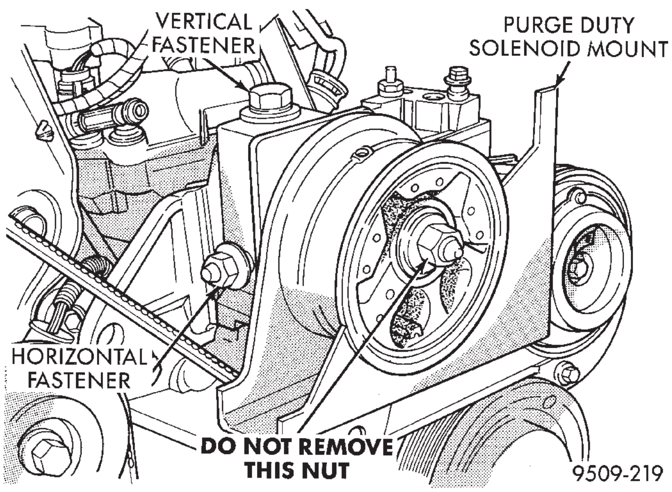


Fig. 20 Engine Mount—Right

(3) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(4) Remove the vertical and horizontal fasteners from the engine side bracket. Remove the engine mount assembly

INSTALLATION

(1) Reverse removal procedure for installation. Tighten assembly in the following order:

(a) Engine mount to rail fasteners to 68 N·m (50 ft. lbs.).

(b) The vertical engine fastener to 102 N·m (75 ft. lbs.).

(c) The horizontal fastener to 150 N·m (111 ft. lbs.).

(2) Install the purge duty solenoid and wiring harness to the engine mount.

(3) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment.

FRONT MOUNT

REMOVAL

(1) Support the engine and transmission assembly with a floor jack so it will not rotate.

(2) Remove the front engine mount through bolt from the insulator and front crossmember mounting bracket (Fig. 21).

(3) Remove six screws from air dam to allow access to the front mount screws.

(4) Remove the front engine mount screws and remove the insulator assembly.

(5) Remove the front mounting bracket, if necessary (Fig. 21).

INSTALLATION

(1) Reverse removal procedure for installation and tighten fasteners in this order:

(a) Tighten bolts 2, 3, and 4 to 108 N·m (80 ft. lbs.).

(b) Tighten bolts 1 and 5 to 54 N·m (40 ft. lbs.).

(2) Engine mount adjustment. Refer to Engine Mount Insulator Adjustment of this section.

(3) Install six screws to air dam and tighten to 12 N·m (105 in. lbs.).

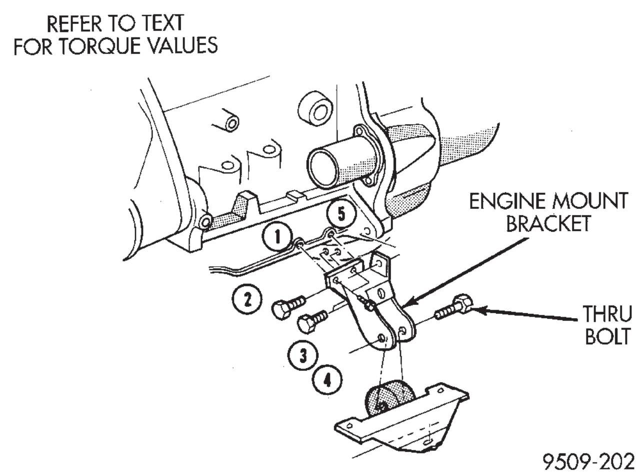


Fig. 21 Engine Mount—Front

LEFT SIDE MOUNT

REMOVAL

(1) Raise vehicle on hoist and remove left front wheel.

(2) Support the transmission with a transmission jack.

(3) Remove the insulator through bolt from the mount.

(4) Remove the transmission mount fasteners and remove mount.

INSTALLATION

(1) Reverse removal procedure for installation.

REMOVAL AND INSTALLATION (Continued)

(2) Tighten mount to transmission bolts to 55 N·m (40 ft. lbs.) (Fig. 22).

Tighten through bolt to 75 N·m (55 ft. lbs.)

(3) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

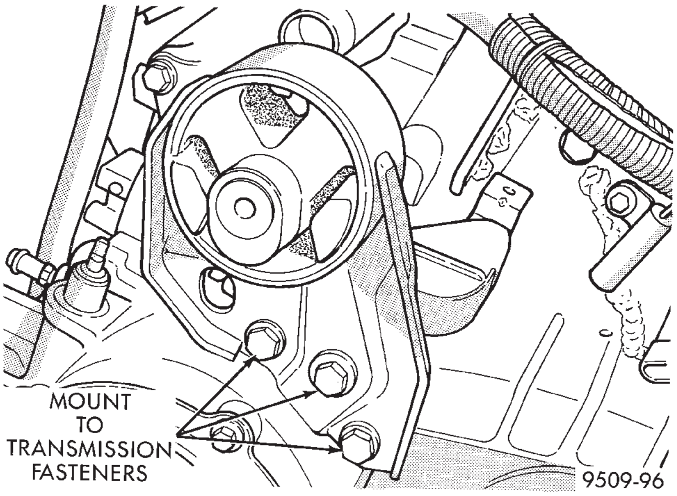


Fig. 22 Engine Mount—Left

REAR MOUNT

(1) Raise vehicle on hoist.

(2) Support the transmission with a transmission jack so it will not rotate.

(3) Remove the insulator through bolt from the mount and rear suspension crossmember.

(4) Remove the four transmission mount fasteners and remove the mount.

(5) Reverse the removal procedure for installation. Refer to (Fig. 23).

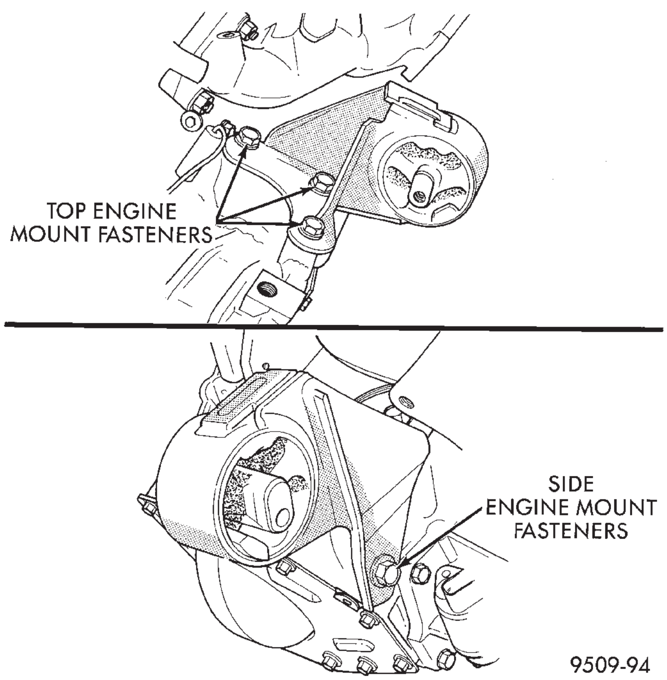


Fig. 23 Engine Mount—Rear

ENGINE MOUNT RUBBER INSULATORS

Insulator location on (right side) is adjustable to allow right/left drive train adjustment in relation to driveshaft assembly length. See Engine Mount Adjustments in this section.

Check and reposition right engine mount insulator. Adjust drive train position, if required, for the following conditions:

- Driveshaft distress: See Group 2, Suspension and Driveshafts.
- Any front end structural damage (after repair).
- Insulator replacement.

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect battery.

(3) Remove Air cleaner and hoses.

(4) Remove battery cover, battery and battery tray, with integral vacuum reservoir, from vehicle.

(5) Block off heater hoses to rear heater assembly, if equipped.

(6) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(7) Disconnect heater hoses.

(8) Remove fan module and radiator. Refer to Group 7, Cooling System for procedure.

(9) Disconnect transmission shift linkage.

(10) Disconnect throttle body linkage and vacuum hoses from throttle body.

(11) Remove accessory drive belts. Refer to Accessory Drive System located in Group 7, Cooling System for procedure.

(12) Remove air conditioning compressor from engine and set it aside.

(13) Disconnect generator wiring harness and remove generator.

(14) Hoist vehicle and remove axle shafts. Refer to Group 2, Driveshaft for procedure.

(15) Remove right and left inner splash shields.

(16) Disconnect exhaust pipe from manifold.

(17) Remove front engine mount and bracket as an assembly.

(18) Remove rear transmission mount and bracket.

(19) Remove power steering pump and bracket assembly.

(20) Remove wiring harness and connectors from front of engine.

(21) Remove bending braces and install tool number 6910 on engine.

(22) Remove trans inspection cover and mark flexplate to torque converter.

(23) Remove driveplate to torque converter bolts.

(24) Lower the vehicle.

REMOVAL AND INSTALLATION (Continued)

(25) Remove ground straps to body.

(26) Raise vehicle enough to allow engine dolly Special Tool 6135 and cradle Special Tool 6710 with post Special Tool 6848 and adaptor Special Tool 6909 to be installed under vehicle (Fig. 24).

(27) Loosen cradle engine mounts to allow movement for positioning onto engine locating holes on the engine. Lower vehicle and position cradle mounts until the engine is resting on mounts. Tighten mounts to cradle frame. This will keep mounts from moving when removing or installing engine and transmission.

(28) Lower vehicle so the weight of **ONLY THE ENGINE AND TRANSMISSION** is on the cradle.

(29) Remove right engine mount assembly and left transmission mount through bolt. Refer to Engine Mounts Section of this Group.

(30) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly on the cradle to allow for removal around body flanges.

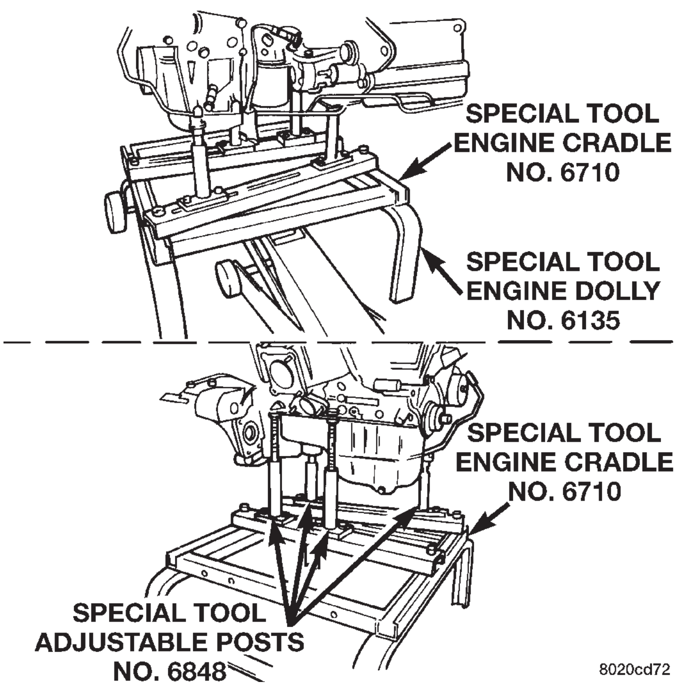


Fig. 24 Positioning Engine Cradle Support Post Mounts—Typical

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission. It may be necessary to move the engine/transmission assembly with the cradle for clearance around body flanges.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right engine and left transmission mounts. Refer to procedures outlined in this section.

(3) Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135, 6710, 6848 and 6909.

(4) Remove Special tools 6910 and install bending braces.

(5) Lower vehicle. Install generator and wiring harness.

(6) Connect wiring harness on the front of the engine.

(7) Install Air Conditioning Compressor.

(8) Install power steering pump and bracket and accessory drive belt. Refer to Group 7. Accessory Drive Belts Section for installation procedure.

(9) Raise vehicle and install axle shafts. Refer to Group 2, Driveshafts for procedure.

(10) Install transmission and engine mount and bracket assemblies. Refer to Engine Mounts in this section for procedure.

(11) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(12) Install left and right inner splash shields.

(13) Connect automatic transmission shifter linkage. Refer to Group 21, Transmission for procedures.

(14) Lower vehicle and connect fuel line and heater hoses. Remove plugs from rear heater hoses and install, if equipped.

(15) Install ground straps. Connect engine and throttle body connections and harnesses.

(16) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(17) Install radiator and fan module assembly. Install radiator hoses. Fill cooling system. Refer to Group 7, Cooling for procedures.

(18) Install battery tray, battery and cover.

(19) Install air cleaner and hoses.

(20) Install oil filter. Fill engine crankcase with proper oil to correct level.

(21) Start engine and run until operating temperature is reached.

(22) Adjust transmission linkage, if necessary.

CYLINDER HEAD COVER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove air inlet resonator when removing left head cover.

(3) When Removing left cylinder head cover, remove dipstick tube.

(4) When removing right cylinder head cover remove wiper unit. Refer to Wiper Unit Removal in Group 8K.

(5) When removing right cylinder head cover, remove accessory drive belt. Refer to Accessory Drive Belt Removal in Group 7.

REMOVAL AND INSTALLATION (Continued)

(6) When removing right cylinder head cover, disconnect generator wiring and remove generator.
(7) Relocate spark plug wires.
(8) Remove vacuum connections.
(9) Remove rocker cover screws and remove cover (Fig. 25).

INSTALLATION

(1) Clean cylinder head and cover mating surfaces. Install new gasket.
(2) See (Fig. 25) and apply sealant such as Mopar Silicone Rubber Adhesive Sealant to cover ends.
(3) Install cover and tighten cover bolt washer and gasket assembly to 10 N·m (88 in. lbs.).
(4) Reverse removal procedures for installation.

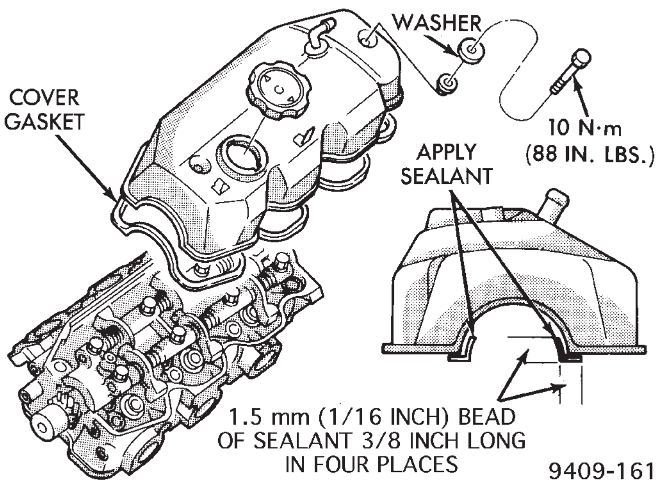


Fig. 25 Rocker Cover

CAMSHAFT

REMOVAL

NOTE: SEE AUTO LASH ADJUSTER FUNCTION CHECK BEFORE DISASSEMBLY

(1) Install auto lash adjuster retainers (Fig. 26).
(2) Remove distributor adaptor (Fig. 27).
(3) When removing camshaft bearing caps do not remove the bolts from the bearing caps. Remove the rocker arm, rocker shafts and bearing cap as an assembly.

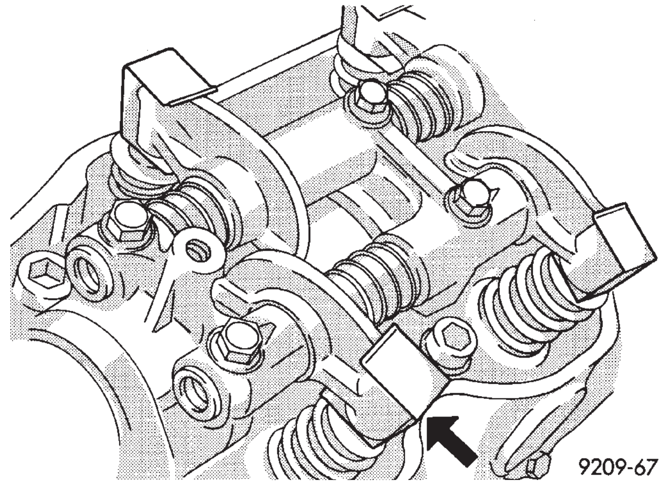


Fig. 26 Auto Lash Adjuster Retainers

CAMSHAFT INSPECTION

(1) Inspect camshaft bearing journals for damage and binding (Fig. 28). If journals are binding, also check the cylinder head for damage. Also check cylinder head oil holes for clogging.
(2) Front cylinder head camshaft check the tooth surface of the distributor drive gear teeth of the camshaft and replace if abnormal wear is evident (Fig. 28).
(3) Check the cam surface for abnormal wear and damage and replace if defective. Also measure the cam height (Fig. 28) and replace if out of limit, standard value is 41.25 mm (1.624 in.), wear **limit** is 40.75 mm (1.604 in.).

CAMSHAFT INSTALL

Lubricate camshaft journals and cams with engine oil and install camshaft on cylinder head.

REMOVAL AND INSTALLATION (Continued)

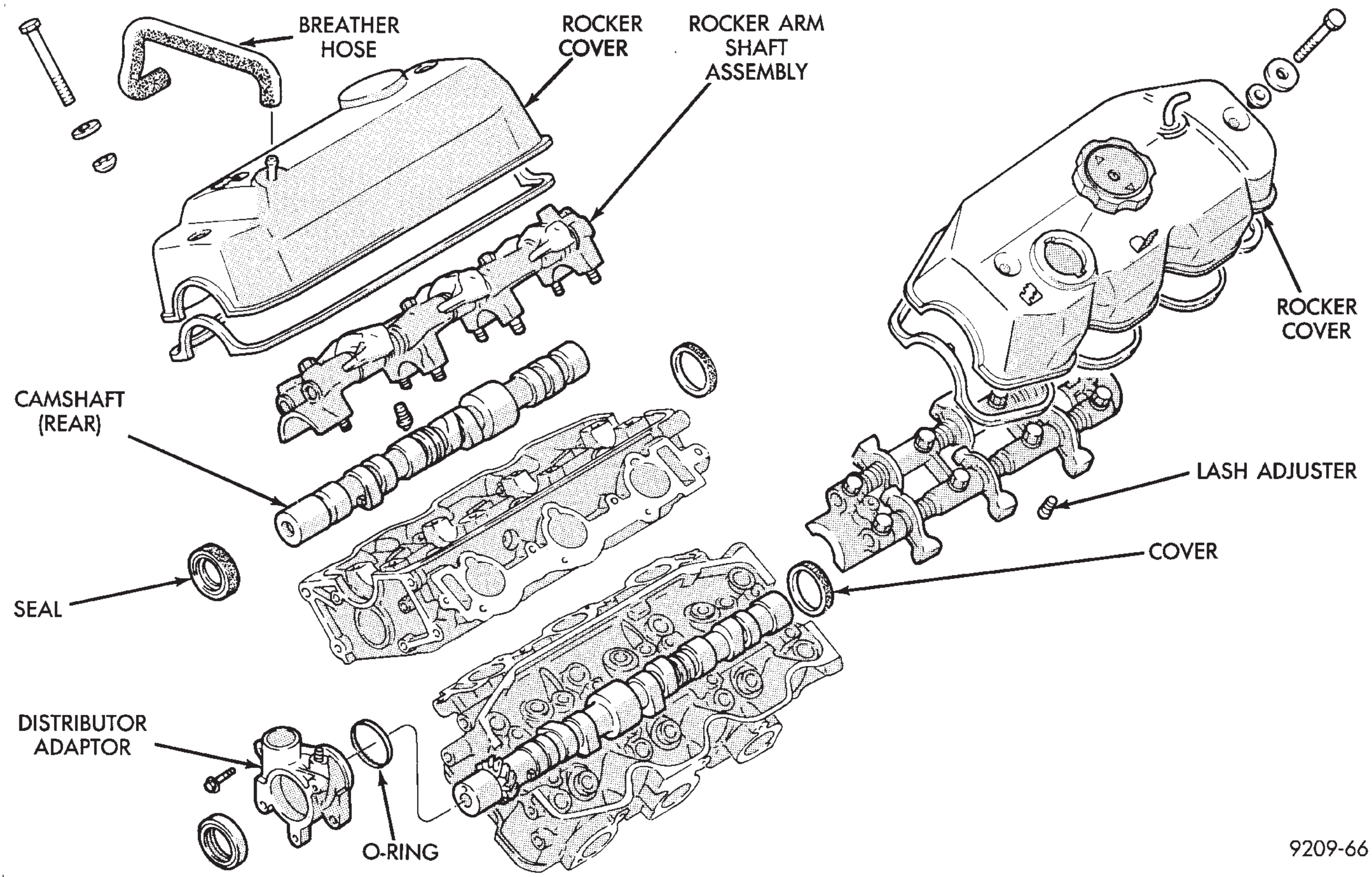


Fig. 27 Cylinder Heads and Camshafts

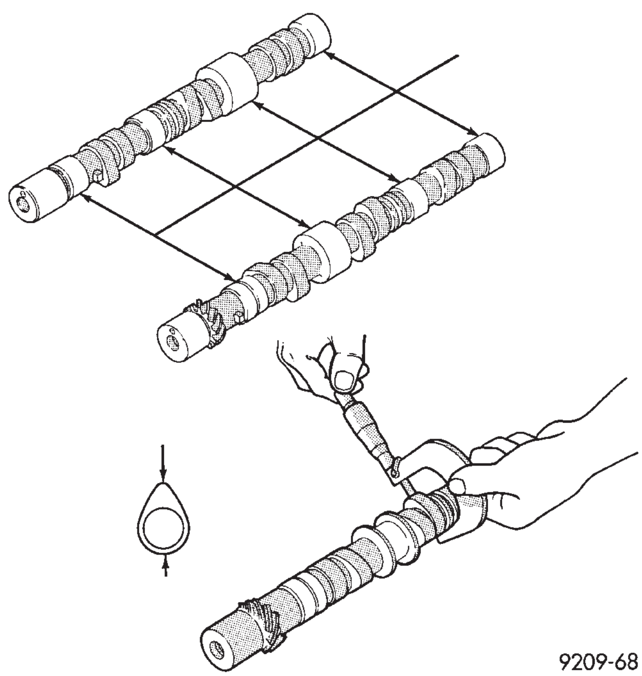


Fig. 28 Checking Camshafts

ROCKER ARMS

INSTALL ROCKER ARM SHAFT ASSEMBLY

(1) Apply Mopar Silicone Rubber Adhesive Sealant at bearing cap ends as shown in (Fig. 29).

(2) Install the rocker arm shaft assembly making sure that the arrow mark on the bearing cap and the arrow mark on the cylinder head are in the same direction (Fig. 29).

NOTE: The direction of arrow marks on the front and rear assemblies are opposite to each other.

(3) Tighten bearing cap bolts in the following order to 10 N·m (85 in. lbs.). First #3, then #2, #1 and #4.

(4) Repeat step 3 increasing the torque to 20 N·m (180 in.lbs.).

(5) Install distributor drive adaptor assembly (Fig. 30).

CAMSHAFT SEAL

CAMSHAFT END SEAL (PLUG)— IN VEHICLE SERVICE

(1) Remove air cleaner assembly from engine.

(2) Use a small punch and a hammer, carefully remove cam plug from cylinder head.

REMOVAL AND INSTALLATION (Continued)

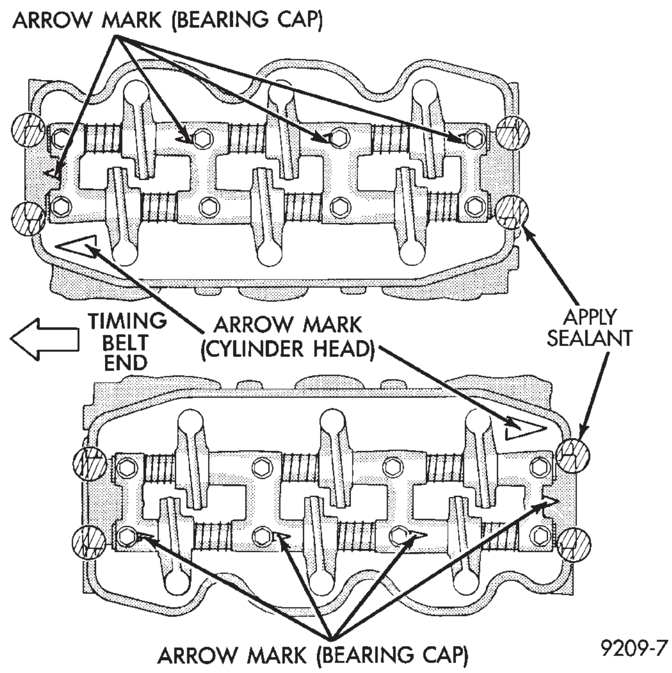


Fig. 29 Rocker Arm Shaft Direction

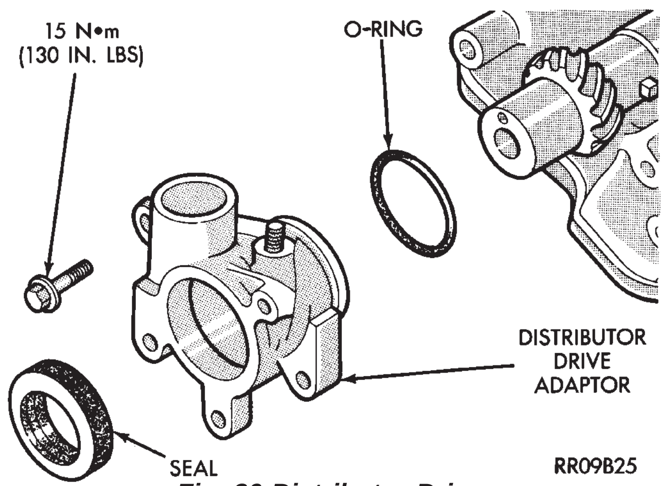


Fig. 30 Distributor Drive

(3) Clean the area of the cylinder head where the new cam plug will be installed.

(4) Apply a light coating of Mopar Silicone Rubber Adhesive Sealant to the outer diameter of the NEW cam plug.

(5) Using a suitable installing tool and a hammer, install the new cam plug to a depth of 0.5 mm (0.020 in.) below the surface of the cylinder head.

(6) Replace air cleaner assembly.

CAMSHAFT OIL SEAL PLUG— OUT OF VEHICLE SERVICE

(1) Apply light coat of engine oil to the camshaft oil seal lip.

(2) Install the oil seal using camshaft oil seal installer tool MD-998713 (Fig. 31).

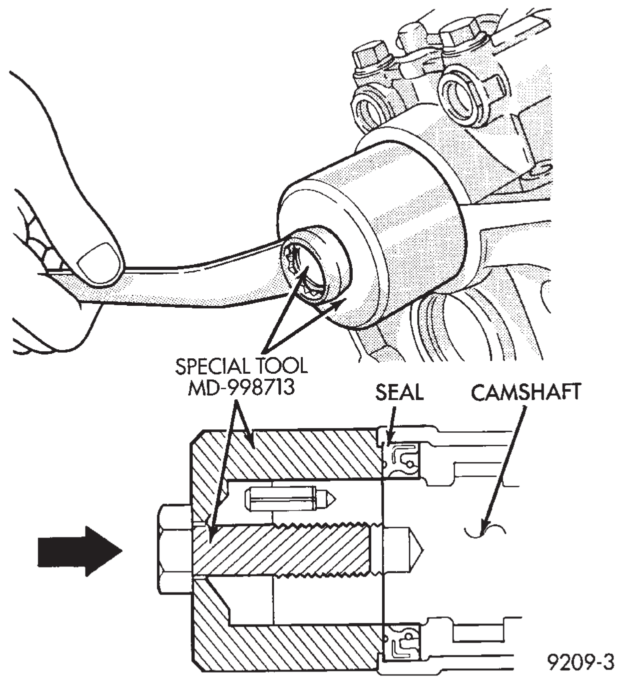


Fig. 31 Camshaft Oil Seal—Installation

CAMSHAFT END SEAL (PLUG) SERVICE — OUT OF VEHICLE SERVICE

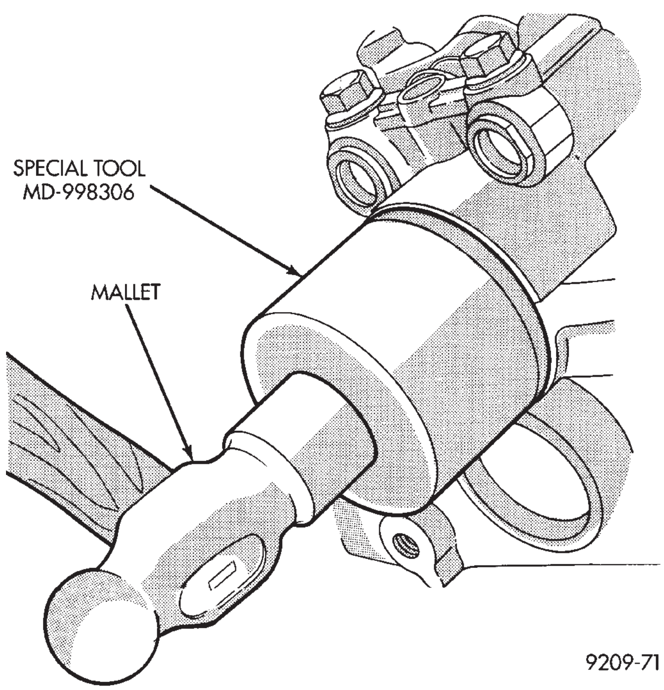


Fig. 32 Camshaft End Seal Plug—Installation

Install end seal plug with Special Tool MD-998306 (Fig. 32).

REMOVAL AND INSTALLATION (Continued)

CYLINDER HEAD

REMOVAL

(1) Remove timing belt and camshaft sprockets. See Timing Belt in this section for procedures.

(2) Remove cylinder head covers and rocker arms and shafts. Refer to procedure outlined in this section.

(3) Remove intake manifolds. Refer to Intake and Exhaust Manifolds, Group 11.

(4) Remove distributor.

(5) Remove exhaust manifolds and cross over Refer to Intake and Exhaust Manifolds, Group 11.

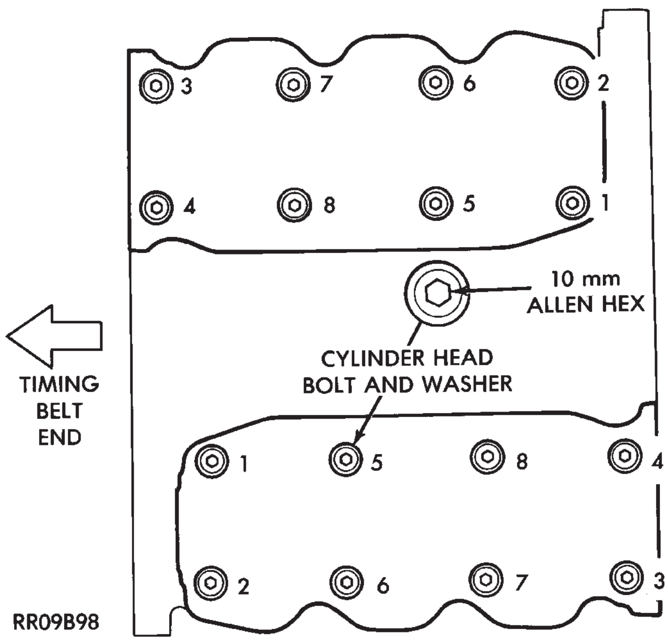


Fig. 33 Cylinder Head Bolt Removal Sequence

(6) Remove cylinder head bolts in sequence shown in (Fig. 33) and remove cylinder head.

INSTALLATION

(1) Clean surfaces of head and block, install head gasket over locating dowels.

(2) Install head on locating dowels.

(3) Install 10 mm Allen hex head bolts with washers.

CAUTION: Attach the cylinder head bolt washer in the direction shown in (Fig. 34).

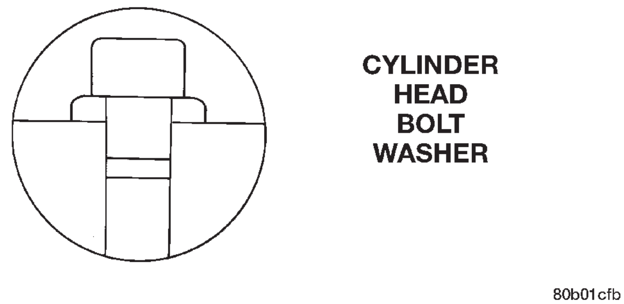


Fig. 34 Cylinder Head Bolt Washer

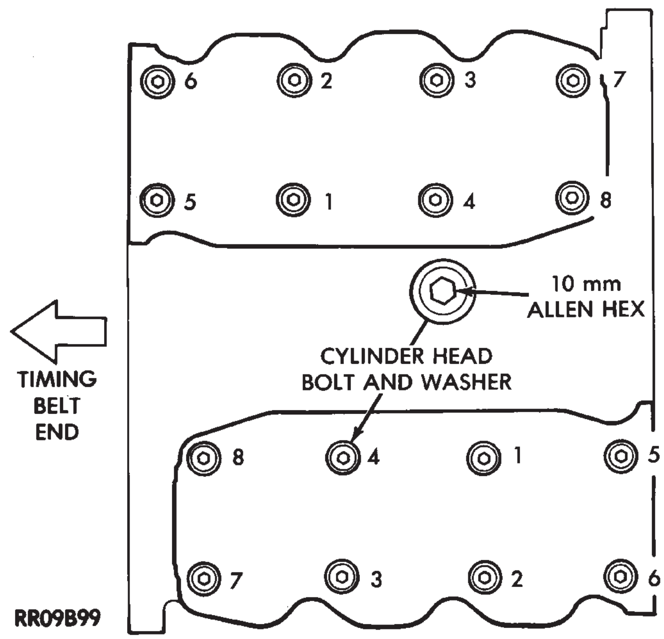


Fig. 35 Cylinder Head Bolt Tightening Sequence

(4) Tighten bolts in the order shown in (Fig. 35). When tightening the cylinder head bolts, tighten gradually, working in two or three steps and finally tighten to specified torque of 108 N·m (80 ft. lbs.).

(5) Install rocker arms and cylinder head covers.

(6) Install camshaft sprockets and timing belt.

(7) Install exhaust manifolds and cross over pipe.

(8) Install distributor.

(9) Install intake manifolds.

REMOVAL AND INSTALLATION (Continued)

TIMING BELT

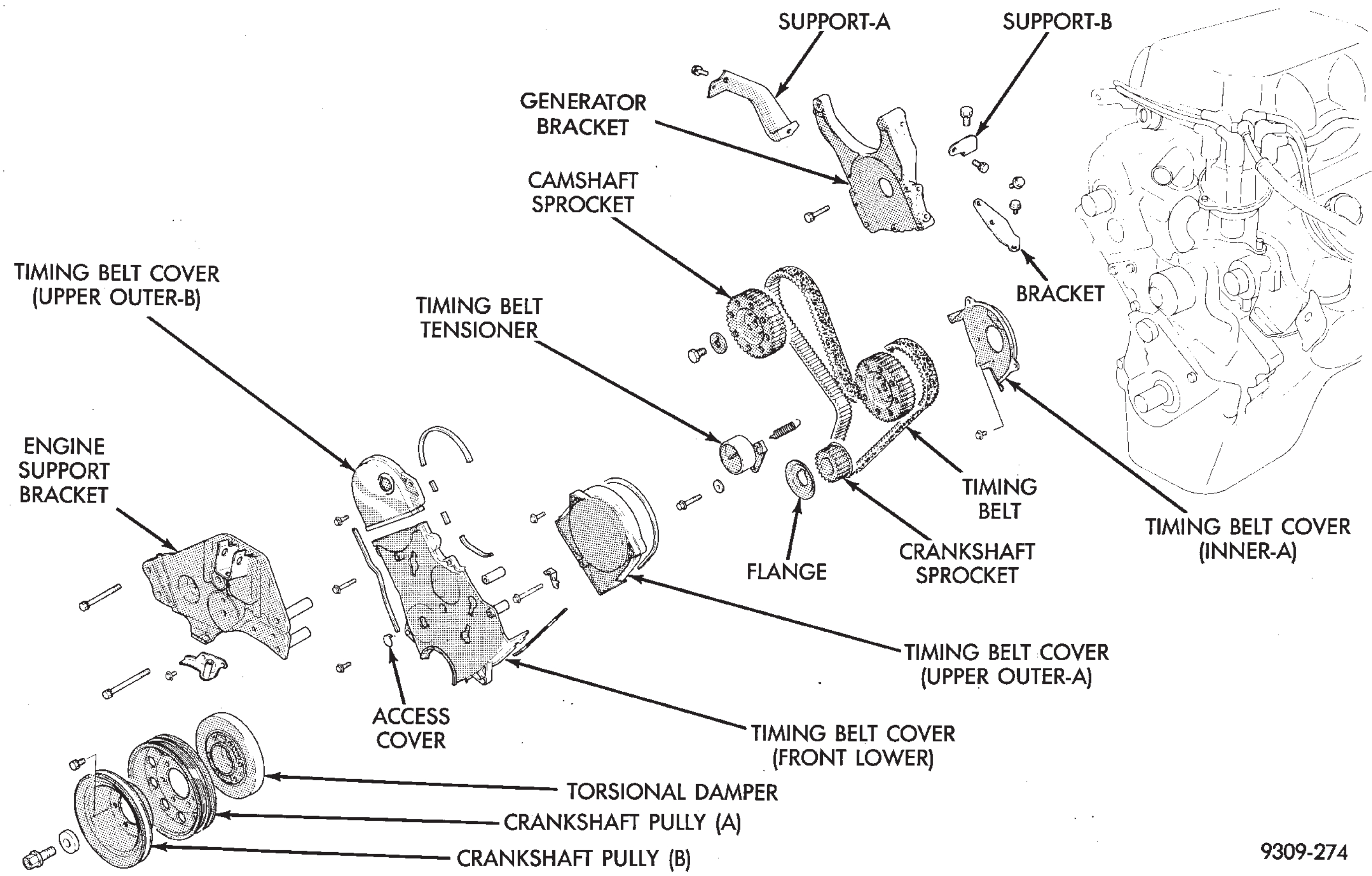


Fig. 36 Timing Belt System

REMOVAL

(1) Mark belt running direction for installation (Fig. 38).

(2) Loosen timing belt tensioner bolt (Fig. 40) and remove timing belt.

(3) Remove crankshaft sprocket flange shield (Fig. 36).

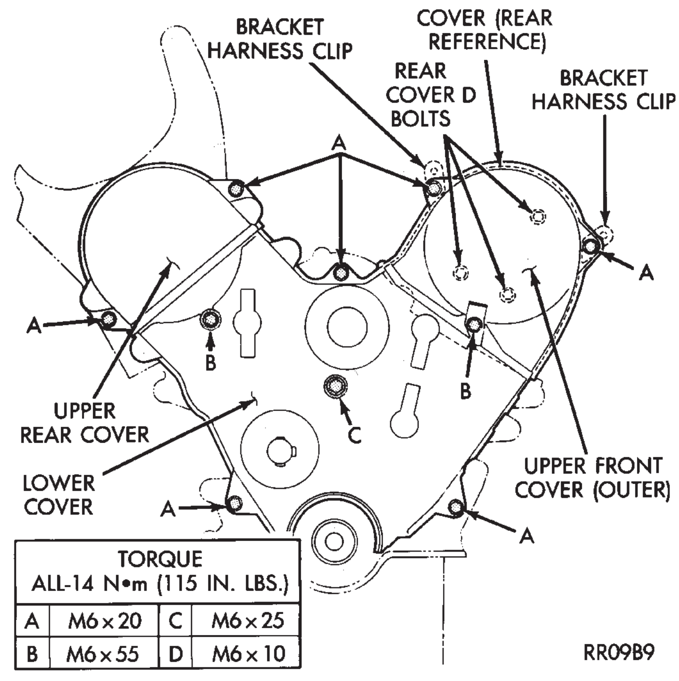


Fig. 37 Timing Belt Covers

REMOVAL AND INSTALLATION (Continued)

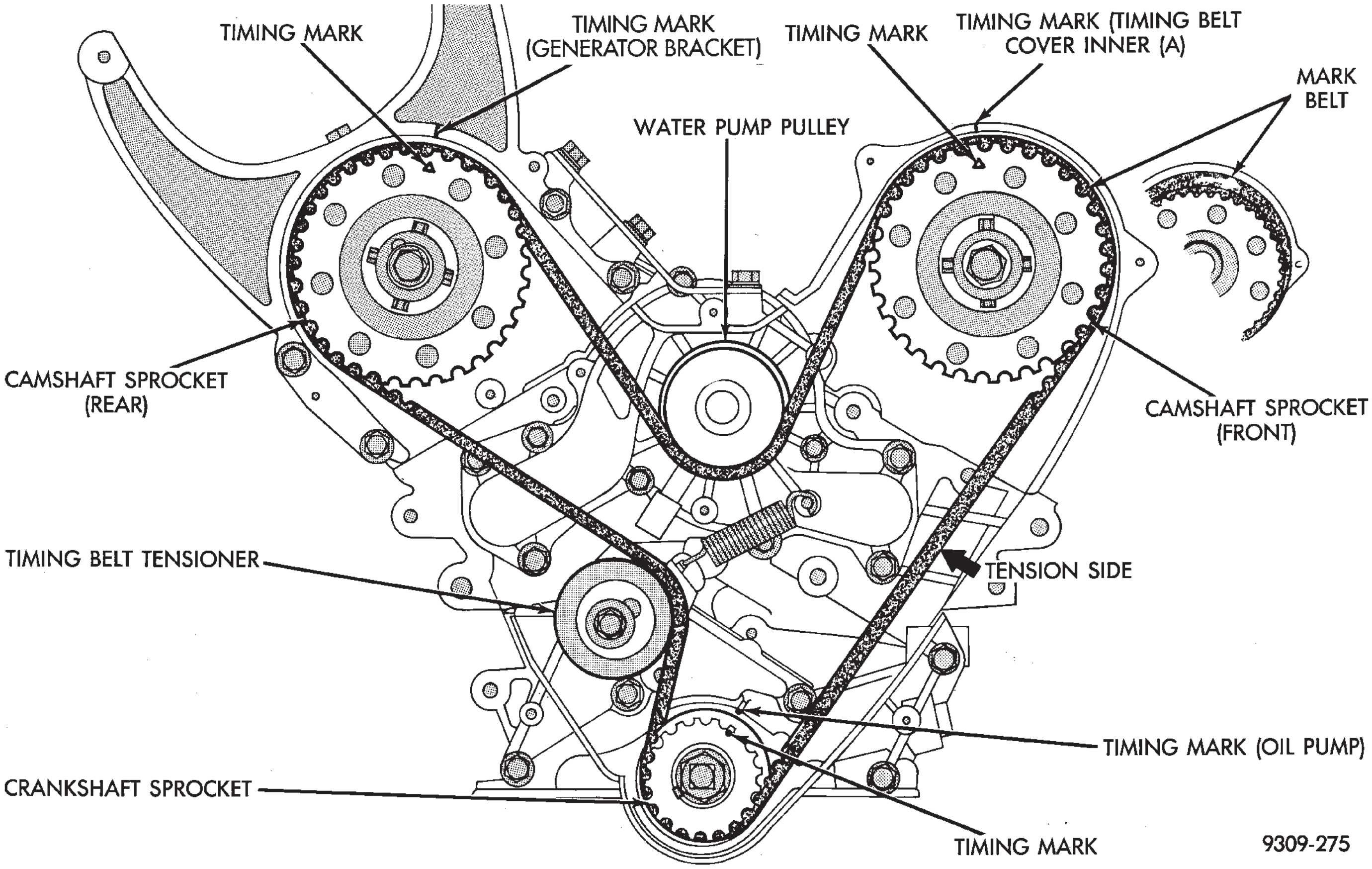


Fig. 38 Timing Belt Engine Sprocket Timing

CAMSHAFT SPROCKETS

To remove camshaft sprockets

1. Hold camshaft sprocket with Spanner Tool MB-990775 loosen and remove bolt and washer (Fig. 39).
2. Remove camshaft sprocket from camshaft.

To install camshaft sprockets

3. Place camshaft sprocket on camshaft.
4. Install bolt and washer to camshaft. Using Spanner Tool MB-990775 hold camshaft sprocket and torque bolt to 95 N·m (70 ft. lbs.) (Fig. 39).

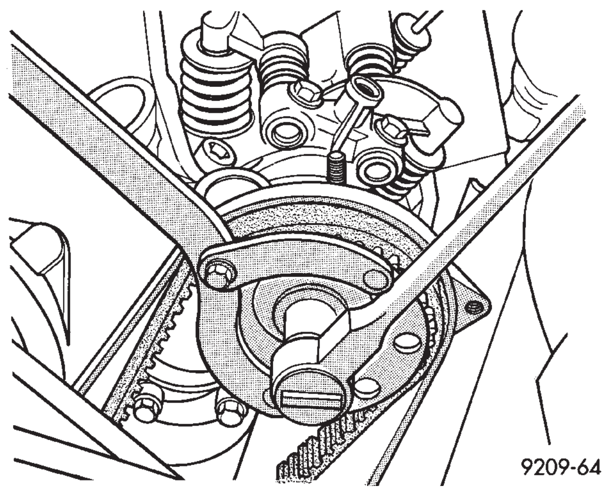


Fig. 39 Camshaft Sprockets

TIMING BELT TENSIONER

(1) Install timing belt tensioner and tensioner spring.

(2) Hook spring upper end to water pump pin and lower end to tensioner bracket with hook out (Fig. 40).

(3) Turn timing belt tensioner counterclockwise full travel in adjustment slot and tighten bolt to temporarily hold this position (Fig. 41).

INSTALLATION—TIMING BELT

(1) Install timing belt on crankshaft sprocket and keep belt tight on tension side (Fig. 38). Install belt on the front (radiator side) camshaft sprocket. Install belt on the water pump pulley, rear camshaft sprocket and finally on the timing belt tensioner.

(2) Rotate the front camshaft sprocket in opposite direction to take up belt slack. Check that all timing marks are aligned (Fig. 38).

(3) Install crankshaft sprocket flange (Fig. 36).

(4) Loosen tensioner bolt and allow spring to tension timing belt.

REMOVAL AND INSTALLATION (Continued)

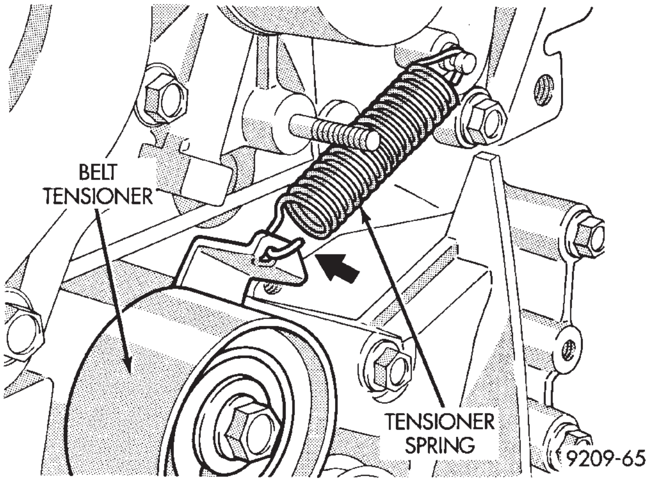


Fig. 40 Timing Belt Tensioner

(5) Turn crankshaft two full turns in clockwise direction. **Turn smoothly and in clockwise direction ONLY.**

(6) Align the timing marks on the sprockets and tighten the timing belt tensioner locking bolt to 25 N·m (250 in. lbs.) torque.

(7) Reassembly belt covers, engine bracket, insulator, crankshaft pulleys, accessories and accessory drive belts in reverse order.

OIL PAN

Oil pan to crankcase sealing is provided with Mopar® Silicone Rubber Adhesive Sealant or equivalent gasket material. See Form-In-Place Gaskets in Standard Service Procedures.

(1) Apply sealant as shown in (Fig. 42).

(2) Install pan and tighten screws to 6 N·m (50 in. lbs.) in sequence shown in (Fig. 43).

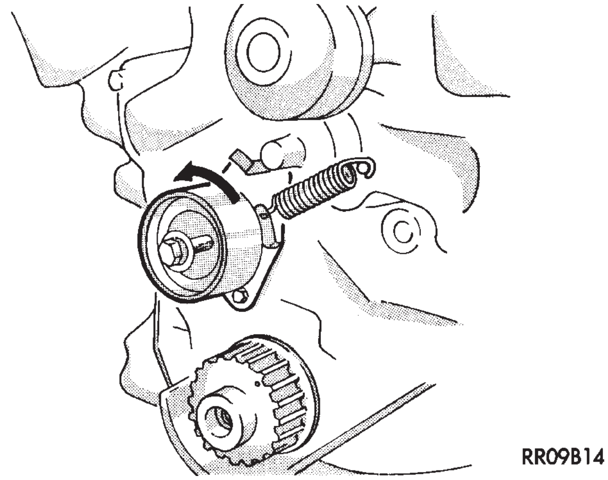


Fig. 41 Positioning Belt Tensioner

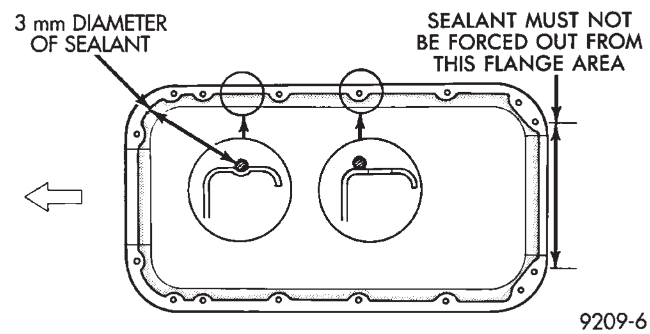


Fig. 42 Oil Pan Sealing

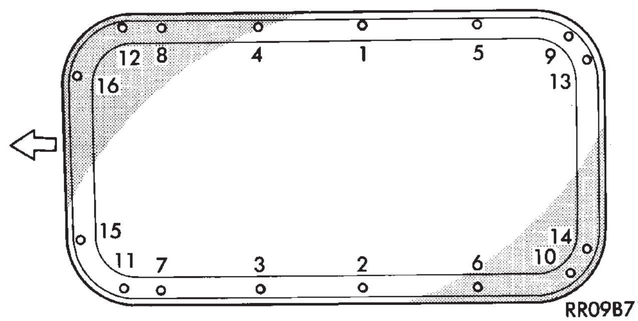


Fig. 43 Oil Pan Screw Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

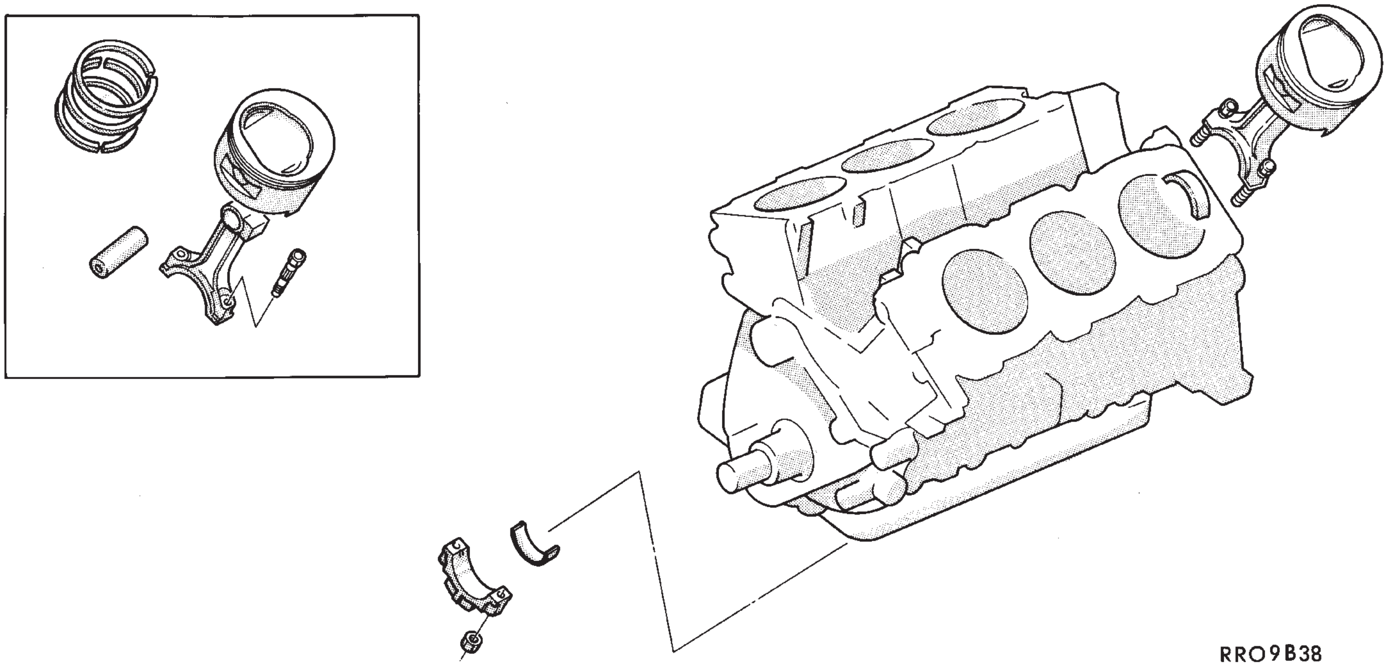


Fig. 44 Pistons and Connecting Rods

PISTON AND CONNECTING ROD

(1) Identify and mark pistons. **The pistons are not interchangeable from bank to bank** (Fig. 45).

(2) Pistons with the letter R and arrow toward the front of engine are to be installed in cylinders 1-3-5. Pistons with the letter L and arrow toward the front of engine are to be installed in cylinders 2-4-6.

(3) Mark connecting rod and cap with cylinder number (Fig. 46).

(4) Remove piston rings (Fig. 47).

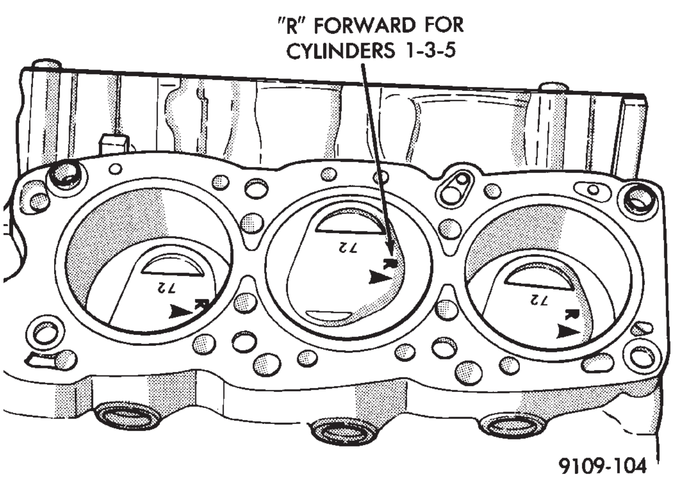


Fig. 45 Mark Pistons

FITTING PISTONS

Measure approximately 2 mm (0.080 in.) above the bottom of the piston skirt and across the thrust face (Fig. 48). See Boring Cylinder in Cylinder Block.

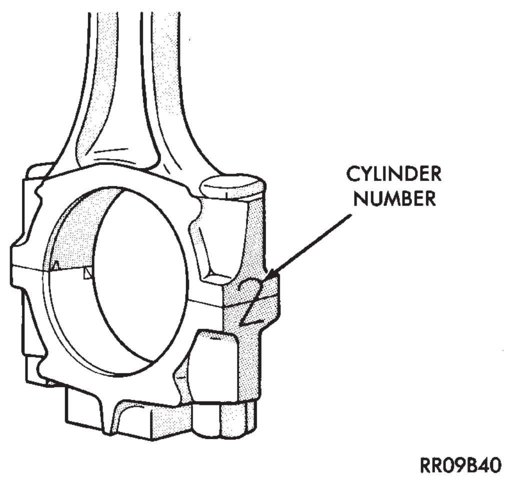


Fig. 46 Mark Matching Parts

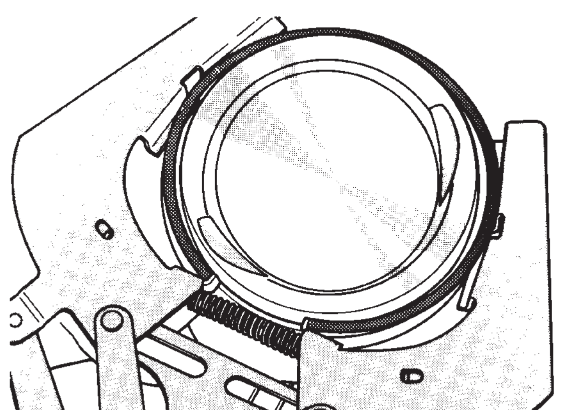


Fig. 47 Remove Piston Rings

REMOVAL AND INSTALLATION (Continued)

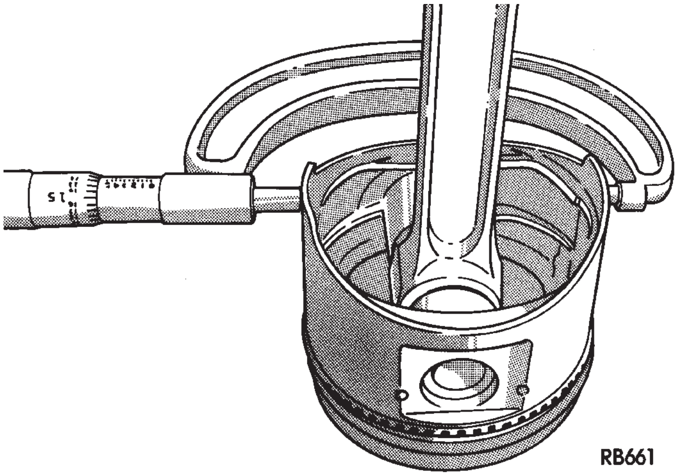


Fig. 48 Piston Clearance and Wear

FITTING PISTON RINGS

(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 16 mm (0.63 in.) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 49). Refer to Piston Ring Specification Chart.

(2) Check piston ring to groove clearance (Fig. 50). Refer to Piston Ring Specification Chart.

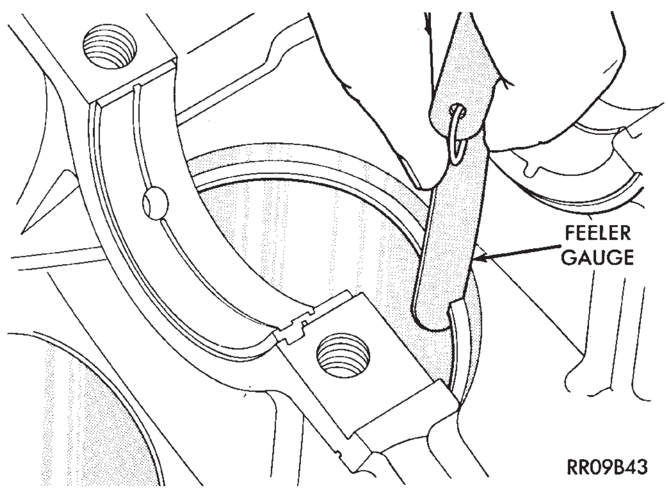


Fig. 49 Check Gap on Piston Rings

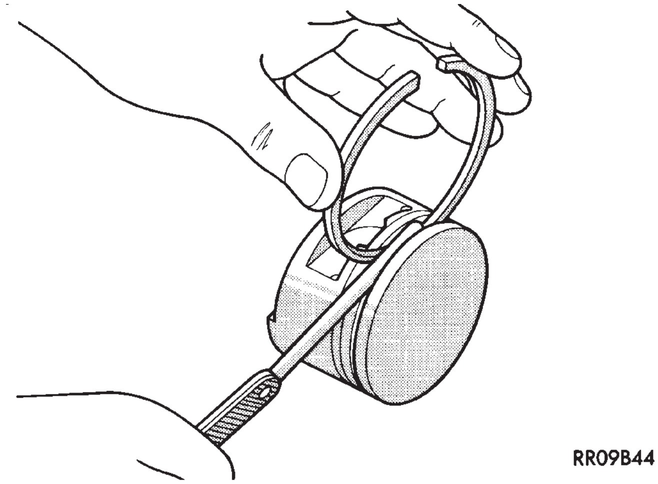


Fig. 50 Piston Ring Clearance

PISTON RINGS—INSTALLATION

(1) The No. 1 and No. 2 piston rings have a different cross section. Install rings with manufacturers mark and size mark facing up, to the top of the piston (Fig. 51).

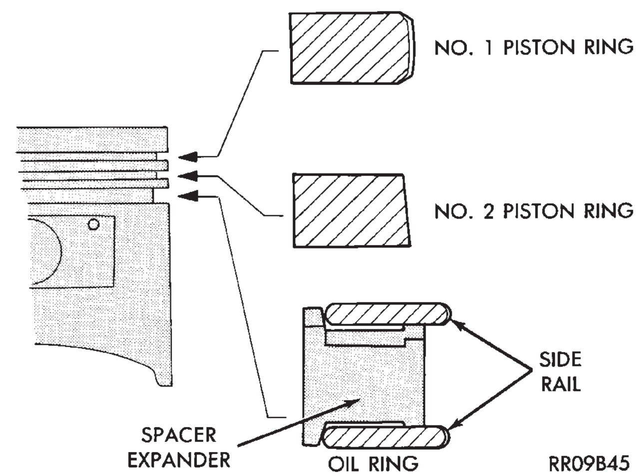


Fig. 51 Piston Ring—Installation

CAUTION: Install piston rings in the following order:

a. Oil ring expander.
b. Upper oil ring side rail.

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Ring Gap Wear Limit	Groove Clearance	Maximum Groove Clearance
Upper Ring	0.30 - 0.45 mm (0.012 - 0.018 in.)	0.8 mm (0.031 in.)	0.05 - 0.09 mm (0.002 - 0.0035 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.25 - 0.40 mm (0.010 - 0.016 in.)	0.8 mm (0.031 in.)	0.02 - 0.06 mm (0.0007 - 0.002 in.)	0.10 mm (0.004 in.)
Oil Control Ring	0.30 - 0.90 mm (0.012 - 0.035 in.)	1.0 mm (0.039 in.)	Oil Ring Side Rails Must Be Free To Rotate After Assembly	

REMOVAL AND INSTALLATION (Continued)

c. Lower oil ring side rail.
d. No. 2 Intermediate piston ring.
e. No. 1 Upper piston ring.

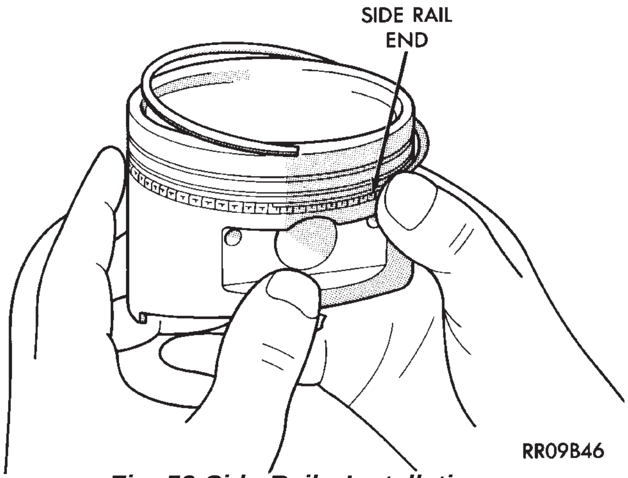


Fig. 52 Side Rail—Installation

(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. 52).

(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. 53).

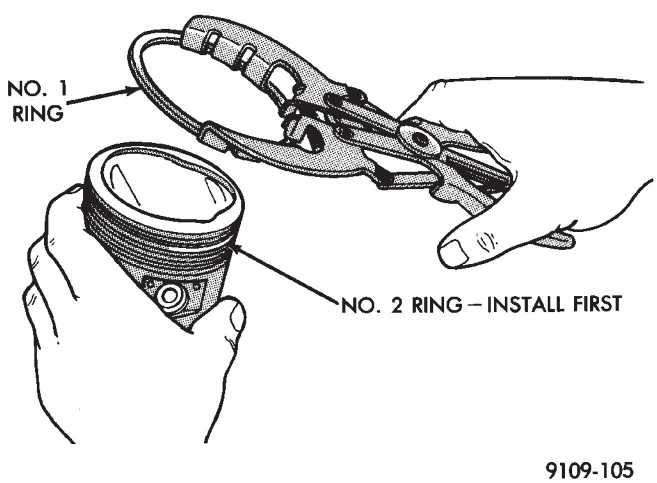


Fig. 53 Installing Upper and Intermediate Rings

(5) Position piston ring end gaps as shown in (Fig. 54).

(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.

(7) Connecting rod front mark 72 must always face forward, toward timing belt end. (Fig. 55)

(8) Install the piston and connecting rod assembly into there respective bore from the cylinder block top.

CAUTION: Piston assemblies are not to be interchanged from bank to bank.

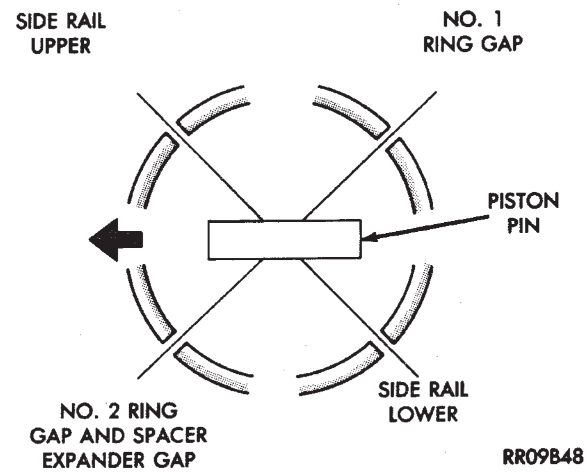


Fig. 54 Piston Ring End Gap Position

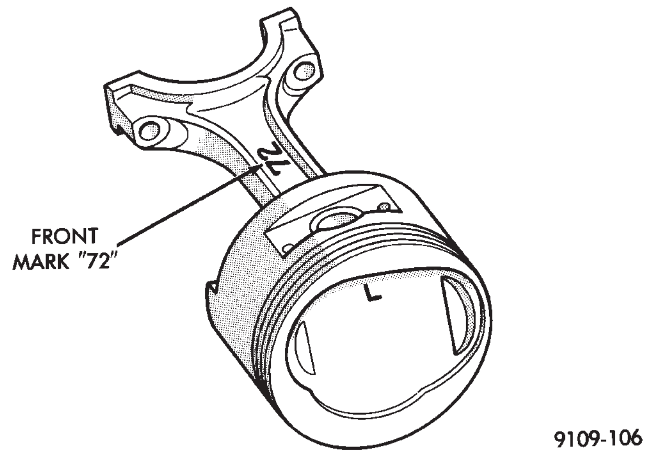


Fig. 55 Identify Piston and Rod Assembly for Cylinder Installation

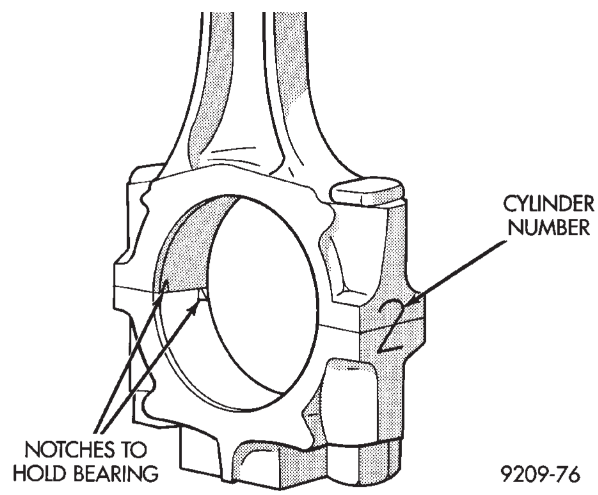


Fig. 56 Connecting Rod and Cap

(9) Check alignment marks made during disassembly and that bearing position notches new or used are on the same side as shown in (Fig. 56).

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT

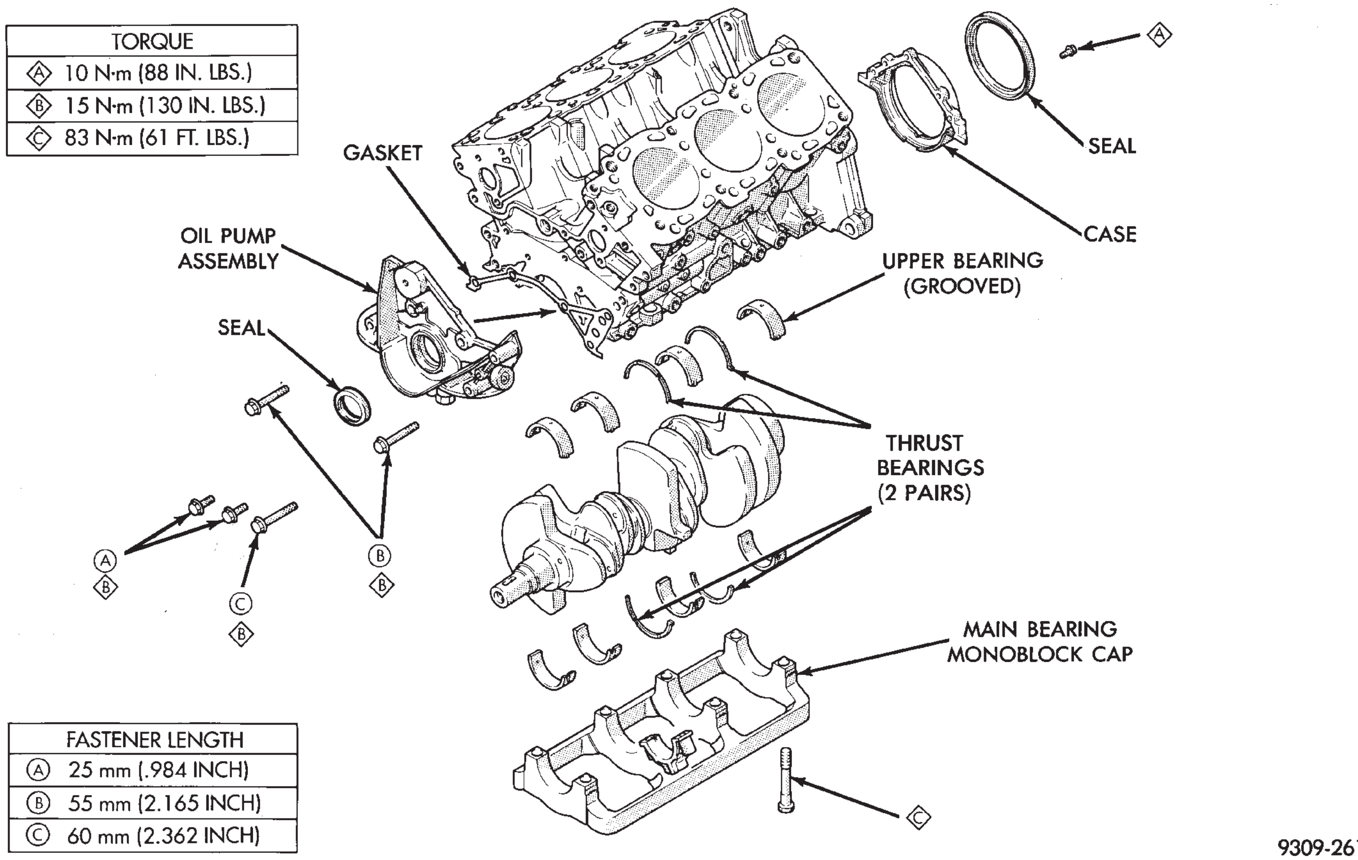


Fig. 57 Crankshaft and Cylinder Block

REMOVAL

(1) Remove front mounted oil pump assembly and gasket (Fig. 57) and (Fig. 58).

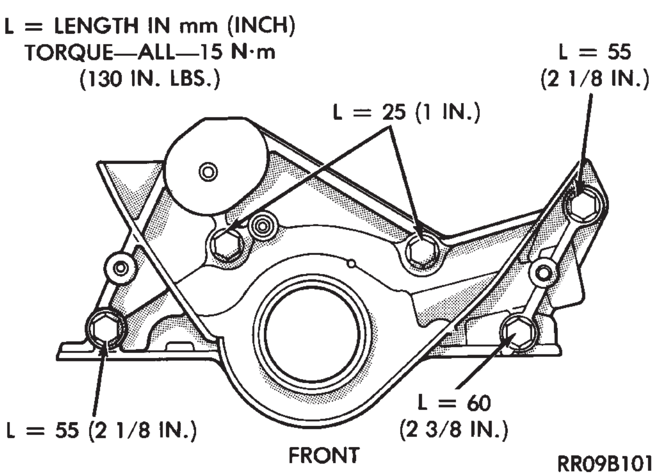


Fig. 58 Oil Pump Assembly

(2) Remove rear oil seal retainer and seal as assembly (Fig. 59).

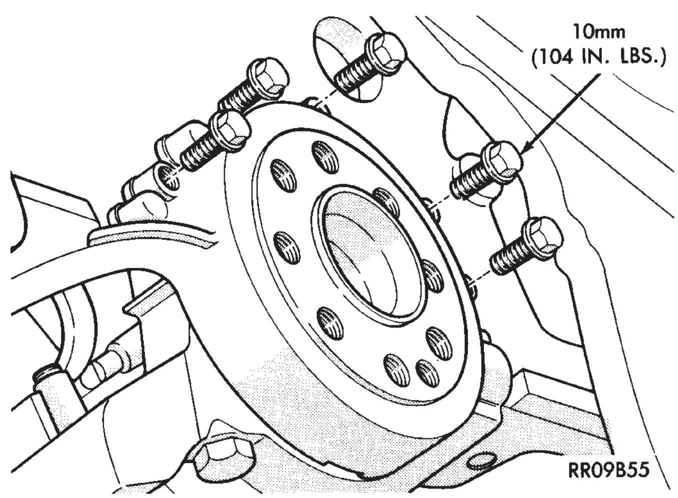


Fig. 59 Rear Seal Assembly

(3) Release mono-block main bearing cap bolts evenly. Remove lower bearing shells and identify for reassembly.

(4) Lift out crankshaft and remove upper thrust washers from each side of number three main bearing in the crankcase (Fig. 57).

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT BEARINGS—INSTALLATION

(1) Install upper main bearing shells making certain oil holes are in alignment, and bearing tabs seat in block tabs. All upper bearings have oil grooves (Fig. 60).

(2) **THRUST BEARINGS.** Crankshaft thrust bearings (washers) are installed at journal #3 separately from the radial bearings. Thrust bearings shown in (Fig. 60) are different, one has end positioning tabs, while the other is plain. One **pair** of each thrust washers are installed into the block and one **pair** into the main bearing cap (Fig. 60).

(3) Apply a thin film of grease to plain side of thrust washers and position them on each side of number three main bearing. Grooved surface towards crankshaft.

(4) Oil the bearings and journals and install crankshaft.

(5) Install lower main bearing shells without oil grooves in mono-block cap.

(6) Install one pair of thrust washers in cap. Refer to Thrust Bearings (Fig. 60).

(7) Carefully install bearing cap with arrows (Fig. 61) toward timing belt end.

(8) Oil the bearing cap bolt threads, install and tighten bolts progressively in sequence shown in (Fig. 61) to 80 N·m (60 ft. lbs.) torque.

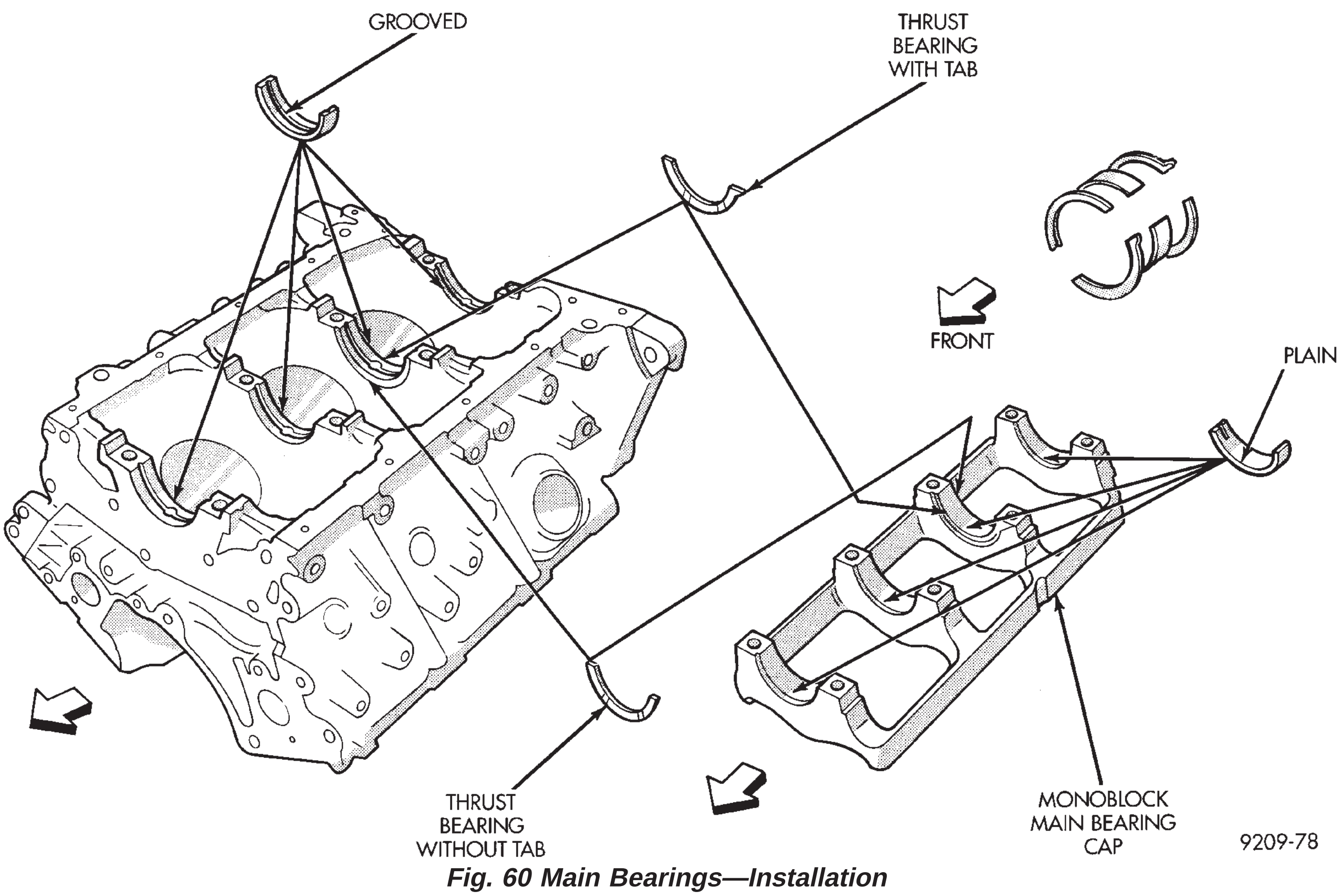


Fig. 60 Main Bearings—Installation

REMOVAL AND INSTALLATION (Continued)

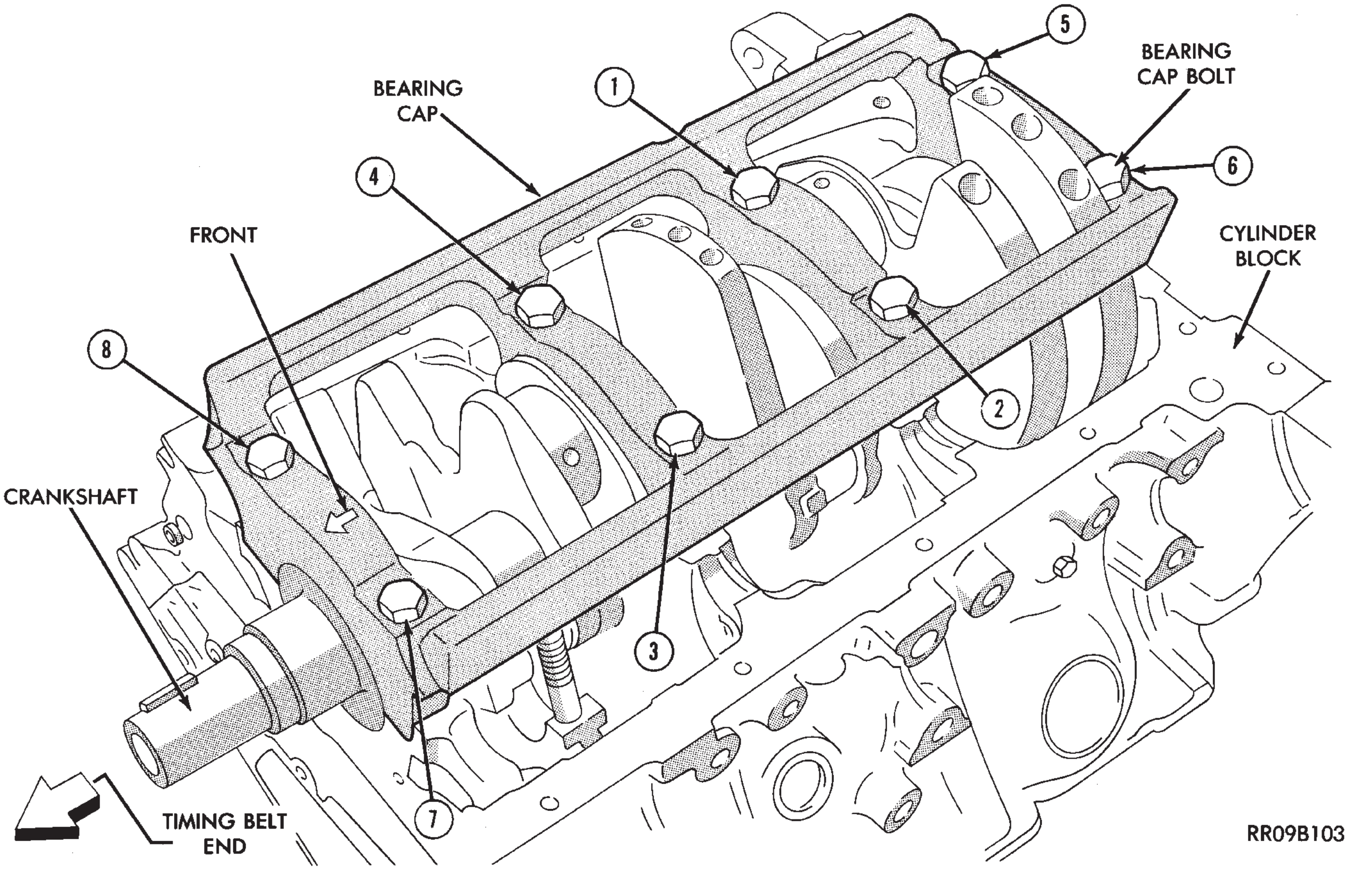


Fig. 61 Crankshaft Main Bearing Cap

REAR CRANKSHAFT SEAL

REAR CRANKSHAFT SEAL RETAINER

(1) Install rear crankshaft oil seal in housing with Special Tool MD-998718 (Fig. 62).

(2) Apply Mopar Silicone Rubber Adhesive Sealant or equivalent to oil seal housing (Fig. 63) per procedure detailed in form-in-place gasket section in Standard Service Procedures.

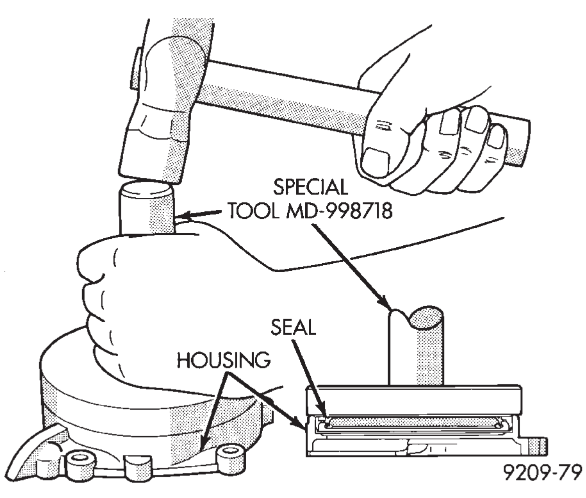


Fig. 62 Rear Crankshaft Oil Seal—Installation

(3) Apply light coating of engine oil to the entire circumference of oil seal lip.

(4) Install seal assembly on cylinder block and tighten bolts to 12 N·m (104 in. lbs.)

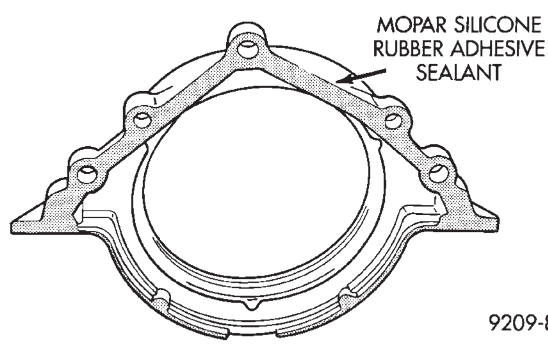


Fig. 63 Apply Sealant to Oil Seal Housing

FRONT CRANKSHAFT OIL SEAL

(1) Install oil pump gasket and oil pump case (Fig. 65) and (Fig. 64).

CAUTION: Install bolts, depending on length in locations shown in (Fig. 64).

(2) Using front crankshaft oil seal installer Special Tool MD-998717 install oil seal in oil pump (Fig. 65).

REMOVAL AND INSTALLATION (Continued)

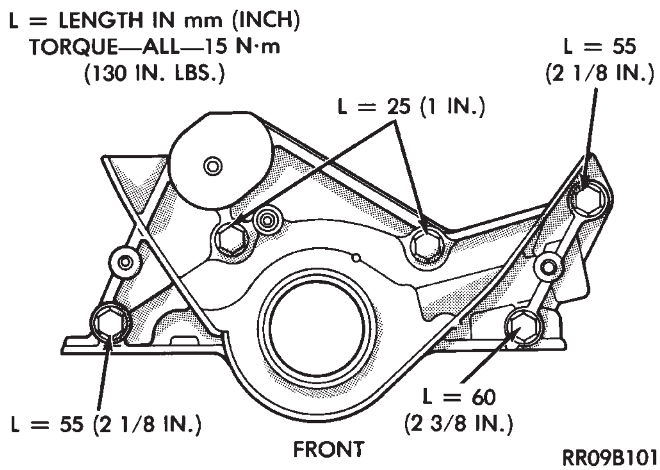


Fig. 64 Oil Pump

OIL PUMP

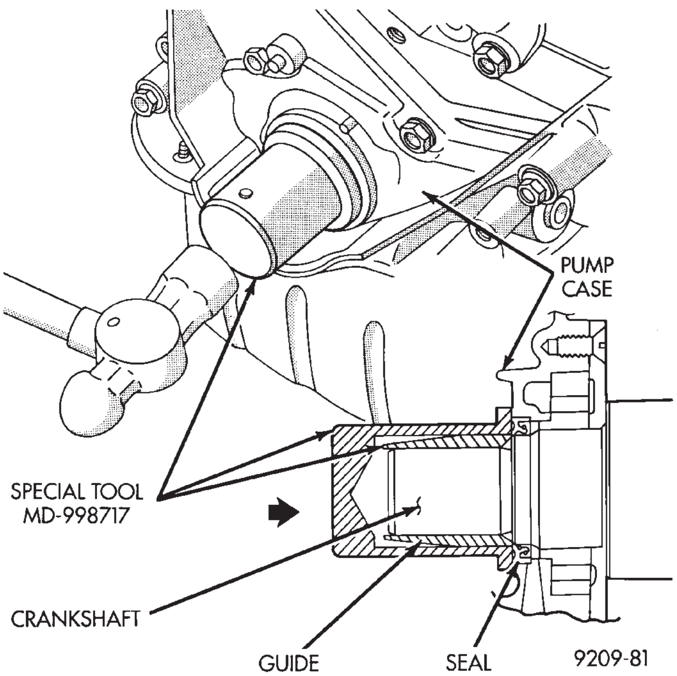


Fig. 65 Front Crankshaft Oil Seal—Installation

REMOVAL

1. Remove accessory drive belts. Refer to Accessory Drive Belts Group 7, Cooling System.
2. Remove Timing Belt. Refer to procedure in this section.
3. Remove 5 bolts that attach oil pump to block (Fig. 66).

INSTALLATION

(1) Clean block and pump surfaces.
(2) Install new gasket (Fig. 67) make sure correct length bolts are used (Fig. 66).
(3) Torque bolts to 13 N·m (120 in. lbs.).

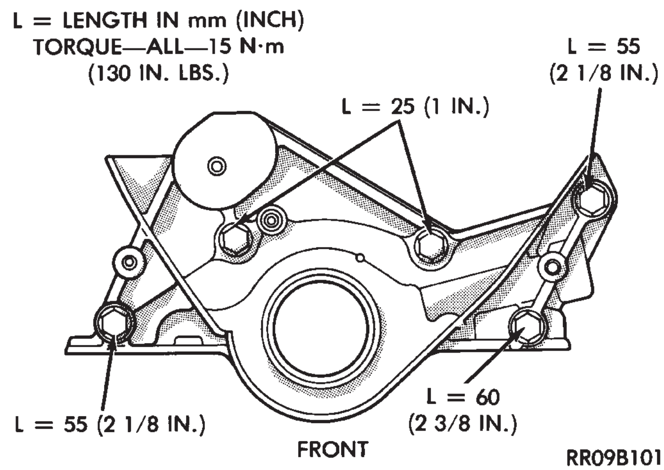


Fig. 66 Oil Pump Assembly

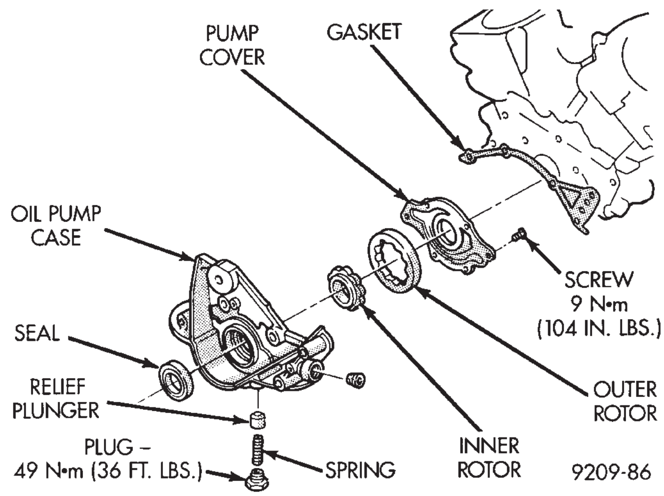


Fig. 67 Oil Pump Components

OIL FILTER AND ADAPTOR

(1) Check the oil filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber (Fig. 68).
(2) Check adaptor for cracks and oil leaks.

CAUTION: When servicing the oil filter avoid deforming the filter. Install the remove/install tool band strap against the can-to-base lock seam. The lock seam joining the can-to-base is reinforced by the base plate.

(3) Using Tool C-4065, turn filter counterclockwise to remove from base. Properly discard filter.
(4) Wipe base clean, then inspect gasket contact surface.
(5) Lubricate gasket of new filter with clean engine oil.

REMOVAL AND INSTALLATION (Continued)

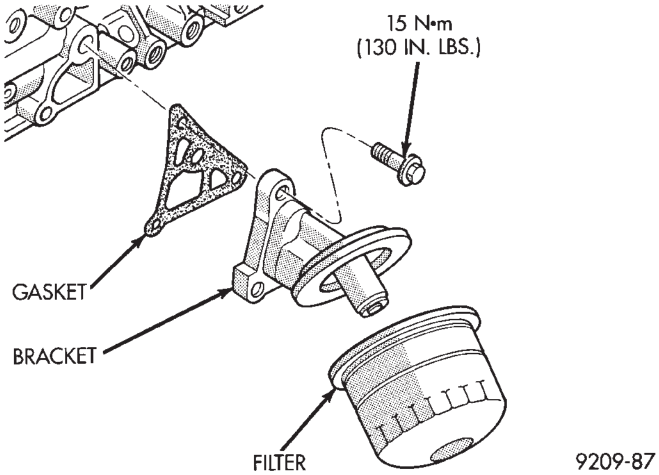


Fig. 68 Oil Filter and Adaptor

(6) Install new filter until gasket contacts base. Tighten filter 1 turn or 20 N·m (15 ft. lbs.). Use filter wrench if necessary.

(7) Start engine and check for leaks.

DISASSEMBLY AND ASSEMBLY

ROCKER ARMS AND SHAFTS

(1) Check rocker arms for wear or damage (Fig. 69). Replace as necessary. Also see Auto Lash Adjuster.

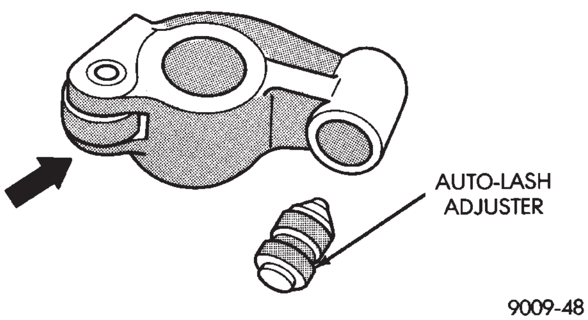


Fig. 69 Inspect Rocker Arms

ROCKER ARM SHAFTS

The rocker arm shaft is hollow and is used as a lubrication oil duct. The rocker arm shaft on the **inlet** side has a 3 mm (0.188 in.) diameter oil passage hole from the cylinder head. The **exhaust** side **does not** have this oil passage (Fig. 70).

(1) Check the rocker arm mounting portion of the shafts for wear or damage. Replace if heavily damaged or worn.

(2) Check oil holes for clogging with small wire, clean as required (Fig. 70).

REASSEMBLE

(1) Align the camshaft bearing caps with arrows (depending on cylinder bank) directed as shown in

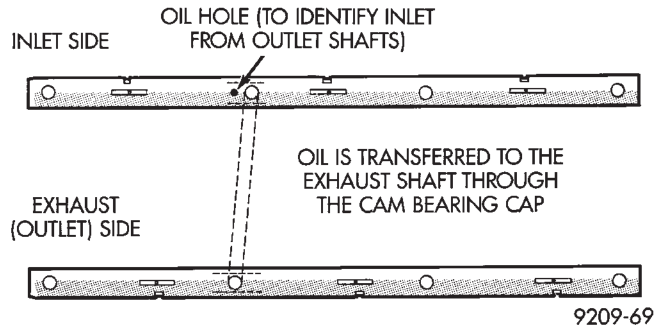


Fig. 70 Rocker Arm Shaft Identification

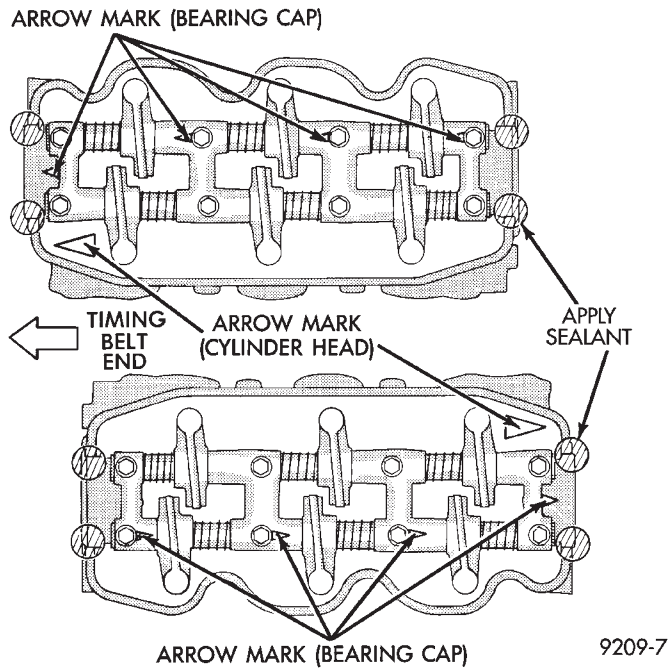


Fig. 71 Camshaft Bearing Caps Position

(Fig. 71) and in numerical order. Identify number one bearing cap number one and number four caps are similar (Fig. 72).

(2) Install rocker shafts so that bearing cap number one with end notches positioned as shown in (Fig. 72) that the machined portion of the rocker shaft is facing down.

(3) Install attaching bolts to retain assembly.

ASSEMBLE ROCKER ASSEMBLY

Install the rocker arms, bearing caps and springs. **Springs are the same and can be used at all locations** on the rocker arm shafts (Fig. 71) and (Fig. 73). Insert bolts in number four bearing cap to retain assembly.

DISASSEMBLY AND ASSEMBLY (Continued)

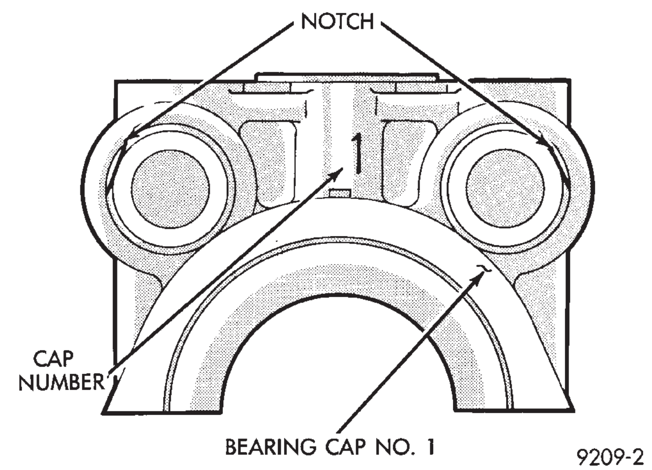


Fig. 72 Number One Camshaft Bearing Cap

CLEANING AND INSPECTION

TIMING BELT

INSPECTION

(1) Remove the upper front outer timing belt cover by loosening the three attaching bolts (Fig. 75).

(2) Inspect both sides of the timing belt drive & back. Replace belt if any of the following conditions exist:

- Rubber back side is glossy, hardened back without resilience and leaves no indent when pressed with fingernail.
- Cracks on rubber back.
- Cracks or peeling of canvas.
- Cracks on rib root.
- Missing teeth.
- The sides are normal if they are sharp as if cut by a knife (Fig. 74).

NOTE: If none of the above conditions are seen on the belt, the belt cover can be installed.

CYLINDER HEAD

CLEANING AND INSPECTION

(1) Before cleaning, check for leaks, damage and cracks.

(2) Clean cylinder head and oil passages.

(3) Check cylinder head for flatness (Fig. 76).

(4) Cylinder head must be flat within:

- Standard dimension = less than 0.05 mm (.002 in.)
- Service Limit = 0.2 mm (.008 in.)
- Grinding Limit = Maximum of 0.2 mm (.008 in.) is permitted.

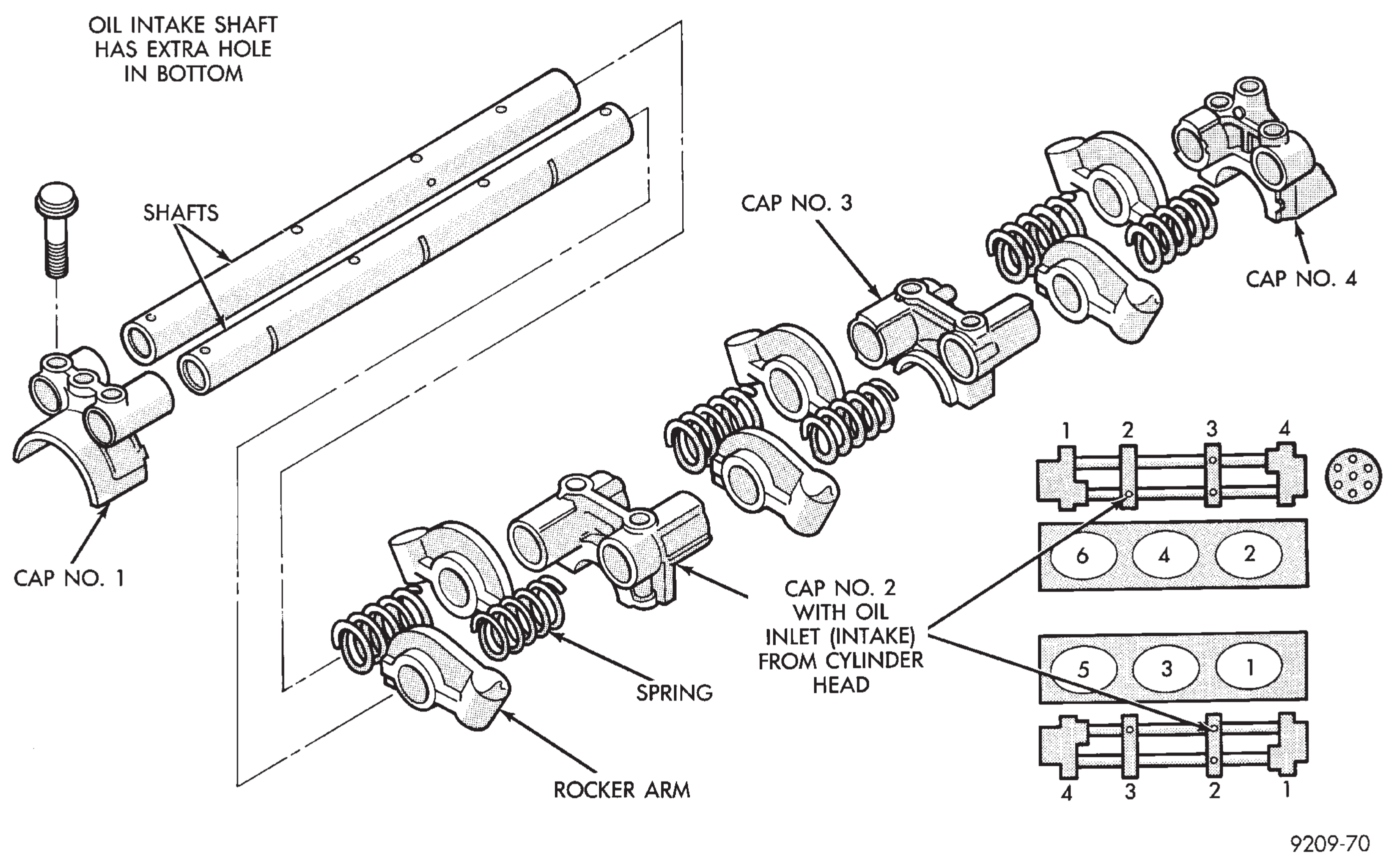


Fig. 73 Rocker Arm and Shafts

CLEANING AND INSPECTION (Continued)

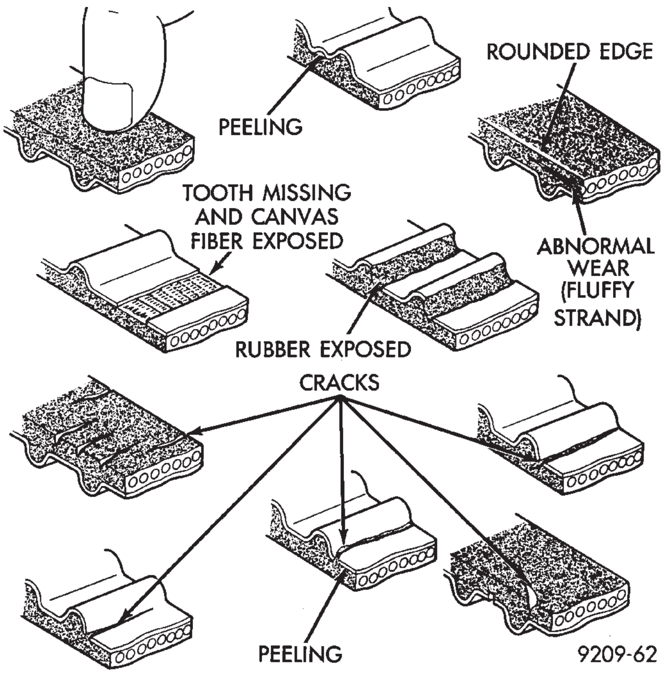


Fig. 74 Timing Belt Inspection

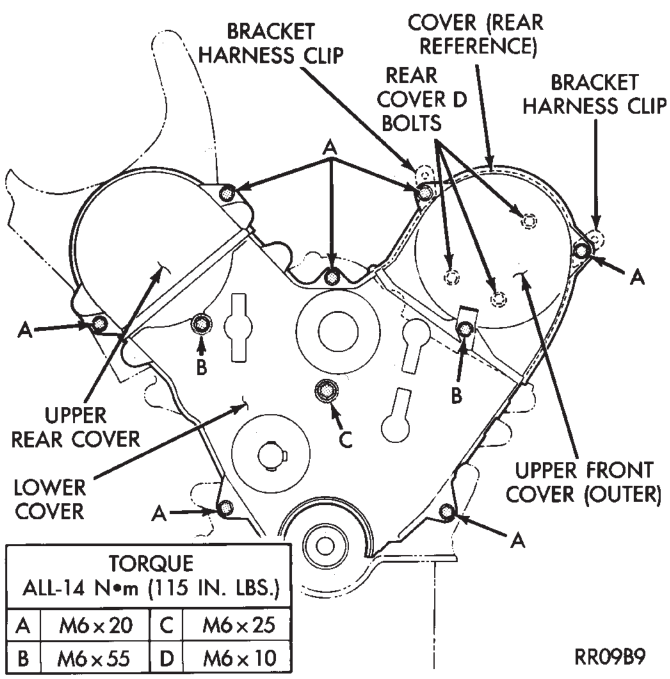


Fig. 75 Timing Belt Covers

CAUTION: This is a combined total dimension of stock removal from cylinder head if any and block top surface.

CYLINDER BORE

INSPECTION

(1) Measure the cylinder bore at three levels in directions A and B (Fig. 77). Top measurement should be 12 mm (0.50 in.) down and bottom measurement should be 10 mm (0.38 in.) up.

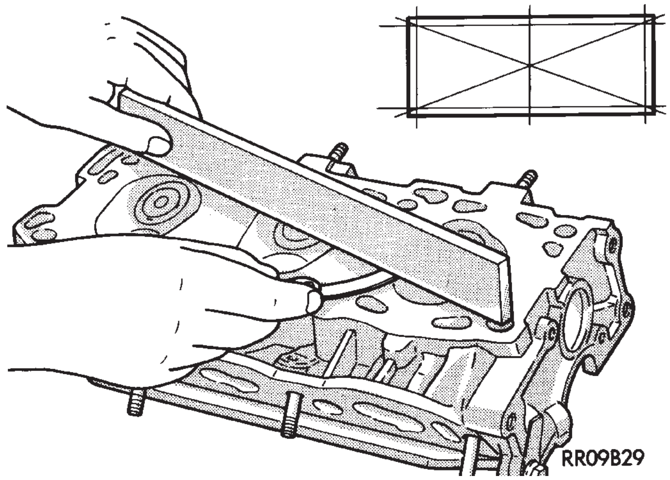


Fig. 76 Check Cylinder Head

(2) Standard bore dimension: 91.1 mm (3.587 in.)

(3) Maximum out-of-round or taper: 0.02 mm (0.0008 in.).

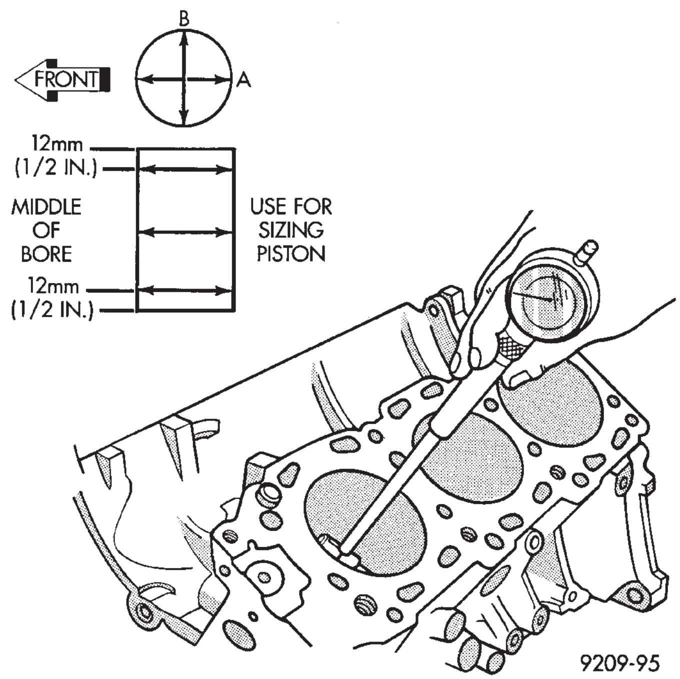


Fig. 77 Checking Cylinder Bore Size

OIL PUMP

(1) Check oil pump case for damage. Remove rear oil pump cover.

(2) Remove pump rotors and inspect case for excessive wear.

(3) Measure clearance between case and inner rotor (Fig. 78).

(4) Insert the rotor into the oil pump case and measure clearance between outer rotor and case with a feeler gauge (Fig. 79). Replace if out of specifications.

CLEANING AND INSPECTION (Continued)

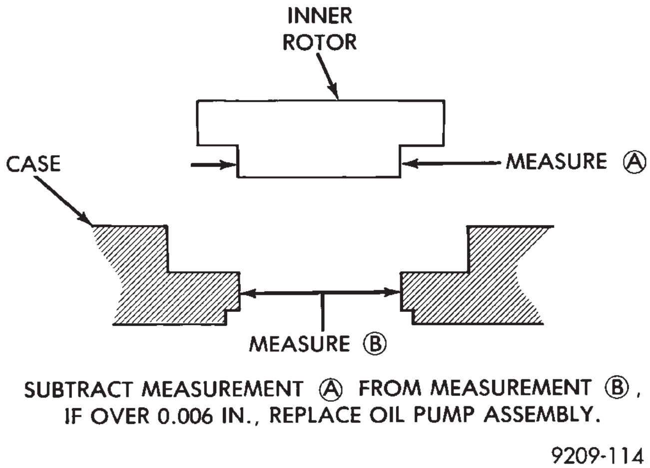


Fig. 78 Inner Rotor to Case

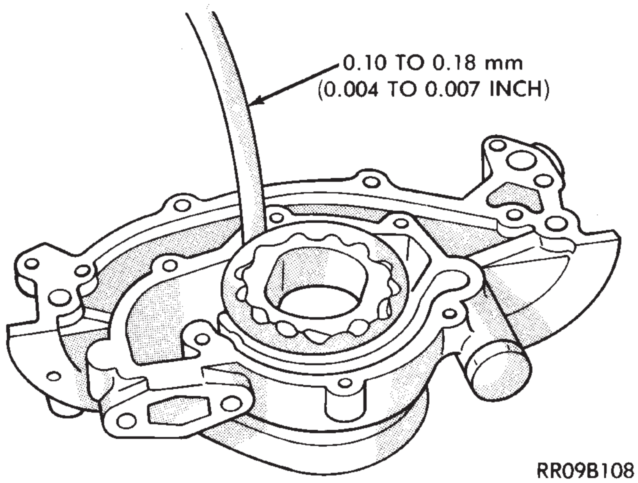


Fig. 79 Measuring Clearance Between Outer Rotor and Case

(5) Using a feeler gauge, measure clearance between inner rotor tip and outer rotor (Fig. 80). Clearance specification is: 0.06 - 0.18 mm (0.003 - 0.007 in.). Replace both rotors if not within specifications

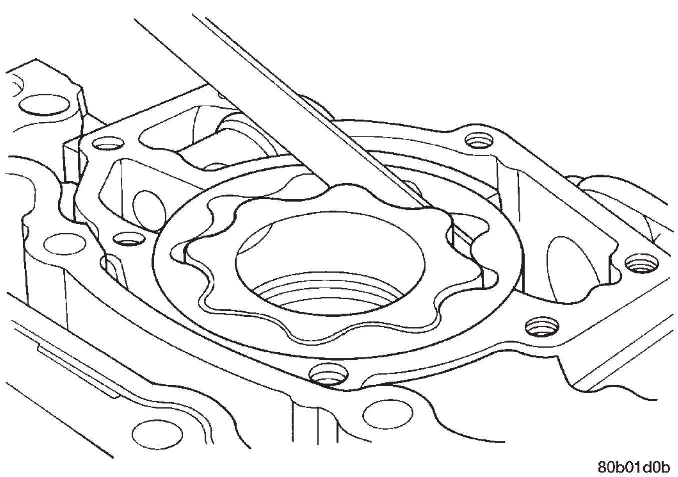


Fig. 80 Measuring Clearance Between Rotors

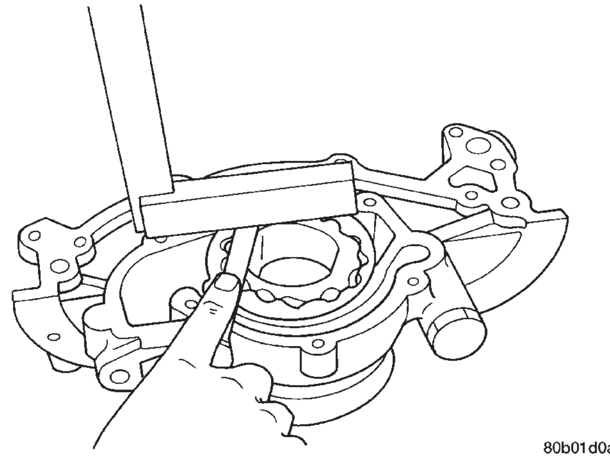


Fig. 81 Measuring Clearance Over Rotors

(6) Place a straightedge across face of pump housing (Fig. 81). Clearance specification is: 0.04 - 0.10 mm (0.0015 - 0.0039 in.). Replace oil pump assembly if not within specifications.

OIL RELIEF PLUNGER

(1) Check that the oil relief plunger slides smoothly.

(2) Check for broken relief spring.

ADJUSTMENTS

ENGINE MOUNTS

ENGINE MOUNT INSULATOR ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine mount insulator vertical fastener and the fore and aft fasteners, and the front engine mount bracket to front crossmember screws.

(3) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshafts for driveshaft identification and related assembly length measuring.

(4) Tighten engine mounts and fasteners in the following order:

(a) Right engine mount insulator vertical bolts to 102 N·m (75 ft. lbs.) and the fore and aft bolts to 150 N·m (110 ft. lbs.).

(b) Front engine mount screws to 54 N·m (40 ft. lbs.) the clearance between the snubbers and the engine should be 2 mm (0.078 inch.) each side.

(c) Left engine mount through bolt to 75 N·m (55 ft. lbs.).

(5) Recheck driveshaft length.

SPECIFICATIONS

3.0L ENGINE

Type . . . . .60° V-6 SOHC
Number of Cylinders. 6
Bore . . . . .91.1 mm (3.587 in.)
Stroke .76 mm (2.992 in.)
Compression Ratio. .8.85:1
Displacement . . . . .3.0L (181 Cubic in.)
Firing Order. 1–2–3–4–5–6
Basic Ignition Timing . . . . .Refer to Emission Control Information Label on Vehicle
Compression Pressure . . . . .1227 kPa (178 psi) @ 250 RPM
Maximum Variation Between Cylinders. 25%

Valve Timing

Intake Valve–Open . . . . .19° BTDC
Intake Valve–Closed . . . . .59° ABDC
Exhaust Valve–Open. . . . . .59° BBDC
Exhaust Valve–Closed . . . . .19° ATDC

Cylinder Block

Cylinder Bore Diameter . . . . . .91.1 mm (3.587 in.)
Top Surface Flatness . . . . .0.05 mm (0.002 in.)
Service Limit. . . . . .0.1 mm (0.0039 in.)
Grinding Limit of Top Surface*. . . . . .0.2 mm (0.008 in.)

*Includes/Combined with cylinder Head Grinding

Pistons

Piston Diameter . . . . .91.06 - 91.09
Piston to Cylinder Clearance. . . . . .0.03 - 0.05 mm (0.0012 - 0.002 in.)
Piston Ring End Gap No. 1 . . . . . .0.30 - 0.45 mm (0.012 - 0.018 in.)
Service Limit. . . . . .0.8 mm (0.031 in.)
Piston Ring End Gap No. 2 . . . . . .0.45 - 0.60 mm (0.018 - 0.024 in.)
Service Limit. . . . . .0.8 mm (0.031 in.)
Piston Ring End Gap Oil Control . .0.20 - 0.60 mm (0.008 - 0.024 in.)
Service Limit. . . . . .1.0 mm (0.039 in.)
Ring Side Clearance No. 1 . . . . . .0.030 - 0.090 mm (0.002 - 0.0035 in.)
Service Limit. . . . . .1.0 mm (0.039 in.)
Ring Side Clearance No. 2 . . . . . .0.040 - 0.085 mm (0.0016 - 0.0033 in.)
Service Limit. . . . . .1.0 mm (0.039 in.)
Oversize Service Pistons . . . . .0.25 - 0.50 mm (0.010 - 0.020 in.), 0.75 - 1.00 mm (0.030 - 0.039 in.)

Connecting Rods

Bearing Clearance . . . . .0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Side Clearance . . . . .0.10 - 0.25 mm (0.004 - 0.010 in.)
Wear Limit . . . . .0.4 mm (0.015 in.)
Length–Center to Center . . . . . . .140.9 - 141.0 mm (5.547 - 5.551 in.)
Parallelism–Twist . . . . .0.05 mm (0.0019 in.)
Torsion . . . . .0.1 mm (0.0039 in.)

Crankshaft

Main Journal Diameter . . . . . . .59.980 - 60.0 mm (2.361 - 2.362 in.)
Connecting Rod Journal Diameter . . . . .49.980 - 50.000 mm (1.968 - 1.969 in.)
Out-of-Round (Max.). . . . . .0.03 mm (0.001 in.)
Taper (Max.) . . . . .0.005 mm (0.0002 in.)
Main and Rod Bearing Clearance . . . . .0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Undersize Service Bearings . . . . .0.25 - 0.50 - 0.75 mm (0.010 - 0.020 - 0.030 in.)
End Play . . . . . . .0.05 - 0.25 mm (0.002 - 0.010 in.)
Service Limit. . . . . .0.3 mm (0.012 in.)

Cylinder Head

Flatness of Gasket Surface. . . .0.05 mm (0.002 in.)
Grinding Limit of Gasket Surface . . . . .0.2 mm (0.008 in.)

Cylinder Head Valve Seat

Angle–Intake and Exhaust . . . . .44° - 44°.3’
Contact Width. . . . . .0.9 - 1.3 mm (0.035 - 0.051 in.)
Sinkage–Service Limit . . . . .0.2 mm (0.078 in.)
Guide Bore Diameter (Std) . . . . . . .7.95 - 7.98 mm (0.313 - 0.314 in.)

Valves

Face Angle . . . . .45° - 45° 30’
Head Diameter Intake. . . . . .48.64 - 48.90 mm (1.915 - 1.925 in.)
Head Diameter Exhaust . . . . . . .40.01 - 40.26 mm (1.575 - 1.585 in.)
Length Intake (Overall) . . . . .103.0 mm (4.055 in.)
Length Exhaust (Overall) . . . .102.7 mm (4.043 in.)
Valve Margin–Intake . . . . .1.2 mm (0.047 in.)
Service Limit. . . . . .0.7 mm (0.027 in.)
Valve Margin–Exhaust . . . . .2.0 mm (0.079 in.)
Service Limit. . . . . .1.5 mm (0.059 in.)
Valve Stem Tip Height . . . . . .49.02 mm (1.929 in.)
Stem Diameter–Intake . . . . .7.960 - 7.975 mm (0.313 - 0.314 in.)
Stem Diameter–Exhaust . . . . . . .7.930 - 7.950 mm (0.312 - 0.3125 in.)
Stem-to-Guide Clearance–Intake. . .0.03 - 0.06 mm (0.001 - 0.002 in.)
Service Limit. . . . . .0.10 mm (0.004 in.)
Stem-to-Guide Clearance–Exhaust .0.05 - 0.09 mm (0.0019 - 0.003 in.)

SPECIFICATIONS (Continued)

Service Limit. . . . . .0.15 mm (0.006 in.)

Valve Guide

Overall Length–Intake . . . . .44 mm (1.732 in.)
Overall Length–Exhaust . . . . . . .48 mm (1.889 in.)
Outside Diameter. . . . . .13.055 - 13.065 mm (0.514 - 0.5143 in.)
Inside Diameter. . . . . .8.000 - 8.018 mm (0.314 - 315 in.)

Valve Springs

Free Length (Approx.) . . . . . . .49.8 mm (1.960 in.)
Service Limit. . . . . .48.8 mm (1.9213 in.)
Loaded Height . . . . .40.4 mm @ 33 kg (1.59 in. @73 lbs.)
Perpendicularity–Intake and Exhaust . . .2° (Max.)
Service Limit. . . . . .4° (Max.)

Oil Pump

Clearance Over Rotors (Max.).0.077 mm (0.003 in.)
Cover Out-of-Flat (Max.). . . . .0.076 mm (0.003 in.)
Inner Rotor Thickness (Min.) .18.92 mm (0.744 in.)

Outer Rotor (Oil Pump)

Clearance (Max.) . . . . .0.19 mm (0.007 in.)
Diameter (Min.) . . . . .82.45 mm (3.246 in.)
Thickness (Min.). . . . . .18.92 mm (0.744 in.)
Tip Clearance Between Rotors (Max.) . . .0.150 mm (0.0068 in.)

Oil Pressure

At Curb Idle Speed* . . . . .68.9 kPa (10 psi)
At 3000 rpm . . . . .310 - 517 kPa (45 - 75 psi)

CAUTION: * If pressure is ZERO at curb Idle, DO NOT run engine at 3,000 rpm.

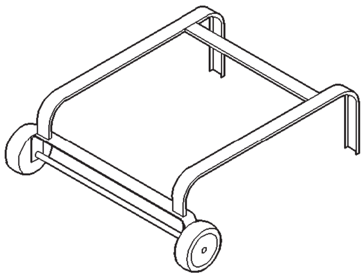
TORQUE CHART 3.0L

DESCRIPTION	TORQUE
Camshaft Bearing Cap	
Bolts	Refer to procedure outlined in this section.
Camshaft Sensor Pick Up	
Bolts	27 N·m (20 ft. lbs.)
Timing Belt Cover	
Outer to Inner Attaching Bolts	4.5 N·m (40 in. lbs.)
Inner Cover to Head/Oil Pump Bolts	12 N·m (105 in. lbs.)
Camshaft Sprocket	
Bolt	95 N·m (70 ft. lbs.)
Connecting Rod Cap	
Bolts	27 N·m (20 ft. lbs.) Plus 1/4 Turn
Crankshaft Main Bearing Cap/Bedplate	
M8 Bedplate Bolts	34 N·m (250 in. lbs.)
M11 Main Cap Bolts	41 N·m (30 ft. lbs.) Plus 1/4 Turn
Crankshaft Vibration Damper	
Bolt	135 N·m (100 ft. lbs.)

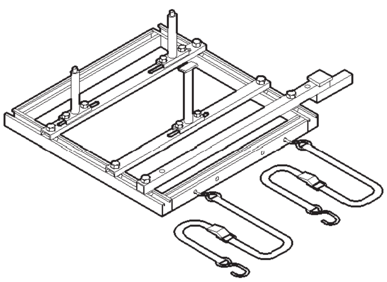
DESCRIPTION	TORQUE
Cylinder Head	
Bolts	Refer To Cylinder Head Installation
Cylinder Head Cover	
Bolts	12 N·m (105 in. lbs.)
Engine Mount Bracket	
Bolts	41 N·m (30 ft. lbs.)
Engine Mount—Front and Rear	
Through Bolt	61 N·m (45 ft. lbs.)
Exhaust Manifold to Cylinder Head	
Bolts	23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield	
Bolts	12 N·m (105 in. lbs.)
Intake Manifold	
Bolts	27 N·m (20 ft. lbs.)
Oil Filter to Engine Block Adapter	
Bolts	55 N·m (40 ft. lbs.)
Oil Filter	
Filter	20 N·m (15 ft. lbs.)
Oil Pan	
Oil Pan Bolts	12 N·m (105 in. lbs.)
Drain Plug	39 N·m (29 ft. lbs.)
Oil Pump Attaching	
Bolts	15 N·m (130 in. lbs.)
Oil Pump Cover Fastener	9 N·m (104 in. lbs.)
Oil Pump Pick-up Tube Bolt	28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap	49 N·m (36 ft. lbs.)
Spark Plugs	
Plugs	28 N·m (20 ft. lbs.)
Thermostat Housing	
Bolts	23 N·m (200 in lbs.)
Timing Belt Tensioner	
Bolt	28 N·m (20 ft. lbs.)
Timing Belt Tensioner Pulley Assembly	
Bolt	41 N·m (30 ft. lbs.)
Water Pump Mounting	
Bolts	12 N·m (105 in. lbs.)

SPECIAL TOOLS

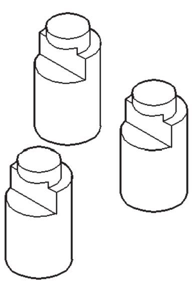
3.0L ENGINE



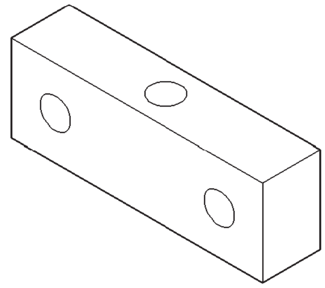
Dolly 6135



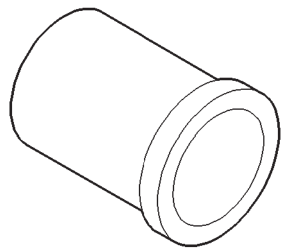
Cradle 6710



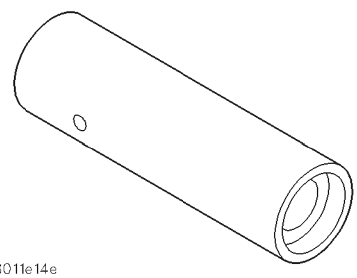
Adaptor 6909



Adaptor 6910



Camshaft End Plug Installer MD-998306



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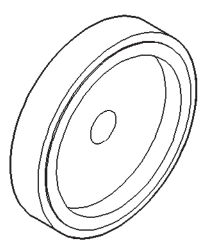
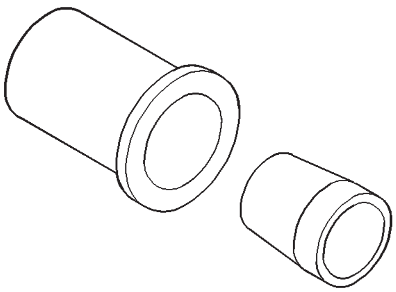
Valve Stem Seal Installer MD-998729

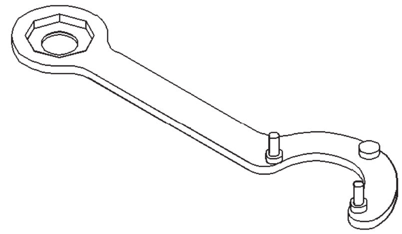


Rear Crankshaft Seal Installer MD-998718

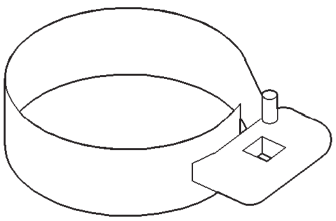
SPECIAL TOOLS (Continued)



Front Crankshaft Seal Installer MD-998717



Spanner Camshaft Sprocket MB-990775



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Oil Filter Wrench C-4065

3.3/3.8L ENGINE

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DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 1).

ENGINE LUBRICATION SYSTEM

The lubrication system is a full flow filtration pressure feed type. Oil from the oil pan is pumped by a internal gear type oil pump directly coupled to the crankshaft. The pressure is regulated by a relief valve located in the chain case cover. The oil is pumped through an oil filter and feeds a main oil galley. This oil gallery feeds oil under pressure to the main and rod bearings, camshaft bearings. Passages in the cylinder block feed oil to the hydraulic lifters and rocker shaft brackets which feeds the rocker arm pivots (Fig. 2).

ENGINE COMPONENTS

ENGINE: The 3.3L (201 Cubic Inches) and 3.8L (231 Cubic Inches) displacement engines are 60° V type six cylinder power plants with cast iron cylinder blocks and aluminum cylinder heads (Fig. 3). Firing order for these engines is 1-2-3-4-5-6. High turbulence cylinder heads allow a 8.9-1 compression ratio.

CRANKSHAFT: The nodular iron crankshaft is supported by four main bearings, with number two being the thrust bearing. Crankshaft end sealing is provided by front and rear rubber seals.

PISTONS: The pistons are cast aluminum alloy. Three rings are used. Piston pins, press fitted into place, join the pistons to forged steel connecting rods.

CAMSHAFT: The nodular iron camshaft is mounted in four steel backed babbitt bearings. A thrust plate located in front of the first bearing, and bolted to the block, controls end play. Silent timing chain drives the camshaft. This chain is enclosed by a cast aluminum cover which also carries a front

DESCRIPTION AND OPERATION (Continued)

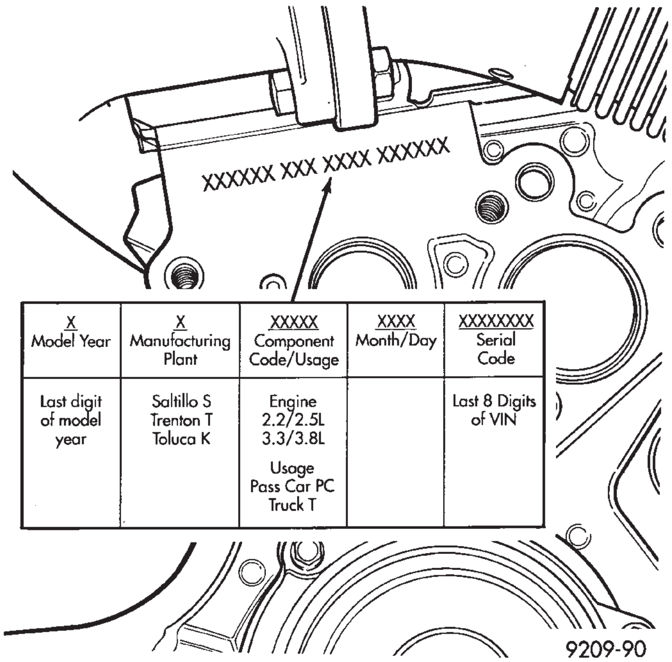


Fig. 1 Engine Identification

crankshaft seal, provides front oil pan closure, water pump mounting.

CYLINDER HEADS: Cylinder heads are designed to create high flow combustion chambers to improve performance, while minimizing the change to the burn rate of the chamber. Valve seat and guides are inserts. A steel flanged composition type gasket is used between head and block.

CYLINDER HEAD COVERS: The covers are sealed with steel reinforced silicon rubber gaskets.

INTAKE MANIFOLD: The intake manifold is a tuned two-piece semi-permanent mold aluminum casting with individual primary runners leading from a plenum to the cylinders. The manifold is designed to boost torque in the 3600 rpm range and contributes to the engine's broad, flat torque curve, which was desired for excellent engine tractability, response and usable power output.

The intake manifold is also cored with upper level EGR passages for balanced cylinder to cylinder EGR distribution.

VALVE TRAIN: Valve train design incorporates the use of hydraulic roller tappets. Rocker arms are installed on a rocker arm shaft attached to the cylinder head with four bolts and retainers. Viton valve stem seals provide valve sealing. Conventional type pushrods, retainers and valve stem locks are used. Unique beehive style valve spring are used with lightweight retainers for improved high RPM performance.

EXHAUST MANIFOLDS: Exhaust manifolds are log type with a crossover and is attached directly to the cylinder heads.

DIAGNOSIS AND TESTING

HYDRAULIC TAPPETS

The valve train includes roller tappet assemblies, aligning yokes and yoke retainer.

Roller tappet alignment is maintained by machined flats on tappet body being fitted in pairs into six

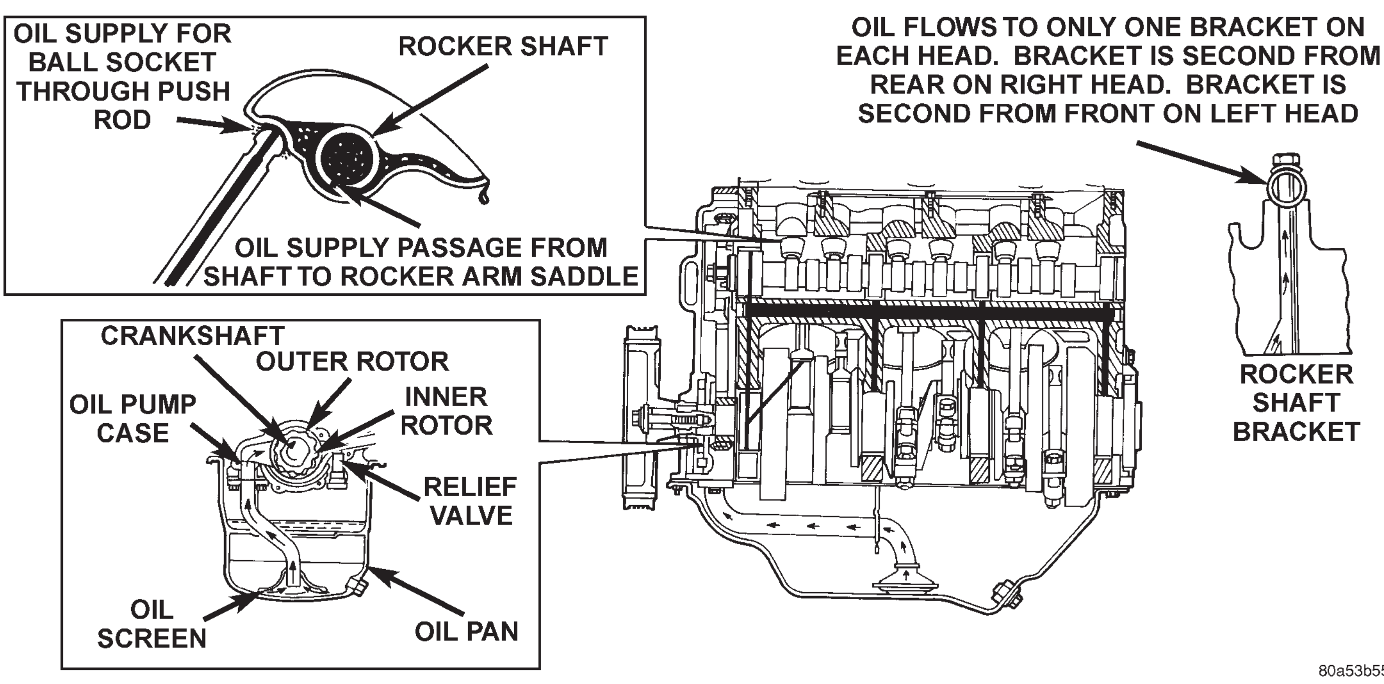


Fig. 2 Engine Oiling System

DIAGNOSIS AND TESTING (Continued)

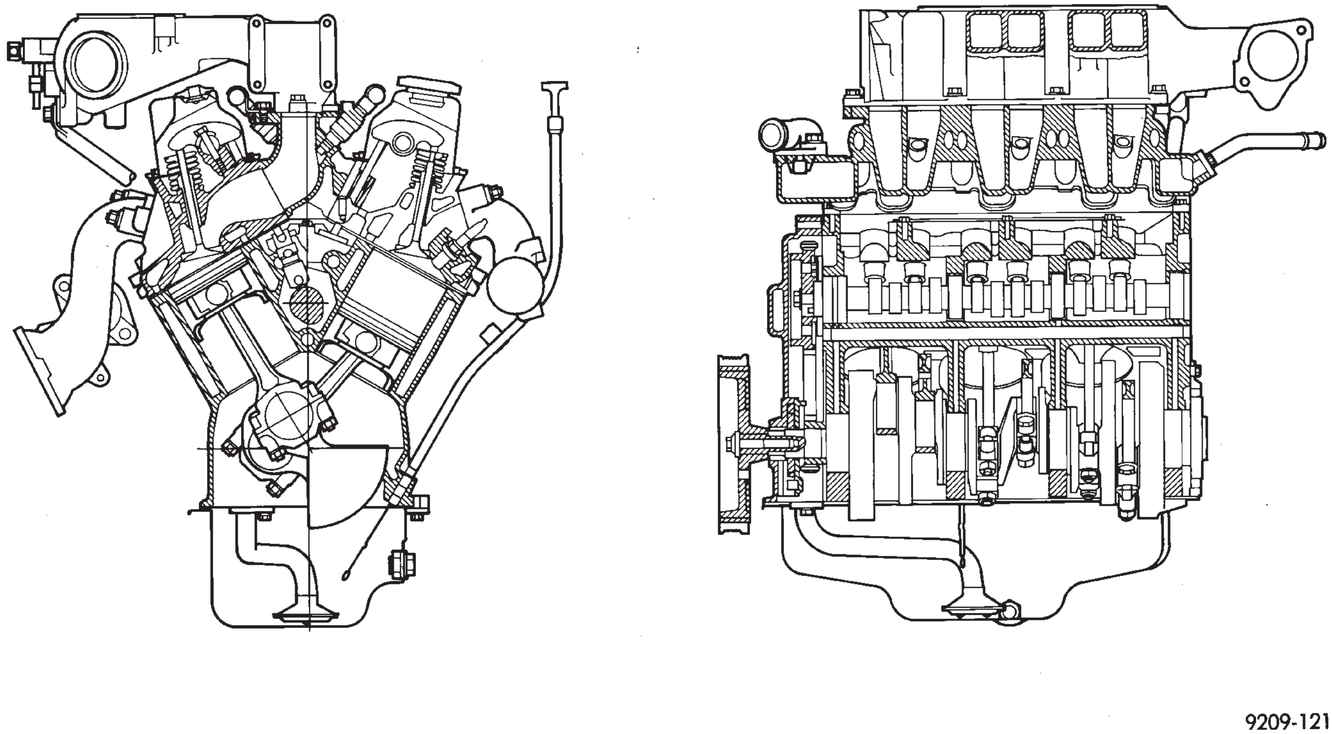


Fig. 3 3.3/3.8L V-6 Engines

aligning yokes. The yokes are secured by an alignment yoke retainer (Fig. 4).

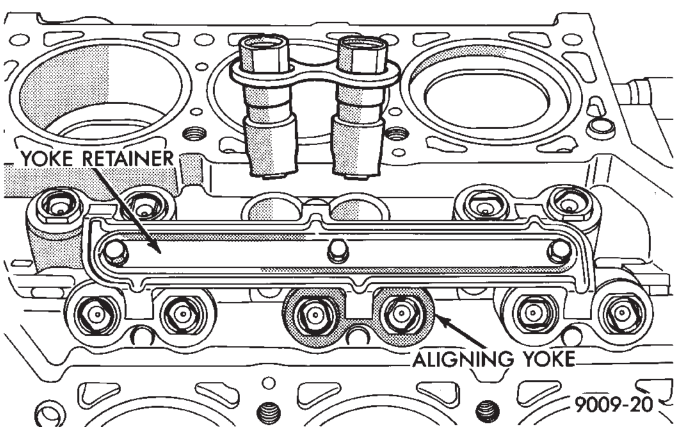


Fig. 4 Roller Tappets Aligning Yoke and Retainer

PRELIMINARY STEP TO CHECKING THE HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, read the oil pressure at the gauge. Install a reliable gauge at pressure sending unit if vehicle has no oil pressure gauge and check the oil level in the oil pan. The pressure should be between 30 and 80 psi (206.8 to 551.6 kPa) at 2000 rpm.

The oil level in the pan should never be above the MAX mark on dipstick, or below the MIN mark. Either of these two conditions could be responsible for noisy tappets. **Oil Level Check: stop engine after reaching normal operating temperature**. Allow 5 minutes to stabilize oil level, check dipstick.

OIL LEVEL TOO HIGH

If oil level is above the MAX mark on dip stick, it is possible for the connecting rods to dip into the oil while engine is running and create foam. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to become soft and allow valves to seat noisily.

OIL LEVEL TOO LOW

Low oil level may allow pump to take in air which when fed to the tappets, causes them to become soft and allows valves to seat noisily. Any leaks on intake side of pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, engine should be operated at fast idle to allow all of the air inside of the tappets to be bled out.

VALVE TRAIN NOISE DIAGNOSIS

To determine source of valve train noise, operate engine at idle with cylinder head covers removed and listen for source of the noise.

DIAGNOSIS AND TESTING (Continued)

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger which will necessitate replacing the tappet, or by the plunger partially sticking in the tappet body cylinder. A heavy click is caused either by a tappet check valve not seating, or by foreign particles becoming wedged between the plunger and the tappet body causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

CHECKING ENGINE OIL PRESSURE

Check oil pressure using gauge at oil pressure switch location. Oil pressure should be 34.47 kPa (5 psi.) at idle or 205 to 551 kPa (30 to 80 psi.) at 3000 RPM.

(1) Remove pressure sending unit and install oil pressure gauge (Fig. 5).

CAUTION: If oil pressure is 0 at idle, do not run engine at 3000 RPM.

(2) Warm engine at high idle until thermostat opens.

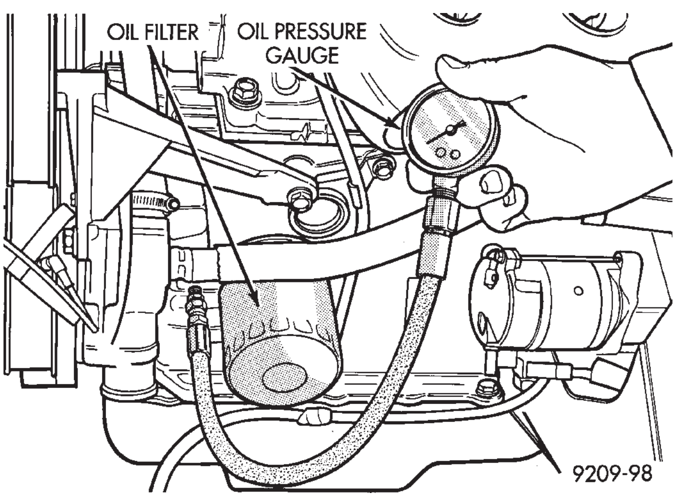


Fig. 5 Checking Oil Pump Pressure

SERVICE PROCEDURES

VALVE TIMING

(1) Remove front cylinder head cover and all 6 spark plugs.

(2) Rotate engine until the #2 piston is at TDC of the compression stroke.

(3) Install a degree wheel on the crankshaft pulley.

(4) With proper adaptor, install a dial indicator into #2 spark plug hole. Using the indicator find TDC on the compression stroke.

(5) Position the degree wheel to zero.

(6) Remove dial indicator from spark plug hole.

(7) Place a 5.08 mm (0.200 in.) spacer between the valve stem tip of #2 intake valve and rocker arm pad. Allow tappet to bleed down to give a solid tappet effect.

(8) Install a dial indicator so plunger contacts the #2 intake valve spring retainer as nearly perpendicular as possible. Zero the indicator.

(9) Rotate the engine clockwise until the intake valve has lifted .254 mm (0.010 in.).

CAUTION: Do not turn crankshaft any further clockwise as intake valve might bottom and result in serious damage.

(10) Degree wheel should read 6 degrees BTDC to 6 degrees ATDC.

MEASURING TIMING CHAIN FOR STRETCH

(1) Place a scale next to timing chain so that any movement of chain may be measured.

(2) Place a torque wrench and socket on camshaft sprocket attaching bolt and apply torque in direction of crankshaft rotation to take up slack; 41 N·m (30 ft. lb.) with cylinder head installed or 20 N·m (15 ft. lb.) with cylinder heads removed. **With a torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block crankshaft to prevent rotation.**

(3) Holding a scale even, with dimension reading as shown (Fig. 6), along edge of chain links. Apply torque in the reverse direction to 41 N·m (30 ft. lbs.) with cylinder heads installed, or 20 N·m (15 ft. lbs.) with cylinder heads removed. Check amount of chain movement.

(4) Install a new timing chain, if its movement exceeds 3.175 mm (1/8 inch).

(5) If chain is not satisfactory, refer to Timing Chain Removal and Installation in this section.

SERVICE PROCEDURES (Continued)

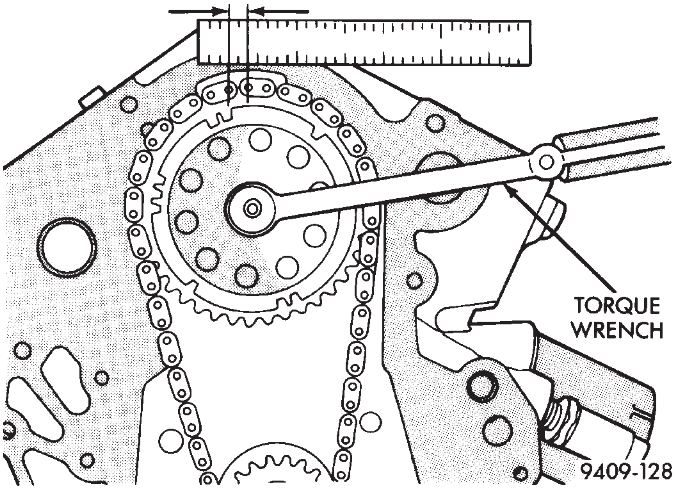


Fig. 6 Measuring Timing Chain Wear and Stretch

FITTING PISTONS AND RINGS

FITTING PISTONS

The piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin at size location shown in (Fig. 8). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 7). Refer to Cylinder Bore and Piston Specification Chart. **Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).**

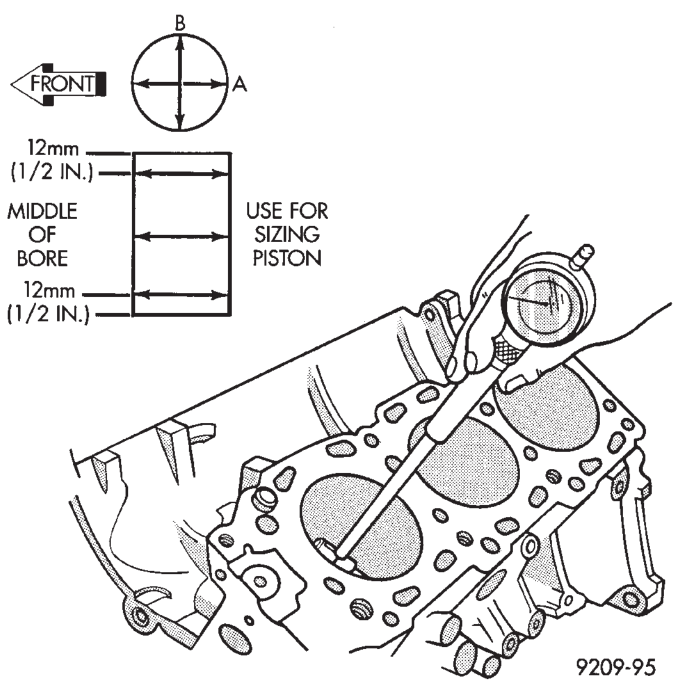


Fig. 7 Checking Cylinder Bore Size

FITTING RINGS

(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 in.) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 9). Refer to Piston Ring Specification Chart.

(2) Check piston ring to groove clearance: (Fig. 10). Refer to Piston Ring Specification Chart.

CYLINDER BORE AND PISTON SPECIFICATION CHART

Engine	Standard Bore	Maximum Out-Of-Round	Maximum Taper
3.3L	92.993 - 93.007 mm (3.661 - 3.6617 in.)	0.076 mm (0.003 in.)	0.51 mm (0.002 in.)
3.8L	95.993 - 96.007 mm 3.7792 - 3.780 in.	Same	Same
Standard Piston Size			
3.3L	92.950 - 92.968 mm (3.6594 - 3.6602 in.)		
3.8L	95.950 - 95.968 mm (3.7776 - 3.7783 in.)		
Piston to Bore Clearance: 0.025 - 0.057 mm (0.0009 - 0.0022 in.)			
Measurements taken at Piston Size Location.			

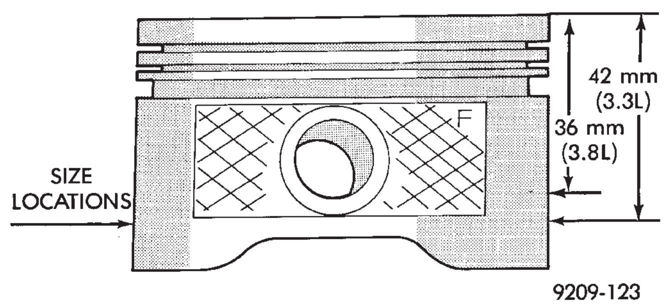


Fig. 8 Piston Measurements

FITTING CONNECTING ROD BEARINGS

Fit all rods on one bank until complete.

The bearing caps are not interchangeable and should be marked at removal to insure correct assembly.

The bearing shells must be installed with the tangs inserted into the machined grooves in the rods and caps. Install cap with the tangs on the same side as the rod.

Limits of taper or out-of-round on any crankshaft journals should be held to 0.025 mm (0.001 in.). Bearings are available in 0.025 mm (0.001 in.) and 0.250 mm (0.010 in.) undersize. **Install the bearings in pairs. Do not use a new bearing half**

SERVICE PROCEDURES (Continued)

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Wear Limit	Groove Clearance	Maximum Clearance
Upper Ring	0.30 - 0.55 mm (0.012 - 0.022 in.)	1.0 mm (0.039 in.)	0.030 - 0.085 mm (0.001 - 0.003 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.30 - 0.55 mm (0.012 - 0.022 in.)	1.0 mm (0.039 in.)	0.030 - 0.095 mm (0.001 - 0.0037 in.)	0.10 mm (0.004 in.)
Oil Control Ring	0.25 - 1.00 mm (0.010 - 0.039 in.)	1.88 mm (0.074 in.)	0.014 - 0.266 mm (0.0005 - 0.009 in.)	0.266 mm (0.009 in.)

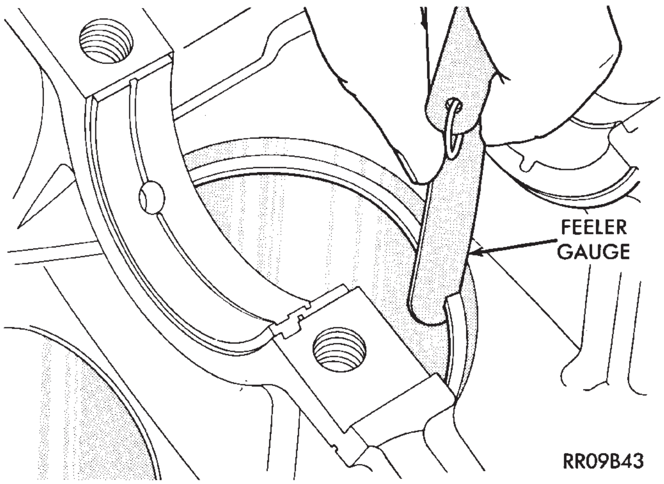


Fig. 9 Check Gap on Piston Rings

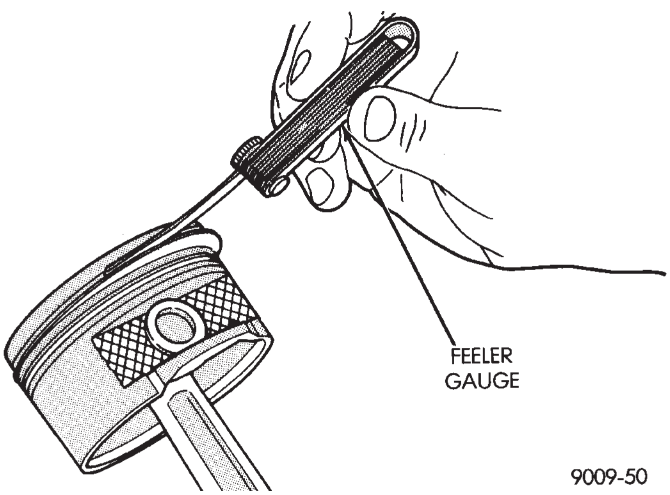


Fig. 10 Measuring Piston Ring Side Clearance

with an old bearing half. Do not file the rods or bearing caps.

(1) Follow procedure specified in the Standard Service Procedure Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 11).

NOTE: The rod bearing bolts should be examined before reuse. If the threads are necked down the bolts should be replaced (Fig. 13). Necking can be checked by holding a scale or straight edge against

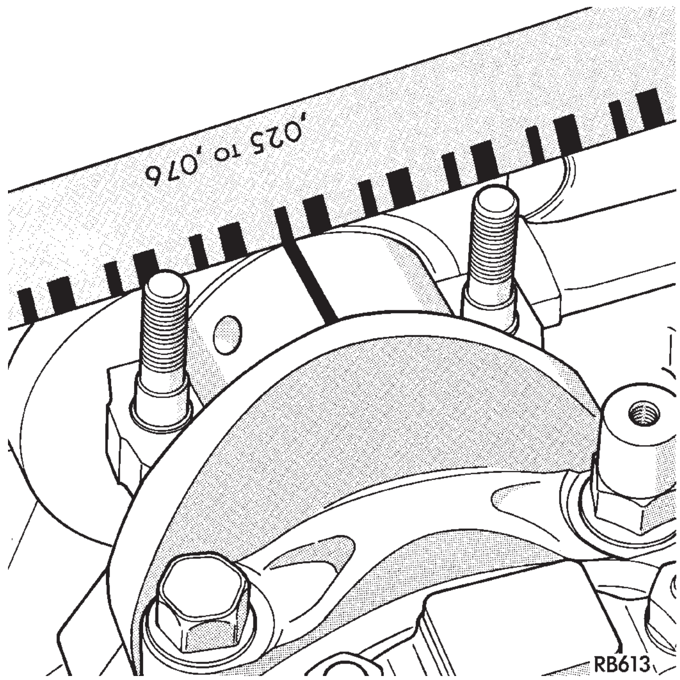


Fig. 11 Checking Connecting Rod Bearing Clearance

the threads. If all the threads do not contact the scale the bolt should be replaced.

(2) Before installing the nuts the threads should be oiled with engine oil.

(3) Install nuts finger tight on each bolt then alternately torque each nut to assemble the cap properly.

(4) Tighten the nuts to 54 N·m PLUS 1/4 turn (40 ft. lbs. PLUS 1/4 turn).

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 12). Refer to Connecting Rod Specification Chart.

FITTING MAIN BEARINGS

CRANKSHAFT OIL CLEARANCE

Measure the journal outside diameter as shown in (Fig. 14). Refer to Crankshaft Specification Chart.

SERVICE PROCEDURES (Continued)

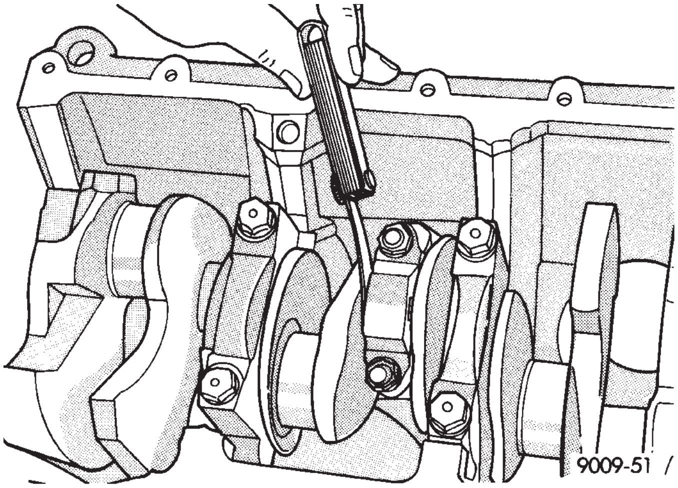


Fig. 12 Checking Connecting Rod Side Clearance

CONNECTING ROD SPECIFICATION CHART

Connecting Rod Bearing Clearance	
New Part:	0.019 - 0.073 mm (0.0008 - 0.0029 in.)
Wear Limit:	0.074 mm (0.003 in.)
Connecting Rod Side Clearance	
New Part:	0.13 - 0.32 mm (0.005 - 0.013 in.)
Wear Limit:	0.38 mm (0.015 in.)

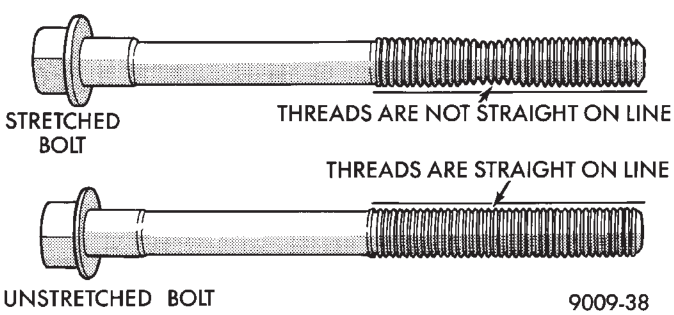


Fig. 13 Check for Stretched (Necked) Bolts

PLASTIGAGE (OIL CLEARANCE) MEASUREMENT

(1) Remove oil from journal and bearing shell.

(2) Install crankshaft.

(3) Cut plastigage to same length as width of the bearing and place it in parallel with the journal axis (Fig. 15).

(4) Install the main bearing cap carefully and tighten the bolts to specified torque.

CAUTION: Do not rotate crankshaft or the plastigage will be smeared.

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.09 - 0.24 mm (0.0036 - 0.0095 in.)
Wear Limit:	0.38 mm (0.015 in.)
Main Bearing Clearance	
New Part:	0.011 - 0.059 mm (0.0005 - 0.0024 in.)
Wear Limit:	0.076 mm (0.003 in.)
Crankshaft Main Bearing Journal	
Standard Size:	63.992 - 64.013 mm (2.5194 - 2.5202 in.)
Crankshaft Connecting Rod Journal	
Standard Size:	57.989 - 58.005 mm (2.2831 - 2.2837 in.)

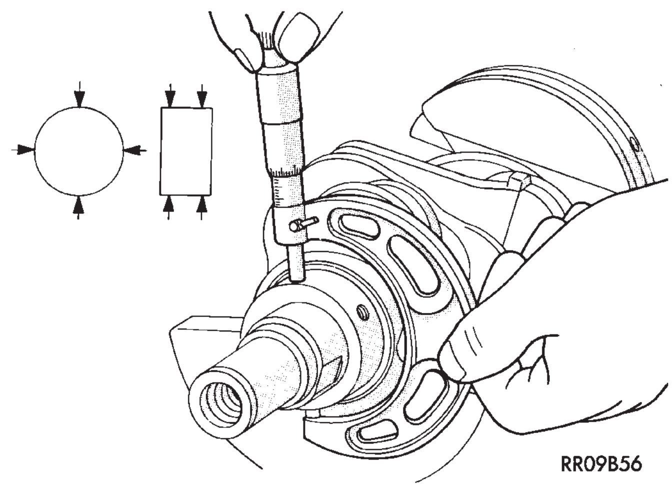


Fig. 14 Measure Crankshaft Journal O.D.

(5) Carefully remove the bearing cap and measure the width of the plastigage at the widest part using the scale on the plastigage package (Fig. 15). Refer to Crankshaft Specification Chart for proper clearances. If the clearance exceeds the specified limits, replace the main bearing(s) and if necessary, have the crankshaft machined to next undersize.

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

CRANKSHAFT END PLAY

DIAL INDICATOR METHOD

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 16).

SERVICE PROCEDURES (Continued)

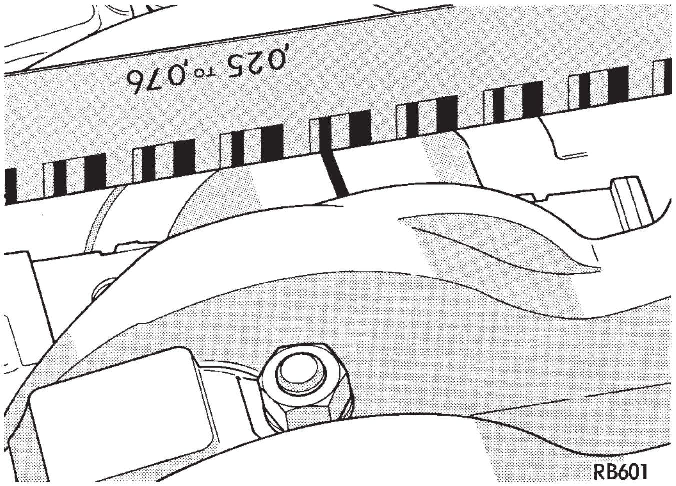


Fig. 15 Measuring Bearing Clearance with Plastigage

(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 Crankshaft Specification Chart.

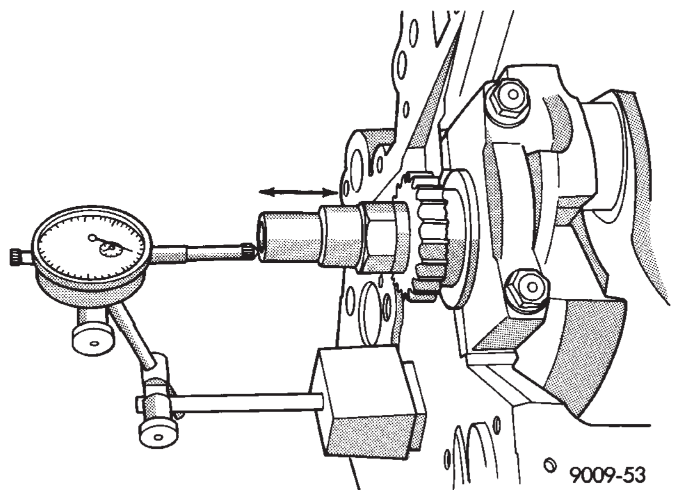


Fig. 16 Checking Crankshaft End Play

FEELER GAUGE METHOD

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek using care not to damage any bearing surface. **Do not** loosen main bearing cap.

(2) Use a feeler gauge between number 2 thrust bearing and machined crankshaft surface to determine end play. Refer to Crankshaft Specification Chart.

VALVE SERVICE RECONDITION

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Refer to Valve Dimension Chart.

CAUTION: Valve stems are chrome plated and should not be polished.

(3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(4) Measure valve stem guide clearance as follows:

a. Install valve into cylinder head so it is 14 mm (0.551 in.) off the valve seat. A small piece of hose may be used to hold valve in place.

b. Attach dial indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured (Fig. 17).

(5) Move valve to and from the indicator. Refer to Valve Guide Specification Chart.

(6) Ream the guides for valves with oversized stems if dial indicator reading is excessive or if the stems are scuffed or scored.

(7) Service valves with oversize stems and over size seals are available in 0.15 mm (0.005 in.), 0.40 mm, (0.015 in.) and 0.80 mm (0.030 in.) oversize.

NOTE: Oversize seals must be used with oversize valves.

(8) Refer to Valve Guide Specification Chart for reamer size to accommodate the oversize valve stems.

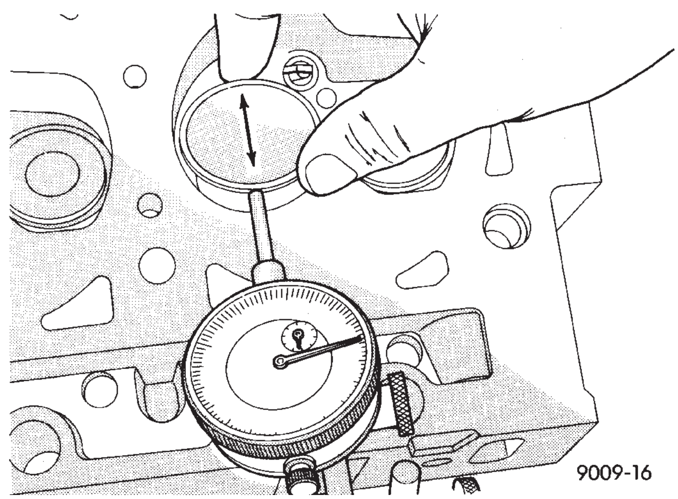


Fig. 17 Measuring Valve Guide Wear

(9) Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Do not attempt to ream the valve guides from standard directly to 0.80 mm (0.030 in.) Use step proce-**

SERVICE PROCEDURES (Continued)

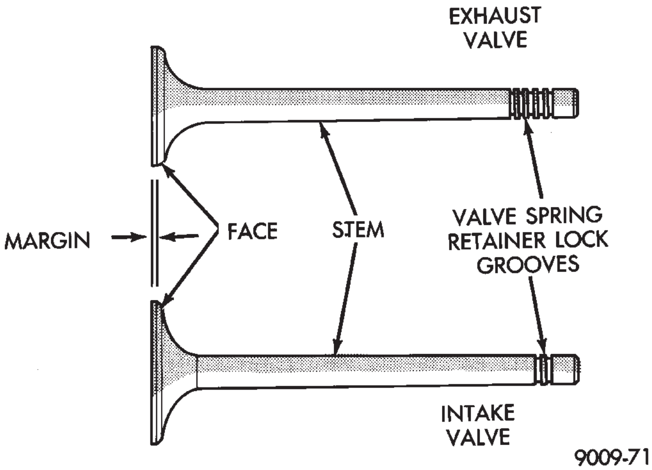


Fig. 18 Intake and Exhaust Valves

VALVE GUIDE SPECIFICATION CHART

	Intake Valve	Exhaust Valve
Dial Indicator Reading (Maximum):	0.247 mm (0.009 in.)	0.414 mm (0.016 in.)
Valve Guide Reamer Oversize	**Valve Guide Size**	
0.15 mm (0.005 in.)	8.125 - 8.150 mm (0.3198 - 0.3208 in.)	
0.40 mm (0.015 in.)	8.375 - 8.400 mm (0.3297 - 0.3307 in.)	
0.80 mm (0.030 in.)	8.775 - 8.800 mm (0.3454 - 0.3464 in.)	

dure of 0.15 mm (0.005 in.), 0.40 mm (0.015 in.) and 0.80 mm (0.030 in.) so the valve guides may be reamed true in relation to the valve seat. After reaming guides, the seat runout should be measured and resurfaced if necessary. See Refacing Valves and Valve Seats.

VALVE SPECIFICATION CHART

Intake Valve (Minimum)	
Stem Diameter:	7.935 mm (0.3124 in.)
Face Angle:	44.5°
Valve Margin:	0.794 mm (0.031 in.)
Head Diameter:	45.5 mm (1.79 in.)
Length:	127.2 mm (5.008 in.)
Exhaust Valve (Minimum)	
Stem Diameter:	7.906 mm (0.3112 in.)
Face Angle:	44.5°
Valve Margin:	1.191 mm (0.0469 in.)
Head Diameter:	37.5 mm (1.476 in.)
Length:	127.82 (5.032 in.)

VALVE GUIDES

NOTE: Replace cylinder head if guide does not clean up with 0.80 mm (0.030 in.) oversize reamer, or if guide is loose in cylinder head.

REFACING VALVES AND VALVE SEATS

The intake and exhaust valves have a 44-1/2 to 45 degree face angle. The valve seats have a 45 to 45-1/2 degree face angle. The valve face and valve seat angles are shown in (Fig. 19).

VALVES

(1) Inspect the remaining margin after the valves are refaced Refer to Valve Dimension Chart.

VALVE SEATS

CAUTION: Remove metal from valve seat only. Do not remove metal from cylinder head (Fig. 20).

(1) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(2) Measure the concentricity of valve seat using dial indicator. Total runout should not exceed 0.051 mm (0.002 in.) total indicator reading.

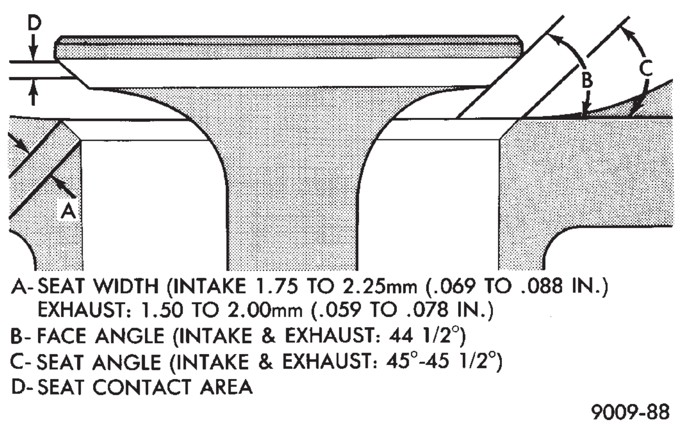


Fig. 19 Valve Seats

(3) Inspect the valve seat using Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of valve face, lower valve seat with a 15 degree stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

SERVICE PROCEDURES (Continued)

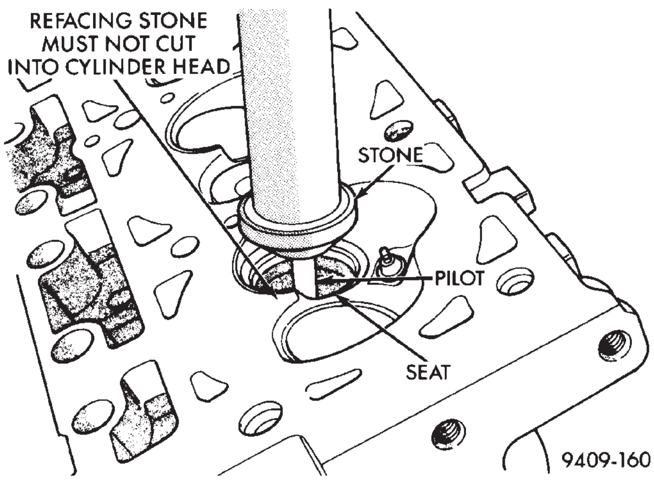


Fig. 20 Refacing Valve Seats

NOTE: Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise cylinder head must be replaced.

(4) When seat is properly positioned the width of intake seats should be 1.75 to 2.25 mm (0.69 to 0.088 in.) The width of the exhaust seats should be 1.50 to 2.00 mm (0.059 to 0.078 in.) (Fig. 19).

(5) Check the valve spring installed height after refacing the valve and seat (Fig. 22).

TESTING VALVE SPRINGS

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested (Fig. 21). **As an example;** the compression length of the spring to be tested is 33.34 mm (1-5/16 inches). Turn table of Tool C-647 until surface is in line with the 33.34 mm (1-5/16 inch) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to specifications to obtain specified height and allowable tensions. Discard the springs that do not meet specifications.

REMOVAL AND INSTALLATION

WIPER UNIT

When performing work on the upper engine. Refer to Section 8K, Windshield Wipers and Washers for removal of the Wiper Unit.

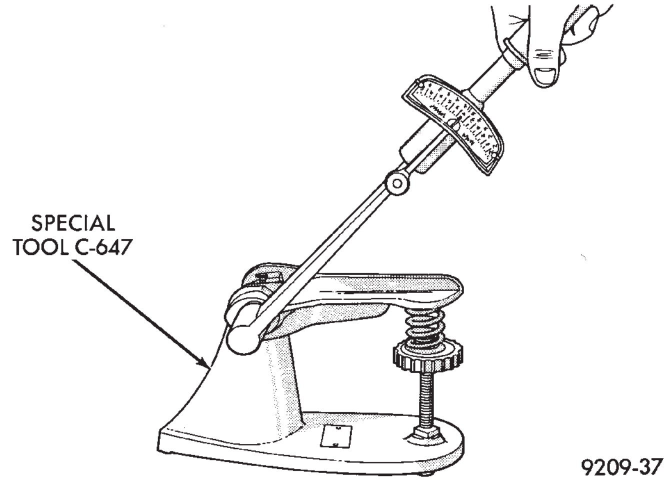


Fig. 21 Testing Valve Springs

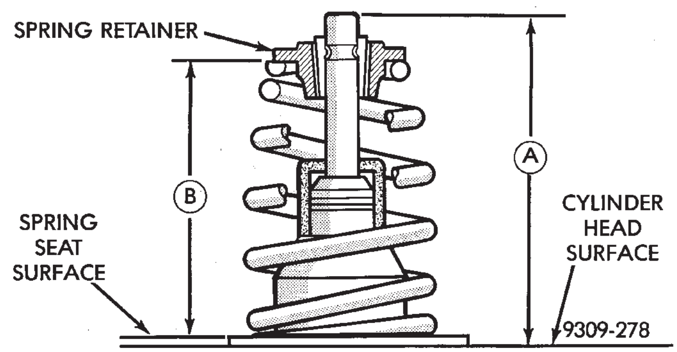


Fig. 22 Checking Valve Installed Height

ITEM	DESCRIPTION
A	Valve Stem Height
B	Valve Installed Height

ENGINE MOUNTS

RIGHT SIDE MOUNT

REMOVAL

NOTE: Right mount should only be serviced as an assembly to prevent noise, vibration and harshness concerns.

(1) Remove the purge duty solenoid and wiring harness from engine mount.

(2) Remove the two right engine mount insulator vertical fasteners and loosen the horizontal fastener, **Do Not** remove the large nut on the end of the core from frame rail (Fig. 23).

(3) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

REMOVAL AND INSTALLATION (Continued)

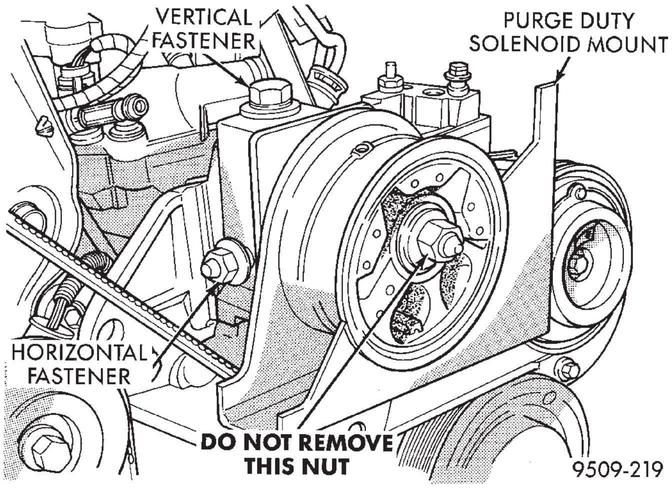


Fig. 23 Engine Mount—Right

(4) Remove the vertical and horizontal fasteners from the engine side bracket. Remove the engine mount assembly

INSTALLATION

(1) Reverse removal procedure for installation. Tighten assembly in the following order:

a. Engine mount to rail fasteners to 68 N·m (50 ft. lbs.).

b. The vertical engine fastener to 102 N·m (75 ft. lbs.)

c. The horizontal fastener to 150 N·m (111 ft. lbs.).

(2) Install the purge duty solenoid and wiring harness to the engine mount.

(3) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

FRONT MOUNT

REMOVAL

(1) Support the engine and transmission assembly with a floor jack so it will not rotate.

(2) Remove the front engine mount through bolt from the insulator and front crossmember mounting bracket (Fig. 24).

(3) Remove six screws from air dam to allow access to the front mount screws.

(4) Remove the front engine mount screws and remove the insulator assembly.

(5) Remove the front mounting bracket, if necessary (Fig. 24).

INSTALLATION

(1) Reverse removal procedure for installation and tighten fasteners in this order:

a. Tighten bolts 2,3, and 4 to 108 N·m (80 ft. lbs.).

b. Tighten bolts 1 and 5 to 54 N·m (40 ft. lbs.).

(2) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

(3) Install six screws to air dam and tighten to 12 N·m (105 in. lbs.).

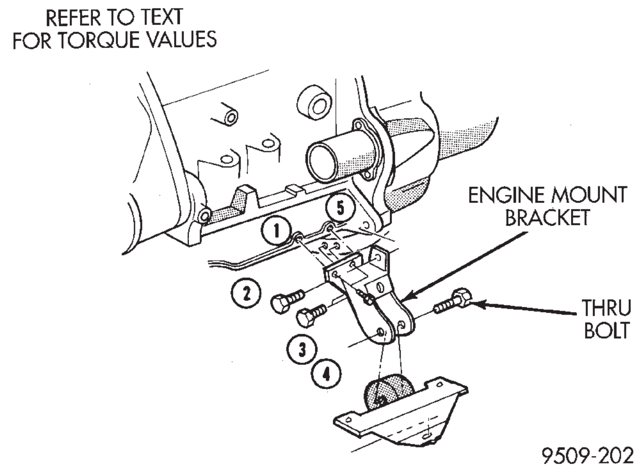


Fig. 24 Engine Mounting—Front

LEFT SIDE MOUNT

REMOVAL

(1) Raise vehicle on hoist and remove left front wheel.

(2) Support the transmission with a transmission jack.

(3) Remove the insulator through bolt from the mount.

(4) Remove the transmission mount fasteners and remove mount.

INSTALLATION

(1) Reverse removal procedure for installation.

(2) Tighten mount to transmission bolts to 55 N·m (40 ft. lbs.)

(3) Tighten through bolt to 75 N·m (55 ft. lbs.) (Fig. 25).

(4) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

REAR MOUNT

REMOVAL

(1) Raise vehicle on hoist.

(2) Support the transmission with a transmission jack so it will not rotate.

(3) Remove the insulator through bolt from the mount and rear suspension crossmember.

(4) Remove the four transmission mount fasteners and remove the mount.

INSTALLATION

(1) Reverse the removal procedure for installation. Refer to (Fig. 26). Tighten through bolt to 75 N·m (55 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

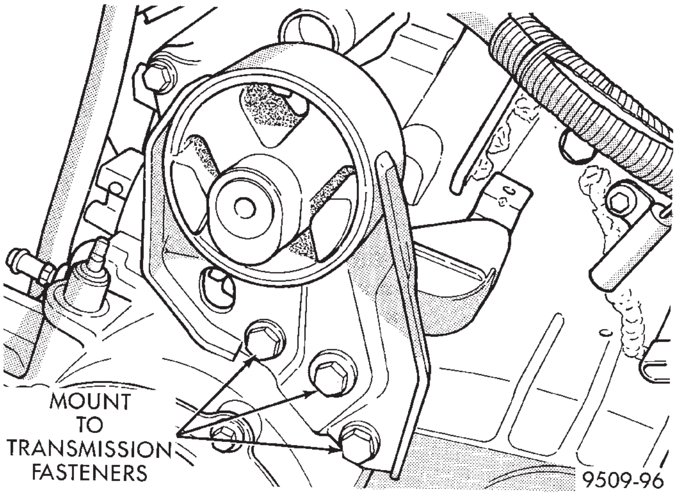


Fig. 25 Engine Mounting—Left

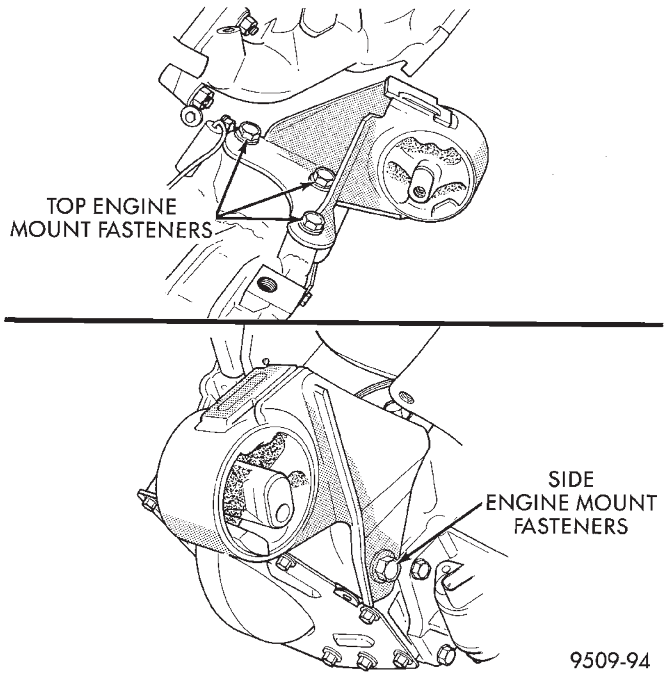


Fig. 26 Engine Mounting—Rear

ENGINE MOUNT RUBBER INSULATORS

Insulator location on (right side) is adjustable to allow right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right engine mount insulator. See Adjustments in this section. Adjust drive train position, if required, for the following conditions:

a. Drive shaft distress. See Group 2, Suspension and Driveshafts.

b. Any front end structural damage (after repair).

c. Insulator replacement.

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to group 14 fuel system for procedure. Remove fuel line to fuel rail.

(2) Disconnect battery.

(3) Remove air cleaner and hoses.

(4) Remove battery cover, battery and battery tray, with integral vacuum reservoir, from vehicle.

(5) Block off heater hoses to rear heater assembly, if equipped.

(6) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(7) Disconnect heater hoses.

(8) Remove fan module and radiator. Refer to Group 7 Cooling System for procedure.

(9) Disconnect transmission shift linkage.

(10) Disconnect throttle body linkage and vacuum hoses from throttle body.

(11) Remove accessory drive belts. Refer to Group 7, Accessory Drive Belts located in Cooling System for procedure.

(12) Remove air conditioning compressor from engine and set it aside.

(13) Disconnect generator wiring harness and remove generator.

(14) Hoist vehicle and remove right and left inner splash shields.

(15) Remove crossmember cradle plate (Fig. 27).

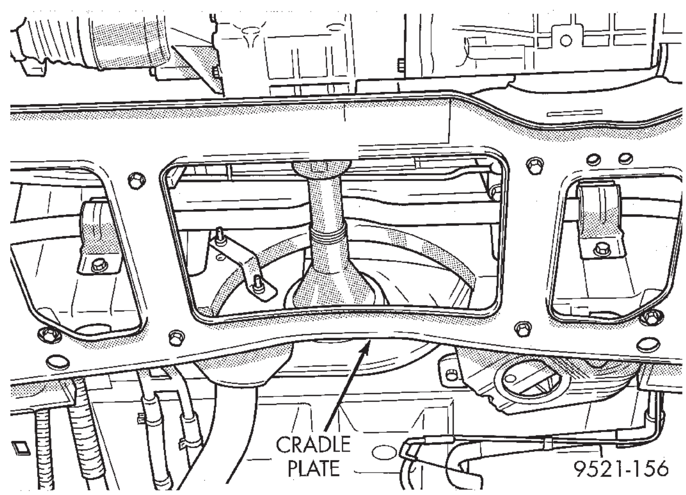


Fig. 27 Crossmember Cradle Plate

(16) Remove axle shafts. Refer to Group 3, Differential and Driveline for procedure.

(17) **(AWD equipped)** Mark orientation and separate propeller shaft from power transfer unit. Refer to Group 3, Differential and Driveline for procedure.

(18) Disconnect exhaust pipe from manifold.

(19) Remove front engine mount and bracket as an assembly.

REMOVAL AND INSTALLATION (Continued)

(20) Remove rear transmission mount and bracket.

(21) Remove power steering pump and bracket assembly.

(22) Remove wiring harness and connectors from front of engine.

(23) Remove bending braces and install tool number 6912 on engine.

(24) Remove transmission inspection cover and mark flexplate to torque converter.

(25) Remove driveplate to torque converter bolts.

(26) Lower the vehicle.

(27) Remove ground straps to body.

(28) Raise vehicle enough to allow engine dolly Special Tool 6135 and cradle Special Tool 6710 with post Special Tool 6848 and adaptor Special Tool 6909 to be installed under vehicle (Fig. 28).

(29) Loosen cradle engine mounts to allow movement for positioning onto engine locating holes on the engine. Lower vehicle and position cradle mounts until the engine is resting on mounts. Tighten mounts to cradle frame. This will keep mounts from moving when removing or installing engine and transmission.

(30) Lower vehicle so the weight of **ONLY THE ENGINE AND TRANSMISSION** is on the cradle.

(31) Remove right engine mount assembly and left transmission mount through bolt. Refer to Engine Mounts Section of this Group.

(32) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly on the cradle to allow for removal around body flanges.

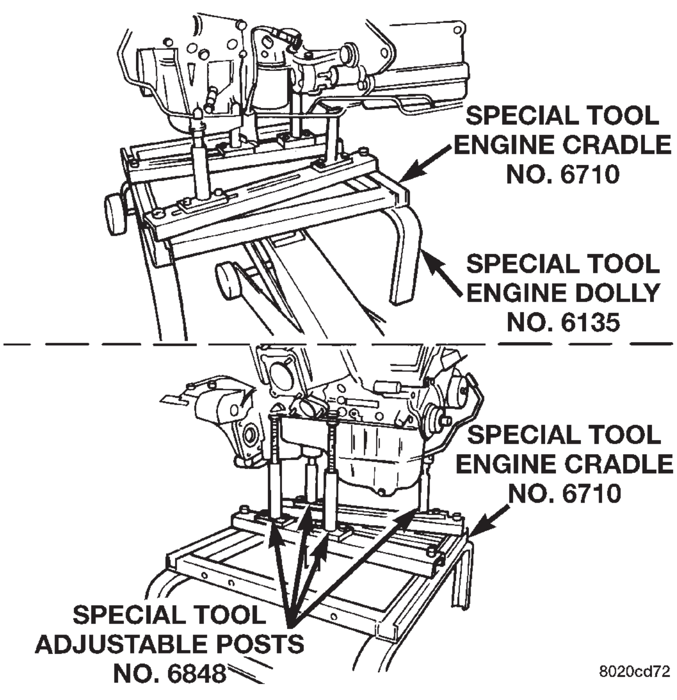


Fig. 28 Positioning Engine Cradle Support Post Mounts—Typical

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission. It may be necessary to move the engine/transmission assembly with the cradle for clearance around body flanges.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right engine and left transmission mounts. Refer to procedures outlined in this section.

(3) Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135, 6710, 6848 and 6909.

(4) Remove Special tools 6912 and install bending braces.

(5) Lower vehicle. Install generator and wiring harness.

(6) Connect wiring harness on the front of the engine.

(7) Install Air Conditioning Compressor.

(8) Install power steering pump and bracket and accessory drive belt. Refer to Accessory drive Section Located in group 7 for installation procedure.

(9) Raise vehicle and install axle shafts. Refer to Group 3, Differential and Driveline for procedure.

(10) Install transmission and engine mount and bracket assemblies. Refer to Engine Mounts section of this Group.

(11) **(AWD equipped)** Install propeller shaft to power transfer unit. Refer to Group 3, Differential and Driveline for procedure.

(12) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(13) Install crossmember cradle plate (Fig. 27).

(14) Install left and right inner splash shields.

(15) Connect automatic transmission shifter linkage. Refer to Group 21, Transmission for procedures.

(16) Lower vehicle and connect fuel line and heater hoses. Remove plugs from rear heater hoses and install, if equipped.

(17) Install ground straps. Connect engine and throttle body connections and harnesses.

(18) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(19) Install radiator and fan module assembly. Install radiator hoses. Fill cooling system. See Group 7 for filling procedure.

(20) Install battery tray, battery and cover.

(21) Install air cleaner and hoses.

(22) Install oil filter. Fill engine crankcase with proper oil to correct level.

(23) Start engine and run until operating temperature is reached.

(24) Adjust transmission linkage, if necessary.

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on hoist.

(3) Remove right wheel and inner splash shield.

(4) Remove drive belt. Refer to Group 7, Cooling System for procedure.

(5) Remove crankshaft pulley (Fig. 29).

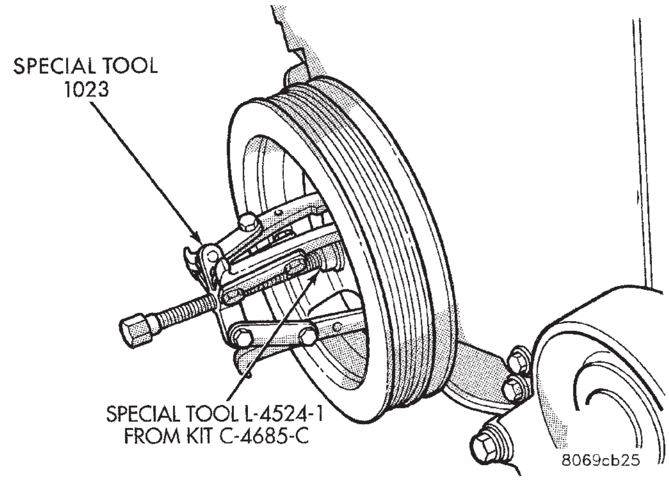


Fig. 29 Crankshaft Damper—Removal

INSTALLATION

(1) Install crankshaft pulley (Fig. 30).

(2) Install drive belt. Refer to Cooling System Group 7 for installation procedure.

(3) Install inner splash shield and wheel.

(4) Connect negative cable to battery.

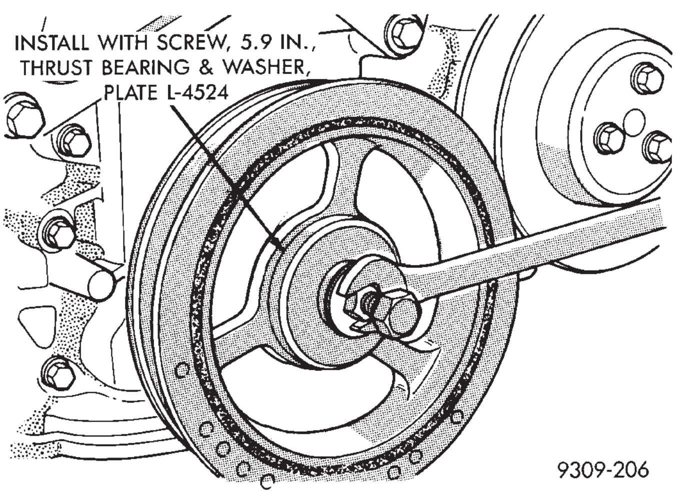


Fig. 30 Crankshaft Damper—Installation

ROCKER ARMS AND SHAFT ASSEMBLY

REMOVAL

(1) Remove upper intake manifold assembly. Refer to Group 11, Intake and Exhaust Manifolds.

(2) Disconnect spark plug wires by pulling on the boot straight out in line with plug.

(3) Disconnect closed ventilation system.

(4) Remove cylinder head cover and gasket.

(5) Remove four rocker shaft bolts and retainers.

(6) Remove rocker arms and shaft assembly.

(7) If rocker arm assemblies are disassembled for cleaning or replacement. Assemble rocker arms in their original position. Refer to (Fig. 31) for rocker arm for positioning on the shaft.

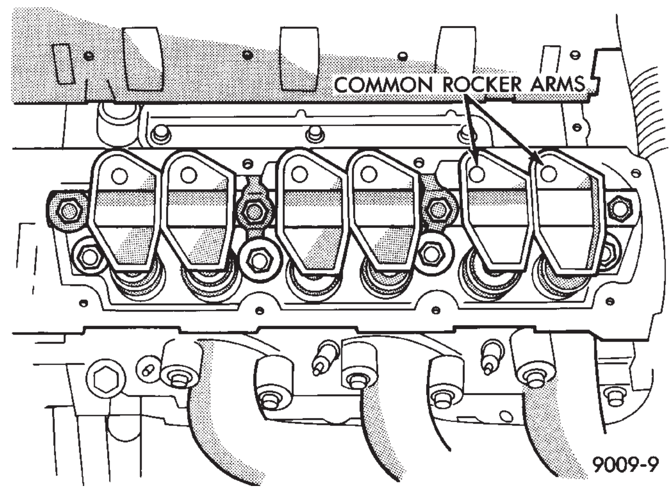


Fig. 31 Rocker Arm Location Left Bank

INSTALLATION

(1) Install rocker arm and shaft assemblies with the stamped steel retainers in the four positions, tighten to 28 N·m (250 in. lbs.) (Fig. 31).

CAUTION: THE ROCKER ARM SHAFT SHOULD BE TORQUED DOWN SLOWLY, STARTING WITH THE CENTER BOLTS. ALLOW 20 MINUTES TAPPET BLEED DOWN TIME AFTER INSTALLATION OF THE ROCKER SHAFTS BEFORE ENGINE OPERATION.

(2) Clean cylinder head cover gasket surface. Inspect cover for distortion and straighten if necessary.

(3) Clean head rail if necessary. Install a new gasket and tighten cylinder head cover fasteners to 12 N·m (105 in. lbs.).

(4) Install closed crankcase ventilation system.

(5) Install spark plug wires.

(6) Install upper intake manifold assembly. Refer to Group 11, Exhaust Systems and Intake Manifolds.

VALVE STEM SEALS OR SPRINGS, CYLINDER HEAD NOT REMOVED

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Disconnect negative cable from battery.

(3) Remove air cleaner cover and hose assembly.

REMOVAL AND INSTALLATION (Continued)

(4) Remove upper intake manifold. Refer to Group 11, Exhaust System and Intake Manifolds for procedure.

(5) Remove cylinder head covers and spark plugs.

(6) Remove electrical connector from ignition coils.

(7) Using suitable socket and flex handle at crankshaft pulley retaining screw, turn engine so the number 1 piston is at Top Dead Center on the compression stroke.

(8) Remove rocker arms with rocker shaft and install a dummy shaft. The rocker arms should not be disturbed and left on shaft.

(9) With air hose attached to spark plug adapter installed in number 1 spark plug hole, apply 90 to 100 psi air pressure (620.5 to 689 kPa). This is to hold valves in place while servicing components.

(10) Using Tool C-4682 or equivalent, compress valve spring and remove retainer valve locks and valve spring.

(11) The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as guide. **Do Not Force** seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

CAUTION: Do not pinch seal between retainer and top of valve guide.

(12) Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-2-3-4-5-6. **Make sure piston in cylinder is at TDC on the valve spring that is being covered.**

(13) Remove spark plug adapter tool.

(14) Remove dummy shaft and install rocker shaft assembly and tighten screws to 28 N·m (250 in. lbs.).

(15) Install cylinder head covers tighten screws to 14 N·m (120 in. lbs.) and electrical connector to ignition coils.

(16) Install Intake Manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure.

(17) Connect negative cable to battery.

CYLINDER HEAD COVER

REMOVAL

NOTE: The cylinder head cover can be either an isolated type (Fig. 32) or a non-isolated type.

FRONT CYLINDER HEAD COVER

(1) Disconnect ignition cables from spark plugs.

(2) Disconnect crankcase vent hose from cylinder head cover.

(3) Remove front cylinder head cover bolts.

(4) Remove cylinder head cover and gasket.

REAR CYLINDER HEAD COVER

(1) Disconnect negative cable from battery.

(2) Remove Wiper Unit. Refer to Group 8K, Windshield Wipers and Washers for procedure.

(3) Remove intake manifold upper plenum. Refer to Group 11, Exhaust System and Intake Manifold for procedure.

(4) Disconnect PCV hose from cylinder head cover.

(5) Remove rear cylinder head cover bolts

(6) Remove cylinder head cover and gasket.

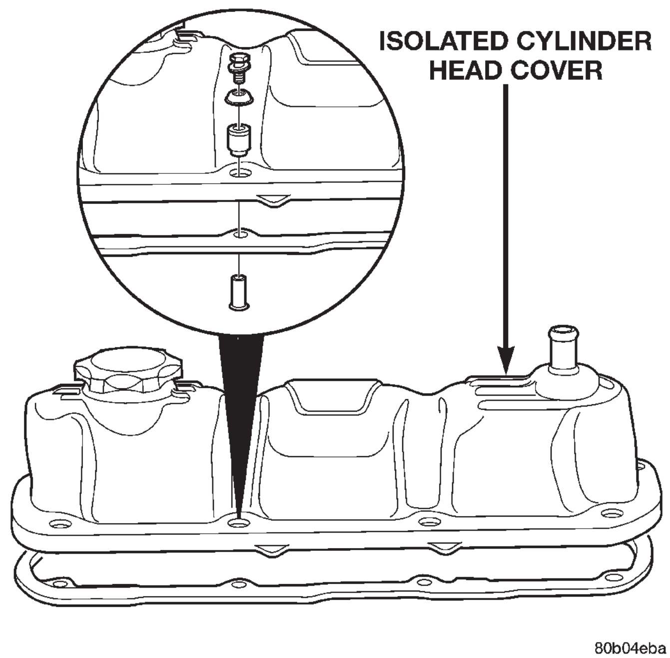


Fig. 32 Cylinder Head Cover—Isolated Type

INSTALLATION

FRONT CYLINDER HEAD COVER

(1) Clean cylinder head and cover mating surfaces. Inspect cylinder head cover surface for flatness. Replace gasket as necessary.

(2) Install cylinder head cover and bolts.

(3) Tighten cylinder head cover bolts to the following specifications:

• **Non–isolated** cylinder head cover to 12 N·m (105 in. lbs.).

• **Isolated** cylinder head cover to 10 N·m (90 in. lbs.) (Fig. 32).

(4) Connect crankcase vent hose.

(5) Connect ignition cables to spark plugs.

REAR CYLINDER HEAD COVER

(1) Clean cylinder head and cover mating surfaces. Inspect cylinder head cover surface for flatness. Replace gasket as necessary.

(2) Install cylinder head cover and bolts.

(3) Tighten cylinder head cover bolts to the following specifications:

REMOVAL AND INSTALLATION (Continued)

• **Non–isolated** cylinder head cover to 12 N·m (105 in. lbs.).
• **Isolated** cylinder head cover to 10 N·m (90 in. lbs.) (Fig. 32).

(4) Connect PCV hose from cylinder head cover.

(5) Install intake manifold upper plenum. Refer to Group 11, Exhaust System and Intake Manifold for procedure.

(6) Install Wiper Unit. Refer to Group 8K, Windshield Wipers and Washers for procedure.

(7) Connect negative cable to battery.

CYLINDER HEAD

REMOVAL

(1) Drain cooling system. Refer to Group 7, Cooling System for procedure and disconnect negative cable from battery.

(2) Remove upper and lower intake manifolds. Refer to Group 11, Exhaust System and Intake Manifold.

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

(3) Disconnect coil wires, sending unit wire, heater hoses and bypass hose.

(4) Remove PCV system hoses, evaporation control system hose and cylinder head covers.

(5) Remove exhaust manifolds.

(6) Remove rocker arm and shaft assemblies. Remove push rods and **mark positions to ensure installation in original locations.**

(7) Remove the 9 head bolts from each cylinder head and remove cylinder heads (Fig. 33).

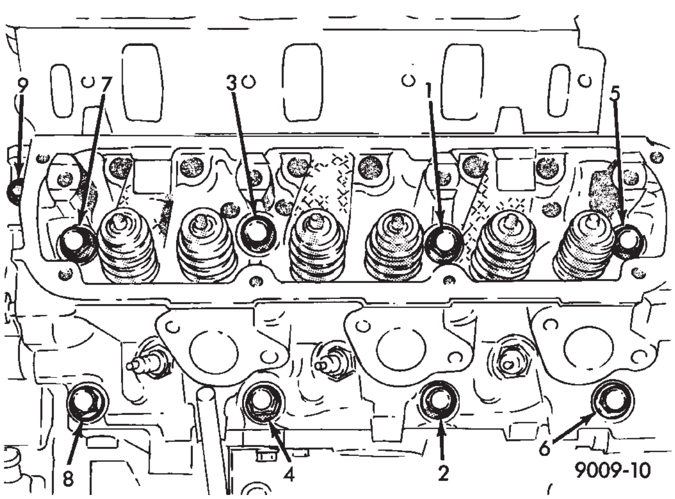


Fig. 33 Cylinder Head Bolts Location and Tightening Sequence

INSTALLATION

(1) Clean all sealing surfaces of cylinder block and cylinder heads.

(2) Install new gaskets on cylinder block (Fig. 34).

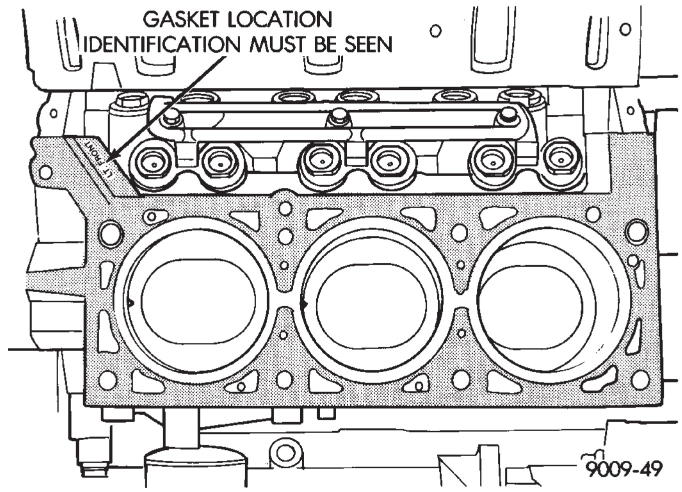


Fig. 34 Head Gasket Installation

(3) **The cylinder head bolts are torqued using the torque yield method, they should be examined BEFORE reuse. If the threads are necked down, the bolts should be replaced** (Fig. 35).

(4) 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.

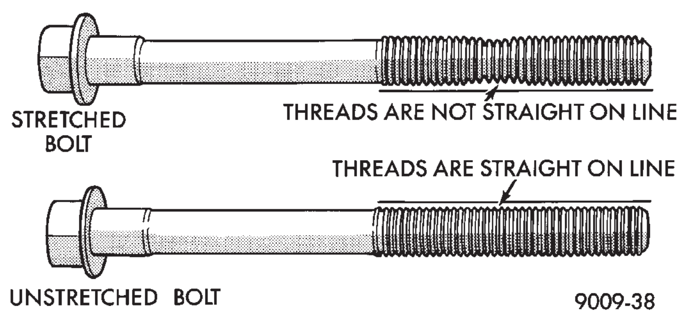


Fig. 35 Checking Bolts for Stretching (Necking)

(5) Tighten the cylinder head bolts 1 - 8 in the sequence shown in (Fig. 33). Using the 4 step torque turn method, tighten according to the following values:

• Step 1: Bolts 1 – 8 to 61 N·m (45 ft. lbs.)
• Step 2: Bolts 1 – 8 to 88 N·m (65 ft. lbs.)
• Step 3: Bolts 1 – 8 (again) to 88 N·m (65 ft. lbs.)
• Step 4: Bolts 1 – 8 turn an additional 1/4 Turn. **(Do not use a torque wrench for this step.)**

NOTE: Bolt torque after 1/4 turn should be over 122 N·m (90 ft. lbs.). If not, replace the bolt.

(6) Tighten head bolt number 9 (Fig. 33) to 33 N·m (25 ft. lbs.) after head bolts 1 – 8 have been tighten to specifications.

REMOVAL AND INSTALLATION (Continued)

(7) Inspect push rods and replace worn or bent rods.

(8) Install push rods, rocker arm and shaft assemblies with the stamped steel retainers in the four positions, tighten to 28 N·m (250 in. lbs.) (Fig. 36).

(9) Place new cylinder head cover gaskets in position and install cylinder head covers. Tighten to 12 N·m (105 in. lbs.).

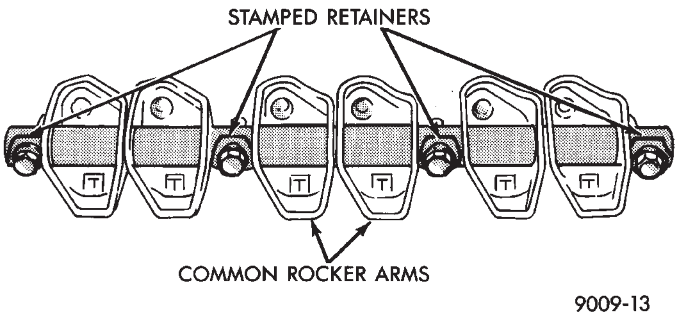


Fig. 36 Rocker Arm Shaft Retainers

INTAKE MANIFOLD SEALING

The intake manifold gasket is a one-piece stamped steel gasket with a sealer applied from the manufacturer. This gasket has end seals incorporated with it.

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

(1) Clean all surfaces of cylinder block and cylinder heads.

(2) Place a drop (about 1/4 in. diameter) of Mopar® Silicone Rubber Adhesive Sealant or equivalent, onto each of the **four** manifold to cylinder head gasket corners (Fig. 37).

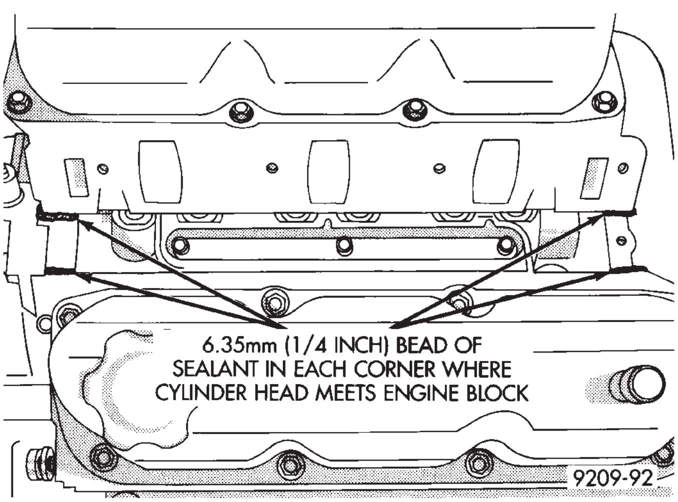


Fig. 37 Intake Manifold Gasket Sealing

(3) Carefully install the intake manifold gasket (Fig. 38). Torque end seal retainer screws to 12 N·m (105 in. lbs.).

(4) Install intake manifold and (8) bolts and torque to 1 N·m (10 in. lbs.). Then tighten bolts to 22 N·m (200 in. lbs.) in sequence shown in (Fig. 39). Then tighten again to 22 N·m (200 in. lbs.). After intake manifold is in place, **inspect to make sure seals are in place.** Refer to Group 11, Exhaust System and Intake Manifold to complete intake manifold installation.

(5) Install exhaust manifolds and tighten bolts to 27 N·m (20 ft. lbs.) and nuts to 20 N·m (15 ft. lbs.).

(6) Adjust spark plugs to specification in Group 8, Electrical Section and install the plugs.

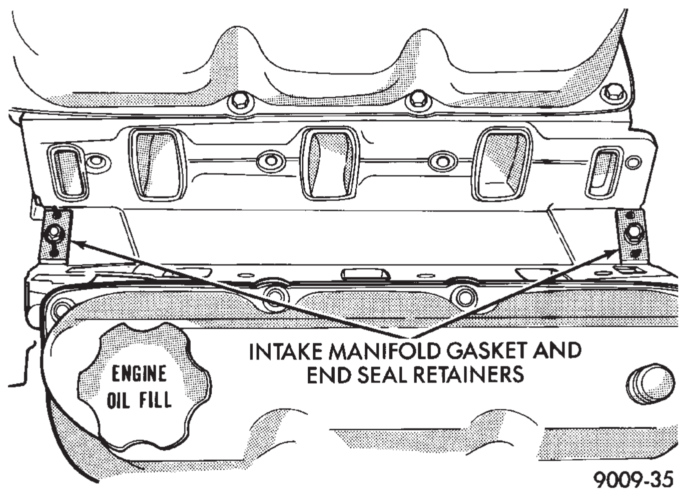


Fig. 38 Intake Manifold Gasket Retainers

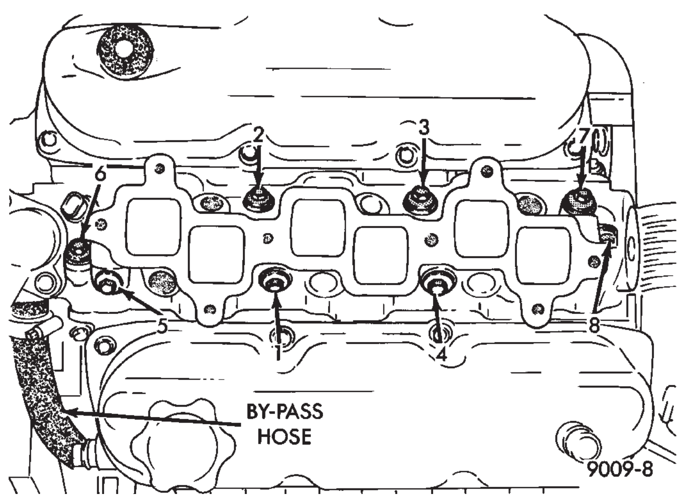


Fig. 39 Intake Manifold Removal and Installation

VALVES AND VALVE SPRINGS

REMOVAL

(1) With cylinder head removed, compress valve springs using Valve Spring Compressor Tool C-3422-B with adapter 6412 as shown in (Fig. 40).

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

REMOVAL AND INSTALLATION (Continued)

(3) Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

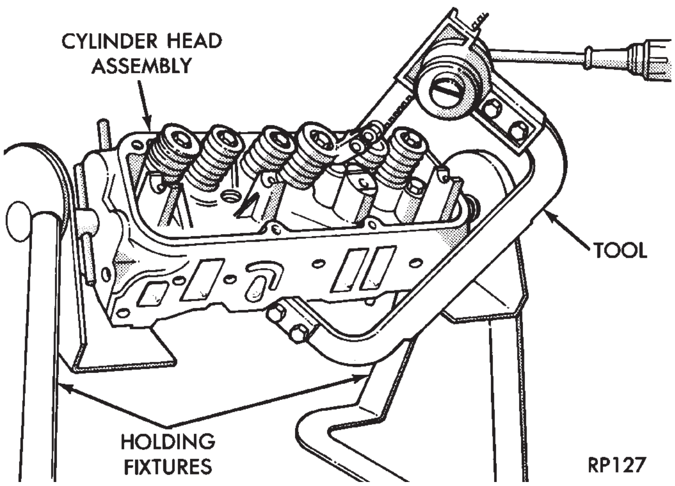


Fig. 40 Compress Valve Springs with Special Tool C-3422-B with Adapter 6412

VALVE INSTALLATION

(1) Coat valve stems with clean engine oil and insert them in cylinder head.

(2) Check valve tip to spring seat dimensions A after grinding the valve seats or faces. Grind valve tip to give 49.541 to 51.271 mm (1.950 to 2.018 in.) over spring seat when installed in the head (Fig. 41). Check valve tip for scoring, if necessary, the tip chamfer should be reground to prevent seal damage when the valve is installed.

(3) Install valve spring seat spacer on head (Fig. 42).

(4) Install new cup seals on all valve stems and over valve guides (Fig. 41). Install valve springs and valve retainers (Fig. 42).

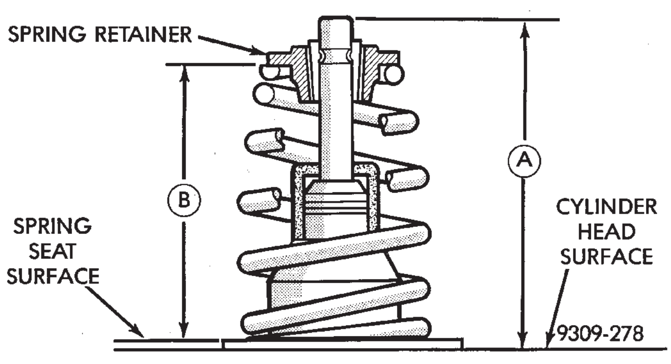


Fig. 41 Checking Valve Installed Height

(5) Compress valve springs with Valve Spring Compressor Tool C-3422-B, with adapter 6412 install locks and release tool. **If valves and/or seats are reground, measure the installed height of springs dimension B, make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 1-19/32 inches, (40.6 mm), install a 1/32 inch (.794 mm) spacer in head counterbore to bring spring height back to normal 1-17/32 to 1-19/32 inch (39.1 to 40.6 mm)**.

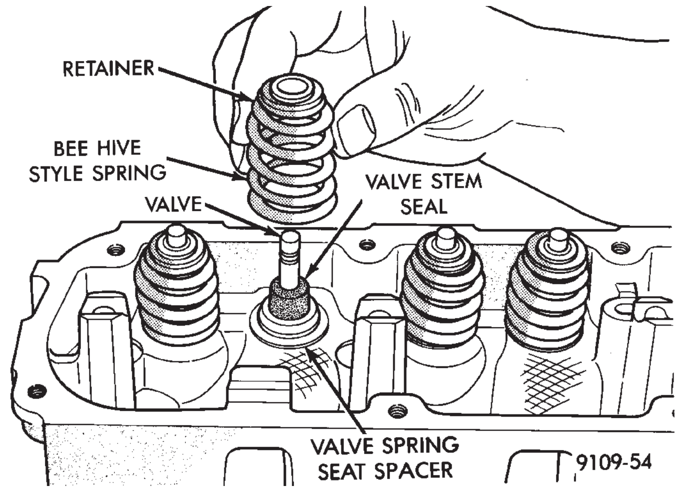


Fig. 42 Valve Seal and Spring—Installation

TAPPET REMOVAL

(1) Refer to Cylinder Head Removal in this section. Cylinder Head must be removed to gain access to tappets for service.

(2) Remove yoke retainer and aligning yokes.

(3) Use Tool C-4129 to remove tappets from their bores. If all tappets are to be removed, identify tappets to insure installation in original location.

NOTE: If the tappet or bore in cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize and replace with oversize tappet.

CAUTION: The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body. It is advisable to work on one tappet at a time to avoid mixing of parts. Mixed parts are not compatible. Do not disassemble a tappet on a dirty work bench.

INSTALLATION

(1) Lubricate tappets.

(2) Install tappets in their original positions.

(3) With roller tappets, install aligning yokes (Fig. 43).

(4) Install yoke retainer and torque screws to 12 N·m (105 in. lbs.) (Fig. 43).

(5) Install cylinder heads. Refer to cylinder head installation of this section for procedure.

REMOVAL AND INSTALLATION (Continued)

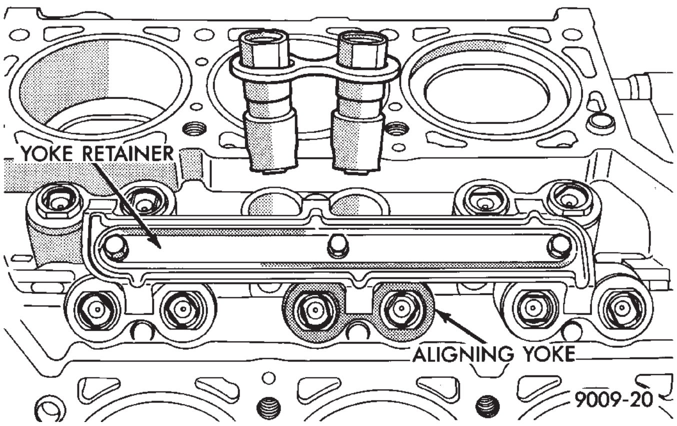


Fig. 43 Roller Tappets Aligning Yoke and Retainer

(6) Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

TIMING CHAIN COVER

REMOVAL

(1) Disconnect negative cable from battery.
(2) Drain cooling system. Refer to Cooling System Group 7 for procedure.
(3) Support engine and remove right engine mount.
(4) Raise vehicle on hoist. Drain engine oil.
(5) Remove oil pan and oil pump pick-up. It may necessary to remove transaxle inspection cover.
(6) Remove right wheel and inner splash shield.
(7) Remove drive belt. Refer to Cooling System Group 7 for procedure.
(8) Remove A/C compressor and set aside.
(9) Remove A/C compressor mounting bracket.
(10) Remove crankshaft damper (Fig. 44).
(11) Remove idler pulley from engine bracket.
(12) Remove engine bracket (Fig. 45).
(13) Remove cam sensor from chain case cover (Fig. 46).
(14) Remove chain case cover (Fig. 46).

INSTALLATION

(1) Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs. Crankshaft oil seal must be removed to insure correct oil pump engagement.

NOTE: DO NOT USE SEALER ON COVER GASKET

(2) Use a new cover gasket, and O-rings (Fig. 47). Adhere new gasket to chain case cover, making sure that the lower edge of the gasket is flush to 0.5 mm (0.020 in.) passed the lower edge of the cover. Refer to Oil Pan sealing outlined in this section.

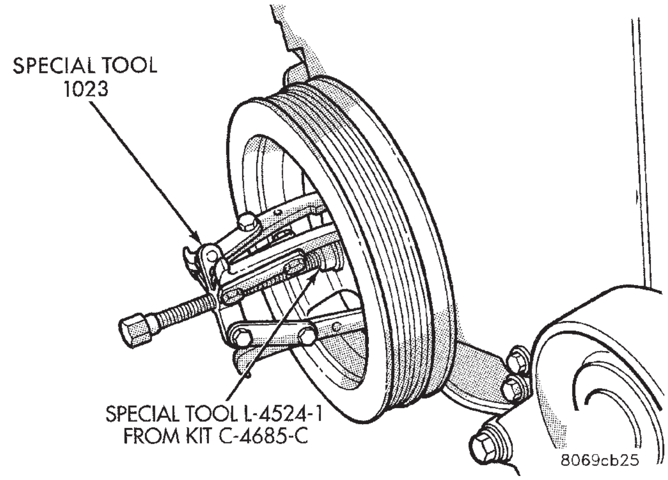


Fig. 44 Crankshaft Damper—Removal

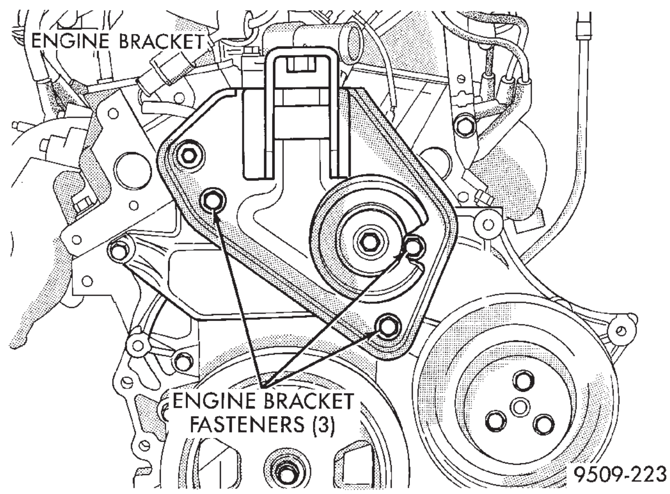


Fig. 45 Engine Bracket

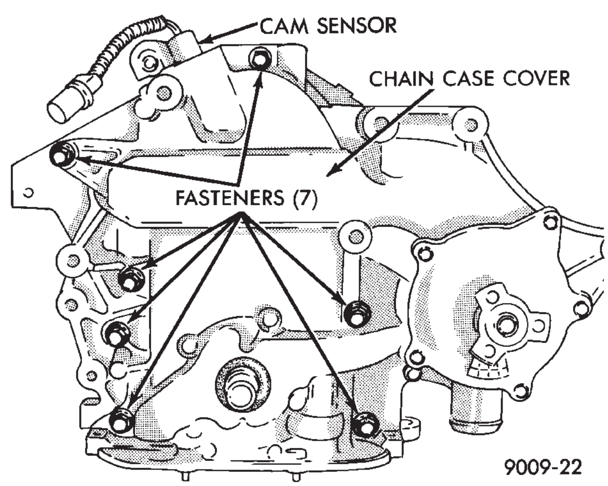


Fig. 46 Timing Chain Case Cover

REMOVAL AND INSTALLATION (Continued)

(3) Rotate crankshaft so that the oil pump drive flats are vertical.

(4) Position oil pump inner rotor so the mating flats are in the same position as the crankshaft drive flats (Fig. 47).

(5) Install cover onto crankshaft. Make sure the oil pump is engaged on the crankshaft correctly or severe damage may result.

(6) Install chain case cover screws and torque to 27 N·m (20 ft. lbs.).

(7) Install crankshaft oil seal (Fig. 48).

(8) Install crankshaft pulley (Fig. 49).

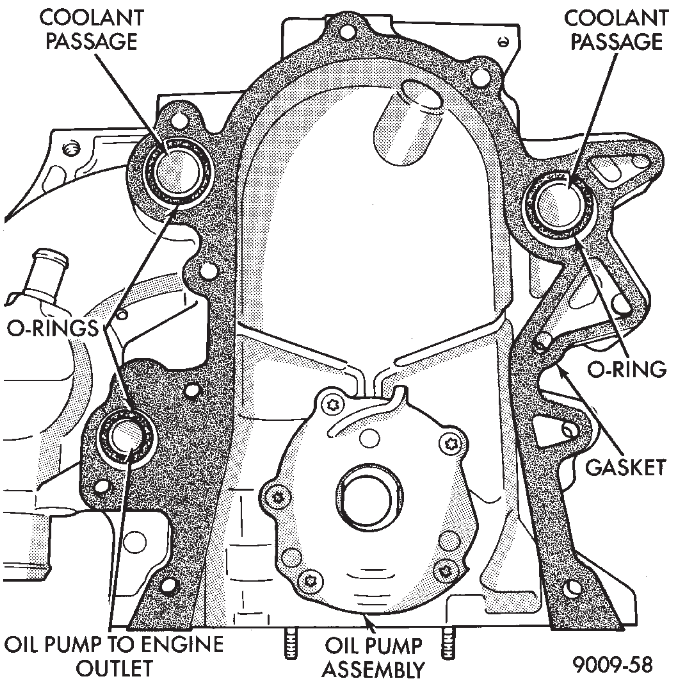


Fig. 47 Timing Chain Case Cover Gaskets and O-Rings

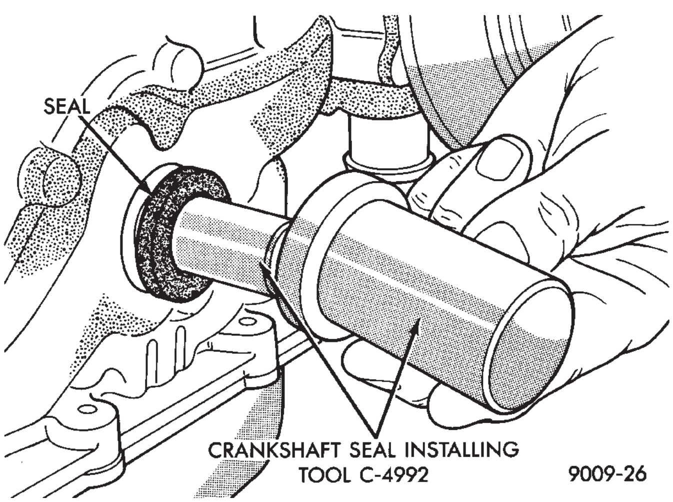


Fig. 48 Crankshaft Oil Seal—Installation

(9) Install engine bracket (Fig. 45) and torque fasteners to 54 N·m (40 ft. lbs.).

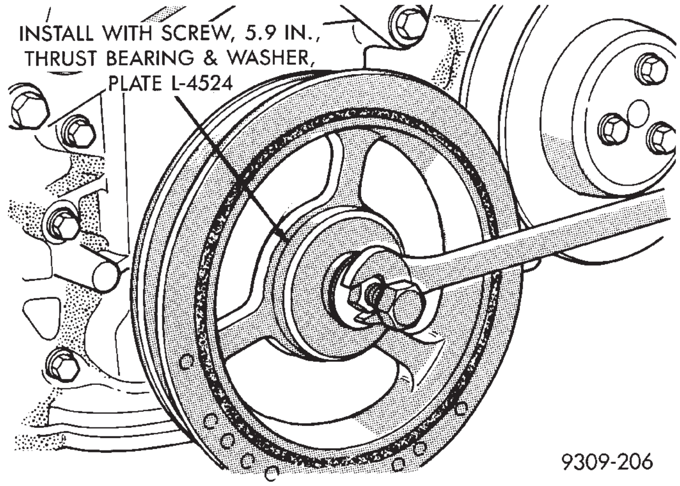


Fig. 49 Crankshaft Damper—Installation

(10) Install idler pulley on engine bracket.

(11) Install cam sensor. Refer to Group 8D, Ignition System for installation procedure.

(12) Install A/C compressor mounting bracket.

(13) Install A/C compressor.

(14) Install drive belt Refer to Group 7, Cooling System for installation procedure.

(15) Install inner splash shield and wheel.

(16) Install oil pump pick-up and oil pan and transaxle inspection cover if removed.

(17) Install engine mount.

(18) Fill crankcase with oil to proper level.

(19) Fill cooling system. Refer to Group 7, Cooling System for procedure.

(20) Connect negative cable to battery.

TIMING CHAIN

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove timing chain cover. Refer to procedure outlined in this section.

(3) Remove camshaft sprocket attaching bolt, and timing chain with camshaft sprocket.

(4) Using a suitable puller remove the crankshaft sprocket. Be careful not to damage the crankshaft surface.

INSTALLATION

(1) Position a new crankshaft sprocket on the shaft, install sprocket with suitable tool and mallet. Be sure sprocket is seated into position.

(2) Rotate crankshaft so the timing arrow is to the 12 o'clock position.

(3) Place timing chain around camshaft sprocket and place the timing mark to the 6 o'clock position.

(4) Align the dark colored links with the dot on the camshaft sprocket, place timing chain around crankshaft sprocket with the dark colored link lined up

REMOVAL AND INSTALLATION (Continued)

with the dot on the sprocket and install camshaft sprocket into position.

(5) Use a straight edge to check alignment of timing marks (Fig. 50).

(6) Install camshaft bolt and washer. Tighten to 54 N·m (40 ft. lbs.).

(7) Rotate crankshaft 2 revolutions. Timing marks should line up. If timing marks do not line up remove cam sprocket and realign.

(8) Check camshaft end play. With new thrust plate the specification is 0.0127 to 0.304 mm (0.005 to 0.012 in.). Old thrust plate specification is 0.31 mm (0.012 in.) maximum. If not within these limits install new thrust plate.

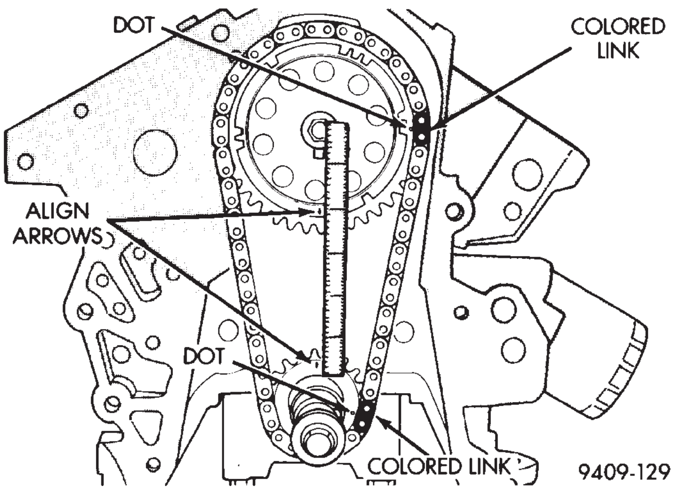


Fig. 50 Timing Marks Alignment

(9) Install timing chain cover and connect negative cable to battery.

CAMSHAFT

REMOVAL—ENGINE REMOVED FROM VEHICLE

Remove intake manifold, cylinder head covers, cylinder heads, timing chain case cover and timing chain.

(1) Remove rocker arm and shaft assemblies.

(2) Remove push rods and tappets; identify so each part will be replaced in its original location.

(3) Remove camshaft thrust plate (Fig. 51).

(4) Install a long bolt into front of camshaft to facilitate removal of the camshaft; remove camshaft, being careful not to damage cam bearings with the cam lobes.

INSTALLATION

(1) Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft to within 2 inches of its final position in cylinder block.

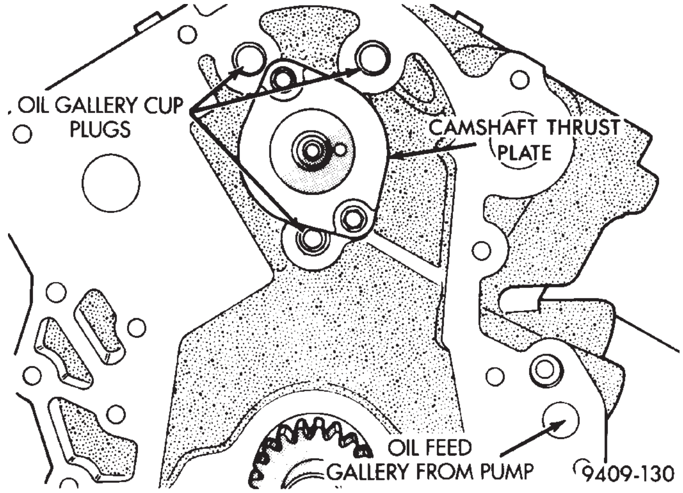


Fig. 51 Camshaft Thrust Plate

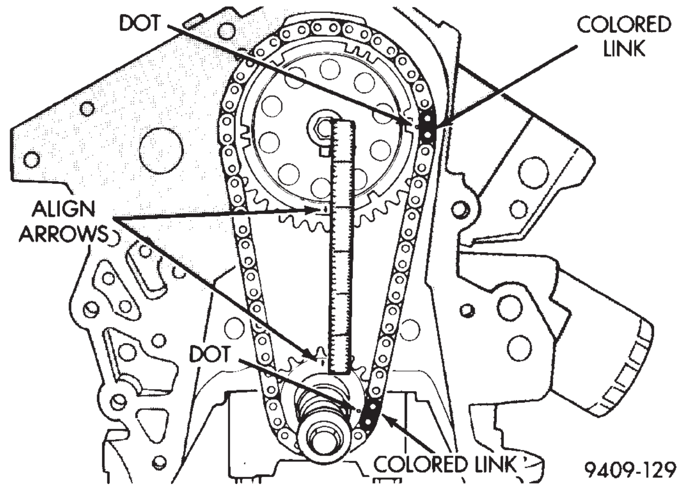


Fig. 52 Alignment of Timing Marks

(2) Install camshaft thrust plate with two screws as shown in (Fig. 51). Tighten to 12 N·m (105 in. lbs.) torque.

(3) Rotate crankshaft so the timing arrow is at the 12 o'clock position.

(4) Place timing chain around camshaft sprocket and place the timing mark to the 6 o'clock position.

(5) Align the dark colored links with the dot on the camshaft sprocket, place timing chain around crankshaft sprocket with the dark colored link lined up with the dot on the sprocket and install camshaft sprocket into position.

(6) Using straight edge to check alignment of timing marks (Fig. 52).

(7) Install the camshaft bolt. Tighten bolt to 54 N·m (40 ft. lbs.).

(8) Rotate crankshaft 2 revolutions. Timing marks should line up. If timing marks do not line up, remove cam sprocket and realign.

(9) Measure camshaft end play. End Play should measure 0.0127 to 0.304 mm (0.005 to 0.012 inches.)

REMOVAL AND INSTALLATION (Continued)

0.310 mm (0.012 in. Max.). If not within limits install a new thrust plate.

(10) Each tappet reused must be installed in the same position from which it was removed. **When camshaft is replaced, all of the tappets must be replaced**.

CAMSHAFT BEARINGS

REMOVAL

(1) With engine removed from vehicle and completely disassembled, drive out rear cam bearing core hole plug.

(2) Install proper size adapters and horseshoe washers (part of Tool C-3132-A) at back of each bearing shell to be removed and drive out bearing shells (Fig. 53).

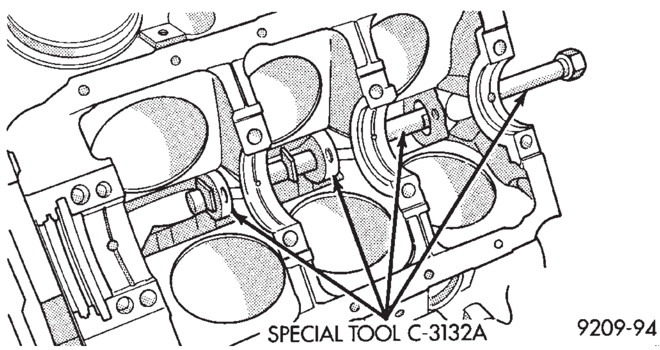


Fig. 53 Removed Installation of Camshaft Bearings with Tool C-3132–A—Typical

INSTALLATION

(1) Install new camshaft bearings with Tool C-3132-A by sliding the new camshaft bearing shell over proper adapter.

(2) Position rear bearing in the tool. Install horseshoe lock and by reversing removal procedure, carefully drive bearing shell into place.

(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main bearing. Number two bearing must index with the oil passage to the left cylinder head and Number three bearing must index with the oil passage to the right cylinder head. If the camshaft bearing shell oil holes are not in exact alignment, remove and reinstall them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

OIL PAN

REMOVAL

(1) Disconnect negative cable from battery and remove engine oil dipstick.

(2) Raise vehicle on hoist and drain engine oil.

(3) Remove bending brace to transaxle attaching bolt.

(4) Remove bolts attaching dust cover to transaxle housing. Lower dust cover to gain access to oil pan bolts.

(5) Remove oil pan screws and remove oil pan.

INSTALLATION

(1) Clean surfaces and apply a 1/8 inch bead of Mopar® Silicone Rubber Adhesive Sealant or equivalent, at the parting line of the chain case cover and the rear seal retainer (Fig. 54).

(2) Use a new pan gasket (Fig. 55).

(3) Install pan and tighten screws to 12 N·m (105 in. lb.).

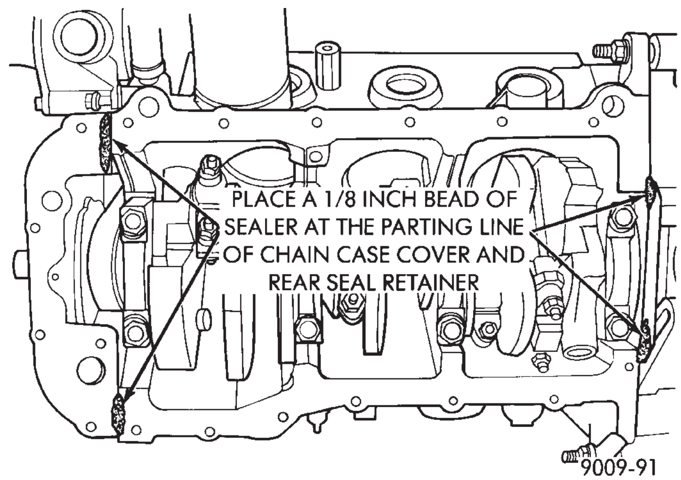


Fig. 54 Oil Pan Sealing

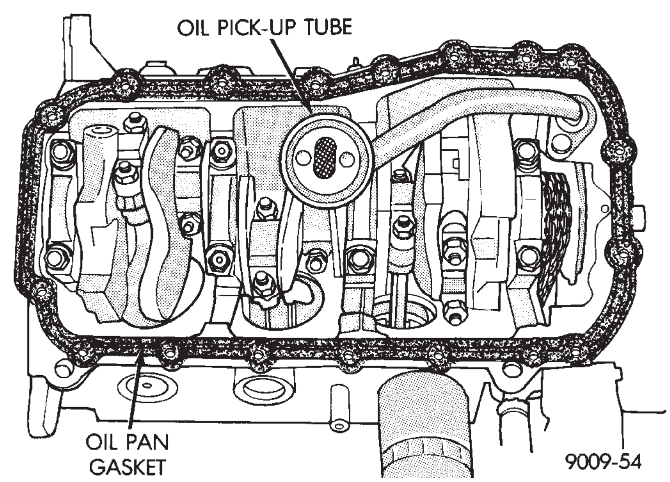


Fig. 55 Oil Pan Gasket Installation

(4) Install dust shield and bending brace to transaxle housing.

(5) Lower vehicle and install oil dipstick.

(6) Connect negative cable to battery.

(7) Fill crankcase with oil to proper level.

REMOVAL AND INSTALLATION (Continued)

PISTON AND CONNECTING ROD

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove cylinder heads and oil pan. Refer to procedure outlined in this section.

(3) 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. Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so that each connecting rod is centered in cylinder bore.**

(4) Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary (Fig. 56).

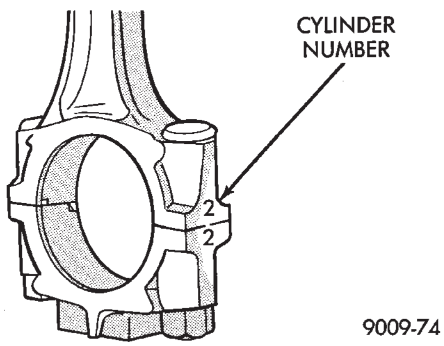


Fig. 56 Identify Connecting Rod to Cylinder

(5) Remove connecting rod cap. Install connecting rod bolt protectors on connecting rod bolts (Fig. 57). Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(6) After removal, install bearing cap on the mating rod.

INSTALLING PISTON AND CONNECTING ROD ASSEMBLY

(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 (Fig. 58).

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 58).

(3) Lubricate the piston and rings with clean engine oil. Position a ring compressor over the piston and rings, and tighten the compressor. **Be sure position of rings does not change during this operation.**

(4) Install connecting rod bolt protectors on rod bolts (Fig. 57).

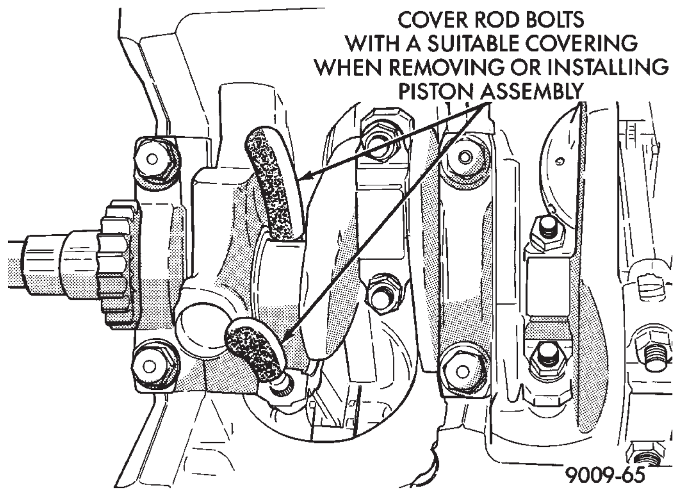


Fig. 57 Connecting Rod Protectors

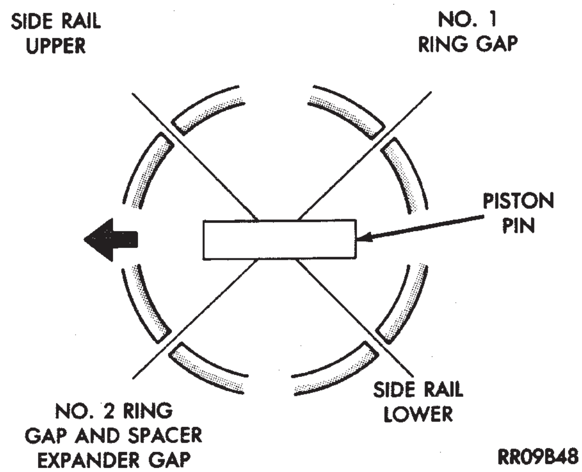


Fig. 58 Piston Ring End Gap Position

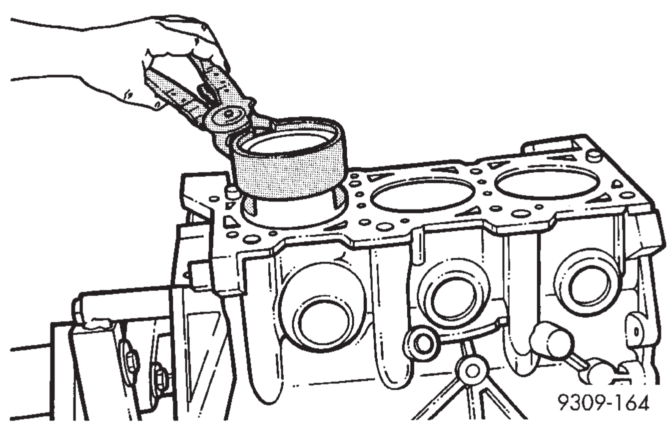


Fig. 59 Piston—Installation

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

REMOVAL AND INSTALLATION (Continued)

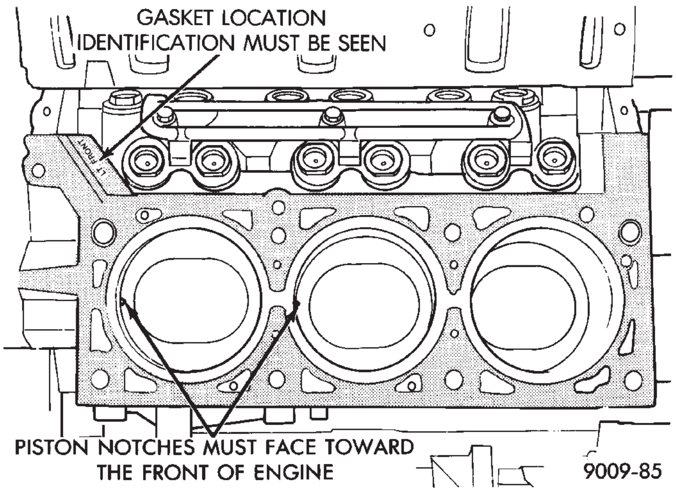


Fig. 60 Piston I.D. Notches

(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.

(7) The notch or groove on top of piston must be pointing toward front of engine (Fig. 60).

(8) Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 54 N·m (40 ft. lb.) Plus 1/4 turn.

(9) Repeat procedure for each piston and rod installation.

(10) Install cylinder heads and oil pan.

(11) Fill engine crankcase with proper oil to correct level.

(12) Connect negative cable to battery.

CRANKSHAFT

MAIN BEARINGS

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly (Fig. 62). Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of 1, 3 and 4 are interchangeable. Upper main bearing halves of 1, 3 and 4 are interchangeable.

CRANKSHAFT MAIN JOURNALS

The crankshaft journals should be checked for excessive wear, taper and scoring. (Fig. 61) Limits of taper or out-of-round on any crankshaft journals should be held to 0.025 mm (0.001 in.). Journal grinding should not exceed 0.305 mm (0.012 in.) under the standard journal diameter. Do NOT grind thrust faces of Number 2 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 used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

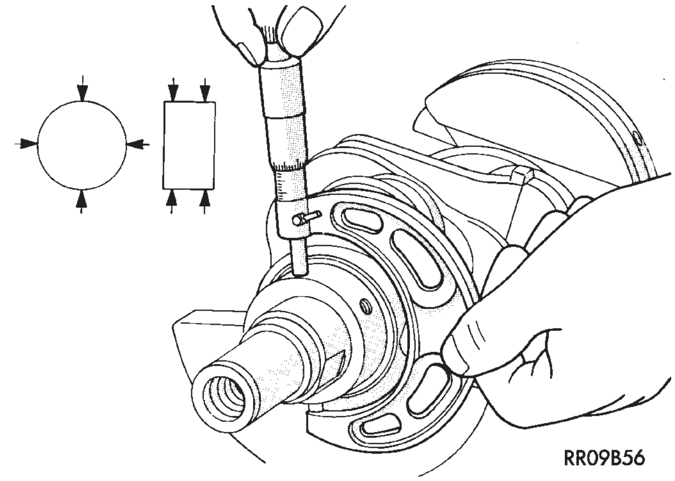


Fig. 61 Measure Crankshaft Journal O.D.

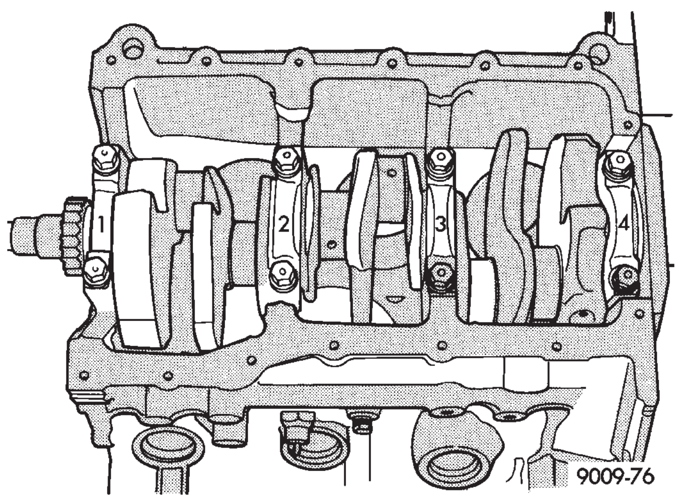


Fig. 62 Main Bearing Cap Identification

Upper and lower Number 2 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine (Fig. 63). 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 undersizes: 0.025 mm (0.001 in.) and 0.254 mm (0.010 in). Never install an undersize bearing that will reduce clearance below specifications.

REMOVAL

(1) Remove oil pan and identify bearing caps before removal.

(2) Remove bearing caps one at a time. Remove upper half of bearing by inserting Special Main Bearing Tool C-3059. (Fig. 64) into the oil hole of crankshaft.

REMOVAL AND INSTALLATION (Continued)

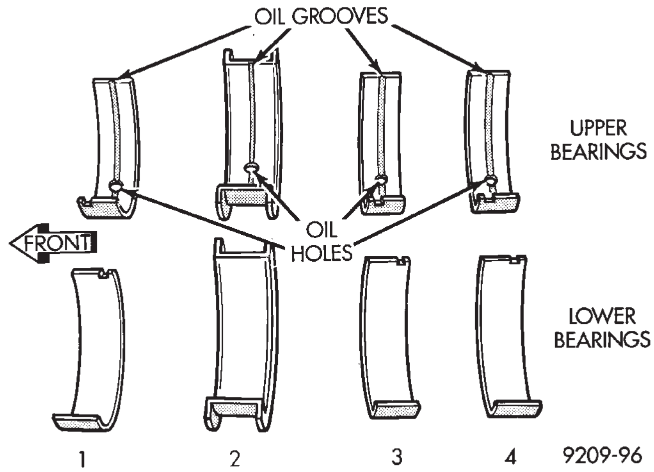


Fig. 63 Main Bearing Identification

(3) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

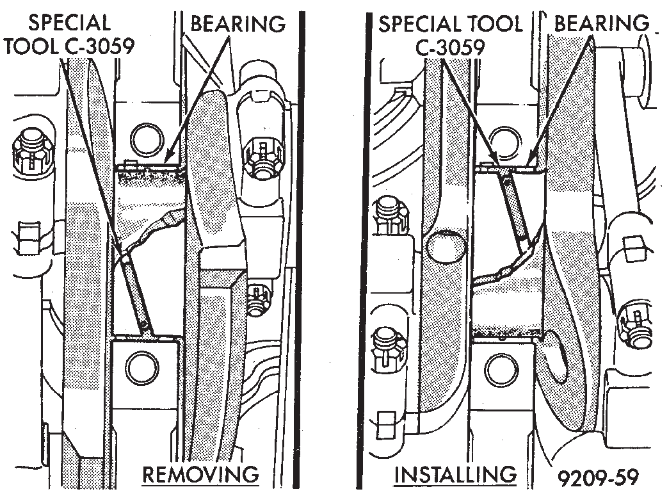


Fig. 64 Removing and Installing Upper Main Bearing With Special Tool C-3059

INSTALLATION

NOTE: Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Main Bearing Tool C-3059 into oil hole of crankshaft (Fig. 64).

(2) Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Special Main Bearing Tool C-3059.

(3) Install each main cap and tighten bolts finger tight.

(4) Tighten number 1, 3 and 4 main cap bolts to 41 N·m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn).

(5) Rotate the crankshaft until number 6 piston is at TDC.

(6) To ensure correct thrust bearing alignment the following procedure must be done:

a. Move crankshaft all the way to the rear of its travel.

b. Then, move crankshaft all the way to the front of its travel.

c. Wedge a appropriate tool between the rear of the cylinder block and rear crankshaft counterweight. This will hold the crankshaft in it's most forward position.

d. Tighten the #2 Thrust Bearing cap bolts to 41 N·m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn). Remove the holding tool.

(7) Install oil pan.

(8) Fill engine crankcase with proper oil to correct level.

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on hoist. Remove right wheel and inner splash shield.

(3) Remove drive belt. Refer to Group 7, Cooling System for procedure.

(4) Remove crankshaft damper (Fig. 65).

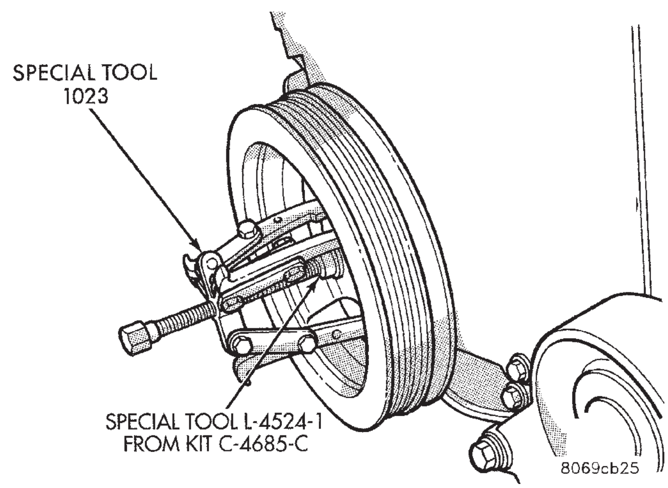


Fig. 65 Crankshaft Damper—Removal

(5) Using Tool 6341A to remove oil seal (Fig. 66). Be careful not to damage that crankshaft seal surface of cover.

INSTALLATION

(1) Install new seal by using Tool C-4992 (Fig. 67).

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

(3) Install crankshaft pulley using plate L-4524. Thrust Bearing/washer and 5.9 inch screw (Fig. 68).

REMOVAL AND INSTALLATION (Continued)

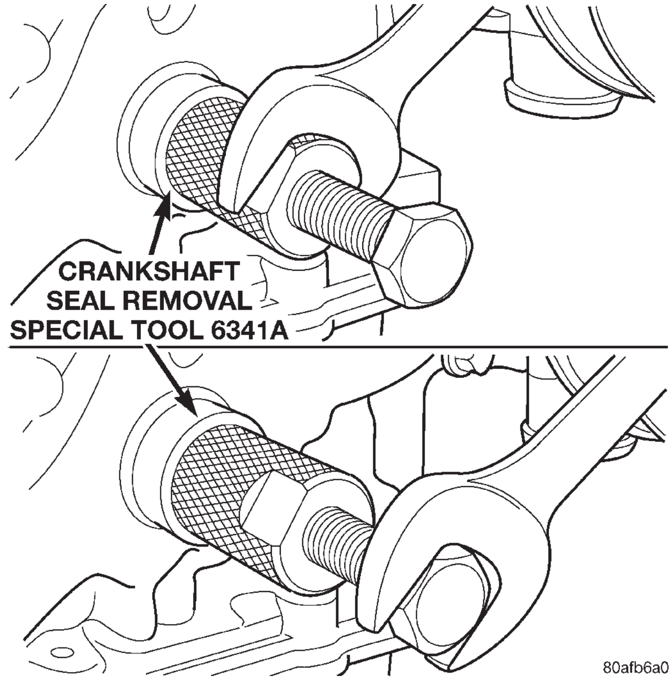


Fig. 66 Front Crankshaft Oil Seal—Removal

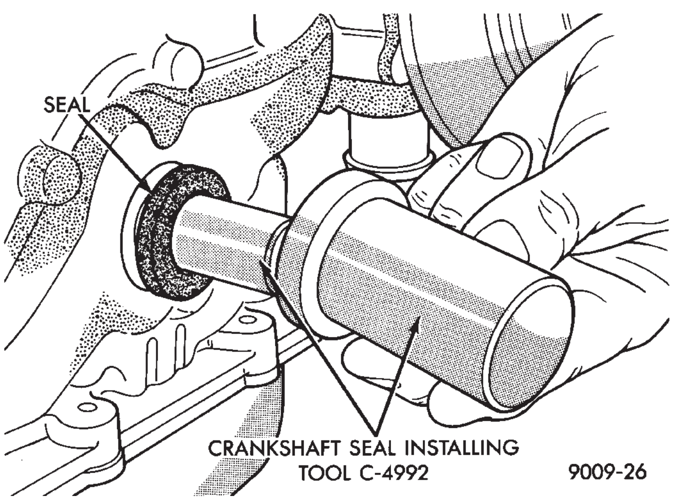


Fig. 67 Crankshaft Oil Seal—Installation

(4) Install drive belt Refer to Group 7, Cooling System for installation procedure.

(5) Install inner splash shield and wheel.

(6) Lower vehicle and connect negative cable to battery.

CRANKSHAFT OIL SEAL—REAR

REMOVAL

(1) Insert a 3/16 flat bladed pry tool between the dust lip and the metal case of the crankshaft seal. Angle the pry tool (Fig. 69) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the pry tool blade to contact crankshaft seal surface. Contact of the pry tool blade against crankshaft edge (chamfer) is permitted.

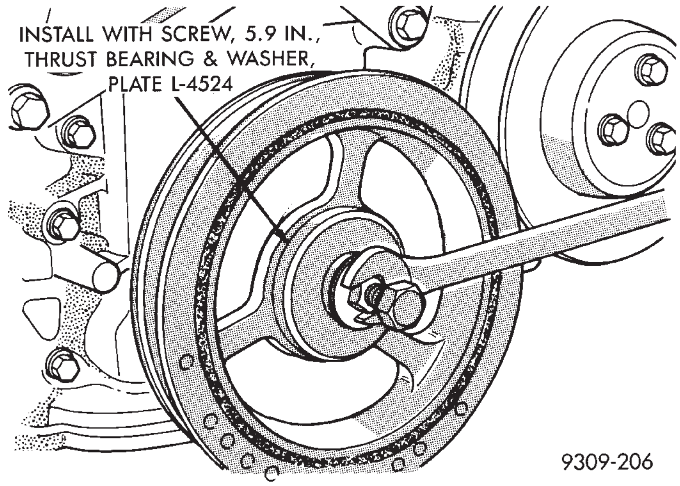


Fig. 68 Crankshaft Damper—Installation

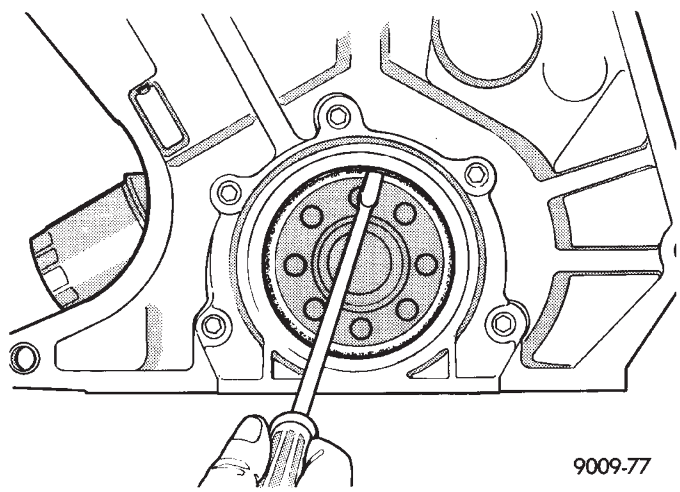


Fig. 69 Rear Crankshaft Oil Seal—Removal

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) Place Special Tool 6926-1 magnetic pilot tool on crankshaft (Fig. 70).

(2) Lightly coat seal O.D. with Mopar® Stud N' Bearing Mount Adhesive or equivalent.

(3) Place seal over Special Tool 6926-1 Pilot. Using Special Tool 6926-2 Installer with C-4171 Handle, drive seal into the retainer housing (Fig. 70).

REAR CRANKSHAFT SEAL RETAINER

When retainer removal is required, remove retainer and clean engine block and retainer of old gasket. Make sure surfaces are clean and free of oil.

REMOVAL AND INSTALLATION (Continued)

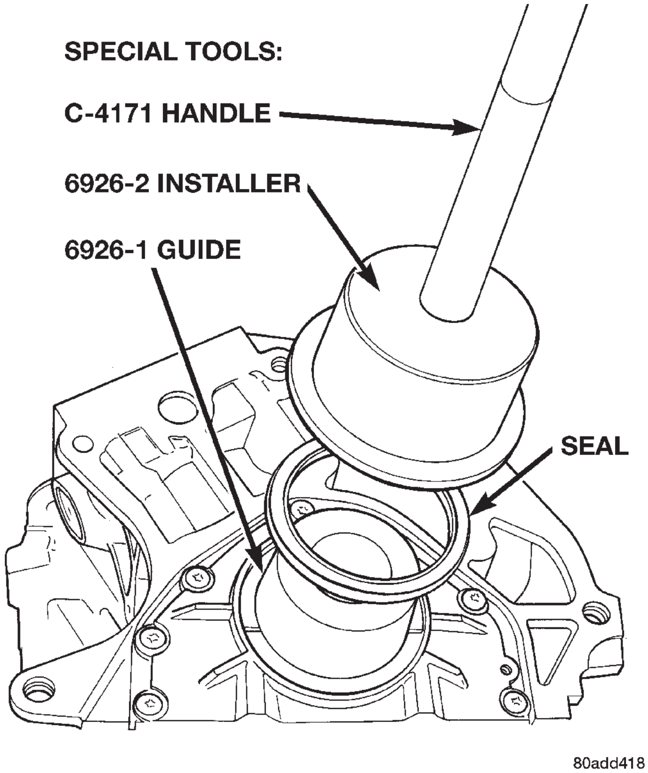


Fig. 70 Rear Crankshaft Oil Seal—Installation

Install new gasket and tighten screws to 12 N·m (105 in. lbs.).

OIL FILTER

CAUTION: When servicing the oil filter (Fig. 71) 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.

(1) Using Tool C-4065, turn filter counterclockwise to remove from base. Properly discard filter.

(2) Wipe base clean, then inspect gasket contact surface.

(3) Lubricate gasket of new filter with clean engine oil.

(4) Install new filter until gasket contacts base. Tighten filter 1 turn or 20 N·m (15 ft. lbs.). Use filter wrench if necessary.

(5) Start engine and check for leaks.

ENGINE OIL GALLERY PLUGS

REMOVAL

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. 72).

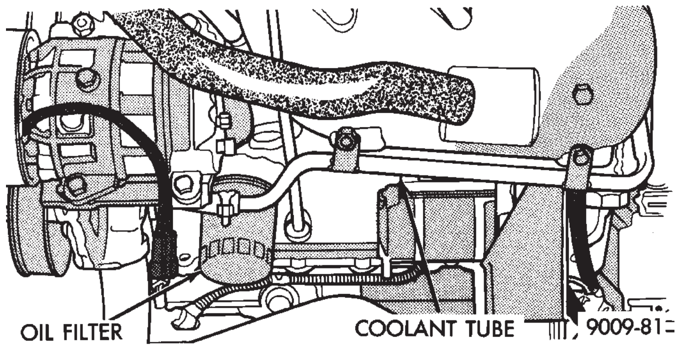


Fig. 71 Oil Filter

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

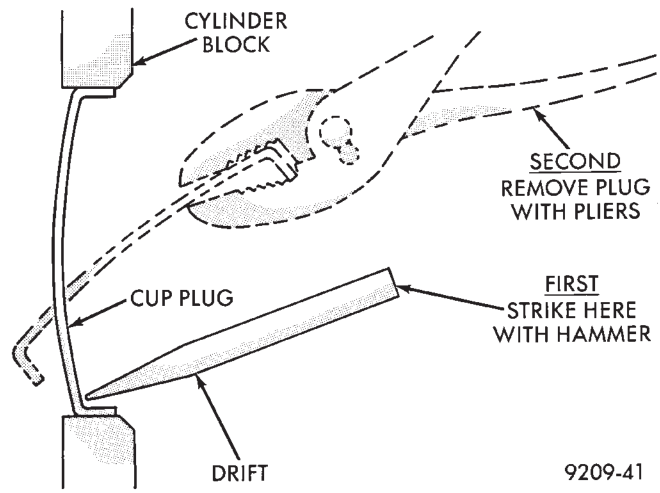


Fig. 72 Core Hole Plug Removal

INSTALLATION

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 Loctite Stud N' Bearing Mount or equivalent. 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.

DISASSEMBLY AND ASSEMBLY

OIL PUMP

It is necessary to remove the oil pan, oil pickup and chain case cover to service the oil pump rotors. The oil pump pressure relief valve can be serviced by removing the oil pan and oil pickup tube. Refer to Timing Chain Cover Removal and Installation of this section for procedures.

DISASSEMBLY

(1) To remove the relief valve, proceed as follows:

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Drill a 3.175 mm (1/8 inch) hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.

(3) Clamp screw into a vise and while supporting chain case cover, remove cap by tapping chain case cover using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 73).

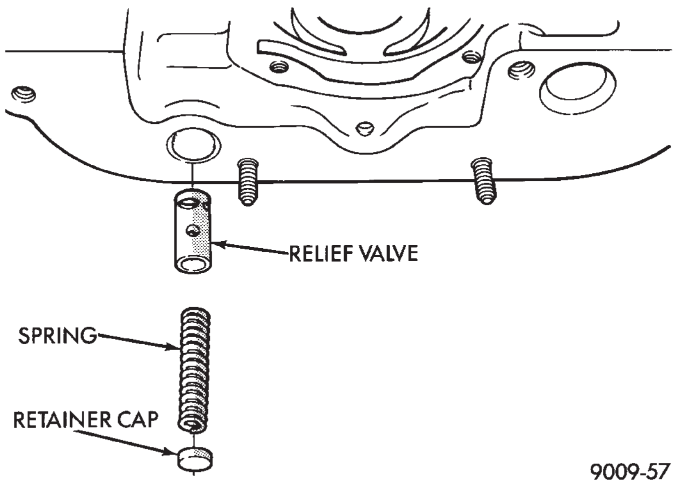


Fig. 73 Oil Pressure Relief Valve

(4) Remove oil pump cover screws, and lift off cover.

(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 76).

OIL PUMP ASSEMBLY

(1) Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**

(2) Tighten cover screws to 12 N·m (105 in. lbs.).

(3) Prime oil pump before installation by filling rotor cavity with engine oil.

(4) Install chain case cover. Refer to Timing Chain Cover Installation of this section.

HYDRAULIC TAPPETS

DISASSEMBLY

(1) Pry out plunger retainer spring clip (Fig. 74).

(2) Clean varnish deposits from inside of tappet body above plunger cap.

(3) Invert tappet body and remove plunger cap, plunger, flat or ball check valve, check valve spring, check valve retainer and plunger spring. Check valve could be flat or ball.

ASSEMBLY

(1) Clean all tappet parts in a solvent that will remove all varnish and carbon.

(2) Replace tappets that are unfit for further service with new assemblies.

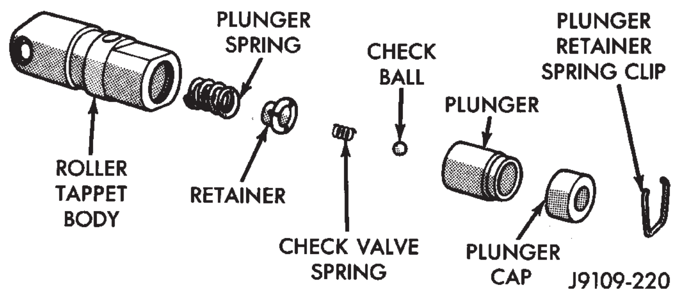


Fig. 74 Hydraulic Roller Tappet Assembly

(3) If plunger shows signs of scoring or wear, valve is pitted, or valve seat on end of plunger indicates any condition that would prevent valve from seating, install a new tappet assembly.

(4) Assemble tappets (Fig. 74).

CLEANING AND INSPECTION

CYLINDER HEAD

(1) Before cleaning, check for leaks, damage and cracks.

(2) Clean cylinder head and oil passages.

(3) Check cylinder head for flatness (Fig. 75).

(4) Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out of flatness exceeds 0.019 mm (0.00075 in.) times the span length in inches, in any direction, either replace head or lightly machine the head surface. As an example, if a 12 inch span is 0.1 mm (.004 in.) out of flat, allowable is 12 x .019 mm (.00075 in.) equals .22 mm (.009 in.) This amount of out of flat is acceptable. Maximum of 0.2 mm (.008 in.) for grinding is permitted.

CAUTION: This is a combined total dimension of stock removal from cylinder head and block top surface.

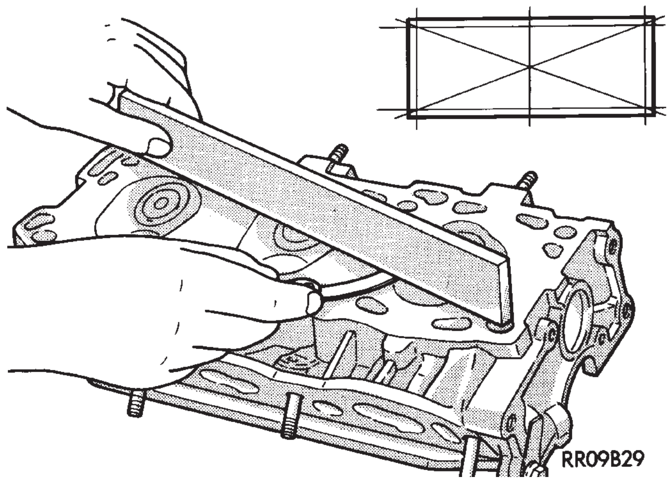


Fig. 75 Check Cylinder Head

CLEANING AND INSPECTION (Continued)

OIL PAN

(1) Clean oil pan in solvent and wipe dry with a clean cloth. Clean all gasket material from mounting surfaces of pan and block.

(2) Inspect oil drain plug and plug hole for stripped or damaged threads and repair as necessary. Install a new drain plug gasket. Tighten to 27 N·m (20 ft. lbs.).

(3) Inspect oil pan mounting flange for bends or distortion. Straighten flange if necessary.

(4) Clean oil screen and pipe in clean solvent. Inspect condition of screen.

OIL PUMP

INSPECTION AND REPAIR

(1) Clean all parts thoroughly. Mating surface of the chain case cover should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 77). 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 7.64 mm (0.301 in.) or less (Fig. 78), or if the diameter is 79.95 mm (3.148 inches.) or less, replace outer rotor.

(4) If inner rotor measures 7.64 mm (0.301 in.) or less replace inner rotor (Fig. 79).

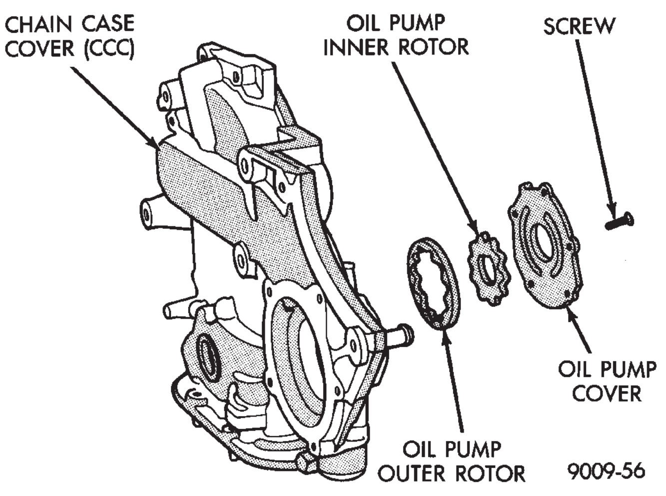


Fig. 76 Oil Pump

(5) Slide outer rotor into chain case cover, press to one side with fingers and measure clearance between rotor and chain case cover (Fig. 80). If measurement is 0.39 mm (0.015 in.) or more, replace CCC only if outer rotor is in specification.

(6) Install inner rotor into chain case cover. If clearance between inner and outer rotors (Fig. 81) is 0.203 mm (0.008 in.) or more, replace both rotors.

(7) Place a straightedge across the face of the chain case cover, between bolt holes. If a feeler gauge

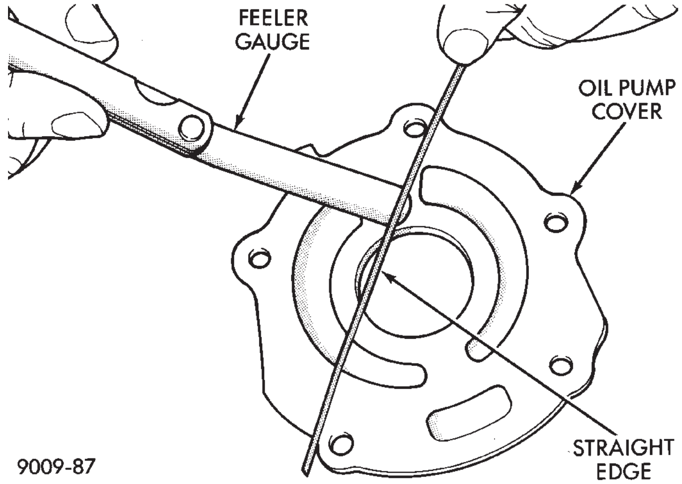


Fig. 77 Checking Oil Pump Cover Flatness

of 0.10 mm (0.004 in.) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 82). **ONLY** if rotors are in specs.

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 49.5 mm (1.95 inches) it should test between 19.5 and 20.5 pounds when compressed to 34 mm (1-11/32 inches). Replace spring that fails to meet specifications (Fig. 73).

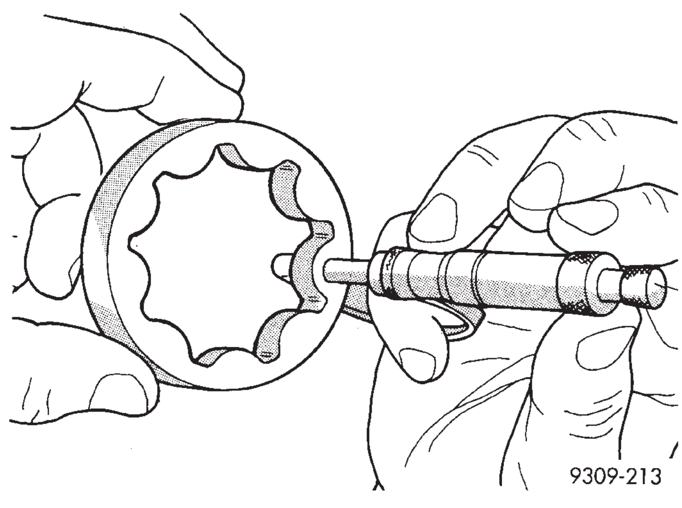


Fig. 78 Measuring Outer Rotor Thickness

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

ENGINE BLOCK AND BORE

CLEANING AND INSPECTION

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

CLEANING AND INSPECTION (Continued)

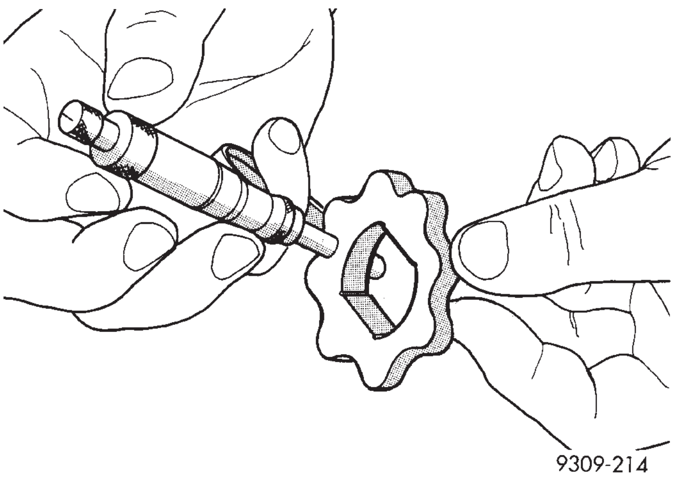


Fig. 79 Measuring Inner Rotor Thickness

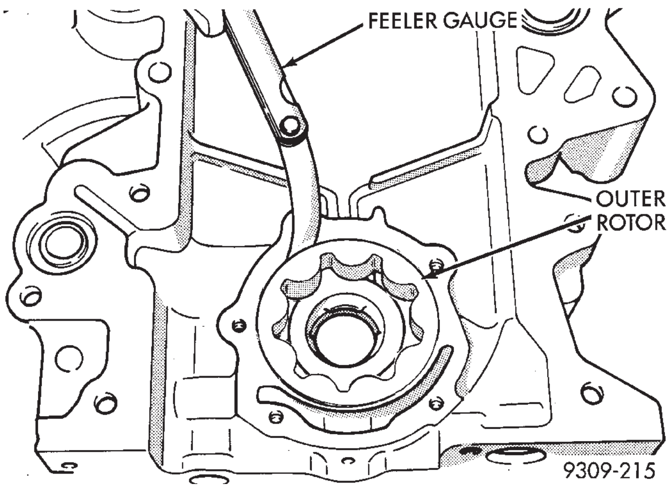


Fig. 80 Measuring Outer Rotor Clearance in Housing

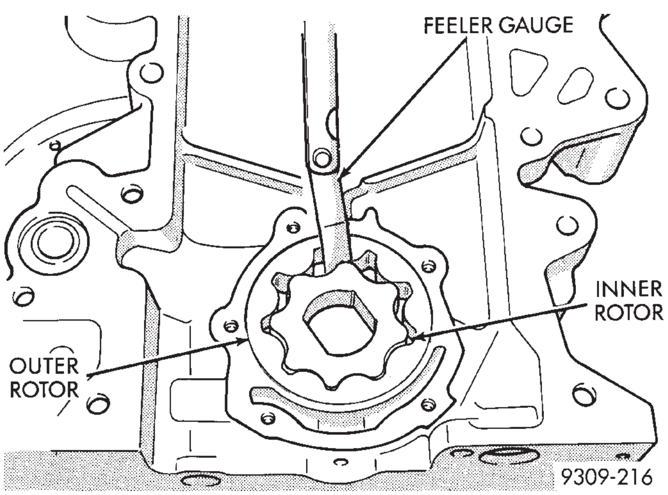


Fig. 81 Measuring Clearance Between Rotors

(2) If new core plugs are installed, see Engine Core Oil and Cam Plugs.

(3) Examine block for cracks or fractures.

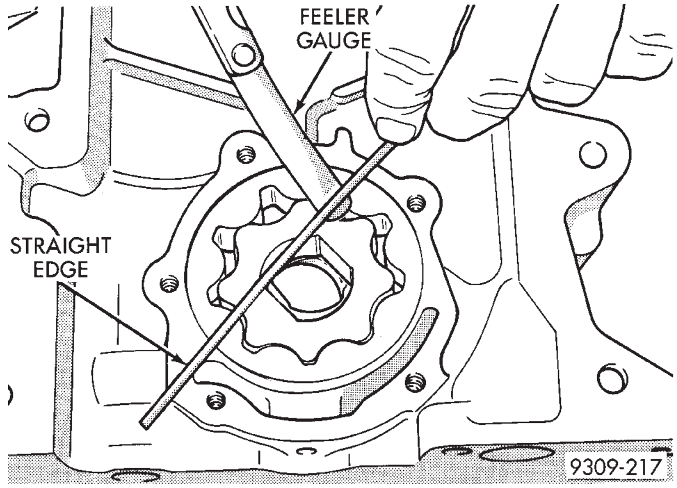


Fig. 82 Measuring Clearance Over Rotors

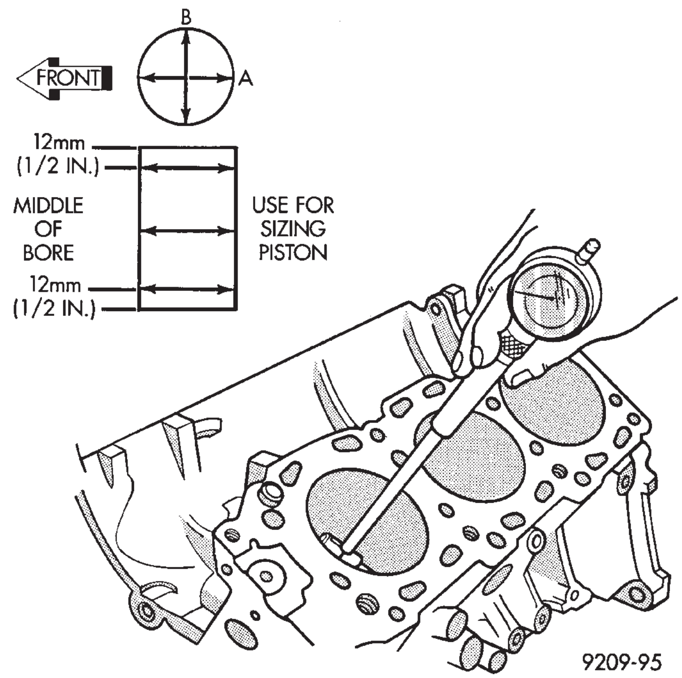


Fig. 83 Checking Cylinder Bore Size

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 83). If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced.

Measure the cylinder bore at three levels in directions A and B (Fig. 83). Top measurement should be 12 mm (0.50 in.) down and bottom measurement should be 12 mm (0.50 in.) up from bottom of bore. Refer to Cylinder Bore and Piston Specification Chart.

CLEANING AND INSPECTION (Continued)

CYLINDER BORE AND PISTON SPECIFICATION CHART

Engine	Standard Bore	Maximum Out-Of-Round	Maximum Taper
3.3L	92.993 - 93.007 mm (3.661 - 3.6617 in.)	0.076 mm (0.003 in.)	0.51 mm (0.002 in.)
3.8L	95.993 - 96.007 mm 3.7792 - 3.780 in.	Same	Same
Standard Piston Size			
3.3L	92.950 - 92.968 mm (3.6594 - 3.6602 in.)		
3.8L	95.950 - 95.968 mm (3.7776 - 3.7783 in.)		
Piston to Bore Clearance: 0.025 - 0.057 mm (0.0009 - 0.0022 in.)			
Measurements taken at Piston Size Location.			

ADJUSTMENTS

ENGINE MOUNTS

ENGINE MOUNT INSULATOR ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine mount insulator vertical fastener and the fore and aft fasteners, and the front engine mount bracket to front crossmember screws.

(3) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshafts for driveshaft identification and related assembly length measuring.

(4) Tighten engine mounts and fasteners in the following order:

(a) Right engine mount insulator vertical bolts to 102 N·m (75 ft. lbs.) and the fore and aft bolts to 150 N·m (110 ft. lbs.).

(b) Front engine mount screws to 54 N·m (40 ft. lbs.) the clearance between the snubbers and the engine should be 2 mm (0.078 inch.) each side.

(c) Left engine mount through bolt to 75 N·m (55 ft. lbs.).

(5) Recheck driveshaft length.

SPECIFICATIONS

3.3/3.8L ENGINE

Type. . . . . .60° V-6 Engine
Bore–3.3L . . . . .93.0 mm (3.66 in.)
Bore–3.8L . . . . .96.0 mm (3.779 in.)
Stroke–3.3L . . . . .81.0 mm (3.188 in.)
Stroke–3.8L . . . . .87.0 mm (3.425 in.)
Compression Ratio–3.3L 8.9:1
Compression Ratio–3.8L 9.6:1
Displacement–3.3L. . . . . .3.3L (201 Cubic in.)
Displacement–3.8L. . . . . .3.8L (231 Cubic in.)
Brake Horsepower–3.3L . . . . .158 @ 4850 RPM
Brake Horsepower–3.8L . . . . .180 @ 4400 RPM
Torque–3.3L . . . . .203 lb. ft. @ 3600 RPM
Torque–3.8L . . . . .240 lb. ft. @ 3600 RPM
Firing Order 1–2–3–4–5–6
Compression Pressure.Refer to Engine Performance in Standard Service Procedures.

Cylinder Number (Front to Rear)

Front Bank 2,4,6
Rear Bank 1,3,6

Cylinder Block

Cylinder Bore (Standard)–3.3L . . . . .93.0 mm (3.66 in.)
Cylinder Bore (Standard)–3.8L . . . . .96.0 mm (3.779 in.)
Out-of-Round (Max.) . . . . .0.076 mm (0.003 in.)
Taper (Max.) . . . . .0.051 mm (0.002 in.)
Cylinder Bore Oversize (Max.). . . . . .0.508 mm (0.020 in.)
Tappet Bore Diameter . . . . .22.9896 - 23.0099 mm (0.9051 - 0.9059 in.)

Pistons

Type Material . . . . . . .Aluminum Alloy Tin Coated
Clearance at Size Location. . . . . .0.025 - 0.057 mm (0.001 - 0.0022 in.)
Weight (Standard Only)–3.3L . . . . . .381 ±5 grams (13.4394 ±0.1764 oz.)
Weight (Standard Only)–3.8L . . . . . .438 ±5 grams (15.4501 ±0.1764 oz.)
Pistons for Service . . . . .Standard Only

Piston Pins

Type . . . . .Press Fit in Rod (Serviced as an Assembly)
Diameter . . . . .22.88 mm (0.9009 - 0.9007 in.)
Length–3.3L . . . . .67.25 - 67.75 mm (2.648 - 2.667 in.)
Lenth–3.8L . . . . .71.25 - 71.75 mm (2.805 - 2.824 in.)
Clearance in Piston @ 70° . . . . . .0.006 - 0.019 mm (0.0002 - 0.0007 in.)
Clearance in Rod . . . .(Interference)

SPECIFICATIONS (Continued)

Piston Rings
Number of Rings 3
Compression 2
Oil Control 1
Oil Ring Type . . .3–Piece, Steel Rail, Chrome Face

Piston Ring Gap
Top & 2nd Compression ing. . . . . . .0.30 - 0.55 mm (0.0118 - 0.0217 in.)
Oil Control (Steel Rails) . . . . .0.25 - 1.00 mm (0.0098 - 0.0394 in.)

Service Rings
Ring Gap–Compression . . . . .0.300 - 0.550 mm (0.0118 - 0.0217 in.)
Ring Gap–Oil Control . . . . .0.250 - 1.00 mm (0.0098 - 0.0394 in.)

Piston Ring Side Clearance
Top & 2nd Compression Rings . . .0.030 - 0.095 mm (0.0012 - 0.0037 in.)
Oil Ring (Steel Rails). . . . . .0.014 - 0.226 mm (0.0005 - 0.0089 in.)

Piston Ring Width
Compression Rings . . . . .1.46 - 1.50 mm (0.0575 - 0.0591 in.)
Oil Ring (Steel Rails). . . . . .0.510 mm (0.0201 in.)

Connecting Rods
Bearing Type . . . . .Aluminum Lead (Bimetal)
Bearing Clearance . . . . .0.019 - 0.065 mm (0.00075 - 0.0026 in.)
Max. Allowable . . . . .0.076 mm (0.003 in.)
Side Clearance . . . . .0.127 - 0.381 mm (0.005 - 0.015 in.)

Crankshaft
Type . . . . .Cast Nodular Iron
Bearing Type . . . . .Aluminum Lead (Bimetal)
Thrust Location. . . . . .No. 2 Bearing
Connecting Rod Journal Diameter . . . . .53.950 - 53.975 mm (2.124 - 2.125 in.)
Main Bearing Diametrical Clearance No. 1- 4. . . . . .0.011 - 0.059 mm (0.0043 - 0.0023 in.)
Max. Allowable . . . . .0.102 mm (0.004 in.)
End Play . . . . .0.09 - 0.24 mm (0.0036 - 0.0095 in.)
Max. Allowable . . . . .0.381 mm (0.015 in.)

Main Bearing Journals
Diameter . . . . .64.013 - 63.993 mm (2.5202 - 2.5195 in.)
Out-of-Round (Max.). . . . . . . .0.025 mm (0.001 in.)
Taper (Max.). . . . . .0.025 mm (0.001 in.)

Connecting Rod Journals
Diameter . . . . .58.005 - 57.979 mm (2.2837 - 2.2827 in.)
Out-of-Round (Max.). . . . . . . .0.025 mm (0.001 in.)
Taper (Max.). . . . . .0.025 mm (0.001 in.)

Camshaft
Drive . . . . .Chain
Bearings. . . . . .Steel Backed Babbitt
Number. 4
Diametrical Clearance . . . . .0.025 - 0.101 mm (0.001 - 0.004 in.)
Max. Allowable . . . . .0.127 mm (0.005 in.)
Thrust Taken By. . . . . .Thrust Plate
End Play . . . . .0.127 - 0.304 mm (0.005 - 0.012 in.)
Max. Allowable . . . . .0.304 mm (0.012 in.)

Camshaft Journals
Bearing Journal Diameter No. 1 . . . . .50.724 - 50.775 mm (1.997 - 1.999 in.)
Bearing Journal Diameter No. 2 . . . . .50.317 - 50.368 mm (1.9809 - 1.9829 in.)
Bearing Journal Diameter No. 3 . . . . .49.936 - 49.987 mm (1.9659 - 1.9679 in.)
Bearing Journal Diameter No. 4 . . . . .49.530 - 49.581 mm (1.9499 - 1.9520 in.)

Camshaft Bearings
Diameter No. 1. . . . . .50.825 - 50.800 mm (2.0009 - 1.9999 in.)
Diameter No. 2. . . . . .50.419 - 50.393 mm (1.9849 - 1.9839 in.)
Diameter No. 3. . . . . .50.038 - 50.013 mm (1.9699 - 1.9690 in.)
Diameter No. 4. . . . . .49.632 - 49.606 mm (1.954 - 1.9529 in.)
Oil Clearance . . . . .0.0254 - 0.0762 mm (0.001 - 0.003 in.)

Valve Timing Exhaust Valve
Closes (ATC) . . . . .12°
Opens (BBC) . . . . .48°
Duration . . . . .240°

Valve Timing Intake Valve
Closes (BTDC) . . . . .58°
Opens . . . . .2°
Duration . . . . .240°
Valve Overlap . . . . .14°

Timing Chain
Number of Links. 64
Pitch . . . . .0.375 inch
Width . . . . .0.750 inch

Hydraulic Tappets
Type . . . . .Roller Hydraulic
Body Diameter. . . . . .22.95 - 22.96 mm (0.9035 - 0.9040 in.)
Clearance in Block. . . . . .0.02 - 0.06 mm (0.0007 - 0.0024 in.)

SPECIFICATIONS (Continued)

Service Tappets Available . . . . .Std., 0.025 mm (0.001), 0.20 mm (0.008 in.), 0.762 mm (0.030 in.)

Cylinder Head

Gasket Thickness (Compressed) . . . . .1.78 mm (0.070 in.)

Cylinder Head Valve Seat

Angle–Intake and Exhaust . . . . .45 - 45.5°
Runout (Max) . . . . .0.0762 mm (0.003 in.)
Width (Finish)–Intake . . . . .1.75 - 2.25 mm (0.069 - 0.088 in.)
Width (Finish)–Exhaust . . . . .1.50 - 2.00 mm (0.057 - 0.078 in.)

Valve Guides

Type. . . . . .Powdered Metal Inserts
Guide Bore Diameter. . . . . .7.975 - 8.00 mm (0.314 - 0.315 in.)

Valves—Intake

Face Angle . . . . .44.5°
Head Diameter. . . . . .45.5 mm (1.79 in.)
Length (Overall). . . . . .127.005 - 128.036 mm (5.000 - 5.041 in.)
Minimum Valve Length After Tip Grinding . . . . .124.892 (4.916 in.)
Lift (Zero Lash) . . . . .10.16 mm (0.400 in.)
Stem Diameter (Standard). . . . . .7.935 - 7.953 mm (0.312 - 0.313 in.)
Valve Tip Height (From Cylinder Head Surface). . . . . .49.541 - 51.271 mm (1.950 - 2.018 in.)
Stem-to-Guide Clearance . . . . . . .0.025 - 0.095 mm (0.001 - 0.003 in.)
Max. Allowable (Rocking Method) . . . .0.247 mm (0.010 in.)
Valves for Service (Oversize Stem Diameters). . . . . . .Std., 0.015 mm (0.005 in.), 0.40 mm (0.015 in.), 0.80 mm (0.030 in.)

Valves—Exhaust

Face Angle . . . . .45°
Head Diameter . . . . .37.5 mm (1.476 in.)
Length Overall . . . . .127.825 - 128.465 (5.032 - 5.058 in.)
Minimum Valve Length After Tip Grinding . . . . . . .125.512 mm (4.941 in.)
Lift (Zero Lash) . . . . .10.16 mm (0.40 in.)
Valve Tip Height (From Cylinder Head Surface). . . . . .49.541 - 51.271 mm (1.950 - 2.018 in.)
Stem Diameter (Standar). . . . . . .7.906 - 7.924 mm (0.3112 - 0.3119 in.)
Stem to Guide Clearance . . . . . . .0.051 - 0.175 mm (0.002 - 0.006 in.)
Max. Allowable (Rocking Method) . . . . . .0.414 mm (0.016 in.)
Valves for Service (Oversize Stem Diameters). . . . . .Std., 0.015 mm (0.005 in.), 0.40 mm (0.015 in.), 0.80 mm (0.030 in.)

Valve Springs

Free Length (Approx.) . . . . . . .48.5 mm (1.909 in.)
Wire Diameter . . . . .4.75 mm (0.187 in.)
Number of Coils 6.8
Spring Tension (Valve Closed) . . . . . . .95 - 100 lbs. @ 1.57 in.
Spring Tension (Valve Open) . . . . . . .207 - 229 lbs. @ 1.169 in.
Installed Height (Spring Seat to Bottom of Retainer) . . . . . . 41.2 - 42.7 mm (1.622 - 1.681 in.)

Oil Pump

Pump Type. . . . . .Rotary Full Pressure
Clearance Over Rotors (Inner & Outer Max.). . . . . . . .0.10 mm (0.004 in.)
Cover Out-of-Flat (Max.). . . . .0.025 mm (0.001 in.)
Inner Rotor Thickness (Min.) . .7.64 mm (0.301 in.)
Outer Rotor Thickness (Min.) . .7.64 mm (0.301 in.)
Outer Rotor Diameter (Min.) .79.95 mm (3.148 in.)
Outer Rotor Clearance . . . . . . .0.39 mm (0.015 in.)
Tip Clearance Between Rotors (Max.) . . . .0.20 mm (0.008 in.)

Oil Pressure

Minimum Pressure at Idle (Engine Fully Warmed Up) *. . . . . .34.47 kPa (5 psi)
At 3000 rpm . . . . .205 - 551 kPa (30 - 80 psi)
Oil Filter Bypass Valve Setting. . . . . .62 - 103 kPa (9 - 15 psi)
Oil Filter Type .Full Flow
Oil Pressure Switch Actuating Pressure (Min.). . . . . .14 - 28 kPa (2 - 4 psi)

CAUTION: * If pressure is ZERO at curb Idle, DO NOT run engine at 3,000 rpm.

SPECIFICATIONS (Continued)

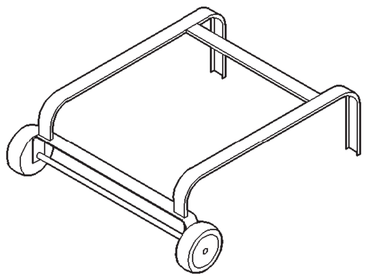
TORQUE CHART

DESCRIPTION	TORQUE
A/C Compressor Mounting	
Compressor Bracket to Water Pump Bolt	41 N·m (30 ft. lbs.)
Compressor to Bracket Bolt	68 N·m (50 ft. lbs.)
Compressor Support Bolt	41 N·m (30 ft. lbs.)
Camshaft Sprocket	
Bolt	54 N·m (40 ft. lbs.)
Camshaft Thrust Plate	
Bolt	12 N·m (105 in. lbs.)
Connecting Rod	
Nut	54 N·m (40 ft. lbs.) +¼ Turn
Crankshaft Damper Pulley to Crankshaft	
Bolt	54 N·m (40 ft. lbs.)
Cylinder Head	
Bolts	Refer to Cylinder Head Removal and Installation Procedure in this Section
Cylinder Head Cover	
Bolts	12 N·m (105 in. lbs.)
Exhaust Manifold	
Bolts	23 N·m (200 in. lbs.)
Exhaust Crossover Pipe Flange	
Fasteners	33 N·m (25 ft. lbs.)
Generator Mounting	
Adjusting Strap Bolt	23 N·m (200 in. lbs.)
Adjusting Strap Mounting Bolt	41 N·m (30 ft. lbs.)
Bracket Bolt	41 N·m (30 ft. lbs.)
Pivot Nut	41 N·m (30 ft. lbs.)
Intake Manifold	
Bolts	23 N·m (200 in. lbs.)
Intake Manifold Gasket Retaining	
Screws	12 N·m (105 in. lbs.)
Intake Manifold Plenum	
Bolts	28 N·m (250 in. lbs.)
Main Bearing Cap	
Bolts	41 N·m (30 ft. lbs.) +¼ Turn
Oil Filter Attaching	
Nipple	41 N·m (30 ft. lbs.)

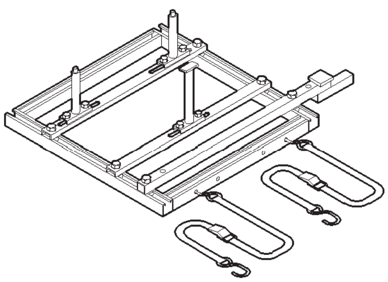
DESCRIPTION	TORQUE
Oil Pan	
Bolts	12 N·m (105 in. lbs.)
Drain Plug	27 N·m (20 ft. lbs.)
Level Sensor Plug	41 N·m (30 ft. lbs.)
Oil Pressure Gauge Sending Unit	
	7 N·m (60 in. lbs.)
Oil Pump	
Cover Bolts	12 N·m (105 in. lbs.)
Pick-up Tube Bolt	28 N·m (250 in. lbs.)
Rocker Shaft Bracket	
Bolts	28 N·m (250 in. lbs.)
Spark Plug	
	27 N·m (20 ft. lbs.)
Starter Mounting	
Bolt	68 N·m (50 ft. lbs.)
Strut—Intake Manifold to Cylinder Head	
Bolt	54 N·m (40 ft. lbs.)
Tappet Retainer Yoke	
Bolt	12 N·m (105 in. lbs.)
Temperature Gauge Sending Unit	
	7 N·m (60 in. lbs.)
Timing Chain Case Cover	
Bolt–M8 × 1.25	27 N·m (20 ft. lbs.)
Bolt–M10 × 1.5	54 N·m (40 ft. lbs.)
Water Pump to Chain Case Cover	
Bolts	12 N·m (105 in. lbs.)

SPECIAL TOOLS

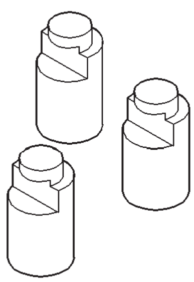
3.3/3.8L ENGINE



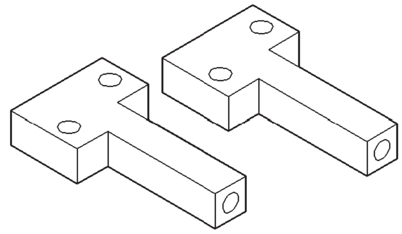
Dolly 6135



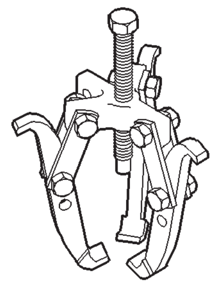
Cradle 6710



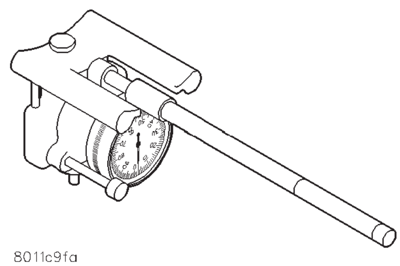
Adaptor 6909



Adaptor 6912

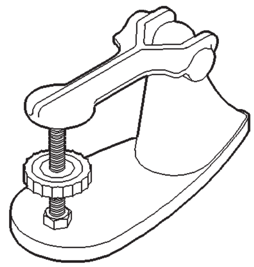


Puller 1023

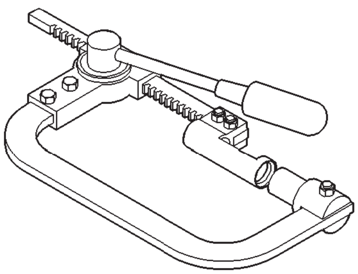


Indicator, Cylinder Bore C-119

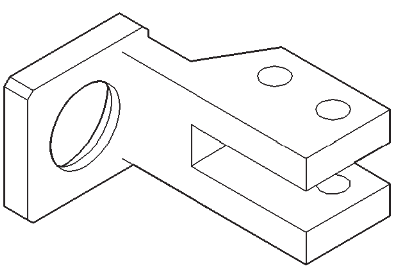
SPECIAL TOOLS (Continued)



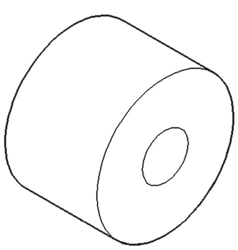
Tester Valve Spring C-647



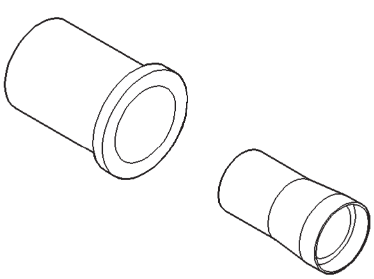
Valve Spring Compressor C-3422–B



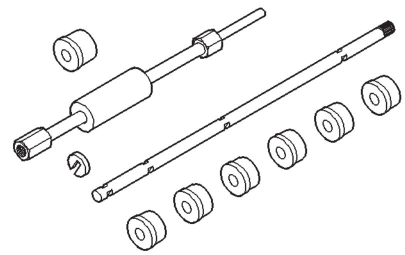
Adaptor Valve Compressor 6412



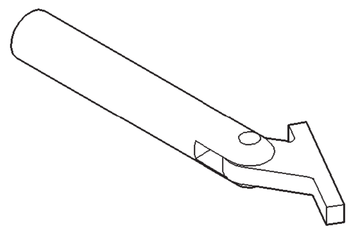
Insert Crankshaft Pulley Remover L-4524-1



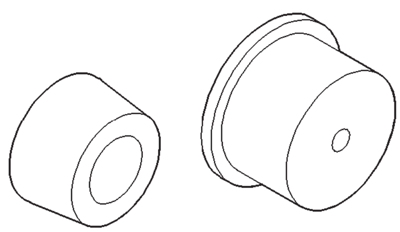
Front Crankshaft Seal Installer C-4992



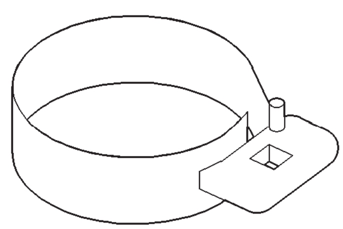
Camshaft Bearing Remover and Installer C-3132–A



Crankshaft Main Bearing Remover and Installer C-3059



Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



8011d480

Oil Filter Wrench C-4065

ENGINE

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2.0L SOHC ENGINE

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DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION

The engine identification number is located on the left rear of the cylinder block behind starter (Fig. 1).

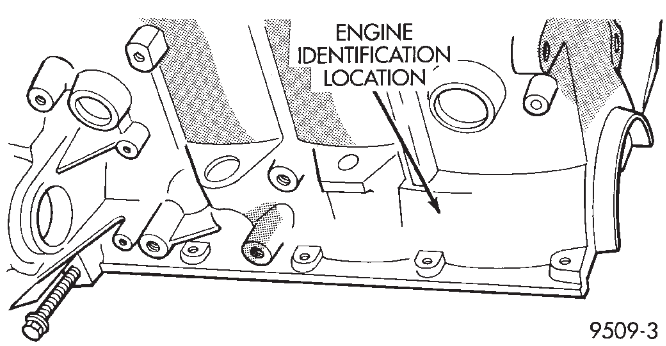
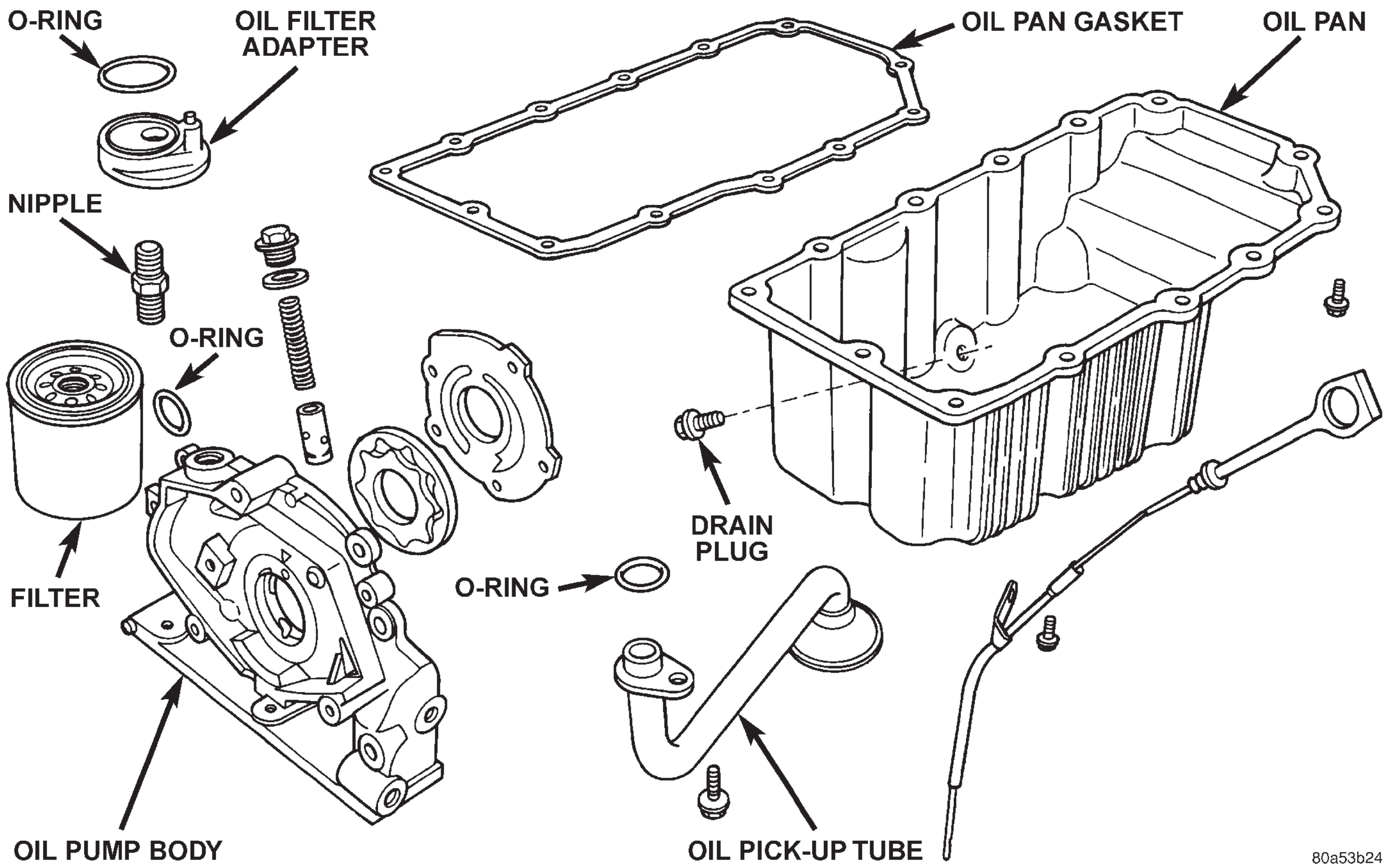


Fig. 1 Engine Identification SOHC

DESCRIPTION AND OPERATION (Continued)



Engine Lubrication Components

GENERAL SPECIFICATION

Type . . . . In-Line OHV, DOHC & SOHC
Bore . . . . 87.5mm (3.445 Inch)
Stroke . . . . 83.0mm (3.268 inch)
Compression Ratio . . . . DOHC - 9.6:1 SOHC - 9.8:1
Displacement . . . . 2.0 Liters (122 Cubic Inch)
Firing Order 1, 3, 4, 2
Compression Pressure . . . . 1172 - 1551 kPa (170 - 225 psi)
Maximum Variation Between Cylinders 25%
Lubrication . . . Pressure Feed - Full Flow Filtration (Crankshaft Driven Pump)
Engine Oil Capacity . . Refer to Group 0, Lubrication and Maintenance

ENGINE LUBRICATION SYSTEM

ENGINE LUBRICATION

Refer to Group 0, Lubrication and Maintenance for recommended oil to be used in various engine application. System is full flow filtration, pressure feed type. The oil pump is mounted in the front engine cover and driven by the crankshaft. Pressurized oil is then routed through the main oil gallery, running the length of the cylinder block, supplying main and rod bearings with further routing. Rod bearing oil throw-off lubricates the pistons from directed slots on the side of the connecting rod assemblies. Camshaft and valve mechanisms are lubricated from a full-length cylinder head oil gallery supplied from the crankcase main oil gallery.

PRESSURE LUBRICATION

Oil drawn up through the pickup tube is pressurized by the pump and routed through the full flow filter to the main oil gallery running the length of the cylinder block. A cylinder head restrictor, located in the block, provides increased oil flow to the main oil gallery (Fig. 2).

MAIN/ROD BEARINGS

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.

CAMSHAFT/HYDRAULIC LASH ADJUSTERS

A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up into the cylinder head. The rocker shafts route oil to the rocker arms/hydraulic lash adjuster assemblies.

DESCRIPTION AND OPERATION (Continued)

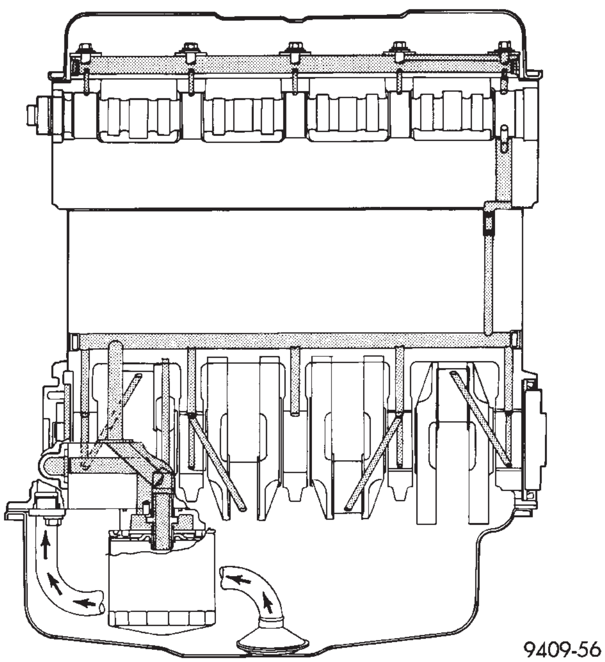


Fig. 2 Engine Lubrication System— SOHC

SPLASH LUBRICATION

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.

ENGINE COMPONENTS

CYLINDER BLOCK AND BEDPLATE ASSEMBLY: A partial open deck is used for cooling and weight reduction with water pump molded into the block. Nominal wall thickness is 4 mm. The bedplate incorporates main bearing caps. Rear seal retainer is integral with the block.

CRANKSHAFT: A nodular cast iron crankshaft is used. The engine has 5 main bearings, with number 3 flanged to control thrust. The 52 mm diameter main and 48 mm diameter crank pin journals (all) have undercut fillet radiuses that are deep rolled for added strength. To optimize bearing loading 8 counterweights are used. Hydrodynamic seals provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for parting line sealing. A sintered iron timing belt sprocket is mounted on the crankshaft nose. This sprocket transmits crankshaft movement, via timing belt to the camshaft sprocket providing timed valve actuation.

PISTONS: The SOHC Engine **DOES NOT** have provision for a free wheeling valve train. Non free wheeling valve train means, in the event of a broken timing belt Pistons will contact the Valves. All engines use pressed-in piston pins to attach forged powdered metal connecting rods. The connecting rods are a cracked cap design and are not repairable. Hex head cap screw are used to provide alignment and durability in the assembly. Pistons And Connecting rods are serviced as an assembly.

PISTON RINGS: The piston rings include a molybdenum faced top ring for reliable compression sealing and a taper faced intermediate ring for additional cylinder pressure control. Oil Control Ring Package consist of 2 steel rails and a expander spacer.

CYLINDER HEAD—SOHC: It features a Single Over Head Camshaft, four-valves per cylinder cross flow design. The valves are arranged in two inline banks, with the two intake per cylinder facing toward the radiator. The exhaust valves facing toward the dash panel. Rocker arm shafts mount directly to the cylinder head. It incorporates powder metal valve guides and seats. The hollow rocker arm shafts supplies oil to the hydraulic lash adjusters, camshaft and valve mechanisms.

CAMSHAFT—SOHC: The nodular iron camshaft has five bearing journals and 3 cam lobes per cylinder. Provision for cam position sensor on the cam at the rear of cylinder head which also acts as thrust plate. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

VALVES—SOHC: Four valves per cylinder are actuated by roller rocker arms/hydraulic lash adjusters assemblies which pivot on rocker arm shafts. All valves have 6 mm diameter chrome plated valve stems. The valve train has 33 mm (1.299 inch) diameter intake valves and 28 mm (1.10 inch) diameter exhaust valves. Viton rubber valve stem seals are integral with spring seats. Valve springs, spring retainers, and locks are conventional design.

INTAKE MANIFOLD: The intake manifold is a molded plastic composition, attached to the cylinder head with ten fasteners. This long branch design enhances low and mid-range torque.

EXHAUST MANIFOLD: The exhaust manifold is made of nodular cast iron for strength and high temperatures. Exhaust gasses exit through a machined, articulated joint connection to the exhaust pipe.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure switch and install gauge assembly C-3292 with adaptor.

(2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not perform the 3000 RPM test in the next step.

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170-550 kPa (25-80 psi).

DIAGNOSIS AND TESTING (Continued)

(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.

SERVICE PROCEDURES

CYLINDER BORE AND PISTON SIZING

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 3). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 3). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Cylinder Bore and Piston Specifications Chart.

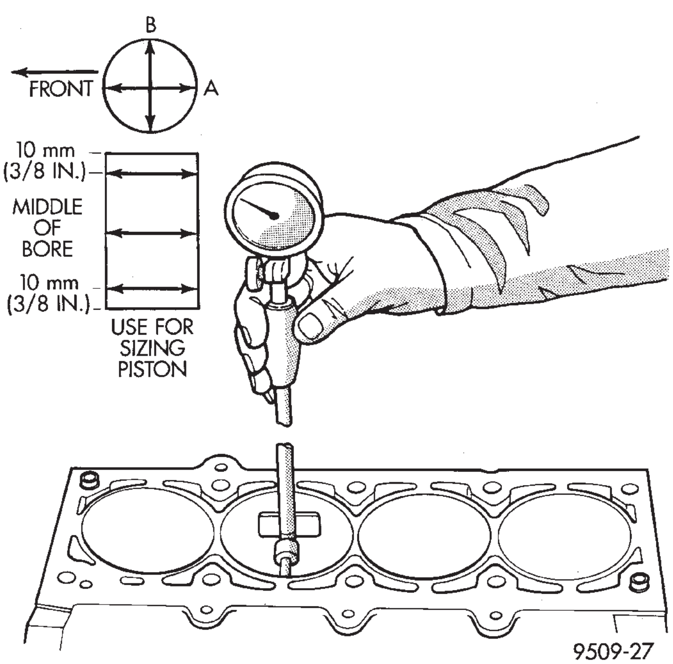


Fig. 3 Checking Cylinder Bore Size

SIZING PISTONS

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 17.5 mm (11/16 inch) from the bottom of the skirt as shown in (Fig. 4). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 3). Refer to Cylinder Bore and Specifications Table. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Maximum Out-of-Round	Maximum Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
Federal Emission:	87.463 - 87.481 mm (3.4434 - 3.4441 in.)	
Low Emission Vehicle (LEV):	87.456 - 87.474 mm (3.4432 - 3.4439 in.)	
Piston to Bore Clearance		
Federal Emission:	0.012 - 0.044 mm (0.0004 - 0.0017 in.)	
Low Emission Vehicle (LEV):	0.18 - 0.050 mm (0.0008 - 0.0020 in.)	
Measurements Taken at Piston Size Location		

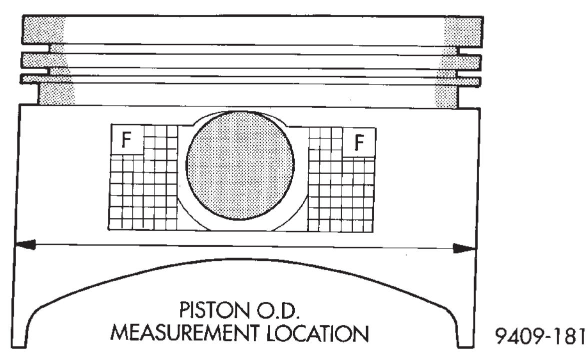


Fig. 4 Piston Measurements

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

FITTING PISTON RINGS

(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. 5). Refer to Piston Ring Specification Chart.

SERVICE PROCEDURES (Continued)

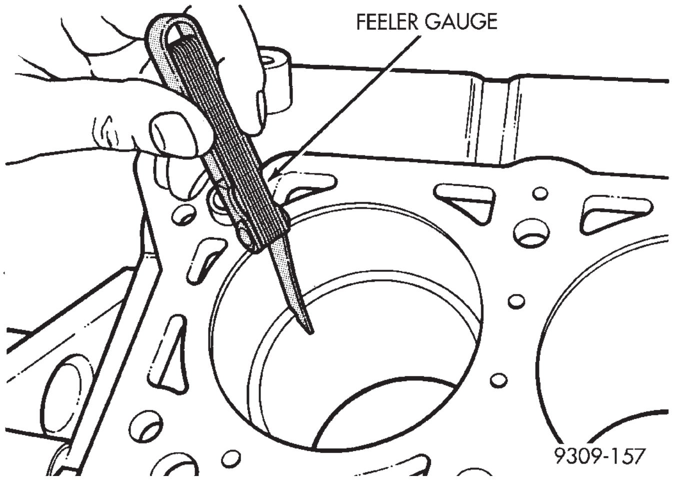


Fig. 5 Piston Ring Gap

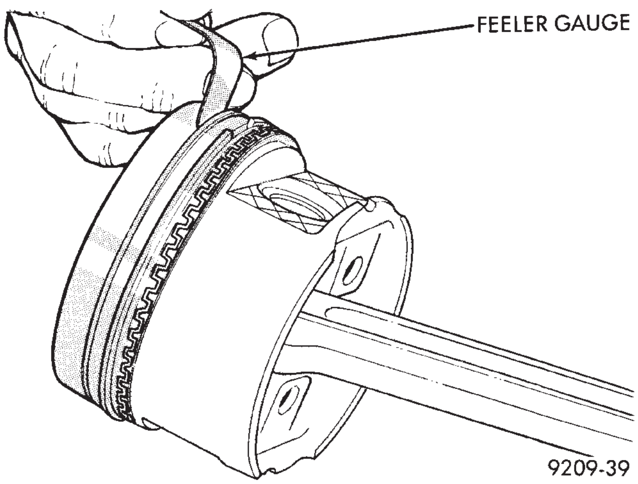


Fig. 6 Piston Ring Side Clearance

(2) Check piston ring to groove side clearance (Fig. 6). Refer to Piston Ring Specification Chart.

FITTING CONNECTING RODS

(1) Follow the procedure specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 7). Refer to specifications.

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

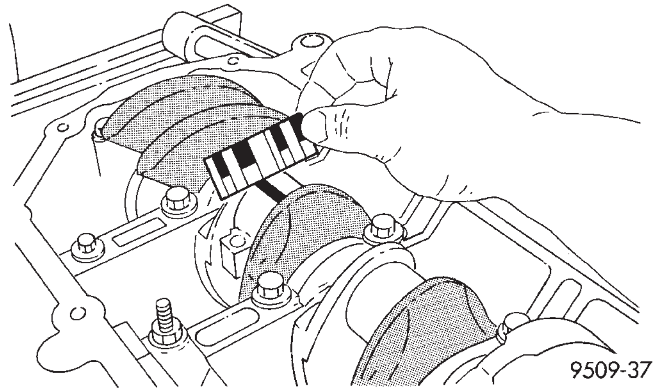


Fig. 7 Connecting Rod Bearing Clearance

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 than 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. 8). Refer to Connecting Rod Specification Chart for specifications.

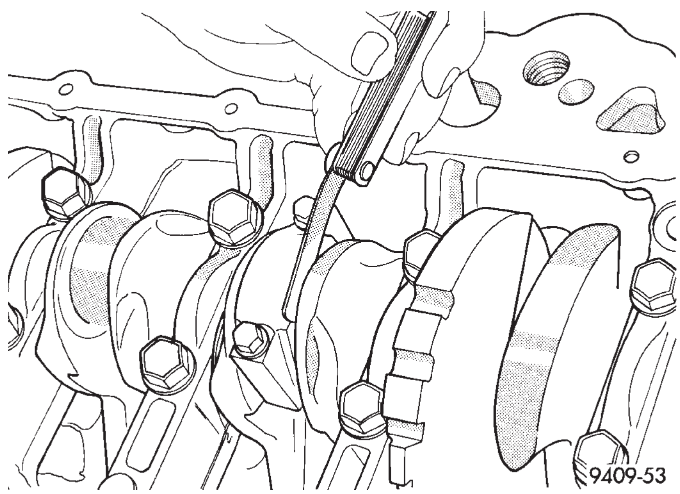


Fig. 8 Connecting Rod Side Clearance

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Ring Gap Wear Limit	Groove Clearance	Maximum Groove Clearance
Upper Ring	0.23 - 0.52 mm (0.009 - 0.020 in.)	0.8 mm (0.031 in.)	0.025 - 0.065 mm (0.0010 - 0.0026 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.49 - 0.78 mm (0.019 - 0.031 in.)	1.0 mm (0.039 in.)	0.025 - 0.065 mm (0.0010 - 0.0026 in.)	0.10 mm (0.004 in.)
Oil Control Ring	0.23 - 0.66 mm (0.009 - 0.026 in.)	1.0 mm (0.039 in.)	Oil Ring Side Rails Must Be Free To Rotate After Assembly	

SERVICE PROCEDURES (Continued)

CONNECTING ROD SPECIFICATION CHART

Connecting Rod Bearing Oil Clearance	
New Part:	0.026 - 0.059 mm (0.001 - 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
Connecting Rod Side Clearance	
New Part:	0.13 - 0.38 mm (0.005 - 0.015 in.)
Wear Limit:	0.40 mm (0.016 in.)

FITTING CRANKSHAFT BEARINGS

Refer to Measuring Main Bearing Clearance in Standard Service Procedures. Refer to Crankshaft Specification Chart for specifications.

CRANKSHAFT END PLAY

DIAL INDICATOR METHOD

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 9).

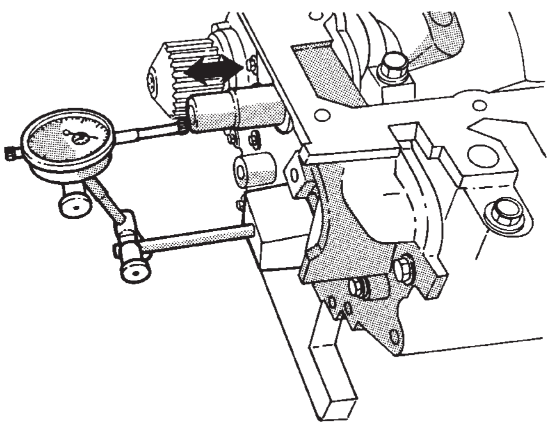


Fig. 9 Checking Crankshaft End Play— Dial Indicator

(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 Crankshaft Specification Chart for specifications.

FEELER GAGE METHOD

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. Do **not** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

REMOVAL AND INSTALLATION

CYLINDER HEAD COVER

REMOVAL

(1) Remove ignition coil pack (Fig. 10).

(2) Remove the cylinder head cover bolts.

(3) Remove cylinder head cover from cylinder head.

INSTALLATION

Before installation, clean cylinder head and cover mating surfaces. Make certain the cylinder head cover mating surface is flat.

(1) Install new valve cover gasket.

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(2) Install cover assembly to head and tighten fasteners to 12 N·m (105 in. lbs.).

(3) Install ignition coil pack. Tighten fasteners to 23 N·m (200 in. lbs.).

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	New Part:	0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Wear Limit:	0.37 mm (0.015 in.)	
Main Bearing Clearance	New Part:	0.022 - 0.062 mm (0.0008 - 0.0024 in.)
Connecting Rod Bearing Clearance	New Part:	0.026 - 0.059 mm (0.001 - 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)	
Main Bearing Journal Diameter	Standard:	52.000 ± 0.008 mm (2.0472 ± 0.0003 in.)
1st Undersize:	51.983 ± 0.008 mm (2.0466 ± 0.0003 in.)	
Connecting Rod Journal Diameter	Standard:	48.000 ± 0.008 mm (1.8897 ± 0.0003 in.)
1st Undersize:	47.983 ± 0.008 mm (1.8891 ± 0.0003 in.)	

REMOVAL AND INSTALLATION (Continued)

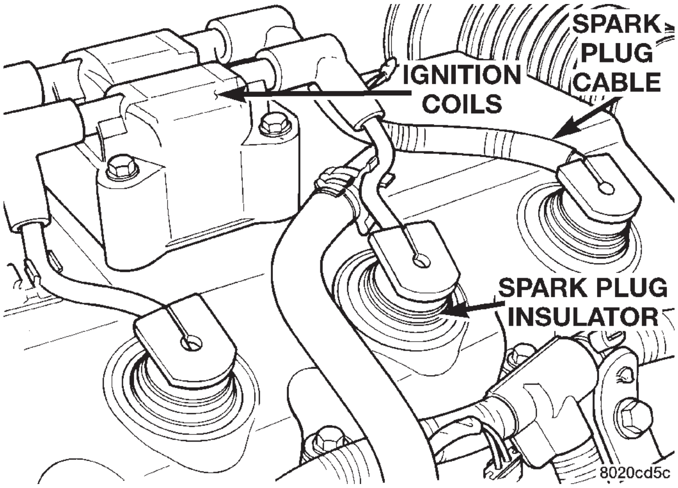


Fig. 10 Ingition Coil Pack

SPARK PLUG TUBE

(1) Remove valve cover. Refer to procedure outlined in this section.

(2) Using locking pliers remove the tube from the cylinder head (Fig. 11). Discard old tube.

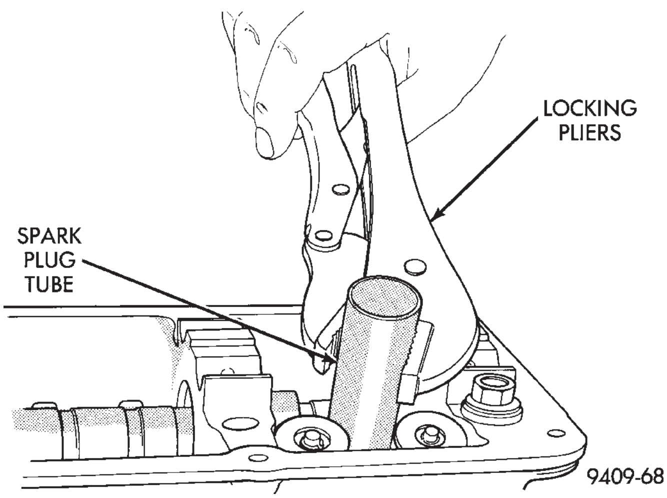


Fig. 11 Servicing Spark Plug Tubes

(3) Clean area around spark plug with Mopar® parts cleaner or equivalent.

(4) Apply Mopar® Stud and Bearing Mount or equivalent to a new tube approximately 1 mm from the end in a 3 mm wide area.

(5) Install sealer end of tube into the cylinder head. Then carefully install the tube using a hardwood block and mallet until the tube is seated into the bottom of the bore.

(6) Install valve cover. Refer to procedure outlined in this section.

SPARK PLUG TUBE SEALS

The spark plug tube seals are located in the cylinder head cover (Fig. 12). These seals are pressed into the cylinder head cover to seal the outside perimeter of the spark plug tubes. If these seals show signs of hardness and/or cracking they should be replaced.

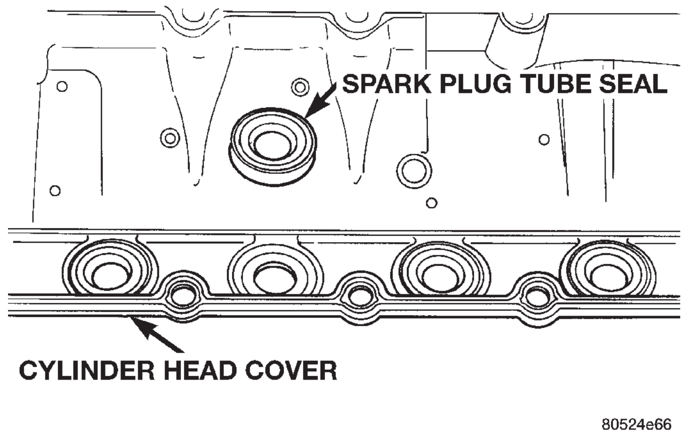


Fig. 12 Spark Plug Tube Seals

CAMSHAFT

NOTE: TO REMOVE CAMSHAFT THE CYLINDER HEAD MUST BE REMOVED.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System

(2) Remove the cylinder head cover. Refer to procedure outlined in this section.

(3) Mark rocker arm shaft assemblies so that they are installed in their original positions.

(4) Remove rocker arm shaft bolts. Refer to procedure outlined in this section.

(5) Remove timing belt, timing belt tensioner, and camshaft sprocket. Refer to timing belt service outlined in this section.

(6) Remove inner timing belt cover.

(7) Remove cylinder head. Refer to procedure outlined in this section.

(8) Remove camshaft sensor and camshaft target magnet.

(9) Remove camshaft from the rear of cylinder head.

INSPECT CYLINDER HEAD FOR THE FOLLOWING:

NOTE:

- **Check oil feed holes for blockage.**
- **Inspect cylinder head camshaft bearings for wear, Refer to Cylinder Head, Inspection and Cleaning.**
- **Check camshaft bearing journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep**

REMOVAL AND INSTALLATION (Continued)

scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

INSTALLATION

(1) Lubricate the camshaft journals with oil and install camshaft **without** rocker arm assemblies installed.

(2) Install camshaft target magnet into the end of the camshaft. Tighten mounting screw to 3.4 N·m (30 in. lbs.).

(3) Install camshaft position sensor and tighten mounting screws to 9 N·m (80 in. lbs.).

(4) Measure camshaft end play using the following procedure:

• Mount dial indicator C-3339 or equivalent, to a stationary point on cylinder head (Fig. 13).

• Using a suitable tool, move camshaft to rearward limits of travel.

• Zero the dial indicator.

• Move camshaft forward to limits of travel and read dial indicator.

• End play travel: 0.13 - 0.33 mm (0.005 - 0.013 in.).

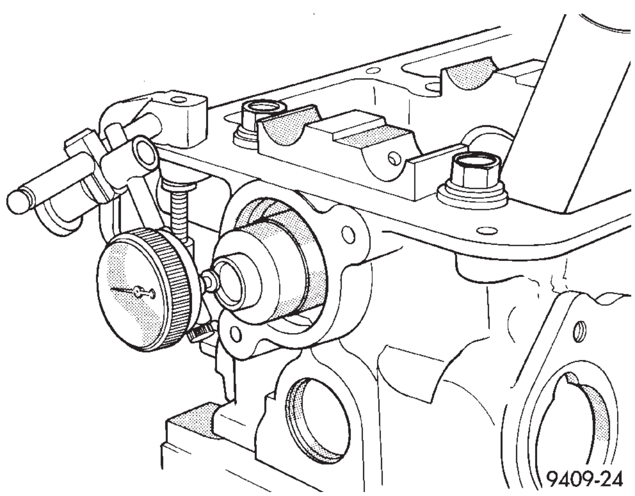


Fig. 13 Camshaft End Play

(5) Install front camshaft seal. Camshaft must be installed before the camshaft seal is installed. Refer to procedure outlined in this section.

(6) Install cylinder head. Refer to procedure outlined in this section.

(7) Install camshaft sprocket and tighten to 115 N·m (85 ft. lbs.).

(8) Install inner timing belt cover.

(9) Install timing belt tensioner and timing belt. Refer to procedures outlined in this section.

(10) Install rocker arm assemblies in correct order as removed. Tighten the rocker arm assemblies in sequence shown in (Fig. 14) to 28 N·m (250 in. lbs.).

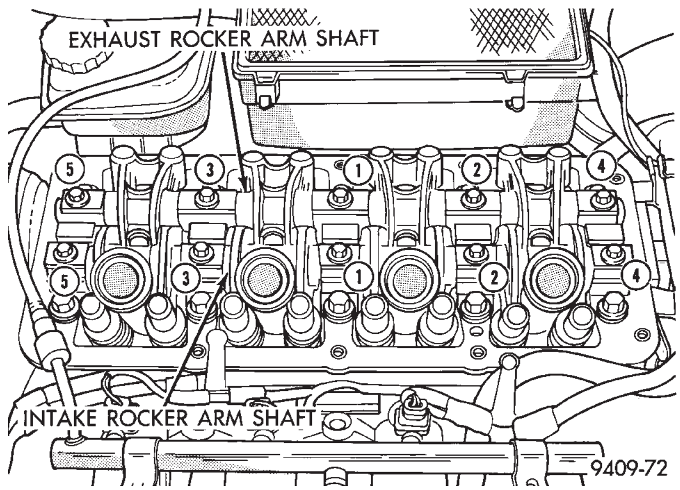


Fig. 14 Rocker Arm Shaft Tightening Sequence

(11) Install cylinder head cover and tighten fasteners to 12 N·m (105 in. lbs.).

(12) Install ignition coil pack and ignition cables.

(13) Perform camshaft and crankshaft timing relearn procedure as follows:

• 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.

• Turn the ignition switch on and access the “miscellaneous” screen.

• Select “re-learn cam/crank” option and follow directions on DRB screen.

ROCKER ARM/HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove valve cover using procedure outlined in this section.

(2) Identify the rocker arm shaft assemblies before removal.

(3) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.

(4) Identify the rocker arms spacers and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts from the shaft (Fig. 15).

(5) Slide the rocker arms and spacers off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

REMOVAL AND INSTALLATION (Continued)

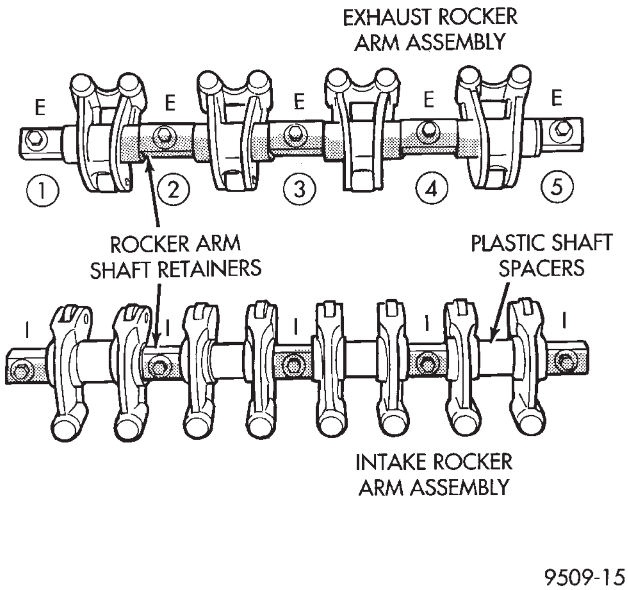


Fig. 15 Rocker Arm Shaft Assemblies

NOTE: Inspect the rocker arm for scoring, wear on the roller or damage to the rocker arm (Fig. 16) Replace if necessary. Check the location where the rocker arms mount to the shafts for wear or damage. Replace if damaged or worn. The rocker arm shaft is hollow and is used as a lubrication oil duct. Check oil holes for clogging with small wire, clean as required. Lubricate the rocker arms and spacers. Install onto shafts in their original position (Fig. 15).

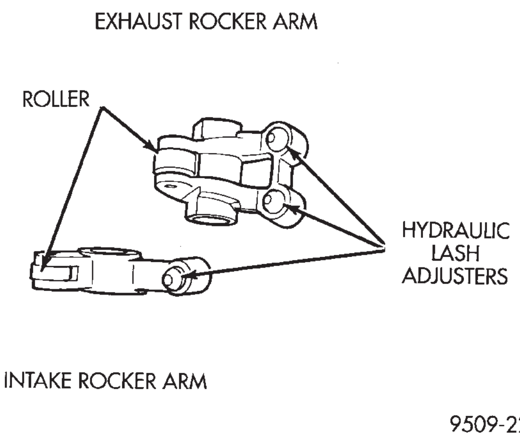


Fig. 16 Rocker Arm Assemblies

INSTALLATION

CAUTION: Set crankshaft to 3 notches before TDC before installing rocker arm shafts. Refer to Timing Belt System and Camshaft Seal Service of this section for procedure.

(1) Install rocker arm/hydraulic lash adjuster assembly making sure that adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed. If there is excessive plunger travel. Place the rocker arm assembly into clean engine oil and pump the plunger until the lash adjuster travel is taken up. If travel is not reduced, replace the assembly. Hydraulic lash adjuster and rocker arm are serviced as an assembly.

(2) Install rocker arm and shaft assemblies with NOTCH in the rocker arm shafts pointing up and toward the timing belt side of the engine (Fig. 17). Install the retainers in their original positions on the exhaust and intake shafts (Fig. 15).

CAUTION: When installing the intake rocker arm shaft assembly be sure that the plastic spacers do not interfere with the spark plug tubes. If the spacers do interfere rotate until they are at the proper angle. To avoid damaging the spark plug tubes, do not attempt rotating the spacers by forcing down the shaft assembly.

(3) Tighten bolts to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 18).

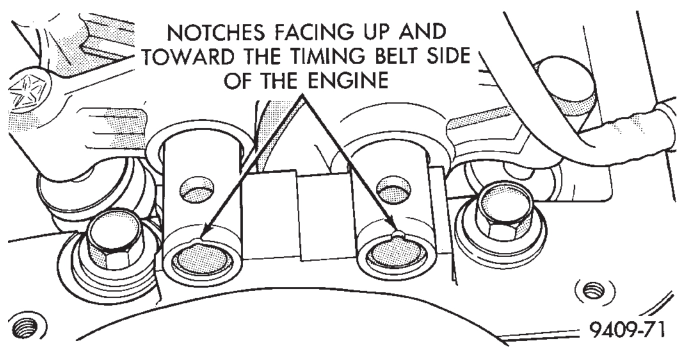


Fig. 17 Rocker Arm Shaft Notches

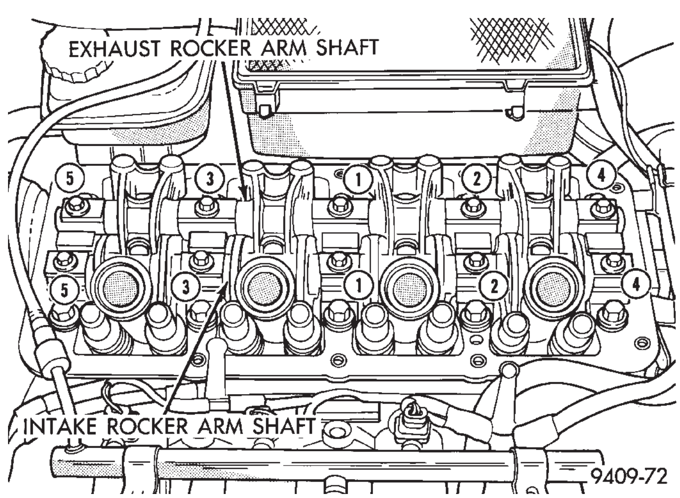


Fig. 18 Rocker Arm Shaft Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

HYDRAULIC LASH ADJUSTER NOISE

A tappet-like noise may be produced from several items. Refer to Lash Adjuster Noise - Diagnosis in Standard Service Procedures, outlined in this Group. **Lash adjusters are replaced with the rocker arm as an assembly.**

VALVE SEALS AND SPRINGS IN VEHICLE

REMOVAL

(1) Remove rocker arm shafts assemblies as previously outlined in this section.

(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-998772A with adapter 6779 (Fig. 19) compress valve springs and remove valve locks.

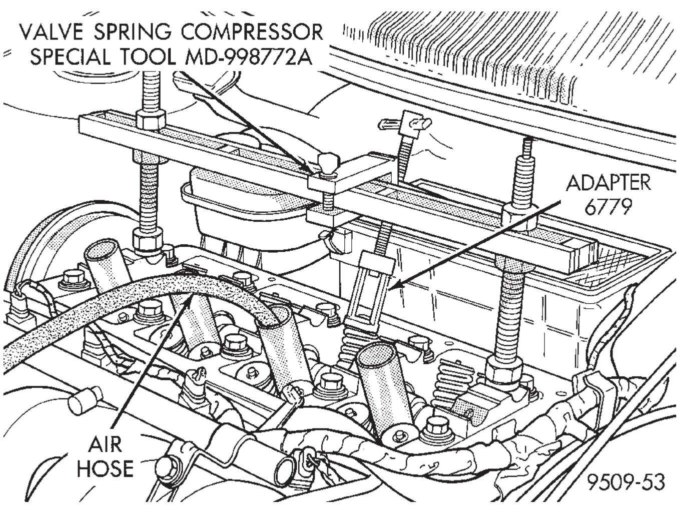


Fig. 19 Removing and Installing Valve Spring

(5) Remove valve spring.

(6) Remove valve stem seal by using a valve stem seal tool (Fig. 20).

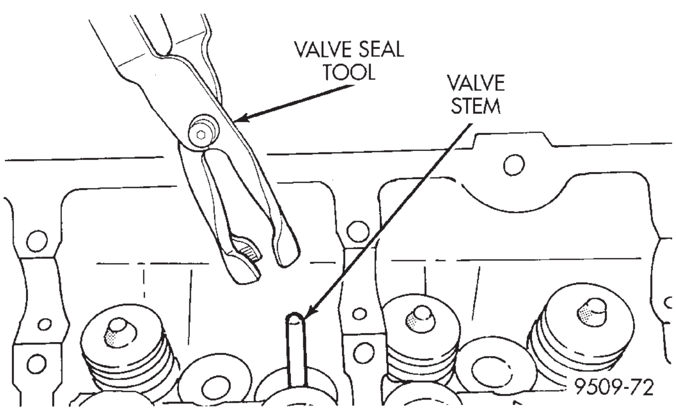


Fig. 20 Valve Stem Oil Seal Tool

INSTALLATION

(1) Install valve seal/valve spring seat assembly as outlined in the Valve Installation procedure in this section.

(2) Using Special Tool MD-998772A compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems (air pressure required), piston at TDC.

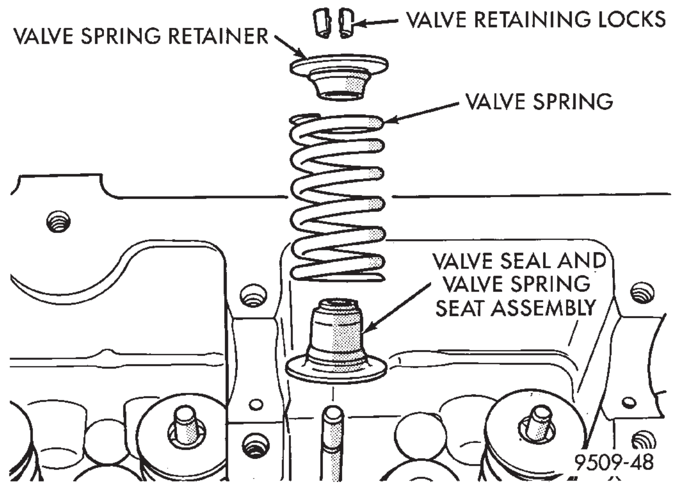


Fig. 21 Valve Spring Assembly

(3) Install rocker arm shaft assemblies as previously outlined in this section.

(4) Install valve cover as previously outlined in this section.

CYLINDER HEAD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System

(2) Disconnect negative battery cable. Drain cooling system. Refer to Group 7, Cooling System.

(3) Disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.

(4) Remove throttle linkage.

(5) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(6) Remove power brake vacuum hose from intake manifold.

(7) Raise vehicle and remove exhaust pipe from manifold.

(8) Remove power steering pump assembly and set aside.

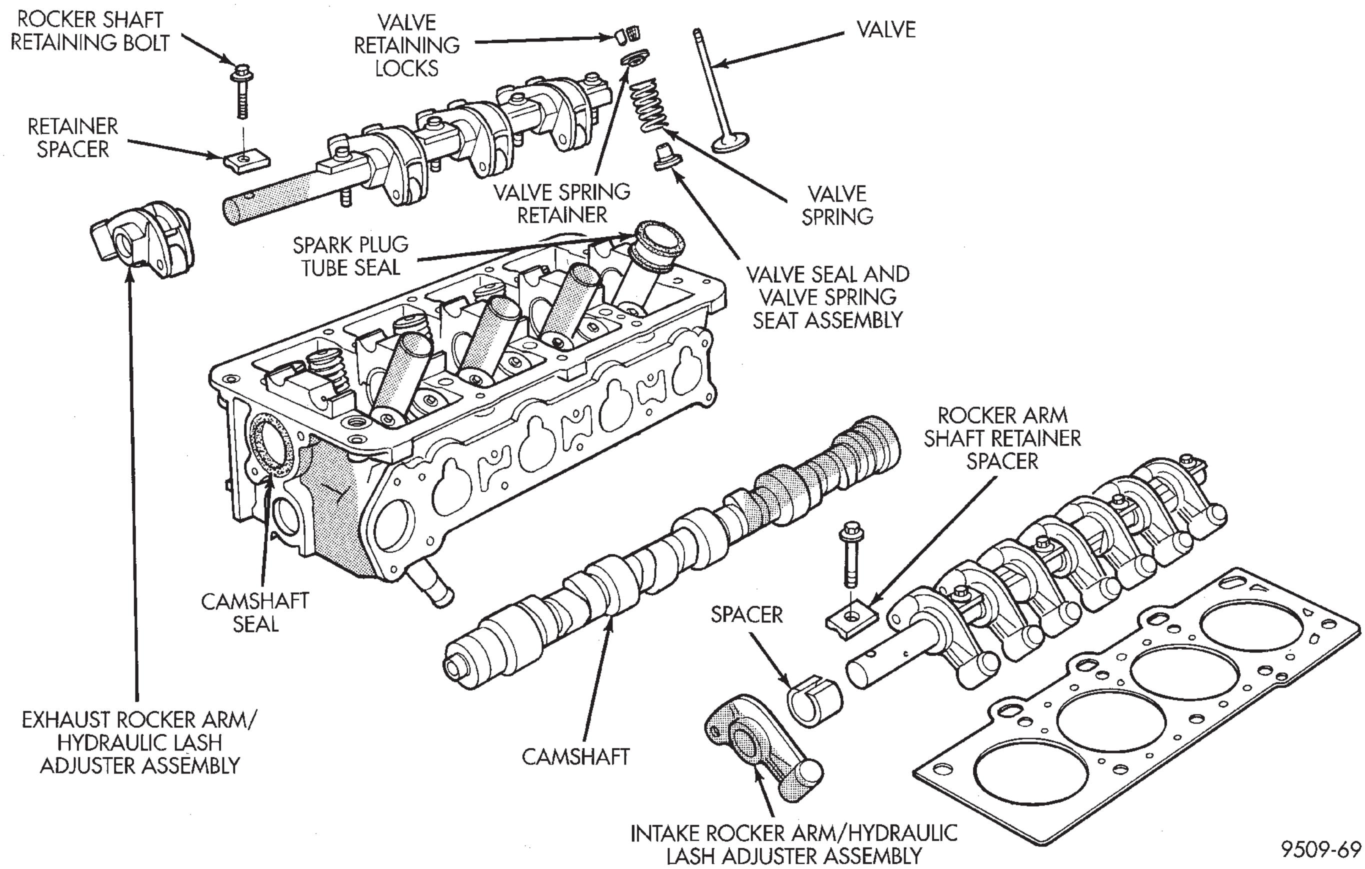
(9) Disconnect coil pack wiring connector and remove coil pack and bracket from engine.

(10) Remove cylinder head cover.

(11) Remove cam sensor and fuel injectors wiring connectors.

(12) Remove intake manifold. Removal procedure outline in Group 11.

REMOVAL AND INSTALLATION (Continued)



Cylinder Head and Valve Assembly

(13) Remove timing belt and camshaft sprocket. Refer to procedure outlined in this section.

(14) Remove rocker arm shaft assemblies.

(15) Remove cylinder head bolts.

NOTE: Inspect camshaft bearing journals for scoring. Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 22).

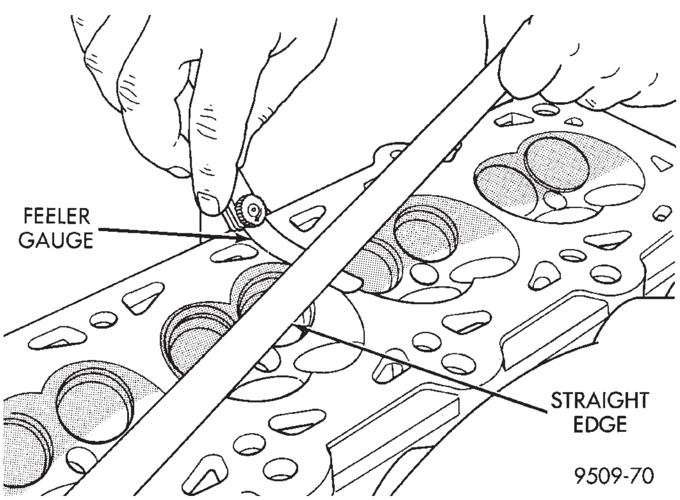


Fig. 22 Checking Cylinder Head Flatness

INSTALLATION

(1) Before installing the bolts the threads should be oiled with engine oil. The 4 short bolts 110 mm (4.330 in.) are to be installed in positions 7, 8, 9, and 10 (Fig. 23).

(2) Tighten the cylinder head bolts in the sequence shown in (Fig. 23). Using the 4 step torque 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.)
- Third All to 68 N·m (50 ft. lbs.)
- Fourth Turn an additional 1/4 Turn, **Do not use a torque wrench for this step.**

For the rest of installation, reverse removal procedure.

TIMING BELT COVER

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Remove crankshaft vibration damper. Refer to procedure outlined in this section for removal.

(3) Remove front timing belt cover (Fig. 24).

REMOVAL AND INSTALLATION (Continued)

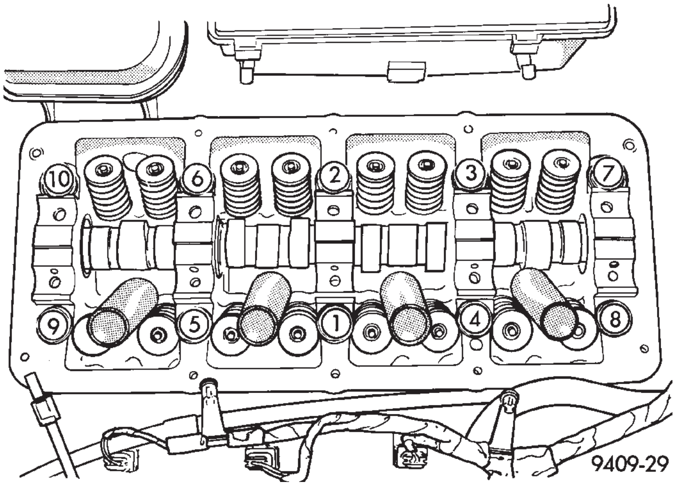


Fig. 23 Cylinder Head Tightening Sequence

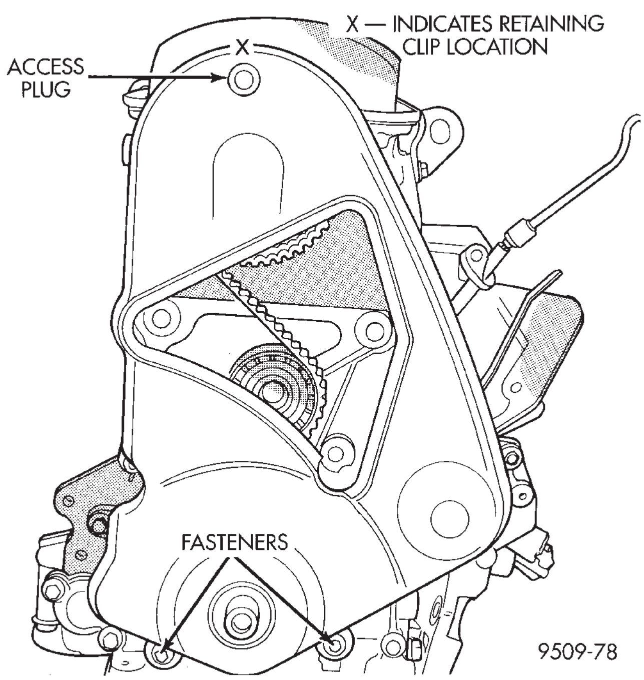


Fig. 24 Timing Belt Cover

INSTALLATION

(1) Install front timing cover.

(2) Install crankshaft vibration damper Refer to procedure outlined in this section for installation.

(3) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

CAMSHAFT OIL SEAL

REMOVAL

CAUTION: Do Not Rotate the camshaft or crankshaft when timing belt is removed damage to the engine may occur.

(1) Remove timing belt cover and belt. Removal procedure is outlined in this section. Remove camshaft sprocket bolt, with the Modified Special Tool C-4687-1 as shown in (Fig. 25).

(2) Hold camshaft sprocket with modified tool while removing bolt. Remove sprocket from camshaft.

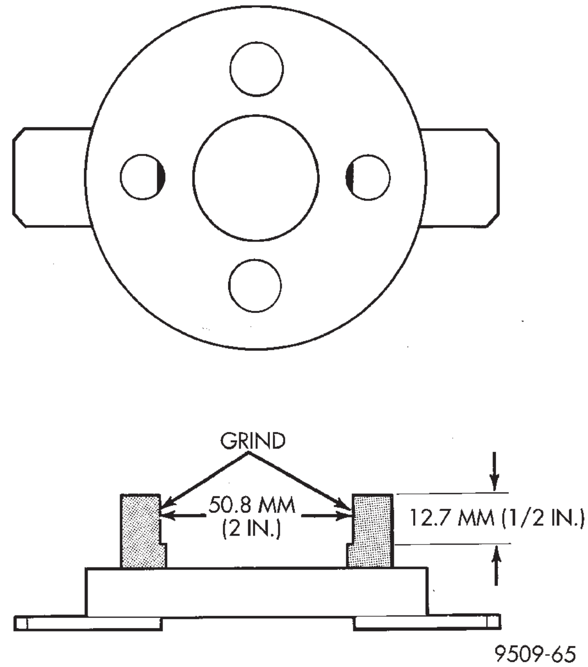


Fig. 25 Modification to Special Tool

(3) Remove camshaft seal using Special Tool C-4679–A (Fig. 26).

CAUTION: Do not nick shaft seal surface or seal bore.

(4) Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

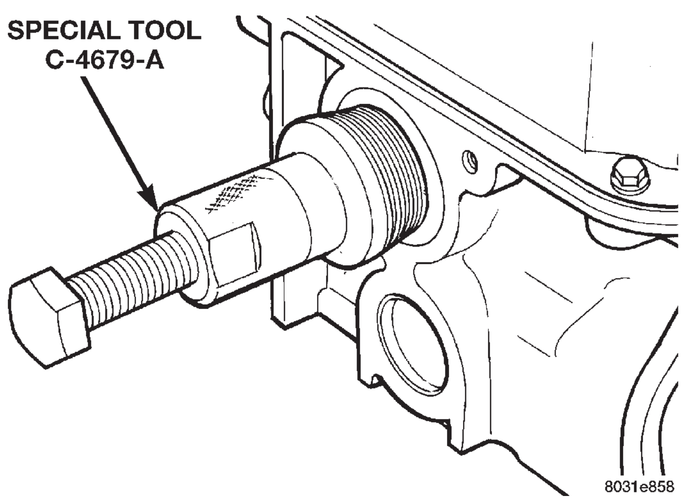


Fig. 26 Removing Camshaft Oil Seal

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install camshaft seal flush with cylinder head using Special Tool MD 998306 (Fig. 27).

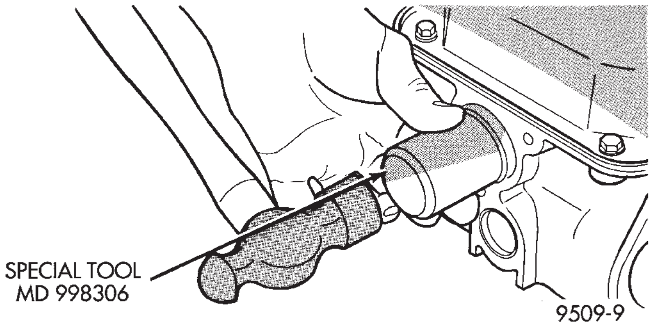


Fig. 27 Installing Camshaft Seal

(2) Install camshaft sprocket retaining bolt. Hold camshaft sprocket with Special Tool C-4687-1 (Fig. 25) and tighten bolt to 115 N·m (85 ft. lbs.).

TIMING BELT SYSTEM

CHECKING BELT TIMING—COVER INSTALLED

• Remove number one spark plug.

• Using a dial indicator, set number one cylinder to TDC on the compression stroke.

• Remove the access plug from the outer timing belt cover (Fig. 28).

• Check the timing mark on the camshaft sprocket, it should align with the arrow on the rear belt cover (Fig. 29).

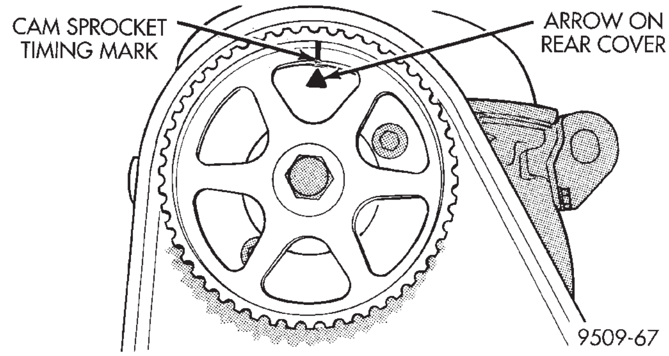


Fig. 29 Camshaft Timing Marks

REMOVAL—TIMING BELT

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 30).

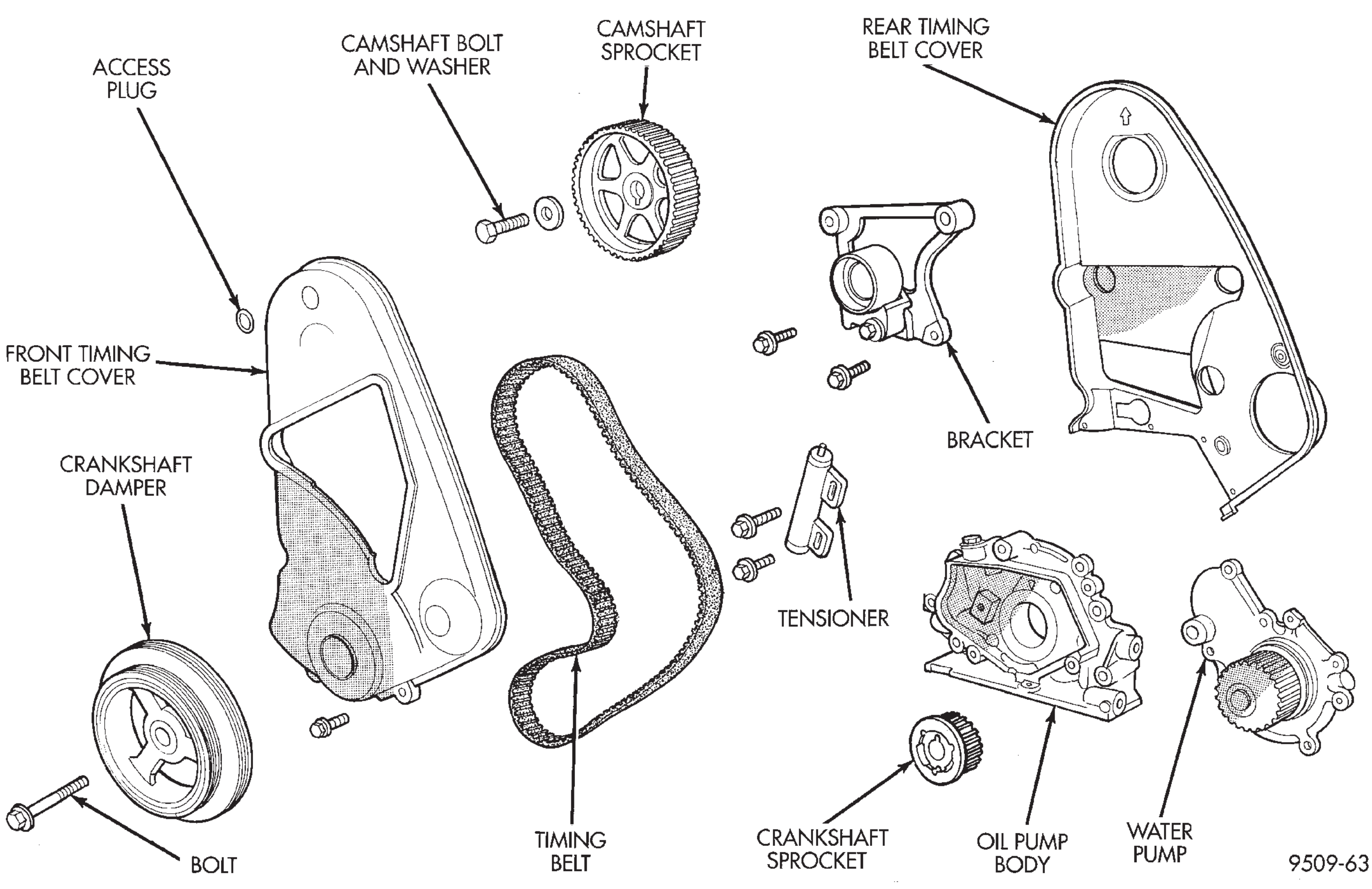


Fig. 28 Timing Belt System

REMOVAL AND INSTALLATION (Continued)

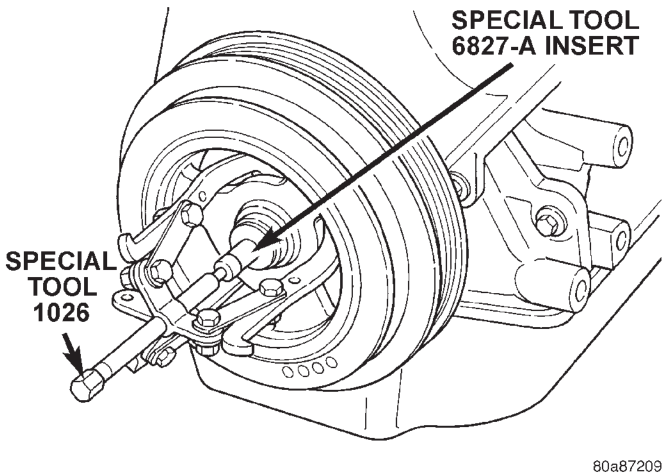


Fig. 30 Crankshaft Damper—Removal

(3) Remove front timing belt cover (Fig. 31).

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt.

(4) Loosen timing belt tensioner fasteners (Fig. 33) and remove timing belt and tensioner.

CAUTION: Do not loosen, tighten, or remove the tensioner pivot bolt (Fig. 32).

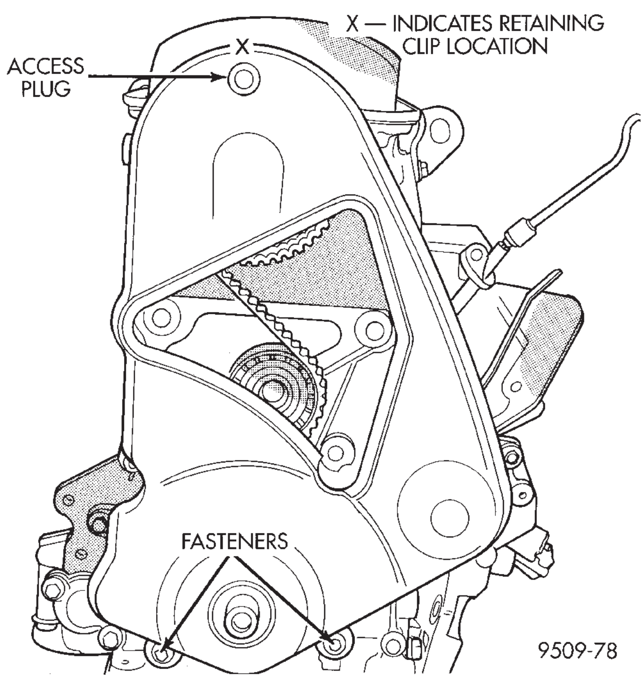


Fig. 31 Timing Belt Cover

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE AND BELT INSTALLATION —SOHC ENGINE

(1) When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

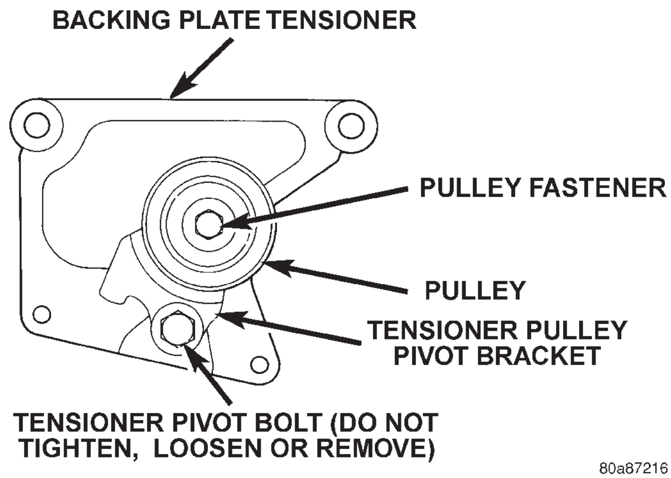


Fig. 32 Tensioner Pulley Assembly

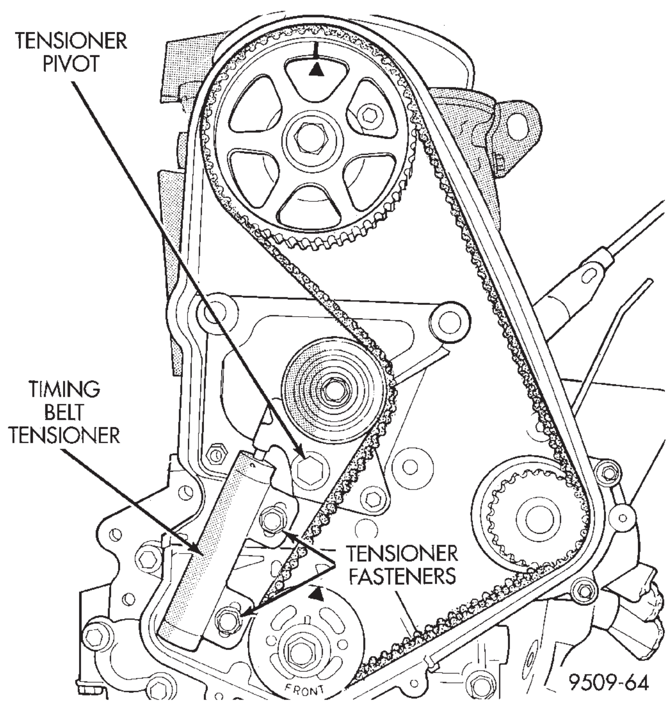


Fig. 33 Remove Timing Belt

(2) Place the tensioner into a vise equipped with soft jaws and slowly compress the plunger (Fig. 34).

CAUTION: Index the tensioner in the vise the same way it is installed on the engine. This is to ensure proper pin orientation when tensioner is installed on the engine.

(3) When plunger is compressed into the tensioner body install a 1.9 mm (5/64) allen wrench or pin through the body and plunger to retain plunger in place until tensioner is installed.

(4) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 35).

REMOVAL AND INSTALLATION (Continued)

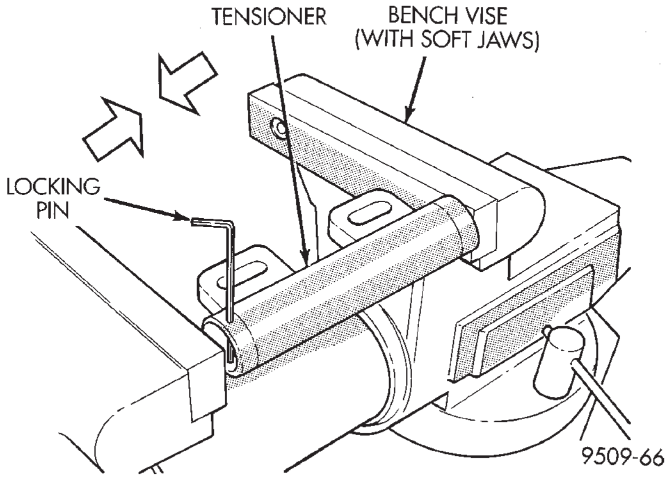


Fig. 34 Compressing Timing Belt Tensioner

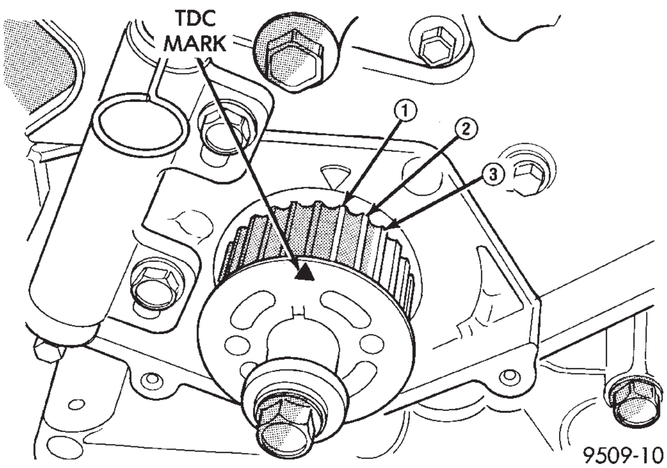


Fig. 35 Crankshaft Sprocket Timing

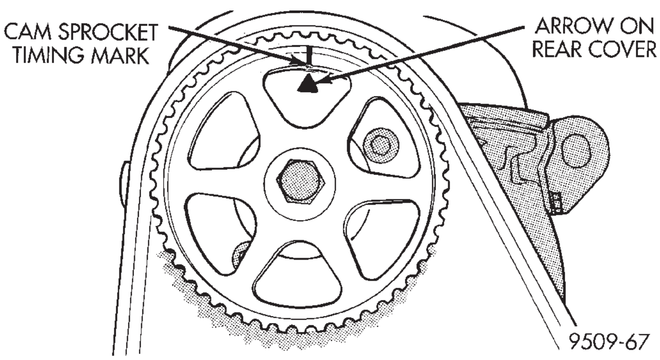


Fig. 36 Camshaft Timing Mark

(5) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear of timing belt cover (Fig. 36).

(6) Move crankshaft to 1/2 mark before TDC (Fig. 37) for belt installation.

(7) Install timing belt. Starting at the crankshaft, go around the water pump sprocket and then around the camshaft sprocket.

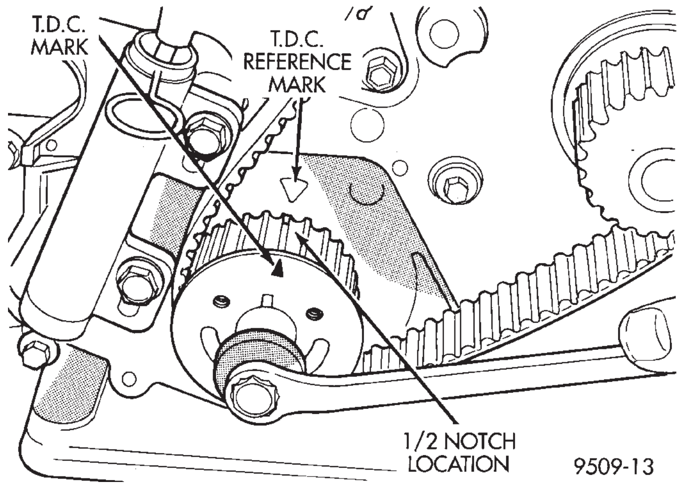


Fig. 37 Adjusting Crankshaft Sprocket for Timing Belt Installation

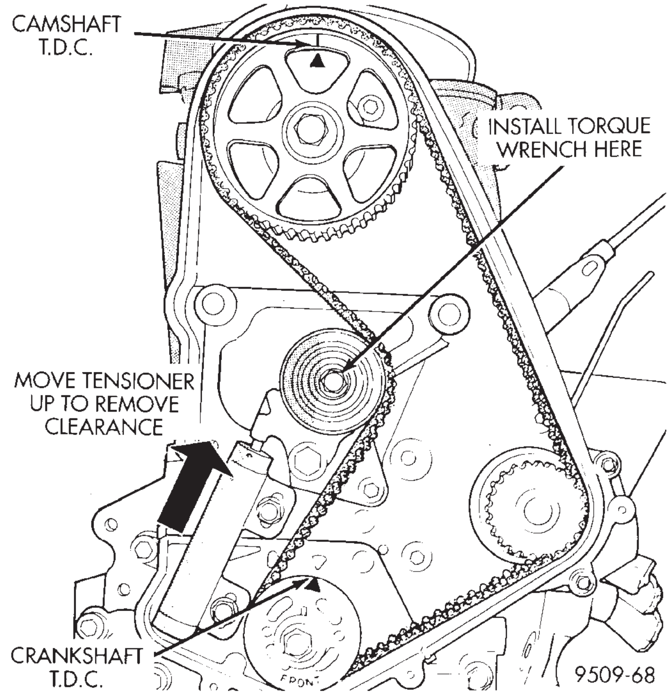


Fig. 38 Adjusting Timing Belt Tension

(8) Move crankshaft sprocket to TDC to take up belt slack. Install tensioner to block but do not tighten fasteners.

(9) Using a torque wrench on the tensioner pulley apply 28 N·m (250 in. lbs.) of torque (Fig. 38).

(10) With torque being applied to the tensioner pulley move the tensioner up against the tensioner pulley bracket and tighten fasteners to 31 N·m (275 in. lbs.) (Fig. 38).

(11) Pull tensioner plunger pin. Pretension is correct when pin can be removed and installed.

(12) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 38).

(13) Install front half of timing cover.

REMOVAL AND INSTALLATION (Continued)

(14) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 39).

(15) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(16) Perform camshaft and crankshaft timing relearn. Refer to Group 25, Emission Control Systems for procedure.

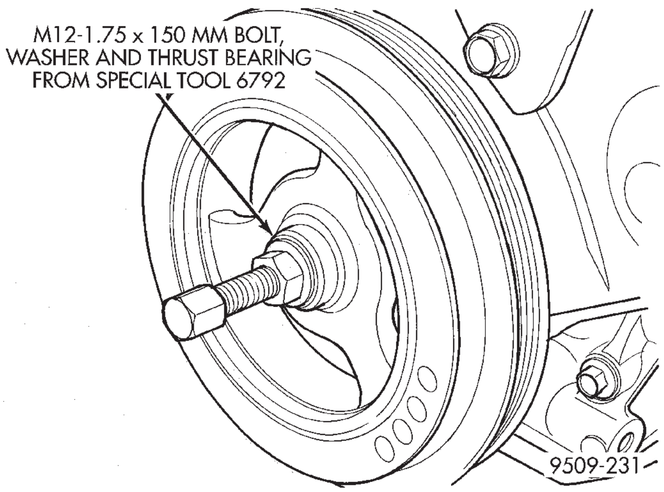


Fig. 39 Crankshaft Damper—Installation

TIMING BELT—w/AUTO TENSIONER—IF EQUIPPED

CHECKING BELT TIMING—COVER INSTALLED

- Remove number one spark plug.
- Using a dial indicator, set number one cylinder to TDC on the compression stroke.
- Remove the access plug from the outer timing belt cover (Fig. 28).
- Check the timing mark on the camshaft sprocket, it should align with the arrow on the rear belt cover (Fig. 29).

REMOVAL—TIMING BELT

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 42).

(3) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 30).

(4) Lower vehicle and place a jack under engine.

(5) Remove right engine mount. Refer to procedure outlined in this section.

(6) Remove right engine mount bracket (Fig. 44).

(7) Remove front timing belt cover (Fig. 31).

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt by rotating the engine with the crankshaft.

(8) Insert a 8 mm Allen wrench into the 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. 33). Rotate the tensioner counterclockwise with the Allen wrench, while pushing in lightly on the 1/8 in. or 3 mm Allen wrench, until it slides into the locking hole.

(9) Remove timing belt.

CAUTION: Do not rotate the camshafts once the timing belt has been removed or damage to valve components may occur.

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE AND BELT INSTALLATION —SOHC ENGINE

(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 35).

(2) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear of timing belt cover (Fig. 36).

(3) Move crankshaft to 1/2 mark before TDC (Fig. 37) for belt installation.

(4) Install timing belt. Starting at the crankshaft, go around the water pump sprocket and then around the camshaft sprocket.

(5) Move crankshaft sprocket to TDC to take up belt slack.

(6) Remove the pin or 1/8” or 3 mm Allen wrench from belt tensioner.

(7) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 50).

(8) Install front half of timing cover.

(9) Install engine mount bracket.

(10) Install Right engine mount. Refer to procedure outlined in this section.

(11) Remove jack from under engine.

(12) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 39).

(13) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(14) Raise vehicle on hoist and install right inner splash shield.

(15) Perform camshaft and crankshaft timing relearn procedure as follows:

- 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.

REMOVAL AND INSTALLATION (Continued)

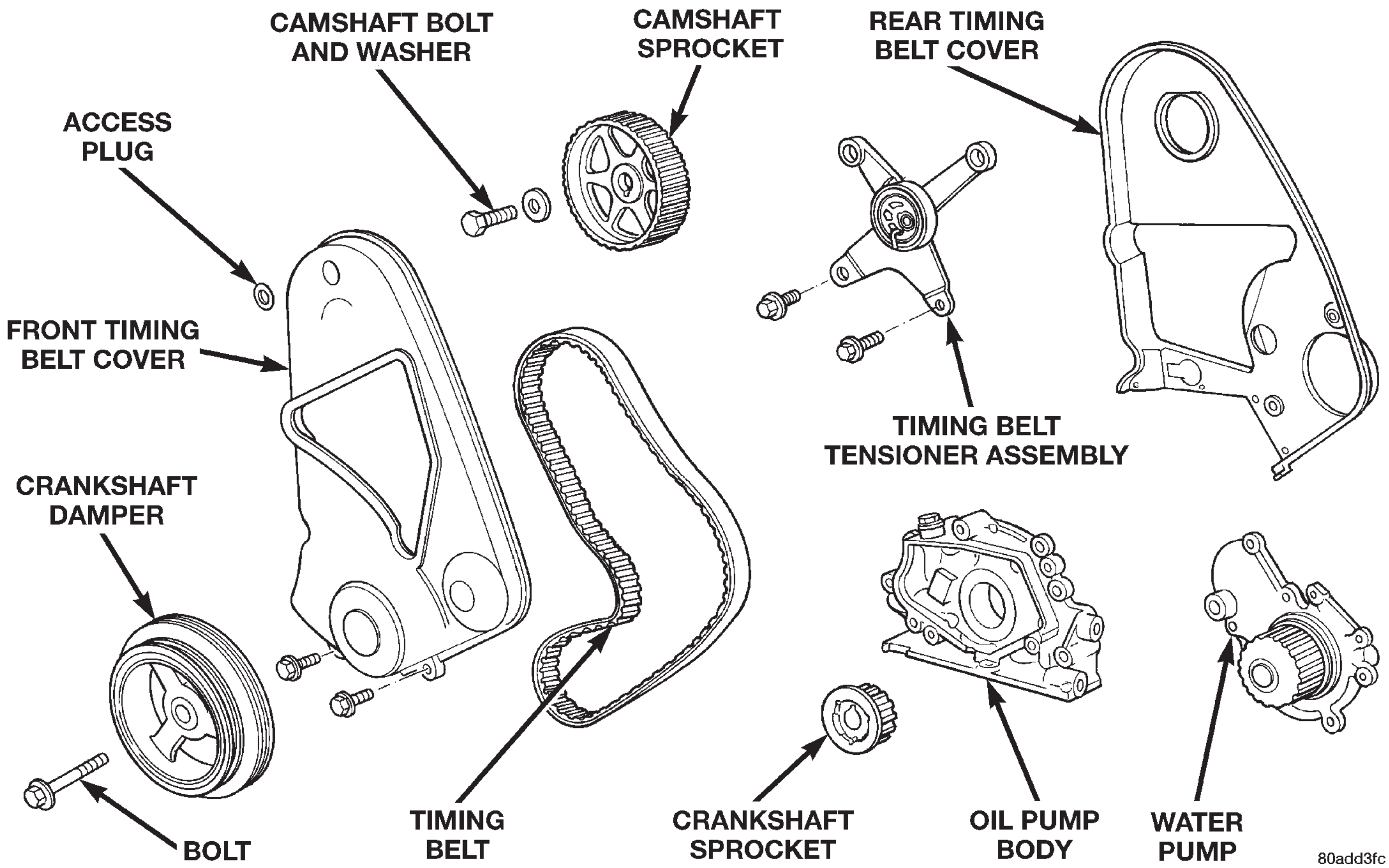


Fig. 40 Timing Belt System

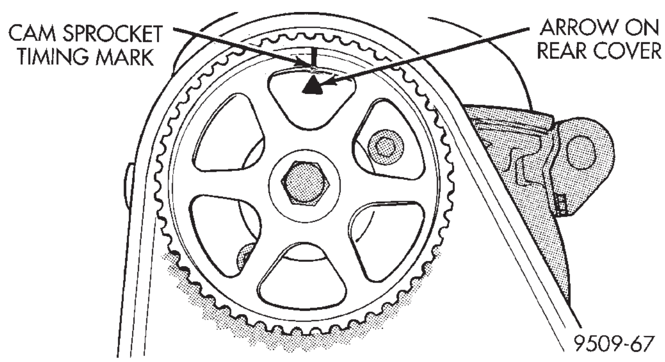


Fig. 41 Camshaft Timing Marks

• Turn the ignition switch on and access the "miscellaneous" screen.

• Select "re-learn cam/crank" option and follow directions on DRB screen.

OIL PAN

REMOVAL

(1) Drain engine oil.

(2) Remove transmission inspection cover.

(3) If equipped with air conditioning remove oil filter and adaptor. Refer to Oil Filter Adapter Removal and Installation in this section.

(4) Remove oil pan.

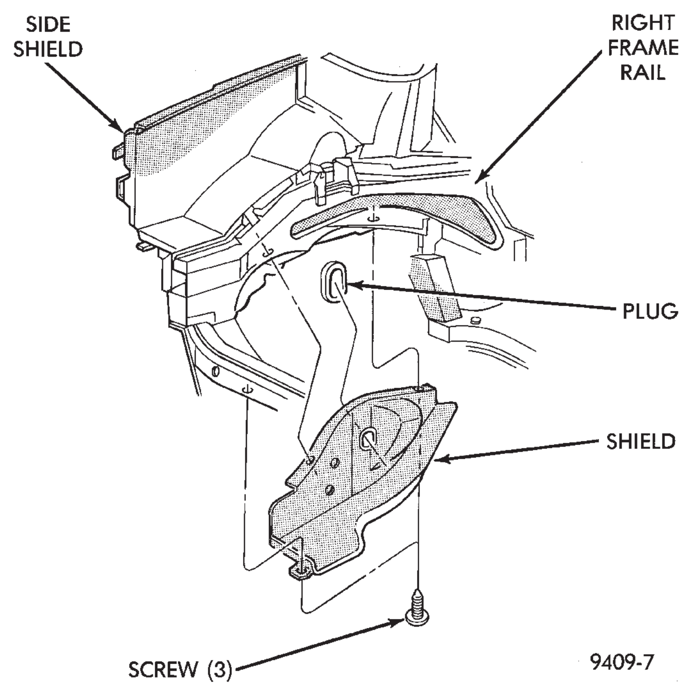


Fig. 42 Right Inner Splash Shield

(5) Clean oil pan and all gasket surfaces.

REMOVAL AND INSTALLATION (Continued)

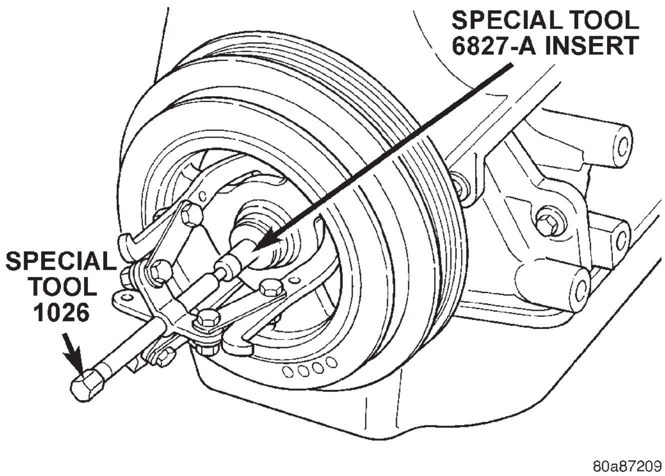


Fig. 43 Crankshaft Damper—Removal

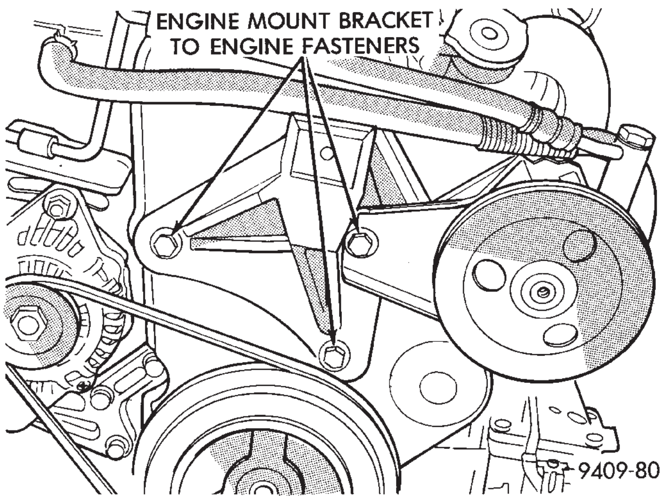


Fig. 44 Right Engine Mount Bracket

INSTALLATION

(1) Apply Mopar Silicone Rubber Adhesive Sealant or equivalent at the oil pump to engine block parting line (Fig. 52).

(2) Install a new oil pan gasket to pan.

(3) Install pan and tighten screws to 12 N·m (105 in. lbs.).

(4) Install oil filter and adaptor.

(5) Install proper amount of oil. With oil filter 4.25 Liters (4.5 Qts.). Without oil filter 3.8 Liters (4.0 Qts.)

FRONT CRANKSHAFT OIL SEAL

REMOVAL

(1) Using Special Tool 1026 and Insert 6827–A, remove crankshaft damper (Fig. 53).

(2) Remove outer timing belt cover and timing belt. Refer to Timing Belt System outlined in this section.

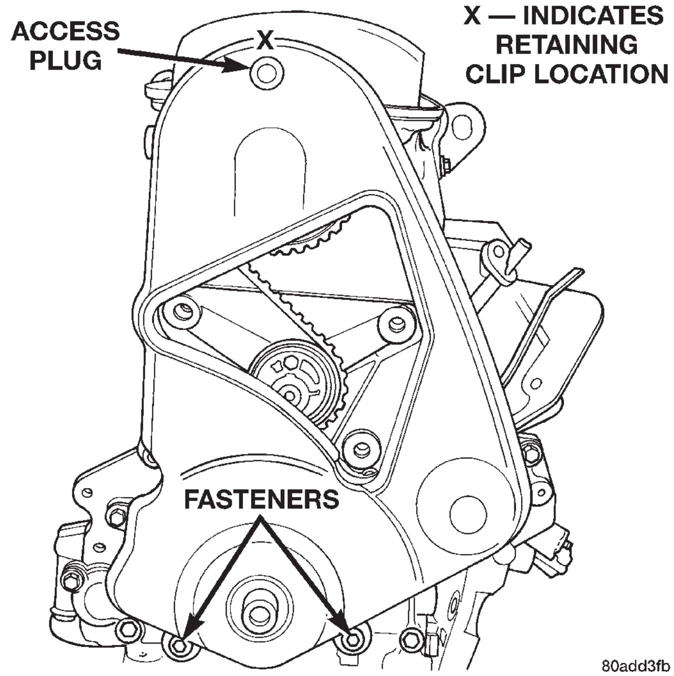


Fig. 45 Timing Belt Cover

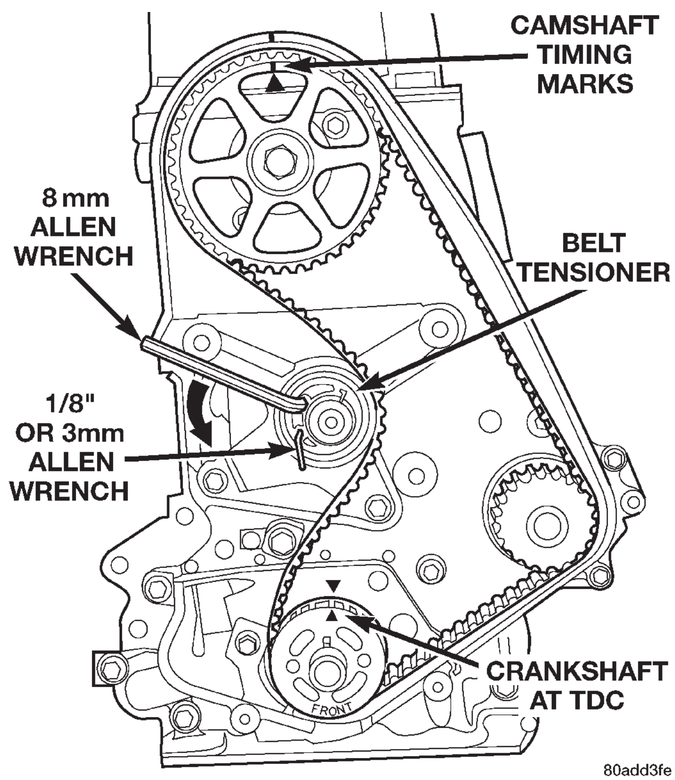


Fig. 46 Timing Belt Removal

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 54).

CAUTION: Do not nick shaft seal surface or seal bore.

REMOVAL AND INSTALLATION (Continued)

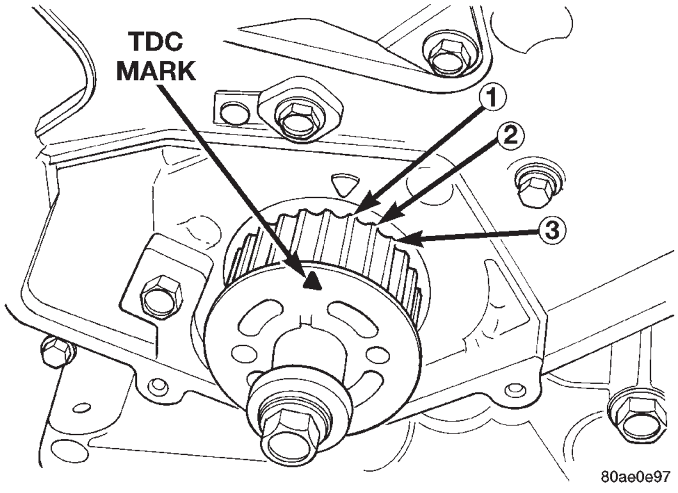


Fig. 47 Crankshaft Sprocket Timing

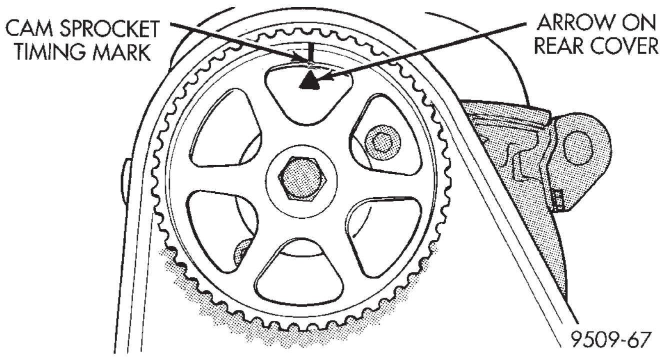


Fig. 48 Camshaft Timing Mark

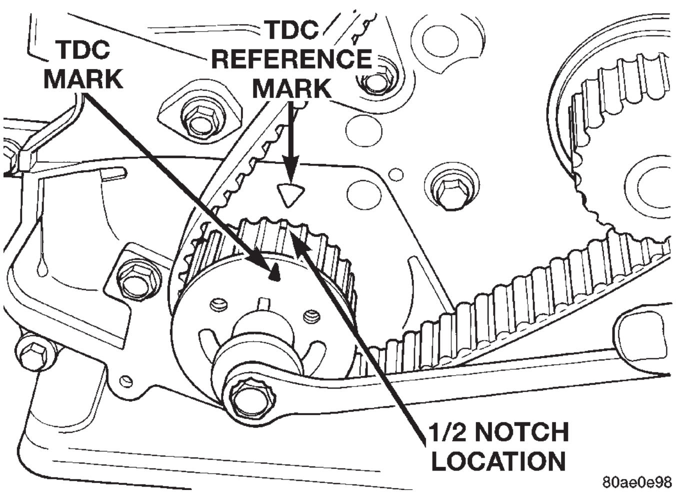


Fig. 49 Adjusting Crankshaft Sprocket for Timing Belt Installation

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 55). Do not damage the seal contact area on the crankshaft.

INSTALLATION

(1) Install new seal by using Tool 6780–1 (Fig. 56).

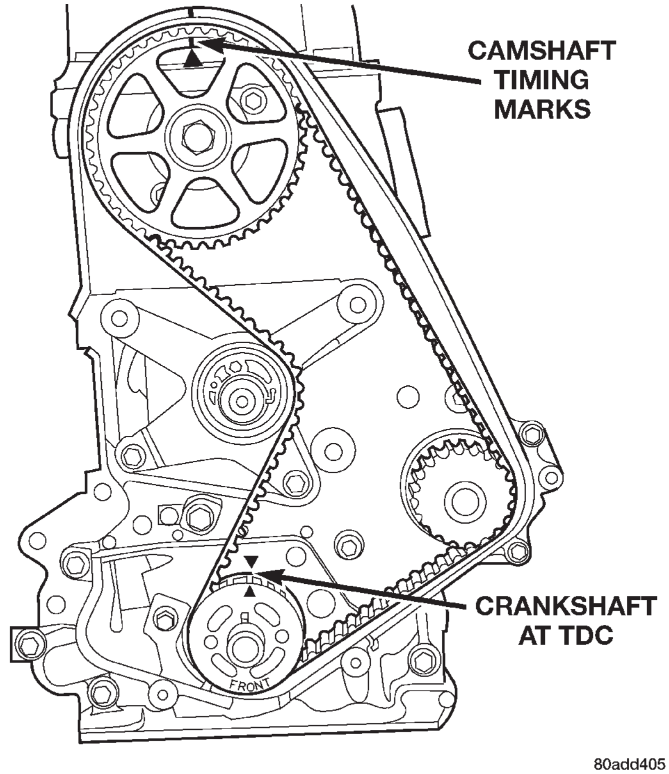


Fig. 50 Crankshaft and Camshaft Timing

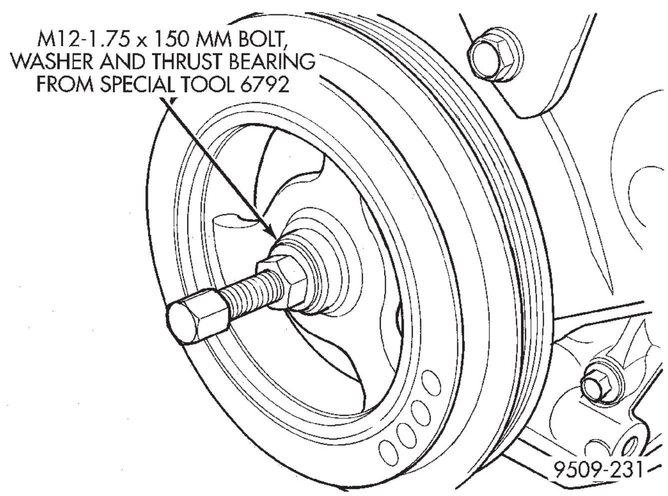


Fig. 51 Crankshaft Damper—Installation

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

(3) Install crankshaft sprocket (Fig. 57). Using Special Tool 6792.

NOTE: Make sure the word “front” on the sprocket is facing you.

(4) Install timing belt and covers. Refer to Timing Belt System in this section for installation.

(5) Install crankshaft damper (Fig. 58). Use thrust bearing/washer and 12M-1.75 x 150 mm bolt from

REMOVAL AND INSTALLATION (Continued)

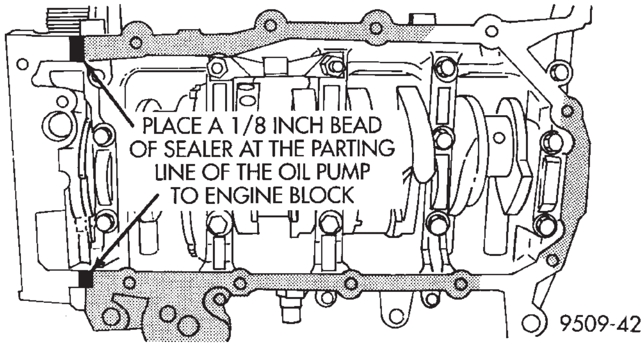


Fig. 52 Oil Pan Sealing

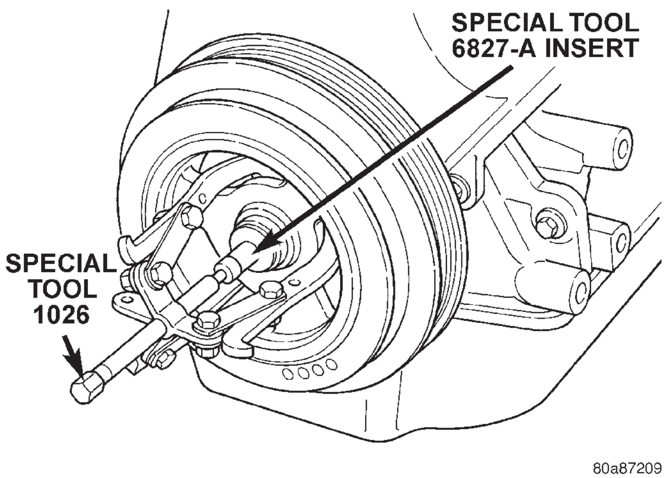


Fig. 53 Crankshaft Damper—Removal

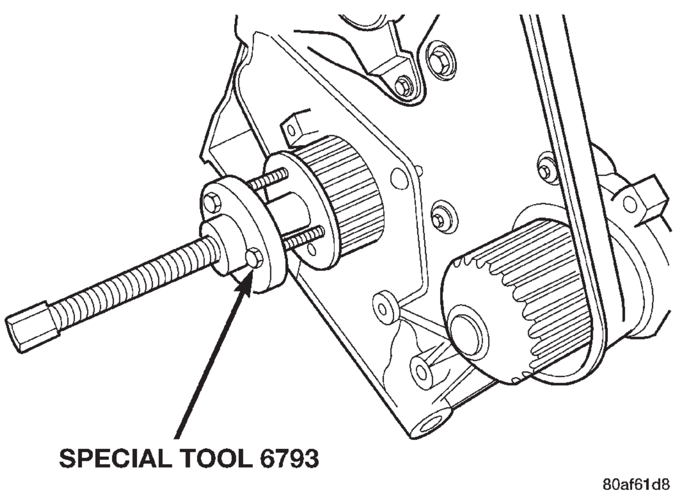


Fig. 54 Crankshaft Sprocket—Removal

Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.)

CRANKSHAFT OIL SEAL—REAR

REMOVAL

(1) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft

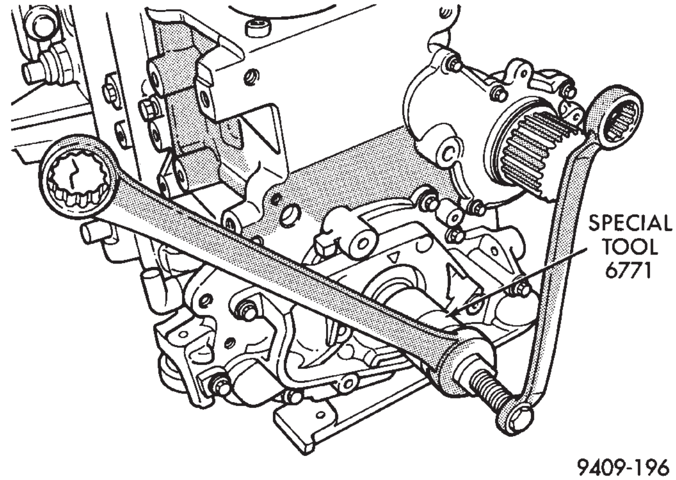


Fig. 55 Front Crankshaft Oil Seal—Removal

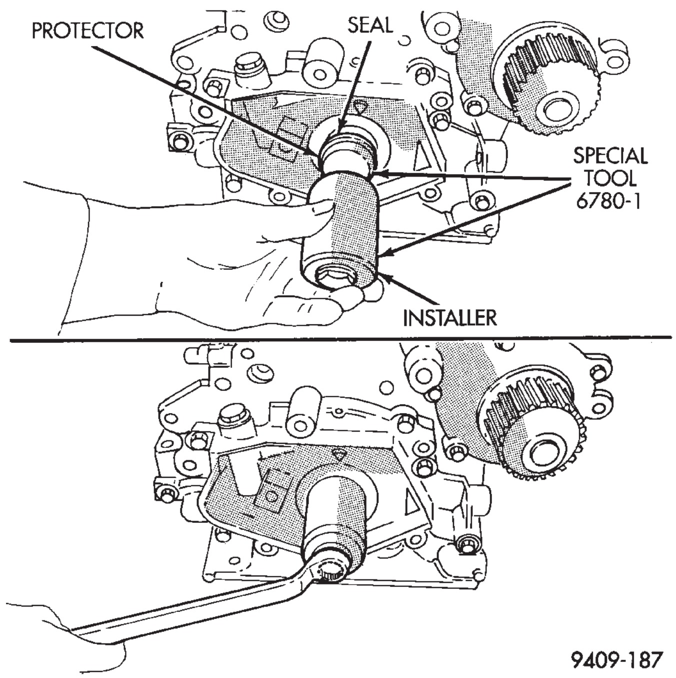


Fig. 56 Front Crankshaft Oil Seal—Installation

seal. Angle the screwdriver (Fig. 59) 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.

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.

REMOVAL AND INSTALLATION (Continued)

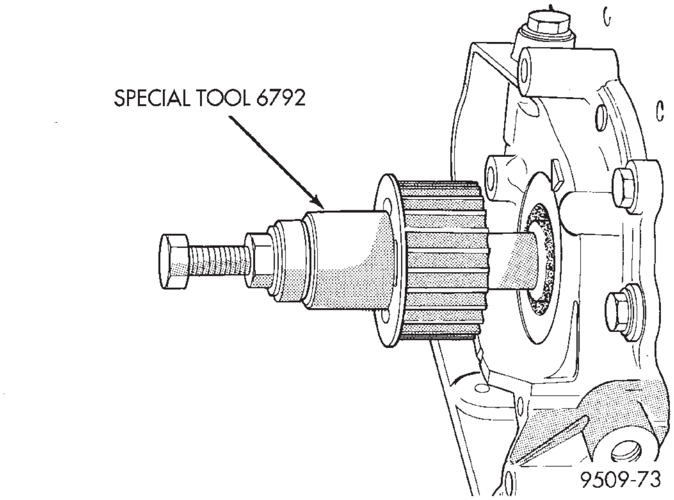


Fig. 57 Crankshaft Sprocket—Installation

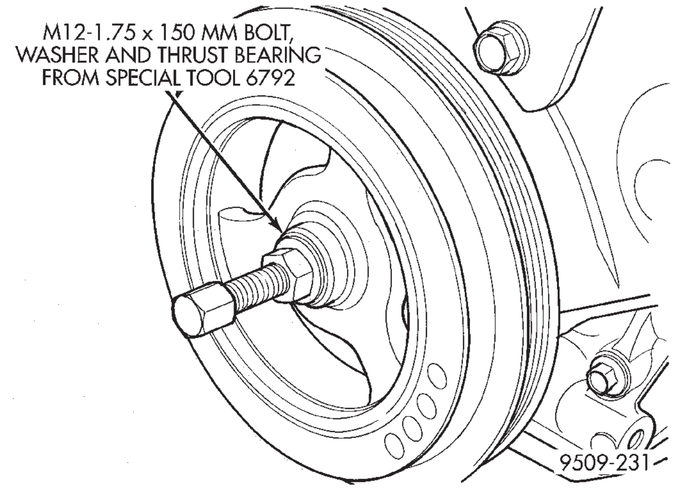


Fig. 58 Crankshaft Damper—Installation

NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 60).

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 60). Pilot 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.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 61) until the tool bottoms out against the block (Fig. 62).

CRANKSHAFT

REMOVAL

(1) Remove oil filter and adapter from bedplate.

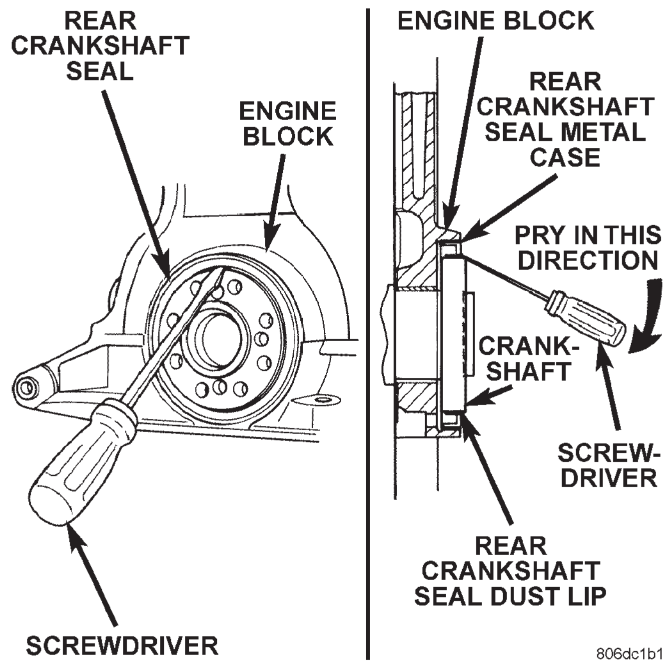


Fig. 59 Rear Crankshaft Oil Seal—Removal

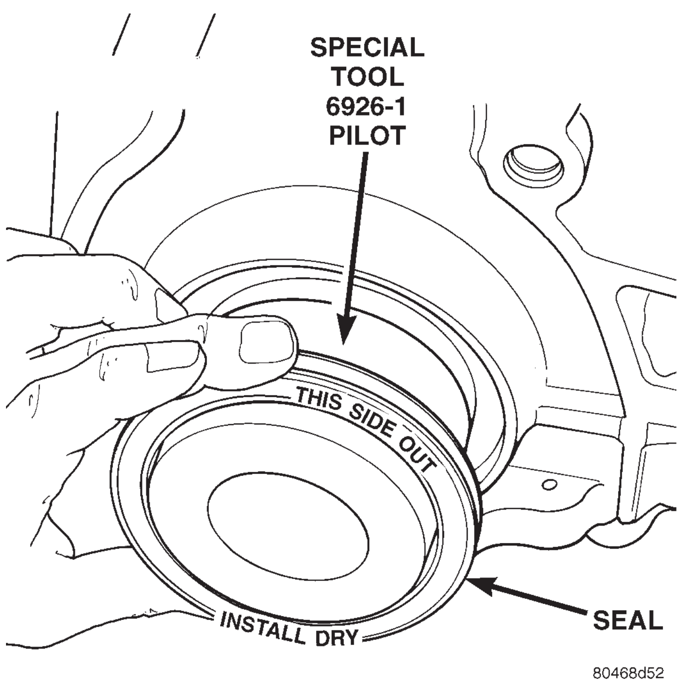


Fig. 60 Rear Crankshaft Seal and Special Tool 6926-1

(2) Remove collar from oil pan to transmission housing.

(3) Remove oil pan.

(4) Remove crankshaft sprocket and oil pump both procedures outlined in this section.

(5) Remove all main bearing cap and bedplate bolts from the engine block (Fig. 63).

(6) Using a mallet tap the bedplate loose from the engine block dowel pins.

REMOVAL AND INSTALLATION (Continued)

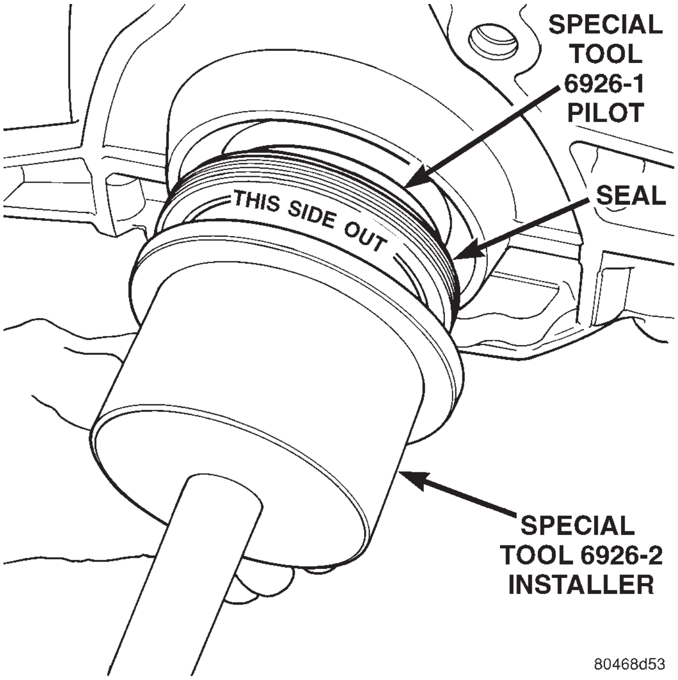


Fig. 61 Crankshaft Seal Special Tool 6926-2

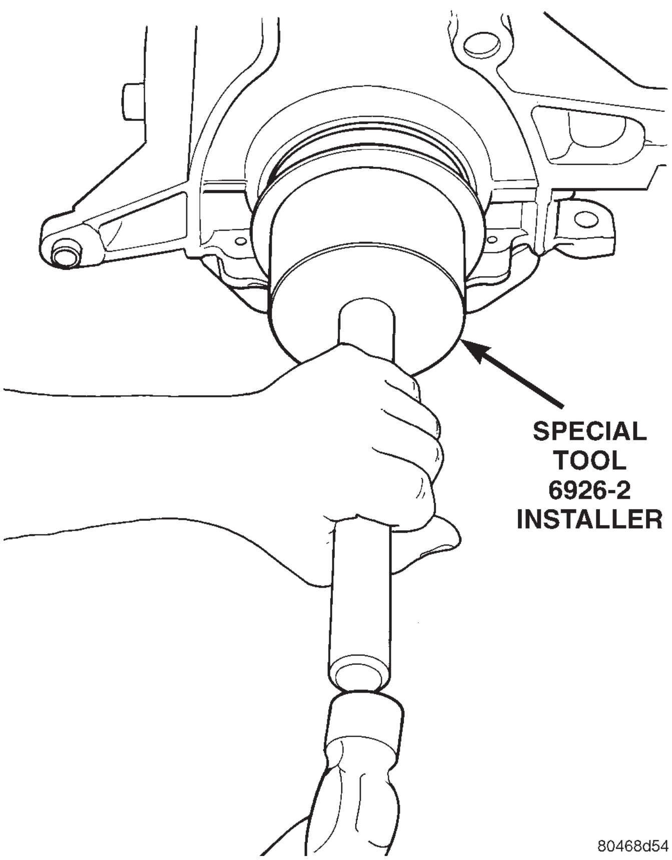


Fig. 62 Rear Crankshaft Seal—Installation

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block and bedplate alignment.

(7) Bedplate should be removed evenly from the cylinder block dowel pins.

(8) Lift out crankshaft from cylinder block. Be sure not to damage the main bearings or journals when removing the crankshaft.

CRANKSHAFT MAIN BEARINGS LOCATION

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells installed in the (bedplate) main bearing cap are plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 64).

NOTE: The upper and lower main Bearing shells are Not interchangeable. The lower shells have a revised tab to prevent improper installation.

CRANKSHAFT MAIN JOURNALS INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. DO NOT grind thrust faces of Number 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 used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

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. 64). 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: 0.016 mm (.0006 inch), .032 mm (.0012 inch), .250 mm (.010 inch). Never install an undersize bearing that will reduce clearance below specifications.

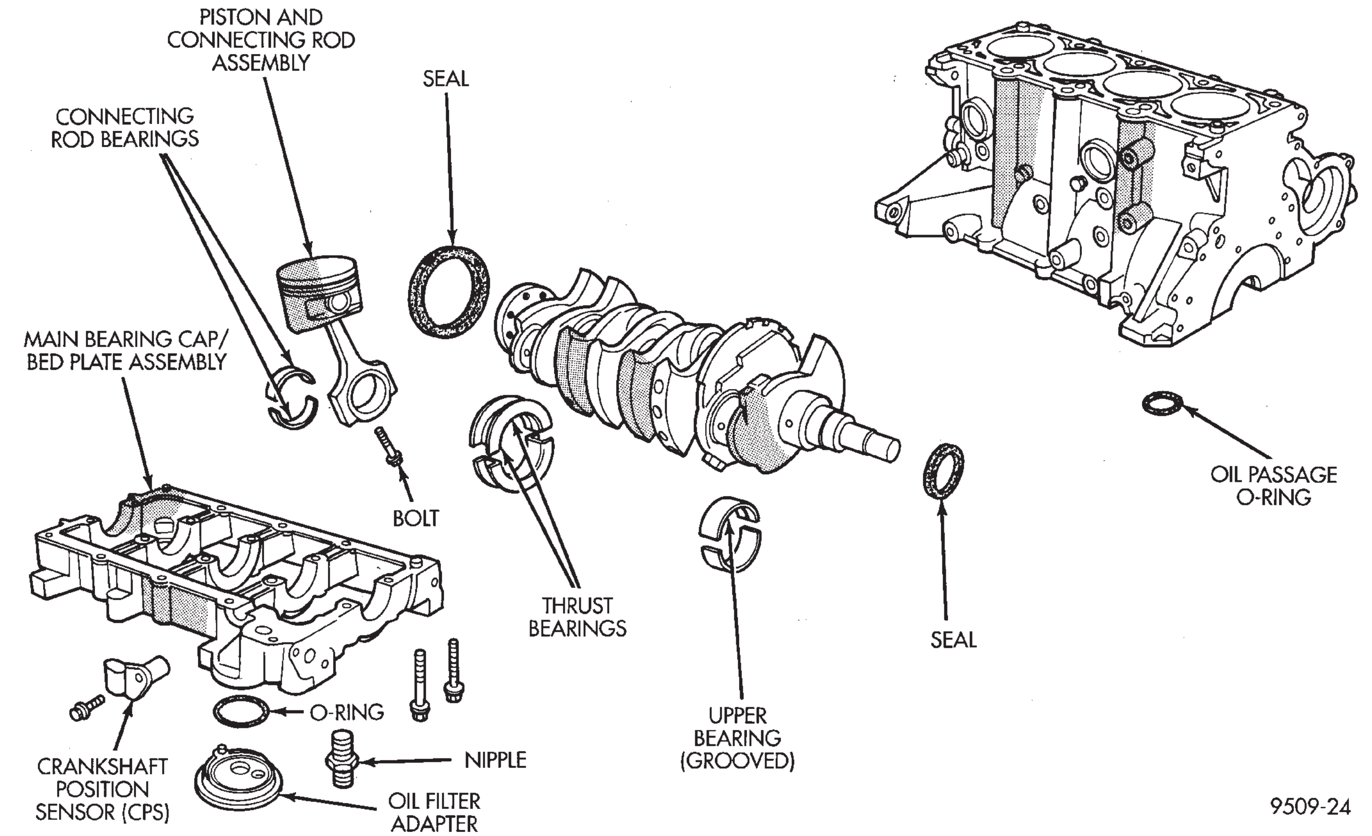
INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block. Install O-ring into recess in the block (Fig. 65).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

CAUTION: Do Not get oil on the bedplate mating surface. It will affect the sealer ability to seal the bedplate to cylinder block.

REMOVAL AND INSTALLATION (Continued)



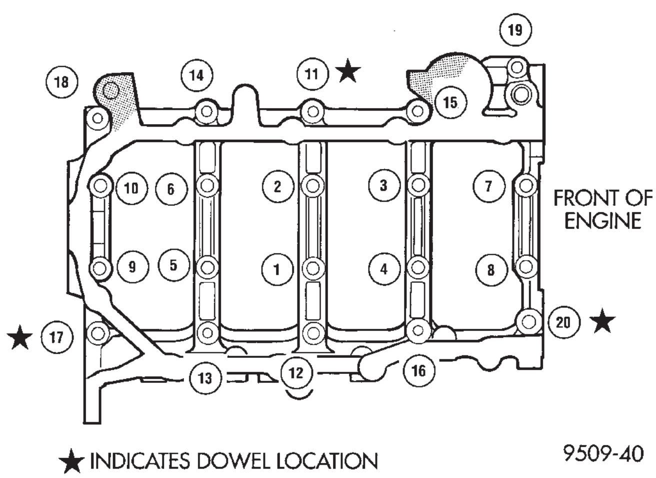


Fig. 63 Bedplate Bolts

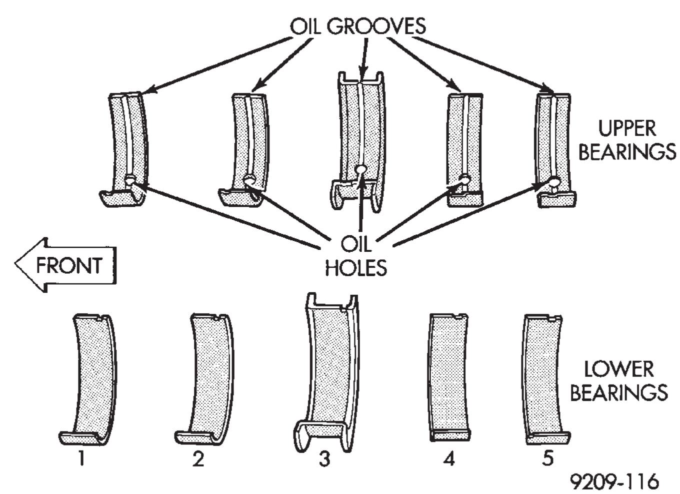


Fig. 64 Main Bearing Identification

(3) Oil the bearings and journals and install crankshaft and O-ring in cylinder block.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar Torque Cure Gasket Maker to cylinder block as shown in (Fig. 66).

(5) 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.

(6) Before installing the bolts oil threads with clean engine oil, wipe off any excess oil.

(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten this bolts down together until the bedplate contacts the cylinder block. Torque bolts to 30 N·m (22 ft. lbs.) (Fig. 67).

REMOVAL AND INSTALLATION (Continued)

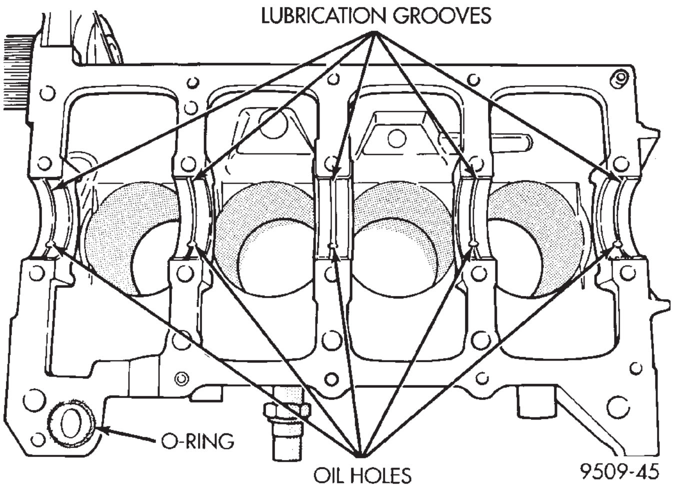


Fig. 65 Installing Main Bearing Upper Shell

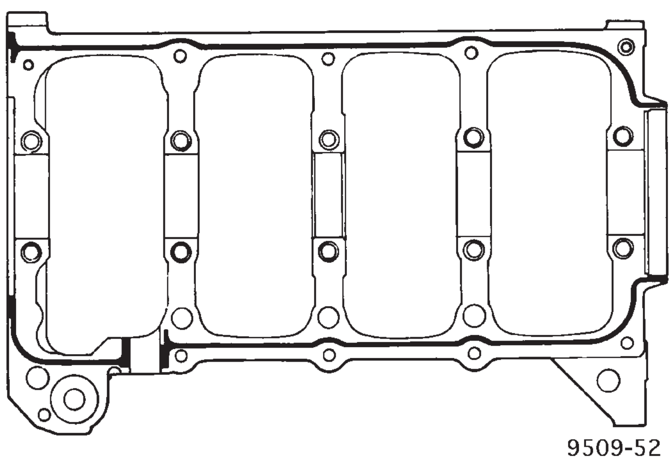


Fig. 66 Main Bearing Caps/Bedplate Sealing

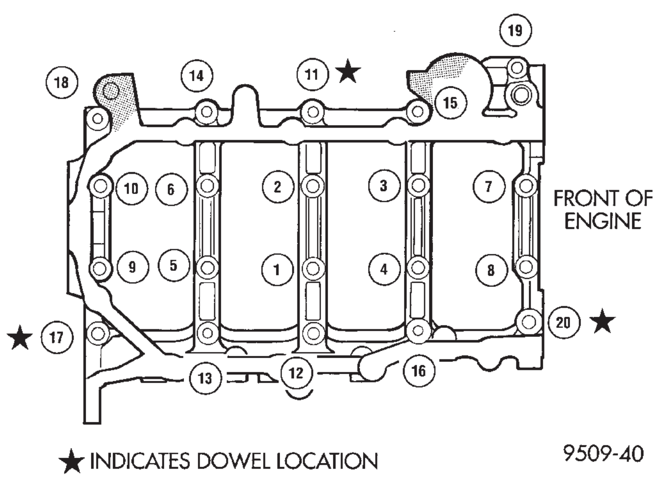


Fig. 67 Main Bearing Caps/Bedplate Torque Sequence

(8) Install main bearing bedplate to engine block bolts (1 thru 10) and torque each bolt to 81 N·m (60 ft. lbs.) in sequence shown in (Fig. 67).

(9) Install main bearing bedplate to engine block bolts (11 thru 20), with baffle studs in positions 12, 13 and 16 and torque each bolt to 30 N·m (22 ft. lbs.) in sequence shown in (Fig. 67).

(10) 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.).

(11) Install oil pump. If crankshaft end play is to be checked refer to service procedures in this section.

(12) Install crankshaft sprocket.

(13) Install oil filter adapter and filter.

(14) Install oil pan and collar. Refer to procedures outlined in the section.

(15) Perform camshaft and crankshaft timing relearn procedure as follows:

- 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.
- Turn the ignition switch on and access the "miscellaneous" screen.
- Select "re-learn cam/crank" option and follow directions on DRB screen.

OIL FILTER ADAPTER

REMOVE AND INSTALL

Ensure O-ring is in the groove on adapter. Align roll pin into engine block and tighten assembly to 80 N·m (60 ft. lbs.) (Fig. 68).

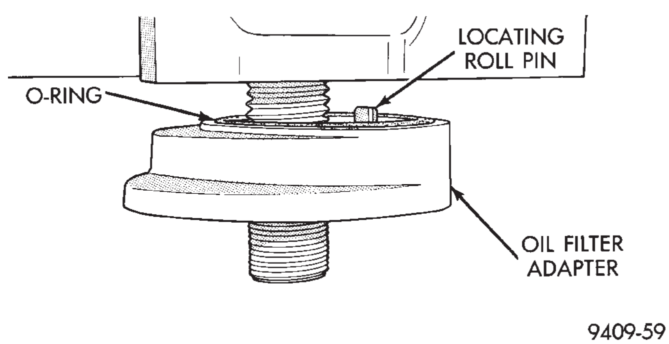


Fig. 68 Engine Oil Filter Adapter to Engine Block

OIL FILTER

REMOVE AND INSTALL

CAUTION: When servicing the oil filter (Fig. 69) avoid deforming the filter, install tool band strap against the seam at the base of the filter. The seam, joining the can to the base is reinforced by the base plate.

(1) Turn counterclockwise to remove.

(2) To install, lubricate new filter gasket. Check filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber. Screw

REMOVAL AND INSTALLATION (Continued)

filter on until gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

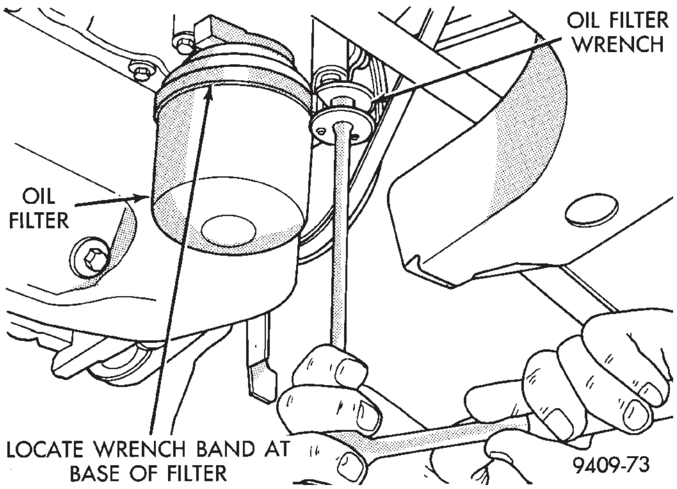


Fig. 69 Engine Oil Filter

OIL PUMP

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove Timing Belt. Refer to Timing Belt System, in this section.

(3) Remove Oil Pan. Refer to Oil Pan Removal in this section.

(4) Remove Crankshaft Sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 70).

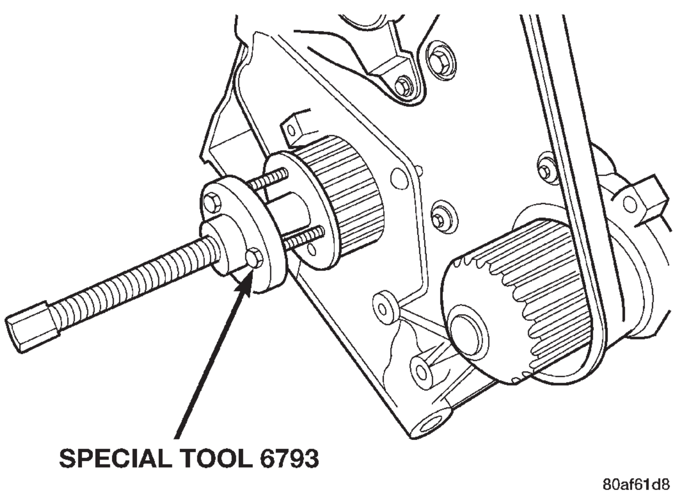


Fig. 70 Crankshaft Sprocket—Removal

(5) Remove oil pick-up tube.

(6) Remove oil pump (Fig. 71) and front crankshaft seal.

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. 72). Install o–ring into oil pump body discharge passage.

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

(5) Torque all oil pump attaching bolts to 28 N·m (250 in. lbs.)

(6) Install new front crankshaft seal using Special Tool 6780 (Fig. 73).

(7) Install crankshaft sprocket, using Special Tool 6792 (Fig. 74).

(8) Install oil pump pick-up tube and oil pan.

(9) Install Timing Belt. Refer to procedure outlined in this section.

(10) Connect negative cable to battery.

PISTON AND CONNECTING ROD

REMOVAL

(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. 75).

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 76) for identification.

(3) Pistons will have a stamping in the approximate location shown in (Fig. 75). These stamps will be either a directional arrow or a weight identification for the assembly. L is for light and H is for heavy. These assemblies should all be the same weight class. Service piston assemblies are marked with a S and can be used with either L or H production assemblies. The weight designation stamps should face toward the timing belt side of the 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 connecting rod cap bolts **Do not use old bolts if reinstalling connecting rod.** Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(6) After removal, install bearing cap on the mating rod.

(7) Piston and Rods are serviced as an assembly.

PISTON RING—REMOVAL

(1) ID mark on face of upper and intermediate piston rings must point toward piston crown.

REMOVAL AND INSTALLATION (Continued)

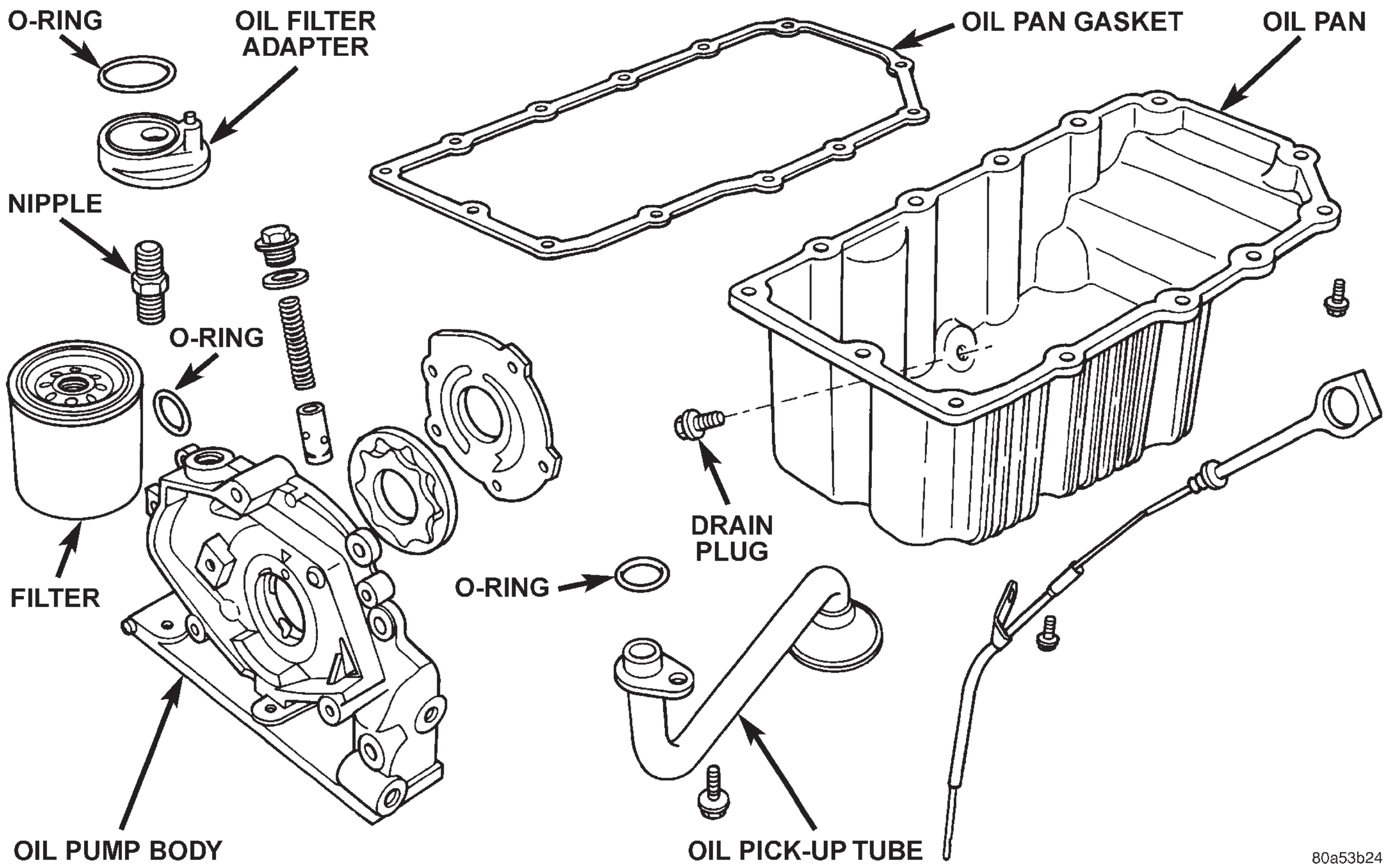


Fig. 71 Oil Pump and Tube

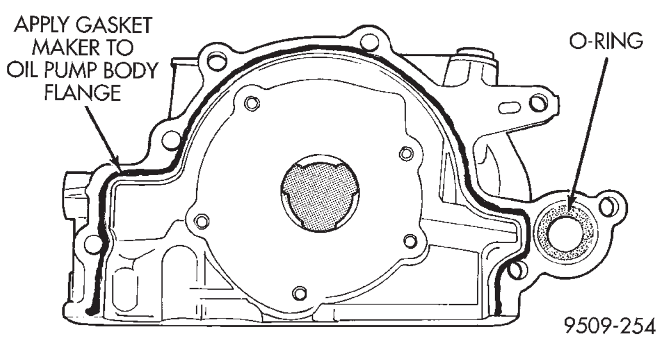


Fig. 72 Oil Pump Sealing

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 77).

(3) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

(4) Clean ring grooves of any carbon deposits.

PISTON RINGS—INSTALLATION

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 78).

CAUTION: Install piston rings in the following order:

a. Oil ring expander.

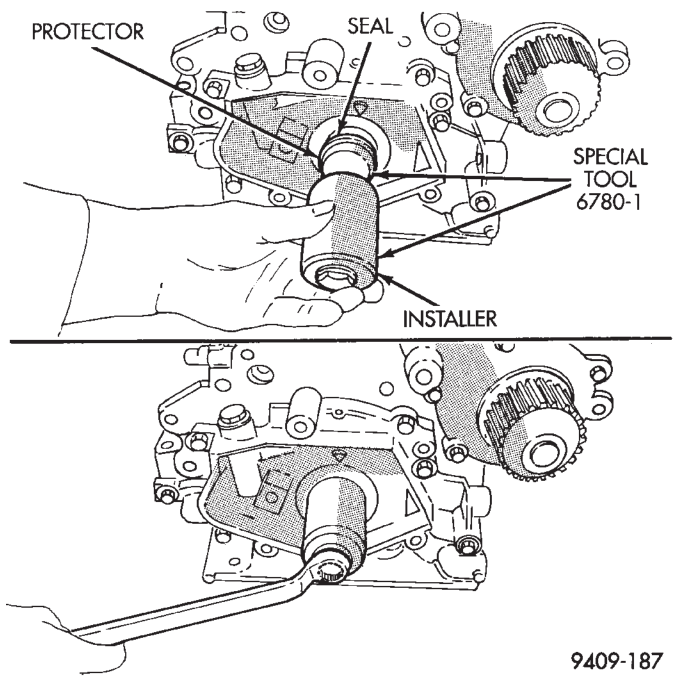


Fig. 73 Front Crankshaft Seal—Installation

b. Upper oil ring side rail.

c. Lower oil ring side rail.

d. No. 2 Intermediate piston ring.

REMOVAL AND INSTALLATION (Continued)

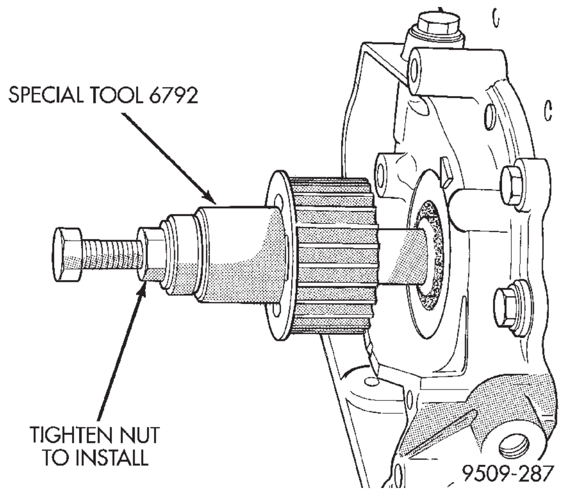


Fig. 74 Crankshaft Sprocket—Installation

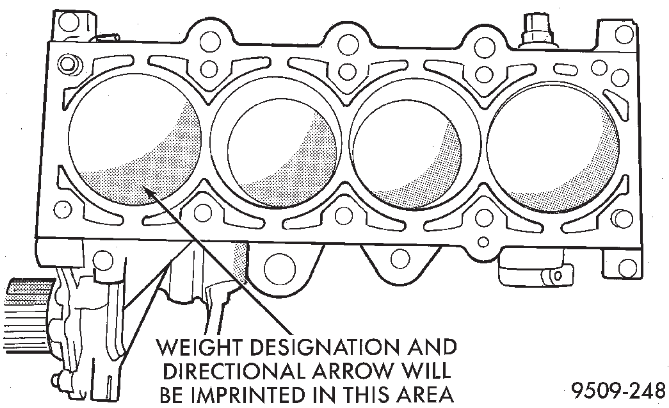


Fig. 75 Piston Markings

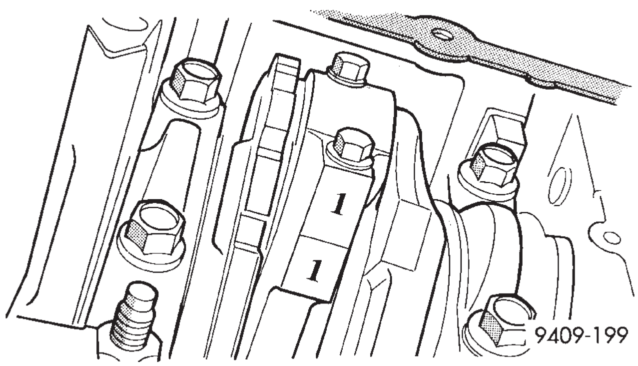


Fig. 76 Identify Connecting Rod to Cylinder

e. No. 1 Upper piston ring.

f. 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. 79).**

(2) Install upper side rail first and then the lower side rail.

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 78).

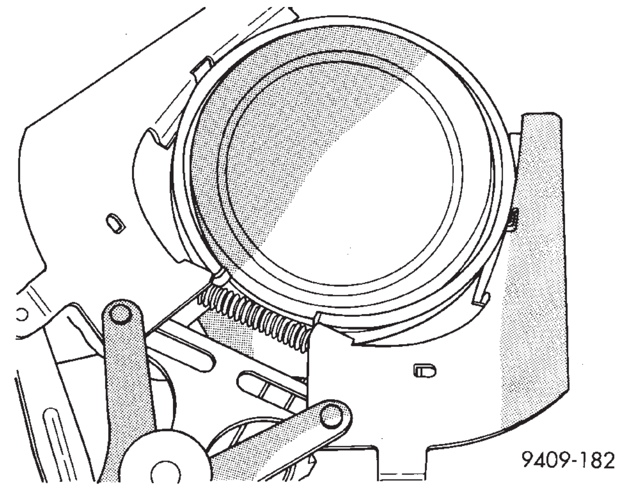


Fig. 77 Piston Rings—Removing and Installing

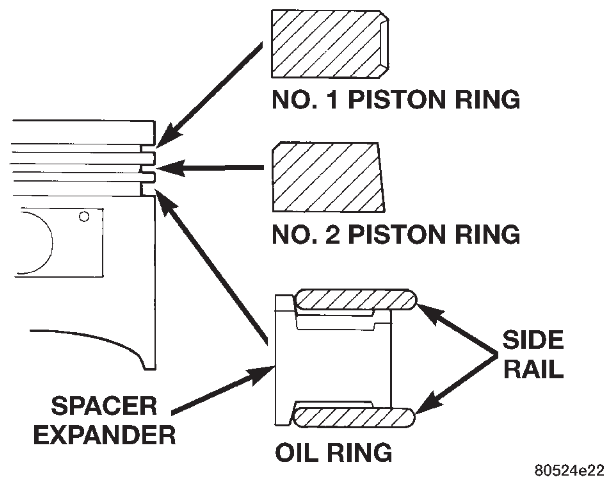


Fig. 78 Piston Ring Installation

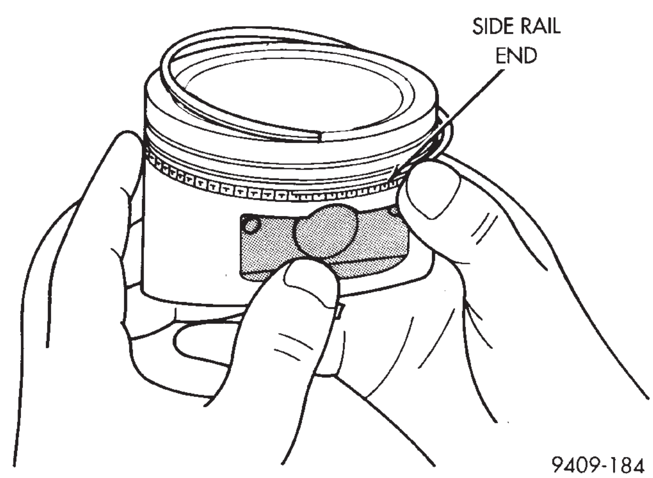


Fig. 79 Installing Side Rail

(4) Position piston ring end gaps as shown in (Fig. 80).

(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or

REMOVAL AND INSTALLATION (Continued)

on the thrust direction. Staggering ring gap is important for oil control.

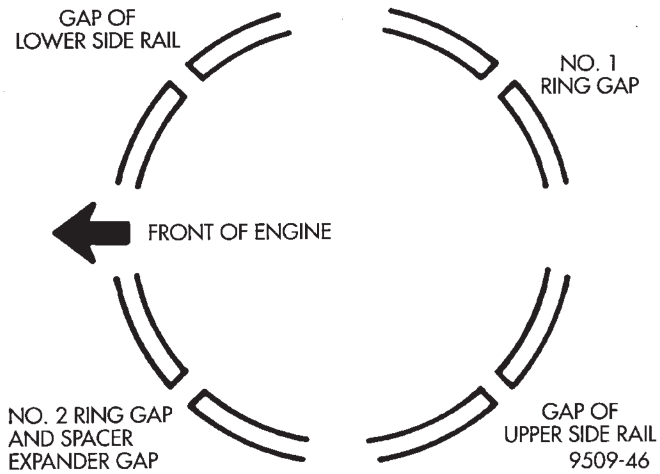


Fig. 80 Piston Ring End Gap Position

PISTON AND ROD —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. 80).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 81). **Be sure position of rings does not change during this operation**.

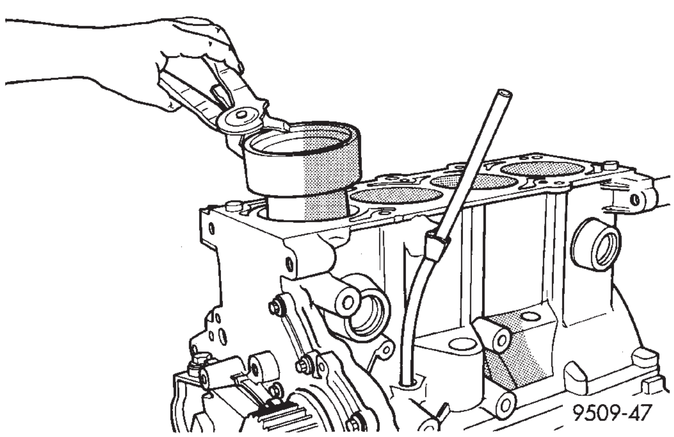


Fig. 81 Installing Piston

(4) The weight stamp designation L or H will be in the front half of the piston should face toward the front of the engine for SOHC engine. The arrow should face toward the front of the engine for DOHC engine (Fig. 75).

(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.

(7) Install rod caps. Install **New** bolts and tighten to 27 N·m (20 ft.lb.) Plus 1/4 turn.

VIBRATION DAMPER

NOTE: If a gap is found in the crankshaft damper, in the area where the Poly-V Generator belt rides this is normal and is acceptable (Fig. 82).

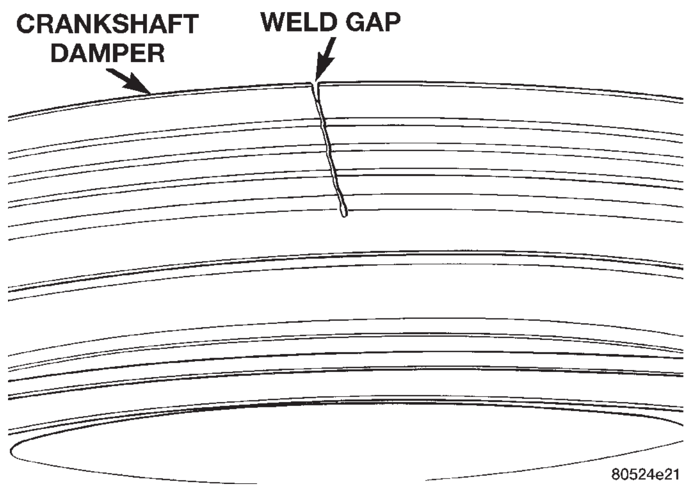


Fig. 82 Weld Gap

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827–A (Fig. 83).

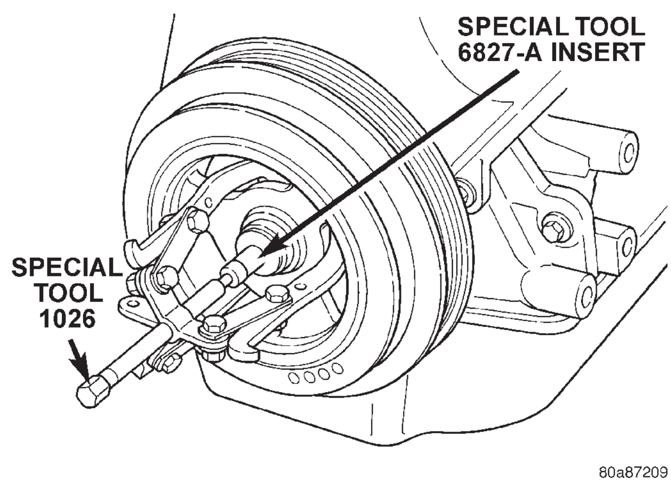


Fig. 83 Crankshaft Damper—Removal

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 84).

(2) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

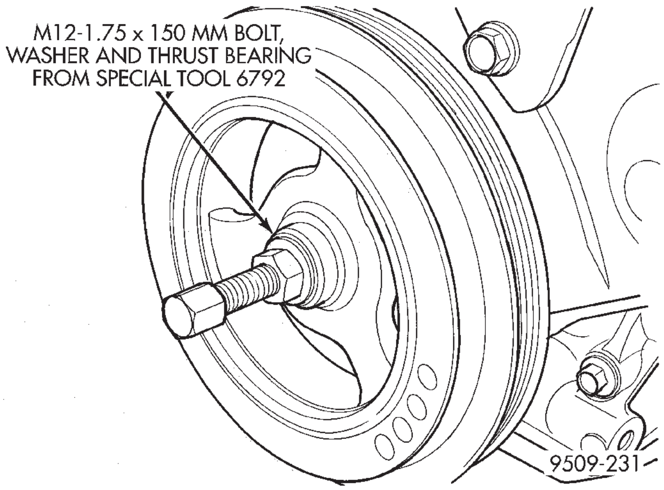


Fig. 84 Crankshaft Damper—Installation

DISASSEMBLY AND ASSEMBLY

OIL PUMP

(1) To remove the relief valve, proceed as follows:

(2) Remove the threaded plug and gasket from the oil pump (Fig. 85).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 85) or serious damage may occur.

(3) Remove spring and relief valve (Fig. 85).

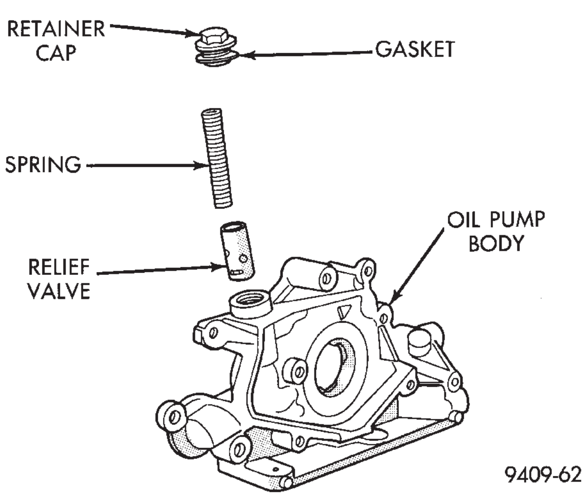


Fig. 85 Oil Pressure Relief Valve

(4) Remove oil pump cover screws, and lift off cover.

(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 86).

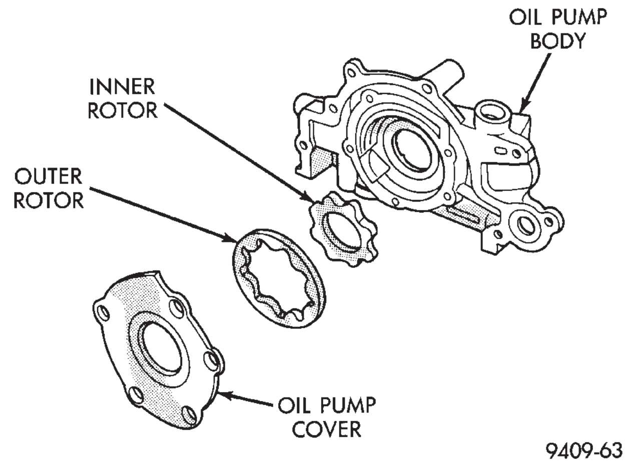


Fig. 86 Oil Pump

VALVE SERVICE WITH THE CYLINDER HEAD REMOVED

REMOVAL

(1) With cylinder head removed, compress valve springs using Special Tool C-3422-B or equivalent.

(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 to insure installation in original location.

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

(3) If valve stems are worn more than 0.05 mm (.002 in.), replace valve.

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 87). Refer to Valve Guide Specification Chart for specifications. Replace guides if they are not within specification.

(3) Check valve guide height (Fig. 88).

TESTING VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs

DISASSEMBLY AND ASSEMBLY (Continued)

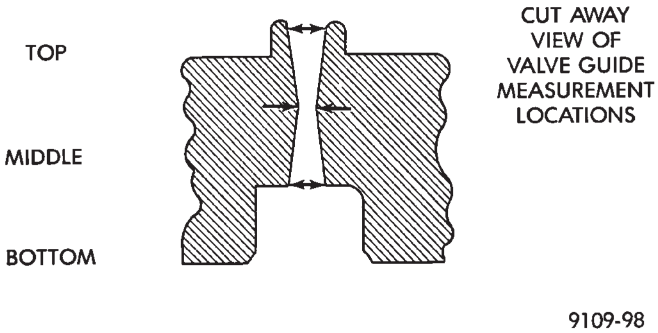


Fig. 87 Checking Wear on Valve Guide—Typical

VALVE GUIDE SPECIFICATION CHART

Valve Guide Diameter	Intake Valve	Exhaust Valve
	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	5.975 - 6.000 mm (0.2352 - 0.2362 in.)
	Valve Guide Clearance	
	Intake Valve	Exhaust Valve
New:	0.023 - 0.066 mm (0.001 - 0.0025 in.)	0.051 - 0.094 mm (0.002 - 0.0037 in.)
Service Limit:	0.25 mm (0.010 in.)	

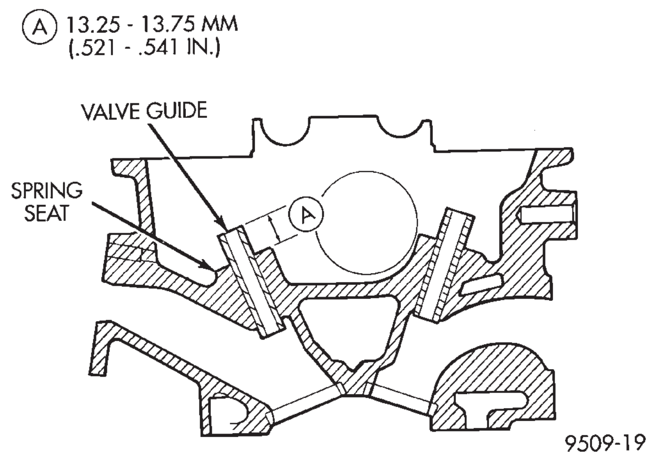


Fig. 88 Valve Guide Height

should be tested Special Tool C-647. As an example, the compression length of the spring to be tested is 33.34 mm (1-5/16 inches). Turn tool table until surface is in line with the 33.34 mm (1-5/16 inch) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device (Fig. 89). Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Discard the springs that do not meet specifications. The Following specifications apply to both intake and exhaust valve springs.

- Valve Closed Nominal Force— 67 lbs. @ 39.8 mm (1.57 in.)
- Valve Open Nominal Force— 160 lbs. @ 32.6 mm (1.28 in.)

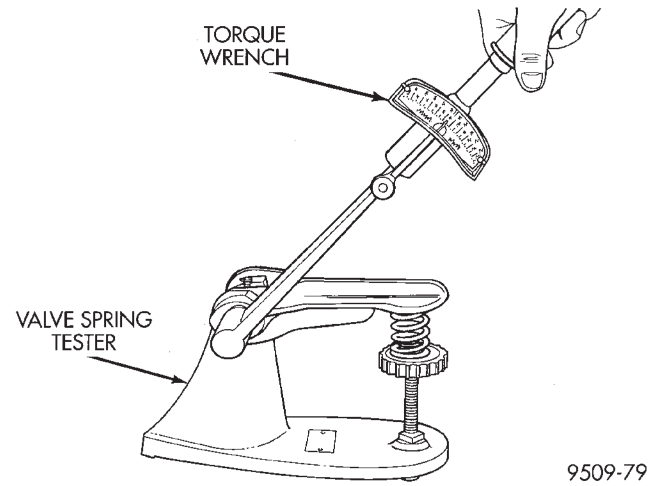


Fig. 89 Valve Spring Testing

(2) Verify springs are not distorted with a steel square and surface plate, check springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and valve face have a 45 degree angle.

(2) Inspect the remaining margin after the valves are refaced (Fig. 90). Intake valves with less than 0.95 mm (1/32 inch.) margin and Exhaust valves with less than 1.05 mm (3/64 inch) margin should be discarded.

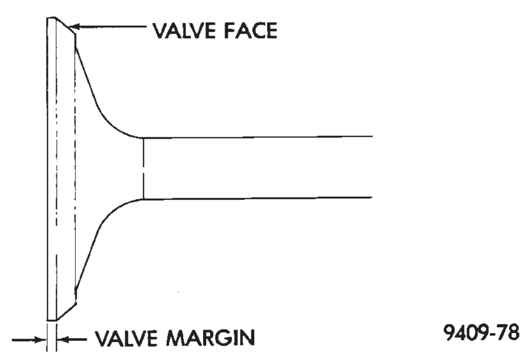


Fig. 90 Intake and Exhaust Valve Refacing

(3) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained. For valve specifications see Valve Specification Chart.

(4) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator.

DISASSEMBLY AND ASSEMBLY (Continued)

VALVE SPECIFICATION CHART

Face Angle	
Intake and Exhaust:	45 - 45 1/2°
Head Diameter	
Intake:	33.12 - 33.37 mm (1.303 - 1.313 in.)
Exhaust:	28.57 - 28.83 mm (1.124 - 1.135 in.)
Length (Overall)	
Intake:	114.69 - 115.19 mm (4.515 - 4.535 in.)
Exhaust:	116.94 - 117.44 mm (4.603 - 4.623 in.)
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	
Intake:	1.15 - 1.48 mm (0.0452 - 0.0582 in.)
Exhaust:	1.475 - 1.805 mm (0.0580 - 0.0710 in.)

Total runout should not exceed. 0.051 mm (0.002 inch.) (total indicator reading).

(5) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

- Intake valve seat diameter is 33 mm (1.299 in.)
- Exhaust valve seat diameter is 28 mm (1.102 in.)

(6) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. The intake valve seat must be serviced when the valve seat width is 2.0 mm (0.079 in.) or greater. The exhaust valve seat must be serviced when the valve seat width is 2.5 mm (0.098 in.) or greater. Otherwise the cylinder head must be replaced.

(7) When seat is properly positioned the width of intake and exhaust seats should be 0.75 to 1.25 mm (0.030 to 0.049 in.) (Fig. 91).

(8) Check valve tip to spring seat dimensions A after grinding the valve seats or faces. Grind valve tip to 43.51 - 44.57 mm (1.71 - 1.75 in.) for exhaust valve and 45.01 - 46.07 mm (1.77 - 1.81 in.) for intake valve over spring seat when installed in the head (Fig. 92). The valve tip chamfer may need to be reground to prevent seal damage when the valve is installed.

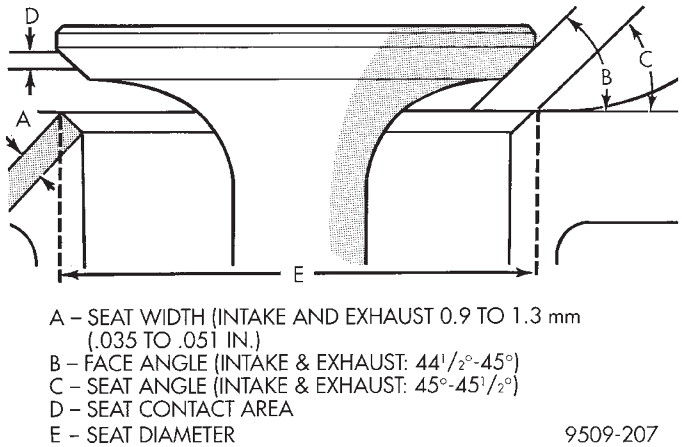


Fig. 91 Valve Seat Refacing

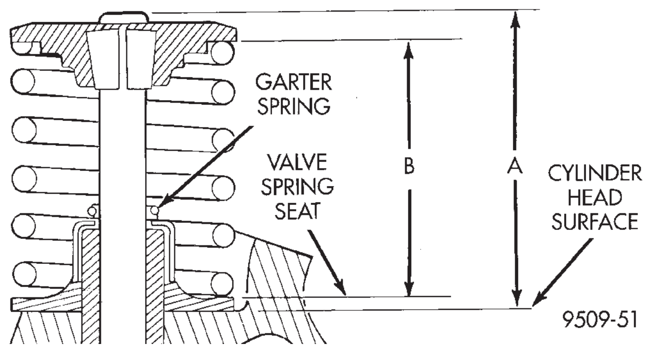


Fig. 92 Spring Installed Height and Valve Tip to Spring Seat Dimensions

CLEANING

Clean all valve guides, valves and valve spring assemblies thoroughly with suitable cleaning solution before reassembling.

VALVE INSTALLATION

(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. 93). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: If oversize valves are used, there is only one oversize valve available. The same stem seal is used on both the standard and oversize valve.

(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.

DISASSEMBLY AND ASSEMBLY (Continued)

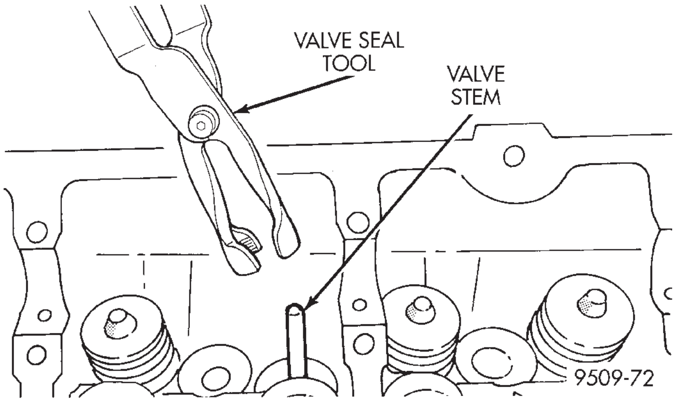


Fig. 93 Valve Stem Oil Seal Tool

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 92). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 40.18 mm (1.58 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

(5) Install rocker arm shafts as previously described in this section.

(6) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.17 mm (0.046 in.) for intake and 1.28 mm (0.050 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster/s to bleed down before rotating cam.

CLEANING AND INSPECTION

CYLINDER HEAD AND CAMSHAFT JOURNALS

INSPECTING CYLINDER HEAD

Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 94).

Inspect cylinder head camshaft bearings for wear.

Check camshaft journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage.

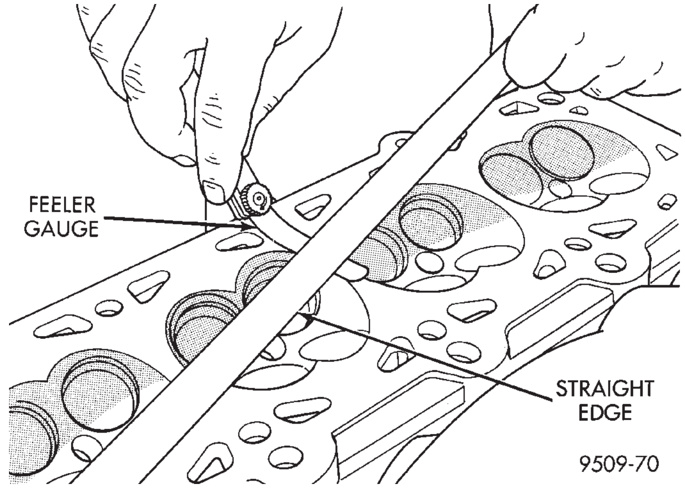


Fig. 94 Checking Cylinder Head Flatness

Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CLEANING

Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

OIL PUMP

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 95). If a 0.076 mm (0.003 inch.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

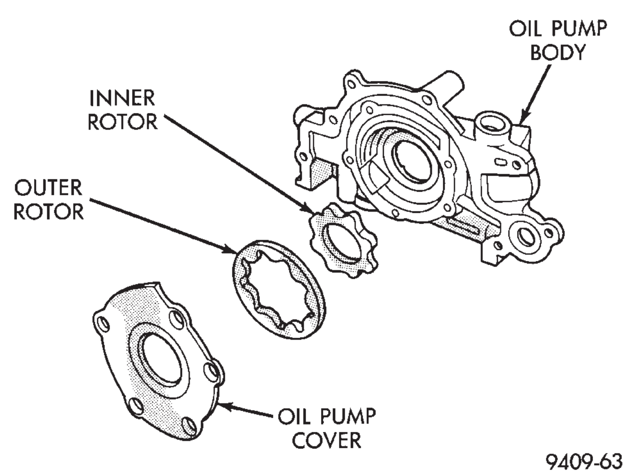


Fig. 95 Checking Oil Pump Cover Flatness

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 inch.) or less (Fig. 96), or if the diameter is 79.95 mm (3.148 inches) or less, replace outer rotor.

CLEANING AND INSPECTION (Continued)

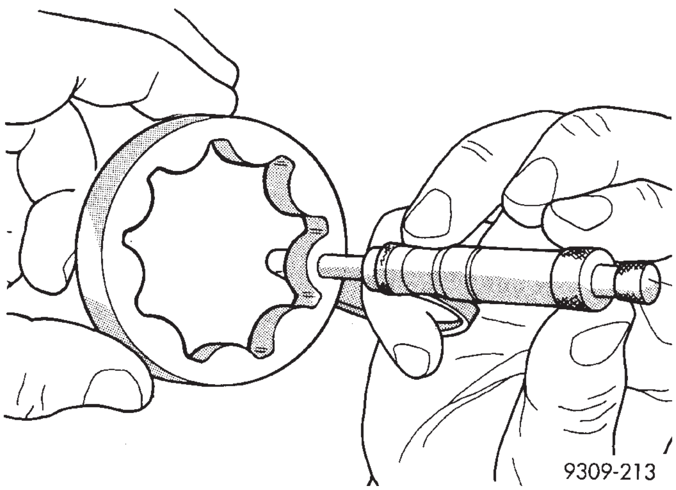


Fig. 96 Measuring Outer Rotor Thickness

(4) If inner rotor measures 7.64 mm (.301 inch) or less replace inner rotor (Fig. 97).

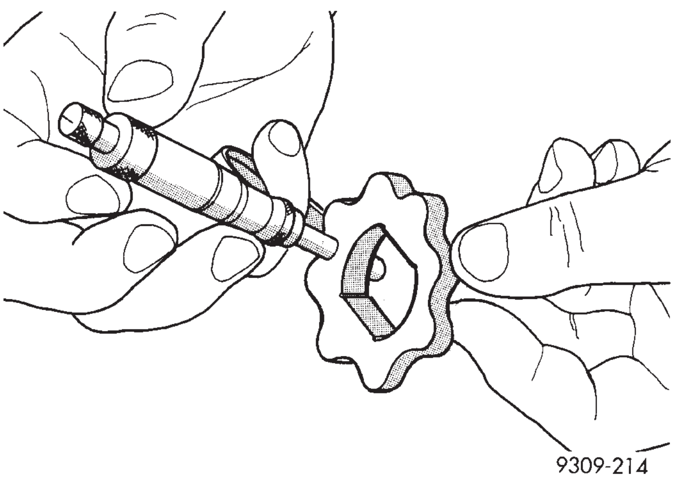


Fig. 97 Measuring Inner Rotor Thickness

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 98). If measurement is 0.39 mm (0.015 inch.) or more, replace housing only if outer rotor is in specification.

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 99) is .203 mm (.008 inch) or more, replace both rotors.

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of .102 mm (.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 100). **ONLY** if rotors are in specs.

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

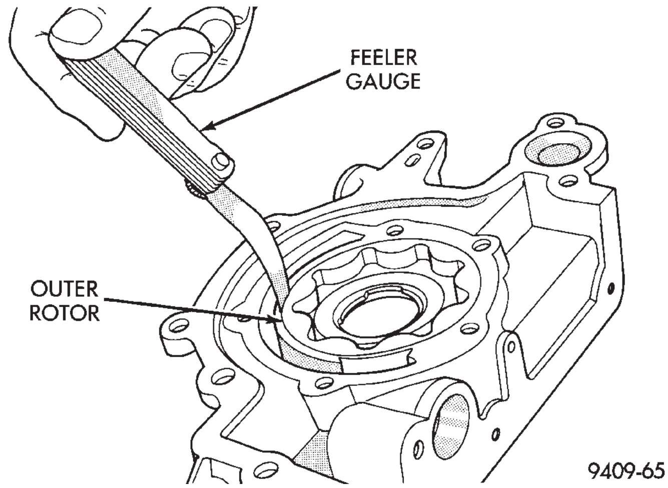


Fig. 98 Measuring Outer Rotor Clearance in Housing

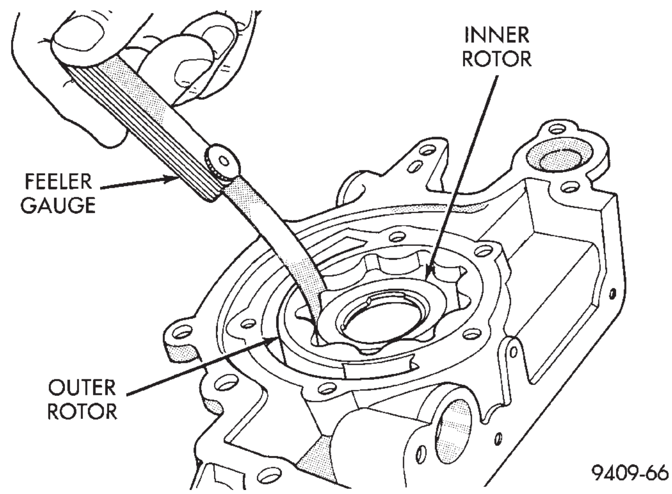


Fig. 99 Measuring Clearance Between Rotors

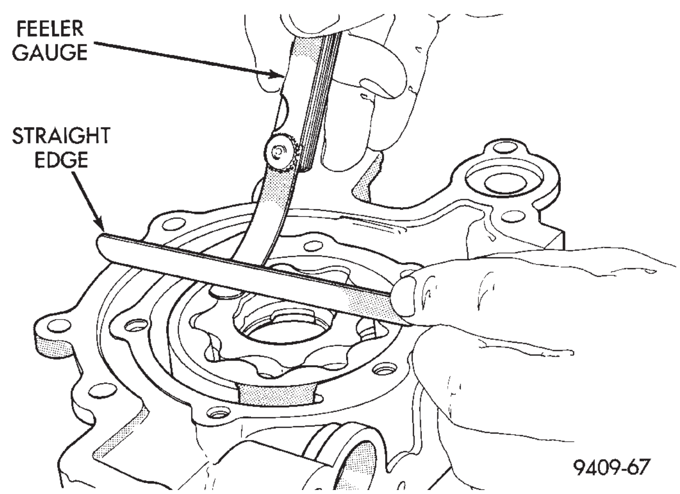


Fig. 100 Measuring Clearance Over Rotors

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings, damaged or missing oil pick-up tube o-ring, clogged oil pick-up tube screen, clogged oil filter and stuck open pressure relief valve or other reasons for oil pressure loss.

CLEANING AND INSPECTION (Continued)

CYLINDER BLOCK AND BORE

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, Refer to Engine Core Plugs outlined in this section.

(3) Examine block and cylinder bores for cracks or fractures.

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 101). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 101). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Cylinder Bore and Piston Specification Chart for specifications.

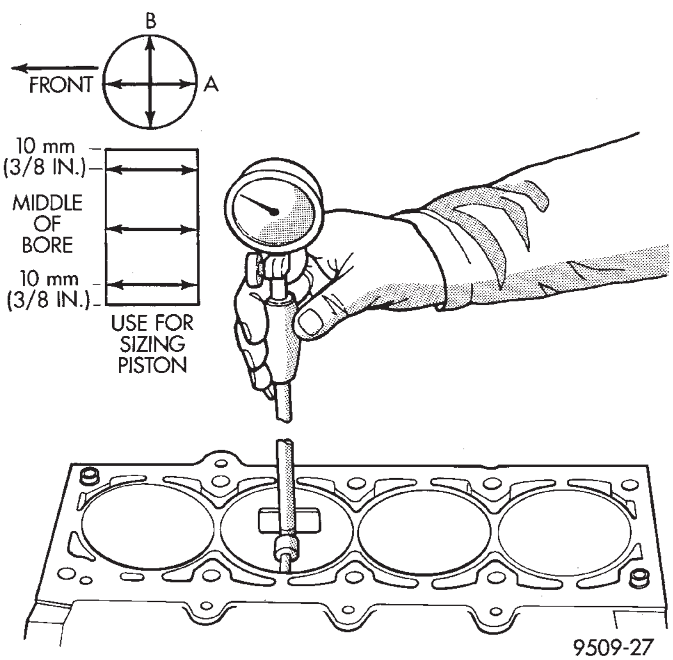


Fig. 101 Checking Cylinder Bore Size

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Max. Out-of-Round	Max. Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size 87.463 - 87.481 mm (3.4434 - 3.4441 in.)		
Piston to Bore Clearance 0.012 - 0.044 mm (0.0005 - 0.0017 in.) Measurements taken at Piston Size Location.		

SPECIFICATIONS

ENGINE 2.0L SOHC

Cylinder Block

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 (Federal Emission)

Clearance 17.5 mm (11/16 in.) from bottom of skirt . . . . . 0.012 - 0.044 mm (0.0004 - 0.0017 in.)

Weight . . . . 325 - 335 grams (11.47 - 11.82 oz.)

Land Clearance (Diametrical) . . 0.734 - 0.797 mm (0.029 - 0.031 in.)

Piston Length . . . . 64 mm (2.520 in.)

Piston Ring Groove Depth No. 1 . . . . 3.989 - 4.188 mm (0.157 - 0.165 in.)

Piston Ring Groove Depth No. 2 . . . . 4.462 - 4.661 mm (0.176 - 0.184 in.)

Piston Ring Groove Depth No. 3 . . . . 3.847 - 4.131 mm (0.151 - 0.163 in.)

Pistons (Low Emission Vehicle—LEV)

Clearance 10.42 mm (0.42 in.) from bottom of skirt . . . . . 0.018 – 0.50 mm (0.0008 – 0.0020 in.)

Weight . . . . . . 320 – 329 grams (11.29 – 11.60 oz.)

Land Clearance (Diametrical) . . 0.758 – 0.790 mm (0.0299 – 0.0312 in.)

Piston Length . . . . 55.8 mm (2.197 in.)

Piston Ring Groove Depth No. 1 . . . . 3.989 - 4.188 mm (0.157 - 0.165 in.)

Piston Ring Groove Depth No. 2 . . . . 4.462 - 4.661 mm (0.176 - 0.184 in.)

Piston Ring Groove Depth No. 3 . . . . 3.847 - 4.131 mm (0.151 - 0.163 in.)

Piston Pins

Clearance in Piston . . . . 0.008 - 0.020 mm (0.0003 - 0.0008 in.)

In Rod (Interference) . . . . 0.018 - 0.043 mm (0.0007 - 0.0017 in.)

SPECIFICATIONS (Continued)

Cylinder Block
Diameter . . . . 20.998 - 21.003 mm (0.8267 - 0.8269 in.)
End Play . . . . None
Length . . . . . 74.75 - 75.25 mm (2.943 - 2.963 in.)

Piston Rings
Ring Gap Top Compression Ring . . 0.23 - 0.52 mm (0.009 - 0.020 in.)
Ring Gap 2nd Compression Ring . . 0.49 - 0.78 mm (0.019 - 0.031 in.)
Ring Gap Oil Control (Steel Rails) . . . 0.23 - 0.66 mm (0.009 - 0.026 in.)
Ring Side Clearance Both Compression Rings . . . . 0.025 - 0.065 mm (0.0010 - 0.0026 in.)
Oil Ring (Pack) . . . . 0.004 - 0.178 mm (0.0002 - 0.0070 in.)
Ring Width Compression Rings . . . 1.17 - 1.19 mm (0.046 - 0.047 in.)
Oil Ring (Pack) . . . . 2.854 - 3.008 mm (0.1124 - 0.1184 in.)

Connecting Rod
Bearing Clearance . . . . 0.026 - 0.059 mm (0.001 - 0.0023 in.)
Piston Pin Bore Diameter . . . . . 20.96 - 20.98 mm (0.8252 - 0.8260 in.)
Large End Bore Diameter . . . 50.991 - 51.005 mm (2.0075 - 2.0081 in.)
Side Clearance . 0.13 - 0.38 mm (0.005 - 0.015 in.)
Total Weight (Less Bearing) . 543 grams (1.20 lbs.)

Crankshaft
Connecting Rod Journal Diameter . . 47.9924 - 48.0076 mm (1.8894 - 1.8900 in.)
Out-of-Round (Max.) . . . . . 0.0035 mm (0.0001 in.)
Taper (Max.) . . . . 0.0038 mm (0.0001 in.)
Main Bearing Diametrical Clearance No. 1 - 5 . . 0.022 - 0.062 mm (0.0008 - 0.0024 in.)
End Play . . . . 0.09 - 0.24 mm (0.0035 - 0.0094 in.)

Main Bearing Journals
Diameter . . . . 51.9924 - 52.0076 mm (2.0469 - 2.0475 in.)
Out-of-Round (Max.) . . . . . 0.0035 mm (0.0001 in.)
Taper (Max.) . . . . 0.0038 mm (0.0001 in.)

ENGINE 2.0L SOHC

Rocker Arm Shaft
Rocker Arm Shaft Diameter . . 19.996 – 19.984mm (0.786 – 0.7867 in.)

Rocker Arm Shaft Retainers (Width)
Intake (All) . . . . 28.46 mm (1.12 in.)
Exhaust . . . . 1 & 5 29.20 mm (1.14in.)
2, 3, and 4 - 40.45 mm (1.59 in.)

Rocker Arm/Hydraulic Lash Adjuster *
Rocker Arm Inside Diameter . . 20.00 – 20.02 mm (0.787 – 0.788 in.)
Rocker Arm Shaft Clearance . . . 0.016 – 0.054 mm (0.0006 – 0.0021 in.)
Body Diameter . . . . 22.949 – 22.962 mm (0.9035 – 0.9040 in.)
Plunger Travel Minimum (Dry) . . . . 2.2 mm (0.087 in.)
Rocker Arm Ratio . . . . 1.4 to 1

Cylinder Head Camshaft Bearing Diameter
No. 1 . . . . 41.20 – 41.221 mm (1.622 – 1.6228 in.)
No. 2 . . . . . . 41.6 – 41.621 mm (1.637 – 1.638 in.)
No. 3 . . . . . . 42.0 – 42.021 mm (1.653 – 1.654 in.)
No. 4 . . . . . . 42.4 – 42.421 mm (1.669 – 1.670 in.)
No. 5 . . . . . 42.8 – 42.821 mm (1.685 – 1.6858 in.)

Camshaft Journal Diameter
No. 1 . . . 41.128 – 41.147 mm (1.619 – 1.6199 in.)
No. 2 . . . . 41.528 – 41.547 mm (1.634 – 1.635 in.)
No. 3 . . . . 41.928 – 41.947 mm (1.650 – 1.651 in.)
No. 4 . . . . 42.328 – 42.374 mm (1.666 – 1.668 in.)
No. 5 . . . 42.728 – 42.747 mm (1.682 – 1.6829 in.)
Diametrical Bearing Clearance . 0.053 – 0.093 mm (0.0027 – 0.003 in.)
Max. Allowable . . . . 0.12 mm (0.0047 in.)
End Play . . . . 0.05 – 0.39 mm (0.0059 in.)

Lift (Zero Lash)
Intake . . . . 7.2 mm (0.283 in.)
Exhaust . . . . 7.03 mm (0.277 in.)

Valve Timing Exhaust Valve**
Closes (ATDC) . . . . 5.4°
Opens (BBDC) . . . . 43.7°
Duration . . . . 229.1°

Valve Timing Intake Valve **
Closes (ABDC) . . . . 41.1°
Opens (ATDC) . . . . 13.9°
Duration . . . . 207.2°
Valve Overlap . . . . 0°

Cylinder Head
Material . . . . Cast Aluminum
Gasket Thickness (Compressed) . . . . 1.15 mm (0.045 in.)

Valve Seat
Angle . . . . 45°
Runout (Max.) . . . . 0.050 mm (0.002)
Width (Finish) Intake and Exhaust . . . . . 0.75 – 1.25 mm (0.030 – 0.049 in.)

Valve Guide Finished
Diameter I.D. . 5.975 – 6.000 mm (.235 – .236 in.)
Guide Bore Diameter (Std.) . . . . . 11.0 – 11.02 mm (0.4330 – 0.4338 in.)

Valves
Face Angle Intake and Exhaust . . . . . 45 – 45-1/2°
Head Diameter Intake . . . . 32.12 – 33.37 mm (1.303 – 1.313 in.)
Head Diameter Exhaust . . . . . . 28.57 – 28.83 mm (1.124 – 1.135 in.)

SPECIFICATIONS (Continued)

Valve Margin
Intake . . . . . 1.15 – 1.48 mm (0.0452 – 0.0582 in.)
Exhaust . . . . 1.475 – 1.805 mm (0.058 – 0.071 in.)
Valve Length (Overall)
Intake . . . . 114.69 – 115.19 mm (4.515 – 4.535 in.)
Exhaust . . 109.59 – 110.09 mm (4.603 – 4.623 in.)
Valve Stem Tip Height
Intake . . . . 45.01 – 46.07 mm (1.77 – 1.81 in.)
Exhaust . . . . . . 43.51 – 44.57 mm (1.71 – 1.75 in.)
Stem Diameter
Intake . . . . . 5.934 – 5.952 mm (0.234 – 0.234 in.)
Exhaust . . . . 5.906 – 5.924 mm (0.233 – 0.233 in.)
Stem to Guide Clearance
Intake . . . 0.048 – 0.066 mm (0.0018 – 0.0025 in.)
Exhaust . 0.0736 – 0.094 mm (0.0029 – 0.0037 in.)
Max. Allowable Intake . . . . . 0.076 mm (0.003 in.)
Max. Allowable Exhaust . . . . 0.101 mm (0.004 in.)
Valve Springs
Free Length (Approx.) . . . . . . 44.4 mm (1.747 in.)
Nominal Force (Valve closed) . 91 N·m @ 39.8 mm (67 ft. lbs. @ 1.57 in.)
Nominal Force (Valve open) . 239 N·m @ 32.6 mm (176 lbs. @ 1.28 in.)
Installed Height . . . . 40.18 mm (1.580 in.)

* SERVICE AS AN ASSEMBLY WITH ROCKER ARM.

** ALL READINGS IN CRANKSHAFT DEGREES, AT 0.5 mm (0.019 in.) OF VALVE LIFT.

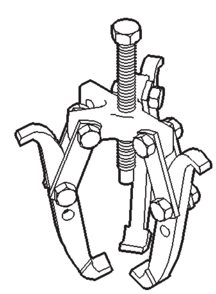
TORQUE CHART 2.0L SOHC

DESCRIPTION . . . . TORQUE
Camshaft Sensor Pick Up
Bolts . . . . 9.6 N·m (85 in. lbs.)
Camshaft Sprocket
Bolt . . . . 115 N·m (85 ft. lbs.)
Connecting Rod Cap
Bolts . . . . 27 N·m (20 ft. lbs.) Plus 1/4 Turn
Collar—Oil Pan to Transaxle
Step 1: Collar to Oil Pan Bolts . 3 N·m (30 in. lbs.)
Step 2: Collar to Transaxle
Bolts . . . . 108 N·m (80 ft. lbs.)
Step 3: Collar to Oil Pan
Bolts . . . . 54 N·m (40 ft. lbs.)
Crankshaft Main Bearing Cap/Bedplate
M8 Bedplate Bolts . . . . 30 N·m (22 ft. lbs.)
M11 Main Cap Bolts . . . . 81 N·m (60 ft. lbs.)
Crankshaft Damper
Bolt . . . . 142 N·m (105 ft. lbs.)
Cylinder Head
Bolts . . . . Refer To Cylinder Head Installation
Cylinder Head Cover
Bolts . . . . 12 N·m (105 in. lbs.)
Engine Mount Bracket—Right
Bolts . . . . 61 N·m (45 ft. lbs.)

DESCRIPTION . . . . TORQUE
Engine Mounting
Bolts . . . . Refer to Engine Mount Installation
Exhaust Manifold to Cylinder Head
Bolts . . . . 23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield
Bolts . . . . 12 N·m (105 in. lbs.)
Intake Manifold
Bolts . . . . 12 N·m (105 in. lbs.)
Oil Filter Adapter
Fastener . . . . 80 N·m (60 ft. lbs.)
Oil Filter . . . . 20 N·m (15 ft. lbs.)
Oil Pan
Bolts . . . . 12 N·m (105 in. lbs.)
Drain Plug . . . . 27 N·m (20 ft. lbs.)
Oil Pump Attaching
Bolts . . . . 28 N·m (250 in. lbs.)
Oil Pump Cover Fastener . . . 12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Bolt . 28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap . . . 41 N·m (30 ft. lbs.)
Rocker Arm Shaft
Bolts . . . . 28 N·m (250 in. lbs.)
Spark Plugs . . . . 28 N·m (20 ft. lbs.)
Thermostat Housing
Bolts . . . . 23 N·m (200 in lbs.)
Timing Belt Cover
Bolts M6 . . . . 12 N·m (105 in. lbs.)
Timing Belt Mechanical Tensioner Assembly
Bolts . . . . 28 N·m (250 in. lbs.)
Timing Belt Hydraulic Tensioner
Pulley Bolt . . . . 68 N·m (50 ft. lbs.)
Pivot Bracket Bolt . . . . 31 N·m (23 ft. lbs.)
Tensioner Bolts . . . . 31 N·m (23 ft. lbs.)
Water Pump Mounting
Bolts . . . . 12 N·m (105 in. lbs.)

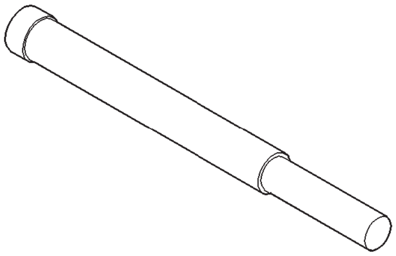
SPECIAL TOOLS

ENGINE 2.0L SOHC

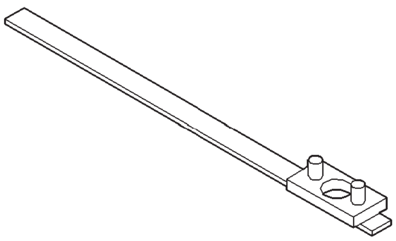


Puller 1026

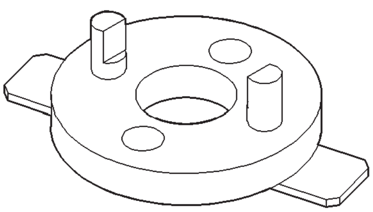
SPECIAL TOOLS (Continued)



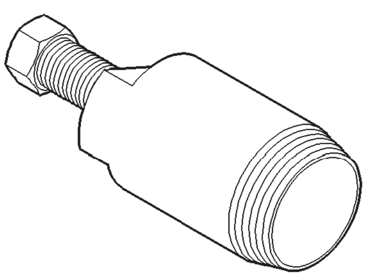
Crankshaft Damper Removal Insert 6827-A



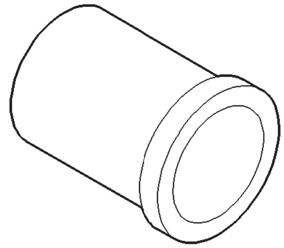
Camshaft Sprocket Remover/Installer C-4687



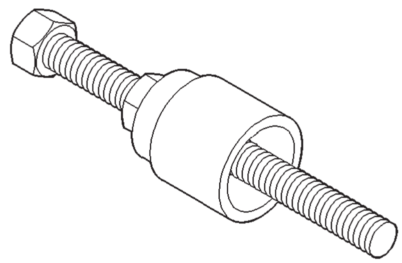
Camshaft Sprocket Remover/Installer Adapter C-4687-1



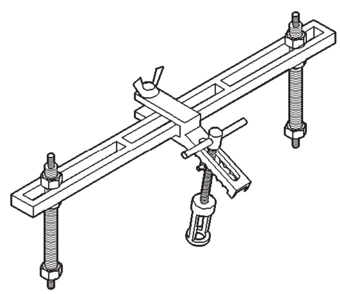
Camshaft Seal Remover C-4679-A



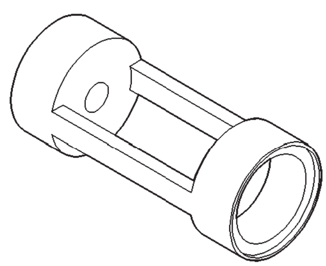
Camshaft Seal Installer MD-998306



Crankshaft Damper Installer 6792

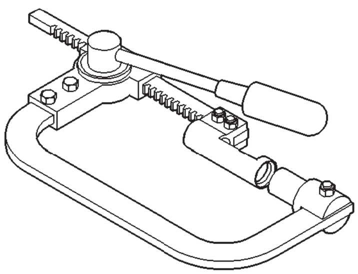


Valve Spring Compressor MD-998772-A

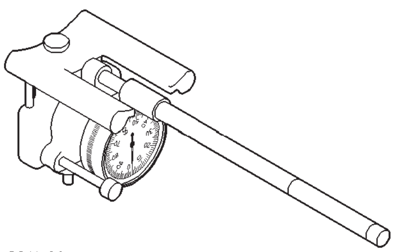


Spring Compressor Adapter 6779

SPECIAL TOOLS (Continued)

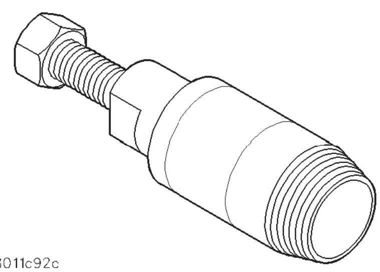


Valve Spring Compressor C-3422-B



8011c9fa

Cylinder Bore Indicator C-119



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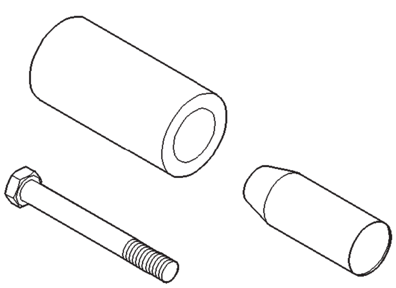
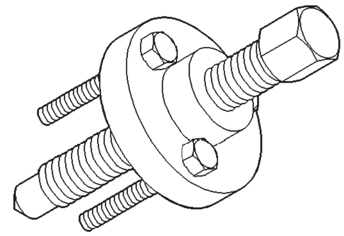
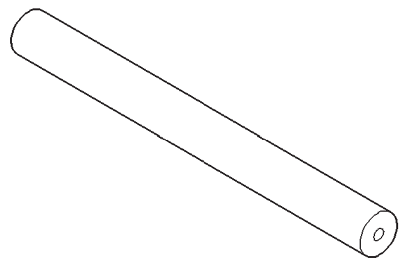
Front Crankshaft Seal Remover 6771



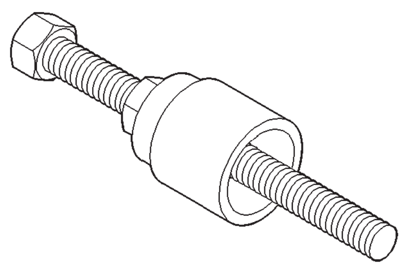
Front Crankshaft Seal Installer 6780



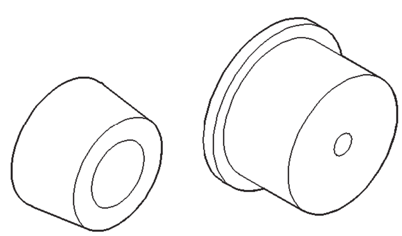
Crankshaft Sprocket Remover 6793



Crankshaft Sprocket Remover Insert C-4685-C2

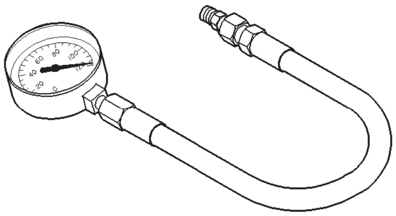


Crankshaft Sprocket Installer 6792

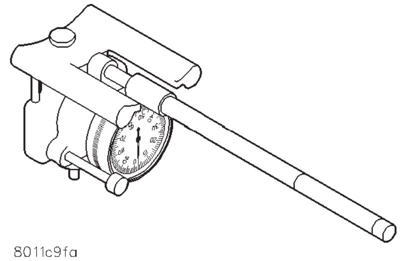


Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2

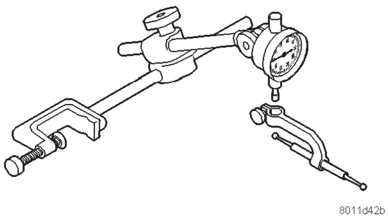
SPECIAL TOOLS (Continued)



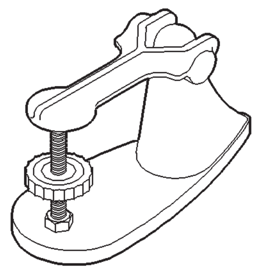
Pressure Gage C-3292



Indicator Bore Size C-119



Dial Indicator C-3339



Valve Spring Tester C-647

2.5L VM DIESEL

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GENERAL INFORMATION

GENERAL SPECIFICATION

Type 425CLIEE (36B)
Displacement . . . . 2.5L (2499 cc)
Bore . . . . 92.00 mm
Stroke . . . . 94.00 mm
Compression Ratio 20.95:1
Vacuum at Idle . . . . 600 mm/Hg (23.6 In/Hg)
Thermostat Opening . . . . 80°C±2°C
Generator Rating . . . . Bosch 50/120 Amp
Cooling System Capacity . . . . 9.5 Liter
Power Steering Capacity . . . . 0.75 Liter
Type 425CLIEE (36B)
Engine Oil Capacity . . . . . 6.5 Liters With Oil Filter Change
Timing System . Pushrod Operated Overhead valves, With Gear-Driven Camshaft.
Air Intake . . . . Dry Filter
Fuel Feed . . . . Vacuum Pump Incorporated in Injection Pump.
Fuel System . . . . Indirect Fuel Injection (Precombustion Chamber)
Combustion Cycle . . . . 4 Stroke
Cooling System . . . . Water Cooled
Injection Pump . . . . Rotary Pump Electronically Controlled.

GENERAL INFORMATION (Continued)

Type 425CLIEE (36B)
Lubrication . Pressure Lubrication by Rotary Pump, Full-Flow Filtration
Engine Rotation . . . . Clockwise Viewed From Front Cover

ENGINE IDENTIFICATION

The engine model code (3-digit number/letter code) and serial number are stamped on the forward facing side of the engine block (Fig. 1).

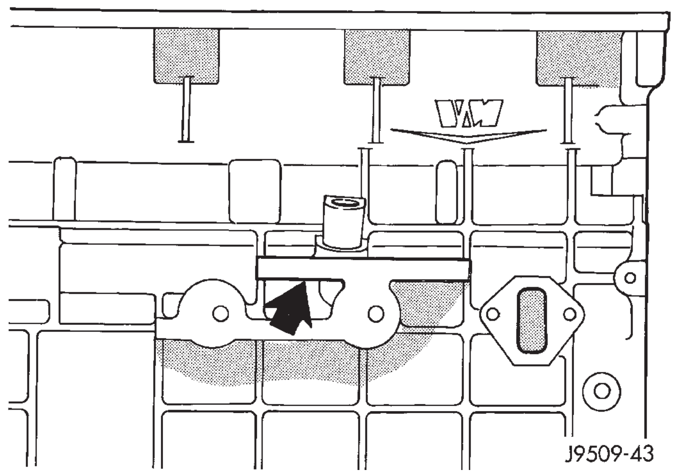

Fig. 1 Engine Code Location

DESCRIPTION AND OPERATION

LUBRICATION SYSTEM

The pressurized system (Fig. 2) uses a rotary pump (3) located in the front of the engine block, driven by a gear which meshes directly with the crankshaft gear. All the oil sent to every lubricated part is filtered. The pump sends the oil through a pressure relief valve (2) to the filter (7) and through galleries in the crankcase to the crankshaft bearings (8), camshaft bearings (11) and turbocharger (10). The piston pins, connecting rod small ends and insides of the pistons are lubricated and cooled by oil sprayed out from jets (9) in the crankshaft mounting blocks. The lubricating oil is sent to the rockers (12) through an external pipe (Fig. 3). A valve in the filter cartridge enables the oil to be circulated even when the cartridge is clogged.

Sump inlet (1). Pressure relief valve (2). Oil pump (3). Oil cooler (6). Filter cartridge (7). Crankshaft bearings (8). Jet valve (9). Turbocharger bearings (10). Camshaft bearings (11). Rockers (12).

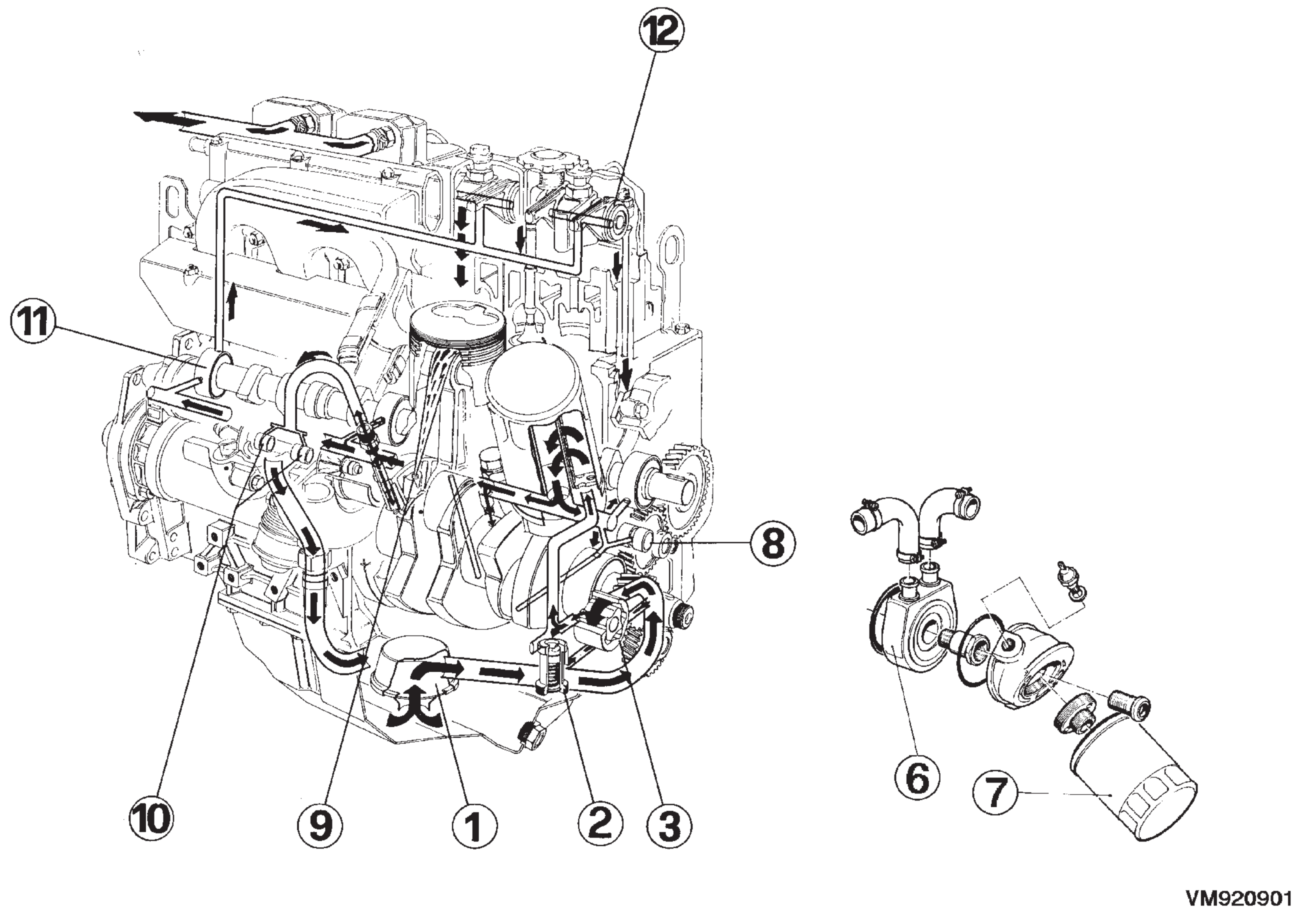

Fig. 2 Lubrication System

DESCRIPTION AND OPERATION (Continued)

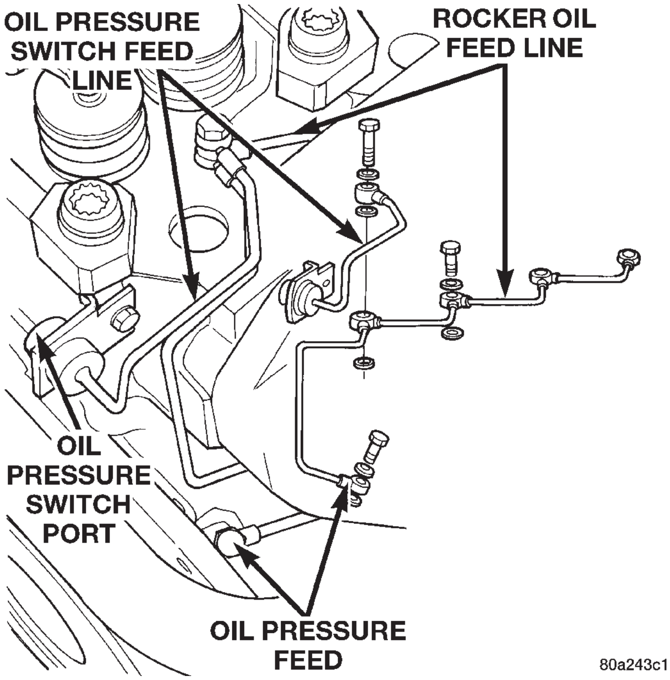

Fig. 3 Lubrication Lines

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK OR CRANKS SLOWLY	1. Starting motor operating, but not cranking the engine.	1. Remove the starter motor. Check for broken flywheel teeth or a broken starter motor spring.
	2. Crankshaft rotation restricted.	2. Rotate the engine to check for rotational resistance.
	3. Starting circuit connections loose or corroded.	3. Clean and tighten connections.
	4. Neutral safety or starter relay inoperative.	4. Check starter relay supply voltage and proper operation of neutral safety switch (if equipped). Replace defective parts.
	5. Battery charge low.	5. Check Battery voltage. Replace battery if a charge cannot be held.
	6. No voltage to starter solenoid.	6. Check voltage to solenoid. If necessary, replace the solenoid.
	7. Solenoid or starter motor inoperative.	7. Replace starter motor.
ENGINE CRANKS, BUT WILL NOT START, NO SMOKE	1. No fuel in supply tank.	1. Fill fuel supply.
	2. Electrical fuel shutdown solenoid not operating.	2. Check for loose wires and verify that the fuel shutdown solenoid is functioning. Check for fault codes in the ECU.
	3. Fuel injection system defective: Cranking speed sensor. Loose connection between ECU and harness. No power supply to the ECU. Loose connection between injection pump and harness.	3. Check for fault codes at ECU. Refer to Group 14, Fuel System for repairs procedures.
	4. Air intake or exhaust plugged.	4. Remove the obstruction.
	5. Fuel filter plugged.	5. Drain fuel/water separator and replace fuel filter.
	6. Excessive fuel inlet restriction.	6. Check for restriction. Correct cause.
	7. Injection pump not getting fuel or fuel is aerated.	7. Check fuel flow/bleed fuel system.
	8. One or more injectors worn or not operating properly.	8. Check/replace bad or improperly operating injectors.
	9. Camshaft out of time.	9. Check/correct timing chain sprocket alignment.
ENGINE HARD TO START, OR WILL NOT START, SMOKE FROM EXHAUST	1. Incorrect starting procedure.	1. The fuel shutoff solenoid control must be in the run position. Ensure the proper procedure is being used.
	2. Cranking speed to slow.	2. Check the battery, starter motor and look for loose or corroded wiring connections.
	3. Cylinder head heater plugs defective.	3. Verify system is working. Verify connection between heater plug relay and ECU. Repair/replace inoperative parts.
	4. Insufficient intake air	4. Inspect or replace air filter and check for obstruction in air supply.
	5. Air in fuel system or the fuel supply is inadequate.	5. Check the fuel flow through the filter and bleed system. Locate and eliminate the air source.
	6. Contaminated fuel.	6. Verify by operating the engine with clean fuel from a temporary tank. Check for the presence of gasoline. Drain and flush fuel supply tank. Replace fuel/water separator filter.
	7. Fuel screen plugged.	7. Check fuel screen.
	8. One or more injectors worn or not operating properly.	8. Check/replace improperly operating injectors.
	9. Injector pump out of time.	9. Check pump timing. Refer to Group 14, Fuel System for procedure.
	10. Engine compression low.	10. Check compression to identify the problem.
	11. Fuel injection system defective.	11. Vacuum modulator defective causing EGR to open in cold condition. Check for fault codes in the ECU.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
LUBRICATING OIL PRESSURE LOW	1. Low oil level.	1a. Check and fill with clean engine oil.
		1b. Check for severe external oil leaks that could reduce the pressure.
	2. Oil viscosity thin, diluted, or wrong specification.	2. Verify the correct oil is being used. Check for oil dilution.
	3. Improperly operating pressure switch/gauge	3. Verify the pressure switch is functioning correctly. If not, replace switch/gauge.
	4. Relief valve stuck open.	4. Check/replace valve.
	5. Plugged oil filter.	5. Change oil filter. Oil filter change interval may need to be revised.
	6. Oil cooler was replaced, shipping plugs left in cooler.	6. Check/removed shipping plugs.
	7. Worn oil pump.	7. Check/replace oil pump.
	8. Suction tube loose or seal leaking.	8. Check and replace seal.
	9. Worn bearing or wrong bearing installed.	9. Inspect and replace connecting rod or main bearings. check and replace piston cooling oil jet.
	10. Oil jets under piston loose or bad fit.	10. Check oil jets position.
LUBRICATING OIL LOSS	1. External oil leaks.	1. Visually inspect for oil leaks. Repair as required.
	2. Crankcase being overfilled.	2. Verify that the correct dipstick is being used.
	3. Incorrect oil specification or viscosity.	3a. Make sure the correct oil is being used.
		3b. Look for reduced viscosity from dilution with fuel.
		3c. Review/reduce the oil change intervals.
	4. Oil cooler leak.	4. Check and replace the oil cooler.
	5. High blow-by forcing oil out the breather.	5. Check the breather tube area for signs of oil loss.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
LUBRICATING OIL LOSS (CONT.)	6. Turbocharger leaking oil into the air intake. 7. Piston rings not sealing (oil being consumed by the engine).	6. Inspect air duct for evidence of oil transfer. 7. Perform blow-by check. Repair as required.
COMPRESSION KNOCKS	1. Air in fuel system. 2. Poor quality fuel or water/gasoline contaminated fuel. 3. Engine Overloaded. 4. Improperly operating injectors. 5. Fuel injection system defective.	1. Bleed the fuel system (refer to Group 14, Fuel System). 2. Verify by operating from a temporary tank with good fuel. Clean and flush the fuel supply tank. Replace fuel/water separator. 3. Verify the engine load rating is not being exceeded. 4. Check and replace injectors. 5a. Instrumented injection. 5b. Timing solenoid of the fuel pump. 5c. Pre and post heat time of the glow plugs. Check the fault codes in the ECU.
EXCESSIVE ENGINE NOISES	1. Drive belt squeal, insufficient tension or abnormally high loading. 2. Intake air and exhaust leak. 3. Excessive valve lash. 4. Turbocharger noise. 5. Power function knock. 6. Fuel injection system defective.	1. Inspect the drive belts. Make sure water pump pulley, generator and power steering all turn freely. 2. Refer to excessive exhaust smoke. (Engine Diagnosis and Testing) 3. Make sure the rocker arms are not bent. Defective hydraulic lash adjuster. 4. Check turbocharger impeller and turbine wheel for housing contact. 5. Check and replace rod and main bearings. 6a. Instrumented injection. 6b. Timing solenoid of the fuel pump. 6c. Pre and post heat time of the glow plugs. Check the fault codes in the ECU.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
GENERATOR NOT CHARGING OR INSUFFICIENT CHARGING	1. Loose or corroded battery.	1. Clean/tighten battery connection.
	2. Generator belt slipping.	2. Check/replace automatic belt tensioner. Check/replace and adjust belt.
	3. Generator pulley loose on shaft.	3. Tighten pulley.
	4. Improperly operating generator.	4. Check/replace generator.

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DIAGNOSIS AND TESTING (Continued)

HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check the oil pressure. If vehicle has no oil pressure gauge, install a reliable gauge at the pressure sending unit. The pressure should be between 3.5 bars to 5.0 bars at 4000 RPM.

Check the oil level after the engine reaches normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick. The oil level in the pan should never be above the FULL mark or below the ADD OIL mark on dipstick. Either of these 2 conditions could be responsible for noisy tappets.

OIL LEVEL HIGH

If oil level is above the FULL mark, it is possible for the connecting rods to dip into the oil. With the engine running, this condition could create foam in the oil pan. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

OIL LEVEL LOW

Low oil level may allow oil pump to take in air. When air is fed to the tappets, they lose length which allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than 1 tappet will be noisy. When oil level and leaks have been corrected, operate the engine at fast idle. Run engine for a sufficient time to allow all of the air inside the tappets to be bled out.

TAPPET NOISE DIAGNOSIS

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak down around the unit plunger or by the plunger partially sticking in the tappet body cylinder. The tappet should be replaced. A heavy click is caused by a tappet check valve not seating or by foreign particles becoming wedged between the plunger and the tappet body. This will cause the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

(4) The valve train generates a noise very much like a light tappet noise during normal operation. Care must be taken to ensure that tappets are making the noise. In general, if more than one tappet seems to be noisy, its probably not the tappets.

SERVICE PROCEDURES

CHECKING OIL LEVEL

To assure proper engine lubrication, the engine oil must be maintained at the correct level. Check the oil level at regular intervals, such as every fuel stop.

The best time to check the oil level is about 5 minutes after a fully warmed-up engine is shut off, or before starting the vehicle after it has sat overnight.

Checking the oil while the vehicle is on level ground, will improve the accuracy of the oil level readings (Fig. 4).

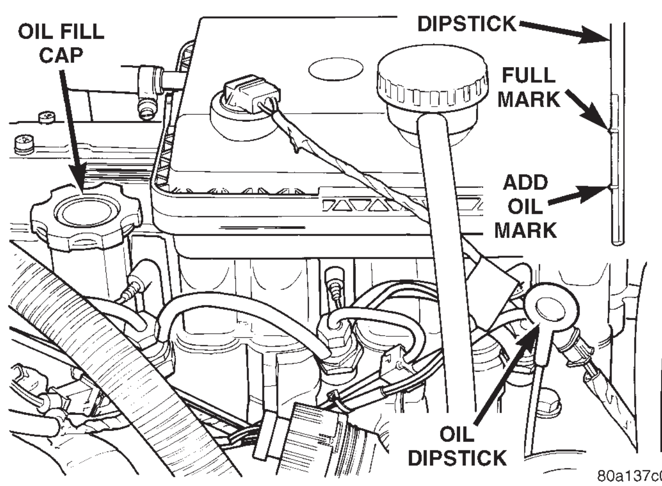


Fig. 4 Checking Engine Oil

CHANGING ENGINE OIL AND FILTER

Change engine oil and filter at mileage and time intervals described in the Maintenance Schedule.

SERVICE PROCEDURES (Continued)

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.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Remove oil fill cap.

(3) Hoist vehicle. Refer to Hoisting and Jacking Recommendations.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan (Fig. 5). Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.

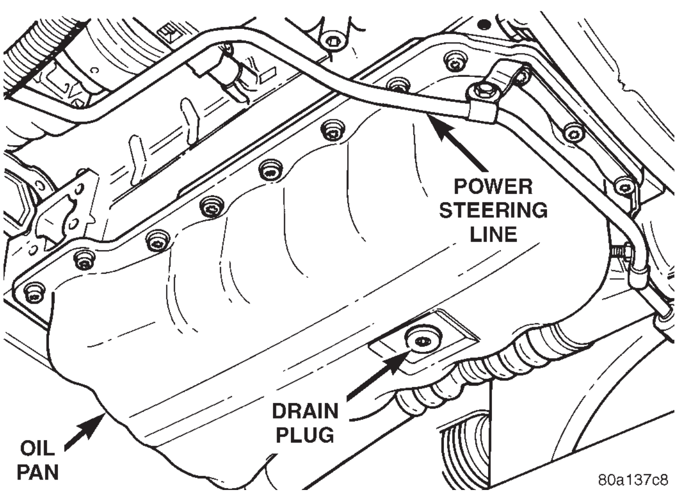


Fig. 5 Oil Drain Plug

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE OIL

ENGINE OIL QUALITY

Use only oils conforming to API (American Petroleum Institute) quality SG/CD, or CCMC G4. Use only Diesel engine oil meeting standard **MIL-2104C** or API service classification **SG/CD or CCMM PD1** .

OIL VISCOSITY

Grade 15W-40 is recommended for temperatures between +35°C to –10°C (95°F to 14°F). Low viscosity oils must have the proper API quality or the CCMC G5 designation. Low viscosity oils are preferred when minimum temperatures consistently fall below –12°C (10°F).

ENGINE OIL FILTER CHANGE

(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 oil filter base (Fig. 6).

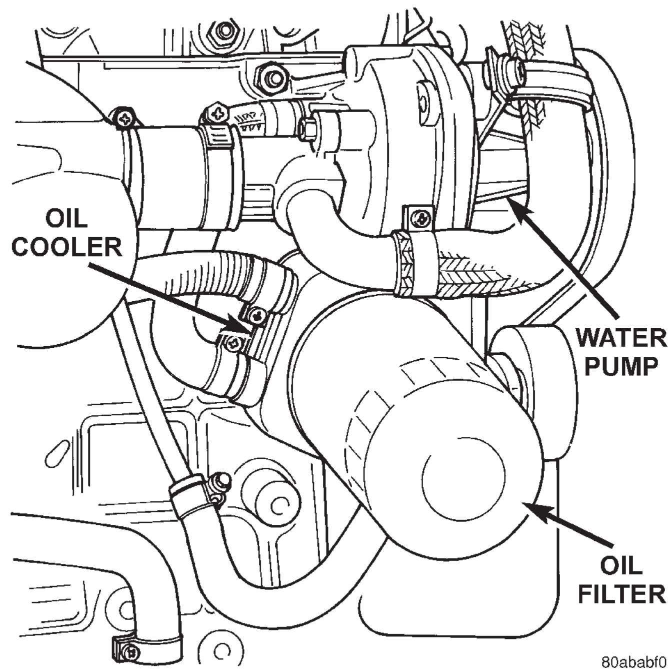


Fig. 6 Oil Filter

(4) When filter separates from base, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) With a cloth, wipe clean the gasket sealing surface of oil and grime.

OIL FILTER INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil.

(2) Thread filter onto the base. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.

SERVICE PROCEDURES (Continued)

(3) Add oil, verify crankcase oil level and start engine. Inspect filter area for oil leaks.

TIMING PROCEDURE

CAUTION: If a timing gear is removed you must loosen the rocker arm supports before rotating the crankshaft or camshaft. This will prevent the valves hitting the pistons.

For the engine components to be in proper timing order, the timing gear marks (dots) must be aligned as shown in (Fig. 7). To facilitate reassembly, align the timing marks as shown in (Fig. 7), or mark the timing gear positions before removal of any marked gears or gear driven component(s).

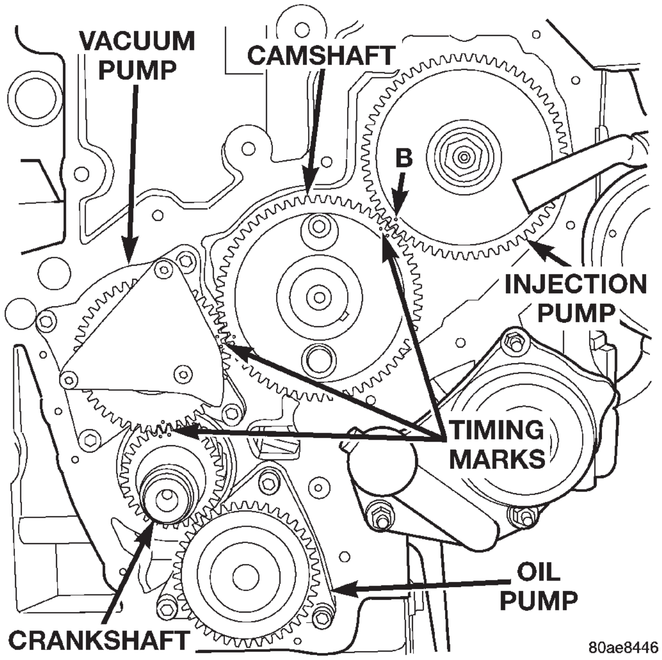


Fig. 7 Aligning Timing Marks

VALVE AND SEAT REFACING

VALVE REFACING

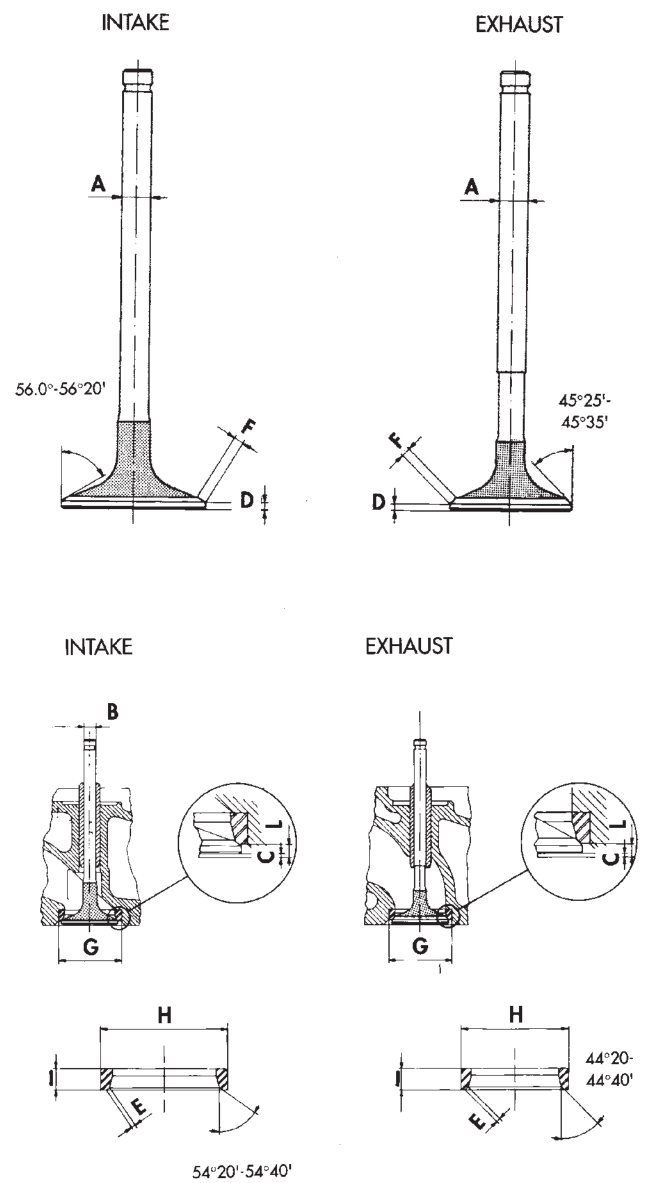
(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 4.52-4.49 mm (.178-.177 inch) must remain (Fig. 8). If the margin is less than 4.49 mm (.177 inch), the valve must be replaced.

VALVE SEAT REFACING

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified 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.



MEASUREMENT	INTAKE	EXHAUST
A	7.940-7.960	7.922-7.940
B	8.00-8.015	8.000-8.015
C	0.880-1.140	0.990-1.250
D	2.2±0.08	$2.09^{+0.07}_{-0.09}$
E	1.80-2.20	1.65-2.05
F	2.73-3.44	2.45-3.02
G	41.962-41.985	35.964-35.987
H	42.070-42.086	36.050-36.066
I	7.14-7.19	7.00-7.05
L	3.11-3.26	3.10-3.25

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Fig. 8 Valve Specification

SERVICE PROCEDURES (Continued)

VALVE STAND DOWN

Valve stand down is to maintain the adequate compression ratio.

(1) Invert cylinder head.

(2) Fit each valve to its respective valve guide.

(3) Using a straight edge and feeler gauge (Fig. 9), check valve head stand down: Inlet valve head stand down .80 to 1.2 mm (.031 to .047 in.) and exhaust valve stand down .79 to 1.19 mm (.031 to .047 in).

(4) If valve head stand down is not in accordance with above, discard original valves, check stand down with new valves and recut valve seat inserts to obtain correct stand down.

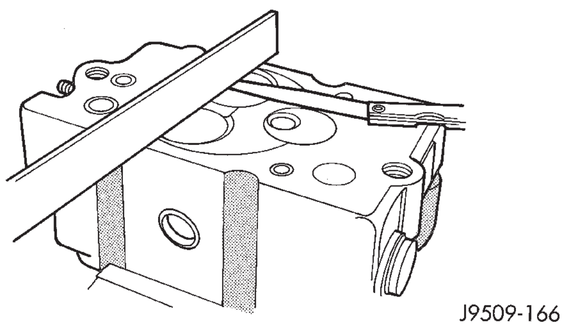

Fig. 9 Checking Valve Stand Down

VALVE GUIDE HEIGHT

(1) Valve Guides height requirement.

(2) Measurement A (Fig. 10): 13.50 - 14.00 mm.

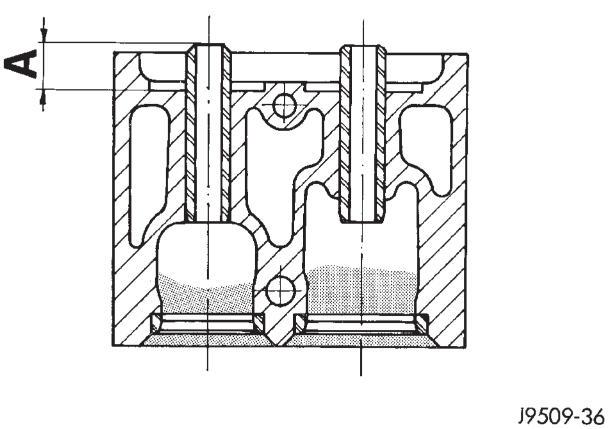

Fig. 10 Valve Guide Height

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

(1) Measure and record internal diameter of valve guides. Valve guide internal diameter is 8.0 to 8.015 mm (.3149 to .3155 in.).

(2) Measure valve stems and record diameters. Intake valve stem diameter 7.94 to 7.96 mm (.3125 to .3133 in). Exhaust valve stem diameter 7.92 to 7.94 mm (.3118 to .31215 in).

(3) Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is .040 to .075 mm (.0015 to .0029 in). Clearance of exhaust valve stem in valve guide is .060 to .095 mm (.0023 to .0037 in).

(4) If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

FITTING PISTON RING

(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 in.) from bottom of cylinder bore (Fig. 11). Check gap with feeler gauge. Top compression ring gap .25 to .50mm (.0098 to .0196 in.). Second compression ring gap .25 to .35mm (.0098 to .0137 in.). Oil control ring gap .25 to .58mm (.0098 to .0228 in.).

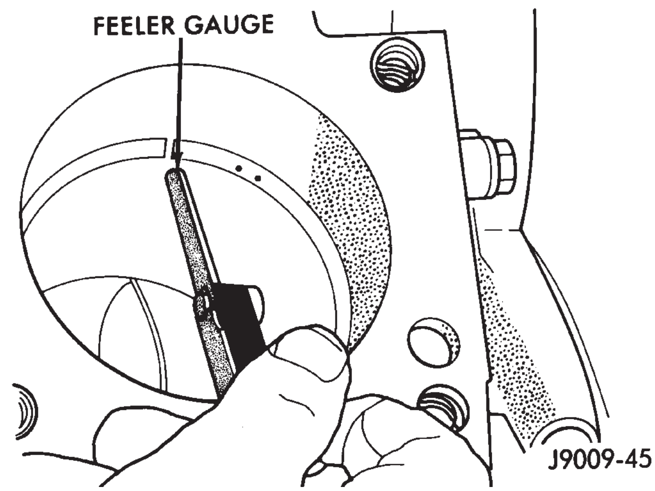

Fig. 11 Ring Gap Measurement

(2) If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

(3) Check piston ring to groove clearance (Fig. 12). Top compression ring gap .08 to .130mm (.0031 to .0051 in.). Second compression ring gap .070 to .102mm (.0027 to .0040 in.). Oil control ring gap .040 to .072mm (.0015 to .0028 in.).

CRANKSHAFT END PLAY

(1) Attach dial indicator to engine block (Fig. 13).

(2) Move crankshaft toward front of engine and zero indicator.

(3) Move crankshaft toward the rear of engine and record measurement.

(4) Subtract specified crankshaft end float from figure obtained. Crankshaft end float 0.08 to 0.21mm.

(5) Select thrust washer which will give correct end float.

SERVICE PROCEDURES (Continued)

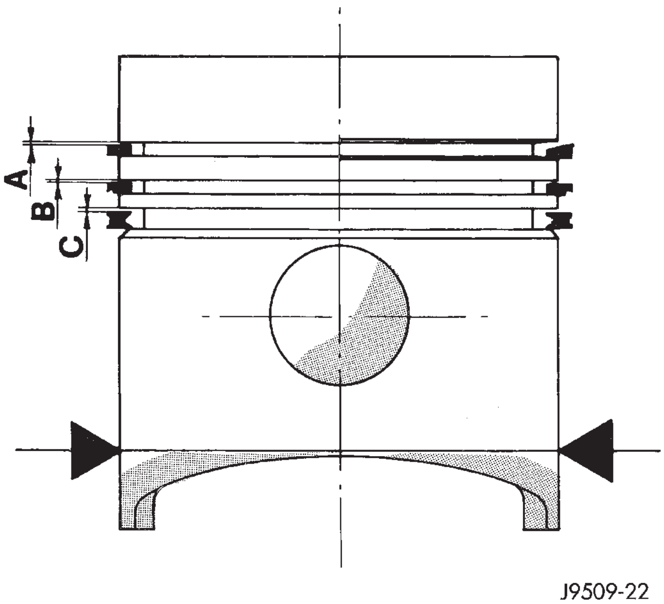

Fig. 12 Piston Ring Side Clearance

(6) Refer to crankshaft main bearing Installation if not in specification.

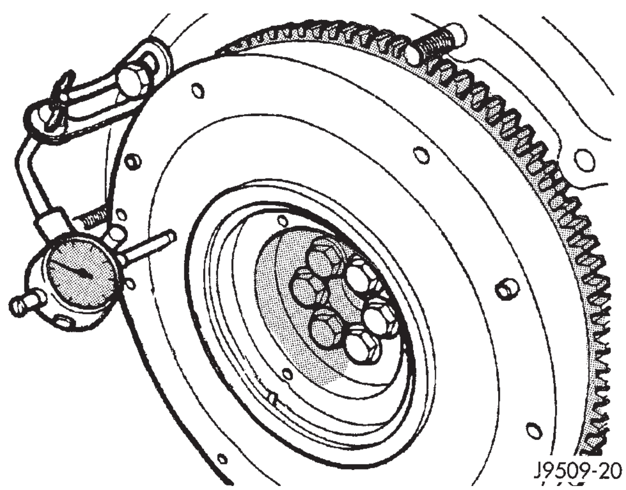

Fig. 13 Measuring Crankshaft End Play

NOTE: If engine is disassembled refer to Crankshaft Main Bearing Removal and Installation for this procedure.

REMOVAL AND INSTALLATION

ENGINE MOUNT—FRONT

(1) Disconnect battery.

(2) Remove lower air dam at front fascia.

(3) Remove the bolts holding tow bracket and front mount to the lower crossmember.

(4) Remove thru bolt in engine mount (Fig. 14). Remove mount.

(5) Reverse removal procedure for installation.

(6) Torque engine mount thru bolt to 65 N·m (48 ft. lbs.)

(7) Torque crossmember bolts for tow bracket and engine mount to 54 N·m (40 ft. lbs.)

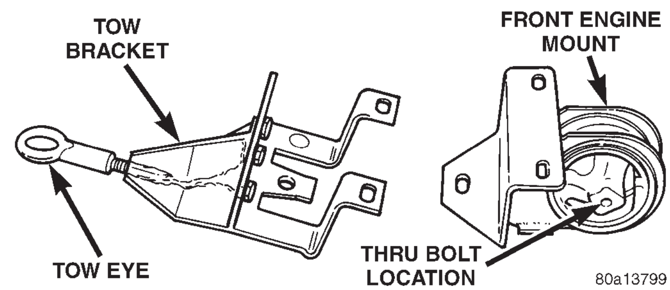

Fig. 14 Front Engine Mount and Tow Bracket

ENGINE MOUNT—RIGHT

(1) Remove the right engine mount top support bracket bolt (Fig. 15).

(2) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(3) Remove the engine mount to frame bolts.

(4) Remove the thru bolt from the mount assembly. Remove insulator

(5) If replaceing or removing right engine mount bracket the torque on the mounting bolts is 40 N·m (30 ft. lbs.)

(6) Reverse removal procedure for installation.

(7) Torque engine mount top bolt (Vertical) to 101 N·m (75 ft. lbs.)

(8) Torque engine mount thru bolt (Horizontal) to 145 N·m (107 ft. lbs.)

(9) Torque engine mount to frame bolts to 68 N·m (50 ft. lbs.)

MOUNT—LEFT SIDE

(1) Raise vehicle on hoist and remove left front wheel.

(2) Remove inner splash shield.

(3) Support the transmission with a transmission jack.

(4) Remove the insulator thru bolt from the mount (Fig. 16).

(5) Remove the transmission mount bolts and remove mount. It may be necessary to lower transmission slightly to remove mount.

(6) Reverse removal procedure for installation.

(7) Install mount. Torque transmission mount bolts to 54 N·m (40 ft. lbs.).

(8) Align mount into frame bracket with transmission jack, install thru bolt. Torque thru bolt to 71 N·m (53 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

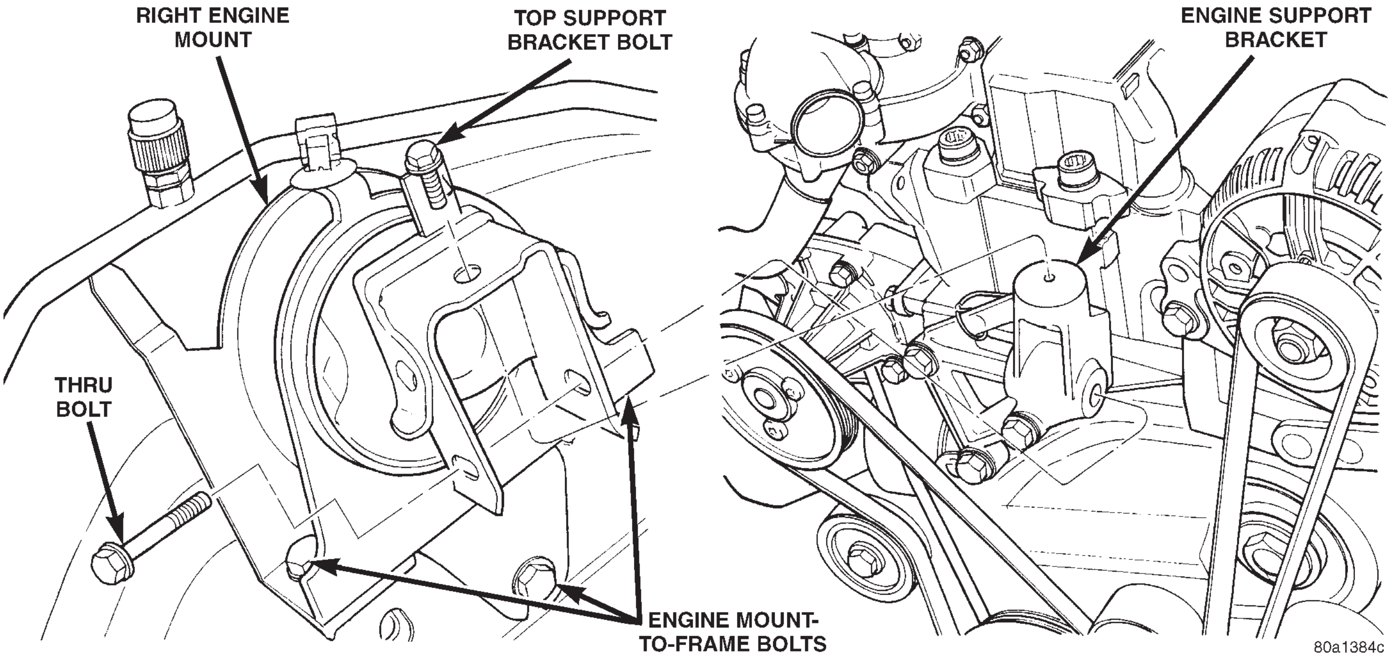

Fig. 15 Right Engine Mount—VM Diesel

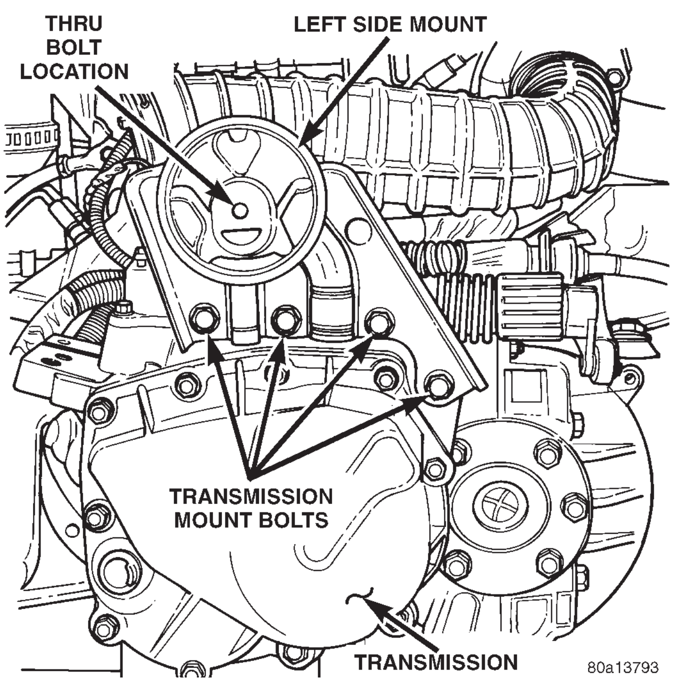

Fig. 16 Left Side Mount—VM Diesel

ENGINE MOUNT—REAR

(1) Raise vehicle on hoist.

(2) Support the engine and transmission assembly with a transmission jack so it will not rotate.

(3) Remove the thru bolt from the insulator at crossmember connection (Fig. 17).

(4) Remove the bolts holding the mount to the engine and transmission.

(5) Disconnect both shifter cables at transmission. Remove the retainers holding the cables to the mount (Fig. 18).

(6) Remove the mount assembly.

(7) Reverse removal procedure for installation.

(8) Install mount assembly. Torque bolts at engine and transmission to 101 N·m (75 ft. lbs.).

(9) Align insulator at crossmember and install thru bolt. Torque to 68 N·m (50 ft. lbs.).

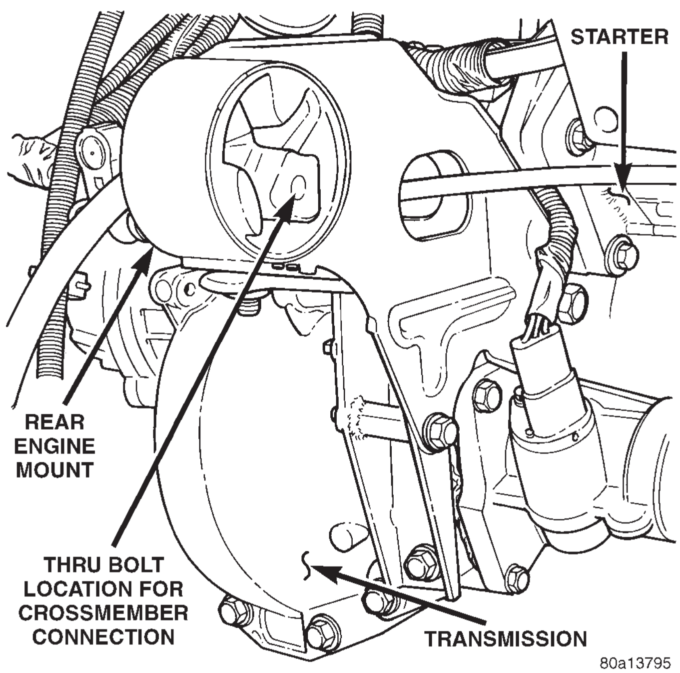

Fig. 17 Rear Engine Mount—VM Diesel

REMOVAL AND INSTALLATION (Continued)

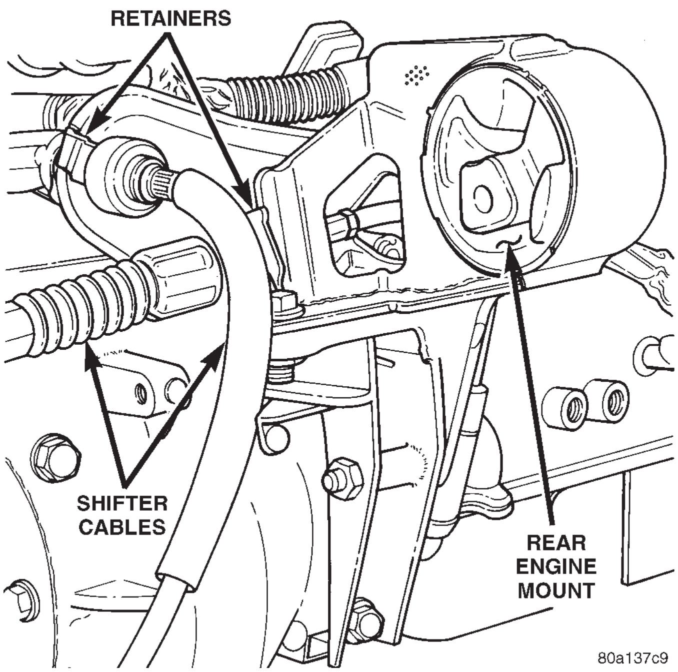

Fig. 18 Shift Cables at Rear Mount

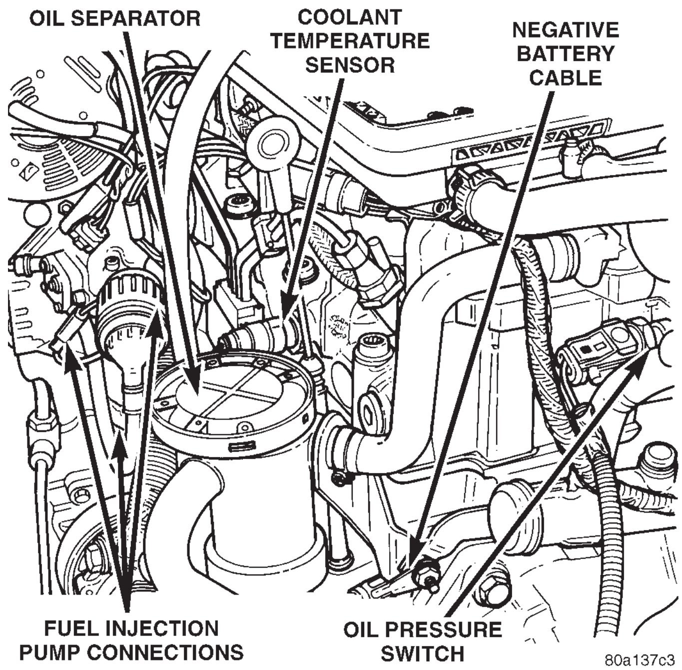

Fig. 19 Component Locations

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect the battery.

(2) Remove the air cleaner assembly and inlet hose.

(3) Remove both hoses at intercooler and engine.

(4) Disconnect EGR vacuum hose.

(5) Disconnect brake booster vacuum hose.

(6) Disconnect oil pressure switch connector (Fig. 19).

(7) Disconnect Wiring harness bracket at transaxle shift tower.

(8) Disconnect transaxle wiring at speed sensor, crank sensor, and backup light switch.

(9) Remove both transmission shift cables at transmission.

(10) Remove negative battery cable at cylinder block (Fig. 19).

(11) Remove oil separator.

(12) Remove connectors at coolant temperature sensor and A/C compressor.

(13) Disconnect fuel injection pump wiring connectors (Fig. 19).

(14) Disconnect glow plug connectors.

(15) Disconnect electrical connector at number 1 fuel injector.

(16) Raise vehicle on hoist.

(17) Remove right side splash shield (Fig. 20).

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. USE CARE TO PREVENT SCALDING BY HOT COOLANT.

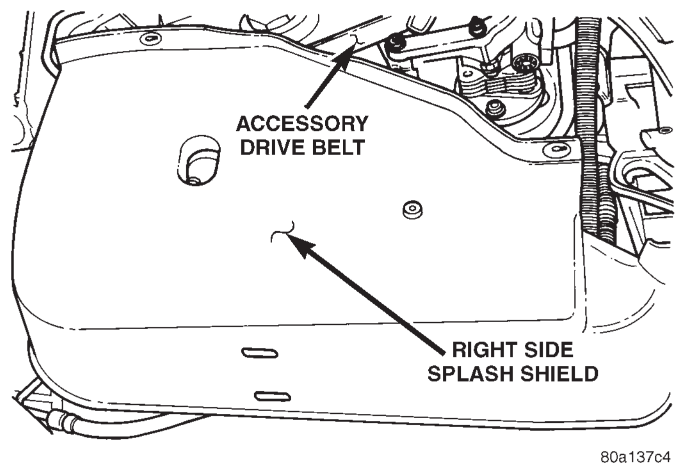

Fig. 20 Right Side Splash Shield

CAREFULLY RELEASE THE PRESSURE BEFORE REMOVING THE RADIATOR DRAIN COCK AND CAP.

(18) Drain the cooling system (refer to Group 7, Cooling).

(19) Lower vehicle.

(20) Remove Coolant pressure bottle and disconnect low coolant level sensor.

(21) Disconnect both heater hoses.

(22) Remove the lower radiator hose.

(23) Remove the upper radiator hose.

(24) Remove fuel line at injector pump and cap.

(25) Remove power steering reservoir and reposition.

(26) Remove upper radiator crossmember.

(27) Disconnect cooling fan module connector.

REMOVAL AND INSTALLATION (Continued)

(28) Remove radiator support bolts. **It is necessary to loosen the receiver/dryer to gain access to the radiator bolts.**

(29) Remove radiator and fans as an assembly.

(30) Remove accessory drive belt generator/power steering. Refer to Group 7, for procedure.

(31) Remove both power steering lines at pump, and cap both lines.

NOTE: It is not necessary to discharge A/C system for engine removal.

(32) Remove A/C compressor. Secure compressor away from engine for clearance during engine removal.

(33) Remove Generator and adjusting bracket.

NOTE: Do not remove the mounting base from the generator. It is aligned at the factory and cannot be realigned in the field.

(34) Hoist vehicle.

(35) Remove exhaust pipe at turbo outlet.

(36) Remove connections at starter.

(37) Remove power steering high pressure line bracket at rear of oil pan.

(38) Remove both driveshafts from transaxle. Refer to Group 2, Suspension and Driveshafts.

(39) Disconnect clutch cable at transaxle.

(40) Remove reinforcement plate on lower cross-member.

(41) Remove front and rear engine mounts. Refer to procedure outlined in this section.

(42) Drain engine oil and remove oil filter if necessary.

(43) Mount both special tool, engine support brackets VM-1026 to cylinder block (Fig. 21).

(44) Using engine dolly and cradle assembly with 4 adjustable posts align posts with holes in the engine support brackets.

(45) Lower vehicle so weight of **only the engine and transmission** is on the dolly and cradle assembly.

(46) Remove left side splash shield to gain access to thru bolt for left side mount.

(47) Remove right engine mount and left side mount. Refer to procedure outlined in this section.

(48) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly on the dolly to allow for removal around body.

(49) Reverse removal procedure for installation.

CYLINDER HEAD COVER

REMOVAL

(1) Disconnect the battery cables.

(2) Remove generator bracket.

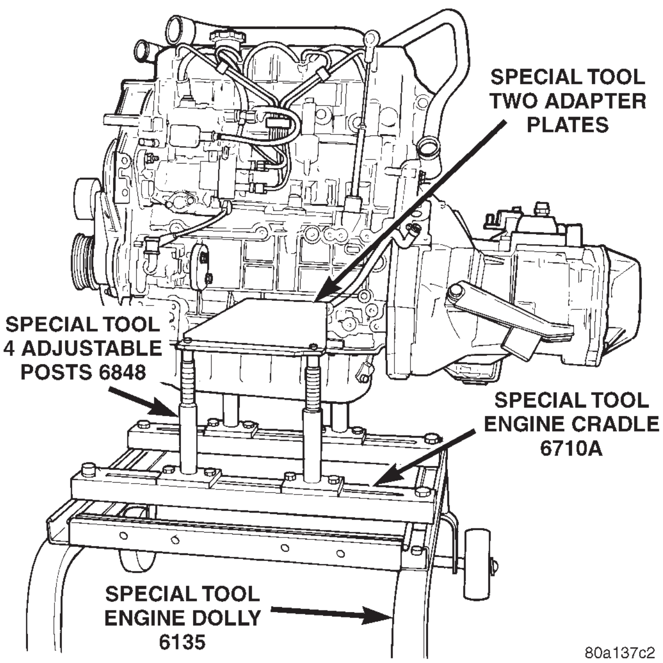

Fig. 21 Engine Removal

(3) Remove breather hose.

(4) Remove coolant pressure tank.

(5) Remove cylinder head cover.

INSTALLATION

(1) Install cylinder head cover, torque nuts to 23.5 N·m (208 in. lbs.).

(2) Install coolant pressure tank.

(3) Install breather hose.

(4) Install generator bracket, tighten bolts to 7 N·m (4 ft. lbs.).

(5) Connect battery cable.

ROCKER ARMS AND PUSH RODS

REMOVAL

(1) Disconnect the battery cables.

(2) Remove generator bracket.

(3) Remove breather hose.

(4) Remove coolant pressure tank.

(5) Remove cylinder head cover.

(6) Remove rocker retaining nuts (Fig. 22).

(7) Remove rocker assembly. Place them on a bench in the same order as removed.

(8) Remove the push rods and place them on a bench in the same order as removed.

INSTALLATION

(1) Install the push rods in the same order as removed.

(2) Install rocker arm assemblies in the same order as removed. Tighten the rocker arm nuts to 29.4 N·m (264 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

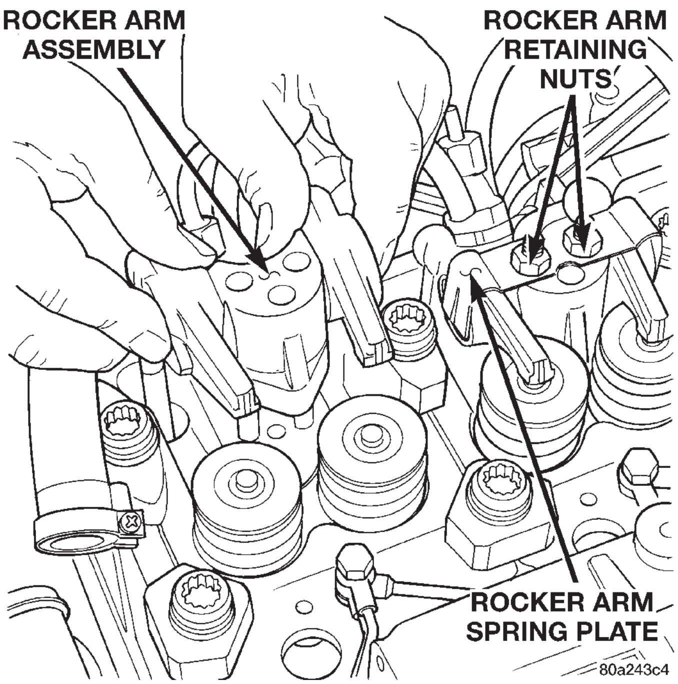

Fig. 22 Rocker Arm Retaining Nut

(3) Install cylinder head cover, torque nuts to 14.7 N·m (132 in. lbs.).

(4) Install coolant pressure tank.

(5) Install breather hose.

(6) Install generator bracket, tighten bolts to 7 N·m (4 ft. lbs.).

(7) Connect the service valves to the A/C compressor ports, if equipped with air conditioning.

(8) Connect battery cable.

VALVE SPRINGS—CYLINDER HEAD NOT REMOVED

This procedure can be done with the engine cylinder head installed on the block.

REMOVAL

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 cylinder head cover removal in this section.

(2) Remove rocker arms assemblies for access to each valve spring to be removed.

(3) Remove push rods. Retain the push rods, and rocker arms assemblies in the same order and position as removed.

(4) Inspect the springs and retainer for cracks and possible signs of weakening.

(5) Install an air hose adaptor in the fuel injector hole.

(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.

(7) Tap the retainer or tip with a rawhide hammer to loosen the lock from the retainer. Use Valve Spring Compressor Tool to compress the spring and remove the locks.

(8) Remove valve spring and retainer.

Inspect the valve stems, especially the grooves. An Arkansas smooth stone should be used to remove nicks and high spots.

INSTALLATION

(1) Install valve spring and retainer.

(2) Compress the valve spring with Valve Spring Compressor Tool 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.

(3) Disconnect the air hose. Remove the adaptor from the fuel injector hole and install the fuel injector.

(4) Repeat the procedures for each remaining valve spring to be removed.

(5) Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

(6) Install the rocker arm assemblies, at their original location.

(7) Tighten the rocker arm assembly nut to 106 N·m (78 ft. lbs.) torque.

(8) Install the engine cylinder head cover, refer to cylinder head cover installation in this section.

CYLINDER HEAD

REMOVAL

(1) Disconnect the battery 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 cooling system. Refer to Group 7, Cooling.

(3) Remove wiper module. Refer to Group 8K, Windshield Wiper Unit Removal for procedure.

(4) Remove coolant pressure bottle.

(5) Remove intercooler hose at intake manifold (Fig. 23).

(6) Remove intercooler hose at turbocharger intercooler tube.

(7) Remove the upper radiator hose.

(8) Remove water manifold.

(9) Disconnect the heater hoses and coolant pressure bottle hoses.

REMOVAL AND INSTALLATION (Continued)

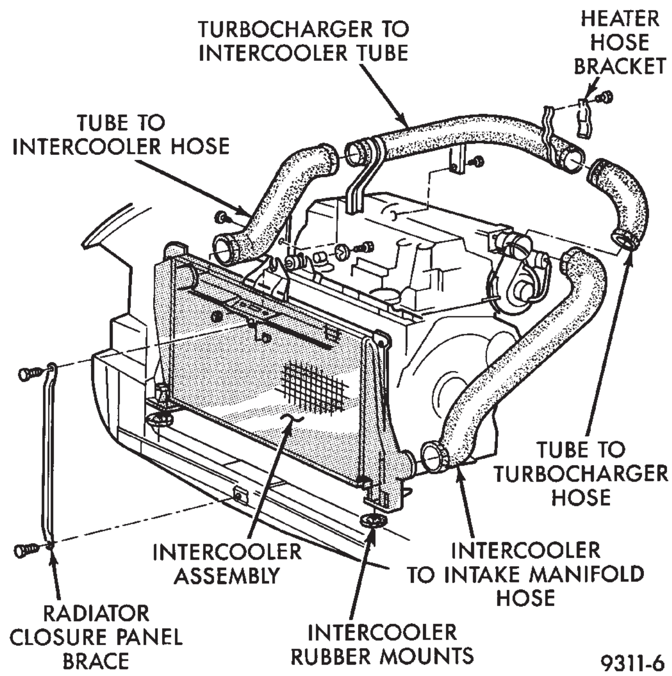

Fig. 23 Intercooler Assembly

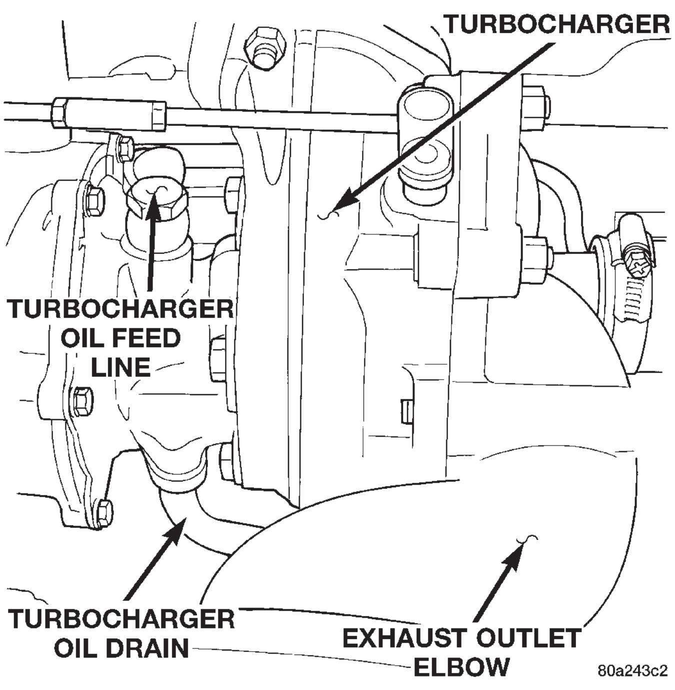

Fig. 24 Turbocharger

(10) Disconnect EGR tube from EGR valve (Fig. 25).

(11) Remove exhaust pipe from turbocharger elbow and.

(12) Disconnect oil feed line from turbo (Fig. 24).

(13) Disconnect oil drain line from turbo.

(14) Remove Intake manifold. Refer to Group 11, Exhaust System and Intake Manifold.

(15) Remove lift eye and brake vacuum tube at rear of exhaust manifold.

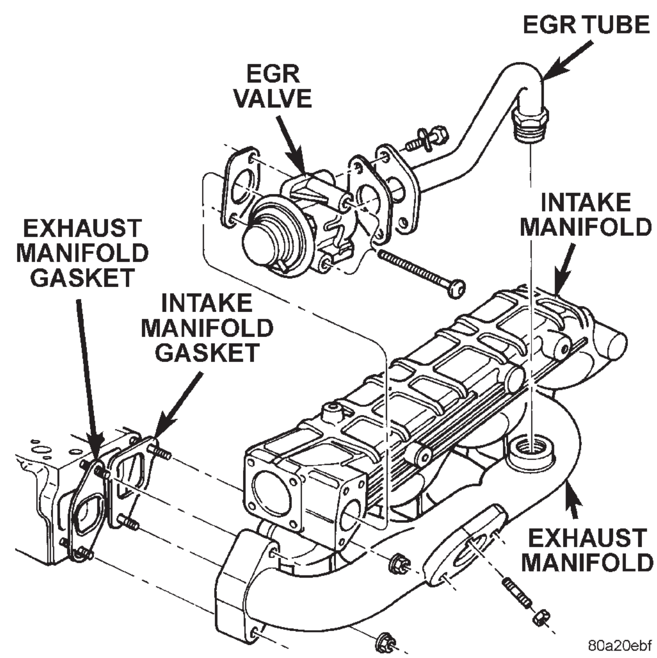

Fig. 25 EGR Valve and Tube

(16) Remove the support strut from block to turbocharger exhaust elbow.

(17) Remove Exhaust manifold. Refer to Group 11, Exhaust System and Intake Manifold.

(18) Remove oil line at pressure switch.

(19) Remove oil feed line for rocker arm assemblies (Fig. 26).

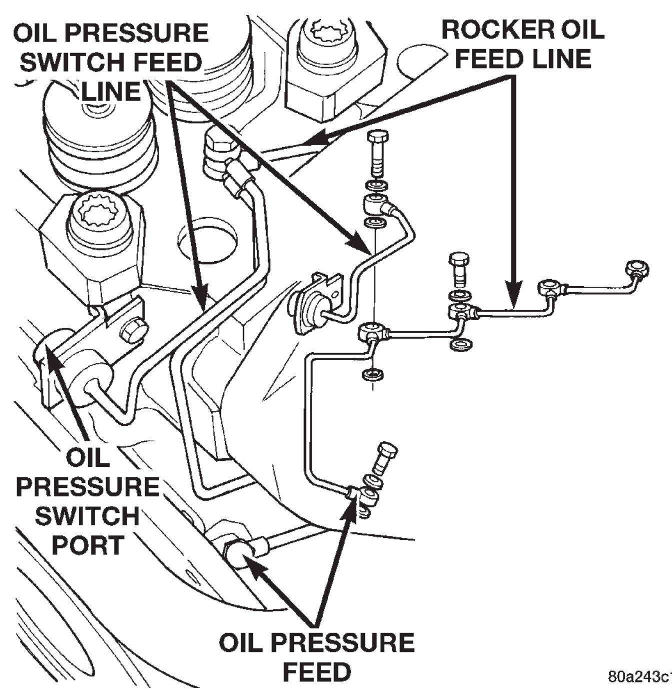

Fig. 26 Rocker Arm Oil Feed Lines

(20) Remove Crankcase breather hose from valve cover

(21) Remove the engine cylinder head cover.

REMOVAL AND INSTALLATION (Continued)

(22) Remove the injector sensor wire at the connector, and glow plug Connectors.

NOTE: The attachment point for the injector sensor wire at the injector is not a connector. The connector is located in the wire 4 to 6 inches away from the injector.

(23) Remove injector fuel lines from injectors to pump.

(24) Remove fuel injectors with tool VM-1012A (Fig. 27) and (Fig. 28) Refer to Group 14, Fuel System.

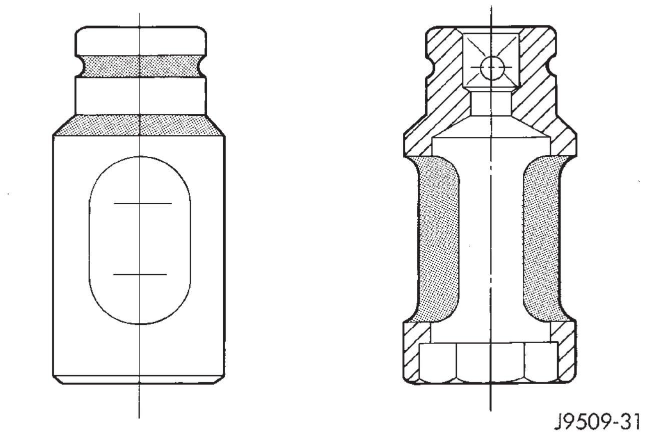

Fig. 27 Fuel Injector Tool VM-1012A

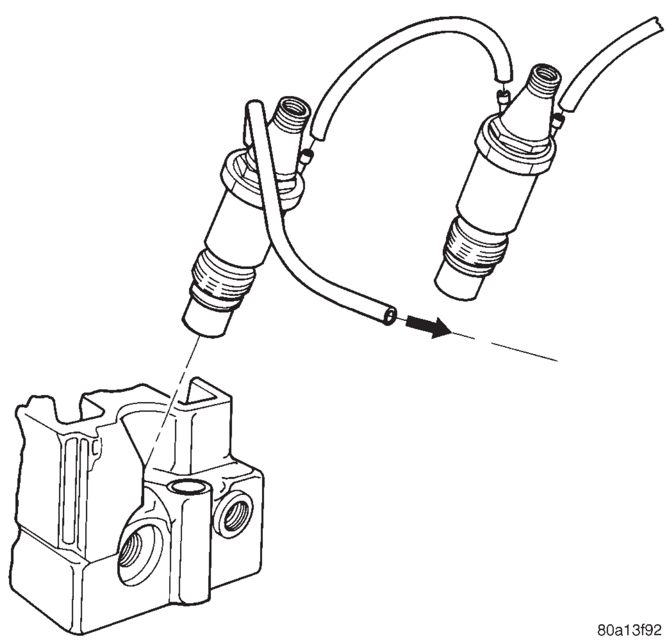

Fig. 28 Fuel Injector

(25) Remove rocker retaining nuts (Fig. 29).

(26) Remove rocker assemblies. Place them on a bench in the same order as removed.

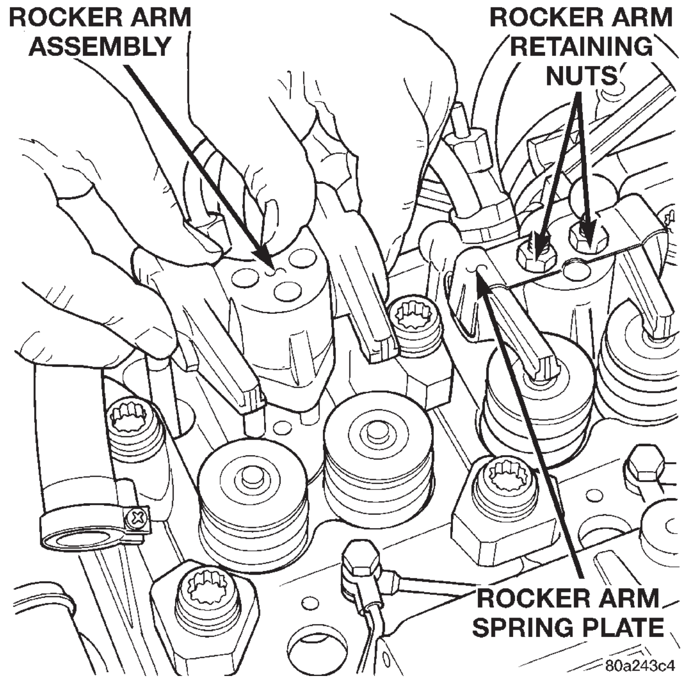

Fig. 29 Rocker Arm Retaining Nut

(27) Remove the push rods and place them on a bench in the same order as removed.

(28) Mark cylinder heads to ensure installation in there original position.

(29) Remove the engine cylinder head bolts with special tool VM-1018 and VM-1019.

(30) Remove the engine cylinder heads and gasket.

NOTE: A single steel head gasket is used for 4 cylinder heads (Fig. 32).

(31) Stuff clean lint free shop towels into the cylinder bores.

CYLINDER HEAD GASKET

NOTE: If cylinder wall liners have not been removed; the same thickness head gasket removed, may be used.

CAUTION: Piston protrusion must be measured, to determine cylinder head gasket thickness, if one or more cylinder wall liners have been replaced.

Cylinder head gaskets are available in three thickness. The different thicknesses are marked with identification holes (one, two or none) (Fig. 32). The gasket is to be installed DRY. **DO NOT use a gasket sealing compound on the gasket.**

(1) Use special tool VM-1010 with dial indicator special tool VM- 1013 (Fig. 30).

(2) Bring the piston of cylinder no. 1 exactly to top dead center.

REMOVAL AND INSTALLATION (Continued)

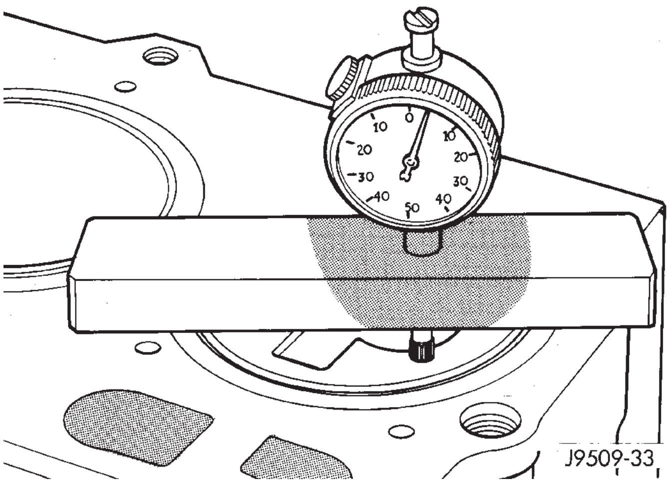

Fig. 30 Measuring Piston Protrusion

(3) Zero the dial indicator on the cylinder block mating surface.

(4) Setup the dial indicator on the piston crown (above the center of the piston pin) 5mm (1/8 in.) from the edge of the piston and note the measurement (Fig. 31).

(5) Repeat the procedure with the rest of the cylinders.

(6) Establish the thickness of the gasket for all four cylinder heads on the basis of the greatest piston protrusion (Fig. 32).

Measured dimension (mm)	0.53 - 0.62
Cyl. head gasket thickness (mm)	1.42
Piston clearance (mm)	0.80 - 0.89
Measured dimension (mm)	0.63 - 0.72
Cyl. head gasket thickness (mm)	1.52
Piston clearance (mm)	0.80 - 0.89
Measured dimension (mm)	0.73 - 0.82
Cyl. head gasket thickness (mm)	1.62
Piston clearance (mm)	0.80 - 0.89

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Fig. 31 Piston Protrusion Chart

INSTALLATION CYLINDER HEAD

(1) Remove the shop towels from the cylinder bores. Coat the bores with clean engine oil.

(2) Install cylinder head alignment studs (VM-1009).

(3) After determining the correct head gasket thickness, clean the block and head mating surfaces, place the engine cylinder head gasket over the dowels.

(4) Place the engine cylinder head over the dowels.

CAUTION: Engine cylinder head bolts can be reused up to three times.

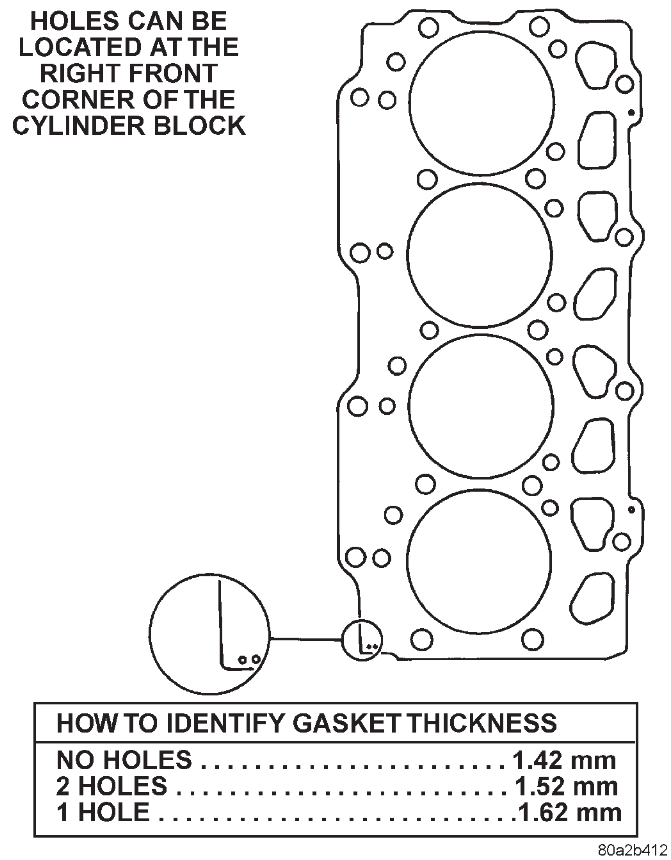


Fig. 32 Head Gasket Identification

(5) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 33):

a. The threads and underside heads of the bolts should be lubricated. Use the cylinder head alignment studs tool number VM-1009. Position the heads on the block and secure with the ten large center bolts and spacers (clamps), finger tight only.

b. Ensure that the various clamps are installed correctly and the head gasket remain in their proper position, completely covered. Then, lubricate and install the eight small bolts, also finger tight.

(6) Loosen assembly oil feed line for rocker arm assemblies

(7) Install the intake and exhaust manifolds with new gaskets, partially tightening the nuts to a maximum of 5 N·m (44 in. lbs.). This will align the heads (refer to Group 11, Exhaust System and Intake Manifold for the proper procedures). Install lift eye and brake vacuum tube at this time.

(8) Then, tighten the 12mm bolts with special tool VM-1019 in the following manner:

(9) **1st Phase:** Tightening Head Bolts (Fig. 33). Central bolts (A-L): Tighten all bolts, starting with bolt A then B-C-D-E-F-G-H-I-L, to 30 N·m. Repeat the operation with the same torque. Following the same sequence rotate each bolt through an angle of

REMOVAL AND INSTALLATION (Continued)

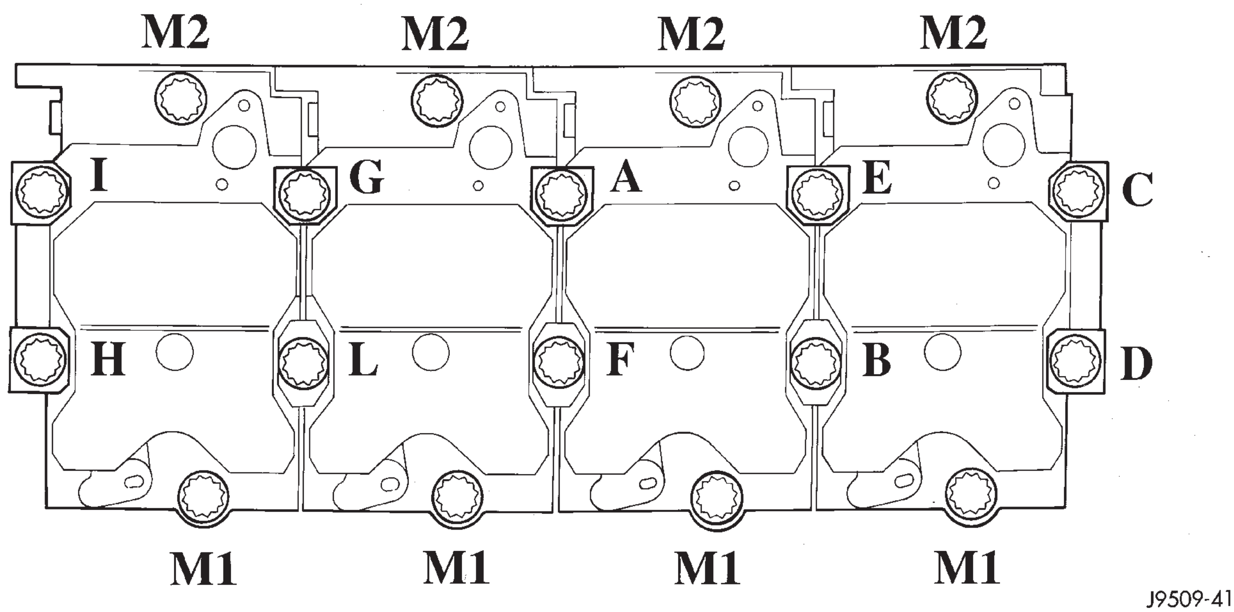


Fig. 33 Engine Cylinder Head Bolt Tightening Sequence

70° using angle torque tool. Then rotate the bolts an additional 70° following tightening sequence.

(10) Then, tighten the 14mm bolts with special tool VM-1018 in the following manner:

(11) Side bolts (M1-M2): Tighten M1 bolts to 30 N·m, then rotate them 85° (±5). Tighten M2 bolts to 30 N·m, then rotate them 85° (±5).

(12) **2nd Phase:** After 20 minutes of engine operation at operating temperature, allow engine to cool down completely. Then retorque the head bolts as follows:

(13) Central bolts A-L: Starting from bolt A, slacken and retorque it immediately to 30 N·m + 65°. Rotate the bolt an additional 65°. Then proceed in the same way, bolt by bolt, following alphabetical order, as indicated.

(14) Side bolts M1-M2: **Without slackening** , torque bolts M1 then bolts M2 to 90 N·m (66 ft. lbs.).

(15) Tighten intake nuts to 30 N·m (22 ft. lbs.) and exhaust manifolds nuts to 30 N·m (22 ft. lbs.) specified torque after completing Phase 2.

(16) 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.

(17) Tighten oil feed lines for rocker arm assemblies and oil pressure switch to 13 N·m (112 in. lbs.).

(18) Install push rods and rocker arm assemblies, tighten nut to 29.4 N·m (264 in. lbs.).

(19) Install fuel injectors use tool VM-1012 (refer to Group 14, Fuel System).

(20) Install valve cover, tighten nuts to 14.7 N·m (132 in. lbs.).

(21) Connect crankcase breather hose.

(22) Connect the injector sensor wire connector, and the glow plug connectors.

(23) Install oil feed line, tighten banjo bolts to 12.7 N·m (108 in. lbs), and oil drain line to turbo.

(24) Install water manifold tighten bolts to 12 N·m (106 in. lbs.).

(25) Install exhaust pipe to turbo elbow, tighten bolts to 28 N·m (250 in. lbs.).

(26) Install the support strut from block to turbocharger exhaust elbow.

(27) Install EGR tube to EGR valve, tighten bolts to 26 N·m (19 ft. lbs.).

(28) Install intercooler hoses at intake manifold.

(29) Install coolant pressure bottle and hoses.

(30) Install wiper module. Refer to Group 8K, Windshield Wiper Unit Installation for procedure.

(31) Install intercooler hose at turbocharger tube.

(32) Install fuel injector lines from the pump to injectors, tighten nuts to 17.6 N·m (156. lbs.).

(33) Connect the upper radiator hose.

(34) Connect negative cable to battery.

(35) Fill the cooling system. Check for leaks.

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.

REMOVAL AND INSTALLATION (Continued)

(36) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the thermostat opens. Add coolant, if required.

VALVES AND VALVE SPRINGS—HEAD OFF

This procedure is done with the engine cylinder head removed from the block.

REMOVAL

(1) Remove the engine cylinder head from the cylinder block. Refer to cylinder head removal in this section.
(2) Use Valve Spring Compressor Tool and compress each valve spring.
(3) Remove the valve locks, retainers, and springs.
(4) Use an Arkansas 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.

INSTALLATION

(1) Fit each valve to its respective valve guide.

NOTE: If valves and valve seats have been refaced refer to Service Procedures in this section. Follow The Valve Stand Down procedure.

(2) Install lower, washer and spring.
(3) Install upper spring collar, and compress valve spring with spring compressor tool. Install split cone retainers.

HYDRAULIC TAPPETS

REMOVAL

(1) Remove coolant pressure bottle.
(2) Remove cylinder head cover. Refer to cylinder head cover removal in this section.
(3) Remove rocker assembly and push rods. Identify push rods to ensure installation in original location (Fig. 34).
(4) Remove cylinder head, intake manifold, and exhaust manifold. Refer to cylinder head removal in this section.
(5) Remove yoke retainer and aligning yokes (Fig. 35).
(6) Slide Hydraulic Tappet Remover/Installer Tool through opening in block and seat tool firmly in the head of tappet.
(7) Pull tappet out of bore with a twisting motion. If all tappets are to be removed, identify tappets to ensure installation in original location.
(8) If the tappet or bore in cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize. Replace with oversize tappet.

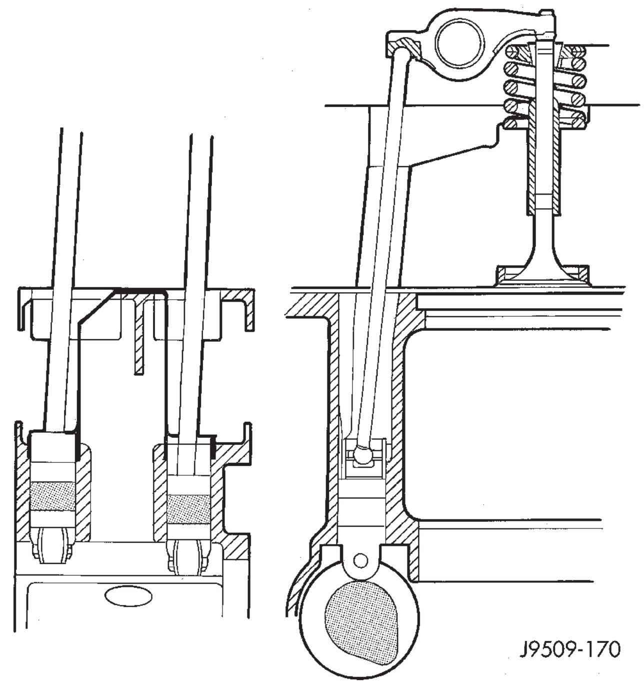


Fig. 34 Tappet and Rocker Arm Assembly

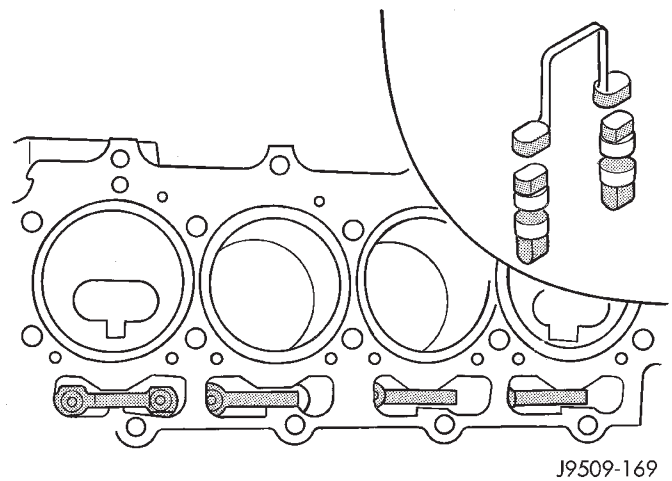


Fig. 35 Tappet and Yoke

CAUTION: The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body. It is advisable to work on one tappet at a time to avoid mixing of parts. Mixed parts are not compatible. DO NOT disassemble a tappet on a dirty work bench.

INSTALLATION

(1) Lubricate tappets.
(2) Install tappets and yoke retainers in their original positions. Ensure that the oil feed hole in the side of the tappet body faces up (away from the crankshaft).

REMOVAL AND INSTALLATION (Continued)

(3) Install cylinder head, intake manifold, and exhaust manifold. Refer to cylinder head installation in this section.

(4) Install push rods in original positions.

(5) Install rocker arms in original positions.

(6) Install cylinder head cover. Refer to cylinder valve cover installation in this section.

(7) Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

VIBRATION DAMPER

REMOVAL

(1) Disconnect the battery cable.

(2) Raise vehicle on hoist.

(3) Remove right side lower splash shield.

(4) Remove generator, power steering belt. Refer to Group 7, Cooling.

(5) Remove water pump belt. Refer to Group 7, Cooling.

(6) Remove engine starter. Refer to Group, 8B for procedure

(7) Install flywheel locking tool VM.1014 to prevent engine rotation.

NOTE: Crankshaft damper nut is left handed thread.

(8) Remove vibration damper nut.

(9) Remove vibration damper. No special tool is needed for removal.

CAUTION: If thread sealant is used it is important to remove all the old thread sealant from the threads on the crankshaft.

INSTALLATION

NOTE: Before installing damper be sure the O-ring inside the center of the damper is in its grove.

(1) Install vibration damper.

CAUTION: Correct torque on the vibration damper nut is important or engine damage can occur.

(2) Install vibration damper nut and tighten to 441 N·m (325 ft. lbs.).

(3) Remove flywheel locking tool, and install engine starter.

(4) Install both accessary drive belts. Refer to Group 7, Cooling.

(5) Install right splash shield.

(6) Lower vehicle.

(7) Connect the battery cable.

TIMING GEAR COVER OIL SEAL

REMOVAL

(1) Disconnect the battery cable.

(2) Remove vibration damper. Refer to vibration damper removal in this section.

(3) Pry out seal (Fig. 36).

INSTALLATION

Remove the oil seal ring. The seating diameter must be 68.000 - 68.030 mm.

(1) Install new seal using special tool VM-1015.

(2) Install vibration damper. Refer to vibration damper installation in this section.

(3) Connect the battery cable.

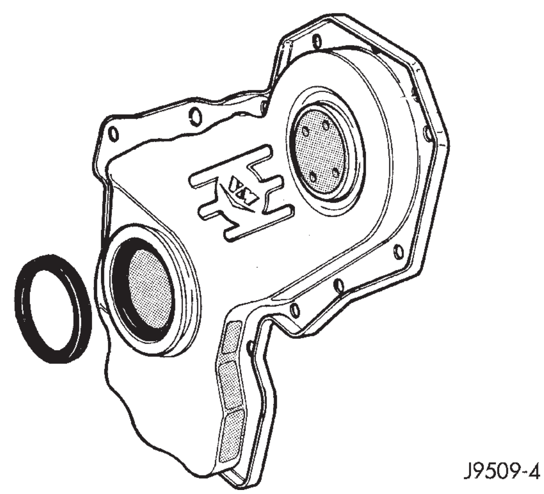


Fig. 36 Front Cover Seal

INJECTION PUMP

For removal and installation of injection pump refer to Group 14, Fuel.

TIMING GEAR COVER

REMOVAL

(1) Disconnect the battery cable.

(2) Raise vehicle on hoist.

(3) Remove right splash shield.

(4) Remove accessary drive belts. Refer to Group 7, Cooling.

(5) Remove vibration damper nut.

NOTE: Crankshaft damper nut is left handed thread.

(6) Remove vibration damper.

REMOVAL AND INSTALLATION (Continued)

(7) Remove power steering/air conditioning pulley nut. Remove pulley.

CAUTION: Remove old loctite from threads on pump.

(8) Remove pump shaft support bracket assembly.
(9) Disconnect the water drain pipe hose at the timing cover.

CAUTION: When separating the timing geat cover from the block take care not to damage the mating surface of the timing gear cover or block. Also take care not to damage the timing gears or components located inside the timing gear cover near the edge.

(10) Remove timing gear cover.

INSTALLATION

(1) Apply a continuous 3 mm bead of Silicone Sealer to timing cover, install within 10 minutes, tighten Torx bolts to 11 N·m (96 in. lbs) (Fig. 37).

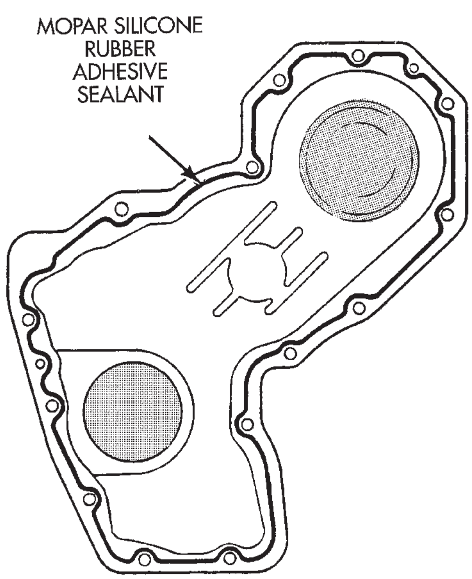


Fig. 37 Front Cover Sealer Location

(2) Install pump shaft support bracket assembly, tighten nuts to 24.5 N·m (216 in. lbs.).
(3) Install Power steering/air conditioning pulley, tighten to 170 N·m (125 ft. lbs.).

CAUTION: Correct torque on the power steering/air conditioning pulley nut is important or engine damage can occur.

(4) Connect water drain pipe hose at the timing cover.

NOTE: Before installing damper be sure O-ring on inside center of damper is in place.

(5) Install vibration damper.

CAUTION: Correct torque on the vibration damper nut is important or engine damage can occur.

(6) Tighten vibration damper nut to 441 N·m (325 ft. lbs.).
(7) Install accessary drive belts. Refer to Group 7, cooling for procedure.
(8) Install splash shield.
(9) Lower vehicle.
(10) Connect battery cable.

CAMSHAFT

REMOVAL

(1) To service the camshaft (Fig. 38) the engine must be removed from the vehicle.

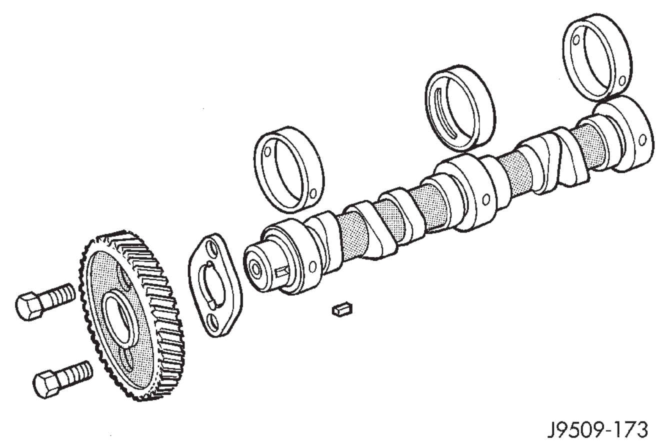


Fig. 38 Camshaft Assembly

(2) Remove valve cover. Refer to valve cover removal in this section.
(3) Remove rocker arms and push rods. Identify push rods to ensure installation in there original location.
(4) Remove cylinder head. Refer to cylinder head removal in this section.
(5) Remove hydraulic tappets. Refer to tappet removal in this section.
(6) Remove vibration damper. Refer to vibration damper removal in this section.
(7) Remove power steering pulley.
(8) Remove pump shaft support bracket.
(9) Remove timing gear cover. Refer to timing gear cover removal in this section.
(10) Remove camshaft.

REMOVAL AND INSTALLATION (Continued)

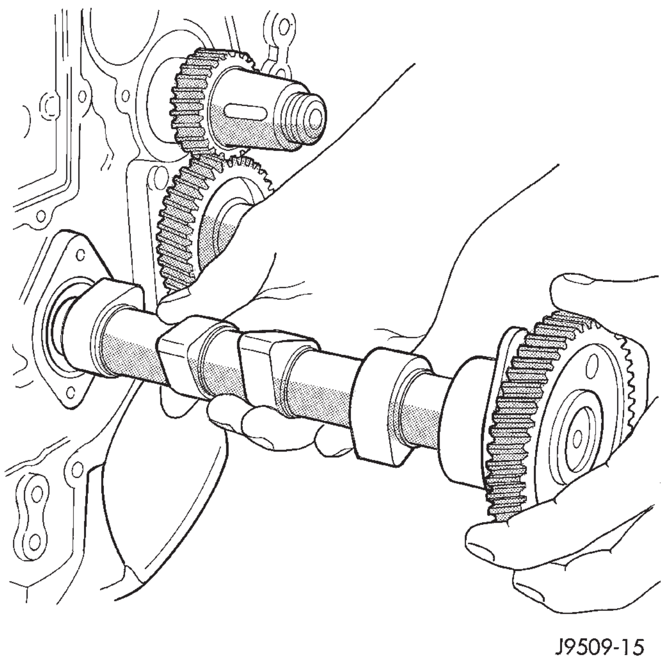


Fig. 39 Camshaft Removal

THRUST PLATE INSPECTION

Check the thickness (Fig. 40) of the plate at points a-b-c-d. If the measurement is not between 3.950 - 4.050 it must be changed.

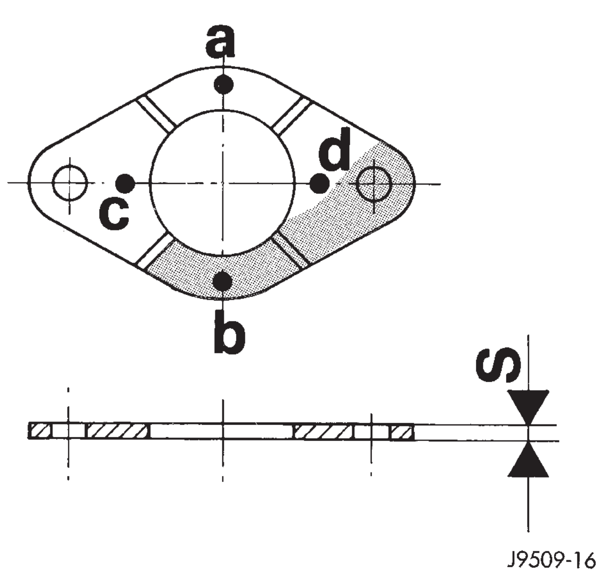


Fig. 40 Camshaft Thrust Plate

INSTALLATION

(1) Coat the camshaft journals with clean engine oil and carefully install the camshaft complete with thrust plate and gear. Tighten the retaining bolts to 24 N·m. Be sure to align the timing marks as shown.

(2) Install hydraulic tappets and retaining yokes.

(3) Install cylinder heads.

(4) Push rods, and rocker arm assemblies. In there original location.

(5) Install valve cover.

(6) Install Timing case cover.

(7) Install Vibration damper.

(8) Reinstall Engine.

CAMSHAFT BEARINGS

This procedure requires that the engine is removed from the vehicle.

REMOVAL

(1) With engine completely disassembled, drive out rear cam bearing core hole plug.

(2) Install proper size adapters and horseshoe washers (part of Camshaft Bearing Remover/Installer Tool) at back of each bearing shell. Drive out bearing shells.

INSTALLATION

(1) Install new camshaft bearings with Camshaft Bearing Remover/Installer Tool by sliding the new camshaft bearing shell over proper adapter.

(2) Position rear bearing in the tool. Install horseshoe lock and by reversing removal procedure, carefully drive bearing shell into place.

(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main bearing. If the camshaft bearing shell oil holes are not in exact alignment, remove and install them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

CRANKSHAFT MAIN BEARINGS

REMOVAL

(1) Disconnect battery cable.

(2) Remove engine from vehicle, refer to engine removal in this section.

(3) Install engine to engine stand.

(4) Remove accessary drive system.

(5) Remove cylinder head cover, refer to cylinder head cover removal in this section.

(6) Remove rocker arm and push rods, refer to rocker arm and push rod section in this section.

(7) Remove intake, exhaust manifold and turbocharger, refer to Group 11, Exhaust System and Intake Manifold.

(8) Remove water manifold.

(9) Remove oil feed lines to rocker arms.

(10) Remove cylinder heads.

(11) Remove oil pan and oil pick-up.

(12) Remove piston and connecting rods from crankshaft journals.

REMOVAL AND INSTALLATION (Continued)

(13) Remove pistons and connecting rods from block.

(14) Remove vibration damper. Refer to procedure in this section.

(15) Remove front cover. Refer to procedure in this section.

(16) Remove oil pump drive gear.

(17) Install special tool VM-1004 onto crankshaft over gear (Fig. 41).

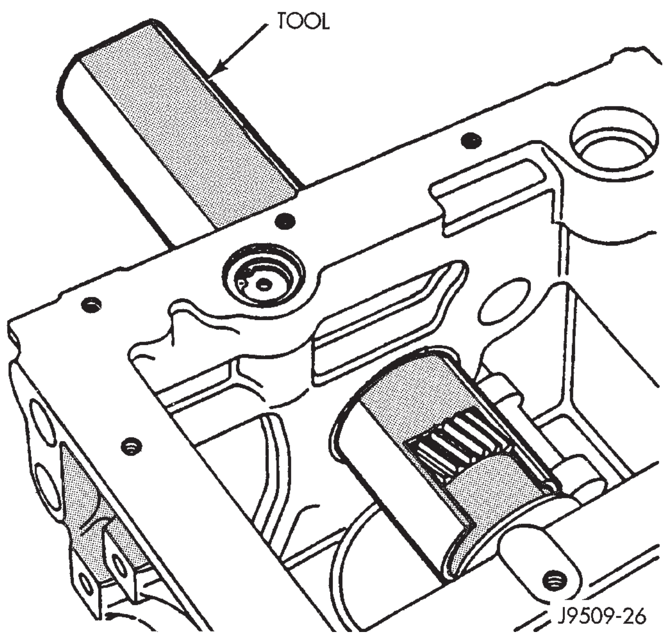


Fig. 41 Crankshaft Special Tool VM.1004

(18) Remove main bearing oil feed and carrier locators from block.

(19) Remove flywheel and adaptor plate from engine block.

(20) Remove thrust bearings from rear main bearing carrier (Fig. 42).

(21) Slide crankshaft and bearing carriers rearward to rear of block. If you encounter difficulty in removing the complete assembly as previously described, slide the assembly rearward sufficiently to gain access to the main bearing carrier bolts. Mark the carriers for assembly and remove the bolts, two for each carrier (Fig. 43).

(22) Separate the two halves of each carrier, remove from the crankshaft and temporarily re-assemble the carriers (Fig. 44). Withdraw the crankshaft through the rear of the crankcase.

INSTALLATION

NOTE: Assemble engine according to sequence described, thus saving time and preventing damages to engine components. Clean parts with a suitable solvent and dry them with compressed air before assembly. Use new gaskets where applicable and torque wrenches for correct tightening of components.

(1) Thoroughly clean crankcase and oil passages, and blow dry with compressed air.

(2) Install new main bearing shells in each of the carrier halves. Assemble the carriers to the crankshaft journals, ensuring that the carriers are installed in their original locations. Secure each carrier with the two bolts tightening evenly to 42 N·m (31 ft. lbs.) (Fig. 44).

(3) Slide special tool (VM-1002) over the crankshaft gear and, insert the crankshaft and carrier assembly into the crankcase in the same manner used for removal.

(4) Align the holes in the lower carriers, with the center of the crankcase webs (Fig. 45).

(5) Secure each carrier assembly to the crankcase with the main bearing oil feed and carrier locators and tighten them to 54 N·m (40 ft. lbs).

(6) Install rear main bearing carrier onto crankshaft ensuring arrow on bearing carrier aligns with vertical web in center of crankcase.

(7) Install rear oil seal.

(8) Install new O-rings in adaptor plate.

(9) Install adaptor plate and tighten bolts to 47 N·m (35 ft. lbs.).

(10) Install bolts to main bearing carrier and tighten to 26.5 N·m (20 ft. lbs.).

(11) Position flywheel and O-ring on crankshaft and align bolt holes.

NOTE: For purposes of checking crankshaft end play used flywheel bolts may be used. Final assembly requires new flywheel bolts.

(12) Install 2 flywheel bolts, 180° apart, and tighten bolts to 20 N·m plus 60° (15 ft. lbs.) plus 60°.

(13) Attach dial indicator to engine block.

(14) Move crankshaft toward front of engine and zero indicator.

(15) Move crankshaft toward the rear of engine and record measurement.

(16) Subtract specified crankshaft end play from figure obtained. Crankshaft end play 0.08 to 0.21 mm (0.0032 to 0.0083 in.).

(17) Select thrust washers which will give correct end play.

(18) Remove tools and flywheel.

(19) Lubricate thrust washer halves and fit them into the rear main bearing carrier.

(20) To verify correct end play, install 2 flywheel bolts 180° apart, and tighten bolts to 20 N·m plus 60° (15 ft. lbs. plus 60°).

(21) Measure crankshaft end play with a dial gauge. Crankshaft end play should not exceed 0.08-

REMOVAL AND INSTALLATION (Continued)

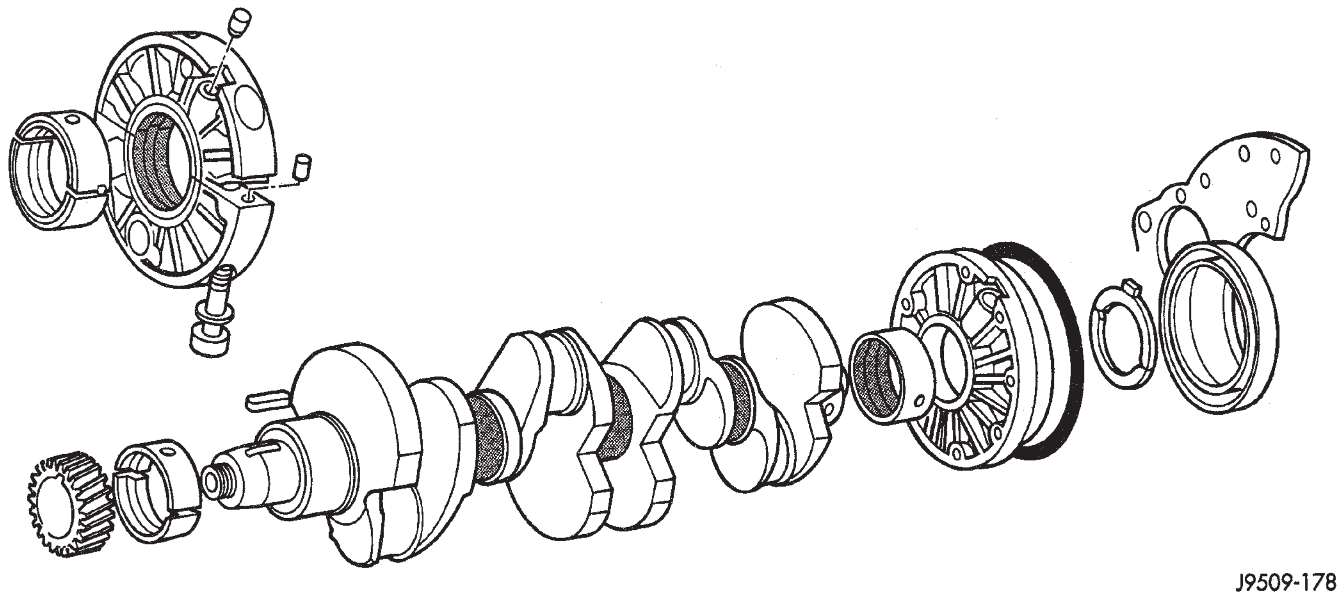


Fig. 42 Crankshaft and Bearings

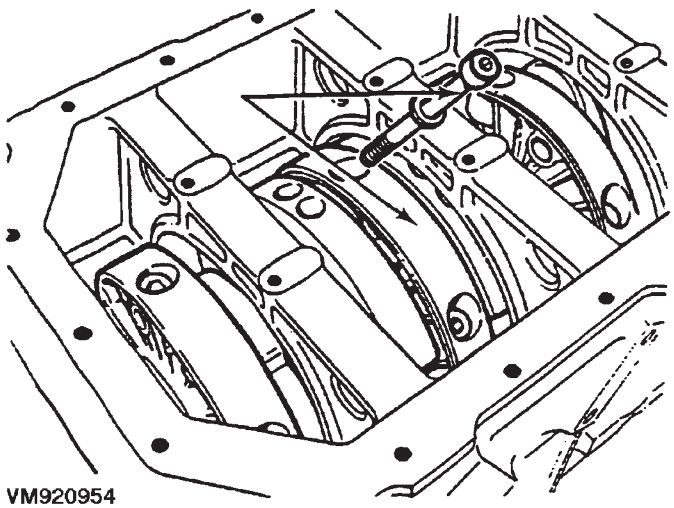


Fig. 43 Carrier Bolts

0.21 mm (0.0032 to 0.0083 in.) (Fig. 46). If end clearance exceeds these values install oversize thrust washer.

CAUTION: Use NEW flywheel bolt for the following procedure.

(22) Install new O-ring on flywheel. Install flywheel. The 6 flywheel bolts must be tightened as follows:

a. Torque the 6 flywheel bolts to 60 N·m (44 ft. lbs.).

b. Loosen 2 of the 6 bolts, 180° apart. Torque the 2 bolts to 20 N·m (180 in. lbs.). Then using a torque angle gauge rotate the 2 bolts 65° additional.

c. Loosen the next 2 bolts, 180° apart and follow the same procedure.

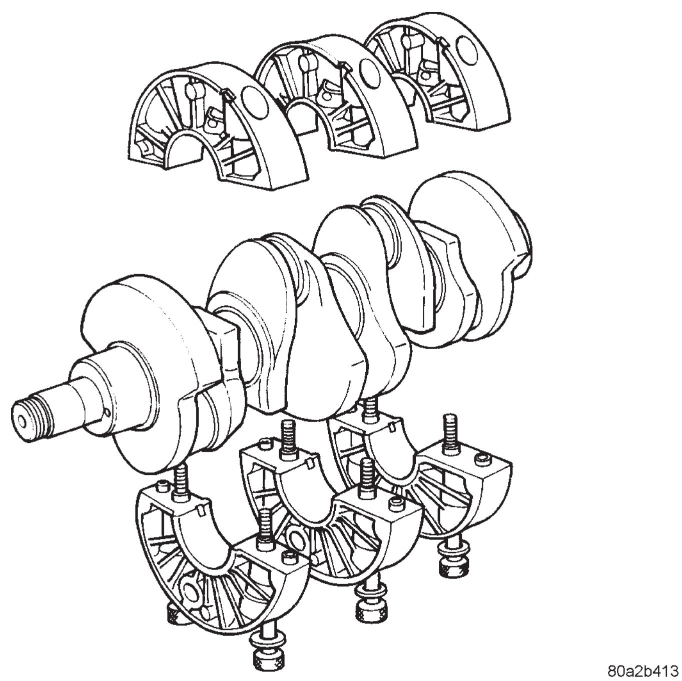


Fig. 44 Crankshaft and Carrier Bearing Assembly

d. Loosen the last 2 bolts, 180° apart and follow the same procedure.

(23) Install Transmission. Refer to procedure in Group 21, Transmission.

(24) Install pistons and connecting rod assemblies, refer to piston and connecting rods in this section.

(25) Install oil pick up tube and tighten bolts to 25 N·m (18 ft. lbs.).

(26) Install oil pan, refer to oil pan installation in this section.

(27) Install vacuum pump. Tighten retaining screws to 20 N·m (15 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

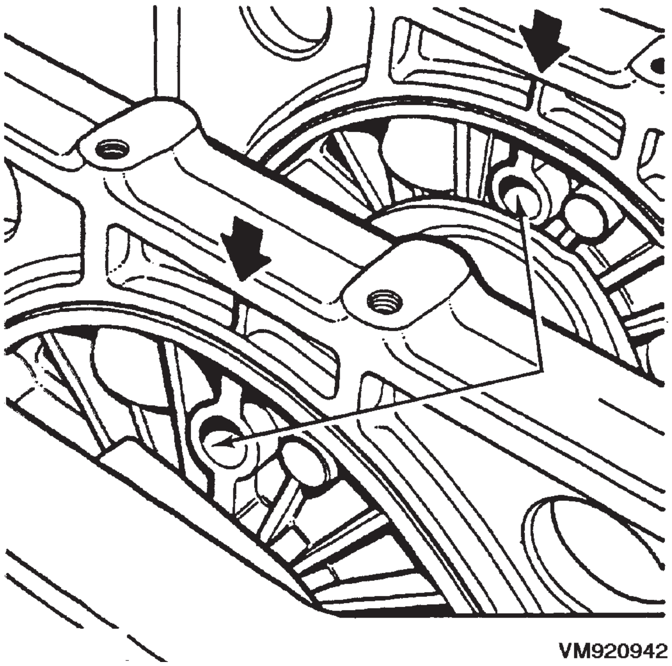


Fig. 45 Main Bearing Carrier Alignment

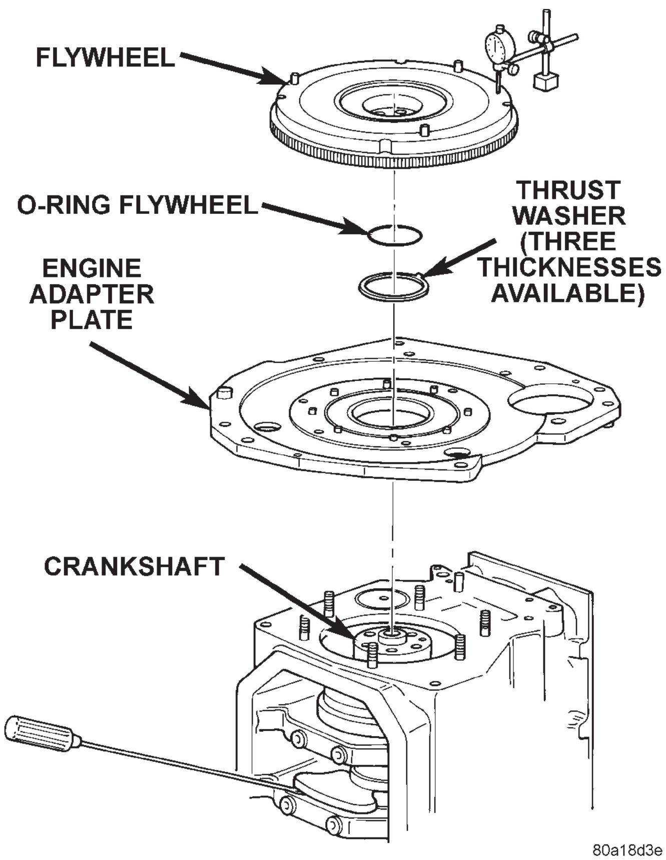


Fig. 46 Measuring Crankshaft End Play

CAUTION: The vacuum pump must be centered in the block and tighten with two bolts. Ensure that the pump spins freely. If vacuum pump drags or does not spin freely loosen bolts and perform procedures again.

(28) Before installing oil pump check pump bore depth in block (A) and pump body height (B) (Fig. 47). Difference between A and B should be 0.020-0.082 mm (.0007 to 0032 in.).

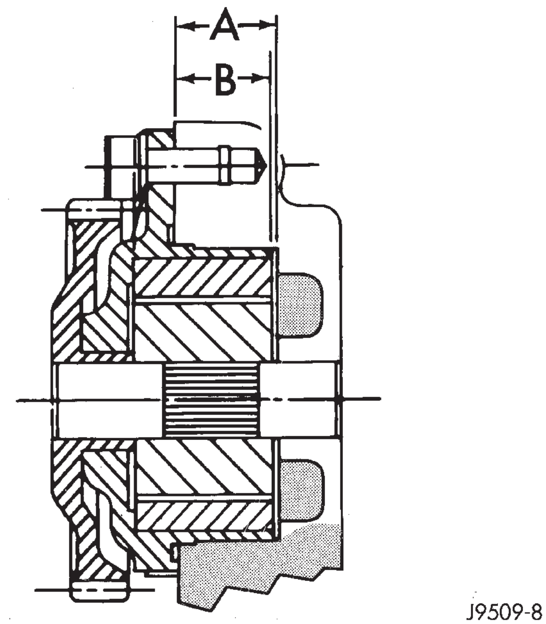


Fig. 47 Oil Pump Bore Depth

(29) Install oil pump and tighten retaining screws to 27 N·m (20 ft. lbs.). Check for normal backlash between pump and crankshaft gears.

(30) Install oil pump drive Gear.

(31) Install front cover. Refer to procedure in this section.

(32) Install vibration damper. Refer to procedure in this section.

(33) Install cylinder heads. Refer to procedure in this section.

(34) Install rocker arms and push rods. Refer to procedure in this section.

(35) Install cylinder head cover. Refer to procedure in this section.

(36) Install accessary drive system.

(37) Install engine in vehicle. Refer to procedure in this section.

(38) Fill engine with the correct amount of fluids specified.

(39) Connect battery cable.

OIL PAN

REMOVAL

(1) Disconnect battery cable.

(2) Raise vehicle on hoist.

REMOVAL AND INSTALLATION (Continued)

(3) Drain oil.
(4) Remove oil pan bolts (Fig. 48).
(5) Remove oil pan.

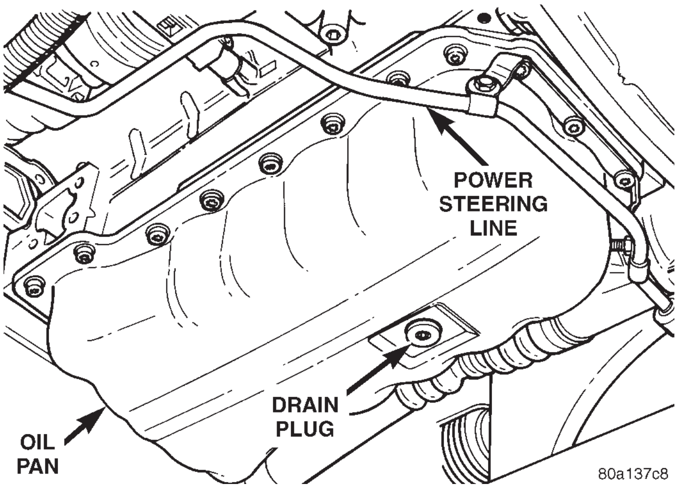


Fig. 48 Oil Pan

INSTALLATION

(1) Install oil pan. Apply a continuous 3 mm bead of Silicone Sealer to oil pan, install within 10 minutes.
(2) Install oil pan bolts and torque bolts to 11 N·m (8 ft. lbs.).
(3) Install oil drain plug tighten to 79 N·m (58 ft. lbs).
(4) Lower vehicle.
(5) Fill engine with proper amount of oil.
(6) Connect battery cable.

OIL PUMP

REMOVAL

(1) Raise vehicle on hoist.
(2) Remove right splash shield.
(3) Remove both accessory drive belts. Refer to Group 7, Cooling.
(4) Remove pump shaft support bracket assembly.
(5) Remove vibration damper. Refer to Vibration Damper Removal in this section.

NOTE: Crankshaft damper nut is left handed thread.

(6) Remove front cover. Refer to Timing Gear Cover Removal in this section.
(7) Remove oil pump.

INSTALLATION

(1) Install new O-ring and lubricate with clean engine oil.
(2) Install oil pump and tighten retaining screws to 27.5 N·m (240 in. lbs.).

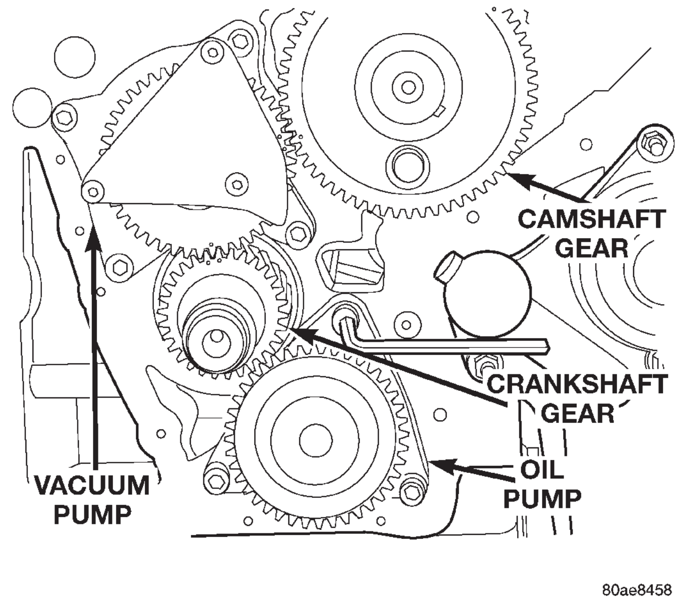


Fig. 49 Oil Pump Drive Gear

(3) Install front cover. Refer to Timing Gear Cover Installation in this section.
(4) Install pump shaft support bracket assembly.

CAUTION: Correct torque on the vibration damper nut is important or engine damage can occur.

(5) Install vibration damper. Torque nut to 441 N·m (325 ft. lbs.)
(6) Install both accessory drive belts. Refer to Group 7, Cooling.
(7) Install right splash shield.

OIL PUMP PRESSURE RELIEF VALVE

REMOVAL

(1) Remove oil pan.
(2) Remove clip retaining relief valve.
(3) Remove relief valve cap, spring, and plunger (Fig. 50).
(4) Check relief valve spring length. Relief valve spring free length is 57.5mm (2.263 in.). If spring length is less or spring is distorted it must be replaced.
(5) Check plunger for scoring, replace if necessary.

INSTALLATION

(1) Thoroughly clean all components and relief valve pocket in cylinder block.
(2) Fit plunger, spring and cap into block.
(3) Compress spring and install retaining clip. Ensure clip is completely seated in groove.

REMOVAL AND INSTALLATION (Continued)

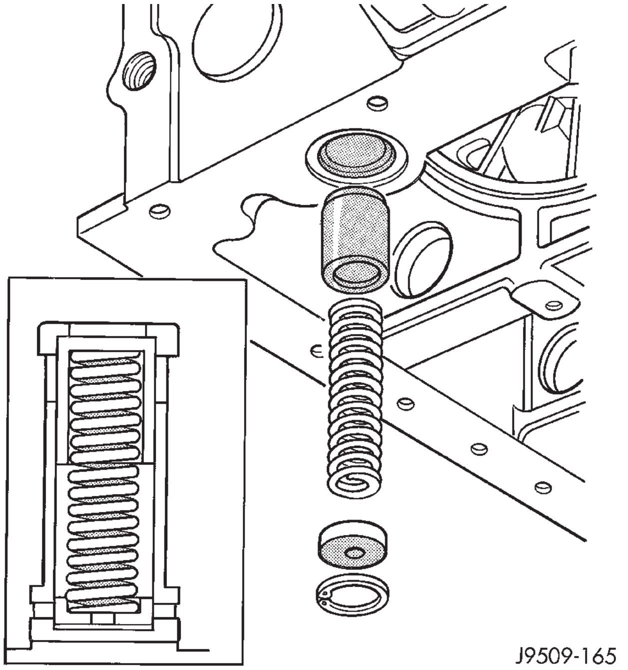


Fig. 50 Oil Pressure Relief Valve

OIL FILTER ADAPTER AND OIL COOLER

REMOVAL

(1) Remove oil filter.

(2) Remove oil cooler adapter bolt.

(3) Remove oil cooler (Fig. 51).

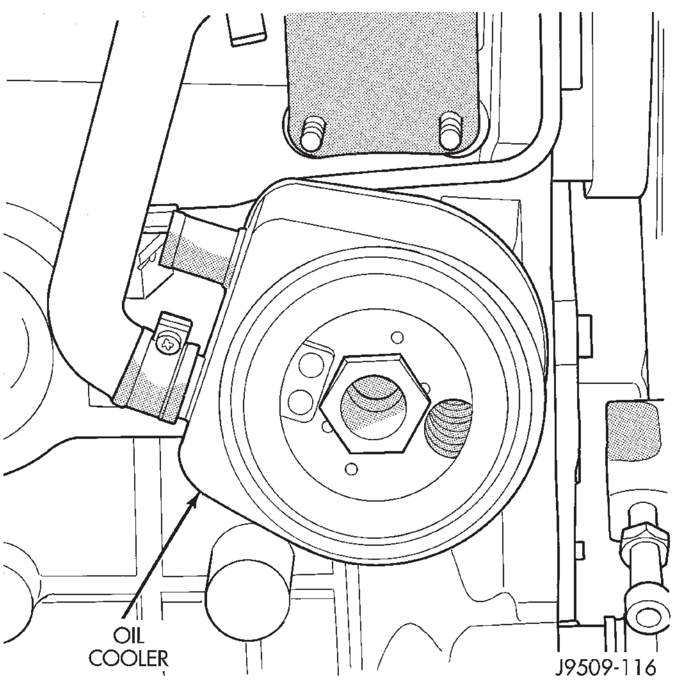


Fig. 51 Oil Cooler

INSTALLATION

(1) Install oil cooler with new gasket, tighten oil cooler adapter bolt to 60 N·m (44 ft. lbs.).

(2) Install oil filter adapter to oil cooler and tighten to 49 N·m (36. lbs.).

(3) Install oil filter and tighten to 9.8 N·m (85 in. lbs.) and add oil.

VACUUM PUMP

REMOVAL

(1) Remove the front cover refer to front cover removal in this section.

(2) Remove 4 bolts.

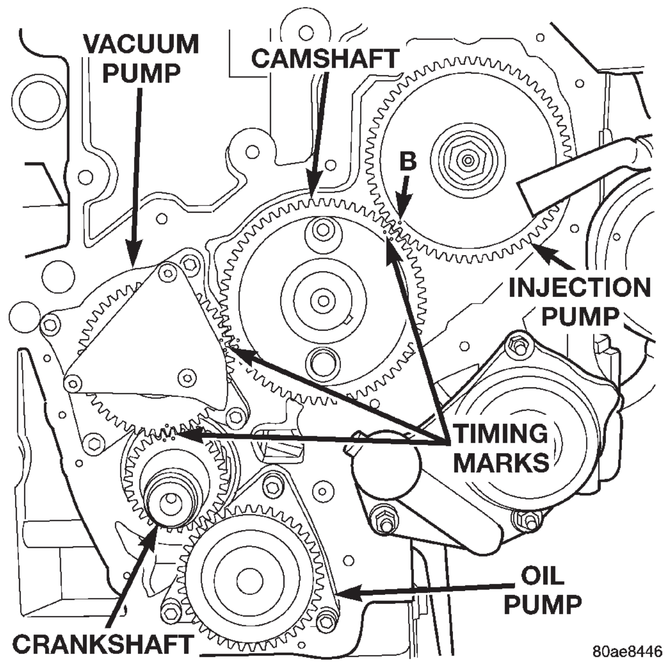


Fig. 52 Vacuum Pump

(3) Remove vacuum pump.

INSTALLATION

(1) To install the vacuum pump, align the outer part of the gear with the inner part using a screw-driver or similar tool, align with timing marks on gear set and install.

(2) Install bolts and tighten to 20 N·m (15 ft. lbs.).

(3) Install front cover.

PISTONS AND CONNECTING ROD

REMOVAL

(1) Disconnect the battery cable.

(2) Remove cylinder heads, refer to cylinder head removal in this section.

(3) Raise vehicle on host.

(4) Remove oil pan, refer to oil pan removal in this section.

(5) Remove top carbon ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons**

REMOVAL AND INSTALLATION (Continued)

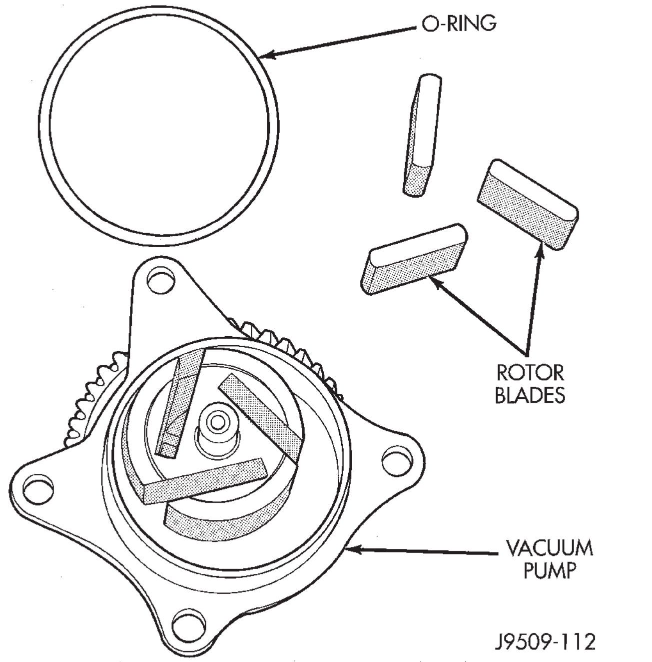


Fig. 53 Vacuum Pump Parts

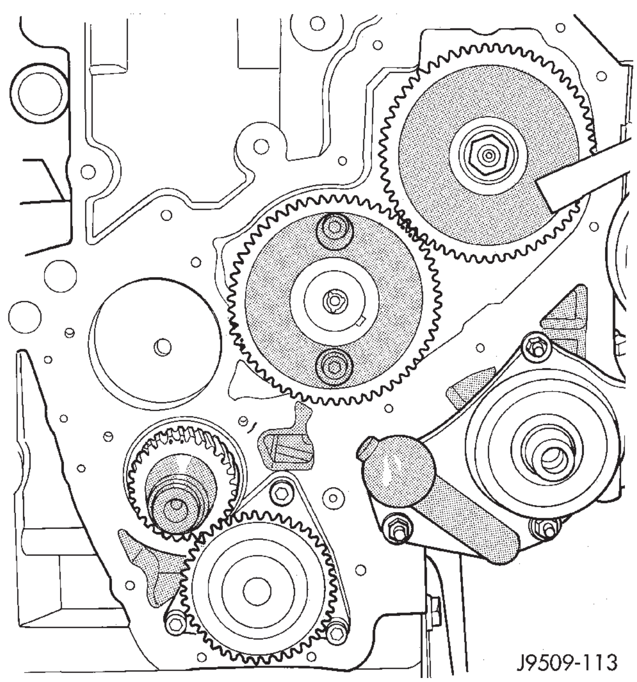


Fig. 54 Vacuum Pump Mounting Hole

covered during this operation. Mark piston with matching cylinder number.

(6) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(7) Remove connecting rod cap. Push each piston and rod assembly out of cylinder bore.

CAUTION: During piston and rod removal. DO NOT rotate piston and connecting rod or damage to the

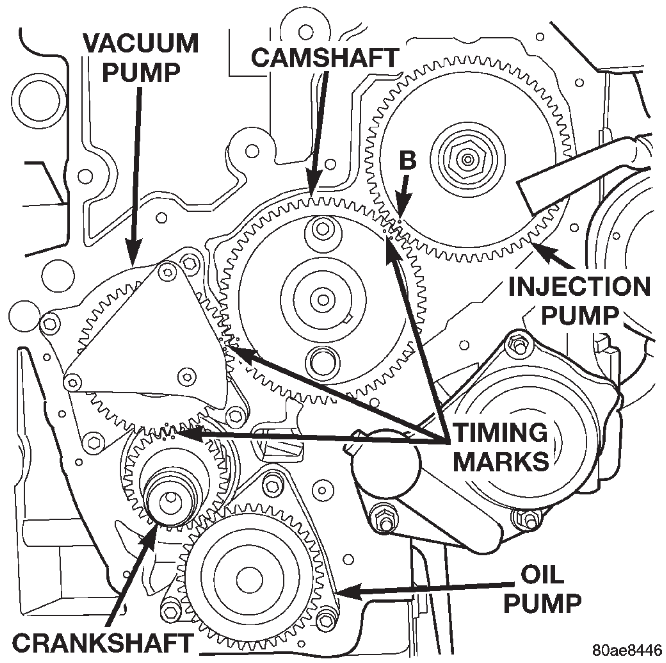


Fig. 55 Timing Marks

oil jets extending out into the cylinder bore will occur (Fig. 56).

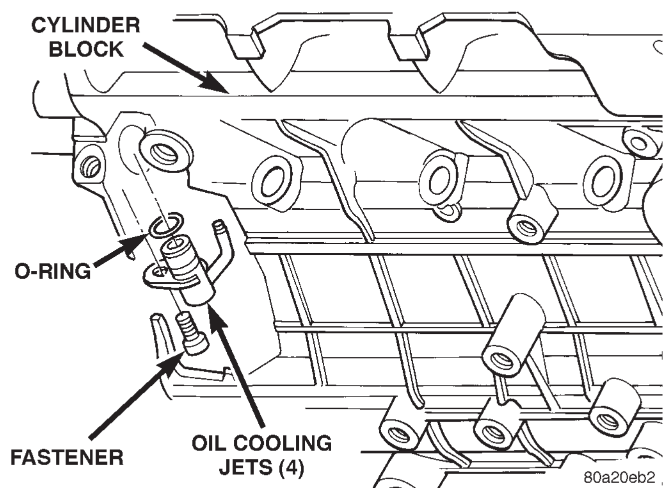


Fig. 56 Oil Jets

NOTE: Be careful not to nick crankshaft journals.

(8) After removal, install bearing cap on the mating rod.

PISTON PIN—REMOVAL

(1) Secure connecting rod in a soft jawed vice.

(2) Remove 2 clips securing piston pin (Fig. 57).

(3) Push piston pin out of piston and connecting rod.

REMOVAL AND INSTALLATION (Continued)

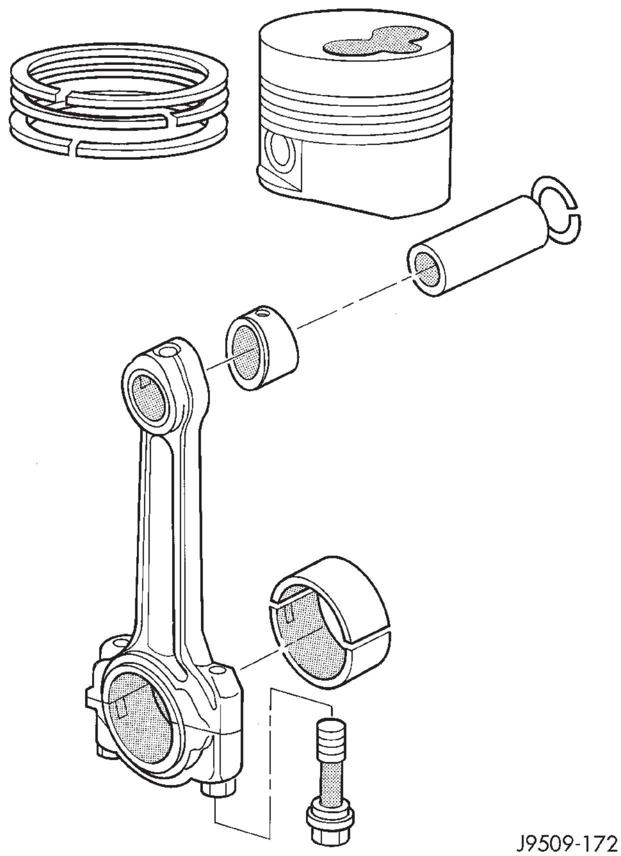


Fig. 57 Piston Assembly

PISTON RING—REMOVAL

(1) Identification (ID) mark on face of upper and intermediate piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 58).

(3) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

(4) Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.

FITTING PISTON RINGS

(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 in.) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 59). Top compression ring gap .25 to .50 mm (.0098 to .0196 in.). Second compression ring gap .25 to .35 mm (.0098 to .0137 in.). Oil control ring gap .25 to .58 mm (.0098 to .0228 in.).

(2) If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

(3) Check piston ring to groove clearance (Fig. 60). Top compression ring gap .08 to .130 mm (.0031 to .0051 in.). Second compression ring gap .070 to .102 mm (.0027 to .0040 in.). Oil control ring gap .040 to .072 mm (.0015 to .0028 in.).

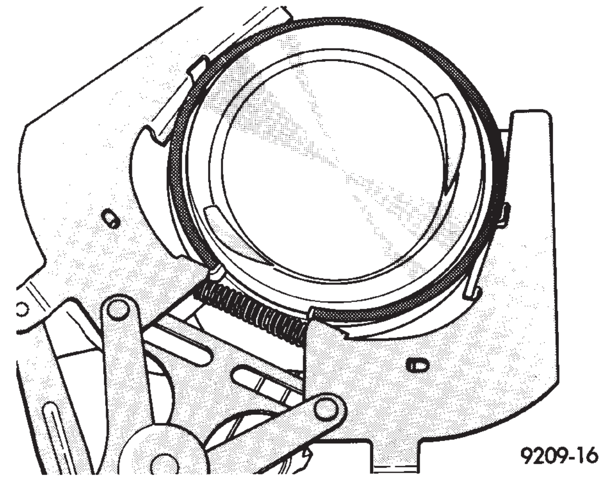


Fig. 58 Piston Rings—Removing and Installing

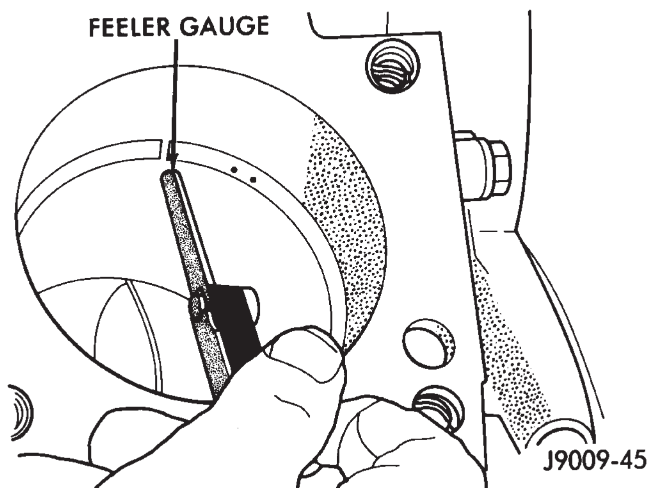


Fig. 59 Ring Gap Measurement

PISTON RINGS—INSTALLATION

(1) Install rings on the pistons using a suitable ring expander (Fig. 58).

(2) Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring (Fig. 61). Ring gaps must be positioned, before inserting piston into the liners, as follows (Fig. 62).

(3) Top ring gap must be positioned at 30 degrees to the right of the combustion chamber recess (looking at the piston crown from above).

(4) Second piston ring gap should be positioned on the opposite side of the combustion chamber recess.

(5) Oil control ring gap to be located 30 degrees to the left of combustion chamber recess.

(6) When assembling pistons check that components are installed in the same position as before dis-

REMOVAL AND INSTALLATION (Continued)

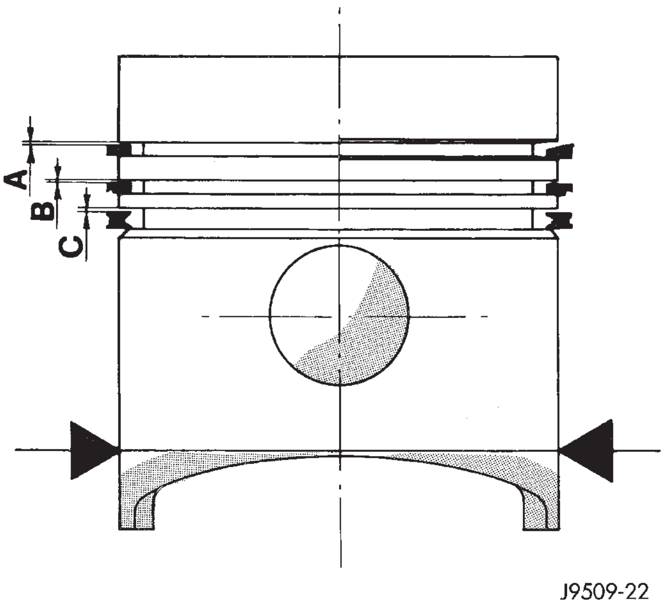


Fig. 60 Piston Ring Side Clearance

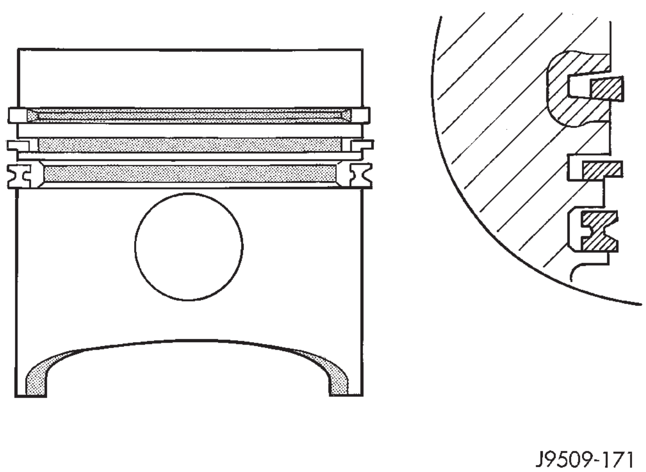


Fig. 61 Piston Ring Identification

assembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face chamber recess side of piston towards camshaft**. Therefore, the numbers stamped on con rod big end should also face in the same direction. To insert piston into cylinder, use a ring compressor as shown in (Fig. 63).

PISTON PIN—INSTALLATION

(1) Secure connecting rod in soft jawed vice.
(2) Lubricate piston pin and piston with clean oil.
(3) Position piston on connecting rod.

CAUTION: Ensure combustion recess in piston crown and the bearing cap numbers on the connecting rod are on the same side.

(4) Install piston pin.
(5) Install clips in piston to retain piston pin.
(6) Remove connecting rod from vice.

PISTON—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 (Fig. 62).

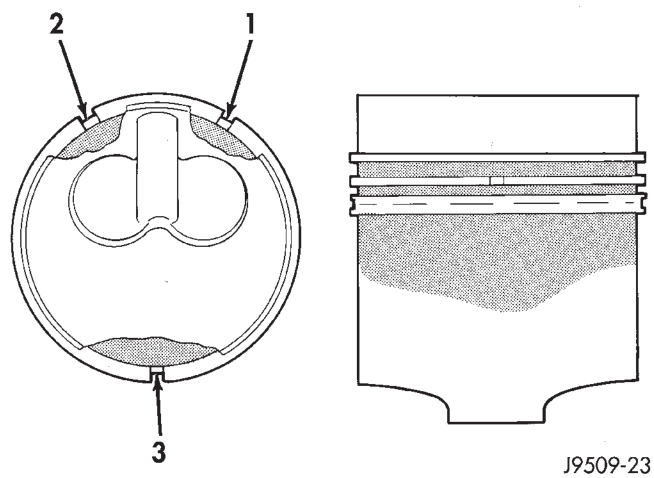


Fig. 62 Piston Ring Gap Location

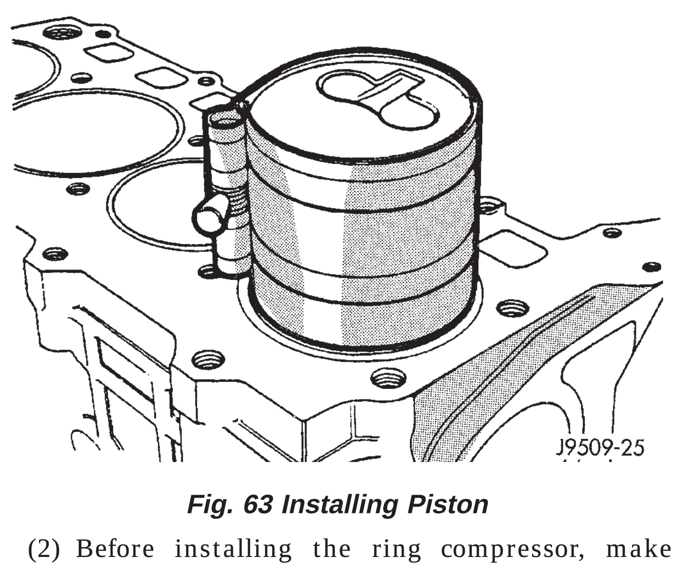


Fig. 63 Installing Piston

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 62).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten with the special wrench (Fig. 63). **Ensure position of rings does not change during this operation**.

REMOVAL AND INSTALLATION (Continued)

(4) Face chamber recess side of piston towards camshaft.

(5) Install connecting rod bolt protectors on rod bolts.

(6) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

CAUTION: During piston and rod installation. DO NOT rotate piston and connecting rod or damage to the oil jets extending out into the cylinder bore will occur (Fig. 56).

(7) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

(8) Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 29.5 N·m (22 ft. lb.) plus 60°.

CYLINDER LINER

REMOVAL

(1) Remove cylinder heads (refer to cylinder head removal in this section).

(2) Remove Oil pan (refer to oil pan removal in this section).

(3) Remove pistons (refer to piston removal in this section).

(4) Use tool VM-1001 to remove liners (Fig. 64).

(5) Remove shims from cylinder liner or cylinder block recess. Keep shims with each cylinder liner.

INSTALLATION

(1) Carefully clean residual **sealer** from liner and crankcase, and degrease the crankcase where it comes into contact with the liners. Referring to (Fig. 65), install the liners in the crankcase as shown (A), rotating them back and forth by 45° in order to guarantee correct positioning.

(2) Measure the liner recess relative to block deck with a dial indicator mounted on a special tool VM-1010 A. **All the measurements must be taken on camshaft side**. Zero dial gauge on block deck.

(3) Move dial gauge to cylinder liner record reading on dial gauge.

(4) Remove liner and special tool.

(5) Then select the correct shim thickness to give proper protrusion (0.01 - 0.06 mm).

(6) Fit the shim and the O-rings onto the liner.

(7) Lubricate the lower liner location in the block. Apply LOCTITE 275 to the corner of the liner seat. Apply LOCTITE 275 uniformly to the upper part of the liner at area.

(8) Fit the liners in the crankcase making sure that the shim is positioned correctly in the seat. Lock the liners in position using special tool (VM-1016) and bolts (Fig. 66). Clean the residual LOCTITE on the upper surface of the block deck.

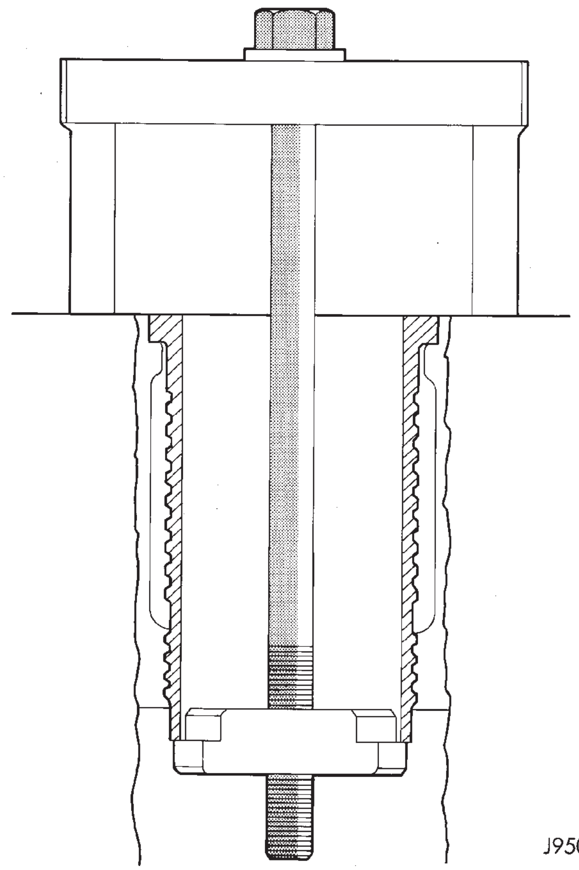


Fig. 64 Cylinder Liner—Removal

(9) Recheck the liner protrusion. It should be 0.01 - 0.06 mm.

NOTE: A period of six hours must elapse between the liners being installed and engine start-up. If engine assembly is not continued after liner installation, the liners need to be clamped for twelve hours minimum.

(10) Refer to Cylinder Head Removal and Installation procedure in this section. To measure piston protrusion for installation of proper head gasket thickness.

CRANKSHAFT—REMOVAL

Refer to CRANKSHAFT MAIN BEARING REMOVAL in this section.

REAR CRANKSHAFT OIL SEAL

REMOVAL

(1) Remove transmission. Refer to Group 21, Transmission for removal procedure.

(2) Remove flywheel.

REMOVAL AND INSTALLATION (Continued)

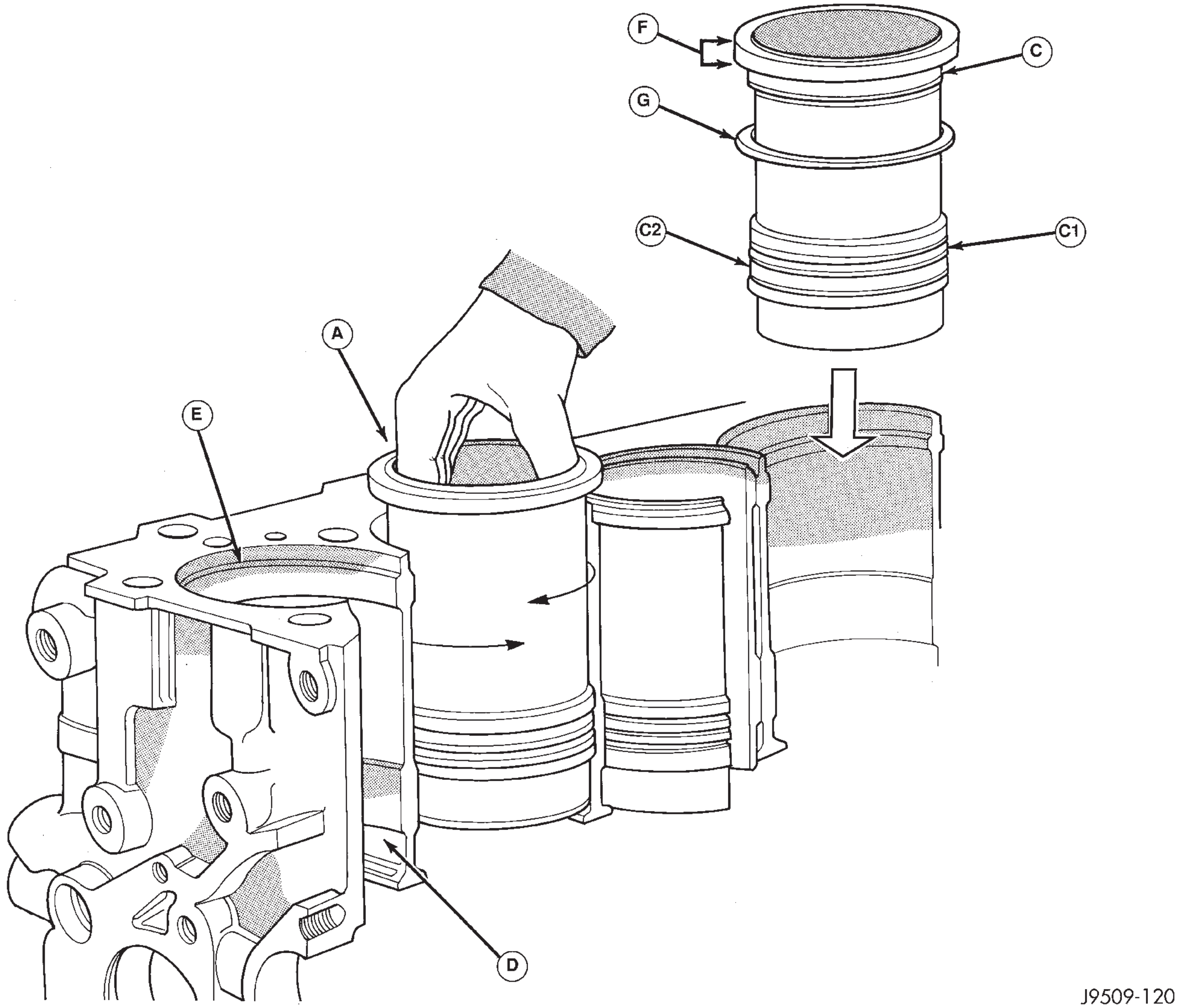


Fig. 65 Cylinder Liner—Installation

NOTE: Inspect O-ring in flywheel (Fig. 67).

(3) Remove rear crankshaft oil seal from retainer (Fig. 68).

CAUTION: When removing seal from retainer take care not to damage retainer.

INSTALLATION

(1) Install crankshaft oil seal.

CAUTION: Use NEW flywheel bolt for the following procedure.

(2) Install new O-ring on flywheel. Install flywheel. The 6 flywheel bolts must be tightened as follows:

a. Torque the 6 flywheel bolts to 60 N·m (44 ft. lbs.).

b. Loosen 2 of the 6 bolts, 180° apart. Torque the 2 bolts to 20 N·m (180 in. lbs.). Then using a torque angle gauge rotate the 2 bolts 65° additional.

c. Loosen the next 2 bolts, 180° apart and follow the same procedure.

d. Loosen the last 2 bolts, 180° apart and follow the same procedure.

(3) Install Transmission. Refer to procedure in Group 21, Transmission.

DISASSEMBLY AND ASSEMBLY

HYDRAULIC TAPPETS

DISASSEMBLE AND ASSEMBLE

(1) Pry out plunger retainer spring clip.

(2) Clean varnish deposits from inside of tappet body above plunger cap.

(3) Invert tappet body and remove plunger cap, plunger, check valve, check valve spring, check valve

DISASSEMBLY AND ASSEMBLY (Continued)

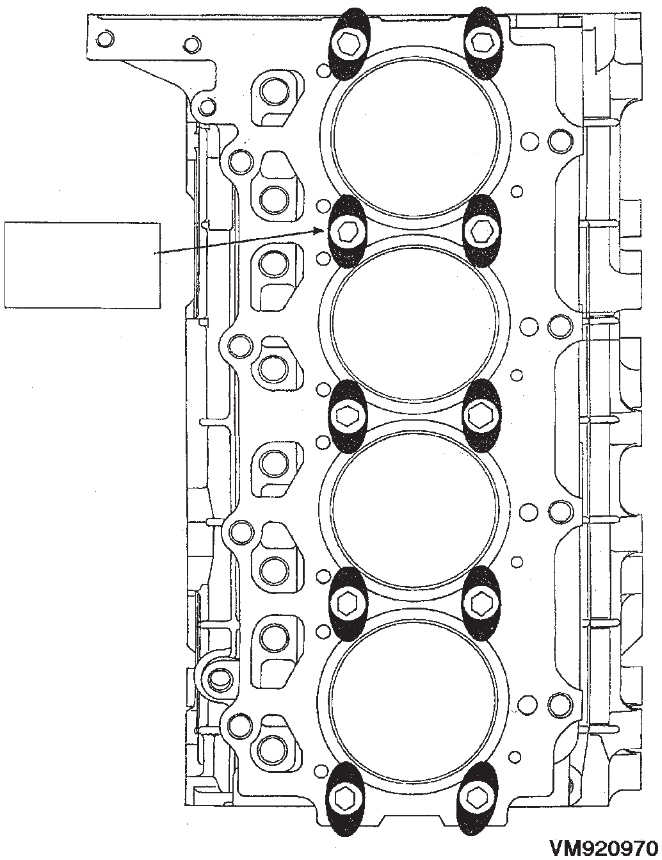


Fig. 66 Liner Clamp Location

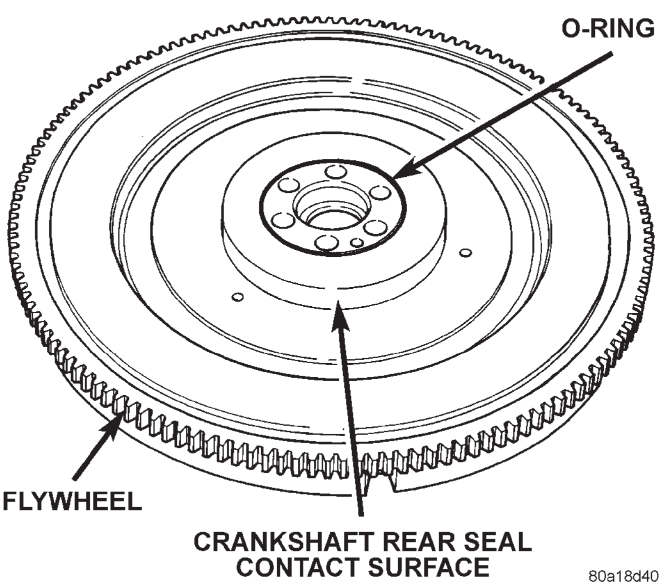


Fig. 67 Flywheel

retainer and plunger spring. Check valve could be flat or ball.

Assemble tappets in reverse order.

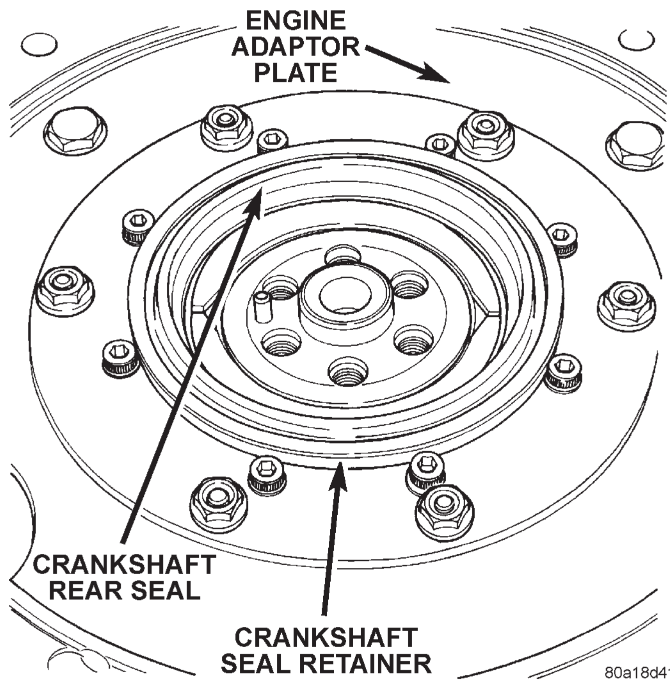


Fig. 68 Crankshaft Seal

CLEANING AND INSPECTION

CYLINDER HEAD COVERS

Remove any original sealer from the cover sealing surface of the engine cylinder head.

Remove all residue from the sealing surface using a clean, dry cloth.

ROCKER ARMS AND PUSH RODS

CLEANING

Clean all the components (Fig. 69) 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.

CLEANING AND INSPECTION (Continued)

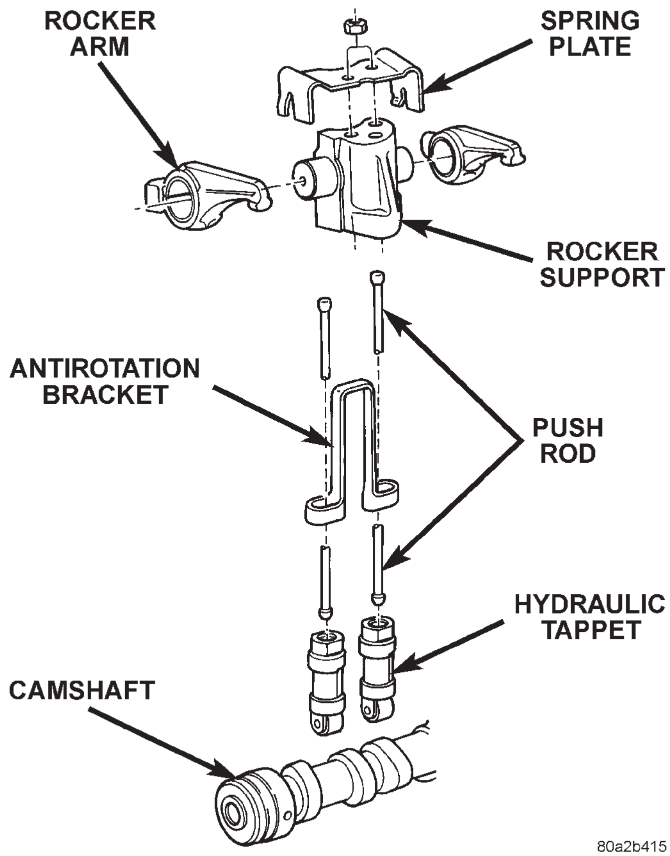


Fig. 69 Rocker Arm Components

CYLINDER HEAD

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and 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. 70).

Minimum cylinder head thickness 89.95mm (3.541 in.)

CAUTION: If only one cylinder head is found to be distorted and requires machining, it will also be necessary to machine the remaining cylinders heads and end plates by a corresponding amount to maintain correct cylinder alignment.

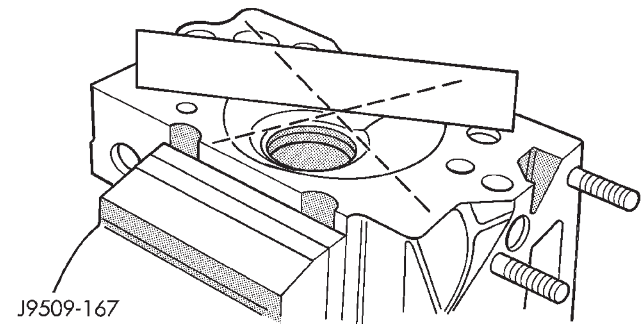


Fig. 70 Checking Cylinder Head Flatness

VALVE GUIDE HEIGHT

(1) Valve Guides height requirement.

(2) Measurement A (Fig. 71): 13.50 - 14.00 mm.

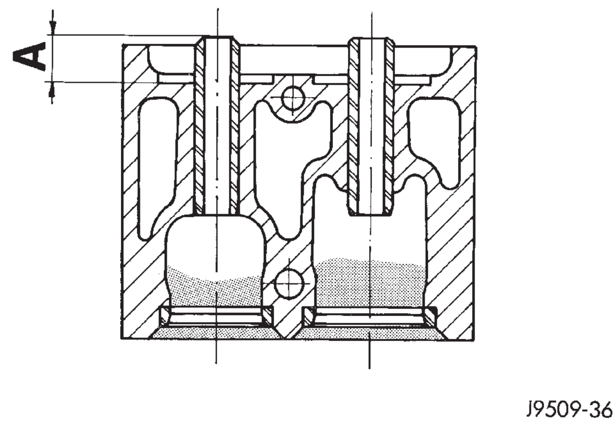


Fig. 71 Valve Guide Height

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

(1) Measure and record internal diameter of valve guides. Valve guide internal diameter is 8.0 to 8.015 mm (.3149 to .3155 in.).

(2) Measure valve stems and record diameters. Intake valve stem diameter 7.94 to 7.96 mm (.3125 to .3133 in). Exhaust valve stem diameter 7.92 to 7.94 mm (.3118 to .31215 in).

(3) Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is .040 to .075 mm (.0015 to .0029 in). Clearance of exhaust valve stem in valve guide is .060 to .095 mm (.0023 to .0037 in).

(4) If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

TIMING GEAR COVER

Be sure mating surfaces of timing gear cover and cylinder block are clean and free from burrs.

CLEANING AND INSPECTION (Continued)

VALVES AND VALVE SPRINGS

VALVE CLEANING

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and heads.

Clean all grime and gasket material from the engine cylinder head machined gasket surfaces.

INSPECTION

Inspect for cracks in the combustion chambers and valve ports.

Inspect for cracks on the exhaust seat.

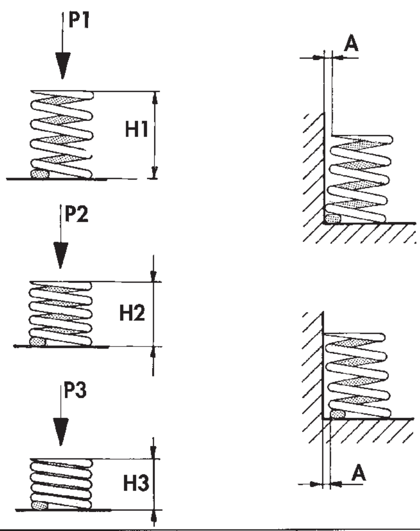
Inspect for cracks in the gasket surface at each coolant passage.

Inspect valves for burned, cracked or warped heads.

Inspect for scuffed or bent valve stems.

Replace valves displaying any damage.

Check valve spring height. (Fig. 72).



LOAD Kg		HEIGHT mm		STATE
P1	0.00	H1	44.65	FREE LENGTH
P2	33-35	H2	38.60	VALVE CLOSED
P3	90-95	H3	28.20	VALVE OPEN

J9509-38

Fig. 72 Valve Spring Chart

HYDRAULIC TAPPETS

(1) Clean all tappet parts in a solvent that will remove all varnish and carbon.

(2) Replace tappets that are unfit for further service with new assemblies.

(3) If plunger shows signs of scoring or wear, install a new tappet assembly. If valve is pitted, or valve seat on end of plunger is prevented from seating, install a new tappet assembly.

OIL PUMP

CLEANING

Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 74).

INSPECTION

(1) Before installing oil pump check pump bore depth in block (A) and pump body height (B) (Fig. 73). Difference between A and B should be 0.020-0.082 mm.

(2) Check clearance between rotors (Fig. 75).

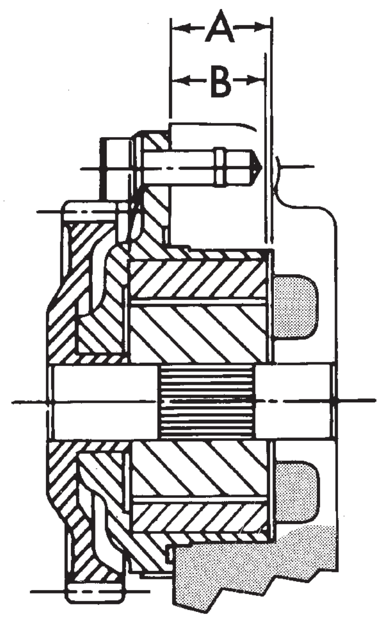


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Fig. 73 Oil Pump Bore Depth

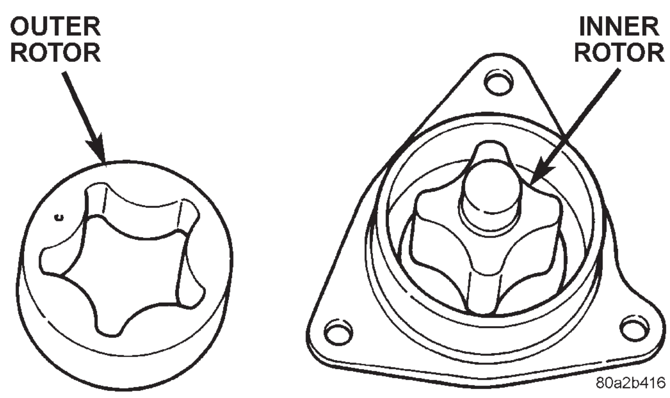


Fig. 74 Oil Pump Inner and Outer Rotors

PISTON AND CONNECTING ROD

PISTONS

(1) Piston Diameter: Size Group A: 91.93-91.94mm (3.6191-3.6196 in.) Size Group B: 91.94-91.95mm

CLEANING AND INSPECTION (Continued)

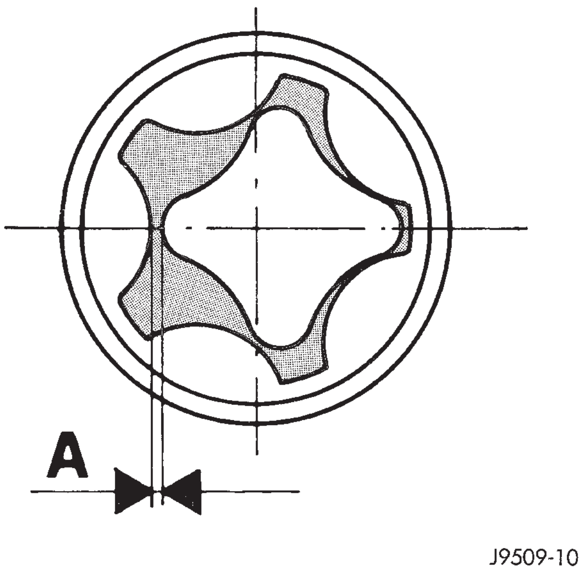


Fig. 75 Checking Rotor Clearance

(3.6196-3.6200 in.). Maximum wear limit .05mm (.0019 in.).

(2) Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .05mm (.0019in.).

(3) The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.

(4) Skirt wear should not exceed 0.1 mm (.00039 in.).

(5) The clearance between the cylinder liner and piston should not exceed 0.25 mm (.0009 in.).

(6) Make sure the weight of the pistons does not differ by more than 5 g.

CONNECTING ROD

(1) Assemble bearing shells and bearing caps to their respective connecting rods ensuring that the serrations on the cap and reference marks are aligned.

(2) Tighten bearing cap bolts to 29 N·m (21 ft. lbs.) plus 60°.

(3) Check and record internal diameter of crank end of connecting rod.

Note: When changing connecting rods, all four must have the same weight and be stamped with the same number. **Replacement connecting rods will only be supplied in sets of four.**

(4) Connecting rods are supplied in sets of four since they all must be of the same weight category. Max allowable weight difference is 18 gr. **NOTE:** On one side of the big end of the con-rod there is a two-digit number which refers to the weight category. On the other side of the big end there is a four digit number on both the rod and the cap. These numbers must both face the camshaft as well as the recess on the piston crown (Fig. 76). Lightly heat the piston in oven. Insert piston pin in position and secure it with provided snap rings. **The Four digit numbers marked on con rod big end and rod cap must be on the same side as the camshaft (Fig. 76)**. After having coated threads with Molyguard, tighten con rod bolts to 29 N·m (21 ft. lbs.) plus 60°.

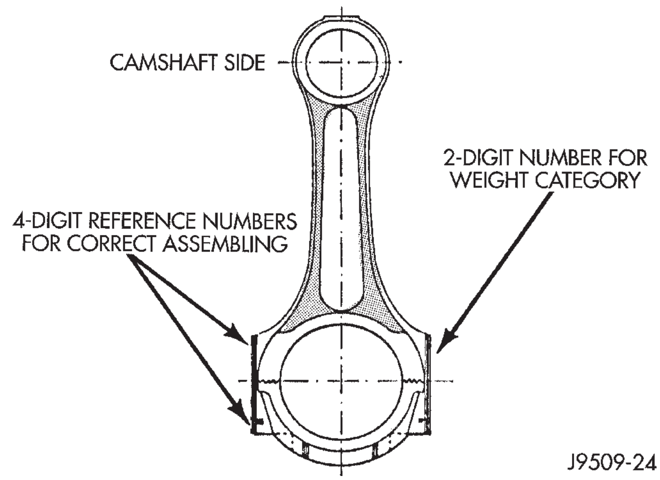


Fig. 76 Connecting Rod Identification

PISTON PIN

(1) Measure the diameter of piston pin in the center and both ends (Fig. 77).

(2) Piston pin diameter is 29.990 to 29.996mm (1.1807 to 1.1809 in.).

CRANKSHAFT

CRANKSHAFT JOURNALS

(1) Using a micrometer, measure and record crankshaft connecting rod journals, take reading of each journal 120° apart. Crankshaft journal diameter is 53.84 to 53.955mm (2.1196 to 2.1242 in.).

(2) Crankshaft journals worn beyond limits or show signs of out of roundness must be reground or replaced. Minimum reground diameter is 53.69mm (2.1137 in.).

BEARING-TO-JOURNAL CLEARANCE

Compare internal diameters of connecting rod with crankshaft journal diameter. Maximum clearance between connecting rod and crankshaft journals .022 to .076mm (.0008 to .0029 in.) (Fig. 78).

CRANKSHAFT MAIN BEARING

INSPECTION

(1) Fit main bearing carriers together and torque to 42 N·m (31 ft. lbs.)

(2) Check internal diameter of bearings.

CLEANING AND INSPECTION (Continued)

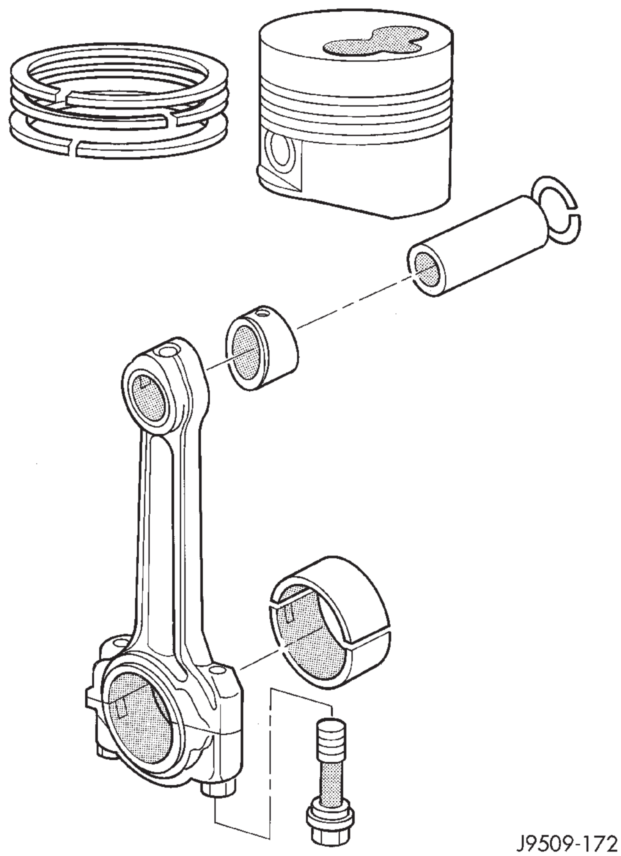


Fig. 77 Piston, Connecting Rod and Pin

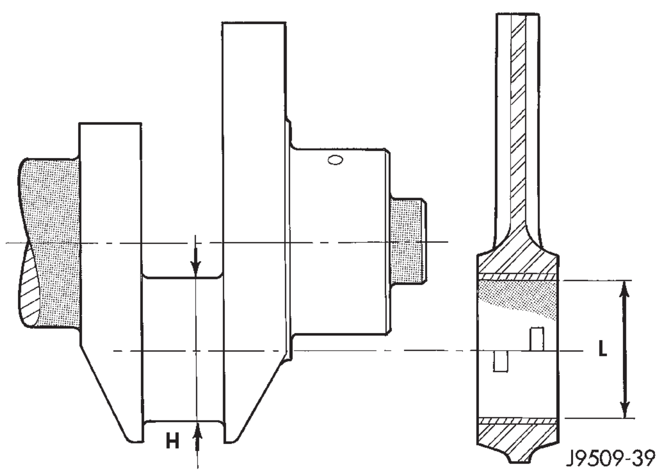


Fig. 78 Bearing Clearance

(3) If internal diameter of original bearing is being checked and figures are not within specifications, new bearings must be used.

(4) Check crankshaft main bearing journals to bearing clearances. Clearances of main bearings is .03 to .088mm (.0011 to .0035 in.).

OIL PAN

Remove all gasket material from cylinder block. Be careful not gouge pan sealing surface.

CYLINDER LINER

INSPECTION

The cylinder walls should be checked for out-of-round and taper with dail bore gauge. The cylinder bore out-of-round is 0.100 mm (.0039 inch) maximum and cylinder bore taper is 0.100 mm (0.0039 inch) maximum. If the cylinder walls are badly scuffed or scored, new liners should be installed and honed, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B (Fig. 79). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore.

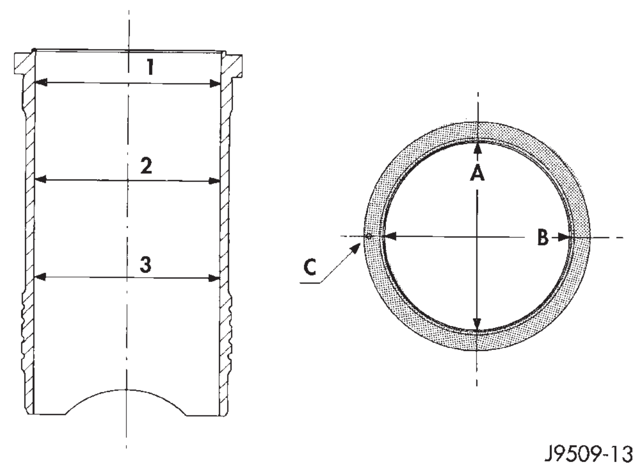


Fig. 79 Liner Inspection

SPECIFICATIONS

2.5L VM DIESEL

DESCRIPTION	SPECIFICATIONS
Type	425CLIEE (36B)
Number of Cylinder	4
Bore	92 mm
Stroke	94 mm
Capacity	2499.5 cm3
Injection Order	1-3-4-2
Compression Ratio	21:1 (± 0.5)
Crankshaft	
Front Journal Diameter	
Nominal	62.985–63.000 mm
–0.25	62.735–62.750 mm
–0.125	62.860–62.875 mm
Front Bearing Diameter	
Nominal	63.043–63.088 mm
–0.25	62.793–62.838 mm
–0.125	62.918–62.963 mm
Clearance Between Journal and Bearing: 0.043–0.103 mm	
Center Journal Diameter	

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATIONS
Nominal	63.005–63.020 mm
–0.25	62.755–62.770 mm
–0.125	62.880–62.895 mm
Center Bearing Diameter	
Nominal	63.050–63.093 mm
–0.25	62.800–62.843 mm
–0.125	62.925–62.968 mm
Clearance Between Journal and Bearing: 0.030–0.088 mm	
Rear Journal Diameter	
Nominal	79.980–80.000 mm
–0.25	79.730–79.750 mm
–0.125	79.855–79.875 mm
Rear Bearing Diameter	
Nominal	80.045–80.070 mm
–0.25	79.795–79.820 mm
–0.125	79.920–79.945 mm
Clearance Between Journal and Bearing: 0.045–0.090 mm (Wear Limit: 0.200 mm)	
Connecting Rod Journal	
Nominal	53.940–53.955 mm
–0.25	53.690–53.705 mm
–0.125	53.815–53.830 mm
Connecting Rod Bearing	
Nominal	53.977–54.016 mm
–0.25	53.727–53.766 mm
–0.125	53.852–53.891 mm
Clearance Between Journal and Bearing: 0.022–0.076 mm (Wear Limit: 0.200 mm)	
Crankshaft End Play	
End Play	0.08–0.21 mm
Adjustment	Thrust Washers
Thrust Washers Available	2.31–2.36 mm
Thrust Washers Available	2.41–2.46 mm
Thrust Washers Available	2.51–2.56 mm
Main Bearing Carriers	
Front	67.025–67.050 mm
Center	66.670–66.690 mm
Rear	85.985–86.005 mm
Liners	
Internal Diameter	92.000–92.010 mm
Protrusion	0.01–0.06 mm
Adjustment	Shims
Available Shims:	0.15 mm
Available Shims:	0.17 mm
Available Shims:	0.20 mm
Available Shims:	0.23 mm
Available Shims:	0.25 mm
Cylinder Head	
Minimum Thickness	89.95–90.05 mm
Gasket	Steel
Gasket thickness:	1.42 ± 0.1 mm 0 Holes
Gasket thickness:	1.62 ± 0.1 mm 1 Holes

DESCRIPTION	SPECIFICATIONS
Gasket thickness:	1.52 ± 0.1 mm 2 Holes
End Plates	
Height	89.02–90.00 mm
Connecting Rods	
Weight (Without the crank bearing)	1129–1195 grams
Small End Bearing Internal Diameter	
Minimum	30.035 mm
Maximum	30.050 mm
Crankshaft Bearings Standard Internal Diameter	53.997–54.016 mm
Pistons	
Skirt Diameter	91.935–91.945 mm
(Measured at approximately 15 mm above the bottom of the skirt)	
Piston Clearance	0.055–0.075 mm
Top of Piston to Cylinder Head	0.80–0.89 mm
Piston Protrusion	0.53–0.62 mm Fit Gasket (1.42), 0 Holes
Piston Protrusion	0.73–0.82 mm Fit Gasket (1.62), 1 Hole
Piston Protrusion	0.63–0.72 mm Fit Gasket (1.52), 2 Holes
Piston Pins	
Type	Full Floating
Pin Diameter	29.990–29.996 mm
Clearance	0.004–0.014 mm
Piston Rings (Clearance in Groove)	
Top	0.080–0.130 mm
Second	0.070–0.102 mm
Oil Control	0.040–0.072 mm
Piston Rings (Fitted Gap)	
Top	0.25–0.50 mm
Second	0.20–0.35 mm
Oil Control	0.25–0.58 mm
Camshaft	
Journal Diameter Front	53.460–53.480 mm
Bearing Clearance	0.06–0.13 mm
Journal Diameter Center	53.460–53.480 mm
Bearing Clearance	0.06–0.13 mm
Journal Diameter Rear	53.460–53.480 mm
Bearing Clearance	0.06–0.13 mm
Tappets	
Outside Diameter	22.195–22.212 mm
Rocker Gear	
Shaft Diameter	21.979–22.00 mm
Bushing internal diameter	22.020–22.041 mm
Assembly Clearance	0.020–0.062 mm
Valves (Intake)	
Opens	26° B.T.D.C.
Closes	58° A.B.D.C.
Valves (Exhaust)	
Opens	64° B.B.D.C.
Closes	38° A.T.D.C.

SPECIFICATIONS (Continued)

DESCRIPTION . . . . SPECIFICATIONS

Valve Face Angle

Intake . . . . 55°30'– 55°50'

Exhaust . . . . 45°25'– 45°35'

Valve Head Diameter

Intake . . . . 40.05–40.25 mm

Exhaust . . . . 33.8–34.0 mm

Valve Head Stand Down

Intake . . . . 1.08–1.34 mm

Exhaust . . . . 1.99–1.25 mm

Valve Stem Diameter

Intake . . . . 7.940–7.960 mm

Exhaust . . . . 7.922–7.940 mm

Valve Clearance in Guide

Intake . . . . 0.040–0.075 mm

Exhaust . . . . 0.060–0.093 mm

Valve Guide

Inside Diameter . . . . 8.0–8.015 mm

Fitted Height . . . . 13.5–14.0 mm

Valve Spring

Free Length . . . . 44.65 mm

Fitted Length . . . . 38.6 mm

Load at Fitted Length . . . . 34 ± 6% Kg

Load at Top of Lift . . . . 92.5 ± 4% Kg

Number of Coils . . . . 5.33 Valve Timing

Oil Pressure

at 4000 rpm . . . . . 3.0 to 4.5 bar (Oil at 90–100°C)

Pressure Relief Valve Opens . . . . 6.38 bar

Pressure Relief Valve–Free Length . . . . . 57.5 mm

Oil Pump

Outer Rotor End Float . . . . 0.03–0.09 mm

Inner Rotor End Float . . . . 0.03–0.09 mm

Outer Rotor to Body Diameter
Clearance . . . . 0.130–0.230 mm

Rotor Body to Drive Gear Clearance (Pump Not
Fitted) . . . . 3.27–3.73 mm

TORQUE

DESCRIPTION . . . . TORQUE

Generator Mounting Bracket

Bolts . . . . 47 N·m (35 ft. lbs.)

Camshaft Thrust Plate Retaining Bolts

Bolt . . . . 24 N·m (18 ft. lbs.)

Cylinder Head

Bolts . . See Cylinder Head Installation Procedure

Connecting Rod

Bolts . . . . 29.5 N·m +60° (22 ft. lbs. +60°)

Crankshaft Bearing Carrier

Bolts . . . . 44 N·m (32 ft. lbs.)

Crankshaft damper (Pulley)

Nut . . . . 441 N·m (325 ft. lbs.)

EGR Valve to Intake Manifold

Tube . . . . 26 N·m (19 ft. lbs.)

DESCRIPTION . . . . TORQUE

EGR Tube to EGR Valve

Bolts . . . . 26 N·m (19 ft. lbs.)

Engine Mount—Front

Support Bracket Engine Bolts . 68 N·m (50 ft. lbs.)

Support Bracket Transmission
Bolts . . . . 101 N·m (75 ft. lbs.)

Support Cushion Crossmember
Bolts . . . . 54 N·m (40 ft. lbs.)

Support Cushion Thru Bolt . . . 65 N·m (48 ft. lbs.)

Engine Mount—Rear

Support Bracket Transmission
Bolts . . . . 101 N·m (75 ft. lbs.)

Support Bracket to Engine
Bracket . . . . 101 N·m (75 ft. lbs.)

Support Cushion Thru Bolt . . . 68 N·m (50 ft. lbs.)

Engine Mount—Left

Transmission Mounting Bolts . 54 N·m (40 ft. lbs.)

Support Cushion Thru Bolt . . . 71 N·m (53 ft. lbs.)

Engine Mount—Right

Mount to Frame Rail Bolts . . . 68 N·m (50 ft. lbs.)

Mount Bolt (Horizontal) . . . 145 N·m (107 ft. lbs.)

Mount Bolt (Vertical) . . . . 101 N·m (75 ft. lbs.)

Right Engine Mount Bracket

Bolts . . . . 40 N·m (30 ft. lbs.)

Exhaust Pipe to Turbocharger

Bolts . . . . 28 N·m (250 in. lbs.)

Exhaust Manifold Outlet to Turbo

Nuts . . . . 32 N·m (24 ft. lbs.)

Exhaust Elbow to Turbo

Bolts . . . . 30 N·m (22 ft. lbs.)

Exhaust Manifold Mounting

Nuts . . . . 30 N·m (22 ft. lbs.)

Flywheel

Bolts . . . . . See Rear Crankshaft Seal Installation
Procedure

Engine Adaptor Plate

Bolts . . . . 47 N·m (35 ft. lbs.)

Front Timing Gear Cover

Bolts . . . . 11 N·m (96 in. lbs.)

Fuel Filter

Nuts . . . . 28 N·m (250 in. lbs.)

Glow Plugs

Plugs . . . . 14 N·m (120 in. lbs.)

Idler Pulley Pump Support Bracket

Nuts . . . . 26 N·m (228 in. lbs.)

Idler Pulleys (left handed threads)

Bolts . . . . 47 N·m (35 ft. lbs.)

Injector Pump fuel lines

Nuts . . . . 17.6 N·m (156 in. lbs.)

Injector Pump Gear

Lock Nut . . . . 86 N·m

Injector Pump Mounting

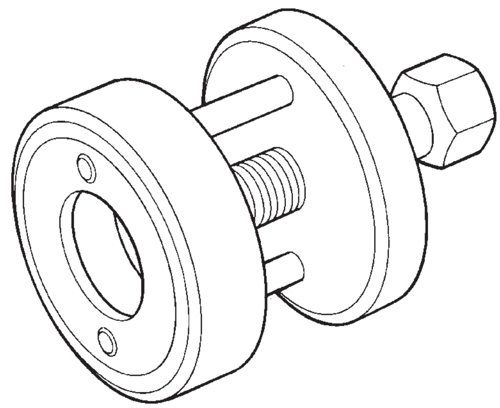
Nuts . . . . 27.5 N·m (240 in. lbs.)

SPECIFICATIONS (Continued)

DESCRIPTION	TORQUE
Injector	
Tighten to	65 N·m (48 ft. lbs.)
Intake Manifold Mounting	
Nuts	30 N·m (264 in. lbs.)
Main Bearing Oil Delivery Union	
Bolts	54 N·m (40 ft. lbs.)
Oil Feed Line To Rocker Arms	
Bolts	12.7 N·m (108 in. lbs.)
Oil Feed Line to Block	
Bolts	12.7 N·m (108 in. lbs.)
Oil Feel Line to Vacuum Pump	
Bolts	16.7 N·m (145 in. lbs.)
Oil Filter	
Tighten to	9.8 N·m (85 in. lbs.)
Oil Filter Adaptor	
Fastener	49 N·m (36 ft. lbs.)
Oil Filter Base	
Fastener	49 N·m (36 ft. lbs.)
Oil Pan Mounting	
Bolts	12 N·m (108 in. lbs.)
Oil Pickup Tube	
Bolts	11.3 N·m (100 in. lbs.)
Oil Pump Mounting	
Bolts	27.5 N·m (240 in. lbs.)
Oil Pan Drain	
Plug	54 N·m (40 ft. lbs.)
Power Steering Pressure Hose	
Fastener	28 N·m (240 in. lbs.)
Power Steering Pulley	
Nut	170 N·m (125 ft. lbs.)
Rear Crankshaft Bearing Carrier	
Bolts	10.8 N·m (95 in. lbs.)
Rocker Arm Cover	
Bolts	14.7 N·m (132 in. lbs.)
Rocker Arm Mounting	
Nuts	29.4 N·m (264 in. lbs.)
Power Steering Pump Mounting	
Nuts	24.5 N·m (216 in. lbs.)
Turbocharger Mounting	
Nuts	32 N·m (288 in. lbs.)
Turbocharger Oil Delivery	
Bolt	27.5 N·m (240 in. lbs.)
Turbocharger Oil Drain	
Bolts	10.8 N·m (95 in. lbs.)
Vacuum Pump Mounting	
Bolts	10.8 N·m (95 in. lbs.)
Water Manifold Mounting	
Bolts	11.8 N·m (108 in. lbs.)
Water Pump Pulley	
Bolts	27.5 N·m (240 in. lbs.)

SPECIAL TOOLS

2.5L VM DIESEL



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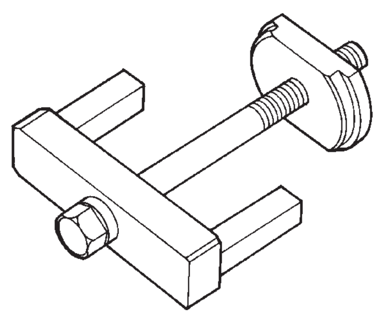
Crankshaft Pulley and Gear Remover VM.1000A



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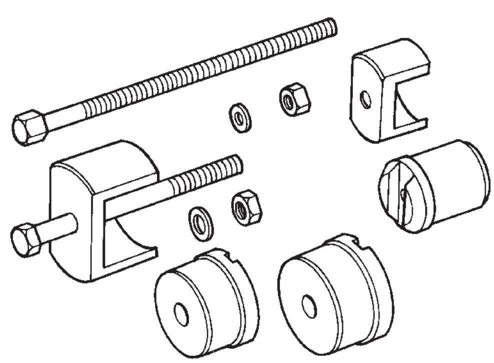
Cylinder Liner Puller VM.1001



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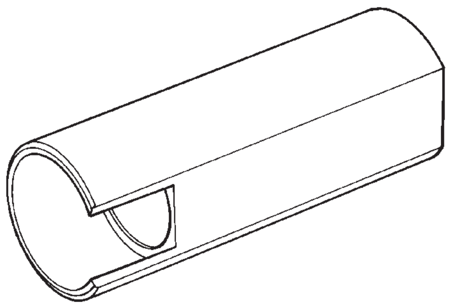
Crankshaft Bearing Remover/Installer VM.1002

SPECIAL TOOLS (Continued)



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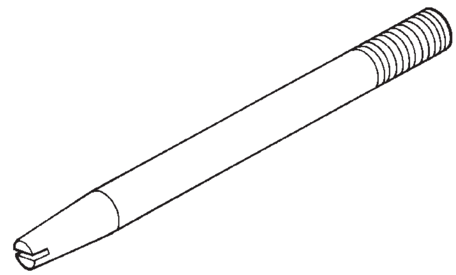
Crankshaft Remover/Installer Sleeve VM.1004



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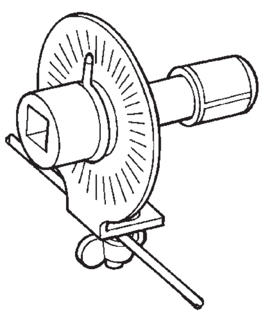
Cylinder Head Guide Studs VM.1009



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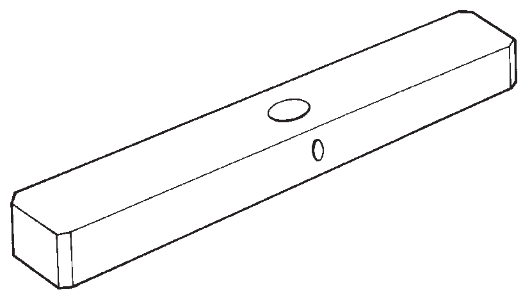
Torque Angle Gauge VM.1005



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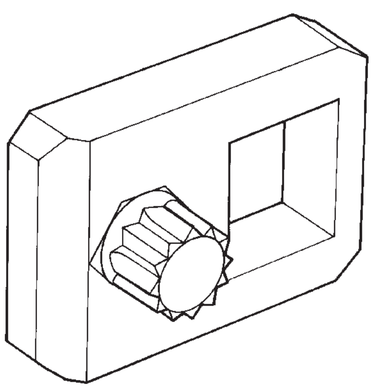
Cylinder Liner Protrusion Tool VM.1010



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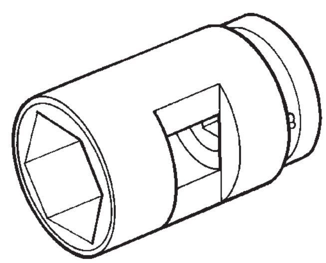
Cylinder Head Bolt Wrench VM.1006A



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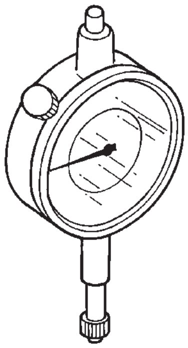
Injector Socket Remover/Installer VM.1012A

SPECIAL TOOLS (Continued)



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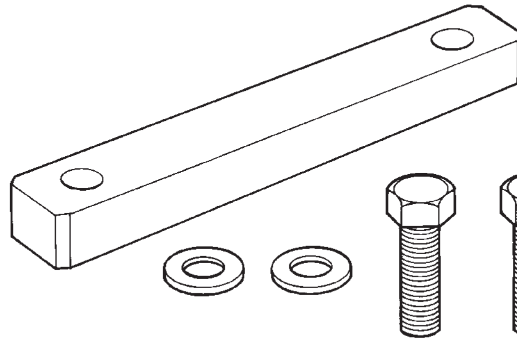

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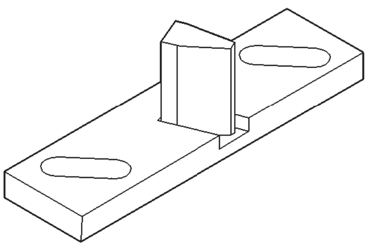
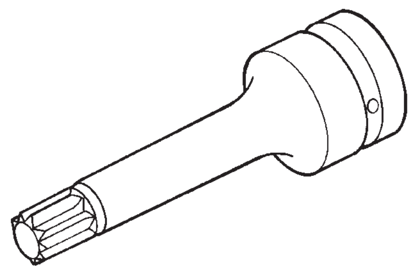
Cylinder Retainers VM.1016



Flywheel Locking Tool VM.1014



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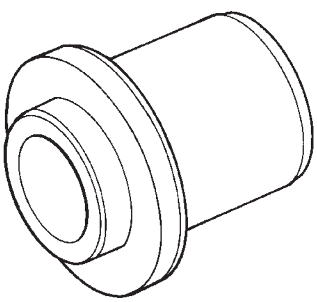
Cylinder Head Bolt Wrench M12 VM.1018



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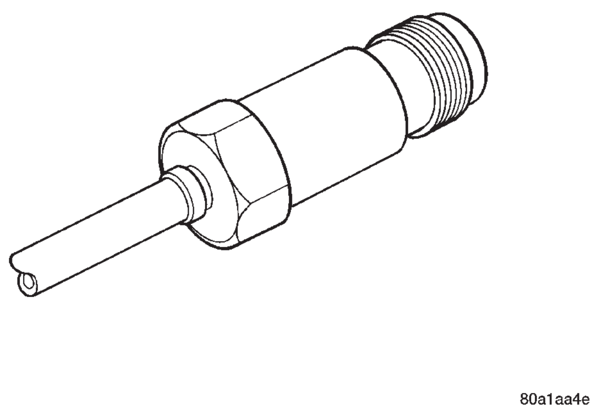
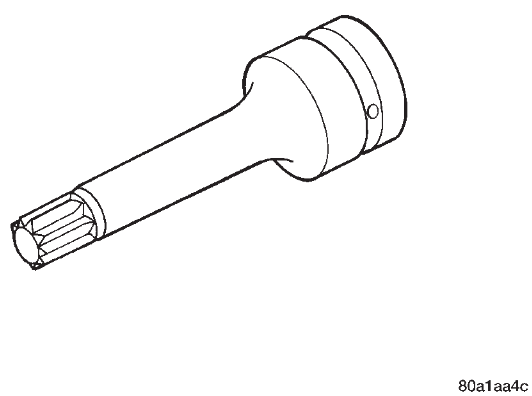
Timing Cover Oil Seal Installer VM.1015

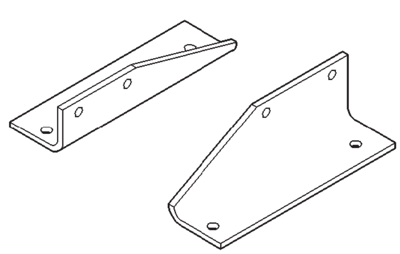
SPECIAL TOOLS (Continued)



Adapter Cylinder Leakage Tester VM.1021



Cylinder Head Bolt Wrench M14 VM.1019



Support Brackets Engine Removal/Installation VM.1026

EXHAUST SYSTEM AND INTAKE MANIFOLD

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GENERAL INFORMATION

EXHAUST SYSTEM

The exhaust systems are produced in several configurations, depending on engine and vehicle (Fig. 1). AWD vehicles have a catalytic converter mounted heat shield. The tailpipes, mufflers, and resonators are tuned to each vehicle/powertrain combination.

CATALYTIC CONVERTERS

There is no regularly scheduled maintenance on any Chrysler catalytic converter. If damaged, the converter must be replaced.

CAUTION: Due to exterior physical similarities of some catalytic converters with pipe assemblies, extreme care should be taken with replacement parts. There are internal converter differences required in some parts of the country.

The combustion reaction caused by the catalyst releases additional heat in the exhaust system. Causing temperature increases in the area of the reactor under severe operating conditions. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency. **Do not** remove spark plug wires from plugs or by any other means short out cylinders of the exhaust system if equipped with

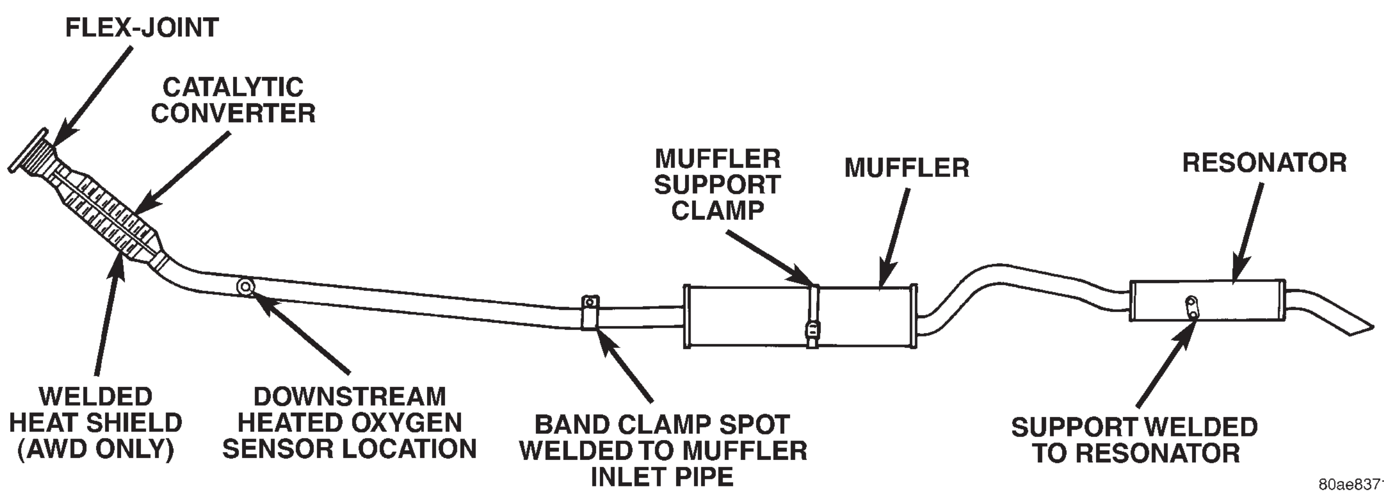

Fig. 1 Exhaust System—Typical (All Vehicles)

GENERAL INFORMATION (Continued)

a catalytic converter. Failure of the catalytic converter can occur due to temperature increases caused by unburned fuel igniting when passing through the converter.

The use of the catalysts also involves some non-automotive problems. Unleaded gasoline must be used to avoid poisoning the catalyst core. Do not allow engine to operate at fast idle for extended periods (over 5 minutes). This condition may result in excessive exhaust system and floor pan temperatures.

EXHAUST GAS RECIRCULATION (EGR)

To assist in the control of oxides of nitrogen (NOx) in engine exhaust, all engines are equipped with an exhaust gas recirculation system. The use of exhaust gas to dilute incoming air/fuel mixtures lowers peak flame temperatures during combustion, thus limiting the formation of NOx.

Exhaust gases are taken from opening in the exhaust manifold passage to the intake manifold. REFER TO SECTION 25 FOR A COMPLETE DESCRIPTION, DIAGNOSIS AND SERVICE PROCEDURES ON THE EXHAUST GAS RECIRCULATION SYSTEM AND COMPONENTS.

HEAT SHIELDS

Heat shields (Fig. 2) are needed to protect both the vehicle and the floor pan from the high temperatures developed near the catalytic converter and muffler.

Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields on cars so equipped. Light over spray near the edges is permitted. Application of coating will greatly reduce the efficiency of the heat shields resulting in excessive floor pan temperatures and objectionable fumes.

EXHAUST FLEX-JOINT COUPLING

A exhaust flex-joint coupling (Fig. 3) is used to secure the catalytic converter to the engine manifold. This living joint actually moves back and forth as the engine moves, preventing breakage that could occur from the back-and-forth motion of a transverse mounted engine.

The exhaust flex-joint has four bolts, four flag nuts and a gasket that are separate parts from the exhaust flex-joint. The flex-joint is welded to the catalytic converter.

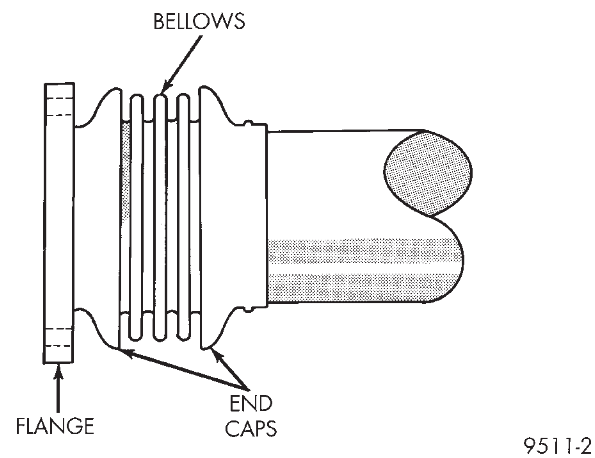

Fig. 3 Flex-Joint

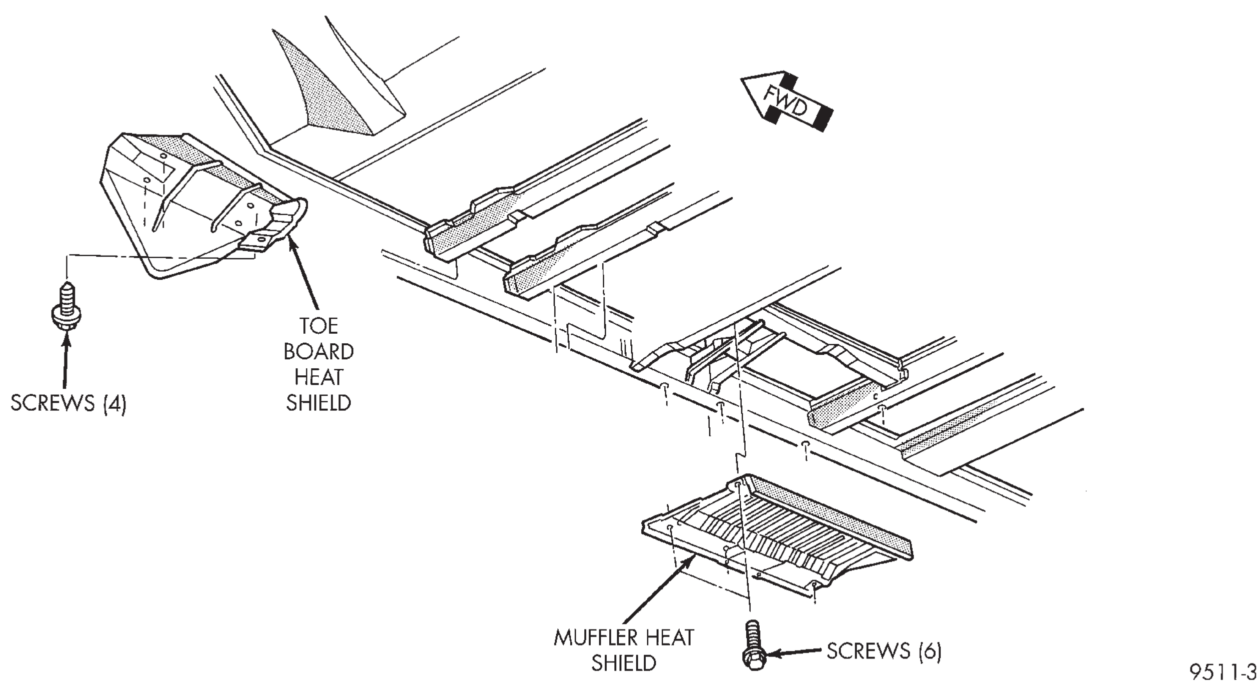

Fig. 2 Heat Shields

GENERAL INFORMATION (Continued)

CAUTION: When servicing, care must be exercised not to dent or bend the bellows of the flex-joint. Should this occur, the flex-joint will eventually fail and require the catalytic converter be replaced.

DESCRIPTION AND OPERATION

INTAKE/EXHAUST MANIFOLD—2.4L ENGINE

The intake manifold is a tuned two-piece aluminum casting with individual primary runners leading from a plenum to the cylinders. The manifold is designed to boost torque which is desired for excellent engine response and usable power output.

The exhaust manifold is made of nodular cast iron for strength and high temperatures.

INTAKE/EXHAUST MANIFOLD—3.0L ENGINE

The aluminum alloy manifold is a cross type with long runners to improve air flow. The runners, attaching below at the cylinder head, also attach above and support an air plenum. The air plenum chamber absorbs air pulsations created during the suction phase of each cylinder.

Both exhaust manifolds are a log style made of ductile cast iron. Exhaust gasses, collected from the front cylinder bank, leave the front manifold through an end outlet and are fed through an upper crossover tube to the rear manifold. The collected exhaust from both manifolds are combined at the exhaust outlet, to the exhaust pipe.

INTAKE/EXHAUST MANIFOLD—3.3/3.8L ENGINES

The intake manifold is a tuned two-piece semi-permanent mold aluminum casting with individual primary runners leading from a plenum to the cylinders. The manifold is designed to boost torque in the 3600 rpm range and contributes to the engine's broad, flat torque curve, which was desired for excellent engine tractability, response and usable power output.

The intake manifold is also cored with upper level EGR passages for balanced cylinder to cylinder EGR distribution.

The exhaust manifolds are log type with a crossover and are attached directly to the cylinder heads. They are made from nodular cast iron.

DIAGNOSIS AND TESTING

EXHAUST SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE EXHAUST NOISE (UNDER HOOD)	1. Exhaust manifold cracked or broken. 2. Manifold to cylinder head leak. 3. EGR Valve to manifold gasket leakage. 4. EGR Valve to EGR tube gasket leakage. 5. EGR tube to manifold tube leakage. 6. Exhaust flex-joint to manifold leak. 7. Exhaust flex-joint. 8. Pipe and shell noise from front exhaust pipe.	1. Replace manifold. 2. Tighten manifold and/or replace gasket. 3. Tighten fasteners or replace gasket. 4. Tighten fasteners or replace gasket. 5. Tighten tube nut. 6. Tighten joint fasteners and/or replace gasket. 7. Replace catalytic converter assembly. 8. Characteristic of single wall pipe.
EXCESSIVE EXHAUST NOISE	1. Leak at exhaust pipe joints. 2. Burned or rusted out muffler assembly or exhaust pipe. 3. Burned or rusted out resonator. 4. Restriction in exhaust system. 5. Converter material in muffler.	1. Tighten clamps at leaking joints. 2. Replace muffler resonator tailpipe assembly or exhaust pipe with catalytic converter assembly. 3. Replace muffler resonator tailpipe assembly. 4. Remove restriction, if possible, or replace as necessary. 5. Replace muffler and converter assemblies. Check fuel injection and ignition systems for proper operation.

REMOVAL AND INSTALLATION

EXHAUST PIPES, MUFFLERS AND TAILPIPES

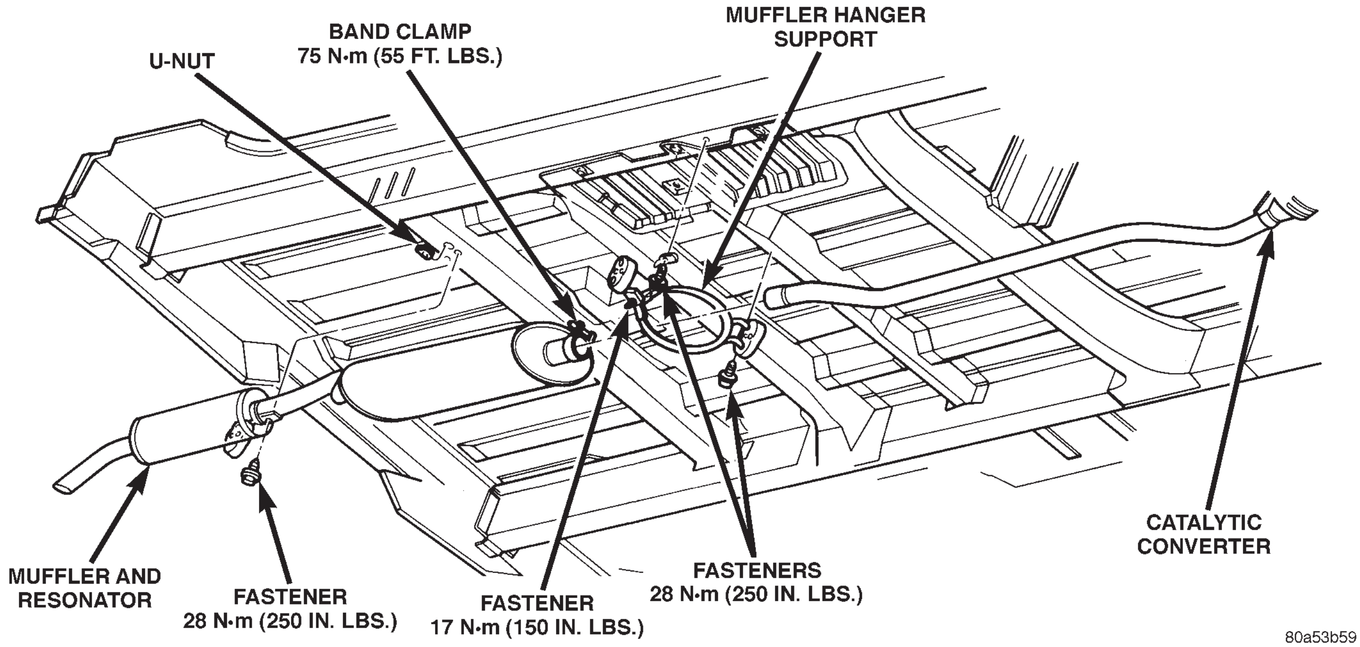

Fig. 4 Exhaust System Components

REMOVAL

(1) Raise vehicle on hoist and apply penetrating oil to clamp bolts and nuts of component being removed.

(2) Loosen clamps and supports (Fig. 5) and (Fig. 4) from exhaust system to permit alignment of parts during assembly.

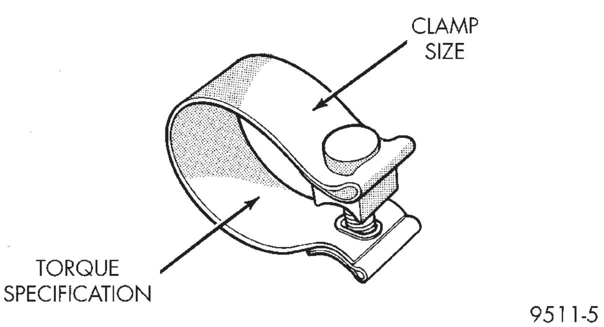

Fig. 5 Band Clamp

(3) When removing tailpipe, raise rear of vehicle to relieve body weight from rear springs to provide clearance between pipe and rear axle parts.

(4) Clean ends of pipes or muffler to assure mating of all parts. Discard broken or worn insulators, rusted clamps, supports and attaching parts. **When replacement is required on any component of the exhaust system. It is important that original equipment parts (or their equivalent) be used;**

- To insure proper alignment with other parts in the system.
- Provide acceptable exhaust noise levels and does not change exhaust system back pressure that could effect emissions and performance.

INSTALLATION

(1) Assemble pipes, muffler support and clamp loosely to permit alignment of all parts.

(2) Beginning at front of system, align and clamp each component to maintain position and proper clearance with underbody parts.

(3) Tighten the clamp and support to the proper torques and clearances (Fig. 4).

UPPER INTAKE MANIFOLD—2.4L ENGINE

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect air intake tube and resonator box from throttle body and remove.

(3) Remove connector from throttle position sensor (Fig. 6).

(4) Remove connector from idle air control motor (Fig. 6).

(5) Remove connector from MAP sensor (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

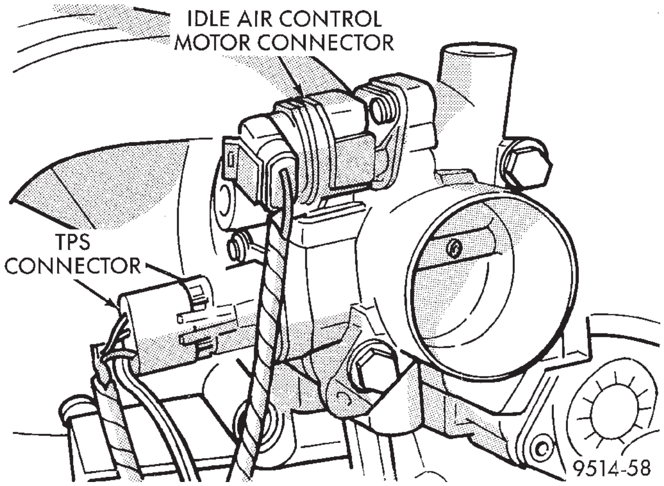

Fig. 6 Throttle Body Electrical Connectors

(6) Remove vacuum lines for purge solenoid and PCV valve at intake manifold (Fig. 7).

(7) Remove vacuum lines for power brake booster and speed control vacuum reservoir at upper intake manifold fittings (Fig. 8).

(8) Remove throttle cable and speed control cable (if equipped) from throttle lever (Fig. 9).

(9) Remove throttle cables from bracket by compressing retaining tabs.

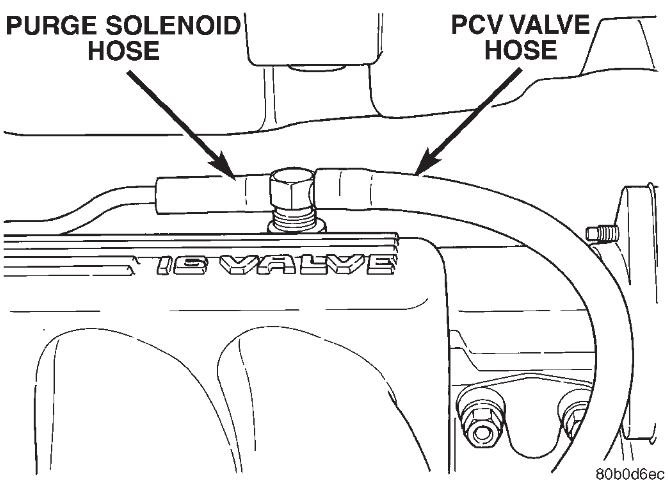

Fig. 7 Vacuum Line Connections

(10) Remove two top bolts from intake manifold to rear support bracket and spacer (Fig. 10).

(11) Remove upper bolt from intake manifold to front support bracket (Fig. 11).

(12) Remove dipstick.

(13) Remove dipstick tube.

CAUTION: Moving the dipstick tube will cause damage to the sealer, causing an oil leak. Dipstick tube must be sealed at cylinder block.

(14) Remove upper intake manifold bolts. Remove upper intake manifold.

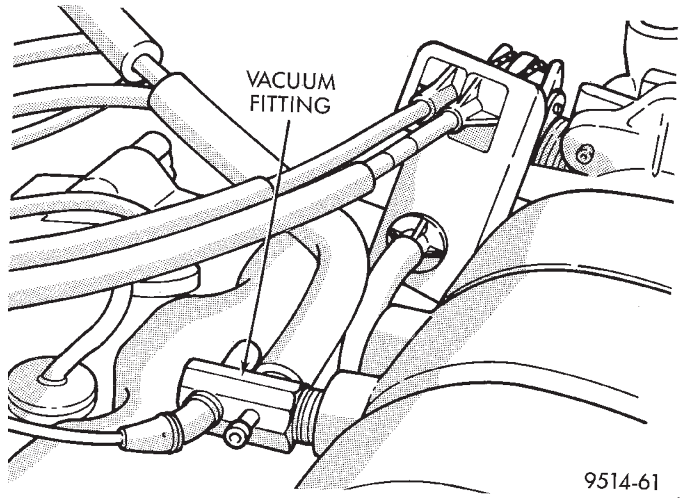

Fig. 8 Vacuum Fitting at Rear of Upper Intake Manifold

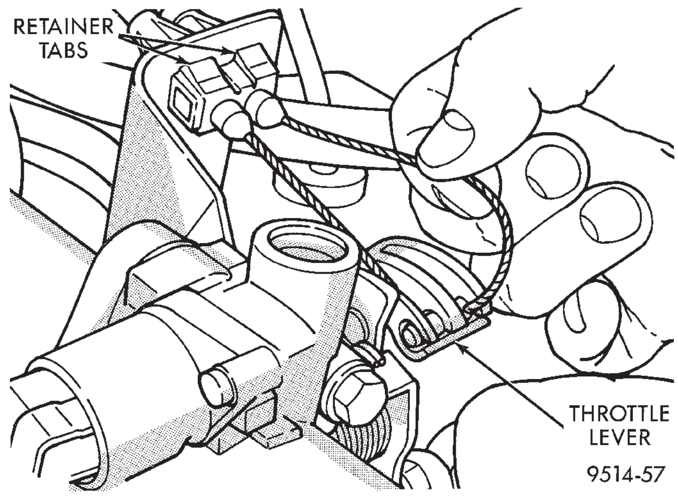

Fig. 9 Throttle Cable Attachment to Throttle Body

CAUTION: Cover intake manifold to prevent foreign material from entering engine.

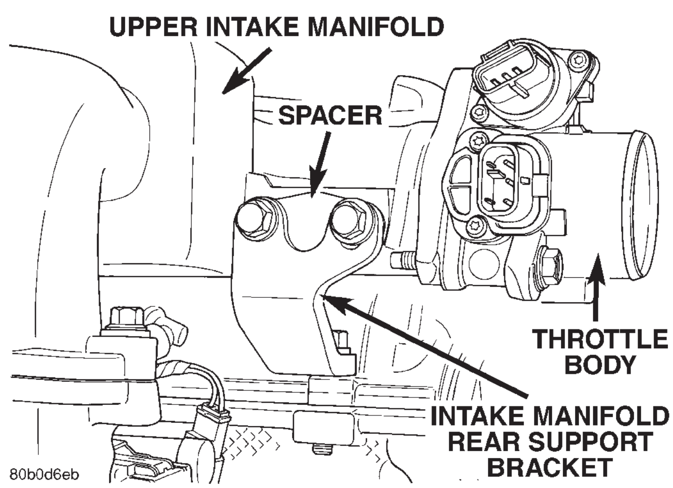

Fig. 10 Intake Manifold Rear Support Bracket

REMOVAL AND INSTALLATION (Continued)

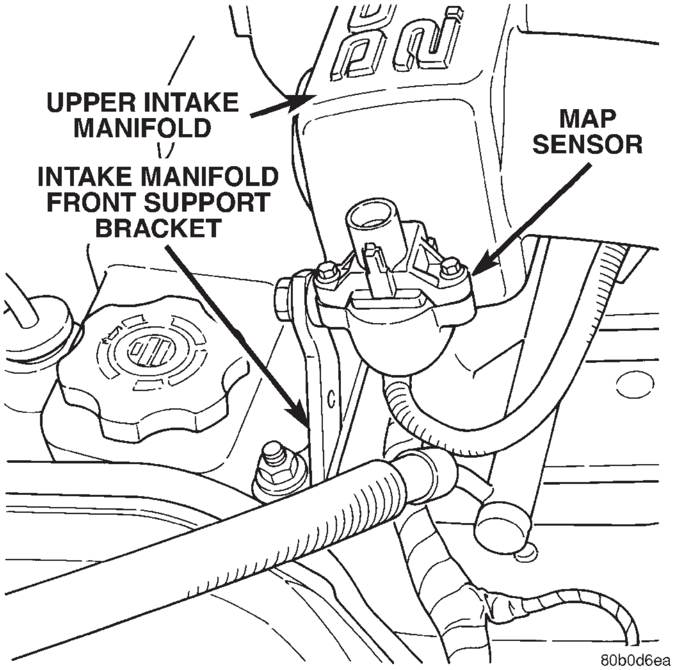

Fig. 11 Intake Manifold Front Support Bracket and Map Sensor

INSTALLATION

(1) Install new upper intake manifold gasket.

NOTE: Center outboard fastener is a double stud.

(2) Tighten upper intake manifold fasteners starting at center and progressing outward in both directions. Tighten bolts to 28 N·m (250 in. lbs.). Repeat this procedures until all fasteners are at specified torque.

(3) Install dipstick tube. Seal tube to cylinder block using Mopar® Stud N' Bearing Mount Adhesive. Tighten dipstick tube fastener to 12 N·m (105 in. lbs.)

(4) Install dipstick.

(5) Install upper bolt in intake manifold to front support bracket (Fig. 11). Torque to 28 N·m (250 in. lbs.).

(6) Install two top bolts at intake manifold to rear support bracket making sure bracket to manifold spacer is in place (Fig. 10). Tighten bolts to 28 N·m (250 in. lbs.)

(7) Install throttle cables in bracket.

(8) Install throttle cable and speed control cable (if equipped) to throttle lever.

(9) Install vacuum lines for power brake booster and speed control vacuum reservoir at upper intake manifold fittings.

(10) Install vacuum lines for purge solenoid and PCV valve.

(11) Install electrical connectors for MAP sensor, throttle position sensor, and idle air control motor.

(12) Install air intake tube and resonator box to throttle body.

(13) Connect negative cable to battery.

INTAKE MANIFOLD LOWER—2.4L ENGINE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE

To release fuel pressure, refer to the Fuel Delivery System Pressure Release section of Group 14 Fuel System for procedure.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Remove upper intake manifold. Refer to procedure in this section.

CAUTION: Cover intake manifold to prevent foreign material from entering engine.

(3) Disconnect electrical connector from intake air temperature sensor (Fig. 12).

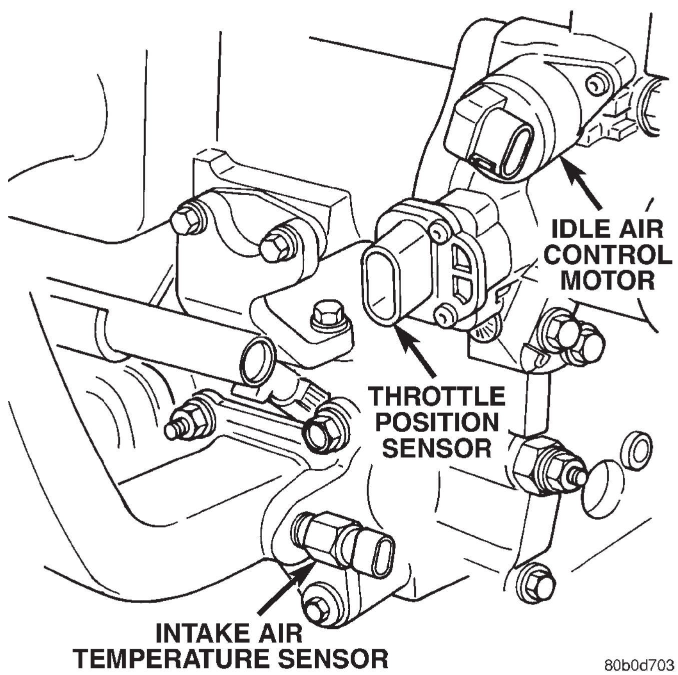

Fig. 12 Intake Air Temperature Sensor

(4) Remove fuel hose quick connect fitting from the chassis tube (Fig. 13). **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group.**

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

REMOVAL AND INSTALLATION (Continued)

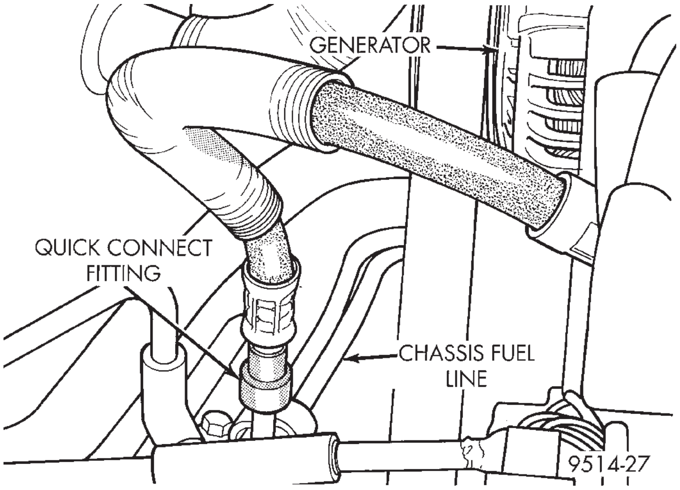

Fig. 13 Fuel Line Quick Disconnect

(5) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(6) Remove heater, and upper radiator hoses at intake manifold.

(7) Disconnect coolant temperature sensor (Fig. 14).

(8) Remove the accessory drive belt. Refer to Accessory Drive belt Removal and Installation in Group 7, Cooling System for procedure.

(9) Remove fasteners attaching generator bracket to cylinder head, and block.

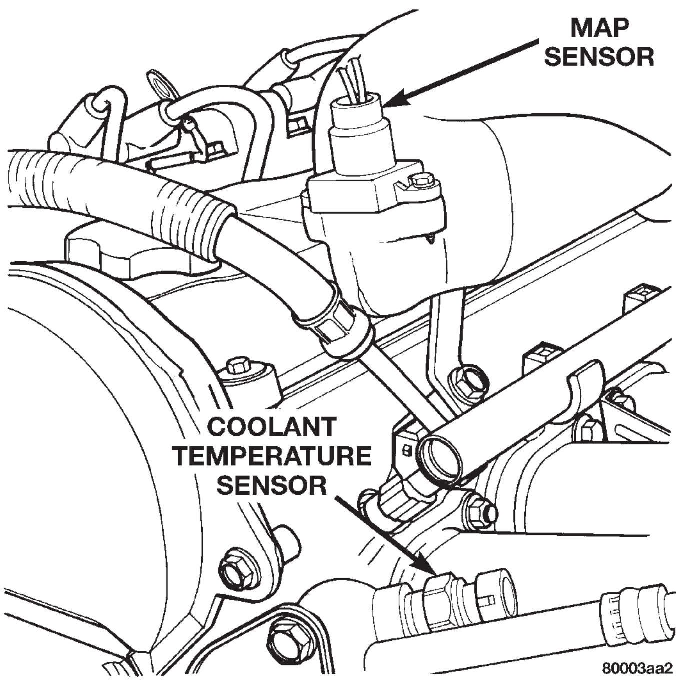

Fig. 14 Coolant Temperature Sensor—2.4L

(10) Remove intake manifold center support bracket bolts (Y bracket) (Fig. 15)

(11) Disconnect fuel injector harness.

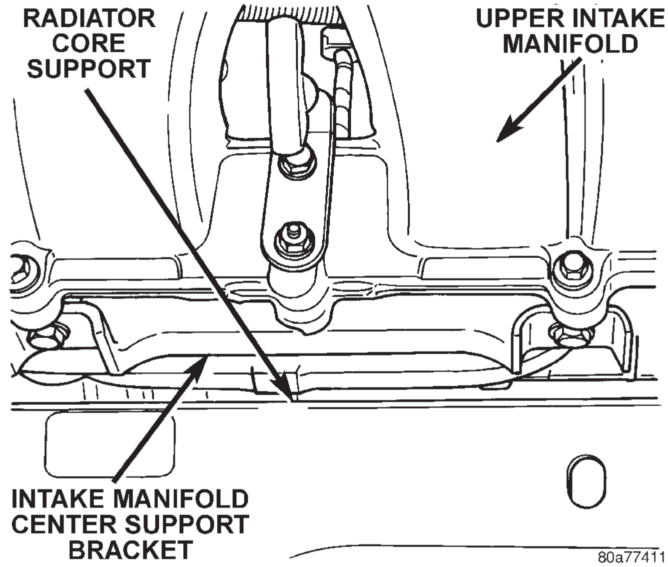

Fig. 15 Intake Manifold Center Support Bracket

(12) Remove lower intake manifold fasteners (Fig. 16). Remove the manifold from engine.

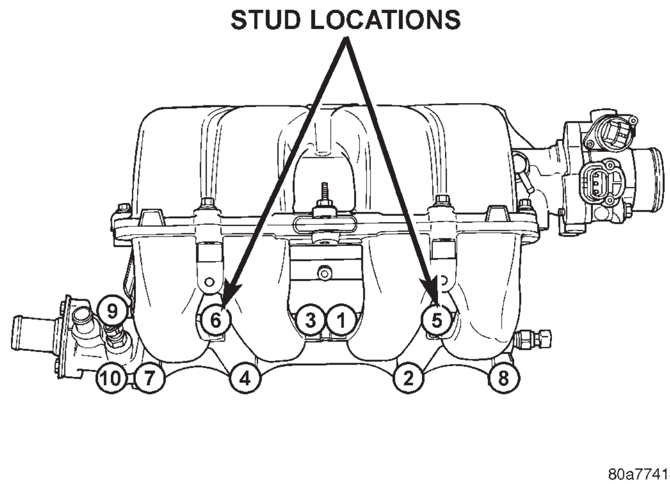

Fig. 16 Intake Manifold Fasteners

(13) Inspect and clean manifold. Refer to Cleaning and Inspection outlined in this section for procedures.

INSTALLATION

If the following items were removed, install and torque to:

- Fuel Rail Bolts 22 N·m (200 in. lbs.)
- Engine Outlet Connector Bolts 28 N·m (250 in. lbs.)
- Coolant Temperature Sensor 7 N·m (60 in. lbs.)
- Intake Air Temperature Sensor 28 N·m (250 in. lbs.)

(1) Using a new intake gasket, position intake manifold on the engine and install retaining bolts.

REMOVAL AND INSTALLATION (Continued)

(2) Tighten intake manifold fasteners in the following sequence (Fig. 16). Torque to 23 N·m (200 in. lbs.). Repeat this procedure until all bolts are at specified torque.

(3) Install intake manifold center support bracket bolts (Y bracket):

- Fastener to block 54 N·m (40 ft. lbs.)
- Fastener to intake 28 N·m (250 in. lbs.)

(4) Install fuel hose quick connector fitting to chassis tubes. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in Group 14, Fuel Delivery.** Push the fitting onto the chassis tube until it clicks into place. Pull on the fitting to ensure complete insertion.

(5) Reverse removal procedures 2 through 12 for installation.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(6) With the ignition key in ON position, access the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

EXHAUST MANIFOLD—2.4L ENGINE

REMOVAL

(1) Raise vehicle and disconnect exhaust pipe from the exhaust manifold at the flex-joint.

(2) Disconnect Oxygen Sensor lead wire at the rear exhaust manifold (Fig. 17).

(3) Remove the bolts attaching the manifold to the cylinder head. Remove manifold (Fig. 17).

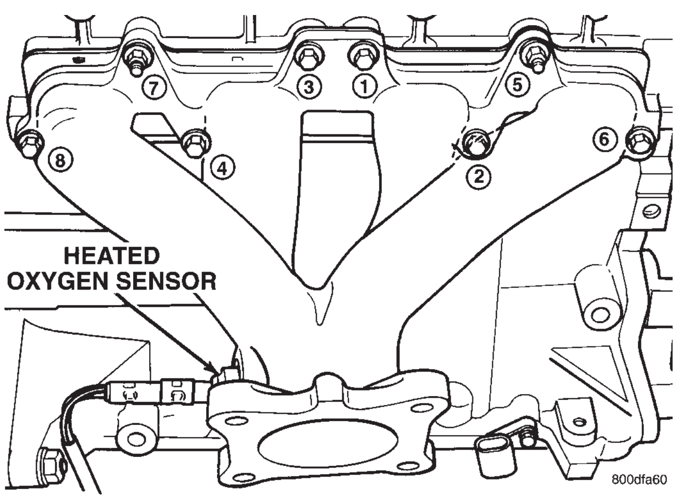

Fig. 17 Exhaust Manifold Attaching Points—2.4L Engine

(4) Inspect and clean manifold. Refer to Cleaning and Inspection outlined in this section for procedures.

INSTALLATION

(1) Install exhaust manifold with a new gasket and tighten attaching nuts in the order shown in (Fig. 17) to 20 N·m (175 in. lbs.).

(2) Attach exhaust pipe to exhaust manifold and tighten bolt to 28 N·m (250 in. lbs.).

(3) Connect heated oxygen sensor lead (Fig. 17).

INTAKE MANIFOLD—3.0L ENGINE

REMOVAL

(1) Perform fuel system pressure release procedure **(before attempting any repairs).** Refer to Group 14 Fuel System for procedure.

(2) Disconnect negative battery cable. Drain cooling system. See Cooling System, Group 7.

(3) Remove air inlet resonator to throttle body hose.

(4) Remove throttle cable and transaxle kickdown linkage (Fig. 18).

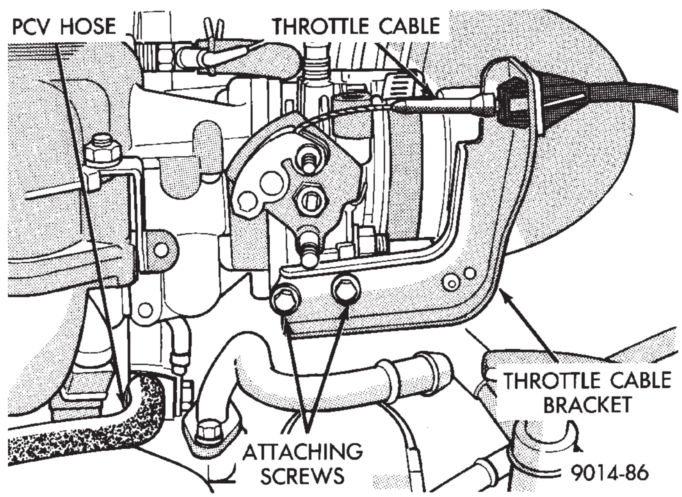

Fig. 18 Throttle Cable Attachment

(5) Remove automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors from throttle body (Fig. 19).

(6) Remove vacuum hose harness from throttle body.

(7) Remove PCV and Brake booster hoses from Air Intake Plenum.

(8) Remove Ignition Coil from Intake Plenum (Fig. 20).

(9) Remove wiring connectors from coolant temperature sensor (Fig. 21).

(10) Remove vacuum connections from Air Intake Plenum vacuum connector.

(11) Remove fuel hose from fuel rail (Fig. 21).

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

REMOVAL AND INSTALLATION (Continued)

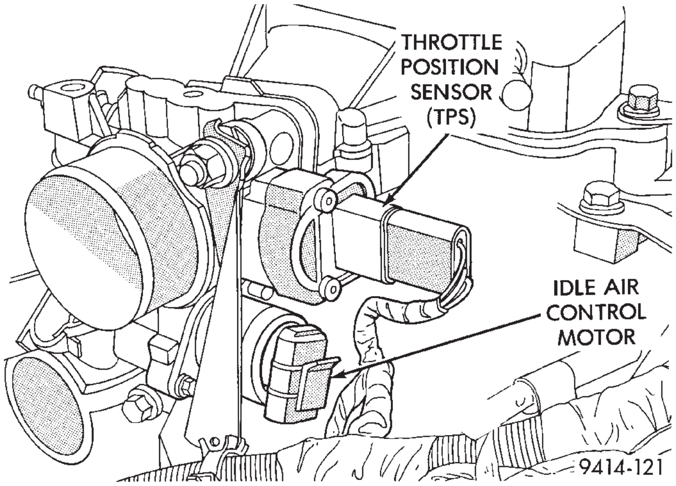

Fig. 19 Electrical and Vacuum Connections to Throttle Body

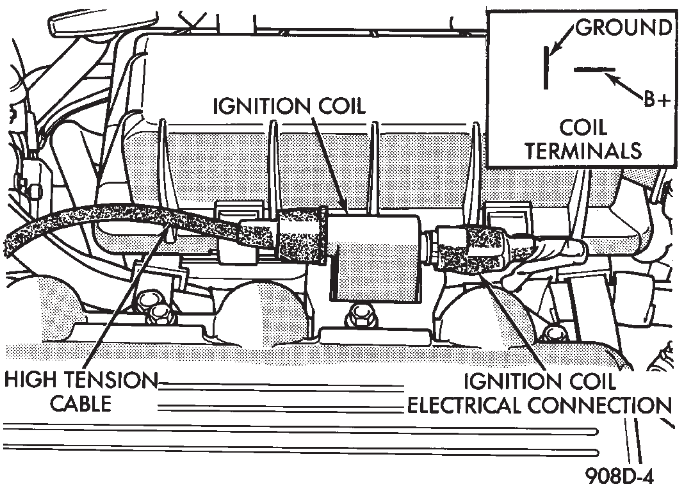

Fig. 20 Ignition Coil Removal

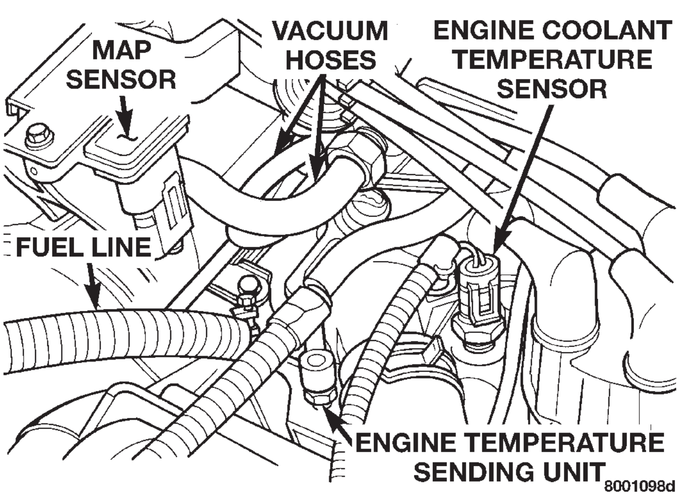

Fig. 21 Coolant Temperature Sensor Electrical Connections

(12) Remove fasteners from Air Intake Plenum to Intake Manifold (Fig. 22).

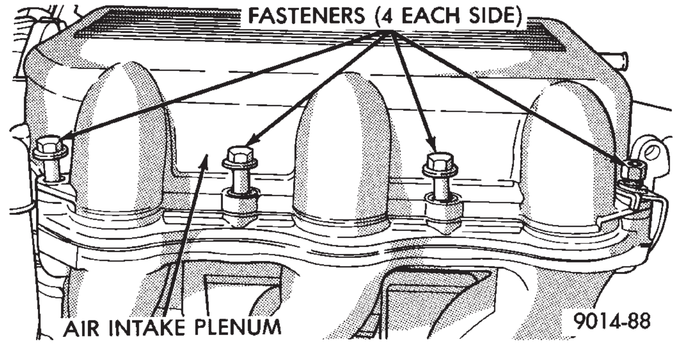

Fig. 22 Air Intake Plenum to Intake Manifold Attaching Bolts

(13) Remove Air Intake Plenum (Fig. 23).

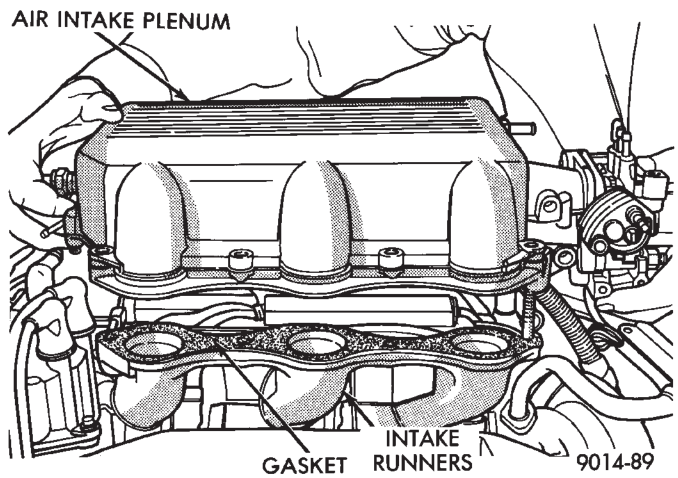

Fig. 23 Removing Air Intake Plenum

(14) Cover intake manifold with suitable cover when servicing (Fig. 24).

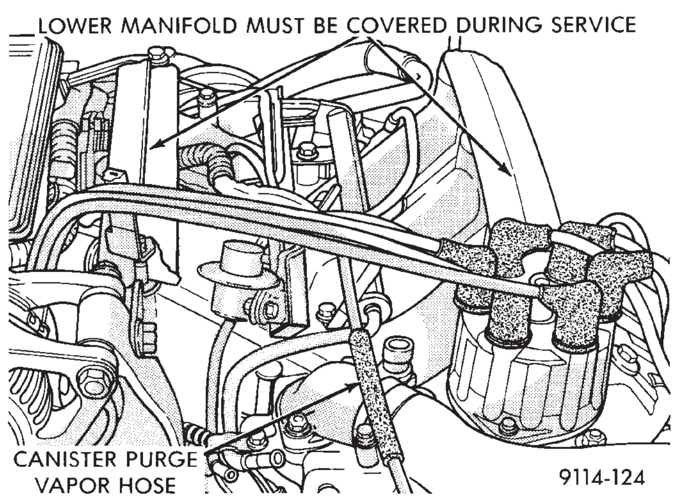

Fig. 24 Vacuum Connections for Fuel Rail and Fuel Pressure Regulator

(15) Disconnect Fuel Injector wiring harness from engine wiring harness.

REMOVAL AND INSTALLATION (Continued)

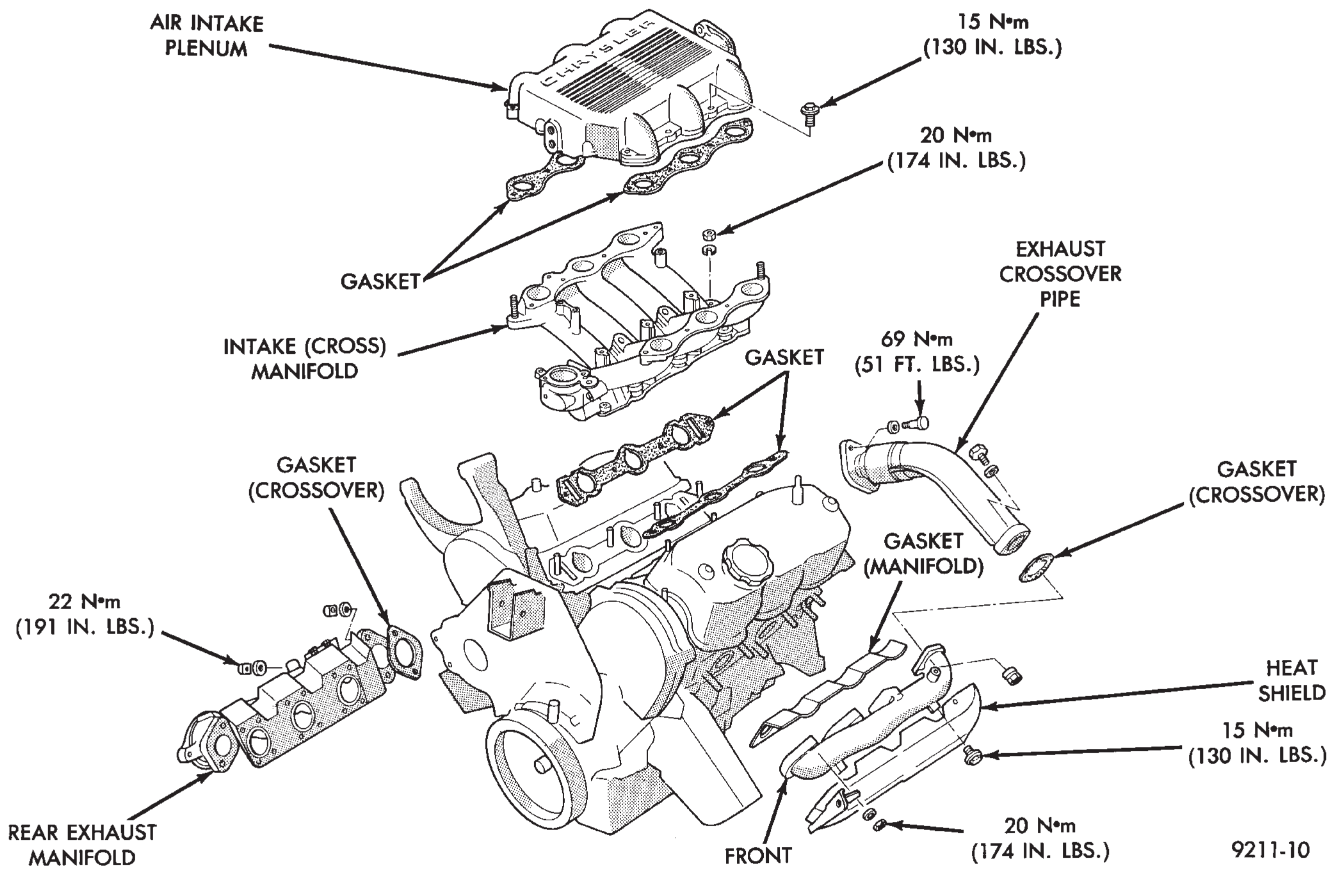

Fig. 25 Intake and Exhaust Manifolds — 3.0L Engine

(16) Remove fuel rail attaching bolts and lift fuel rail assembly from intake manifold.

(17) Separate radiator hose from thermostat housing and heater hose from heater pipe.

(18) Remove nut and washer assemblies and remove intake manifold (Fig. 25).

(19) Inspect and clean manifold. Refer to Cleaning and Inspection outlined in this section for procedures.

INSTALLATION

(1) Position new intake manifold gaskets on cylinder head and install intake (cross) manifold.

(2) Install nuts and washers and tighten in several steps in order shown in (Fig. 26) to 20 N·m (174 in. lbs.).

(3) Make sure the injector holes are clean and all plugs have been removed.

(4) Lube injector O-ring with a drop of clean engine oil to ease installation.

(5) Put the tip of each injector into their ports. Push the assembly into place until the injectors are seated in the ports.

(6) Install the fuel rail attaching bolts and torque to 13 N·m (115 in. lbs.).

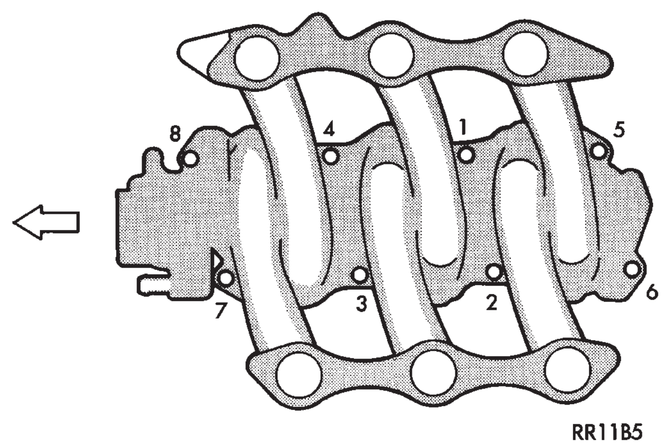

Fig. 26 Fastener Tightening Sequence for Intake (Cross) Manifold

(7) Install fuel supply and the vacuum crossover tube hold-down bolt and torque to 10 N·m (95 in. lbs.).

(8) Remove covering from lower intake manifold and clean surface.

(9) Place intake manifold gaskets **with beaded sealant side up** on lower manifold. Put air intake in place. Install attaching fasteners and tighten in several steps in sequence shown (Fig. 27) to 13 N·m (115 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

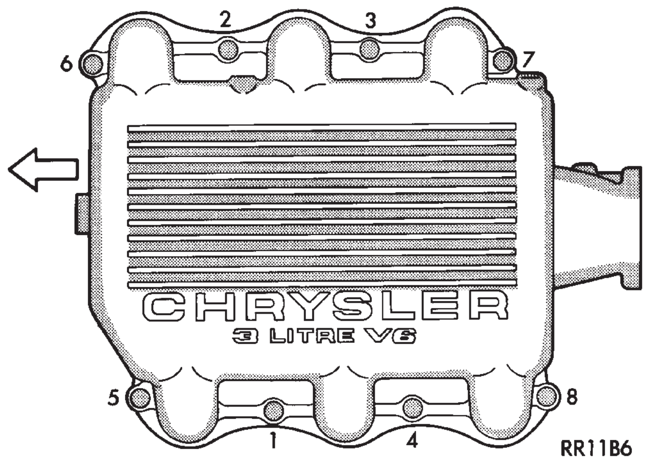

Fig. 27 Intake Plenum Tightening Sequence

(10) Connect fuel line to fuel rail (Fig. 21). Torque hose clamps to 1 N·m (10 in. lbs.).

(11) Connect vacuum harness to air intake plenum.

(12) Connect and coolant temperature sensor electrical connector to sensor (Fig. 21).

(13) Connect PCV and brake booster supply hose to intake plenum.

(14) Connect automatic idle speed (AIS) motor and throttle position sensor (TPS) electrical connectors (Fig. 19).

(15) Connect vacuum vapor harness to throttle body (Fig. 19).

(16) Install throttle cable and transaxle kickdown linkage (Fig. 18).

(17) Install air inlet resonator hose assembly to throttle body.

(18) Install radiator to thermostat housing hose and heater hose to heater pipe nipple.

(19) Fill cooling system. Refer to Filling the Cooling System outlined in Group 7 Cooling System for procedure.

(20) Connect negative battery cable.

(21) With the DRB Scan Tool use ASD Fuel System Test to pressurize system to check for leaks.

CAUTION: When using the ASD Fuel System Test, The Auto Shutdown (ASD) Relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

EXHAUST MANIFOLD—3.0L ENGINE

REMOVAL

(1) Raise vehicle and disconnect exhaust pipe from rear (cowl side) exhaust manifold at the flex-joint.

(2) Disconnect Oxygen Sensor lead wire at the rear exhaust manifold (Fig. 28).

(3) Remove bolts attaching cross-over pipe to manifold (Fig. 30).

(4) Remove rear heat shield (Fig. 29).

(5) Remove nuts attaching rear manifold to cylinder head and remove manifold.

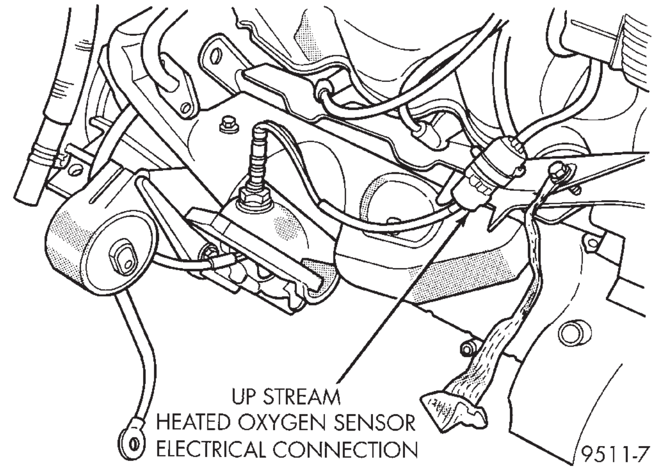

Fig. 28 Disconnect Up Stream Heated Oxygen Sensor Connection

(6) Lower vehicle and remove screws attaching front heat shield to front manifold (Fig. 31).

(7) Remove bolts fastening crossover pipe to front exhaust manifold and nuts fastening manifold to cylinder head. Remove assemblies.

(8) Inspect and clean manifolds. Refer to Cleaning and Inspection outlined in this section for procedures.

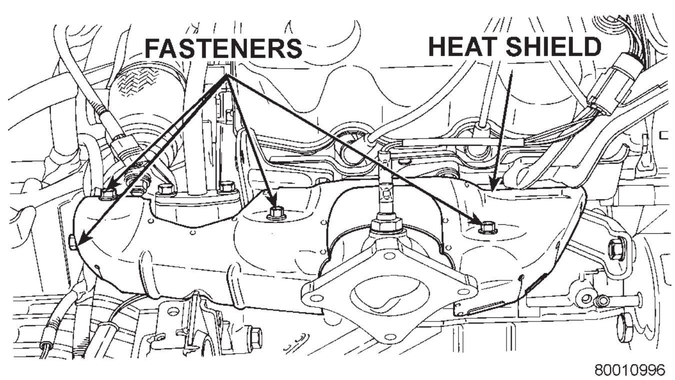

Fig. 29 Rear Exhaust Manifold Heat Shield

INSTALLATION

Install the gaskets with the numbers 1-3-5 embossed on the top on the rear bank and those with numbers 2-4-6 on the front (Radiator side) bank (Fig. 32).

(1) Install rear exhaust manifold and tighten attaching nuts to 20 N·m (175 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

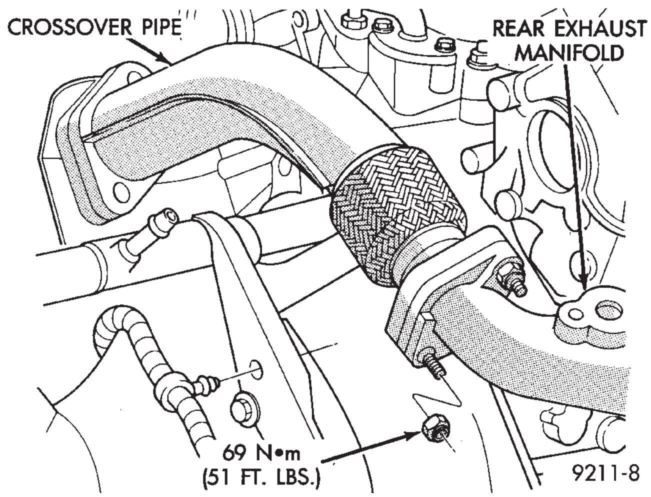

Fig. 30 Crossover Pipe

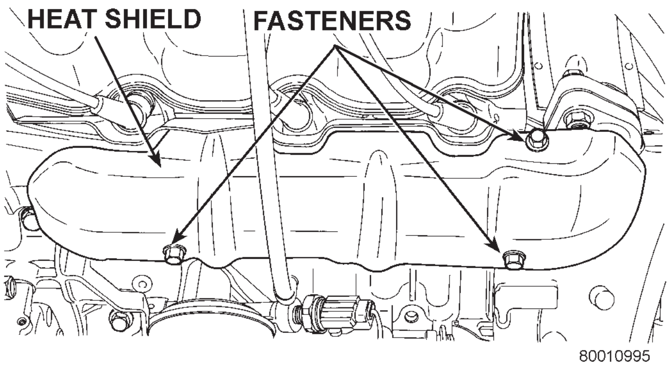

Fig. 31 Front Exhaust Manifold Heat Shield

(2) Attach exhaust pipe to exhaust manifold and tighten bolts to 28 N·m (250 in. lbs.)

(3) Attach crossover pipe to exhaust manifold and tighten bolt to 69 N·m (51 ft. lbs.)

(4) Install rear exhaust manifold heat shield (Fig. 29).

(5) Connect heated oxygen sensor lead (Fig. 28).

(6) Install front exhaust manifold and attach exhaust crossover.

(7) Install front exhaust manifold heat shield and tighten attaching screws to 15 N·m (130 in. lbs.) (Fig. 31).

INTAKE MANIFOLD—3.3/3.8L ENGINE

REMOVAL

(1) Remove windshield wiper module. Refer to Group 8K Windshield Wiper and Washer Systems for procedure.

(2) Perform fuel system pressure release procedure **(before attempting any repairs).** Refer to Group 14 Fuel System for procedure.

(3) Drain cooling system. See Cooling System, Group 7 for procedure.

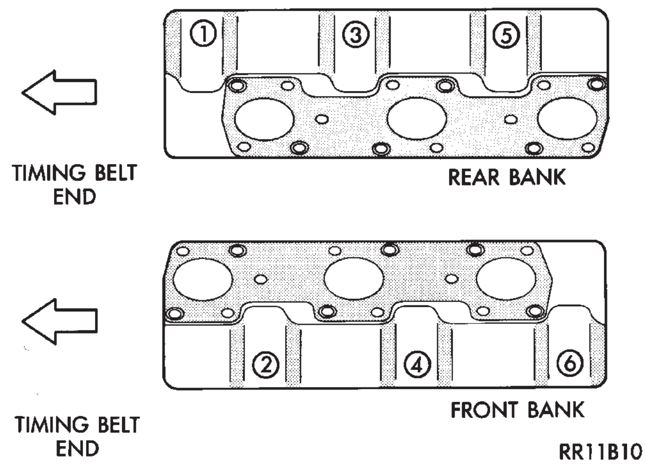

Fig. 32 Identify Exhaust Manifold Gaskets

(4) Remove air inlet resonator to throttle body hose assembly.

(5) Remove throttle cable. Refer to Group 14 Fuel Systems for procedure. Remove wiring harness from throttle cable bracket.

(6) Remove automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors from throttle body (Fig. 33).

(7) Remove EGR transducer connector.

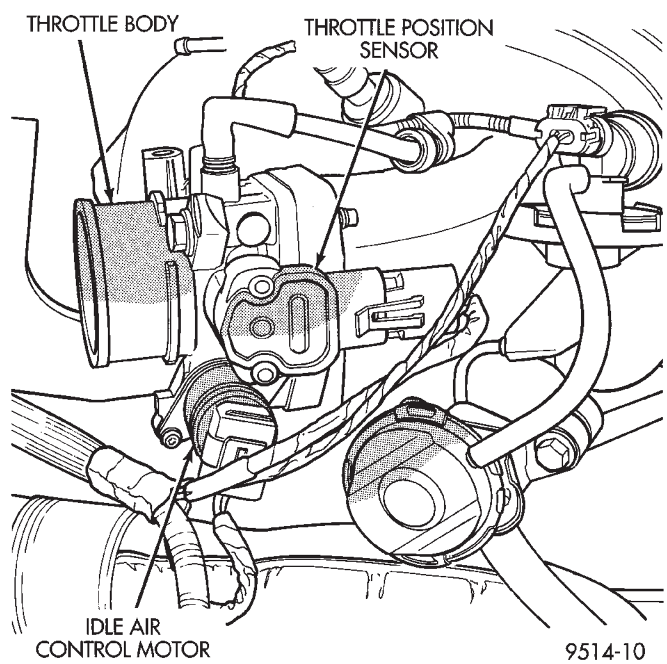

Fig. 33 Electrical and Vacuum Connection to Throttle Body

(8) Remove vacuum hose harness from throttle body (Fig. 33).

(9) Remove PCV and brake booster hoses from air intake plenum.

REMOVAL AND INSTALLATION (Continued)

(10) Disconnect MAP Sensor electrical connection (Fig. 34).

(11) Remove EGR tube flange from intake plenum.

(12) Remove vacuum harness connectors from intake plenum (Fig. 34).

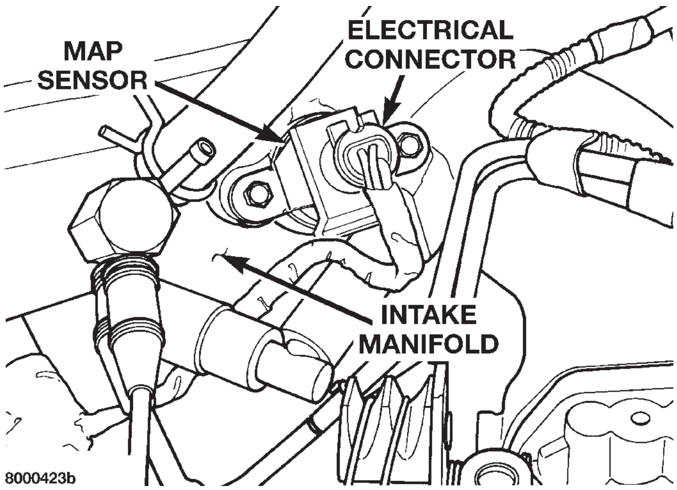

Fig. 34 Vacuum and Electrical Connections to Intake Manifold

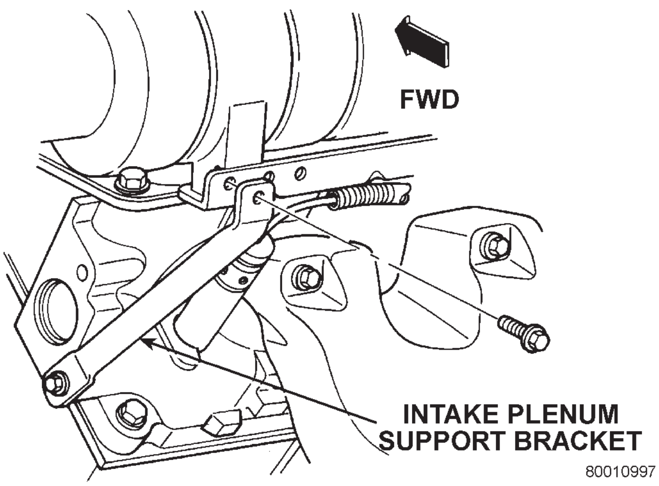

Fig. 35 Intake Manifold Plenum Support Bracket

(13) Remove cylinder head to intake plenum strut (Fig. 35)

(14) Remove the engine mounted ground strap.

(15) Remove the fuel hose quick connect fitting from the fuel line by using an open end wrench pushing in on the plastic ring located on the end of the fittings. Gently pull the fitting from the fuel line (Fig. 36).

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE DURING REMOVAL.

(16) Remove direct ignition system (DIS) coils and generator bracket to intake manifold bolt (Fig. 37).

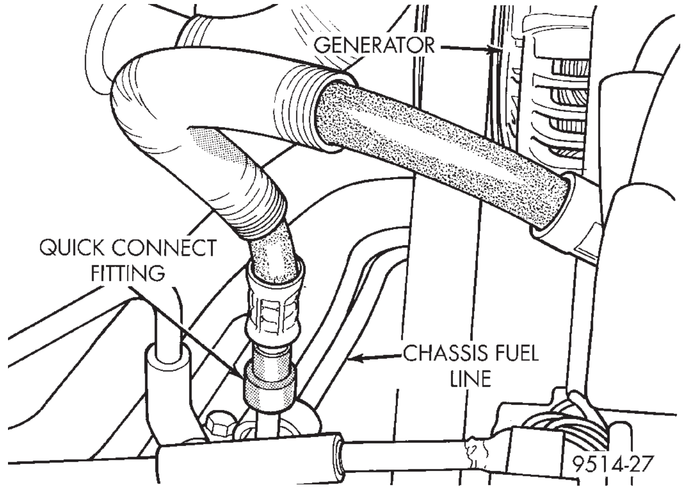

Fig. 36 Quick Connect Fuel Fitting to Fuel Line

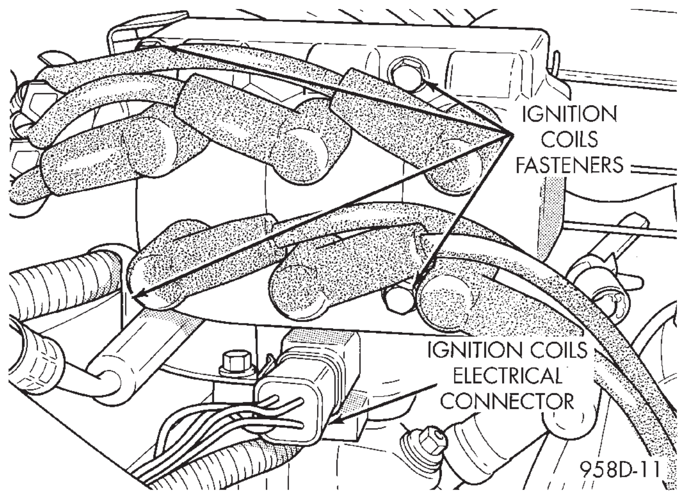

Fig. 37 Ignition Coils

(17) Remove bolts from generator to intake manifold bracket. Loosen top generator mounting bolt, and move bracket up so intake manifold can clear mounting studs (Fig. 38).

(18) Remove intake manifold bolts and remove the manifold (Fig. 38).

(19) Cover intake manifold with suitable cover when servicing (Fig. 39).

(20) Remove fuel tube retainer bracket screw and fuel rail attaching bolts (Fig. 39). Spread the retainer bracket to allow fuel tube removal clearance.

(21) Disconnect cam sensor and coolant temperature sensor (Fig. 40).

(22) Remove fuel injector wiring clip from intake manifold water tube.

(23) Remove fuel rail. Be careful not to damage the rubber injector O-rings upon removal from their ports (Fig. 41).

(24) Remove upper radiator hose, bypass hose and rear intake manifold hose (Fig. 42).

REMOVAL AND INSTALLATION (Continued)

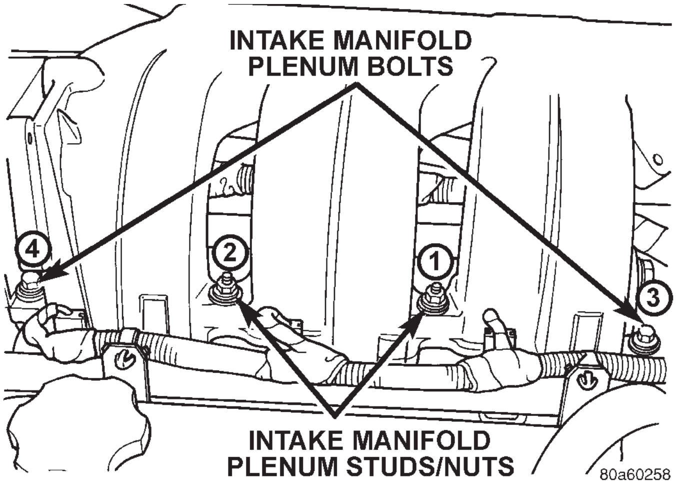

Fig. 38 Intake Manifold Plenum Bolts and Nuts

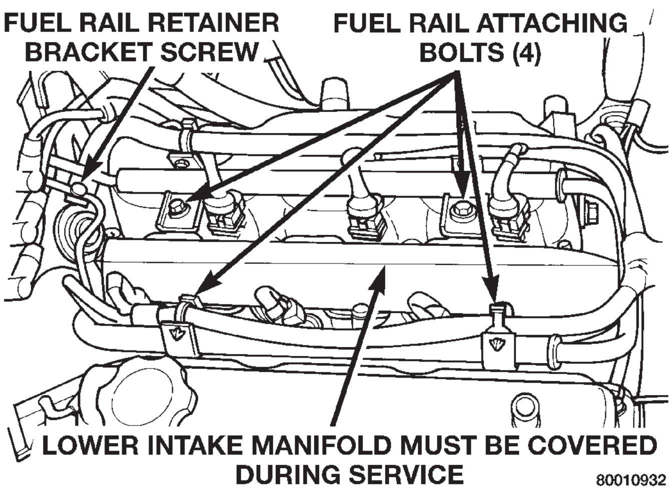

Fig. 39 Fuel Rail Attaching Bolts

(25) Remove intake manifold bolts. Remove intake manifold.

(26) Inspect and clean manifold. Refer to Cleaning and Inspection outlined in this section for procedures.

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

(27) Remove intake manifold seal retainers screws (Fig. 43). Remove intake manifold gasket.

INSTALLATION

(1) Clean all surfaces of cylinder block and cylinder heads.

(2) Place a drop (approximately 1/4 in. diameter) of Mopar® Silicone Rubber Adhesive Sealant or equivalent, onto each of the **four** manifold to cylinder head gasket corners (Fig. 44).

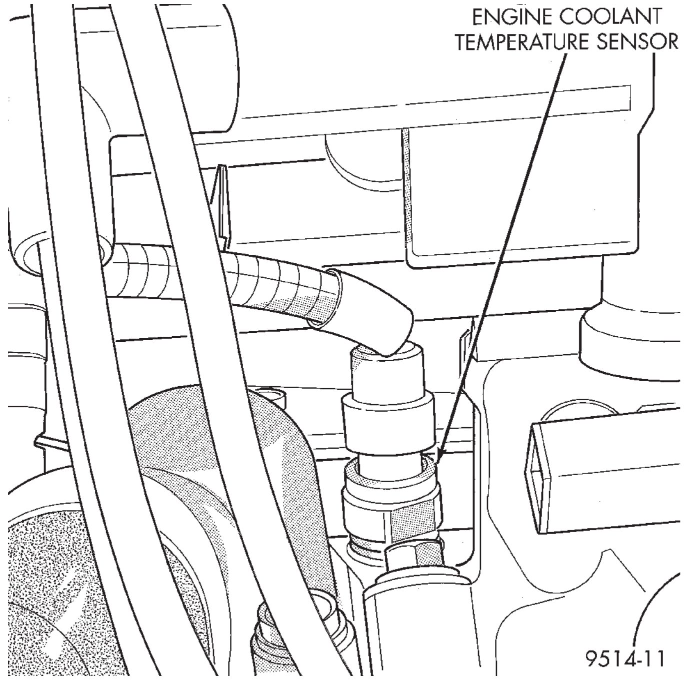

Fig. 40 Coolant Temperature Sensor Electrical Connector

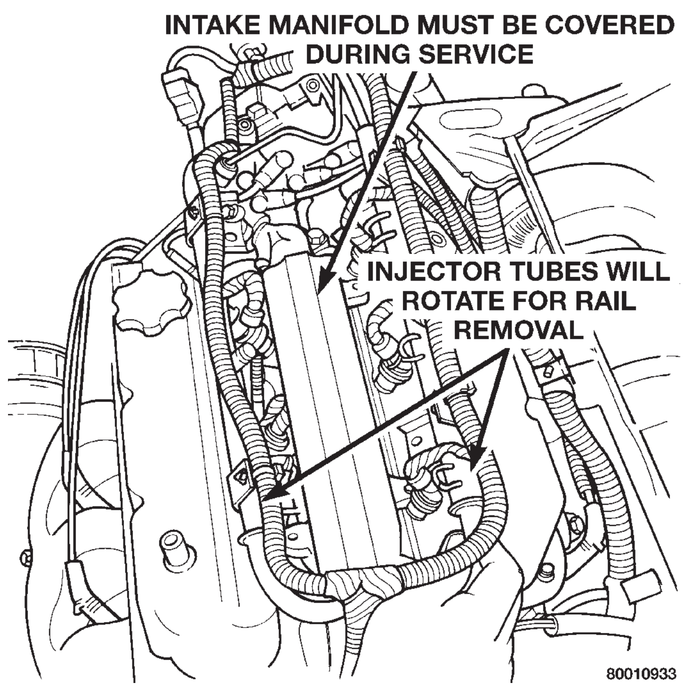

Fig. 41 Fuel Rail Removal

(3) Carefully install the new intake manifold gasket (Fig. 43). Torque end seal retainer screws to 12 N·m (105 in. lbs.).

(4) Install intake manifold and bolts and torque to 1 N·m (10 in. lbs.). Then torque bolts to 22 N·m (200 in. lbs.) in sequence shown in (Fig. 42). Then torque again to 22 N·m (200 in. lbs.). After intake manifold is in place, **inspect to make sure seals are in place.**

REMOVAL AND INSTALLATION (Continued)

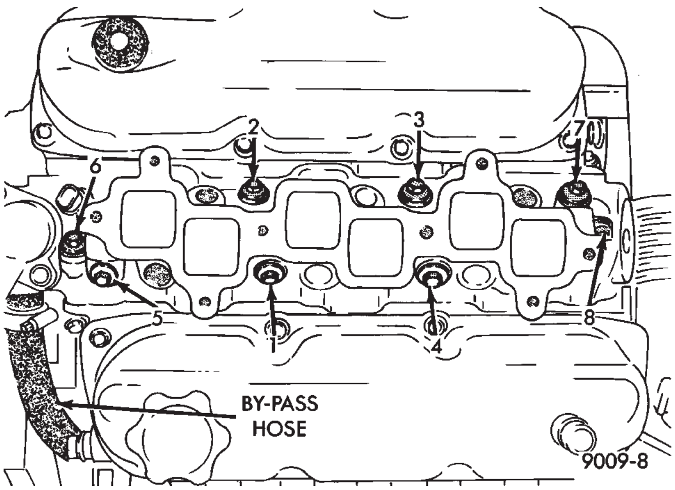

Fig. 42 Intake Manifold Removal and Installation

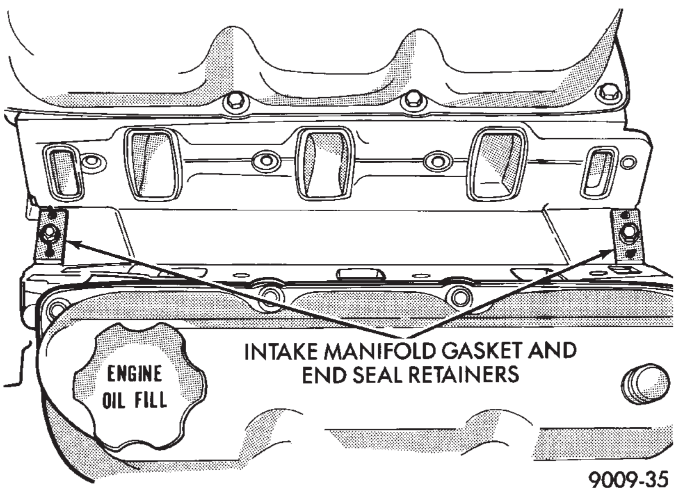

Fig. 43 Intake Manifold Gasket

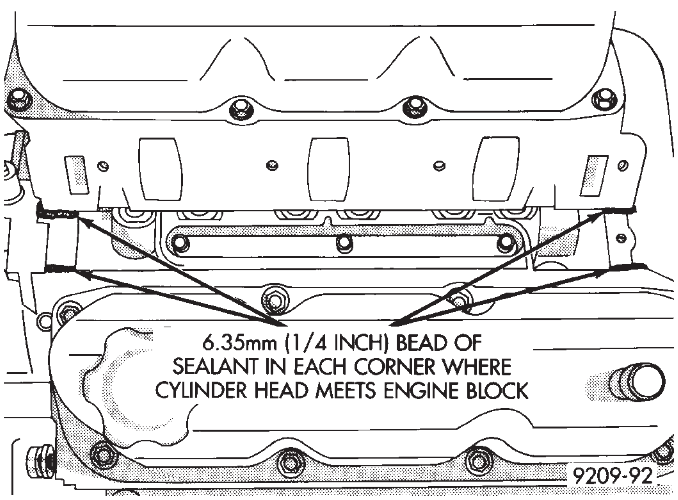

Fig. 44 Intake Manifold Gasket Sealing

(5) Make sure the injector holes are clean and all plugs have been removed.

(6) Lube injector O-ring with a drop of clean engine oil to ease installation.

(7) Put the tip of each injector into their ports. Push the assembly into place until the injectors are seated in the ports (Fig. 41).

(8) Install the fuel rail attaching bolts and torque to 22 N·m (200 in. lbs.) (Fig. 39).

(9) Install fuel tube retaining bracket screw and torque to 4 N·m (35 in. lbs.) (Fig. 39).

(10) Connect cam sensor and coolant temperature sensor (Fig. 40).

(11) Remove covering on lower intake manifold and clean surface.

(12) Place the new intake manifold gasket on lower manifold. Put upper manifold into place and install bolts and nuts finger tight.

NOTE: At no time should the studs be replaced with a bolt and washer.

(13) Install the generator bracket to intake manifold bolt and the cylinder head to intake manifold strut bolts. (Do not torque.)

(14) Torque intake manifold bolts to 28 N·m (250 in. lbs.) following torque sequence in (Fig. 38).

(15) Torque generator bracket to intake manifold bolt to 54 N·m (40 ft. lbs.).

(16) Torque the cylinder head to intake manifold strut bolts to 54 N·m (40 ft. lbs.) (Fig. 35).

(17) Connect ground strap and MAP sensor electrical connectors.

(18) Connect vacuum harness to intake plenum (Fig. 34).

(19) Using a new gasket, connect the EGR tube flange to the intake manifold and torque to 22 N·m (200 in. lbs.).

(20) Clip wiring harness into the hole in the throttle cable bracket.

(21) Connect the wiring connectors to the throttle position sensor (TPS) and Automatic Idle Speed (AIS) motor (Fig. 33).

(22) Connect vacuum harness to throttle body (Fig. 33).

(23) Install the direct ignition system (DIS) coils. Torque fasteners to 12 N·m (105 in. lbs.) (Fig. 37).

(24) Lubricate the end of the chassis fuel tube with 30 wt. oil. Connect fuel supply hose to chassis fuel tube assembly. Pull back on the quick connect fitting to ensure complete insertion (Fig. 36). (Refer to Fuel Hoses, Clamps and Quick Connect Fittings in Group 14 Fuel Systems).

(25) Install throttle cable. Refer to Group 14 Fuel System for procedure.

(26) Connect fuel injector wiring harness.

(27) Install air cleaner and hose assembly.

(28) Connect negative battery cable. Fill Cooling System. See Cooling System, Group 7.

(29) With the DRB Scan Tool use ASD Fuel System Test to pressurize system to check for leaks.

REMOVAL AND INSTALLATION (Continued)

CAUTION: When using the ASD Fuel System Test, The Auto Shutdown (ASD) Relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

EXHAUST MANIFOLDS—3.3/3.8L ENGINE

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove accessory drive belt. Refer to Accessory Drive section located in Group 7 Cooling System for procedure.

(3) Remove generator.

(4) Raise vehicle and disconnect exhaust pipe from rear (cowl side) exhaust manifold at flex-joint.

(5) Disconnect down stream oxygen sensor connector.

(6) Lower exhaust system to gain access to rear manifold.

(7) Separate EGR tube from rear manifold and disconnect Heated Oxygen Sensor lead wire (Fig. 45).

(8) Remove heat shield from rear engine mount.

(9) Remove Generator/Power Steering Support Strut (Fig. 45).

(10) Remove bolts attaching crossover pipe to manifold (Fig. 45).

(11) Disconnect up stream oxygen sensor connector.

(12) Remove bolts attaching rear manifold to cylinder head and remove manifold.

(13) Lower vehicle and remove screws attaching front heat shield to front manifold (Fig. 46).

(14) Remove bolts fastening crossover pipe to front exhaust manifold and nuts fastening manifold to cylinder head. Remove assemblies (Fig. 47).

(15) Inspect and clean manifold. Refer to Cleaning and Inspection outlined in this section for procedures.

INSTALLATION

(1) Install rear exhaust manifold and tighten attaching bolts to 23 N·m (200 in. lbs.).

(2) Install generator.

NOTE: Inspect crossover pipe fasteners for damage from heat and corrosion. Replace if necessary.

(3) Using new gasket attach crossover pipe to exhaust manifold and tighten bolts to 54 N·m (40 ft. lbs.) and connect oxygen sensor lead (Fig. 45).

(4) Install EGR Tube and Generator/Power Steering Strut (Fig. 45).

(5) Using new gaskets install front exhaust manifold and tighten attaching bolts to 23 N·m (200 in. lbs.).

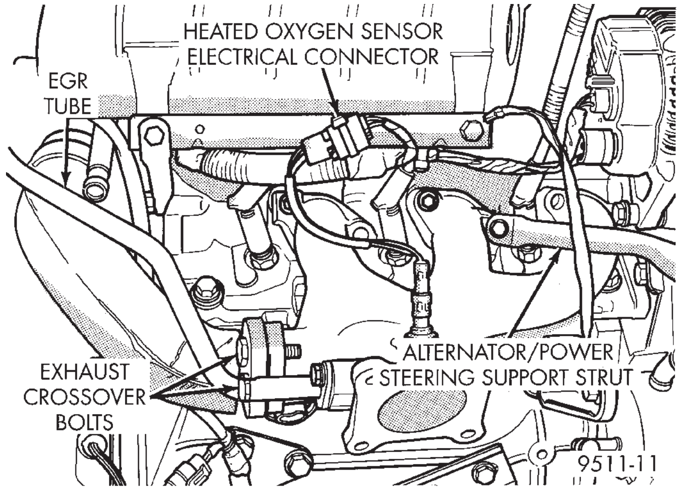

Fig. 45 EGR Tube, Heated Oxygen Sensor and Generator/Power Steering Strut

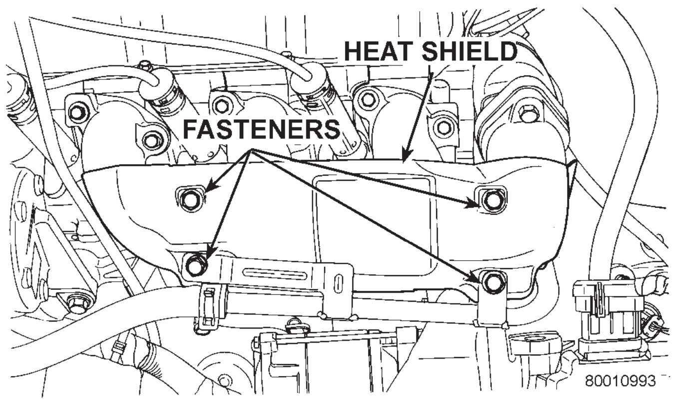

Fig. 46 Heat Shield—Front

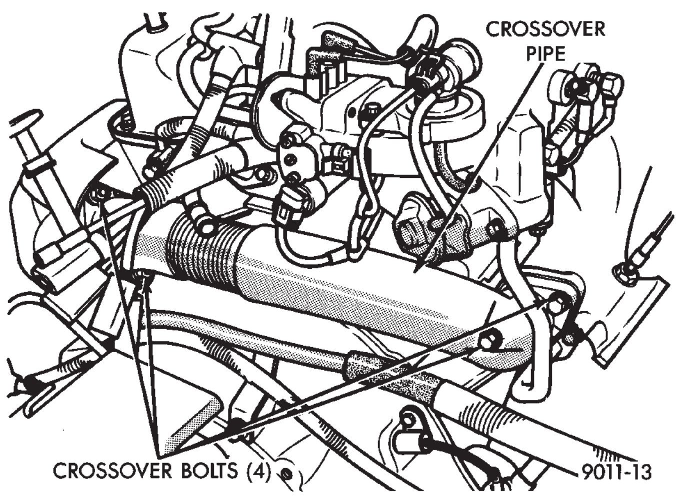

Fig. 47 Crossover Pipe

(6) Attach exhaust crossover with a new gasket and tighten fasteners to 54 N·m (40 ft. lbs.) (Fig. 47).

(7) Connect up stream oxygen sensor connector.

(8) Install exhaust system.

REMOVAL AND INSTALLATION (Continued)

(9) Attach exhaust pipe to exhaust manifold using new gasket and tighten bolts to 28 N·m (250 in. lbs.).

(10) Connect down stream oxygen sensor connector.

(11) Install front manifold heat shield and tighten attaching screws to 12 N·m (105 in. lbs.) (Fig. 46).

(12) Install accessory drive belt. Refer to Accessory Drive section located in Group 7 Cooling System for procedure.

(13) Connect battery negative cable.

CLEANING AND INSPECTION

INTAKE MANIFOLD

INSPECTION

Check for:

- Damage and cracks of each section.
- Clogged water passages in end cross-overs (if equipped).
- Check for cylinder head mounting surface distortion using a straightedge and thickness gauge. Refer to specifications for warpage specification.

CLEANING

Remove the gasket material from the manifold surfaces.

Be careful not to gouge or scratch the sealing surface.

EXHAUST MANIFOLD

INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust cross-over mounting surface with a straightedge and thickness gauge (Fig. 48).

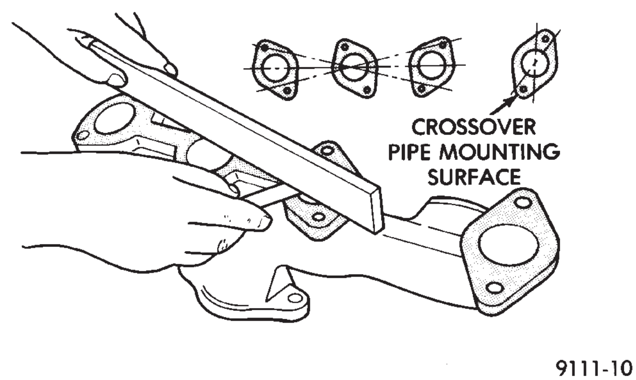

Fig. 48 Check Exhaust Manifold Mounting

CLEANING

Remove the gasket material from the manifold surfaces (if equipped). Be careful not to gouge or scratch the sealing surface.

SPECIFICATIONS

TORQUE CHART

DESCRIPTION **TORQUE**

Band Clamp (Torca)
Fastener . . . . .75 N·m (55 ft. lbs.)
Exhaust Manifold—2.4L
Fastener . . . . .23 N·m (200 in. lbs.)
Exhaust Manifold—3.0L
Nuts .22 N·m (191 in. lbs.)
Exhaust Manifold—3.3/3.8L
Fastener . . . . .23 N·m (200 in. lbs.)
Exhaust Manifold—3.3/3.8L
Stud .23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield—3.0L
Fasteners . . . . .15 N·m (130 in. lbs.)
Exhaust Manifold Heat Shield—3.3/3.8L
Fasteners . . . . .12 N·m (105 in. lbs.)
Exhaust Manifold Crossover—3.0L
Bolts . . . . .69 N·m (51 ft. lbs.)
Exhaust Manifold Crossover—3.3/3.8L
Fasteners. . . . . .54 N·m (40 ft. lbs.)
Exhaust Manifold Flange (All)
Fastener . . . . .28 N·m (250 in. lbs.)
Heat Shield—Muffler
Fastener . . . . .2 N·m (23 in. lbs.)
Heat Shield—Toe Board
Fastener . . . . .2 N·m (23 in. lbs.)
Insulator Mounting Bracket on Muffler to Body
Bolts .28 N·m (250 in. lbs.)
Insulator Mounting Bracket on Resonator to Body
Bolts .28 N·m (250 in. lbs.)
Intake Manifold Gasket Retainer
Fastener . . . . .12 N·m (105 in. lbs.)
Intake Air Plenum—3.0L
Bolts .15 N·m (130 in. lbs.)
Intake (Cross) Manifold—3.0L
Bolts .20 N·m (174 in. lbs.)
Intake Plenum Support Bracket—3.3/3.8L
Fastener . . . . .54 N·m (40 ft. lbs.)
Intake Manifold—2.4L
Fastener . . . . .28 N·m (250 in. lbs.)
Intake Manifold Upper—2.4L
Bolts .28 N·m (250 in. lbs.)
Intake Manifold—3.3/3.8L
Fastener . . . . .23 N·m (200 in. lbs.)
Intake Manifold Plenum—3.3/3.8L
Bolts .28 N·m (250 in. lbs.)
Muffler Hanger Support Clamp
Fastener . . . . .17 N·m (150 in. lbs.)

FRAME AND BUMPERS

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BUMPERS AND FASCIA

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REAR BUMPER REINFORCEMENT 2

REMOVAL AND INSTALLATION

FRONT BUMPER FASCIA

REMOVAL

(1) Release hood latch and open hood.
(2) Remove bolts holding fascia to headlamp mounting panel at each side of grille.
(3) Hoist and support vehicle on safety stands.
(4) Remove front wheels. Refer to Group 22, Wheels and Tires, for proper procedures and sequence.
(5) Remove front wheelhouse splash shields fasteners as necessary to gain access to bolts holding front fascia to fender. Refer to Group 23, Body, for proper procedures.
(6) Remove bolts holding fascia to bottom of front fenders (Fig. 1).
(7) Remove bolts holding bottom of fascia/air dam to radiator closure panel.
(8) Disconnect fog lamp/parking and turn signal lamp wire connector, if necessary.
(9) Remove bumper fascia from vehicle.

INSTALLATION

(1) Position front bumper fascia on vehicle.
(2) Lower vehicle.
(3) Install bolts to hold fascia to headlamp mounting panel at each side of grille.
(4) Raise vehicle.
(5) Install bolts to hold fascia to bottom of front fenders (Fig. 1). The fascia should be flush to fender.

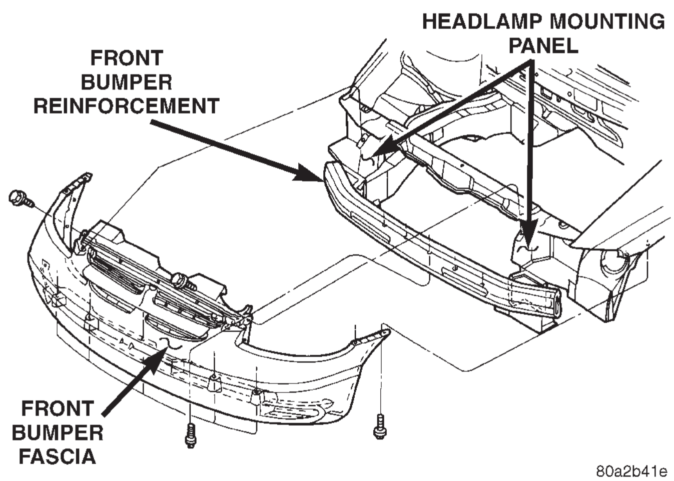

Fig. 1 Front Bumper Fascia

(6) Install front wheelhouse splash shields fasteners. Refer to Group 23, Body, for proper procedures.
(7) Install front wheels. Refer to Group 22, Wheels and Tires, for proper procedures and tightening sequence.
(8) Install bolts to hold bottom of fascia to radiator closure panel.

FRONT BUMPER REINFORCEMENT

REMOVAL

(1) Remove front bumper fascia.
(2) Support front bumper reinforcement on a suitable lifting device.
(3) Remove nuts holding front bumper reinforcement to frame rail (Fig. 2).

REMOVAL AND INSTALLATION (Continued)

(4) Remove front bumper reinforcement from vehicle.

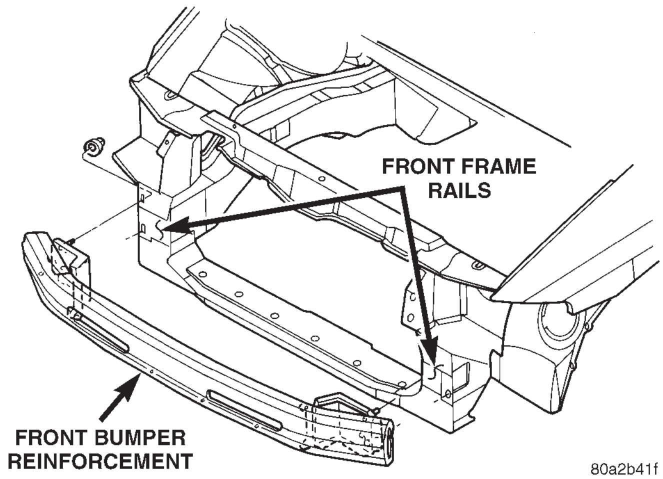

Fig. 2 Front Bumper Reinforcement

INSTALLATION

(1) Position front bumper reinforcement on vehicle.

(2) Install nuts to hold reinforcement to frame rails. Tighten nuts to 54 N·m (40 ft. lbs.) torque.

(3) Install front fascia.

REAR BUMPER FASCIA

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Hoist and support vehicle on safety stands.

(3) Remove screws holding rear fascia to rear fascia brackets (Fig. 3).

(4) Remove plastic rivets holding bottom of rear fascia to bumper reinforcement.

(5) Disengage hooks on sides of fascia from tabs in rear fascia brackets.

(6) Remove rear fascia from vehicle.

INSTALLATION

(1) Position rear fascia on vehicle.

(2) Engage fascia tabs under liftgate.

(3) Engage hooks on sides of fascia to tabs in rear fascia brackets.

NOTE: Verify all fascia tabs are still engaged under the liftgate. Ensure acceptable and consistent gap between liftgate and fascia.

(4) Install plastic rivets to hold bottom of rear fascia to bumper reinforcement.

(5) Install screws holding rear fascia to rear fascia brackets.

(6) Lower vehicle.

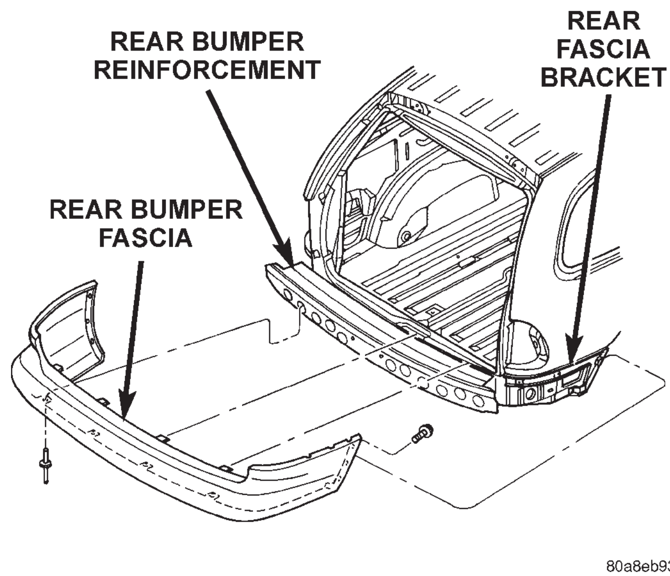

Fig. 3 Rear Bumper Fascia

REAR BUMPER REINFORCEMENT

REMOVAL

(1) Remove rear bumper fascia.

(2) Support rear bumper reinforcement on a suitable lifting device.

(3) Mark position of nuts on frame rail extensions to aid installation.

(4) Remove nuts holding rear bumper reinforcement to frame rail extensions (Fig. 4).

(5) Remove rear bumper reinforcement from vehicle.

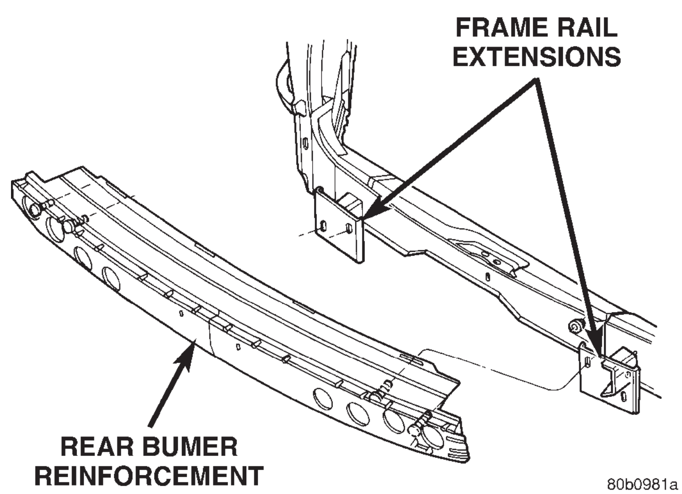

Fig. 4 Rear Bumper Reinforcement

INSTALLATION

(1) Position rear bumper reinforcement on vehicle.

(2) Loosely install nuts to hold rear bumper reinforcement to frame rail extensions (Fig. 4).

(3) Align nuts to previously made marks on frame rail extensions. Tighten nuts to 27 N·m (20 ft. lbs.) torque.

(4) Install rear bumper fascia.

FRAME

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REMOVAL AND INSTALLATION

FRONT CROSSMEMBER

The front suspension crossmember must be installed in the design location to achieve proper front end suspension alignment. If the crossmember is removed without applying reference marks on the frame rails, align the crossmember according to the dimensions provided in this group.

NOTE: If the caged nuts in the frame rails become damaged and cannot be reused, a replacement nut can be obtained through a Mopar® Parts supplier.

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove steering column lower cover from instrument panel. Refer to Group 8E, Instrument Panel and Systems.

(3) Remove knee blocker reinforcement. Refer to Group 8E, Instrument Panel and Systems.

(4) Position steering so front wheels are straight ahead.

CAUTION: Do not rotate steering wheel after disengaging lower coupling from steering gear, damage to airbag clock spring can result.

(5) Remove clinch bolt holding steering column coupling to steering gear shaft (Fig. 1).

(6) Remove steering column coupling from telescoping steering gear shaft.

(7) Hoist and support vehicle on safety stands.

(8) Position a drain pan under power steering pump and oil return hose coupling.

(9) Using a hose pinch-off pliers (C-4390), pinch power steering oil return hose off between the crossmember coupling and the pump.

(10) Loosen hose clamp at the crossmember coupling.

(11) Disconnect return hose from metal tube.

(12) While holding pressure relief valve nut on back of power steering pump, Remove flare nut holding high pressure hose to back of pump.

(13) Separate high pressure hose from pump.

(14) Allow power steering fluid to drain into pan.

(15) Remove bolts holding anti-lock brake sensor leads to crossmember.

(16) Position anti-lock brake leads out of the way.

(17) Disconnect stabilizer bar links from ends of stabilizer bar. Refer to Group 2, Suspension.

(18) Disconnect lower ball joints from lower control arms. Refer to Group 2, Suspension.

(19) Remove bolt holding rear engine mount to crossmember (Fig. 2).

(20) Using paint or grease pencil, mark outline of crossmember on frame rails to aid installation.

(21) Support crossmember on suitable lifting device (Fig. 4).

(22) Remove bolts holding crossmember to front frame rails (Fig. 3).

(23) Remove crossmember from vehicle (Fig. 4).

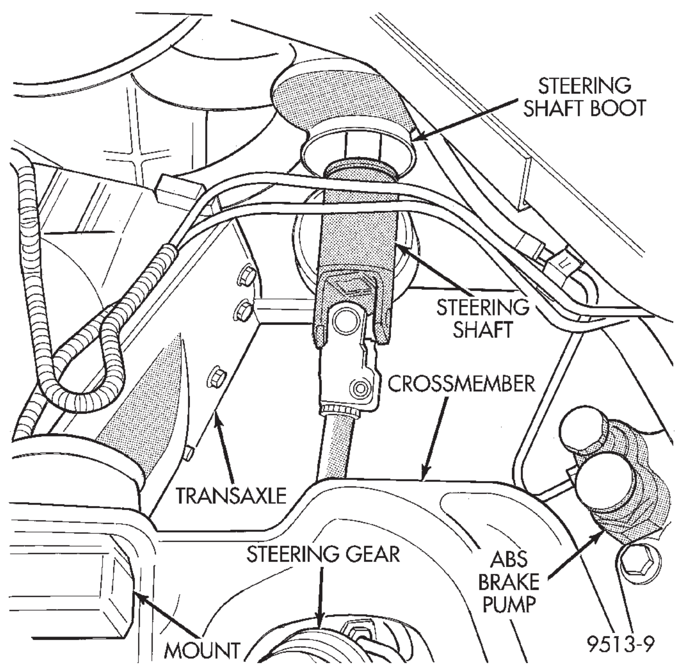

Fig. 1 Steering Coupling Boot

REMOVAL AND INSTALLATION (Continued)

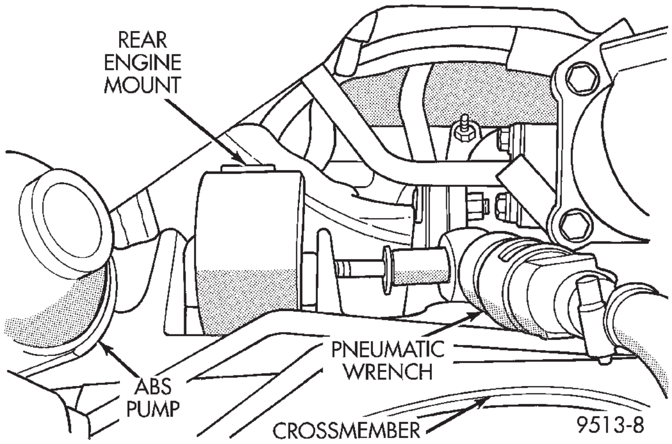

Fig. 2 Rear Engine Mount

INSTALLATION

NOTE: If crossmember requires replacement. Refer to Group 2, Suspension, to transfer suspension components and Group 19, Steering, to transfer steering components.

(1) Support crossmember on suitable lifting device (Fig. 4).

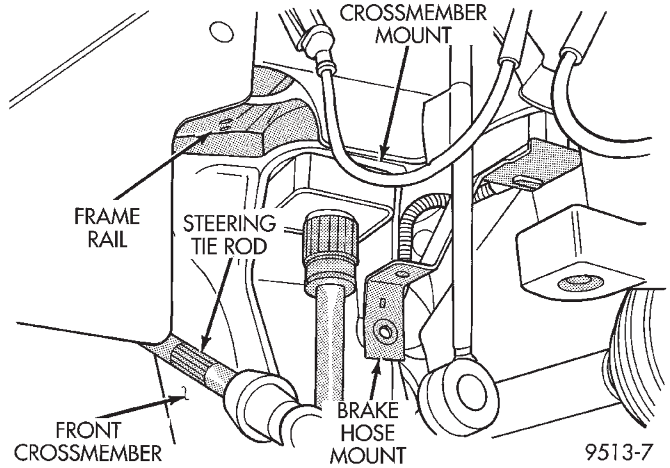

Fig. 3 Crossmember Mount

(2) Position crossmember to vehicle.

(3) Loosely install bolts to hold crossmember to front frame rails.

(4) Align crossmember to previously made marks on frame rails.

(5) Tighten bolts holding crossmember to frame rails.

(6) Install bolt holding rear engine mount to crossmember.

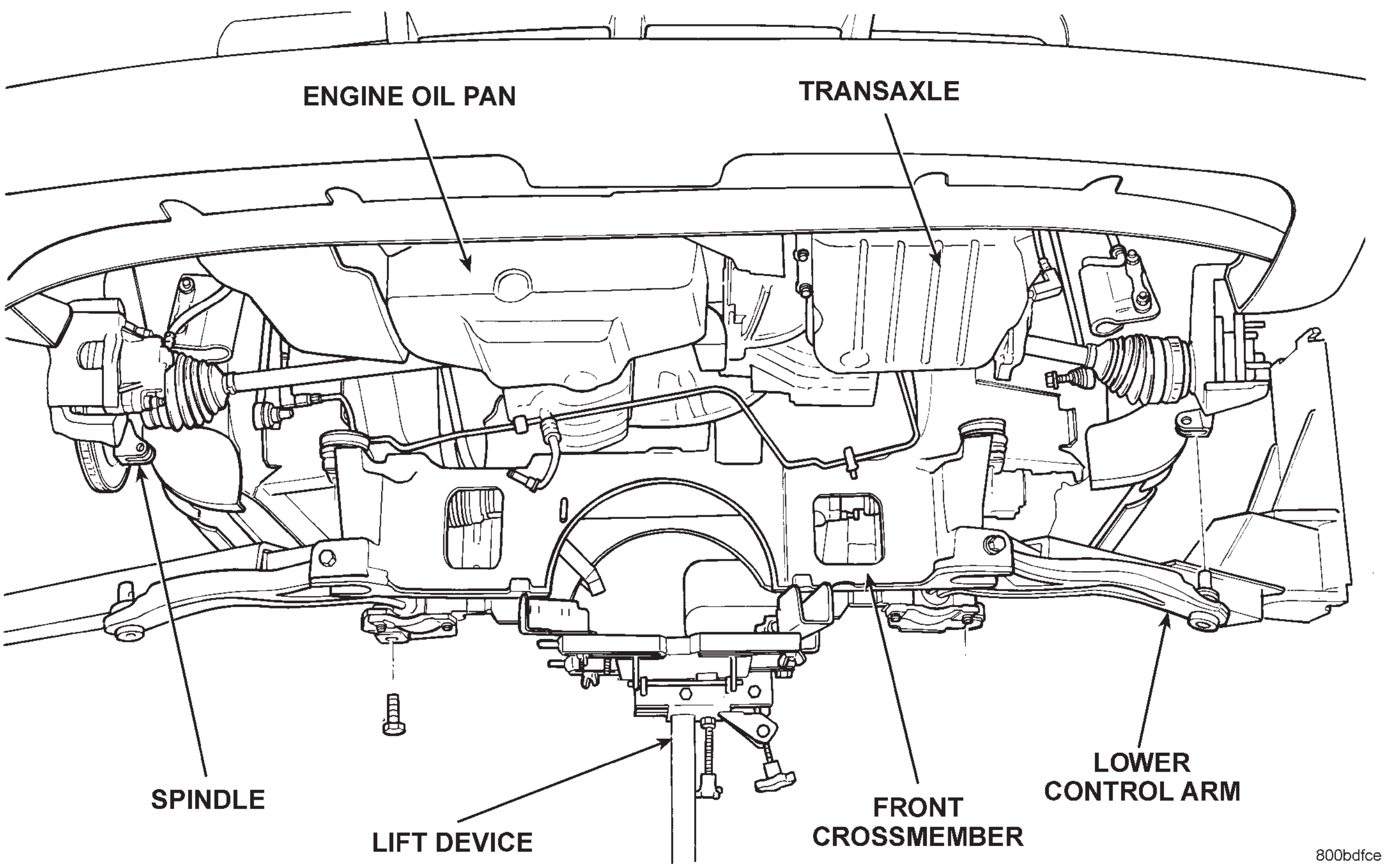

Fig. 4 Crossmember

REMOVAL AND INSTALLATION (Continued)

(7) Connect lower ball joints to lower control arms. Refer to Group 2, Suspension.

(8) Connect stabilizer bar links to ends of stabilizer bar. Refer to Group 2, Suspension.

(9) Install bolts to hold anti-lock brake sensor leads to crossmember.

(10) Install high pressure hose to pump.

(11) Connect return hose to metal tube.

(12) Tighten hose clamp at the crossmember coupling.

(13) Remove pinch-off pliers.

(14) Position steering so front wheels are straight ahead.

(15) Install steering column coupling to telescoping steering gear shaft.

(16) Install clinch bolt to hold steering column coupling to steering gear shaft.

(17) Install knee blocker reinforcement. Refer to Group 8E, Instrument Panel and Systems.

(18) Install steering column lower cover from instrument panel. Refer to Group 8E, Instrument Panel and Systems.

(19) Connect battery negative cable.

FRONT CROSSMEMBER MOUNT BUSHINGS

REMOVAL

(1) Using paint or grease pencil, mark outline of crossmember on frame rails.

(2) Loosen bolts holding crossmember to frame rails.

(3) Remove bolt on bushing that requires replacement.

(4) Allow crossmember to drop down enough to gain clearance for bushing removal.

(5) Remove bushing from vehicle.

INSTALLATION

(1) Apply rubber lube or soap to replacement bushing.

(2) Insert lower half of bushing into square hole in crossmember.

(3) Place upper half of bushing on top of crossmember aligned to receive square tube protruding upward from lower bushing half.

(4) Squeeze bushing halves together to ensure they are properly mated.

(5) Lift crossmember upward to close gap between the bushing and frame.

(6) Verify that lower bushing is fully seated into crossmember and upper bushing.

(7) Install bolt to hold bushing and crossmember to frame rail hand tight.

(8) Align crossmember to reference marks on frame rails.

(9) Tighten crossmember to frame rails attaching bolts to 163 N·m (120 ft. lbs.) torque.

SPECIFICATIONS

FRAME AND BODY OPENING DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principal Locating Point (PLP), or from center to center of PLP and fastener location.

VEHICLE PREPARATION

Position the vehicle on a frame alignment rack, refer to instructions provided with equipment being used. Adjust the vehicle PLP heights to the specified dimension above the work surface (datum line). Vertical dimensions can be taken from the datum line to the locations indicated were applicable. Refer to (Fig. 5), (Fig. 6), (Fig. 7), (Fig. 8), (Fig. 9), (Fig. 10) and (Fig. 11) for proper dimensions.

SPECIFICATIONS (Continued)

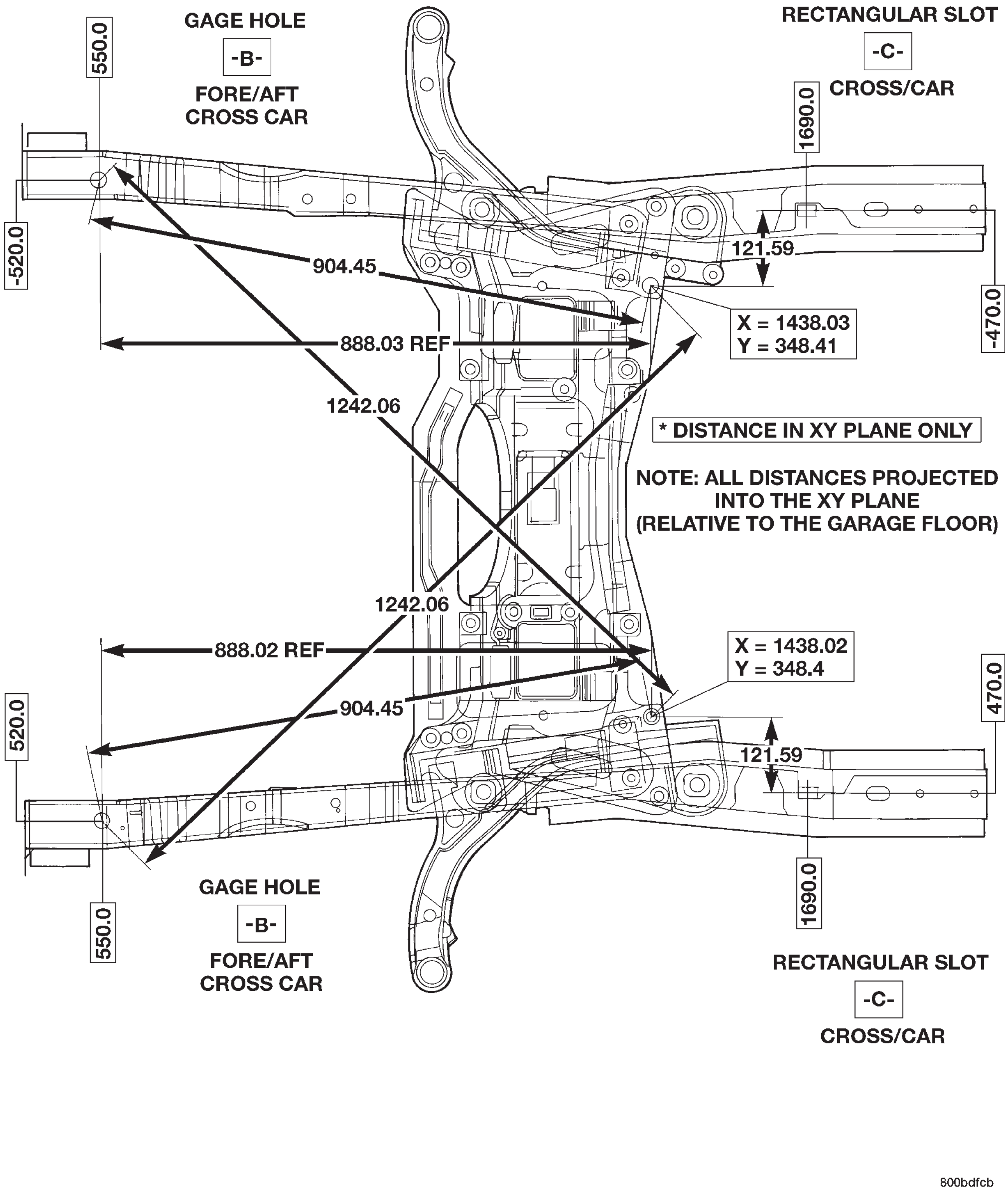

Fig. 5 Front Crossmember Dimensions

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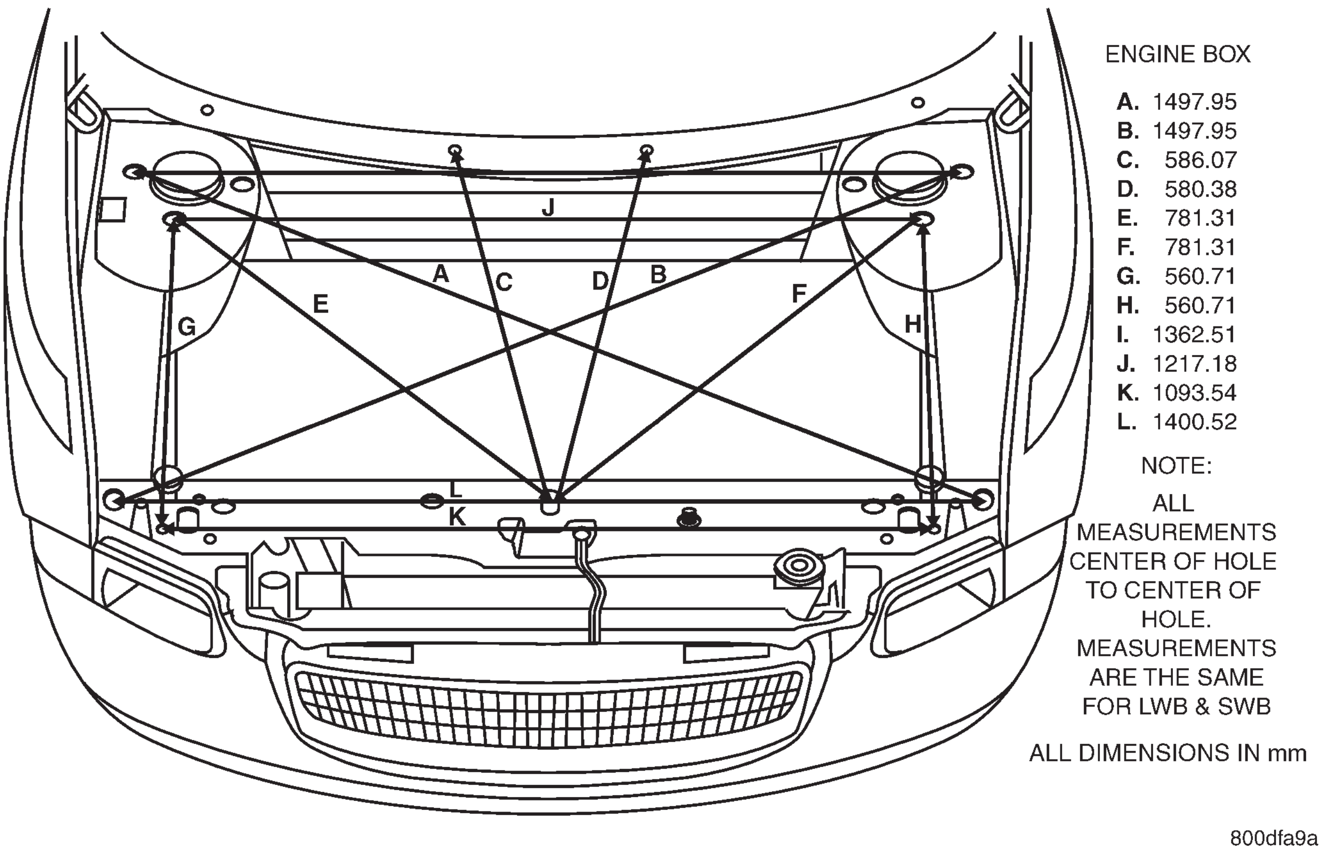


Fig. 6 Engine Compartment Top View

SPECIFICATIONS (Continued)

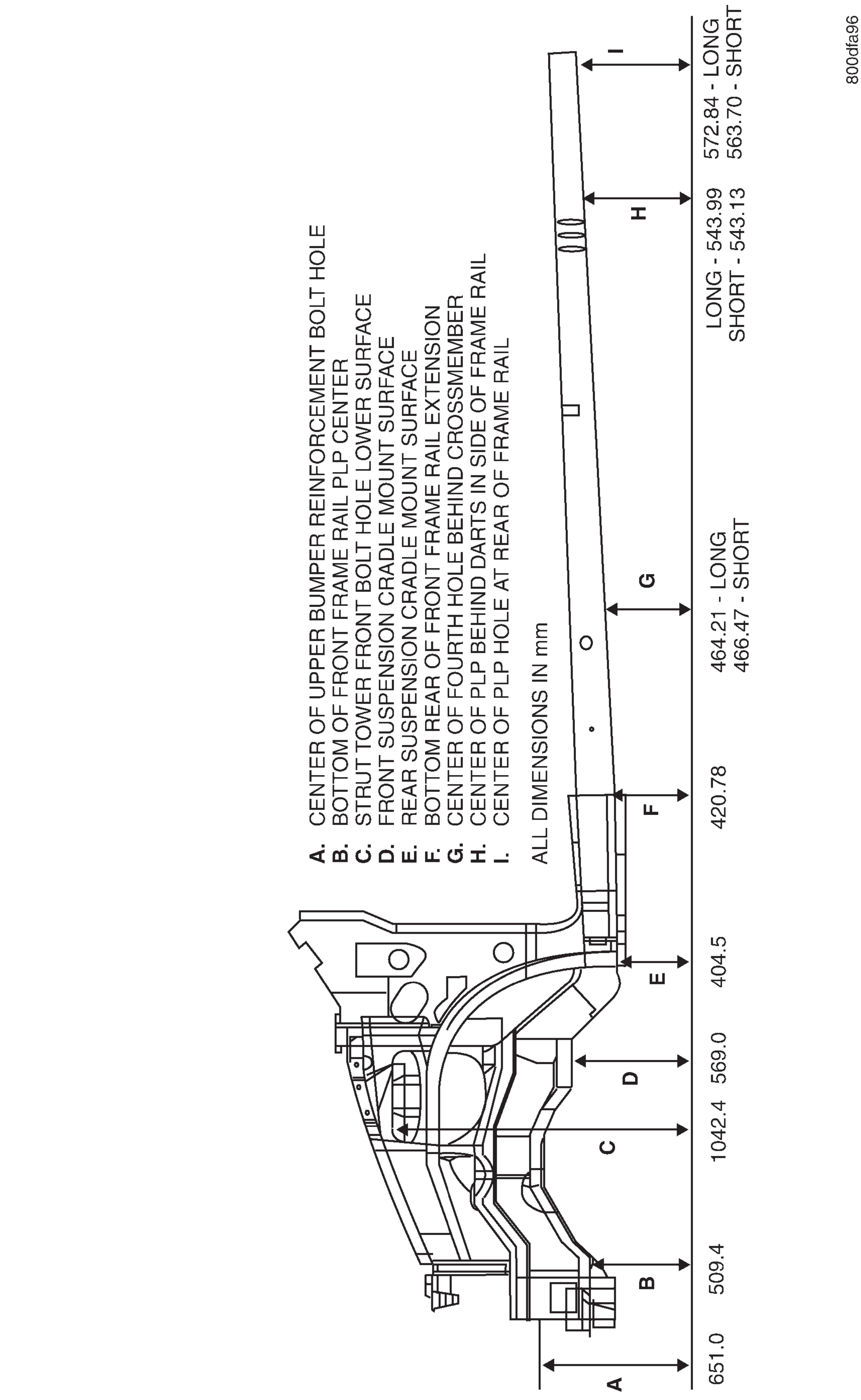
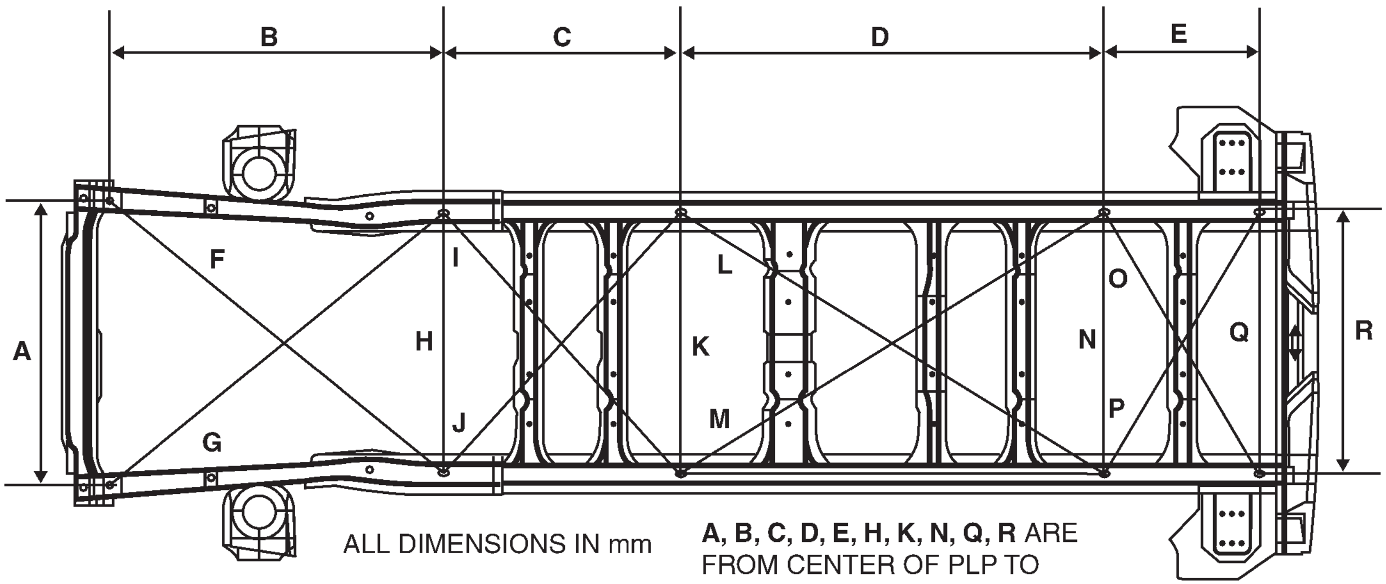


Fig. 7 Engine Compartment and Frame Rail Side View

SPECIFICATIONS (Continued)



A, B, C, D, E, H, K, N, Q, R ARE FROM CENTER OF PLP TO CENTER OF PLP OR CONSTANT HOLE CENTER

F, G, J, I, L, M, O, P ARE ALL CROSS MEASUREMENTS

Y	LONG WHEELBASE	SHORT WHEELBASE
A.	1040.0	1040.0
B.	1251.1	1251.1
C.	889.72	890.0
D.	1559.7	1407.5
E.	563.9	377.7
F.	1599.31	1599.31
G.	1599.31	1599.31
H.	944.0	944.0
I.	1298.2	1298.30
J.	1298.2	1298.30
K.	944.0	944.0
L.	1824.85	1696.52
M.	1824.85	1696.52
N.	944.0	944.0
O.	1099.98	1016.96
P.	1099.98	1016.96
Q.	944.0	944.00
R.	944.0	944.00

800bdfc0

Fig. 8 Full Vehicle Bottom View

SPECIFICATIONS (Continued)

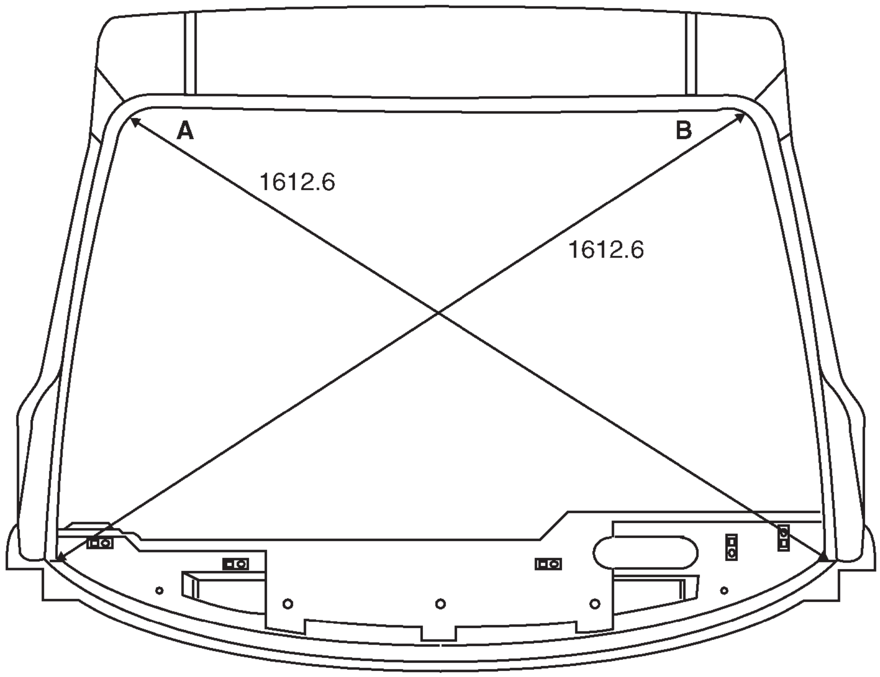


Fig. 9 Windshield Opening

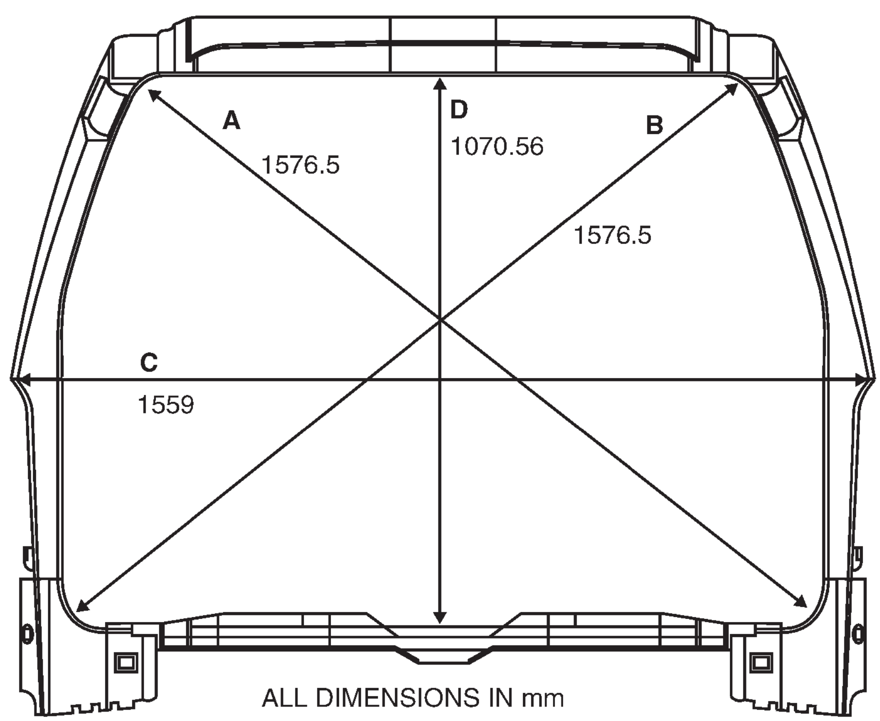


Fig. 10 Liftgate Opening

SPECIFICATIONS (Continued)

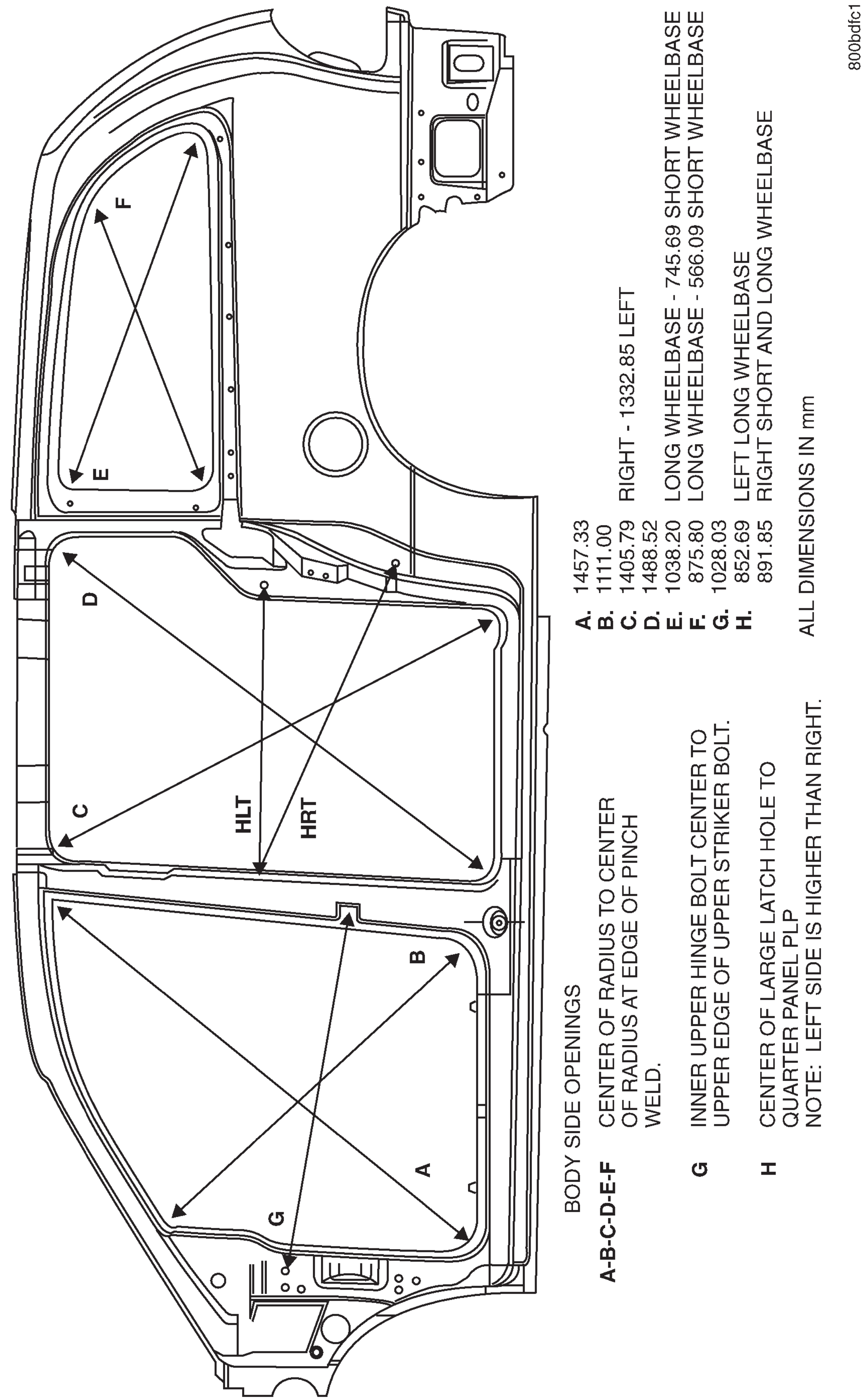


Fig. 11 Body Side Openings

FRAME AND BUMPERS

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REMOVAL AND INSTALLATION

FRONT TOW HOOK BRACKET

REMOVAL

(1) Hoist and support vehicle. Refer to Group 0, Lubrication and Maintenance, for proper lifting procedures.

(2) Remove screws holding the bottom of the front fascia to the lower radiator crossmember.

(3) Remove front tow hook eyelet from front tow hook bracket.

(4) Support engine and transaxle assembly using suitable support stand.

(5) Remove bolts holding front tow hook bracket to lower radiator crossmember.

(6) Separate front tow hook bracket from vehicle.

INSTALLATION

(1) Position front tow hook bracket to vehicle.

(2) Install bolts to hold front tow hook bracket to lower radiator crossmember.

(3) Remove support stand from under engine and transaxle assembly.

(4) Install front tow hook eyelet to front tow hook bracket.

(5) Install screws to hold the bottom of the front fascia to the lower radiator crossmember.

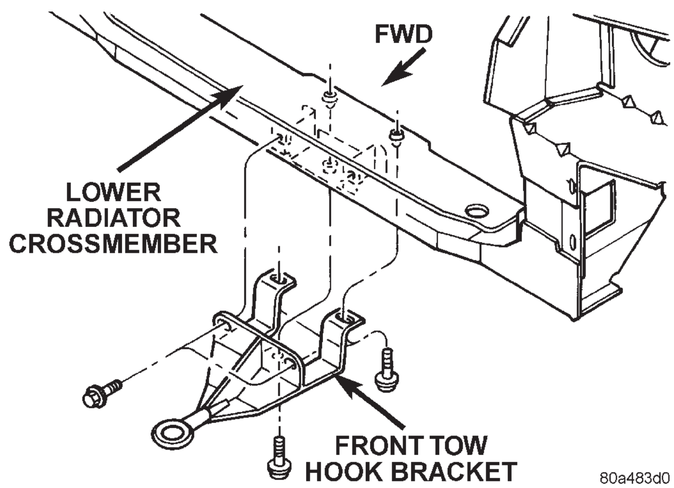

Fig. 1 Front Tow Hook Bracket

(6) Lower vehicle.

REAR TOW HOOK BRACKET

REMOVAL

(1) Hoist and support vehicle. Refer to Group 0, Lubrication and Maintenance, for proper lifting procedure.

(2) Remove bolts holding rear tow hook bracket to rear frame rail (Fig. 2).

REMOVAL AND INSTALLATION (Continued)

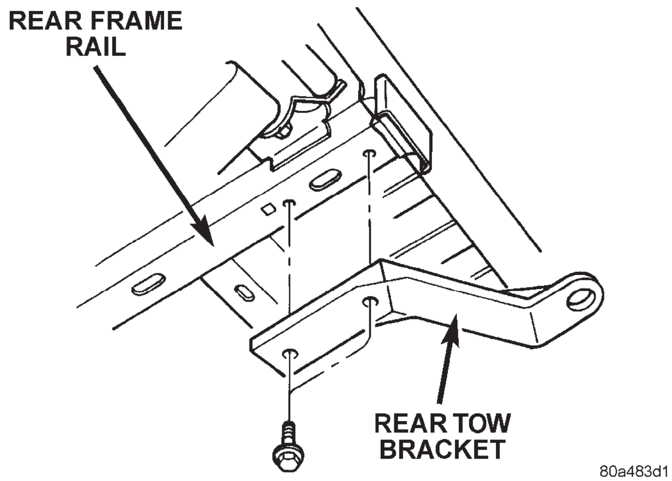

Fig. 2 Rear Tow Hook Bracket

(3) Separate rear tow hook bracket from vehicle.

INSTALLATION

(1) Position rear tow hook bracket on vehicle.

(2) Install bolts to hold rear tow hook bracket to rear frame rail.

(3) Lower vehicle.

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GENERAL INFORMATION

INTRODUCTION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

The Evaporation Control System, is also considered part of the fuel system. The system reduces the emission of fuel vapor into the atmosphere.

The description and function of the Evaporation Control System is found in Group 25 of this manual.

PCM REPLACEMENT

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW 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.

FUEL REQUIREMENTS

Your vehicle was designed to meet all emission regulations and provide excellent fuel economy when using high quality unleaded gasoline.

Use unleaded gasolines having a minimum posted octane of 87.

If your vehicle develops occasional light spark knock (ping) at low engine speeds this is not harmful. However; continued heavy knock at high speeds can cause damage and should be reported to your dealer immediately. Engine damage as a result of heavy knock operation may not be covered by the new vehicle warranty.

In addition to using unleaded gasoline with the proper octane rating, those that contain detergents, corrosion and stability additives are recommended. Using gasolines that have these additives will help improve fuel economy, reduce emissions, and maintain vehicle performance.

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

GENERAL INFORMATION (Continued)

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with materials that contain oxygen such as alcohol, MTBE (Methyl Tertiary Butyl Ether) and ETBE (Ethyl Tertiary Butyl Ether). Oxygenates are required in some areas of the country during winter months to reduce carbon monoxide emissions. The type and amount of oxygenate used in the blend is important.

The following are generally used in gasoline blends:

Ethanol - (Ethyl or Grain Alcohol) properly blended, is used as a mixture of 10 percent ethanol and 90 percent gasoline. Gasoline blended with ethanol may be used in your vehicle.

MTBE/ETBE - Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline and up to 15 percent MTBE. Gasoline and ETBE (Ethyl Tertiary Butyl Ether) are blends of gasoline and up to 17 percent ETBE. Gasoline blended with MTBE or ETBE may be used in your vehicle.

Methanol - Methanol (Methyl or Wood Alcohol) is used in a variety of concentrations blended with unleaded gasoline. You may encounter fuels containing 3 percent or more methanol along with other alcohols called cosolvents.

DO NOT USE GASOLINES CONTAINING METHANOL.

Use of methanol/gasoline blends may result in starting and driveability problems and damage critical fuel system components.

Problems that are the result of using methanol/gasoline blends are not the responsibility of Chrysler Corporation and may not be covered by the vehicle warranty.

Reformulated Gasoline

Many areas of the country are requiring the use of cleaner-burning fuel referred to as **Reformulated Gasoline**. Reformulated gasolines are specially blended to reduce vehicle emissions and improve air quality.

Chrysler Corporation strongly supports the use of reformulated gasolines whenever available. Although your vehicle was designed to provide optimum performance and lowest emissions operating on high quality unleaded gasoline, it will perform equally well and produce even lower emissions when operating on reformulated gasoline.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain active solvents of similar ingredients that can be harmful to fuel system gasket and diaphragm materials.

E-85 GENERAL INFORMATION

The information in this section is for Flexible Fuel Vehicles (FFV) only. These vehicles can be identified by the unique Fuel Filler Door Label that states Ethanol (E-85) or Unleaded Gasoline Only. This section only covers those subjects that are unique to these vehicles. Please refer to the other sections of this manual for information on features that are common between Flexible Fuel and gasoline only powered vehicles.

ETHANOL FUEL (E-85)

E-85 is a mixture of approximately 85% fuel ethanol and 15% unleaded gasoline.

WARNING: Ethanol vapors are extremely flammable and could cause serious personal injury. Never have any smoking materials lit in or near the vehicle when removing the fuel filler tube cap (gas cap) or filling the tank. Do not use E-85 as a cleaning agent and never use it near an open flame.

FUEL REQUIREMENTS

Your vehicle will operate on both unleaded gasoline with an octane rating of 87, or E-85 fuel, or any mixture of these two.

For best results, a refueling pattern that alternates between E-85 and unleaded gasoline should be avoided. When you do switch fuels, it is recommended that

- you do not switch when the fuel gauge indicates less than 1/4 full
- you do not add less than 5 gallons when refueling
- you operate the vehicle immediately after refueling for a period of at least 5 minutes

Observing these precautions will avoid possible hard starting and/or significant deterioration in drivability during warm up.

NOTE: When the ambient temperature is above 90°F, you may experience hard starting and rough idle following start up even if the above recommendations are followed.

STARTING

The characteristics of E-85 fuel make it unsuitable for use when ambient temperatures fall below 0°F. In the range of 0°F to 32°F, you may experience an increase in the time it takes for your engine to start, and a deterioration in drivability (sags and/or hesitations) until the engine is fully warmed up.

GENERAL INFORMATION (Continued)

CRUISING RANGE

Because E-85 fuel contains less energy per gallon than gasoline, you will experience an increase in fuel consumption. You can expect your MPG and your driving range to decrease by about 30% compared to gasoline operation.

REPLACEMENT PARTS

Many components in your Flexible Fuel Vehicle (FFV) are designed to be compatible with ethanol. Always be sure that your vehicle is serviced with correct ethanol compatible parts.

CAUTION: Replacing fuel system components with non-ethanol compatible components can damage your vehicle and may void the warranty.

FUEL DELIVERY SYSTEM

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DESCRIPTION AND OPERATION

FUEL DELIVERY SYSTEM

The front wheel drive van uses a plastic fuel tank located on the left side of the vehicle.

The Fuel Delivery System consists of: the electric fuel pump module, fuel filter, tubes/lines/hoses, fuel rail, and fuel injectors.

The in-tank fuel pump module contains the fuel pump and pressure regulator. The pump is serviced as part of the fuel pump module. Refer to Fuel Pump Module.

The fuel filter is a replaceable in-line filter. The filter attaches to a bracket mounted on top of the fuel tank. Refer to the Maintenance Schedules in the Introduction section of this manual for recommended fuel filter replacement intervals.

A returnless fuel system is used on all vehicles. Fuel is returned through the fuel pump module and back to the fuel tank. A separate fuel return line from the tank to the engine is no longer used.

FUEL PUMP MODULE

The fuel pump module is installed in the top of the fuel tank (Fig. 1). The fuel pump module contains the following:

- Electric fuel pump
- Fuel pump reservoir
- Inlet strainer
- Fuel pressure regulator
- Fuel gauge sending unit
- Fuel supply line connection

The inlet strainer, fuel pressure regulator and fuel level sensor are the only serviceable items. If the fuel pump or electrical wiring harness requires service, replace the fuel pump module.

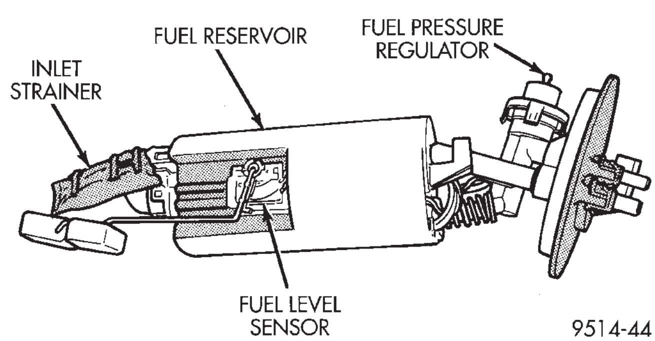


Fig. 1 Fuel Pump Module

ELECTRIC FUEL PUMP

The electric fuel pump is located in and is part of the fuel pump module. It is a positive displacement, gerotor type, immersible pump with a permanent magnet electric motor. The pump draws fuel through a strainer and pushes it through the motor to the outlet. The pump contains one check valve. The

DESCRIPTION AND OPERATION (Continued)

check valve, in the pump outlet, maintains pump pressure during engine off conditions. The fuel pump relay provides voltage to the fuel pump.

The fuel pump has a maximum deadheaded pressure output of approximately 635 kPa (95 psi). The regulator adjusts fuel system pressure to approximately 338 kPa (49 psi).

FUEL PUMP ELECTRICAL CONTROL

Voltage to operate the electric pump is supplied through the fuel pump relay. For an electrical operational description of the fuel pump refer to fuel Pump Relay—PCM Output.

ELECTRICAL PUMP REPLACEMENT

The electric fuel pump is not serviceable. If the fuel pump or electrical wiring harness needs replacement, the complete fuel pump module must be replaced. Perform the Fuel System Pressure Release procedure before servicing the fuel pump.

FUEL LEVEL SENSOR

The level sensor is attached to the side of the fuel pump module. The level sensor consists of a float, an arm, and a variable resistor. As the fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the fuel gauge on the instrument panel to read full.

FUEL PRESSURE REGULATOR

The fuel system uses a nonadjustable pressure regulator that maintains fuel system pressure at approximately 338 kPa (49 psi), 3.3l uses approximately 379 kPa (55 psi). The fuel pressure regulator contains a diaphragm, calibrated spring and a fuel return valve. The spring pushes down on the diaphragm and closes off the fuel return port. System fuel pressure reflects the amount of fuel pressure required to open the return port.

The pressure regulator is a mechanical device that is NOT controlled by the PCM or engine vacuum.

FUEL INJECTORS

The fuel injectors are 12 ohm electrical solenoids (Fig. 2). 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 hollow cone. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber. The injectors are positioned in the intake manifold. Fuel injectors are not interchangeable between engines.

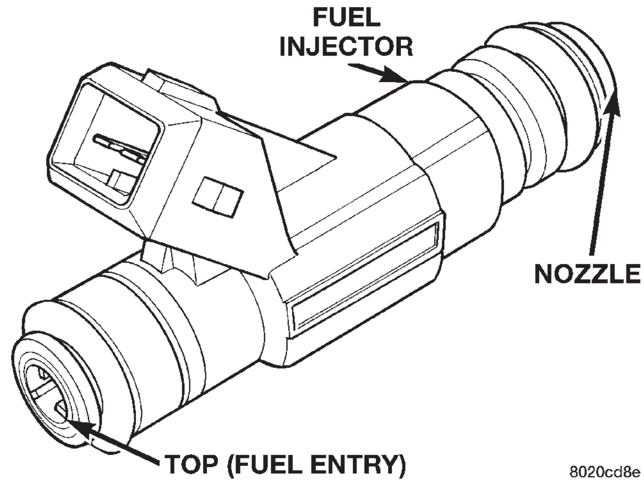


Fig. 2 Fuel Injector

The injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port (Fig. 3).

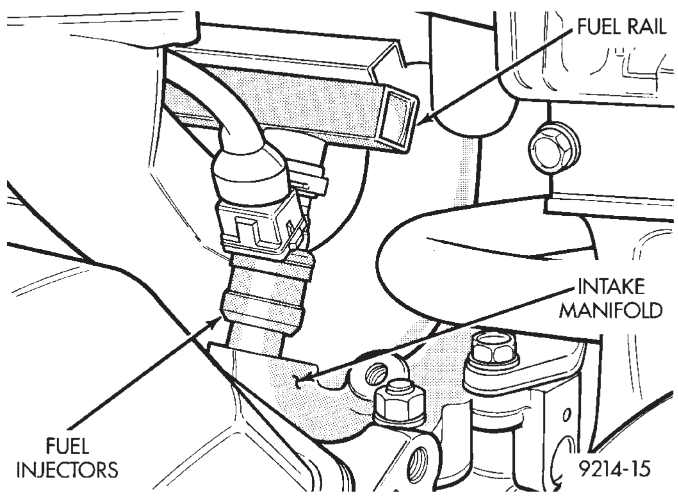


Fig. 3 Fuel Injector Location—Typical

FUEL TANK

The fuel tanks of all Chrysler Motors built vehicles are equipped with fuel and vapor controls that allow the vehicle to pass a full 360° rollover without fuel leakage.

Front Wheel Drive fuel delivery systems contain a fuel tank rollover valve. The valve is mounted on top of the fuel tank. The valve functions as a tank pressure control valve while the vehicle is upright, but contains a check valve that prevents fuel from escaping from the fuel tank when the vehicle is turned over.

The fuel filler cap acts as a pressure/vacuum relief valve. When air pressure inside the fuel tank gets too high or too low, the fuel filler cap opens to relieve the difference in pressure.

An evaporation control system restricts fuel evaporation into the atmosphere and reduces unburned

DESCRIPTION AND OPERATION (Continued)

hydrocarbons. Vapors from the fuel tank are collected in a charcoal filled canister. The vapors are held in the canister until the engine is operating. When the engine is running, the vapors are drawn through the intake manifold into the combustion chambers.

PRESSURE-VACUUM FILLER CAP

The loss of any fuel or vapor out of the filler neck is prevented by the use of a safety filler cap. The cap will release pressure only under significant pressure of 10.9 to 13.45 kPa (1.58 to 1.95 psi). The vacuum release for all gas caps is between 0.97 and 2.0 kPa (0.14 and 0.29 psi). The cap must be replaced by a similar unit if replacement is necessary.

WARNING: REMOVE FILLER CAP TO RELIEVE TANK PRESSURE BEFORE REMOVING OR REPAIRING FUEL SYSTEM COMPONENTS.

QUICK-CONNECT FITTINGS

Different types of quick-connect fittings are used to attach various fuel system components. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Refer to the Removal/Installation section for more information.

CAUTION: The interior components (o-rings, spacers) of quick-connect fitting are not serviced separately. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

Fuel tubes connect fuel system components with plastic quick-connect fuel fittings. The fitting contains non-serviceable O-ring seals (Fig. 4).

CAUTION: Quick-connect fittings are not serviced separately. Do not attempt to repair damaged quick-connect fittings or fuel tubes. Replace the complete fuel tube/quick-connect fitting assembly.

The quick-connect fitting consists of the O-rings, retainer and casing (Fig. 4). When the fuel tube enters the fitting, the retainer locks the shoulder of the nipple in place and the O-rings seal the tube.

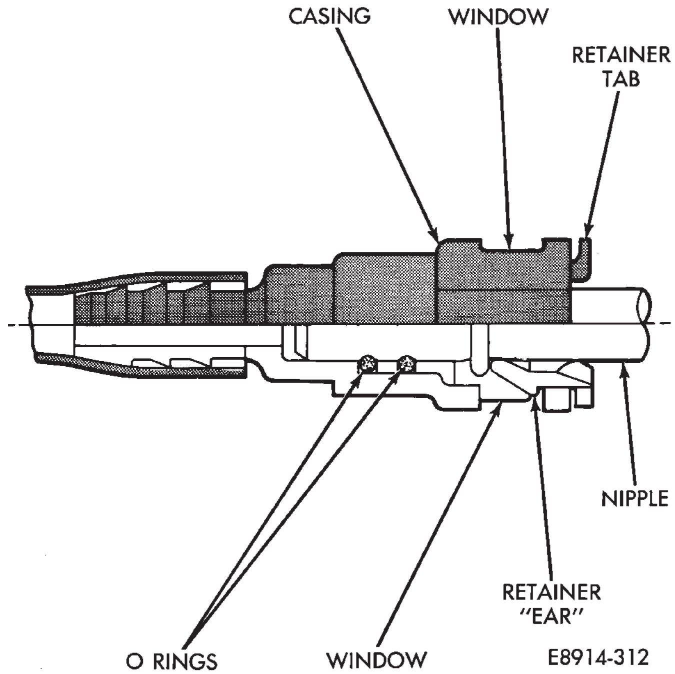


Fig. 4 Plastic Quick-Connect Fittings

The fuel system operates at approximately 338 kPa (49 psi), 3.3L uses approximately 379 kPa (55 psi). Check fuel system pressure at the test port on the fuel rail (Fig. 5) or (Fig. 6).

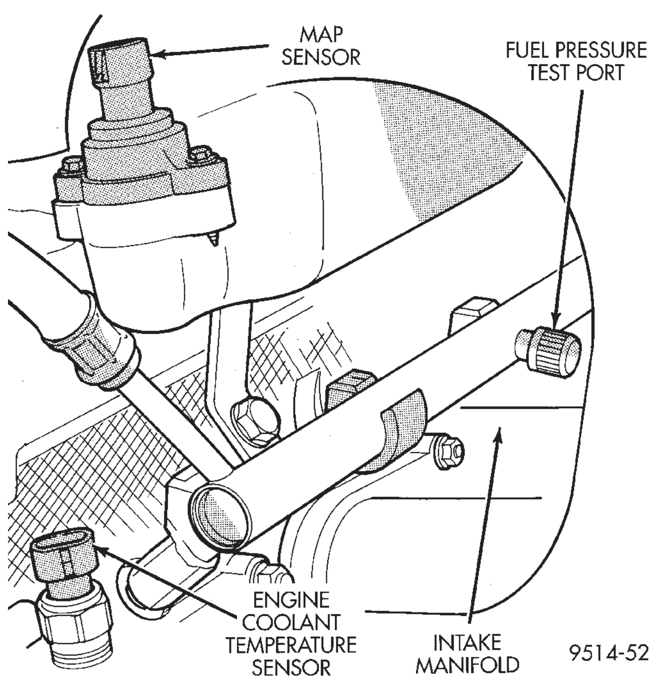


Fig. 5 Fuel Pressure Test Port—2.4L

DIAGNOSIS AND TESTING

FUEL PUMP PRESSURE TEST 2.4/3.3/3.8L

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE A FUEL SYSTEM HOSE OR COMPONENT IS DISCONNECTED.

DIAGNOSIS AND TESTING (Continued)

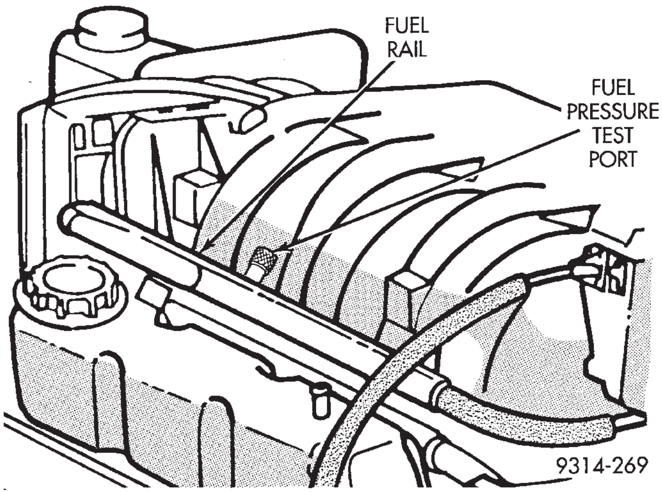


Fig. 6 Fuel Pressure Test Port—3.3/3.8L

(1) Remove cap from fuel pressure test port on fuel rail.

(2) Connect Fuel Pressure Gauge C-4799B to test port (Fig. 7).

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(3) Place the ignition key in the ON position. Using the DRB scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

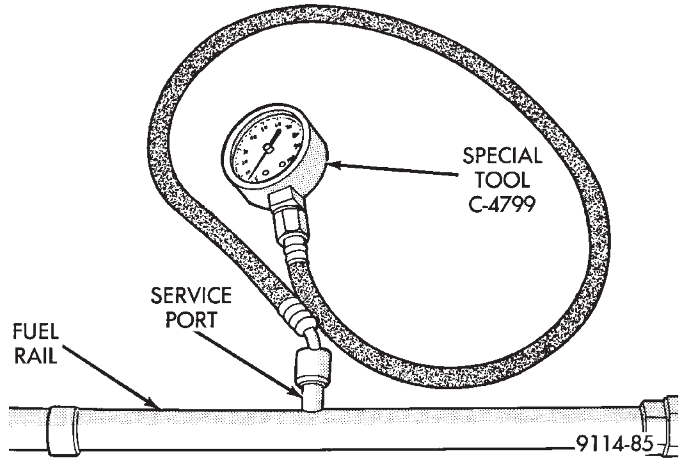


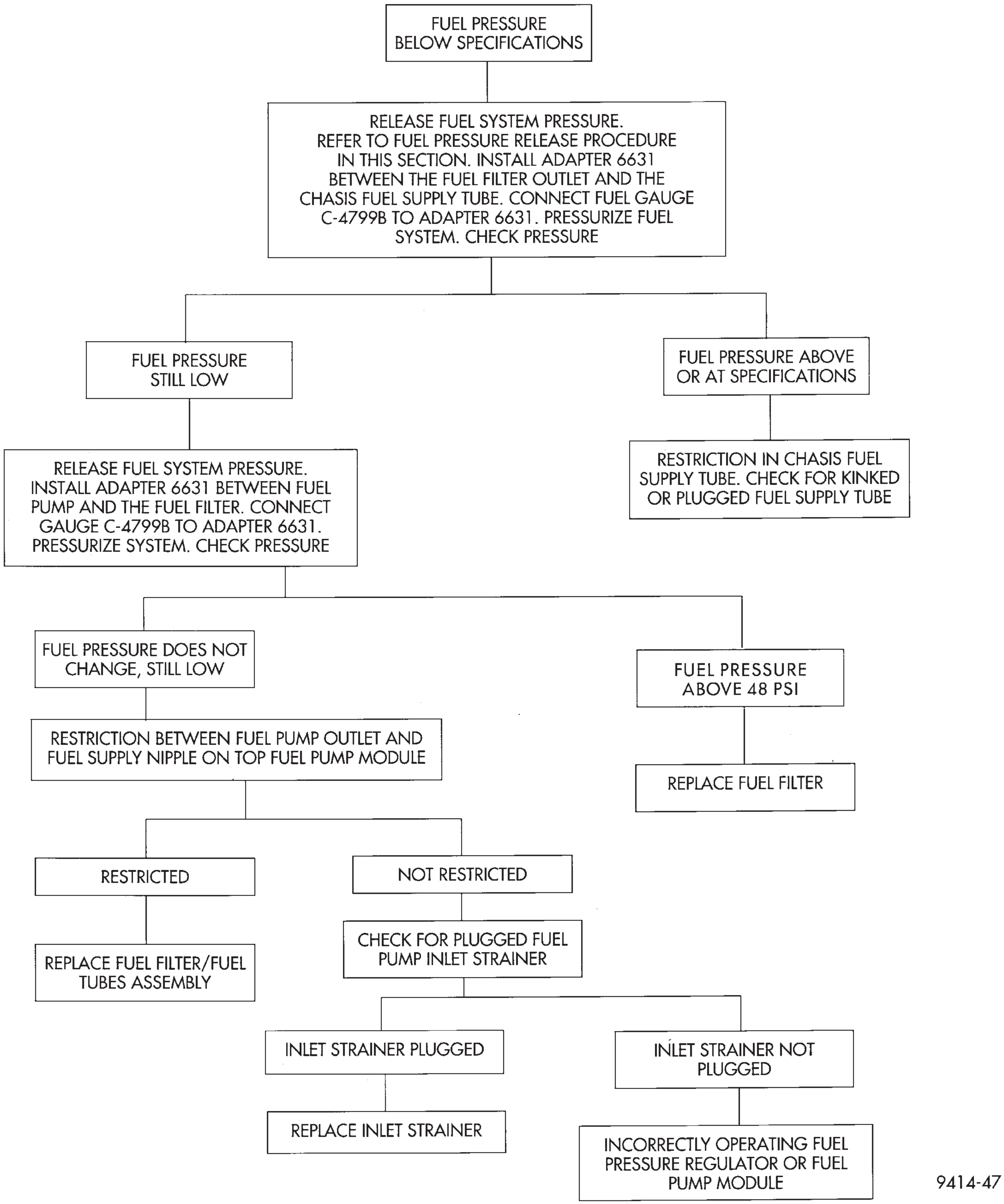
Fig. 7 Checking Fuel Pressure at Fuel Rail

- If the gauge reading equals 338 kPa (49 psi) 3.3L uses approximately 379 kPa (55 psi) further testing is not required. If pressure is not correct, record the pressure.
- If pressure is above specifications, check for a kinked or restricted fuel return tube (from filter to pump module). If the fuel return tube is not pinched or restricted, replace the fuel pressure regulator.
- If fuel pressure is below specifications, refer to the diagnosis chart for Fuel Pressure Below Specifications.

(4) **Replace Pressure test port cap when finished doing pressure test.**

DIAGNOSIS AND TESTING (Continued)

FUEL PRESSURE BELOW SPECIFICATIONS



DIAGNOSIS AND TESTING (Continued)

FUEL LEVEL SENSOR

This procedure tests the resistance of the level sensor itself. It does not test the level sensor circuit. Refer to Group 8W - Wiring Diagrams for circuit identification.

The level sensor is a variable resistor. Its resistance changes with the amount of fuel in the tank. The float arm attached to the sensor moves as the fuel level changes. To test the level sensor, connect an ohmmeter across the sensor signal and sensor ground terminals of the fuel pump module connector (Fig. 8). Move the float lever to the positions shown in the resistance chart (Fig. 8). Record the resistance at each point. Replace the level sensor if the resistance is not within specifications.

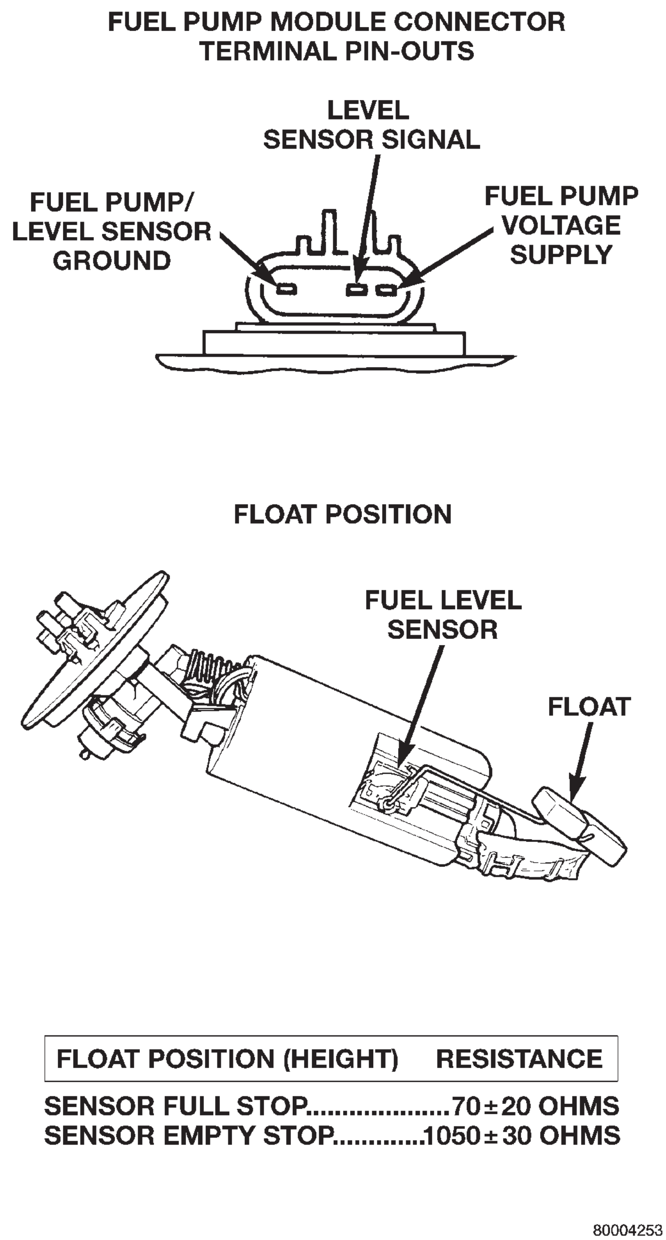


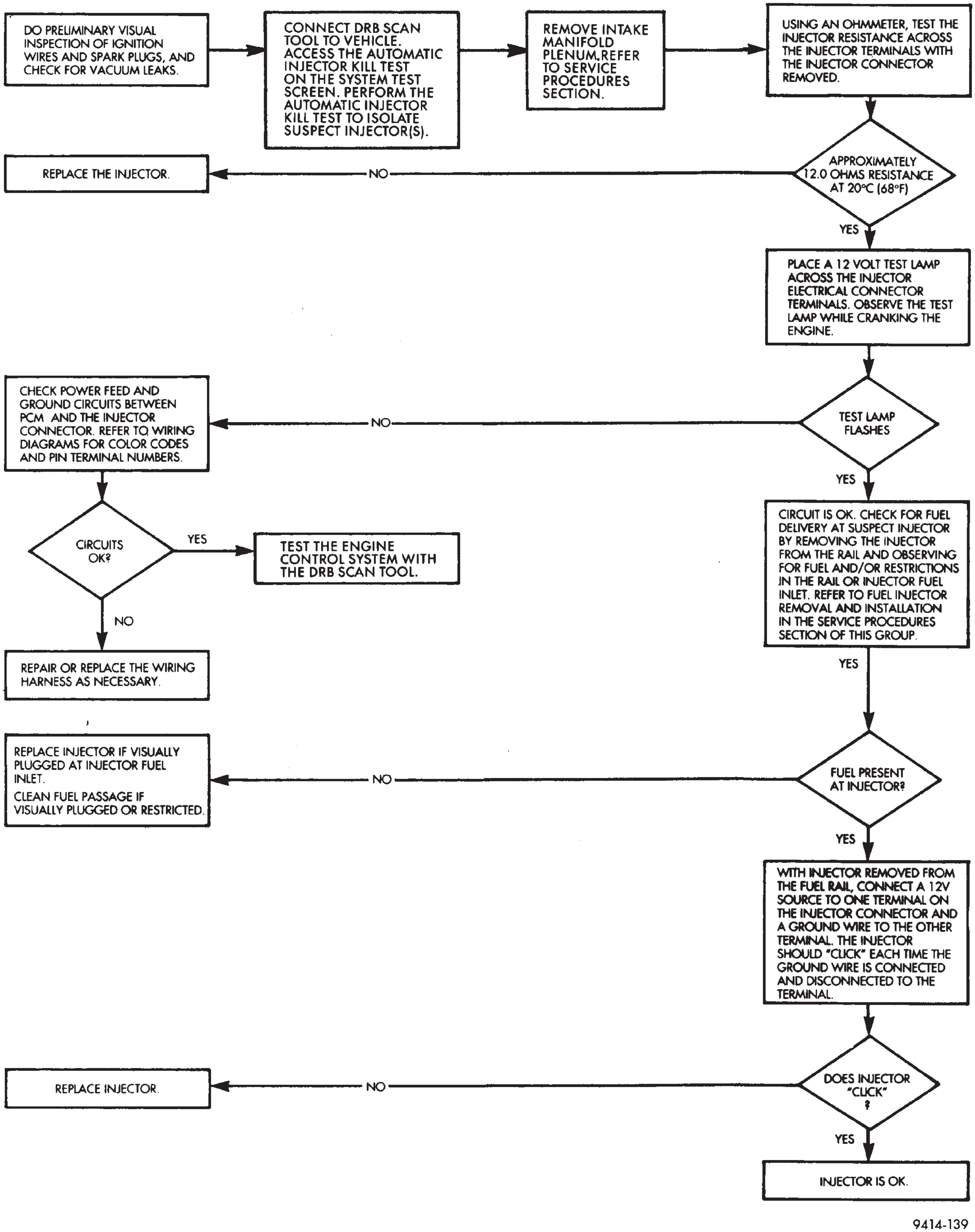
Fig. 8 Level Sensor Diagnosis

FUEL INJECTORS

For fuel injector diagnosis, refer to the Fuel Injector Diagnosis charts. For poor fuel economy diagnosis or engine miss, also refer to Transmission Driveplate in this section.

DIAGNOSIS AND TESTING (Continued)

FUEL INJECTOR DIAGNOSIS



SERVICE PROCEDURES

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—2.4/3.3/3.8L

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap.

(3) Remove protective cap from fuel pressure test port on fuel rail (Fig. 9) or (Fig. 10).

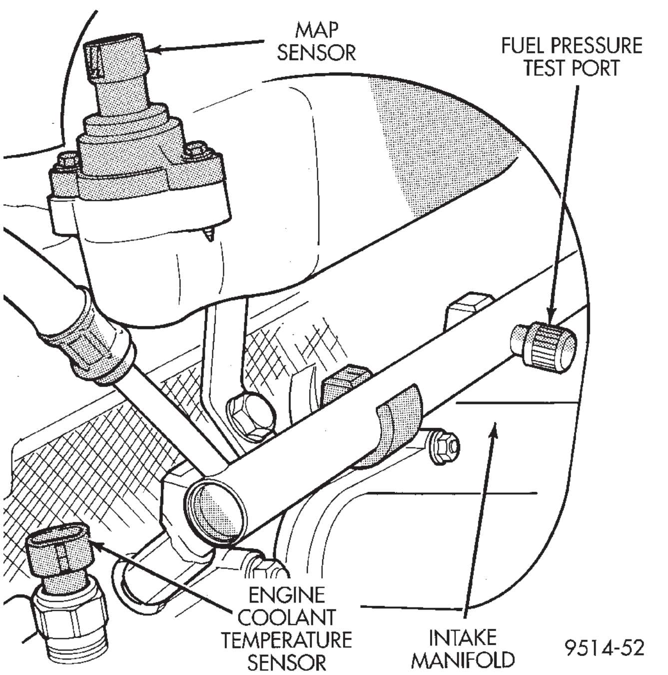


Fig. 9 Fuel Pressure Test Port—2.4L

(4) Place open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect other end of hose C-4799-1 to fuel pressure test port (Fig. 11). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-B contains hose C-4799-1.

(5) **Replace Pressure test port cap when finished doing pressure test.**

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—3.0L ENGINE

(1) Remove the Fuel Pump relay from the Power Distribution Center (PDC). For location of the relay, refer to the label on the underside of the PDC cover.

(2) Start and run engine it stalls.

(3) Attemp restarting engine until it will no longer run.

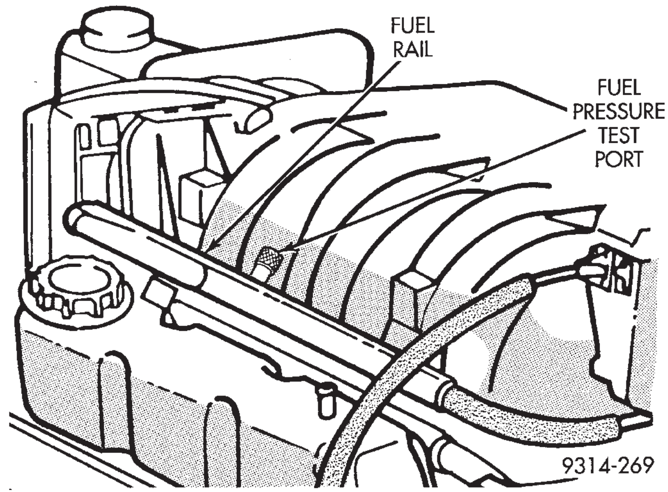


Fig. 10 Fuel Pressure Test Port—3.3/3.8L

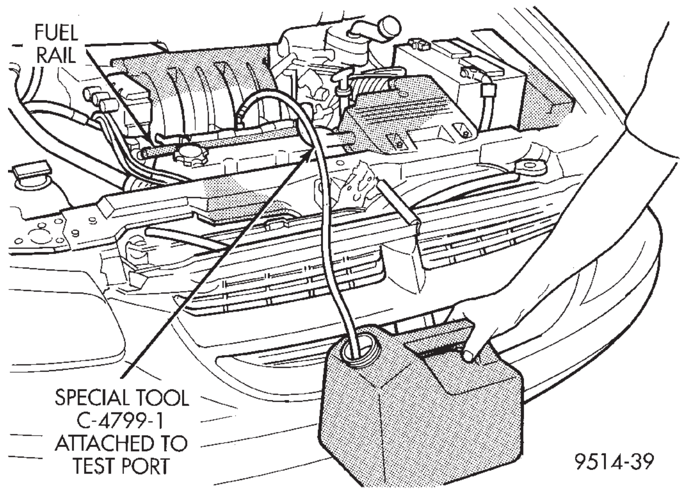


Fig. 11 Releasing Fuel Pressure

(4) Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within the fuel rail. Do not attempt to use the following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

(5) Unplug connector from any injector.

(6) Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.

(7) Connect the other end of the jumper wire to the positive side of the battery.

(8) Connect one end of a second jumper wire to the remaining injector terminal.

CAUTION: Supplying power to an injector for more than 4 seconds will permantely damage the injector. Do not leave the injector connected to power for more than 4 seconds.

SERVICE PROCEDURES (Continued)

(9) Momentarily touch the other end of this jumper wire to the negative terminal of the battery for no more than 4 seconds.

(10) Place a rag or towel below the fuel line at the quick connect to the rail.

(11) Disconnect the quick connect fitting to the rail. Refer to Quick-Connect Fittings in this section.

(12) Return the fuel pump relay to the PDC.

(13) One or more Diagnostic Trouble Codes (DTC's) may have been stored in the PCM memory due to the fuel pump relay removal. The DRB scan tool must be used to erase a DTC. Refer to group 25, On-Board Diagnostics.

HOSES AND CLAMPS

Inspect all hose connections (clamps and quick connect fittings) for completeness and leaks. Replace cracked, scuffed, or swelled hoses. Replace hoses that rub against other vehicle components or show sign of wear.

Fuel injected vehicles use specially constructed hoses. When replacing hoses, only use hoses marked EFM/EFI.

When installing hoses, ensure that they are routed away from contact with other vehicle components that could rub against them and cause failure. Avoid contact with clamps or other components that cause abrasions or scuffing. Ensure that rubber hoses are properly routed and avoid heat sources.

The hose clamps have rolled edges to prevent the clamp from cutting into the hose. Only use clamps that are original equipment or equivalent. Other types of clamps may cut into the hoses and cause high pressure fuel leaks. Tighten hose clamps to 1 N·m (10 in. lbs.) torque.

QUICK-CONNECT FITTINGS

REMOVAL

When disconnecting a quick-connect fitting, the retainer will remain on the fuel tube nipple.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

(1) Disconnect negative cable from battery.

(2) Perform Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.

(3) Squeeze retainer tabs together and pull fuel tube/quick-connect fitting assembly off of fuel tube nipple. The retainer will remain on fuel tube.

INSTALLATION

CAUTION: Never install a quick-connect fitting without the retainer being either on the fuel tube or already in the quick-connect fitting. In either case, ensure the retainer locks securely into the quick-connect fitting by firmly pulling on fuel tube and fitting to ensure it is secured.

(1) Using a clean lint free cloth, clean the fuel tube nipple and retainer.

(2) Prior to connecting the fitting to the fuel tube, coat the fuel tube nipple with clean 30 weight engine oil.

(3) Push the quick-connect fitting over the fuel tube until the **retainer seats and a click is heard.**

(4) The plastic quick-connect fitting has windows in the sides of the casing. When the fitting completely attaches to the fuel tube, the retainer locking ears and the fuel tube shoulder are visible in the windows. If they are not visible, the retainer was not properly installed (Fig. 12). **Do not rely upon the audible click to confirm a secure connection.**

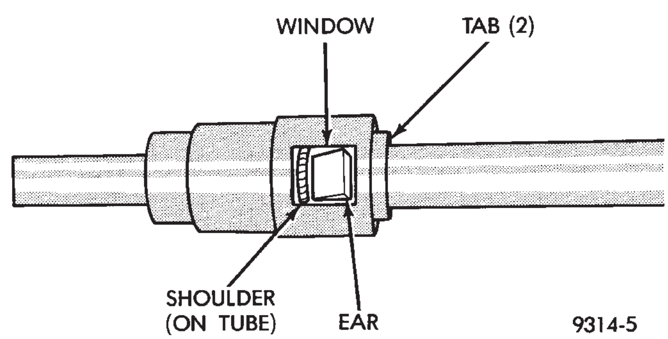


Fig. 12 Plastic Quick-Connect Fitting/Fuel Tube Connection

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) Relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

(5) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

REMOVAL AND INSTALLATION

FUEL FILTER

The fuel filter mounts to the top of the fuel tank. The inlet and outlet tubes are permanently attached to the filter (Fig. 13).

REMOVAL AND INSTALLATION (Continued)

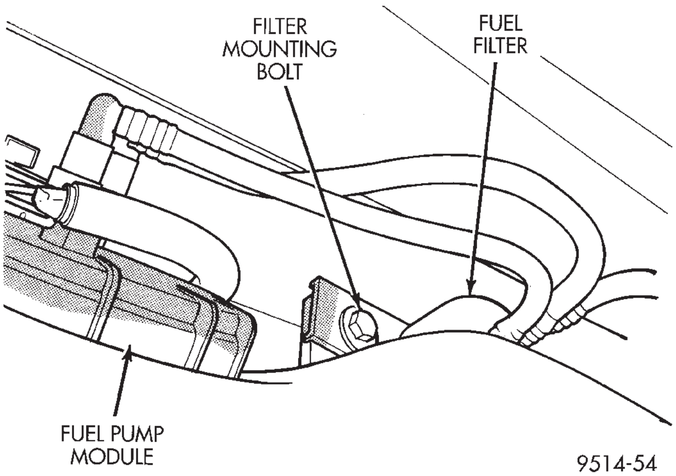


Fig. 13 Fuel Filter

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING QUICK-CONNECT FITTINGS AT FUEL FILTER. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

REMOVAL

(1) Perform fuel system pressure release.

(2) Disconnect quick-connect fittings from fuel pump module and chassis fuel supply tube. Refer to Quick-Connect Fittings in this section.

(3) Remove filter retaining screw (Fig. 13) and remove filter from tank.

INSTALLATION

(1) Install fuel filter to tank.

(2) The fuel supply (to filter) tube, return tube (to pump module) and fuel supply (to chassis fuel line) are permanently attached the fuel filter. The ends of the fuel supply and return tubes have different size quick-connect fittings.

(3) Apply a light coating of clean 30 weight engine oil to the fuel filter nipples. Install fuel tubes. Refer to Fuel Tubes and Quick-Connect Fittings in this section.

FUEL PUMP MODULE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

WARNING: THE FUEL RESERVOIR OF THE FUEL PUMP MODULE DOES NOT EMPTY OUT WHEN THE TANK IS DRAINED. THE FUEL IN THE RESERVOIR WILL SPILL OUT WHEN THE MODULE IS REMOVED.

REMOVAL

(1) Remove fuel filler cap and perform Fuel System Pressure Release procedure.

(2) Disconnect negative cable from battery.

(3) Insert fuel siphon hose into fuel filler neck and push it into the tank.

(4) Drain fuel tank dry into holding tank or a properly labeled **GASOLINE** safety container.

(5) Raise vehicle on hoist.

(6) Use a transmission jack to support the fuel tank. Remove bolts from fuel tank straps. Lower tank slightly.

(7) Clean area around fuel tank module and tank to keep dirt and foreign material out of tank.

(8) Disconnect fuel lines from fuel pump module by depressing quick connect retainers with thumb and fore finger (Fig. 14).

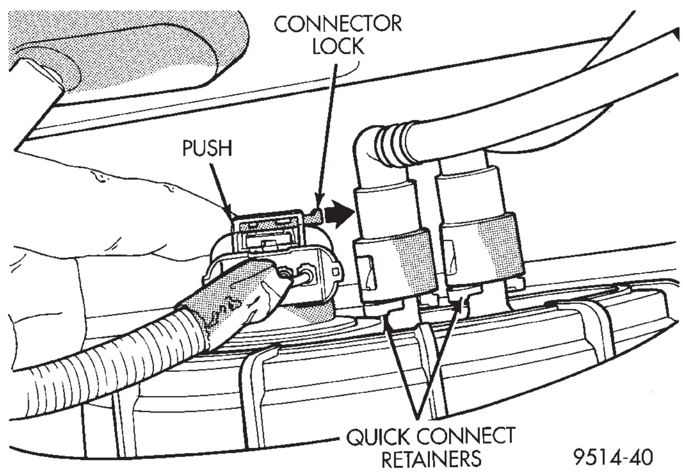


Fig. 14 Fuel Line Retainers and Pump Connector Lock

(9) Slide fuel pump module electrical connector lock to unlock.

(10) Push down on connector retainer (Fig. 15) and pull connector off module.

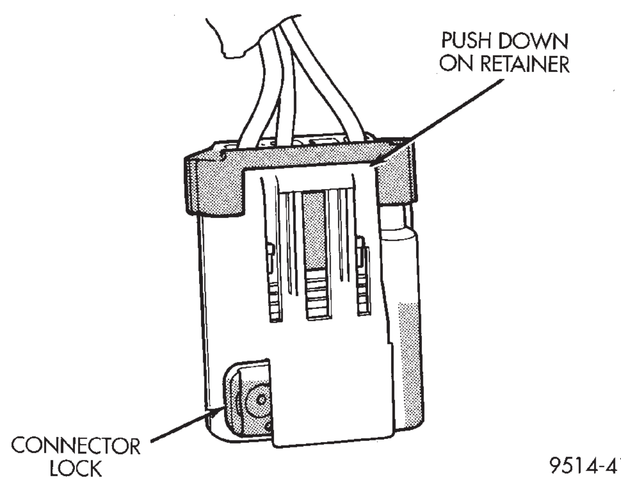


Fig. 15 Pump Module Connector Retainer and Lock

REMOVAL AND INSTALLATION (Continued)

(11) Using Special Tool 6856, remove plastic locknut counterclockwise to release pump module (Fig. 16).

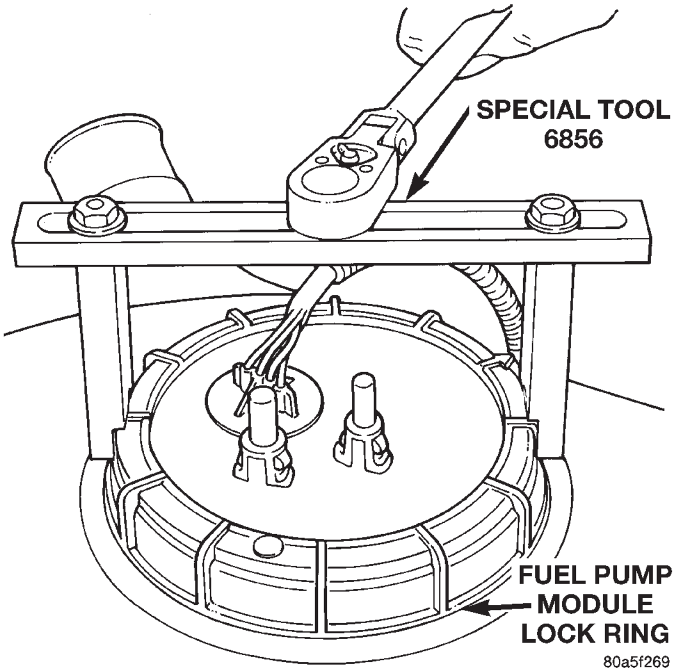


Fig. 16 Fuel Pump Module Lock Nut Removal

(12) Carefully remove pump module and O-ring from tank (Fig. 17).

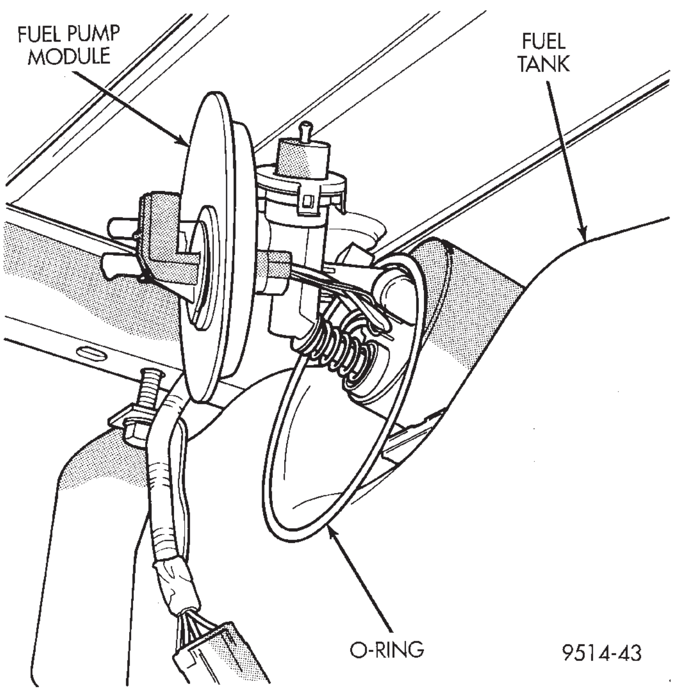


Fig. 17 Fuel Pump Module Removal

(13) Discard old O-ring.

INSTALLATION

(1) Wipe seal area of tank clean and place a new O-ring seal in position on pump.

(2) Position fuel pump in tank with locknut.

(3) Tighten locknut to 53 N·m (43 ft. lbs.).

(4) Connect fuel lines.

(5) Plug in electrical connector. Slide connector lock into position.

(6) Raise fuel tank, install bolts into fuel tank straps and tighten.

(7) Lower vehicle on hoist.

(8) Connect negative cable from battery.

(9) Fill fuel tank. Check for leaks.

(10) Install fuel filler cap.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is part of the fuel pump module (Fig. 18). Remove the fuel pump module from the fuel tank to access the fuel pressure regulator.

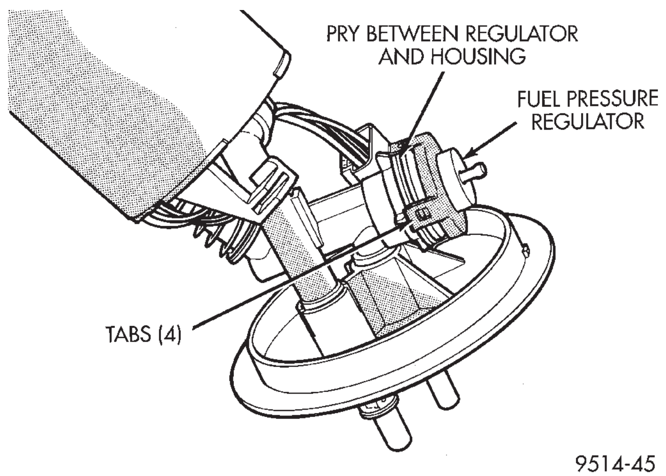


Fig. 18 Fuel Pressure Regulator

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE SERVICING ANY FUEL SYSTEM COMPONENT. PERFORM THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

REMOVAL

(1) Spread tangs on pressure regulator retainer (Fig. 18).

(2) Pry fuel pressure regulator out of housing.

(3) Ensure both upper and lower O-rings were removed with regulator.

INSTALLATION

(1) Lightly lubricate the O-rings with clean engine oil and place them into opening in pump module (Fig. 19).

(2) Push regulator into opening in pump module.

REMOVAL AND INSTALLATION (Continued)

(3) Fold tangs on regulator retainer over tabs on housing.

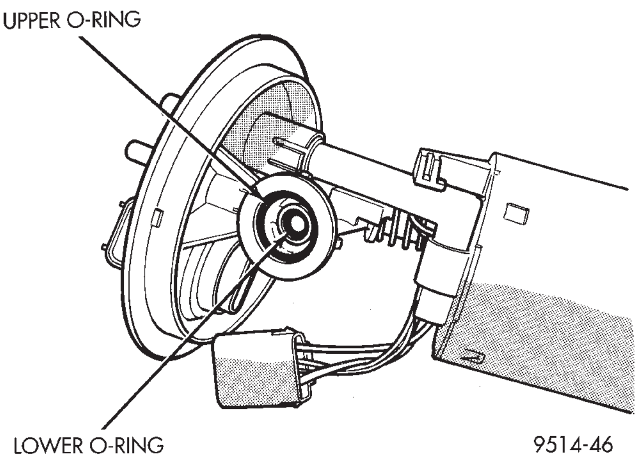


Fig. 19 Fuel Pressure Regulator O-rings

FUEL PUMP INLET STRAINER

REMOVAL

(1) Remove fuel pump module. Refer to Fuel Pump Module Removal in this section.

(2) Using a thin straight blade screwdriver, pry back the locking tabs on fuel pump reservoir and remove the strainer (Fig. 20).

(3) Remove strainer O-ring from the fuel pump reservoir body.

(4) Remove any contaminants in the fuel tank by washing the inside of the fuel tank.

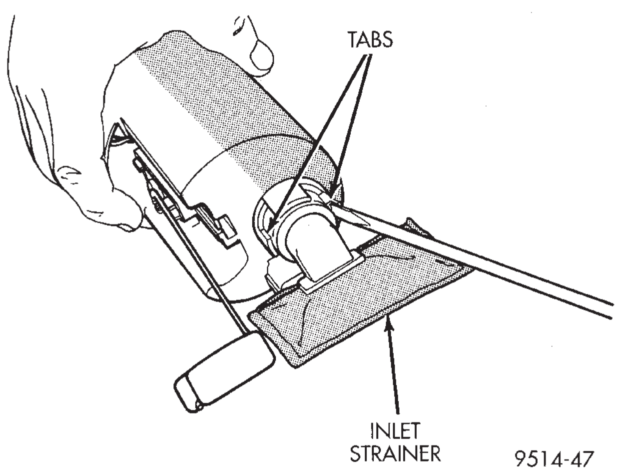


Fig. 20 Inlet Strainer Removal

INSTALLATION

(1) Lubricate the strainer O-ring with clean engine oil.

(2) Insert strainer O-ring into outlet of strainer so that it sits evenly on the step inside the outlet.

(3) Push strainer onto the inlet of the fuel pump reservoir body. Make sure the locking tabs on the reservoir body lock over the locking tangs on the strainer.

(4) Install fuel pump module. Refer to Fuel Pump Module Installation in this section.

FUEL LEVEL SENSOR

REMOVAL

Remove fuel pump module. Refer to Fuel Pump Module in this section.

(1) Depress retaining tab and remove the fuel pump/level sensor connector from the **BOTTOM** of the fuel pump module electrical connector (Fig. 21).

NOTE: The pump module harness on TOP of flange is not serviceable or removable.

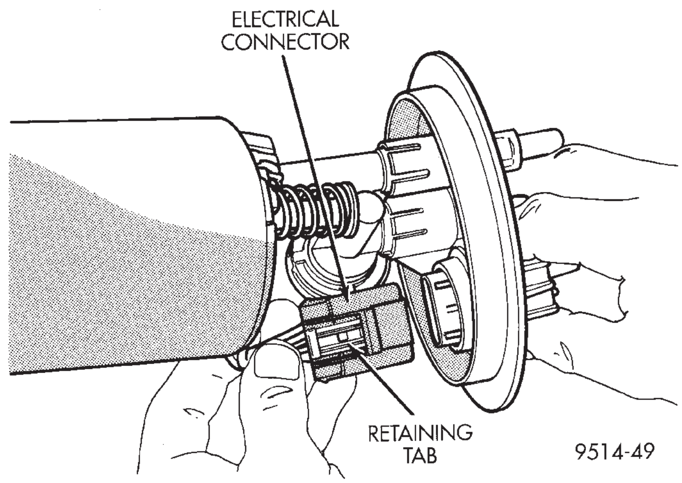


Fig. 21 Fuel Pump/Level Sensor Electrical Connector

(2) Pull off blue locking wedge (Fig. 22).

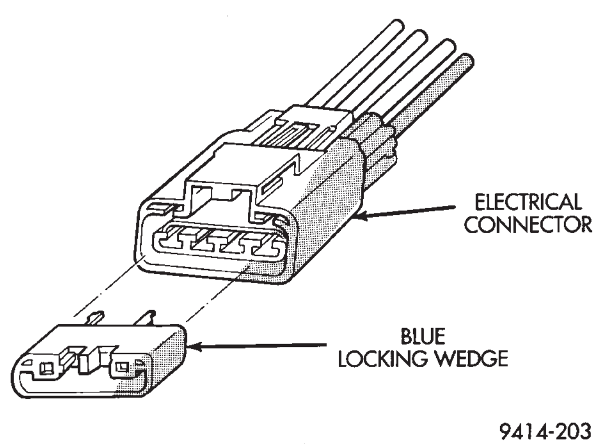


Fig. 22 Wire Terminal Locking Wedge

(3) Using a small screwdriver lift locking finger away from terminal and push terminal out of connector (Fig. 23).

REMOVAL AND INSTALLATION (Continued)

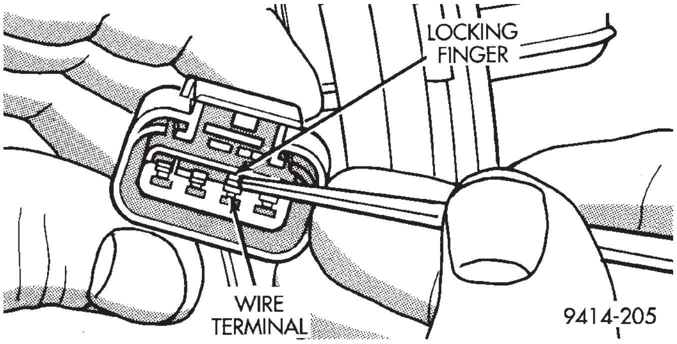


Fig. 23 Wire Terminal Locking Finger

(4) Push level sensor signal and ground terminals out of the connector (Fig. 24).

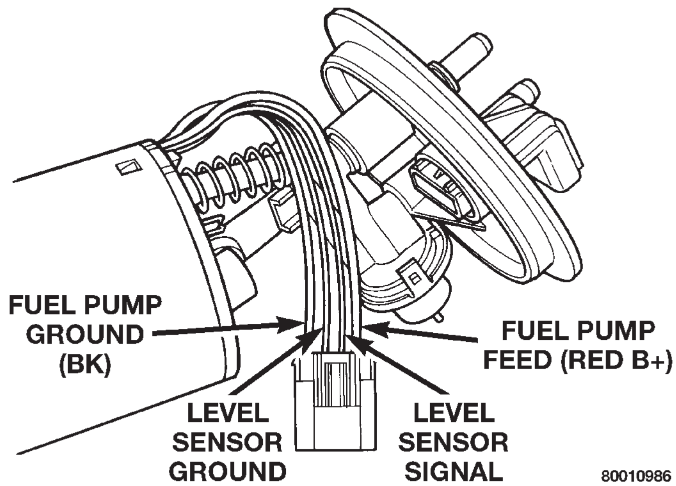


Fig. 24 Removing Wires From Connector

(5) Insert a screwdriver between the fuel pump module and the top of the level sensor housing (Fig. 25). Push level sensor down slightly.

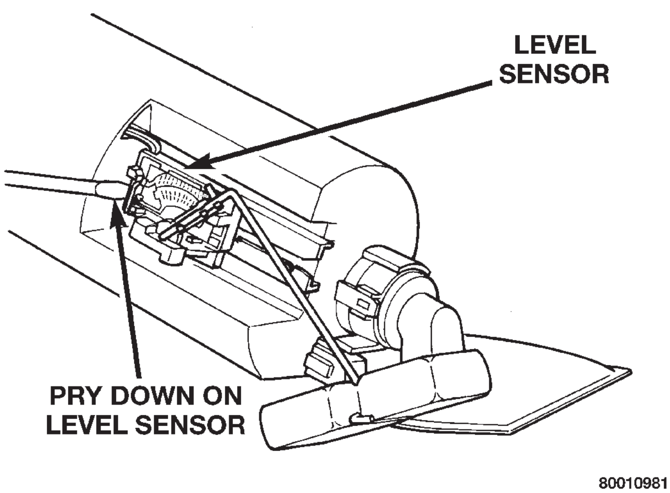


Fig. 25 Loosening Level Sensor

(6) Slide level sensor wires through opening fuel pump module (Fig. 26).

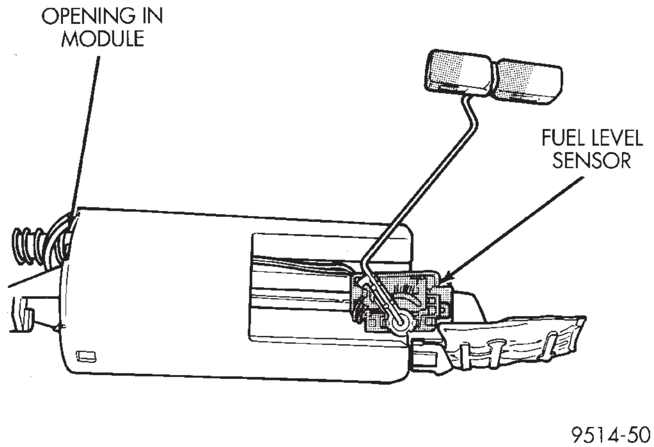


Fig. 26 Level Sensor Removal/Installation

(7) Slide level sensor out of installation channel in module.

INSTALLATION

(1) Insert level sensor wires into bottom of opening in module.

(2) Wrap wires into groove in back of level sensor (Fig. 27).

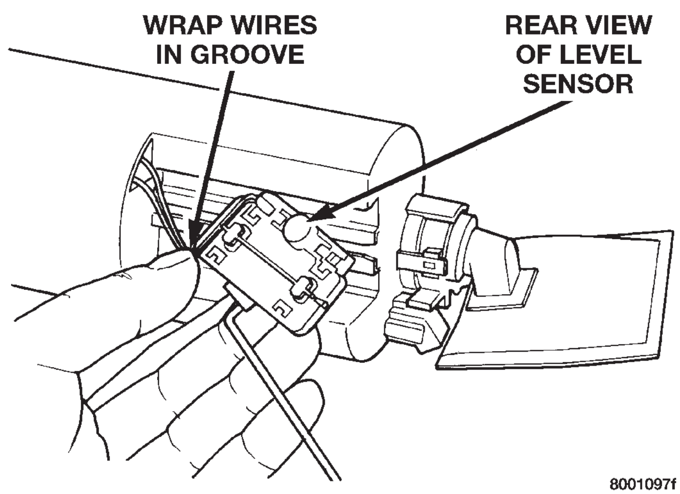


Fig. 27 Groove in Back Side of Level Sensor

(3) While feeding wires into guide grooves, slide level sensor up into channel until it snaps into place (Fig. 28). Ensure tab at bottom of sensor locks in place.

(4) Install level sensor wires in connector. Push the wires up through the connector and then pull them down until they lock in place. Ensure signal and ground wires are installed in the correct position.

(5) Install locking wedge on connector.

(6) Push connector up into bottom of fuel pump module electrical connector.

REMOVAL AND INSTALLATION (Continued)

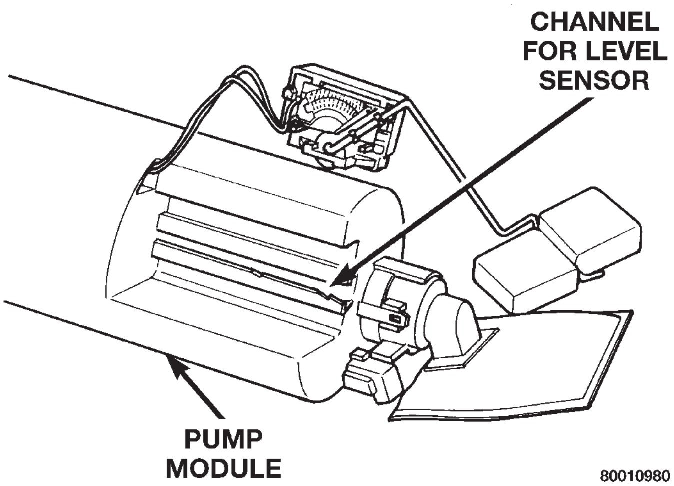
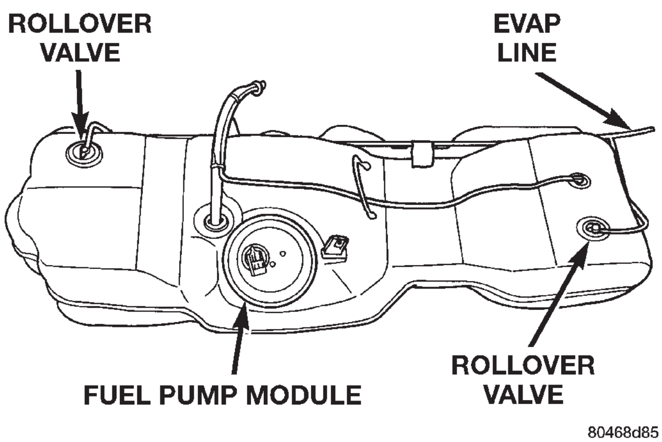


Fig. 28 Installation Channel

(7) Install fuel pump module. Refer to Fuel Pump Module in this section.

FUEL TANK



Fuel Tank

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap and perform Fuel System Pressure Release procedure.

(3) Insert fuel siphon hose into fuel filler neck and push it into the tank.

(4) Drain fuel tank dry into holding tank or a properly labeled **GASOLINE** safety container.

(5) Raise vehicle on hoist.

(6) Disconnect both the fuel fill and fuel vent rubber hoses at the fuel tank.

(7) Disconnect fuel supply lines from the steel supply line.

The fuel pump module electrical connector has a retainer that locks it in place.

(8) Slide fuel pump module electrical connector lock to unlock (Fig. 29).

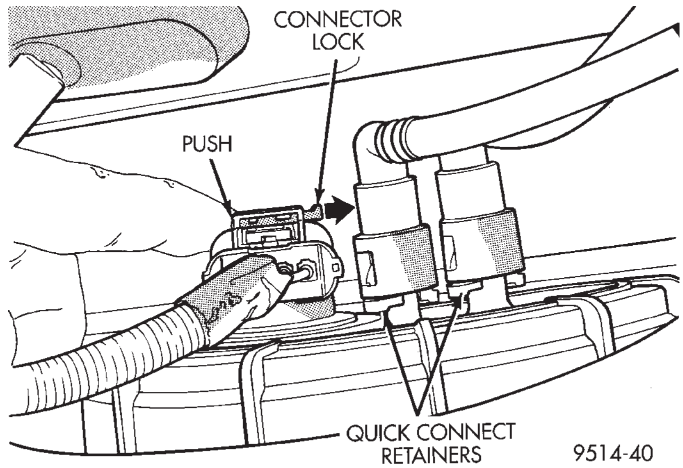


Fig. 29 Fuel Line Retainers and Pump Connector Lock

(9) Push down on connector retainer (Fig. 30) and pull connector off module.

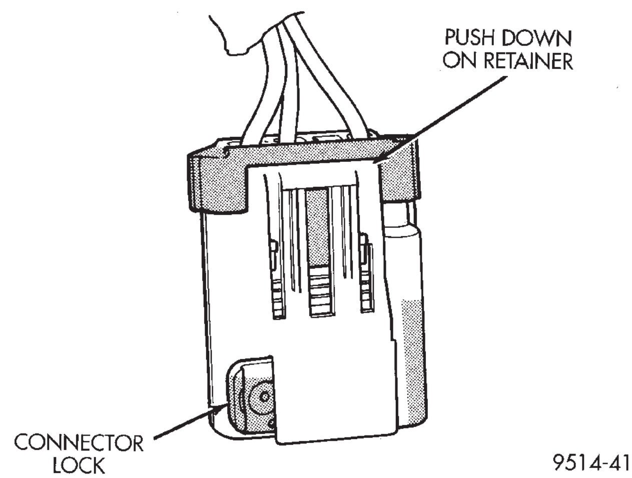


Fig. 30 Pump Module Connector Retainer and Lock

(10) Use a transmission jack to support fuel tank. Remove bolts from fuel tank straps.

(11) Lower tank slightly. Carefully remove filler hose from tank.

(12) Lower the fuel tank. Disconnect pressure relief/rollover valve hose at the front of tank. Remove clamp and remove fuel filler tube vent hose. Remove fuel tank from vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position fuel tank on transmission jack. Connect pressure relief/rollover valve hose. Connect fuel filler tube vent hose and replace clamp.

(2) Raise tank into position and carefully work filler tube into tank. A light coating of clean engine oil on the tube end may be used to aid assembly.

(3) Feed filler vent line thru frame rail. Careful not to cross lines.

(4) Tighten strap bolts to 54 N·m (40 ft. lbs.) torque. Remove transmission jack.

(5) Tighten filler hose clamp to 3.3 N·m (30 in. lbs.).

CAUTION: Ensure straps are not twisted or bent before or after tightening strap nuts.

(6) Connect fuel pump/module electrical connector. Place retainer in locked position.

(7) Lubricate the fuel supply line with clean 30 weight engine oil, install the quick connect fuel fitting. Refer to Tube/Fitting Assembly in the Fuel Delivery section of this Group.

(8) Attach filler line to filler tube. Pull on connector to make sure of connection.

(9) Fill fuel tank, replace cap, and connect battery negative cable.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(10) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL INJECTOR RAIL—2.4L

REMOVAL

(1) Perform fuel system pressure release procedure **before servicing or starting repairs.** Refer to Fuel System Pressure Release Procedure in this section.

(2) Disconnect negative cable from battery.

(3) Remove air cleaner inlet hose from throttle body.

(4) Remove throttle cable and speed control cable (if equipped) from throttle lever.

(5) Remove throttle cables from bracket by compressing retaining tabs.

(6) Remove connector from throttle position sensor.

(7) Remove connector from idle air control motor.

(8) Remove vacuum lines from intake plenum fittings (Fig. 31) and (Fig. 32).

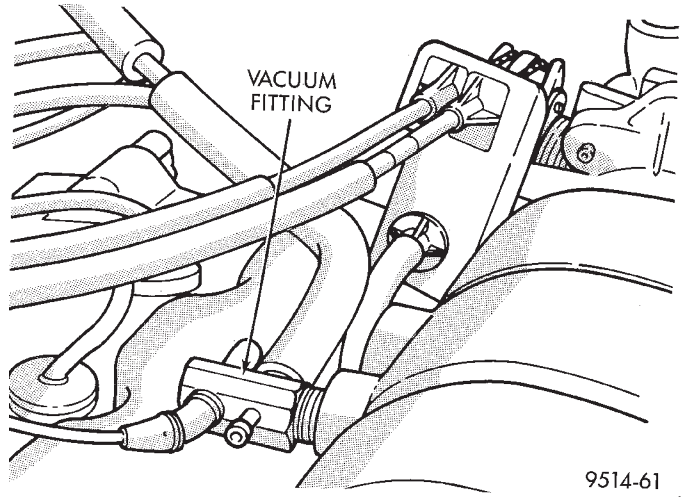


Fig. 31 Vacuum Fitting on Rear of Intake Manifold

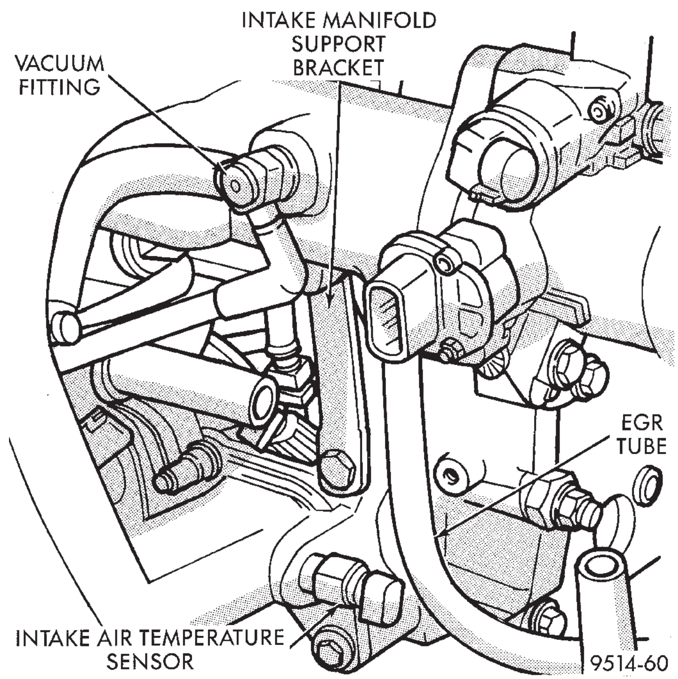


Fig. 32 Electrical and Vacuum Connections

(9) Remove connector from intake air temperature sensor (Fig. 32).

(10) Remove connector from MAP sensor (Fig. 33).

(11) Remove fuel hose quick connect fitting from the chassis tube (Fig. 34). **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in this Section.** Place a shop towel under the connections to absorb any fuel spilled from the fitting.

REMOVAL AND INSTALLATION (Continued)

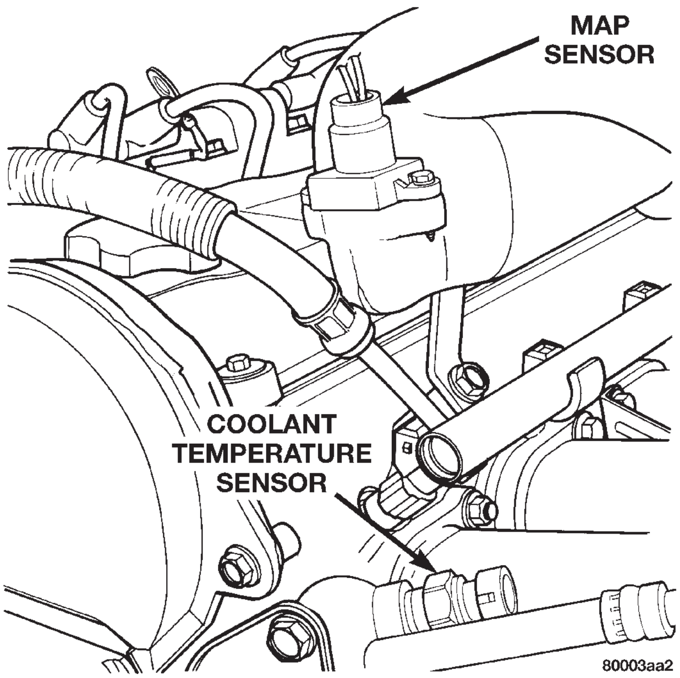


Fig. 33 Map Sensor—2.4L

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

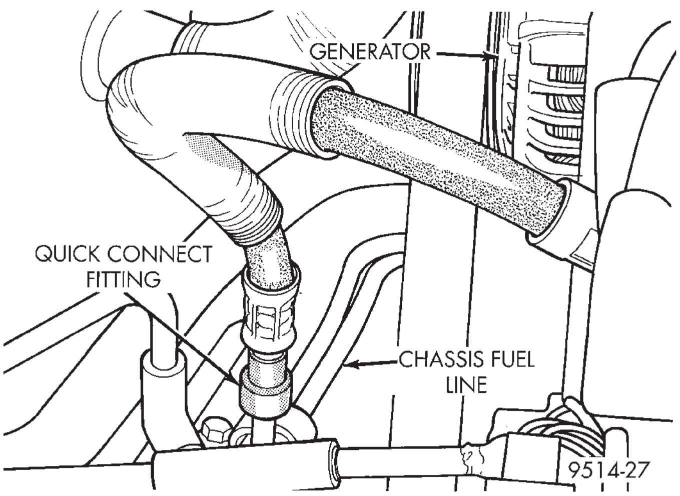


Fig. 34 Fuel Line Quick Disconnect

(12) Remove bolt holding bottom of intake support bracket.

(13) Remove intake manifold screws (Fig. 35).

(14) Remove fuel rail attaching bolts.

(15) Remove fuel rail. Be careful not to damage the injector O-rings upon removal from their ports.

INSTALLATION

(1) Ensure injector holes are clean. Replace O-rings if damaged.

(2) Lubricate injector O-rings with a drop of clean engine oil to ease installation.

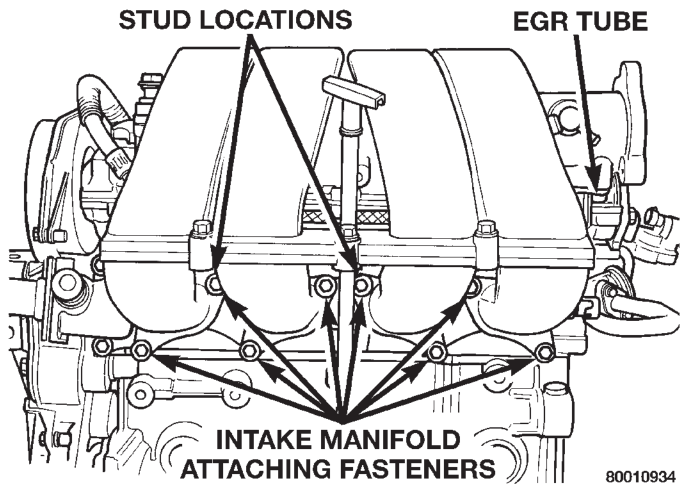


Fig. 35 Intake Manifold Attaching Points

(3) Put the tip of each injector into their ports. Push the assembly into place until the injectors are seated in the ports.

(4) Install the fuel rail mounting bolts. Tighten bolts to 22 N·m (200 in. lbs.) torque (Fig. 35).

(5) Install a new intake manifold gasket.

(6) Position intake manifold.

(7) Tighten retaining bolts starting at center and progressing outward in both directions to 23 N·m (200 in. lbs.) (Fig. 35). Repeat this procedure until all bolts are at specified torque.

(8) Install fuel hose quick connector fitting to chassis tubes. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in this Section.** Push the fitting onto the chassis tube until it clicks into place. Pull on the fitting to ensure complete insertion.

(9) Reverse removal procedures Step 2 thru Step 12 for installation.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(10) With the ignition key in ON position, access the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL INJECTOR RAIL—3.0L

WARNING: THE 3.0L MPI FUEL SYSTEM IS UNDER A CONSTANT PRESSURE OF APPROXIMATELY 330 KPA (48 PSI). PERFORM FUEL PRESSURE RELEASE PROCEDURE BEFORE SERVICING THE FUEL RAIL OR FUEL INJECTORS.

REMOVAL

(1) Perform the Fuel Pressure Release Procedure.

(2) Disconnect negative cable from battery.

REMOVAL AND INSTALLATION (Continued)

(3) Remove air inlet resonator (Fig. 36).

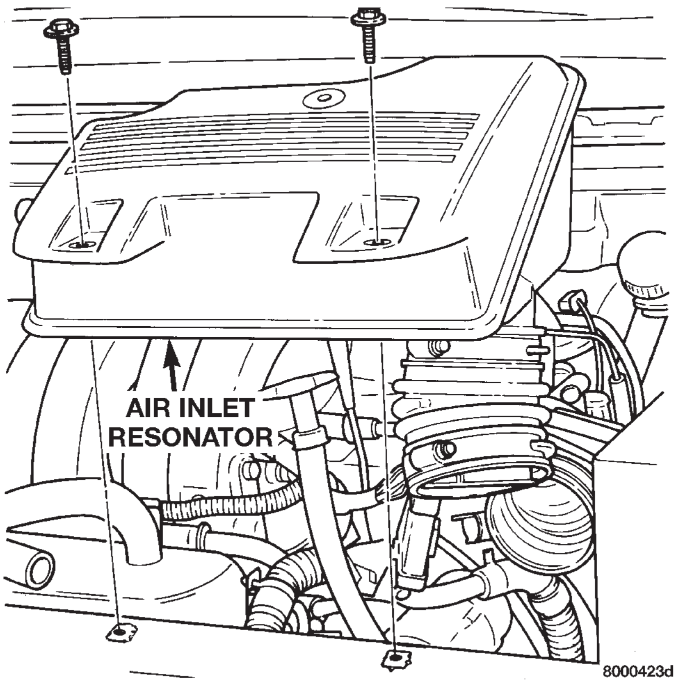


Fig. 36 Air Inlet Resonator

(4) Remove throttle cable (Fig. 37).

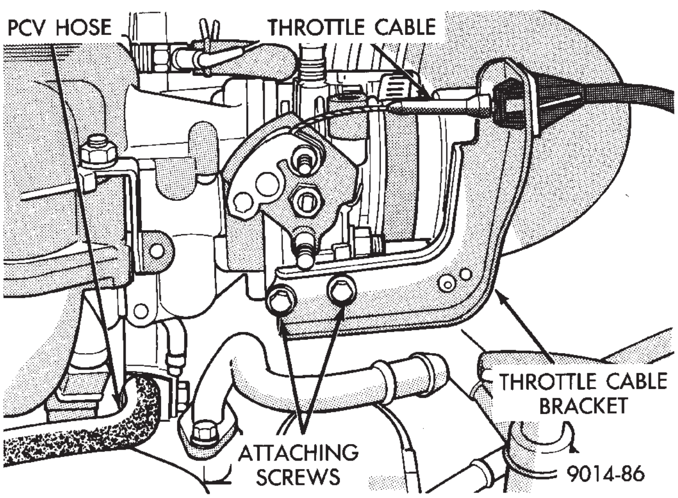


Fig. 37 Throttle Cable Attachment

(5) Disconnect electrical connectors from the idle air control motor and Throttle Position Sensor (TPS).

(6) Remove vacuum hose harness from throttle body (Fig. 38).

(7) Remove electrical connector from the coolant temperature sensor (Fig. 39).

(8) Remove vacuum connections from air intake plenum vacuum connector (Fig. 39).

(9) Remove the fuel hose quick connect fitting from the chassis tube (Fig. 40). **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in this Section.** Place a shop towel under the connections to absorb any fuel spilled from the fitting.

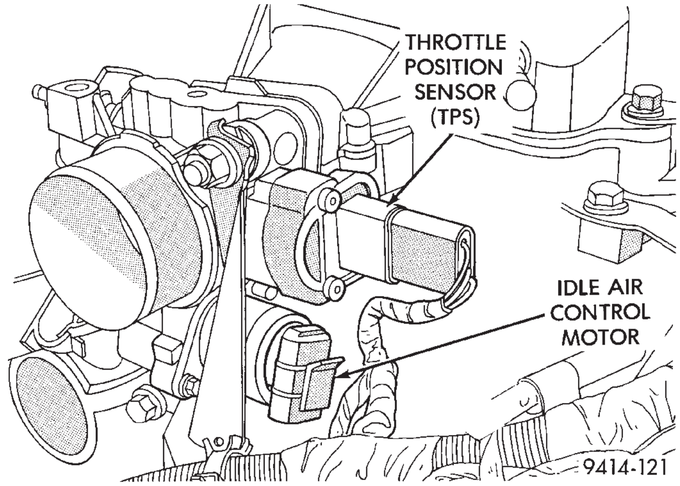


Fig. 38 Electrical and Vacuum Connection to Throttle Body

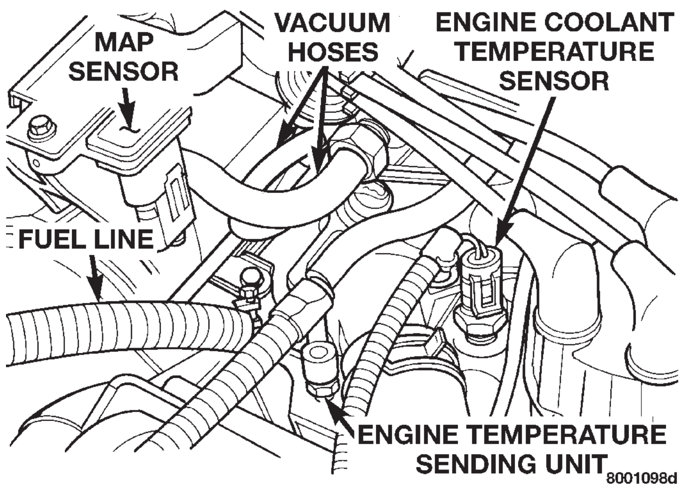


Fig. 39 Coolant Temperature Sensor Electrical Connections

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

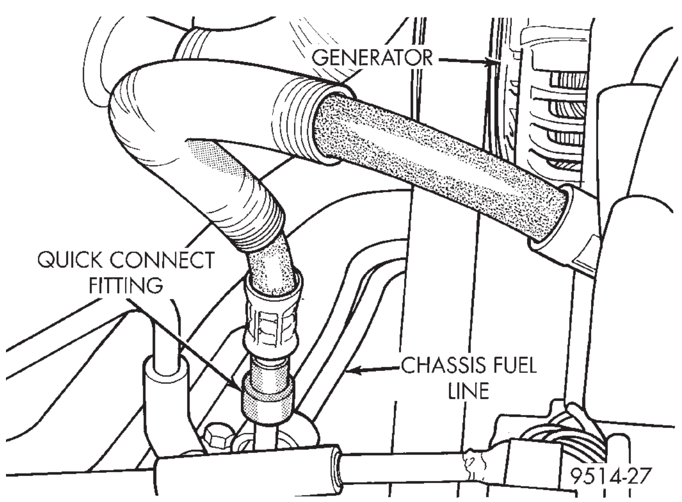


Fig. 40 Fuel Line Quick Disconnect

REMOVAL AND INSTALLATION (Continued)

(10) Remove air intake plenum to intake manifold mounting fasteners (Fig. 41).

(11) Remove ignition coil.

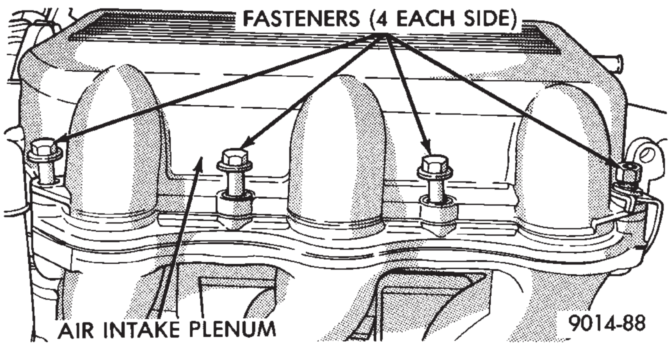


Fig. 41 Air Intake Plenum to Intake Manifold Attaching Fasteners

(12) Remove air intake plenum (Fig. 42).

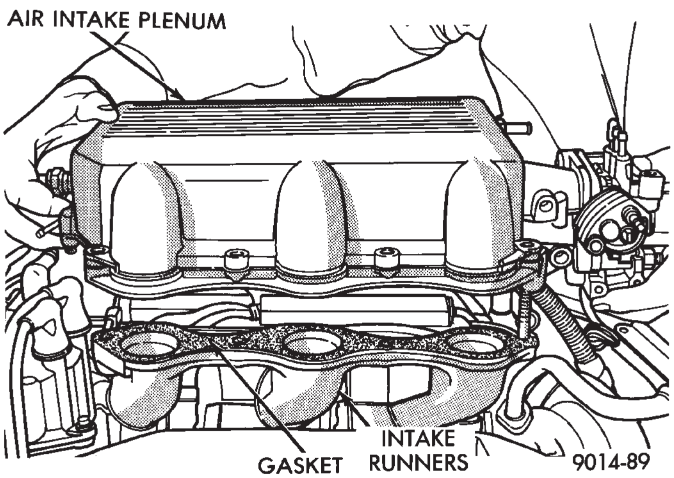


Fig. 42 Removing Air Intake Plenum

(13) Cover intake manifold while servicing injector fuel rail.

(14) Disconnect fuel injector wiring harness from engine wiring harness.

CAUTION: Do not damage the injector O-Rings when removing the injectors and fuel rail assembly.

(15) Remove fuel rail mounting bolts. Lift fuel rail assembly off of intake manifold.

INSTALLATION

(1) Ensure injectors are seated into the receiver cup of fuel rail with lock ring in place.

(2) Make sure the injector holes in the manifold are clean.

(3) To ease installation, lubricate injector O-ring with a drop of clean engine oil.

(4) Put the tip of each injector into their ports. Push the assembly into place until the injectors are seated in the ports.

(5) Install fuel rail attaching bolts. Tighten bolts to 13 N·m (115 in. lbs.) torque.

(6) Install fuel supply and return tube holddown bolt and the vacuum crossover tube holddown bolt. Tighten bolts to 10 N·m (95 in. lbs.) torque.

(7) Connect fuel injector wiring harness to engine wiring harness.

(8) Remove covering from lower intake manifold and clean surface.

(9) Place intake manifold gaskets **with beaded sealer** upon lower manifold. Put air intake in place. Install ignition coil. Install attaching fasteners and tighten to 13 N·m (115 in. lbs.) torque.

(10) Connect fuel line to fuel rail.

(11) Connect vacuum harness to air intake plenum.

(12) Connect coolant temperature sensor electrical connector to sensor.

(13) Connect PCV and brake booster supply hose to intake plenum.

(14) Connect idle air control motor and Throttle Position Sensor (TPS) electrical connectors.

(15) Connect vacuum vapor harness to throttle body.

(16) Install throttle cable.

(17) Install air inlet resonator.

(18) Connect negative cable to battery.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(19) With the ignition key in ON position, access the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL INJECTOR RAIL—3.3/3.8L

WARNING: THE 3.3/3.8L MPI FUEL SYSTEM IS UNDER A CONSTANT PRESSURE OF APPROXIMATELY 330 KPA (49 PSI), 3.3L USES APPROXIMATELY 379 KPA (55 PSI). PERFORM FUEL PRESSURE RELEASE PROCEDURE BEFORE SERVICING THE FUEL RAIL OR FUEL INJECTORS.

REMOVAL

(1) Perform fuel system pressure release procedure.

(2) Disconnect negative cable from battery.

(3) Remove intake manifold cover.

(4) Remove air inlet resonator (Fig. 36).

(5) Remove throttle cable and speed control cable (if equipped) (Fig. 43) from throttle lever and bracket.

REMOVAL AND INSTALLATION (Continued)

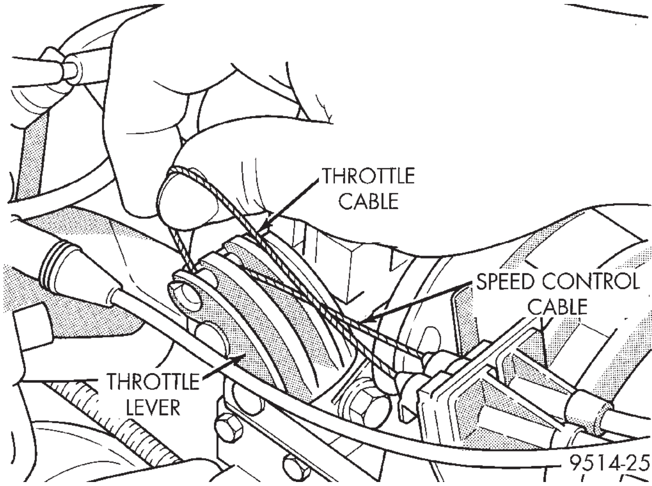


Fig. 43 Throttle Cable Attachment

(6) Disconnect idle air control motor and Throttle Position Sensor (TPS) electrical connectors (Fig. 44).

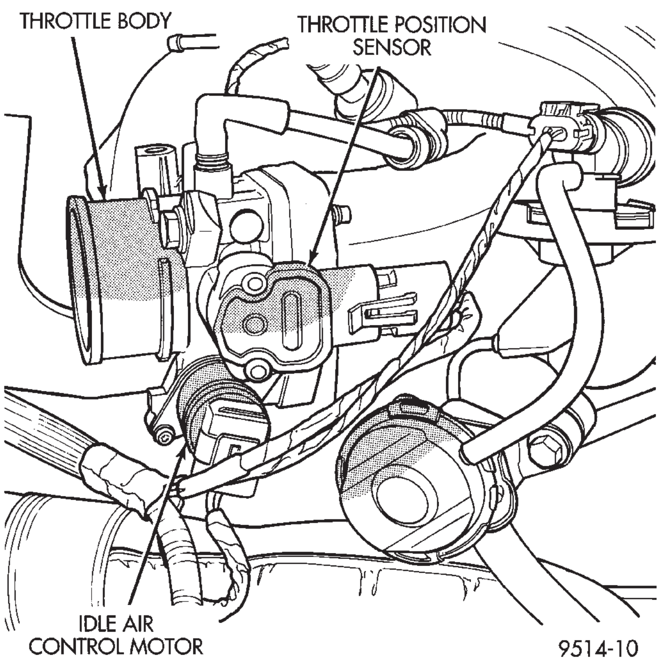


Fig. 44 Electrical and Vacuum Connection to Throttle Body

(7) Remove vacuum hose harness from throttle body and intake manifold (Fig. 45).

(8) Remove EGR tube to intake manifold flange bolts (Fig. 46).

(9) Remove cylinder head to intake plenum strut.

(10) Disconnect electrical connector from the MAP sensor (Fig. 47)

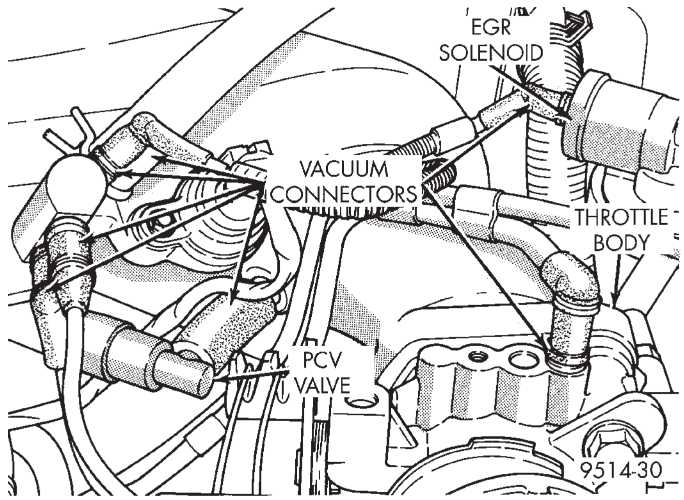


Fig. 45 Vacuum Connections

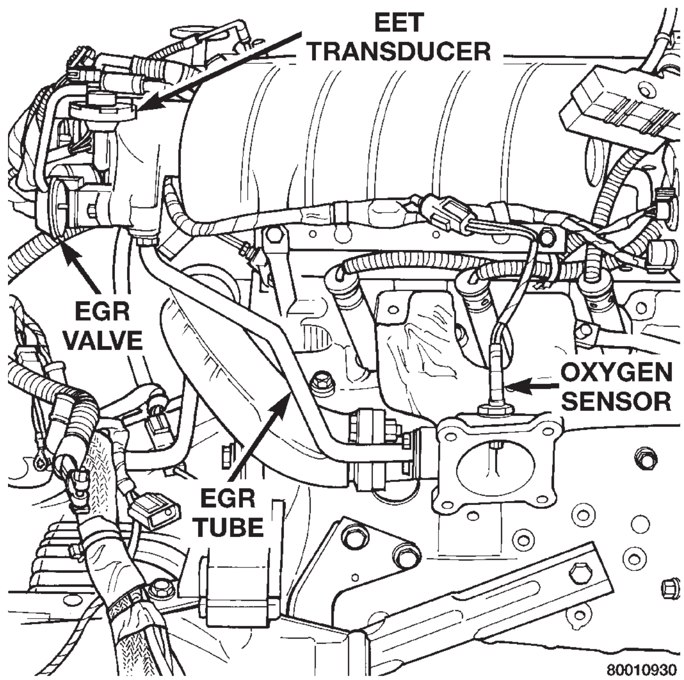


Fig. 46 EGR Tube—3.3L/3.8

(11) Remove engine mounted ground strap.

(12) Remove the fuel hose quick connect fitting from the chassis tube (Fig. 48). **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in this Section.**

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

REMOVAL AND INSTALLATION (Continued)

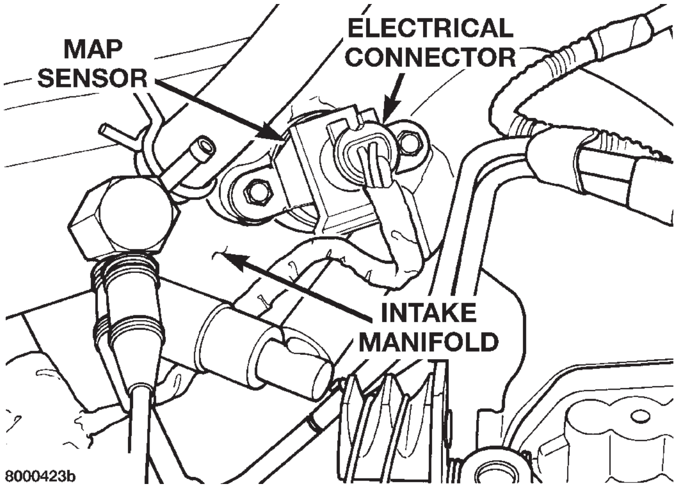


Fig. 47 Map Sensor

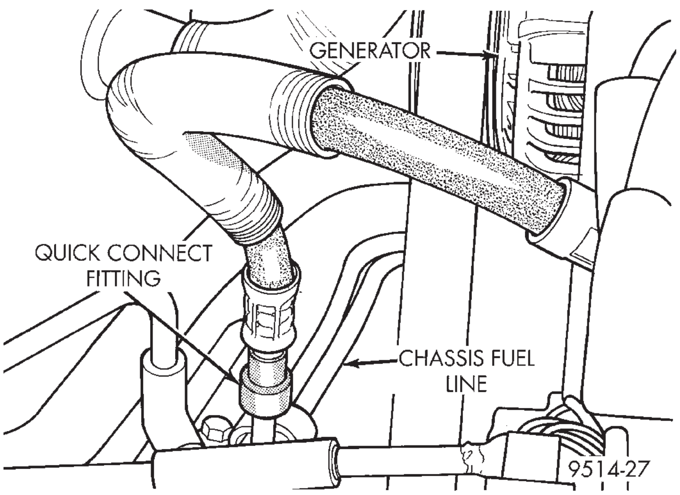


Fig. 48 Fuel Line Quick Disconnect

(13) Remove Direct Ignition System (DIS) coils (Fig. 49).

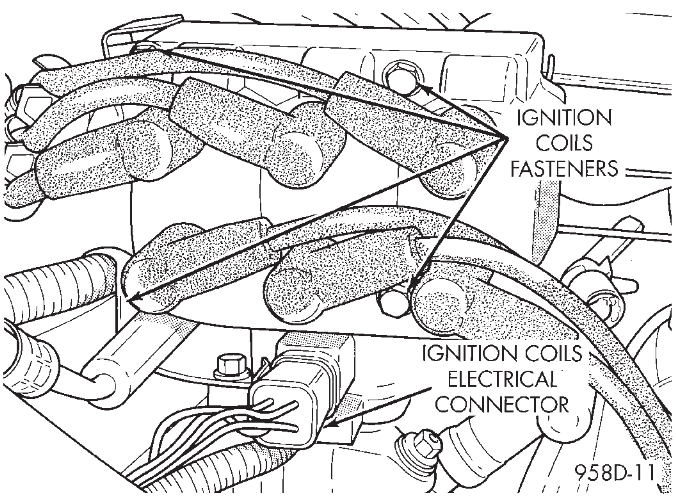


Fig. 49 Ignition Coils

(14) Remove generator bracket to intake manifold bolt.

(15) Remove intake mounting manifold bolts and rotate manifold back over rear valve cover (Fig. 50).

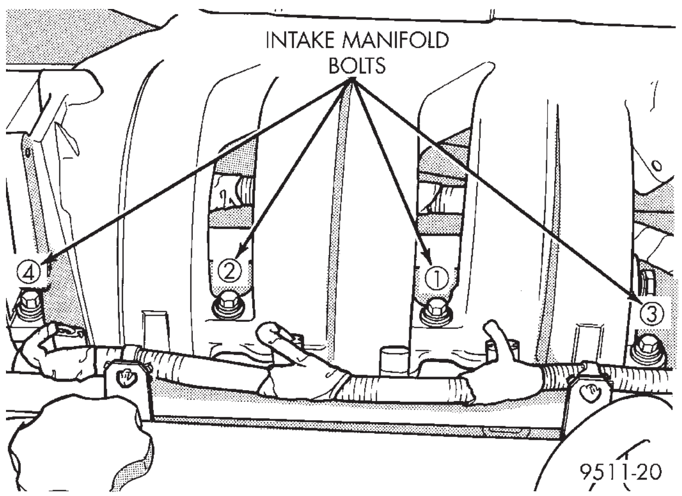


Fig. 50 Intake Manifold Bolts

(16) Cover intake manifold with suitable cover when servicing (Fig. 51).

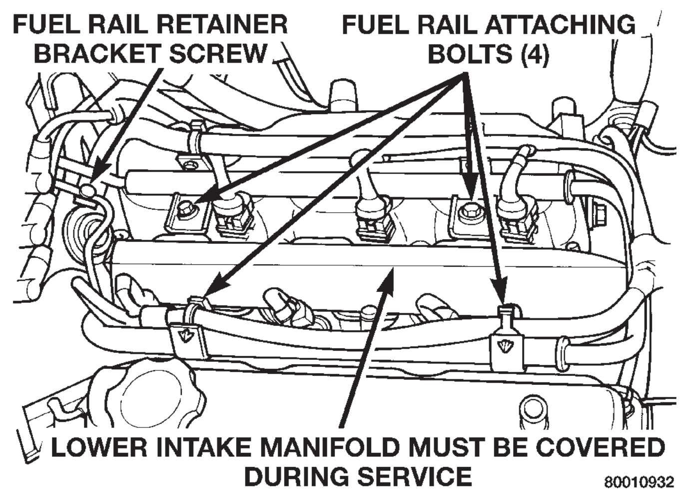


Fig. 51 Fuel Rail Attaching Bolts

(17) Remove fuel tube retainer bracket screw and fuel rail attaching bolts (Fig. 51). Spread the retainer bracket to allow fuel tube removal clearance.

(18) Disconnect camshaft position sensor (Fig. 52) and engine coolant temperature sensor.

(19) Remove fuel rail. Be careful not to damage the injector O-rings upon removal from their ports (Fig. 53).

INSTALLATION

(1) Ensure injector holes are clean. Replace O-rings if damaged.

(2) Lubricate injector O-rings with a drop of clean engine oil to ease installation.

(3) Put the tip of each injector into their ports. Push the assembly into place until the injectors are seated in the ports.

REMOVAL AND INSTALLATION (Continued)

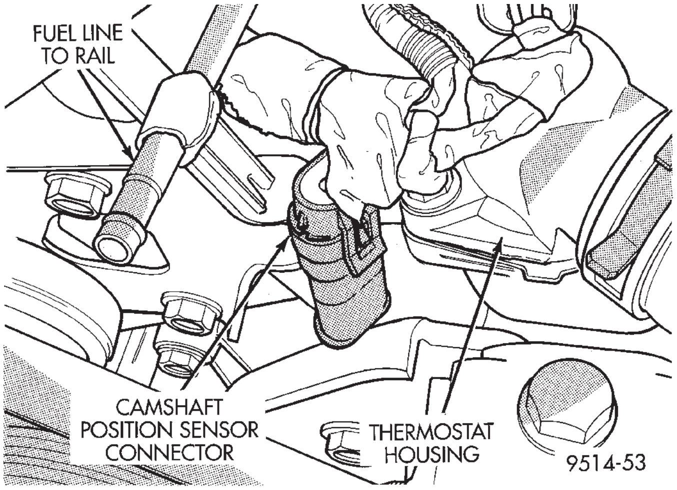


Fig. 52 Camshaft Position Sensor Connector

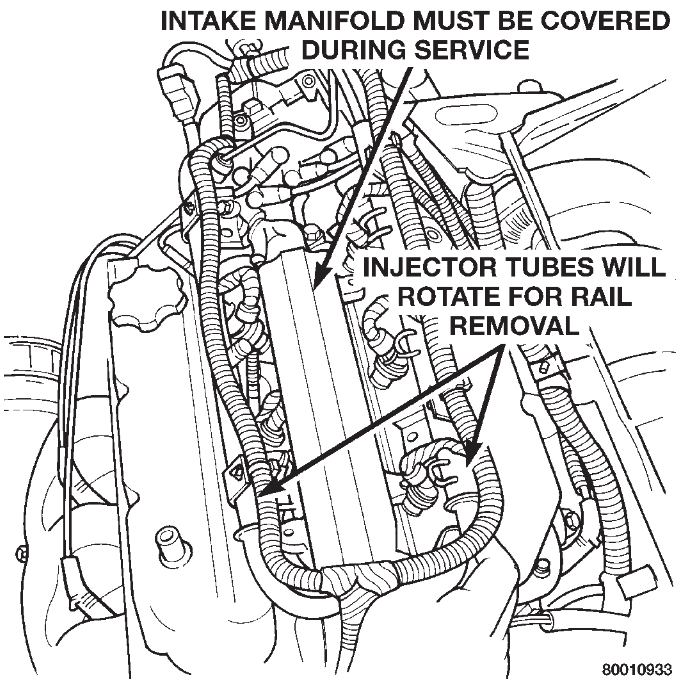


Fig. 53 Fuel Rail Removal

(4) Install the fuel rail mounting bolts. Tighten bolts to 22 N·m (200 in. lbs.) torque (Fig. 51).

(5) Install fuel tube retaining bracket screw. Tighten screw to 4 N·m (35 in. lbs.) torque.

(6) Connect electrical connectors to camshaft position sensor and engine coolant temperature sensor.

(7) Remove covering on lower intake manifold and clean surface.

(8) Place intake manifold gasket on lower manifold. Put upper manifold into place and install bolts finger tight.

(9) Install the generator bracket to intake manifold bolt and the cylinder head to intake manifold strut bolts (do not tighten.)

(10) Following the tightening sequence in (Fig. 50), tighten intake manifold bolts to 28 N·m (250 in. lbs.) torque.

(11) Tighten generator bracket to intake manifold bolt to 54 N·m (40 ft. lbs.) torque.

(12) Tighten the cylinder head to intake manifold strut bolts to 54 N·m (40 ft. lbs.) torque.

(13) Connect ground strap and MAP sensor electrical connector.

(14) Connect vacuum harness to intake plenum. Connect PCV system hoses.

(15) Using a new gasket, connect the EGR tube to the intake manifold plenum. Tighten screws to 22 N·m (200 in. lbs.) torque.

(16) Connect electrical connectors to the TPS and idle air control motor.

(17) Connect vacuum harness to throttle body.

(18) Install the direct ignition system (DIS) coils. Tighten fasteners to 12 N·m (105 in. lbs.) torque.

(19) Install fuel hose quick connector fitting to chassis tubes. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in this Section.** Push the fitting onto the chassis tube until it clicks into place. Pull on the fitting to ensure complete insertion.

(20) Install throttle cable and speed control cable (if equipped).

(21) Install air inlet resonator.

(22) Connect negative cable to battery.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(23) With the ignition key in ON position, access the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL INJECTOR—2.4L

The fuel rail must be removed first. Refer to Fuel Injector Rail Removal in this section.

REMOVAL

(1) Disconnect injector wiring connector from injector.

(2) Position fuel rail assembly so that the fuel injectors are easily accessible (Fig. 54).

(3) Rotate injector and pull injector out of fuel rail. The clip will stay on the injector.

(4) Check injector O-ring for damage. If O-ring is damaged, it must be replaced. If injector is reused, a protective cap must be installed on the injector tip to prevent damage. Replace the injector clip if it is damaged.

(5) Repeat for remaining injectors.

REMOVAL AND INSTALLATION (Continued)

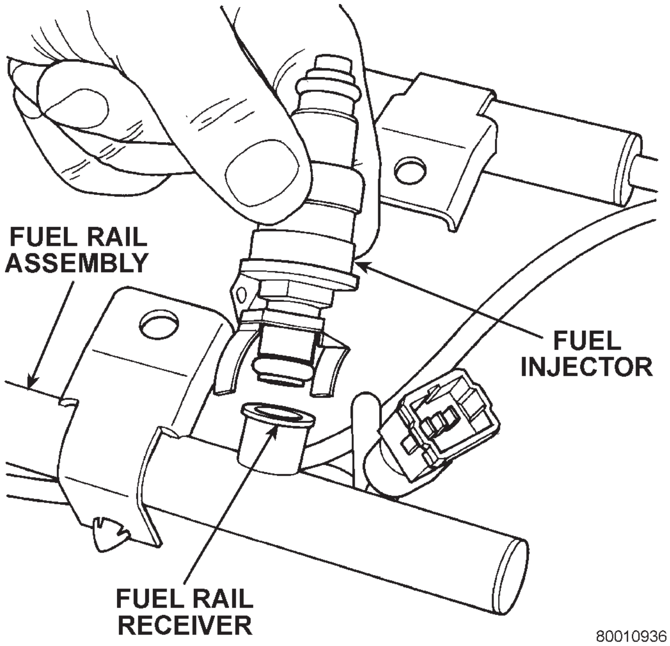


Fig. 54 Fuel Injector and Rail—Typical

INSTALLATION

(1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.

(2) Install injector clip by sliding open end into the top slot of the injector. The edge of the receiver cup will slide into the side slots of clip.

(3) Install injector top end into fuel rail receiver cap. Be careful not to damage O-ring during installation (Fig. 55).

(4) Repeat steps for remaining injectors.

(5) Connect fuel injector wiring.

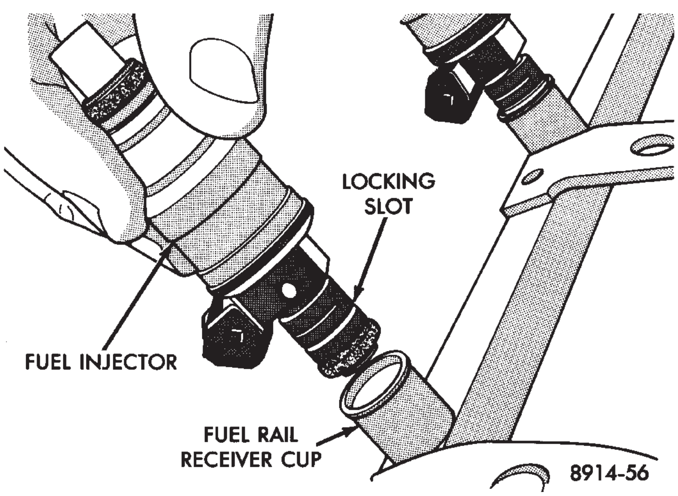


Fig. 55 Servicing Fuel Injector—Typical

FUEL INJECTORS—3.0L

WARNING: THE 3.0L MPI FUEL SYSTEM IS UNDER A CONSTANT PRESSURE OF APPROXIMATELY 330 KPA (48 PSI). PERFORM FUEL PRESSURE RELEASE PROCEDURE BEFORE SERVICING THE FUEL INJECTORS.

REMOVAL

(1) Perform the Fuel Pressure Release Procedure.

(2) Disconnect negative cable from battery.

(3) The fuel rail must be removed first to service the injectors. Refer to Fuel Injector Rail Assembly Removal in this section.

(4) Label each injector connector with its cylinder number. Disconnect electrical connector from injector.

(5) Position fuel rail assembly so that the fuel injectors are easily accessible.

(6) Remove injector clip from fuel rail and injector (Fig. 54).

(7) Pull injector straight out of fuel rail receiver cup (Fig. 55).

(8) Check injector O-ring for damage. If O-ring is damaged, it must be replaced. If injector is to be reused, a protective cap must be installed on the injector tip to prevent damage.

(9) Repeat procedure for remaining injectors.

INSTALLATION

(1) Before installing an injector, the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.

(2) Being careful not to damage O-ring, install injector nozzle end into fuel rail receiver cap.

(3) Install injector clip by sliding open end into **top slot** of the injector. The edge of the receiver cup will slide into the side slots of clip (Fig. 55)

(4) Repeat steps for remaining injectors.

(5) Install fuel rail assembly. Refer to Fuel Rail Assembly Installation in this section.

(6) Connect electrical connectors to injectors in correct order.

(7) Connect negative battery cable.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(8) With the ignition key in ON position, access the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

FUEL INJECTOR—3.3/3.8L

The fuel rail must be removed first. Refer to Fuel Injector Rail Assembly Removal in this section.

REMOVAL

(1) Disconnect injector wiring connector from injector.

(2) Position fuel rail assembly so that the fuel injectors are easily accessible (Fig. 54).

(3) Rotate injector and pull injector out of fuel rail. The clip will stay on the injector.

(4) Check injector O-ring for damage. If O-ring is damaged, it must be replaced. If injector is reused, a protective cap must be installed on the injector tip to prevent damage. Replace the injector clip if it is damaged.

(5) Repeat for remaining injectors.

INSTALLATION

(1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.

(2) Install injector clip by sliding open end into the top slot of the injector. The edge of the receiver cup will slide into the side slots of clip (Fig. 56).

(3) Install injector top end into fuel rail receiver cap. Be careful not to damage O-ring during installation (Fig. 56).

(4) Repeat steps for remaining injectors.

(5) Connect fuel injector wiring.

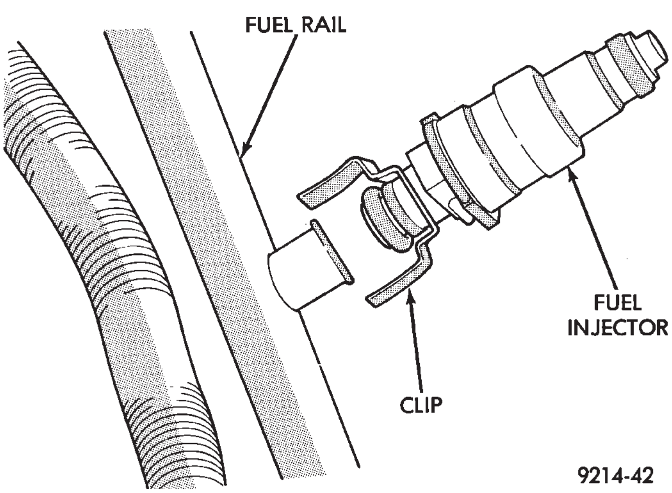


Fig. 56 Servicing Fuel Injector—Typical

ACCELERATOR PEDAL

CAUTION: When servicing the accelerator pedal, throttle cable or speed control cable, do not damage or kink the core wire inside the cable sheathing.

REMOVAL

(1) Working from the engine compartment, remove the throttle control shield.

(2) Hold the throttle body throttle lever in the wide open position. Remove the throttle cable from the throttle body cam.

(3) From inside the vehicle, hold up the pedal and remove the cable retainer and throttle cable from the upper end of the pedal shaft (Fig. 57) and (Fig. 58).

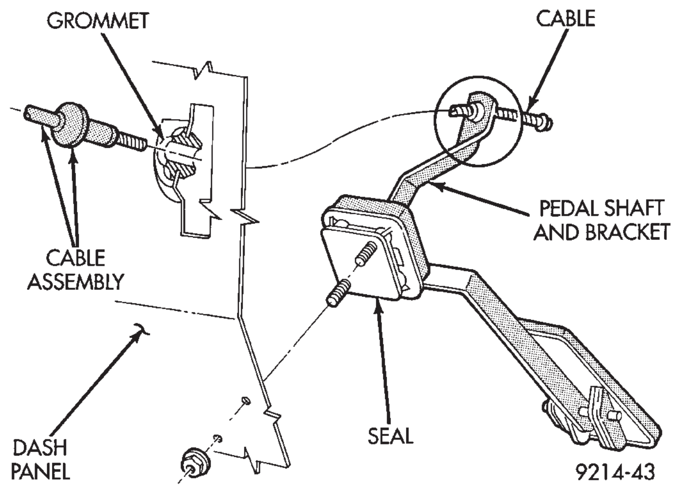


Fig. 57 Accelerator Pedal and Throttle Cable—Front View

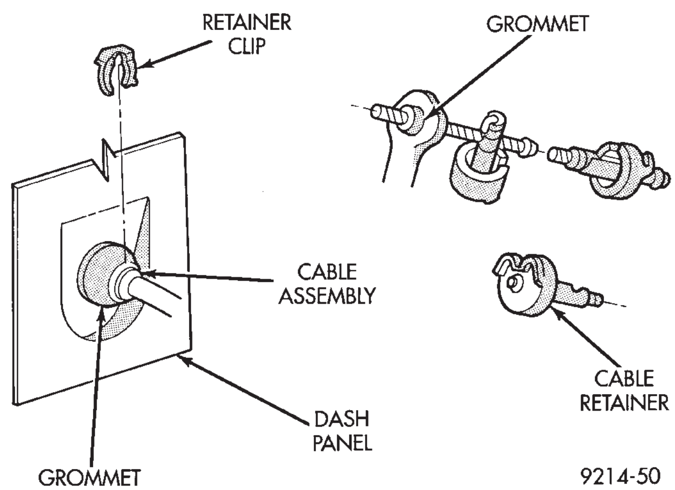


Fig. 58 Accelerator Pedal and Throttle Cable—Rear View

(4) Working from the engine compartment, remove nuts from accelerator pedal attaching studs (Fig. 57). Remove assembly from vehicle.

INSTALLATION

(1) Position accelerator pedal assembly on dash panel. Install retaining nuts. Tighten retaining nuts to 12 N·m (105 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

(2) From inside the vehicle, hold up the pedal and install the throttle cable and cable retainer in the upper end of the pedal shaft.

(3) From the engine compartment, hold the throttle body lever in the wide open position and install the throttle cable. Install the throttle control shield.

THROTTLE CABLE

CAUTION: When servicing the accelerator pedal, throttle cable or speed control cable, do not damage or kink the core wire inside the cable sheathing.

REMOVAL

(1) Working from the engine compartment, hold the throttle body throttle lever in the wide open position.

(2) Remove the throttle cable from the throttle body cam (Fig. 59), (Fig. 60) and (Fig. 61).

(3) From inside the vehicle, hold up the pedal and remove the cable retainer and throttle cable from the upper end of the pedal shaft (Fig. 57).

(4) Remove retainer clip from throttle cable and grommet at dash panel (Fig. 58).

(5) From the engine compartment, pull the throttle cable out of the dash panel grommet. The grommet should remain in the dash panel.

(6) Remove the throttle cable from throttle bracket by carefully compressing both retaining ears simultaneously. Then gently pull the throttle cable from throttle bracket.

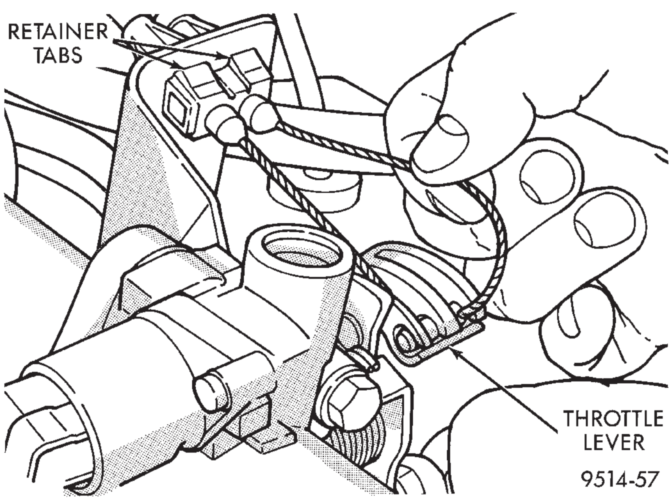


Fig. 59 Throttle Cable Attachment to Throttle Body Attachment—2.4L Engine

INSTALLATION

(1) From the engine compartment, push the housing end fitting into the dash panel grommet.

(2) Install the cable housing (throttle body end) into the cable mounting bracket on the engine.

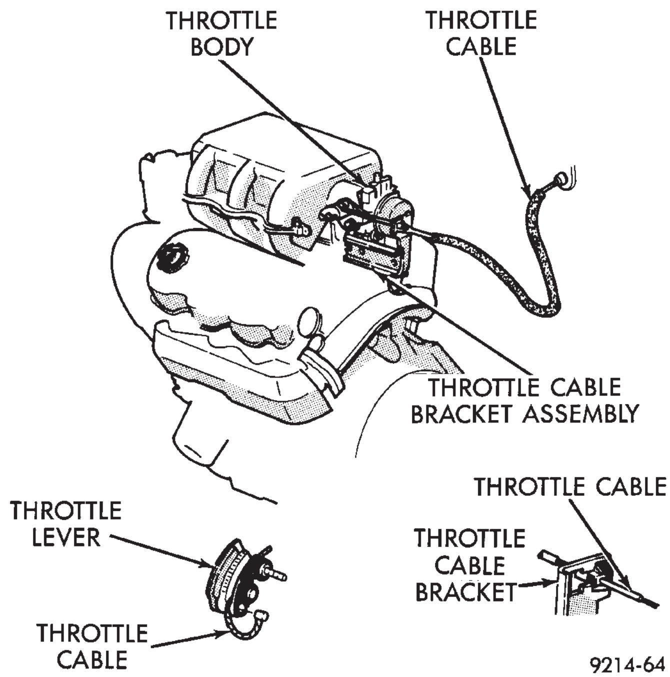


Fig. 60 Throttle Cable Attachment to Throttle Body Attachment—3.0L Engine

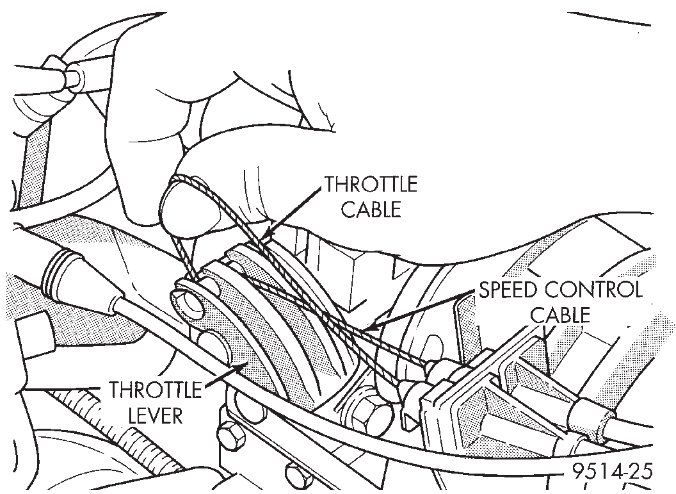


Fig. 61 Throttle Cable Attachment to Throttle Body Attachment—3.3/3.8L Engines

(3) From inside the vehicle, hold up the pedal and install throttle cable and cable retainer in the upper end of the pedal shaft.

(4) At the dash panel, install the cable retainer clip between the end of the throttle cable fitting and grommet (Fig. 58)

(5) From the engine compartment, rotate the throttle lever wide open and install the throttle cable.

SPECIFICATIONS

TORQUE

DESCRIPTION	TORQUE
Fuel Pump Module Locknut	58 N·m (43 ft. lbs.)
Fuel Tank Strap Bolts	54 N·m (40 ft. lbs.)
Fuel Rail Bolts—2.4L	22 N·m (200 in. lbs.)
Fuel Rail Bolts—3.0L	13 N·m (115 in. lbs.)
Fuel Rail Bolts—3.3/3.8L	10 N·m (95 in. lbs.)
Fuel Tube Holddown Bolts—3.0L	22 N·m (200 in. lbs.)
Fuel Tube Holddown Screw	4 N·m (35 in. lbs.)
Intake Manifold Bolts—2.4L	22 N·m (200 in. lbs.)
Intake Manifold Bolts—3.0L	13 N·m (115 in. lbs.)
Intake Manifold Bolts—3.3/3.8L	28 N·m (250 in. lbs.)
Accelerator Pedal to Dash Nuts	12 N·m (105 in. lbs.)

FUEL TANK CAPACITY

Vehicle	Liters	U.S. Gallons
NS	75.O	20
Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		

FUEL INJECTION SYSTEM

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GENERAL INFORMATION

INTRODUCTION

All engines used in this section have a sequential Multi-Port Electronic Fuel Injection system. The MPI system is computer regulated and provides precise air/fuel ratios for all driving conditions. The Powertrain Control Module (PCM) operates the fuel injection system.

The PCM regulates:
- Ignition timing
- Air/fuel ratio
- Emission control devices
- Cooling fan
- Charging system
- Idle speed
- Vehicle speed control

Various sensors provide the inputs necessary for the PCM to correctly operate these systems. In addition to the sensors, various switches also provide inputs to the PCM.

All inputs to the PCM are converted into signals. The PCM can adapt its programming to meet changing operating conditions.

Fuel is injected into the intake port above the intake valve in precise metered amounts through electrically operated injectors. The PCM fires the injectors in a specific sequence. Under most operating conditions, the PCM maintains an air fuel ratio of 14.7 parts air to 1 part fuel by constantly adjusting injector pulse width. Injector pulse width is the length of time the injector is open.

The PCM adjusts injector pulse width by opening and closing the ground path to the injector. Engine RPM (speed) and manifold absolute pressure (air density) are the primary inputs that determine injector pulse width.

MODES OF OPERATION

As input signals to the PCM change, the PCM adjusts its response to output devices. For example, the PCM must calculate a different injector pulse width and ignition timing for idle than it does for Wide Open Throttle (WOT). There are several different modes of operation that determine how the PCM responds to the various input signals.

There are two different areas of operation, OPEN LOOP and CLOSED LOOP.

During OPEN LOOP modes the PCM receives input signals and responds according to preset PCM programming. Input from the oxygen (O2S) sensor is not monitored during OPEN LOOP modes.

During CLOSED LOOP modes the PCM does monitor the O2S sensor input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air/fuel ratio of 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. Fine tuning injector pulse width allows the PCM to achieve optimum fuel economy combined with low emissions.

The multi-port fuel injection system has the following modes of operation:
- Ignition switch ON (zero RPM)
- Engine start-up
- Engine warm-up
- Cruise (Idle)
- Acceleration
- Deceleration
- Wide Open Throttle
- Ignition switch OFF

The engine start-up (crank), engine warm-up, and wide open throttle modes are OPEN LOOP modes. Under most operating conditions, the acceleration, deceleration, and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes.

IGNITION SWITCH ON (ZERO RPM) MODE

When the multi-port fuel injection system is activated by the ignition switch, the following actions occur:

- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the coolant temperature sensor and throttle position sensor input. The PCM modifies fuel strategy based on this input.

When the key is in the ON position and the engine is not running (zero rpm), the Automatic Shutdown (ASD) relay and fuel pump relay are not energized. Therefore battery voltage is not supplied to the fuel pump, ignition coil, fuel injectors or oxygen sensor heating element.

ENGINE START-UP MODE

This is an OPEN LOOP mode. The following actions occur when the starter motor is engaged.

If the PCM receives the camshaft position sensor and crankshaft position sensor signals, it energizes the ASD relay and fuel pump relay. These relays supply battery voltage to the fuel pump, fuel injectors,

GENERAL INFORMATION (Continued)

ignition coil, and oxygen sensor heating element. If the PCM does not receive the camshaft position sensor and crankshaft position sensor signals within approximately one second, it de-energizes the ASD relay and fuel pump relay.

The PCM energizes all injectors until it determines crankshaft position from the camshaft position sensor and crankshaft position sensor signals. The PCM determines crankshaft position within 1 engine revolution.

After determining crankshaft position, the PCM begins energizing the injectors in sequence. The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

When the engine idles within ±64 RPM of its target RPM, the PCM compares current MAP sensor value with the atmospheric pressure value received during the Ignition Switch On (zero RPM) mode. If the PCM does not detect a minimum difference between the two values, it sets a MAP diagnostic trouble code into memory.

Once the ASD and fuel pump relays have been energized, the PCM:

- Determines injector pulse width based on engine coolant temperature, MAP and the number of engine revolutions since cranking was initiated.
- Monitors the engine coolant temperature sensor, camshaft position sensor, crankshaft position sensor, MAP sensor, and throttle position sensor to determine correct ignition timing.

ENGINE WARM-UP MODE

This is a OPEN LOOP mode. The following inputs are received by the PCM:

- Engine coolant temperature
- Manifold absolute pressure
- Engine speed (crankshaft position sensor)
- Throttle position
- A/C switch
- Battery voltage

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts ignition timing and engine idle speed. Engine idle speed is adjusted through the idle air control motor.

CRUISE OR IDLE MODE

This is a CLOSED 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 fuel demand.

When the engine is at operating temperature this is a CLOSED LOOP mode. During cruising speed the following inputs are received by the PCM:

- Engine coolant temperature
- Manifold absolute pressure
- Engine speed (crankshaft position sensor)
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Battery voltage

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts engine idle speed and ignition timing. The PCM adjusts the air/fuel ratio according to the oxygen content in the exhaust gas.

ACCELERATION MODE

This is a CLOSED 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 fuel demand.

DECELERATION MODE

This is a CLOSED LOOP mode. During deceleration the following inputs are received by the PCM:

- Engine coolant temperature
- Manifold absolute pressure
- Engine speed
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Battery voltage

The PCM may receive a closed throttle input from the Throttle Position Sensor (TPS) when it senses an abrupt decrease in manifold pressure. This indicates a hard deceleration. The PCM may reduce injector pulse width or the number of injectors firing per engine revolution. This helps maintain better control of the air/fuel mixture (as sensed through the O2S sensor).

WIDE OPEN THROTTLE (WOT) MODE

This is an OPEN LOOP mode. During WOT operation, the following inputs are received by the PCM:

- Engine coolant temperature
- Manifold absolute pressure
- Engine speed
- Throttle position

When the PCM senses WOT condition through the Throttle Position Sensor (TPS) it will:

- De-energize the air conditioning relay. This disables the air conditioning system.

The exhaust gas oxygen content input is not accepted by the PCM during WOT operation. The PCM will adjust injector pulse width to supply a predetermined amount of additional fuel.

GENERAL INFORMATION (Continued)

IGNITION SWITCH OFF MODE

When the ignition switch is turned to the OFF position, the following occurs:

- All outputs are turned off.
- No inputs are monitored.
- The PCM shuts down.

DESCRIPTION AND OPERATION

SYSTEM DIAGNOSIS

The PCM can test many of its own input and output circuits. If the PCM senses a fault in a major system, the PCM stores a Diagnostic Trouble Code (DTC) in memory.

For DTC information, refer to Group 25, Emission Control Systems. See On-Board Diagnostics.

CCD BUS

Various controllers and modules exchange information through a communications port called the CCD Bus. The PCM transmits the malfunction indicator (check engine) lamp On/Off signal, engine RPM and vehicle load information on the CCD Bus.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is a digital computer containing a microprocessor (Fig. 1). The PCM receives input signals from various switches and sensors that are referred to as PCM Inputs. Based on these inputs, the PCM adjusts various engine and vehicle operations through devices that are referred to as PCM Outputs.

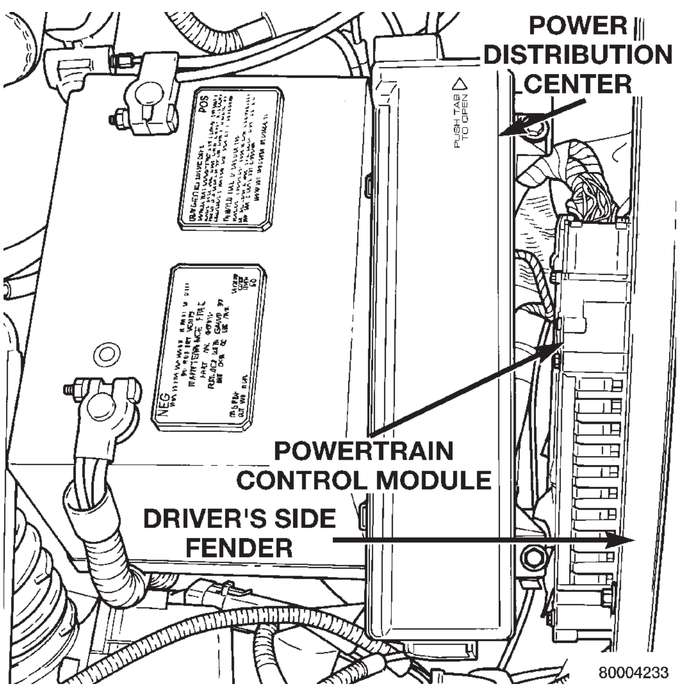


Fig. 1 Powertrain Control Module (PCM)

PCM Inputs:

- Air Conditioning Head Pressure
- Battery Voltage
- Brake Switch
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Engine Coolant Temperature Sensor
- Heated Oxygen Sensors (Upstream and Downstream)
- Intake Air Temperature Sensor (2.4L only)
- Knock Sensor (execpt 3.0L)
- Manifold Absolute Pressure (MAP) Sensor
- SCI Receive
- Speed Control System Controls
- Throttle Position Sensor
- Transaxle Park/Neutral Position Switch (automatic transaxle)
- Transmission Control Module
- Vehicle Speed Sensor

PCM Outputs:

- Air Conditioning Clutch Relay
- Automatic Shutdown (ASD) Relay
- Data Link Connector
- Proportional Purge Solenoid
- Electric EGR Transducer
- Fuel Injectors
- Fuel Pump Relay
- Generator Field
- Idle Air Control Motor
- Ignition Coil
- Leak Detection Pump
- Malfunction Indicator (Check Engine) Lamp
- Radiator Fan Control Module
- Speed Control Solenoids
- Tachometer Output
- Torque Converter Clutch Solenoid (3 speed transmission)
- Transmission Control Module

Based on inputs it receives, the PCM adjusts fuel injector pulse width, idle speed, ignition spark advance, ignition coil dwell and canister purge operation. The PCM regulates the cooling fan, air conditioning and speed control systems. The PCM changes generator charge rate by adjusting the generator field.

The PCM adjusts injector pulse width (air/fuel ratio) based on the following inputs:

- Battery voltage
- Engine coolant temperature
- Exhaust gas content (oxygen sensors)
- Engine speed (crankshaft position sensor)
- Manifold absolute pressure
- Throttle position

The PCM adjusts ignition timing based on the following inputs.

- Barometric pressure

DESCRIPTION AND OPERATION (Continued)

- Engine coolant temperature
- Engine speed (crankshaft position sensor)
- Intake air temperature (2.4L only)
- Manifold absolute pressure
- Throttle position
- Transaxle gear selection (park/neutral switch)

The PCM also adjusts engine idle speed through the idle air control motor based on the following inputs.

- Air conditioning select switch head pressure
- Brake switch
- Engine coolant temperature
- Engine speed (crankshaft position sensor)
- Manifold absolute pressure
- Throttle position
- Transaxle gear selection (park/neutral switch)
- Vehicle distance (speed)

The Automatic Shutdown (ASD) and fuel pump relays are located in the Power Distribution Center (PDC).

The camshaft position sensor (distributor pick-up signal 3.0L) and crankshaft position sensor signals are sent to the PCM. If the PCM does not receive both signals within approximately one second of engine cranking, it deactivates the ASD relay and fuel pump relay. When these relays are deactivated, power is shut off to the fuel injectors, ignition coil, oxygen sensor heating element and fuel pump.

The PCM contains a voltage converter that changes battery voltage to a regulated 8.0 volts to power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5.0 volt supply for the manifold absolute pressure sensor, throttle position sensor and engine coolant temperature sensor.

AIR CONDITIONING PRESSURE TRANSDUCER—PCM INPUT

The Powertrain Control Module (PCM) monitors the A/C compressor discharge (high side) pressure through the air conditioning pressure transducer. The transducer supplies an input to the PCM. The PCM engages the A/C compressor clutch if pressure is sufficient for A/C system operation.

AIR CONDITIONING SWITCH SENSE—PCM INPUT

When the air conditioning or defrost switch is put in the ON position and the low pressure switch, combination valve, and high pressure switch close, the PCM receives an A/C input. After receiving this input, the PCM activates the A/C compressor clutch by grounding the A/C clutch relay. The PCM also adjusts idle speed to a scheduled RPM to compensate for increased engine load.

AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT

The ASD sense circuit informs the PCM when the ASD relay energizes. A 12 volt signal at this input indicates to the PCM that the ASD has been activated. This input is used only to sense that the ASD relay is energized.

When energized, the ASD relay supplies battery voltage to the fuel injectors, ignition coils and the heating element in each oxygen sensor. If the PCM does not receive 12 volts from this input after grounding the ASD relay, it sets a Diagnostic Trouble Code (DTC).

BATTERY VOLTAGE—PCM INPUT

The PCM monitors the battery voltage input to determine fuel injector pulse width and generator field control.

If battery voltage is low the PCM will increase injector pulse width (period of time that the injector is energized).

BRAKE SWITCH—PCM INPUT

When the brake switch is activated, the PCM receives an input indicating that the brakes are being applied. After receiving this input the PCM maintains idle speed to a scheduled RPM through control of the idle air control motor. The brake switch is mounted on the brake pedal support bracket.

CAMSHAFT POSITION SENSOR—PCM INPUT

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

3.3/3.8L

The sensor generates pulses as groups of notches on the camshaft sprocket pass underneath it (Fig. 2). The PCM keeps track of crankshaft rotation and identifies each cylinder by the pulses generated by the notches on the camshaft sprocket. Four crankshaft pulses follow each group of camshaft pulses.

When the PCM receives two camshaft pulses followed by the long flat spot on the camshaft sprocket, it knows that the crankshaft timing marks for cylinder one are next (on driveplate). When the PCM receives one camshaft pulse after the long flat spot on the sprocket, cylinder number two crankshaft timing marks are next. After 3 camshaft pulses, the PCM knows cylinder four crankshaft timing marks follow. One camshaft pulse after the three pulses indicates cylinder five. The two camshaft pulses after cylinder 5 signals cylinder six (Fig. 3). The PCM can synchronize on cylinders 1 or 4.

DESCRIPTION AND OPERATION (Continued)

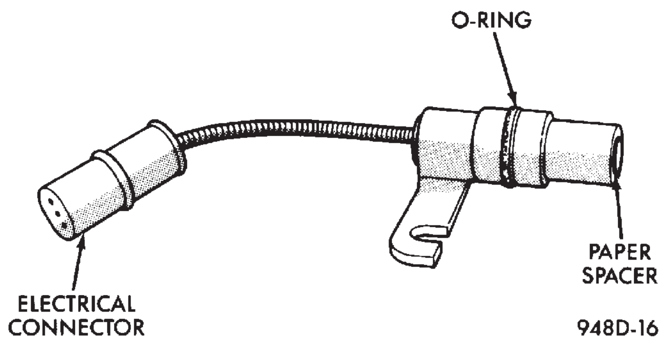


Fig. 2 Camshaft Position Sensor

When metal aligns with the sensor, voltage goes low (less than 0.5 volts). When a notch aligns with the sensor, voltage spikes high (5.0 volts). As a group of notches pass under the sensor, the voltage switches from low (metal) to high (notch) then back to low. The number of notches determine the amount of pulses. If available, an oscilloscope can display the square wave patterns of each timing events.

Top dead center (TDC) does not occur when notches on the camshaft sprocket pass below the cylinder. TDC occurs after the camshaft pulse (or pulses) and after the 4 crankshaft pulses associated with the particular cylinder. The arrows and cylinder call outs on Figure 4 represent which cylinder the flat spot and notches identify, they do not indicate TDC position.

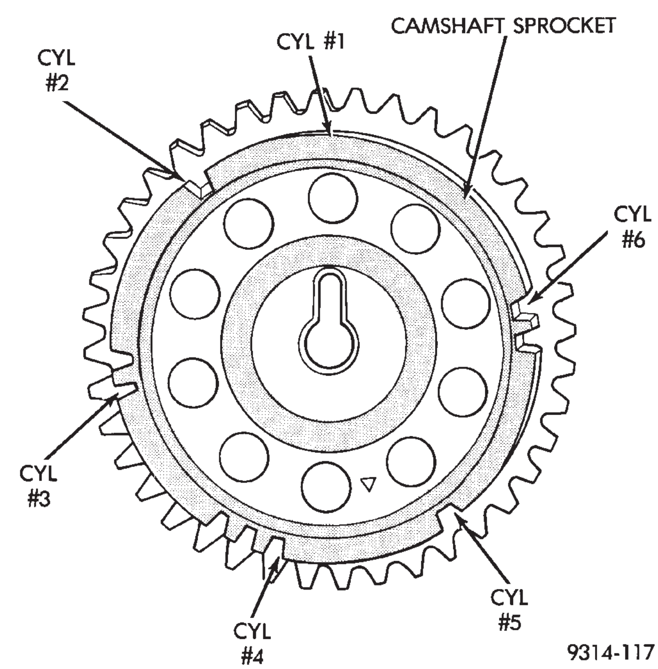


Fig. 3 Camshaft Sprocket

The camshaft position sensor is mounted to the top of the timing case cover (Fig. 4). The bottom of the sensor is positioned above the camshaft sprocket. **The distance between the bottom of sensor and the camshaft sprocket is critical to the operation of the system. When servicing the camshaft position sensor, refer to the 3.3L and 3.8L Multi-Port Fuel Injection—Service Procedures section in this Group.**

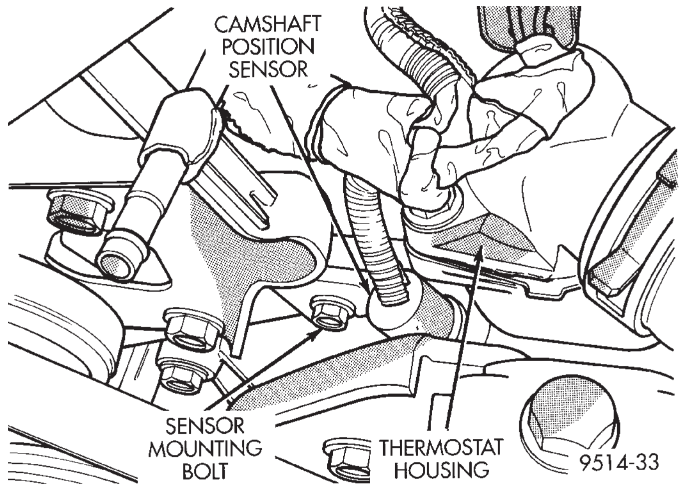


Fig. 4 Camshaft Position Sensor Location

2.4L

The camshaft position sensor attaches to the rear of the cylinder head (Fig. 5). A target magnet attaches to the rear of the camshaft and indexes to the correct position (Fig. 6). The target magnet has four different poles arranged in an asymmetrical pattern. As the target magnet rotates, the camshaft position sensor senses the change in polarity (Fig. 7). The sensor output switch switches from high (5.0 volts) to low (0.30 volts) as the target magnet rotates. When the north pole of the target magnet passes under the sensor, the output switches high. The sensor output switches low when the south pole of the target magnet passes underneath.

DESCRIPTION AND OPERATION (Continued)

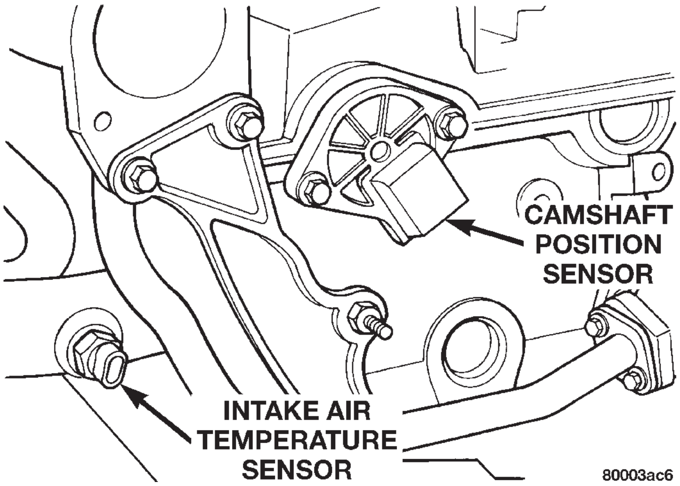


Fig. 5 Camshaft Position Sensor

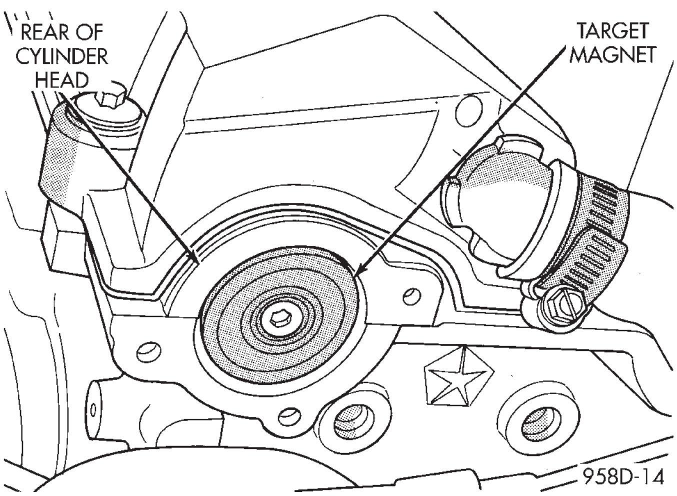


Fig. 6 Target Magnet

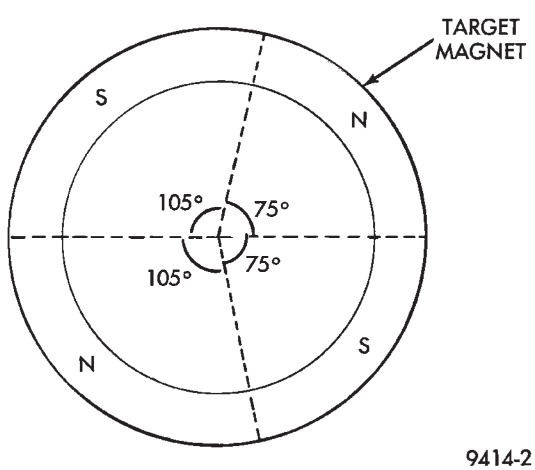


Fig. 7 Target Magnet Polarity

CRANKSHAFT POSITION SENSOR—PCM INPUT

3.0/3.3/3.8L

The crankshaft position sensor (Fig. 8) senses slots cut into the transaxle driveplate extension. There are 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 9). Basic timing is set by the position of the last slot in each group. Once the PCM senses the last slot, it determines crankshaft position (which piston will next be at TDC) from the camshaft position sensor input. It may take the PCM one engine revolution to determine crankshaft position.

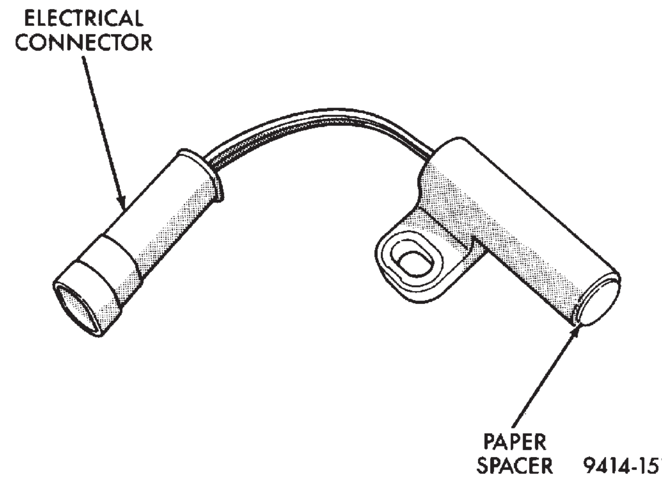


Fig. 8 Crankshaft Position Sensor

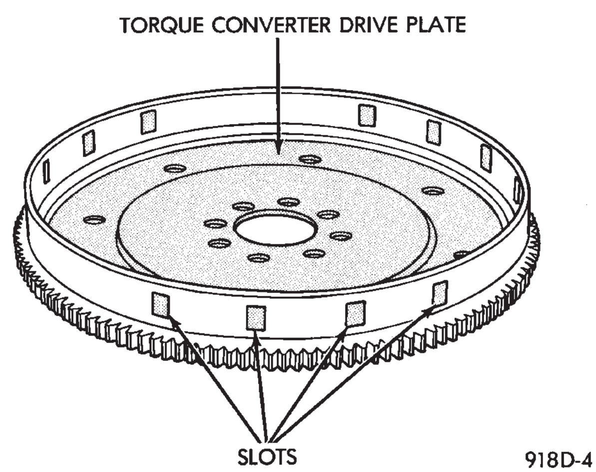


Fig. 9 Timing Slots

The PCM uses the crankshaft position sensor signal to determine injector sequence, ignition timing and presence of misfire. Once crankshaft position has been determined, the PCM begins energizing the injectors in sequence.

DESCRIPTION AND OPERATION (Continued)

The crankshaft position sensor is located in the transaxle housing, above the vehicle speed sensor (Fig. 10). The bottom of the sensor is positioned next to the drive plate. **The distance between the bottom of sensor and the drive plate is critical to the operation of the system. When servicing the crankshaft position sensor, refer to the appropriate Multi-Port Fuel Injection Service Procedures section in this Group.**

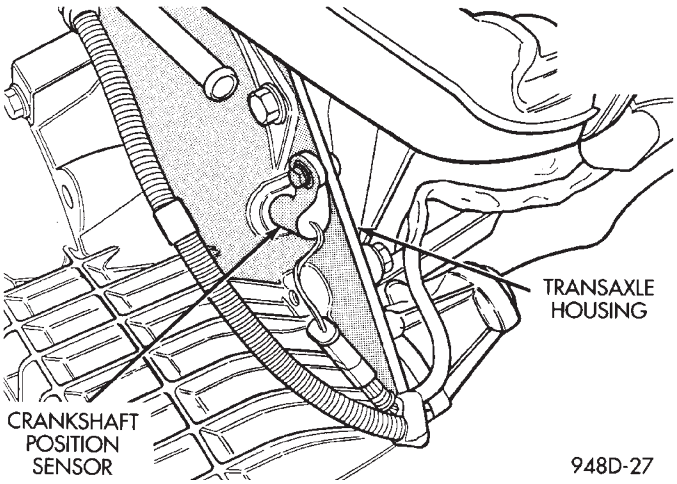


Fig. 10 Crankshaft Position Sensor Location—3.0/3.3/3.8L

2.4L

The second crankshaft counterweight has machined into it two sets of four timing reference notches and a 60 degree signature notch (Fig. 11). From the crankshaft position sensor input the PCM determines engine speed and crankshaft angle (position).

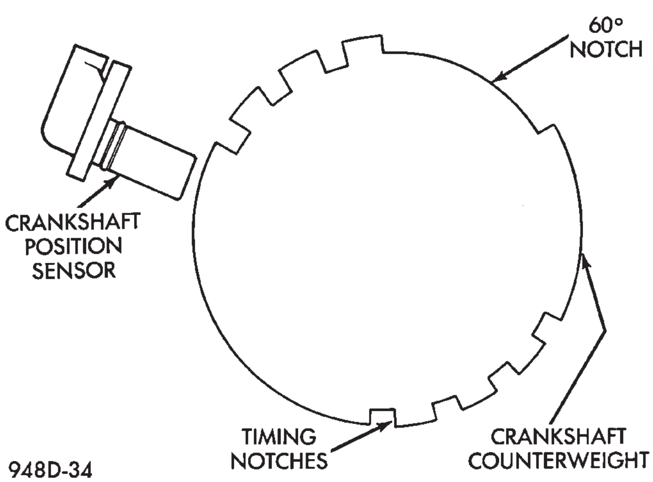


Fig. 11 Timing Reference Notches

The notches generate pulses from high to low in the crankshaft position sensor output voltage. When a metal portion of the counterweight aligns with the crankshaft position sensor, the sensor output voltage goes low (less than 0.3 volts). When a notch aligns with the sensor, voltage spikes high (5.0 volts). As a group of notches pass under the sensor, the output voltage switches from low (metal) to high (notch) then back to low.

If available, an oscilloscope can display the square wave patterns of each voltage pulse. From the width of the output voltage pulses, the PCM calculates engine speed. The width of the pulses represent the amount of time the output voltage stays high before switching back to low. The period of time the sensor output voltage stays high before switching back to low is referred to as pulse width. The faster the engine is operating, the smaller the pulse width on the oscilloscope.

By counting the pulses and referencing the pulse from the 60 degree signature notch, the PCM calculates crankshaft angle (position). In each group of timing reference notches, the first notch represents 69 degrees before top dead center (BTDC). The second notch represents 49 degrees BTDC. The third notch represents 29 degrees. The last notch in each set represents 9 degrees before top dead center (TDC).

The timing reference notches are machined to a uniform width representing 13.6 degrees of crankshaft rotation. From the voltage pulse width the PCM tells the difference between the timing reference notches and the 60 degree signature notch. The 60 degree signature notch produces a longer pulse width than the smaller timing reference notches. If the camshaft position sensor input switches from high to low when the 60 degree signature notch passes under the crankshaft position sensor, the PCM knows cylinder number one is the next cylinder at TDC.

The crankshaft position sensor mounts to the engine block behind the generator, just above the oil filter (Fig. 12).

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The engine coolant temperature sensor is a variable resistor with a range of -40°C to 129°C (-40°F to 265°F).

The engine coolant temperature sensor provides an input voltage to the PCM. As coolant temperature varies, the sensor resistance changes resulting in a different input voltage to the PCM.

When the engine is cold, the PCM will demand slightly richer air/fuel mixtures and higher idle speeds until normal operating temperatures are reached.

The engine coolant sensor is also used for cooling fan control.

DESCRIPTION AND OPERATION (Continued)

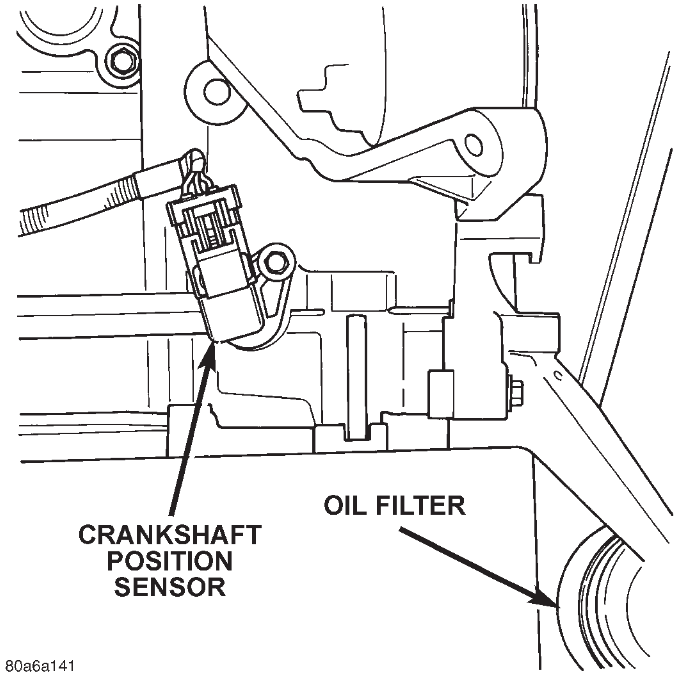


Fig. 12 Crankshaft Position Sensor—2.4L

3.0/3.3/3.8L

The sensor is installed next to the thermostat housing (Fig. 13) and (Fig. 14).

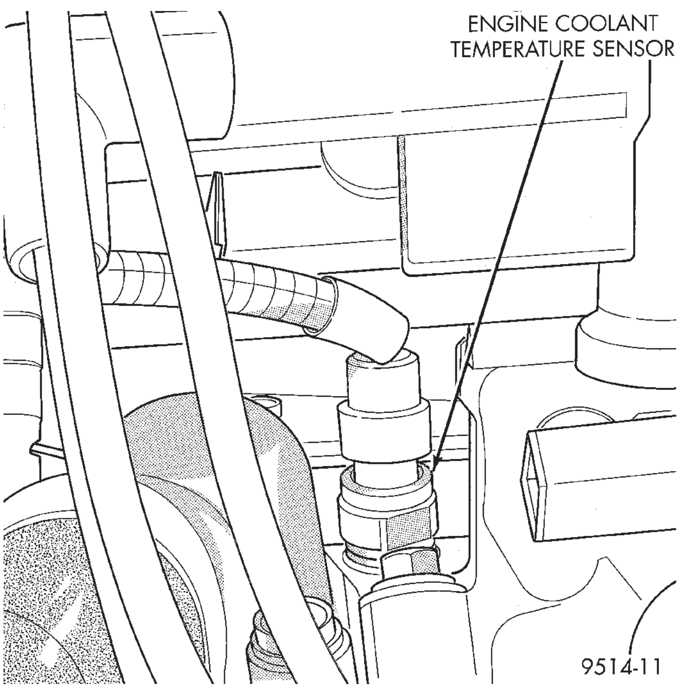


Fig. 13 Engine Coolant Temperature Sensor—3.3/3.8L

2.4L

The coolant sensor threads into the top of the thermostat housing (Fig. 15). New sensors have sealant applied to the threads.

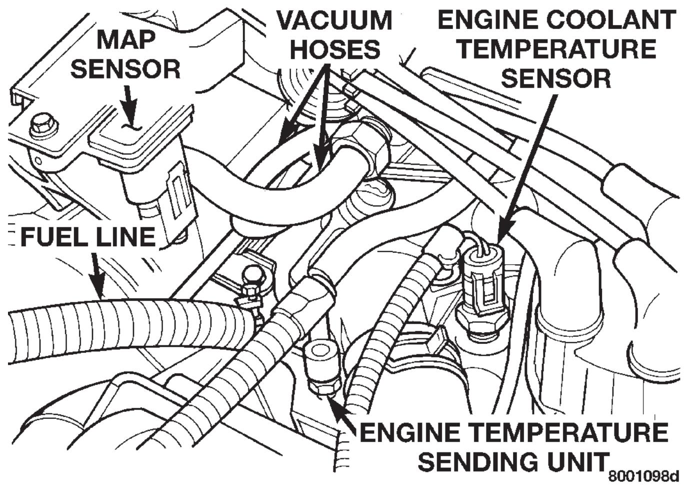


Fig. 14 Engine Coolant Temperature Sensor—3.0L

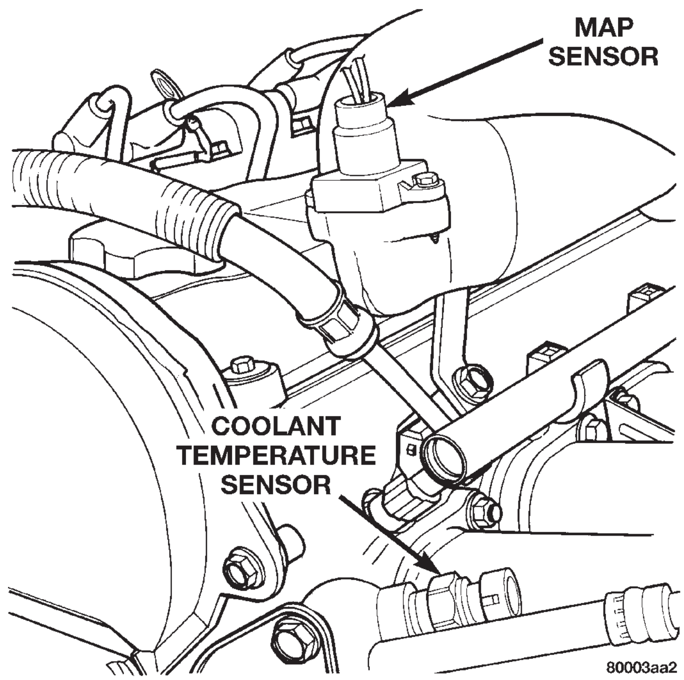


Fig. 15 Engine Coolant Temperature Sensor—2.4L

HEATED OXYGEN SENSOR (O2S SENSOR)—PCM INPUT

The O2S produce voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas in the exhaust manifold. When a large amount of oxygen is present (caused by a lean air/fuel mixture), the sensors produces a low voltage. When there is a lesser amount present (rich air/fuel mixture) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensors act as a rich- lean switch.

The oxygen sensors are equipped with a heating element that keeps the sensors at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the

DESCRIPTION AND OPERATION (Continued)

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 the O2S input (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.

The Automatic Shutdown (ASD) relay supplies battery voltage to both the upstream and downstream heated oxygen sensors. The oxygen sensors are equipped with a heating element. The heating elements reduce the time required for the sensors to reach operating temperature.

UPSTREAM HEATED OXYGEN SENSOR

The upstream O2S is located in the exhaust manifold and provides an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas (Fig. 16) or (Fig. 17) or (Fig. 18). The PCM uses this information to fine tune the air/fuel ratio by adjusting injector pulse width.

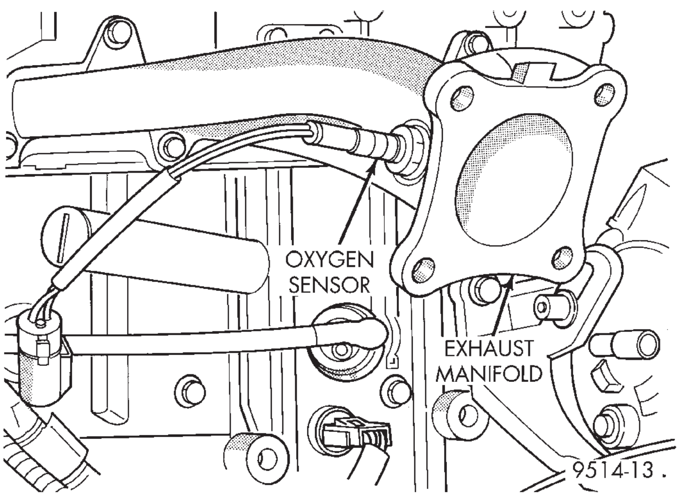


Fig. 16 Heated Oxygen Sensor—2.4L Engine

DOWNSTREAM HEATED OXYGEN SENSOR

The downstream heated oxygen sensor threads into the outlet pipe at the rear of the catalytic convertor (Fig. 19). The downstream heated oxygen sensor input is used to detect catalytic convertor deterioration. As the convertor deteriorates, the input from the downstream sensor begins to match the upstream sensor input except for a slight time delay. By comparing the downstream heated oxygen sensor input to the input from the upstream sensor, the PCM calculates catalytic convertor efficiency.

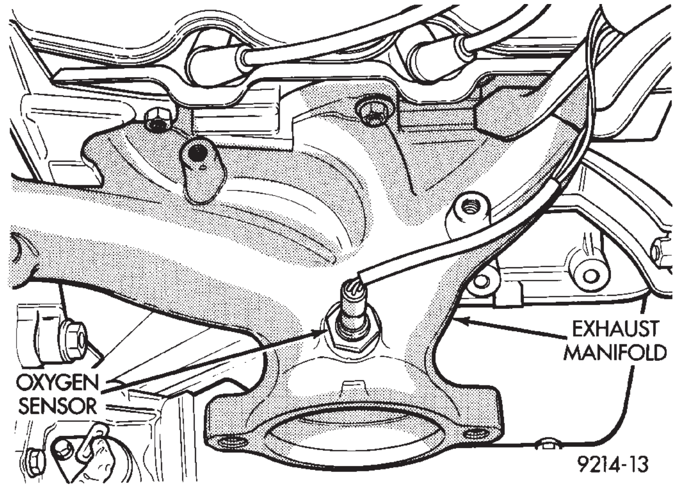


Fig. 17 Heated Oxygen Sensor—3.0L Engine

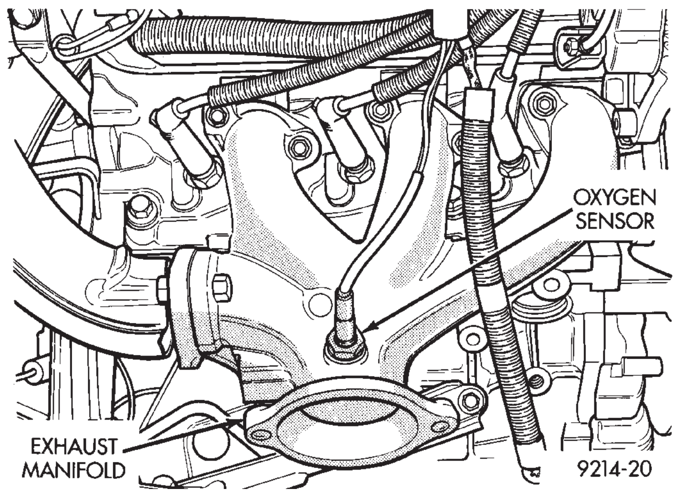


Fig. 18 Heated Oxygen Sensor—3.3/3.8L Engine

When the catalytic converter efficiency drops below emission standards, the PCM stores a diagnostic trouble code and illuminates the Malfunction Indicator Lamp (MIL). For more information, refer to Group 25 - Emission Control Systems.

KNOCK SENSOR—PCM INPUT

The knock sensor is only on the 2.4/3.3/3.8L engines, not used on the 3.0L engine.

The knock sensor threads into the side of the cylinder block in front of the starter (Fig. 20) or (Fig. 21). When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which sends an input voltage (signal) to the PCM. As the intensity of the engine knock vibration increases, the knock sensor output voltage also increases.

DESCRIPTION AND OPERATION (Continued)

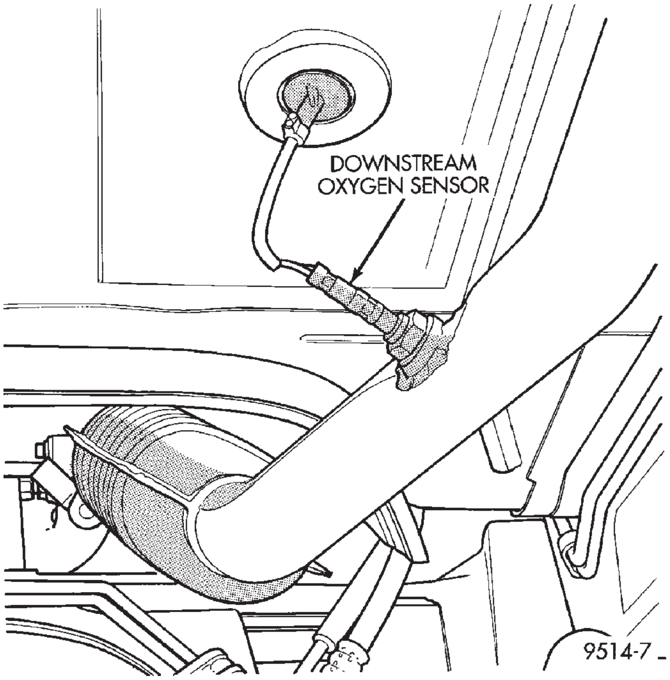


Fig. 19 Downstream Heated Oxygen Sensor

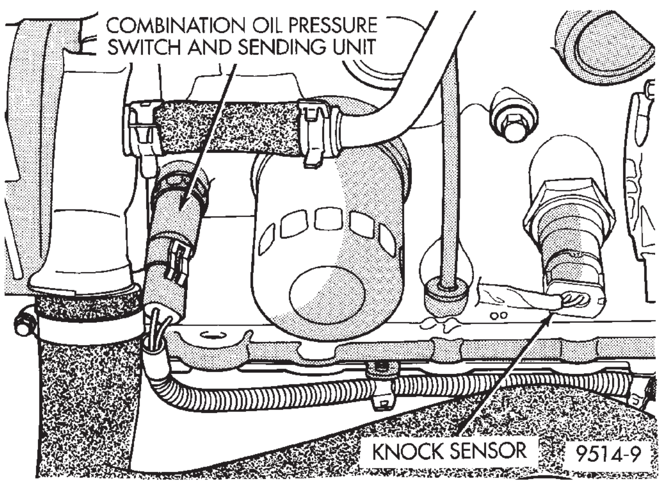


Fig. 20 Knock Sensor—3.3/3.8L Engines

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

The PCM supplies 5 volts to the MAP sensor. The MAP sensor converts intake manifold pressure into voltage. The PCM monitors the MAP sensor output voltage. As vacuum increases, MAP sensor voltage decreases proportionately. Also, as vacuum decreases, MAP sensor voltage increases proportionately.

During cranking, before the engine starts running, the PCM determines atmospheric air pressure from the MAP sensor voltage. While the engine operates, the PCM determines intake manifold pressure from the MAP sensor voltage.

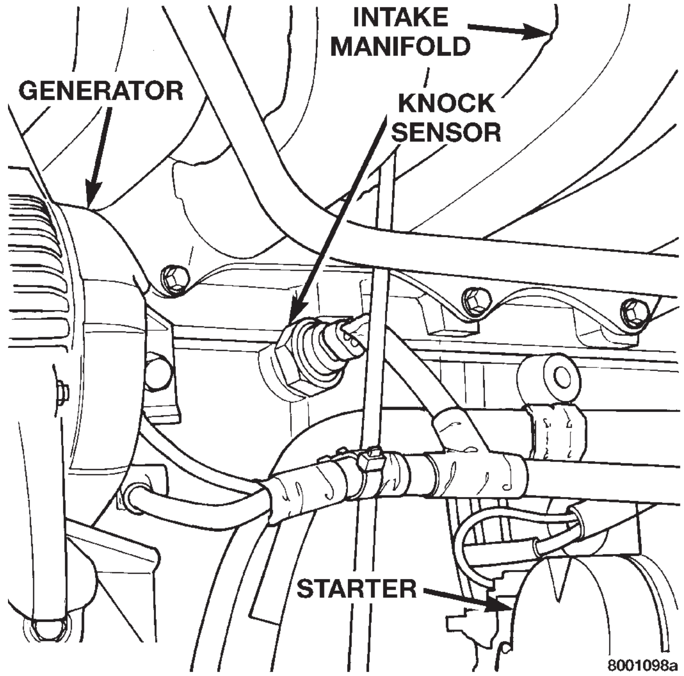


Fig. 21 Knock Sensor—2.4L Engine

Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

The MAP sensor (Fig. 22) or (Fig. 23) or (Fig. 24) mounts to the intake manifold near the throttle body inlet to the manifold. The sensor connects electrically to the PCM.

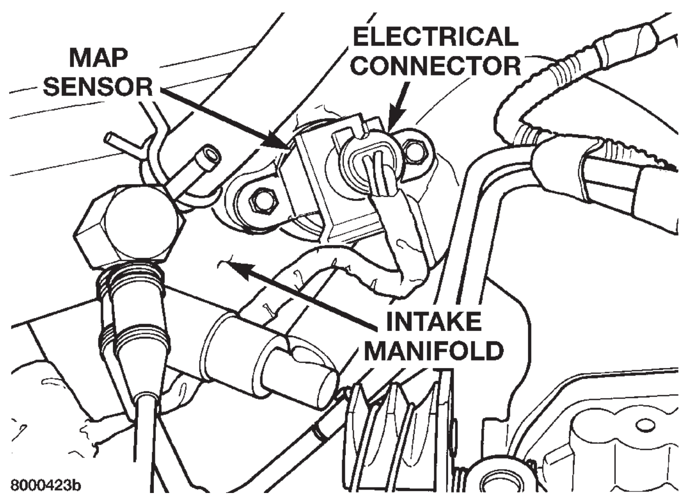


Fig. 22 MAP Sensor—3.3/3.8L

SPEED CONTROL—PCM INPUT

The speed control system provides five separate voltages (inputs) to the Powertrain Control Module (PCM). The voltages correspond to the ON/OFF, SET, RESUME and CANCEL.

The speed control ON voltage informs the PCM that the speed control system has been activated. The speed control SET voltage informs the PCM that

DESCRIPTION AND OPERATION (Continued)

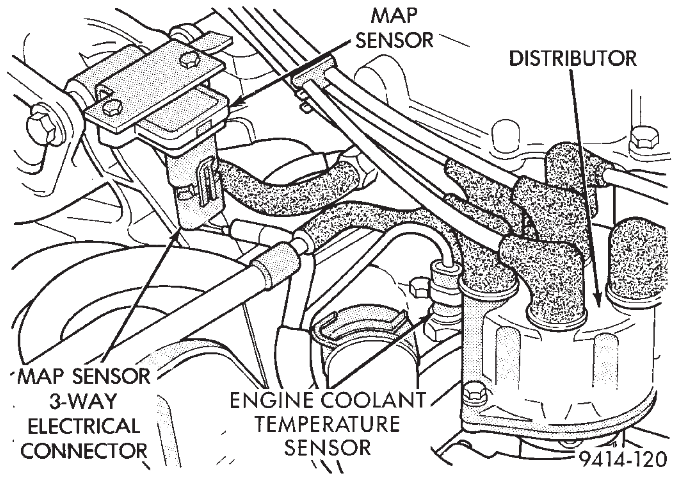


Fig. 23 MAP Sensor—3.0L

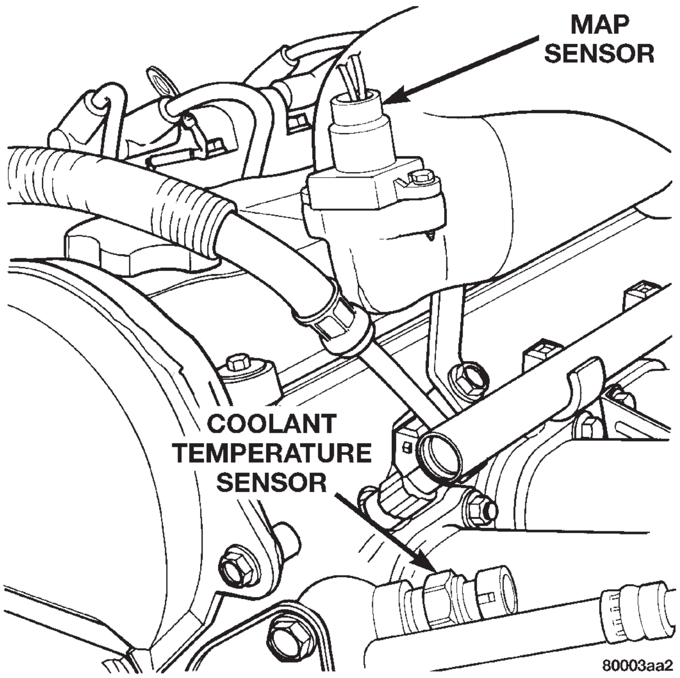


Fig. 24 MAP Sensor—2.4L

a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control CANCEL voltage tells the PCM to deactivate but retain set speed in memory (same as depressing the brake pedal). The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for more speed control information.

TRANSAXLE PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the transaxle housing (Fig. 25). It provides an input to the PCM indicating whether the automatic transaxle is in Park or Neutral. This input is used to determine idle speed (varying with gear selection) and ignition timing advance. The park neutral switch is sometimes referred to as the neutral safety switch.

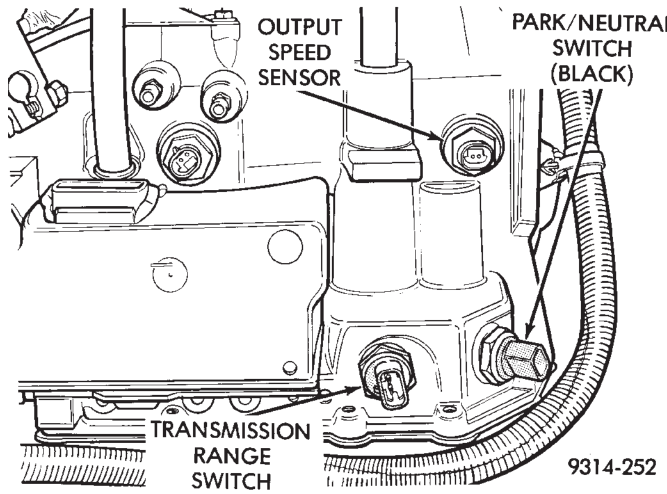


Fig. 25 Park Neutral Switch—4-Speed Electronic Automatic Transaxle—Typical

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The TPS is mounted on the throttle body and connected to the throttle blade shaft (Fig. 26) or (Fig. 27) or (Fig. 28). The TPS is a variable resistor that provides the (PCM) with an input signal (voltage) representing throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.

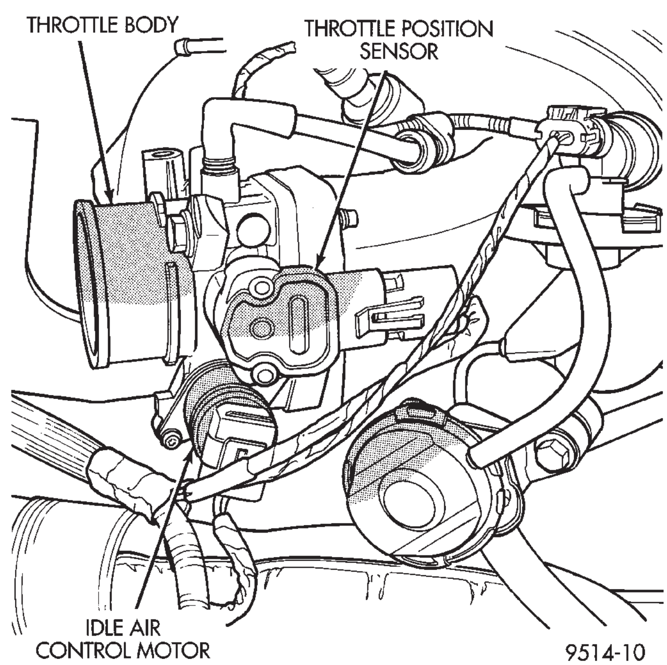


Fig. 26 Throttle Position Sensor—3.3/3.8L

DESCRIPTION AND OPERATION (Continued)

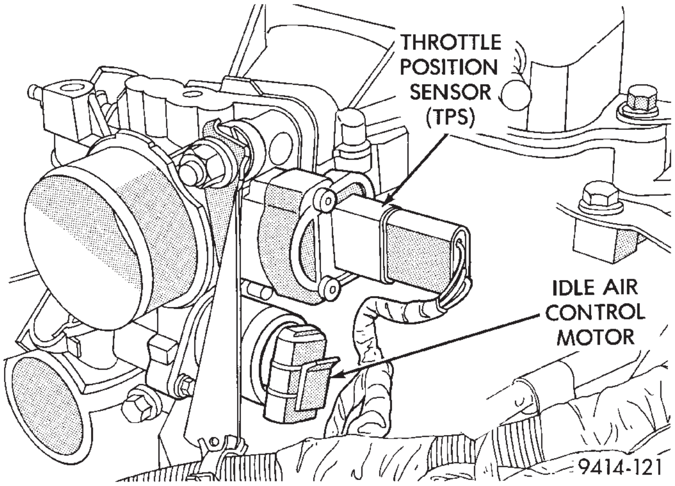


Fig. 27 Throttle Position Sensor—3.0L

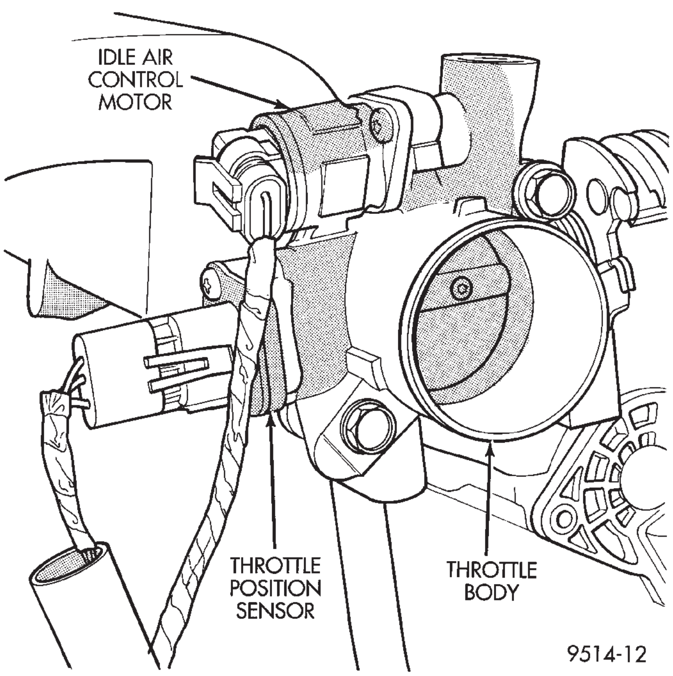


Fig. 28 Throttle Position Sensor—2.4L

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The TPS output voltage to the PCM varies from approximately 0.5 volt at minimum throttle opening (idle) to 4 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions and adjust fuel injector pulse width and ignition timing.

VEHICLE SPEED AND DISTANCE—PCM INPUT

The transaxle output speed sensor supplies the vehicle speed and distance inputs to the PCM. The output speed sensor is located on the side of the transaxle (Fig. 25).

The speed and distance signals, along with a closed throttle signal from the TPS, determine if a closed throttle deceleration or normal idle condition (vehicle stopped) exists. Under deceleration conditions, the PCM adjusts the idle air control motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the idle air control motor to maintain a desired engine speed.

INTAKE AIR TEMPERATURE SENSOR—PCM INPUT (2.4L ONLY)

The Intake Air Temperature (IAT) sensor measures the temperature of the intake air as it enters the engine. The sensor supplies one of the inputs the PCM uses to determine injector pulse width and spark advance.

The IAT sensor threads into the intake manifold (Fig. 29).

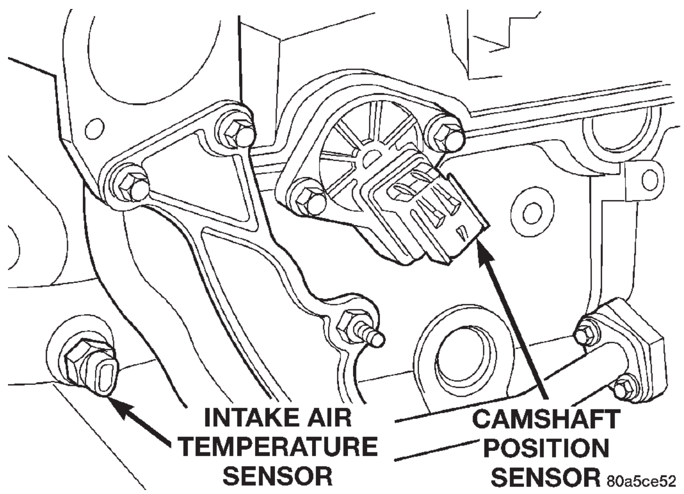


Fig. 29 Intake Air Temperature Sensor

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit. The radiator fan control module supplies battery power to the solenoid side of the relay. The air conditioning clutch relay will not energize unless the radiator fan control module energizes. The radiator control module energizes when the air conditioning or defrost switch is put in the ON position and the low pressure switch, combination valve, and high pressure switch close.

With the engine operating, the PCM cycles the air conditioning clutch on and off when the A/C switch closes with the blower motor switch in the On position. When the PCM senses low idle speeds or wide-open-throttle through the throttle position sensor, it de-energizes the A/C clutch relay. The relay contacts open, preventing air conditioning clutch engagement.

The air conditioning clutch relay is located in the Power Distribution Center (PDC). The PDC is located

DESCRIPTION AND OPERATION (Continued)

in the engine compartment next to the battery (Fig. 30). A label affixed to the underside of the PDC cover identifies the relays and fuses in the PDC.

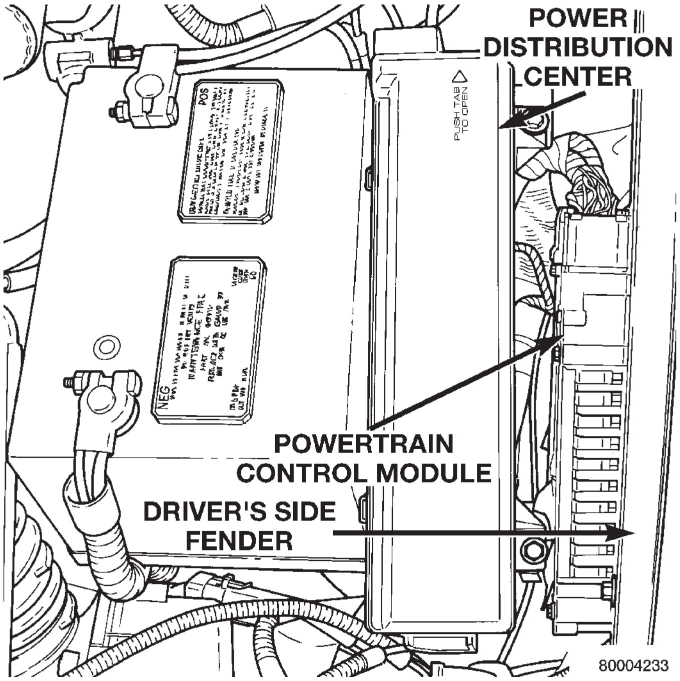


Fig. 30 Power Distribution Center (PDC)

GENERATOR FIELD—PCM OUTPUT

The PCM regulates the charging system voltage within a range of 12.9 to 15.0 volts. Refer to Group 8A for Battery system information and 8C for charging system information.

AUTOMATIC SHUTDOWN RELAY—PCM OUTPUT

The Automatic Shutdown (ASD) relay supplies battery voltage to the fuel injectors, electronic ignition coil and the heating elements in the oxygen sensors.

A buss bar in the Power Distribution Center (PDC) supplies voltage to the solenoid side and contact side of the relay. The ASD relay power circuit contains a 25 amp fuse between the buss bar in the PDC and the relay. The fuse is located in the PDC. Refer to Group 8W, Wiring Diagrams for circuit information.

The PCM controls the relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position unless the 02 Heater Monitor test is being run. Refer to Group 25, On-Board Diagnostics. When the ignition switch is in the On or Crank position, the PCM monitors the crankshaft position sensor and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive the crankshaft position sensor and camshaft position sensor signals when the ignition switch is in the Run position, it will de-energize the ASD relay.

The ASD relay is located in the PDC (Fig. 30). A label affixed to the underside of the PDC cover identifies the relays and fuses in the PDC.

FUEL PUMP RELAY—PCM OUTPUT

The fuel pump relay supplies battery voltage to the fuel pump. The fuel pump relay power circuit contains a 9 amp fuse. The fuse is located in the PDC. Refer to Group 8W, Wiring Diagrams for circuit information.

The PCM controls the fuel pump relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position. When the ignition switch is in the On position, the PCM energizes the fuel pump. If the crankshaft position sensor does not detect engine rotation, the PCM de-energizes the relay after approximately one second.

The fuel pump relay is located in the PDC (Fig. 30). A label affixed to the underside of the PDC cover identifies the relays and fuses in the PDC.

STARTER RELAY—PCM OUTPUT

Double Start Override ia a feature that prevents the starter from operating if the engine is already running. This feature is accomplished with software only. There was no hardware added because of this feature. To incorporate the unique feature of Double Start Override, it was necessary to use the PCM (software) to control the starter circuit. To use the PCM it was necessary to separate the starter relay coil ground from the park neutral switch. The starter relay ground is now controlled through Pin 60 of the PCM. This allows the PCM to interrupt the ground circuit if other inputs tell it that the engine is turning. If the starter system is operating properly, it can be assumed that the override protection is also working.

IDLE AIR CONTROL MOTOR—PCM OUTPUT

The idle air control motor is mounted on the throttle body. The PCM operates the idle air control motor (Fig. 26) or (Fig. 27) or (Fig. 28). The PCM adjusts engine idle speed through the idle air control motor to compensate for engine load or ambient conditions.

The throttle body has an air bypass passage that provides air for the engine at idle (the throttle blade is closed). The idle air control motor pintle protrudes into the air bypass passage and regulates air flow through it.

The PCM adjusts engine idle speed by moving the idle air control motor pintle in and out of the bypass passage. The adjustments are based on inputs the PCM receives. The inputs are from the throttle position sensor, crankshaft position sensor, coolant temperature sensor, and various switch operations

DESCRIPTION AND OPERATION (Continued)

(brake, park/neutral, air conditioning). Deceleration die out is also prevented by increasing airflow when the throttle is closed quickly after a driving (speed) condition.

DUTY CYCLE EVAP CANISTER PURGE SOLENOID—PCM OUTPUT

The duty cycle EVAP purge solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

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 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 the solenoid energizes.

A rubber boot covers the duty cycle EVAP purge solenoid. The solenoid attaches to a bracket mounted to the right engine mount (Fig. 31). The top of the solenoid has the word TOP on it. The solenoid will not operate properly unless it is installed correctly.

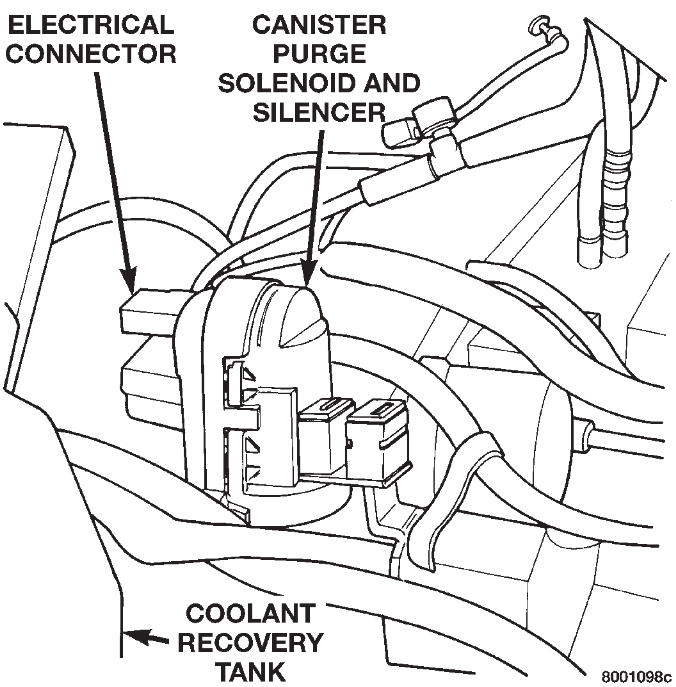


Fig. 31 Duty Cycle EVAP Purge Solenoid

PROPORTIONAL PURGE SOLENOID

All vehicles use a proportional purge solenoid. The solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

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 proportional purge solenoid operates at a frequency of 200 hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

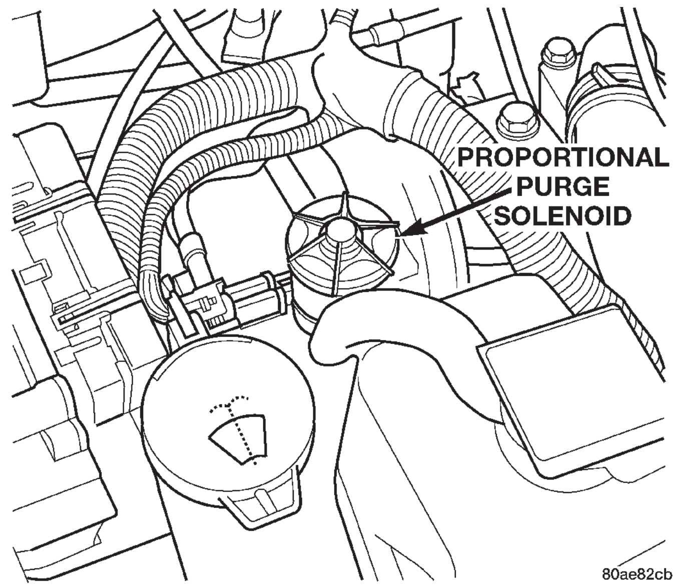


Fig. 32 Proportional Purge Solenoid

ELECTRONIC EGR TRANSDUCER SOLENOID—PCM OUTPUT

The electronic EGR transducer contains an electrically operated solenoid and a back-pressure transducer (Fig. 33) or (Fig. 34) or (Fig. 35). The PCM operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back-pressure controls the transducer.

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of vacuum applied to the EGR valve. Varying the strength of the vacuum changes the amount of EGR supplied to the engine. This pro-

DESCRIPTION AND OPERATION (Continued)

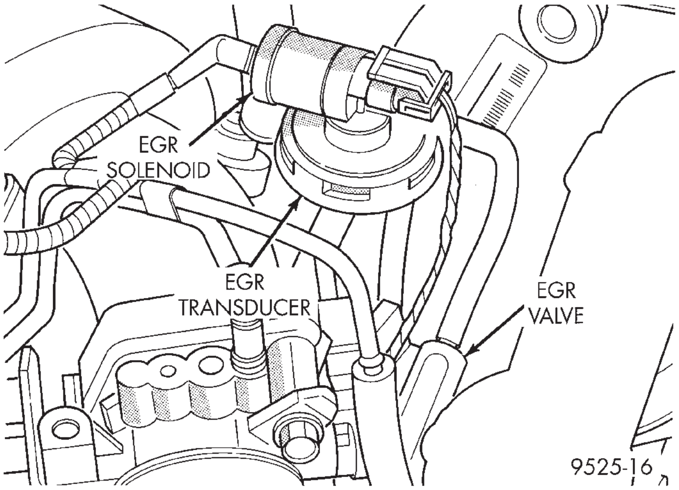


Fig. 33 EGR Solenoid—3.3/3.8L

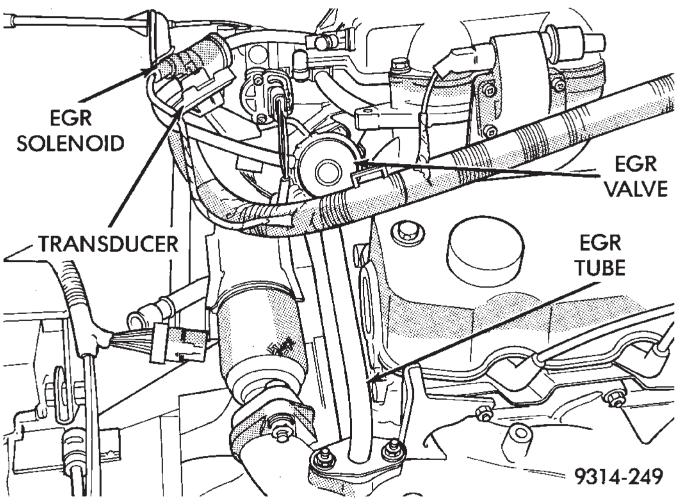


Fig. 34 EGR Solenoid—3.0L

vides the correct amount of exhaust gas recirculation for different operating conditions.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector provides the technician with the means to connect the DRB scan tool to diagnosis the vehicle. The connector is located under the dash (Fig. 36).

AUTOMATIC TRANSAXLE CONTROL MODULE—PCM OUTPUT

The electronic automatic transaxle control module and the PCM supply information to each other through the CCD Bus. The information includes engine speed and vehicle load. The PCM uses the information when adjusting the fuel and ignition strategy.

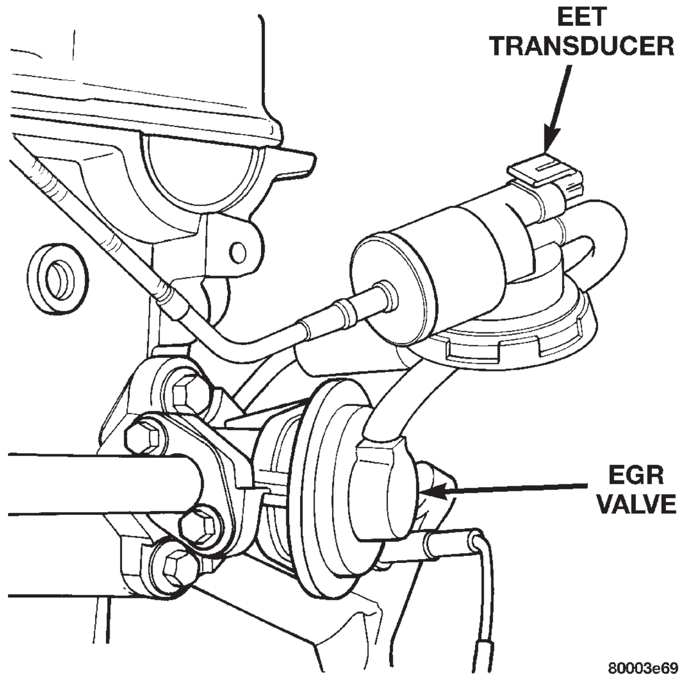


Fig. 35 EGR Solenoid—2.4L

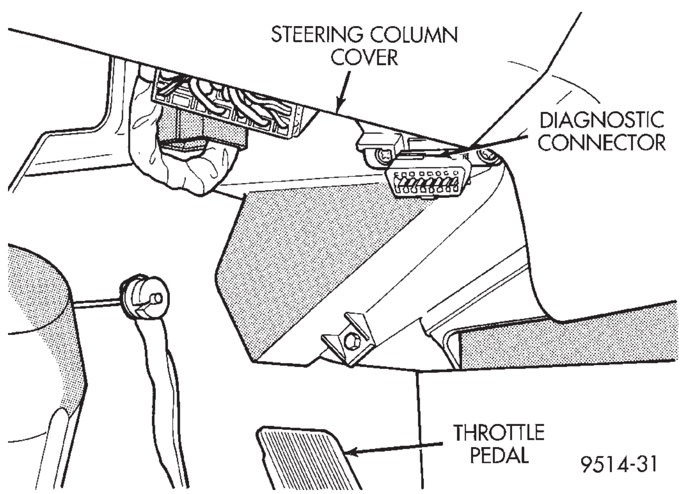


Fig. 36 Data Link Connector

FUEL INJECTORS—PCM OUTPUT

The fuel injectors are 12 ohm electrical solenoids (Fig. 37). 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 hollow cone. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber. The injectors are positioned in the intake manifold.

DESCRIPTION AND OPERATION (Continued)

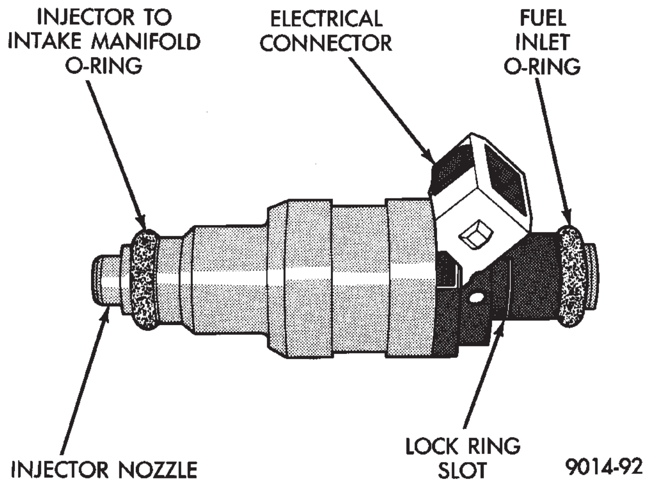


Fig. 37 Fuel Injector

The injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port (Fig. 38).

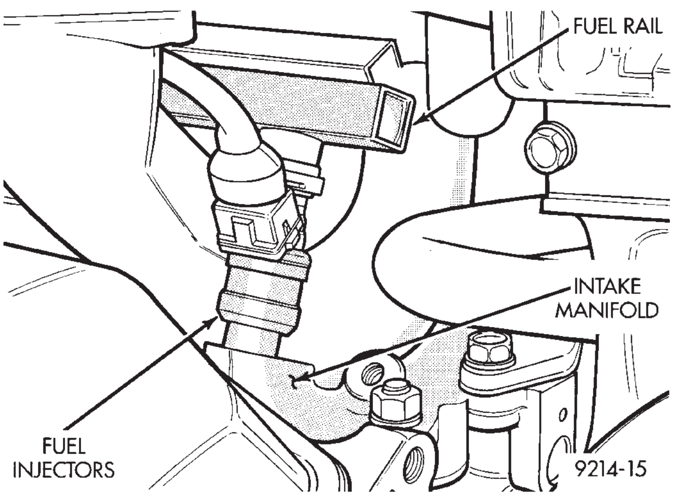


Fig. 38 Fuel Injector Location—Typical

The fuel injectors are operated by the PCM. They are energized in a sequential order during all engine operating conditions except start up. The PCM initially energizes all injectors at the same time. Once PCM determines crankshaft position, it begins energizing the injectors in sequence.

The Automatic Shutdown (ASD) relay supplies battery voltage to the injectors. The PCM provides the ground path for the injectors. By switching the ground path on and off, the PCM adjusts injector pulse width. Pulse width is the amount of time the injector is energized. The PCM adjusts injector pulse width based on inputs it receives.

IGNITION COIL—PCM OUTPUT

The coil assembly consists of independent coils molded together (Fig. 39) or (Fig. 40) or (Fig. 41). The coil assembly is mounted on the intake manifold. High tension leads route to each cylinder from the coil. The coil fires two spark plugs every power stroke. One plug is the cylinder under compression, the other cylinder fires on the exhaust stroke. The PCM determines which of the coils to charge and fire at the correct time.

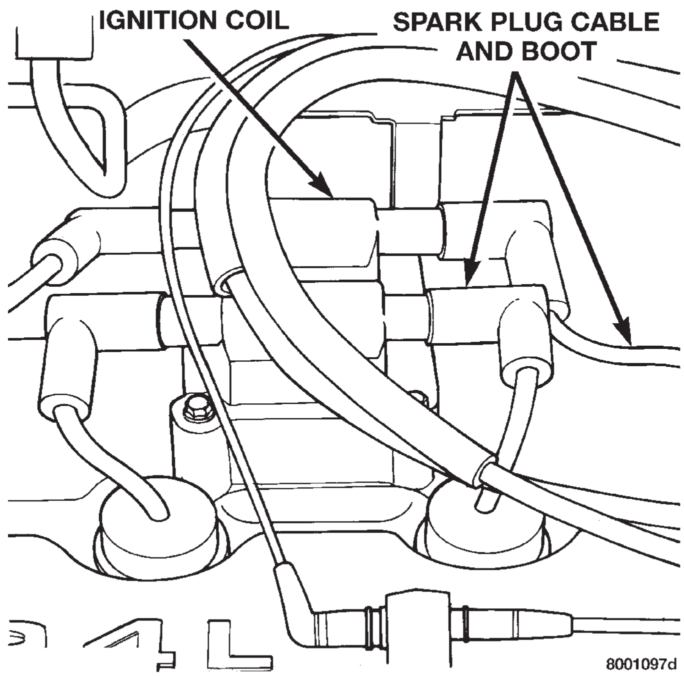


Fig. 39 Ignition Coil—2.4L

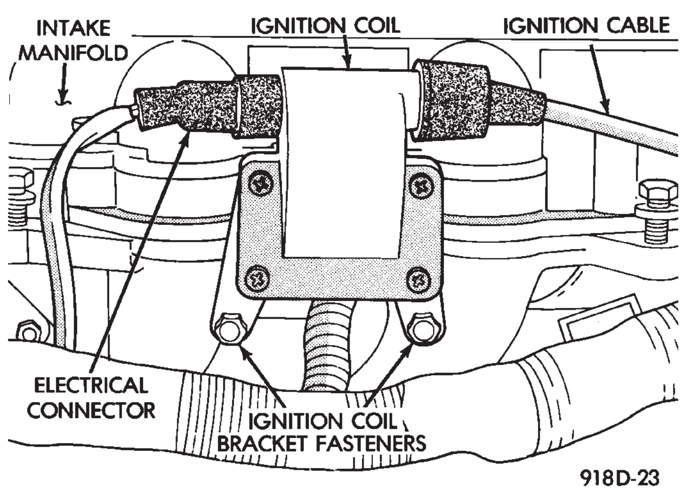


Fig. 40 Ignition Coil—3.0L

The Automatic 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 primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs. Refer to Automatic

DESCRIPTION AND OPERATION (Continued)

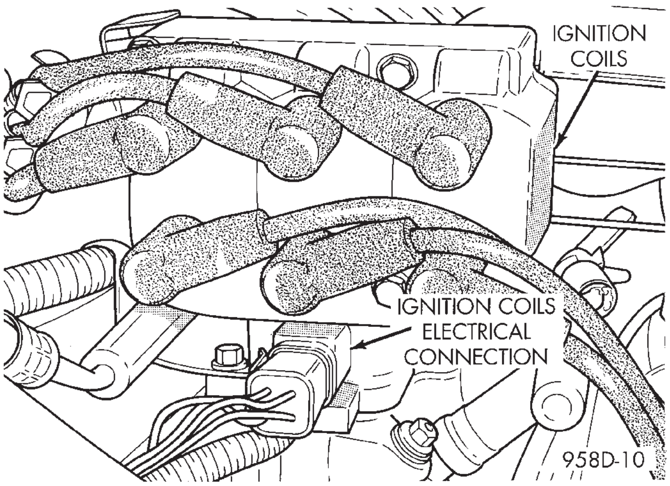


Fig. 41 Ignition Coil —3.3/3.8L

Shutdown (ASD) Relay—PCM Output in this section for relay operation.

TORQUE CONVERTER CLUTCH SOLENOID—PCM OUTPUT

Three-speed automatic transaxles use a torque converter clutch solenoid. The PCM controls the engagement of the torque converter clutch through the solenoid. The torque converter clutch is engaged only in direct drive mode. Refer to Group 21 for transaxle information.

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT

The PCM supplies the malfunction indicator (check engine) lamp on/off signal to the instrument panel through the CCD Bus. The CCD Bus is a communications port. Various modules use the CCD Bus to exchange information.

The Check Engine lamp comes on each time the ignition key is turned ON and stays on for 3 seconds as a bulb test.

The Malfunction Indicator Lamp (MIL) stays on continuously, when the PCM has entered a Limp-In mode or identified a failed emission component. During Limp-in Mode, the PCM attempts to keep the system operational. The MIL signals the need for immediate service. In limp-in mode, the PCM compensates for the failure of certain components that send incorrect signals. The PCM substitutes for the incorrect signals with inputs from other sensors.

If the PCM detects active engine misfire severe enough to cause catalyst damage, it flashes the MIL. At the same time the PCM also sets a Diagnostic Trouble Code (DTC).

For signals that can trigger the MIL (Check Engine Lamp) refer to Group 25, On-Board Dianostics.

SOLID STATE FAN RELAY—PCM OUTPUT

The radiator fan runs at a variable speed depending on coolant temperature and A/C system pressure. The radiator fan circuit contains a Solid State Fan Relay (SSFR). Refer to the Group 8W for a circuit schematic.

A 5 volt signal is supplied to the SSFR. The PCM provides a pulsed ground for the SSFR. Depending upon the amount of pulse on time, the SSFR puts out a proportional voltage to the fan motor at the lower speed. For instance, if the on time is 30 percent, then the voltage to the fan motor will be 3.6 volts.

When engine coolant reaches approximately 102°C (215°F) the PCM grounds the SSFR relay. If engine coolant reaches 207°C (225°F) the PCM grounds the high speed ground relay and high speed fan relay. If the fan operates at high speed, the PCM de-energizes the high speed relay and high speed ground relay when coolant temperature drops to approximately 101°C (214°F). When coolant temperature drops to 101°C (214°F) the fan operates at low speed. The PCM de-energizes the low speed relay when coolant temperature drops to approximately 93°C (199°F).

Also, when the air conditioning pressure switch closes, the fan operates at high speed. The air conditioning switch closes at 285 psi ±10 psi. When air conditioning pressure drops approximately 40 psi, the pressure switch opens and the fan operates at low speed.

The SSFR relay is located on the left front inner frame just behind the radiator (Fig. 42).

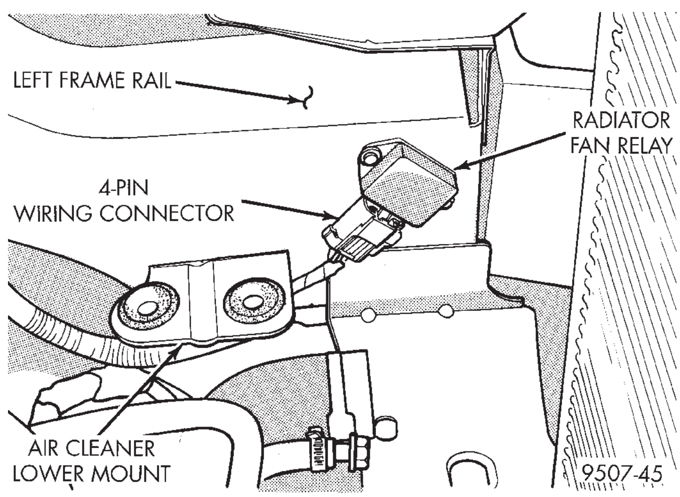


Fig. 42 Fan Control Module

SPEED CONTROL SOLENOIDS—PCM OUTPUT

The speed control vacuum and vent solenoids are operated by the PCM. When the PCM supplies a ground to the vacuum and vent solenoids, the speed control system opens the throttle plate. When the PCM removes the ground from the vacuum and vent solenoids, the throttle blade closes. The PCM bal-

DESCRIPTION AND OPERATION (Continued)

ances the two solenoids to maintain the set speed. Refer to Group 8H for speed control information.

TACHOMETER—PCM OUTPUT

The PCM supplies engine RPM to the instrument panel tachometer through the CCD Bus. The CCD Bus is a communications port. Various modules use the CCD Bus to exchange information. Refer to Group 8E for more information.

THROTTLE BODY

On all engine assemblies (2.4, 3.0, and 3.3/3.8L) the throttle body's are located on the left side of the intake manifold plenum. The throttle body houses the throttle position sensor and the idle air control motor. Air flow through the throttle body is controlled by a cable operated throttle blade located in the base of the throttle body (Fig. 43) or (Fig. 44) or (Fig. 45).

DIAGNOSIS AND TESTING

VISUAL INSPECTION—2.4L ENGINE

A visual inspection for loose, disconnected, or misrouted wires and hoses should be made before attempting to diagnose or service the fuel injection system. A visual check helps save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Check ignition cable routing from the coil pack to the spark plugs. Verify the cable are routed in the correct order and are fully seated to the coil and spark plug.

(2) Check direct ignition system (DIS) coil electrical connection for damage and a complete connection to the coil pack (Fig. 46).

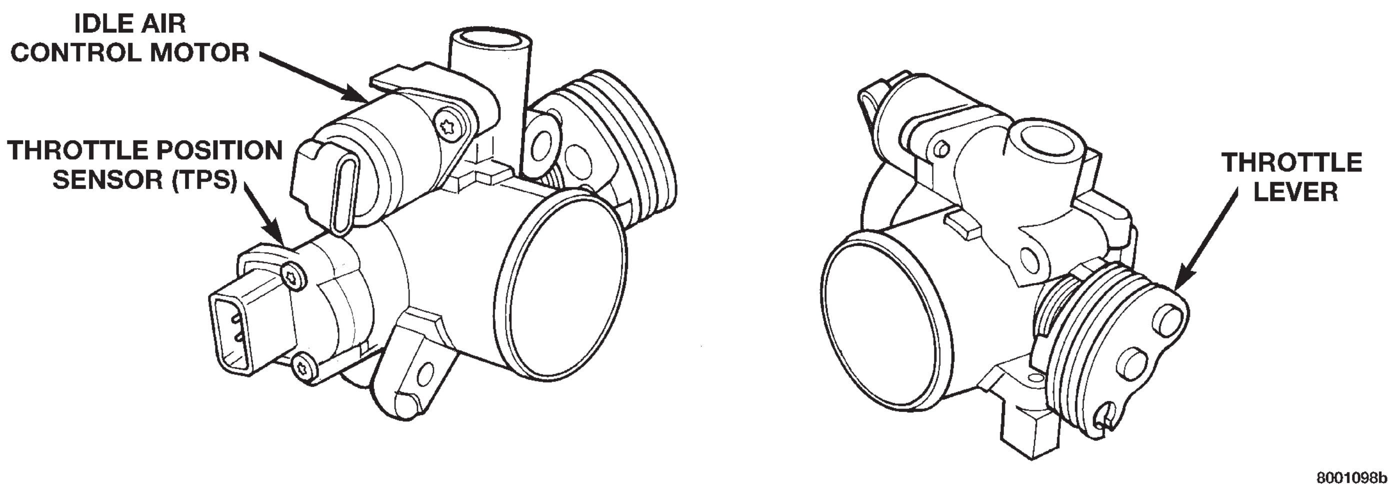


Fig. 43 Throttle Body—2.4L

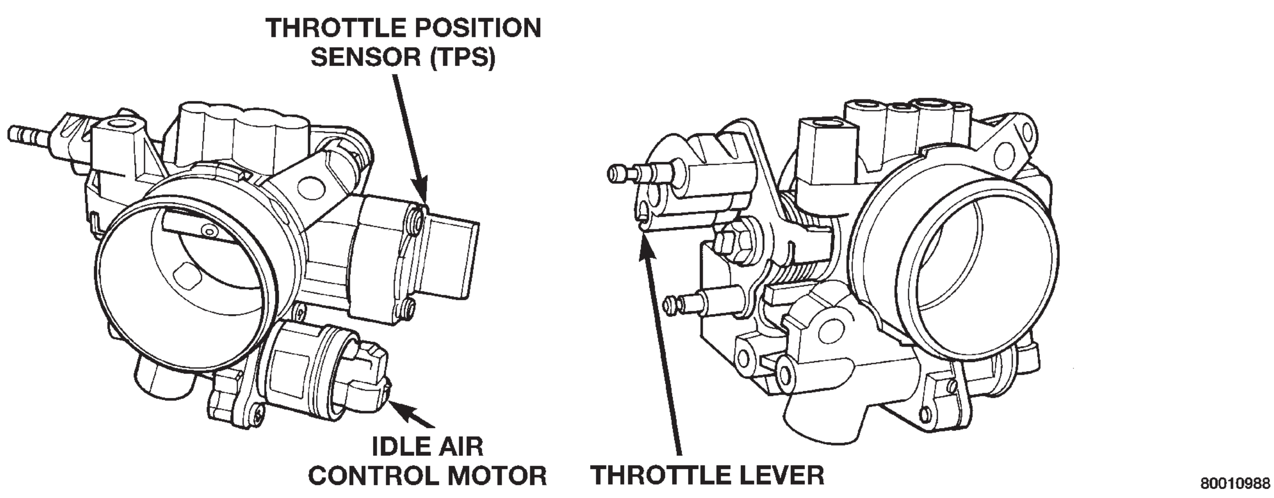


Fig. 44 Throttle Body—3.0L

DIAGNOSIS AND TESTING (Continued)

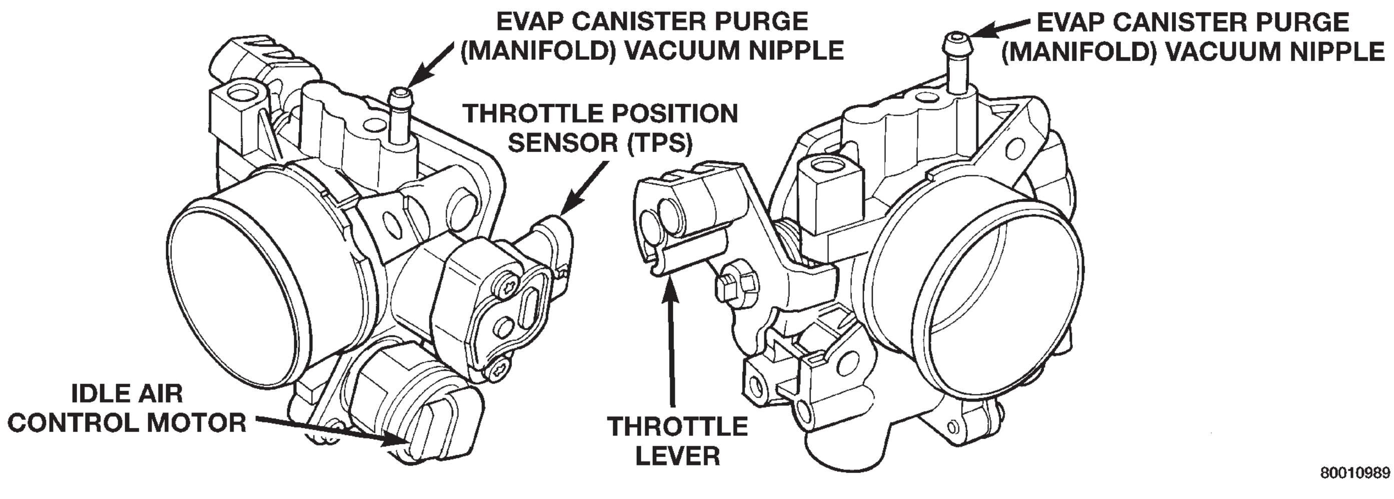


Fig. 45 Throttle Body—3.3/3.8L

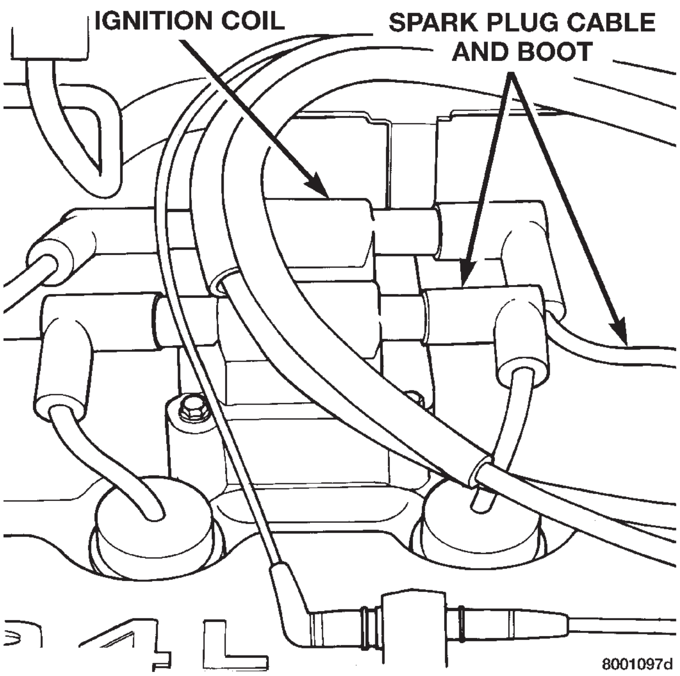


Fig. 46 Ignition Coil Pack Electrical Connection

(3) Verify the camshaft position sensor electrical connector is connected to the harness and not damaged (Fig. 47).

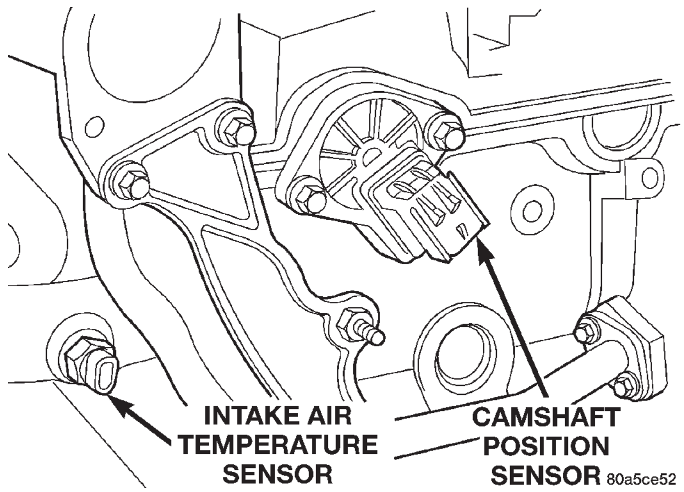


Fig. 47 Camshaft Position Sensor

(4) Ensure the engine temperature sensor electrical connector is connected to the sensor and not damaged (Fig. 48).

(5) Verify the quick connect fuel fitting is fully inserted on the fuel supply tube.

(6) Check the oil pressure sending unit electrical connection.

(7) Verify the electrical connector at the knock sensor is fully seated and not damaged (Fig. 49).

DIAGNOSIS AND TESTING (Continued)

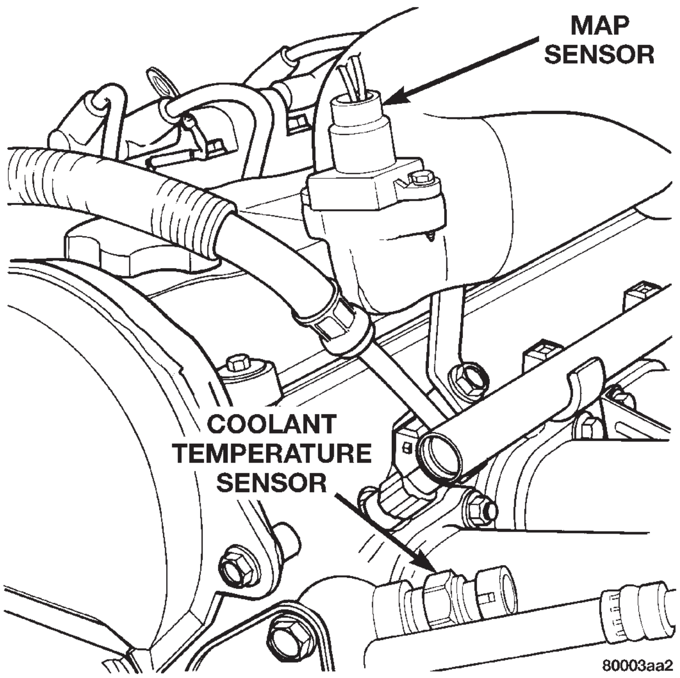


Fig. 48 Engine Coolant Temperature Sensor

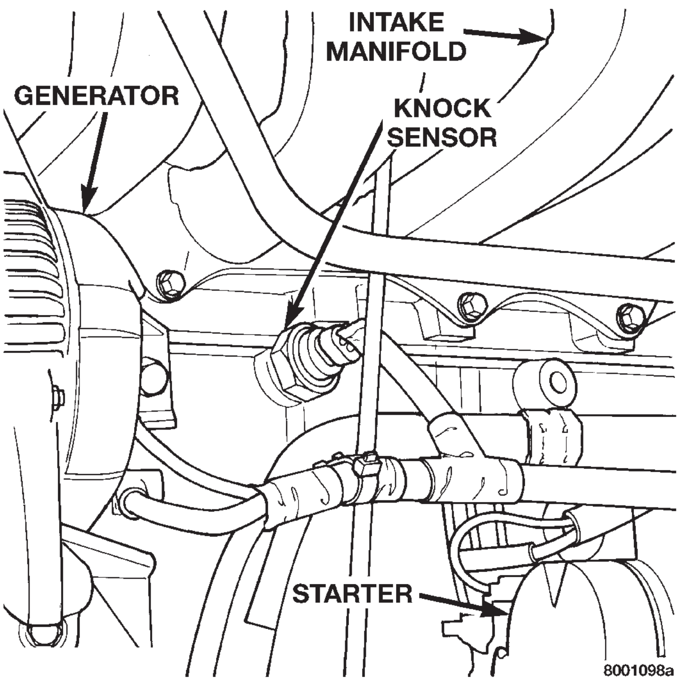


Fig. 49 Knock Sensor

(8) Verify the electrical connector is attached to the Proportional purge solenoid (Fig. 50) and not damaged.

(9) Verify the vacuum connection at the Proportional purge solenoid is secure and not leaking.

(10) Verify the hoses are securely attached to the EVAP canister (Fig. 51).

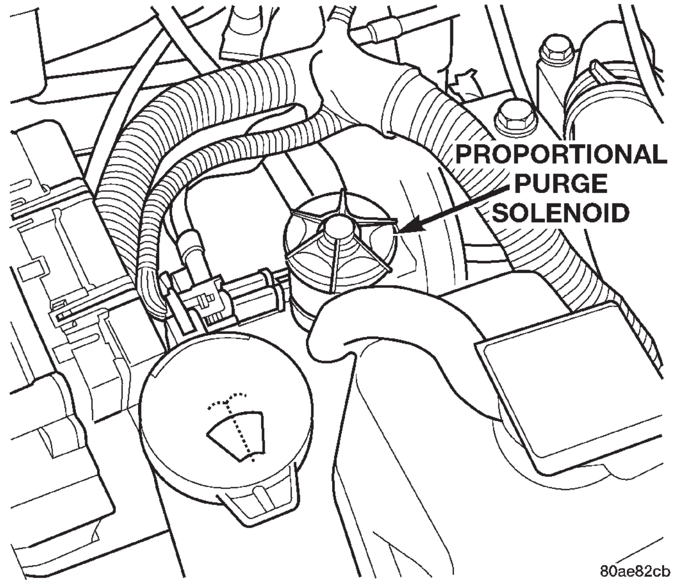


Fig. 50 Proportional Purge Solenoid

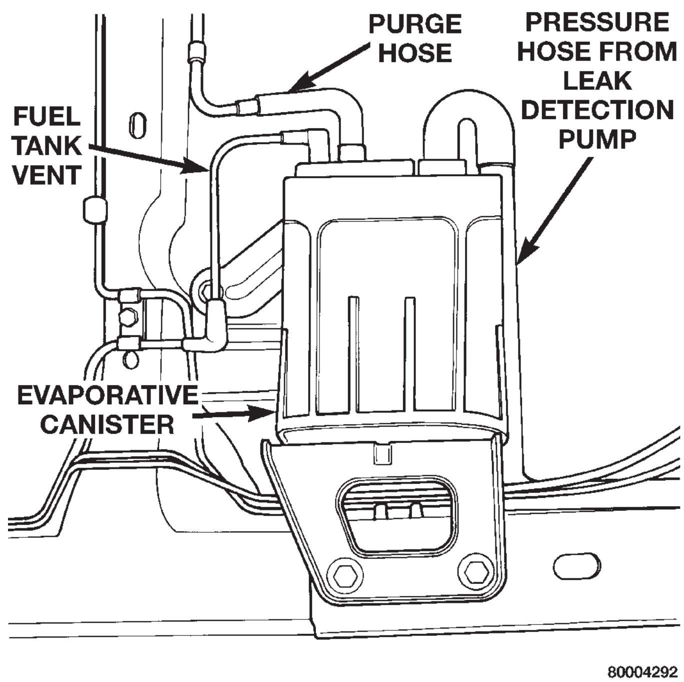


Fig. 51 Evaporative Canister

(11) Ensure the harness connectors for the fuel injectors are attached to the correct injector and not damaged.

(12) Verify the fuel injector harness and engine wiring harness connectors are fully inserted into the main wiring harness.

(13) Check the vacuum connections at the throttle body and intake plenum.

DIAGNOSIS AND TESTING (Continued)

(14) Ensure the idle air control motor and TPS electrical connectors are fully seated and not damaged (Fig. 52).

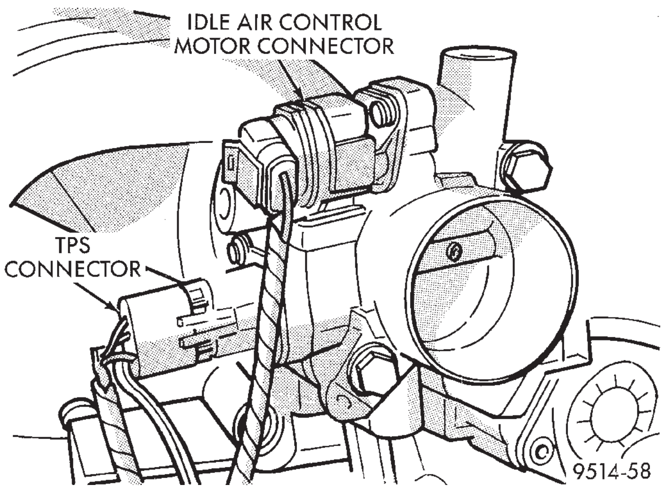


Fig. 52 Throttle Body Electrical Connections

(15) Inspect the park/neutral switch wiring connection for damage. Ensure the automatic transaxle electrical connections are not damaged (Fig. 53).

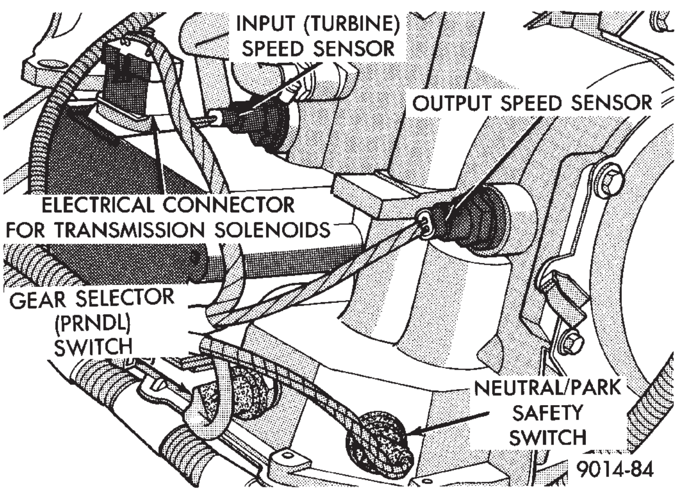


Fig. 53 Automatic Transaxle Electrical Connections

(16) Inspect the PCV system connections for damage (Fig. 54).

(17) Inspect the crankshaft position sensor electrical connector for damage (Fig. 55).

(18) Verify the Manifold Absolute Pressure (MAP) sensor electrical connector is attached to the sensor and not damaged (Fig. 56).

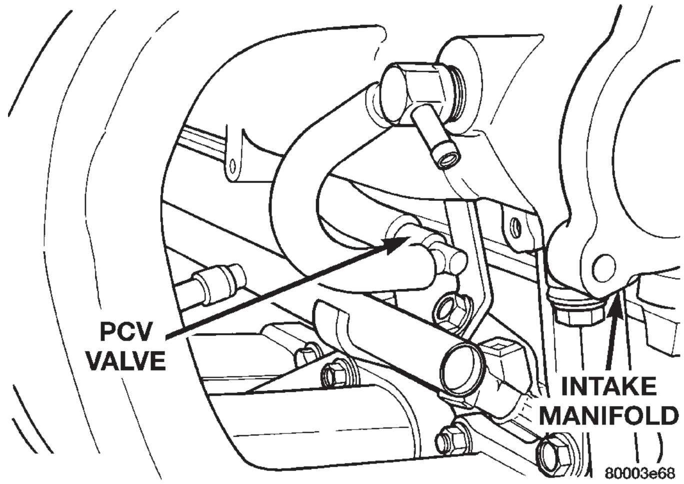


Fig. 54 PCV Valve

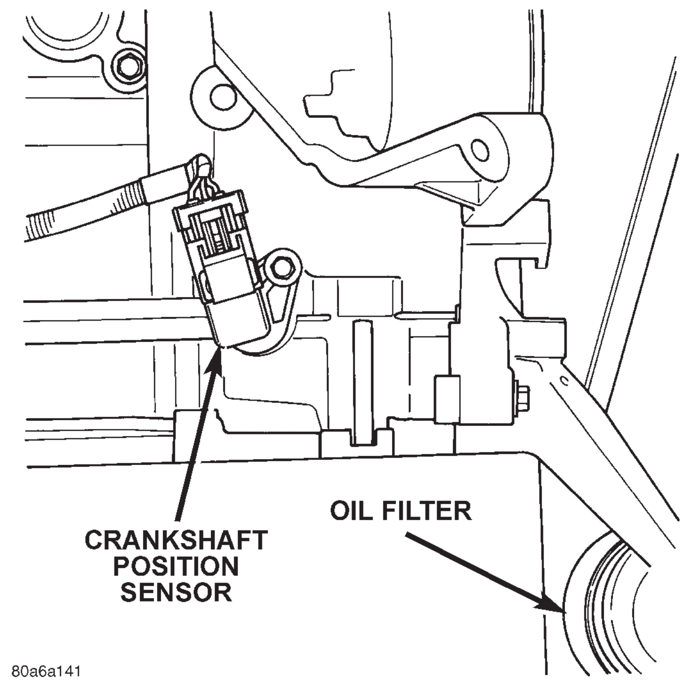


Fig. 55 Crankshaft Position Sensor

(19) Check the heated oxygen sensor electrical connectors for damage (Fig. 57) and (Fig. 58).

(20) Verify the engine ground strap is attached at the engine and dash panel. Inspect the strap for corrosion or damage.

(21) Inspect the generator wiring connections for damage.

DIAGNOSIS AND TESTING (Continued)

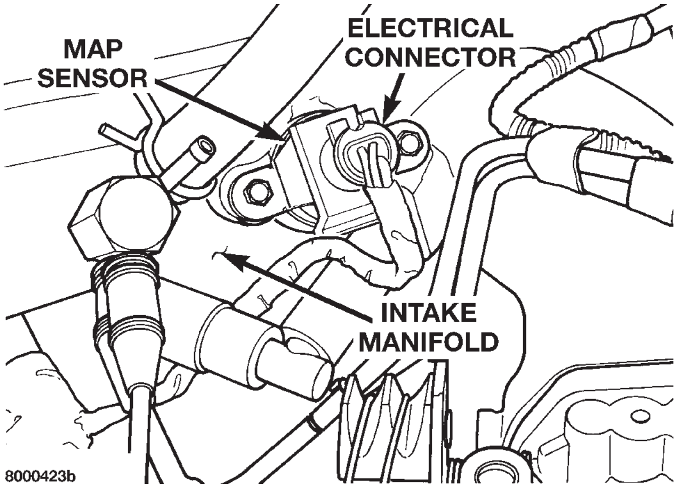


Fig. 56 Map Sensor

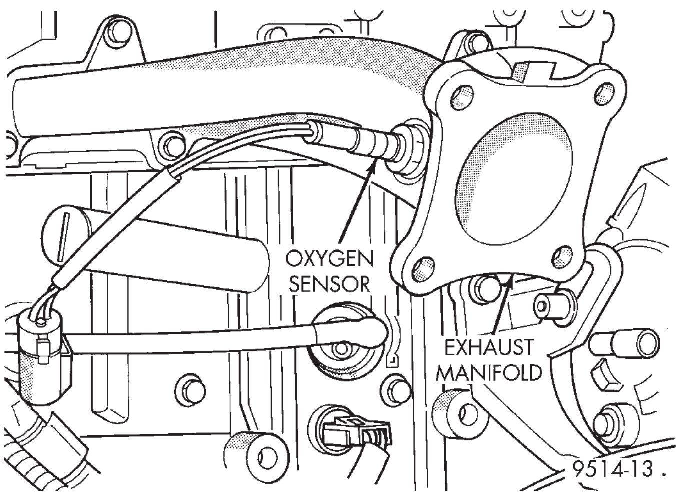


Fig. 57 Upstream Heated Oxygen Sensor

(22) Check the accessory drive belt tension.

(23) Check the 40-way electrical connectors at the Powertrain Control Module (PCM) (Fig. 59) for damage or spread terminals. Verify that the connectors are fully inserted into the PCM sockets. Ensure the wires are not stretched or pulled out of the connector.

(24) Inspect fuses in the Power Distribution Center (PDC). Verify all fuses and relays are fully inserted into the PDC (Fig. 60). A label affixed to the underside of the PDC cover identifies the relays and fuses in the PDC.

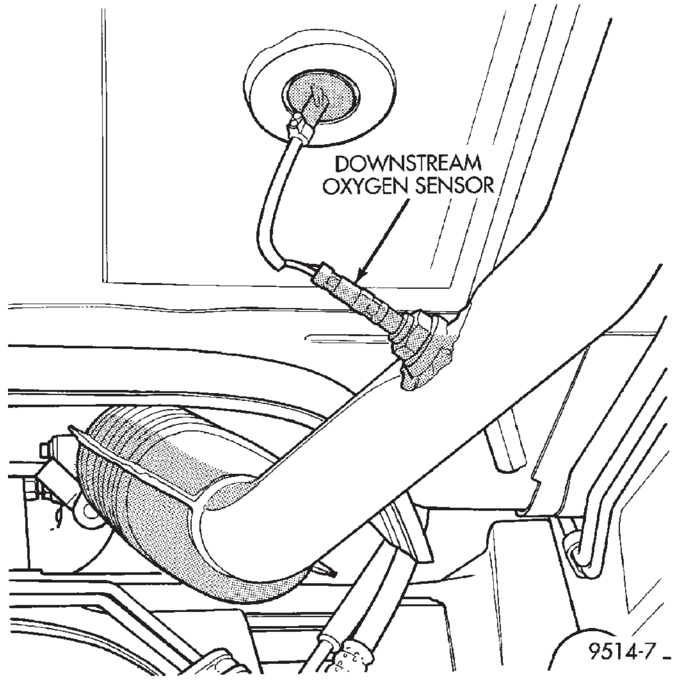


Fig. 58 Downstream Heated Oxygen Sensor

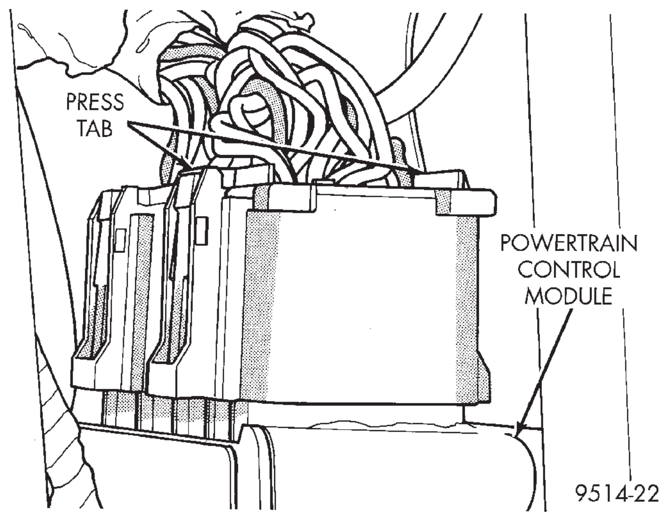


Fig. 59 Powertrain Control Module (PCM) Connectors

(25) Inspect battery cable connections for corrosion.

(26) Check the power brake booster hose connection (without anti-lock brake systems) (Fig. 61).

(27) Inspect the speed control vacuum connection.

(28) Inspect hose and wiring connections at fuel pump module. Check that wiring connector is making contact with terminals on pump.

DIAGNOSIS AND TESTING (Continued)

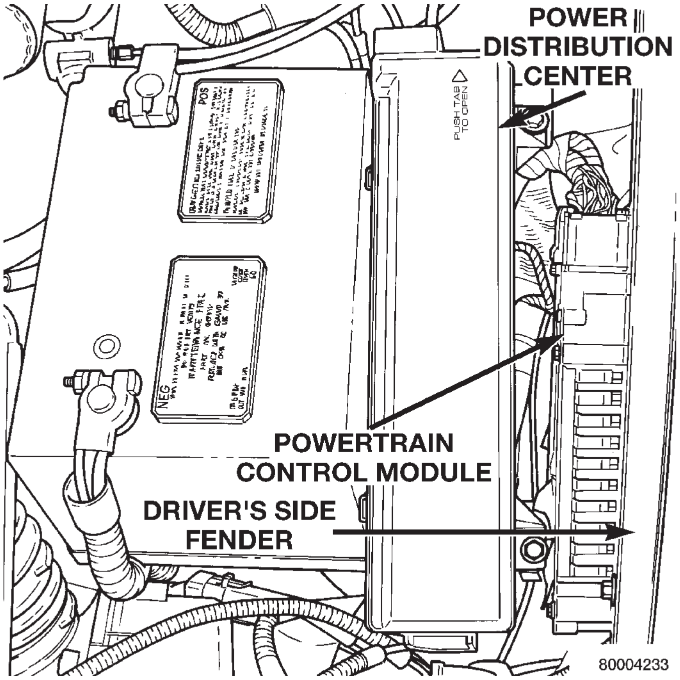


Fig. 60 Power Distribution Center (PDC)

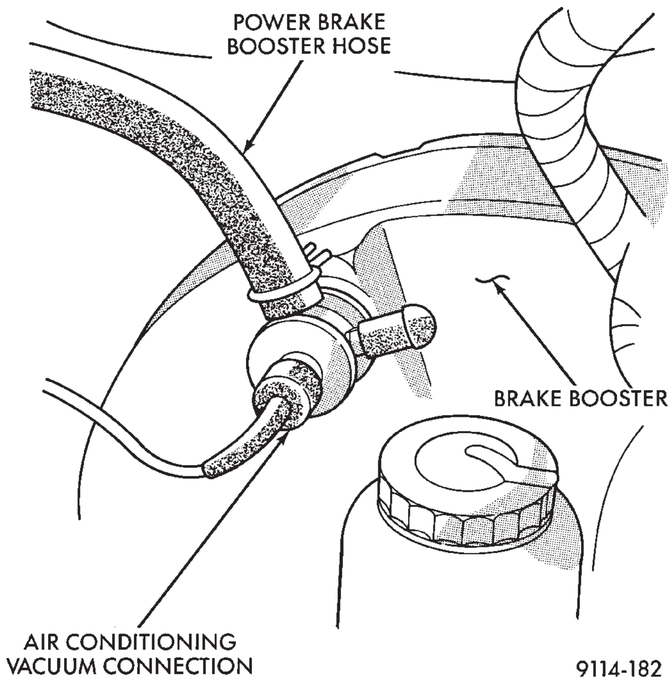


Fig. 61 Power Brake Booster Hose

VISUAL INSPECTION—3.0L ENGINE

A visual inspection for loose, disconnected, or misrouted wires and hoses should be made before attempting to diagnose or service the fuel injection system. A visual check helps save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Check for correct spark plug cable routing. Ensure that the cables are completely connected to the spark plugs and distributor.

(2) Check ignition coil electrical connections (Fig. 62).

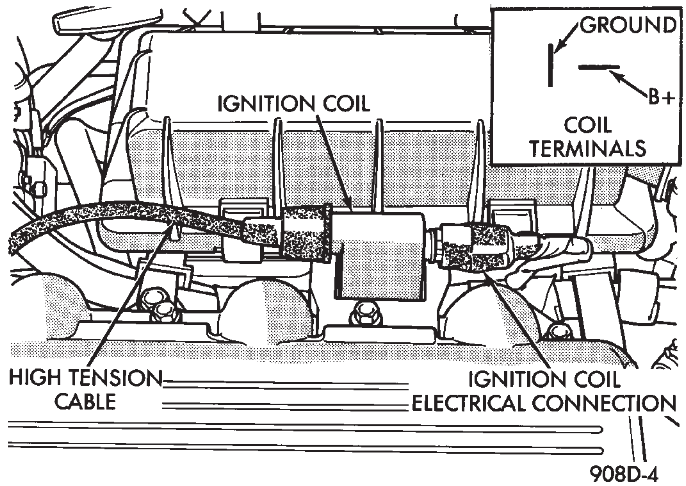


Fig. 62 Ignition Coil Electrical Connection

(3) Verify that the electrical connector is attached to the Proportional Purge Solenoid (Fig. 63).

(4) Verify that vacuum connection at the duty cycle Proportional Purge Solenoid valve is secure and not leaking.

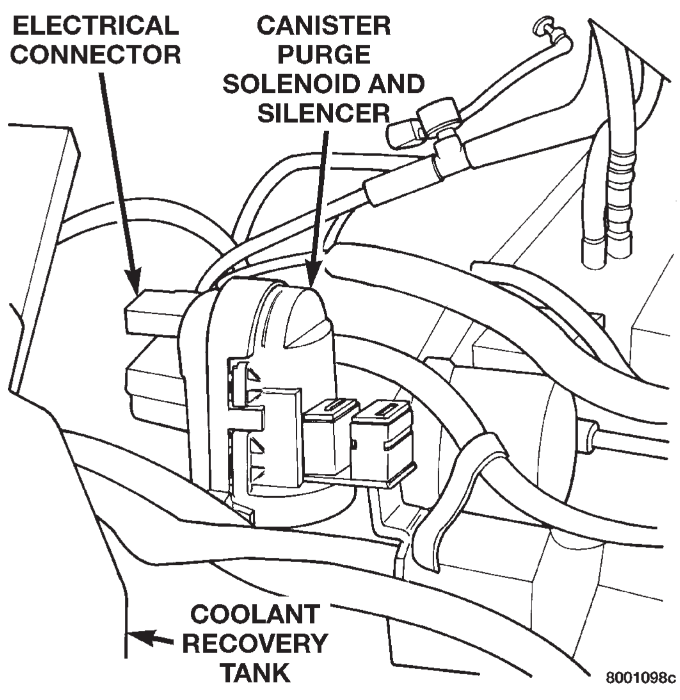


Fig. 63 Proportional Purge Solenoid Valve

DIAGNOSIS AND TESTING (Continued)

(5) Verify that the electrical connector is attached to the MAP sensor (Fig. 64).

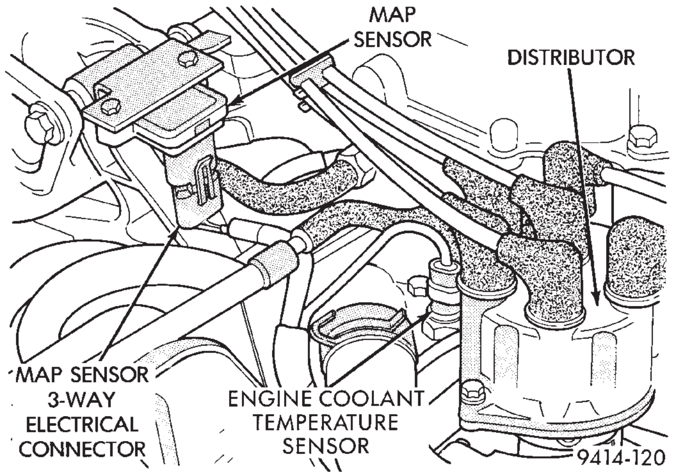


Fig. 64 Map Sensor Electrical and Vacuum Connections

(6) Check generator wiring connections. Ensure the accessory drive belt has proper tension.

(7) Verify that hoses are securely attached to the evaporative canister (Fig. 65).

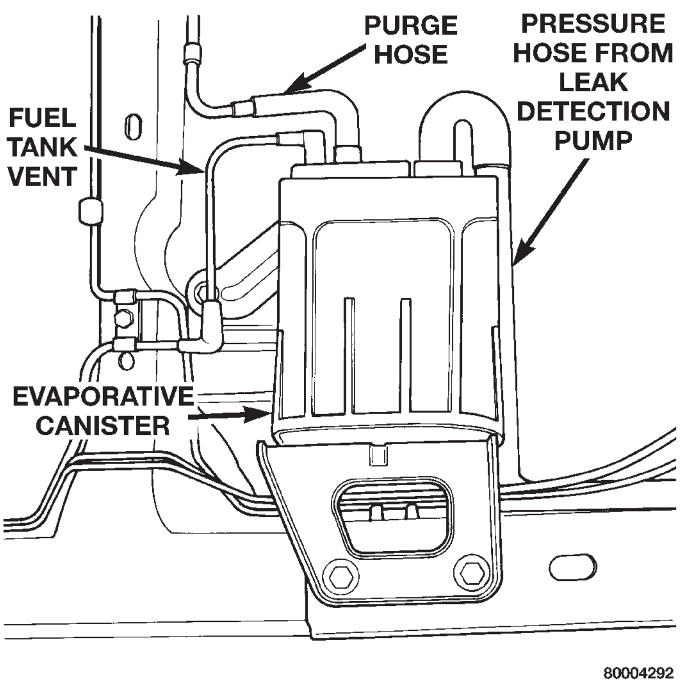


Fig. 65 Evaporative Canister

(8) Verify the engine ground strap is attached at the engine and dash panel (Fig. 66).

(9) Ensure the heated oxygen sensor connector is connected to the harness connector.

(10) Verify the distributor connector is connected to the harness connector (Fig. 67).

(11) Verify the coolant temperature sensor connector is connected to the harness connector (Fig. 68).

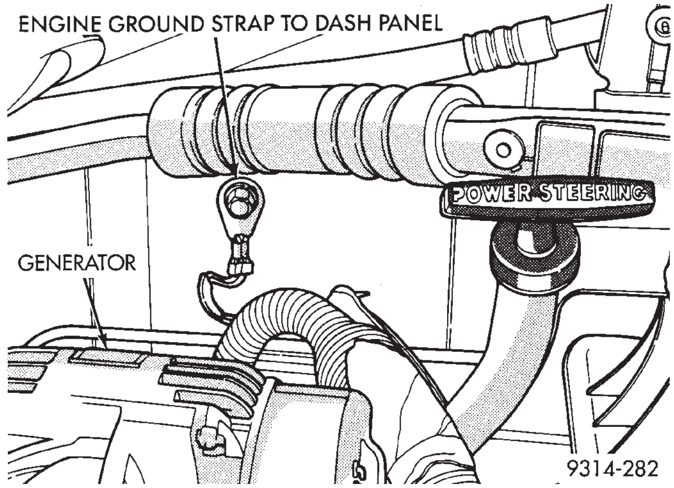


Fig. 66 Engine Ground Strap

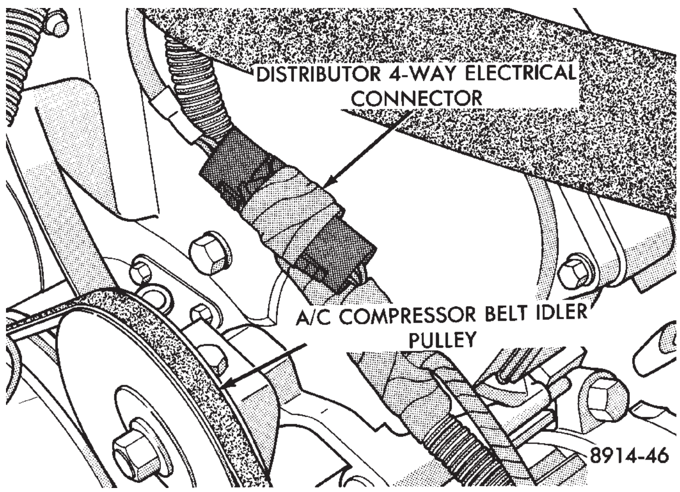


Fig. 67 Distributor Connector

(12) Check vacuum hose connection at fuel pressure regulator and intake plenum connector (Fig. 68).

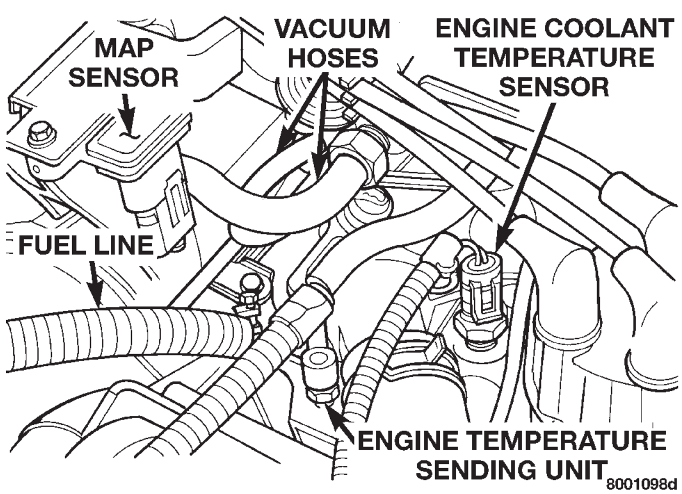


Fig. 68 Coolant Temperature Sensor Electrical Connections and Vacuum Hose Connections at the Air Intake Plenum

DIAGNOSIS AND TESTING (Continued)

(13) Ensure the harness connector is securely attached to each fuel injector.

(14) Check the oil pressure sending unit electrical connection (Fig. 69).

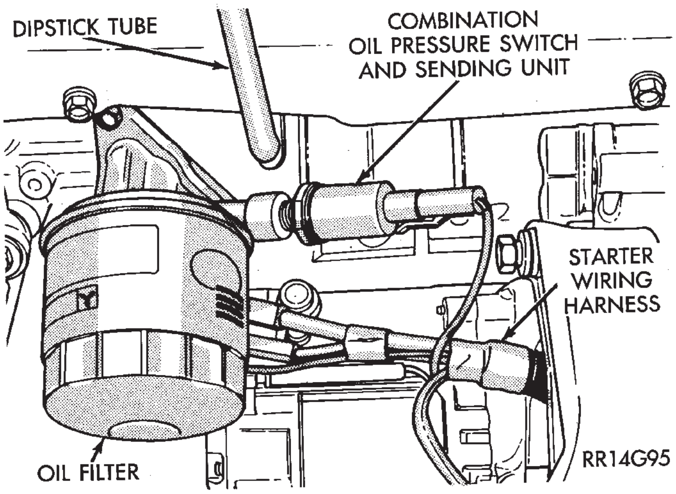


Fig. 69 Oil Pressure Sending Unit Electrical Connection

(15) Check hose connections at throttle body.

(16) Check throttle body electrical connections (Fig. 70).

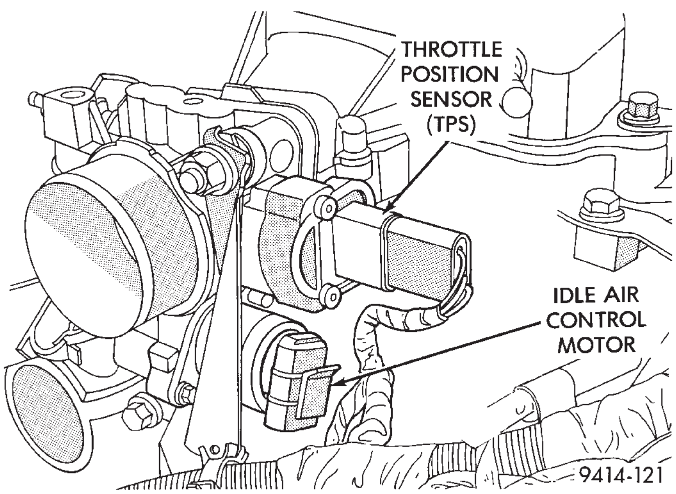


Fig. 70 Throttle Body Electrical and Vacuum Hose Connections

(17) Check PCV hose connections (Fig. 71).

(18) Check EGR system vacuum hose connections (Fig. 72).

(19) Check EGR tube to intake plenum connections.

(20) Check power brake booster vacuum connections.

(21) Check engine harness to main harness electrical connections.

(22) Check all electronic automatic transaxle electrical connections (Fig. 73).

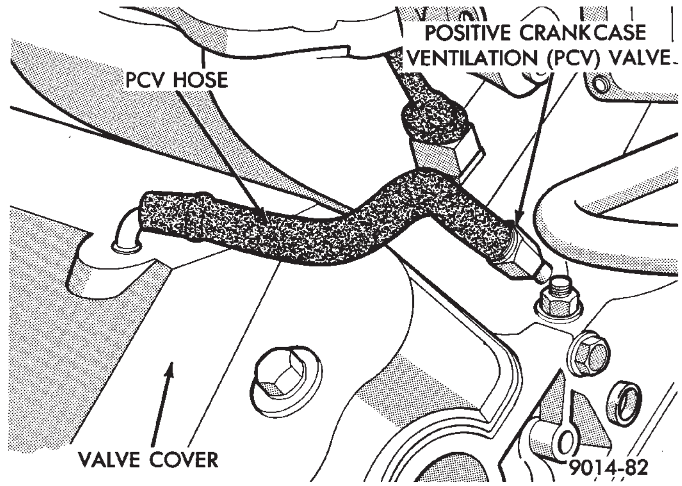


Fig. 71 Positive Crankcase Ventilation (PCV) System

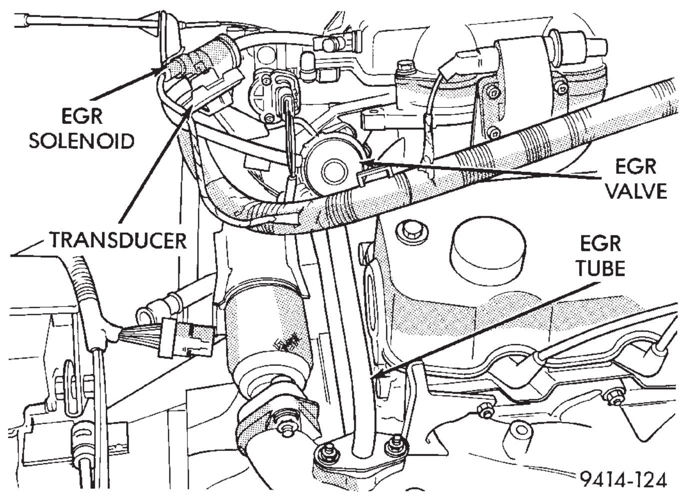


Fig. 72 EGR System

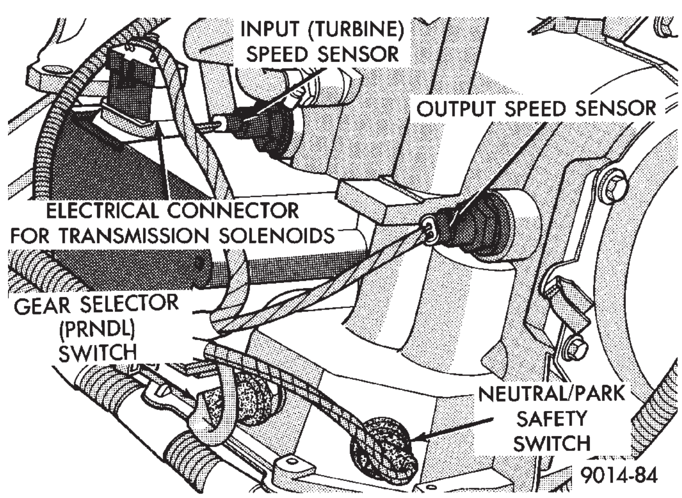


Fig. 73 Electronic Automatic Transaxle Electrical Connections

(23) Inspect the Powertrain Control Module (PCM) 40-way electrical connectors for damage or spread

DIAGNOSIS AND TESTING (Continued)

terminals. Verify the connectors are fully inserted into the socket of the PCM (Fig. 74). Ensure that wires are not stretched or pulled out of the connector.

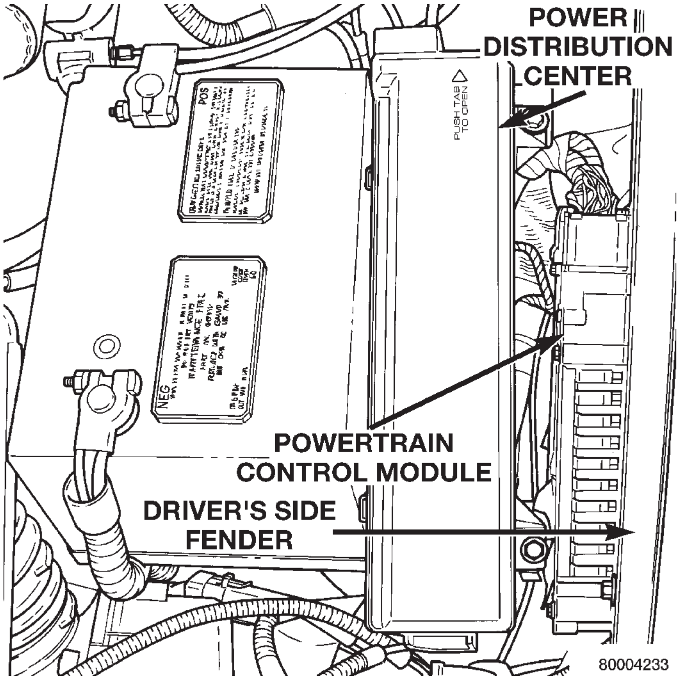


Fig. 74 Powertrain Control Module (PCM)

(24) Inspect fuses in the Power Distribution Center (PDC). Verify all fuses and relays are fully inserted into the PDC (Fig. 74). A label affixed to the underside of the PDC cover identifies the relays and fuses in the PDC.

(25) Check Battery Cable Connections.

(26) Check hose and wiring connections at fuel pump module. Check that wiring connector is making contact with terminals on pump.

VISUAL INSPECTION—3.3/3.8L ENGINES

A visual inspection for loose, disconnected, or misrouted wires and hoses should be made before attempting to diagnose or service the fuel injection system. A visual check helps save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Check ignition cable routing from the coil pack to the spark plugs. Verify the cable are routed in the correct order and are fully seated to the coil and spark plug.

(2) Check direct ignition system (DIS) coil electrical connection for damage and a complete connection to the coil pack (Fig. 75).

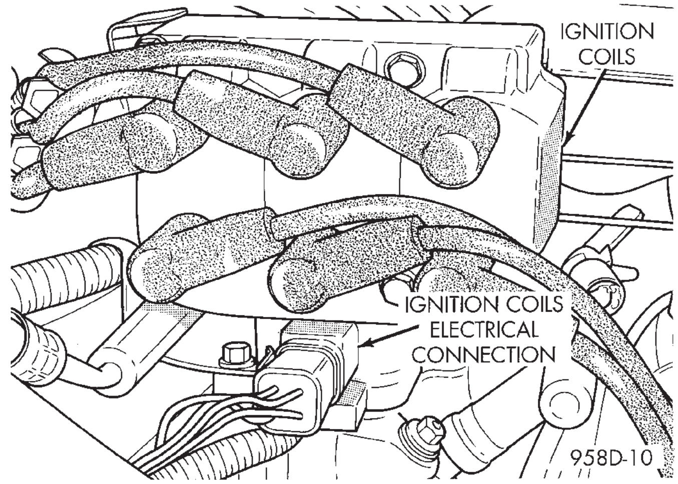


Fig. 75 Ignition Coil Pack Electrical Connection

(3) Verify the camshaft position sensor electrical connector is connected to the harness and not damaged (Fig. 76).

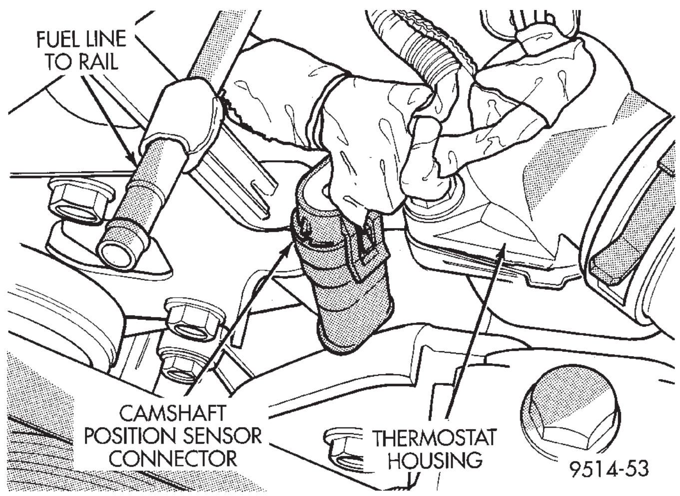


Fig. 76 Camshaft Position Sensor

(4) Ensure the engine temperature sensor electrical connector is connected to the sensor and not damaged (Fig. 77).

(5) Verify the quick connect fuel fitting is fully inserted on the fuel supply tube.

(6) Check the oil pressure sending unit electrical connection (Fig. 78).

DIAGNOSIS AND TESTING (Continued)

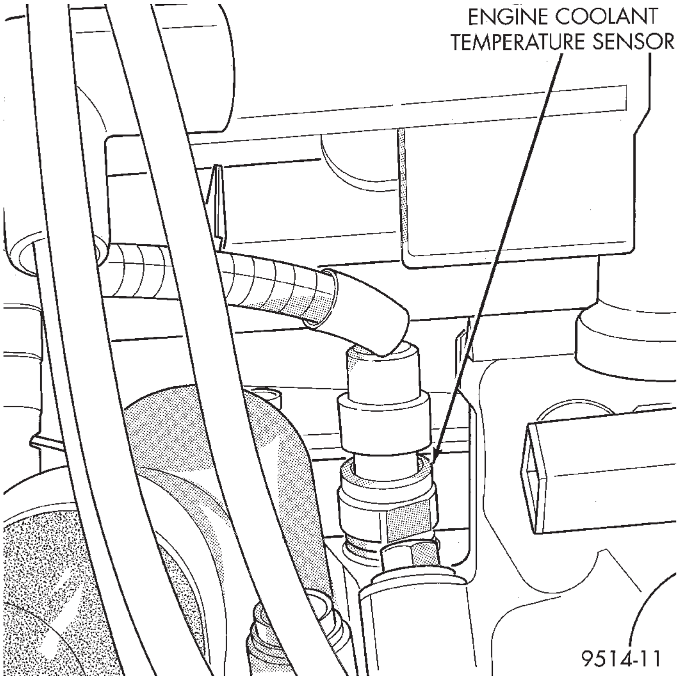


Fig. 77 Engine Coolant Temperature Sensor

(7) Verify the electrical connector at the knock sensor is fully seated and not damaged (Fig. 78).

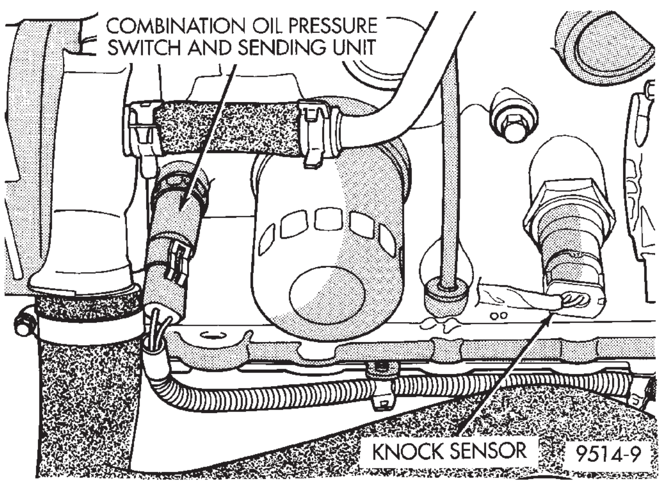


Fig. 78 Knock Sensor and Oil Pressure Sending Unit Electrical Connection

(8) Verify the electrical connector is attached to the Proportional purge solenoid (Fig. 79) and not damaged.

(9) Verify the vacuum connection at the Proportional purge solenoid is secure and not leaking (Fig. 79).

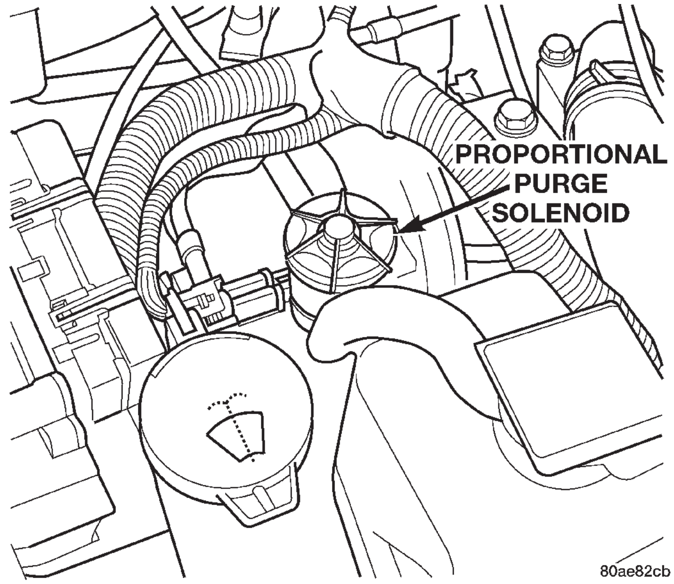


Fig. 79 Proportional Purge Solenoid

(10) Verify the hoses are securely attached to the EVAP canister (Fig. 80).

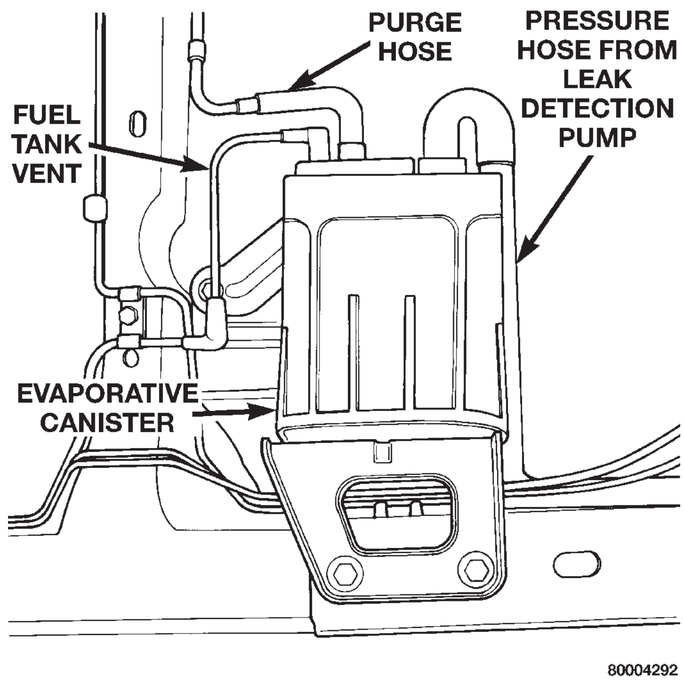


Fig. 80 Evaporative Canister

(11) Ensure the harness connectors for the fuel injectors are attached to the correct injector and not damaged.

(12) Verify the fuel injector harness and engine wiring harness connectors are fully inserted into the main wiring harness.

DIAGNOSIS AND TESTING (Continued)

(13) Check the vacuum connections at the throttle body and intake plenum (Fig. 81).

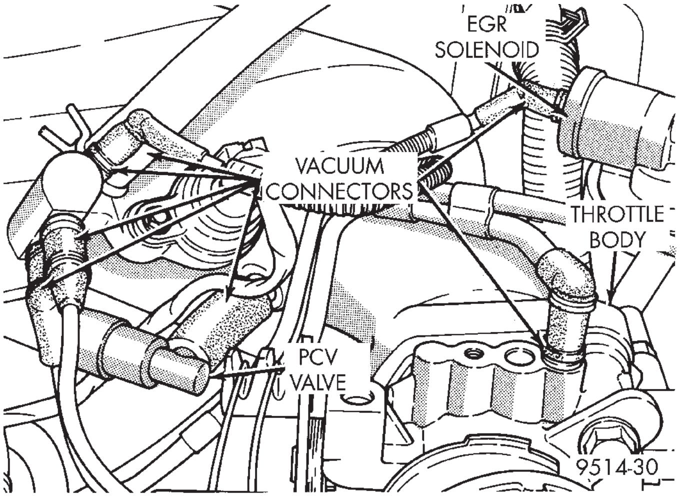


Fig. 81 Throttle Body Vacuum Connections

(14) Ensure the idle air control motor and TPS electrical connectors are fully seated and not damaged (Fig. 82).

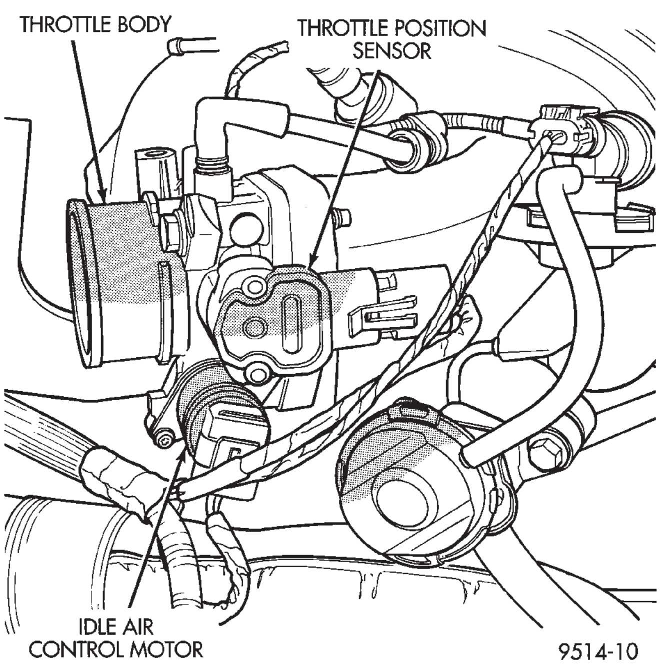


Fig. 82 Throttle Body Electrical Connections

(15) Inspect the park/neutral switch wiring connection for damage. Ensure the automatic transaxle electrical connections are not damaged (Fig. 83).

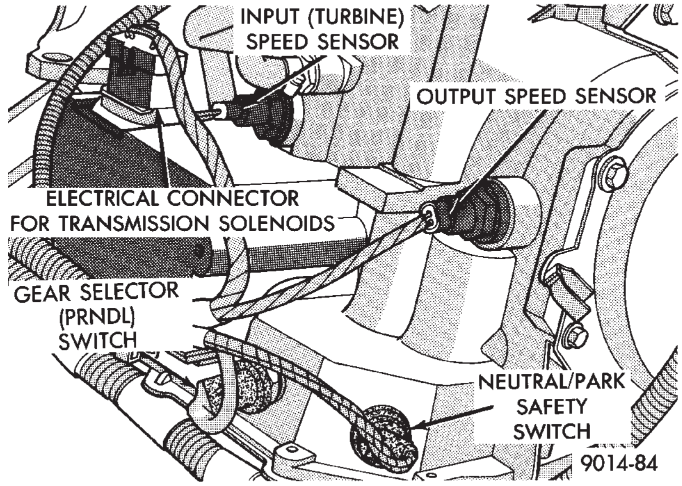


Fig. 83 Automatic Transaxle Electrical Connections

(16) Inspect the PCV system connections for damage (Fig. 84).

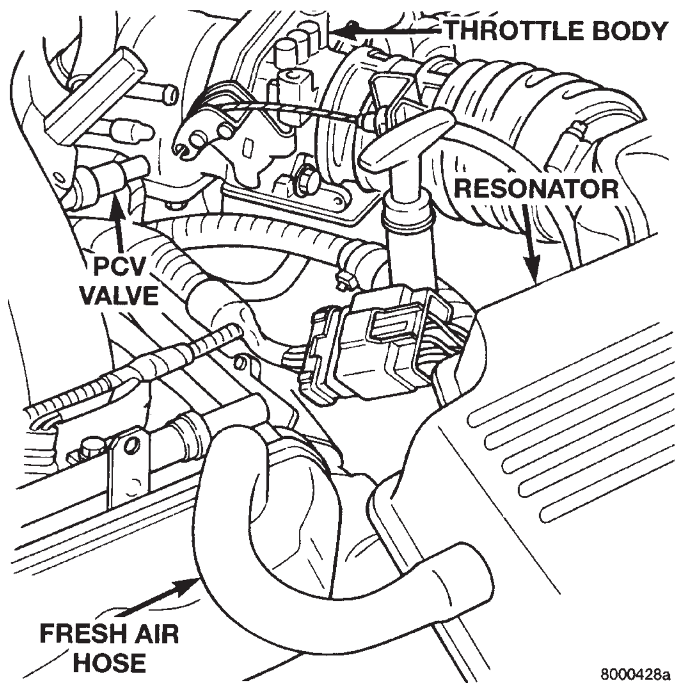


Fig. 84 PCV Valve and Fresh Air Hose

(17) Inspect the crankshaft position sensor electrical connector for damage (Fig. 85).

(18) Verify the Manifold Absolute Pressure (MAP) sensor electrical connector is attached to the sensor and not damaged (Fig. 86).

DIAGNOSIS AND TESTING (Continued)

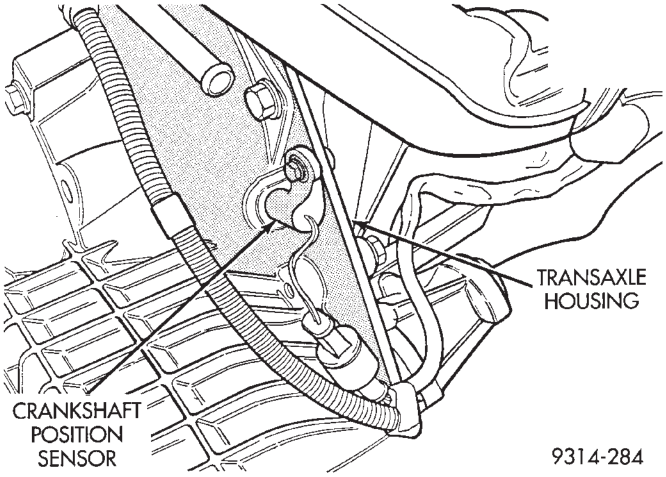


Fig. 85 Crankshaft Position Sensor

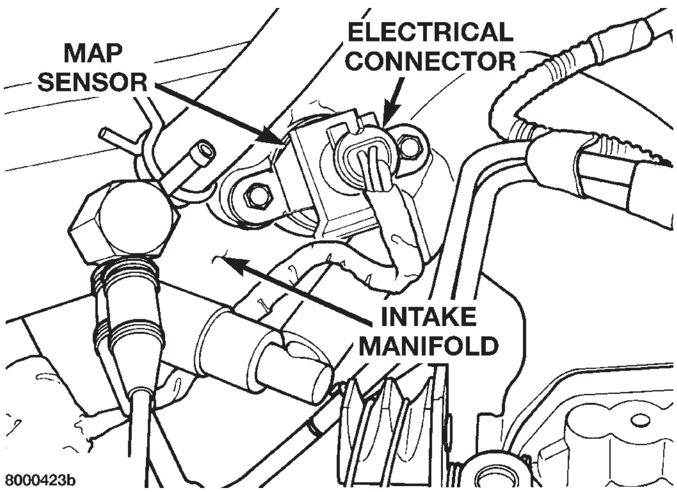


Fig. 86 MAP Sensor

(19) Check the heated oxygen sensor electrical connectors for damage (Fig. 87) and (Fig. 88).

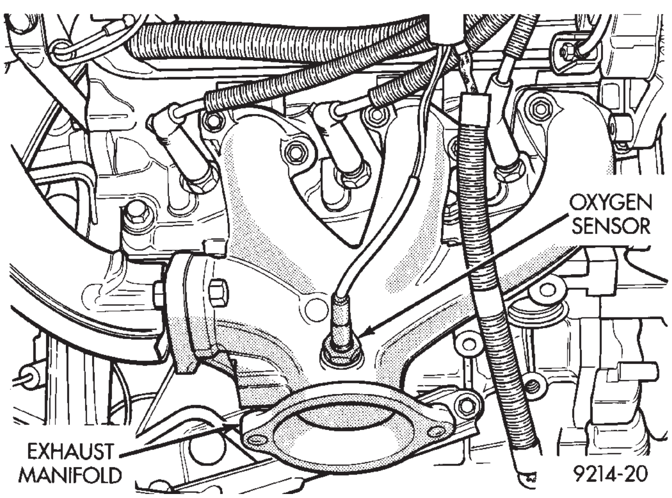


Fig. 87 Upstream Heated Oxygen Sensor

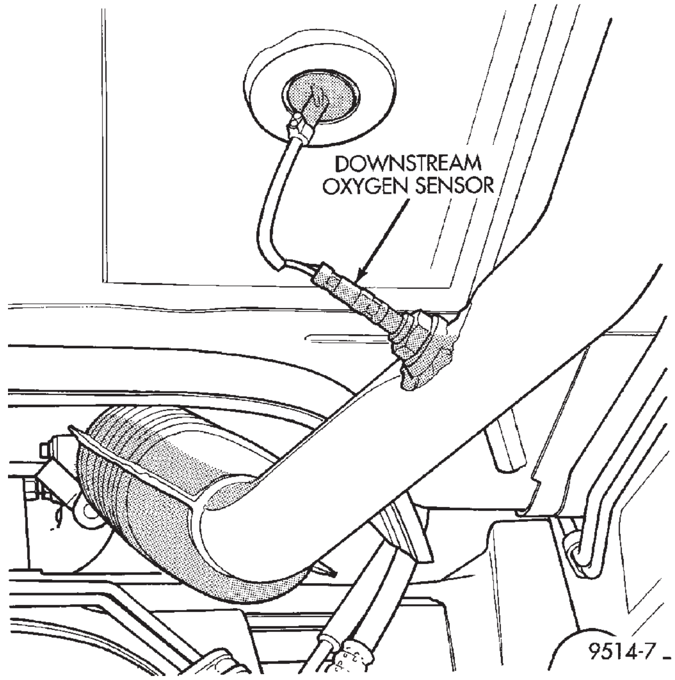


Fig. 88 Downstream Heated Oxygen Sensor

(20) Verify the engine ground strap is attached at the engine and dash panel. Inspect the strap for corrosion or damage.

(21) Inspect the generator wiring connections for damage.

(22) Check the accessory drive belt tension.

(23) Check the 40-way electrical connectors at the Powertrain Control Module (PCM) (Fig. 89) for damage or spread terminals. Verify that the connectors are fully inserted into the PCM sockets. Ensure the wires are not stretched or pulled out of the connector.

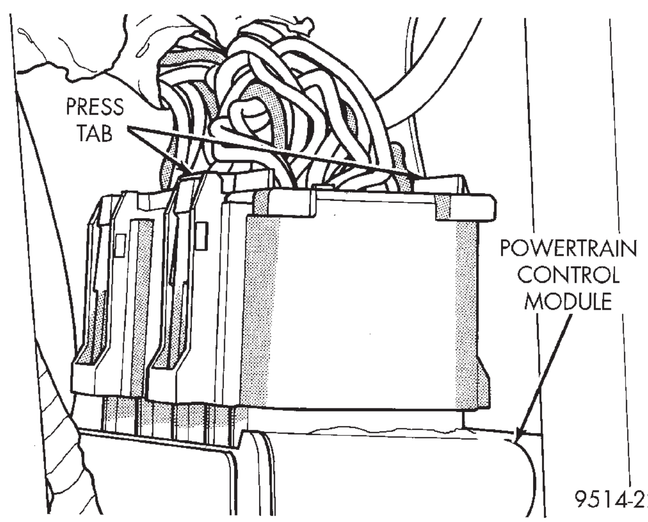


Fig. 89 Powertrain Control Module (PCM) Connectors

(24) Inspect fuses in the Power Distribution Center (PDC). Verify all fuses and relays are fully

DIAGNOSIS AND TESTING (Continued)

inserted into the PDC (Fig. 90). A label affixed to the underside of the PDC cover identifies the relays and fuses in the PDC.

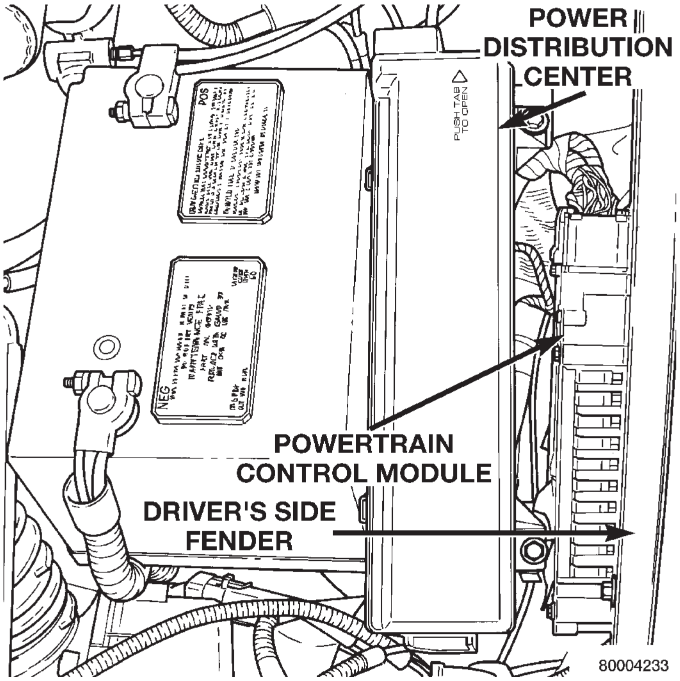


Fig. 90 Power Distribution Center (PDC)

(25) Inspect battery cable connections for corrosion.

(26) Check the power brake booster hose connection (without anti-lock brake systems) (Fig. 91).

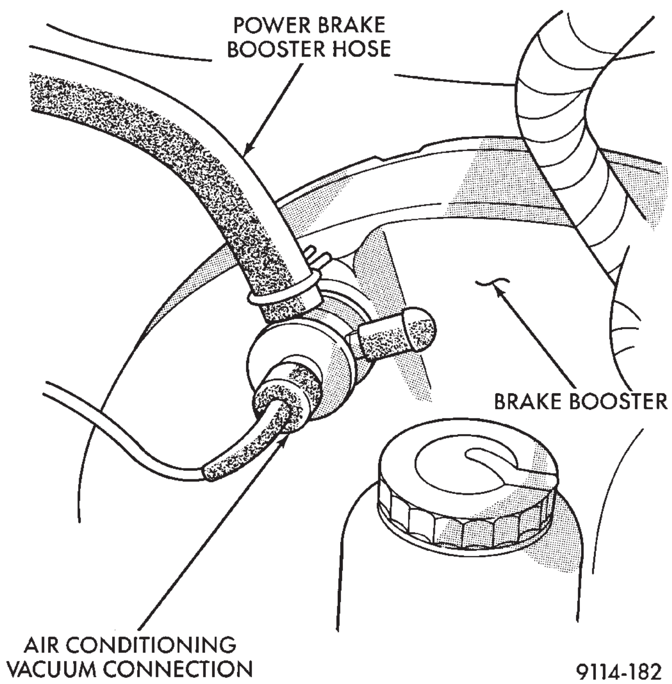


Fig. 91 Power Brake Booster Hose

(27) Inspect the speed control vacuum connection (Fig. 92).

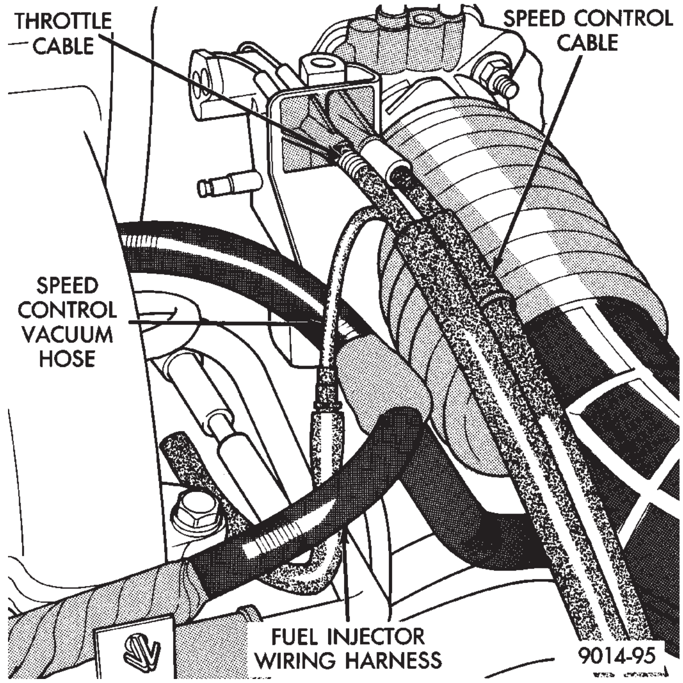
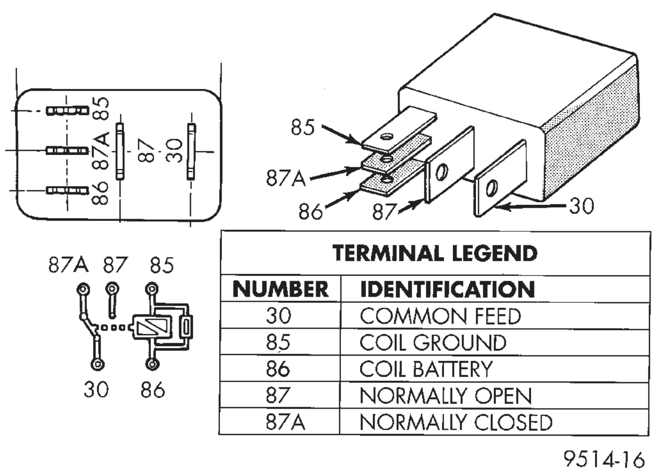


Fig. 92 Speed Control Vacuum

(28) Inspect hose and wiring connections at fuel pump module. Check that wiring connector is making contact with terminals on pump.

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 (Fig. 93) or (Fig. 94).



TERMINAL LEGEND

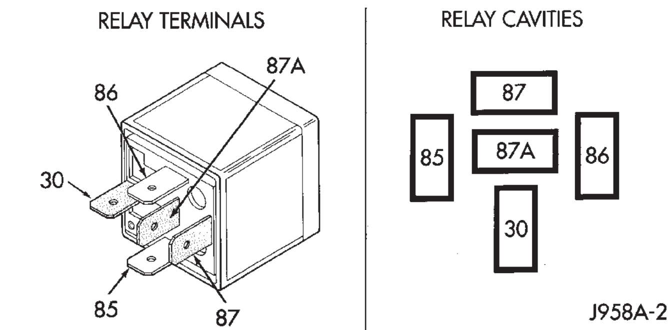
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 93 ASD and Fuel Pump Relay Terminals

OPERATION

- 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.

DIAGNOSIS AND TESTING (Continued)



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 94 ASD and Fuel Pump Relay Terminals

• 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.

TESTING

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 between 75 ±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.

(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.

(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 group 8W, Wiring Diagrams.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

To perform a complete test of the MAP sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the MAP sensor only, refer to the following:

CAUTION: When testing the MAP sensor, be sure that the harness wires are not damaged by the test meter probes.

(1) Test the MAP sensor output voltage at the MAP sensor connector between terminals 2 and 3 (Fig. 95). With the ignition switch ON and the engine not running, output voltage should be 4 to 5 volts. The voltage should drop to 1.5 to 2.1 volts with a hot, neutral idle speed condition. If OK, go to next step. If not OK, go to step 3.

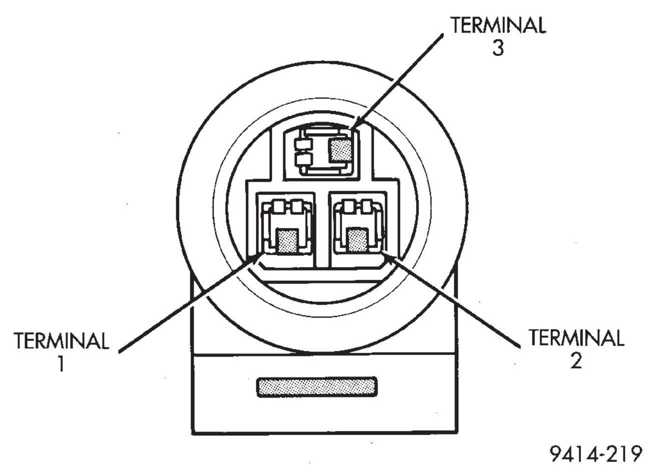


Fig. 95 MAP Sensor Connector

(2) Test PCM terminal 36 for the same voltage described in the previous step to verify wire harness condition. Repair as required.

(3) Test the MAP sensor ground circuit at sensor connector terminal 1 and PCM terminal 43. If OK, go to next step. If not OK, repair as required.

(4) Test MAP sensor supply voltage between sensor connector terminals 2 and 1 with the key ON. The voltage should be approximately 5 volts (±.5V). Five volts (±.5V) should also be at terminal 61 of the

DIAGNOSIS AND TESTING (Continued)

PCM. If OK, replace MAP sensor. If not OK, repair or replace the wire harness as required.

HEATED OXYGEN SENSOR

Use an ohmmeter to test the heating element of the oxygen sensors. Disconnect the electrical connector from each oxygen sensor. The white wires in the sensor connector are the power and ground circuits for the heater. Connect the ohmmeter test leads to terminals of the white wires in the heated oxygen sensor connector. Replace the heated oxygen sensor if the resistance is not between 4 and 7 ohms.

KNOCK SENSOR

The engine knock sensor is affected by a number of factors. A few of these are: ignition timing, cylinder pressure, fuel octane, etc. The knock sensor generates an AC voltage whose amplitude increases with the increase of engine knock. The knock sensor can be tested with a digital voltmeter. The RMS voltage starts at about 20mVac (at about 700 rpm) and increases to approximately 600 mVac (5000 rpm). If the output falls outside of this range a DTC will be set.

CAMSHAFT AND CRANKSHAFT POSITION SENSOR

Refer to Group 8D, Ignition for Diagnosis and Testing of Camshaft and Crankshaft Sensors.

ENGINE COOLANT TEMPERATURE SENSOR

(1) With the key off, disconnect wire harness connector from coolant temperature sensor (Fig. 96) or (Fig. 97) or (Fig. 98).

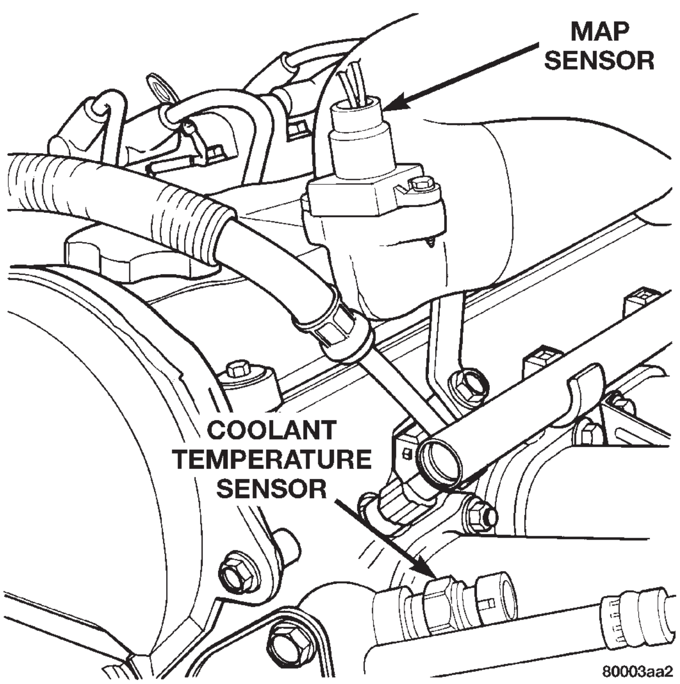


Fig. 96 Engine Coolant Temperature Sensor—2.4L

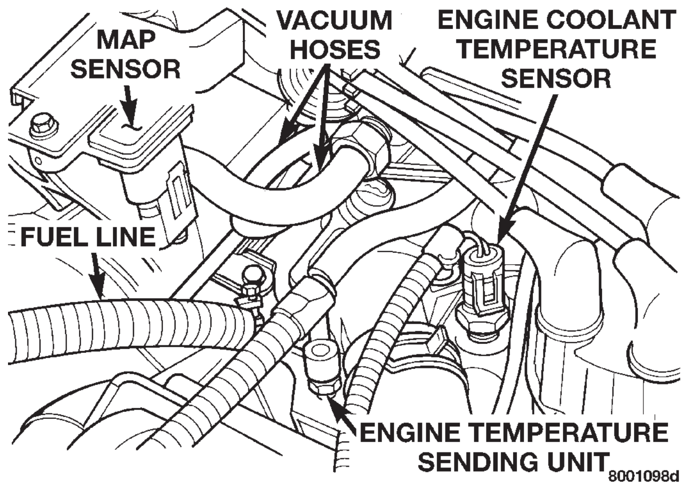


Fig. 97 Engine Coolant Temperature Sensor—3.0L

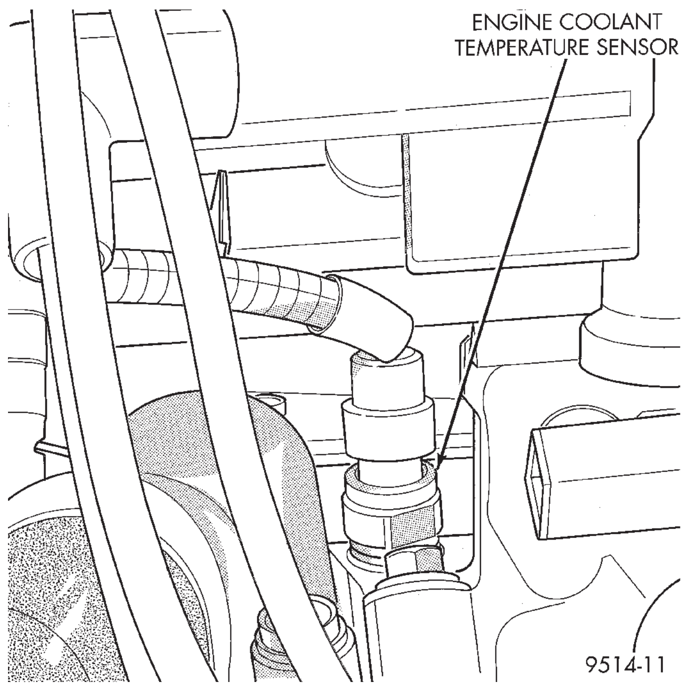


Fig. 98 Engine Coolant Temperature Sensor—3.3/3.8L

(2) Connect a high input impedance (digital) volt-ohmmeter to terminals A and B (Fig. 99). The ohmmeter should read as follows:

(a) ECT STET at normal operating temperature around 200°F should read approximately 700 to 1,000 ohms.

(b) ECT STET at room temperature around 70°F ohmmeter should read approximately 7,000 to 13,000 ohms.

(3) Test the resistance of the wire harness between the PCM connector terminal 26 and the sensor harness connector. Also check for continuity between PCM connector terminal 43 and the sensor harness connector. Refer to Group 8W, Wiring diagrams for

DIAGNOSIS AND TESTING (Continued)

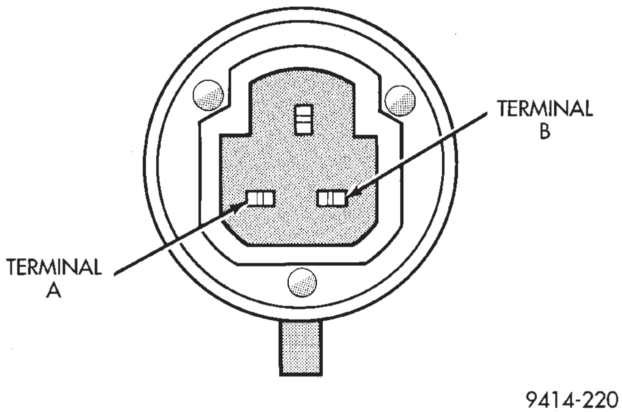


Fig. 99 Engine Coolant Temperature Sensor

circuit information. If the resistance is greater than 1 ohm, repair the wire harness as necessary.

THROTTLE POSITION SENSOR

To perform a complete test of the this sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the throttle position sensor only, refer to the following:

The Throttle Position Sensor (TPS) can be tested with a digital voltmeter (DVM). The center terminal of the sensor is the output terminal. One of the other terminals is a 5 volt supply and the remaining terminal is ground.

Connect the DVM between the center and sensor ground terminal. Refer to Group 8W - Wiring Diagrams for correct pinout.

With the ignition switch in the ON position, check the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at Wide-Open-Throttle (WOT). At idle, TPS output voltage should be approximately 0.38 volts to 1.2 volts. At wide open throttle, TPS output voltage should be approximately 3.1 volts to 4.4 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE

(1) Warm engine in Park or Neutral until the cooling fan has cycled on and off at least once.

(2) Ensure that all accessories are off.

(3) Shut off engine.

(4) **3.0L Engine**

(a) Hook-up the timing check device and tachometer.

(b) Disconnect the engine coolant temperature sensor and set basic timing to 12° BTDC ± 2°.

(c) Shut off engine. Reconnect coolant temperature sensor wire.

(5) Disconnect the PCV valve hose from the intake manifold nipple (Fig. 101), (Fig. 102) or (Fig. 103).

(6) Cap the PCV valve nipple.

(7) **3.3/3.8L Engines**

(a) Install Air Metering Fitting 6457 (0.125 in. orifice) to the intake manifold PCV nipple (Fig. 100).

(b) Disconnect the idle purge line from the throttle body nipple.

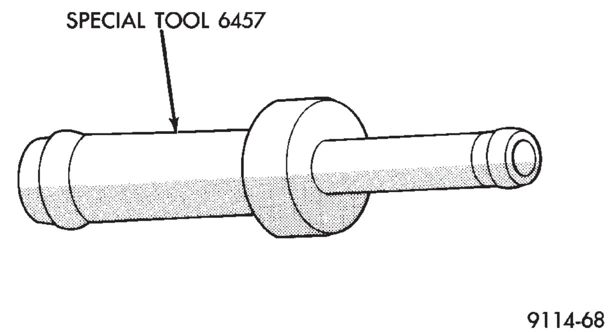


Fig. 100 Air Metering Fitting 6457

(8) **3.0/2.4L Engines**

(a) Install Air Metering Fitting 6457 (0.125 in. orifice) to the purge nipple on the throttle body.

(9) **3.3/3.8L Engines**

(a) Cap the 3/16 inch nipple.

(b) Connect the DRB scan tool to the data link connector.

(10) Restart the engine. Allow engine to idle until the cooling fan has cycled on and off at least one 180°F cycle.

(11) Using the DRB scan tool, access the Minimum Airflow Idle Speed screen.

(12) The following will then occur:

- Idle air control motor will fully close.
- Idle spark advance will become fixed.
- DRB scan tool displays engine rpm.

(13) If idle rpm is within the range shown in the Idle Specification chart, throttle body minimum airflow is set correctly.

IDLE SPECIFICATIONS—2.4L ENGINE

Odometer Reading	Idle RPM
Below 1000 Miles	500-875 RPM
Above 1000 Miles	550–875 RPM

DIAGNOSIS AND TESTING (Continued)

IDLE SPECIFICATIONS—3.0L ENGINE

Odometer Reading	Idle RPM
Below 1000 Miles	560-910 RPM
Above 1000 Miles	610-910 RPM

IDLE SPECIFICATIONS—3.3/3.3L ENGINE

Odometer Reading	Idle RPM
Below 1000 Miles	525–875 RPM
Above 1000 Miles	575–875 RPM

(14) If idle rpm is not within specifications, shut off the engine and clean the throttle body as follows:

(a) Remove the throttle body from engine.

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

(b) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(c) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when closed, must be free of deposits.**

(d) Use compressed air to dry the throttle body.

(e) Inspect throttle body for foreign material.

(f) Install throttle body on manifold.

(g) Repeat steps 1 through 12. If the minimum air flow is still not within specifications, the problem is not caused by the throttle body.

(15) Shut off engine.

(16) Remove Air Metering Fitting 6457 from the intake manifold PCV nipple. Reinstall the PCV valve hose.

(17) Uncap the throttle body idle purge nipple and connect the idle purge line.

(18) Remove DRB scan tool.

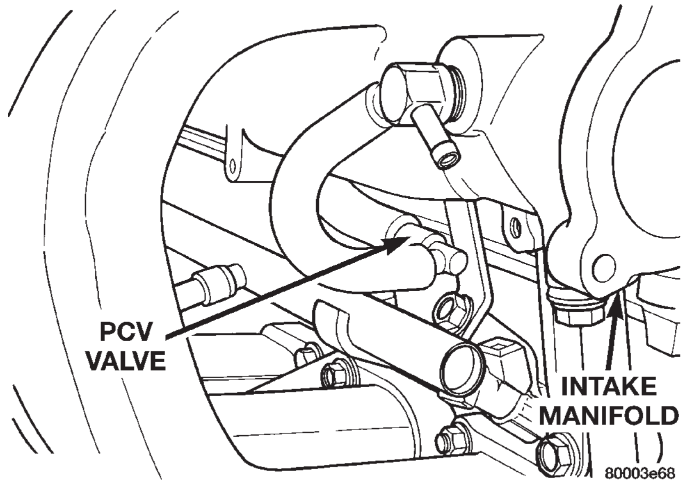


Fig. 101 PCV Valve—2.4L Engine

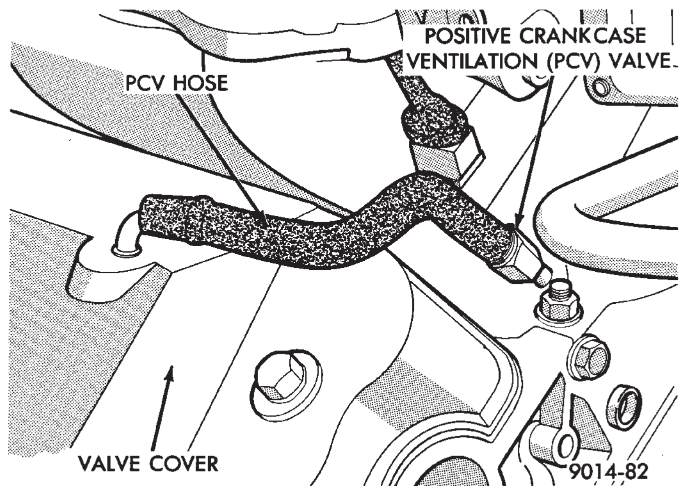


Fig. 102 PCV Valve—3.0L Engine

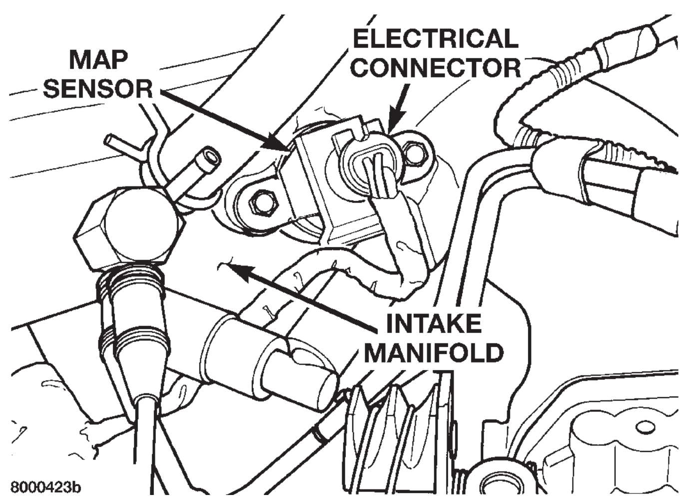


Fig. 103 PCV Valve—3.3/3.8L Engines

REMOVAL AND INSTALLATION

THROTTLE BODY

REMOVAL

(1) Disconnect negative cable from battery cable.

(2) Remove air inlet to throttle body hose clamp.

(3) Remove 2 screws and air inlet resonator (Fig. 104).

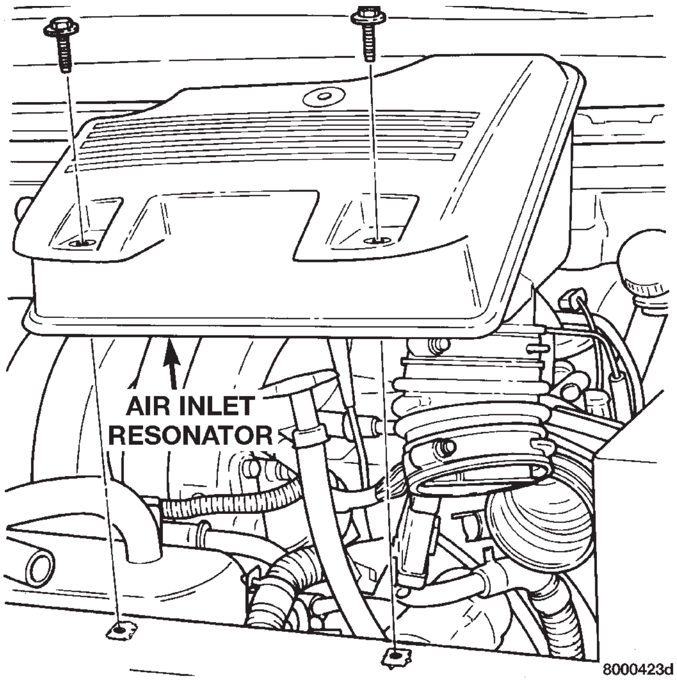


Fig. 104 Air Inlet Resonator

(4) Remove throttle and the speed control (if equipped) cables from lever and bracket (Fig. 105).

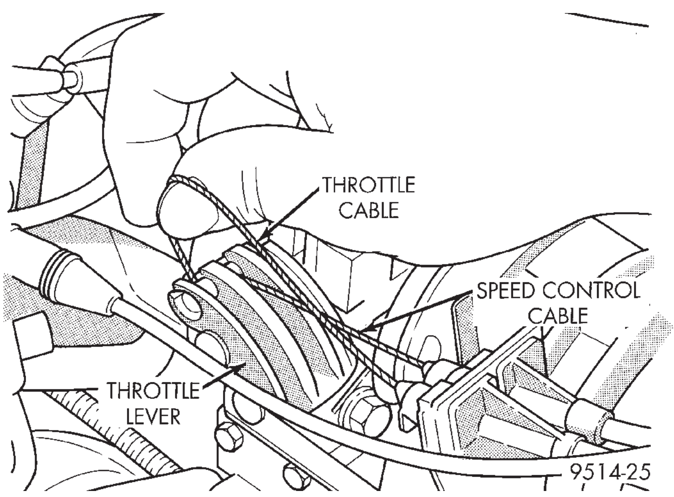


Fig. 105 Throttle Cable Attachment to Throttle Body Attachment

(5) Disconnect electrical connectors from the idle air control motor and throttle position sensor (TPS) (Fig. 106) or (Fig. 107) or (Fig. 108).

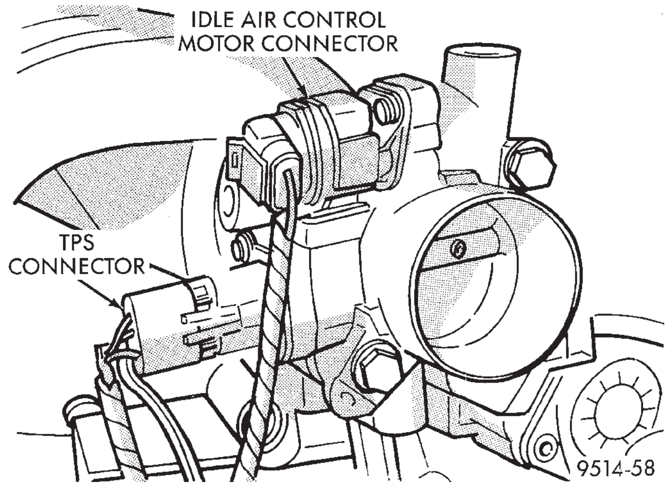


Fig. 106 Throttle Body Electrical and Vacuum Connections—2.4L

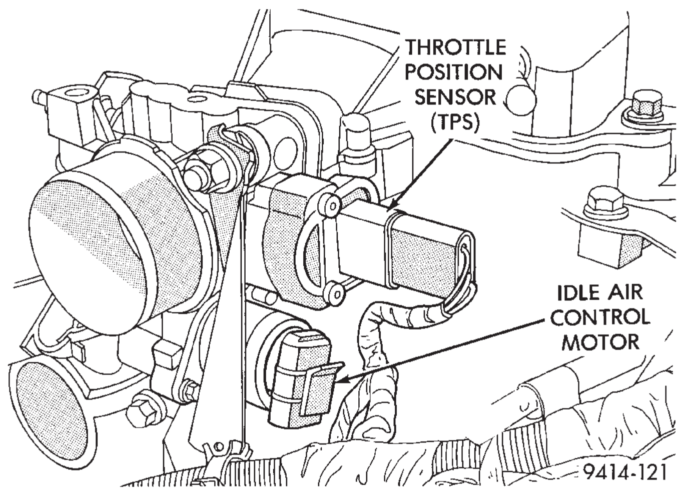


Fig. 107 Throttle Body Electrical and Vacuum Connections—3.0L

(6) Disconnect vacuum hoses from throttle body.

(7) Remove throttle body to intake manifold attaching nuts.

(8) Remove throttle body and gasket.

INSTALLATION

(1) Reverse procedure for installation. Tighten throttle body mounting nuts to 25 N·m (225 in. lbs.) torque.

FUEL PUMP RELAY

The fuel pump relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

AUTOMATIC SHUTDOWN (ASD) RELAY

The Automatic Shutdown relay (ASD) relay is located in the PCD. The inside top of the PDC cover has a label showing relay and fuse location.

REMOVAL AND INSTALLATION (Continued)

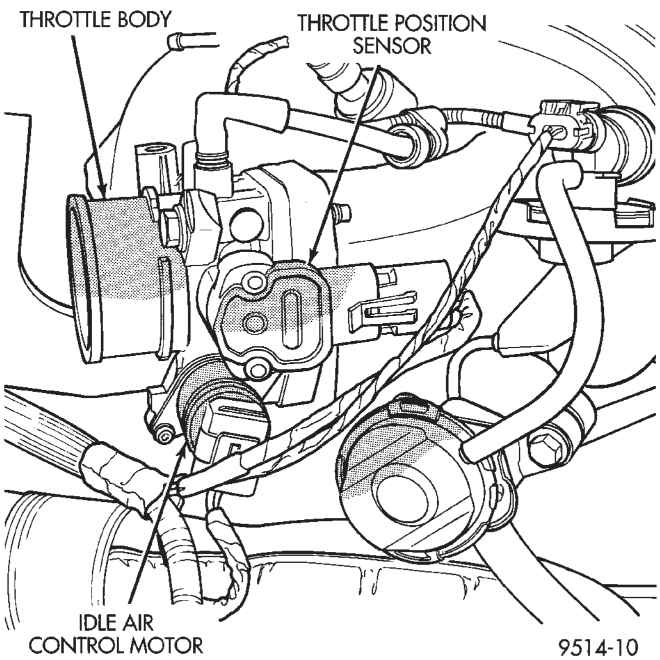


Fig. 108 Throttle Body Electrical and Vacuum Connections—3.3/3.8L

THROTTLE POSITION SENSOR

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove electrical connector from throttle position sensor.

(3) Remove throttle position sensor mounting screws.

(4) Lift throttle position sensor off throttle shaft (Fig. 109), (Fig. 110) or (Fig. 111).

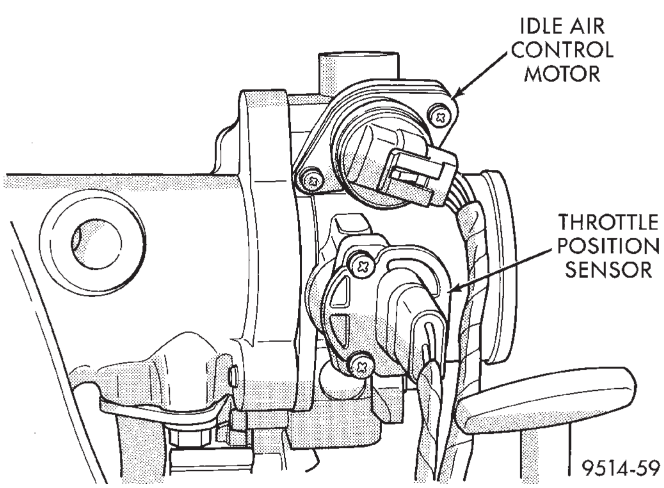


Fig. 109 Servicing Throttle Position Sensor—2.4L

INSTALLATION

(1) Install throttle position sensor on throttle shaft. Install mounting screws. Tighten screw to 2 N·m (17 in. lbs.) torque.

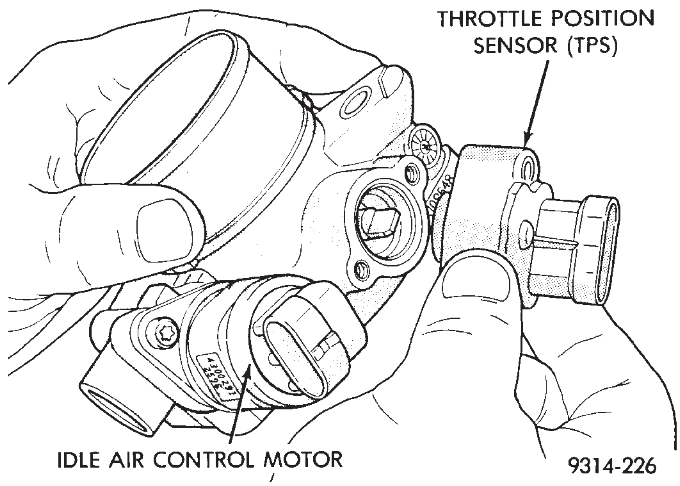


Fig. 110 Servicing Throttle Position Sensor—3.0L

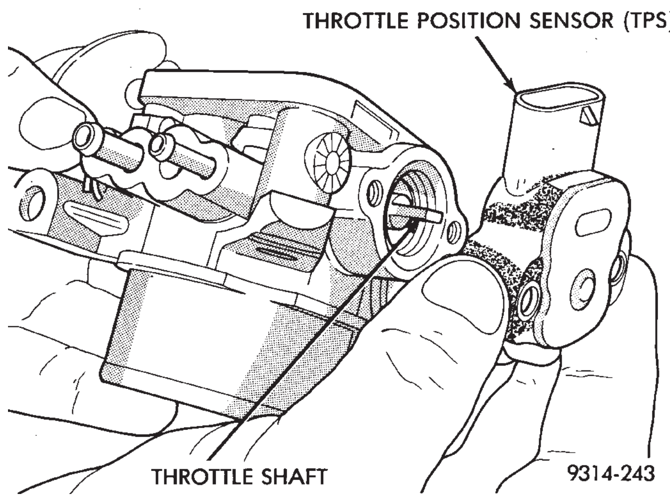


Fig. 111 Servicing Throttle Position Sensor—3.3/3.8L

(2) Connect electrical connector to throttle position sensor.

(3) Connect negative cable to battery.

IDLE AIR CONTROL MOTOR

When servicing throttle body components, always reassemble components with new O-rings and seals where applicable. Never use lubricants on O-rings or seals, damage may result. If assembly of component is difficult, use water to aid assembly. Use care when removing hoses to prevent damage to hose or hose nipple.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove electrical connector from idle air control motor.

(3) Remove idle air control motor mounting screws (Fig. 112).

(4) Remove motor from throttle body. Ensure the O-ring is removed with the motor.

REMOVAL AND INSTALLATION (Continued)

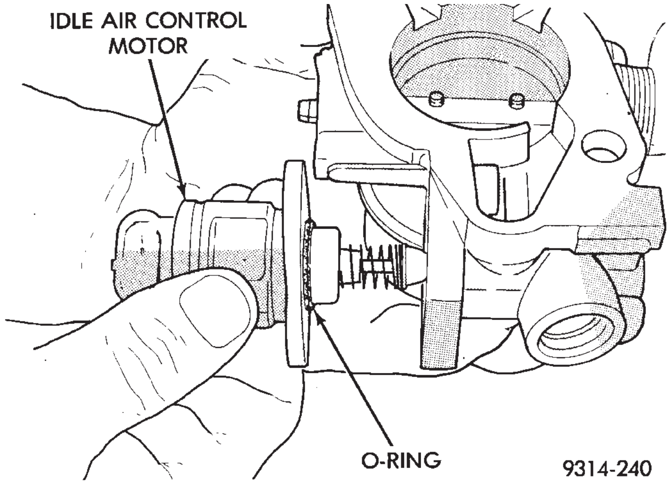


Fig. 112 Servicing Idle Air Control Motor

INSTALLATION

(1) The new idle air control motor has a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRB Idle Air Control Motor Open/Close Test to retract the pintle (battery must be connected.)

(2) Carefully place idle air control motor into throttle body.

(3) Install mounting screws. Tighten screws to 2 N·m (17 in. lbs.) torque.

(4) Connect electrical connector to idle air control motor.

(5) Connect negative cable to battery.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.4/3.3/3.8L

REMOVAL

(1) Disconnect electrical connector from MAP sensor (Fig. 113).

(2) Remove two screws holding sensor to the intake manifold.

INSTALLATION

(1) Reverse the above procedure for installation.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.0L

REMOVAL

(1) Remove vacuum hose and mounting screws from manifold absolute pressure (MAP) sensor (Fig. 114).

(2) Disconnect electrical connector from sensor. Remove sensor.

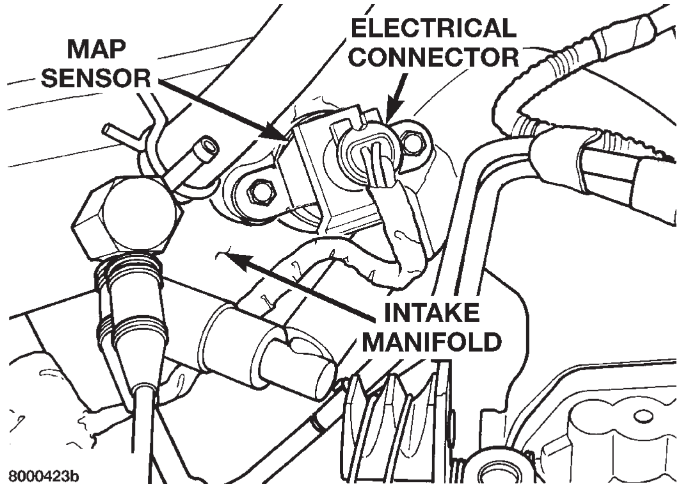


Fig. 113 Map Absolute Pressure Sensor

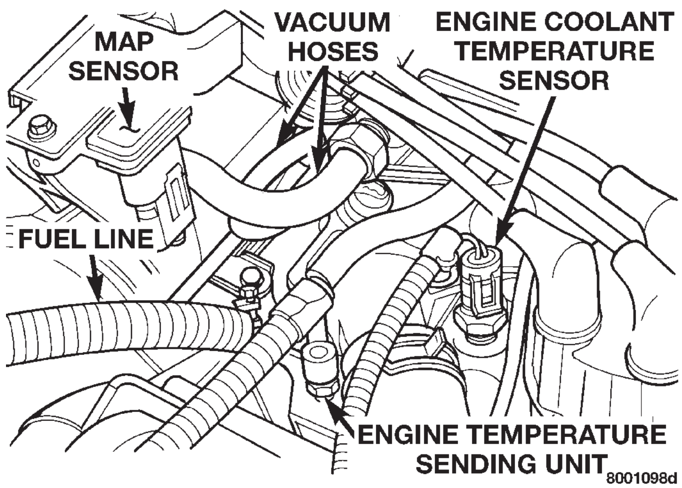


Fig. 114 Manifold Absolute Pressure Sensor

INSTALLATION

(1) Reverse the above procedure for installation.

PROPORTIONAL PURGE SOLENOID VALVE

REMOVAL

(1) Remove vacuum hose and electrical connector from solenoid (Fig. 115).

(2) Pull solenoid up to remove it from mounting bracket.

INSTALLATION

Reverse above procedure for installation.

REMOVAL AND INSTALLATION (Continued)

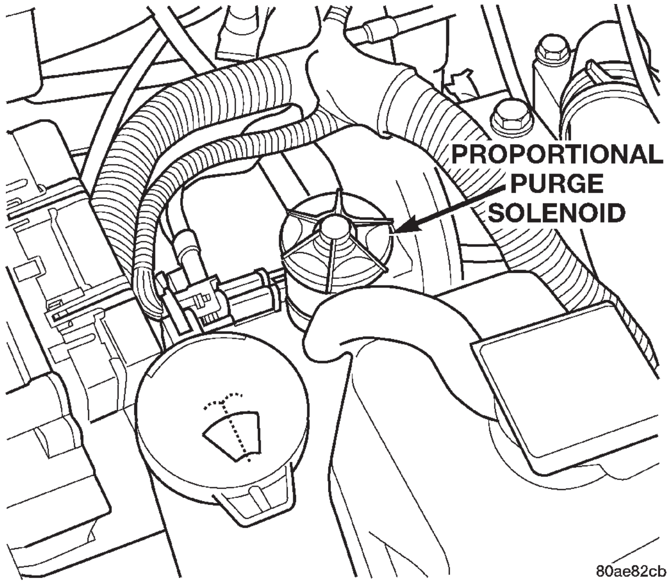


Fig. 115 Proportional Purge Solenoid Valve

POWERTRAIN CONTROL MODULE

REMOVAL

(1) Disconnect both cables from battery, negative cable first.

(2) Remove 2 screws holding Power Distribution Center (PDC) to bracket (Fig. 116).

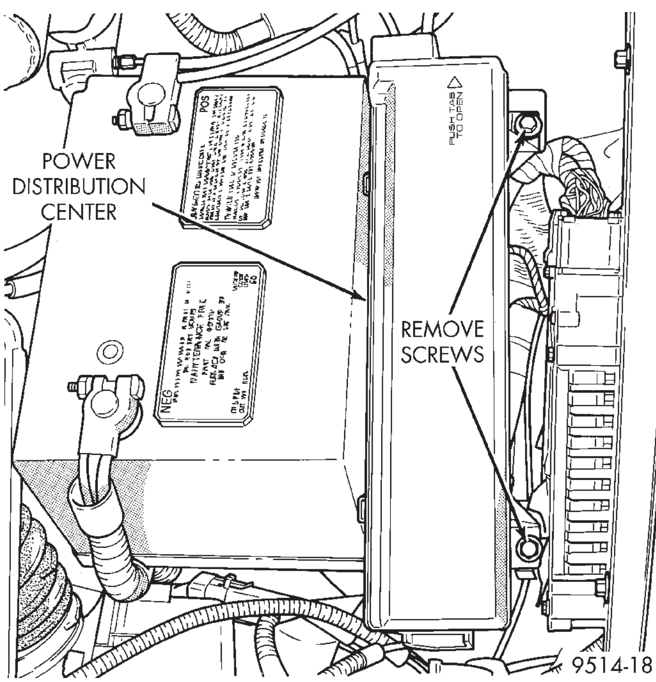


Fig. 116 Power Distribution Center Retaining Screws

(3) Remove heat shield from battery (Fig. 117).

(4) Remove nut and clamp holding battery to battery tray (Fig. 118).

(5) Remove battery from vehicle.

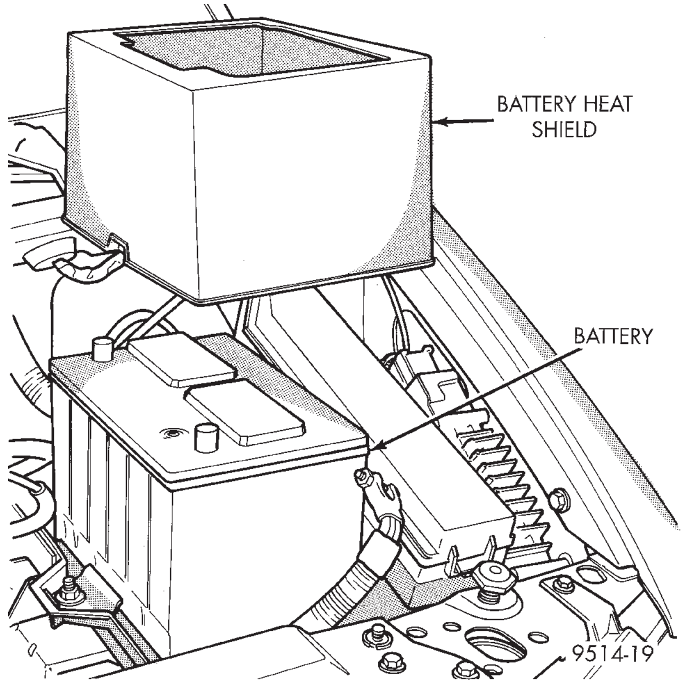


Fig. 117 Battery Heat Shield

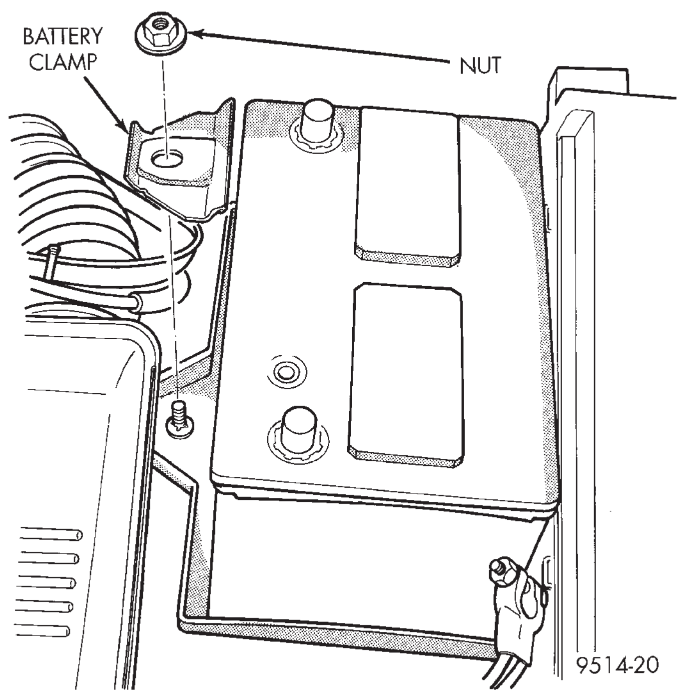


Fig. 118 Battery Clamp

(6) Rotate PDC toward center of vehicle to remove from rear bracket (Fig. 119).

(7) Pull PDC rearward to remove from front bracket. Lay PDC aside to allow access to Powertrain Control Module (PCM).

(8) Squeeze tabs on 40-way connector. Pull connector rearward to remove from PCM (Fig. 120). Remove both way connectors.

REMOVAL AND INSTALLATION (Continued)

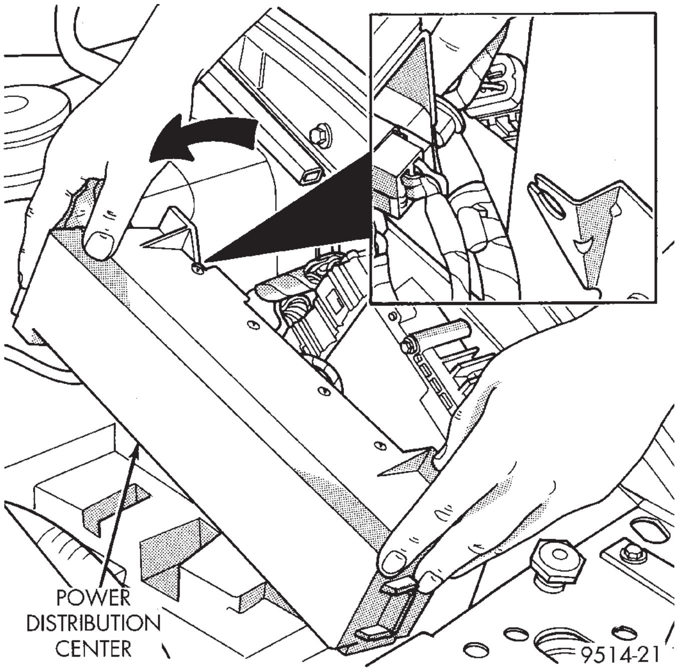


Fig. 119 PDC Rear Bracket

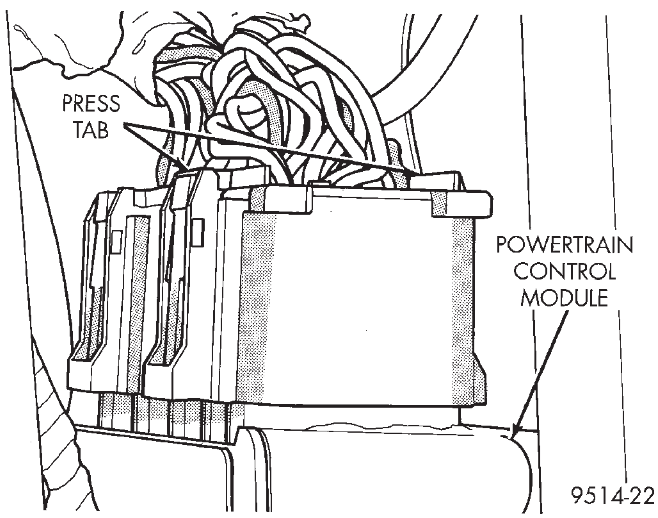


Fig. 120 PCM 40-Way Connectors

(9) Remove 3 screws holding PCM to fender (Fig. 121).

(10) Remove PCM from vehicle.

INSTALLATION

(1) Connect 2 40-Way electrical connectors to PCM (Fig. 120).

(2) Install PCM. Tighten mounting screws.

(3) Install PDC bracket.

(4) Install battery.

CRANKSHAFT POSITION SENSOR

For removal/installation procedures refer to group 8D - Ignition System, Service Procedures.

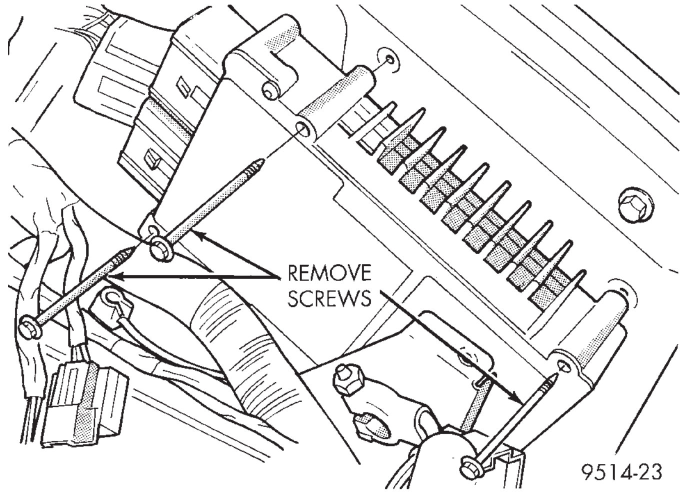


Fig. 121 PCM Removal/Installation

CAMSHAFT POSITION SENSOR

For removal/installation procedures refer to group 8D - Ignition System, Service Procedures.

UPSTREAM OXYGEN SENSOR

The oxygen sensor is installed in the exhaust manifold (Fig. 122) or (Fig. 123) or (Fig. 124).

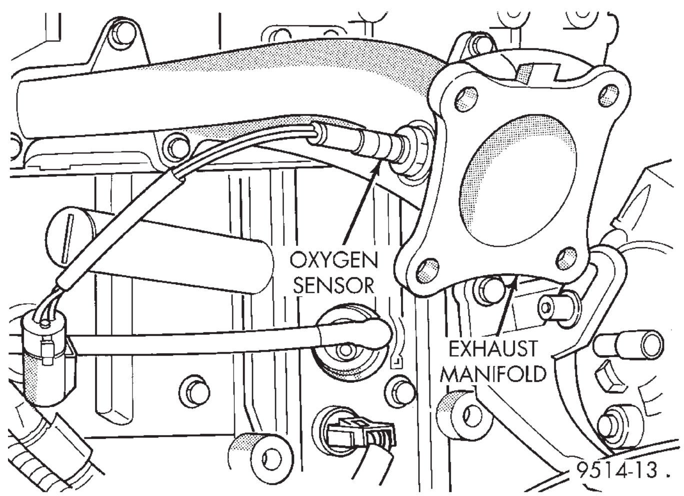


Fig. 122 Upstream Heated Oxygen Sensor—2.4L

CAUTION: Do not pull on the oxygen sensor wire when unplugging the electrical connector.

WARNING: THE EXHAUST MANIFOLD AND CATALYTIC CONVERTER MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

REMOVAL

(1) Raise and support vehicle.

(2) Unplug oxygen sensor electrical connector.

(3) Use a socket such as Snap-On YA8875 or equivalent to remove sensor.

REMOVAL AND INSTALLATION (Continued)

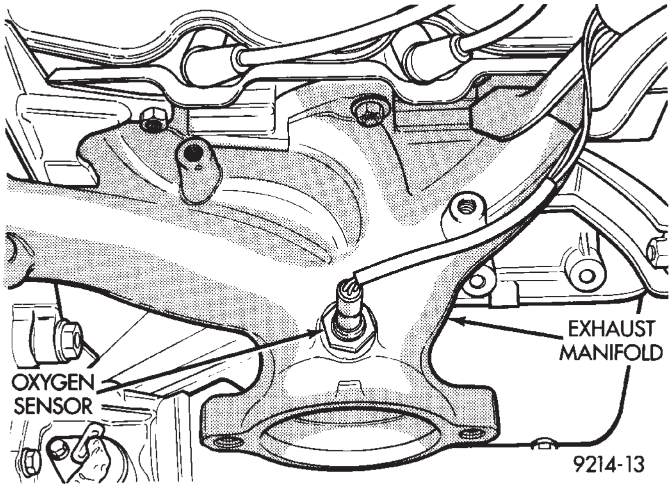


Fig. 123 Upstream Heated Oxygen Sensor—3.0L

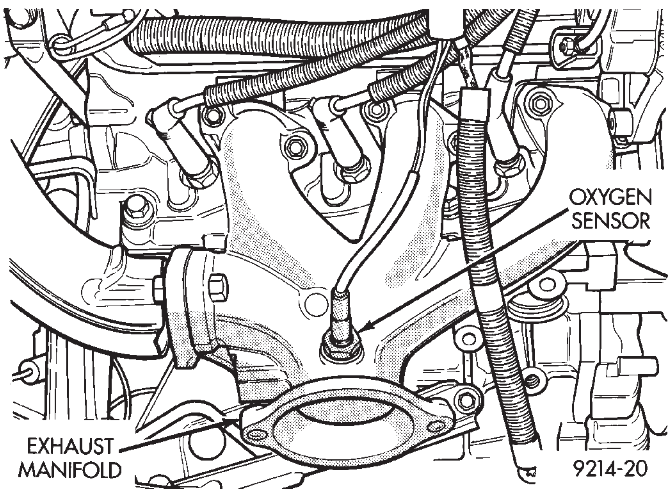


Fig. 124 Upstream Heated Oxygen Sensor—3.3/3.8L

(4) When the sensor is removed, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If using original sensor, coat the threads with Loctite 771-64 anti-seize compound or equivalent.

INSTALLATION

(1) Reverse removal procedure to install a new sensor.

New sensors are packaged with compound on the threads and no additional compound is required. The sensor must be tightened to 27 N·m (20 ft. lbs.) torque.

DOWNSTREAM OXYGEN SENSOR

REMOVAL

(1) Raise and support vehicle.

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

(2) Remove grommet cover to expose connector (Fig. 125).

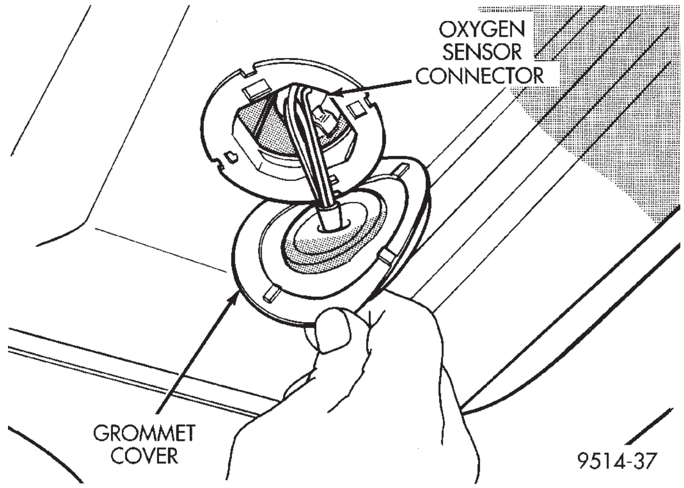


Fig. 125 Oxygen Sensor Grommet Cover

(3) Push locking tab back and unplug oxygen sensor electrical connector (Fig. 126).

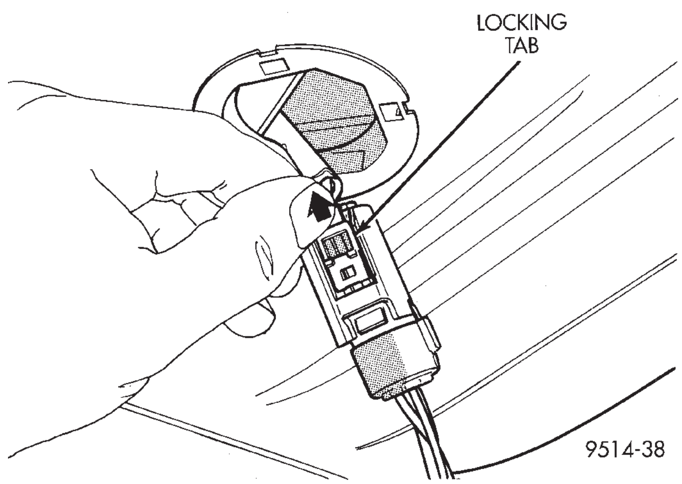


Fig. 126 Oxygen Sensor Connector Locking Tab

(4) Use a socket such as Snap-On YA8875 or equivalent to remove sensor (Fig. 127).

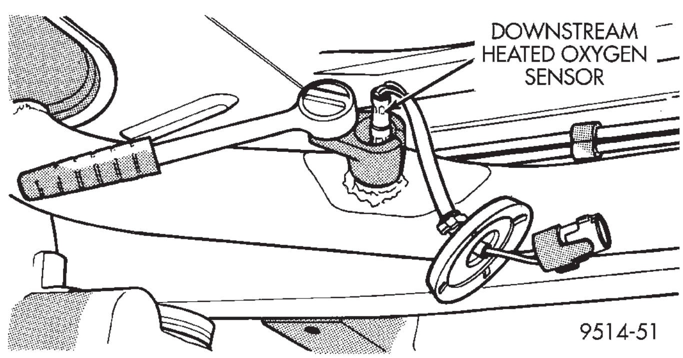


Fig. 127 Oxygen Sensor Removal/Installation

REMOVAL AND INSTALLATION (Continued)

(5) When the sensor is removed, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If using original sensor, coat the threads with Loctite 771-64 anti-seize compound or equivalent.

INSTALLATION

(1) Reverse removal procedure to install a new sensor.

New sensors are packaged with compound on the threads and no additional compound is required. The sensor must be tightened to 27 N·m (20 ft. lbs.) torque.

KNOCK SENSOR

For removal/installation procedures refer to Group 8D- Ignition System, Service Procedures.

AIR CLEANER ELEMENT

REMOVAL

(1) Remove 2 screws and air inlet resonator (Fig. 128).

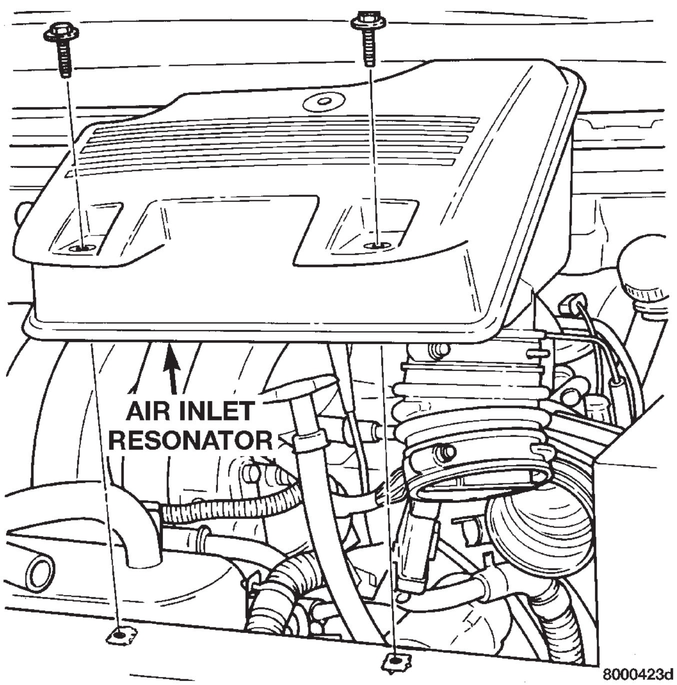


Fig. 128 Air Inlet Resonator

(2) Loosen 3 clamps holding air cleaner housing halves together.

(3) Remove left side of air cleaner housing (Fig. 129).

(4) Remove element from air cleaner housing (Fig. 130).

INSTALLATION

(1) Install a new element in housing.

(2) Position left side of housing.

(3) Snap clamps into place.

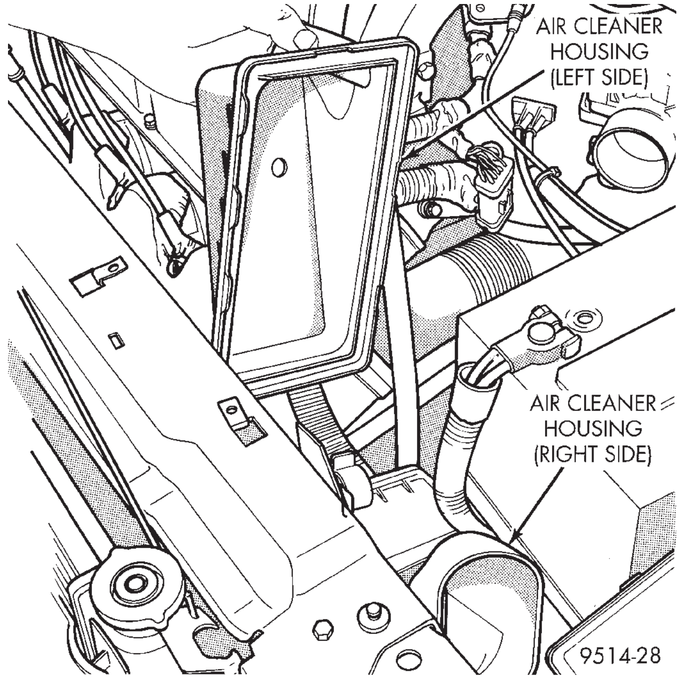


Fig. 129 Air Cleaner Housing (Left Side)

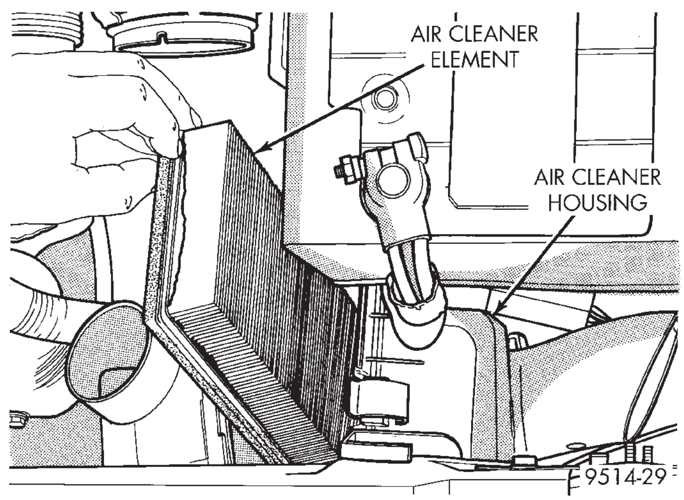


Fig. 130 Air Cleaner Element

(4) Install hoses and air inlet resonator.

ENGINE COOLANT TEMPERATURE SENSOR—2.4L

The coolant sensor threads into the top of the thermostat housing (Fig. 131). New sensors have sealant applied to the threads.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7- COOLING.

REMOVAL AND INSTALLATION (Continued)

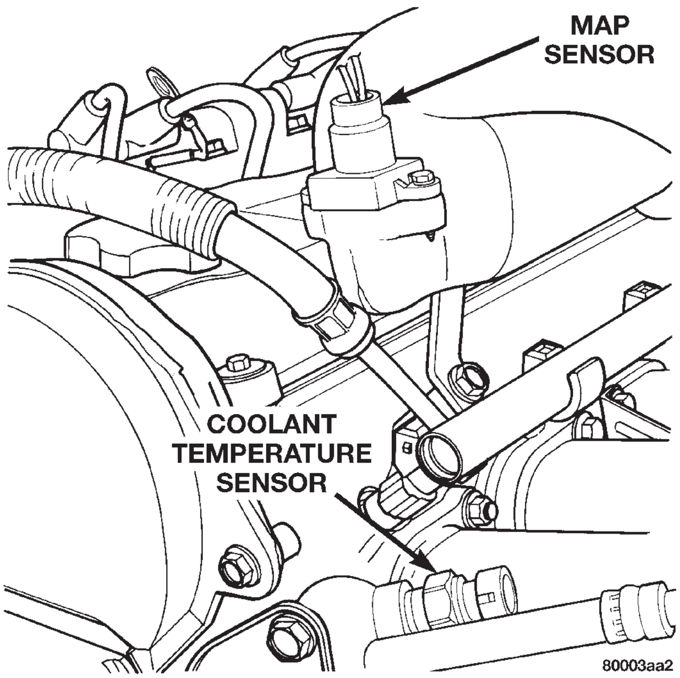


Fig. 131 Engine Coolant Temperature Sensor—2.4L

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 7 N·m (60 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

ENGINE COOLANT TEMPERATURE SENSOR—3.0L

The sensor is installed next to the thermostat housing (Fig. 114).

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7- COOLING.

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 7 N·m (60 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

ENGINE COOLANT TEMPERATURE SENSOR—3.3/3.8L

The sensor is installed next to the thermostat housing (Fig. 132).

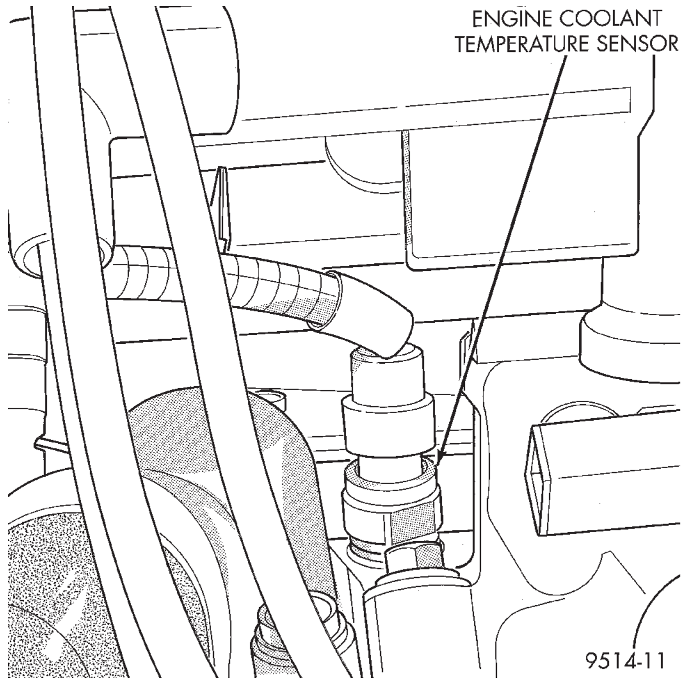


Fig. 132 Engine Coolant Temperature Sensor

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7- COOLING.

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 7 N·m (60 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

REMOVAL AND INSTALLATION (Continued)

INTAKE AIR TEMPERATURE SENSOR—2.4L

The intake air temperature sensor threads into the intake manifold plenum (Fig. 133).

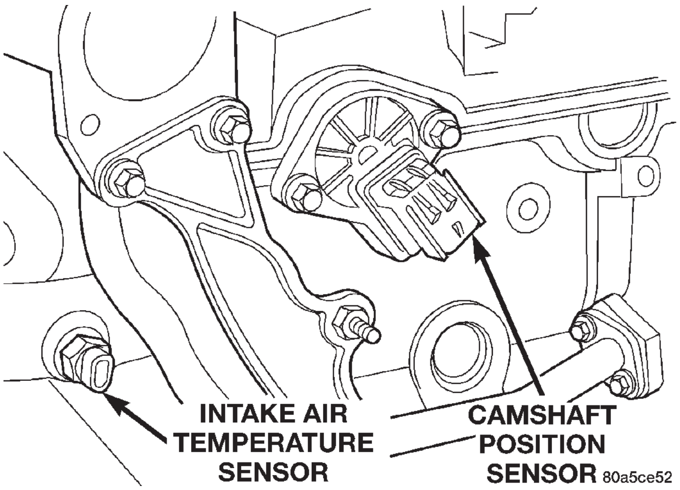


Fig. 133 Intake Air Temperature Sensor

REMOVAL

(1) Remove electrical connector from sensor.
(2) Remove sensor.

INSTALLATION

(1) Install sensor. Tighten sensor to 28 N·m (20 ft. lbs.) torque.
(2) Attach electrical connector to sensor.

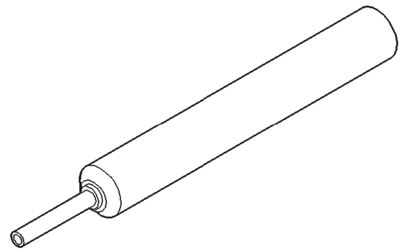
SPECIFICATIONS

TORQUE

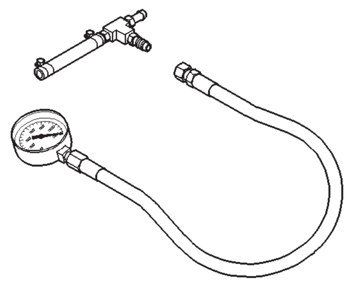
DESCRIPTION	TORQUE
Generator Brkt. to Intake Manifold Bolts—3.3/3.8L	54 N·m (40 ft. lbs.)
Coolant Sensor—2.4L	7 N·m (62 in. lbs.)
Coolant Sensor—3.0L	7 N·m (62 in. lbs.)
Coolant Sensor—3.3/3.8L	7 N·m (62 in. lbs.)
Cly. Head to Intake Manifold Strut Bolts—3.3/3.8L	54 N·m (40 ft. lbs.)
EGR Tube to Intake Manifold Screws	22 N·m (200 in. lbs.)
Idle Air Control Motor	2 N·m (18 in. lbs.)
Ignition Coil Fasteners	12 N·m (105 in. lbs.)
Intake Air Temperature Sensor	28 N·m (20 ft. lbs.)
MAP Sensor—2.4L	4 N·m (35 in. lbs.)
MAP Sensor—3.0L	4 N·m (35 in. lbs.)
MAP Sensor—3.3/3.8L	4 N·m (35 in. lbs.)
Upstream O2S	27 N·m (20 ft. lbs.)
Downstream O2S	27 N·m (20 ft. lbs.)
Throttle Body Bolts	26 N·m (225 in. lbs.)

SPECIAL TOOLS

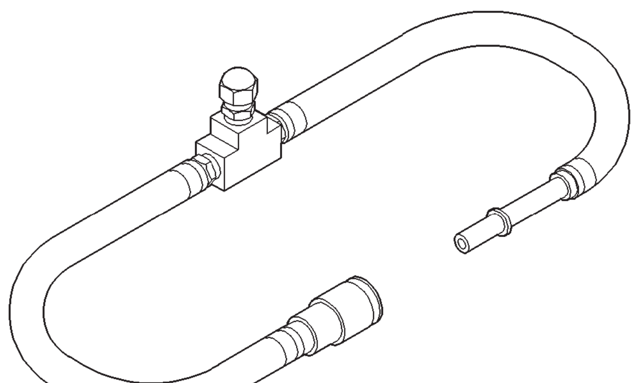
FUEL



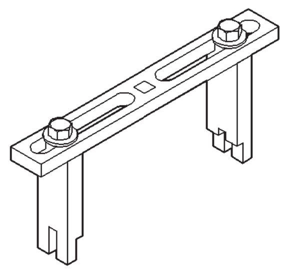
Extractor C–4334



Pressure Gauge Assembly C–4799–B

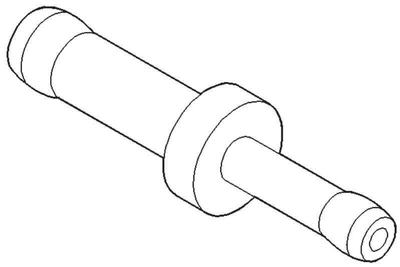


Fuel Pressure Test Adapter 6539

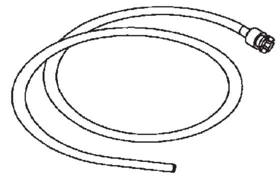


Spanner Wrench 6856

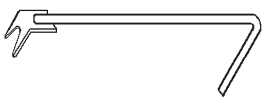
SPECIAL TOOLS (Continued)



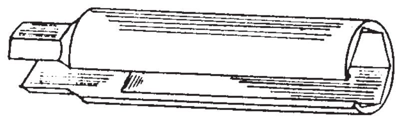
Metering Orifice



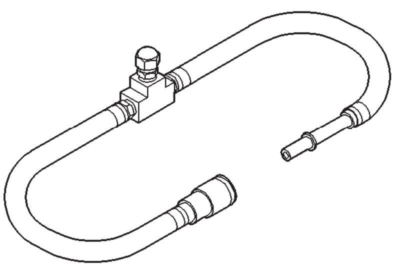
Fuel Line Adapter 1/4



Fuel Line Tool



O2S (Oxygen Sensor) Remover/Installer—C-4907



Fuel Line Adapter

FUEL SYSTEM—2.5L DIESEL ENGINE/2.0L GAS ENGINE

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GENERAL INFORMATION

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GENERAL INFORMATION

INTRODUCTION—2.5L DIESEL

Certain components of the fuel system on the 2.5L diesel engine are controlled by the Bosch Engine controller which is a Powertrain Control Module (PCM). Refer to Powertrain Control Module in the Fuel Injection System—2.5L Diesel Engine section of this group for a list of items controlled by the PCM. The Body Control Module (BCM) is mounted to a bracket located inside the vehicle under the dashpanel to the left of the steering column (Fig. 1). The PCM is mounted at the base of the center console in front of the Air Bag Module. (Fig. 2).

The **Fuel System** consists of: the fuel tank, fuel injection pump (engine mounted), fuel filter/water separator, fuel tank module, electrical fuel gauge sending unit, glow plugs, glow plug relay, PCM, and all the electrical components that control the fuel system. It also consists of fuel tubes/lines/hoses and fittings, vacuum hoses, and fuel injector(s).

A **Fuel Return System.** A separate fuel return system is used. This will route excess fuel: from the fuel injectors; through individual injector drain tubes; through the fuel injection pump overflow valve; and back to the fuel tank through a separate fuel line.

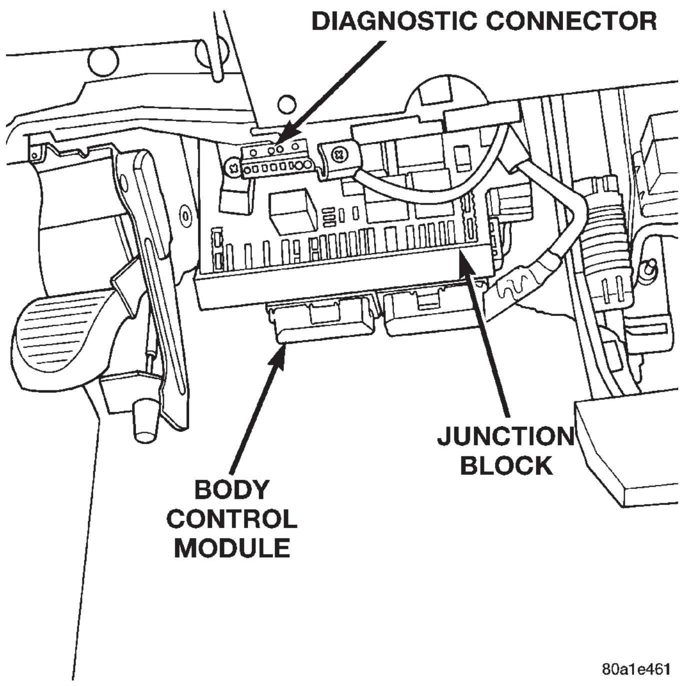

Fig. 1 BCM Location

The **Fuel Tank Assembly** consists of: the fuel tank, two pressure relief/rollover valves, fuel filler tube, fuel tank module containing a fuel gauge sending unit, and a pressure-vacuum filler cap.

GENERAL INFORMATION (Continued)

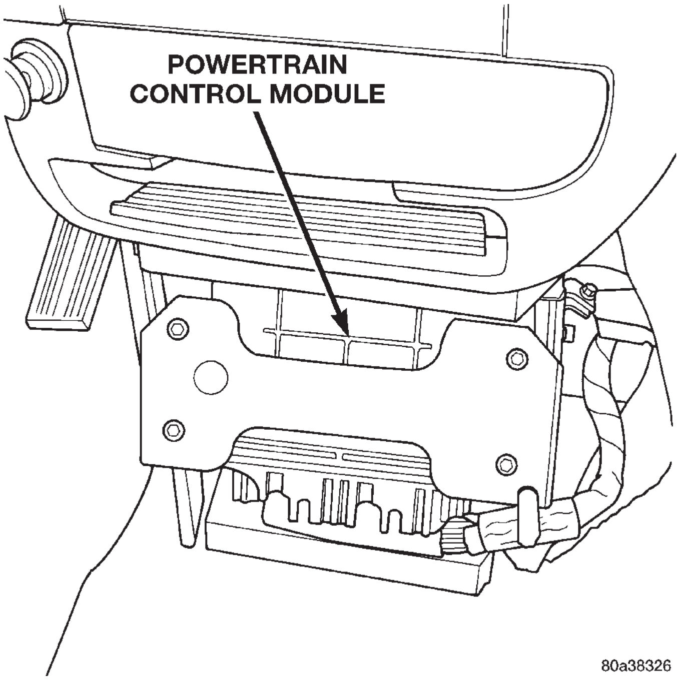

Fig. 2 PCM Location

INTRODUCTION—2.0L ENGINE

Refer to the introduction in group 14 for the 2.4/3.0/3.3/3.8l engines.

FUEL REQUIREMENTS—2.5L DIESEL

Refer to the Lubrication and Maintenance section of this manual for information. Also refer to the Owner Manual.

FUEL REQUIREMENTS—2.0L ENGINE

Your vehicle was designed to meet all emission regulations and provide excellent fuel economy when using high quality unleaded gasoline.

Use high quality unleaded gasoline with a minimum research octane rating of 91.

The vehicle will operate on fuels ranging from unleaded fuel having a minimum research octane of 91 to super unleaded fuel with a minimum research octane of 98.

GASOLINE/OXYGENATE BLENDS

Refer to Gasoline/Oxygenate blends for the 2.4/3.0/3.3/3.8l engines in group 14.

FUEL DELIVERY SYSTEM—2.5L DIESEL ENGINE

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DESCRIPTION AND OPERATION

INTRODUCTION

This Fuel Delivery section will cover components not controlled by the PCM. For components controlled by the PCM, refer to the Fuel Injection System—2.5L Diesel Engine section of this group.

The fuel heater relay, fuel heater and fuel gauge are not operated by the PCM. These components are controlled by the ignition (key) switch. All other fuel system electrical components necessary to operate the engine are controlled or regulated by the PCM.

FUEL SYSTEM PRESSURE WARNING

WARNING: HIGH–PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 45,000 KPA (6526 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH–PRESSURE FUEL LEAKS. INSPECT FOR HIGH–PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD (Fig. 1). HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

FUEL TANK

The fuel tank and tank mounting used with the diesel powered engine is the same as used with gasoline powered models, although the fuel tank module is different.

The fuel tank contains the fuel tank module and two rollover valves. Two fuel lines are routed to the fuel tank module. One line is used for fuel supply to the fuel filter/water separator. The other is used to return excess fuel back to the fuel tank.

The fuel tank module contains the fuel gauge electrical sending unit. **An electrical fuel pump is not used with the diesel engine.**

DESCRIPTION AND OPERATION (Continued)

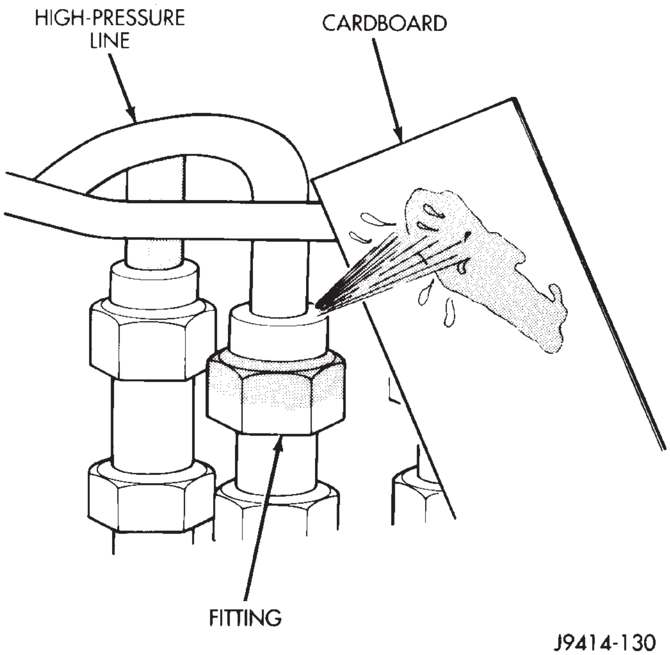


Fig. 1 Typical Fuel Pressure Test at Injector

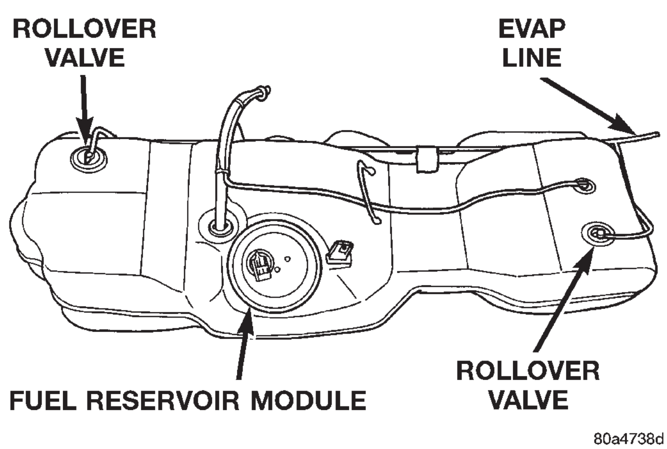


Fig. 2 Fuel Tank

FUEL TANK MODULE

An electric fuel pump is not attached to the fuel tank module for diesel powered engines. Fuel is supplied by the fuel injection pump.

The fuel tank module is installed in the top of the fuel tank (Fig. 2). The fuel tank module contains the following components:

- Fuel reservoir
- A separate in-tank fuel filter
- Electric fuel gauge sending unit
- Fuel supply line connection
- Fuel return line connection

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor (track). The track is used to send an electrical signal used for fuel gauge operation.

As the fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the fuel gauge on the instrument panel to read full. As the fuel level decreases, the float and arm move down. This increases the sending unit resistance, causing the fuel gauge on the instrument panel to read empty.

FUEL FILTER/WATER SEPARATOR

The fuel filter/water separator assembly is located in the engine compartment near the strut tower (Fig. 3).

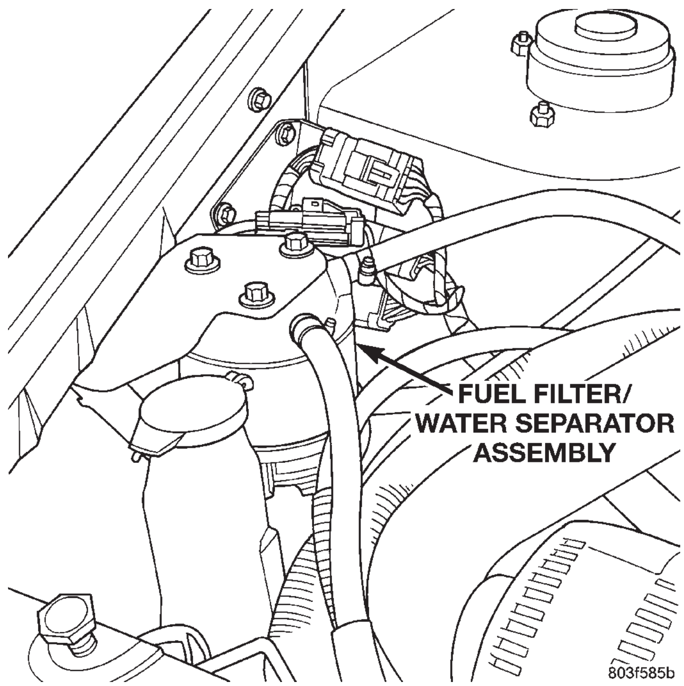


Fig. 3 Fuel Filter/Water Separator Location

The combination fuel filter/water separator protects the fuel injection pump by helping to remove water and contaminants from the fuel. Moisture collects at the bottom of the filter/separator in a plastic bowl.

The fuel filter/water separator assembly contains the fuel filter, fuel heater element, and fuel drain valve.

For information on the fuel heater, refer to Fuel Heater in this group.

Refer to the maintenance schedules in Group 0 in this manual for the recommended fuel filter replacement intervals.

DESCRIPTION AND OPERATION (Continued)

For periodic draining of water from the bowl, refer to Fuel Filter/Water Separator Removal/Installation in this group.

FUEL SHUTDOWN SOLENOID

The fuel shutdown solenoid is controlled and operated by the PCM.

The fuel shutdown (shut-off) solenoid is used to electrically shut off the diesel fuel supply to the high-pressure fuel injection pump. The solenoid is mounted to the rear of the injection pump (Fig. 4).

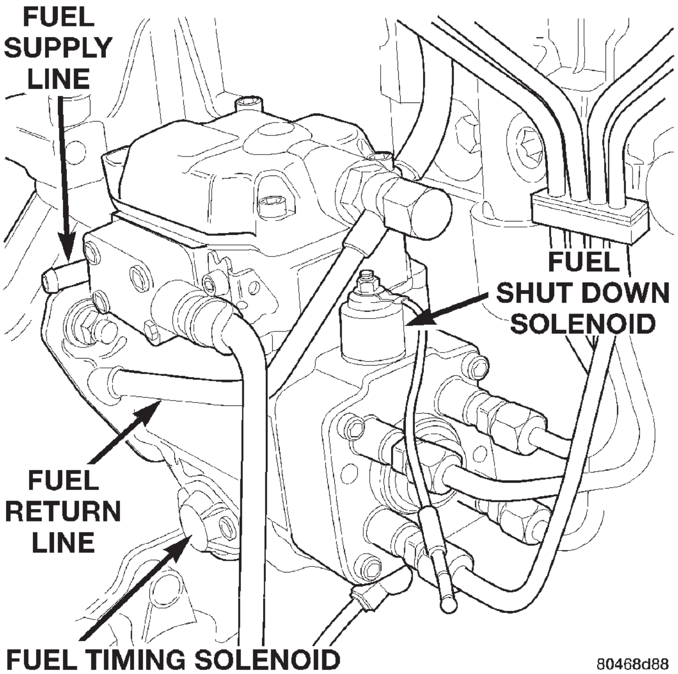


Fig. 4 Fuel Shutdown Solenoid and Overflow Valve Location

The solenoid controls starting and stopping of the engine regardless of the position of the accelerator pedal. When the ignition (key) switch is OFF, the solenoid is shut off and fuel flow is not allowed to the fuel injection pump. When the key is placed in the ON or START positions, fuel supply is allowed at the injection pump.

FUEL INJECTION PUMP

The fuel injection pump is a mechanical distributor–type, Bosch VP36 series (Fig. 5). A gear on the end of the injection pump shaft meshes with the drive gear at the front of engine. The pump is mechanically timed, relative to the position of the cam and crankshaft. The PCM can make adjustments to the timing of the injection pump.

The injection pump contains the fuel shutdown solenoid, fuel temperature sensor, control sleeve sensor, fuel quantity actuator and the fuel timing solenoid (Fig. 5).

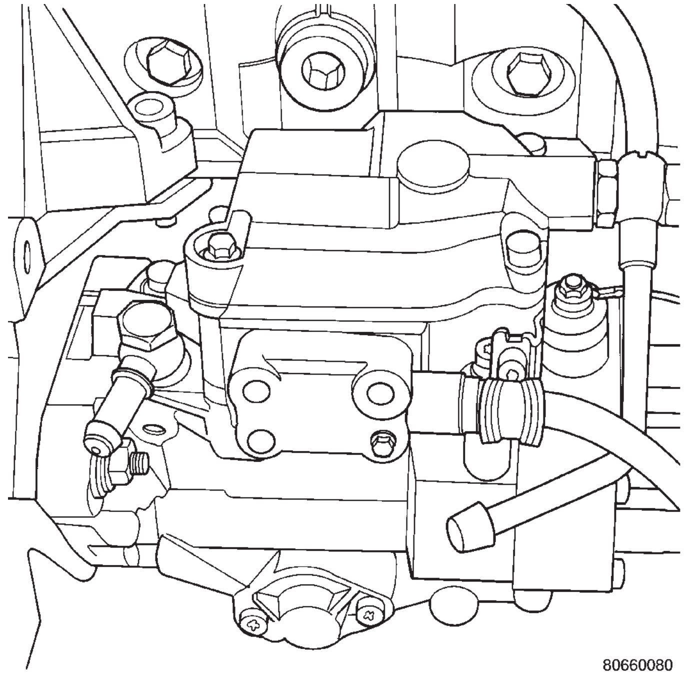


Fig. 5 Fuel Injection Pump

In the electronically controlled injection pump, the pump plunger works the same as the pump plunger in a mechanically controlled injection pump, but the amount of fuel and the time the fuel is injected is controlled by the vehicle's PCM, instead of by a mechanical governor assembly. A solenoid controlled by the PCM is used in place of the mechanical governor assembly, and it moves a control sleeve inside the pump that regulates the amount of fuel being injected. There is no mechanical connection between the accelerator pedal and the electronically controlled injection pump. Instead, a sensor connected to the accelerator pedal sends a signal to the PCM that represents the actual position of the accelerator pedal. The PCM uses this input, along with input from other sensors to move the control sleeve to deliver the appropriate amount of fuel. This system is known as “Drive-By-Wire”

The actual time that the fuel is delivered is very important to the diesel combustion process. The PCM monitors outputs from the engine speed sensor (flywheel position in degrees), and the fuel injector sensor (mechanical movement within the #1 cylinder fuel injector). Outputs from the Accelerator Pedal Position sensor, engine speed sensor (engine rpm) and engine coolant temperature sensor are also used. The PCM will then compare its set values to these outputs to electrically adjust the amount of fuel timing (amount of advance) within the injection pump. This is referred to as “Closed Loop” operation. The PCM monitors fuel timing by comparing its set value to when the injector #1 opens. If the value is greater than a preset value a fault will be set.

DESCRIPTION AND OPERATION (Continued)

Actual electric fuel timing (amount of advance) is accomplished by the fuel timing solenoid mounted to the bottom of the injection pump (Fig. 5). Fuel timing will be adjusted by the PCM, which controls the fuel timing solenoid.

An overflow valve is attached into the fuel return line at the rear of the fuel injection pump (Fig. 4). This valve serves two purposes. One is to ensure that a certain amount of residual pressure is maintained within the pump when the engine is switched off. This will prevent the fuel timing mechanism within the injection pump from returning to its zero position. The other purpose is to allow excess fuel to be returned to the fuel tank through the fuel return line. The pressure values within this valve are preset and can not be adjusted.

The fuel injection pump supplies high–pressure fuel of approximately 45,000 kPa (6526 psi) to each injector in precise metered amounts at the correct time.

For mechanical injection pump timing, refer to Fuel Injection Pump Timing in the Service Procedures section of this group.

FUEL INJECTORS

Fuel drain tubes (Fig. 6) are used to route excess fuel back to the overflow valve (Fig. 4) at the rear of the injection pump. This excess fuel is then returned to the fuel tank through the fuel return line.

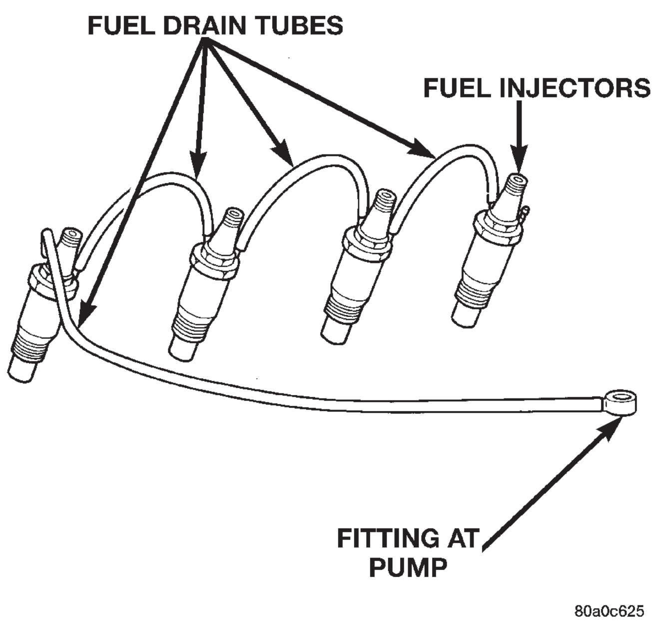


Fig. 6 Fuel Injectors and Drain Tubes

The injectors are connected to the fuel injection pump by the high– pressure fuel lines. A separate injector is used for each of the four cylinders. An injector containing a sensor (Fig. 7) is used on the cylinder number one injector. This injector is called instrumented injector #1 or needle movement sensor. It is used to tell the PCM when the #1 injector's internal spring-loaded valve seat has been forced open by pressurized fuel being delivered to the cylinder, which is at the end of its compression stroke. When the instrumented injector's valve seat is force open, it sends a small voltage spike pulse to the PCM. This tells the PCM that the engine is at TDC on the number one cylinder. It is not used with the other three injectors.

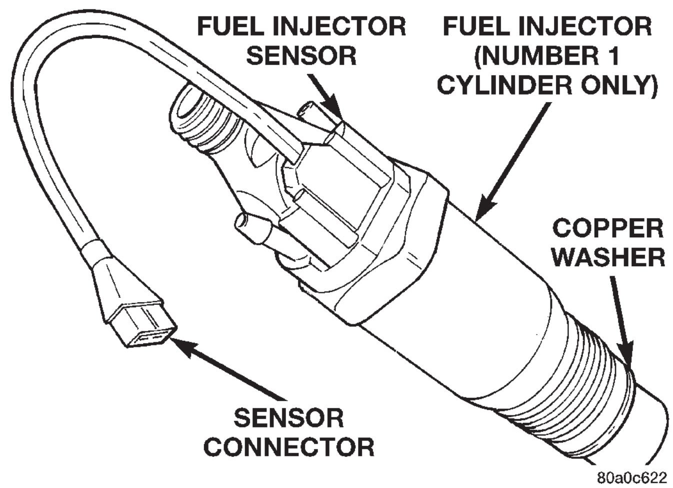


Fig. 7 Fuel Injector Sensor

Fuel enters the injector at the fuel inlet (top of injector) and is routed to the needle valve bore. When fuel pressure rises to approximately 15,000–15,800 kPa (2175–2291 psi), the needle valve spring tension is overcome. The needle valve rises and fuel flows through the spray holes in the nozzle tip into the combustion chamber. The pressure required to lift the needle valve is the injector opening pressure setting. This is referred to as the "pop-off" pressure setting.

Fuel pressure in the injector circuit decreases after injection. The injector needle valve is immediately closed by the needle valve spring and fuel flow into the combustion chamber is stopped. Exhaust gases are prevented from entering the injector nozzle by the needle valve.

A copper washer (gasket) is used at the base of each injector (Fig. 7) to prevent combustion gases from escaping.

Fuel injector firing sequence is 1–3–4–2.

FUEL TUBES/LINES/HOSES AND CLAMPS—LOW-PRESSURE TYPE

Also refer to the proceeding section on Quick–Connect Fittings.

Inspect all hose connections such as clamps, couplings and fittings to make sure they are secure and

DESCRIPTION AND OPERATION (Continued)

leaks are not present. The component should be replaced immediately if there is any evidence of degradation that could result in failure.

Never attempt to repair a plastic fuel line/tube or a quick–connect fitting. Replace complete line/tube as necessary.

Avoid contact of any fuel tubes/hoses with other vehicle components that could cause abrasions or scuffing. Be sure that the fuel lines/tubes are properly routed to prevent pinching and to avoid heat sources.

The lines/tubes/hoses are of a special construction. If it is necessary to replace these lines/tubes/hoses, use only original equipment type.

The hose clamps used to secure the rubber hoses 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 fuel leaks.

Where a rubber hose is joined to a metal tube (staked), do not attempt to repair. Replace entire line/tube assembly.

Use new original equipment type hose clamps. Tighten hose clamps to 2 N·m (20 in. lbs.) torque.

QUICK-CONNECT FITTINGS—LOW PRESSURE TYPE

Different types of quick-connect fittings are used to attach various fuel system components. These are: a single-tab type, a two-tab type or a plastic retainer ring type (Fig. 8). Refer to Quick-Connect Fittings in the Removal/Installation section for more information.

CAUTION: The interior components (o-rings, spacers) of quick-connect fitting are not serviced separately, but new pull tabs are available for some types. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

HIGH-PRESSURE FUEL LINES

CAUTION: The high–pressure fuel lines must be held securely in place in their holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

High–pressure fuel lines deliver fuel under pressure of up to approximately 45,000 kPa (6526 PSI) from the injection pump to the fuel injectors. The

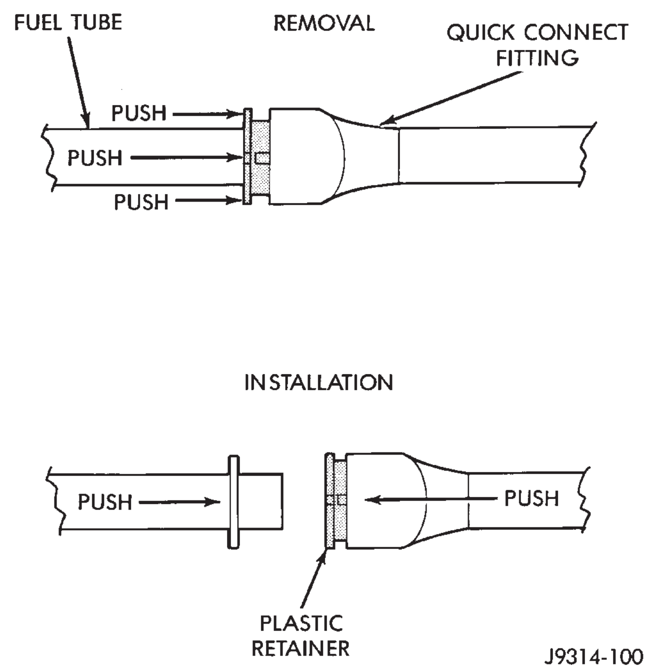


Fig. 8 Plastic Retainer Ring-Type Fitting

lines expand and contract from the high–pressure fuel pulses generated during the injection process. All high–pressure fuel lines are of the same length and inside diameter. Correct high–pressure fuel line usage and installation is critical to smooth engine operation.

WARNING: USE EXTREME CAUTION WHEN INSPECTING FOR HIGH–PRESSURE FUEL LEAKS. INSPECT FOR HIGH–PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

FUEL DRAIN TUBES

These rubber tubes are low–pressure type.

Some excess fuel is continually vented from the fuel injection pump. During injection, a small amount of fuel flows past the injector nozzle and is not injected into the combustion chamber. This fuel drains into the fuel drain tubes (Fig. 9) and back to the tee banjo fitting, which is connected to the same line as the overflow valve, which allows a variable quantity to return to the fuel tank. The overflow valve is calibrated to open at a preset pressure. Excess fuel not required by the pump to maintain the minimum pump cavity pressure is then returned through the overflow valve and on to the fuel tank through the fuel return line.

DESCRIPTION AND OPERATION (Continued)

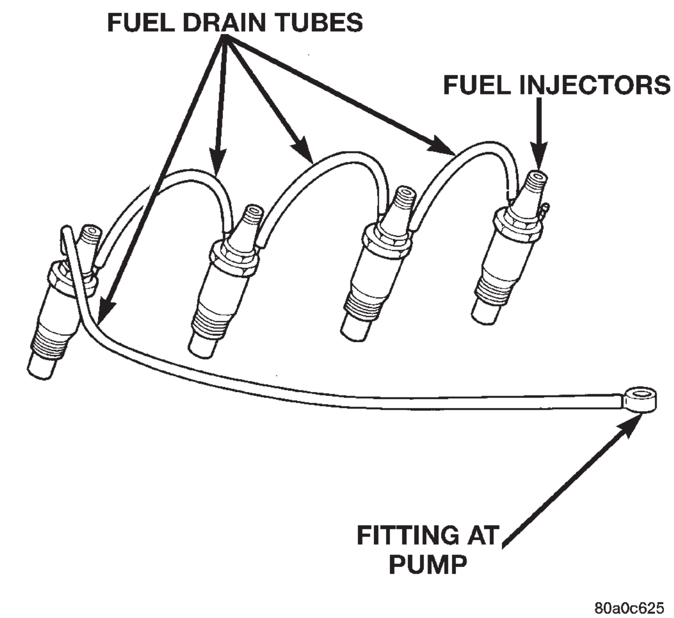


Fig. 9 Fuel Drain Tubes

FUEL HEATER

The fuel heater is used to prevent diesel fuel from waxing during cold weather operation. The fuel heater is located in the bottom plastic bowl of the fuel filter/water separator (Fig. 10).

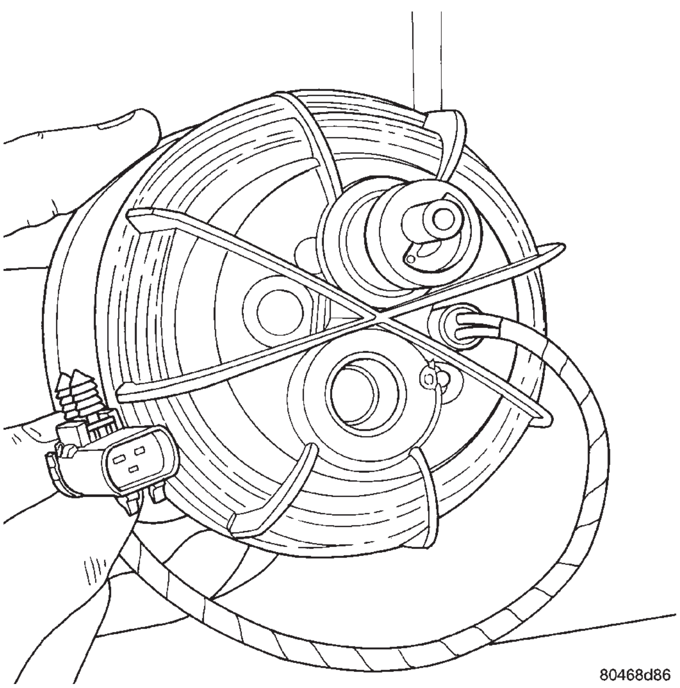


Fig. 10 Fuel Heater Temperature Sensor and Element Location

The element inside the heater assembly is made of a Positive Temperature Coefficient (PTC) material, and has power applied to it by the fuel heater relay anytime the ignition key is in the "on" position. PTC material has a high resistance to current flow when its temperature is high, which means that it will not generate heat when the temperature is above a certain value. When the temperature is below 7°C (45° F), the resistance of the PTC element is lowered, and allows current to flow through the fuel heater element warming the fuel. When the temperature is above 29°C (85° F), the PTC element's resistance rises, and current flow through the heater element stops.

Voltage to operate the fuel heater is supplied from the ignition (key) switch and through the fuel heater relay. Refer to the following Fuel Heater Relay for additional information. **The fuel heater and fuel heater relay are not controlled by the Powertrain Control Module (PCM).**

Current draw for the heater element is 150 watts at 14 volts (DC).

FUEL HEATER RELAY

Voltage to operate the fuel heater is supplied from the ignition (key) switch through the fuel heater relay. **The PCM is not used to control this relay.**

The fuel heater relay is located in the PDC. The PDC is located next to the battery in the engine compartment (Fig. 11). For the location of the relay within the PDC, refer to label on PDC cover.

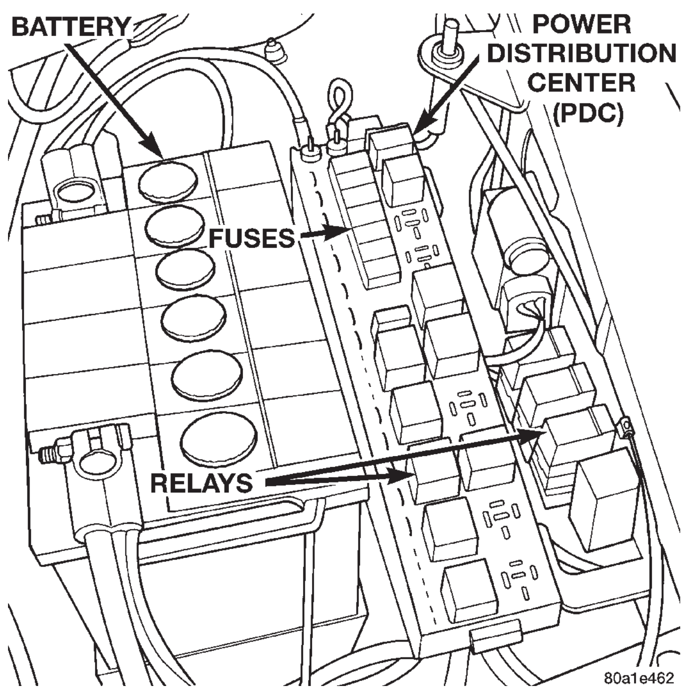


Fig. 11 Relay Location

WASTEGATE (TURBOCHARGER)

Refer to Group 11, Exhaust System and Intake Manifold for information.

DIAGNOSIS AND TESTING

GENERAL INFORMATION

This section of the group will cover a general diagnosis of diesel engine fuel system components.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

The PCM must be tested with the DRBIII scan tool. The DRBIII should be the first step in any diagnosis of engine performance complaints. Refer to the 1997 GS 2.5L Diesel Powertrain Diagnostic Procedures manual for diagnosis and testing of the diesel engine control system.

VISUAL INSPECTION

A visual inspection for loose, disconnected, or incorrectly routed wires and hoses should be made before attempting to diagnose or service the diesel fuel injection system. A visual check will help find these conditions. It also saves unnecessary test and diagnostic time. A thorough visual inspection of the fuel injection system includes the following checks:

(1) Be sure that the battery connections are tight and not corroded.

(2) Be sure that the 68 way connector is fully engaged with the PCM (Fig. 12).

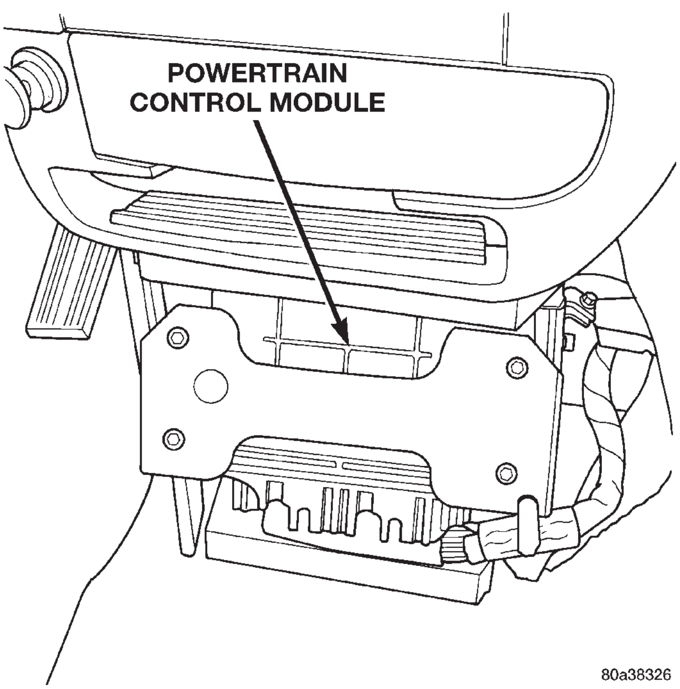


Fig. 12 PCM Location—Typical

(3) Verify that the electrical connections for the Diesel PCM relay are clean and free of corrosion. This relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

(4) Verify that the electrical connections for the fuel heater relay are clean and free of corrosion. This relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

(5) Be sure the electrical connectors at the ends of the glow plugs (Fig. 13) are tight and free of corrosion.

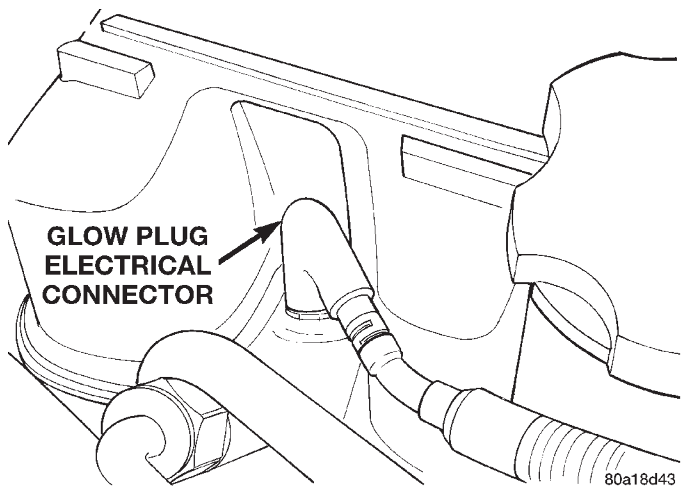


Fig. 13 Glow Plug Connector

(6) Be sure that the electrical connections at the glow plug relay are tight and not corroded. The glow plug relay is located in the engine compartment on the left–inner fender (Fig. 14).

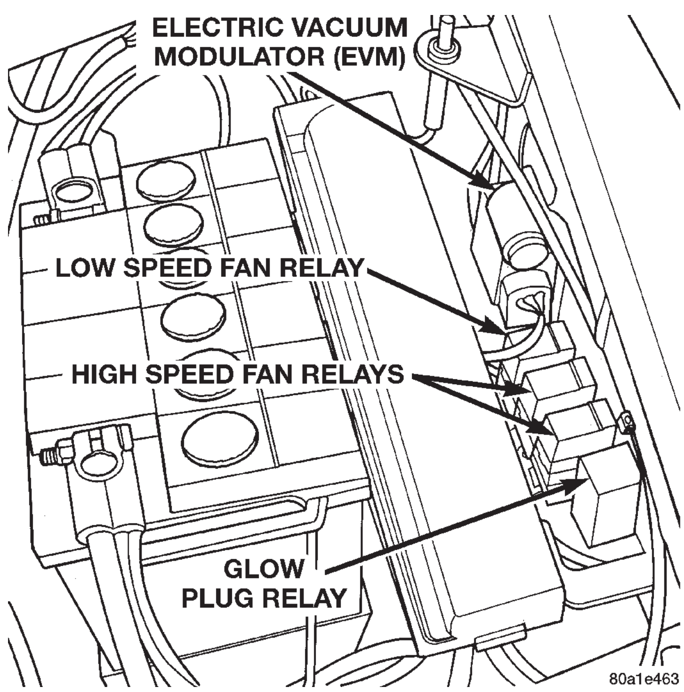


Fig. 14 Glow Plug Relay Location

DIAGNOSIS AND TESTING (Continued)

(7) Inspect the starter motor and starter solenoid connections for tightness and corrosion.

(8) Verify that the electrical connector is firmly connected to the fuel shutdown solenoid. Inspect the connector for corrosion or damaged wires. The solenoid is mounted to the rear of the injection pump (Fig. 15).

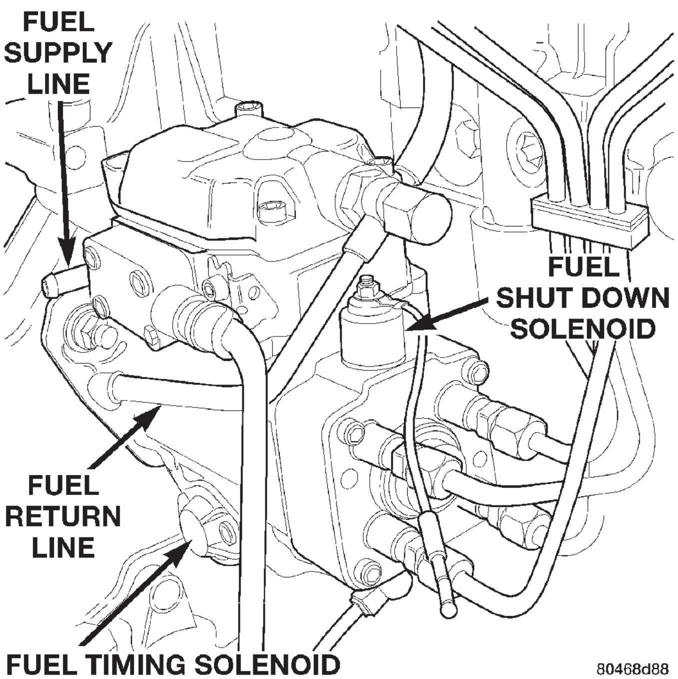


Fig. 15 Fuel Shutdown Solenoid Location

(9) Verify that the fuel heater electrical connector is firmly attached to the filter bowl at the bottom of the fuel filter/water separator. Inspect the connector for corrosion or damaged wires.

(10) Verify that the electrical pigtail connector (sensor connector) (Fig. 16) for the fuel injector sensor is firmly connected to the engine wiring harness. Inspect the connector for corrosion or damaged wires. This sensor is used on the #1 cylinder injector only.

(11) Verify that the electrical pigtail connector (sensor connector) (Fig. 17) for the fuel timing solenoid is firmly connected to the engine wiring harness. Inspect the connector for corrosion or damaged wires. The fuel timing solenoid is located on the bottom of the fuel injection pump (Fig. 17).

(12) Inspect for exhaust system restrictions such as pinched exhaust pipes or a collapsed or plugged muffler.

(13) Verify that the harness connector is firmly connected to the vehicle speed sensor (Fig. 18).

(14) Verify turbocharger wastegate operation. Refer to Group 11, Exhaust System and Intake Manifold Group for information.

(15) Verify that the harness connector is firmly connected to the engine coolant temperature sensor.

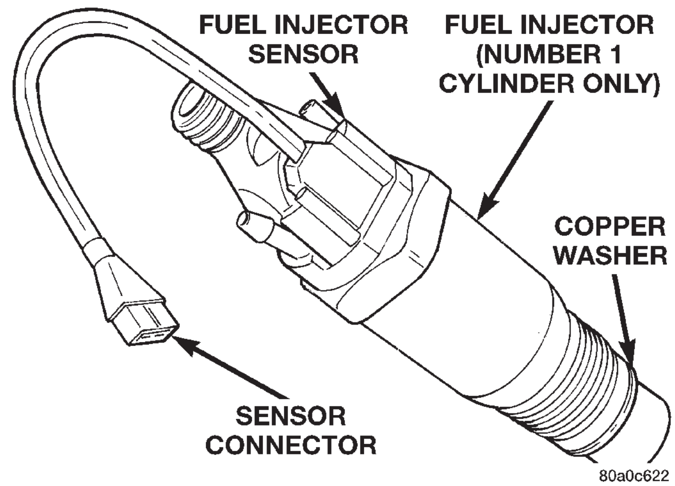


Fig. 16 Fuel Injector Sensor

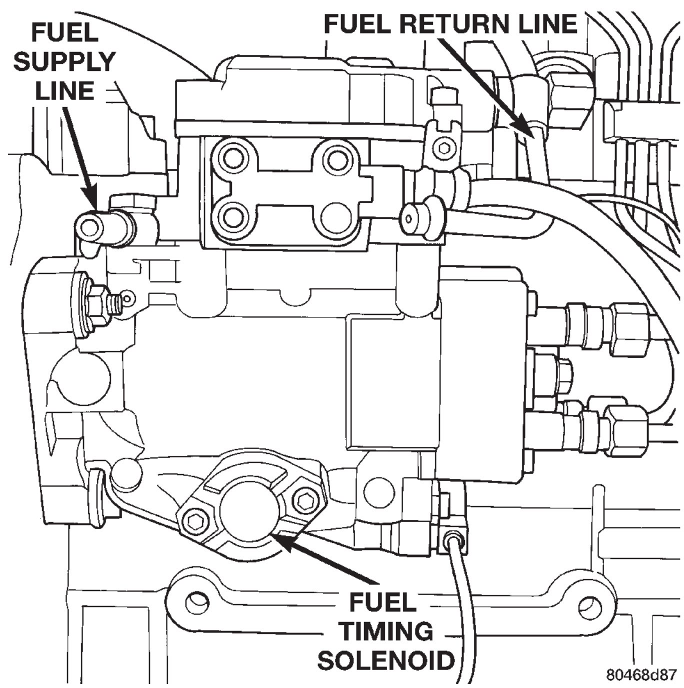


Fig. 17 Fuel Timing Solenoid

The sensor is located on the side of cylinder head near the rear of fuel injection pump (Fig. 19).

(16) Check for air in the fuel system. Refer to the Air Bleed Procedure.

(17) Inspect all fuel supply and return lines for signs of leakage.

(18) Be sure that the ground connections are tight and free of corrosion. Refer to Group 8, Wiring for locations of ground connections.

(19) Inspect the air cleaner element (filter) for restrictions.

(20) Be sure that the turbocharger output hose is properly connected to the charge air cooler (intercooler) inlet tube. Verify that the charge air cooler output hose is properly connected to the cooler and

DIAGNOSIS AND TESTING (Continued)

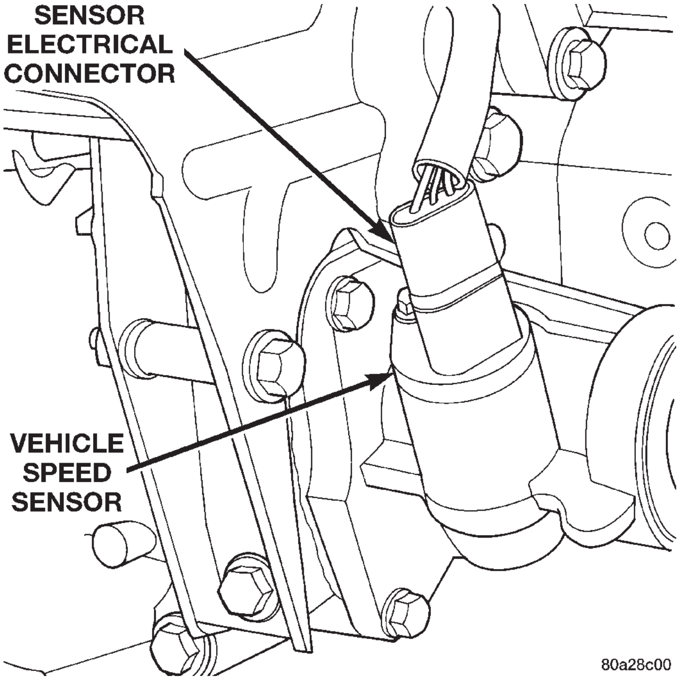


Fig. 18 Vehicle Speed Sensor—Typical

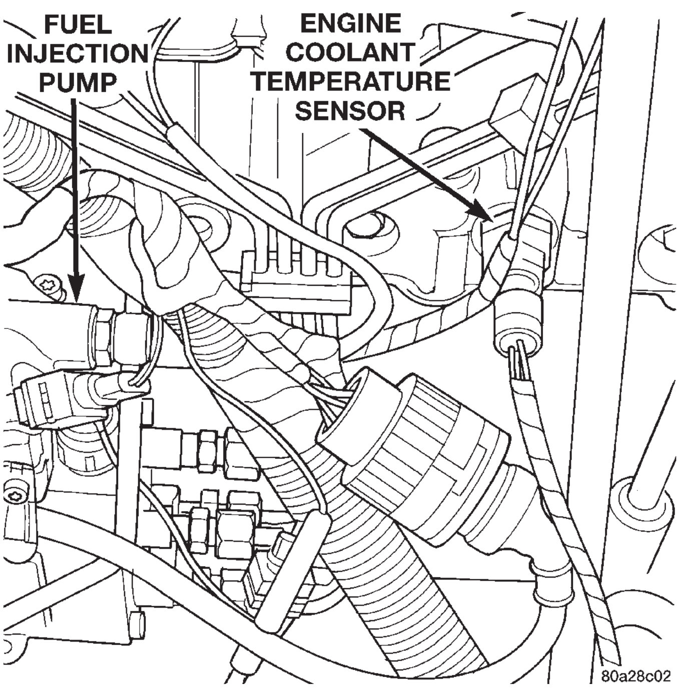


Fig. 19 Engine Coolant Temperature Sensor Location

the intake manifold. Refer to Group 11, Exhaust System and Intake Manifold for information.

(21) Be sure that the vacuum hoses to the vacuum pump are connected and not leaking. The pump is located on the front of engine (internal) and is driven from the crankshaft gear and chain (Fig. 20). Disconnect the hose and check for minimum vacuum from the pump. Refer to Group 5, Brake System for specifications and procedures.

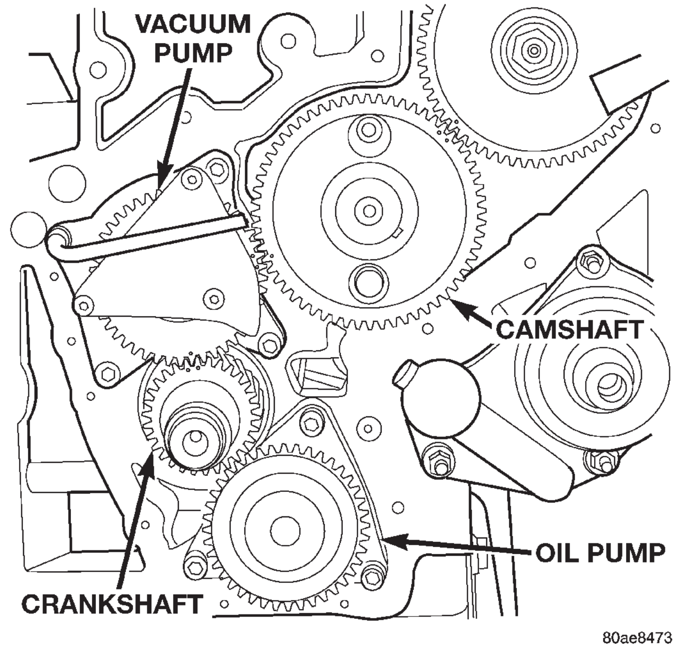


Fig. 20 Vacuum Pump at Front of Engine

(22) Be sure that the accessory drive belt is not damaged or slipping.

(23) Verify there is a good connection at the engine speed sensor. Refer to the Fuel Injection System in this section for location of the engine speed sensor location.

(24) Verify there is a good connection at the Mass Air Flow Sensor, which is a part of the air intake assembly.

AIR IN FUEL SYSTEM

Air will enter the fuel system whenever the fuel supply lines, fuel filter/water separator, fuel filter bowl, injection pump, high–pressure lines or injectors are removed or disconnected. Air will also enter the fuel system whenever the fuel tank has been run empty.

Air trapped in the fuel system can result in hard starting, a rough running engine, engine misfire, low power, excessive smoke and fuel knock. After service is performed, air must be bled from the system before starting the engine.

Inspect the fuel system from the fuel tank to the injectors for loose connections. Leaking fuel is an indicator of loose connections or defective seals. Air can also enter the fuel system between the fuel tank and the injection pump. Inspect the fuel tank and fuel lines for damage that might allow air into the system.

For air bleeding, refer to Air Bleed Procedure in the Service Procedures section of this group.

DIAGNOSIS AND TESTING (Continued)

FUEL HEATER RELAY TEST

The fuel heater relay is located in the Power Distribution Center (PDC). Refer to Relays—Operation/ Testing in Fuel Ingection System section of this group for test procedures.

FUEL INJECTOR TEST

The fuel injection nozzels, located on the engine cylinder head, spray fuel under high pressure into the individual combustion chambers. Pressurized fuel, delivered by the fuel injection pump, unseats a spring-loaded needle valve inside the injector, and the fuel is atomized as it escapes through the injector opening into the engine's combustion chamber. If the fuel injector does not operate properly, the engine may misfire, or cause other driveability problems.

A leak in the injection pump–to–injector high–pressure fuel line can cause many of the same symptoms as a malfunctioning injector. Inspect for a leak in the high–pressure lines before checking for a malfunctioning fuel injector.

WARNING: THE INJECTION PUMP SUPPLIES HIGH––PRESSURE FUEL OF UP TO APPROXIMATELY 45,000 KPA (6526 PSI) TO EACH INDIVIDUAL INJECTOR THROUGH THE HIGH–PRESSURE LINES. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE THE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING. AVOID CONTACT WITH FUEL SPRAY WHEN BLEEDING HIGH–PRESSURE FUEL LINES.

WARNING: DO NOT BLEED AIR FROM THE FUEL SYSTEM OF A HOT ENGINE. DO NOT ALLOW FUEL TO SPRAY ONTO THE EXHAUST MANIFOLD WHEN BLEEDING AIR FROM THE FUEL SYSTEM.

To determine which fuel injector is malfunctioning, run the engine and loosen the high–pressure fuel line nut at the injector (Fig. 21). Listen for a change in engine speed. If engine speed drops, the injector was operating normally. If engine speed remains the same, the injector may be malfunctioning. After testing, tighten the line nut to 30 N·m (22 ft. lbs.) torque. Test all injectors in the same manner one at a time.

Once an injector has been found to be malfunctioning, remove it from the engine and test it. Refer to the Removal/Installation section of this group for procedures.

After the injector has been removed, install it to a bench–mount injector tester. Refer to operating instructions supplied with tester for procedures.

The opening pressure or "pop" pressure should be 15,000–15,800 kPa (2175–2291 psi). If the fuel injector needle valve is opening ("popping") to early or to late, replace the injector.

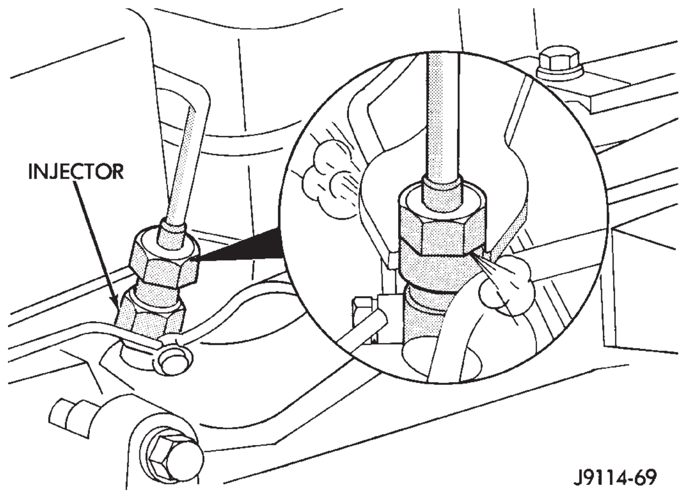


Fig. 21 Typical Inspection of Fuel Injector

FUEL INJECTOR SENSOR TEST

The fuel injector sensor is used only on the fuel injector for the number–1 cylinder (Fig. 22). It is not used on the injectors for cylinders number 2, 3, or 4.

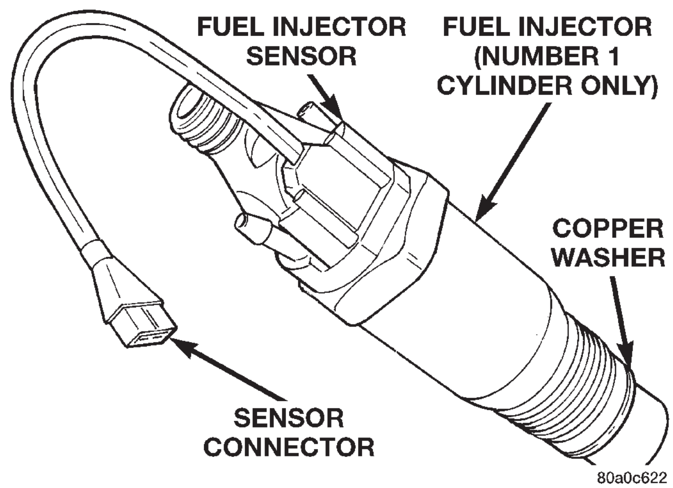


Fig. 22 Fuel Injector Sensor Location

To test the sensor, unplug the sensor connector (Fig. 22) from the engine wiring harness. Check resistance across terminals. Resistance should be 110 ohms ± 10 ohms at 20°C (68°F). Replace sensor if specification cannot be met.

FUEL INJECTION PUMP TEST

The injection pump is not to be serviced or the warranty may be voided. If the injection pump requires service, the complete assembly must be replaced.

Incorrect injection pump timing (mechanical or electrical) can cause poor performance, excessive smoke and emissions and poor fuel economy.

DIAGNOSIS AND TESTING (Continued)

A defective fuel injection pump, defective fuel timing solenoid or misadjusted mechanical pump timing can cause starting problems or prevent the engine from revving up. It can also cause:

- Engine surge at idle
- Rough idle (warm engine)
- Low power
- Excessive fuel consumption
- Poor performance
- Low power
- Black smoke from the exhaust
- Blue or white fog like exhaust
- Incorrect idle or maximum speed

The electronically controlled fuel pump has no mechanical governor like older mechanically controlled fuel pumps. Do not remove the top cover of the fuel pump, or the screws fastening the wiring pigtail to the side of the pump. **The warranty of the injection pump and the engine may be void if those seals have been removed or tampered with.**

FUEL SUPPLY RESTRICTIONS

LOW–PRESSURE LINES

Restricted or Plugged supply lines or fuel filter can cause a timing fault that will cause the PCM to operate the engine in a “Limp Home” mode. See the introduction of the Fuel Injection System in this group for more information on the Limp Home mode. Fuel supply line restrictions can cause starting problems and prevent the engine from revving up. The starting problems include; low power and blue or white fog like exhaust. Test all fuel supply lines for restrictions or blockage. Flush or replace as necessary. Bleed the fuel system of air once a fuel supply line has been replaced. Refer to the Air Bleed Procedure section of this group for procedures.

HIGH–PRESSURE LINES

Restricted (kinked or bent) high–pressure lines can cause starting problems, poor engine performance and black smoke from exhaust.

Examine all high–pressure lines for any damage. Each radius on each high–pressure line must be smooth and free of any bends or kinks.

Replace damaged, restricted or leaking high–pressure fuel lines with the correct replacement line.

CAUTION: The high–pressure fuel lines must be clamped securely in place in the holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

FUEL SHUTDOWN SOLENOID TEST

Since diesel fuel injection does not use spark plugs to start combustion, the only way to stop the engine is to cut off the fuel supply. This is done with the Fuel Shutdown Solenoid. If the engine cranks, but refuses to start, it may be caused by a defective fuel shutdown solenoid.

The fuel shutdown solenoid is not controlled or operated by the PCM. Voltage to operate the solenoid is supplied from the ignition (key) switch.

NOTE: Although the fuel shutdown solenoid is not operated by the PCM, if the Fuel Shutdown Solenoid has been disconnected, and the key turned on, the PCM will sense that the solenoid is not in the circuit, and will switch to a “Limp Home” mode. After reconnecting the solenoid, the PCM will have to be reset by clearing the codes with the DRBIII scan tool, or disconnecting the vehicle’s battery for several minutes. The DRBIII scan tool is the preferred method for resetting the PCM. Refer to the 1998 GS 2.5L Diesel Powertrain Diagnostic Manual for procedure.

The fuel shutdown (shut–off) solenoid is used to electrically shut off the diesel fuel supply to the high–pressure fuel injection pump. The solenoid is mounted to the rear of the injection pump (Fig. 23).

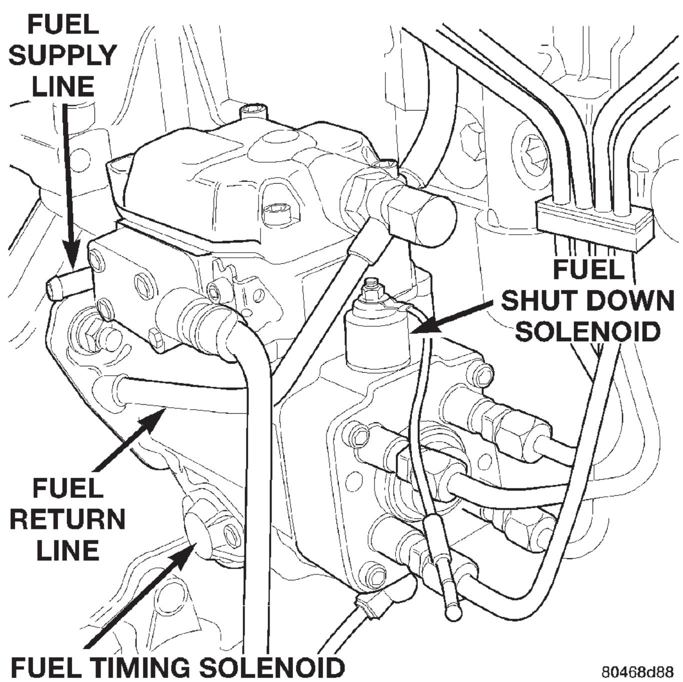


Fig. 23 Fuel Shutdown Solenoid Location

The solenoid controls starting and stopping of the engine regardless of the position of the accelerator pedal. When the ignition (key) switch is OFF, the solenoid is shut off and fuel flow is not allowed to the fuel injection pump. When the key is placed in the ON or

DIAGNOSIS AND TESTING (Continued)

START positions, fuel supply is allowed at the injection pump.

(1) Disconnect the electrical pigtail connector (test connector) (Fig. 23) from the main engine wiring harness. Do not disconnect wiring directly at solenoid.

(2) Connect the leads of a voltmeter between a good ground and the disconnected engine wiring harness.

(3) Turn the key to the ON position. Do not attempt to start engine.

(4) 12V+ should be observed at wiring harness. If not, refer to Group 8, Wiring for wiring schematics and repair as necessary.

(5) Turn the key to the START position. 12V+ should be observed at wiring harness. If not, refer to Group 8, Wiring for wiring schematics and repair as necessary. The fault may be in the ignition (key) switch.

12V+ must be observed in both the ON and START positions. If 12V+ was observed, proceed to the next step.

(6) With key still in the ON position, connect and disconnect the wiring harness to the solenoid. As this is done, a clicking noise should be heard coming from the solenoid. If not, replace solenoid. Refer to Fuel Shutdown Solenoid in the Removal/Installation section of this group for procedures.

HIGH-PRESSURE FUEL LINE LEAK TEST

High–pressure fuel line leaks can cause starting problems and poor engine performance.

WARNING: DUE TO EXTREME FUEL PRESSURES OF UP TO 45,000 KPA (6526 PSI), USE EXTREME CAUTION WHEN INSPECTING FOR HIGH–PRESSURE FUEL LEAKS. DO NOT GET YOUR HAND, OR ANY PART OF YOUR BODY NEAR A SUSPECTED LEAK. INSPECT FOR HIGH–PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

Start the engine. Move the cardboard over the high–pressure fuel lines and check for fuel spray onto the cardboard (Fig. 24). If a high–pressure line connection is leaking, bleed the system and tighten the connection. Refer to the Air Bleed Procedure in this group for procedures. Replace damaged, restricted or leaking high–pressure fuel lines with the correct replacement line.

CAUTION: The high–pressure fuel lines must be clamped securely in place in the holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

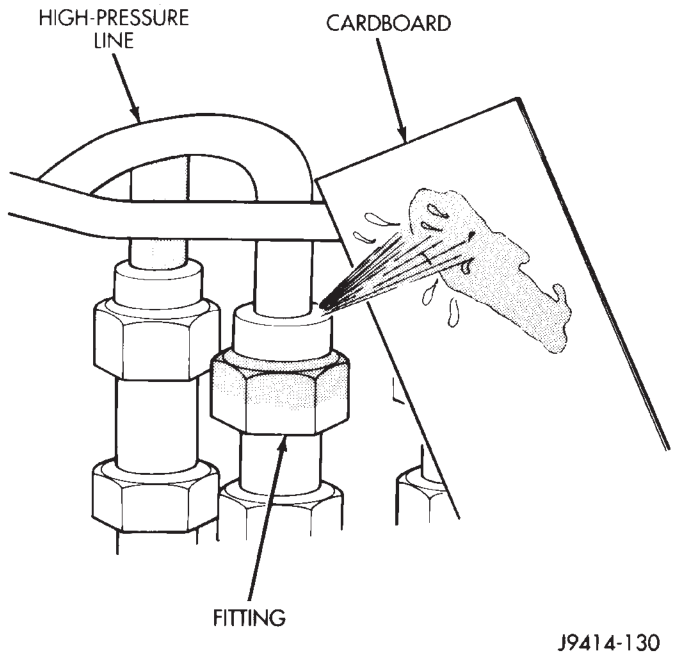


Fig. 24 Typical Test for Leaks with Cardboard

WASTEGATE (TURBOCHARGER)

Refer to Group 11, Exhaust System and Intake Manifold for information.

SERVICE PROCEDURES

AIR BLEED PROCEDURES

AIR BLEEDING AT FUEL FILTER

A certain amount of air may become trapped in the fuel system when fuel system components are serviced or replaced. Bleed the system as needed after fuel system service according to the following procedures.

WARNING: DO NOT BLEED AIR FROM THE FUEL SYSTEM OF A HOT ENGINE. DO NOT ALLOW FUEL TO SPRAY ONTO THE EXHAUST MANIFOLD WHEN BLEEDING AIR FROM THE FUEL SYSTEM.

Some air enters the fuel system when the fuel filter or injection pump supply line is changed. This small amount of air is vented automatically from the injection pump through the fuel drain manifold tubes if the filter was changed according to instructions. Ensure the bowl of the fuel filter/water separator is full of fuel

It may be necessary to manually bleed the system if:

- The bowl of the fuel filter/water separator is not partially filled before installation of a new filter
- The injection pump is replaced

SERVICE PROCEDURES (Continued)

- High–pressure fuel line connections are loosened or lines replaced
- Initial engine start–up or start–up after an extended period of no engine operation
- Running fuel tank empty

FUEL INJECTION PUMP BLEEDING

(1) If the fuel injection pump has been replaced, air should be bled at the overflow valve before attempting to start engine.

(a) Loosen the overflow valve (Fig. 25) at the rear of the injection pump.

(b) Place a towel below the valve.

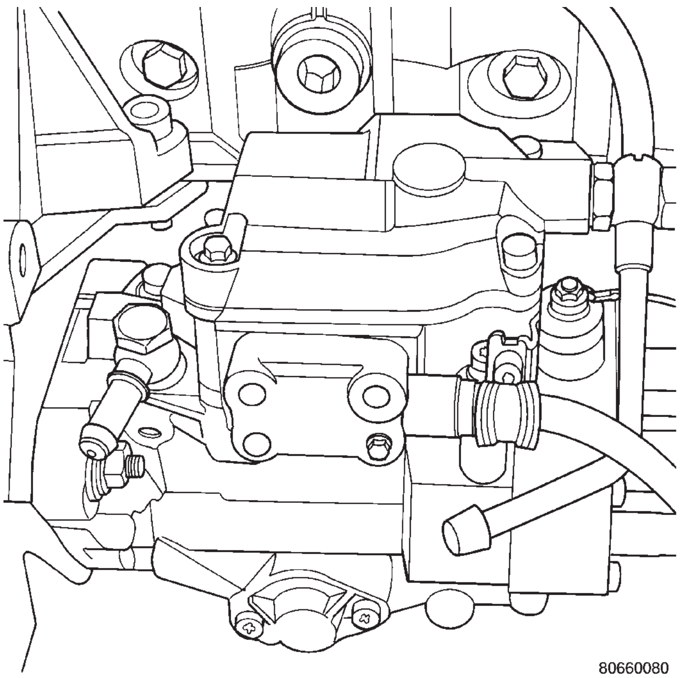


Fig. 25 Overflow Valve

WARNING: WHEN CRANKING THE ENGINE TO BLEED AIR FROM THE INJECTION PUMP, THE ENGINE MAY START. PLACE THE TRANSMISSION IN NEUTRAL OR PARK AND SET PARKING BRAKE BEFORE ENGAGING THE STARTER MOTOR.

CAUTION: Do not engage the starter motor for more than 30 seconds at a time. Allow 2 minutes between cranking intervals.

(2) Crank the engine for 30 seconds at a time to allow air trapped in the injection pump to vent out the fuel injector drain tubes. Continue this procedure until the engine starts. Observe the previous WARNING and CAUTION.

(3) Tighten overflow valve.

HIGH–PRESSURE FUEL LINE BLEEDING

WARNING: THE INJECTION PUMP SUPPLIES HIGH–PRESSURE FUEL OF APPROXIMATELY 59,000 KPA (8,557 PSI) TO EACH INDIVIDUAL INJECTOR THROUGH THE HIGH–PRESSURE LINES. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE THE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING AND AVOID CONTACT WITH FUEL SPRAY WHEN BLEEDING HIGH–PRESSURE FUEL LINES.

WARNING: DO NOT BLEED AIR FROM THE FUEL SYSTEM OF A HOT ENGINE. DO NOT ALLOW FUEL TO SPRAY ONTO THE EXHAUST MANIFOLD WHEN BLEEDING AIR FROM THE FUEL SYSTEM.

Bleed air from one injector at time.

(1) Loosen the high–pressure fuel line fitting at the injector (Fig. 26).

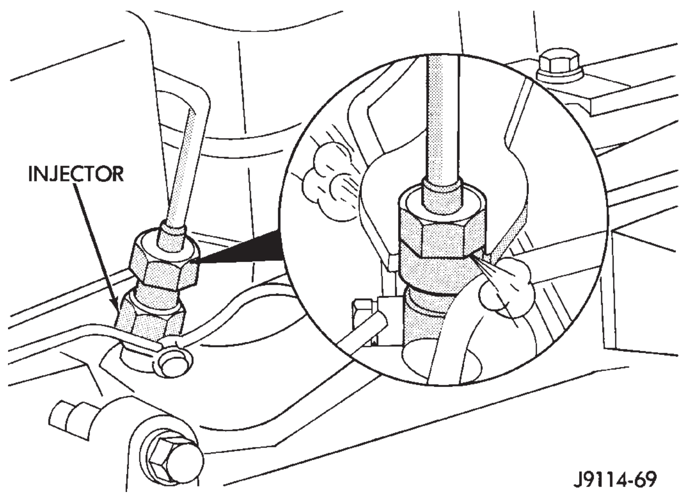


Fig. 26 Bleeding High–Pressure Fuel Line—Typical

(2) Crank the engine until all air has been bled from the line. **Do not operate the starter motor for longer than 30 seconds. Wait 2 minutes between cranking intervals.**

(3) Start the engine and bleed one injector at a time until the engine runs smoothly.

FUEL INJECTION PUMP TIMING

Refer to Removal/Installation and Adjusting Fuel Pump Timing in this Group.

REMOVAL AND INSTALLATION

ACCELERATOR PEDAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing the accelerator pedal or throttle cable.

REMOVAL

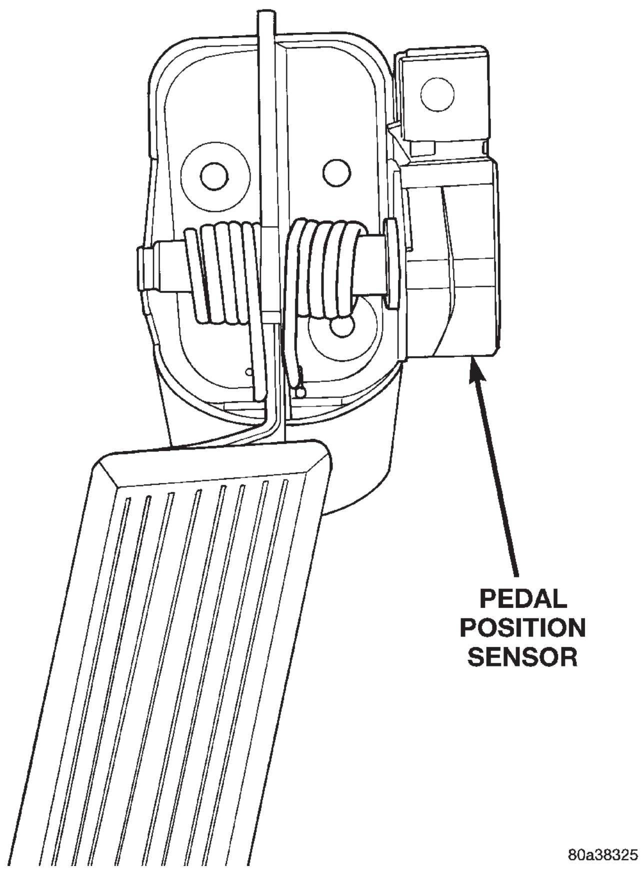


Fig. 27 Accelerator Pedal Mounting-Typical

(1) Disconnect electrical connector.
(2) Remove accelerator pedal mounting bracket nuts. Remove accelerator pedal assembly.

INSTALLATION

(1) Place accelerator pedal assembly over studs protruding from floor pan. Tighten mounting nuts to 5 N·m (46 in. lbs.) torque.
(2) Connect electrical connector.
(3) Before starting the engine, operate the accelerator pedal to check for any binding.

AIR CLEANER ELEMENT

REMOVAL

(1) Remove hose clamp at Mass Air Flow Sensor.
(2) Remove hose from Mass Air Flow Sensor.
(3) Loosen 2 clamps holding air cleaner housing halves together.
(4) Remove left side of air cleaner housing.
(5) Remove element from air cleaner housing.

INSTALLATION

(1) Install a new element in housing.
(2) Position left side of housing.
(3) Snap clamps into place.
(4) Install hoses and clamps.

FUEL DRAIN TUBES

The fuel drain tubes (Fig. 28) are low–pressure type.

Pull each tube from the injector for removal. Push on for installation. Clamps are not required for these tubes.

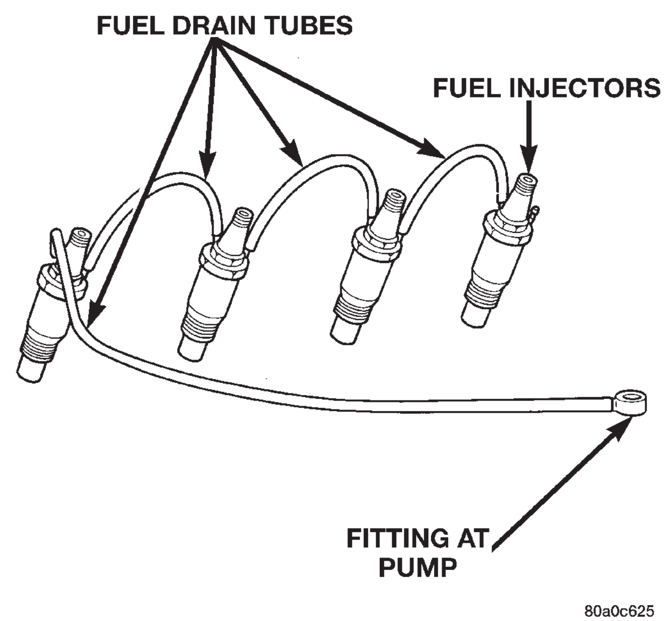


Fig. 28 Fuel Drain Tubes

FUEL FILTER/WATER SEPARATOR

The fuel filter/water separator is located in the engine compartment on the right side near the shock tower. (Fig. 29).

The fuel filter/water separator assembly contains the fuel filter, fuel heater element, and fuel drain valve (Fig. 29).

DRAINING WATER FROM FILTER BOWL

Moisture (water) collects at the bottom of the filter/separator in a plastic bowl. Water entering the fuel injection pump can cause serious damage to the pump. **Note that the bulb will be illuminated for approximately 2 seconds each time the key is initially placed in the ON position. This is done for a bulb check.**

REMOVAL AND INSTALLATION (Continued)

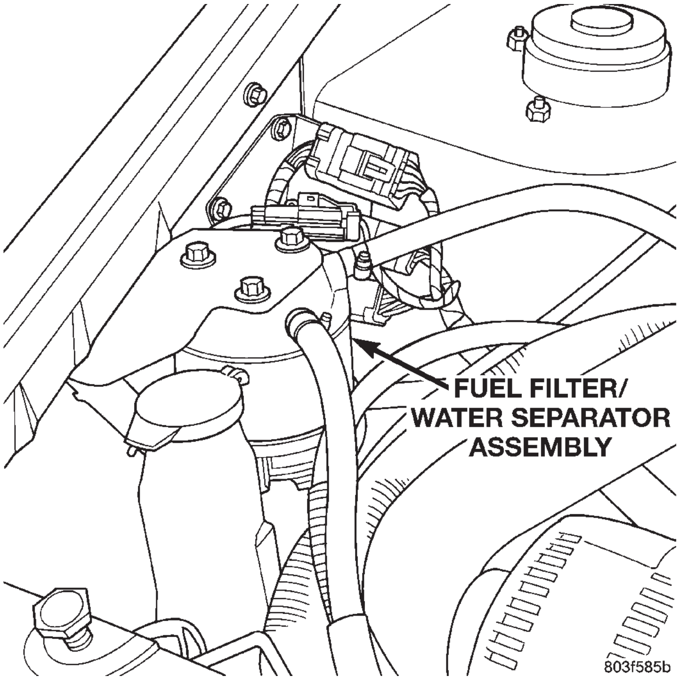


Fig. 29 Fuel Filter/Water Separator Location

WARNING: DO NOT ATTEMPT TO DRAIN WATER FROM THE FILTER/SEPARATOR WITH THE ENGINE HOT.

(1) The bottom of the filter/separator bowl is equipped with a drain valve (Fig. 29). The drain valve is equipped with a fitting. Attach a piece of rubber hose to this fitting. This hose is to be used as a drain hose.

(2) Place a drain pan under the drain hose.

(3) With the engine not running, open the drain valve (unscrew—drain valve has right hand threads) from the filter/separator bowl. To gain access to this fitting, the two filter–to–mounting bracket nuts (Fig. 29) may have to be loosened a few turns.

(4) Hold the drain open until clean fuel exits the drain.

(5) After draining, close drain valve.

(6) Remove rubber drain hose.

(7) Dispose of mixture in drain pan according to applicable local or federal regulations.

FUEL FILTER REMOVAL

(1) Drain all fuel and/or water from fuel filter/water separator assembly. Refer to the previous Draining Water From Filter Bowl.

(2) Unplug the electrical connectors at bottom of plastic bowl.

(3) Remove plastic bowl from bottom of fuel filter (unscrews).

(4) Remove fuel filter from bottom of filter base (unscrews).

FUEL FILTER INSTALLATION

(1) Clean bottom of fuel filter base.

(2) Apply clean diesel fuel to new fuel filter gasket.

(3) Install and tighten filter to filter base. The beveled part of the rubber gasket should be facing up towards the filter base.

(4) Clean the inside of bowl with a soap and water mixture before installation. Carefully clean any residue between the two metal probes at the top of the water–in–fuel sensor. Do not use chemical cleaners as damage to the plastic bowl may result.

(5) Pour diesel fuel into the plastic bowl before installing bowl to bottom of fuel filter. Do this to help prevent air from entering fuel injection pump while attempting to starting engine.

(6) Install filter bowl to bottom of filter.

(7) Install the electrical connectors at bottom of bowl.

(8) Tighten the filter–to–mounting bracket nuts (Fig. 29) to 28 N·m (250 in. lbs.) torque.

FUEL HEATER

If the fuel heater element needs replacement, the plastic filter bowl assembly must be replaced. Refer to Fuel Filter/Water Separator for information.

FUEL HEATER RELAY

The fuel heater relay is located in the PDC. For the location of the relay within the PDC (Fig. 30), refer to label on PDC cover.

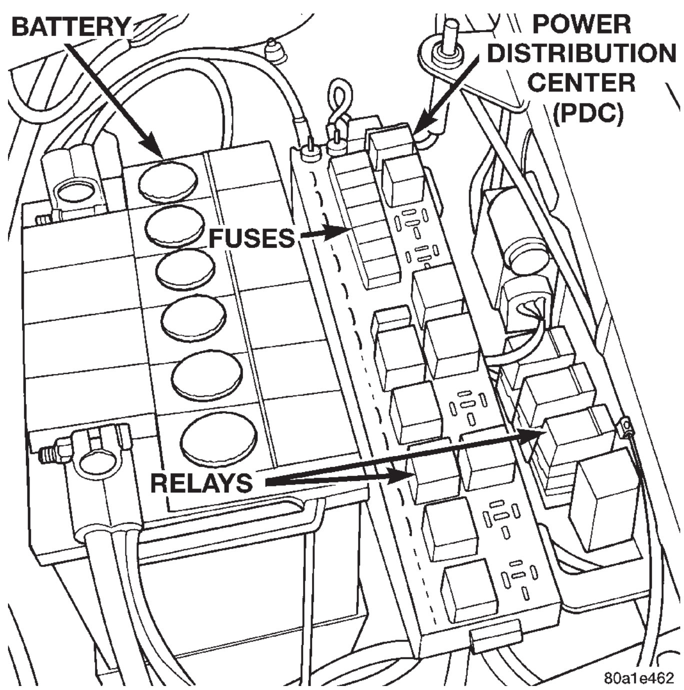


Fig. 30 Power Distribution Center (PDC) Location

REMOVAL AND INSTALLATION (Continued)

FUEL LEVEL SENSOR

REMOVAL

Remove fuel reservoir module. Refer to Fuel Reservoir Module in this section.

(1) Depress retaining tab and remove the level sensor connector from the **BOTTOM** of the fuel module electrical connector (Fig. 31).

NOTE: The pump module harness on TOP of flange is not serviceable or removable.

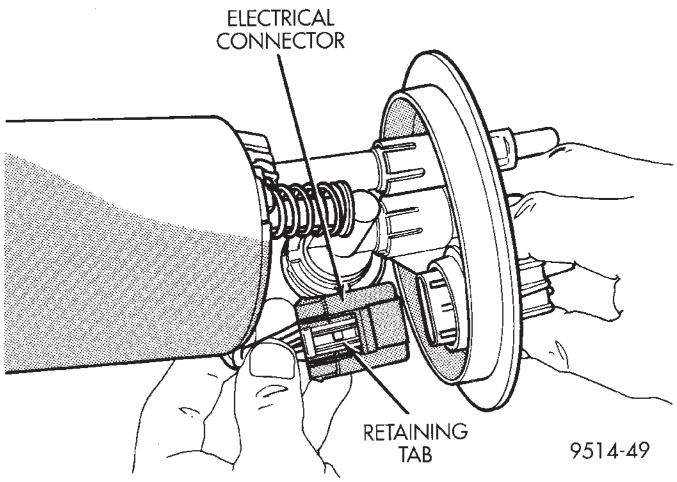


Fig. 31 Fuel Module/Level Sensor Electrical Connector

(2) Pull off blue locking wedge (Fig. 32).

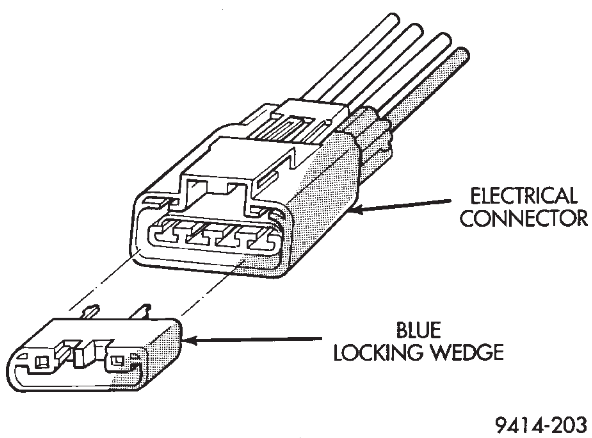


Fig. 32 Wire Terminal Locking Wedge

(3) Using a small screwdriver lift locking finger away from terminal and push terminal out of connector (Fig. 33).

(4) Push level sensor signal and ground terminals out of the connector (Fig. 34).

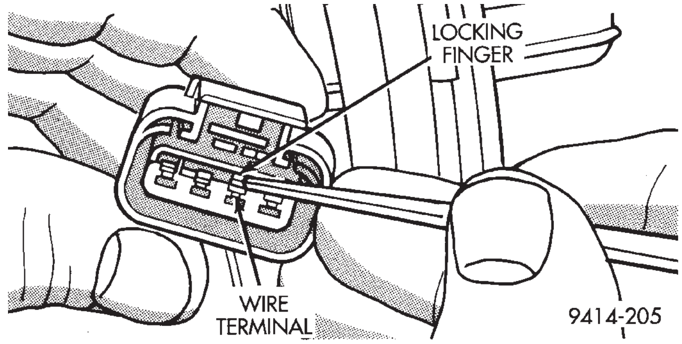


Fig. 33 Wire Terminal Locking Finger

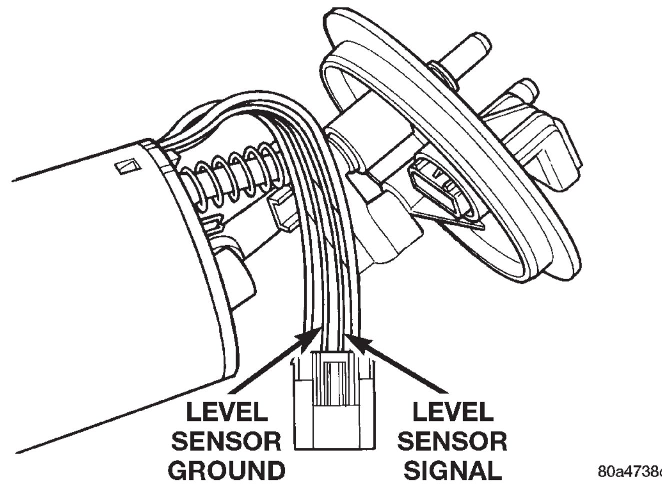


Fig. 34 Removing Wires From Connector

(5) Insert a screwdriver between the fuel module and the top of the level sensor housing (Fig. 35). Push level sensor down slightly.

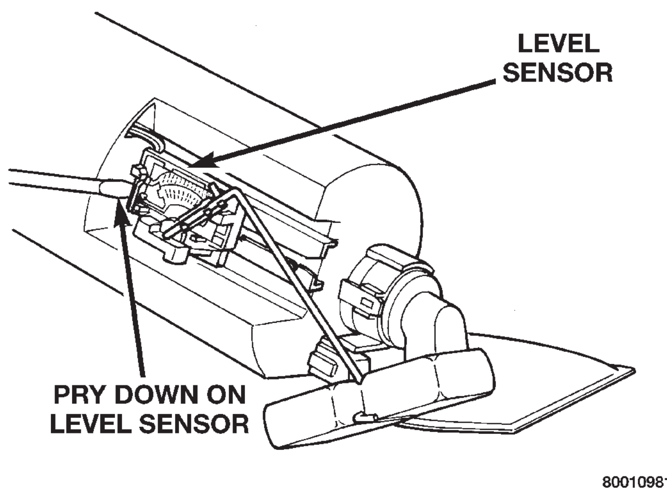


Fig. 35 Loosening Level Sensor

(6) Slide level sensor wires through opening fuel module (Fig. 36).

(7) Slide level sensor out of installation channel in module.

REMOVAL AND INSTALLATION (Continued)

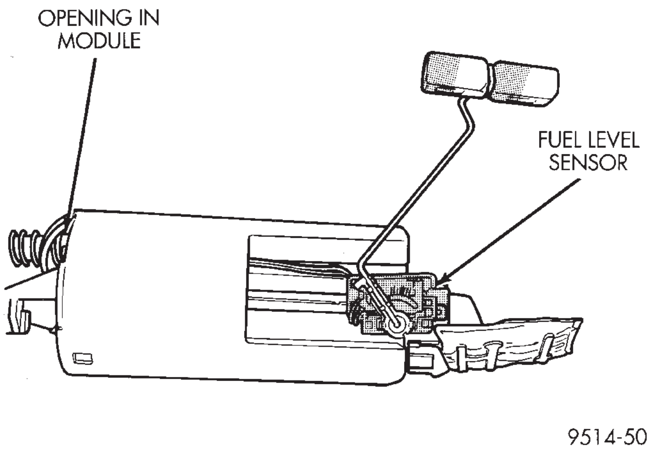


Fig. 36 Level Sensor Removal/Installation

INSTALLATION

(1) Insert level sensor wires into bottom of opening in module.

(2) Wrap wires into groove in back of level sensor (Fig. 37).

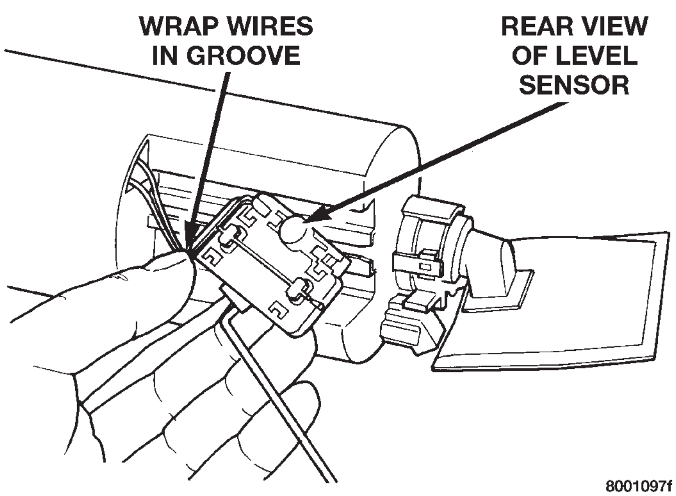


Fig. 37 Groove in Back Side of Level Sensor

(3) While feeding wires into guide grooves, slide level sensor up into channel until it snaps into place (Fig. 38). Ensure tab at bottom of sensor locks in place.

(4) Install level sensor wires in connector. Push the wires up through the connector and then pull them down until they lock in place. Ensure signal and ground wires are installed in the correct position.

(5) Install locking wedge on connector.

(6) Push connector up into bottom of fuel module electrical connector.

(7) Install fuel module. Refer to Fuel Reservoir Module in this section.

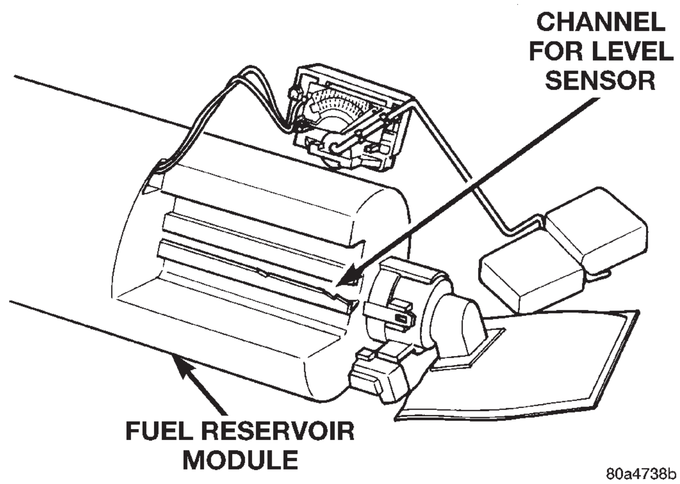


Fig. 38 Installation Channel

FUEL INJECTION PUMP

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Thoroughly clean the area around the injection pump and fuel lines of all dirt, grease and other contaminants. **Due to the close internal tolerances of the injection pump, this step must be performed before removing pump.**

(3) Remove the engine accessory drive belt. Refer to Group 7, Cooling System for procedures.

(4) Remove the generator assembly.

(5) Remove the rubber fuel return and supply hoses from metal lines at pump (Fig. 39).

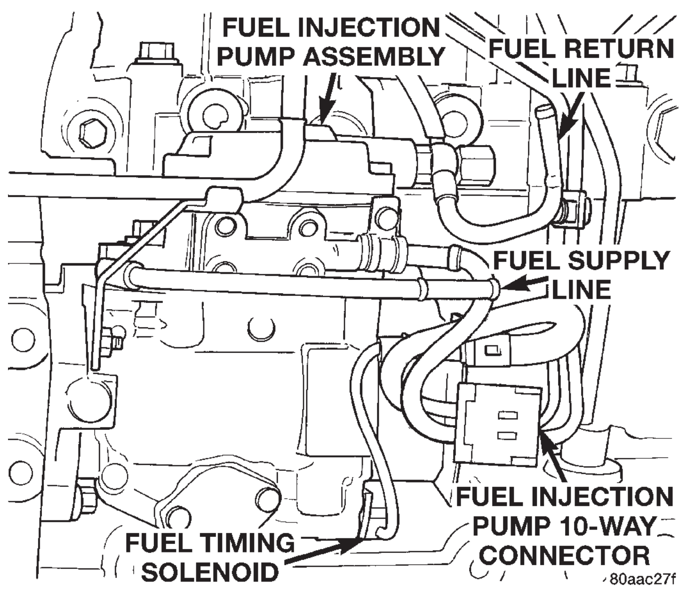


Fig. 39 Overflow Valve and Fuel Shutdown Solenoid

(6) Remove the electrical connector at engine coolant temperature sensor (Fig. 40).

(7) Disconnect the Fuel Injection Pump electrical connector at fuel pump. (Fig. 39).

REMOVAL AND INSTALLATION (Continued)

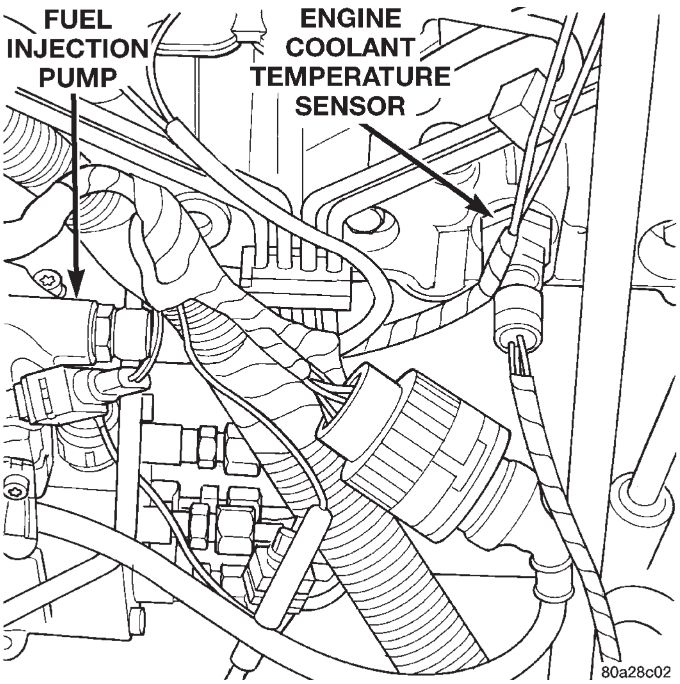


Fig. 40 Engine Coolant Temperature Sensor

(8) Disconnect the main engine wiring harness from the glow plugs.

(9) Disconnect the four high–pressure fuel lines from the fuel injection pump. Also disconnect fuel lines at the fuel injectors. For procedures, refer to High–Pressure Fuel Lines in this group. Place a rag beneath the fittings to catch excess fuel.

(10) Remove plug from timing gear cover.

(11) The "Top Dead Center" (TDC) compression firing stroke must be determined as follows:

(a) Remove the valve cover, refer to Group 9, Valve Cover Removal/Installation.

(b) Remove the right front tire and splash shield. Using a socket attached to the end of crankshaft, rotate the engine (counter—clockwise as viewed from front).

(c) Rotate the engine until cylinder #4 rockers are in between movement.

(d) Remove rocker arm assembly.

(e) Remove valve spring and keepers. **CAUTION: When the piston is at TDC there is only 2 mm (.080 thousand) clearance between the valve and piston.**

(f) Let the valve set on top of piston. Install a dial indicator to the top of the valve stem.

(g) Rotate engine back and forth to find the TDC position with the indicator on the valve stem. Mark the damper and timing cover for TDC.

NOTE: On later model 1997 engines, a hole in the bottom of the clutch housing can be lined up with a hole in the flywheel, allowing the engine to be held at TDC with a special alignment tool, part # VM1035.

(12) Remove injection pump drive gear nut (Fig. 41) and washer. **CAUTION: Be very careful not to drop the washer into the timing gear cover.**

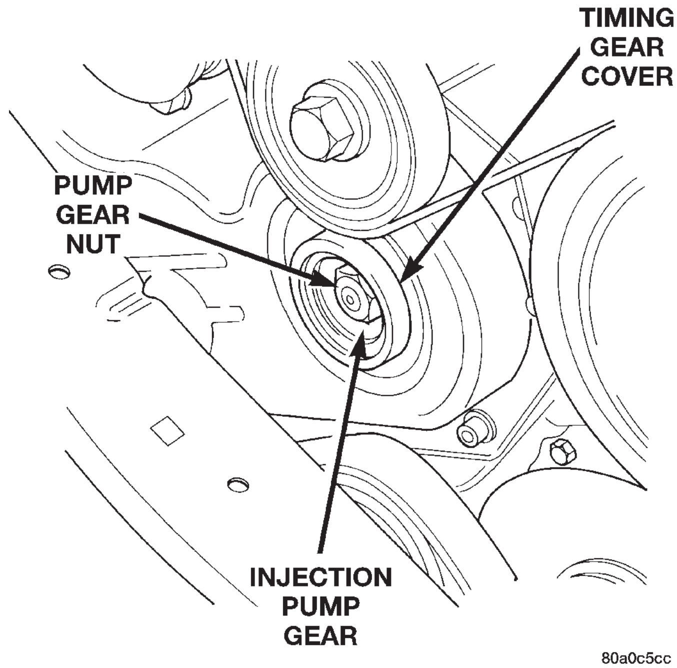


Fig. 41 Removing Pump Drive Gear Nut

(13) A special 3–piece gear removal tool set VM.1003 (Fig. 42) must be used to remove the injection pump drive gear from the pump shaft.

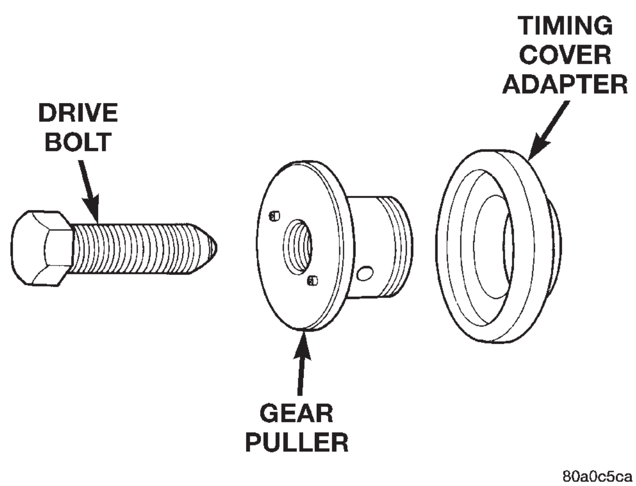


Fig. 42 Pump Gear Tools

(a) Thread the adapter (Fig. 43) into the timing cover.

(b) Thread the gear puller into the injection pump drive gear (Fig. 43). This tool is also used to hold the gear in synchronization during pump removal.

(c) Remove the three injection pump–to–gear cover mounting nuts (Fig. 44). **CAUTION: This step must be done to prevent breakage of the**

REMOVAL AND INSTALLATION (Continued)

three injection pump mounting flanges while gear is being removed.

(d) Install the drive bolt into the gear puller (Fig. 43). Tighten the drive bolt to press (remove) the drive gear from injection pump shaft while driving injection pump rearward from timing gear cover mounting studs.

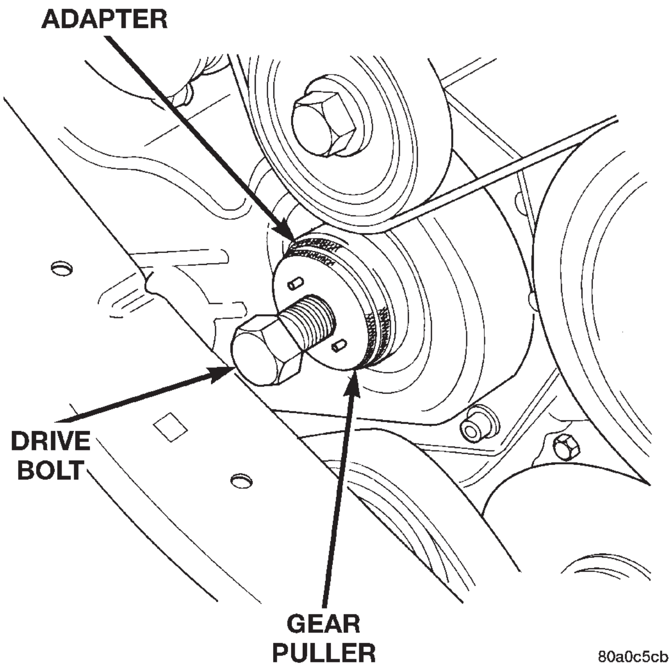


Fig. 43 Installing Pump Drive Gear Removal Tools

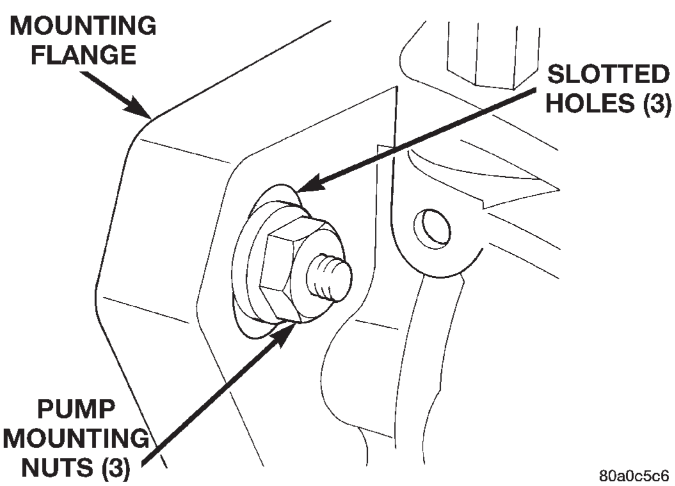


Fig. 44 Injection Pump Mounting Nuts

(14) Remove pump from engine. **Do not rotate engine while gear puller is installed. Engine damage will occur.**

INSTALLATION/ADJUSTING PUMP TIMING

(1) Clean the mating surfaces of injection pump and timing gear cover.

(2) Install a new injection pump–to–timing gear cover gasket.

(3) Remove the gear removing bolt (drive bolt) from gear puller. **CAUTION: Do not remove the special gear puller or timing cover adapter tools from timing cover at this time. Gear misalignment will result.**

(4) Place the key way on the pump shaft to the 11 o'clock position as viewed from the front of pump. Install the pump into the rear of timing gear cover while aligning key way on pump shaft into pump gear.

(5) Install and snug the 3 injection pump mounting nuts. This is not the final tightening sequence.

(6) Remove the special gear puller and adapter tools from timing gear cover.

(7) Install the injection pump drive gear nut and washer. Tighten nut to 88 N·m (65 ft. lbs.) torque.

(8) Remove access plug and plug washer at rear of pump (Fig. 45). Thread special dial indicator adapter tool VM.1011 (Fig. 46) into this opening. Hand tighten only.

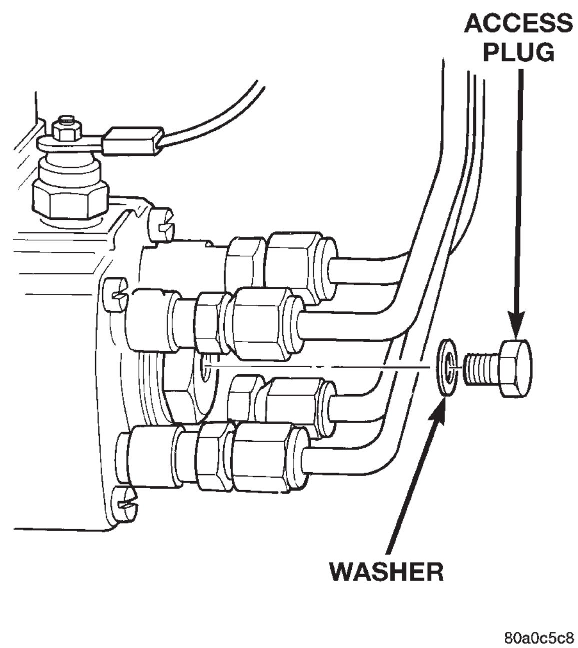


Fig. 45 Access Plug at Rear of Pump

(9) Attach special dial indicator tool VM.1013 into the adapter tool (Fig. 46).

(10) Using a socket attached to the end of crankshaft, rotate the engine (counter—clockwise as viewed from front) until thedial indicator stops moving. This rotation is about 20° to 30°.

(11) Set the dial indicator to 0 mm. Be sure the tip of dial indicator is touching the tip inside the adapter tool.

(12) Very slowly rotate the crankshaft clockwise until movement on dial indicator needle has stopped. **Do not rotate crankshaft after needle movement has stopped. Engine should be at TDC at this point**

(13) Check the TDC dial indicator for TDC.

REMOVAL AND INSTALLATION (Continued)

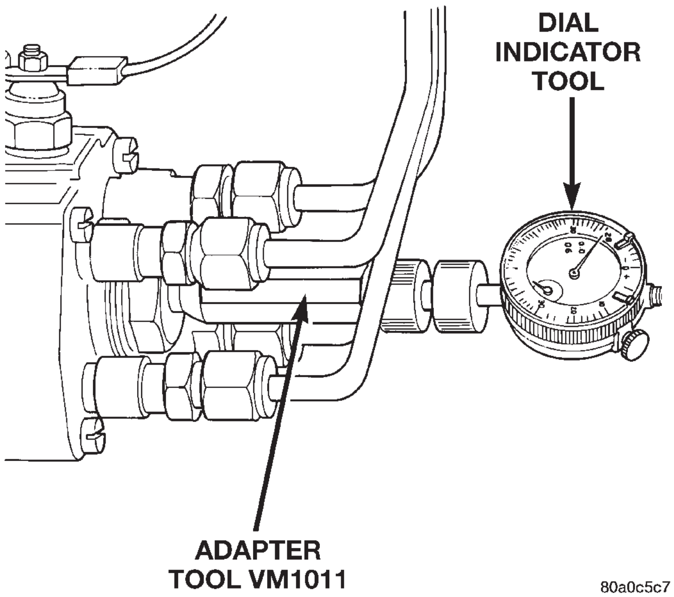


Fig. 46 Installing Dial Indicator and Special Adapter Tools

(14) Gauge reading should be at 0.60 mm. If not, the pump must be rotated for adjustment:

(a) Loosen the three injection pump mounting nuts at the mounting flanges. These flanges are equipped with slotted holes. The slotted holes are used to rotate and position the injection pump for fuel timing. Loosen the three nuts just enough to rotate the pump.

(b) Rotate the pump **clockwise** (as viewed from front) until .60 mm is indicated on the dial indicator gauge.

(c) Tighten the three pump mounting nuts to 30 N·m (22 ft. lbs.) torque.

(d) Recheck the dial indicator after tightening the pump mounting nuts. Gauge should still be reading 0.60 mm. Loosen pump mounting nuts and readjust if necessary.

(15) Remove dial indicator and adapter tools.

(16) Install access plug and washer to rear of injection pump.

(17) Install plug at timing gear cover.

(18) Remove dial indicator from valve stem.

(19) Install valve spring and keepers.

(20) Install rocker arm assembly and tighten nuts.

(21) Install and connect the four high–pressure fuel lines to the fuel injection pump. Also connect fuel lines at the fuel injectors. For procedures, refer to High–Pressure Fuel Lines in this group.

(22) Install electrical connector at engine coolant temperature sensor.

(23) Connect electrical connector at fuel shutdown solenoid.

(24) Connect the main engine wiring harness to the glow plugs.

(25) Connect the fuel timing solenoid pigtail harness to the engine wiring harness.

(26) Connect the overflow valve/banjo fitting (fuel return line assembly). Replace copper gaskets before installing.

(27) Connect the rubber fuel return and supply hoses to metal lines at pump. Tighten hose clamps to 2 N·m (20 in. lbs.) torque.

(28) Install generator assembly.

(29) Install engine accessory drive belt. Refer to Group 7, Cooling System for procedures.

(30) Install negative battery cable to battery.

(31) Start the engine and bring to normal operating temperature.

(32) Check for fuel leaks.

FUEL INJECTORS

Four fuel injectors are used on each engine. Of these four, two different types are used. The fuel injector used on cylinder number one is equipped with a fuel injector sensor (Fig. 47). The other three fuel injectors are identical. **Do not place the fuel injector equipped with the fuel injector sensor into any other location except the cylinder number one position.**

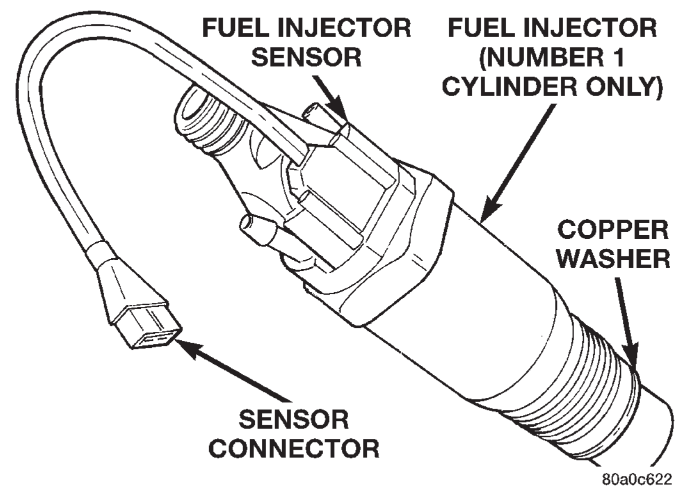


Fig. 47 Fuel Injector Sensor—Number–1 Cylinder

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Thoroughly clean the area around the injector with compressed air.

(3) Remove the fuel drain hoses (tubes) at each injector (Fig. 48) being serviced. Each of these hoses is slip–fit to the fitting on injector.

(4) Remove the high–pressure fuel line at injector being removed. Refer to High–Pressure Fuel Lines in this group for procedures.

(5) Remove the injector using special socket tool number VM.1012A. When removing cylinder number

REMOVAL AND INSTALLATION (Continued)

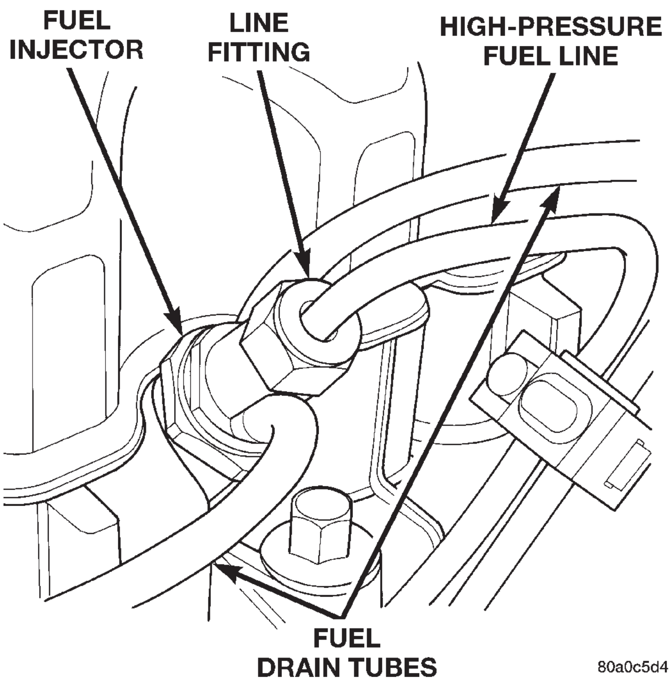


Fig. 48 Fuel Injector—Typical

one injector, thread the wiring harness through the access hole on the special socket (Fig. 49).

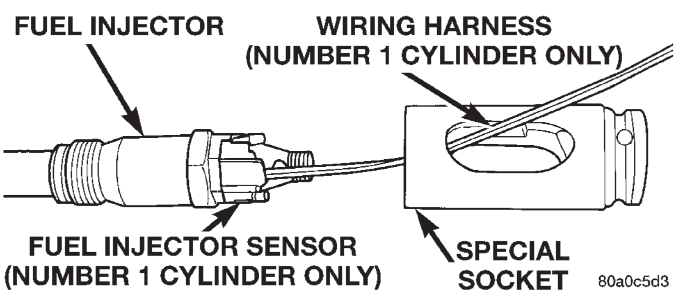


Fig. 49 Wiring Harness Through Socket

(6) Remove and discard the copper washer (seal) at bottom of injector (Fig. 47).

INSTALLATION

(1) Clean the injector threads in cylinder head.
(2) Install new copper washer (seal) to injector.
(3) Install injector to engine. Tighten to 70 N·m (52 ft. lbs.) torque.
(4) Install high–pressure fuel lines. Refer to High–Pressure Fuel Lines in this group for procedures.
(5) Install fuel drain hoses (tubes) to each injector. Do not use clamps at fuel drain hoses.
(6) Connect negative battery cable to battery.
(7) Bleed the air from the high–pressure lines. Refer to the Air Bleed Procedure section of this group.

FUEL SHUTDOWN SOLENOID

The solenoid is mounted to the rear of the injection pump (Fig. 50).

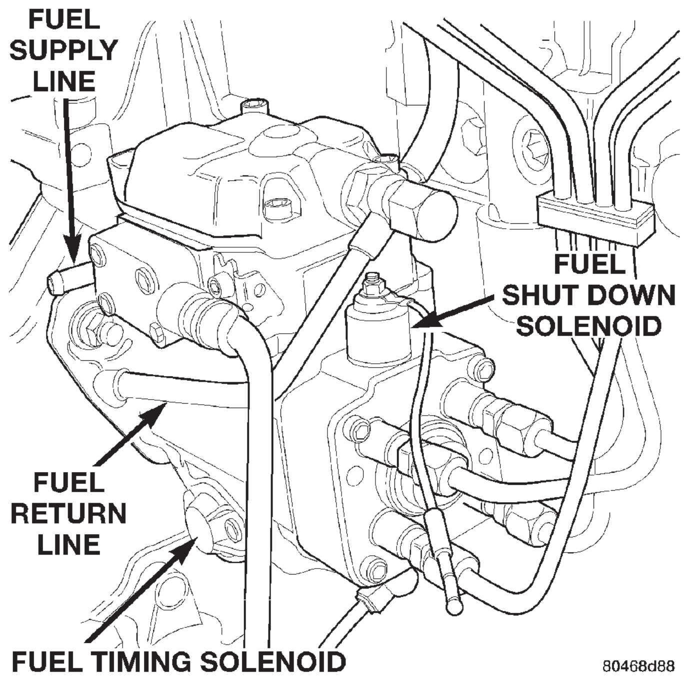


Fig. 50 Fuel Shutdown Solenoid Location

REMOVAL

(1) Thoroughly clean the area around the solenoid with compressed air.
(2) Disconnect the fuel return line and banjo fitting above the solenoid by removing (un–threading) the overflow valve (Fig. 50). Place a towel below the valve before removal. Discard old sealing washers after removal.
(3) Disconnect the electrical connector nut (Fig. 50).
(4) Remove wiring at solenoid.
(5) Remove solenoid from injection pump.

INSTALLATION

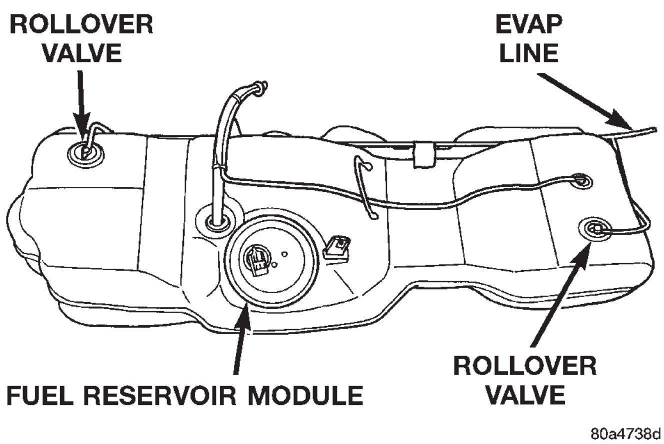
(1) Install solenoid into injection pump.
(2) Install wiring and nut at solenoid.
(3) Install new sealing washers to banjo fitting.
(4) Install overflow valve, banjo fitting and fuel return line to pump.
(5) Bleed air from system. Refer to Air Bleed Procedures in this section of the group.

FUEL TANK

REMOVAL

(1) Disconnect negative cable from battery.
(2) Insert fuel siphon hose into fuel filler neck and push it into the tank.
(3) Drain fuel tank dry into holding tank or a properly labeled **diesel** safety container.

REMOVAL AND INSTALLATION (Continued)



Fuel Tank

(4) Raise vehicle on hoist.

(5) Disconnect both the fuel fill and fuel vent rubber hoses at the fuel tank.

(6) Disconnect fuel supply and return lines from the steel supply line (Fig. 51).

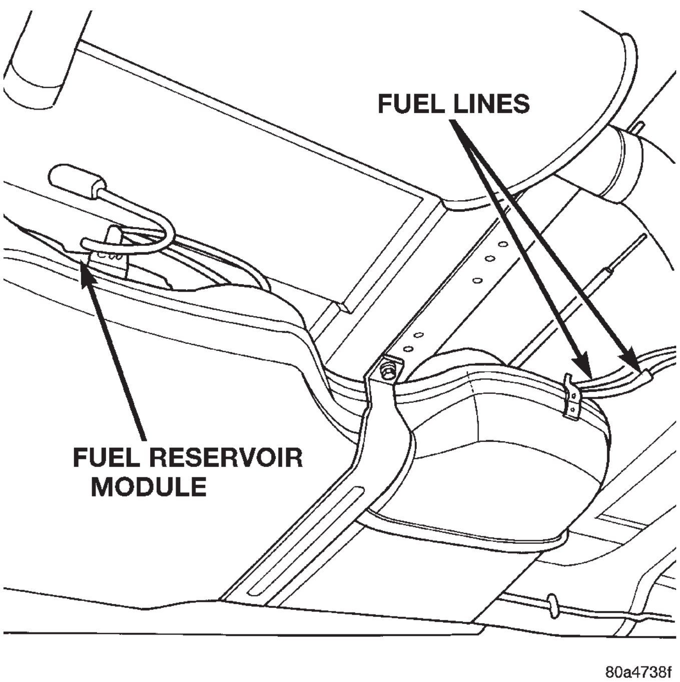


Fig. 51 Fuel Tank and Lines

The fuel reservoir module electrical connector has a retainer that locks it in place.

(7) Slide electrical connector lock to unlock (Fig. 52).

(8) Push down on connector retainer (Fig. 53) and pull connector off module.

(9) Use a transmission jack to support fuel tank. Remove bolts from fuel tank straps.

(10) Lower tank slightly. Carefully remove filler hose from tank.

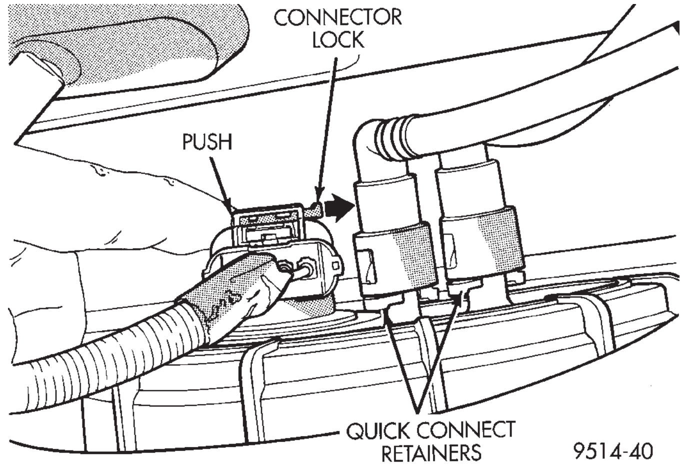


Fig. 52 Fuel Line Retainers and Pump Connector Lock

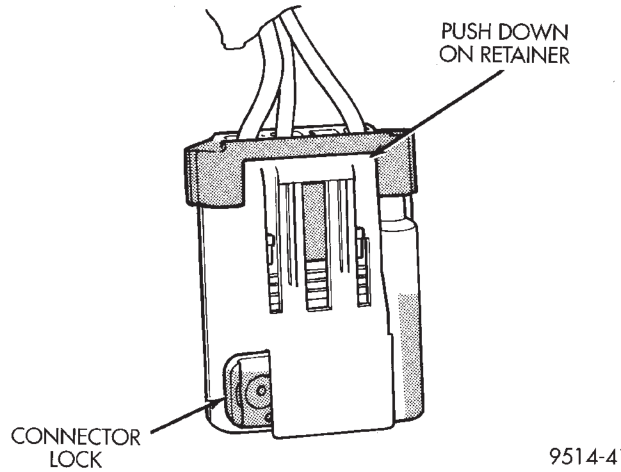


Fig. 53 Module Connector Retainer and Lock

(11) Lower the fuel tank. Remove clamp and remove fuel filler tube vent hose. Remove fuel tank from vehicle.

INSTALLATION

(1) Position fuel tank on transmission jack. Connect fuel filler tube vent hose and replace clamp.

(2) Raise tank into position and carefully work filler tube into tank. A light coating of clean engine oil on the tube end may be used to aid assembly.

(3) Feed filler vent line thru frame rail. Careful not to cross lines.

(4) Tighten strap bolts to 54 N·m (40 ft. lbs.) torque. Remove transmission jack.

CAUTION: Ensure straps are not twisted or bent before or after tightening strap nuts.

(5) Connect module electrical connector. Place retainer in locked position.

(6) Lubricate the fuel supply and return lines with clean 30 weight engine oil, install the quick connect

REMOVAL AND INSTALLATION (Continued)

fuel fitting. Refer to Tube/Fitting Assembly in the Fuel Delivery section of this Group.

(7) Attach filler line to filler tube. Pull on connector to make sure of connection.

(8) Fill fuel tank, replace cap, and connect battery negative cable.

FUEL RESERVOIR MODULE

REMOVAL

WARNING: THE FUEL RESERVOIR OF THE FUEL MODULE DOES NOT EMPTY OUT WHEN THE TANK IS DRAINED. THE FUEL IN THE RESERVOIR WILL SPILL OUT WHEN THE MODULE IS REMOVED.

(1) Disconnect negative cable from battery.

(2) Insert fuel siphon hose into fuel filler neck and push it into the tank.

(3) Drain fuel tank dry into holding tank or a properly labeled **diesel** safety container.

(4) Raise vehicle on hoist.

(5) Use a transmission jack to support the fuel tank. Remove bolts from fuel tank straps. Lower tank slightly.

(6) Clean area around fuel reservoir module and tank to keep dirt and foreign material out of tank.

(7) Disconnect fuel lines from fuel module by depressing quick connect retainers with thumb and fore finger (Fig. 54).

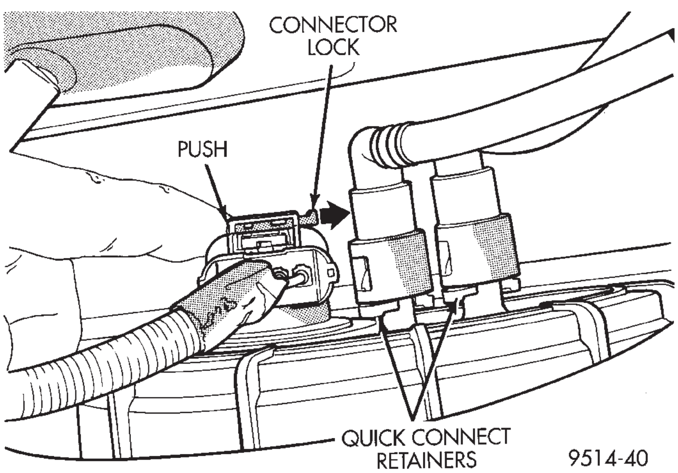


Fig. 54 Fuel Line Retainers and Pump Connector Lock

(8) Slide module electrical connector lock to unlock.

(9) Push down on connector retainer (Fig. 55) and pull connector off module.

(10) Using Special Tool 6856, remove plastic locknut counterclockwise to release pump module (Fig. 56).

(11) Carefully remove module and O-ring from tank (Fig. 57).

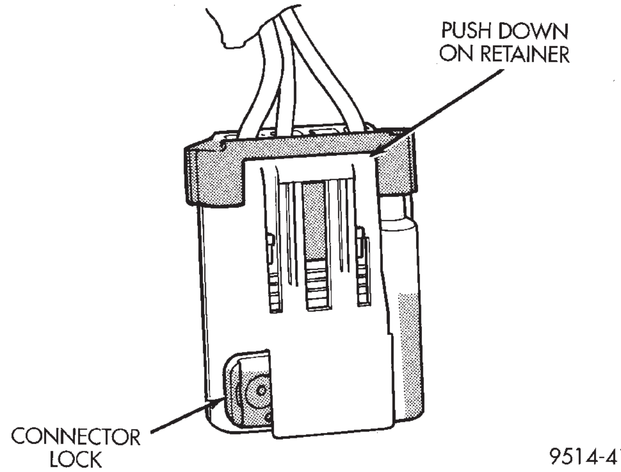


Fig. 55 Module Connector Retainer and Lock

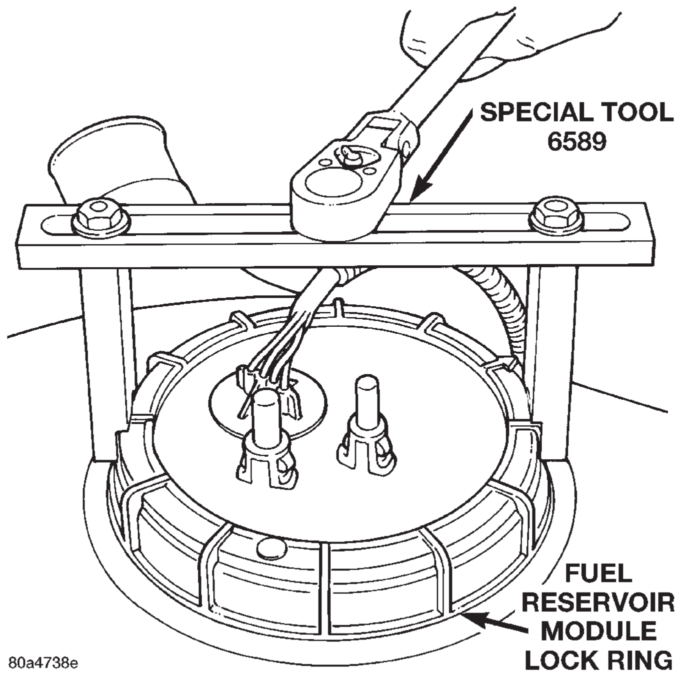


Fig. 56 Fuel Reservoir Module Lock Nut Removal

(12) Discard old O-ring.

INSTALLATION

(1) Wipe seal area of tank clean and place a new O-ring seal in position on pump.

(2) Position fuel reservoir module in tank with locknut.

(3) Tighten locknut to 58 N·m (43 ft. lbs.).

(4) Connect fuel lines.

(5) Plug in electrical connector. Slide connector lock into position.

(6) Raise fuel tank, install bolts into fuel tank straps and tighten.

(7) Lower vehicle on hoist.

(8) Connect negative cable from battery.

(9) Fill fuel tank. Check for leaks.

(10) Install fuel filler cap.

REMOVAL AND INSTALLATION (Continued)

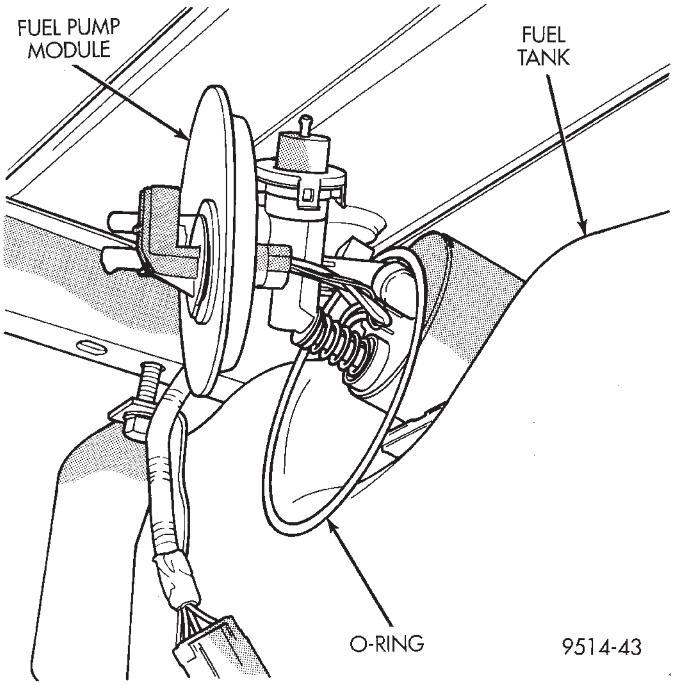


Fig. 57 Fuel Reservoir Module Removal

HIGH-PRESSURE LINES

All high–pressure fuel lines are of the same length and inside diameter. Correct high–pressure fuel line usage and installation is critical to smooth engine operation.

CAUTION: The high–pressure fuel lines must be clamped securely in place in the holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) Remove the necessary clamps (Fig. 58) holding the lines to the engine.

(3) Clean the area around each fuel line connection. Disconnect each line at the top of each fuel injector (Fig. 59).

(4) Disconnect each high–pressure line fitting at each fuel injection pump delivery valve.

(5) Very carefully remove each line from the engine. Note the position (firing order) of each line while removing. **Do not bend the line while removing.**

CAUTION: Be sure that the high–pressure fuel lines are installed in the same order that they were removed. Prevent the injection pump delivery valve holders (Fig. 58) from turning when removing or installing high–pressure lines from injection pump.

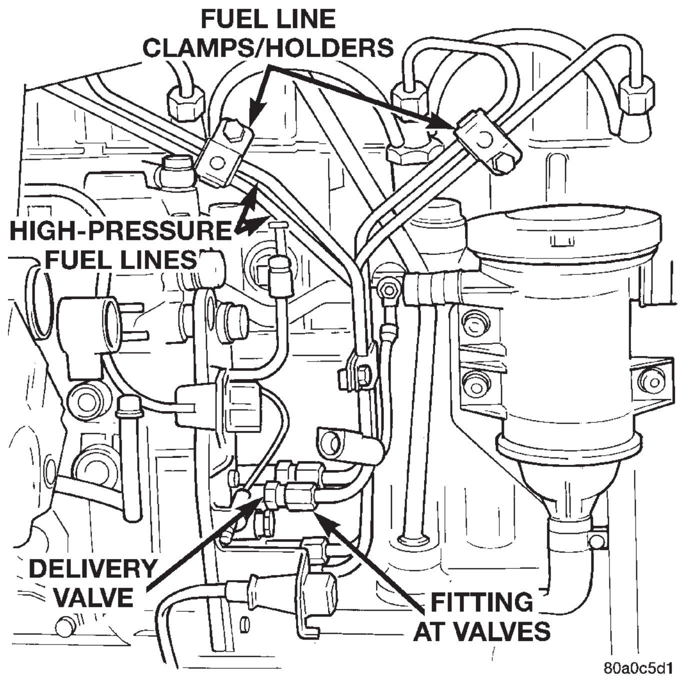


Fig. 58 Fuel Lines and Clamps/Holders

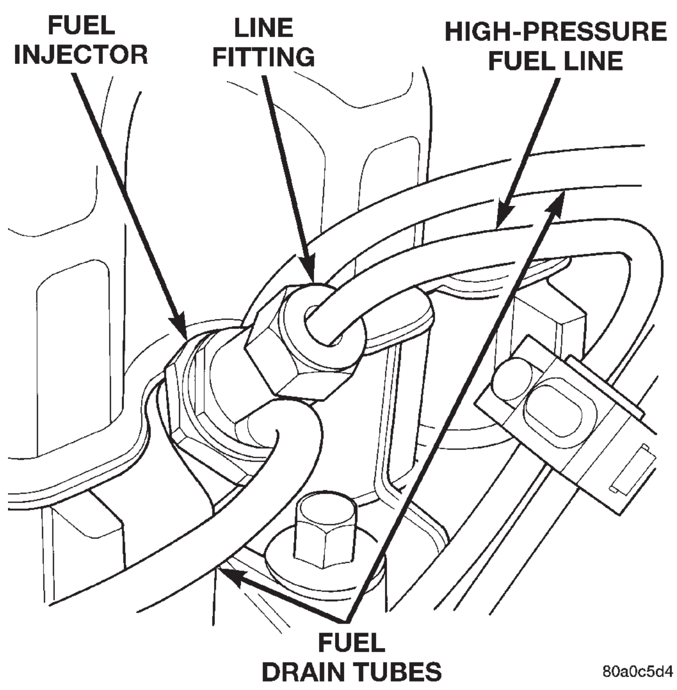


Fig. 59 Fuel Lines at Fuel Injectors

INSTALLATION

(1) Carefully position each high–pressure fuel line to the fuel injector and fuel injection pump delivery valve holder in the correct firing order. Also position each line in the correct line holder.

(2) Loosely install the line clamp/holder bolts.

(3) Tighten each line at the delivery valve to 30 N·m (22 ft. lbs.) torque.

(4) Tighten each line at the fuel injector to 30 N·m (22 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

Be sure the lines are not contacting each other or any other component.

(5) Tighten the clamp bracket bolts to 24 N·m (18 ft. lbs.) torque.

(6) Bleed air from the fuel system. Refer to the Air Bleed Procedure section of this group.

SPECIFICATIONS

FUEL TANK CAPACITY

75 Liters (20.0 Gals.)

Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerances, ambient temperatures and refill procedures.

IDLE SPEED

900 rpm ±**25 rpm** with engine at normal operating temperature.

FUEL INJECTOR FIRING SEQUENCE

1–3–4–2

FUEL SYSTEM PRESSURE

Peak Injection Pressure/Fuel Injection Pump Operating Pressure: 40,000–45,000 kPa (5801–6526 psi).

Opening Pressure of Fuel Injector: 15,000–15,800 kPa (2175–2291 psi).

FUEL DELIVERY SYSTEM—2.0L ENGINE

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DESCRIPTION AND OPERATION

FUEL DELIVERY SYSTEM

Refer to the Fuel Delivery Sytem in the Fuel Delivery Section of group 14 for the 2.4/3.0/3.3/3.8L engines for more information.

FUEL PUMP MODULE

Refer to the Fuel Pump Module for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14.

ELECTRIC FUEL PUMP

Refer to the Electric Fuel Pump for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System Section of group 14 for more information.

FUEL LEVEL SENSOR

Refer to the Fuel Level Sensor for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

FUEL PRESSURE REGULATOR

Refer to the Fuel Pressure Regulator for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

FUEL INJECTORS

Refer to the Fuel Injectors for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

FUEL TANK

Refer to the Fuel Tank for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

PRESSURE-VACUUM FILLER CAP—2.0L ENGINE

Refer to the Pressure-Vacuum Filler Cap for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

QUICK-CONNNECT FITTINGS—2.0L ENGINE

Refer to the Quick Connect Fittings for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

DIAGNOSIS AND TESTING

FUEL PUMP PRESSURE TEST—2.0L ENGINE

Refer to the Fuel Pressure Test for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

FUEL LEVEL SENSOR—2.0L ENGINE

Refer to the Fuel Level Sensor for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

DIAGNOSIS AND TESTING (Continued)

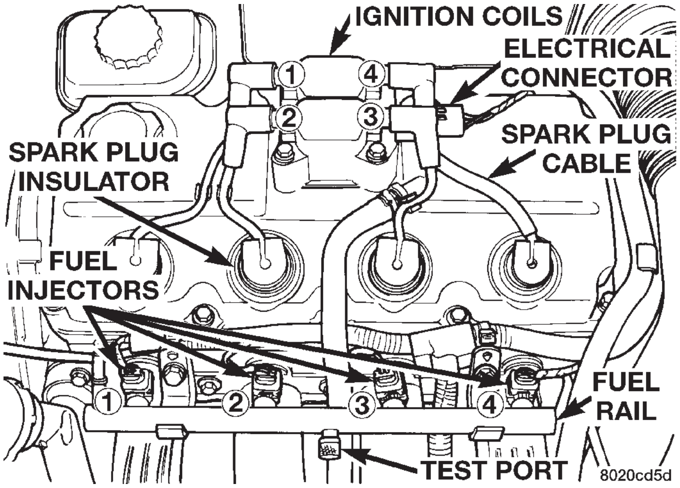


Fig. 1 Fuel Pressure Test Port—2.0L

FUEL INJECTORS—2.0L ENGINE

Refer to the Fuel Injectors for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

SERVICE PROCEDURES

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—2.0L ENGINE

Refer to the Fuel System Pressure Release Procedure for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

HOSES AND CLAMPS—2.0L ENGINE

Refer to Hoses and Clamps for the 2.4/3.0/3.3/3.8L engines in the Fuel Delivery System section of group 14 for more information.

QUICK-CONNNECT FITTINGS—2.0L ENGINE

Refer to the Quick Connect Fittings for the 2.4/3.0/3.3/3.8L engines under Service Procedures in the Fuel Delivery System section of group 14 for more information.

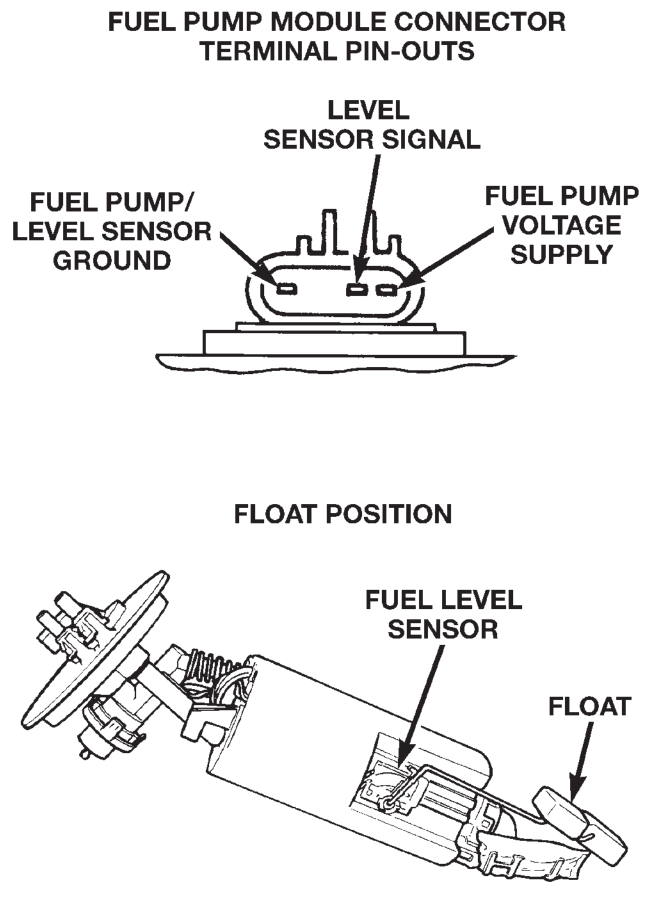
REMOVAL AND INSTALLATION

FUEL FILTER—2.0L ENGINE

Refer to the Fuel Filter for the 2.4/3.0/3.3/3.8L engines under Removal and Installation in the Fuel Delivery System section of group 14 for more information.

FUEL PUMP MODULE—2.0L ENGINE

Refer to the Fuel Pump Module for the 2.4/3.0/3.3/3.8L engines under Removal and Installation in the Fuel Delivery System section of group 14 for more information.



FLOAT POSITION (HEIGHT)	RESISTANCE
SENSOR FULL STOP....................	70±20 OHMS
SENSOR EMPTY STOP............	1050±30 OHMS

80004253

Fig. 2 FUEL LEVEL SENSOR DIAGNOSIS

FUEL PRESSURE REGULATOR—2.0L ENGINE

Refer to the Fuel Pressure Rgulator for the 2.4/3.0/3.3/3.8L engines under Removal and Installation in the Fuel Delivery System section of group 14 for more information.

FUEL PRESSURE REGULATOR—2.0L ENGINE

Refer to the Fuel Pressure Regulator for the 2.4/3.0/3.3/3.8L engines under Removal and Installation in the Fuel Delivery System section of group 14 for more information.

REMOVAL AND INSTALLATION (Continued)

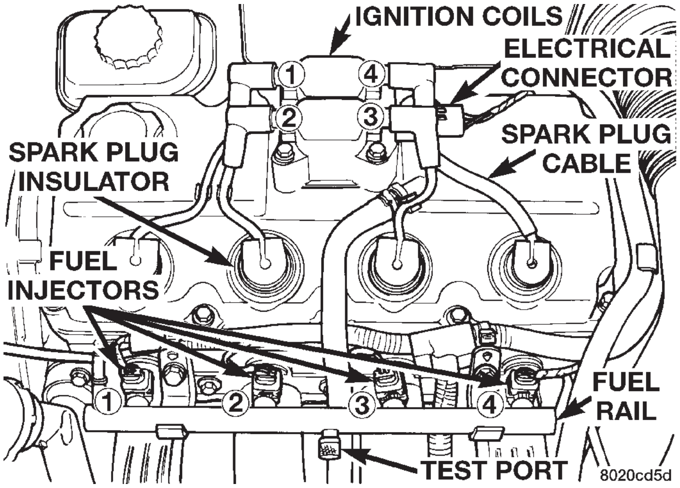


Fig. 3 Fuel Pressure Test Port—2.0L

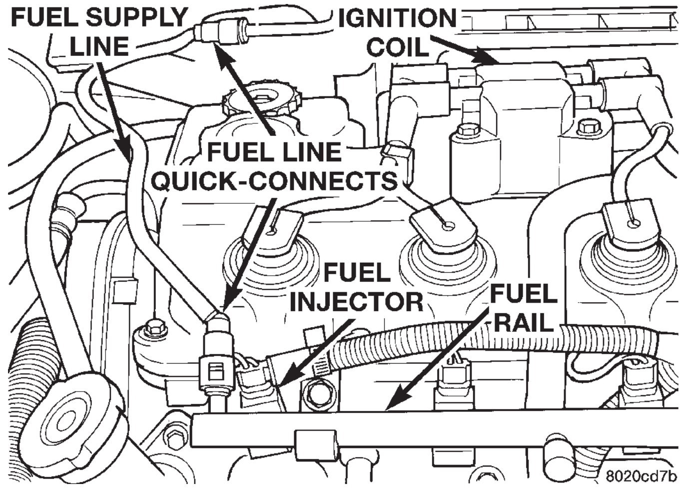


Fig. 4 Fuel Rail and Injectors

FUEL LEVEL SENSOR—2.0L ENGINE

Refer to the Fuel Pump Inlet Strainer for the 2.4/3.0/3.3/3.8L engines under Removal and Installation in the Fuel Delivery System section of group 14 for more information.

FUEL TANK—2.0L ENGINE

Refer to the Fuel Tank for the 2.4/3.0/3.3/3.8L engines under Removal and Installation in the Fuel Delivery System section of group 14 for more information.

FUEL INJECTORS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Release fuel system pressure. Refer to Fuel System Pressure Release procedure in this section.

(3) Disconnect fuel supply tube from rail. Refer to Quick-Connect Fittings in the Fuel Delivery section of this group.

(4) Disconnect electrical connectors from fuel injectors (Fig. 4).

(5) Remove fuel rail mounting screws.

(6) Lift rail off of intake manifold. Cover the fuel injector openings in the intake manifold.

(7) Remove fuel injector retainer (Fig. 5).

(8) Pull injector out of fuel rail. Replace fuel injector O-rings (Fig. 6).

INSTALLATION

(1) Apply a light coating of clean engine oil to the upper O-ring.

(2) Install injector in cup on fuel rail.

(3) Install retaining clip.

(4) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

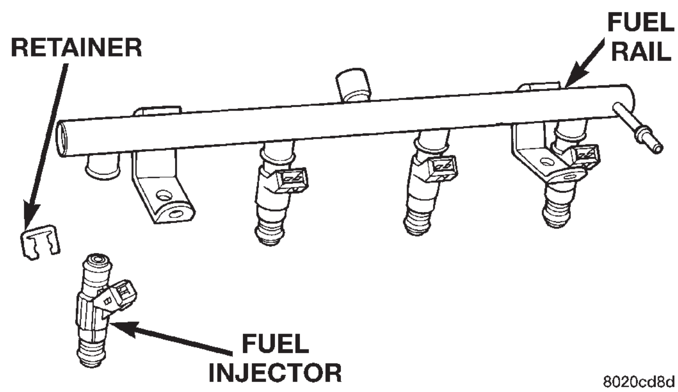


Fig. 5 Fuel Injector Retainer

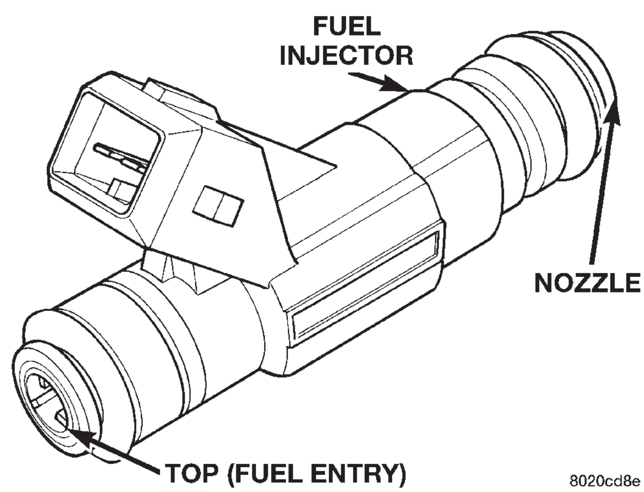


Fig. 6 Fuel Injector O-Rings

(5) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail mounting screws to 22.5 N·m ± 3 N·m (200±30 in. lbs.).

(6) Attach electrical connectors to fuel injectors.

REMOVAL AND INSTALLATION (Continued)

(7) Connect fuel supply tube to fuel rail. Refer to Quick Connect Fittings in the Fuel Delivery Section of this Group.

ACCELERATOR PEDAL

Refer to the Accelerator Pedal for the 2.4/3.0/.3.3/3.8L engines under Removal and Installation in the Fuel Delivery section of group 14 for more information.

TORQUE SPECIFICATION

DESCRIPTION	TORQUE
Accelerator Pedal to Dash Nuts	12 N·m (105 in. lbs.)
Fuel Pump Module Locknut	58 N·m (43 ft. lbs.)
Fuel Tank Strap Bolts	54 N·m (40 ft lbs.)
Fuel Rail Bolts	23 N·m (195 in. lbs.)
Ignition Coil Mounting Bolts	11 N·m (95 in. lbs.)
Intake Manifold Bolts	11 N·m (95 in. lbs.)
Throttle Control Shield	5.6 N·m (50 in. lbs.)

FUEL INJECTION SYSTEM—2.0L ENGINE

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INTRODUCTION—2.0L ENGINE

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MODES OF OPERATION—2.0L ENGINE

Refer to the Modes of Operation for 2.4/3.0/3.3/3.8L engines under General Information in the Fuel Injection System section of group 14 for more information.

DESCRIPTION AND OPERATION

SYSTEM DIAGNOSIS—2.0L ENGINE

Refer to System diagnosis for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

POWERTRAIN CONTROL MODULE—2.0L ENGINE

Refer to the Powertrain Control Module for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

AIR CONDITIONING PRESSURE TRANSDUCER—PCM INPUT—2.0L ENGINE

Refer to the Air Conditioning Pressure Transducer for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

AIR CONDITIONING SWITCH SENSE—PCM INPUT—2.0L ENGINE

Refer to the Air Conditioning Switch Sense for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT—2.0L ENGINE

Refer to the Automatic Shutdown (ASD) Sense for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

BATTERY VOLTAGE—PCM INPUT—2.0L ENGINE

Refer to the Battery Voltage for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

CAMSHAFT POSITION SENSOR—PCM INPUT—2.0L ENGINE

Refer to the Camshaft Position Sensor for 2.4L engine under Description and Operation in the Fuel Injection System section of group 14 for more information.

CRANKSHAFT POSITION SENSOR—PCM INPUT—2.0L ENGINE

Refer to the Crankshaft Position Sensor for 2.4L engine under Description and Operation in the Fuel Injection System section of group 14 for more information.

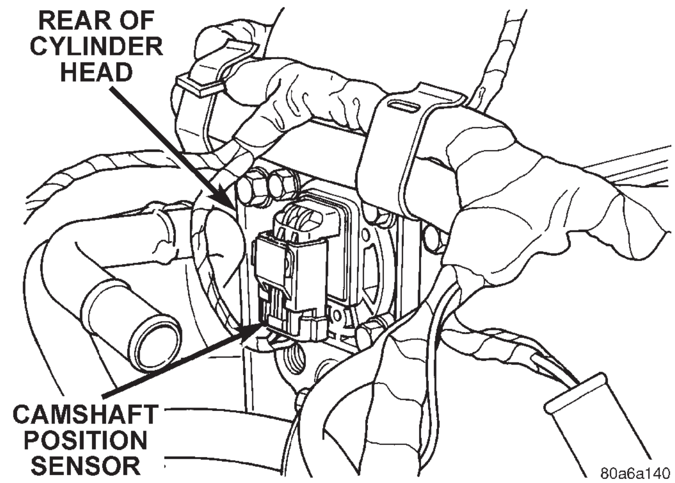


Fig. 1 Camshaft Position Sensor—2.0L Engine

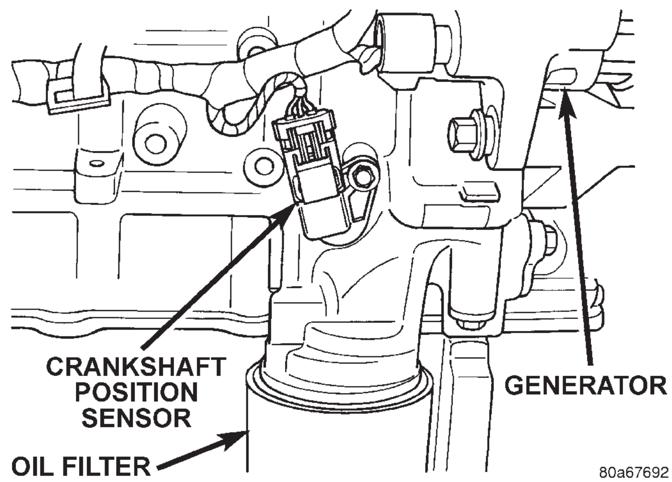


Fig. 2 Crankshaft Posistion Sensor—2.0L engine

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT—2.0L ENGINE

The coolant temperature sensor threads into the rear of the cylinder head, next to the camshaft position sensor (Fig. 3). New sensors have sealant applied to the threads.

Refer to the Engine Coolant Temperature Sensor for the 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

HEATED OXYGEN SENSOR—PCM INPUT—2.0L ENGINE

Refer to the Heated Oxygen Sensor for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

DESCRIPTION AND OPERATION (Continued)

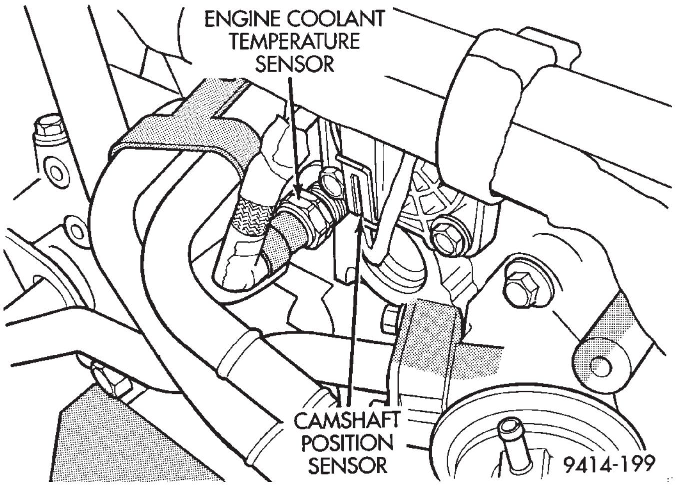


Fig. 3 Engine Coolant Temperature Sensor—2.0L engine

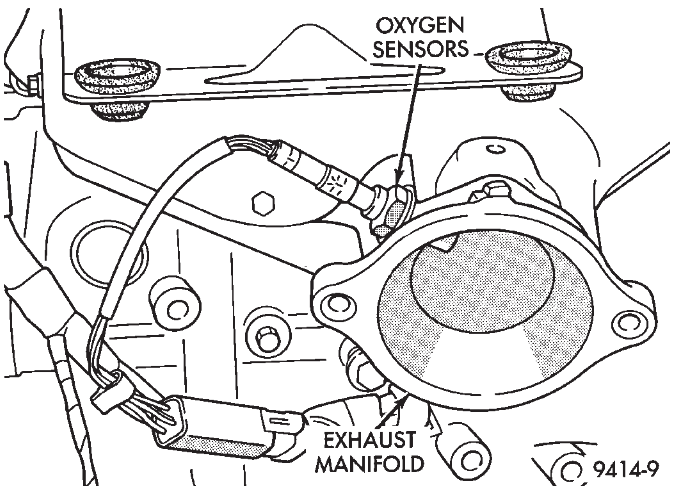


Fig. 4 Upstream Heated Oxygen Sensor—2.0L Engine

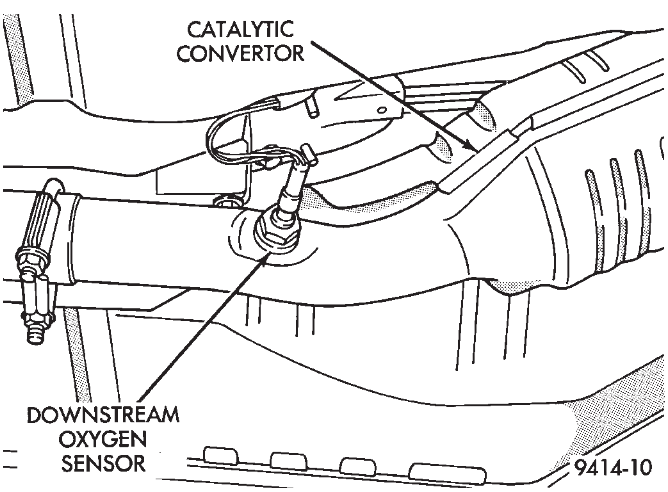


Fig. 5 Downstream Heated Oxygen Sensor—2.0L Engine

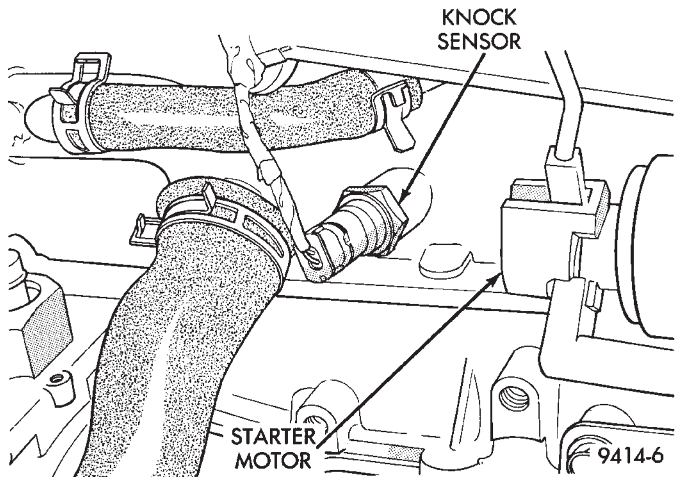


Fig. 6 Knock Sensor—2.0L engine

KNOCK SENSOR—PCM INPUT—2.0L ENGINE

Refer to the Knock Sensor for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

MANIFOLD ABSOLUTE PRESSURE (MAP SENSOR)—PCM INPUT—2.0L ENGINE

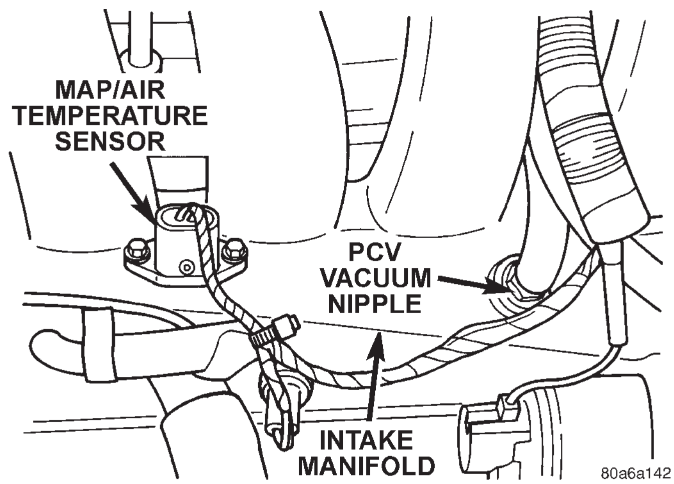


Fig. 7 MAP/IAT sensor—2.0L engine

Refer to the Manifold Absolute Pressure and Intake Air Temperature sensors for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

SPEED CONTROL—PCM INPUT—2.0L ENGINE

Refer to the Speed Control for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

DESCRIPTION AND OPERATION (Continued)

THROTTLE POSITION SENSOR/ IDLE AIR CONTROL MOTOR—PCM INPUT—2.0L ENGINE

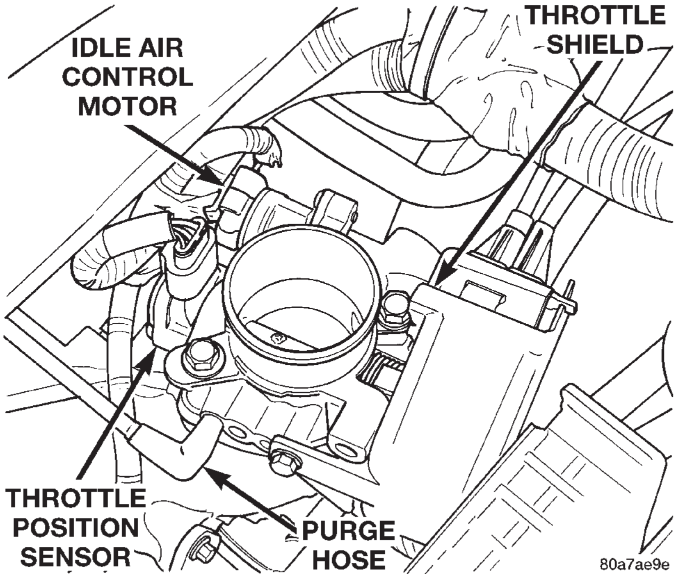


Fig. 8 Throttle Position Sensor/Idle Air Control motor—2.0L engine

Refer to the Throttle Control and Idle Air Control motor for the 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

AIR CONDITIONING (A/C) RELAY—PCM OUTPUT—2.0L ENGINE

Refer to the Air Conditioning relay for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

GENERATOR FIELD—PCM OUTPUT—2.0L ENGINE

Refer to Generator Field for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

AUTOMATIC SHUTDOWN RELAY—PCM OUTPUT—2.0L ENGINE

Refer to Automatic Shutdown Relay for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

FUEL PUMP RELAY—PCM OUTPUT—2.0L ENGINE

Refer to the Fuel Pump Relay for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

STARTER RELAY—PCM OUTPUT—2.0L ENGINE

Refer to the Starter Relay for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

IDLE AIR CONTROL MOTOR—PCM OUTPUT—2.0L ENGINE

Refer to the Idle Air Control Motor for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information. Refer to (Fig. 8) for component location

ELECTRONIC EGR TRANSDUCER—PCM OUTPUT—2.0L ENGINE

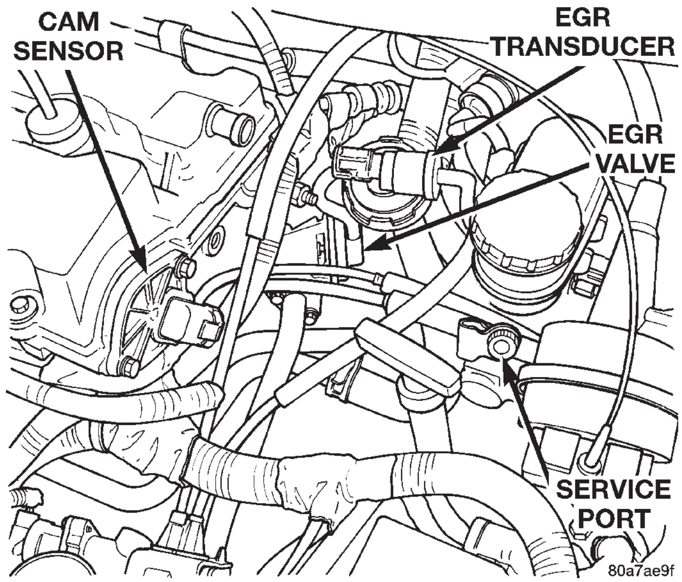


Fig. 9 Electronic EGR Transducer—2.0L engine

Refer to the Electronic EGR Transducer for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

DATA LINK CONNECTOR—PCM OUTPUT—2.0L ENGINE

Refer to the Data Link Connector for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

FUEL INJECTORS—PCM OUTPUT—2.0L ENGINE

Refer to the Fuel Injectors for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

DESCRIPTION AND OPERATION (Continued)

IGNITION COIL—PCM OUTPUT—2.0L ENGINE

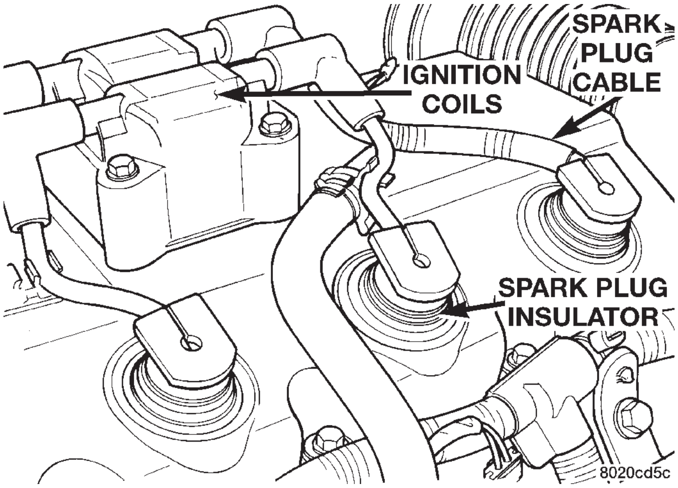


Fig. 10 Ignition Coil—2.0L engine

Refer to the Ignition Coil for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT—2.0L ENGINE

Refer to the Malfunction Indicator Lamp for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

RADIATOR FAN CONTROL MODULE—PCM OUTPUT—2.0L ENGINE

Refer to the Radiator Fan Control Module for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

SPEED CONTROL SOLENOIDS—PCM OUTPUT—2.0L ENGINE

Refer to the Speed Control Solenoids for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

TACHOMETER—PCM OUTPUT—2.0L ENGINE

Refer to the Tachometer for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

THROTTLE BODY—2.0L ENGINE

Refer to the Throttle Body for 2.4/3.0/3.3/3.8L engines under Description and Operation in the Fuel Injection System section of group 14 for more information.

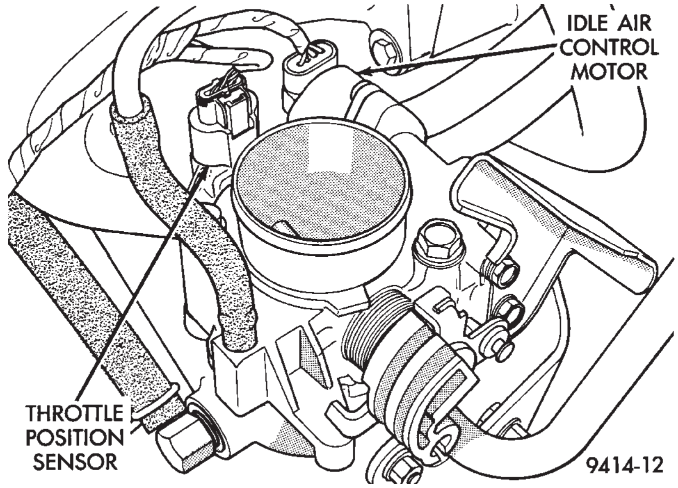


Fig. 11 Throttle Body—2.0L engine

DIAGNOSIS AND TESTING

VISUAL INSPECTION—SOHC

Before diagnosing or servicing the fuel injection system, perform a visual inspection for loose, disconnected, or misrouted wires and hoses. A thorough visual inspection that includes the following checks saves unnecessary test and diagnostic time.

(1) Inspect the battery connections. Clean corroded terminals.

(2) Check the 2 PCM 40-way connector for stretched wires on pushed out terminals

(3) Open the Power Distribution Center (PDC). Check for blown fuses. Ensure the relays and fuses are fully seated in the PDC. A label on the underside of the PDC cover shows the locations of each relay and fuse.

(4) Verify the throttle cable operates freely.

(5) Check the electrical connections at the idle air control motor and throttle position sensor.

(6) Check hose connections between the PCV valve, vacuum port - intake manifold and the oil separator (Fig. 13).

(7) Inspect the electrical connections at the MAP sensor/intake air temperature sensor and the (Fig. 14).

(8) Inspect the fuel injector electrical connections (Fig. 15).

(9) Inspect the ignition coil electrical connector. Ensure the spark plug insulators are firmly seated over the spark plugs (Fig. 16).

(10) Check the electrical connection to the radiator fan.

(11) Inspect for corrosion on the electrical connections at the starter motor solenoid. Check the ground cable connection below the starter motor (Fig. 17).

(12) Inspect the air cleaner filter element. Replace as necessary. Check the air induction system for restrictions.

DIAGNOSIS AND TESTING (Continued)

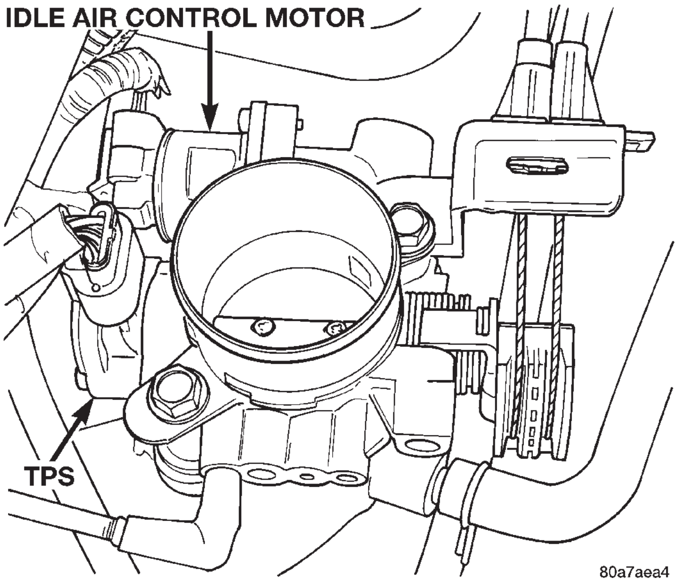


Fig. 12 Idle Air Control Motor and Throttle Position Sensor—Typical

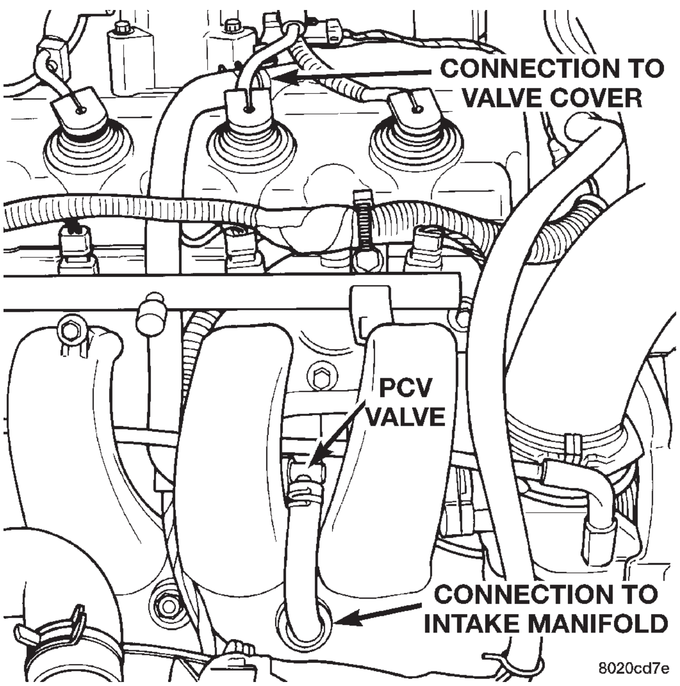


Fig. 13 PCV Valve

(13) Check the electrical connection at the knock sensor (Fig. 18).

(14) Check the electrical connections at the camshaft position sensor and engine coolant temperature sensor (Fig. 19).

(15) Check the electrical connector at the Electronic EGR Transducer. Inspect the vacuum and back pressure hoses at the solenoid and transducer for leaks (Fig. 20).

(16) Inspect the electrical connections at the generator (Fig. 21). Check the generator belt for glazing or damage.

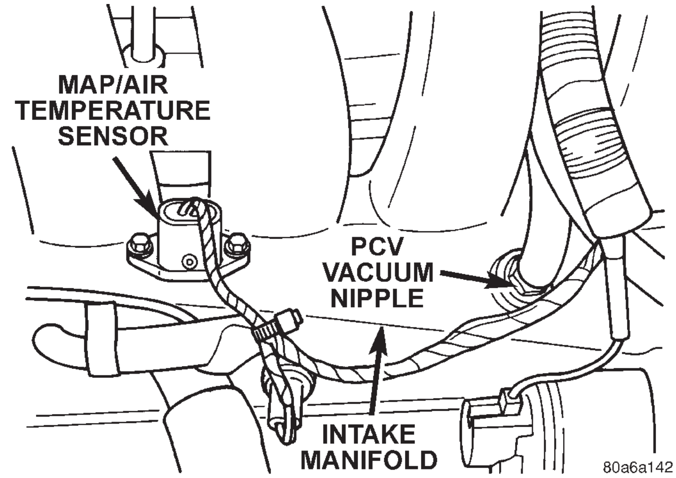


Fig. 14 MAP/Intake Air Temperature Sensor

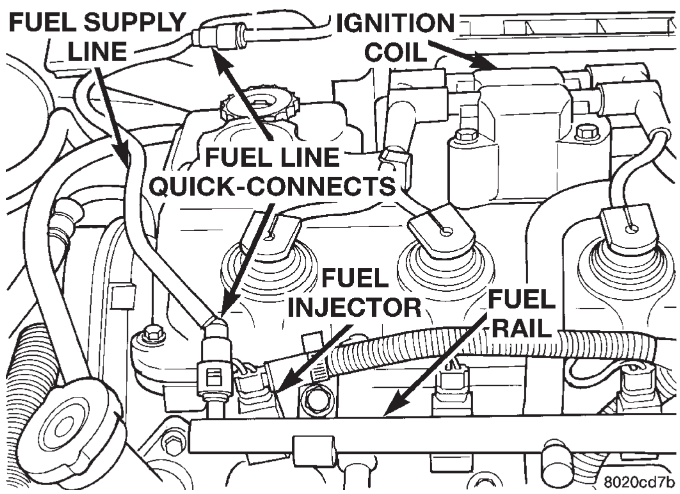


Fig. 15 Fuel Injectors

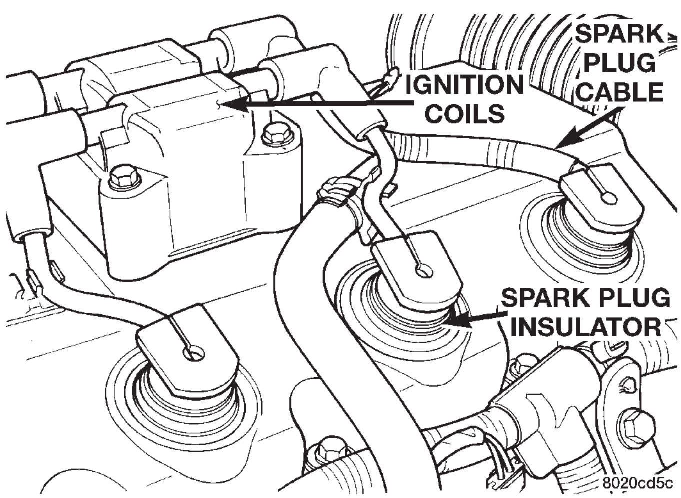


Fig. 16 Ignition Coil and Spark Plugs—Typical

(17) Inspect the electrical connector at the crankshaft position sensor (Fig. 22).

(18) Check the electrical connection at the vehicle speed sensor (Fig. 23).

DIAGNOSIS AND TESTING (Continued)

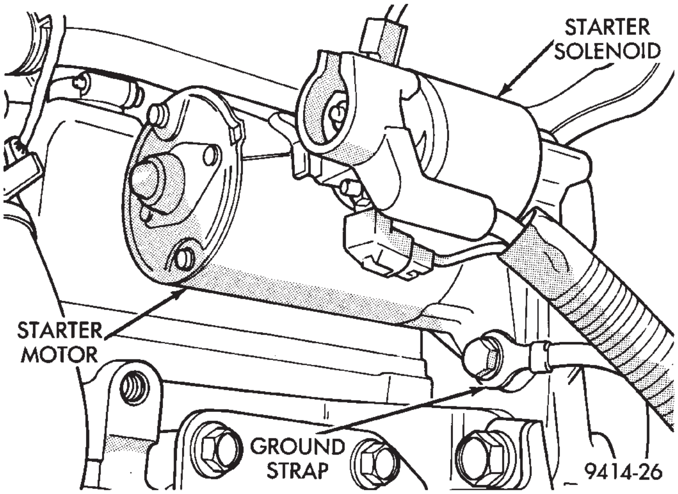


Fig. 17 Starter Motor and Ground Strap

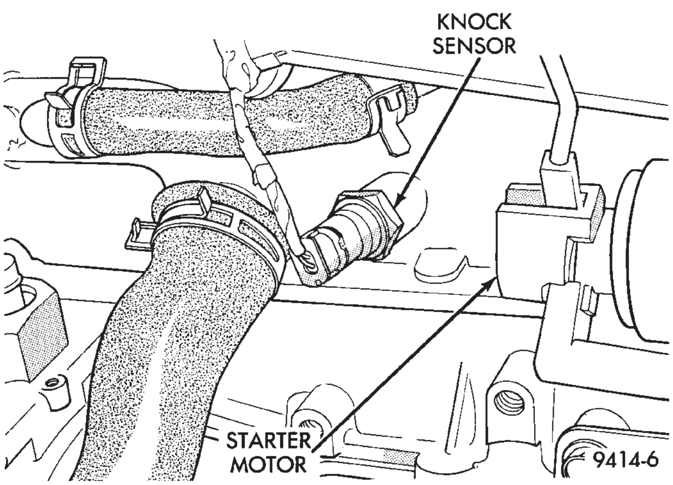


Fig. 18 Knock Sensor

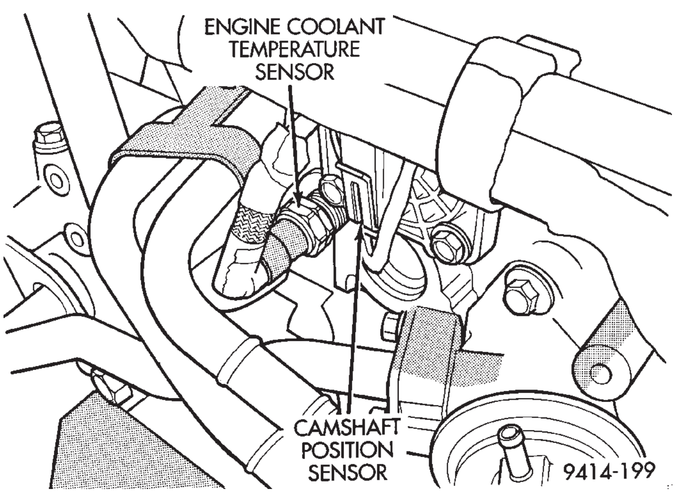


Fig. 19 Camshaft Position Sensor and Engine Coolant Temperature Sensor

(19) Check the electrical connection at the power steering pressure switch on the power steering gear housing (Fig. 24).

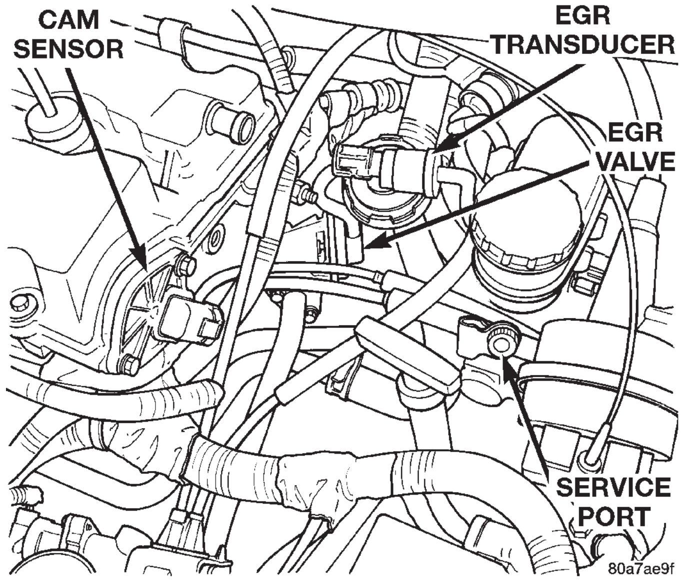


Fig. 20 Electronic EGR Transducer

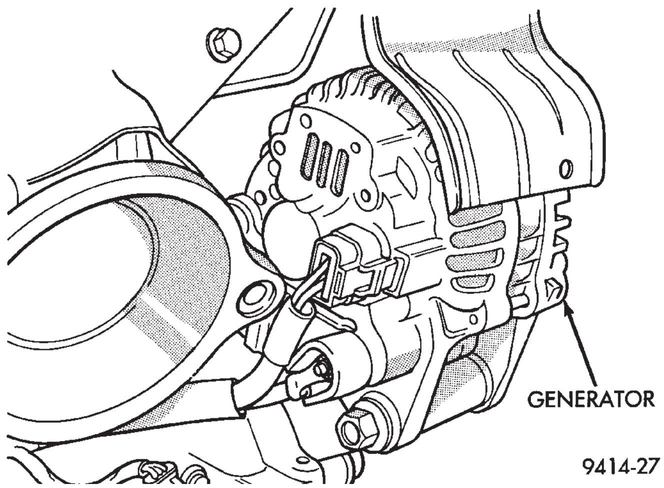


Fig. 21 Generator

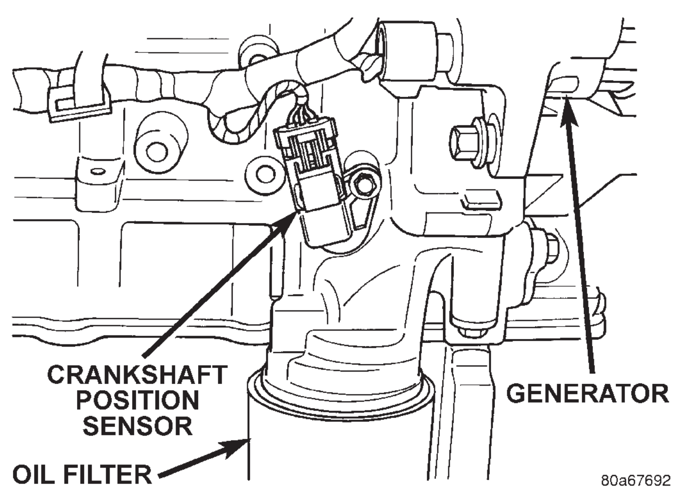


Fig. 22 Crankshaft Position Sensor

DIAGNOSIS AND TESTING (Continued)

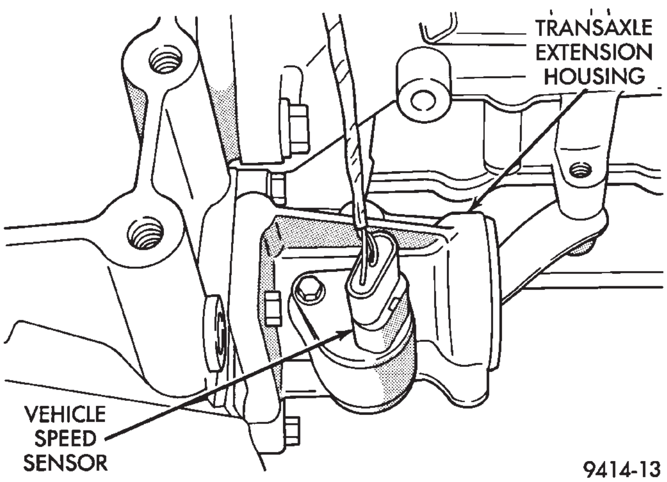


Fig. 23 Vehicle Speed Sensor

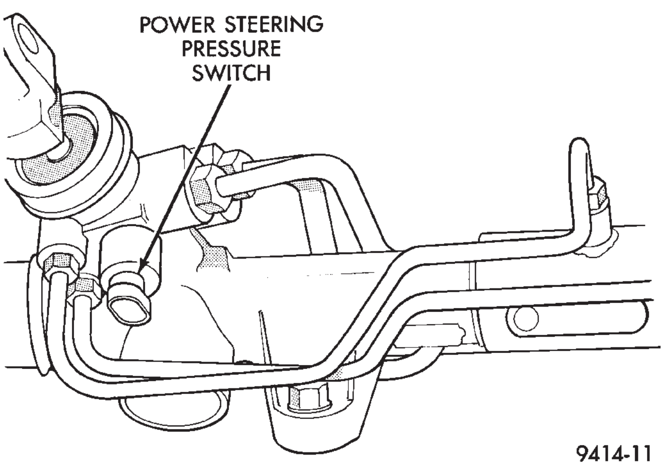


Fig. 24 Power Steering Pressure Switch

(20) Inspect the electrical connections at the upstream and downstream heated oxygen sensors (Fig. 25) and (Fig. 26).

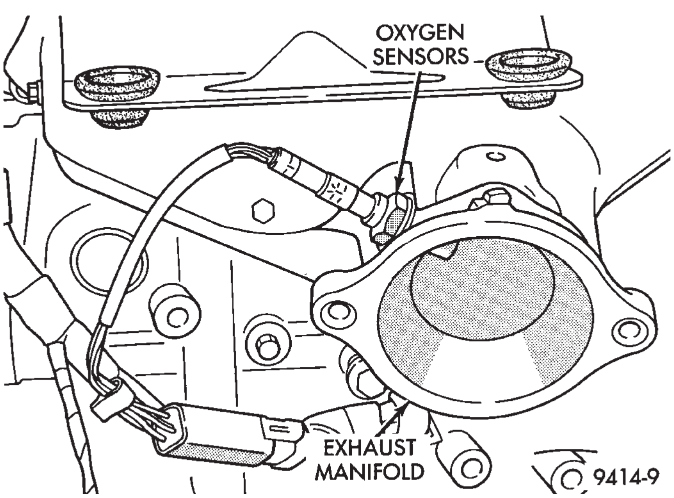


Fig. 25 Upstream Heated Oxygen Sensor

(21) Inspect the fuel pump module electrical connection at the fuel tank for corrosion or damage (Fig.

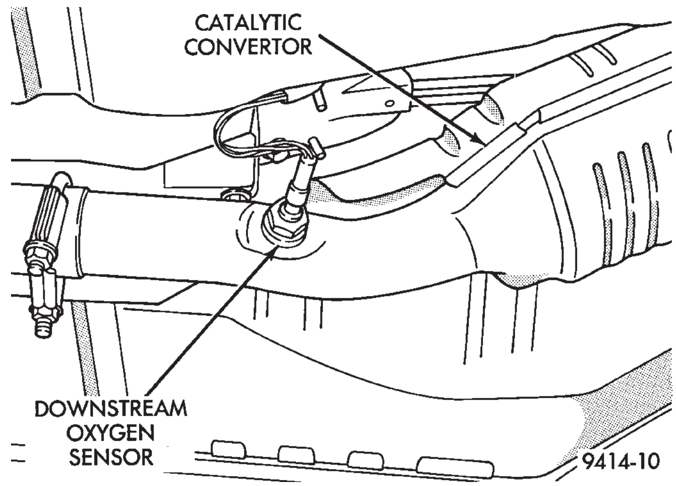


Fig. 26 Downstream Heated Oxygen Sensor

27). Check for pinched, kinked or damaged fuel supply tube.

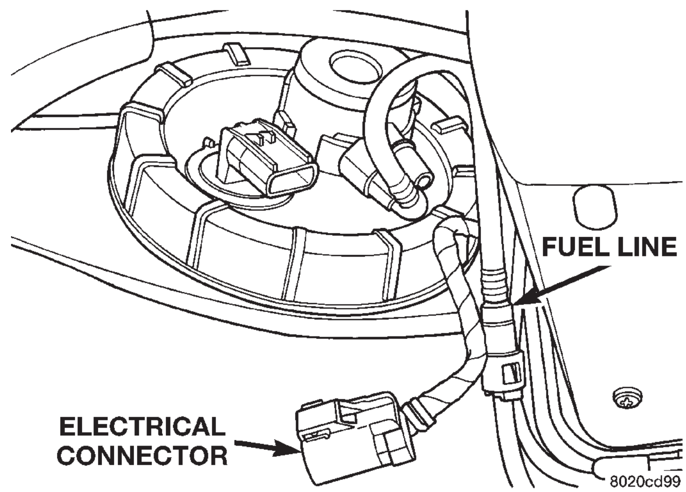


Fig. 27 Fuel Pump Module Electrical Connector

(22) Inspect the connections to the speed control servo, if equipped. Refer to Group 8H, Vehicle Speed Control.

(23) Inspect the connection at the battery temperature sensor.

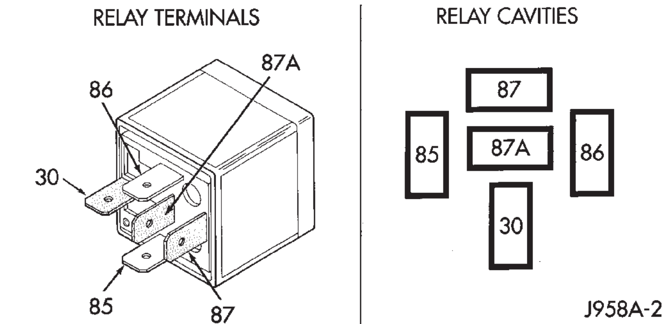
ASD AND FUEL PUMP RELAYS—2.0L ENGINE

Refer to the ASD and Fuel Pump Relays for 2.4/3.0/3.3/3.8L engines under Diagnosis and Testing in the Fuel Injection System section of group 14 for more information.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.0L ENGINE

To perform a complete test of the MAP sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the MAP sensor only, refer to the following:

DIAGNOSIS AND TESTING (Continued)



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 28 ASD and Fuel Pump Relay Terminals

CAUTION: When testing the MAP sensor, be sure that the harness wires are not damaged by the test meter probes.

(1) Test the MAP sensor output voltage at the MAP sensor connector between terminals 1 and 4 (Fig. 29). With the ignition switch ON and the engine not running, output voltage should be 4 to 5 volts. The voltage should drop to 1.5 to 2.1 volts with a hot, neutral idle speed condition. If OK, go to next step. If not OK, go to step 3.

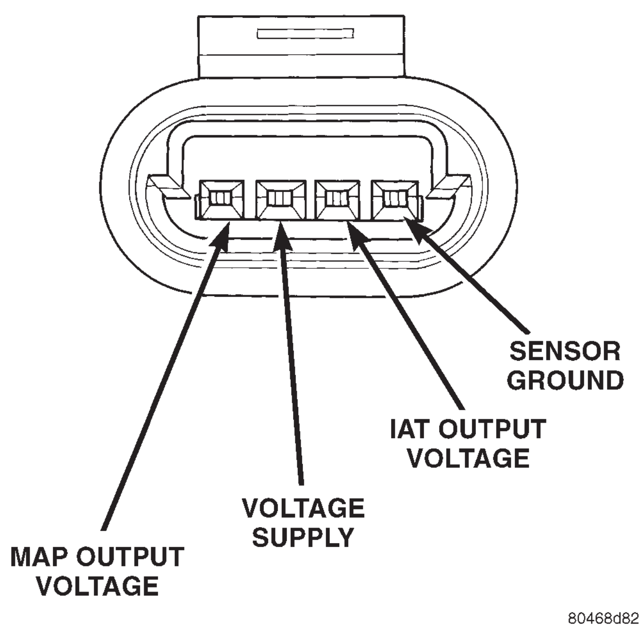


Fig. 29 MAP Sensor Connector

(2) Test PCM terminal 36 for the same voltage described in the previous step to verify wire harness condition. Repair as required.

(3) Test the MAP sensor ground circuit at sensor connector terminal 1 and PCM terminal 43. If OK, go to next step. If not OK, repair as required.

(4) Test MAP sensor supply voltage between sensor connector terminals 3 and 1 with the key ON. The voltage should be approximately 5 volts (±.5V). Five volts (±.5V) should also be at terminal 61 of the PCM. If OK, replace MAP sensor. If not OK, repair or replace the wire harness as required.

KNOCK SENSOR—2.0L ENGINE

The knock sensor output voltage to the PCM can be read with the DRB III scan tool. Sensor output should be between 80 mV and 4 volts with the engine running between 576 and 2208 rpm. If the output falls outside of this range a DTC will be set.

CAMSHAFT AND CRANKSHAFT POSITION SENSOR

Refer to Group 8D, Ignition for Diagnosis and Testing of Camshaft and Crankshaft Sensors.

ENGINE COOLANT TEMPERATURE SENSOR

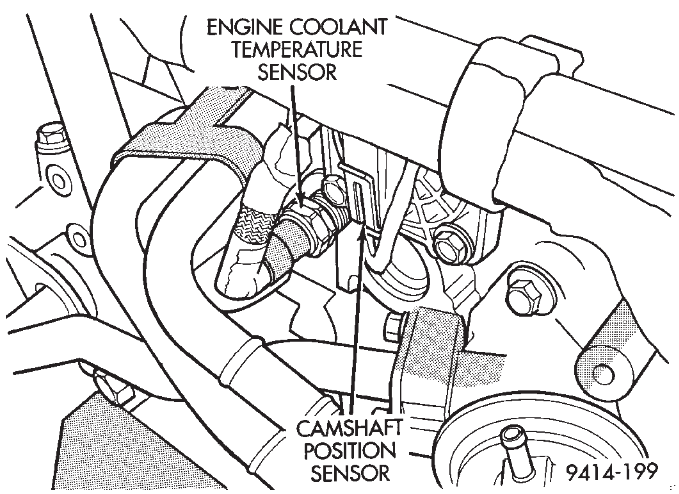


Fig. 30 Engine Coolant Temperature Sensor Location—SOHC

Refer to the Engine Coolant Temperature sensor for the 2.4/3.0/3.3/3.8L engines under Diagnosis and Testing in the Fuel Injection System section of group 14 for more information.

THROTTLE POSITION SENSOR

To perform a complete test of the this sensor and its circuitry, the DRB III scan tool is the best method. To test the throttle position sensor only, refer to the following:

The Throttle Position Sensor (TPS) can be tested with a digital voltmeter (DVM). The center terminal of the sensor is the output terminal. One of the other terminals is a 5 volt supply and the remaining terminal is ground.

DIAGNOSIS AND TESTING (Continued)

Connect the DVM between the center and sensor ground terminal. Refer to Group 8W - Wiring Diagrams for correct pinout.

With the ignition switch in the ON position, check the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at Wide-Open-Throttle (WOT). At idle, TPS output voltage should be approximately 0.38 volts to 1.2 volts. At wide open throttle, TPS output voltage should be approximately 3.1 volts to 4.4 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

THROTTLE BODY MINIMUM AIR FLOW

(1) Turn ignition key to Off.

(2) Disconnect the PCV valve hose from the intake manifold nipple (Fig. 31). Cap the PCV vacuum nipple.

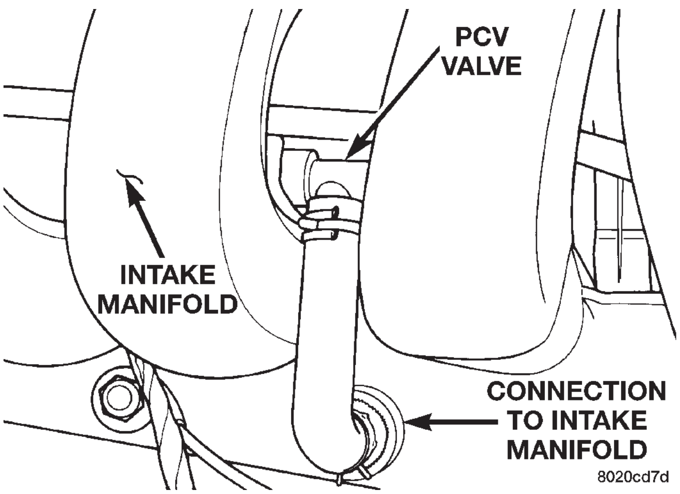


Fig. 31 PCV Vacuum Nipple

(3) Disconnect purge hose from the nipple on the throttle body (Fig. 32).

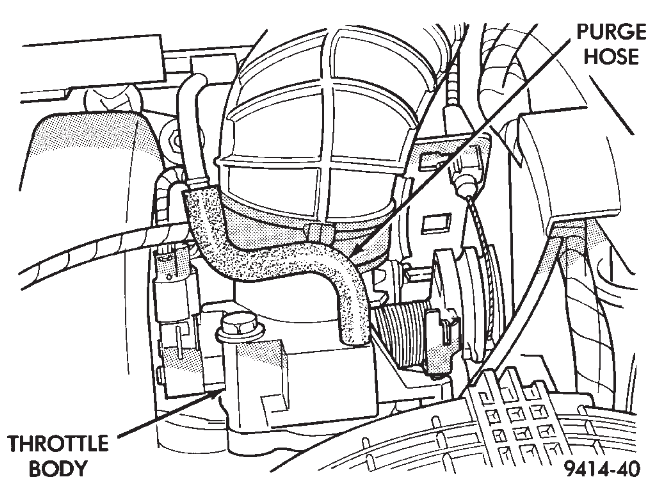


Fig. 32 Purge Hose

(4) Use a piece of hose to attach Air Metering Orifice 6457 (0.125 in. orifice) to the purge nipple on the throttle body (Fig. 33).

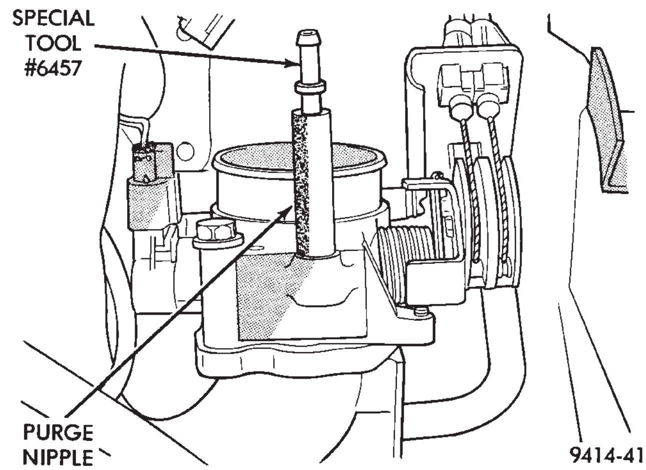


Fig. 33 Orifice 6457 Attached to Purge Nipple

(5) Ensure that all accessories are off.

(6) Connect the DRB scan tool to the data link connector inside the passenger compartment.

(7) Run engine in Park or Neutral until the cooling fan has cycled on and off at least once (180°F).

(8) Using the DRB scan tool, access Minimum Airflow Idle Speed.

(9) The following will then occur:

- Idle air control motor will fully close
- Idle spark advance will become fixed
- PCM will go open loop enriched
- DRB scan tool displays engine RPM

(10) If idle RPM is within the range shown in the Idle Specification chart, throttle body minimum airflow is set correctly.

IDLE SPECIFICATION —2.0L ENGINE

Odometer Reading	Idle RPM
Below 1000 Miles	550–1300 RPM
Above 1000 Miles	600–1300 RPM

(11) If idle RPM is above specifications, use the DRB scan tool to check idle air control motor operation. If idle air control motor is OK, replace throttle body. If idle air flow is below specification, shut off the engine and clean the throttle body as follows:

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

DIAGNOSIS AND TESTING (Continued)

(a) Remove the throttle body from engine.

(b) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(c) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when closed, must be free of deposits.**

(d) Use compressed air to dry the throttle body.

(e) Inspect throttle body for foreign material.

(f) Install throttle body on manifold.

(g) Repeat steps 1 through 14. If the minimum air flow is still not within specifications, the problem is not caused by the throttle body.

(12) Shut off engine.

(13) Remove Air Metering Orifice 6457. Install purge hose.

(14) Remove cap from PCV valve. Connect hose to PCV valve.

(15) Remove DRB scan tool.

SPECIFICATIONS

TORQUE

DESCRIPTION	TORQUE
Air Cleaner Wingnut	1.5 N·m (15 in. lbs.)
Air Cleaner Mount. Stud-To-Thrott. Body	10 N·m (90 in. lbs.)
Crankshaft Position Sensor Mounting Bolts	8 N·m (70 in. lbs.)
Engine Coolant Temperature Sensor	18 N·m (165 in. lbs.)
IAC Motor-To-Throttle Body Bolts	7 N·m (60 in. lbs.)
MAP/IAT Sensor	2 N·m (20 in. lbs.)
MAP/IAT Sensor	3 N·m (30 in. lbs.)
Oxygen Sensor	28 N·m (20 ft. lbs.)
Powertrain Control Module (PCM) Mounting Screws	4 N·m (35 in. lbs.)
Throttle Cable Cover	4.5 N·m (40 in. lbs.).
Throttle Body Mounting Bolts	23 N·m (200 in. lbs.)
Throttle Position Sensor Mounting Screws	2 N·m (20 in. lbs.)
Vehicle Speed Sensor Mounting Bolt	2.2 N·m (20 in. lbs.)

FUEL INJECTION SYSTEM—2.5L DIESEL ENGINE

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GENERAL INFORMATION

INTRODUCTION

This section will cover components either regulated or controlled by the Powertrain Control Module (PCM). The fuel heater relay, fuel heater and fuel gauge are not operated by the PCM. These components are controlled by the ignition (key) switch. All other fuel system electrical components necessary to operate the engine are controlled or regulated by the PCM. Refer to the following PCM description for more information.

Certain fuel system component failures may cause a no start, or prevent the engine from running. It is important to know that the PCM has a feature where, if possible, it will ignore the failed sensor, set a code related to the sensor, and operate the engine in a “Limp Home” mode. When the PCM is operating in a “Limp Home” mode, the Diesel Glow Plug lamp on the instrument panel will be constantly illuminated, and the engine will most likely have a noticeable loss of performance. An example of this would be an Accelerator Pedal Position Sensor failure, and in that situation, the engine would run at a constant 1100 RPM, regardless of the actual position of the pedal. This is the most extreme of the three “Limp Home” modes.

In addition to indicating that the glow plugs are hot enough to start combustion, the Glow Plug Lamp is also used in the diagnosis of the PCM, and when

GENERAL INFORMATION (Continued)

illuminated constantly, it usually indicates a problem has been detected somewhere within the fuel system. The DRBIII scan tool is the best method for communicating with the PCM to diagnose faults within the system.

DESCRIPTION AND OPERATION

POWERTRAIN CONTROL MODULE (PCM)

The Powertrain Control Module (PCM) is mounted in the center consule to a bracket located in front of the Air Bag Module (Fig. 1).

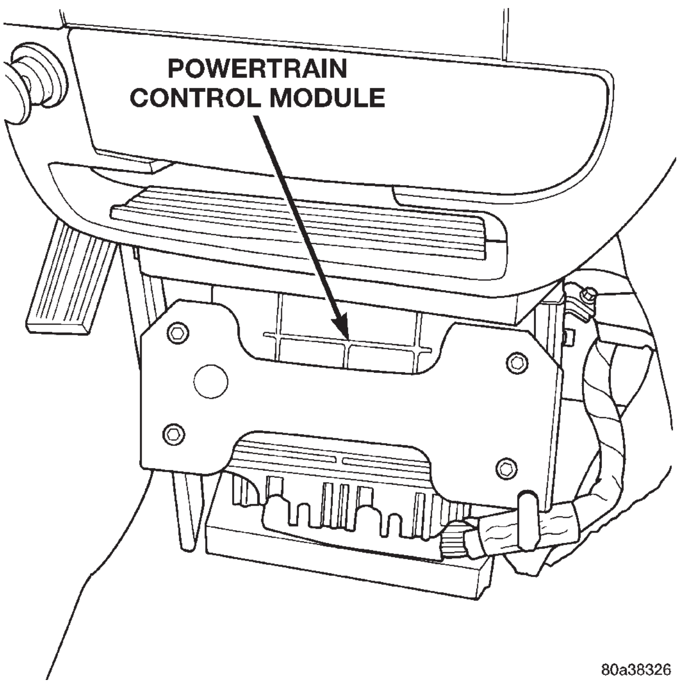

Fig. 1 PCM Location

The PCM is a pre–programmed, dual micro–processor digital computer. It will either directly operate or partially regulate the:

- Speed Control
- Speed Control LED lamp
- Fuel Timing Solenoid
- Glow Plug Relay
- Glow Plugs
- EGR Solenoid
- Glow Plug Lamp
- Diesel PCM Relay
- Air Conditioning Operation
- Tachometer
- Exhaust Gas Recirculation (EGR) Solenoid

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.**

PCM Inputs are:

- Air Conditioning Selection
- Theft Alarm
- Clutch Switch
- Diesel PCM Relay
- ISO-Protocol
- Control Sleeve
- Fuel Temperature
- Boost Pressure Sensor
- Accelerator Pedal Sensor
- EGR
- A/C Pressure
- Engine Coolant Temperature Sensor
- Low Idle Position Switch
- 5 Volt Supply
- Vehicle Speed Sensor
- Sensor Return
- Glow Plug
- Engine Speed Sensor (rpm)
- Fuel Injector #1 Sensor
- Starter Signal
- Brake Switch
- Speed Control Switch Position
- Power Ground
- Signal Ground
- Ignition (key) Switch Sense
- Battery Voltage
- SCI Receive (DRB scan tool connection)

PCM Outputs:

After inputs are received by the PCM, certain sensors, switches and components are controlled or regulated by the PCM. These are considered **PCM Outputs.** These outputs are for:

- A/C Clutch Relay (for A/C clutch operation)
- Speed Control LED
- Data Link Connectors (for DRB scan tool)
- Diesel PCM Relay
- Diesel PCM Sense
- Accelarator Pedal
- 5 Volts Supply
- Glow Plug Relay
- Fan Relay
- Fuel Quantity
- Fuel Timing Solenoid
- Fuel Shut-Off Solenoid
- Engine Speed Sensor
- Glow Plug Lamp (malfunction indicator lamp)
- Exhaust Gas Recirculation (EGR) Solenoid
- Glow Plug Relay
- Tachometer
- SCI transmit (DRB scan tool connection)

DESCRIPTION AND OPERATION (Continued)

BOOST PRESSURE SENSOR

The Boost Pressure Sensor is mounted to the top of the intake manifold. (Fig. 2) It is a sensor that measures both manifold vacuum and turbo boost, and it also contains an integrated intake air temperature sensor. The Boost Pressure Sensor takes the place of the Mass Air Flow (MAF). In the Intake Air Temperature Sensor component, there is a ceramic element that changes its resistance based on temperature. The ceramic element is part of an electronic circuit connected to the PCM, and has a voltage applied to it. The ceramic element is exposed to the air inside the intake. This air has a cooling effect on the ceramic element, and its resistance changes. This causes the voltage flowing through the intake air temperature circuit to vary. The voltage signal produced by the Intake Air Temperature Sensor changes inversely to the temperature, and is measured by the PCM. As a general rule, when the temperature of the air in the intake is high, the voltage signal produced by the Intake Air Temperature Sensor is low. The component of the Boost Pressure Sensor that measures manifold vacuum and turbo boost produces a voltage signal that is proportional to the pressure in the inake manifold. When the intake manifold pressure is low, the voltage is low, and when the pressure is high, the voltage is high. The PCM uses the voltage signals from the Boost Pressure Sensor, and the Intake Air Temperature Sensor to determine the amount of air flowing through the intake manifold.

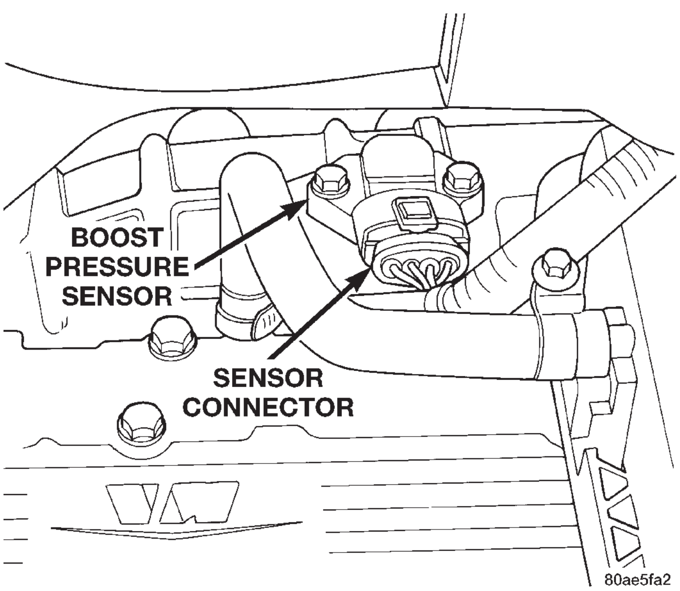

Fig. 2 Boost Pressure Sensor Location

VEHICLE THEFT ALARM

The PCM can learn if the vehicle has a Vehicle Theft Alarm (VTA) system. Once it detects the vehicle having VTA, **the controller can ONLY BE USED ON VEHICLES WITH VTA.**

If the PCM is put it on a vehicle without VTA the Glow Plug Lamp will start to blink and the vehicle will not start.

The PCM cannot be flashed to remove the VTA.

BATTERY VOLTAGE—PCM INPUT

The battery voltage input provides power to the PCM. It also informs the PCM what voltage level is being supplied by the generator once the vehicle is running.

The battery input also provides the voltage that is needed to keep the PCM memory alive. The memory stores Diagnostic Trouble Code (DTC) messages. Trouble codes will still be stored even if the battary voltage is lost.

SENSOR RETURN—PCM INPUT (ANALOG GROUND)

Sensor Return provides a low noise Analog ground reference for all system sensors.

SIGNAL GROUND—PCM INPUT

Signal ground provides a low noise ground to the data link connector.

IGNITION CIRCUIT SENSE—PCM INPUT

The ignition circuit sense input signals the PCM that the ignition (key) switch has been turned to the ON position. This signal initiates the glow plug control routine to begin the “pre–heat” cycle.

START SIGNAL—PCM INPUT

This input tells the PCM that the engine starter is being operated. This in turn will start the glow plug “post–heat” cycle.

POWER GROUND

Provides a common ground for power devices (solenoid and relay devices).

NEEDLE MOVEMENT OR INSTRUMENTED FIRST INJECTOR—PCM INPUT

This input from the PCM supplies a constant 30 mA electrical current source for the first injector sensor. It will vary the voltage to this sensor when it senses a mechanical movement within the injector needle (pintle) of the number–1 cylinder fuel injector. When this voltage has been determined by the PCM, it will then control an output to the fuel timing solenoid (the fuel timing solenoid is located on the fuel injection pump). Also refer to Fuel Injection Pump for additional information.

The first injector sensor is a magnetic (inductive) type.

DESCRIPTION AND OPERATION (Continued)

The first injector sensor is used only on the fuel injector for the number–1 cylinder (Fig. 3). It is not used on the injectors for cylinders number 2, 3, or 4.

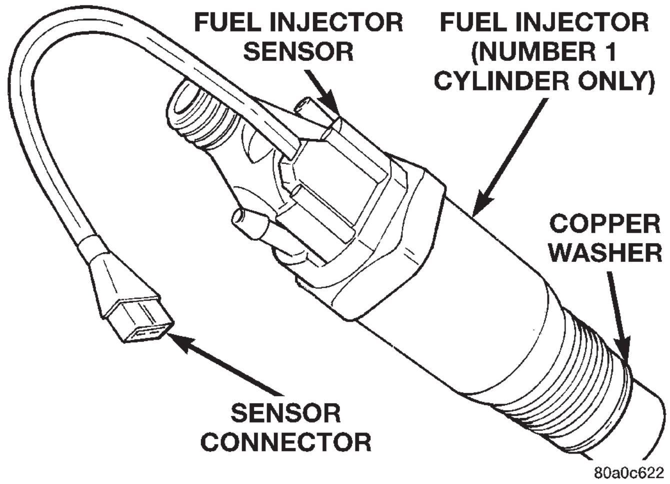

Fig. 3 Fuel Injector Sensor

FUEL INJECTOR SENSOR—GROUND

Provides a low noise ground for the fuel injector sensor only.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The 0–5 volt input from this sensor tells the PCM the temperature of the engine coolant. Based on the voltage received at the PCM, it will then determine operation of the fuel timing solenoid, glow plug relay, electrical vacuum modulator (emission component) and generator (charging system).

The sensor is located on the side of the #3 cylinder head near the rear of fuel injection pump (Fig. 4).

ENGINE SPEED SENSOR—PCM INPUT

The engine speed sensor is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 5).

The engine speed sensor produces its own output signal. If this signal is not received the engine will not start by the PCM.

The engine speed sensor input is used in conjunction with the first injector sensor to establish fuel injection pump timing.

The flywheel has four notches at its outer edge (Fig. 6). Each notch is spaced equally every 90°. The notches cause a pulse to be generated when they pass under the speed sensor (Fig. 6). These pulses are the input to the PCM. The input from this sensor determines crankshaft position (in degrees) by monitoring the notches.

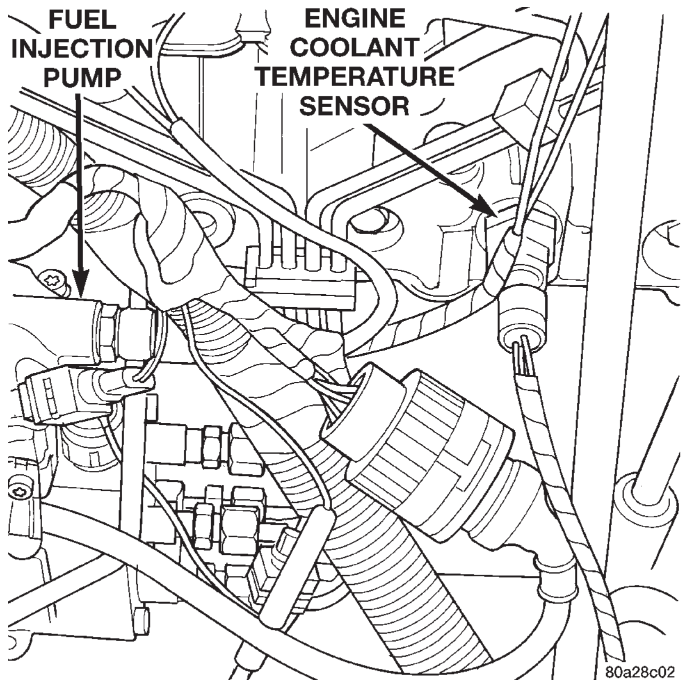

Fig. 4 Engine Coolant Temperature Sensor Location

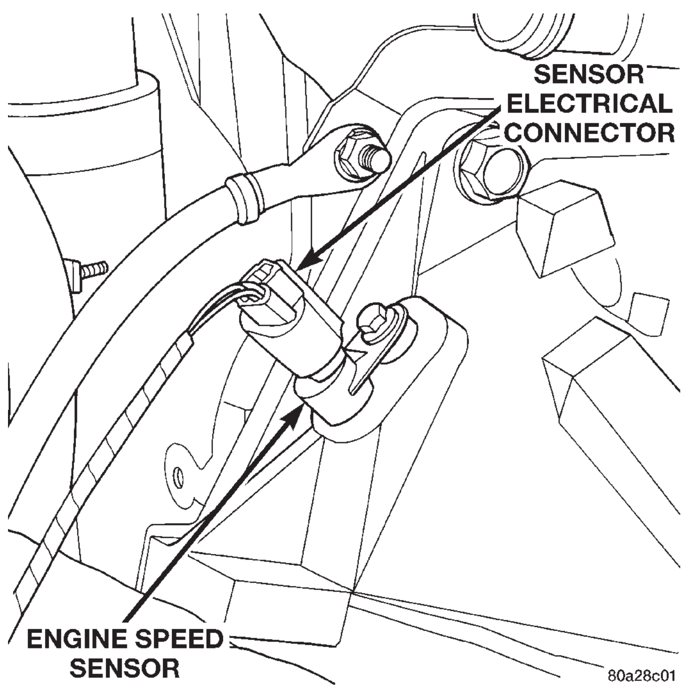

Fig. 5 Engine Speed Sensor Location

The sensor also generates an rpm signal to the PCM. This signal is used as an input for the Diesel relay for control of the generator field, vehicle speed control, and instrument panel mounted tachometer.

If the engine speed sensor should fail, the system is unable to compensate for the problem and the car will stop.

DESCRIPTION AND OPERATION (Continued)

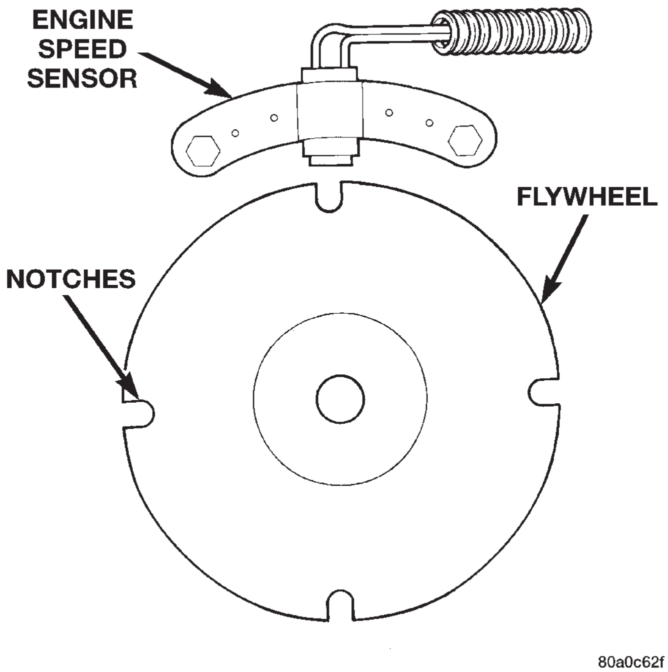

Fig. 6 Speed Sensor Operation

AIR CONDITIONING (A/C) CONTROLS—PCM INPUTS

The A/C control system information applies to factory installed air conditioning units.

A/C REQUEST SIGNAL: When either the A/C or Defrost mode has been selected and the A/C low and high–pressure switches are closed, an input signal is sent to the powertrain control module (PCM). The PCM uses this input to cycle the A/C compressor through the A/C relay.

If the A/C low or high–pressure switch opens, the PCM will not receive an A/C request signal. The PCM will then remove the ground from the A/C relay. This will deactivate the A/C compressor clutch. Also, if the engine coolant reaches a temperature outside normal of its normal range, or it overheats, the PCM will deactivate the A/C clutch.

BRAKE SWITCH—PCM INPUT

When the brake light switch is activated, the PCM receives an input indicating that the brakes are being applied. After receiving this input, the PCM is used to control the speed control system. There is a Primary and a Secondary brake switch. The Secondary brake switch is closed until the brake pedal is pressed.

DATA LINK CONNECTOR—PCM INPUT AND OUTPUT

The 16–way data link connector (diagnostic scan tool connector) links the Diagnostic Readout Box (DRB) scan tool with the PCM. The data link connector is located under the instrument panel near the bottom of steering column (Fig. 7).

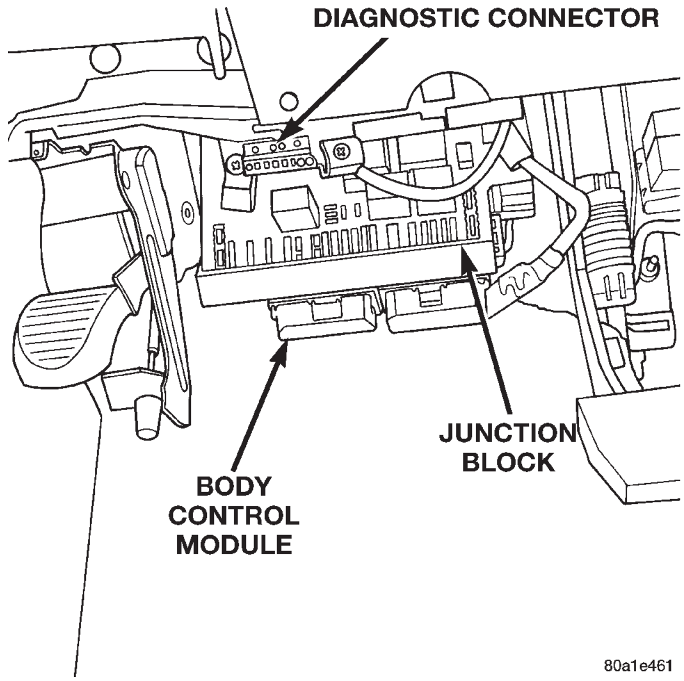

Fig. 7 Data Link Connector Location

VEHICLE SPEED SENSOR—PCM INPUT

The vehicle speed sensor (Fig. 8) is located in the extension housing of the transmission. The sensor input is used by the PCM to determine vehicle speed and distance traveled.

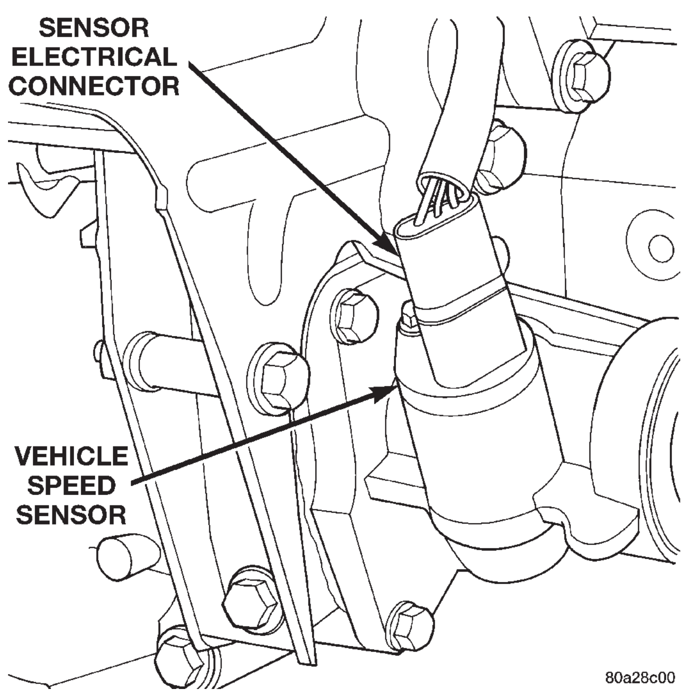

Fig. 8 Vehicle Speed Sensor—Typical

DESCRIPTION AND OPERATION (Continued)

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).

In addition to determining distance and vehicle speed, the output from the sensor is used to control speed control operation.

SPEED CONTROL—PCM INPUTS

The speed control system provides five separate inputs to the PCM; On/Off, Set, Resume/Accel, Cancel, and Decel.. The On/Off input informs the PCM that the speed control system has been activated. The Set input informs the PCM that a fixed vehicle speed has been selected. The Resume input indicates to the PCM that the previous fixed speed is requested.

Speed control operation will start at 50 km/h–142 km/h (35–85 mph). The upper range of operation is not restricted by vehicle speed. Inputs that affect speed control operation are vehicle speed sensor and throttle position sensor.

Refer to Group 8H for further speed control information.

DIESEL PCM RELAY—PCM INPUT

A 12 volt signal at this input indicates to the PCM that the Diesel relay has been activated. The Diesel relay is located in the PDC. The PDC is located next to the battery in the engine compartment. For the location of the relay within the PDC, refer to label on PDC cover.

This input is used only to sense that the Diesel relay is energized. If the PCM does not see 12 volts + at this input when the Diesel relay should be activated, it will set a Diagnostic Trouble Code (DTC).

FIVE VOLT POWER—PCM OUTPUT

This circuit supplies approximately 5 volts to power the Accelerator Pedal Postion Sensor, Mass Air Flow Sensor, and A/C Pressure Sensor.

ENGINE COOLANT GAUGE—PCM OUTPUT

Refer to the Instrument Panel and Gauges group for additional information.

ENGINE OIL PRESSURE GAUGE—PCM OUTPUT

Refer to the Instrument Panel and Gauges group for additional information.

GLOW PLUG LAMP—PCM OUTPUT

The Glow Plug lamp (malfunction indicator lamp) illuminates on the message center each time the ignition (key) switch is turned on. It will stay on for about two seconds as a bulb test.

If the PCM receives an incorrect signal, or no signal from certain sensors or components, the lamp BLINKS. This is a warning that the PCM has recorded a system or sensor malfunction. It signals an immediate need for service. There are only 5 HARD faults that can turn on this lamp to make it blink.

Fig. 9 Glow Plug Lamp Symbol

SPEED CONTROL—PCM OUTPUTS

These two circuits control the fuel quantity actuator to regulate vehicle speed. Refer to Group 8H for Speed Control information.

AIR CONDITIONING RELAY—PCM OUTPUT

This circuit controls a ground signal for operation of the A/C clutch relay. Also refer to Air Conditioning (A/C) Controls—PCM Input for additional information.

The A/C relay is located in the Power Distribution Center (PDC). The PDC is located next to the battery in the engine compartment. For the location of the relay within the PDC, refer to label on PDC cover.

FUEL TIMING SOLENOID—PCM OUTPUT

The fuel timing solenoid is located on the bottom of the fuel injection pump (Fig. 10).

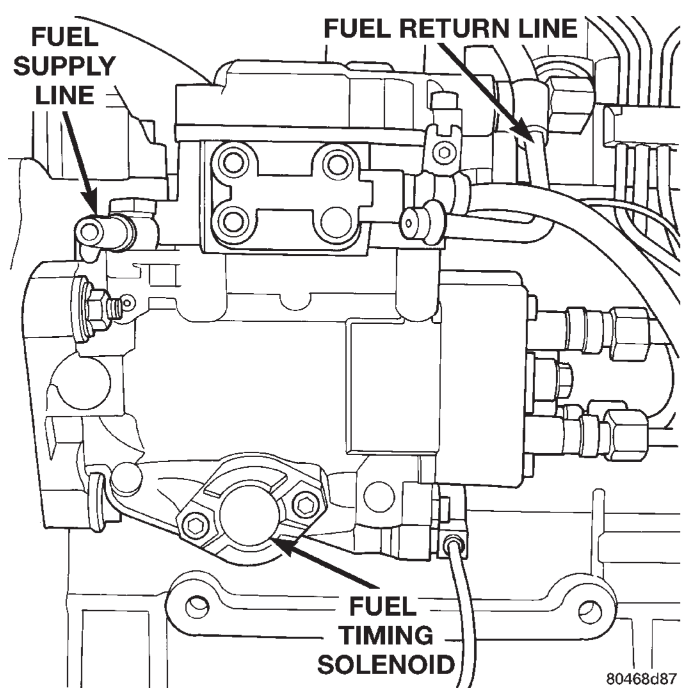

Fig. 10 Fuel Timing Solenoid

This 12+ volt, pulse width modulated (duty–cycle) output controls the amount of fuel timing (advance) in the fuel injection pump. The higher the duty-

DESCRIPTION AND OPERATION (Continued)

–cycle, the lower the advance. The lower the duty–cycle, the more advanced the fuel timing.

The duty–cycle is determined by the PCM from inputs it receives from the fuel injector sensor and engine speed sensor.

TACHOMETER—PCM OUTPUT

The PCM supplies engine rpm values to the Body Controller that then supplies the instrument cluster mounted tachometer (if equipped). Refer to Group 8E for tachometer information.

GLOW PLUG RELAY—PCM OUTPUT

The glow plug relay is located in the engine compartment on the left–inner fender (Fig. 11).

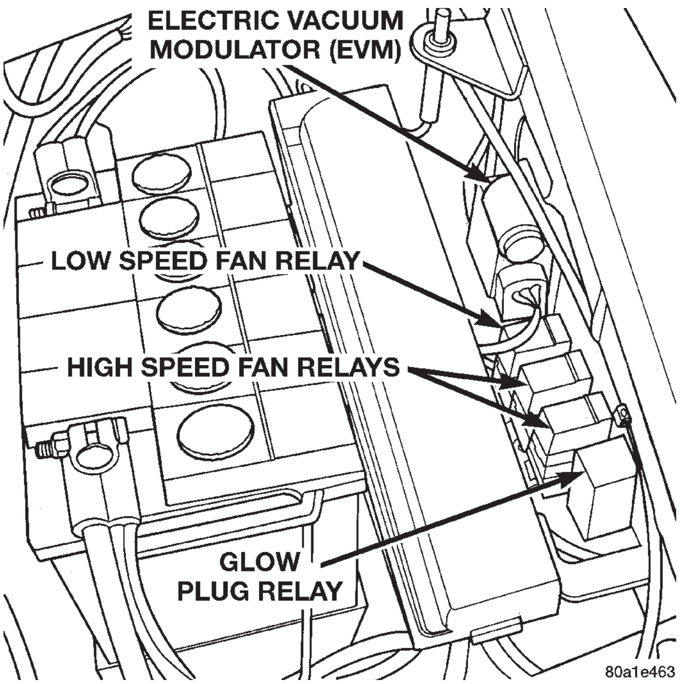

Fig. 11 Glow Plug Relay Location

When the ignition (key) switch is placed in the ON position, a signal is sent to the PCM relating current engine coolant temperature. This signal is sent from the engine coolant temperature sensor.

After receiving this signal, the PCM will determine if, when and for how long a period the glow plug relay should be activated. This is done before, during and after the engine is started. Whenever the glow plug relay is activated, it will control the 12V+ 100 amp circuit for the operation of the four glow plugs.

The Glow Plug lamp is tied to this circuit. Lamp operation is also controlled by the PCM.

With a cold engine, the glow plug relay and glow plugs may be activated for a maximum time of 200 seconds. Refer to the following Glow Plug Control chart for a temperature/time comparison of glow plug relay operation.

In this chart, Pre–Heat and Post–Heat times are mentioned. Pre–heat is the amount of time the glow plug relay circuit is activated when the ignition (key) switch is ON, but the engine has yet to be started. Post–heat is the amount of time the glow plug relay circuit is activated after the engine is operating. The Glow Plug lamp will not be illuminated during the post–heat cycle.

GLOW PLUG CONTROL

ENGINE COOLANT TEMPERATURE KEY ON	WAIT-TO-START LAMP ON (SECONDS)	PRE-HEAT CYCLE (GLOW PLUGS ON) (SECONDS)	POST-HEAT CYCLE (SECONDS)
-30 C	15 SEC.	45 SEC.	200 SEC.
-10 C	8 SEC.	35 SEC.	180 SEC.
+10 C	6 SEC.	25 SEC.	118 SEC.
+30 C	5 SEC.	20 SEC.	70 SEC.
+40 C	4 SEC.	16 SEC.	60 SEC.
+70 C	3 SEC.	16 SEC.	20 SEC.

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GLOW PLUGS

Glow plugs are used to help start a cold or cool engine. The plug will heat up and glow to heat the combustion chamber of each cylinder. An individual plug is used for each cylinder. Each plug is threaded into the cylinder head above the fuel injector (Fig. 12).

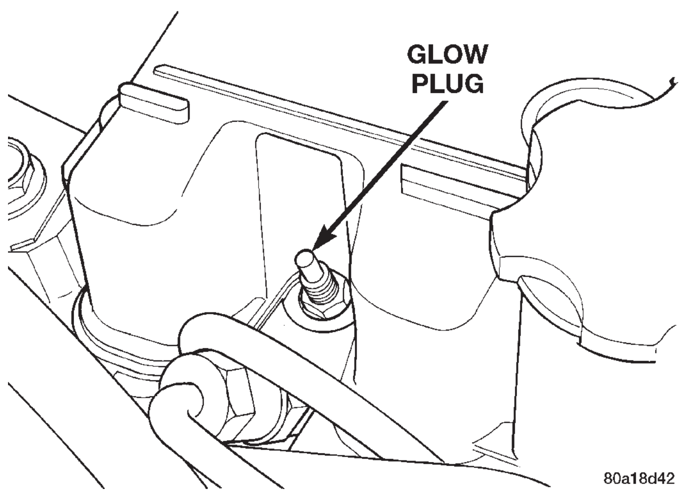

Fig. 12 Glow Plug

Each plug will momentarily draw approximately 25 amps of electrical current during the initial key–on cycle. This is on a cold or cool engine. After heating,

DESCRIPTION AND OPERATION (Continued)

the current draw will drop to approximately 9–12 amps per plug.

Total momentary current draw for all four plugs is approximately 100 amps on a cold engine dropping to a total of approximately 40 amps after the plugs are heated.

Electrical operation of the glow plugs are controlled by the glow plug relay. Refer to the previous Glow Plug Relay—PCM Output for additional information.

EXHAUST GAS RECIRCULATION (EGR) SOLENOID—PCM OUTPUT

This circuit controls operation of the Exhaust Gas Recirculation (EGR) solenoid. The EGR solenoid (Fig. 11) controls operation of the EGR valve.

Refer to Group 25, Emission Control System for information. See EGR solenoid.

DIAGNOSIS AND TESTING

DIESEL DIAGONSTICS

The PCM controller does engine off diagonstics tests, which may be heard for about 60 seconds after turning the key off.

DIESEL PCM RELAY TEST

To perform a test of the relay and its related circuitry, refer to the DRB scan tool. To test the relay only, refer to Relays—Operation/Testing in this section of the group.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

ENGINE SPEED SENSOR TEST

To perform a test of the engine speed sensor and its related circuitry, refer to the DRB scan tool.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

ENGINE COOLANT TEMPERATURE SENSOR TEST

The sensor is located on the side of cylinder head near the rear of fuel injection pump (Fig. 13).

For a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components, refer to On-Board Diagnostics in Group 25, Emission Control System. To test the sensor only, refer to the following:

(1) Disconnect wire harness connector from coolant temperature sensor.

(2) Test the resistance of the sensor with a high input impedance (digital) volt–ohmmeter. The resistance (as measured across the sensor terminals) should be less than 1340 ohms with the engine warm. Refer to the following Sensor Resistance (OHMS) chart. Replace the sensor if it is not within the range of resistance specified in the chart.

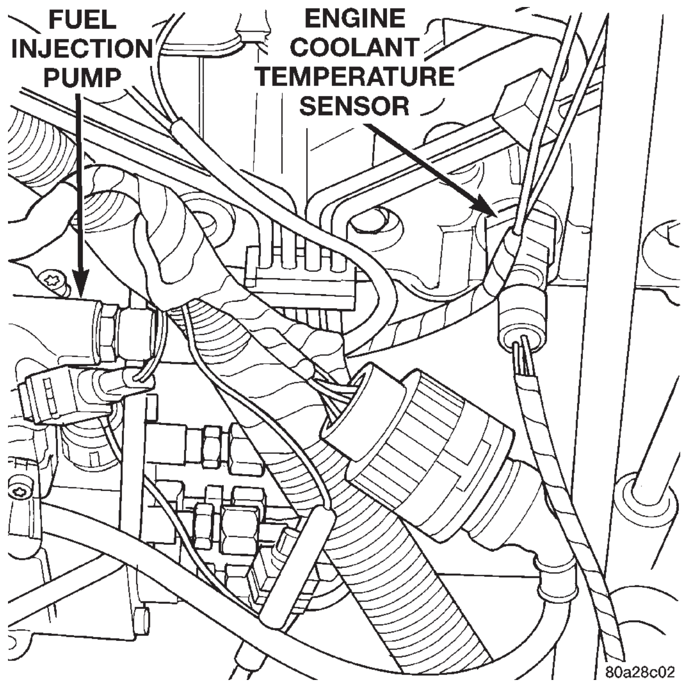

Fig. 13 Engine Coolant Temperature Sensor Location

SENSOR RESISTANCE (OHMS)

TEMPERATURE		RESISTANCE (OHMS)	
C	F	MIN	MAX
−40	−40	291,490	381,710
−20	−4	85,850	108,390
−10	14	49,250	61,430
0	32	29,330	35,990
10	50	17,990	21,810
20	68	11,370	13,610
25	77	9,120	10,880
30	86	7,370	8,750
40	104	4,900	5,750
50	122	3,330	3,880
60	140	2,310	2,670
70	158	1,630	1,870
80	176	1,170	1,340
90	194	860	970
100	212	640	720
110	230	480	540
120	248	370	410

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(3) Test continuity of the wire harness. Do this between the PCM wire harness connector and the sensor connector terminal. Also test continuity of wire harness to the sensor connector terminal. Refer

DIAGNOSIS AND TESTING (Continued)

to Group 8W for wiring connector and circuitry information. Repair the wire harness if an open circuit is indicated.

(4) After tests are completed, connect electrical connector to sensor.

GLOW PLUG TEST

Hard starting or a rough idle after starting may be caused by one or more defective glow plugs. Before testing the glow plugs, a test of the glow plug relay should be performed. This will ensure that 12V+ is available at the plugs when starting the engine. Refer to the Glow Plug Relay Test for information.

For accurate test results, the glow plugs should be removed from the engine. The plugs must be checked when cold. **Do not check the plugs if the engine has recently been operated. If plugs are checked when warm, incorrect amp gauge readings will result.**

Use Churchill Glow Plug Tester DX.900 or an equivalent (Fig. 14) for the following tests. This tester is equipped with 4 timer lamps.

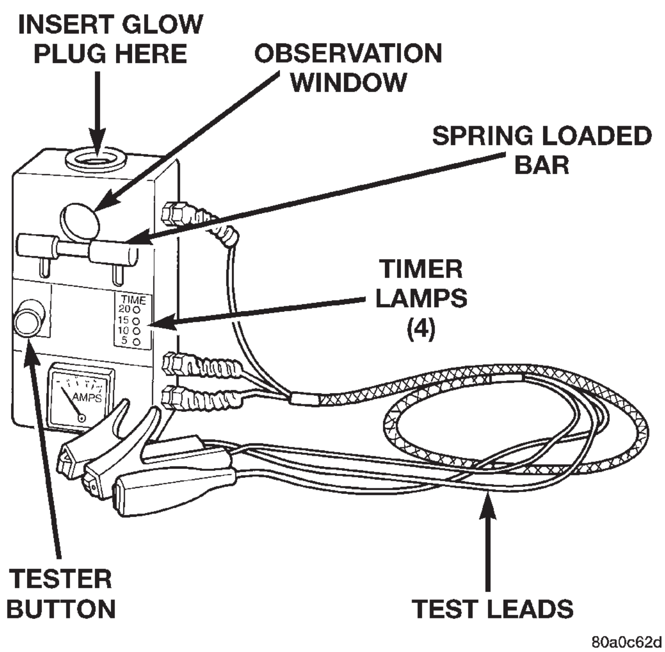

Fig. 14 Typical Glow Plug Tester

(1) Remove the glow plugs from the engine. Refer to Glow Plug Removal/Installation.

(2) Attach the red lead of the tester to the 12V+ (positive) side of the battery.

(3) Attach the black lead of the tester to the 12V– (negative) side of the battery.

(4) Fit the glow plug into the top of the tester and secure it with the spring loaded bar (Fig. 14).

(5) Attach the third lead wire of the tester to the electrical terminal at the end of the glow plug.

(6) When performing the test, the tester button (Fig. 14) should be held continuously without release for 20 seconds as indicated by the 4 timer lamps. Each illuminated lamp represents a 5 second time lapse.

(a) Press and hold the tester button (Fig. 14) and note the amp gauge reading. The gauge reading should indicate a momentary, initial current draw (surge) of approximately 25 amps. After the initial surge, the amp gauge reading should begin to fall off. The glow plug tip should start to glow an orange color after 5 seconds. If the tip did not glow after 5 seconds, replace the glow plug. Before discarding the glow plug, check the position of the circuit breaker on the bottom of the plug tester. It may have to be reset. Reset if necessary.

(b) Continue to hold the tester button while observing the amp gauge and the 4 timer lamps. When all 4 lamps are illuminated, indicating a 20 second time lapse, the amp gauge reading should indicate a 9–12 amp current draw. If not, replace the glow plug. Refer to Glow Plug Removal/Installation.

(7) Check each glow plug in this manner using one 20 second cycle. If the glow plug is to be retested, it must first be allowed to cool to room temperature.

WARNING: THE GLOW PLUG WILL BECOME EXTREMELY HOT (GLOWING) DURING THESE TESTS. BURNS COULD RESULT IF IMPROPERLY HANDLED. ALLOW THE GLOW PLUG TO COOL BEFORE REMOVING FROM TESTER.

(8) Remove the glow plug from the tester.

GLOW PLUG RELAY TEST

The glow plug relay is located in the engine compartment on the left–inner fender (Fig. 15).

When the ignition (key) switch is placed in the ON position, a signal is sent to the PCM relating current engine coolant temperature. This signal is sent from the engine coolant temperature sensor.

After receiving this signal, the PCM will determine if, when and for how long a period the glow plug relay should be activated. This is done before, during and after the engine is started. Whenever the glow plug relay is activated, it will control the 12V+ 100 amp circuit for the operation of the four glow plugs.

The Glow Plug lamp is tied to this circuit. Lamp operation is also controlled by the PCM.

With a cold engine, the glow plug relay and glow plugs may be activated for a maximum time of 200 seconds. Refer to the Glow Plug Control chart for a temperature/time comparison of glow plug relay operation.

DIAGNOSIS AND TESTING (Continued)

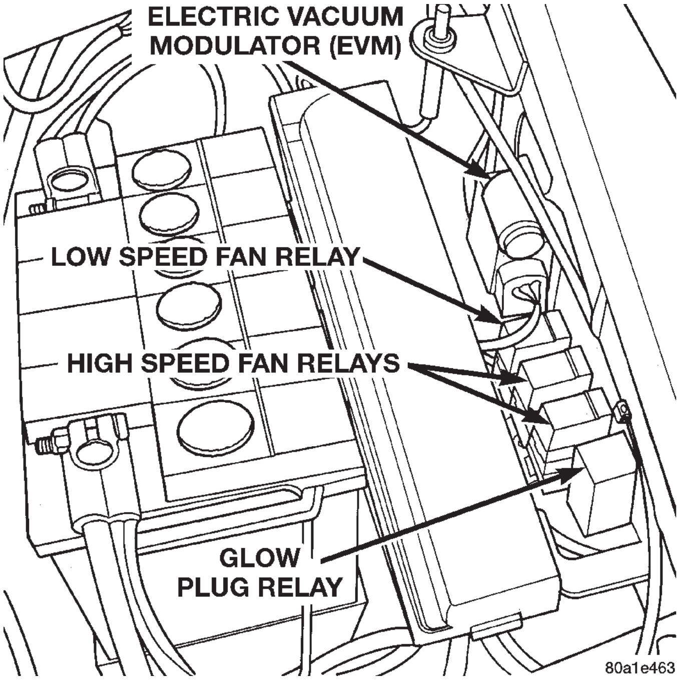

Fig. 15 Glow Plug Relay Location

In this chart, Pre–Heat and Post–Heat times are mentioned. Pre–heat is the amount of time the glow plug relay circuit is activated when the ignition (key) switch is ON, but the engine has yet to be started. Post–heat is the amount of time the glow plug relay circuit is activated after the engine is operating. The Glow Plug lamp will not be illuminated during the post–heat cycle.

TESTING:

Disconnect and isolate the electrical connectors (Fig. 16) at all four glow plugs. With the engine cool or cold, and the key in the ON position, check for 10–12 volts + at each electrical connector. 10–12 volts + should be at each connector whenever the PCM is operating in the pre–heat or post–heat cycles (refer to the following Glow Plug Control chart). **Be very careful not to allow any of the four disconnected glow plug electrical connectors to contact a metal surface. When the key is turned to the ON position, approximately 100 amps at 12 volts is supplied to these connectors.** If 10–12 volts + is not available at each connector, check continuity of wiring harness directly to the relay. If continuity is good directly to the relay, the fault is either with the relay or the relay input from the PCM. To test the relay only, refer to Relays—Operation/Testing in this section of the group. If the relay test is good, refer to the DRB scan tool.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

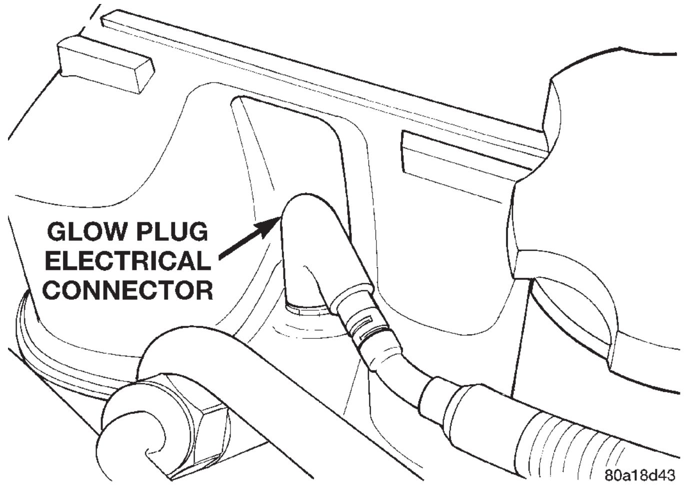

Fig. 16 Wiring Connection at Glow Plug

GLOW PLUG CONTROL

ENGINE COOLANT TEMPERATURE KEY ON	WAIT-TO-START LAMP ON (SECONDS)	PRE-HEAT CYCLE (GLOW PLUGS ON) (SECONDS)	POST-HEAT CYCLE (SECONDS)
-30 C	15 SEC.	45 SEC.	200 SEC.
-10 C	8 SEC.	35 SEC.	180 SEC.
+10 C	6 SEC.	25 SEC.	118 SEC.
+30 C	5 SEC.	20 SEC.	70 SEC.
+40 C	4 SEC.	16 SEC.	60 SEC.
+70 C	3 SEC.	16 SEC.	20 SEC.

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RELAYS—OPERATION/TESTING

The following description of operation and tests apply only to the Diesel PCM and other relays. The terminals on the bottom of each relay are numbered (Fig. 17).

OPERATION

- Terminal number 30 is connected to battery voltage. For both the Diesel and other 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 Diesel PCM and other 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.

DIAGNOSIS AND TESTING (Continued)

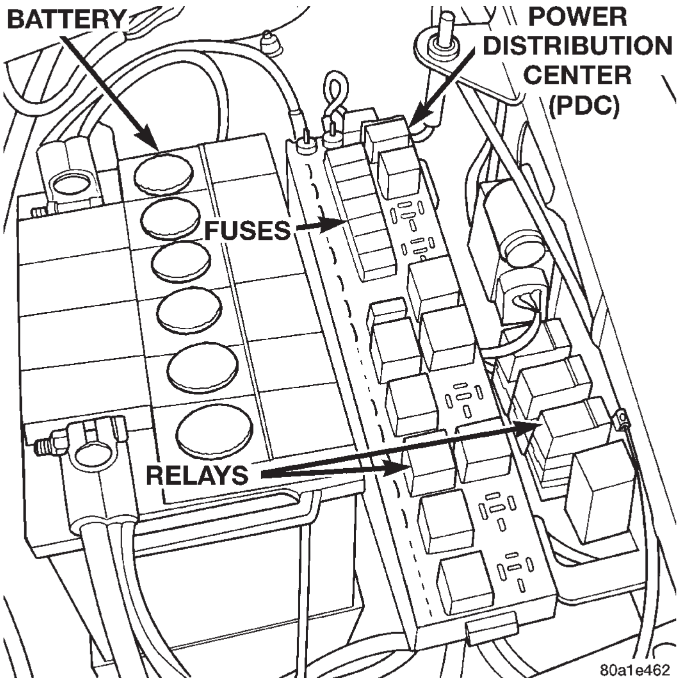

Fig. 17 Diesel PCM and Other Relay Terminals

• When the PCM energizes the Diesel PCM and other relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

TESTING

The following procedure applies to the Diesel PCM and other 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 between 75 ±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.

(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.

(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 Diesel PCM and other relay circuits. Refer to group 8W, Wiring Diagrams.

BOOST PRESSURE SENSOR

If the boost pressure sensor fails, the PCM records a DTC into memory and continues to operate the engine in one of the three “limp-in” modes. When the PCM is operating in this mode, a loss of power will be present, as if the turbocharger was not operating. The best method for diagnosing faults with the boost pressure sensor is with the DRB III scan tool.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC’s) for certain fuel system components.

VEHICLE SPEED SENSOR TEST

To perform a test of the sensor and its related circuitry, refer to DRB scan tool.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC’s) for certain fuel system components.

DIAGNOSTIC TROUBLE CODES

For a list of Diagnostic Trouble Codes (DTC’s), refer to Group 25, Emission Control System for information. See On-Board Diagnostics.

REMOVAL AND INSTALLATION

DIESEL PCM RELAY

The Diesel PCM relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

A/C CLUTCH RELAY

The A/C clutch relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

ENGINE SPEED SENSOR

The engine speed sensor is mounted to the transmission bellhousing at the rear of the engine block (Fig. 18).

REMOVAL

(1) Disconnect the harness (on the sensor) from the main electrical harness.

REMOVAL AND INSTALLATION (Continued)

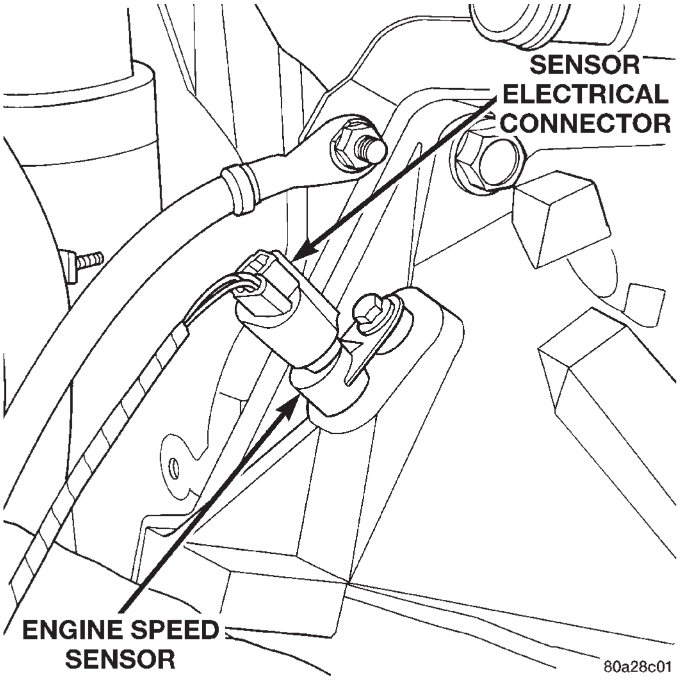

Fig. 18 Engine Speed Sensor

(2) Remove the sensor mounting bolts.
(3) Remove the sensor.

INSTALLATION

(1) Install the sensor flush against the opening in the transmission housing.
(2) Install and tighten the sensor mounting bolt to 19 N·m (14 ft. lbs.) torque.
(3) Connect the electrical connector to the sensor.

ENGINE COOLANT TEMPERATURE SENSOR

The sensor is located on the side of cylinder head near the rear of fuel injection pump (Fig. 19).

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

(1) Partially drain cooling system. Refer to Group 7, Cooling.
(2) Disconnect electrical connector from sensor.
(3) Remove sensor from cylinder head.

INSTALLATION

(1) Install a new copper gasket to sensor.
(2) Install sensor to cylinder head.
(3) Tighten sensor to 18 N·m (13 ft. lbs.) torque.
(4) Connect electrical connector to sensor.
(5) Replace any lost engine coolant. Refer to Group 7, Cooling System.

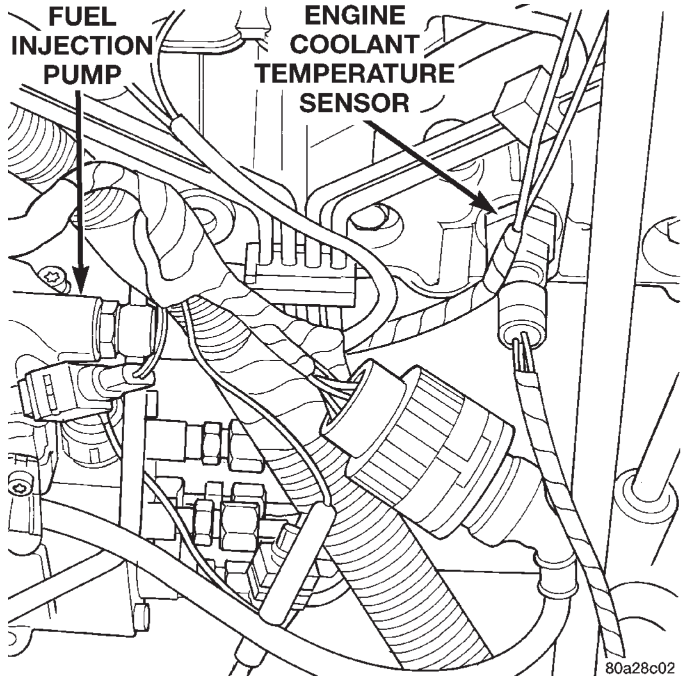

Fig. 19 Engine Coolant Temperature Sensor Location

GLOW PLUGS

The glow plugs are located above each fuel injector (Fig. 20). Four individual plugs are used.

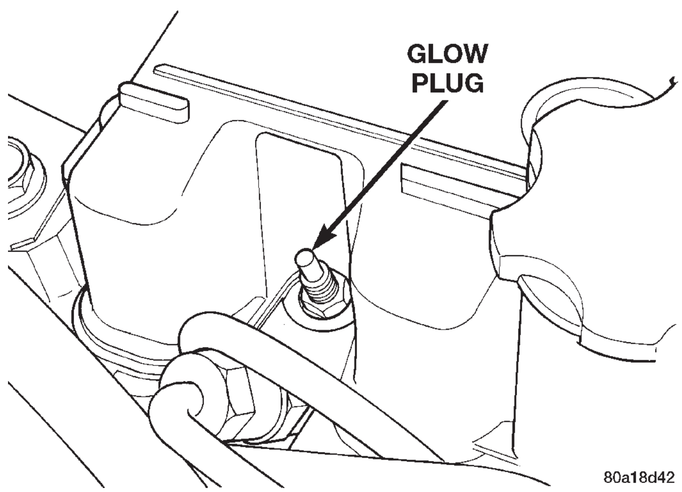

Fig. 20 Glow Plug

REMOVAL

(1) Disconnect the negative battery cable at the battery.
(2) Clean the area around the glow plug with compressed air before removal.
(3) Disconnect electrical connector (Fig. 21) at glow plug.
(4) Remove the glow plug (Fig. 20) from cylinder head.

REMOVAL AND INSTALLATION (Continued)

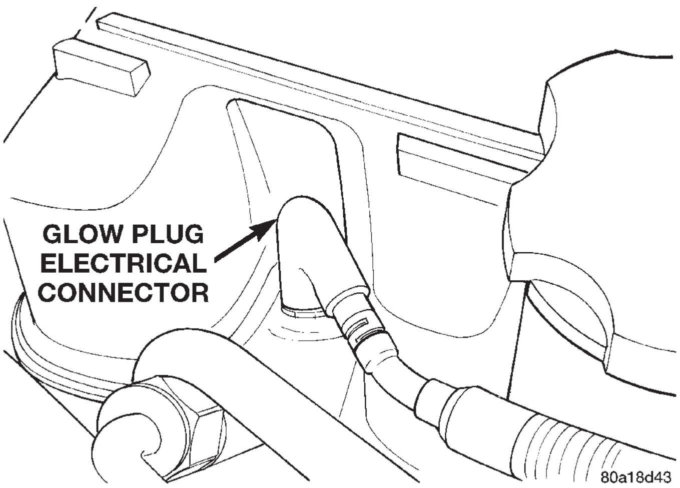

Fig. 21 Glow Plug Electrical Connector

INSTALLATION

(1) Apply high–temperature anti–seize compound to glow plug threads before installation

(2) Install the glow plug into the cylinder head. Tighten to 23 N·m (203 in. lbs.) torque.

(3) Connect battery cable to battery.

GLOW PLUG RELAY

The glow plug relay is located in the engine compartment on the left–inner fender (Fig. 22).

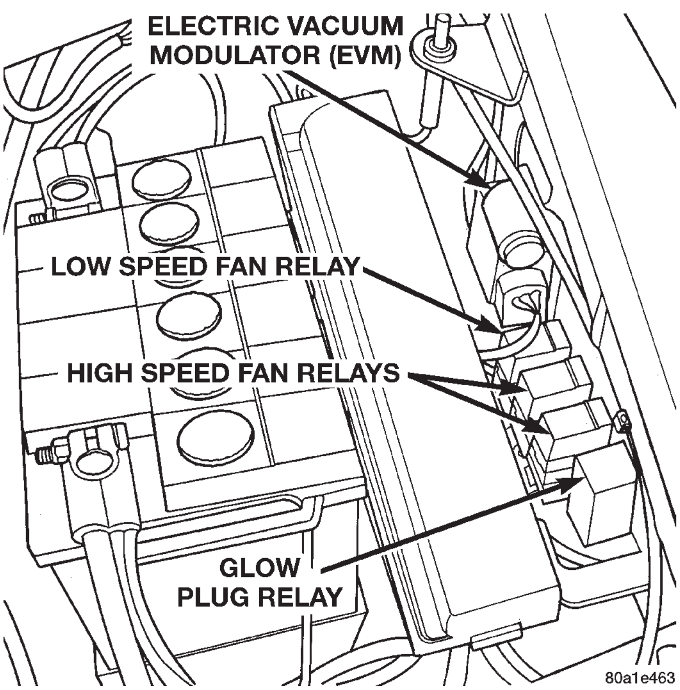

Fig. 22 Glow Plug Relay Location

REMOVAL

(1) Disconnect the negative battery cable at the battery.

(2) Remove relay mounting bolt.

(3) Disconnect electrical connector at relay and remove relay.

INSTALLATION

(1) Check condition of electrical connector for damage or corrosion. Repair as necessary.

(2) Install electrical connector to relay.

(3) Install relay to inner fender.

(4) Connect battery cable to battery.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is mounted to a bracket located in the center consule in front of the air bag module (Fig. 23).

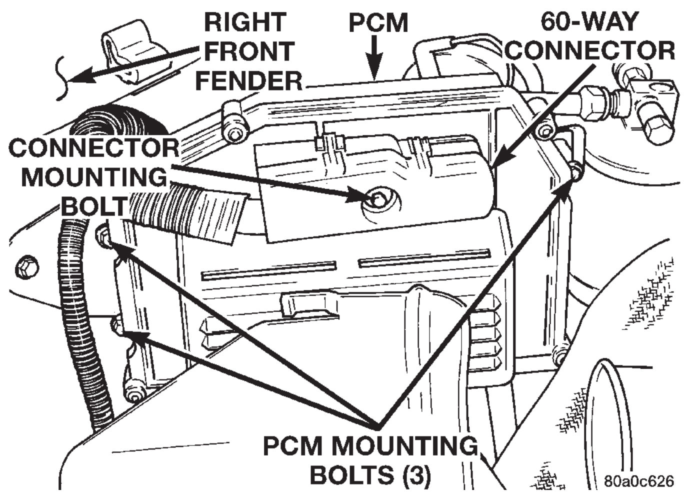

Fig. 23 PCM Location

REMOVAL

(1) Disconnect the negative battery cable at the battery.

(2) Loosen the 68–Way connector (Fig. 23). The electrical connector has a sliding bar which moves inward to lock or outward to unlock.

(3) Remove the electrical connector by pulling straight out.

(4) Remove PCM.

INSTALLATION

(1) After the PCM electrical connector has been separated from the PCM, inspect the pins for corrosion, being spread apart, bent or misaligned. Also inspect the pin heights in the connector. If the pin heights are different, this would indicate a pin has separated from the connector. Repair as necessary.

(2) Engage 68–way connector into PCM. Move slide bar to lock connector.

(3) Connect negative cable to battery.

VEHICLE SPEED SENSOR

The vehicle speed sensor (Fig. 24) is located on the extension housing of the transmission.

REMOVAL AND INSTALLATION (Continued)

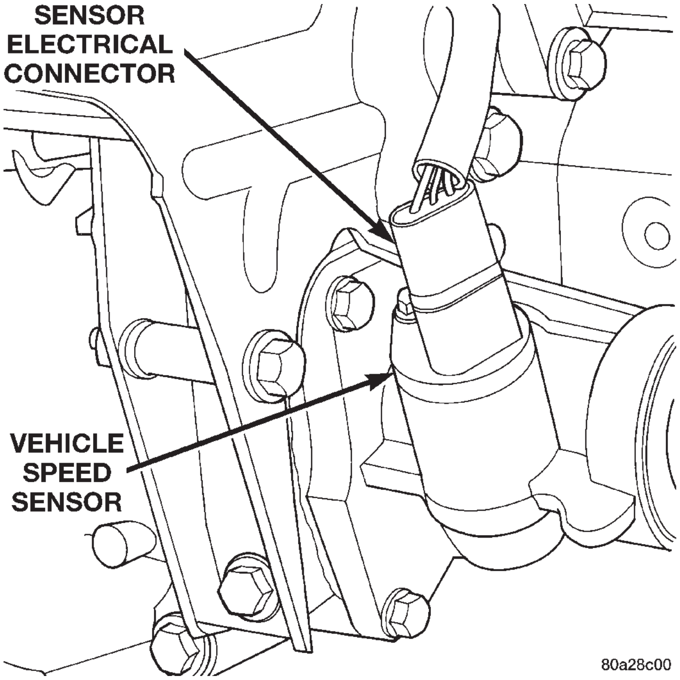

Fig. 24 Vehicle Speed Sensor Location—Typical

REMOVAL

(1) Raise and support vehicle.

(2) Clean the area around the sensor before removal.

(3) Disconnect the electrical connector from the sensor (Fig. 25).

(4) Remove the sensor mounting bolt (Fig. 25).

(5) Pull the sensor from the speedometer pinion gear adapter for removal.

INSTALLATION

(1) Install new sensor into speedometer gear adapter.

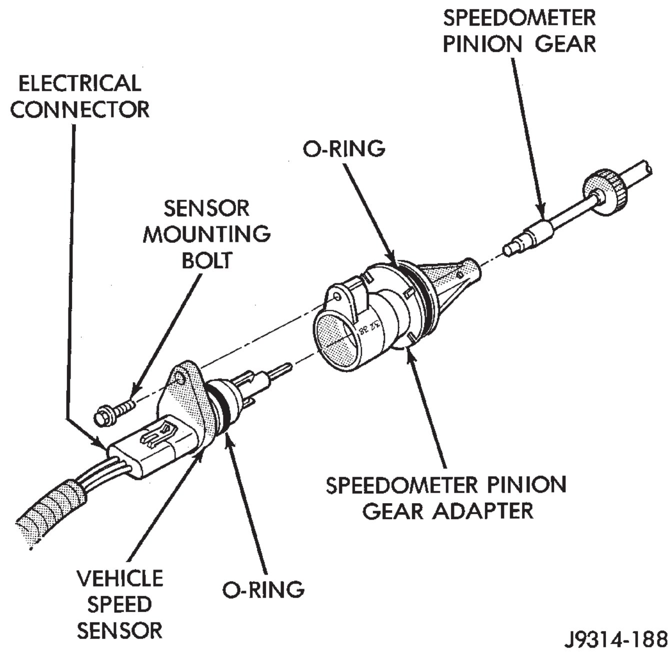

Fig. 25 Sensor Removal/Installation—Typical

(2) Tighten sensor mounting bolt. To prevent damage to sensor or speedometer adapter, be sure the sensor is mounted flush to the adapter before tightening.

(3) Connect electrical connector to sensor.

SPECIFICATIONS

GLOW PLUG CURRENT DRAW

Initial Current Draw: Approximately 22–25 amps per plug.

After 20 seconds of operation: Approximately 9–12 amps per plug.

SPECIFICATIONS (Continued)

TORQUE CHART—2.5L DIESEL

DESCRIPTION	TORQUE
Accelerator Pedal Bracket Mounting Nuts	5 N·m (46 in. lbs.)
Banjo-Type Fittings	19 N·m (14 ft. lbs.)
Engine Coolant Temperature Sensor	18 N·m (13 ft. lbs.)
Engine Speed Sensor Bolts	19 N·m (14 ft. lbs.)
Fuel Hose (Tube) Clamps For Rubber Hose	2 N·m (20 in. lbs.)
Fuel Injector	70 N·m (52 ft. lbs.)
Fuel Injector Line At Injector	30 N·m (22 ft. lbs.)
Fuel Injector Line At Injector Pump	30 N·m (22 ft. lbs.)
Fuel Injection Pump Mounting Nuts	30 N·m (22 ft. lbs.)
Fuel Injection Pump Drive Gear	88 N·m (65 ft. lbs.)
Fuel Line Clamp Bracket Bolts	24 N·m (18 ft. lbs.)
Fuel Tank Nuts	11 N·m (100 in. lbs.)
Glow Plugs	23 N·m (203 in. lbs.)
Powertrain Control Module Mounting Bolts	1 N·m (9 in. lbs.)
Throttle Position Sensor Mounting Bolts	7 N·m (60 in. lbs.)
Vehicle Speed Sensor Mounting Bolt	3 N·m (26 in. lbs.)

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STEERING

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GENERAL INFORMATION

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GENERAL INFORMATION

STEERING SYSTEM AND COMPONENT DESCRIPTION

The power steering system consists of these four major components. Power Steering Pump, Power Steering Gear, Pressure Hose, and Return Line. Turning of the steering wheel is converted into linear travel through the meshing of the helical pinion teeth with the rack teeth. Power assist steering is provided by an open center, rotary type control valve. It is used to direct oil from the pump to either side of the integral steering rack piston.

Road feel is controlled by the diameter of a torsion bar which initially steers the vehicle. As required steering effort increases, as in a turn, the torsion bar twists, causing relative rotary motion between the rotary valve body and the valve spool. This movement directs oil behind the integral rack piston, which, in turn, builds up hydraulic pressure and assists in the turning effort.

Drive tangs on the power steering gear pinion shaft, mate loosely with the shaft of the steering gear. This is to allow manual steering control to be maintained, if the drive belt on the power steering pump should break. However, under these conditions, steering effort will significantly increase.

DIAGNOSIS AND TESTING

STEERING SYSTEM DIAGNOSIS CHARTS

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at standstill parking. Hiss is a very high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every valve and results from high velocity fluid passing over the edges of the valve orifice. There is no relationship between this noise and the performance of the vehicles steering system. Hiss may be expected when the steering wheel is at the end of its travel or slowly turning when the vehicle is at a standstill.

CONDITION	POSSIBLE CAUSES	CORRECTION
Objectionable Hiss Or Whistle	1. Damaged or mispositioned steering column coupler to dash panel seal. 2. Noisy valve in power steering gear. 3. Mis-routed power steering hose	1. Check for proper seal between steering column coupler and dash seal. 2. Replace steering gear assembly. 3. Check for proper routing of power steering hoses and ensure they do contact other components.
Rattle Or Clunk	1. Steering gear loose on front suspension crossmember. 2. Front suspension crossmember to frame bolts or studs loose. 3. Tie rod is loose (outer or inner). 4. Loose lower control arm to front suspension crossmember bolts. 5. Loose upper control arm/ shock absorber mounting bracket to body attaching bolts. 6. Power steering fluid pressure hose touching the body of the vehicle. 7. Noise internal to power steering gear. 8. Damaged front suspension crossmember. 9. Loose stabilizer bar attaching link mounting nuts.	1. Check steering gear to front suspension crossmember mounting bolts. Tighten to specified torque if found to be loose. 2. Tighten the front suspension crossmember attaching bolts or studs to the specified torque. 3. Check tie rod pivot points for wear. Replace worn/loose parts as required. 4. Tighten control arm mounting bolts to the specified torques. 5. Check mounting bracket to body attaching bolts for looseness. If required tighten to the specified torques. 6. Adjust hose to proper position by loosening, repositioning, and tightening fitting to specified torque. Do not bend tubing. 7. Replace steering gear assembly. 8. Replace front suspension crossmember. 9. Tighten the stabilizer bar attaching link mounting nuts to the specified torque.
Chirp or squeal (in the area of the power steering pump). Particularly noticeable at full wheel travel and during standstill parking.	1. Loose power steering pump drive belt.	1. Adjust power steering pump drive belt to specified tension.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Power steering pump growl results from the development of high pressure fluid flow. Normally this noise should not be high enough to be objectionable. Abnormal situations, such as a low oil level causing aeration or hose touching the vehicle body, can create a noise level that could bring complaints.		
WHINE OR GROWL (PUMP NOISE)	1. Low fluid level. 2. Power steering hose touching vehicle body or frame. 3. Extreme wear of power steering pump internal parts.	1. Fill power steering fluid reservoir to proper level and perform leakage diagnosis. (Recheck fluid level after power steering fluid is free of air.) 2. Reposition power steering hose. Replace hose if tube ends are bent. 3. Replace power steering pump and flush system.
SUCKING AIR SOUND	1. Loose clamp on power steering fluid low pressure hose. 2. Missing O-Ring on power steering pressure hose connection. 3. Low power steering fluid level 4. Air leak between power steering fluid reservoir and power steering pump.	1. Tighten or replace hose clamp. 2. Inspect connection and replace O-Ring as required. 3. Fill power steering fluid reservoir to proper level and perform leakage diagnosis. 4. Inspect and/or replace power steering fluid reservoir or supply hose as required.
SQUEAK OR RUBBING SOUND	1. Sound coming from steering column. 2.Clockspring 3. Sound internal to steering gear.	1.Check for squeak in steering column. Inspect for contact between shroud, intermediate shaft, column, and steering wheel. Realign if necessary. **Note: Check steering column for noise without clockspriing installed and with the steering column shaft removed from the steering intermediate shaft. This must be done before removing the steering column for a noise complaint.** 2. Check for lack or grease on steering column dash panel to lower coupler seal. 3. Replace Clockspring 4. Replace steering gear assembly.
SCRUBBING OR KNOCKING SOUND	1. Incorrect tire size. 2. Check clearance between tires and other vehicle components, through the full travel of the suspension. 3. Check for interference between steering gear and other components. 4.Incorrect steering gear supplied.	1. Verify that tire size on vehicle is the same as originally supplied. 2. Correct as necessary. 3.Correct as necessary. 4. Replace steering gear with correct steering gear for specific vehicle.

DIAGNOSIS AND TESTING (Continued)

BINDING STICKING SEIZED

CONDITION	POSSIBLE CAUSES	CORRECTION
CATCHES, STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN.	1. Low power steering fluid level. 2. Tires not inflated to specified pressure. 3. Lack of lubrication in front suspension lower control arm ball joints. 4. Worn lower ball joint. 5. Lack of lubrication in steering gear outer tie rod ends. 6. Loose power steering pump drive belt. 7. Faulty power steering pump flow control. (Verify cause using Power Steering Pump Test Procedure.) 8. Excessive friction in steering column or intermediate shaft. 9. Steering column coupler binding. 10. Binding lower ball joint. 11. Excessive friction in steering gear.	1. Fill power steering fluid reservoir to specified level and perform leakage diagnosis. 2. Inflate tires to the specified pressure. 3. Replace lower ball joint. 4. Replace the lower ball joint. 5. Replace tie rod end. 6. Tighten the power steering pump drive belt to the specified tension. See accessory drive in service manual. 7. Replace power steering pump. 8. Correct condition. (See Steering Column Service Procedure) 9. Realign the steering column to eliminate the binding condition. 10. Replace the lower ball joint. 11. Replace steering gear assembly.

SHAKE SHUDDER VIBRATION

CONDITION	POSSIBLE CAUSES	CORRECTION
VIBRATION OF THE STEERING WHEEL AND/OR DASH DURING DRY PARK OR LOW SPEED STEERING MANEUVERS.	1. Air in the fluid of the power steering system. 2. Tires not properly inflated. 3. Excessive engine vibration. 4. Loose tie rod end. 5.Overcharged air conditioning system.	1. Steering shudder can be expected in new vehicles and vehicles with recent steering system repairs. Shudder should improve after the vehicle has been driven several weeks. 2. Inflate tires to the specified pressure. 3. Ensure that the engine is running properly. 4. Check the inner to outer tie rod jam nut for looseness. If loose tighten to the specified torque. Inspect inner tie rod for looseness at steering gear. Inspect outer tie rod ball for excessive wear/looseness. If inner tie rod is loose replace steering gear, if outer tie has excessive wear replace tie rod end. 5.Check air conditioning pump head pressure. (See Air Conditioning Refrigerant System Diagnosis)

DIAGNOSIS AND TESTING (Continued)

LOW ASSIST, NO ASSIST, HARD STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
STIFF, HARD TO TURN, SURGES, MOMENTARY INCREASE IN EFFORT WHEN TURNING.	1. Tires not properly inflated.	1. Inflate tires to specified pressure.
	2. Low power steering fluid level.	2. Add power steering fluid as required to power steering fluid reservoir to obtain proper level. Perform leakage diagnosis on power steering system.
	3. Loose power steering pump drive belt.	3. Tighten the power steering pump drive belt to the specified tension. If drive belt is defective, replace and correctly tension.
	4. Lack of lubrication in lower control arm ball joint.	4. Replace lower ball joint.
	5. Worn lower ball joint.	5. Replace lower ball joint.
	6. Low power steering pump pressure. (Verify using Power Steering System Test Procedure)	6. Verify cause using the Power Steering System Test Procedure. Replace the power steering pump if necessary.
	7. High internal leak in steering gear assembly.	7. Check steering system using the Power Steering System Test Procedure. If steering gear is defective replace steering gear.

POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT RETURN TO CENTER POSITION.	1. Tires not inflated to specified pressure.	1. Inflate tires to specified pressure.
	2. Improper front wheel alignment.	2. Check and adjust as necessary.
	3. Steering column U-joints misaligned.	3. Realign steering column U-joints.
	4. Mispositioned dash cover.	4. Reposition dash cover.
		To evaluate items 6 and 7, disconnect the intermediate shaft. Turn the steering wheel and feel or listen for internal rubbing in steering column.
	5. Steering wheel rubbing.	5. Adjust steering column shrouds to eliminate rubbing condition.
	6. Damaged, mis-positioned or un-lubricated steering column coupler to dash seal.	6. Determine condition which exists and correct.
	7. Binding shaft bearing in steering column assembly.	7. Replace the steering column. **Note: Before replacing steering column, disconnect intermediate steering coupler from steering column shaft and remove steering wheel, clockspring and shrouds from steering column. This must be done to verify a binding shaft bearing in the steering column before replacing the steering column.**
	8. Excessive friction in steering column coupler.	8. Replace steering column coupler.
	9. Excessive friction in steering gear.	9. Replace steering gear.
	10. Excessive friction in front strut mount bearing	10. Replace the strut mount or strut mount pivot bearing.

DIAGNOSIS AND TESTING (Continued)

LOOSE STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE STEERING WHEEL KICKBACK OR TOO MUCH STEERING WHEEL FREE PLAY.	1. Air in the fluid of the power steering system.	1. Fill power steering fluid reservoir to the specified level. Perform procedure to bleed the air out of the power steering system. Perform leakage diagnosis.
	2. Steering gear loose on front suspension crossmember.	2. Check steering gear to front suspension crossmember mounting bolt torque. Tighten to specified torque if found to be loose.
	3. Worn, broken or loose steering column to steering gear coupler.	3. Check for worn universal joint, broken isolator or loose fasteners.
	4. Free play in steering column.	4.Check components of steering system and repair or replace as required. Note: Inspect steering column with steering wheel installed and steering column shaft disconnected from intermediate coupler. Verify that steering wheel attaching nut is tightened to the specified torque. Verify that the 4 mounting nuts for the steering column are tightened to the specified torque.
	5. Loose lower control arm ball joint.	5. Check and or replace the ball joint or control arm as required.
	6. Loose steering knuckle to lower ball joint stud attaching nut.	6. Check attaching nut and tighten if required to specified torque.
	7. Front wheel bearings loose or worn.	7. Tighten hub nut to specified torque or replace with new parts as necessary.
	8. Loose outer tie rod ends.	8. Check free play of outer tie rod ends and replace if required.
	9. Loose inner tie rod ends.	9. Replace steering gear assembly.
	10. Defective steering gear rotary valve.	10. Replace steering gear assembly.
	11. Intermediate steering shaft coupler flex joint binding.	11. Replace intermediate steering shaft/coupler.

DIAGNOSIS AND TESTING (Continued)

VEHICLE LEADS TO THE SIDE

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT WANT RETURN TO CENTER POSITION.	1. Radial tire lead.	1.Rotate tires as recommended in the Tire And Wheel Group of this service manual.
	2. Front suspension misaligned.	2. Align the front suspension as required. Refer to the Wheel Alignment Procedure in the Suspension Group of this service manual for the required wheel alignment procedure.
	3. Wheel braking.	3. Check for dragging brakes. Refer to the procedures in the Brake Group of this service manual.
	4. Unbalanced steering gear valve. (If this is the cause, the steering efforts will be very light in direction of lead and heavier in the opposite direction.	4. Replace steering gear.
STEERING WHEEL HAS FORE AND AFT LOOSENESS.	1. Steering wheel to steering column shaft retaining nut not properly tightened and torqued.	1. Tighten the retaining nut to its specified torque specification.
	2. Steering column lower bearing spring retainer slipped on steering column shaft.	2. Replace steering column.
	3. Loose steering column to instrument panel mounting nuts.	3. Verify that the 4 mounting nuts for the steering column are tightened to the specified torque.
	4. Binding intermediate steering shaft coupler.	4. Disconnect intermediate steering coupler and see if looseness no longer exists. If yes replace intermendiate steering coupler.

POWER STEERING FLUID LEAK

CONDITION	POSSIBLE CAUSES	CORRECTION
LOW FLUID LEVEL WITH: NO VISIBLE SIGNS OF A LEAK ON THE STEERING GEAR, POWER STEERING PUMP, FLOOR OR ANYWHERE ELSE.	1. Overfilled power steering pump fluid reservoir.	1. Adjust the power steering fluid fill to the correct level.
LOW FLUID LEVEL WITH: VISIBLE LEAK ON STEERING GEAR, POWER STEERING PUMP, FLOOR OR ANYWHERE ELSE.	2. Power steering hose connections at the power steering pump or steering gear.	2. Check for loose fittings and if found, tighten the fitting to its specified torque. If fittings are tight examine the fittings for damaged or missing O-ring seals and replace as required.
	3. Power steering pump or power steering gear leaking.	3. Identify the location of the leak and repair or replace the component as required. Refer to Power Steering Pump and/or Power Steering Gear in this group of the service manual for required procedures.

DIAGNOSIS AND TESTING (Continued)

FOAMY OR MILKY POWER STEERING FLUID

CONDITION	POSSIBLE CAUSES	CORRECTION
AERATION AND OVERFLOW OF FLUID.	1. Air leaks.	1. Check for air leaking into the power steering system as described under Sucking Air Diagnosis and correct condition.
	2. Low fluid level.	2. Extremely cold temperatures may cause power steering fluid aeration if the power steering fluid is low. Add power steering fluid as required to bring level up to specification.
	3. Cracked power steering pump housing.	3. Remove power steering pump from vehicle and inspect the power steering pump housing for cracks. If a defect in the housing is found, replace the power steering pump.
	4. Water contamination.	4. Drain the power steering fluid from the system if there is evidence of contamination. Then refill the system with fresh clean power steering fluid.

POWER STEERING PUMP

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DESCRIPTION AND OPERATION

POWER STEERING PUMP OPERATION

Hydraulic pressure for the operation of the power steering gear is provided by a belt driven power steering pump (Fig. 1). The power steering pump is a constant flow rate and displacement vane type pump. The power steering pump used on all applications is the Vane-Submerged remote reservoir style power steering pump.

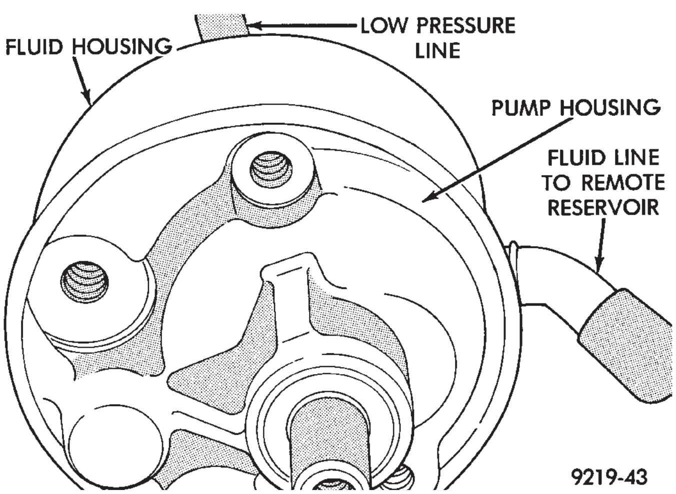


Fig. 1 Vane Submerged Remote Reservoir Power

The remote reservoir type pump (Fig. 1) has the pump housing and internal components combined with the fluid housing. But it has a remote reservoir for the power steering fluid supply.

DIAGNOSIS AND TESTING

POWER STEERING PUMP FLOW RATE AND PRESSURE TEST

The following procedure can be used to test the operation of the power steering system on the vehicle. This test will provide the flow rate of the power steering pump along with the maximum relief pressure. This test is to be performed any time a power steering system problem is present to determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Pressure/Flow Tester, Special Tool 6815 (Fig. 2).

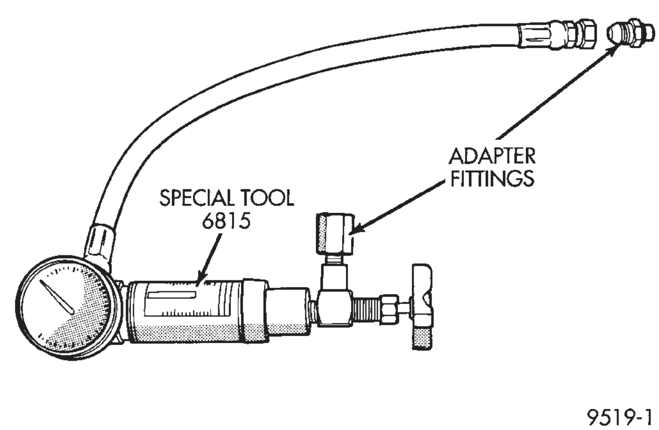


Fig. 2 Power Steering Pump Flow/Pressure Tester

DIAGNOSIS AND TESTING (Continued)

POWER STEERING PUMP FLOW AND PRESSURE TEST PROCEDURE

(1) Check power steering pump drive belt tension and adjust as necessary.

(2) Disconnect power steering fluid pressure hose, at power steering pump. Use a container for dripping fluid.

(3) Connect Pressure Gauge, Special Tool from kit 6815 to both hoses using adapter fittings. Connect spare pressure hose, to power steering pump pressure hose fitting.

(4) Completely open valve on Special Tool 6815.

(5) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test and get air out of fluid. Then shut off engine.

(6) Check power steering fluid level, and add fluid as necessary. Start engine again and let idle.

(7) Pressure 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). The flow meter should read between 1.3 and 1.9 GPM

CAUTION: The following test procedure involves testing power steering pump maximum pressure output and flow control valve operation. Do not leave valve closed for more than 5 seconds as the pump could be damaged.

(8) Close valve fully three times and record highest pressure indicated each time. **All three readings must be within specifications and within 345 kPa (50 psi) of each other.**

NOTE: Power steering pump maximum relief pressure is 9653 to 10342 kPa (1400 to 1500 psi.).

- If power steering pump pressures are within the specifications but not within 345 kPa (50 psi) of each other, then replace power steering pump.
- If pressures are within 345 kPa (50 psi) of each other but below specifications, then replace power steering pump.

CAUTION: Do not force the pump to operate against the stops for more than 5 seconds at a time because, pump damage will result.

(9) Open test valve. Turn steering wheel to the extreme left and right positions until against the stops, recording the highest indicated pressure at each position. Compare pressure gauge readings to power steering pump specifications. If highest output pressures are not the same against either stop, the steering gear is leaking internally and must be replaced.

SERVICE PROCEDURES

POWER STEERING SYSTEM FLUID LEVEL CHECK

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING PARTS. DO NOT USE AUTOMATIC TRANSMISSION FLUID IN THE POWER STEERING SYSTEM. DO NOT OVERFILL THE POWER STEERING SYSTEM.

Wipe reservoir filler cap free of dirt. Then check fluid level. The dipstick should indicate COLD when fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F). In all pumps add fluid as necessary, use only **Mopar Power Steering Fluid, or equivalent. DO NOT USE ANY TYPE OF AUTOMATIC TRANSMISSION FLUID.**

POWER STEERING PUMP INITIAL OPERATION

CAUTION: The fluid level should be checked with engine off to prevent injury from moving components. Use only Mopar® Power Steering Fluid. Do not use automatic transmission fluid. Do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **FULL COLD** when the fluid is at normal temperature of approximately 21°C to 27°C (70°F to 80°F).

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(2) Start the engine and let run for a few seconds. Then turn the engine off.

(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) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(6) Add power steering fluid if necessary.

(7) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(8) Stop the engine. Check the fluid level and refill as required.

(9) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

REMOVAL AND INSTALLATION

2.4 LITER POWER STEERING PUMP

REMOVE

WARNING: POWER STEERING OIL, ENGINE COMPONENTS AND THE EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

(1) Remove cap from power steering fluid reservoir.

(2) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(3) Remove the (-) negative battery cable from the battery and isolate cable.

(4) Remove the drive belt from the power steering pump pulley. See Cooling, Group 7 for detailed removal procedure.

(5) Loosen **but do not remove** the nut attaching the front bracket for the power steering pump (Fig. 3) to the aluminum mounting bracket.

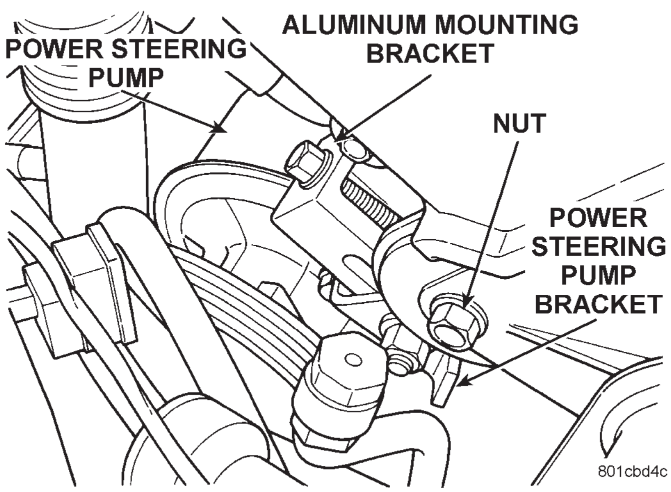


Fig. 3 Power Steering Pump Bracket Attaching Nut

(6) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting, in the Lubrication and Maintenance section of this service manual for the required lifting procedure.

(7) Disconnect the oxygen sensor wiring harness from the vehicle wiring harness. Access to connection at vehicle wiring harness is through the oxygen sensor wiring harness grommet in the floor pan of the vehicle.

NOTE: The exhaust system needs to be removed from the engine to allow for an area to remove the power steering pump from the vehicle.

(8) Remove the catalytic converter from the exhaust manifold. Then remove all the exhaust system hangers/isolators from the brackets on the exhaust system.

(9) Move the exhaust system as far rearward and to the left side of the vehicle as possible (Fig. 4).

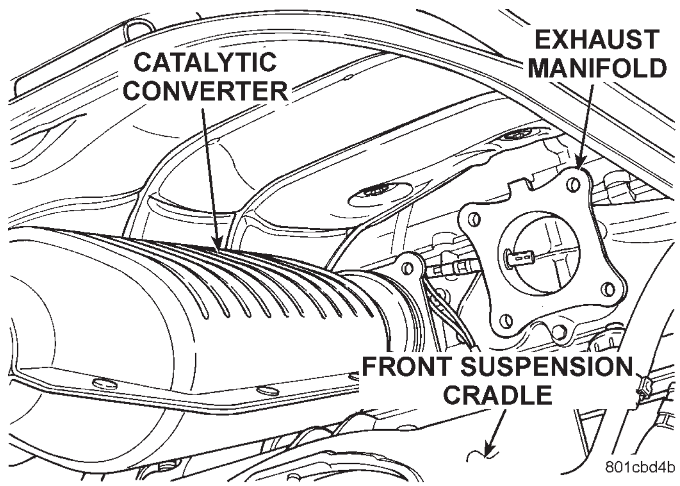


Fig. 4 Exhaust Positioned For Removing Power Steering Pump

(10) Raise the heat sleeve on the power steering return hose to expose the hose to steel tube connection (Fig. 5). Remove the hose from the power steering fluid return line on the front suspension cradle (Fig. 5). Allow the remaining power steering fluid to drain from the power steering pump and reservoir through the removed return hose.

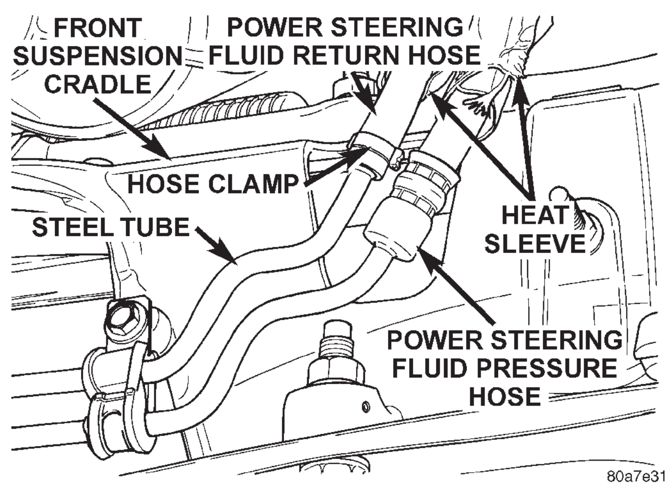


Fig. 5 Power Steering Return Hose At Return Line

REMOVAL AND INSTALLATION (Continued)

(11) Remove the accessory drive splash shield (Fig. 6).

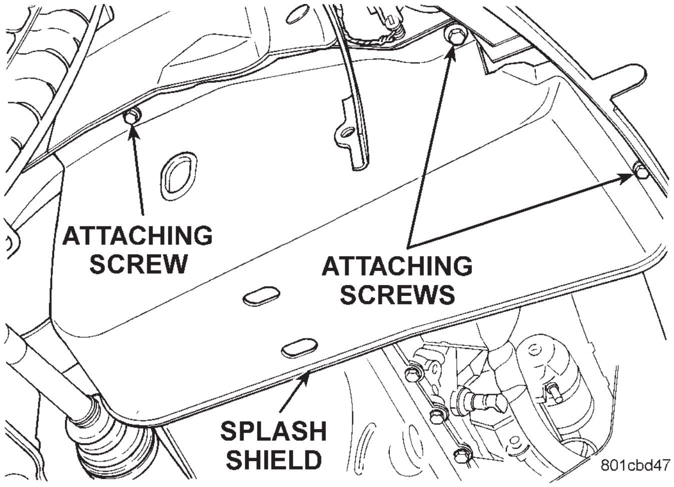


Fig. 6 Accessory Drive Splash Shield

(12) Remove the power steering fluid supply hose coming from the remote fluid reservoir, from the fitting on the power steering pump (Fig. 7). Drain off excess power steering fluid from hose.

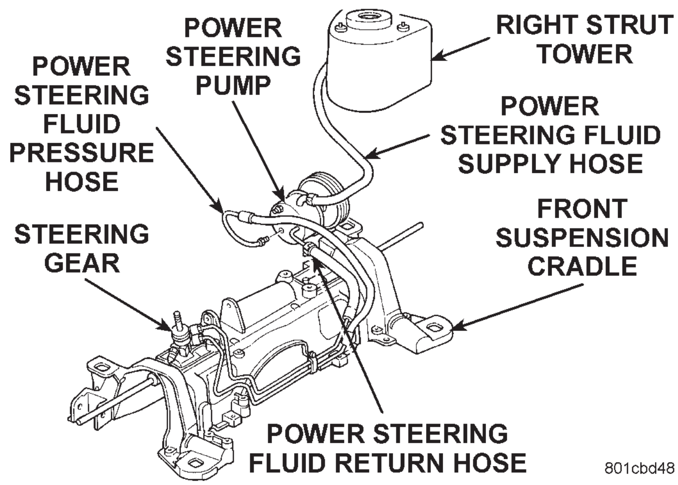


Fig. 7 Power Steering Hoses At Power Steering Pump

(13) Remove the power steering fluid pressure line (Fig. 8) from the power steering pump. Drain excess power steering fluid from tube.

(14) Remove the power steering fluid return hose (Fig. 8) from the power steering pump. Drain excess power steering fluid from tube.

(15) Remove the nut attaching rear of power steering pump to the cast mounting bracket. (Fig. 9)

(16) Loosen the 3 bolts (Fig. 10) attaching the power steering pump to its front mounting bracket. Then remove the nut and the bolt (Fig. 10), attaching the power steering pump front to the cast bracket.

(17) Remove the power steering pump and the front bracket from the cast bracket as an assembly.

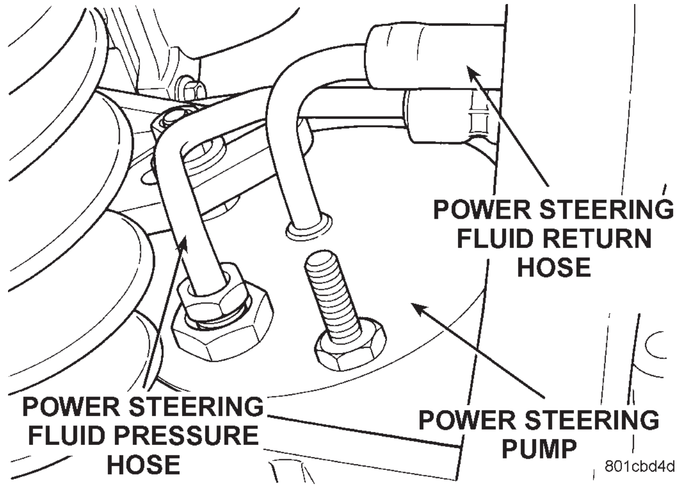


Fig. 8 Power Steering Fluid Pressure And Return Hose

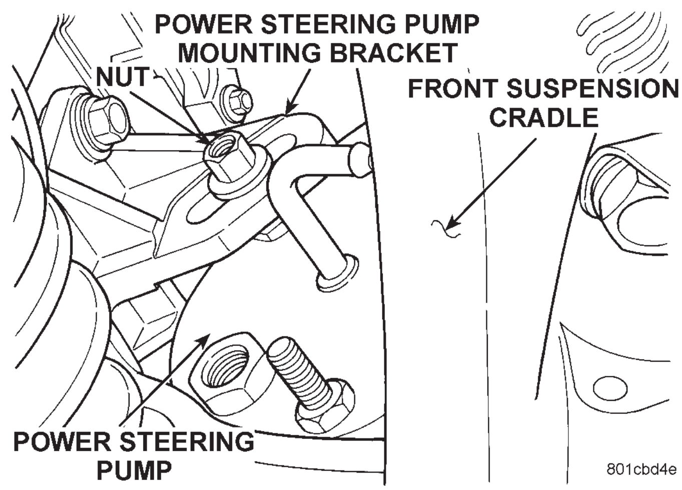


Fig. 9 Power Steering Pump Attaching Nut

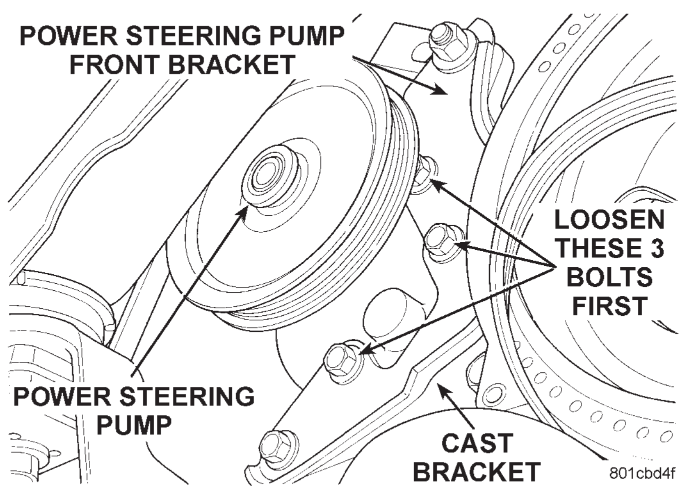


Fig. 10 Power Steering Pump Mounting To Front Bracket

REMOVAL AND INSTALLATION (Continued)

(18) Remove the 3 previously loosened bolts attaching the front bracket to the power steering pump and separate the power steering pump from the front bracket prior to removing the pump from the vehicle.

(19) The power steering pump is removed from the vehicle by pulling it out through the exhaust tunnel area in the floor pan of the vehicle.

INSTALL

(1) Install power steering pump back in vehicle using the reverse order of its removal through the exhaust tunnel are of the vehicle.

(2) Install the power steering pump on its cast mounting bracket and loosely install nut to hold pump in place (Fig. 9).

(3) Install the front bracket on the power steering pump and loosely install the 3 mounting bolts (Fig. 10). Then install the nut and bolt attaching the front bracket to the cast bracket (Fig. 10).

(4) Tighten the 3 power steering pump mounting bolts (Fig. 10) to a torque of 54 N·m (40 ft. lbs.).

NOTE: Before installing power steering fluid pressure hose on power steering pump, inspect the O-ring on the pressure hose for damage and replace if necessary.

(5) Install the power steering fluid pressure line onto the output fitting of the power steering pump (Fig. 8). Tighten the pressure line to pump fitting tube nut to a torque of 31 N·m (275 in. lbs.).

(6) Install the power steering fluid, low pressure return hose on the power steering pump low pressure fitting (Fig. 8). **Be sure hose clamps are properly reinstalled.**

(7) Install the power steering fluid supply hose from the power steering fluid reservoir, on the power steering pump fluid fitting (Fig. 7). **Be sure hose is clear of accessory drive belts all hose clamps are properly reinstalled.**

(8) Install the power steering pump drive belt on pulley. See Cooling, Group 7 for detailed installation procedure.

(9) Install the accessory drive splash shield (Fig. 6).

(10) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 5).

(11) Install a screw type hose clamp on the power steering hose to steel tube connection. **Be sure hose clamps are properly reinstalled.**Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat shield sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 5). This is required to prevent the overheating of the power steering hoses.

(12) When used, properly position the protective heat sleeves on the power steering hoses (Fig. 5). Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(13) Install the exhaust pipe on the exhaust manifold. Install all exhaust system hangers/isolators on the exhaust system brackets.

(14) Connect the oxygen sensor wiring harness to the vehicle wiring harness. Install wiring harness grommet in the floor pan of the vehicle.

(15) Lower vehicle.

(16) Adjust the power steering pump drive belt. See Cooling, Group 7 for detailed adjustment procedure.

(17) Tighten the top nut and bottom bolt on the power steering pump front mounting bracket (Fig. 3) to a torque of 54 N·m (40 ft. lbs.).

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(18) Fill the remote power steering pump fluid reservoir to correct fluid level.

(19) Install cap on power steering fluid reservoir.

(20) Connect the negative battery cable on the negative battery post.

(21) Start engine and turn steering wheel several times from stop to stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. See Checking Fluid Level.

3.0 LITER POWER STEERING PUMP

REMOVE

WARNING: POWER STEERING OIL, ENGINE COMPONENTS AND THE EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

(1) Remove the (-) negative battery cable from the battery and isolate cable.

(2) Remove cap from power steering fluid reservoir.

(3) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the serpentine accessory drive belt from the engine (Fig. 11). See Cooling, Group 7 for detailed removal procedure.

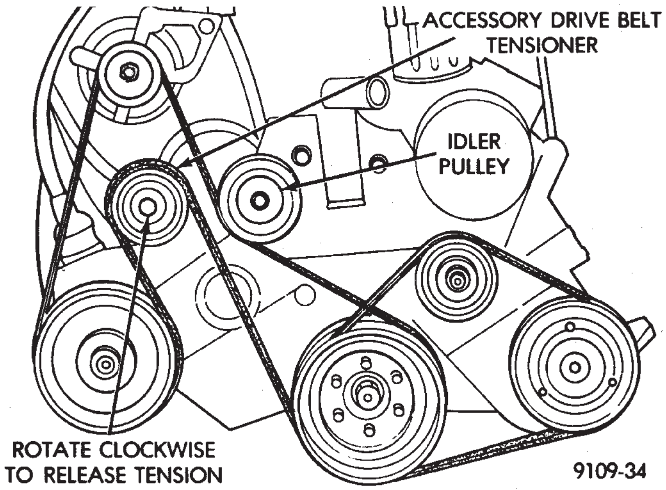


Fig. 11 3.0L Serpentine Drive Belt And Routing

(5) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting, in the Lubrication and Maintenance section of this service manual for the required lifting procedure.

(6) Disconnect the oxygen sensor wiring harness from the vehicle wiring harness. Access to connection at vehicle wiring harness is through the oxygen sensor wiring harness grommet in the floor pan of the vehicle.

NOTE: The exhaust system needs to be removed from the engine to allow for an area to remove the power steering pump from the vehicle.

(7) Remove the catalytic converter from the exhaust manifold. Then remove all the exhaust system hangers/isolators from the brackets on the exhaust system.

(8) Move the exhaust system as far rearward and to the left side of the vehicle as possible (Fig. 12).

(9) Raise the heat sleeve on the power steering return hose to expose the return hose to steel tube connection. Remove the hose from the power steering fluid return line on the front suspension cradle (Fig. 13). Allow the remaining power steering fluid to drain from the power steering pump and reservoir through the removed hose.

(10) Remove the accessory drive splash shield (Fig. 14).

(11) Remove the power steering fluid supply hose coming from the remote fluid reservoir, from the fitting on the power steering pump (Fig. 15). Drain off excess power steering fluid from hose.

(12) Remove the power steering fluid pressure line (Fig. 15) from the power steering pump. Drain excess power steering fluid from tube.

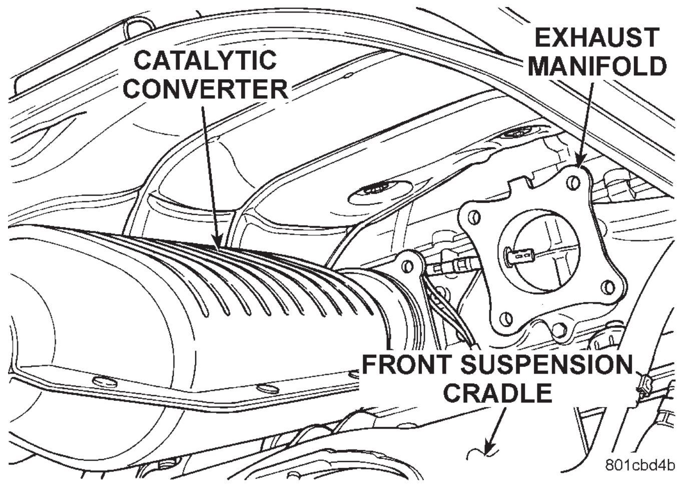


Fig. 12 Exhaust Position For Removing Power Steering Pump

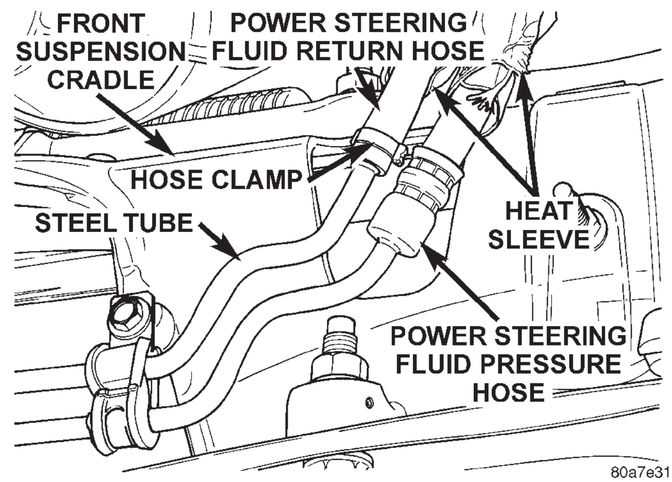


Fig. 13 Power Steering Return Hose At Return Line

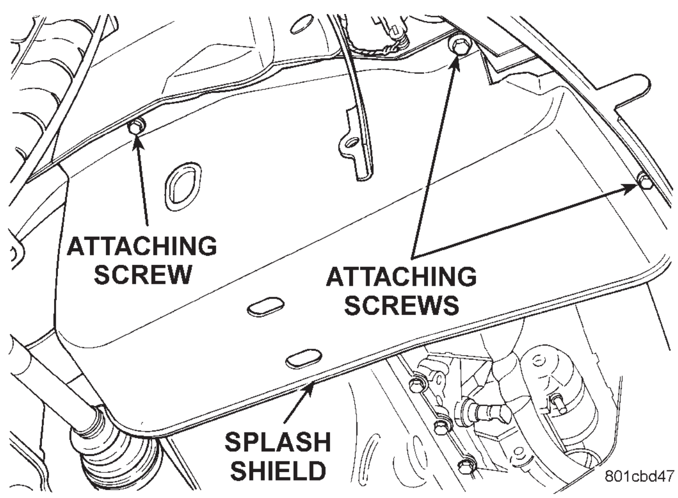


Fig. 14 Accessory Drive Splash Shield

NOTE: If the return hose is not removed from the power steering pump, it is very difficult to remove the power steering pump from the vehicle.

REMOVAL AND INSTALLATION (Continued)

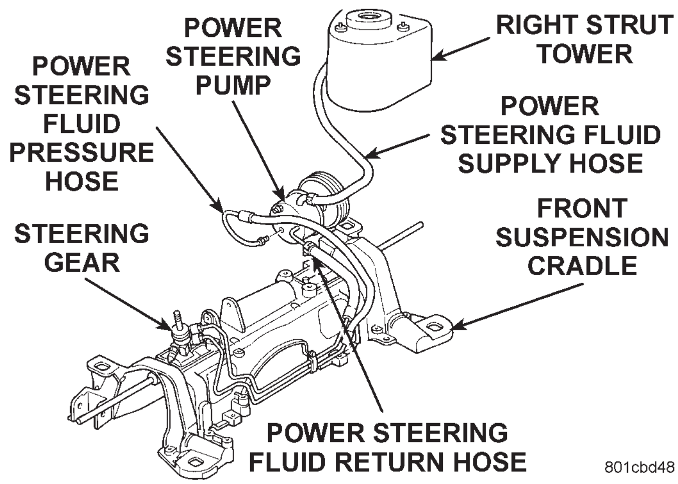


Fig. 15 Power Steering Hoses At Power Steering Pump

(13) Remove the power steering fluid return hose (Fig. 15) from the power steering pump.

(14) Remove the support bracket at the rear of the power steering pump attaching the pump to the rear of the engine (Fig. 16).

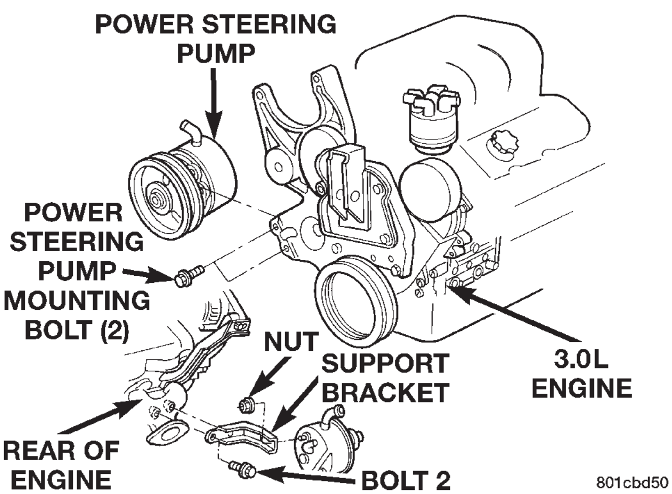


Fig. 16 Power Steering Pump Mounting

(15) Remove the 2 bolts mounting the power steering pump to the alternator/power steering pump and belt tensioner mounting bracket (Fig. 16).

(16) Remove the power steering pump from its mounting bracket.

(17) The power steering pump is removed from the vehicle by pulling it out through the exhaust tunnel area in the floor pan of the vehicle.

INSTALL

(1) Install power steering pump back in vehicle using the reverse order of its removal through the exhaust tunnel are of the vehicle.

(2) Install the power steering pump on its mounting bracket. Install the 2 power steering pump mounting bolts (Fig. 16). Tighten the power steering pump mounting bolts to a torque of 54 N·m (40 ft. lbs.).

(3) Install the support bracket attaching rear of power steering pump to engine (Fig. 16). Tighten the nut and bolts to a torque of 54 N·m (40 ft. lbs).

NOTE: Before connecting the power steering pressure line to the power steering pump, inspect the O-ring on the pressure line for damage and replace if damaged.

(4) Install the power steering fluid pressure line onto the output fitting of the power steering pump (Fig. 15). Tighten the pressure line to pump fitting tube nut to a torque of 31 N·m (275 in. lbs.).

(5) Install the power steering fluid low pressure return hose on the power steering pump low pressure fitting (Fig. 15). **Be sure hose clamps are properly reinstalled and return hose is clear of all accessory drive belts.**

(6) Install the power steering fluid supply hose from the power steering fluid reservoir, on the power steering pump fluid fitting (Fig. 15). **Be sure all hose clamps are properly reinstalled.**

(7) Install the serpentine drive belt (Fig. 11). See Cooling, Group 7 for detailed installation procedure.

(8) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 13).

(9) Install a screw type hose clamp on the power steering hose to steel tube connection. Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat shield sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 13). This is required to prevent overheating of the power steering hoses.

(10) When used, properly position the protective heat sleeves on the power steering hoses. Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(11) Install the exhaust pipe on the exhaust manifold. Install all exhaust system hangers/isolators on the exhaust system brackets.

(12) Connect the oxygen sensor wiring harness to the vehicle wiring harness. Install wiring harness grommet in the floor pan of the vehicle.

(13) Install the accessory drive splash shield (Fig. 14).

(14) Lower vehicle.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

REMOVAL AND INSTALLATION (Continued)

(15) Fill the remote power steering pump fluid reservoir to correct fluid level.

(16) Install cap on power steering fluid reservoir.

(17) Connect the negative battery cable on the negative battery post.

(18) Start engine and turn steering wheel several times from stop to stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. See Checking Fluid Level.

3.3/3.8 LITER POWER STEERING PUMP

REMOVE

WARNING: POWER STEERING OIL, ENGINE COMPONENTS AND THE EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

(1) Remove the (-) negative battery cable from the battery and isolate cable.

(2) Remove cap from power steering fluid reservoir.

(3) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(4) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting, in the Lubrication and Maintenance section of this service manual for the required lifting procedure.

(5) Disconnect the oxygen sensor wiring harness from the vehicle wiring harness. Access to connection at vehicle wiring harness is through the oxygen sensor wiring harness grommet in the floor pan of the vehicle.

NOTE: The exhaust system needs to be removed from the engine to allow for an area to remove the power steering pump from the vehicle.

(6) Remove the catalytic converter from the exhaust manifold. Then remove all the exhaust system hangers/isolators from the brackets on the exhaust system.

(7) Move the exhaust system as far rearward and to the left side of the vehicle as possible (Fig. 17).

(8) Raise the heat sleeve on the power steering hoses to expose the hose to steel tube connection. Remove the hose from the power steering fluid return line on the front suspension cradle (Fig. 18). Allow the remaining power steering fluid to drain from the pump and fluid reservoir through the removed return hose.

(9) Remove the accessory drive splash shield (Fig. 19).

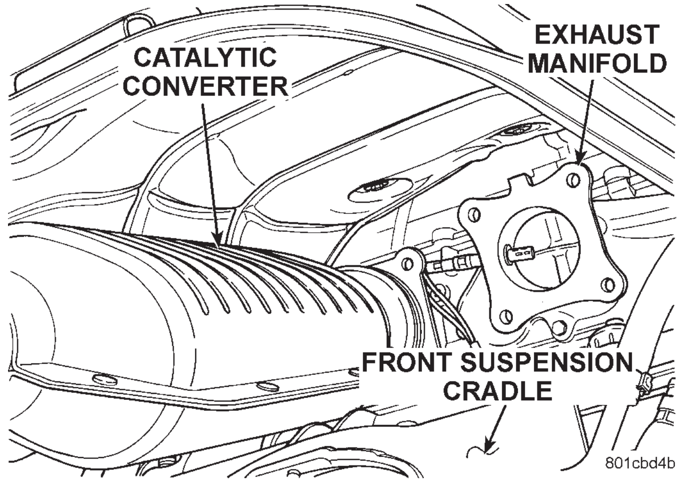


Fig. 17 Exhaust Position For Removing Power Steering Pump

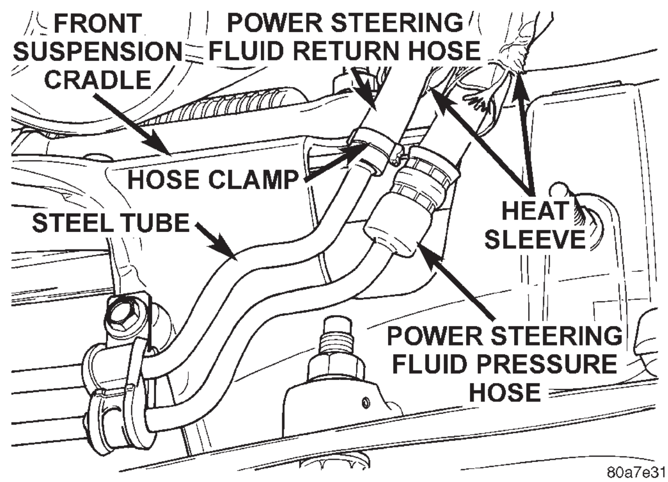


Fig. 18 Power Steering Return Hose At Return Line

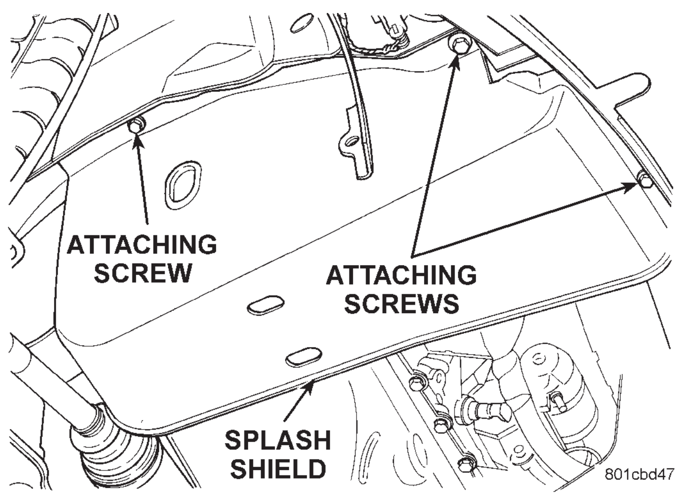


Fig. 19 Accessory Drive Splash Shield

REMOVAL AND INSTALLATION (Continued)

(10) Remove the serpentine accessory drive belt from the engine (Fig. 20). See Cooling, Group 7 for detailed removal procedure.

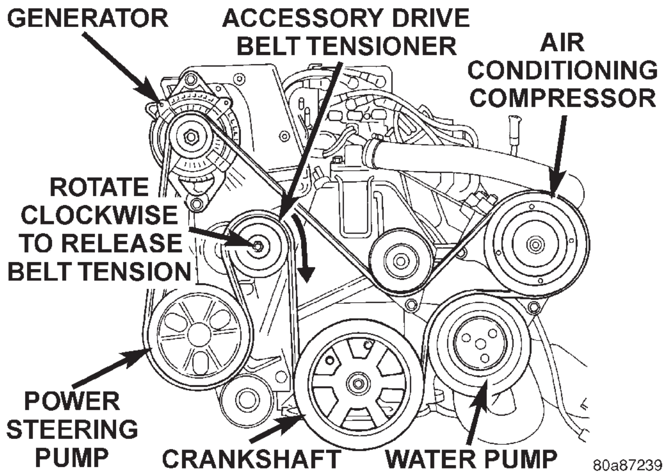


Fig. 20 Serpentine Drive Belt And Routing

(11) Remove the power steering fluid supply hose coming from the remote fluid reservoir, from the fitting on the power steering pump (Fig. 21). Drain off excess power steering fluid from hose.

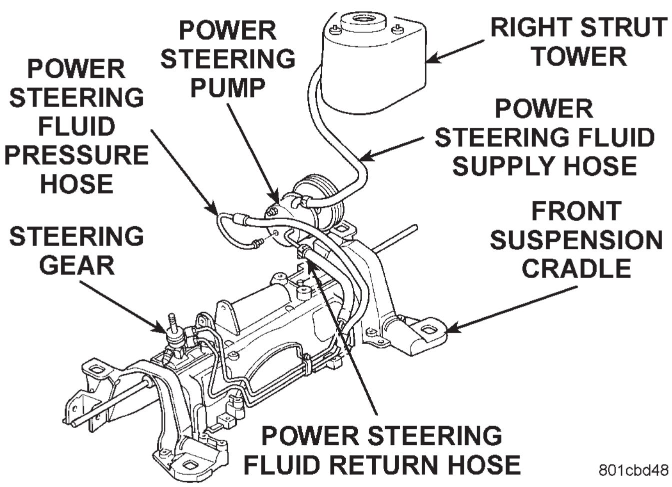


Fig. 21 Power Steering Hoses At Power Steering Pump

(12) Remove the power steering fluid pressure line (Fig. 21) from the power steering pump. Drain excess power steering fluid from tube.

(13) Remove the power steering fluid return hose (Fig. 21) from the power steering pump. Drain excess power steering fluid from tube.

(14) Remove the support bracket at the rear of the power steering pump attaching the pump to the rear of the engine (Fig. 22).

(15) Remove the 3 bolts mounting the power steering pump to the alternator/power steering pump and belt tensioner mounting bracket (Fig. 23).

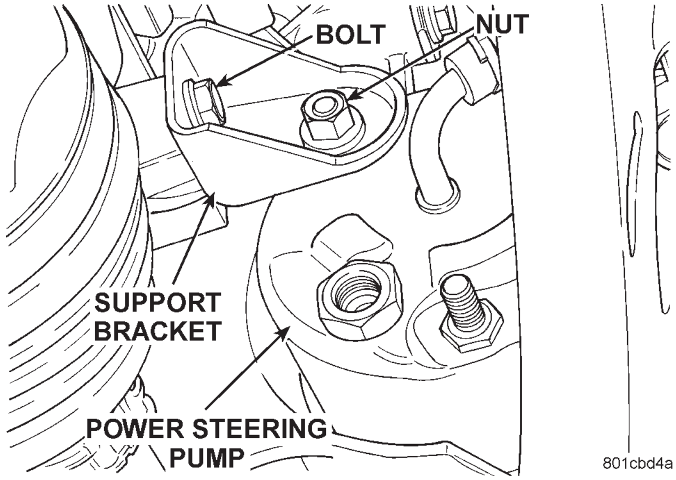


Fig. 22 Power Steering Pump Support Bracket

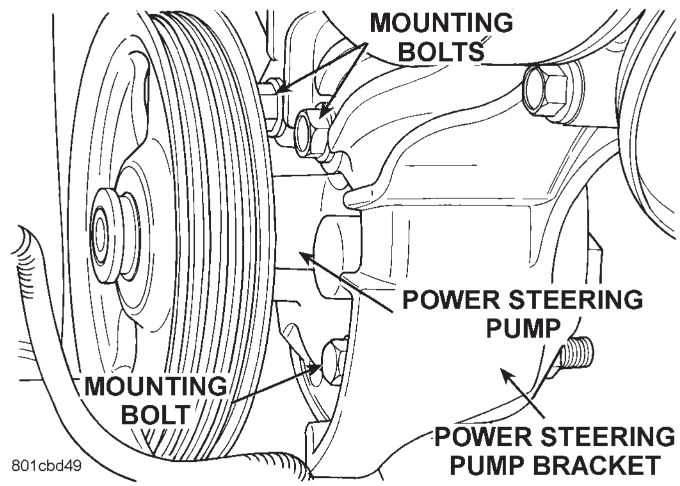


Fig. 23 Power Steering Pump Mounting Bolts

(16) Remove the power steering pump from its mounting bracket.

(17) The power steering pump is removed from the vehicle by pulling it out through the exhaust tunnel area in the floor pan of the vehicle.

INSTALL

(1) Install power steering pump back in vehicle using the reverse order of its removal through the exhaust tunnel are of the vehicle.

(2) Install the power steering pump on its mounting bracket. Install the 3 power steering pump mounting bolts (Fig. 23). Tighten the power steering pump mounting bolts to a torque of 54 N·m (40 ft. lbs.).

(3) Install the support bracket attaching rear of power steering pump to engine (Fig. 22). Tighten the nut and bolt holding the strut assembly to bracket and the intake manifold stud to a torque of 54 N·m (40 ft. lbs).

REMOVAL AND INSTALLATION (Continued)

NOTE: Before installing power steering pressure hose on power steering pump, inspect the O-ring on the power steering pressure hose for damage and replace if required.

(4) Install the power steering fluid pressure line onto the output fitting of the power steering pump (Fig. 21). Tighten the pressure line to pump fitting tube nut to a torque of 31 N·m (275 in. lbs.).

(5) Install the power steering fluid, low pressure return hose on the power steering pump low pressure fitting (Fig. 21). **Be sure hose clamps are properly reinstalled.**

(6) Install the power steering fluid supply hose from the power steering fluid reservoir, on the power steering pump fluid fitting (Fig. 21). **Be sure hose is clear of accessory drive belts and all hose clamps are properly reinstalled.**

(7) Install the serpentine drive belt (Fig. 20). See Cooling, Group 7 for detailed installation procedure.

(8) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 18).

(9) Install a screw type hose clamp on the power steering hose to steel tube connection. **Be sure hose clamps are properly reinstalled.**Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat shield sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 18). This is required to keep the power steering hoses from becoming overheated.

(10) When used, properly position the protective heat sleeves on the power steering hoses (Fig. 18). Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(11) Install the exhaust pipe on the exhaust manifold. Install all exhaust system hangers/isolators on the exhaust system brackets.

(12) Connect the oxygen sensor wiring harness to the vehicle wiring harness. Install wiring harness grommet in the floor pan of the vehicle.

(13) Install the accessory drive splash shield (Fig. 19).

(14) Lower vehicle.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(15) Fill the remote power steering pump fluid reservoir to correct fluid level.

(16) Install cap on power steering fluid reservoir.

(17) Connect the negative battery cable on the negative battery post.

(18) Start engine and turn steering wheel several times from stop to stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. See Checking Fluid Level.

POWER STEERING FLUID RESERVOIR TO PUMP SUPPLY HOSE

REMOVE

(1) Remove the filler cap from remote power steering fluid reservoir (Fig. 24).

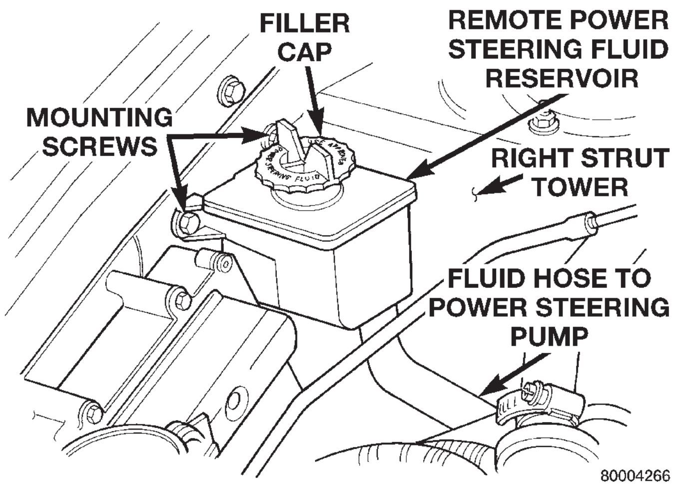


Fig. 24 Fluid Supply Hose At Power Steering Fluid Reservoir

(2) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(3) Remove power steering fluid supply hose routing clip (Fig. 25) from stud in strut tower.

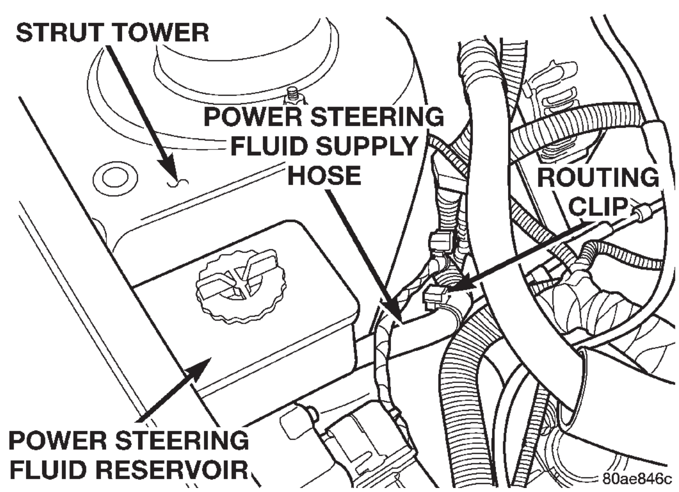


Fig. 25 Power Steering Fluid Hose Routing Clip

(4) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubri-

REMOVAL AND INSTALLATION (Continued)

cation and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(5) Remove at power steering pump, the power steering fluid hose coming from the power steering fluid reservoir. Let the power steering fluid drain out of the reservoir and hose.

(6) Lower vehicle.

(7) Remove hose clamp attaching the power steering fluid supply hose to the power steering fluid reservoir (Fig. 24).

(8) Remove the power steering fluid supply hose from the vehicle. Hose is removed from the top of the engine compartment.

INSTALL

CAUTION: On V-6 engine applications, the power steering fluid reservoir to power steering hose must be routed tightly against the strut tower and parallel to the dash panel. It must also be routed under the wiring harness and below the drip tube. This routing will prevent the power steering fluid supply hose from coming in contact with the accessory drive belt.

(1) Install and correctly route the power steering fluid supply hose from remote fluid reservoir down to power steering pump.

(2) Install the fluid supply hose onto the power steering fluid reservoir (Fig. 24). Install the hose clamp on the fluid supply hose. **Be sure hose clamp is installed past bead on fluid reservoir fitting.**

(3) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(4) Install power steering fluid supply hose on power steering pump. Install the hose clamp on the fluid supply hose. **Be sure hose clamp is installed past bead on pump fitting.**

(5) Lower vehicle.

(6) Install routing clip on power steering fluid supply hose. Be sure routing clip is installed in a position to correctly align with stud in strut tower.

(7) Install routing clip for power steering fluid supply hose on stud in strut tower (Fig. 25).

(8) Fill the remote fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(9) Start the engine and let run for a few seconds. Then turn the engine off.

(10) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(11) Raise the front wheels off the ground.

(12) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(13) Add power steering fluid if necessary.

(14) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(15) Stop the engine. Check the fluid level and refill as required.

(16) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

POWER STEERING FLUID PRESSURE HOSE

Service all power steering hoses with vehicle raised on hoist. Cap all open ends of hoses, power steering pump fittings and steering gear ports to prevent entry of foreign material into the components.

WARNING: POWER STEERING OIL, ENGINE PARTS AND THE EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

For part reference and part location for the vehicle that is being serviced, refer to the following figure numbers. These show the hose bracket locations, hose routings and fitting locations by the engine application of the vehicle. Use these figure numbers when referring to the removal or installation procedures for the power steering hoses listed below.

REMOVE

(1) Remove cap from power steering fluid reservoir.

(2) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(3) Raise vehicle See Hoisting, Group 0. Put oil drain pan under vehicle to catch power steering fluid.

(4) Raise the heat sleeve on the power steering fluid return hose (Fig. 26) to expose the return hose to steel tube connection. Remove the hose clamp from the power steering fluid return hose (Fig. 26). Remove power steering fluid return hose from steel tube and allow power steering fluid to drain from pump.

REMOVAL AND INSTALLATION (Continued)

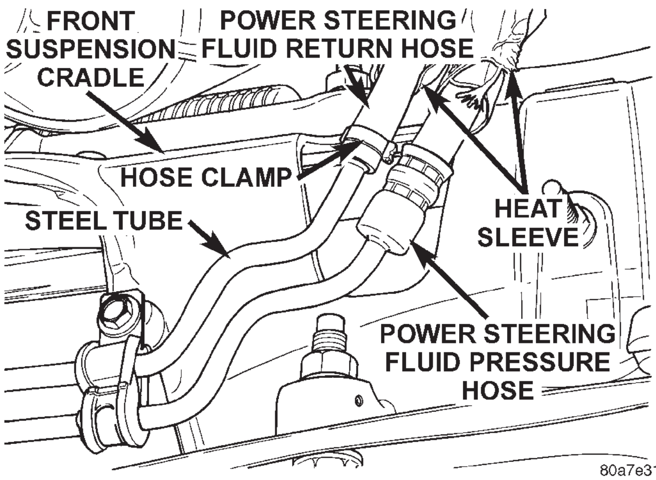


Fig. 26 Return Hose Connection To Steel Tube

(5) Remove the power steering fluid pressure line from the power steering pump pressure fitting (Fig. 27). Drain excess power steering fluid from hose.

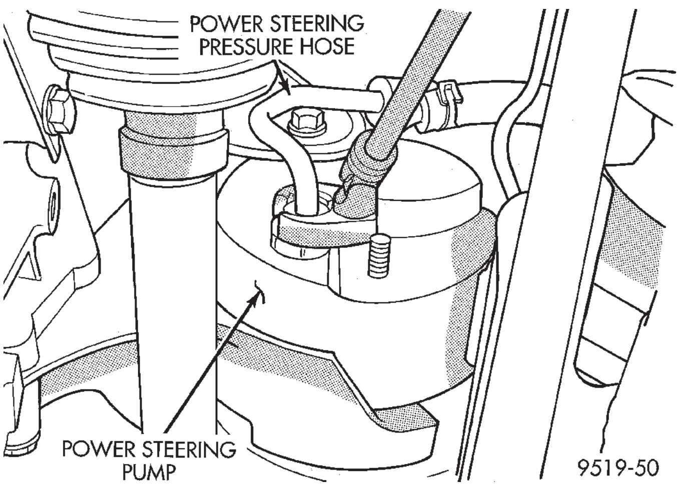


Fig. 27 Pressure Hose Connection To Power Steering Pump

(6) Remove bolt, attaching power steering hose routing bracket to front suspension cradle (Fig. 28).

(7) Disconnect power steering hose at power steering gear assembly (Fig. 29). Drain the power steering fluid from power steering pump and hose.

(8) Discard the O-rings on the ends of power steering fluid pressure hose.

INSTALL

(1) Using a lint free towel, wipe clean the open power steering hose ends, power steering pump pressure fitting and steering gear ports.

(2) Install new O-rings on the ends of the power steering fluid pressure hose. Lubricate O-rings using clean power steering fluid.

(3) Attach the power steering pressure hose to the fittings on the power steering pump and steering gear. Route hose avoiding tight bends or kinking. Do not bend tube ends of the power steering hoses when installing.

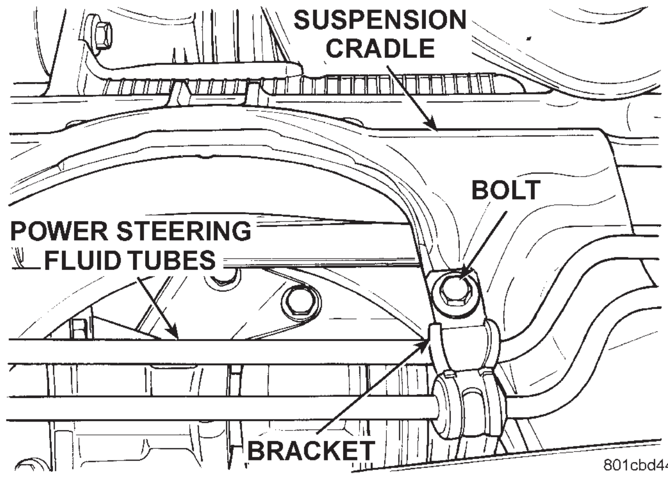


Fig. 28 Power Steering Hose Attachment To Suspension Cradle

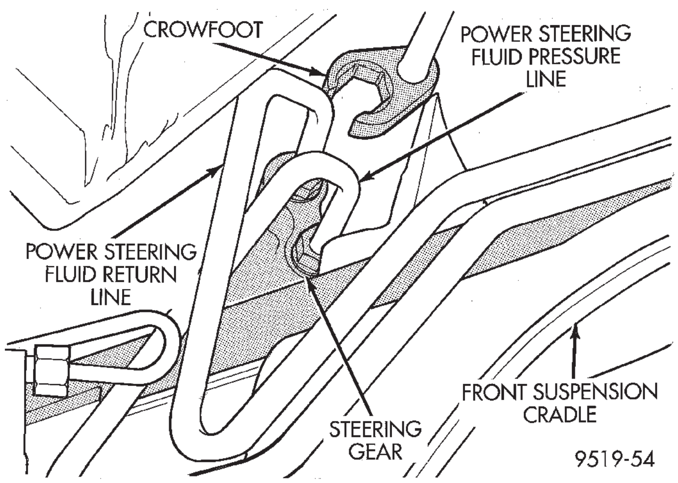


Fig. 29 Power Steering Pressure Hose At Steering Gear

(4) Install the power steering fluid hoses to suspension cradle routing bracket (Fig. 28). Power steering fluid hoses must remain away from the exhaust system and **must not** come in contact with any unfriendly surfaces of the vehicle.

CAUTION: When tightening and torquing the pressure hose at the power steering pump, the pressure hose is to be rotated against the fluid return hose fitting on the pump.

(5) Tighten all fasteners shown for specific applications to their correct torques listed below:

- Pump End Tube Nut 34 N·m (25 ft. lbs.)
- Gear End Tube Nut 34 N·m (25 ft. lbs.)
- Pump Bracket Nut 40 N·m (30 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

(6) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 26).

(7) Install a screw type hose clamp on the power steering hose to steel tube connection. Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 26).

(8) When used, properly position the protective heat sleeves on the power steering hoses. Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(9) After hoses are installed and power steering system is filled with fluid and cap is installed on reservoir. Start the engine and check for leaks. (See Pump Installation).

POWER STEERING FLUID RETURN HOSE

Service all power steering hoses with vehicle raised on hoist. Cap all open ends of hoses, power steering pump fittings and steering gear ports to prevent entry of foreign material into the components.

WARNING: POWER STEERING OIL, ENGINE PARTS AND THE EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

For part reference and part location for the vehicle that is being serviced, refer to the following figure numbers. These show the hose bracket locations, hose routings and fitting locations by the engine application of the vehicle. Use these figure numbers when referring to the removal or installation procedures for the power steering hoses listed below.

REMOVE

(1) Remove cap from power steering fluid reservoir.

(2) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(3) Raise vehicle See Hoisting, Group 0. Put oil drain pan under vehicle to catch power steering fluid.

(4) Raise the insulating heat sleeve on the power steering hoses to expose the hose to steel tube connection. Remove hose clamp where rubber portion of power steering fluid return hose attaches to steel tube on suspension cradle (Fig. 30). Remove rubber hose from steel tube and allow power steering fluid to drain from pump.

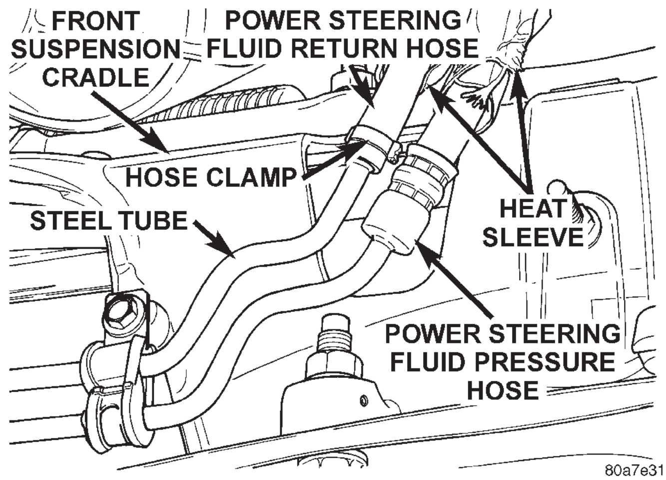


Fig. 30 Power Steering Return Hose At Steel Tube

(5) Remove the power steering fluid return hose from the power steering pump return hose fitting.

INSTALL

(1) Using a lint free towel, wipe clean the open power steering hose ends and power steering pump fitting.

(2) Attach the power steering return hose to the fitting on the power steering pump. Route hose smoothly avoiding tight bends or kinking. Hose must remain away from the exhaust system and not come in contact with any unfriendly surfaces of the vehicle.

(3) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 30).

(4) Install a screw type hose clamp on the power steering hose to steel tube connection. Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat shield sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 30). This is to prevent overheating of the power steering fluid hoses.

(5) When used, position the protective heat sleeves on the power steering hoses so they cover the connection to the power steering pump. Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(6) After hoses are installed and power steering system is filled with fluid and cap is installed on reservoir. Start the engine and check for leaks. (See Pump Installation).

REMOVAL AND INSTALLATION (Continued)

REMOTE POWER STEERING FLUID RESERVOIR

REMOVE

(1) Remove the filler cap from remote power steering fluid reservoir (Fig. 31).

(2) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(3) Remove at power steering pump, the power steering fluid hose coming from the power steering fluid reservoir. Let the power steering fluid drain out of the reservoir and hose.

(4) Lower vehicle.

(5) Remove the fluid supply hose (Fig. 31) from the remote power steering fluid reservoir.

(6) Remove the 2 mounting screws (Fig. 31) attaching the remote fluid reservoir to the inner fender.

(7) Remove remote reservoir from inner fender.

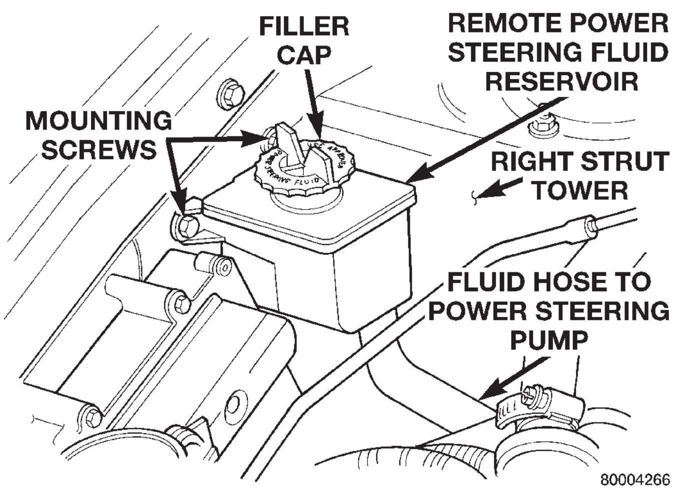


Fig. 31 Remote Power Steering Fluid Reservoir

INSTALL

(1) Install remote power steering fluid reservoir on inner fender, by first inserting tab on reservoir into hole in inner fender. Then rotate reservoir so mounting tabs are against inner fender.

(2) Install and securely tighten the 2 reservoir mounting screws (Fig. 31).

CAUTION: The power steering fluid reservoir to power steering pump supply hose must be routed tightly against the strut tower and parallel to the dash panel. It must also be routed under the wiring harness and below the drip tube. This will prevent the hose from coming in contact with the accessory drive belt. The power steering fluid supply hose must be located in its correct position by clipping it to the stud in the strut tower (Fig. 32).

(3) Install the fluid supply hose onto the power steering fluid reservoir fitting (Fig. 31). Install the hose clamp on the fluid supply hose at the fluid reservoir. **Be sure hose clamp in installed past bead on fluid reservoir fitting.**

(4) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(5) Install power steering fluid supply hose on power steering pump. Install the hose clamp on the fluid supply hose at the power steering pump. **Be sure hose clamp in installed past bead on pump fitting.**

(6) Lower vehicle.

(7) Install routing clip for power steering fluid supply hose on stud in strut tower (Fig. 32).

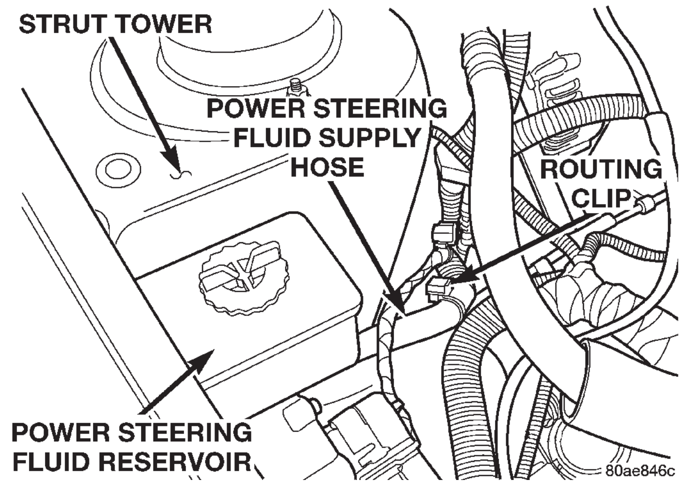


Fig. 32 Power Steering Fluid Hose Routing Clip

(8) Fill the remote fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(9) Start the engine and let run for a few seconds. Then turn the engine off.

(10) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(11) Raise the front wheels off the ground.

(12) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(13) Add power steering fluid if necessary.

(14) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(15) Stop the engine. Check the fluid level and refill as required.

(16) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

DISASSEMBLY AND ASSEMBLY

POWER STEERING PUMP PULLEY

DISASSEMBLY

(1) Remove the pulley from the shaft of the power steering pump using Puller C-4333 or C-4068 (Fig. 33).

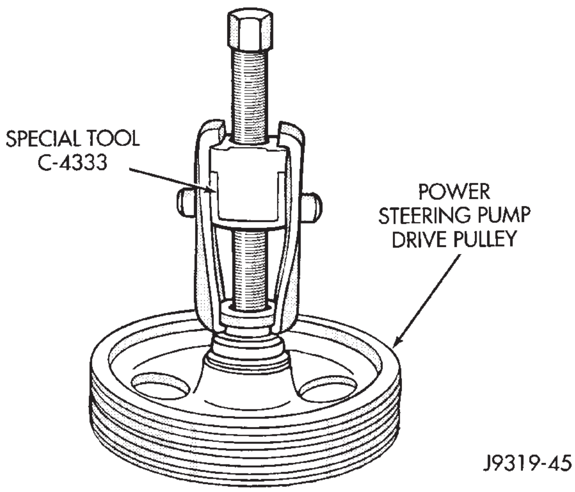


Fig. 33 Pulley Removal

CAUTION: Do not hammer on power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Replace pulley if it is found to be bent, cracked, or loose.

ASSEMBLY

(1) Install the pulley with Installer C-4063 (Fig. 34). Do not use the tool adapters.

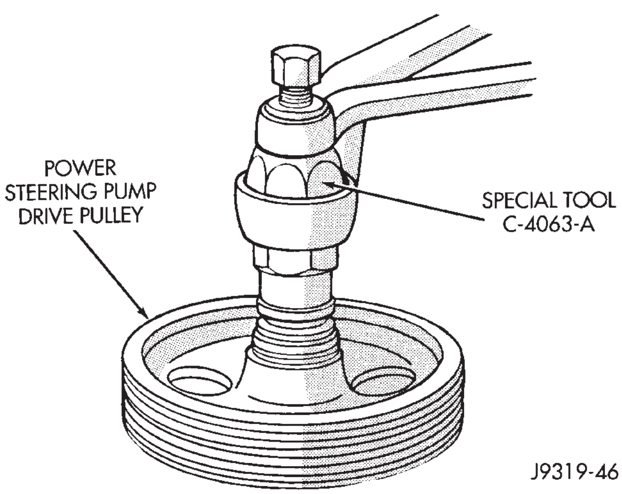


Fig. 34 Pulley Installation

(2) Ensure that the tool and the pulley remain aligned with the pump shaft. Prevent the pulley from being cocked on the shaft.

(3) Force pulley flush with the end of the power steering pump shaft (Fig. 35).

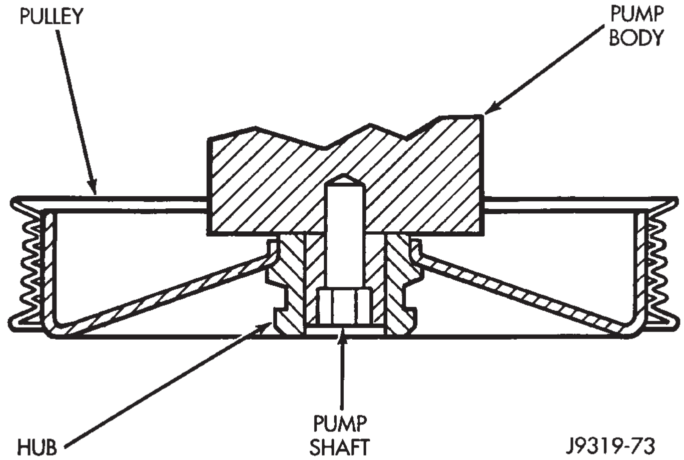


Fig. 35 Pulley To Pump Shaft Location

(4) With serpentine belts, 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.**

POWER STEERING PUMP FLOW CONTROL VALVE SEAL

DISASSEMBLE

WARNING: POWER STEERING OIL, ENGINE PARTS AND THE EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

(1) Remove cap from power steering fluid reservoir.

(2) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(3) Raise vehicle See Hoisting, Group 0. Put oil drain pan under vehicle to catch power steering fluid.

(4) Raise the heat sleeve (Fig. 36) on the power steering return hose to expose the return hose to steel tube connection. Remove hose clamp from power steering fluid return hose (Fig. 36). Remove power steering return hose from steel tube and allow remaining power steering fluid to drain from power steering pump and reservoir.

(5) Remove the power steering fluid pressure line from the power steering pump pressure fitting (Fig. 37). Drain excess power steering fluid from hose.

DISASSEMBLY AND ASSEMBLY (Continued)

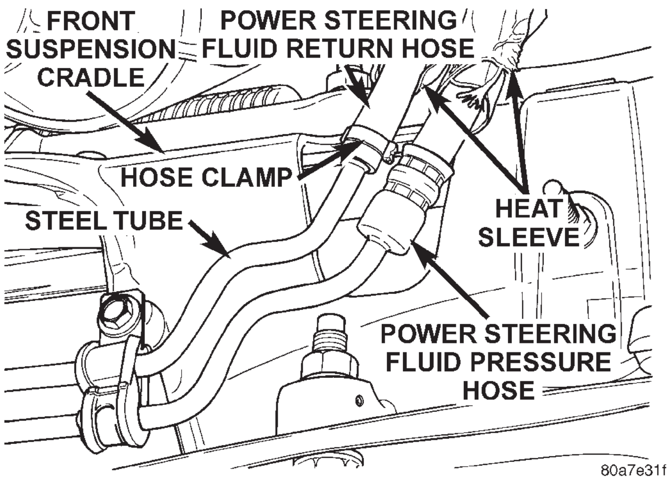


Fig. 36 Return Hose At Steel Tube

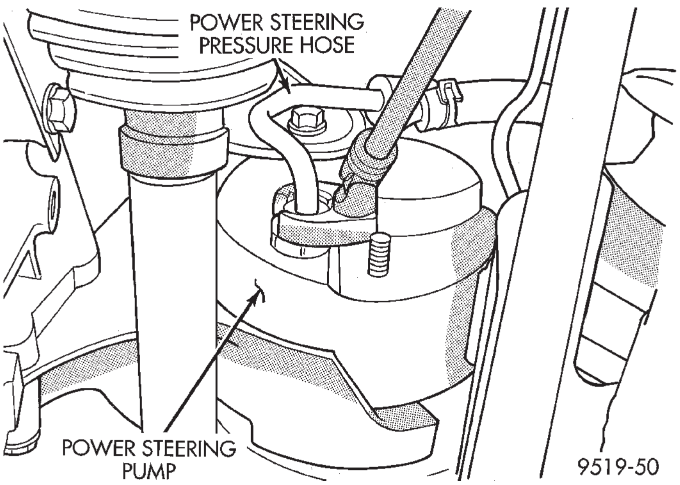


Fig. 37 Pressure Hose Connection To Power Steering Pump

(6) Remove the pressure fitting/flow control valve from the power steering pump and remove and discard the O-Ring seal.

ASSEMBLE

(1) Install a new O-Ring seal on the pressure fitting/flow control valve, and wet the O-Ring with clean fresh power steering fluid.

(2) Install the pressure fitting/flow control valve in the power steering pump. Tighten the pressure fitting/flow control valve to a torque of 75 N·m (55 ft. lbs.).

CAUTION: When tightening and torquing the pressure hose at the power steering pump, the hose should be rotated against the fluid return hose fitting on the pump.

(3) Install the power steering fluid pressure hose in the pressure fitting/flow control valve (Fig. 37). Tighten the tube nut to a torque of 34 N·m (25 ft. lbs.)

(4) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 36).

(5) Install a screw type hose clamp on the power steering hose to steel tube connection. Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat shield sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 36). This is required to keep the power steering hoses from becoming overheated.

(6) When used, properly position the protective heat sleeves (Fig. 36) on the power steering hoses. Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(7) Fill the power steering system with fluid, bleed air from system and check that power steering fluid is at correct level.

SPECIFICATIONS

POWER STEERING SYSTEM SPECIFICATIONS

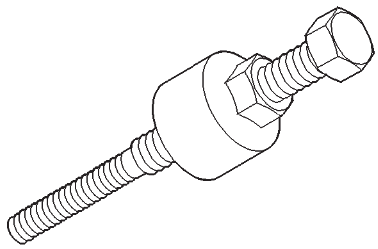
Flow At 1500 RPM And Minimum Pressure.5.0 to 7.0 Liters/Min (1.3 to 1.9 GPM)
Control Valve Pressure Relief. 9653 to 10342 kPa (1400 to 1500psi)

POWER STEERING PUMP FASTENER TORQUE SPECIFICATIONS

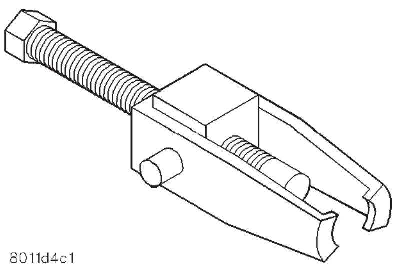
DESCRIPTION	TORQUE
POWER STEERING PUMP:	
Flow Control Valve Fitting	75 N·m (55 ft. lbs.)
Mounting Bolts	54 N·m (40 ft. lbs.)
Rear Bracket To Engine Mounting Bolts	54 N·m (40 ft. lbs.)
POWER STEERING FLUID HOSES:	
Hose Tube Nuts	34 N·m (25 ft. lbs.)
Routing Bracket To Suspension Cradle	28 N·m (21 ft. lbs.)

SPECIAL TOOLS

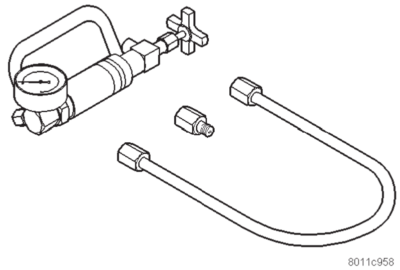
POWER STEERING PUMP



Installer C-4063B



Puller C-4333



P/S System Analyzer 6815

POWER STEERING GEAR

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DESCRIPTION AND OPERATION

STEERING GEAR OPERATION DESCRIPTION

NOTE: The power steering gear (Fig. 1) should NOT be serviced or adjusted. If a malfunction or oil leak occurs, the complete steering gear should be replaced.

If a steering gear boot needs to be replaced due to damage, refer to the power steering gear service section in this manual for proper procedure.

The power steering system consists of these four major components. Power Steering Gear, Power Steering Pump, Pressure Hose, and Return Line. Turning of the steering wheel is converted into linear travel through the meshing of the helical pinion teeth with the rack teeth. Power assist steering is provided by an open center, rotary type control valve which directs oil from the pump to either side of the integral rack piston.

Road feel is controlled by the diameter of a torsion bar which initially steers the vehicle. As required steering effort increases, as in a turn, the torsion bar twists, causing relative rotary motion between the rotary valve body and the valve spool. This movement directs oil behind the integral rack piston, which, in turn, builds up hydraulic pressure and assists in the turning effort.

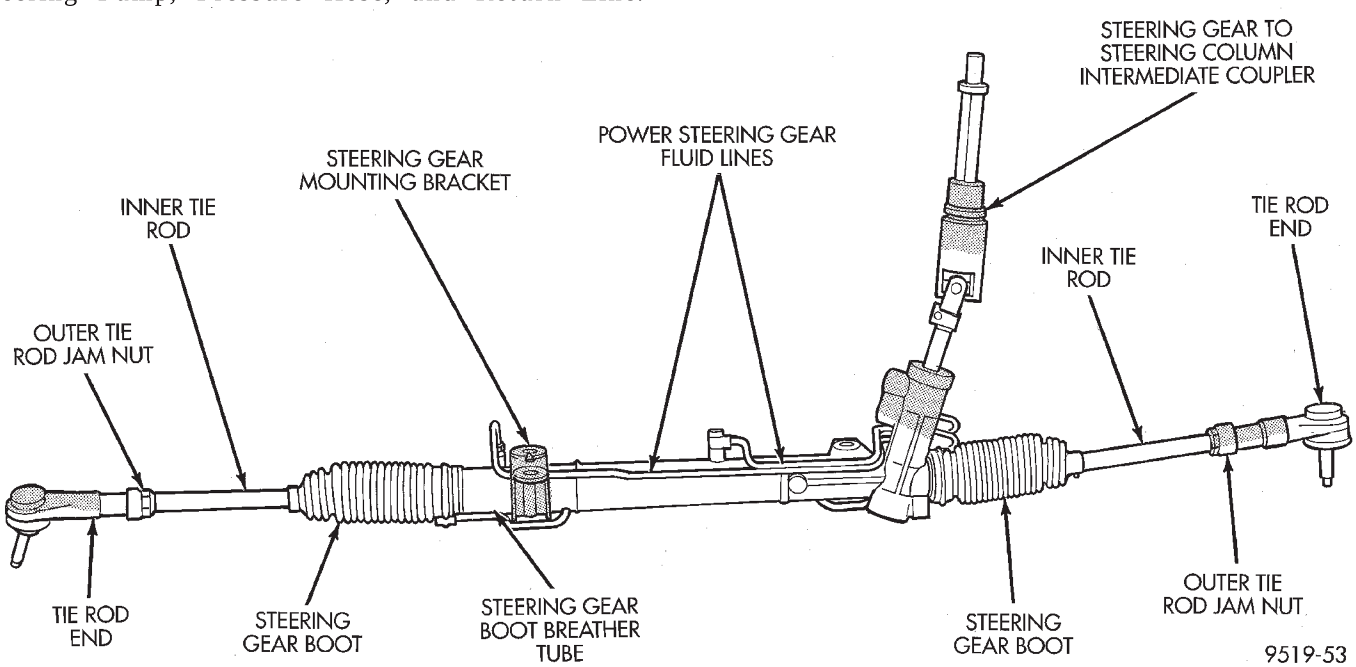


Fig. 1 Power Steering Gear Assembly

DESCRIPTION AND OPERATION (Continued)

The drive tangs on the pinion mate loosely with a stub shaft to permit manual steering control to be maintained if the drive belt on the power steering pump should break. However, under these conditions, steering effort will be increased.

DIAGNOSIS AND TESTING

POWER STEERING GEAR

The following procedure can be used to test the operation of the power steering system on this vehicle. This test will provide the flow rate for the power steering system along with the maximum relief pressure of the power steering pump. This test is to be performed any time a power steering system problem is present to determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Pressure/Flow Tester, Special Tool 6815 (Fig. 2).

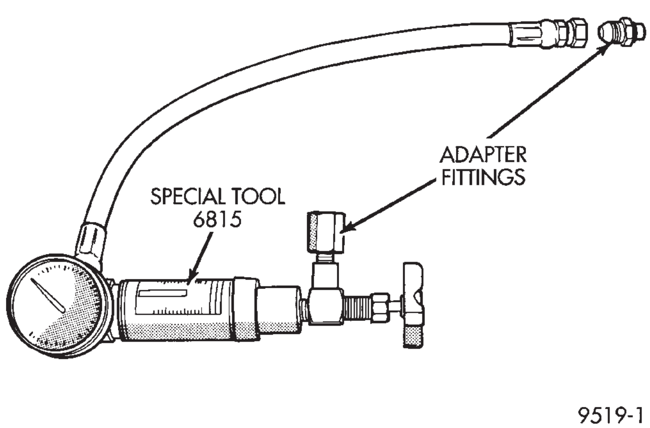


Fig. 2 Power Steering Pump Flow/Pressure Tester

POWER STEERING PUMP FLOW AND PRESSURE TEST PROCEDURE

(1) Check power steering pump drive belt tension and adjust as necessary.

(2) Disconnect power steering fluid pressure hose, at power steering pump. Use a container for dripping fluid.

(3) Connect Pressure Gauge, Special Tool from kit 6815 to both hoses using adapter fittings. Connect spare pressure hose, to power steering pump pressure hose fitting.

(4) Completely open valve on Special Tool 6815.

(5) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test and get air out of fluid. Then shut off engine.

(6) Check power steering fluid level, and add fluid as necessary. Start engine again and let idle.

(7) Pressure 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). The flow meter should read between 1.3 and 1.9 GPM

CAUTION: The following test procedure involves testing power steering pump maximum pressure output and flow control valve operation. Do not leave valve closed for more than 5 seconds as the pump could be damaged.

(8) Close valve fully three times and record highest pressure indicated each time. **All three readings must be within the specifications and within 345 kPa (50 psi) of each other.**

NOTE: Power steering pump maximum relief pressure is 9653 to 10342 kPa (1400 to 1500 psi.).

- If power steering pump pressures are within specifications but not within 345 kPa (50 psi) of each other, then replace power steering pump.
- If pressures are within 345 kPa (50 psi) of each other but below specifications, then replace power steering pump.

CAUTION: Do not force the pump to operate against the stops for more than 5 seconds at a time because, pump damage will result.

(9) Open test valve. Turn steering wheel to the extreme left and right positions until against the stops, recording the highest indicated pressure at each position. Compare pressure gauge readings to power steering pump specifications. If highest output pressures are not the same against either stop, the steering gear is leaking internally and must be replaced.

REMOVAL AND INSTALLATION

STEERING GEAR

NOTE: The power steering gear should NOT be serviced or adjusted. If a malfunction or oil leak occurs, the complete steering gear assembly must be replaced.

REMOVE

CAUTION: Positioning the steering column in the locked position will prevent the clockspring from being accidentally over-extended when the steering column is disconnected from the intermediate steering coupler.

REMOVAL AND INSTALLATION (Continued)

(1) Remove cap from power steering fluid reservoir.

(2) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(3) With the ignition key in the locked position turn the steering wheel to the left until the steering wheel is in the locked position.

(4) With the vehicle on the ground, disconnect the steering column shaft coupler from the steering gear intermediate coupler (Fig. 3).

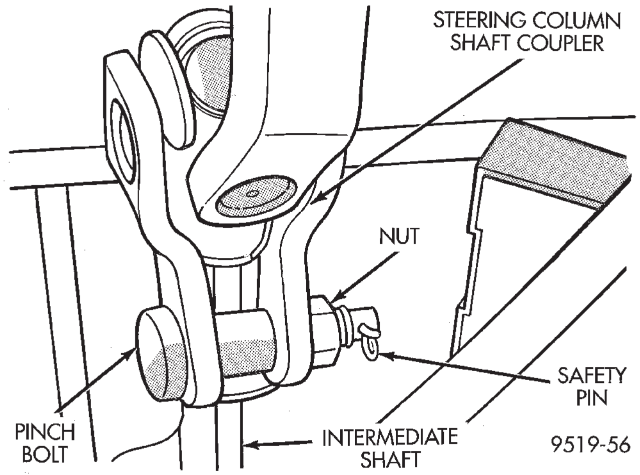


Fig. 3 Steering Column Shaft To Intermediate Shaft Attachment

(5) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(6) Remove the front tires.

(7) Raise the heat sleeve (Fig. 4) on the power steering return hose to expose the return hose to steel tube connection. Remove the return hose from the metal tube of the power steering fluid return line (Fig. 4). Then allow the remaining power steering fluid to drain from the system through the hose and metal tube.

(8) Remove nut attaching outer tie rod end to steering knuckle (Fig. 5). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench.**

(9) Remove both tie rod ends from steering knuckles, using Puller Special Tool MB-990635 or MB-991113 (Fig. 6).

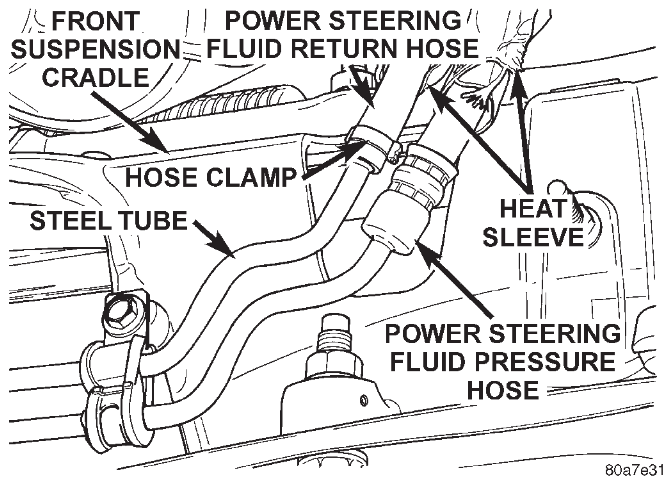


Fig. 4 Power Steering Fluid Return Hose Connection

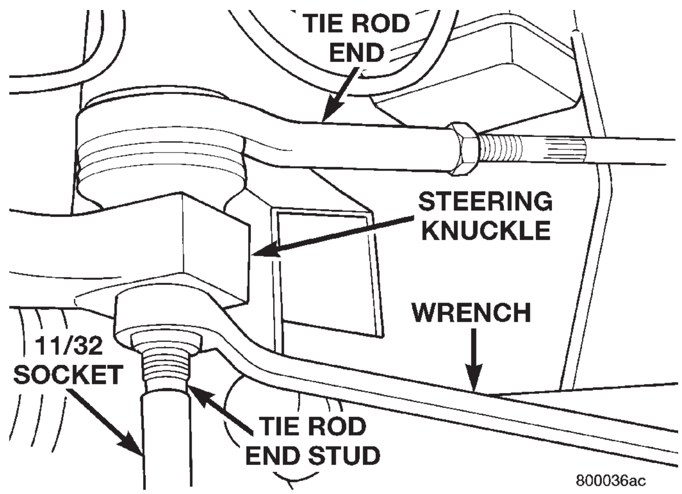


Fig. 5 Removing/Installing Tie Rod End Attaching Nut

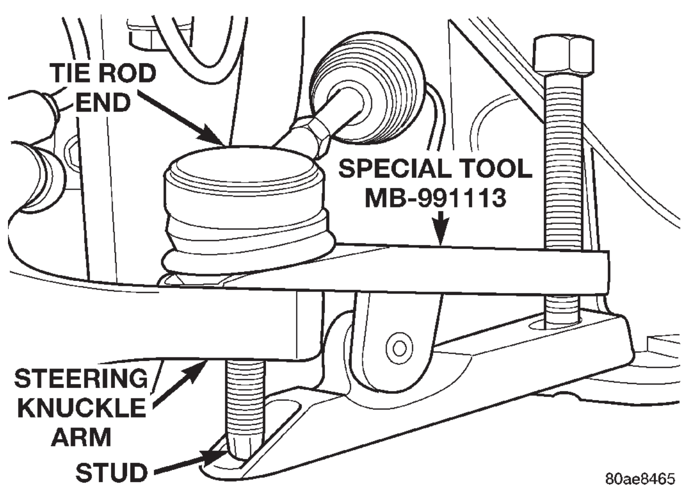


Fig. 6 Tie Rod End Removal From Steering Knuckle

REMOVAL AND INSTALLATION (Continued)

(10) Remove the 2 bolts and loosen the third (Fig. 7) attaching the antilock brakes hydraulic control unit (HCU) to the front suspension cradle. Then rotate the HCU rearward to allow access to the cradle plate attaching nut and bolt just forward of the HCU.

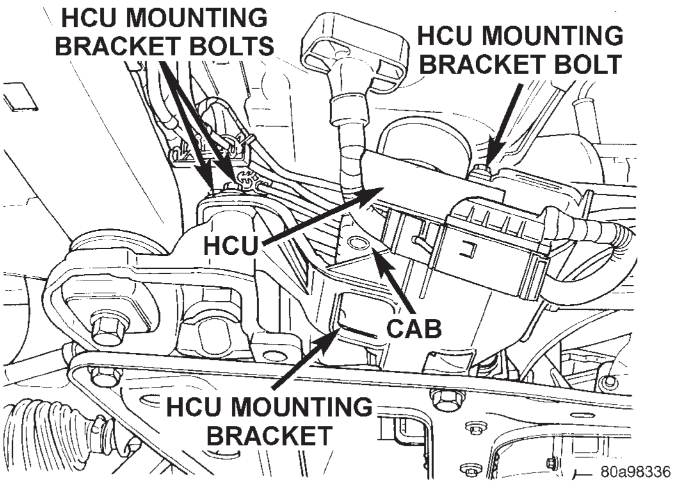


Fig. 7 HCU Bracket Attaching Bolts

(11) Remove the 10 nuts and bolts (Fig. 8) attaching the cradle plate to the bottom of the front suspension cradle. Then remove the cradle plate from the cradle.

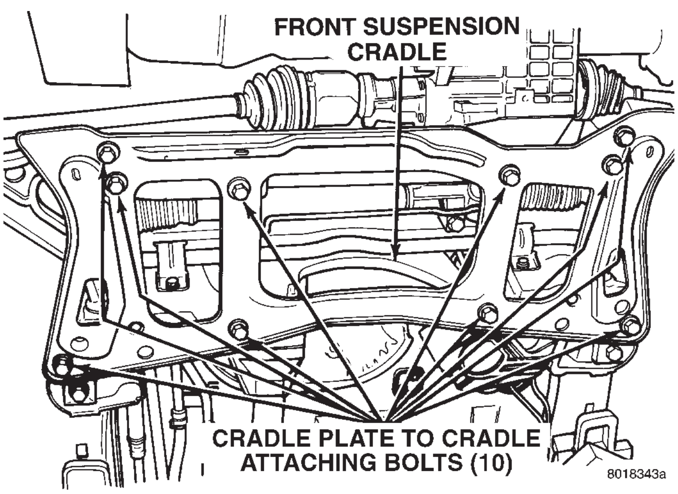


Fig. 8 Front Suspension Cradle Plate And Attaching Bolts

(12) Remove the bracket (Fig. 9) attaching the power steering fluid tubes to the front suspension cradle.

(13) Using a 18mm crowfoot, (Fig. 10) remove the power steering fluid pressure and return lines (Fig. 10) from the power steering gear.

(14) Remove the 3 bolts and nuts (Fig. 11) mounting the steering gear to the front suspension cradle.

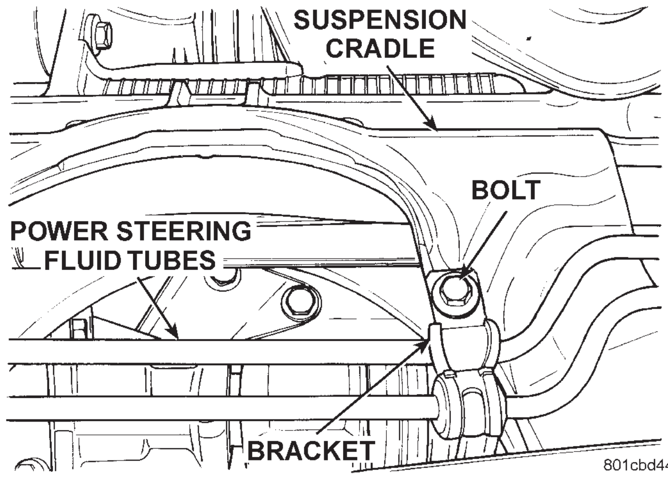


Fig. 9 Power Steering Tube Bracket

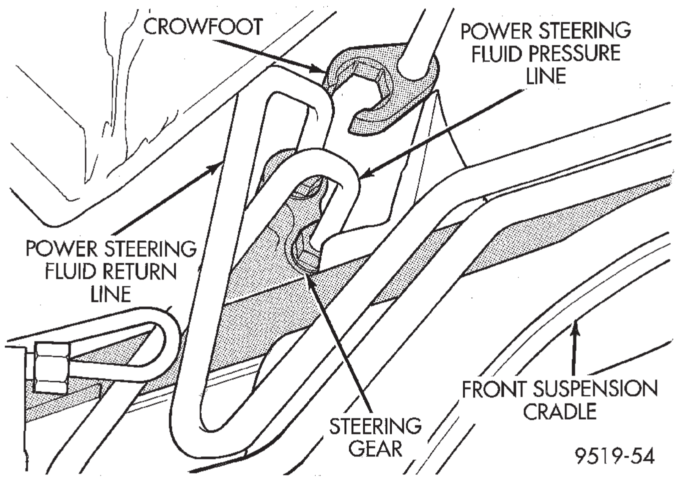


Fig. 10 Power Steering Fluid Pressure And Return Hoses At Steering Gear

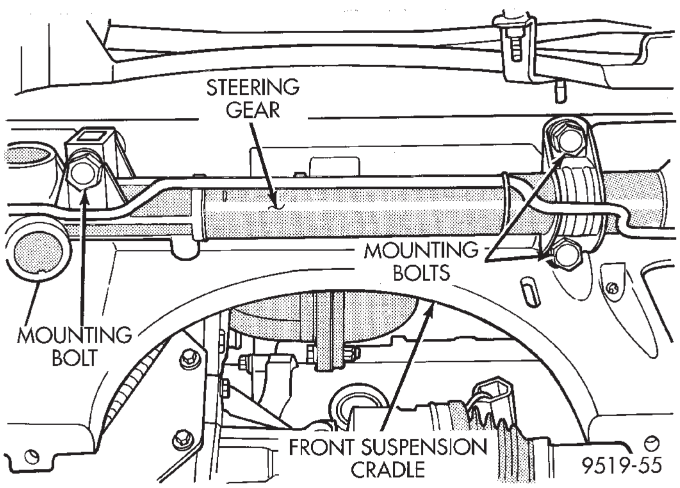


Fig. 11 Steering Gear Mounting To Suspension Cradle

REMOVAL AND INSTALLATION (Continued)

NOTE: The next step must be done to allow the removal of the steering gear from the front suspension cradle. The steering gear can not be removed from the vehicle with the intermediate coupler attached to the steering gear.

(15) Lower steering gear from suspension cradle enough to allow access to the intermediate coupler roll pin (Fig. 12). Install Remover/Installer Special Tool 6831A through the center of the roll pin, securing with the knurled nut (Fig. 12). Hold threaded rod stationary while turning nut, this will pull the roll pin out of the intermediate coupler.

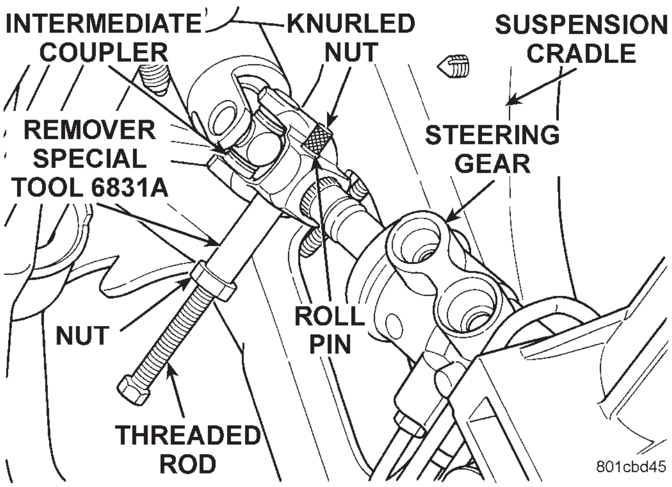


Fig. 12 Removing Roll Pin From Intermediate Coupler

(16) Separate the intermediate coupler from the shaft of the steering gear.

(17) Remove the steering gear assembly from the front suspension cradle.

INSTALL

(1) Install the steering gear up in the front suspension cradle, leaving room to install intermediate coupler.

(2) Start the roll pin into the intermediate coupler before installing coupler on steering gear shaft. Start roll pin into coupler, using a hammer and tapping it into the coupler. Then install the intermediate coupler on the shaft of the steering gear.

(3) Install Remover/Installer Special Tool 6831A through the center of the roll pin, securing it with the knurled nut (Fig. 13). Hold threaded rod stationary while turning nut, this will pull the roll pin into the intermediate coupler.

(4) Install steering gear assembly on the front suspension cradle. Install the 3 steering gear to front suspension cradle mounting bolts and nuts (Fig. 11).

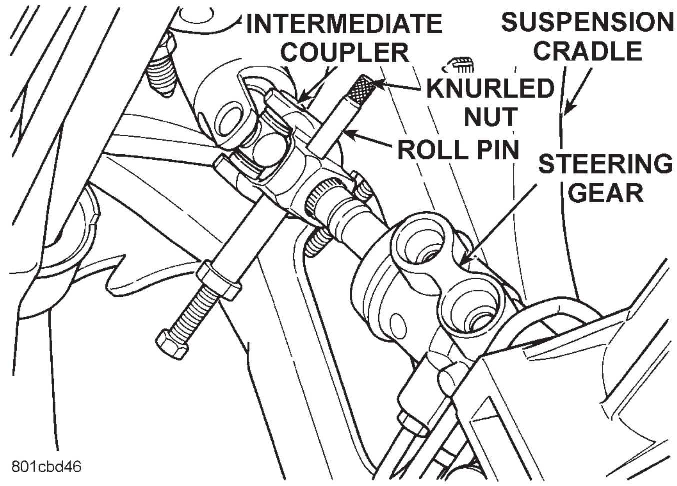


Fig. 13 Installing Roll Pin In Intermediate Coupler

CAUTION: Proper torque on the steering gear to suspension cradle mounting bolts is very important.

(5) Tighten the 3 steering gear to suspension cradle mounting bolts to a torque of 183 N·m (135 ft. lbs.).

(6) Attach the power steering fluid pressure and return lines (Fig. 10) to the proper fittings on the steering gear. Tighten the power steering fluid line tube nuts to a torque of 31 N·m (275 in. lbs.).

(7) Install tie rod end into steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary using a 11/32 socket, (Fig. 5) tighten tie rod end to steering knuckle attaching nut. Then using a crowfoot and 11/32 socket (Fig. 14), tighten the tie rod end attaching nut to a torque of 54 N·m (40 ft. lbs.).

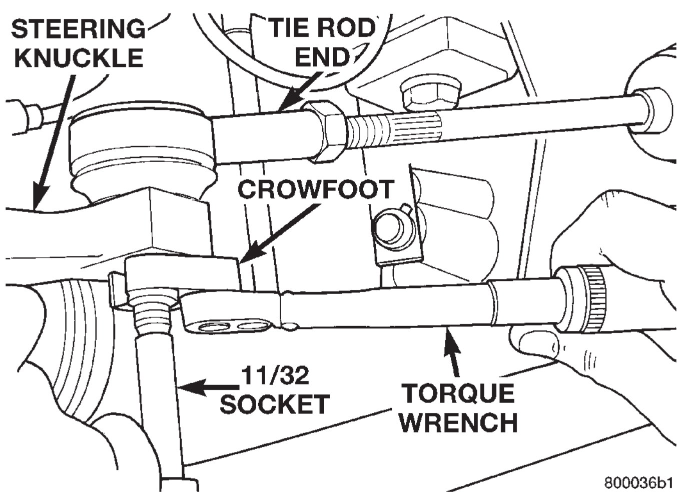


Fig. 14 Torquing Tie Rod End Attaching Nut

REMOVAL AND INSTALLATION (Continued)

CAUTION: Proper torque on the cradle plate to suspension cradle mounting bolts is very important.

(8) Install cradle plate on front suspension cradle and install the 10 cradle plate to cradle attaching bolts and nuts (Fig. 8). Tighten all attaching bolts to a torque of 165 N·m (123 ft. lbs.).

(9) Install the bracket (Fig. 9) attaching the power steering fluid tubes to the front suspension cradle.

CAUTION:

(10) Install the power steering fluid return hose on the steel tube at the front suspension cradle (Fig. 4).

(11) Install a screw type hose clamp on the power steering hose to steel tube connection. **Be sure hose clamp is installed on return tube past the upset bead on the tube.** Tighten the screw clamp to a torque of 2 N·m (18 in. lbs.).

CAUTION: The protective heat shield sleeves must cover the entire rubber hose and hose to tube connection portion of both the power steering fluid pressure and return hoses (Fig. 4). This is required to prevent the power steering hoses from being overheated.

(12) When used, properly position the protective heat sleeves on the power steering hoses. Then, tie strap the heat sleeves to the power steering hoses to keep them in their proper position.

(13) Install the front tire and wheel assemblies on vehicle. Install the wheel lug nuts and torque to 129 N·m (95 ft. lbs.).

(14) Lower the vehicle to a level were the interior of vehicle is accessible.

(15) Using the intermediate coupler, turn the front wheels of the vehicle to the left until the intermediate coupler shaft is properly aligned with the steering column coupler. Assemble the steering column shaft coupler (Fig. 3) onto the steering gear intermediate coupler. Install steering column coupler to intermediate shaft retaining pinch bolt (Fig. 3). Tighten the pinch bolt nut to a torque of 28 N·m (250 in. lbs.).

CAUTION: Do not use automatic transmission fluid in the power steering system. Only use Mopar, Power Steering Fluid or an exact equivalent product.

(16) Fill power steering pump fluid reservoir to the proper level.

(17) Start the engine and let run for a few seconds. Then turn the engine off.

(18) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(19) Raise front wheels of vehicle off the ground.

(20) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(21) Add power steering fluid if necessary.

(22) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(23) Stop the engine. Check the fluid level and refill as required.

(24) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(25) Fill power steering reservoir to correct level with Mopar®, Power Steering Fluid, or equivalent.

(26) Adjust toe (Refer to Group 2 Suspension).

DISASSEMBLY AND ASSEMBLY

STEERING GEAR INNER TIE ROD BOOT

DISASSEMBLE

NOTE: The removal and installation of the inner tie rod boot must be performed with the steering gear assembly removed from the vehicle.

(1) Loosen the inner to outer tie rod jam nut (Fig. 15). Remove the outer tie rod from the inner tie rod.

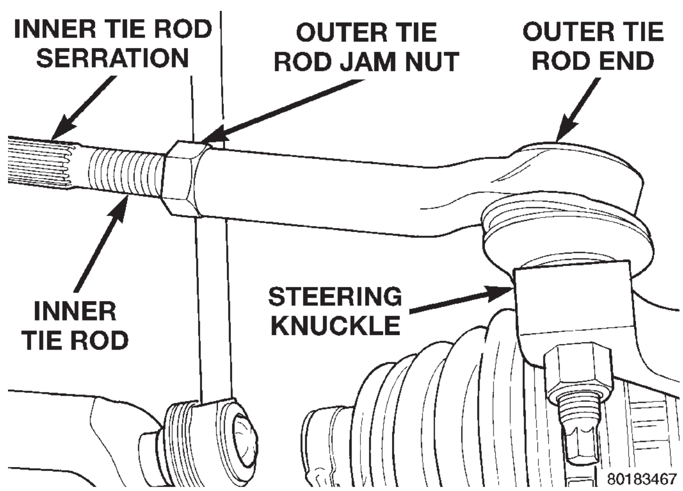


Fig. 15 Inner To Outer Tie Rod Jam Nut

(2) Remove nut attaching the outer tie rod end to the steering knuckle (Fig. 16). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with an 11/32 socket, while loosening and removing nut with wrench.**

DISASSEMBLY AND ASSEMBLY (Continued)

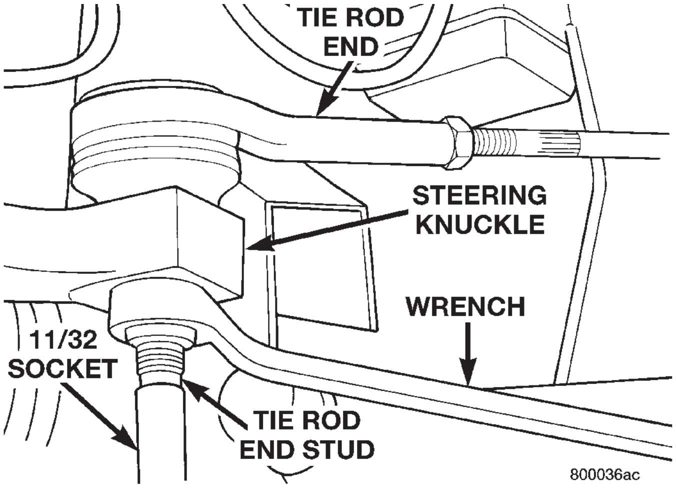


Fig. 16 Removing Tie Rod End Attaching Nut

(3) Remove the tie rod end from the steering knuckle using Remover, Special Tool MB-991113 (Fig. 17) or MB-990635.

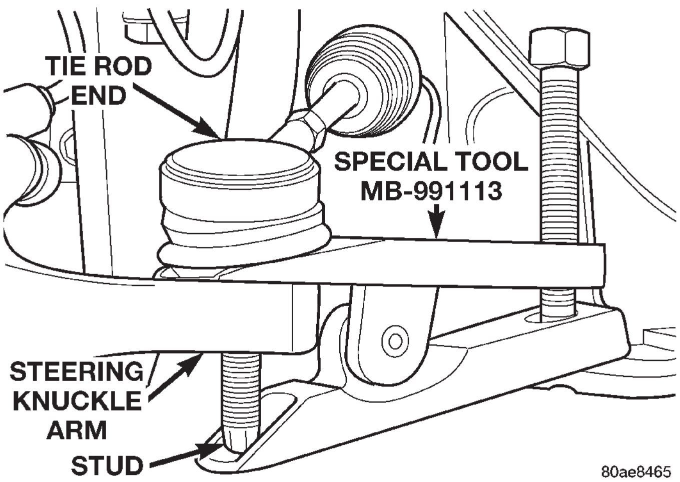


Fig. 17 Tie Rod End Removal From Steering Knuckle

(4) Remove jam nut (Fig. 15) from inner tie rod.

(5) Using pliers expand tie rod boot, to inner tie rod clamp (Fig. 18) and remove from steering gear boot.

(6) Remove inner tie rod boot to steering gear clamp (Fig. 19).

NOTE: After removing inner boot clamps. Use a very small screwdriver to lift boot from its retaining groove in steering gear. Then the boot can be removed from steering gear.

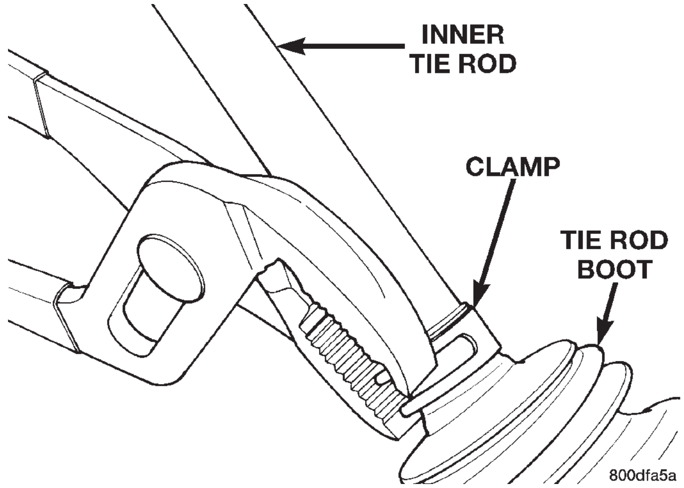


Fig. 18 Tie Rod Boot To Tie Rod Clamp

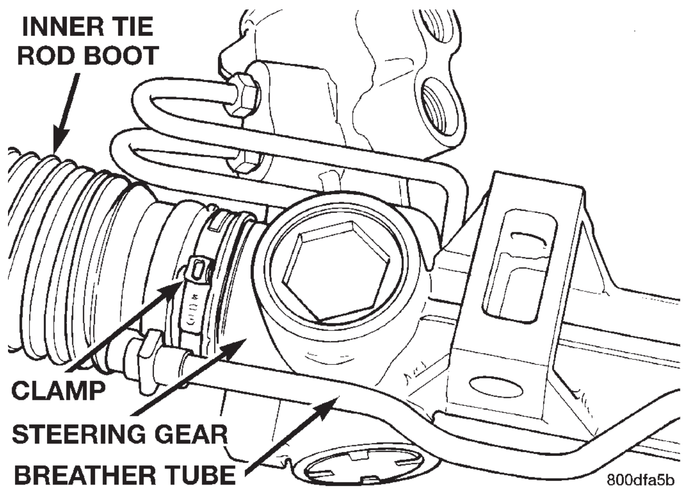


Fig. 19 Tie Rod Boot To Steering Gear Clamp

ASSEMBLE

(1) Install tie rod boot to steering gear clamp on tie rod boot.

(2) Install tie rod boot and clamp on inner tie rod.

(3) Install tie rod boot over steering gear housing and onto the end of the breather tube (Fig. 19).

(4) Crimp inner tie rod boot to steering gear clamp using Crimper, Special Tool C4975A (Fig. 20). When installing clamp, Special Tool C4975A must have bottom bolt tightened until their is no gap between the 2 bars of the tool (Fig. 20)

(5) Lubricate inner tie rod boot groove with silicone type lubricant, then install outer boot seal to inner tie rod clamp (Fig. 18). (Clamp will have to be loosened for toe adjustment.)

(6) Install inner to outer tie rod jam nut (Fig. 15) on inner tie rod.

(7) Install outer tie rod on inner tie rod. Do not tighten jam nut.

(8) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod

DISASSEMBLY AND ASSEMBLY (Continued)

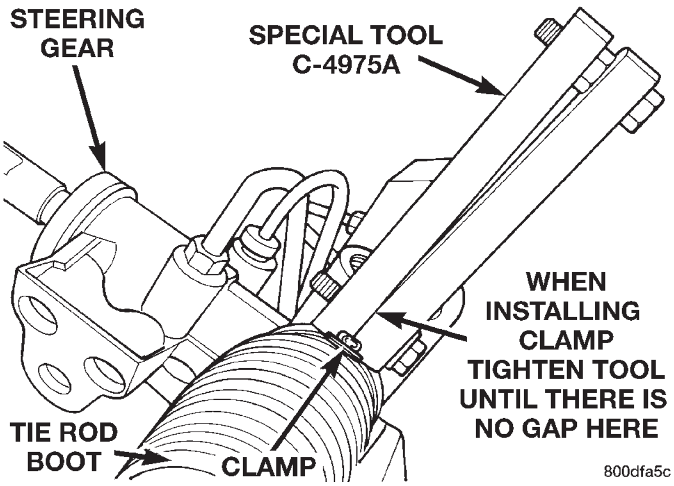


Fig. 20 Installing Tie Rod Boot To Steering Gear Clamp

end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 17). Then using a crow-foot and 11/32 socket (Fig. 21), torque tie rod end attaching nut to 54 N·m (40 ft. lbs.).

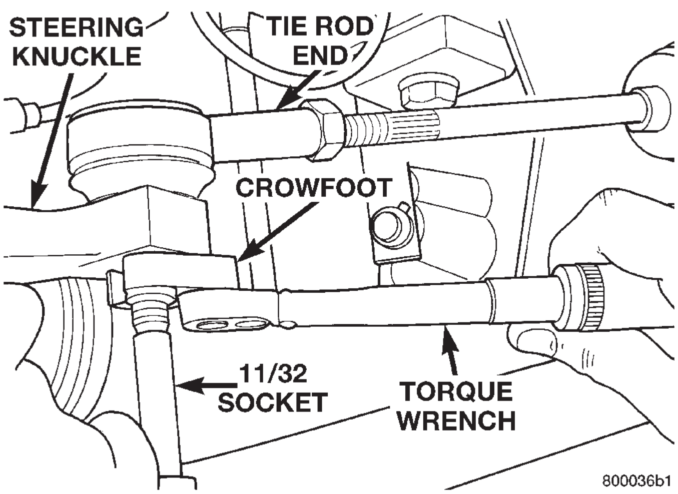


Fig. 21 Torquing Tie Rod End Attaching Nut

CAUTION: During this procedure do not allow the steering gear boot to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(9) Make toe adjustment by turning inner tie rod.

(10) Tighten the inner to outer tie rod jam nut to 75 N·m (55 ft. lbs.) torque. Lubricate tie rod boot groove with silicone type lubricant, before installing outer boot clamp, making sure boot is not twisted.

OUTER TIE ROD END

DISASSEMBLE

(1) Loosen inner tie rod to outer tie rod jam nut (Fig. 22).

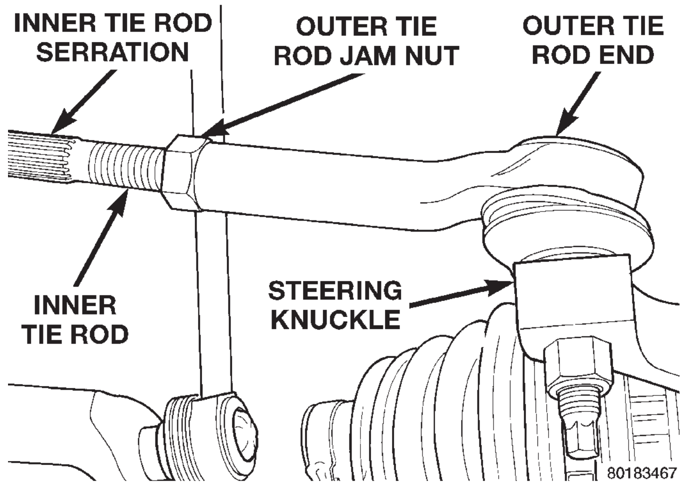


Fig. 22 Inner To Outer Tie Rod Jam Nut

(2) Remove nut attaching outer tie rod end to steering knuckle (Fig. 23). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench.**

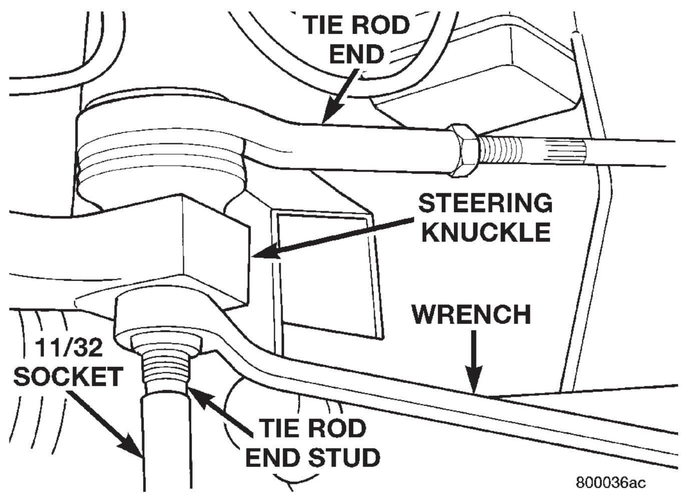


Fig. 23 Tie Rod End Attaching Nut

(3) Remove the tie rod end stud from steering knuckle arm, using Remover, Special Tool, MB-991113 (Fig. 24) or MB-990635.

(4) Remove outer tie rod end from inner tie rod by un-threading it from the inner tie rod.

DISASSEMBLY AND ASSEMBLY (Continued)

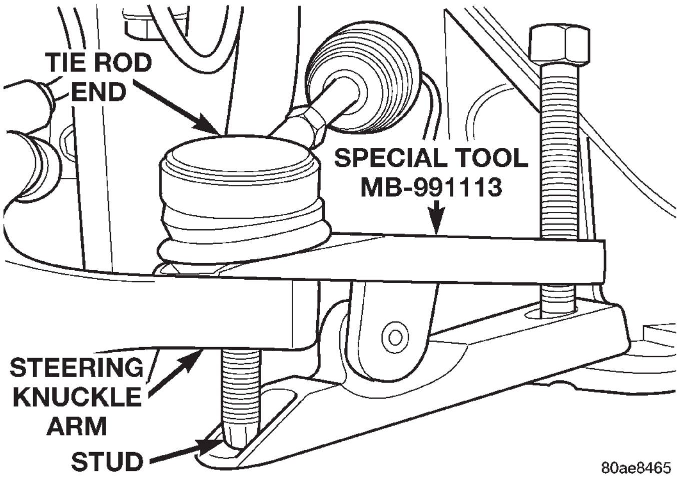


Fig. 24 Tie Rod End Removal From Steering Knuckle

ASSEMBLE

(1) Install outer tie rod onto inner tie rod. **Make sure jam nut (Fig. 22) is on inner tie rod.**

(2) Do not tighten jam nut.

(3) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 23). Then using a crowfoot and 11/32 socket (Fig. 25), torque tie rod end attaching nut to 54 N·m (40 ft. lbs.).

CAUTION: During this procedure do not allow the steering gear boot to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(4) Adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

(5) Tighten tie rod jam nut (Fig. 22) to 55 N·m (75 ft. lbs.) torque.

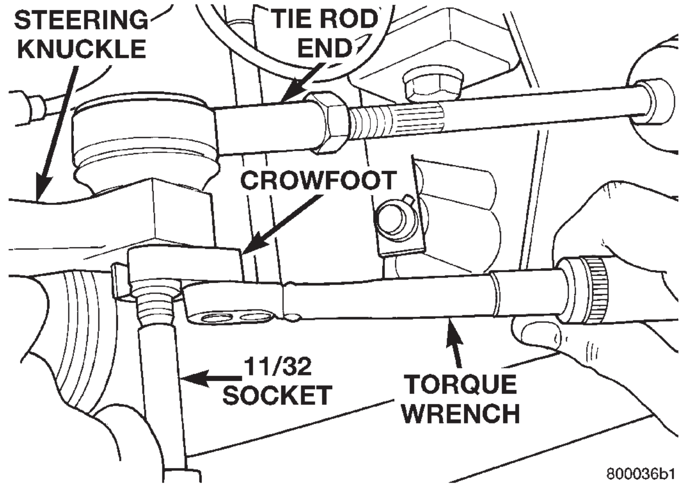


Fig. 25 Torquing Tie Rod End Attaching Nut

(6) Adjust the steering gear to inner tie rod boots at inner tie rod if they became twisted during Toe adjustment.

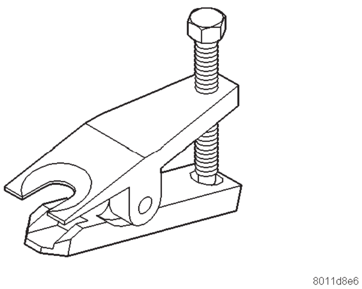
SPECIFICATIONS

STEERING GEAR FASTENER TORQUE SPECIFICATIONS

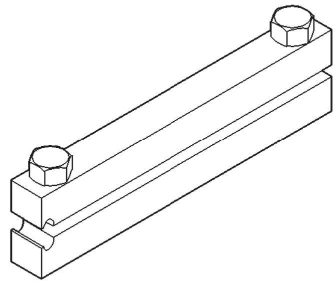
DESCRIPTION	TORQUE
STEERING GEAR:	
To Suspension Cradle Bolts	183 N·m (135 ft. lbs.)
Tie Rod To Steering Knuckle Nut	54 N·m (40 ft. lbs.)
Outer To Inner Tie Rod Jam Nut	75 N·m (55 ft. lbs.)
Power Steering Hose Tube Nuts	31 N·m (275 in. lbs.)
Coupler Pinch Bolt	28 N·m (250 in. lbs.)
SUSPENSION CRADLE:	
Cradle Plate To Cradle Attaching Bolts	165 N·m (123 ft. lbs.)

SPECIAL TOOLS

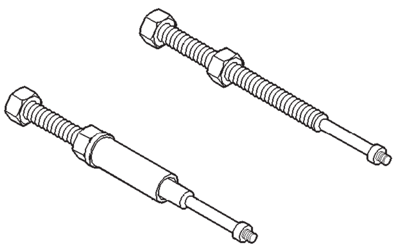
POWER STEERING GEAR



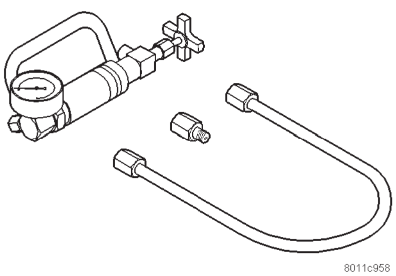
Remover Tie Rod End MB–991113



Installer Boot Clamp C-4975A



Remover/Installer Steering Shaft Roll Pin 6831A



P/S System Analyzer 6815

STEERING COLUMN

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DESCRIPTION AND OPERATION

STEERING COLUMN DESCRIPTION

The steering column (Fig. 1) has been designed to be serviced only as a complete assembly, if a component of the steering column is defective. The only replaceable components of the steering column assembly are the key cylinder, ignition switch, multi-function switch, clockspring, halo lamp, speed control switches, driver airbag, trim shrouds and steering wheel. These replaceable components of the steering column can be serviced without requiring removal of the steering column from the vehicle.

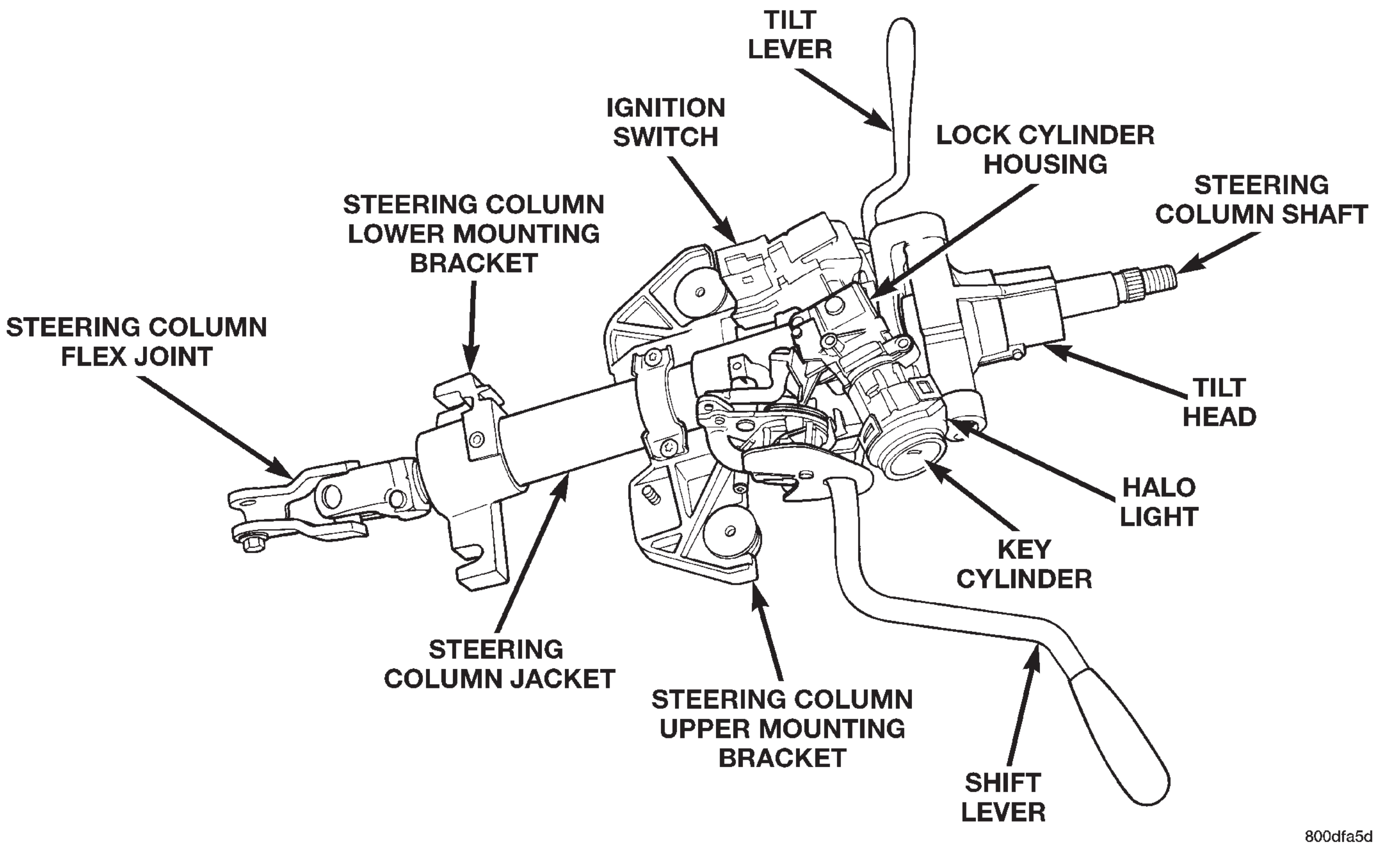
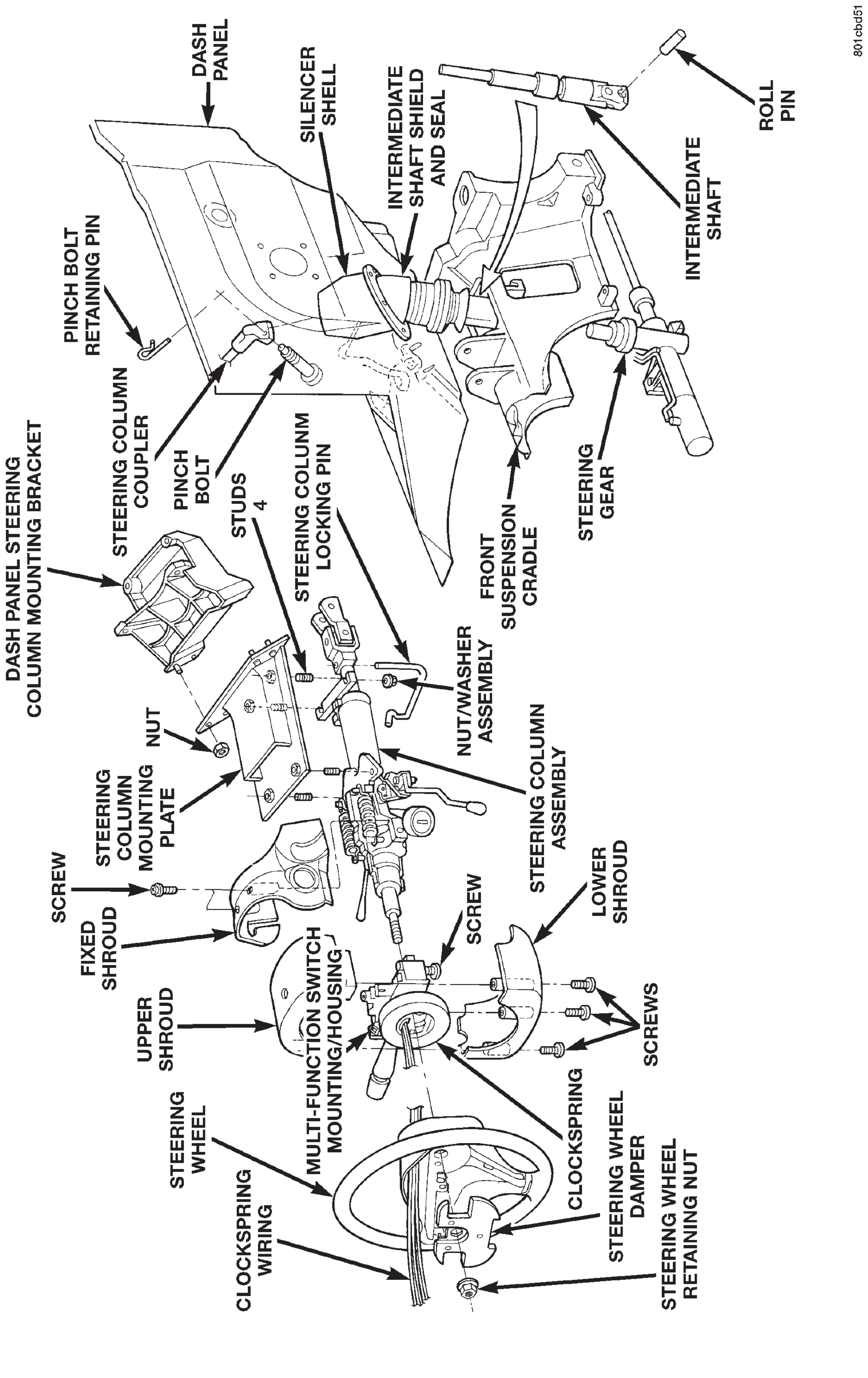


Fig. 1 Steering Column Assembly Components

DESCRIPTION AND OPERATION (Continued)



Steering Column And Steering System Components

DIAGNOSIS AND TESTING

STEERING COLUMN

For diagnosis of conditions relating to the steering column, refer to the steering system diagnosis charts, in the diagnosis and testing section at the beginning of this group.

SERVICE PROCEDURES

STEERING COLUMN SERVICE PROCEDURE WARNINGS

WARNING: BEFORE BEGINNING ANY SERVICE PROCEDURES THAT INVOLVES REMOVING THE AIR BAG. REMOVE AND ISOLATE THE NEGATIVE (-) BATTERY CABLE (GROUND) FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIR BAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIR BAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIR BAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIR BAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIR BAG 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. BEFORE SERVICING A STEERING COLUMN EQUIPPED WITH AN AIR BAG, REFER TO GROUP 8M, ELECTRICAL FOR PROPER AND SAFE SERVICE PROCEDURES.

NOTE: Safety goggles should be worn at all times when working on steering columns.

CAUTION: Disconnect negative (ground) cable from the battery, before servicing any column component.

CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Damage will occur.

REMOVAL AND INSTALLATION

STEERING COLUMN ASSEMBLY

To service the steering wheel and its components or the air bag, refer to Group 8M, Restraint Systems. Follow all WARNINGS.

To service the switches, refer to the appropriate section of Group 8, Electrical.

To replace the steering column assembly, refer to the steering column removal procedure.

REMOVE

(1) Make sure the front wheels of the vehicle are in the **straight ahead** position before beginning the column removal procedure.

(2) Disconnect negative (ground) cable from the battery and isolate cable from battery terminal.

(3) Remove the screws attaching the lower steering column cover to the instrument panel (Fig. 2). Remove the lower trim panel from the lower instrument panel.

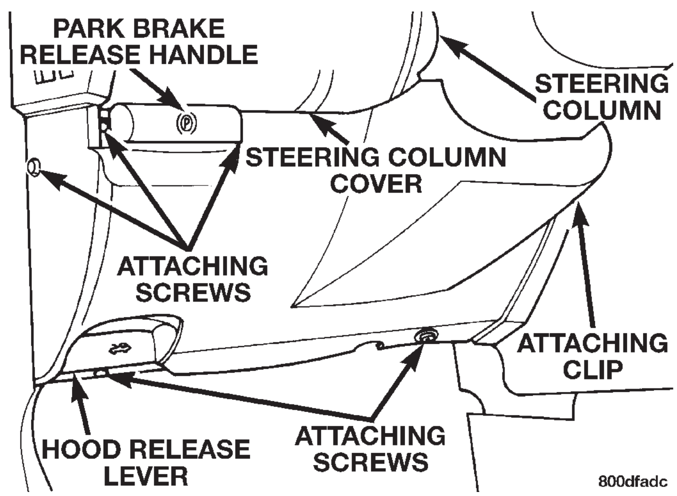


Fig. 2 Lower Steering Column Cover Attachment Locations

(4) Remove the park brake pedal release cable from the park brake release lever (Fig. 3).

(5) Remove the 10 bolts attaching the steering column cover liner (Fig. 4) to the instrument panel. Remove the steering column cover liner from the lower instrument panel.

(6) Rotate key cylinder to the lock position and remove key. Rotate the steering wheel a half turn to the left until the steering column lock engages keeping the steering column in the locked position (Fig. 5).

REMOVAL AND INSTALLATION (Continued)

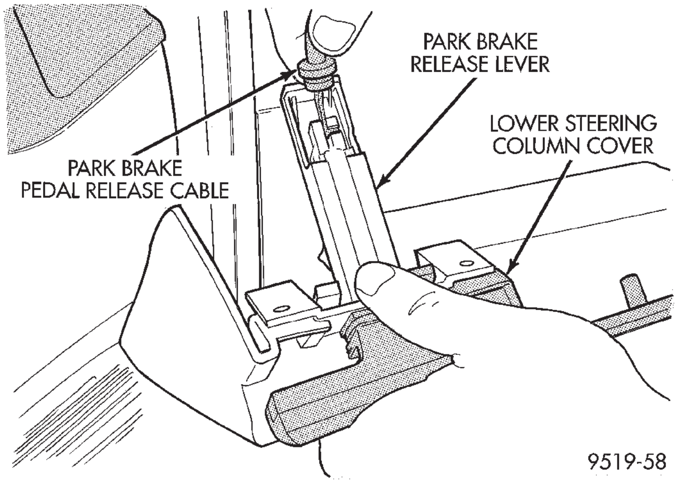


Fig. 3 Park Brake Release Cable Attachment To Release Lever

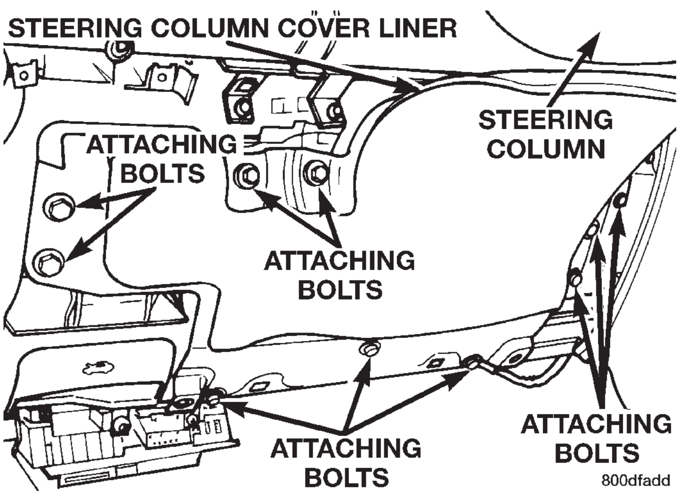


Fig. 4 Lower Steering Column Cover Attachment

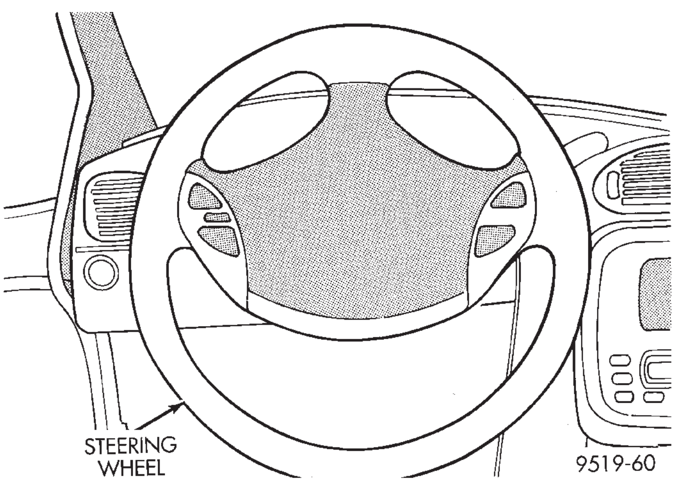


Fig. 5 Steering Wheel In Locked Position

(7) Remove the 3 bolts (1 in each spoke of the steering wheel) attaching the air bag module to the steering wheel. Remove air bag module from steering wheel.

(8) Remove wiring harness connectors from air bag, horn switch wire, and speed control switches (Fig. 6). Remove the wiring harness routing clip (Fig. 6) from the air bag module studs.

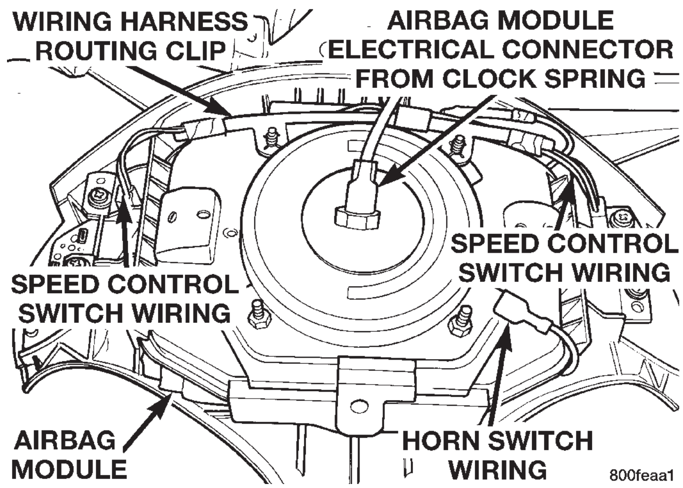


Fig. 6 Air Bag Module Wiring Connections

(9) Remove the steering wheel retaining nut (Fig. 7) from the steering column shaft.

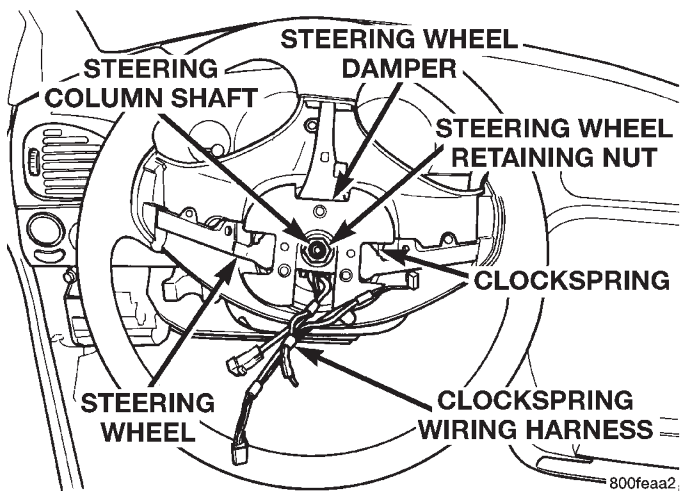


Fig. 7 Steering Wheel Retaining Nut

(10) Remove the steering wheel damper (Fig. 7) from the steering wheel.

CAUTION: Do not bump or hammer on steering column or steering column shaft when removing steering wheel from steering column shaft.

REMOVAL AND INSTALLATION (Continued)

CAUTION: When installing steering wheel puller bolts in steering wheel, (Fig. 8) do not thread bolt into steering wheel more than a half inch. If bolts are threaded into the steering wheel more than a half inch they will contact and damage the clock-spring.

(11) Remove the steering wheel from steering column shaft using Puller, Special Tool, Snap-On CJ2001JP or an equivalent (Fig. 8).

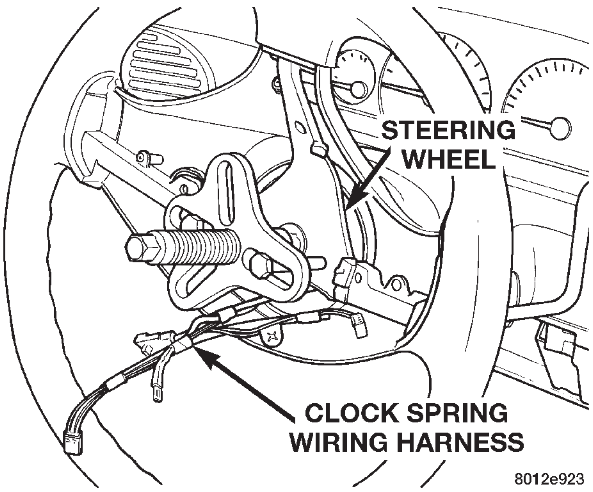


Fig. 8 Removing Steering Wheel From Steering Column Shaft

CAUTION: The upper and lower steering column shrouds are held together using retaining clips. When separating and removing the shrouds from the steering column be careful not to break the retaining clips off the shrouds

(12) Remove the 3 screws (Fig. 9) attaching the upper and lower shrouds to the steering column. Then remove the upper and lower shrouds (Fig. 9) from the steering column.

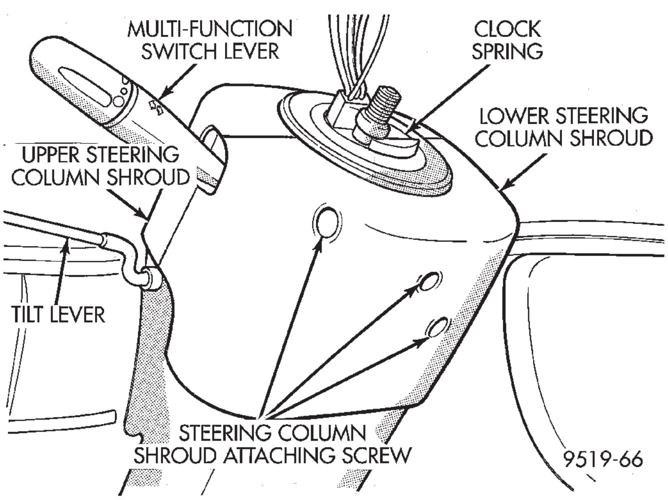


Fig. 9 Steering Column Shrouds

(13) Remove the vehicle wiring harness connectors (Fig. 10) from the clock spring assembly.

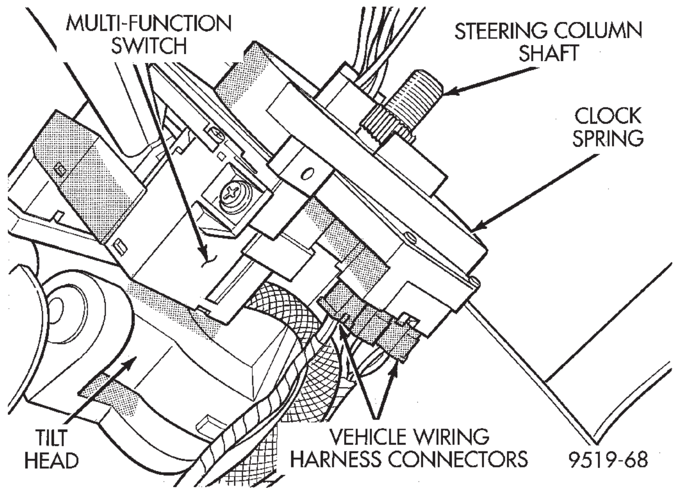


Fig. 10 Wiring Harness Connections To Clock Spring

CAUTION: Do not rotate the clock spring after it is removed from the multifunction switch.

(14) Remove the clock spring from the multi-function switch.

(15) Remove the vehicle wiring harness connector from the top of the multi-function switch (Fig. 11).

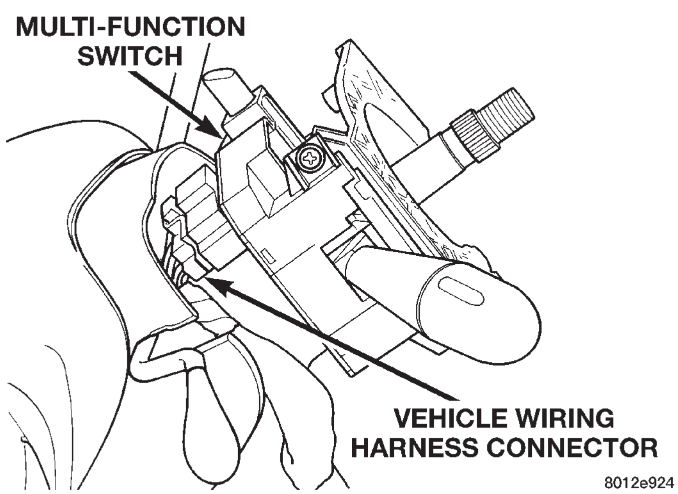


Fig. 11 Wiring Harness Connection To Multi-Function Switch

(16) Remove the screw (Fig. 12) attaching the multi-function switch housing to the tilt head of the steering column assembly.

(17) Remove the multi-function switch (Fig. 12) from the tilt head of the steering column assembly.

(18) Remove the vehicle wiring harness connector from the key cylinder halo light (Fig. 13).

(19) Remove the 3 wiring harness connectors from the ignition switch (Fig. 14).

REMOVAL AND INSTALLATION (Continued)

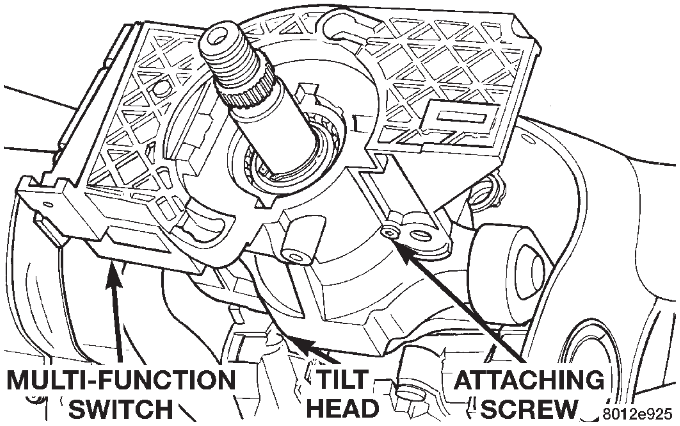


Fig. 12 Multi-Function Switch Mounting Housing Attaching Screw

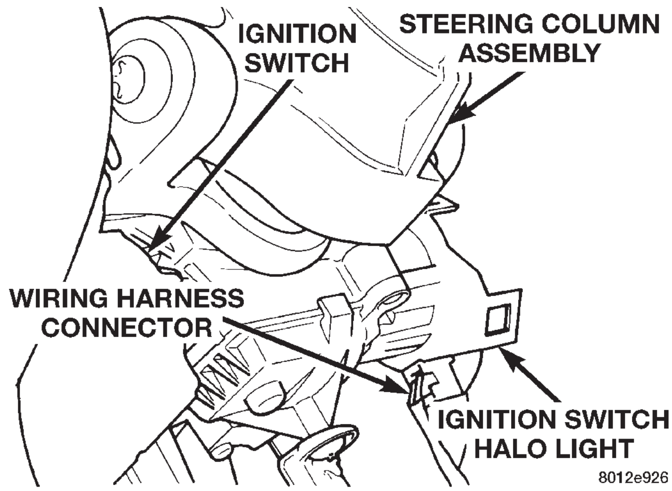


Fig. 13 Wiring Harness Connection To Halo Light

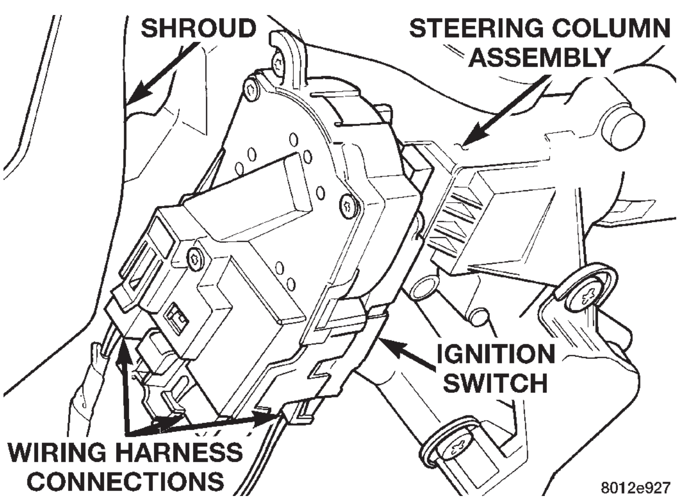


Fig. 14 Ignition Switch Wiring Harness Connections

(20) If the vehicle is equipped with a 3 speed non-electronic transmission, remove the PRNDL actuating cable from the pin on the gear shifter (Fig. 15). **PRNDL actuating cable MUST be removed from the pin on the gear shifter prior to removing the gear selector cable from the gear shifter.**

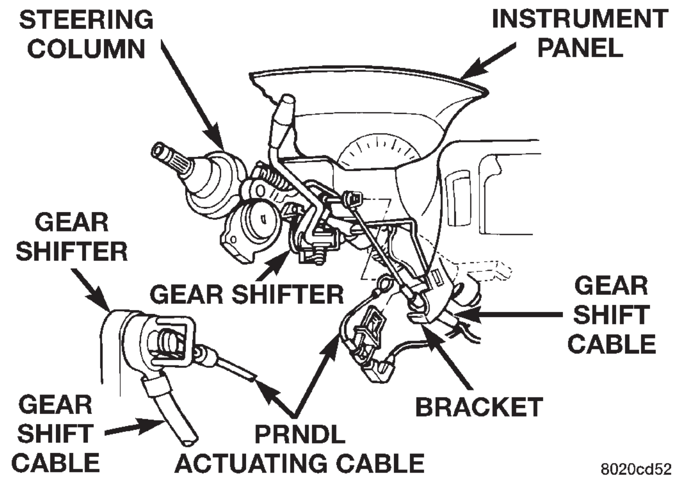


Fig. 15 PRNDL Actuating Cable At Steering Column

(21) Remove the attaching clip (Fig. 15) for the PRNDL actuating cable from the steering column/ shift cable bracket.

(22) Remove the gear selector cable from the gear shifter the steering column (Fig. 16). Gear selector cable is removed from pin on shift module by **carefully** prying it off with a screw driver (Fig. 16).

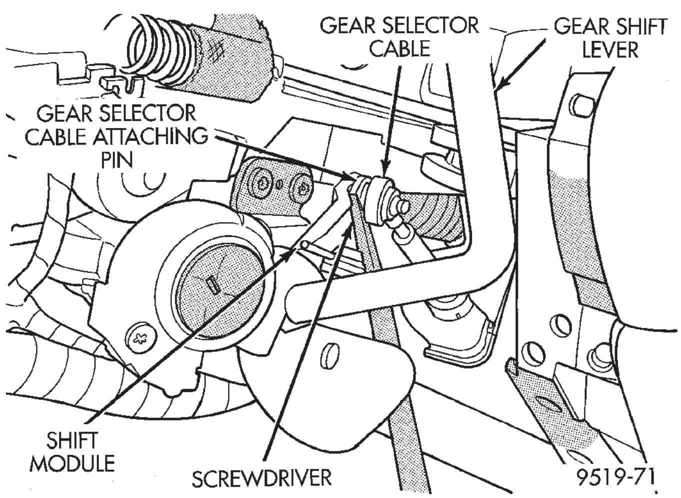


Fig. 16 Gear Selector Cable Removal From Shift Module

(23) Remove the gear selector cable and its mounting bracket as an assembly, from the upper mounting bracket for the steering column (Fig. 17).

(24) Remove the instrument cluster trim bezel (Fig. 18) from the instrument panel. The trim bezel is mounted to the instrument panel using 2 attaching screws and retaining clips.

(25) Remove the steering column fixed shroud from the steering column assembly (Fig. 19). Shroud

REMOVAL AND INSTALLATION (Continued)

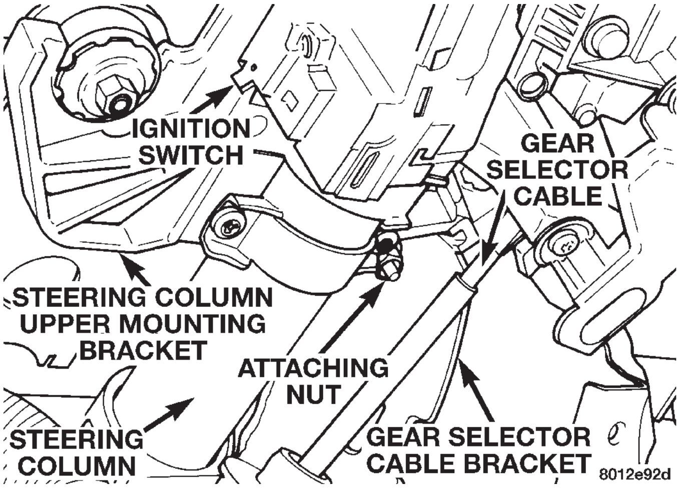


Fig. 17 Gear Selector Cable Mounting Bracket

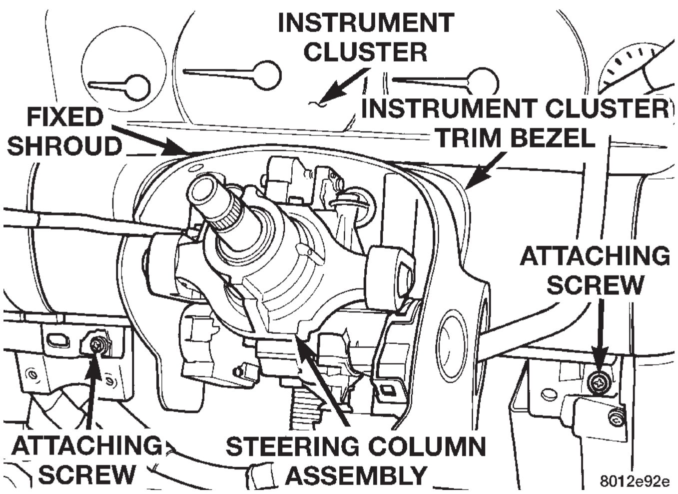


Fig. 18 Instrument Cluster Trim Bezel

is mounted to steering column using 2 attaching screws accessed from top of fixed shroud.

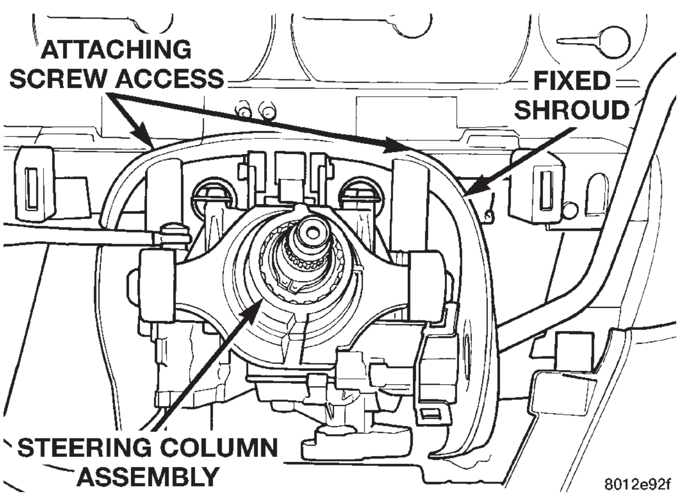


Fig. 19 Steering Column Fixed Shroud

(26) Disconnect the steering column shaft coupler, from the steering gear intermediate steering coupler (Fig. 20).

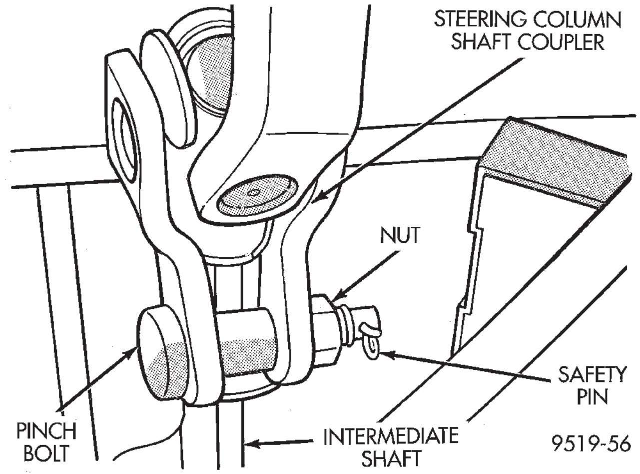


Fig. 20 Steering Column Shaft To Intermediate Coupler Attachment

(27) Loosen but do not fully remove the 2 nut/washer assemblies attaching the steering column lower mounting bracket (Fig. 21). Then remove the 2 nut/washer assemblies attaching the steering column upper mounting bracket (Fig. 21).

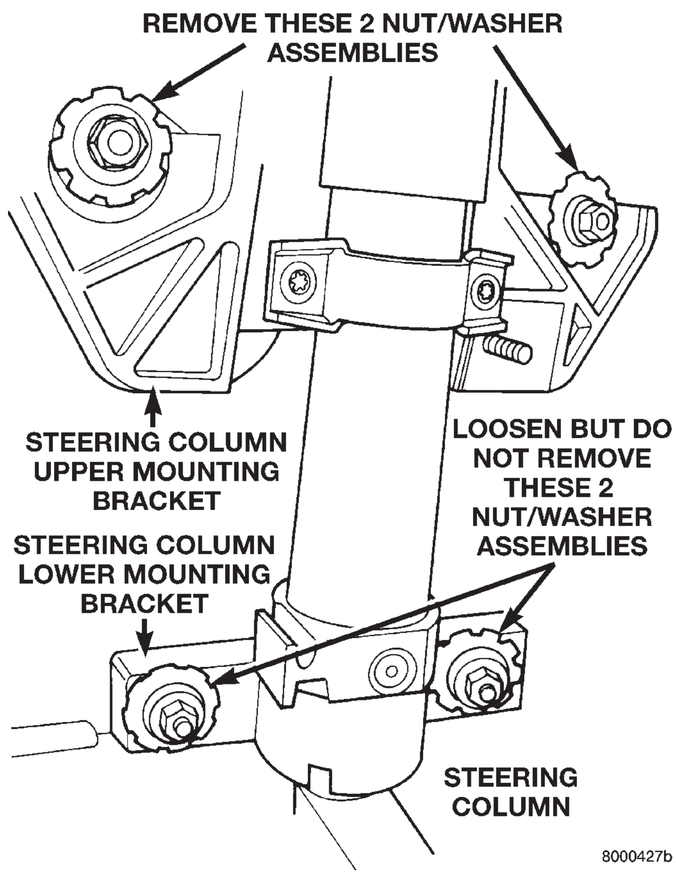


Fig. 21 Steering Column Upper And Lower Mounting Brackets

REMOVAL AND INSTALLATION (Continued)

(28) Remove steering column assembly from vehicle. Use care to avoid damage to paint or interior trim.

INSTALL

(1) Ensure the plastic mounting capsules (Fig. 22) are installed in the upper mounting bracket of the steering column. Mounting capsules must be installed as shown in (Fig. 22) with the thicker edge of the capsule facing the top of the steering column.

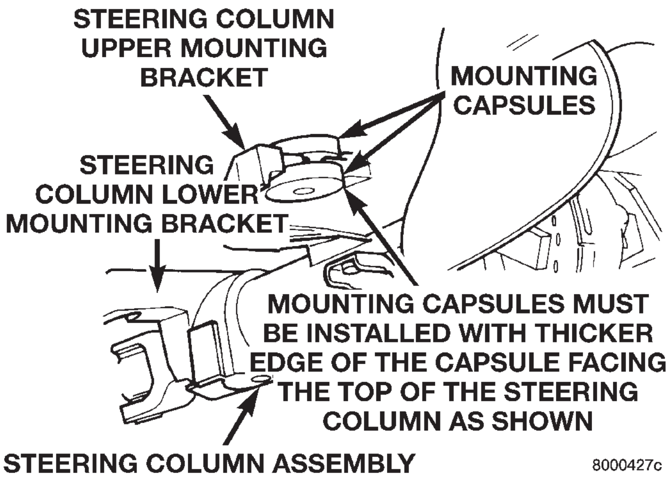


Fig. 22 Mounting Capsules Correctly Installed On Steering Column

(2) Install steering column assembly into its opening in instrument panel. Install the steering column lower bracket so the bracket is squarely installed on its mounting studs (Fig. 21). Then align and install steering column upper bracket on its mounting studs (Fig. 21). Tighten the 4 steering column assembly mounting nut/washer assemblies to a torque of 12 N·m (105 in. lbs.).

(3) Assemble the steering column shaft coupler (Fig. 20) onto the steering gear intermediate coupler. Install steering column coupler to intermediate shaft retaining pinch bolt (Fig. 20). Tighten the pinch bolt nut to a torque of 28 N·m (250 in. lbs.). Install safety pin (Fig. 20) in steering column shaft coupler pinch bolt.

(4) Install the gear slector cable and its mounting bracket on the upper mounting bracket of the steering column (Fig. 17). Install and securely tighten the mounting bracket attaching bolt.

(5) Install the gear selector cable on the pin of the gear shifter (Fig. 16).

(6) If the vehicle is equipped with a 3 speed non-electronic transmission, install the PRNDL actuating cable on the gear shifter pin after the gear selector cable is installing (Fig. 15).

(7) If the vehicle is equipped with a 3 speed non-electronic transmission, install the attaching clip (Fig. 15) for the PRNDL actuating cable on the steering column/shift cable bracket. Cable guide tube will bow toward passenger side of vehicle. Verify that actuating cable is operating correctly, then slip the loop on the end of the cable over end of pin on shift lever and install in groove (Fig. 15).

(8) Install the steering column fixed shroud on the steering column assembly (Fig. 19). Shroud is mounted to steering column using 2 attaching screws accessed from top of fixed shroud.

(9) Install the instrument cluster trim bezel (Fig. 18) on the instrument panel. The trim bezel is mounted to the instrument panel using 2 attaching screws (Fig. 18) and retaining clips.

(10) Install the 3 wiring harness connectors on the ignition switch (Fig. 14).

(11) Install the vehicle wiring harness connector into the key cylinder halo light (Fig. 13).

(12) Install the multi-function switch (Fig. 12) on the tilt head of the steering column assembly. Then install screw (Fig. 12) attaching multi-function switch to tilt head of steering column.

(13) Install the vehicle wiring harness connector on the multi-function switch (Fig. 11). Be sure latch on connector is fully engaged with tab on switch.

(14) Install the clock spring on the multi-function switch.

(15) Install the vehicle wiring harness connector (Fig. 10) on the clock spring assembly.

(16) Install the lower steering column shroud on the tilt head of the steering column (Fig. 23). Install and securely tighten the screw attaching the lower shroud to the tilt head.

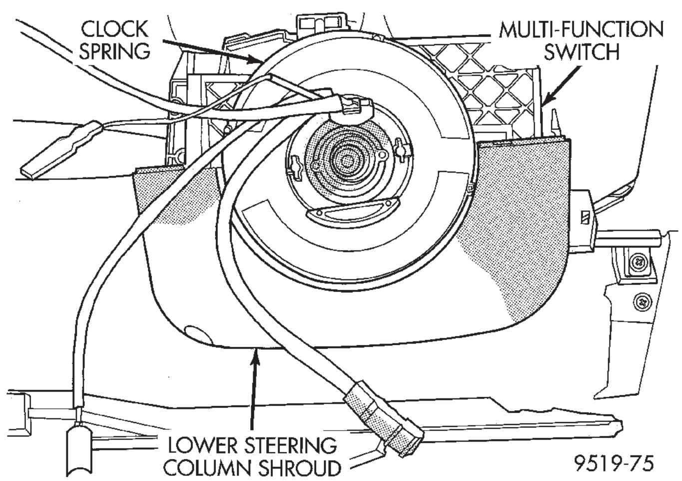


Fig. 23 Lower Steering Column Shroud Installed

(17) Install the upper steering column shroud on the tilt head of the steering column (Fig. 24). Install and securely tighten the 2 screws attaching the upper shroud to the lower shroud.

REMOVAL AND INSTALLATION (Continued)

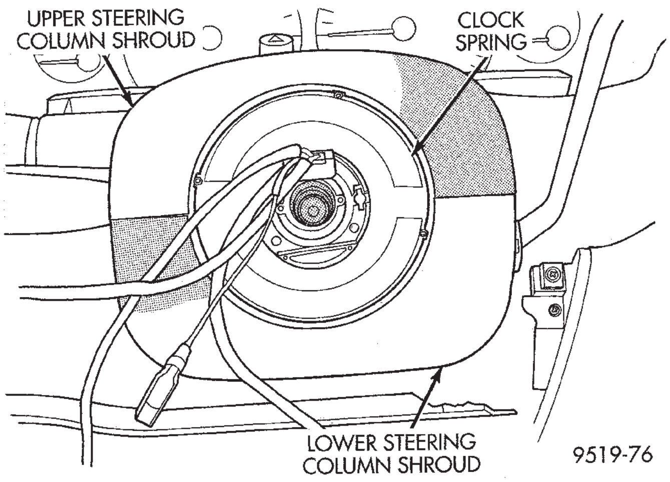


Fig. 24 Upper And Lower Steering Column Shroud Installed

CAUTION: Before installing the steering wheel the clockspring must be centered. If clockspring is not centered, the wiring in the clockspring may be over-extended and break when the steering wheel is rotated. Use the following procedure to center the clockspring.

CLOCKSPRING CENTERING PROCEDURE

- Depress the 2 plastic locking pins to disengage the lock mechanism (Fig. 25).
- With the lock mechanism disengaged, rotate the clockspring rotor clockwise until the rotor stops. **Do not apply excessive force.**
- From the end of the clockwise travel, rotate the rotor three turns counterclockwise. The clockspring wires should be at the top. Engage clockspring locking pins.
- From the center locked position, rotate the clockspring one-half additional turn counterclockwise. The clockspring wiring should now be at the bottom. The clockspring is now correctly positioned for installation of the steering wheel.

CAUTION: Do not force steering wheel onto steering column shaft by driving it on. Pull steering wheel down onto shaft using ONLY the steering wheel retaining nut.

(18) Align master splines on steering wheel and steering shaft, and flats on steering wheel with formations on clock spring. Install the steering wheel on the steering column shaft (Fig. 26). All wiring leads from the clock spring **must** be routed as shown in (Fig. 26).

NOTE: Before installing the damper on the steering wheel, inspect the damper to ensure the rubber isolator on the damper is not deteriorated or damaged.

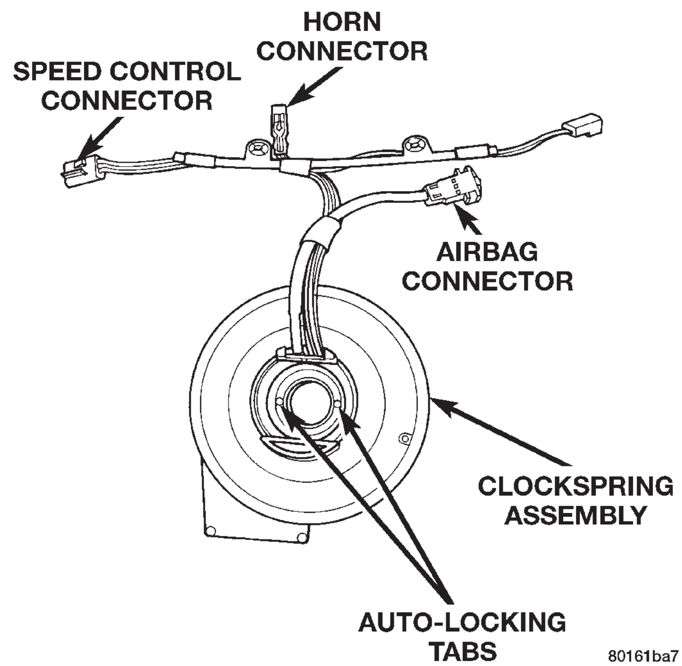


Fig. 25 Clockspring Assembly

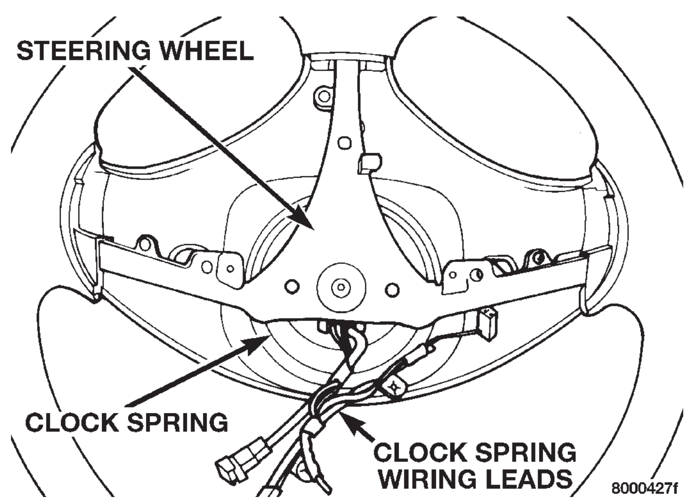


Fig. 26 Steering Wheel And Clock Spring Wire Routing

If the damper is installed with a damaged isolator a buzz, squeak or rattle condition may develop.

(19) Install the steering wheel damper on the steering wheel. When damper is installed, it **must** be positioned on the steering wheel as shown in (Fig. 7).

(20) Install the steering wheel to steering shaft retaining nut. Tighten the steering wheel retaining nut to a torque of 61 N·m (45 ft. lbs.).

(21) Install the wiring leads from the clock spring on the air bag, horn switch wire, and speed control switches (Fig. 6). Attach the wire routing clip (Fig. 6) to the studs on the air bag module.

(22) Install the air bag module in the steering wheel.

REMOVAL AND INSTALLATION (Continued)

(23) Install the 3 bolts (1 in each spoke of the steering wheel) attaching the air bag module to the steering wheel. Tighten the 3 air bag module attaching nuts to a torque of 11 N·m (100 in. lbs.).

(24) Install the steering column cover liner (Fig. 4) on the lower instrument panel. Install and securely tighten the 10 bolts (Fig. 4) attaching the steering column cover liner to the instrument panel.

(25) Install the park brake pedal release cable on the park brake release lever in the lower steering column cover (Fig. 3).

(26) Install the lower steering column trim panel on the lower instrument panel. Install and securely the screws attaching the lower steering column cover to the instrument panel (Fig. 2).

(27) Connect negative (ground) cable on the battery terminal.

SPECIFICATIONS

STEERING COLUMN FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
STEERING WHEEL:	
Retaining Nut	61 N·m (45 ft. lbs.)
STEERING COLUMN ASSEMBLY:	
Mounting Bracket Attaching Nuts	12 N·m (105 in. lbs.)
Flex Coupler Pinch Bolt	27 N·m (240 in. lbs.)
Airbag Module Attaching Nuts	11 N·m (100 in. lbs.)

STEERING

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POWER STEERING—2.5L VM DIESEL

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GENERAL INFORMATION

POWER STEERING PUMP

The power steering pump used with the 2.5L VM Diesel engine operates the same way as the power steering pump used with the 2.5/4.0L gasoline engines. Refer to the Description and Operation section for the 2.5/4.0L gasoline engine power steering pump for more information.

STEERING GEAR OPERATION—RHD & LHD VEHICLES

NOTE: The power steering gear should NOT be serviced or adjusted. If a malfunction or oil leak occurs, the complete steering gear should be replaced.

Refer to the Power Steering Gear in group 19 for more information

POWER STEERING GEAR

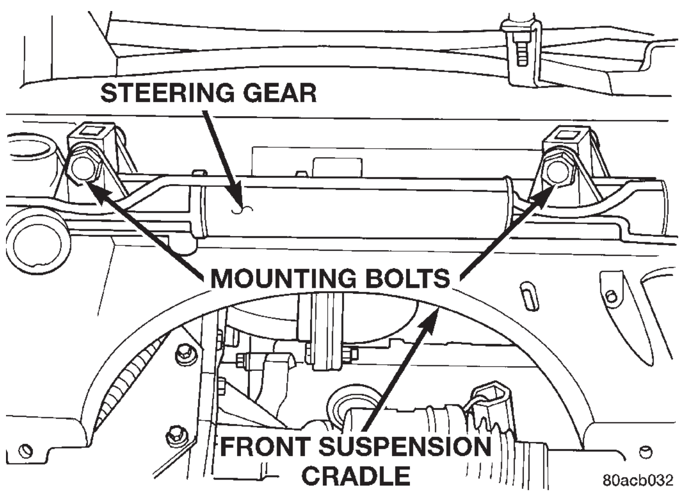

Fig. 1 Power Steering Gear—RHD Vehicles

SERVICE PROCEDURES

POWER STEERING PUMP – INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal 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.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

SERVICE PROCEDURES (Continued)

(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 AND INSTALLATION

POWER STEERING PUMP—2.5L DIESEL

NOTE: The power steering pump is mounted below the fuel pump on the left side of the engine. The vehicle should be raised on a hoist to access the pump from below.

REMOVAL

(1) Remove serpentine drive belt. Refer to Group 7, Cooling System, for procedure.

(2) Remove power steering pump pulley. Use a hex wrench to secure the power steering shaft while removing the pulley bolt with a box wrench. (Fig. 2)

CAUTION: Do not use an impact wrench to remove the pump pulley – this can cause rear pump seal damage. Do not secure power steering shaft with a wrench on the coupling to the A/C compressor – this can cause rear pump seal damage.

(3) Remove coupling bolts (2) from A/C compressor side of coupling.

(4) Loosen A/C compressor bolts and separate compressor from bracket. Do not disconnect A/C hoses.

(5) Remove bolts (2) securing the power steering pump to the power steering bracket.

(6) Disconnect power steering pump supply hose at the pump and drain fluid.

(7) Disconnect power steering pressure hose at the steering gear assembly.

(8) Remove power steering pump.

INSTALLATION

(1) Install pump on engine.

(2) Tighten pump bracket bolts to 47 N·m (35 ft. lbs.).

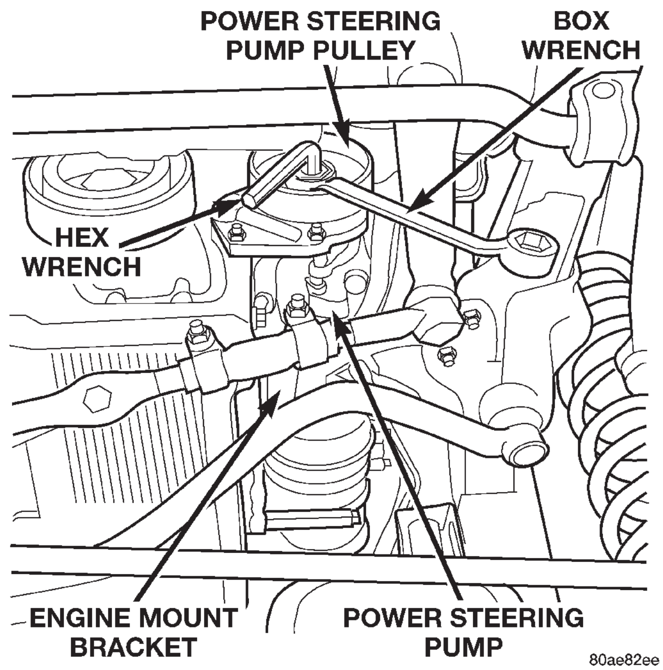

Fig. 2 Power Steering Pump Pulley Removal

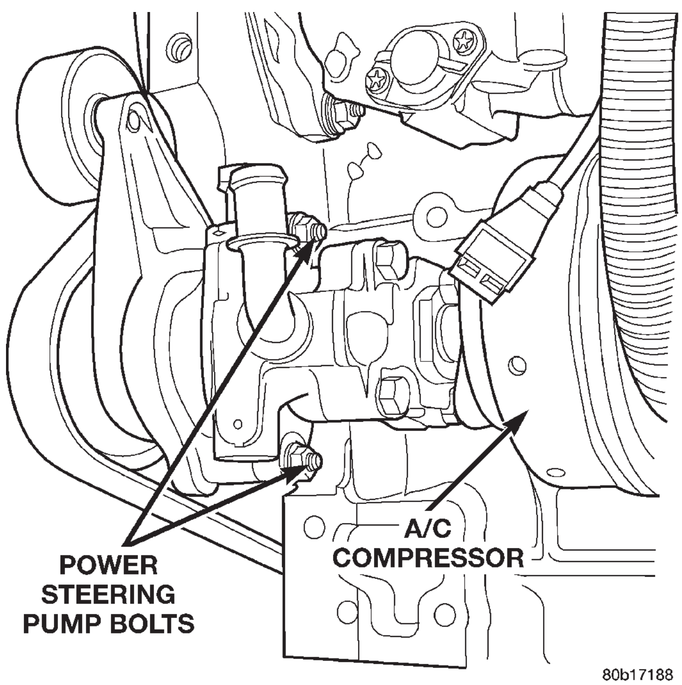

Fig. 3 Left SIde Motor Mount—VM DIesel

(3) Reverse the above procedures in steps 8 through 1 to complete installation.

(4) Add power steering fluid and perform Power Steering Pump Initial Operation.

TRANSAXLE AND POWER TRANSFER UNIT

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GENERAL INFORMATION

31TH TRANSAXLE

NOTE: Safety goggles should be worn at all times when working on these transaxles.

This transaxle combines torque converter, three speed transmission, final drive gearing, and differential into a front wheel drive system. The identification markings and usage of the transaxle are charted in Diagnosis and Tests.

NOTE: Transaxle operation requirements are different for each vehicle and engine combination. Some internal parts will be different to provide for this. Therefore, when replacing parts, refer to the seven digit part number stamped on rear of the transaxle oil pan flange.

Within this transaxle, there are three primary areas:

(1) Main center line plus valve body.

(2) Transfer shaft center line (includes governor and parking sprag).

(3) Differential center line.

(4) Center distances between the main rotating parts in these three areas are held precise to maintain a low noise level.

(5) The torque converter, transaxle area, and differential are housed in an integral aluminum die casting. **The differential oil sump is common with the transaxle sump. Separate filling of the differential is NOT necessary.**

(6) The torque converter is attached to the crankshaft through a flexible driving plate. Cooling of the converter is accomplished by circulating the transaxle fluid through a remote cooler. There are two types of coolers used. An oil-to-water type cooler located in the radiator side tank and/or an oil-to air heat exchanger. The torque converter assembly is a sealed unit that cannot be disassembled.

(7) The transaxle fluid is filtered by an internal filter attached to the lower side of the valve body assembly.

(8) Engine torque is transmitted to the torque converter then, through the input shaft to multiple-disc clutches in the transaxle. The power flow depends on the application of the clutches and bands. Refer to Elements in Use Chart in Diagnosis and Tests section.

(9) The transaxle consists of:

- Two multiple-disc clutches
- An overrunning clutch
- Two servos
- A hydraulic accumulator
- Two bands
- Two planetary gear sets

This provides three forward ratios and a reverse ratio. The common sun gear of the planetary gear sets is connected to the front clutch by a driving shell. The drive shell is splined to the sun gear and front clutch retainer. The hydraulic system consists of an oil pump, and a single valve body which contains all of the valves except the governor valves. The transaxle sump and differential sump are both vented through the dipstick. Output torque from the main center line is delivered through helical gears to the transfer shaft. This gear set is a factor of the final drive (axle) ratio. The shaft also carries the governor and parking sprag. An integral helical gear on the transfer shaft drives the differential ring gear. The final drive gearing is completed with one of two gear ratios of 2.98 or 3.19 depending on model and application.

FLUID LEVEL AND CONDITION

NOTE: The transmission and differential sump have a common oil sump with a communicating opening between the two.

The torque converter fills in both the P Park and N Neutral positions. Place the selector lever in P 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. This will assure complete oil level stabilization between differential and transmission.** The fluid should be 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 dipstick.

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transaxle has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, the air bubbles can cause overheating, fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transaxle dipstick where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transaxle overhaul is needed. Be sure to examine the fluid on the dipstick closely.

GENERAL INFORMATION (Continued)

If there is any doubt about its condition, drain out a sample for a double check.

SELECTION OF LUBRICANT

It is important that the proper lubricant be used in these transmissions. Mopar ATF PLUS 3 (Automatic Transmission Fluid- type 7176) should be used to aid in ensuring optimum transmission performance. It is important that the transmission fluid be maintained at the prescribed level using the recommended fluids.

SPECIAL ADDITIVES

Chrysler Corporation does not recommend the addition of any fluids to the transmission, other than fluid listed above. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

DESCRIPTION AND OPERATION

TORQUE CONVERTER CLUTCH

A torque converter clutch is standard on all vehicles. The torque converter clutch is activated only in direct drive and is controlled by the engine electronics. A solenoid on the valve body, is powered by the powertrain control module to activate torque converter clutch.

HYDRAULIC CONTROL SYSTEM

The hydraulic control system makes the transaxle fully automatic, and has four important functions to perform. The components of any automatic control system may be grouped into the following basic groups:

The pressure supply system, the pressure regulating valves, the flow control valves, the clutches, and band servos.

Taking each of these basic groups or systems in turn, the control system may be described as follows:

PRESSURE SUPPLY SYSTEM

The pressure supply system consists of an oil pump driven by the engine through the torque converter. The single pump furnishes pressure for all the hydraulic and lubrication requirements. **Oil pump housing assemblies are available with preselected pump gears.**

PRESSURE REGULATING VALVES

The pressure regulating valve controls line pressure dependent on throttle opening. The governor valve transmits regulated pressure to the valve body (in conjunction with vehicle speed) to control upshift and downshift.

The throttle valve transmits regulated pressure to the transaxle (dependent on throttle position) to control upshift and downshift.

FLOW CONTROL VALVES

The manual valve provides the different transaxle drive ranges as selected by the vehicle operator.

The 1-2 shift valve automatically shifts the transaxle from first to second or from second to first, depending on the vehicle operation.

The 2-3 shift valve automatically shifts the transaxle from second to third or from third to second depending on the vehicle operation.

The kickdown valve makes possible a forced downshift from third to second, second to first, or third to first (depending on vehicle speed). This can be done by depressing the accelerator pedal past the detent feel near wide open throttle.

The shuttle valve has two separate functions and performs each independently of the other. The first is providing fast release of the kickdown band, and smooth front clutch engagement when a lift-foot upshift from second to third is made. The second function is to regulate the application of the kickdown servo and band when making third to second kickdown.

The by-pass valve provides for smooth application of the kickdown band on 1-2 upshifts.

The torque converter clutch solenoid allows for the electronic control of the torque converter clutch. It also disengages the torque converter at closed throttle. This is done during engine warm-up, and part-throttle acceleration.

The switch valve directs oil to apply the torque converter clutch in one position. The switch valve releases the torque converter clutch in the other position.

CLUTCHES, BAND SERVOS, AND ACCUMULATOR

The front and rear clutch pistons, and both servo pistons are moved hydraulically to engage the clutches and apply the bands. The pistons are released by spring tension when hydraulic pressure is released. On the 2-3 upshift, the kickdown servo piston is released by spring tension and hydraulic pressure.

The accumulator controls the hydraulic pressure on the apply side of the kickdown servo during the 1-2 upshift; thereby, cushioning the kickdown band application at any throttle position.

DESCRIPTION AND OPERATION (Continued)

GEARSHIFT AND PARKING LOCK CONTROLS

The transaxle is controlled by a lever type gearshift incorporated within the steering column. The control has six selector lever positions: P (park), R (reverse), N (neutral), and D (drive), 2 (second), and 1 (first). The parking lock is applied by moving the selector lever past a gate to the P position. **Do not apply the parking lock until the vehicle has stopped; otherwise, a severe ratchet noise will occur.**

TORQUE CONVERTER CLUTCH SOLENOID WIRING CONNECTOR

If wiring connector is unplugged, the torque converter will not engage (Fig. 1) .

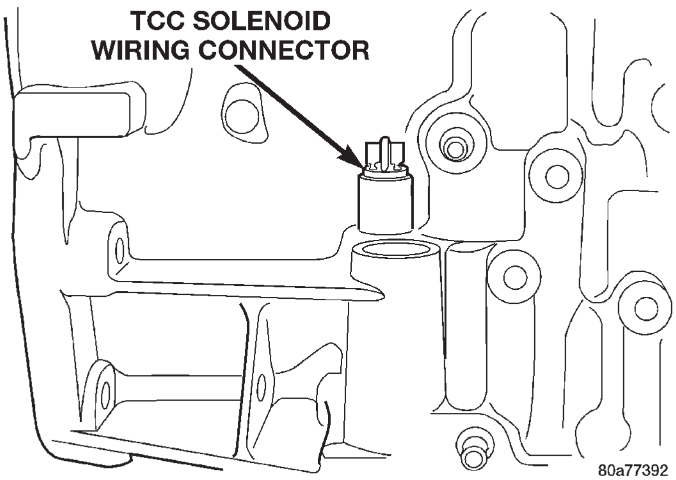

Fig. 1 Torque Converter Clutch Solenoid Wiring Connector

GOVERNOR

The governor may be serviced by removing the transaxle oil pan and valve body assembly. The governor may be unbolted from the governor support and removed from the transaxle for reconditioning or replacement.

When cleaning or assembling the governor, make sure the governor valves move freely in the bores of the governor body.

DIAGNOSIS AND TESTING

THREE SPEED TRANSAXLE DIAGNOSIS AND TESTS

Automatic transaxle malfunctions may be caused by four general conditions:

(1) Poor engine performance
(2) Improper adjustments
(3) Hydraulic malfunctions
(4) Mechanical malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables; fluid level and condition, gearshift cable adjustment, and throttle pressure cable adjustment. 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 tests should be performed

31TH HYDRAULIC TROUBLE CODE CHARTS

The following charts should be used to help diagnose hydraulic or mechanical faults in the transaxle .

ROAD TEST

Prior to performing a road test, check the fluid level, and control cable adjustments.

During the road test, the transaxle should be operated in each position to check for slipping and any variation in shifting.

If vehicle operates at high speeds, but has poor acceleration, the converter's overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed for high speeds, the stator clutch may have seized.

Observe closely for slipping or engine speed flare-up. Slipping or flare-up in any gear usually indicates clutch, band, or overrunning clutch problems. If the condition is far advanced, an overhaul will probably be necessary to restore normal operation.

In most cases, the clutch or band that is slipping can be determined by noting the transaxle operation in all selector positions. Then comparing which internal units are applied in those positions. The Elements in Use Chart provides a basis for road test analysis .

The rear clutch is applied in both the D first gear and 1 first gear positions. Also the overrunning clutch is applied in D first gear and the low/reverse band is applied in 1 first gear position. If the transaxle slips in D range first gear, but does not slip in 1 first gear, the overrunning clutch is slipping. Similarly, if the transaxle slips in any two forward gears, the rear clutch is slipping.

Using the same procedure, the rear clutch and front clutch are applied in D third gear. If the transaxle slips in third gear, either the front clutch or the rear clutch is slipping. By selecting another gear which does not use one of those units, the unit which is slipping can be determined. If the transaxle also slips in reverse, the front clutch is slipping. If the transaxle does not slip in reverse, the rear clutch is slipping.

The process of eliminating can be used to detect any unit which slips and to confirm proper operation of good units. Road testing can usually diagnose slipping units. Although the actual cause of the problem

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT FROM NEUTRAL TO DRIVE	1. Engine idle speed too high. 2. Valve body malfunction. 3. Hydraulic pressure too high. 4. Worn or faulty rear clutch. 5. Engine performance.	1. Set engine curb idle. 2. Inspect valve body and repair. 3. Check fluid pressure at ports. 4. Replace discs and seals at rear clutch. 5. Set engine to specs.
HARSH ENGAGEMENT FROM NEUTRAL TO REVERSE	1. Low reverse band misadjusted. 2. Engine idle speed too high. 3. Low reverse band worn out. 4. Low reverse band, servo or linkage malfunction. 5. Hydraulic pressure too high. 6. Worn or faulty rear clutch. 7. Engine performance.	1. Adjust bands to specs. 2 Set up engine to specs. 3. Replace low reverse band. 4. Repair low reverse servo. Adjust reverse band and linkage. 5. Check fluid pressure at ports. 6. Replace discs and seals at rear clutch. 7. Set engine to specs.
DELAYED ENGAGEMENT FROM NEUTRAL TO DRIVE	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Oil filter clogged. 6. Faulty oil pump. 7. Worn input shaft seal rings. 8. Aerated fluid. 9. Engine idle speed too low. 10. Worn or faulty rear clutch.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Replace oil filter. 6. Replace oil pump. 7. Replace input shaft seal rings. 8. Replace trans. fluid. 9. Set up engine to specs. 10. Replace discs and seals at rear clutch.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT FROM NEUTRAL TO REVERSE	1. Low reverse band misadjusted. 2. Hydraulic pressures too low. 3. Low reverse band worn out. 4. Valve body malfunction. 5. Low reverse band, servo or linkage malfunction. 6. Low fluid level. 7. Incorrect gearshift linkage adjustment. 8. Oil filter clogged. 9. Faulty oil pump. 10. Worn input shaft seal rings. 11. Aerated fluid. 12. Engine idle speed too low. 13. Worn reaction shaft support seal rings. 14. Worn or faulty front clutch.	1. Adjust bands to specs. 2. Check fluid pressure at ports. 3. Replace low reverse band. 4. Inspect valve body and repair. 5. Repair low reverse servo. Adjust reverse band and linkage. 6. Fill trans. to level. 7. Adjust gearshift linkage. 8. Replace oil filter. 9. Replace oil pump. 10. Replace input shaft seal rings. 11. Replace trans. fluid. 12. Set up engine to specs. 13. Inspect and replace reaction shaft support seal rings. 14. Replace discs and seals at front clutch.
RUNAWAY UPSHIFT	1. Hydraulic pressures too low. 2. Valve body malfunction. 3. Low fluid level. 4. Oil filter clogged. 5. Aerated fluid. 6. Incorrect throttle linkage. 7. Worn reaction shaft support seal rings. 8. Governor malfunction. 9. Kickdown band, servo or linkage malfunction. 10. Worn front clutch.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace oil filter. 5. Replace trans. fluid. 6. Adjust throttle linkage. 7. Replace reaction shaft support seal rings. 8. Inspect and repair governor. 9. Inspect and repair kickdown band, servo or linkage. 10. Replace discs and seals at front clutch.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO UPSHIFT	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Incorrect throttle linkage. 6. Governor support seal rings worn. 7. Worn reaction shaft support seal rings. 8. Governor malfunction. 9. Kickdown band, servo or linkage malfunction. 10. Worn front clutch. 11. Engine performance.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Adjust throttle linkage. 6. Replace governor support seal rings. 7. Replace reaction shaft support seal rings. 8. Inspect and repair governor. 9. Inspect and repair kickdown band, servo or linkage. 10. Replace discs and seals at front clutch. 11. Set up engine to specs.
3-2 KICKDOWN RUNAWAY	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Aerated fluid. 5. Incorrect throttle linkage adjustment. 6. Kickdown band out of adjustment. 7. Governor support seal rings worn. 8. Kickdown band, servo or linkage malfunction. 9. Worn front clutch.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace trans. fluid. 5. Adjust throttle linkage. 6. Adjust kickdown band. 7. Replace governor support seal rings. 8. Inspect and repair kickdown band, servo or linkage. 9. Replace discs and seals at front clutch.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Valve body malfunction. 2. Incorrect throttle linkage adjustment. 3. Governor malfunction. 4. Kickdown band, servo or linkage malfunction.	1. Inspect valve body and repair. 2. Adjust throttle linkage. 3. Inspect and repair governor. 4. Inspect and repair kickdown band, servo or linkage.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SHIFTS ERRATIC	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Oil filter clogged. 6. Faulty oil pump. 7. Aerated fluid. 8. Incorrect throttle linkage adjustment. 9. Governor support seal rings worn. 10. Worn reaction shaft support seal rings. 11. Governor malfunction. 12. Kickdown band, servo or linkage malfunction. 13. Worn front clutch. 14. Engine performance.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Replace oil filter. 6. Replace oil pump. 7. Replace trans. fluid. 8. Adjust throttle linkage. 9. Replace governor support seal rings. 10. Replace reaction shaft support seal rings. 11. Inspect and repair governor. 12. Inspect and repair kickdown band, servo or linkage. 13. Replace discs and seals at front clutch. 14. Set up engine to specs.
SLIPS IN FORWARD DRIVE POSITIONS	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Oil filter clogged. 6. Faulty oil pump. 7. Worn input shaft seal rings. 8. Aerated fluid. 9. Incorrect throttle linkage adjustment. 10. Overrunning clutch not holding. 11. Worn rear clutch. 12. Overrunning clutch worn, broken or seized.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Replace oil filter. 6. Replace oil pump. 7. Replace input shaft seal rings. 8. Replace trans. fluid. 9. Adjust throttle linkage. 10. Inspect and repair overrunning clutch. 11. Replace discs and seals at rear clutch. 12. Replace overrunning clutch assembly.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN REVERSE ONLY	1. Low reverse band misadjusted. 2. Hydraulic pressure too low. 3. Low reverse band worn out. 4. Valve body malfunction. 5. Low reverse band, servo or linkage malfunction. 6. Low fluid level. 7. Incorrect gearshift linkage adjustment. 8. Faulty oil pump. 9. Aerated fluid. 10. Worn reaction shaft support seal rings. 11. Worn front clutch.	1. Adjust low reverse band. 2. Check fluid pressure at ports. 3. Replace low reverse band. 4. Inspect valve body and repair. 5. Repair low reverse servo. Adjust reverse band and linkage. 6. Fill trans. to level. 7. Adjust gearshift linkage. 8. Replace oil pump. 9. Replace trans. fluid. 10. Replace reaction shaft support seal rings. 11. Replace discs and seals at front clutch.
SLIPS IN ALL POSITIONS	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Oil filter clogged. 5. Faulty oil pump. 6. Worn input shaft seal rings. 7. Aerated fluid.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace oil filter. 5. Replace oil pump. 6. Replace input shaft seal rings. 7. Replace trans. fluid.
NO DRIVE IN ANY POSITION	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Oil filter clogged. 5. Faulty oil pump. 6. Planetary gear sets broken or seized.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace oil filter. 5. Replace oil pump. 6. Replace planetary gear sets.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE IN FORWARD DRIVE POSITIONS	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Worn input shaft seal rings. 5. Overrunning clutch not holding. 6. Worn rear clutch. 7. Planetary gear sets broken or seized. 8. Overrunning clutch worn, broken or seized.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace input shaft seal rings. 5. Inspect and repair overrunning clutch. 6. Replace discs and seals at rear clutch. 7. Replace planetary gear sets. 8. Replace overrunning clutch assembly.
NO DRIVE IN REVERSE	1. Hydraulic pressure too low. 2. Low reverse band worn out. 3. Valve body malfunction. 4. Low reverse band, servo or linkage malfunction. 5. Incorrect gearshift linkage adjustment. 6. Worn reaction shaft support seal rings. 7. Worn front clutch. 8. Worn rear clutch. 9. Planetary gear sets broken or seized.	1. Check fluid pressure at ports. 2. Replace low reverse band. 3. Inspect valve body and repair. 4. Repair low reverse servo. Adjust reverse band and linkage. 5. Adjust gearshift linkage. 6. Replace reaction shaft support seal rings. 7. Replace discs and seals at front clutch. 8. Replace discs and seals at rear clutch. 9. Replace planetary gear sets.
DRIVES IN NEUTRAL	1. Valve body malfunction. 2. Incorrect gearshift linkage adjustment. 3. Insufficient clutch plate clearance. 4. Worn rear clutch. 5. Rear clutch dragging.	1. Inspect valve body and repair. 2. Adjust gearshift linkage. 3. Check and adjust clutch plate clearance. 4. Replace discs and seals at rear clutch. 5. Inspect and repair rear clutch.
DRAGS OR LOCKS	1. Low reverse band worn out. 2. Kickdown band adjustment too tight. 3. Planetary gear sets broken or seized. 4. Overrunning clutch worn, broken or seized.	1. Replace low reverse band. 2. Adjust kickdown band. 3. Replace planetary gear sets. 4. Replace overrunning clutch assembly.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GRATING, SCRAPING, OR GROWLING NOISE	1. Low reverse band worn out. 2. Kickdown band out of adjustment. 3. Drive shaft bushing damaged. 4. Planetary gear sets broken or seized. 5. Overrunning clutch worn, broken or seized.	1. Replace low reverse band. 2. Adjust kickdown band. 3. Replace drive shaft bushing. 4. Replace planetary gear sets. 5. Replace overrunning clutch assembly.
BUZZING NOISE	1. Valve body malfunction. 2. Low fluid level. 3. Aerated fluid. 4. Overrunning clutch inner race damaged.	1. Inspect valve body and repair. 2. Fill fluid to level. 3. Replace trans. fluid. 4. Replace overrunning clutch assembly.
HARD TO FILL, OIL BLOWS OUT FILLER HOLE	1. Oil filter clogged. 2. Aerated fluid. 3. High fluid level.	1. Replace oil filter. 2. Replace trans. fluid. 3. Adjust fluid level to specs.
TRANSAXLE OVERHEATS	1. Stuck cooler flow switch valve. 2. Engine idle speed too high. 3. Hydraulic pressures too low. 4. Low fluid level. 5. Incorrect gearshift linkage adjustment. 6. Faulty oil pump. 7. Kickdown band adjustment too tight. 8. Faulty cooling system. 9. Insufficient clutch plate clearance.	1. Replace switch valve behind oil pump housing. 2. Adjust engine idle to specs. 3. Check fluid pressure at ports. 4. Fill trans. to level. 5. Adjust gearshift linkage. 6. Replace oil pump. 7. Adjust kickdown band. 8. Check cooling system temperature and repair as needed. 9. Check and adjust clutch plate clearance.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH UPSHIFT	1. Hydraulic pressures too low. 2. Incorrect throttle linkage adjustment. 3. Kickdown band out of adjustment. 4. Hydraulic pressure too high. 5. Engine performance.	1. Check fluid pressure at ports. 2. Adjust throttle linkage. 3. Adjust kickdown band. 4. Check fluid pressure at ports. 5. Set up engine to specs.
DELAYED UPSHIFT	1. Incorrect throttle linkage adjustment. 2. Kickdown band out of adjustment. 3. Governor support seal rings worn. 4. Worn reaction shaft support seal rings. 5. Governor malfunction. 6. Kickdown band, servo or linkage malfunction. 7. Worn front clutch. 8. Engine performance.	1. Adjust throttle linkage. 2. Adjust kickdown band. 3. Replace governor support seal rings. 4. Replace reaction shaft support seal rings. 5. Inspect and repair governor. 6. Inspect and repair kickdown band, servo or linkage. 7. Replace discs and seals at front clutch. 8. Set up engine to specs.
NO TORQUE CONVERTER CLUTCH APPLICATION	1. Stuck cooler flow switch valve. 2. Hydraulic pressures too low. 3. Low fluid level. 4. Faulty oil pump. 5. Worn input shaft seal rings. 6. Aerated fluid.	1. Replace switch valve behind oil pump housing. 2. Check fluid pressure at ports. 3. Fill trans. to level. 4. Replace oil pump. 5. Replace input shaft seal rings. 6. Replace trans. fluid.

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Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

Lever Position	Start Safety	Parking Sprag	Clutches: Front	Clutches: Rear	Clutches: Lockup	Clutches: Over-running	Bands: (Kickdown) Front	Bands: (Low-Rev.) Rear
P — PARK	X	X						
R — REVERSE			X					X
N — NEUTRAL	X							
D — DRIVE:								
First				X		X		
Second				X			X	
Third			X	X	X			
2 — SECOND:								
First				X		X		
Second				X			X	
1 — LOW (First)				X				X

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ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER

may not be detected. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Therefore, unless the condition is obvious, the transaxle should never be disassembled until hydraulic pressure tests have been performed.

HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transaxle problems.

Before performing pressure tests, be certain that fluid level and condition, and control 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 front wheels to turn, and position tachometer so it can be read.

Disconnect throttle cable and shift cable from transaxle levers so they can be controlled from outside the vehicle.

Attach 150 psi gauges to ports required for test being conducted. A 300 psi gauge (C-3293) is required for reverse pressure test at rear servo.

Test port locations are shown in (Fig. 2) .

TEST ONE (SELECTOR IN 1)

(1) Attach gauges to line and low-reverse ports.

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transaxle all the way rearward (1 position).

(4) Read pressures on both gauges as throttle lever on transaxle is moved from full clockwise position to full counterclockwise position.

(5) Line pressure should read 52 to 58 psi with throttle lever clockwise. Pressure should gradually increase, as lever is moved counterclockwise, to 80 to 88 psi.

(6) Low-reverse pressure should read the same as line pressure within 3 psi.

(7) This tests pump output, pressure regulation, and condition of rear clutch and rear servo hydraulic circuits.

TEST TWO (SELECTOR IN 2)

(1) Attach one gauge to line pressure port and tee another gauge into lower cooler line fitting. This will allow lubrication pressure readings to be taken..

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transaxle one detent forward from full rearward position. This is selector 2 position.

(4) Read pressures on both gauges as throttle lever on transaxle is moved from full clockwise position to full counterclockwise position.

(5) Line pressure should read 52 to 58 psi with throttle lever clockwise. Pressure should gradually increase, as lever is moved counterclockwise, to 80 to 88 psi.

(6) Lubrication pressure should be 10 to 25 psi with lever clockwise and 10 to 35 psi with lever full counterclockwise.

(7) This tests pump output, pressure regulation, and condition of rear clutch and lubrication hydraulic circuits.

TEST THREE (SELECTOR IN D)

(1) Attach gauges to line and kickdown release ports.

(2) Operate engine at 1600 rpm for test.

(3) Move selector lever on transaxle two detents forward from full rearward position. This is selector D position.

(4) Read pressures on both gauges as throttle lever on transaxle is moved from full clockwise position to full counterclockwise position.

(5) Line pressure should read 52 to 58 psi with throttle lever clockwise. Pressure should gradually

DIAGNOSIS AND TESTING (Continued)

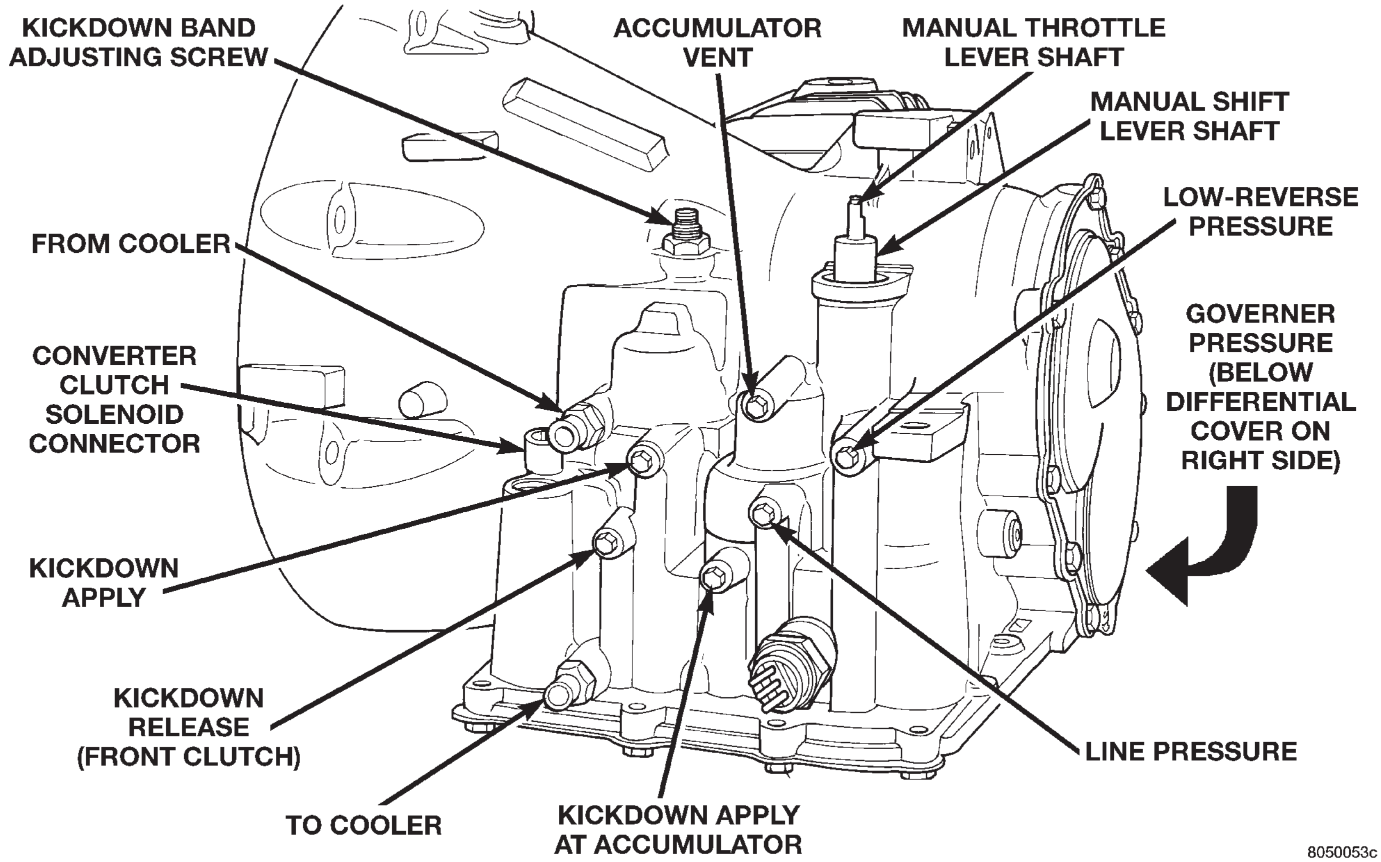

Fig. 2 Test Port Locations

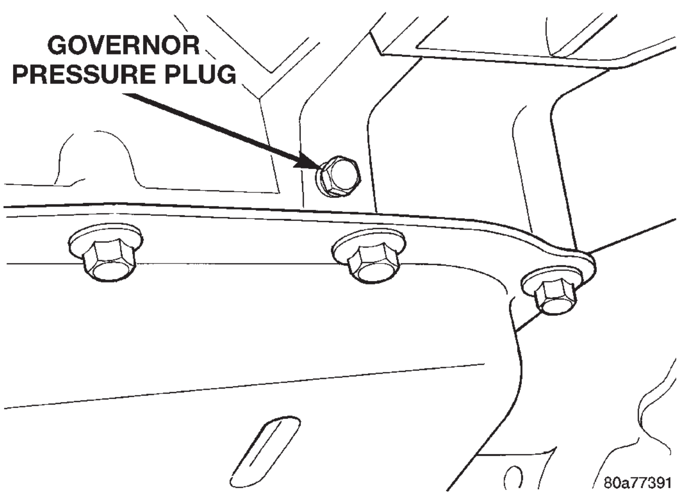

Fig. 3 Governor Pressure Tap

increase, as lever is moved counterclockwise to 80 to 88 psi.

(6) Kickdown release is pressurized only in direct drive and should be same as line pressure within 3 psi, up to kickdown point.

(7) This tests pump output, pressure regulation, and condition of rear clutch, front clutch, and hydraulic circuits.

TEST FOUR (SELECTOR IN REVERSE)

(1) Attach 300 psi gauge to low-reverse port.

(2) Operate engine at 1600 rpm for test.

(3) Move selector lever on transaxle four detents forward from full rearward position. This is selector R position.

(4) Low-reverse pressure should read 180 to 220 psi with throttle lever clockwise. Pressure should gradually increase, as lever is moved counterclockwise to 260 to 300 psi.

(5) This tests pump output, pressure regulation, and condition of front clutch and rear servo hydraulic circuits.

(6) Move selector lever on transaxle to D position to check that low-reverse pressure drops to zero.

(7) This tests for leakage into rear servo, due to case porosity, which can cause reverse band burn out.

TEST RESULT INDICATIONS

(1) If proper line pressure, minimum to maximum, is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in D, 1, and 2 but correct pressure in R indicates rear clutch circuit leakage.

(3) Low pressure in D and R but correct pressure in 1 indicates front clutch circuit leakage.

DIAGNOSIS AND TESTING (Continued)

(4) Low pressure in R and 1 but correct pressure in 2 indicates rear servo circuit leakage.

(5) Low line pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

GOVERNOR PRESSURE

Test only if transaxle shifts at wrong vehicle speeds when throttle cable is correctly adjusted.

(1) Connect a 0-150 psi pressure gauge to governor pressure take-off point. It is located at lower right side of case, below differential cover.

(2) Operate transaxle in third gear to read pressures. The governor pressure should respond smoothly to changes in mph and should return to 0 to 3 psi when vehicle is stopped. High pressure at standstill (above 3 psi) will prevent the transaxle from downshifting.

THROTTLE PRESSURE

No gauge port is provided for throttle pressure. Incorrect throttle pressure should be suspected if part throttle upshift speeds are either delayed or occur too early in relation to vehicle speeds. Engine runaway on shifts can also be an indicator of low throttle pressure setting, or misadjusted throttle cable.

In no case should throttle pressure be adjusted until the transaxle throttle cable adjustment has been verified to be correct.

CLUTCH AND SERVO AIR PRESSURE TESTS

A no drive condition might exist even with correct fluid pressure, because of inoperative clutches or bands. The inoperative units, clutches, bands, and servos can be located through a series of tests. This is done by substituting air pressure for fluid pressure (Fig. 4) .

The front and rear clutches, kickdown servo, and low-reverse servo may be tested by applying air pressure to their respective passages. To make air pressure tests, proceed as follows:

NOTE: Compressed air supply must be free of all dirt or moisture. Use a pressure of 30 psi.

Remove oil pan and valve body. Refer to Valve Body for removal procedure.

FRONT CLUTCH

Apply air pressure to front clutch apply passage and listen for a dull thud which indicates that front clutch is operating. Hold air pressure on for a few seconds and inspect system for excessive oil leaks.

REAR CLUTCH

Apply air pressure to rear clutch apply passage and listen for a dull thud which indicates that rear clutch is operating. Also inspect for excessive oil leaks. If a dull thud cannot be heard in the clutches, place finger tips on clutch housing and again apply air pressure. Movement of piston can be felt as the clutch is applied.

KICKDOWN SERVO (FRONT)

Direct air pressure into KICKDOWN SERVO ON passage. Operation of servo is indicated by a tightening of front band. Spring tension on servo piston should release the band.

LOW AND REVERSE SERVO (REAR)

Direct air pressure into LOW-REVERSE SERVO APPLY passage. Operation of servo is indicated by a tightening of rear band. Spring tension on servo piston should release the band.

If clutches and servos operate properly, no upshift indicates that a malfunction exists in the valve body.

FLUID LEAKAGE-TRANSAXLE TORQUE CONVERTER HOUSING AREA

(1) Check for source of leakage.

(2) Since fluid leakage near the torque converter area may be from an engine oil leak, the area should be checked closely. Factory fill fluid is dyed red and, therefore, can be distinguished from engine oil.

(3) Prior to removing the transaxle, perform the following checks:

(4) When leakage is determined to originate from the transaxle, check fluid level prior to removal of the transaxle and torque converter.

(5) High oil level can result in oil leakage out the vent in the dipstick. If the fluid level is high, adjust to proper level.

(6) After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle. This will determine if the torque converter or transaxle is leaking.

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter (peripheral) weld.
- Torque converter hub weld.
- Torque converter impeller shell cracked adjacent to hub.
- At drive lug welds.

NOTE: Hub weld is inside and not visible. Do not attempt to repair. Replace torque converter.

SERVICE PROCEDURES (Continued)

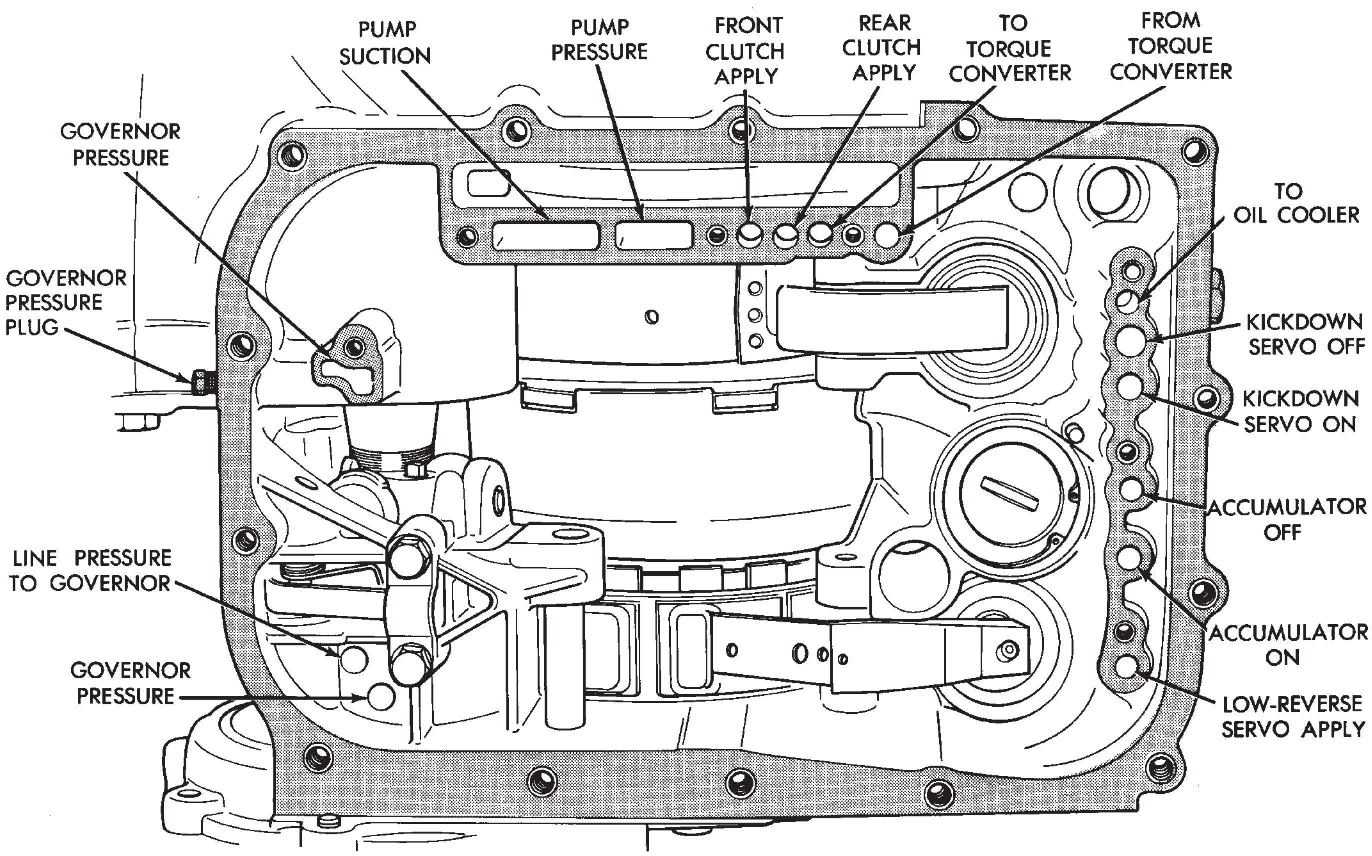

Fig. 4 Air Pressure Tests

SERVICE PROCEDURES

FLUID AND FILTER CHANGE

When the factory fill fluid is changed, only fluids labeled MOPAR® ATF PLUS 3 (Automatic Transmission fluid) Type 7176 should be used.

If the transaxle is disassembled for any reason, the fluid and filter should be changed.

30,000 MILE TRANSAXLE OIL CHANGE

When a vehicle attains 30,000 miles on its odometer it is recommended that the transaxle oil be changed. To change the oil, use the procedure that follows:

It is recommended that a transaxle fluid exchanger (ATF 2000+ or equivalent) be used to replace the used fluid in the transaxle. If a fluid exchanger is not available use a fluid suction pump (Vacula™ or equivalent) to draw the fluid out of the dipstick tube. If a fluid suction pump is not available remove the oil pan and drain the fluid.

CAUTION: Chrysler Corporation does not recommend using any fluid exchanger that introduces additives into the transaxle.

TRANSAXLE FLUID EXCHANGER METHOD

(1) To perform the transaxle fluid exchange, the transaxle must be at operating temperature. Drive the vehicle till it reaches full operating temperature.

(2) Verify that the fill tank on the transaxle fluid exchanger (ATF 2000+ or equivalent) is clean and dry.

(3) Fill the tank to the recommended fill capacity with Mopar ATF Plus 3 Type 7176.

(4) Hookup the vehicle to the machine following the manufacturers instructions. Perform the exchange procedure following the instructions provided with the machine.

(5) Once machine has completed the fluid exchange. Check the fluid level and condition and fill to proper level with Mopar ATF Plus 3 Type 7176.

NOTE: Verify that the transaxle cooler lines are tightened to proper specifications. Cooler line torque specification is 2 N•m (18 in. lbs.).

DIPSTICK TUBE FLUID SUCTION METHOD

(1) When performing the fluid suction method, make sure the transaxle is at full operating temperature.

SERVICE PROCEDURES (Continued)

(2) To perform the dipstick tube fluid suction method, use a suitable fluid suction device (Vacula™ or equivalent).

(3) Insert the fluid suction line into the dipstick tube.

NOTE: Verify that the suction line is inserted to the lowest point of the transaxle oil pan. This will ensure complete evacuation of the fluid in the pan.

(4) Follow the manufacturers recommended procedure and evacuate the fluid from the transaxle.

(5) Remove the suction line from the dipstick tube.

(6) Add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(7) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(8) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(9) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range.

TRANSAXLE OIL PAN DROP METHOD

This procedure involves removing the transaxle oil pan to drain the transaxle fluid.

(1) Bring the vehicle up to normal operating temperature. Drive the vehicle a minimum of 10 miles.

(2) Raise the vehicle on the hoist.

(3) Loosen the transaxle oil pan and drain the fluid into a suitable container.

(4) Remove the pan and clean all sealant from the pan and transaxle mating surfaces. Clean the magnet and the inside of the pan.

(5) Apply a 1/8 inch bead of Mopar RTV Sealant to the mounting flange of the transaxle oil pan. Apply RTV Sealant to the underside of the attaching bolts. Attach the oil pan to the transaxle. Tighten the bolts to 19 N•m (165 in. lbs.).

(6) Lower the vehicle and add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(7) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(8) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(9) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range. Drive the vehicle a minimum of 10 miles.

(10) Raise the vehicle on the hoist.

(11) Check for leaks around the transaxle oil pan sealing surfaces.

(12) Recheck the fluid level. The level should be in the HOT range.

SEVERE USAGE SERVICE

If the vehicle exhibits any of the following symptoms, it is recommended that the transaxle oil and filter be replaced.

- Transaxle oil discolored
- Transaxle oil has high mileage
- Oil feels grimy when rubbed between fingertips
- Poor shift quality
- Delayed gear engagement
- Vehicle shudder between shifts

TRANSAXLE OIL AND FILTER REPLACEMENT

This procedure involves changing the transaxle fluid and filter, driving the vehicle for 10 miles and changing the transaxle fluid a second time.

(1) Bring the vehicle up to normal operating temperature. Drive the vehicle a minimum of 10 miles.

(2) Raise the vehicle on the hoist.

(3) Loosen the transaxle oil pan and drain the fluid into a suitable container.

(4) Remove the pan and clean all sealant from the pan and transaxle mating surfaces. Clean the magnet and the inside of the pan.

(5) Separate the filter and O-ring from the valve body. Inspect the O-ring for cuts or improper installation. This could lead to delayed garage shifts.

(6) Install a new filter. Replace the O-ring as necessary.

(7) Apply a 1/8 inch bead of Mopar RTV Sealant to the mounting flange of the transaxle oil pan. Apply RTV Sealant to the underside of the attaching bolts. Attach the oil pan to the transaxle. Tighten the bolts to 19 N•m (165 in. lbs.).

(8) Lower the vehicle and add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(9) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(10) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(11) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range. Drive the vehicle a minimum of 10 miles.

(12) Raise the vehicle on the hoist.

SERVICE PROCEDURES (Continued)

(13) Remove the pan and clean all sealant from the pan and transaxle mating surfaces. Clean the magnet and the inside of the pan.

(14) Separate the filter from the valve body to allow additional fluid to drain from the transaxle. Inspect the filter O-ring for any damage and replace as necessary.

(15) After the transaxle has stopped draining, reinstall the filter and O-ring.

(16) Apply a 1/8 inch bead of Mopar RTV Sealant to the mounting flange of the transaxle oil pan. Apply RTV Sealant to the underside of the attaching bolts. Attach the oil pan to the transaxle. Tighten the bolts to 19 N•m (165 in. lbs.).

(17) Lower the vehicle and add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(18) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(19) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(20) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range.

FLUID DRAIN AND REFILL

(1) Raise vehicle on a hoist (See Group 0, Lubrication). Place a drain container with a large opening, under transaxle oil pan.

(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 gasket on bottom of the valve body and tighten retaining screws to 5 N·m (40 inch-pounds).

(4) Clean the oil pan and magnet. Reinstall pan using new sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).

(5) Pour four quarts of Mopar ATF PLUS 3 (Automatic Transmission Fluid) Type 7176 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) Add sufficient fluid to bring level to 1/8 inch below the ADD mark.

(8) Recheck fluid level after transaxle is at normal operating temperature. The level should be in the HOT region.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transaxle 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 tapping the hole with a 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.

FLUSHING COOLERS AND TUBES

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed. The cooler bypass valve in the transaxle must be replaced also. The torque converter must also be replaced with an exchange unit. This will ensure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transaxle.

The recommended procedure for flushing the coolers and tubes is to use Tool 6906A Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906A

(1) Remove cover plate filler plug on Tool 6906A. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906A.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

SERVICE PROCEDURES (Continued)

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar ATF Plus 3 ® type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

OIL PUMP VOLUME CHECK

After the new or repaired transmission has been installed, fill to the proper level with Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid. The volume should be checked using the following procedure:

(1) Disconnect the **From cooler** line at the transmission and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF PLUS 3, disconnect the **To Cooler** line at the transaxle.

(4) Refill the transaxle to proper level and recheck pump volume.

(5) If flow is found to be within acceptable limits, replace the cooler. Then fill transmission to the proper level, using Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid.

(6) If fluid flow is still found to be inadequate, check the line pressure using the Transaxle Hydraulic Pressure Test procedure.

REMOVAL AND INSTALLATION

VEHICLE SPEED SENSOR PINION GEAR

When the sensor is removed for any reason, a NEW O-ring must be installed on its outside diameter.

REMOVAL

(1) Remove harness connector from sensor. Make sure weatherseal stays on harness connector.

(2) Remove bolt securing the sensor in the extension housing.

(3) Carefully pull sensor and pinion gear assembly out of extension housing.

(4) Remove pinion gear from sensor.

INSTALLATION

(1) To install, reverse the above procedure. Make sure extension housing and sensor flange are clean prior to installation. Always use a NEW sensor O-ring.

(2) Tighten bolt to 7 N·m (60 in. lbs.). Tighten speedometer cable to 4 N·m (35 in. lbs.).

PARK/NEUTRAL STARTING AND BACK-UP LAMP SWITCH

TEST

The park/neutral starting switch is the center terminal of the 3 terminal switch. It provides ground for the starter solenoid circuit through the selector lever in only Park and Neutral positions.

(1) To test switch, remove wiring connector from switch and test for continuity between center pin of switch and transaxle case. Continuity should exist only when transaxle is in Park or Neutral.

(2) Check gearshift cable adjustment before replacing a switch which tests bad.

REMOVAL

(1) Unscrew switch from transaxle case allowing fluid to drain into a container. Move selector lever to Park, then to Neutral position, and inspect to see the switch operating lever fingers are centered in switch opening.

INSTALLATION

(1) Screw the switch with a new seal into transaxle case and tighten to 33 N·m (24 ft. lbs.). Retest switch with the test lamp.

(2) Add fluid to transaxle to bring up to proper level.

(3) The back-up lamp switch circuit is through the two outside terminals of the 3 terminal switch.

(4) To test switch, remove wiring connector from switch and test for continuity between the two outside pins.

REMOVAL AND INSTALLATION (Continued)

(5) Continuity should exist only with transaxle in Reverse position.

(6) No continuity should exist from either pin to the case.

TRANSAXLE AND TORQUE CONVERTER REMOVAL

NOTE: Transaxle removal does NOT require engine removal.

The transaxle and torque converter must be removed as an assembly; otherwise, the torque converter drive plate, pump bushing, or oil seal may be damaged. The drive plate will not support a load; therefore, none of the weight of the transaxle should be allowed to rest on the plate during removal.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove air cleaner and hoses.

(3) Disconnect throttle linkage and shift linkage from transaxle.

(4) Unplug torque converter clutch connector, located near the dipstick. Unplug the gear position switch.

(5) Remove transaxle dipstick tube.

(6) Remove the transaxle cooler lines and plug.

(7) Install engine support fixture (Fig. 5) .

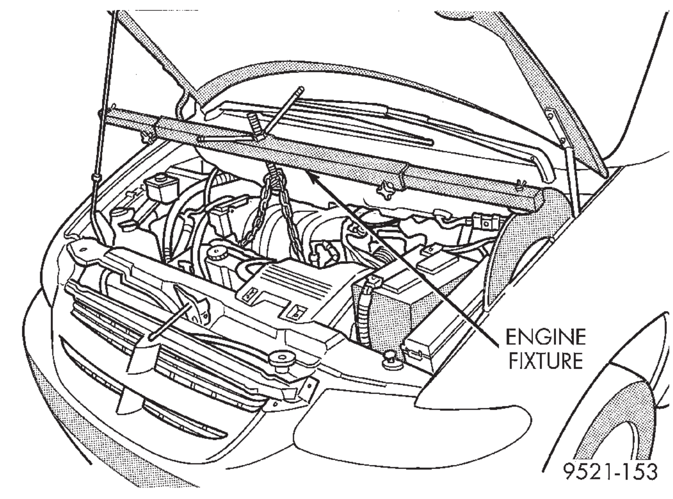

Fig. 5 Engine Support Fixture

(8) Remove bell housing upper bolts.

(9) Raise vehicle. Remove front wheels. Refer to Group 2, Suspension to remove or install wheel hub nut and both drive shafts.

CAUTION: The exhaust flex joint must be disconnected from the exhaust manifold anytime the engine is lowered. If the engine is lowered while the flex pipe is attached, damage will occur.

(10) Remove bolts securing exhaust flex joint to exhaust manifold. Disconnect exhaust pipe from manifold.

(11) Remove torque converter dust cover. Mark torque converter and drive plate with chalk, for reassembly. Rotate engine clockwise and remove torque converter mounting bolts.

(12) Remove engine mount bracket from front crossmember.

(13) Remove front mount insulator through-bolt and bellhousing bolts.

(14) Position transaxle jack (Fig. 6) .

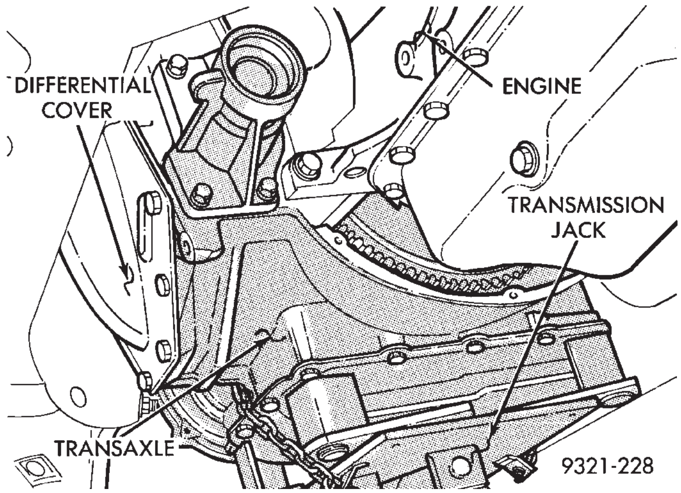

Fig. 6 Transaxle Jack

(15) Remove rear engine mount shield.

(16) Remove rear engine mount bracket bolts and bracket.

(17) Remove left engine mount thru-bolt.

(18) Remove left engine mount from transaxle.

(19) Remove starter. Remove lower bell housing bolts.

(20) Carefully work transaxle and torque converter assembly rearward off engine block dowels and disengage converter hub from end of crankshaft. **Attach a small C clamp to edge of bell housing. This will hold torque converter in place during transaxle removal.** Lower transaxle and remove assembly from under the vehicle.

(21) To remove torque converter assembly, remove C–clamp from edge of bellhousing and slide converter out of transaxle.

INSTALLATION

(1) When installing transaxle, reverse the above procedure.

(2) If torque converter was removed from transaxle be sure to align pump inner gear pilot flats with torque converter impeller hub flats.

(3) Adjust gearshift and throttle cables.

(4) Refill transaxle with Mopar ATF PLUS 3 (Automatic Transmission Fluid) Type 7176.

REMOVAL AND INSTALLATION (Continued)

FRONT PUMP OIL SEAL

The pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transaxle case.

REMOVAL

(1) Screw seal remover Tool C-3981-B into seal (Fig. 7), then tighten screw portion of tool to withdraw the seal.

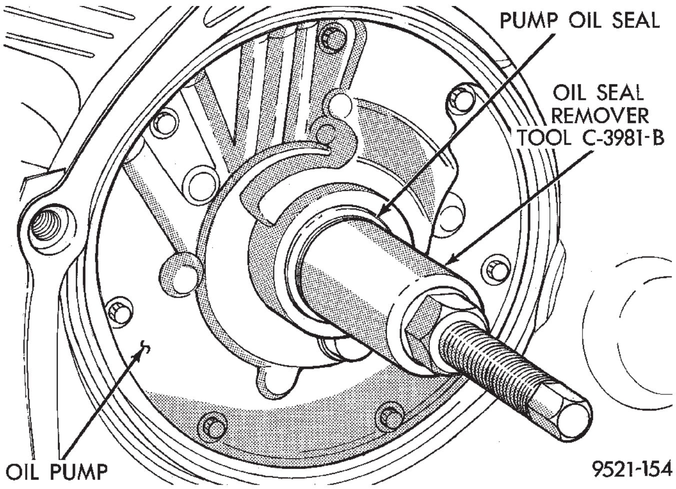

Fig. 7 Remove Pump Oil Seal

INSTALLATION

(1) To install a new seal, place seal in opening of the pump housing (lip side facing inward). Using Tool C-4193 and Handle Tool C-4171, drive new seal into housing until tool bottoms (Fig. 8).

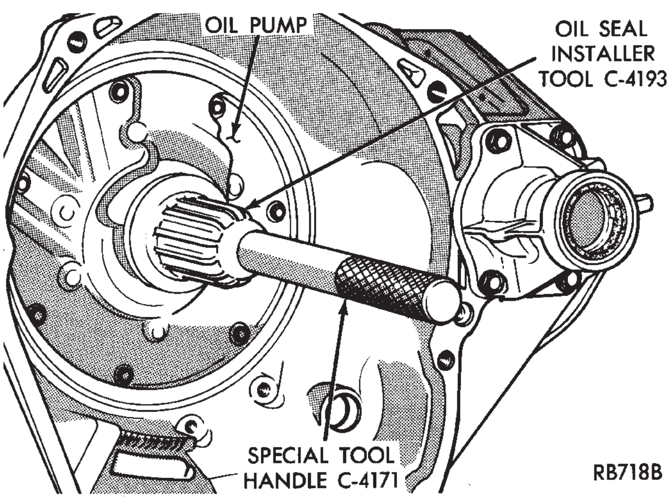

Fig. 8 Install Pump Oil Seal

DISASSEMBLY AND ASSEMBLY

TRANSAXLE

Prior to removing any transaxle parts, plug all openings and clean the unit, preferably with steam. When disassembling, each part should be washed in a suitable solvent, then dried with compressed air. Do not wipe parts with shop towels. All mating surfaces in the transaxles are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

DISASSEMBLY

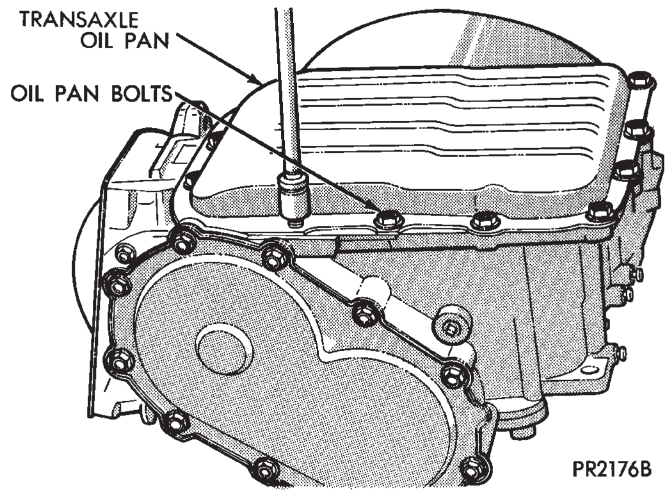

Fig. 9 Transaxle Oil Pan Bolts

Remove all old sealant before applying new sealant.

Use only Mopar® Silicone Rubber Sealant or equivalent when installing oil pan.

Put sealant on the oil pan flange (Fig. 10) and on all oil pan bolts (underside of bolt head).

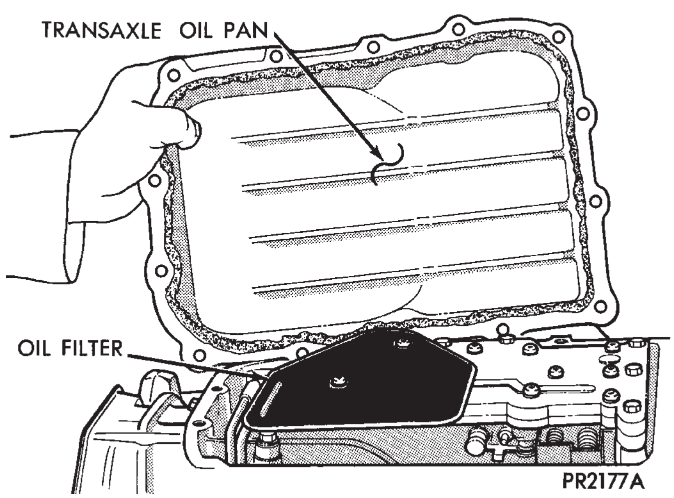

Fig. 10 Transaxle Oil Pan

DISASSEMBLY AND ASSEMBLY (Continued)

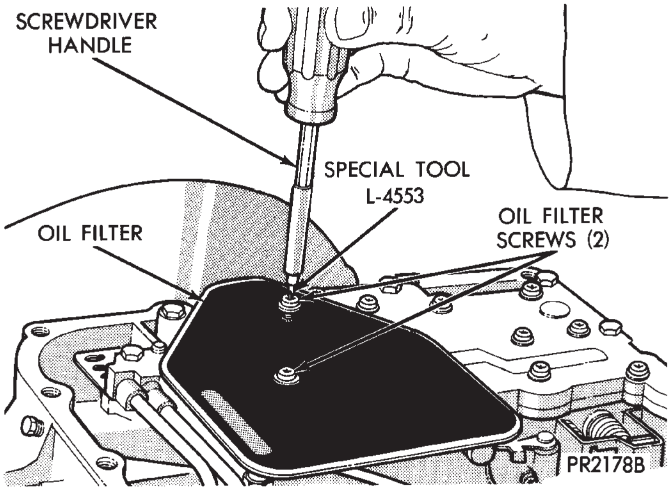

Fig. 11 Oil Filter Screws

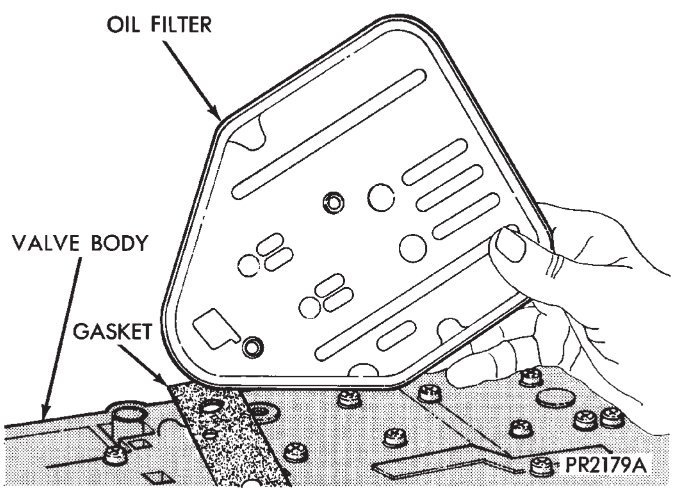

Fig. 12 Oil Filter

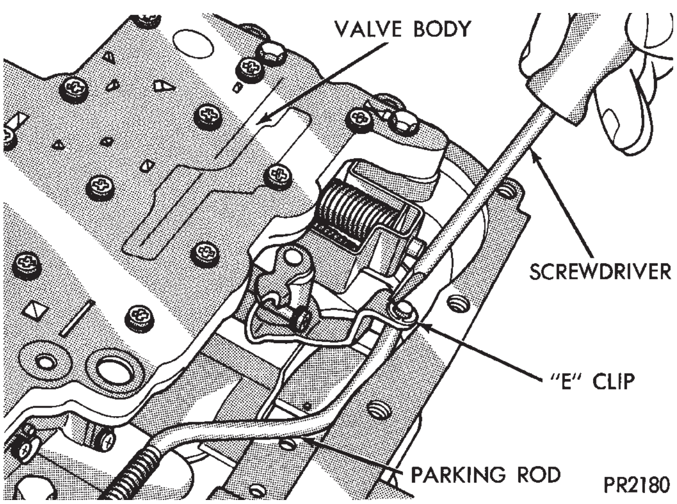

Fig. 13 Remove Parking Rod E-Clip

Remove neutral starting and back-up lamp switch. Measuring input shaft end play before disassembly will usually indicate if a thrust washer change is required. The thrust washer is located between input and output shafts.

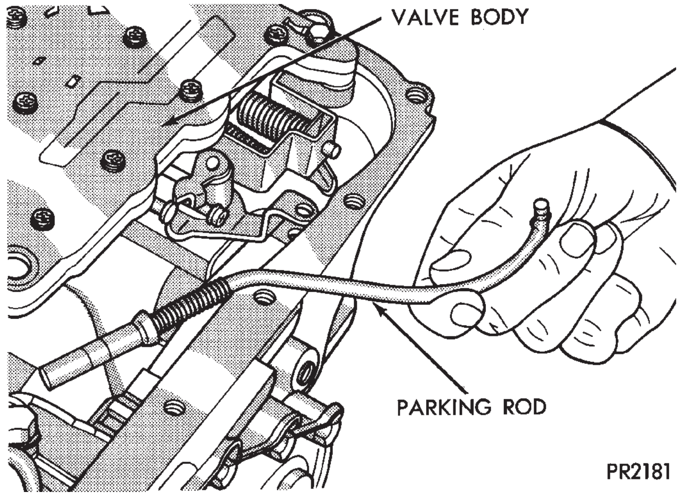

Fig. 14 Parking Rod

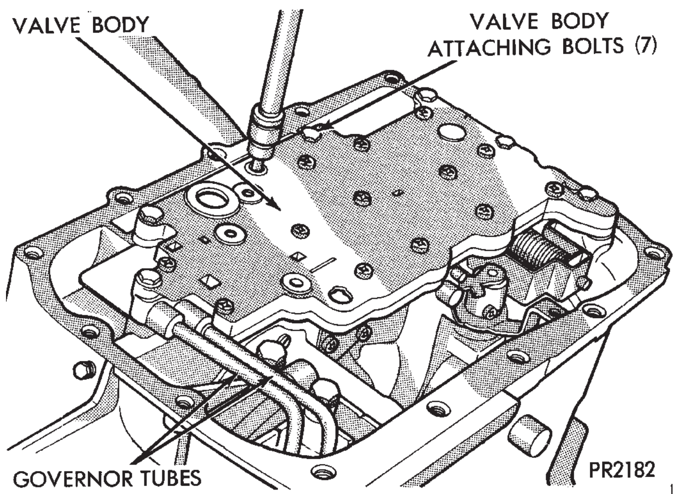

Fig. 15 Valve Body Attaching Bolts

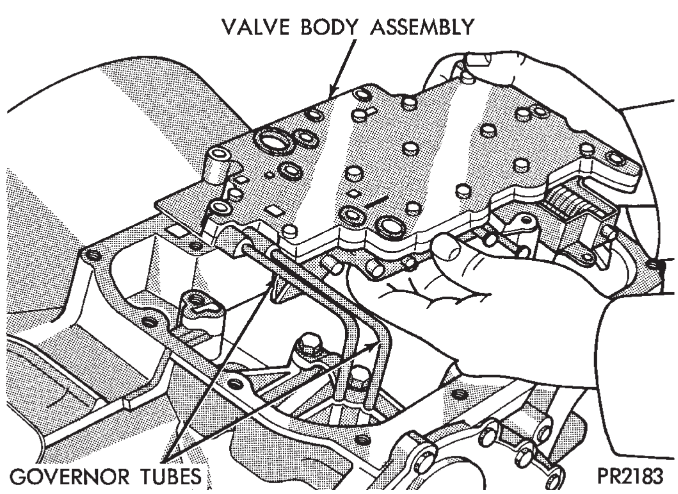

Fig. 16 Valve Body and Governor Tubes

DISASSEMBLY AND ASSEMBLY (Continued)

Attach a dial indicator to transaxle bell housing with its plunger seated against end of input shaft (Fig. 17).

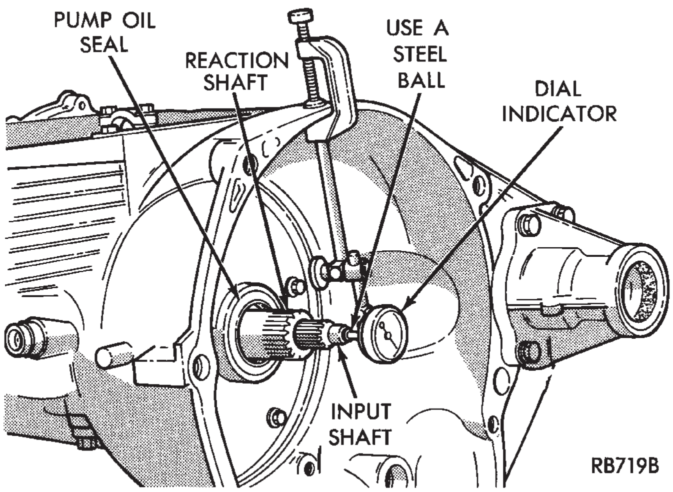

Fig. 17 Measure Input Shaft End Play

Move input shaft in and out to obtain end play reading. End play specifications are 0.19 to 1.50 mm (0.008 to 0.060 inch).

Record indicator reading for reference when reassembling the transaxle.

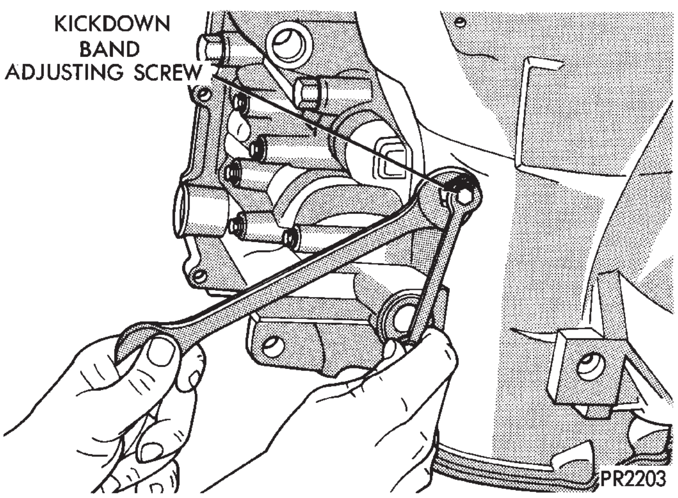

Fig. 18 Loosen Lock Nut and Tighten Kickdown Band Adjusting Screw

Remove Number 6 thrust washer from sun gear driving shell.

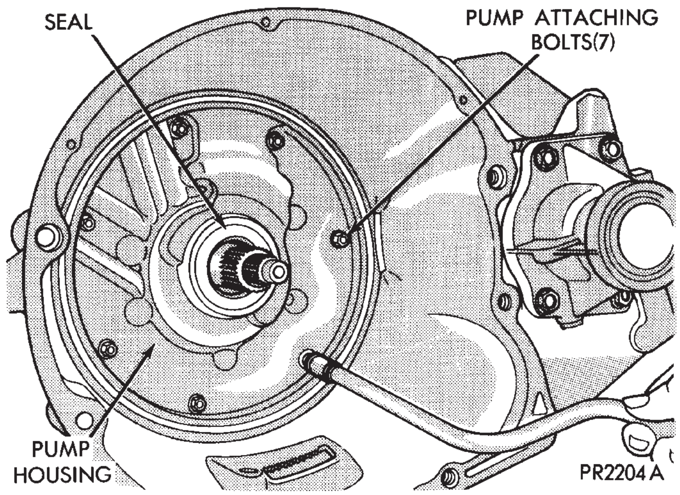

Fig. 19 Pump Attaching Bolts

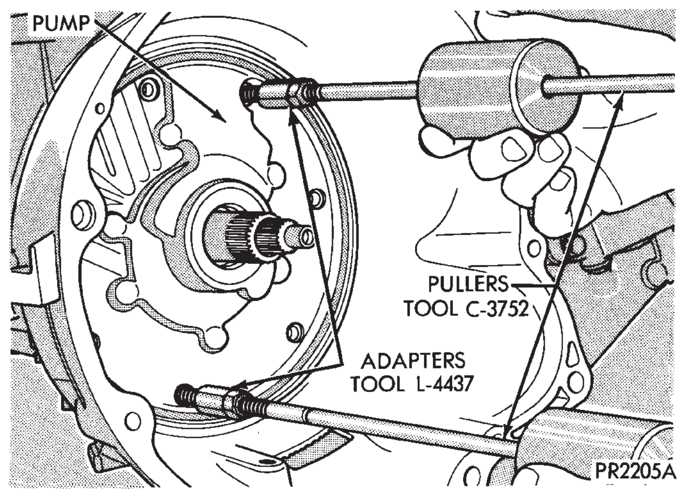

Fig. 20 Install Tool C-3752 with Adapters L-4437

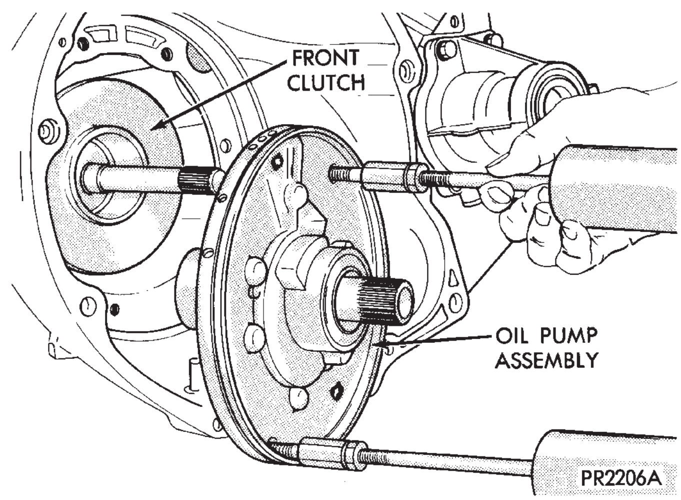

Fig. 21 Oil Pump with No. 1 Thrust Washer

DISASSEMBLY AND ASSEMBLY (Continued)

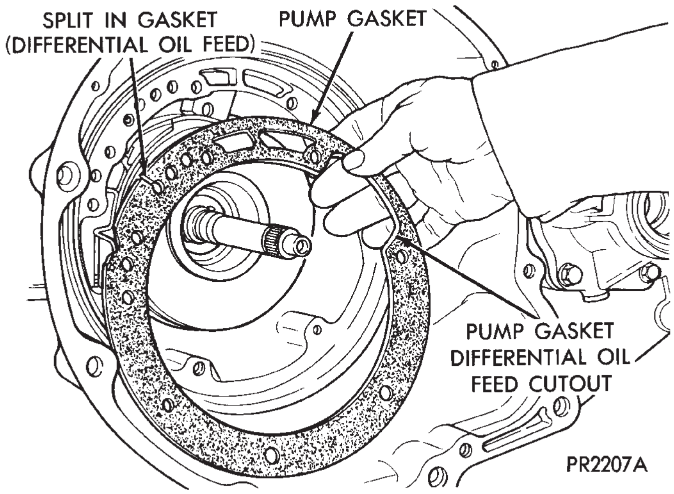

Fig. 22 Oil Pump Gasket

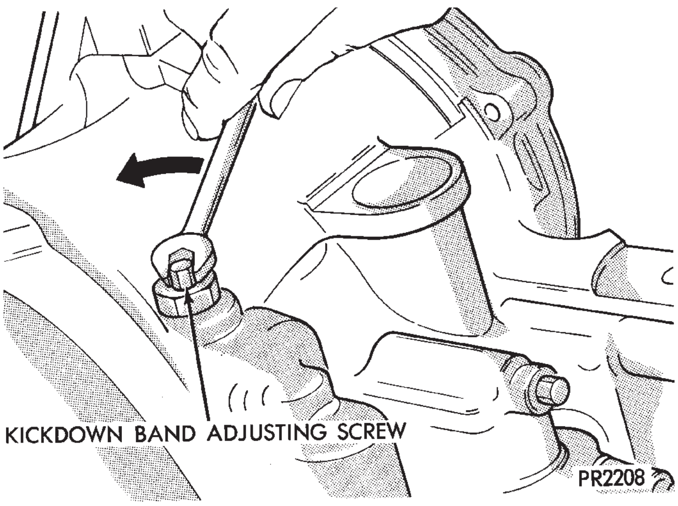

Fig. 23 Loosen Kickdown Band Adjusting Screw

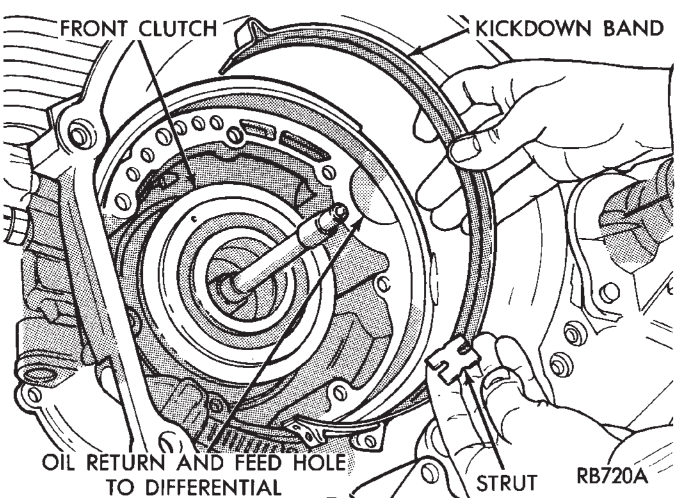

Fig. 24 Kickdown Band and Strut

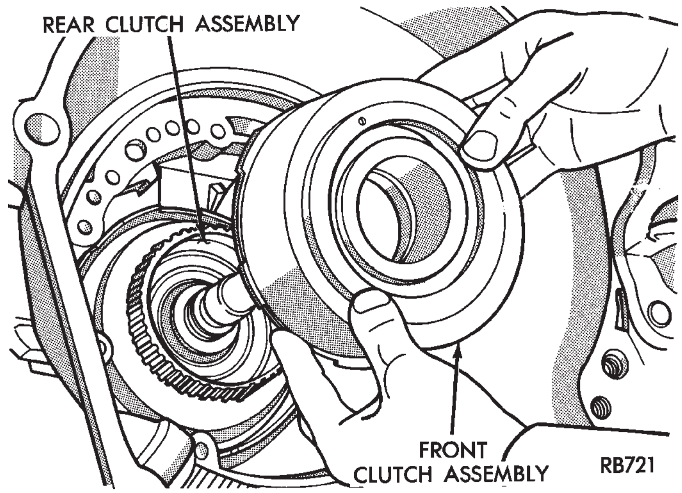

Fig. 25 Front Clutch Assembly

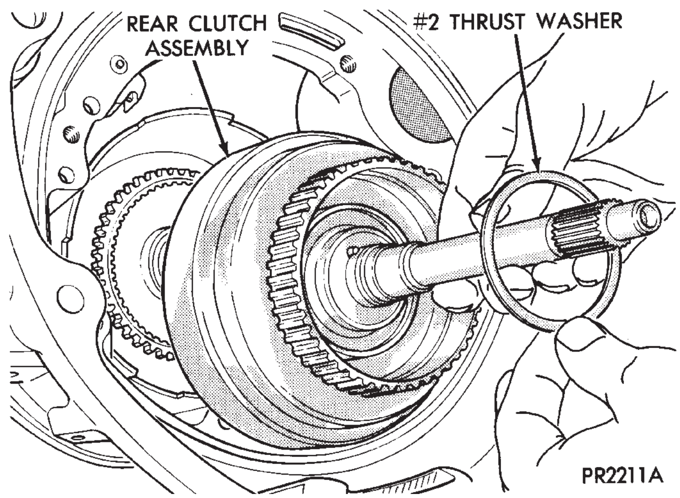

Fig. 26 No. 2 Thrust Washer and Rear Clutch

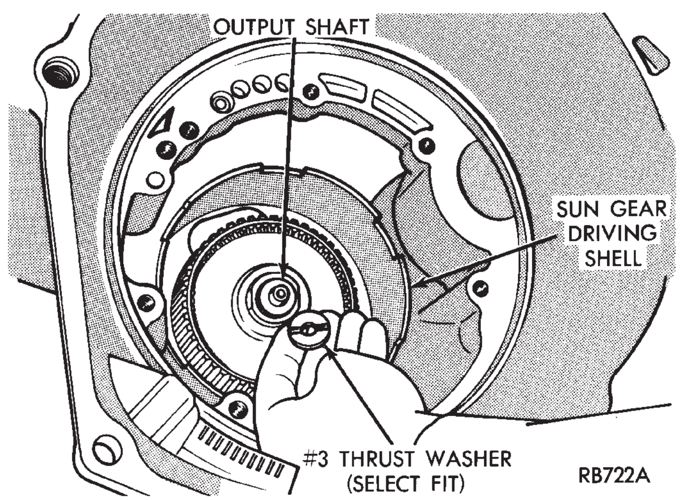

Fig. 27 No. 3 Thrust Washer

DISASSEMBLY AND ASSEMBLY (Continued)

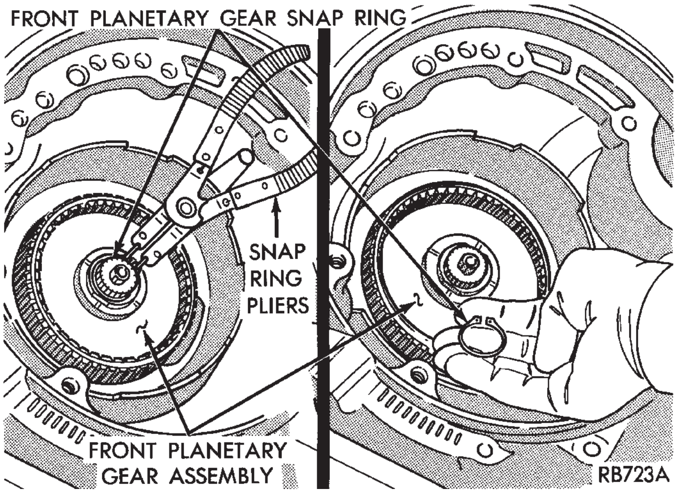

Fig. 28 Front Planetary Gear Snap Ring

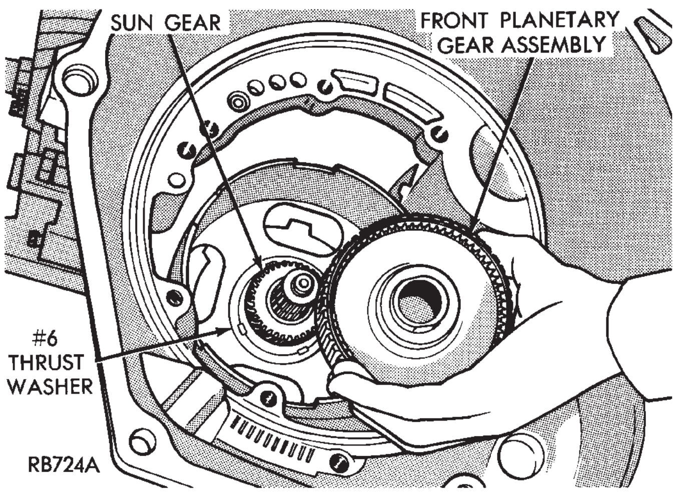

Fig. 29 Front Planetary Gear Assembly

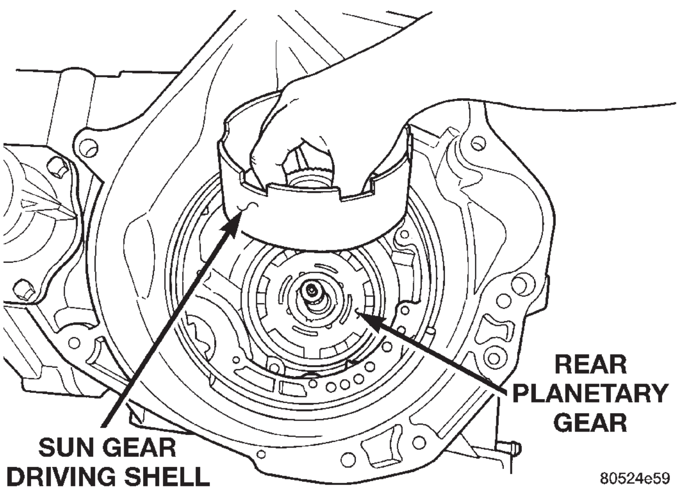

Fig. 30 Sun Gear Driving Shell

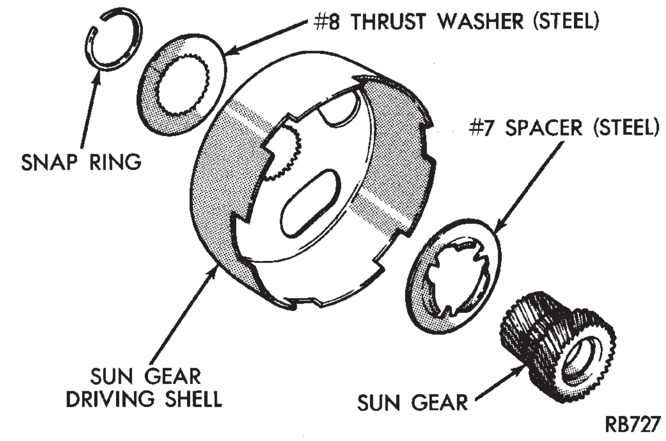

Fig. 31 Sun Gear Driving Shell Components

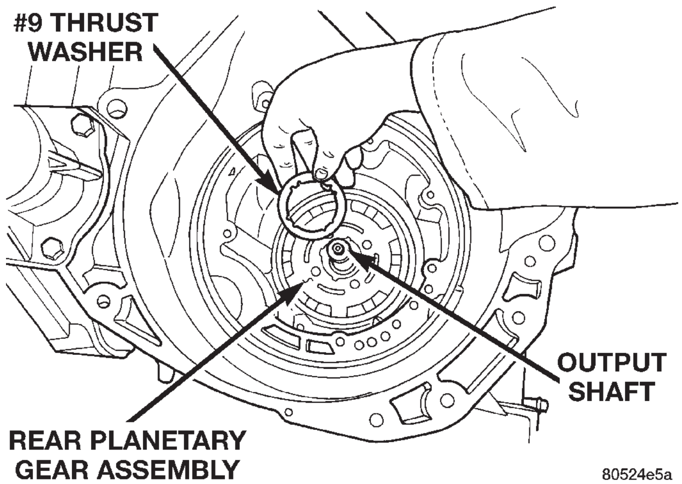

Fig. 32 No. 9 Thrust Washer

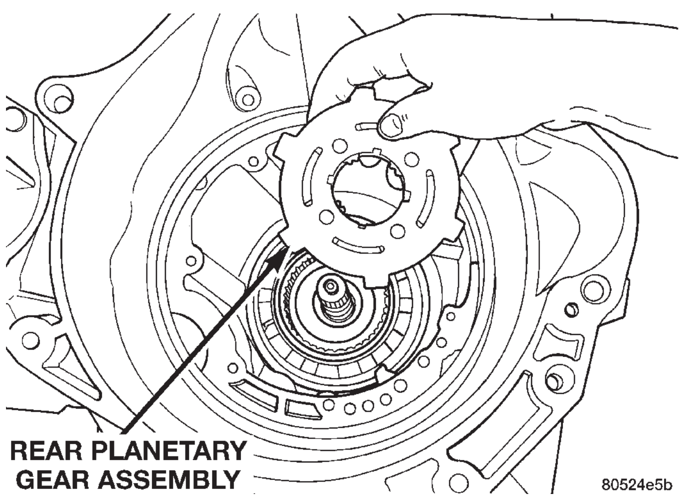

Fig. 33 Rear Planetary Gear Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

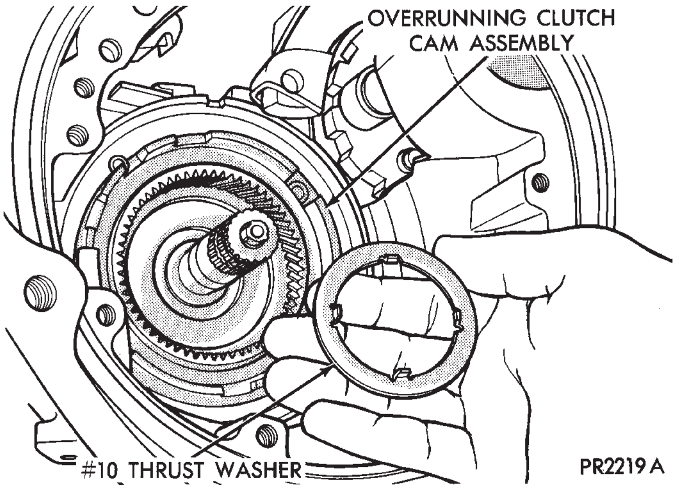

Fig. 34 No. 10 Thrust Washer

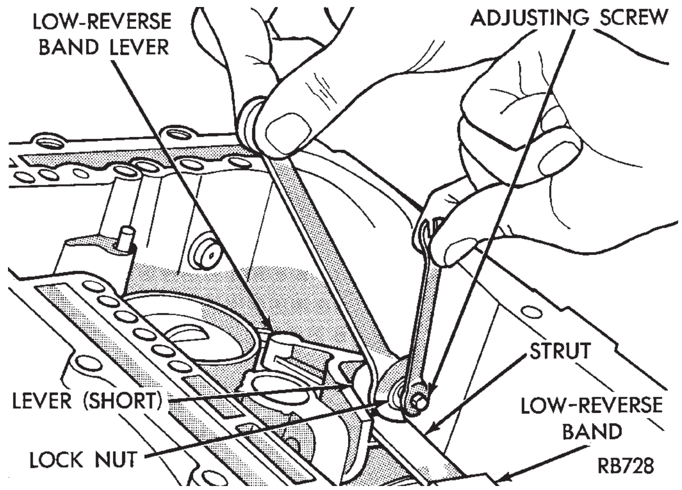

Fig. 37 Loosen or Adjust Low/Reverse Band

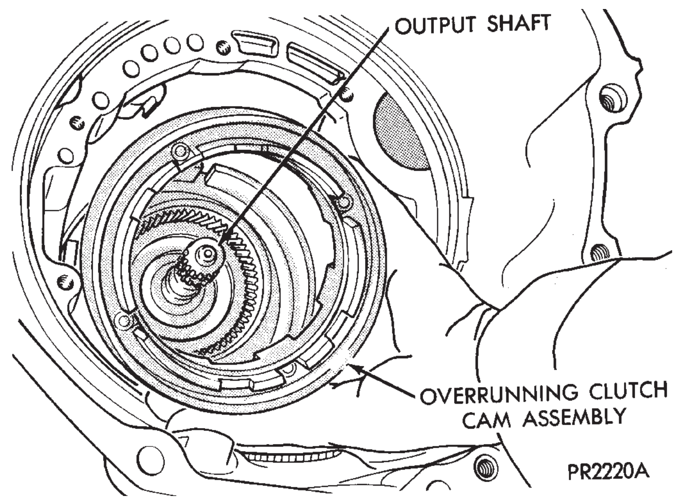

Fig. 35 Overrunning Clutch Cam Assembly

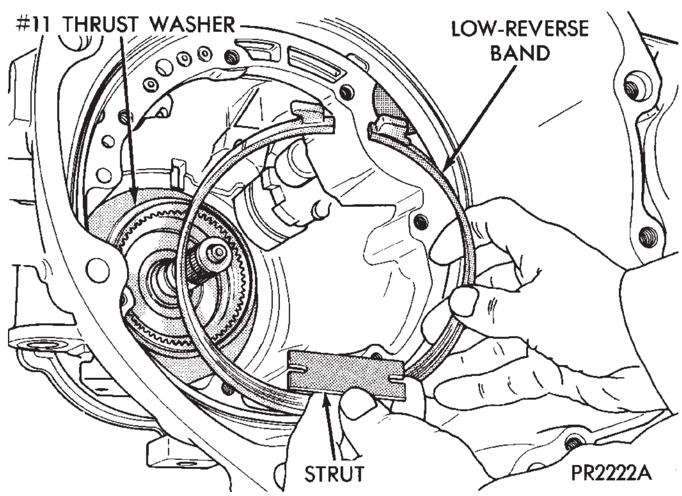

Fig. 38 Low/Reverse Band and Strut

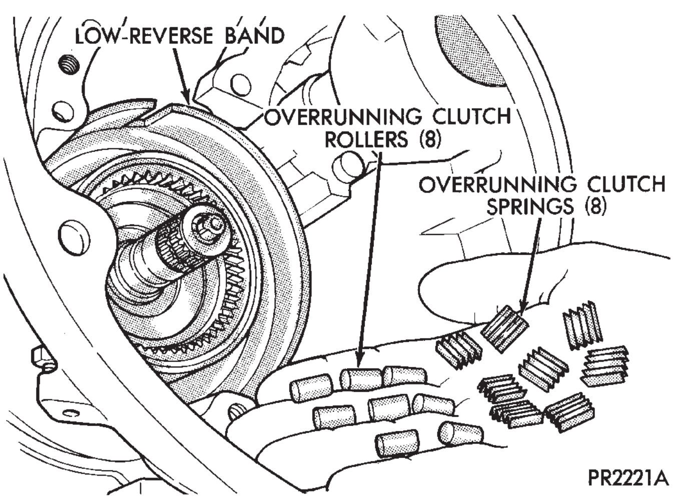

Fig. 36 Overrunning Clutch Rollers and Spring

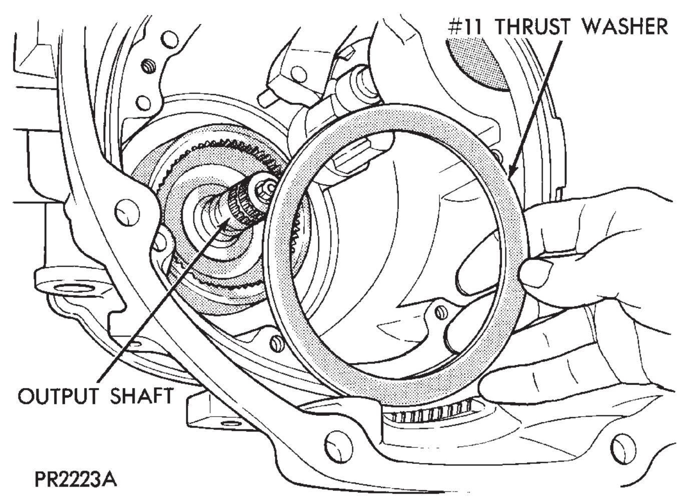

Fig. 39 No. 11 Thrust Washer

DISASSEMBLY AND ASSEMBLY (Continued)

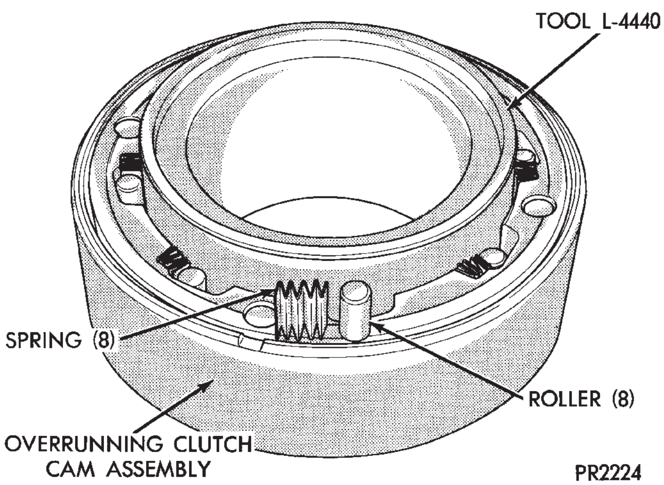

Fig. 40 Install Overrunning Clutch Rollers and Springs

ASSEMBLY

When rebuilding, reverse the above procedure.

VALVE BODY RECONDITION

NOTE: Tighten all valve body screws to 5 N·m (40 in. lbs.).

Do not clamp any portion of valve body or transfer plate in a vise. Any slight distortion of the aluminum body or transfer plate will result in sticking valves, excessive leakage or both. **When removing or installing valves or plugs, slide them in or out carefully. Do not use force.**

NOTE: TAG ALL SPRINGS AS THEY ARE REMOVED FOR REASSEMBLY IDENTIFICATION.

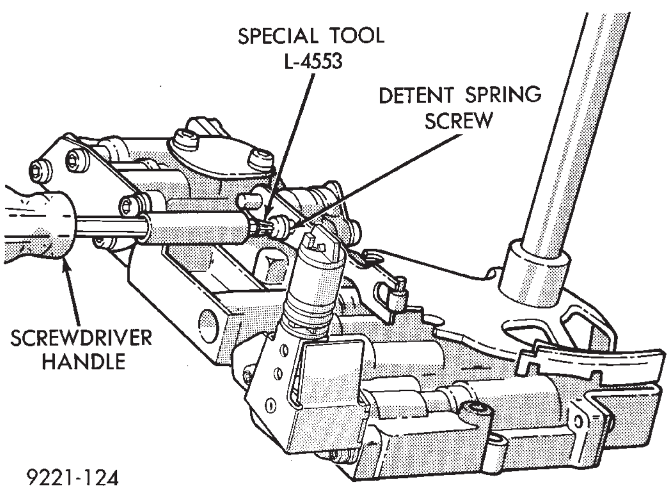

Fig. 41 Detent Spring Attaching Screw and Spring

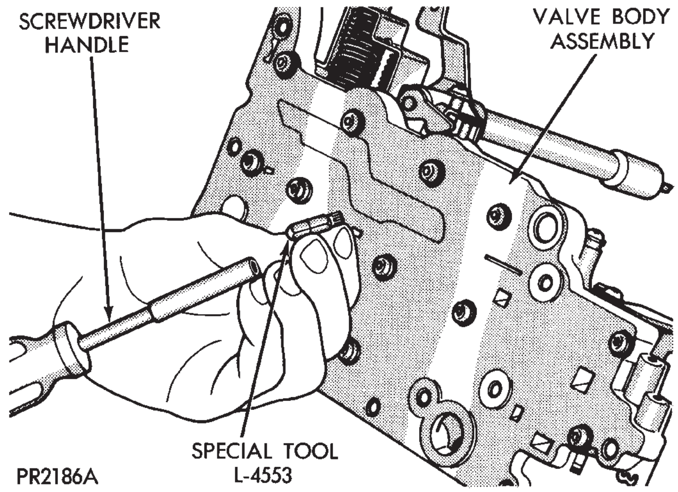

Fig. 42 Using Tool L-4553 on Valve Body Screw

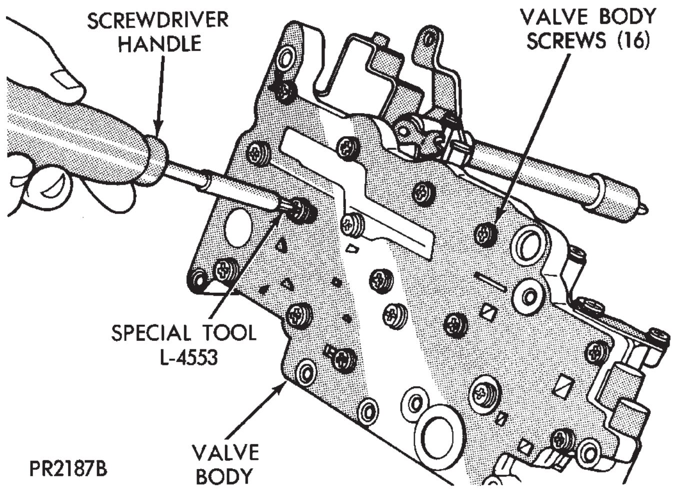

Fig. 43 Remove or Install Valve Body Screws

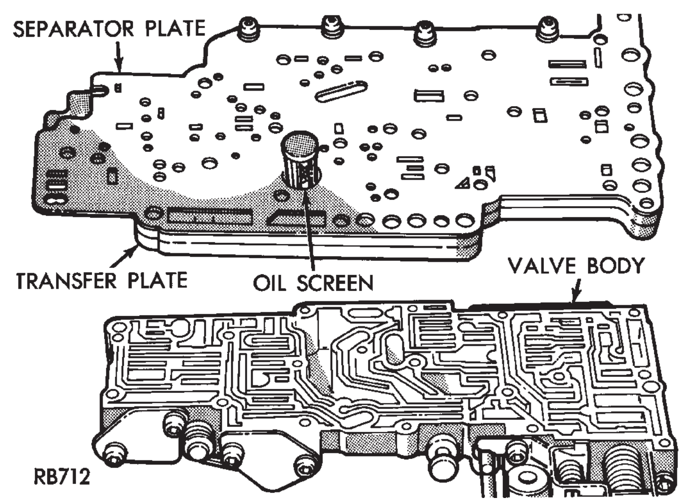

Fig. 44 Transfer Plate and Separator Plate

DISASSEMBLY AND ASSEMBLY (Continued)

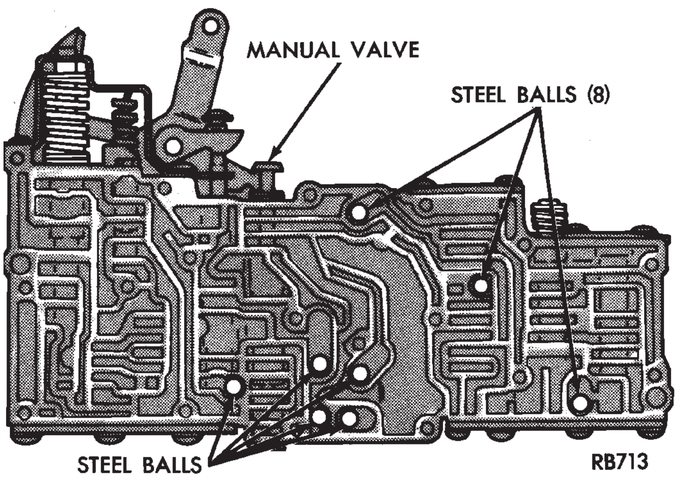

Fig. 45 Steel Ball Locations

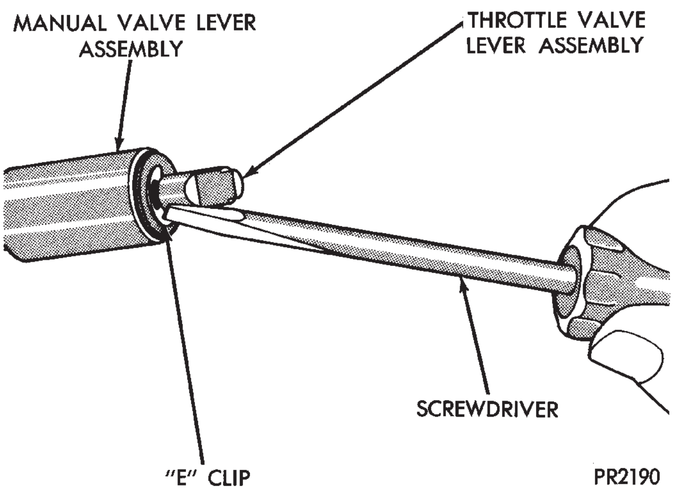

Fig. 46 Remove or Install Throttle Shaft E-Clip

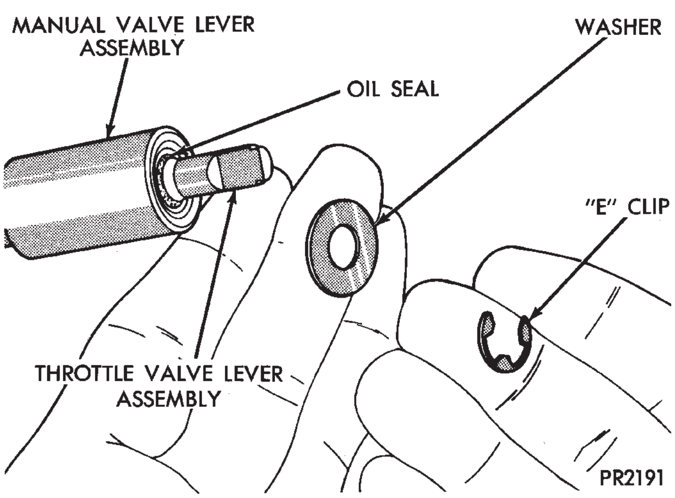

Fig. 47 Throttle Shaft E-Clip, Washer, and Seal

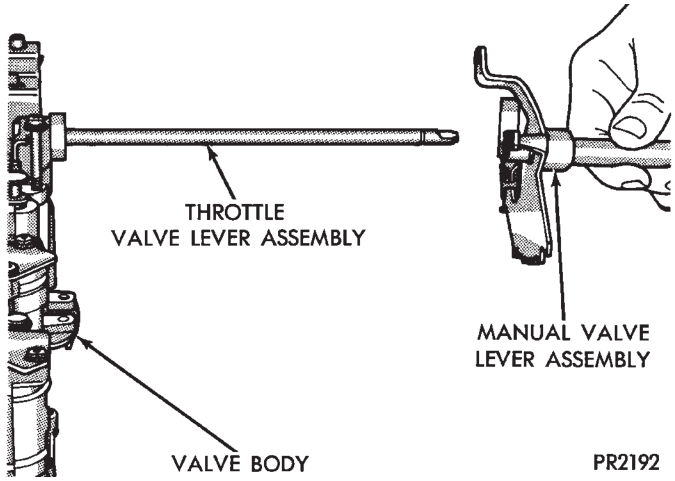

Fig. 48 Manual Valve Lever Assembly

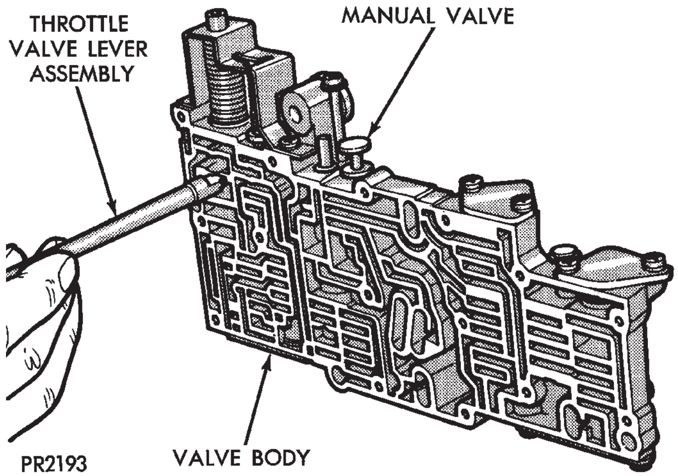

Fig. 49 Throttle Valve Lever Assembly

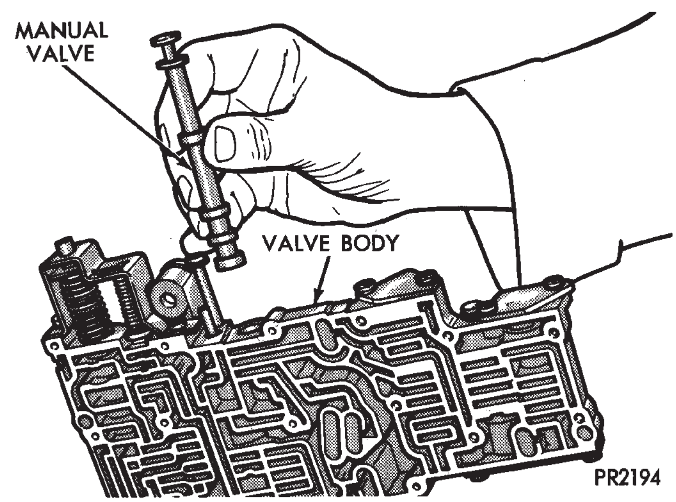

Fig. 50 Manual Valve

DISASSEMBLY AND ASSEMBLY (Continued)

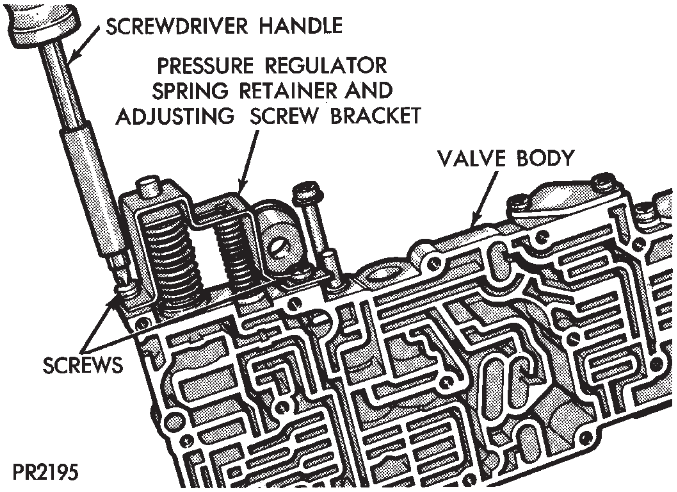

Fig. 51 Pressure Regulator and Adjusting Screw Bracket

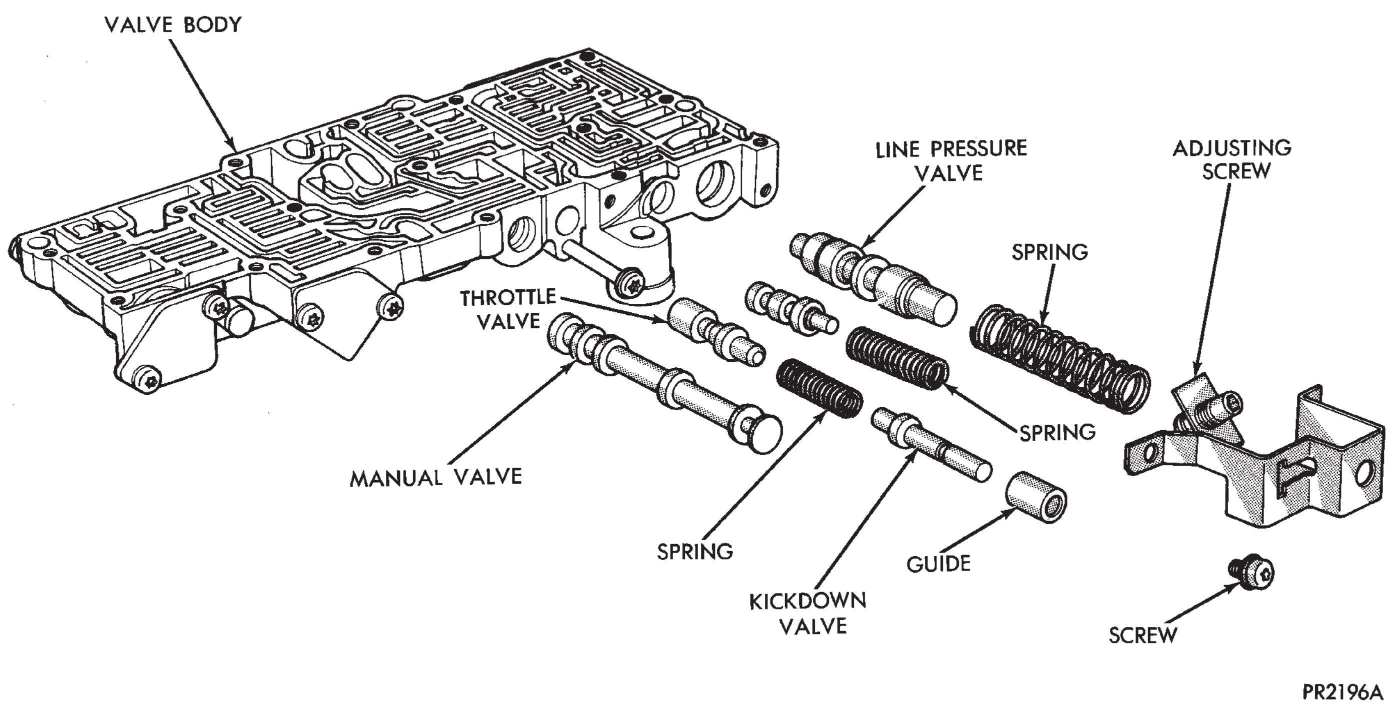

Fig. 52 Pressure Regulators and Manual Controls

DISASSEMBLY AND ASSEMBLY (Continued)

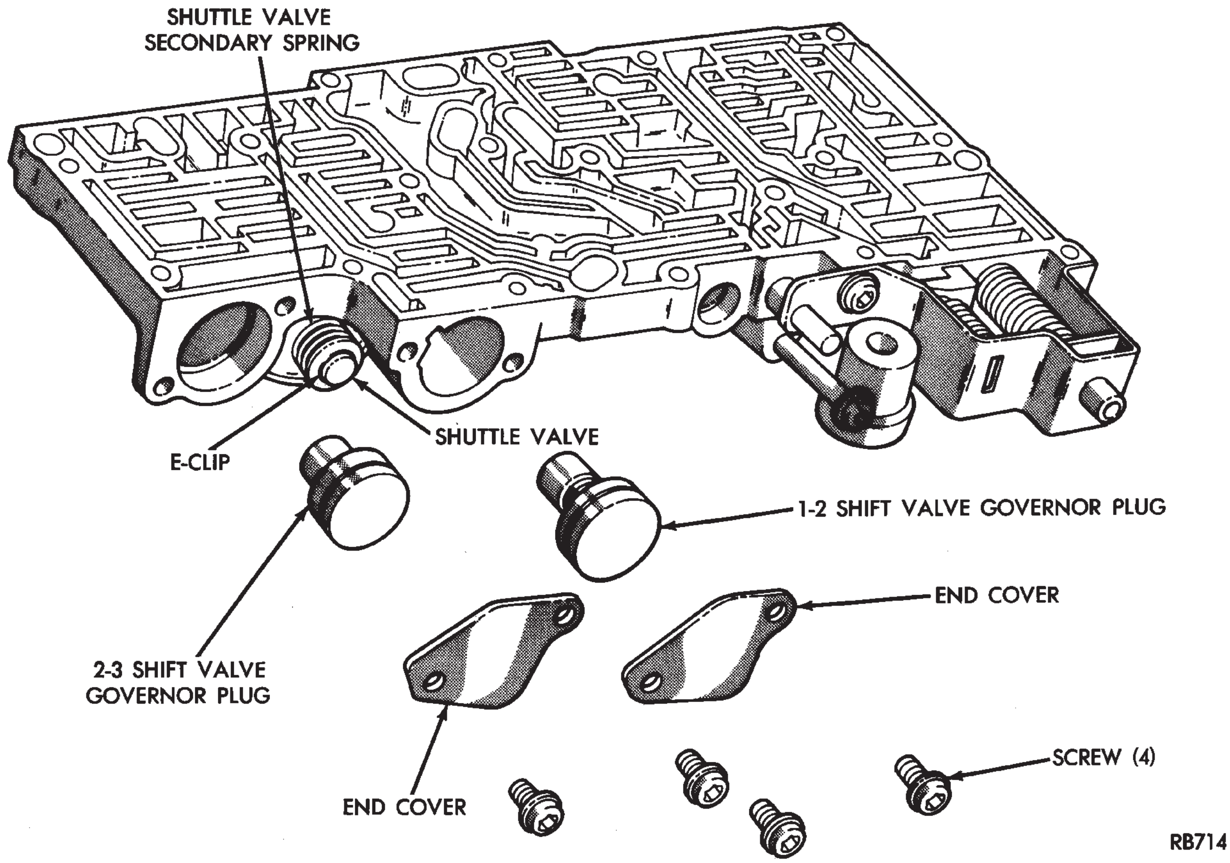

Fig. 53 Governor Plugs

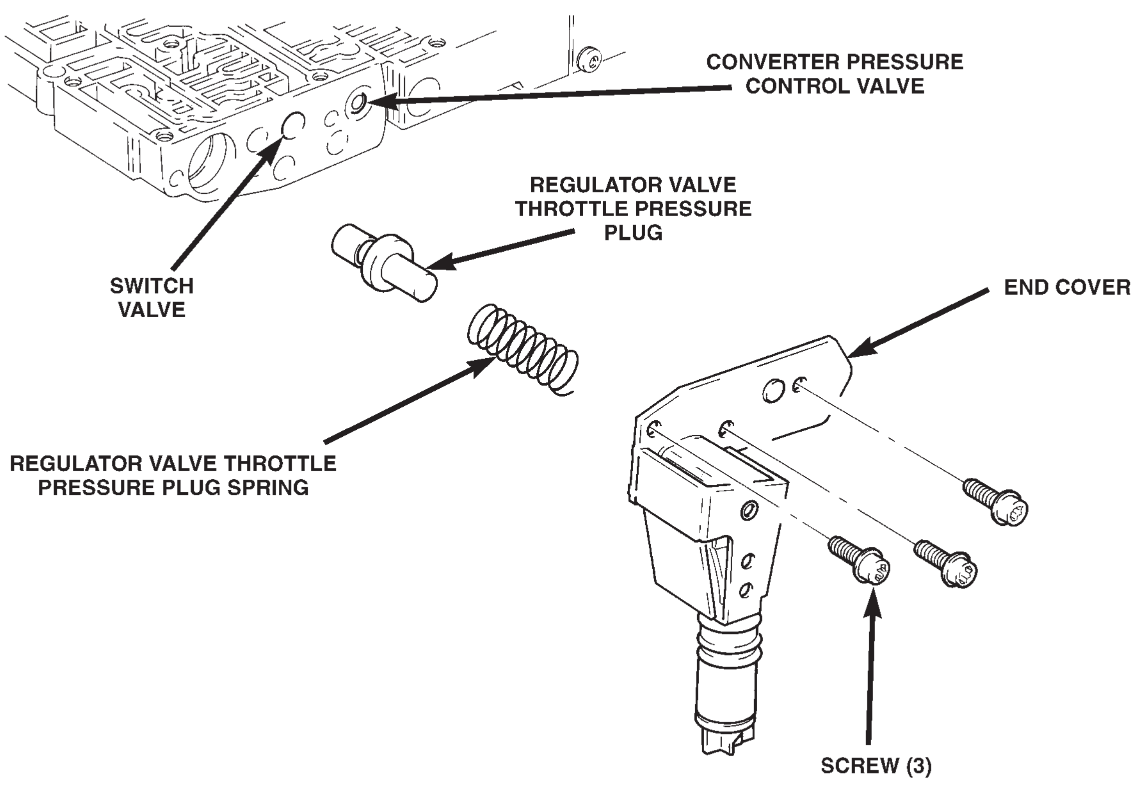

Fig. 54 Pressure Regulator Valve Plugs

80500534

DISASSEMBLY AND ASSEMBLY (Continued)

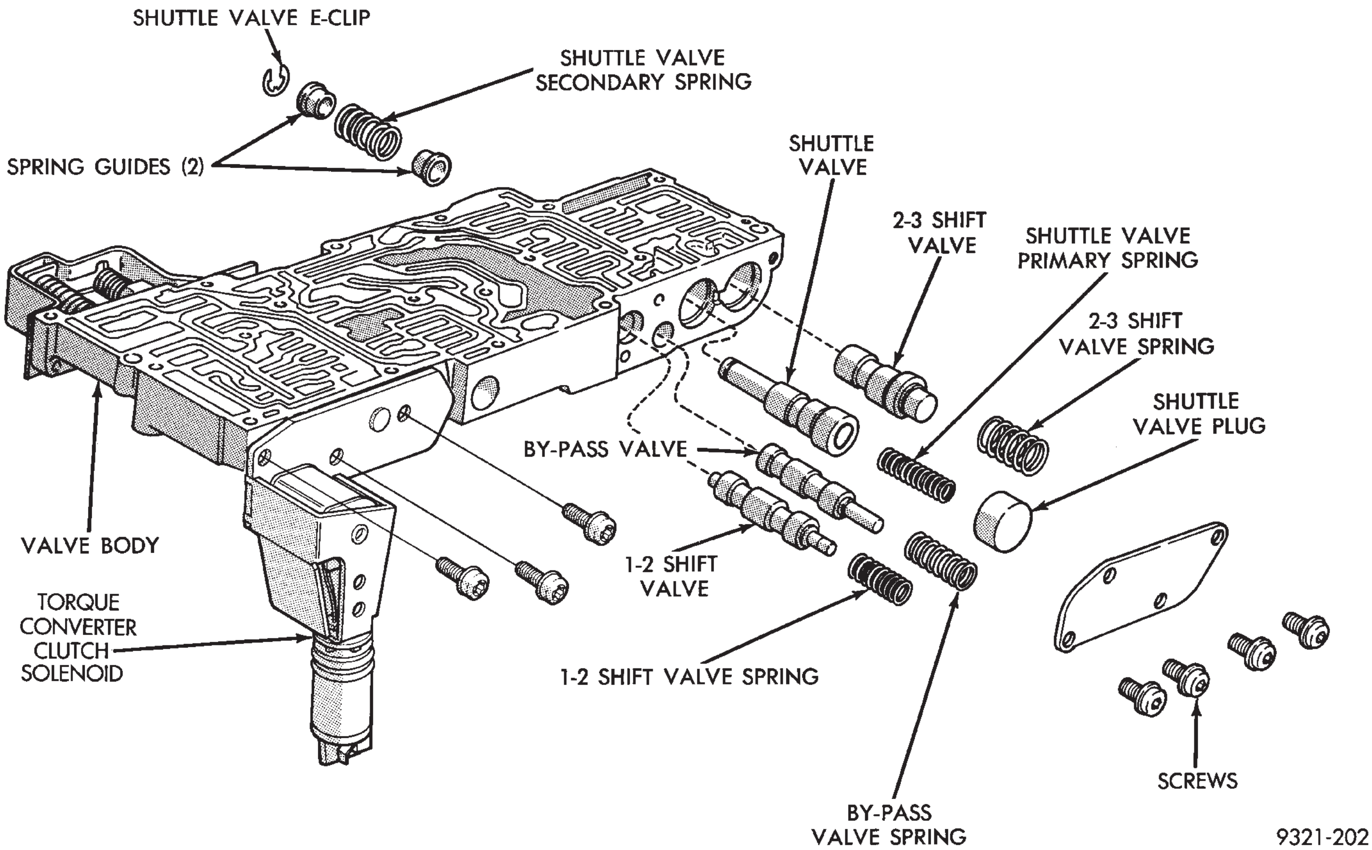

Fig. 55 Shift Valves and Shuttle Valve

OIL PUMP-RECONDITION

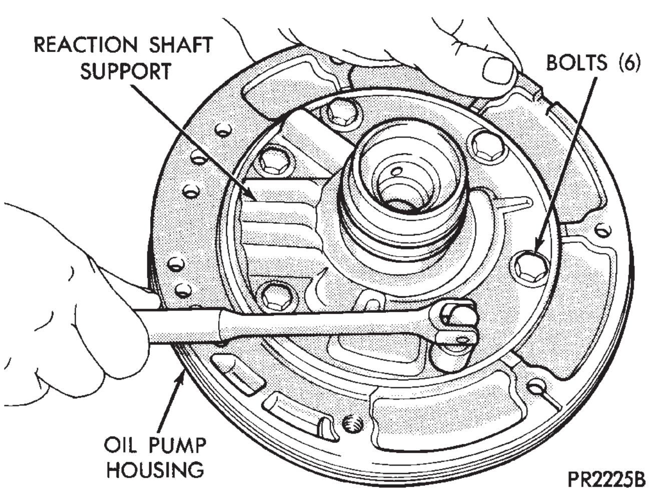

Fig. 56 Reaction Shaft Support Bolts

NOTE: Also, check gear side clearance with a straight edge and a feeler gauge (See Specifications).

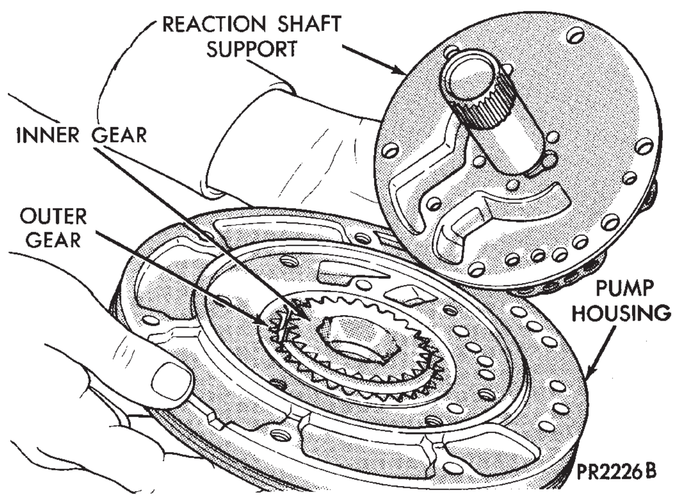

Fig. 57 Reaction Shaft Support

DISASSEMBLY AND ASSEMBLY (Continued)

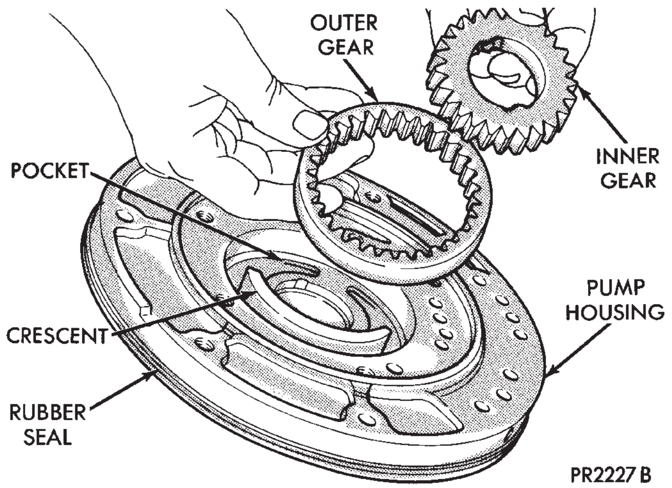

Fig. 58 Inner and Outer Pump Gears

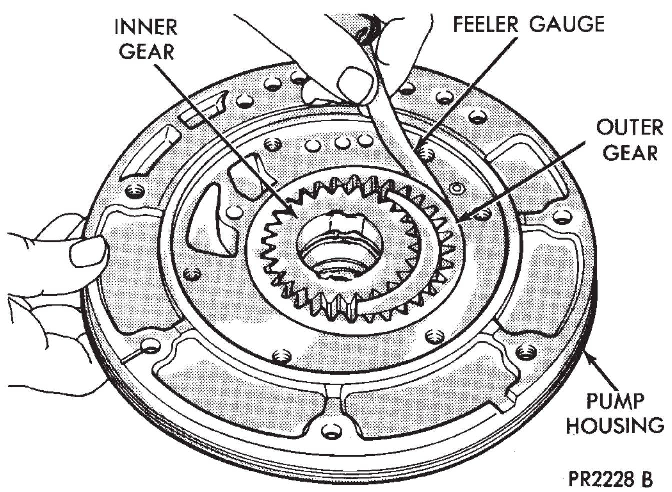

Fig. 59 Measuring Pump Clearance (Gear to Pocket)

FRONT CLUTCH-RECONDITION

INSPECTION

Inspect plates and discs for flatness. They must not be warped or cone shaped.

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate surfaces for burning, scoring, or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect band contacting surface on clutch retainer for scores, the contact surface should be protected from damage during disassembly and handling. Note ball check in clutch retainer, make sure ball moves freely. Inspect piston seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of seals. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect inside bore of piston for score marks, if light, remove with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect seals for deterioration, wear, and hardness. Inspect piston spring, retainer and snap ring for distortion.

DISASSEMBLY

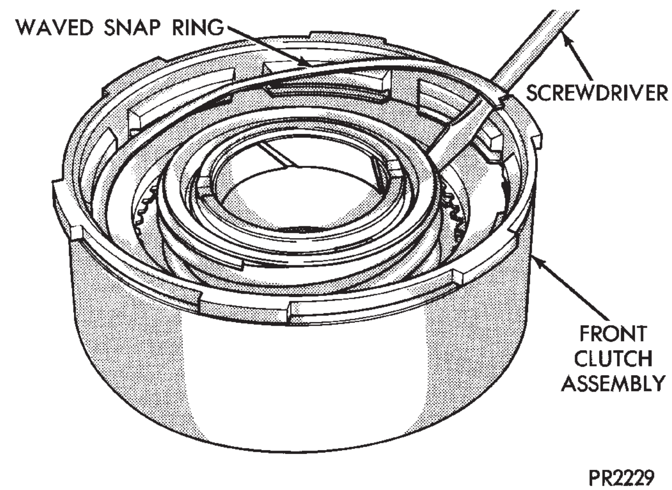

Fig. 60 Front Clutch Waved Snap Ring

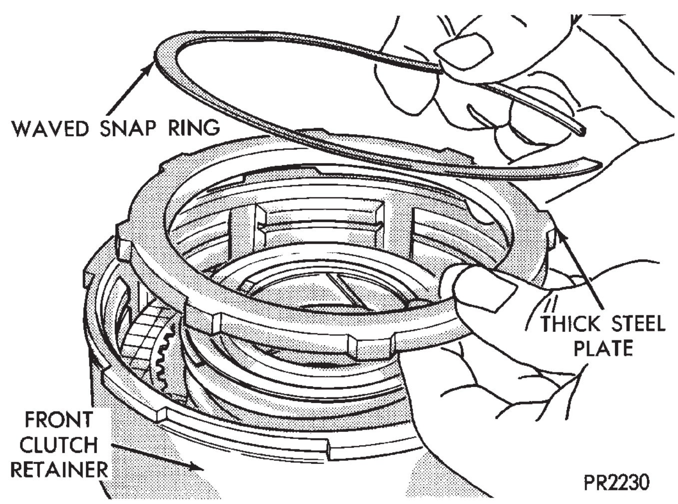

Fig. 61 Thick Steel Plate and Waved Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

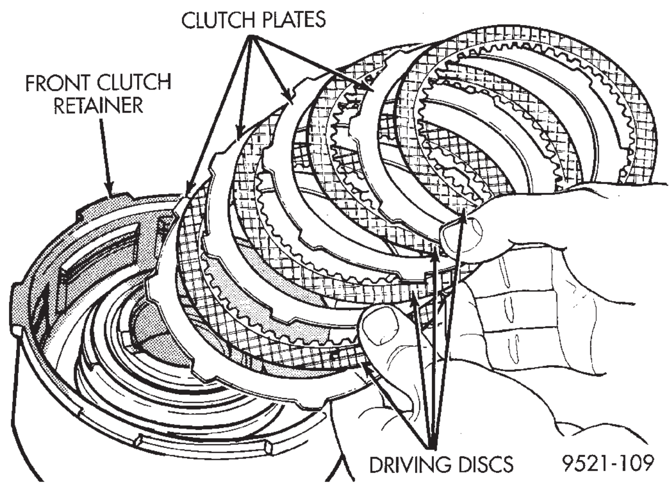

Fig. 62 Front Clutch (4-Disc Shown)

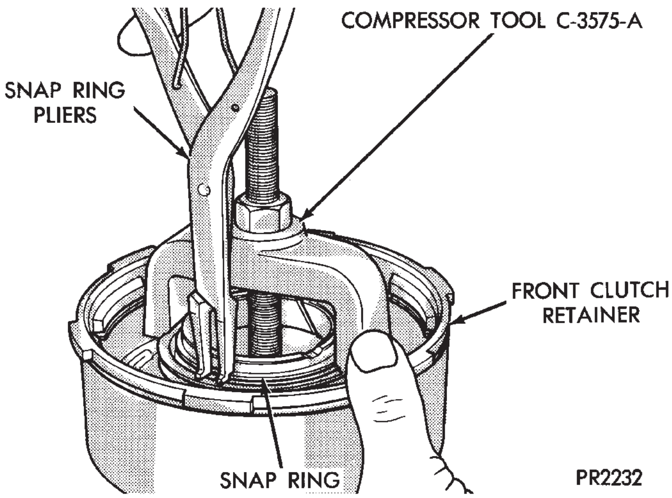

Fig. 63 Front Clutch Return Spring Snap Ring

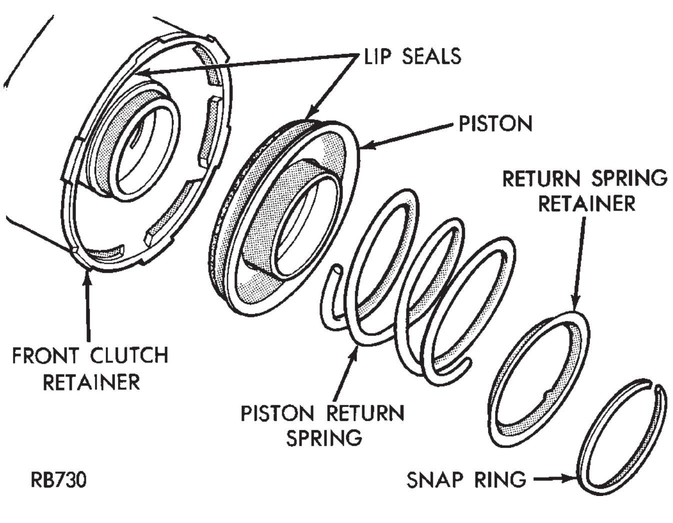

Fig. 64 Front Clutch Return Spring and Piston

ASSEMBLY

To reassemble, reverse the above procedure.

MEASURING PLATE CLEARANCE

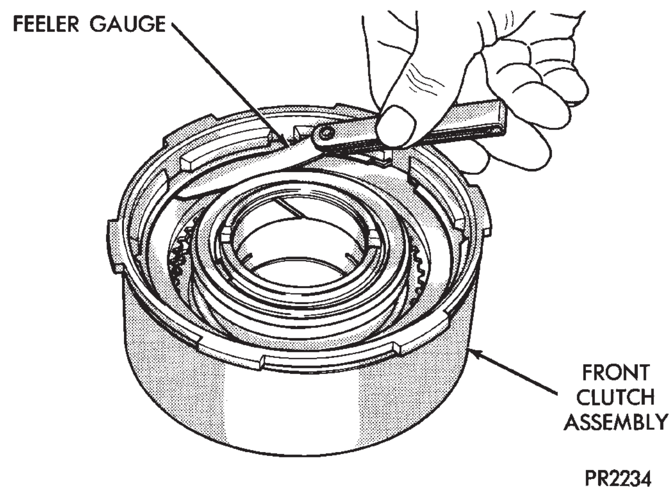

Fig. 65 Measuring Front Clutch Plate Clearance

REAR CLUTCH-RECONDITION

INSPECTION

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surface for burning, scoring or damaged driving lugs. Re place if necessary. Inspect plates and discs for flatness, they must not be warped or cone-shaped.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Note ball check in piston; make sure ball moves freely. Inspect seal rings surfaces in clutch retainer for nicks or deep scratches; light scratches will not interfere with sealing of the seals. Inspect neoprene seal rings for deterioration, wear and hardness. Inspect piston spring and waved snap ring for distortion or breakage.

Inspect teflon and/or cast iron seal rings on input shaft for wear. Do not remove rings unless conditions warrant. Inspect rear clutch to front clutch No. 2 thrust washer for wear. Washer thickness should be .061 to .063 inch, replace if necessary.

DISASSEMBLY

Press out input shaft, if required.

ASSEMBLY

To reassemble, reverse the above procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

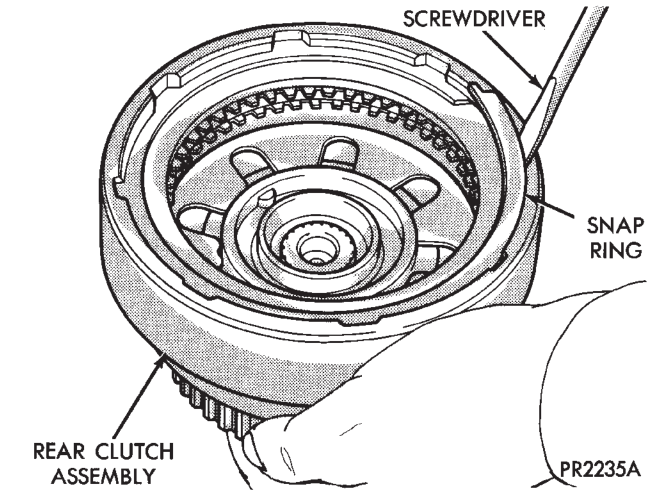

Fig. 66 Rear Clutch Outer Snap Ring

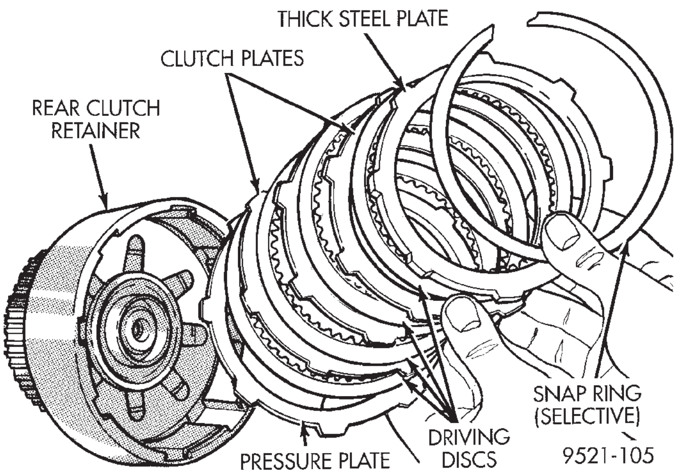

Fig. 67 Rear Clutch (4-Disc Shown)

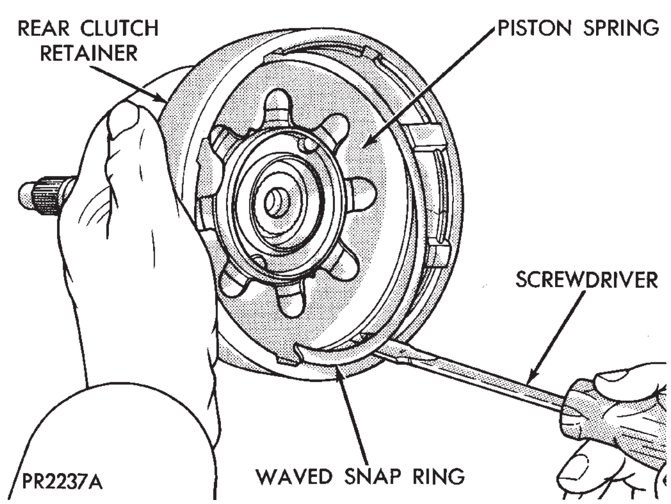

Fig. 68 Piston Spring Waved Snap Ring

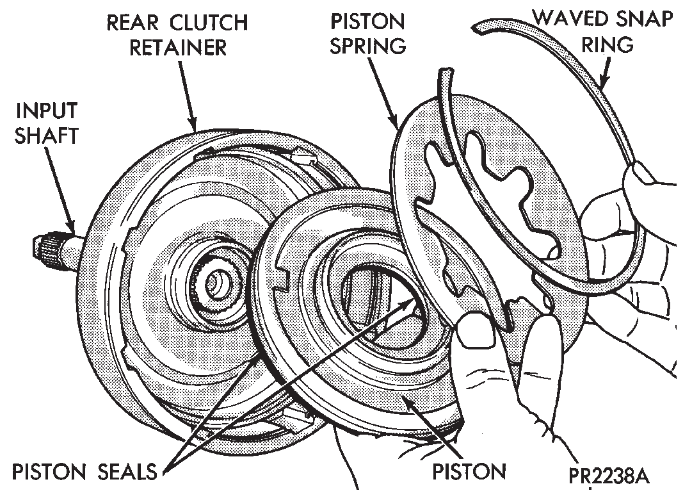

Fig. 69 Rear Clutch Piston and Piston Spring

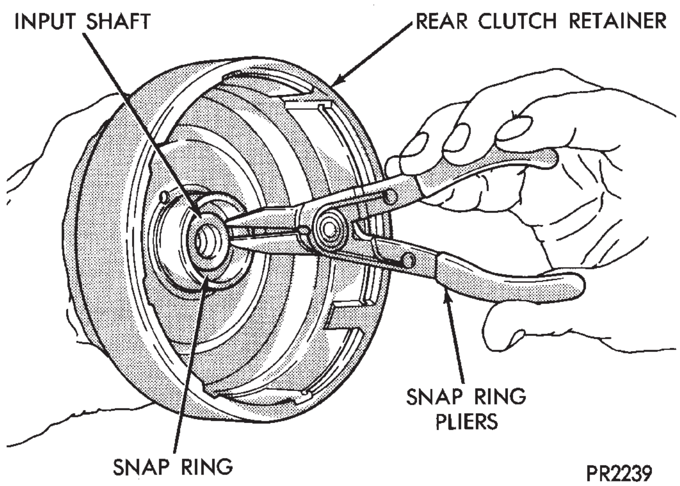

Fig. 70 Remove or Install Input Shaft Snap Ring

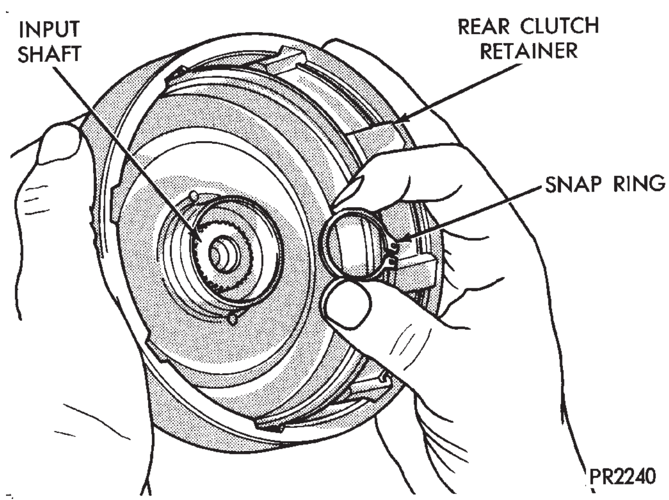

Fig. 71 Input Shaft Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

MEASURING PLATE CLEARANCE

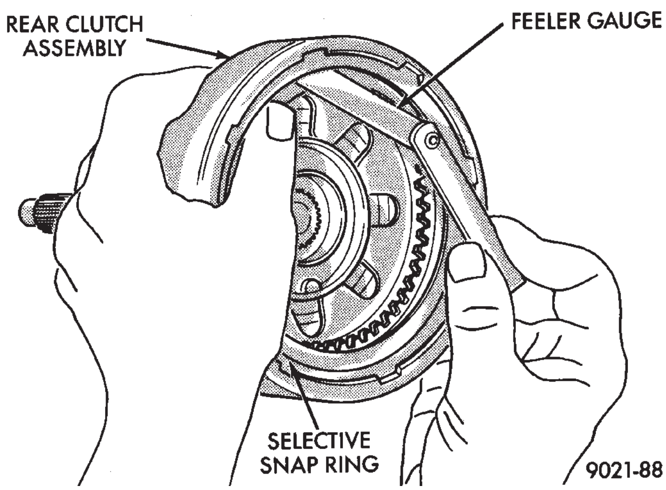

Fig. 72 Measuring Rear Clutch Plate Clearance

FRONT PLANETARY & ANNULUS GEAR-RECONDITION

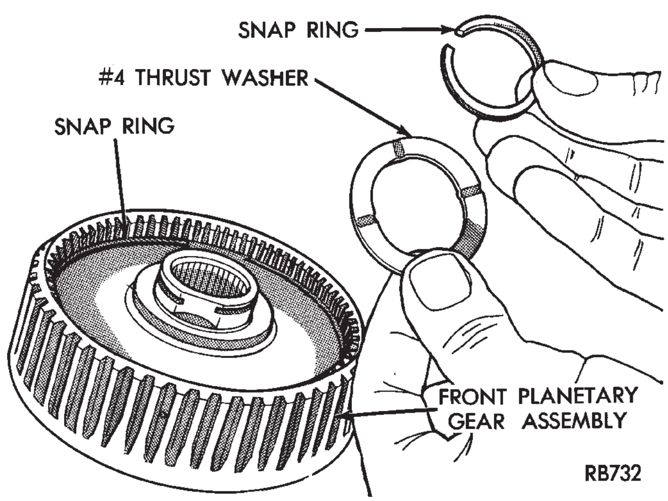

Fig. 73 Front Planetary Gear Snap Ring and No. 4 Thrust Washer (Always Install a New Snap Ring)

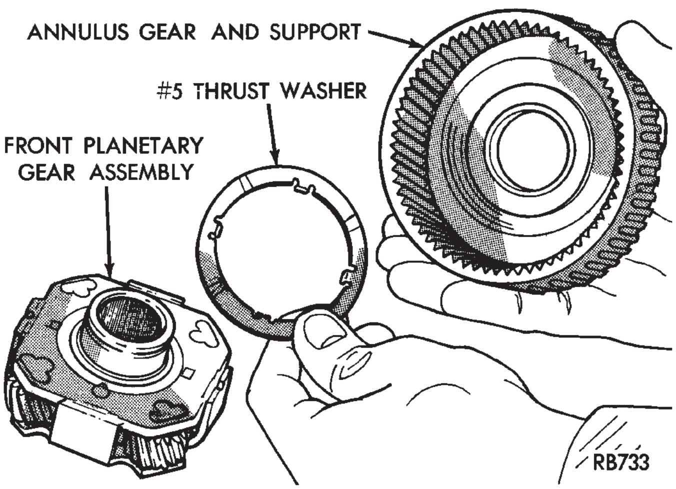

Fig. 74 Front Planetary Gear

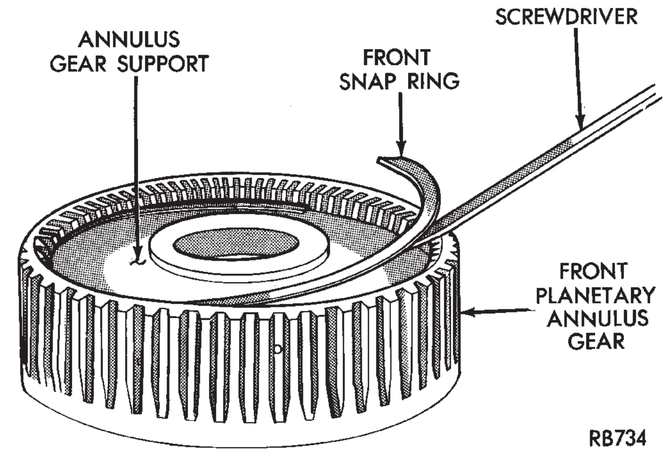

Fig. 75 Annulus Gear Support Front Snap Ring

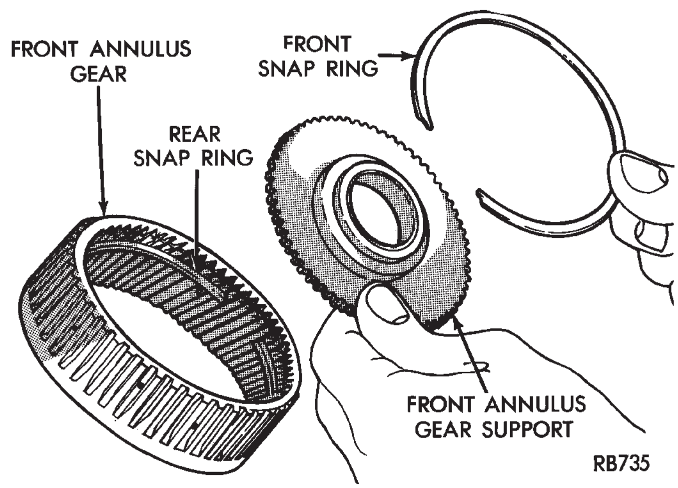

Fig. 76 Front Annulus Gear Support and Snap Ring

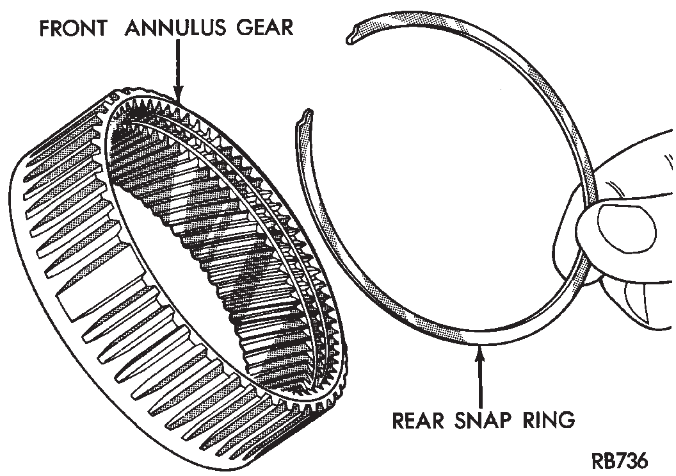

Fig. 77 Front Annulus Gear Support Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

LOW/REVERSE (REAR) SERVO-RECONDITION

DISASSEMBLY

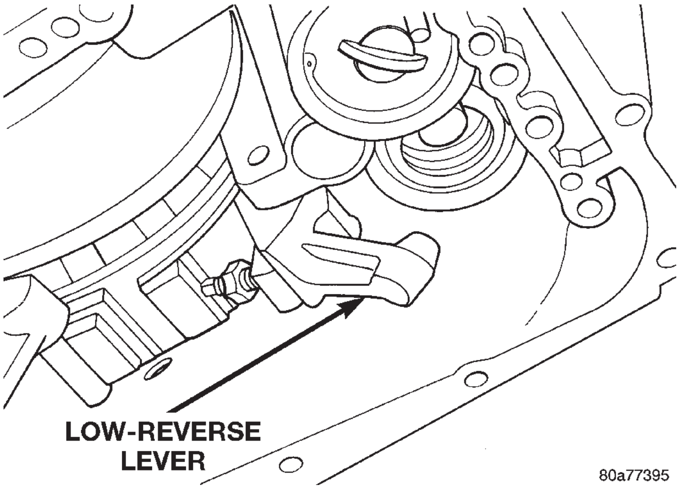

Fig. 78 Low/Reverse Lever

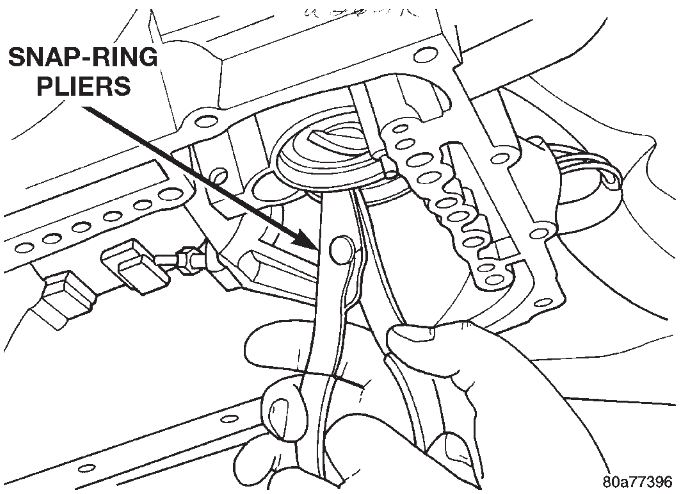

Fig. 79 Low/Reverse Servo Snap Ring

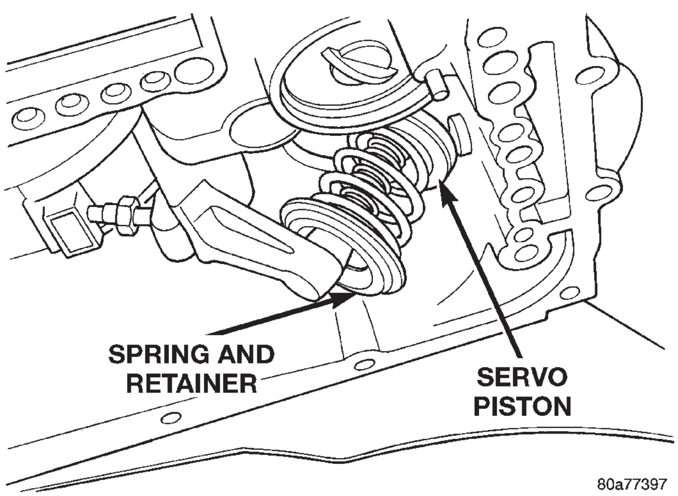

Fig. 80 Remove Retainer, Spring and Servo

ASSEMBLY

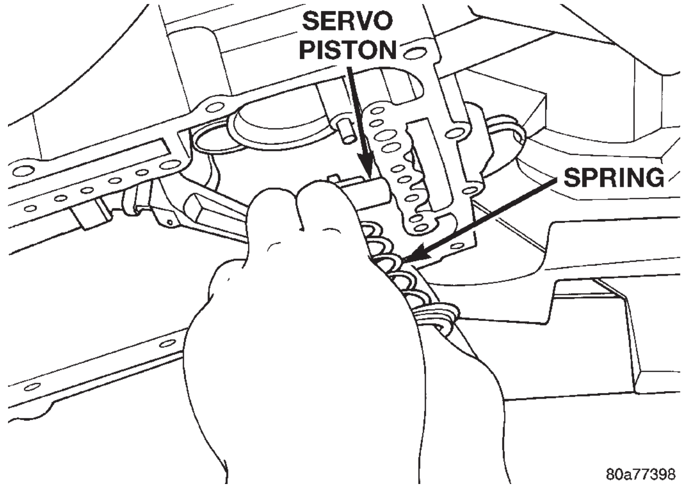

Fig. 81 Low/Reverse Servo Assembly

To assemble, reverse the above procedure.

ACCUMULATOR-RECONDITION

DISASSEMBLY

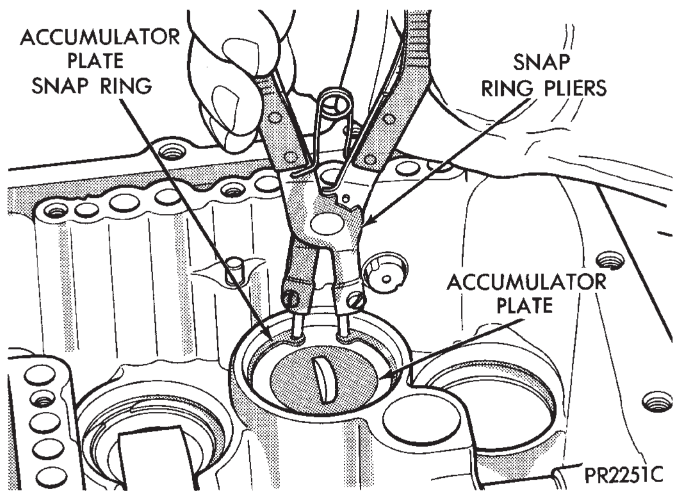

Fig. 82 Accumulator Snap Ring

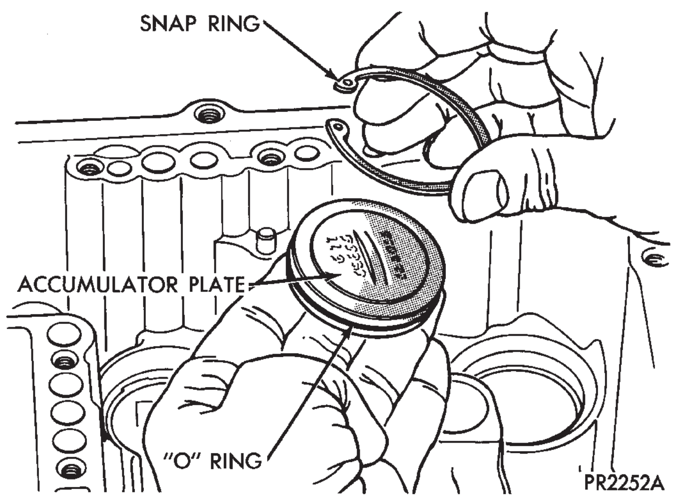

Fig. 83 Accumulator Plate and Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

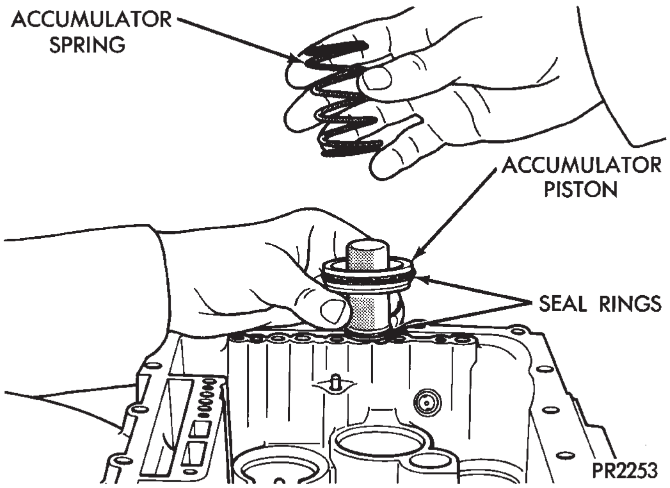

Fig. 84 Accumulator Spring and Piston

ASSEMBLY

To assemble, reverse the above procedure.

KICKDOWN SERVO (CONTROLLED LOAD)-RECONDITION

DISASSEMBLY

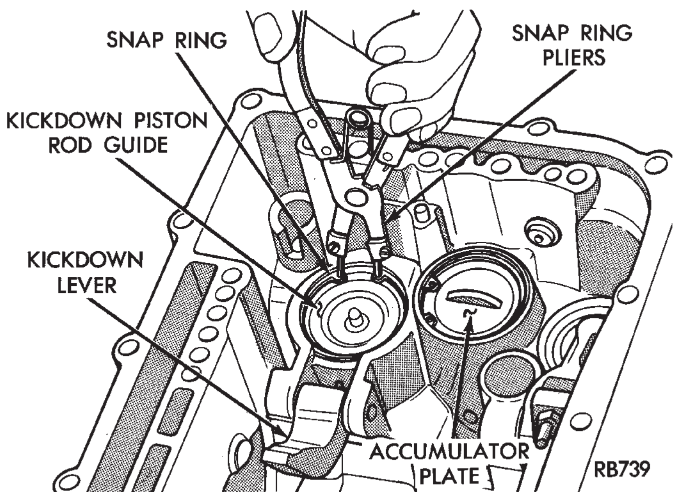

Fig. 85 Kickdown Servo Snap Ring

ASSEMBLY

To assemble, reverse the above procedure.

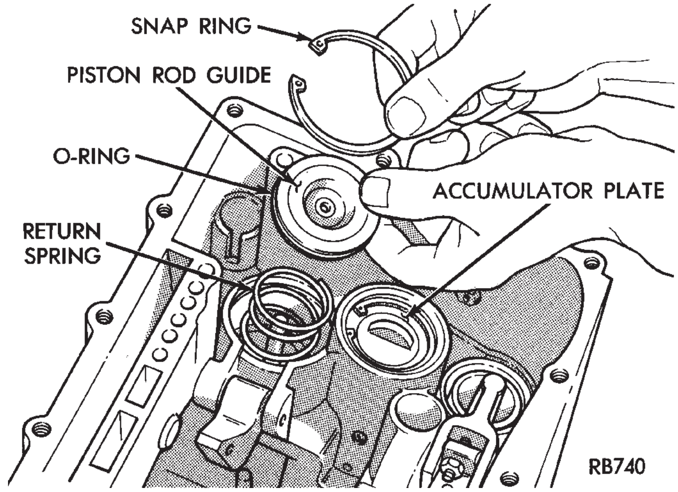

Fig. 86 Kickdown Servo Rod Guide and Snap Ring

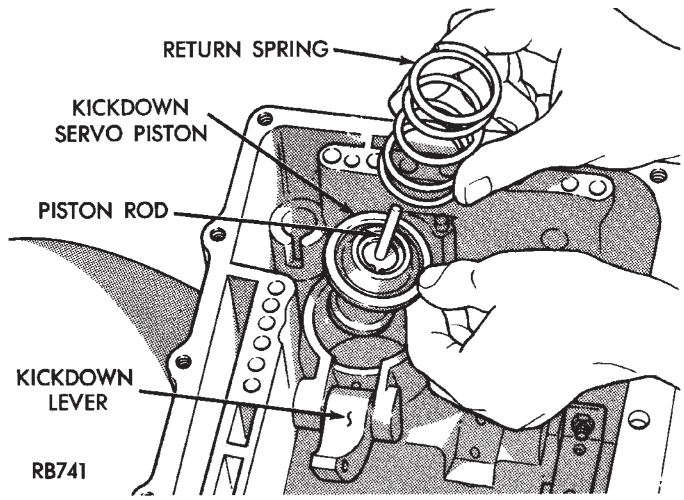

Fig. 87 Kickdown Piston Return Spring and Piston

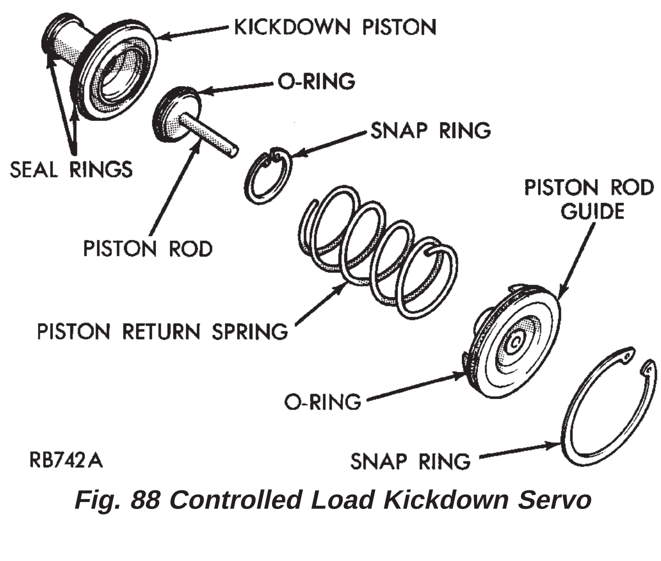

Fig. 88 Controlled Load Kickdown Servo

DISASSEMBLY AND ASSEMBLY (Continued)

TRANSFER SHAFT REPAIR

DISASSEMBLY

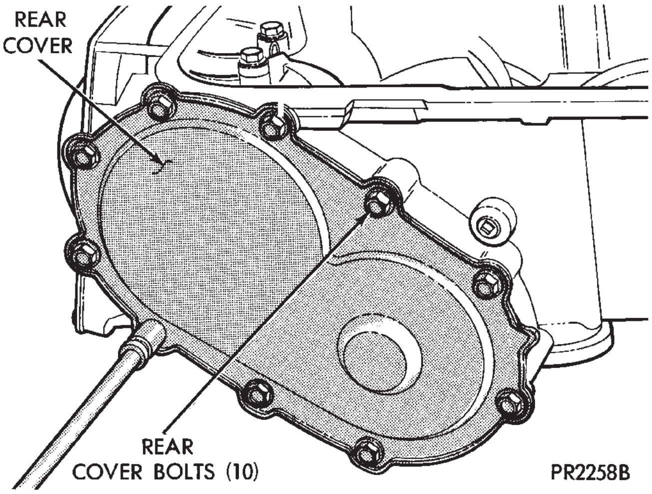

Fig. 89 Rear Cover Bolts

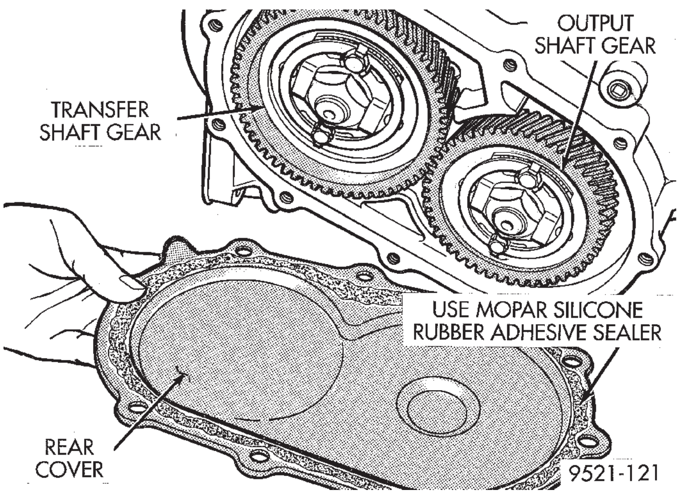

Fig. 90 Remove or Install Rear Cover

NOTE: Remove old sealant before applying new sealant. Use Mopar® RTV sealant or equivalent when installing cover.

NOTE: Remove or install both governor valves and governor body.

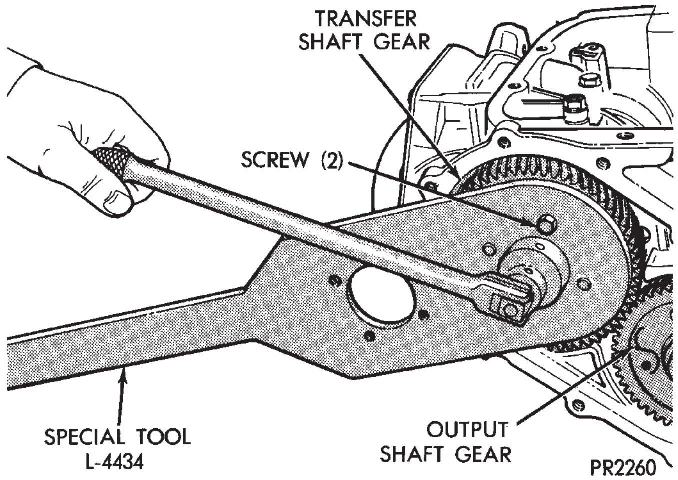

Fig. 91 Remove Transfer Shaft Gear Retaining Nut

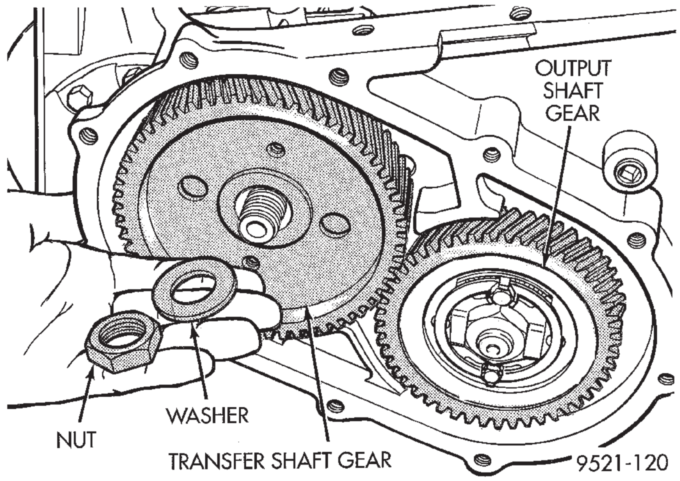

Fig. 92 Transfer Shaft Gear Nut and Washer

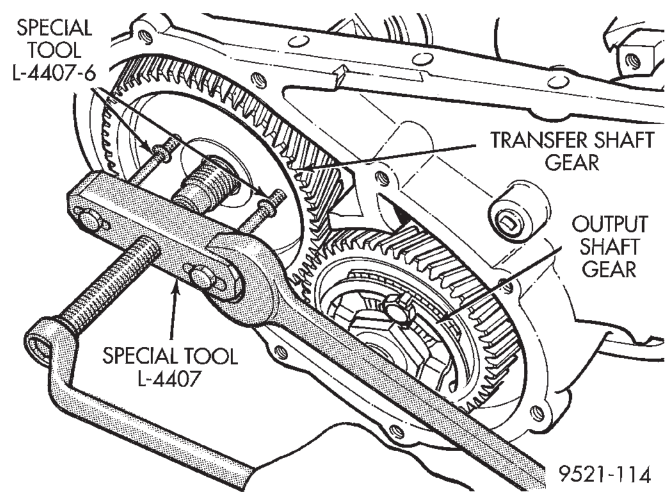

Fig. 93 Remove Transfer Shaft Gear

DISASSEMBLY AND ASSEMBLY (Continued)

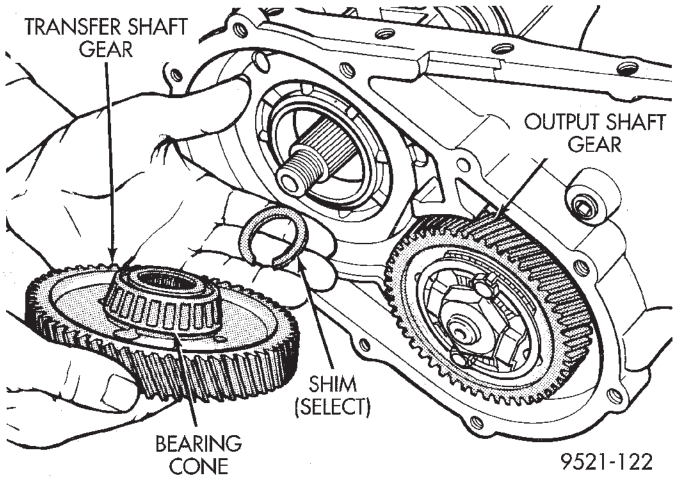

Fig. 94 Transfer Shaft Gear and (Select) Shim

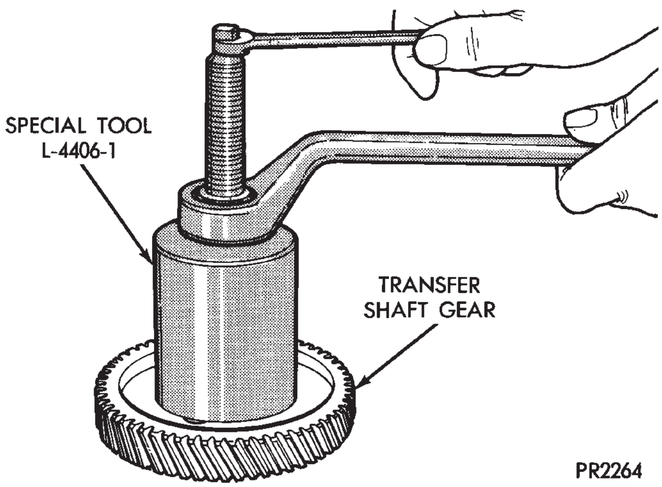

Fig. 95 Using Tool L-4406-1 with Adapter L-4406-3, Remove Transfer Shaft Gear Bearing Cone

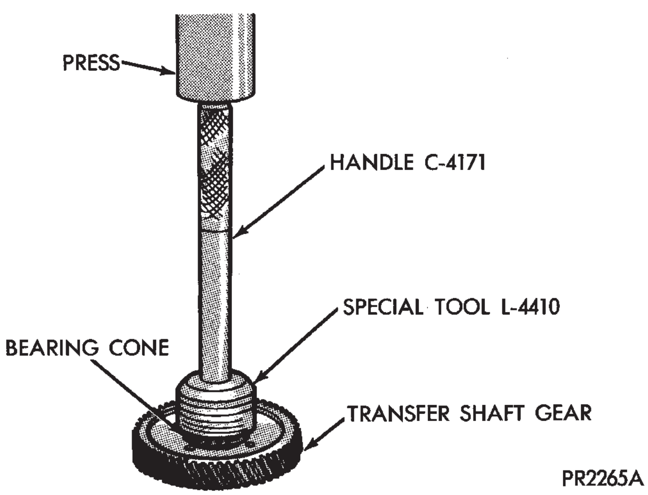

Fig. 96 Install Transfer Shaft Gear Bearing Cone

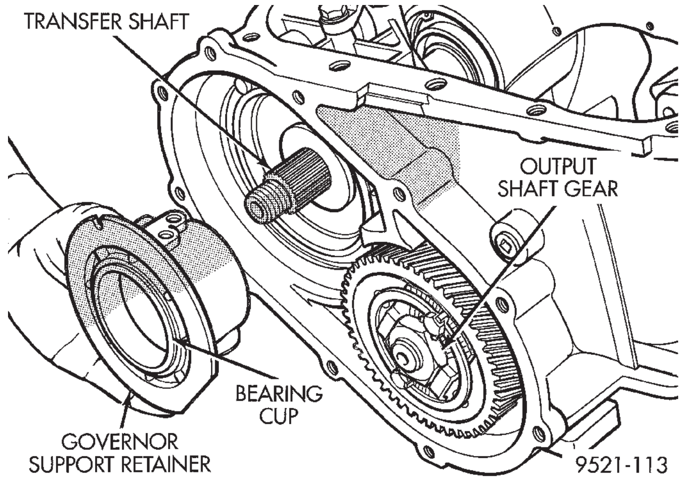

Fig. 97 Governor Support Retainer

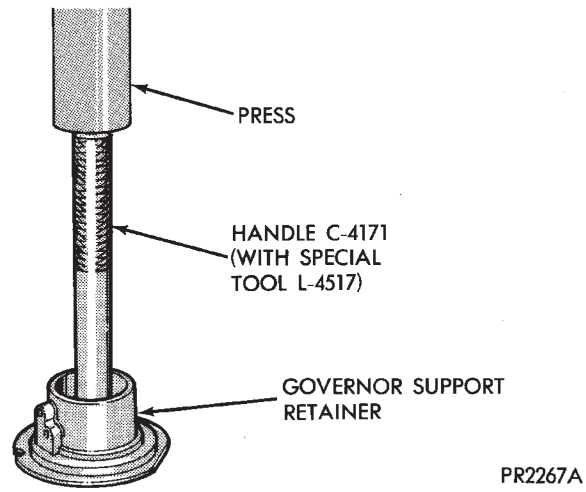

Fig. 98 Remove Governor Support Retainer Bearing Cup

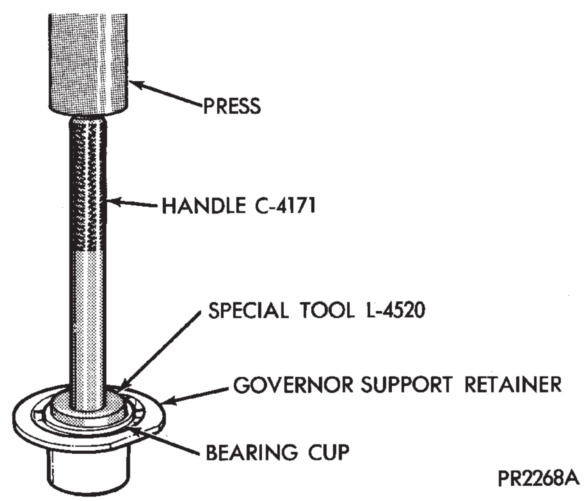

Fig. 99 Install Governor Support Retainer Bearing Cup

DISASSEMBLY AND ASSEMBLY (Continued)

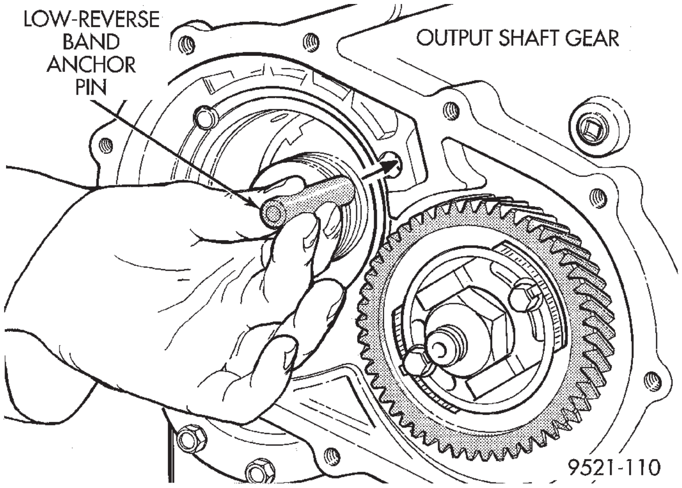

Fig. 100 Low-Reverse Band Anchor Pin

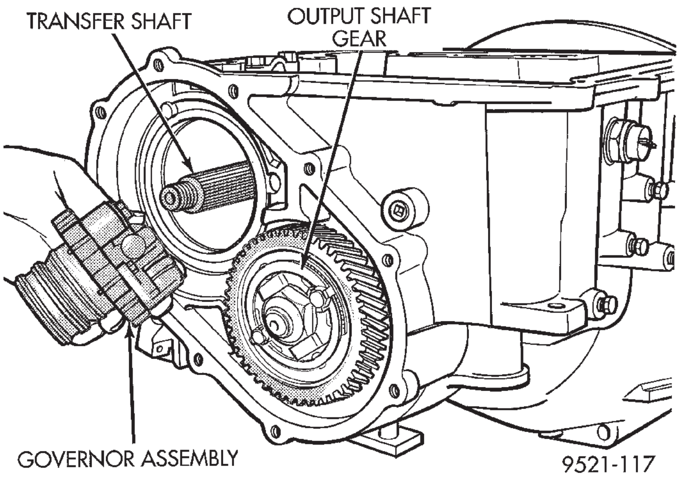

Fig. 101 Governor Assembly

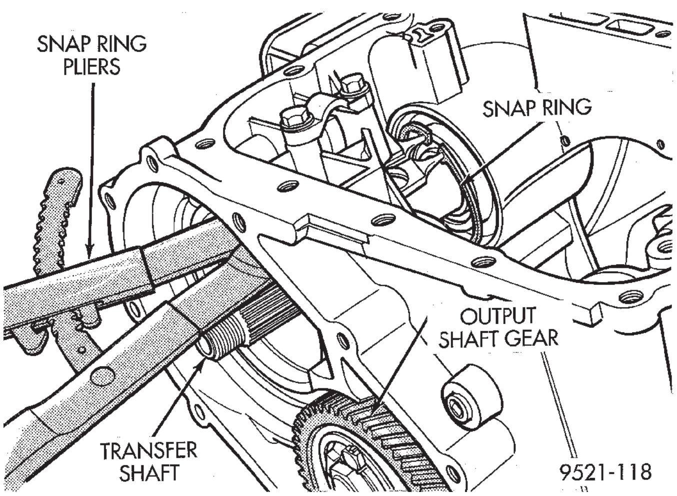

Fig. 102 Transfer Shaft Bearing Snap Ring

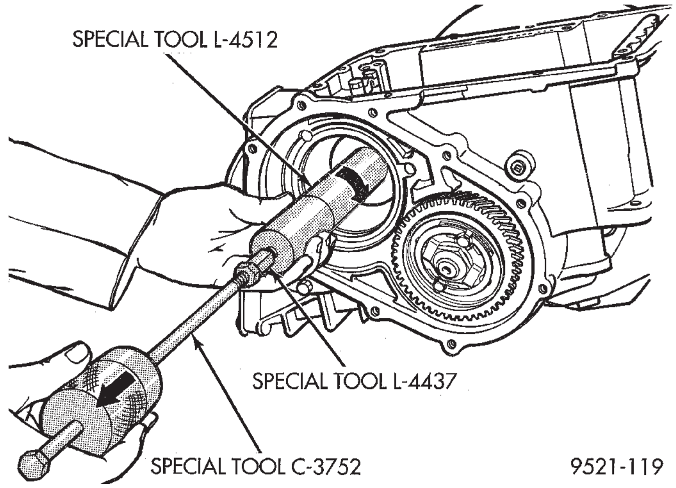

Fig. 103 Remove Transfer Shaft and Bearing Retainer Assembly

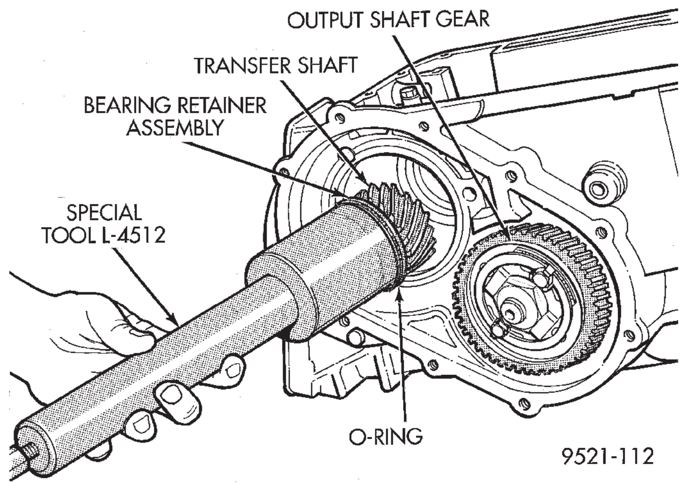

Fig. 104 Remove or Install Transfer Shaft and Bearing Retainer Assembly Using Tool L-4512

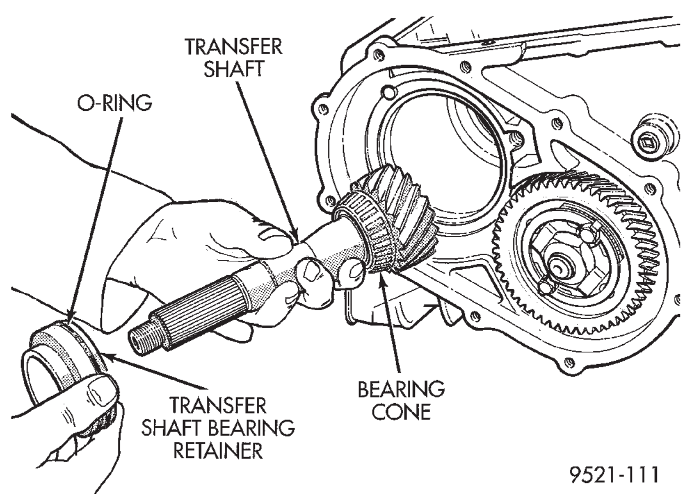

Fig. 105 Transfer Shaft and Bearing Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

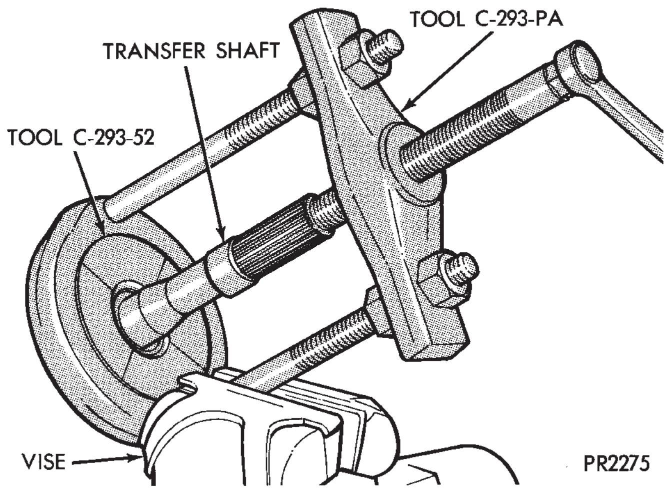

Fig. 106 Remove Transfer Shaft Bearing Cone

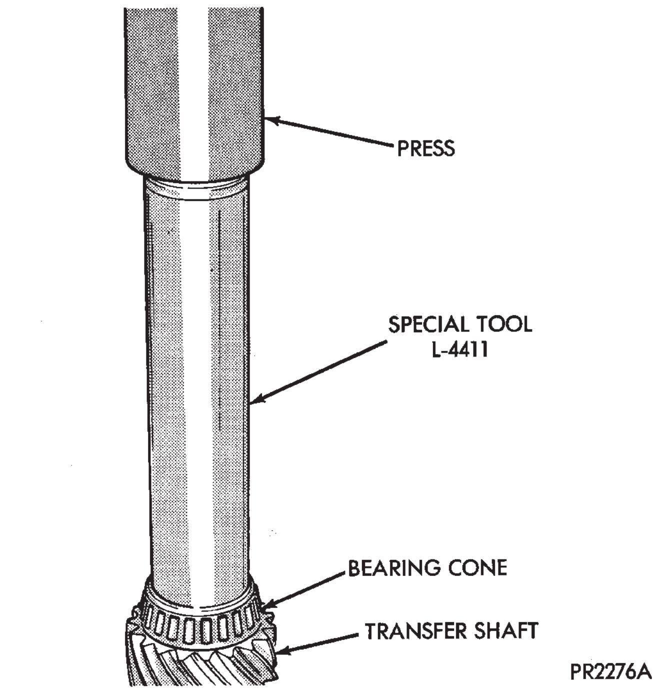

Fig. 107 Install Transfer Shaft Bearing Cone

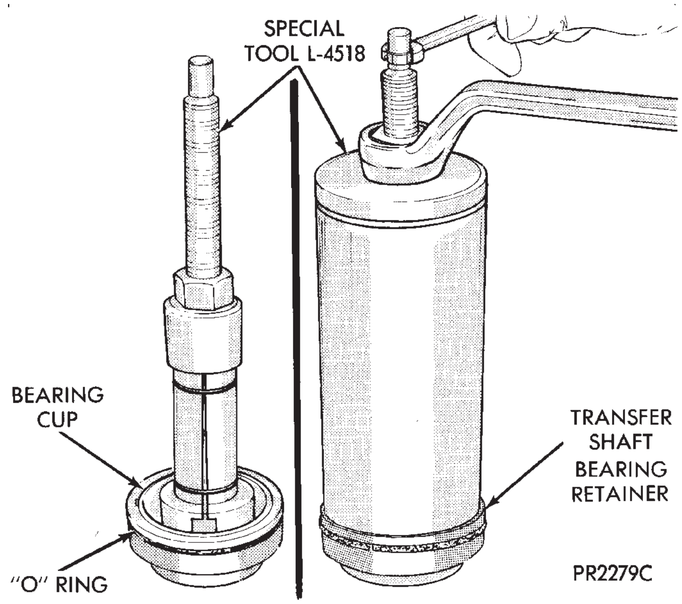

Fig. 108 Remove Transfer Shaft Bearing Cup

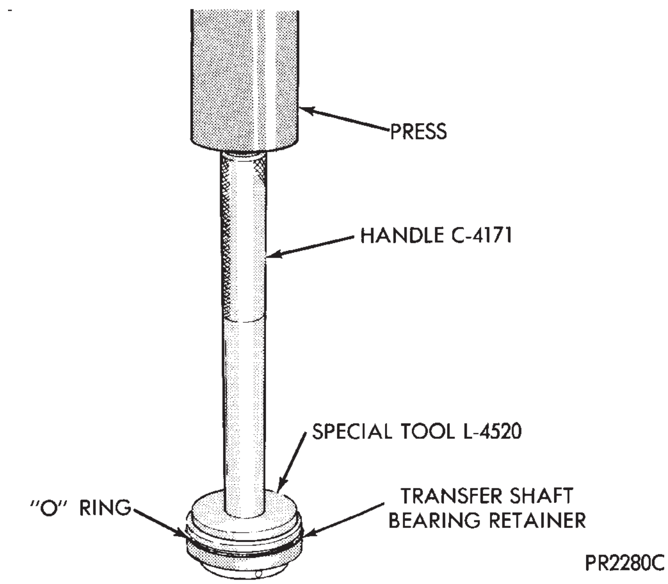

Fig. 109 Install Transfer Shaft Bearing Cup

DISASSEMBLY AND ASSEMBLY (Continued)

DETERMINING SHIM THICKNESS

Shim thickness need only be determined if any of the following parts are replaced:

- Transaxle case
- Transfer shaft
- Transfer shaft gear
- Transfer shaft bearings
- Governor support retainer
- Transfer shaft bearing retainer
- Retainer snap ring
- Governor support

Refer to Bearing Adjustment Procedure in rear of this section to determine proper shim thickness.

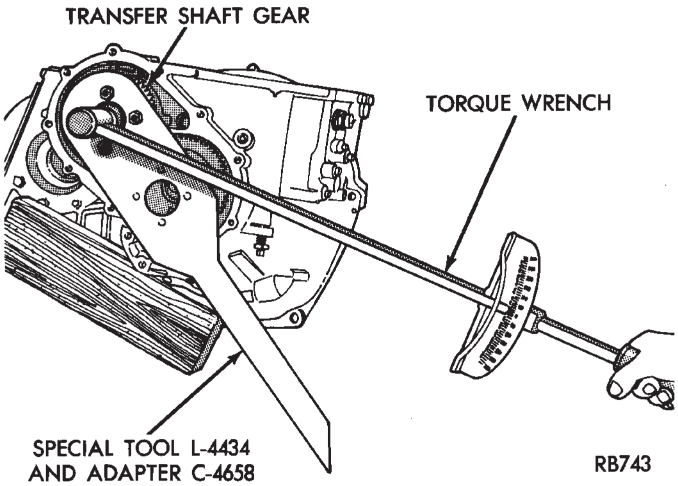

Fig. 110 Tighten Transfer Shaft Gear Retaining Nut to 271 N·m (200 ft. lbs.)

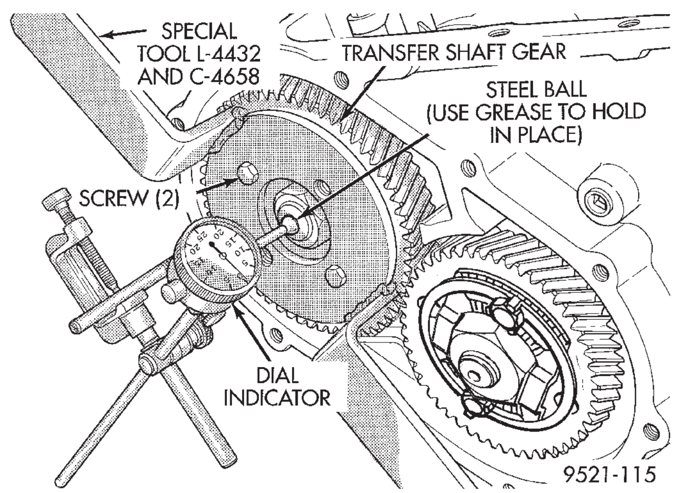

Fig. 111 Checking Transfer Shaft End Play

ASSEMBLY

To install transfer shaft, reverse the above procedure.

PARKING PAWL

DISASSEMBLY

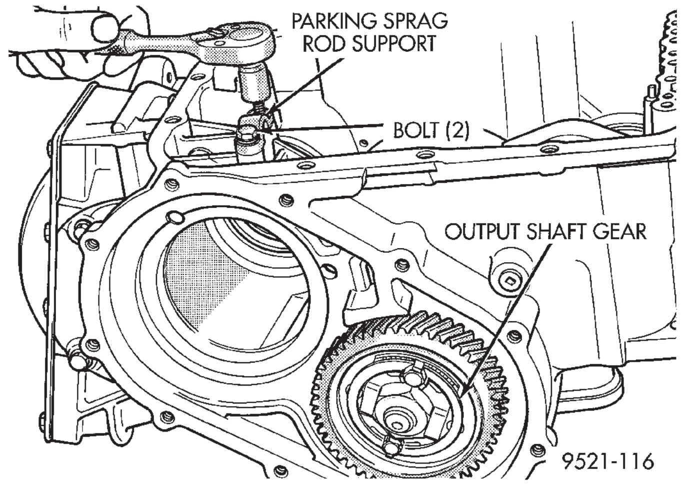

Fig. 112 Parking Sprag Rod Support

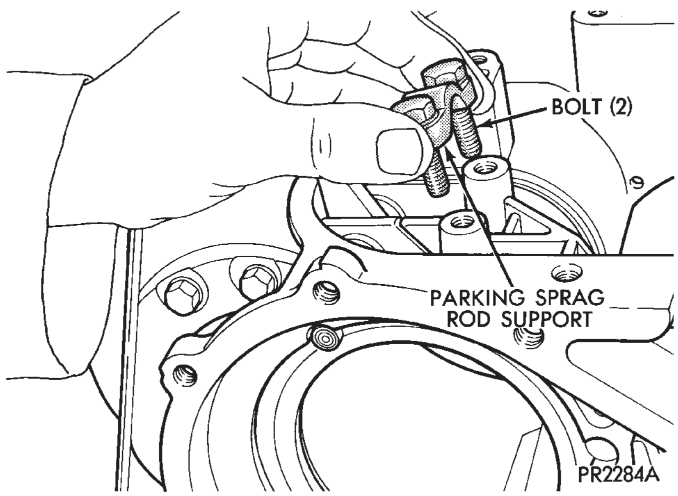

Fig. 113 Support and Bolts

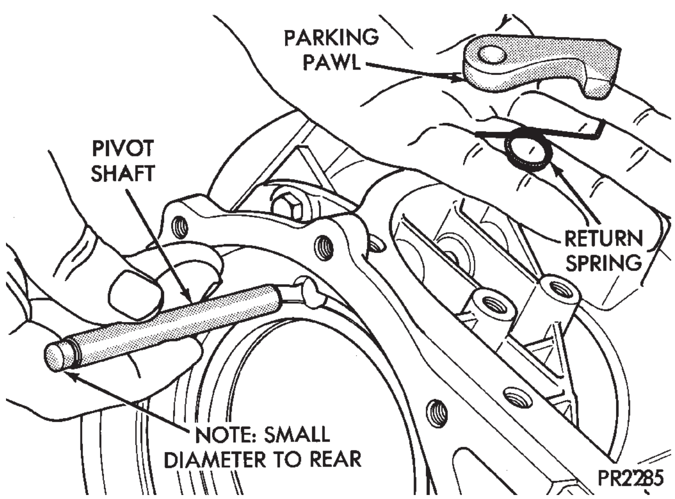

Fig. 114 Parking Pawl, Return Spring, and Pivot Shaft

ASSEMBLY

To install, reverse the above procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

OUTPUT SHAFT REPAIR

NOTE: Transfer shaft should be removed for repair of output shaft. Planetary gear sets must be removed to accurately check output shaft bearing turning torque.

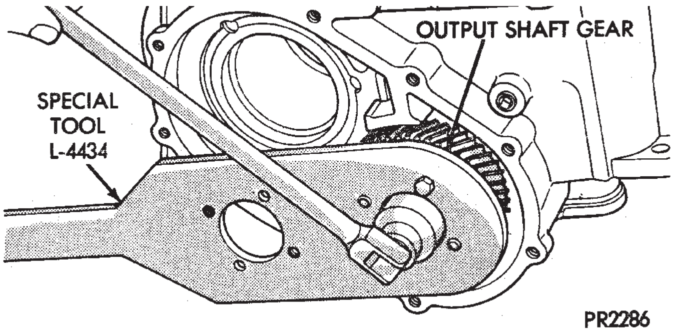

Fig. 115 Remove Output Shaft Retaining Nut and Washer

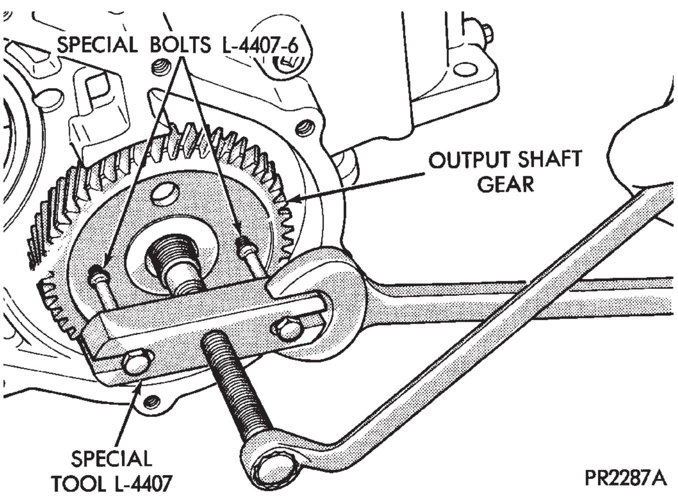

Fig. 116 Remove Output Shaft Gear

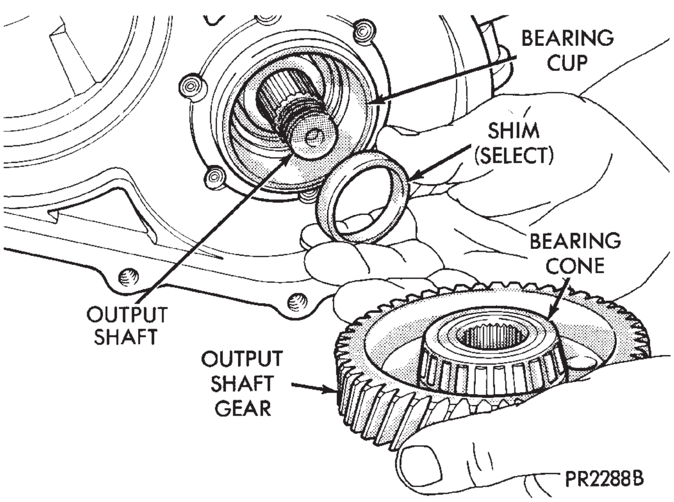

Fig. 117 Output Shaft Gear and (Select) Shim

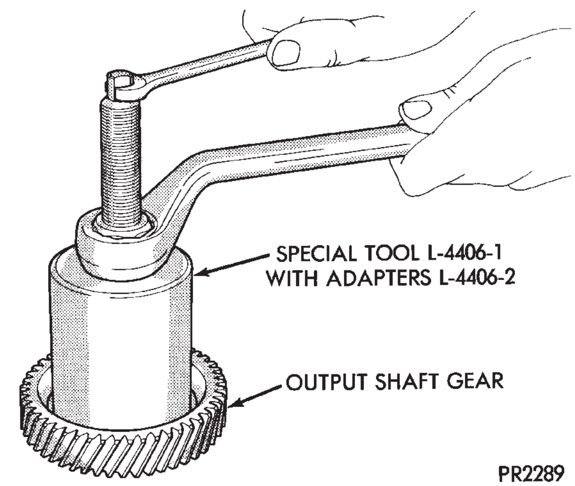

Fig. 118 Remove Output Shaft Gear Bearing Cone

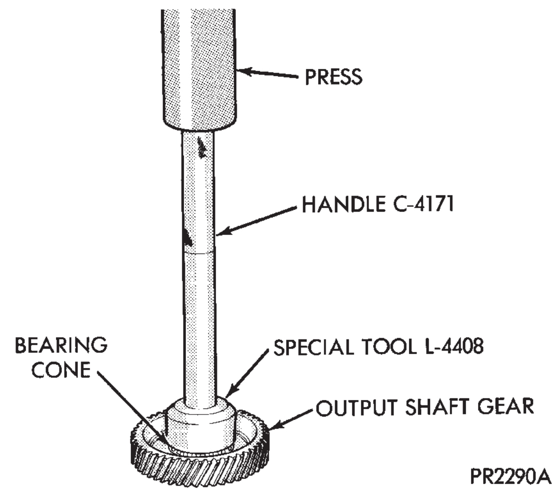

Fig. 119 Install Output Shaft Gear Bearing Cone

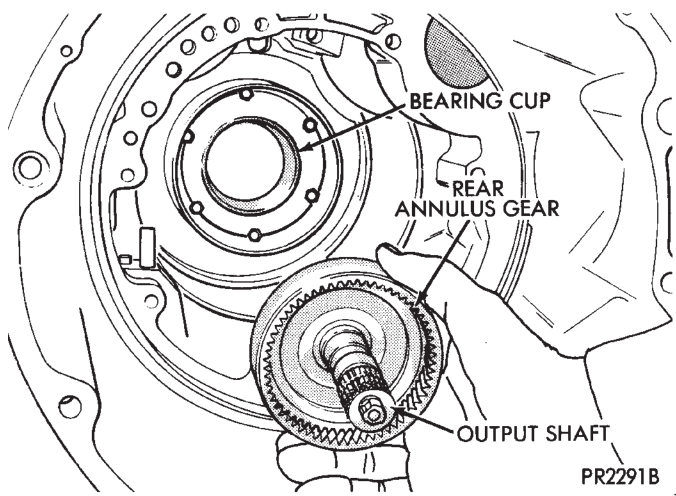

Fig. 120 Remove Output Shaft and Rear Annulus Gear Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

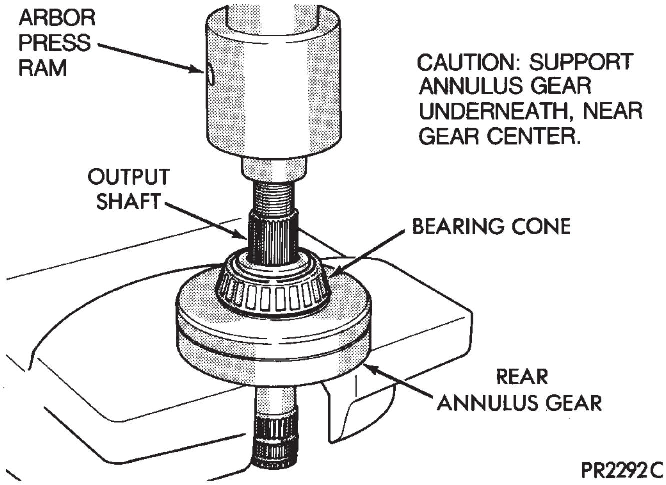

Fig. 121 Remove Output Shaft

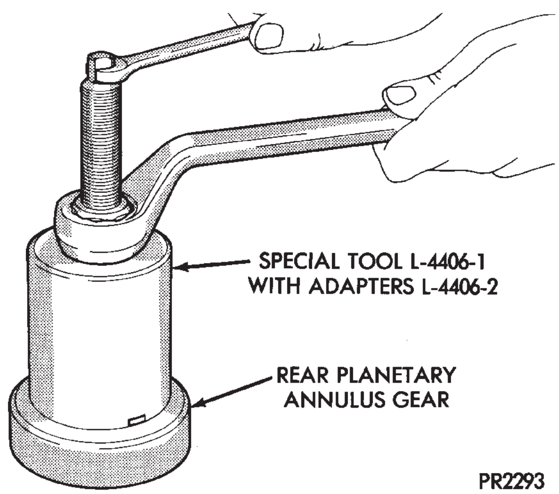

Fig. 122 Remove Rear Planetary Annulus Gear Bearing Cone

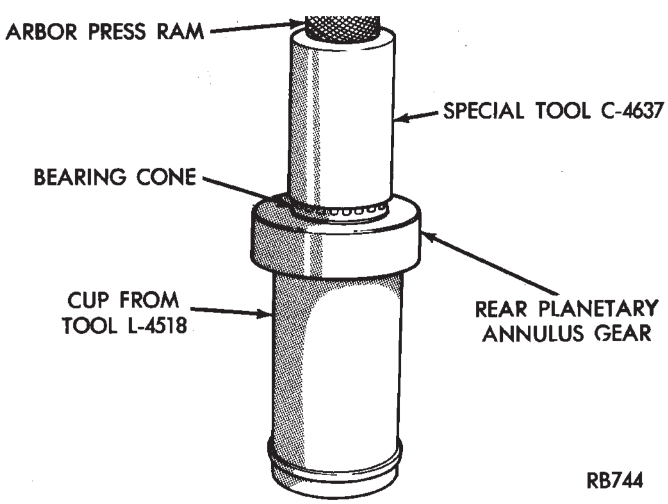

Fig. 123 Install Rear Planetary Annulus Gear Bearing Cone

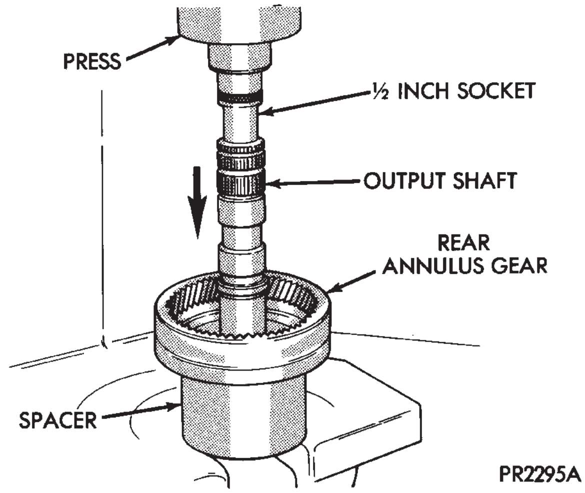

Fig. 124 Install Output Shaft into Rear Planetary Annulus Gear

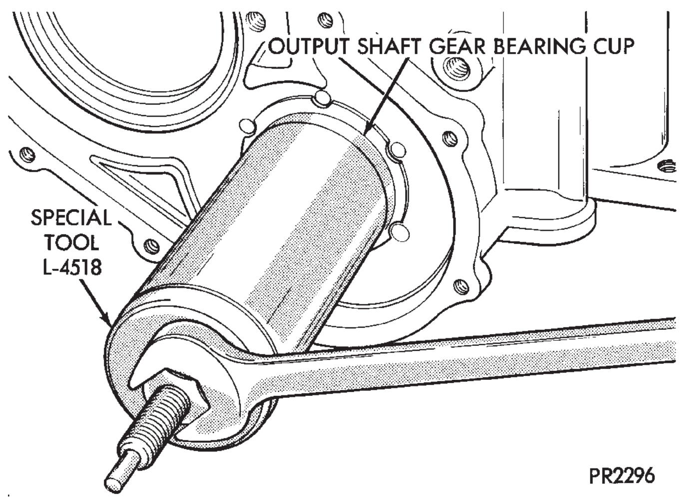

Fig. 125 Remove Output Shaft Gear Bearing Cup

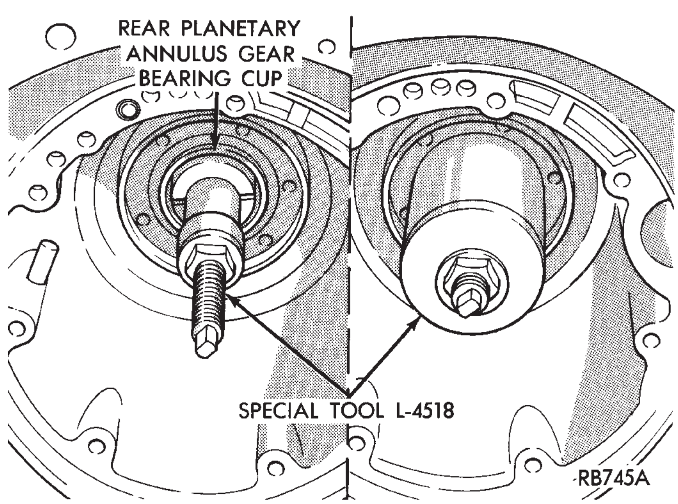

Fig. 126 Remove Rear Planetary Annulus Gear Bearing Cup

DISASSEMBLY AND ASSEMBLY (Continued)

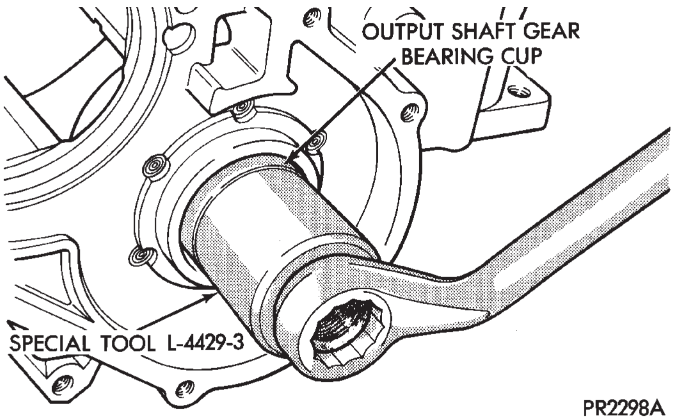

Fig. 127 Install Output Shaft Gear Bearing Cup

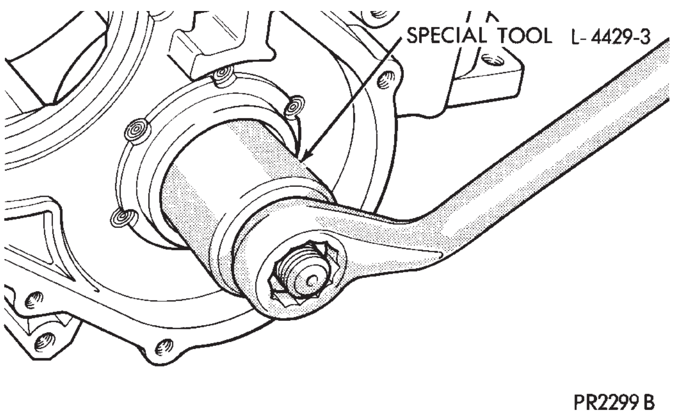

Fig. 128 Install Rear Planetary Annulus Gear Bearing Cup

DETERMINING SHIM THICKNESS

Shim thickness need only be determined if any of the following parts are replaced:

- Transaxle case
- Output shaft
- Rear planetary annulus gear
- Output shaft gear
- Rear annulus and output shaft gear bearing cones
- Overrunning clutch race cups

Refer to Bearing Adjustment Procedure at the rear of this section, to determine proper shim thickness. **Check output shaft bearings turning torque, using an inch-pound torque wrench. If turning torque is 3 to 8 inch-pounds, the proper shim has been installed.**

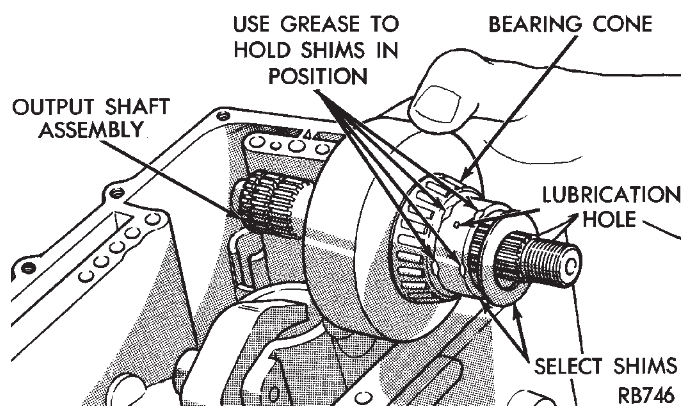

Fig. 129 Install Output Shaft Assembly

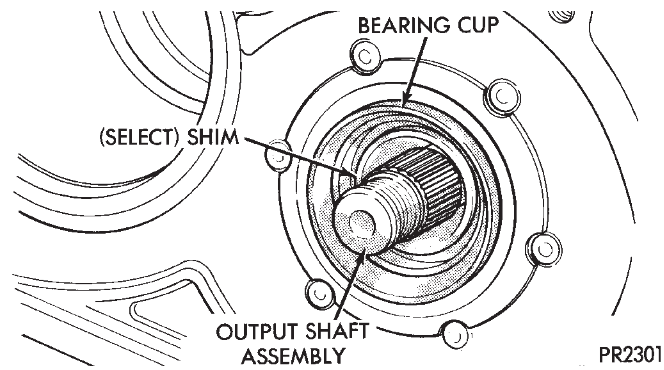

Fig. 130 Output Shaft and (Select) Shims in Position

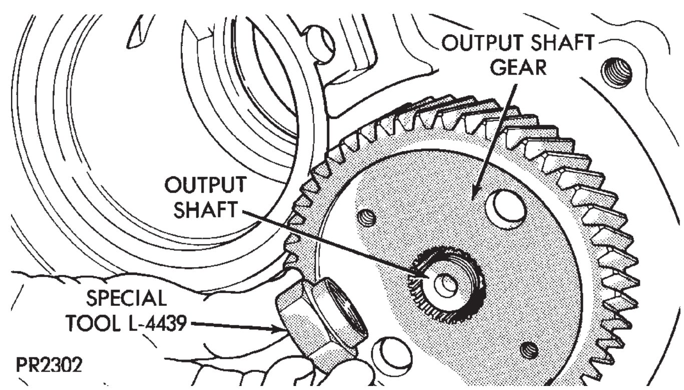

Fig. 131 Start Output Shaft Gear onto Output Shaft

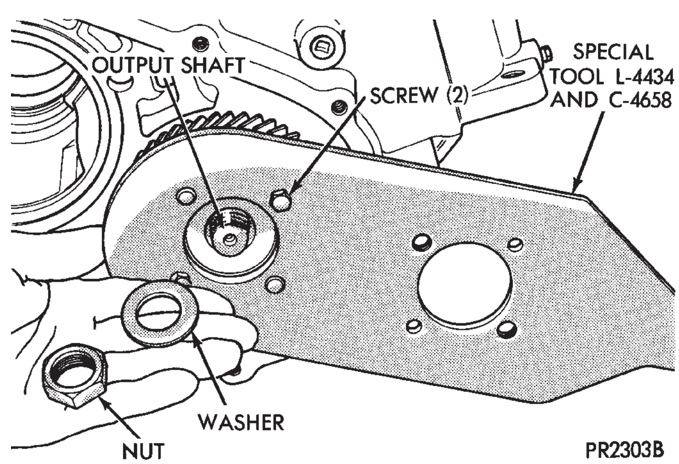

Fig. 132 Holding Output Shaft Gear

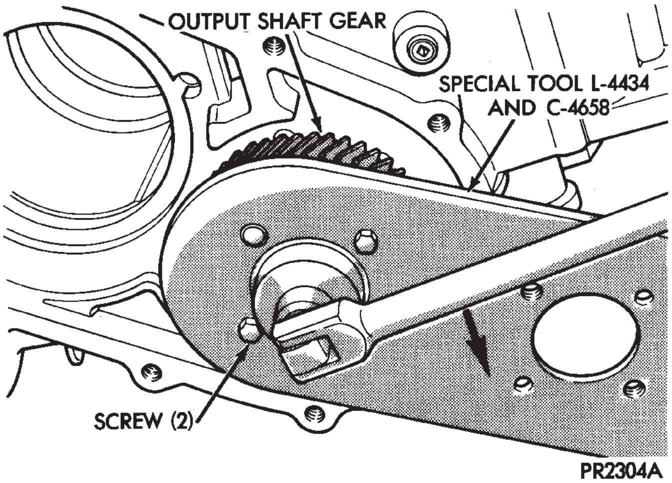

Fig. 133 Tighten Output Shaft Retaining Nut to 271 N·m (200 ft. lbs.)

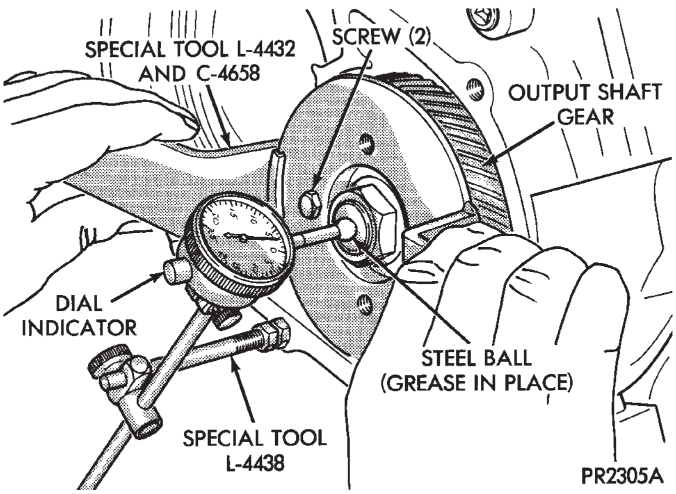

Fig. 134 Checking Output Shaft End Play

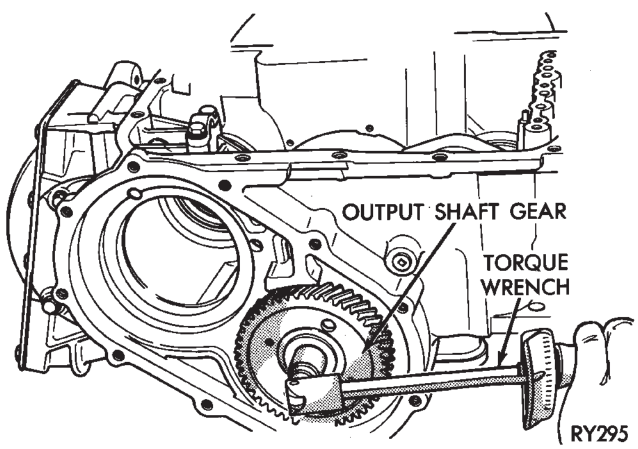

Fig. 135 Checking Bearings Turning Torque

DIFFERENTIAL REPAIR

NOTE: The transfer shaft should be removed for differential repair and bearing turning torque checking.

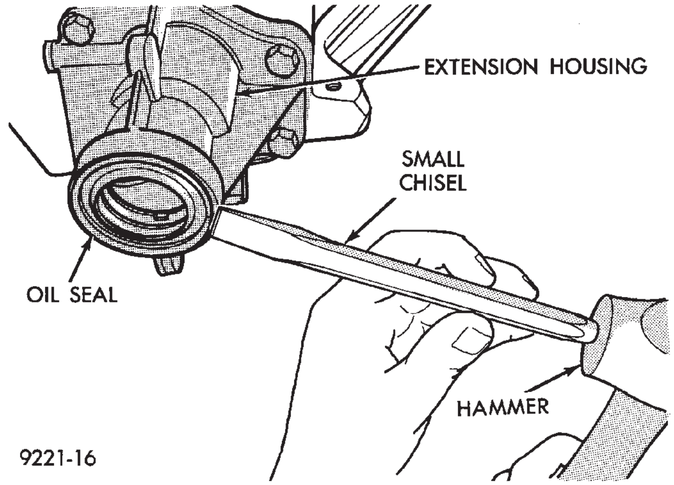

Fig. 136 Remove Extension Seal

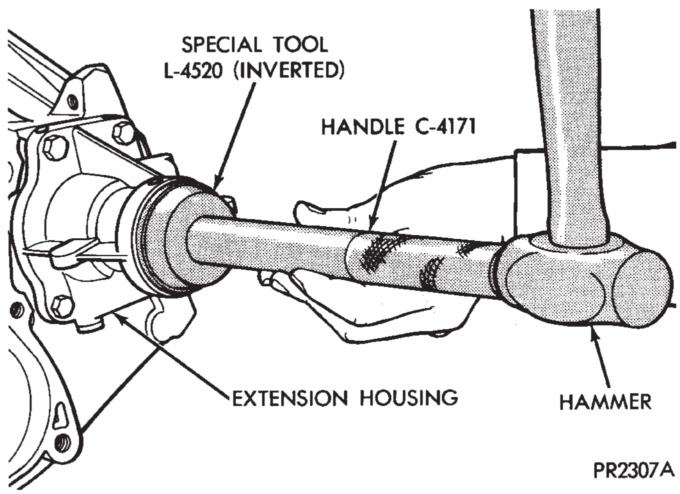

Fig. 137 Install New Seal into Extension

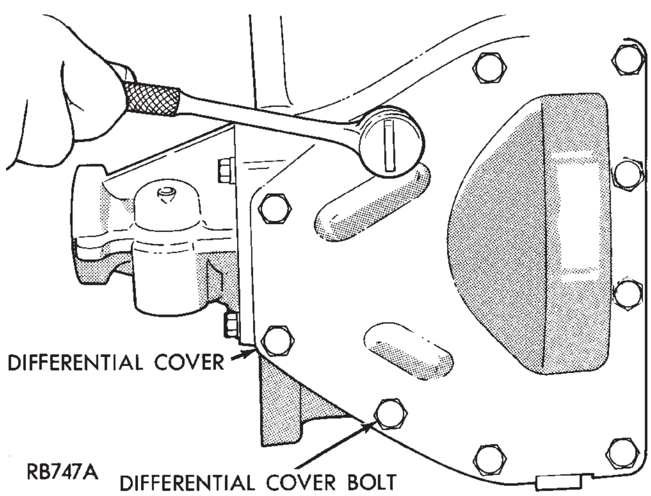

Fig. 138 Differential Cover Bolts

DISASSEMBLY AND ASSEMBLY (Continued)

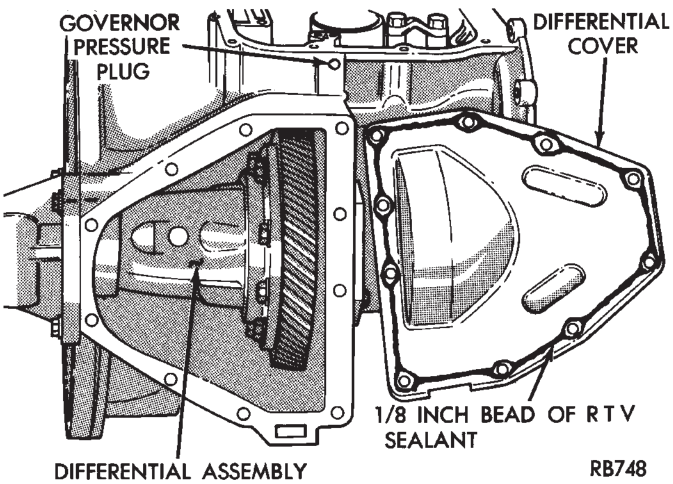

Fig. 139 Remove or Install Differential Cover

NOTE: Use Mopar® RTV sealant, or equivalent, when installing differential cover.

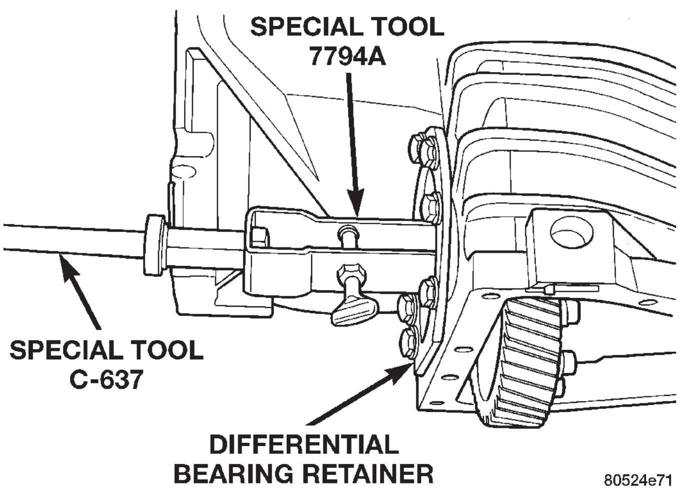

Fig. 140 Remove Bearing Retainer Axle Seal

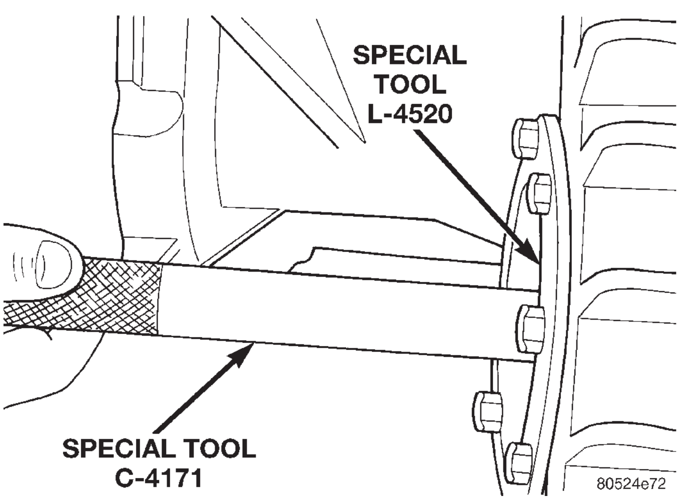

Fig. 141 Install Bearing Retainer Axle Seal

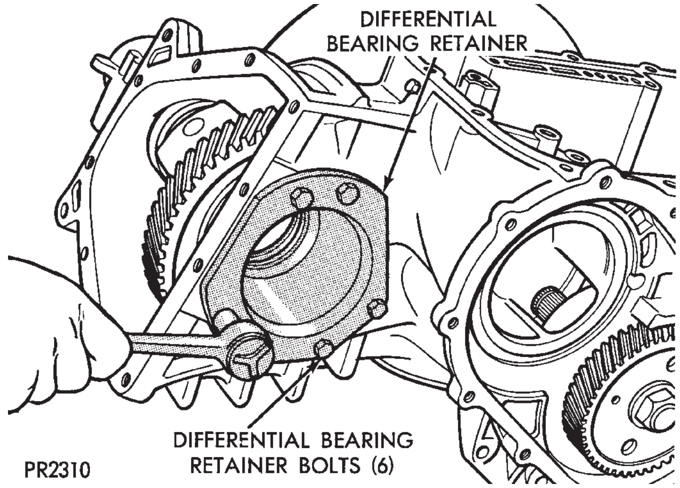

Fig. 142 Differential Bearing Retainer Bolts

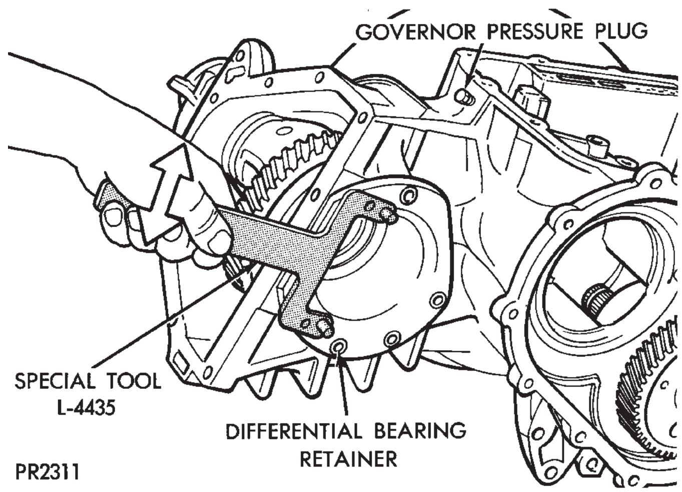

Fig. 143 Remove or Install Bearing Retainer

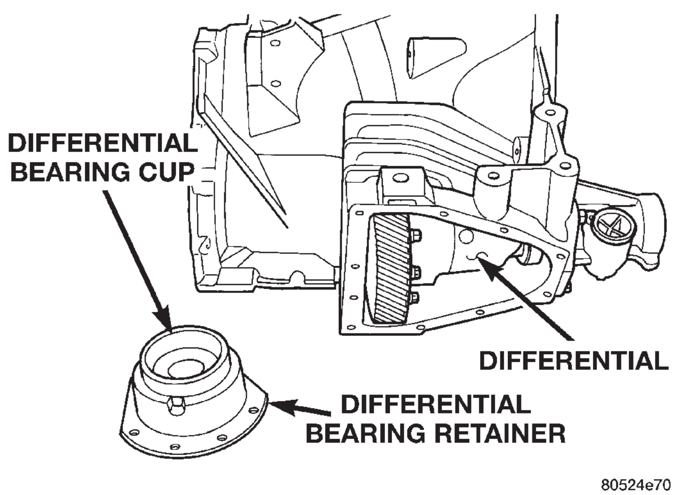

Fig. 144 Differential Bearing Retainer (Typical)

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Use Mopar® RTV sealant, or equivalent, when installing differential bearing retainer.

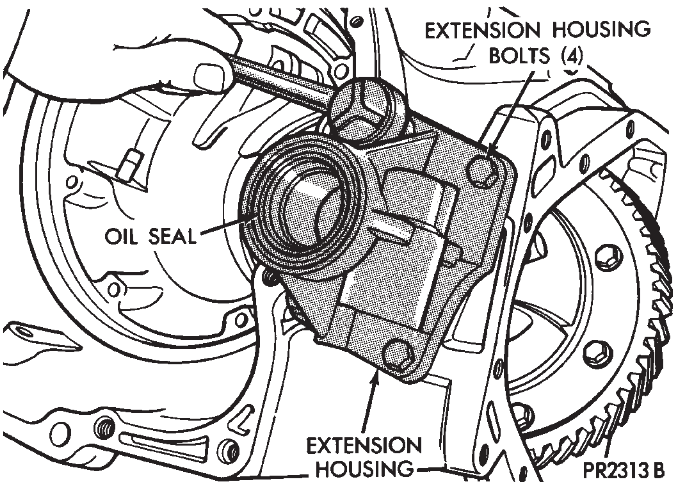

Fig. 145 Extension Bolts

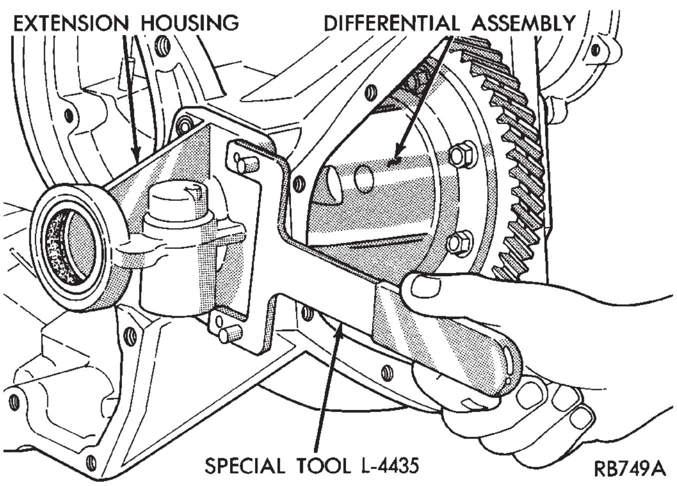

Fig. 146 Remove or Install Extension Housing

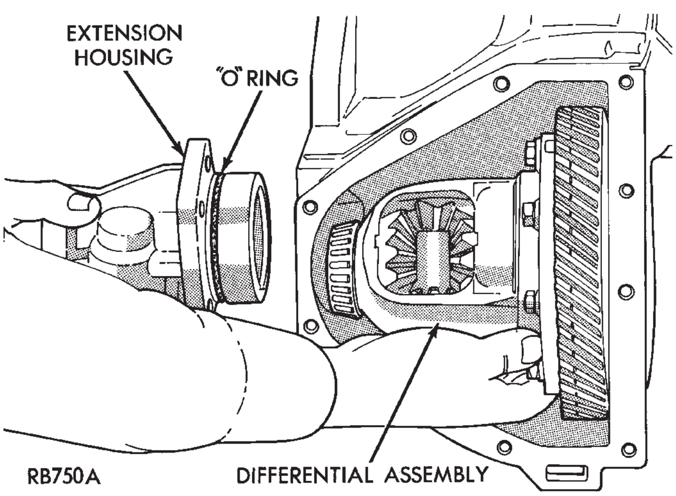

Fig. 147 Differential and Extension

WARNING: HOLD ONTO DIFFERENTIAL ASSEMBLY TO PREVENT IT FROM ROLLING OUT OF HOUSING.

Use Mopar® Silicone Rubber Adhesive Sealant, or equivalent, when installing extension housing.

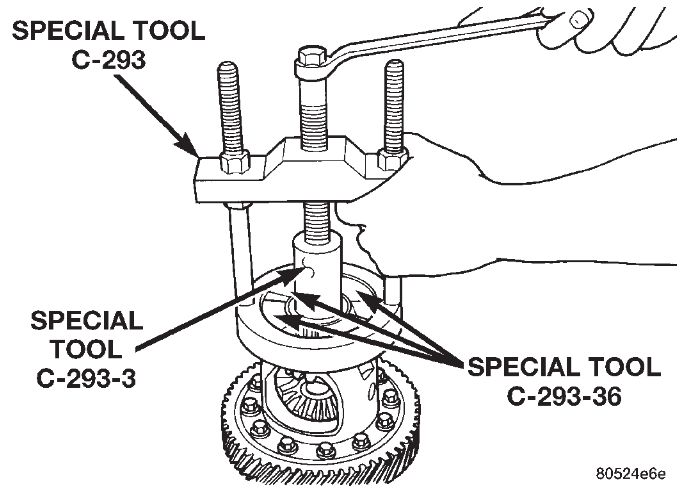

Fig. 148 Remove Differential Bearing Cone (Extension Housing Side)

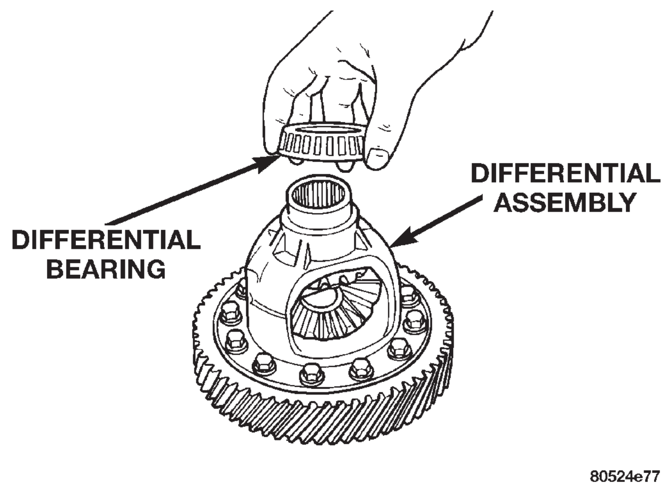

Fig. 149 Position Bearing Cone Onto Differential

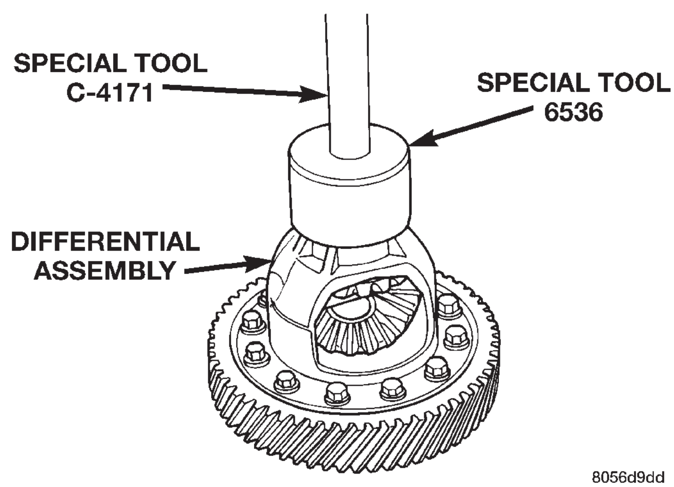

Fig. 150 Install Differential Bearing Cone

DISASSEMBLY AND ASSEMBLY (Continued)

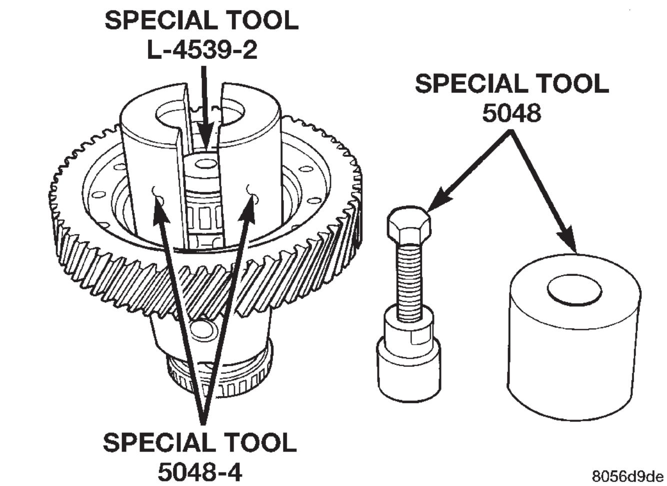

Fig. 151 Position Button and Collets Onto Differential and Bearing (Ring Gear Side)

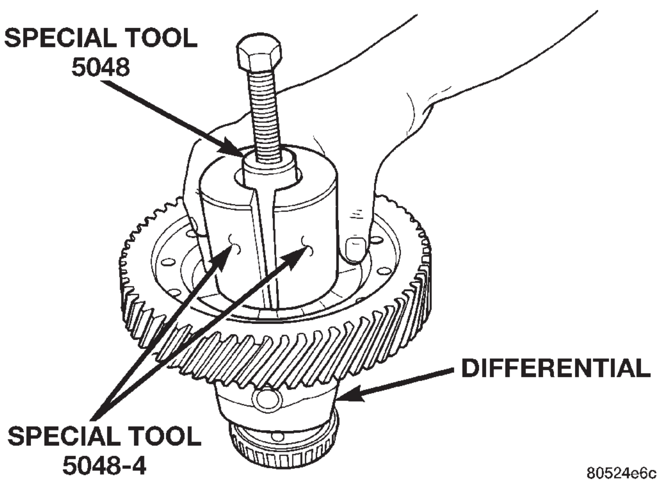

Fig. 152 Position Tool 5048 Over Button and Collets at Differential Bearing

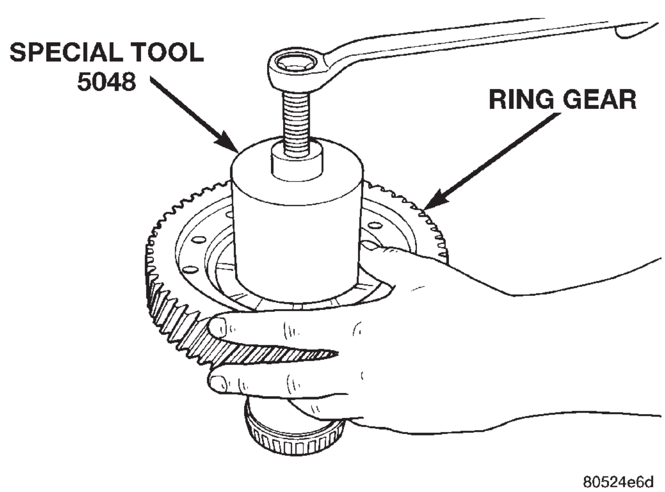

Fig. 153 Remove Differential Bearing Cone

To install the differential bearing cup and cone on the ring gear side, use Special Tool 5052, and Special Tool C-4171.

NOTE: The differential is serviced as an assembly. The only parts that are serviceable within the differential are the differential bearing cups and cones. If any other part fails within the differential, you must replace the differential assembly along with the transfer shaft.

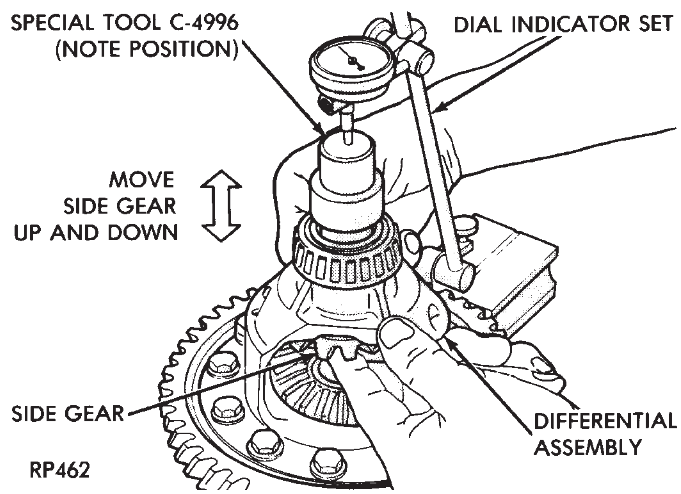

Fig. 154 Checking Side Gear End Play

CAUTION: Side gear end play must be BETWEEN 0.001 to 0.013 inch.

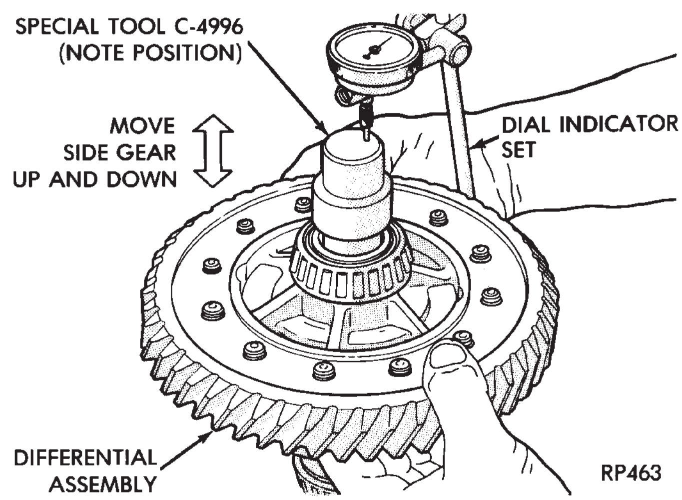

Fig. 155 Checking Side Gear End Play (Typical)

DISASSEMBLY AND ASSEMBLY (Continued)

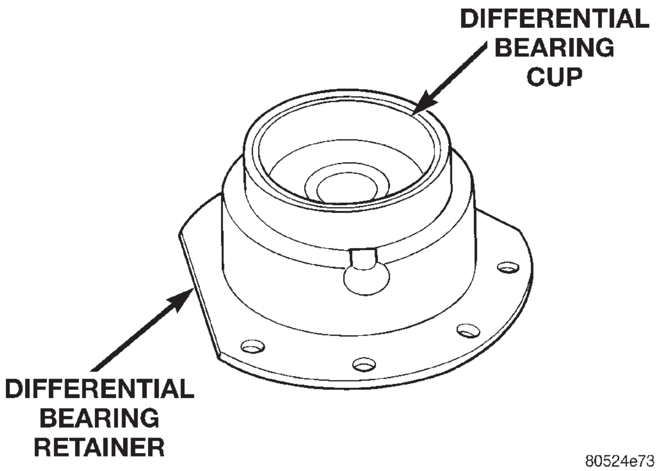

Fig. 156 Differential Bearing Retainer

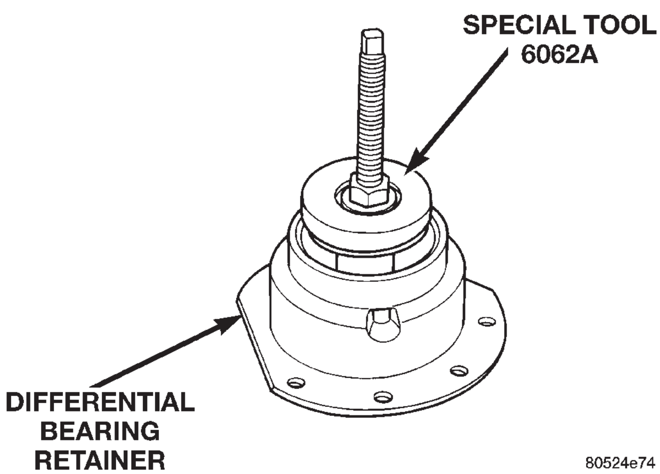

Fig. 157 Position Bearing Cup Remover Tool in Retainer

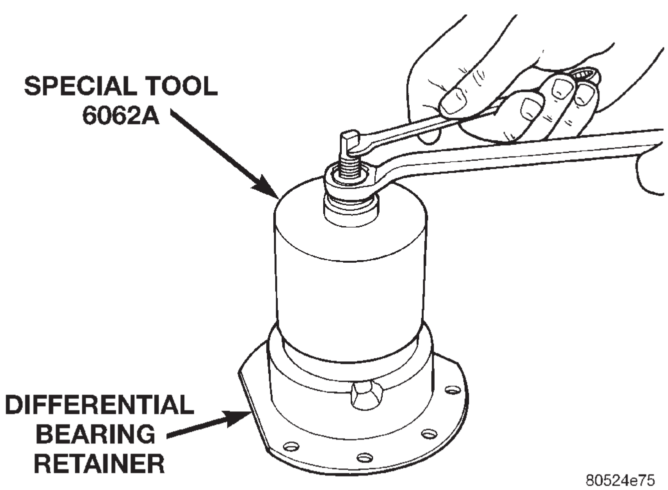

Fig. 158 Remove Bearing Cup

To remove the differential bearing cup from the extension housing/adapter side, use Special Tool 6062A, Remover. To install the differential bearing cup on the extension housing/adapter side, use Special Tool 6536, Driver and Special Tool C-4171, Handle.

DETERMINING SHIM THICKNESS

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Differential carrier
- Differential bearing retainer
- Extension housing
- Differential bearing cups and cones

Refer to Bearing Adjustment Procedure in rear of this section to determine proper shim thickness.

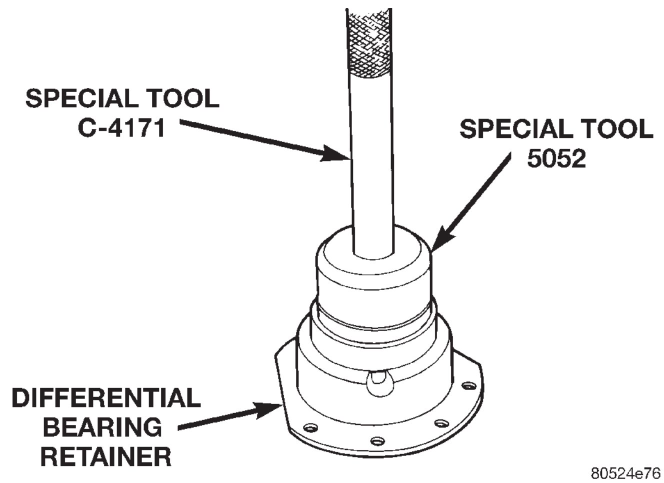

Fig. 159 Install Bearing Cup

CLEANING AND INSPECTION

VALVE BODY

Allow all parts to soak a few minutes in a suitable clean solvent. Wash thoroughly and blow dry with compressed air. Make sure all passages are clean and free from obstructions.

Inspect manual and throttle valve operating levers and shafts for being bent, worn or loose. If a lever is loose on its shaft, it should be replaced. Do not attempt to straighten bent levers.

Inspect all mating surfaces for burrs, nicks and scratches. Minor blemishes may be removed with crocus cloth, using only a very light pressure. Using a straightedge, inspect all mating surfaces for warpage or distortion. Slight distortion may be corrected, using a surface plate. Make sure all metering holes in steel plate are open. Using a pen light, inspect bores in valve body for scores, scratches, pits and irregularities.

CLEANING AND INSPECTION (Continued)

Inspect all valve springs for distortion and collapsed coils. Inspect all valves and plugs for burrs, nicks, and scores. Small nicks and scores may be removed with crocus cloth, providing extreme care is taken not to round off sharp edges. The sharpness of these edges is vitally important. It prevents foreign matter from lodging between valve and valve body. This reduces the possibility of sticking. Inspect all valves and plugs for freedom of operation in valve body bores.

When bores, valves, and plugs are clean and dry, the valves and plugs should fall freely in the bores. The valve body bores do not change its dimensions with use. Therefore, a valve body that was functioning properly when vehicle was new, will operate correctly if it is properly and thoroughly cleaned. There is no need to replace valve body unless it is damaged in handling.

ADJUSTMENTS

GEARSHIFT CABLE ADJUSTMENT

Lift and rotate the gearshift hand lever into the park (P) gate position and remove the ignition key. This confirms the shift lever is in the gated park (P) position.

After confirming the park gate position, turn the ignition switch. If the starter will operate, the park gate position is correct. Move the shift lever into the neutral (N) position. If the starter will operate in this position, the linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

(1) Park the vehicle on level ground and set the parking brake.

(2) Place the gearshift lever in park (P) gate position and remove key.

(3) Loosen the cable adjustment screw at the transaxle operating lever (Fig. 160).

(4) Pull the transaxle operating lever fully forward to the park detent position.

(5) Release the park brake, then rock the vehicle to assure it is in park lock. Reset the park brake.

(6) Tighten the cable adjustment screw to 8 N·m (70 in. lbs.). Gearshift cable should now be properly adjusted.

(7) Verify PRNDL indicator still displays the corresponding gear completely. If not, readjustment of PRNDL may be required.

(8) Check adjustment by using the preceding procedure.

THROTTLE PRESSURE LINKAGE ADJUSTMENT

The throttle pressure rod adjustment is very important to proper transaxle operation. This adjustment positions a valve which controls shift speed, shift quality, and part throttle downshift sensitivity. If the setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle downshifts may be very sensitive.

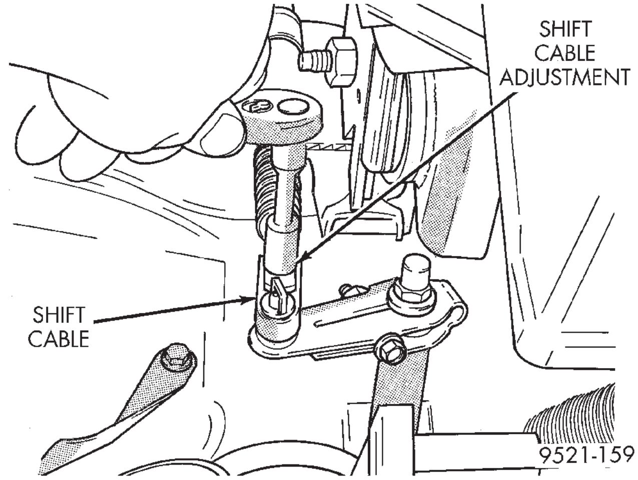

Fig. 160 Gearshift Cable Adjustment

With engine at operating temperature, adjust idle speed of engine using a tachometer. Refer to Group 14, Fuel System for idle speed Specifications and adjustment.

ROD ADJUSTMENT PROCEDURE

(1) Perform transaxle throttle pressure adjustment while engine is at normal operating temperature.

(2) Loosen adjustment swivel lock screw.

(3) To insure proper adjustment, swivel must be free to slide along flat end of throttle rod. Disassemble and clean or repair parts to assure free action, if necessary.

(4) Hold transaxle throttle lever firmly toward engine, against its internal stop. Tighten swivel lock screw to 11 N·m (100 in. lbs.)

(5) The adjustment is finished and linkage backlash was automatically removed by the preload spring.

(6) If lubrication is required see Group 0, Lubrication.

BAND ADJUSTMENT

KICKDOWN BAND (FRONT)

The kickdown band adjusting screw is located on left side (top front) of the transaxle case.

(1) Loosen locknut and back off nut approximately five turns. Test adjusting screw for free turning in the transaxle case.

(2) Using wrench, tighten adjusting screw to 8 N·m (72 in. lbs.).

ADJUSTMENTS (Continued)

(3) Back off adjusting screw the number of turns listed in Specifications. Hold adjusting screw in this position and tighten locknut to 47 N·m (35ft. lbs.)

LOW/REVERSE BAND (REAR)

To adjust low-reverse band, proceed as follows:

(1) Loosen and back off locknut approximately 5 turns.

(2) Using an inch-pound torque wrench, tighten adjusting screw to 5 N·m (41 in. lbs.) true torque.

(3) Back off adjusting screw the number of turns listed under Specifications. This chart is located at the rear of this section.

(4) Tighten locknut to 14 N·m (10 ft. lbs.).

HYDRAULIC CONTROL PRESSURE ADJUSTMENTS

LINE PRESSURE

An incorrect throttle pressure setting will cause incorrect line pressure readings even though line pressure adjustment is correct. Always inspect and correct throttle pressure adjustment before adjusting the line pressure.

The approximate adjustment for line pressure is 1-5/16 inches, measured from valve body to inner edge of adjusting nut. However, due to manufacturing tolerances, the adjustment can be varied to obtain specified line pressure.

The adjusting screw may be turned with an Allen wrench. One complete turn of adjusting screw changes closed throttle line pressure approximately 1-2/3 psi. Turning adjusting screw counterclockwise increases pressure, and clockwise decreases pressure.

THROTTLE PRESSURE

Throttle pressures cannot be tested accurately; therefore, the adjustment should be measured if a malfunction is evident.

(1) Insert gauge pin of Tool C-3763 between the throttle lever cam and kickdown valve.

(2) By pushing in on tool, compress kickdown valve against its spring so throttle valve is completely bottomed inside the valve body.

(3) While compressing spring, turn throttle lever stop screw with adapter C-4553. Turn until head of screw touches throttle lever tang, with throttle lever cam touching tool and throttle valve bottomed. Be sure adjustment is made with spring fully compressed and valve bottomed in the valve body.

BEARING ADJUSTMENT PROCEDURES

(1) 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.

(2) Bearing cups and cones should be replaced if they show signs of pitting or heat distress.

(3) If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

NOTE: Bearing end play and drag torque specifications must be maintained to avoid premature bearing failures.

(4) 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, except the transfer gear bearing.

(5) Refer to the conversion chart in specifications to convert inches to millimeter measurements. Refer to bearing shim chart for proper shim thicknesses.

OUTPUT SHAFT BEARING

(1) With output shaft gear removed, install a 13.65 mm (.537 inch) and a 1.34 mm (.053 inch) gauging shims on the planetary rear annulus gear hub using grease to hold the shims in place. The 13.65 mm shim has a larger inside diameter and must be installed over the output shaft first. The 1.34 mm shim pilots on the output shaft.

(2) Install output shaft gear and bearing assembly, torque to 271 N·m (200 ft. lbs.).

(3) To measure bearing end play:

(4) Attach Tool L-4432 to the output shaft gear.

(5) Mount a steel ball with grease into the end of the output shaft.

(6) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(7) Using a dial indicator, mounted to the transaxle case, measure output shaft end play.

(8) Once bearing end play has been determined, refer to the output shaft bearing shim chart.

(9) The 12.65 mm (.498 inch), 13.15 mm (.518 inch) or 13.65 mm (.537 inch) shims are always installed first. **These shims have lubrication slots which are necessary for proper bearing lubrication.**

(10) Shims thinner than 12.65 mm listed in the chart are common to both the transfer shaft and output shaft bearings.

(11) Use Tool L-4434 to remove the retaining nut and washer. To remove the output shaft gear use Tool L-4407.

(12) Remove the two gauging shims and install the proper shim combination, making sure to install the 12.65, 13.15, or 13.65 mm shim first. Use grease to

ADJUSTMENTS (Continued)

hold the shims in place. Install the output shaft gear and bearing assembly.

(13) Install the retaining nut and washer and torque to 271 N·m (200 ft. lbs.).

(14) Using an inch-pound torque wrench, check the turning torque. **The torque should be between 3 and 8 inch-pounds.**

(15) If the turning torque is too high, install a .05mm (.002 inch) thicker shim. If the turning torque is too low, install a .05 mm (.002 inch) thinner shim. Repeat until the proper turning torque is 3 to 8 inch pounds.

End Play (with 13.65 mm and 1.34 mm gauging shims installed)		Required Shim Combination	Total Thickness	
mm	inch	mm	mm	inch
.0	.0	13.65 + 1.34	14.99	.590
.05	.002	13.65 + 1.24	14.89	.586
.10	.004	13.65 + 1.19	14.84	.584
.15	.006	13.65 + 1.14	14.79	.582
.20	.008	13.65 + 1.09	14.74	.580
.25	.010	13.65 + 1.04	14.69	.578
.30	.012	13.65 + .99	14.64	.576
.35	.014	13.65 + .94	14.59	.574
.40	.016	13.15 + 1.39	14.54	.572
.45	.018	13.15 + 1.34	14.49	.570
.50	.020	13.15 + 1.29	14.44	.568
.55	.022	13.15 + 1.24	14.39	.566
.60	.024	13.15 + 1.19	14.34	.564
.65	.026	13.15 + 1.14	14.29	.562
.70	.028	13.15 + 1.09	14.24	.560
.75	.030	13.15 + 1.04	14.19	.558
.80	.032	13.15 + .99	14.14	.556
.85	.034	13.15 + .94	14.09	.554
.90	.036	12.65 + 1.39	14.04	.552
.95	.038	12.65 + 1.34	13.99	.550
1.00	.040	12.65 + 1.29	13.94	.548
1.05	.042	12.65 + 1.24	13.89	.547
1.10	.044	12.65 + 1.19	13.84	.545
1.15	.046	12.65 + 1.14	13.79	.543
1.20	.048	12.65 + 1.09	13.74	.541
1.25	.049	12.65 + 1.04	13.69	.539
1.30	.051	12.65 + .99	13.64	.537
1.35	.053	12.65 + .94	13.59	.535

Average Conversion .05 mm = .002 inch 9121-17

OUTPUT SHAFT BEARING SHIM CHART

DIFFERENTIAL BEARING

(1) Position the transaxle assembly vertically on the support stand, differential bearing retainer side up.

(2) Install Tool L-4436A into the differential and onto the pinion mate shaft .

(3) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

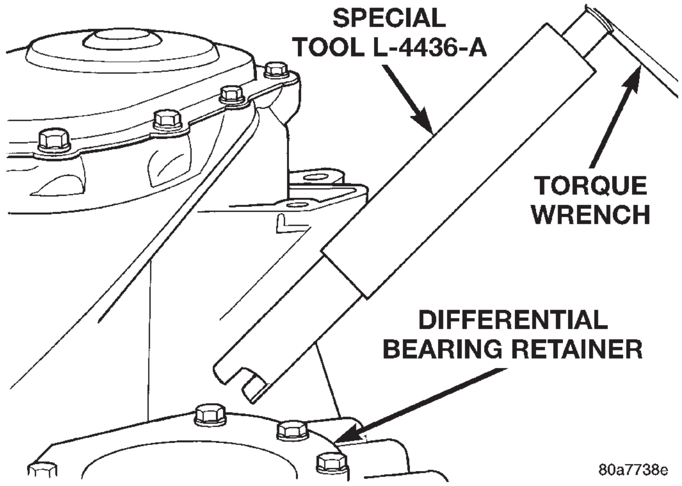

Fig. 161 Tool L-4436 and Torque Wrench

(4) Using Tool L-4436A and an inch-pound torque wrench, check the turning torque of the differential. **The turning torque should be between 5 and 18 inch-pounds.**

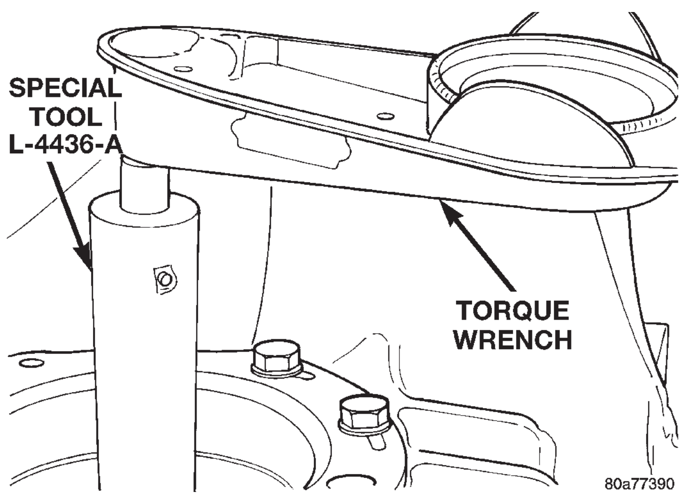

Fig. 162 Checking Differential Bearings Turning Torque

(5) If the turning torque is within specifications, remove tools. Setup is complete.

(6) If turning torque is not within specifications proceed with the following steps.

(a) Remove differential bearing retainer from the transaxle case.

(b) Remove the bearing cup from the differential bearing retainer using Tool 6062A.

(c) Remove the existing shim from under the cup.

(d) Measure the existing shim.

ADJUSTMENTS (Continued)

NOTE: If the turning torque was too high when measured, install a .05 mm (.002 inch) thinner shim. If the turning torque is was too low, install a .05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained.

Oil Baffle is not required when making shim selection.

(e) Install the proper shim under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(f) Install the differential bearing retainer using Tool 5052 and C-4171. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N·m (250 in. lbs.).

DIFFERENTIAL BEARING SHIM CHART

SHIM THICKNESS	
MM	INCH
.980	0.0386
1.02	0.0402
1.06	0.0418
1.10	0.0434
1.14	0.0449
1.18	0.0465
1.22	0.0481
1.26	0.0497
1.30	0.0512
1.34	0.0528
1.38	0.0544
1.42	0.0560
1.46	0.0575
1.50	0.0591
1.54	0.0607
1.58	0.0623
1.62	0.0638
1.66	0.0654
1.70	0.0670
2.02	0.0796
2.06	0.0812

(7) Using Tool L-4436A and an inch-pound torque wrench, recheck the turning torque of the differential. **The turning torque should be between 5 and 18 inch-pounds.**

TRANSFER SHAFT BEARING

(1) Use Tool L-4434 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

(2) Install a 2.29 mm (.090 inch) and a 1.39 mm (.055 inch) gauging shims on the transfer shaft behind the governor support.

(3) Install transfer shaft gear and bearing assembly and torque the nut to 271 N·m (200 ft. lbs.).

(4) To measure bearing end play:

(5) Attach Tool L-4432 to the transfer gear.

(6) Mount a steel ball with grease into the end of the transfer shaft.

(7) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(8) Using a dial indicator, measure transfer shaft end play.

(9) Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

(10) Use Tool L-4434 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

(11) Remove the two gauging shims and install the correct shim combination. Install the transfer gear and bearing assembly.

(12) Install the retaining nut and washer and torque to 271 N·m (200 ft. lbs.). Measure transfer shaft end play, end play should be .05 to .25 mm (.002 to .010 inch).

(13) Measure bearing end play as outlined in Step (4). End play should be between .05 mm and .25 mm (.002 to .010 inch).

ADJUSTMENTS (Continued)

End Play (with 2.29 mm and 1.39 mm gauging shims installed)		Required Shim Combination	Total Thickness	
mm	inch	mm	mm	inch
.0	.0	2.29 + 1.39	3.68	.145
.05	.002	2.29 + 1.39	3.68	.145
.10	.004	2.29 + 1.39	3.68	.145
.15	.006	2.29 + 1.39	3.68	.145
.20	.008	2.29 + 1.34	3.63	.143
.25	.010	2.29 + 1.29	3.58	.141
.30	.012	2.29 + 1.24	3.53	.139
.35	.014	2.29 + 1.19	3.48	.137
.40	.016	2.29 + 1.14	3.43	.135
.45	.018	2.29 + 1.09	3.38	.133
.50	.020	2.29 + 1.04	3.33	.131
.55	.022	2.29 + .99	3.28	.129
.60	.024	1.84 + 1.39	3.23	.127
.65	.026	1.84 + 1.34	3.18	.125
.70	.028	1.84 + 1.29	3.13	.123
.75	.030	1.84 + 1.24	3.08	.121
.80	.032	1.84 + 1.19	3.03	.119
.85	.034	1.84 + 1.14	2.98	.117
.90	.036	1.84 + 1.09	2.93	.115
.95	.038	1.84 + 1.04	2.88	.113
1.00	.040	1.84 + .99	2.83	.111
1.05	.042	1.39 + 1.39	2.78	.109
1.10	.044	1.39 + 1.34	2.73	.107
1.15	.046	1.39 + 1.29	2.68	.105
1.20	.048	1.39 + 1.24	2.63	.103
1.25	.049	1.39 + 1.19	2.58	.101
1.30	.050	1.39 + 1.14	2.53	.099
1.35	.052	1.39 + 1.09	2.48	.097
1.40	.055	1.39 + 1.04	2.43	.095
1.45	.057	1.39 + .99	2.38	.093
1.50	.059	.94 + 1.39	2.33	.091
1.55	.061	.94 + 1.34	2.28	.089
1.60	.063	.94 + 1.29	2.23	.087

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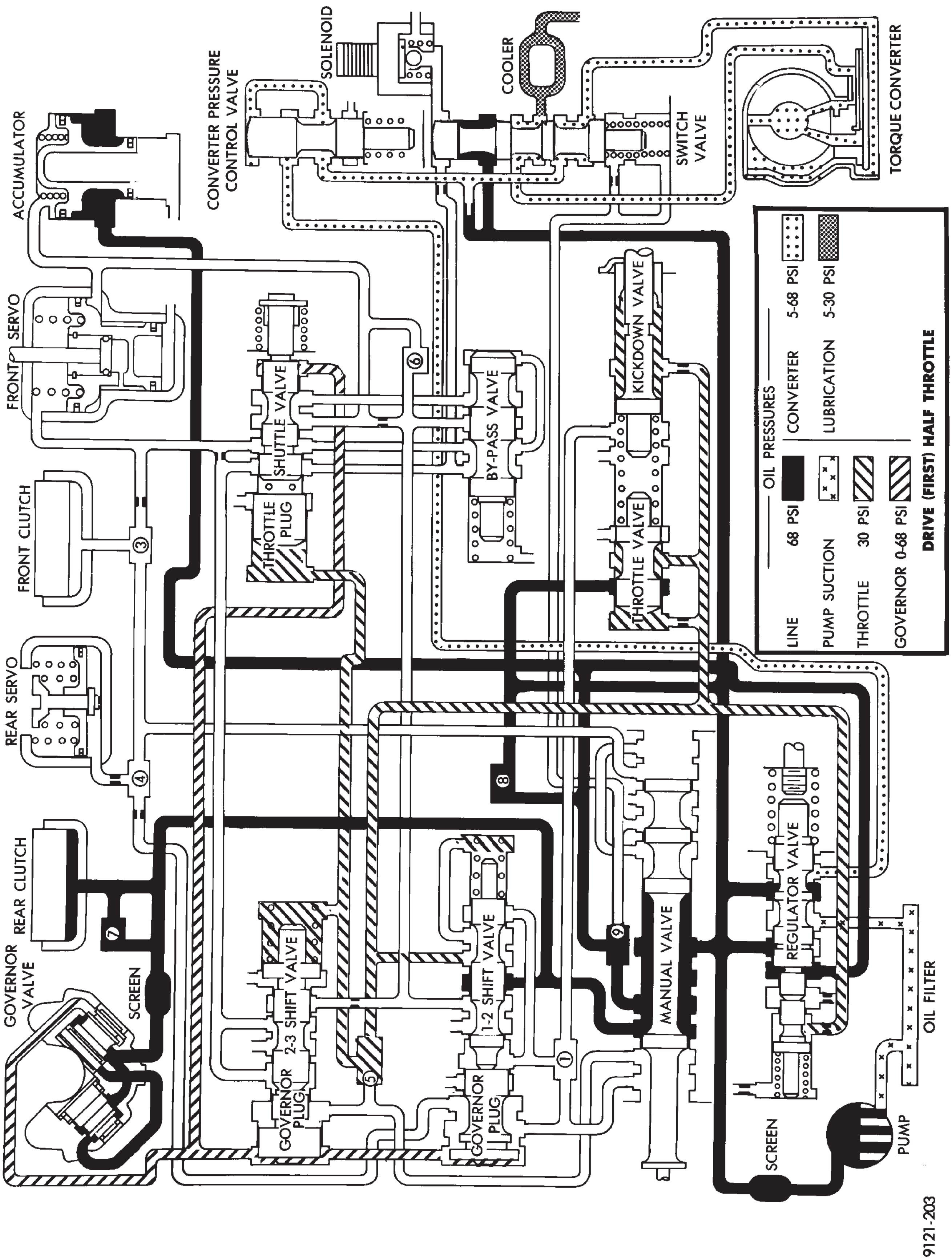
TRANSFER BEARING SHIM CHART

NOTE: If end play is too high, install a .05 mm (.002 inch) thinner shim combination. If end play is too low, install a .05 mm (.002 inch) thicker shim combination. Repeat until .05 to .25 mm (.002 to .010 inch) end play is obtained.

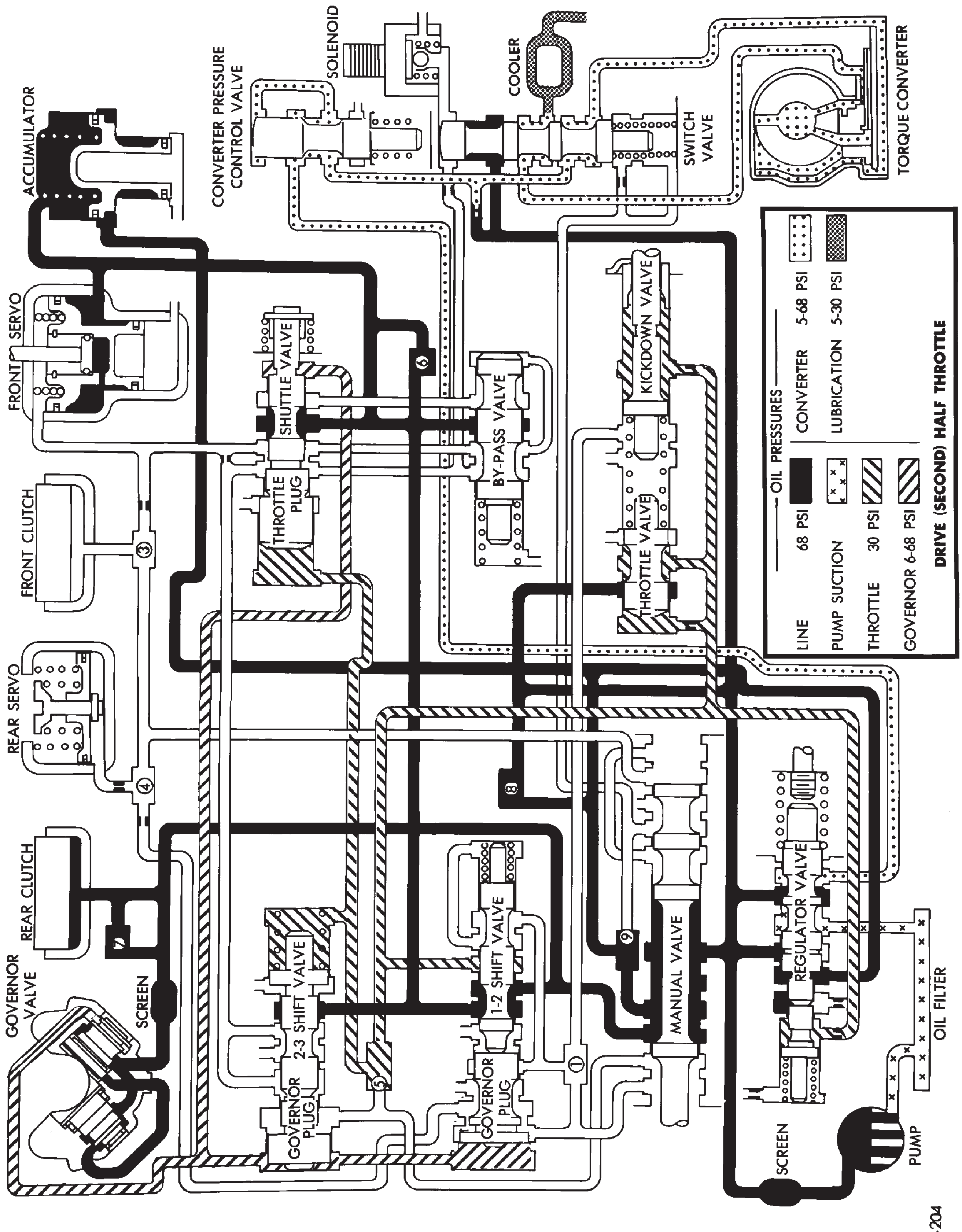
SCHEMATICS AND DIAGRAMS

31TH TRANSAXLE HYDRAULIC SCHEMATIC



31TH TRANSAXLE HYDRAULIC SCHEMATIC

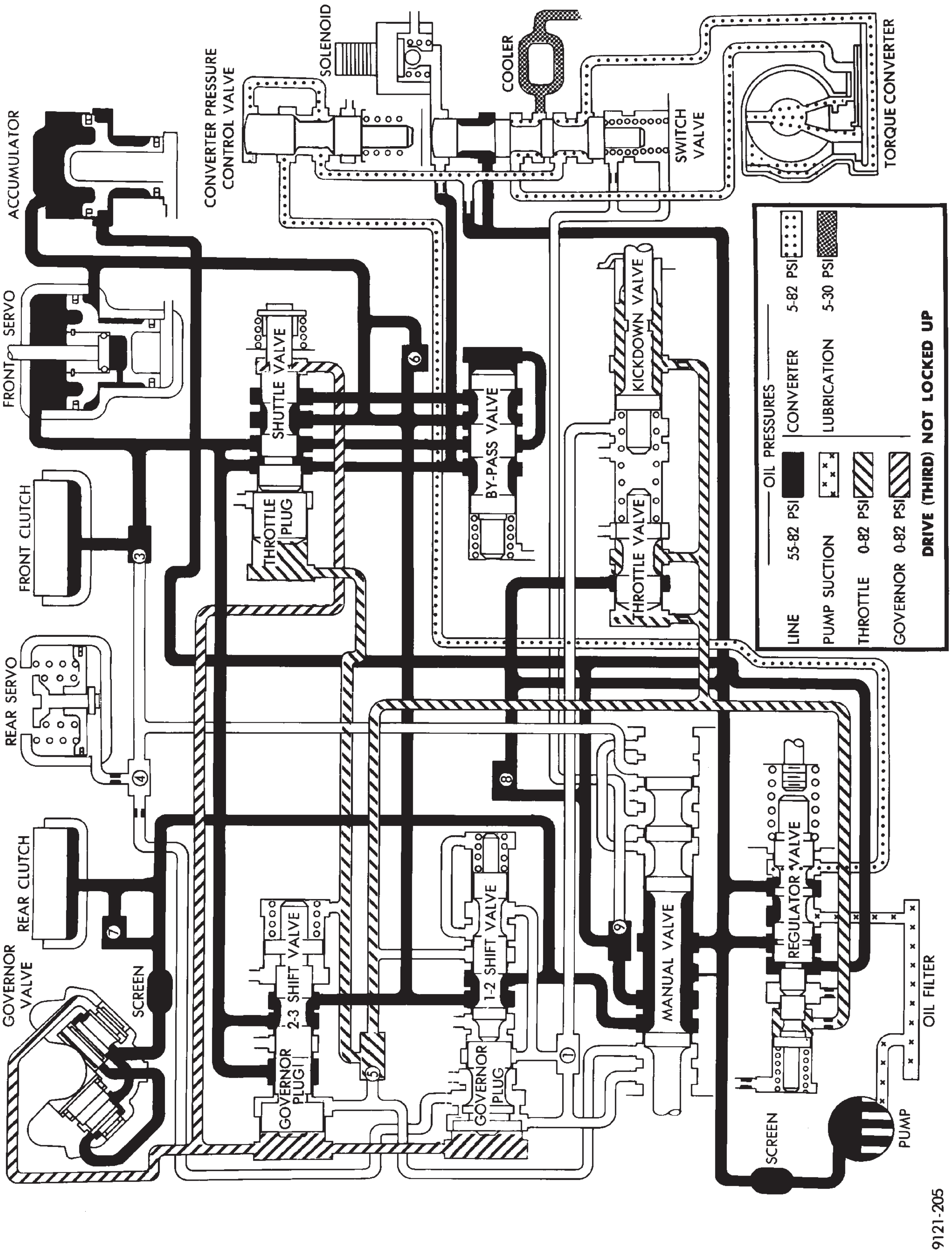
SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

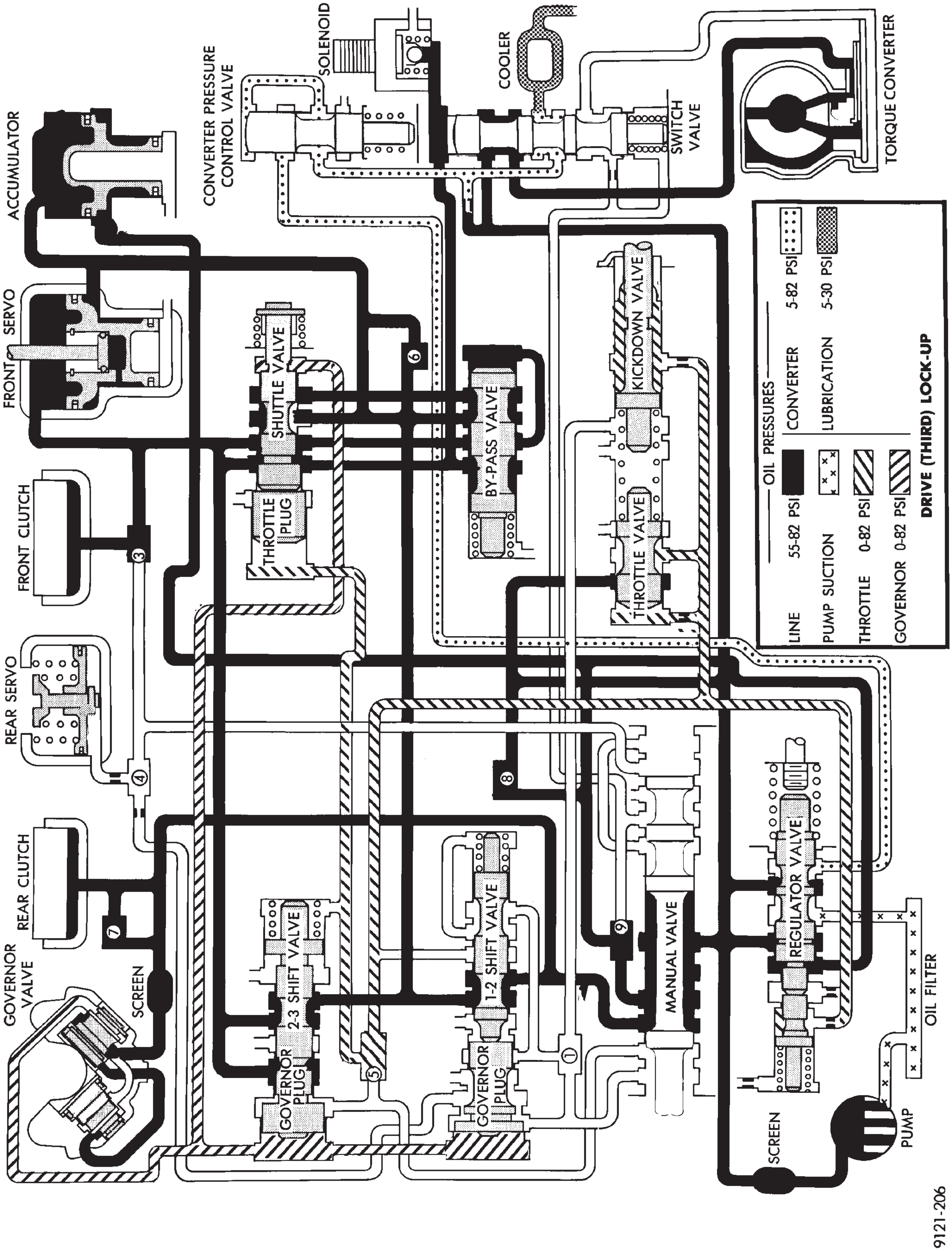
9121-204

SCHEMATICS AND DIAGRAMS (Continued)



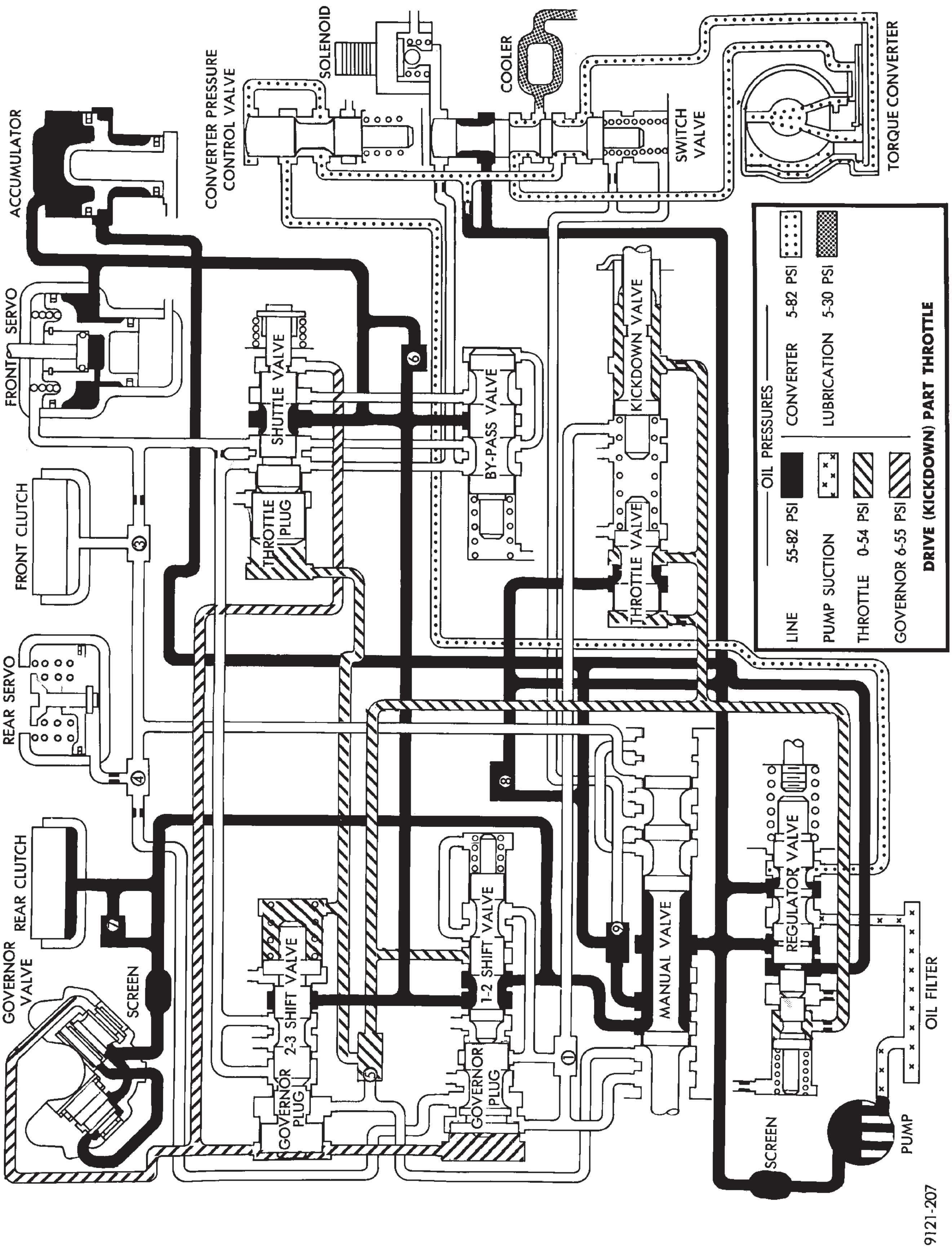
31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



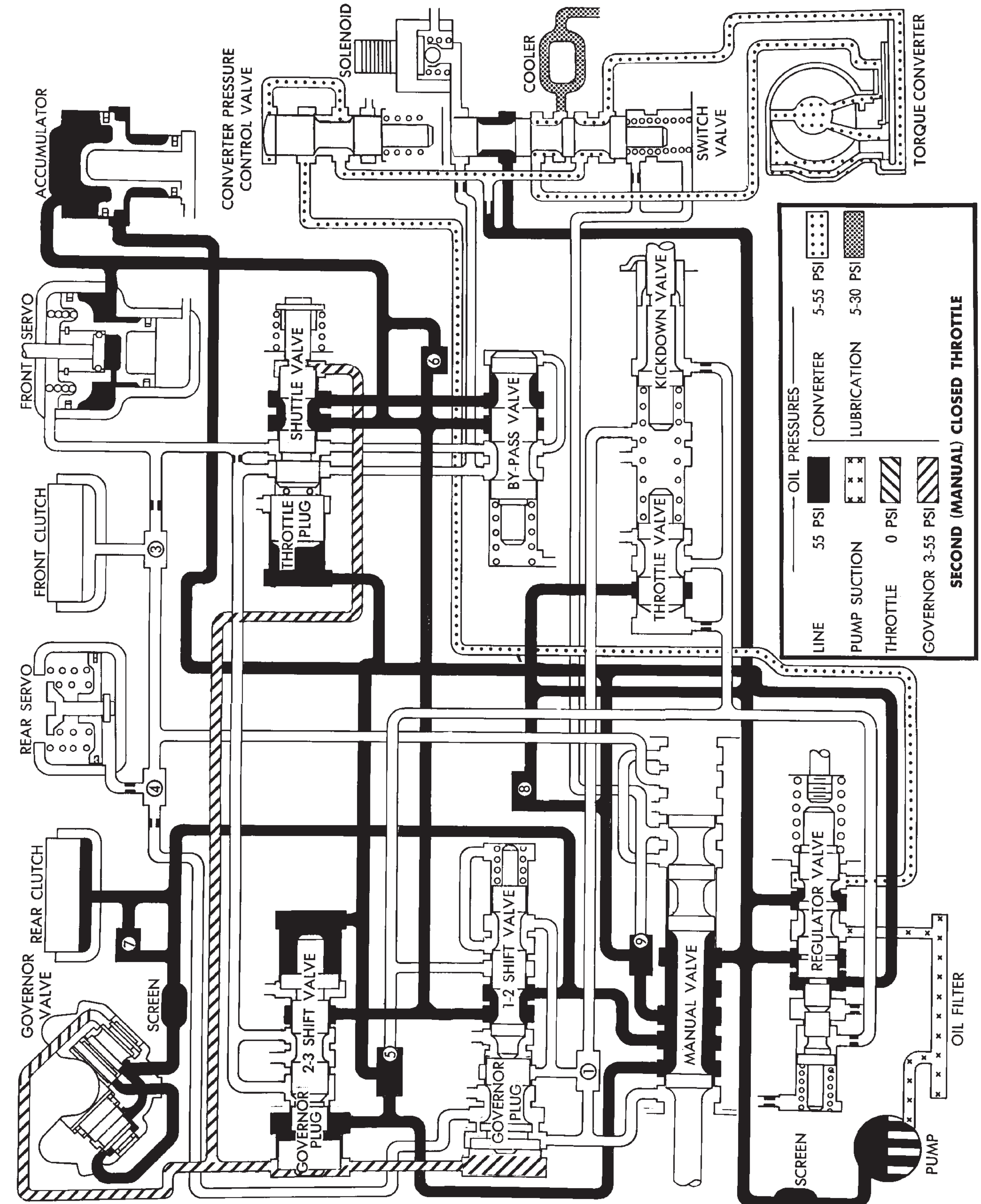
31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

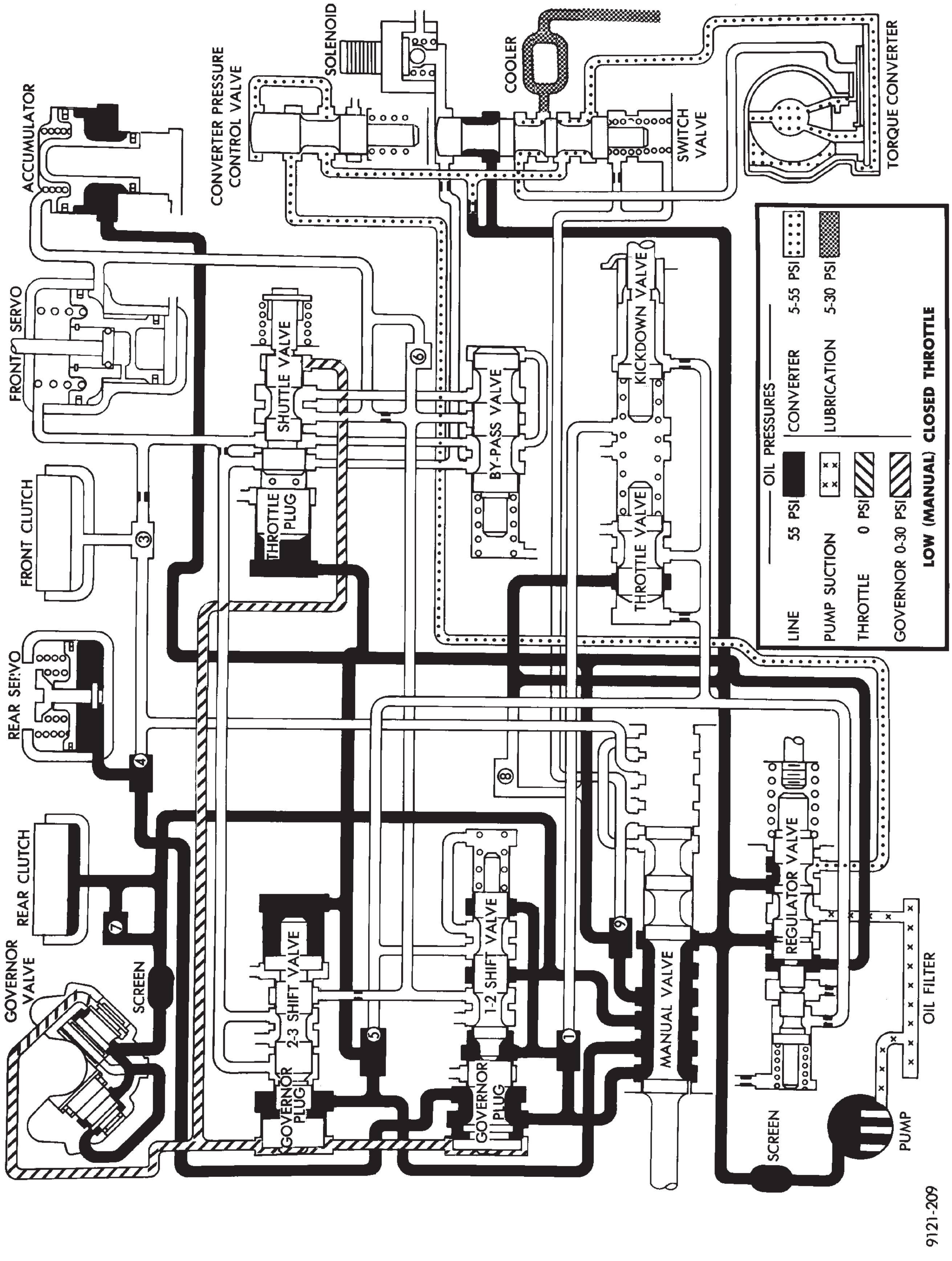
SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

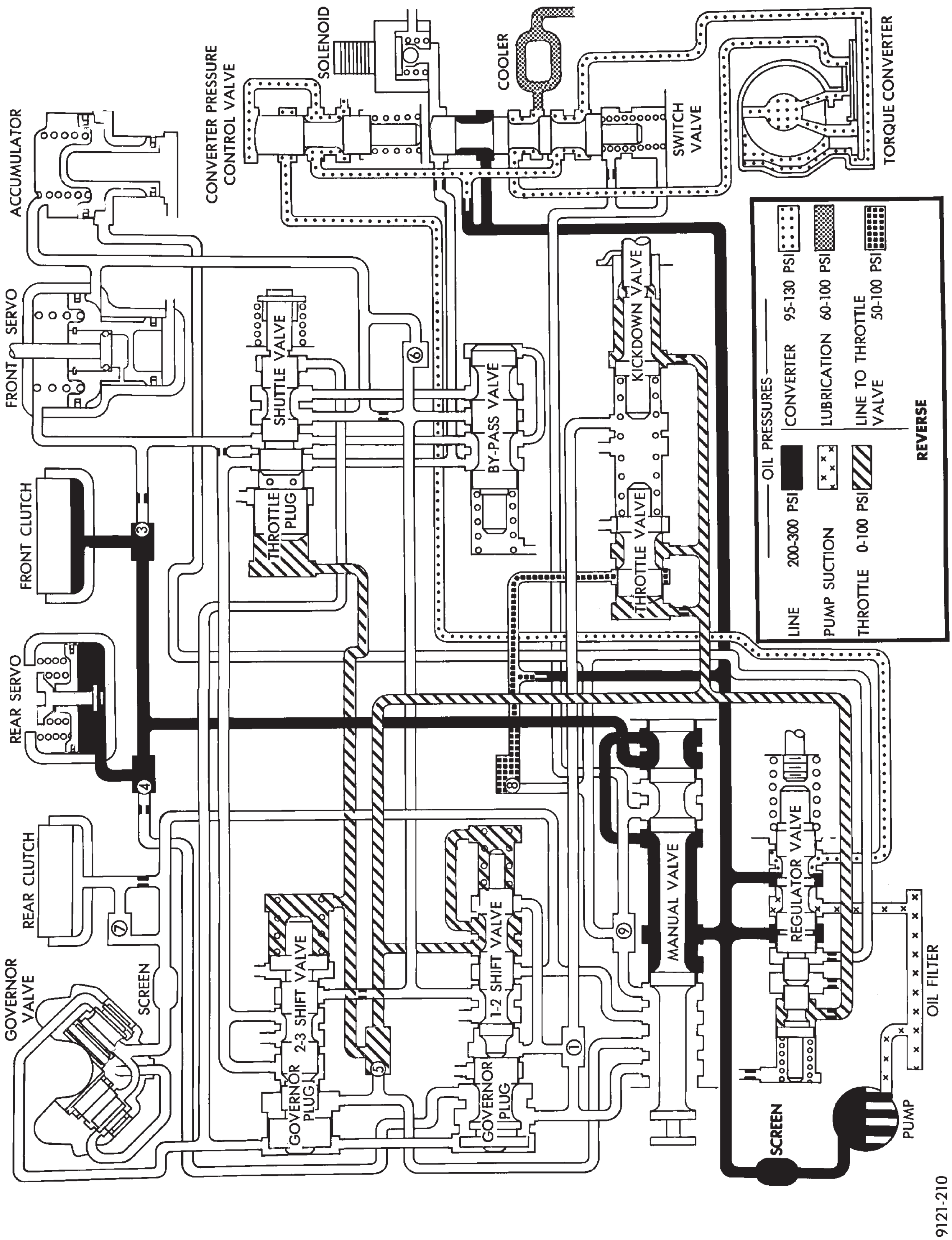
9121-208

SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

SPECIFICATIONS

31TH AUTOMATIC TRANSAXLE

Type . . . . .Automatic three speed with torque converter and integral differential
Torque Converter Diameter . . . . .241 millimeters (9.48 in.)
Oil Capacity . . . . .8.6 Liters (18.25 pints)
Oil Type . . . . .Mopar® ATF PLUS 3 Type 7176
Cooling Method . . . . . .Water Heat Exchanger and/or air to oil heat exchanger
Lubrication . . . . . .Pump (internal-external gear-type

Gear Ratios

Transmission Portion

First Gear 2.69
Second Gear. 1.55
Third Gear. 1.00
Reverse Gear 2.10

Pump Clearances

Outer Gear To Pocket . . . . .0.045-0.141mm (0.0018-0.0056 in.)
Outer Gear Side Clearance. . . . . .0.020-0.046mm (0.0008-0.0018 in.)
Inner Gear Side Clearance . . . . .0.020-0.046mm (0.0008-0.0018 in.)

Tapered Roller Bearing Settings

Differential Assembly . . .6 to 12 in. lbs. Drag Torque
Output Hub. . . . . .0 to 3 in. lbs. Drag Torque
Transfer Shaft . . . . .0.002 to 0.010 in. End Play
Overall Drag At Output Hub . . . . .3 to 16 in. lbs. Drag Torque

Clutch Pack Clearances

Front Clutch (Not Adjustable) . . . . .1.27-2.79mm (0.050-0.110 in.)
Rear Clutch . . . . .0.71-1.10mm (0.028-0.043 in.)

Band Adjustment

Kickdown, Backed Off From 8 N·m (72 in. lbs.) . . . . 2 1/4 Turns
Low-Reverse, Backed Off From 5 N·m (41 in. lbs.) . . . . .3 1/2 Turns

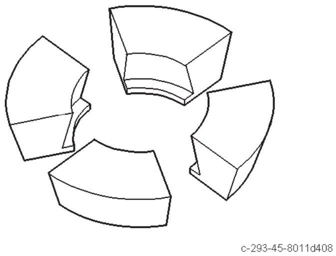
SPECIFICATIONS (Continued)

31TH TORQUE SPECIFICATIONS

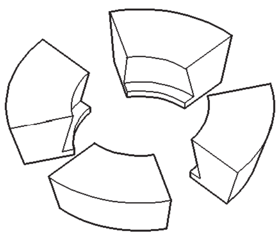
DESCRIPTION	TORQUE		DESCRIPTION	TORQUE
Bell Housing Cover Bolts	12 N·m (106 in. lbs.)		Output Shaft Nut	271 N·m (200 ft. lbs.)
Cooler Hose To Rad. Conn.	12 N·m (105 in. lbs.)		Park/Neutral Switch	34 N·m (25 ft. lbs.)
Cooler Line Conn.	28 N·m (250 in. lbs.)		Pressure Check Plug	5 N·m (45 in. lbs.)
Diff. Bear. Ret. To Case Bolt	28 N·m (250 in. lbs.)		Pump To Case Bolts	31 N·m (275 in. lbs.)
Diff. Cover To Case Bolt	19 N·m (165 in. lbs.)		Reaction Shaft Assembly Bolt	28 N·m (250 in. lbs.)
Exten. Hous. To Case Bolt	28 N·m (250 in. lbs.)		Rear Cover To Case Screw	19 N·m (165 in. lbs.)
Flex Plate To Crankshaft Bolts	95 N·m (70 ft. lbs.)		Reverse Band Adj. Lock Nut	14 N·m (125 in. lbs.)
Flex Plate To Torque Conv. Bolts	68 N·m (50 ft. lbs.)		Reverse Band Shaft Plug	7 N·m (60 in. lbs.)
Fluid Filter Screw	5 N·m (45 in. lbs.)		Ring Gear Screw	95 N·m (70 ft. lbs.)
Front Motor Mount Bolt	54 N·m (40 ft. lbs.)		Speedo. To Ext. Hous. Screw	7 N·m (60 in. lbs.)
Governor Counterweight Screw	28 N·m (250 in. lbs.)		Sprag Ret. To Transfer Case Bolt	28 N·m (250 in. lbs.)
Governor To Support Bolt	7 N·m (60 in. lbs.)		Starter To Trans. Bell Bolts	54 N·m (40 ft. lbs.)
Kickdown Band Adj. Lock Nut	47 N·m (35 ft. lbs.)		Throttle Cable To Trans. Case Bolt	12 N·m (105 in. lbs.)
Left Motor Mount Bolts	54 N·m (40 ft. lbs.)		Throttle Lever To Trans. Shaft Bolts	12 N·m (105 in. lbs.)
Lower Bell Housing Cover Screw	41 N·m (30 ft. lbs.)		Trans. To Cyl. Block Bolt	95 N·m (70 ft. lbs.)
Manual Cable To Trans. Case Bolt	28 N·m (250 in. lbs.)		Transfer Shaft Nut	271 N·m (200 ft. lbs.)
Manual Control Lever Screw	12 N·m (105 i n. lbs.)		Transfer Gear Strap Bolts	23 N·m (17 ft. lbs.)
Oil Pan To Trans. Case Screw	19 N·m (165 in. lbs.)		Valve Body Assy. To Case Bolts	12 N·m (105 in. lbs.)
Output Gear Strap Bolts	23 N·m (17 ft. lbs.)		Valve Body Screw	5 N·m (45 in. lbs.)

SPECIAL TOOLS

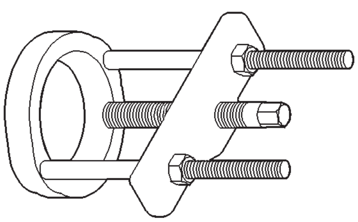
31TH AUTOMATIC TRANSAXLE



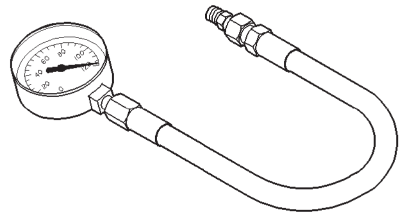
Adapter Blocks C-293–45



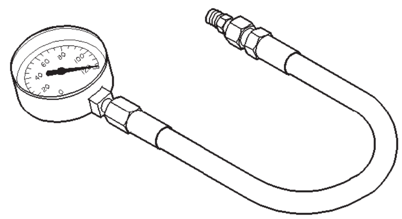
Adapter Blocks C-293–52



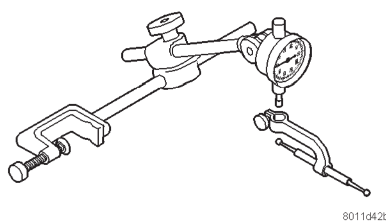
Puller Press C-293–PA



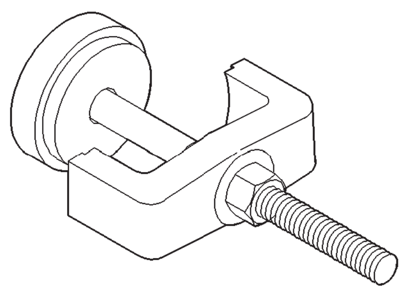
Pressure Gauge (Low) C-3292



Pressure Gauge (High) C-3293SP

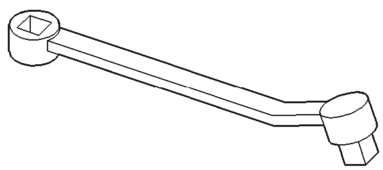


Dial Indicator C-3339

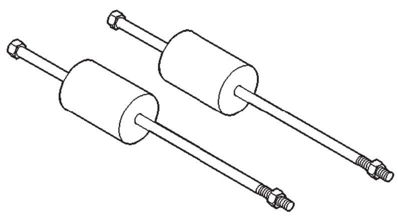


Spring Compressor C-3575–A

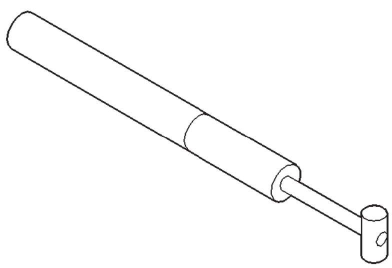
SPECIAL TOOLS (Continued)



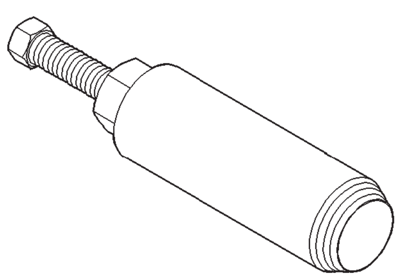
Band Adjusting Adapter



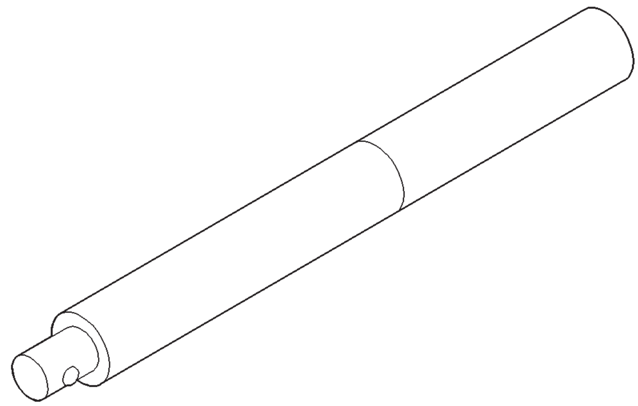
Oil Pump Puller C-3752



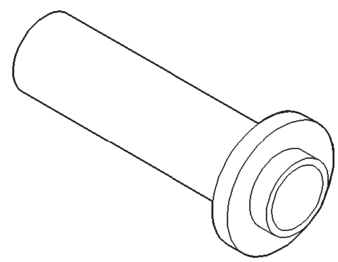
Throttle Setting Gauge



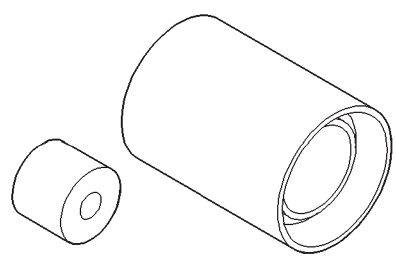
Seal Puller C-3981B



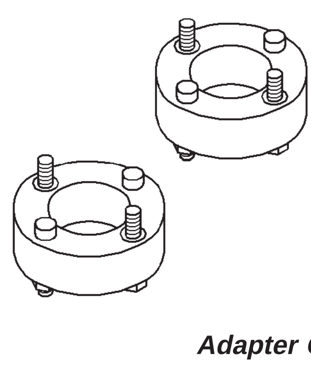
Universal Handle C-4171



Seal Installer C-4193A

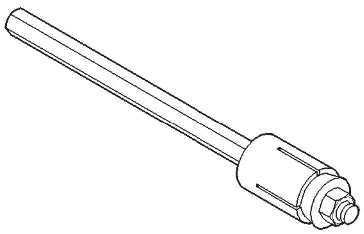


Bearing Installer C-4637

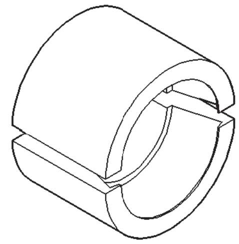


Adapter C-4658

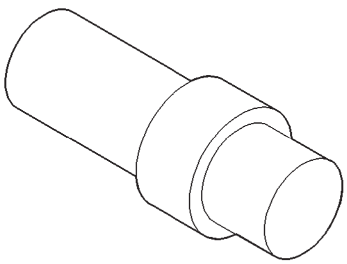
SPECIAL TOOLS (Continued)



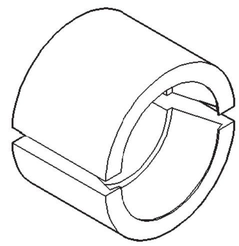
Torque Tool C-4995



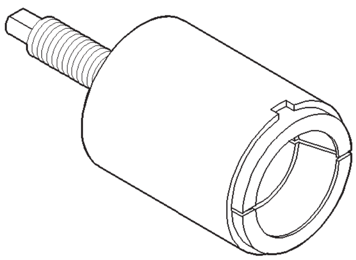
Bearing Remover Jaws L-4406–2



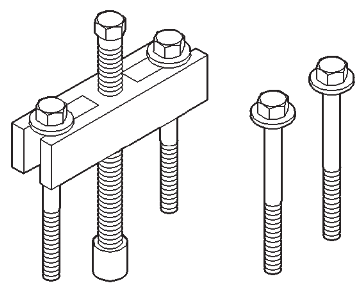
Adapter C-4996



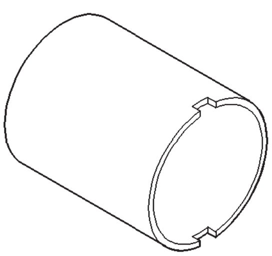
Adapter L-4406–3



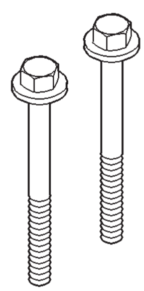
Remover Kit L-4406



Gear Puller L-4407A

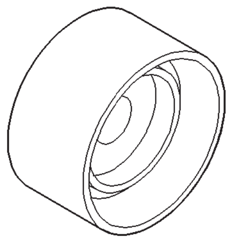


Bearing Remover Cup L-4406–1

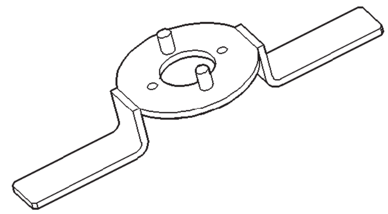


Puller L-4407–6

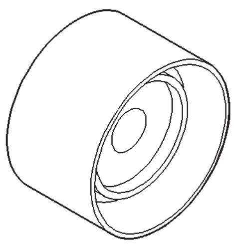
SPECIAL TOOLS (Continued)



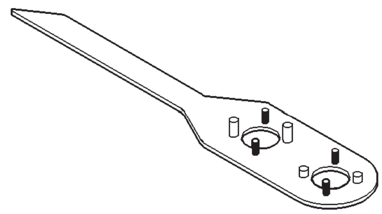
Bearing Installer L-4408



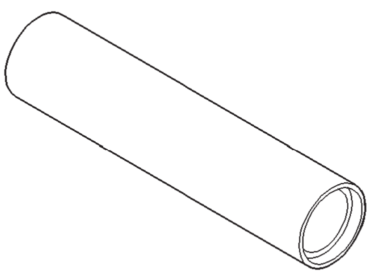
Gear Checking Plate L-4432



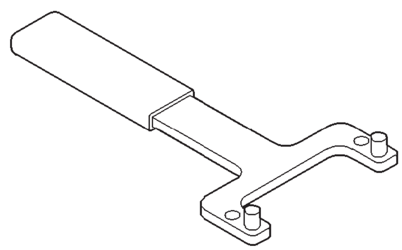
Bearing Installer L-4410



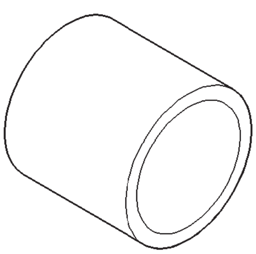
Gear Removing Plate L-4434



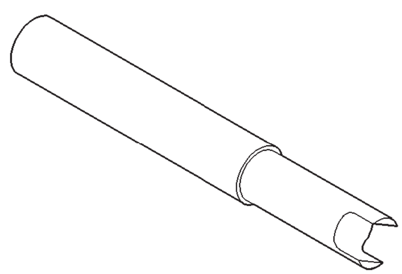
Bearing Installer L-4411



Bearing Puller L-4435

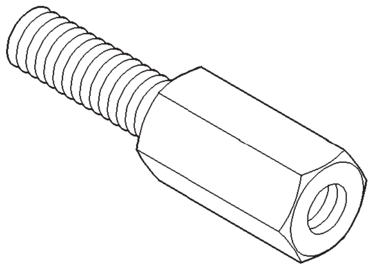


Installer Adapter L-4429-3

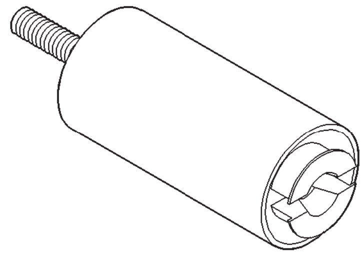


Differential Tool L-4436A

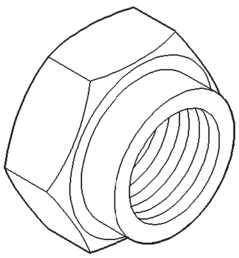
SPECIAL TOOLS (Continued)



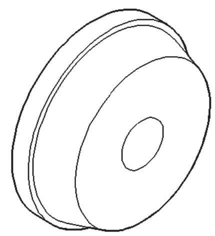
Housing Remover Adapter L-4437



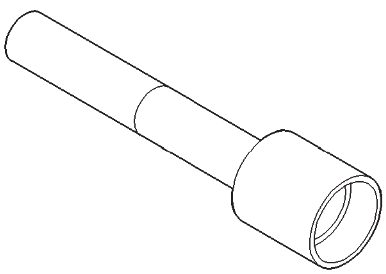
Special Jaw Set L-4518



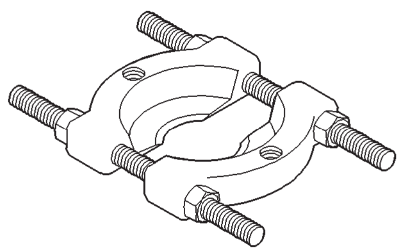
Starter Nut L-4439



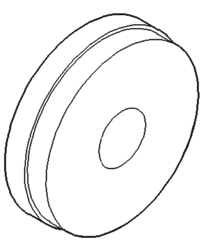
Installer L-4520



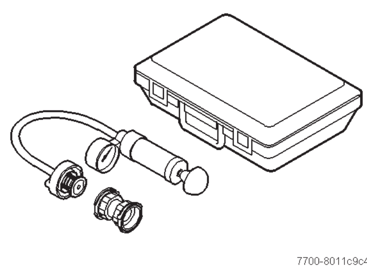
Transfer Shaft Remover-Installer L-4512



Bearing Splitter P-334



Bearing Cup Remover L-4517



Cooling System Tester 7700

41TE AUTOMATIC TRANSAXLE

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GENERAL INFORMATION

41TE FOUR SPEED AUTOMATIC TRANSAXLE

The 41TE four-speed FWD transaxle uses fully-adaptive controls. Adaptive controls are those which perform their functions based on real-time feedback sensor information. The transaxle uses hydraulically applied clutches to shift a planetary gear train.

TRANSAXLE IDENTIFICATION

The 41TE transaxle identification code is printed on a label. The label is located on the transaxle case next to the solenoid assembly (Fig. 1).

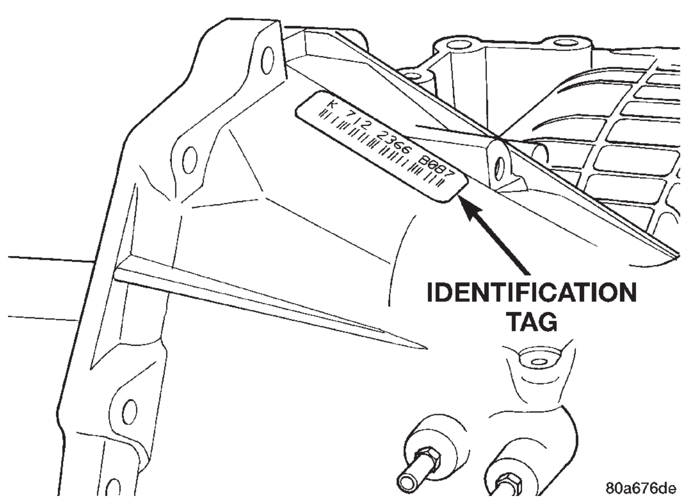

Fig. 1 Identification Tag Location

GENERAL INFORMATION (Continued)

OPERATION

The gear ratios for the 41TE transaxle are as follows:

- **1st—2.84**
- **2nd—1.57**
- **3rd—1.00**
- **OD—0.69**
- **Reverse—2.21**

Final Drive Ratio is dependent on which engine option is selected.

- 2.4 Liter: 3.91 FDR
- 3.3 Liter: 3.62 FDR
- 3.8 Liter: 3.45 FDR

The torque converter clutch is available in 2nd, direct, or overdrive gear;. The shift lever is conventional with six positions: P, R, N, OD, 3, and L available. When OD is selected the transaxle shifts through all four speeds with torque converter clutch available in overdrive. This position is recommended for most driving. The 3 position is tailored for use in hilly or mountainous driving. When 3 is selected, the transmission uses only 1st, 2nd, and direct gears with 2nd-direct shift delayed to 40 mph or greater. When operating in 3 or L positions torque converter clutch application occurs in direct gear. This improves transmission cooling under heavy loads. If high engine coolant temperature occurs, the torque converter clutch will also engage in 2nd gear. The L position provides maximum engine braking for descending steep grades. Unlike most current transaxles, upshifts are provided to 2nd or direct gear at peak engine speeds if the accelerator is depressed. This provides engine over-speed protection and maximum performance.

FLUID LEVEL AND CONDITION

NOTE: The transmission and differential sump have a common oil sump with an opening between the two.

The torque converter fills in both the (P) Park and (N) Neutral positions. Place the selector lever in (P) Park to check the fluid level. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground. This will assure complete oil level stabilization between differential and transmission.** The fluid should be 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.

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transaxle has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, the air bubbles can cause overheating, fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transaxle overhaul is needed. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

SELECTION OF LUBRICANT

It is important that the proper lubricant be used in the 41TE transaxle. MOPAR® ATF PLUS 3 (Automatic Transmission Fluid—type 7176) should be used to aid in assuring optimum transmission performance. Fluids of the type labeled DEXRON II Automatic Transmission Fluid are **not recommended**. It is important that the transmission fluid be maintained at the prescribed level using the recommended fluids.

SPECIAL ADDITIVES

Chrysler Corporation does not recommend the addition of any fluids to the transaxle, other than the fluid listed above. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

DESCRIPTION AND OPERATION

CLUTCH AND GEAR

The transaxle consists of:

- Three multiple disc input clutches
- Two multiple disc grounded clutches
- Four hydraulic accumulators
- Two planetary gear sets

This provides four forward ratios and a reverse ratio. The input clutch-apply pistons were designed with centrifugally balanced oil cavities so that quick response and good control can be achieved at any speed. A push/pull piston is incorporated for two of the three input clutches.

DESCRIPTION AND OPERATION (Continued)

CAUTION: Some clutch packs appear similar, but they are not the same. Do not interchange clutch components, as they might fail.

HYDRAULICS

The hydraulics of the transaxle provide:

- Manual shift lever select function
- Main line pressure regulation
- Torque converter and cooler flow control

Oil flow to the friction elements is controlled directly by four solenoid valves. The hydraulics also include a unique logic- controlled solenoid torque converter clutch control valve. This valve locks out the 1st gear reaction element with the application of 2nd, direct, or overdrive gear elements. It also redirects the 1st gear solenoid output so that it can control torque converter clutch operation. To regain access to 1st gear, a sequence of commands must be used to move the solenoid TCC control valve. This precludes any application of the 1st gear reaction element with other elements applied. It also allows one solenoid to control two friction elements.

Small, high-rate accumulators are provided in each controlled friction element circuit. These serve to absorb the pressure responses, and allow the controls to read and respond to changes that are occurring.

SOLENOIDS

The solenoid valves perform most control functions, these valves must be extremely durable and tolerant of dirt. For that reason hardened-steel poppet and ball valves are used. These are free from any close operating clearances. The solenoids operate the valves directly without any intermediate element. Direct operation means that these units must have very high output. They must close against the sizeable flow areas and high line pressures. Fast response is also required to meet the control requirements.

Two of the solenoids are normally-venting and two are normally-applying; this was done to provide a default mode of operation. With no electrical power, the transmission provides 2nd gear in (OD), (3), or (L) shift lever positions. All other transmission lever positions will operate normally. The choice of 2nd gear was made to provide adequate breakaway performance while still accommodating highway speeds.

SENSORS

There are three pressure switches to identify solenoid application. There are two speed sensors to read input (torque converter turbine) and output (parking sprag) speeds. There is also a transmission range sensor to indicate the manual shift lever position. The pressure switches are incorporated in an assembly with the solenoids. Engine speed, throttle position, temperature, etc., are also observed. Some of these signals are read directly from the engine control sensors; others are read from a multiplex circuit with the powertrain control module.

ELECTRONICS

The 41TE Transmission Control Module (TCM) is located underhood in a potted, die-cast aluminum housing. The module used is a new controller called EATX III. The TCM has a sealed, 60-way connector.

ADAPTIVE CONTROLS

These controls function by reading the input and output speeds over 140 times a second and responding to each new reading. This provides the precise and sophisticated friction element control needed to make smooth clutch-to-clutch shifts for all gear changes. The use of overrunning clutches or other shift quality aids are not required. As with most automatic transaxles, all shifts involve releasing one element and applying a different element. In simplified terms, the upshift logic allows the releasing element to slip backwards slightly. This ensures that it does not have excess capacity. The apply element is filled until it begins to make the speed change to the higher gear. The apply pressure is then controlled to maintain the desired rate of speed change. This continues until the shift is made. The key to providing excellent shift quality is precision. For example, the release element for upshifts is allowed to slip backwards slightly. The amount of that slip is typically less than a total of 20 degrees. To achieve that precision, the TCM learns the traits of the transaxle that it is controlling. It learns the release rate of the releasing element and the apply time of the applying element. It also learns the rate at which the apply element builds pressure sufficient to begin making the speed change. This method achieves more precision than would be possible with exacting tolerances. It can also adapt to any changes that occur with age or environment.

For kickdown shifts, the control logic allows the releasing element to slip. Then controls the rate at which the input (and engine) accelerate. When the lower gear speed is achieved, the releasing element reapplies to maintain that speed until the apply element is filled. This provides quick response since the engine begins to accelerate immediately. This also provides a smooth torque exchange since the release element can control the rate of torque increase. This control can make any powertrain feel more responsive without increasing harshness.

Adaptive controls respond to input speed changes. They compensate for changes in engine or friction element torque and provide good, consistent shift quality for the life of the transaxle.

DESCRIPTION AND OPERATION (Continued)

TORQUE MANAGEMENT

Most 41TE transaxles utilize torque management. Torque management is a unique function of the Powertrain Control Module (PCM). The PCM receives output signals from the Transmission Control Module (TCM) and many various engine sensors. The PCM evaluates these signals and decides if it is necessary to decrease the output of the engine's torque. This reduction in torque does not interfere with the normal operation of the vehicle. This reduction in torque will prolong the life of the drivetrain components. Torque reduction is not noticeable in normal driving functions. The torque reduction function shuts off above 16 MPH.

ON-BOARD DIAGNOSTICS

This vehicle utilizes a diagnostic system called OBDII. The powertrain control module communicates with the Transmission Control Module. Whenever the transaxle sets a fault in the Transmission Control Module (dependent on which fault is set), the powertrain control module will turn on a MIL (Malfunction Indicator Lamp) on the instrument cluster. By reading the code in the powertrain control module it will tell you where the fault occurred. If the fault occurred in the transaxle, the controller will read a **CODE 45.** For further information regarding OBDII, refer to Group 25, Emission Systems.

These controls provide comprehensive, on-board transaxle diagnostics. The information available can aid in transaxle diagnosis. For example, apply element buildup rate indicates solenoid performance. Also included are self diagnostic functions. Self diagnostics allow the technician to test the condition of the electronic controls. The Transmission Control Module continuously monitors its critical functions. It also records any malfunctions, and the number of engine starts since the last malfunction. This allows the technician to use the information in the event of a customer complaint.

TRANSMISSION CONTROL MODULE

Do not interchange Transmission Control Modules with previous year transmission control modules. If a same year TCM is being used from a different vehicle, the following procedures must be performed:

- Quick Learn Procedure
- Electronic Pinion Factor Procedure

The Transmission Control Module is located on the right inner fender panel, in the engine compartment. It is held in place by four mounting screws.

NOTE: If the Transmission Control Module has been replaced, the following procedures must be performed:

- Quick Learn Procedure: This procedure will allow the transmission control module to learn the characteristics of the vehicle.
- Electronic Pinion Factor Procedure: This procedure will reprogram the TCM to compensate for different tire sizes and final drive ratios.

GEARSHIFT AND PARKING LOCK CONTROLS

The transaxle is controlled by a lever type gearshift incorporated within the steering column. The control has six selector lever positions: P (park), R (reverse), N (neutral), and D (drive), 2 (second), and 1 (first). The parking lock is applied by moving the selector lever past a gate to the P position. **Do not apply the parking lock until the vehicle has stopped; otherwise, a severe ratchet noise will occur.**

TRANSMISSION RANGE SENSOR

The 41TE transaxle is equipped with a transmission range sensor that is located on top of the valve body. This sensor will allow for accurate transmission gear position measurement.

To service the transmission range sensor (TRS), you must remove the valve body. For repair procedures, refer to the Removal and Installation section within this group.

Also located within the TRS is a transmission temperature sensor. This sensor is used to measure the transmission fluid sump temperature. The transmission temperature sensor is serviced with the TRS as a unit.

SHIFT POSITION INDICATOR

The shifter position indicator is located in the instrument cluster. The shifter position indicator outlines with a box the gear position the transaxle manual valve lever is in.

The transmission range sensor (located on the valvebody) sends a signal to the TCM on the position of the transaxle manual valve lever. The TCM receives the switch signal and processes the data. The TCM sends the Shift Lever Position (SLP) information to the BCM via the CCD bus. The BCM then outlines with a box the appropriate shifter position indicator in the instrument cluster.

To replace the shifter position indicator, refer to Group 8E, Instrument Panel And Gauges.

DIAGNOSIS AND TESTING

41TE TRANSAXLE GENERAL DIAGNOSIS

CAUTION: Before attempting any repair on a 41TE four speed automatic transaxle, check for Diagnostic Trouble Codes with the DRBIII scan tool. Always use the Powertrain Diagnostic Test Procedure Manual.

Transaxle malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

ROAD TEST

Prior to performing a road test, check the fluid level.

During the road test, the transaxle should be operated in each position to check for slipping and any variation in shifting.

If vehicle operates properly at high speeds, but has poor acceleration, the converter's overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed for high speeds, the clutch may have seized. Both of these stator defects require replacement of the torque converter.

The clutch that is slipping can be determined by noting the transaxle operation in all selector positions. Then comparing which internal units are applied in those positions. The **Elements in Use Chart** provides a basis for road test analysis.

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 usually diagnose slipping units. However, the actual cause of the malfunction may not be detected. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most hydraulic transaxle 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 front wheels to turn, and position tachometer so it can be read.

			CLUTCHES				
Shift Lever Position	Start Safety	Park Sprag	Underdrive	Overdrive	Reverse	2/4	Low/ Reverse
P — PARK	X	X					X
R — REVERSE					X		X
N — NEUTRAL	X						X
OD — OVERDRIVE							
First			X				X
Second			X			X	
Direct			X	X			
Overdrive				X		X	
3 — DRIVE GEAR*							
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.

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ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER

DIAGNOSIS AND TESTING (Continued)

Attach 150 psi gauges to ports required for test being conducted. A 300 psi gauge (C-3293) is required for reverse pressure test.

Test port locations are shown in (Fig. 2).

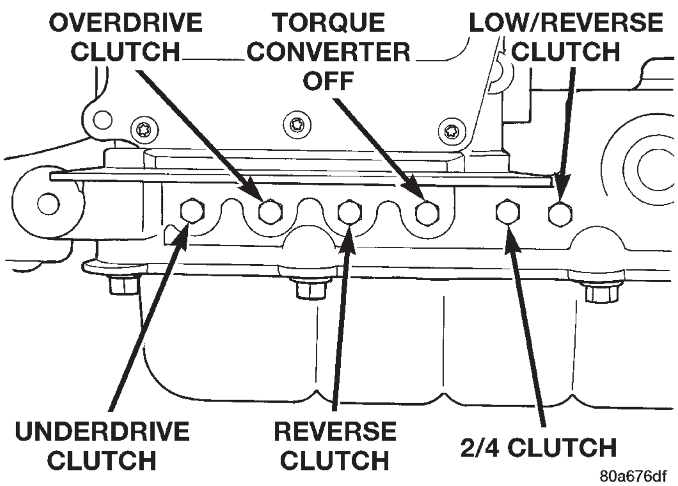


Fig. 2 Pressure Taps

TEST ONE-SELECTOR IN LOW 1st GEAR

(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.

(5) This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.

TEST TWO-SELECTOR IN DRIVE 2nd 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 2A–SELECTOR IN OD

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

(1) Attach gauge to the UD 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 TCM is at fault.

TEST THREE-OVERDRIVE CLUTCH CHECK

(1) Attach gauge to the overdrive clutch tap.

(2) Move selector lever to the (Circle D) 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.

(7) This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.

TEST FOUR-SELECTOR IN CIRCLE DRIVE, OVERDRIVE GEAR

(1) Attach gauge to the 2/4 clutch tap.

(2) Move selector lever to the (Circle D) position.

(3) Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.

(4) The 2/4 clutch pressure should read 75 to 95 psi.

(5) This test checks the 2/4 clutch hydraulic circuit.

TEST FIVE-SELECTOR IN CIRCLE DRIVE, OVERDRIVE

(1) Attach gauge to the torque converter clutch off pressure tap.

(2) Move selector lever to the (Circle D) position.

(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph.

CAUTION: Both wheels must turn at the same speed.

(4) Torque converter clutch off pressure should be less than 5 psi.

(5) This test checks the torque converter clutch hydraulic circuit.

TEST SIX-SELECTOR IN REVERSE

(1) Attach gauge to the reverse and LR 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.

DIAGNOSIS AND TESTING (Continued)

(4) Reverse and LR clutch pressure should read 165 to 235 psi.

(5) This test checks the reverse clutch hydraulic circuit.

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 4 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 2A, a defective solenoid assembly or TCM is the cause.

CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure (Fig. 3) (Fig. 4). The clutches may be tested by applying air pressure to their respective passages. The valve body must be removed and Tool 6056 installed. 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 removal.

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.

ALL PRESSURE SPECIFICATIONS ARE PSI

(on hoist, with front wheels free to turn)

Gear Selector Position	Actual Gear	PRESSURE TAPS: Under-Drive Clutch	Over-Drive Clutch	Reverse Clutch	Torque Converter Clutch Off	2/4 Clutch	Low/ Reverse Clutch
PARK * 0 mph	PARK	0-2	0-5	0-2	60-110	0-2	115-145
REVERSE * 0 mph	REVERSE	0-2	0-7	165-235	50-100	0-2	165-235
NEUTRAL * 0 mph	NEUTRAL	0-2	0-5	0-2	60-110	0-2	115-145
L # 20 mph	FIRST	110-145	0-5	0-2	60-110	0-2	115-145
3 # 30 mph	SECOND	110-145	0-5	0-2	60-110	115-145	0-2
3 # 45 mph	DIRECT	75-95	75-95	0-2	60-90	0-2	0-2
OD # 30 mph	OVERDRIVE	0-2	75-95	0-2	60-90	75-95	0-2
OD # 50 mph	OVERDRIVE WITH TCC	0-2	75-95	0-2	0-5	75-95	0-2

***Engine speed at 1500 rpm**
#CAUTION: Both front wheels must be turning at same speed.

9321-200

PRESSURE CHECK SPECIFICATIONS

DIAGNOSIS AND TESTING (Continued)

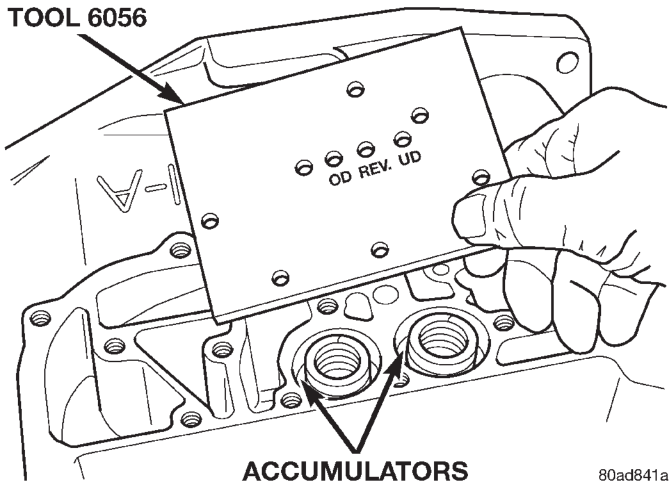


Fig. 3 Air Pressure Test Plate

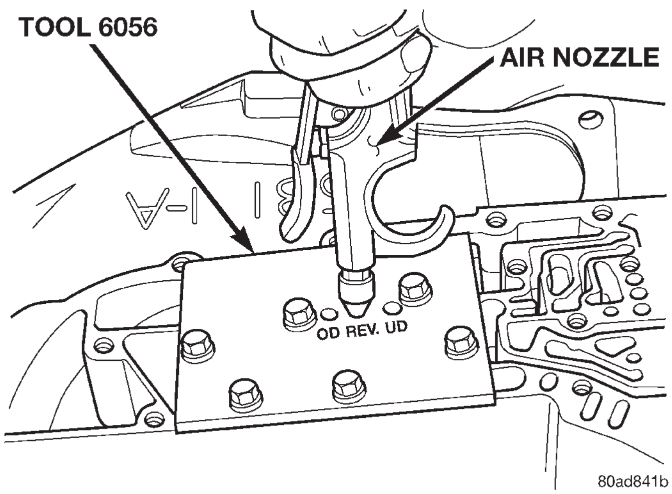


Fig. 4 Testing Reverse Clutch

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 (rear of case, between 2 bolt holes). Then, 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.

UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Air pressure is applied to the low/reverse and 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. The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.

FLUID LEAKAGE-TORQUE CONVERTER HOUSING AREA

(1) Check for source of leakage.

(2) Fluid leakage at or around the torque converter area may originate from an engine oil leak. The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.

(3) Prior to removing the transaxle, perform the following checks:

(4) When leakage is determined to originate from the transaxle, check fluid level prior to removal of the transaxle and torque converter.

(5) High oil level can result in oil leakage out the vent in the manual shaft. If the fluid level is high, adjust to proper level.

(6) After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle. This will determine if the torque converter or transaxle is leaking.

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside (peripheral) weld.
- Torque converter hub weld.

NOTE: Hub weld is inside and not visible. Do not attempt to repair. Replace torque converter.

SHIFT POSITION INDICATOR

The transmission range sensor (on the valve body) sends a signal to the TCM on the position of the transaxle manual valve lever. The TCM receives the switch signal and processes the data. The TCM sends the Shift Lever Position (SLP) information to the BCM via the CCD bus. The BCM then outlines with a box the appropriate shifter position indicator in the instrument cluster.

DIAGNOSIS AND TESTING (Continued)

If a problem arises with the shifter position indicator, consult the following chart for diagnostic information. If the malfunction cannot be corrected using the chart, consult the proper diagnostic manual.

To replace the shifter position indicator, refer to Group 8E, Instrument Panel And Gauges.

CONDITION	POSSIBLE CAUSE
ALL PRND3L DISPLAY LIGHTS ″ON″ IN P&N GEAR POSITIONS	1.Check wiring and connectors
	2. Faulty trans. range sensor
	3. Faulty manual lever
ALL DISPLAY LIGHTS ″ON″ IN ALL GEAR POSITIONS	1. Check wiring & connectors
	2. Faulty trans. range sensor
	3. Faulty manual lever
	4. CCD communication malfunction
	5. Check oil level
ALL DISPLAY LIGHTS ″OFF″	1. Normal transient condition between P&R and R&N gear positions
	2. Check shift lever linkage
	3. Body controller malfunction
	4. Check wiring and connectors
	5. Faulty cluster
ALL DISPLAY LIGHTS ″OFF″ ACCOMPANIED BY A ″NO BUS″ MESSAGE	1. CCD communication malfunction
DISPLAY LIGHTS OUT OF SEQUENCE WITH SHIFT LEVER	1. Check wiring and connectors
	2. Faulty trans. range sensor
	3. Faulty manual lever
	4. CCD communication malfunction

SERVICE PROCEDURES

FLUID AND FILTER CHANGE

When the factory fill fluid is changed, only fluids labeled MOPAR® ATF PLUS 3 (Automatic Transmission fluid) Type 7176 should be used.

If the transaxle is disassembled for any reason, the fluid and filter should be changed.

30,000 MILE TRANSAXLE OIL CHANGE

When a vehicle attains 30,000 miles on its odometer it is recommended that the transaxle oil be changed. To change the oil, use the procedure that follows:

It is recommended that a transaxle fluid exchanger (ATF 2000+ or equivalent) be used to replace the used fluid in the transaxle. If a fluid exchanger is not available use a fluid suction pump (Vacula™ or equivalent) to draw the fluid out of the dipstick tube. If a fluid suction pump is not available remove the oil pan and drain the fluid.

CAUTION: Chrysler Corporation does not recommend using any fluid exchanger that introduces additives into the transaxle.

TRANSAXLE FLUID EXCHANGER METHOD

(1) To perform the transaxle fluid exchange, the transaxle must be at operating temperature. Drive the vehicle till it reaches full operating temperature.

(2) Verify that the fill tank on the transaxle fluid exchanger (ATF 2000+ or equivalent) is clean and dry.

(3) Fill the tank to the recommended fill capacity with Mopar ATF Plus 3 Type 7176.

(4) Hookup the vehicle to the machine following the manufacturers instructions. Perform the exchange procedure following the instructions provided with the machine.

(5) Once machine has completed the fluid exchange. Check the fluid level and condition and fill to proper level with Mopar ATF Plus 3 Type 7176.

NOTE: Verify that the transaxle cooler lines are tightened to proper specifications. Cooler line torque specification is 2 N·m (18 in. lbs.).

SERVICE PROCEDURES (Continued)

DIPSTICK TUBE FLUID SUCTION METHOD

(1) When performing the fluid suction method, make sure the transaxle is at full operating temperature.

(2) To perform the dipstick tube fluid suction method, use a suitable fluid suction device (Vacula™ or equivalent).

(3) Insert the fluid suction line into the dipstick tube.

NOTE: Verify that the suction line is inserted to the lowest point of the transaxle oil pan. This will ensure complete evacuation of the fluid in the pan.

(4) Follow the manufacturers recommended procedure and evacuate the fluid from the transaxle.

(5) Remove the suction line from the dipstick tube.

(6) Add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(7) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(8) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(9) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range.

TRANSAXLE OIL PAN DROP METHOD

This procedure involves removing the transaxle oil pan to drain the transaxle fluid.

(1) Bring the vehicle up to normal operating temperature. Drive the vehicle a minimum of 10 miles.

(2) Raise the vehicle on the hoist.

(3) Loosen the transaxle oil pan and drain the fluid into a suitable container.

(4) Remove the pan and clean all sealant from the pan and transaxle mating surfaces. Clean the magnet and the inside of the pan.

(5) Apply a 1/8 inch bead of Mopar RTV Sealant to the mounting flange of the transaxle oil pan. Apply RTV Sealant to the underside of the attaching bolts. Attach the oil pan to the transaxle. Tighten the bolts to 19 N•m (165 in. lbs.).

(6) Lower the vehicle and add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(7) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(8) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(9) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range. Drive the vehicle a minimum of 10 miles.

(10) Raise the vehicle on the hoist.

(11) Check for leaks around the transaxle oil pan sealing surfaces.

(12) Recheck the fluid level. The level should be in the HOT range.

SEVERE USAGE SERVICE

If the vehicle exhibits any of the following symptoms, it is recommended that the transaxle oil and filter be replaced.

- Transaxle oil discolored
- Transaxle oil has high mileage
- Oil feels grimy when rubbed between fingertips
- Poor shift quality
- Delayed gear engagement
- Vehicle shudder between shifts

TRANSAXLE OIL AND FILTER REPLACEMENT

This procedure involves changing the transaxle fluid and filter, driving the vehicle for 10 miles and changing the transaxle fluid a second time.

(1) Bring the vehicle up to normal operating temperature. Drive the vehicle a minimum of 10 miles.

(2) Raise the vehicle on the hoist.

(3) Loosen the transaxle oil pan and drain the fluid into a suitable container.

(4) Remove the pan and clean all sealant from the pan and transaxle mating surfaces. Clean the magnet and the inside of the pan.

(5) Separate the filter and O-ring from the valve body. Inspect the O-ring for cuts or improper installation. This could lead to delayed garage shifts.

(6) Install a new filter. Replace the O-ring as necessary.

(7) Apply a 1/8 inch bead of Mopar RTV Sealant to the mounting flange of the transaxle oil pan. Apply RTV Sealant to the underside of the attaching bolts. Attach the oil pan to the transaxle. Tighten the bolts to 19 N·m (165 in. lbs.).

(8) Lower the vehicle and add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(9) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(10) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

SERVICE PROCEDURES (Continued)

(11) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range. Drive the vehicle a minimum of 10 miles.

(12) Raise the vehicle on the hoist.

(13) Remove the pan and clean all sealant from the pan and transaxle mating surfaces. Clean the magnet and the inside of the pan.

(14) Separate the filter from the valve body to allow additional fluid to drain from the transaxle. Inspect the filter O-ring for any damage and replace as necessary.

(15) After the transaxle has stopped draining, reinstall the filter and O-ring.

(16) Apply a 1/8 inch bead of Mopar RTV Sealant to the mounting flange of the transaxle oil pan. Apply RTV Sealant to the underside of the attaching bolts. Attach the oil pan to the transaxle. Tighten the bolts to 19 N·m (165 in. lbs.).

(17) Lower the vehicle and add 4 Quarts of Mopar ATF Plus 3 Type 7176 transaxle fluid.

(18) Start the engine and allow it to idle for a minimum of one minute. With the parking brake applied, press your foot on the service brake and cycle the transaxle from park to all gear positions ending in neutral or park.

(19) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the ADD mark on the dipstick.

(20) Recheck the fluid level after the transaxle is at normal operating temperature. The level should be in the HOT range.

FLUID DRAIN AND REFILL

(1) Raise vehicle on a hoist (See Group 0, Lubrication). Place a drain container with a large opening, under transaxle oil pan.

(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.

(4) Clean the oil pan and magnet. Reinstall pan using new MOPAR® RTV sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).

(5) Pour four quarts of MOPAR® ATF PLUS 3 (Automatic Transmission Fluid) Type 7176 through the fill tube.

(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) Add sufficient fluid to bring level to 1/8 inch below the ADD mark.

CAUTION: Do not overfill transaxle. Do not add oil if level is between: Lower holes for warm oil (100°F). Upper holes for hot oil (180°F).

(8) Recheck fluid level after transaxle is at normal operating temperature. The level should be in the HOT region (Fig. 5).

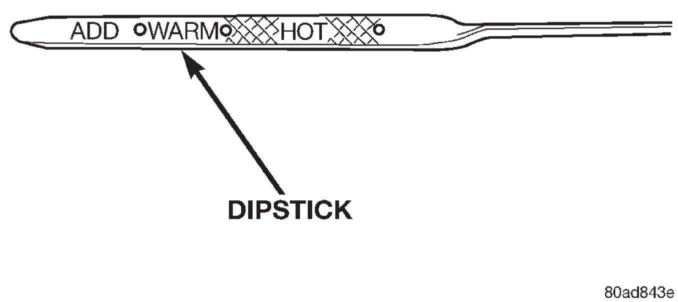


Fig. 5 Oil Level Indicator

(9) To prevent dirt from entering transaxle, make certain that dipstick is seated into the dipstick fill tube.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transaxle 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.

FLUSHING COOLERS AND TUBES

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed. The cooler bypass valve in the transaxle must be replaced also. The torque converter must also be replaced with an exchange unit. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transaxle.

The recommended procedure for flushing the transaxle cooler is to use Tool 6906A Cooler Flusher.

SERVICE PROCEDURES (Continued)

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906A

(1) Remove cover plate filler plug on Tool 6906A. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906A.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF PLUS 3 Type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

OIL PUMP VOLUME CHECK

After the new or repaired transmission has been installed, fill to the proper level with Mopar ATF PLUS 3 (Type 7176) automatic transmission fluid. The volume should be checked using the following procedure:

(1) Disconnect the **From cooler** line at the transmission and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF, disconnect the **To Cooler** line at the transaxle.

(4) Refill the transaxle to proper level and recheck pump volume.

(5) If flow is found to be within acceptable limits, replace the cooler. Then fill transmission to the proper level, using Mopar ATF PLUS 3 (Type 7176) automatic transmission fluid.

(6) If fluid flow is still found to be inadequate, check the line pressure using the Transaxle Hydraulic Pressure Test procedure.

(7) Check the cooler for debris on the external surfaces. Clean as necessary.

TRANSAXLE QUICK LEARN PROCEDURE

The quick learn procedure requires the use of the DRBIII scan tool.

This program allows the electronic transaxle system to recalibrate itself. This will provide the best possible transaxle operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transaxle 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

SERVICE PROCEDURES (Continued)

- The shift lever position must stay until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRBIII indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

(1) Plug the DRBIII scan tool into the data link connector. The connector is located under the instrument panel.

(2) Go to the Transmission screen.

(3) Go to the Miscellaneous screen.

(4) Select Quick Learn Procedure. Follow the instructions of the DRBIII to perform the Quick Learn Procedure.

PINION FACTOR PROCEDURE

The vehicle speed readings for the speedometer are taken from the output speed sensor. The TCM must be calibrated to the different combinations of equipment available. A procedure has been developed called Pinion Factor. It allows the technician to set the Transmission Control Module initial setting so that the speedometer readings will be correct.

Failure to perform this procedure will cause a No Speedometer Operation condition.

This procedure must be performed if the Transmission Control Module has been replaced.

To properly read or reset the Pinion Factor, it is necessary to use a DRBIII scan tool. Perform the following steps with the DRBIII scan tool to read or reset the Pinion Factor:

(1) Plug the DRBIII scan tool into the data link connector located under the instrument panel.

(2) Select the Transmission menu.

(3) Select the Miscellaneous menu.

(4) Select Pinion Factor. Then follow the instructions on the DRBIII scan tool screen.

REMOVAL AND INSTALLATION

GEARSHIFT CABLE

REMOVAL

(1) Remove cable eyelet attachment from transaxle operating lever pin (Fig. 6).

(2) Using pliers, squeeze ears of cable conduit attachment at mounting bracket (Fig. 7) and push through hole to remove (Fig. 8).

(3) Remove the under instrument panel silencer (Fig. 9). Refer to Group 8E, Instrument Panel And Gauges for more information.

(4) At the steering column attachment, remove the cable eyelet attachment from the shift lever pin.

(5) Using pliers, squeeze ears of cable attachment at mounting bracket then push through hole to remove.

(6) Unseat the dash grommet and remove the cable from the vehicle.

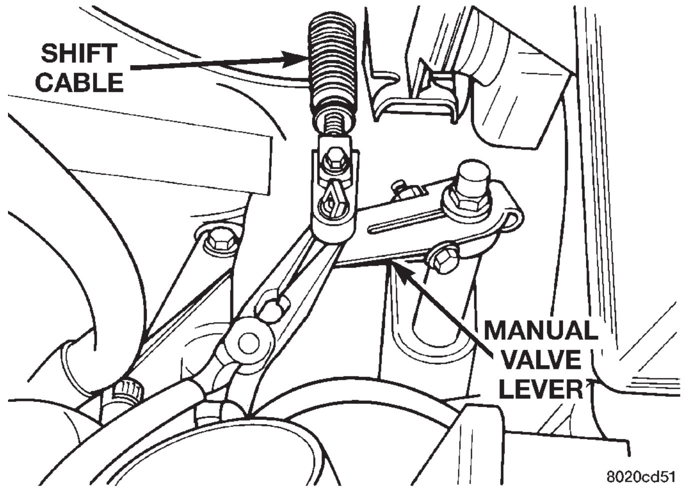


Fig. 6 Gearshift Cable

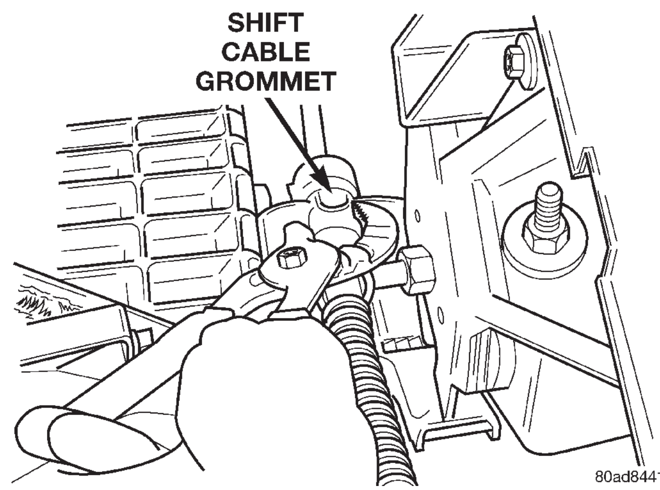


Fig. 7 Grommet Clips

INSTALLATION

(1) Install cable into steering column attachment bracket. Verify conduit ears are fully engaged. Verify cable does not interfere with brake pedal actuation.

(2) Attach cable eyelet fitting onto shift lever pin.

(3) Insert transaxle end of cable through dash panel hole and fully seat grommet.

(4) Install instrument panel silencer. Verify gearshift cable is routed through the slot in the silencer.

CAUTION: Failure to route the cable properly at the silencer may cause brake pedal interference.

(5) Attach transaxle end of cable to the mounting bracket on the transaxle. Assure the conduit attachment ears are fully seated.

REMOVAL AND INSTALLATION (Continued)

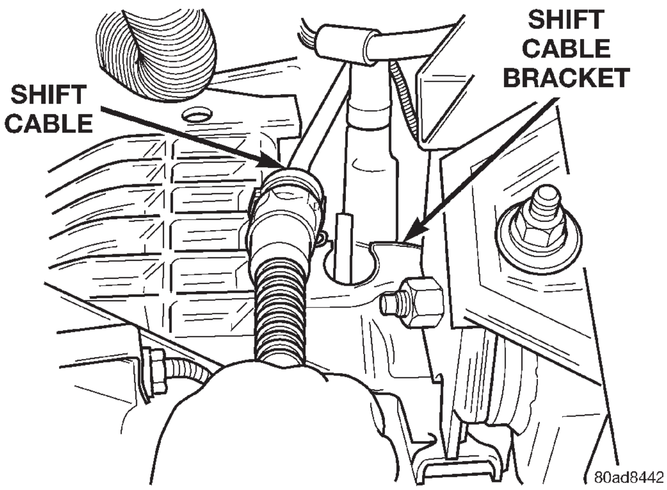


Fig. 8 Remove Cable From Bracket

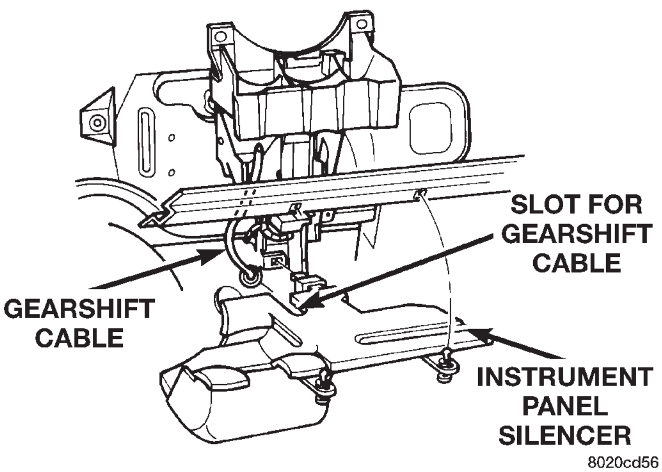


Fig. 9 Instrument Panel Silencer

(6) Attach cable eyelet fitting onto the transaxle operating lever.

(7) Complete adjustment using the gearshift cable adjustment procedure.

ADJUSTMENT

Lift and rotate the gearshift hand lever into the park (P) gate position and remove the ignition key. This confirms the shift lever is in the gated park (P) position.

After confirming the park gate position, turn the ignition switch. If the starter will operate, the park gate position is correct. Move the shift lever into the neutral (N) position. If the starter will operate in this position, the linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

(1) Park the vehicle on level ground and set the parking brake.

(2) Place the gearshift lever in park (P) gate position and remove key.

(3) Loosen the cable adjustment screw at the transaxle operating lever (Fig. 10).

(4) Pull the transaxle operating lever fully forward to the park detent position.

(5) Release the park brake, then rock the vehicle to assure it is in park lock. Reset the park brake.

(6) Tighten the cable adjustment screw to 8 N·m (70 in. lbs.). Gearshift cable should now be properly adjusted.

(7) Check adjustment by using the preceding procedure.

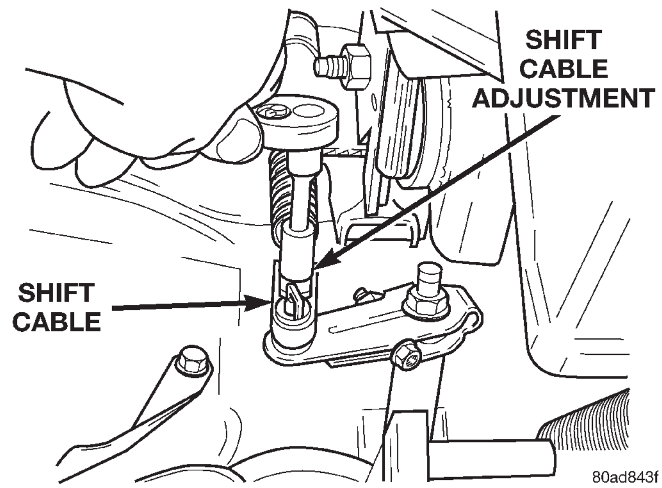


Fig. 10 Gearshift Cable

MANUAL VALVE LEVER (SHIFT LEVER)

REMOVAL

(1) Remove shift cable from lever (Fig. 11).

(2) Loosen the lever mounting bolt (Fig. 12). Do not remove bolt (not necessary).

(3) Pull up on lever and remove.

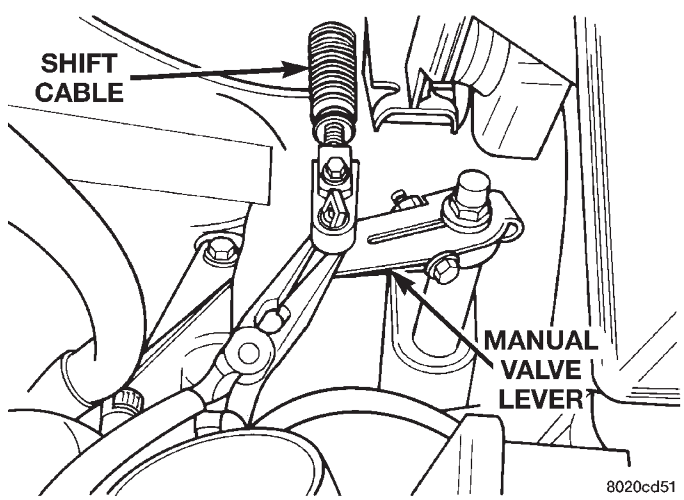


Fig. 11 Shift Cable

INSTALLATION

(1) For installation, reverse removal procedure.

REMOVAL AND INSTALLATION (Continued)

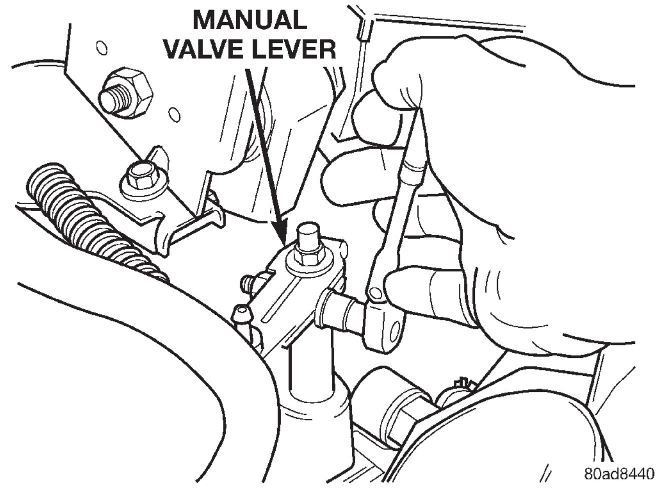


Fig. 12 Manual Valve Lever (Shift Lever)

SOLENOID ASSEMBLY-REPLACE

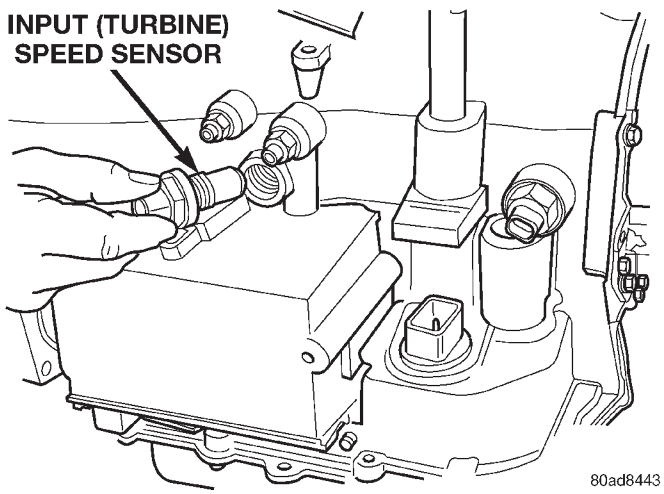


Fig. 13 Remove Input Speed Sensor

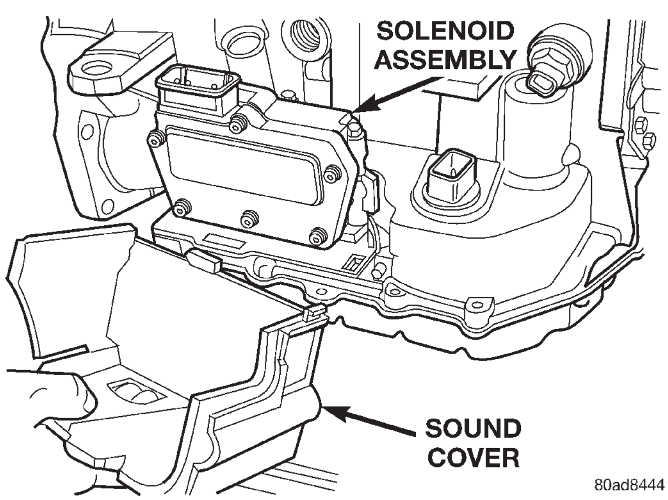


Fig. 14 Remove Sound Cover

To install solenoid assembly, reverse removal procedure. Tighten screws to 12 N·m (105 in. lbs.).

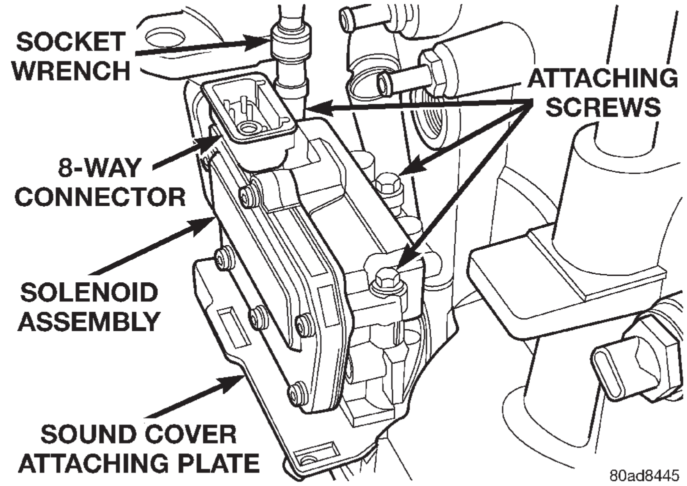


Fig. 15 Remove Attaching Screws

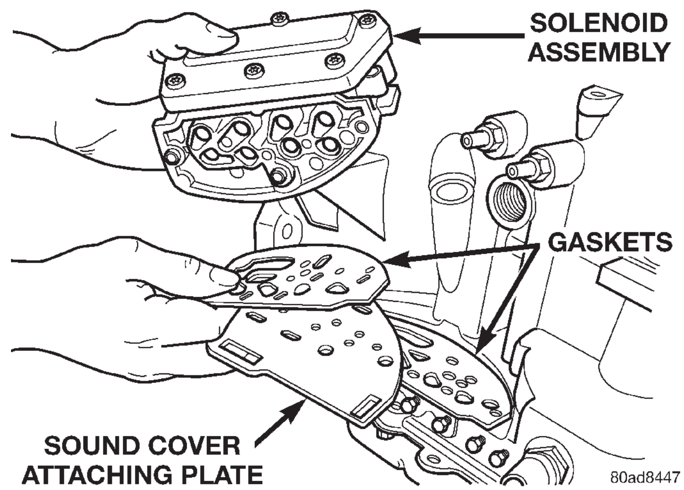


Fig. 16 Remove Solenoid Assembly

TRANSMISSION RANGE SENSOR

The transmission range sensor is located within the transaxle. To remove the TRS the transaxle oil pan and valve body must be removed.

REMOVAL

(1) Disconnect battery negative cable.
(2) Remove engine air cleaner and tube.
(3) Remove gearshift cable (Fig. 17).
(4) Remove manual valve lever.
(5) Disconnect transmission range sensor connector.
(6) Hoist vehicle.
(7) Carefully remove transaxle oil pan and drain fluid.
(8) Remove transaxle oil filter. Let transaxle oil drain fully.
(9) Remove valve body retaining bolts.
(10) Extract park rod from guide bracket and remove valve body from transaxle.
(11) Place valve body on workbench (Fig. 18).
(12) Remove TRS retaining screw (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

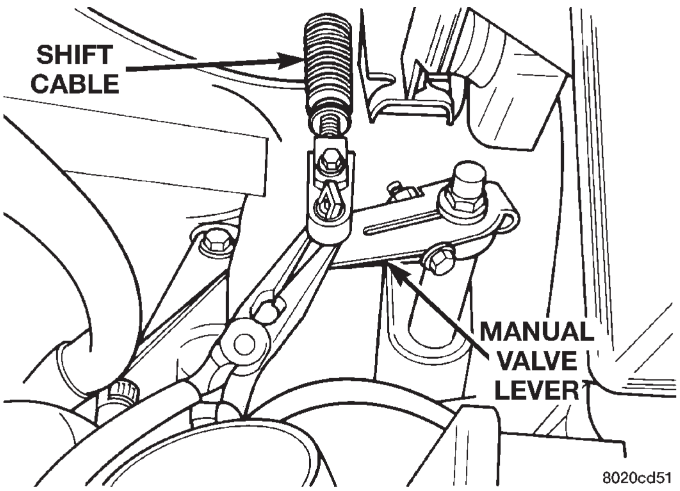


Fig. 17 Gearshift Cable And Manual Valve Lever

(13) Remove manual shaft seal (Fig. 20).

(14) Slide Transmission Range Sensor up the manual shaft and remove (Fig. 21).

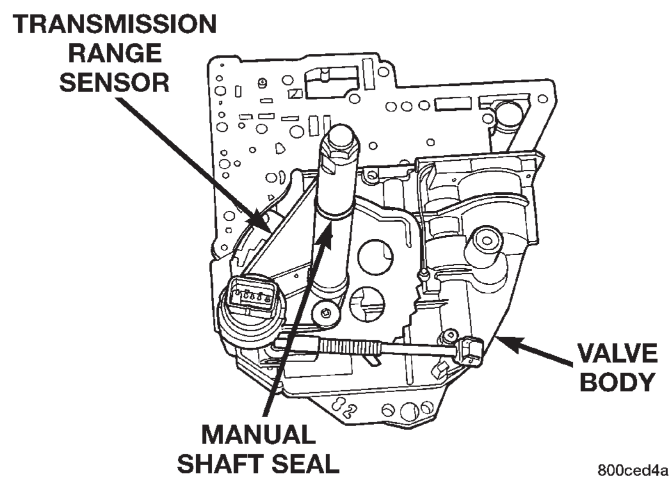


Fig. 18 Valve Body W/TRS

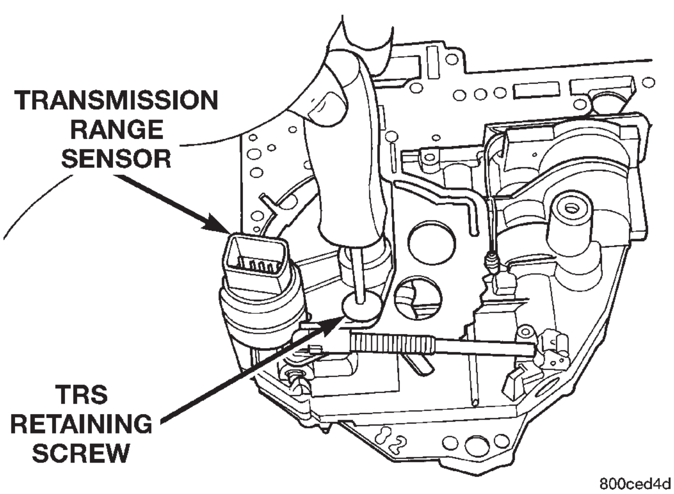


Fig. 19 Remove Retaining Screw

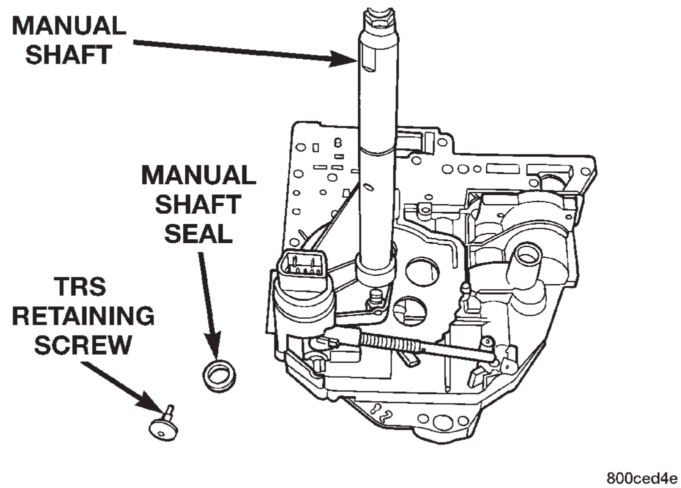


Fig. 20 Remove Manual Shaft Seal

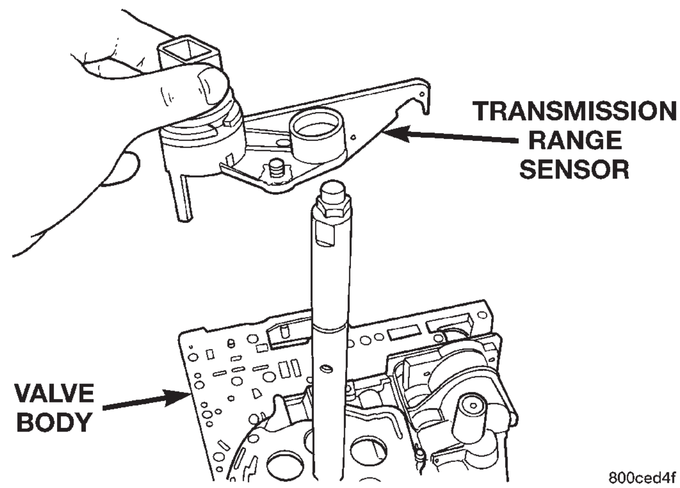


Fig. 21 Remove Transmission Range Sensor

INSTALLATION

(1) For installation, reverse removal procedure. Tighten TRS retaining screw to 5 N·m (45 in. lbs.) Reseal transaxle oil pan using RTV.

SPEED SENSOR-INPUT

CAUTION: When disconnecting speed sensor connector, be sure that the weather seal does not fall off or remain in old sensor.

The input speed sensor is located to the left of the manual shift lever (Fig. 22).

SPEED SENSOR-OUTPUT

CAUTION: When disconnecting speed sensor connector, be sure that the weather seal does not fall off or remain in old sensor.

The output speed sensor is located to the right of the manual shift lever (Fig. 23).

REMOVAL AND INSTALLATION (Continued)

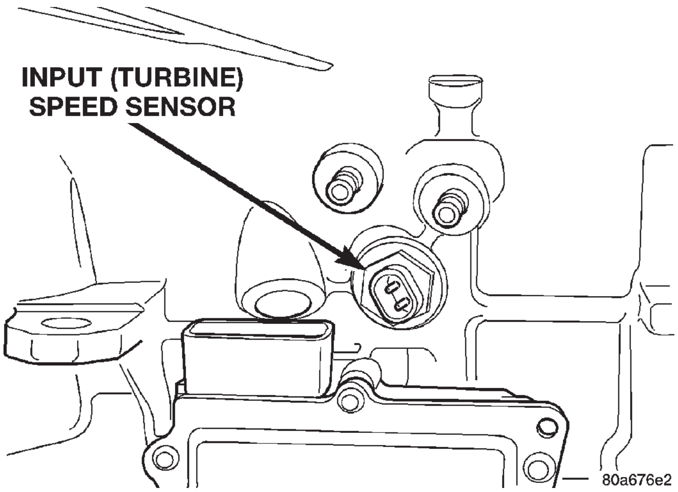


Fig. 22 Input (Turbine) Speed Sensor

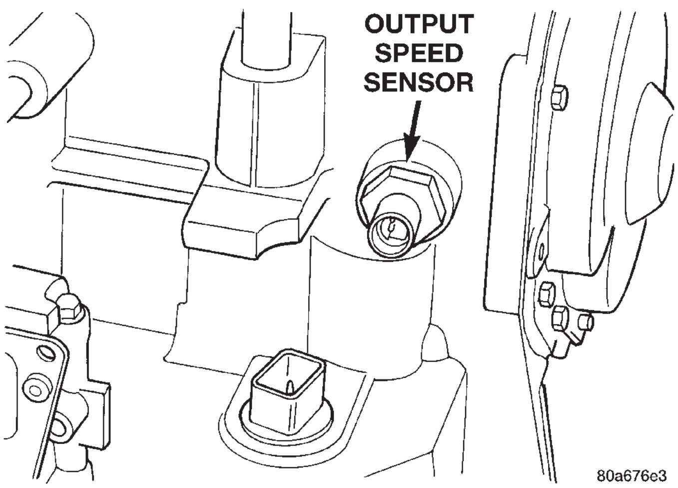


Fig. 23 Output Speed Sensor

TRANSMISSION CONTROL MODULE

Do not interchange Transmission Control Modules with previous year transmission control modules. If a same year TCM is being used from a different vehicle, the following procedures must be performed:

- Quick Learn Procedure
- Electronic Pinion Procedure

The Transmission Control Module is located on the right fender inner panel, in the engine compartment. It is held in place by four mounting screws.

NOTE: If the Transmission Control Module has been replaced, the following procedures must be performed:

- Quick Learn Procedure: This procedure will allow the transmission control module to learn the characteristics of the vehicle.
- Electronic Pinion Factor Procedure: This procedure will reprogram the TCM to compensate for different tire sizes and final drive ratios.

REMOVAL

(1) Loosen 60 way retaining screw, located in the center of the 60 way connector (Fig. 24). Then disconnect the 60 way connector on Transmission Control Module.

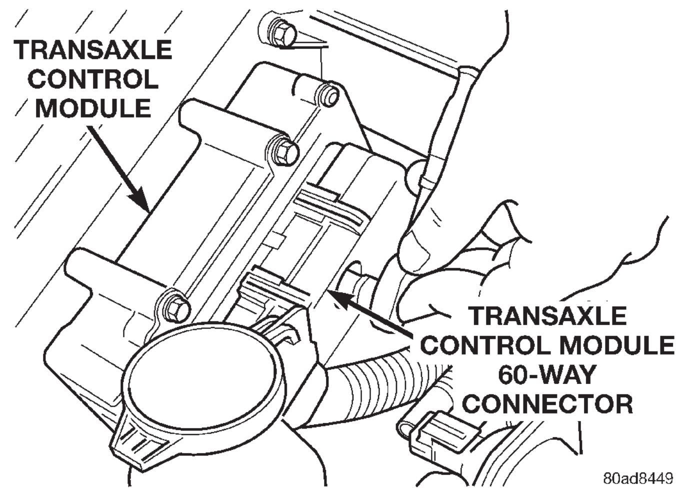


Fig. 24 Loosen Connector Screw

(2) Remove Transmission Control Module mounting screws and lift module from vehicle (Fig. 25) (Fig. 26).

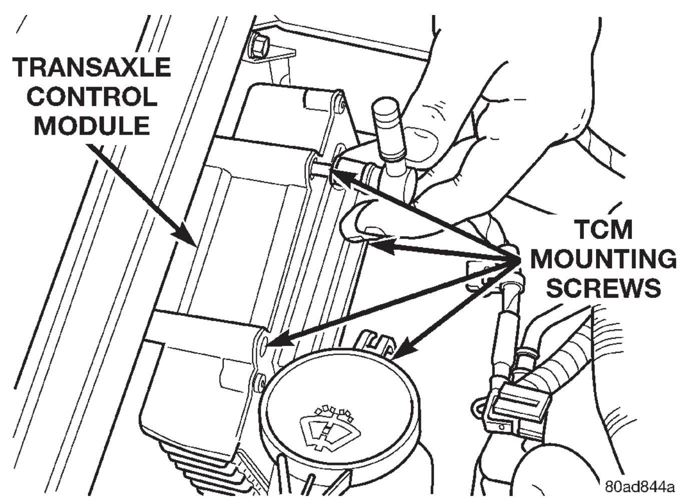


Fig. 25 Mounting Screws

INSTALLATION

(1) To install, reverse removal procedure.

REMOVAL AND INSTALLATION (Continued)

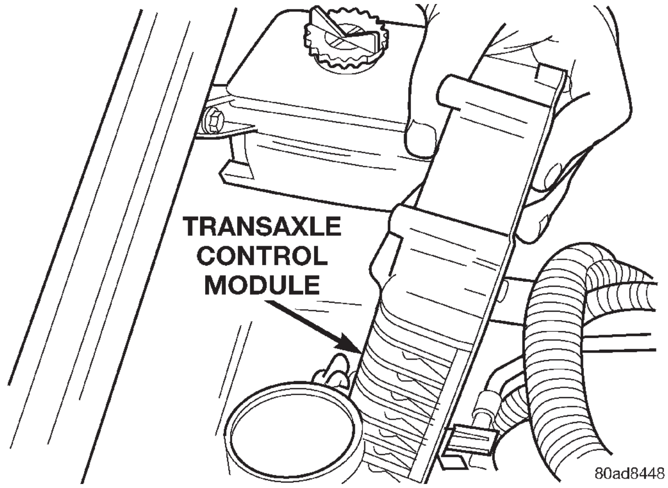


Fig. 26 Transaxle Control Module

VALVE BODY

REMOVAL

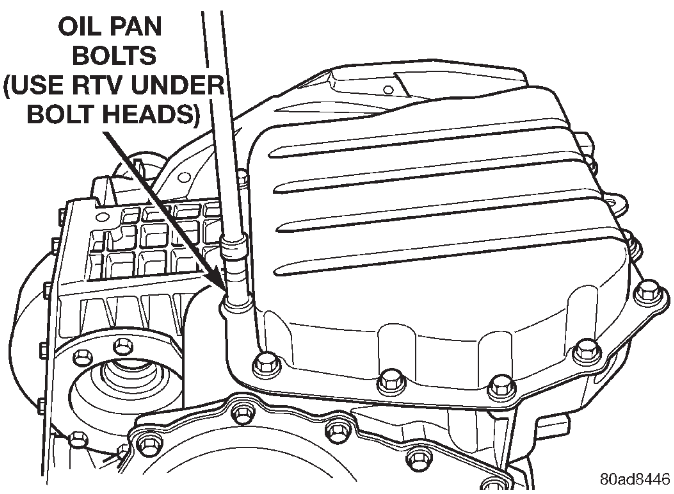


Fig. 27 Remove Oil Pan Bolts

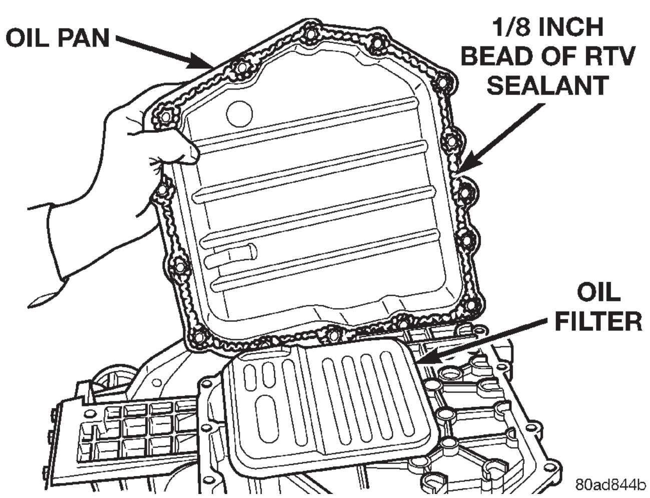


Fig. 28 Remove Oil Pan

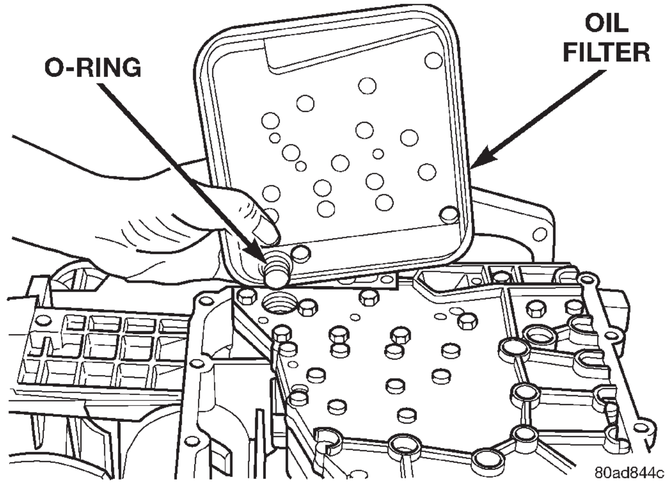


Fig. 29 Remove Oil Filter

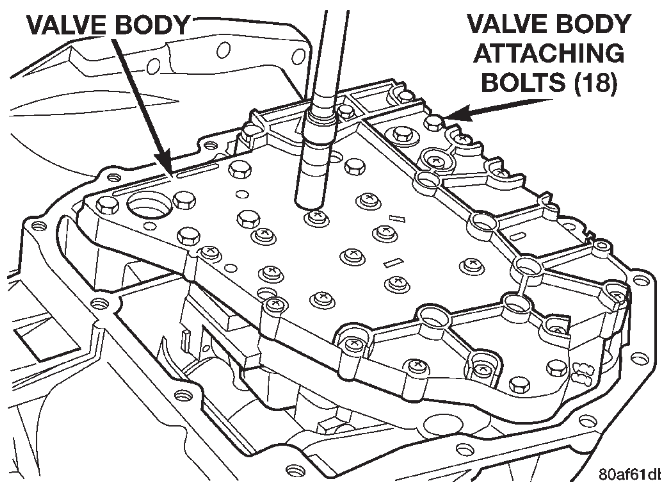


Fig. 30 Remove Valve Body Attaching Bolts

NOTE: To ease removal of the valve body, turn the manual valve lever fully clockwise.

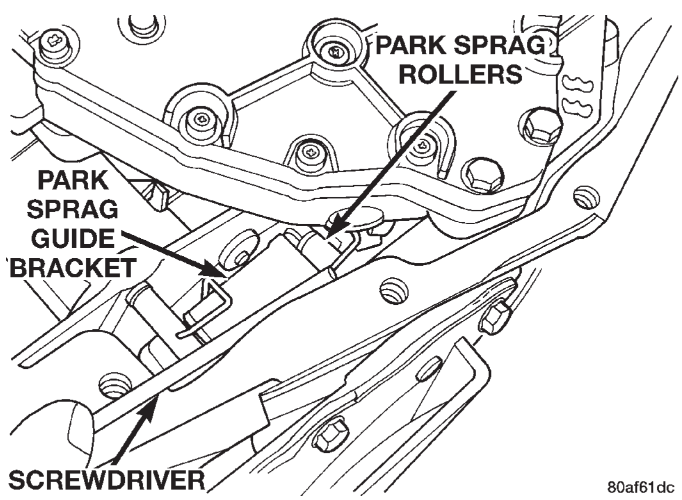


Fig. 31 Push Park Rod Rollers from Guide Bracket

REMOVAL AND INSTALLATION (Continued)

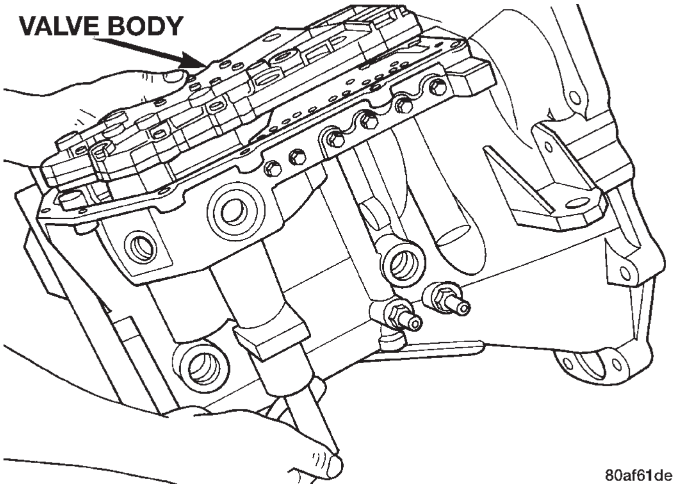


Fig. 32 Remove Valve Body

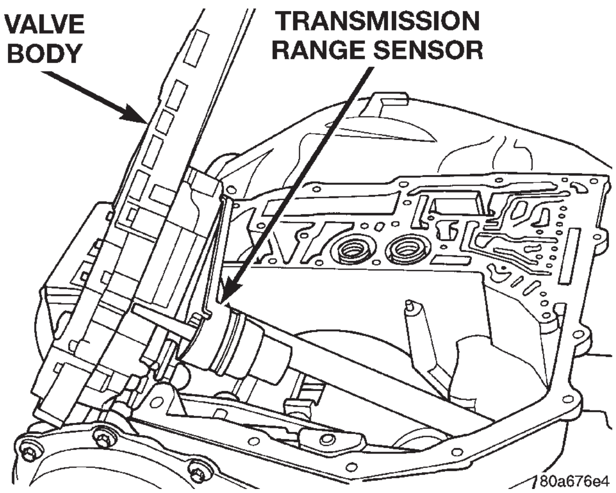


Fig. 33 Valve Body Removed

INSTALLATION

To install valve body, reverse removal procedure

CAUTION: The valve body manual shaft pilot may distort and bind the manual valve if the valve body is mishandled or dropped.

NOTE: To ease installation of the valve body, turn the manual valve lever fully clockwise.

Guide park rod rollers into guide bracket, while shifting manual lever assembly out of the installation position.

TRANSAXLE

Transaxle removal does NOT require engine removal.

See Group 7, Cooling to drain engine cooling system and remove coolant return extension (3.0 liter engine only).

The transaxle and torque converter must be removed as an assembly; otherwise, the torque converter drive plate, pump bushing or oil seal may be damaged. The drive plate will not support a load; therefore, none of the weight of the transaxle should be allowed to rest on the drive plate during removal.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove air cleaner duct. Disconnect transaxle shift linkage at manual valve lever (Fig. 34).

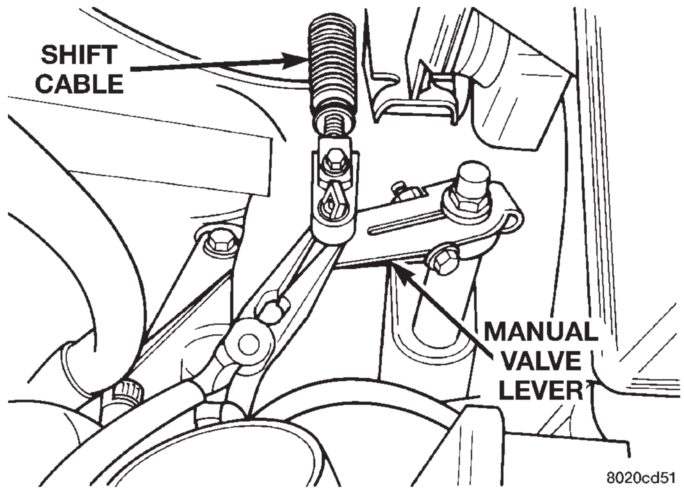


Fig. 34 Shift Linkage At Manual Valve Lever

(3) Squeeze grommet clips and remove cable at transaxle bracket (Fig. 35) (Fig. 36).

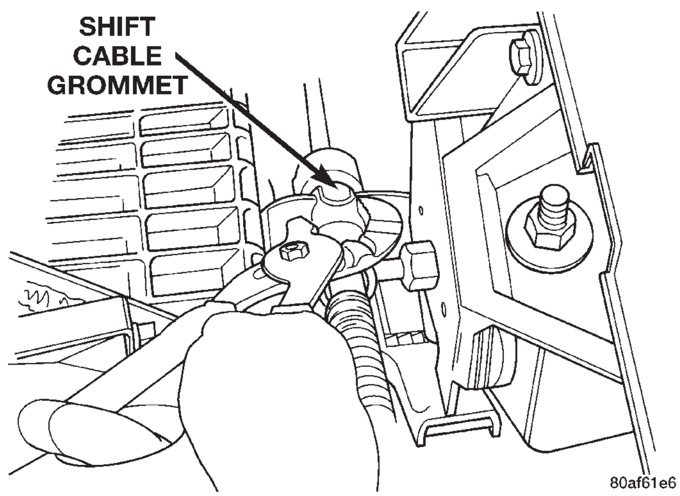


Fig. 35 Grommet Clips

(4) Remove 16–way engine harness connector from dipstick tube bracket. Remove dipstick tube bracket nut at cylinder head. Remove dipstick tube.

(5) Remove transaxle cooler lines.

(6) Remove connector at transaxle solenoid pack.

(7) Remove input and output speed sensor wiring connectors (Fig. 37) (Fig. 38).

REMOVAL AND INSTALLATION (Continued)

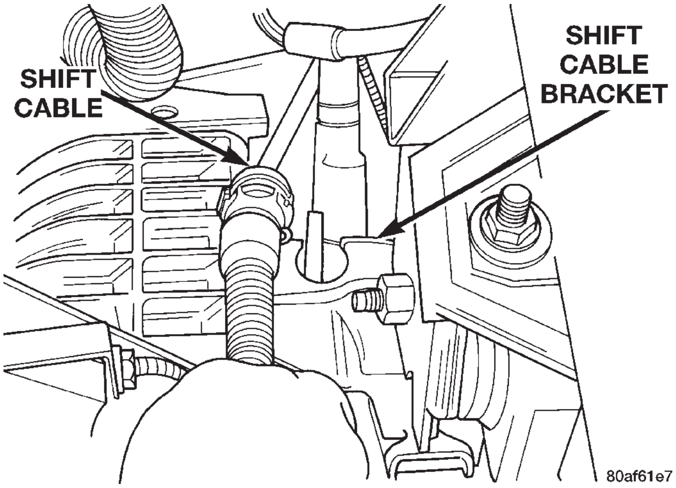


Fig. 36 Remove Cable From Bracket

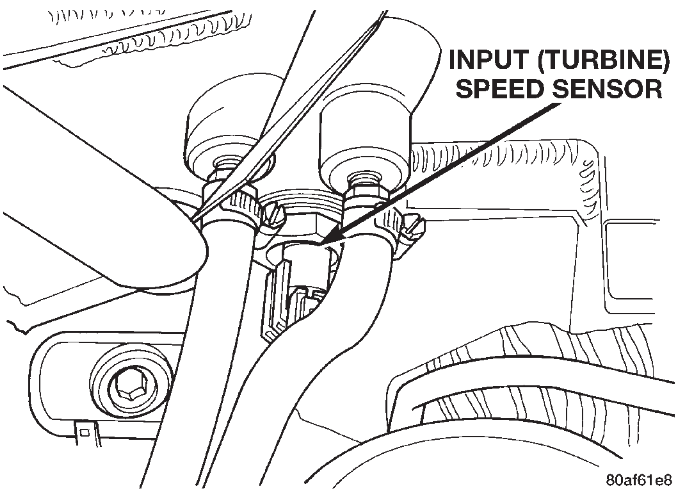


Fig. 37 Input (Turbine) Speed Sensor

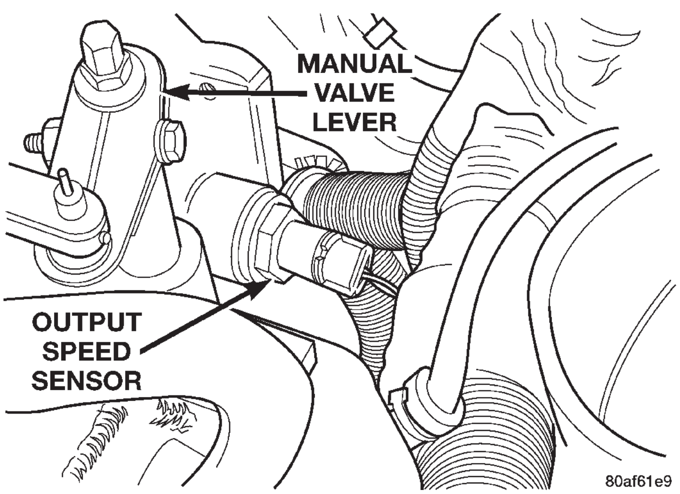


Fig. 38 Output Speed Sensor

(8) Disconnect electrical connector at transmission range sensor.

(9) Remove upper bellhousing upper bolts.

(10) Remove heater tube mounting bolt.

(11) Remove vehicle speed sensor wiring at sensor.

(12) Remove one rear engine mount bolt from top.

(13) Remove rear engine mount shield screw.

(14) Install engine support fixture and support engine (Fig. 39).

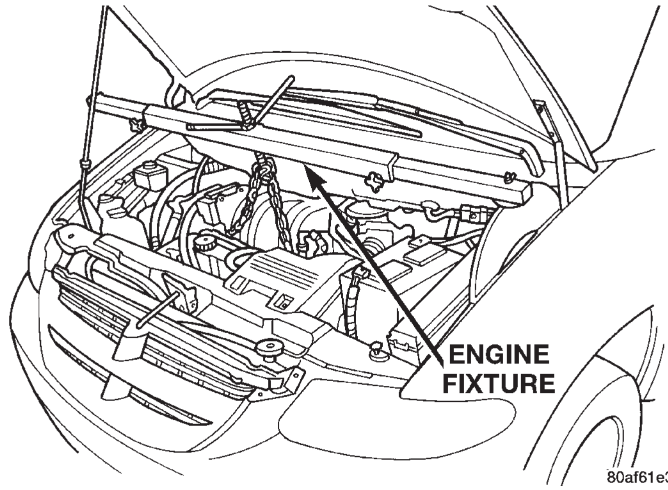


Fig. 39 Engine Support Fixture

(15) Raise vehicle. Remove front wheels. Refer to Group 2, Suspension to remove wheel hub nuts and both drive shafts.

CAUTION: The exhaust flex joint must be disconnected from the exhaust manifold anytime the engine is lowered. If the engine is lowered while the flex pipe is attached, damage will occur.

(16) Remove bolts securing exhaust flex joint to exhaust manifold. Disconnect exhaust pipe from manifold.

(17) Remove torque converter dust shield to gain access to torque converter bolts (Fig. 40).

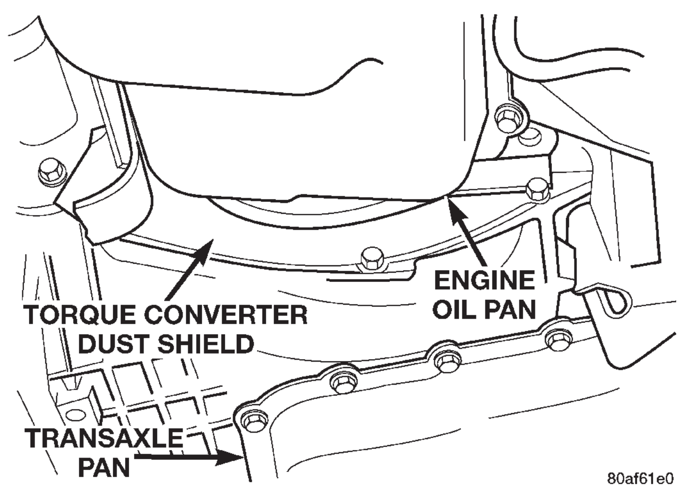


Fig. 40 Remove Torque Converter Dust Shield

REMOVAL AND INSTALLATION (Continued)

(18) Rotate engine clockwise to gain access to torque converter bolts (Fig. 41). Remove torque converter mounting bolts.

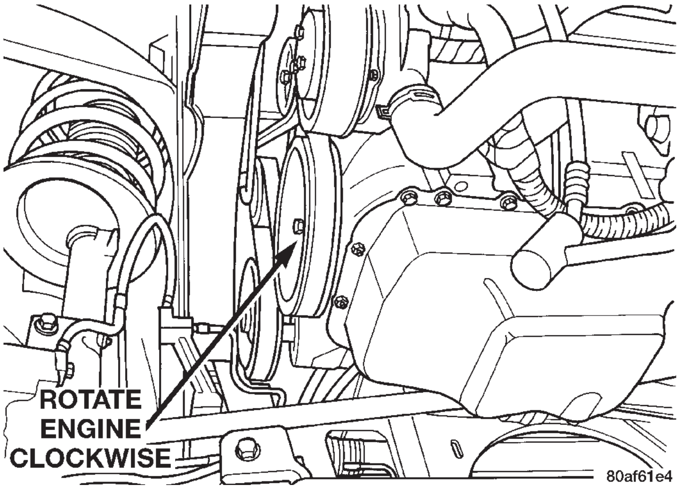


Fig. 41 Rotate Engine

(19) Remove front engine mount insulator and bracket (Fig. 42).

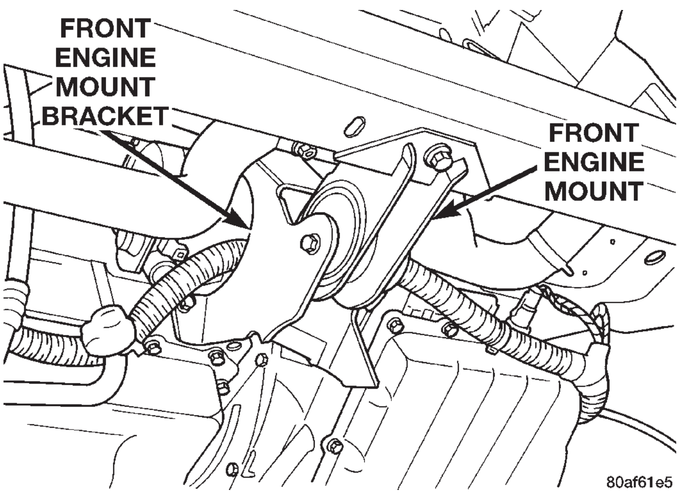


Fig. 42 Remove Front Engine Mount

(20) Remove rear engine mount shield.

(21) Remove rear engine mount bracket bolts and bracket.

(22) Remove starter bolts and set starter aside. Do not allow the starter to hang from battery cable (Fig. 43).

(23) Position transmission jack securely under transaxle (Fig. 44).

(24) Remove left fender splash shield.

(25) With transmission jack in position, remove the left transmission mount.

(26) Lower transaxle to access the crankshaft position sensor, remove crankshaft position sensor from bell housing. For installation procedure refer to section 8D of this service manual.

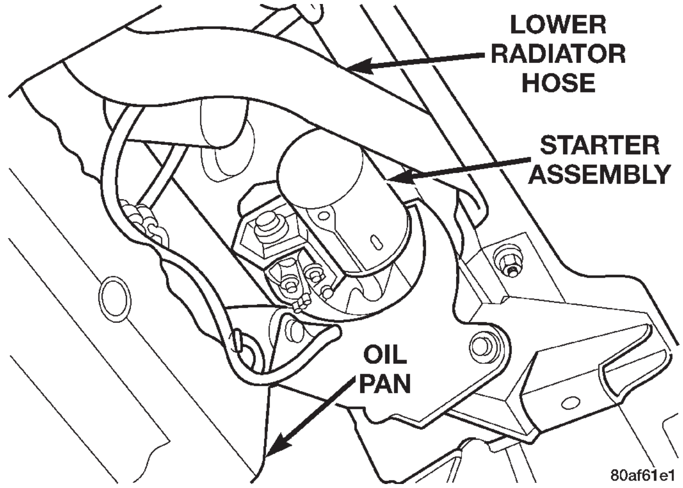


Fig. 43 Starter Assembly

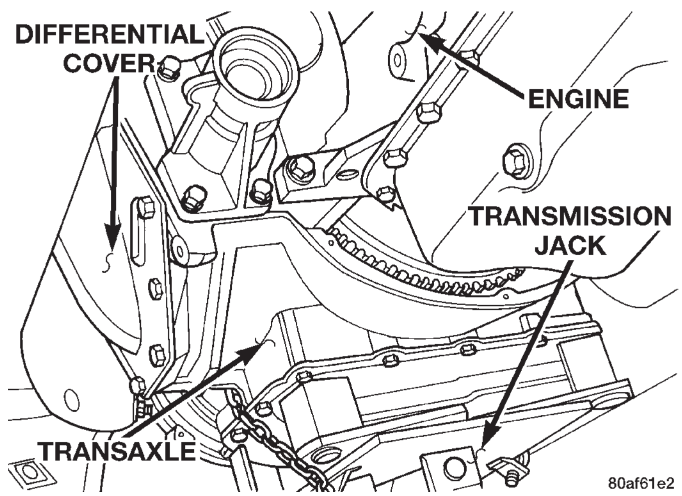


Fig. 44 Position Transmission Jack

CAUTION: Remove the crankshaft position sensor from the bell housing before transmission removal or installation.

(27) Remove lower bellhousing bolts.

(28) Carefully lower the transaxle assembly from vehicle.

INSTALLATION

(1) For installation of transaxle, reverse the above procedure.

(2) Check and/or adjust gearshift cable.

(3) Refill transaxle with MOPAR® ATF PLUS 3 (Automatic Transmission Fluid) Type 7176.

REMOVAL AND INSTALLATION (Continued)

OIL PUMP SEAL

REMOVAL

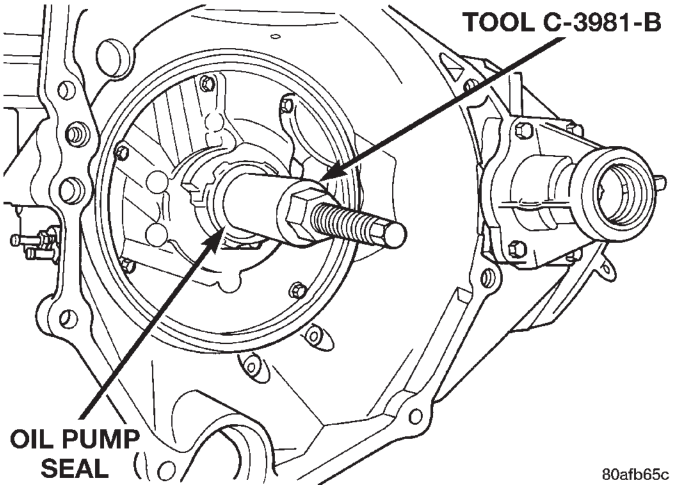


Fig. 45 Remove Oil Pump Seal

INSTALLATION

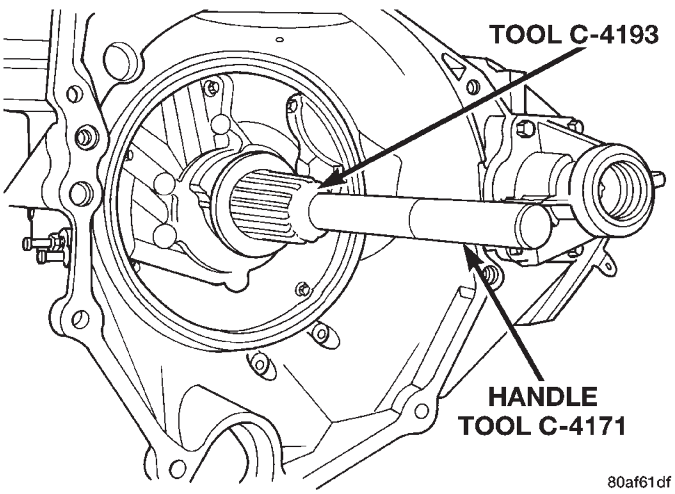


Fig. 46 Install Oil Pump Seal

DISASSEMBLY AND ASSEMBLY

VALVE BODY RECONDITION

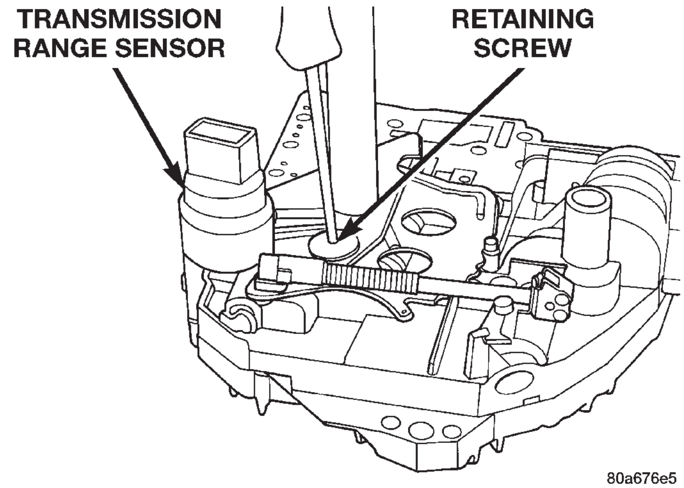


Fig. 47 Transmission Range Sensor Screw

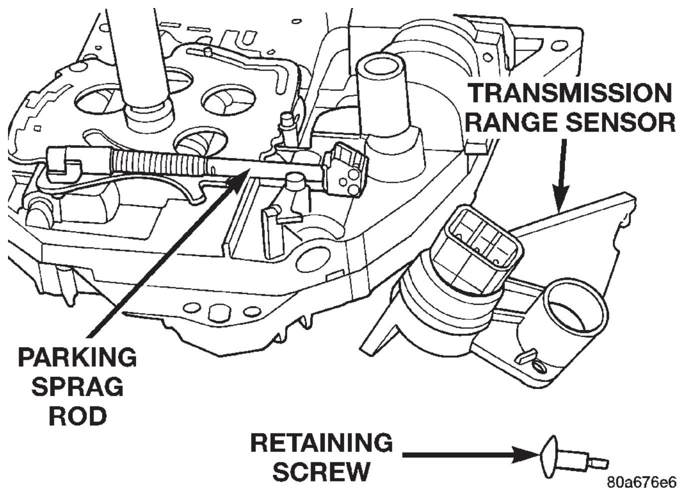


Fig. 48 Transmission Range Sensor Removed

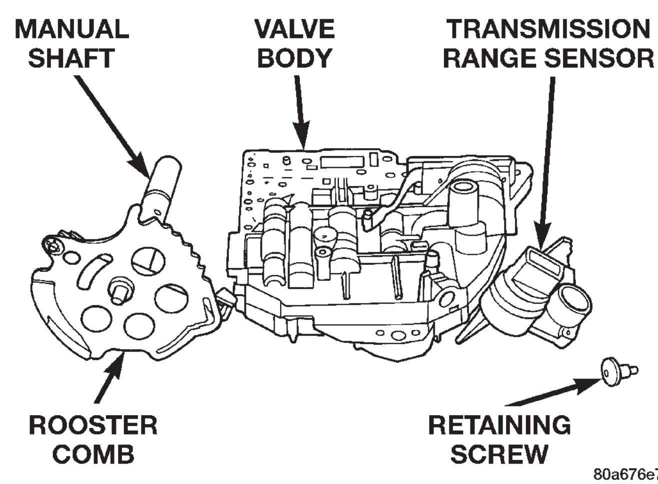


Fig. 49 Manual Shaft and Rooster Comb

DISASSEMBLY AND ASSEMBLY (Continued)

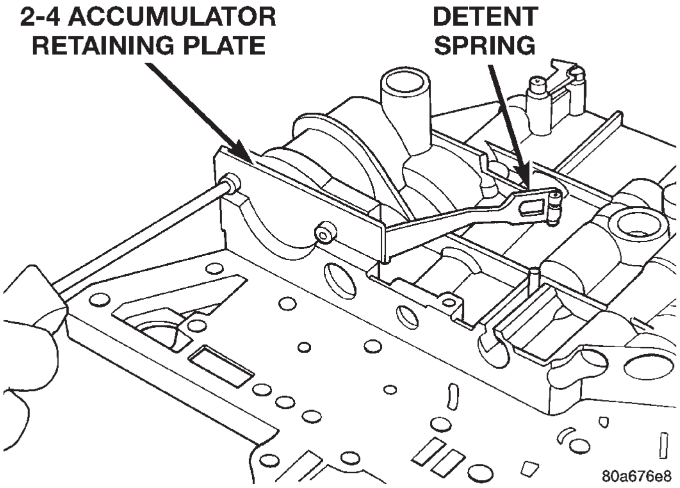


Fig. 50 2-4 Accumulator Plate

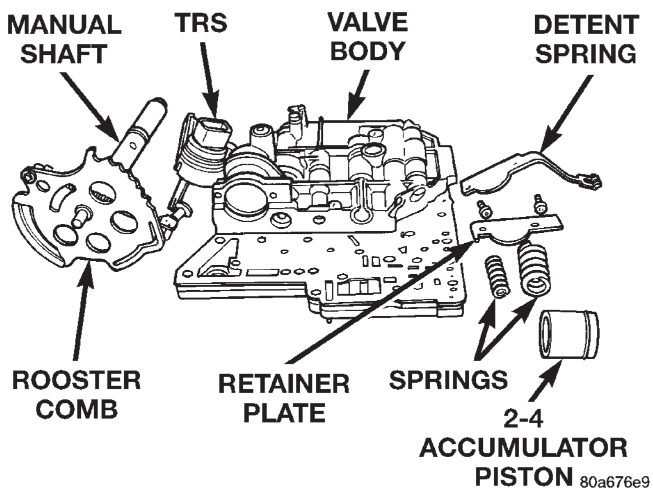


Fig. 51 TRS, Manual Shaft, and 2-4 Accumulator

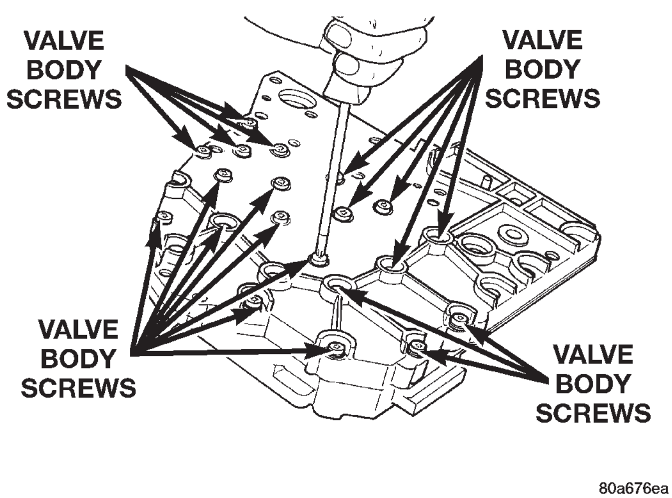


Fig. 52 Valve Body Screws

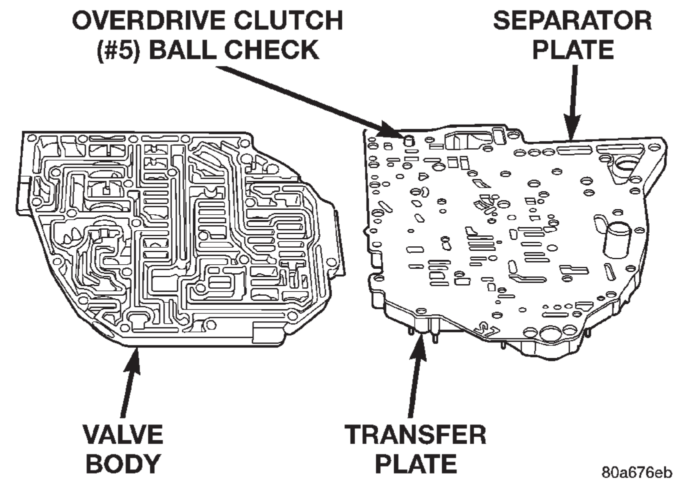


Fig. 53 Valve Body and Transfer Plate

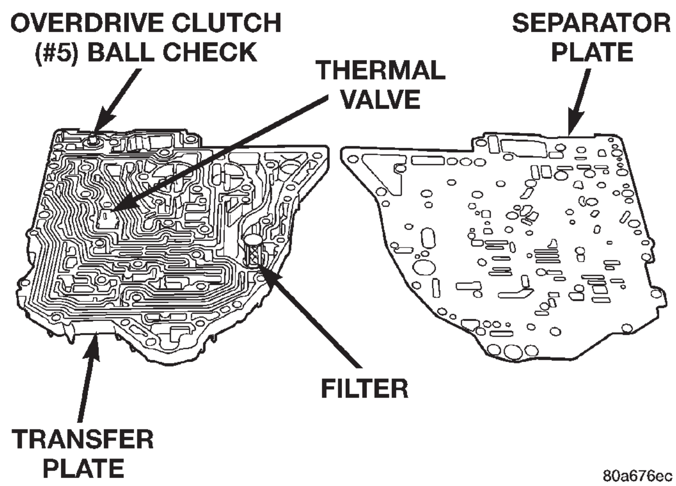


Fig. 54 Transfer Plate and Separator Plate

DISASSEMBLY AND ASSEMBLY (Continued)

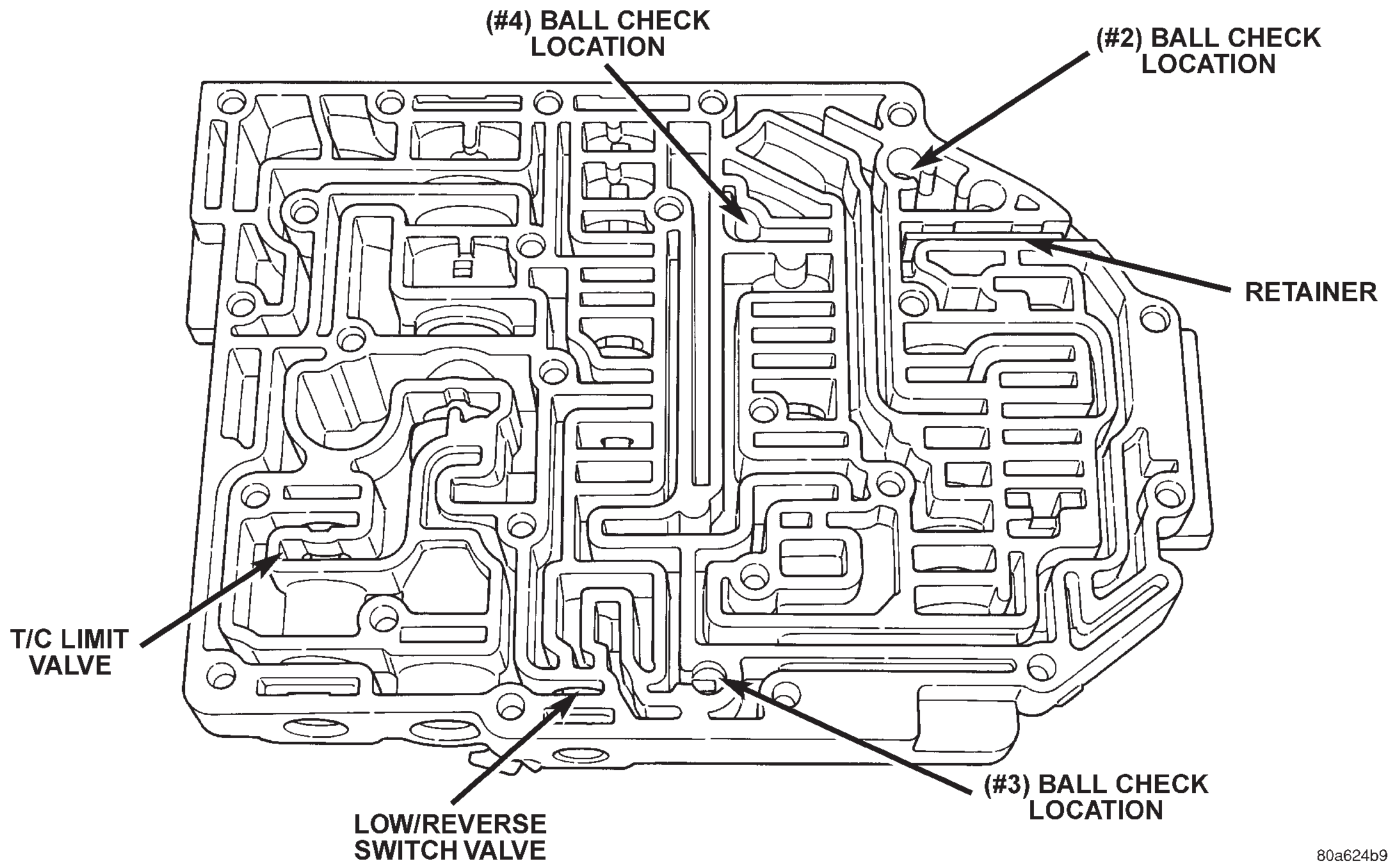


Fig. 55 Ball Check Location

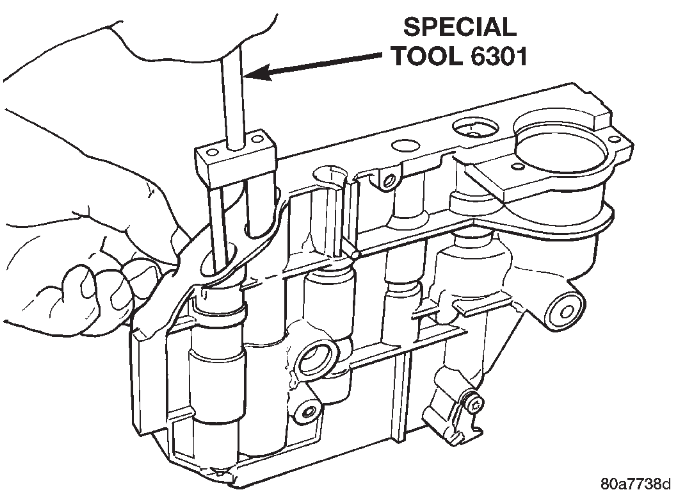


Fig. 56 Remove Dual Retainer Plate

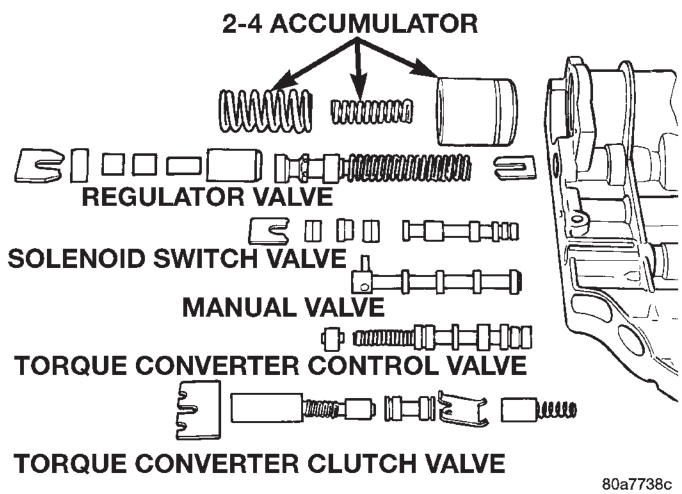


Fig. 57 Springs and Valves Location

DISASSEMBLY AND ASSEMBLY (Continued)

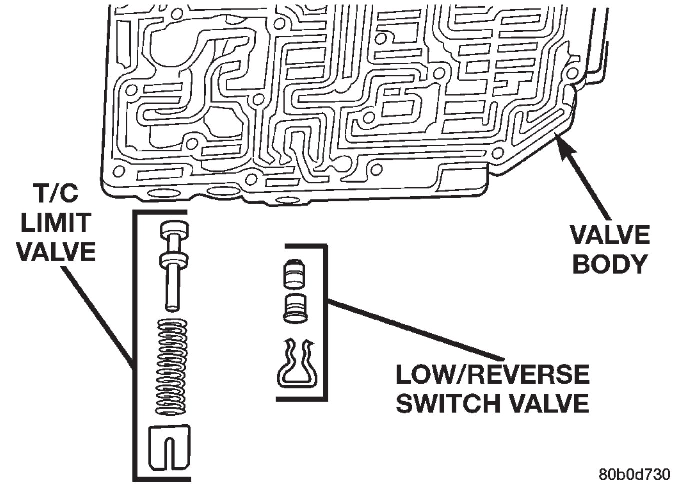


Fig. 58 Low/Reverse Switch Valve And T/C Limit Valve

TRANSAXLE DISASSEMBLE

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 input and output speed sensors.
(2) Remove transaxle solenoid pack (Fig. 59).

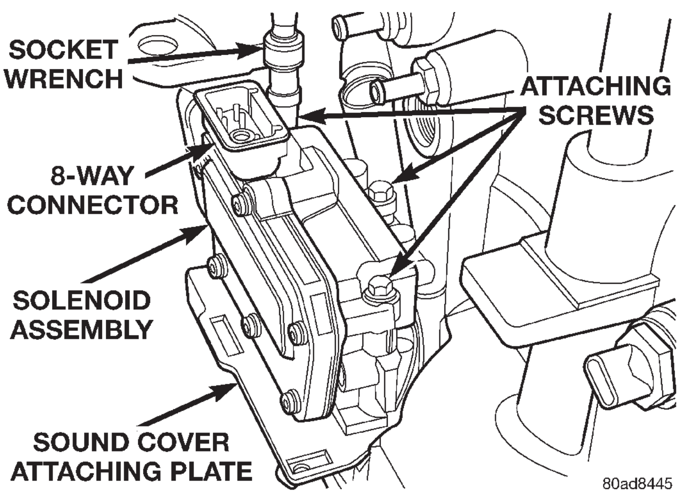


Fig. 59 Remove Solenoid Pack

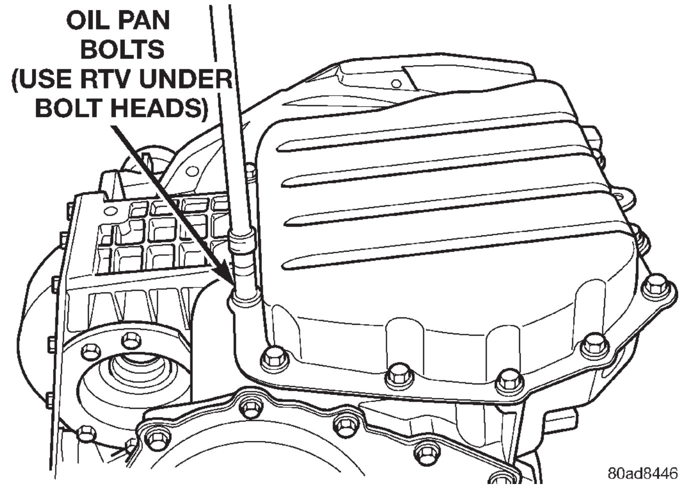


Fig. 60 Remove Oil Pan Bolts

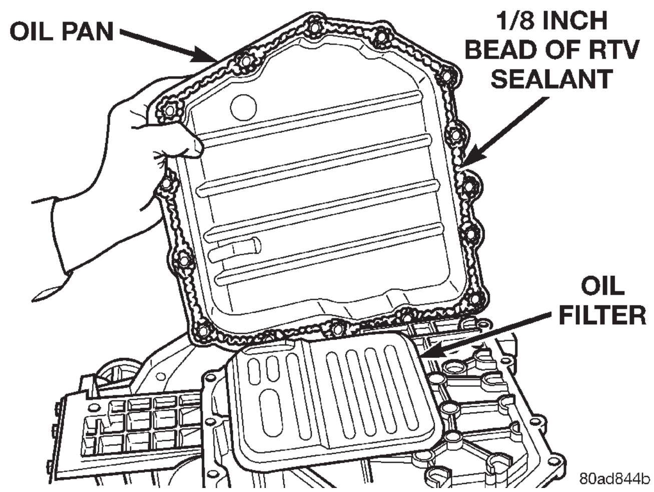


Fig. 61 Remove Oil Pan

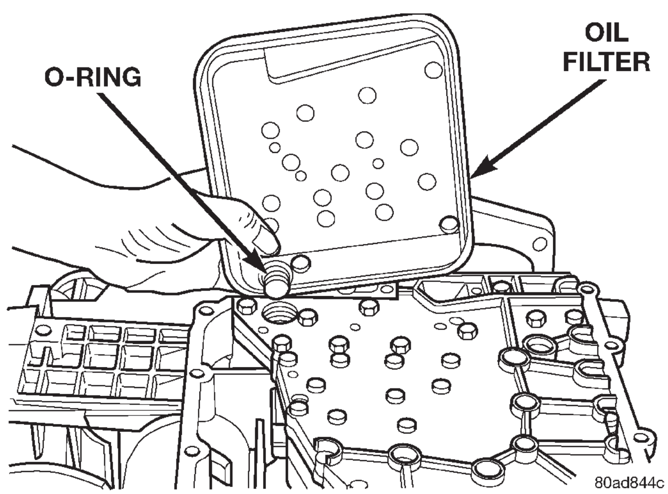


Fig. 62 Remove Oil Filter

DISASSEMBLY AND ASSEMBLY (Continued)

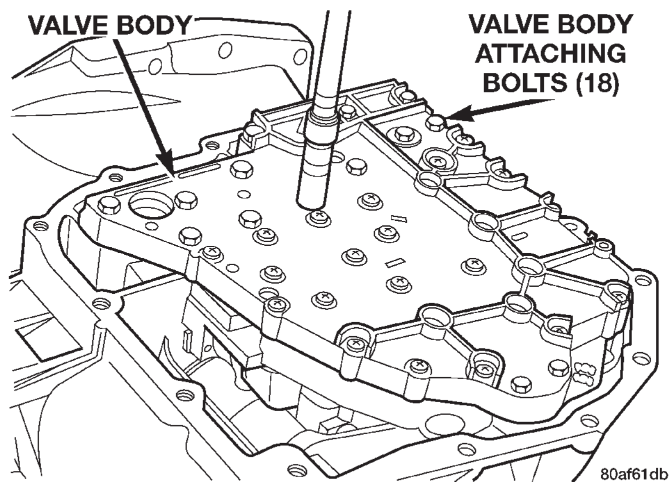


Fig. 63 Remove Valve Body Attaching Bolts

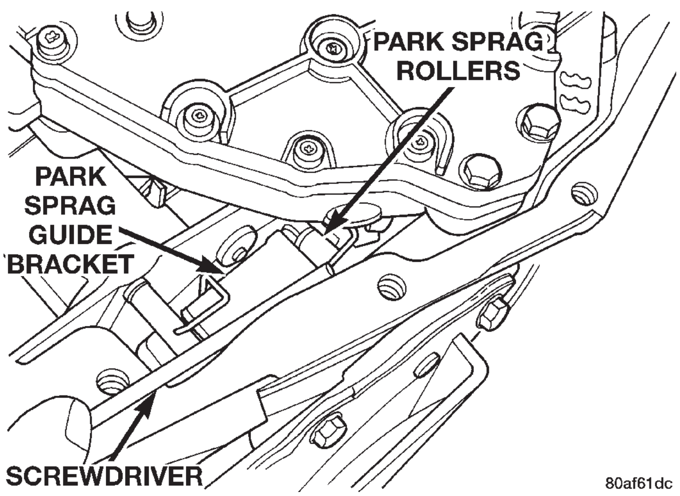


Fig. 64 Push Park Rod Rollers from Guide Bracket

NOTE: To ease removal of the valve body, turn the manual valve fully clockwise.

CAUTION: Do not handle the valve body from the manual valve. Damage could result.

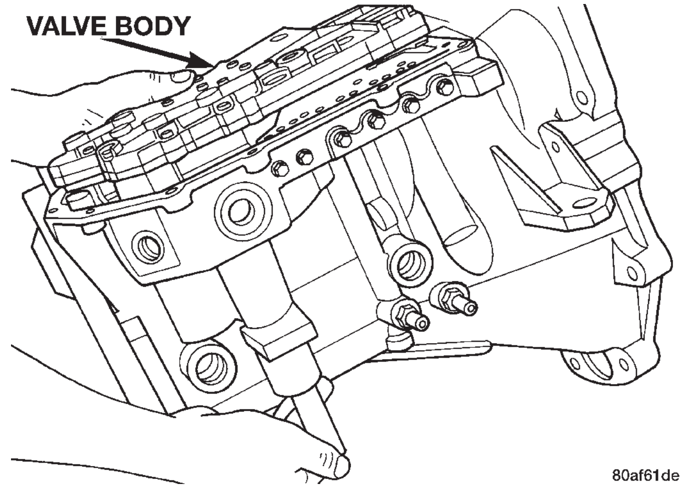


Fig. 65 Remove Valve Body

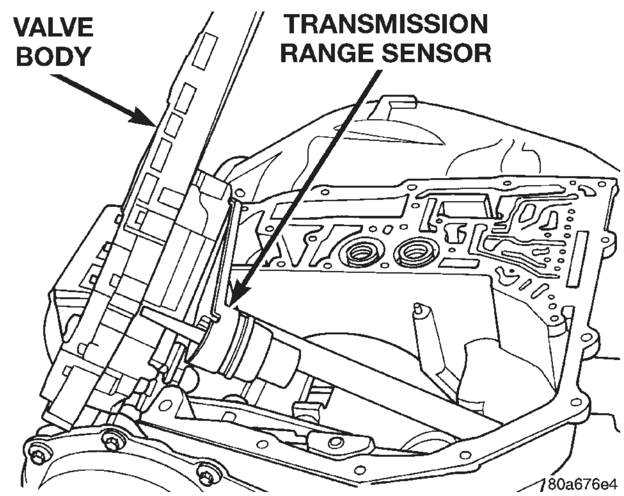


Fig. 66 Valve Body Removed

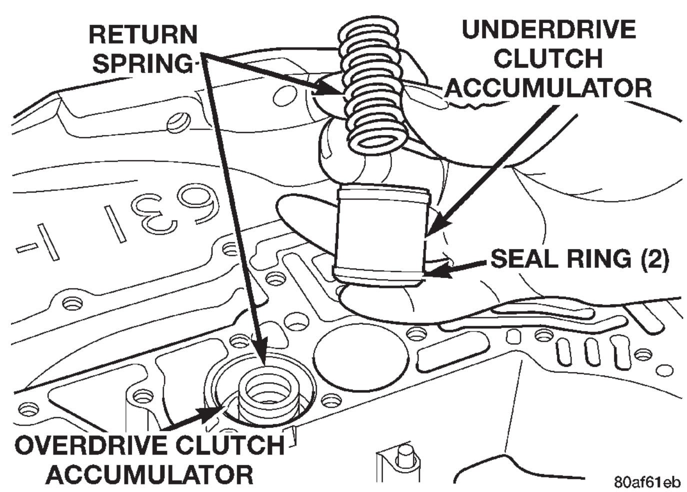


Fig. 67 Remove Accumulators

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Dependent on engine application, some accumulators will have two springs and others will have one spring. The springs are color coded according to application and year. When disassembling, mark accumulator spring location to ease assembly.

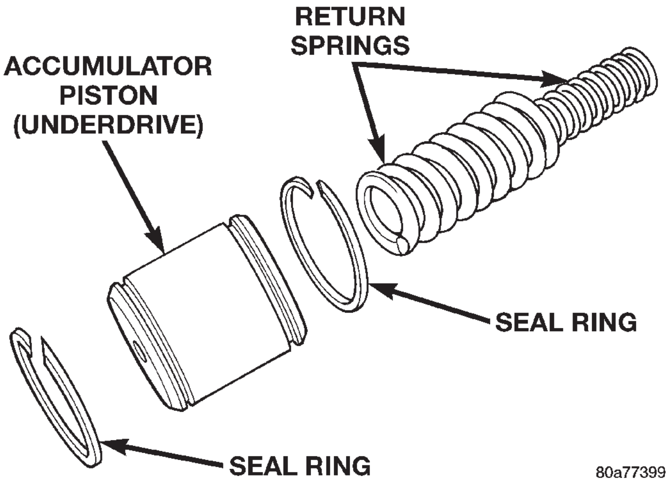


Fig. 68 Accumulator (Underdrive)

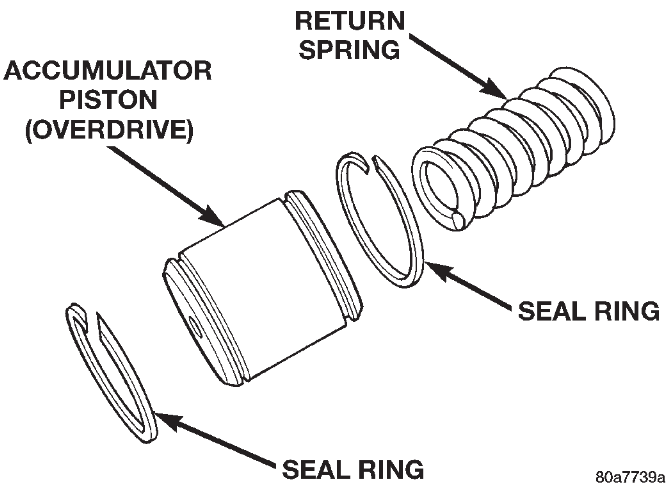


Fig. 69 Accumulator (Overdrive)

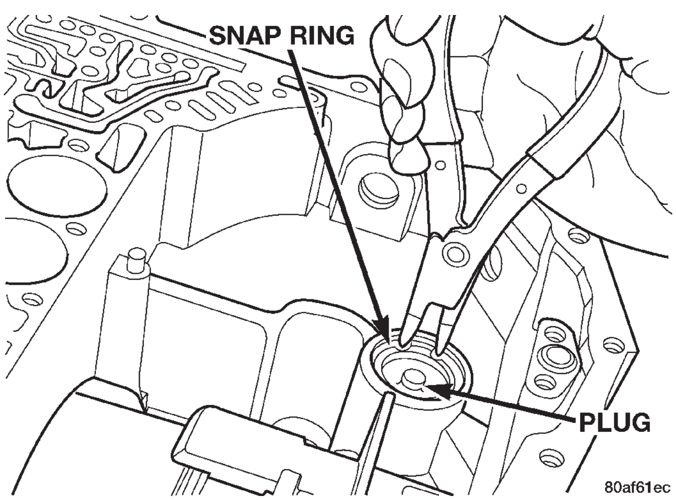


Fig. 70 Remove Low/Reverse Accumulator Snap Ring

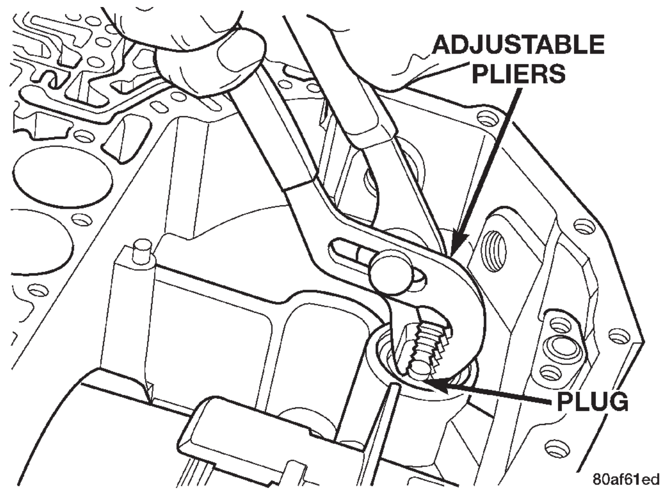


Fig. 71 Remove Low/Reverse Accumulator Plug (Cover)

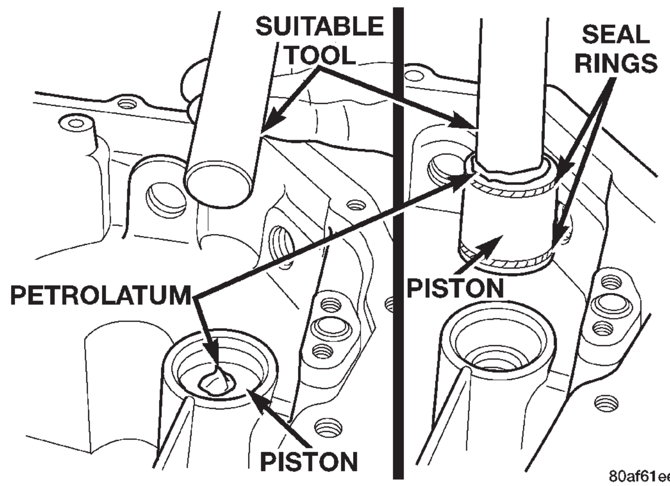


Fig. 72 Remove Low/Reverse Accumulator Piston

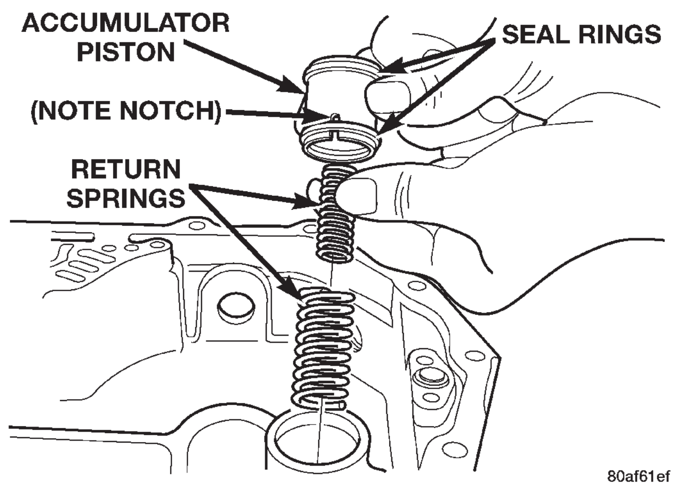


Fig. 73 Remove Low/Reverse Accumulator

DISASSEMBLY AND ASSEMBLY (Continued)

Measure the input shaft end play with the transaxle in the vertical position. This will ensure that the measurement will be accurate.

Measuring input shaft end play before disassembly will usually 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 transaxle bell housing with its plunger seated against end of input shaft (Fig. 74).

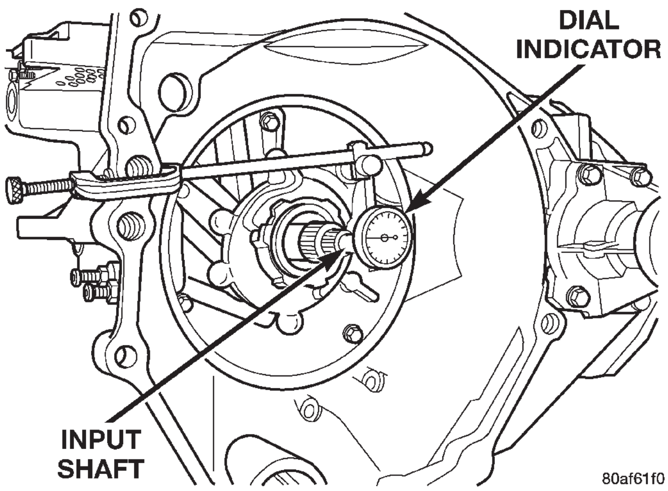


Fig. 74 Measure Input Shaft End Play

Move input shaft in and out to obtain end play reading. End play specifications are .13 to .64 mm (.005 to .025 inch).

Record indicator reading for reference when reassembling the transaxle.

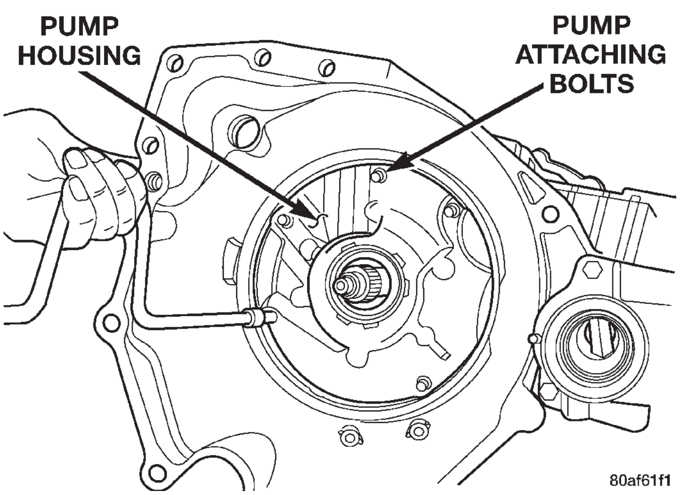


Fig. 75 Remove Pump Attaching Bolts

CAUTION: Be sure input speed sensor is removed before removing oil pump.

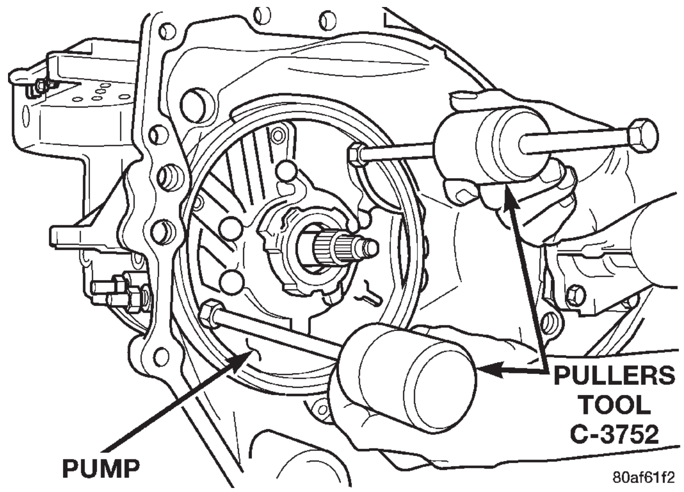


Fig. 76 Install Tool C-3752

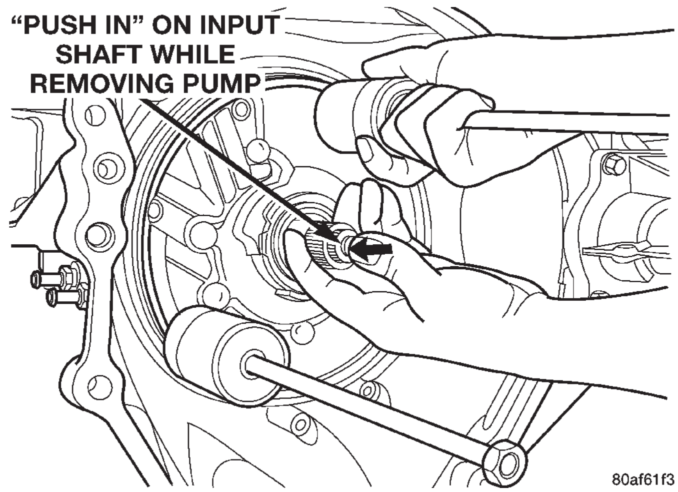


Fig. 77 Remove Oil Pump

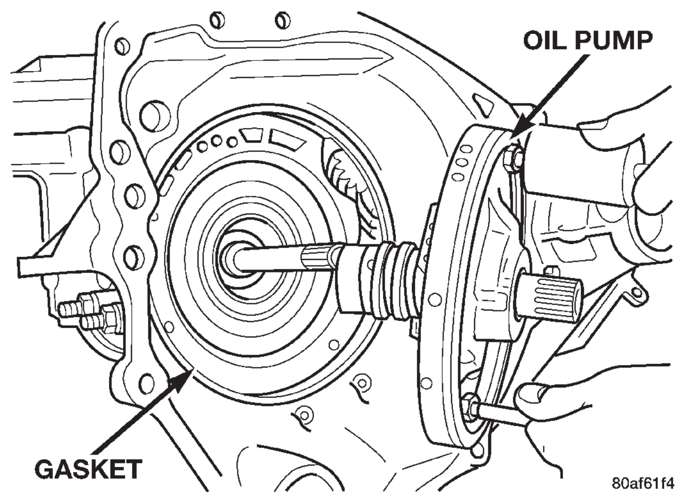


Fig. 78 Oil Pump Removed

OIL PUMP INSPECTION

When disassembling the transaxle it is necessary to inspect the oil pump for wear and damage.

(1) Remove the reaction shaft support bolts.

DISASSEMBLY AND ASSEMBLY (Continued)

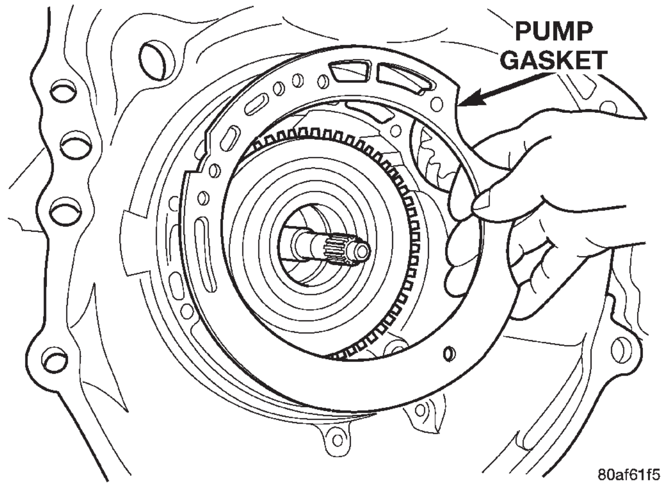


Fig. 79 Remove Oil Pump Gasket

(2) Remove reaction shaft support from pump housing (Fig. 80).

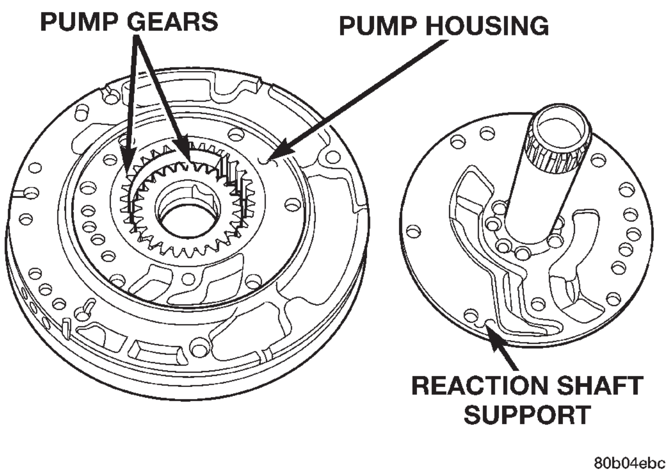


Fig. 80 Reaction Shaft Support

(3) Remove the pump gears and check for wear and damage.

(4) Install the gears and check clearances.

(5) Measure the clearance between the outer gear and the pump pocket (Fig. 81). Clearance should be 0.045-0.141mm (0.0018-0.0056 in.).

(6) Measure the clearance between the outer gear and the pump crescent. Clearance should be 0.020-0.046mm (0.0008-0.0018 in.) (Fig. 82).

(7) Measure the clearance between the inner gear and the pump crescent. Clearance should be 0.020-0.046mm (0.0008-0.0018 in.) (Fig. 83).

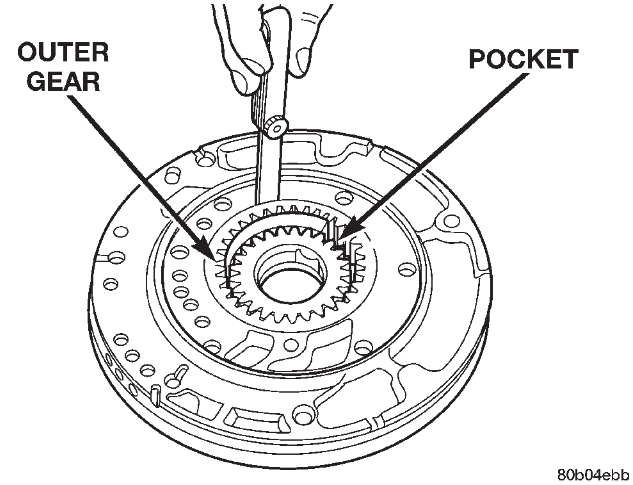


Fig. 81 Measure Outer Gear to Pocket

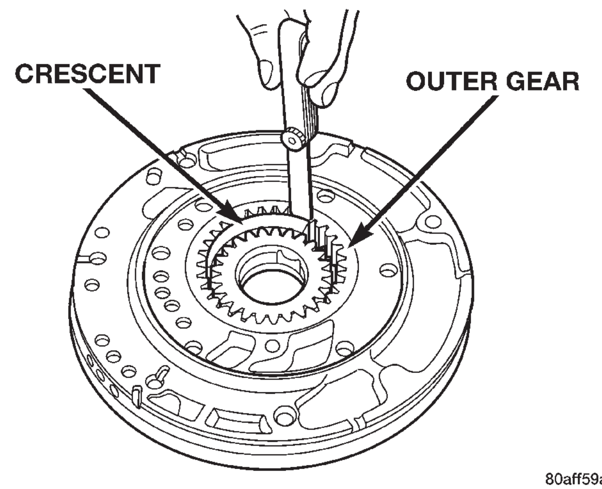


Fig. 82 Measure Outer Gear To Crescent

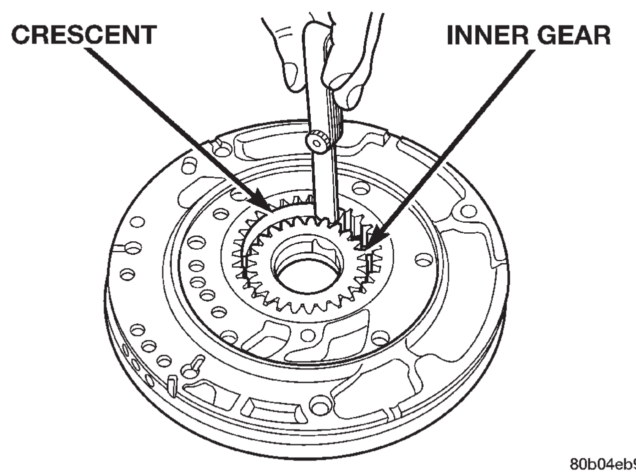


Fig. 83 Measure Inner Gear To Crescent

DISASSEMBLY AND ASSEMBLY (Continued)

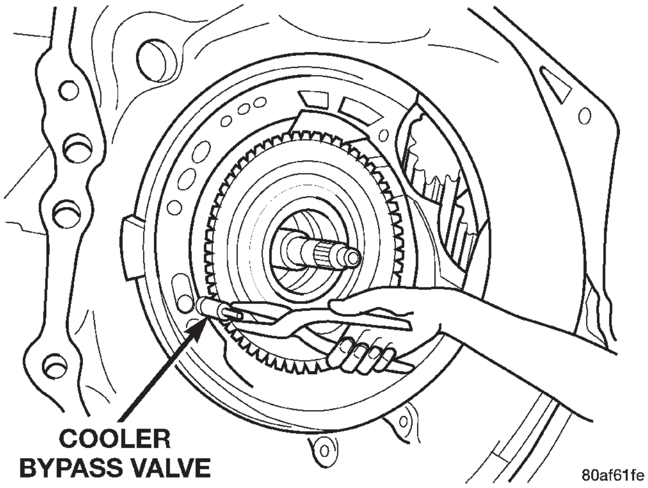


Fig. 84 Remove Bypass Valve

CAUTION: The cooler bypass valve must be replaced if a transaxle failure has occurred. Do not reuse old valve or attempt to clean old valve. When installing bypass valve, insert with O-ring end towards rear of case.

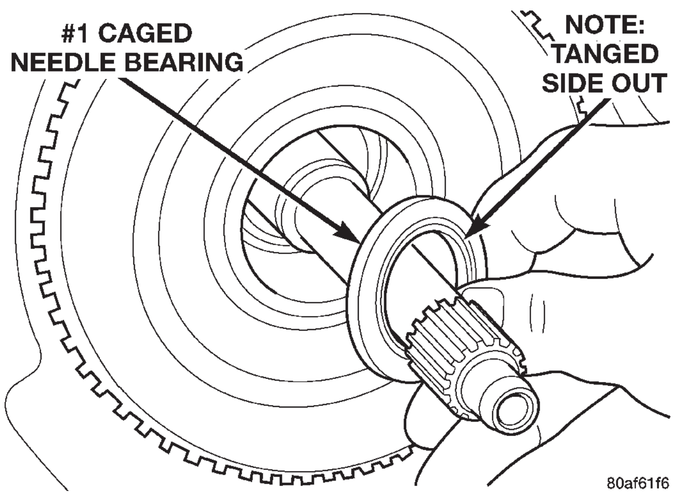


Fig. 85 Remove Caged Needle Bearing

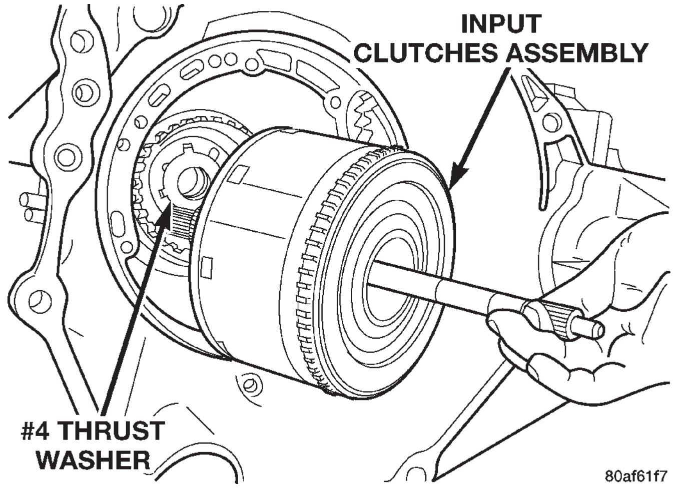


Fig. 86 Remove Input Clutches Assembly

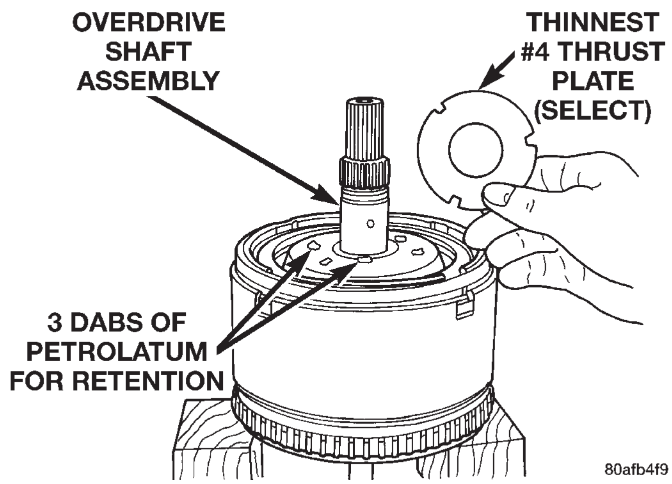


Fig. 87 No. 4 Thrust Plate

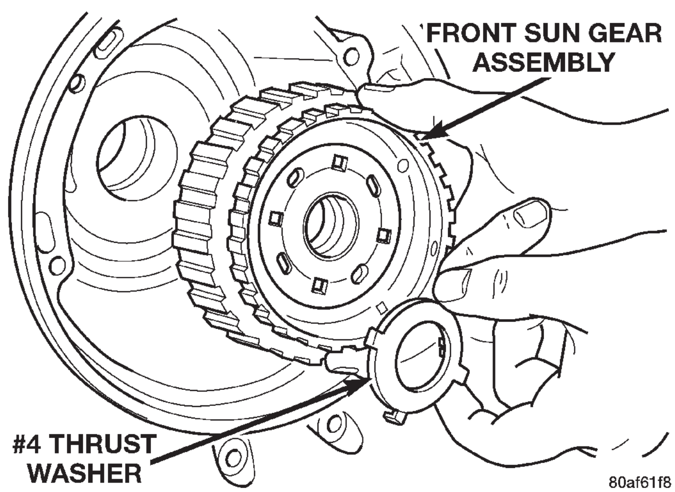


Fig. 88 Remove Front Sun Gear Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

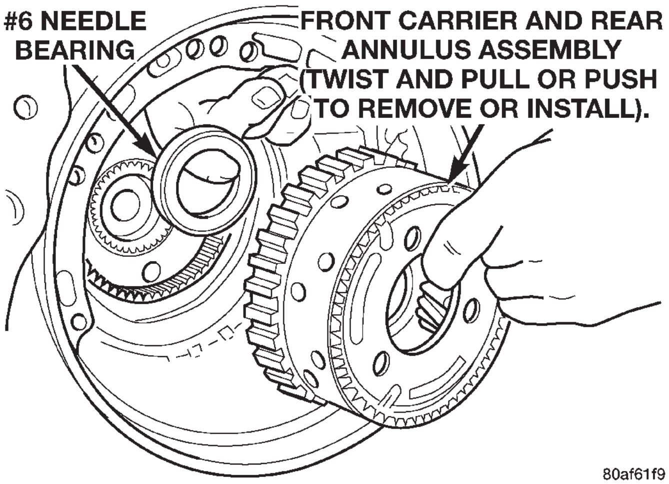


Fig. 89 Remove Front Carrier and Rear Annulus Assembly

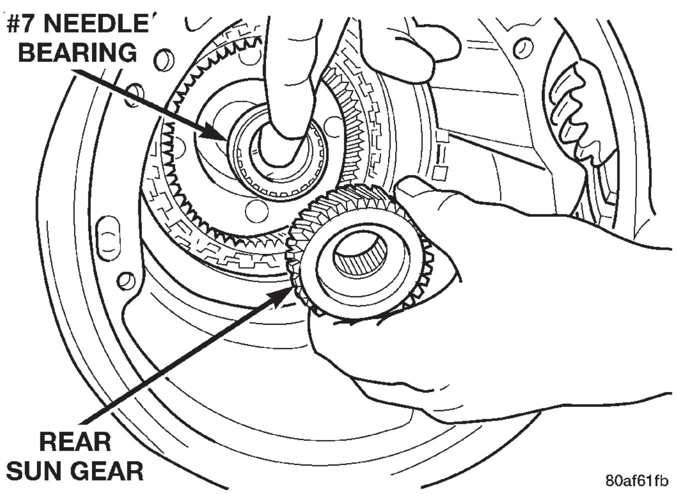


Fig. 90 Remove Rear Sun Gear

NOTE: Verify that Miller Tool 5058 is centered properly to the 2/4 clutch retainer before depressing the tool.

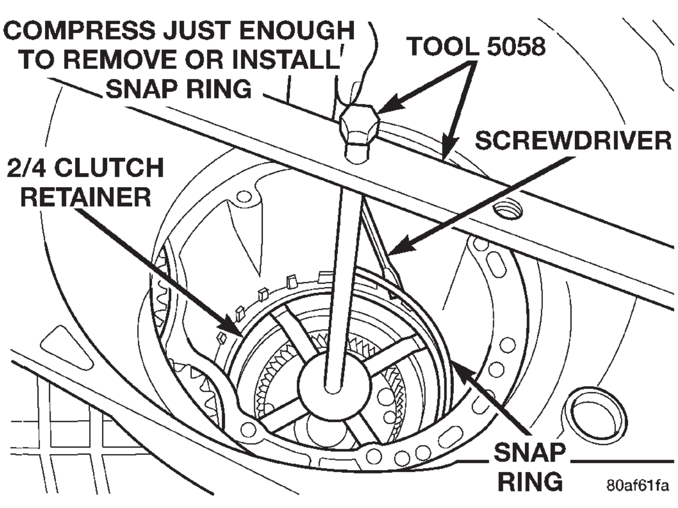


Fig. 91 Remove 2/4 Clutch Retainer Snap Ring

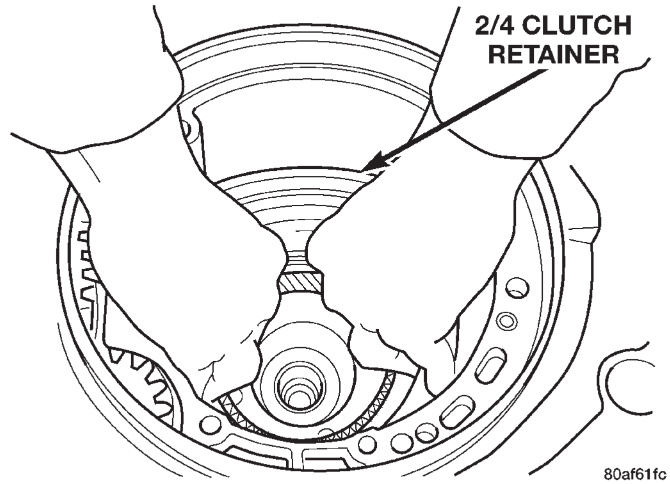


Fig. 92 Remove 2/4 Clutch Retainer

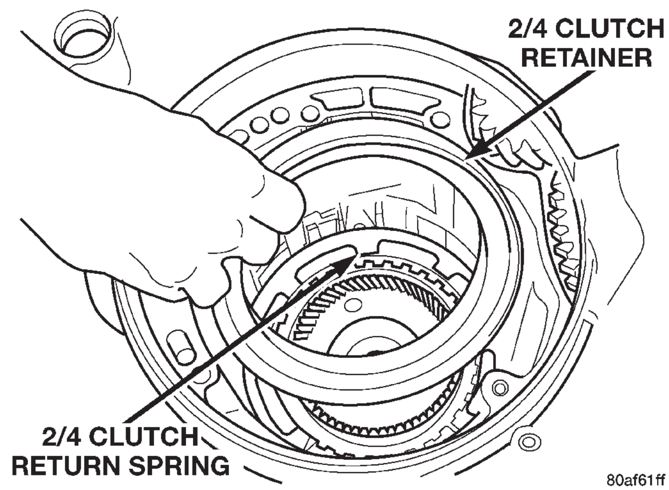


Fig. 93 2/4 Clutch Retainer

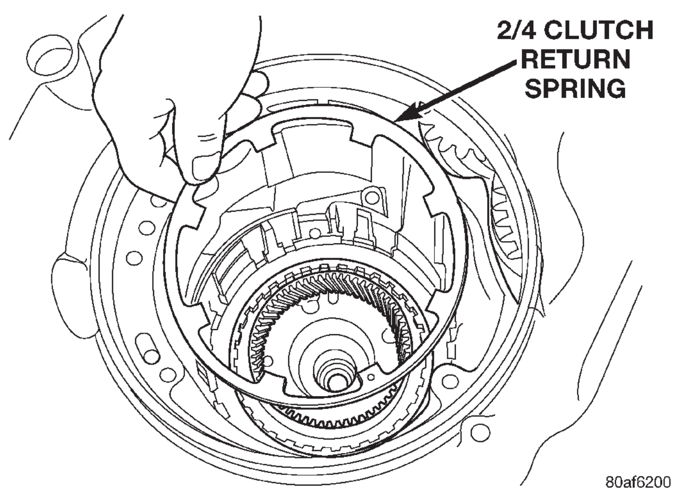


Fig. 94 Remove 2/4 Clutch Return Spring

DISASSEMBLY AND ASSEMBLY (Continued)

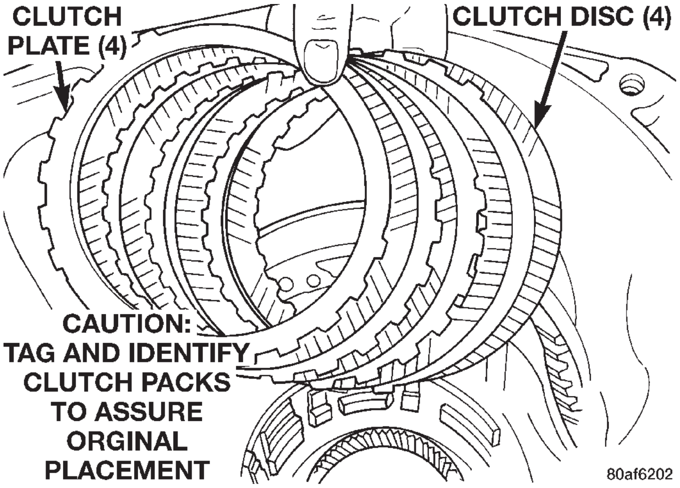


Fig. 95 Remove 2/4 Clutch Pack

NOTE: Tag 2/4 clutch pack for reassembly identification.

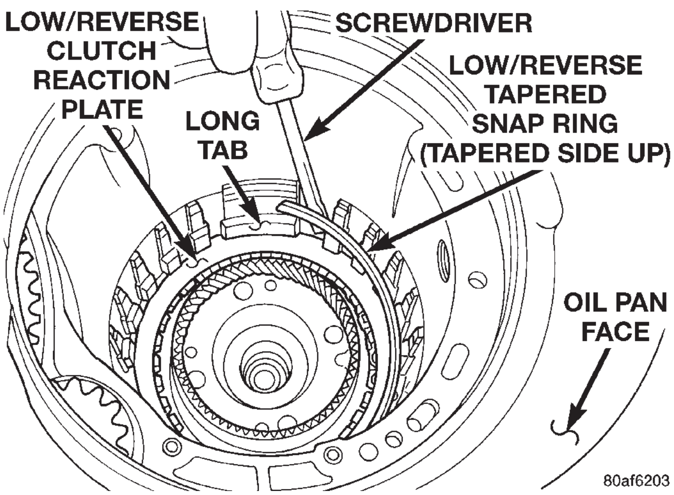


Fig. 96 Remove Tapered Snap Ring

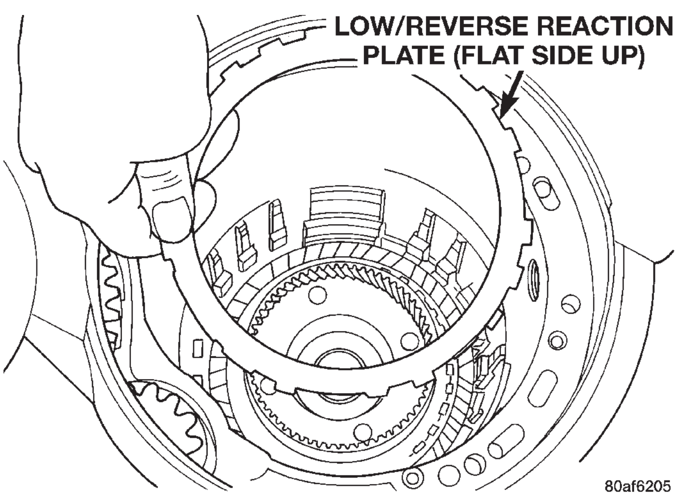


Fig. 97 Remove Low/Reverse Reaction Plate

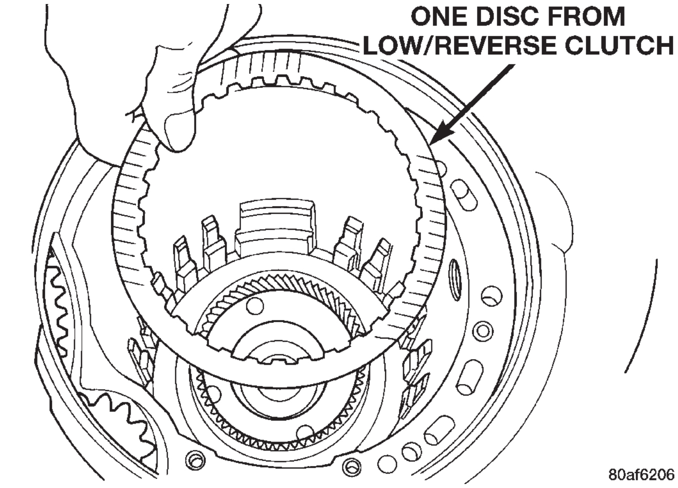


Fig. 98 Remove One Disc

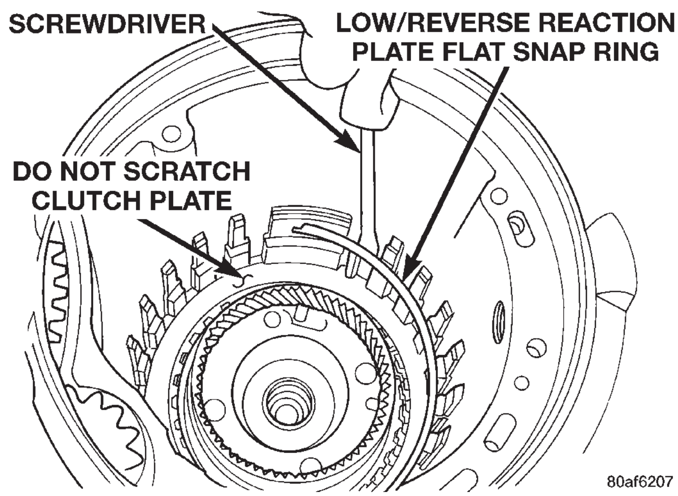


Fig. 99 Remove Low/Reverse Reaction Plate Snap Ring

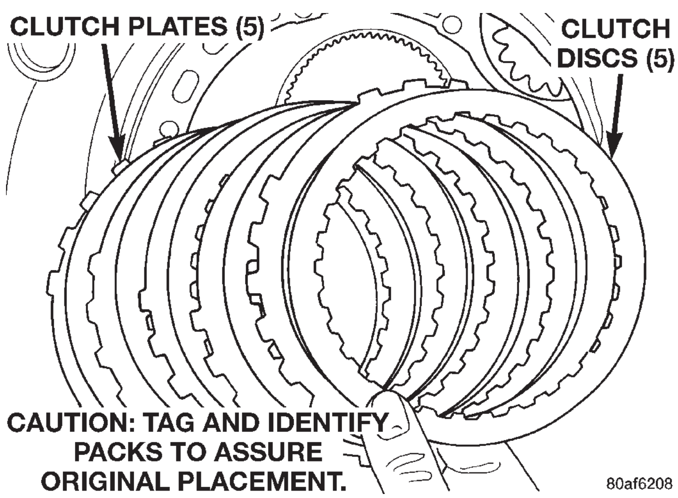


Fig. 100 Remove Low/Reverse Clutch Pack

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Tag low/reverse clutch pack for reassembly identification.

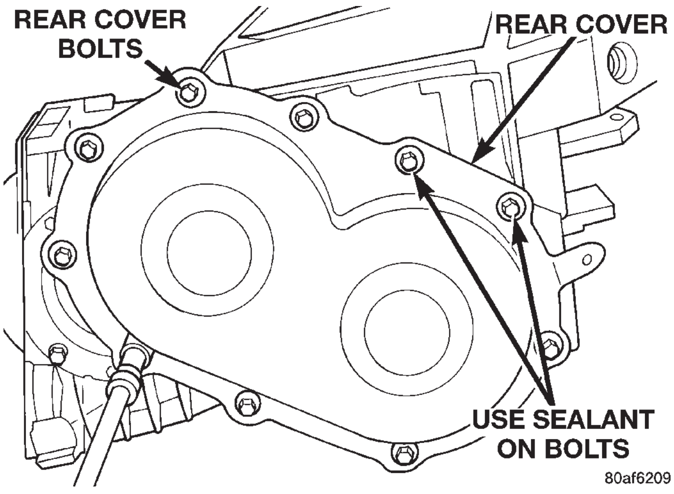


Fig. 101 Remove Rear Cover Bolts

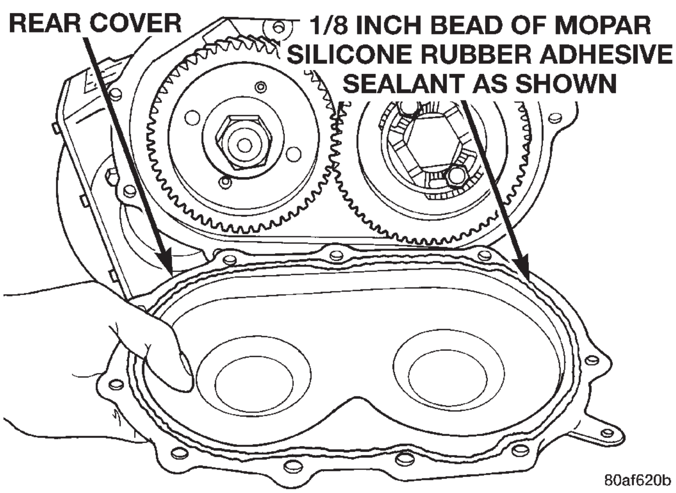


Fig. 102 Remove Rear Cover

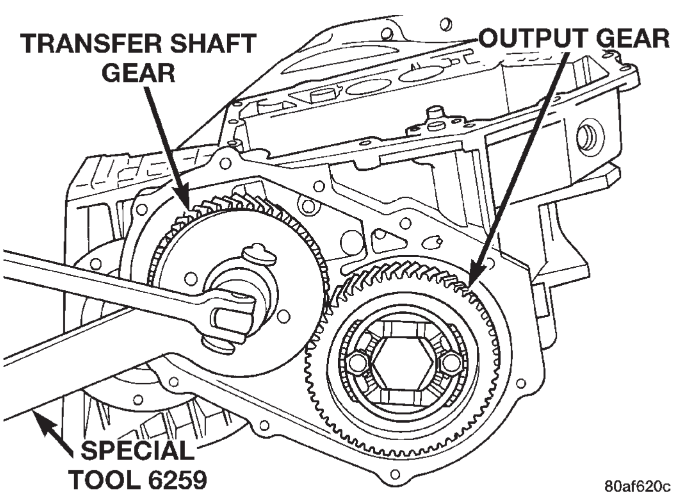


Fig. 103 Remove Transfer Shaft Gear Nut

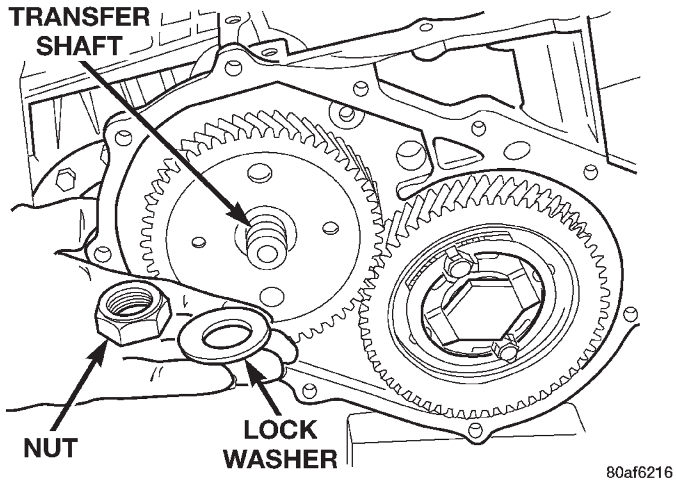


Fig. 104 Transfer Shaft Gear Nut and Coned Washer

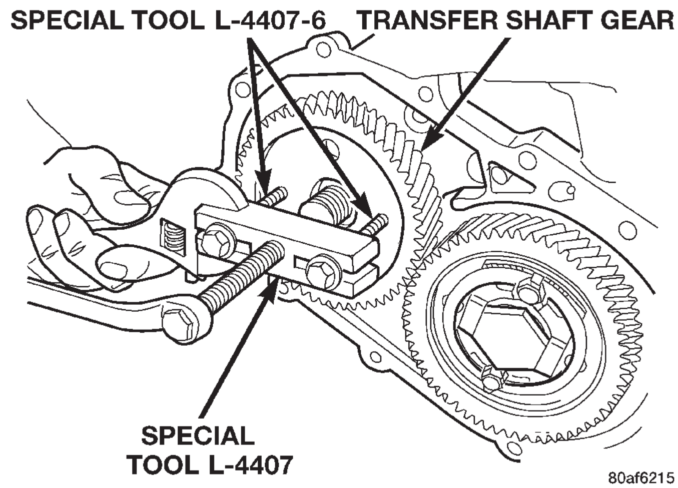


Fig. 105 Remove Transfer Shaft Gear

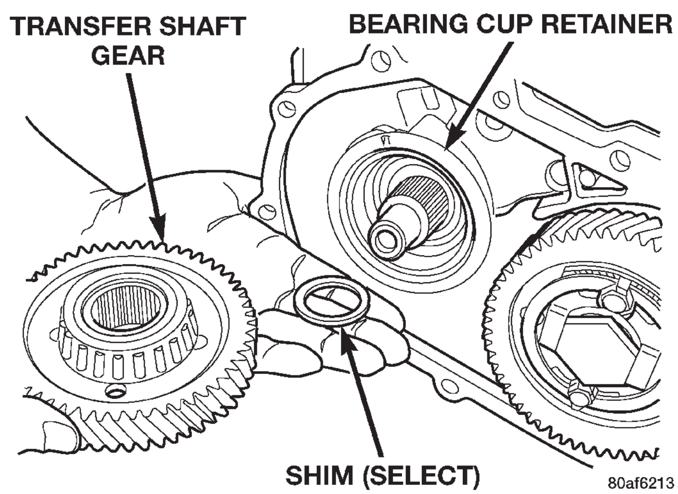


Fig. 106 Remove Transfer Shaft Gear and (Select) Shim

DISASSEMBLY AND ASSEMBLY (Continued)

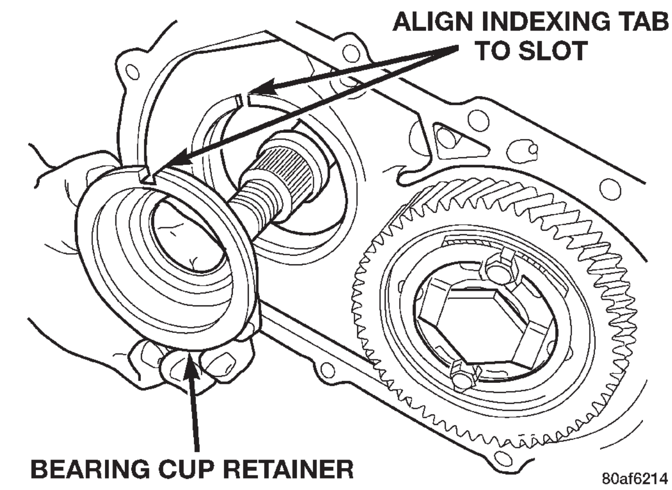


Fig. 107 Remove Bearing Cup Retainer

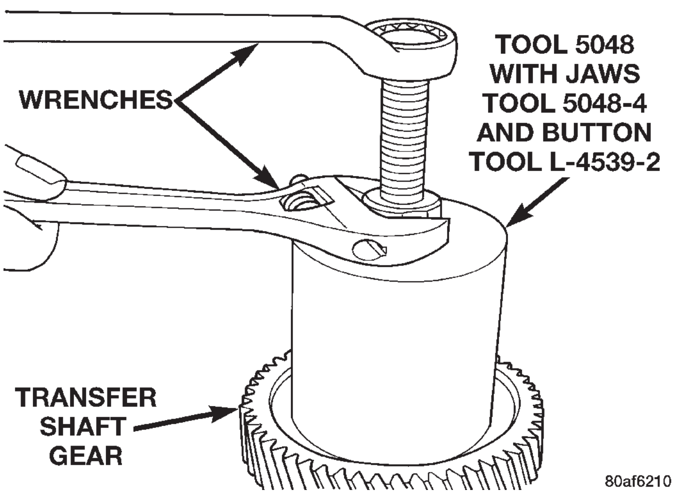


Fig. 108 Remove Transfer Gear Bearing Cone

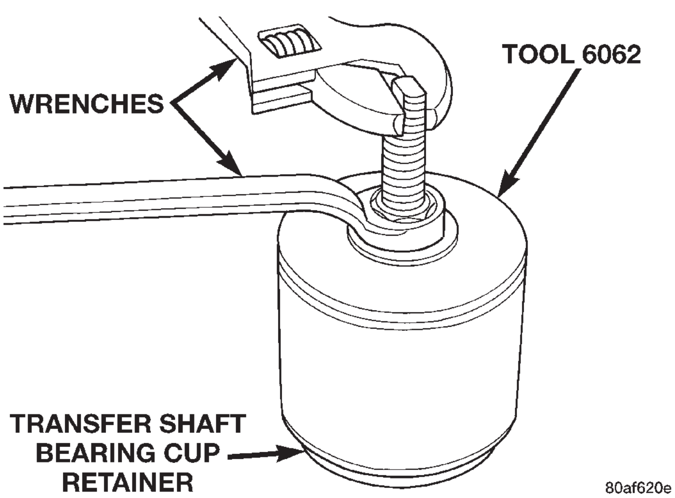


Fig. 109 Remove Transfer Shaft Bearing Cup

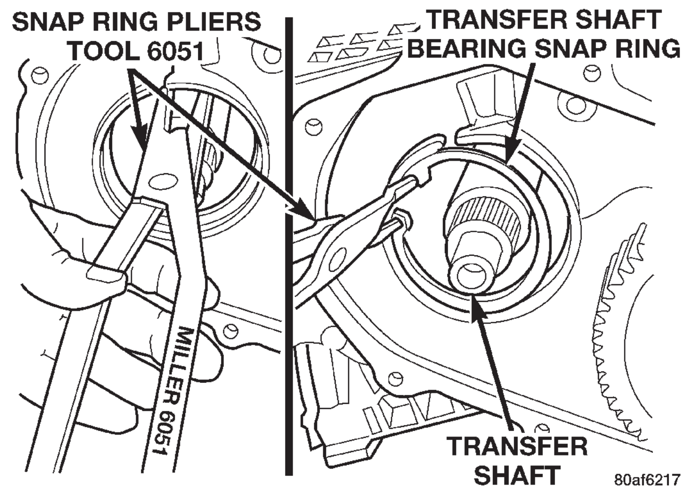


Fig. 110 Remove Transfer Shaft Bearing Snap Ring

NOTE: Screw Tool 5049-A onto transfer shaft. Remove transfer shaft.

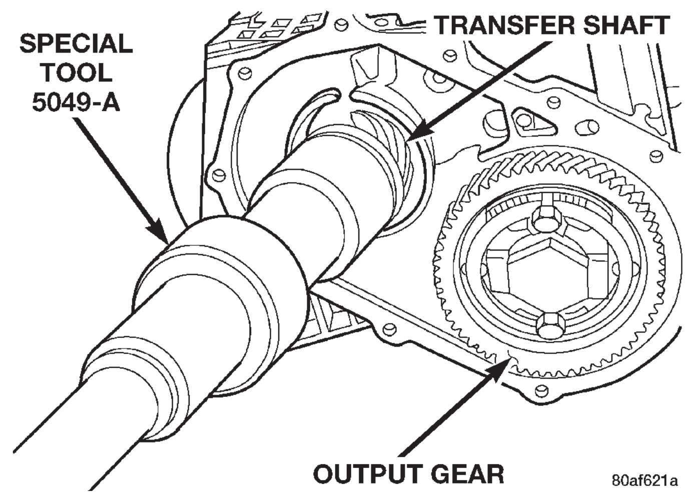


Fig. 111 Remove Transfer Shaft

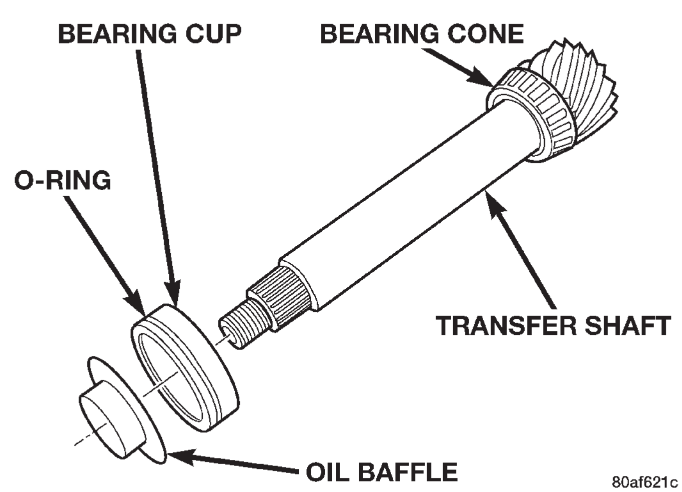


Fig. 112 Bearing Cup Removed

DISASSEMBLY AND ASSEMBLY (Continued)

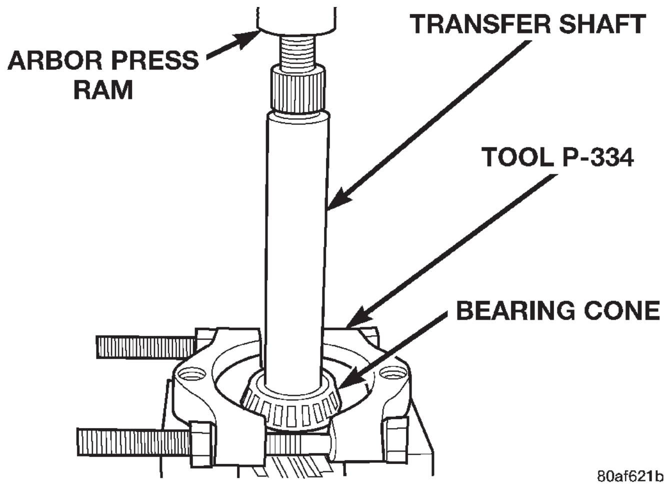


Fig. 113 Remove Transfer Shaft Bearing Cone

NOTE: Remove output gear stirrup and strap bolts.

All transaxles utilize a stirrup and retaining strap that is attached to the output gear. The stirrup prevents the output gear retaining bolt from turning and backing out of the rear carrier. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.

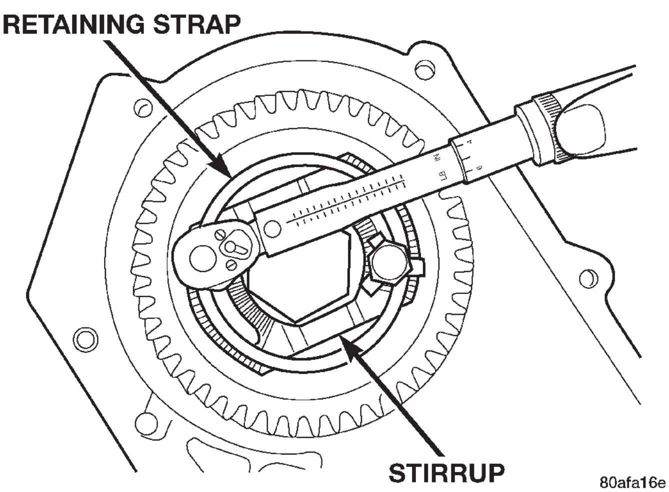


Fig. 114 Loosen Stirrup Strap Bolts

CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.

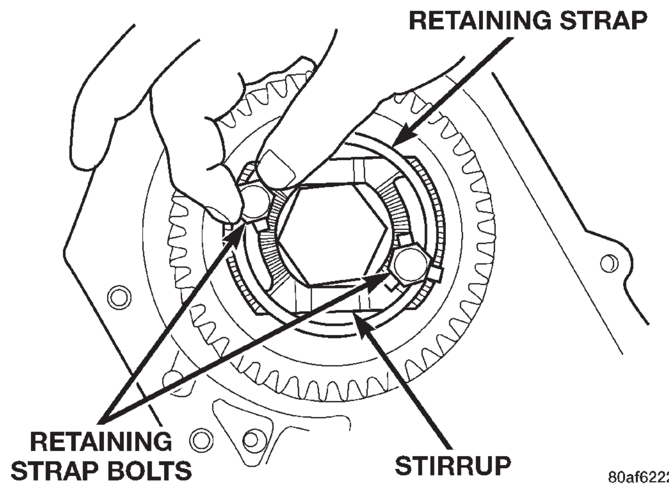


Fig. 115 Remove Strap Bolts

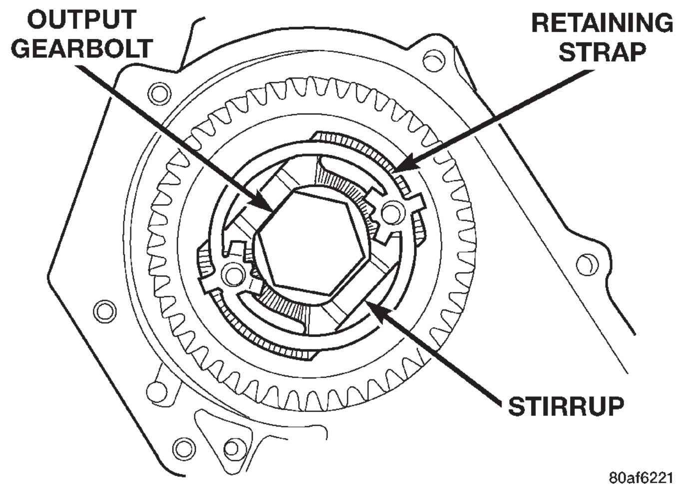


Fig. 116 Remove Stirrup Strap

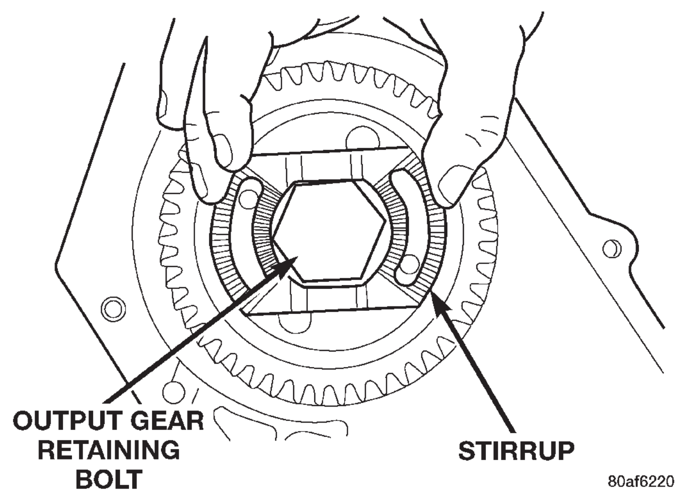


Fig. 117 Remove Stirrup

DISASSEMBLY AND ASSEMBLY (Continued)

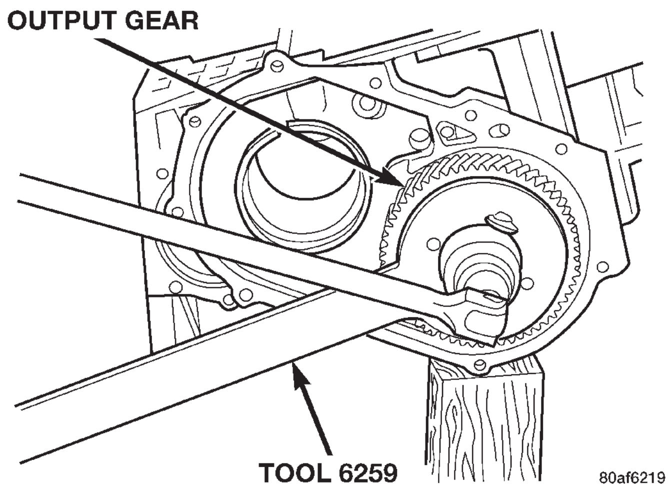


Fig. 118 Remove Output Gear Bolt

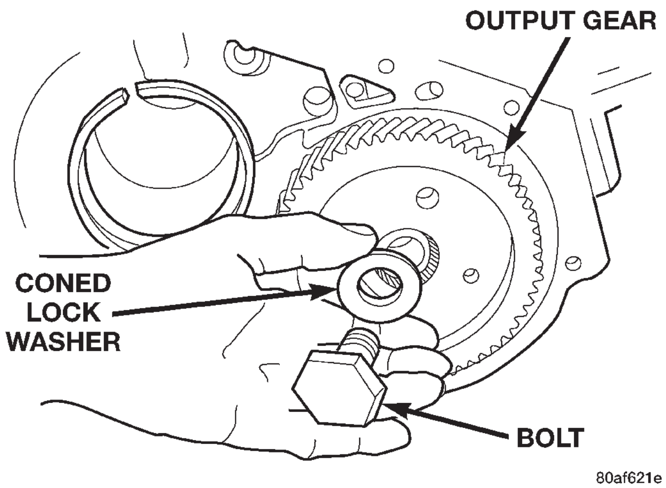


Fig. 119 Output Gear Bolt and Washer

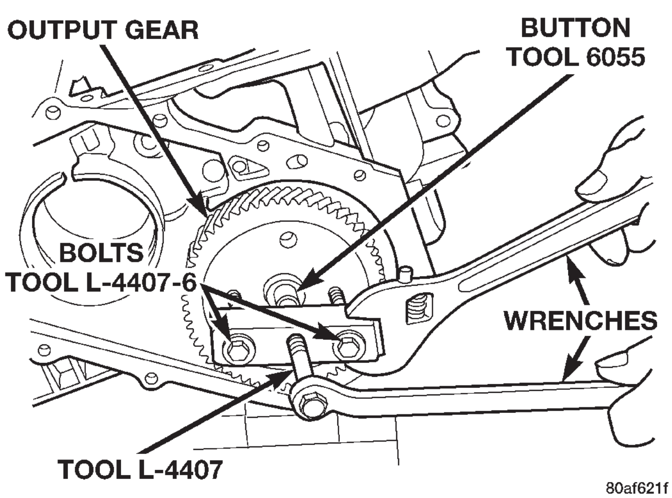


Fig. 120 Remove Output Gear

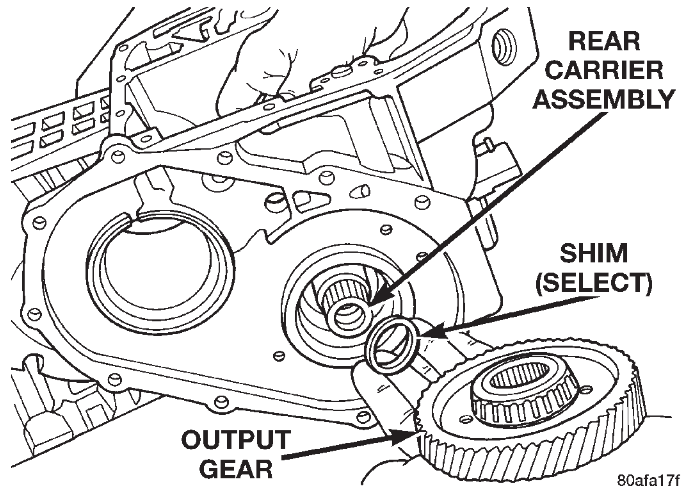


Fig. 121 Output Gear and (Select) Shim

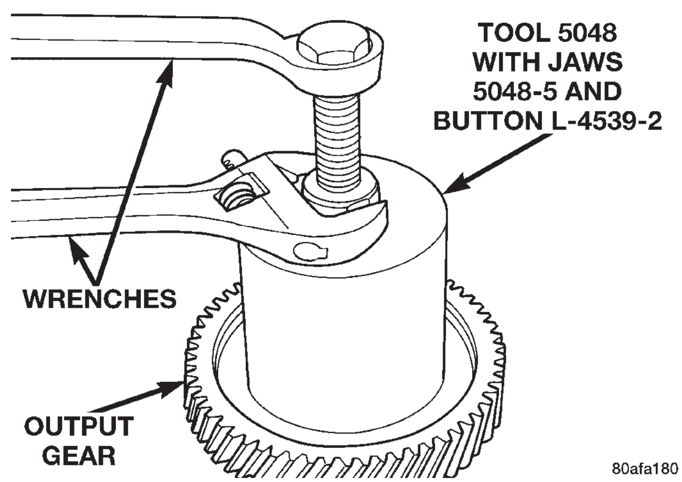


Fig. 122 Remove Bearing Cone

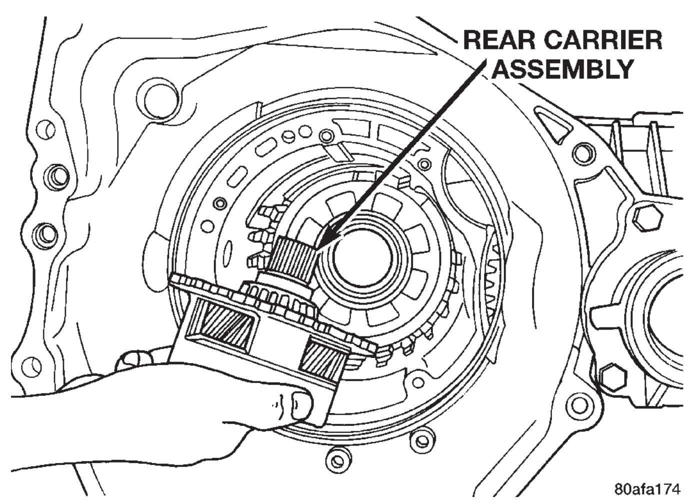


Fig. 123 Remove Rear Carrier Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

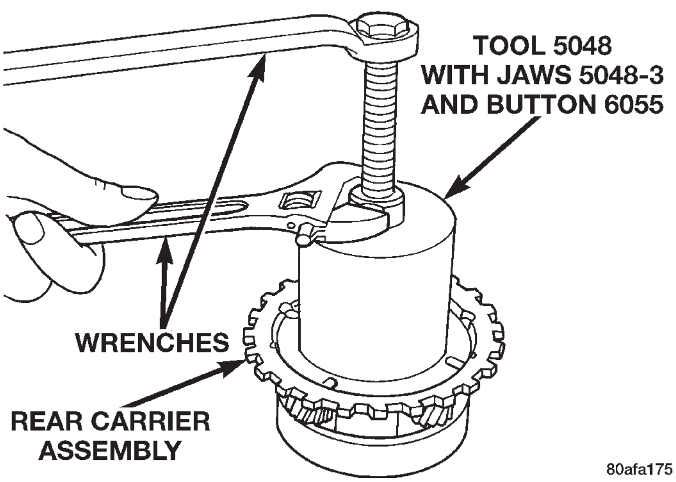


Fig. 124 Remove Rear Carrier Bearing Cone

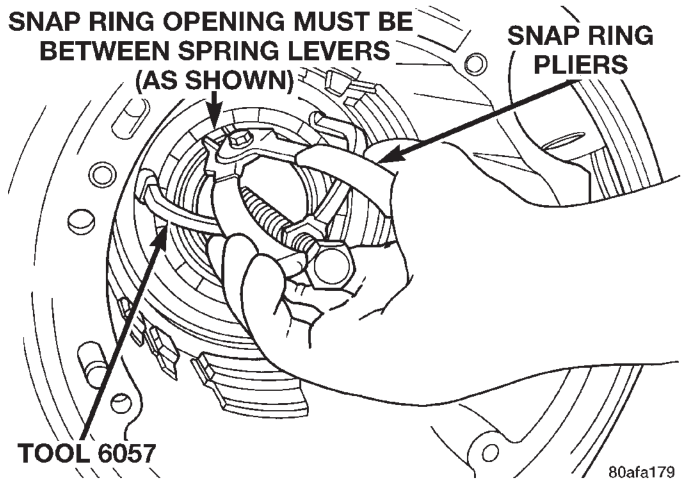


Fig. 127 Remove Snap Ring

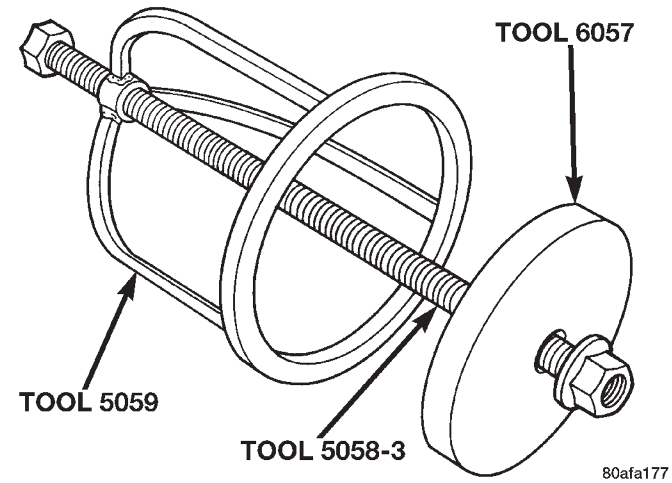


Fig. 125 Low/Reverse Spring Compressor Tool

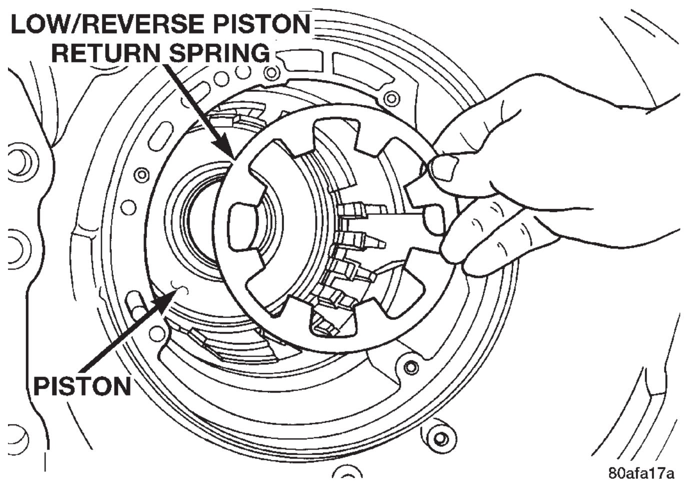


Fig. 128 Low/Reverse Piston Return Spring

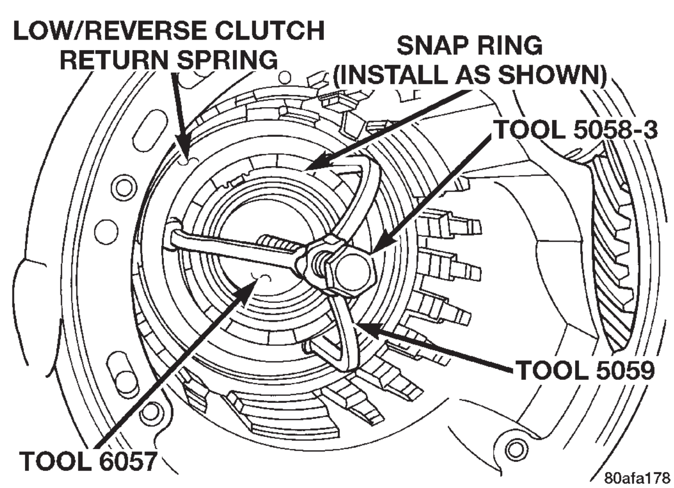


Fig. 126 Compressor Tool in Use

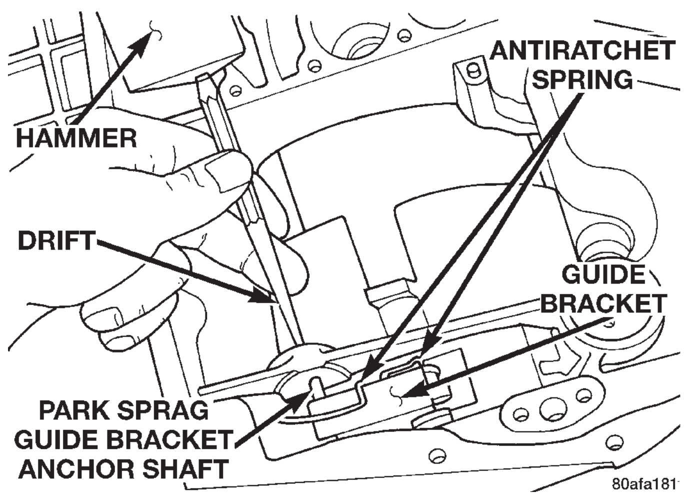


Fig. 129 Drive Out Anchor Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

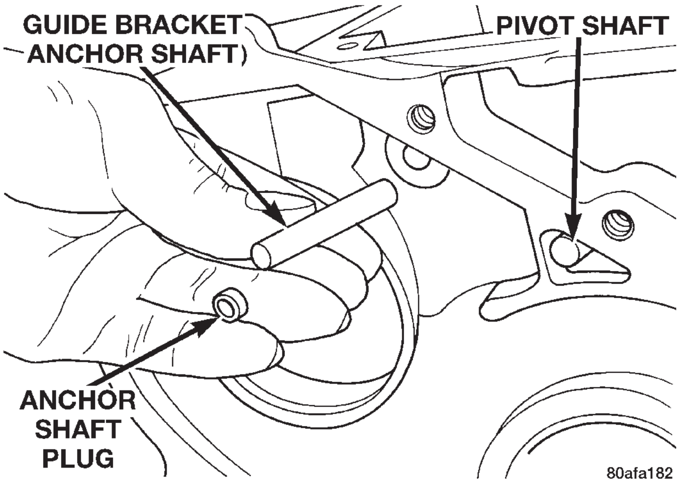


Fig. 130 Remove Anchor Shaft and Plug

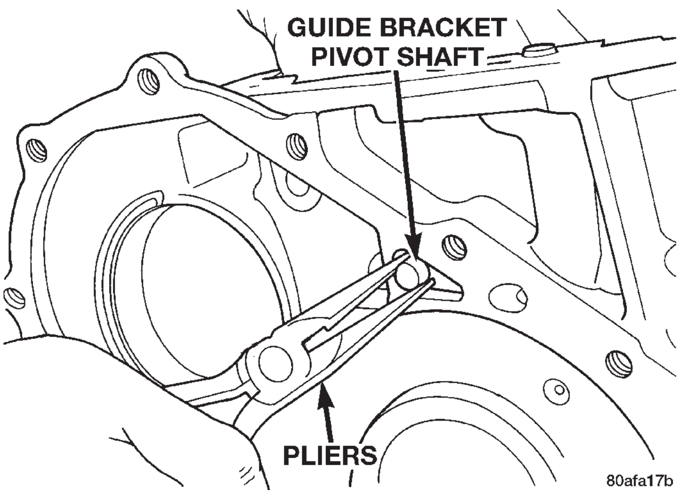


Fig. 131 Remove Guide Bracket Pivot Shaft

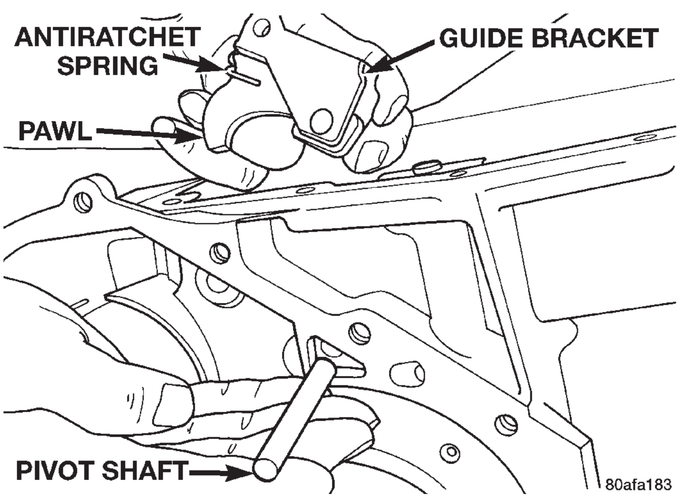


Fig. 132 Pivot Shaft and Guide Bracket

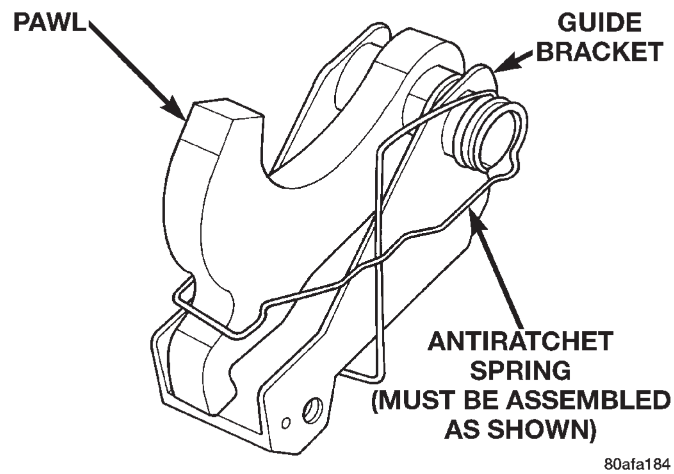


Fig. 133 Guide Bracket

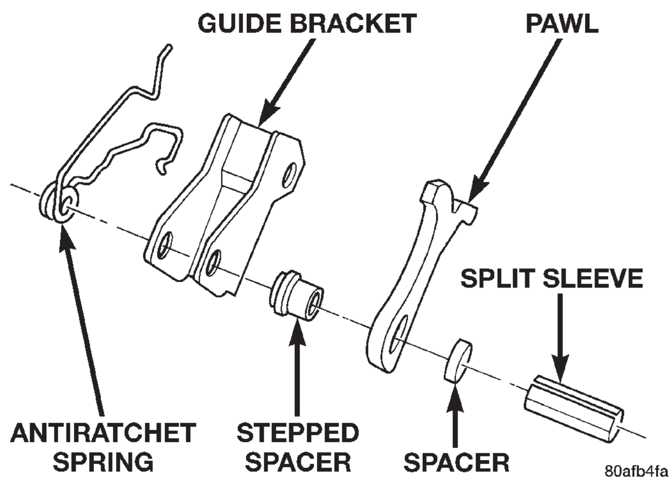


Fig. 134 Guide Bracket Disassembled

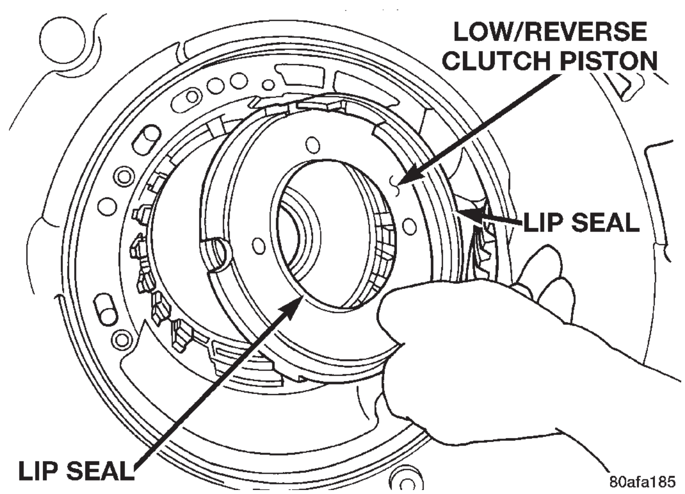


Fig. 135 Remove Low/Reverse Clutch Piston

DISASSEMBLY AND ASSEMBLY (Continued)

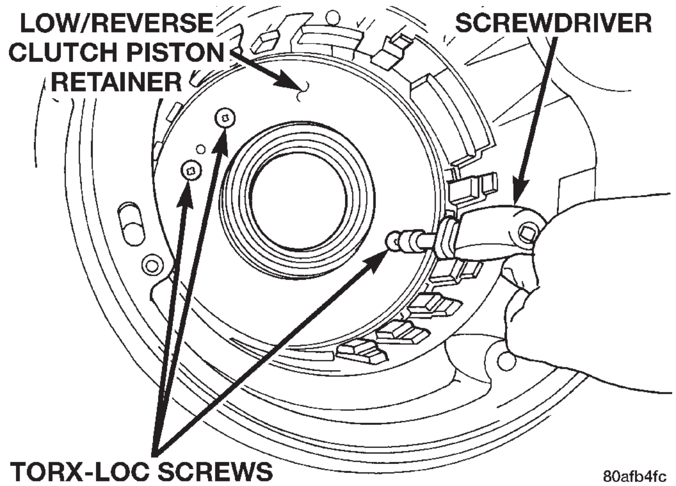


Fig. 136 Remove Piston Retainer Attaching Screws

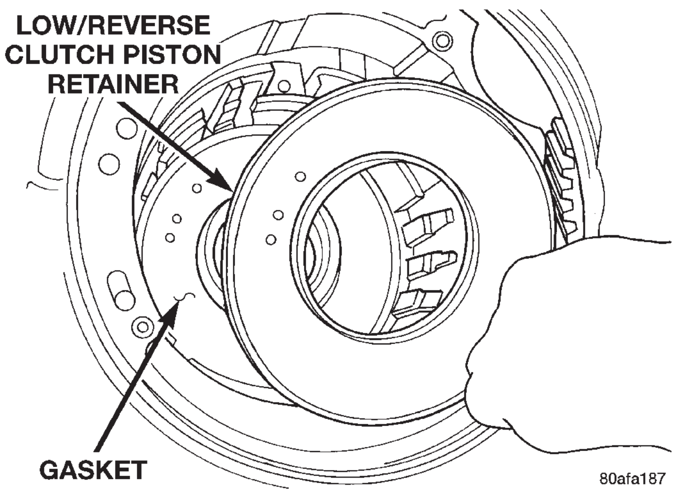


Fig. 137 Remove Piston Retainer

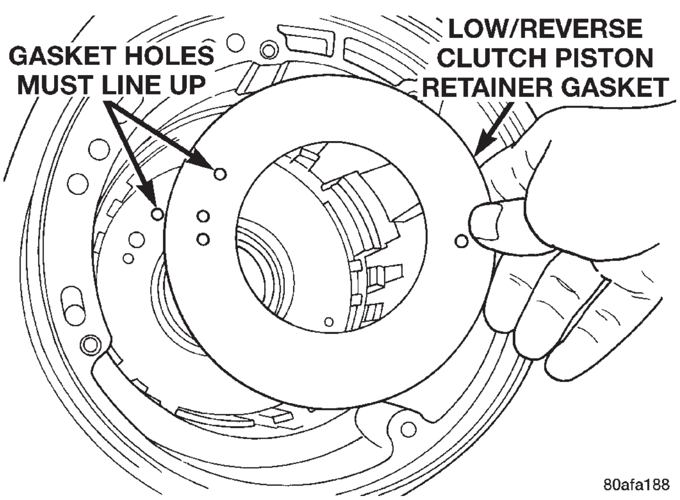


Fig. 138 Remove Piston Retainer Gasket

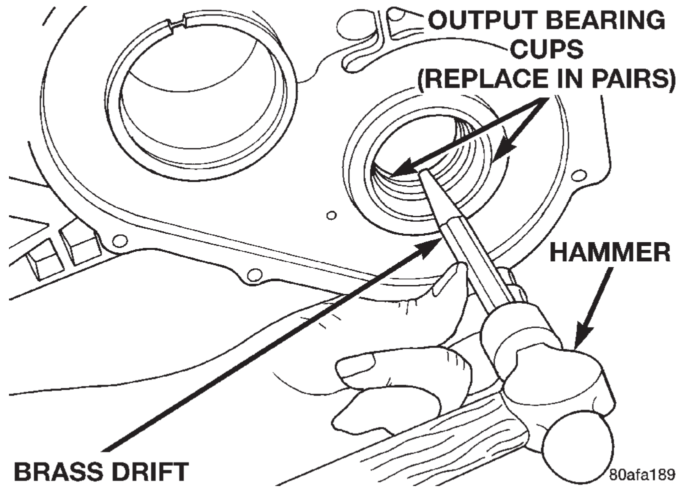


Fig. 139 Remove Output Bearing Inner Cup

CAUTION: Drift bearing cup all the way around.

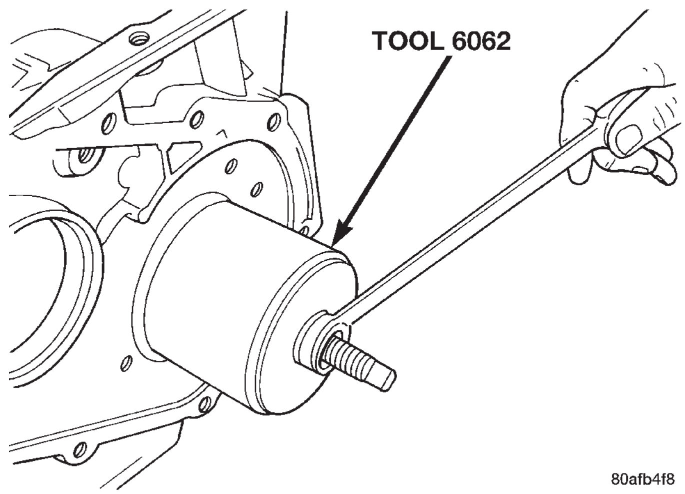


Fig. 140 Remove Output Bearing Outer Cup

This concludes the disassemble of the transaxle centerline. To disassemble the input clutch assembly, refer to Input Clutches-Recondition.

DISASSEMBLY AND ASSEMBLY (Continued)

INPUT CLUTCHES-RECONDITION

DISASSEMBLY

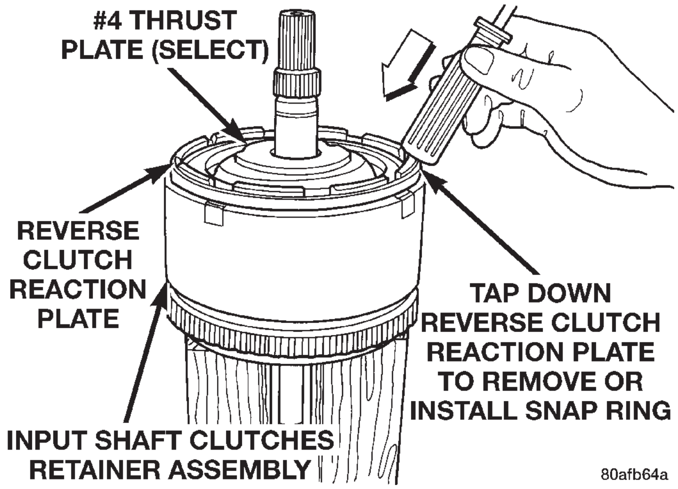


Fig. 141 Tapping Reaction Plate

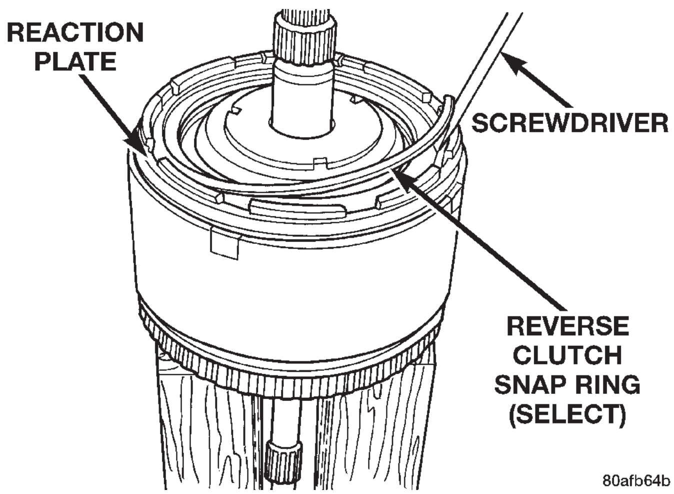


Fig. 142 Reverse Clutch Snap Ring

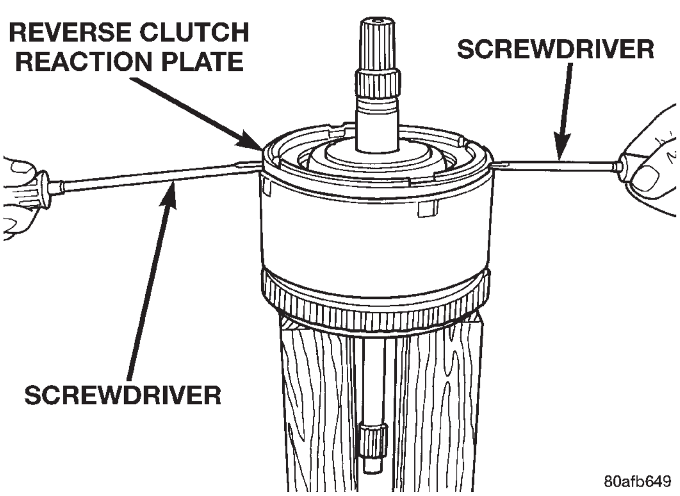


Fig. 143 Pry Reverse Clutch Reaction Plate

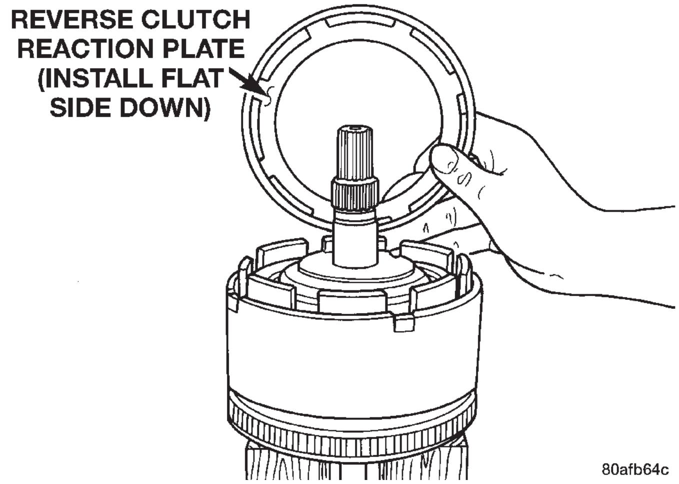


Fig. 144 Reverse Clutch Reaction Plate

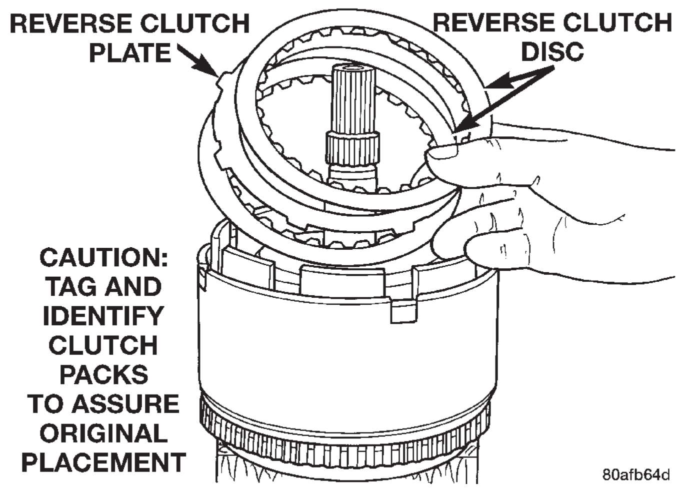


Fig. 145 Reverse Clutch Pack

NOTE: Tag reverse clutch pack for reassembly identification .

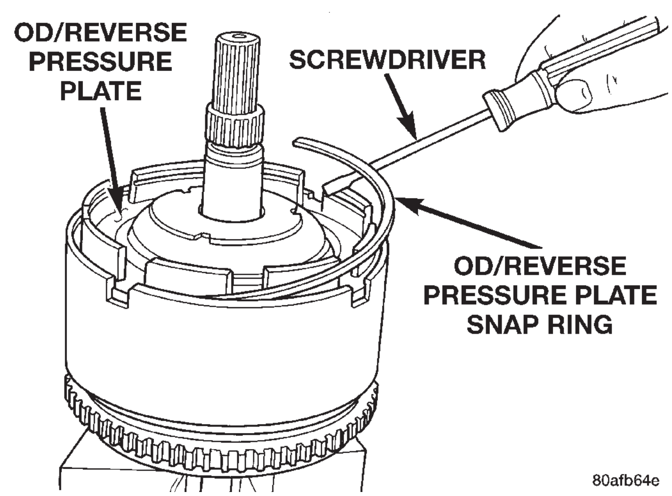


Fig. 146 OD/Reverse Pressure Plate Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

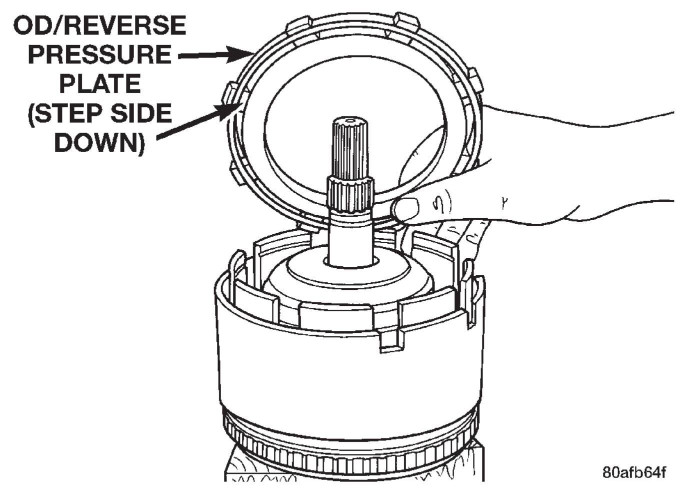


Fig. 147 OD/Reverse Pressure Plate

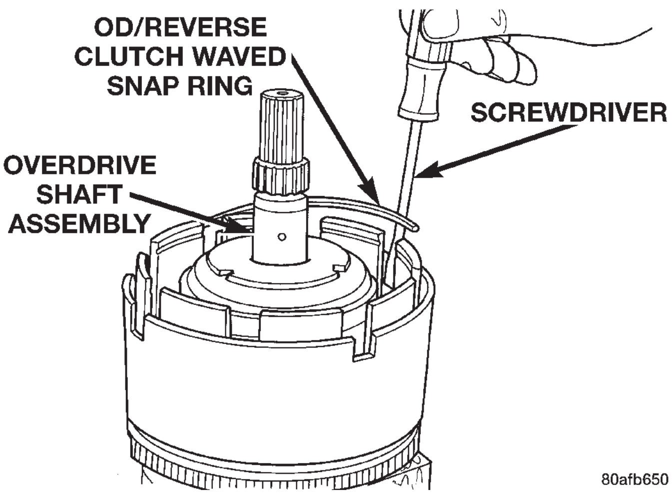


Fig. 148 Waved Snap Ring

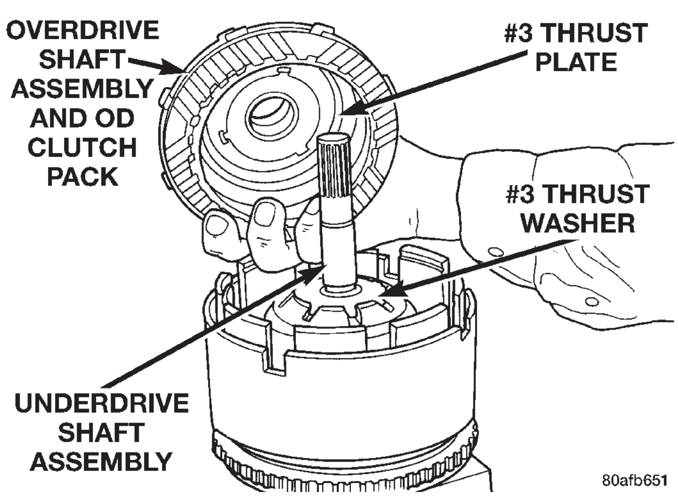


Fig. 149 Remove OD Clutch Pack

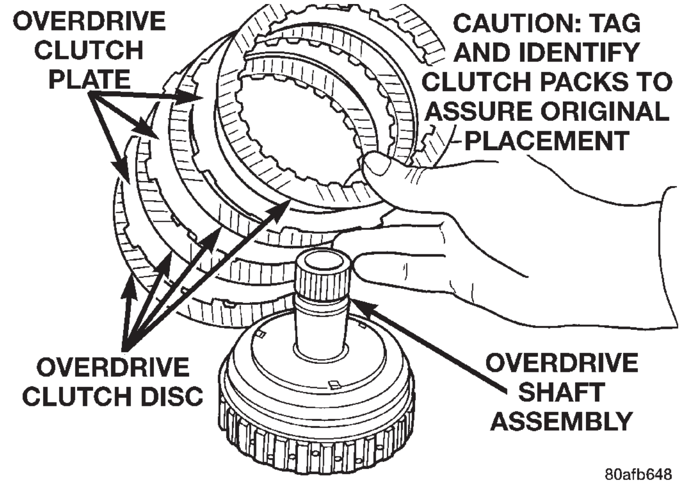


Fig. 150 Overdrive Clutch Pack

NOTE: Tag overdrive clutch pack for reassembly identification.

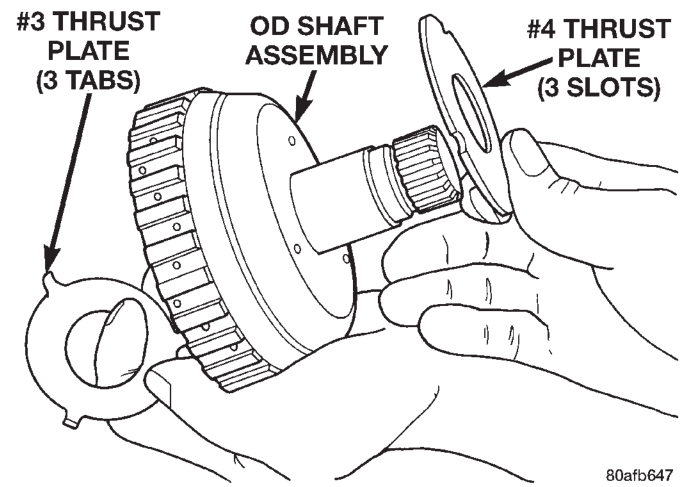


Fig. 151 Overdrive Shaft Assembly

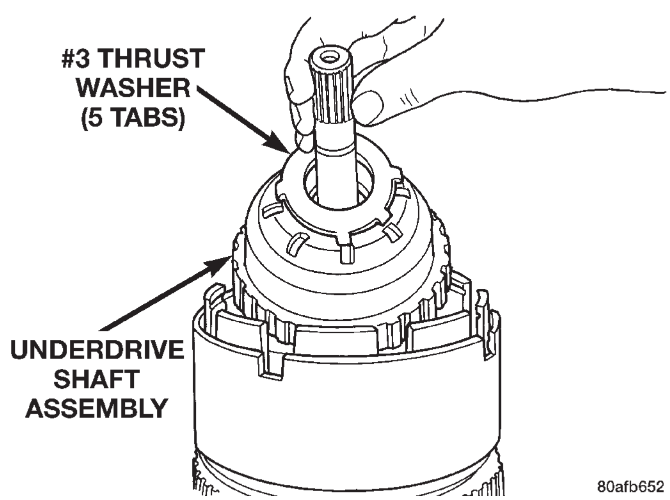


Fig. 152 Underdrive Shaft Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

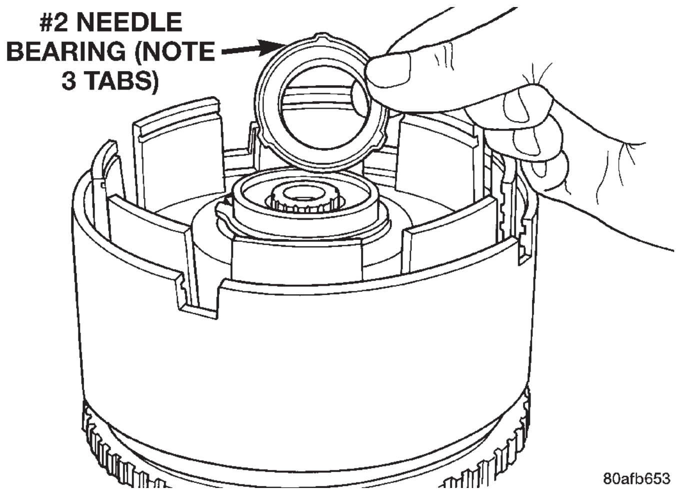


Fig. 153 No. 2 Needle Bearing

NOTE: The OD/UD Reaction Plate, Snap Rings, and Input Clutches Retainer is not interchangeable with previous year 41TE components. The snap rings are thicker and the position of the ring lands have changed.

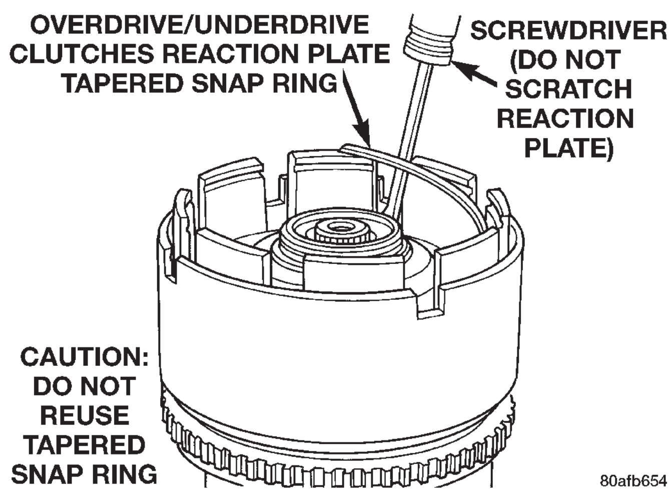


Fig. 154 OD/UD Reaction Plate Tapered Snap Ring

NOTE: The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

NOTE: Tag underdrive clutch pack for reassembly identification.

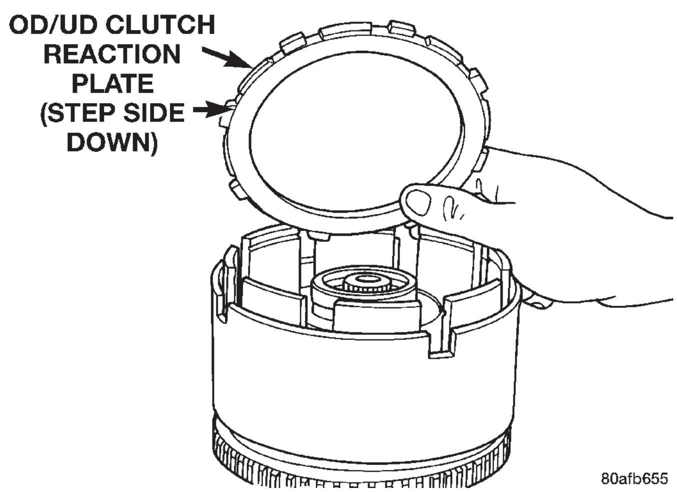


Fig. 155 OD/UD Reaction Plate

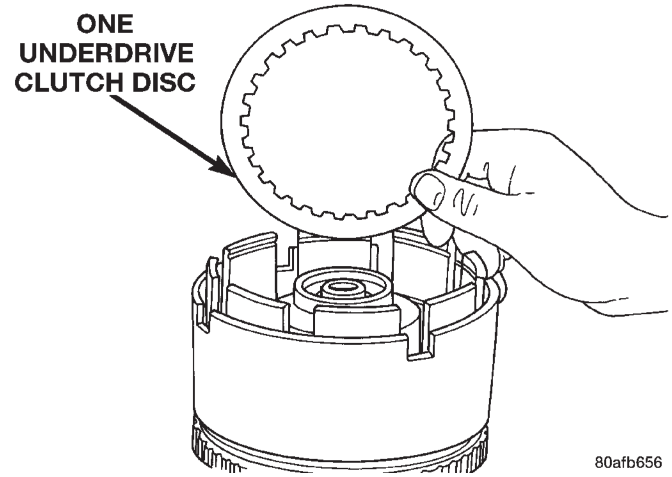


Fig. 156 Remove One UD Clutch Disc

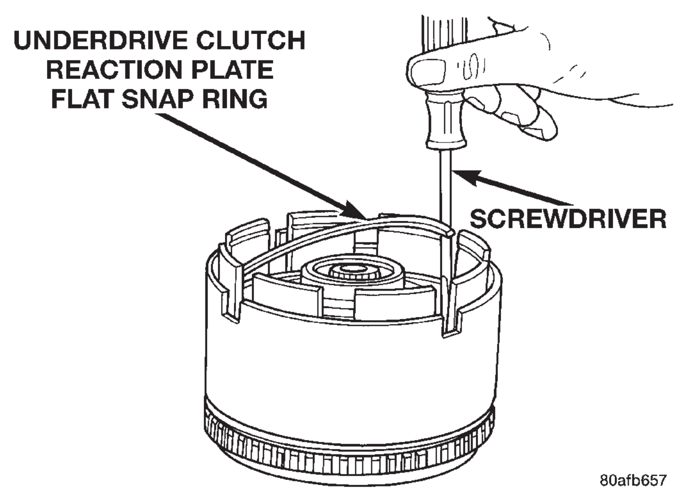


Fig. 157 UD Clutch Flat Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

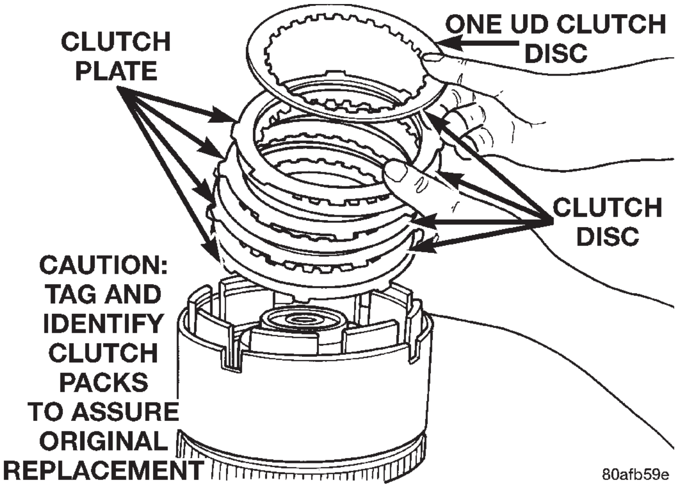


Fig. 158 Underdrive Clutch Pack

CAUTION: Compress return spring just enough to remove or install snap ring.

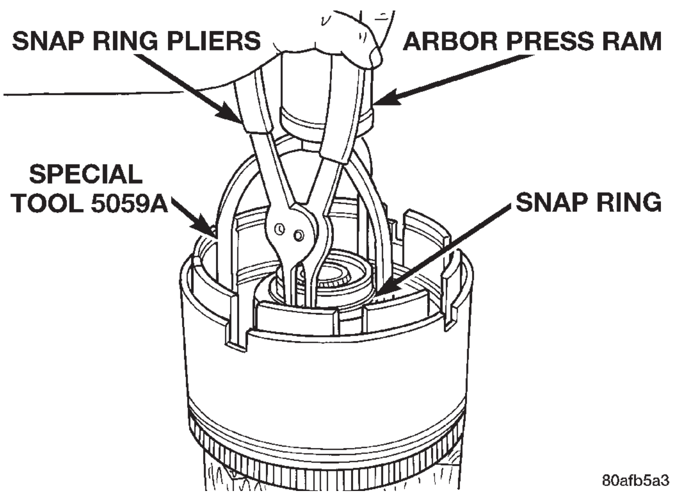


Fig. 159 UD Spring Retainer Snap Ring

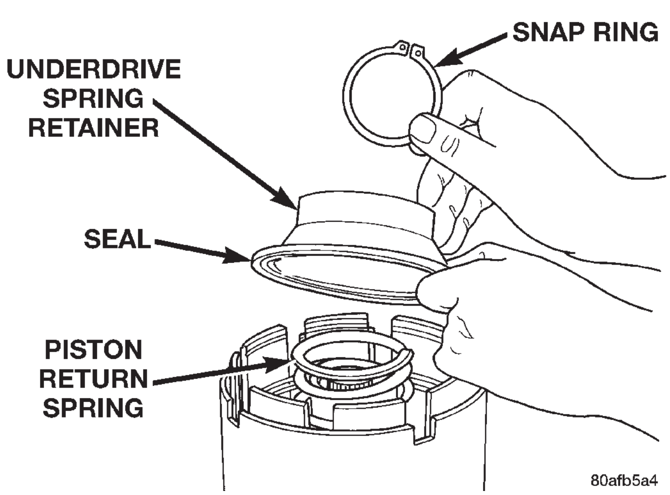


Fig. 160 UD Return Spring and Retainer

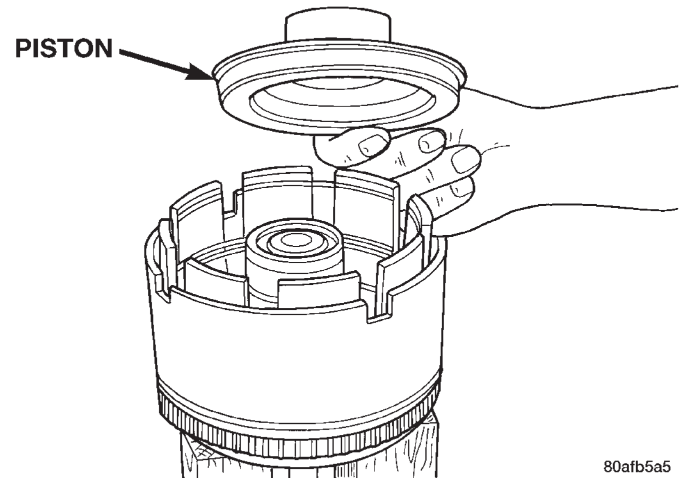


Fig. 161 Underdrive Clutch Piston

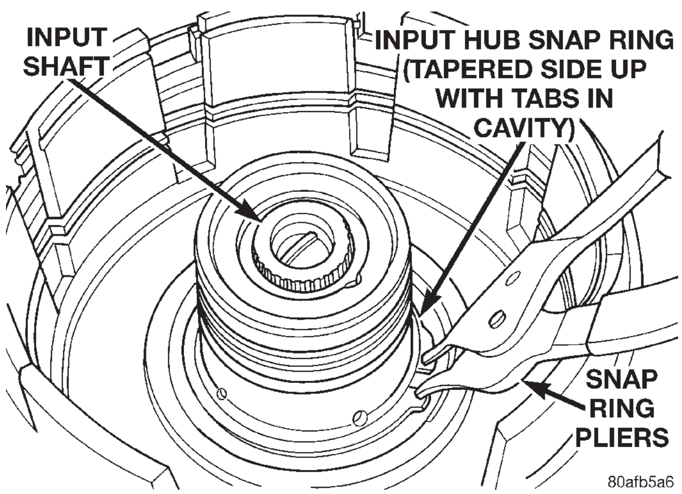


Fig. 162 Input Hub Tapered Snap Ring

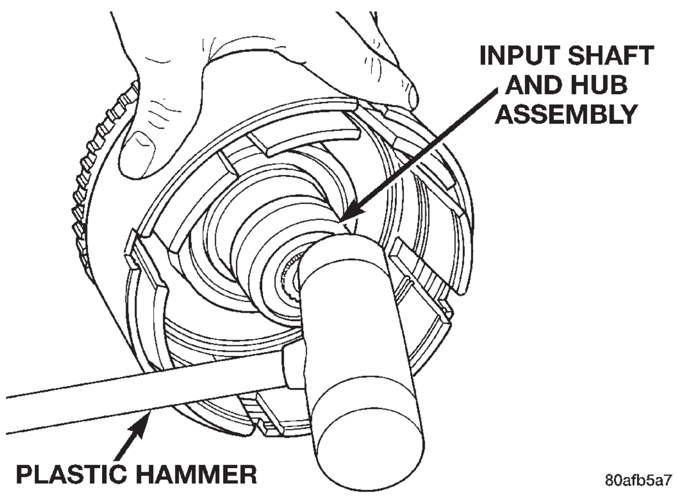


Fig. 163 Tap on Input Hub

DISASSEMBLY AND ASSEMBLY (Continued)

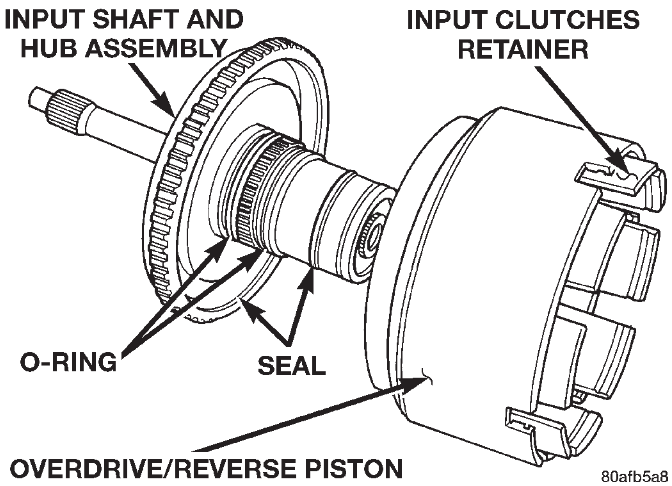


Fig. 164 Input Hub Removed

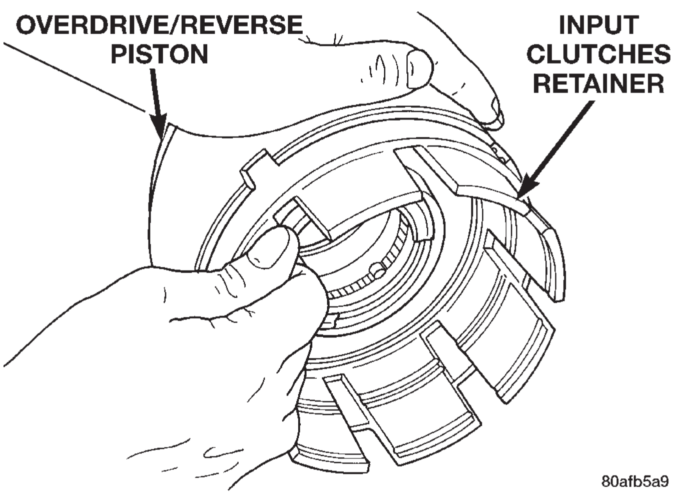


Fig. 165 Pull Retainer from Piston

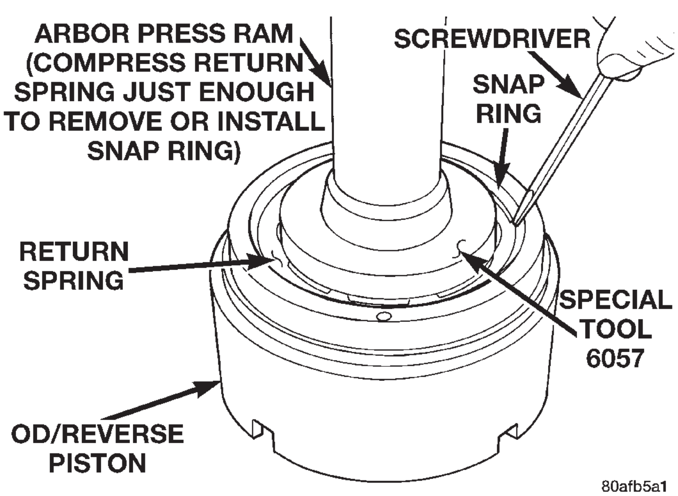


Fig. 166 Remove Snap Ring

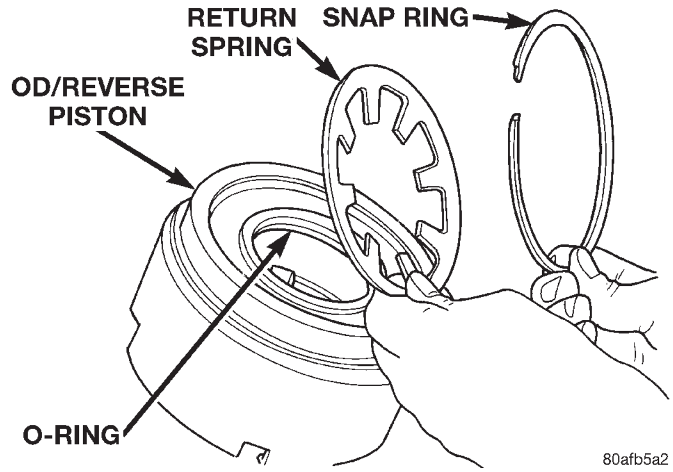


Fig. 167 Snap Ring and Return Spring

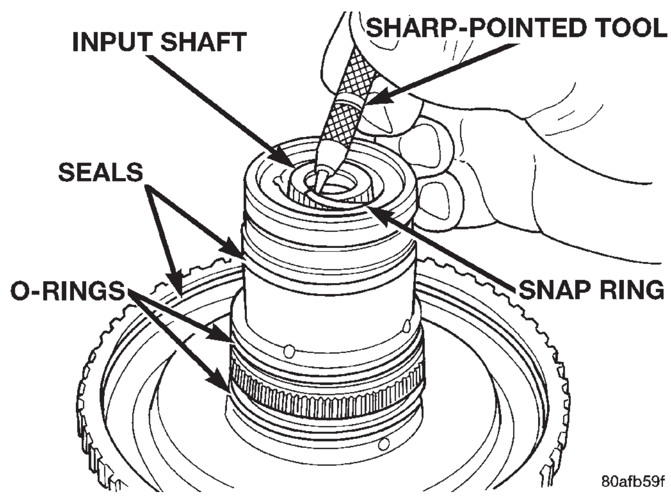


Fig. 168 Remove Input Shaft Snap Ring

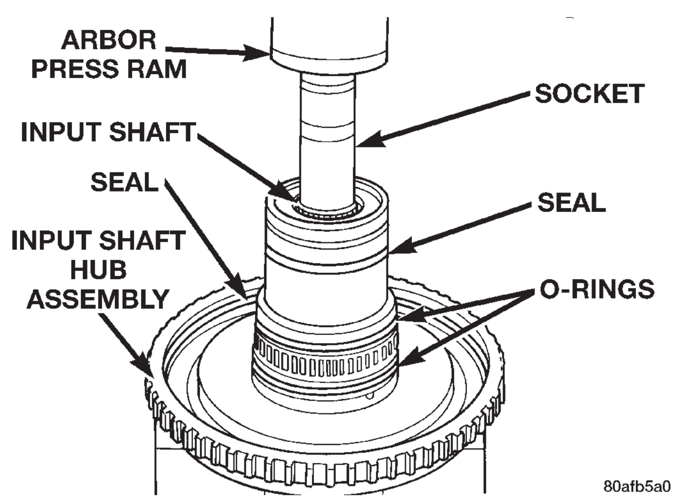


Fig. 169 Remove Input Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

Use petrolatum on all seals to ease assembly of components.

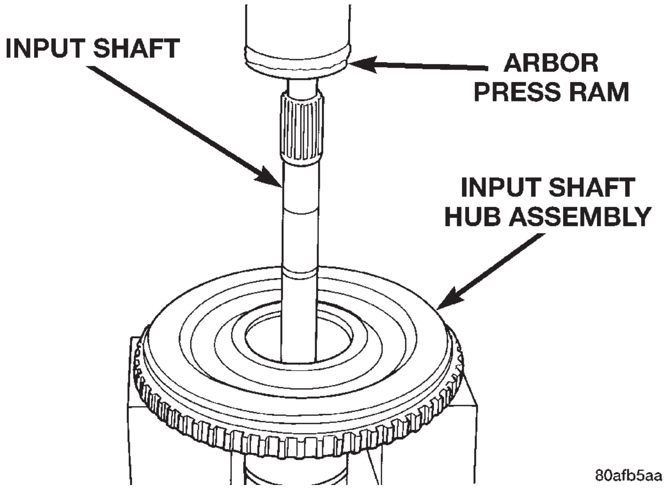


Fig. 170 Install Input Shaft

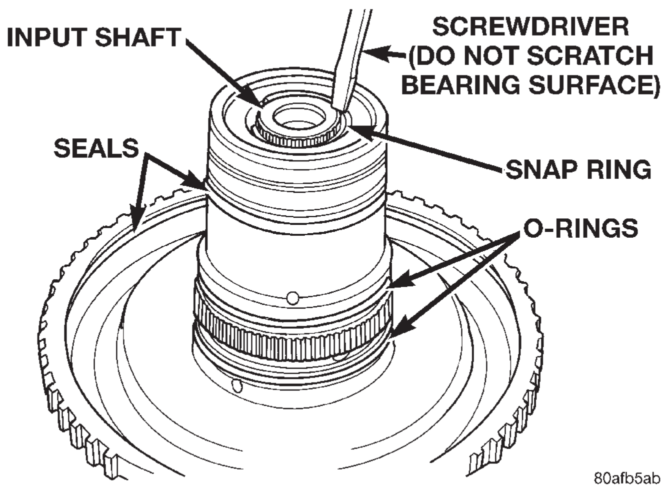


Fig. 171 Install Input Shaft Snap Ring

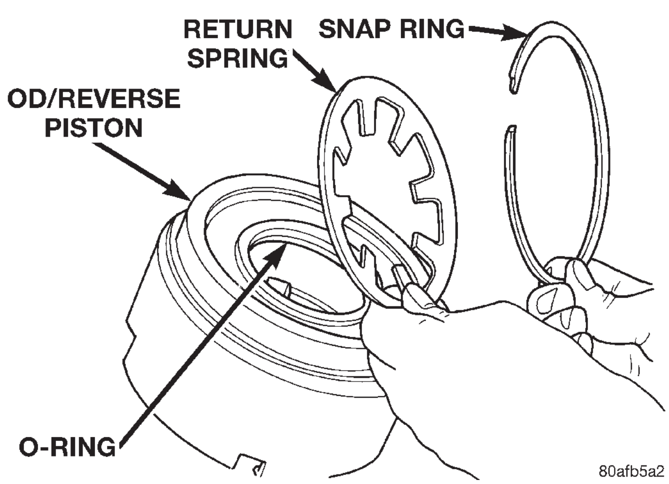


Fig. 172 Return Spring and Snap Ring

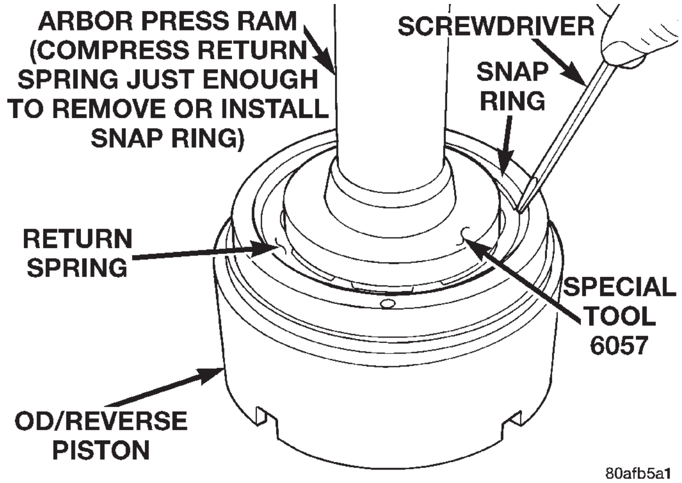


Fig. 173 Install Snap Ring

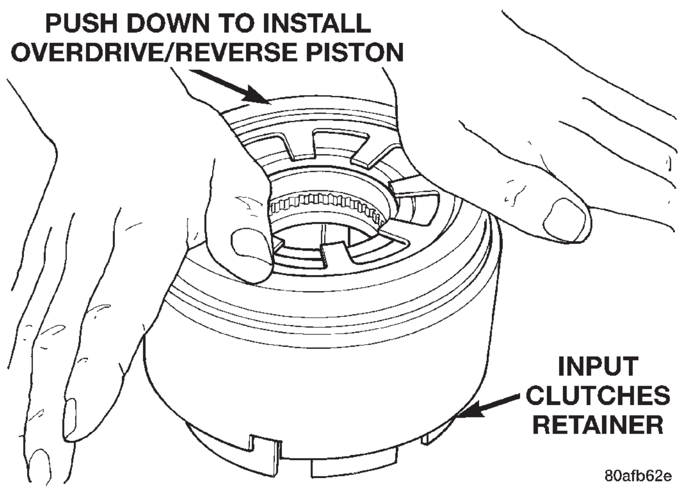


Fig. 174 Install OD/Reverse Piston

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: The OD/UD Reaction Plate, Snap Rings, and Input Clutches Retainer is not interchangeable with previous year 41TE components. The snap rings are thicker and the position of the ring lands have changed.

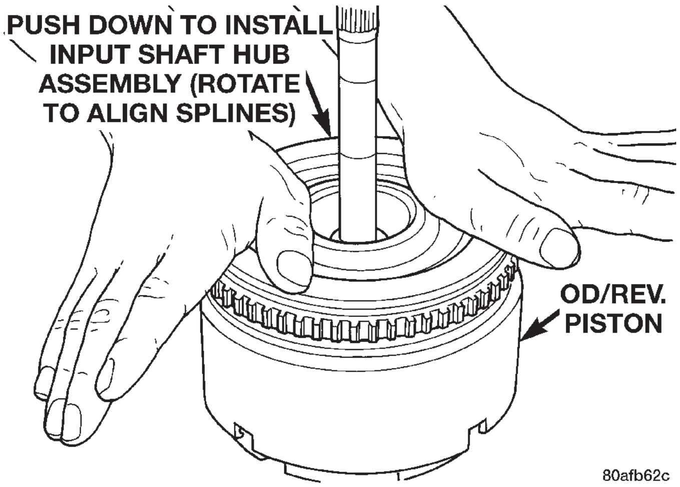


Fig. 175 Install Input Shaft Hub Assembly

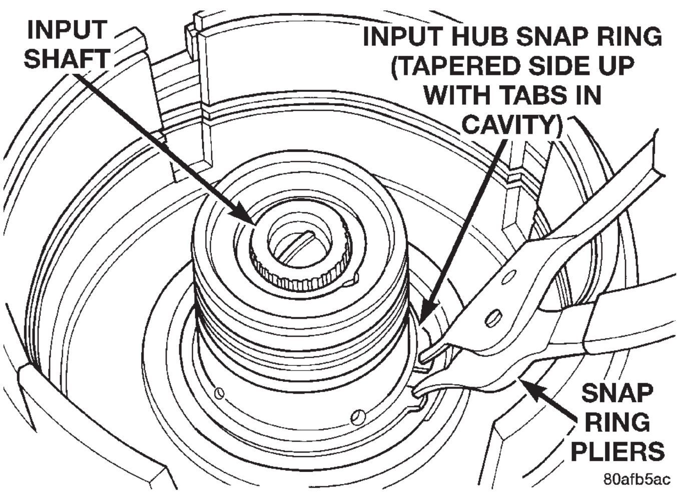


Fig. 176 Install Input Hub Tapered Snap Ring

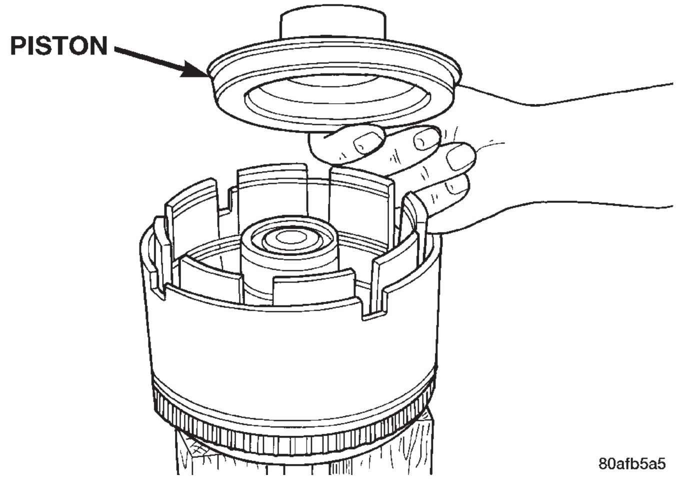


Fig. 177 Underdrive Clutch Piston

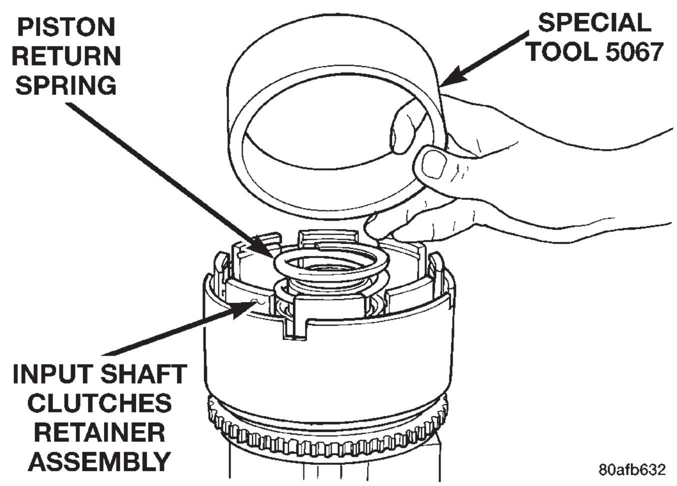


Fig. 178 Seal Compressor Special Tool 5067

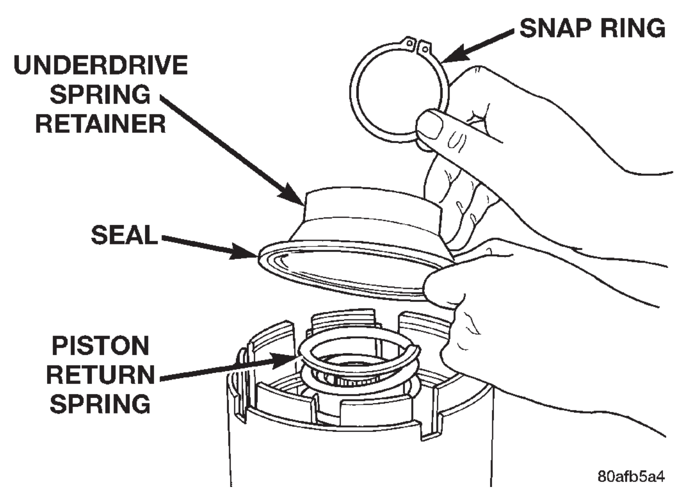


Fig. 179 UD Return Spring and Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Compress return spring just enough to remove or install snap ring.

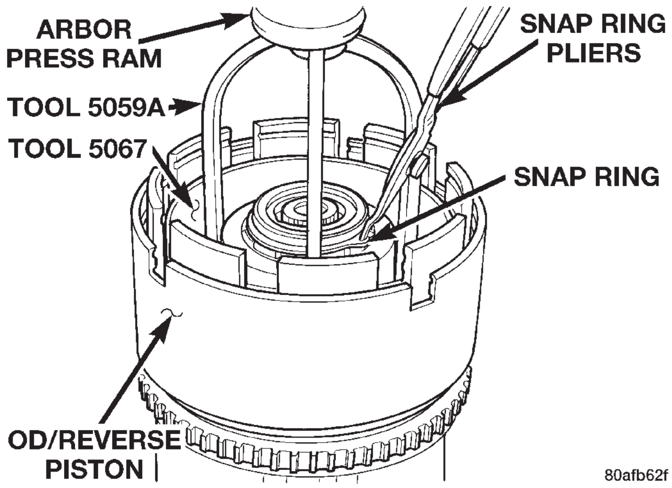


Fig. 180 Install UD Spring Retainer and Snap Ring

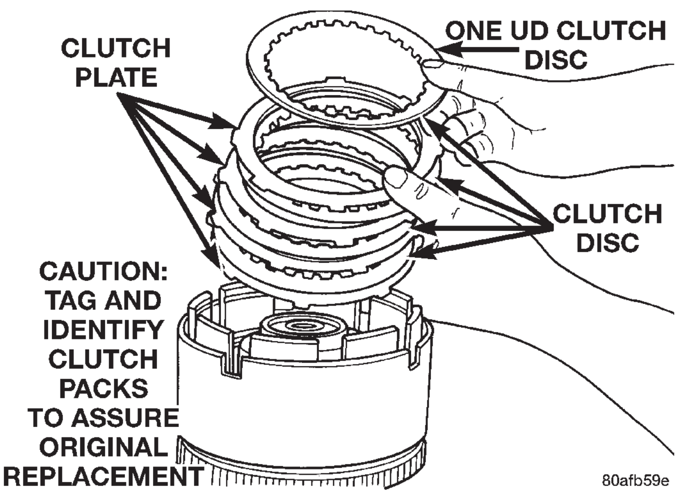


Fig. 181 Underdrive Clutch Pack

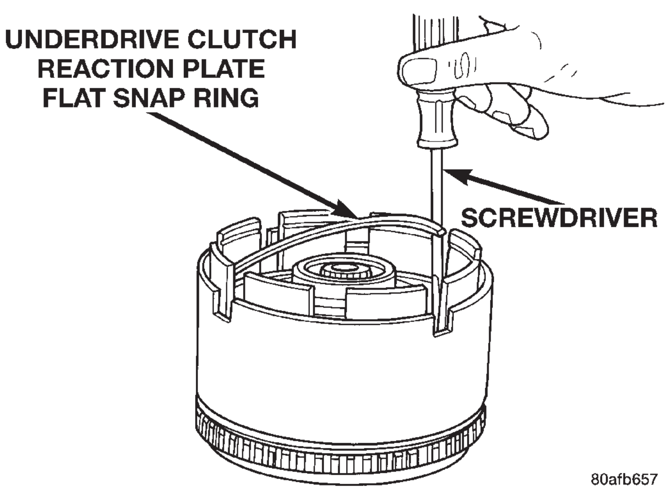


Fig. 182 UD Clutch Flat Snap Ring

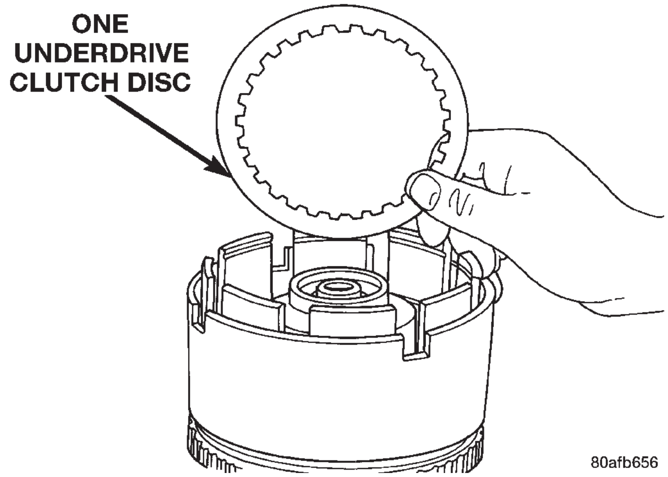


Fig. 183 Install Last UD Clutch Disc

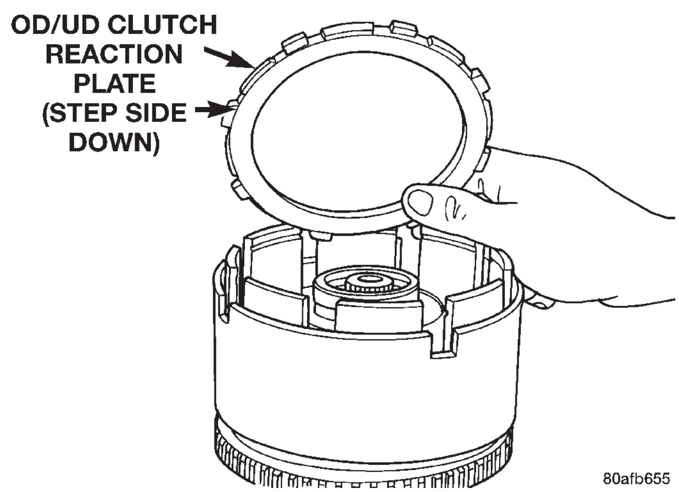


Fig. 184 OD/UD Reaction Plate

The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

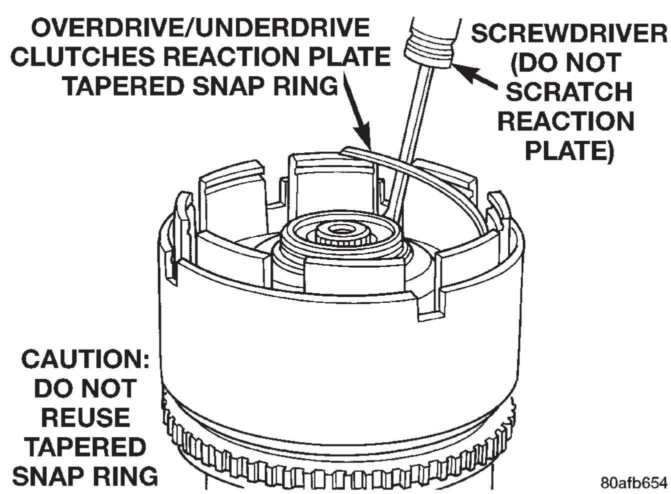


Fig. 185 Tapered Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

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.

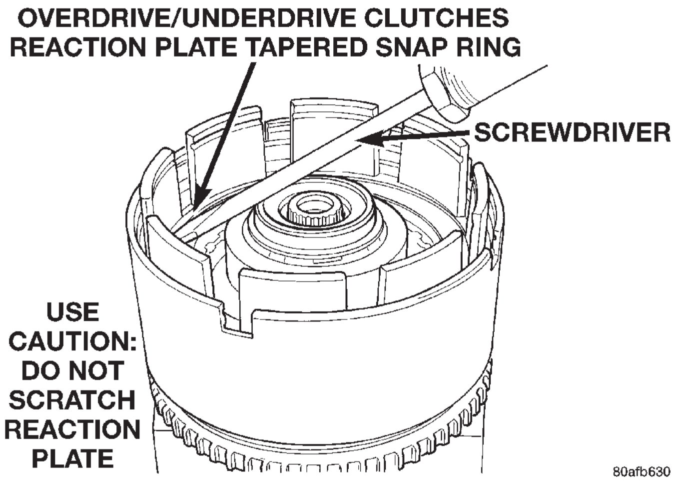


Fig. 186 Seating Tapered Snap Ring

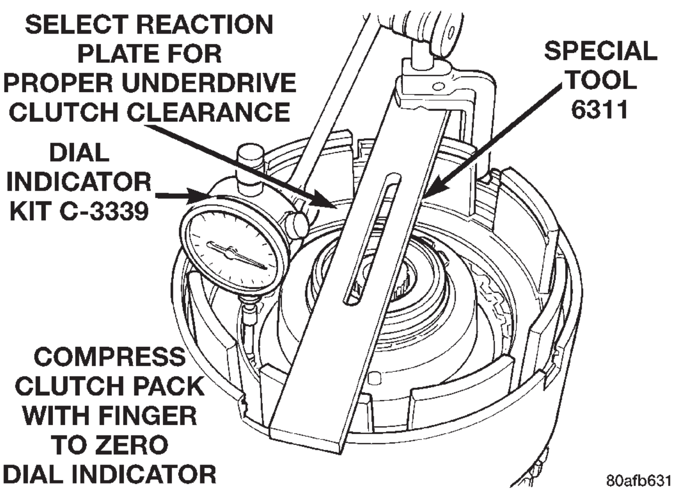


Fig. 187 Set Up Dial Indicator for Clutch Clearance

Underdrive clutch pack clearance must be 0.91 to 1.47 mm (.036 to .058 inch). Select the proper reaction plate to achieve specifications:

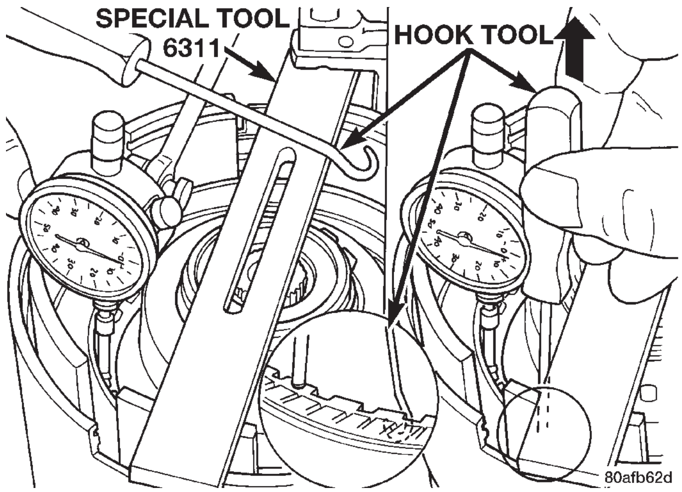


Fig. 188 Use Hook Tool to Raise One Clutch Disc

THICKNESS
6.99 mm (.275 in.)
6.50 mm (.256 in.)
6.01 mm (.237 in.)
5.52 mm (.217 in.)

9121-5

UNDERDRIVE REACTION PLATE CHART

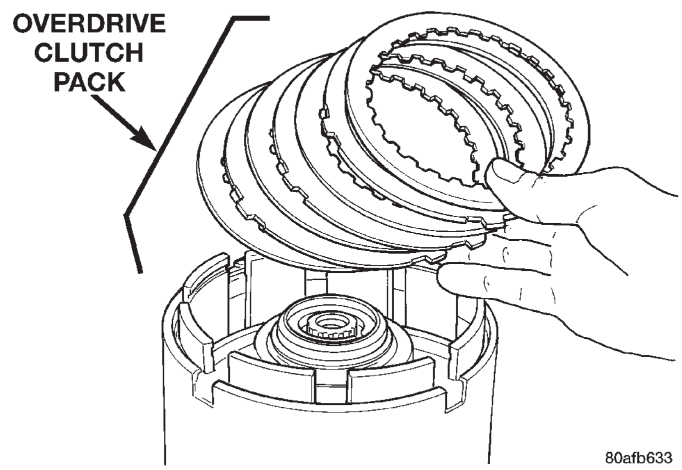


Fig. 189 Install OD Clutch Pack

DISASSEMBLY AND ASSEMBLY (Continued)

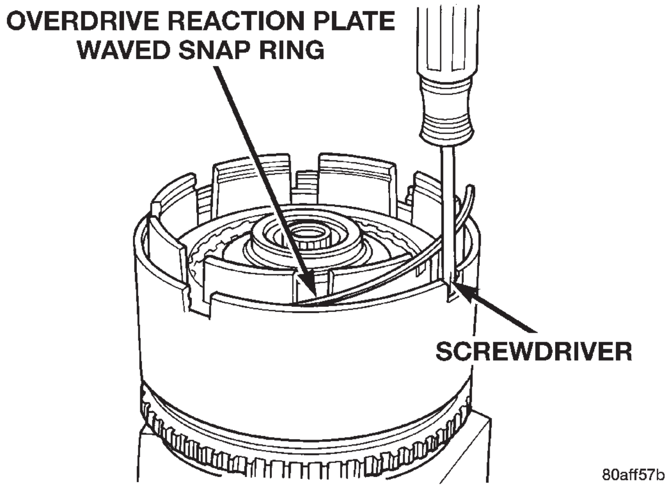


Fig. 190 Install Waved Snap Ring

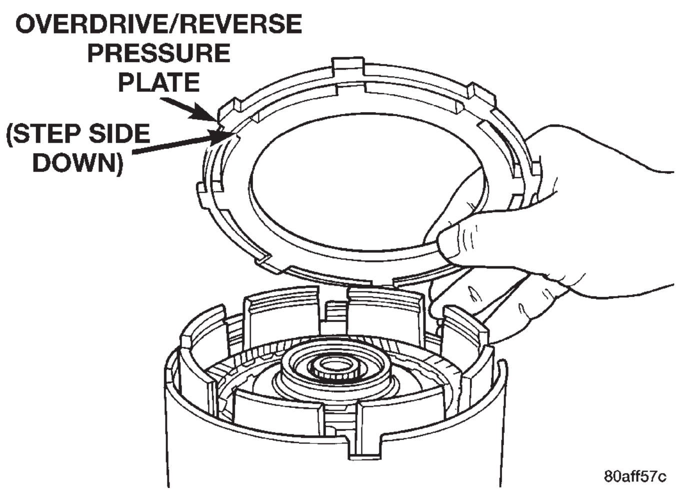


Fig. 191 OD/Reverse Pressure Plate

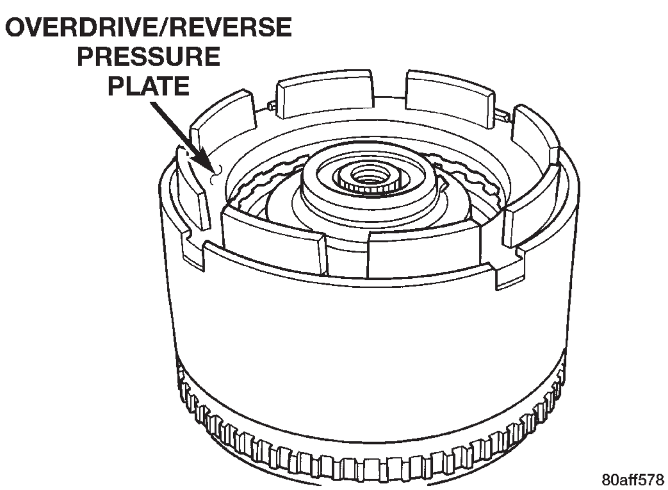


Fig. 192 Pressure Plate Installed

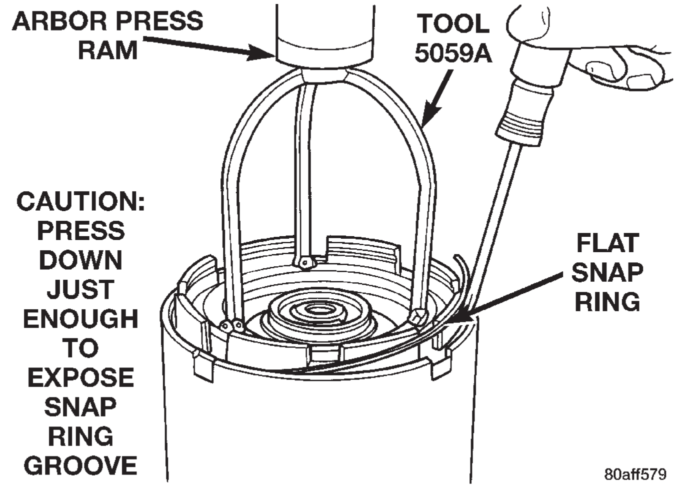


Fig. 193 Install Flat Snap Ring

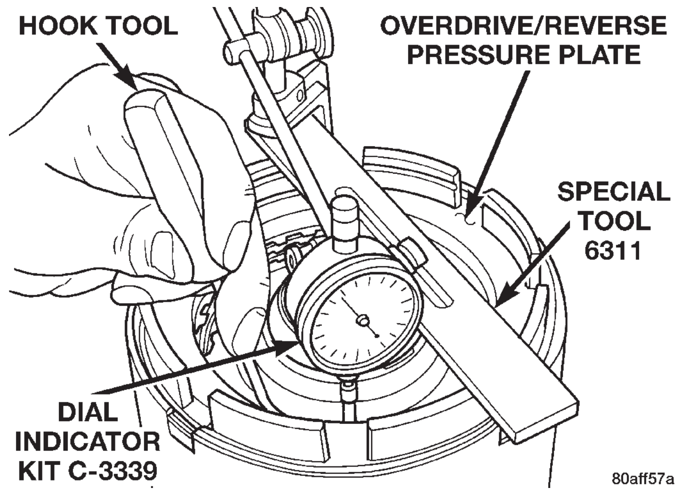


Fig. 194 Check OD Clutch Pack Clearance

DISASSEMBLY AND ASSEMBLY (Continued)

The overdrive (OD) clutch pack clearance is 1.07 to 2.44 mm (.042 to .096 inch). If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.

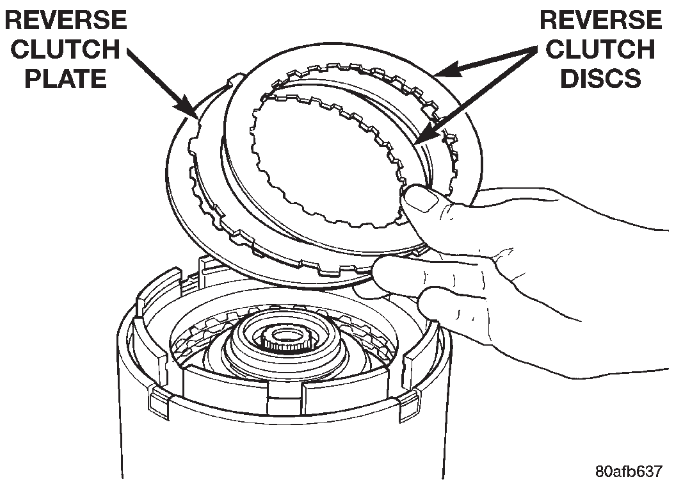


Fig. 195 Install Reverse Clutch Pack

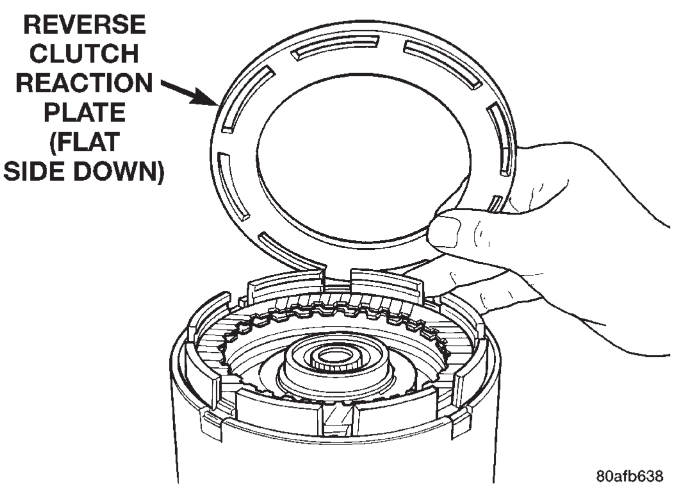


Fig. 196 Install Reaction Plate

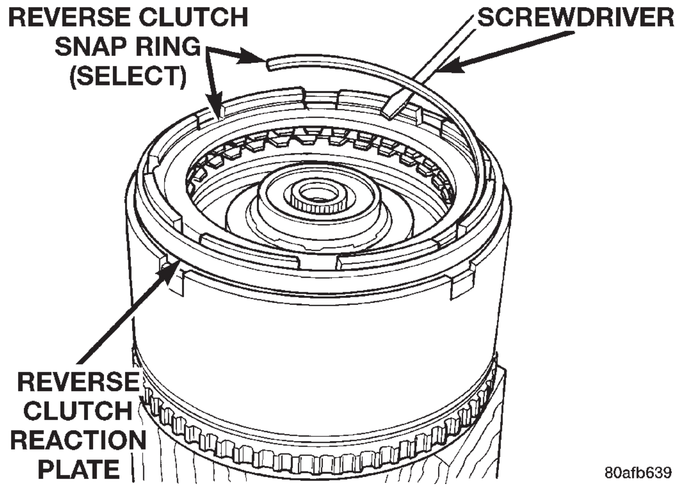


Fig. 197 Install Reverse Clutch Snap Ring

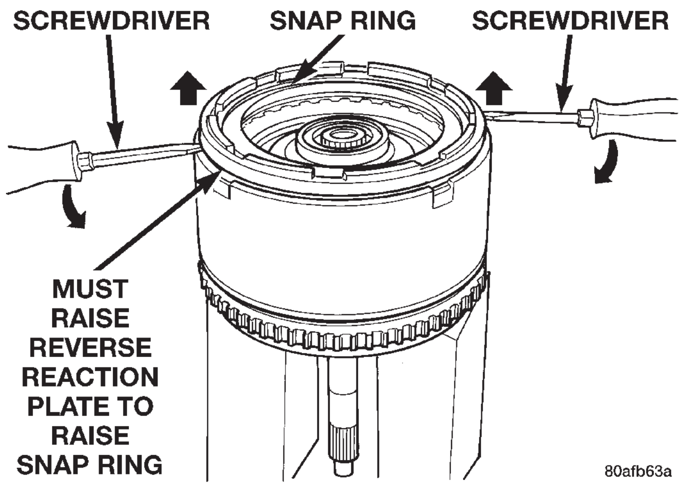


Fig. 198 Seating Snap Ring to Determine Reverse Clutch Clearance

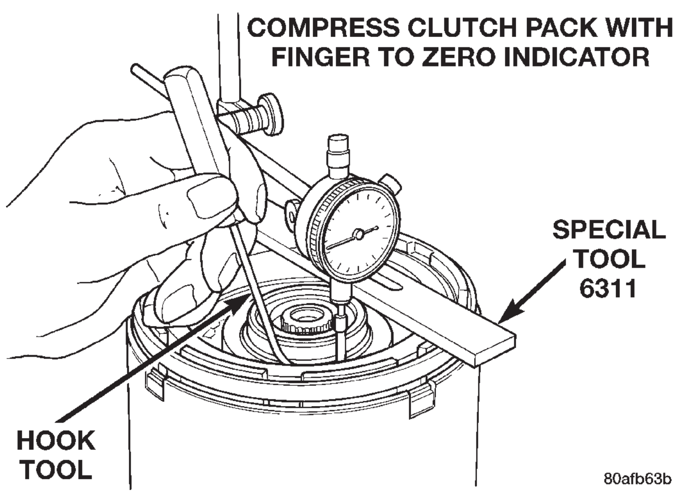


Fig. 199 Check Reverse Clutch Pack Clearance

DISASSEMBLY AND ASSEMBLY (Continued)

The reverse clutch pack clearance is 0.76 to 1.24 mm (.030 to .049 inch). Select the proper reverse clutch snap ring to achieve specifications:

THICKNESS
1.56 mm (.061 in.)
1.80 mm (.071 in.)
2.05 mm (.081 in.)
2.30 mm (.090 in.)

9121-6

REVERSE CLUTCH SNAP RING CHART

All clutch clearances in the input clutch retainer have now been checked and approved.

To complete the assembly of the input clutch retainer, the reverse clutch and the overdrive clutch must be removed from the retainer.

CAUTION: Do not intermix clutch parts. Keep in exact same order.

Now proceed with the next phase of the assembly:

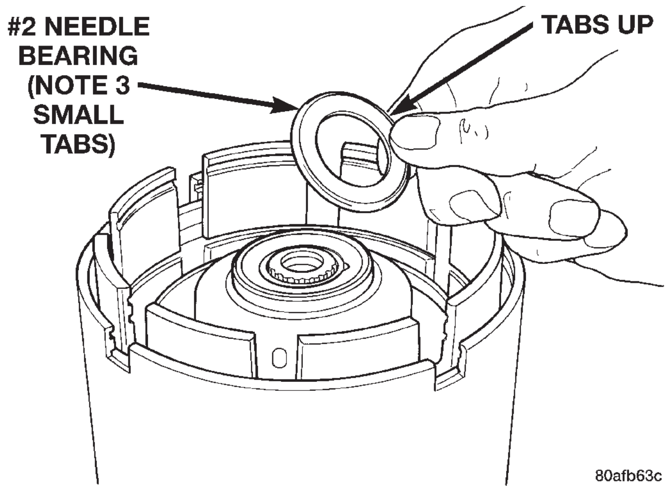


Fig. 200 Install No. 2 Needle Bearing

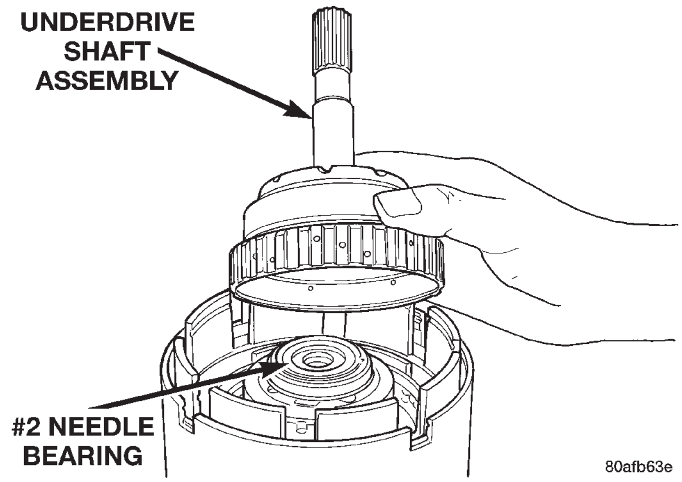


Fig. 201 Install Underdrive Shaft Assembly

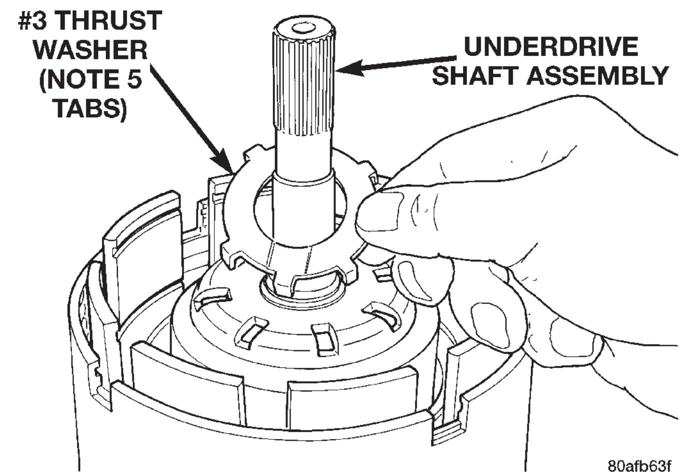


Fig. 202 Install No. 3 Thrust Washer

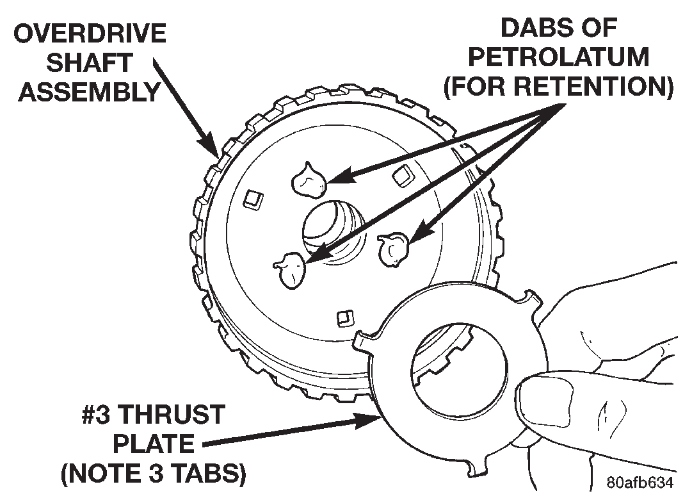


Fig. 203 Install No. 3 Thrust Plate

DISASSEMBLY AND ASSEMBLY (Continued)

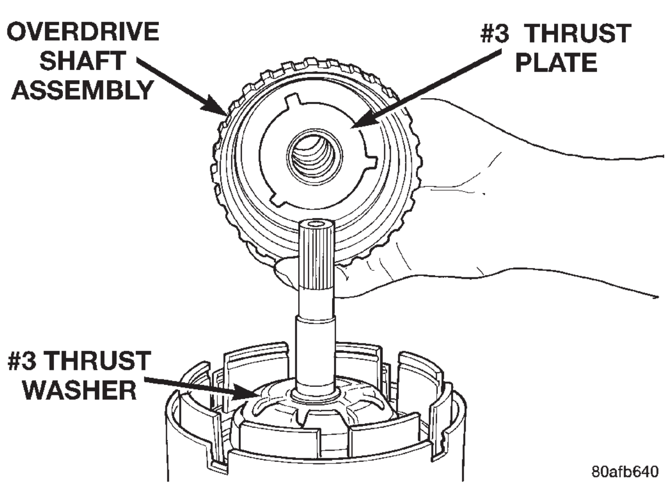


Fig. 204 Install Overdrive Shaft Assembly

Reinstall overdrive clutch and reverse clutch as shown. **Rechecking these clutch clearances is not necessary, as they were set and approved previously.**

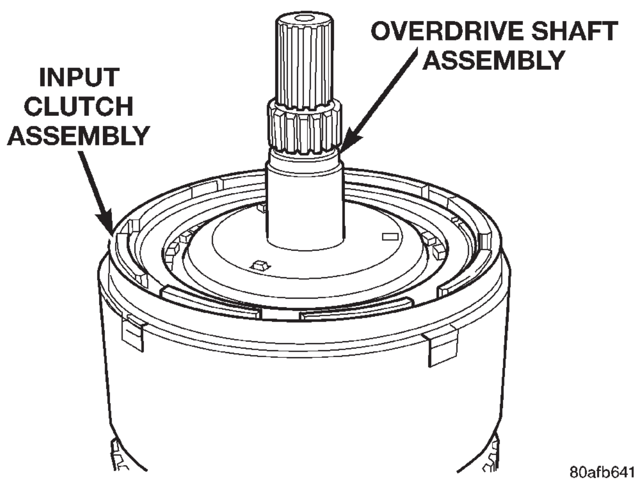


Fig. 205 Input Clutch Assembly

TRANSAXLE ASSEMBLE

To assemble the transaxle centerline, refer to the following procedures.

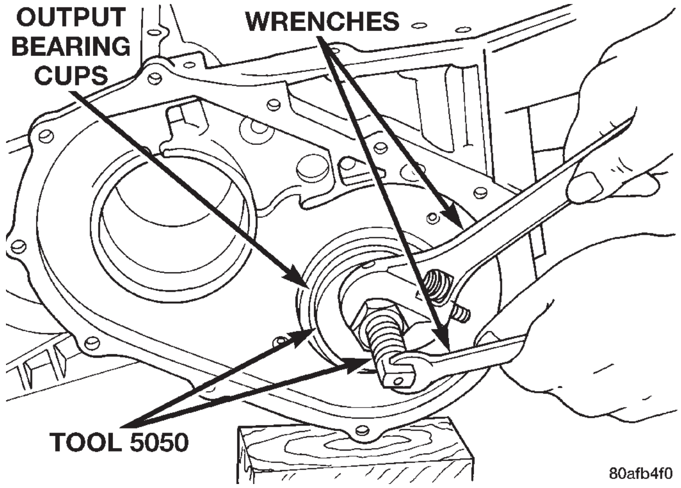


Fig. 206 Install Both Output Bearing Cups

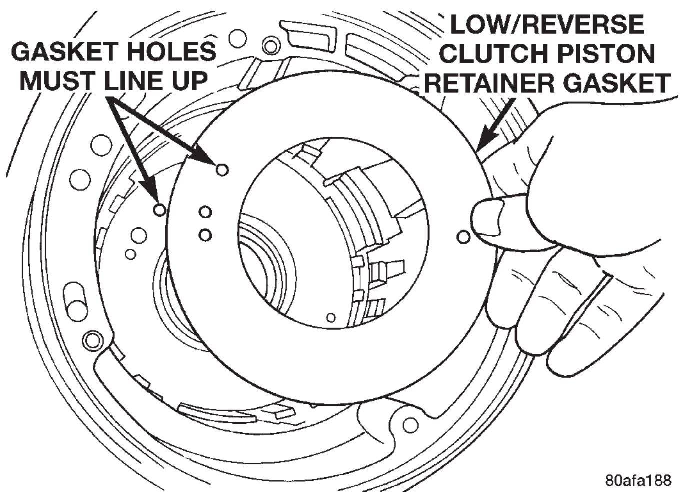


Fig. 207 Install Piston Retainer Gasket

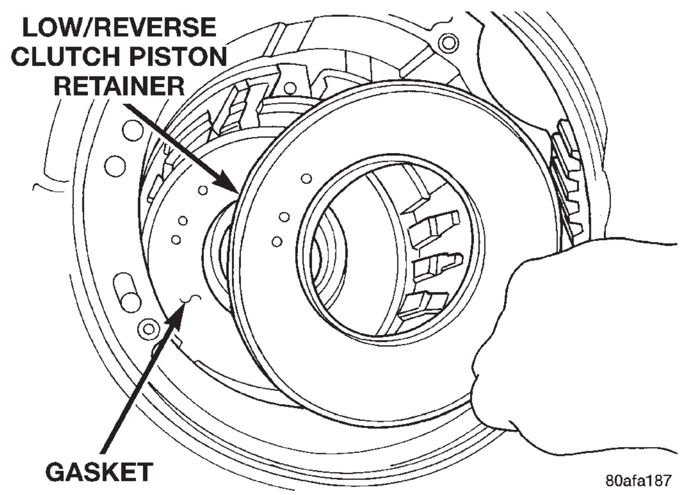


Fig. 208 Install Piston Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

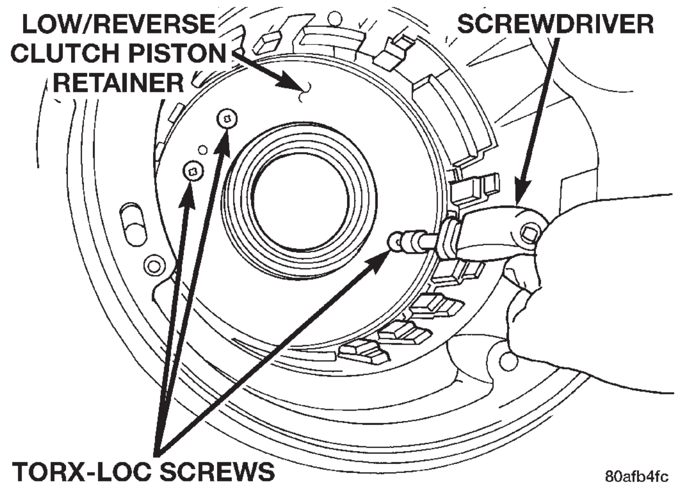


Fig. 209 Install Retainer Attaching Screws

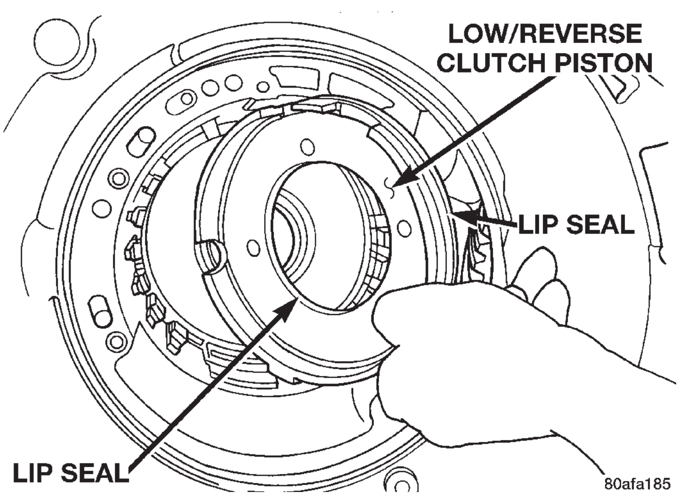


Fig. 210 Install Low/Reverse Clutch Piston

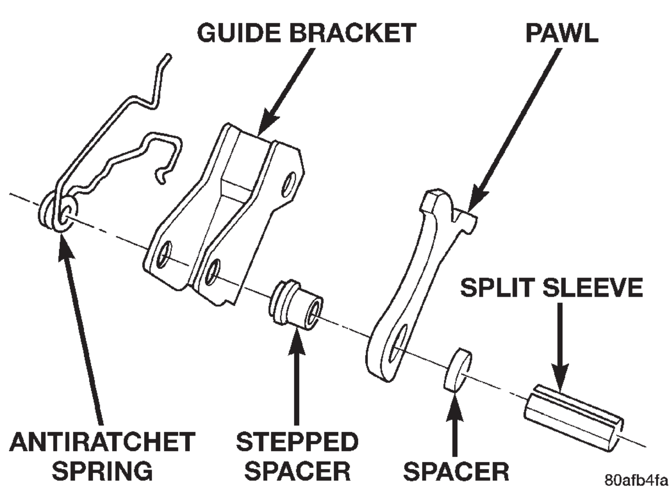


Fig. 211 Guide Bracket Disassembled

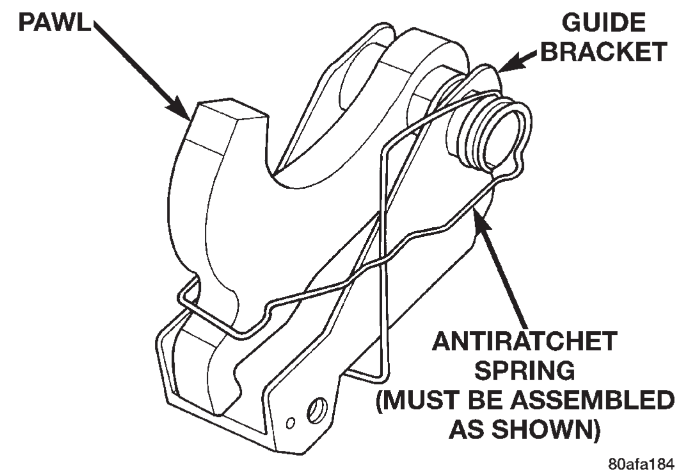


Fig. 212 Guide Bracket

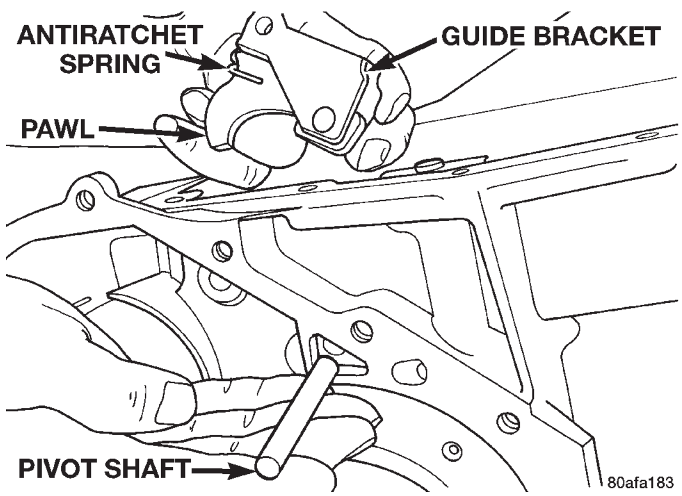


Fig. 213 Pivot Shaft and Guide Bracket

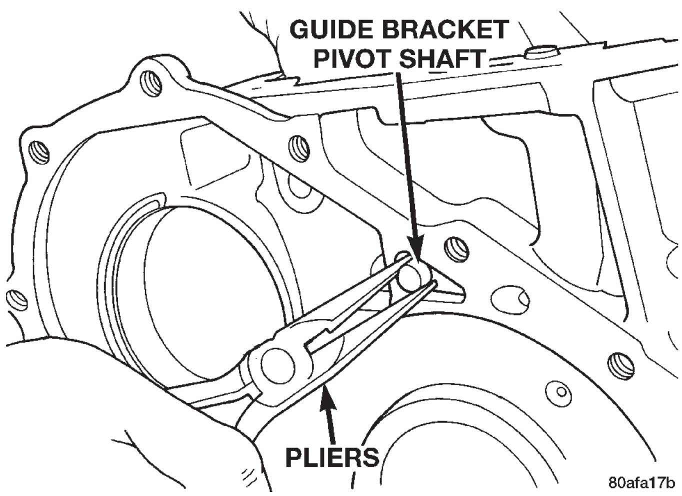


Fig. 214 Install Guide Bracket Pivot Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

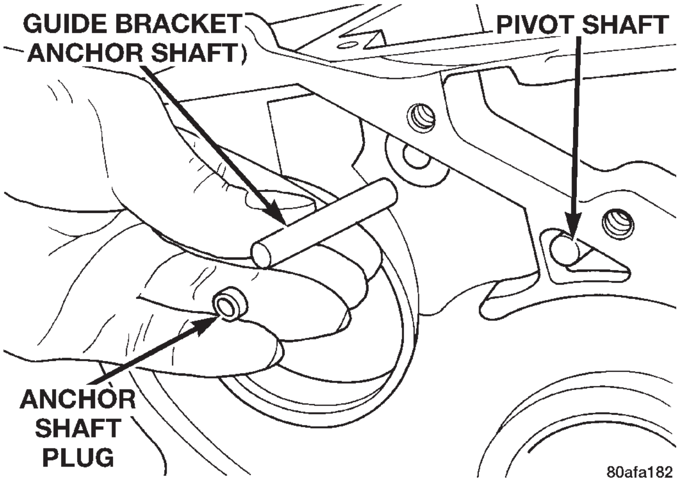


Fig. 215 Install Anchor Shaft and Plug

CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.

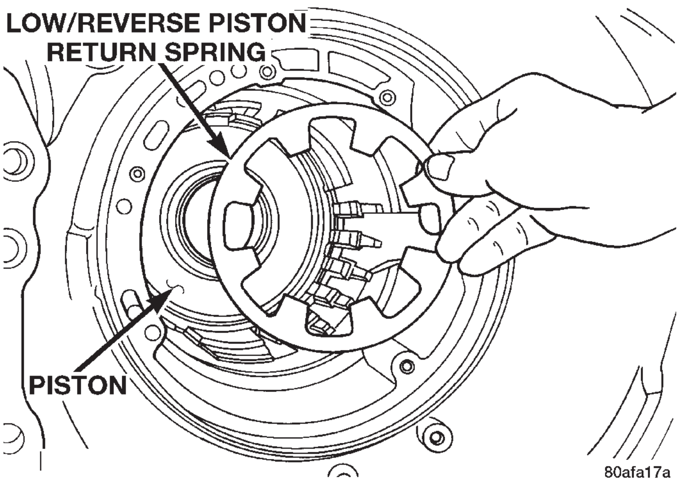


Fig. 216 Install Low/Reverse Piston Return Spring

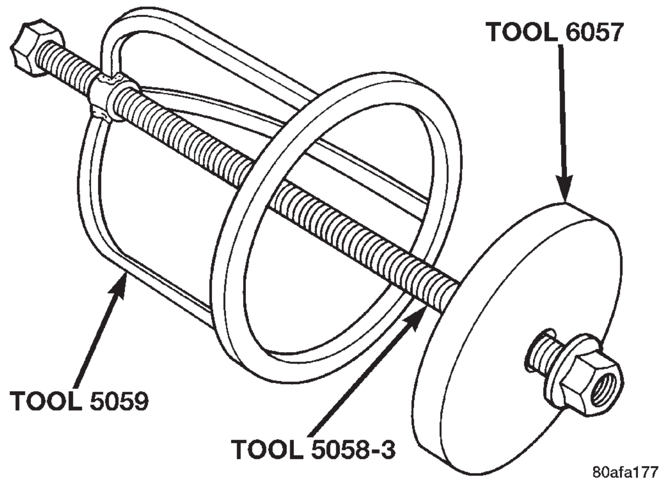


Fig. 217 Low/Reverse Spring Compressor Tool

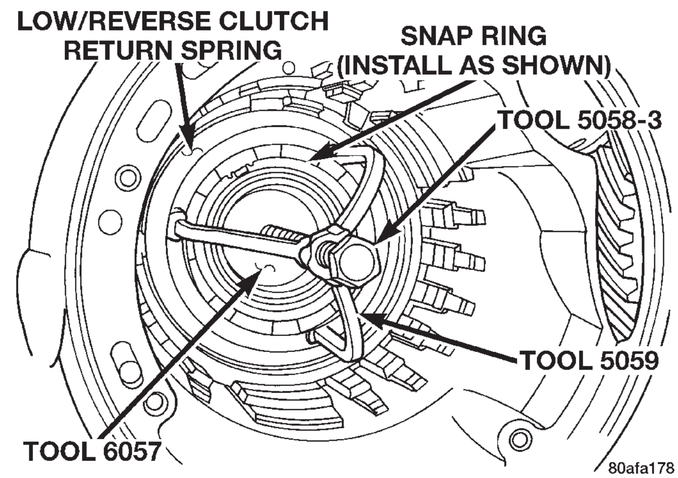


Fig. 218 Compressor Tool in Use

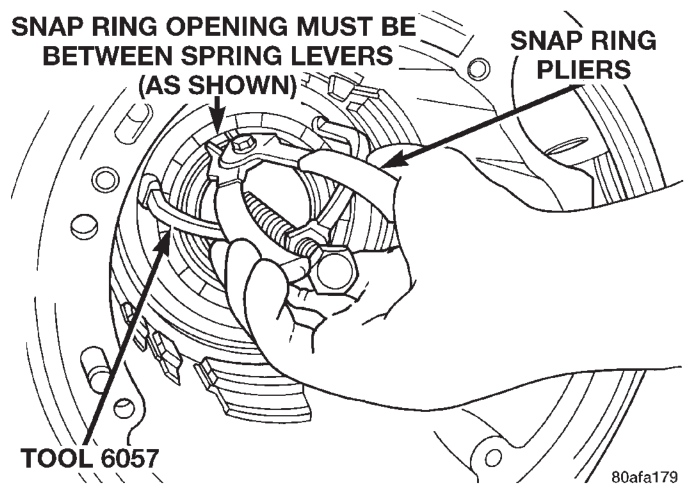


Fig. 219 Install Snap Ring

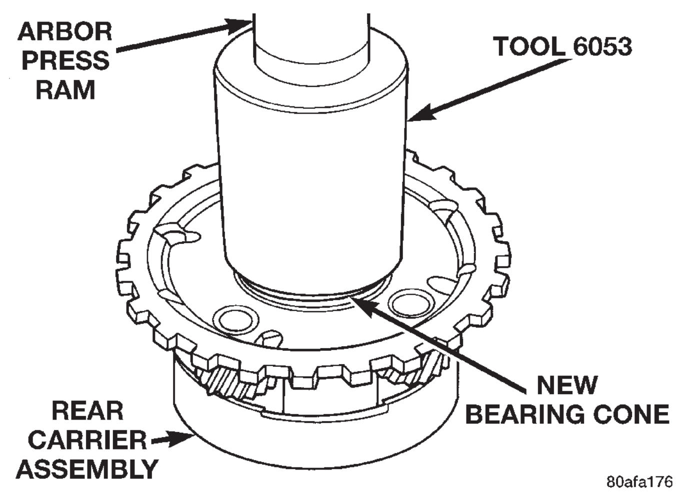


Fig. 220 Install Rear Carrier Bearing Cone

DISASSEMBLY AND ASSEMBLY (Continued)

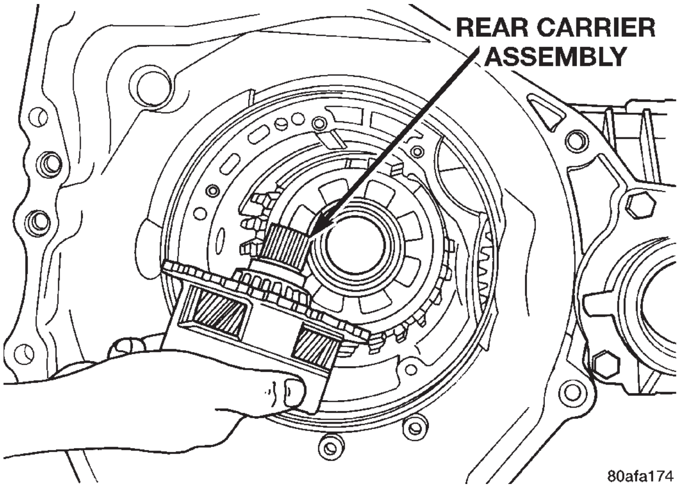


Fig. 221 Install Rear Carrier Assembly

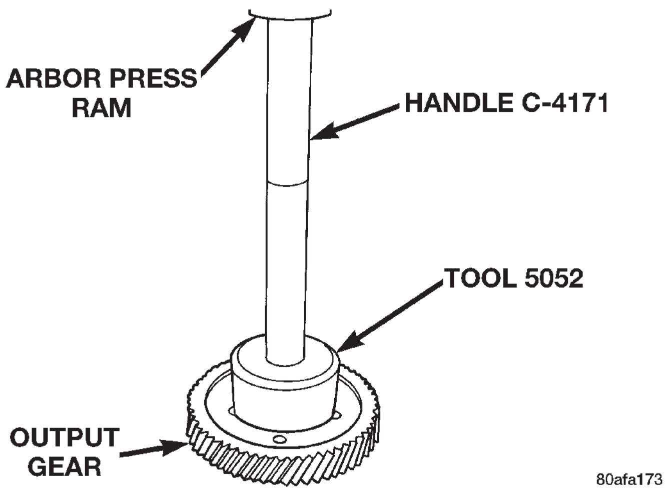


Fig. 222 Install Output Gear Bearing Cone

OUTPUT GEAR BEARING ADJUSTMENT

(1) With output gear removed: install a 4.50 mm (0.177 inch) gauging shim on the rear carrier assembly hub, using grease to hold the shim in place.

(2) Using Tool 6259, install output gear and bearing assembly. Torque to 271 N·m (200 ft. lbs.).

To measure bearing end play:

(3) Attach Tool L-4432 to the gear.

(4) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

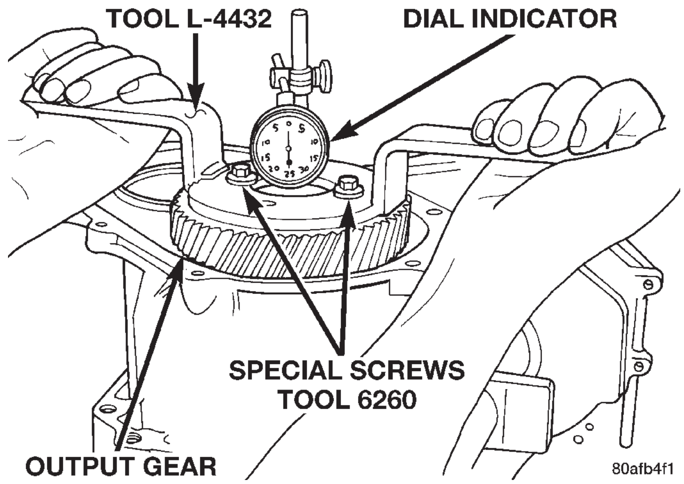


Fig. 223 Checking Output Gear Bearings End Play

(5) Using a dial indicator, mounted to the transaxle case, measure output gear end play (Fig. 223).

DISASSEMBLY AND ASSEMBLY (Continued)

OUTPUT GEAR BEARING SHIM CHART

End Play	Shim Needed	Part Number		End Play	Shim Needed	Part Number
.05mm .002 in.	4.42mm .174 in.	4412830		.53mm .021 in.	3.94mm .155 in.	4412818
.08mm .003 in.	4.38mm .172 in.	4412829		.56mm .022 in.	3.90mm .154 in.	4412817
.10mm .004 in.	4.38mm .172 in.	4412829		.58mm .023 in.	3.90mm .154 in.	4412817
.13mm .005 in.	4.34mm .171 in.	4412828		.61mm .024 in.	3.86mm .152 in.	4412816
.15mm .006 in.	4.30mm .169 in.	4412827		.64mm .025 in.	3.82mm .150 in.	4412815
.18mm .007 in.	4.30mm .169 in.	4412827		.66mm .026 in.	3.82mm .150 in.	4412815
.20mm .008 in.	4.26mm .168 in.	4412826		.69mm .027 in.	3.78mm .149 in.	4412814
.23mm .009 in.	4.22mm .166 in.	4412825		.71mm .028 in.	3.74mm .147 in.	4412813
.25mm .010 in.	4.22mm .166 in.	4412825		.74mm .029 in.	3.74mm .147 in.	4412813
.28mm .011 in.	4.18mm .165 in.	4412824		.76mm .030 in.	3.70mm .146 in.	4412812
.30mm .012 in.	4.14mm .163 in.	4412823		.79mm .031 in.	3.66mm .144 in.	4412811
.33mm .013 in.	4.14mm .163 in.	4412823		.81mm .032 in.	3.66mm .144 in.	4412811
.36mm .014 in.	4.10mm .161 in.	4412822		.84mm .033 in.	3.62mm .143 in.	4412810
.38mm .015 in.	4.10mm .161 in.	4412822		.86mm .034 in.	3.62mm .143 in.	4412810
.41mm .016 in.	4.06mm .160 in.	4412821		.89mm .035 in.	3.58mm .141 in.	4412809
.43mm .017 in.	4.02mm .158 in.	4412820		.91mm .036in.	3.54mm .139 in.	4412808
.46mm .018 in.	4.02mm .158 in.	4412820		.94mm .037 in.	3.54mm .139 in.	4412808
.48mm .019 in.	3.98mm .157 in.	4412819		.97mm .038 in.	3.50mm .138 in.	4412807
.51mm .020 in.	3.94mm .155 in.	4412818				

(6) Refer to the output gear bearing shim chart for the required shim to obtain proper bearing setting.

(7) Use Tool 6259 to remove the retaining bolt and washer. To remove the output gear, use Tool L-4407.

(8) Remove the gauging shim and install the proper shim (Fig. 224). Use grease to hold the shim in place. Install the output gear and bearing assembly (Fig. 225).

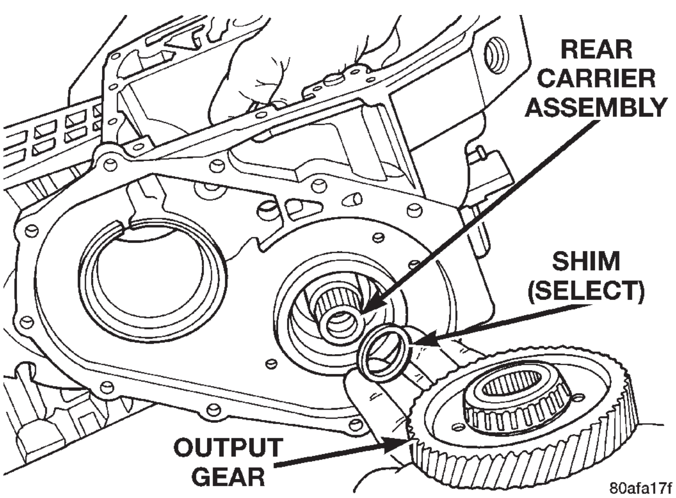


Fig. 224 Output Gear and (Select) Shim

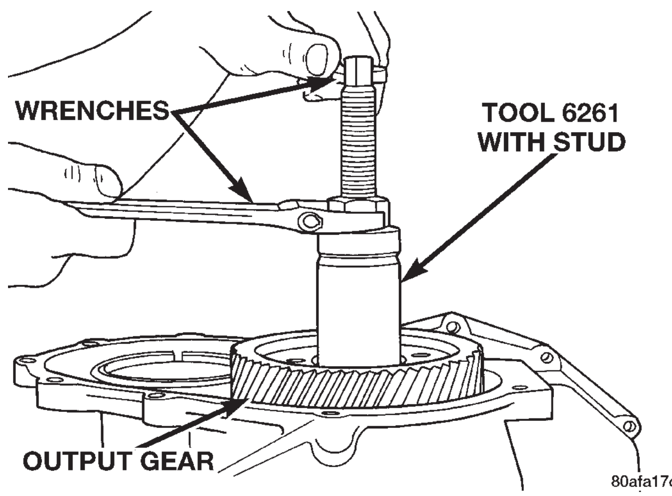


Fig. 225 Install Output Gear

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Always use new retaining bolt, old retaining bolt may not be reused.

(9) Install the new retaining bolt and washer (Fig. 226). Tighten to 271 N·m (200 ft. lbs.) (Fig. 227).

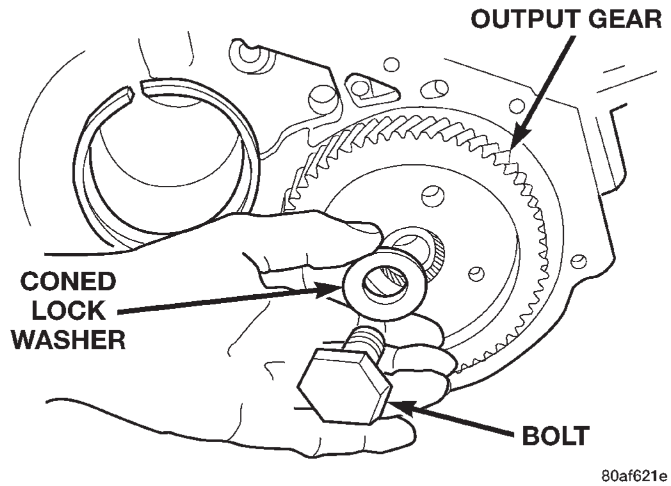


Fig. 226 Install Output Gear Bolt and Washer

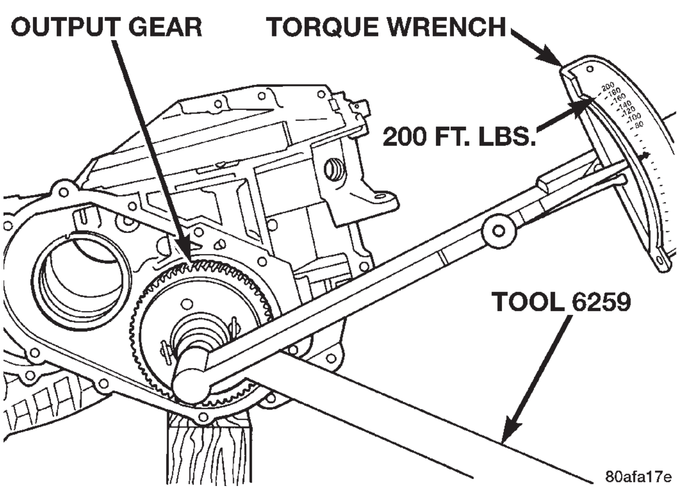


Fig. 227 Tighten Output Gear to 271 N·m (200 ft. lbs.)

(10) Using an inch-pound torque wrench, check the turning torque (Fig. 228). **The torque should be between 3 and 8 inch-pounds.**

If the turning torque is too high, install a .04 mm (.0016 inch) thicker shim. If the turning torque is too low, install a .04 mm (.0016 inch) thinner shim. Repeat until the proper turning torque is 3 to 8 inch pounds.

NOTE: Install output gear stirrup and strap bolts.

All transaxles utilize a stirrup and retaining strap that is attached to the output gear. The stirrup prevents the output gear retaining bolt from turning and backing out of the rear carrier. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.

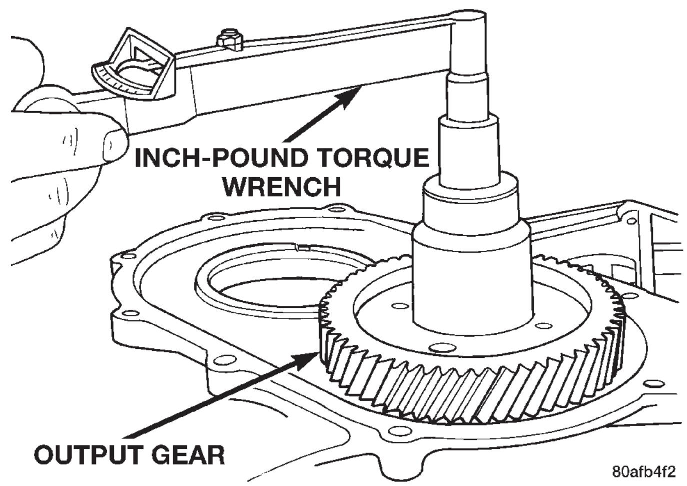


Fig. 228 Check Output Gear Bearings Turning Torque

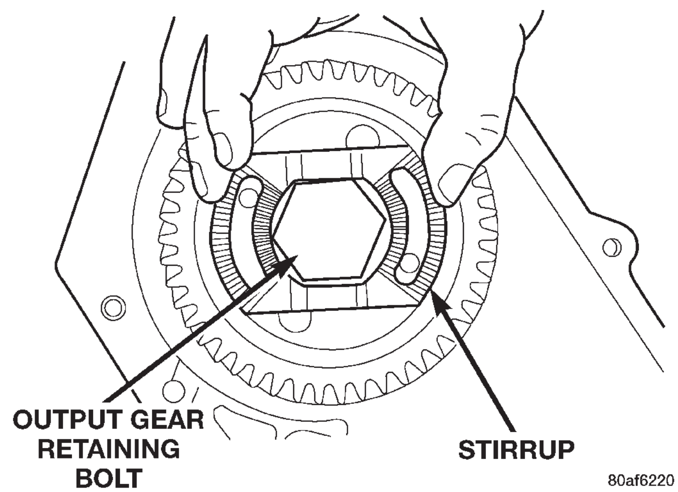


Fig. 229 Output Gear Retaining Bolt Stirrup (Serration Side Out)

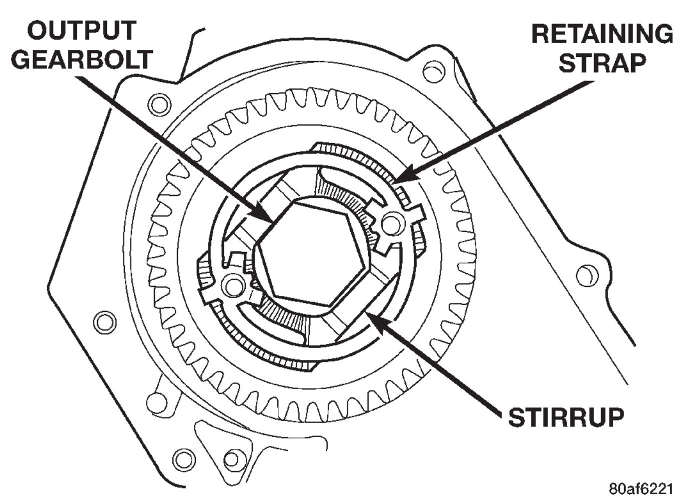


Fig. 230 Stirrup Strap (Align Strap Holes With Tapped Gear Holes)

DISASSEMBLY AND ASSEMBLY (Continued)

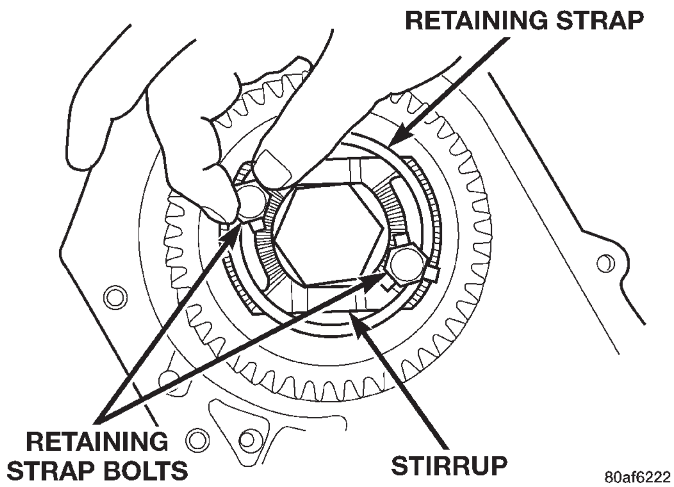


Fig. 231 Install Strap Bolts

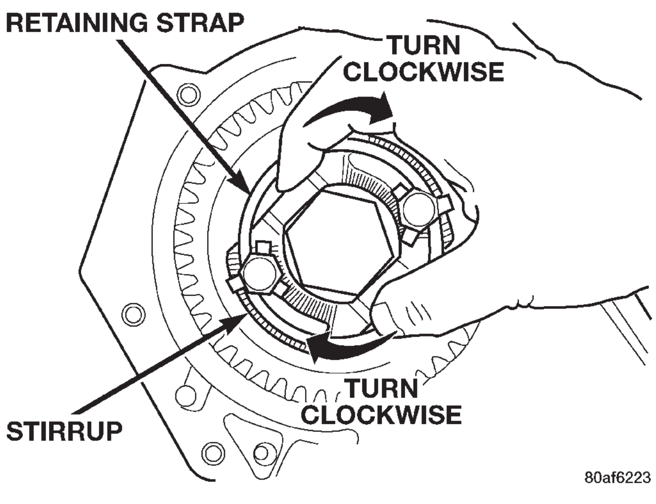


Fig. 232 Turn Stirrup Clockwise Against Flats Of Output Gear Retaining Bolt

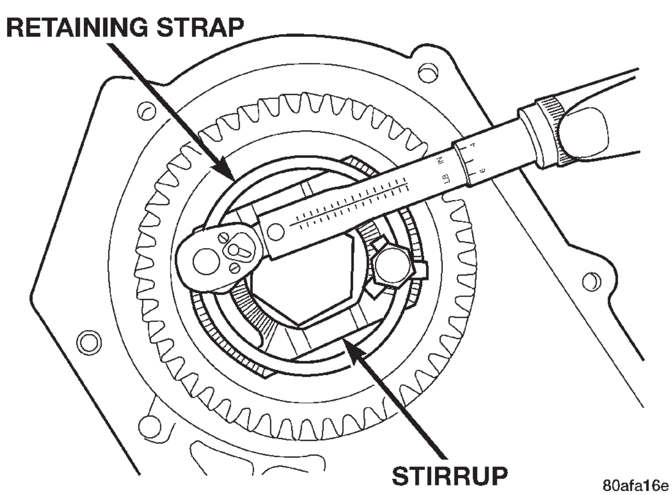


Fig. 233 Tighten Stirrup Strap Bolts To 23 N·m (200 in. lbs.)

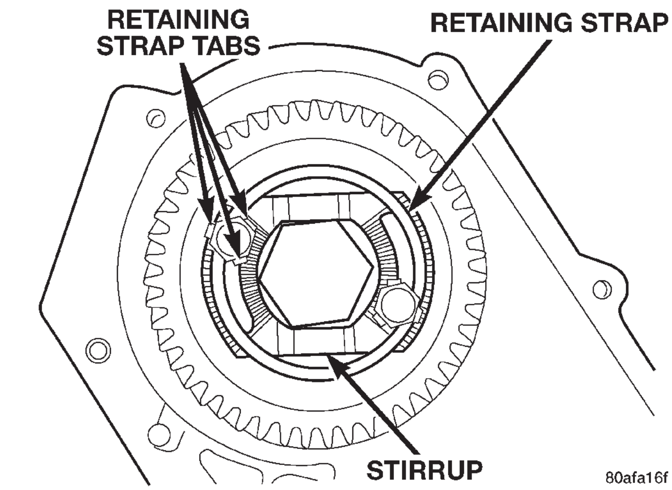


Fig. 234 Bend Tabs On Strap Up Against Flats Of Bolts

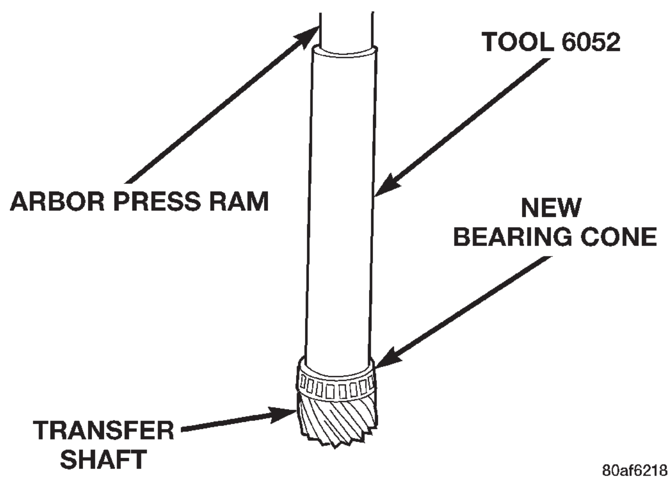


Fig. 235 Install Transfer Shaft Bearing Cone

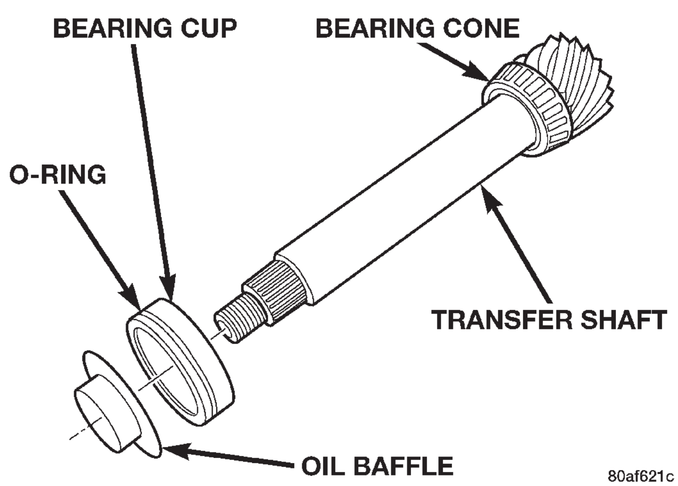


Fig. 236 Install Bearing Cup To Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Screw Tool 5049-A onto transfer shaft. Install transfer shaft.

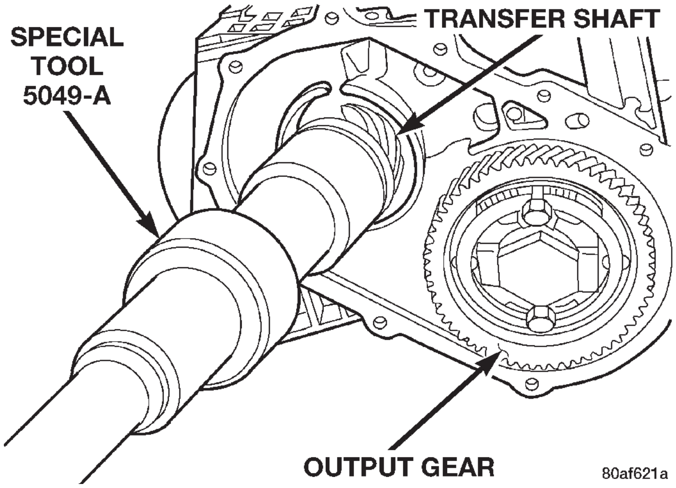


Fig. 237 Install Transfer Shaft

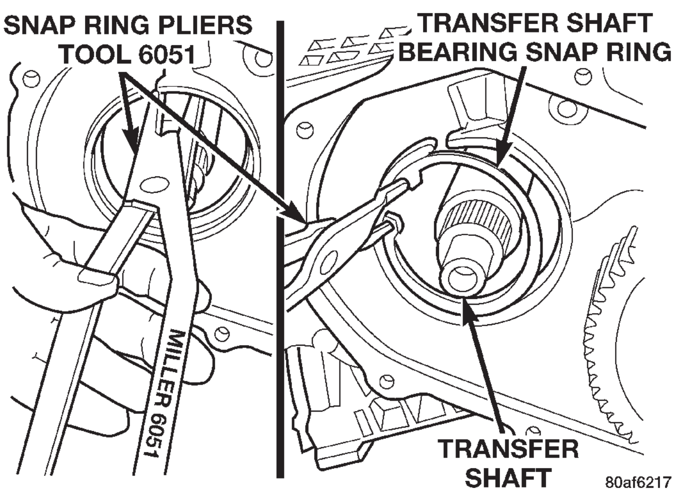


Fig. 238 Install Transfer Shaft Bearing Snap Ring

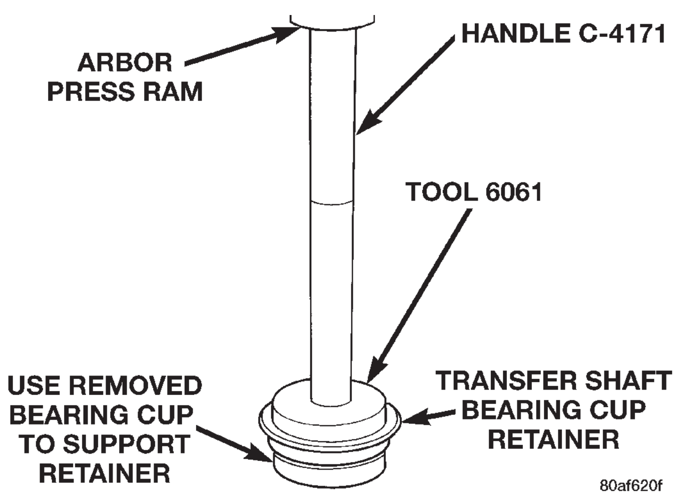


Fig. 239 Install Transfer Shaft Bearing Cup Into Retainer

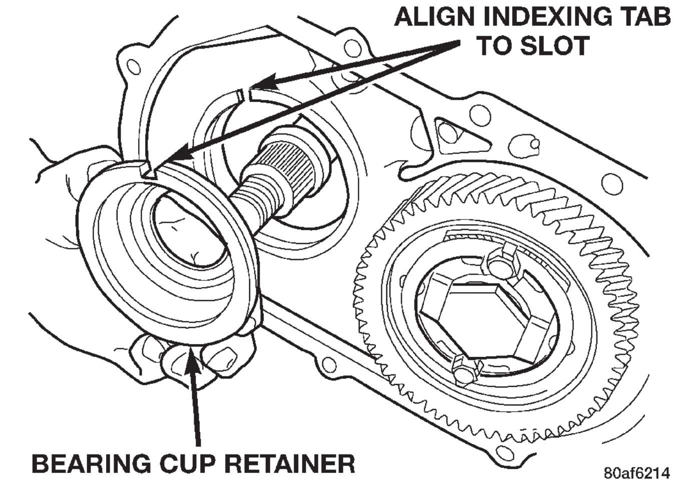


Fig. 240 Install Bearing Cup Retainer

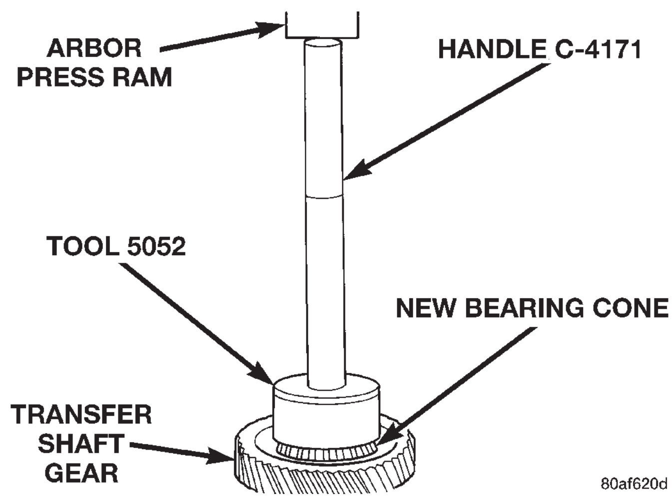


Fig. 241 Install Transfer Gear Bearing Cone

TRANSFER SHAFT BEARING

(1) Install a 4.66 mm (.184 inch) gauging shim on the transfer shaft.

(2) Install transfer shaft gear and bearing assembly and torque the nut to 271 N·m (200 ft. lbs.).

To measure bearing end play:

- Attach Tool L-4432 to the transfer gear.
- Mount a steel ball with grease into the end of the transfer shaft.
- Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.
- Using a dial indicator, measure transfer shaft end play.

(3) Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

(4) Use Tool 6259 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

DISASSEMBLY AND ASSEMBLY (Continued)

TRANSFER SHAFT BEARING SHIM CHART

End Play	Shim Needed	Part Number		End Play	Shim Needed	Part Number
.05mm .002 in.	4.66mm .183 in.	4505588		.76mm .030 in.	3.94mm .155 in.	4412818
.08mm .003 in.	4.62mm .182 in.	4412835		.79mm .031 in.	3.90mm .154 in.	4412817
.10mm .004 in.	4.58mm .180 in.	4412834		.81mm .032 in.	3.90mm .154 in.	4412817
.13mm .005 in.	4.58mm .180 in.	4412834		.84mm .033 in.	3.86mm .152 in.	4412816
.15mm .006 in.	4.54mm .178 in.	4412833		.86mm .034 in.	3.82mm .150 in.	4412815
.18mm .007 in.	4.50mm .177 in.	4412832		.89mm .035 in.	3.82mm .150 in.	4412815
.20mm .008 in.	4.50mm .177 in.	4412832		.91mm .036 in.	3.78mm .149 in.	4412814
.23mm .009 in.	4.46mm .175 in.	4412831		.94mm .037 in.	3.74mm .147 in.	4412813
.25mm .010 in.	4.46mm .175 in.	4412831		.97mm .038 in.	3.74mm .147 in.	4412813
.28mm .011 in.	4.42mm .174 in.	4412830		.99mm .039 in.	3.70mm .146 in.	4412812
.30mm .012 in.	4.38mm .172 in.	4412829		1.02mm .040 in.	3.66mm .144 in.	4412811
.33mm .013 in.	4.38mm .172 in.	4412829		1.04mm .041 in.	3.66mm .144 in.	4412811
.36mm .014 in.	4.34mm .171 in.	4412828		1.07mm .042 in.	3.62mm .143 in.	4412810
.38mm .015 in.	4.30mm .169 in.	4412827		1.08mm .043 in.	3.62mm .143 in.	4412810
.41mm .016 in.	4.30mm .169 in.	4412827		1.12mm .044 in.	3.58mm .141 in.	4412809
.43mm .017 in.	4.26mm .168 in.	4412826		1.14mm .045 in.	3.54mm .139 in.	4412808
.46mm .018 in.	4.22mm .166 in.	4412825		1.17mm .046 in.	3.54mm .139 in.	4412808
.48mm .019 in.	4.22mm .166 in.	4412825		1.19mm .047 in.	3.50mm .138 in.	4412807
.50mm .020 in.	4.18mm .165 in.	4412824		1.22mm .048 in.	3.46mm .136 in.	4412806
.53mm .021 in.	4.18mm .165 in.	4412824		1.24mm .049 in.	3.46mm .136 in.	4412806
.56mm .022 in.	4.14mm .163 in.	4412823		1.27mm .050 in.	3.42mm .135 in.	4412805
.58mm .023 in.	4.10mm .161 in.	4412822		1.30mm .051 in.	3.38mm .133 in.	4412804
.61mm .024 in.	4.10mm .161 in.	4412822		1.32mm .052 in.	3.38mm .133 in.	4412804
.64mm .025 in.	4.06mm .160 in.	4412821		1.35mm .053 in.	3.34mm .132 in.	4412803
.66mm .026 in.	4.02mm .158 in.	4412820		1.37mm .054 in.	3.34mm .132 in.	4412803
.69mm .027 in.	4.02mm .158 in.	4412820		1.40mm .055 in.	3.30mm .130 in.	4412802
.71mm .028 in.	3.98mm .157 in.	4412819		1.45mm .057 in	3.26mm .128 in.	4412801
.74mm .029 in.	3.94mm .155 in.	4412818		1.47mm .058 in.	2.22mm .127 in.	4505570

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Remove the gauging shim and install the correct shim (Fig. 242). Install the transfer gear and bearing assembly (Fig. 243).

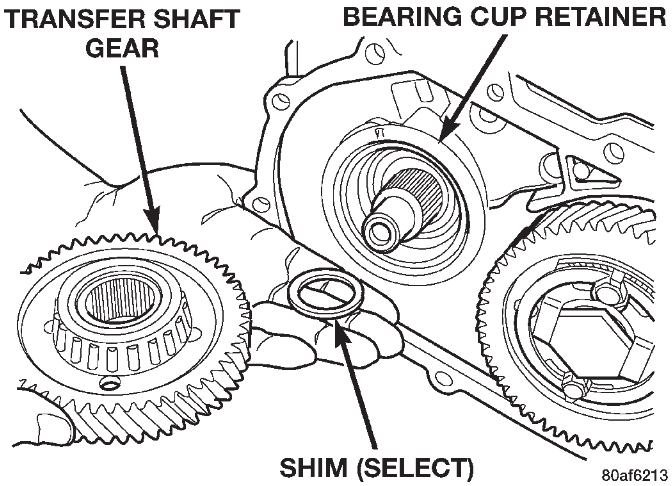


Fig. 242 Transfer Shaft Gear and (Select) Shim

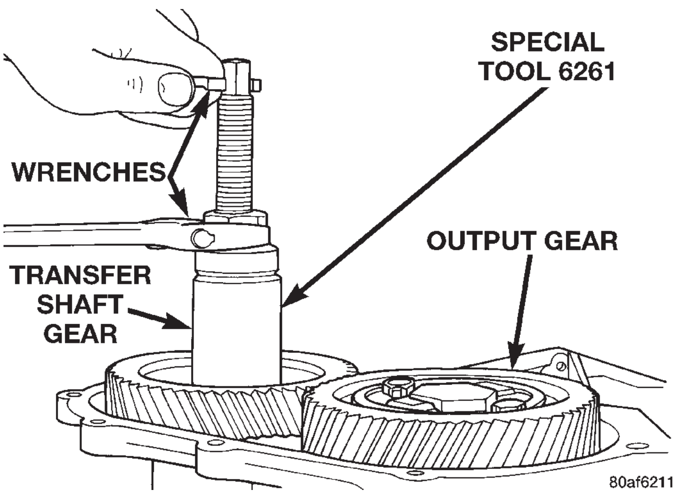


Fig. 243 Install Transfer Shaft Gear

CAUTION: Original retaining nut may not be reused. Always use a new retaining nut when reassembling.

(6) Install the new retaining nut and washer and torque to 271 N·m (200 ft. lbs.) (Fig. 244). **Measure transfer shaft end play, end play should be .05 to .10 mm (.002 to .004 inch).**

(7) Measure bearing end play as outlined in . End play should be between .05 mm and .10 mm (.002 to .004 inch).

NOTE: If end play is too high, install a .04 mm (.0016 inch) thinner shim. If end play is too low, install a .04 mm (.0016 inch) thicker shim combination. Repeat until .05 to .10 mm (.002 to .004 inch) end play is obtained.

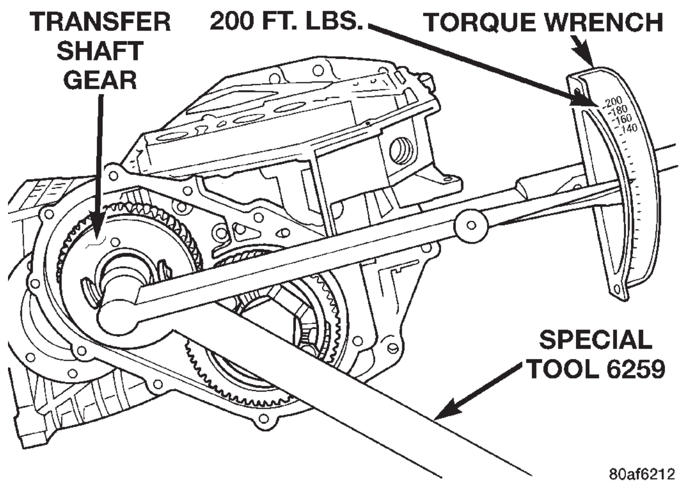


Fig. 244 Tighten Nut to 271 N·m (200 ft. lbs.)

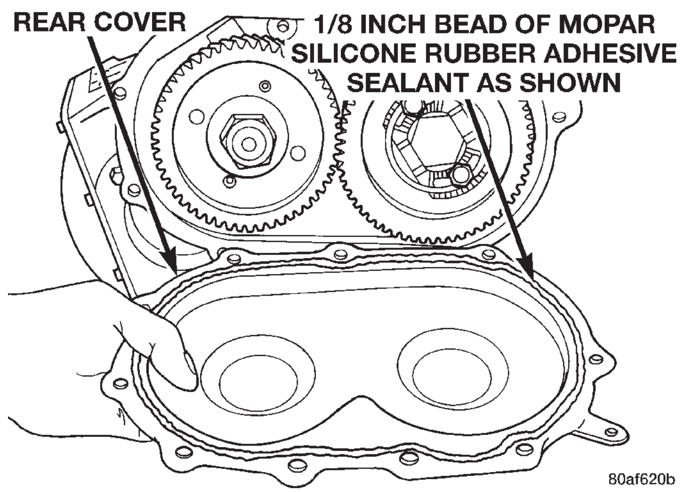


Fig. 245 Install Rear Cover

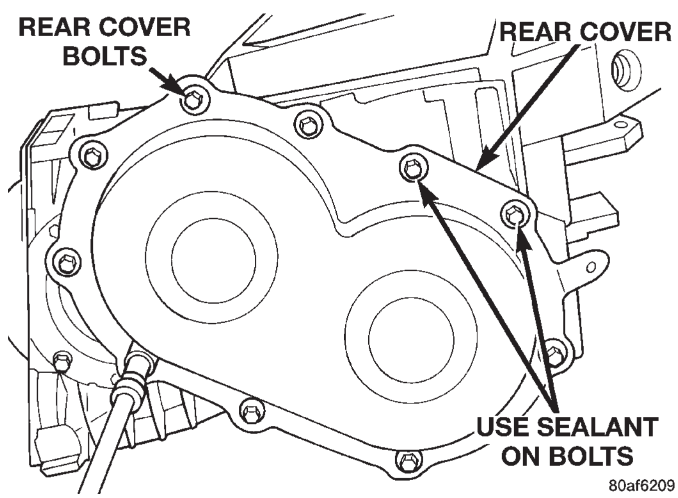


Fig. 246 Install Rear Cover Bolts

NOTE: Install the low/reverse reaction plate stepped side up.

DISASSEMBLY AND ASSEMBLY (Continued)

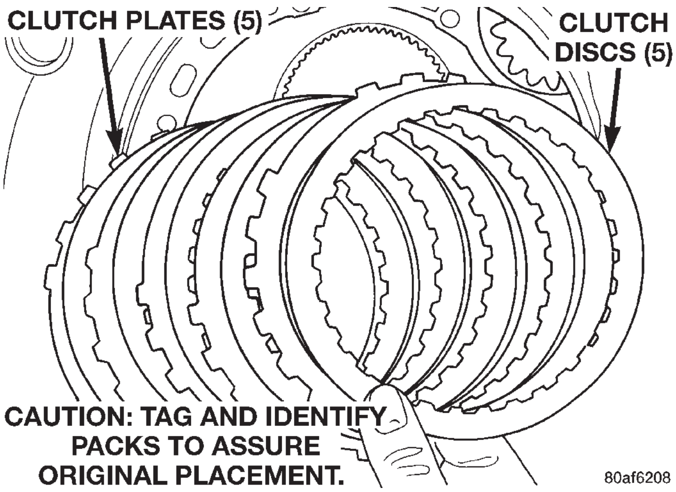


Fig. 247 Install Low/Reverse Clutch Pack

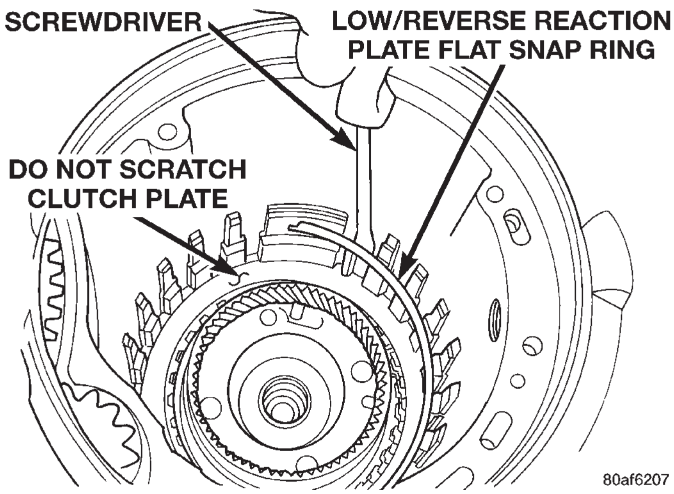


Fig. 248 Install Low/Reverse Reaction Plate Snap Ring

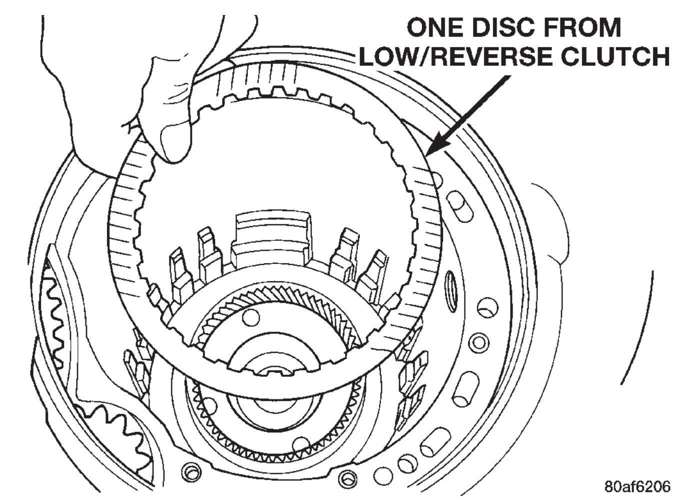


Fig. 249 Install One Disc

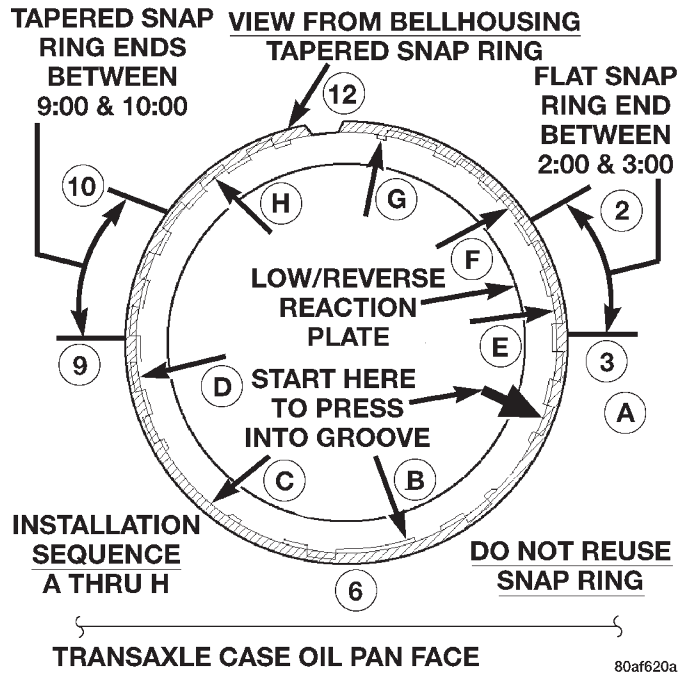


Fig. 250 Tapered Snap Ring Instructions

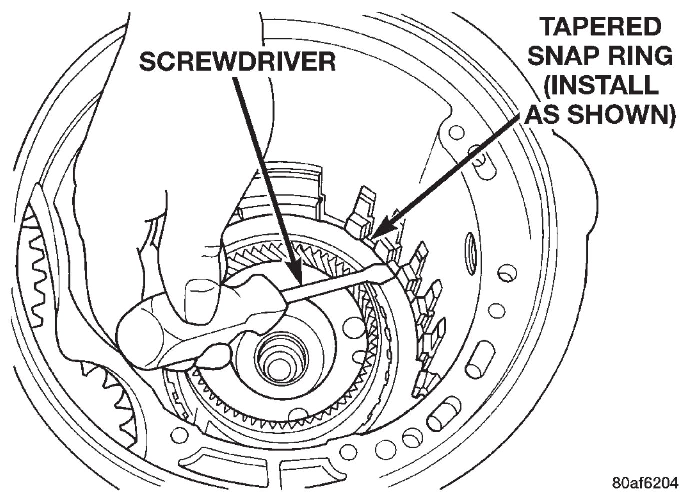


Fig. 251 Snap Ring Installed

DISASSEMBLY AND ASSEMBLY (Continued)

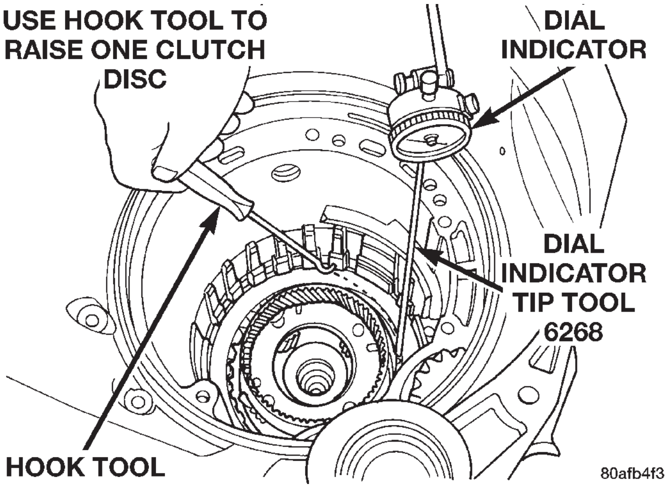


Fig. 252 Check Low/Reverse Clutch Clearance

Press down clutch pack with finger and zero dial indicator. **Low/Reverse clutch pack clearance is 0.89 to 1.04 (.035 to .042 inch).**

Select the proper low/reverse reaction plate to achieve specifications:

LOW/REVERSE REACTION PLATE CHART

PART NUMBER	THICKNESS
4567893	6.92mm (.273 in.)
4567899	6.66mm (.262 in.)
4567898	6.40mm (.252 in.)
4567897	6.14mm (.242 in.)
4567896	5.88mm (.232 in.)
4567895	5.62mm (.221 in.)
4567894	5.36mm (.211 in.)

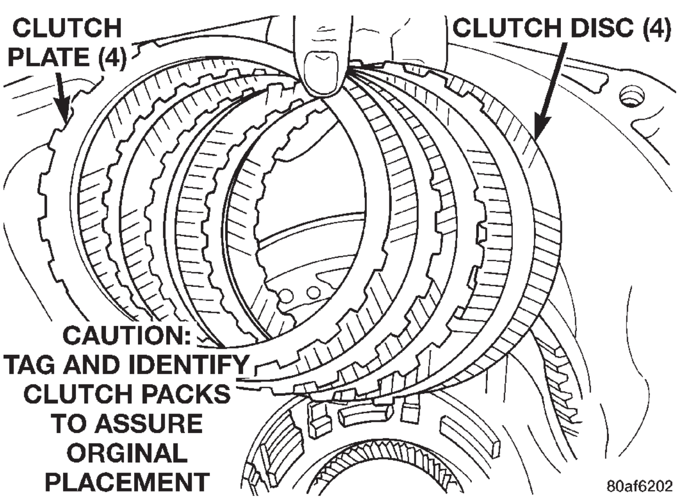


Fig. 253 Install 2/4 Clutch Pack

NOTE: When installing the 2-4 clutch plates and discs, the orientation should be alternated so the pilot pads of adjacent plates do not align, refer to (Fig. 254).

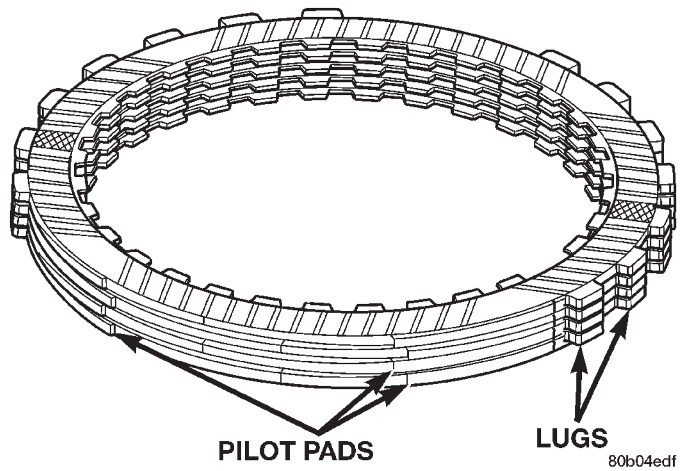


Fig. 254 Stagger 2/4 Clutch Plate Pads

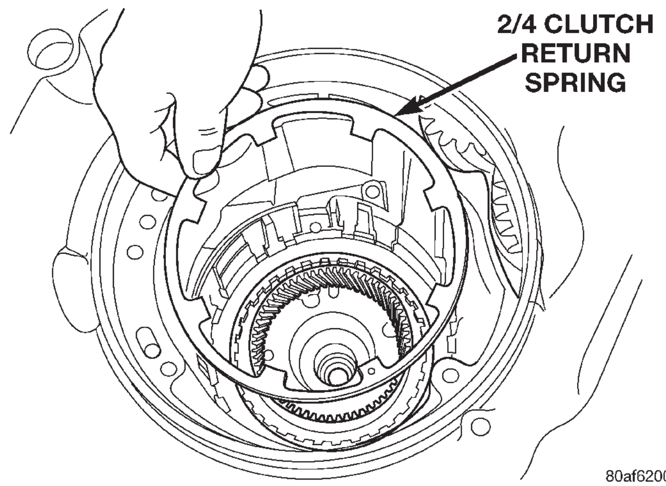


Fig. 255 Install 2/4 Clutch Return Spring

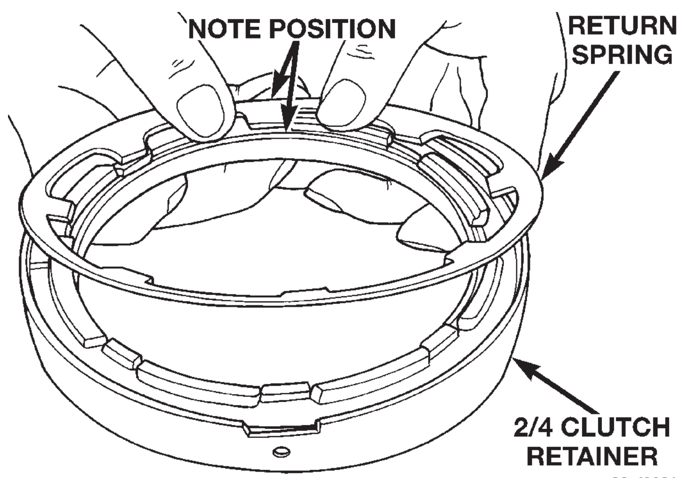


Fig. 256 Proper Orientation of 2/4 Clutch Retainer and Spring

DISASSEMBLY AND ASSEMBLY (Continued)

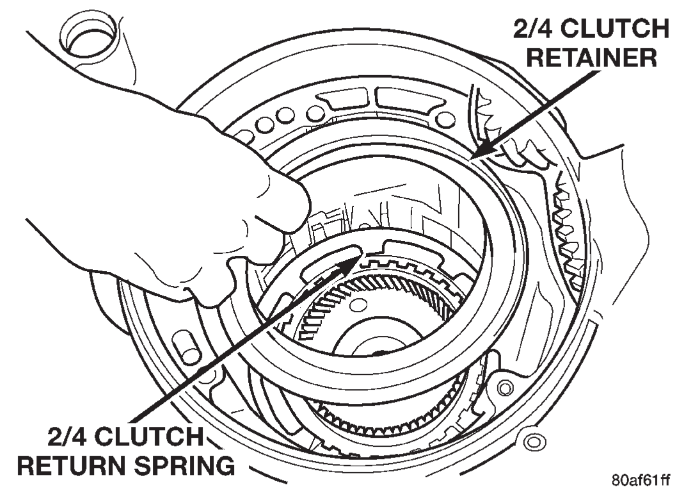


Fig. 257 Install 2/4 Clutch Retainer

NOTE: Verify that Miller Tool 5058 is centered properly to the 2/4 clutch retainer before depressing the tool.

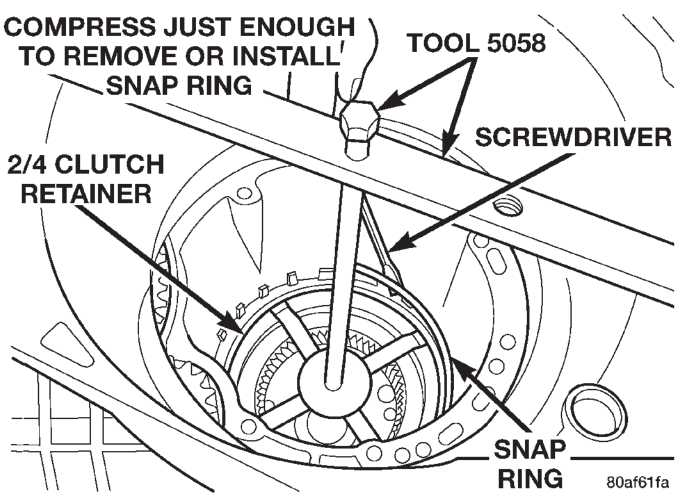


Fig. 258 Install 2/4 Clutch Retainer Snap Ring

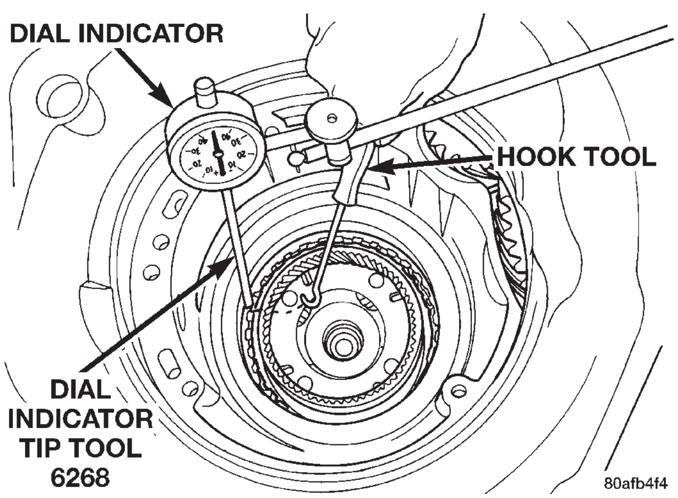


Fig. 259 Check 2/4 Clutch Clearance

Press down clutch pack with finger and zero dial indicator. **The 2/4 clutch pack clearance is 0.76 to 2.64mm (.030 to .104 inch).** If not within specifications, the clutch is not assembled properly. **There is no adjustment for the 2/4 clutch clearance.**

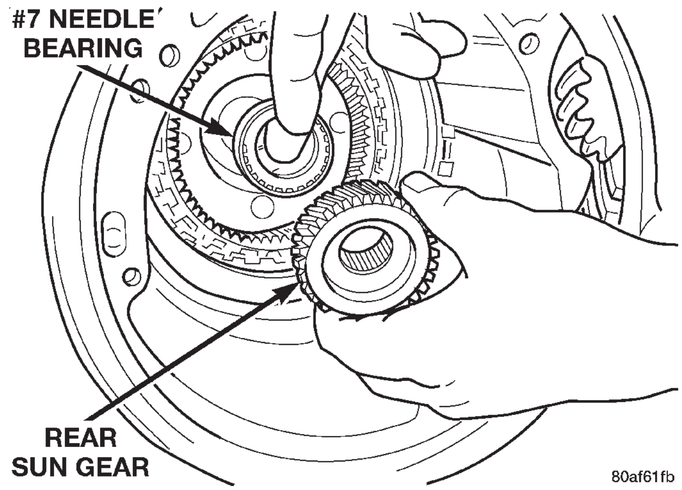


Fig. 260 Install Rear Sun Gear

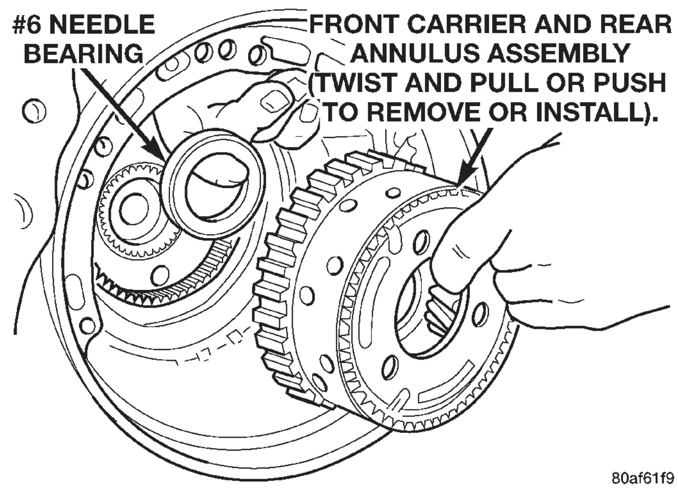


Fig. 261 Install Front Carrier and Rear Annulus Assembly

DETERMINING No. 4 THRUST PLATE THICKNESS—INPUT SHAFT END PLAY

To determine the proper thickness of the No. 4 thrust plate, select the thinnest No. 4 thrust plate. Using petrolatum (Fig. 263) to hold thrust plate in position, install input clutch assembly. Be sure the input clutch assembly is completely seated (Fig. 264).

CAUTION: If view through input speed sensor hole is not as shown above, the input clutches assembly is not seated properly.

Remove the oil pump O-ring (Fig. 265). You will be able to install and remove the oil pump and gasket very easily to select the proper No. 4 thrust plate.

DISASSEMBLY AND ASSEMBLY (Continued)

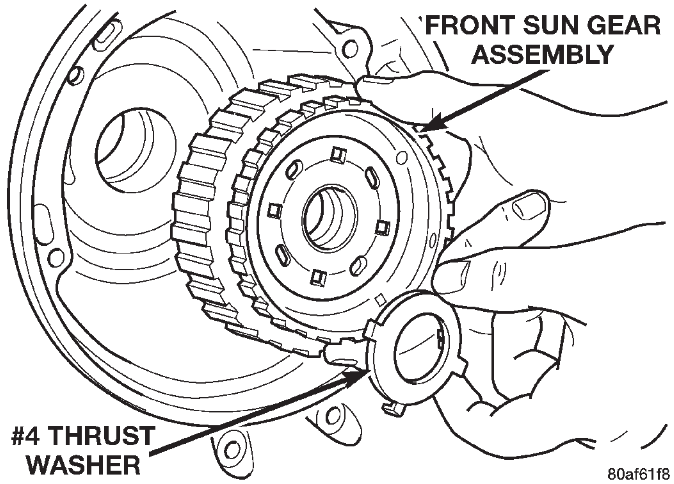


Fig. 262 Install Front Sun Gear Assembly

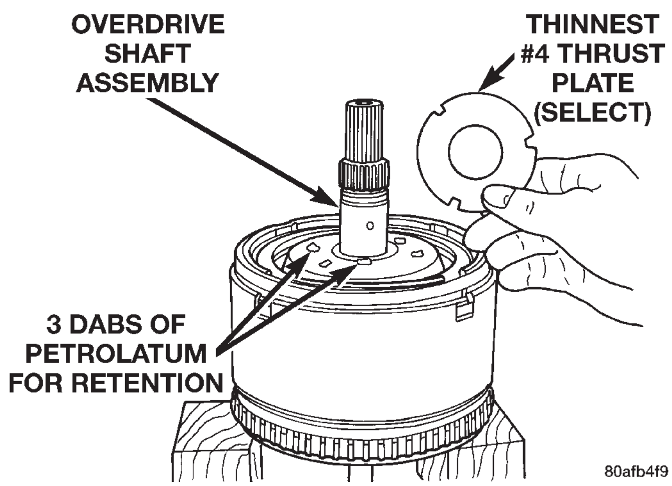


Fig. 263 Select Thinnest No. 4 Thrust Plate

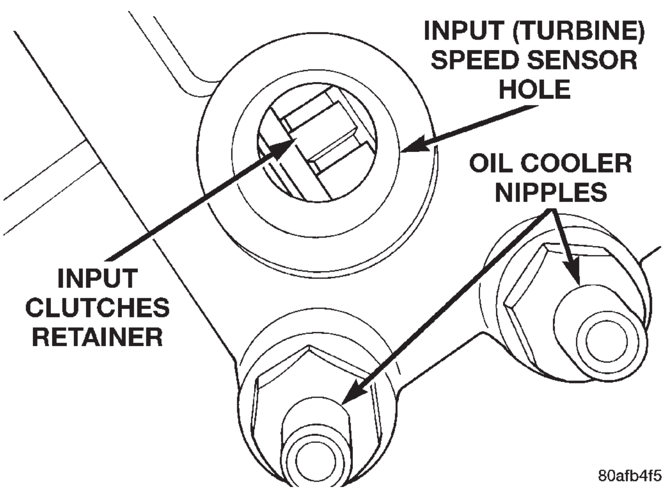


Fig. 264 View Through Input Speed Sensor Hole

NOTE: Use screw-in dowels or phillips-head screw-drivers to align pump to case.

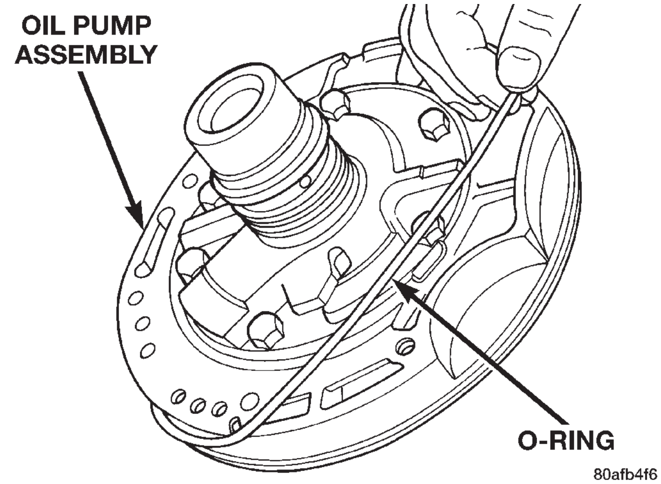


Fig. 265 Remove Oil Pump O-Ring

CAUTION: Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.

Measure the input shaft end play with the transaxle in the vertical position. This will ensure that the measurement will be accurate.

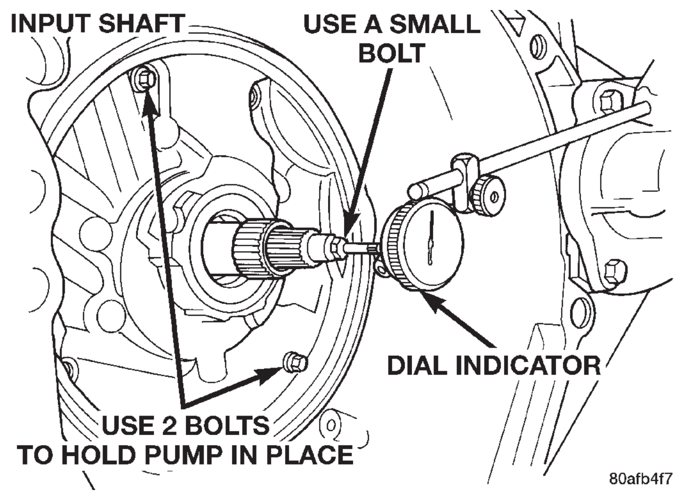


Fig. 266 Measure Input Shaft End Play

NOTE: Input shaft end play must be .005 to .025 inch.

For example, if end play reading is .055 inch, select No. 4 Thrust Plate which is .071 to .074 thick. This should provide an input shaft end play reading of .020 inch which is within specifications.

DISASSEMBLY AND ASSEMBLY (Continued)

See chart to select the proper No. 4 thrust plate.

NO. 4 THRUST PLATE CHART

PART NUMBER	THICKNESS
4431662	.91mm (.036 in.)
4431663	1.14mm (.045 in.)
4431664	1.37mm (.054 in.)
4431665	1.60mm (.063 in.)
3836237	1.73mm (.068 in.)
4431666	1.80mm (.071 in.)
3836238	1.96mm (.077 in.)
4431667	2.03mm (.080 in.)
3836239	2.16mm (.085 in.)
4431668	2.24mm (.088 in.)
3836240	2.39mm (.094 in.)
4431669	2.46mm (.097 in.)
3836241	2.62mm (.103 in.)
4446670	2.67mm (.105 in.)
4446671	2.90mm (.114 in.)
4446672	3.15mm (.124 in.)
4446601	3.38mm (.133 in.)

Reinstall the input clutches assembly with the selected thrust plate .

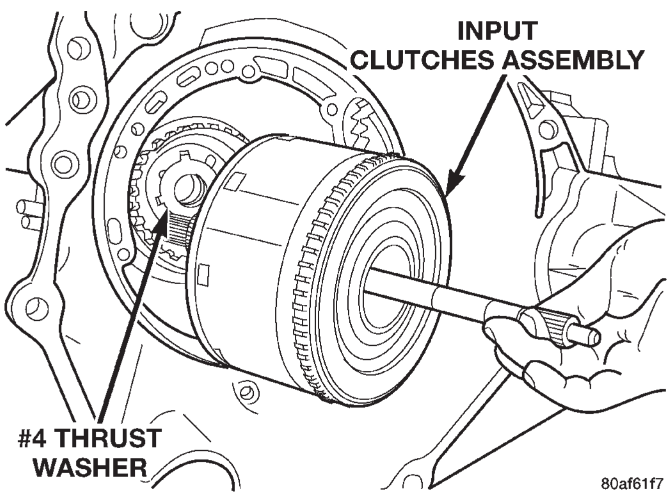


Fig. 267 Install Input Clutches Assembly

CAUTION: The cooler bypass valve must be replaced if a transaxle failure has occurred. Do not reuse old valve or attempt to clean old valve. When installing bypass valve, insert with O-ring end towards rear of case.

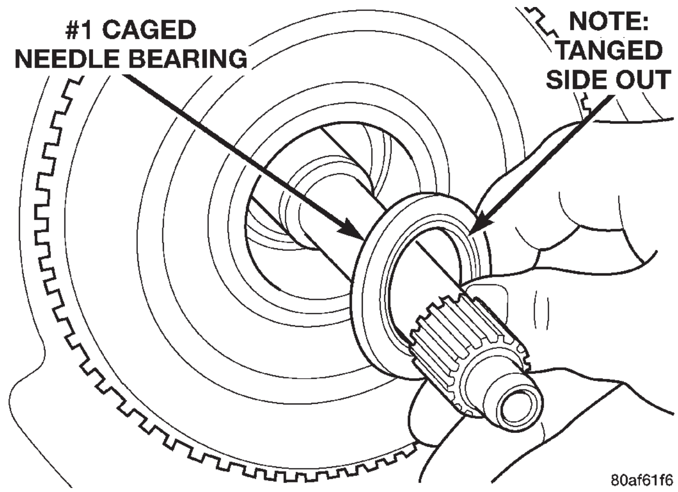


Fig. 268 Install Caged Needle Bearing

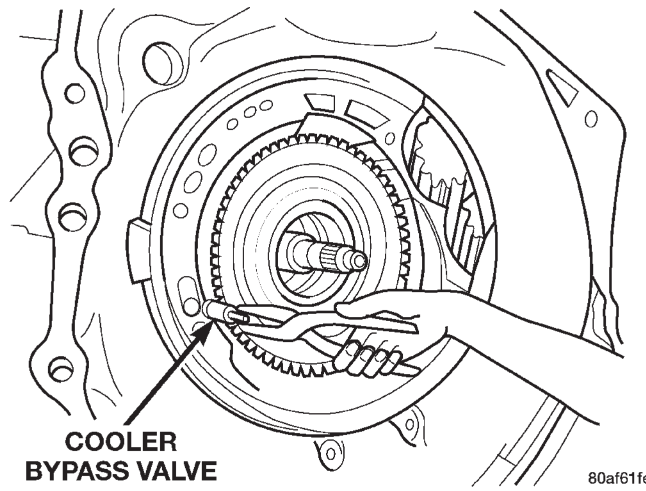


Fig. 269 Install Bypass Valve

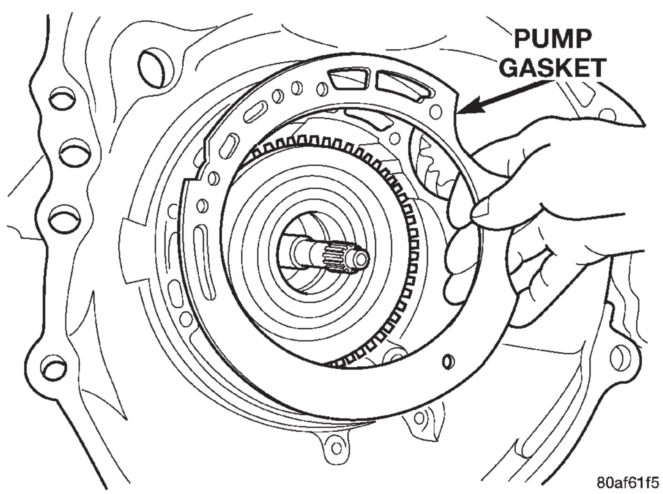


Fig. 270 Install Oil Pump Gasket

DISASSEMBLY AND ASSEMBLY (Continued)

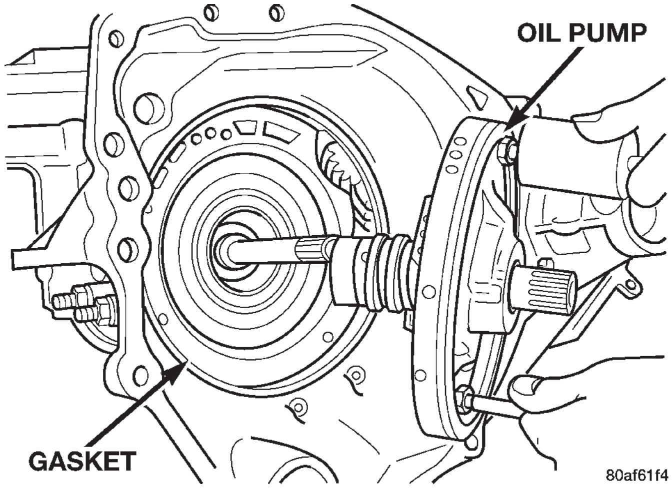


Fig. 271 Install Oil Pump

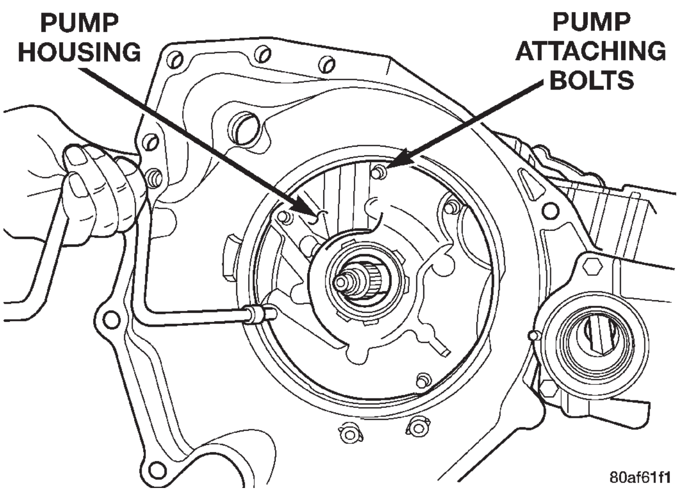


Fig. 272 Install Pump Attaching Bolts

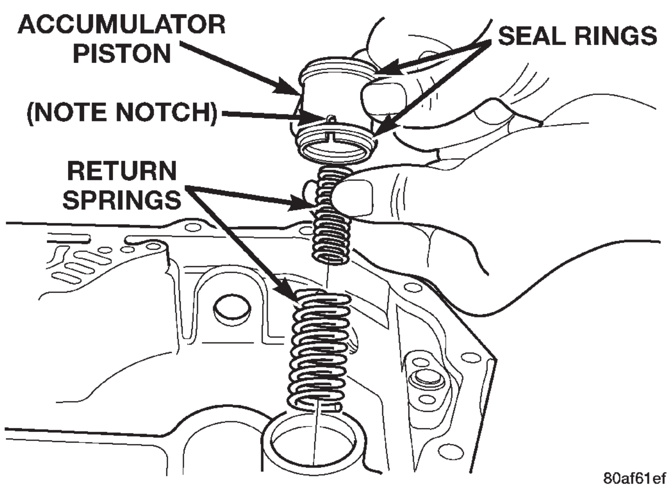


Fig. 273 Install Low/Reverse Accumulator

NOTE: Dependent on engine application, some accumulators will have two springs and others will have one spring. The springs are color coded for application and year.

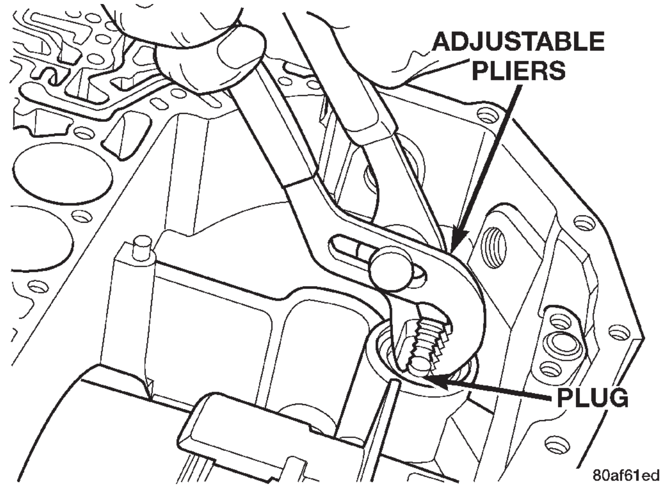


Fig. 274 Install Low/Reverse Accumulator Plug (Cover)

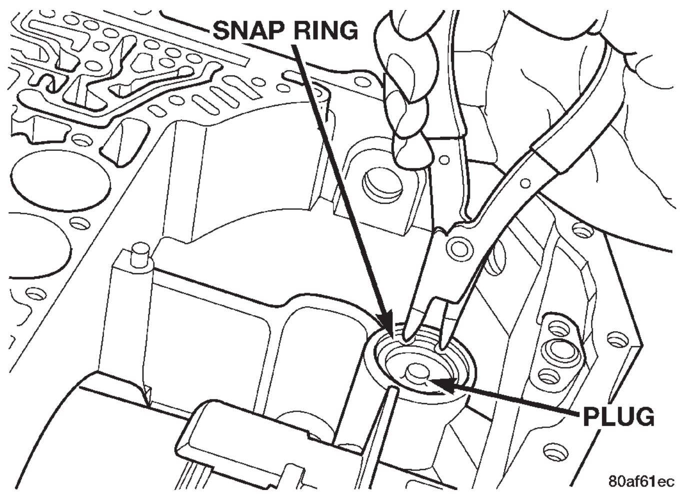


Fig. 275 Install Low/Reverse Accumulator Snap Ring

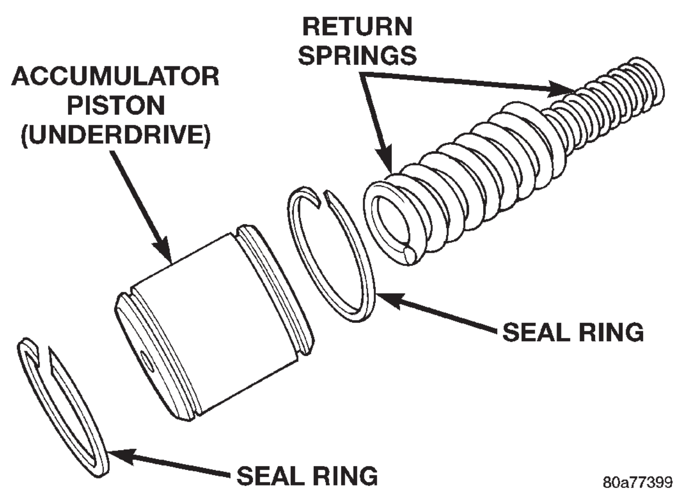


Fig. 276 Accumulator (Underdrive)

NOTE: To ease installation of the valve body, turn the manual valve fully clockwise.

DISASSEMBLY AND ASSEMBLY (Continued)

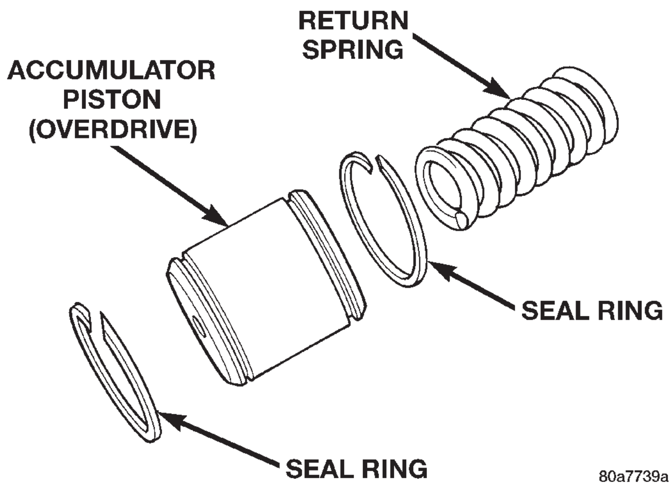


Fig. 277 Accumulator (Overdrive)

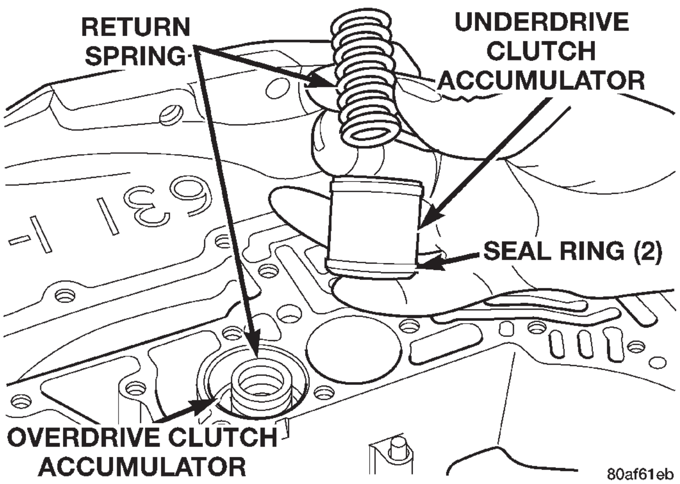


Fig. 278 Install Accumulators

CAUTION: Do not handle the valve body from the manual valve. Damage could result.

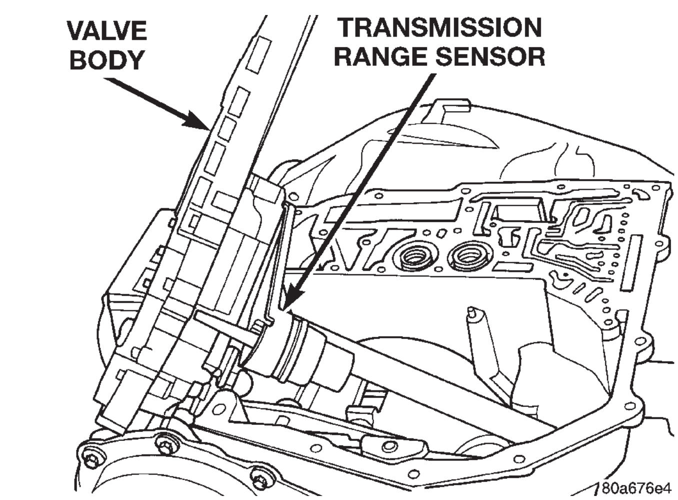


Fig. 279 Install Valve Body

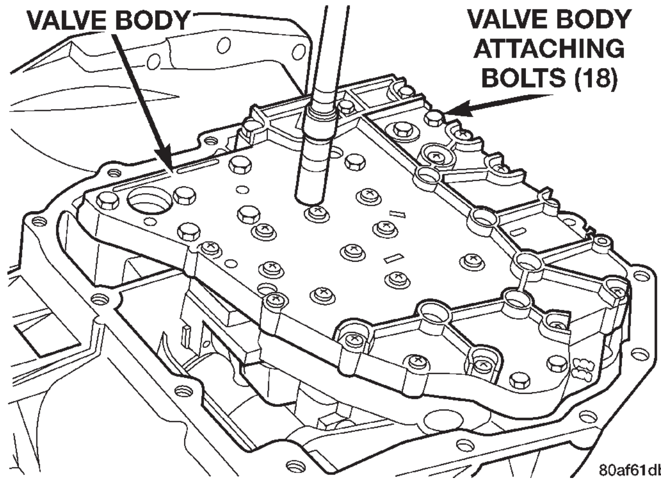


Fig. 280 Install Valve Body Attaching Bolts

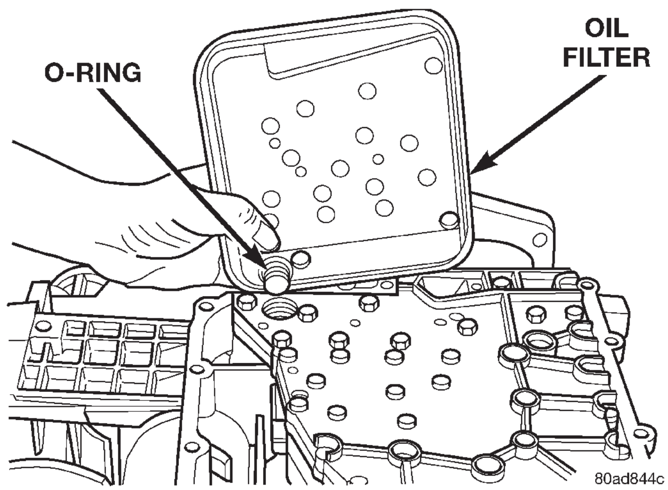


Fig. 281 Install Oil Filter

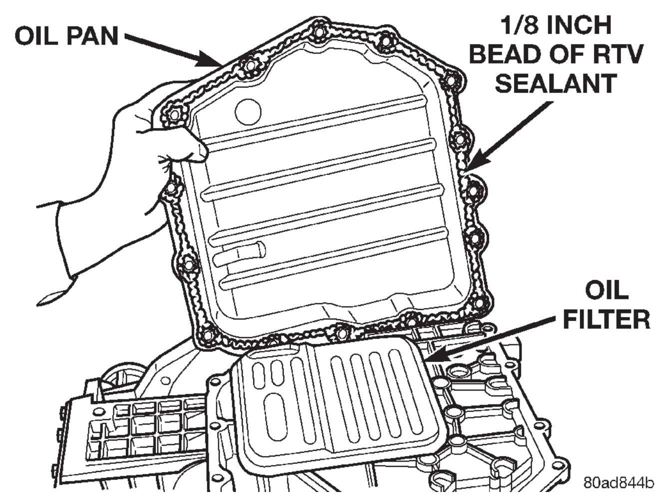


Fig. 282 Install Oil Pan

DISASSEMBLY AND ASSEMBLY (Continued)

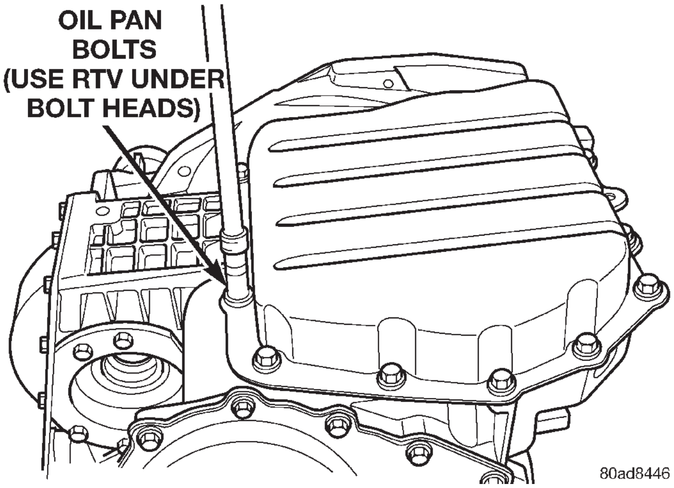


Fig. 283 Install Pan Bolts

(1) Install transaxle solenoid pack (Fig. 284).

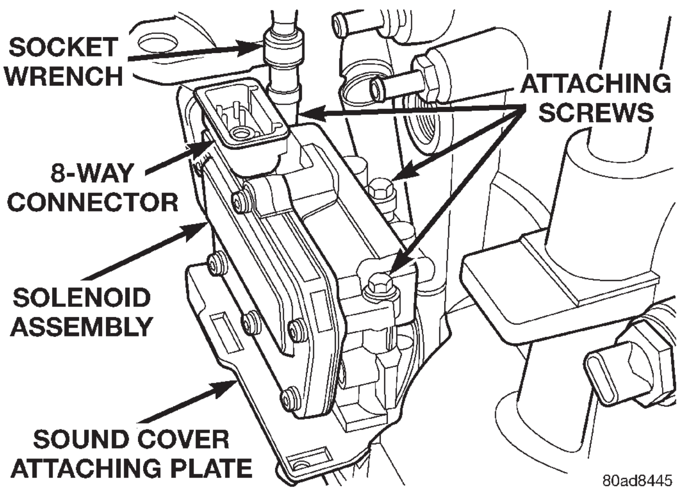


Fig. 284 Install Solenoid Pack

(2) Install input and output speed sensors.

This concludes the assembly of the transaxle centerline.

DIFFERENTIAL REPAIR

NOTE: The differential is serviced as an assembly. The only parts that are serviceable within the differential are the differential bearing cups and cones. If any other part fails within the differential, you must replace the differential assembly along with the transfer shaft.

DISASSEMBLE

The transfer shaft should be removed for differential repair and bearing turning torque checking.

(1) Remove the differential cover and bolts (Fig. 285) (Fig. 286).

(2) Remove the differential bearing retainer and bolts (Fig. 287) (Fig. 288).

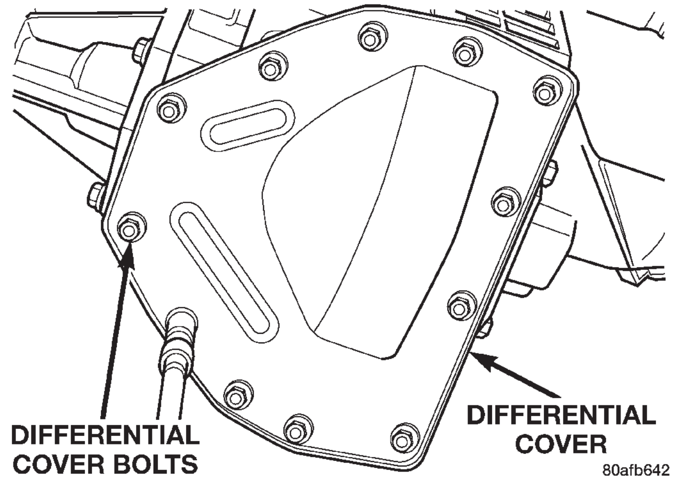


Fig. 285 Differential Cover Bolts

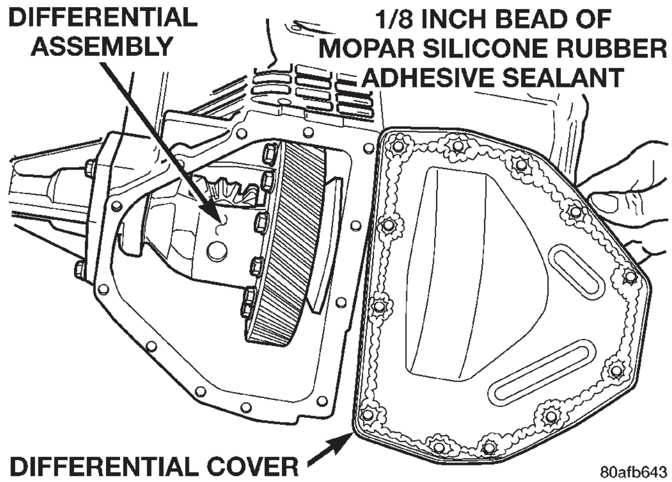


Fig. 286 Remove Differential Cover

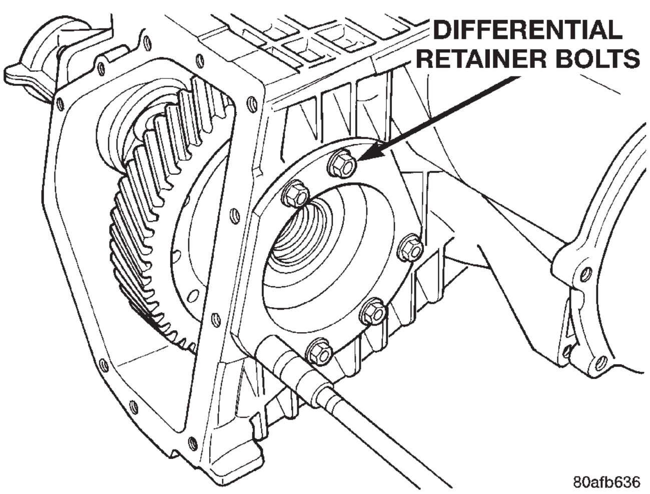


Fig. 287 Differential Retainer Bolts

(3) Using a plastic hammer, remove extension housing/adapter plate on the right side of the transaxle.

DISASSEMBLY AND ASSEMBLY (Continued)

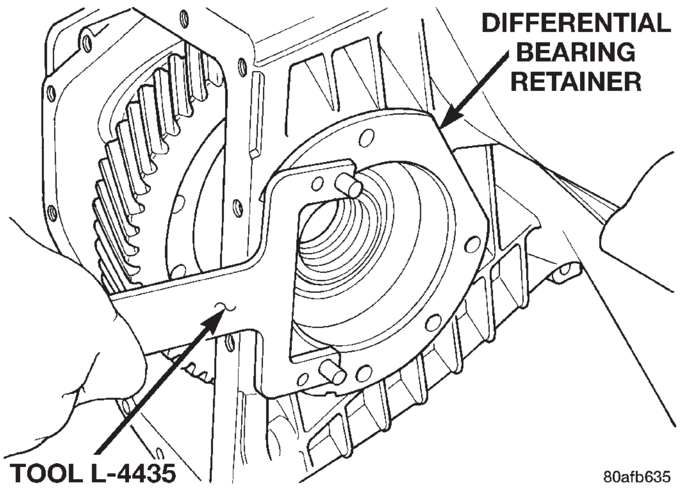


Fig. 288 Remove Bearing Retainer

WARNING: HOLD ONTO DIFFERENTIAL ASSEMBLY TO PREVENT IT FROM ROLLING OUT OF HOUSING.

(4) Use Miller Special Tool 5048, 5048-3 Collets, and L-4539-2 Button to remove the differential bearing cone on the extension housing side.

(5) Use Miller Special Tool 5048, 5048-4 Collets, and L-4539-2 Button to remove the differential bearing cone on the bearing retainer side (Fig. 289) (Fig. 290) (Fig. 291).

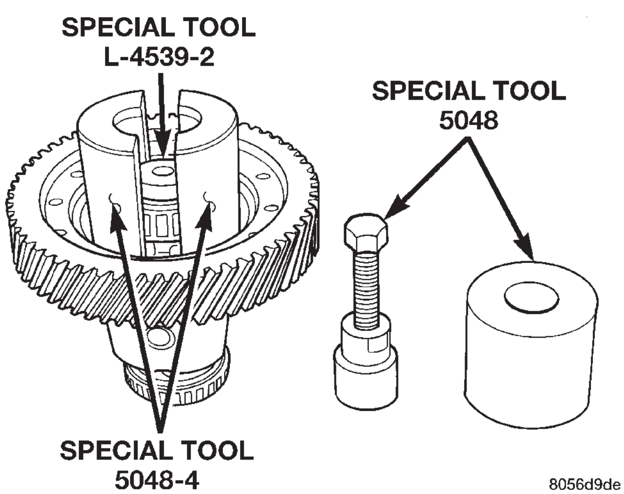


Fig. 289 Position Button and Collets Onto Differential and Bearing (Ring Gear Side)

(6) Using Miller Special Tool L-4518, remove the differential bearing race from the extension housing.

(7) Using Miller Special Tool 6062A, remove the differential bearing race from the bearing retainer (Fig. 292) (Fig. 293).

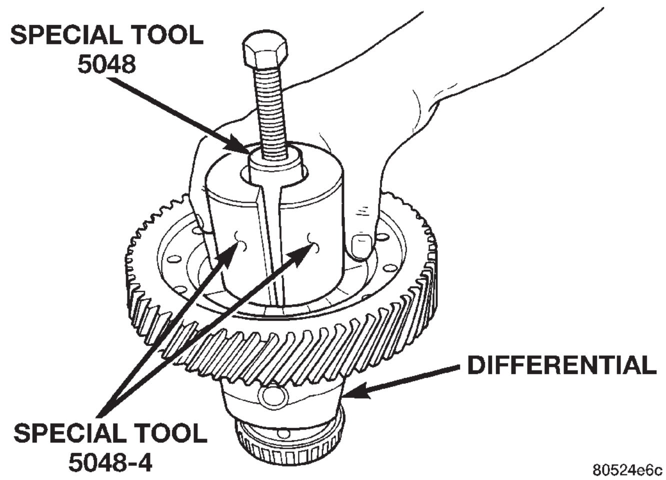


Fig. 290 Position Tool 5048 Over Button and Collets at Differential Bearing (Ring Gear Side)

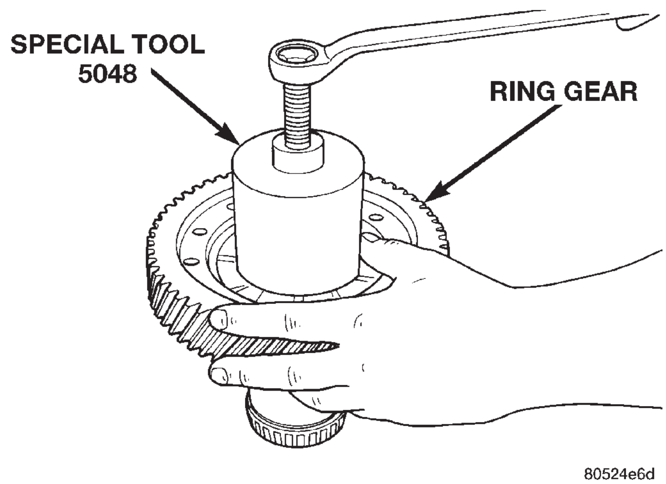


Fig. 291 Remove Differential Bearing Cone (Ring Gear Side)

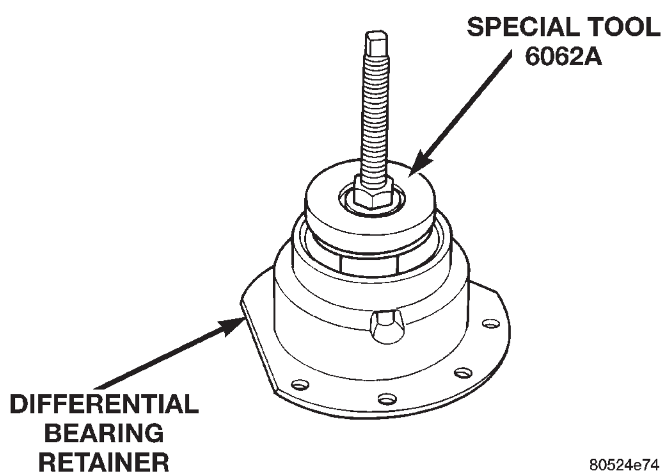


Fig. 292 Position Bearing Cup Remover Tool in Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

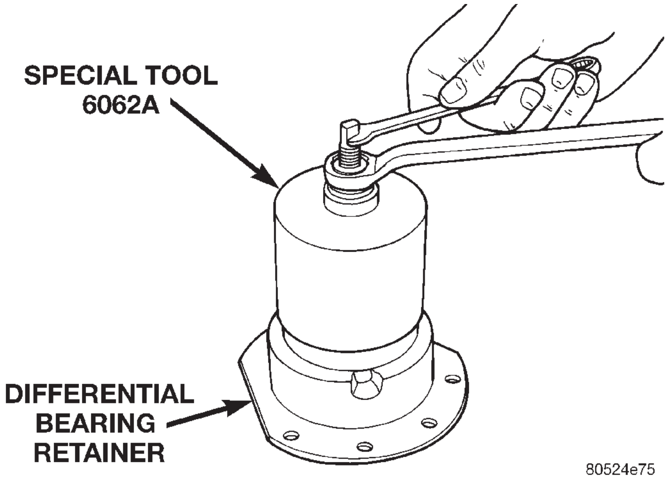


Fig. 293 Remove Bearing Cup

DIFFERENTIAL SERVICE TOOLS

COMPONENT	REMOVER	INSTALLER
Diff. Bear. On Retainer Side	5048, 5048-4 Collets, L-4539-2 Button	5052, C-4171
Diff. Bear. On Ext. Hous. Side	5048, 5048-3 Collets, L-4539-2 Button	L-4410, C-4171
Diff. Race. On Retainer Side	6062-A	6061, C-4171
Diff. Race. On Ext. Hous. Side	L-4518	L-4520, C-4171
Extension Housing Seal	7794-A, C-637 Slide Hammer	L-4520, C-4171
Bearing Retainer Seal	794-A, C-637 Slide Hammer	L-4520, C-4171

CHECKING SIDE GEAR END PLAY

Check side gear end play whenever the differential is removed for service.

NOTE: Side gear end play must be BETWEEN 0.001 to 0.013 inch.

ASSEMBLE

NOTE: Use Mopar® Silicone Rubber Adhesive Sealant, or equivalent, on retainer and extension housing/adapter plate to seal to case.

(1) Using Miller Special Tool L-4410, and C-4171, install differential bearing to differential (extension housing side) (Fig. 296).

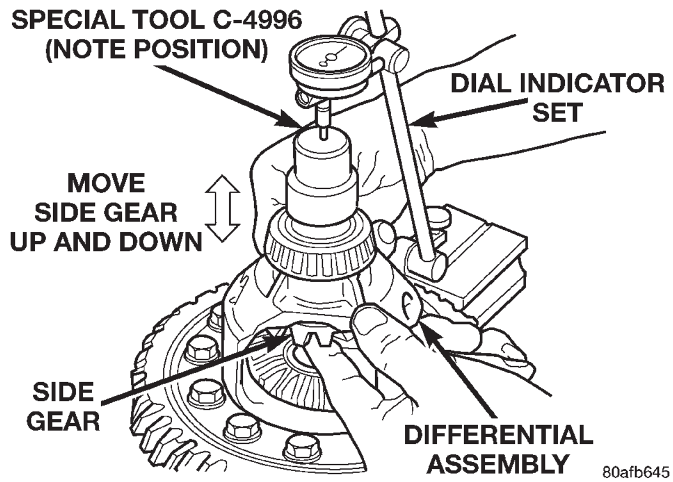


Fig. 294 Checking Side Gear End Play (Extension Housing Side)

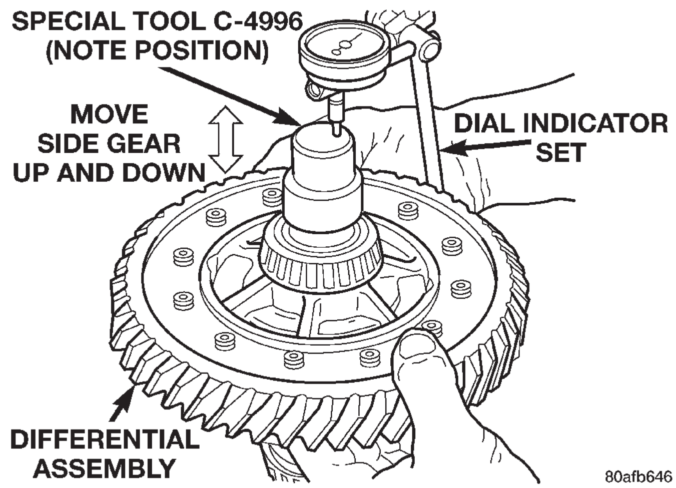


Fig. 295 Checking Side Gear End Play (Bearing Retainer Side)

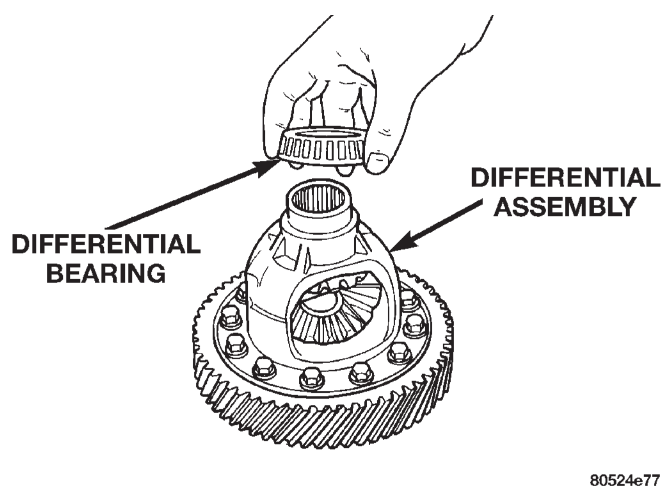


Fig. 296 Position Bearing Cone Onto Differential

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Using Miller Special Tool 5052 and C-4171, install differential bearing to differential (bearing retainer side).

(3) Using Miller Special Tool 6061 and C-4171, install differential bearing race to bearing retainer (Fig. 297).

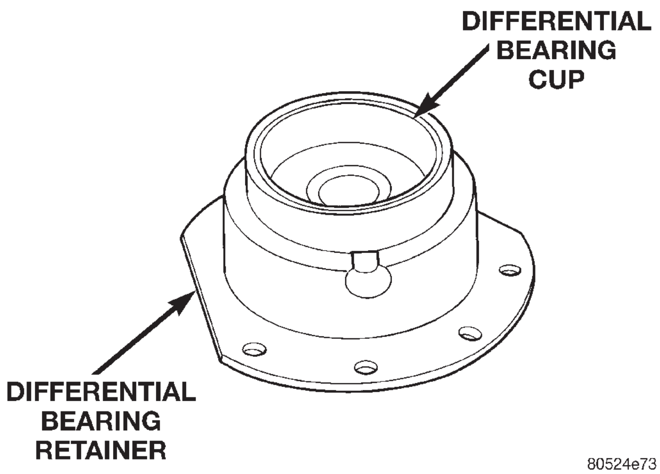


Fig. 297 Differential Bearing Retainer

(4) Using Miller Special Tool L–4520 and C-4171, install differential bearing to extension housing.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

NOTE: Perform all differential bearing preload measurements with the transfer shaft and gear removed.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT USING EXISTING SHIM

(1) Position the transaxle assembly vertically on the support stand, differential bearing retainer side up.

(2) Install Tool L-4436A into the differential and onto the pinion mate shaft (Fig. 298).

(3) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(4) Using Tool L-4436A and an inch-pound torque wrench, check the turning torque of the differential (Fig. 299). **The turning torque should be between 5 and 18 inch-pounds.**

(5) If the turning torque is within specifications, remove tools. Setup is complete.

(6) If turning torque is not within specifications proceed with the following steps.

(a) Remove differential bearing retainer from the transaxle case.

(b) Remove the bearing cup from the differential bearing retainer using Tool 6062A.

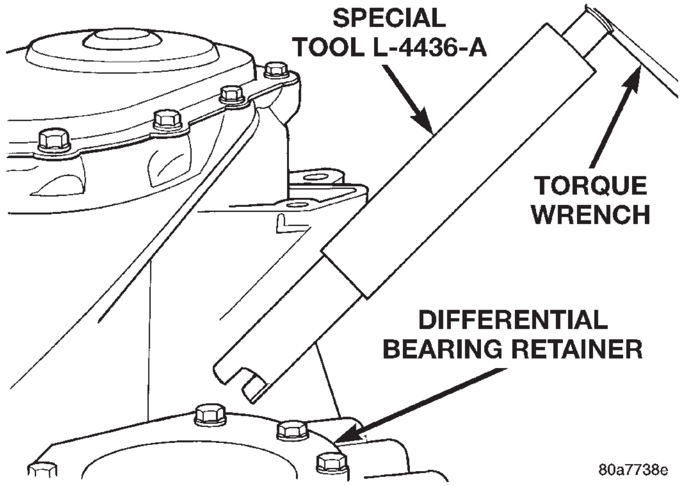


Fig. 298 Tool L-4436 and Torque Wrench

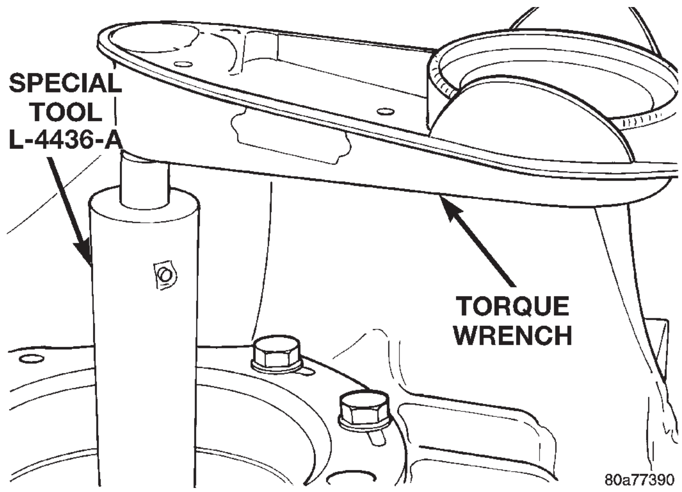


Fig. 299 Checking Differential Bearings Turning Torque

(c) Remove the existing shim from under the cup.

(d) Measure the existing shim.

NOTE: If the turning torque was too high when measured, install a .05 mm (.002 inch) thinner shim. If the turning torque is was too low, install a .05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained.

Oil Baffle is not required to be installed when making shim selection.

(e) Install the proper shim under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(f) Install the differential bearing retainer using Tool 5052 and C-4171. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N·m (250 in. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Using Tool L-4436A and an inch-pound torque wrench, recheck the turning torque of the differential (Fig. 299). **The turning torque should be between 5 and 18 inch-pounds.**

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Differential carrier
- Differential bearing retainer
- Extension housing
- Differential bearing cups and cones

(5) Position the transaxle assembly vertically on the support stand and install Miller Special Tool L-4436-A into the bearing retainer.

(6) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(7) Attach a dial indicator to the case and zero the dial. Place the tip on the end of Special Tool L-4436-A.

(8) Place a large screwdriver to each side of the ring gear and lift. Check the dial indicator for the amount of end play.

DIFFERENTIAL BEARING SHIM CHART

PART NUMBER	SHIM	THICKNESS
	MM	INCH
4659257	.980	0.0386
4659258	1.02	0.0402
4659259	1.06	0.0418
4659260	1.10	0.0434
4659261	1.14	0.0449
4659262	1.18	0.0465
4659263	1.22	0.0481
4659264	1.26	0.0497
4659265	1.30	0.0512
4659266	1.34	0.0528
4659267	1.38	0.0544
4659268	1.42	0.0560
4659269	1.46	0.0575
4659270	1.50	0.0591
4659271	1.54	0.0607
4659272	1.58	0.0623
4659273	1.62	0.0638
4659274	1.66	0.0654
4659275	1.70	0.0670
4659283	2.02	0.0796
4659284	2.06	0.0812

CAUTION: Do not damage the transaxle case and/or differential retainer sealing surface.

(9) Using the end play measurement that was determined, add .18mm (.007 inch). This should give you between 5 and 18 inch pounds of bearing preload. Refer to the Differential Bearing Shim Chart to determine which shim to use.

(10) Remove the differential bearing retainer. Remove the bearing cup.

PRELOAD ADJUSTMENT W/O SHIM

(1) Remove the bearing cup from the differential bearing retainer using Miller special Tool 6062A.

(2) Remove existing shim from under bearing cup.

(3) Reinstall the bearing cup into the retainer using Miller Special Tool 6061, and C-4171.

NOTE: Oil baffle is not required when making the shim calculation.

(4) Install the bearing retainer into the case. Torque bolts to 28 N·m (250 in. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

(11) Install the oil baffle. Install the proper shim combination under the bearing cup.

(12) Install the differential bearing retainer. Seal the retainer to the housing with Mopar® Silicone Rubber Adhesive Sealant. Torque bolts to 28 N·m (250 in. lbs.).

(13) Using Miller Special Tool L-4436-A and an inch-pound torque wrench, check the turning torque of the differential (Fig. 299). The turning torque should be between 5-18 inch-pounds.

NOTE: If turning torque is too high install a .05mm (.002 inch) thicker shim. If the turning torque is too low, install a .05mm (.002 inch) thinner shim. Repeat until 5-18 inch-pounds of turning torque is obtained.

CLEANING AND INSPECTION

CLEANING VALVE BODY

Prior to removing any transaxle parts, plug all openings and clean unit, preferably by steam. Cleanliness through entire disassembly and assembly 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 transaxles are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

NOTE: Tag all springs, as they are removed, for reassembly identification.

ADJUSTMENTS

GEARSHIFT CABLE ADJUSTMENT

Lift and rotate the gearshift hand lever into the park (P) gate position and remove the ignition key. This confirms the shift lever is in the gated park (P) position.

After confirming the park gate position, turn the ignition switch. If the starter will operate, the park gate position is correct. Move the shift lever into the neutral (N) position. If the starter will operate in this position, the linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

(1) Park the vehicle on level ground and set the parking brake.

(2) Place the gearshift lever in park (P) gate position and remove key.

(3) Loosen the cable adjustment screw at the transaxle operating lever (Fig. 300).

(4) Pull the transaxle operating lever fully forward to the park detent position.

(5) Release the park brake, then rock the vehicle to assure it is in park lock. Reset the park brake.

(6) Tighten the cable adjustment screw to 8 N·m (70 in. lbs.). Gearshift cable should now be properly adjusted.

(7) Check adjustment by using the preceding procedure.

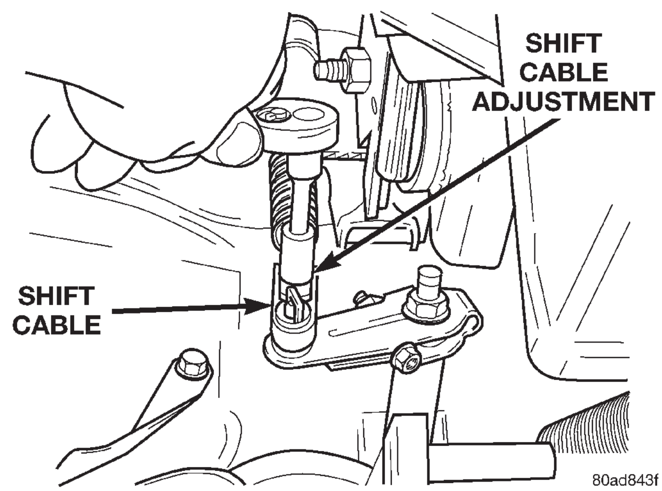
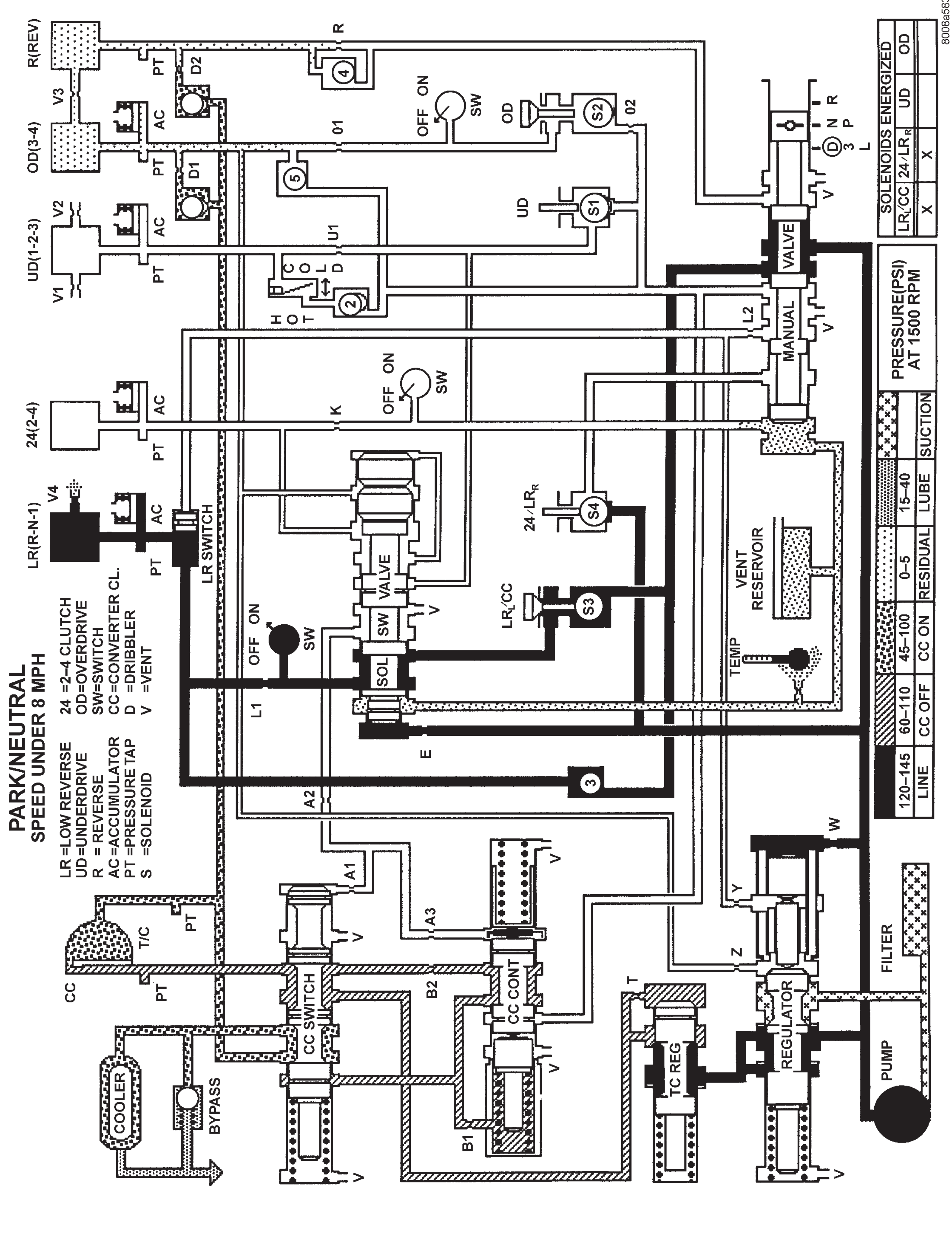


Fig. 300 Gearshift Cable Adjustment

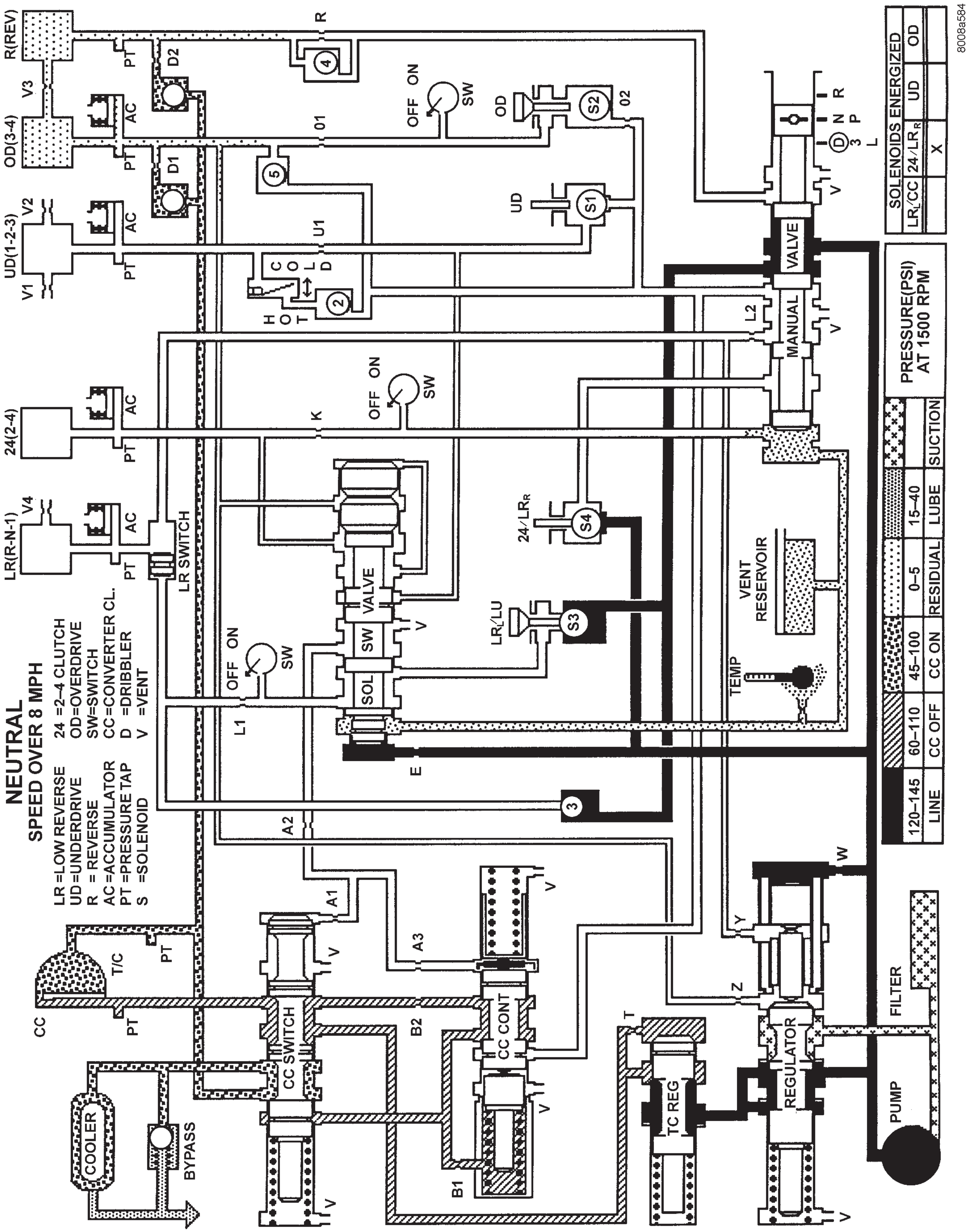
SCHEMATICS AND DIAGRAMS

41TE TRANSAXLE HYDRAULIC SCHEMATICS



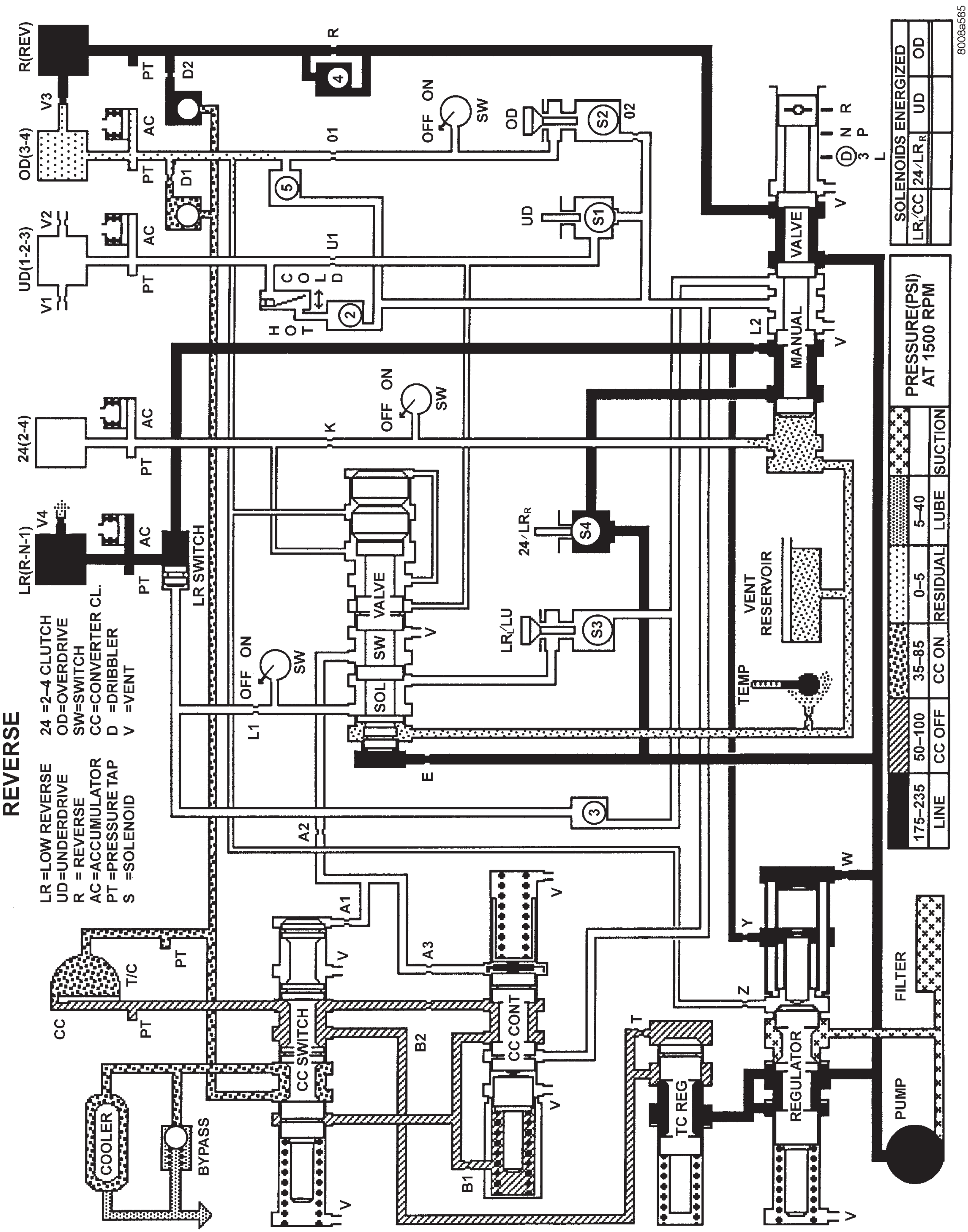
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



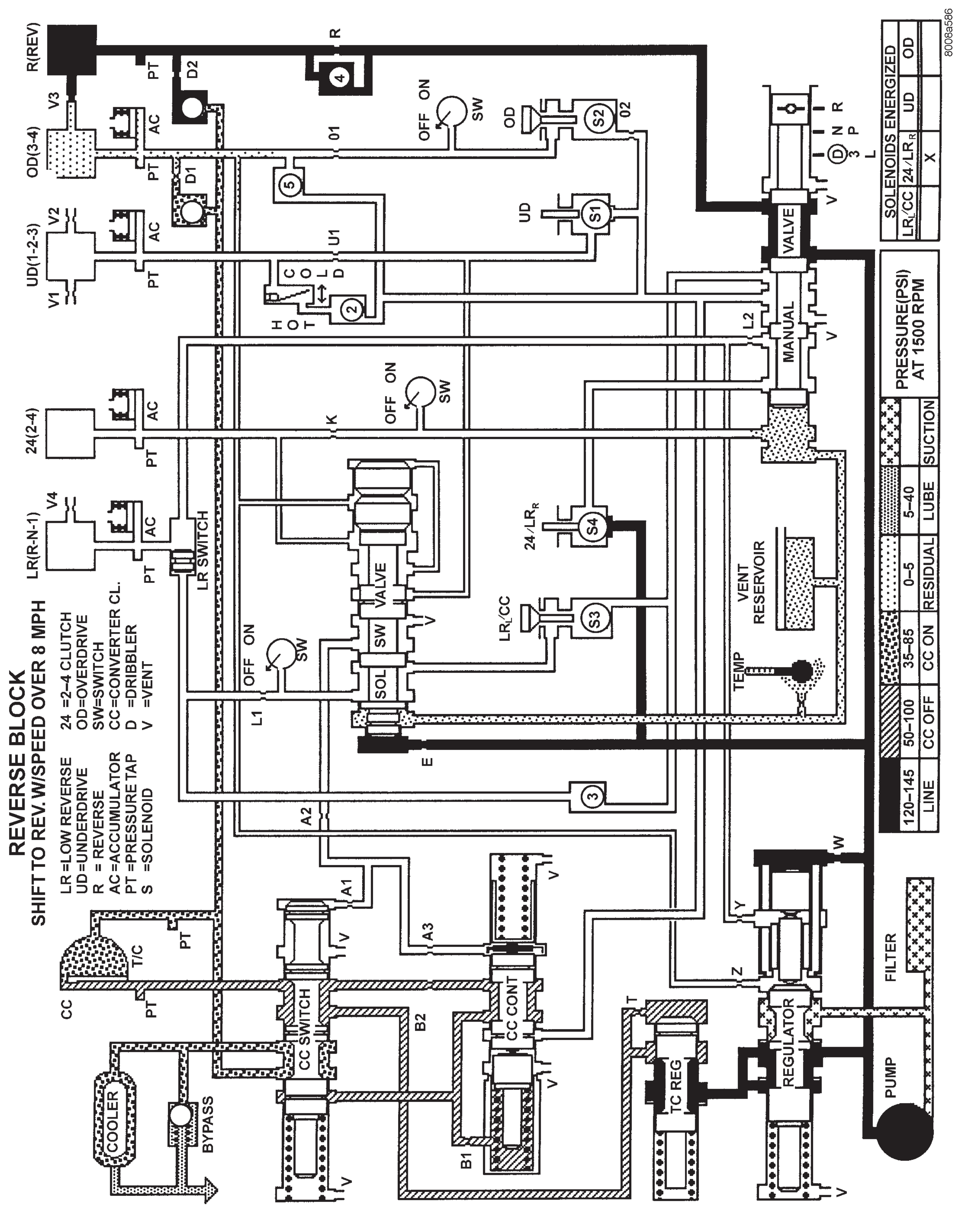
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

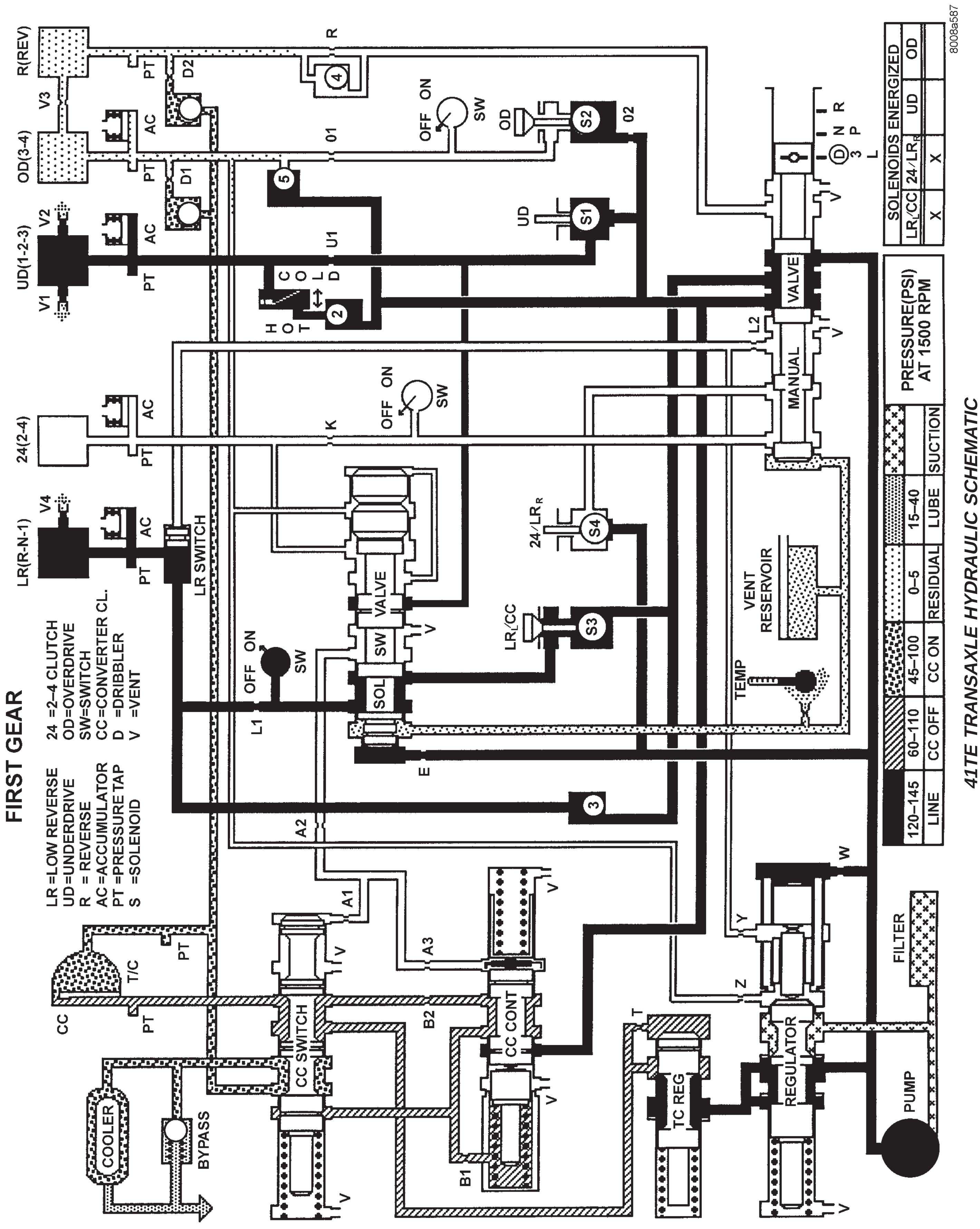


41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

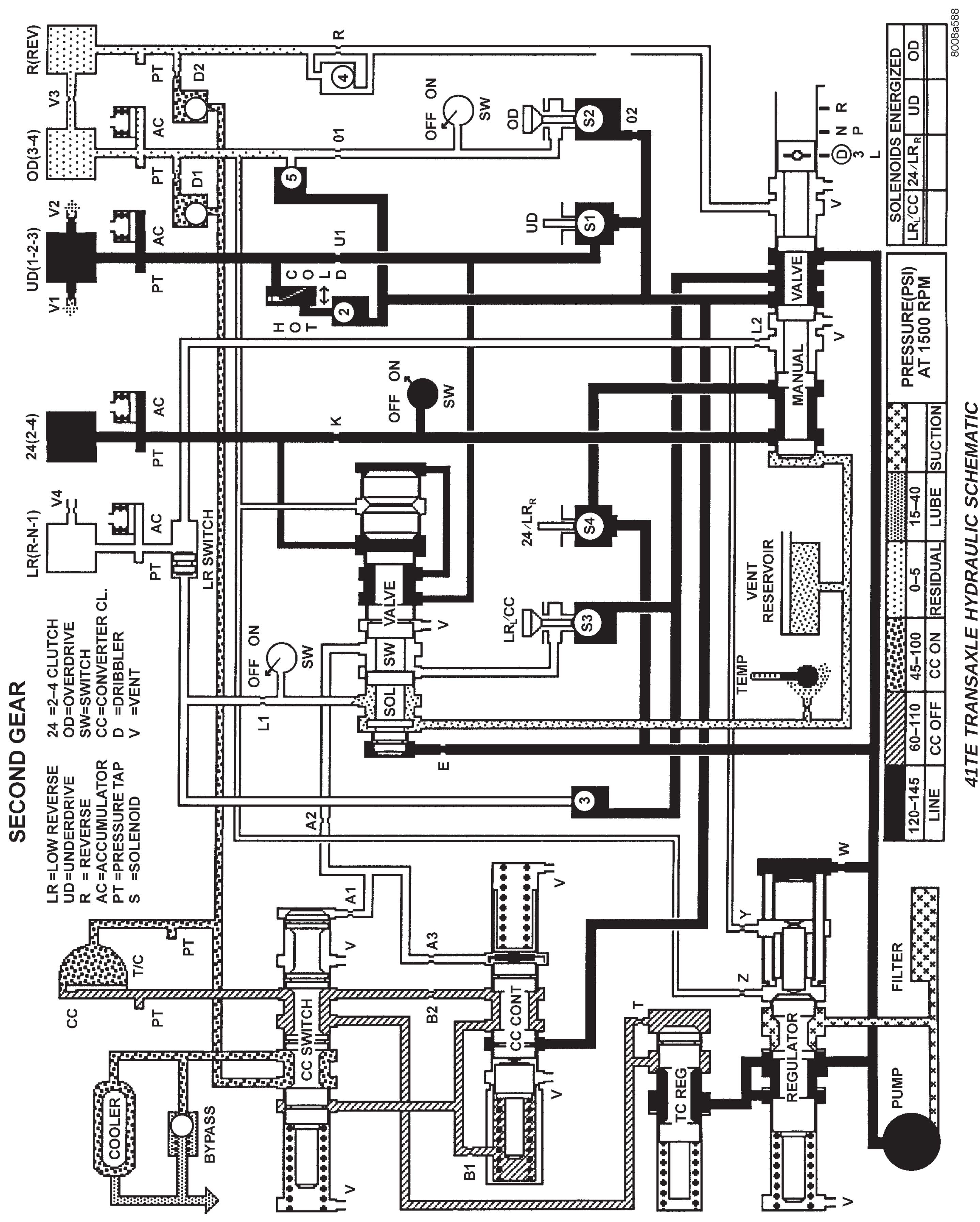


SCHEMATICS AND DIAGRAMS (Continued)



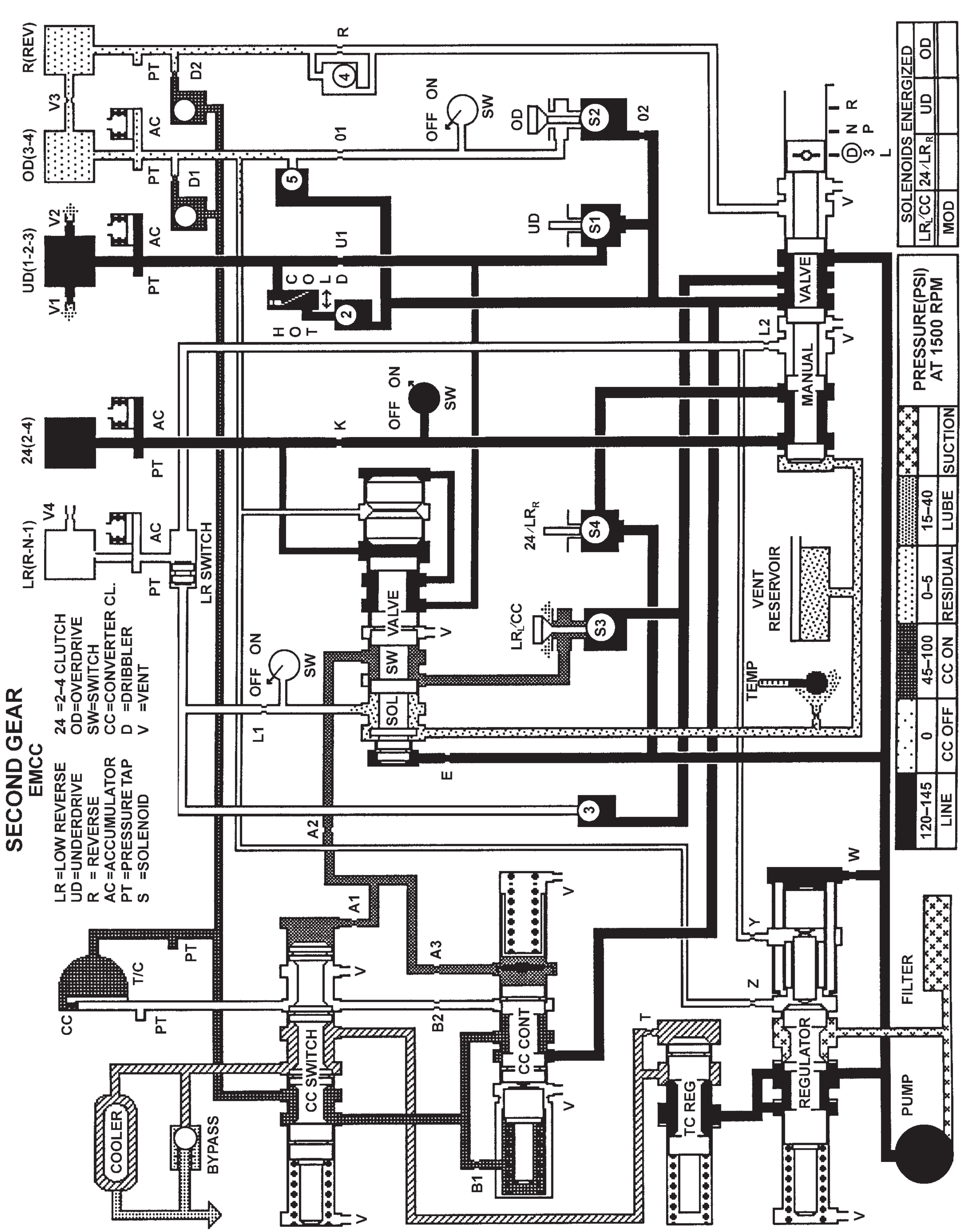
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



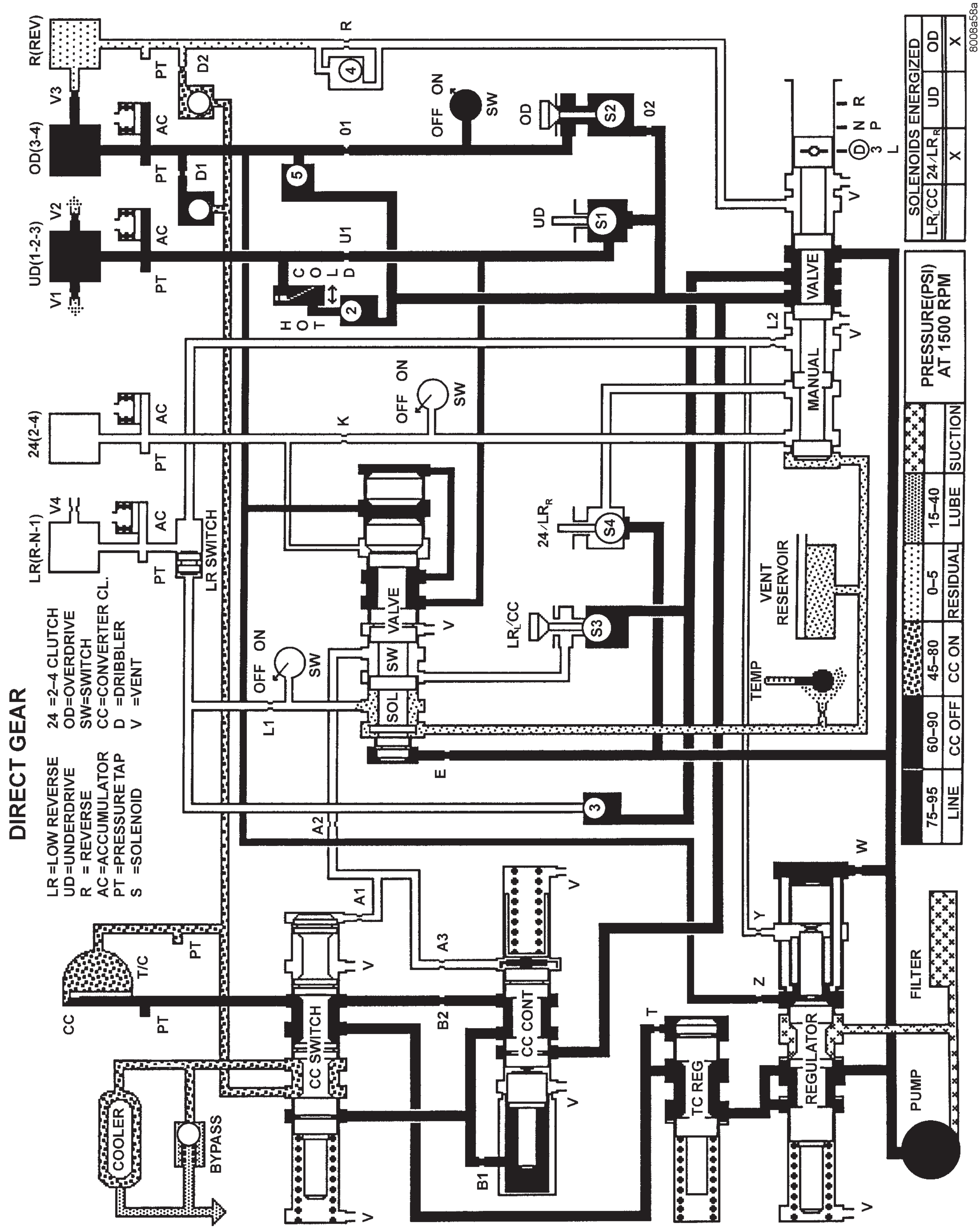
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

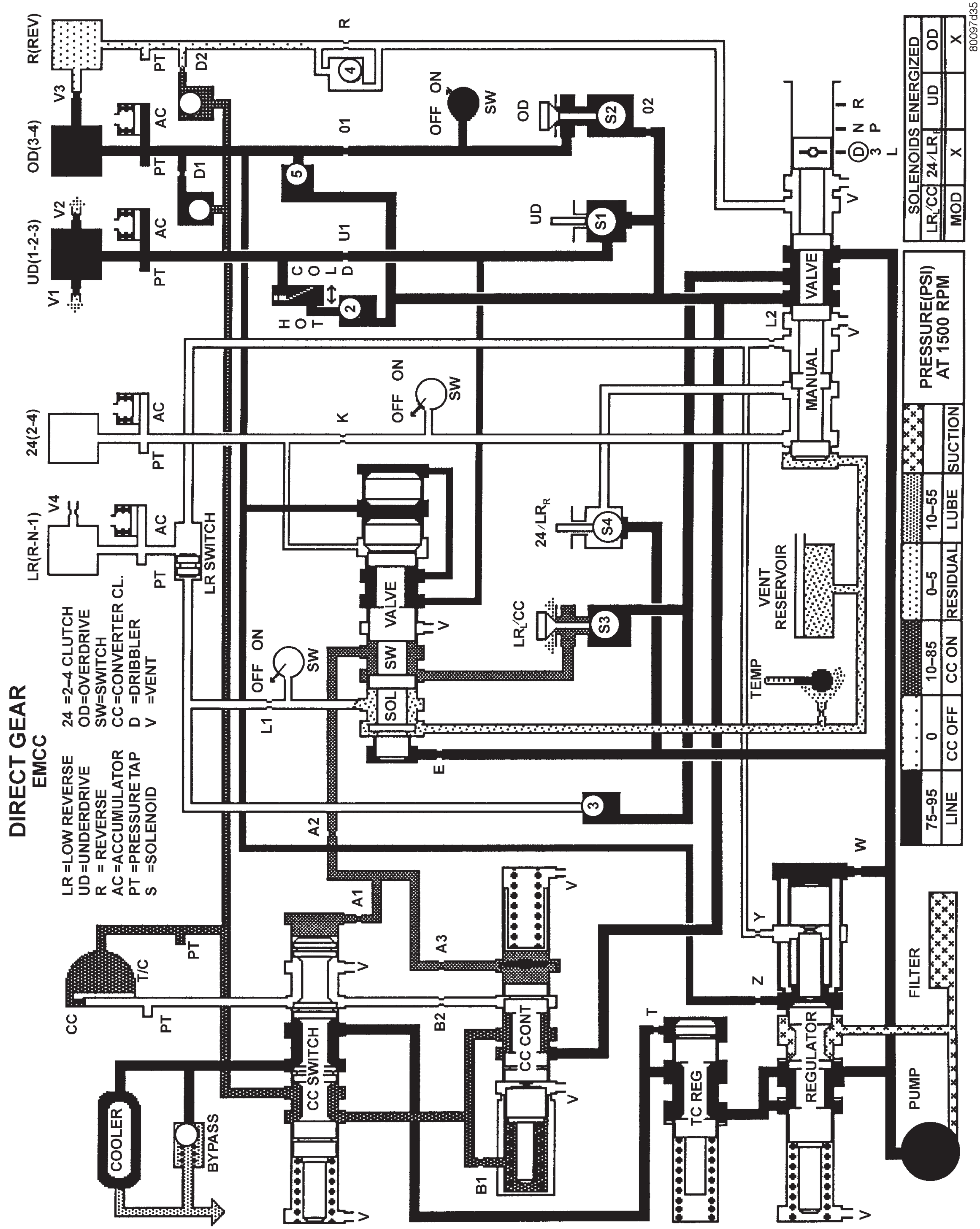


41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

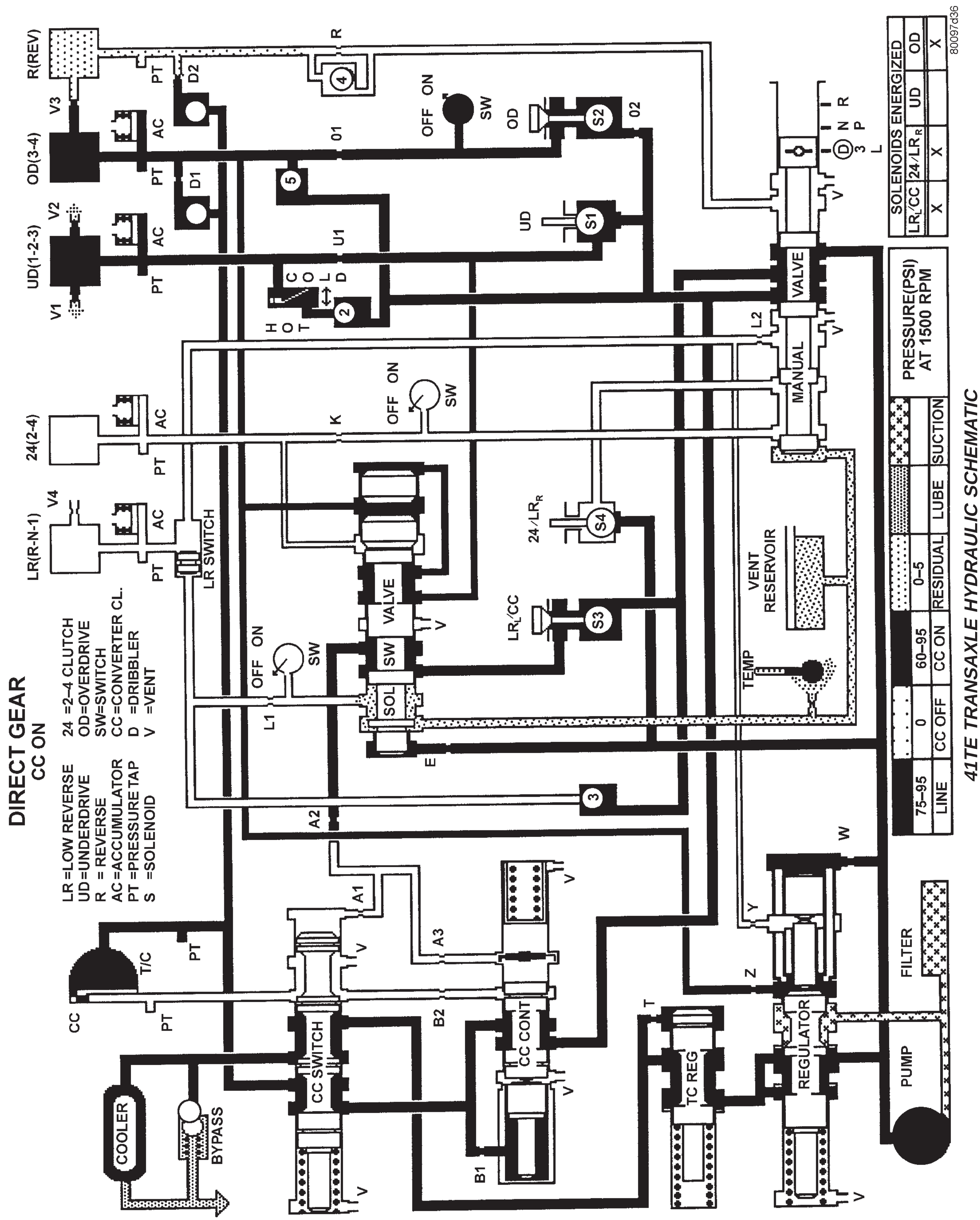


SCHEMATICS AND DIAGRAMS (Continued)



41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



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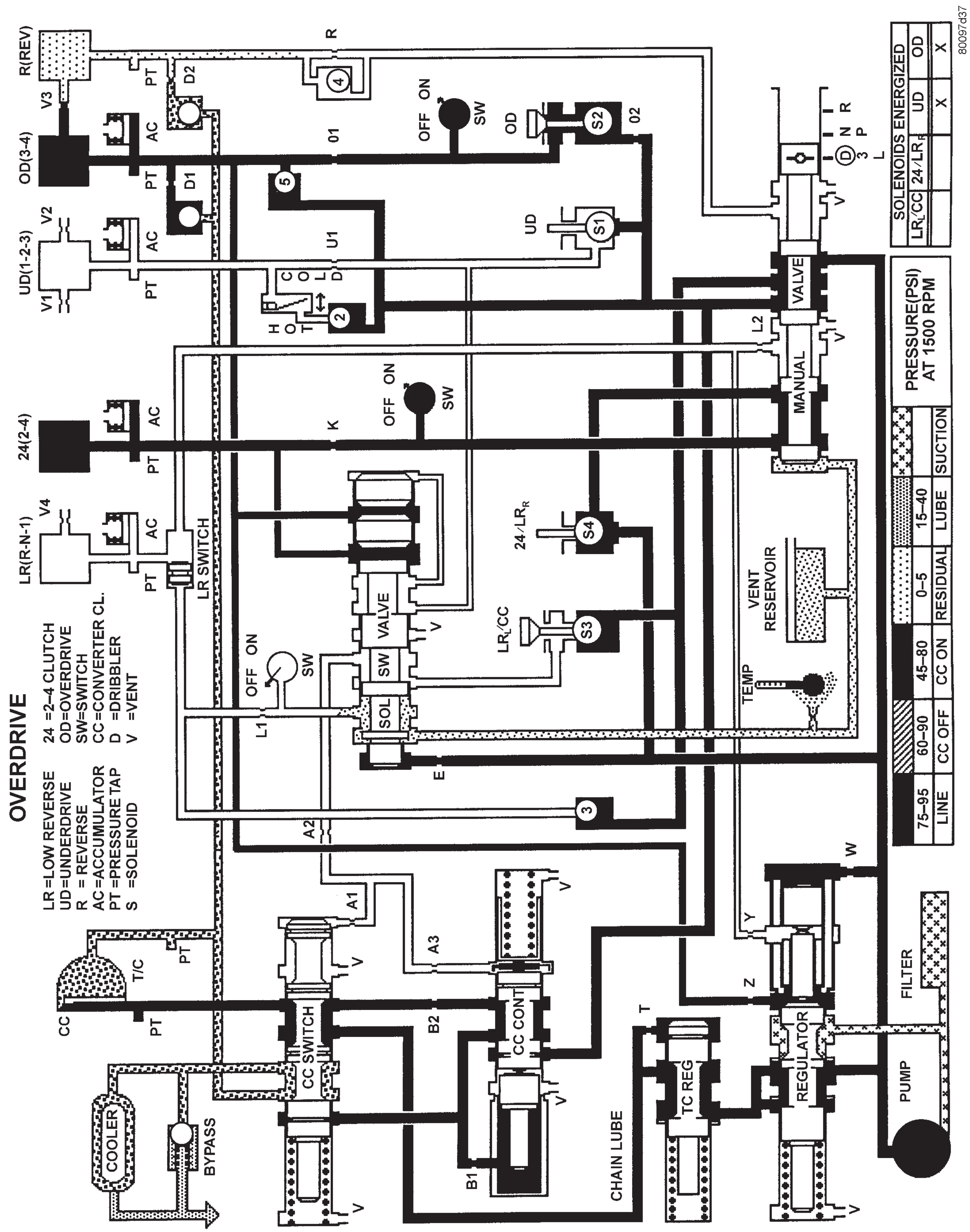

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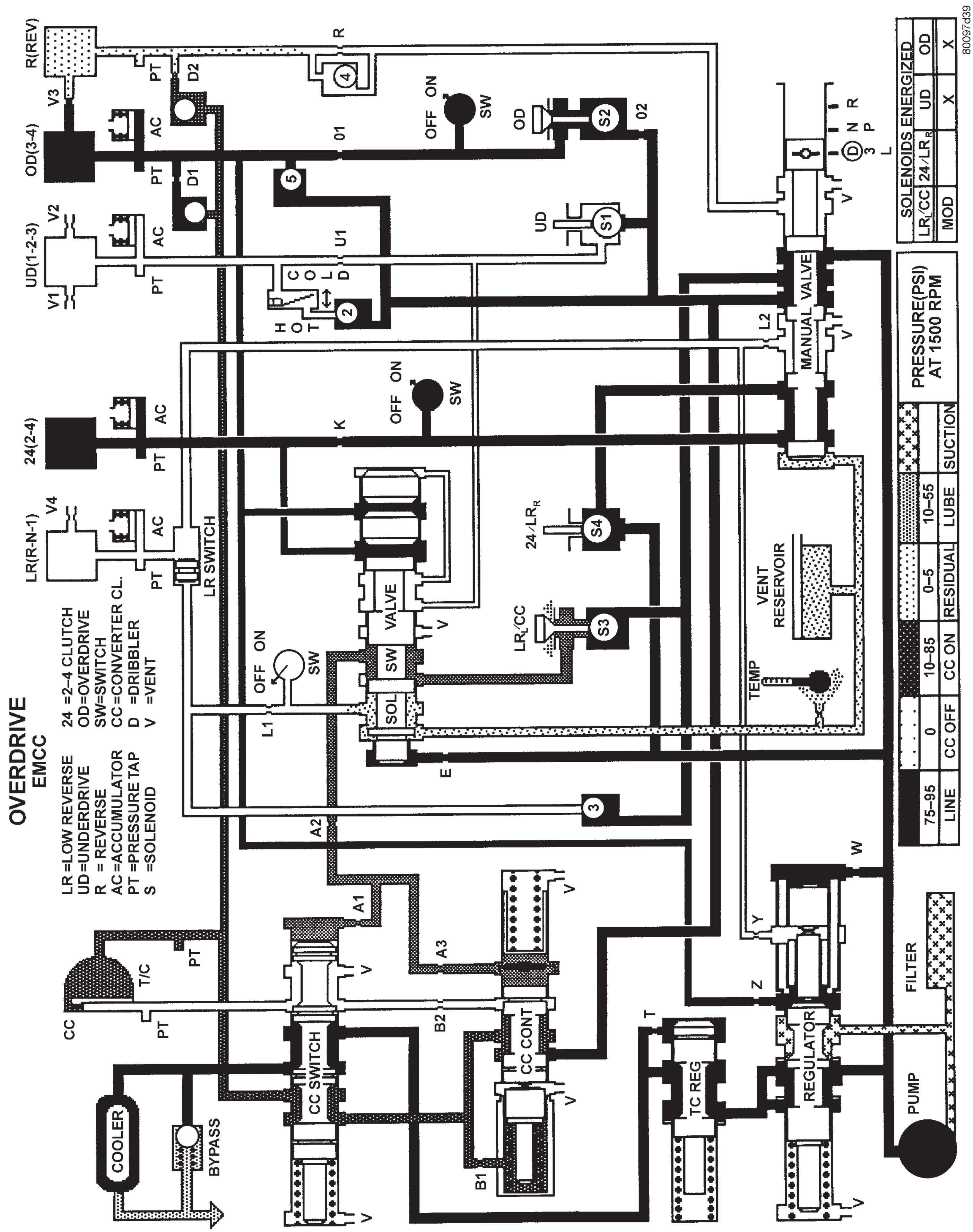

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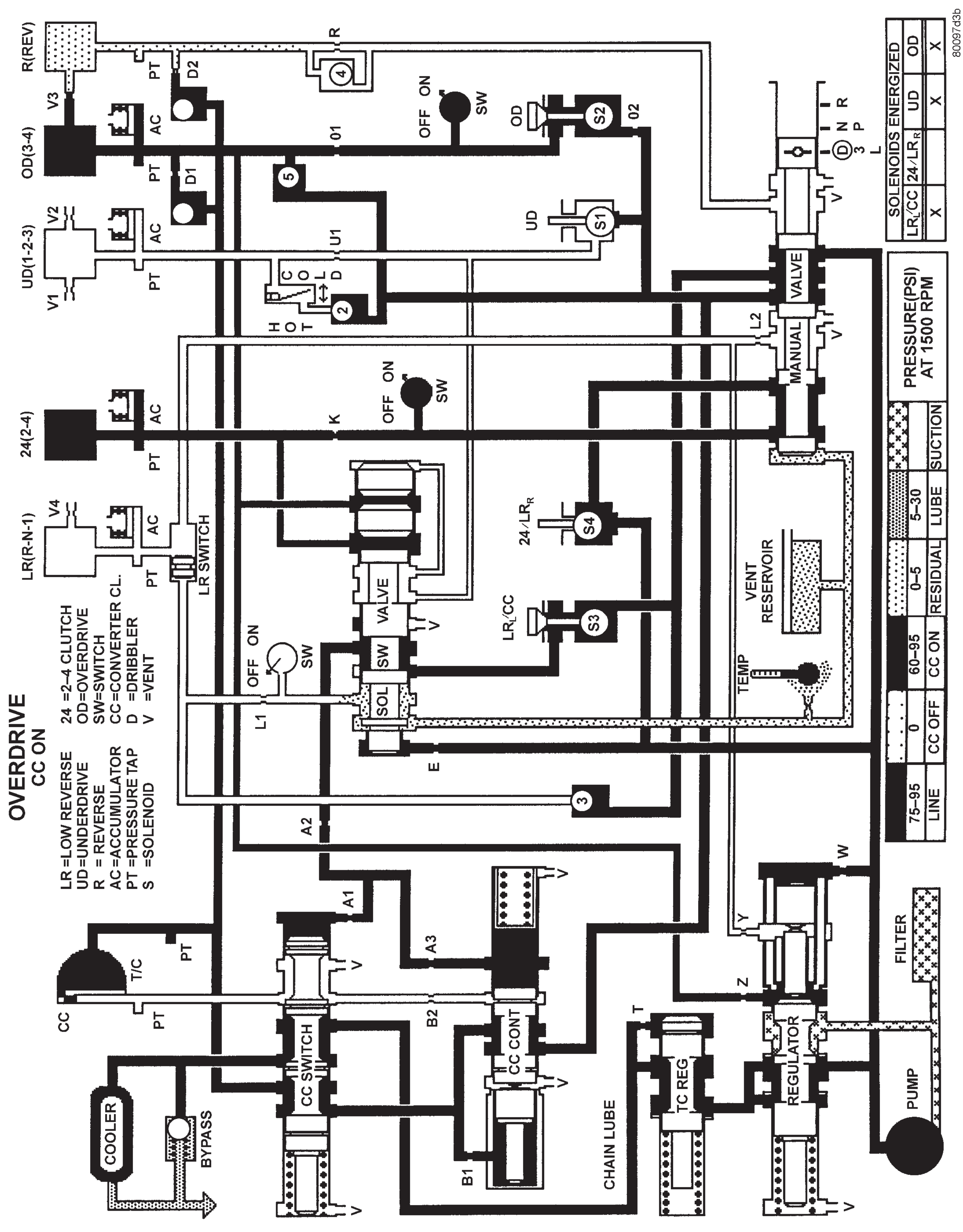


41TE TRANSAXLE HYDRAULIC SCHEMATIC

SPECIFICATIONS

41TE AUTOMATIC TRANSAXLE

Type . . . . .Fully adaptive, electronically controlled, four speed automatic with torque converter and integral differential
Torque Converter Diameter . . . . .241 millimeters (9.48 in.)
Oil Capacity . . . . .8.6 Liters (18.25 pints)
Oil Type. . . . . .Mopar® ATF PLUS 3Type 7176
Cooling Method . . . . .Water Heat Exchanger and/or air to oil heat exchanger
Lubrication . . . . . .Pump (internal-external gear-type

Gear Ratios

Transmission Portion
First Gear 2.84
Second Gear. 1.57
Direct Gear 1.00
Overdrive Gear 0.69
Reverse Gear 2.21

Overall Top Gear Ratio
3.8 Liter. 2.38
3.3 Liter. 2.49
2.4 Liter. 2.69

Pump Clearances
Outer Gear To Pocket . . . . .0.045-0.141mm (0.0018-0.0056 in.)
Outer Gear Side Clearance. . . . . .0.020-0.046mm (0.0008-0.0018 in.)
Inner Gear Side Clearance . . . . .0.020-0.046mm (0.0008-0.0018 in.)

Tapered Roller Bearing Settings
Differential Assembly . . .5 to 18 in. lbs. Drag Torque
Output Hub. . . . . .3 to 8 in. lbs. Drag Torque
Transfer Shaft . . . . .0.002 to 0.004 in. End Play
Overall Drag At Output Hub . . . . .3 to 16 in. lbs. Drag Torque

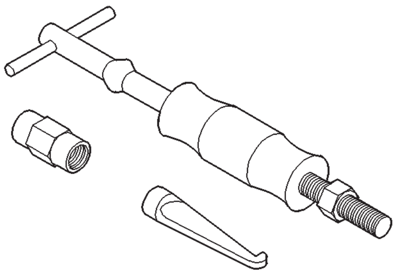
Clutch Pack Clearances
Low/Rev Clutch
(Select Reaction Plate) . . . . .0.89-1.04mm (0.035-0.042 in.)
Two/Four Clutch
(No Selection). . . . . .0.76-2.64mm (0.030-0.104 in.)
Reverse Clutch (Select Snap Ring). . . . .0.76-1.24mm (0.030-0.049 in.)
Overdrive Clutch
(No Selection). . . . . .0.96-2.26mm (0.038-0.089 in.)
Underdrive Clutch
Select Pressure Plate) . . . . .0.91-1.47mm (0.036-0.058 in.)
Transmission End Play . . . . .0.12-0.63mm (0.005-0.025 in.)

41TE TORQUE SPECIFICATIONS

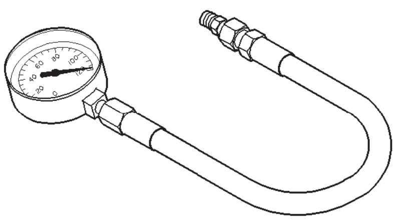
DESCRIPTION	TORQUE
Cooler Line Fittings	12 N·m (105 in. lbs.)
Differential Cover	19 N·m (165 in. lbs.)
Differential Ring Gear	95 N·m (70 ft. lbs.)
Differential Bearing Ret.	28 N·m (21 ft. lbs.)
Driveplate To Crank. Bolts	95 N·m (70 ft. lbs.)
Driveplate To Torque Conv.	75 N·m (55 ft. lbs.)
Eight Way Solenoid Conn.	4 N·m (35 in. lbs.)
Extension Housing	28 N·m (21 ft. lbs.)
Input Speed Sensor	27 N·m (20 ft. lbs.)
L/R Clutch Retainer	5 N·m (45 in. lbs.)
Oil Pan To Trans. Case	19 N·m (165 in. lbs.)
Output Gear Bolt	271 N·m (200 ft. lbs.)
Output Gear Stirrup Ret.	23 N·m (17 ft. lbs.)
Output Speed Sensor	27 N·m (20 ft. lbs.)
Pressure Taps	5 N·m (45 in. lbs.)
Pump To Case Bolts	27 N·m (20 ft. lbs.)
Reaction Shaft Bolts	27 N·m (20 ft. lbs.)
Rear End Cover	19 N·m (14 ft. lbs.)
Sixty-Way Connector	4 N·m (35 in. lbs.)
Solenoid Assembly To Case	12 N·m (105 in. lbs.)
Transmission Range Sensor	5 N·m (45 in. lbs.)
Transfer Gear Nut	271 N·m (200 ft. lbs.)
Transfer Plate To Case	12 N·m (105 in. lbs.)
Valve Body To Case Bolts	12 N·m (105 in. lbs.)
Valve Body Bolts	5 N·m (45 in. lbs.)
Vent Assembly	12 N·m (105 in. lbs.)

SPECIAL TOOLS

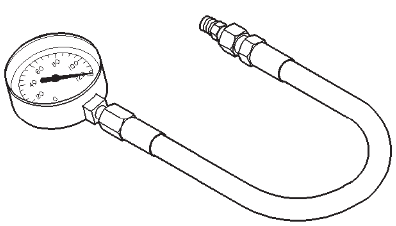
41TE AUTOMATIC TRANSAXLE



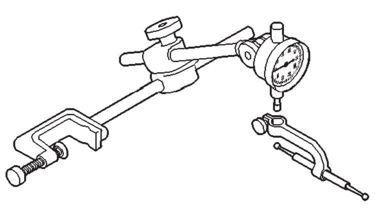
Puller C-637



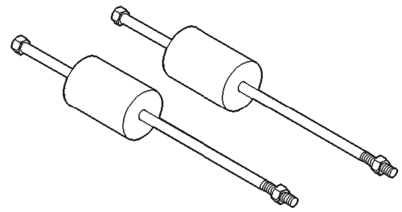
Pressure Gauge (Low) C-3292



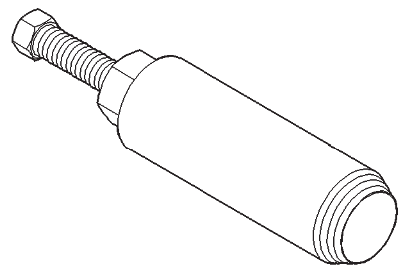
Pressure Gauge (High) C-3293SP



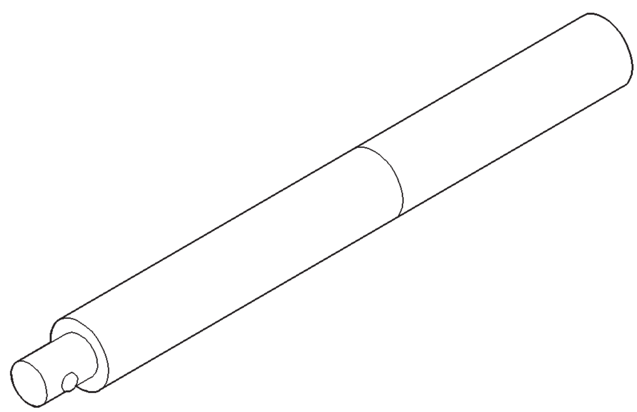
Dial Indicator C-3339



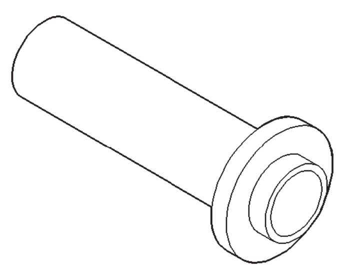
Oil Pump Puller C-3752



Seal Puller C-3981B

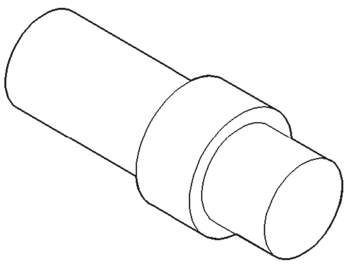


Universal Handle C-4171

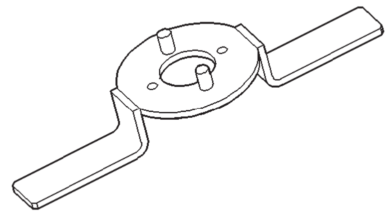


Seal Installer C-4193A

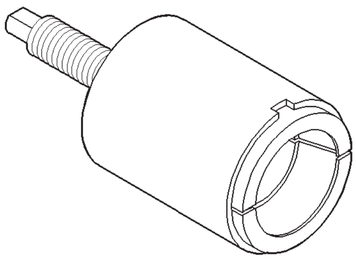
SPECIAL TOOLS (Continued)



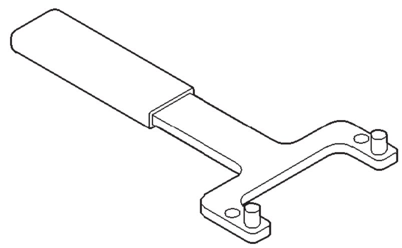
Adapter C-4996



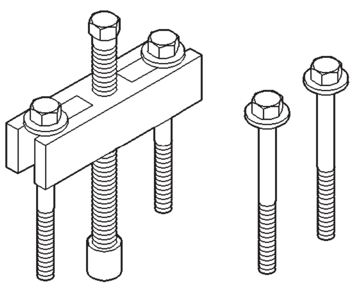
Gear Checking Plate L-4432



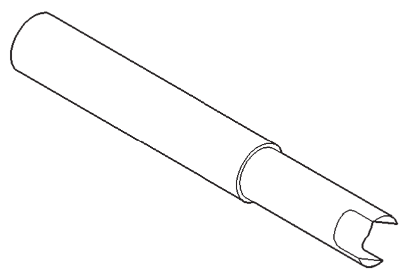
Remover Kit L-4406



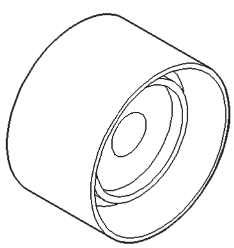
Bearing Puller L-4435



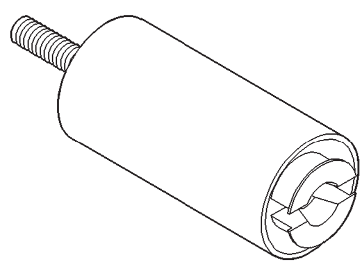
Gear Puller L-4407A



Differential Tool L-4436A

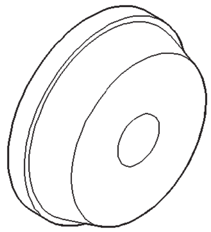


Bearing Installer L-4410

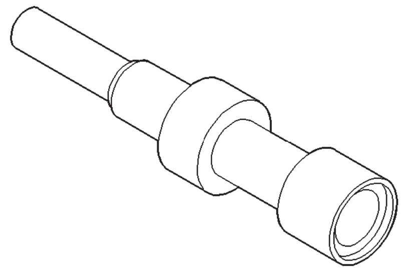


Special Jaw Set L-4518

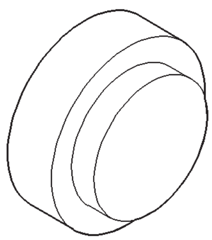
SPECIAL TOOLS (Continued)



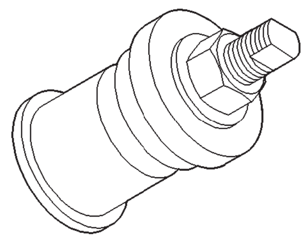
Installer L-4520



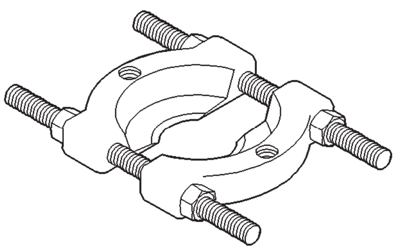
Remover/Installer 5049-A



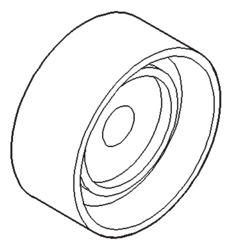
Thrust Button L-4539-2



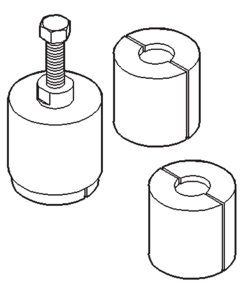
Installer 5050A



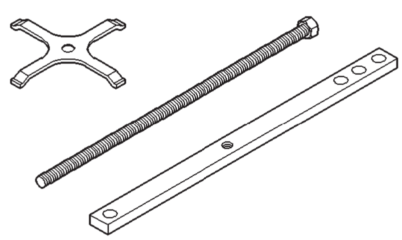
Bearing Splitter P-334



Installer 5052

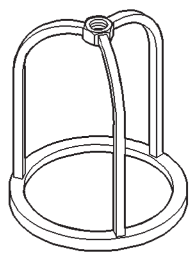


Puller Set 5048

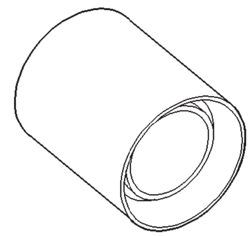


Compressor 5058A

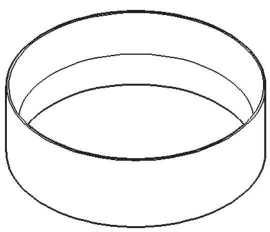
SPECIAL TOOLS (Continued)



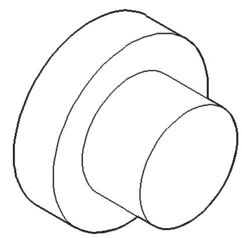
Compressor 5059-A



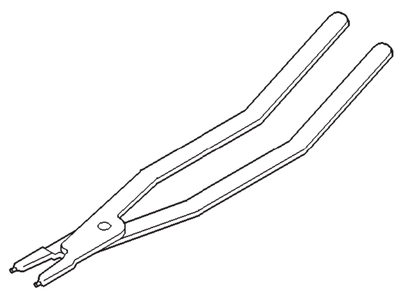
Installer 6053



Installer 5067



Button 6055



Pliers 6051

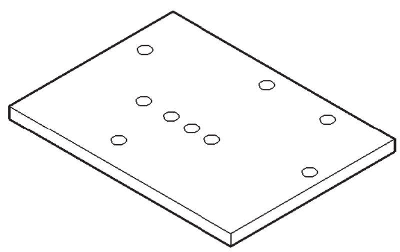
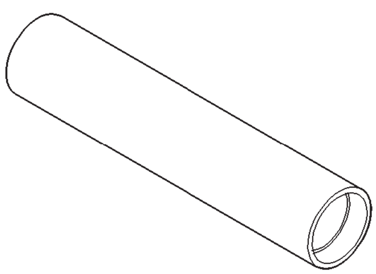
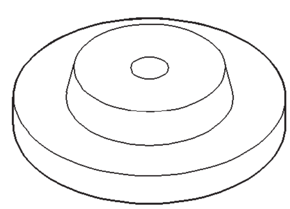


Plate 6056

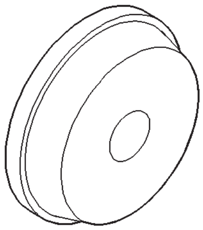


Installer 6052

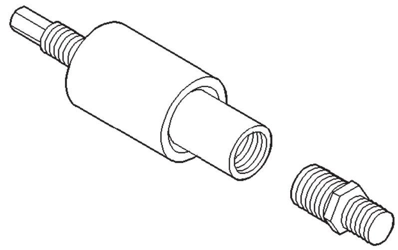


Disk 6057

SPECIAL TOOLS (Continued)



Installer 6061



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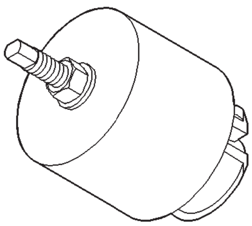
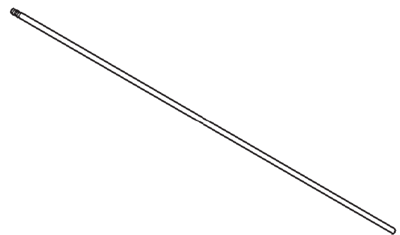
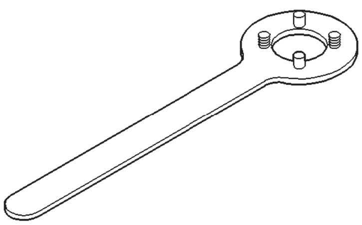


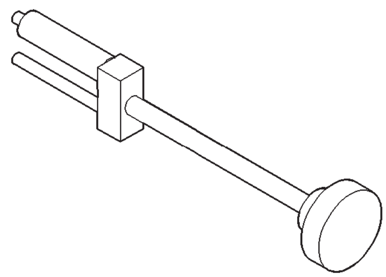
Remover 6062-A



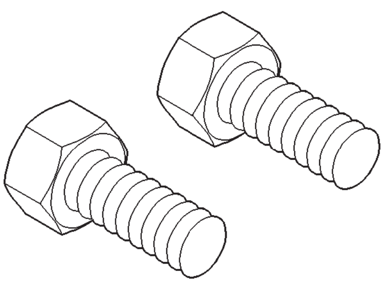
Tip 6268



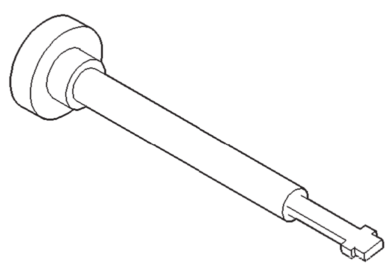
Holder 6259



Remover/Installer 6301

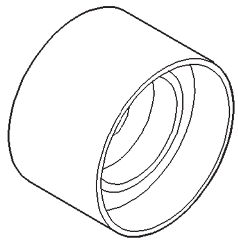


Bolt 6260

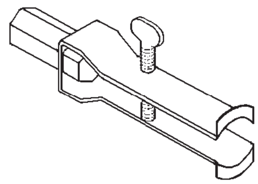


Remover/Installer 6302

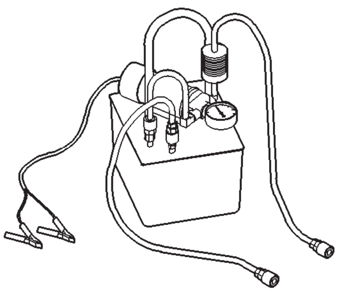
SPECIAL TOOLS (Continued)



Installer 6536-A



Puller 7794-A



Cooler Flusher 6906A

POWER TRANSFER UNIT

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GENERAL INFORMATION

POWER TRANSFER UNIT

The Power Transfer Unit (P.T.U.) is attached to a modified automatic transaxle case where the right half shaft extension housing would normally be located. The Transfer Unit provides the power to the rear wheels through a hypoid ring gear and pinion set.

The Power Transfer Unit is sealed from the transaxle and has its own oil sump. The Unit uses SAE 85W-90 gear lubricant and holds 1.15 liters (1.22 quarts).

The Power Transfer Unit fill plug is located on the end cover (Fig. 1). **Do not mistake the black plastic inspection plug located on the P.T.U. case for the fill plug.**

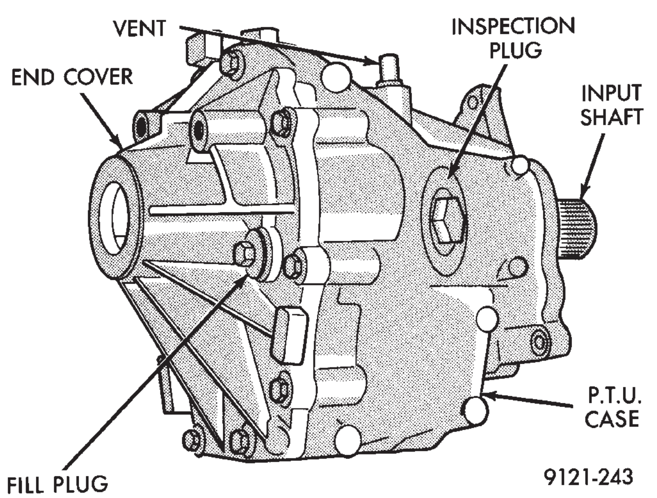


Fig. 1 Fill Plug Location

Service of the Power Transfer Unit is limited to:

- Seals
- Gaskets
- One ball bearing
- Output flange

If the ring gear and pinion, any tapered roller bearings, case, covers, or pinion carrier fail the entire unit must be replaced.

DIAGNOSIS AND TESTING

SEAL IDENTIFICATION

For accurate seal diagnosis, repair seal name and location is critical. Refer to (Fig. 2), (Fig. 3), (Fig. 4) and (Fig. 5) for correct seal name and location.

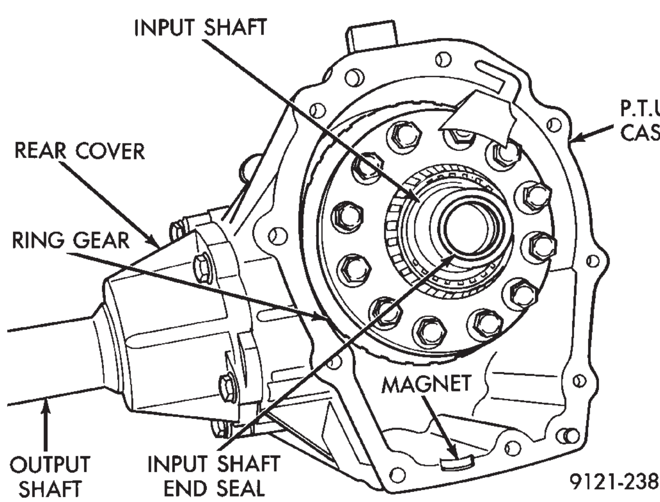
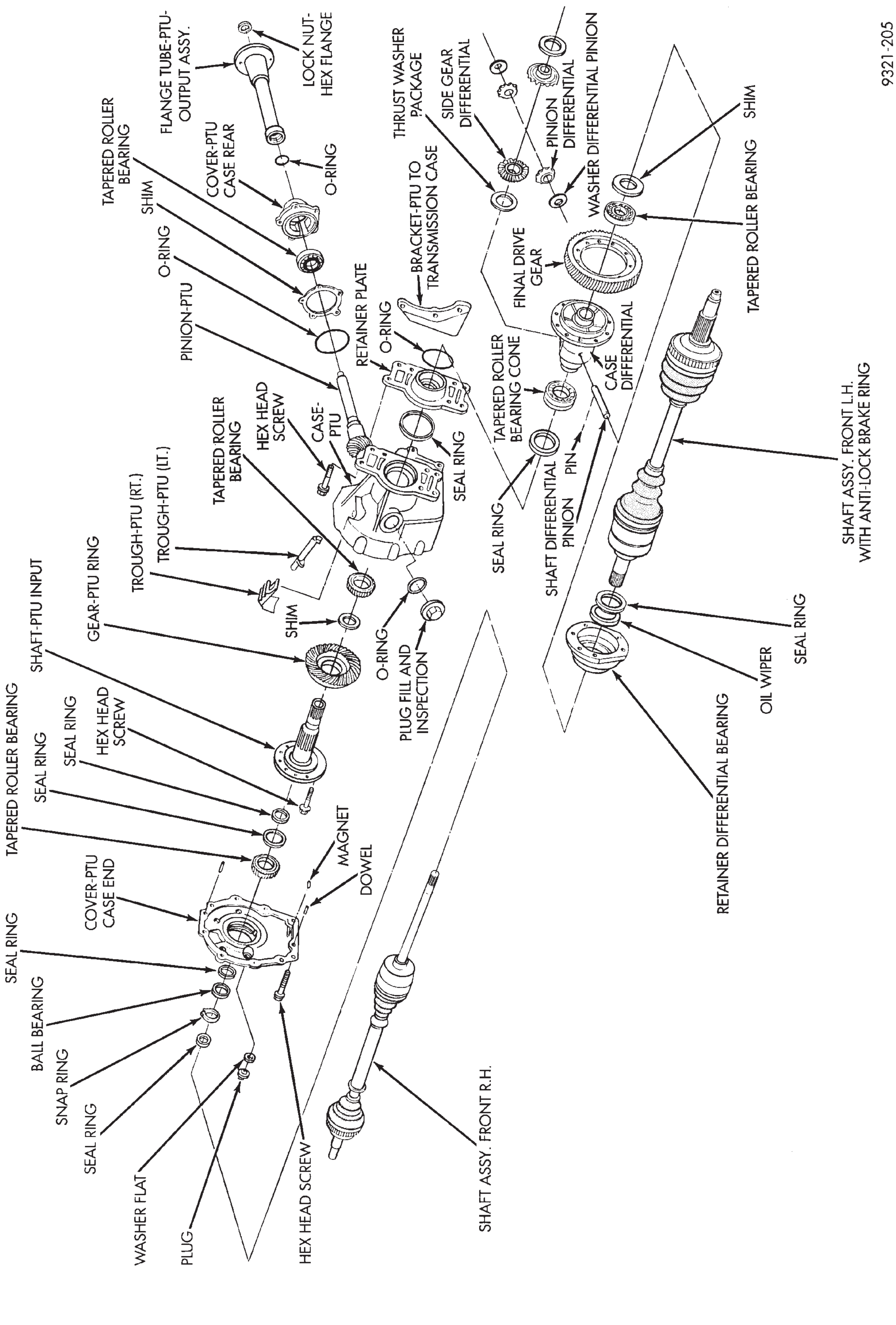


Fig. 2 Seal Location

DIAGNOSIS AND TESTING (Continued)



Power Transfer Unit Components

DIAGNOSIS AND TESTING (Continued)

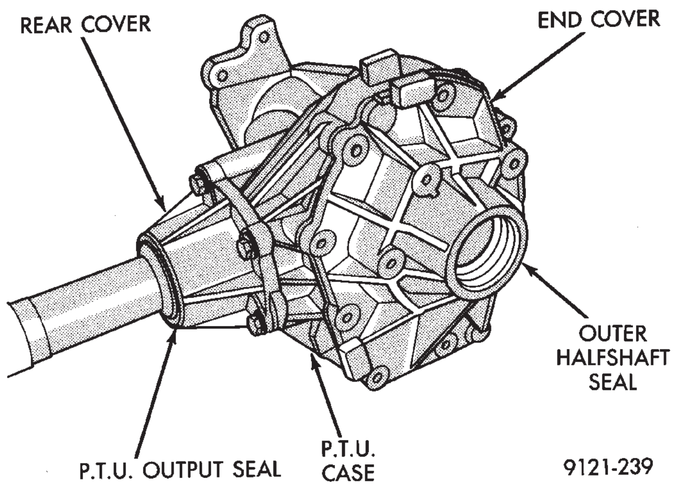


Fig. 3 Seal Location

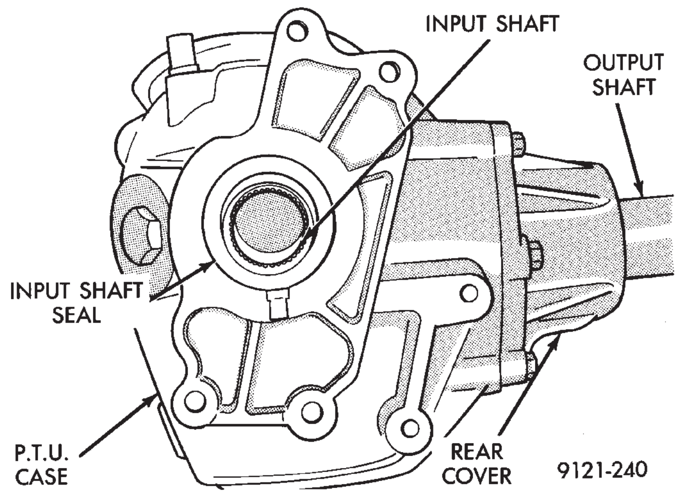


Fig. 4 Seal Location

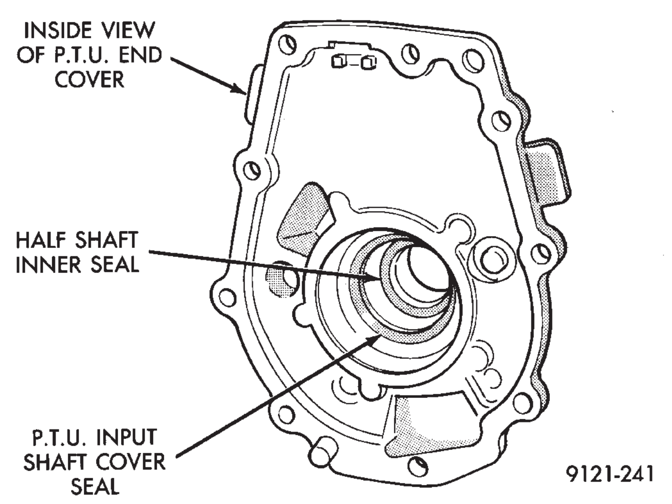


Fig. 5 Seal Location

FLUID LEAK DIAGNOSIS

When diagnosing fluid leaks on the Power Transfer Unit two weep holes are provided to diagnose certain seal leaks. These holes are located on the bottom side of the assembly (Fig. 6).

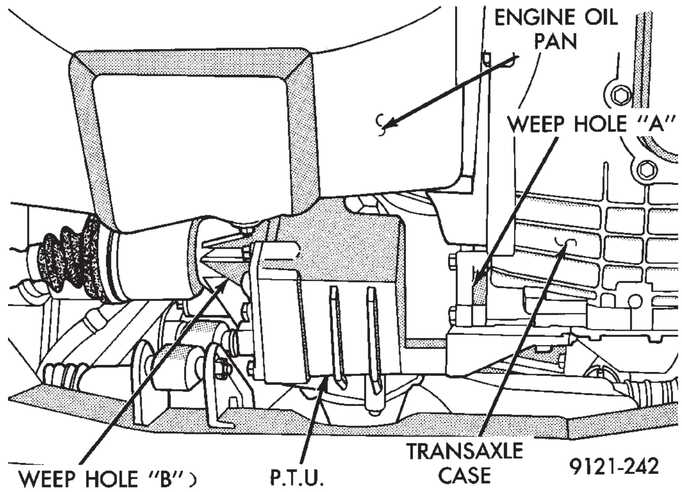


Fig. 6 Weep Hole Locations

If fluid leak is detected from either weep hole, seal replacement is necessary. **Do not attempt to repair the leak by sealing weep holes,** they must be kept clear of sealants for proper seal operation.

If fluid is leaking from weep hole A (Fig. 6) the type of fluid leaking will determine which seal needs to be replaced. If the fluid leaking is red in color (transmission fluid) this indicates that the Transmission differential carrier seal should be replaced. If the fluid leaking is light brown (gear lube) this indicates that the Power Transfer Unit input seal should be replaced. For replacement of these seals refer to Power Transfer Unit Service Procedures.

If fluid is leaking from weep hole B (Fig. 6) the type of fluid leaking will determine which seal is leaking. If the fluid leaking is red in color (transmission fluid) this indicates that the input shaft end seal should be replaced. If the fluid leaking is light brown (gear lube) this indicates that the half shaft inner seal and P.T.U. input shaft cover seal should be replaced. For replacement of these seals refer to Power Transfer Unit Service Procedures.

Before condemning any seal or gasket be sure that the rear rocker arm cover on the engine is not the cause of the oil leak. Oil leaking from the rocker arm cover is easily mistaken for a leaking Power Transfer Unit.

REMOVAL AND INSTALLATION

POWER TRANSFER UNIT (P.T.U.)

REMOVAL

(1) Raise vehicle and remove front wheels.

REMOVAL AND INSTALLATION (Continued)

CAUTION: A certain amount of oil will drain out of the transaxle when the drive shaft is removed.

(2) Remove right front drive shaft. Install a plug into the right driveshaft seal hole. Refer to Group 2, Suspension to remove or install wheel hub nut and right drive shaft.

(3) Mark propeller shaft front flange.

(4) Separate propeller shaft from P.T.U. assembly (Fig. 7).

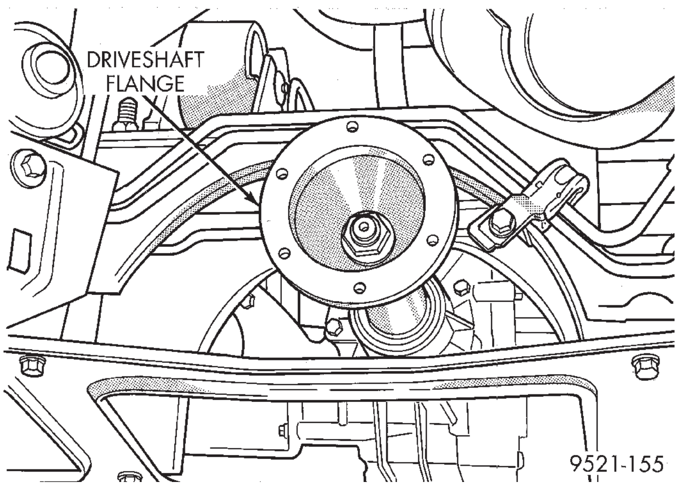


Fig. 7 Driveshaft Flange

CAUTION: Do not let propeller shaft to hang freely. Damage to the shaft will occur.

(5) Suspend propeller shaft from underbody of vehicle.

(6) Remove cradle plate (Fig. 8).

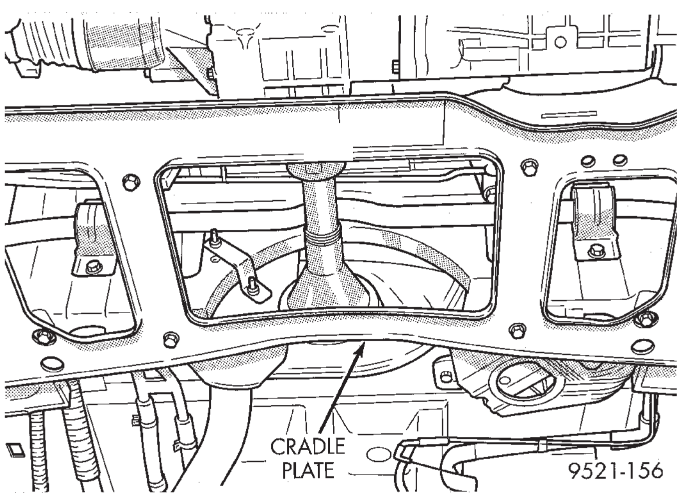


Fig. 8 Cradle Plate

(7) Remove the Power Transfer Unit mounting bracket bolts at the rear of the unit (Fig. 9).

(8) Remove the right outboard support bracket and bolts near the right axle shaft.

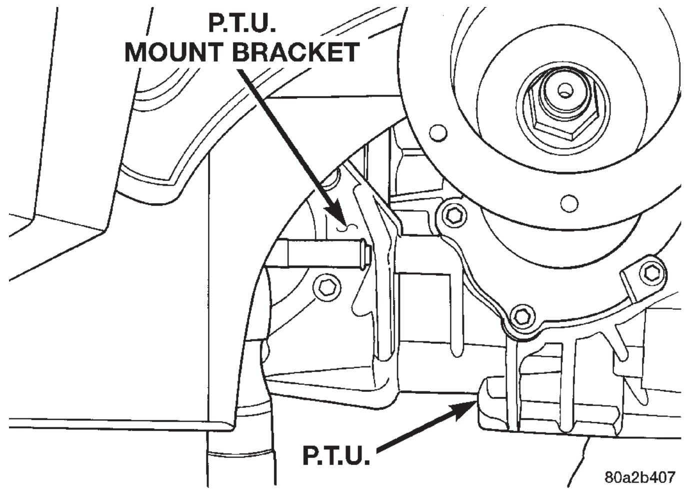


Fig. 9 Remove Rear P.T.U Bracket Bolts

(9) Remove the four mounting bolts for the P.T.U. (Fig. 10) and (Fig. 11).

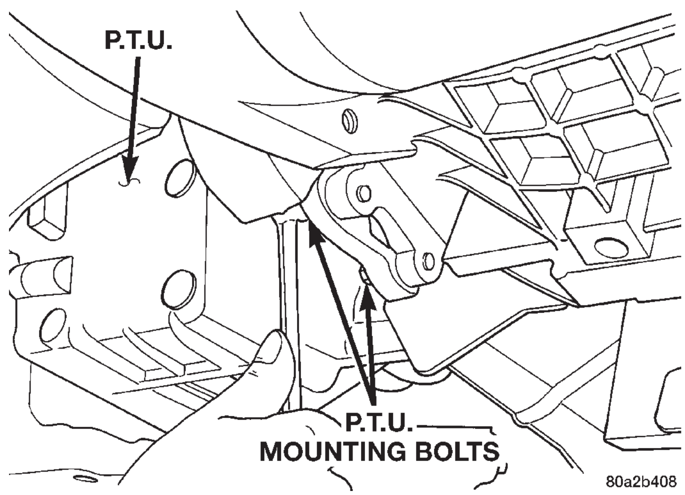


Fig. 10 P.T.U. Lower Mounting Bolts

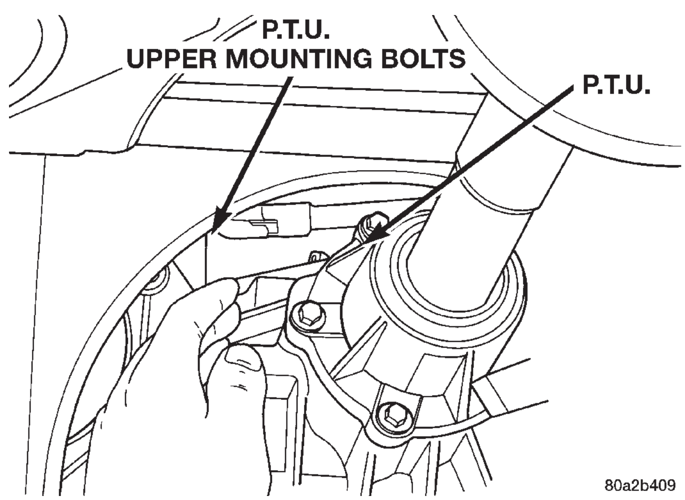


Fig. 11 P.T.U. Upper Mounting Bolts

(10) Remove P.T.U. assembly from vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) To install, reverse removal procedure. Check transaxle fluid and P.T.U. fluid and fill to level.

(2) Refer to the Specifications section for the proper torque specifications.

END COVER SEAL

The Power Transfer Unit must be removed from the vehicle to perform this operation. Refer to Power Transfer Unit Removal in this section for procedures.

(1) Remove P.T.U. end cover bolts (Fig. 12).

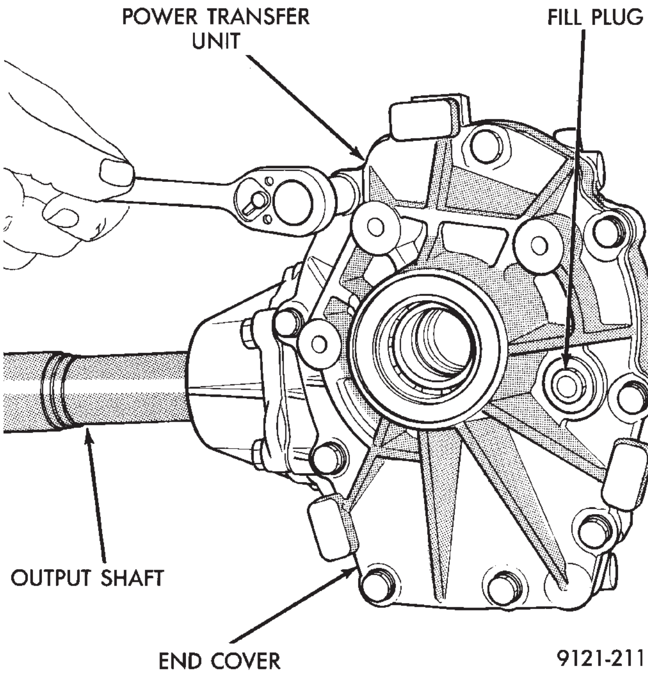


Fig. 12 P.T.U. End Cover Bolts

(2) Gently tap on end cover ears with a hammer to separate end cover from the case (Fig. 13).

(3) Clean and inspect sealer surfaces.

(4) Apply Mopar® Gasket Maker, Loctite Gasket Eliminator No.518 or equivalent to sealing surfaces.

(5) Reinstall cover and tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 14). Retighten first bolt after all others are tight.

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

(6) Reinstall P.T.U. into vehicle.

(7) Check and fill fluids as required.

INPUT SHAFT SEAL

The Power Transfer Unit must be removed from the vehicle to service this seal. Refer to Power Transfer Unit Removal in this section for procedures.

REMOVAL

(1) Remove P.T.U. end cover bolts (Fig. 15).

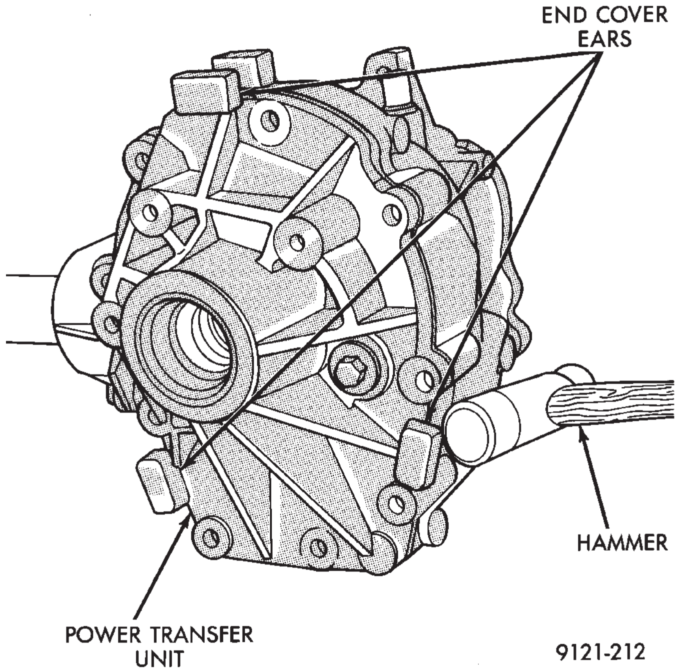


Fig. 13 End Cover Removal

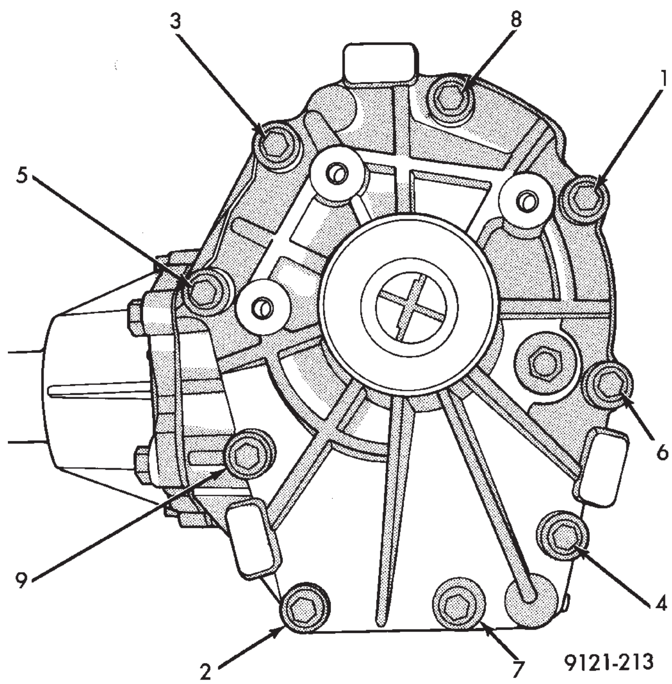


Fig. 14 Bolt Tightening Sequence

(2) Gently tap on end cover ears to separate cover from case (Fig. 16).

(3) Remove ring gear oil trough (Fig. 17).

(4) Remove input shaft and ring gear from case (Fig. 18).

(5) Use Special Tool No. 7794-A (seal puller) to remove seal (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

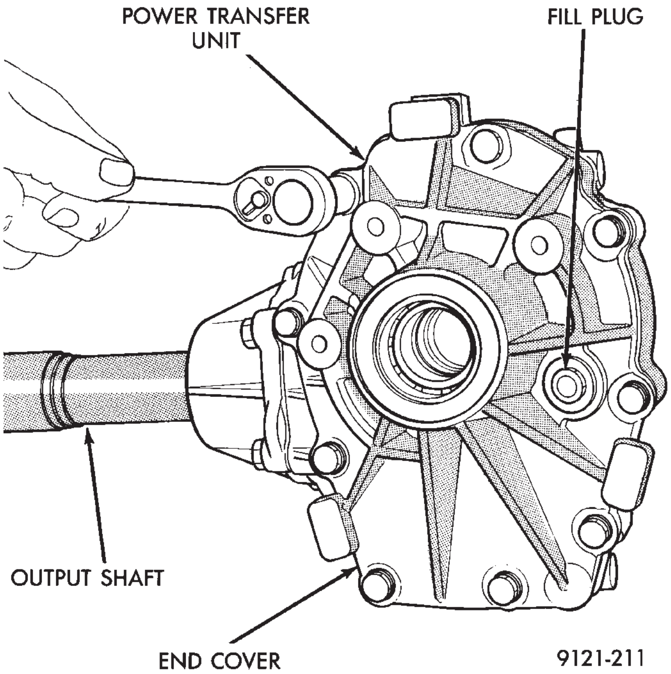


Fig. 15 P.T.U. End Cover Bolts

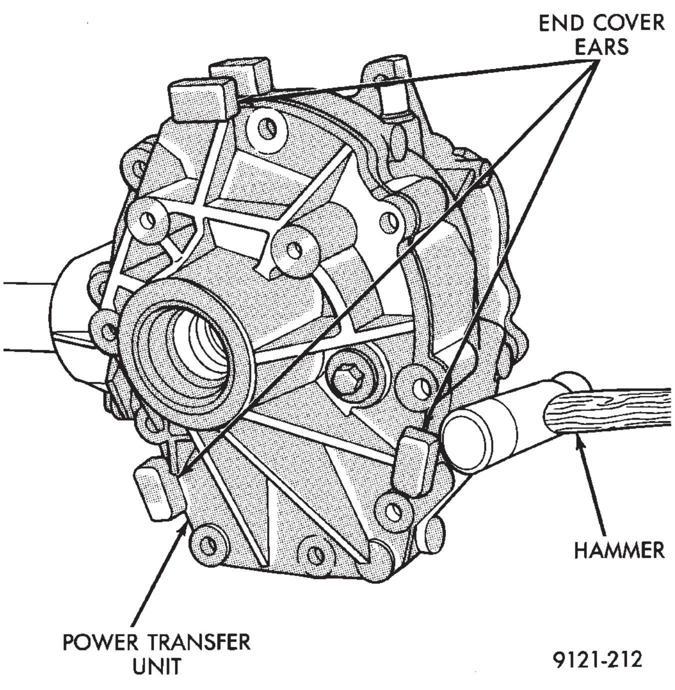


Fig. 16 End Cover Removal

INSTALLATION

(1) Clean and inspect seal area.

(2) Lay housing on bench and install new seal with seal driver C-4657 and handle C-4171 (Fig. 20). The seal must be installed with the spring side facing towards the ring gear. Drive the seal in until it bottoms against the case shoulder.

(3) Install input shaft.

(4) Install oil trough.

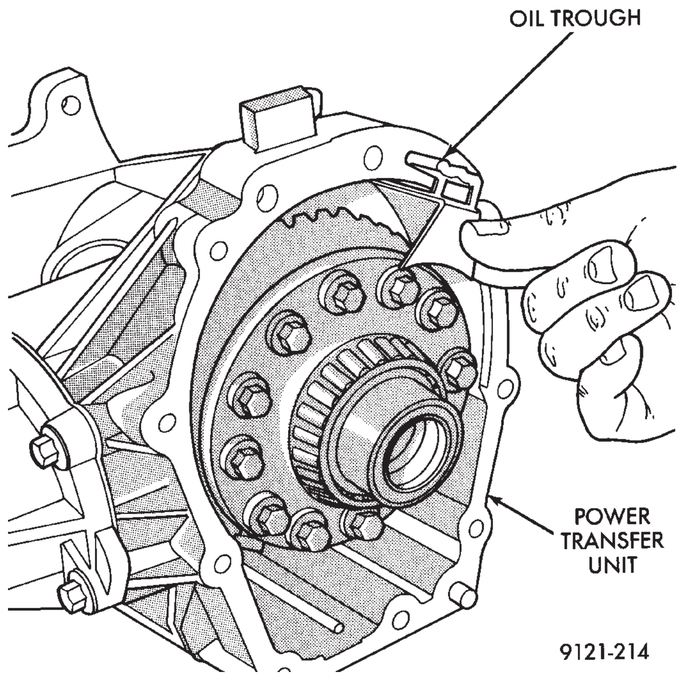


Fig. 17 Oil Trough

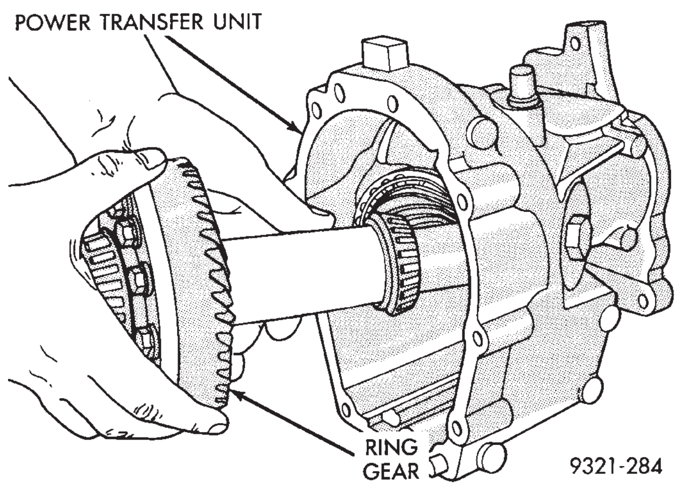


Fig. 18 Input Shaft and Ring Gear Removal

(5) Apply Mopar® Gasket Maker or equivalent to sealing surfaces of end cover and reinstall. Tighten bolts to 28 N·m (250 in. lbs.).

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

(6) Reinstall P.T.U. assembly into vehicle.

(7) Check and fill fluids as required.

DIFFERENTIAL CARRIER SEAL

The Power Transfer Unit must be removed from the vehicle to replace this seal.

REMOVAL

(1) Remove P.T.U. from vehicle.

REMOVAL AND INSTALLATION (Continued)

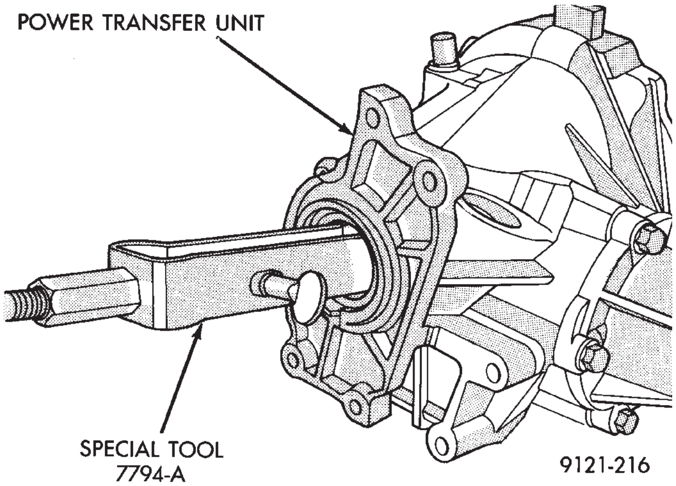


Fig. 19 Seal Removal

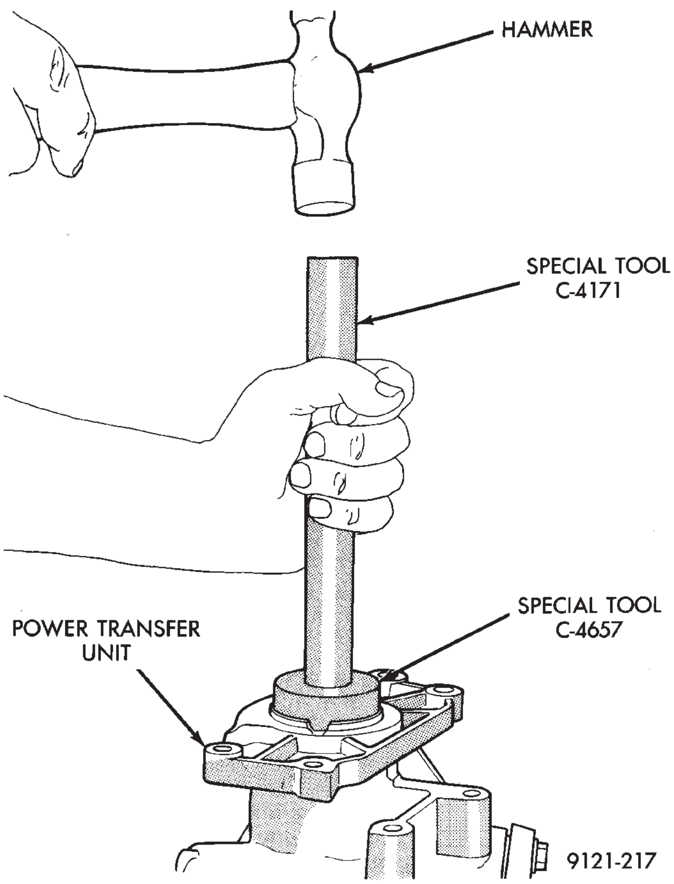


Fig. 20 Seal Installation

(2) Use a pry bar to remove seal from retainer plate (Fig. 21). Be careful not to damage seal journal when removing seal.

INSTALLATION

(1) Using a large socket, carefully install new seal. The spring side of the seal must face the transaxle differential.

(2) Reinstall the P.T.U. into the vehicle.

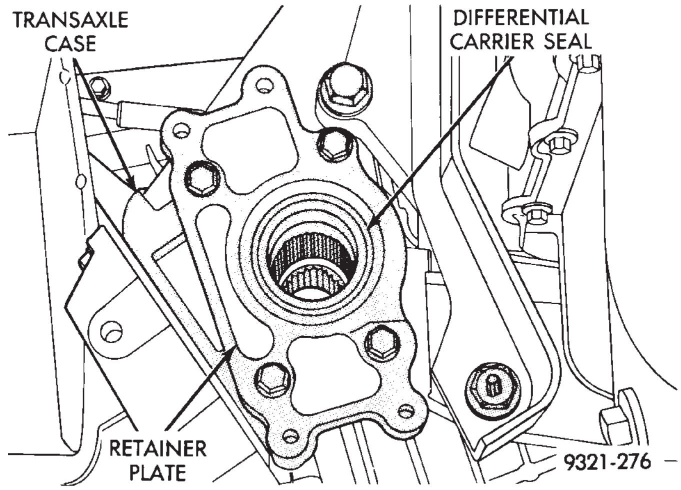


Fig. 21 Transaxle Differential Carrier Seal

(3) Check and fill fluids as required.

REAR COVER O-RING

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove rear cover retaining bolts (Fig. 22).

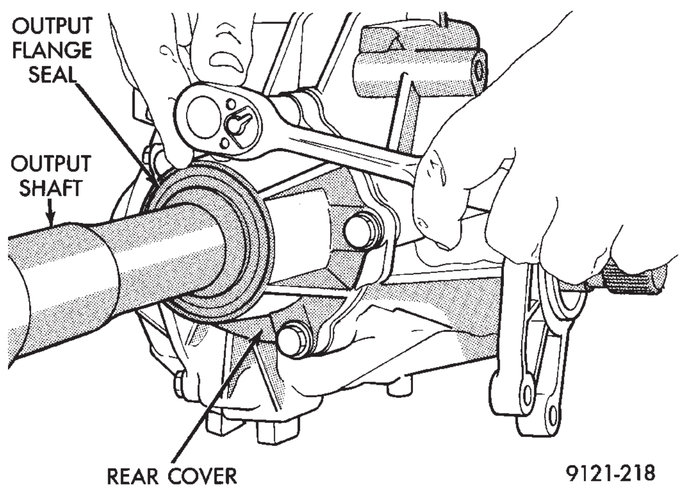


Fig. 22 Rear Cover Bolts

(3) Index rear cover to the case for later reassembly (Fig. 23).

(4) Pull rear cover out of the P.T.U. case (Fig. 24).

(5) Remove rear cover O-Ring (Fig. 25).

INSTALLATION

(1) To install, reverse removal procedure.

POWER TRANSFER UNIT OUTPUT SEAL

The power transfer unit must be removed from the vehicle to replace this seal.

REMOVAL AND INSTALLATION (Continued)

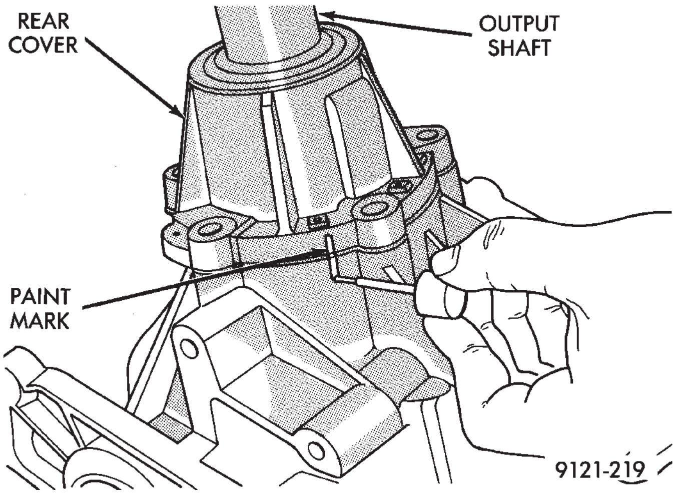


Fig. 23 Mark Rear Cover

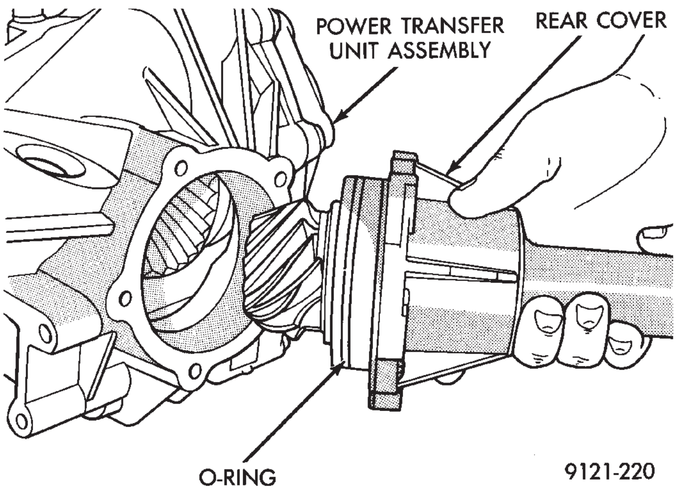


Fig. 24 Rear Cover Removal

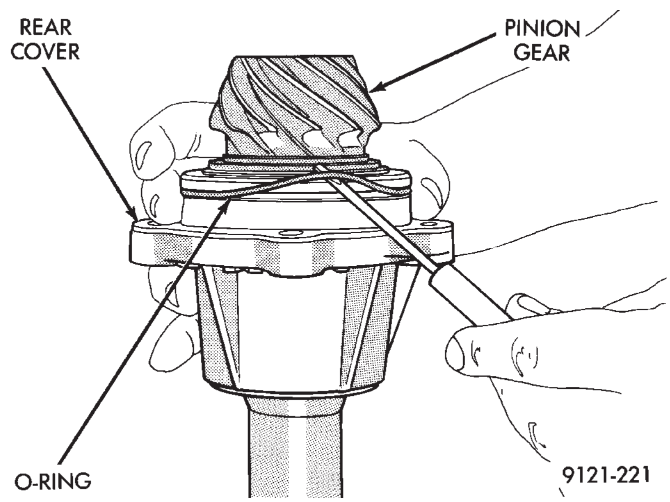


Fig. 25 O-Ring Removal

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove propeller shaft.

(3) Remove rear cover retaining bolts (Fig. 26).

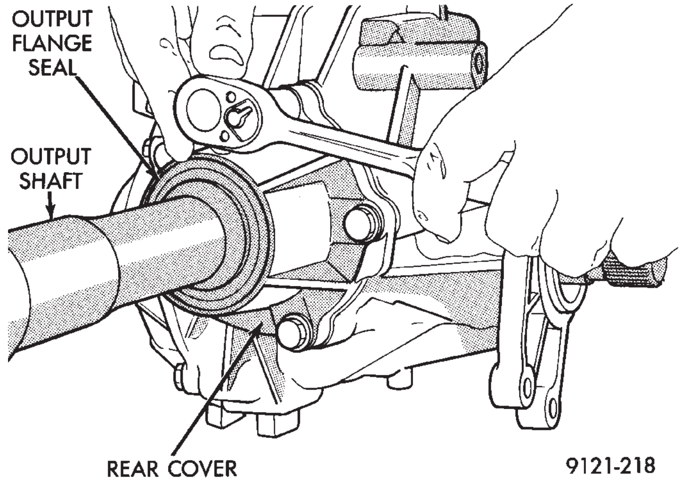


Fig. 26 Rear Cover Bolts

(4) Index rear cover to the case for later reassembly (Fig. 27).

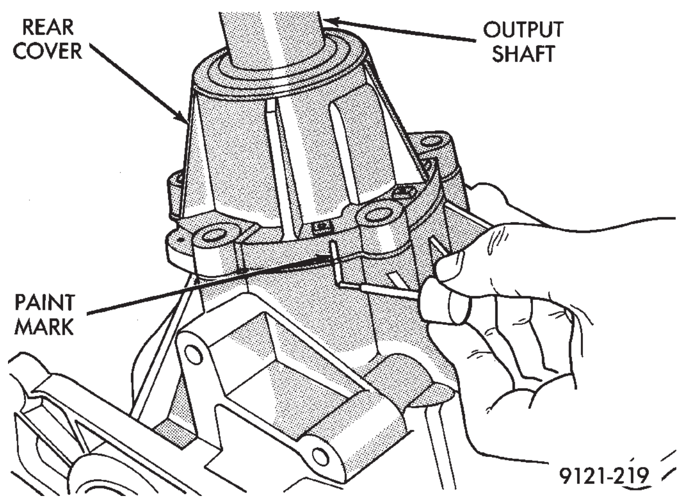


Fig. 27 Mark Rear Cover

(5) Pull rear cover out of the P.T.U. case (Fig. 28).

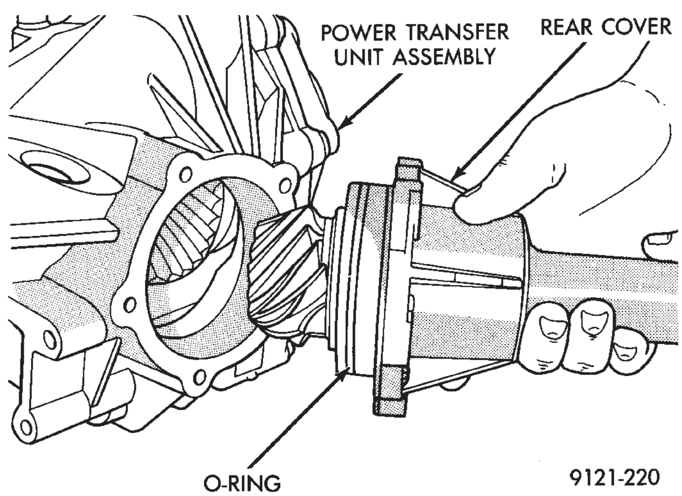


Fig. 28 Rear Cover Removal

REMOVAL AND INSTALLATION (Continued)

(6) Remove output flange nut (Fig. 29).

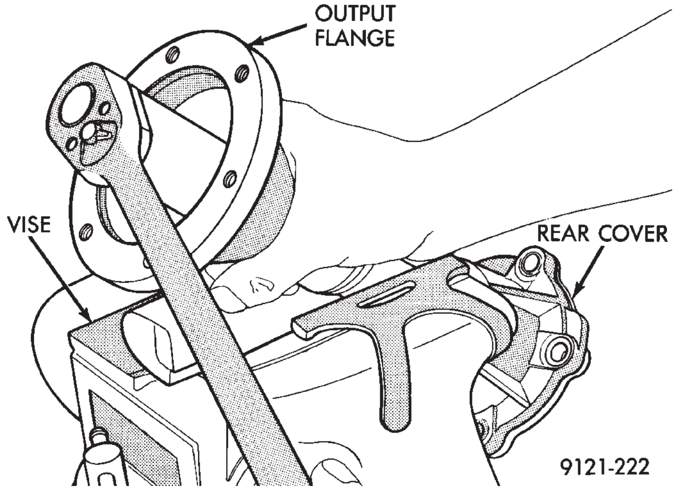


Fig. 29 Output Flange Nut

(7) Index the pinion to the flange (Fig. 30).

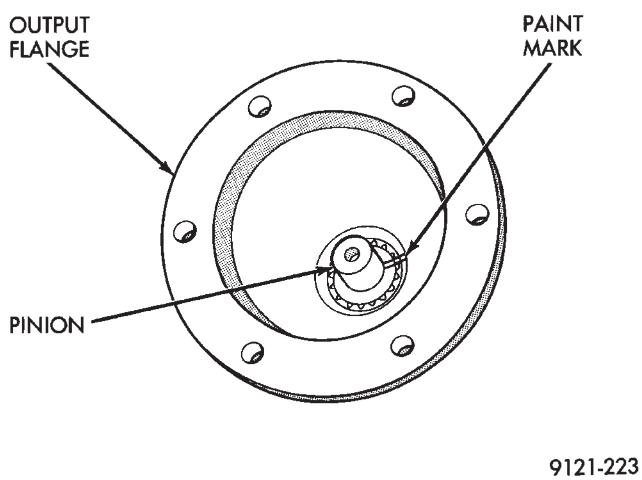


Fig. 30 Mark Flange and Shaft

(8) Using a hydraulic press, press off output flange from pinion.

(9) Use a hammer and chisel to remove output seal (Fig. 31).

CAUTION: If the output flange requires replacement, a new shim may be required. Refer to Output Flange Shim Selection procedure in this section to determine correct shim requirements.

INSTALLATION

(1) Install new seal with Seal Installer 5049 (Fig. 32).

(2) If the original flange is used, align index marks and press flange onto pinion. If a new flange is used disregard the alignment marks on the pinion and press flange onto the pinion.

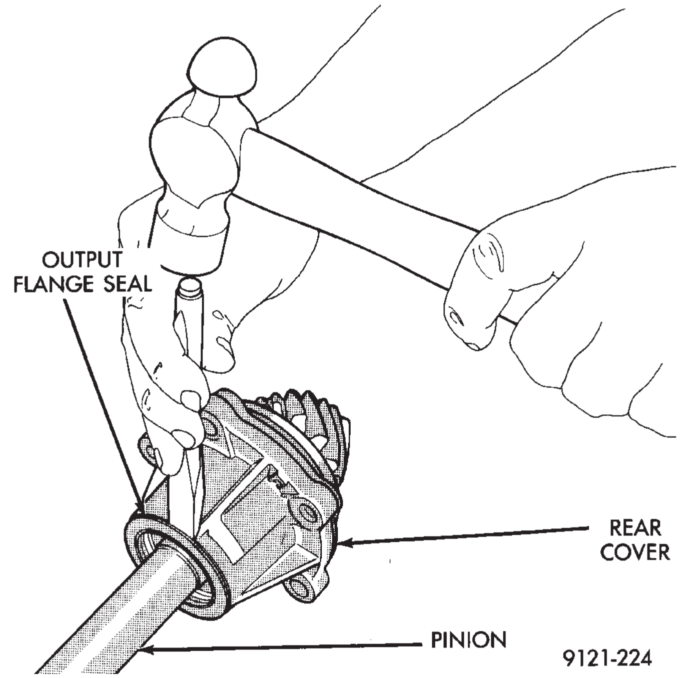


Fig. 31 Seal Removal

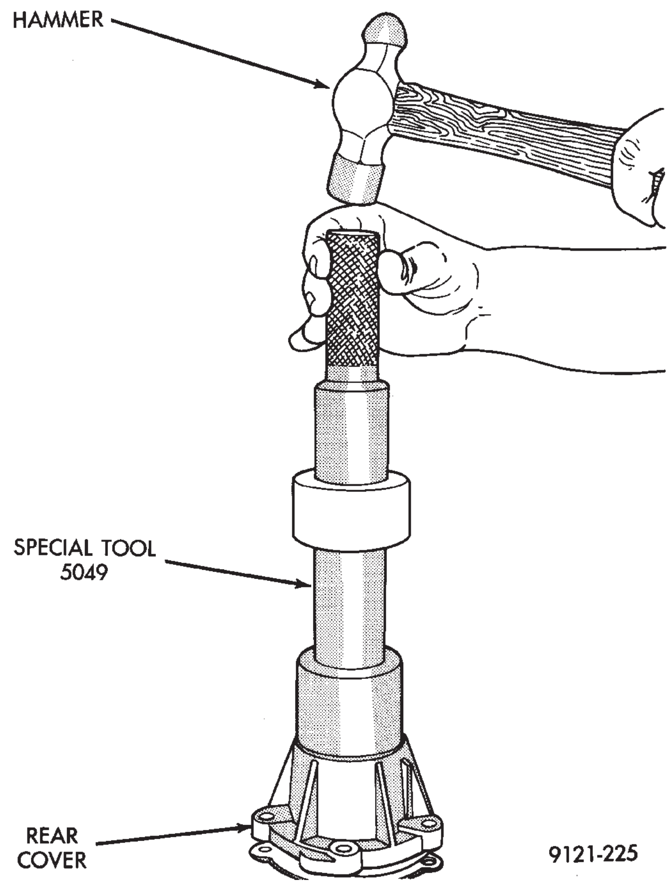


Fig. 32 Seal Installation

(3) Install flange nut and tighten to 244 N·m (180 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

(4) Install rear cover. Use care not to cut rear cover O-Ring when installing rear cover into P.T.U. housing.

(5) Install rear cover retaining bolts and tighten to 28 N·m (250 in. lbs.).

(6) Install propeller shaft.

(7) Check and fill fluids as required.

INPUT SHAFT COVER SEAL

The power transfer unit input shaft cover seal is the larger of the two seals located on the inside of the end cover. The differential bearing cup must be removed to service this seal.

The Power Transfer Unit must be removed from vehicle to perform this operation.

REMOVAL

(1) Remove P.T.U. end cover bolts (Fig. 33).

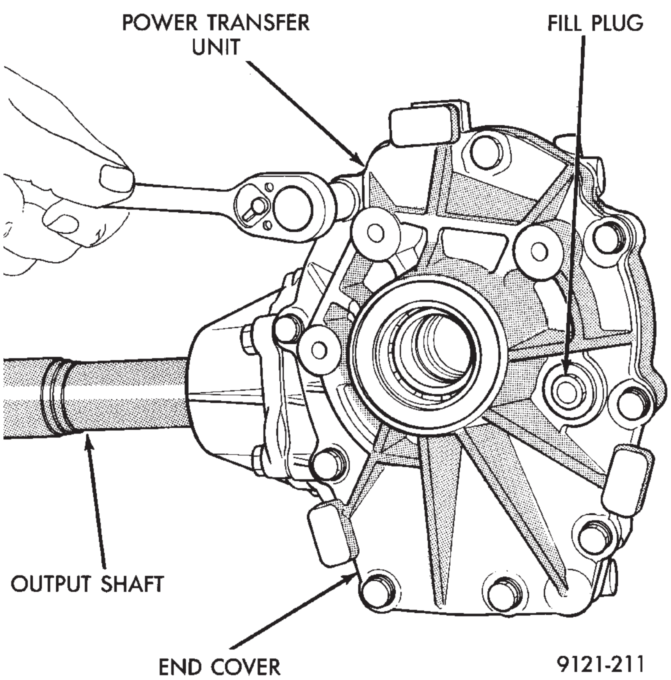


Fig. 33 P.T.U. End Cover Bolts

(2) Gently tap on end cover ears to separate cover from case (Fig. 34).

(3) Use special tool No. 6514 and remove the differential bearing race located in the end cover (Fig. 35). The race must be removed to gain access to the seal.

(4) Use special tool No. 7794-A to remove seal (Fig. 36).

INSTALLATION

(1) Clean and inspect seal area.

(2) Use special tool No. MD998803 and install seal (Fig. 37). When installing seal the spring side of the seal must face toward the special tool.

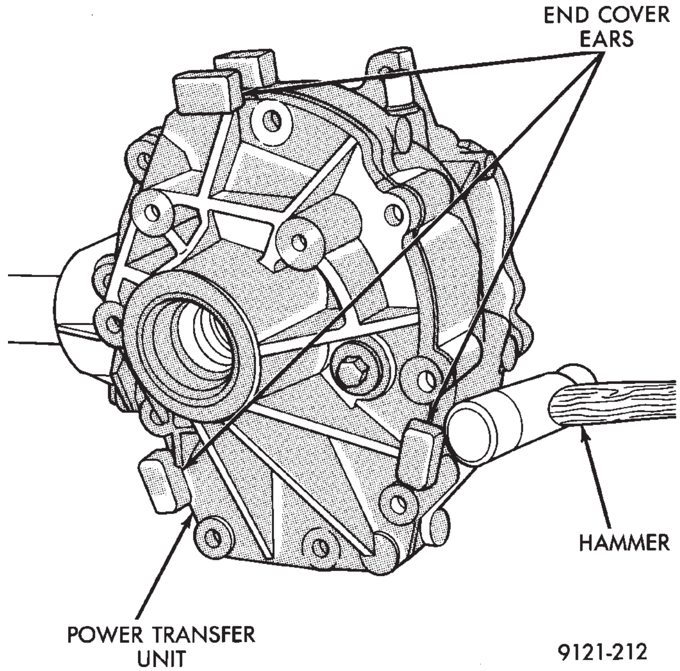


Fig. 34 End Cover Removal

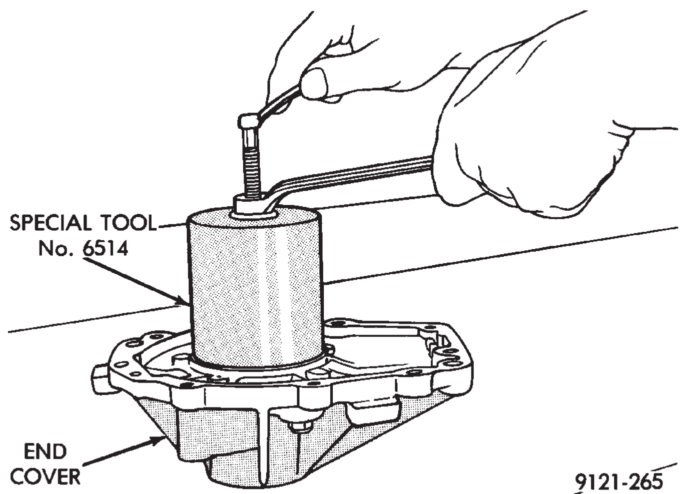


Fig. 35 Bearing Race Removal

(3) Reinstall the original bearing race and shim using special tool No. 6522 (Fig. 38) and (Fig. 39).

CAUTION: The original shim must be installed behind the bearing cup to maintain proper bearing preload.

(4) Apply Mopar® Gasket Maker, Loctite Gasket Eliminator No. 518 or equivalent to sealing surfaces of end cover.

(5) Place end cover onto P.T.U. case and install bolts. Tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 40). Retighten first bolt after all others are tight.

REMOVAL AND INSTALLATION (Continued)

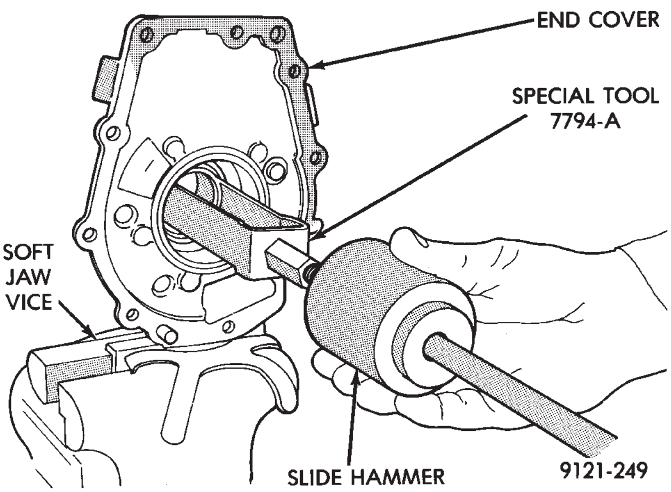


Fig. 36 Seal Removal

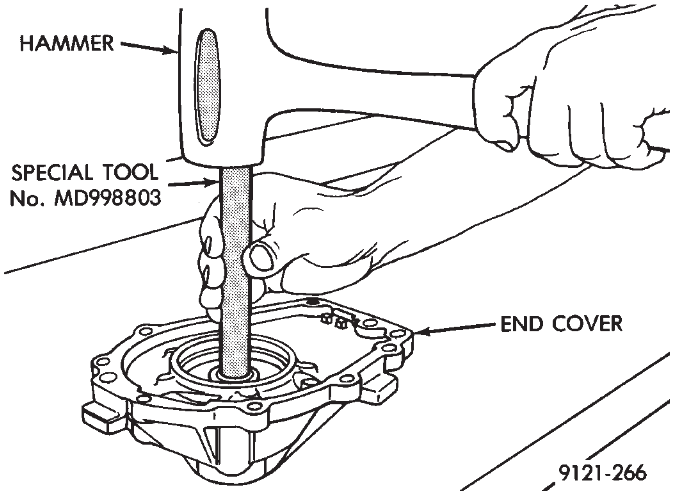


Fig. 37 Seal Installation

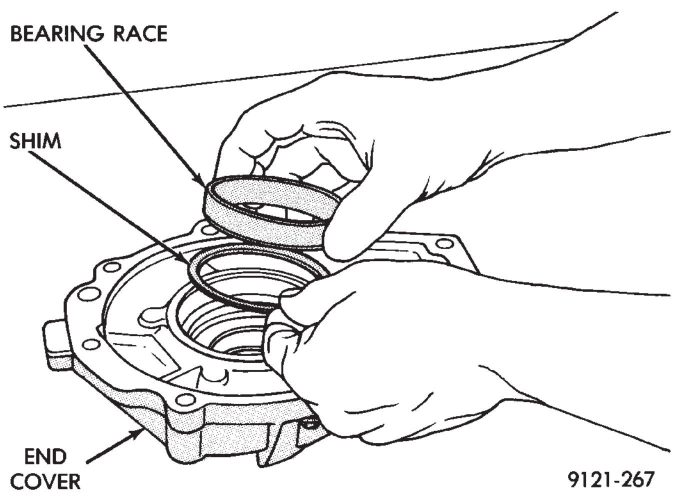


Fig. 38 Bearing Shim and Race

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

(6) Reinstall P.T.U. assembly into vehicle.

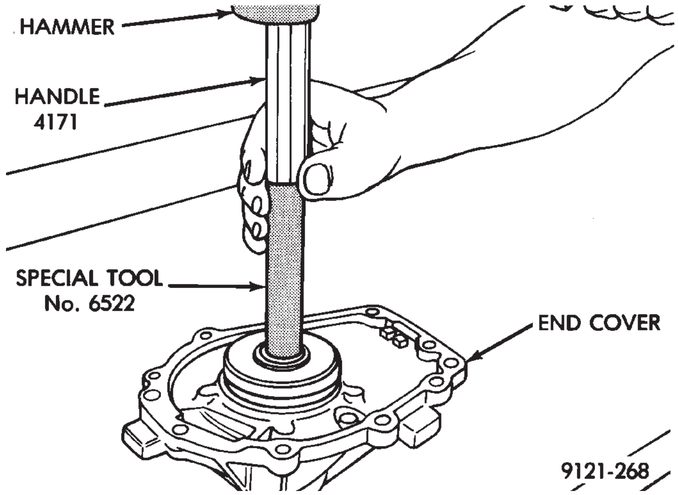


Fig. 39 Installing Bearing Race

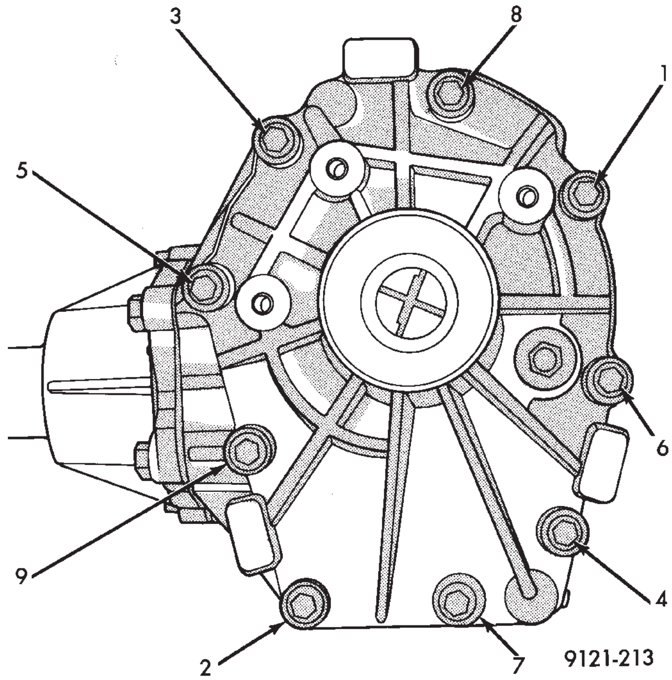


Fig. 40 Bolt Tightening Sequence

(7) Check and fill fluids as required.

HALF SHAFT INNER SEAL

The power transfer unit half shaft inner seal is the smaller of the two seals located on the inside of the end cover.

REMOVAL

(1) Remove power transfer unit from the vehicle.

(2) Remove end cover bolts (Fig. 41).

(3) Tap on end cover ears to separate cover from case (Fig. 42).

(4) Drive seal out with a hammer and small chisel (Fig. 43).

REMOVAL AND INSTALLATION (Continued)

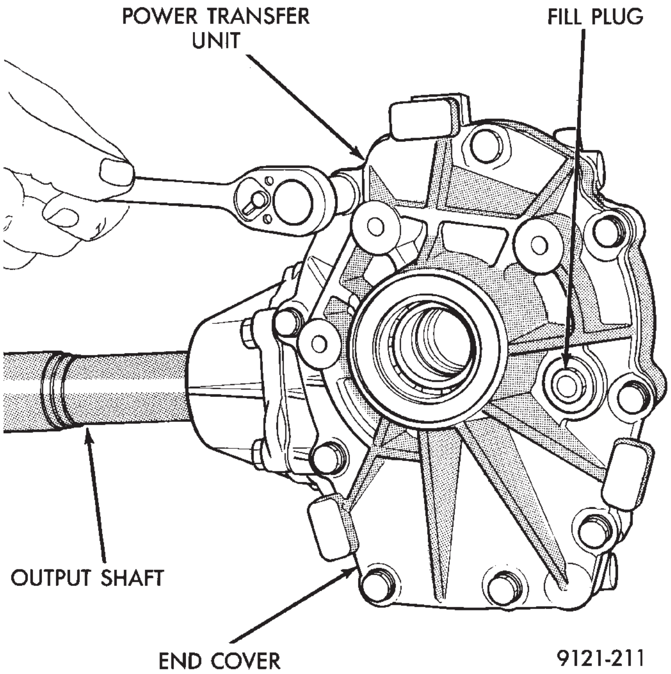


Fig. 41 End Cover Bolts

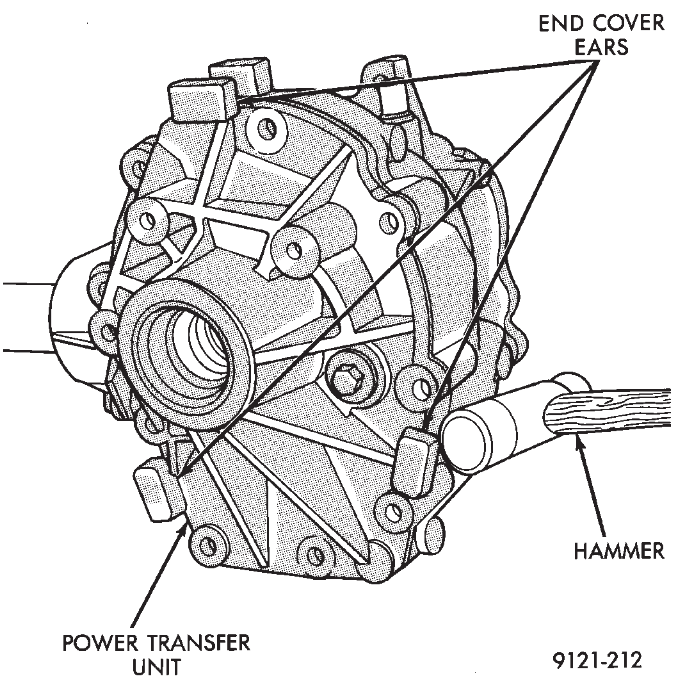


Fig. 42 End Cover Removal

INSTALLATION

(1) Clean and inspect seal area.

(2) Install seal with a 1 1/16 inch socket (Fig. 44). The seal must be installed with the spring side of the seal facing end cover ball bearing. The seal will bottom against a machined shoulder in the cover.

(3) Clean sealing surfaces of the end cover and P.T.U. case. Apply a bead of Mopar® Gasket Maker, Loctite Gasket Eliminator No. 518 or equivalent.

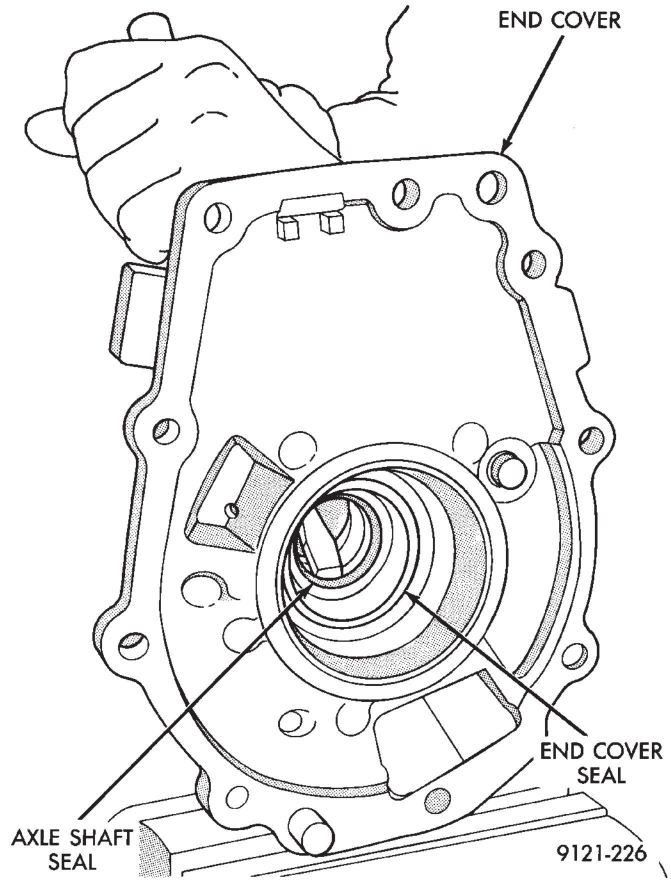


Fig. 43 Seal Removal

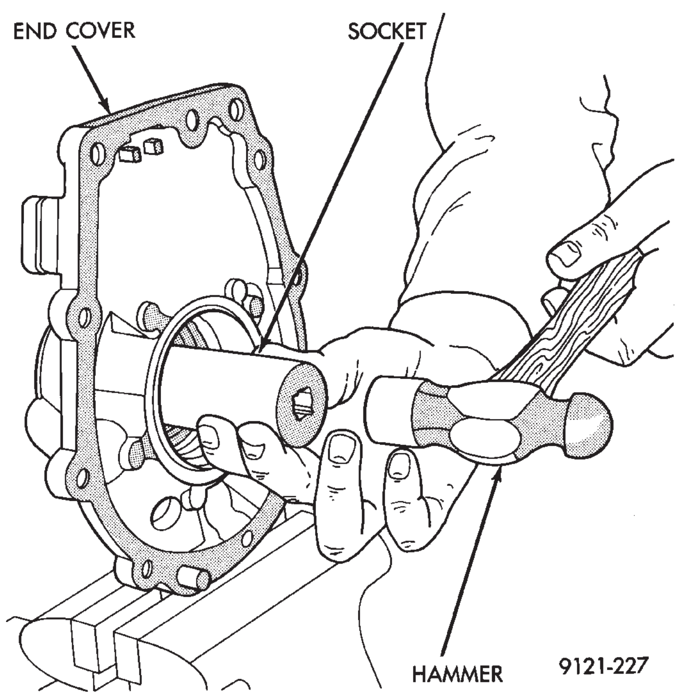


Fig. 44 Seal Installation

(4) Place end cover onto P.T.U. case and install bolts. Tighten bolts to 28 N·m (250 in. lbs.) in the

REMOVAL AND INSTALLATION (Continued)

sequence shown in (Fig. 45). Retighten first bolt after all other bolts are tight.

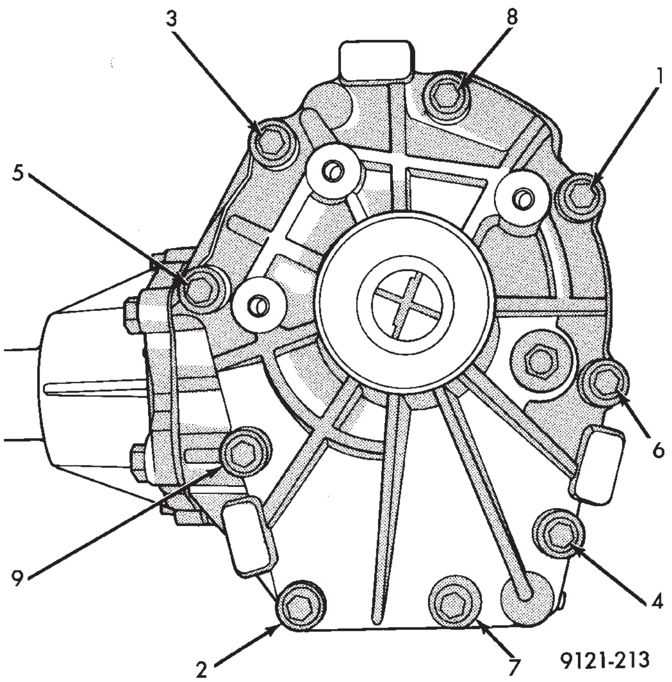


Fig. 45 Bolt Tightening Sequence

(5) Reinstall P.T.U. assembly.
(6) Check and fill fluids as required.

INPUT SHAFT END SEAL

The input shaft end seal is located on the end of the input shaft.

REMOVAL

(1) Remove power transfer unit from the vehicle.
(2) Remove end cover bolts (Fig. 46).
(3) Tap on end cover ears to separate end cover from case (Fig. 47).
(4) Pry out seal with a pry bar (Fig. 48).

INSTALLATION

(1) Clean and inspect seal area.
(2) Remove input shaft from housing and stand on soft block of wood. Install input shaft end seal with seal installer 5065 and handle C-4171.
(3) Lubricate seal lip after installing seal into input shaft.
(4) Clean sealing surfaces of the end cover and P.T.U. case. Apply a bead of Mopar® Gasket Maker, Loctite Gasket Eliminator No. 518 or equivalent.
(5) Place end cover onto P.T.U. case and install bolts. Tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 49). Retighten first bolt after all others are tight.

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

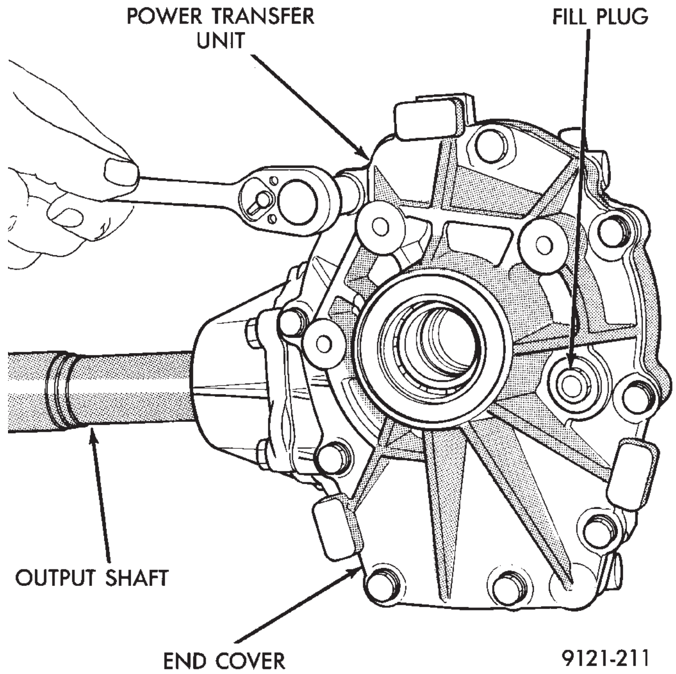


Fig. 46 End Cover Bolts

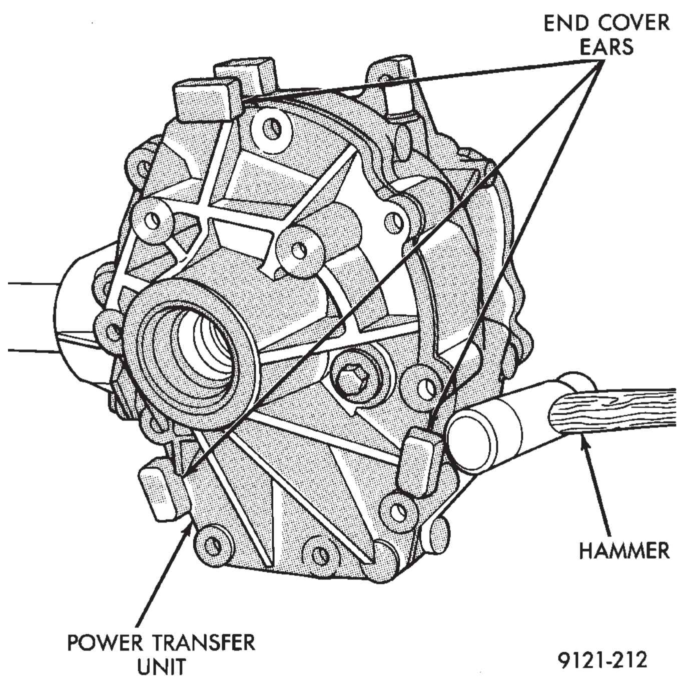


Fig. 47 Side Cover Removal

(6) Reinstall P.T.U. assembly.
(7) Check and fill fluids as required.

OUTER HALF SHAFT SEAL

The outer half shaft seal is located on the outside of the end cover. The P.T.U. does not have to be removed to replace this seal.

REMOVAL AND INSTALLATION (Continued)

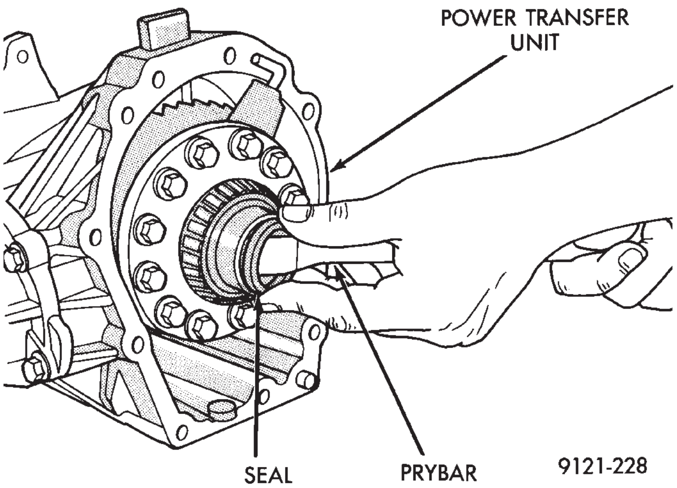


Fig. 48 Seal Removal

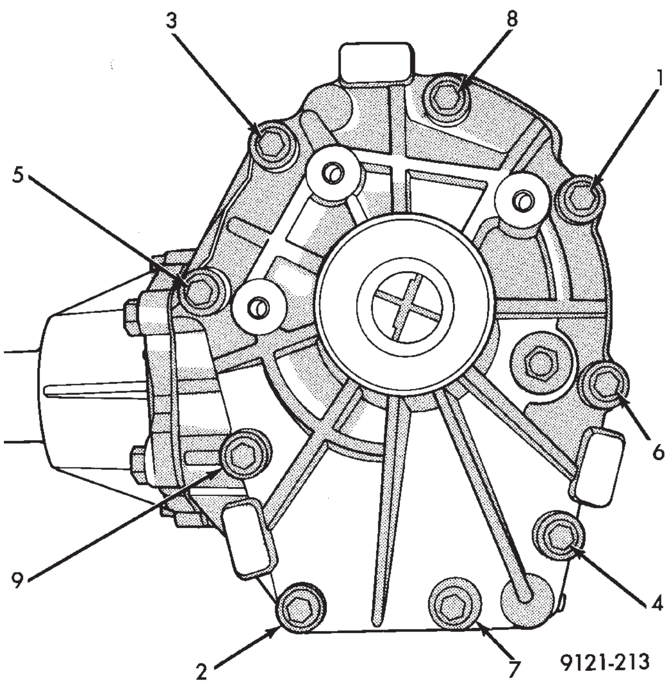


Fig. 49 Bolt Tightening Sequence

REMOVAL

(1) Lift vehicle on hoist.

(2) Remove right front half shaft from vehicle.

(3) Remove seal with a chisel and hammer (Fig. 50).

INSTALLATION

(1) Clean and inspect seal area.

(2) Install new seal with seal installer MD998334 (Fig. 51).

(3) Reinstall right front half shaft.

(4) Check and fill fluids as required.

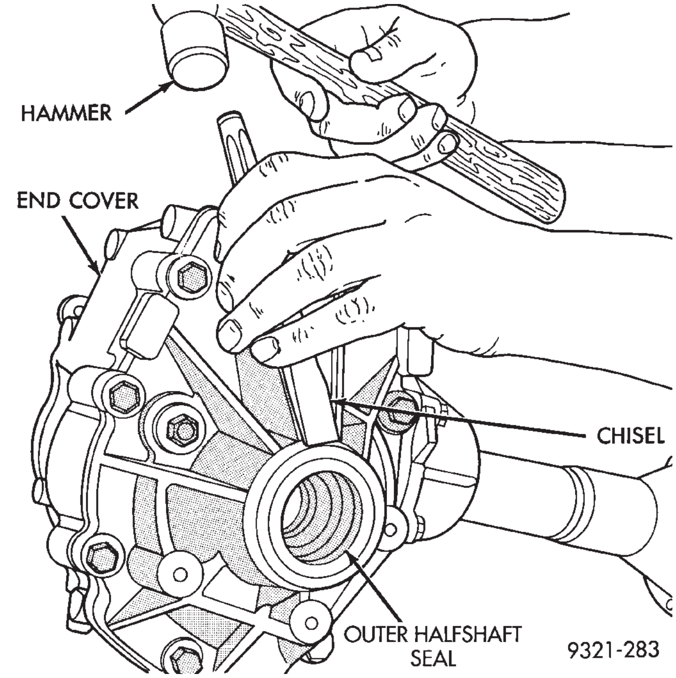


Fig. 50 Seal Removal

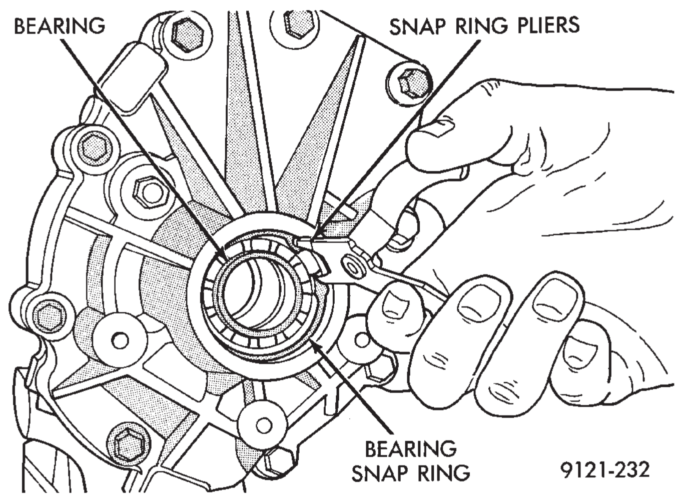


Fig. 51 Seal Installation

END COVER BALL BEARING

The end cover ball bearing can be removed and installed without removing the Power Transfer Unit from the vehicle. When replacing the bearing the output seal must be removed to gain access to the bearing.

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove right front half shaft from vehicle.

(3) Remove output seal with a hammer and chisel (Fig. 52).

(4) Remove bearing retaining snap ring (Fig. 53).

(5) Use bearing puller MD998346 to remove bearing (Fig. 54).

REMOVAL AND INSTALLATION (Continued)

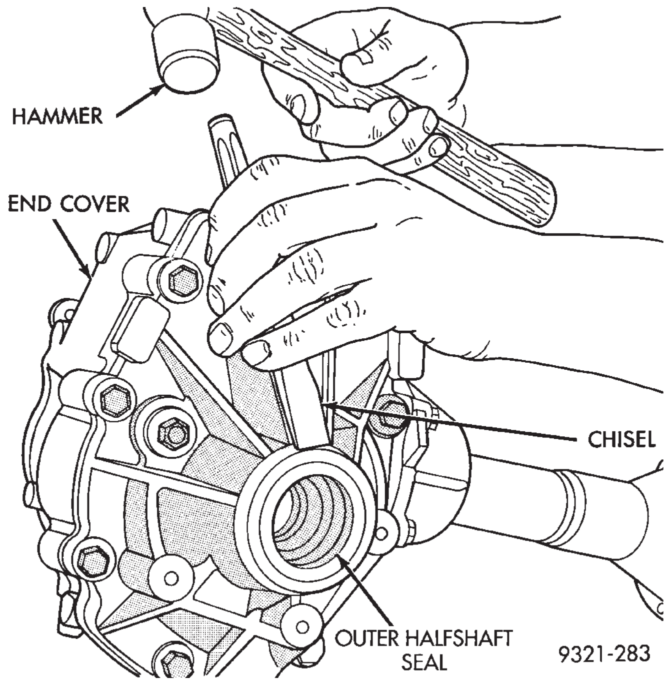


Fig. 52 Output Seal Removal

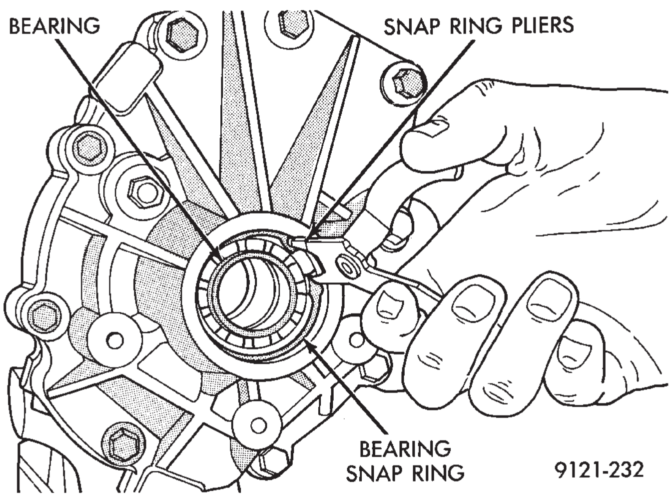


Fig. 53 Bearing Snap Ring

INSTALLATION

(1) Use bearing driver L-4530 and handle C-4171-2 to install bearing (Fig. 55).

(2) Install bearing retaining snap ring.

CAUTION: When installing bearing retaining snap ring, be sure to index the snap ring so that the snap ring does not cover bearing oil passage.

(3) Install new outer half shaft seal using MD998334 seal installer (Fig. 56). **Do not reuse the old seal.**

(4) Reinstall right front half shaft.

(5) Check and fill fluids as required.

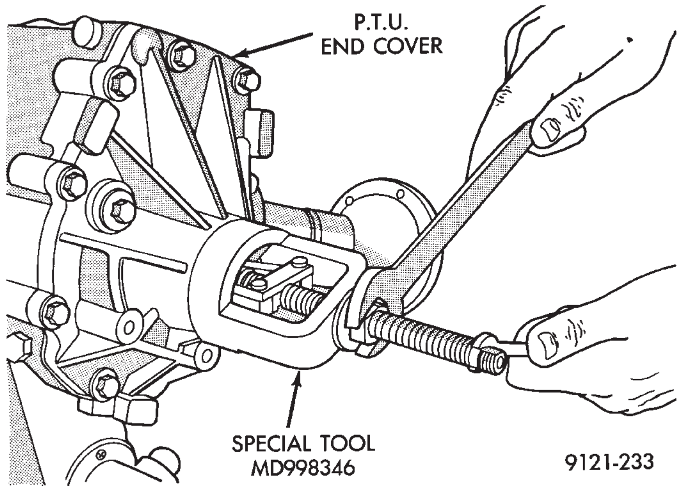


Fig. 54 Bearing Removal

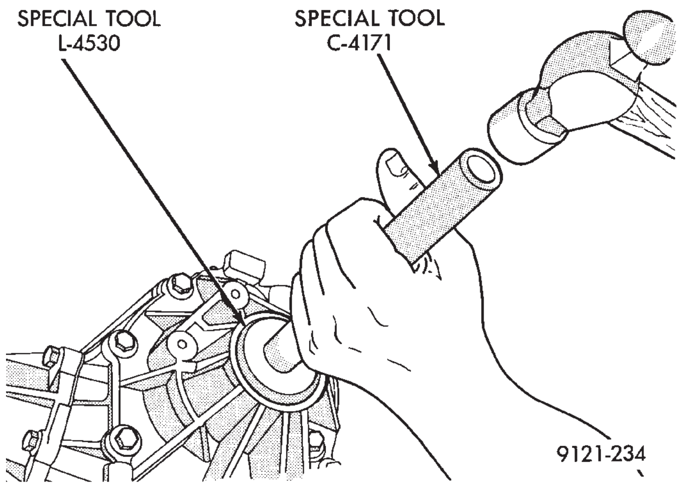


Fig. 55 Bearing Installation

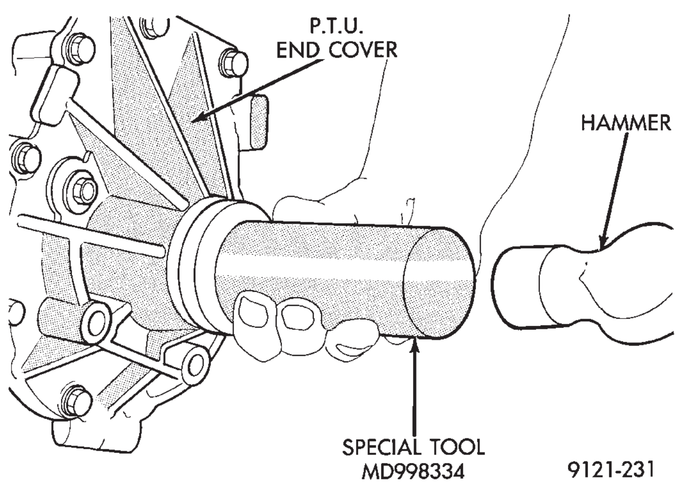


Fig. 56 Installing New Seal

ADJUSTMENTS

OUTPUT FLANGE SHIM SELECTION

This procedure is used when the output flange is replaced. Replacement of the output flange requires installation of the correct size shim to maintain bearing preload. **The shim must protrude from the new output flange the same distance that the original shim protruded from the original flange.**

(1) Stand the original output flange on end with shim side pointing up.

(2) Place original shim into groove in top of flange.

(3) Place a straight edge across the shim.

(4) Using feeler gauge, measure the distance between the straight edge and the top of the flange (Fig. 57). Record this measurement.

(5) Repeat steps Step 1 through Step 4 using the **new flange and the original shim.** Record this measurement.

(6) If measurements are not equal, use a new shim that protrudes from new output flange. Make sure it protrudes the same amount.

(7) For Example: The original shim protrudes 0.075 inch from the original output flange. Place the **original shim** into the new output flange. The protrusion of the shim in the new flange is 0.085 inch. This indicates that a 0.010 inch thinner shim is required to maintain the original protrusion.

(8) Install output flange and torque flange nut to 244 N·m (180 ft. lbs.).

(9) Check the turning torque of the pinion before installing the rear cover into the P.T.U. The turning torque should be between 2.0 N·m and 2.5 N·m (17 in. lbs. and 22 in. lbs.).

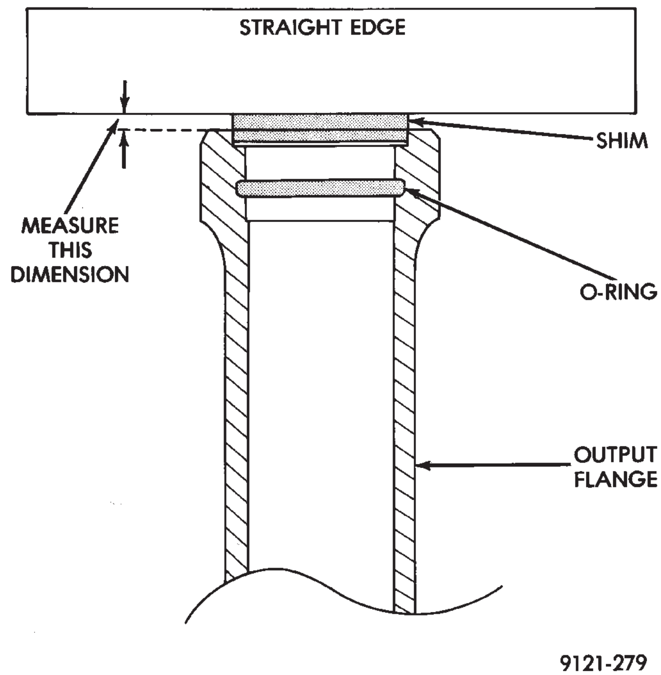


Fig. 57 Output Flange Shim Measurement

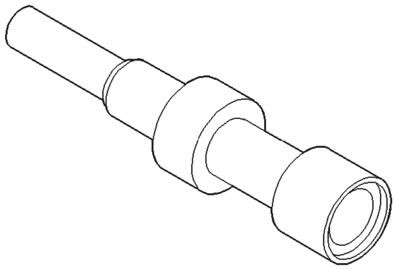
SPECIFICATIONS

TORQUE

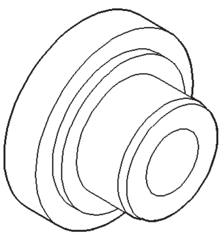
DESCRIPTION	TORQUE
End Cover	28 N·m (250 in. lbs.)
Fill Plug	27 N·m (240 in. lbs.)
Flange Nut	162 N·m (120 ft. lbs.)
Inspection Plug	20 N·m (180 in. lbs.)
Rear Cover	28 N·m (250 in. lbs.)
Ring Gear	94 N·m (70 ft. lbs.)

SPECIAL TOOLS

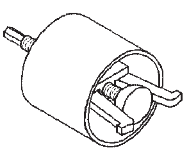
SDP POWER TRANSFER UNIT



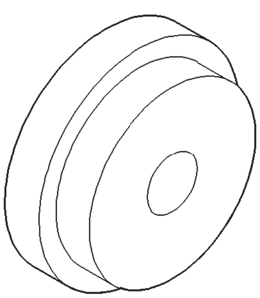
5049-a Seal Puller



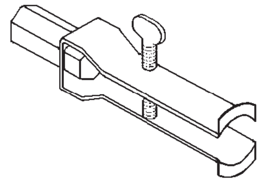
5065 Bearing Installer



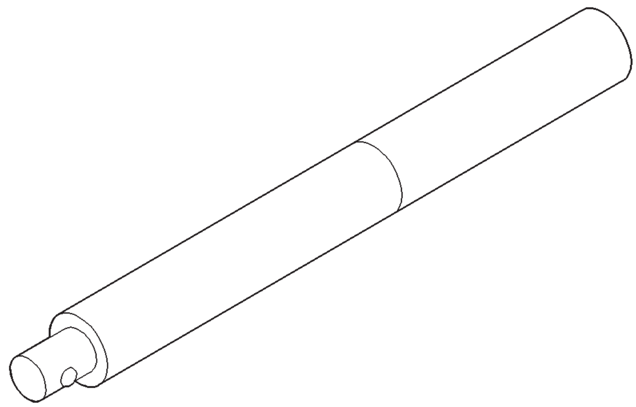
6514 Bearing Remover



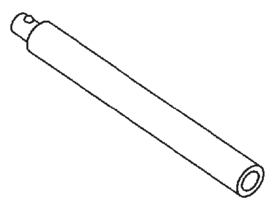
6522 Bearing Remover



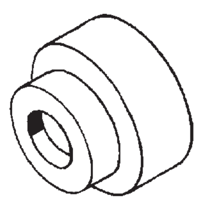
7794-a Bearing Remover



C-4171 Handle



C-4171-2 Handle Extension



C-4657 Seal Installer

A–598 MANUAL TRANSAXLE

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GENERAL INFORMATION

A-598 MANUAL TRANSAXLE

Safety goggles should be worn at all times when working on these transaxles. The A-598 manual transaxle uses SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications, as the factory fill lubricant. SAE G5 10W-40 engine oil is a suitable service fill alternative.

This transaxle combines gear reduction, ratio selection, and differential functions in one unit. It is housed in a die-cast aluminum case.

A-558 MANUAL TRANSAXLE—RHD VEHICLES

Safety goggles should be worn at all times when working on these transaxles. The A-558 manual transaxle uses SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications, as the factory fill lubricant. SAE G5 10W-40 engine oil is a suitable service fill alternative.

This transaxle combines gear reduction, ratio selection, and differential functions in one unit. It is housed in a die-cast aluminum case.

TRANSAXLE IDENTIFICATION INFORMATION

The A-598 transaxle model, assembly number, build date, and final-drive ratio are stamped on a tag that is attached to the top of the transaxle (Fig. 1).

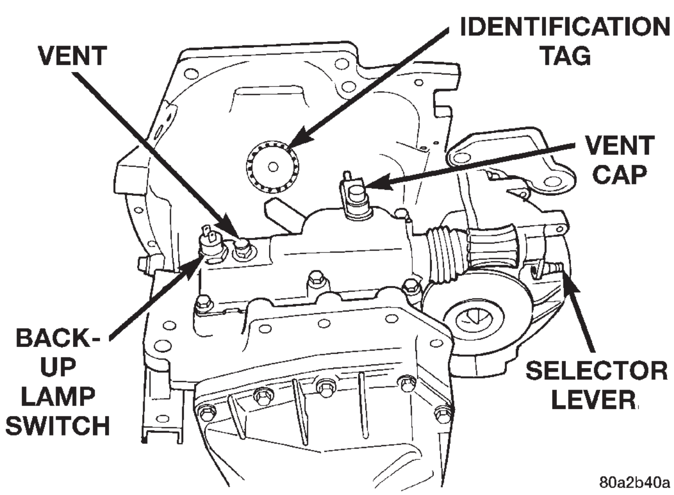


Fig. 1 Transaxle Identification

The last eight digits of the Vehicle Identification Number (V.I.N.) are stamped on a raised boss on top of the clutch housing area.

TRANSAXLE IDENTIFICATION INFORMATION—RHD VEHICLES

The A-558 transaxle model, assembly number, build date, and final-drive ratio are stamped on a tag that is attached to the top of the transaxle (Fig. 2).

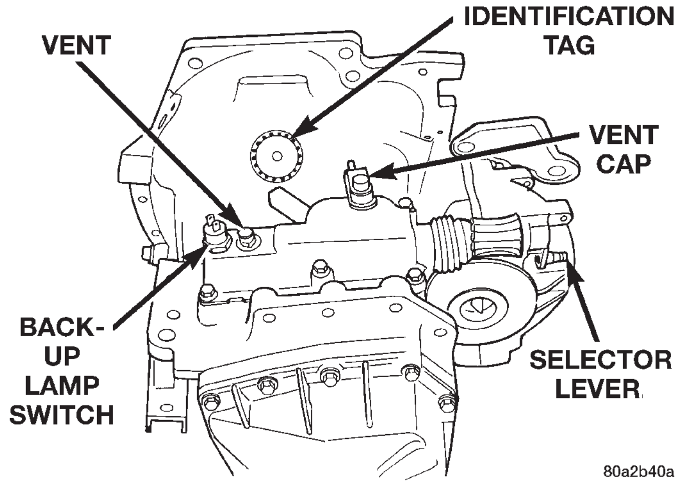


Fig. 2 Transaxle Identification

NOTE: Certain transaxle assemblies utilize high-strength steel in various gears. It is imperative that the correct transaxle assembly number is utilized when ordering service parts. Do not remove this tag, so the information is available for future service.

The last eight digits of the Vehicle Identification Number (V.I.N.) are stamped on a raised boss on top of the clutch housing area.

SELECTION OF LUBRICANT

The A-598 manual transaxle uses SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications, as the factory fill lubricant. G5 SAE 10W-40 engine oil is a suitable service fill alternative. **Hypoid gear lube, manual transmission fluid, and/or automatic transmission fluid should not be used in this transaxle.** Hard shifting effort, bearing, gear, and/or synchronizer failure may occur if incorrect fluid is used.

SELECTION OF LUBRICANT—RHD VEHICLES

The A-558 manual transaxle uses SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications, as the factory fill lubricant. G5 SAE 10W-40 engine oil is a suitable service fill alternative. **Hypoid gear lube, manual transmission fluid, and/or automatic transmission fluid should not be used in this transaxle.** Hard shifting effort, bearing, gear, and/or synchronizer failure may occur if incorrect fluid is used.

SPECIAL ADDITIVES

The addition of any fluids to the transaxle, other than the fluid listed above, is not recommended. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission

GENERAL INFORMATION (Continued)

sealers should be avoided, since they may adversely affect seals.

SPECIAL ADDITIVES—RHD VEHICLES

The addition of any fluids to the transaxle, other than the fluid listed above, is not recommended. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

GEAR RATIOS

Gear ratios for the 2.4L gasoline engine and 2.5L Turbo Diesel MTX are as follows:

- 1st—3.36
- 2nd—1.90
- 3rd—1.28
- 4th—0.92
- 5th—0.71
- Reverse—3.17

Final drive ratio of 3.88 was selected for maximum performance. All forward gears are synchronized.

Gear ratios for the 2.0L GAS MTX are as follows:

- 1st—3.69
- 2nd—2.24
- 3rd—1.45
- 4th—1.03
- 5th—0.81
- Reverse—3.17

Final drive ratio of 4.08 was selected for maximum performance. All forward gears are synchronized.

GEAR RATIOS—RHD VEHICLES

Gear ratios for the 2.0L GAS MTX are as follows:

- 1st—3.69
- 2nd—2.24
- 3rd—1.45
- 4th—0.1.03
- 5th—0.81
- Reverse—3.17

Final drive ratio of 4.08 was selected for maximum performance. All forward gears are synchronized.

GEARSHIFT PATTERN

The A-598 transaxle shift pattern is a H–pattern (Fig. 3). Overdrive fifth and reverse gears are in–line and to the right of the first through fourth gear positions.

GEARSHIFT PATTERN—RHD VEHICLES

The A-558 transaxle shift pattern is a H–pattern (Fig. 4). Overdrive fifth and reverse gears are in–line and to the right of the first through fourth gear positions.

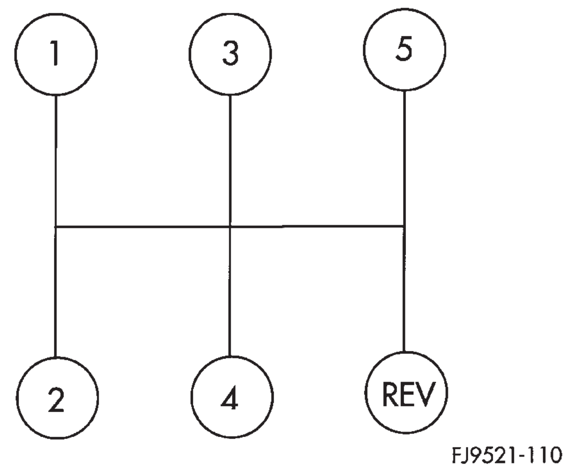


Fig. 3 A-598 Shift Pattern

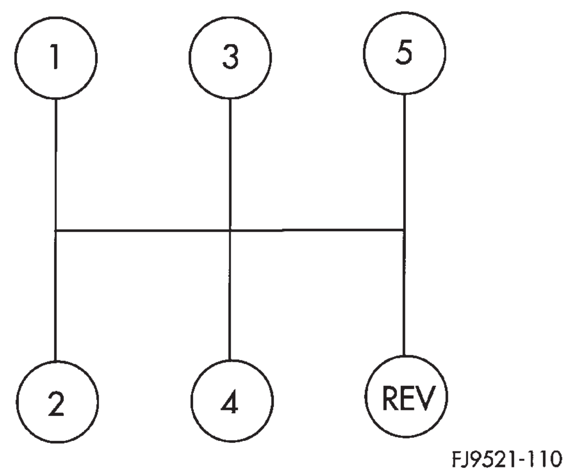


Fig. 4 A-558 Shift Pattern

DESCRIPTION AND OPERATION

GEARSHIFT LEVERS

The gear shift levers at the transaxle are serviceable in the vehicle. The shift levers are different from each other and do not interchange. The select lever is not interchangeable with model years earlier than 96 (length is different).

AXLE SEALS

The axle shaft seals are identical for both sides of the differential and will interchange.

DIAGNOSIS AND TESTING

COMMON PROBLEM CAUSES

The majority of transaxle malfunctions are a result of:

- Insufficient lubrication
- Incorrect lubricant
- Misassembled or damaged internal components

DIAGNOSIS AND TESTING (Continued)

- Improper operation

HARD SHIFTING

Hard shifting may be caused by a misadjusted crossover cable. If hard shifting is accompanied by gear clash, synchronizer clutch and stop rings or gear teeth may be worn or damaged.

Misassembled synchronizer components also cause shifting problems. Incorrectly installed synchronizer sleeves, struts, or springs can cause shift problems.

NOISY OPERATION

Transaxle noise is most often a result of worn or damaged components. Chipped, broken gear or synchronizer teeth, and brinnelled, spalled bearings all cause noise.

Abnormal wear and damage to the internal components is frequently the end result of insufficient lubricant.

SLIPS OUT OF GEAR

Transaxle disengagement may be caused by misaligned or damaged shift components, or worn teeth on the drive gears or synchronizer components. Incorrect assembly also causes gear disengagement.

LOW LUBRICANT LEVEL

Insufficient transaxle lubricant is usually the result of leaks, or inaccurate fluid level check or refill method. Leakage is evident by the presence of oil around the leak point. If leakage is not evident, the condition is probably the result of an underfill.

If air–powered lubrication equipment is used to fill a transaxle, be sure the equipment is properly calibrated. Equipment out of calibration can lead to an underfill condition.

The transaxle fill plug is located on the lower left side of the transaxle end cover. With the vehicle at a level position, remove the fill plug and check the level of the lubricant. The lubricant level should be within 3.175mm (1/8 inch) from the bottom of the fill hole. If the lubricant level is low, fill the transaxle to the bottom of the fill hole with SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications, as the factory fill lubricant. SAE GL5 10W-40 engine oil is a suitable service fill alternative.

CLUTCH PROBLEMS

Worn, damaged, or misaligned clutch components can cause difficult shifting, gear clash, and noise.

A worn or damaged clutch disc, pressure plate, or release bearing can cause hard shifting and gear clash.

SERVICE PROCEDURES

FLUID DRAIN AND FILL

TRANSAXLE FLUID DRAIN

(1) Hoist vehicle.

(2) Install a drain pan underneath the transaxle drain plug.

(3) Remove the transaxle drain plug. The drain plug is located on the bottom of the transaxle housing.

(4) Let fluid drain out till there is just an occasional drip.

(5) Reinstall drain plug. Tighten drain plug to 28 N·m (250 in. lbs.)

TRANSAXLE FLUID FILL

NOTE: All A-598 transaxles are equipped with a fill plug. The fill plug is located on the end cover side of the transaxle.

(1) Remove transaxle fill plug

The fluid level should be within 3.175mm (1/8 inch) from the bottom of the transaxle fill hole (vehicle must be level when checking).

(2) Fill transaxle to proper level with SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications. G5 SAE 10W-40 engine oil is a suitable service fill alternative. Dry fill lubricant capacity is approximately 1.9-2.2 liters (4.0-4.6 pints)..

(3) Wipe the outside of the transaxle if any lubricant spills.

(4) Reinstall transaxle fill plug.

FLUID DRAIN AND FILL—RHD VEHICLES

TRANSAXLE FLUID DRAIN

(1) Hoist vehicle.

(2) Install a drain pan underneath the transaxle drain plug.

(3) Remove the transaxle drain plug. The drain plug is located on the bottom of the transaxle housing (Fig. 5).

(4) Let fluid drain out till there is just an occasional drip.

(5) Reinstall drain plug. Tighten drain plug to 28 N·m (250 in. lbs.)

TRANSAXLE FLUID FILL

NOTE: All A-558 transaxles are equipped with a fill plug. The fill plug is located on the end cover side of the transaxle.

(1) Remove transaxle fill plug

SERVICE PROCEDURES (Continued)

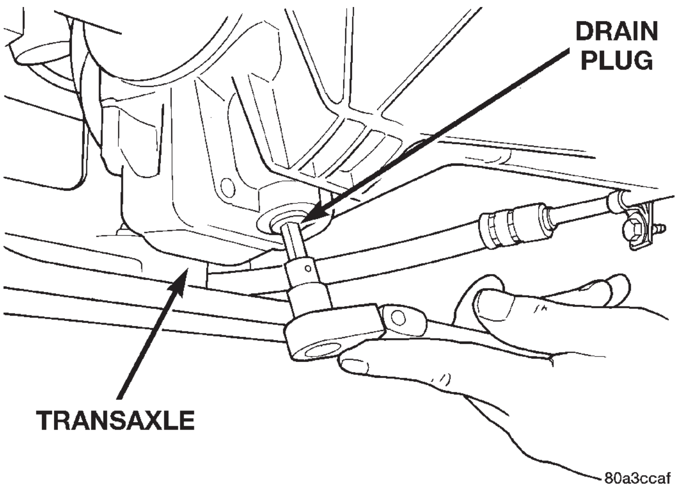


Fig. 5 Transaxle Drain Plug

The fluid level should be within 3.175mm (1/8 inch) from the bottom of the transaxle fill hole (vehicle must be level when checking).

(2) Fill transaxle to proper level with SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications. G5 SAE 10W-40 engine oil is a suitable service fill alternative. Dry fill lubricant capacity is approximately 1.9-2.2 liters (4.0-4.6 pints).

(3) Wipe the outside of the transaxle if any lubricant spills.

(4) Reinstall transaxle fill plug.

REMOVAL AND INSTALLATION

GEARSHIFT KNOB

REMOVAL

(1) Pull shifter boot down and away from shifter roll pin.

(2) Pry legs of shift knob away from shift lever roll pin using a flat blade pry tool (Fig. 6).

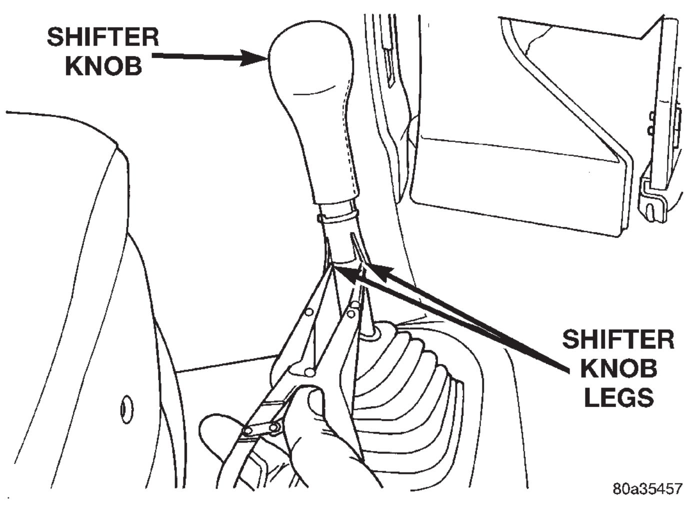


Fig. 6 Shifter Knob

(3) Remove knob from shifter handle.

INSTALLATION

(1) For installation, reverse removal procedure, omitting step (2).

GEARSHIFT BOOT

REMOVAL

(1) Remove shifter knob. Refer to gearshift knob removal.

(2) Pull up on boot until retention clips disengage from the console and remove (Fig. 7).

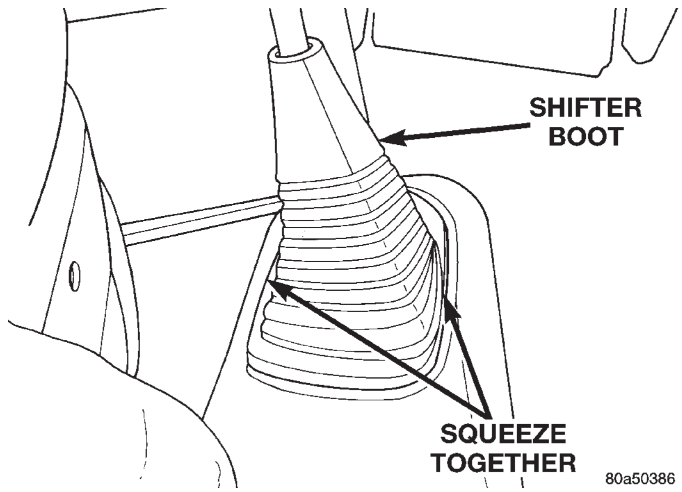


Fig. 7 Shifter Boot

INSTALLATION

(1) For installation, reverse removal procedure, taking care to fully engage the retention clips.

GEARSHIFT BOOT

REMOVAL

(1) Remove shifter knob. Refer to gearshift knob removal.

(2) Pull up on boot until retention clips disengage from the console and remove (Fig. 8).

INSTALLATION

(1) For installation, reverse removal procedure, taking care to fully engage the retention clips.

GEARSHIFT CABLES

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove air cleaner assembly.

(3) Disconnect gearshift cable ends from transaxle shift levers (Fig. 9) (Fig. 10).

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushings to avoid damaging cable isolator bushings.

REMOVAL AND INSTALLATION (Continued)

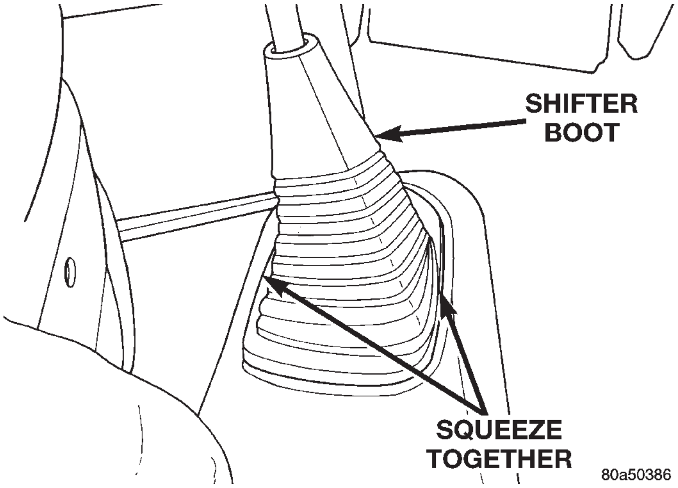


Fig. 8 Gearshift Boot

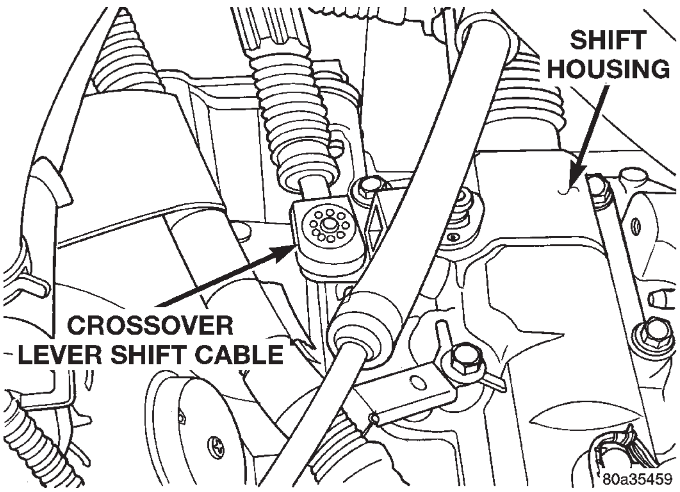


Fig. 9 Crossover Lever Shift Cable

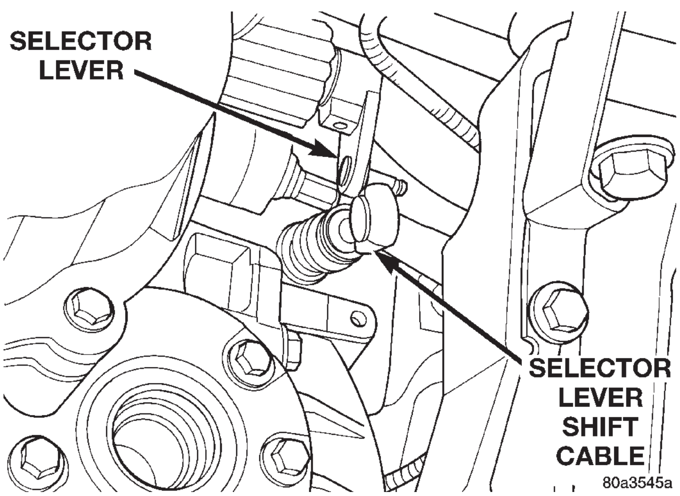


Fig. 10 Selector Lever Shift Cable

(4) Remove cable to bracket retaining clips at transaxle (Fig. 11).

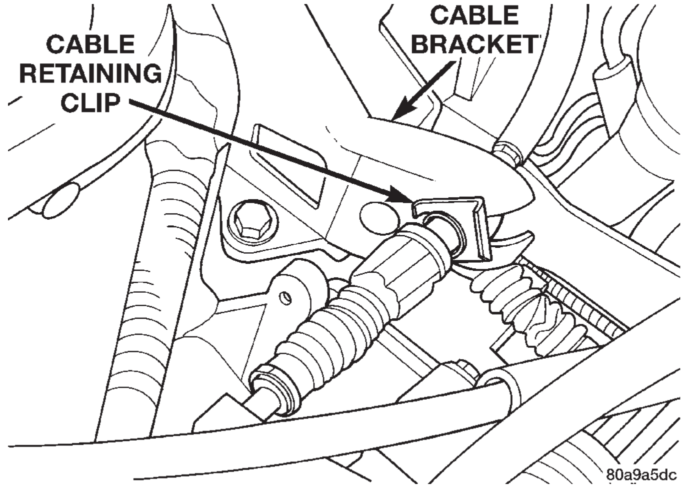


Fig. 11 Cable Retaining Clip

CAUTION: It is recommended that new cable retaining clips be used for reinstallation.

(5) Pull cables up out of engine mount bracket.

(6) Remove gearshift knob and boot. Refer to Knob and Boot Removal in this section.

(7) Remove console screws (Fig. 12).

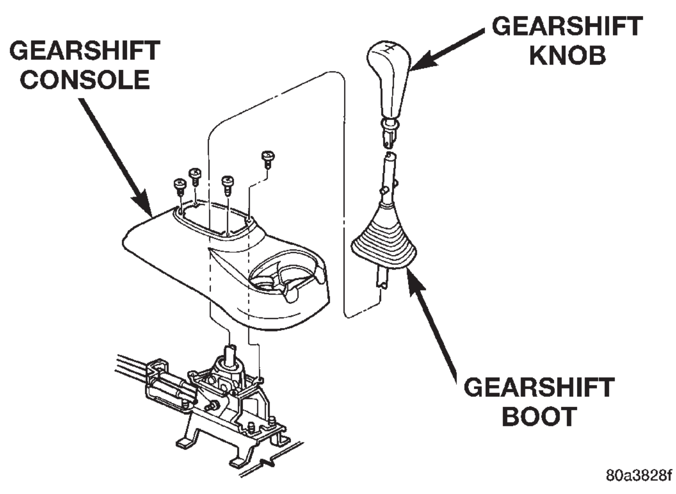


Fig. 12 Gearshift Console

(8) Remove cable retaining clips at shifter (Fig. 13) (Fig. 14).

CAUTION: It is recommended that new cable retaining clips be used for reinstallation. Clips must be installed to span the slotted holes.

(9) Disconnect shift cables from shifter. Pry with equal force on both sides of shifter cable isolator bushings to avoid damaging bushings.

(10) Lift vehicle on hoist. Cut gearshift cable tie strap at floor pan with diagonal cutters.

(11) Remove shift cables from vehicle by grasping cables and grommets one at a time and tugging down through floor pan holes (Fig. 15).

REMOVAL AND INSTALLATION (Continued)

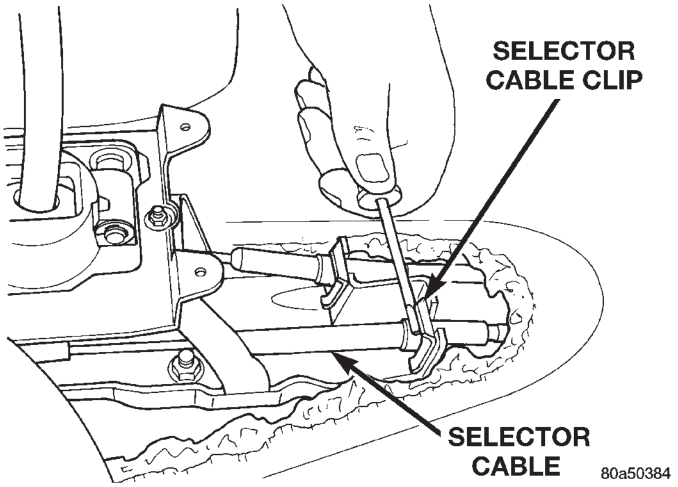


Fig. 13 Selector Cable Clip

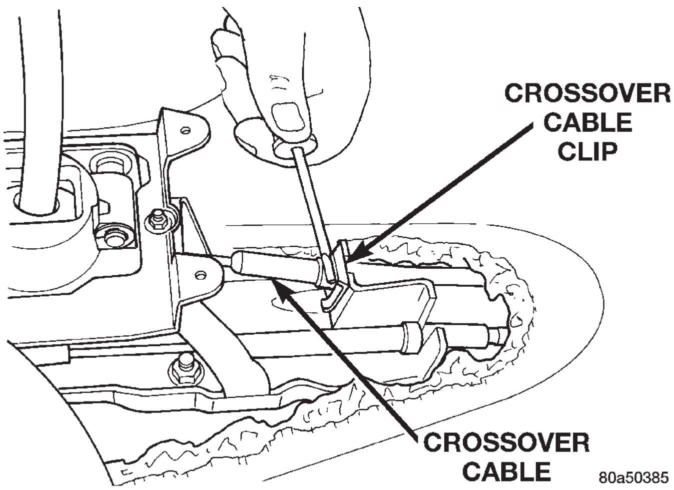


Fig. 14 Crossover Cable Clip

INSTALLATION

(1) To install, reverse removal procedure. After cables have been replaced, cable adjustment should be checked. Refer to cable adjustment procedure in this section.

NOTE: High temperature tie straps must be used when replacing cable(s). Locate the new tie strap at the white band on the crossover cable and cinch cables tightly together.

CAUTION: Only the crossover cable is adjustable. The selector cable does not have any adjustment capabilities.

GEARSHIFT CABLES—RHD VEHICLES

REMOVAL

(1) Disconnect battery negative cable.
(2) Remove air cleaner assembly.
(3) Disconnect gearshift cable ends from transaxle shift levers (Fig. 16) (Fig. 17).

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushings to avoid damaging cable isolator bushings.

(4) Remove cable to bracket retaining clips at transaxle (Fig. 18).

CAUTION: It is recommended that new cable retaining clips be used for reinstallation.

(5) Pull cables up out of engine mount bracket.
(6) Remove gearshift knob and boot. Refer to Knob and Boot Removal in this section.
(7) Remove console screws (Fig. 19).
(8) Remove cable retaining clips at shifter (Fig. 20) (Fig. 21).

CAUTION: It is recommended that new cable retaining clips be used for reinstallation. Clips must be installed to span the slotted holes.

(9) Disconnect shift cables from shifter. Pry with equal force on both sides of shifter cable isolator bushings to avoid damaging bushings.
(10) Lift vehicle on hoist. Cut gearshift cable tie strap at floor pan with diagonal cutters.
(11) Remove shift cables from vehicle by grasping cables and grommets one at a time and tugging down through floor pan holes (Fig. 22).

INSTALLATION

(1) To install, reverse removal procedure. After cables have been replaced, cable adjustment should be checked. Refer to cable adjustment procedure in this section.

NOTE: High temperature tie straps must be used when replacing cable(s). Locate the new tie strap at the white band on the crossover cable and cinch cables tightly together.

CAUTION: Only the crossover cable is adjustable. The selector cable does not have any adjustment capabilities.

GEARSHIFT MECHANISM REPLACEMENT

REMOVAL

(1) Remove shifter knob and boot. refer to Shifter Knob And Boot Removal procedure in this section.
(2) Remove console assembly. Refer to Console Removal procedure in this section.

REMOVAL AND INSTALLATION (Continued)

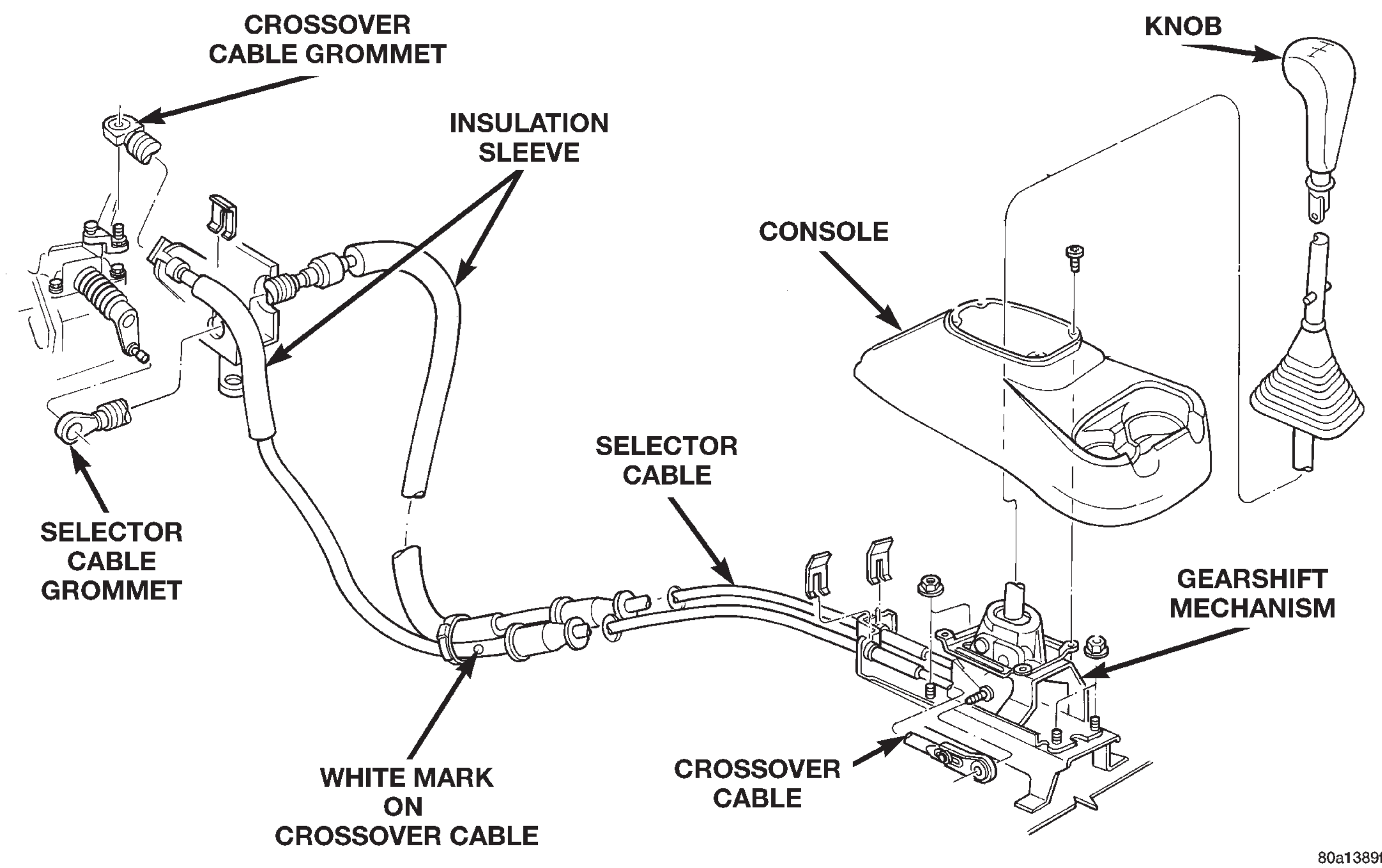


Fig. 15 Gearshift Cables

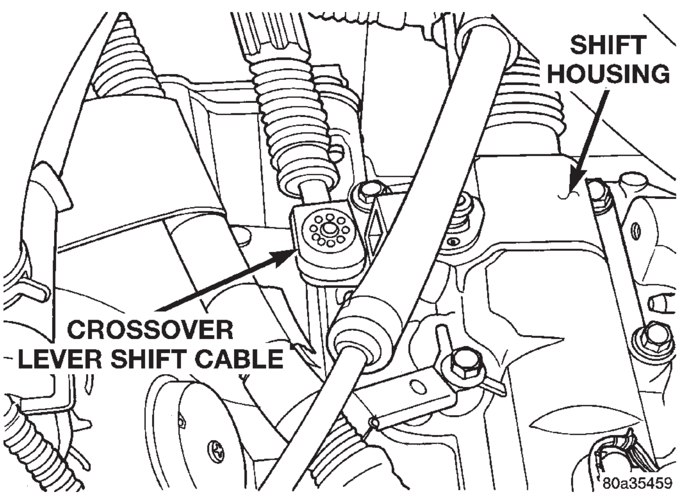


Fig. 16 Crossover Lever Shift Cable

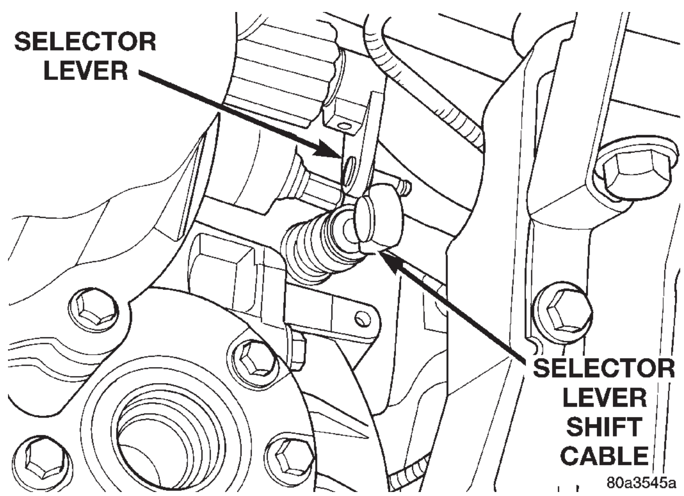


Fig. 17 Selector Lever Shift Cable

(3) Remove gearshift cables. Refer to Gearshift Cable Removal in this section.

(4) Remove retaining nuts at the base of the gearshift mechanism. Remove shifter.

INSTALLATION

(1) For installation, reverse removal procedure.

GEARSHIFT MECHANISM REPLACEMENT—RHD VEHICLES

REMOVAL

(1) Remove shifter knob and boot. Refer to Shifter Knob And Boot Removal procedure in this section.

(2) Remove console assembly. Refer to Console Removal procedure in Group 23 in this manual.

REMOVAL AND INSTALLATION (Continued)

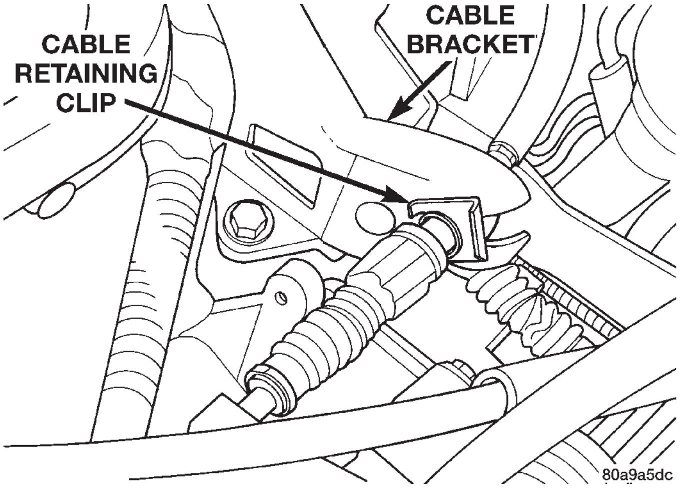


Fig. 18 Cable Retaining Clip

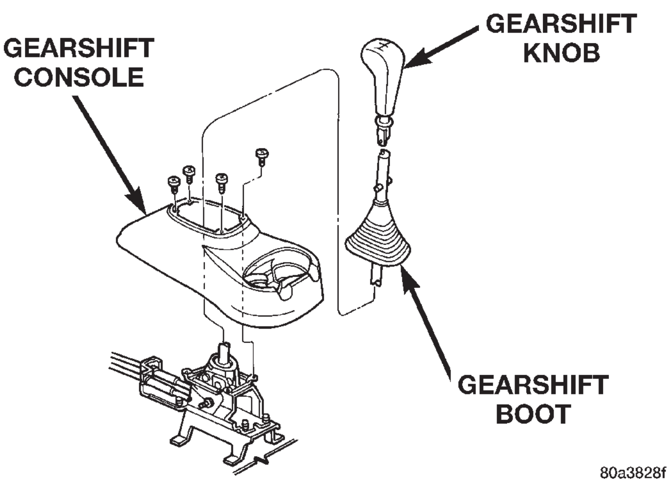


Fig. 19 Gearshift Console

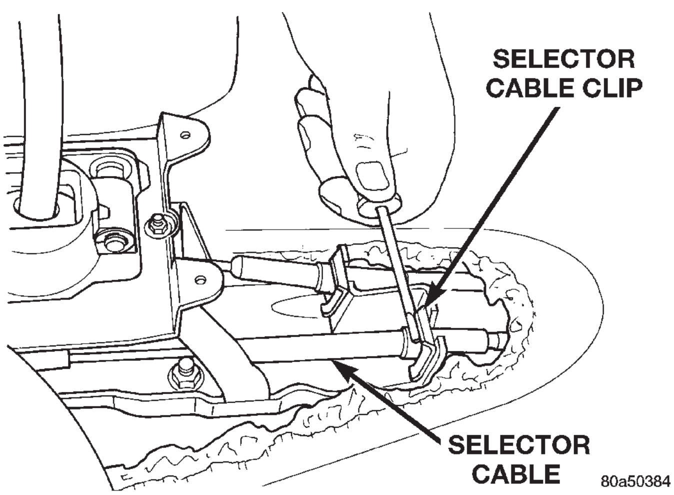


Fig. 20 Selector Cable Clip

(3) Remove gearshift cables. Refer to Gearshift Cable Removal in this section.

(4) Remove retaining nuts at the base of the gearshift mechanism. Remove shifter.

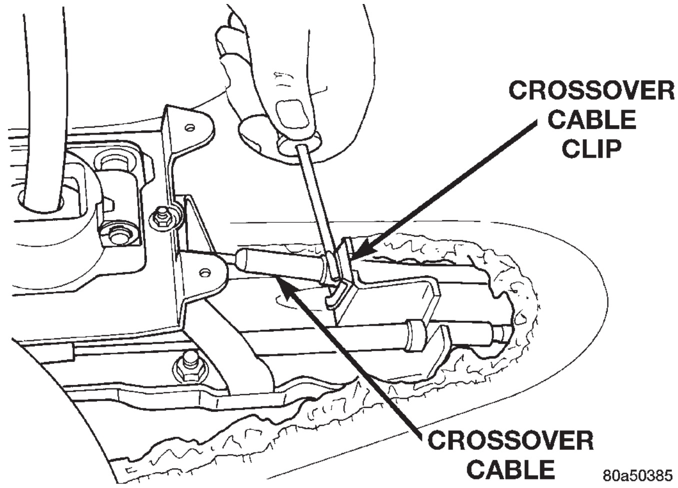


Fig. 21 Crossover Cable Clip

INSTALLATION

(1) For installation, reverse removal procedure.

VEHICLE SPEED SENSOR DRIVE GEAR

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove wiring connector from speed sensor.

CAUTION: Clean area around speed sensor before removing. This will prevent the possibility of dirt from entering the transaxle during speed sensor removal.

(3) Remove speed sensor retaining bolt.

(4) Remove speed sensor from transaxle extension housing (Fig. 23).

CAUTION: Carefully remove vehicle speed sensor so that sensor drive gear does not fall into transaxle. Should sensor drive gear fall into the transaxle during sensor removal, drive gear must be reattached to sensor.

(5) Remove speed sensor drive gear from speed sensor.

INSTALLATION

(1) To install, reverse removal procedure.

(2) Confirm vehicle speedometer is functioning properly following installation.

BACK-UP LAMP SWITCH

The back-up lamp switch is located on the gearshift housing on top of the transaxle case.

REMOVAL

(1) From top side of vehicle, remove wiring connector from switch (Fig. 24).

(2) Unscrew switch from transaxle.

REMOVAL AND INSTALLATION (Continued)

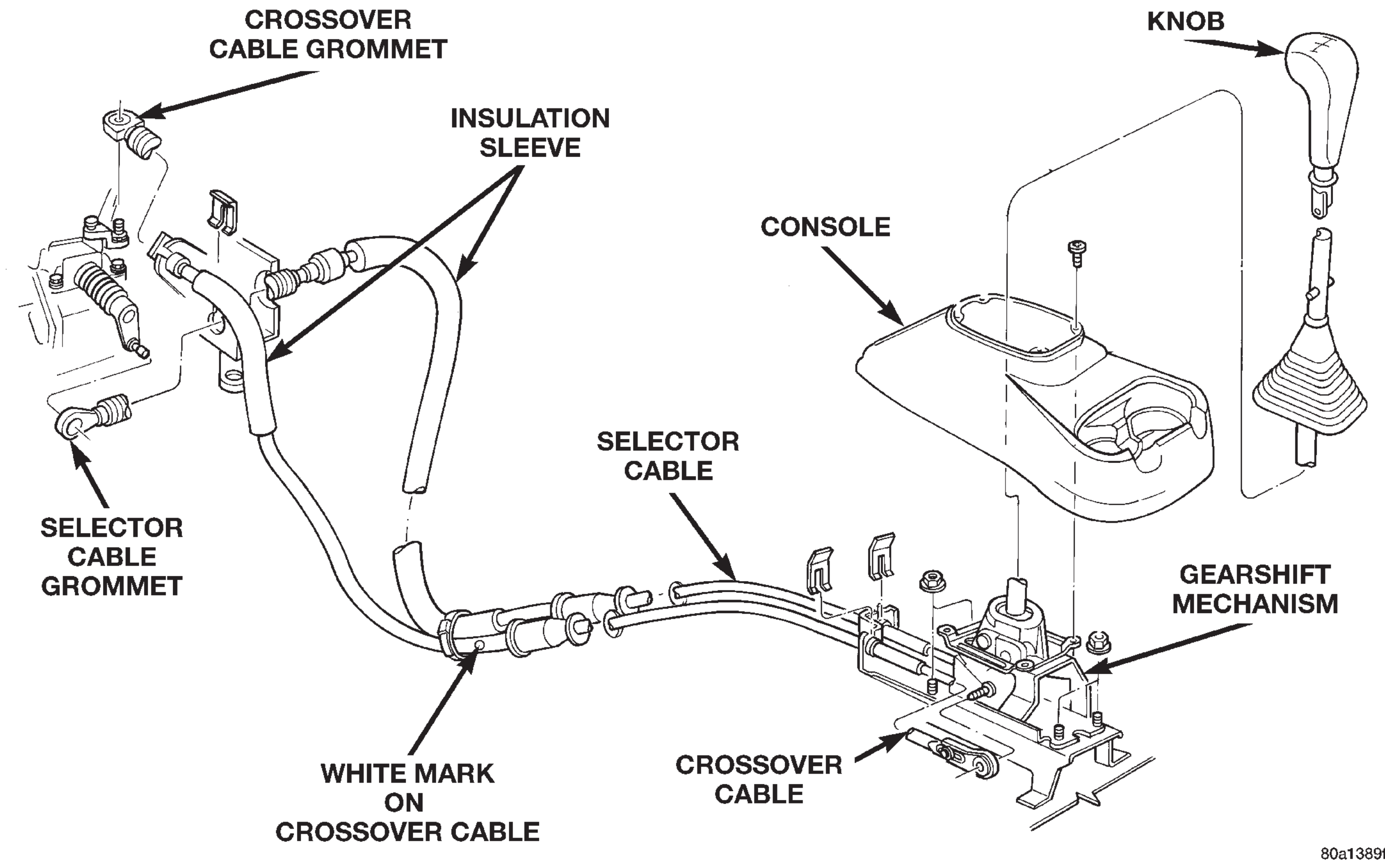


Fig. 22 Gearshift Cables

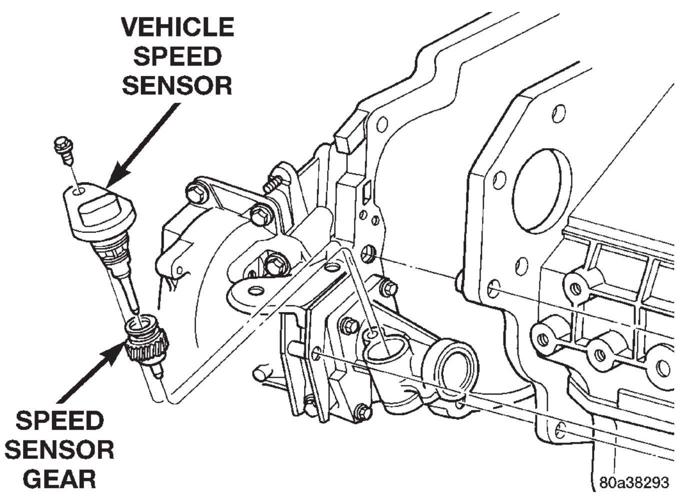


Fig. 23 Vehicle Speed Sensor

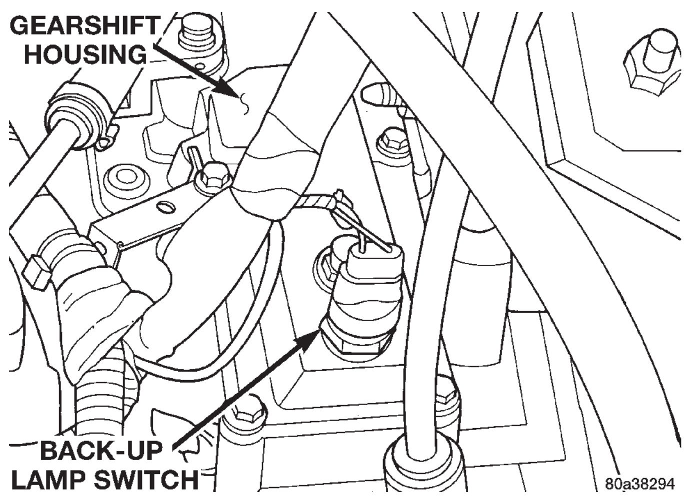


Fig. 24 Back-Up Lamp Switch Location

INSTALLATION

(1) To install, reverse removal procedure. Teflon tape or equivalent must be used on switch threads.

CAUTION: Do not overtighten switch.

(2) Confirm back-up lamps are functioning properly following installation.

CRANKSHAFT POSITION SENSOR — 2.5L VM DIESEL

The crankshaft position sensor is located on the transaxle bellhousing. The sensor measures the position of the crankshaft and relays that information to the Powertrain Control Module.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove electrical connector at crankshaft position sensor (Fig. 25).

(2) Remove screw retaining the crankshaft position sensor to the bellhousing.

(3) Remove the crankshaft position sensor.

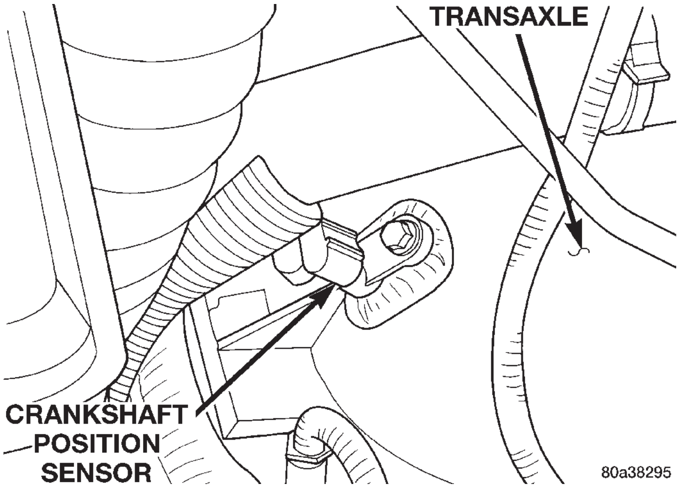


Fig. 25 Crankshaft Position Sensor

INSTALLATION

(1) For installation, reverse removal procedure.

CROSSOVER LEVER

REMOVAL

(1) Remove crossover cable. Refer to Gearshift Cable removal.

(2) Using a pin punch, remove the crossover roll pin from lever.

(3) Pull up and remove the crossover lever from the transaxle crossover shaft.

INSTALLATION

(1) For installation, reverse removal procedure. Replace the roll pin that was removed with a new one.

SELECTOR LEVER

REMOVAL

(1) Remove the selector cable. Refer to Gearshift Cable removal.

(2) Using a pin punch, remove the roll pin from the lever.

(3) Remove the selector lever from the transaxle selector shaft

INSTALLATION

(1) For installation, reverse removal procedure. Replace the roll pin with a new one.

AXLE SEALS

The axle shaft seals are identical for both sides of the differential and will interchange.

EXTENSION HOUSING AXLE SEAL

REMOVAL

(1) Remove axle shaft. Refer to Group 2, Suspension and Driveshafts for service procedures.

(2) Insert a flat–blade pry tool into the axle seal bore (Fig. 26).

(3) Using the pry tool, carefully pop out the seal taking care not to nick the seal bore.

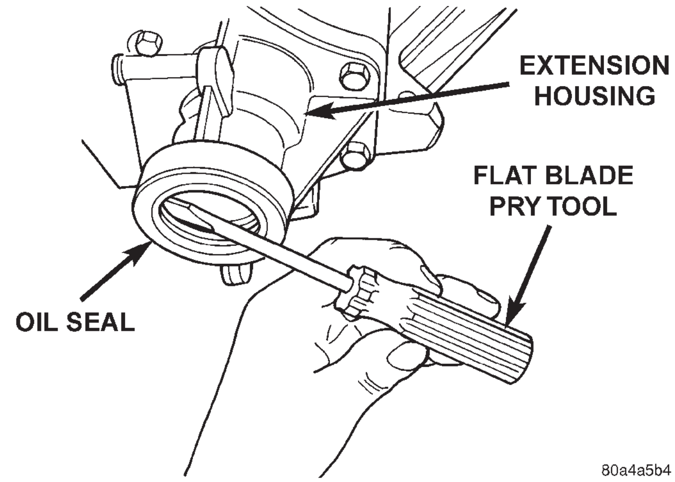


Fig. 26 Extension Housing Axle Seal

INSTALLATION

(1) Clean axle shaft seal bore of any excess sealant.

(2) Align axle shaft seal with axle shaft seal bore.

(3) Position axle seal at extension housing.

(4) Using Tool L-4520 and Tool C-4171, tap seal into position (Fig. 27).

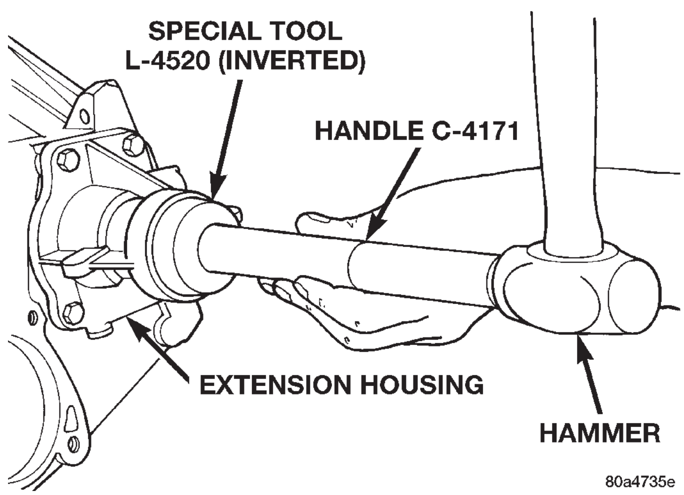


Fig. 27 Install Seal

REMOVAL AND INSTALLATION (Continued)

DIFFERENTIAL BEARING RETAINER AXLE SEAL

REMOVAL

(1) Remove axle shaft. Refer to Group 2, Suspension and Driveshafts for service procedures.

(2) Insert a flat–blade pry tool into the axle seal bore.

(3) Using the pry tool, carefully pop out the seal taking care not to nick the seal bore.

INSTALLATION

(1) Clean axle shaft seal bore of any excess sealant.

(2) Align axle shaft seal with axle shaft seal bore.

(3) Position axle seal at extension housing.

(4) Using Tool L-4520 and Tool C-4171, tap seal into position.

SHIFT SHAFT SEALS

It is **not** necessary to remove the shift shaft cover from the transaxle to service the shift shaft seals.

REMOVAL

(1) Remove the shift lever from the seal that is to be serviced. Refer to shift lever removal for service procedure.

(2) Using a pick tool, pry up on the shift shaft seal and remove seal from bore.

INSTALLATION

(1) Position new shift shaft seal in bore.

(2) Install shift shaft seal into bore using an appropriate size deep–well socket.

TRANSAXLE

The following items can be serviced without removing the transaxle from the vehicle:

- Gearshift housing
- 5th speed synchronizer
- 5th speed gear
- Roller detents and springs
- Speedometer pinion
- Vehicle speed sensor
- Bearing retainer plate.
- All external covers
- Shift shaft seals
- Axle shaft seals

To service any other component of the A-598 transaxle you must remove it from the vehicle.

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove air intake hose. Disconnect air mass meter connector.

(3) Remove intercooler hose.

(4) Remove connectors for back-up lamp (Fig. 28) and crank position sensor (Fig. 29).

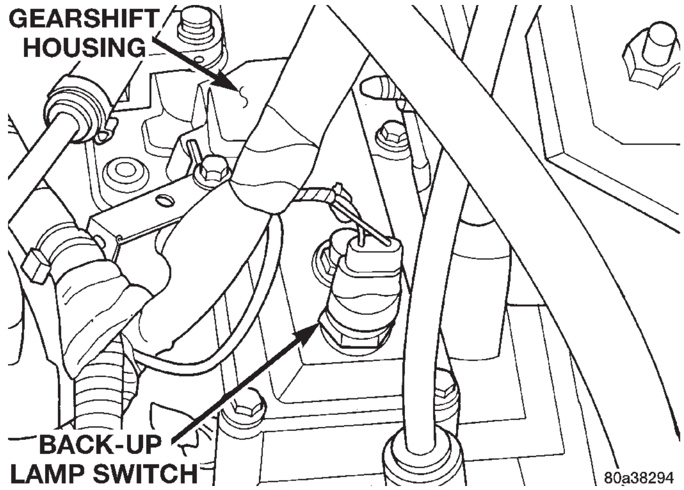


Fig. 28 Back-up Lamp Connector

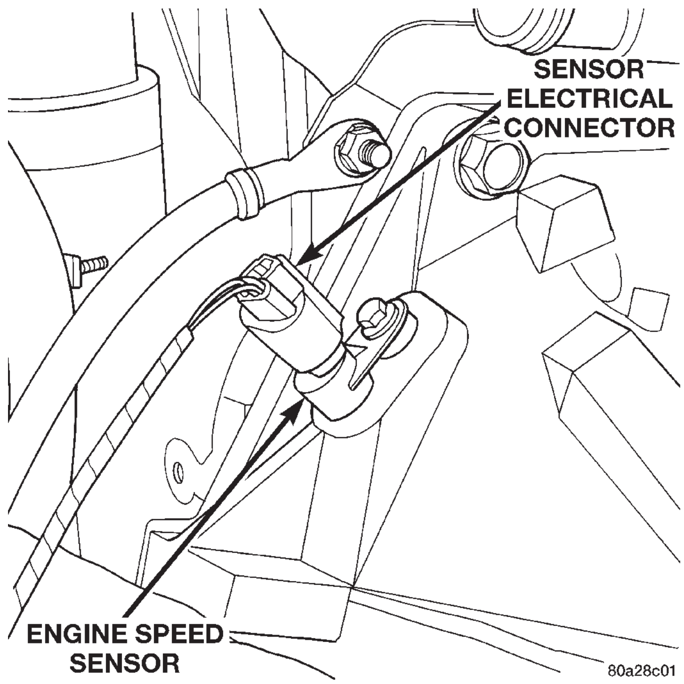


Fig. 29 Crankshaft Position Sensor

(5) Remove crank position sensor (2.5L VM Diesel only).

(6) Remove wiring harness bracket at transaxle (Fig. 30).

(7) Remove crossover and shift selector cables (Fig. 31).

(8) Remove the two top bolts at the rear engine mount bracket.

(9) Remove bolts securing the coolant reservoir to the top of the engine. Move the coolant reservoir out of the way.

(10) Install an engine support chain to the cylinder head assembly (Fig. 32).

REMOVAL AND INSTALLATION (Continued)

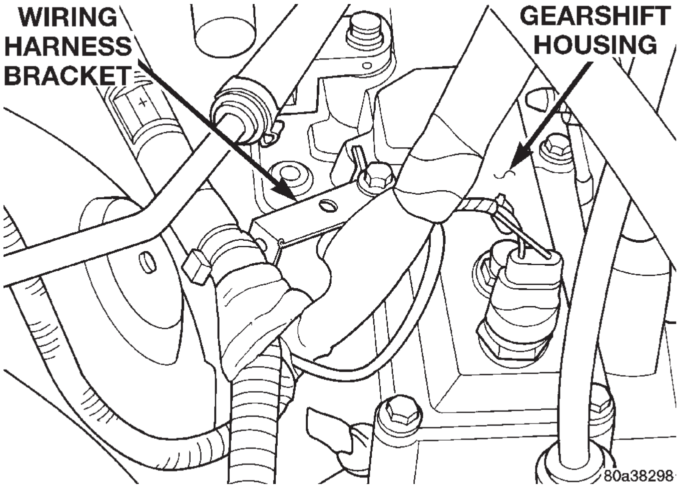


Fig. 30 Wiring Harness Bracket

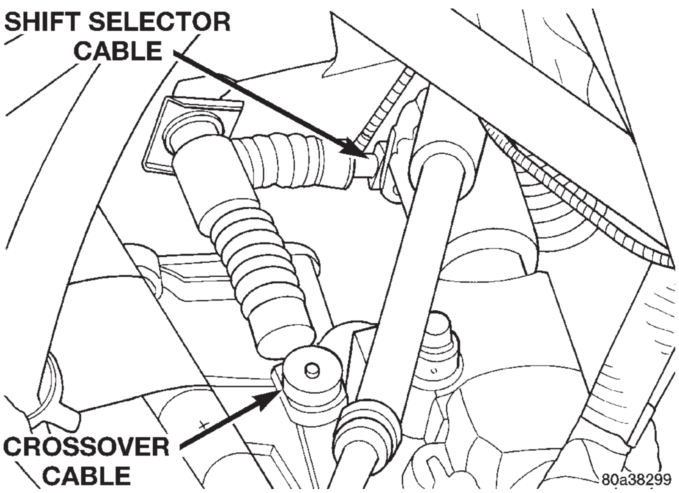


Fig. 31 Shift Cables

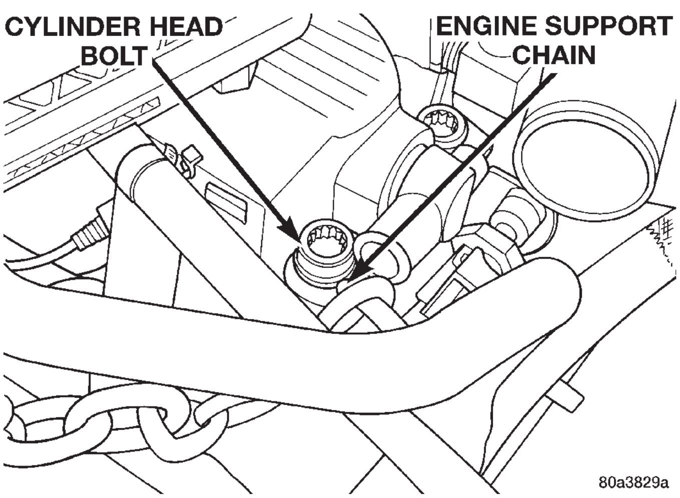


Fig. 32 Engine Support Chain

(11) Remove three upper bellhousing bolts (Fig. 33).

(12) Install engine bridge fixture to chain and support engine (Fig. 34).

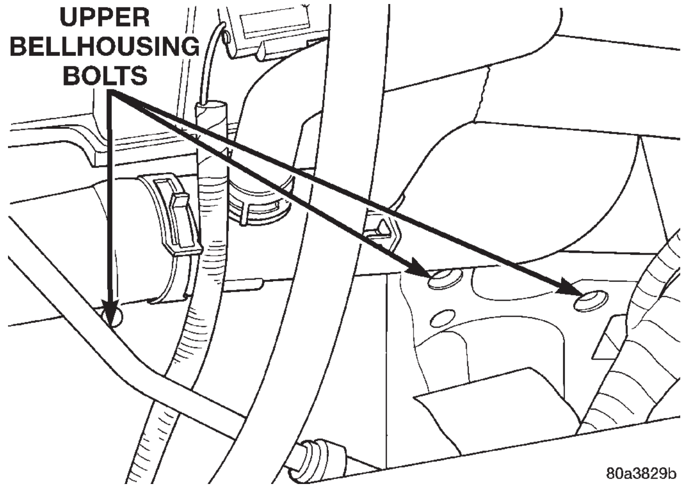


Fig. 33 Upper Bellhousing Bolts

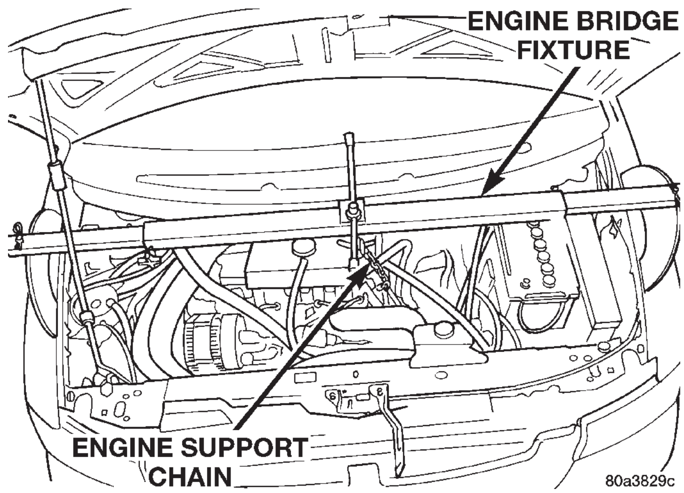


Fig. 34 Engine Bridge Fixture

(13) Hoist the vehicle.

(14) Remove front wheels.

(15) Remove axle shaft hub nuts.

(16) Remove steering knuckle steering stop studs.

(17) Remove lower control arm pinch bolts (Fig. 35).

(18) Using a pry bar, unseat lower control arm from steering knuckle (Fig. 36).

(19) Remove drain plug and drain transaxle fluid (Fig. 37).

(20) Remove right and left axle shaft assemblies

(21) Remove vehicle speed sensor wiring connector (Fig. 38).

(22) Remove clutch cable retaining clip (Fig. 39). Remove clutch cable from transaxle housing.

(23) Remove adapter plate and front engine mount bolts (Fig. 40) (Fig. 41).

(24) Remove two remaining rear engine mount bolts.

CAUTION: Always use a safety chain when removing or installing transaxle assembly.

REMOVAL AND INSTALLATION (Continued)

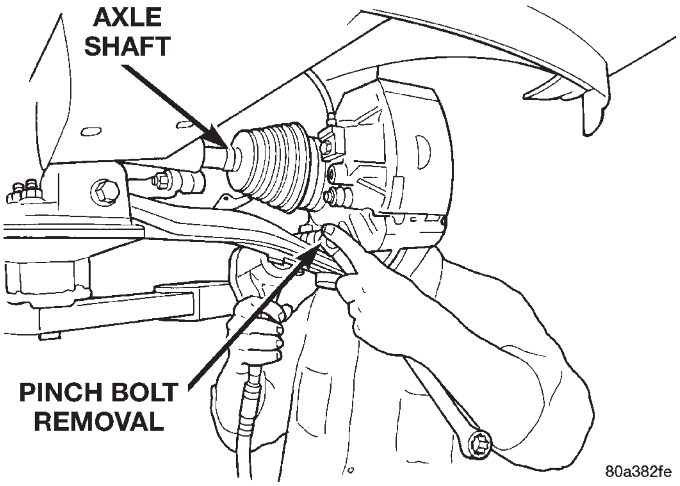


Fig. 35 Lower Control Arm Pinch Bolt

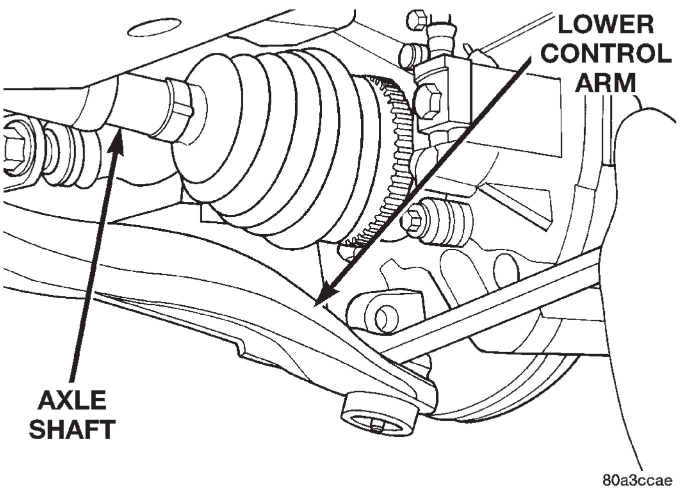


Fig. 36 Unseat Control Arm

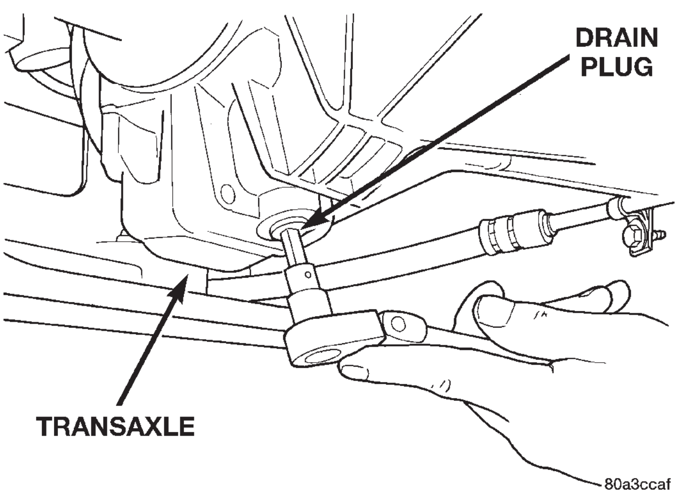


Fig. 37 Transaxle Drain Plug

(25) Install transmission jack under transaxle assembly.

(26) Remove left fender splash shield.

(27) Remove (4) left mount bolts (Fig. 42).

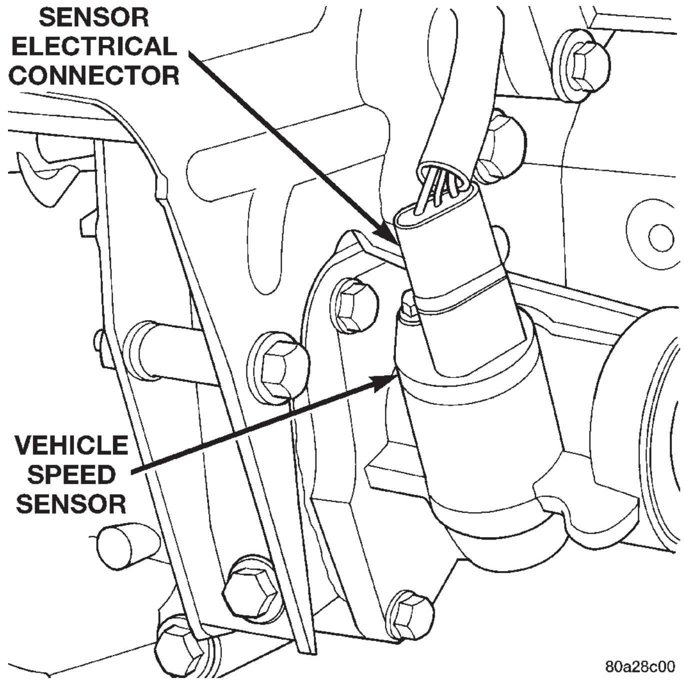


Fig. 38 Vehicle Speed Sensor

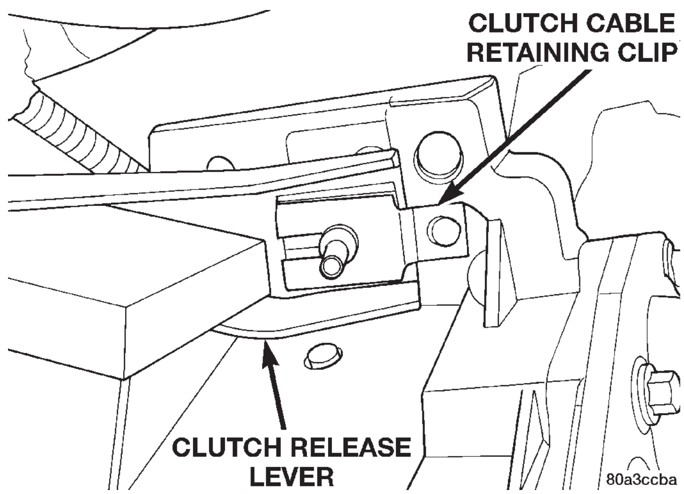


Fig. 39 Clutch Cable Clip

(28) Remove lower bellhousing bolts.

(29) Lower transaxle and remove.

INSTALLATION

(1) For installation, reverse removal procedure.

NOTE: Lower control arm pinch bolts must be installed with the bolt heads to the rear of the ball joints.

(2) Fill transaxle to the proper level with the specified lubricant.

(3) While the vehicle is elevated slightly, run the transaxle through all the forward gears. Apply brakes and shift into reverse. Run the transaxle through reverse gear.

REMOVAL AND INSTALLATION (Continued)

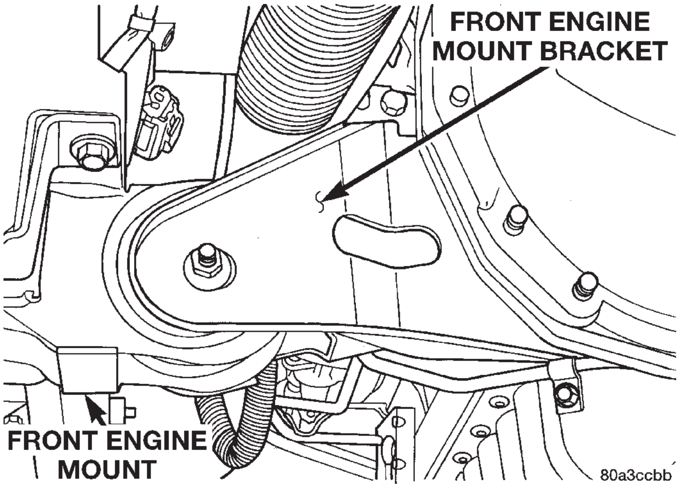


Fig. 40 Front Engine Mount (Left Side)

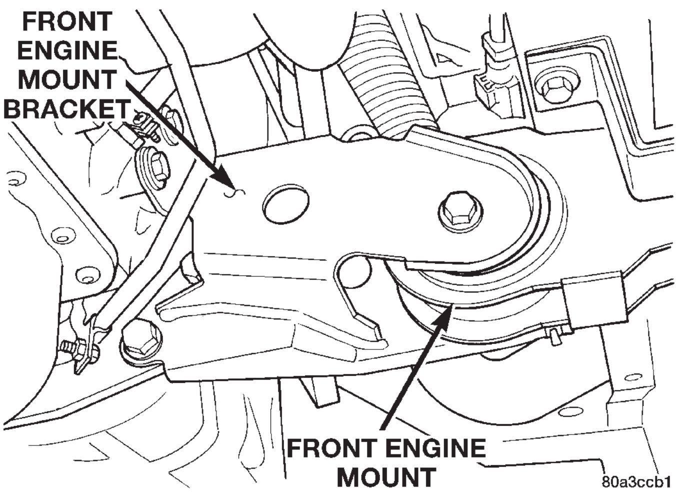


Fig. 41 Front Engine Mount (Right Side)

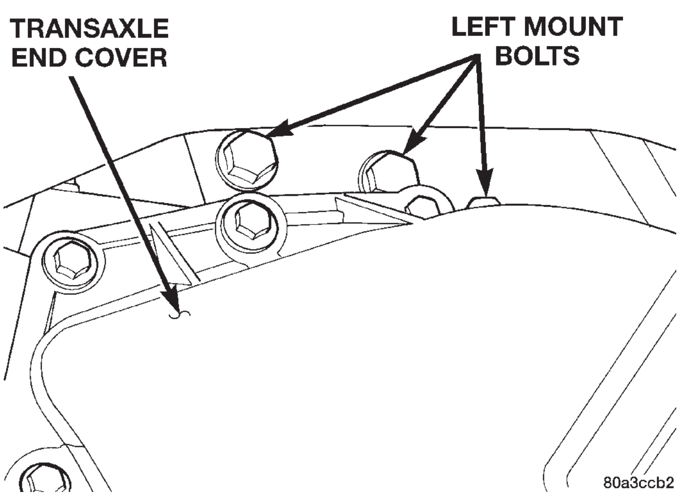


Fig. 42 Left Mount Bolts

(4) Check the transaxle for leaks and recheck the level of the transaxle lubricant.

INPUT SHAFT FRONT BEARING RETAINER

REMOVAL

(1) Remove the transaxle assembly from the vehicle. For removal procedure, refer to Transaxle, Removal and Installation.

(2) From inside the bellhousing, remove the E-clip retaining the clutch release lever shaft (Fig. 43).

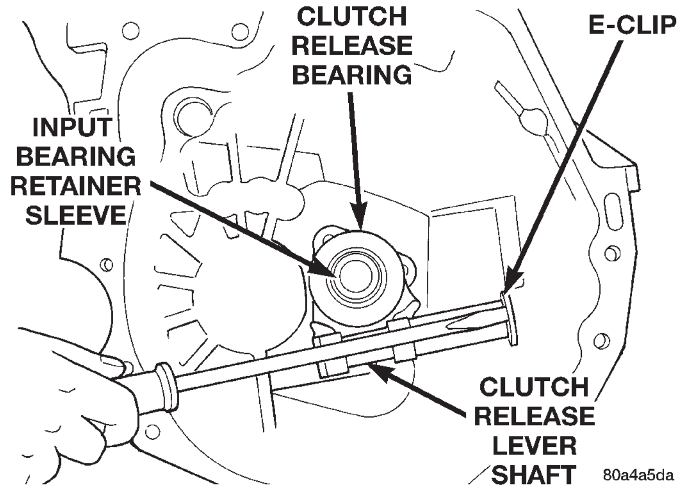


Fig. 43 E-clip at Clutch Release Lever Shaft

(3) Pull release lever shaft out of the clutch bellhousing (Fig. 44).

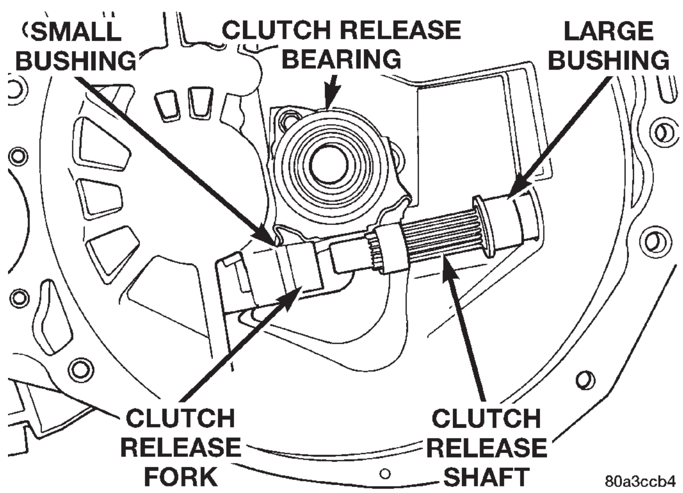


Fig. 44 Clutch Release Shaft

(4) Remove the clutch release bearing from the input bearing retainer sleeve (Fig. 45).

(5) Remove the three bolts retaining the input shaft bearing retainer sleeve (Fig. 46).

(6) Remove the input bearing retainer sleeve from the front of the bellhousing.

INSTALLATION

(1) For installation, reverse removal procedure. Use Mopar® Gasket Maker to seal input bearing retainer sleeve to bellhousing.

REMOVAL AND INSTALLATION (Continued)

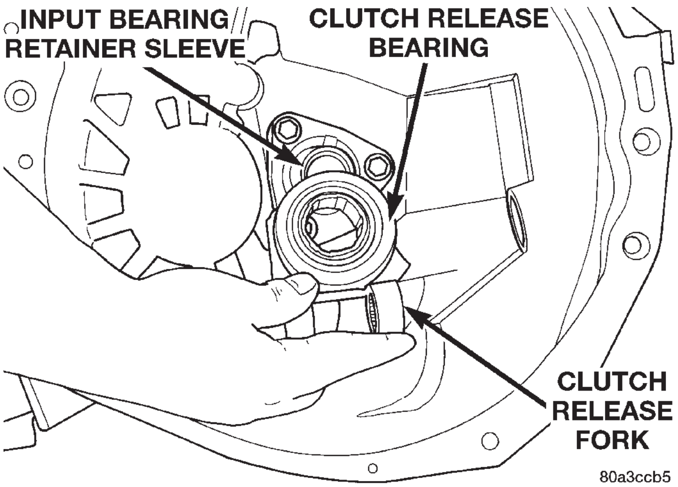


Fig. 45 Clutch Release Fork

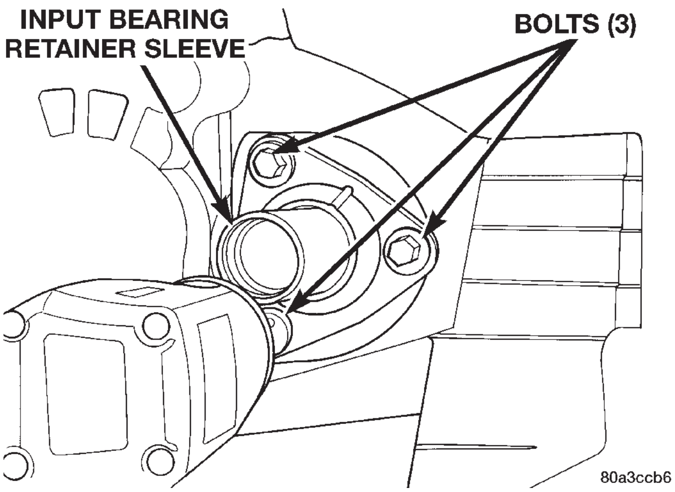


Fig. 46 Input Bearing Retainer

(2) Tighten the input bearing retainer sleeve bolts to 28 N·m (250 in. lbs.).

INPUT SHAFT SEAL

REMOVAL

(1) Remove input shaft front bearing retainer from transaxle case. Refer to Input Bearing Retainer Removal in this group.

(2) Place the retainer in a soft-jawed vise.

(3) Using a flat-blade pry tool, remove the input shaft seal from the retainer.

INSTALLATION

(1) Position the new input shaft seal in the retainer.

(2) Place the retainer on a flat surface (seal side down).

(3) Push down on bearing retainer to install seal (Fig. 47).

(4) Install input bearing retainer. Refer to Input Bearing Retainer Installation in this group.

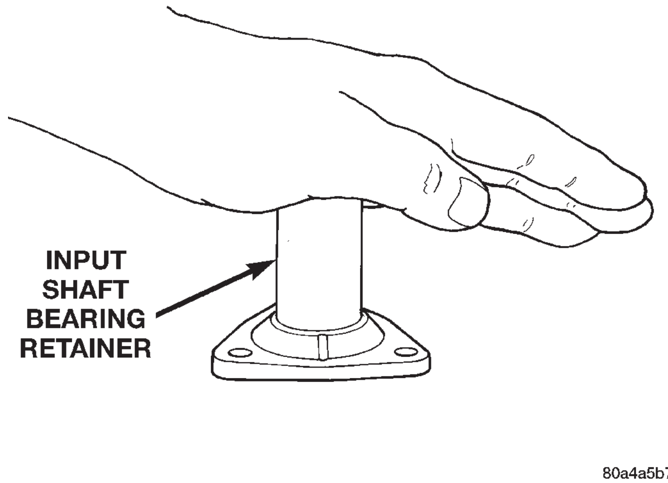


Fig. 47 Install Seal

A-558 TRANSAXLE ASSEMBLY—RHD VEHICLES

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove air intake hose.

(3) Remove connector for back-up lamp (Fig. 48).

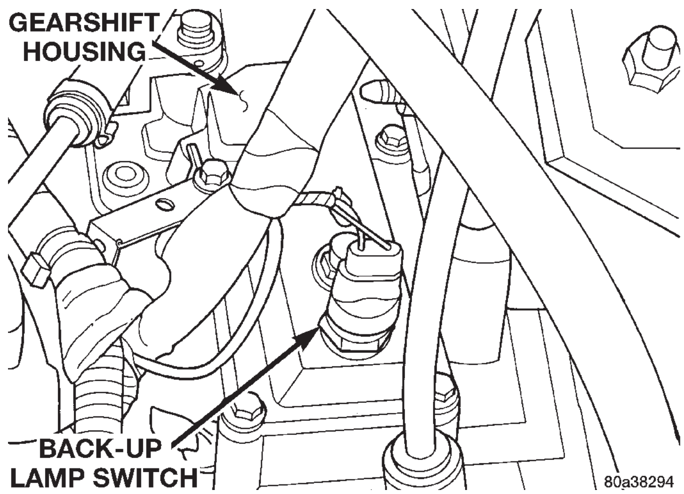


Fig. 48 Back-up Lamp Connector

(4) Remove wiring harness bracket at transaxle (Fig. 49).

(5) Unbolt slave cylinder and actuator rod at the transaxle (Fig. 50).

(6) Install engine support fixture and chain onto engine (Fig. 51) and (Fig. 52).

(7) Remove cover from accelerator cables at throttle body (Fig. 53).

(8) Remove throttle body to transaxle bracket (Fig. 54).

(9) Remove two (2) upper transaxle nuts/studs (Fig. 54).

(10) Remove crossover and shift selector cables (Fig. 55).

(11) Lift the vehicle on hoist.

REMOVAL AND INSTALLATION (Continued)

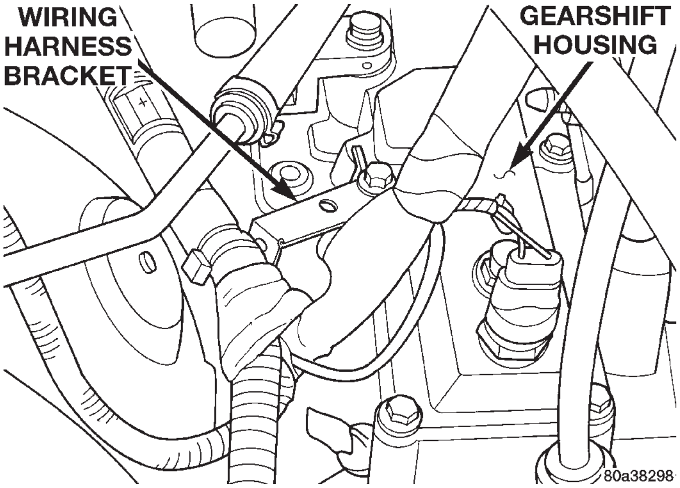


Fig. 49 Wiring Harness Bracket

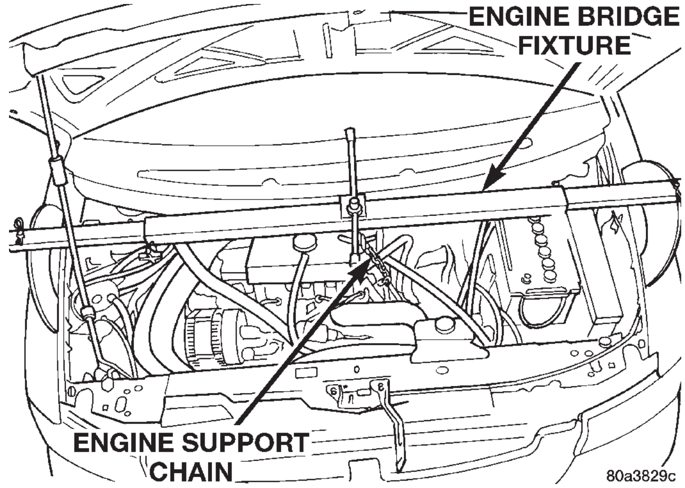


Fig. 51 Engine Bridge Fixture

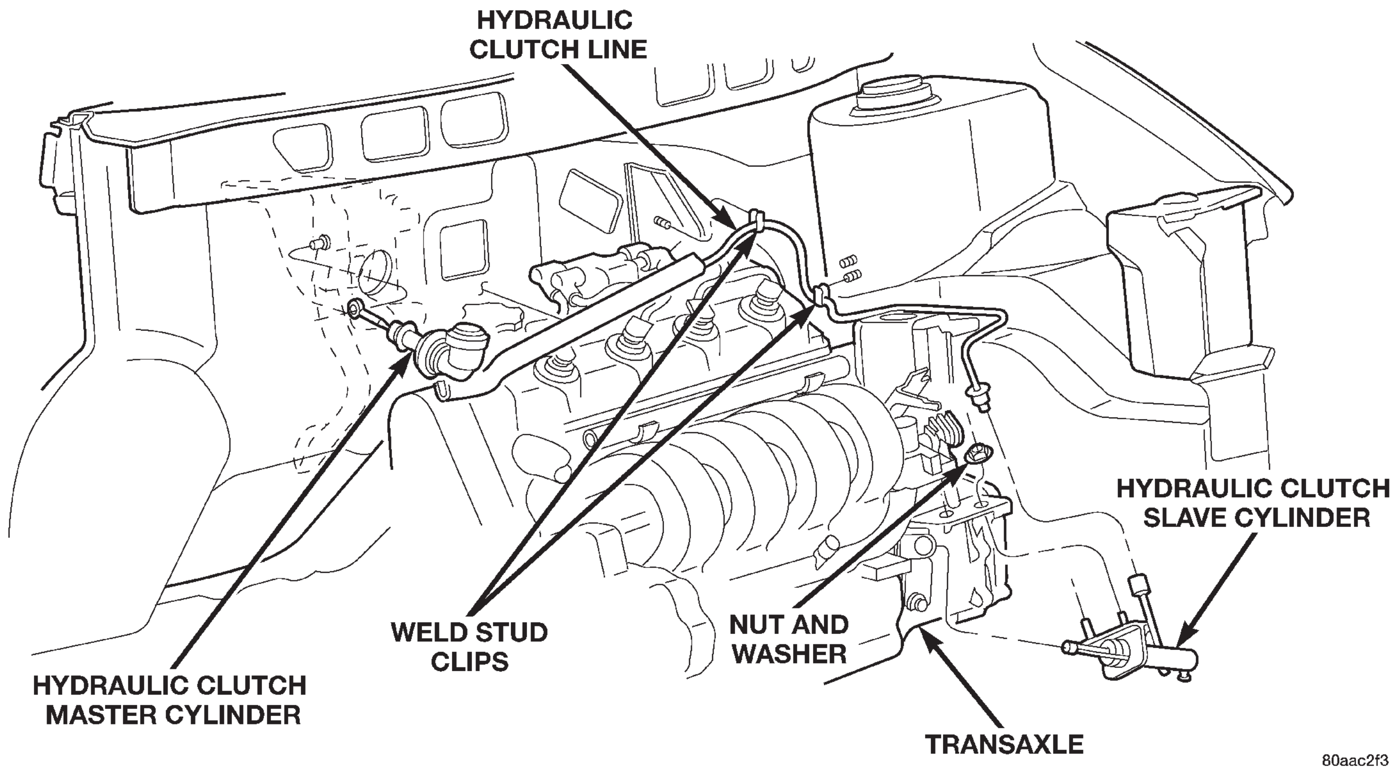


Fig. 50 Hydraulic Clutch Linkage

REMOVAL AND INSTALLATION (Continued)

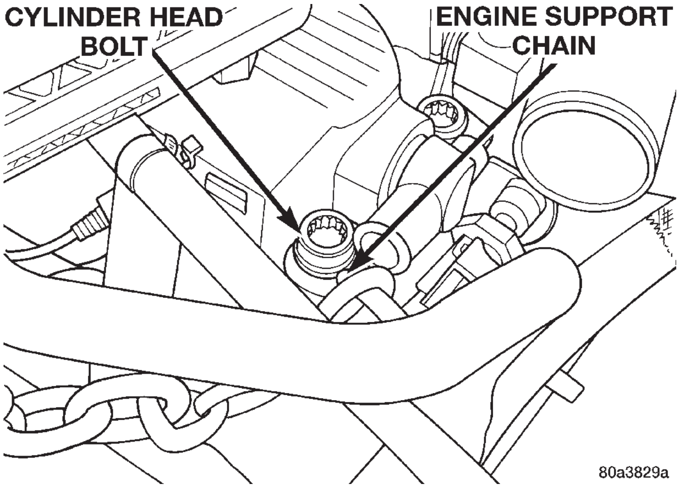


Fig. 52 Engine Support Chain — Typical

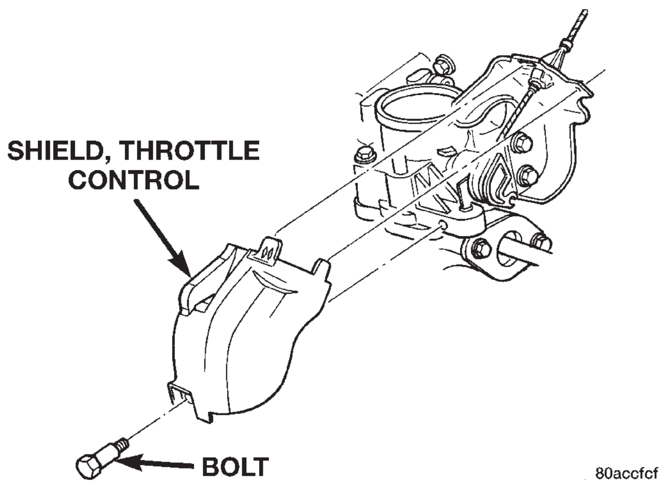


Fig. 53 Throttle Control Shield

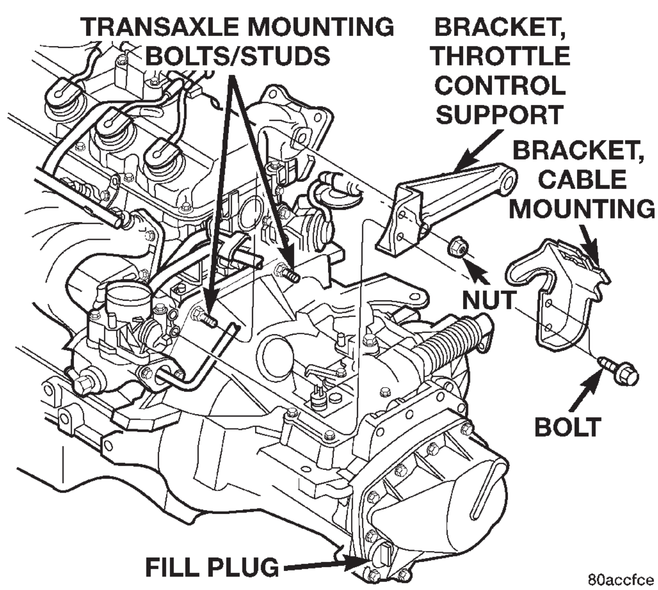


Fig. 54 Throttle Control Support Bracket

(12) Remove the front wheels.

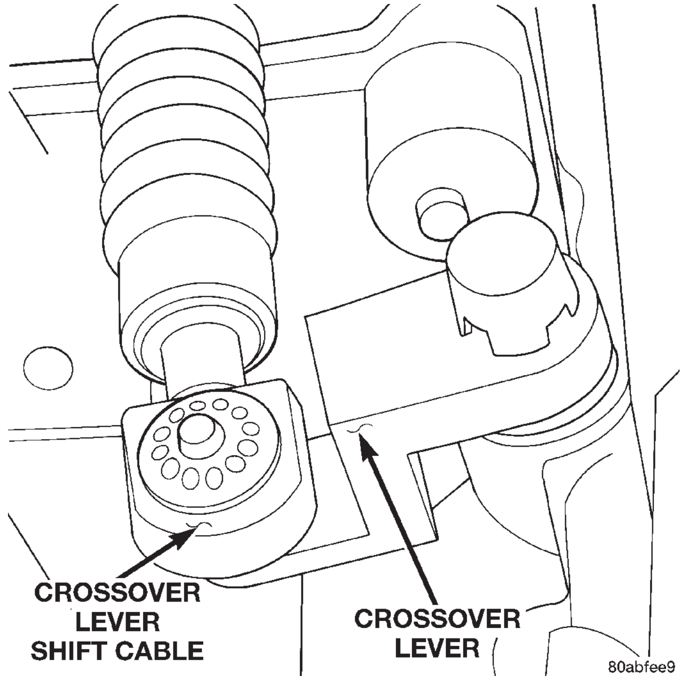


Fig. 55 Shift Cables

(13) Remove the two (2) axle shaft hub nuts.

(14) Remove three upper bellhousing bolts.

(15) Remove steering stop studs at steering knuckles.

(16) Remove lower control arm pinch bolts (Fig. 56).

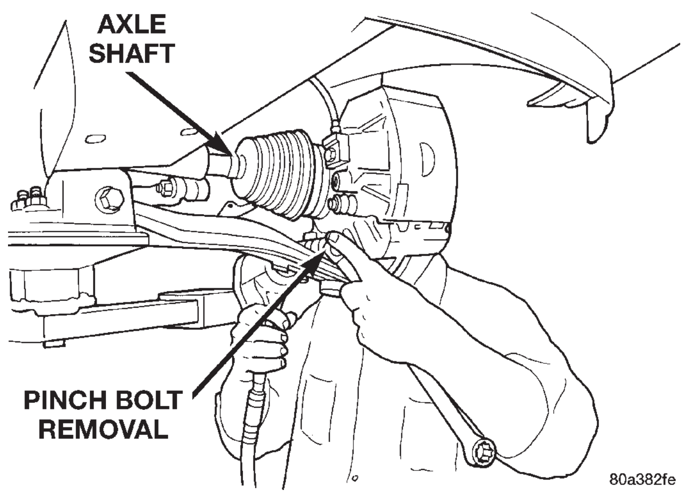


Fig. 56 Lower Control Arm Pinch Bolt

(17) Using a pry bar, unseat lower control arm from steering knuckle (Fig. 57).

(18) Remove drain plug and drain transaxle fluid (Fig. 58).

(19) Remove right and left axle shaft assemblies

(20) Remove vehicle speed sensor wiring connector (Fig. 59).

(21) Remove structural brace from engine and transaxle.

REMOVAL AND INSTALLATION (Continued)

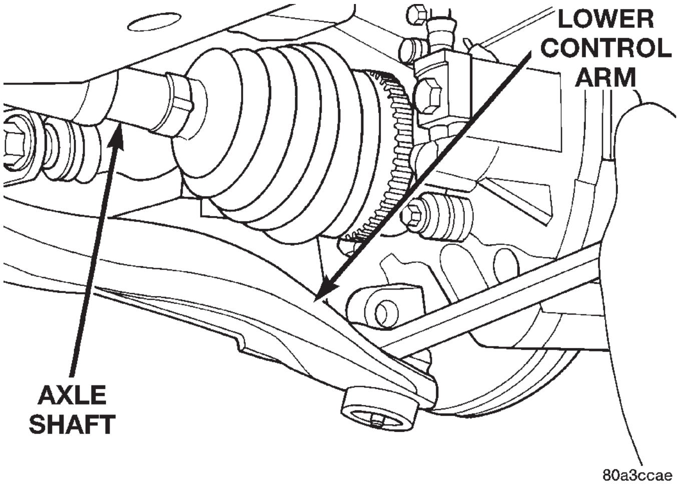


Fig. 57 Unseat Control Arm

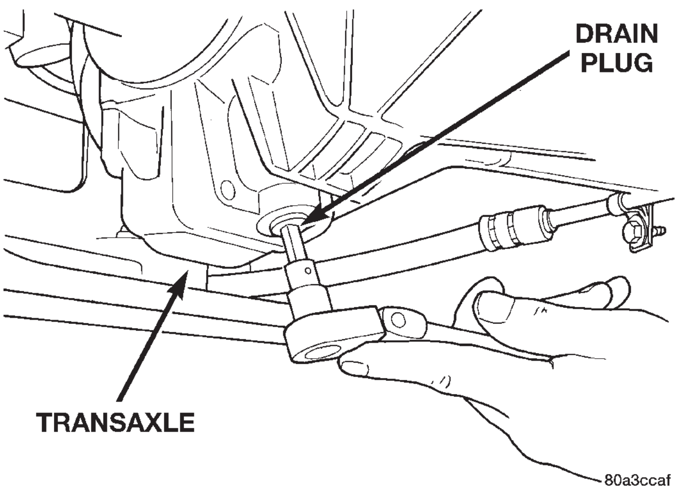


Fig. 58 Transaxle Drain Plug

(22) Remove lower starter bolt.

(23) Remove engine wiring harness clip.

CAUTION: Always use a safety chain when removing or installing transaxle assembly.

(24) Place a transmission jack under the transmission

(25) Remove the transaxle lower dust cover.

(26) Remove the access cover in right splash shield to access torsional damper bolt.

(27) Remove drive plate to modular clutch bolts while holding torsional damper bolt with socket and ratchet. To avoid distortion of the drive plate, remove the modular clutch bolts a few turns at a time. Use a crisscross pattern until all bolts are loosened.

(28) Unbolt rear engine mount through bolt and two (2) mount bolts.

(29) Remove the left front fender splash shield.

(30) Unbolt left engine mount through bolt and unbolt mount from the transaxle.

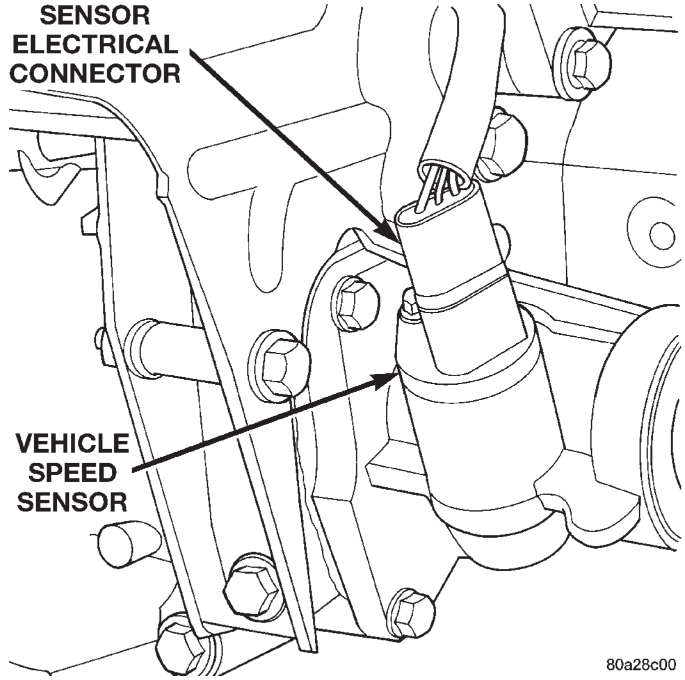


Fig. 59 Vehicle Speed Sensor

(31) Remove front engine mount (Fig. 60) and (Fig. 61).

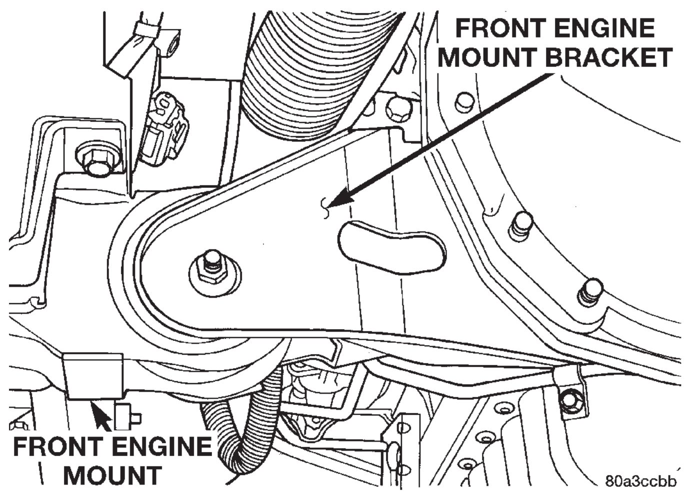


Fig. 60 Front Engine Mount (Left Side)

(32) Lower the transaxle and modular clutch.

To service the drive plate, refer to Group 9, Engine.

INSTALLATION

(1) Position the modular clutch assembly onto the input shaft of the transaxle (Fig. 62).

(2) To reinstall transaxle, reverse removal procedure making certain to align the elongated hole in the drive plate with the modular clutch bolt hole that has the white paint mark.

REMOVAL AND INSTALLATION (Continued)

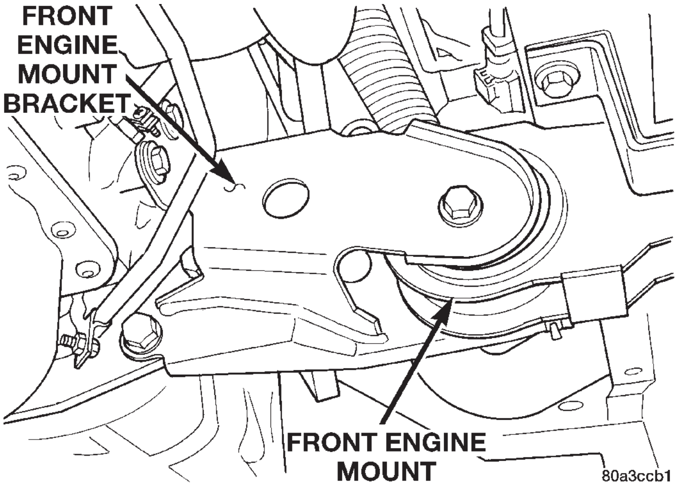


Fig. 61 Front Engine Mount (Right Side)

NOTE: To avoid distortion of the drive plate, bolts should be tightened a few turns at a time. Use a crisscross pattern until all bolts are seated. Tighten modular clutch plate bolts to 74 N·m (55 ft. lbs.).

NOTE: Lower control arm pinch bolts must be installed with the bolt head rearward of the ball joint.

(3) Fill transaxle to the proper level with the specified lubricant.

(4) While the vehicle is elevated slightly, run the transaxle through all the forward gears. Apply brakes and shift into reverse. Run the transaxle through reverse gear.

(5) Check the transaxle for leaks and recheck the level of the transaxle lubricant.

DISASSEMBLY AND ASSEMBLY

TRANSAXLE

The A-598 transaxle (Fig. 63) is similar to the A-523, A-568 transaxle with the following exceptions. The major differences are that the input shaft is supported by ball and roller bearings and the intermediate shaft is supported by tapered roller bearings. Also the front intermediate bearing will not clear the final drive gear for disassembly or reassembly.

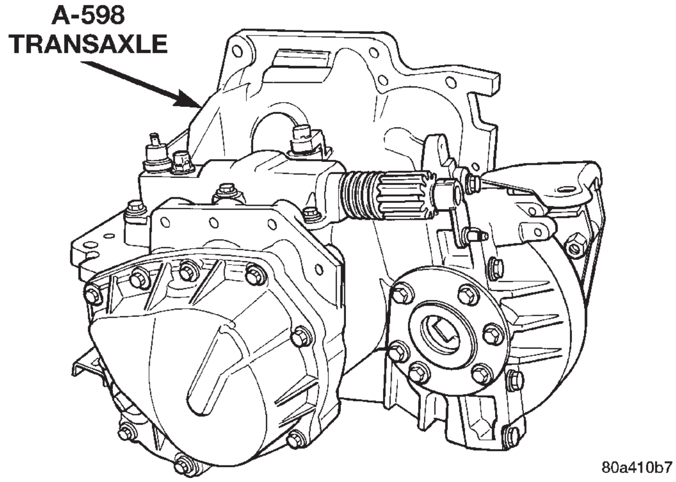


Fig. 63 A-598 Transaxle

In vehicle service is limited to:

- Shift cover components
- Sealing external joints and seals
- Service of 5th gear set and synchronizer

DISASSEMBLY

(1) Remove engine mount bracket (Fig. 64).

(2) Remove differential bearing retainer (Fig. 65).

(3) Remove extension housing (Fig. 66).

(4) Remove differential cover with soft-faced hammer (Fig. 67).

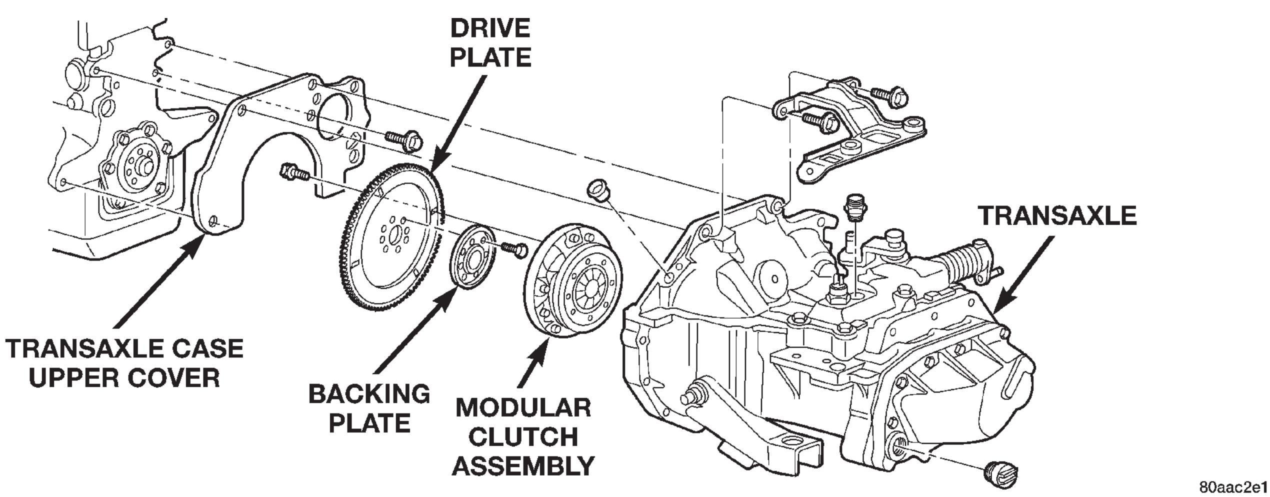


Fig. 62 Modular Clutch Mounting

DISASSEMBLY AND ASSEMBLY (Continued)

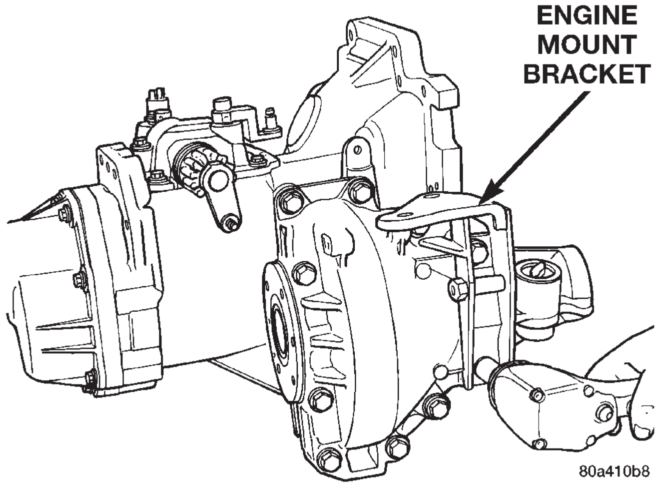


Fig. 64 Engine Mount Bracket

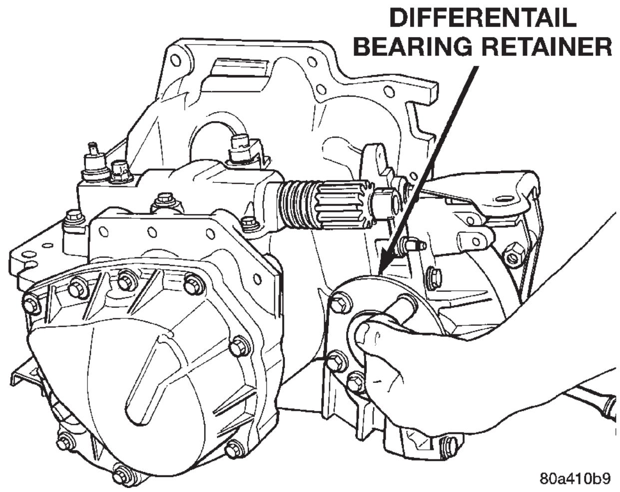


Fig. 65 Differential Bearing Retainer

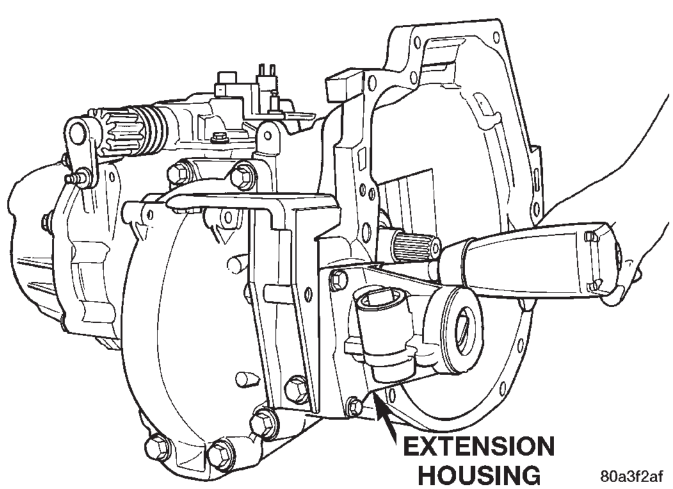


Fig. 66 Extension Housing

(5) Remove differential assembly (Fig. 68) (Fig. 69).

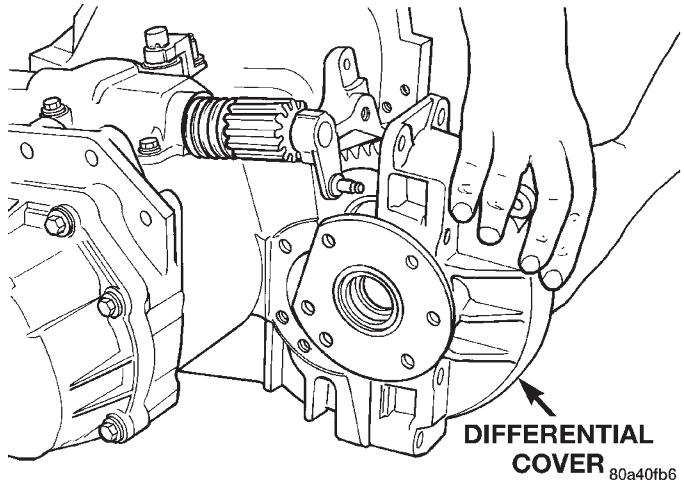


Fig. 67 Differential Cover

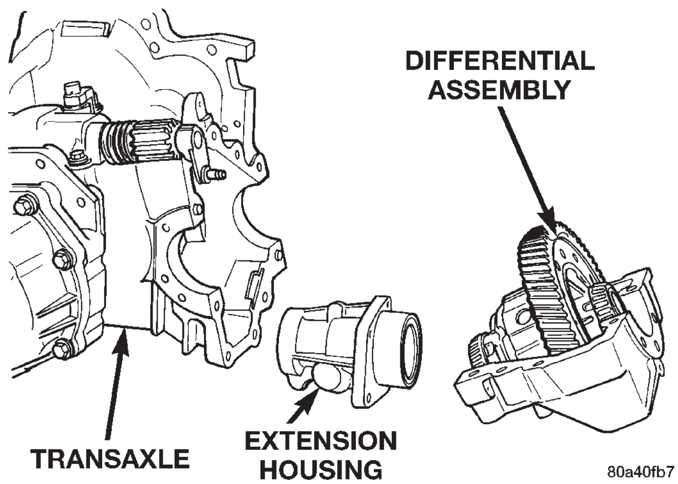


Fig. 68 Differential

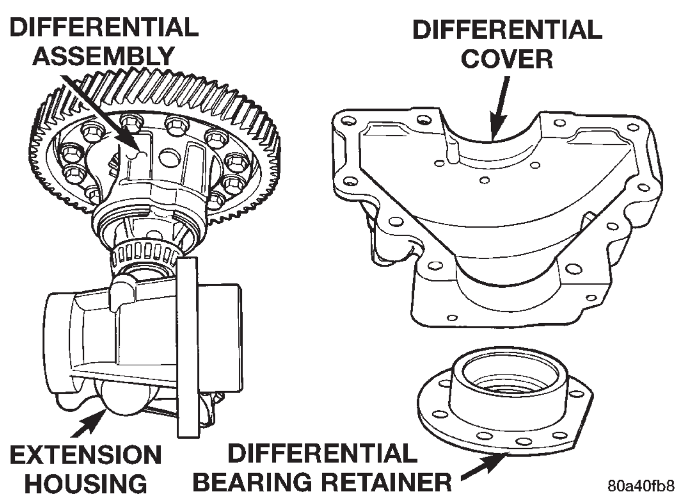


Fig. 69 Differential Components

CAUTION: Shift detent springs are located underneath shift cover. Remove shift cover carefully.

(6) Remove shift cover (Fig. 70) (Fig. 72).

DISASSEMBLY AND ASSEMBLY (Continued)

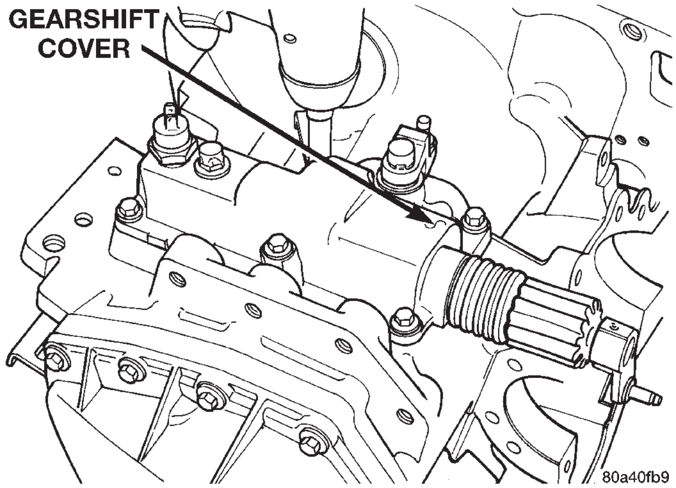


Fig. 70 Gearshift Cover

NOTE: Two of the bolts retaining the shift cover are shouldered. Mark the bolts and the location (Fig. 71).

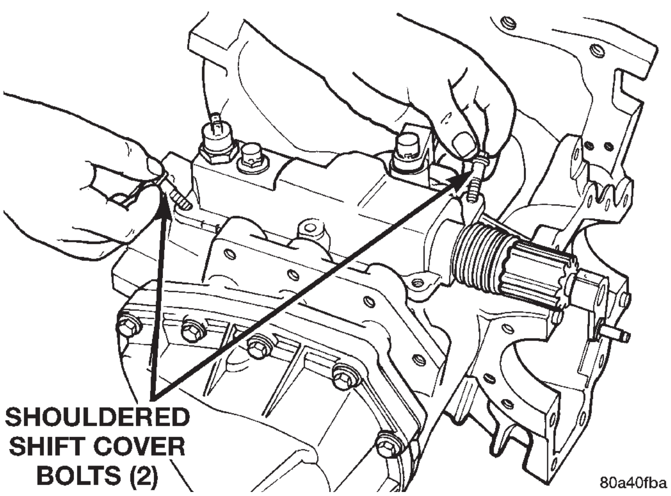


Fig. 71 Gearshift Cover Shouldered Bolts

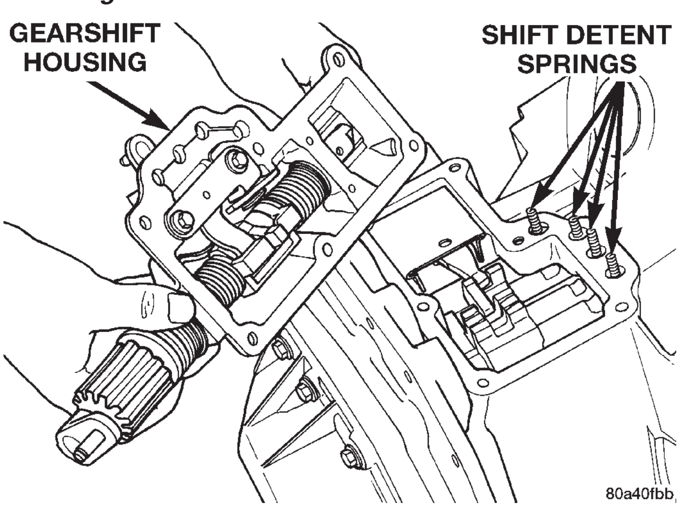


Fig. 72 Shift Cover Removed

(7) Remove shift cover splash shield (Fig. 73).

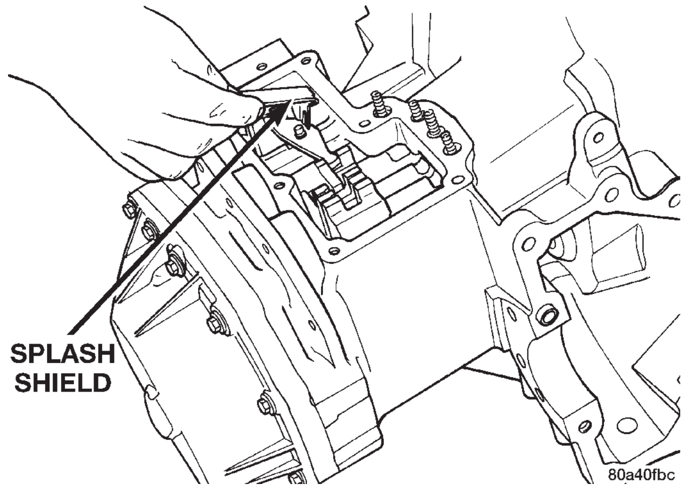


Fig. 73 Shift Cover Splash Shield

(8) Remove shift detent springs (Fig. 74) and rollers (Fig. 75).

NOTE: On some A-598 transaxles all four detent springs are of the same color and spring tension. On other A-598 transaxles, three identical springs are used on the forward gear detents, while the reverse detent spring is a different tension and color.

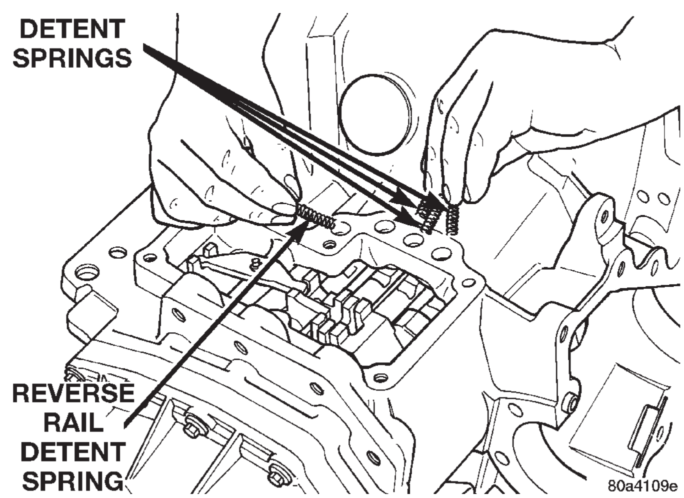


Fig. 74 Shift Detent Springs

(9) Remove reverse pivot lever actuator arm (Fig. 76).

(10) Remove 1–2 roll pin at 1–2 shift fork (Fig. 77).

(11) Rotate 1–2 shift lug out of the way.

(12) Remove 3–4 roll pin at 3–4 shift lug (Fig. 78).

(13) Remove 5th gear/synchro end cover (Fig. 79) (Fig. 80).

DISASSEMBLY AND ASSEMBLY (Continued)

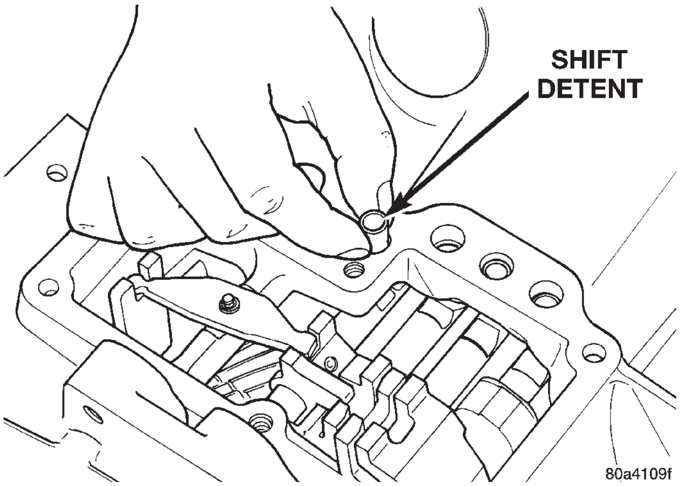


Fig. 75 Shift Detent Rollers

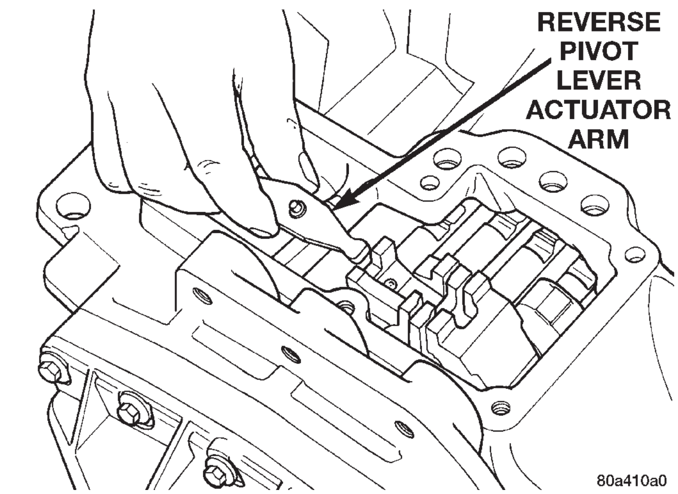


Fig. 76 Reverse Pivot Lever Actuator Arm

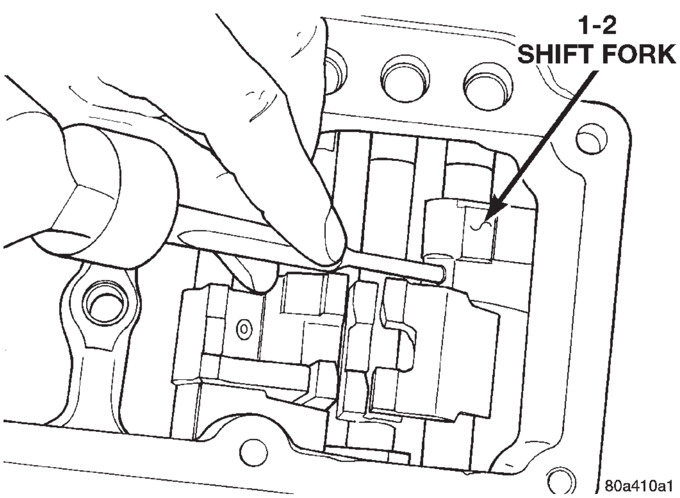


Fig. 77 1–2 Shift Fork Roll Pin

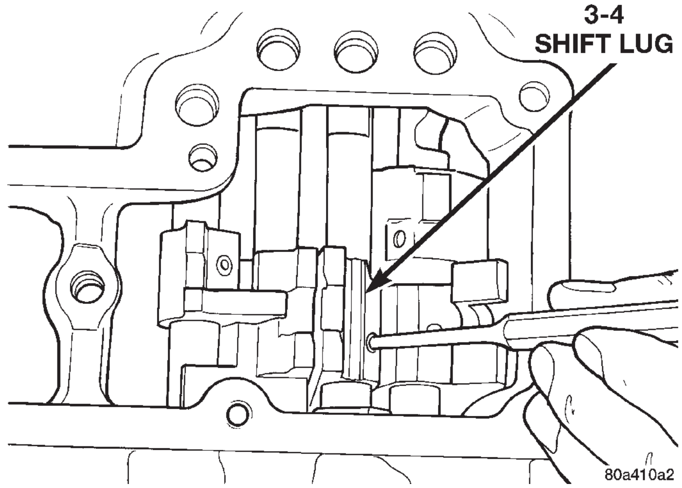


Fig. 78 3–4 Shift Lug Roll Pin

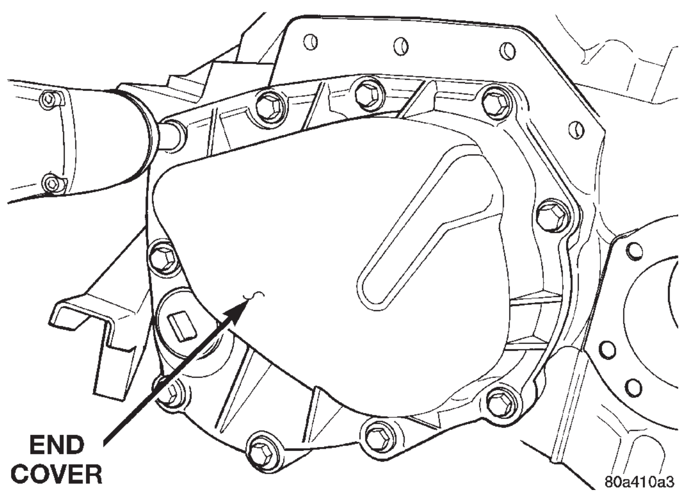


Fig. 79 End Cover

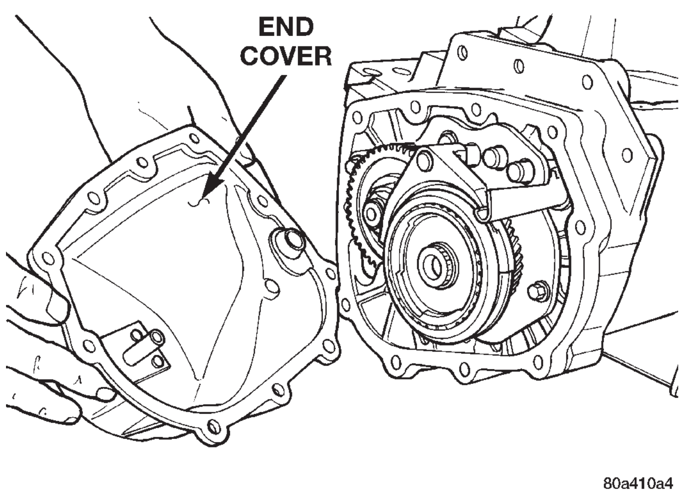


Fig. 80 End Cover Removed

(14) Remove 5th gear shift fork roll pin (Fig. 81).

(15) Remove snap ring at 5th gear synchro (Fig. 82).

(16) Remove 5th gear shift fork, synchro plate, and synchro (Fig. 83) (Fig. 84).

(17) Use Special Tool # 6252 to hold 5th gear and remove 5th gear nut (Fig. 85) at input shaft .

DISASSEMBLY AND ASSEMBLY (Continued)

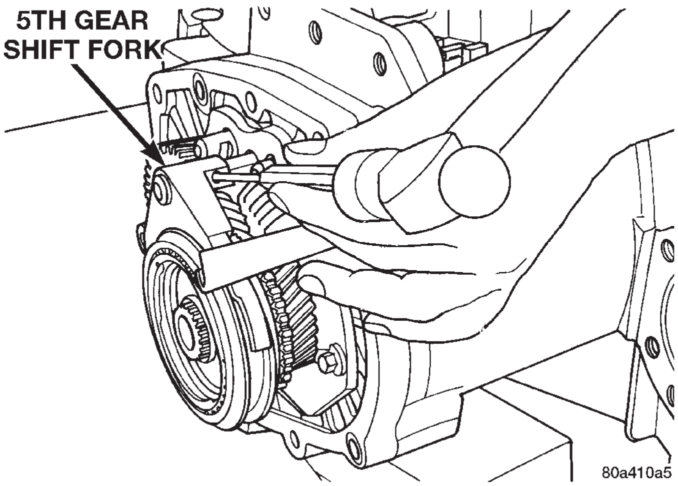


Fig. 81 5th Gear Shift Fork Roll Pin

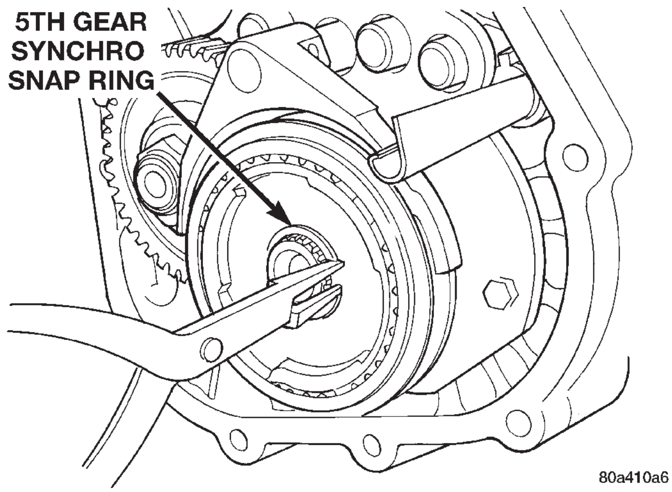


Fig. 82 5th Gear Synchronizer Snap Ring

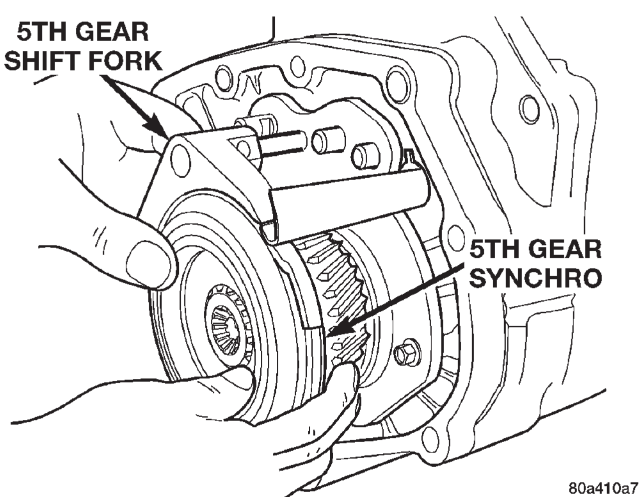


Fig. 83 5th Gear Shift Fork, Rail, and Synchronizer

(18) Remove 5th gear (Fig. 86).

(19) Remove bearing retainer plate bolts (Fig. 87).

(20) Remove bearing retainer plate (Fig. 88) (Fig. 89).

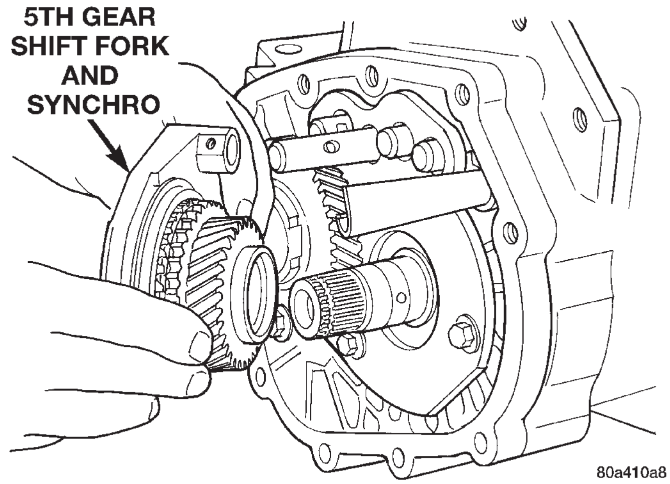


Fig. 84 5th Gear Shift Fork, Rail, and Synchronizer Removed

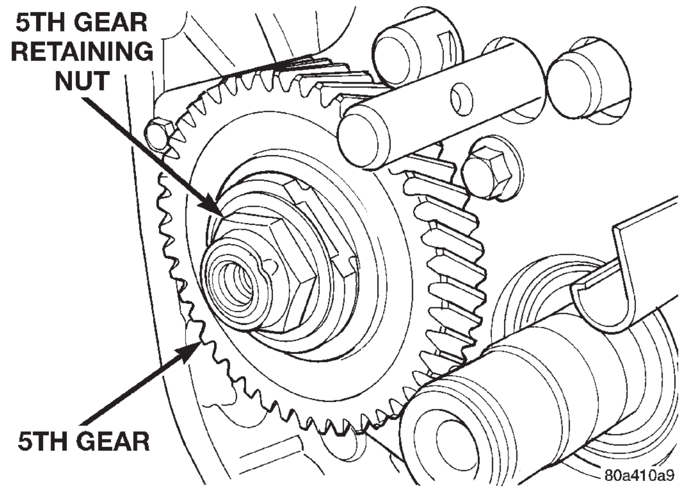


Fig. 85 5th Gear Retaining Nut

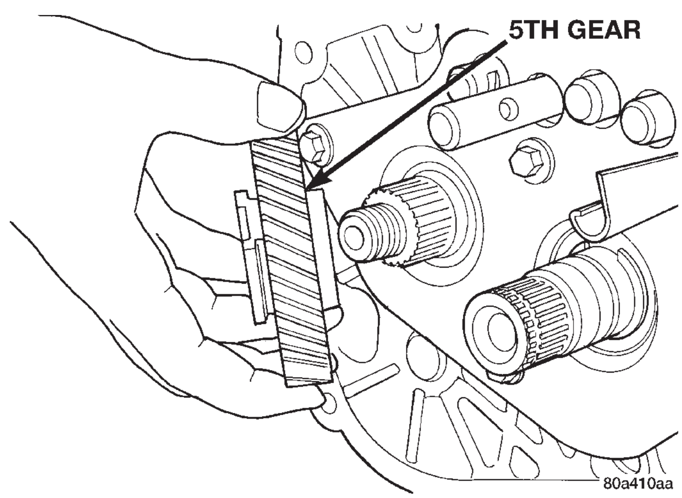


Fig. 86 5th Gear

(21) Remove preload shim at intermediate shaft (Fig. 90).

DISASSEMBLY AND ASSEMBLY (Continued)

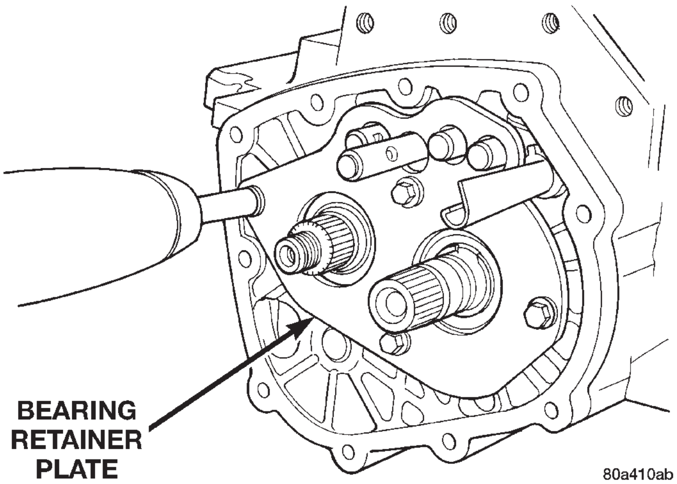


Fig. 87 Bearing Retainer Plate Bolts

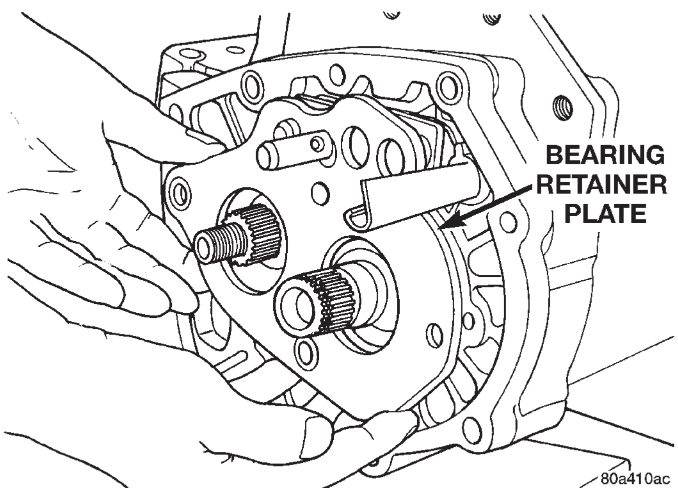


Fig. 88 Bearing Retainer Plate

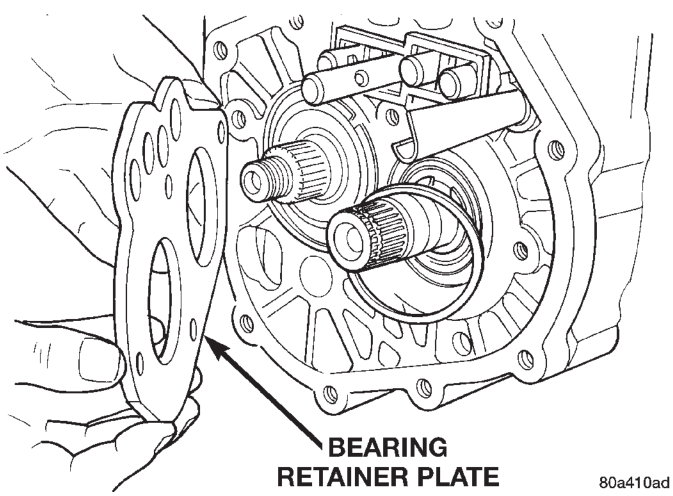


Fig. 89 Retainer Plate Removed

(22) Remove input shaft bearing snap ring (Fig. 91) (Fig. 92).

(23) Remove interlock plate (Fig. 93) and shuttles (Fig. 94).

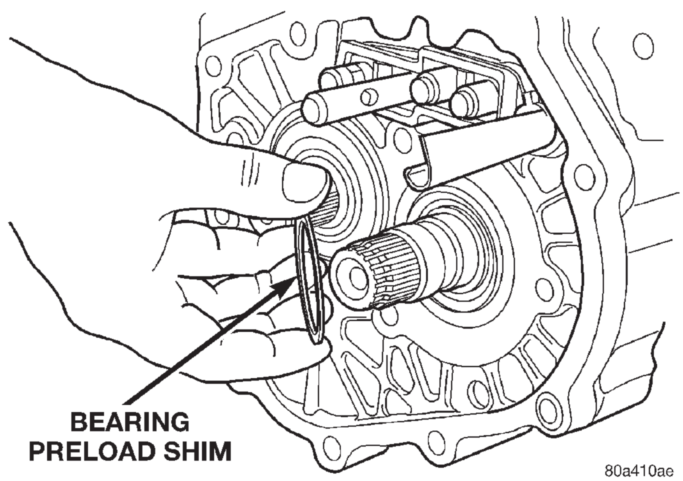


Fig. 90 Bearing Preload Shim

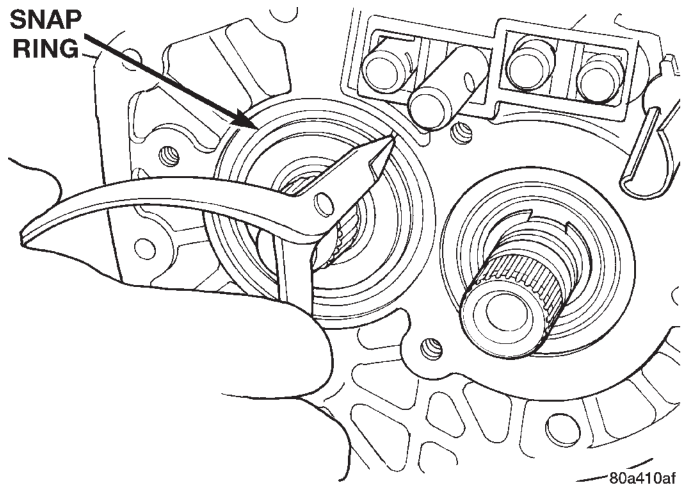


Fig. 91 Input Shaft Bearing Snap Ring

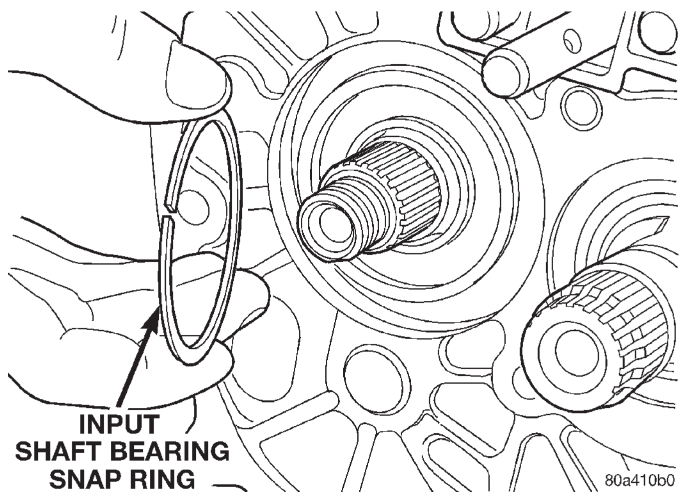


Fig. 92 Snap Ring Removed

NOTE: The shift rails are positioned as shown (Fig. 95).

DISASSEMBLY AND ASSEMBLY (Continued)

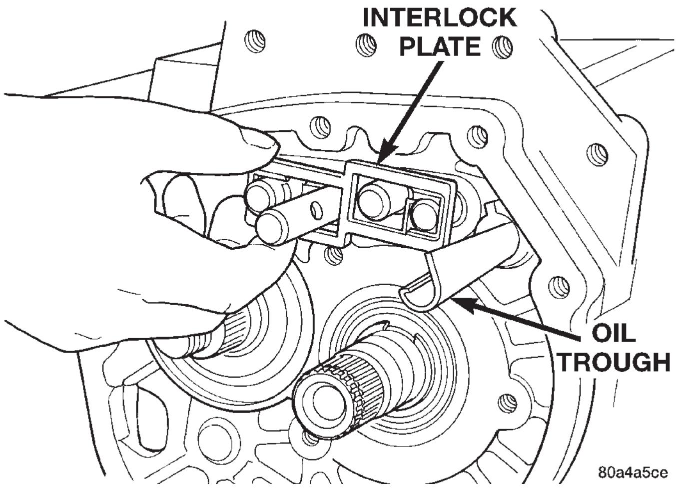


Fig. 93 Interlock Plate

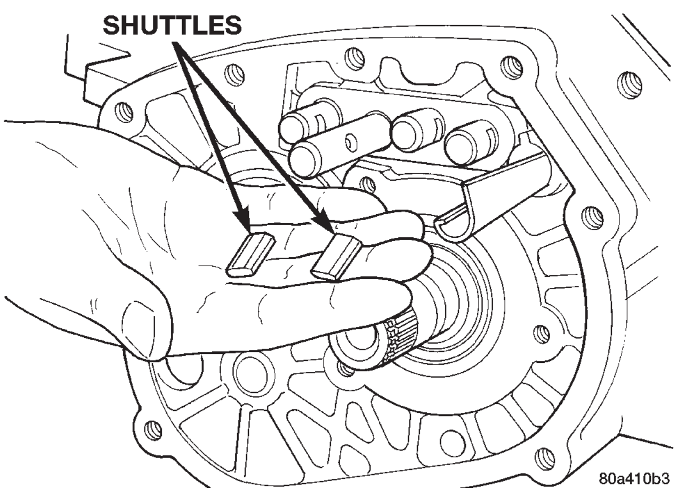


Fig. 94 Shuttles

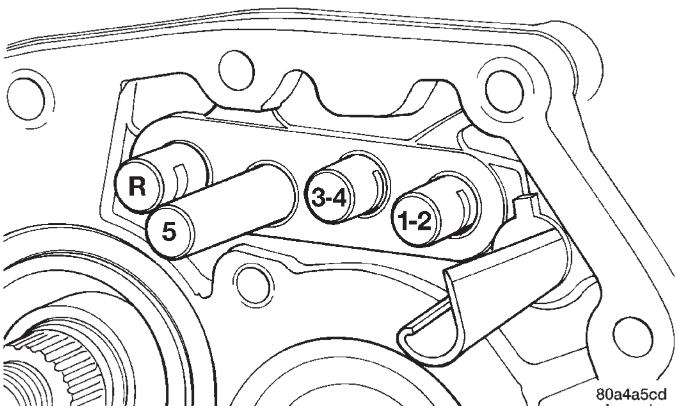


Fig. 95 Shift Rail Identification

(24) Remove bearing support plate (Fig. 96) (Fig. 97).

(25) Remove reverse idler gear (Fig. 98) (Fig. 99).

(26) Remove 5th gear shift rail C-clip (Fig. 100).

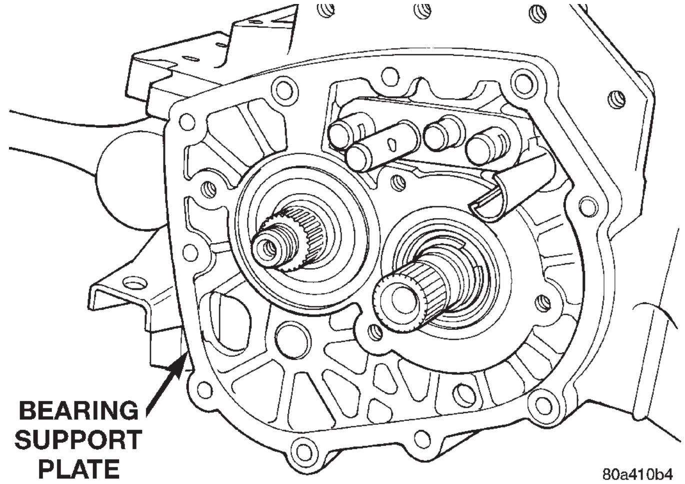


Fig. 96 Bearing Support Plate

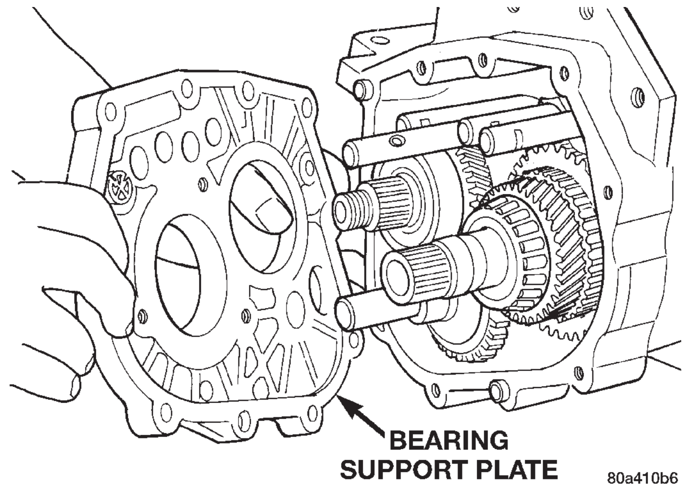


Fig. 97 Support Plate Removed

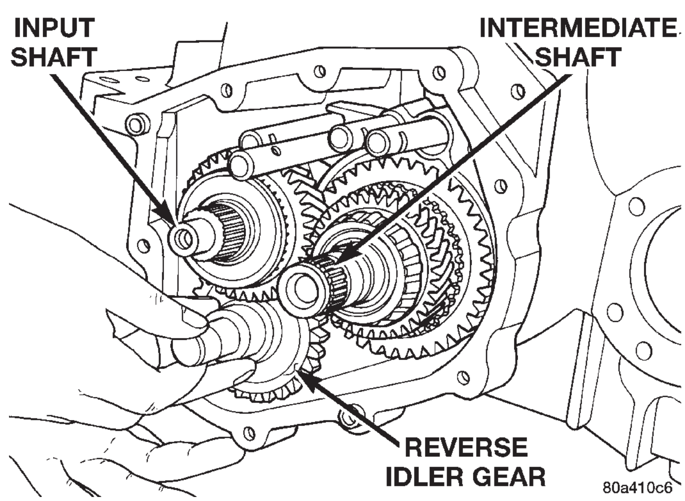


Fig. 98 Reverse Idler Gear

CAUTION: The 5th gear shift rail has a small interlock pin that is contained within the shift lug and rail. Use caution when removing shift rail.

DISASSEMBLY AND ASSEMBLY (Continued)

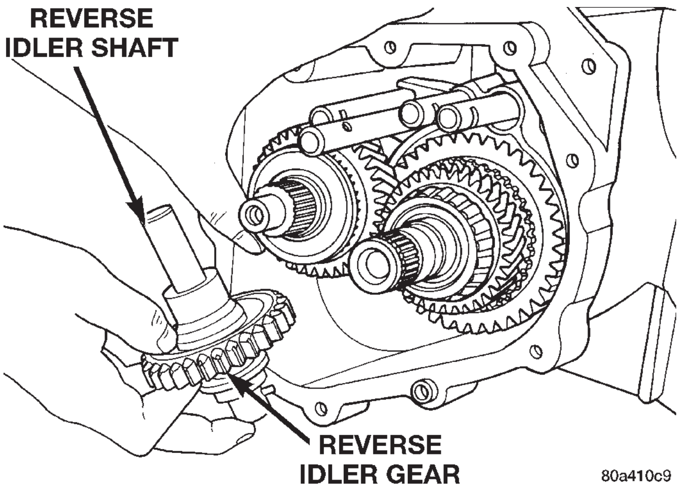


Fig. 99 Reverse Idler Removed

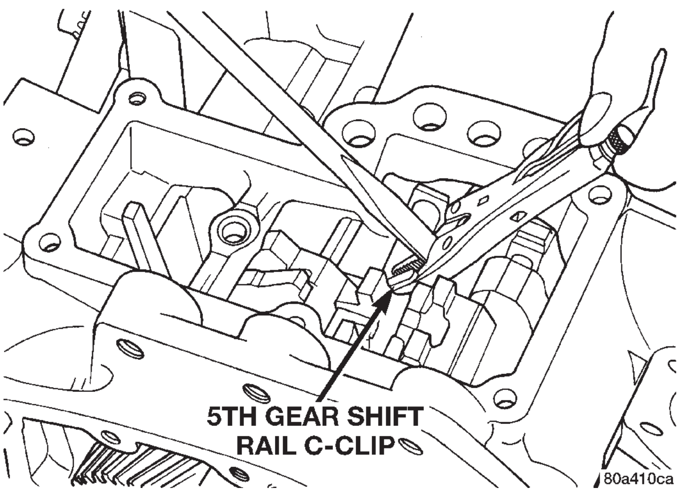


Fig. 100 Shift Rail C-clip

(27) Carefully remove 5th gear shift rail (Fig. 101) (Fig. 102) (Fig. 103).

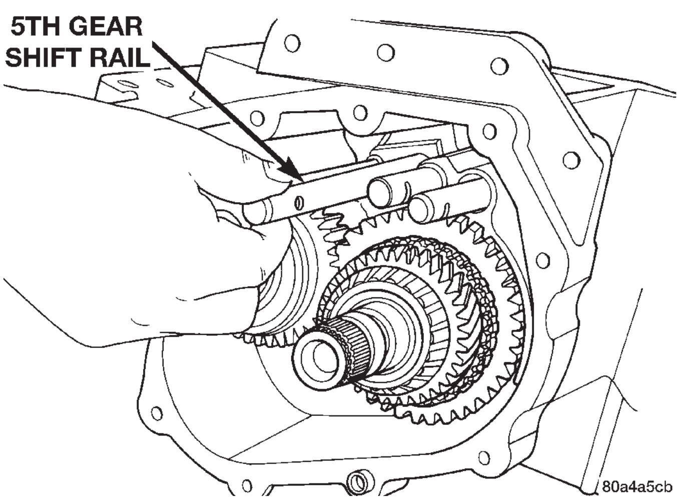


Fig. 101 5th Gear Shift Rail

(28) Remove reverse shift rail (Fig. 104) (Fig. 105).

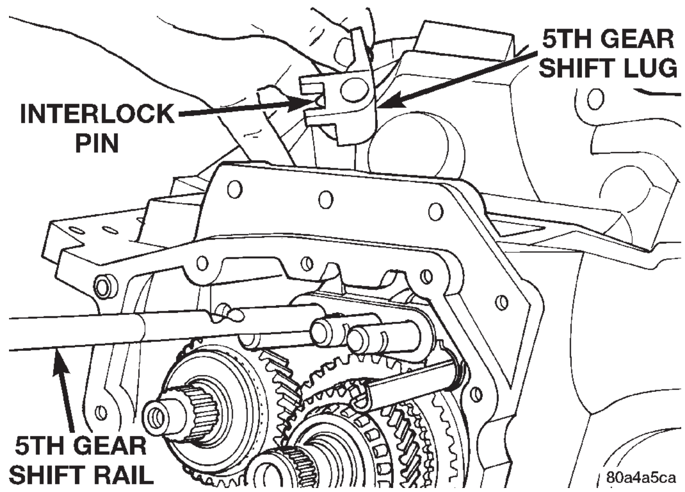


Fig. 102 5th Gear Shift Rail Removed

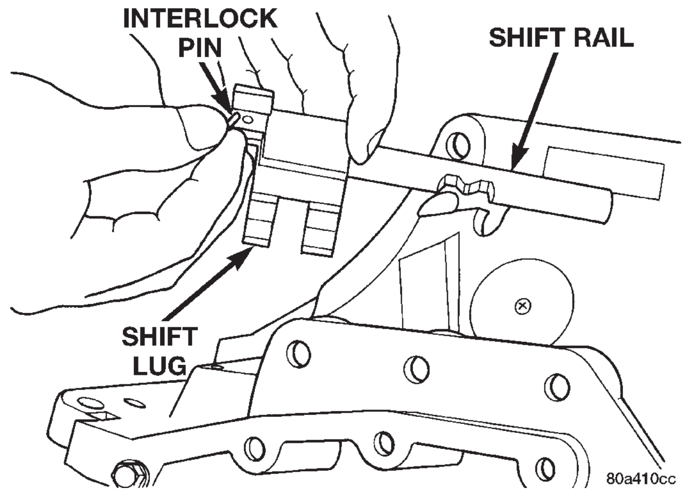


Fig. 103 5th Gear Shift Rail, Interlock, and Pin

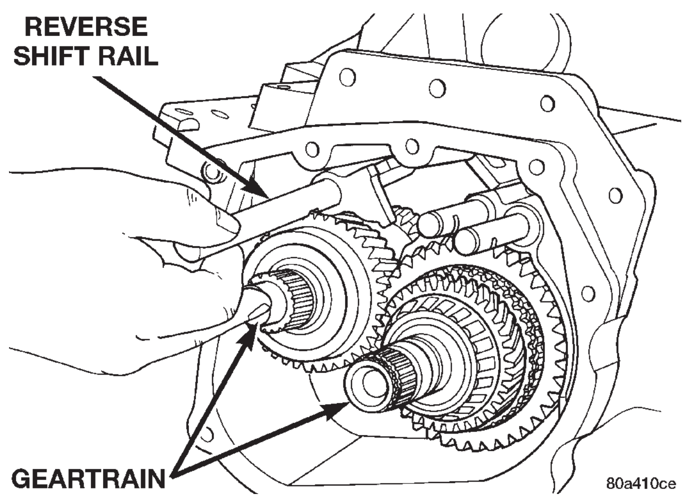


Fig. 104 Reverse Shift Rail

(29) Move the 1–2 and 3–4 shift rail lugs out of the way (Fig. 106).

(30) Remove geartrain set (Fig. 107).

DISASSEMBLY AND ASSEMBLY (Continued)

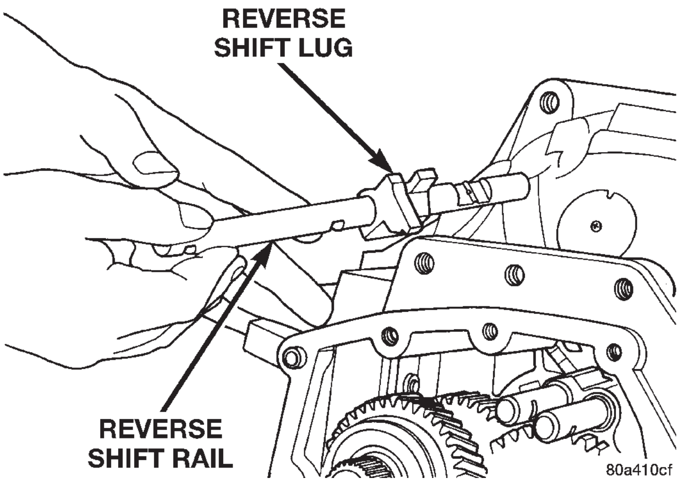


Fig. 105 Reverse Shift Rail Removed

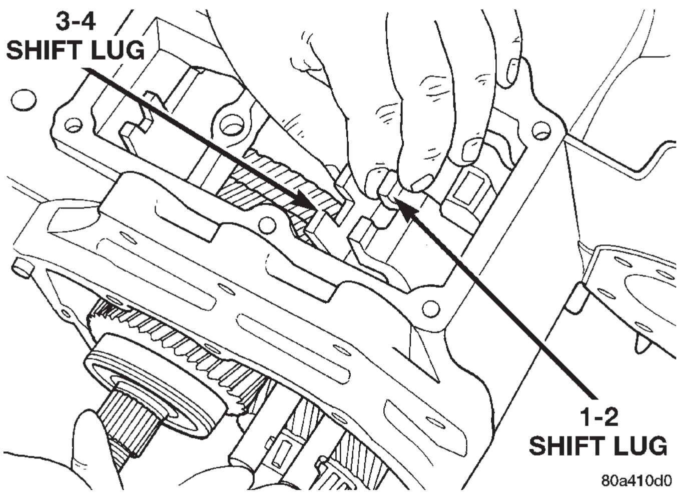


Fig. 106 Reposition Shift Rail Lugs

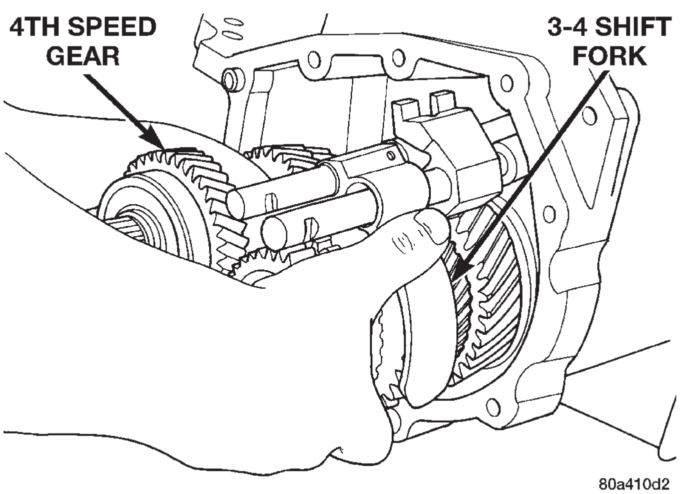


Fig. 107 Geartrain Removal

NOTE: The input shaft is serviced as an assembly. The only serviceable components of the input shaft are the bearings.

To disassemble the intermediate shaft, differential, synchronizers, or transaxle case, refer to the appropriate procedure in this section (Fig. 108).

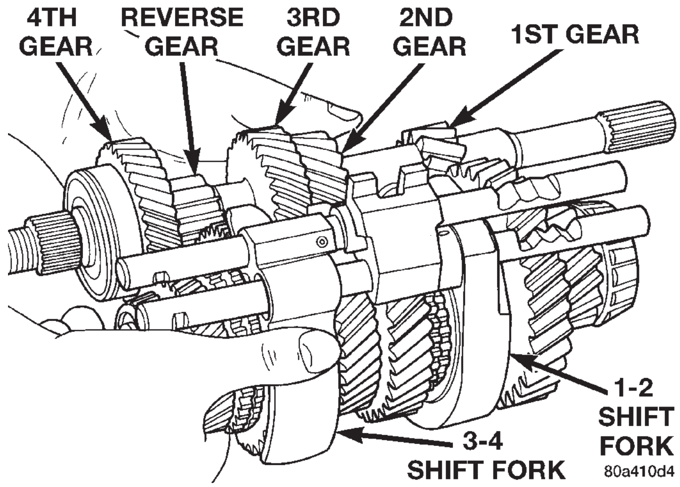


Fig. 108 Geartrain Components

ASSEMBLY

If the transaxle housing, intermediate shaft, bearing plate, or bearings were replaced, you must adjust the intermediate shaft bearing preload. To adjust intermediate shaft preload, refer to Intermediate Shaft Preload Adjustment.

(1) Install geartrain set.

CAUTION: The 5th gear shift rail has a small interlock pin that is contained within the shift lug and rail. Use caution when installing shift rail.

(2) Carefully install 5th gear shift rail (Fig. 109) (Fig. 110).

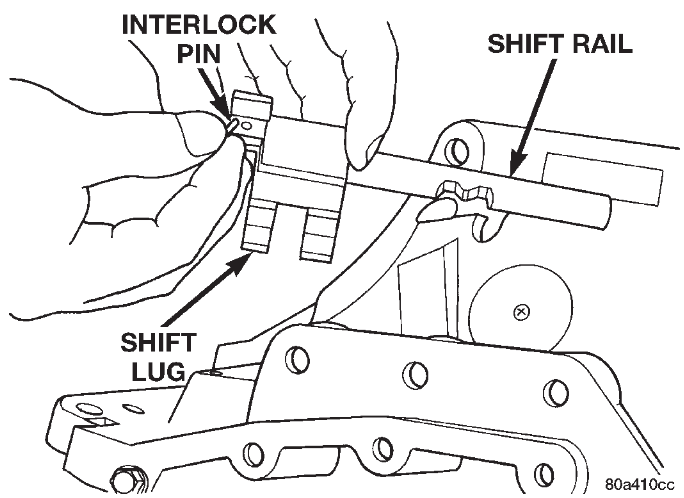


Fig. 109 5th Gear Shift Rail and Interlock

(3) Install 5th gear shift rail C-clip.

(4) Install reverse shift rail.

(5) Install reverse idler gear (Fig. 111).

DISASSEMBLY AND ASSEMBLY (Continued)

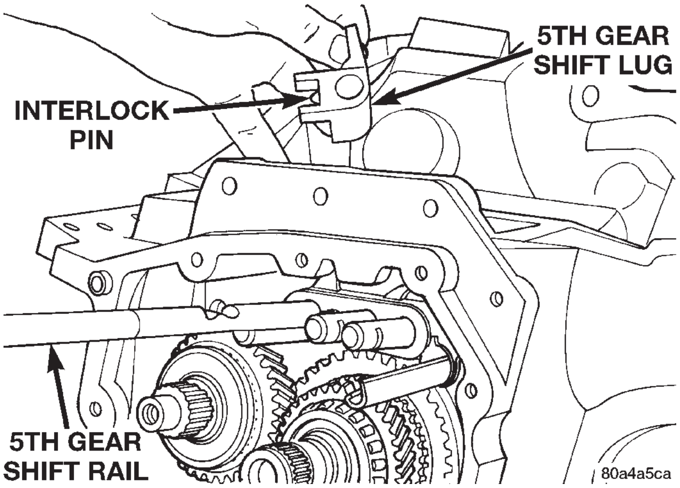


Fig. 110 5th Gear Shift Rail

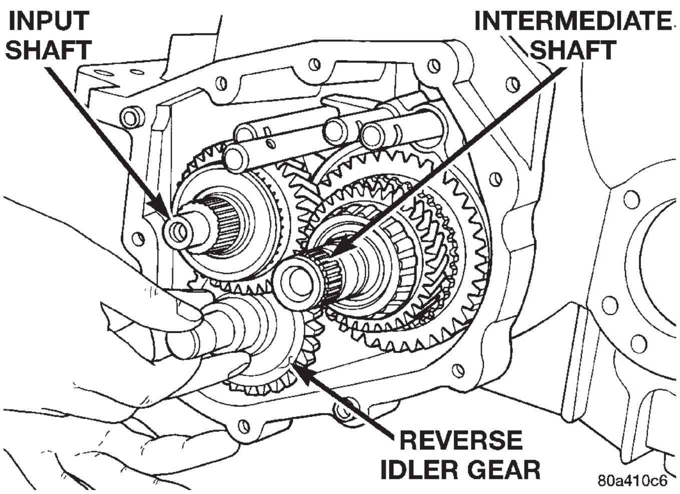


Fig. 111 Reverse Idler Gear

NOTE: Verify that the rear oil trough is properly installed and retained in the bearing support plate before installing support plate.

(6) Apply a bead of Mopar® Gasket Maker or equivalent onto bearing support plate. Install bearing support plate (Fig. 112).

(7) Install interlock plate (Fig. 113) and shuttles (Fig. 114).

(8) Install input shaft bearing snap ring (Fig. 115).

(9) Install preload shim at intermediate shaft (Fig. 116).

(10) Install bearing retainer plate. Tighten bearing retainer plate to 17 N·m (250 in. lbs.).

NOTE: If the transaxle housing, intermediate shaft, bearing retainer plate, or bearings are replaced, you must perform the intermediate shaft bearing preload procedure. Refer to Intermediate Shaft Bearing Preload Adjustment procedure in the ADJUSTMENTS section.

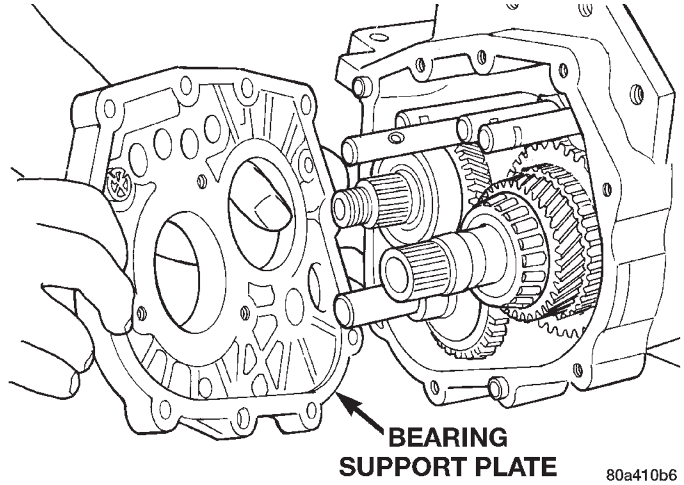


Fig. 112 Support Plate

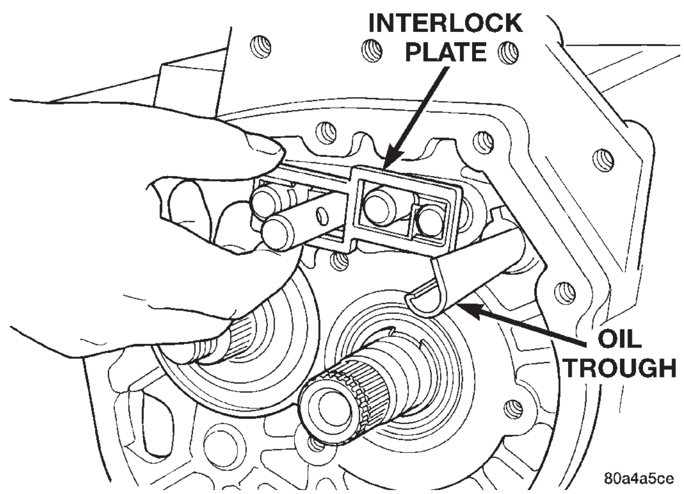


Fig. 113 Interlock Plate

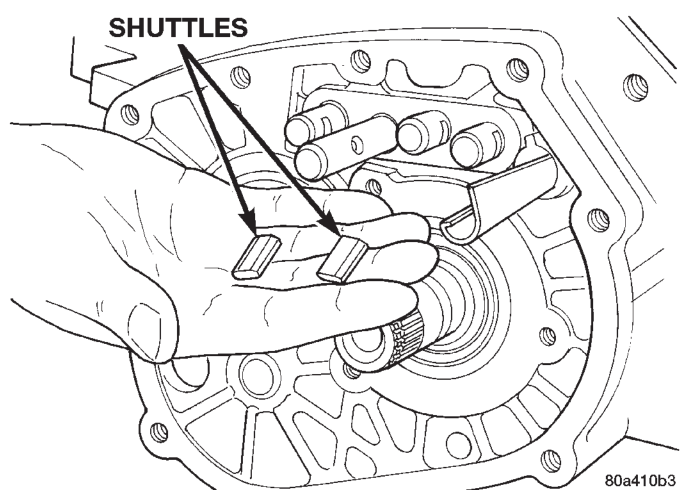


Fig. 114 Shuttles

(11) Install 5th gear.

(12) Use Special Tool 6252 to hold 5th gear and install 5th gear nut at input shaft. Tighten the retaining nut to 176 N·m (130 ft. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

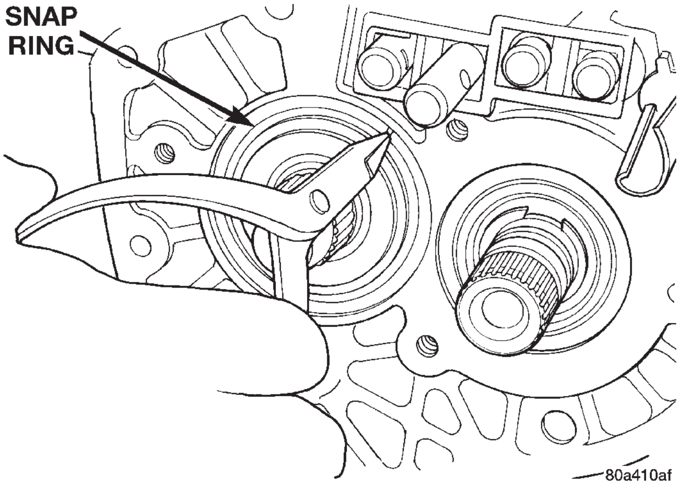


Fig. 115 Input Shaft Bearing Snap Ring

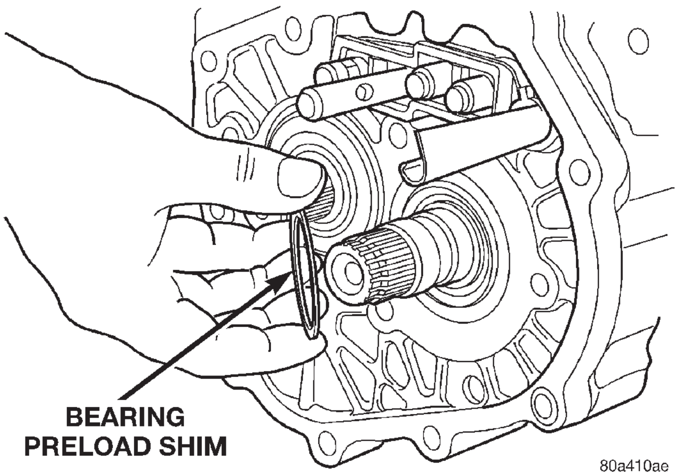


Fig. 116 Bearing Preload Shim

(13) Use Special Tool 6930 to stake the 5th gear retaining nut onto the input shaft (Fig. 117).

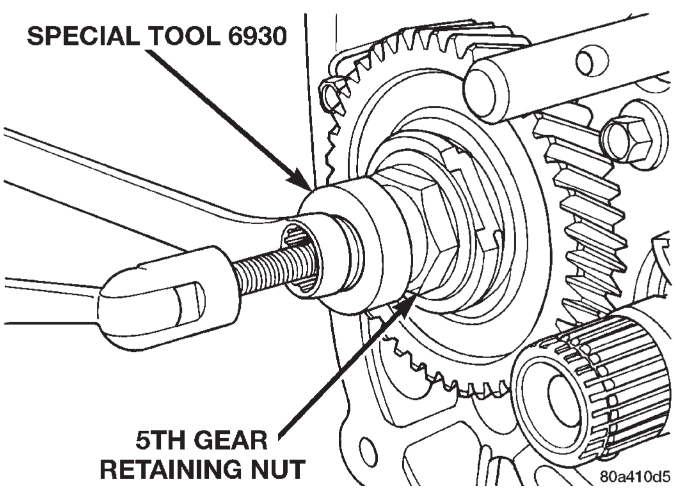


Fig. 117 Staking 5th Gear Retaining Nut

(14) Install 5th gear shift fork, synchro, and plate (Fig. 118).

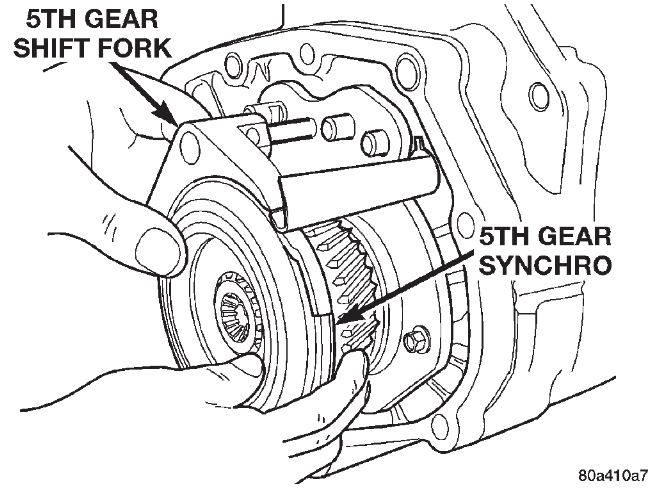


Fig. 118 5th Gear Shift Fork, Rail, and Synchronizer

(15) Install snap ring at 5th gear synchro (Fig. 119).

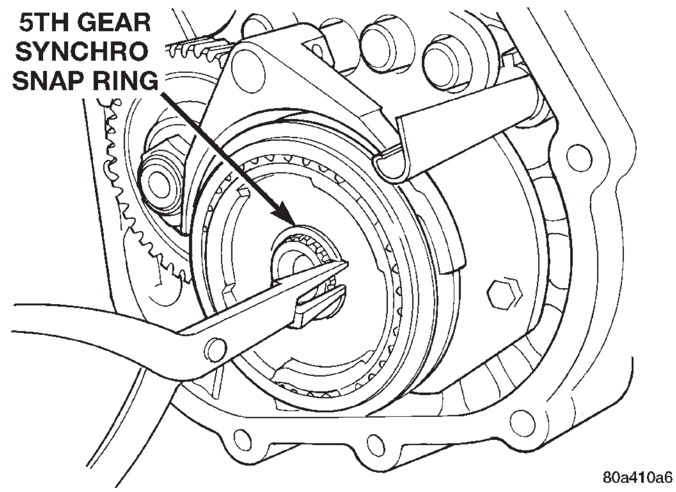


Fig. 119 5th Gear Synchronizer Snap Ring

(16) Install 5th gear shift fork roll pin (Fig. 120).

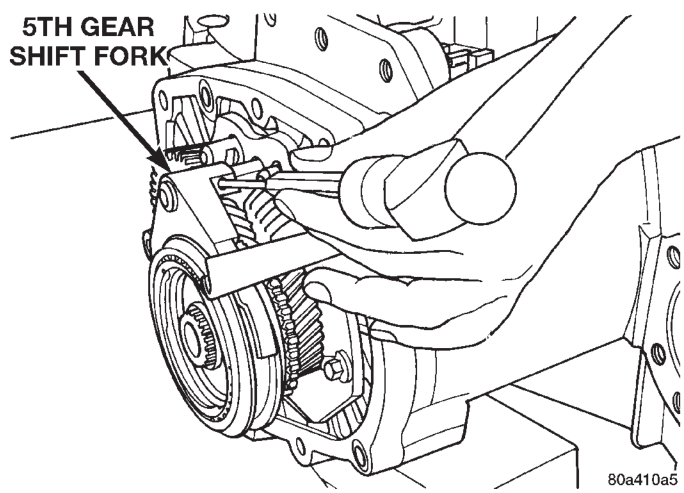


Fig. 120 5th Gear Shift Fork Roll Pin

DISASSEMBLY AND ASSEMBLY (Continued)

(17) Apply a bead of Mopar® Gasket Maker or equivalent onto end cover. Install 5th gear/synchro end cover. Tighten bolts to 28 N·m (250 in. lbs.).

(18) Move 3–4 shift lug into position. Install 3–4 roll pin at 3–4 shift lug (Fig. 121).

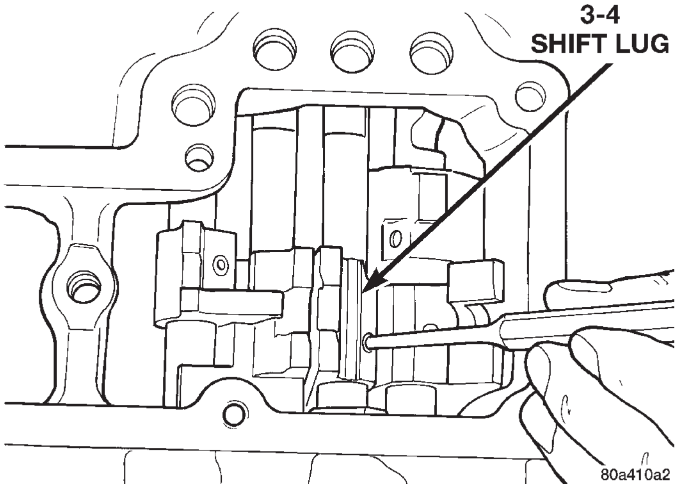


Fig. 121 3–4 Shift Lug Roll Pin

(19) Install 1–2 roll pin at 1–2 shift fork (Fig. 122).

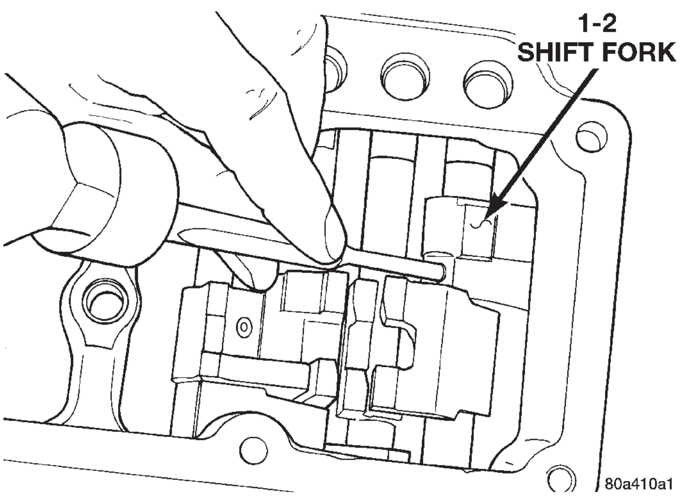


Fig. 122 1–2 Shift Fork Roll Pin

(20) Install reverse pivot lever actuator arm (Fig. 123).

NOTE: When installing shift detents, align the detent slots in line with the longitudinal axis of the transaxle (same direction as the shift rails).

NOTE: On some A-598 transaxles all four detent springs are of the same color and spring tension. On other A-598 transaxles, three identical springs are used on the forward gear detents, while the reverse detent spring is a different tension and color.

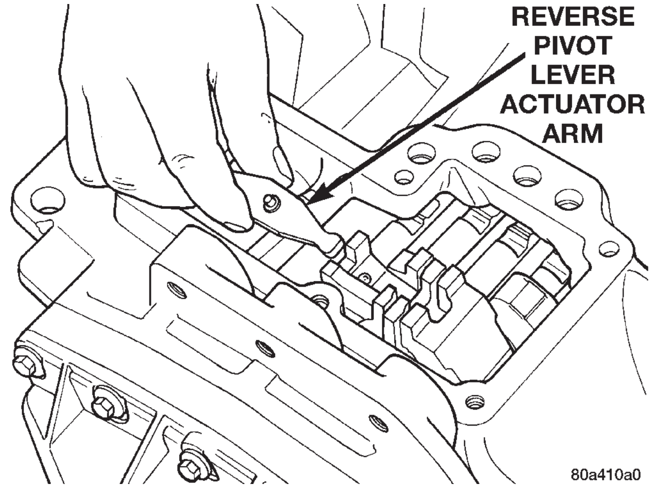


Fig. 123 Reverse Pivot Lever Actuator Arm

(21) Install shift detents, springs, and rollers (Fig. 124) (Fig. 125).

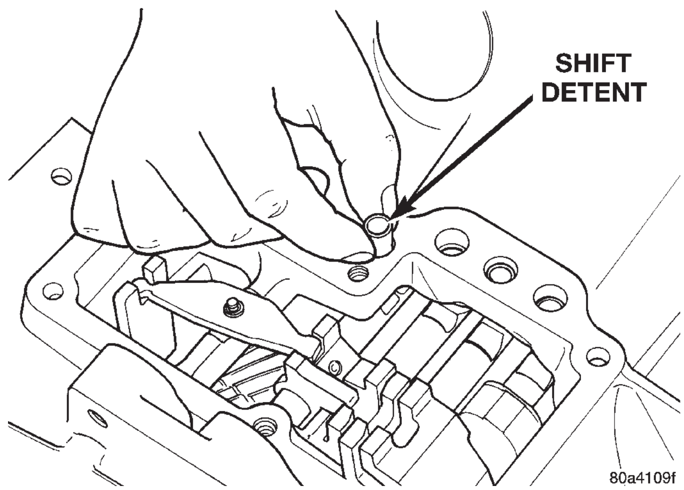


Fig. 124 Shift Detent Rollers

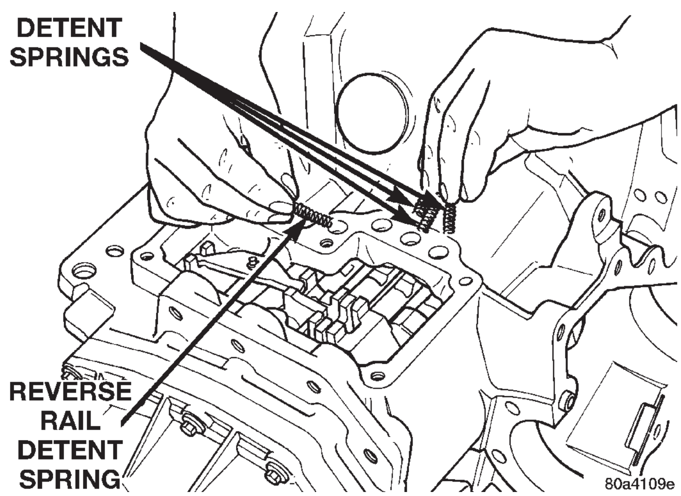


Fig. 125 Shift Detent Springs

(22) Install shift cover splash shield (Fig. 126).

DISASSEMBLY AND ASSEMBLY (Continued)

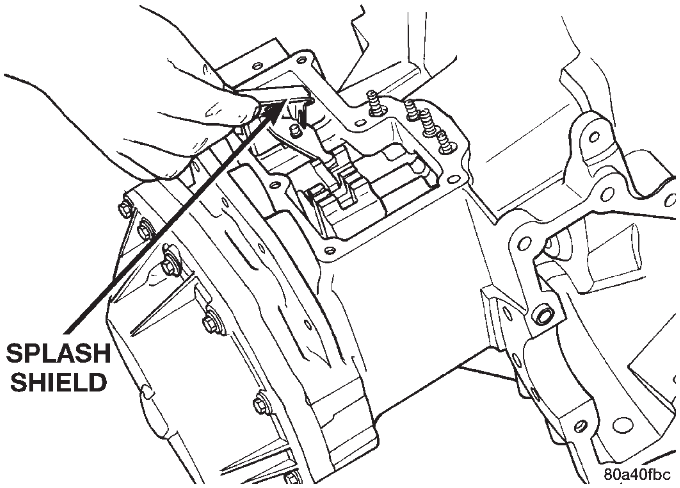


Fig. 126 Shift Cover Splash Shield

NOTE: Two of the bolts retaining the shift cover are shouldered (Fig. 127).

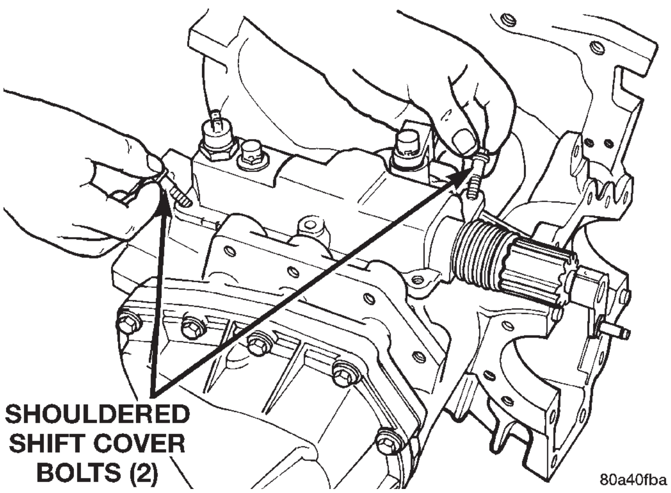


Fig. 127 Gearshift Cover Shouldered Bolts

(23) Apply a bead of Mopar® Gasket Maker or equivalent onto shift cover. Line up the shift detent springs so the springs are aligned with the shift cover spring pockets. Install shift cover. Tighten shift cover bolts to 28 N·m (250 in. lbs.).

(24) Install differential assembly.

(25) Apply a bead of Mopar® Gasket Maker or equivalent onto differential cover. Install differential cover. Tighten differential cover bolts to 61 N·m (45 ft. lbs.).

(26) Apply a bead of RTV silicone to the differential bearing retainer. Install differential bearing retainer. Tighten differential bearing retainer bolts to 61 N·m (45 ft. lbs.).

(27) Apply a bead of RTV silicone to the extension housing. Install extension housing. Tighten extension housing bolts to 28 N·m (250 in. lbs.).

(28) Install engine mount bracket.

INPUT SHAFT

The input shaft is serviced as an assembly. The only serviceable component of the input shaft is the rear bearing.

DISASSEMBLY

(1) Install the bearing splitter 1130 under the rear bearing.

(2) Position the input shaft into a shop press (Fig. 128).

(3) Remove the rear bearing (Fig. 129).

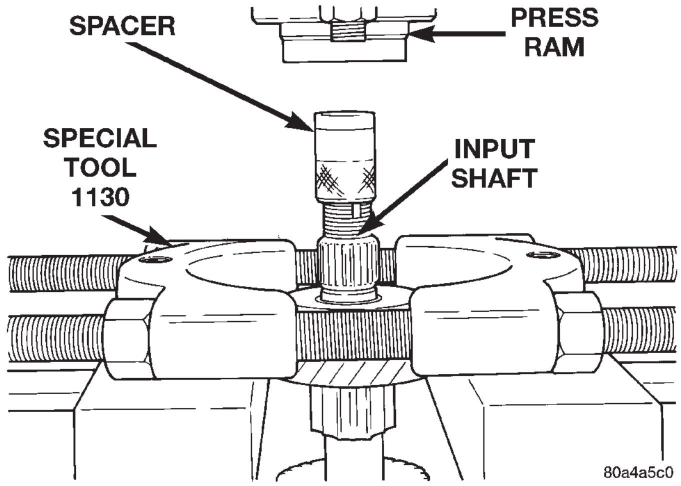


Fig. 128 Input Shaft

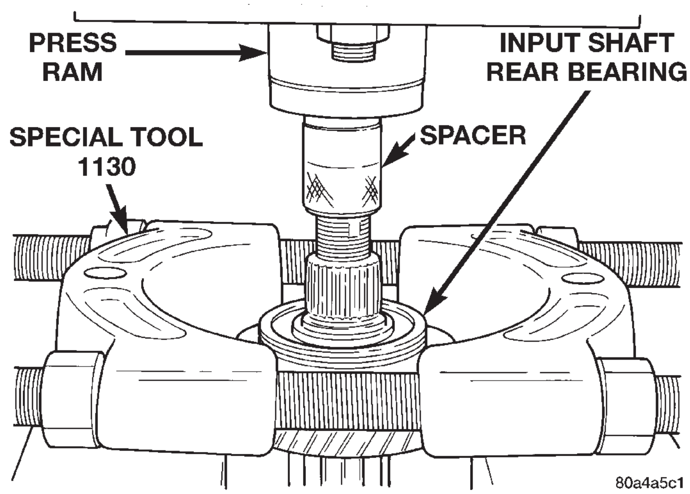


Fig. 129 Remove Bearing

ASSEMBLY

(1) Position replacement bearing onto the input shaft (Fig. 130).

(2) Place input shaft into shop press.

(3) Position Special Tool 6950 over input shaft on top of bearing.

(4) Press input shaft bearing into position (Fig. 131).

DISASSEMBLY AND ASSEMBLY (Continued)

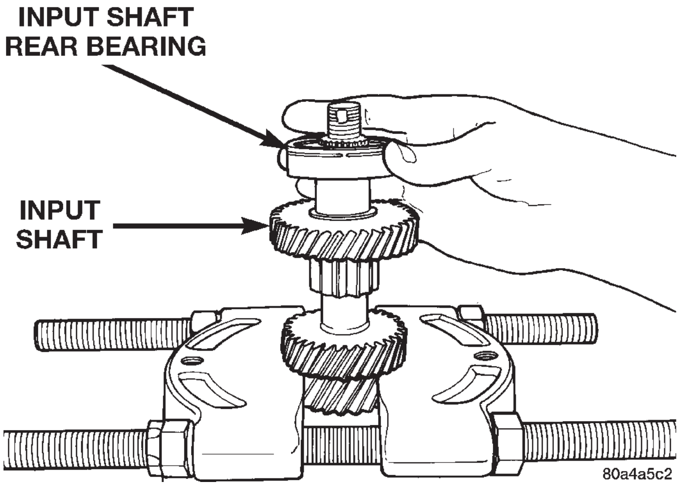


Fig. 130 Position Bearing

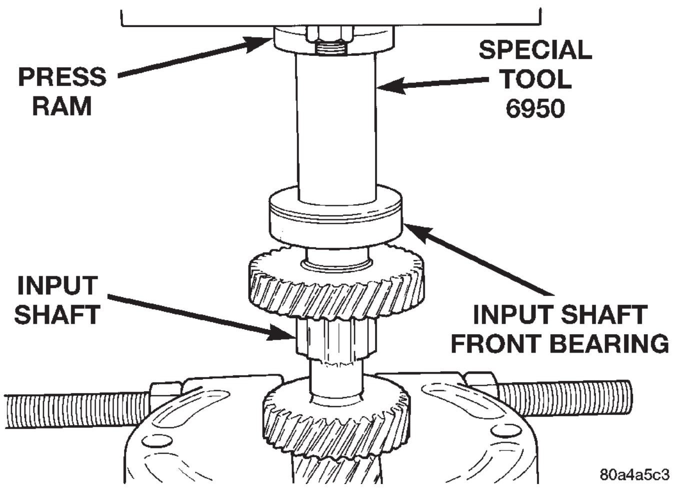


Fig. 131 Press Input Bearing Onto Shaft

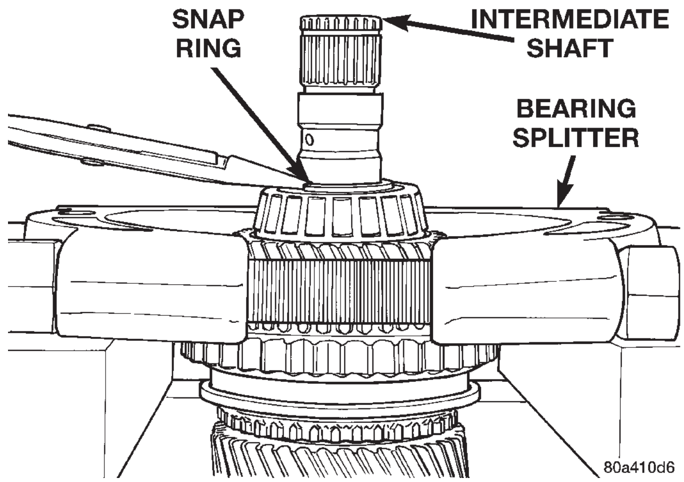


Fig. 132 Bearing Splitter Installed

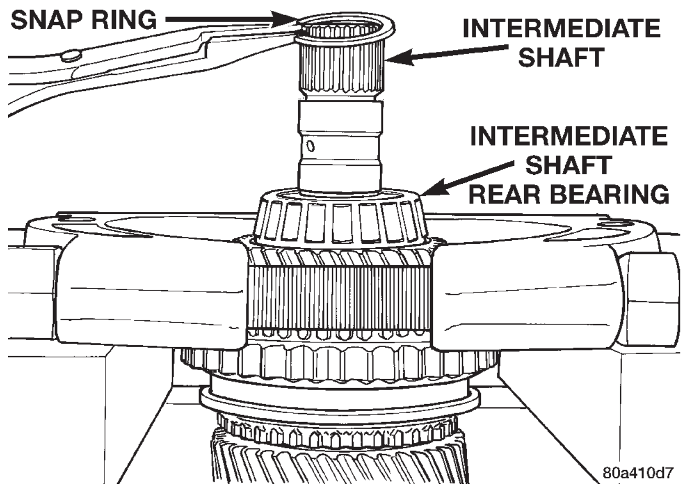


Fig. 133 Intermediate Shaft Rear Bearing Snap Ring

INTERMEDIATE SHAFT

DISASSEMBLY

(1) Install intermediate shaft into shop press.

(2) Install bearing splitter 1130 under the 4th speed gear clutch teeth (Fig. 132).

(3) Remove intermediate shaft rear bearing snap ring (Fig. 133).

(4) Position Special Tool 6792–1 over intermediate shaft.

CAUTION: To prevent damaging the intermediate shaft, grasp the bottom of the shaft when doing shop press procedures.

(5) Using Special Tool 6792–1 as a driver, press off and remove 4th speed gear (Fig. 134).

(6) Remove intermediate shaft from shop press.

(7) Install Special Tool 6938 onto front intermediate bearing for protection.

(8) Remove 3–4 synchro snap ring (Fig. 135) (Fig. 136).

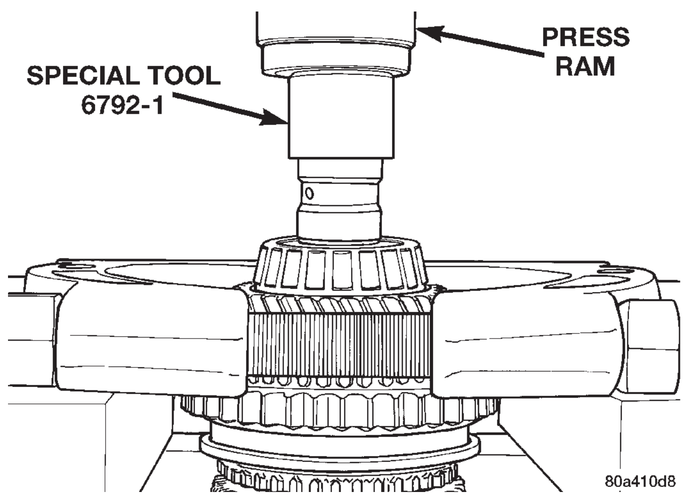


Fig. 134 Press Off 4th Speed Gear

NOTE: The 3–4 synchro has a master spline (Fig. 137).

DISASSEMBLY AND ASSEMBLY (Continued)

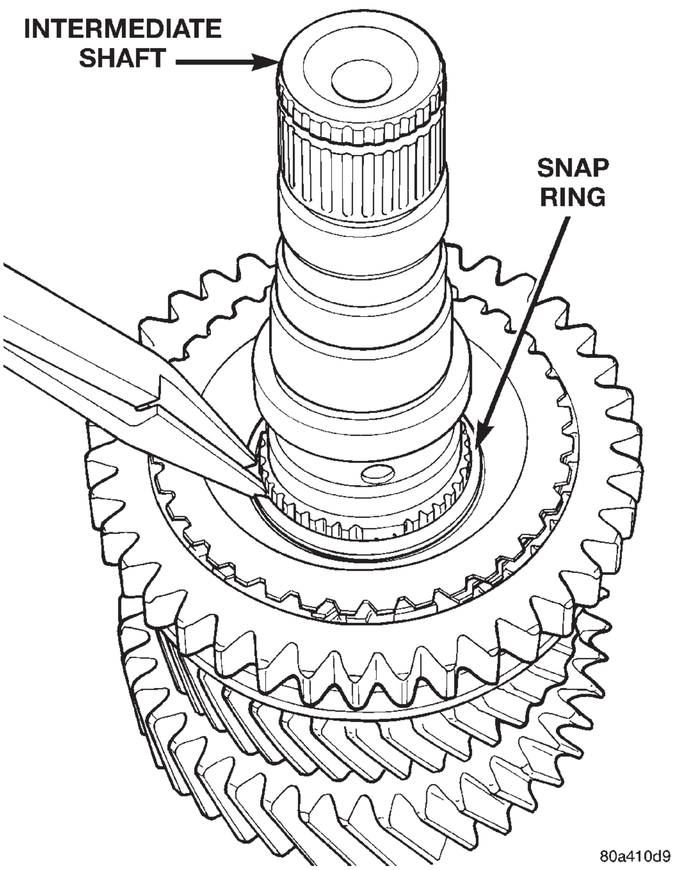


Fig. 135 3–4 Synchro Snap Ring

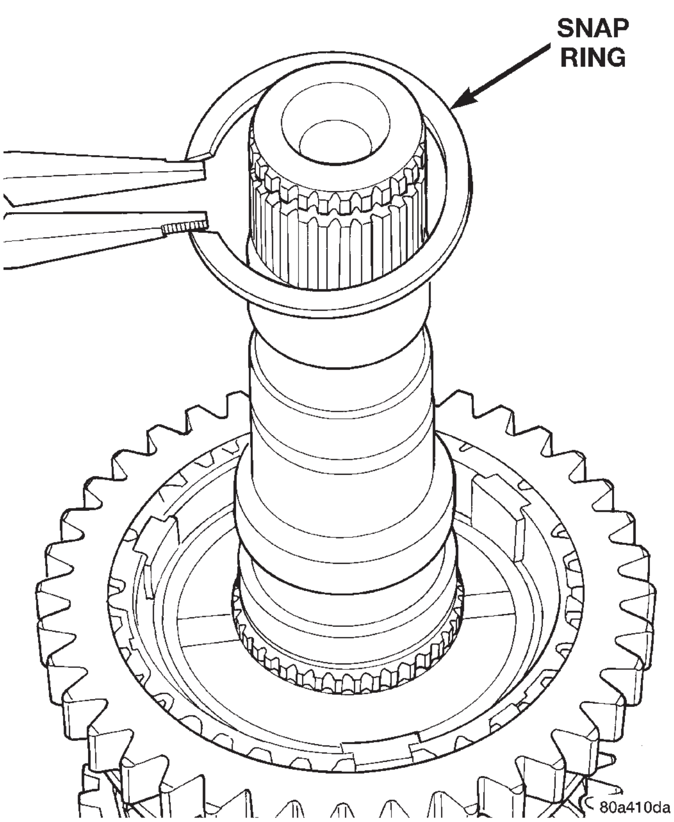


Fig. 136 Snap Ring Removed

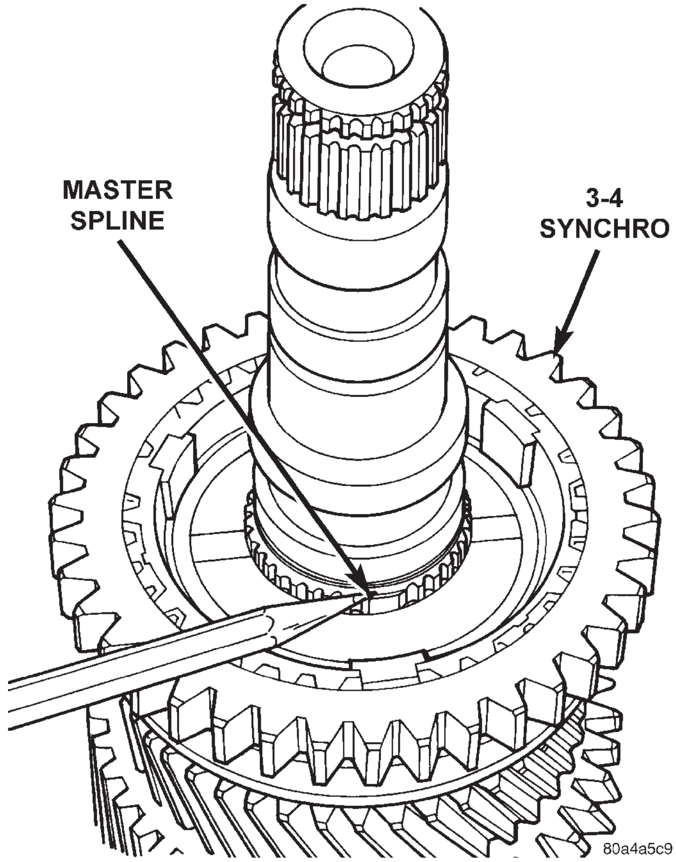


Fig. 137 Master Spline

(9) Remove 3–4 synchro assembly and 3rd speed gear (Fig. 138).

(10) Remove thrust washer outer retainer (Fig. 139).

(11) Remove the two split washers.

(12) Remove the anti-spin pin (Fig. 140).

(13) Remove 2nd speed gear (Fig. 141).

(14) Remove 1–2 synchro snap ring (precision ground) (Fig. 142) (Fig. 143).

DISASSEMBLY AND ASSEMBLY (Continued)

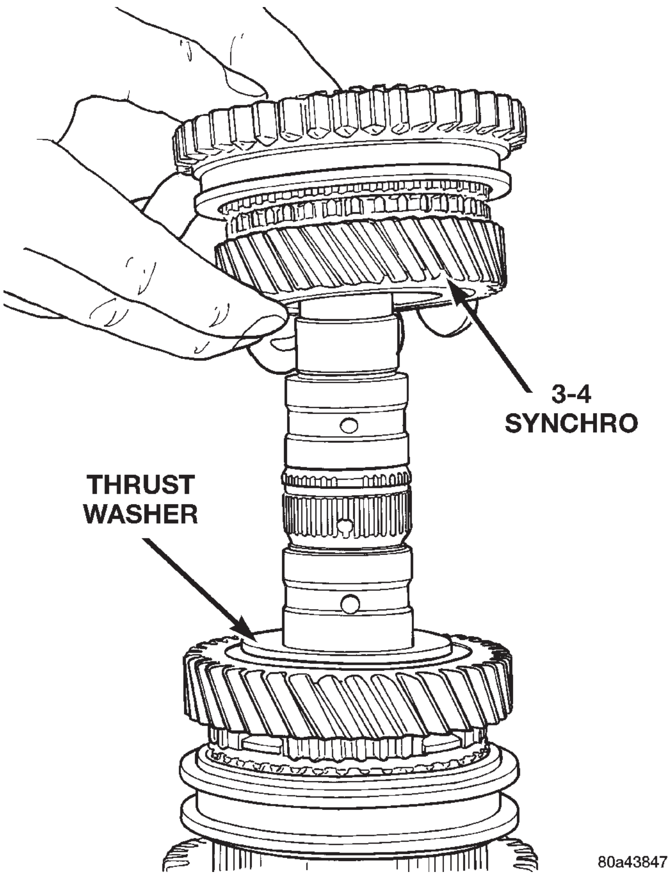


Fig. 138 3–4 Synchro and 3rd Speed Gear

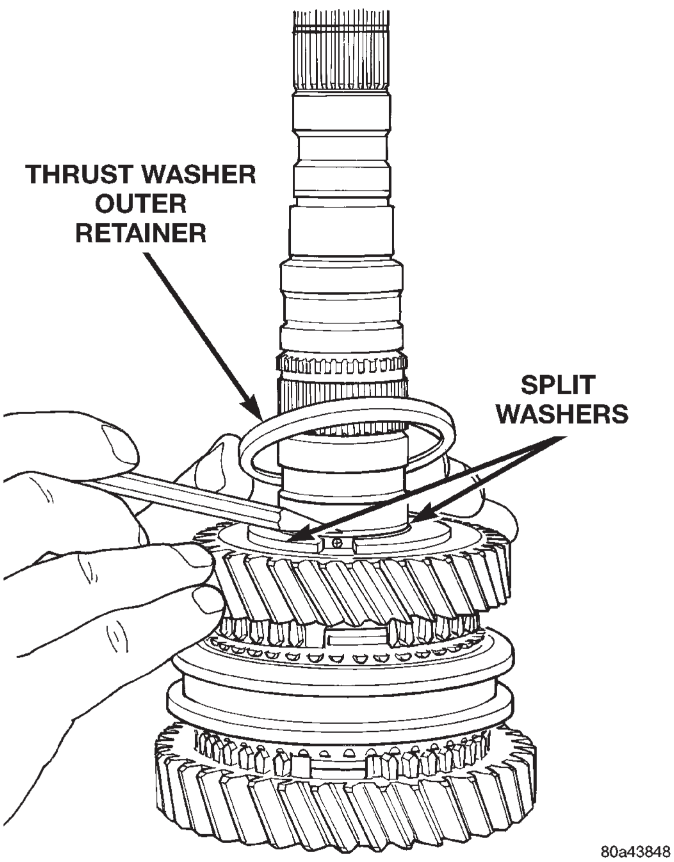


Fig. 139 Thrust Washer Outer Retainer

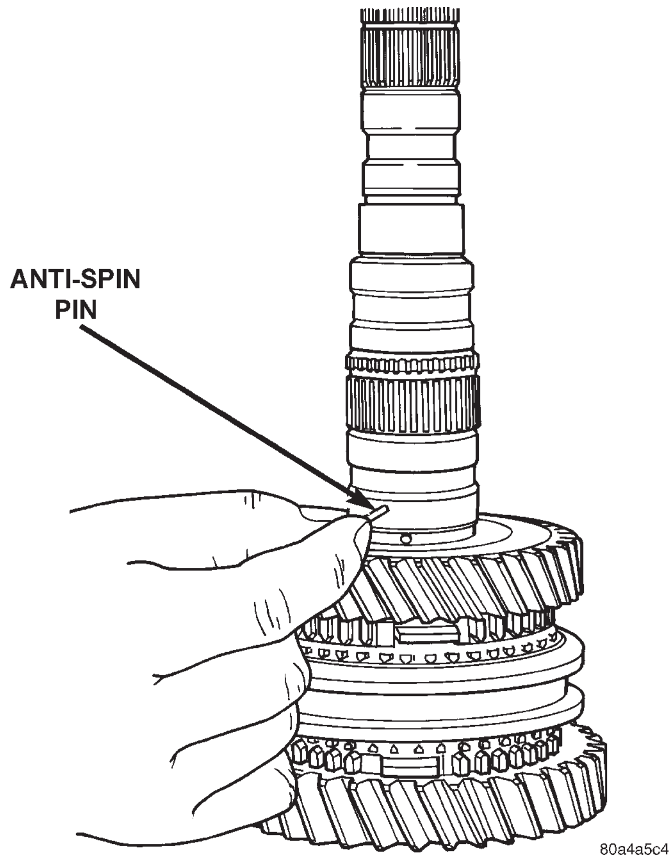


Fig. 140 Anti-Spin Pin

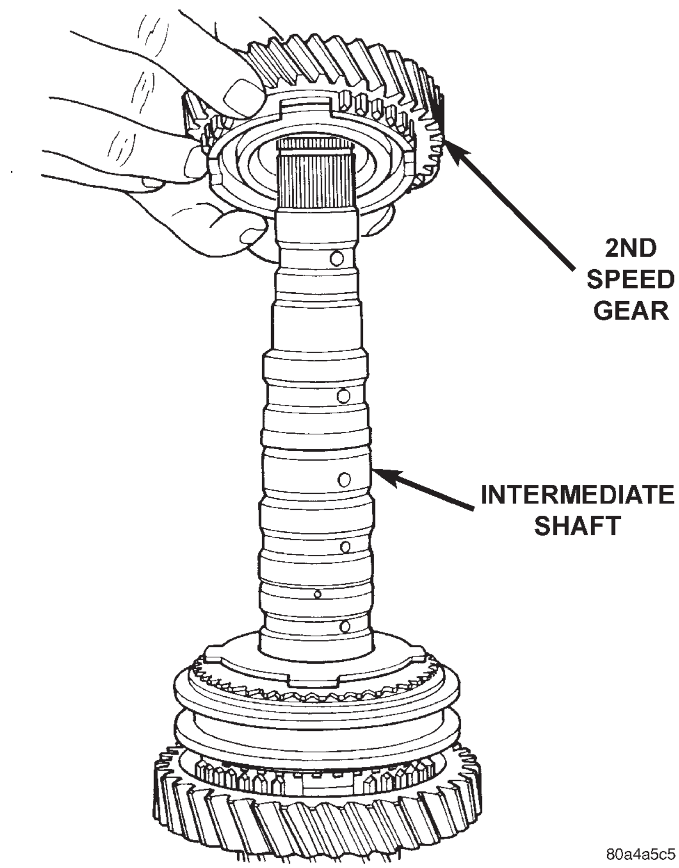


Fig. 141 2nd Speed Gear

DISASSEMBLY AND ASSEMBLY (Continued)

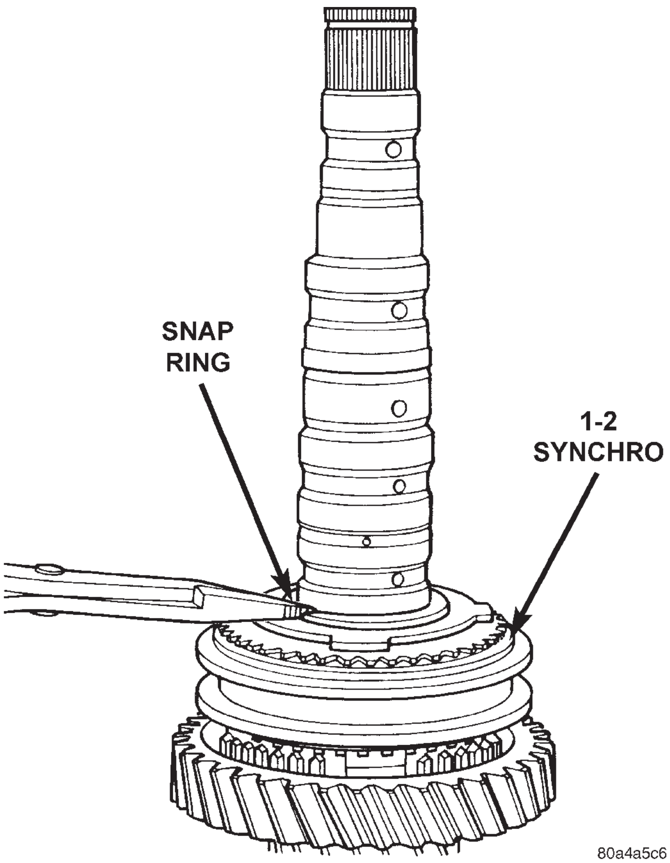


Fig. 142 1–2 Synchro Snap Ring

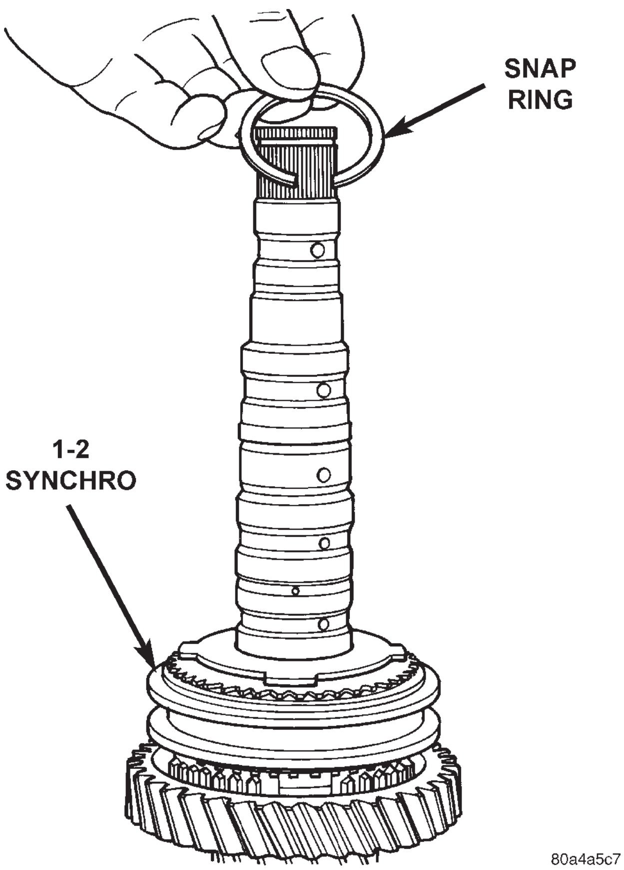


Fig. 143 Snap Ring Removed

(15) Remove 1–2 dual cone synchro assembly and 1st speed gear (Fig. 144).

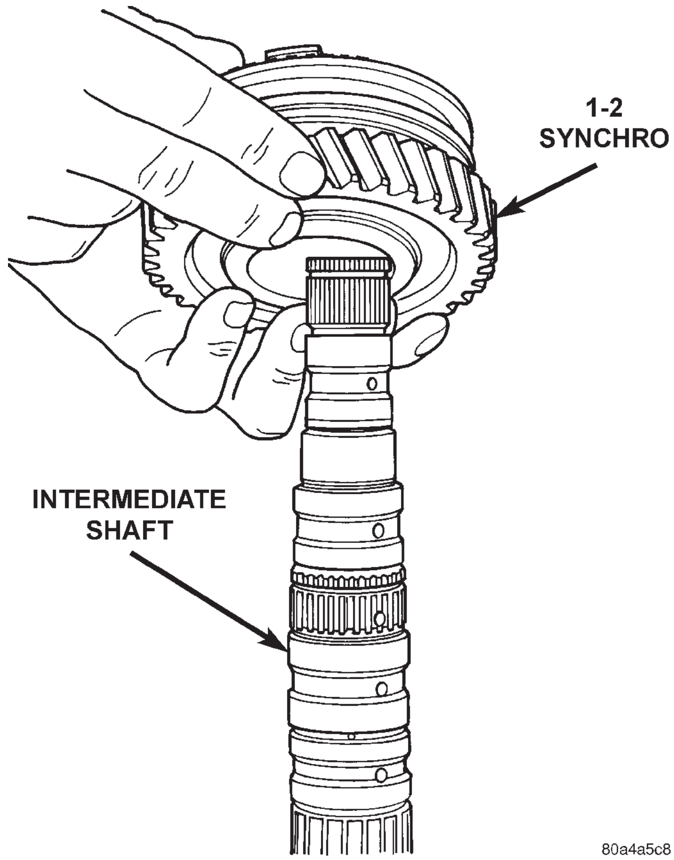


Fig. 144 1–2 Dual Cone Synchro

(16) Install Special Tool 1130 bearing splitter under the plastic intermediate shaft front bearing

(17) Position shaft into shop press.

(18) Position Special Tool MD998802–01 over the intermediate shaft.

(19) Remove the intermediate shaft front bearing (Fig. 145).

DISASSEMBLY AND ASSEMBLY (Continued)

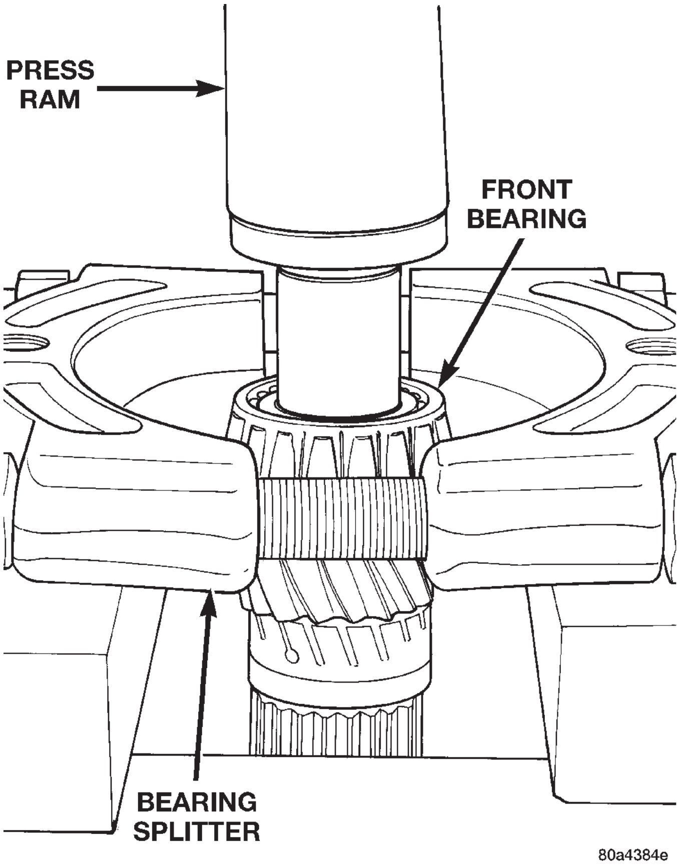


Fig. 145 Intermediate Shaft Front Bearing

ASSEMBLY

(1) Position intermediate shaft front bearing onto intermediate shaft. Install Special Tool 6938 over bearing and shaft. Install the intermediate shaft front bearing (Fig. 146).

(2) Remove intermediate shaft from shop press.

(3) Position intermediate shaft bearing side down. Place intermediate shaft into Special Tool 6938 to protect front bearing. Install 1–2 dual cone synchro assembly and 1st speed gear.

(4) Install 1–2 synchro snap ring (precision ground) (Fig. 147).

(5) Install 2nd speed gear (Fig. 148).

(6) Install the anti-spin pin (Fig. 149).

(7) Install the two split washers.

(8) Install thrust washer outer retainer (Fig. 150).

NOTE: The 3–4 synchro has a master spline (Fig. 151).

(9) Install 3–4 synchro assembly and 3rd speed gear.

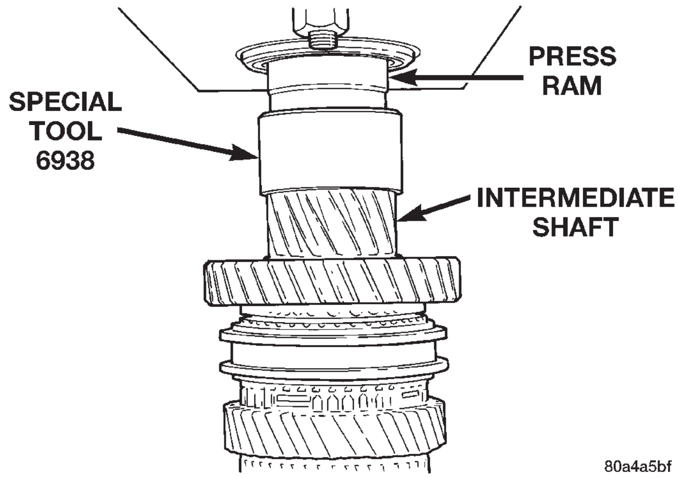


Fig. 146 Install Intermediate Shaft Front Bearing

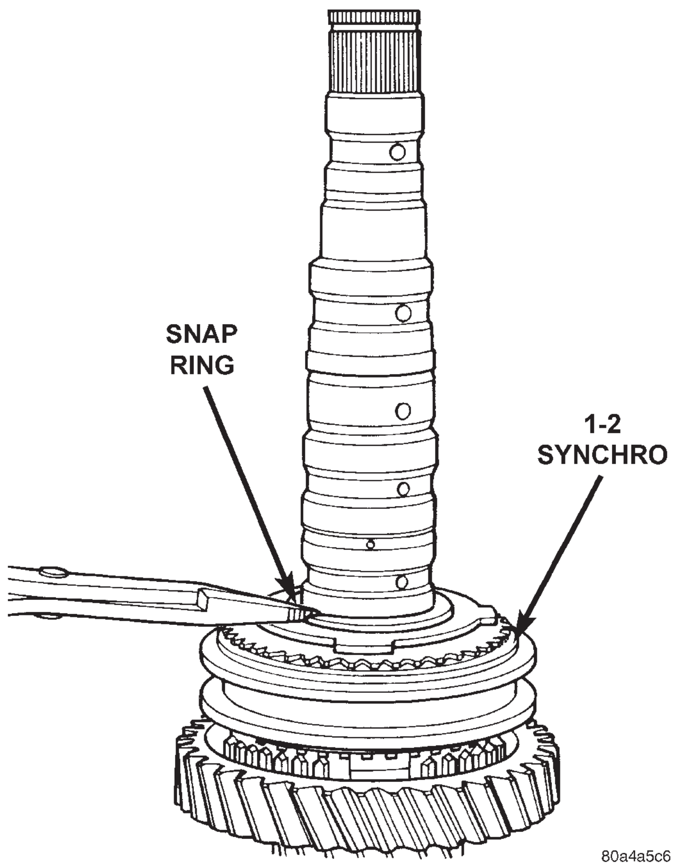


Fig. 147 1–2 Synchro Snap Ring

(10) Install 3–4 synchro snap ring (Fig. 152).

(11) Install 4th speed gear over the 3–4 synchro.

DISASSEMBLY AND ASSEMBLY (Continued)

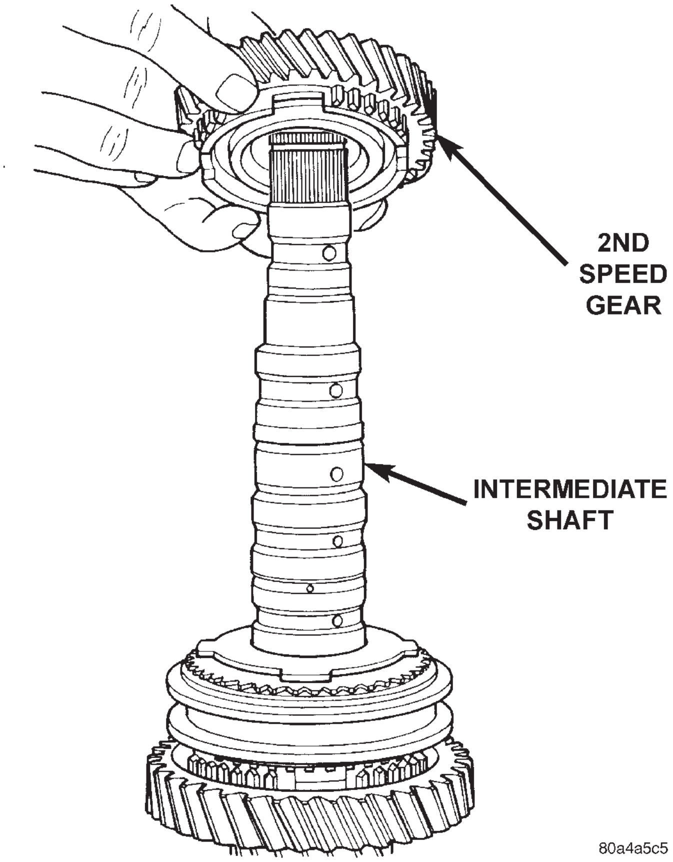


Fig. 148 2nd Speed Gear

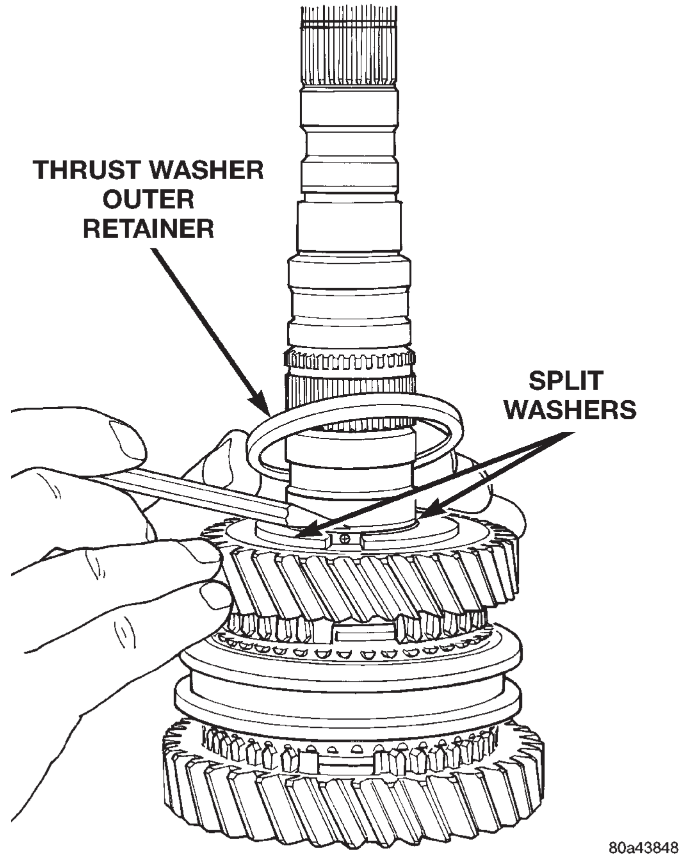


Fig. 150 Thrust Washer Outer Retainer

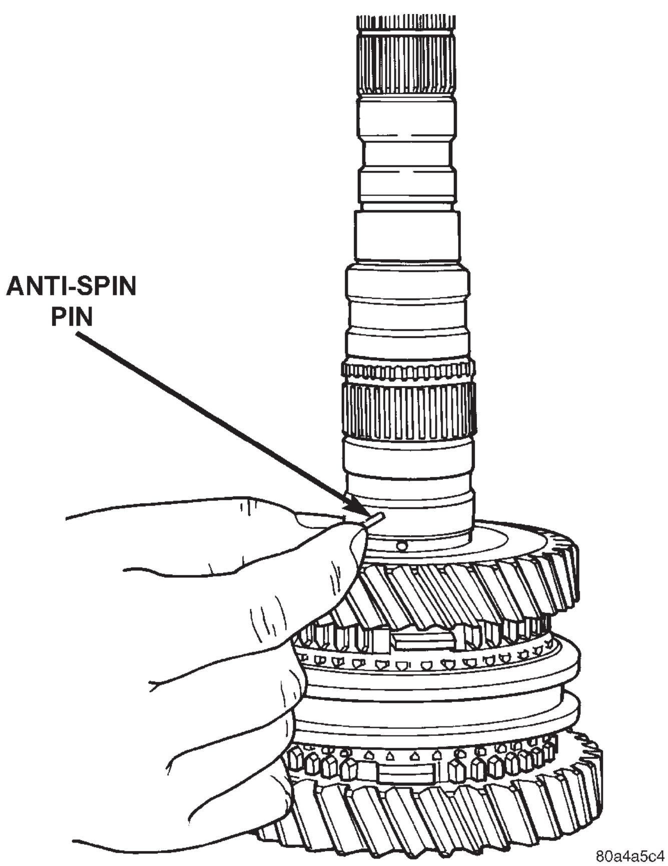


Fig. 149 Anti-Spin Pin

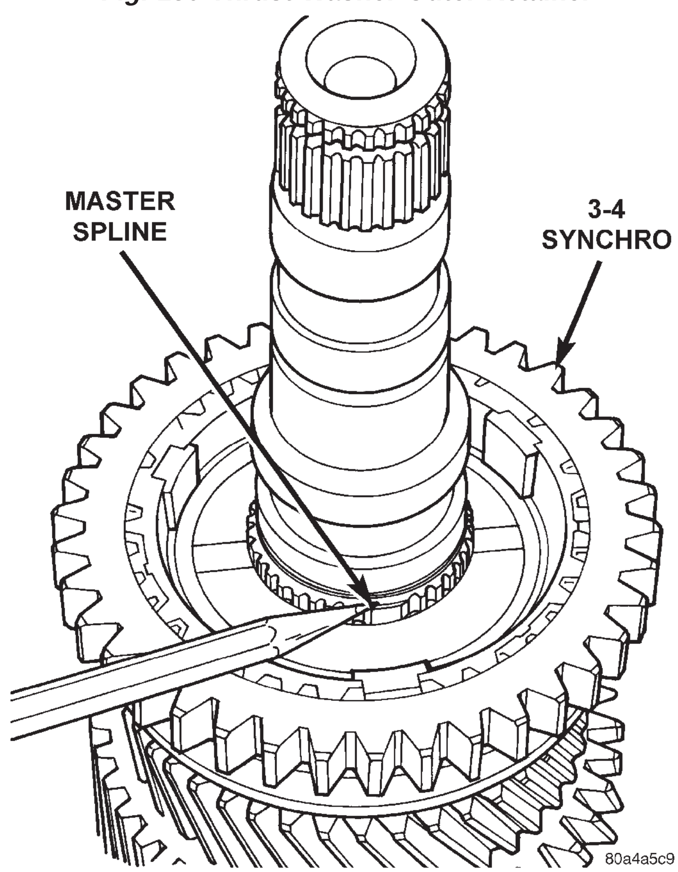


Fig. 151 Master Spline

DISASSEMBLY AND ASSEMBLY (Continued)

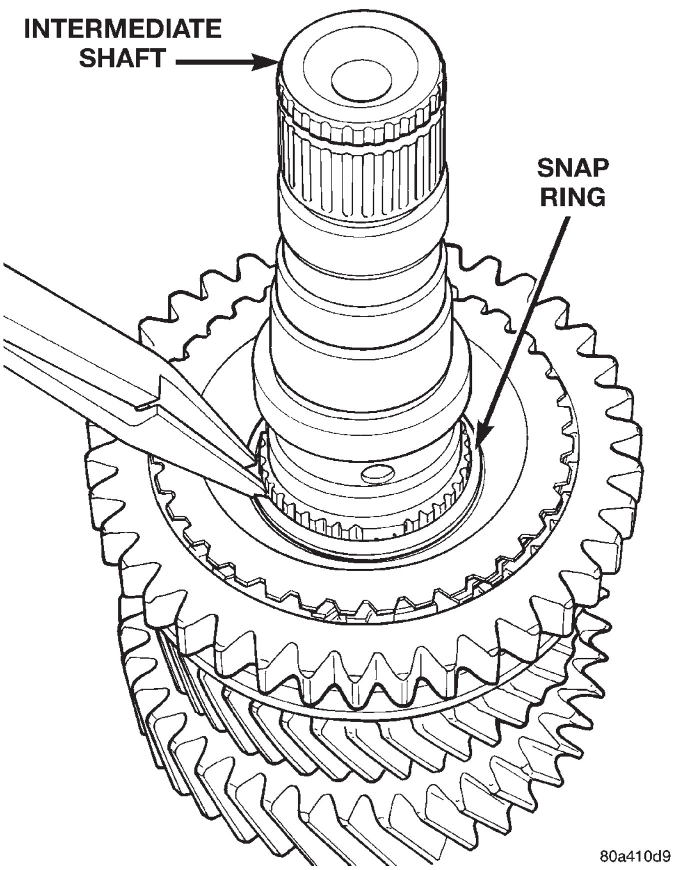


Fig. 152 3–4 Synchro Snap Ring

(12) Position the intermediate shaft rear bearing onto the intermediate shaft.

(13) Install the intermediate shaft into a shop press.

(14) Position Special Tool MD998323 over the intermediate shaft rear bearing

(15) Press on the intermediate shaft rear bearing (Fig. 153).

(16) Install intermediate shaft rear bearing snap ring.

DIFFERENTIAL

NOTE: The differential is typically serviced as an assembly. The only parts that are serviceable within the differential are the differential bearing cups and cones. If any other part fails within the differential, you should replace the differential assembly.

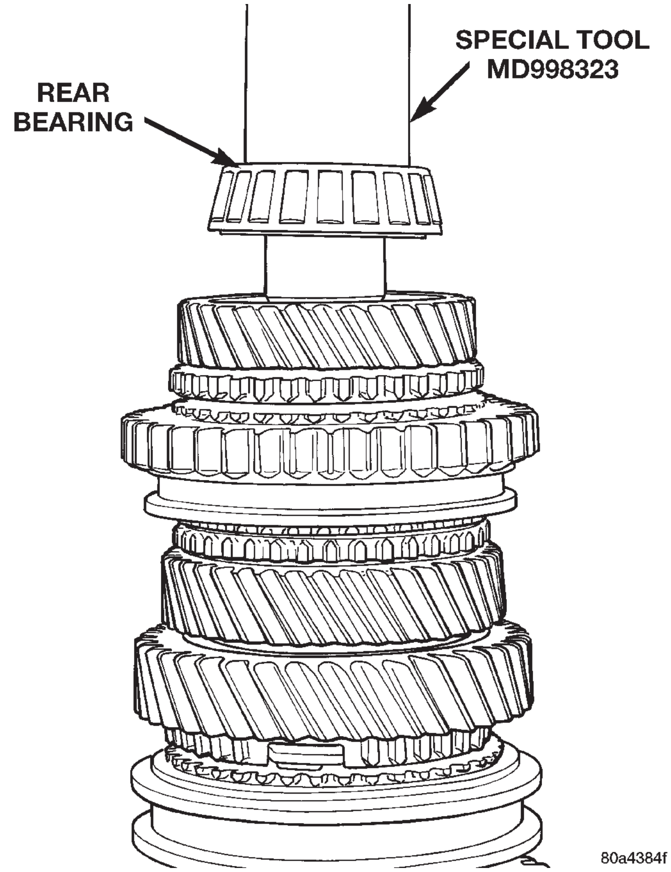


Fig. 153 Intermediate Shaft Rear Bearing Installation

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle gear case
- Differential case
- Differential bearings
- Differential cover

Refer to **Bearing Adjustment Procedure** in the Adjustments section at the end of this section to determine proper shim thickness. This will provide correct bearing preload and proper bearing turning torque.

DIFFERENTIAL BEARINGS

Differential bearings are usually serviced as pairs. If one differential bearing fails, you should replace both bearing cups and cones

DISASSEMBLY AND ASSEMBLY (Continued)

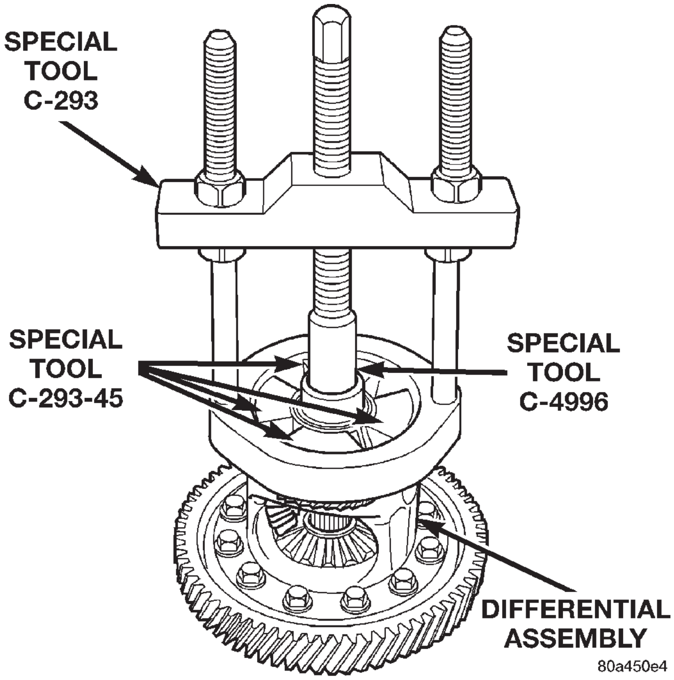


Fig. 154 Remove Differential Bearing Cone

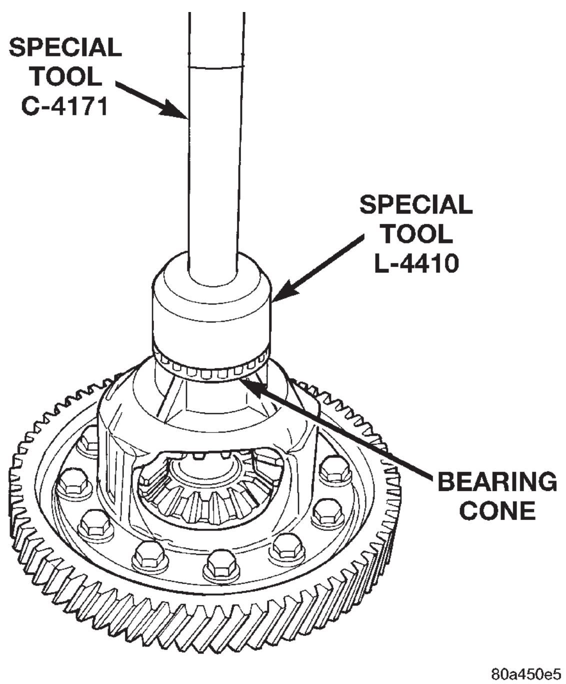


Fig. 155 Install Differential Bearing Cone

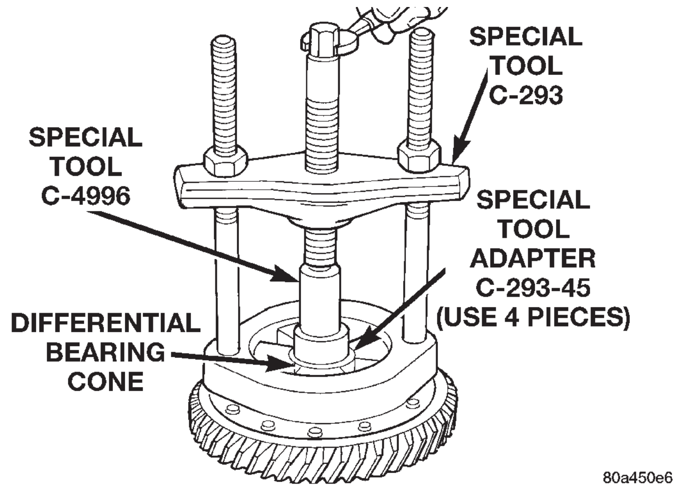


Fig. 156 Remove Differential Bearing Cone

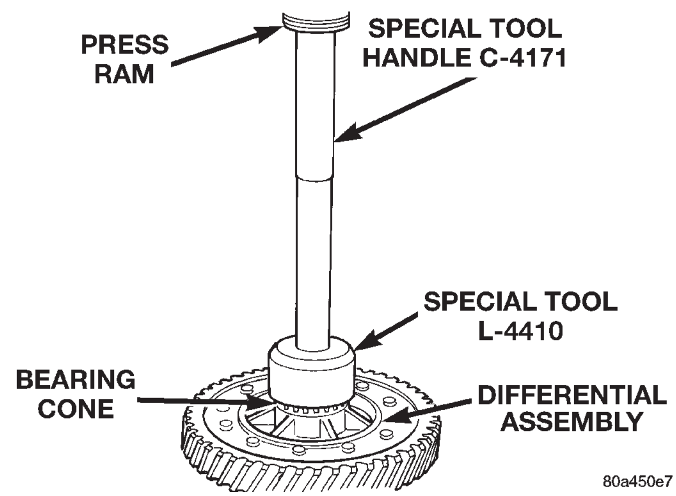


Fig. 157 Install Differential Bearing Cone

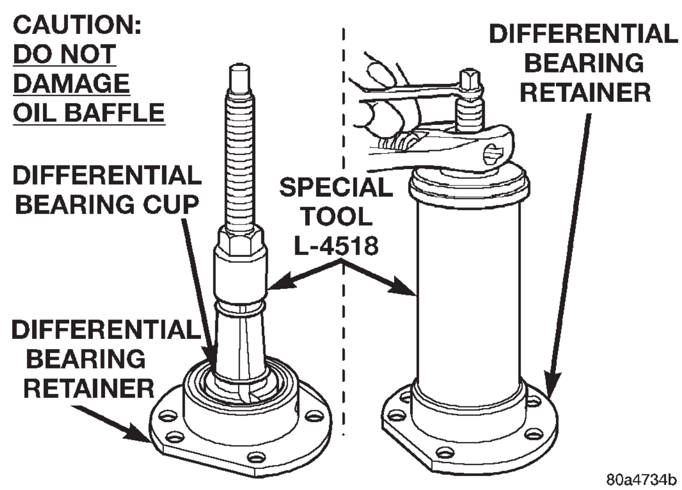


Fig. 158 Remove Differential Bearing Retainer Cup

DISASSEMBLY AND ASSEMBLY (Continued)

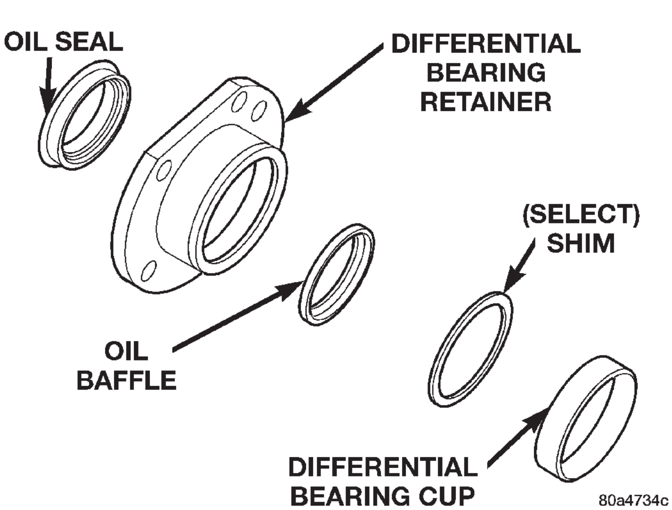


Fig. 159 Differential Bearing Retainer

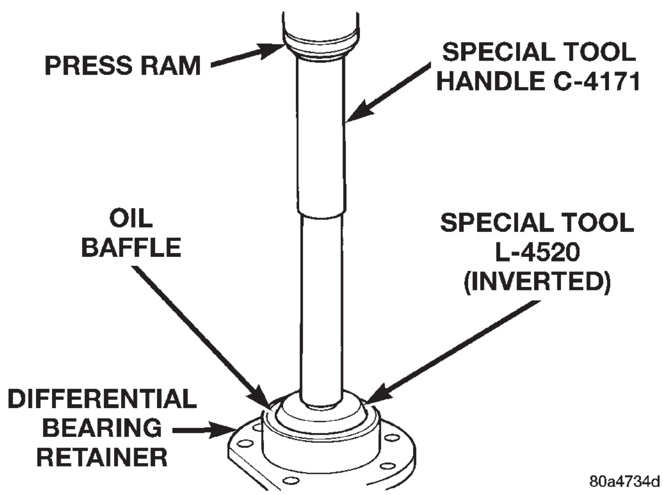


Fig. 160 Install Oil Baffle

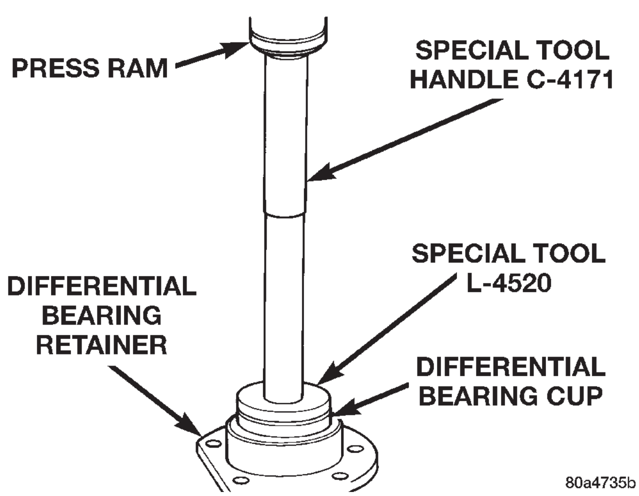


Fig. 161 Insert (Select) Shim and Differential Bearing Retainer Cup

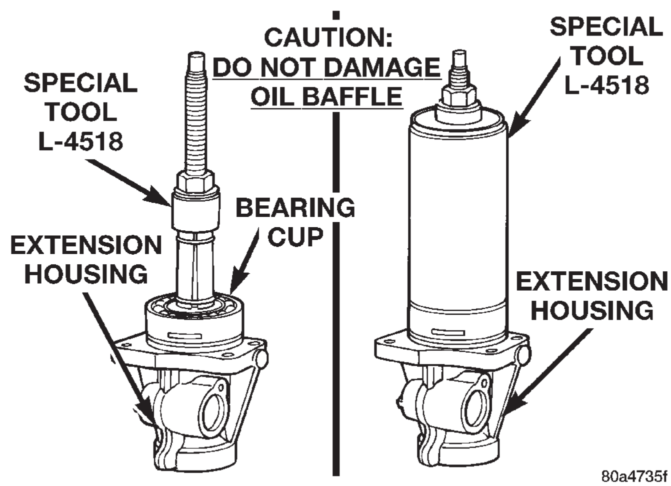


Fig. 162 Remove Extension Bearing Cup

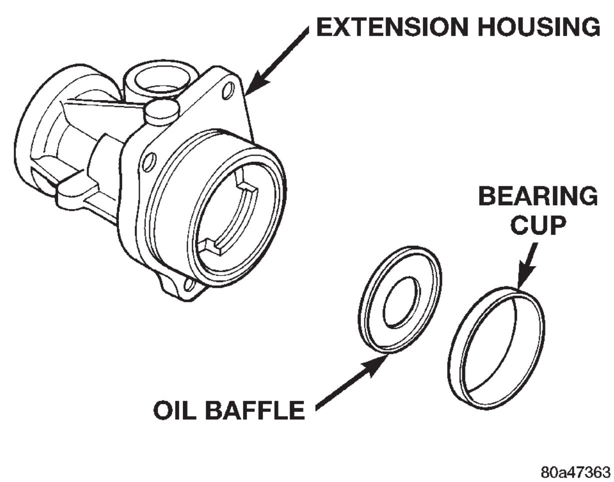


Fig. 163 Extension

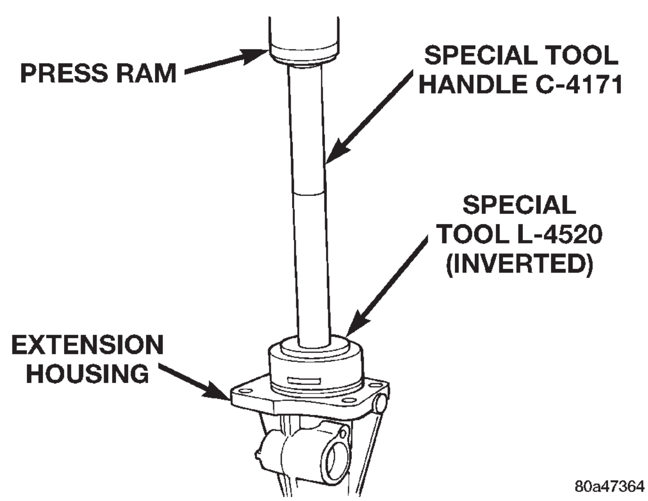


Fig. 164 Install Extension Oil Baffle

DISASSEMBLY AND ASSEMBLY (Continued)

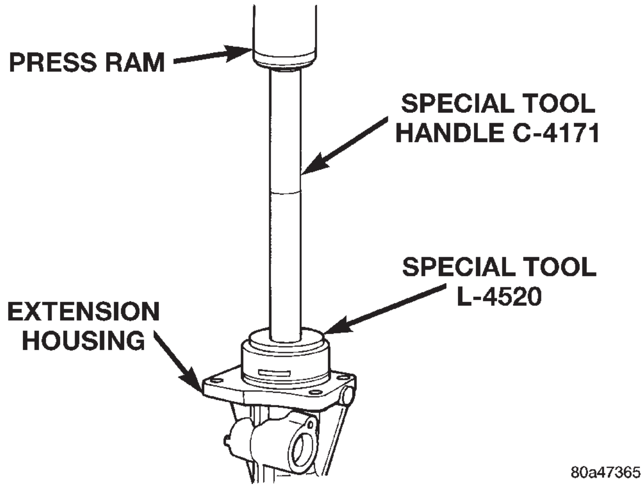


Fig. 165 Install Extension Bearing Cup

RING GEAR

CAUTION: Always install new ring gear bolts. Tighten ring gear bolts to 94 N·m (70 ft. lbs.) torque.

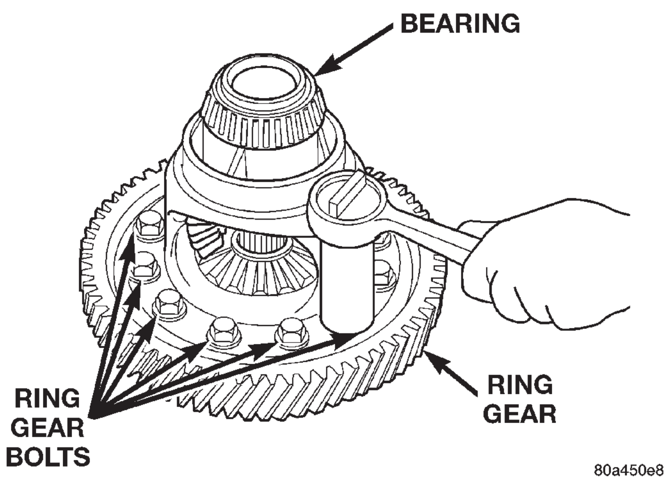


Fig. 166 Remove or Install Ring Gear Bolts and Ring Gear

DIFFERENTIAL GEARS

REMOVAL

(1) Remove pinion shaft retaining pin (Fig. 167) (Fig. 168).

(2) Remove pinion shaft (Fig. 169).

(3) Rotate side gears to opening in differential (Fig. 170).

(4) Remove differential gears (Fig. 171).

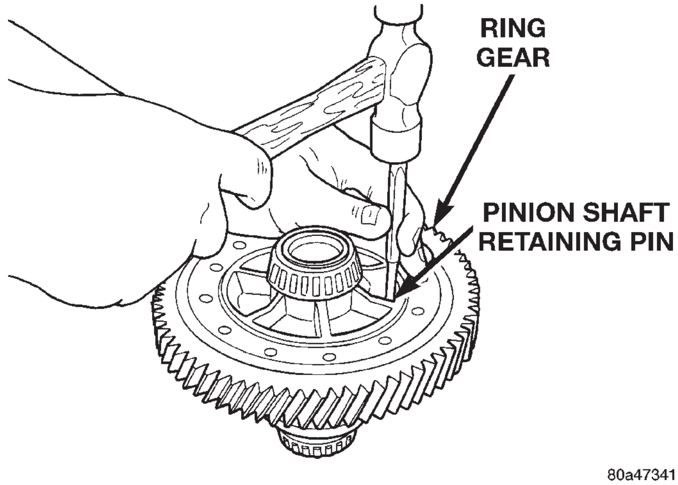


Fig. 167 Remove Pinion Shaft Retaining Pin

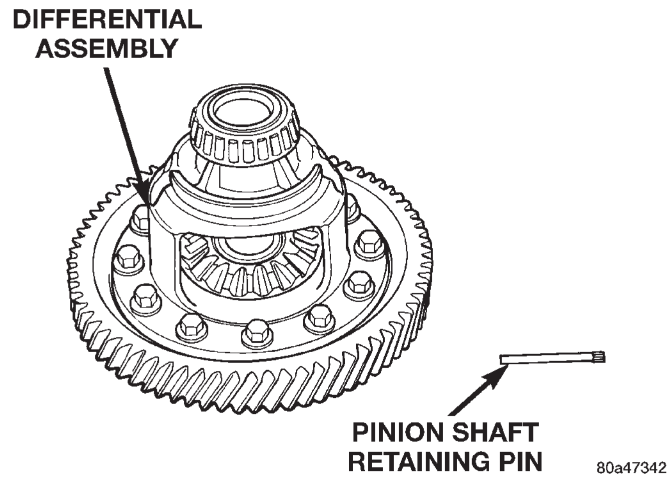


Fig. 168 Retaining Pin Removed

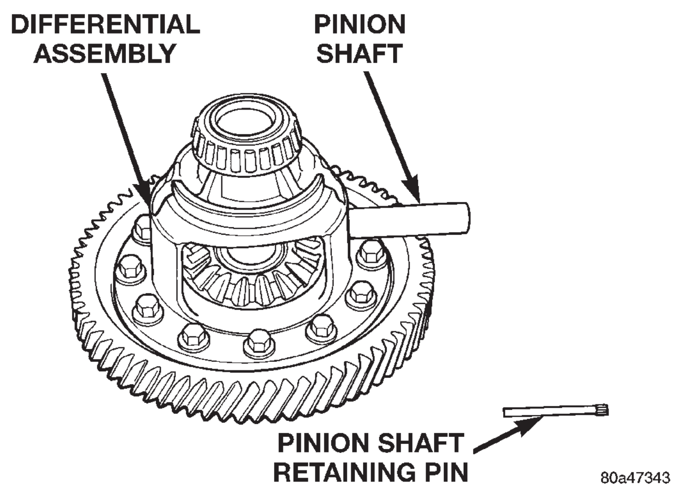


Fig. 169 Pinion Shaft Removal

DISASSEMBLY AND ASSEMBLY (Continued)

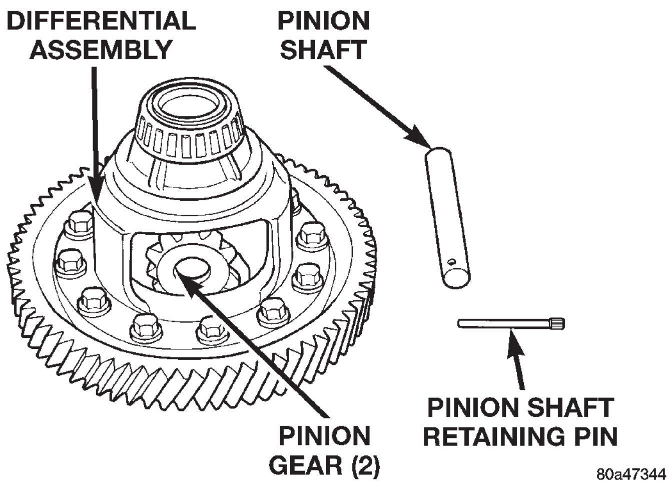


Fig. 170 Remove Pinion Gears, Side Gears, and Thrust Washers by Rotating Side Gears to Opening in Case

INSTALLATION

(1) Assemble the differential side gears, pinion gears and pinion gears with the pinion gear washers.

(2) Install pinion shaft retaining pin (Fig. 172).

(3) Stake pinion shaft retaining pin with a suitable chisel (Fig. 173).

(4) Rotate the assembly two full revolutions both clockwise and counterclockwise. Set up dial indicator as shown and record end play (Fig. 174) (Fig. 175). Rotate side gear 90 degrees and record another end play. Again, rotate side gear 90 degrees and record a final end play.

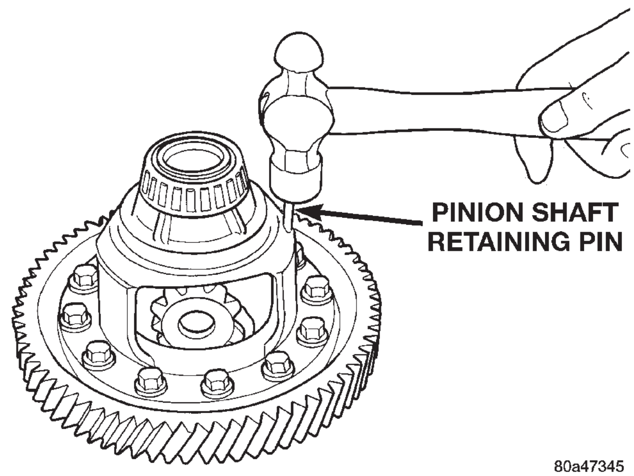


Fig. 172 Install Retaining Pin

(5) Using the smallest end play recorded, shim that side gear to within .02540 mm to .3302 mm (0.001 to 0.013 inch). The other side gear should be checked using the same procedure.

CAUTION: Side gear end play must be within 02540 mm to .3302 mm (0.001 to 0.013 inch). Five select thrust washers are available: 0.027, 0.032, 0.037, 0.042, and 0.047 inch.

SYNCHRONIZER

The 1–2 synchronizer is a dual-cone synchronizer (Fig. 176). The disassembly and assembly procedures are the same as the 3–4 synchronizer (Fig. 177)

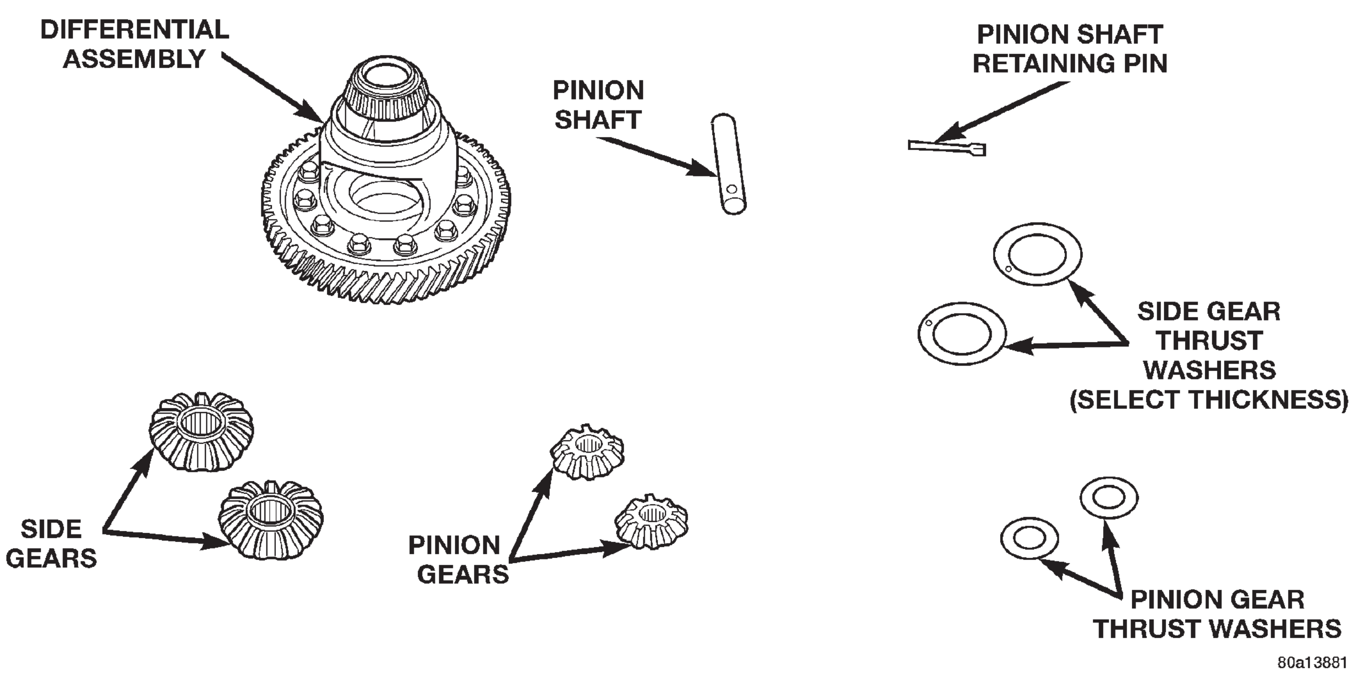


Fig. 171 Differential Gears

DISASSEMBLY AND ASSEMBLY (Continued)

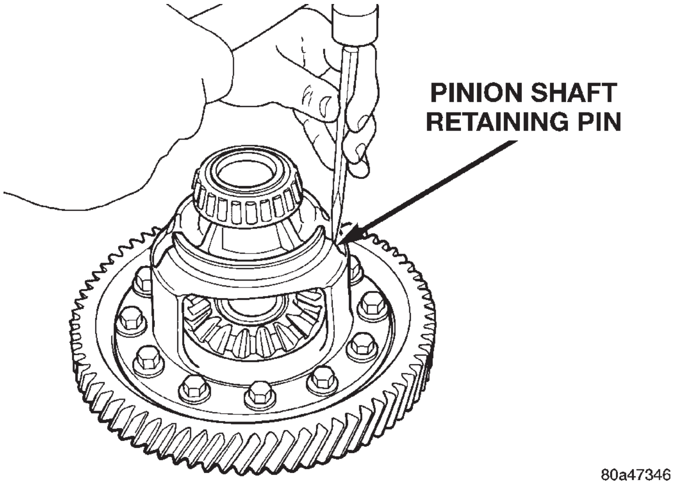


Fig. 173 Staking Retaining Pin

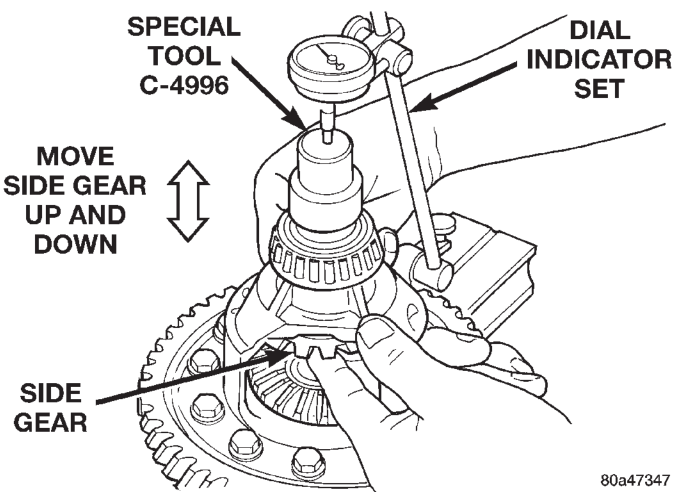


Fig. 174 Checking Side Gear End Play (Typical)

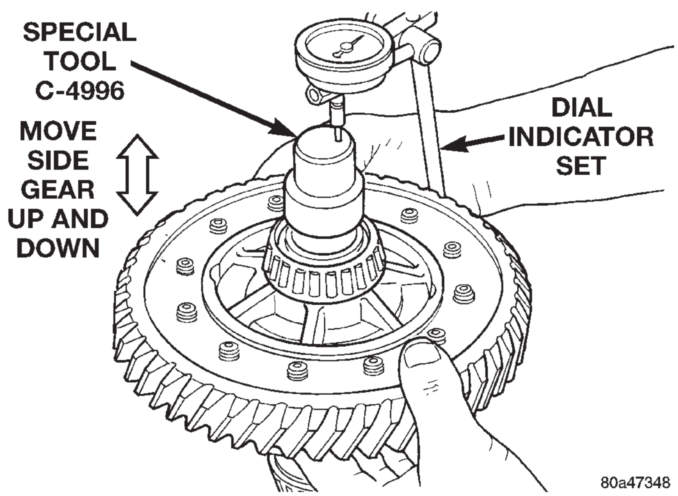


Fig. 175 Checking Side Gear End Play (Typical)

except you must first remove two inner and outer cones from the synchronizer and stop ring assembly.

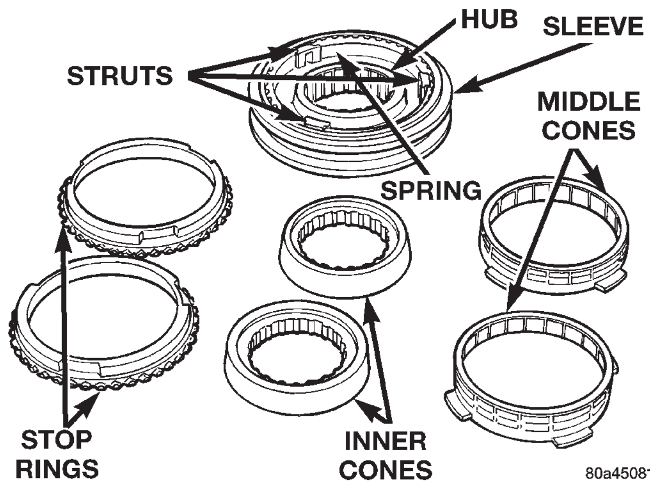


Fig. 176 1–2 Synchronizer

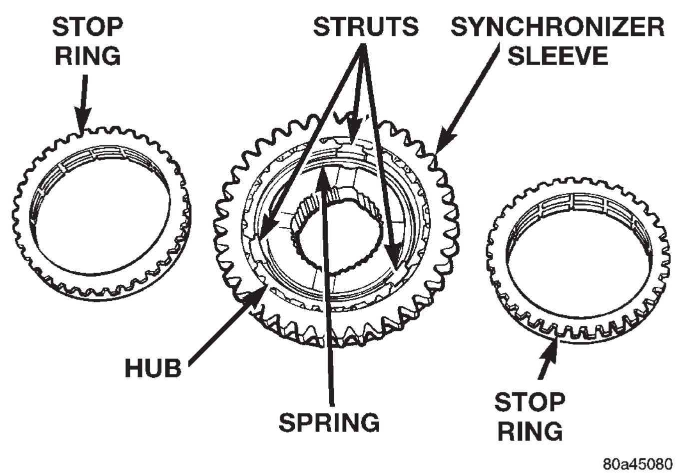


Fig. 177 3–4 Synchronizer

DISASSEMBLY

(1) Place the synchronizer on a clean shop rag on a table.

(2) Remove the inner cones (dual-cone synchronizer) from the outer cones.

(3) Remove the outer cones (dual-cone synchronizer) from the synchronizer stop rings.

(4) Remove the synchronizer stop rings.

(5) Remove the synchronizer springs on both sides of the hub.

(6) Carefully remove the synchro hub from the synchro sleeve.

(7) Remove the three struts from the hub.

ASSEMBLY

(1) Insert the three struts into the synchro hub.

(2) Place the hub into the synchro sleeve.

NOTE: Stagger both synchronizer springs (install tang in different winged struts).

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Install the synchro springs into the synchro struts.

(4) Line up stop ring tang over the struts in the hub. Install stop rings. Center the struts by pushing on both stop rings.

(5) Install the outer cones (dual-cone synchronizer) into the synchronizer stop rings.

(6) Install the inner cones (dual-cone synchronizer) into the outer cones.

SHIFT COVER

The gearshift cover can be disassembled and worn parts can be replaced individually (Fig. 178).

DISASSEMBLY

(1) Remove gearshift housing roll pin at shift lever (Fig. 179).

(2) Remove shift selector shaft dust boot (Fig. 180).

(3) Remove selector shaft oil seal (Fig. 181).

(4) Remove shifter housing vent cap at crossover lever (Fig. 182).

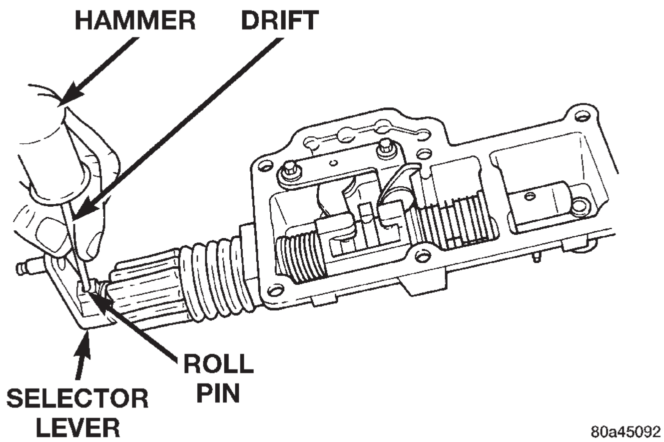


Fig. 179 Shift Lever Roll Pin

(5) Remove roll pin and crossover lever at crossover shaft (Fig. 183).

(6) Remove the 5th/reverse gear blocker (Fig. 184).

(7) Remove the crossover shaft (Fig. 185).

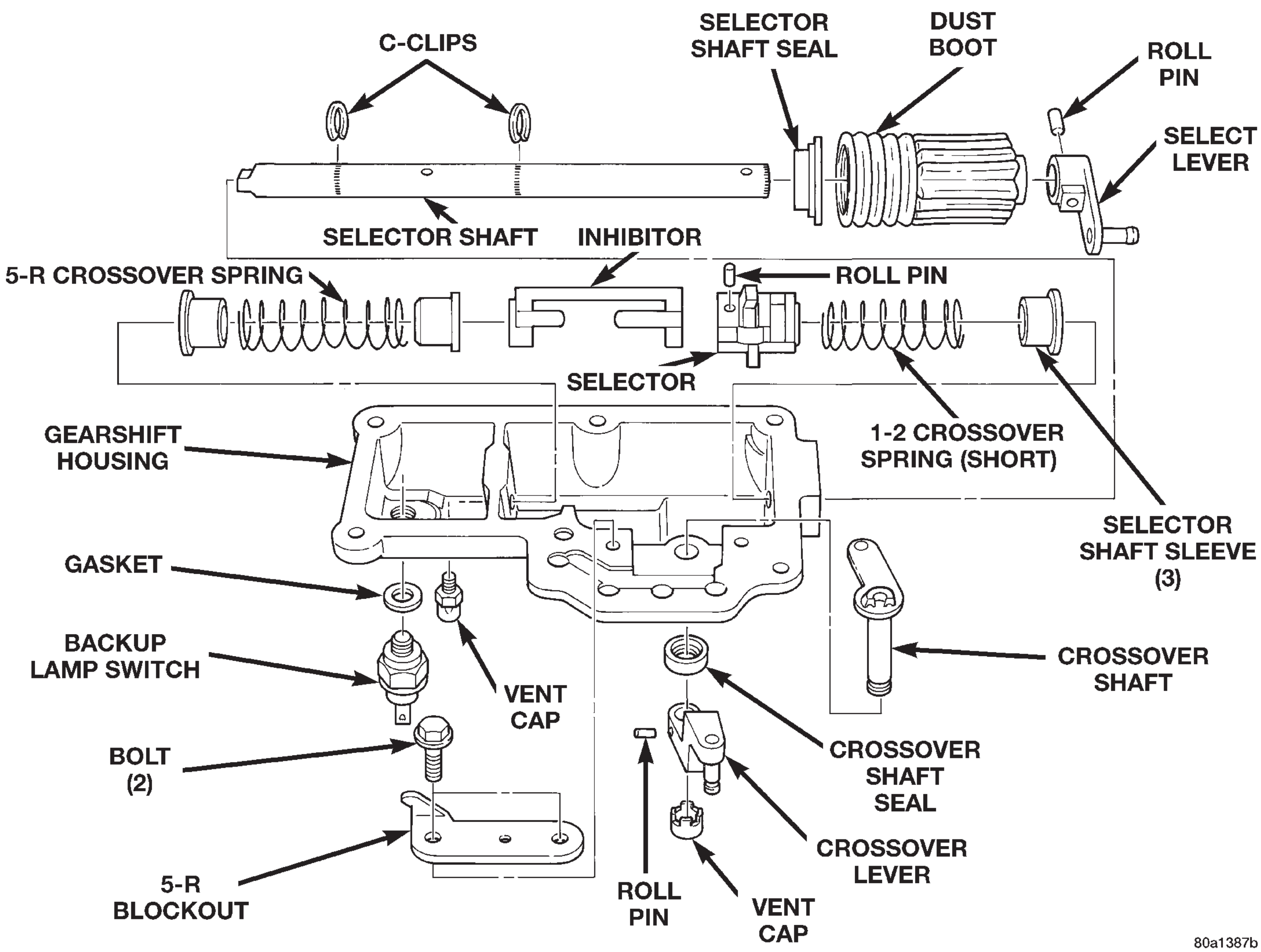


Fig. 178 Gearshift Housing-Exploded View

DISASSEMBLY AND ASSEMBLY (Continued)

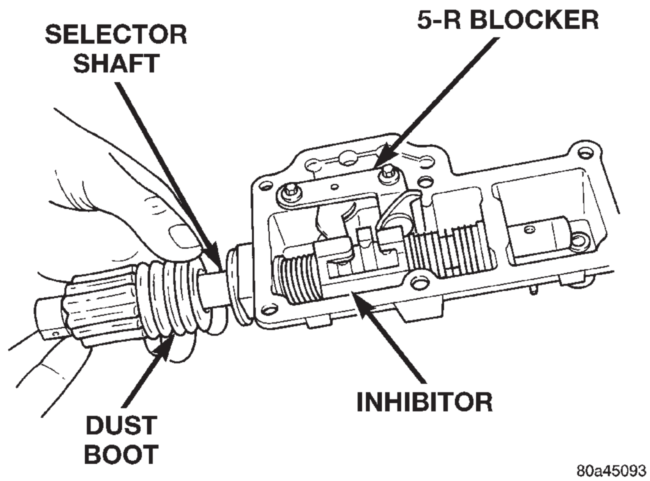


Fig. 180 Dust Boot

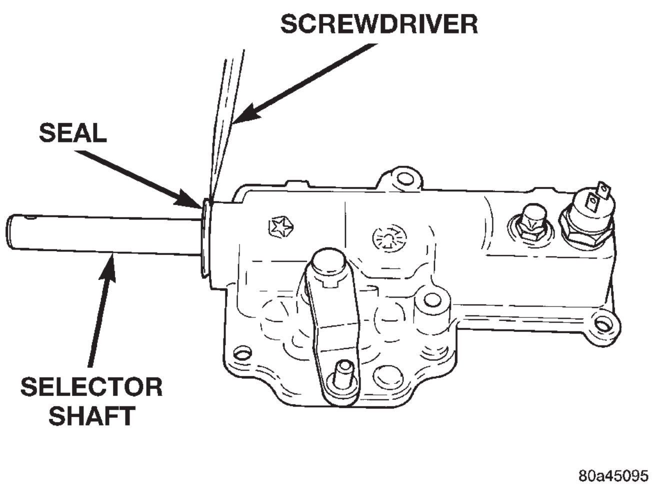


Fig. 181 Oil Seal

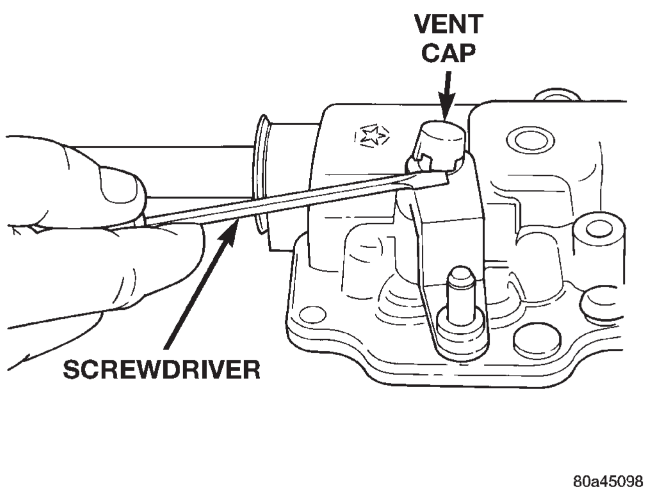


Fig. 182 Vent Cap

(8) Remove selector shaft inner C-clip (Fig. 186).

(9) Remove selector shaft outer C-clip (Fig. 187).

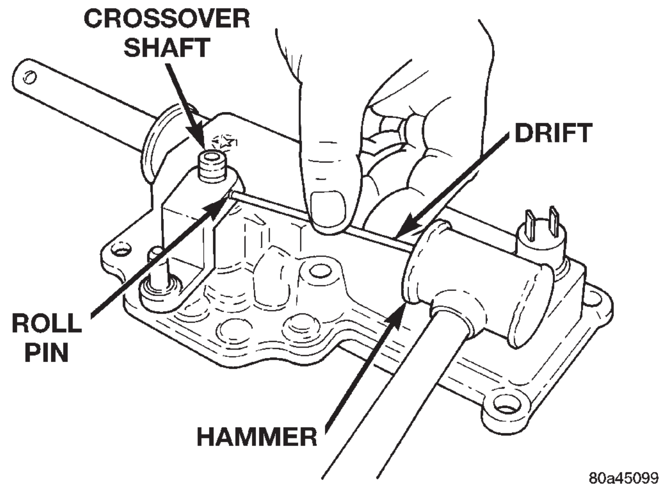


Fig. 183 Crossover Lever and Roll Pin

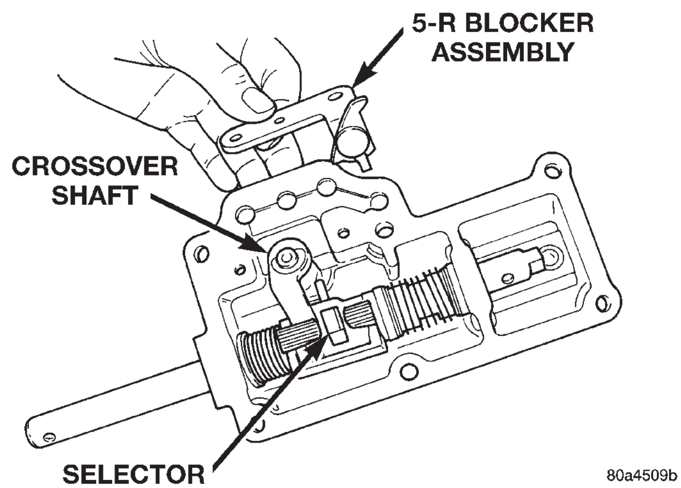


Fig. 184 5th/Reverse Blocker

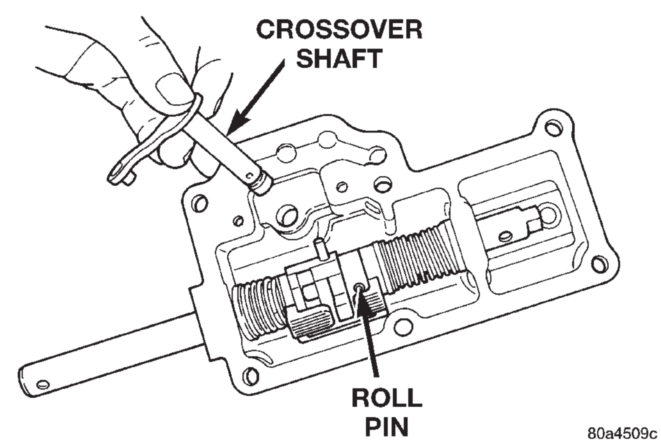


Fig. 185 Crossover Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

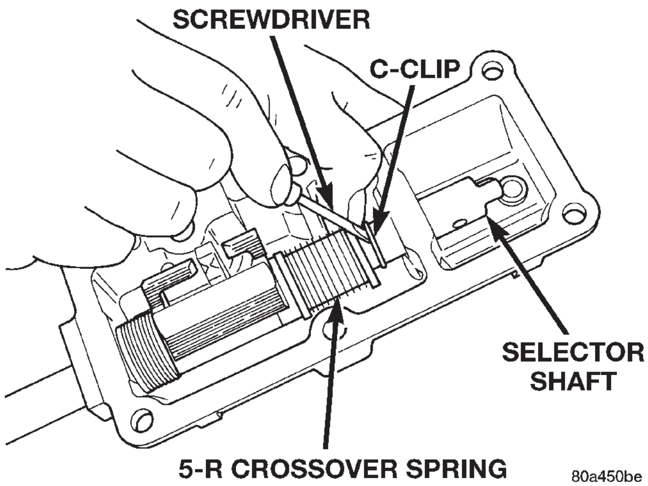


Fig. 186 Inner C-clip

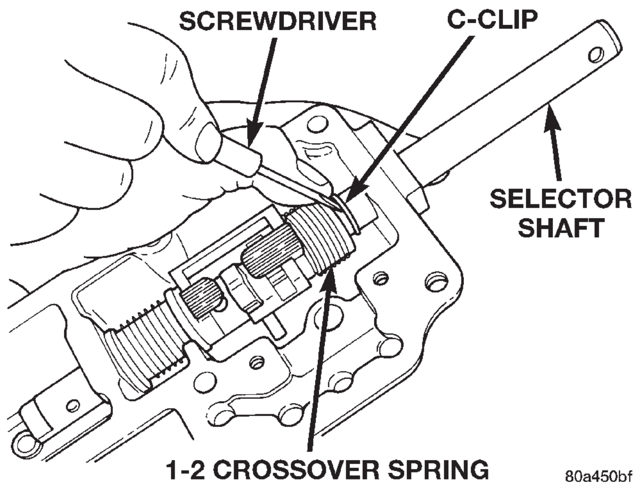


Fig. 187 Outer C-clip

NOTE: Drive roll pin out far enough to clear the selector shaft, but not through. The pin must remain in the selector so not to break the housing.

(10) Remove selector shaft center roll pin (Fig. 188).

(11) Remove selector shaft from the shift housing (Fig. 189) (Fig. 190).

ASSEMBLY

(1) Install selector shaft components and selector shaft into shift housing.

(2) Install selector shaft roll pin flush with selector.

(3) Install outer selector shaft C-clip.

(4) Install inner selector shaft C-clip.

(5) Install crossover shaft.

NOTE: Proper torque of the 5-R blocker bolts is very important.

(6) Install the 5th/reverse gear blocker bolts (Fig. 191).

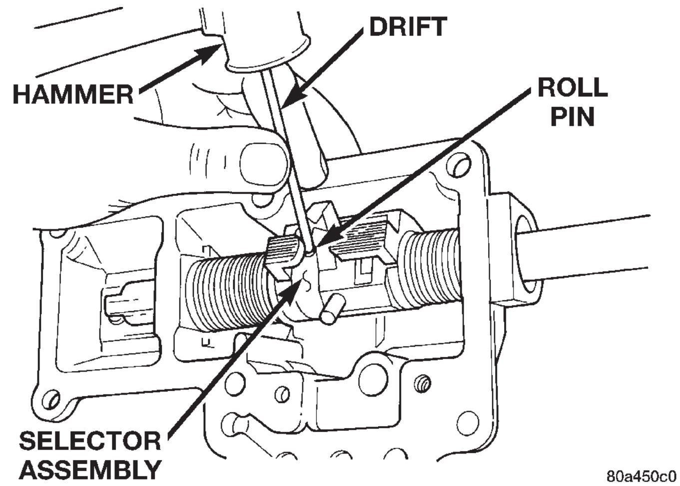


Fig. 188 Center Roll Pin

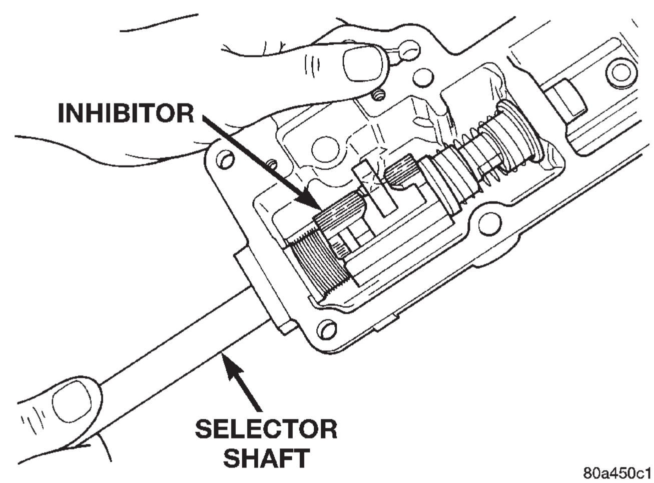


Fig. 189 Selector Shaft Removal

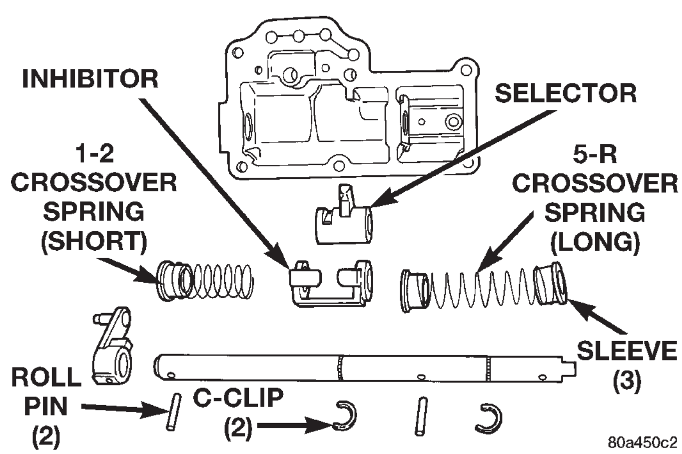


Fig. 190 Selector Shaft Components

(7) Install roll pin and crossover lever at crossover shaft

(8) Install vent cap.

DISASSEMBLY AND ASSEMBLY (Continued)

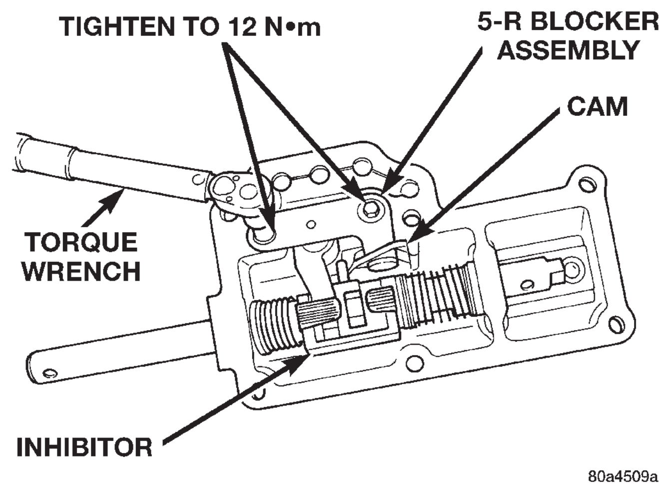


Fig. 191 5–R Blocker Bolts

NOTE: The C-Clip grooves in the selector shaft will damage the oil seal. Install oil seal after selector shaft is installed. Always use a new oil seal when selector shaft is removed.

(9) Install selector shaft oil seal (Fig. 192).

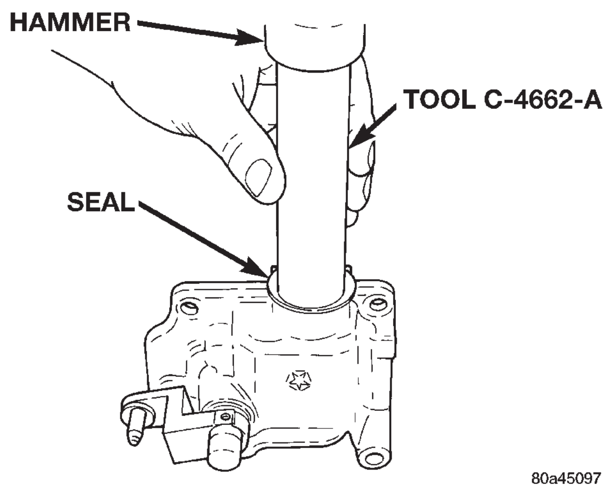


Fig. 192 Selector Shaft Oil Seal

(10) Install selector shaft dust boot.
(11) Install selector shaft selector lever.

NOTE: Roll pin must be flush with top of lever.

TRANSAXLE CASE

INTERMEDIATE SHAFT FRONT BEARING CUP

REMOVAL

(1) Insert Special Tool 6787 into the intermediate shaft front bearing cup (Fig. 193).

(2) Tighten the special tool so that the tool fingers spread out and seat underneath the bearing cup.

(3) Install Special Tool 3752 (Slide Hammer) onto the Special Tool 6787.

(4) Remove the intermediate shaft front bearing cup (Fig. 194).

(5) Remove the bearing oil feeder (if necessary).

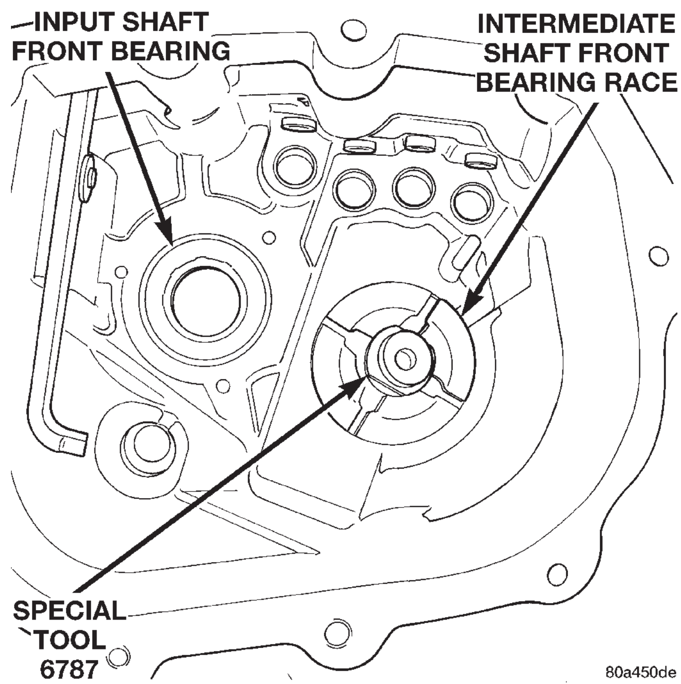


Fig. 193 Special Tool 6787 Installed in Bearing Cup

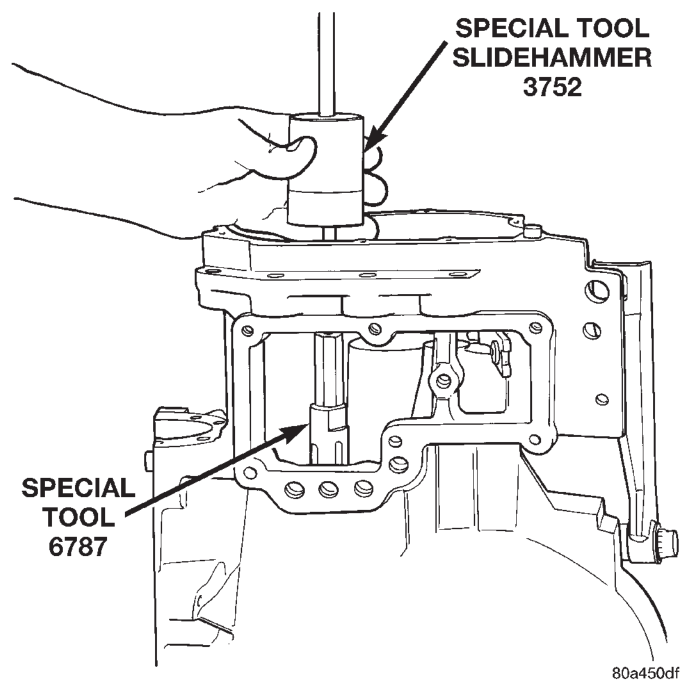


Fig. 194 Remove Intermediate Shaft Front Bearing Cup

INSTALLATION

(1) Insert the bearing oil feeder (if necessary) into the transaxle case (Fig. 195).

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Verify the oil feeder is centered within the bearing bore.

(3) Position the bearing cup into the bearing bore.

(4) Position Special Tool 6939 and Special Tool C-4171 into the intermediate shaft bearing cup.

(5) Press new bearing cup into the case (Fig. 196).

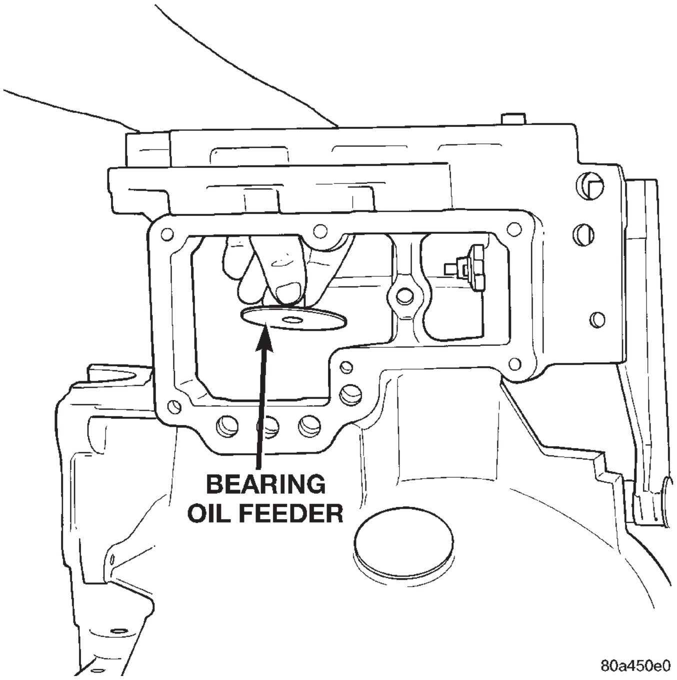


Fig. 195 Install Bearing Oil Feeder

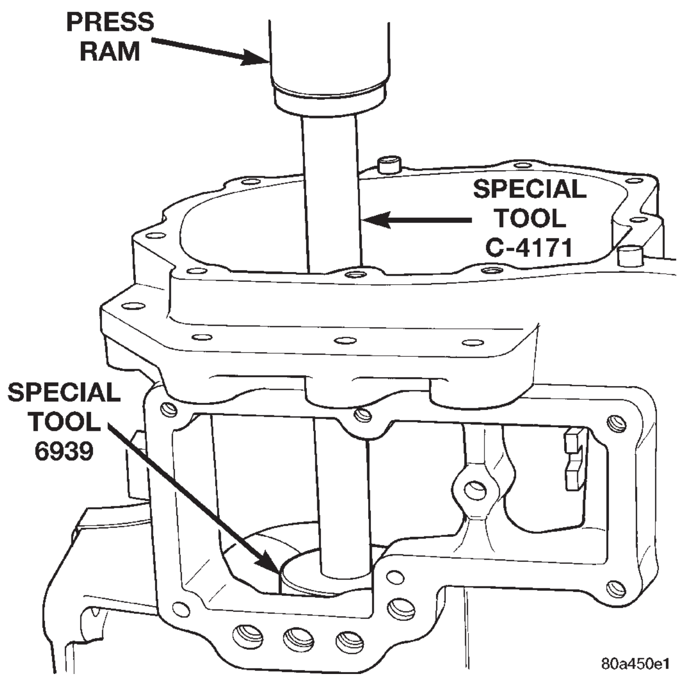


Fig. 196 Install Intermediate Shaft Bearing Front Bearing Cup

INPUT SHAFT FRONT BEARING

REMOVAL

(1) From inside the bellhousing, remove the E-clip retaining the clutch release lever shaft (Fig. 197).

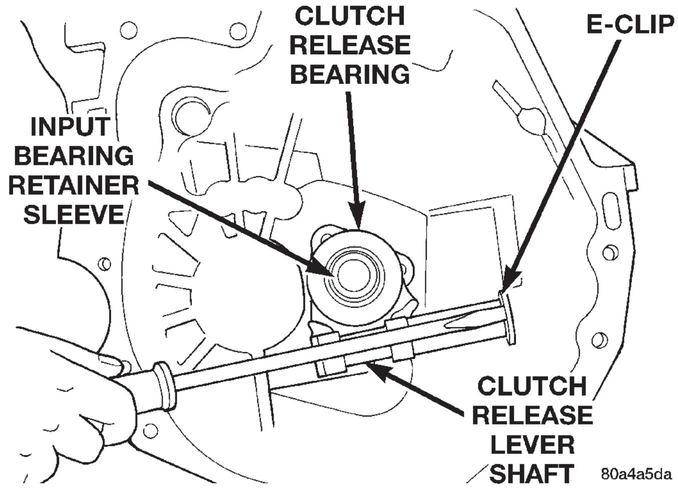


Fig. 197 E-clip at Clutch Release Lever Shaft

(2) Pull release lever shaft out of the clutch bellhousing (Fig. 198).

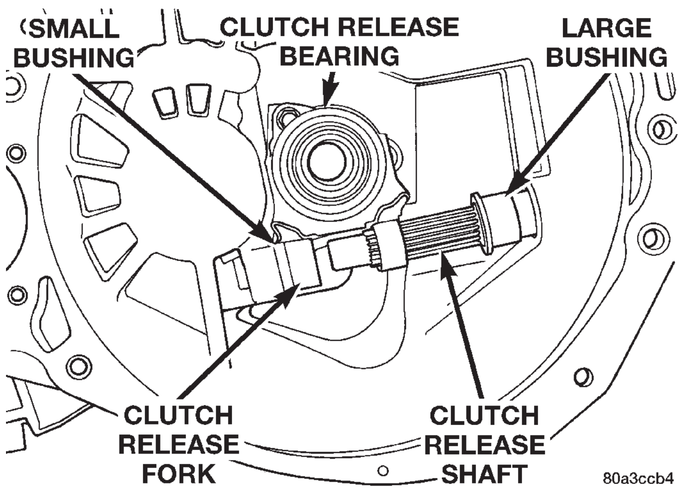


Fig. 198 Clutch Release Shaft

(3) Remove the clutch release bearing from the input bearing retainer sleeve (Fig. 199).

(4) Remove the three bolts retaining the input shaft bearing retainer sleeve (Fig. 200).

(5) Remove the input bearing retainer sleeve from the front of the bellhousing (Fig. 201).

(6) Position transaxle case in a shop press (bellhousing side down).

(7) Install Special Tool 5066 into input bearing.

(8) Install Special Tool C-4171 into Special Tool 5066

(9) Press out the input bearing from the case (Fig. 202).

DISASSEMBLY AND ASSEMBLY (Continued)

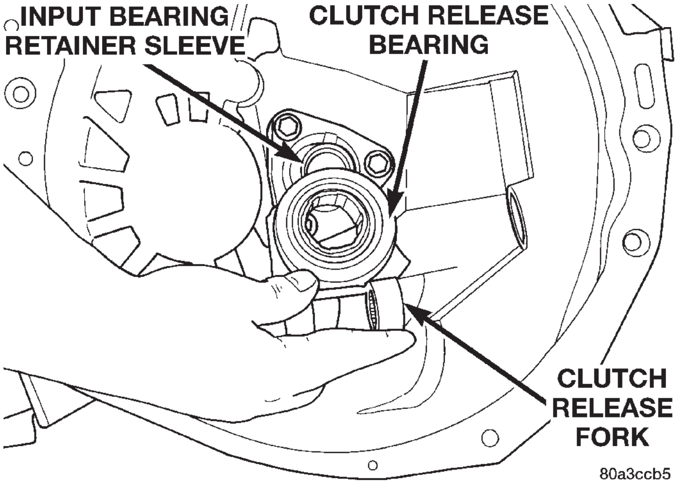


Fig. 199 Clutch Release Fork

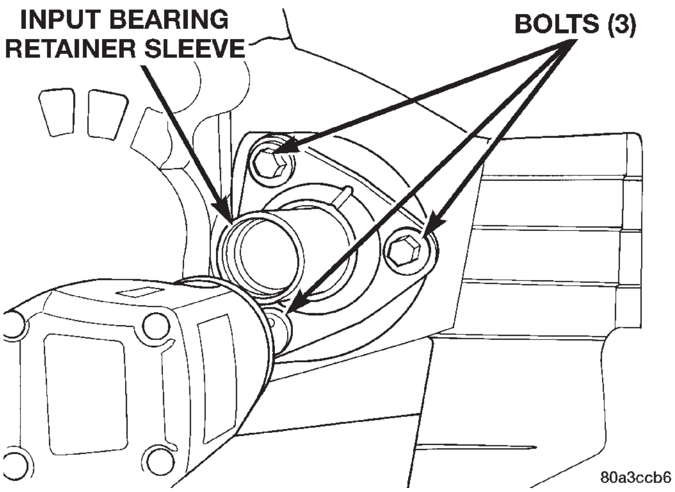


Fig. 200 Input Bearing Retainer

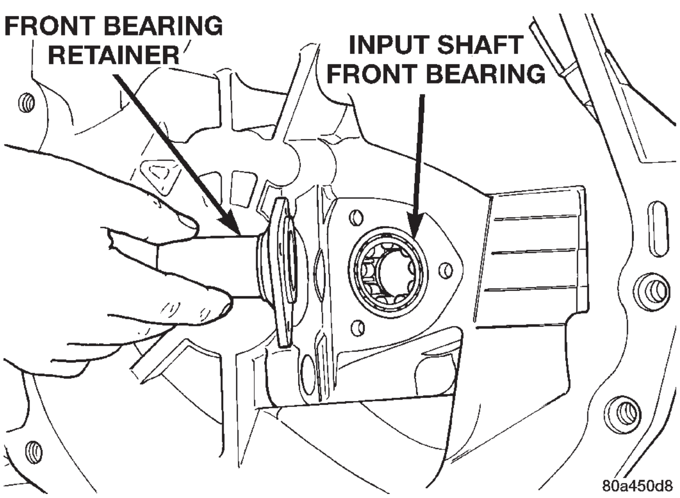


Fig. 201 Remove Input Bearing Retainer

INSTALLATION

(1) Position new input bearing into the transaxle case (Fig. 203).

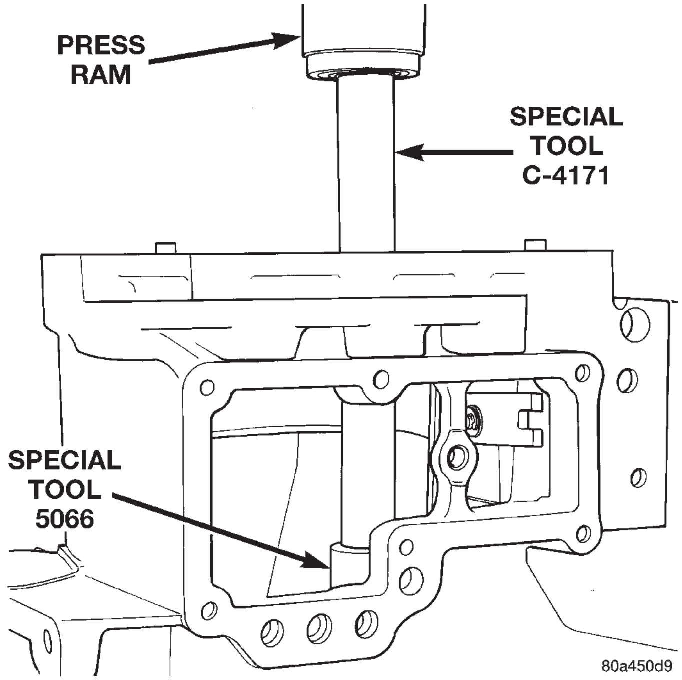


Fig. 202 Press Out Input Bearing

(2) Position transaxle case in shop press (bellhousing side up).

(3) Install Special Tool 6933 into input bearing (Fig. 204).

(4) Install Special Tool C-4171 into Special Tool 6933.

(5) Press input bearing into transaxle case (Fig. 205).

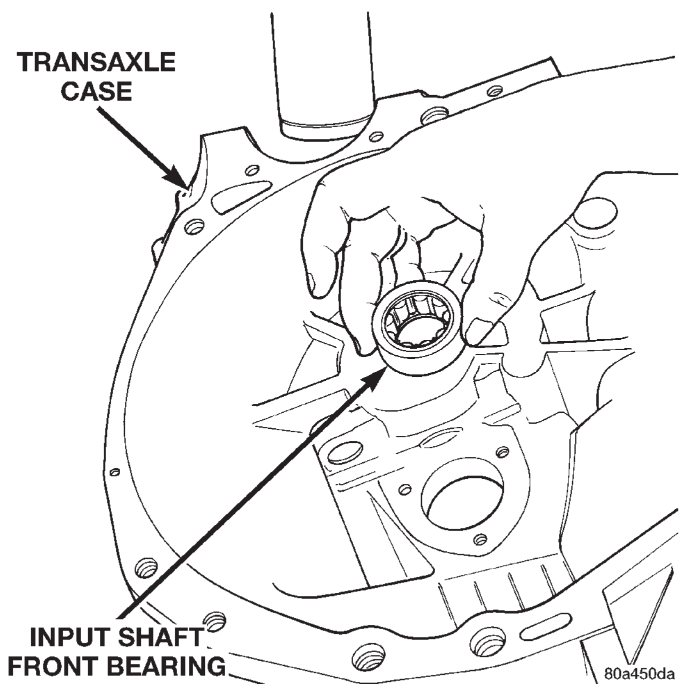


Fig. 203 Input Bearing

DISASSEMBLY AND ASSEMBLY (Continued)

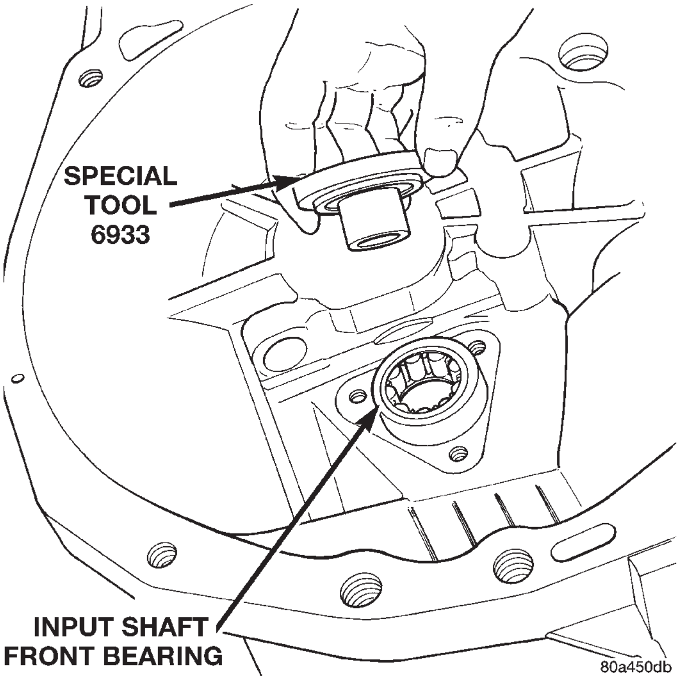


Fig. 204 Special Tool 6933

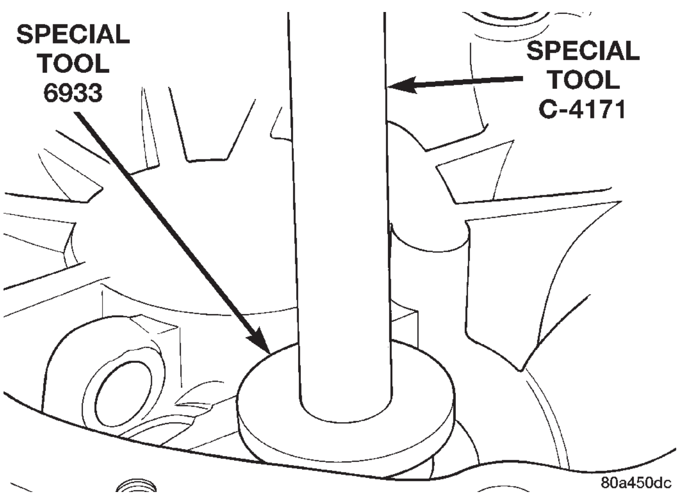


Fig. 205 Press Input Bearing Into Case

(6) Apply a small bead of Mopar® gasket Maker to the input bearing retainer.

(7) Install bearing retainer.

(8) Install clutch release fork onto clutch release bearing.

(9) Install bearing and fork onto input bearing retainer sleeve.

(10) Install clutch release shaft bushings into transaxle case.

(11) Install clutch release shaft into case and install E-clip onto shaft (Fig. 206).

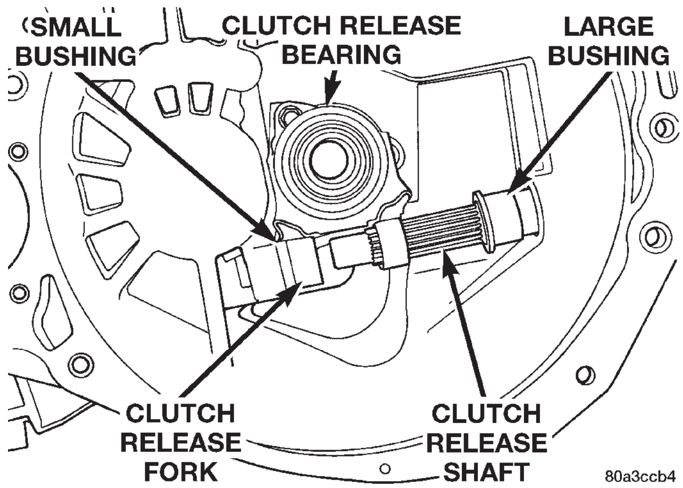


Fig. 206 Clutch Release Shaft

SHIFT RAIL BUSHINGS

REMOVAL

(1) Install Special Tool 6786 into rail bushing that is to be removed (Fig. 207).

(2) Tighten tool until the tool is thoroughly imbedded into the bushing.

(3) Install Special Tool 3752 (Slide Hammer) into Special Tool 6786 (Fig. 208).

(4) Tap out shift rail bushing (Fig. 209).

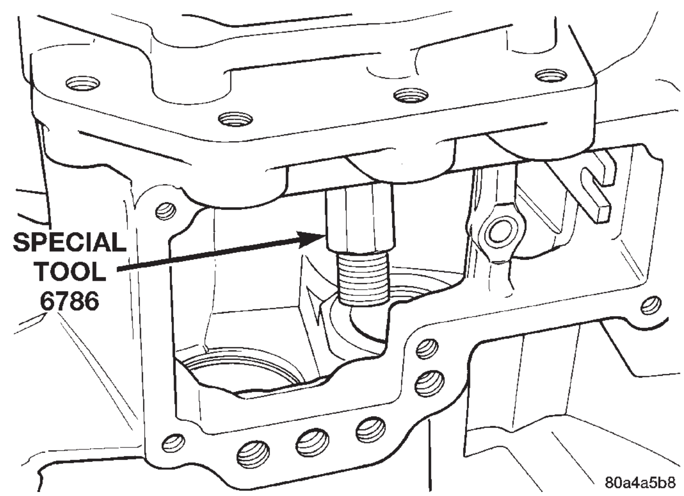


Fig. 207 Special Tool 6786

INSTALLATION

(1) Lubricate outer shell of the shift rail bushing.

(2) Position shift rail bushing into the shift rail bore.

(3) Tap bushing into the bore, flush with the bore face

DISASSEMBLY AND ASSEMBLY (Continued)

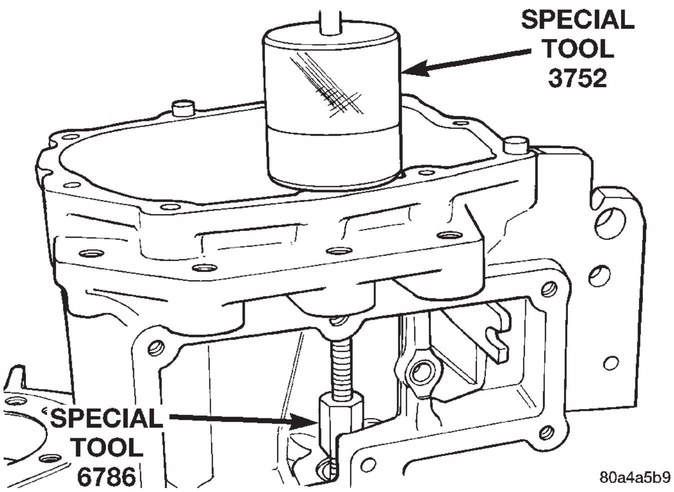


Fig. 208 Slide Hammer 3752

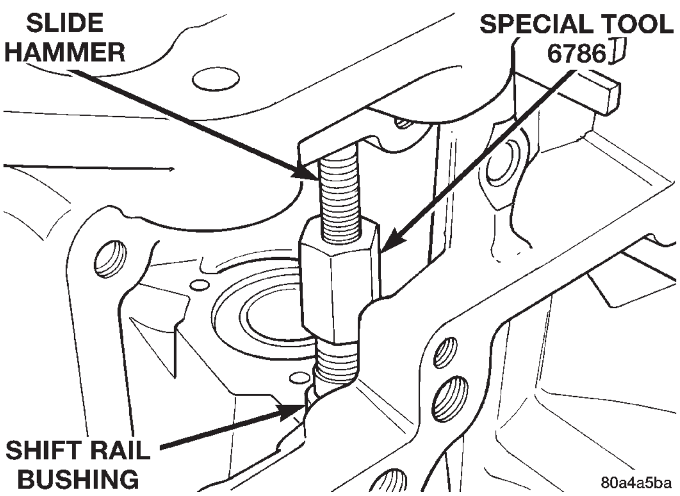


Fig. 209 Shift Rail Bushing Removal

REVERSE SHIFT LEVER

REMOVAL

(1) Remove reverse shift lever E-clip.

(2) Remove the flat and wave washers.

(3) Remove the reverse shift lever from the mounting stud.

INSTALLATION

(1) Position the reverse shift lever onto the mounting stud.

(2) Install the washers onto the mounting stud.

(3) Install the E-clip.

CLEANING AND INSPECTION

TRANSAXLE

Clean the gears, bearings, shafts, synchronizers, thrust washers, oil feeder, shift mechanism, gear case, and bellhousing with solvent. Dry all parts except the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

Inspect the gears, bearings, shafts and thrust washers. Replace the bearings and cups if the rollers are worn, chipped, cracked, flat spotted, or brinnelled, or if the bearing cage is damaged or distorted. Replace the thrust washers if cracked, chipped, or worn. Replace the gears if the teeth are chipped, cracked, or worn thin. Inspect the synchronizers. Replace the sleeve if worn or damaged in any way. Replace the stop rings if the friction material is burned, flaking off, or worn. Check the condition of the synchro struts and springs. Replace these parts if worn, cracked, or distorted.

SYNCHRONIZER

CLEAN

Do not attempt to clean the blocking rings in solvent. The friction material will become contaminated. Place synchronizer components in a suitable holder and clean with solvent. Air dry.

INSPECT

Proper inspection of components involve:

- Teeth, for wear, scuffed, nicked, burred, or broken teeth
- Struts, for wear or distortion
- Springs, for distortion, cracks, or wear

If any of these conditions exist in these components, replace as necessary.

ADJUSTMENTS

GEARSHIFT CROSSOVER CABLE

Before replacing the gearshift cables for a hard-shifting complaint, disconnect both cables at the transaxle. Then, from the driver's seat, manually operate the gearshift lever through all gear ranges. If the gearshift lever moves smoothly, the cable(s) should NOT be replaced. If the gear lever binds replace the cable that is causing the binding condition. If the problem still exists, check the crossover cable adjustment (Fig. 210).

(1) Working over the left front fender, remove the auxiliary vent from the selector shaft housing (Fig. 211).

(2) Locate the gearshift lock pin that has been included in the new vehicle packet located in the glove box.

(3) Place transaxle gearshift in the neutral position.

(4) Insert lock pin (so long end is down) into same threaded hole (Fig. 212). A hole in the selector shaft will align with the lock pin, allowing the lock pin to

ADJUSTMENTS (Continued)

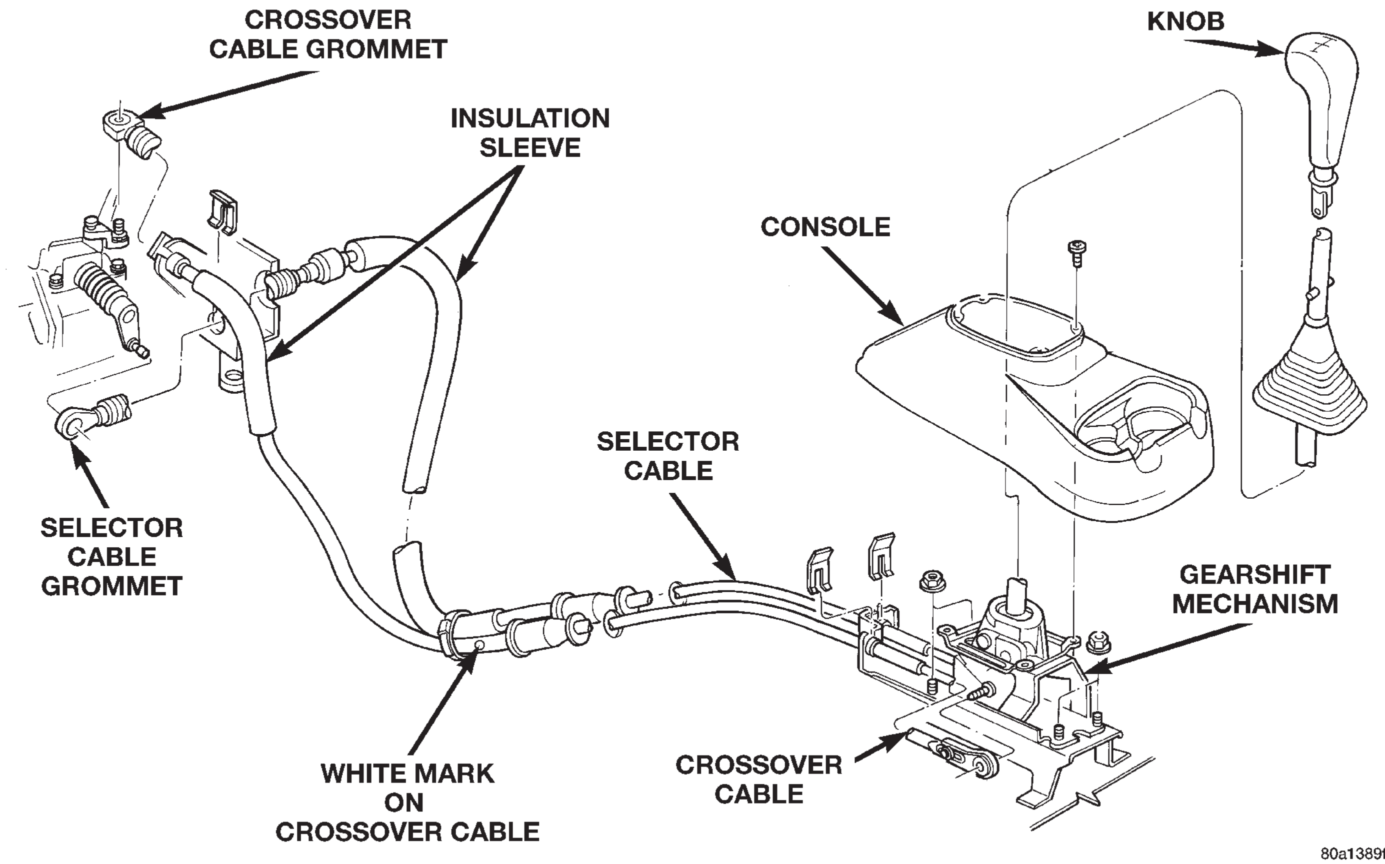


Fig. 210 Gearshift Mechanism

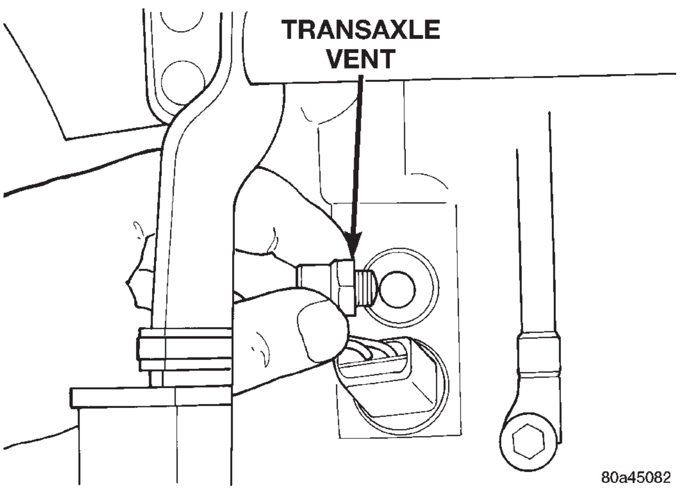


Fig. 211 Auxiliary Vent Removal

be screwed into the housing. This operation locks the selector shaft in the 3-4 neutral position.

(5) Remove gearshift knob (Fig. 213).

(6) Remove gearshift boot (Fig. 214).

(7) Remove gearshift console screws and remove the console (Fig. 215).

(8) Loosen crossover cable adjustment screw.

(9) Verify gearshift mechanism is in the neutral position.

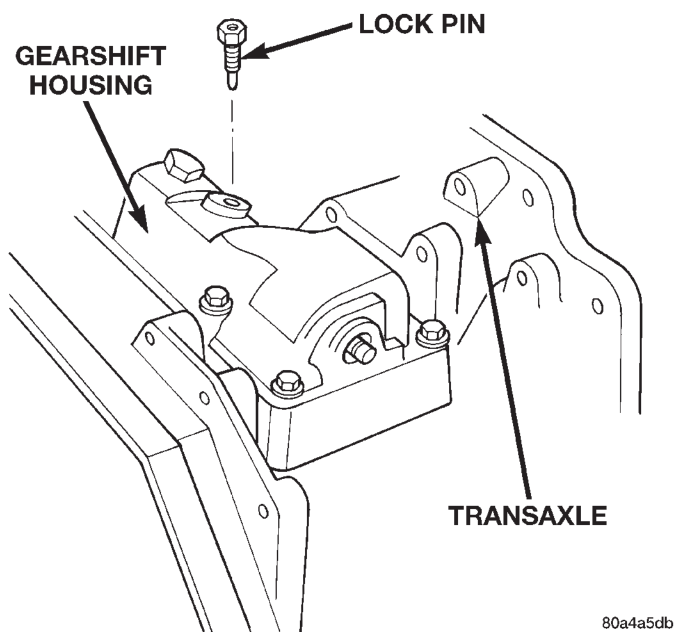


Fig. 212 Lock Pin Installation

CAUTION: Be sure crossover bellcrank does NOT move when tightening adjusting screw.

ADJUSTMENTS (Continued)

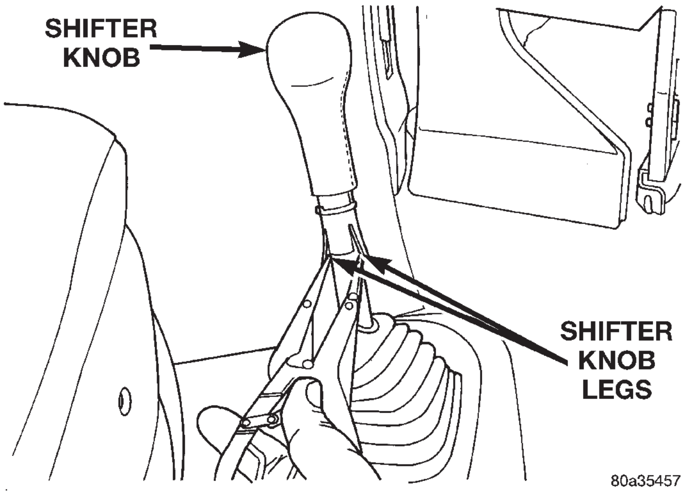


Fig. 213 Gearshift Knob

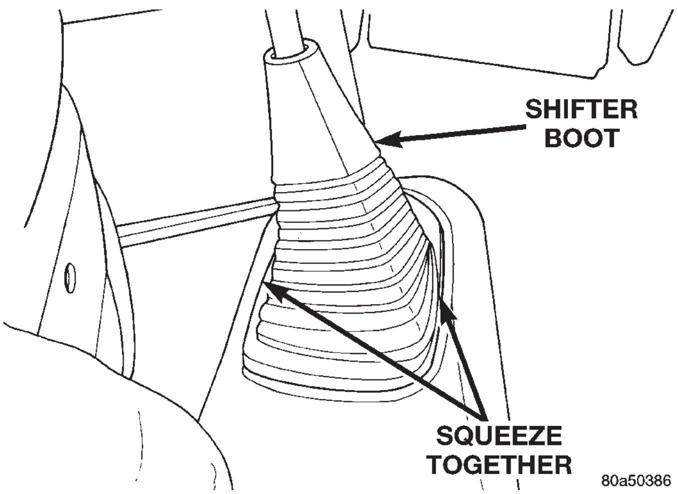


Fig. 214 Gearshift Boot

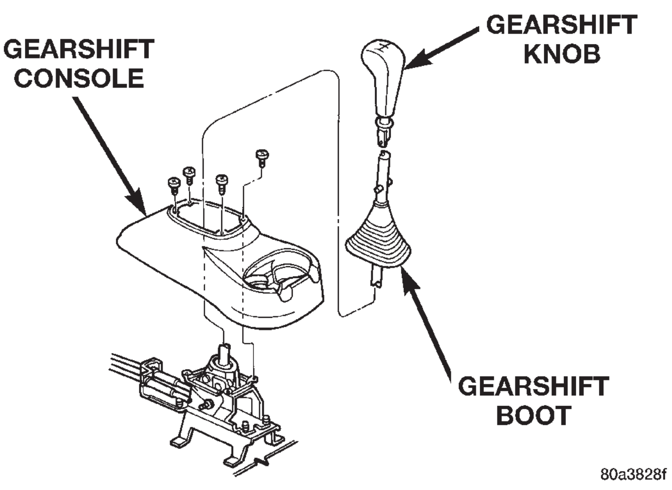


Fig. 215 Gearshift Console

(10) Tighten crossover cable adjuster to 8 N·m (70 in. lbs.) (Fig. 216).

CAUTION: Proper torque to the crossover cable adjusting screw is very important.

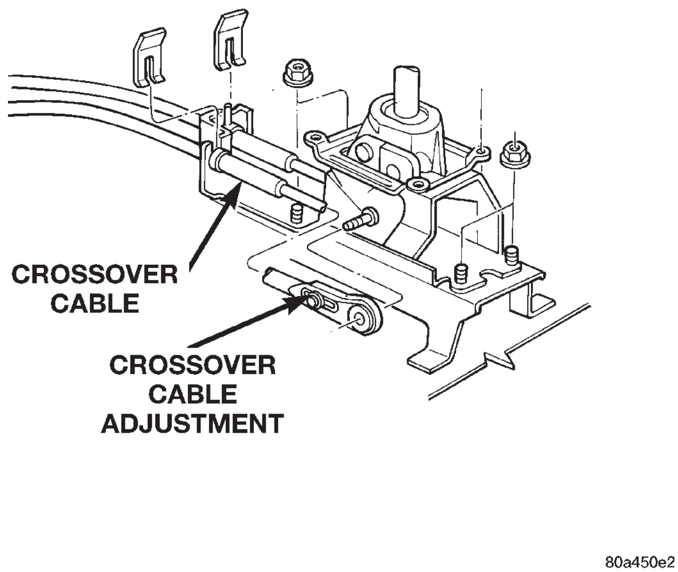


Fig. 216 Crossover Cable Adjustment

(11) Remove lock pin from gearshift housing. Reinstall auxiliary vent in gear shift housing (Fig. 217). Tighten auxiliary vent to 8 N·m (70 in. lbs.).

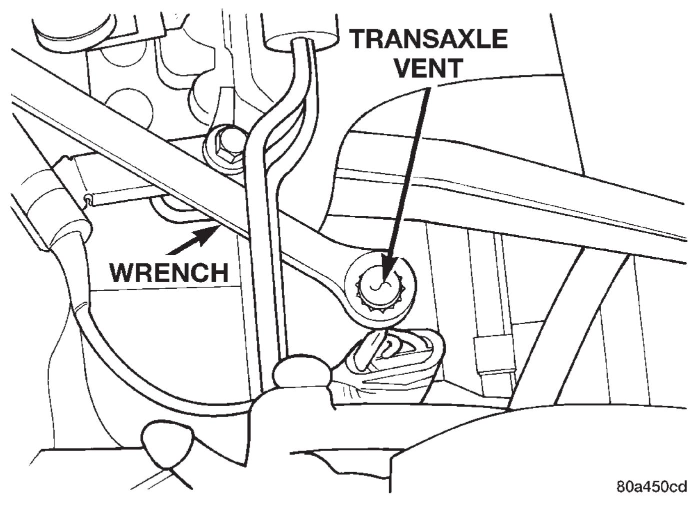


Fig. 217 Auxiliary Vent Installation

(12) Check for shift into first and reverse.

(13) Gearshift mechanism and cables are now functioning properly.

(14) Install gearshift console.

(15) Install gearshift boot.

(16) Install gearshift knob.

(17) Stow gearshift lock pin in glove packet.

ADJUSTMENTS (Continued)

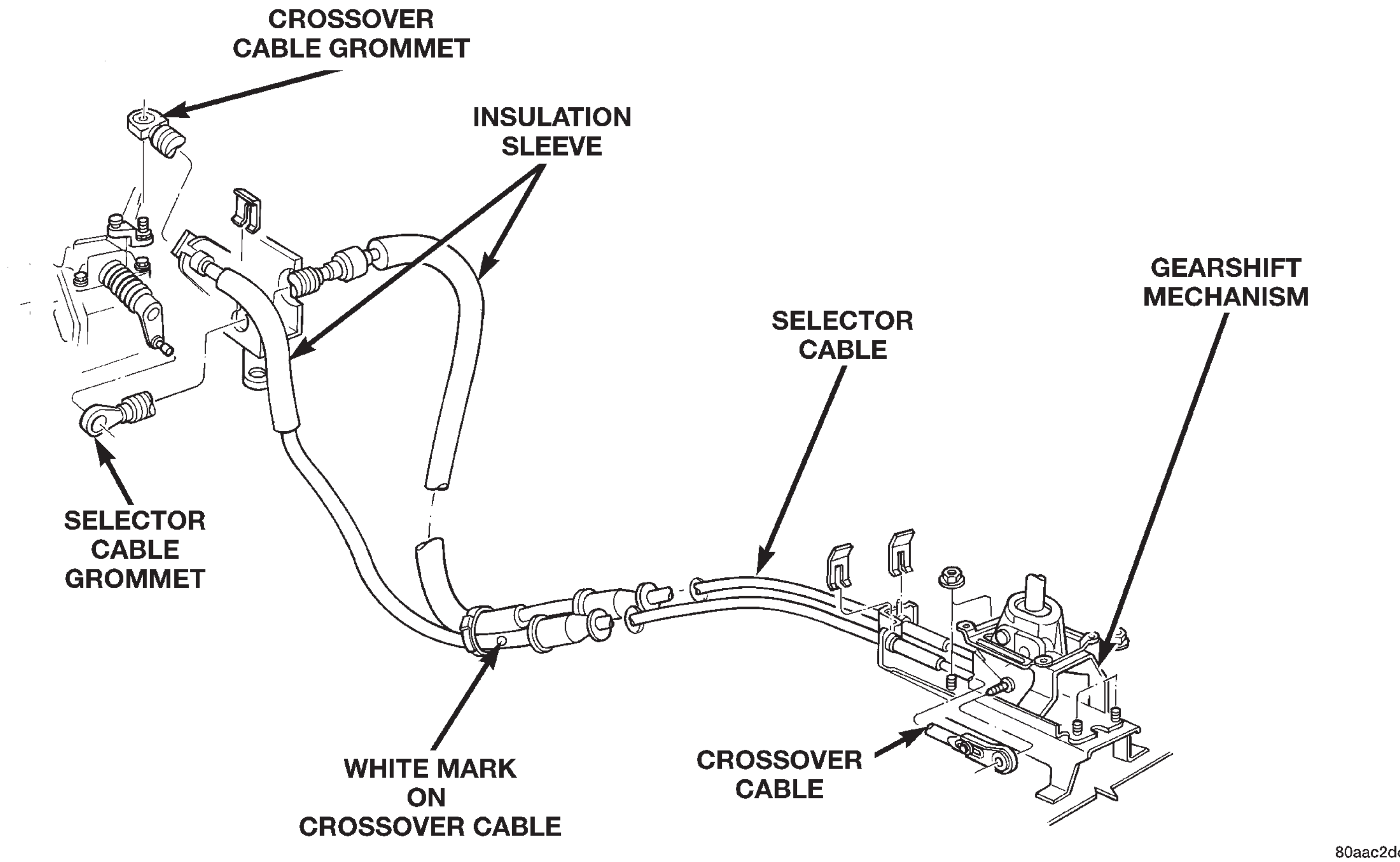


Fig. 218 Gearshift Mechanism

GEARSHIFT CROSSOVER CABLE

Before replacing the gearshift cables for a hard-shifting complaint, disconnect both cables at the transaxle. Then, from the driver's seat, manually operate the gearshift lever through all gear ranges. If the gearshift lever moves smoothly, the cable(s) should NOT be replaced. If the gear lever binds replace the cable that is causing the binding condition. If the problem still exists, check the crossover cable adjustment (Fig. 218).

(1) Working over the left front fender, remove the auxiliary vent from the selector shaft housing (Fig. 219).

(2) Locate the gearshift lock pin that has been included in the new vehicle packet located in the glove box.

(3) Place transaxle gearshift in the neutral position.

(4) Insert lock pin (so long end is down) into same threaded hole (Fig. 220). A hole in the selector shaft will align with the lock pin, allowing the lock pin to be screwed into the housing. This operation locks the selector shaft in the 3-4 neutral position.

(5) Remove gearshift knob (Fig. 221).

(6) Remove gearshift boot (Fig. 222).

(7) Remove gearshift console screws and remove the console (Fig. 223).

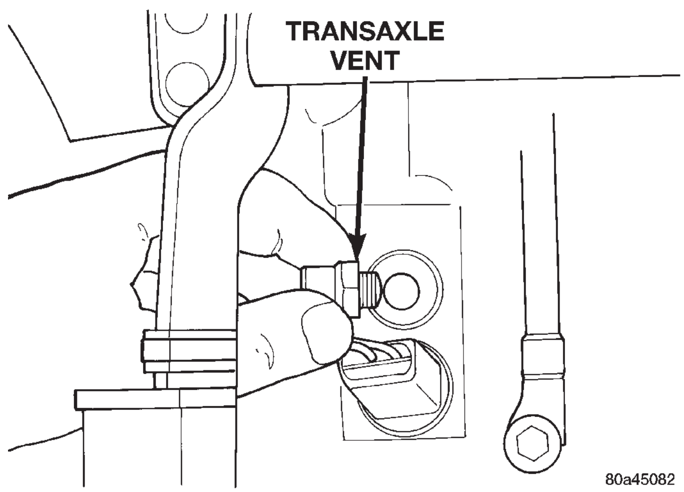


Fig. 219 Auxiliary Vent Removal

(8) Loosen crossover cable adjustment screw.

(9) Verify gearshift mechanism is in the neutral position.

CAUTION: Be sure crossover bellcrank does NOT move when tightening adjusting screw.

ADJUSTMENTS (Continued)

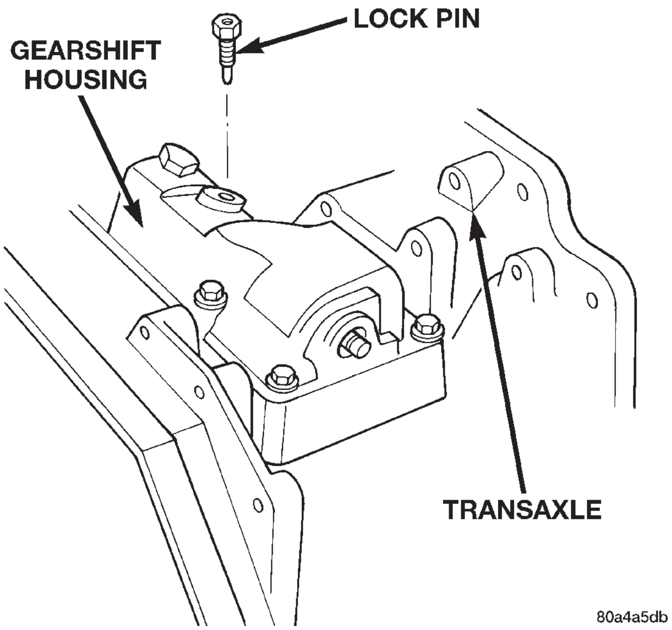


Fig. 220 Lock Pin Installation

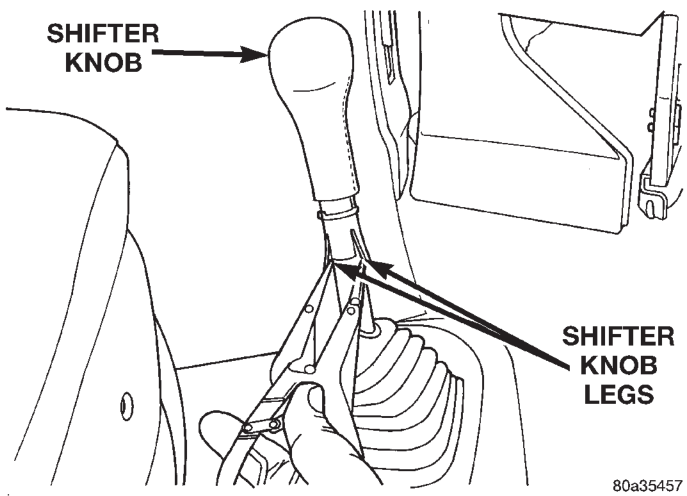


Fig. 221 Gearshift Knob

(10) Tighten crossover cable adjuster to 8 N·m (70 in. lbs.) (Fig. 224).

CAUTION: Proper torque to the crossover cable adjusting screw is very important.

(11) Remove lock pin from gearshift housing. Reinstall auxiliary vent in gear shift housing (Fig. 225). Tighten auxiliary vent to 8 N·m (70 in. lbs.).

(12) Check for shift into first and reverse.

(13) Gearshift mechanism and cables are now functioning properly.

(14) Install gearshift console.

(15) Install gearshift boot.

(16) Install gearshift knob.

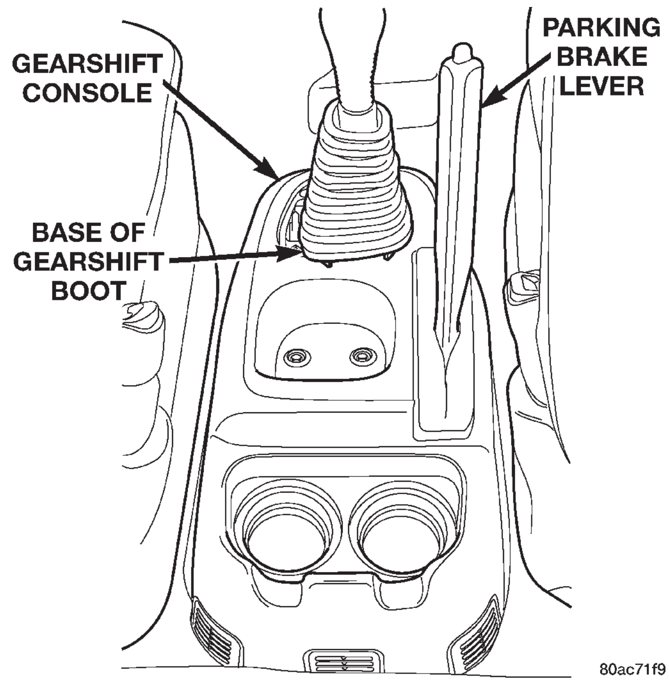


Fig. 222 Gearshift Boot

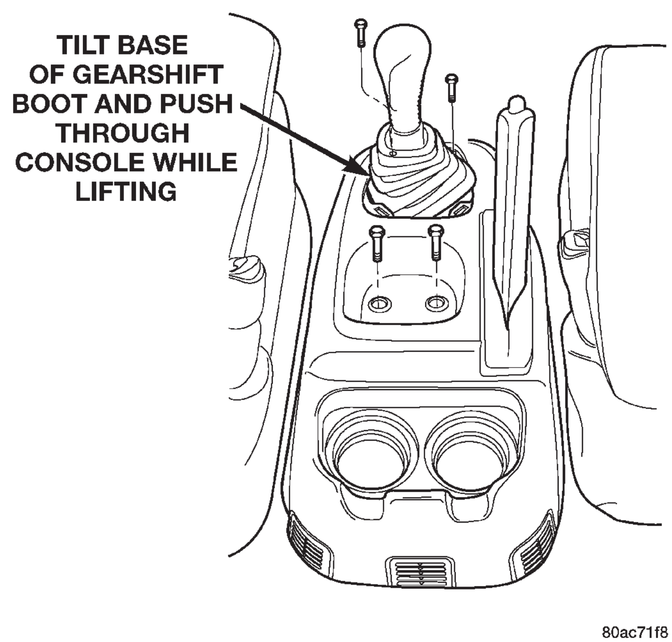


Fig. 223 Gearshift Console

(17) Stow gearshift lock pin in glove packet.

BEARING ADJUSTMENT PROCEDURE

The A-598 (T-750) transaxle has two bearing adjustment procedures that must be performed if the transaxle case or related components have been replaced. If the intermediate shaft, and/or bearing cups and cones have been replaced, you must perform the intermediate shaft preload shim adjustment. If the differential case, cups or cones have

ADJUSTMENTS (Continued)

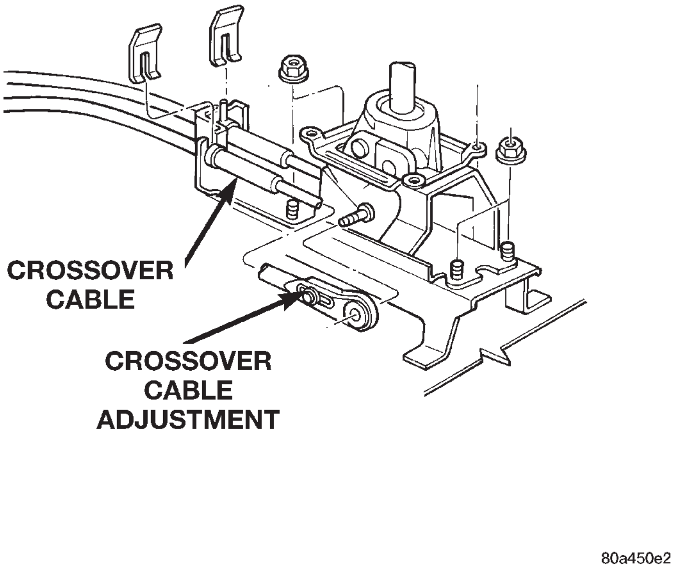


Fig. 224 Crossover Cable Adjustment

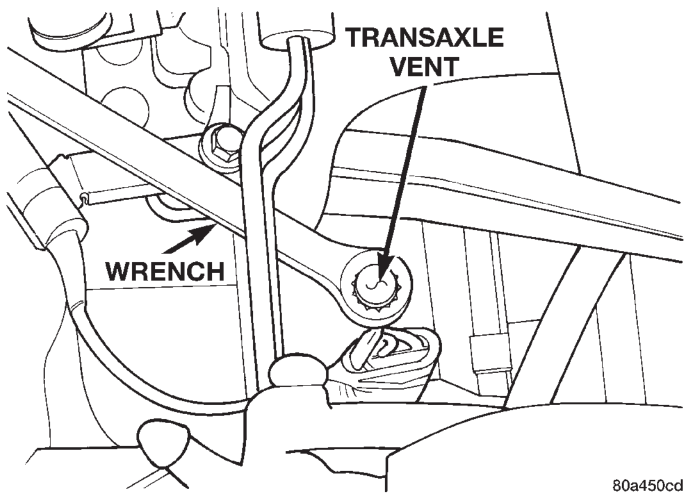


Fig. 225 Auxiliary Vent Installation

been replaced, you must perform the differential bearing preload shim adjustment. If the transaxle case has been replaced, you must perform both procedures.

GENERAL RULES ON SERVICING BEARINGS

(1) Use extreme care when removing and installing bearing cups and cones. Burrs or nicks on the bearing seat will give a false end play reading while gauging for proper shims. Improperly seated bearing cups and cones are subject to low–mileage failure.

(2) 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.

(3) Bearing preload and drag torque specifications must be maintained to avoid premature bearing failures. Used (original) bearings may lose up to 50% of their original drag torque after break in. All bearing adjustments must be made with no other component interference or gear intermesh.

(4) Replace bearings as a pair: If one differential bearing is defective, replace both differential bearings.

(5) Bearing cones must not be reused if removed.

(6) Turning torque readings should be obtained while smoothly rotating in either direction.

INTERMEDIATE SHAFT BEARING PRELOAD

The intermediate shaft preload must be checked if the housing, intermediate shaft, bearing plate, bearings, or transaxle case are replaced.

The intermediate shaft bearing preload procedure must be done with the transaxle out of the vehicle and on a bench.

(1) Remove end cover (Fig. 226).

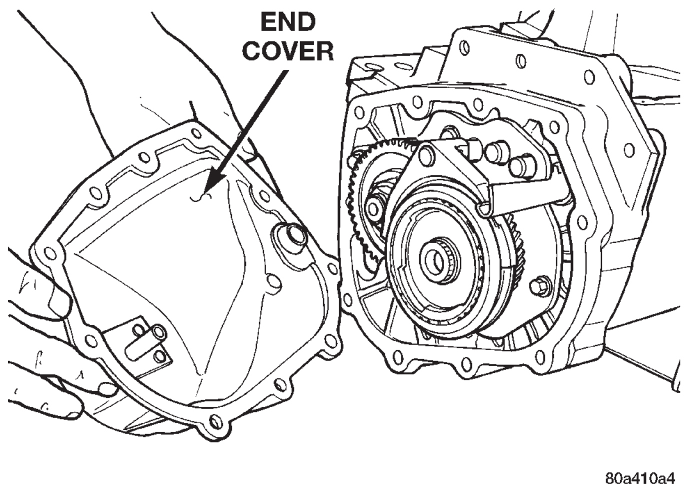


Fig. 226 End Cover Removed

(2) Remove 5th shift fork roll pin (Fig. 227).

(3) Use Special Tool 6252 to hold 5th gear. Remove input shaft 5th gear nut (Fig. 228).

(4) Remove 5th gear synchro snap ring (Fig. 229).

(5) Remove 5th gear synchro, synchro plate, and fork.

(6) Remove 5th drive gear off of the input shaft (Fig. 230).

(7) Remove bearing retainer plate (Fig. 231).

(8) Remove bearing preload shim (Fig. 232).

(9) Bolt down the bearing support plate in two places (verify dowels are in place).

(10) Seat the intermediate bearing cup against the bearing.

(11) Measure depth of intermediate bearing cup with dial depth gauge (Fig. 233).

ADJUSTMENTS (Continued)

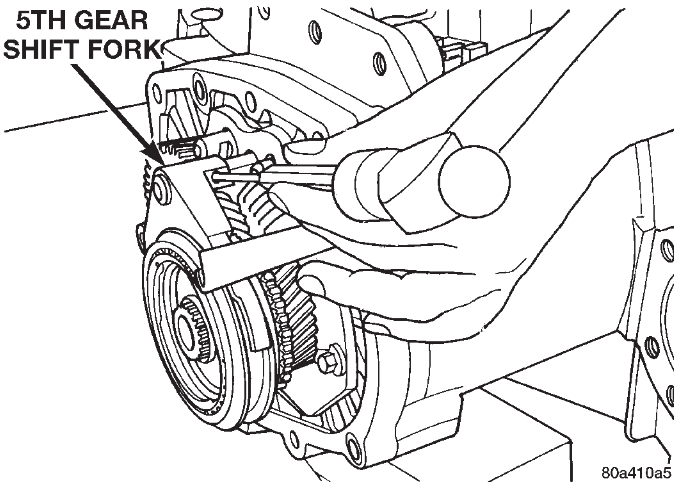


Fig. 227 5th Gear Shift Fork Roll Pin

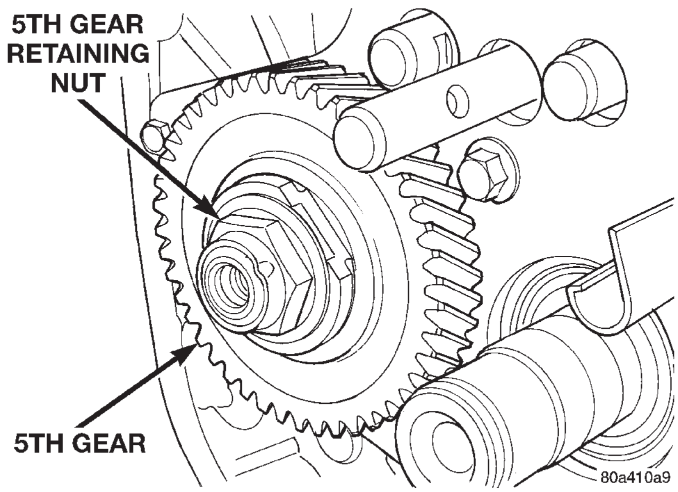


Fig. 228 5th Gear Retaining Nut

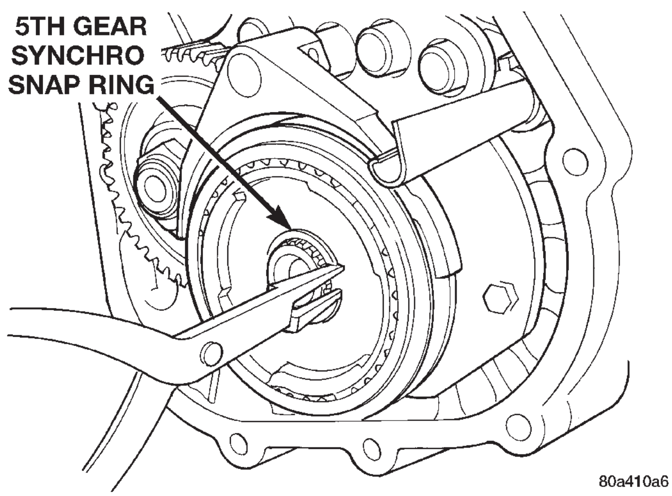


Fig. 229 5th Gear Synchronizer Snap Ring

(12) Add .007 (0.178) to the depth measurement taken. This amount is the actual size of the bearing shim needed.

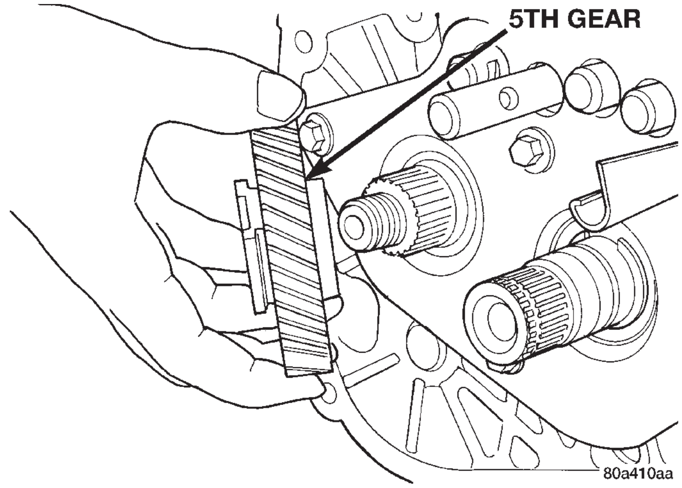


Fig. 230 5th Gear

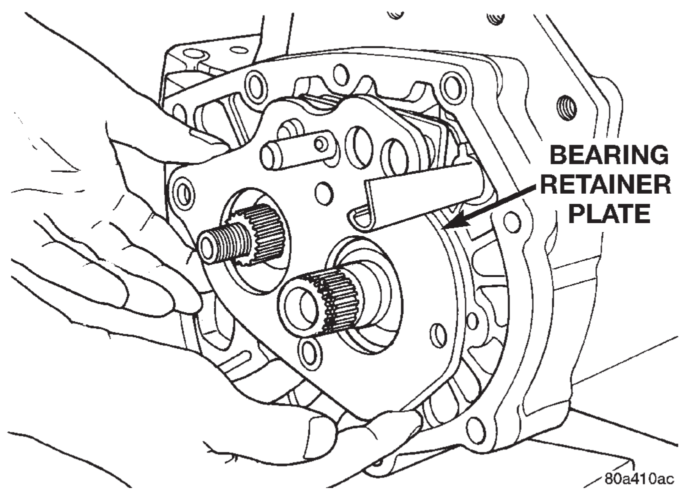


Fig. 231 Bearing Retainer Plate

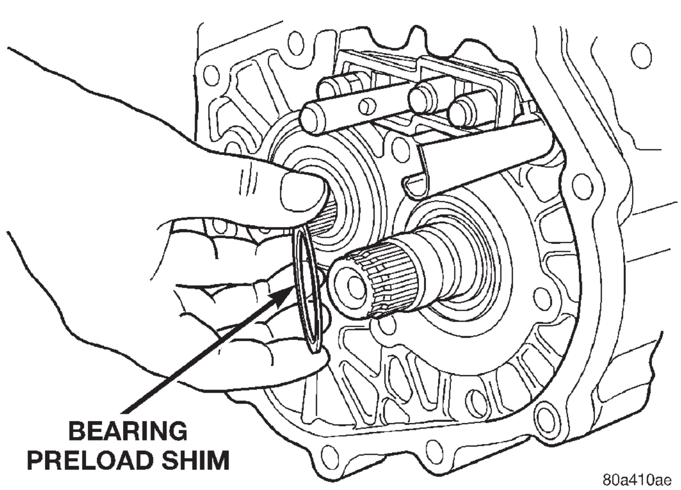


Fig. 232 Bearing Preload Shim

(13) Remove the two bolts retaining the bearing support plate. Remove the bearing support plate.

ADJUSTMENTS (Continued)

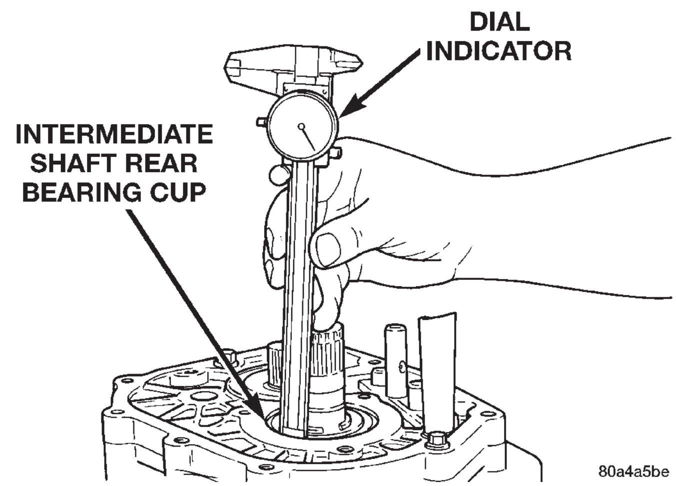


Fig. 233 Measure Depth Of Cup

(14) Apply a bead of Mopar® Gasket Maker or equivalent onto bearing support plate. Install bearing support plate.

(15) Install necessary shim calculated from Step 12

(16) Install bearing retainer plate. Tighten bearing retainer plate to 17 N·m (250 in. lbs.).

(17) Install 5th drive gear onto the input shaft.

(18) Install 5th gear, synchro, fork, and plate.

(19) Install 5th gear synchro snap ring.

(20) Install 5th gear shift fork roll pin.

(21) Use Special Tool 6252 to hold 5th gear and install new 5th gear nut at input shaft. Tighten the retaining nut to 176 N·m (130 ft. lbs.).

(22) Use Special Tool 6930 to stake the 5th gear retaining nut onto the input shaft (Fig. 234).

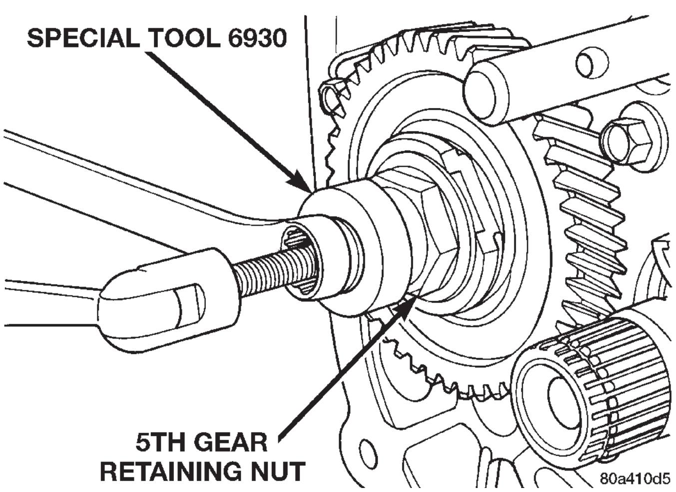


Fig. 234 Staking 5th Gear Retaining Nut

(23) Apply a bead of Mopar® Gasket Maker or equivalent onto end cover. Install 5th gear/synchro end cover. Tighten bolts to 28 N·m (250 in. lbs.).

SPECIFICATIONS

A-598 (T-750) MANUAL TRANSAXLE

DESCRIPTION	TORQUE
Back-up Lamp Switch	27 N·m (20 ft. lbs.)
Bearing Retainer Plate	28 N·m (250 in. lbs.)
Crossover Cable Adj. Screw	8 N·m (70 in. lbs.)
Drain Plug	23 N·m (17 ft. lbs.)
Differential Housing	54 N·m (40 ft. lbs.)
Diff. Bearing Retainer	61 N·m (45 ft. lbs.)
Diff. Ring Gear Bolts	94 N·m (70 ft. lbs.)
End Cover Bolts	28 N·m (21 ft. lbs.)
Extension Housing	28 N·m (250 in. lbs.)
Gearshift Housing	28 N·m (250 in. lbs.)
*Input Gear Nut	176 N·m (130 ft. lbs.)
Input Retainer	28 N·m (250 in. lbs.)
Reverse Blocker	12 N·m (105 in. lbs.)
Transaxle Case Bolts	29 N·m (21 ft. lbs.)
Vehicle Speed Sensor	7 N·m (60 in. lbs.)
Vent	6 N·m (60 in. lbs.)

NOTE: *The 5th/input gear is torqued to specification and then staked in two places using Special Tool 6930.

NOTE: Bolts that have thread sealer or torque lock patches should not be reused. Always install new bolts in these applications.

NV T750 (A-598) MANUAL TRANSAXLE FLUID FILL

TRANSAXLE	METRIC MEASURE	U.S. MEASURE
NV T750	1.9-2.2 Liters	2.0-2.3 Quarts

A-558 MANUAL TRANSAXLE—RHD VEHICLES

DESCRIPTION	TORQUE
Back-up Lamp Switch	27 N·m (20 ft. lbs.)
Bearing Retainer Plate	28 N·m (250 in. lbs.)
Crossover Cable Adj. Screw	8 N·m (70 in. lbs.)
Drain Plug	23 N·m (17 ft. lbs.)
Modular Clutch to Drive Plate Bolts	74 N·m (55 ft. lbs.)
Transaxle Case Bolts	29 N·m (21 ft. lbs.)
Vehicle Speed Sensor	7 N·m (60 in. lbs.)
Vent	6 N·m (60 in. lbs.)

SPECIAL TOOLS

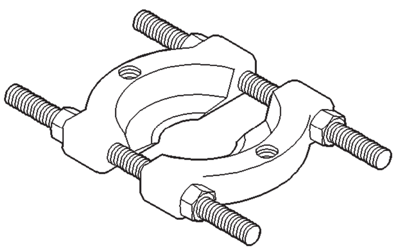
A-558 MANUAL TRANSAXLE FLUID FILL

The fluid level should be within 3.175mm (1/8 inch) from the bottom of the transaxle fill hole (vehicle must be level when checking).

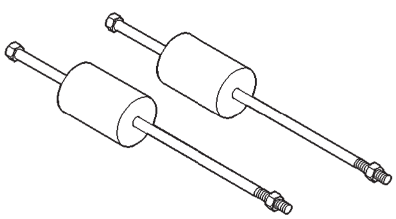
Fill transaxle to proper level with SAE 5W-30 engine oil, meeting SG and/or SG-CD qualifications. G5 SAE 10W-40 engine oil is a suitable service fill alternative.

TRANSAXLE	METRIC MEA-SURE	U.S. MEASURE
A-558	1.9-2.2 Liters	2.0-2.3 Quarts

A-598 (T-750) MANUAL TRANSAXLE

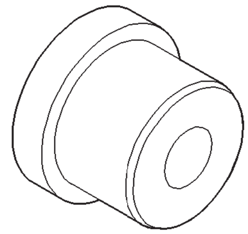


Bearing Splitter 1130

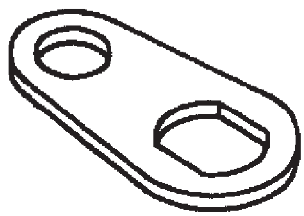


Slide Hammer 3752

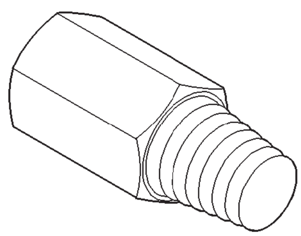
A-558 MANUAL TRANSAXLE—RHD VEHICLES



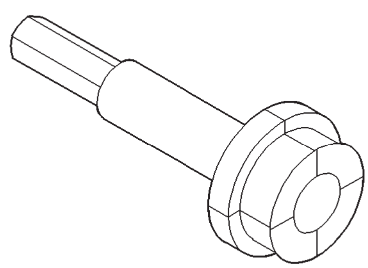
Bearing Remover 5066



Gear Holder 6252

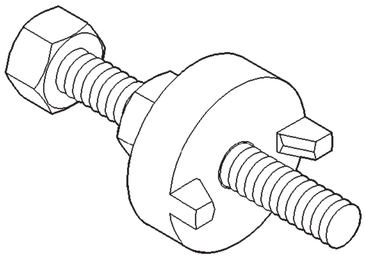


Bearing Remover 6786

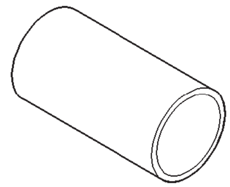


Bearing Remover 6787

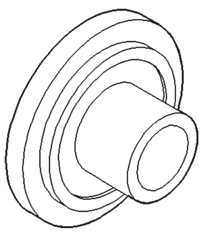
SPECIAL TOOLS (Continued)



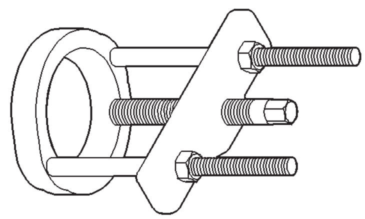
Staking Tool 6930



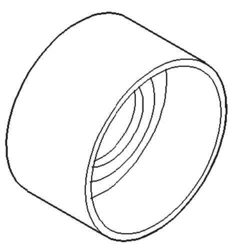
Bearing Installer 6950



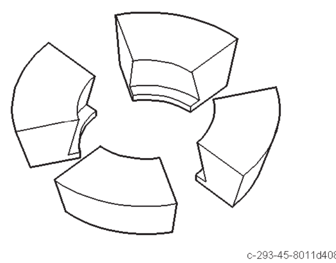
Bearing Installer 6933



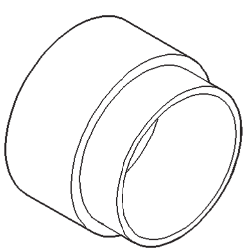
Puller Press C-293-PA



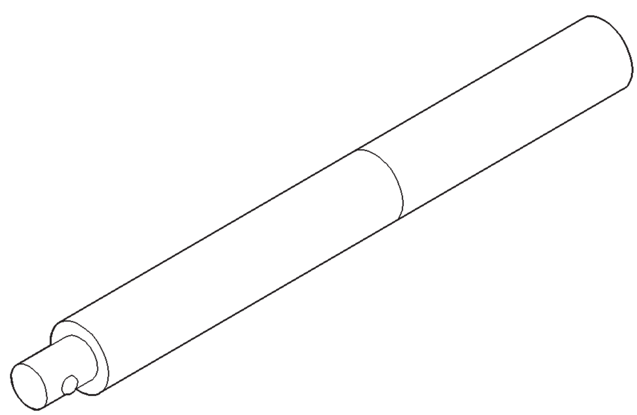
Bearing Installer 6938



Adapters C-293-45

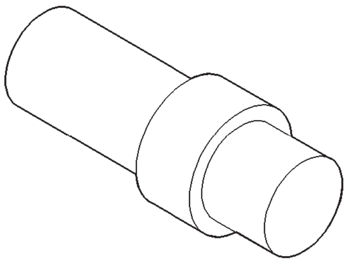


Bearing Installer 6939

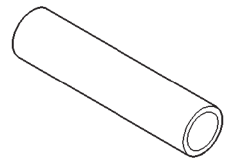


Handle C-4171

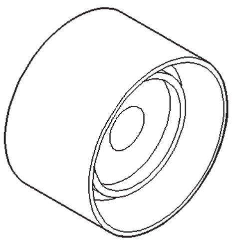
SPECIAL TOOLS (Continued)



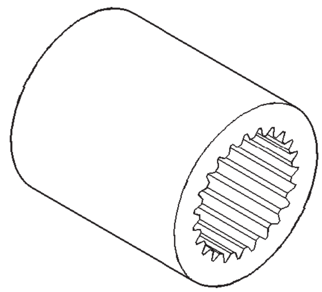
Adapter C-4996



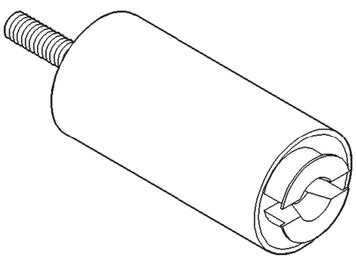
Bearing Installer MD998323



Bearing Installer L-4410



Bearing Remover MD998802–01



Bearing Remover L-4518

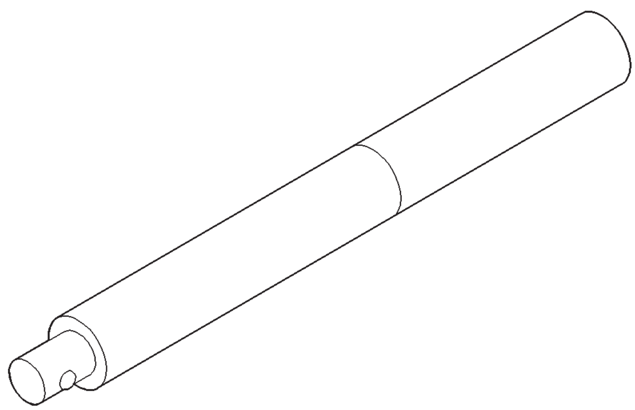
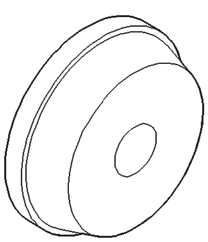


Fig. 235 Handle C-4171



Bearing Installer L-4520

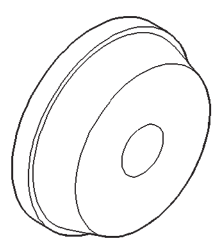


Fig. 236 Bearing Installer L-4520

TIRES AND WHEELS

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TIRES

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DESCRIPTION AND OPERATION

TIRE INFORMATION

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 application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles

Radial ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation. This will help to achieve a greater tread-life potential.

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. 1).

Performance tires will have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. The letter **S** indicates that the tire is speed rated up to 112 mph.

- **Q** up to 100 mph
- **T** up to 118 mph
- **U** up to 124 mph
- **H** up to 130 mph
- **V** up to 149 mph
- **Z** more than 149 mph (consult the tire manufacturer for the specific speed rating)

An All Season type tire will have either **M + S, M & S or M–S** (indicating mud and snow traction) imprinted on the side wall.

TIRE CHAINS

This vehicle was designed to allow the use of a specified type of snow chain on the tires. Only compact snow chains or other traction aidsmeeting SAE type “Class S” specifications may be used. **Any style**

DESCRIPTION AND OPERATION (Continued)

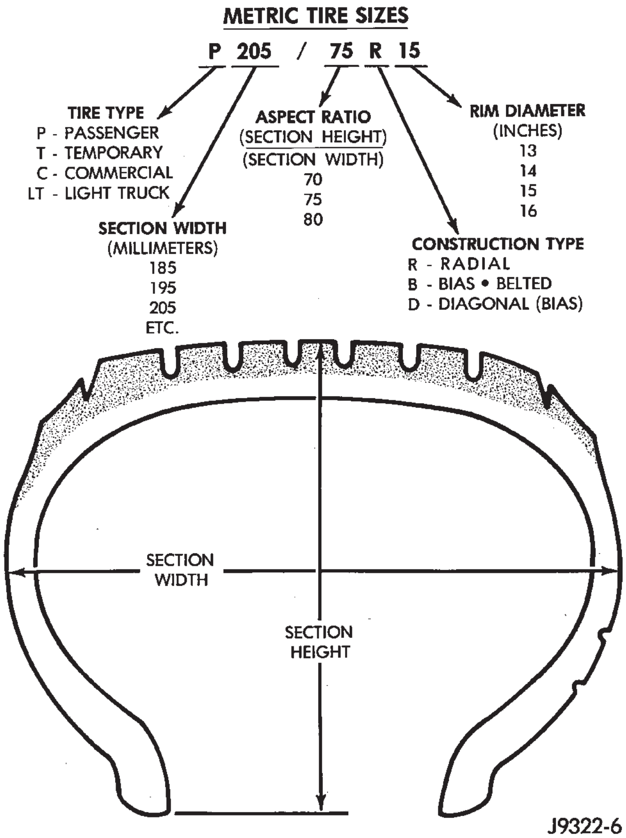


Fig. 1 Tire Size Identification

snow chain or other type of traction aid is not to be used on the compact spare tire.

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life, ride quality and decrease rolling resistance.

Radial-ply tires must always be used in sets of four and under no circumstances should they be used on the front only. They may be mixed with a temporary spare tire 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.

It is recommended that tires from different manufactures NOT be mixed. The proper tire pressure should be maintained on all four tires. For proper tire pressure refer to the Tire Inflation Pressure Placard located in the glove box.

SPARE TIRE (TEMPORARY)

The temporary spare tire is designed for emergency use only. The original tire should be repaired and reinstalled at the first opportunity, or replaced with a new. Do not exceed speeds of 50 MPH when the temporary spare tire is in use on the vehicle. Refer to the Owner's Manual for complete details.

TIRE INFLATION PRESSURES

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING. THE TIRE CAN FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

Under inflation causes rapid shoulder wear of the tire tread and tire flexing. This can result in failure of the tire. (Fig. 2).

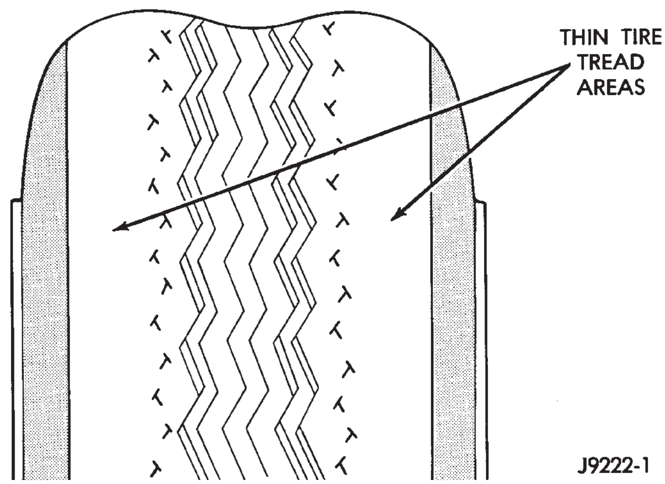


Fig. 2 Under Inflation Wear

Over inflation causes rapid center wear and loss of the tire's ability tocushion shocks (Fig. 3).

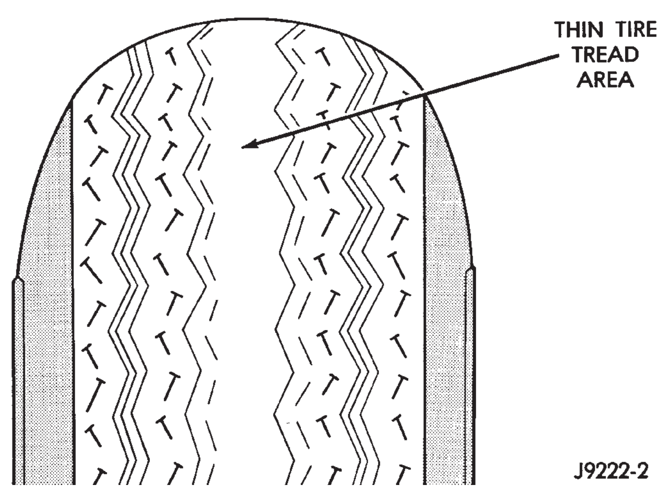


Fig. 3 Over Inflation Wear

DESCRIPTION AND OPERATION (Continued)

Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- The vehicle to drift.

Proper tire air inflation pressure specifications can be found on the Vehicle Tire Placard provided with the vehicle. See owner's manual.

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once per month. Check tire pressure more frequently when the weather temperature varies widely. Tire pressure will decrease when the outdoor temperature drops.

Tire inflation pressures specified on the placard are always cold inflation pressure. Cold inflation pressure is obtained after the vehicle has not been operated for at least 3 hours, or the vehicle is driven less than one mile after being inoperative 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.

TIRE PRESSURE FOR HIGH-SPEED DRIVING

Chrysler Corporation advocates driving at safe speeds within posted speed limits. 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 75 mph (120 km/h), tires must be inflated to the pressures shown on the tire placard.

Vehicles loaded to the maximum capacity should not be driven at 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.

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 recommend 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 not listed in the specification charts 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

PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

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. 4).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

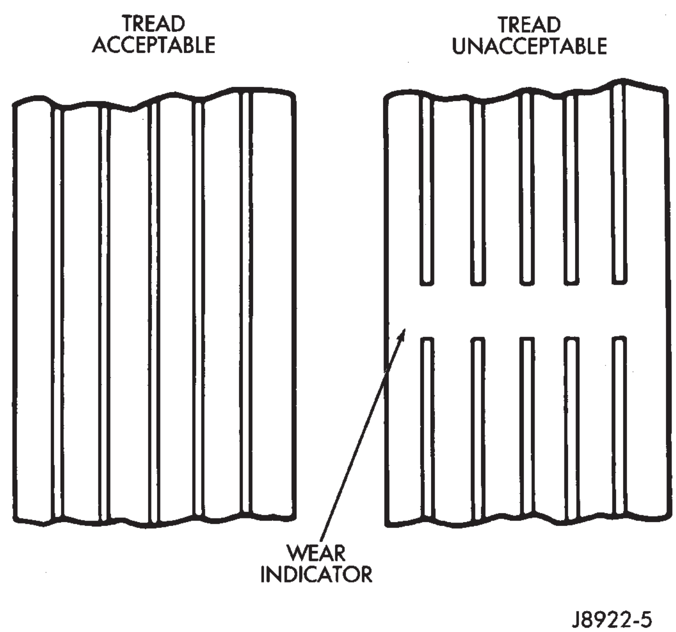


Fig. 4 Tread Wear Indicators

DIAGNOSIS AND TESTING (Continued)

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. 5).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 5).

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.

LEAD CORRECTION CHART

Use the following chart to correct a vehicle leading or drifting problem.

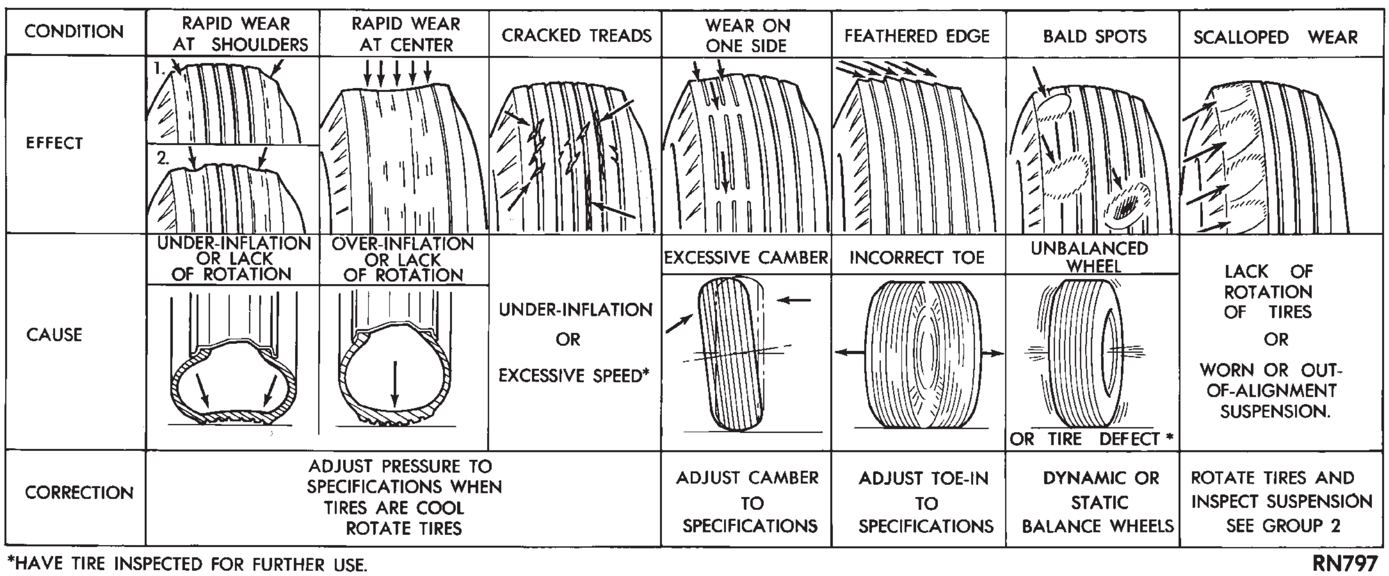
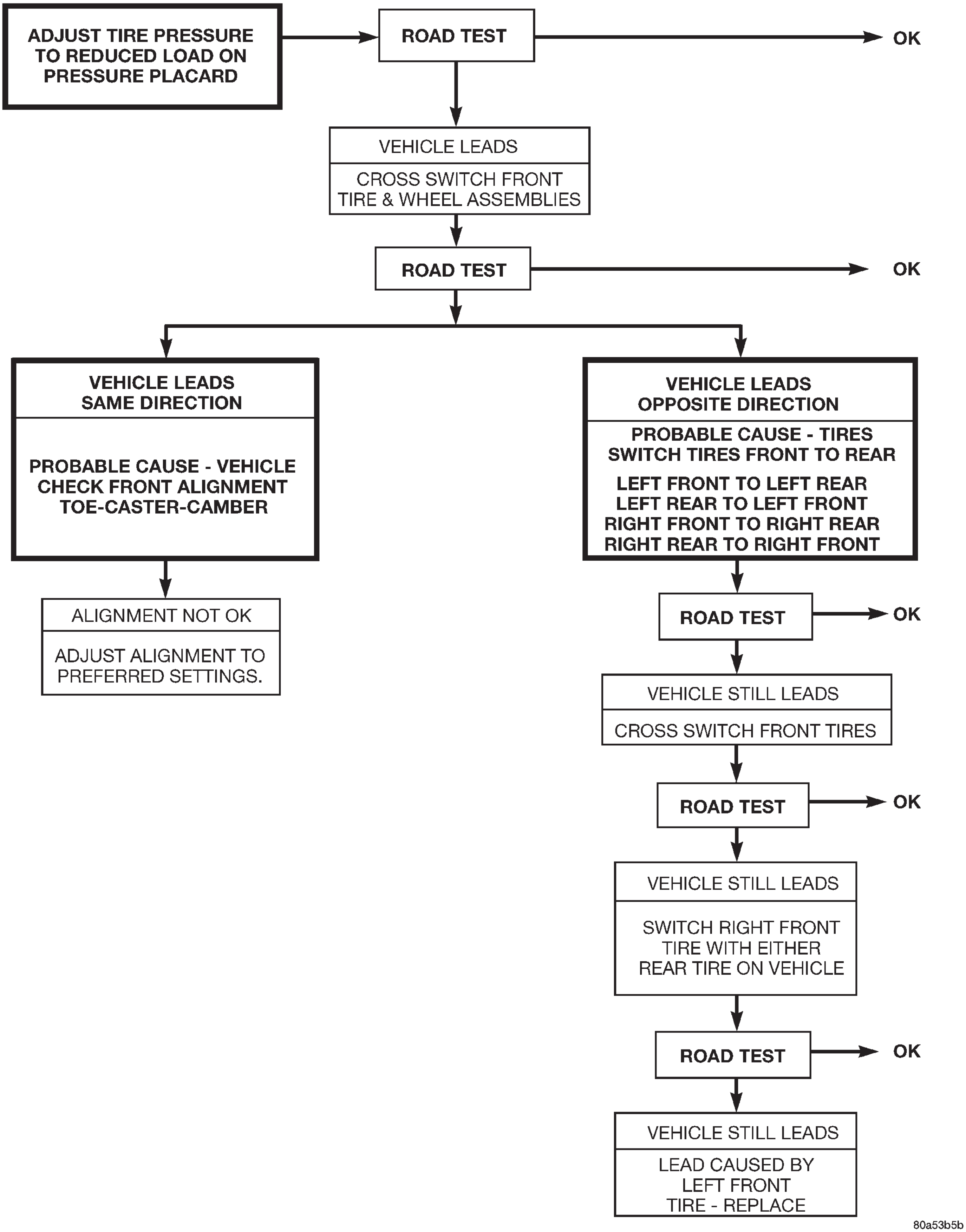


Fig. 5 Tire Wear Patterns

DIAGNOSIS AND TESTING (Continued)

LEAD CORRECTION CHART



SERVICE PROCEDURES

TIRE AND WHEEL ROTATION (NON-DIRECTIONAL THREAD PATTERN)

Tires on the front and rear axles operate at different loads and perform different functions. For these reasons, they wear at unequal rates, and tend to develop irregular wear patterns. These effects can be reduced by timely rotation of tires. The benefits of rotation are especially worthwhile. Rotation will increase tread life, help to maintain mud, snow, and wet traction levels, and contribute to a smooth, quiet ride.

The suggested rotation method is the forward-cross tire rotation method (Fig. 6). This method takes advantage of current tire industry practice which allows rotation of radial-ply tires. Other rotation methods may be used, but may not have all the benefits of the recommended method.

NOTE: Only the 4 tire rotation method may be used if the vehicle is equipped with a low mileage or temporary spare tire.

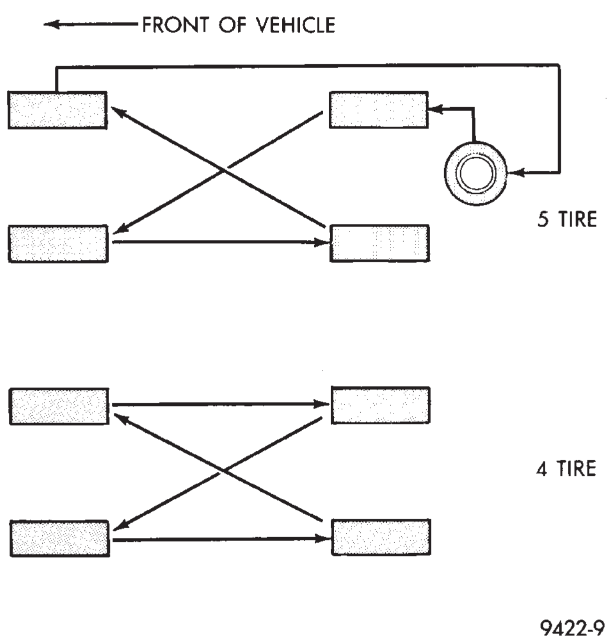


Fig. 6 Forward-Cross Tire Rotation Method

REPAIRING TIRE LEAKS

For proper repairing, a radial tire must be removed from the wheel. Before dismounting the tire from the wheel, a reference mark should be placed on the tire at the valve stem location. This reference mark will ensure that the tire is remounted back on the wheel in its original position. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 7). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before dismounting 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 progressively tighten all 5 wheel nuts to a torque of 135 N·m (100 ft. lbs.).

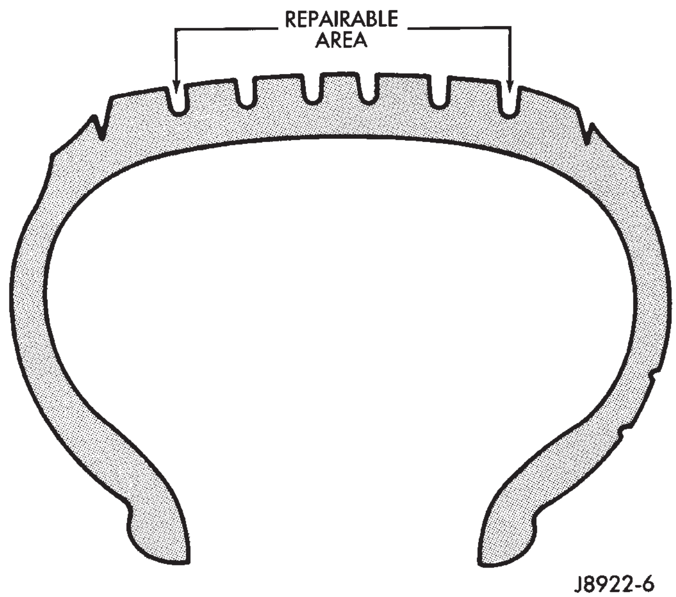


Fig. 7 Tire Repair Area

TIRE AND WHEEL MATCH MOUNTING

Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. This technique is used to reduce run-out in the wheel/tire assembly. 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 or line on the inside of the rim. If the outside label has been removed the tire will have to be removed to locate the dot or line 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) Measure the total indicator runout on the center of the tire tread rib. Record the indicator reading. Mark the tire to indicate the high spot. Place a mark on the tire at the valve stem location (Fig. 8).

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 9).

(3) Measure the total indicator runout again. Mark the tire to indicate the high spot.

SERVICE PROCEDURES (Continued)

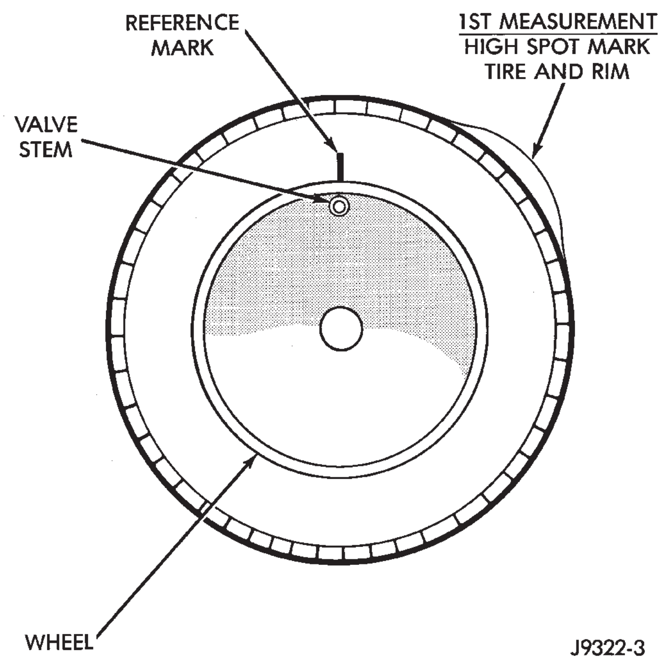


Fig. 8 First Measurement On Tire

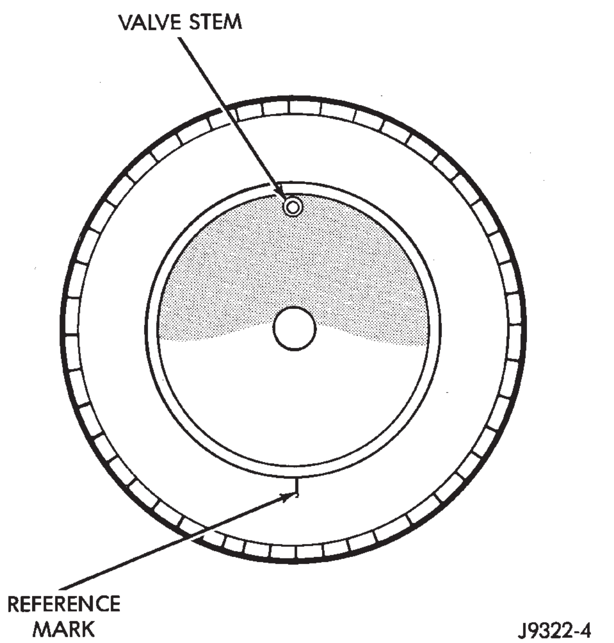


Fig. 9 Remount Tire 180 Degrees

(4) If runout is still excessive, the following procedures must be done.

- If the high spot is within 102 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 102 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 102 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. 10). This procedure will normally reduce the runout to an acceptable amount.

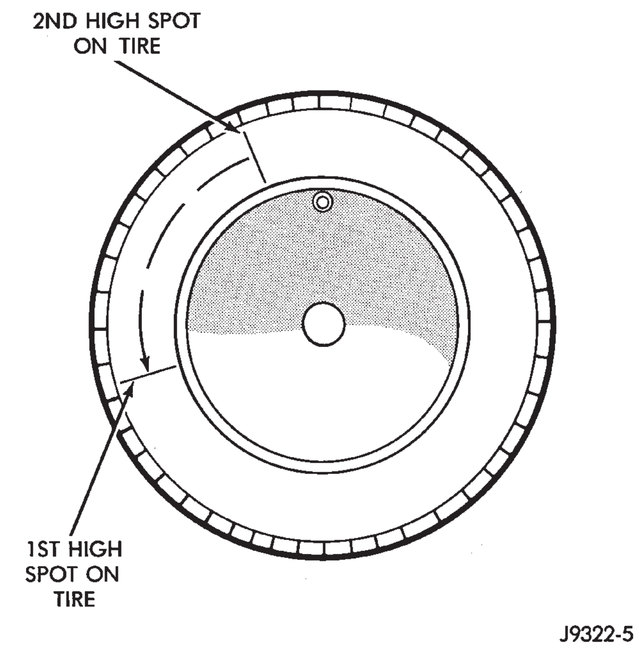


Fig. 10 Remount Tire 90 Degrees In Direction of Arrow

CLEANING AND INSPECTION

CLEANING TIRES

Remove protective coating on tires before delivery of vehicle. This coating may cause deterioration of tires.

To remove the protective coating applying warm water and let it soak for a few minutes. Then 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 wire brush for cleaning.

SPECIFICATIONS

TIRE SPECIFICATIONS

The following guide should help you understand the tire designations:

P	Passenger car tire (or ''T'' for temporary-use tire).
185	Nominal width of tire in millimeters.
70	Tire height-to-width ratio.
R	Radial-ply tire (or ''D'' for bias-ply tire).
14	Nominal rim diameter in inches.

Do not install smaller than minimum size tires shown on the tire inflation placard on the vehicle.

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WHEELS

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DESCRIPTION AND OPERATION

WHEEL INFORMATION

Original equipment wheels are designed for proper operation at all loads up to the specified maximum vehicle capacity.

All models use steel or aluminum drop center wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 1).

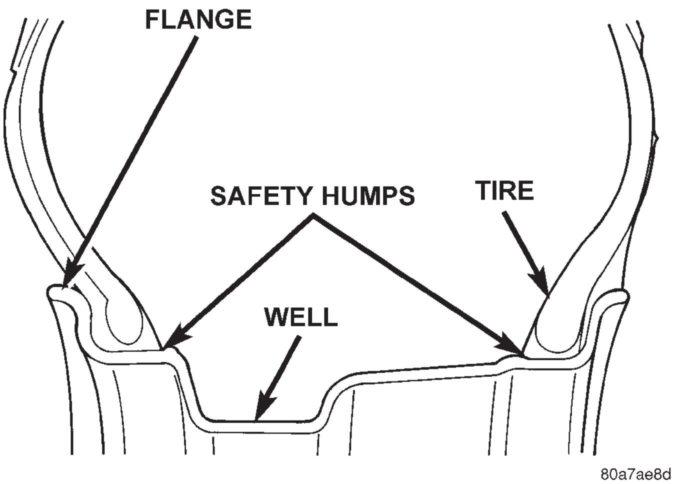

Fig. 1 Safety Rim

Initial inflation of the tires forces the bead over these raised sections. In case of air loss the raised sections hold the tire in position on the wheel until the vehicle can be brought to a safe stop.

Cast aluminum wheels require special balance weights to fit on the thicker flange of the rim and special wheel clamps for the alignment equipment.

The wheel studs and nuts are designed for the specific wheel applications used on a vehicle and must be replaced with equivalent parts.

Do not use replacement parts of lesser quality or of a substitute design from the original equipment part.

All aluminum wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels.

Vehicles that are equipped with bolt-on wheel covers use large nose wheel nuts. The wheel nuts used on a vehicle equipped with bolt-on wheel covers are externally threaded so that the wheel covers can be attached to the wheel nuts.

Before installing a wheel, remove any buildup of corrosion on the wheel mounting surface.

WARNING: INSTALLING WHEELS WITHOUT GOOD METAL-TO-METAL CONTACT COULD CAUSE LOOSENING OF WHEEL LUG NUTS. THIS COULD ADVERSELY AFFECT THE SAFETY AND HANDLING OF YOUR VEHICLE.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

Wheels must be replaced if they:
- Have excessive run out
- Are bent or dented
- Leak air
- Have damaged wheel lug holes

Wheel repairs employing hammering, heating, welding or repairing leaks are not allowed.

Original equipment replacement wheels are available through the dealer. When obtaining replacement wheels from any other source, they must be equivalent in load carrying capacity. The wheel features (diameter, width, offset, brake clearance, and mounting configuration) must match the original equipment wheels.

WARNING: FAILURE TO USE ORIGINAL EQUIPMENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF YOUR VEHICLE.

DIAGNOSIS AND TESTING (Continued)

WARNING: REPLACEMENT WITH USED WHEELS IS NOT RECOMMENDED. THE SERVICE HISTORY OF THE RIM MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

TIRE AND WHEEL RUNOUT

NOTE: Runout should always be measured off the vehicle and on a suitable balance machine.

Radial run out is the difference between the high and low points on the outer edge of the tire or wheel.

Lateral run out is the total side–to–side wobble of the tire or wheel.

Radial run out of more than 0.762 mm (.030 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral run out of more than 0.762 mm (.030 inch) measured at the side of the tire as close to the tread as possible may cause the vehicle to shake.

Sometimes radial run out can be reduced by relocating the wheel and tire on the wheel studs (See Method 1). If this does not reduce run out to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

METHOD 1 (RELOCATE WHEEL ON HUB)

Check accuracy of the wheel mounting surface; adjust wheel bearings.

Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

Verify all wheel nuts are properly torqued (Fig. 2).

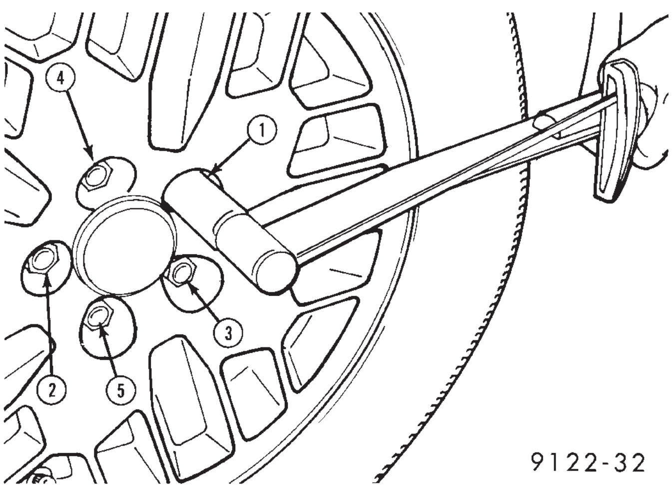

Fig. 2 Tightening Wheel Nuts

Use run out gauge D-128-TR to determine run out (Fig. 3).

Relocate the wheel on the mounting studs, two studs over from the original position.

Retighten wheel nuts until all are properly torqued. This will prevent brake distortion.

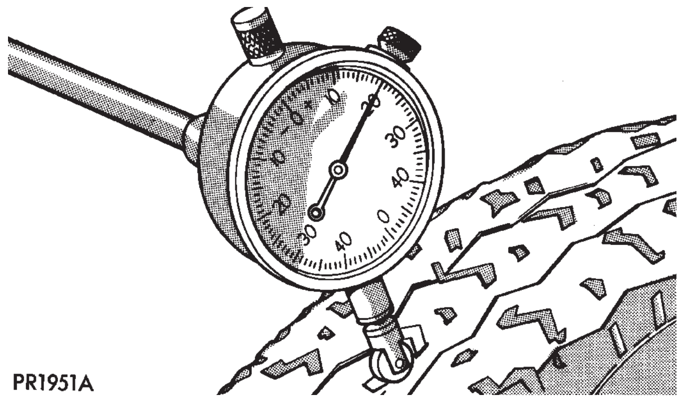

Fig. 3 Run Out Gauge

Check radial run out. If still excessive, mark tire sidewall, wheel, and stud at point of maximum run out (Fig. 4) and proceed to Method 2.

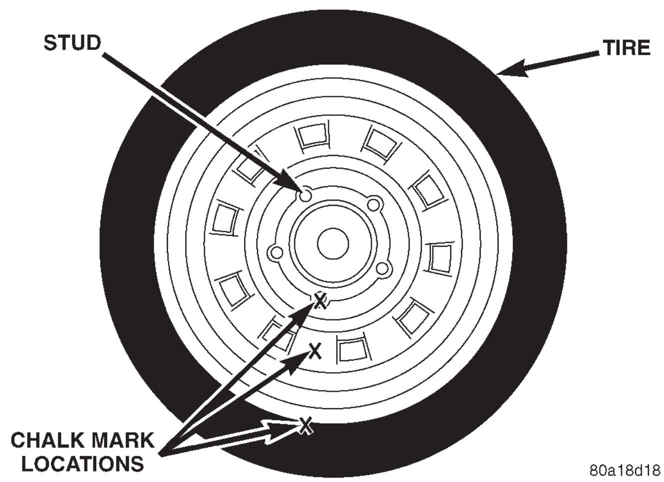

Fig. 4 Chalk Marking On Wheel, Tire And Stud

METHOD 2 (RELOCATE TIRE ON WHEEL)

Rotating tire on wheel is particularly effective when there is run out in both tire and wheel.

Remove tire from wheel and remount wheel on hub in former position.

Check the radial run out of the wheel (Fig. 5). The radial run out should be no more than 0.5 mm (0.020 inch) for steel wheels and 0.38 mm (0.015 inch) for cast aluminum wheels.

Check the lateral run out of the wheel (Fig. 6). The lateral runout should be no more than 0.8 mm (0.032 inch).

If the point of greatest wheel radial run out is near the original chalk mark, remount the tire on the rim 180 degrees from its original position. Recheck the run out. If this does not reduce the run out to an acceptable level, replace the wheel and/or the tire.

DIAGNOSIS AND TESTING (Continued)

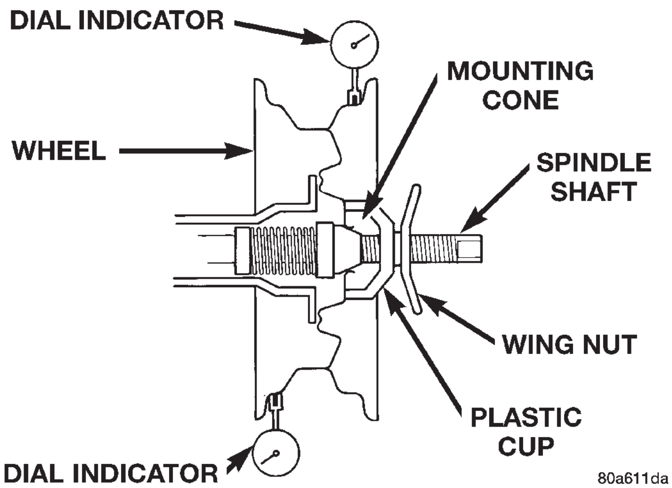

Fig. 5 Checking Wheel Radial Run Out

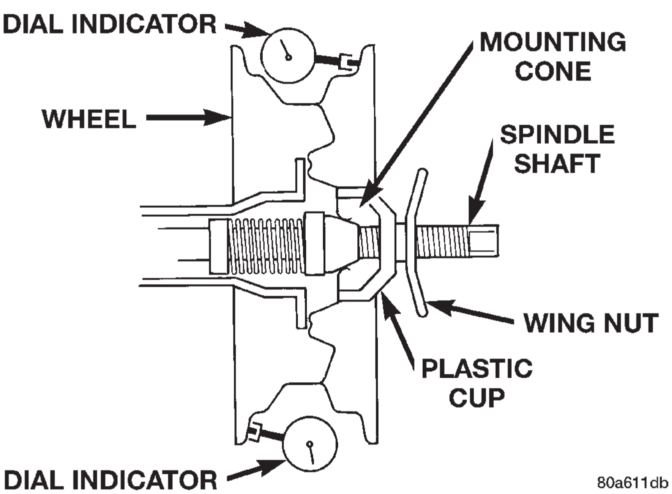

Fig. 6 Checking Wheel Lateral Run Out

SERVICE PROCEDURES

WHEEL INSTALLATION

To install the wheel, first position it properly on the mounting surface of the hub using the hub pilot as a guide. All wheel nuts should be lightly tightened before progressively tightening them in the proper sequence (Fig. 7). Then fully tighten the wheel nuts in the proper sequence (Fig. 7) to a torque of 135 N·m (100 ft. lbs.). Never use oil or grease on studs or nuts.

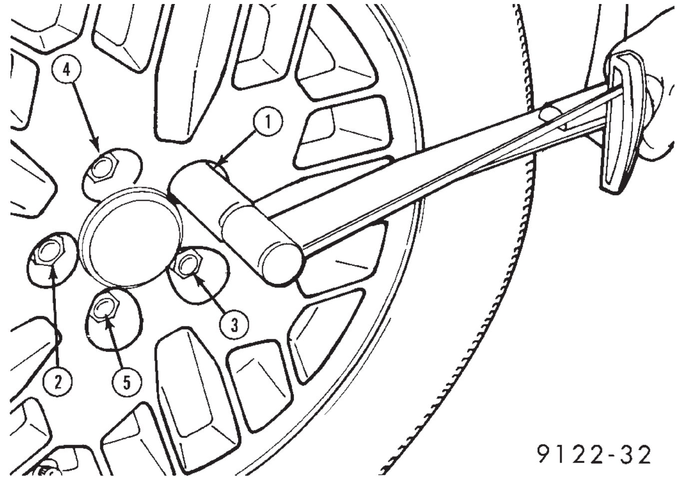

Fig. 7 Tightening Wheel Nuts

TIRE AND WHEEL BALANCE

Balancing need is indicated by vibration of seats, floor pan, or steering wheel. The vibration will be noticed mostly when driving over 90 km/h (55 mph) on a smooth road.

It is recommended that a two plane dynamic balancer be used when a wheel and tire assembly require balancing. Static balancing should be used only when a two plane balancer is not available.

Off-vehicle tire and wheel balancing is recommended to be used on this vehicle.

NOTE: If on vehicle equipment is being used to balance the tire /wheel assemblies, remove the opposite tire/wheel from the vehicle.

For static balancing, find the location of heavy spot on tire/wheel causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counterbalance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 8).

For dynamic balancing, the balancing equipment is designed to indicate the location and amount of weight to be applied to both the inner and outer rim flanges (Fig. 9).

SERVICE PROCEDURES (Continued)

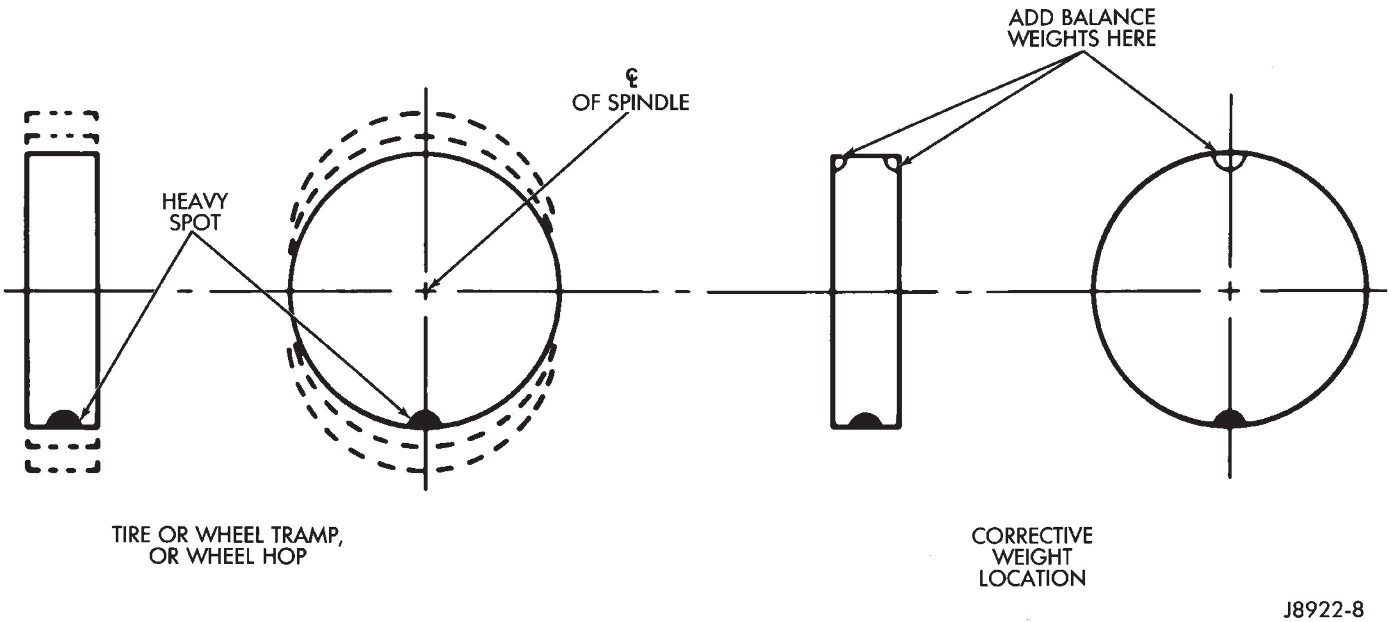

Fig. 8 Static Unbalance & Balance

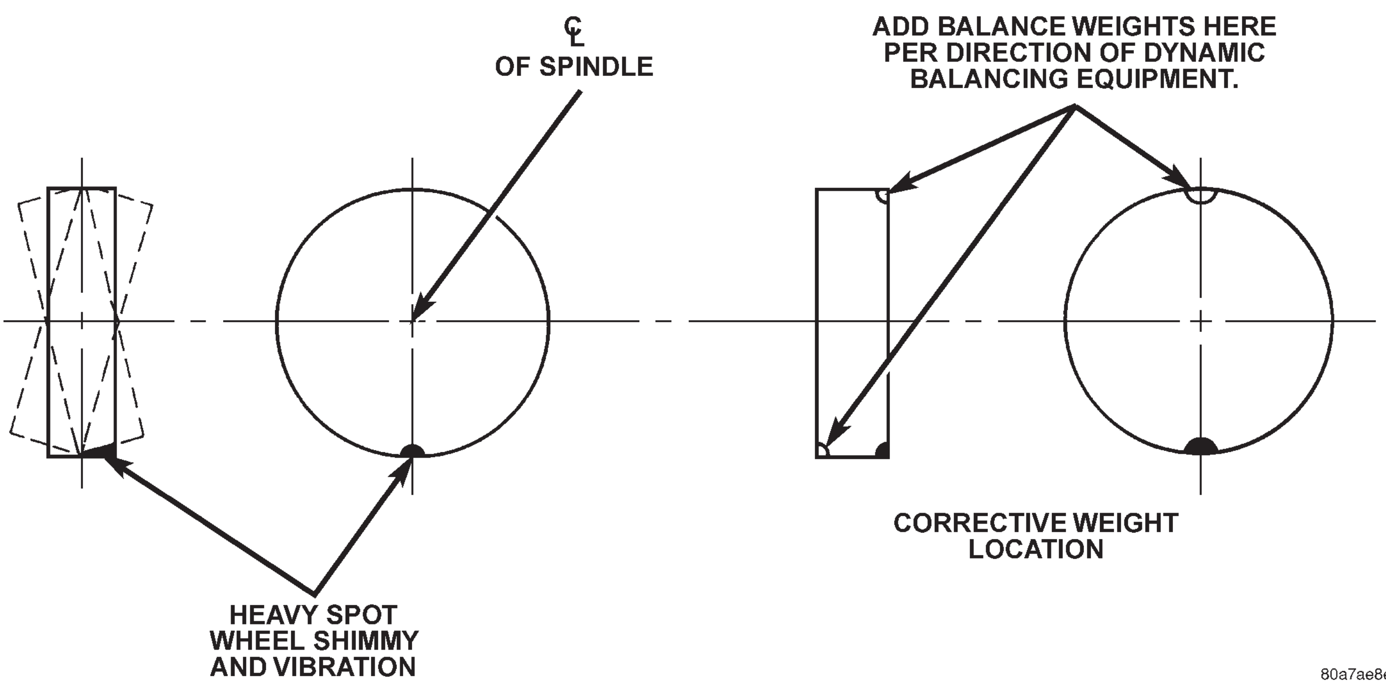

Fig. 9 Dynamic Unbalance & Balance

SPECIFICATIONS

WHEEL SPECIFICATIONS

Wheel:

Mounting Stud Size. . . . . .M12 x 1.5mm
Mounting Stud Lug Nut Hex Size. 19mm
Mounting Lug Nut Tightening
Torque . . . . .135 N·m (100 ft. lbs.)

BODY

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GENERAL SERVICE INFORMATION

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GENERAL INFORMATION
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GENERAL INFORMATION

SAFETY PRECAUTIONS AND WARNINGS

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

USE A 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.

Chrysler Corporation uses many different types of push-in fasteners to secure the interior and exterior trim to the body. Most of these fasteners can be reused to assemble the trim during various repair procedures. At times, a push-in fastener cannot be removed without damaging the fastener or the component it is holding. If it is not possible to remove a fastener without damaging a component or body, cut or break the fastener and use a new one when installing the component. Never pry or pound on a plastic or pressed-board trim component. Using a suitable fork-type prying device, pry the fastener from the retaining hole behind the component being removed. When installing, verify fastener alignment with the retaining hole by hand. Push directly on or over the fastener until it seats. Apply a low-force pull to the panel to verify that it is secure.

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 holding the component in place.

PAINT

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GENERAL INFORMATION

PAINT CODE

A paint code is provided on the body code plate located in the engine compartment. Refer to the Introduction section at the front of this manual for body code plate description. The paint and trim codes are also included on the Vehicle Safety Label located on the driver's door end frame.

BASE COAT/CLEAR COAT FINISH

On most vehicles a two-part paint application (base coat/clear coat) is used. Color paint that is applied to primer is called base coat. The clear coat protects the base coat from ultraviolet light and provides a durable high-gloss finish.

WET SANDING, BUFFING, AND POLISHING

Minor acid etching, orange peel, or smudging in clear coat or single-stage finishes can be reduced with light wet sanding, hand buffing, and polishing. **If the finish has been wet sanded in the past, it cannot be repeated. Wet sanding operation should be performed by a trained automotive paint technician.**

CAUTION: Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat for durability.

PAINTED SURFACE 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 Top Coat. Refer to Introduction group of this manual for Body Code Plate information.

TOUCH-UP PROCEDURE

(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 defect 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 wet sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

GENERAL INFORMATION (Continued)

AFTERMARKET PAINT REPAIR PRODUCTS

EXTERIOR COLORS

EXTERIOR COLOR	CHRY CODE*	PPG	BASF	DuPONT	S-W ACME M-S	AKZO NOBEL SIKKENS
Alpine Green Pearl coat	VGT	5358	28061	B9843	54162	CHA98·VGT
Bright White Clear Coat	GW7	4037	18238	B8833	37298	CHA88·GW7
Candy Apple Red Mt. Tint Clear Coat	RH2	4974 5025	26098	B9616	51063 5106	CHA95·RH2
Deep Amethyst Pearl Coat	TCN	5246	27038	B9736	52566	CHA97·TCN
Deep CranberryPearl Coat	VMT	5359	28071	B9842	54119	CHA98·VMT
Deep Hunter Green Pearl Coat	SG8	47439	26078	B9609	5106	CHA95·SG8
Deep Slate Pearl Coat	VAW	5292	27166	B9774	54118	CHA97·VAW
Flame Red Clear Coat	PR4	4679	21836	B9326	46916	CHA93·PR4
Golden White Pearl Tri-Coat	GW7	83554 83642	26095	B9623 B9624	51074 51075	CHA96·SWP
Island Teal Satin Glow	SPJ	47425	26085	B9610	51065	CHA95·SPJ
Light Iris Pearl Coat	PC5	4788	24078	B9455	48782	CHA94·PC5
Light Silverfern Pearl Coat	RJM	47383	25043	B9525	50269	CHA95·RJM
Taupe Frost Pearl Coat	TTK	5244	27040	B9750	52567	CHA97·TTK

*Herberts Standox and Spies Hecker use the Chrysler paint code as listed on the Body Code Plate.

INTERIOR COLORS

INTERIOR COLOR	CHRY CODE	PPG	BASF	DuPONT	S-W ACME M-S	AKZO NOBEL SIKKENS
Camel	K5	27731/2-1584	26120	C9603	51541	CHA·RJ5I
Mist Gray	C3	35799/2-1576	25065	C9507	50508	CHA·RC3I
Silver Fern	JK	35798/2-1577	25066	C9509	50510	CHA·RJKI

STATIONARY GLASS

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DESCRIPTION AND OPERATION

SAFETY PRECAUTIONS

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 PINCHWELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.

CHRYSLER 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.

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.

REMOVAL AND INSTALLATION

WINDSHIELD

The urethane adhesive holding the windshield to the opening pinch weld (fence) can be cut using a sharp cold knife from the exterior of the vehicle. Using the cold knife method is effective if the windshield is already broken. If the glass must be salvaged, cutting the urethane adhesive from the interior of the vehicle using a reciprocating or oscillating power knife is recommended.

WINDSHIELD REMOVAL – EXTERIOR METHOD

(1) Remove inside rear view mirror.
(2) Remove windshield wiper arms.
(3) Remove cowl cover.
(4) Remove A-pillar trim panels.
(5) Disconnect wire connectors to windshield defroster grid.
(6) Place protective covers over instrument panel and hood.
(7) Remove windshield molding (Fig. 1). Using pliers, pull outward on molding at the bottom of A-pillars.
(8) Using a sharp cold knife, cut urethane adhesive holding the windshield to the A-pillars, roof header and cowl pinch weld fences (Fig. 2). A power cutting device can be used if available.
(9) Remove windshield from vehicle.

REMOVAL AND INSTALLATION (Continued)

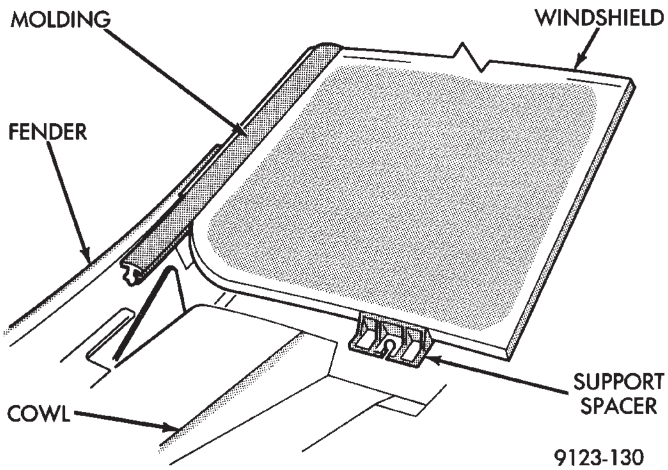

Fig. 1 Windshield Molding

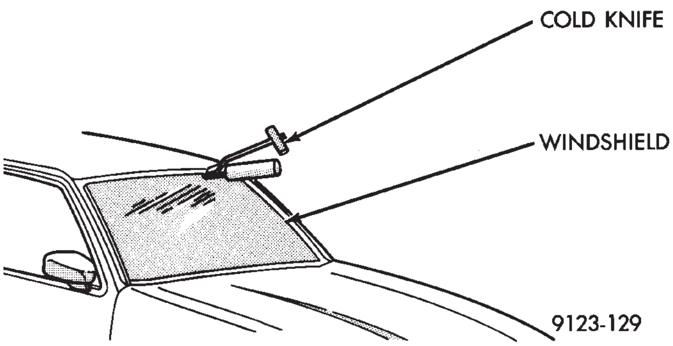

Fig. 2 Cut Urethane Around Windshield

WINDSHIELD REMOVAL – INTERIOR METHOD

(1) Remove inside rear view mirror.

(2) Remove instrument panel top cover. Refer to Group 8E, Instrument Panel and Systems.

(3) Remove A-pillar trim covers.

(4) Disconnect wire connectors to windshield defroster grid.

(5) Place protective covers over instrument panel and hood.

(6) Using a reciprocating or oscillating power knife, cut urethane adhesive holding the windshield to the A-pillars, roof header and cowl pinch weld fences. Refer to instructions provided with the equipment being used.

(7) Remove windshield from vehicle.

WINDSHIELD INSTALLATION

CAUTION: Open the left front door glass before installing windshield to avoid pressurizing the passenger compartment. If a door is slammed before urethane bonding is cured, water leaks can result.

Allow the urethane at least 24 hours to cure before returning the vehicle to use.

To avoid stressing the replacement windshield, the urethane bonding material on the windshield fence should be smooth and consistent to the shape of the replacement windshield. The support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

(1) Place replacement windshield into windshield opening and position glass in the center of the opening against the support spacers.

(2) Verify the glass lays evenly against the pinch weld fence at the sides, top and bottom of the replacement windshield. If not, the pinch weld fence must be formed to the shape of the new glass.

(3) Mark the glass at the support spacers with a grease pencil or pieces of masking tape and ink pen to use as a reference for installation (Fig. 3).

(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. 4).

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) Install molding to perimeter of 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) Using a razor knife, remove as much original urethane as possible. Do not damage paint on windshield fence.

(11) Apply pinch weld primer 15 mm (.75 in.) wide around the windshield fence. Allow at least three minutes drying time.

(12) If a low viscosity urethane adhesive is used, install compression spacers on the fence around the windshield opening (Fig. 5).

(13) Apply a 10 mm (0.4 in.) bead of urethane on center line of windshield fence.

(14) With the aid of a helper, position the windshield over the windshield opening. Align the reference marks at the bottom of the windshield to the support spacers.

(15) Slowly lower windshield glass to windshield opening fence. Guide the molding into proper position as necessary. Push windshield inward until molding is flush to roof line and A-pillars (Fig. 5).

REMOVAL AND INSTALLATION (Continued)

(16) Clean access urethane from exterior with Mopar® Super Kleen or equivalent.

(17) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold molding in place until urethane cures.

(18) Engage wire connectors to windshield defroster grid.

(19) Install A-pillar trim panels.

(20) Install cowl cover and wipers.

(21) Install inside rear view mirror.

(22) After urethane has cured, remove tape strips and water test windshield to verify repair.

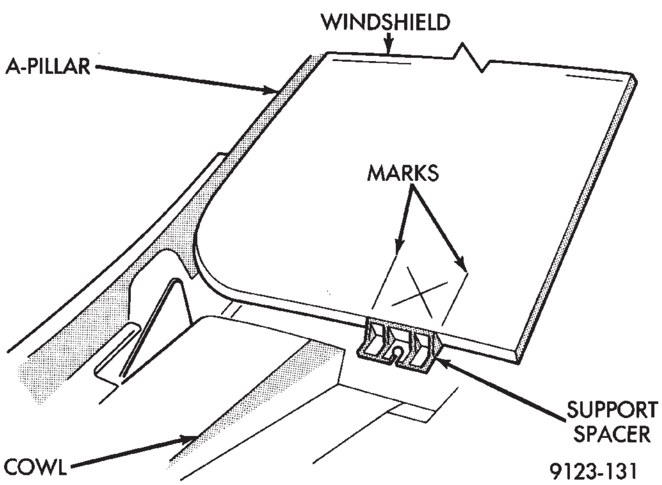

Fig. 3 Center Windshield and Mark at Support Spacers

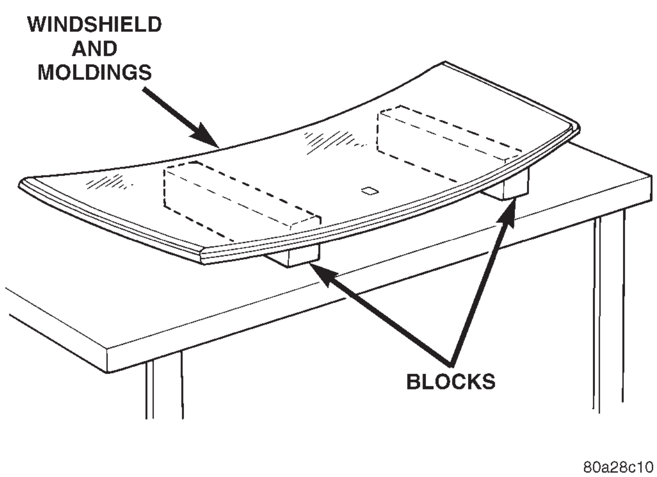

Fig. 4 Work Surface Set up and Molding Installation

BODY SIDE/SLIDING DOOR STATIONARY GLASS

The temperature of the vehicle should be at least 21° C (70° F) before removing the stationary quarter/ sliding door glass. Butyl sealer becomes more pliable at high temperatures.

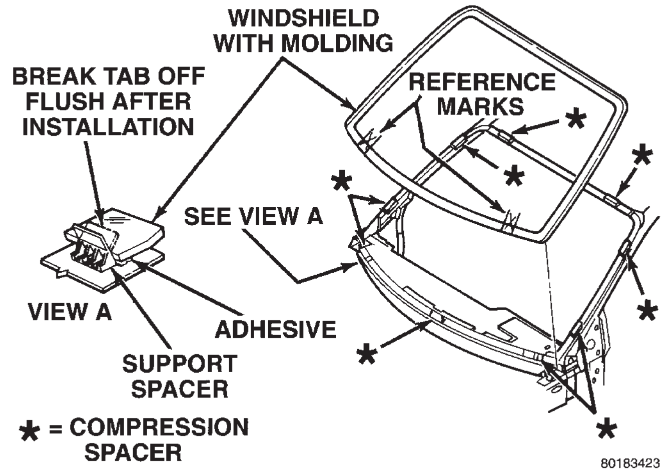

Fig. 5 Lower Windshield Into Position

REMOVAL

(1) Remove interior trim as necessary to gain access attaching locations on back of glass.

(2) Remove nuts holding stationary glass to fence.

(3) Using razor knife, cut butyl sealer holding glass to fence from between the mounting studs (Fig. 6).

(4) Push glass from opening.

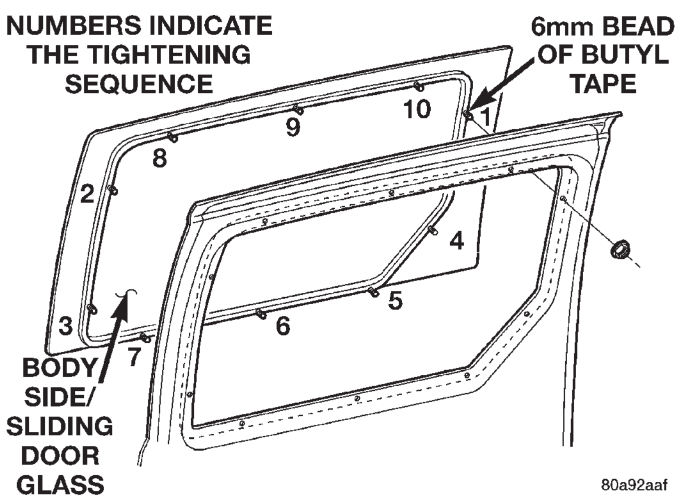

Fig. 6 Sliding Door Stationary Glass

INSTALLATION

The stationary glass fence should be cleaned of all old butyl sealer.

(1) Apply a 6 mm (0.25 in.) butyl tape around perimeter of glass assembly encapsulation track. Ensure that the butyl tape is wrapped around the mounting studs.

(2) Place the glass into the opening and insert mounting studs through holes in fence.

(3) Install nuts to hold stationary glass to fence.

REMOVAL AND INSTALLATION (Continued)

NOTE: Tighten nuts to 3.4 N·m (30 in. lbs.) torque in the sequence indicated. Do not over torque, or glass breakage may result (Fig. 6).

(4) Install interior trim.

REAR WINDOW

Refer to the Safety Precautions in this section for description of tools and adhesive systems that are recommended for use in this procedure.

REAR WINDOW REMOVAL – EXTERIOR METHOD

(1) Remove rear window wiper arm, if equipped.

(2) Remove screws holding moldings to liftgate at the sides of the rear window (Fig. 7).

(3) Using pliers, pull outward on molding at the top and bottom of liftgate.

(4) Using a sharp cold knife, cut urethane adhesive holding the rear window to the liftgate. A power cutting device can be used if available (Fig. 2).

(5) Remove rear window from vehicle.

REAR WINDOW REMOVAL – INTERIOR METHOD

(1) Remove rear window wiper arm, if equipped.

(2) Remove screws holding moldings to liftgate at the sides of the rear window (Fig. 7).

(3) Remove liftgate inside lamps and trim covers.

(4) Remove center high mounted stop lamp.

(5) Using a reciprocating or oscillating power knife, cut urethane adhesive holding the rear window to the liftgate. Refer to instructions provided with the equipment being used.

(6) Remove rear window from vehicle.

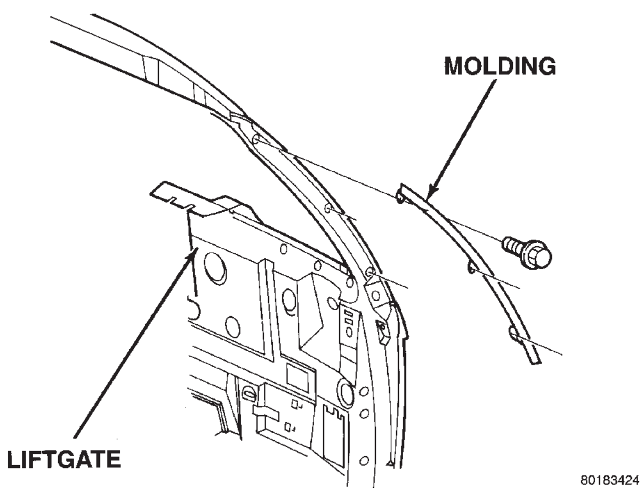

Fig. 7 Rear Window Side Moldings

REAR WINDOW INSTALLATION

CAUTION: Open the left front door glass before installing rear window to avoid pressurizing the passenger compartment. If a door is slammed before urethane bonding is cured, water leaks can result.

Allow the urethane at least 24 hours to cure before returning the vehicle to use.

To avoid stressing the replacement rear window, the urethane bonding material on the rear window fence should be smooth and consistent to the shape of the replacement glass.

(1) Place replacement glass into rear window opening.

(2) Verify the glass lays evenly against the pinch weld fence at the sides, top and bottom of the replacement rear window. If not, the fence must be formed to the shape of the new glass.

(3) Using a grease pencil, mark the glass and liftgate in several locations to aid installation.

(4) Remove replacement glass from liftgate opening.

(5) Position the rear window 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. 4).

WARNING: DO NOT USE SOLVENT BASED GLASS CLEANER TO CLEAN REAR WINDOW BEFORE APPLYING GLASS PREP AND PRIMER. POOR ADHESION CAN RESULT.

(6) Clean inside of rear window with ammonia based glass cleaner and lint-free cloth.

(7) Apply molding to top and bottom of rear window.

(8) Apply Glass Prep adhesion promoter 25 mm (1 in.) wide around perimeter of rear window 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 rear window. Allow at least three minutes drying time.

(10) Apply Pinchweld Primer 15 mm (.75 in.) wide around the rear window fence. Allow at least three minutes drying time.

(11) If a low viscosity urethane adhesive is used, install compression spacers on the fence around the rear window opening (Fig. 8).

(12) Apply a 10 mm (0.4 in.) bead of urethane along center line of rear window fence.

REMOVAL AND INSTALLATION (Continued)

(13) With the aid of a helper, position the rear window over the rear window opening and align the reference marks.

(14) Slowly lower the glass to rear window opening fence. Guide the molding into proper position as necessary. Push glass inward until molding is flush to liftgate surface (Fig. 8).

(15) Clean excess urethane from exterior with Mopar® Super Kleen, or equivalent.

(16) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold molding in place until urethane cures.

(17) Install rear window side moldings and wiper arm (Fig. 7).

(18) Install interior trim.

(19) After urethane has cured, remove tape strips and water test rear window to verify repair.

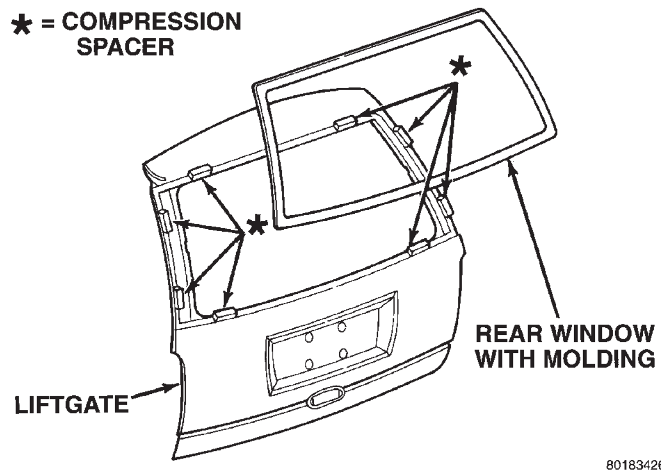

Fig. 8 Lower Rear Window Into Position

SEATS

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REMOVAL AND INSTALLATION

ARM REST

REMOVAL

(1) Using a screw driver, pry cap from side of arm rest (Fig. 1).

(2) Remove bolt holding arm rest to seat back.

(3) Remove arm rest from seat.

INSTALLATION

(1) Place arm rest in position on seat.

(2) Install bolt to hold arm rest to seat back.

(3) Install cap into side of arm rest (Fig. 1).

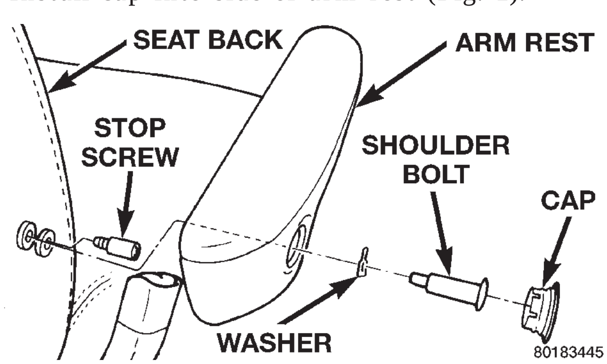

Fig. 1 Arm Rest

BENCH SEAT BACK COVER

REMOVAL

(1) Remove plastic grocery bag retainer attaching screws and remove retainer.

(2) Using a fork type prying tool (C4829), disengage push-in fasteners holding bottom of seat back cover to seat back frame (Fig. 2).

(3) Disengage hooks holding top of seat back cover to seat back frame.

(4) Remove seat back cover from seat.

INSTALLATION

(1) Place seat back cover in position on seat.

(2) Engage hooks to hold top of seat back cover to seat back frame.

(3) Install push-in fasteners to hold bottom of seat back cover to seat back frame (Fig. 2).

BENCH SEAT BACK HINGE

Bench seats equipped with child restraint seats have an interlock feature that will not allow the seat back to fold forward with the child seat open.

REMOVAL

(1) Remove bench seat back hinge covers.

(2) Remove shoulder bolts holding seat back hinge to seat back frame (Fig. 3).

(3) Remove bolts holding seat back hinge to seat cushion frame.

REMOVAL AND INSTALLATION (Continued)

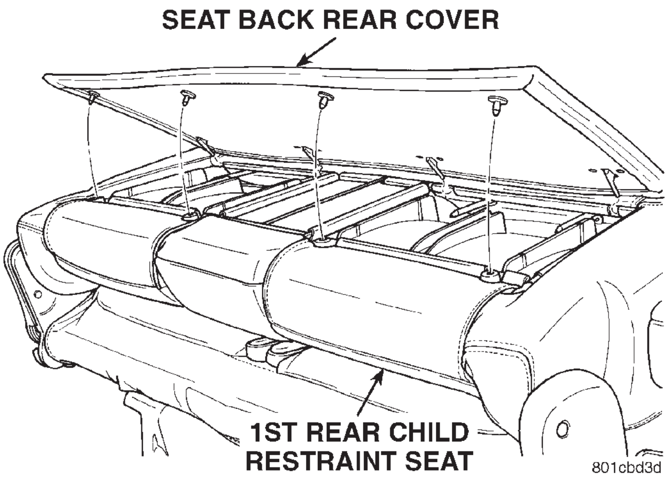

Fig. 2 Bench Seat Back Cover

(4) Remove seat back hinge from seat.
(5) Disengage synchronizing cable housing from seat back hinge.
(6) Disengage synchronizing cable end from (clip on left side) hinge latch release arm.
(7) Remove hinge from seat.

INSTALLATION

(1) Place hinge in position on seat.
(2) Engage synchronizing cable end into (clip on left side) hinge latch release arm.
(3) Engage synchronizing cable housing into seat back hinge.
(4) Place seat back hinge in position on seat.
(5) Install bolts to hold seat back hinge to seat cushion frame.
(6) Install shoulder bolts to hold seat back hinge to seat back frame (Fig. 3).
(7) Install bench seat back hinge covers.
(8) Verify seat back hinge operation.

SYNCHRONIZING CABLE ADJUSTMENT

If the seat back hinges do not release at the same time the synchronizing cable must be adjusted.
(1) Remove seat from vehicle. Refer to Owner's Manual for proper procedures (Fig. 4).
(2) Using a awl, pry synchronizing cable end from clip on left seat back hinge.
(3) Pull cable out of housing until cable is tight.
(4) Push retaining clip on hinge latch release arm rearward to take up play in hinge mechanism.
(5) Engage cable end into retaining clip on hinge.

BENCH SEAT BACK HINGE COVERS

REMOVAL

(1) If necessary, remove seat from vehicle. Refer to Owner's Manual for proper procedures.

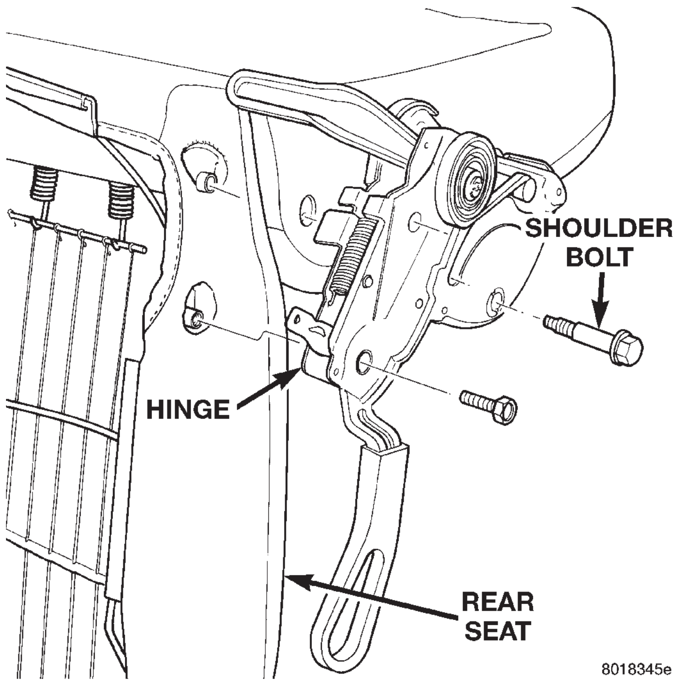

Fig. 3 Bench Seat Back Hinge

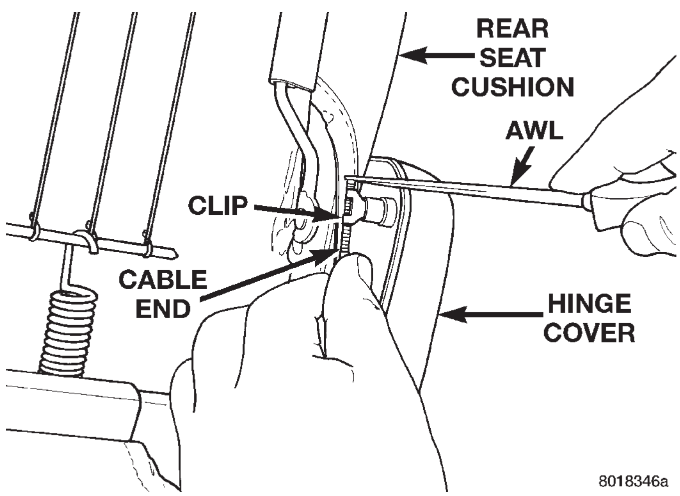

Fig. 4 SYNCHRONIZING CABLE ADJUSTMENT

(2) Remove screws holding lower cover to seat back hinge (Fig. 5).
(3) Remove lower cover from hinge.
(4) Remove screws holding upper hinge cover to seat back hinge.
(5) Remove upper cover from seat back hinge.

INSTALLATION

(1) Place upper cover in position on seat back hinge.
(2) Install screws to hold upper hinge cover to seat back hinge.
(3) Place lower cover in position on hinge.
(4) Install screws to hold lower cover to seat back hinge (Fig. 5).
(5) If necessary, install seat in vehicle.

REMOVAL AND INSTALLATION (Continued)

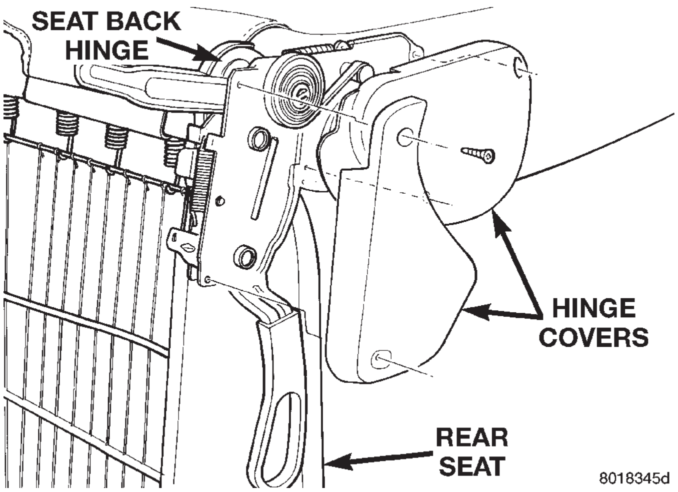

Fig. 5 Bench Seat Back Hinge Covers

BENCH SEAT RISER – FIRST REAR

REMOVAL

(1) Remove first rear seat from vehicle. Refer to Owner's Manual for proper procedures.

(2) Place seat bottom side up on a clean covered work surface.

(3) Remove bolts holding seat riser to seat cushion frame (Fig. 6).

(4) Remove riser from seat.

INSTALLATION

(1) Place riser in position on seat.

(2) Install bolts to hold seat riser to seat cushion frame (Fig. 6).

(3) Install first rear seat into vehicle.

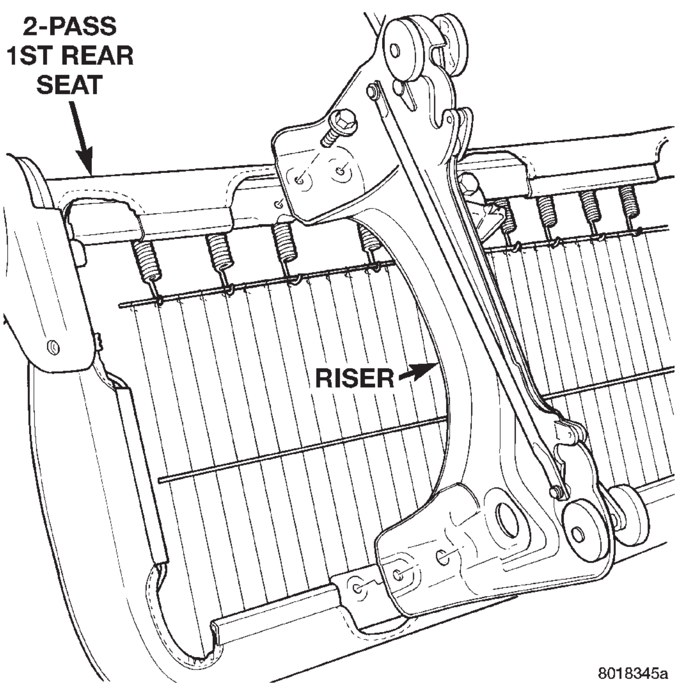

Fig. 6 Bench Seat Riser – First Rear

BENCH SEAT RISER – SECOND REAR

REMOVAL

(1) Remove seat track.

(2) Remove bolts holding riser to seat cushion frame (Fig. 7).

(3) Remove riser from seat.

INSTALLATION

(1) Place riser in position on seat.

(2) Install bolts to hold riser to seat cushion frame (Fig. 7).

(3) Install seat track.

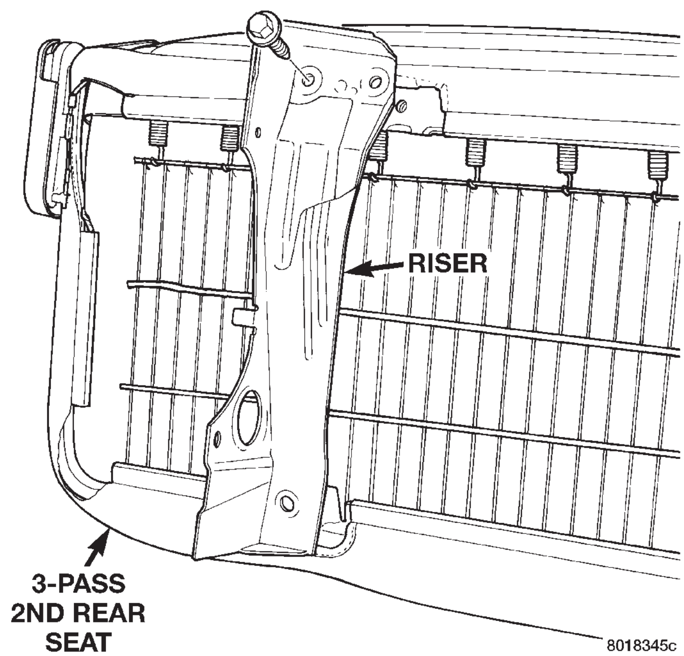

Fig. 7 Bench Seat Riser – Second Rear

BENCH SEAT TRACK – SECOND REAR

REMOVAL

(1) Remove second rear seat from vehicle. Refer to Owner's Manual for proper procedure.

(2) Place seat on clean covered work surface bottom side up.

(3) Disengage seat track adjuster link wire from track being removed.

(4) Remove nuts holding track to seat riser (Fig. 8).

(5) Remove track from seat riser.

INSTALLATION

(1) Place track in position on seat riser.

(2) Install nuts to hold track to seat riser. (Fig. 8).

(3) Engage seat track adjuster link wire onto track being installed.

(4) Install second rear seat from vehicle.

REMOVAL AND INSTALLATION (Continued)

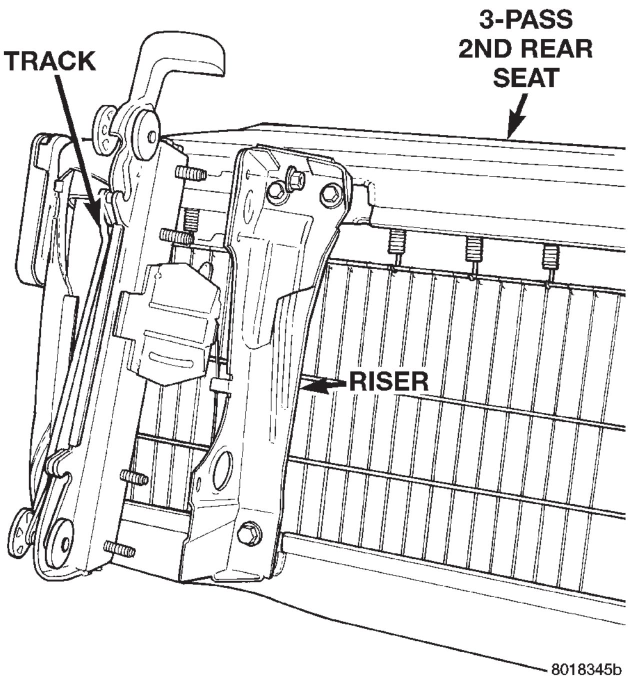

Fig. 8 Bench Seat Track – Second Rear

BUCKET SEAT BACK

REMOVAL

(1) Remove seat cushion pan.
(2) Remove nut holding recliner to seat back frame (Fig. 9).
(3) Remove pivot bolts holding seat back frame to seat track.
(4) Remove seat back from recliner.

INSTALLATION

(1) Place seat back mounting stud into recliner.
(2) Install pivot bolts to hold seat back frame to seat track.
(3) Install nut to hold recliner to seat back frame (Fig. 9).
(4) Install seat cushion pan.

BUCKET SEAT BACK ASSIST STRAP

REMOVAL

(1) Using a small screw driver, pry screw plugs from ends of assist strap (Fig. 10).
(2) Remove screws holding assist strap to seat back.
(3) Remove assist strap from vehicle.

INSTALLATION

(1) Place assist strap in position on vehicle.
(2) Install screws to hold assist strap to seat back.
(3) Insert screw plugs into ends of assist strap (Fig. 10).

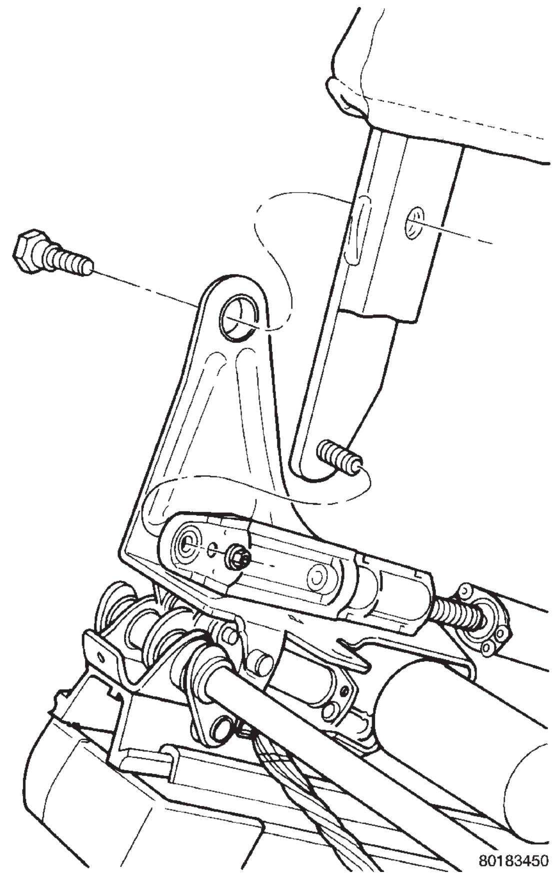

Fig. 9 Bucket Seat Back

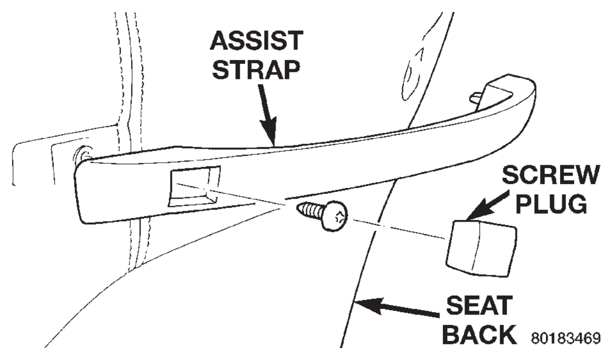

Fig. 10 Bucket Seat Back Assist Strap

BUCKET SEAT CUSHION PAN

REMOVAL

(1) Remove bucket seat from vehicle.
(2) Remove seat cushion side covers.
(3) If equipped, remove power seat track front and rear cover.
(4) If equipped, remove stowage bin.
(5) Remove bolts holding seat cushion pan to seat track.
(6) Remove seat cushion pan from seat.
(7) Disengage J-strip retainers holding seat cover to cushion pan.
(8) Separate seat cushion pan from cover and pad.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place seat cushion pan in position in seat cover and pad.

(2) Engage J-strip retainers to hold seat cover to cushion pan.

(3) Place seat cushion pan in position on seat.

(4) Install bolts to hold seat cushion pan to seat track.

(5) If equipped, install stowage bin.

(6) If equipped, install power seat track front and rear cover.

(7) Install seat cushion side covers.

(8) Install bucket seat in vehicle.

BUCKET SEAT CUSHION SIDE COVER

REMOVAL

(1) Remove screws holding seat cushion side cover to bucket seat (Fig. 11).

(2) Slide seat cushion rear listing toward the center of the seat to gain access to rear screw.

(3) Remove screw holding rear of side cover to seat cushion frame.

(4) Remove side cover from seat cushion.

(5) If equipped, disconnect wire connector from power seat switch (Fig. 12).

INSTALLATION

(1) Place side cover in position on seat cushion.

(2) If equipped, connect wire connector into power seat switch.

(3) Install screw to hold rear of side cover to seat cushion frame.

(4) Install screws to hold seat cushion side cover to bucket seat (Fig. 11).

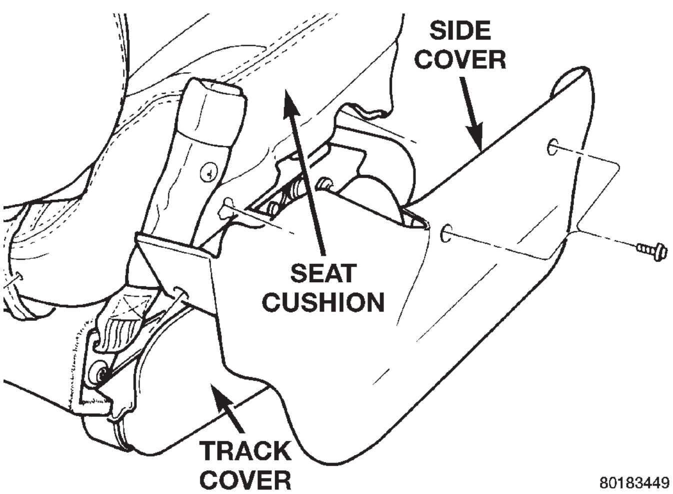

Fig. 11 Bucket Seat Cushion Side Cover

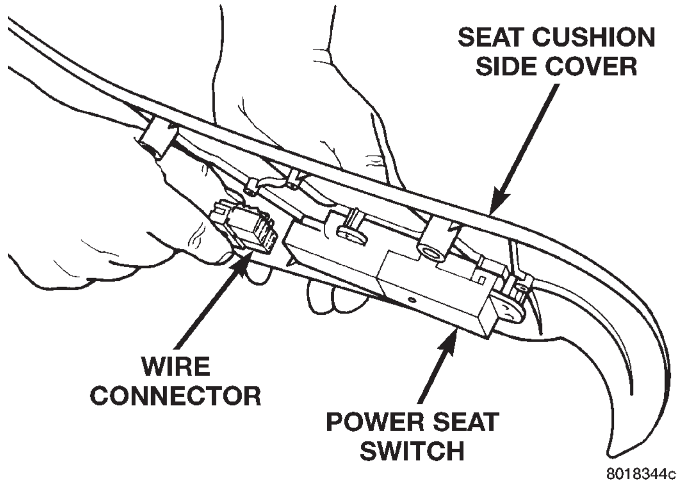

Fig. 12 Power Seat Switch Wire Connector

BUCKET SEAT RECLINER – MANUAL

REMOVAL

(1) Remove bucket seat cushion pan.

(2) Remove E-clip holding pin in seat track.

(3) Remove pin holding manual recliner to seat track (Fig. 13).

(4) Remove nut holding recliner to seat back frame.

(5) Remove recliner from seat.

INSTALLATION

(1) Place recliner in position on seat.

(2) Insert stud on seat back through hole in recliner.

(3) Install nut to hold recliner to seat back frame.

(4) Install roll pin to hold manual recliner to seat track (Fig. 13).

(5) Install E-clip to hold pin in seat track.

(6) Install bucket seat cushion pan.

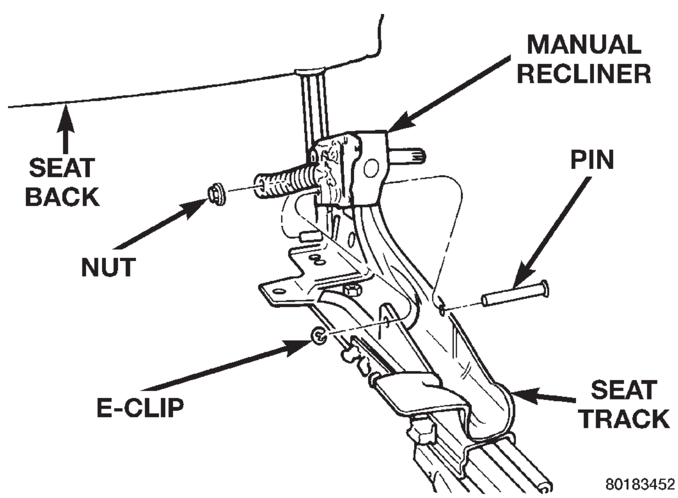

Fig. 13 Bucket Seat Recliner – Manual

REMOVAL AND INSTALLATION (Continued)

BUCKET SEAT RECLINER – POWER

REMOVAL

(1) Remove seat cushion pan.
(2) Remove nut holding seat back frame to recliner.
(3) Using a suitable punch, remove roll pin holding recliner to seat track (Fig. 14).
(4) Remove recliner from seat track.
(5) Remove recliner from stud on seat back frame.
(6) Disconnect wire connector from power recliner.
(7) Remove power recliner from seat.

INSTALLATION

(1) Place power recliner in position on seat.
(2) Connect wire connector into power recliner.
(3) Insert stud on seat back through hole in recliner.
(4) Place recliner in position on seat track.
(5) Install roll pin to attach recliner to seat track (Fig. 14).
(6) Install nut to hold seat back frame to recliner.
(7) Install seat cushion pan.

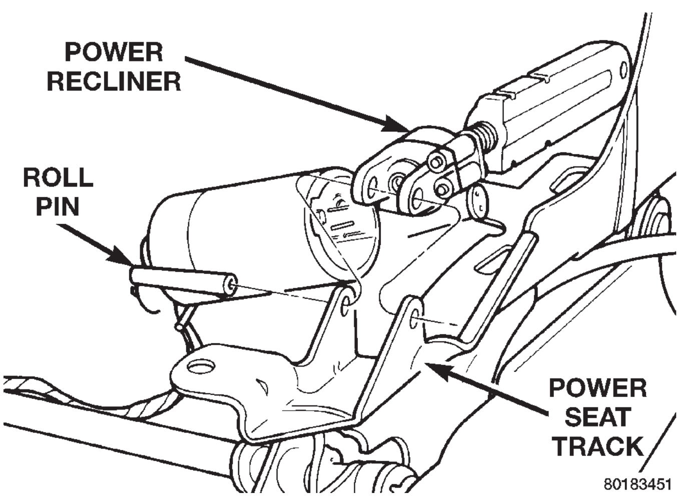

Fig. 14 Bucket Seat Recliner – Power

BUCKET SEAT RISER – MANUAL TRACK

REMOVAL

(1) Remove seat from vehicle.
(2) If equipped, remove storage bin from riser.
(3) Remove nuts holding riser to manual seat track (Fig. 15).
(4) Remove riser from seat.

INSTALLATION

(1) Place riser in position on seat.
(2) Install nuts to hold riser to manual seat track (Fig. 15).
(3) If equipped, install storage bin into riser.
(4) Install seat into vehicle.

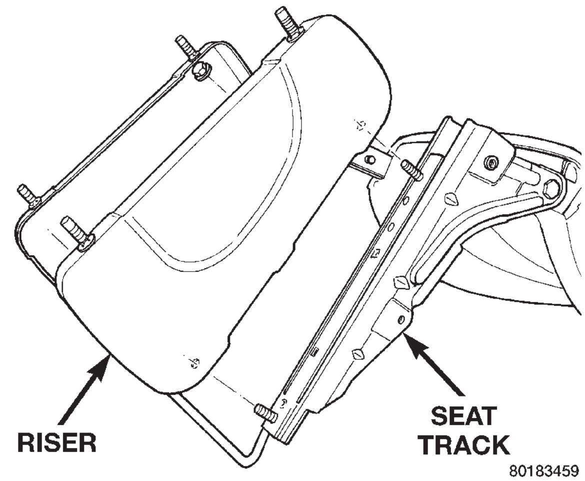

Fig. 15 Bucket Seat Riser – Manual Track

BUCKET SEAT TRACK – MANUAL

REMOVAL

(1) Remove seat from vehicle.
(2) Remove seat cushion pan.
(3) Remove riser.
(4) On inboard track, remove nut holding recliner to seat back frame.
(5) Remove bolt holding seat back frame to seat track (Fig. 16).
(6) Remove seat track from seat adjuster handle (Fig. 17).
(7) Remove seat track from seat.

INSTALLATION

(1) Place seat track in position on seat.
(2) Place adjuster handle in position on seat track (Fig. 17).
(3) Insert stud on seat back frame into recliner.
(4) Install bolt to hold seat back frame to seat track (Fig. 16).
(5) On inboard track, install nut to hold recliner to seat back frame.
(6) Install riser.
(7) Install seat cushion pan.
(8) Install seat in vehicle.

BUCKET SEAT TRACK – POWER

The power seat track and motors are serviced as an assembly.

REMOVAL

(1) Remove seat from vehicle.
(2) Remove seat cushion pan.
(3) Remove nut holding recliner to seat back frame.
(4) Remove bolts holding seat back frame to seat track.
(5) Remove stud on seat back frame from recliner.

REMOVAL AND INSTALLATION (Continued)

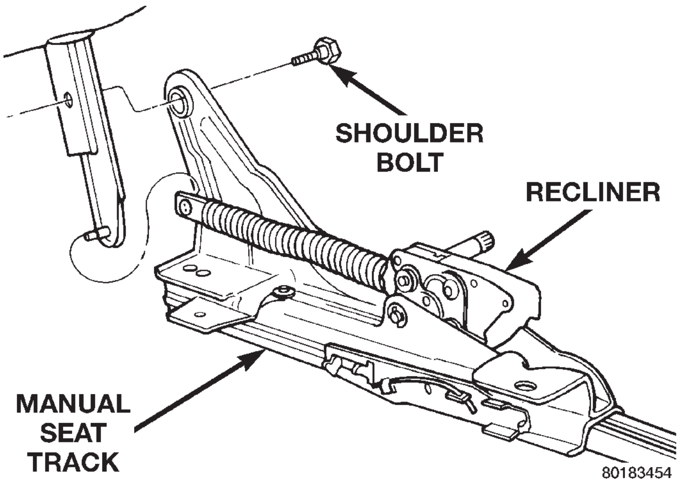

Fig. 16 Bucket Seat Track – Manual

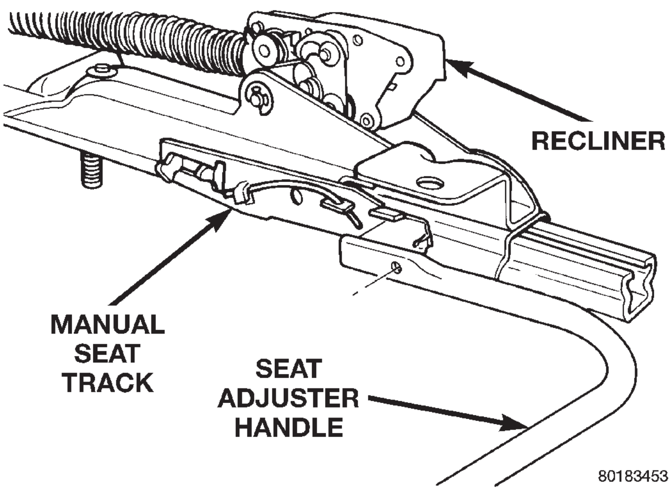

Fig. 17 Seat Track Adjuster Handle

(6) Remove seat back from recliner.

INSTALLATION

If power seat track is being replaced, transfer power recliner, wire harness and trim covers to replacement seat track.

(1) Insert stud on seat back frame into recliner.

(2) Install bolts to hold seat back frame to seat track.

(3) Install nut to hold recliner to seat back frame.

(4) Install seat cushion pan.

(5) Install seat in vehicle.

BUCKET SEAT TRACK FRONT COVER – POWER

REMOVAL

(1) Remove screws holding front cover to seat track (Fig. 18).

(2) Remove front cover from vehicle.

INSTALLATION

(1) Place front cover in position on seat.

(2) Install screws to hold front cover to seat track (Fig. 18).

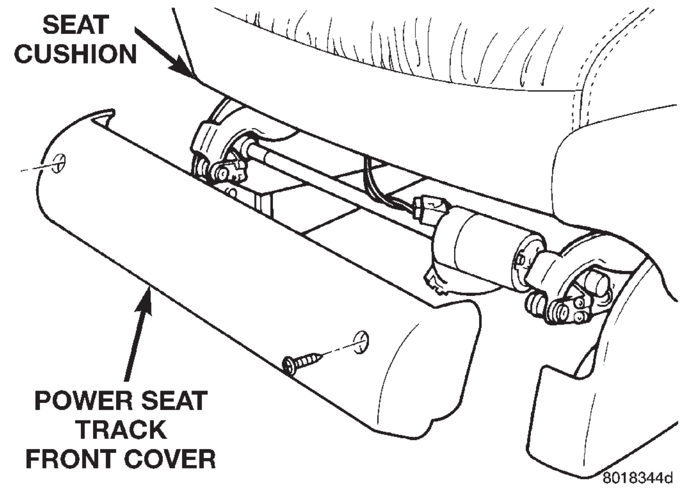

Fig. 18 Bucket Seat Track Front Cover – Power

BUCKET SEAT TRACK REAR COVER – POWER

REMOVAL

(1) Disengage arrowhead retainer from loop strip holding rear cover to power seat track crossbar (Fig. 19).

(2) Disengage fasteners holding rear cover to slots on power seat track.

(3) Remove rear cover from seat.

INSTALLATION

(1) Place rear cover in position on seat.

(2) Engage fasteners to hold rear cover to slots on power seat track.

(3) Engage arrowhead retainer into loop strip to hold rear cover to power seat track crossbar (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

CHILD RESTRAINT SEAT MODULE

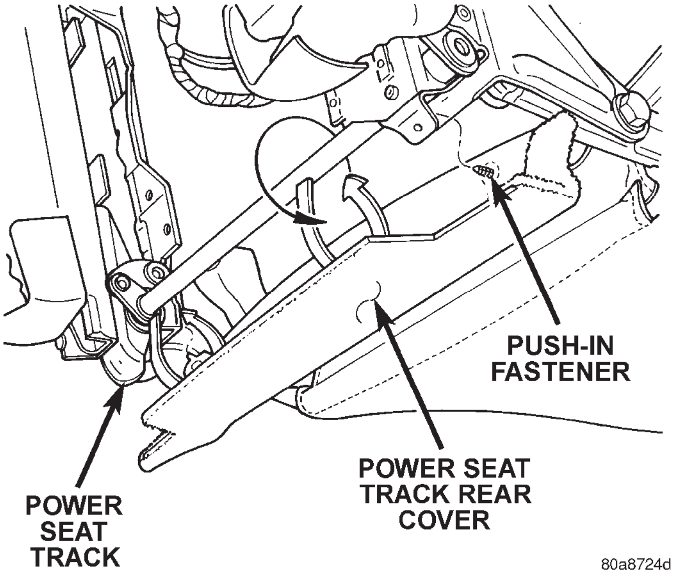

Fig. 19 Bucket Seat Track Rear Cover – Power

REMOVAL

(1) Close child restraint seat.

(2) Remove seat back cover.

(3) Remove screws holding child restraint seat module hinges to seat back frame lower rail (Fig. 20).

(4) Return seat back to upright position.

(5) Disengage push-in fasteners holding upper bolster to child restraint seat module (Fig. 21).

(6) Remove screws holding top of module to seat back frame upper rail (Fig. 22).

(7) Remove child restraint seat module from seat back (Fig. 23).

INSTALLATION

(1) Place child restraint seat module in position on seat back (Fig. 23).

(2) Position seat back hinge interlock lever over the top of the outboard child restraint seat hinge (Fig. 24).

(3) Install screws to hold child restraint seat module hinges to seat back frame lower rail (Fig. 20).

(4) Install screws to hold top of module to seat back frame upper rail (Fig. 22).

(5) Install push-in fasteners to hold upper bolster to child restraint seat module (Fig. 21).

(6) Return seat back to folded position.

(7) Install seat back cover.

(8) Verify child restraint seat operation.

HEAD RESTRAINT – BENCH SEAT

REMOVAL

(1) Lift head restraint to top of travel.

(2) Remove escutcheon from head restraint sleeve.

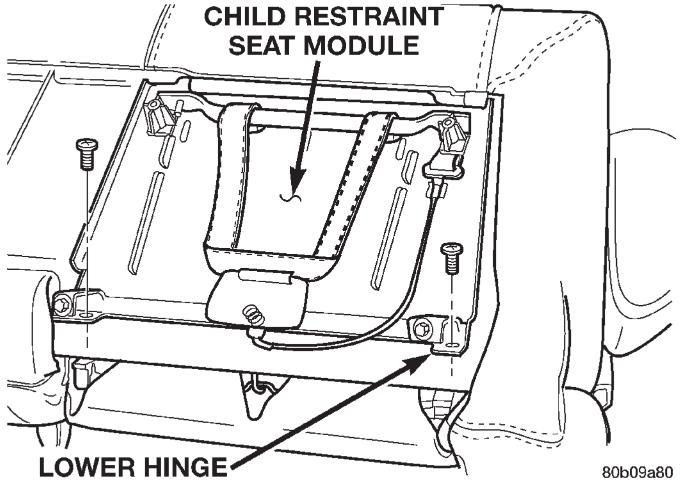

Fig. 20 Child Restraint Seat Lower Hinge

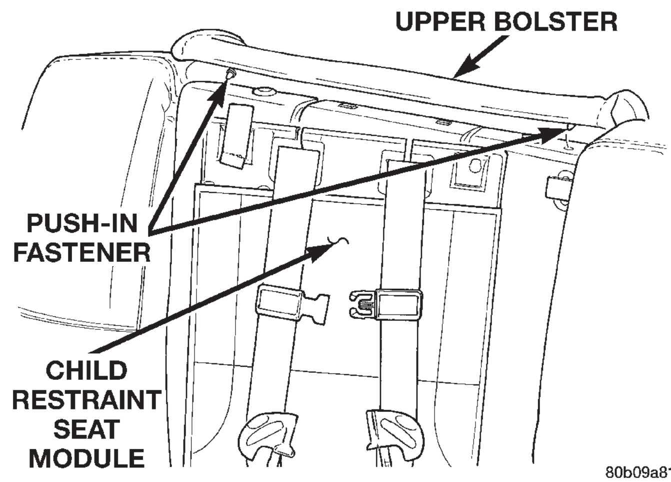

Fig. 21 Child Restraint Seat Upper Bolster

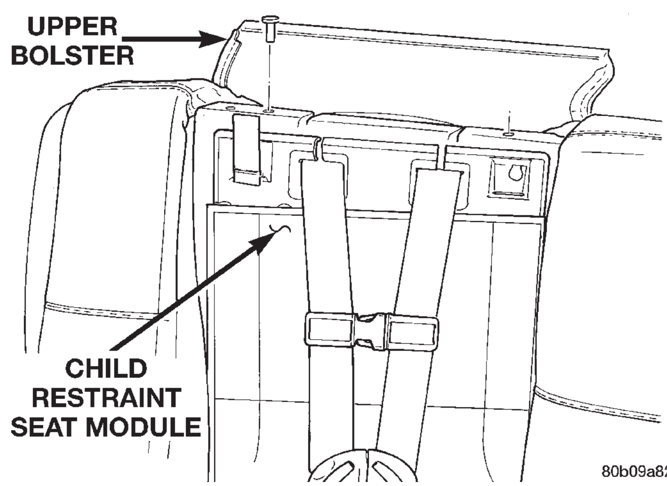

Fig. 22 Child Restraint Seat Upper Screws

(3) Using a small screw driver, depress retainer inward to release head restraint (Fig. 25).

(4) Pull head restraint from top of seat back (Fig. 26).

REMOVAL AND INSTALLATION (Continued)

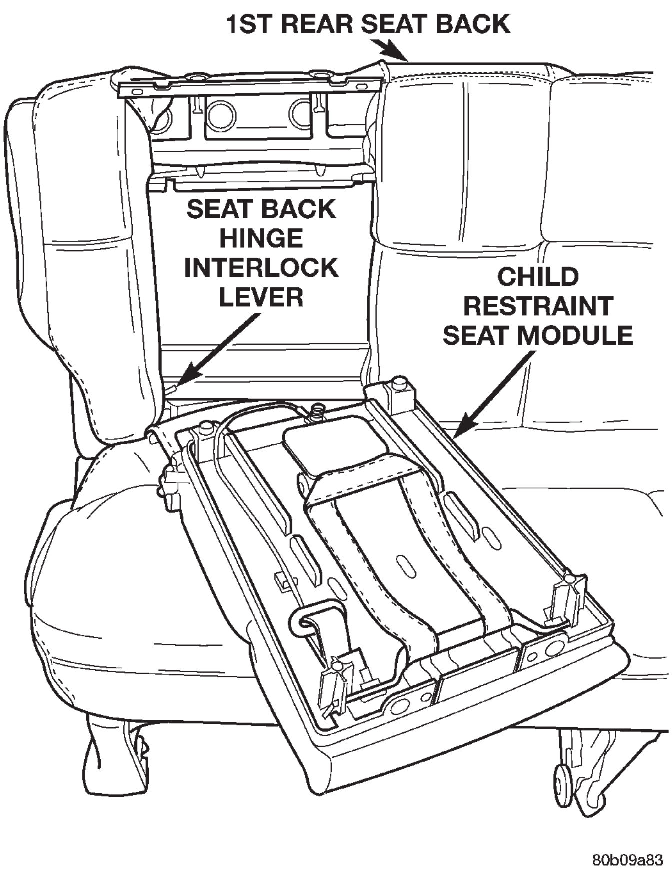

Fig. 23 Child Restraint Seat Module

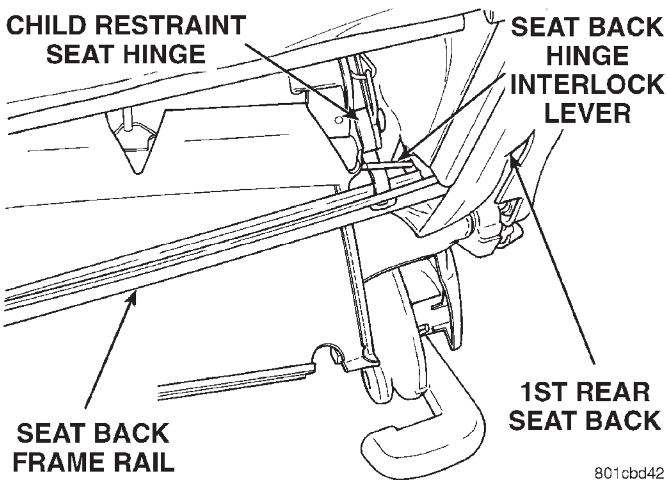

Fig. 24 Interlock Lever

INSTALLATION

(1) Insert retainer and escutcheon into head restraint sleeve (Fig. 27).

(2) Insert head restraint into sleeve. The lock button must be depressed to lower the head rest.

HEAD RESTRAINT – BUCKET SEAT

REMOVAL

(1) Lift head restraint to top of travel.

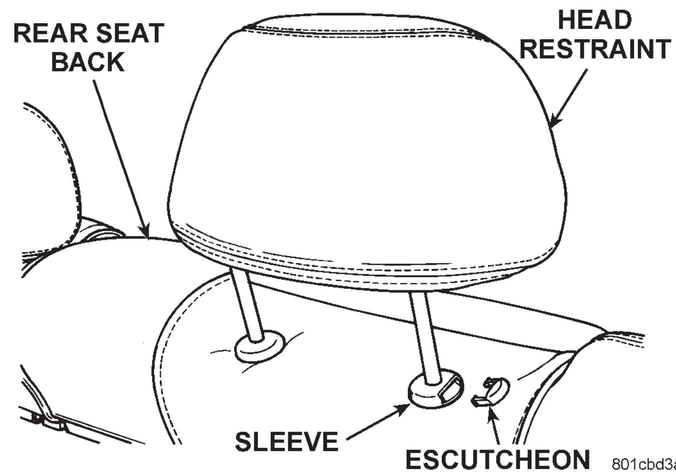

Fig. 25 Head Restraint Sleeve Escutcheon

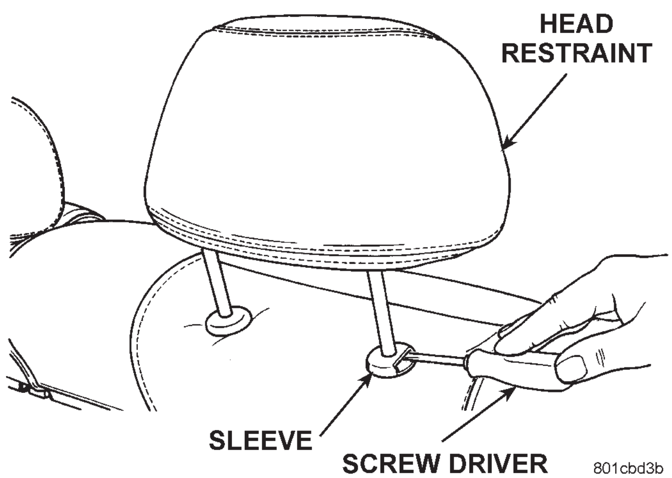

Fig. 26 Release Retainer

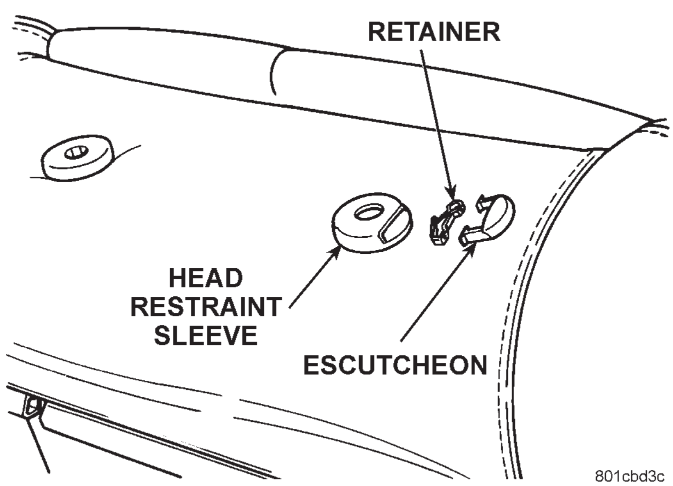

Fig. 27 Install Retainer and Escutcheon

(2) Depress lock button on side of sleeve at top of seat back (Fig. 28).

(3) Pull head restraint from top of seat back.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

For installation, reverse the above procedures.

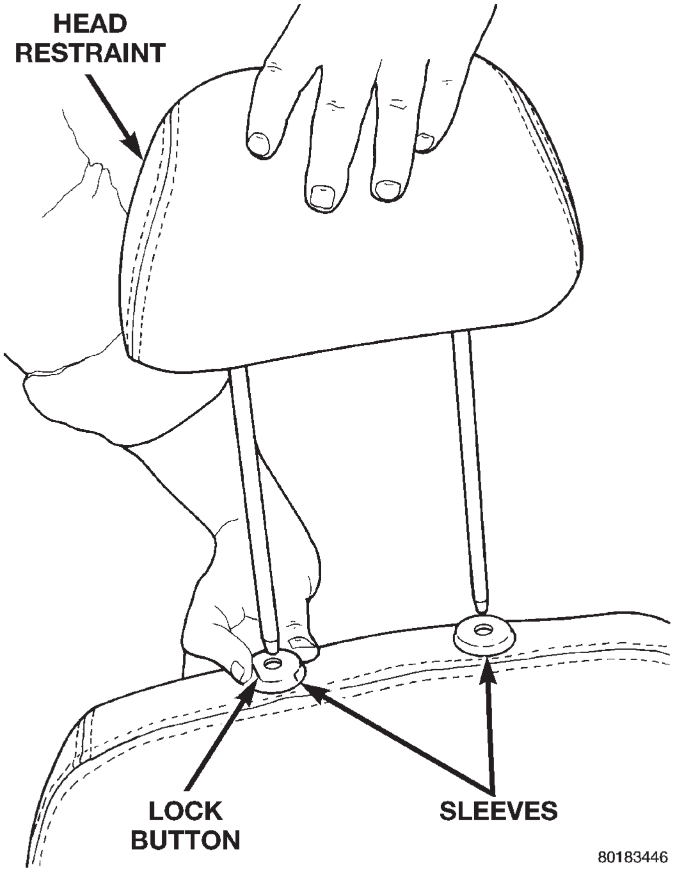

Fig. 28 Head Restraint – Bucket Seat

HEAD RESTRAINT SLEEVE

REMOVAL

(1) Remove head restraint.

(2) Disengage closure holding bottom of trim cover together.

(3) Reach under trim cover through opening at bottom of seat back.

(4) Pinch retainer barbs on end of head restraint sleeve together (Fig. 29).

(5) Pull head restraint sleeve upward and out the top of the seat back frame guide tube (Fig. 30).

INSTALLATION

(1) Insert head restraint sleeve into guide tube at top of seat back.

(2) Push head restraint sleeve downward until retainer clicks into lock position.

(3) Engage closure to hold bottom of trim cover together.

(4) Install head restraint.

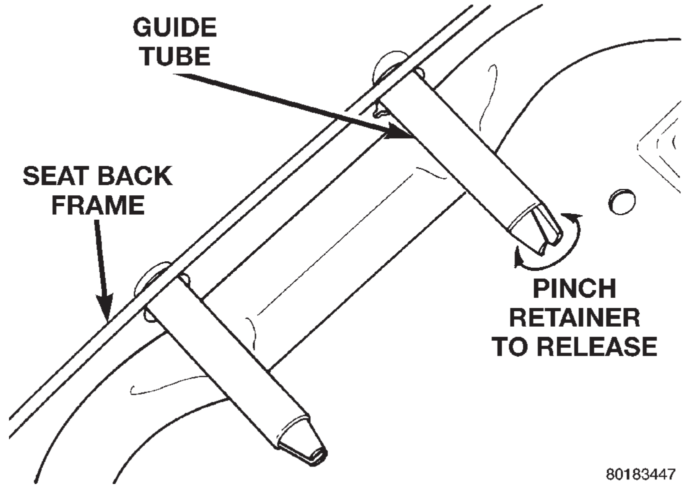

Fig. 29 Head Restraint Sleeve Retainer

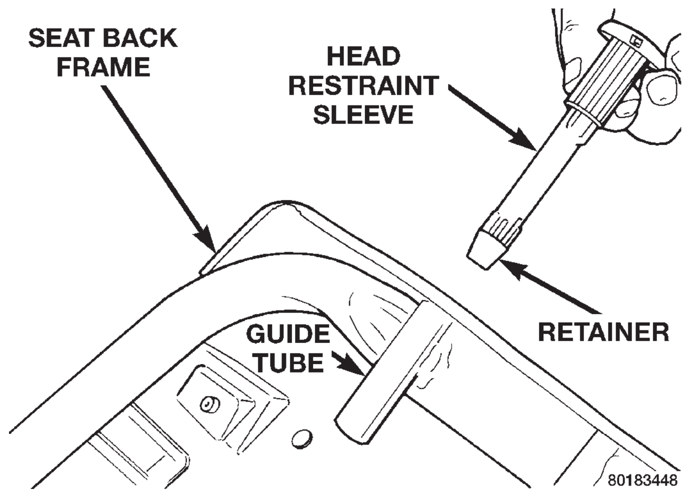

Fig. 30 Head Restraint Sleeve

HEATED SEAT HEATING ELEMENT

Diagnostic information for heated seat heating element is located in Group 8R, Power Seats.

The heating elements are sewn into the covers. To replace a heating element the cushion or back trim covers need to be replaced.

HEATED SEAT MODULE

Diagnostic information for heated seat module is located in Group 8R, Power Seats.

REMOVAL

(1) Remove four bolts attaching seat to the floor pan. Tip seat forward to access the heated seat module.

(2) Disconnect wire connectors from heated seat module.

(3) Pry power seat switch knobs straight off switch.

(4) Remove screws attaching module to the seat pan.

(5) Remove heated seat module.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place heated seat module in position on seat pan.
(2) Install module attaching screws.
(3) Connect module wire connectors.
(4) Install seat.

HEATED SEAT SWITCH

Diagnostic information for heated seat switch is located in Group 8R, Power Seats.

REMOVAL

(1) Remove inboard side cover (Fig. 31) and (Fig. 32).
(2) Disconnect wire connector from heated seat switch.
(3) Carefully depress locking legs on switch and push switch free of cover.

INSTALLATION

(1) Place heated seat switch in position on side cover.
(2) Press switch into locked position.
(3) Connect wire connector into heated seat switch.
(4) Install inboard side cover.

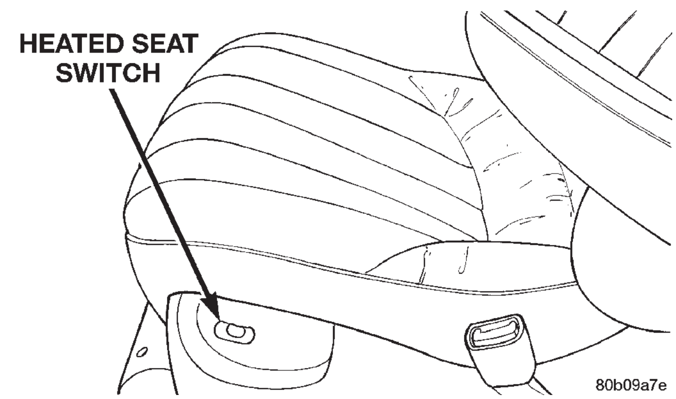

Fig. 31 Right Heated Seat Switch

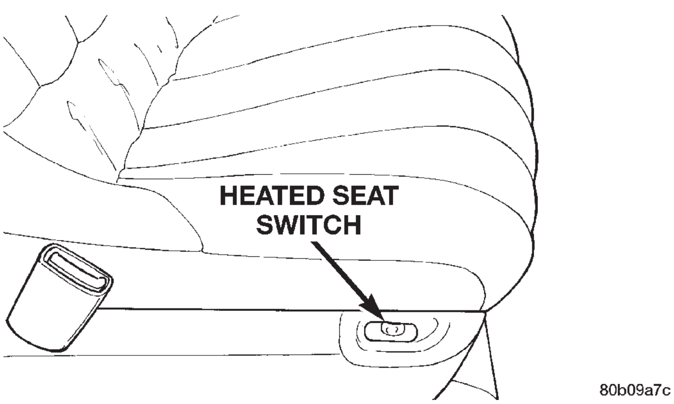

Fig. 32 Left Heated Seat Switch

MECHANICAL LUMBAR HANDLE ASSEMBLY

REMOVAL

(1) Remove screw attaching lumbar handle to seat back (Fig. 33).
(2) Remove seat back assembly from cushion.
(3) Detrim the seat back assembly.
(4) Remove frame and replace.

INSTALLATION

(1) Trim the seat back frame.
(2) Install seat back assembly to cushion.
(3) Install attaching screw to lumbar handle. The handle is to be installed, between two and three O'clock position.
(4) Test lumbar operation.

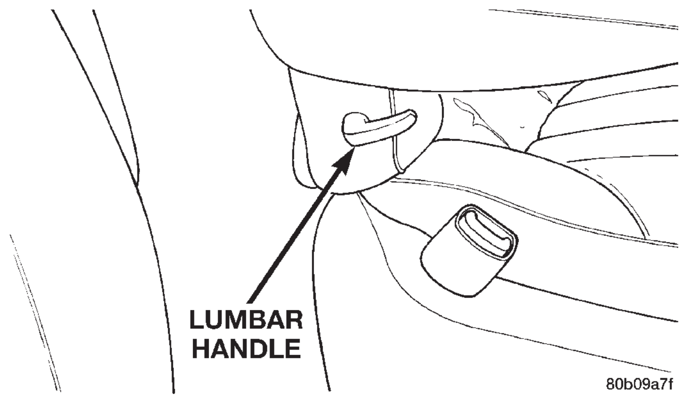

Fig. 33 Lumbar Handle

PLASTIC GROCERY BAG RETAINER

REMOVAL

(1) Remove five screws attaching the plastic grocery bag retainer to the steel slates on the back frame (Fig. 34).
(2) Remove retainer.

INSTALLATION

(1) Place retainer in position.
(2) Install attaching screws.

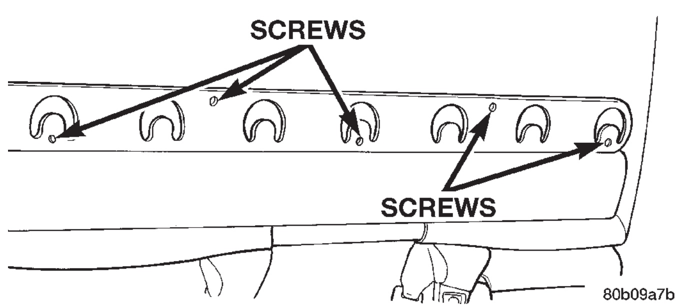

Fig. 34 Plastic Grocery Bag Retainer

REMOVAL AND INSTALLATION (Continued)

POWER SEAT SWITCH

Diagnostic information for power seat switch is located in Group 8R, Power Seats.

REMOVAL

(1) Remove seat cushion side cover.
(2) Disconnect wire connector from power seat switch.
(3) Pry power seat switch knobs straight off switch (Fig. 35).
(4) Remove screws holding power seat switch to side cover (Fig. 36).
(5) Remove power seat switch from side cover.

INSTALLATION

(1) Place power seat switch in position on side cover.
(2) Install screws to hold power seat switch to side cover (Fig. 36).
(3) Push power seat switch knobs straight on switch (Fig. 35).
(4) Connect wire connector into power seat switch.
(5) Install seat cushion side cover.

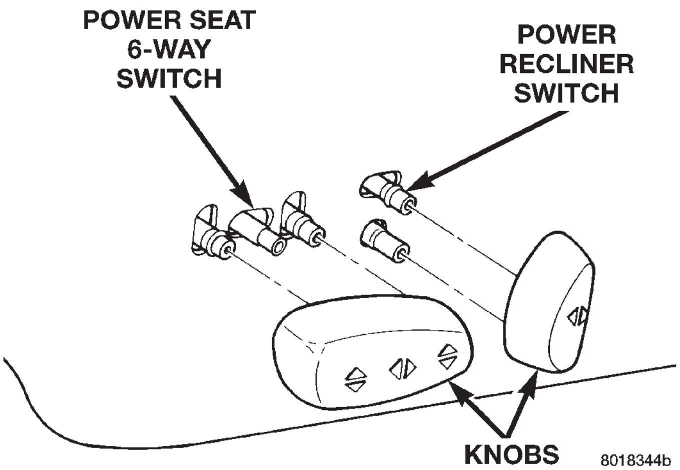

Fig. 35 Power Seat Switch Knobs

RECLINER HANDLE – MANUAL

REMOVAL

(1) Remove screw holding recliner handle to recliner spline shaft (Fig. 37).
(2) Remove recliner handle from spline shaft.

INSTALLATION

(1) Place recliner handle in position on spline shaft.
(2) Install screw to hold recliner handle to recliner spline shaft (Fig. 37).

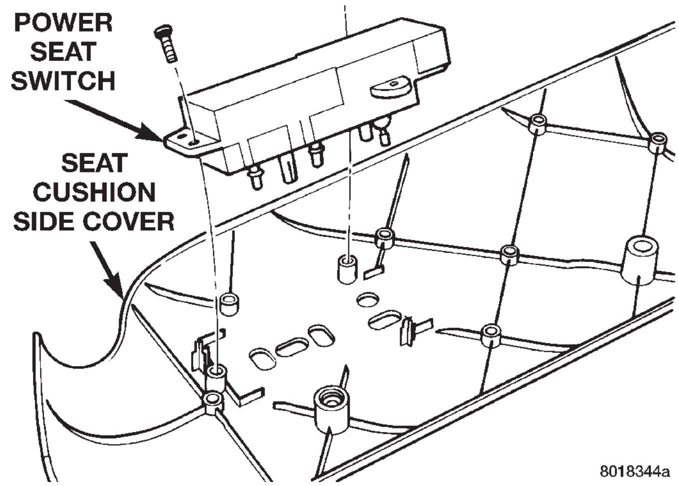

Fig. 36 Power Seat Switch

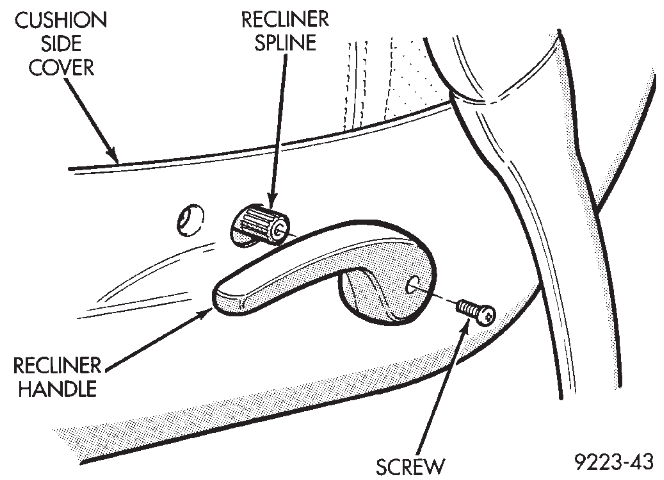

Fig. 37 Recliner Handle – Manual

UNDER SEAT STORAGE BIN

REMOVAL

(1) Release under seat storage bin latch and open bin.
(2) Depress lock tabs at the rear/top edge of the storage bin (Fig. 38).
(3) Pull storage bin from bucket seat riser.

INSTALLATION

(1) Engage storage bin tracks into guides on each side of seat riser.
(2) Push storage bin inward until lock tabs snap past retaining ridge on tracks
(3) Verify storage bin latch operation.

REMOVAL AND INSTALLATION (Continued)

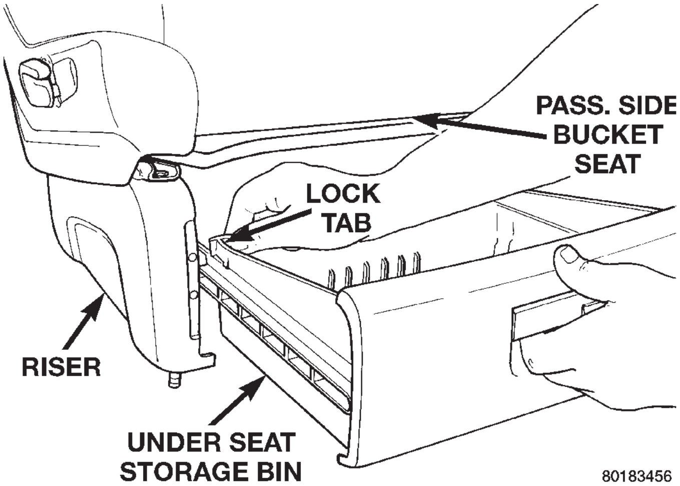

Fig. 38 Storage Bin

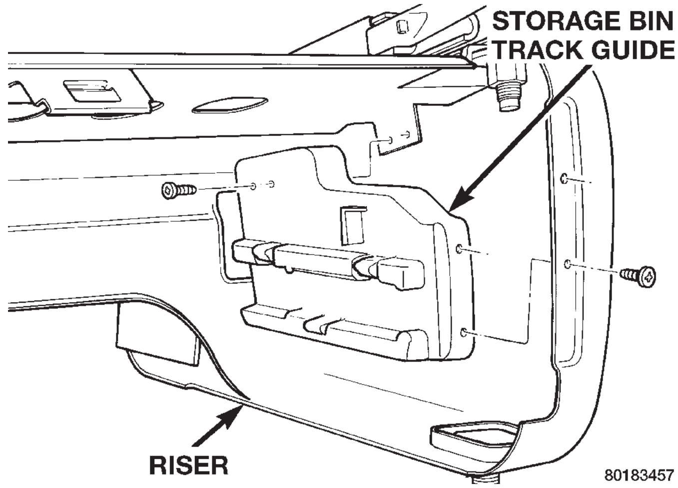

Fig. 39 Under Seat Storage Bin Guide

UNDER SEAT STORAGE BIN GUIDE

REMOVAL

(1) Remove under seat storage bin.

(2) Remove screws holding storage bin track guide to seat riser (Fig. 39).

(3) Remove track guide from vehicle.

INSTALLATION

(1) Place track guide in position on seat riser.

(2) Install screws to hold storage bin track guide to seat riser (Fig. 39).

(3) Install under seat storage bin.

UNDER SEAT STORAGE BIN LOCK/LATCH

REMOVAL

(1) Open under seat storage bin.

(2) Remove screws holding under seat storage bin lock/latch to storage bin (Fig. 40).

(3) Remove lock/latch from bin.

INSTALLATION

(1) Place lock/latch in position on storage bin.

(2) Install screws to hold lock/latch to storage bin (Fig. 40).

(3) Verify under seat storage bin latch operation.

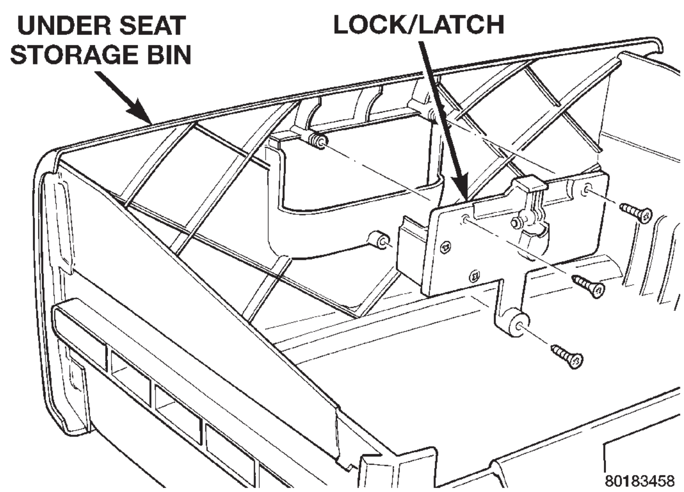

Fig. 40 Under Seat Storage Bin Lock/Latch

BODY COMPONENT SERVICE

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DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water-test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

DIAGNOSIS AND TESTING (Continued)

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high crosswinds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

SERVICE PROCEDURES

HEAT STAKING

(1) Remove trim panel.

(2) Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.

(3) Heat stake the components.

(a) If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

(b) If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it

SERVICE PROCEDURES (Continued)

may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

(4) Allow the repaired area to cool and verify the repair.

(5) Install trim panel.

REMOVAL AND INSTALLATION

A-PILLAR LOWER EXTENSION TRIM

REMOVAL

(1) Remove instrument panel side cover.

(2) Remove screw holding A-pillar extension to door hinge pillar.

(3) Remove A-pillar extension trim from vehicle (Fig. 1).

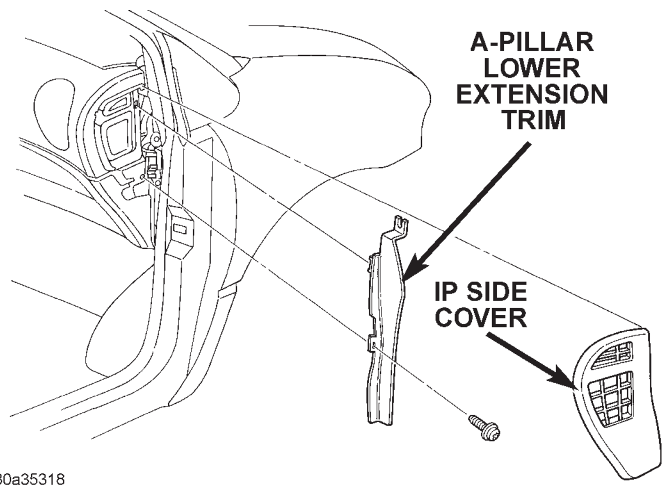


Fig. 1 A-pillar Lower Extension Trim

INSTALLATION

(1) Place A-pillar extension trim in position on vehicle.

(2) Install screw to hold A-pillar extension to door hinge pillar.

(3) Install instrument panel side cover.

A-PILLAR TRIM PANEL

REMOVAL

(1) Disengage hidden clips holding A-pillar trim panel to A-pillar (Fig. 2).

(2) Remove A-pillar trim from vehicle.

INSTALLATION

(1) Position foot on A-pillar trim panel into instrument panel top cover channel.

(2) Position A-pillar trim in vehicle.

(3) Align locator pins.

(4) Engage hidden clips.

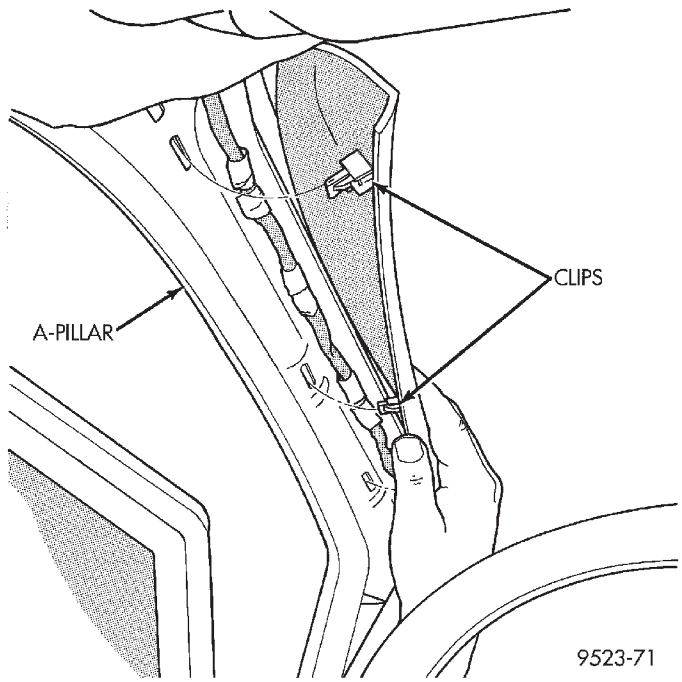


Fig. 2 A-pillar Trim

COWL COVER

WARNING: No fingers or tools should be put under the cowl cover while the wiper motor is operating.

REMOVAL

(1) Remove wiper arms. Refer to Group 8K, Windshield Wipers and Washers for proper procedures.

(2) Remove screws holding lower area of cowl cover to wiper module (Fig. 3).

(3) Disengage quarter turn fasteners holding outer ends of cowl cover to wiper module.

(4) Release hood latch and open hood.

(5) Remove wing nuts holding front of cowl cover to wiper module.

(6) Close hood. Do not latch. Remove outboard screws. (Fig. 4).

(7) Lift cowl cover upward enough to gain access to right washer hose.

(8) Disconnect washer hose from right washer nozzle.

(9) Close hood. Do not latch.

(10) Remove cowl cover from vehicle.

INSTALLATION

For installation, reverse the above procedures.

COWL TRIM

REMOVAL

(1) Remove door sill plate.

(2) Disengage hidden clips holding cowl trim to cowl panel (Fig. 5).

(3) Remove cowl trim from vehicle.

REMOVAL AND INSTALLATION (Continued)

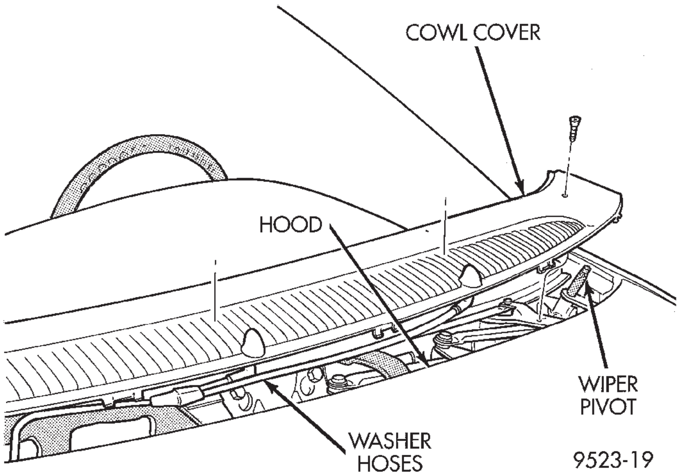


Fig. 3 Cowl Cover

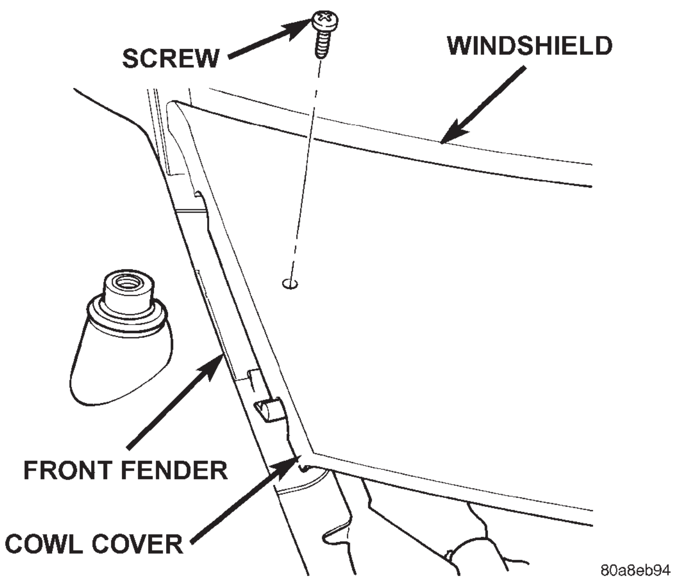


Fig. 4 Cowl Cover Retainers

INSTALLATION

(1) Place cowl trim sill plate in position on vehicle.
(2) Engage hidden clips to hold cowl trim to cowl panel.
(3) Install door sill plate.

FLOOR CARPET

REMOVAL

(1) Remove front seats.
(2) Remove front center console.
(3) Remove first rear seat.
(4) Remove second rear seat.
(5) Remove front cowl panels and sill plates.
(6) Remove sliding door sill plates.
(7) Remove rear door sill plate.
(8) Remove lower B-pillar trim covers.
(9) Remove D-pillar trim covers.
(10) Remove Quarter trim panels.

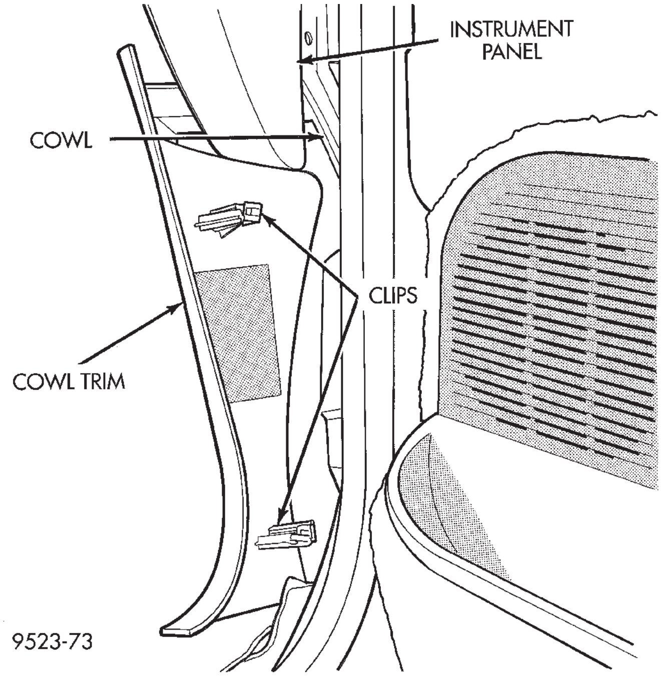


Fig. 5 Cowl Trim

(11) Remove floor escutcheons (Fig. 6).
(12) Remove push-in fasteners holding carpet to floor in front seat area.
(13) Roll carpet from under instrument panel to center of sliding door.
(14) Roll carpet forward away from rear door opening.
(15) Extract carpet through sliding door opening (Fig. 7).

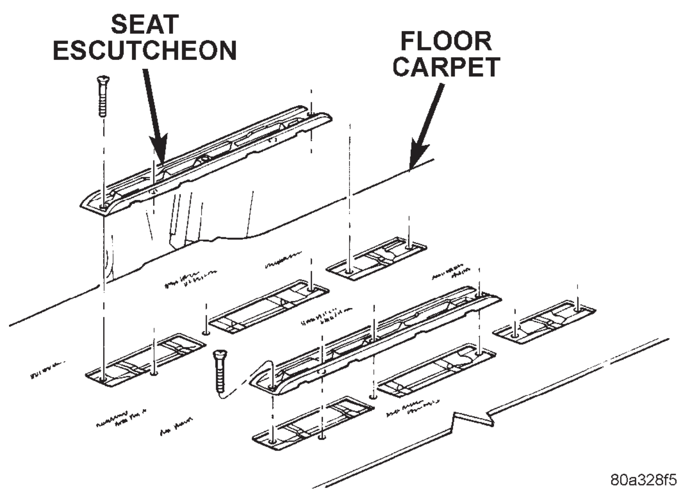


Fig. 6 Seat Escutcheons

INSTALLATION

(1) Insert carpet through sliding door opening.
(2) Roll carpet rearward toward rear door opening.
(3) Roll carpet under instrument panel.
(4) Install push-in fasteners through carpet and grommet into floor to hold carpet to floor in front seat area.

REMOVAL AND INSTALLATION (Continued)

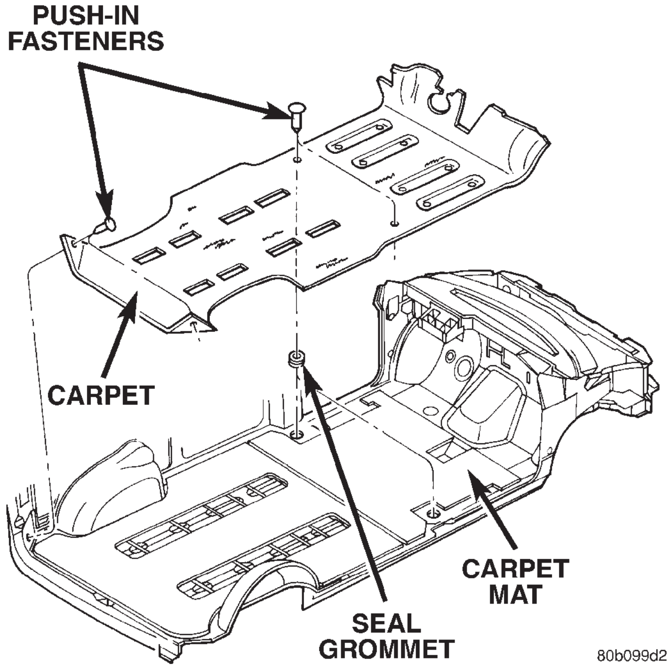


Fig. 7 Floor Carpet

CAUTION: Ensure that the correct fasteners are installed in the proper locations. Damage to the fuel tank may result.

(5) Install floor escutcheons.
(6) Install Quarter trim panels.
(7) Install D-pillar trim covers.
(8) Install lower B-pillar trim covers.
(9) Install rear door sill plate.
(10) Install sliding door sill plates.
(11) Install front cowl panels and sill plates.
(12) Install second rear seat.
(13) Install first rear seat.
(14) Install front center console.
(15) Install front seats.

FRONT DOOR

CAUTION: If the hinge pin must be removed from the hinge, do not reuse the original pin. The structural integrity of the hinge would be reduced. Verify availability prior to proceeding if hinge pins are to be removed.

NOTE: The retaining clips used on the door hinge pins are not to be re-used. Verify availability prior to proceeding if clips are to be removed.

REMOVAL

(1) Open front door.
(2) Remove front wheelhouse splash shield.
(3) Disengage clips holding door harness wire connector to inner fender brace.
(4) Disconnect positive lock slide on the side of the wire connectors (Fig. 8).
(5) Depress lock tab holding wire connector halves together.
(6) Disconnect door harness from body wiring harness.
(7) Remove bolts holding door check strap to A-pillar (Fig. 9).
(8) Support door on suitable lifting device.
(9) Remove bolts holding lower hinge to door end frame (Fig. 10).
(10) Steady door on lifting device and remove bolts holding upper hinge to door end frame.
(11) Remove door from vehicle.

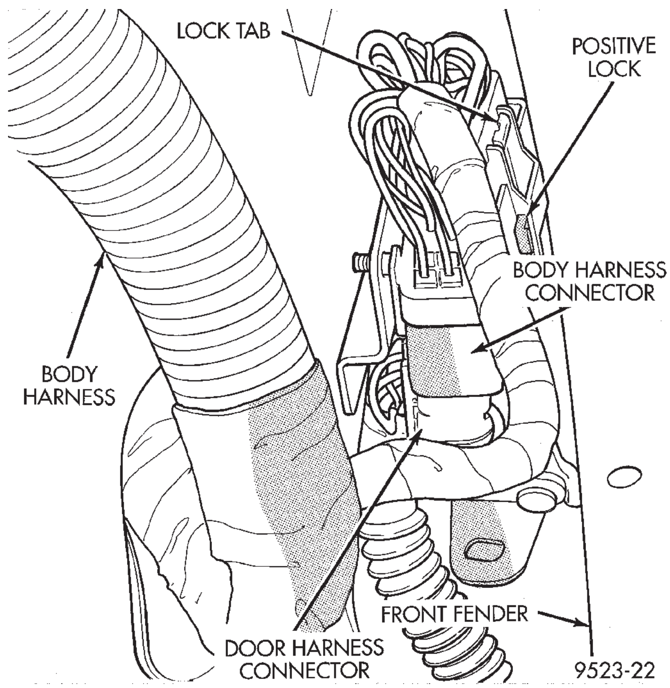


Fig. 8 Front Door Wire Connectors

INSTALLATION

NOTE: If new hinge pins are to be used, verify that the knurling on the hinge pin is aligned with the knurling on in the door hinge prior to driving in the pin. Also, verify that the hinge pin is fully seated to the door hinge and a new retaining clip is installed.

(1) Support door on suitable lifting device.
(2) Position door to vehicle.
(3) Steady door on lifting device and install bolts to hold upper hinge to door end frame.
(4) Install bolts to hold door check strap to A-pillar.
(5) Install bolts to hold lower hinge to door end frame. Align door to achieve equal spacing to surrounding body panels. Panels should be flush across all gaps.

REMOVAL AND INSTALLATION (Continued)

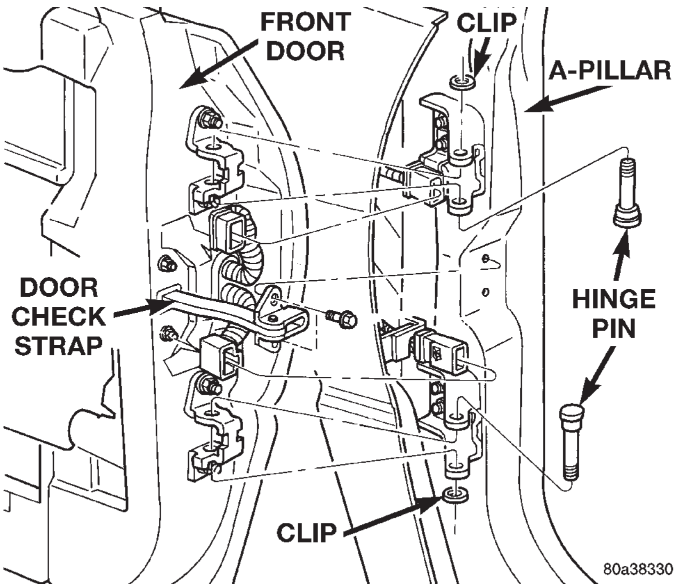


Fig. 9 Front Door – Hinge Pin Removal

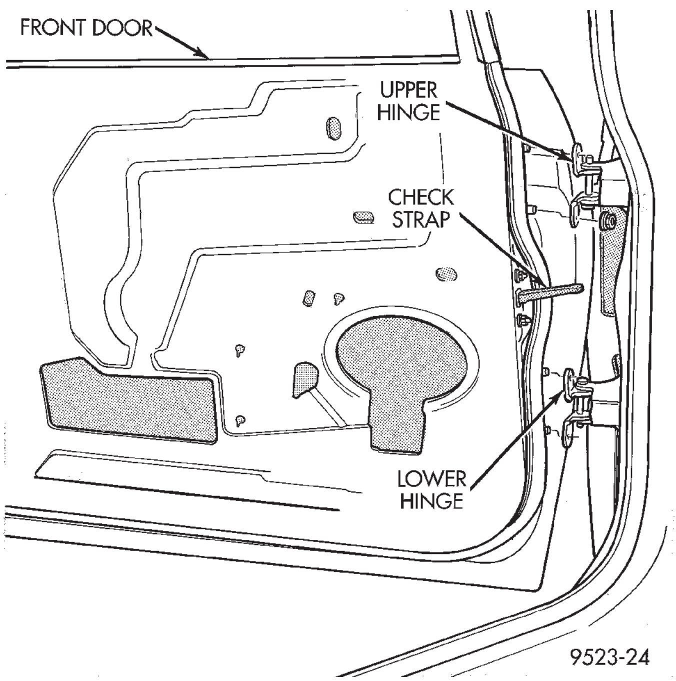


Fig. 10 Front Door – Hinge Bolt Removal

(6) Connect door harness into body wiring harness.
(7) Connect positive lock slide on the side of the wire connectors.
(8) Connect clips to hold door harness wire connector to inner fender brace.
(9) Install front wheelhouse splash shield.
(10) Verify door operation and alignment. Adjust as necessary.

FRONT DOOR APPLIQUE

REMOVAL

(1) Roll door glass down.
(2) Remove outer door belt molding.
(3) Disengage clips holding front edge of applique to door frame.
(4) Remove applique from vehicle (Fig. 11).

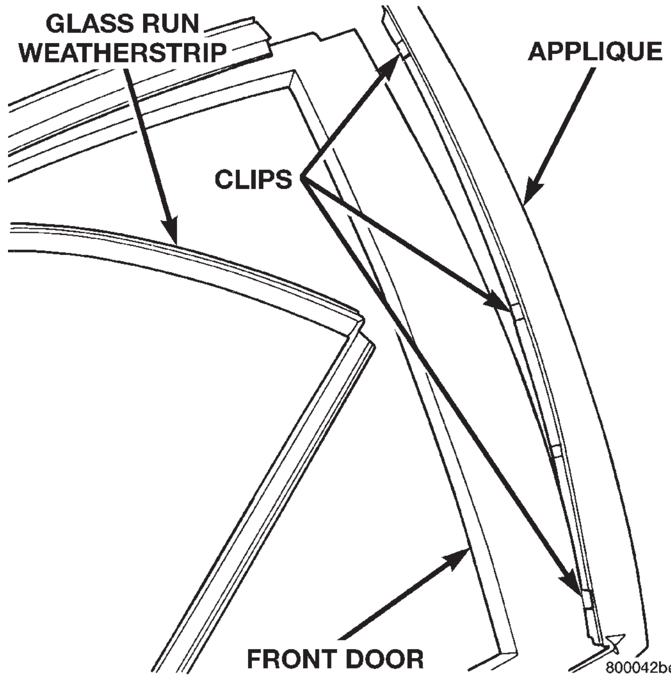


Fig. 11 Front Door Applique

INSTALLATION

(1) Position applique on vehicle.
(2) Hook rear edge of applique over rear edge of door frame and seat applique bottom edge on sheet metal.
(3) Engage clips to hold front edge of applique to door frame.
(4) Install outer door belt molding.

FRONT DOOR CHECK STRAP

REMOVAL

(1) Remove front door trim panel.
(2) Remove door speaker, if equipped.
(3) Remove bolts attaching door check strap to A-pillar (Fig. 9).
(4) Remove nuts attaching check strap to door end frame (Fig. 12).
(5) Remove check strap from door through speaker hole.

REMOVAL AND INSTALLATION (Continued)

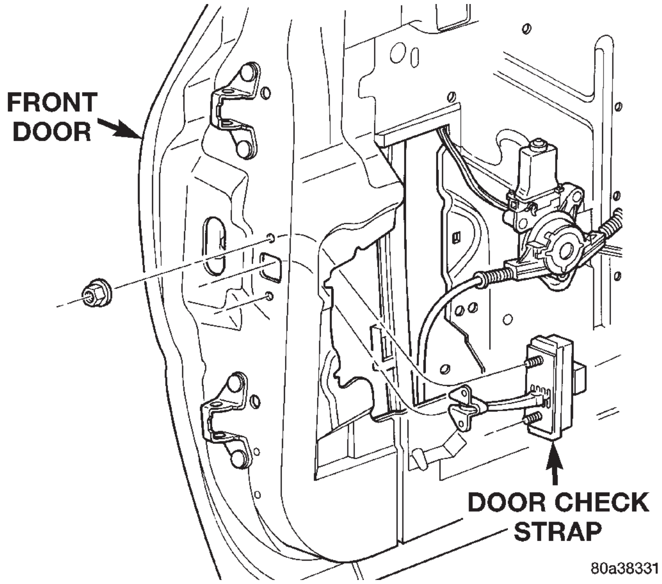


Fig. 12 Front Door Check Strap

INSTALLATION

(1) Position check strap on door through speaker hole.

(2) Install nuts to attach check strap to door end frame.

(3) Install bolts to attach check strap to A-pillar.

(4) Install door speaker, if equipped.

(5) Install front door trim panel.

FRONT DOOR FRAME CLOSEOUT MOLDINGS

REMOVAL – A-PILLAR, HEADER, OR B-PILLAR

(1) Roll door glass down.

(2) Using a hook tool, pull front door frame closeout molding from window frame channel (Fig. 13).

(3) Remove closeout molding from vehicle.

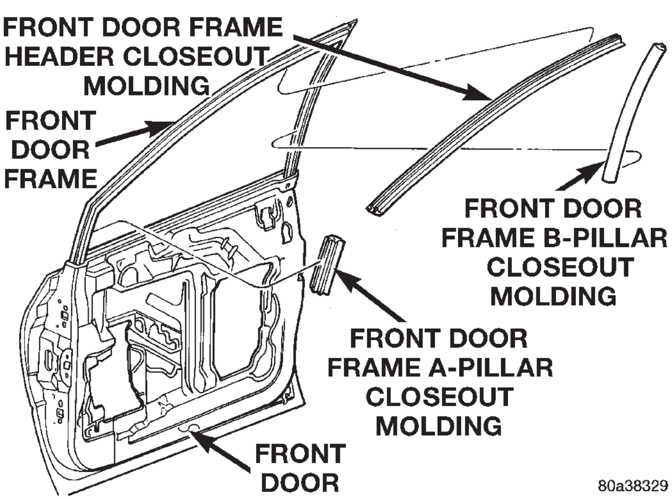


Fig. 13 Front Door Frame Closeout Moldings

INSTALLATION – A-PILLAR, HEADER, OR B-PILLAR

(1) Position closeout molding in window frame.

(2) Insert closeout molding into window frame channel starting at the corners and working inward.

(3) Verify door glass operation.

FRONT DOOR GLASS

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove inner belt molding.

(3) Remove outer belt molding.

(4) Remove radio speaker, if equipped.

(5) Position glass to gain access to front and rear regulator lift plates through front and rear access holes in door panel.

(6) Remove clips holding door glass to regulator lift plates (Fig. 14).

(7) Remove glass from regulator lift plates.

(8) Disengage glass from glass run weather-strip.

(9) Insert front of glass between glass run channel and outer door panel.

(10) Lift glass upward and out of exterior side of the opening at top of door (Fig. 15).

(11) Remove glass from vehicle.

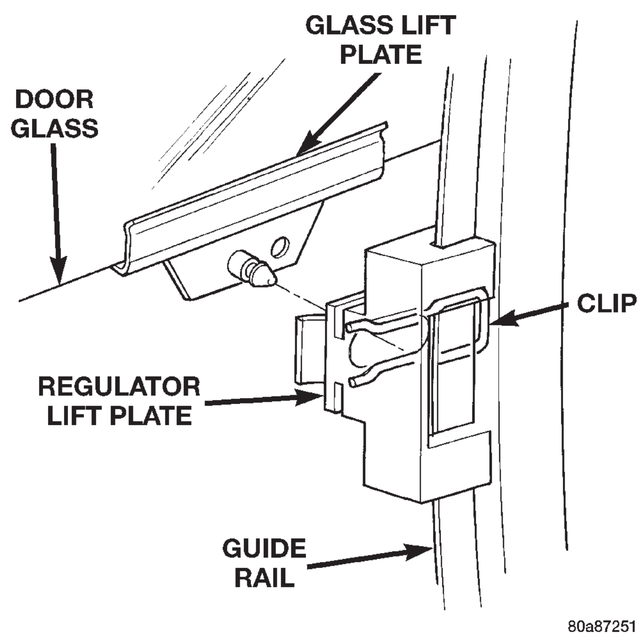


Fig. 14 Front Door Glass Clips

INSTALLATION

(1) Install clips that hold door glass to regulator lift plates (Fig. 14).

(2) Place glass in window opening with front inserted between run channel and outer door panel (Fig. 15).

REMOVAL AND INSTALLATION (Continued)

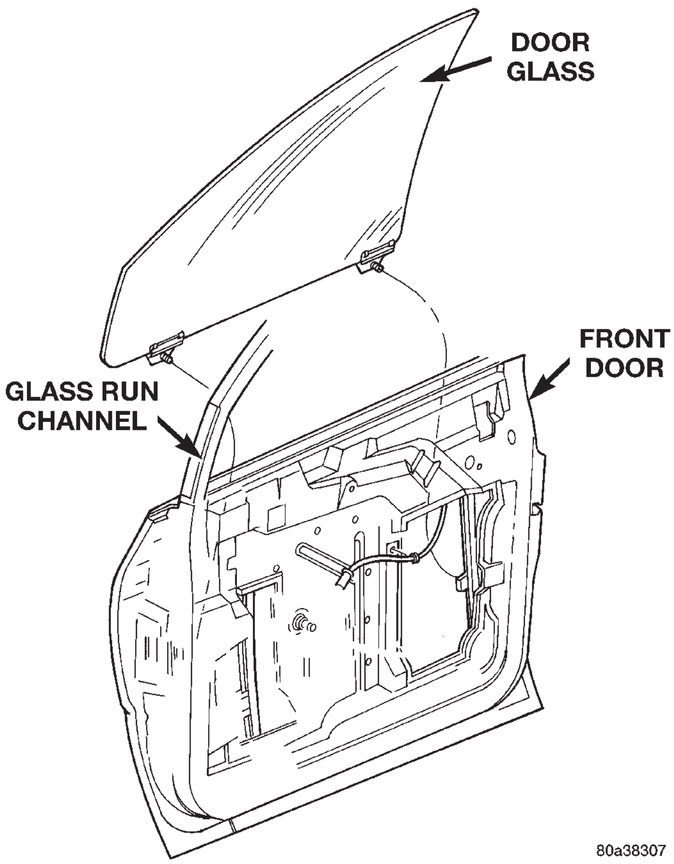


Fig. 15 Front Door Glass

(3) Lower glass downward into door.

(4) Insert ends of glass into glass run weather-strip channels at front and rear of door.

(5) Place glass in position on regulator lift plates.

(6) Snap glass mounting studs into clips on regulator lift plates.

(7) Install radio speaker, if equipped.

(8) Install outer belt molding.

(9) Install inner belt molding.

(10) Verify door glass operation and fit.

(11) Install water shield and door trim panel.

FRONT DOOR GLASS RUN WEATHER-STRIP

REMOVAL

(1) Remove door frame closeout moldings.

(2) Pull weather-strip from glass run channel at rear of door frame, working from the bottom to the top.

(3) Disengage clip holding weather-strip to door frame.

(4) Pull weather-strip from lip along top of door frame (Fig. 16).

(5) Remove door trim panel.

(6) Remove door speaker, if equipped.

(7) Remove watershed as necessary to gain access to screw holding front lower corner of glass run weather-strip to inner door panel.

(8) Remove screw holding glass run weather-strip to inner door panel.

(9) Remove inner belt weather-strip.

(10) Pull weather-strip from front glass run channel.

(11) Remove glass run weather-strip from vehicle.

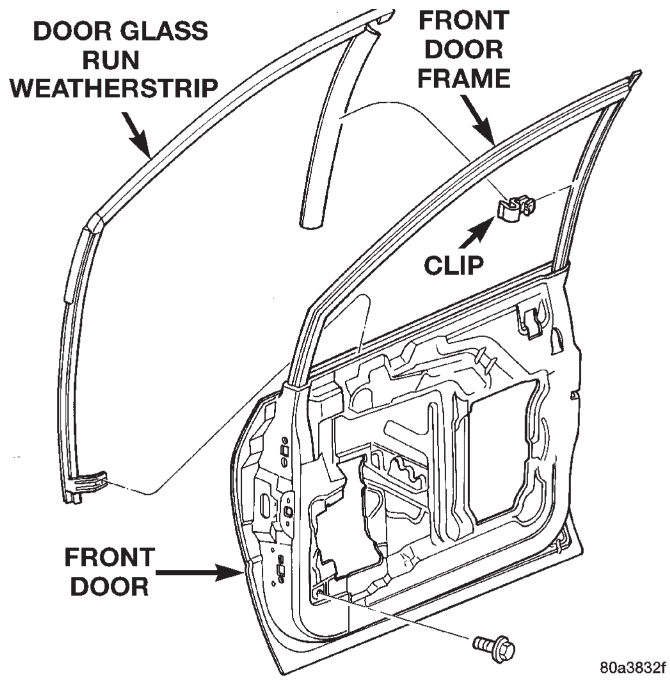


Fig. 16 Front Door Glass Run Weather-strip

INSTALLATION

(1) Position glass run weather-strip on vehicle.

(2) Push weather-strip into front glass run channel.

(3) Install screw to hold glass run weather-strip to inner door panel.

(4) Install inner belt weather-strip.

(5) Install watershed.

(6) Push weather-strip groove onto lip along top of door frame.

(7) Engage clip into slot in door frame.

(8) Push weather-strip into channel at rear of door frame, working from the top to bottom.

(9) Install door frame closeout moldings.

(10) Install door speaker, if equipped.

(11) Install door trim panel.

FRONT DOOR HINGE

CAUTION: If the hinge pin must be removed from the hinge, do not reuse the original pin. The structural integrity of the hinge would be reduced.

REMOVAL AND INSTALLATION (Continued)

NOTE: If both hinges on one door are to be replaced, remove and install one hinge completely prior to beginning the second hinge.

REMOVAL

(1) Release front door latch and open door.
(2) Support door on suitable lifting device.
(3) Remove bolts holding front door to door hinge.
(4) Remove bolts holding hinge to pillar.
(5) Remove door hinge from vehicle.

INSTALLATION

CAUTION: When installing a new hinge, make sure that the head of each hinge pin is fully seated into the door hinge. Also, remove the plastic shipping clip and replace it with the correct metal retaining clip once the hinge pin is seated.

(1) Paint hinge prior to installation, if necessary.
(2) Position door hinge on vehicle.
(3) Install bolts to hold hinge to pillar.
(4) Install bolts to hold front door to door hinge.
(5) Align door to achieve equal spacing to surrounding body panels. Panels should be flush across all gaps.
(6) Verify door alignment and operation. Adjust as necessary.

FRONT DOOR INNER BELT MOLDING

REMOVAL

(1) Remove door trim panel.
(2) Peel upper corner seals away form inner belt molding to clear removal path.
(3) Pull inner belt molding upward to disengage retaining channel in bottom of molding from door panel flange (Fig. 17).
(4) Remove inner belt molding from vehicle.

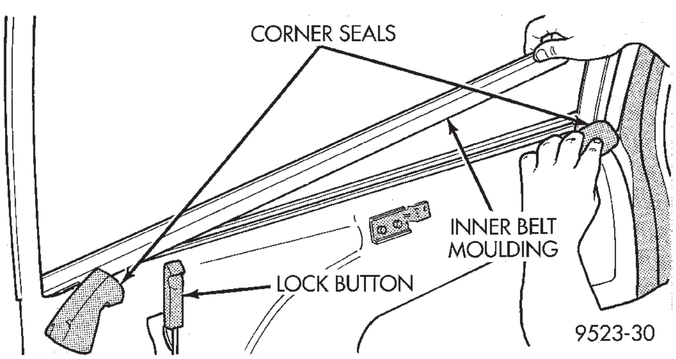


Fig. 17 Front Door Inner Belt Molding

INSTALLATION

(1) Place inner belt molding in position on door.
(2) Push inner belt molding downward to engage retaining channel onto door panel flange.
(3) Install upper corner seals in proper location.
(4) Install door trim panel.

FRONT DOOR LATCH

REMOVAL

(1) Remove front door trim panel.
(2) Remove water shield as necessary to gain access to the outside door handle.
(3) Roll door glass up.
(4) Through access hole at rear of inner door panel, disengage wire connector from power door lock motor, if equipped.
(5) Disengage clips holding linkage to door latch.
(6) Remove linkages from door latch.
(7) Remove screws holding door latch to door end frame (Fig. 18).
(8) Remove door latch from door.

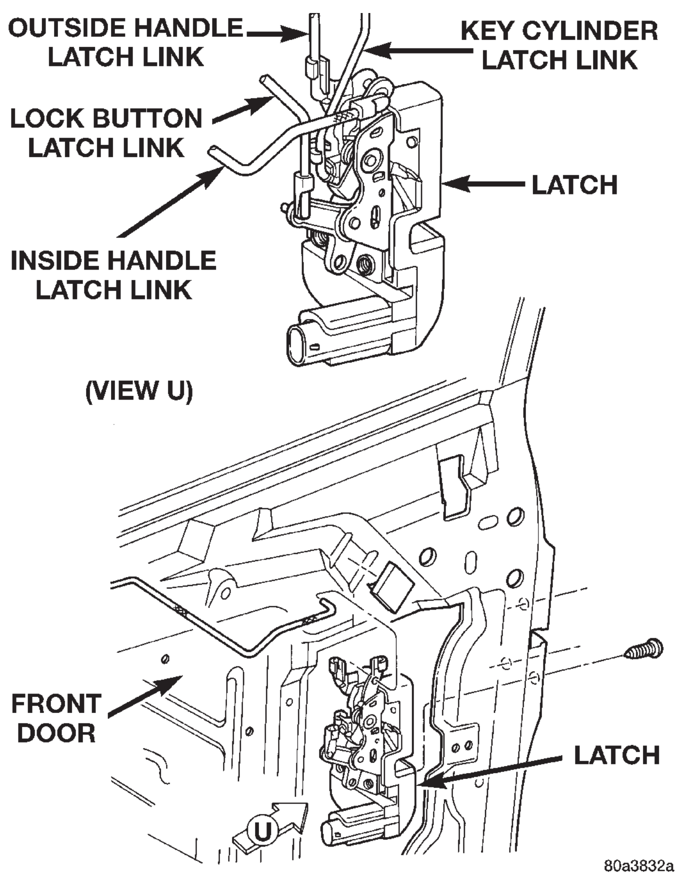


Fig. 18 Front Door Latch

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

NOTE: The screws attaching the door latch to the door end frame have nylon patches on the threads. All screws must be replaced when the latch has been removed.

(1) Place door latch in position on door end frame.
(2) Install screws to hold door latch to door end frame.
(3) Insert linkage into door latch.
(4) Engage clips to hold linkage to door latch.
(5) Connect wire connector into power door lock motor, if equipped.
(6) Insert a hex wrench through the elongated hole located in the door shut face above the latch.
(7) Loosen allen head screw.
(8) Pull outward on the outside door handle and release.
(9) Tighten allen head screw.
(10) Verify door latch and power door lock operation.
(11) Install water shield and front door trim panel.

FRONT DOOR LATCH STRIKER

REMOVAL

(1) Mark outline of door striker on B-pillar to aid in installation.
(2) Remove screws holding door latch striker to B-pillar (Fig. 19).
(3) Remove door latch striker from vehicle.
(4) Retrieve any shims found between latch striker and B-pillar.

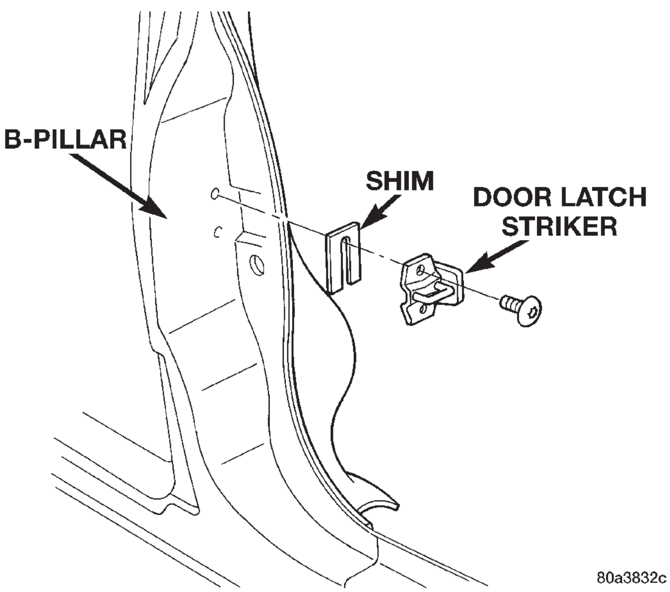


Fig. 19 Door Latch Striker

INSTALLATION

(1) Position latch striker and any shims retrieved on vehicle.
(2) Loosely install screws to hold latch striker to B-pillar.
(3) Align latch striker to outline on B-pillar made previously.
(4) Tighten all fasteners.
(5) Verify door fit and operation. Adjust latch striker as necessary.

FRONT DOOR LOCK CYLINDER

REMOVAL

(1) Remove front door trim panel and water shield as necessary to gain access to the outside door handle.
(2) Roll door glass up.
(3) Through access hole at rear of inner door panel, disconnect vehicle theft Security System (VTSS) switch connector from door harness, if equipped.
(4) Disengage push-in fasteners holding VTSS switch harness to inner door reinforcement bar, if equipped.
(5) Disengage clip holding door latch linkage to door latch.
(6) Remove latch linkage from latch.
(7) Disengage clip holding door lock linkage to door latch.
(8) Remove lock linkage from latch.
(9) Remove nuts holding outside door handle to door outer panel (Fig. 23).
(10) Remove outside door handle from vehicle.
(11) Disengage clip holding lock cylinder into outside handle (Fig. 20).
(12) Pull lock cylinder from door handle.

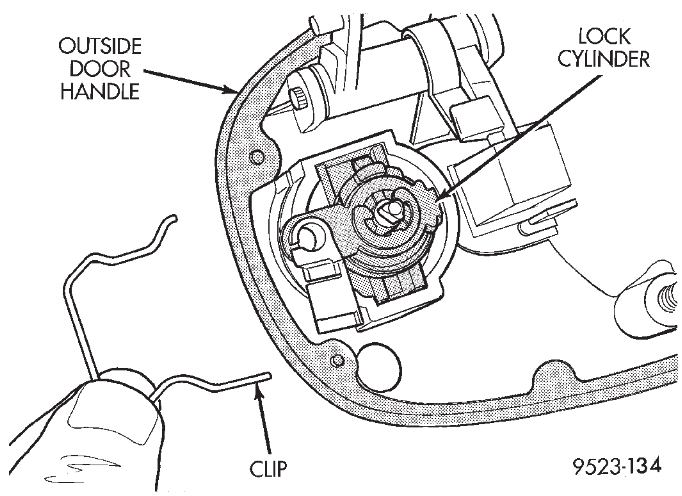


Fig. 20 Remove Front Door Lock Cylinder

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Engage clip into outside handle to hold lock cylinder.

(2) With link arm toward rear of vehicle, push lock cylinder into door handle until clip snaps into place (Fig. 21).

(3) Insert lock linkage into door latch.

(4) Engage clip to hold door lock linkage to latch.

(5) Insert latch linkage into door latch.

(6) Engage clip to hold door latch linkage to latch.

(7) Install push-in fasteners to hold VTSS switch harness to inner door reinforcement bar, if equipped.

(8) Connect VTSS switch connector into door harness, if equipped.

(9) Verify door latch operation.

(10) Install water shield and door trim panel.

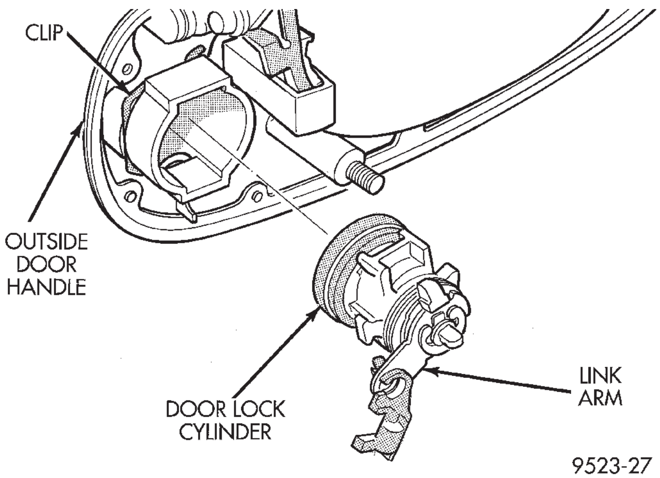


Fig. 21 Install Front Door Lock Cylinder

FRONT DOOR OUTER BELT MOLDING

REMOVAL

(1) Remove door trim panel.

(2) Roll door glass down.

(3) Using a hook tool, disengage interlocking lip at the base of the inward edge of the belt molding (Fig. 22).

(4) Remove belt molding from door.

INSTALLATION

(1) Place belt molding in position on door.

(2) Engage interlocking lip at the base of the inward edge of the belt molding on door panel.

(3) Install door trim panel.

FRONT DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove front door trim panel and water shield as necessary to gain access to the outside door handle.

(2) Roll door glass up.

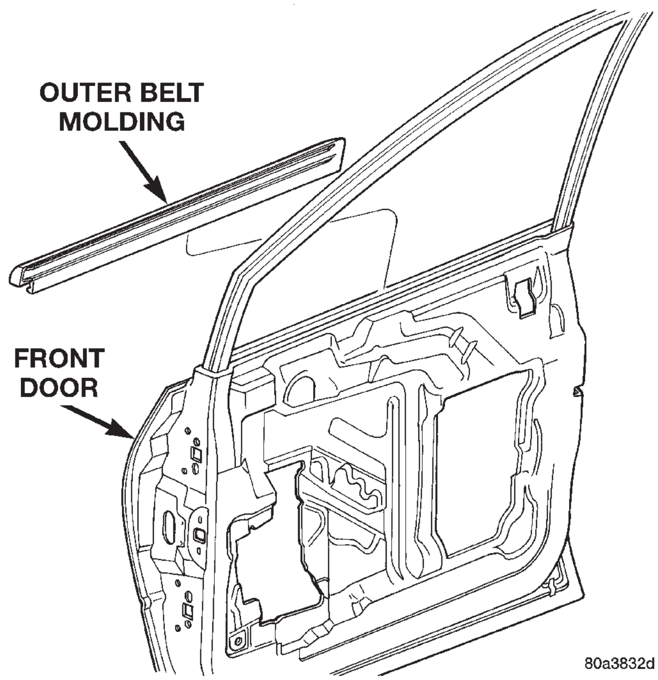


Fig. 22 Front Door Outer Belt Molding

(3) Through access hole at rear of inner door panel, disconnect vehicle theft Security System (VTSS) switch connector from door harness, if equipped.

(4) Disengage push-in fasteners holding VTSS switch harness to inner door reinforcement bar, if equipped.

(5) Disengage clip holding door latch linkage to door latch.

(6) Remove latch linkage from latch.

(7) Disengage clip holding door lock linkage to door latch.

(8) Remove lock linkage from latch.

(9) Remove nuts holding outside door handle to door outer panel (Fig. 23).

(10) Remove outside door handle from vehicle.

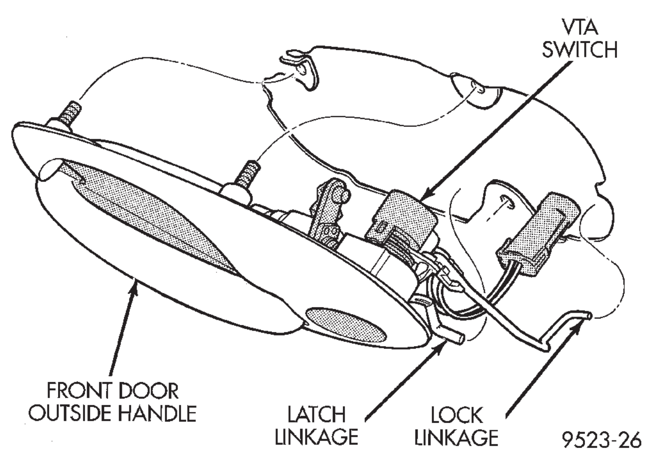


Fig. 23 Front Door Outside Handle

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

If outside door handle replacement is necessary, transfer lock cylinder from the original handle to the new one.

(1) Place outside door handle in position on vehicle.

(2) Install nuts to hold outside door handle to door outer panel (Fig. 23).

(3) Insert lock linkage into door latch.

(4) Engage clip to hold door lock linkage to latch.

(5) Insert latch linkage into door latch.

(6) Engage clip to hold door latch linkage to latch.

(7) Install push-in fasteners to hold VTSS switch harness to inner door reinforcement bar, if equipped.

(8) Connect VTSS switch connector into door harness, if equipped.

(9) Verify door latch operation.

(10) Install water shield and door trim panel.

FRONT DOOR REFLECTOR

REMOVAL

(1) Insert small, flat bladed pry tool between outer edge of door reflector and HVAC outlet vent.

(2) Pry outward on outer edge of reflector.

(3) Remove reflector from vehicle (Fig. 24).

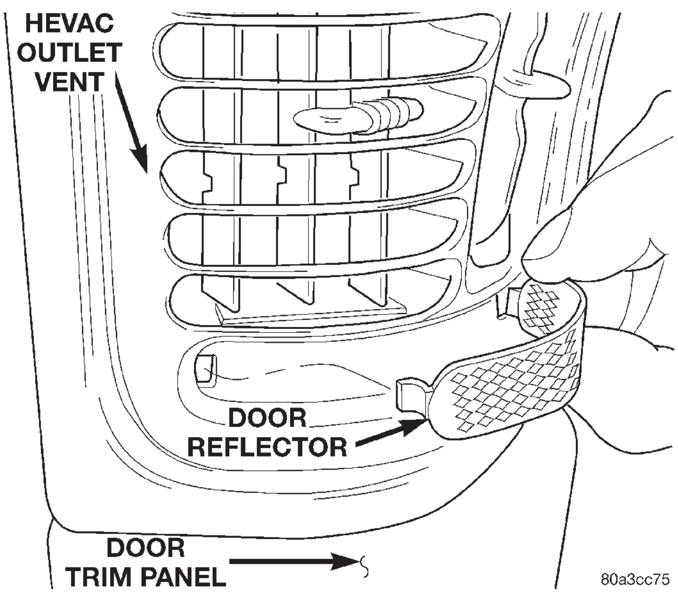


Fig. 24 Front Door Reflector

INSTALLATION

(1) Position reflector on vehicle.

(2) Insert inner edge of reflector into slot in HVAC outlet vent.

(3) Snap outer edge of reflector into slot in HVAC outlet vent.

FRONT DOOR SILL PLATE

REMOVAL

(1) Using trim stick (C-4755), disengage hidden clips holding door sill plate from door sill.

(2) Remove sill plate from vehicle (Fig. 25).

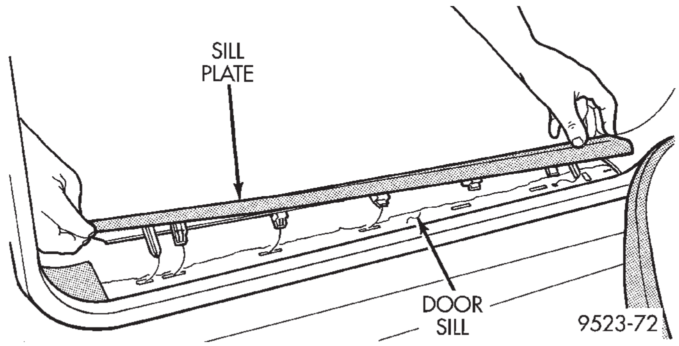


Fig. 25 Door Sill Plate

INSTALLATION

(1) Place sill plate in position on vehicle.

(2) Align locating pins on backside of trim plate to mating holes in door sill.

(3) Engage hidden clips to hold door sill plate to door sill.

FRONT DOOR TRIM PANEL

REMOVAL

(1) Using a trim stick (C-4755), pry courtesy lamp from door trim.

(2) Disconnect wire connector from courtesy lamp.

(3) If equipped, remove screws attaching door assist handle to inner door panel.

(4) If equipped, remove screw attaching door pull cup to inner door panel.

(5) If equipped, remove screws attaching trim panel to door from below map pocket.

(6) If equipped, remove window crank.

(7) Using a trim stick, remove screw cover from switch panel.

(8) Remove screws attaching switch panel to door trim.

(9) Remove power accessary switch from door trim (Fig. 26).

(10) Disconnect power switch from wire connector.

(11) If equipped, using a small, flat bladed pry tool, remove memory seat/mirror switch and disconnect wire connector (Fig. 27).

(12) If equipped, remove screw holding door trim to door panel from behind inside latch release handle.

(13) Disengage clips attaching door trim to door frame around perimeter of panel (Fig. 28).

(14) Lift trim panel upward to disengage flange from inner belt molding at top of door.

REMOVAL AND INSTALLATION (Continued)

(15) Tilt top of trim panel away from door to gain access to latch linkage.

(16) Disengage clip attaching linkage rod to inside latch release handle (Fig. 29).

(17) Separate linkage rod from latch handle.

(18) Remove front door trim panel from vehicle.

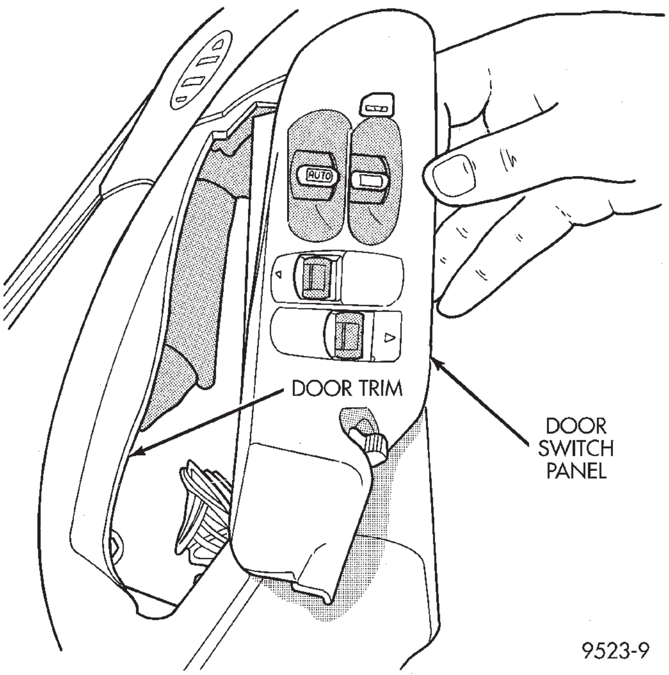


Fig. 26 Front Door Switch Panel

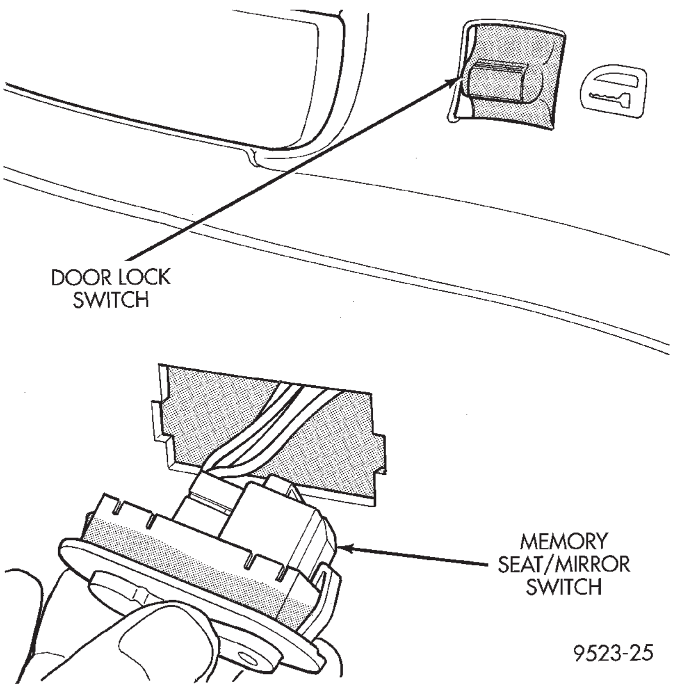


Fig. 27 Memory Seat/Mirror Switch

INSTALLATION

(1) Hold top of trim panel away from door to gain access to latch linkage.

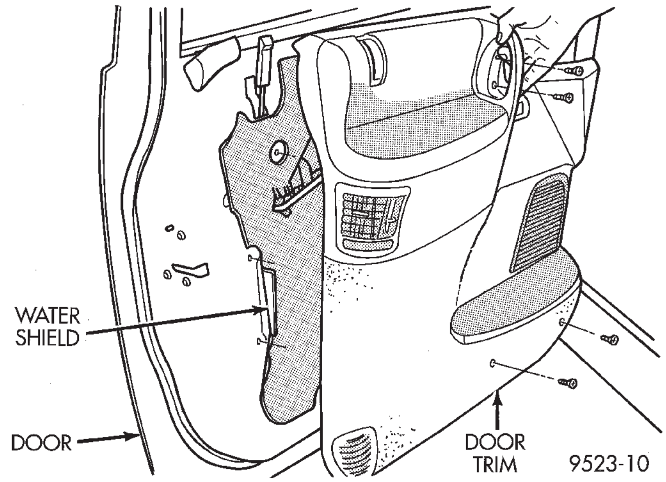


Fig. 28 Front Door Trim Panel

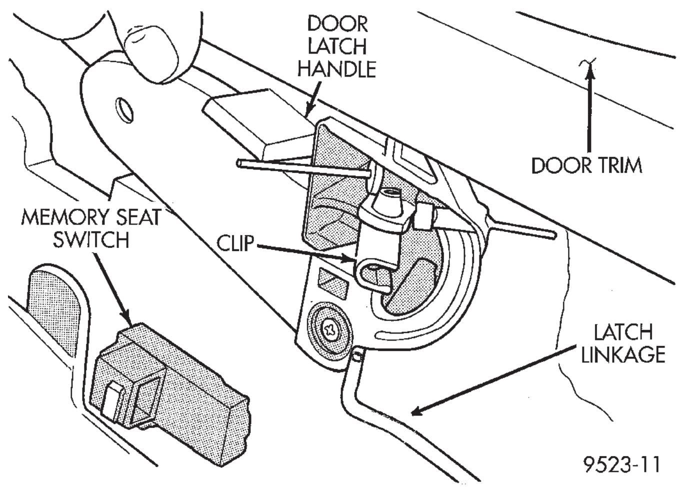


Fig. 29 Inside Door Handle Linkage

(2) Place linkage rod in position on latch handle.

(3) Engage clip to hold linkage rod to inside latch release handle.

(4) Place front door trim panel in position on door.

(5) Install trim panel into inner belt molding at top of door.

(6) Install clips to attach door trim to door frame around perimeter of panel.

(7) If equipped, install screw to attach door trim to door panel behind inside latch release handle.

(8) If equipped, connect power switch into wire connector.

(9) Place power accessary switch in position on door trim.

(10) Connect wire connector into memory seat/mirror switch and install switch into trim panel.

(11) Install screws to attach accessary switch panel to door trim.

(12) Install screw cover into switch panel.

(13) If equipped, install window crank.

(14) If equipped, install screws to attach trim panel to door inside map pocket.

REMOVAL AND INSTALLATION (Continued)

(15) If equipped, install screw to attach door pull cup to inner door panel.

(16) If equipped, install screws to attach door assist handle to inner door panel.

(17) Connect wire connector into courtesy lamp.

(18) Install lamp in door trim.

FRONT DOOR WEATHER-STRIP

REMOVAL

(1) Open front door.

(2) Using fork tool (C-4829), remove push-in fasteners holding front door weather-strip to end frames and bottom of door (Fig. 30).

(3) Pull weather-strip from retaining channel around window frame.

(4) Remove weather-strip from vehicle.

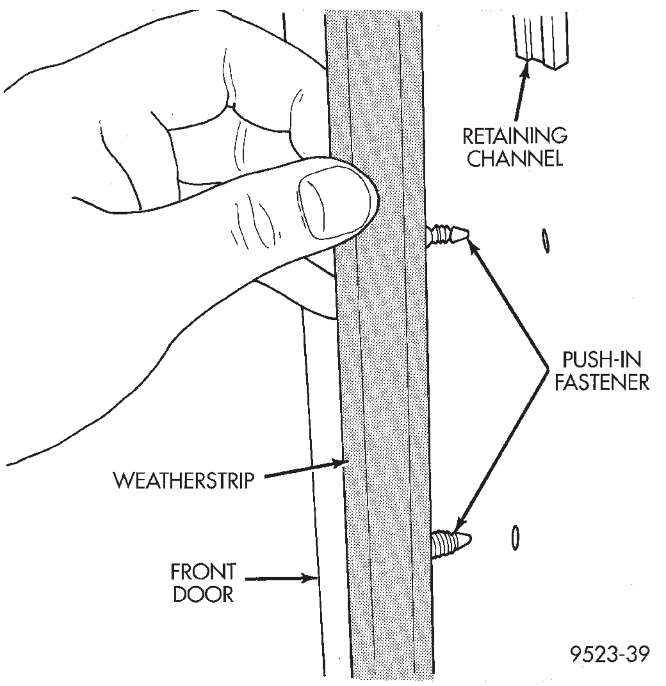


Fig. 30 Front Door Weather-strip

INSTALLATION

For installation, reverse the above procedures.

FRONT DOOR WINDOW CRANK

REMOVAL

(1) Using a suitable tool, disengage clip holding window crank to regulator shaft (Fig. 31).

(2) Pull window crank from regulator shaft.

INSTALLATION

(1) Position window crank to regulator shaft.

(2) Push window crank onto regulator shaft to engage retaining clip.

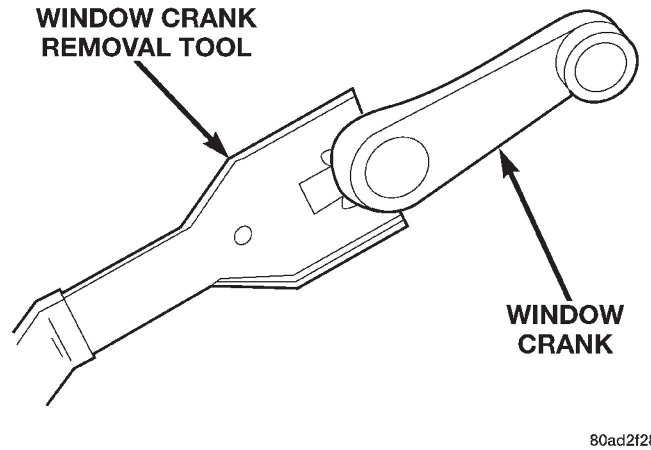


Fig. 31 Window Crank

FRONT DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove door glass retaining clips and allow glass to rest on bottom of door.

(3) Disconnect wire connector from power window motor, if equipped. Refer to Group 8S, Power Windows, for proper procedures.

(4) Loosen screws attaching front and rear window guide rails to inner door panel (Fig. 32).

(5) Remove screw heads on guide rails from key hole slots in inner door panel.

(6) Loosen screws attaching regulator to inner door panel.

(7) Remove regulator from inner door panel.

(8) Extract rear guide rail through inner door panel rear access hole (Fig. 33).

(9) Extract front guide rail through front access hole.

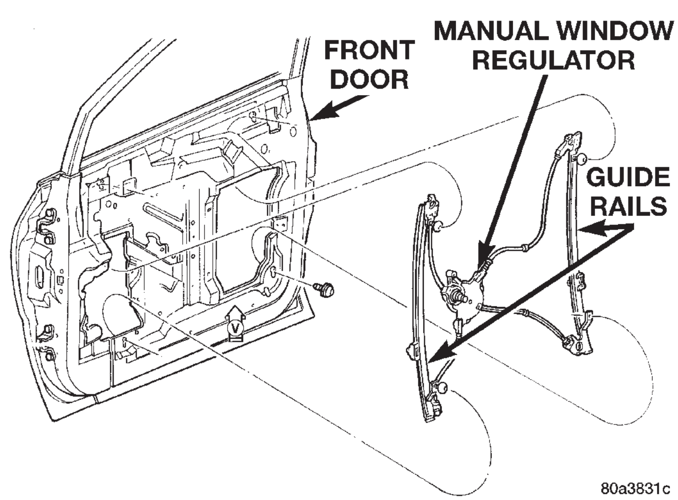


Fig. 32 Front Door Manual Window Regulator

REMOVAL AND INSTALLATION (Continued)

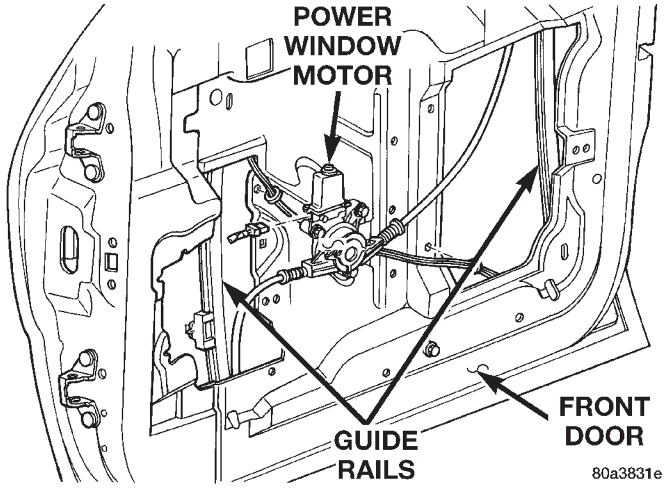


Fig. 33 Front Door Power Window Regulator

INSTALLATION

(1) Insert front guide rail through front access hole.

(2) Insert rear guide rail through rear access hole.

(3) Place window regulator in position on inner door panel.

(4) Place screw heads on guide rails in position through key hole slots in inner door panel.

(5) Tighten screws to attach front and rear guide rails to inner door panel.

(6) Connect wire connector into power window motor, if equipped.

(7) Install door glass.

(8) Verify door glass alignment and operation.

(9) Install water shield and door trim panel.

FRONT SEAT

REMOVAL

(1) From under vehicle, remove nuts attaching front seat risers to the floor.

(2) Remove seat and riser from floor (Fig. 34).

(3) Tip seat rearward and disconnect wire connectors from body harness, if equipped.

(4) Remove seat from vehicle.

INSTALLATION

For installation, reverse the above procedures.

FRONT WHEELHOUSE SPLASH SHIELD

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove front wheel. Refer to Group 22, Wheels and Tires, for proper procedures.

(3) Remove push-in fasteners holding splash shield to frame rail forward of suspension.

(4) Remove push-in fasteners holding splash shield to frame rail rearward of suspension.

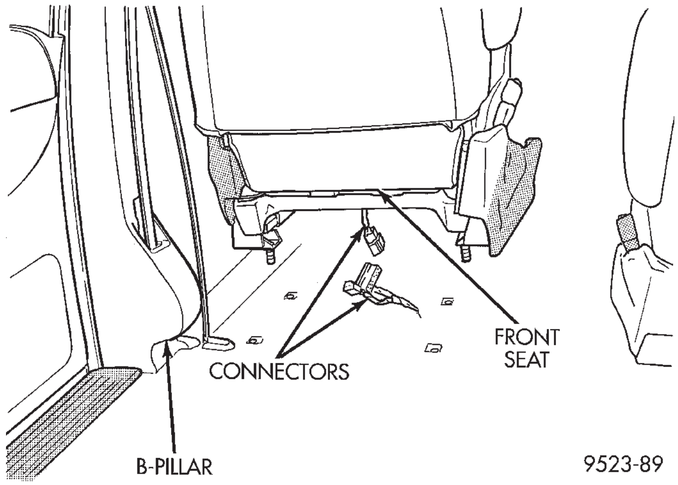


Fig. 34 Front Seat

(5) Remove screws holding wheelhouse splash shield to front fender.

(6) Remove splash shield from vehicle (Fig. 35).

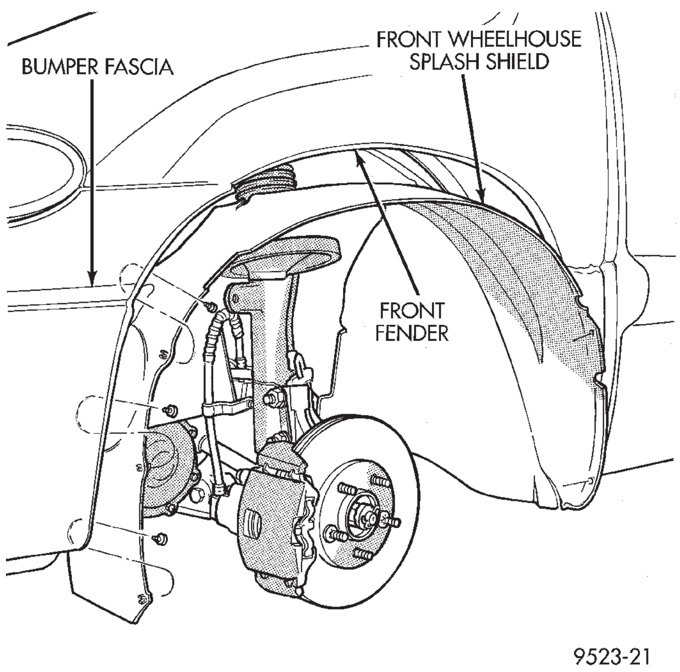


Fig. 35 Front Wheelhouse Splash Shield

INSTALLATION

(1) Place splash shield in position on vehicle (Fig. 35).

(2) Install screws to hold wheelhouse splash shield to front fender.

(3) Install push-in fasteners to hold splash shield to frame rail rearward of suspension.

(4) Install push-in fasteners to hold splash shield to frame rail forward of suspension.

(5) Install front wheel. Refer to Group 22, Wheels and Tires, for proper procedures.

(6) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

FUEL FILL DOOR BLOCKER LATCH

REMOVAL

(1) Remove left quarter trim panel.

(2) Remove water shield patch covering access hole in C-pillar.

(3) Disengage latch release link from clip on fuel fill blocker latch arm (Fig. 38).

(4) Remove screws holding fuel fill blocker latch to C-pillar (Fig. 36).

(5) Remove fuel fill blocker latch from vehicle.

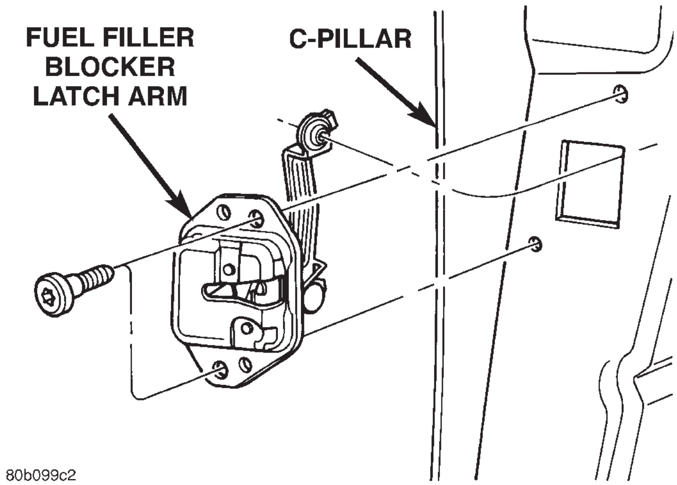


Fig. 36 FUEL FILL DOOR BLOCKER LATCH

INSTALLATION

(1) Position fuel fill blocker latch on vehicle.

(2) Install screws to hold fuel fill blocker latch to C-pillar.

(3) Engage latch release link into clip on fuel fill blocker latch arm with fuel door in the closed position.

(4) Install water shield patch to cover access hole in C-pillar.

(5) Verify fuel fill blocker latch operation.

(6) Install left quarter trim panel.

FUEL FILL DOOR BLOCKER LATCH STRIKER

REMOVAL

(1) Remove sliding door trim panel.

(2) Remove watershield as necessary to access striker

(3) Remove screws holding fuel fill door blocker latch striker to sliding door rear end frame (Fig. 37).

(4) Remove fuel fill door blocker latch striker from vehicle.

INSTALLATION

(1) Position fuel fill door blocker latch striker on vehicle.

(2) Install screws to hold fuel fill door blocker latch striker to sliding door rear end frame.

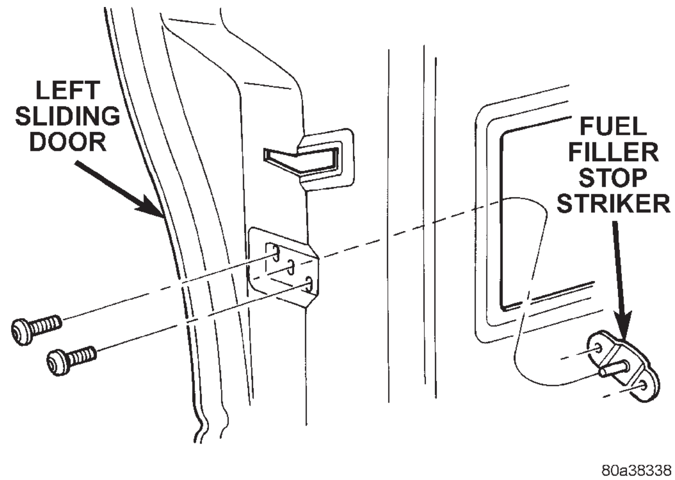


Fig. 37 Fuel Fill Door Blocker Latch Striker

(3) Install sliding door water shield.

(4) Install sliding door trim panel.

FUEL FILL DOOR BLOCKER LOCKOUT LINK

REMOVAL

(1) Remove left quarter trim panel.

(2) Remove water shield patch covering access hole in C-pillar.

(3) Disengage fuel filler lockout link from clip on fuel fill blocker latch arm (Fig. 38).

(4) Open fuel fill door.

(5) Remove screws holding fuel filler housing to fuel filler tube neck.

(6) Reaching inside fuel filler housing, release clips holding housing to outer quarter panel.

(7) Remove fuel filler housing and lockout link from vehicle.

(8) Disengage clip holding link to fuel fill door (Fig. 39).

(9) Remove link from fuel fill door.

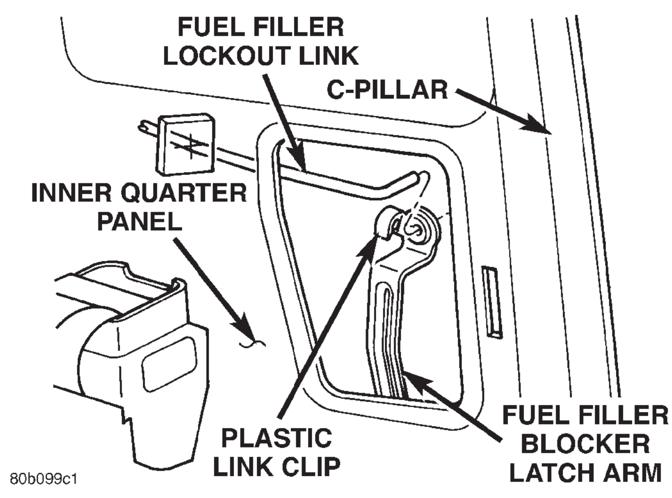


Fig. 38 Fuel Filler Lockout Link at Latch Arm

REMOVAL AND INSTALLATION (Continued)

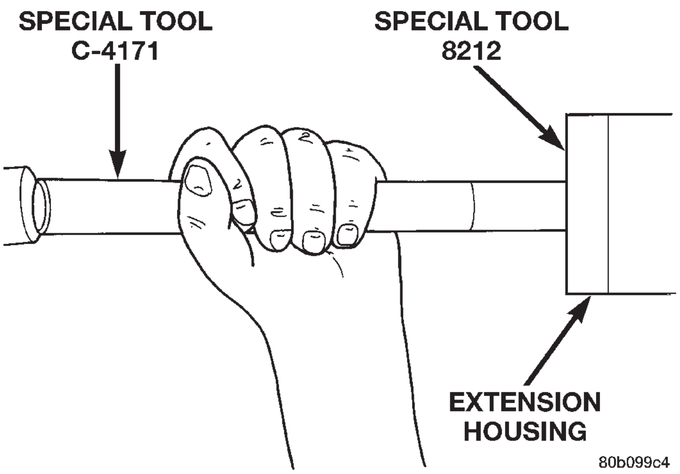


Fig. 39 Fuel Filler Lockout Link

INSTALLATION

(1) Insert link into clip on fuel fill door.

(2) Engage clip to hold link to fuel fill door.

(3) Insert lockout link through grommet in panel between inner and outer quarter panel.

(4) Close fuel fill door.

(5) Install fuel filler housing to outer quarter panel.

(6) Verify that all clips on fuel filler housing are fully engaged to outer quarter panel.

(7) Engage fuel filler lockout link into clip on fuel fill blocker latch arm.

(8) Install water shield patch covering access hole in C-pillar.

(9) Install left quarter trim panel.

FUEL FILLER HOUSING – WITH BLOCKER LATCH

REMOVAL

(1) Remove left quarter trim panel.

(2) Remove water shield patch covering access hole in C-pillar.

(3) Disengage latch release link from clip on fuel fill blocker latch arm (Fig. 38).

(4) Open fuel fill door.

(5) Remove screws holding fuel fill neck to fuel filler housing.

(6) Position fuel fill neck out of the way.

(7) Reaching inside fuel filler housing, release clips holding housing to quarter panel (Fig. 40).

(8) Remove fuel fill door from vehicle.

(9) Disengage clip holding link to fuel fill door (Fig. 39).

(10) Remove link from fuel fill door.

INSTALLATION

(1) Install spring to housing and door

(2) Snap door into housing.

(3) Insert lockout link into clip on fuel fill door.

(4) Engage clip to hold link to fuel fill door.

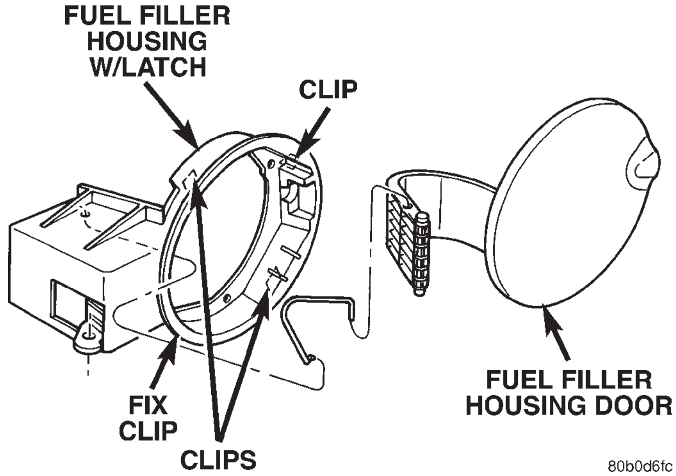


Fig. 40 Fuel Filler Housing and Door

(5) Insert lockout link through grommet in panel between inner and outer quarter panel.

(6) Close fuel fill door.

(7) Install fuel filler housing to outer quarter panel.

(8) Verify that all clips on fuel filler housing are fully engaged to outer quarter panel.

(9) Place fuel fill neck in position.

(10) Install screws to hold fuel fill neck to fuel filler housing.

(11) Engage latch release link into clip on fuel fill blocker latch arm.

(12) Verify fuel fill blocker latch operation.

(13) Install water shield patch to cover access hole in C-pillar.

(14) Install left quarter trim panel.

GRILLE

REMOVAL

(1) Remove front fascia. Refer to Group 13, Frame and Bumpers, for proper procedures.

(2) Disengage clips holding grille to front fascia (Fig. 41).

(3) Remove plastic rivets holding grille to fascia.

(4) Remove grille from fascia.

INSTALLATION

(1) Position grille on fascia.

(2) Install plastic rivets to hold grille to fascia.

(3) Install clips to hold grille to fascia along bottom of grille.

(4) Install front fascia. Refer to Group 13, Frame and Bumpers, for proper procedure.

HEADLINING

REMOVAL

(1) Remove sun visors and vanity mirrors.

(2) Remove sun visor center supports.

(3) If equipped, remove coat hooks.

(4) If equipped, remove roof rail modules.

REMOVAL AND INSTALLATION (Continued)

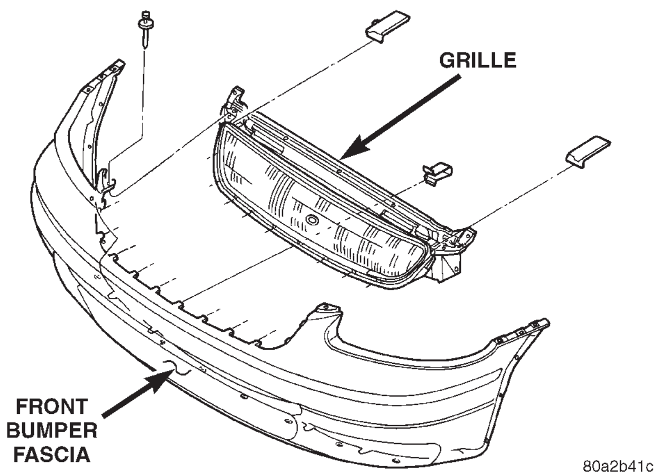


Fig. 41 Grille

(5) Remove A-pillar trim covers.
(6) Remove B-pillar upper trim covers.
(7) Remove C-pillar upper trim covers.
(8) Remove D-pillar upper trim covers.
(9) Remove rear door opening header trim.
(10) If equipped, remove overhead console.
(11) If equipped, remove reading lamp.
(12) Remove dome lamp.
(13) Remove push-in locking fasteners holding headlining to rear roof header (Fig. 42) or (Fig. 43).
(14) Remove headlining from roof.
(15) Extract headlining through rear door opening.

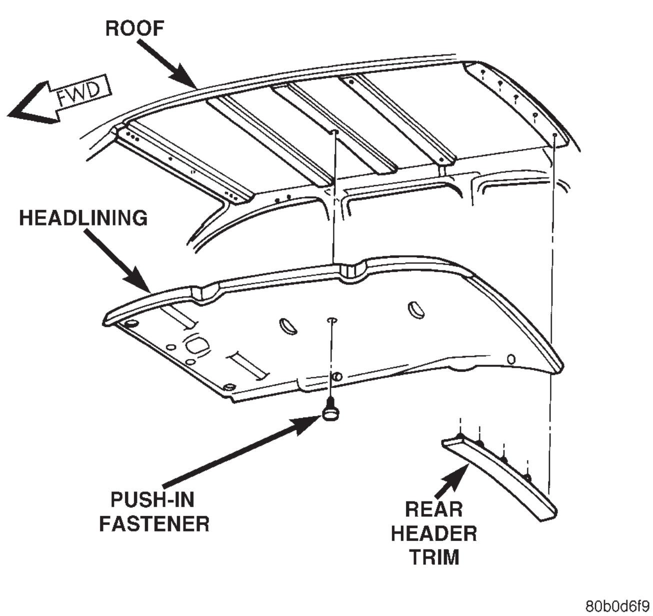


Fig. 42 Headlining – SWB

INSTALLATION

(1) Insert headlining through rear door opening.
(2) Place headlining in position on roof.
(3) Install left sun visor support.

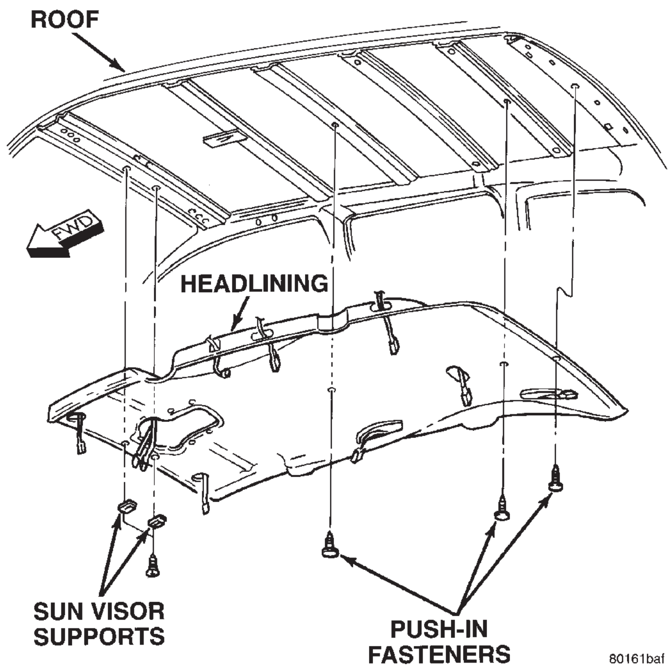


Fig. 43 Headlining – LWB

(4) Install push-in locking fasteners to hold headlining to rear roof header (Fig. 42) or (Fig. 43).
(5) Install right sun visor support.
(6) Install sun visors and vanity mirrors.
(7) If equipped, install roof rail modules.
(8) If equipped, install coat hooks.
(9) Install dome lamp.
(10) If equipped, install reading lamp.
(11) If equipped, install overhead console.
(12) Install rear door opening header trim.
(13) Install D-pillar upper trim covers.
(14) Install C-pillar upper trim covers.
(15) Install B-pillar upper trim covers.
(16) Install A-pillar trim covers.

HOOD

REMOVAL

(1) Raise hood to full up position.
(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation.
(3) Remove the top bolts holding hood to hinge and loosen the bottom bolts until they can be removed by hand (Fig. 44).
(4) With assistance from a helper at the opposite side of the vehicle to support the hood, remove bottom bolts holding hood to hinge.
(5) Remove the hood from the vehicle.

INSTALLATION

(1) Place hood in position on vehicle. With assistance from a helper at the opposite side of the vehicle

REMOVAL AND INSTALLATION (Continued)

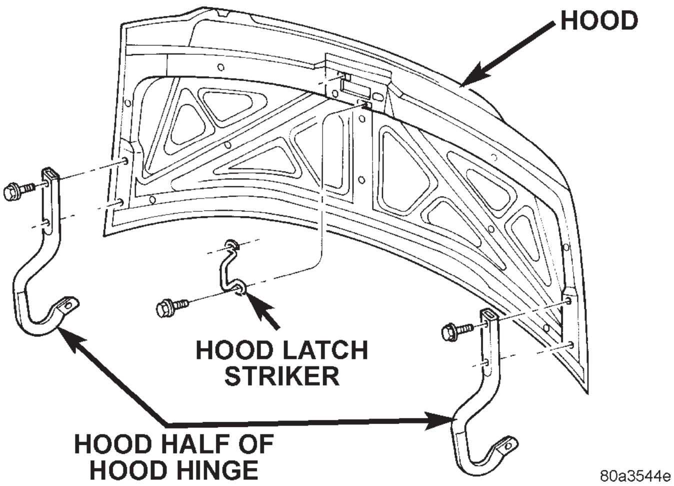


Fig. 44 Hood

to support the hood, install bottom bolts to hold hood to hinge finger tight.

(2) Install top bolts to hold hood to hinge finger tight.

(3) Position bolts at marks and tighten bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders.

(4) Verify hood operation and alignment.

HOOD HINGE

REMOVAL

(1) Remove hood.

(2) Remove wiper unit. Refer to Group 8K, Windshield Wipers and Washers, for procedure.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation.

(4) Remove bolts attaching body half of hood hinge to front fender flange and remove hinge from vehicle (Fig. 45).

INSTALLATION

(1) If necessary, paint new hinge before installation.

(2) Place body half of hood hinge in position on vehicle.

(3) Install bolts to hold hood hinge to front fender flange.

(4) Install wiper unit. Refer to Group 8K, Windshield Wipers and Washers, for proper procedures.

(5) Install hood.

(6) Align all marks and secure bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders. Shims can be added or removed under hood hinge to achieve proper hood height.

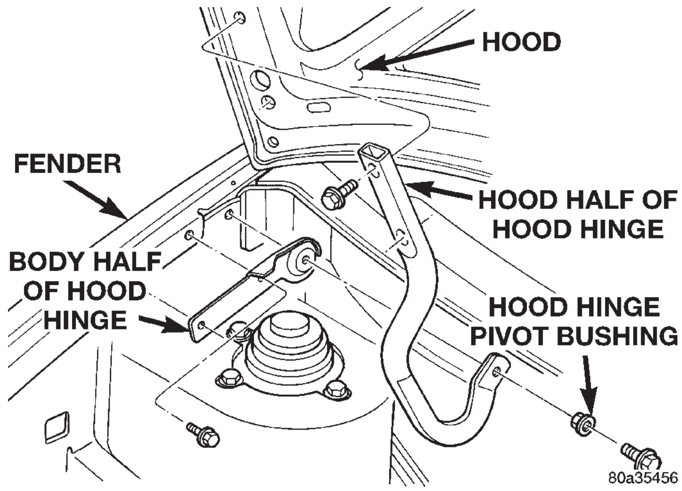


Fig. 45 Hood Hinge

HOOD LATCH

REMOVAL

(1) Release hood latch and open hood.

(2) Remove bolts holding hood latch to radiator closure panel crossmember (Fig. 46).

(3) Remove hood latch from crossmember.

(4) Disconnect hood release cable from hood latch (Fig. 47).

(5) Remove hood latch from vehicle.

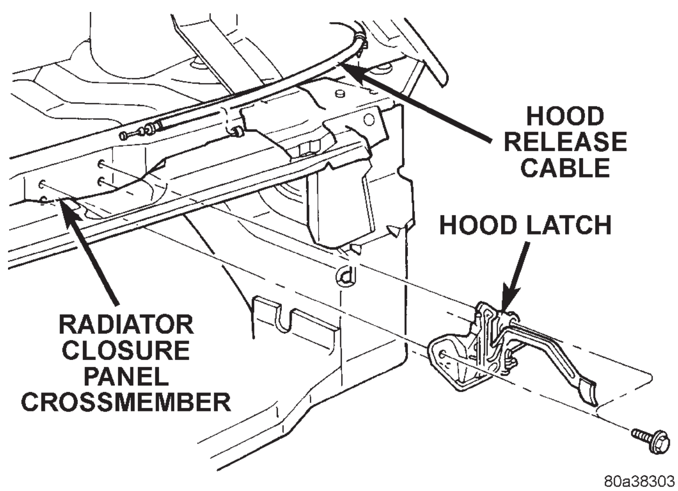


Fig. 46 Hood Latch

INSTALLATION

(1) Position hood latch on vehicle.

(2) Connect hood release cable from hood latch.

(3) Position hood latch on crossmember.

(4) Align hood latch by placing latch over net-pierced tabs. If alignment is required, flatten tabs.

(5) Install bolts attaching hood latch to radiator closure panel crossmember.

(6) Verify hood operation and alignment. Adjust as necessary.

REMOVAL AND INSTALLATION (Continued)

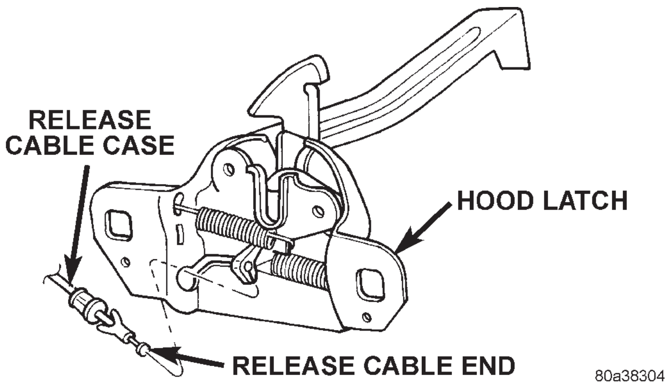


Fig. 47 Hood Release Cable End Attachment

(7) Tighten attaching bolts to 11 to 16 N·m (100 to 140 in. lbs.) torque.

HOOD LATCH STRIKER

REMOVAL

(1) Release hood latch and open hood.

(2) Remove bolts holding striker to inside of hood (Fig. 44).

(3) Remove hood latch striker from vehicle.

INSTALLATION

(1) Position hood latch striker on vehicle.

(2) Install bolts to hold hood latch striker to hood.

(3) Align hood latch striker to engage smoothly into hood latch.

(4) Verify hood operation and alignment. Adjust as necessary.

(5) Tighten attaching bolts to 11 to 16 N·m (100 to 140 in. lbs.) torque.

HOOD RELEASE CABLE

REMOVAL

(1) Remove hood latch.

(2) Disengage cable end from hood latch locking mechanism.

(3) Slide cable case end sideways in keyhole slot of hood latch while pinching barb on cable case closed.

(4) Remove cable from latch (Fig. 47).

(5) Remove hood release handle from instrument panel.

(6) Disengage rubber grommet cable insulator from hole in dash panel.

(7) Attach a suitable length of mechanic's wire to latch end of cable to assist cable installation.

(8) Route cable back from latch through engine compartment toward dash panel near power brake booster (Fig. 48).

(9) Remove attaching clips from cable case.

(10) From inside vehicle, pull cable through dash panel until mechanic's wire is exposed.

(11) Disconnect cable from mechanic's wire.

(12) Remove hood release cable from vehicle.

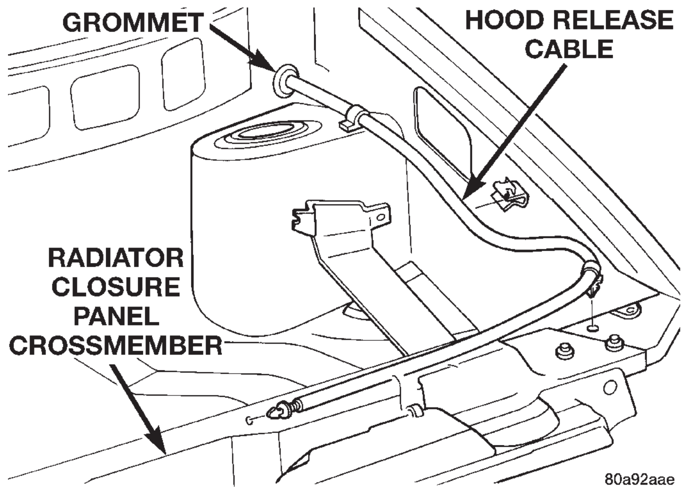


Fig. 48 Hood Release Cable Routing

INSTALLATION

(1) Place hood release cable in position under instrument panel.

(2) Attach latch end of hood release cable to mechanic's wire protruding through dash panel.

(3) Route cable forward through engine compartment toward latch by pulling on mechanic's wire (Fig. 48).

(4) Disconnect mechanic's wire from cable.

(5) Engage rubber grommet cable insulator into hole in dash panel.

(6) Install hood release handle into instrument panel.

(7) Place cable in position on latch.

(8) Slide cable case end sideways into keyhole slot of hood latch.

(9) Engage cable end into hood latch locking mechanism.

(10) Install hood latch.

(11) Install attaching clips to cable case and install clips into original holes in strut tower, fender, headlamp area, and radiator closure panel crossmember.

HOOD RELEASE HANDLE

REMOVAL

(1) Remove lower steering column cover and knee blocker reinforcement. Refer to Group 8E, Instrument Panel and Systems for proper procedures.

(2) Remove hood latch cable.

(3) Remove screws holding hood latch release handle to instrument panel brace (Fig. 49).

(4) Remove hood latch release handle from vehicle.

INSTALLATION

(1) Position hood latch release handle on vehicle.

(2) Install screws to hold hood latch release handle to instrument panel brace.

REMOVAL AND INSTALLATION (Continued)

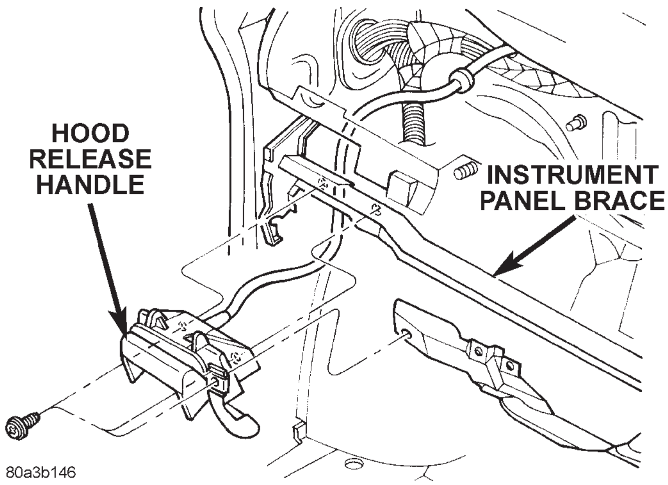


Fig. 49 Hood Release Handle

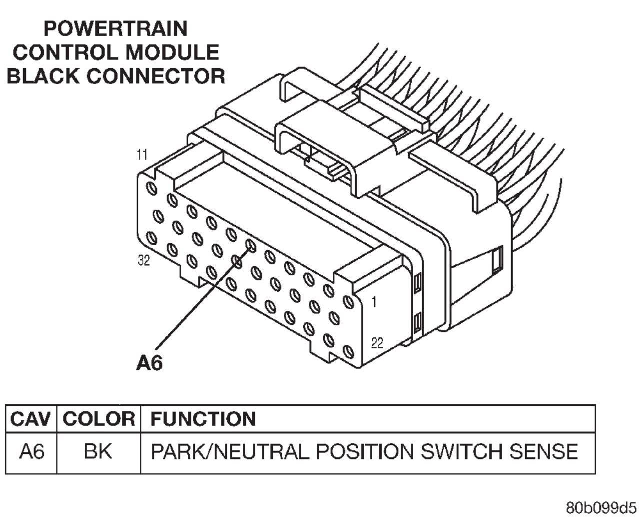
(3) Install hood latch cable.
(4) Install lower steering column cover and knee blocker reinforcement.

JACK STORAGE COVER

LONG WHEEL BASE

REMOVAL

(1) Depress latch handle at top of jack storage cover (Fig. 50).
(2) Pull outward at top of cover to disengage latch.
(3) Remove jack storage cover from vehicle.



CAV	COLOR	FUNCTION
A6	BK	PARK/NEUTRAL POSITION SWITCH SENSE

Fig. 50 Jack Storage Cover – LWB

INSTALLATION

(1) Place jack storage cover in position on vehicle.
(2) Align guide pins.
(3) Push inward at top of cover to engage latch and fastener.

SHORT WHEEL BASE

REMOVAL

(1) Open quarter panel bin storage cover.
(2) Lift upward and rearward on jack storage cover retaining latch to disengage (Fig. 51).
(3) Remove jack storage cover from vehicle.

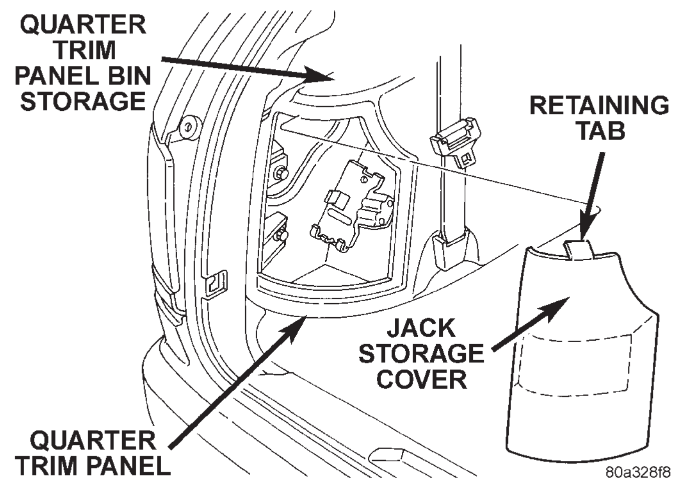


Fig. 51 Jack Storage Cover – SWB

INSTALLATION

(1) Position jack storage cover to vehicle.
(2) Snap storage cover latch into position on quarter trim panel.
(3) Close quarter trim panel bin storage cover.

LEFT D-PILLAR TRIM PANEL

REMOVAL

(1) Remove rear header trim cover.
(2) Remove liftgate sill plate.
(3) Remove second rear seat belt turning loop on long wheel base vehicle.
(4) Remove bolt holding second rear seat belt lower anchor to quarter on short wheel base vehicle.
(5) Remove jack storage cover.
(6) Remove screws holding trim panel to D-pillar (Fig. 52), (Fig. 53), and (Fig. 54).
(7) Disengage hidden clips holding trim to D-pillar.
(8) Disconnect speaker wire connector, if equipped.
(9) Pass seat belt through slot in D-pillar trim panel on short wheel base vehicle.
(10) Remove D-pillar trim from vehicle.

INSTALLATION

(1) Pass seat belt through slot in D-pillar trim panel on short wheel base vehicle.
(2) Position D-pillar trim panel on vehicle.

REMOVAL AND INSTALLATION (Continued)

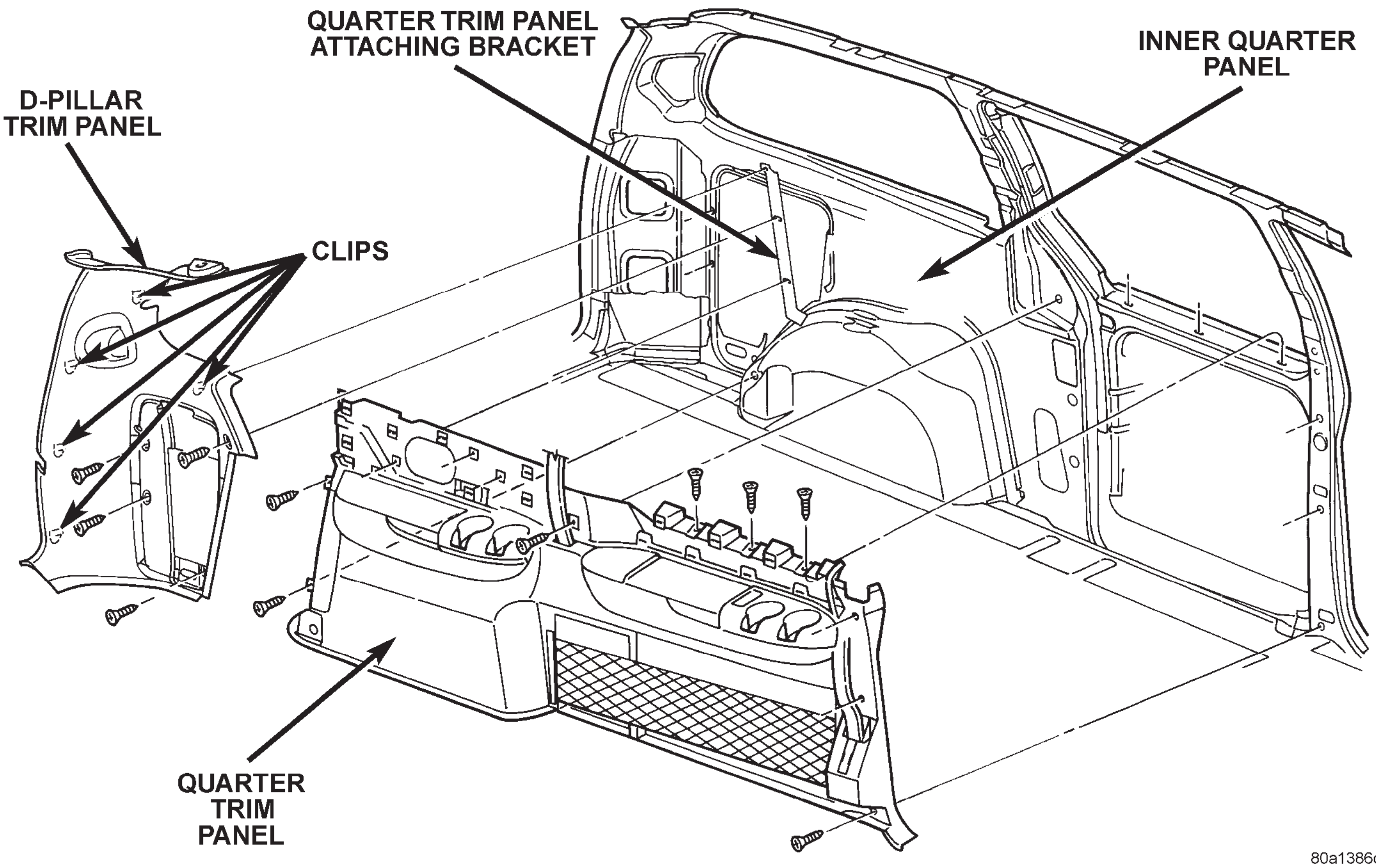


Fig. 52 Left Quarter and D-Pillar Trim Panels – LWB 3 Door

(3) Connect speaker wire connector to speaker, if equipped.

(4) Align locating pins on backside of trim panel to mating holes in inner quarter panel.

(5) Engage hidden clips to hold trim to D-pillar.

(6) Install screws to hold trim to D-pillar.

(7) Install jack storage cover.

(8) Install bolt to hold second rear seat belt lower anchor to quarter on short wheel base vehicle. Tighten all seat belt bolts to 39 N·m (29 in. lbs.).

(9) Install second rear seat belt turning loop on long wheel base vehicle.

(10) Install liftgate sill plate.

(11) Install rear header trim cover.

LEFT QUARTER TRIM PANEL

REMOVAL

CAUTION: Disconnect the negative cable clamp from battery post. Damage to accessory feed circuit can result.

(1) Remove first rear seat.

(2) Remove second rear seat, if equipped.

(3) Remove front door sill plate on three door vehicle.

(4) Remove sliding door sill plate on four door vehicle.

(5) Remove left quarter trim bolster.

(6) Remove upper left B-pillar trim on three door vehicle.

(7) Remove C-pillar trim panel.

(8) Remove left D-pillar trim panel.

(9) Remove first rear seat belt anchor.

(10) Remove second rear seat belt anchor on long wheel base vehicle.

(11) Remove left front seat belt opening bezel from quarter trim on three door vehicle.

(12) Remove screws holding quarter trim to quarter panel in B-pillar area on three door vehicle (Fig. 52) and (Fig. 54).

(13) Remove screws holding quarter trim to quarter panel from bolster area (Fig. 52), (Fig. 53), and (Fig. 54).

(14) Remove screws holding rear edge of quarter trim to attaching bracket or inner quarter trim panel.

(15) Remove screws holding top of trim panel to inner sheet metal between B-pillar and C-pillar on three door vehicle.

(16) Disconnect wire connector from accessory power outlet, if equipped.

(17) Remove quarter trim from quarter panel.

REMOVAL AND INSTALLATION (Continued)

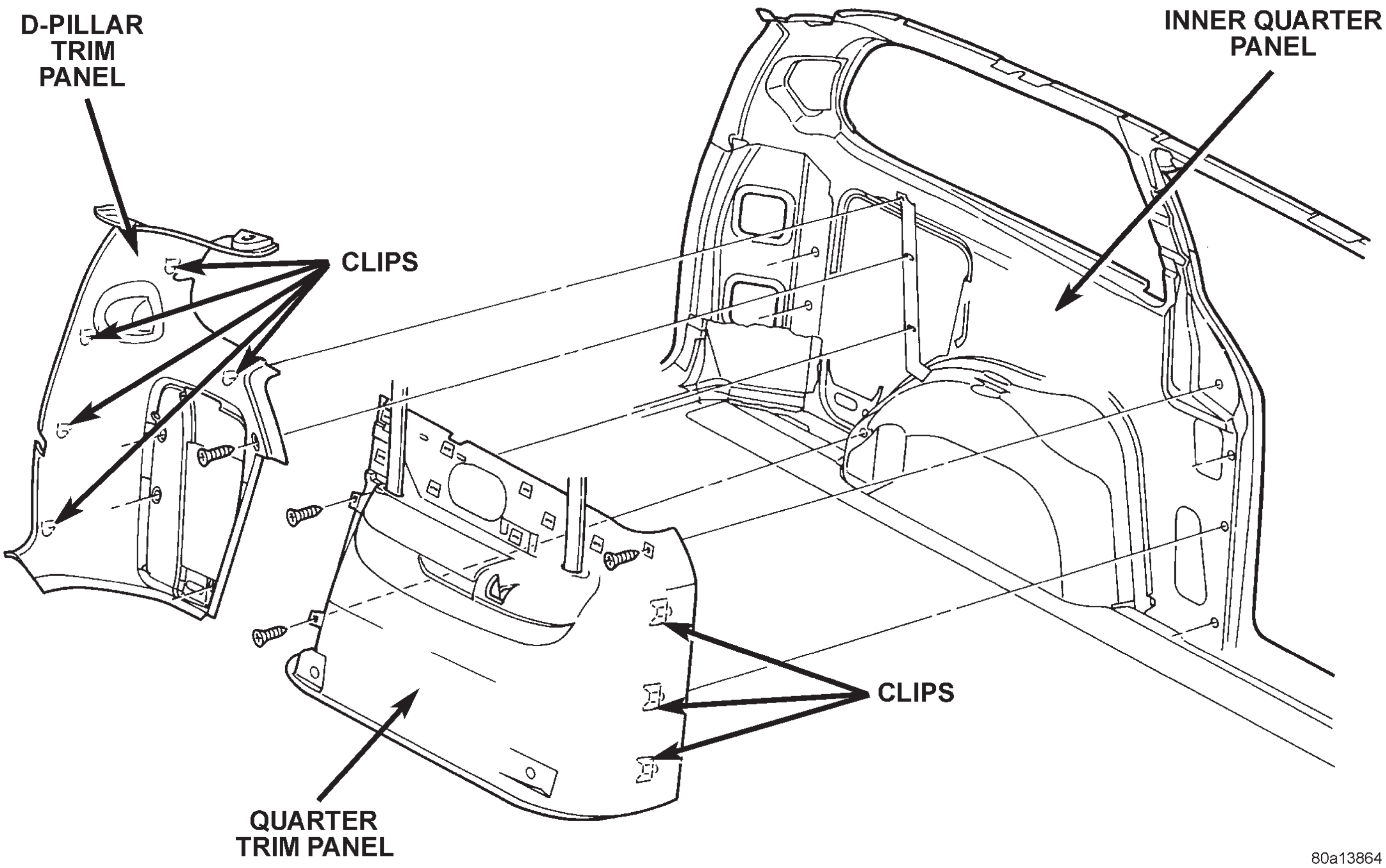


Fig. 53 Left Quarter and D-Pillar Trim Panels – LWB Four Door

(18) Pass front seat belt and turning loop through slot in quarter trim panel on three door vehicle.

(19) Pass first rear seat belt through slot in quarter trim panel.

(20) Pass second rear seat belt, if equipped, through slot in quarter trim panel on long wheel base vehicle.

(21) Remove quarter trim panel from vehicle.

INSTALLATION

(1) Position quarter trim panel on vehicle.

(2) Pass second rear seat belt, if equipped, through slot in quarter trim panel on long wheel base vehicle.

(3) Pass first rear seat belt through slot in quarter trim panel.

(4) Pass front seat belt through slot in quarter trim panel on three door vehicle.

(5) Connect wire connector into accessory power outlet, if equipped.

(6) Align locating pins on backside of trim panel to mating holes in inner panels.

(7) Position quarter trim panel on inner quarter panel.

(8) Install screws to hold top of trim panel to inner sheet metal between B-pillar and C-pillar on three door vehicle.

(9) Install screws to hold rear edge of quarter trim to attaching bracket or inner quarter panel.

(10) Install screws to hold quarter trim to inner quarter panel in bolster area.

(11) Install screws to hold quarter trim to inner quarter panel in B-pillar area on three door vehicle.

(12) Install left front seat belt opening bezel into quarter trim on three door vehicle.

(13) Install second rear seat belts anchor on long wheel base vehicle. Tighten all seat belt bolts to 39 N·m (28 in. lbs.) torque.

(14) Install first rear seat belt anchor.

(15) Install left D-pillar trim panel.

(16) Install C-pillar trim panel.

(17) Install upper left B-pillar trim on three door vehicle.

(18) Install left quarter trim bolster.

(19) Install front door sill plate on three door vehicle.

(20) Install sliding door sill plate on four door vehicle.

(21) Install second rear seat, if equipped.

(22) Install first rear seat.

(23) Connect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

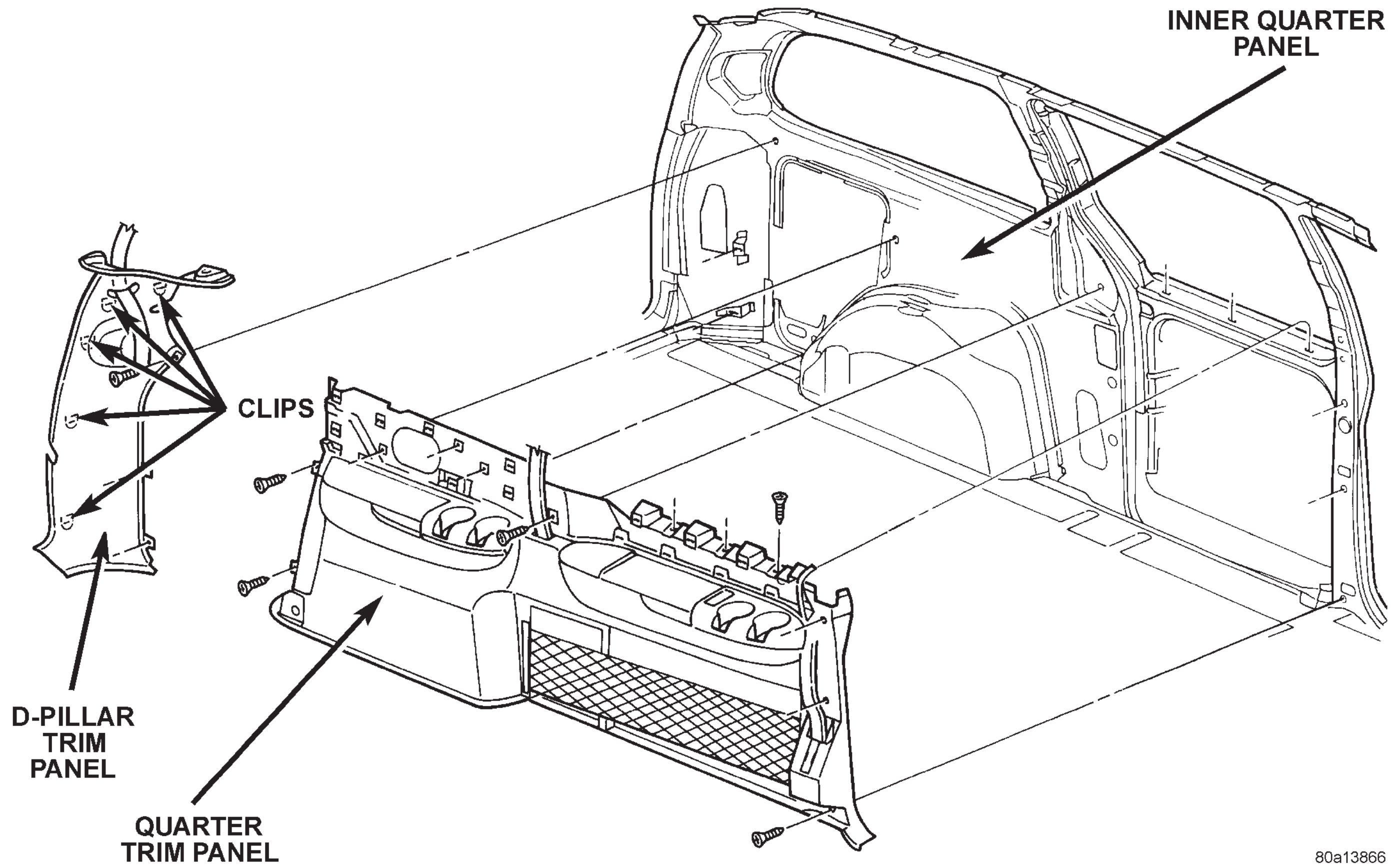


Fig. 54 Left Quarter and D-Pillar Trim Panels – SWB

LIFTGATE

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Remove screws holding liftgate wire connector to rear header.

(3) Disconnect liftgate wire harness from body wire harness.

(4) Remove liftgate upper frame molding.

(5) Disconnect rear window washer hose from spray nozzle.

(6) Support liftgate on a suitable lifting device.

(7) Remove screws holding support cylinders to liftgate.

(8) Remove bolts holding liftgate hinge to roof header (Fig. 55).

(9) With assistance, remove liftgate from vehicle.

INSTALLATION

(1) With assistance, place liftgate in position on vehicle.

(2) Install bolts to hold liftgate hinge to roof header.

(3) Install screws to hold support cylinders to liftgate.

(4) Remove lifting device from under liftgate.

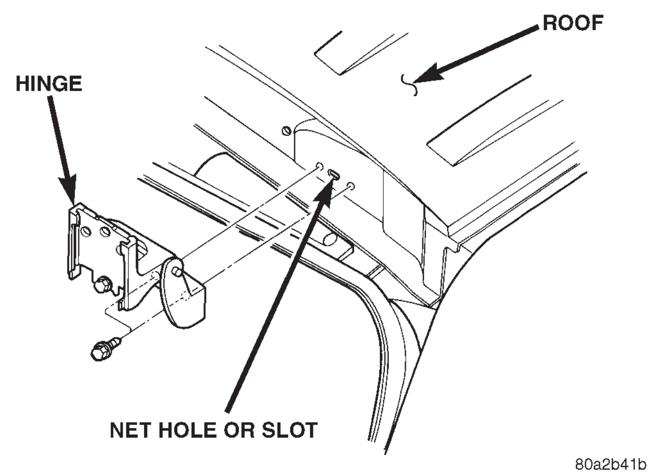


Fig. 55 Liftgate

(5) Connect liftgate wire harness into body wire harness.

(6) Install screws to holding wire connector to rear header.

(7) Connect rear window washer hose onto spray nozzle.

(8) Install liftgate upper frame molding.

REMOVAL AND INSTALLATION (Continued)

(9) Verify liftgate alignment. The liftgate should have a gap to adjacent panels and fit flush across the gaps. The gap is;

- 7 mm (0.280 in.) to the fascia,
- 6 mm (0.240 in.) to the roof,
- 4 mm (0.160 in.) to the aperture.

LIFTGATE CHMSL ACCESS PANEL

REMOVAL

(1) Using a trim stick (C-4755), disengage clips holding CHMSL access panel to liftgate trim panel.

(2) Remove access panel from vehicle.

INSTALLATION

(1) Place access panel in position on vehicle.

(2) Engage clips to hold CHMSL access panel to liftgate trim panel.

LIFTGATE HINGE

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Support liftgate on a suitable lifting device.

(3) Apply several layers of duct tape on the outside of to roof across the gap to the lift gate to hold the liftgate in position.

(4) Remove bolts holding liftgate hinge to roof header.

(5) Remove bolts holding hinge to liftgate (Fig. 56).

(6) Remove hinge from vehicle.

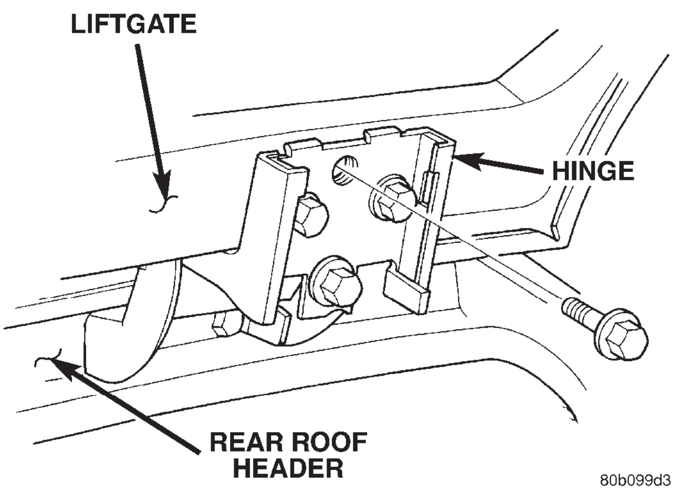


Fig. 56 Liftgate Hinge

INSTALLATION

(1) If necessary, paint replacement hinge before installation.

(2) Place hinge in position on vehicle.

(3) Align hinge to marks on liftgate.

(4) Install bolts to hold hinge to liftgate (Fig. 56).

(5) Align hinge to marks on roof header.

(6) Install bolts to hold liftgate hinge to roof header.

(7) Remove duct tape from roof and liftgate.

(8) Support liftgate on a suitable lifting device.

(9) Verify liftgate alignment. Refer to Liftgate Remove and Installation for proper gap measurements.

LIFTGATE LATCH

REMOVAL

(1) Remove liftgate trim panel.

(2) Disengage outside handle link from clip on latch.

(3) Disconnect wire connector from liftgate ajar switch (Fig. 57).

(4) Remove screws holding latch to liftgate.

(5) Remove latch from vehicle.

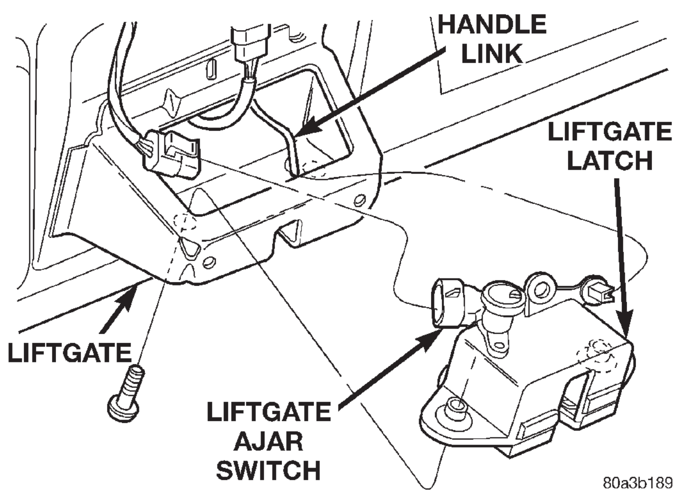


Fig. 57 Liftgate Latch

INSTALLATION

(1) Place latch in position on vehicle.

(2) Install screws to hold latch to liftgate.

(3) Pull downward on outside handle link and engage link to clip on latch.

(4) Connect wire connector to liftgate ajar switch.

(5) Verify liftgate fit and operation. Adjust as necessary.

(6) Install liftgate trim panel.

LIFTGATE LATCH STRIKER

REMOVAL

(1) Open liftgate.

(2) Mark outline of striker on sill to aid installation.

(3) Remove screws attaching striker to sill (Fig. 58).

(4) Remove striker from vehicle.

REMOVAL AND INSTALLATION (Continued)

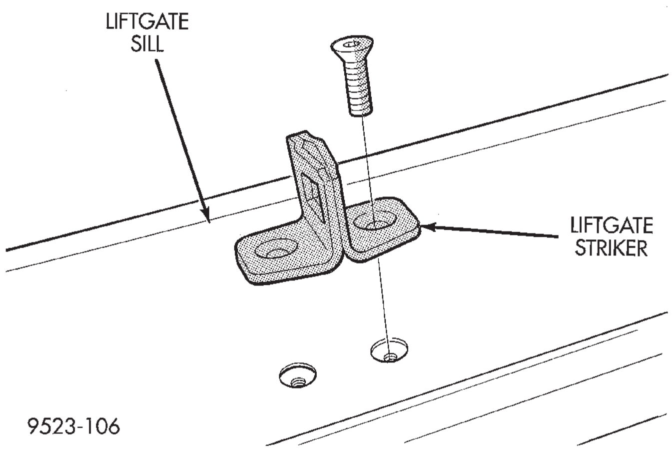


Fig. 58 Liftgate Latch Striker

INSTALLATION

(1) Place striker in position on vehicle.
(2) Align striker to outline mark on sill.
(3) Install screws to attach striker to sill.
(4) Verify liftgate alignment and operation.

LIFTGATE LOCK CYLINDER

REMOVAL

NOTE: Do not remove E-clip.

(1) Remove outside liftgate handle.
(2) Remove lock cylinder clip from handle (Fig. 59).
(3) Remove lock cylinder and arm from handle.

INSTALLATION

(1) Install lock cylinder clip into liftgate handle.
(2) Push lock cylinder into handle until clip engages groove in lock cylinder with an audible click (Fig. 60).
(3) Install outside liftgate handle.
(4) Verify lock cylinder operation.

LIFTGATE OUTSIDE HANDLE

REMOVAL

(1) Remove liftgate trim panel.
(2) Remove power lock motor.
(3) Disengage outside handle link from clip on liftgate latch.
(4) Disconnect VTSS switch from back of lock cylinder, if equipped.
(5) Disengage lock link, if equipped.
(6) Remove nut attaching outside liftgate handle to liftgate (Fig. 61).
(7) Disengage retaining groove holding handle to liftgate.
(8) Remove outside liftgate handle and links from vehicle.

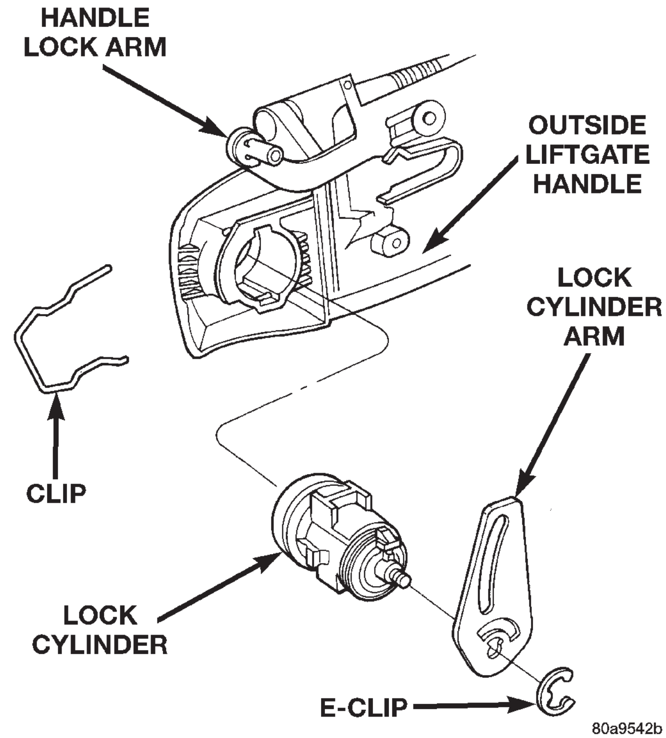


Fig. 59 Lock Cylinder Removal

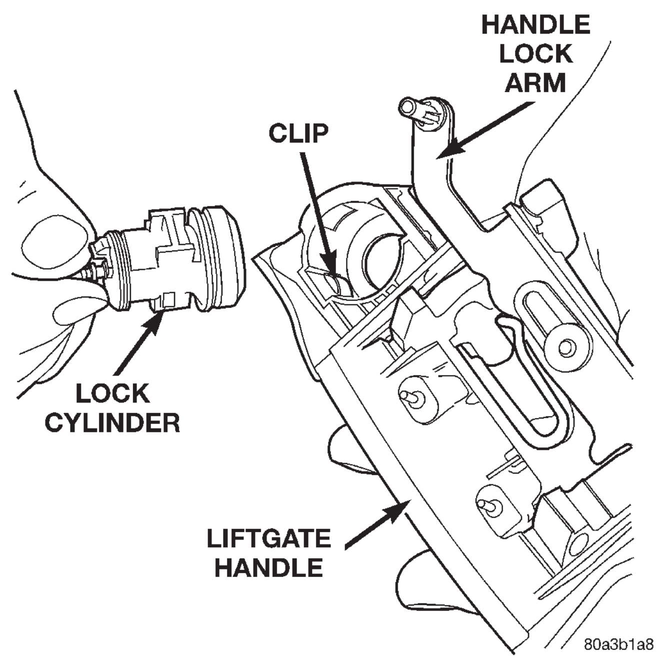


Fig. 60 Lock Cylinder Installation

INSTALLATION

(1) Position outside liftgate handle and links on vehicle.
(2) Engage retaining groove to hold handle to liftgate by pushing handle to the right for centering.
(3) Install nut to attach outside liftgate handle to liftgate.

REMOVAL AND INSTALLATION (Continued)

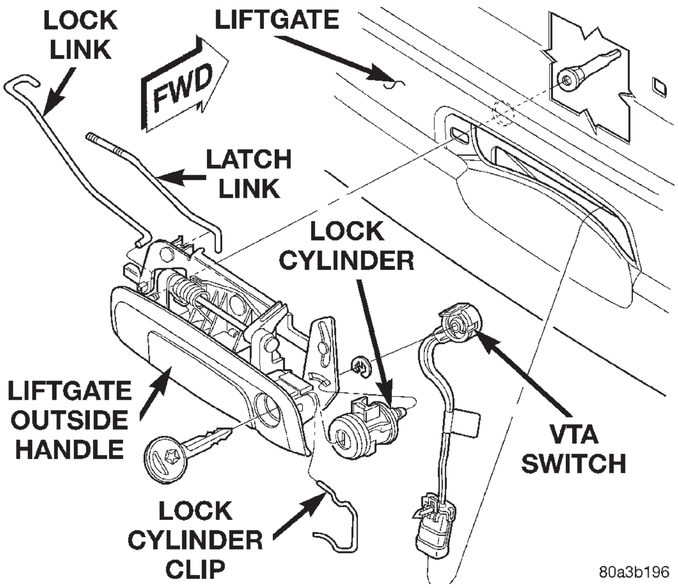


Fig. 61 Liftgate Outside Handle

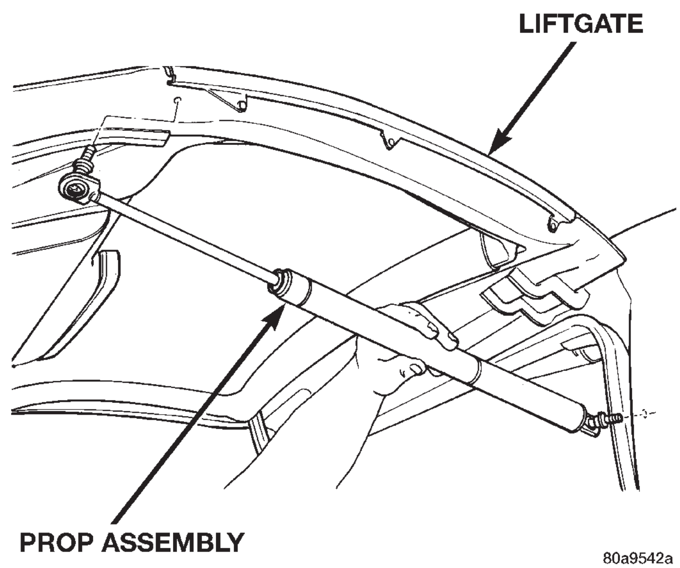


Fig. 62 Liftgate Prop Assembly

(4) Connect VTSS switch from back of lock cylinder, if equipped.

(5) Engage outside handle link to clip on liftgate latch.

(6) Install lock link, if equipped.

(7) Install power lock motor.

(8) Verify liftgate operation. Adjust as necessary.

(9) Install liftgate trim panel.

LIFTGATE PROP ASSEMBLY

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Support liftgate on a suitable lifting device.

(3) Pull liftgate opening weatherstrip from D-pillar flange next to prop assembly end pivot.

(4) Remove bolt holding end pivot to D-pillar (Fig. 62).

(5) Remove bolt holding prop assembly to liftgate.

(6) Remove prop assembly from vehicle.

INSTALLATION

For installation, reverse the above procedures.

LIFTGATE SILL PLATE

REMOVAL

(1) Disengage hidden clips holding sill plate to liftgate door opening sill (Fig. 63).

(2) Remove sill plate from vehicle.

INSTALLATION

(1) Place sill plate in position on vehicle.

(2) Align locator rib into recess in liftgate sill.

(3) Engage hidden clips to hold sill plate to liftgate door opening sill.

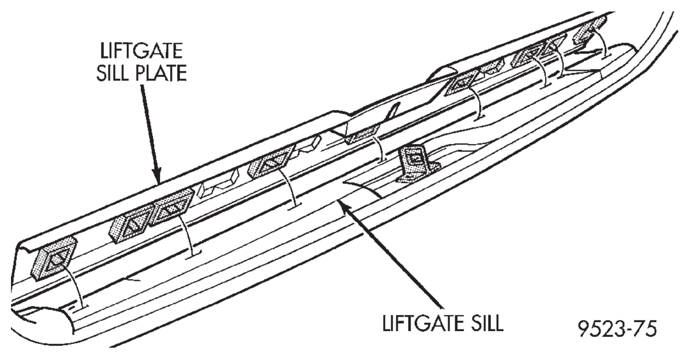


Fig. 63 Liftgate Sill Plate

LIFTGATE STABILIZER WEDGE

REMOVAL

(1) Open liftgate.

(2) Mark outline of stabilizer wedge on liftgate to aid installation.

(3) Remove rivets attaching wedge to liftgate (Fig. 64).

(4) Remove wedge from vehicle.

INSTALLATION

(1) Position stabilizer wedge on vehicle.

(2) Align stabilizer wedge to outline previously made on liftgate.

(3) Install rivet to hold wedge to liftgate.

(4) Verify liftgate fit and operation. Adjust as necessary.

LIFTGATE STABILIZER WEDGE STRIKER

REMOVAL

(1) Open liftgate.

REMOVAL AND INSTALLATION (Continued)

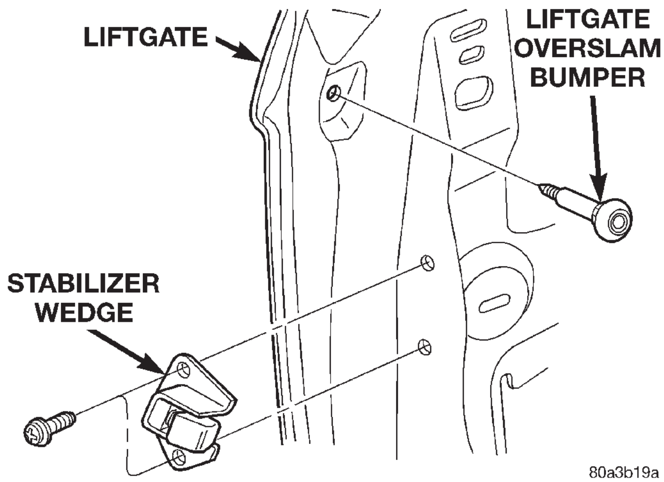


Fig. 64 Liftgate Wedge

(2) Remove screws attaching stabilizer wedge striker to D-pillar (Fig. 65).

(3) Retrieve shims from between wedge striker and D-pillar, if necessary.

(4) Remove wedge striker from vehicle.

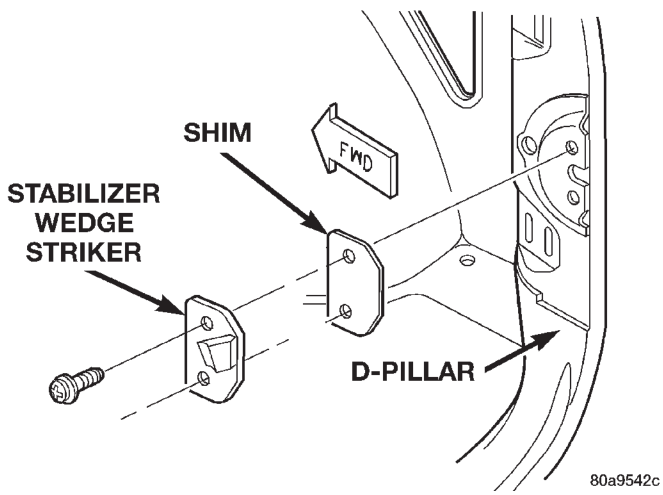


Fig. 65 Liftgate Wedge Striker

INSTALLATION

(1) Position wedge striker on vehicle.

(2) Install any shims previously retrieved from between wedge striker and D-pillar or add shims to ensure proper contact.

(3) Install screws attaching stabilizer wedge striker to D-pillar (Fig. 65).

LIFTGATE TRIM PANEL

REMOVAL

(1) Remove liftgate upper frame molding.

(2) Remove upper frame side moldings.

(3) Remove screws holding assist handle to liftgate and fasteners around the perimeter of the lower trim panel.

(4) If equipped, using a trim stick (C-4755), pry courtesy lamps from liftgate trim.

(5) Disconnect wire connector from lamp.

(6) Remove CHMSL cover and fasteners holding the trim panel.

(7) Disengage hidden clips holding trim panel to liftgate from around perimeter or liftgate (Fig. 66).

(8) Remove liftgate trim panel from vehicle.

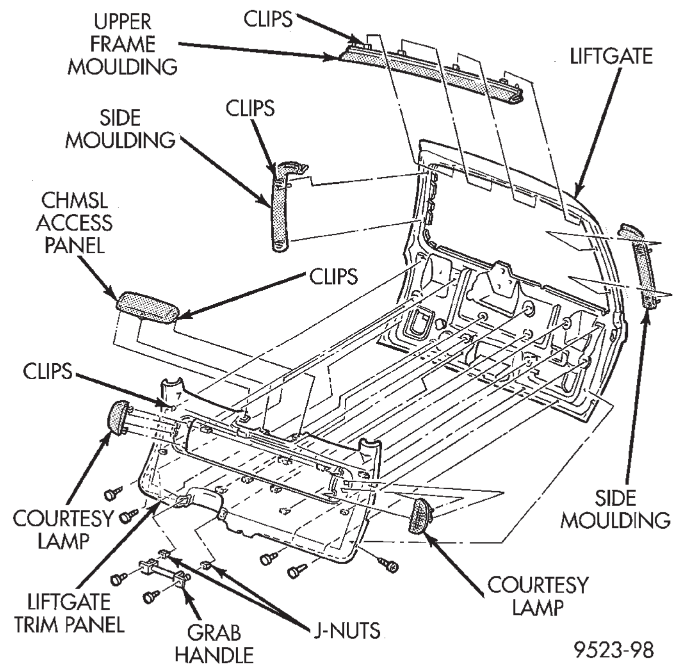


Fig. 66 Liftgate Trim

INSTALLATION

(1) Place liftgate trim panel in position on vehicle.

(2) Engage hidden clips to hold trim panel to liftgate and fasteners around perimeter of liftgate (Fig. 66).

(3) Install fasteners into trim brackets and install CHMSL cover.

(4) Connect wire connector into lamp.

(5) Install courtesy lamps into liftgate trim.

(6) Install screws to hold assist handle to liftgate.

(7) Install upper frame side moldings.

(8) Install liftgate upper frame molding.

LIFTGATE UPPER FRAME MOLDING

REMOVAL

(1) Release liftgate latch and open liftgate.

(2) Disengage hidden clips holding molding to liftgate upper frame (Fig. 66).

(3) Remove liftgate upper molding from vehicle.

INSTALLATION

(1) Place liftgate upper molding in position on vehicle.

REMOVAL AND INSTALLATION (Continued)

(2) Engage hidden clips to hold molding to liftgate upper frame (Fig. 66).

LIFTGATE UPPER FRAME SIDE MOLDINGS

REMOVAL

(1) Remove liftgate upper frame molding.

(2) Disengage hidden clips holding side moldings to liftgate upper frame (Fig. 66).

(3) Remove liftgate upper frame side molding from vehicle.

INSTALLATION

(1) Place liftgate upper frame side moldings in position on vehicle.

(2) Engage hidden clips to hold side moldings to liftgate upper frame (Fig. 66).

(3) Install liftgate upper frame molding.

LOWER B-PILLAR TRIM COVER

REMOVAL

(1) Slide lower seat belt cover rearward to expose anchor bolt.

(2) Remove bolt holding lower seat belt anchor to floor.

(3) Remove upper B-pillar trim cover.

(4) Remove access panel from B-pillar trim (Fig. 67).

(5) Remove screw holding lower trim cover to B-pillar from below seat belt retractor.

(6) Disengage hidden clips holding lower trim cover to B-pillar.

(7) Remove lower B-pillar trim cover from vehicle.

INSTALLATION

(1) Place lower B-pillar trim cover in position on vehicle.

(2) Insert seat belt through hole in lower B-pillar trim.

(3) Engage hidden clips to hold lower trim cover to B-pillar.

(4) Install screw to hold lower trim cover to B-pillar below seat belt retractor.

(5) Install access cover.

(6) Install upper B-pillar trim cover.

(7) Place seat belt anchor in position on floor so webbing is pointed rearward and slightly outboard.

(8) Install bolt to hold lower seat belt anchor to floor. Tighten all seat belt bolts to 39 N·m (29 in. lbs.) torque.

(9) Verify that seat belt anchor does not interfere with seat track travel.

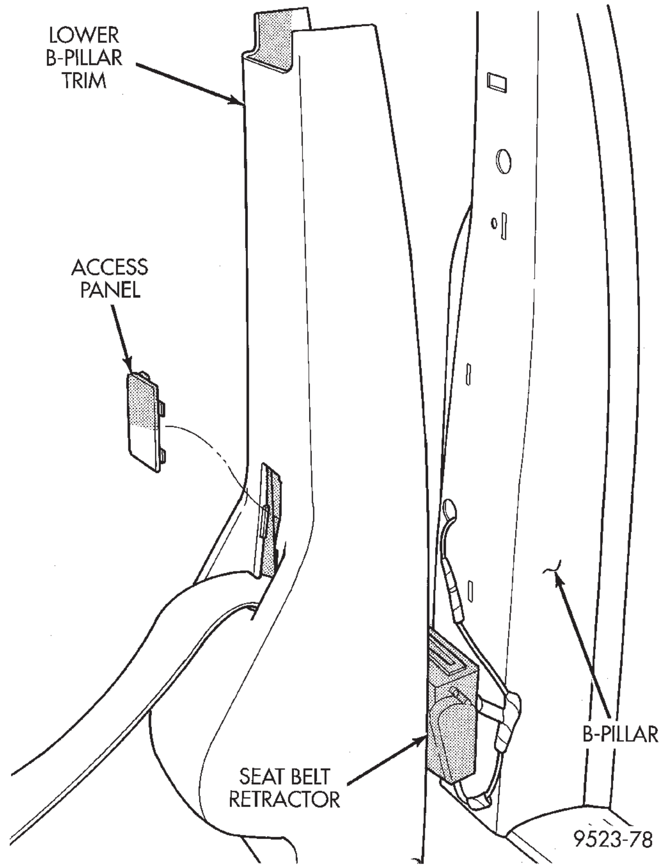


Fig. 67 Lower B-pillar Trim Cover

LUGGAGE RACK CROSSBAR

REMOVAL

(1) Remove luggage rack front riser covers.

(2) Disengage lock and slide crossbar forward into notch in front riser (Fig. 68).

(3) Remove crossbar from roof.

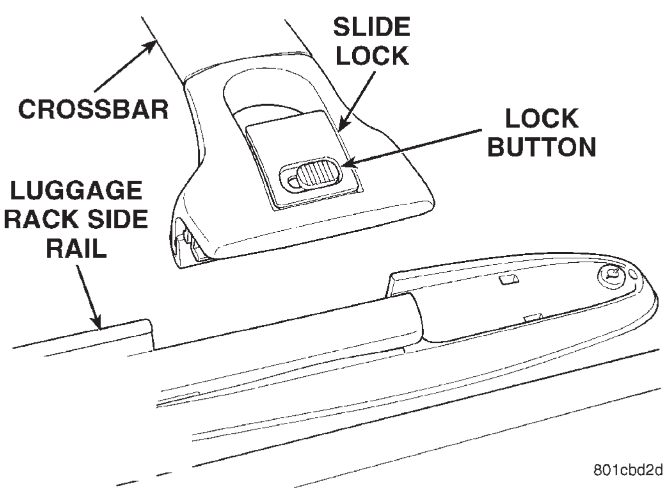


Fig. 68 Luggage Rack Crossbar

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place crossbar in position on roof.
(2) Engage crossbar into notch in front riser.
(3) Slide crossbar rearward into desired position.
(4) Install luggage rack front riser covers.

LUGGAGE RACK RISER COVER

REMOVAL

(1) Disengage lock tabs holding luggage rack front riser cover to riser.
(2) Remove cover from riser (Fig. 69).

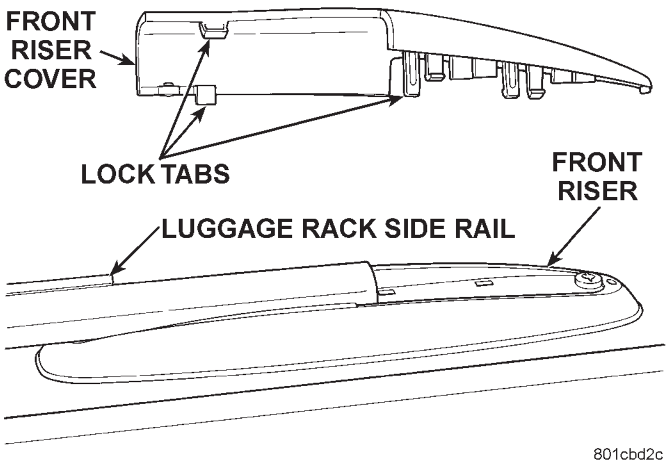


Fig. 69 Luggage Rack Riser Cover

INSTALLATION

(1) Place cover in position on luggage rack riser.
(2) Engage lock tabs to holding luggage rack front riser cover to riser.

LUGGAGE RACK SIDE RAIL

REMOVAL

(1) Remove luggage rack front riser covers.
(2) Remove crossbars.
(3) Remove screws attaching side rail to front riser and roof panel (Fig. 70).
(4) Remove screws attaching side rail to center riser and roof panel.
(5) Remove screws attaching side rail to rear riser and roof panel (Fig. 71).
(6) Remove side rail from vehicle.

INSTALLATION

(1) Place side rail in position on vehicle.
(2) Install screws to attach side rail to rear riser and roof panel.
(3) Install screws to attach side rail to center riser and roof panel.
(4) Install screws to attach side rail to front riser and roof panel.
(5) Install crossbars.
(6) Install luggage rack front riser covers.

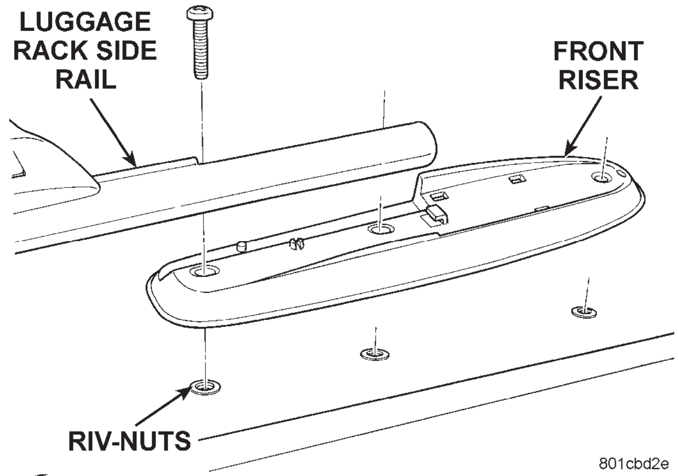


Fig. 70 Luggage Rack Front Riser

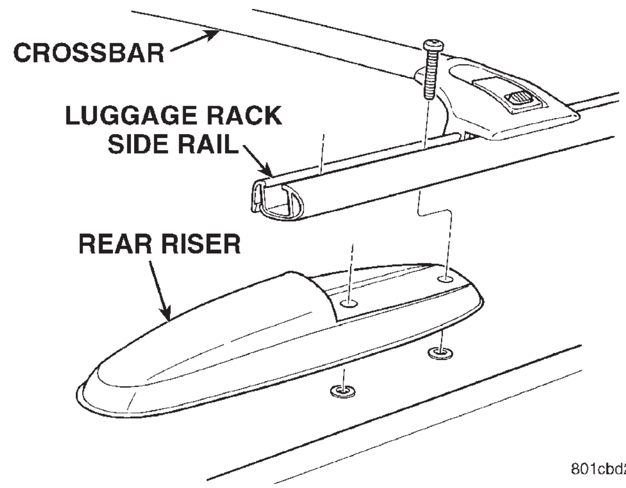


Fig. 71 Luggage Rack Rear Riser

OVERHEAD GRAB-HANDLES

REMOVAL

(1) Using a trim stick (C-4755), remove screw access covers from grab-handle.
(2) Remove screws holding grab-handle to roof rail.
(3) Remove grab-handle from vehicle.

INSTALLATION

(1) Place grab-handle in position on vehicle.
(2) Install screws to hold grab-handle to roof rail.
(3) Install screw access covers into grab-handle.

QUARTER GLASS

REMOVAL

(1) Remove C-pillar trim.
(2) Open quarter glass to vent position.
(3) Remove screw attaching quarter window retainer to vent motor arm.
(4) Disengage quarter window retainer from vent motor arm.

REMOVAL AND INSTALLATION (Continued)

(5) Remove nuts holding quarter glass to C-pillar (Fig. 72).

(6) Remove quarter glass from vehicle.

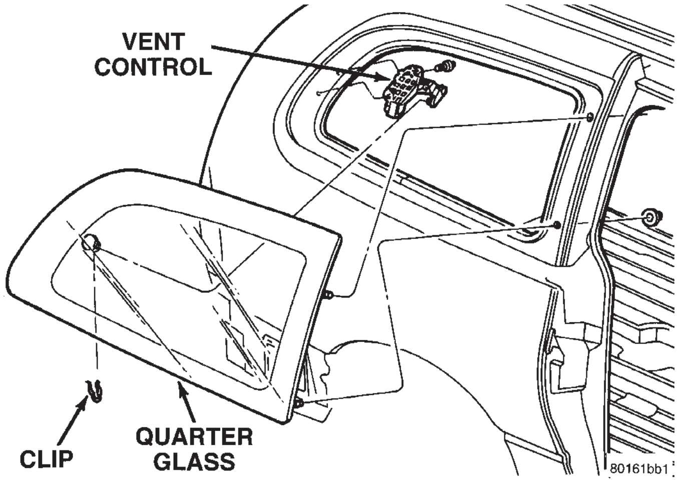


Fig. 72 Quarter Glass

INSTALLATION

(1) Place quarter glass in position on vehicle.

(2) Install nuts to attach quarter glass to C-pillar.

(3) Engage quarter window retainer to vent motor arm.

(4) Install screw holding quarter window retainer to vent motor arm.

(5) Close quarter glass.

(6) Install C-pillar trim.

QUARTER TRIM BOLSTER

The speaker grille in the quarter trim bolster is not removable. The trim bolster must removed to service the speaker.

REMOVAL

(1) Disengage hidden clips holding trim bolster to quarter trim panel (Fig. 73) and (Fig. 74).

(2) Disengage hook retainer holding front of trim bolster to quarter trim panel, if applicable (Fig. 73).

(3) Remove quarter trim bolster from vehicle.

INSTALLATION

(1) Place quarter trim bolster in position on vehicle.

(2) Engage hook retainer to hold front of trim bolster to quarter trim panel, if applicable.

(3) Engage hidden clips to hold trim bolster to quarter trim panel.

RADIATOR CLOSURE PANEL CROSSMEMBER

REMOVAL

(1) Release hood latch and open hood.

(2) Remove bolts attaching hood latch to crossmember and position latch out of the way.

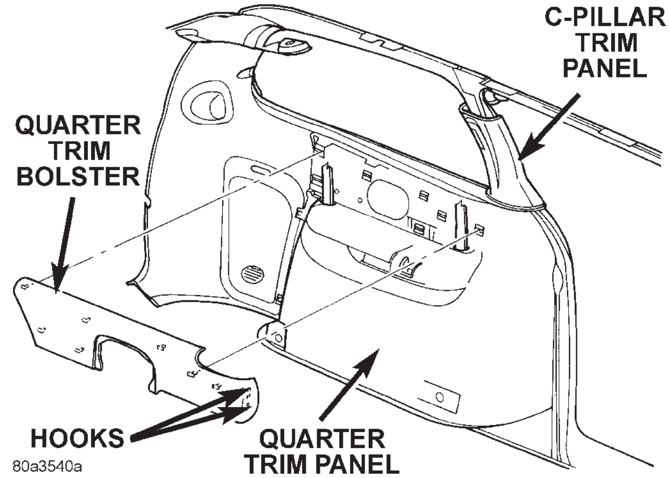


Fig. 73 Left Quarter Trim Bolster – LWB Four Door

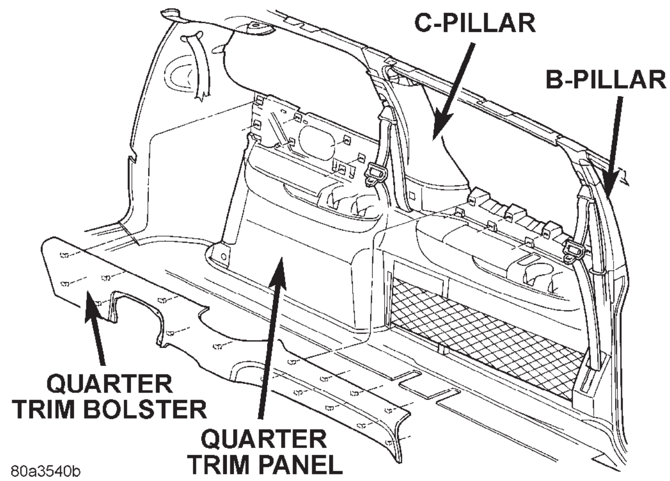


Fig. 74 Left Quarter Trim Bolster – SWB and LWB Three Door

(3) Remove radiator sight shield.

(4) Remove engine air inlet resonator.

(5) Remove bolt holding air cleaner housing to crossmember.

(6) Remove screw holding coolant recovery bottle to crossmember.

(7) Remove bolts holding radiator isolators to crossmember.

(8) Remove bolts holding ends of crossmember to radiator closure panel (Fig. 75).

(9) Lift crossmember upward and away from radiator closure panel.

(10) Remove crossmember from vehicle.

INSTALLATION

(1) Place radiator closure panel crossmember in position on vehicle.

(2) Insert ends of crossmember between layered metal sections of radiator closure panel at each side of radiator.

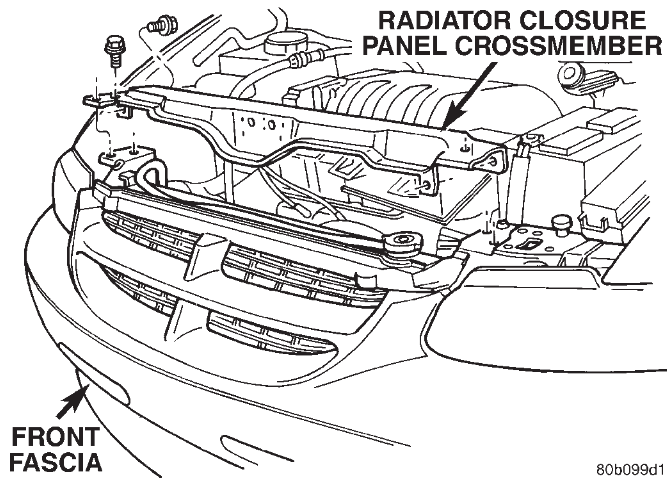


Fig. 75 Radiator Closure Panel Crossmember

(3) Install bolts to hold ends of crossmember to radiator closure panel (Fig. 75).

(4) Install bolts to hold radiator isolators to crossmember.

(5) Install screw to hold coolant recovery bottle to crossmember.

(6) Install bolt to hold air cleaner housing to crossmember.

(7) Install engine air inlet resonator.

(8) Install radiator sight shield.

(9) Align hood latch by placing latch over netpierce tabs. If alignment is required, flatten tabs.

(10) Install bolts to hold hood latch to crossmember.

(11) Verify hood latch operation and hood alignment.

RAIL LAMP MODULE

WITHOUT REAR HVAC

REMOVAL

(1) Pull coat hook open.

(2) Remove screw attaching rail lamp module to roof rail.

(3) Remove rail lamp module from headlining (Fig. 76).

(4) Disconnect wire connector from body wiring harness.

(5) Remove rail lamp module from vehicle.

INSTALLATION

(1) Position rail lamp module in vehicle.

(2) Connect wire connector to body wiring harness.

(3) Position rail lamp module to headlining.

(4) Install screw attaching module to roof rail inside coat hook.

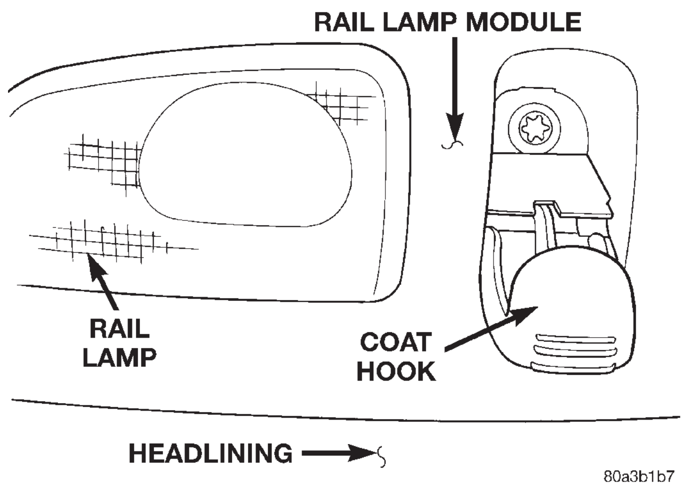


Fig. 76 Rail Lamp Module – w/o Rear HVAC

WITH REAR HVAC

REMOVAL

(1) Pull coat hook open.

(2) Remove screw attaching rail lamp module to roof rail inside coat hook (Fig. 77).

(3) Remove screws attaching rail lamp module to roof rail from behind grab handle.

(4) Remove rail lamp module from headlining.

(5) Disconnect wire connector from body wiring harness.

(6) Remove rail lamp module from vehicle.

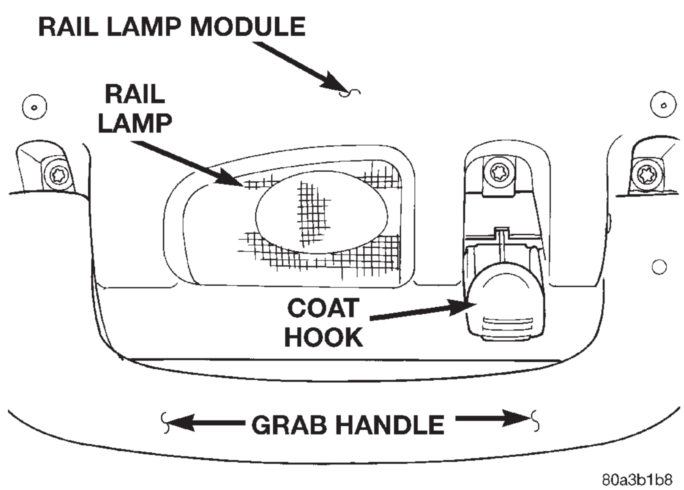


Fig. 77 Rail Lamp Module – w/Rear HVAC

INSTALLATION

(1) Position rail lamp module to vehicle.

(2) Connect wire connector to body wiring harness.

(3) Position rail lamp module to headlining.

(4) Install screws to attach rail lamp module to roof rail behind grab handle.

(5) Install screw to attach rail lamp module to roof rail inside coat hook.

REMOVAL AND INSTALLATION (Continued)

REAR HVAC LOUVER AND BEZEL

REMOVAL

(1) Using a trim stick (C-4755), pry edge of louver from bezel.

(2) Remove HVAC louver from bezel.

(3) Using a trim stick, pry lower edge of HVAC bezel away from headlining (Fig. 78).

(4) Remove louver from vehicle.

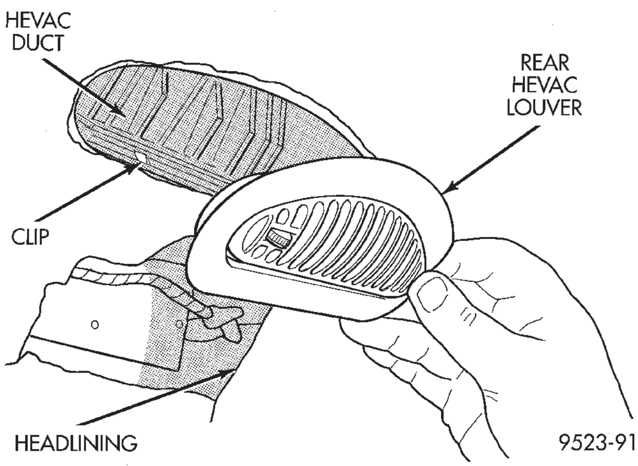


Fig. 78 Rear HVAC Louver

INSTALLATION

(1) Place bezel in position in HVAC duct opening.

(2) Push inward on bezel until clips snap in place. Verify that all four clips have been engaged to the bezel and that the bezel is flush to the headlining

(3) Position HVAC louver to bezel.

(4) Snap both ends of the louver into HVAC bezel.

REAR HEADER TRIM

REMOVAL

(1) Disengage hidden clips holding trim to rear header (Fig. 79).

(2) Separate rear header trim from vehicle.

INSTALLATION

(1) Place rear header trim in position on vehicle.

(2) Align guide pins on trim to holes in header.

(3) Engage hidden clips to hold trim to rear header.

RIGHT D-PILLAR TRIM PANEL

REMOVAL

(1) Remove rear header trim cover.

(2) Remove liftgate sill plate.

(3) Remove second rear seat belt turning loop on long wheel base vehicle.

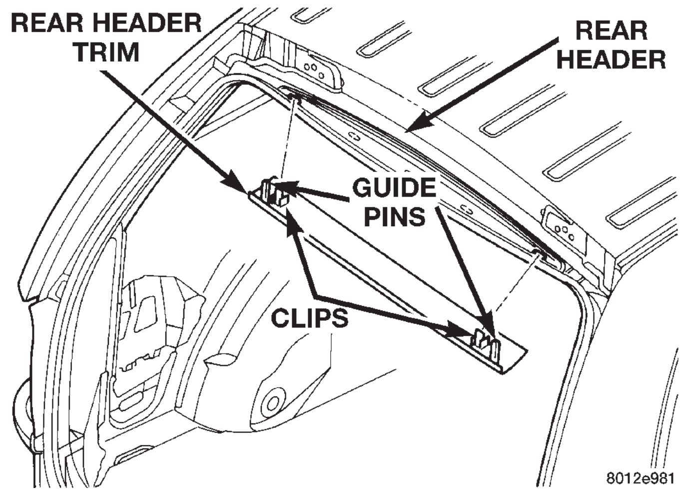


Fig. 79 Rear Header Trim

(4) Remove bolt holding second rear seat belt, if equipped, anchor to quarter on short wheel base vehicle.

(5) Remove quarter trim bolster on short wheel base vehicle.

(6) Remove screws holding trim panel to attaching bracket on short wheel base vehicle (Fig. 80).

(7) Disengage hidden clips holding trim to D-pillar (Fig. 80), (Fig. 81), and (Fig. 82).

(8) Remove D-pillar trim panel from D-pillar.

(9) Disconnect speaker wire connector, if equipped.

(10) Pass second rear seat belt, if equipped, through slot in trim panel on short wheel base vehicle.

(11) Remove D-pillar trim from vehicle.

INSTALLATION

(1) Position D-pillar trim on vehicle.

(2) Pass second rear seat belt, if equipped, through slot in trim panel on short wheel base vehicle.

(3) Connect speaker wire connector to speaker, if equipped.

(4) Align locating pins on backside of trim panel to mating holes in D-pillar.

(5) Engage hidden clips to hold trim to D-pillar.

(6) Install screws to hold trim panel to attaching bracket on short wheel base vehicle.

(7) Install quarter trim bolster on short wheel base vehicle.

(8) Install bolt to attach second rear seat belt, if equipped, anchor to quarter on short wheel base vehicle. Tighten all seat belt bolts to 39 N·m (29 in. lbs.) torque.

(9) Install second rear seat belt turning loop on long wheel base vehicle.

(10) Install liftgate sill plate.

(11) Install rear header trim cover.

REMOVAL AND INSTALLATION (Continued)

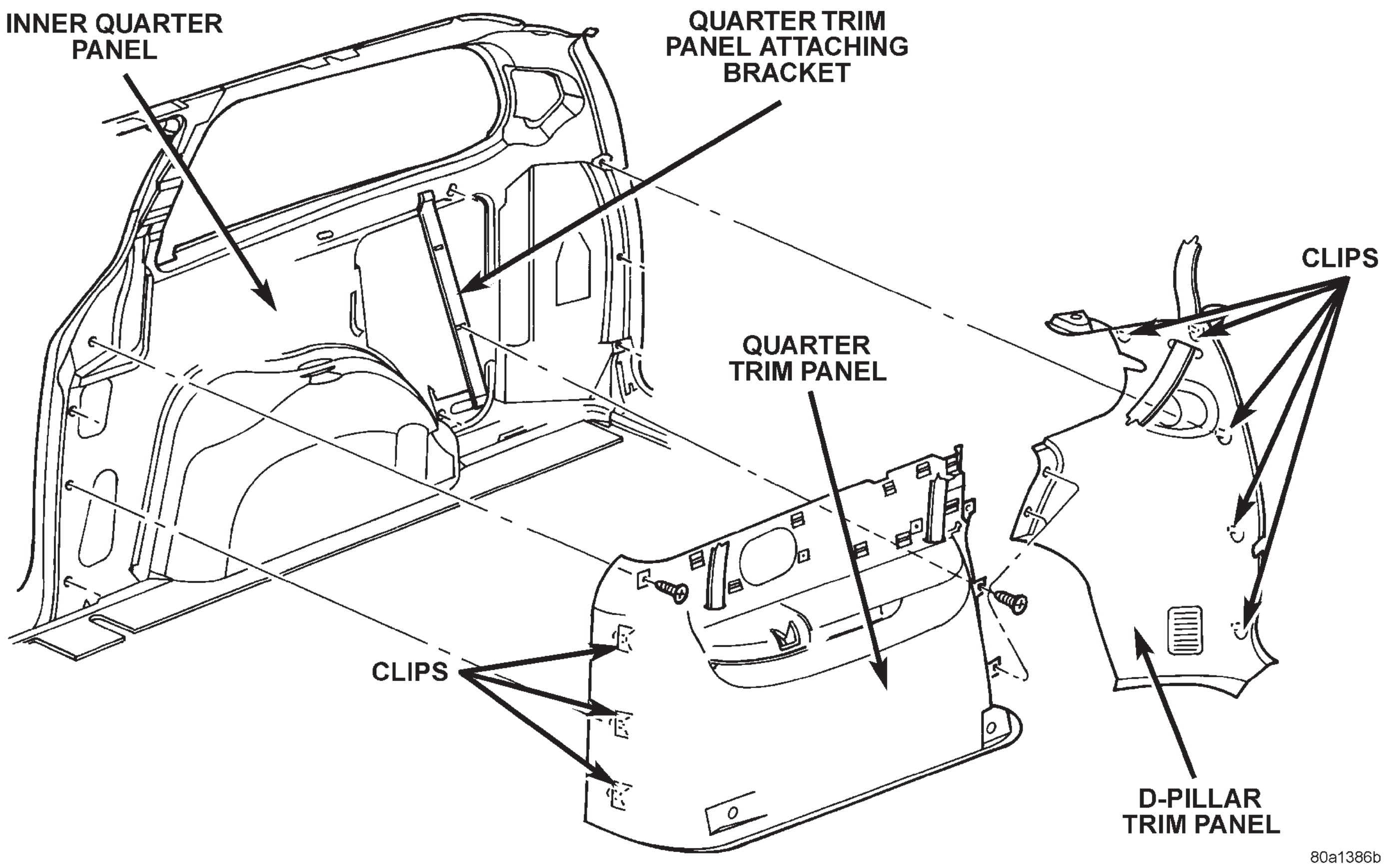


Fig. 80 Right Quarter and D-Pillar Trim Panels – SWB

RIGHT QUARTER TRIM PANEL

REMOVAL

CAUTION: Disconnect the battery negative cable. Damage to accessory feed circuit can result.

(1) Remove first rear seat.
(2) Remove second rear seat, if equipped.
(3) Remove sliding door sill trim panel.
(4) Remove quarter trim bolster.
(5) Remove C-pillar trim panel.
(6) Remove D-pillar trim panel.
(7) Remove first rear seat belt anchor.
(8) Remove second rear seat belt anchor on long wheel base vehicle.
(9) Remove screws holding quarter trim to quarter panel from bolster area.
(10) Remove screws holding rear edge of quarter trim to attaching bracket.
(11) Disengage hidden clips holding front of quarter trim to quarter panel rearward of sliding door opening.
(12) Remove quarter trim from quarter panel.
(13) Disconnect wire connector from accessory power outlet, if equipped.
(14) Pass second rear seat belt through slot in trim panel on long wheel base vehicle.
(15) Pass first rear seat belt through slot in trim panel.
(16) Remove quarter trim panel from vehicle.

INSTALLATION

(1) Position quarter trim panel on vehicle.
(2) Pass first rear seat belt through slot in trim panel.
(3) Pass second rear seat belt through access hole in trim panel on long wheel base vehicle.
(4) Connect wire connector into accessory power outlet, if equipped.
(5) Align locating pins on backside of trim panel to mating holes in inner quarter panel.
(6) Engage hidden clips to hold front of quarter trim to quarter panel rearward of sliding door opening.
(7) Install screws to hold rear edge of quarter trim to attaching bracket.
(8) Install screws to hold quarter trim to inner quarter panel in bolster area.
(9) Install second rear seat belt anchor on long wheel base vehicle. Tighten all seat belt bolts to 39 N·m (29 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

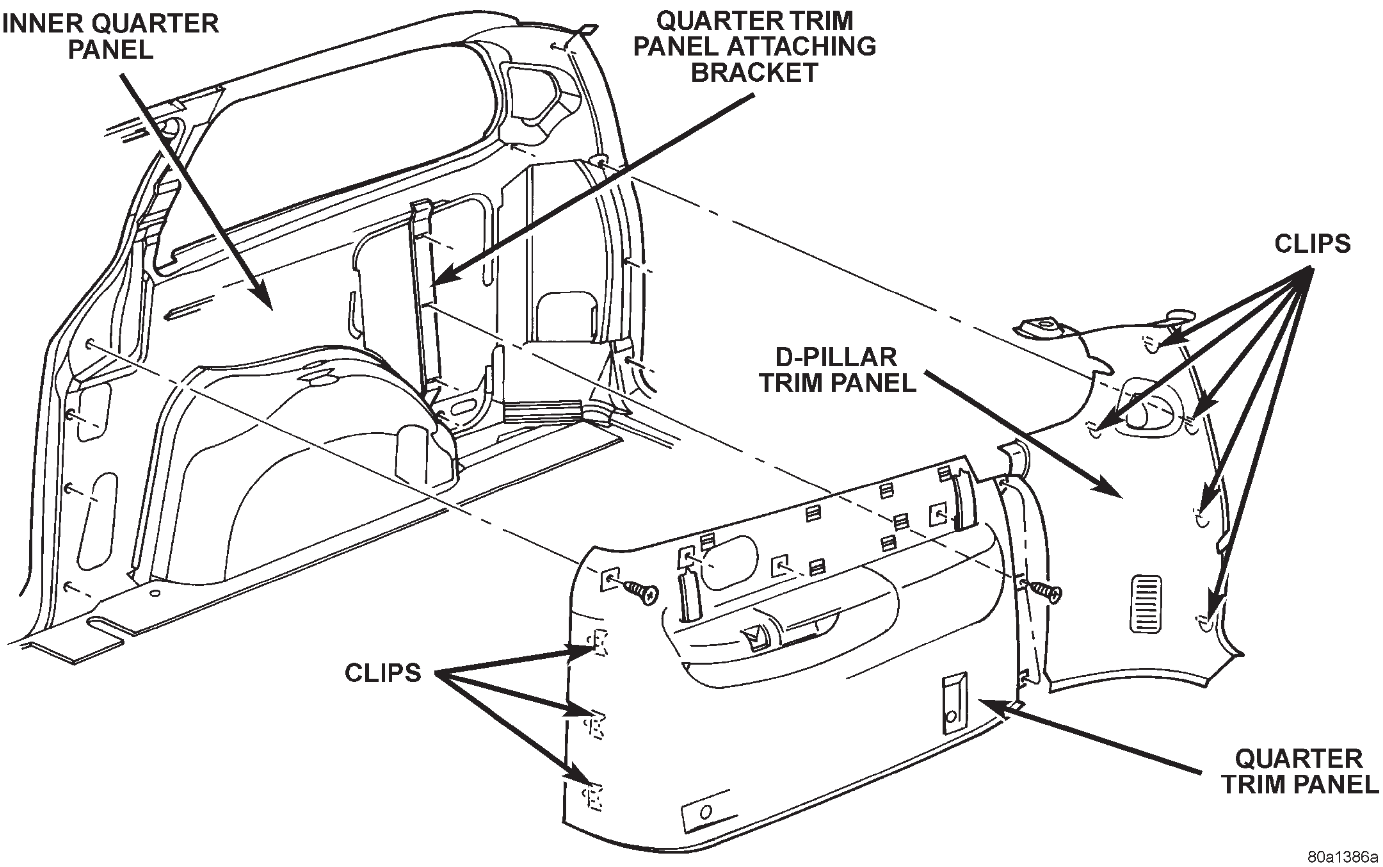


Fig. 81 Right Quarter and D-Pillar Trim Panels – LWB without Rear A/C

(10) Install first rear seat belt anchor.
(11) Install D-pillar trim panel.
(12) Install C-pillar trim panel.
(13) Install quarter trim bolster.
(14) Install sliding door sill trim panel.
(15) Install second rear seat, if equipped.
(16) Install first rear seat.
(17) Connect the battery negative cable.

ROOF APERTURE (RAP) MOLDING

The RAP molding is set with body side molding tape. The temperature in the work area and the vehicle should be at least 21° C (70° F) to avoid damaging the RAP moldings.

REMOVAL

(1) Warm the affected stick-on molding and body metal to approximately 38° C (100° F) using a suitable heat lamp or heat gun.
(2) Pull stick-on molding from painted surface.
(3) Remove adhesive tape residue from painted surface of vehicle. Use a 3M Scotch-Brite™ Molding Adhesive and Stripe Removal Discs, or equivalent, to clean adhesive residue from painted surfaces. The adhesive removal discs are available from automotive paint suppliers. Refer to instructions supplied with the discs for proper usage.

INSTALLATION

(1) If molding is to be reused;
(a) Remove tape residue from molding.
(b) Clean back of molding with Mopar® Super Kleen solvent, or equivalent.
(c) Wipe molding dry with lint free cloth.
(d) Apply new body side molding (two sided adhesive) tape to back of molding.
(2) Clean body surface with Mopar® Super Kleen solvent, or equivalent. Wipe surface dry with lint free cloth.
(3) Remove protective cover from tape on back of molding.
(4) Apply molding to body from front of vehicle to rear.
(5) Using a roller tool, roll molding onto body panel with enough force to assure adhesion and not bend roof panels.

SEAT BELT BUCKLE – FRONT INBOARD

REMOVAL

(1) Remove screws holding front inboard side cover to seat cushion frame.
(2) Remove side cover from vehicle.
(3) Remove bolt holding seat belt buckle to front seat track (Fig. 83).

REMOVAL AND INSTALLATION (Continued)

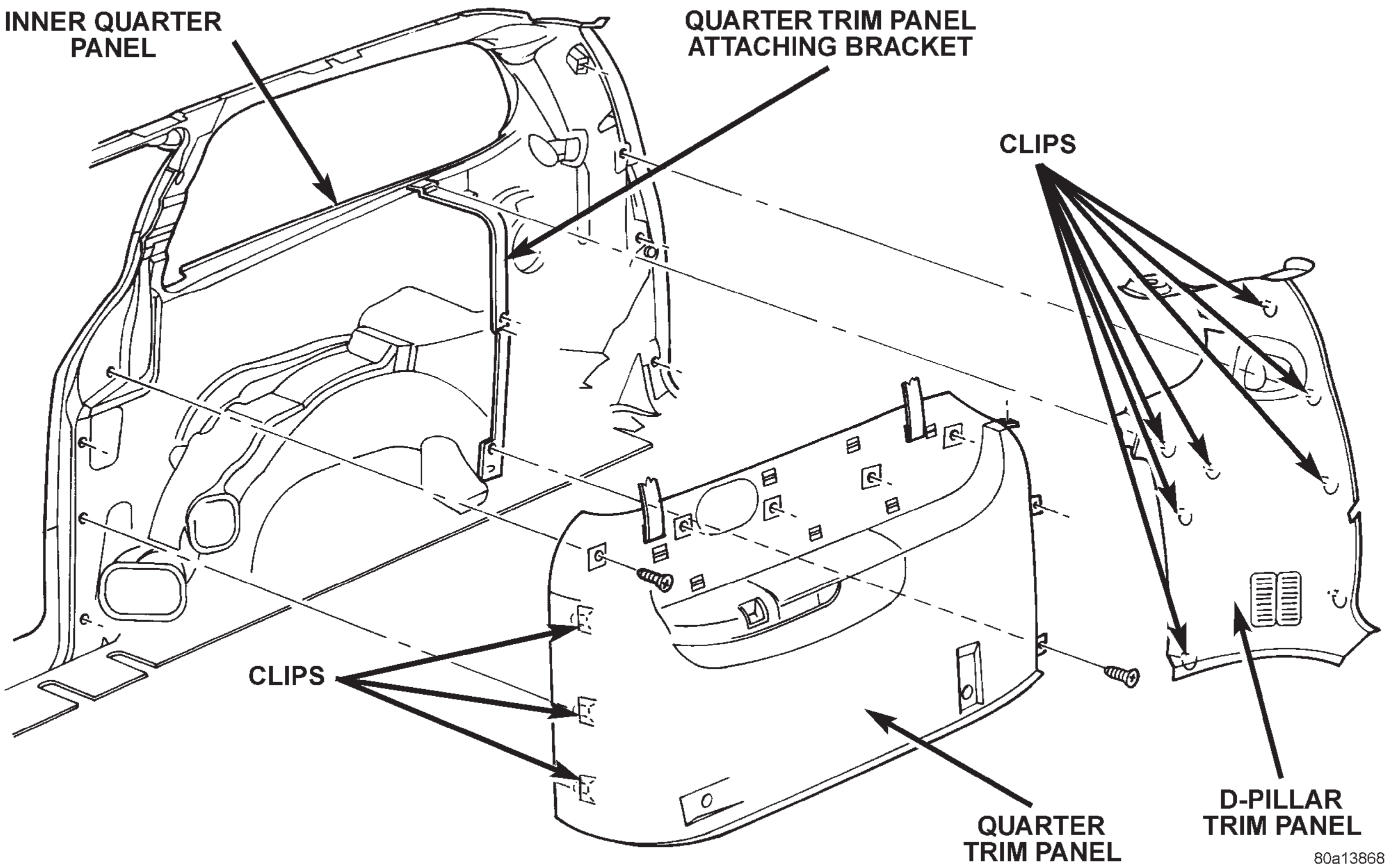


Fig. 82 Right Quarter and D-Pillar Trim Panels – LWB with Rear A/C

(4) Remove buckle from vehicle.

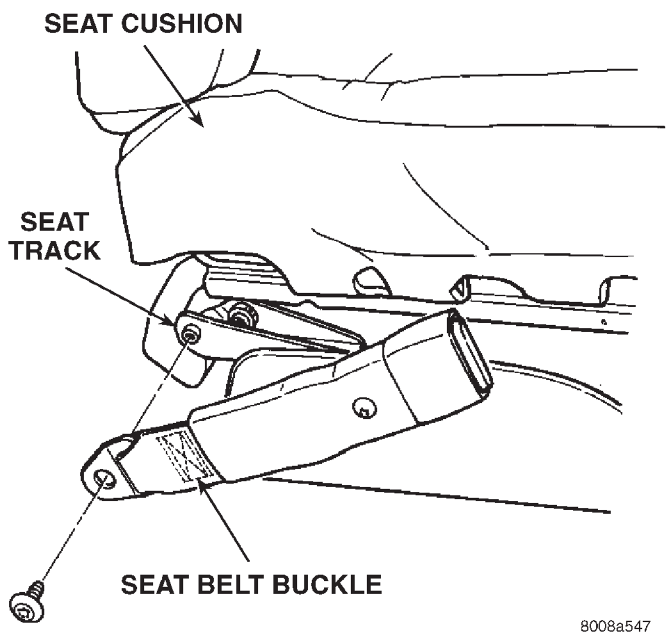


Fig. 83 Seat Belt Buckle – Front Inboard

INSTALLATION

For installation, reverse the above procedures. Tighten seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT BUCKLE FIRST REAR – TWO PASSENGER BENCH

REMOVAL

(1) Remove seat from vehicle. Refer to Owner's Manual for proper procedures.

(2) Remove bolt attaching inboard seat belt/buckle to seat frame (Fig. 84).

(3) Remove belt from seat.

INSTALLATION

For installation, reverse the above procedures. Tighten all seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT BUCKLE FIRST REAR QUAD BUCKET

REMOVAL

(1) Remove seat from vehicle. Refer to Owner's Manual for proper procedures.

(2) Remove screws attaching inboard side cover to seat cushion.

REMOVAL AND INSTALLATION (Continued)

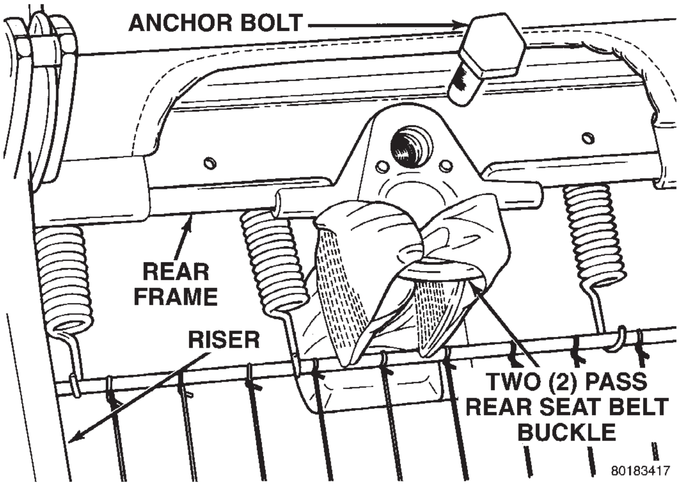


Fig. 84 Seat Belt Buckle First Rear – Two Passenger Bench

(3) Remove side cover from seat.

(4) Remove bolts attaching recliner bracket to seat cushion.

(5) Remove recliner bracket from seat.

(6) Remove bolt attaching seat belt buckle to seat track (Fig. 83).

(7) Remove buckle from vehicle.

INSTALLATION

For installation, reverse the above procedures. Tighten all seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT BUCKLE SECOND REAR – THREE PASSENGER BENCH

REMOVAL

(1) Remove bolt attaching seat belt buckle to seat rear frame rail (Fig. 85).

(2) Remove seat belt buckle from seat.

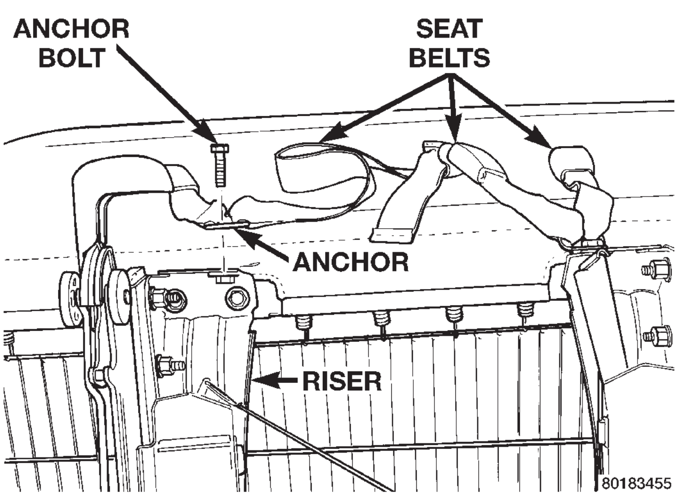


Fig. 85 Seat Belt Buckle Second Rear – Three Passenger Bench

INSTALLATION

(1) Place seat belt buckle in position on seat.

(2) Install bolt to attach seat belt buckle to seat rear frame rail. Tighten all seat belt bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT – OUTBOARD FRONT

REMOVAL

(1) Remove shoulder harness height adjuster knob by pulling it straight away from adjuster.

(2) Remove cover from seat belt turning loop.

(3) Remove bolt holding turning loop to shoulder belt height adjuster (Fig. 86).

(4) Remove turning loop from B-pillar.

(5) Remove lower B-pillar trim cover or quarter trim panel on three door left side.

(6) Remove bolt holding seat belt retractor to B-pillar (Fig. 86).

(7) Lift retractor upward and disengage arrow head retainer holding retractor to B-pillar.

(8) Remove seat belt from vehicle.

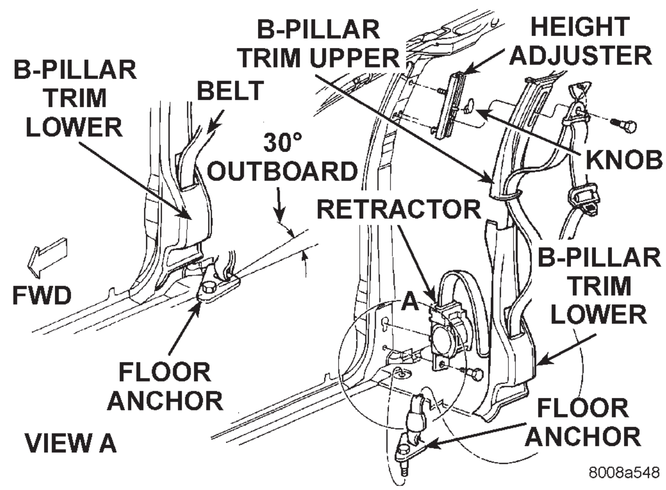


Fig. 86 Seat Belt – Outboard Front

INSTALLATION

For installation, reverse the above procedures. Tighten all seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT FIRST REAR ANCHOR BRACKET – LWB

REMOVAL

(1) Remove lower quarter trim panel.

(2) Remove bolt holding first rear seat belt anchor bracket to floor.

(3) Remove bracket from vehicle.

INSTALLATION

(1) Position bracket to vehicle.

(2) Install bolt holding first rear seat belt anchor bracket to floor.

(3) Install lower quarter trim panel.

REMOVAL AND INSTALLATION (Continued)

NOTE: The tightening specification for all seat belt anchor bolts is 39 N·m (29 ft. lbs.) torque.

SEAT BELT FIRST REAR OUTBOARD – LWB FOUR DOOR

REMOVAL

(1) Remove first and second rear seats. Refer to Owner's manual for proper procedures.

(2) Remove shoulder harness height adjuster knob by pulling it straight away from adjuster.

(3) Slide floor anchor cover from over the anchor bolt.

(4) Remove floor anchor bolt.

(5) Remove anchor from floor.

(6) Open clam shell cover from over seat belt turning loop.

(7) Remove bolt holding turning loop to shoulder belt height adjuster.

(8) Remove turning loop from C-pillar.

(9) Remove lower quarter trim panel.

(10) Route seat belt webbing and turning loop through access hole in lower quarter trim panel.

(11) Remove bolt holding seat belt retractor to quarter panel.

(12) Lift retractor upward and disengage arrow head retainer holding retractor to quarter panel.

(13) Remove seat belt from vehicle.

INSTALLATION

(1) Position seat belt to vehicle.

(2) Install arrow head retainer to quarter panel and push downward to seat retainer.

(3) Install bolt holding seat belt retractor to quarter panel.

(4) Route seat belt webbing and turning loop through access hole in lower quarter trim panel.

(5) Install lower quarter trim panel.

(6) Position turning loop to C-pillar.

(7) Install bolt holding turning loop to shoulder belt height adjuster.

(8) Close clam shell cover from over seat belt turning loop.

(9) Position anchor to floor.

(10) Install floor anchor bolt.

(11) Slide floor anchor cover over the anchor bolt.

(12) Install shoulder harness height adjuster knob by pushing it straight onto adjuster.

(13) Install first and second rear seats. Refer to Owner's manual for proper procedures.

NOTE: The tightening specification for all seat belt anchor bolts is 39 N·m (29 ft. lbs.) torque.

SEAT BELT FIRST REAR OUTBOARD – SWB FOUR DOOR

REMOVAL

(1) Remove first and second rear seats. Refer to Owner's manual for proper procedures.

(2) Remove shoulder harness height adjuster knob by pulling it straight away from adjuster.

(3) Slide floor anchor cover from over the anchor bolt.

(4) Remove floor anchor bolt (Fig. 87).

(5) Remove anchor from floor.

(6) Open clam shell cover from over seat belt turning loop.

(7) Remove bolt attaching turning loop to shoulder belt height adjuster (Fig. 87).

(8) Remove turning loop from C-pillar.

(9) Remove lower quarter trim panel.

(10) Route seat belt webbing and turning loop through access hole in lower quarter trim panel.

(11) Remove bolt holding seat belt retractor to quarter panel (Fig. 87).

(12) Lift retractor upward and disengage arrow head retainer holding retractor to quarter panel.

(13) Remove seat belt from vehicle.

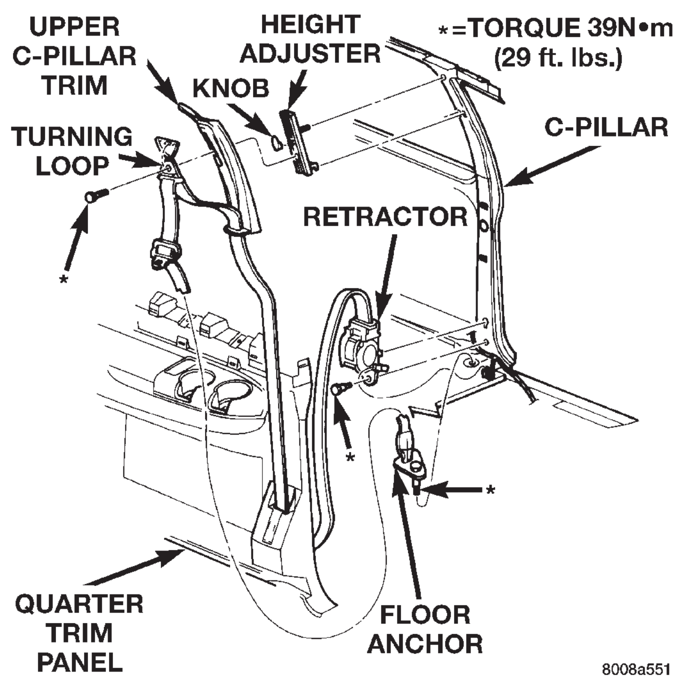


Fig. 87 Seat Belt First Rear Outboard – SWB Four Door

INSTALLATION

For installation, reverse the above procedures. Tighten seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

SEAT BELT LEFT FIRST REAR OUTBOARD – LWB THREE DOOR

REMOVAL

(1) Remove first and second rear seats. Refer to Owner's manual for proper procedures.

(2) Remove shoulder harness height adjuster knob by pulling it straight away from adjuster.

(3) Slide floor anchor cover from over the anchor bolt.

(4) Remove floor anchor bolt (Fig. 88).

(5) Remove anchor from floor.

(6) Open clam shell cover from over seat belt turning loop.

(7) Remove bolt holding turning loop to shoulder belt height adjuster (Fig. 88).

(8) Remove turning loop from C-pillar.

(9) Remove C-pillar upper trim cover.

(10) Remove lower quarter trim panel.

(11) Route seat belt webbing and turning loop through access hole in lower quarter trim panel.

(12) Remove bolt holding seat belt retractor to quarter panel.

(13) Lift retractor upward and disengage arrow head retainer holding retractor to quarter panel (Fig. 88).

(14) Remove seat belt from vehicle.

INSTALLATION

For installation, reverse the above procedures. Tighten all seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT LEFT FIRST REAR OUTBOARD – SWB THREE DOOR

REMOVAL

(1) Remove first and second rear seats. Refer to Owner's manual for proper procedures.

(2) Remove shoulder harness height adjuster knob by pulling it straight away from adjuster.

(3) Slide floor anchor cover from over the anchor bolt.

(4) Remove floor anchor bolt (Fig. 88).

(5) Remove anchor from floor.

(6) Open clam shell cover from over seat belt turning loop.

(7) Remove bolt attaching turning loop to shoulder belt height adjuster.

(8) Remove turning loop from C-pillar.

(9) Remove B-pillar upper trim cover.

(10) Remove C-pillar upper trim cover.

(11) Remove lower quarter trim panel.

(12) Route seat belt webbing and turning loop through access hole in lower quarter trim panel.

(13) Remove bolt holding seat belt retractor to quarter panel.

(14) Lift retractor upward and disengage arrow head retainer holding retractor to quarter panel (Fig. 88).

(15) Remove seat belt from vehicle.

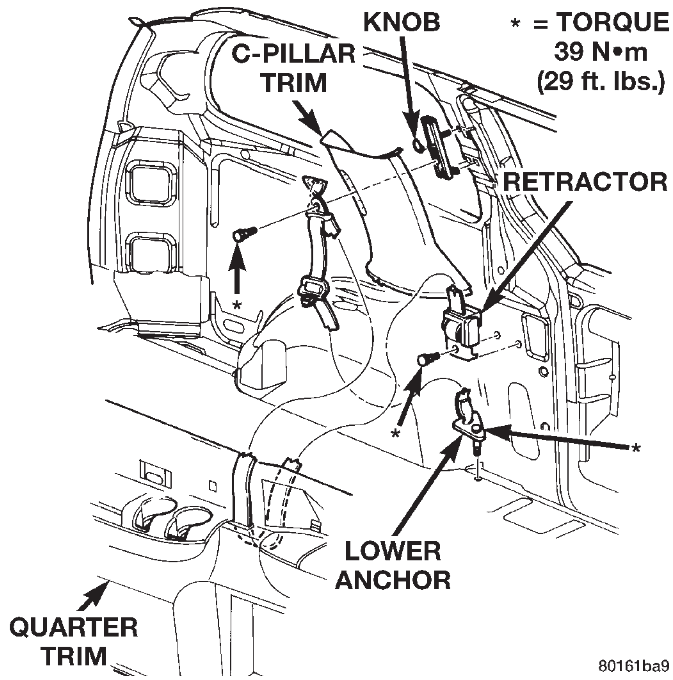


Fig. 88 Seat Belt Left First Rear Outboard – SWB Three Door

INSTALLATION

For installation, reverse the above procedures. Tighten all seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT SECOND REAR OUTBOARD – SWB

REMOVAL

(1) Remove second rear seat from vehicle. Refer to Owner's Manual for proper procedures.

(2) Slide lower anchor cover from over the anchor shoulder-nut.

(3) Remove lower anchor shoulder-nut.

(4) Remove lower anchor from wheelhouse (Fig. 89).

(5) Remove D-pillar trim panel.

(6) Route seat belt webbing and turning loop through access hole in quarter trim.

(7) Remove bolts attaching seat belt guide loop to inner quarter panel.

(8) Remove anchor bolt attaching retractor to inner quarter panel.

(9) Remove second rear seat belt retractor from vehicle (Fig. 89).

REMOVAL AND INSTALLATION (Continued)

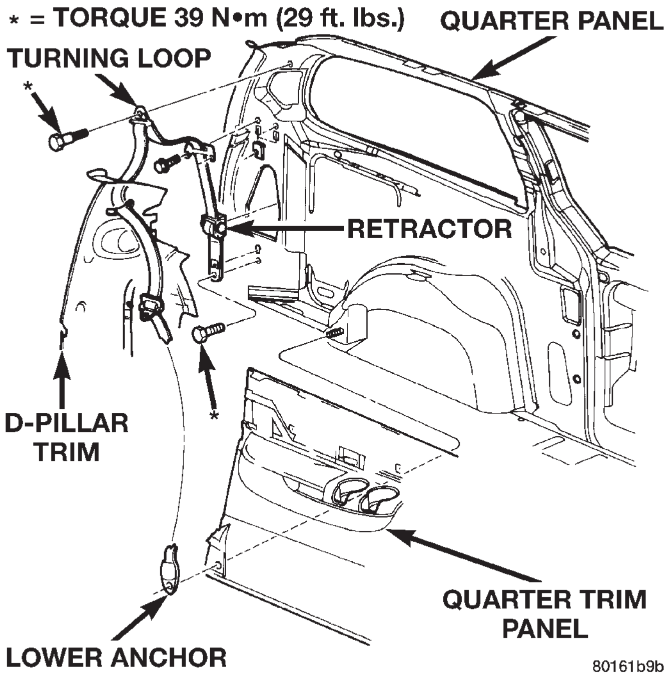


Fig. 89 Seat Belt Second Rear Outboard – SWB

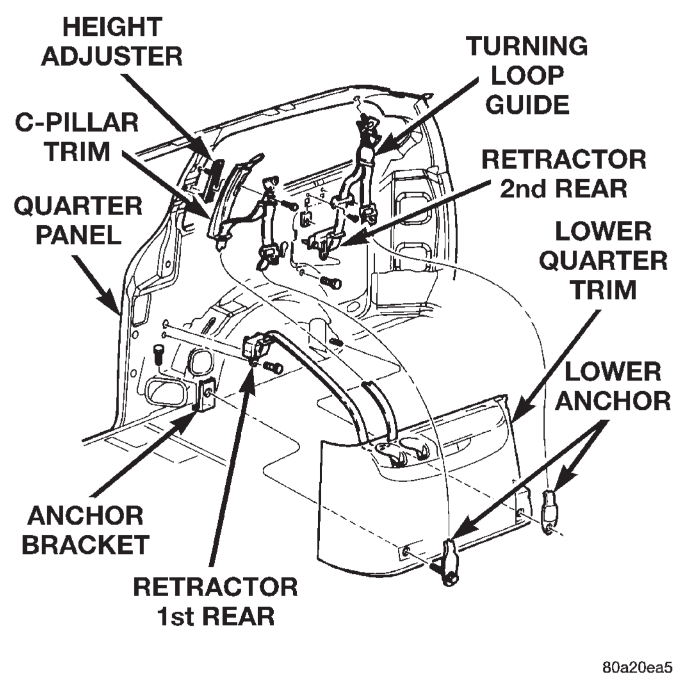


Fig. 90 Second Right Rear Outboard Seat Belt – LWB

INSTALLATION

For installation, reverse the above procedures. Tighten all seat belts to 39 N·m (29 ft. lbs.) torque.

SEAT BELT SECOND RIGHT REAR OUTBOARD – LWB

REMOVAL

(1) Remove second rear seat from vehicle. Refer to Owner's Manual for proper procedures.
(2) Slide lower anchor cover from over the anchor shoulder-nut.
(3) Remove lower anchor shoulder-nut (Fig. 90).
(4) Remove lower anchor from wheelhouse.
(5) Fold upper turning loop extension cover downward to gain access to anchor bolt.
(6) Remove bolt holding turning loop to extension bracket above quarter glass (Fig. 90).
(7) Remove turning loop from extension bracket.
(8) Remove D-pillar trim panel.
(9) Remove quarter trim bolster.
(10) Route seat belt webbing and turning loop through access hole in quarter trim.
(11) Remove bolt attaching retractor to inner quarter panel (Fig. 90).
(12) Remove screw attaching retractor to inner quarter panel.
(13) Remove second rear seat belt retractor from vehicle.

INSTALLATION

(1) Position second rear seat belt retractor in vehicle.
(2) Install screw attaching retractor to inner quarter panel.
(3) Install bolt to attach retractor to inner quarter panel.
(4) Route seat belt webbing and turning loop through access hole in quarter trim.
(5) Install quarter trim bolster.
(6) Install D-pillar trim panel.
(7) Position turning loop to extension bracket.
(8) Install bolt to hold turning loop to extension bracket above quarter glass. Tightening specifications for all seat belt bolts is 39 N·m (29 ft. lbs.) torque.
(9) Install upper turning loop extension cover.
(10) Position lower anchor to wheelhouse.
(11) Install lower anchor shoulder-nut.
(12) Install lower anchor cover over the anchor shoulder-nut.
(13) Install second rear seat to vehicle. Refer to Owner's Manual for proper procedures.

SECOND RIGHT REAR OUTBOARD SEAT BELT – LWB W/REAR HVAC

REMOVAL

(1) Remove second rear seat from vehicle. Refer to Owner's Manual for proper procedures.
(2) Slide lower anchor cover from over the anchor shoulder-nut.
(3) Remove lower anchor shoulder-nut.
(4) Remove lower anchor from wheelhouse.
(5) Fold upper turning loop extension cover downward to gain access to anchor bolt.

REMOVAL AND INSTALLATION (Continued)

(6) Remove bolt attaching turning loop to extension bracket above quarter glass.

(7) Remove turning loop from extension bracket.

(8) Remove D-pillar trim panel.

(9) Remove quarter trim bolster.

(10) Remove quarter trim panel as necessary to gain access to HVAC unit.

(11) Route seat belt webbing and turning loop through access hole in quarter trim.

(12) Loosen HVAC unit enough to gain access to seat belt retractor fasteners.

(a) Remove bracket around HVAC unit (Fig. 91).

(b) Remove air duct (Fig. 92).

(c) Remove fasteners holding HVAC unit to inner quarter panel (Fig. 93).

(d) Remove screws attaching upper evaporator housing to lower evaporator housing.

(e) Remove coolant line retaining bracket hold-down bolt.

(13) Remove bolts attaching seat belt guide loop to inner quarter panel.

(14) Pull outward on HVAC unit and remove bolt holding retractor to inner quarter panel.

(15) Remove screw attaching retractor to inner quarter panel.

(16) Remove second rear seat belt retractor from vehicle.

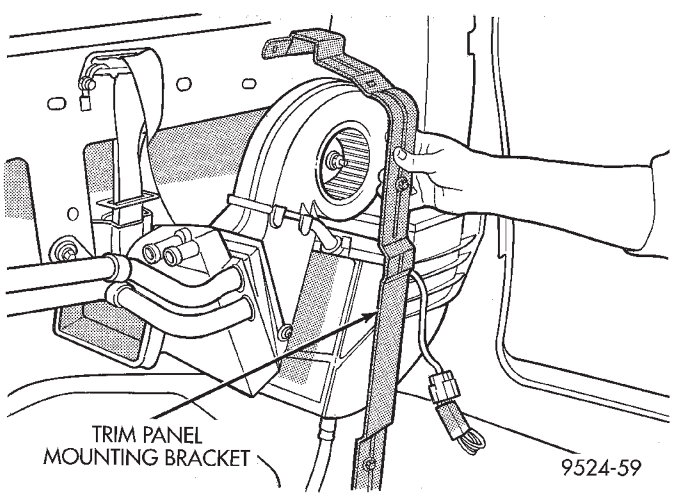


Fig. 91 Trim Panel Mounting Bracket

INSTALLATION

(1) Position second rear seat belt retractor to vehicle.

(2) Install screw attaching retractor to inner quarter panel.

(3) Pull outward on HVAC unit and install bolt attaching retractor to inner quarter panel.

(4) Install bolts attaching seat belt guide loop to inner quarter panel.

(5) Install coolant line retaining bracket holdown bolt.

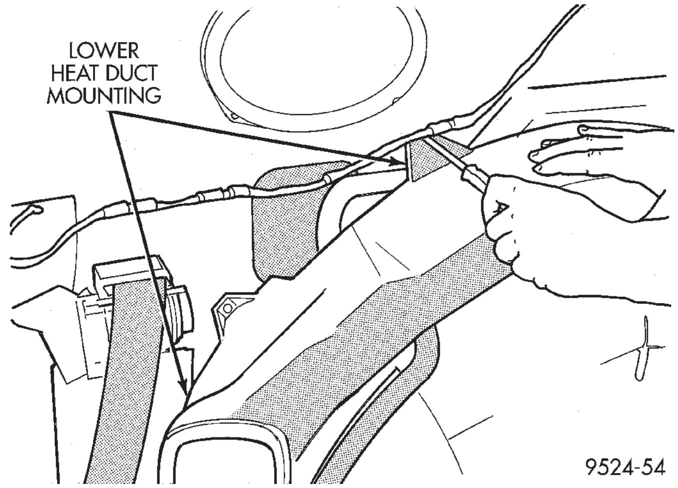


Fig. 92 Lower Heater Duct

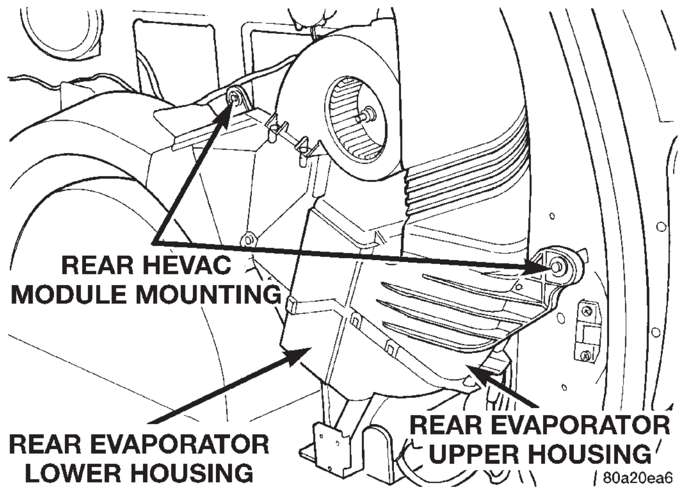


Fig. 93 Rear HVAC Mounting

(6) Install screws holding upper evaporator housing to lower evaporator housing.

(7) Install fasteners attaching HVAC unit to inner quarter panel.

(8) Install air duct.

(9) Install bracket around HVAC unit.

(10) Route seat belt webbing and turning loop through access hole in quarter trim.

(11) Install quarter trim panel as necessary to gain access to HVAC unit.

(12) Install quarter trim bolster.

(13) Install D-pillar trim panel.

(14) Position turning loop to extension bracket.

(15) Install bolt attaching turning loop to extension bracket above quarter glass.

(16) Pull upper turning loop extension cover upward over anchor bolt.

(17) Install lower anchor shoulder-nut.

(18) Slide lower anchor cover over anchor shoulder-nut.

(19) Install second rear seat from vehicle. Refer to Owner's Manual for proper procedures.

REMOVAL AND INSTALLATION (Continued)

SHOULDER BELT HEIGHT ADJUSTER – B OR C-PILLAR

REMOVAL

(1) Remove B or C-pillar trim cover.

(2) Remove screws holding shoulder belt height adjuster to pillar.

(3) Remove height adjuster from vehicle (Fig. 94).

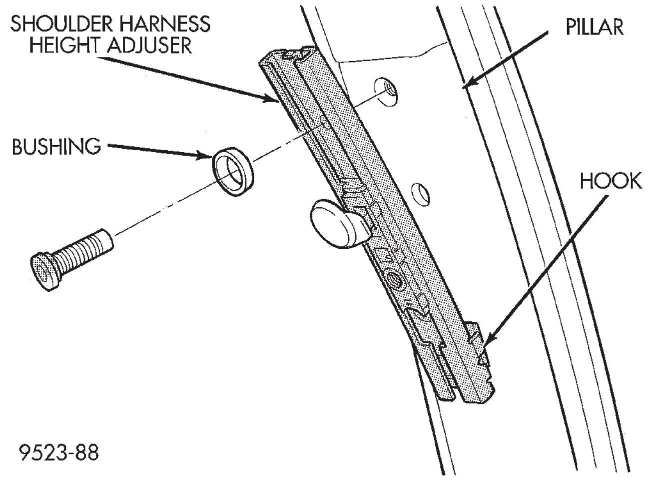


Fig. 94 Shoulder Belt Height Adjuster

INSTALLATION

For installation, reverse the above procedures. Tighten seat belt anchor bolts to 39 N·m (29 ft. lbs.) torque.

SHOULDER BELT HEIGHT ADJUSTER KNOB

REMOVAL

(1) Disengage clips holding clam shell cover to seat belt turning loop and open cover.

(2) Using a Snap-on® trim tool, pry knob from shoulder belt height adjuster (Fig. 95).

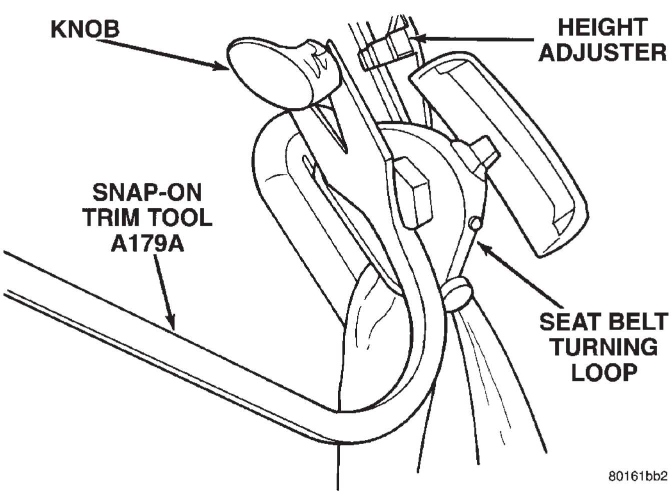


Fig. 95 Shoulder Belt Height Adjuster Knob

INSTALLATION

(1) Place shoulder belt height adjuster knob in position on height adjuster.

(2) Push knob on until retainers engage.

SIDE VIEW MIRROR

REMOVAL

(1) Release front door latch and open door.

(2) Remove screw holding molding to base of side view mirror (Fig. 96).

(3) Remove molding from mirror.

(4) Remove bolts holding bottom of side view mirror to A-pillar.

(5) Remove bolt attaching top of side view mirror to A-pillar (Fig. 96).

(6) If equipped, disconnect power side view mirror wire connector from instrument panel harness.

(7) Remove side view mirror from vehicle.

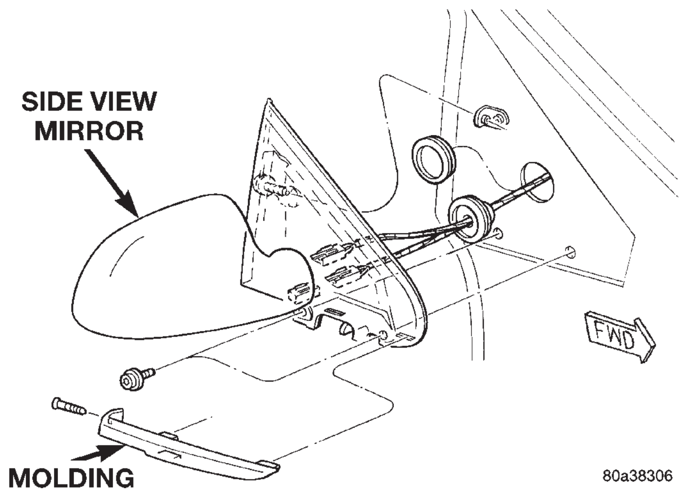


Fig. 96 Side View Mirror

INSTALLATION

(1) Connect power side view mirror wire connector into instrument panel harness, if equipped.

(2) Place side view mirror in position on vehicle (Fig. 96).

(3) Install bolt to hold top of side view mirror to A-pillar.

(4) Install bolts to hold bottom of side view mirror to A-pillar.

(5) Place molding in position on mirror.

(6) Install screw to hold molding to base of side view mirror.

SLIDING DOOR

CAUTION: Apply several layers of masking tape to the body around the rear end of the upper roller channel and the forward edge of the quarter panel, to avoid damaging the paint.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Apply masking tape to outside surface of quarter panel below the center roller channel, rearward of the door opening.

(2) Release sliding door latch and open door.

(3) Apply masking tape to door jamb area, rearward of the upper roller channel.

(4) Remove screw holding upper roller arm stop bumper to upper roller arm (Fig. 97).

(5) Remove stop bumper from upper roller arm.

(6) Remove center stop bumper trim cover from sliding door (Fig. 98).

(7) Remove center stop from sliding door.

(8) Remove sliding door sill plate.

(9) Remove hold open latch striker (Fig. 99).

(10) Open quarter glass.

(11) Remove center roller channel end cover (Fig. 100).

(12) Support sliding door on a suitable lifting device with a padded upper surface. The door must be moveable with lifting device in place.

CAUTION: Do not allow the center hinge roller to contact the quarter glass. Glass can break.

(13) Roll door rearward until lower rollers disengage from lower channel.

(14) Roll the door rearward until the upper (Fig. 101) and center hinge rollers exit the upper and center channels (Fig. 102).

(15) Remove sliding door from vehicle.

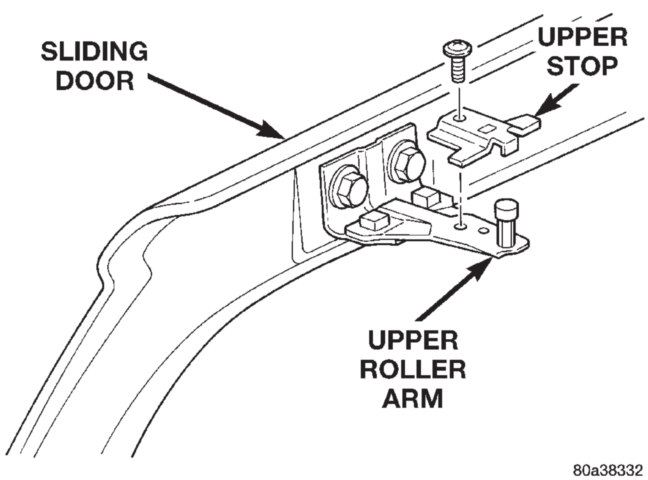


Fig. 97 Sliding Door Upper Stop

INSTALLATION

(1) Place sliding door in position on lifting device.

(2) Position door rearward of the sliding door opening.

CAUTION: Do not allow the center hinge roller to contact the quarter glass. Glass can break.

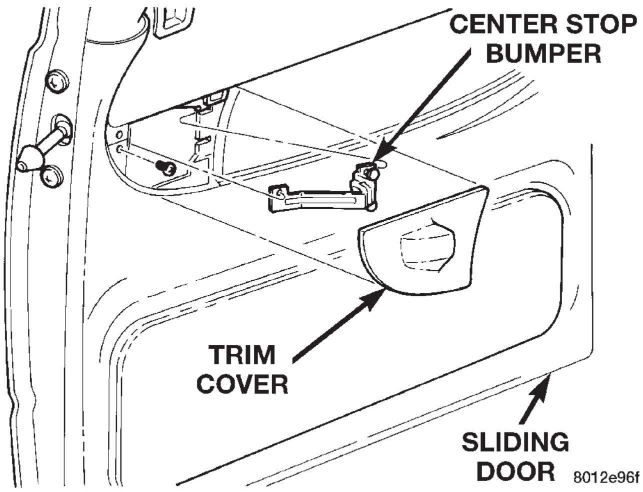


Fig. 98 Sliding Door Center Stop Bumper

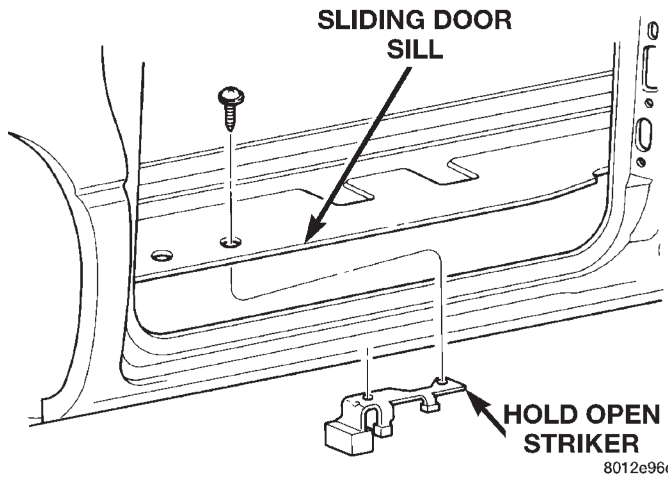


Fig. 99 Sliding Door Hold Open Latch Striker

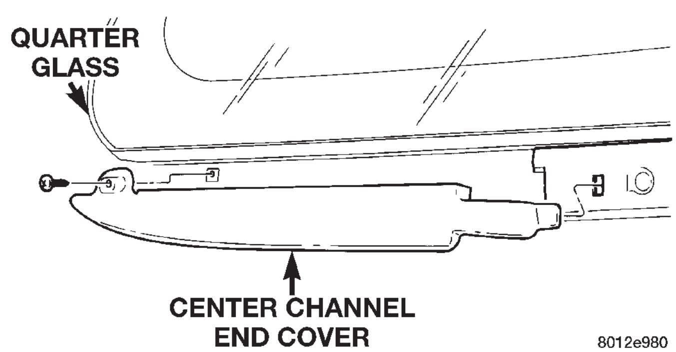


Fig. 100 Center Channel End Cover

(3) Engage the center hinge rollers into the center channels (Fig. 102).

(4) Roll door forward until lower rollers engage into rear of lower channel.

(5) Engage the upper hinge into the upper channels (Fig. 101).

(6) Install hold open latch striker (Fig. 99).

(7) Install sliding door sill plate.

REMOVAL AND INSTALLATION (Continued)

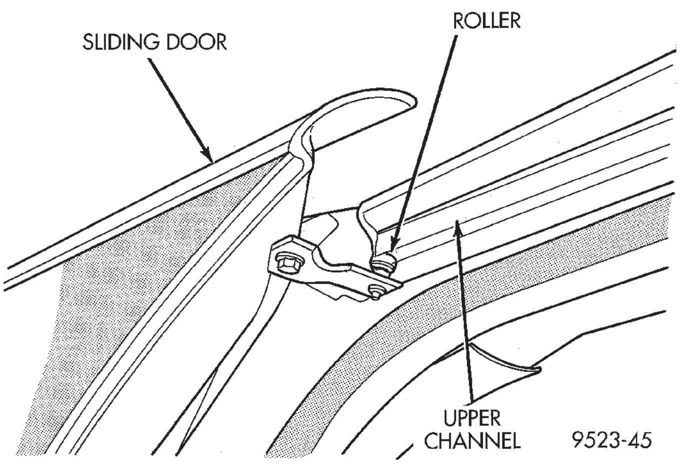


Fig. 101 Sliding Door Upper Roller

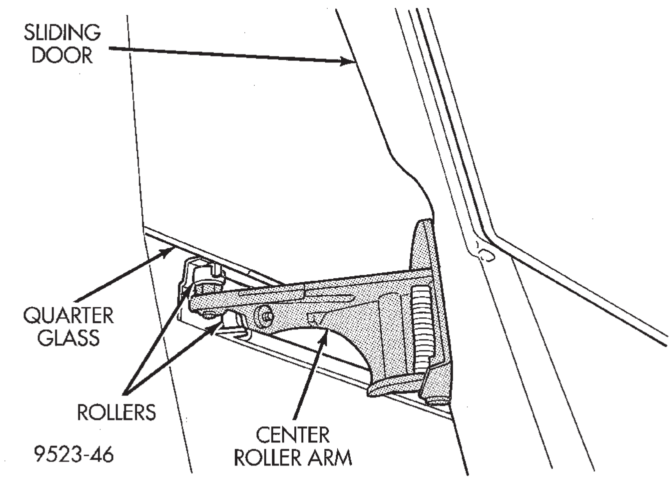


Fig. 102 Sliding Door Center Roller

(8) Install center roller channel end cover (Fig. 100).

(9) Install center stop on sliding door (Fig. 98).

(10) Install center stop bumper trim cover on sliding door.

(11) Place upper roller stop bumper in position on upper roller arm.

(12) Install screw to hold upper roller arm stop bumper to upper roller arm (Fig. 97).

(13) Remove masking tape from body surfaces.

(14) Verify door operation and fit. Adjust as necessary.

SLIDING DOOR CENTER HINGE

REMOVAL

(1) Open sliding door to the mid point of its travel.

(2) Support sliding door on a suitable lifting device.

(3) Mark outline of center hinge of inner door panel to aid installation.

(4) Remove bolts holding center hinge to sliding door.

(5) Remove center hinge from sliding door.

(6) Roll center hinge to rear of roller channel.

(7) Separate center hinge from vehicle.

INSTALLATION

NOTE: Center hinge has an adjustable bolt for up/down alignment. Refer to Siding Door Center Hinge Adjustment.

(1) Place center hinge in position on vehicle.

(2) Roll center hinge forward in roller channel.

(3) Place center hinge in position on sliding door and align marks.

(4) Install bolts to hold center hinge to sliding door.

(5) Verify sliding door alignment and operation.

SLIDING DOOR CENTER STOP TRIM COVER

REMOVAL

(1) Using a trim stick (C-4755), disengage clips holding center stop trim cover from door trim panel.

(2) Remove trim cover from vehicle (Fig. 103).

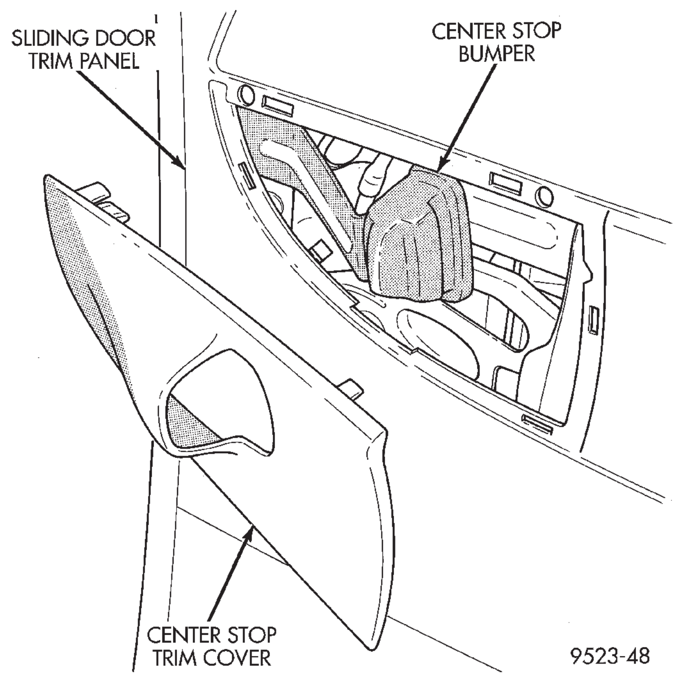


Fig. 103 Sliding Door Center Stop Trim Cover

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

SLIDING DOOR CENTER STRIKER ASSEMBLY

REMOVAL

(1) Remove sliding door trim panel.

(2) Remove screws attaching center striker assembly to door end frame (Fig. 104).

(3) Remove center striker assembly from door through access hole.

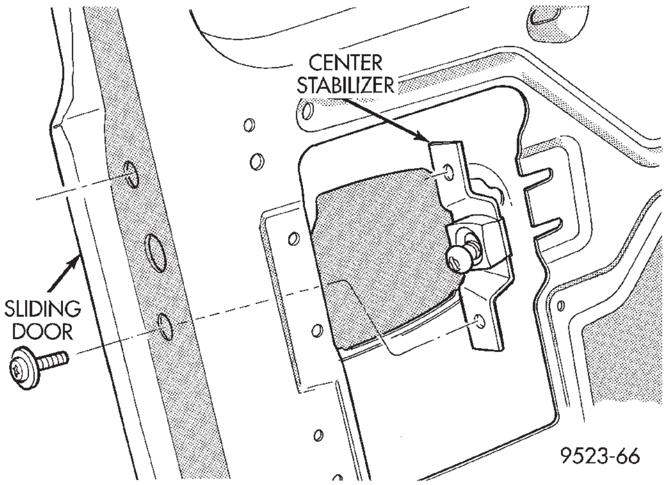


Fig. 104 Sliding Door Center Striker Assembly

INSTALLATION

(1) Place center striker in position on door through access hole.

(2) Install screws to attach center striker to door end frame.

(3) Install sliding door trim panel.

SLIDING DOOR HOLD OPEN LATCH

REMOVAL

(1) Open sliding door.

(2) Remove sliding door sill plate.

(3) Remove nuts holding hold open latch to lower roller arm (Fig. 105).

(4) Separate hold open latch from lower arm.

(5) Disconnect cable from hold open latch.

(6) Remove hold open latch from vehicle.

INSTALLATION

(1) Place hold open latch in position on vehicle.

(2) Connect cable to hold open latch.

(3) Place hold open latch in position on lower arm.

(4) Install nuts to hold the hold open latch to lower roller arm.

(5) Install sliding door sill plate.

(6) Verify sliding door operation.

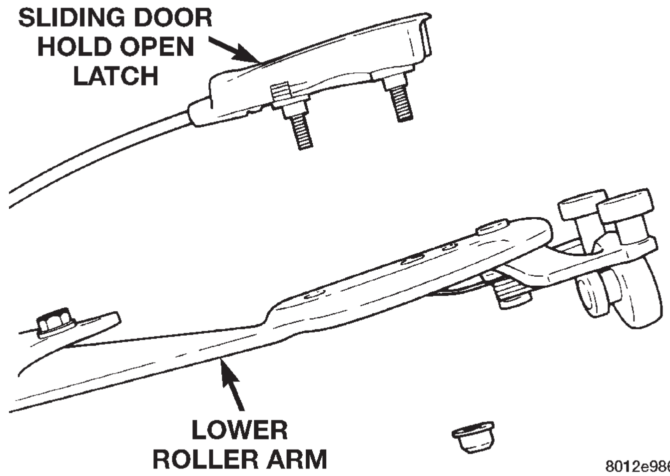


Fig. 105 Sliding Door Hold Open Latch

SLIDING DOOR HOLD OPEN LATCH STRIKER

REMOVAL

(1) Open sliding door, do not latch open.

(2) Remove sliding door sill plate.

(3) Remove screws holding sliding door hold open latch striker to door sill (Fig. 106).

(4) Remove hold open latch striker from vehicle.

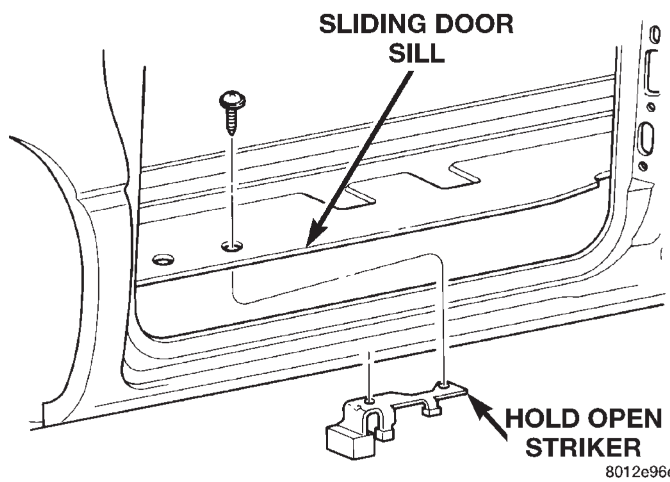


Fig. 106 Sliding Door Hold Open Latch Striker

INSTALLATION

(1) Place hold open latch striker in position on vehicle.

(2) Install screws to hold sliding door hold open latch striker to door sill.

(3) Install sliding door sill plate.

(4) Verify sliding door operation.

REMOVAL AND INSTALLATION (Continued)

SLIDING DOOR INSIDE LATCH HANDLE

REMOVAL

(1) Remove sliding door upper molding as necessary to gain access to upper door handle fastener.
(2) Remove sliding door trim panel.
(3) Remove screws holding bottom of inside latch handle to sliding door (Fig. 107).
(4) Remove screw holding top of inside latch handle to sliding door.
(5) Disengage cable end from clip on bellcrank assembly.
(6) Disengage cable end from bellcrank assembly.
(7) Remove latch handle from sliding door.
(8) Remove push-in fastener holding cable end to latch handle.
(9) Disengage cable casing end from latch handle (Fig. 108).
(10) Disengage cable end from latch handle.
(11) Remove handle from vehicle.

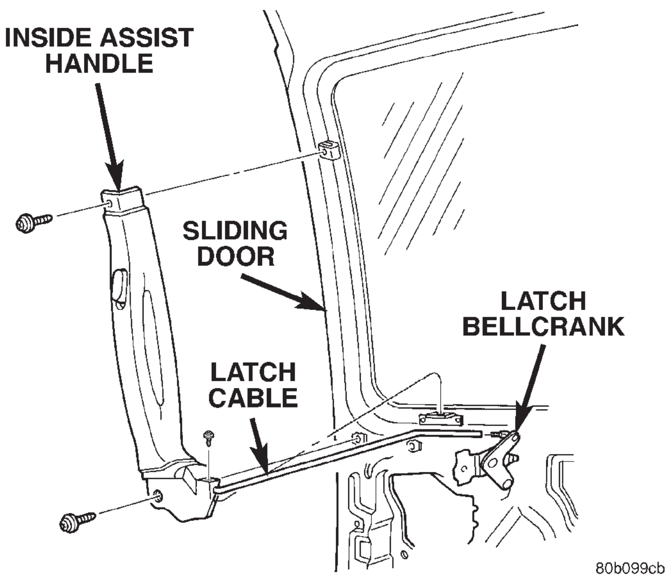


Fig. 107 Sliding Door Inside Handle

INSTALLATION

(1) Place inside latch handle in position on vehicle.
(2) Engage cable end into latch handle.
(3) Engage cable casing end into latch handle.
(4) Install push-in fastener to hold cable into latch handle.
(5) Place latch handle in position on sliding door.
(6) Install screw to hold top of inside latch handle to sliding door.
(7) Install screws to hold bottom of inside latch handle to sliding door.
(8) Engage cable end into bellcrank assembly.
(9) Engage clip to hold cable end into bellcrank assembly.
(10) Verify sliding door operation. Adjust as necessary.

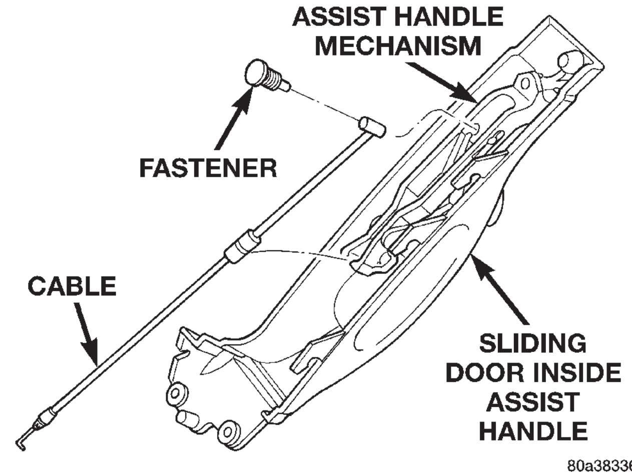


Fig. 108 Sliding Door Handle Cable

(11) Install sliding door trim panel.
(12) Install sliding door upper molding.

SLIDING DOOR INSIDE LATCH HANDLE BELLCRANK

REMOVAL

(1) Remove sliding door trim panel.
(2) Remove watershield as necessary to gain access to latch bellcrank.
(3) Remove latch/lock control cover.
(4) Disengage clip holding inside release bellcrank link to latch/lock control.
(5) Separate bellcrank link from latch/lock control.
(6) Disengage clip holding release handle latch cable to bellcrank.
(7) Remove cable from bellcrank.
(8) Remove screw holding bellcrank to inner door panel (Fig. 109).
(9) Remove bellcrank from vehicle.

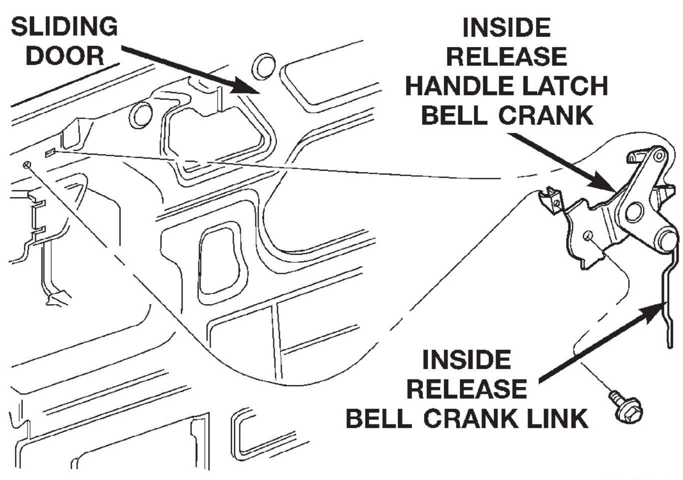


Fig. 109 Inside Latch Handle Bellcrank

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position bellcrank on vehicle.

(2) Install screw holding bellcrank to inner door panel.

(3) Position cable from bellcrank.

(4) Engage clip to hold release handle latch cable to bellcrank.

(5) Position bellcrank link on latch/lock control.

(6) Engage clip to hold inside release bellcrank link to latch/lock control.

(7) Install latch/lock control cover.

(8) Install watershield.

(9) Install sliding door trim panel.

SLIDING DOOR INSIDE LATCH RELEASE MECHANISM

REMOVAL

(1) Remove sliding door inside latch handle.

(2) Remove push-in fastener holding cable end to release mechanism (Fig. 108).

(3) Disengage cable end from release mechanism.

(4) Disengage latch cable from assist handle.

(5) Remove screws holding release mechanism to handle (Fig. 110).

(6) Remove release mechanism from handle.

(7) Rotate latch release button away from mechanism until flats on button pivots align with slots in mechanism (Fig. 111).

(8) Remove button from release mechanism.

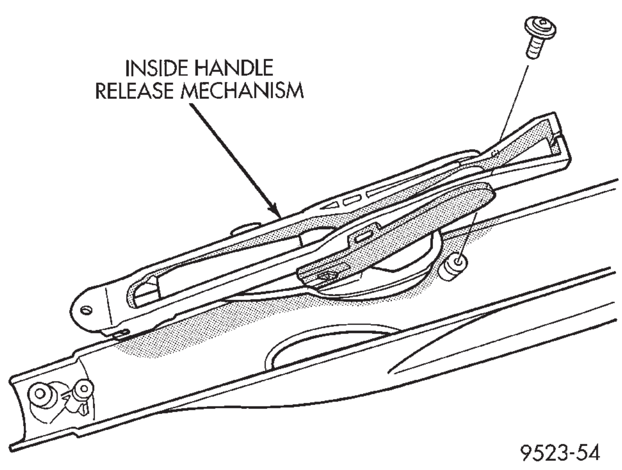


Fig. 110 Sliding Door Inside Latch Release Mechanism

INSTALLATION

(1) Position button on release mechanism.

(2) Align and engage flats on button pivots into slots in mechanism (Fig. 111).

(3) Rotate latch release button into mechanism.

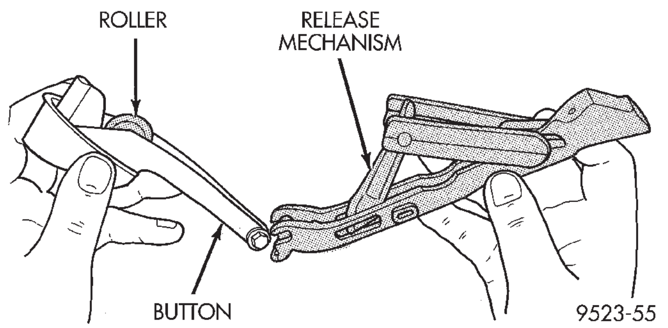


Fig. 111 Sliding Door Inside Latch Button

(4) Place release mechanism in position on handle.

(5) Install screws to hold release mechanism to handle (Fig. 110).

(6) Engage latch cable into handle.

(7) Engage cable end from release mechanism.

(8) Install push-in fastener holding cable end to release mechanism.

(9) Install sliding door inside latch handle.

SLIDING DOOR LATCH STRIKER

REMOVAL

(1) Open sliding door.

(2) Mark outline of striker on C-pillar door jamb face to aid installation.

(3) Remove screws holding striker to C-pillar (Fig. 112).

(4) Remove striker from vehicle.

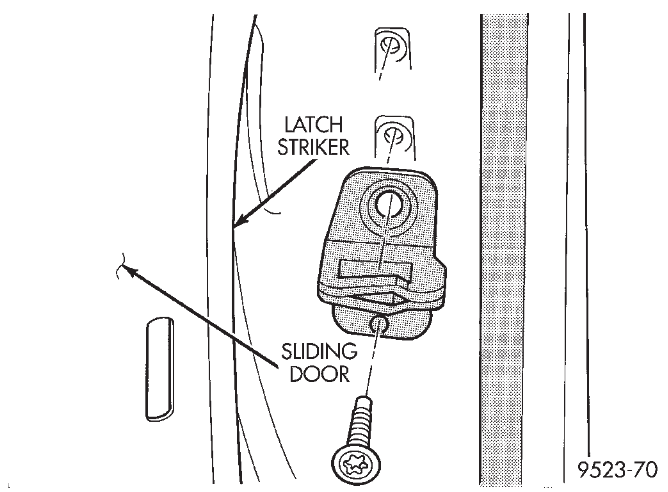


Fig. 112 Sliding Door Latch Striker

INSTALLATION

(1) Place striker in position on vehicle.

(2) Align striker to outline marks on C-pillar.

(3) Install screws to hold striker to C-pillar.

(4) Verify sliding door alignment and operation.

REMOVAL AND INSTALLATION (Continued)

SLIDING DOOR LATCH/LOCK CONTROL

REMOVAL

(1) Remove sliding door trim panel.

(2) Remove sliding door stop bumper.

(3) Remove sound pad, if equipped.

(4) Remove latch/lock control cover (Fig. 113).

(5) With sliding door ajar, disengage clip holding rear latch link to latch/lock control (Fig. 114) (Fig. 115).

(6) Place a flat head screw driver between metal clip ears and bottom of link.

NOTE: Rotate screw driver to remove link.

CAUTION: Replace the latch/lock control if any of the metal clips on the latch/lock control are bent or broken. DO NOT attempt to repair the clips to retain the links.

(7) Remove rear latch link from latch/lock control.

(8) Disengage clip holding outside door handle link to latch/lock control (Fig. 115).

(9) Remove outside door handle link from latch/lock control.

(10) Disengage clip holding inside door handle bellcrank link to latch/lock control (Fig. 115).

(11) Separate inside door handle bellcrank link from latch/lock control.

(12) Disengage clip holding lock cylinder link to latch/lock control.

(13) Remove lock cylinder link from control.

(14) Disengage clip holding inside lock link to latch/lock control.

(15) Remove inside lock link from control.

(16) Disengage lock tabs holding hold open latch cable case to latch/lock control.

(17) Remove hold open latch cable ball end from latch/lock control.

(18) Loosen bolts holding latch/lock control to sliding door.

(19) If equipped, disconnect wire connector from power door lock motor.

(20) Remove latch/lock from vehicle.

INSTALLATION

(1) Position latch/lock locking lever in unlocked position.

(2) Engage rigging cam (Fig. 114).

(3) Place latch/lock in position on vehicle.

(4) If equipped, engage wire connector into power door lock motor.

(5) Insert bolt heads into slots in sliding door inner panel.

(6) Tighten bolts to hold latch/lock control to sliding door.

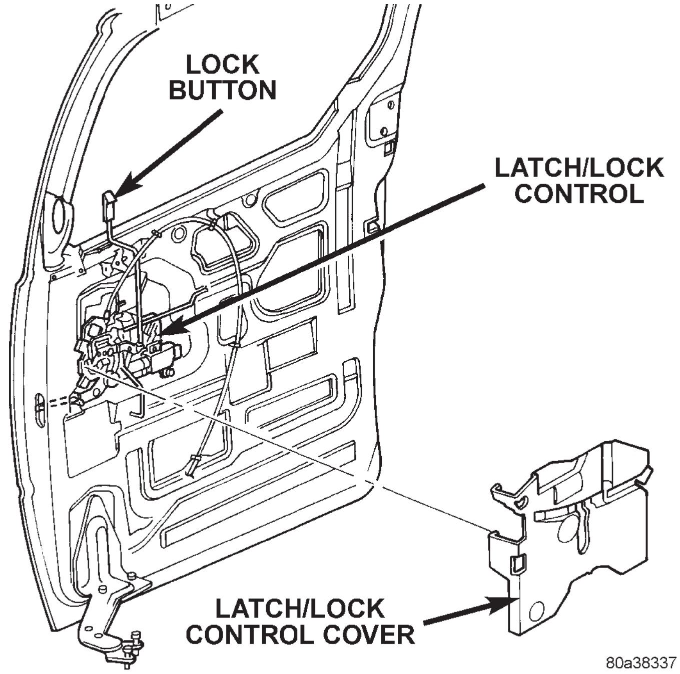


Fig. 113 Latch/Lock Cover

(7) Engage hold open latch cable ball end into latch/lock control.

(8) Engage lock tabs to hold the hold open latch cable case to latch/lock control.

(9) Insert lock cylinder link into control.

(10) Engage clip to hold lock cylinder link to latch/lock control.

(11) Insert inside lock link into control.

(12) Engage clip to hold inside lock link to latch/lock control.

(13) Lift clip for inside door handle bellcrank link to top of slot in mechanism (Fig. 114).

(14) Engage clip to hold bellcrank link to latch/lock control.

(15) Lower clip for outside door handle link to bottom of slot in mechanism and engage link to clip (Fig. 114).

NOTE: Move link rearward until movement stops before engaging link to clip.

(16) Place rear latch link in position on control by moving link rearward until movement stops.

(17) Engage clip to hold rear latch release link to latch/lock control.

(18) Push inside lock link button downward to disengage rigging cam.

(19) Verify sliding door operation.

(20) Install latch/lock cover.

(21) Install sound pad, if equipped.

(22) Install sliding door stop bumper.

(23) Install sliding door trim panel.

REMOVAL AND INSTALLATION (Continued)

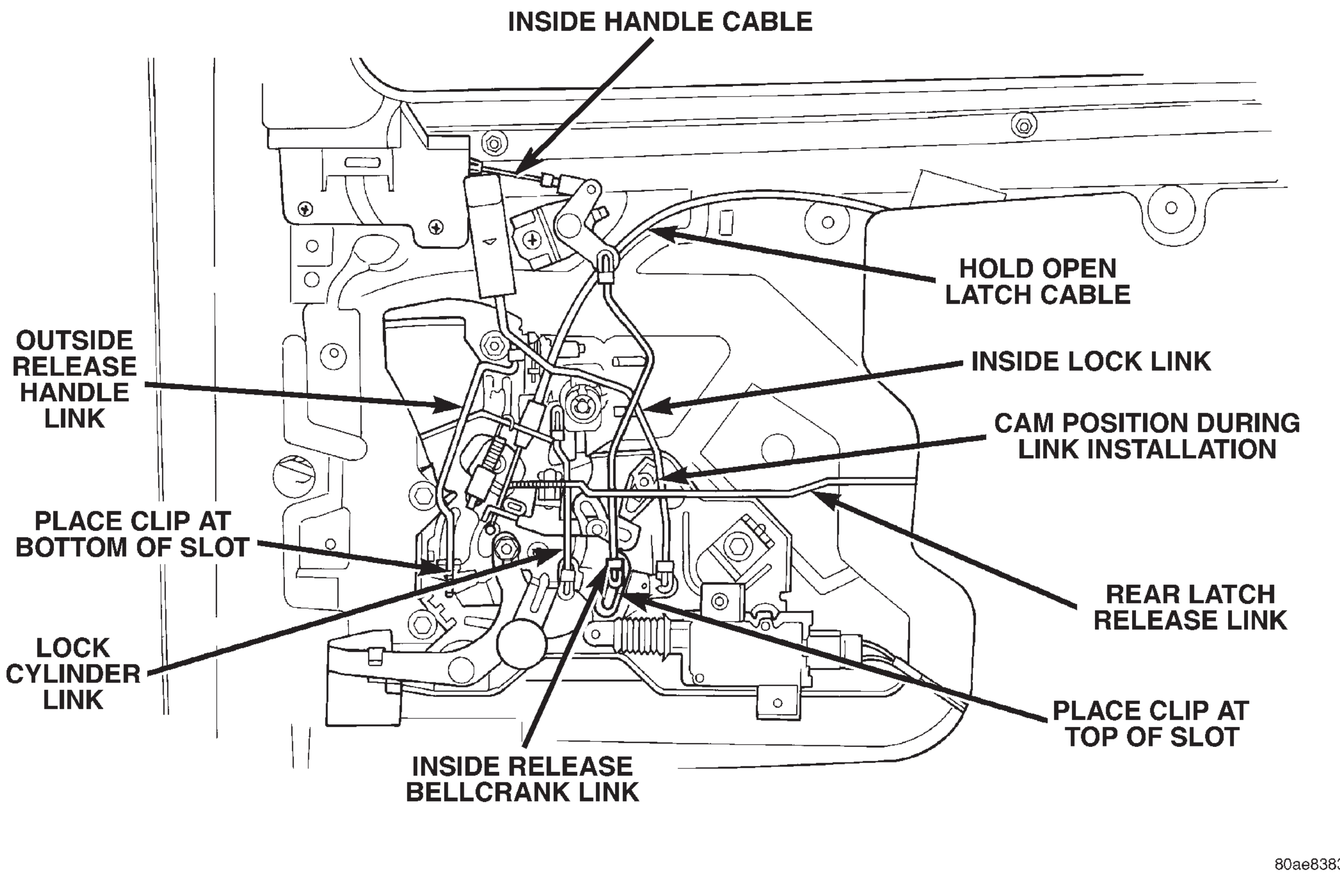


Fig. 114 Sliding Door Latch/Lock Control Linkage

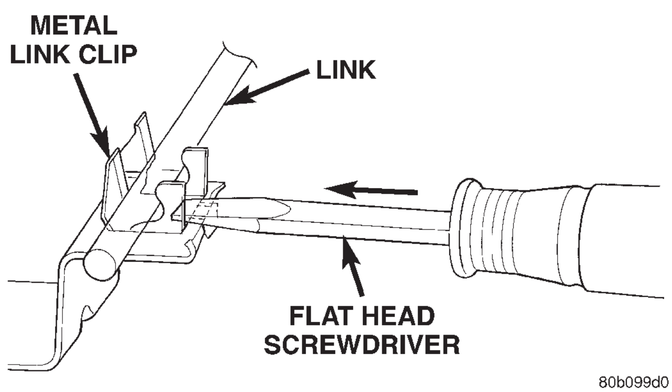


Fig. 115 Latch/Lock Control Link Removal

SLIDING DOOR LOWER ROLLER ARM

REMOVAL

(1) Open sliding door.

(2) Mark outline of roller arm on sliding door bracket to aid installation.

(3) Remove sliding door sill plate.

(4) Remove screws holding hold open latch to lower roller arm.

(5) Separate hold open latch from lower arm.

(6) Support sliding door on a suitable lifting device with a padded upper surface. The door must be moveable with lifting device in place.

(7) Remove bolts holding lower roller arm to sliding door (Fig. 116).

(8) Remove roller arm from sliding door.

(9) Disengage roller arm from lower channel (Fig. 117).

(10) Remove roller arm from vehicle.

INSTALLATION

For installation, reverse the above procedures.

SLIDING DOOR LOWER ROLLER ARM BRACKET

REMOVAL

(1) Remove access hole plug.

(2) Open sliding door.

(3) Support sliding door on a suitable lifting device.

(4) Remove lower roller arm.

(5) Mark outline of roller arm bracket on inside of sliding door.

(6) Remove bolts holding lower roller arm bracket to sliding door (Fig. 118).

(7) Remove lower roller bracket from vehicle.

REMOVAL AND INSTALLATION (Continued)

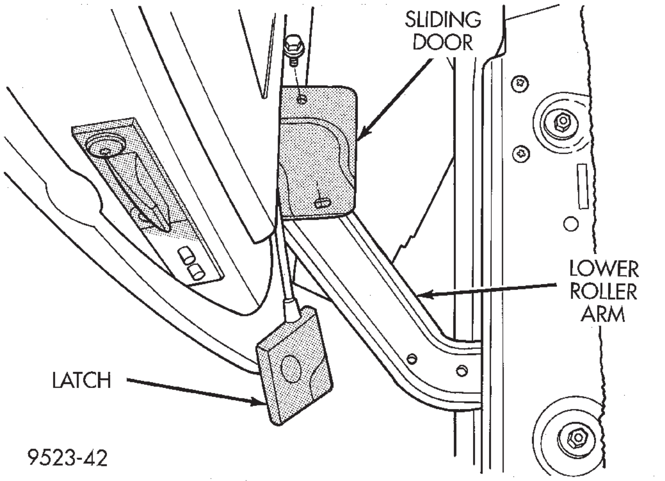


Fig. 116 Sliding Door Lower Roller Arm

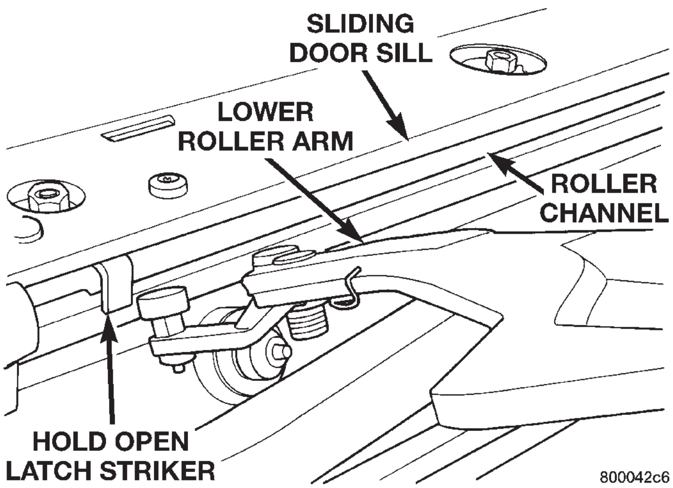


Fig. 117 Sliding Door Roller Arm Channel

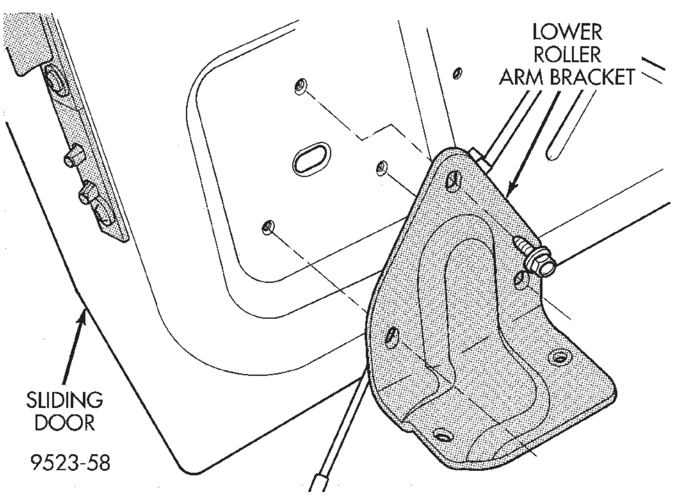


Fig. 118 Sliding Door Lower Roller Arm Bracket

INSTALLATION

(1) Place lower roller bracket in position on vehicle.

(2) Align outline mark on inside of sliding door to roller arm bracket.

(3) Install bolts holding lower roller arm bracket to sliding door.

(4) Install lower roller arm.

(5) Remove lifting device.

(6) Verify sliding door operation.

(7) Install access hole plug.

SLIDING DOOR OUTSIDE LATCH RELEASE HANDLE

REMOVAL

(1) Remove sliding door trim panel.

(2) Remove sliding door stop bumper.

(3) Remove watershield as necessary to access outside release handle fasteners.

(4) Remove latch/lock control cover.

(5) Disengage clip holding outside door handle linkage to door handle.

(6) Separate linkage from outside door handle.

(7) Separate linkage from latch/lock control.

(8) Remove nuts holding outside door handle to outer door panel (Fig. 119).

(9) Remove outside door handle from vehicle.

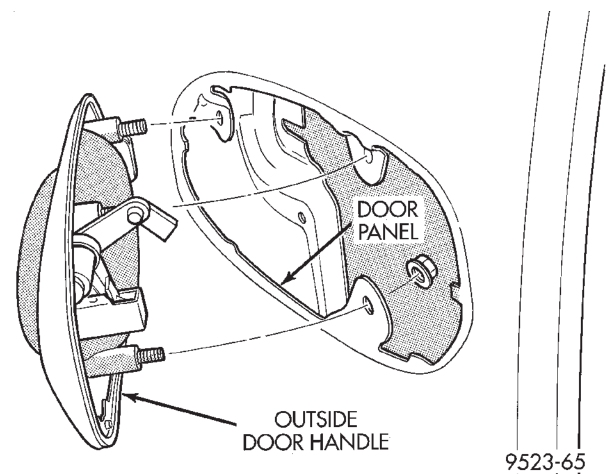


Fig. 119 Sliding Door Outside Latch Release Handle

INSTALLATION

(1) Position outside door handle on vehicle.

(2) Install nuts to hold outside door handle to outer door panel.

(3) Insert linkage into outside door handle.

(4) Engage clip to hold linkage to outside door handle.

(5) Engage rigging cam to latch/lock control mechanism.

(6) Move clip on latch/lock control to bottom of slot and engage linkage to latch/lock control.

(7) Verify sliding door operation. Adjust as necessary.

(8) Install latch/lock cover.

(9) Install watershield.

(10) Install sliding door stop bumper.

(11) Install sliding door trim panel.

REMOVAL AND INSTALLATION (Continued)

SLIDING DOOR REAR LATCH

REMOVAL

(1) Remove sliding door trim panel.
(2) Remove water shield as necessary.
(3) Open sliding door to the ajar position.
(4) Disengage clip holding linkage to rear latch.
(5) Remove screws holding rear latch to sliding door end frame (Fig. 120).
(6) Remove sliding door rear latch from door through rear access hole.

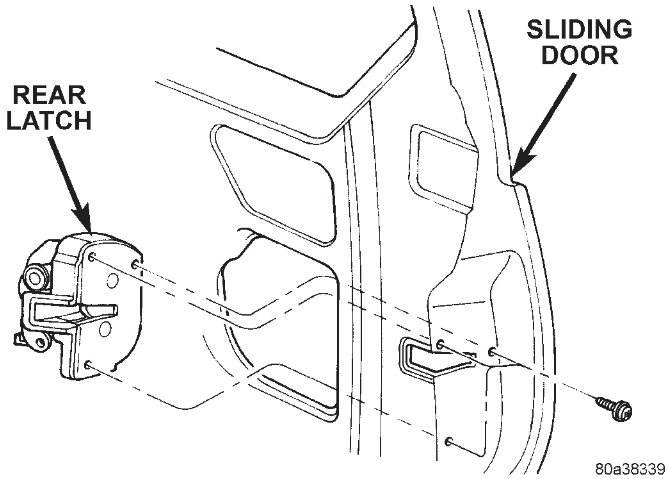


Fig. 120 Sliding Door Rear Latch

INSTALLATION

NOTE: The screws attaching the rear latch to sliding door end frame have locking patch on the threads. Screws must be replaced during installation.

(1) Position sliding door rear latch on door through rear access hole.
(2) Install screws to hold rear latch to sliding door end frame.
(3) Engage clip to hold linkage to rear latch.
(4) Verify sliding door operation. Adjust as necessary.
(5) Install water shield.
(6) Install sliding door trim panel.

SLIDING DOOR SILL PLATE

REMOVAL

(1) Disengage hidden clips holding sill plate to sliding door opening sill.
(2) Disengage hooks holding outside edge of sill plate to door sill (Fig. 121).
(3) Remove sill plate from vehicle.

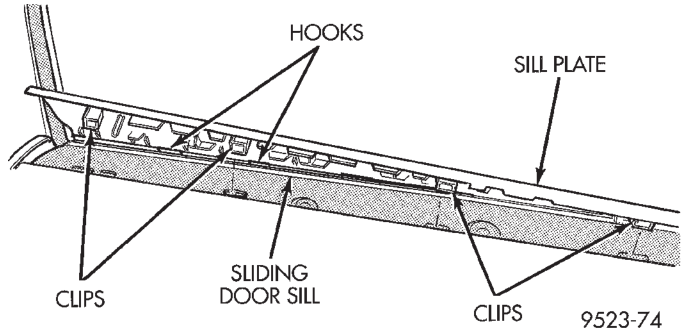


Fig. 121 Sliding Door Sill Plate

INSTALLATION

(1) Place sill plate in position on vehicle.
(2) Engage hooks to hold outside edge of sill plate to door sill.
(3) Align guide pins to holes in door sill.
(4) Engage hidden clips to hold sill plate to sliding door opening sill.

SLIDING DOOR STABILIZER

REMOVAL

(1) Open sliding door.
(2) Remove screws holding stabilizer to door end frame (Fig. 122).
(3) Remove stabilizer from vehicle.

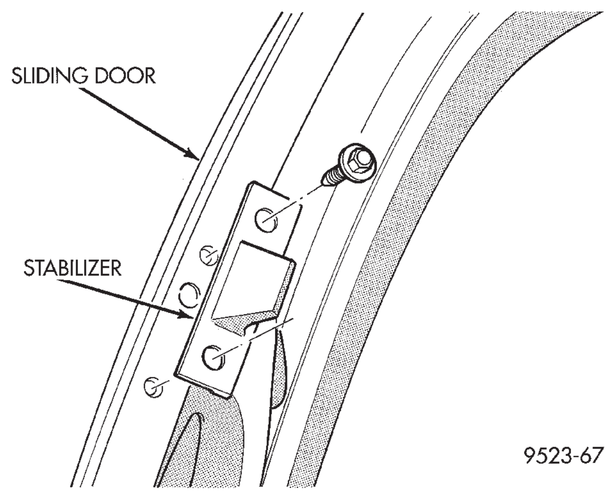


Fig. 122 Sliding Door Stabilizer

INSTALLATION

(1) Place stabilizer in position on vehicle.

NOTE: Loose install screws first. Fit should be snug but free to move when closing door to align to body half stabilizer.

(2) Install screws to hold stabilizer to door end frame.
(3) Open door and final torque screws.
(4) Verify sliding door operation.

REMOVAL AND INSTALLATION (Continued)

SLIDING DOOR STABILIZER SOCKET

REMOVAL

(1) Open sliding door.

(2) Remove screws holding stabilizer socket to B-pillar (Fig. 123).

(3) Remove stabilizer socket from vehicle.

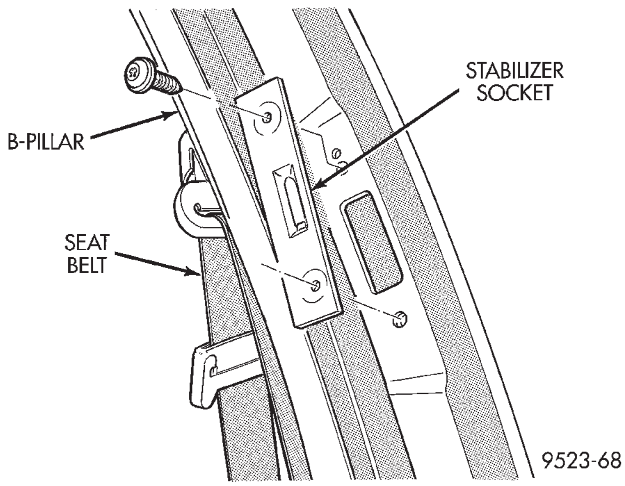


Fig. 123 Sliding Door Stabilizer Socket

INSTALLATION

(1) Place stabilizer socket in position on vehicle.

(2) Install screws to hold stabilizer socket to B-pillar.

(3) Close sliding door and verify operation.

SLIDING DOOR STOP BUMPER

REMOVAL

(1) Remove center stop bumper trim panel.

(2) Loosen screws holding rear of stop bumper to door inner panel (Fig. 124).

(3) Remove screw holding front of stop bumper to door inner panel.

(4) Remove stop bumper from vehicle.

INSTALLATION

(1) Place stop bumper in position on vehicle.

(2) Install screw to hold front of stop bumper to door inner panel (Fig. 124).

(3) Tighten screws to hold rear of stop bumper to door inner panel.

(4) Install trim panel.

SLIDING DOOR TRIM PANEL

REMOVAL

(1) Remove sliding door upper frame molding.

(2) If removing the left sliding door trim panel, remove screw from inside ash receiver bezel.

(3) Remove screws holding trim panel to inner door panel (Fig. 126).

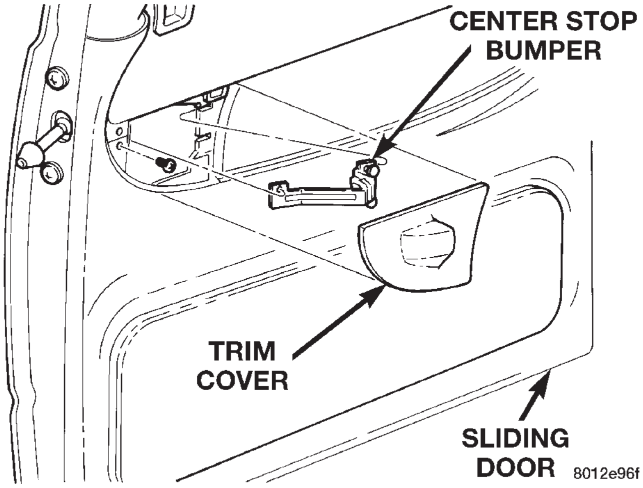


Fig. 124 Sliding Door Stop Bumper

(4) Disengage push-in fasteners holding trim to door panel around perimeter and upper edge of door (Fig. 125).

(5) Remove sliding door trim panel from vehicle.

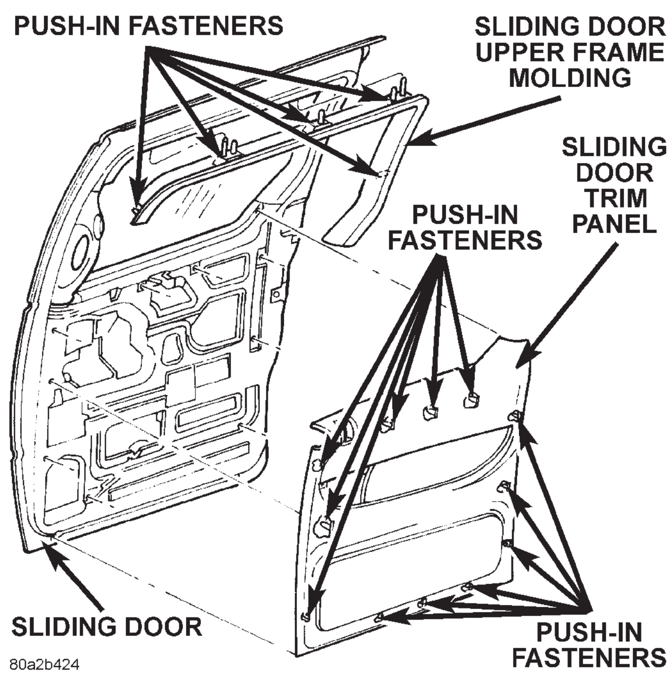


Fig. 125 Sliding Door Trim Panel

INSTALLATION

(1) Place sliding door trim panel in position on vehicle.

(2) Align locating pins on backside of trim panel to mating holes in the inner door panel.

(3) Engage push-in fasteners to hold trim to door panel around perimeter and upper edge of door (Fig. 125).

(4) Install screws to hold trim panel to inner door panel.

REMOVAL AND INSTALLATION (Continued)

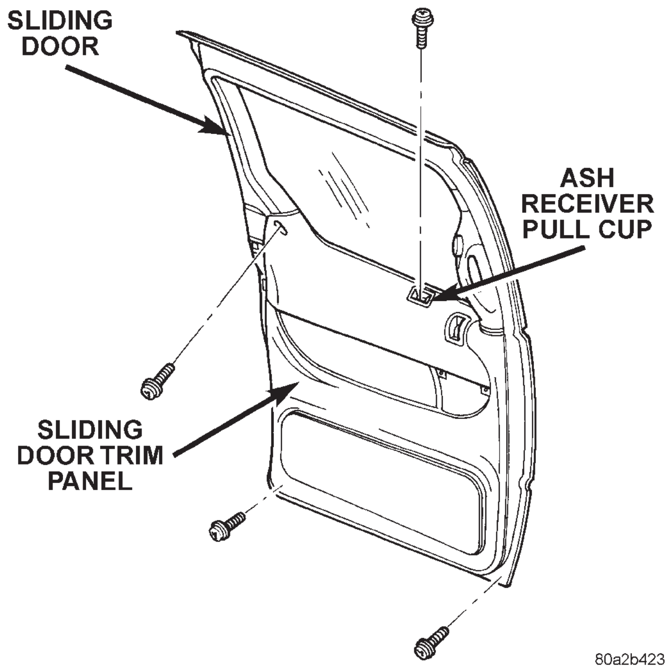


Fig. 126 Sliding Door Trim Panel Screws

(5) If necessary, install screw from inside ash receiver bezel on left sliding door trim panel.

(6) Install sliding door upper frame molding.

SLIDING DOOR UPPER ROLLER

REMOVAL

(1) Open sliding door, do not latch open.

(2) Remove screw holding upper stop bracket to upper roller bracket (Fig. 127).

(3) Remove stop bracket from vehicle.

(4) Place a padded block between the open sliding door and the roof rail.

(5) Mark outline of upper roller bracket on sliding door.

(6) Remove bolts holding upper roller to sliding door (Fig. 128).

(7) Remove upper roller from door.

(8) Slide roller out of rear end of roof rail channel.

(9) Remove upper roller from vehicle.

INSTALLATION

(1) Place upper roller in position on vehicle.

(2) Slide roller into rear end of roof rail channel.

(3) Place upper roller in position on door.

(4) Align outline marks on sliding door to upper roller bracket

(5) Install bolts to hold upper roller to sliding door.

(6) Remove padded block from between sliding door and roof rail.

(7) Place stop bracket in position on vehicle.

(8) Install screw to hold upper stop bracket to upper roller bracket.

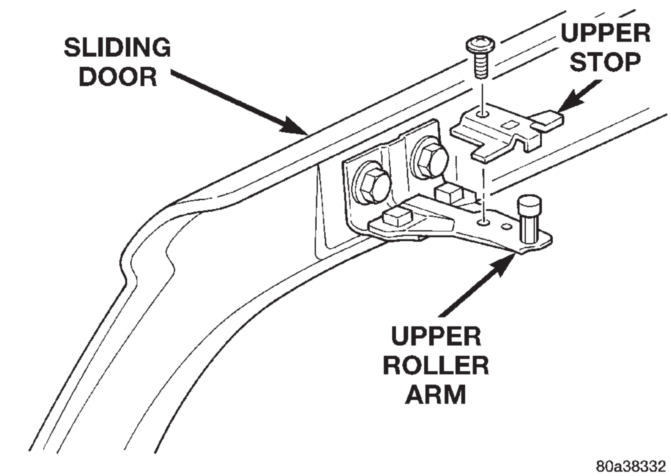


Fig. 127 Sliding Door Upper Stop

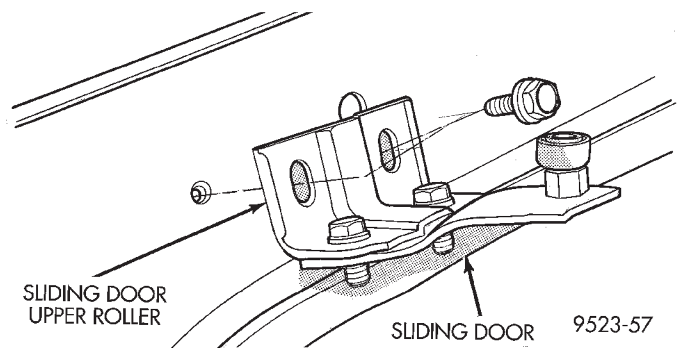


Fig. 128 Sliding Door Upper Roller

(9) Verify sliding door alignment and operation. Adjust as necessary.

SLIDING DOOR WEATHER-STRIP

REMOVAL

(1) Open sliding door.

(2) Remove door opening sill plate.

(3) Loosen B-pillar trim covers.

(4) Loosen quarter panel trim panels.

(5) From splice at the bottom center of door opening, pull weather-strip from pinch flange around door opening.

INSTALLATION

For installation, reverse the above procedures.

STICK-ON BODY SIDE MOLDING

REMOVAL

Refer to (Fig. 129), (Fig. 130), (Fig. 131), (Fig. 132) or (Fig. 133) for proper location of fasteners holding the molding to the wheelhouse lip and rocker panels.

(1) Warm the affected stick-on molding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

REMOVAL AND INSTALLATION (Continued)

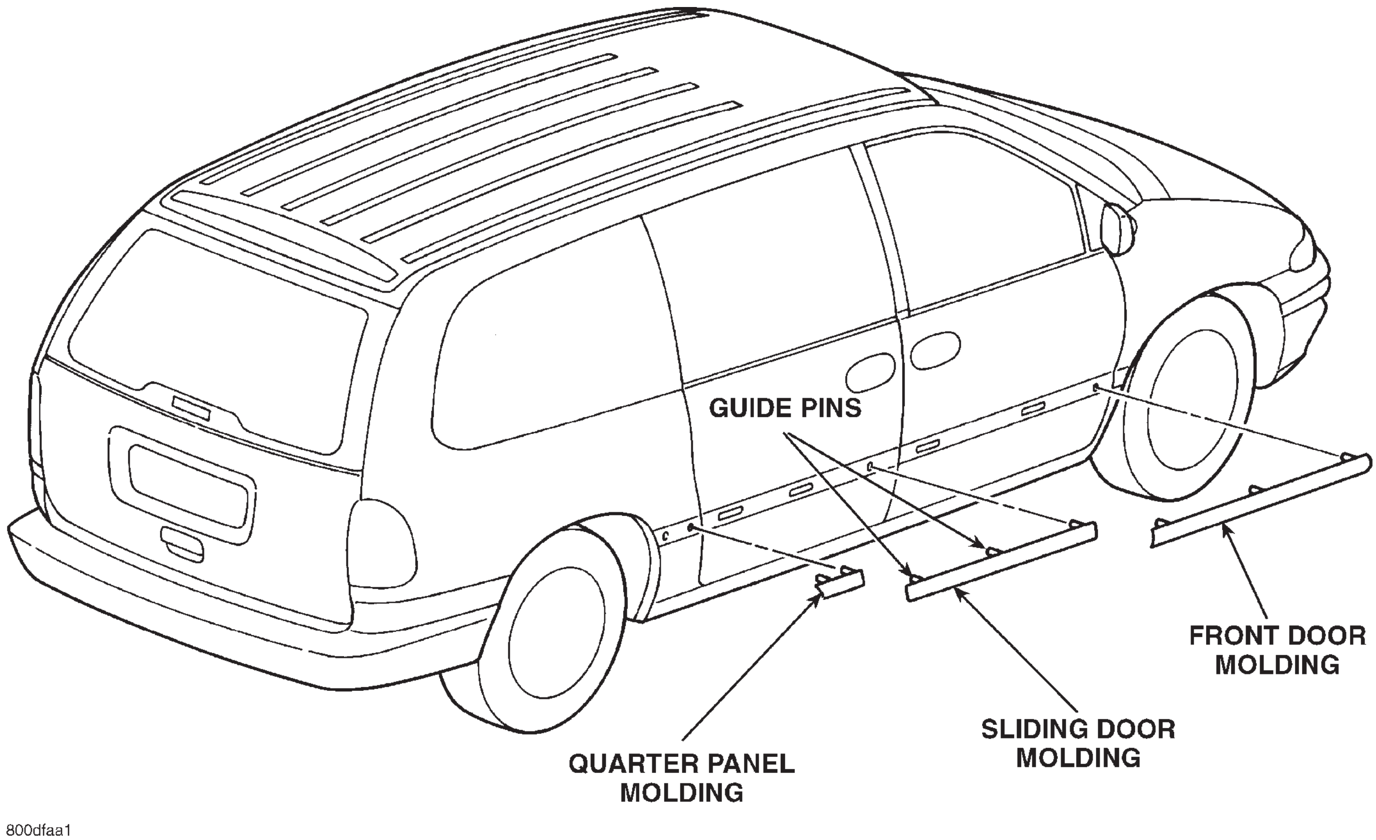


Fig. 129 Body Side Moldings – Base

(2) If equipped, remove pop-rivets holding molding edge to wheelhouse lip.

(3) Pull stick-on molding from painted surface.

(4) Remove adhesive tape residue from painted surface of vehicle. Use a 3M Scotch-Brite™ Molding Adhesive and Stripe Removal Disc, or equivalent, to clean adhesive residue from painted surfaces. These products are available from automotive paint suppliers. Refer to instructions supplied with the specific product for proper usage.

INSTALLATION

Refer to (Fig. 129), (Fig. 130), (Fig. 131), (Fig. 132) or (Fig. 133) for proper location of fasteners to hold the molding to the wheelhouse lip and rocker panels.

(1) If molding is to be reused;

(a) Remove tape residue from molding.

(b) Clean back of molding with Mopar® Super Kleen, or equivalent.

(c) Wipe molding dry with lint free cloth.

(d) Apply a single coat of Mopar® TPO Molding Prep to tape side of molding and allow to dry thoroughly.

(e) Apply new body side molding (two sided adhesive) tape to back of molding.

(2) Clean body surface with Mopar® Super Kleen, or equivalent. Wipe surface dry with lint free cloth.

(3) Remove protective cover from tape on back of molding.

(4) Apply molding to body from front to rear, inserting locator pins into hole in body panel.

(5) Using a roller tool, roll molding onto body panel with enough force to assure adhesion. Do not apply excessive force, or damage to body panels may result.

(6) Install pop-rivets to hold molding edge to wheelhouse lip, if necessary.

SUN VISOR

All vehicles with driver and passenger side airbags must have a colored coded five Bullet point airbag warning label applied to the sun visor, verify label availability and ensure the label is installed.

REMOVAL

(1) Disengage sun visor from center support.

(2) Remove screws attaching sun visor to roof header (Fig. 134).

(3) Remove sun visor from roof.

(4) If equipped, disconnect illuminated vanity mirror wire connector from body harness.

(5) Remove sun visor from vehicle.

REMOVAL AND INSTALLATION (Continued)

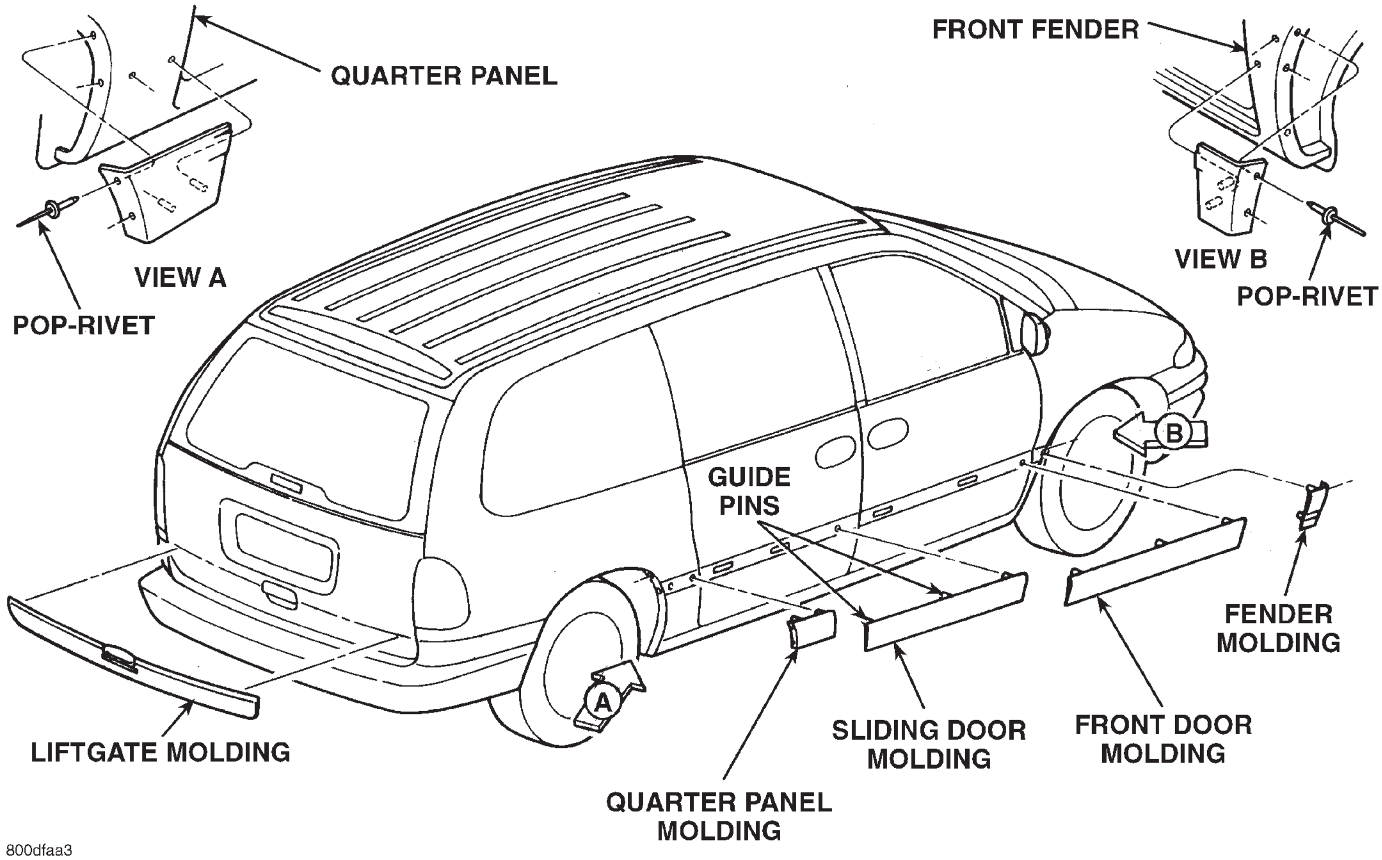


Fig. 130 Body Side Moldings – Highline

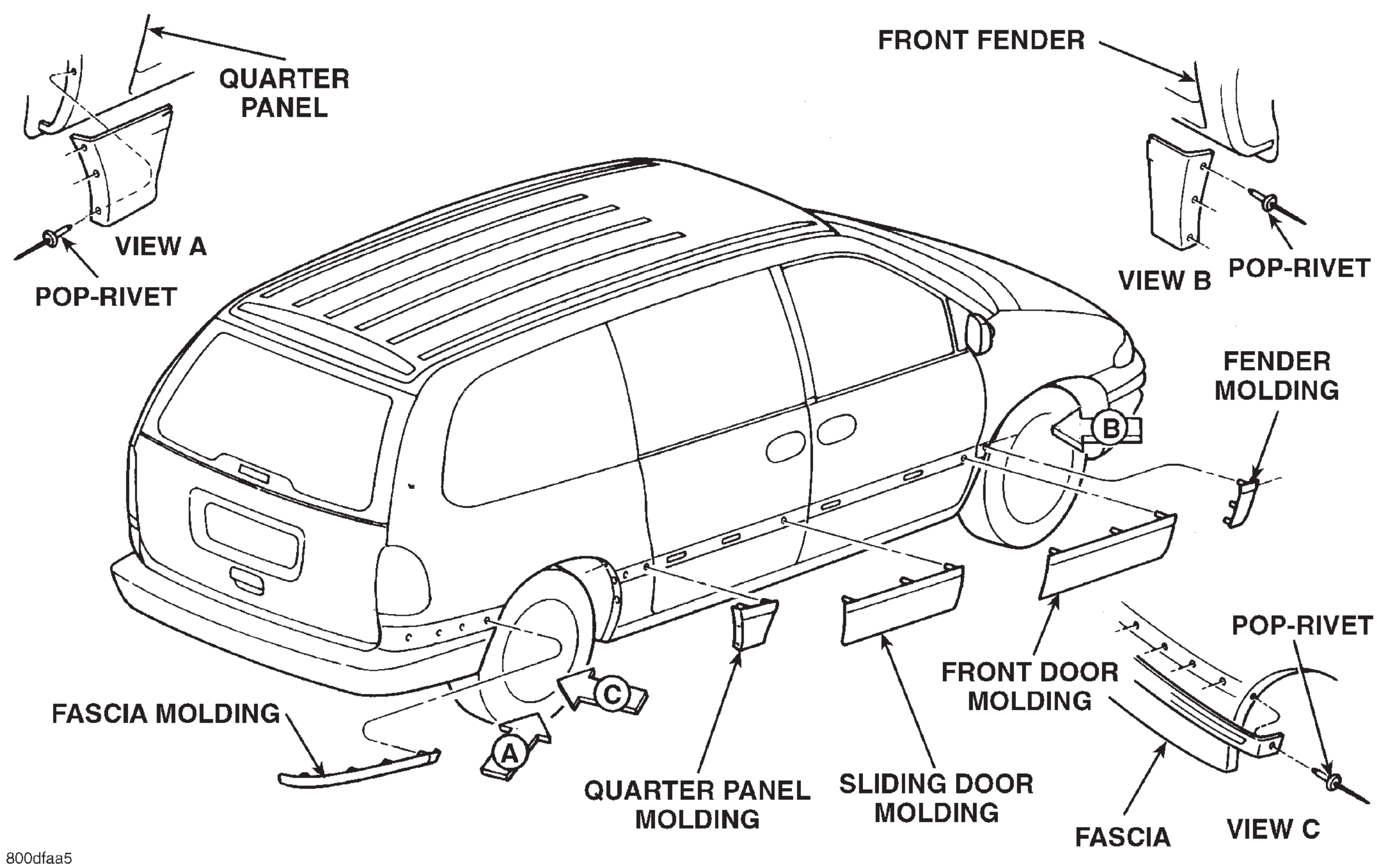


Fig. 131 Body Side Moldings – Premium

REMOVAL AND INSTALLATION (Continued)

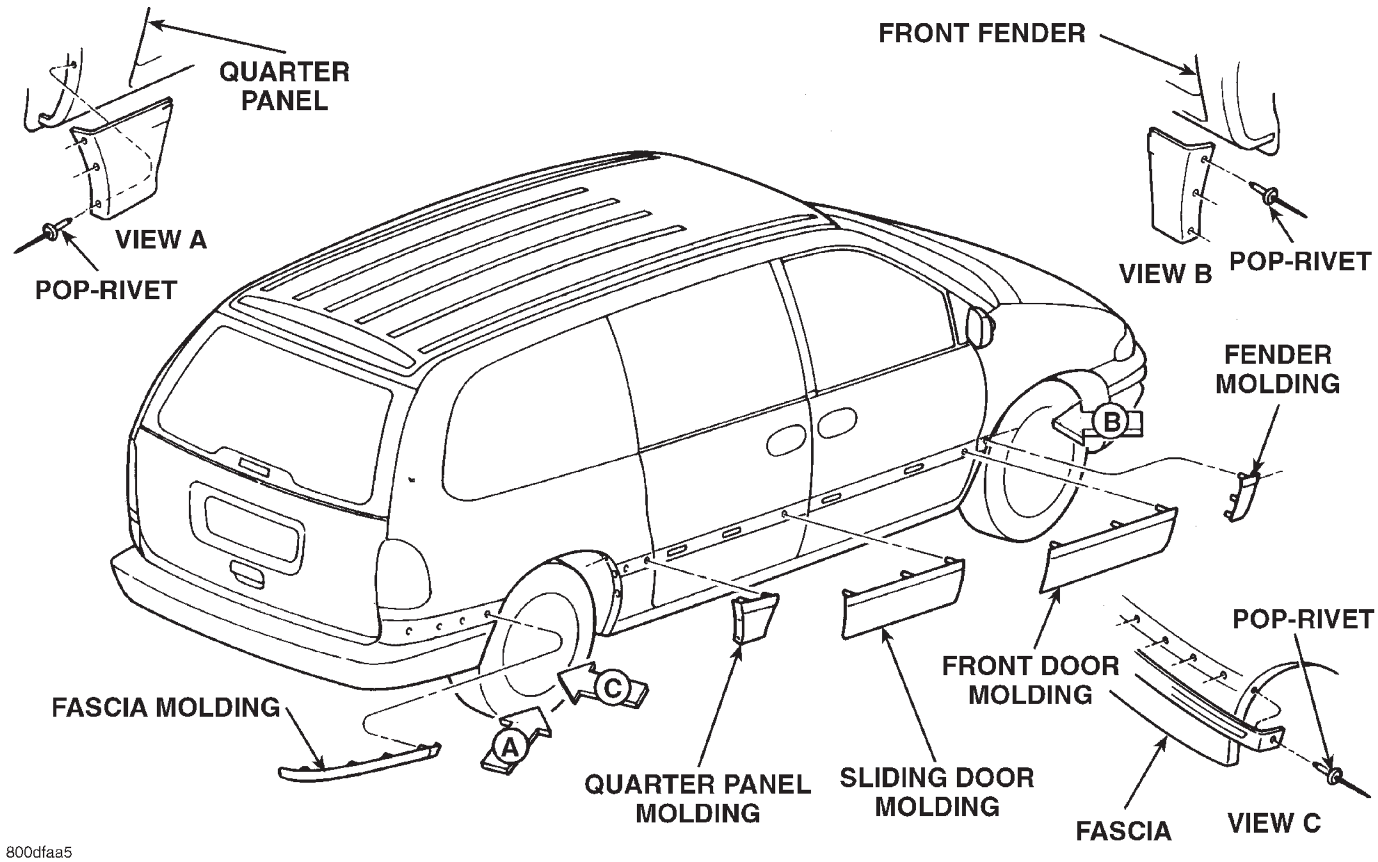


Fig. 132 Body Side Moldings – Luxury

INSTALLATION

(1) Place sun visor in position on vehicle.

(2) Connect illuminated vanity mirror wire connector into body harness.

(3) Place sun visor in position on roof.

(4) Install screws to hold sun visor to roof header (Fig. 134).

(5) Engage sun visor into center support.

SUN VISOR SUPPORT

REMOVAL

(1) Disengage sun visor from support.

(2) Remove screw holding support to roof header (Fig. 135).

(3) Remove sun visor support from vehicle.

INSTALLATION

(1) Place sun visor support in position on vehicle.

(2) Install screw holding support to roof header (Fig. 135).

(3) Engage sun visor into support.

UPPER B-PILLAR TRIM COVER

REMOVAL

(1) Remove bolt holding lower seat belt anchor to floor.

(2) Lower shoulder belt height adjuster to the bottom of travel.

(3) Remove shoulder belt turning loop from height adjuster.

(4) Using Snap-on® prying tool (A179A), or equivalent, remove shoulder belt height adjuster knob.

(5) Remove shoulder belt bezel from trim cover.

(6) Remove screw holding trim cover to B-pillar from inside bezel cavity.

(7) Disengage hidden clips holding trim cover to B-pillar.

(8) Remove B-pillar trim cover from vehicle (Fig. 136).

REMOVAL AND INSTALLATION (Continued)

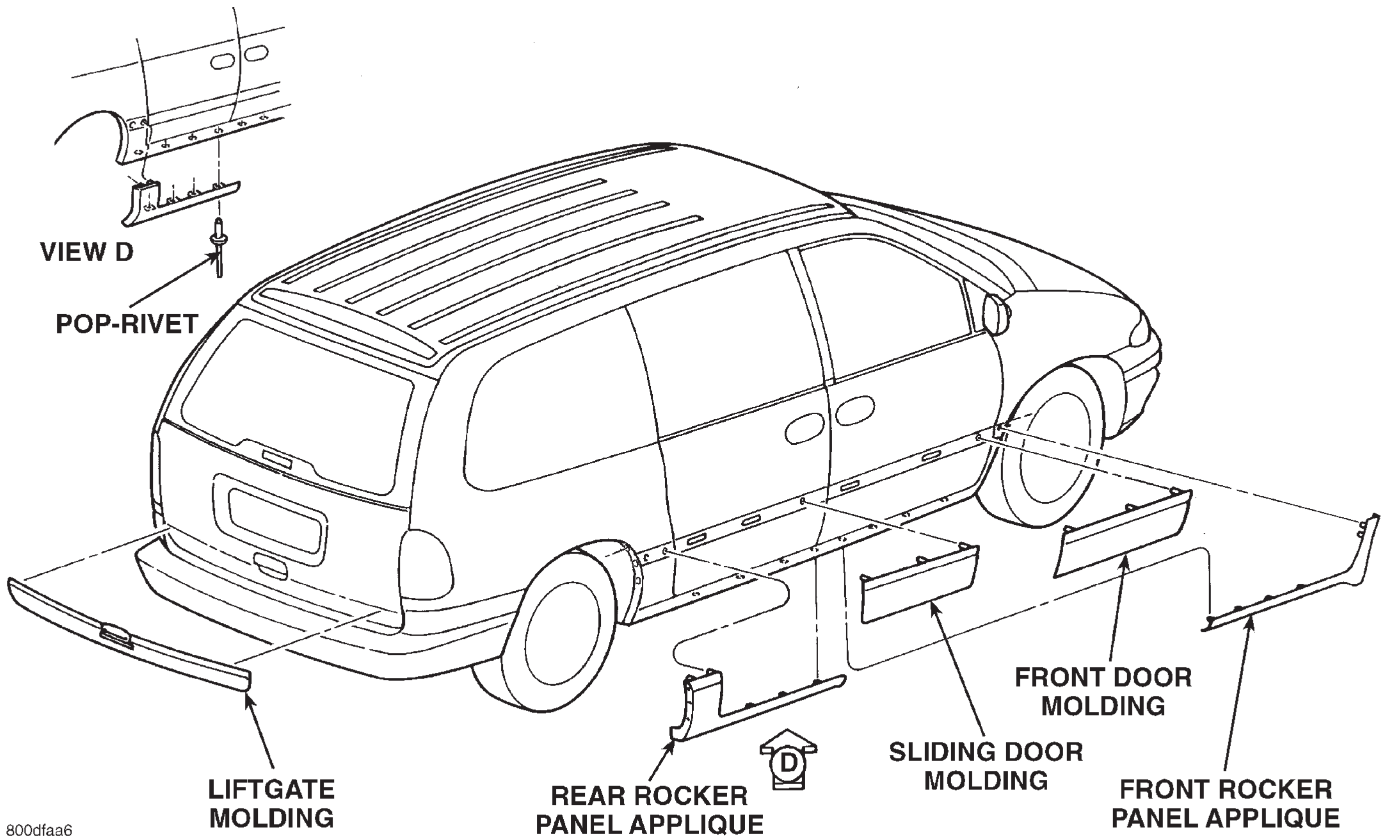


Fig. 133 Body Side Moldings with Applique

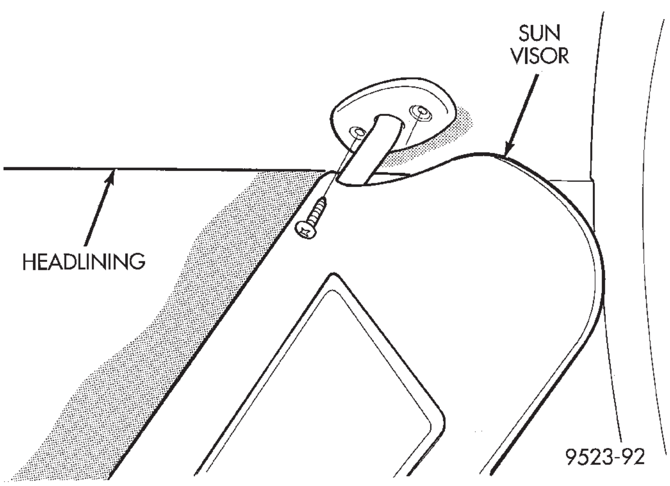


Fig. 134 Sun Visor

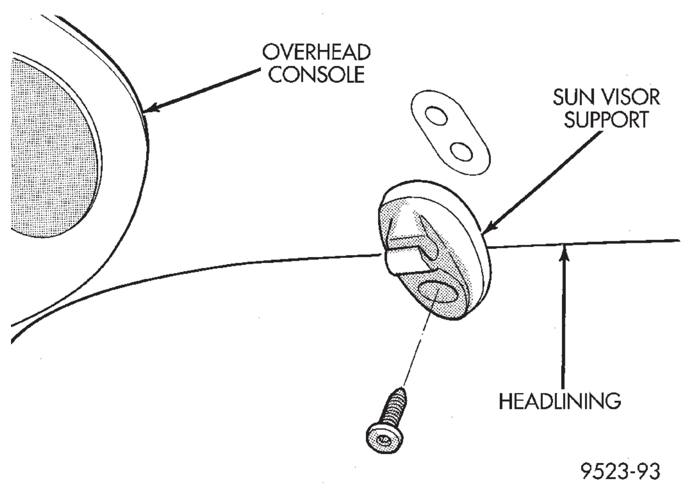


Fig. 135 Sun Visor Support

INSTALLATION

(1) Insert seat belt through B-pillar trim and web guide.

(2) Place B-pillar trim cover in position on vehicle.

(3) Engage hidden clips to hold trim cover to B-pillar.

(4) Install screw to hold trim cover to B-pillar inside bezel cavity.

(5) Install shoulder belt bezel into trim cover.

(6) Install height adjuster knob.

(7) Install shoulder belt turning loop onto height adjuster.

(8) Place seat anchor in position on floor so webbing is pointed rearward and slightly outboard.

(9) Install bolt to hold lower seat belt anchor to floor. Tighten seat belt bolts to 39 N·m (29 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

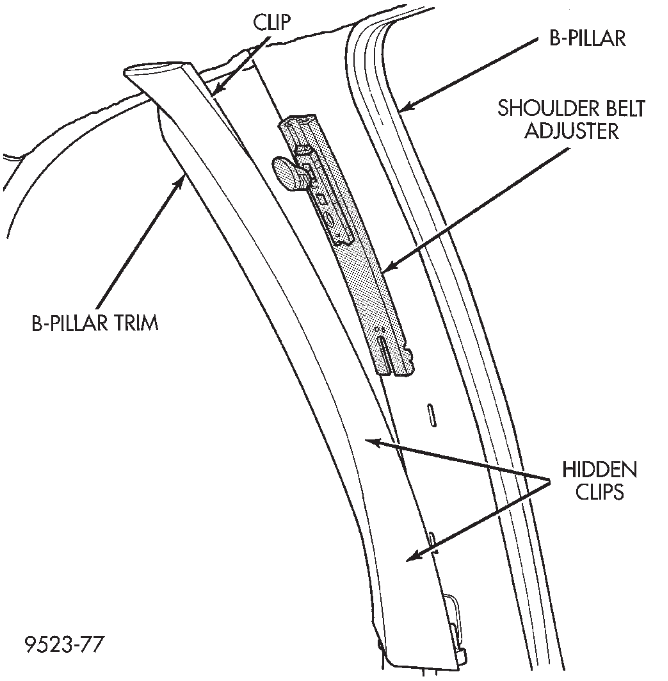


Fig. 136 Upper B-pillar Trim Cover

UPPER C-PILLAR TRIM

REMOVAL

(1) Remove quarter trim bolster.

(2) Remove seat belt turning loop from height adjuster.

(3) Remove screw holding C-pillar trim panel to C-pillar on right side of SWB vehicle.

(4) Disengage hidden clips holding trim to upper C-pillar.

(5) Remove upper C-pillar trim from vehicle.

INSTALLATION

(1) Place upper C-pillar trim in position on vehicle.

(2) Engage hidden clips to hold trim to upper C-pillar.

(3) Install screw to hold C-pillar trim panel to C-pillar on right side of SWB vehicle.

(4) Install seat belt turning loop onto height adjuster. Tighten all seat belt bolts to 39 N·m (29 in. lbs.) torque.

(5) Install quarter trim bolster.

ADJUSTMENTS

SLIDING DOOR ADJUSTMENTS

PRELIMINARY CHECKS

(1) Close sliding door, visually checking C-post striker alignment entry into latch. Striker at this point must not affect alignment.

(2) On vehicles with left sliding doors, check the fuel door blocker striker entry into latch. Striker at this point must not affect alignment.

(3) Check C-post and B-post for door to aperture gaps and door to door gaps. All gaps should be 5 mm ± 1 mm.

(4) Check door for height using character lines as a reference. Also check roof contour as a controlling factor.

UP/DOWN ADJUSTMENT

(1) Visually inspect the sliding door for fitting low at the rear of the door by checking the alignment of the belt line of the door to quarter panel.

(2) Fully open the sliding door.

(3) Verify that all center hinge bolts are tight.

(4) Adjust the rear of the sliding door up by turning the center hinge bolt clockwise (Fig. 137).

(5) Close the door and check the sliding door alignment.

(6) Readjust the center hinge if necessary to obtain alignment between the belt line of the sliding door and quarter panel.

(7) Fully open door and apply thread lock nut onto the center hinge bolt. Tighten nut until till it butts up against the welded nut on the center hinge. Tighten nut to 15 N·m (130 in. lbs.). It may be necessary to hold the center hinge bolt to prevent it from turning while tightening nut.

(8) Verify alignment. Re-adjust as necessary.

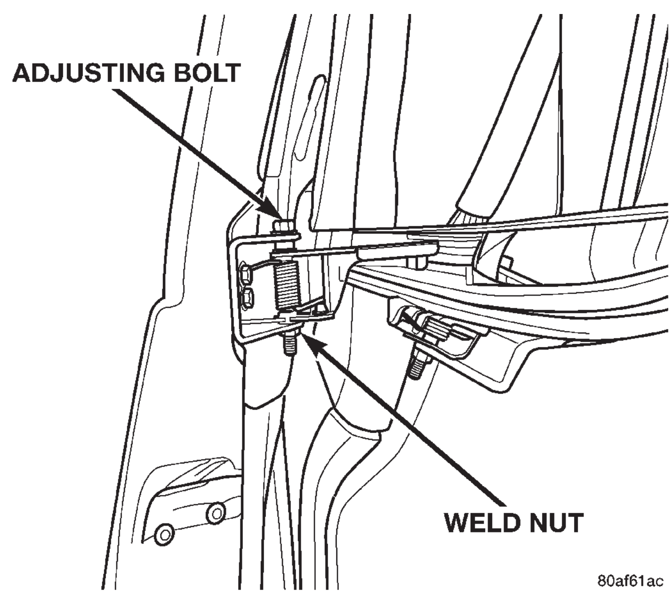


Fig. 137 Sliding Door Center Hinge

FORE/AFT ADJUSTMENT

(1) Check height of sliding door at the B-post and C-post to determine which area is contributing the greatest to the incorrect gaps.

(2) If the sliding door is high at the C-post;

(a) Open the door to mid-point of travel.

ADJUSTMENTS (Continued)

(b) Mark outline of center hinge on sliding door to assist in making adjustments.

(c) Loosen center hinge bolts (Fig. 137).

(d) Move hinge fore or aft to position the sliding door into the correct location.

(e) Tighten center hinge bolts.

(f) Verify alignment. Re-adjust as necessary.

(3) If the sliding door is low at the B-post;

(a) Remove access plug in the sliding door trim panel.

(b) Open the door to mid-point of travel.

(c) Mark outline of lower roller arm bracket on sliding door to assist in making adjustments.

(d) Loosen lower roller arm bracket bolts (Fig. 138).

(e) Move hinge downward to raise the door.

(f) Tighten lower roller arm bracket bolts.

(g) Verify alignment. Re-adjust as necessary.

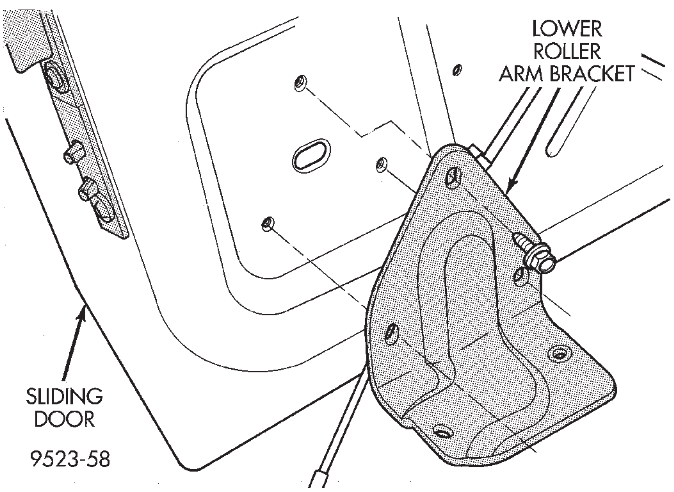


Fig. 138 Sliding Door Lower Roller Arm Bracket

(4) If the sliding door is low at the C-post;

(a) Open the door to mid-point of travel.

(b) Mark outline of center hinge on sliding door to assist in making adjustments.

(c) Adjust the adjustment bolt up or down to move the door position. (Fig. 137).

(d) Move hinge downward to raise the door.

(e) Tighten center hinge bolts.

(f) Verify alignment. Re-adjust as necessary.

(5) If the sliding door is high at the B-post;

(a) Remove access plug in the sliding door trim panel.

(b) Open the door to mid-point of travel.

(c) Mark outline of lower roller arm bracket on sliding door to assist in making adjustments.

(d) Loosen lower roller arm bracket bolts (Fig. 138).

(e) Move hinge upward to raise the door.

(f) Tighten lower roller arm bracket bolts.

(g) Verify alignment. Re-adjust as necessary.

SEAL COMPRESSION

(1) Check seal compression at top and bottom of B-post seal.

(2) Adjust seal compression at the top of the B-post seal;

(a) Open door to mid-point of travel.

(b) Mark outline of upper roller arm on bracket to assist in making adjustments.

(c) Loosen bolts holding upper roller arm to bracket (Fig. 139)

(d) Decrease the length of the upper roller arm to increase seal compression.

(e) Increase the length of the upper roller arm to decrease seal compression.

(f) Tighten all upper roller arm bolts.

(g) Verify door alignment. Re-adjust as necessary.

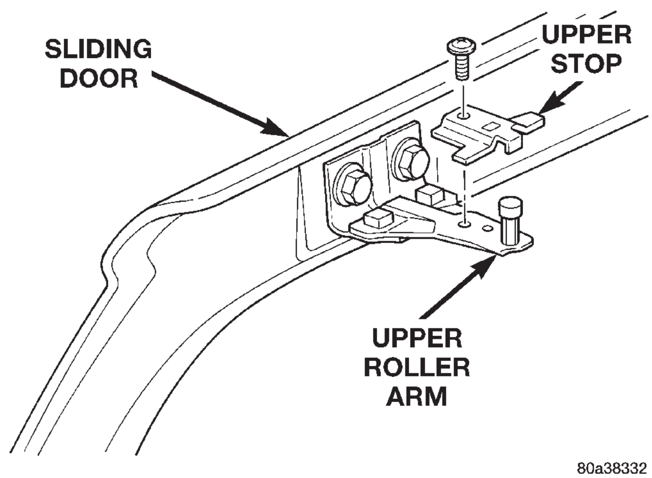


Fig. 139 Sliding Door Upper Roller Arm

(3) Adjust seal compression at the bottom of B-post seal.

(a) Open door to mid-point of travel.

(b) Mark outline of lower roller arm on lower roller arm bracket to assist in making adjustments.

(c) Loosen bolts holding lower roller arm to lower roller arm bracket.

(d) Pivot lower roller arm toward center of vehicle to decrease seal compression.

(e) Pivot lower roller arm outward to increase seal compression.

(f) Tighten lower roller arm bolts.

(g) Verify alignment. Re-adjust as necessary.

ADJUSTMENTS (Continued)

NOTE: Adjusting seal compression at the B-post can affect door flushness the C-post.

STABILIZER ADJUSTMENT

(1) Open sliding door.

(2) Loosen bolts holding stabilizers to sliding door enough that the stabilizers can move with some effort.

(3) Close and then reopen sliding door.

(4) Tighten all bolts.

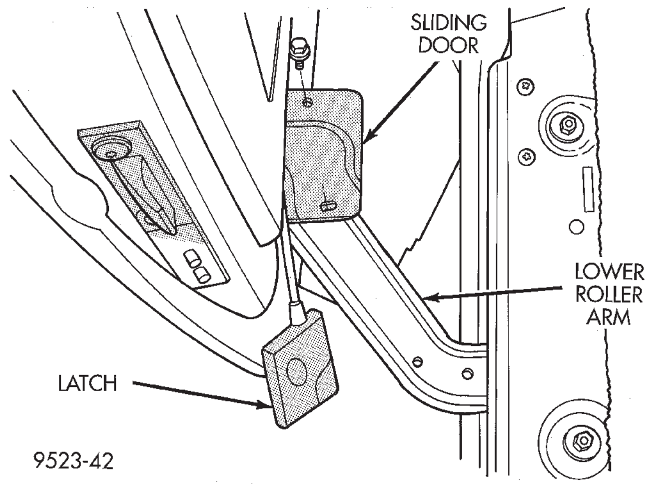


Fig. 140 Sliding Door Lower Roller Arm

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REMOVAL AND INSTALLATION

HEAD RESTRAINT

REMOVAL

(1) Lift head restraint to top of travel.

(2) Depress lock button on side of sleeve at top of seat back (Fig. 1).

(3) Pull head restraint from top of seat back.

INSTALLATION

(1) Position head restraint to seat.

(2) Depress lock button on side of sleeve at top of seat back.

(3) Insert head restraint into sleeves at top of seat back.

HEAD RESTRAINT ESCUTCHEON

REMOVAL

(1) Remove head restraint from seat.

(2) Remove escutcheon from head restraint sleeve (Fig. 2).

(3) Remove head restraint retainer from sleeve.

(4) Separate escutcheon and retainer from vehicle.

INSTALLATION

(1) Position escutcheon and retainer to seat.

(2) Install retainer to sleeve.

(3) Install escutcheon to sleeve.

(4) Install head restraint to seat.

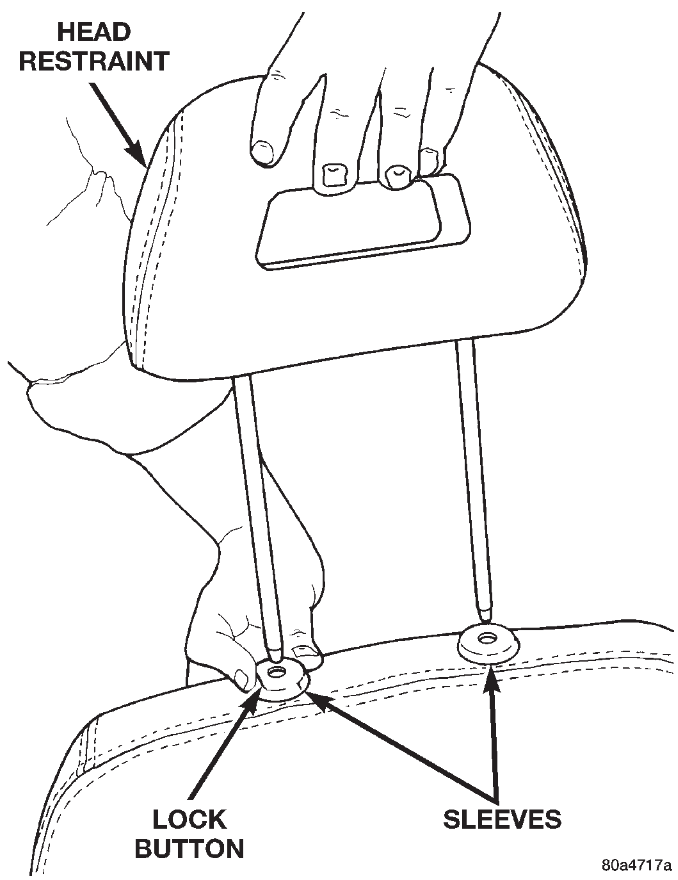

Fig. 1 Head Restraint—Bucket Seat

REMOVAL AND INSTALLATION (Continued)

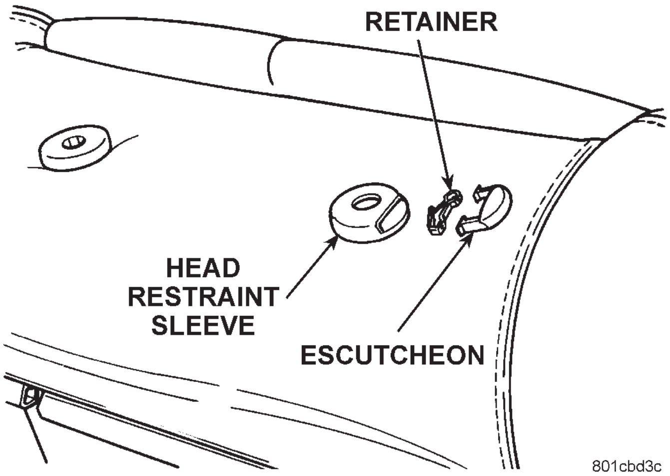

Fig. 2 Head Restraint Escutcheon and Retainer

HEAD RESTRAINT SLEEVE

REMOVAL

(1) Remove head restraint.

(2) Disengage closure holding bottom of trim cover together.

(3) Reach under trim cover through opening at bottom of seat back.

(4) Pinch retainer barbs on middle of head restraint sleeve together (Fig. 3).

(5) Pull head restraint sleeve upward and out the top of the seat back frame guide tube.

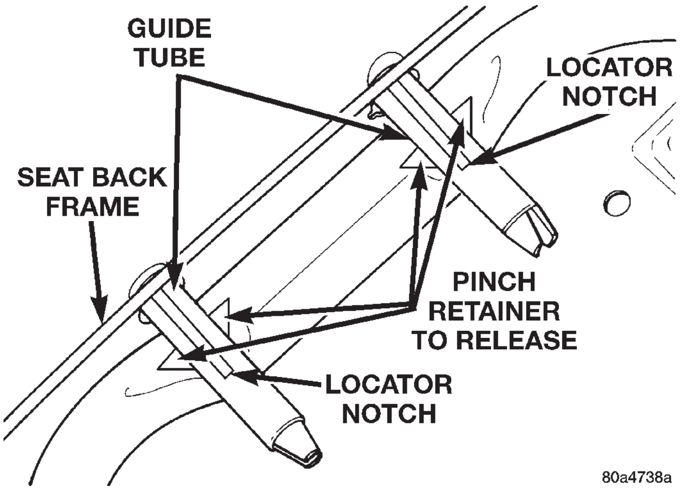

Fig. 3 Head Restraint Sleeve Removal

INSTALLATION

(1) Insert head restraint sleeve into guide tube at top of seat back.

(2) Align locator rib to locator rib notch in guide tube (Fig. 4).

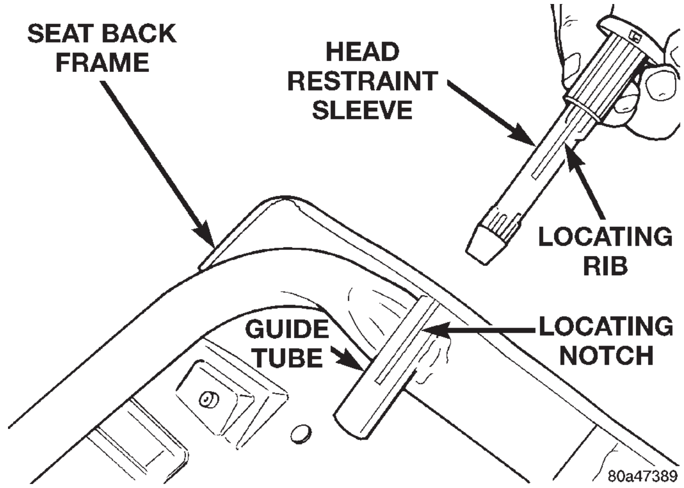

Fig. 4 Head Restraint Sleeve Installation

(3) Push head restraint sleeve downward until retainer clicks into lock position.

(4) Engage closure to hold bottom of trim cover together.

(5) Install head restraint.

BENCH SEAT BACK COVER

REMOVAL

(1) Remove screws holding the bottom of the bench seat back cover to the seat frame (Fig. 5).

(2) Disengage hooks holding top of seat back cover to seat back frame.

(3) Separate seat back cover from seat.

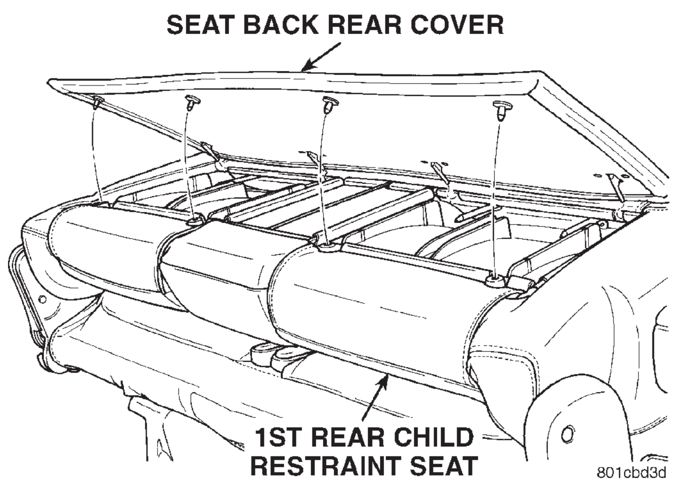

Fig. 5 Bench Seat Back Cover

INSTALLATION

(1) Place seat back cover in position on seat.

(2) Engage hooks to hold top of seat back cover to seat back frame.

(3) Install screws to hold bottom of bench seat back cover to seat frame.

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REMOVAL AND INSTALLATION

GEARSHIFT CONSOLE

REMOVAL

(1) Lift the parking brake lever to the full up position (Fig. 1).

(2) Carefully pull the base of the gearshift boot off the top of the gearshift console.

(3) Remove the four (4) screws from the top of the gearshift console (Fig. 2).

(4) Tilt the gearshift boot and carefully push the boot through the opening in the gearshift console.

(5) Separate console from vehicle.

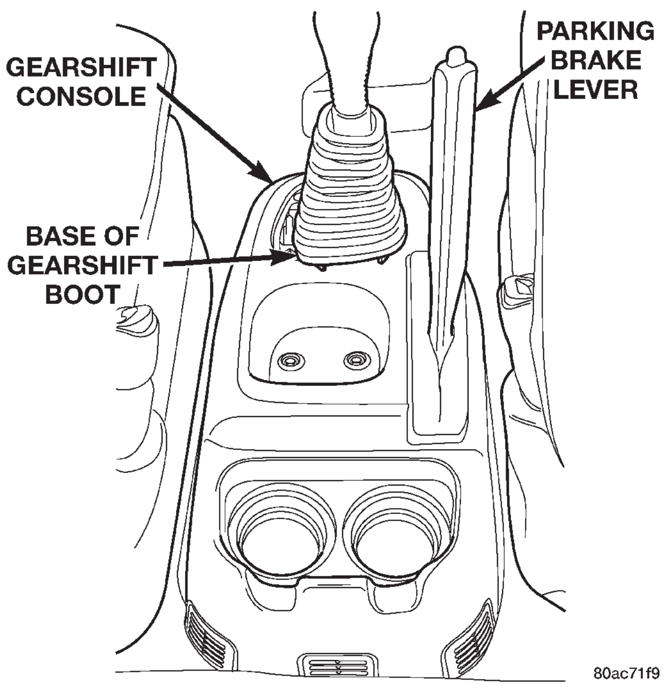

Fig. 1 Console, Parking Brake Lever, and Gearshift Boot

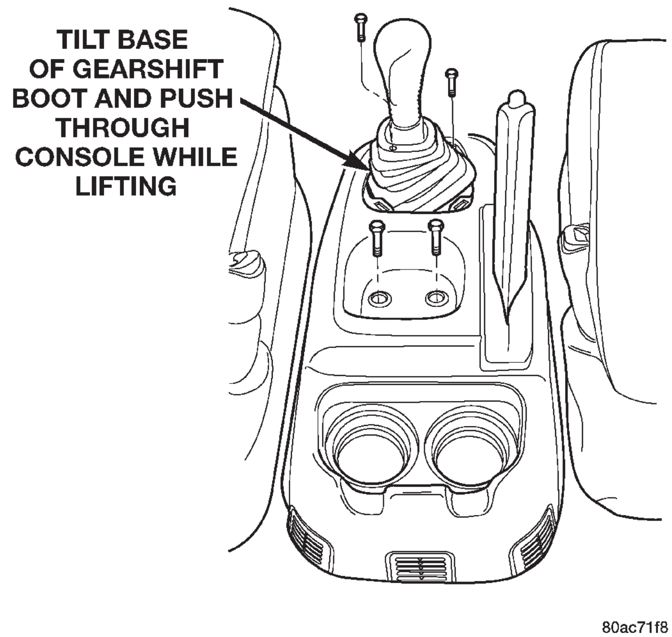

Fig. 2 Gearshift Console and Boot Removal

INSTALLATION

(1) Tilt the gearshift boot and carefully push the boot through the gearshift console.

(2) Install screws to hold gearshift console to gearshift mechanism.

(3) Install gearshift boot and carefully push the clips into the three (3) slots in the gearshift console.

LIFTGATE CHMSL ACCESS PANEL

REMOVAL

(1) Using a trim stick (C-4755), disengage clip holding CHMSL access panel to liftgate trim panel (Fig. 3).

(2) Disengage hooks on CHMSL access cover from liftgate trim panel.

(3) Separate access panel from vehicle.

REMOVAL AND INSTALLATION (Continued)

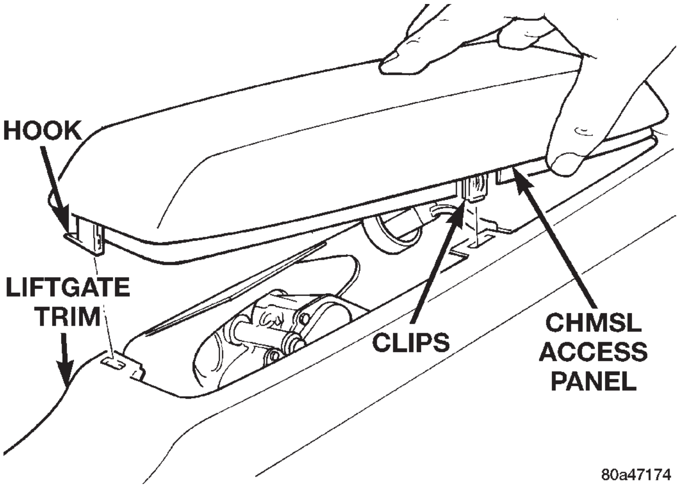

Fig. 3 CHMSL Access Panel

INSTALLATION

(1) Place access panel in position on vehicle.

(2) Engage hooks on CHMSL access cover to liftgate trim panel.

(3) Engage clip to hold CHMSL access panel to liftgate trim panel.

HEATING AND AIR CONDITIONING

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FRONT HEATING AND AIR CONDITIONING SYSTEM

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GENERAL INFORMATION

INTRODUCTION

Both the heater and the heater/air conditioning systems share many of the same components. This group will deal with both systems together when component function is common, and separately when they are not.

For proper operation of the instrument panel controls, refer to the Owner's Manual provided with the vehicle.

All vehicles are equipped with a common A/C-heater unit housing assembly. When the vehicle has only a heater system, the evaporator and recirculating air door are omitted.

An optional zone control HVAC unit is available. This unit has dual blend-air doors that can be regulated independently of each other. The temperature setting can be different from driver's side to passenger side. There is also a rear (aux.) heating and A/C system available when the vehicle is equipped with zone control.

SAFETY PRECAUTIONS AND WARNINGS

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM EYE CONTACT WITH REFRIGERANT. IF EYE CONTACT IS MADE, SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC TYPE LEAK DETECTOR IS RECOMMENDED.

LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

THE EVAPORATION RATE OF REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH REFRIGERANT. R-134a SERVICE EQUIPMENT OR VEHICLE A/C 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 INJURY OR PROPERTY DAMAGE.

ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. SEEK MEDICAL ATTENTION IMMEDIATELY IF SWALLOWED OR INHALED. 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 AND PETS.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY CAN RESULT.

CAUTION: The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi). Allow the vehicle to cool a minimum of 15 minutes before opening the cooling system. Refer to Group 7, Cooling System.

DESCRIPTION AND OPERATION

AIR DISTRIBUTION DUCTS

The air distribution ducts for the A/C, Heater, Defroster, and Second Seating Air Distribution are not serviceable in vehicle. The procedures for service of these ducts are covered in Group 8E, Instrument Panel and Gauges.

The only ducts that are serviceable in the vehicle are the side window demister ducts and the ducts that feed the front door outlets for the first rear passenger(s) seating. To service the door ducts refer to Group 23, Body.

A/C PRESSURE TRANSDUCER

The A/C Pressure Transducer (Fig. 1) monitors the refrigerant gas pressure on the high side of the system. The transducer is located on the liquid line. The pressure transducer turns off the voltage to the compressor clutch coil when refrigerant gas pressure drops to levels that could damage the compressor. The transducer also is used to adjust condenser fan speeds and will turn off compressor at high refrigerant pressures. The pressure transducer is a sealed factory calibrated unit. It must be replaced if defective. O-ring replacement is required whenever the pressure transducer is serviced. Be sure to use the O-ring specified for the transducer.

A/C SERVICE PORTS

The A/C service port valve cores are located within the A/C lines (Fig. 2). The High Side (Discharge) valve service port is located on the liquid line near the right frame rail. The Low Side (Suction) valve service port is located on the suction line near the compressor.

DESCRIPTION AND OPERATION (Continued)

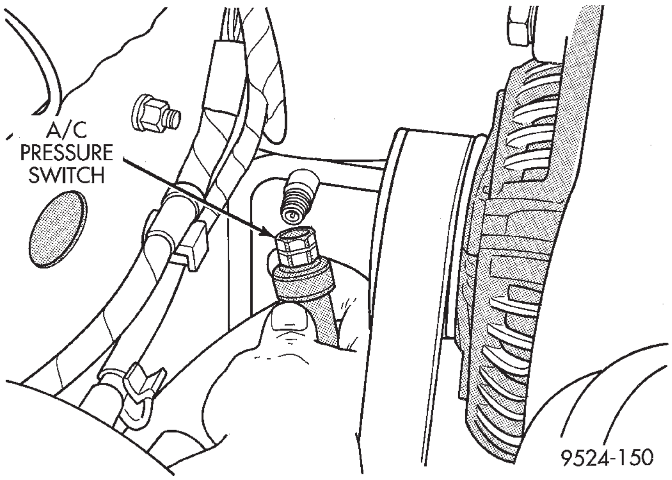


Fig. 1 A/C Pressure Transducer

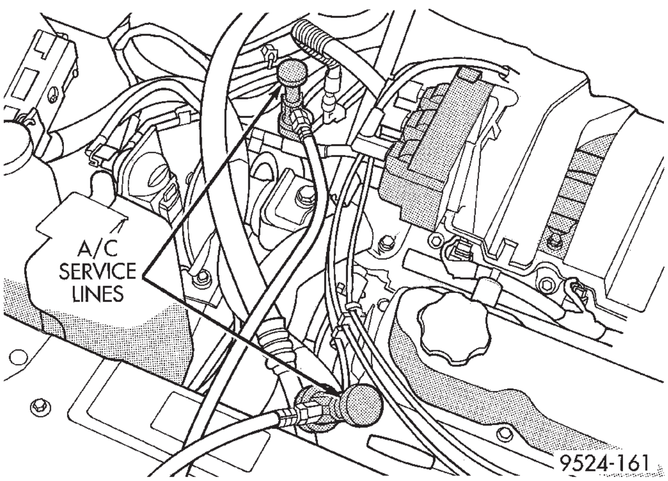


Fig. 2 Valve Service Ports

The High Side service port is a two piece port and is serviceable. The Low Side service port is not serviceable, the suction line would have to be replaced.

REAR BLOWER SPEED SWITCH

The rear blower speed switch controls the rear blower with the choice of low and high speeds. When the switch is on it allows the blower speed switch located on the rear headliner to control rear blower speed. This switch will override the rear headliner blower switch. For operation instructions refer to the Owner's Manual. The rear blower speed switch is serviced separately from the A/C control module. For service procedures, refer to Group 8E, Instrument Panel And Gauges.

COMPRESSOR HIGH-PRESSURE RELIEF VALVE

The High Pressure Relief Valve prevents damage to the air conditioning system if excessive pressure develops. Excessive pressure can be caused by condenser air flow blockage, refrigerant overcharge, or air and moisture in the system.

The high pressure relief valve vents only a small amount of refrigerant necessary to reduce system pressure and then reseats itself. The majority of the refrigerant is conserved in the system. The valve is calibrated to vent at a pressure of 3450 to 4140 kPa (500 to 600 psi). If a valve has vented a small amount of refrigerant, it does not necessarily mean the valve is defective.

The High Pressure Relief Valve is located on the compressor manifold at the discharge passage.

NOTE: 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.

CONDENSATE DRAIN

Condensation from the evaporator housing is drained through the dash panel and on to the ground. This drain must be kept open to prevent water from collecting in the bottom of the housing.

If the drain is blocked condensate cannot drain, causing water to back up and spill into the passenger compartment. It is normal to see condensate drainage below the vehicle.

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain ample temperature levels from the heating-A/C system, the cooling system must be in proper working order. Refer to Group 0, Lubrication and Maintenance or Group 7, Cooling System of this manual.

The use of a bug screen is not recommended. Any obstructions forward of the condenser can reduce the effectiveness of the air conditioning system.

EVAPORATOR PROBE

The Evaporator probe is located on the HVAC. The probe prevents evaporator freeze-up by signaling the Powertrain Control Module to cycle the compressor ON and OFF. The probe monitors the temperature of the refrigerant after expansion.

The evaporator probe is inserted into the evaporator between the coils. The probe is a sealed unit and cannot be adjusted or repaired. It must be replaced if found defective.

HANDLING TUBING AND FITTINGS

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The refrigerant oil will

DESCRIPTION AND OPERATION (Continued)

absorb moisture readily out of the air. This moisture will convert into acids within a closed system.

CAUTION: The system must be completely empty before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been emptied. If any pressure is noticed as a fitting is loosened, retighten fitting and evacuate the system again.

A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 3 inches (80 mm) from the exhaust manifold. Inspect all flexible hose lines to make sure they are in good condition and properly routed.

The use of correct wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings.

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.

When opening a refrigeration system, have everything you will need to repair the system ready. This will minimize the amount of time the system must be opened. Cap or plug all lines and fittings as soon as they are opened. This will help prevent the entrance of dirt and moisture. All new lines and components should be capped or sealed until they are ready to be used.

All tools, including the refrigerant dispensing manifold, the manifold gauge set, and test hoses should be kept clean and dry.

HVAC CONTROL MODULE

The HVAC control module regulates the operation of the various actuator motors. The actuator motors are used to move the mode, blend- air, and RECIRC. doors (Fig. 3).

The control module is included in the A/C control head located on the instrument panel. The control head includes the blower speed switch, rear wiper and washer operation, front & rear window defogger, recirculation door operation, and A/C compressor operation if equipped. Refer to Group 8E, Instrument Panel and Systems for service procedures.

NOTE: The RECIRC. function on the HVAC control module automatically defaults to the OFF position after a ignition key cycle. To reactivate the RECIRC. function, the RECIRC. button must be repressed

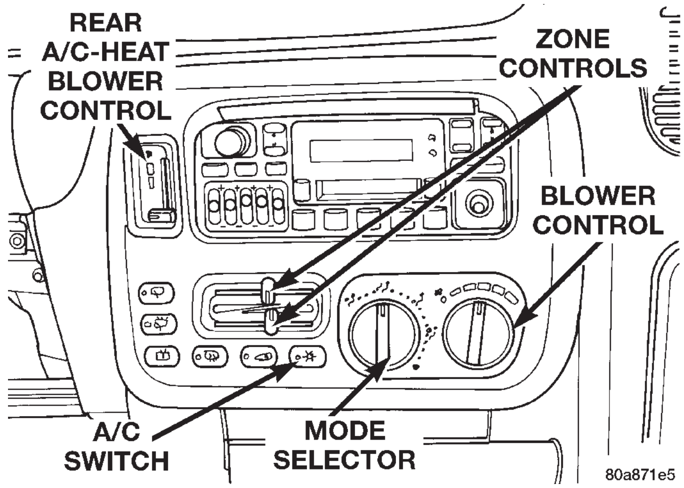


Fig. 3 HVAC Control Module

The rear blower speed switch is serviced separately from the control head.

SIDE DOOR HEATER A/C OUTLETS

The driver's and passenger side doors have supplemental air outlets and duct work. The air is channeled from the instrument panel to the door duct and either to the lower floor or upper door outlets (Fig. 4). The air can be adjusted to blow on the first rear passenger seat(s).

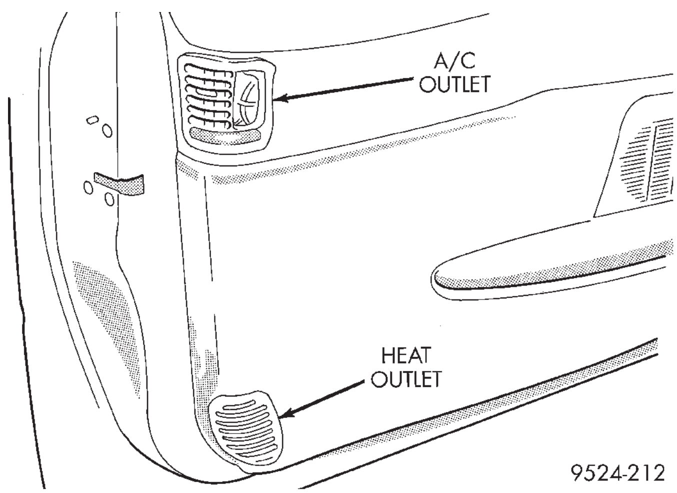


Fig. 4 Door Outlets

SIDE WINDOW DEMISTER

The side window demisters direct air from the heater assembly. The outlets are located on the top forward corners of the front door panels (Fig. 5). The demisters operate when the control mode selector is on FLOOR, MIX or DEFROST setting.

SYSTEM AIRFLOW

The system pulls outside (ambient) air through the cowl opening at the base of the windshield. Then it goes into the plenum chamber above the heater—A/C

DESCRIPTION AND OPERATION (Continued)

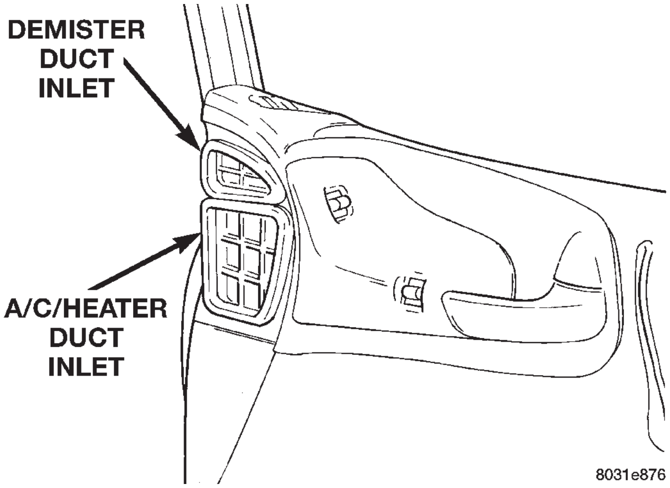


Fig. 5 Demister Inlet

unit housing. On air conditioned vehicles, the air passes through the evaporator. At this point the air flow can be directed either through or around the heater core. This is done by adjusting the blend- air door with the TEMP control on the control head. An optional zone control HVAC control module is available. This unit has dual blend-air doors that can be regulated independently of each other. The temperature setting can be different from driver's side to passenger side. After the air passes the blend-air door(s), the air flow can then be directed from the Panel, Floor, and Defrost outlets. Air flow velocity can be adjusted with the blower speed selector switch on the control head.

Ambient air intake can be shut off by closing the recirculating air door. This will recirculate the air that is already inside the vehicle. This is done by depressing the Recirc. button on the control head. On air conditioned vehicles, moving the control to Mix or Defrost depresses the A/C button and will engage the compressor. This will send refrigerant through the evaporator, and remove heat and humidity from the air before it goes through the heater core.

CAUTION: In cold weather, use of the Recirculation mode may lead to excessive window fogging. The Recirculation mode is automatically deactivated in Mix and Defrost modes to improve window clearing operation.

SYSTEM OIL LEVEL

It is important to have the correct amount of oil in the A/C system to ensure 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 system and consequently result in higher discharge air temperatures.

NOTE: The oil used in the compressor is ND8 PAG R134a 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 oil level in the compressor or to add oil unless there has been an oil loss. Oil loss at a leak point will be evident by the presence of a wet, shiny surface around the leak.

REFRIGERANT OIL LEVEL CHECK

When an air conditioning system is first assembled, all components (except the compressor) are refrigerant oil free. After the system has been charged with R134a refrigerant and operated, the oil in the compressor is dispersed through the lines and components. The evaporator, condenser, and filter-drier will retain a significant amount of oil, refer to the Refrigerant Oil Capacities chart. When a component is replaced, the specified amount of refrigerant oil must be added. When the compressor is replaced, the amount of oil that is retained in the rest of the system must be drained from the replacement compressor. When a line or component has ruptured and oil has escaped, the compressor should be removed and drained. The filter-drier must be replaced along with the ruptured part. The oil capacity of the system, minus the amount of oil still in the remaining components, can be measured and poured into the suction port of the compressor.

Example: On a dual system the evaporator retains 60 ml (2 oz). The condenser retains 30 ml (1 oz) of oil, and system capacity may be 220 ml (7.40 oz) of oil.

220 ml minus 90 ml = 130 ml (4.40 oz).

DESCRIPTION AND OPERATION (Continued)

REFRIGERANT OIL CAPACITIES

Refrigerant Oil Capacities	Front	A/C	Dual	A/C
Component	**ml**	**oz**	**ml**	**oz**
Compressor	150 ml	5.0 oz	220 ml	7.4 oz
Filter-Drier	30 ml	1.0 oz	30 ml	1.0 oz
Condenser	30 ml	1.0 oz	30 ml	1.0 oz
Evaporator	60 ml	2.0 oz	60 ml	2 .0 oz
Rear Evap.	N/A	N/A	60 ml	2.0 oz

CAUTION: The refrigerant oil used in a R-134a A/C system is unique. Use only oils which were designed to work with R-134a refrigerant. The oil designated for this vehicle is ND8 PAG (polyalkalene glycol).

SERVICING REFRIGERANT OIL LEVEL

(1) Using a refrigerant recovery machine, remove refrigerant from the A/C system.

(2) Remove refrigerant lines from A/C compressor.

(3) Remove compressor from vehicle.

(4) From suction port on top of compressor, drain refrigerant oil from compressor.

(5) Add system capacity minus the capacity of components that have not been replaced through suction port on compressor. Refer to the Refrigerant Oil Capacity Chart.

(6) Install compressor, connect refrigerant lines, evacuate, and charge refrigerant system.

DIAGNOSIS AND TESTING

ACTUATOR CALIBRATION/DIAGNOSTICS AND COOLDOWN TEST

GENERAL INFORMATION

If the HVAC control module is replaced, the Calibration Diagnostic and Cooldown tests will need to be performed. Once this group of tests have successfully passed, they can be performed individually. The engine must be running during the test to provide hot coolant for the heater, A/C compressor operation and to assure that the actuators are calibrated correctly. The HVAC control module is capable of troubleshooting the system in approximately 120 seconds. If a condition is detected, an error code is displayed. The error code cannot be erased until the condition is repaired and the diagnostic test is performed. Check wire before replacing components, refer to Group 8W, Wiring Diagrams.

CAUTION: Do not remove the actuators from the Heater-A/C unit assembly with power applied. Removal should only be done with the Ignition OFF. The actuators have no mechanical stops to limit the travel. If the actuator rotates and is not connected to the unit assembly, it will become out of calibration.

ACTUATOR CALIBRATION

Mode, Blend and Zone (if equipped) door calibration compensates for mechanical variations in the actuators, HVAC control module and its linkages. In-vehicle calibration can be entered from the control's front panel. If the REAR WIPE and INTERMITTENT LED's flash simultaneously when Ignition is cycled ON, the actuators have not been calibrated or during the previous calibration a failure occurred (Fig. 6) and (Fig. 7). Diagnostics will always occur during Calibration Diagnostic and Cooldown test.

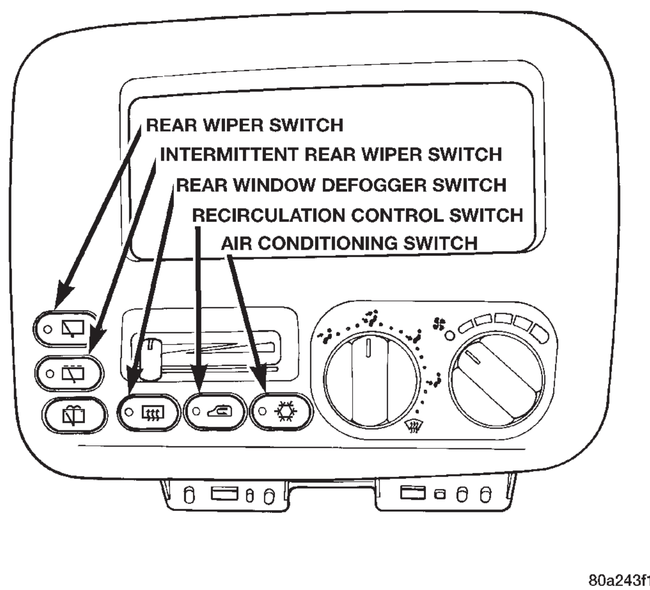


Fig. 6 Radio Bezel and HVAC Control

DIAGNOSIS AND TESTING (Continued)

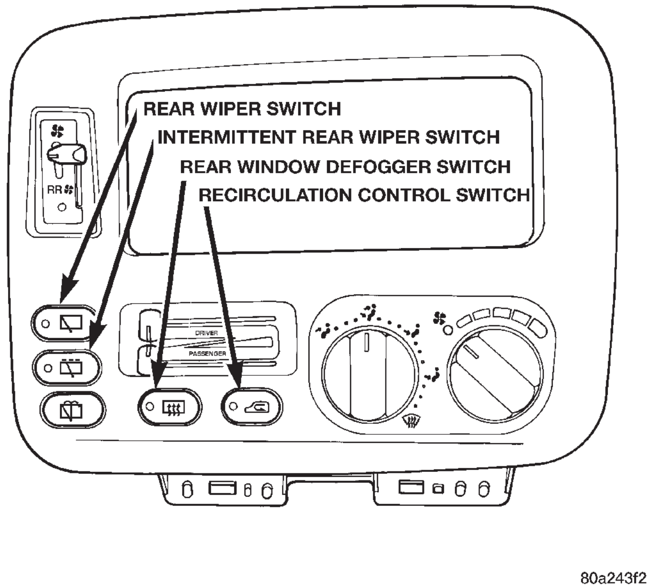


Fig. 7 Radio Bezel and HVAC Control, Rear Blower Motor Switch and Zone Control

DIAGNOSTICS

During the Actuator calibration, diagnostics are performed on the actuators and evaporator temperature Fin Sensor. Once diagnostics are completed the REAR WIPER and INTERMITTENT LED's will flash to indicate either a successful calibration or the appropriate fail code(s). At this time manual testing of the Blend, Mode and Driver (if equipped) potentiometers can be performed. If a failure is detected during Diagnostics a fault will be set in the control. When Ignition is cycled OFF and then ON or Diagnostics is aborted, the REAR WIPER and INTERMITTENT LED's will flash simultaneously showing that a failure has occurred. The control will not indicate the fail code, but only that a failure had occurred during the last diagnostics test. The only way to clear the failure codes is repeat the Calibration Diagnostic and Cooldown test, after all repairs are completed.

COOLDOWN TEST

This test has been designed for performance testing of the A/C system at the manufacturing facility. If the HVAC control module is replaced, the Cooldown test will occur during Calibration test. Cooldown will not occur on Heater Only units. During the Cooldown test the control will monitor the temperature of the Fin Sensor. The A/C system must be able to bring the evaporator temperature down a predetermined minimum amount in less than 2 minutes.

CALIBRATION/COOLDOWN LED DISPLAY CODES

See table for definition of flashing LED's. If no problems are found, the control functions normally.

CALIBRATION/COOLDOWN LED DISPLAY CODES

LED'S	PASS/FAIL	CORRECTIVE ACTION
NO LED'S FLASHING- NORMAL OPERATION	PASSED CALIBRATION, DIAGNOSTICS AND COOLDOWN	NONE
REAR WIPER AND INTERMITTENT LED'S FLASH SIMULTANEOUSLY	FAILED CALIBRATION DIAGNOSTICS	RUN CALIBRATION TEST
A/C AND RECIRC LED'S FLASH SIMULTANEOUSLY	FAILED COOLDOWN	RUN COOLDOWN TEST
REAR WIPER AND INTERMITTENT LED'S ARE FLASHING SIMULTANEOUSLY A/C AND RECIRC LED'S ARE FLASHING SIMULTANEOUSLY	FAILED CALIBRATION, DIAGNOSTICS AND FAILED COOLDOWN TEST	RUN CALIBRATION TEST

CALIBRATION/DIAGNOSTICS TEST ENTRY

TO INITIATE TESTS:

- Set Blower motor ON HIGH
- Set Mode position to Panel
- Open all A/C outlets
- Set Temperature to Cold (Both slide pots if equipped)
- Depress WASH and REAR WIPER button simultaneously for 5 Seconds (Until all LED's light)

RESULTS:

- All LED's will turn on for 5 Seconds
- Calibration Test is running when REAR WIPER and INTERMITTENT are alternately flashing. Cooldown test is running if A/C and RECIRC are alternately flashing.
- Acceptable results is REAR WIPER LED is the only LED flashing. Push Rear Wiper to exit.
- After all tests have passed, Calibration Diagnostics and Cooldown can be run separately.

DIAGNOSIS AND TESTING (Continued)

COOLDOWN TEST ENTRY

TO INITIATE TESTS:

- Set Blower motor ON HIGH
- Set Mode position to Panel
- Open all A/C outlets
- Set Temperature to Cold (Both slide pots if equipped)
- Depress WASH and A/C simultaneously for 5 Seconds

NOTE: Prior to start of test, If the evaporator is already cold, the system will fail test. To correct, operate system with A/C OFF and the blower motor ON high for three minutes prior to starting test.

RESULTS:

- All LED's will turn on for 5 Seconds
- Cooldown Test is running when A/C and RECIRC. are alternately flashing. If A/C and RECIRC. are flashing simultaneously, Cooldown has failed.

CALIBRATION DIAGNOSTICS AND COOLDOWN ABORT

Test can be aborted by doing one of the following:

- Depressing Rear Window Defogger, RECIRC and Rear Wiper buttons.
- Cycling Ignition OFF and then ON.
- Control will automatically abort after 15 minutes from the time Calibration Diagnostics and Cooldown was entered.

The HVAC control module will return to normal operation or may indicate unsuccessful Calibration Diagnostics or Cooldown test by LED's flashing simultaneously.

EEPROM DATA

Calibration Diagnostics, Cooldown Status and evaporator temperature Fin Sensor values are stored in an EEPROM memory internal to the control. The microcomputer within the HVAC control module uses this information:

- To determine if Cooldown needs to run
- For proper position of the Heater-A/C unit assembly doors

ACTUATOR CALIBRATION AND DIAGNOSTICS.

NOTE: Do not run actuators unless they are properly mounted on the HVAC control module.

Actuator end point calibration takes approximately 60 seconds. The REAR WIPER and INTERMITTENT LED's will flash alternately during the test. The control will cycle the Blend actuator(s) to the Heat stop first then back to Cold. After the Blend actuator(s) have been calibrated the Mode actuator will be cycled to Defrost and then to Panel. Successful calibration is defined as actuator travel falling within their minimum and maximum limits.

BLEND/PASSENGER ACTUATOR BACKGROUND

The Blend/Passenger Actuator can move the temperature door in two directions. When the voltage at Pin 12 of the control module is high, about 11.5 volts, and the voltage at Pin 17 is low, about 1.5 volts, the door will move towards the Heat position. When Pin 17 is High and Pin 12 is Low the door will move towards the Cold position. When both Pins are high or both Pins are low, the actuator will not move. The Blend/Passenger feedback signal is a voltage signal that is supplied by the actuator to the control. The signal will be about 4.0 volts in the Heat position and 1.0 volt in the Cold position. As the position of the Blend/Passenger actuator changes, so will the feedback signal. The feedback signal is necessary for the correct positioning of the temperature door.

DRIVER ACTUATOR BACKGROUND

The Driver Actuator can move the temperature door in two directions. When the voltage at Pin 15 of the control module is high, about 11.5 volts, and the voltage at Pin 13 is low, about 1.5 volts the door will move towards the Cold position. When Pin 13 is High and Pin 15 is Low the door will move towards the Heat position. When both Pins are high or when both Pins are low, the actuator will not move. The Driver feedback signal is a voltage signal that is supplied by the actuator to the control. The signal will be about 4.0 volts in the Heat position and 1.0 volt in the Cold position. As the position of the Driver Actuator changes, so will the feedback signal. The feedback signal is necessary for the correct positioning of the temperature door.

MODE ACTUATOR BACKGROUND

The Mode actuator can move the mode door in two directions. When the voltage at Pin 18 of the control module is high, about 11.5 volts, and the voltage at Pin 12 is low, about 1.5 volts the door will move towards the Panel position. When Pin 12 is High and Pin 18 is Low the door will move towards the Defrost position. When both Pin are high or when both Pins are low, the actuator will not move. The Mode door feedback signal is a voltage signal that is supplied by the actuator to the control. The signal will be about 4.5 volts in the Panel position and 0.5 volts in the Defrost position. As the position of the Mode actuator changes, so will the feedback signal. The feedback signal is necessary for the correct positioning of the mode door.

DIAGNOSIS AND TESTING (Continued)

FAIL CODES/LEVEL DISPLAY

Fail Codes/Level are displayed using the REAR WIPER and INTERMITTENT LED's flashing in the sequence indicated below. The REAR WIPER LED represents the Level and the INTERMITTENT LED represents the Value. After Calibration/Diagnostics is completed, the control will begin flashing Level 1 codes. Depressing the WASH button will cycle to Level 2, depressing WASH again will cycle to Level 3. Each time the WASH button is depressed will cycle to the next level. After Level 5 is reached, you will cycle back to Level 1. If the Control is a Heater Only you will only cycle from Levels 1 to 3.

WIPE BUTTON LED

LEVEL	DISPLAY
1	FAIL CODES
2	MODE POTENTIOMETER TEST
3	BLEND/PASS. POTENTIOMETER TEST
4	EVAPORATOR PROBE (A/C AND ZONE UNITS ONLY)
5	DRIVER POTENTIOMETER (ZONE UNITS ONLY)

LEVEL 1–FAILURE CODE VALUES (INTERMITTENT WIPE BUTTON LED)

CODE	DEFINITION
0	PASSED ALL TESTS
1	MODE ACTUATOR DID NOT REACH DEFROST POSITION
2	MODE ACTUATOR DID NOT REACH PANEL POSITION
3	BLEND/PASS. ACTUATOR DID NOT REACH COLD STOP
4	BLEND PASS. ACTUATOR DID NOT REACH HEAT STOP
5	EVAPORATOR PROBE OPEN
6	EVAPORATOR PROBE SHORTED
7	DRIVER ACTUATOR DID NOT REACH COLD STOP
8	ZONE/DRIVER ACTUATOR DID NOT REACH HEAT STOP
9	CONTROL HEAD INTERNAL FAILURE

TEMPERATURE AND MODE POTENTIOMETER DIAGNOSTICS

The Temperature and Mode Potentiometer can be tested after calibration is complete by pressing the WASH button and cycling to Levels 2, 3 or 5 as displayed by the REAR WIPER LED. On Heater Only units you can only cycle to Levels 2 and 3. In each individual test the INTERMITTENT LED flash rate will change as the Temperature or Mode potentiometer is moved from one end to the other, see Potentiometer vs. Position and Flash Rate table.

POTENTIOMETER VS. POSITION AND FLASH RATE

POTENTIOMETER	INTERMITTENT LED FASTER FLASH RATE	INTERMITTENT LED SLOWER FLASH RATE
MODE	PANEL	DEFROST
BLEND/PASS.	HOT	COLD
DRIVER	HOT	COLD

EVAPORATOR PROBE TEMPERATURE DIAGNOSTICS

The evaporator probe can be tested by using the INTERMITTENT LED to display the actual temperature the sensor is reading. The HVAC control module can only display temperatures from 1 to 99 degrees. To read the temperature, perform the following:

- Set Blower motor to any speed other than OFF
- Set A/C to ON, if A/C Clutch does not engage make sure Fail Codes 5 and 6 are cleared.To clear the error code 5 and 6 the evaporator probe and/or the wiring repair needs to be completed. Then, press and hold the intermittent wipe button for 5 seconds.
- Run Diagnostics (Depress REAR WIPER and REAR WASH)
- When Diagnostics is complete, Cycle to Level 4.

Display Sequence is as follows:

- REAR WIPER LED will display the Level
- INTERMITTENT LED will display ten's digit
- Short Pause
- INTERMITTENT LED will display the one's digit.

The HVAC control module will continue to cycle the Level and then Temperature until the level is changed or Calibration Diagnostics and Cooldown test is exited.

HVAC CONTROL DIAGNOSTIC CONDITIONS

For wiring circuits, wiring connectors, and Pin numbers, refer to Group 8W, Wiring Diagrams.

After calibration, Rear Wiper LED flashing once, Intermittent LED not flashing.

The system has passed calibration. Press the Rear Wiper button to exit calibration.

DIAGNOSIS AND TESTING (Continued)

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing once. The mode actuator did not reach defrost position.

(1) Using a voltmeter, check the mode door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from the defrost to panel position, and check Pin 6 voltage it should change from 0.5 - 1 volts to 3.5 - 4.5 volts. If voltage is OK, go to Step 2. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(2) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 3. If not OK, repair as necessary.

(3) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(4) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing twice. The mode actuator did not reach panel position.

(1) Using a voltmeter, check the mode door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from panel to defrost position, and check Pin 6 voltage it should change from 3.5 - 4.5 volts to 0.5 - 1 volts. If voltage is OK, go to Step 2. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(2) Remove actuator, and check if the gear pins are in the correct cam track or binding. If OK, go to Step 3. If not OK, repair as necessary.

(3) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(4) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing three times. The main temperature actuator/passenger temperature actuator on a zone system did not reach cold stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check the temperature door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from the cold to hot position, and check Pin 5 voltage it should change from 0.5 - 4 volts to 3.5 - 4.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if gear pins are in the correct cam track or binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing four times. The main temperature actuator/passenger temperature actuator on a zone system did not reach hot stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check the temperature door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from hot to cold position and check Pin 5 voltage it should change from 3.5 -4.5 volts 0.5 - 1.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing five times. The evaporator probe is open.

(1) Using a voltmeter, check Pin 1 of the evaporator probe wiring connector for 0.1 - 4.75 volts. If OK, go to Step 2. If not OK, if greater than 4.75 volts check for loose or corroded connector, open circuit and repair as necessary.

(2) Using a ohmmeter, check Pin 2 for a good ground, If OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) If ground and power circuit are OK, replace Evaporator Probe.

(4) Once repairs are completed, press the intermittent button about 5 seconds until all LED's light to remove fault code from memory. Then repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

DIAGNOSIS AND TESTING (Continued)

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing six times. The evaporator probe is shorted.

(1) Using a voltmeter, check Pin 1 of the evaporator probe wiring connector for 0.1 - 4.75 volts. If OK, go to Step 2. If less than 0.1 volts, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(2) Using a ohmmeter, check Pin 2 for a good ground, If OK, go to Step 3. If not OK, check for shorted circuit and repair as necessary.

(3) If ground and power circuit are OK, replace Evaporator Probe

(4) Once repairs are completed, press the intermittent button about 5 seconds until all LED's light to remove fault code from memory. Then repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing seven times. The Driver's temperature actuator on a zone system did not reach cold stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check at the temperature door actuator wiring connector, check Pin 1 for battery voltage. Move the HVAC control from cold to the hot position, check Pin 4 voltage it should change from 0.5 - 1.5 volts 3.5 - 4.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding doors, if door are binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing eight times. The Driver's temperature actuator on a zone system did not reach hot stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check at the temperature door actuator wiring connector, check Pin 1 for battery voltage. Move the HVAC control from hot to cold position, Pin 4 voltage it should change from 3.5 - 4.5 volts to 0.5 - 1.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing nine times. The HVAC control module, has a internal failure.

(1) Replace the HVAC control module.

(2) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration and testing the A/C and RECIRC LED flashing simultaneously. Failed Cooldown test.

(1) Determine if the refrigerant system is operating correctly:

- Check the outlet air temperature
- Feel the compressor suction plumbing, is it hot?

(2) If not OK, go to Step 3. If OK, repeat the Calibration Diagnostic and Cooldown test.

(3) If system does not seem to be operating correctly, perform diagnostics for poor performance:

- Low refrigerant charge
- No charge
- Compressor not operating

Verify that the test was done with the evaporator at room temperature. The test consists of starting the compressor and measuring the time it takes for the evaporator temperature to fall 7°C (20°F). If the compressor has been running, the evaporator is cold already and will not be capable of falling 7°C (20°F). If the test was run with a cold evaporator, turn A/C off and turn the blower motor switch to high position for 3 to 5 minutes till the evaporator is to room temperature. Then repeat the Calibration Diagnostic and Cooldown test.

If refrigerant system is performing properly and the system will not pass test. Repeat the Calibration Diagnostic and Cooldown test to determine if the evaporator temperature FIN sensor has developed an open or a short circuit. If the HVAC control module still passes Calibration test, verify Cooldown test manually with a pocket thermometer. The outlet air temperature must drop at least 7°C (20°F) within two minutes. If the vehicle passes with the manual thermometer, take HVAC control to level 4 (evaporator probe temperature readout) and repeat the Cooldown test. Ensure the evaporator is at room temperature before starting test. Check if evaporator

DIAGNOSIS AND TESTING (Continued)

probe will drop the temperature 7°C (20°F) in two minutes. If the Evaporator Probe is found to be faulty, check that the sensor is positioned in the evaporator fins properly. If not, correct and repeat test. If OK, replace the evaporator probe.

Once the repairs are completed, repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

A/C PERFORMANCE TEST

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 RECIRC, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels rise.

PERFORMANCE TEST PROCEDURE

Review Safety Precautions and Warnings in this group before proceeding with this procedure. 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 manifold gauge set.

(2) Set control to A/C, RECIRC, and PANEL, temperature lever on full cool and blower on high.

(3) Start engine and hold at 1000 rpm with A/C clutch engaged.

(4) Engine should be warmed up with doors and windows closed.

(5) Insert a thermometer in the left center A/C outlet and operate the engine for five minutes. The A/C clutch may cycle depending on ambient conditions.

(6) With the A/C clutch engaged, compare the discharge air temperature to the A/C Performance Temperatures table.

(7) If the discharge air temperature fails to meet the specifications in the performance temperature chart. Refer to the Refrigerant Service Procedures for further diagnosis.

A/C PRESSURE TRANSDUCER

The work area temperature must not be below 10°C (50°F) to test the compressor clutch circuit. Before starting to test the transducer ensure that the wire connector is clean of corrosion and connected properly.

(1) With gear selector in park or neutral and park brake set, start engine and allow to idle.

(2) Install scan tool (DRB):

- Go to main menu
- Select stand alone scan tool (DRB)
- Select refer to the proper year diagnostics
- Select climate control
- Select sensor display
- Select A/C high side volts

For A/C system to operate a voltage between .451 (Low Pressure Cutout) to 4.519 (High Pressure Cutout is required. Voltages outside this range indicate a low or high pressure condition and **will not** allow the compressor to cycle.

Refer to the A/C Pressure Transducer Voltage table for the appropriate condition(s):

A/C PERFORMANCE TEMPERATURES

AMBIENT TEMPERATURE	21°C (70°F)	26.5°C (80°F)	32°C (90°F)	37°C (100°F)	43°C (110°F)
AIR TEMPERATURE AT LEFT CENTER PANEL OUTLET	1-8°C (34-46°F)	3-9°C (37-49°F)	4-10°C (39-50°F)	6-11°C (43-52°F)	7-18°C (45-65°F)
COMPRESSOR DISCHARGE PRESSURE AFTER THE FILTER DRIER	1034-1724 kPa (150-250 PSI)	1517-2275 kPa (220-330 PSI)	1999-2620 kPa (290-380 PSI)	2068-2965 kPa (300-430 PSI)	2275-3421 kPa (330-496 PSI)
EVAPORATOR SUCTION PRESSURE	103-207 kPa (15-30 PSI)	117-221 kPa (17-32 psi)	138-241 kPa (20-35 PSI)	172-269 kPa (25-39 PSI)	207-345 kPa (30-50 PSI)

DIAGNOSIS AND TESTING (Continued)

A/C PRESSURE TRANSDUCER VOLTAGE

VOLTAGE	CONDITION
0	TRANSDUCER FAULTY OR NO VOLTAGE FROM PCM
.150 TO .450	TRANSDUCER GOOD/LOW PRESSURE CUTOUT CONDITION
.451 TO 4.519	NORMAL OPERATING CONDITION
4.520 TO 4.850	TRANSDUCER GOOD/HIGH PRESSURE CUTOUT CONDITION
5	TRANSDUCER FAULTY

BLOWER MOTOR AND WHEEL ASSEMBLY

VIBRATION AND/OR NOISE DIAGNOSIS

The blower speed switch, in conjunction with the resistor block, supplies the blower motor with varied voltage.

CAUTION: Stay clear of the blower motor and resistor block (Hot). Do not operate the blower motor with the resistor block removed from the heater A/C housing.

Refer to the Blower Motor Vibration/Noise chart in this section for diagnosis.

COMPRESSOR NOISE DIAGNOSIS

Excessive noise while the A/C is being used, can be caused by loose mounts, loose clutch, or high operating pressure. Verify compressor drive belt condition, proper refrigerant charge and head pressure before compressor repair is performed.

If the A/C drive belt slips at initial start-up, it does not necessarily mean the compressor has failed.

With the close tolerances of a compressor it is possible to experience a temporary lockup. The longer the A/C system is inactive, the more likely the condition to occur.

This condition is the result of normal refrigerant movement within the A/C system caused by temperature changes. The refrigerant movement may wash the oil out of the compressor.

COMPRESSOR CLUTCH/COIL

The air conditioning compressor clutch electrical circuit is controlled by the Powertrain Control Module. It is located in the engine compartment outboard of the battery.

If the compressor clutch does not engage verify refrigerant charge.

If the compressor clutch still does not engage check for battery voltage at the pressure transducer located on the liquid line. If voltage is not detected, refer to:

- Group 8W, Wiring diagrams.
- Powertrain Diagnostic Procedures manual for diagnostic information.

If voltage is detected at the pressure transducer, connect pressure transducer and check for battery voltage between the compressor clutch connector terminals.

If voltage is detected, perform A/C Clutch Coil Tests.

TESTS

(1) Verify battery state of charge. (Test indicator in battery should be green).

(2) Connect an ampmeter (0-10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0-20 volt scale) with clip leads measuring voltage across the battery and A/C clutch.

(3) With A/C control in A/C mode and blower at low speed, start the engine and run at normal idle.

(4) The A/C clutch should engage immediately and the clutch voltage should be within two volts of the battery voltage. If the A/C clutch does not engage, test the fuse.

(5) The A/C clutch coil is acceptable if the current draw is 2.0 to 3.7 amperes at 11.5-12.5 volts at clutch coil. This is with the work area temperature at 21°C (70°F). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.

(6) If coil current reads zero, the coil is open and should be replaced. If the ammeter reading is 4 amperes or more, the coil is shorted and should be replaced. If the coil voltage is not within two volts of the battery voltage, test clutch coil feed circuit for excessive voltage drop.

EXPANSION VALVE

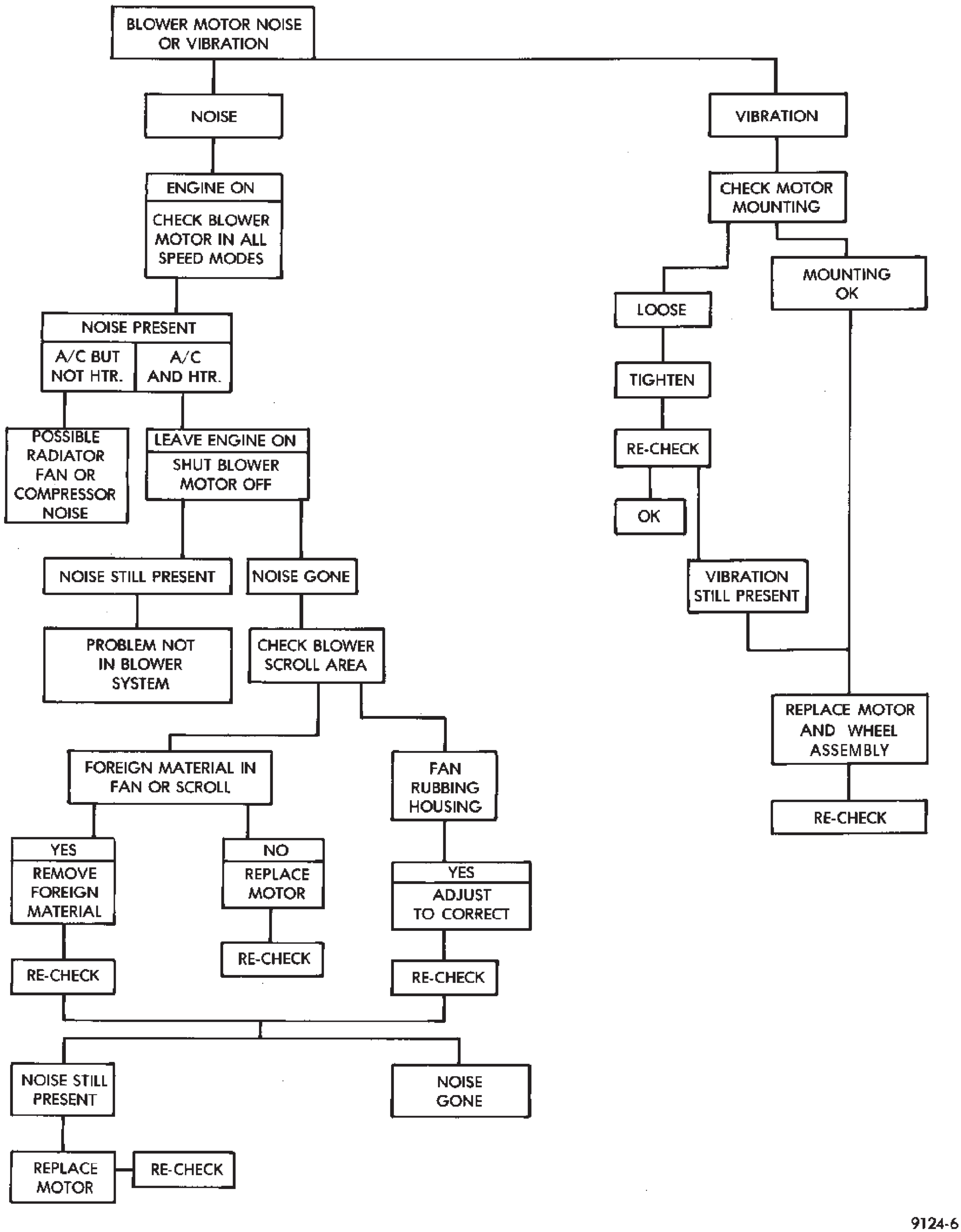
NOTE: Special effort must be used to keep all R-134a system components moisture-free. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

TESTS

NOTE: Expansion valve tests should be performed after compressor tests.

Review Safety Precautions and Warnings in this group. The work area and vehicle temperature must

DIAGNOSIS AND TESTING (Continued)



Blower Motor Noise/Vibration Diagnosis

DIAGNOSIS AND TESTING (Continued)

be 21°C to 27°C (70°F to 85°F). To test the expansion valve:

NOTE: Liquid CO2 is required to test the expansion valve. It is available from most welding supply facilities. CO2 is also available from companies which service and sell fire extinguishers.

(1) Connect a charging station or manifold gauge set to the refrigerant system service ports. Verify the refrigerant charge level.

(2) Close all doors, windows and vents to the passenger compartment.

(3) Set heater A/C control to A/C, full heat, FLOOR, and high blower.

(4) Start the engine and allow to idle (1000 rpm). After the engine has reached running temperature, allow the passenger compartment to heat up. This will create the need for maximum refrigerant flow into the evaporator.

(5) If the refrigerant charge is sufficient, discharge (high pressure) gauge should read 965 to 1655 kPa (140 to 240 psi). Suction (low pressure) gauge should read 140 kPa to 207 kPa (20 psi to 30 psig). If system cannot achieve proper pressure readings, replace the expansion valve. If pressure is correct, proceed with test.

WARNING: PROTECT SKIN AND EYES FROM CONTACTING CO2 PERSONAL INJURY CAN RESULT.

(6) If suction side low pressure is within specified range, freeze the expansion valve control head for 30 seconds. Use a super cold substance (liquid CO2). **Do not spray R-134a or R-12 Refrigerant on the expansion valve for this test.** Suction side low pressure should drop by 10 psi. If not, replace expansion valve.

(7) Allow expansion valve to thaw. The low pressure gauge reading should stabilize at 140 kPa to 240 kPa (20 psi to 30 psig). If not, replace expansion valve.

(8) When expansion valve test is complete, test A/C overall performance. Remove all test equipment before returning vehicle to use.

HEATER PERFORMANCE TEST

PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings in this group before performing the following procedures.

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 16 mm (5/8 inch inside diameter) heater hoses. With engine idling at normal running temperature, set the control to maximum heat, floor, and high blower setting. Using a test thermometer, check the air temperature coming from the floor outlets, refer to Temperature Reference Table.

TEMPERATURE REFERENCE TABLE

AMBIENT TEMPERATURE		MINIMUM FLOOR OUTLET TEMPERATURE	
CELSIUS	FAHRENHEIT	CELSIUS	FAHRENHEIT
15.5°	60°	62.2°	144°
21.1°	70°	63.8°	147°
26.6°	80°	65.5°	150°
32.2°	90°	67.2°	153°

If the floor outlet air temperature is insufficient, refer to Group 7, Cooling Systems for specifications. Both heater hoses should be HOT to the touch (coolant return hose should be slightly cooler than the supply hose). If coolant return hose is much cooler than the supply hose, locate and repair engine coolant flow obstruction in heater system.

POSSIBLE LOCATIONS OR CAUSE OF OBSTRUCTED COOLANT FLOW

(1) Pinched or kinked heater hoses.

(2) Improper heater hose routing.

(3) Plugged heater hoses or supply and return ports at cooling system connections, refer to Group 7, Cooling System.

(4) Plugged heater core.

(5) Air locked heater core.

(6) If coolant flow is verified and outlet temperature is insufficient, a mechanical problem may exist.

POSSIBLE LOCATION OR CAUSE OF INSUFFICIENT HEAT

(1) Obstructed cowl air intake.

(2) Obstructed heater system outlets.

(3) Blend-air door not functioning properly.

DIAGNOSIS AND TESTING (Continued)

TEMPERATURE CONTROL

If temperature cannot be adjusted with the TEMP lever on the control panel, the following could require service:

(1) Blend-air door binding.
(2) Faulty blend-air door motor.
(3) Improper engine coolant temperature.
(4) Faulty Instrument Panel Control.

SYSTEM CHARGE LEVEL TEST

The procedure below should be used to check and/or fill the refrigerant charge in the air conditioning system.

NOTE: The amount of R134a refrigerant that the air conditioning system holds is:

- Without rear A/C– .96 kg (34 oz. or 2.13 lbs.)
- With Rear A/C– 1.36 kg (48 oz. or 3.00 lbs.)

NOTE: Low Charge, condition may be described as:
- **Loss of A/C performance**
- **Fog from A/C outlets**
- **evaporator may have a HISS sound**

There are two different ways the system can be tested:

- With a scan tool (DRB), thermocouple and the Charge Determination Graph. Use the scan tool (DRB) diagnostic topic: Engine–System Monitors, A/C Pressure.
- Using a manifold gauge set, a thermocouple and the Charge Determination Graph.

It is recommended to use the gauges or reclaim/recycle equipment.

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. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

(1) Establish your preferred method of measuring liquid line pressure. Use a manifold gauge set or a DRB scan tool.

(2) Attach a clamp-on thermocouple (P.S.E. 66-324-0014 or 80PK-1A) or equivalent to the liquid line. It must be placed as close to the A/C Pressure Transducer as possible to observe liquid line temperature. Refer to “Thermocouple Probe” in this section for more information on probe.

(3) The vehicle must be in the following modes:

- Transaxle in Park
- Engine Idling at 700 rpm
- A/C Controls Set to Outside Air
- Panel Mode
- Full Cool
- High Blower motor, (vehicle equipped with rear A/C turn rear blower motor ON HIGH)
- A/C Button in the ON position
- Vehicle Windows Open.
- Recirc. button turned OFF

(4) Operate system for a couple of minutes to allow the system to stabilize.

(5) Set system pressure to about 1793 kPa (260 psi) by placing a piece of cardboard over part of the front side of the condenser. To place cardboard properly, remove the upper radiator-condenser cover. Insert cardboard between condenser and radiator front. This will maintain a constant pressure.

(6) Observe Liquid Line pressure and Liquid line temperature. Using the **Charge Determination Chart** determine where the system is currently operating. If the system is in the undercharged region, ADD 0.057 Kg. (2 oz.) to the system and recheck readings. If the system is in the overcharged region, RECLAIM 0.057 Kg. (2 oz.) from the system and recheck readings. Continue this process until the system readings are in the proper charge area on the **Charge Determination Chart**.

(7) The same procedure can be performed using the scan tool (DRB). To determine liquid line pressure, attach the scan tool, go to System Monitors–A/C Pressure. Observe liquid line pressure from A/C Pressure Transducer on digital display and digital thermometer. Refer to **Charge Determination Chart** and determine where the system is operating.

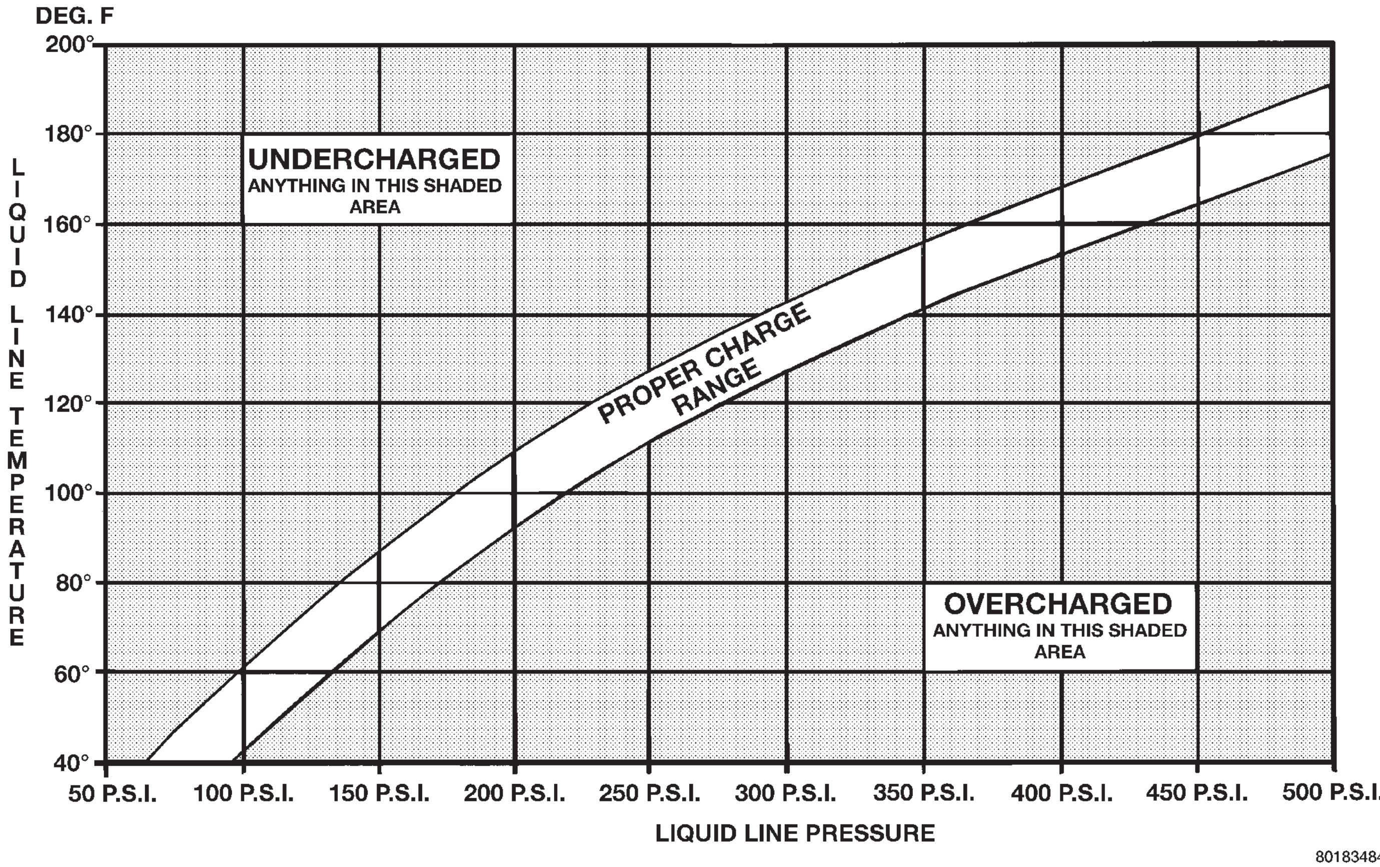
SERVICE PROCEDURES

R-134a REFRIGERANT

This vehicle uses a new type of refrigerant called R-134a. It is a non-toxic, non-flammable, clear colorless liquefied gas.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 in a R-134a system could cause compressor failure, refrigerant oil to sludge and/or poor performance. **Never add any other type of refrigerant to a system designed to use R-134a refrigerant. System failure will occur.**

SERVICE PROCEDURES (Continued)



Charge Determination Chart

The high pressure service port is located on the liquid line near the strut tower. The low pressure service port is located on the suction line near the compressor manifold.

When servicing a system, it is required that an air conditioning charging recovery/recycling machine be used (Fig. 8). Contact an automotive service equipment supplier for proper equipment. Refer to the operating instructions provided with the equipment for proper operation.

A manifold gauge set (Fig. 9) must also be used in conjunction with the charging and/or recovery/recycling device. Only use gauges that have not been used for R-12. The service hoses on the gauge set should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant R-134a from being released into the atmosphere.

R-134a refrigerant requires a special type of compressor oil. When adding oil, make sure to use the oil that is specified on the under hood label.

Due to the different characteristics of R-134a it requires all new service procedures.

The use of R-134a will have a positive environmental impact due to it's zero ozone depletion and low global warming impact.

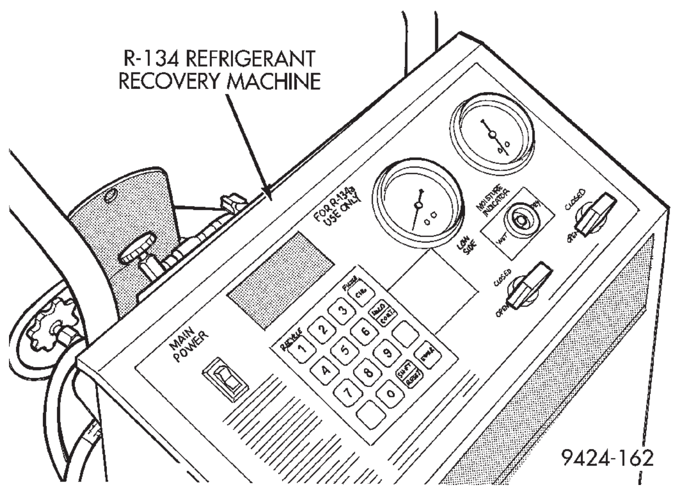


Fig. 8 Refrigerant Recovery/Recycling Station (Typical)

CHARGING REFRIGERANT SYSTEM

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.

SERVICE PROCEDURES (Continued)

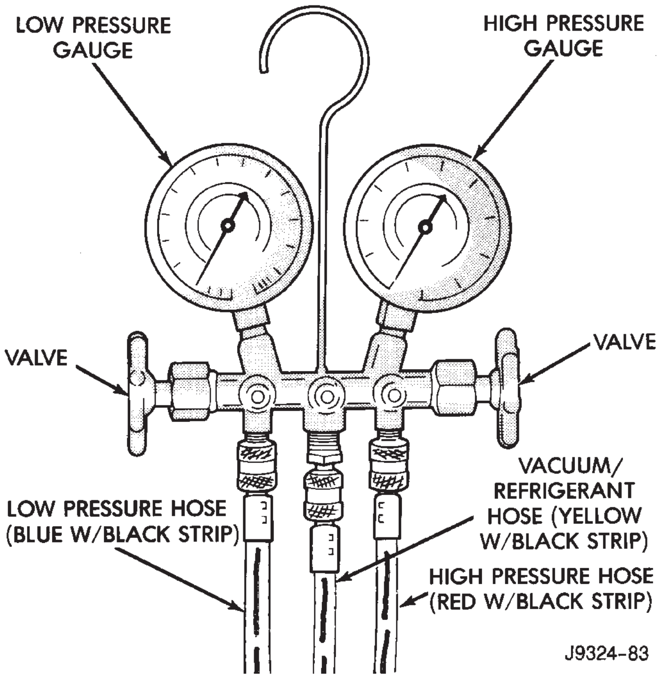


Fig. 9 Manifold Gauge Set- Typical

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 manifold gauge set.

(2) Measure refrigerant (refer to capacities) and heat to 52°C (125°F) with the charging station. Refer to the instructions provided with the equipment being used.

REFRIGERANT CAPACITIES

- Without Rear A/C = .96 kg (34 oz. or 2.13lb.)
- With Rear A/C = 1.36 kg (48 oz. or 3.00 lb.)

(3) Open the suction and discharge valves. Open the charge valve to allow the heated 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, run engine at a high idle (1400 rpm). Set the A/C control to A/C, low blower speed, and open windows. If the A/C compressor does not engage, test the compressor clutch control circuit and correct any failure. Refer to Group 8W, Wiring Diagrams.

(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.

EVACUATING REFRIGERANT SYSTEM

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.

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) Connect a suitable charging station, refrigerant recovery machine, and a manifold gauge set with vacuum pump (Fig. 10).

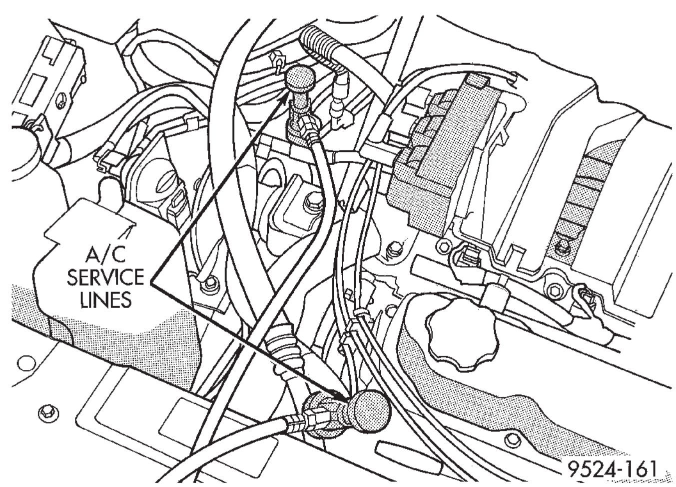


Fig. 10 Refrigerant Recovery Machine Hookup

(2) 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

SERVICE PROCEDURES (Continued)

eliminate all moisture in system. When the suction gauge reads -88 kPa (- 26 in. Hg) vacuum or greater for 45 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.

(3) Close all valves. Turn off and disconnect the vacuum pump.

(4) The refrigerant system is prepared to be charged with refrigerant.

THERMOCOUPLE PROBE

To diagnose the A/C system, a temperature probe is required to measure liquid line temperature. The clamp-on type K probe shown in this manual is available through the Chrysler Professional Service Equipment (PSE) program. This probe is compatible with temperature-measuring instruments that accept Type K Thermocouples and have a miniature connector input. Other temperature probes are available through aftermarket sources. All references in this manual will reflect the use of the probe made available through the Professional Service Equipment program.

In order to use the temperature probe, a digital thermometer will be required. If a digital thermometer is not available, an adapter is available through the Professional Service Equipment program. It can convert any standard digital multimeter into a thermometer. This adapter is designed to accept any standard K-type thermocouple.

If a digital multimeter is not available, it to can be ordered through Professional Service Equipment program.

STICKING HVAC CONTROL MODULE PUSH BUTTONS

To service HVAC control module push buttons that are sticking, spray between the buttons with Mopar® MP-50. The MP-50 is a all purpose lubricant for mechanical and electrical uses. After spraying around the push buttons wipe any excess off the radio bezel and HVAC control module push buttons. Operate the buttons to ensure that they are operating freely.

SYSTEM LEAK CHECKING

WARNING: R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

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 207 kPa (30 psi) proceed to Empty Refrigerant System Leak Test. If liquid line pressure is greater than 207 kPa (30 psi) proceed to low refrigerant level leak test. 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.

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.

EMPTY REFRIGERANT SYSTEM LEAK TEST

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible (about 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 with this procedure.

(2) Prepare a .284 Kg. (10 oz.) refrigerant charge to be injected into the system.

(3) Connect and dispense .284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.

(4) Proceed to step two of Low Refrigerant Level Leak Test.

LOW REFRIGERANT LEVEL LEAK TEST

(1) Determine if there is any (R-134a) refrigerant in the system. Use the scan tool (DRB) under the menu Systems Sensors–A/C Pressure test or pressure gauge liquid line temperature partial charge check. See system charge level check or fill for procedure.

(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 system set to the following:

SERVICE PROCEDURES (Continued)

- Transaxle in Park
- Engine Idling at 700 rpm
- A/C Controls Set in 100 percent outside air
- Full Panel Mode
- Blower motor ON HIGH
- A/C in the ON position
- Front Windows Open.
- Rear Air Off (If Equipped)

CAUTION: A leak detector designed for R-12 refrigerant will not detect leaks in a R-134a refrigerant system.

(4) Shut off the vehicle and wait 2 to 7 minutes. Then use an Electronic Leak Detector that is designed to detect R-134a type refrigerant and search for leaks. Fittings, lines, or components that appear to be oily usually indicates a refrigerant leak. To inspect the evaporator core for leaks, insert the leak detector probe into the recirculating air door opening or a heat duct.

If a thorough leak check has been completed without indication of a leak, proceed to System Charge Level-Check or Fill.

REMOVAL AND INSTALLATION

A/C PRESSURE TRANSDUCER

REMOVAL

(1) Disconnect the wire connector at the pressure transducer.

(2) Using an open end wrench, remove the transducer from the liquid line (Fig. 11).

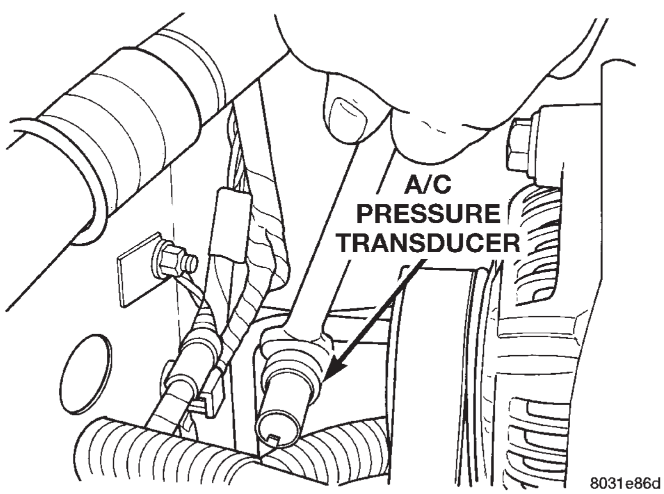


Fig. 11 A/C Pressure Transducer Removal

INSTALLATION

(1) Replace transducer O-ring.

(2) For installation, reverse the above procedures.

A/C SERVICE PORTS

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

The High Side service port is serviceable, the Low Side is not serviceable.

REMOVAL

(1) Disconnect the battery negative cable.

(2) Recover A/C system refrigerant.

(3) Unscrew the High Side service port from the liquid line.

(4) Remove O-ring

INSTALLATION

For installation, reverse the above procedures.

- **Install new O-ring.**
- Evacuate and recharge A/C system.

BLEND-AIR DOOR ACTUATOR

REMOVAL

The air conditioning system can be equipped with either a standard, single blend-air door actuator, or it can be equipped with dual actuators. The dual system has separate blend-air controls. This allows for separate control of the driver's side air, and the passenger side air (Fig. 12).

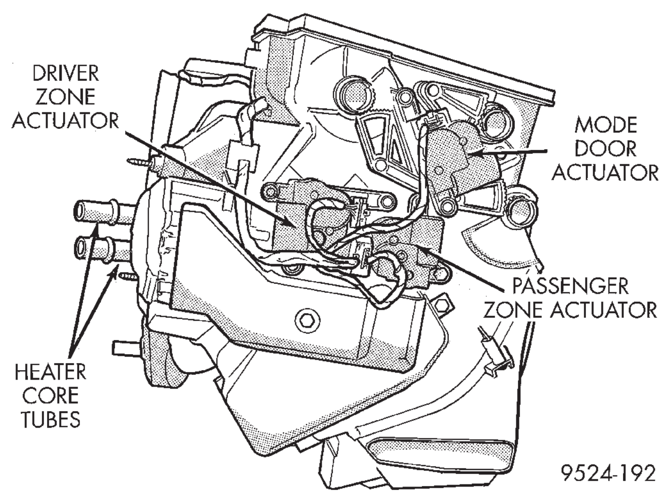


Fig. 12 Side View Of HVAC With Actuators

(1) Remove the lower left side steering column cover. Refer to Group 8E, Instrument Panel and Systems.

(2) Remove ABS control module (Fig. 13).

(3) Remove blend-air actuator connector.

(4) Remove blend-air actuator (Fig. 14).

INSTALLATION

(1) For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

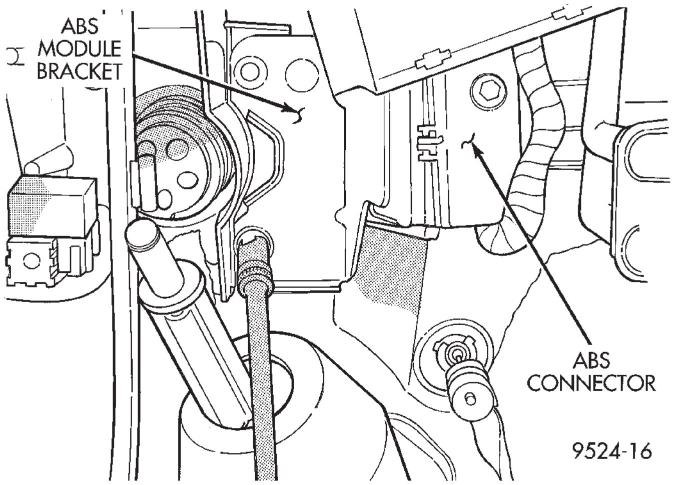


Fig. 13 ABS Control Module

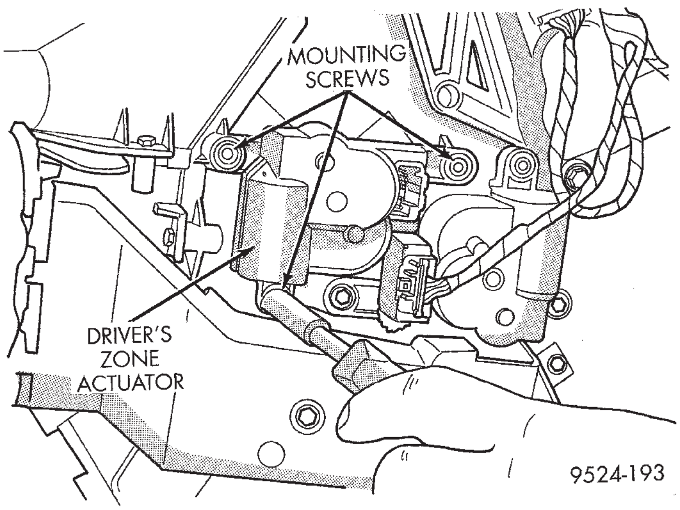


Fig. 14 Blend-Air Actuator

(2) Perform the HVAC Control Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

BLOWER MOTOR AND WHEEL ASSEMBLY

REMOVAL

(1) Remove glove box. Refer to Group 8E, Instrument Panel and Systems.
(2) Remove (4) hex head screws to blower motor cover (Fig. 15).
(3) Disconnect blower motor wiring.
(4) Remove grommet for wiring (Fig. 16). Feed wiring through blower housing (Fig. 17).
(5) Remove mounting screws for blower motor (Fig. 18).
(6) Allow the blower assembly to drop down, and remove assembly from vehicle.

INSTALLATION

For installation, reverse the above procedures.

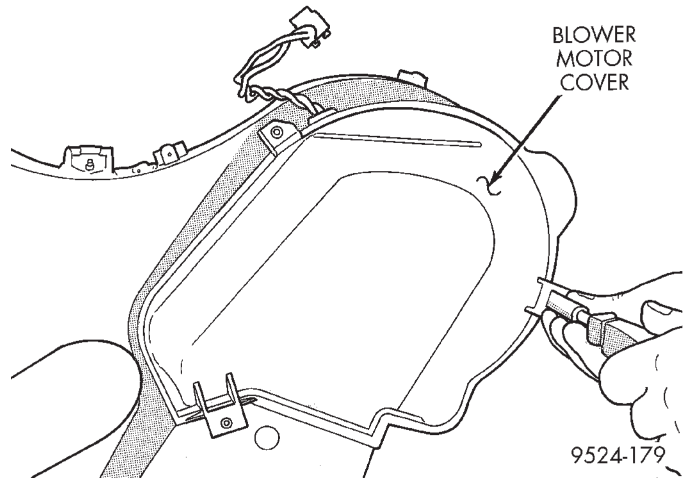


Fig. 15 Blower Motor Cover

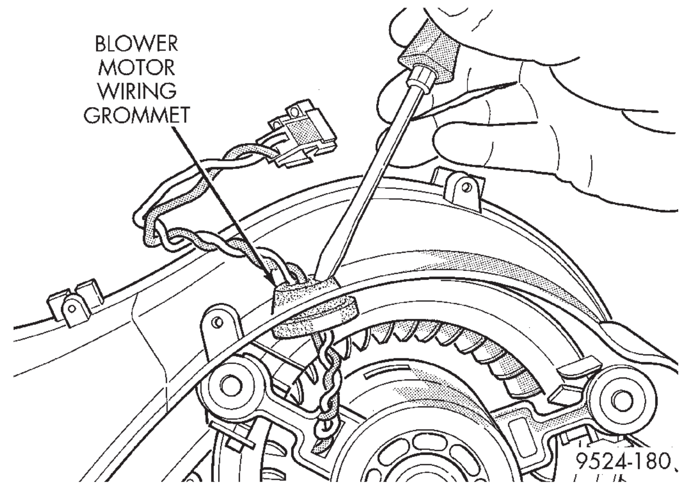


Fig. 16 Wiring Grommet

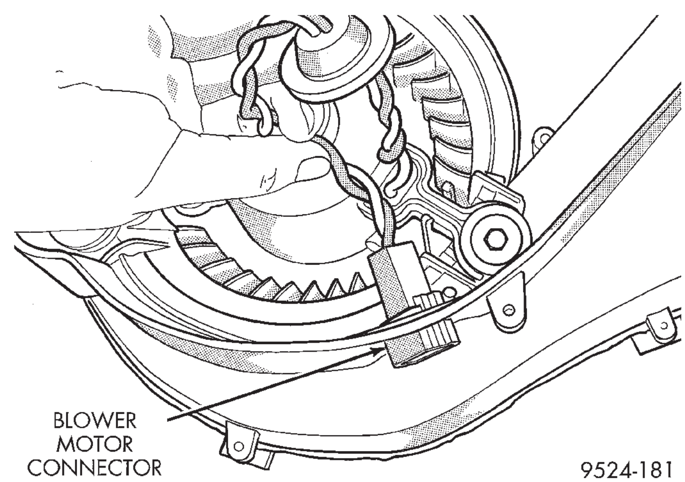


Fig. 17 Feeding Wiring Through Housing

BLOWER MOTOR RESISTOR BLOCK

REMOVAL

(1) Open hood.
(2) Disconnect and isolate negative battery cable.

REMOVAL AND INSTALLATION (Continued)

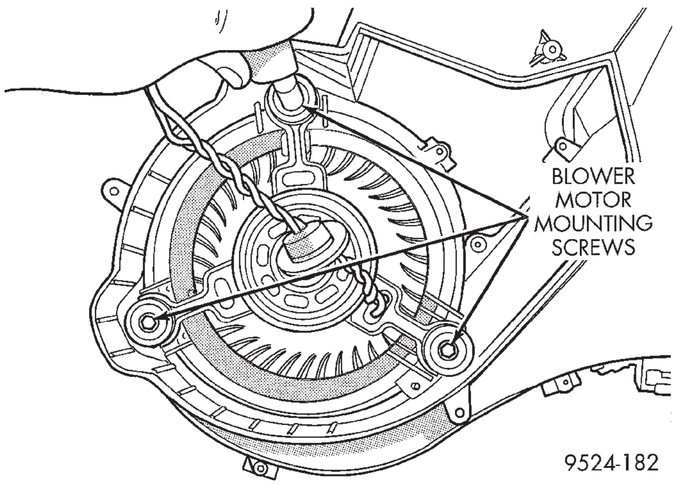


Fig. 18 Blower Motor Screws

(3) Locate and remove the wire connector from the blower resistor block. Block is located at the back of the engine compartment on the passenger side of the vehicle under the wiper module (Fig. 19).

NOTE: It may not necessary to remove the wiper module to access the resistor block.

(4) Using a long flad blade screwdriver, gently push in on drivers side of resistor. Be careful to catch the inner release tang and gently pry outward (Fig. 20).

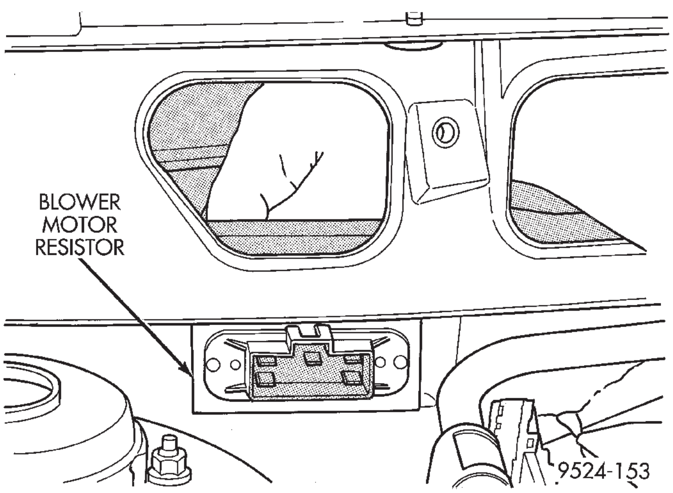


Fig. 19 Resistor Block Location

WARNING: THE RESISTOR BLOCK MAY BE HOT. DO NOT ATTEMPT TO SERVICE THE RESISTOR BLOCK IF THE SYSTEM HAS BEEN RUNNING RECENTLY. LET THE SYSTEM COOL DOWN BEFORE REPAIRS ARE INITIATED.

(5) Remove resistor block by inserting a flat blade pry tool on the side of the resistor block and pushing inward. Two guide lines are shown on the right hand edge of the resistor block to help guide the blade

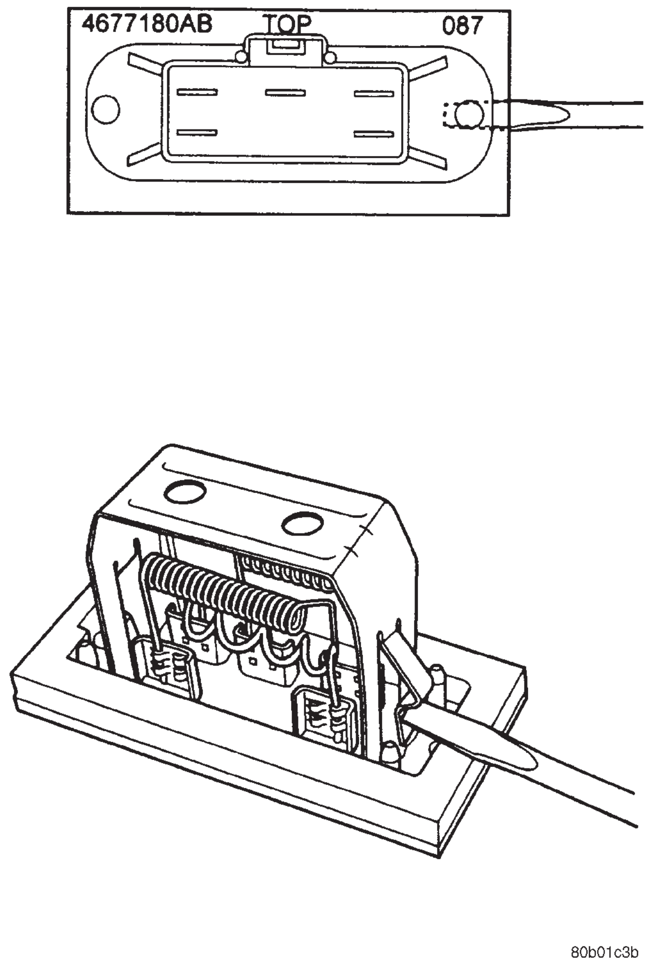


Fig. 20 Resistor Block Removal

position. This will release the clips on the side of the resistor block. Pull resistor block out.

INSTALLATION

For installation, reverse the above procedures. Make sure the "TOP" lettering is on the top of the resistor. The coils on the Resistor Block should not be contacting one another. Before installation, gently separate the coils (with fingers only) if one coil is contacting another.

BLOWER MOTOR WHEEL

The blower motor wheel is not serviced separately. If the wheel needs to be replaced it is serviced as an assembly of the blower motor. For service procedure information, refer to Blower Motor Replacement in this group.

REMOVAL AND INSTALLATION (Continued)

COMPRESSOR

REMOVAL

WARNING: REFER TO REFRIGERANT SERVICE PROCEDURES FOR INFORMATION REGARDING PROPER RECOVERY OF THE REFRIGERANT BEFORE ATTEMPTING TO REMOVE THE COMPRESSOR.

(1) Disconnect negative battery cable.
(2) Pinch off coolant lines to rear Heat unit (if equipped). Drain engine coolant.
(3) Remove upper radiator hose.
(4) Remove drive belt (refer to Group 7, Cooling System). Disconnect compressor clutch wire lead.
(5) Remove refrigerant lines from compressor (Fig. 21) and (Fig. 22).

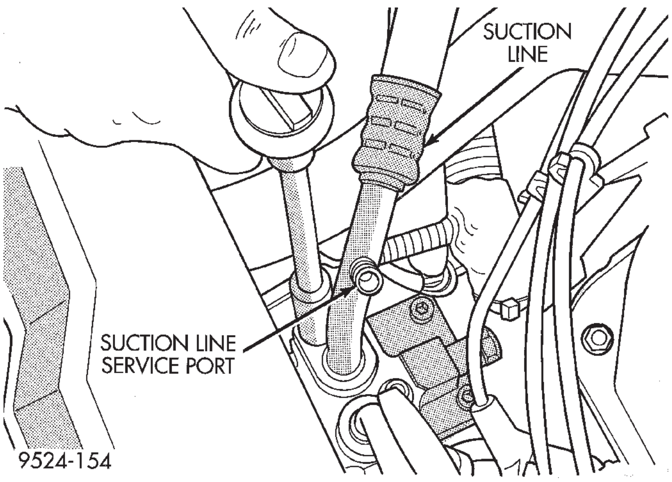


Fig. 21 Suction Line

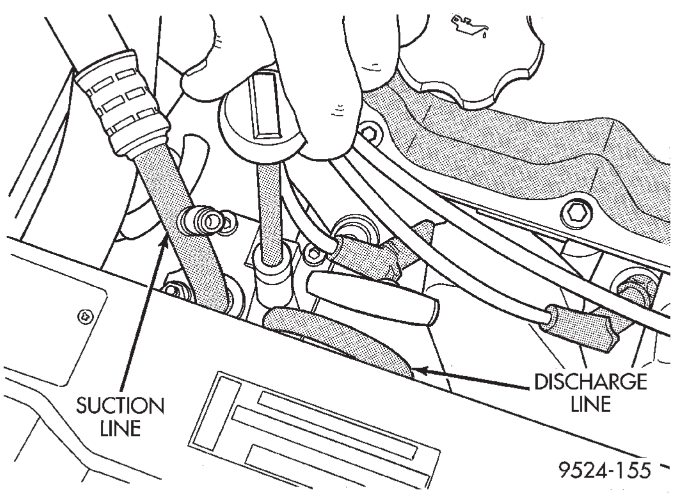


Fig. 22 Discharge line

(6) Remove compressor nuts and bolts (Fig. 23).
(7) Remove compressor (Fig. 24).

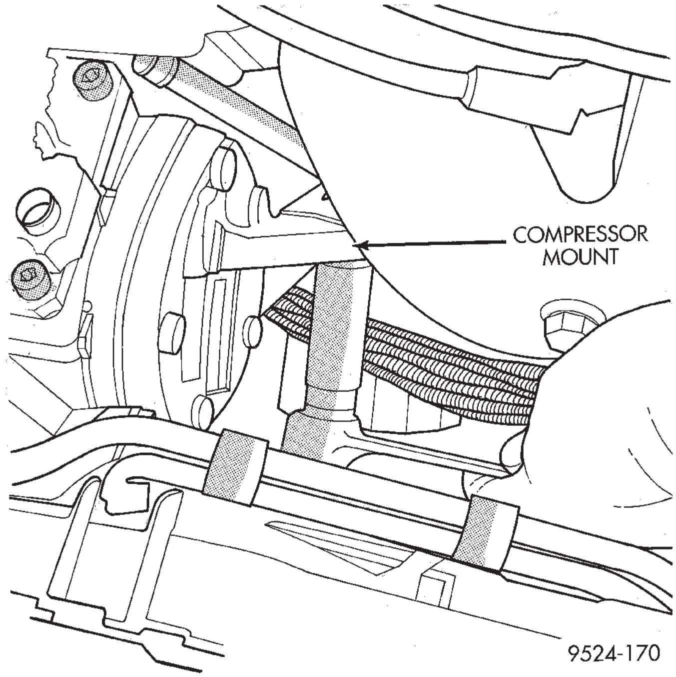


Fig. 23 Compressor Mounts

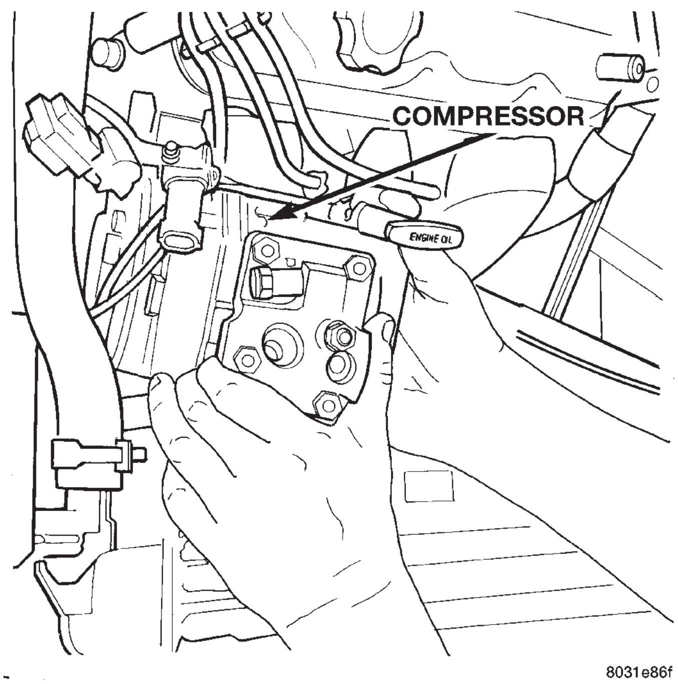


Fig. 24 Compressor Removal

INSTALLATION

For installation, reverse the above procedures.

COMPRESSOR CLUTCH/COIL

REMOVAL

(1) Remove the compressor shaft bolt (Fig. 25). A band type oil filter removal tool can be placed around the clutch plate to aid in bolt removal.

REMOVAL AND INSTALLATION (Continued)

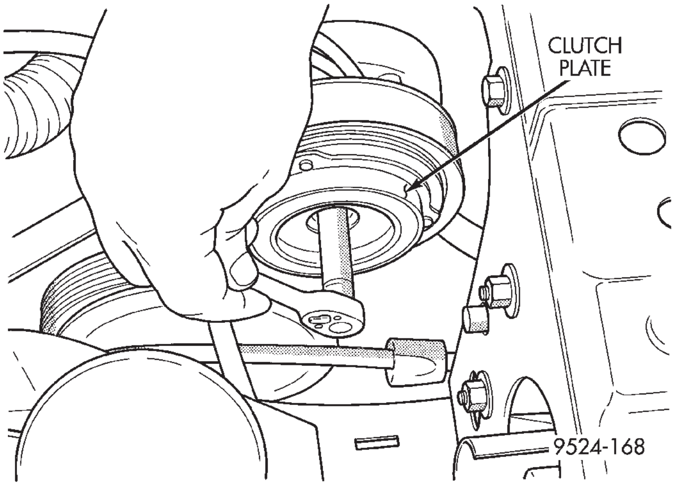


Fig. 25 Compressor Shaft Bolt and Clutch Plate

CAUTION: Do not use screwdrivers between the clutch plate assembly and pulley to remove front plate as this may damage the front plate assembly.

(2) Tap the clutch plate with a plastic hammer and remove clutch plate and shim (Fig. 26).

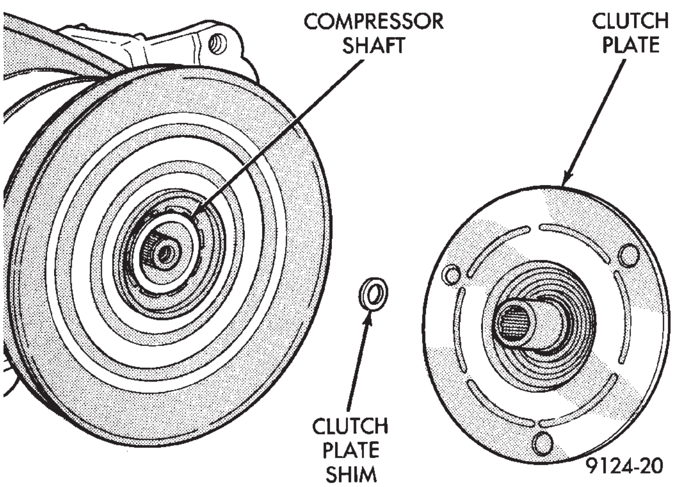


Fig. 26 Clutch Plate and Shim(s)

(3) Remove pulley retaining snap ring with snap ring pliers (C-4574), and slide pulley assembly off of compressor (Fig. 27).

(4) Remove coil wire clip screw and wire harness.

(5) Remove snap ring retaining field coil onto compressor housing (Fig. 28). Slide field coil off of compressor housing.

(6) Examine frictional faces of the clutch pulley and front plate for wear. The pulley and front plate should be replaced if there is excessive wear or scoring. If the friction surfaces are oily, inspect the shaft nose area of the compressor for oil and remove the felt from the front cover. If the compressor felt is saturated with oil, the shaft seal is leaking and will have to be replaced.

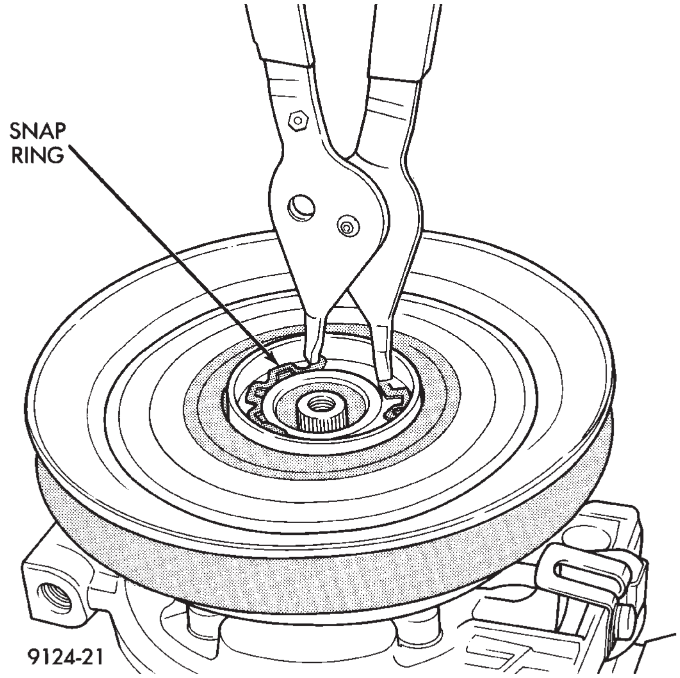


Fig. 27 Removing Pulley Snap Ring

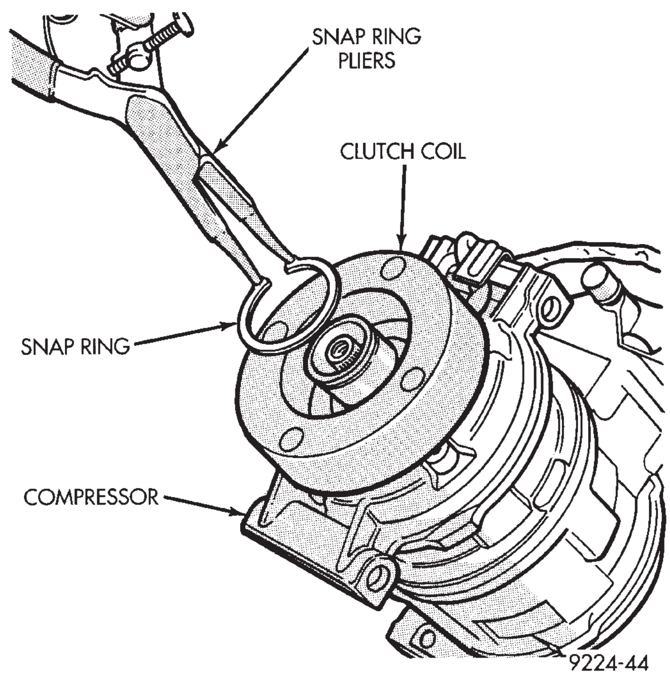


Fig. 28 Clutch Coil Snap Ring

(7) Check bearing for roughness, excessive leakage or grease. If grease from bearing has contaminated the faces of the pulley or front plate, they should be replaced. If the bearing is rough or binds, replace clutch pulley and front plate assembly.

REMOVAL AND INSTALLATION (Continued)

CAUTION: The clutch pulley and the front plate were mated at the factory by a burnishing operation. No attempt should be made to separately replace either part. This will result in clutch slippage due to insufficient contact area.

INSTALLATION

(1) Align pin in back of field coil with hole in compressor end housing, and position field coil into place. Make sure that lead wires are properly routed, and fasten with the wire clip screw.

(2) Install field coil retaining snap ring with snap ring pliers. The bevel side of the snap ring facing outward. Also both snap ring eyelets must be to the right or left of the pin on compressor. Press snap ring to make sure it is properly seated in the groove.

CAUTION: If snap ring is not fully seated it will vibrate out, resulting in a clutch failure and severe damage to the front face of the compressor.

(3) Install pulley assembly to compressor. If necessary, tap gently with a block of wood on the friction surface (Fig. 29).

CAUTION: Do not mar the pulley frictional surface.

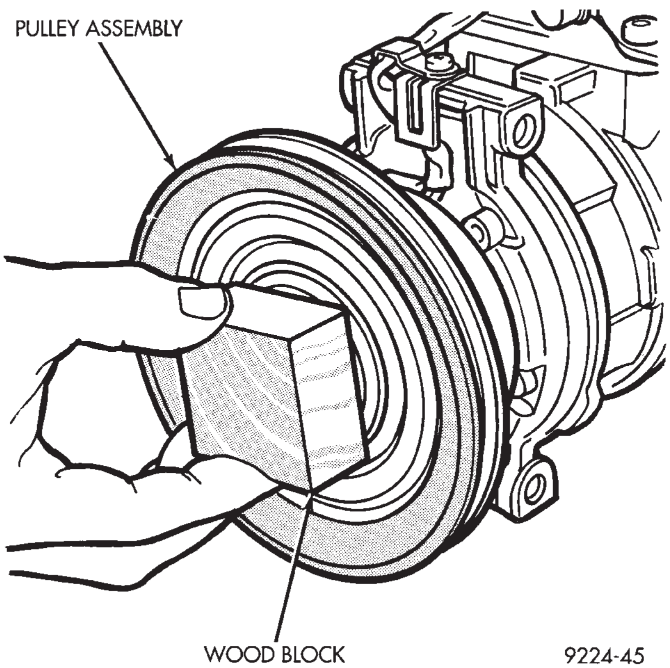


Fig. 29 Installing Pulley Assembly

(4) Install pulley assembly retaining snap ring (bevel side outward) with snap ring pliers. Press the snap ring to make sure it is properly seated in the groove.

(5) If the original front plate assembly and pulley assembly are to be reused, the old shim(s) can be used. If not, place a trial stack of shims, 1 mm (0.040 in.) thick, on the shaft against the shoulder.

(6) Install front plate assembly onto shaft.

(7) With the front plate assembly tight against the shim(s), measure the air gap between front plate and pulley face with feeler gauges. The air gap should be between 0.5 and 0.9 mm (.020 and .035 inch) If proper air gap is not obtained, add or subtract shims until desired air gap is obtained.

(8) Install compressor shaft bolt. Tighten to 17.5±2 N·m (155±20 in. lbs.).

NOTE: Shims may compress after tightening shaft nut. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

CLUTCH BREAK-IN

After a new clutch has been installed, check the voltage and amperage to the clutch (determine it to be satisfactory). Then cycle the A/C clutch approximately 20 times (5 sec. on and 5 sec. off). For this procedure, set the system to the A/C mode, using high blower, and engine rpm at 1500-2000. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher clutch torque capability.

CONDENSER ASSEMBLY

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

NOTE: 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.

REMOVAL

(1) Recover A/C system refrigerant.

(2) Remove liquid line at filter-drier (Fig. 30).

(3) Remove (2) bolts attaching filter-drier to radiator module (Fig. 31).

(4) Remove upper radiator crossmember.

(5) Tilt radiator rearward.

(6) Remove upper discharge line at condenser (Fig. 32).

(7) Through fascia, remove lower liquid line from filter-drier.

(8) Remove (2) lower condenser mounting bolts.

(9) Remove (2) upper mounting bolts.

(10) Remove condenser from vehicle (Fig. 33).

REMOVAL AND INSTALLATION (Continued)

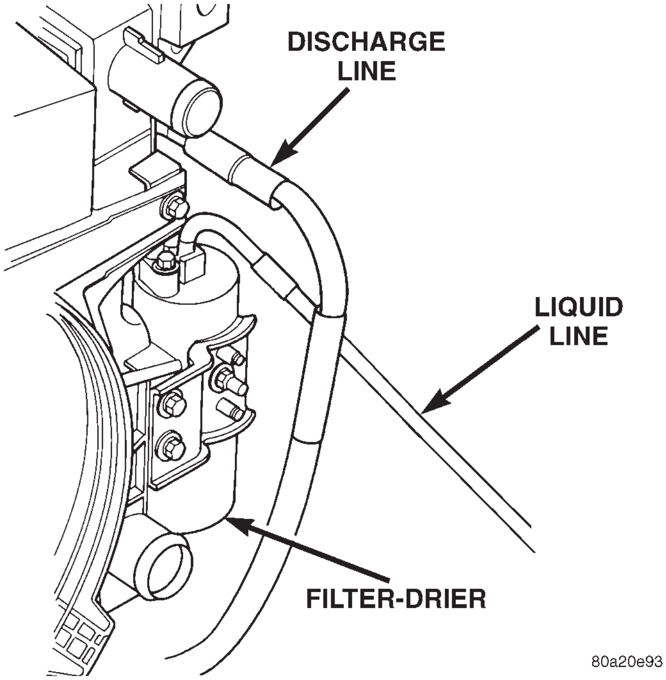


Fig. 30 Liquid Line

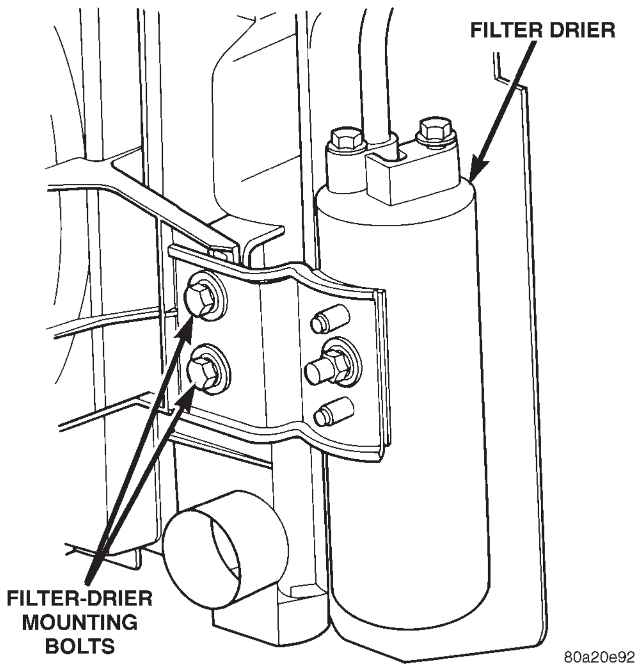


Fig. 31 Filter-Drier

INSTALLATION

NOTE: Inspect Cooling Module for presence of seals. Verify seals are available for re-installation.

(1) Before installation, replace all O-rings and gaskets, coat all sealing surfaces with approved wax-free refrigerant oil. Then, reverse the above procedures.

(2) Torque the following components to specifications:

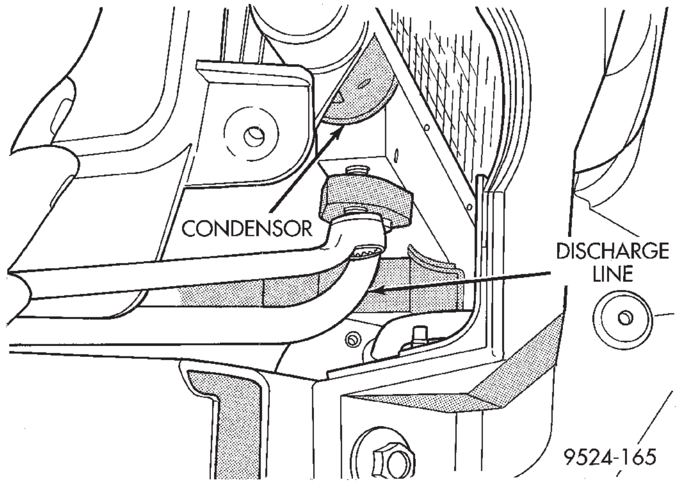


Fig. 32 Upper Discharge Line

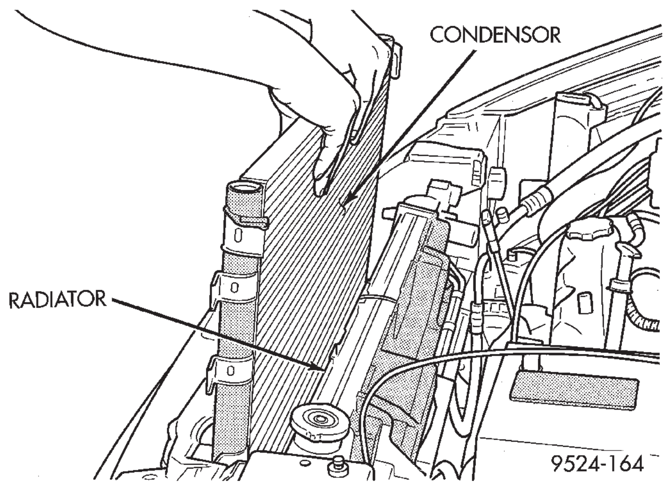


Fig. 33 Condenser Removal

- Liquid line at filter/drier – 45 in. lbs. ± 10.
- Upper discharge line at condenser – 180 in. lbs. ± 20
- Lower liquid line to condenser – 180 in. lbs. ± 20.
- (2) lower, condenser mounting bolts – 45 in. lbs. ± 10.
- (2) upper, condenser mounting bolts – 45 in. lbs. ± 10.

(3) Evacuate and charge system.

DISCHARGE LINE

REMOVAL

(1) Recover A/C system refrigerant.

(2) Remove discharge line mounting nut at compressor (Fig. 34).

(3) Remove discharge line at the top fitting on the condenser (Fig. 35).

REMOVAL AND INSTALLATION (Continued)

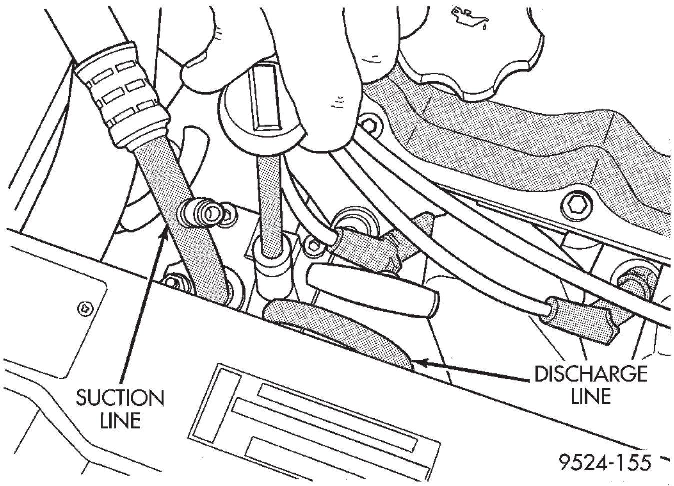


Fig. 34 Compressor Discharge Line

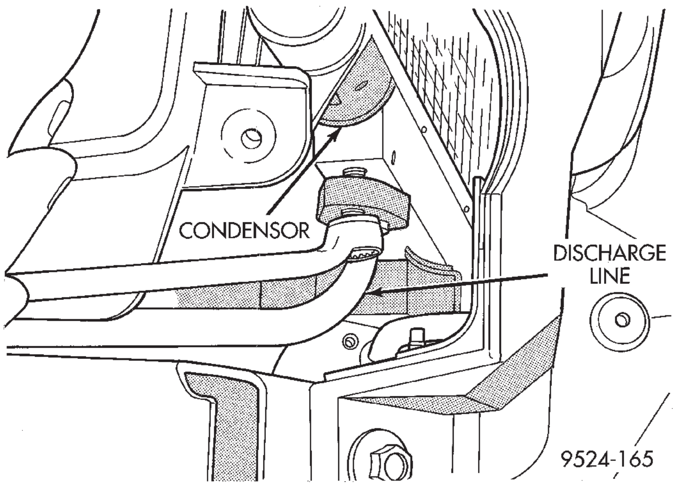


Fig. 35 Condenser Discharge Line

INSTALLATION

(1) For installation, reverse the above procedures. Replace all O-rings. Torque discharge line at condenser bolt to 180 in. lbs. ± 10.

(2) Evacuate and recharge A/C system.

(3) Perform the HVAC Control Calibration Diagnostic and Cooldown test.

EVAPORATOR PROBE

REMOVAL

(1) Remove the glove box. Refer to Group 8E, Instrument Panel and Systems.

(2) Disconnect the evaporator probe connector (Fig. 36).

(3) Using a flat blade pry tool, pry the evaporator probe grommet from the HVAC housing (Fig. 37).

(4) Remove evaporator probe from evaporator (Fig. 38).

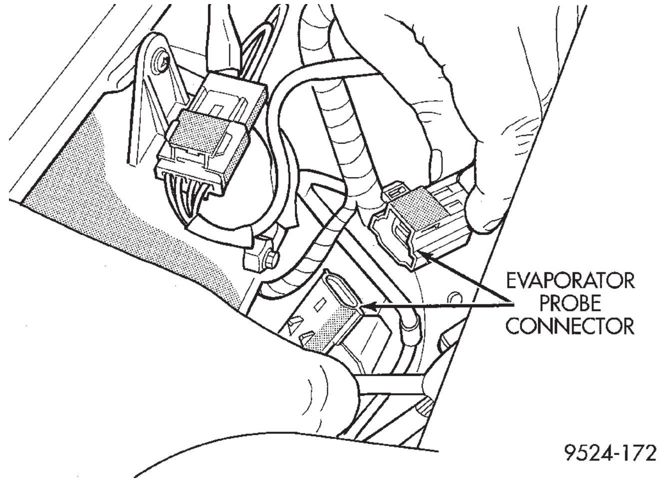


Fig. 36 Evaporator Probe Connector

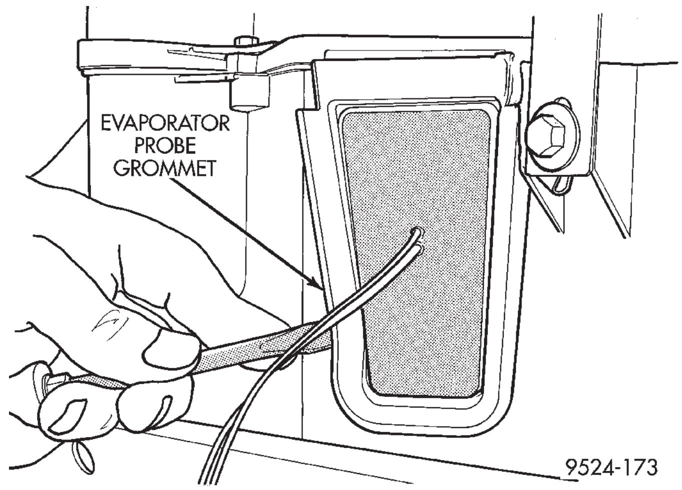


Fig. 37 Evaporator Probe Grommet

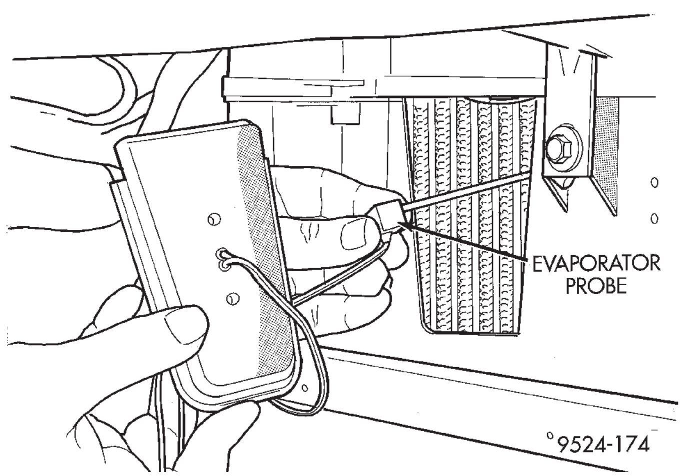


Fig. 38 Evaporator Probe

INSTALLATION

For installation, reverse the above procedures. Three holes are provided in evaporator for probe location. When reinstalling probe, use a different hole than original one. If a new evaporator is installed, insert the probe in the uppermost hole provided.

REMOVAL AND INSTALLATION (Continued)

EXPANSION VALVE

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

REMOVAL

(1) Disconnect the battery negative cable.
(2) Recover A/C system refrigerant.
(3) Remove the accessory drive belt.
(4) Remove upper generator bracket.
(5) Disconnect generator field wire connector.
(6) Push generator forward.
(7) Remove ground wire at dash panel.
(8) Remove the nut retaining the refrigerant line sealing plate to the expansion valve (Fig. 39).
(9) Remove the stud from the expansion valve (Fig. 40).
(10) Carefully pull the refrigerant line sealing plate assembly from expansion valve towards the front of the vehicle. Use care not to scratch the expansion valve sealing surfaces with pilot tubes.
(11) Cover the openings to prevent contamination.
(12) Remove two screws securing the expansion valve to the evaporator sealing plate (Fig. 40).
(13) Carefully remove expansion valve (Fig. 41).
(14) Remove the old O-rings.

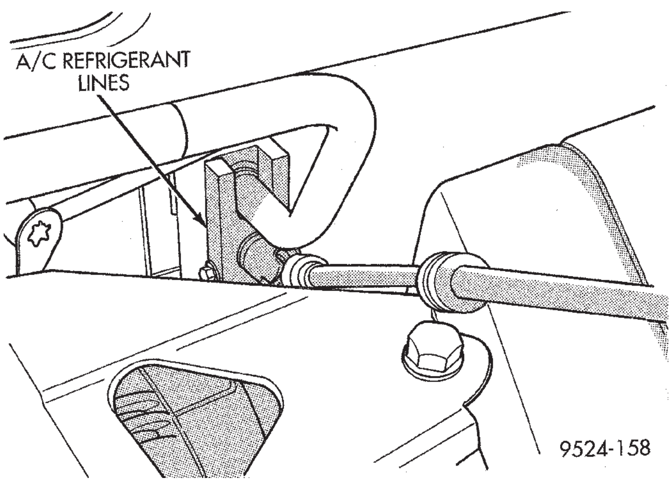


Fig. 39 A/C Refrigerant Line Plate

INSTALLATION

(1) Ensure old O-rings are removed. Install new O-rings on the refrigerant lines and evaporator sealing plate.
(2) Hand-start the stud into the expansion valve and torque to 7 - 11 N·m (64 - 96 in. lbs.).
(3) Carefully install the expansion valve to the sealing plate. Install the two screws and tighten 8 to 14 N·m (70 to 130 in. lbs.) torque.

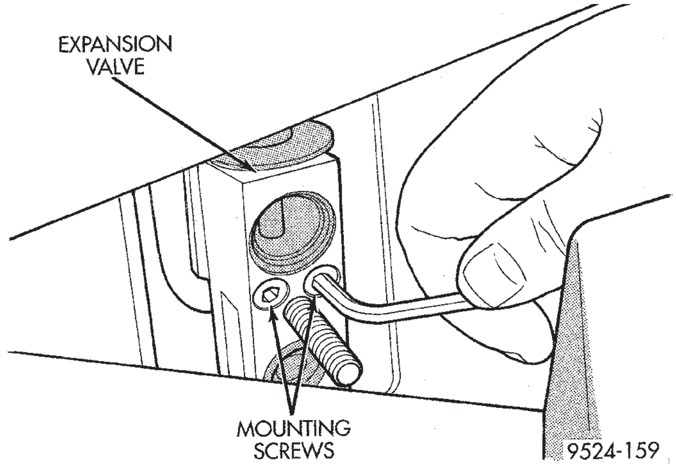


Fig. 40 Expansion Valve Stud and Mounting Screws

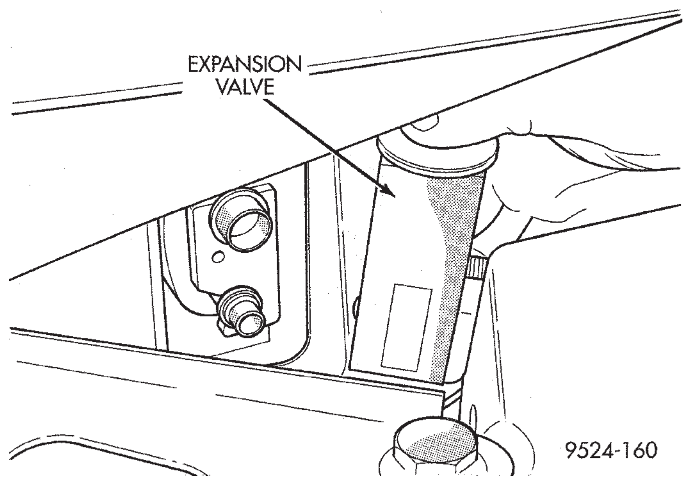


Fig. 41 Expansion Valve Removal

(4) Carefully install the refrigerant lines and sealing plate to the expansion valve. Install the nut and tighten 20 to 26 N·m (170 to 230 in. lbs.) torque.
(5) Install the ground wire at dash panel.
(6) Pull generator back into the proper position for bracket mounting.
(7) Install generator field wire connector.
(8) Install the upper generator bracket.
(9) Install accessory drive belt.
(10) Evacuate and recharge system.
(11) After expansion valve is installed, the system is charged, and leaks have checked repeat the A/C performance check.

FILTER-DRIER ASSEMBLY

REMOVAL

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

(1) Recover A/C system refrigerant.

REMOVAL AND INSTALLATION (Continued)

(2) Remove liquid line at filter-drier (Fig. 42).

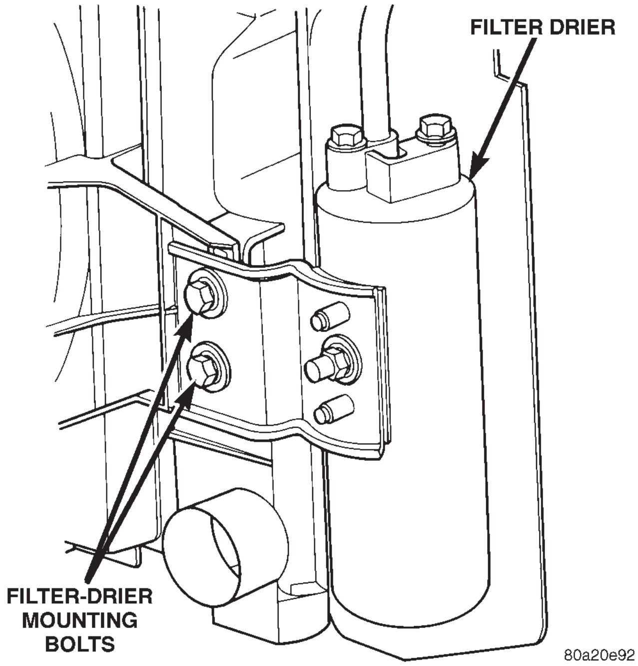


Fig. 42 Filter-Drier Assembly

(3) Remove the (2) bolts holding filter-drier bracket to radiator fan module bracket.

(4) Remove the lower liquid line at condenser.

(5) Remove the upper radiator crossmember.

(6) Pull up on radiator and slide filter-drier from the mounting location.

INSTALLATION

(1) Before installation, replace both refrigerant line O-rings. Then reverse the above procedures. Torque filter/drier mounting bolts to 45 in. lbs. ± 10.

(2) Evacuate and recharge system.

HEATER A/C UNIT HOUSING

REMOVAL

WARNING: IF EQUIPPED WITH AIR CONDITIONING, THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING.

(1) Set parking brake.

(2) Disconnect battery negative cable.

(3) Using a refrigerant recovery machine, remove refrigerant from the A/C system (Fig. 43).

(4) Remove wiper module. Refer to Group 8K, Windshield Wipers and Washers.

(5) Pinch off rear heater lines if equipped.

(6) Drain engine coolant. Remove heater hoses at the heater core (Fig. 44). Plug coolant lines.

(7) Remove suction and liquid lines at the expansion valve (Fig. 45).

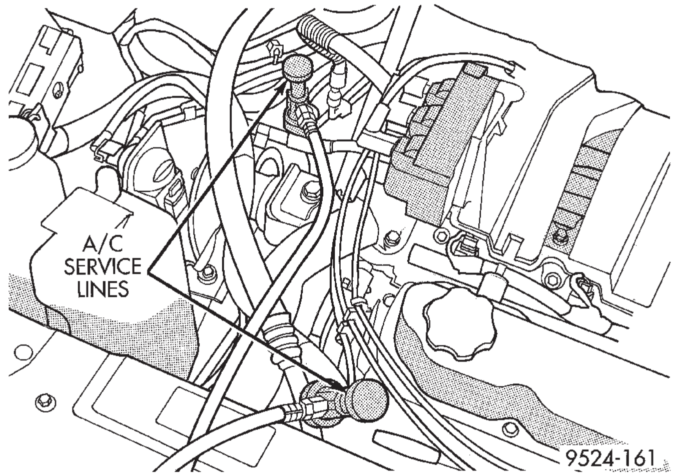


Fig. 43 A/C Service Ports

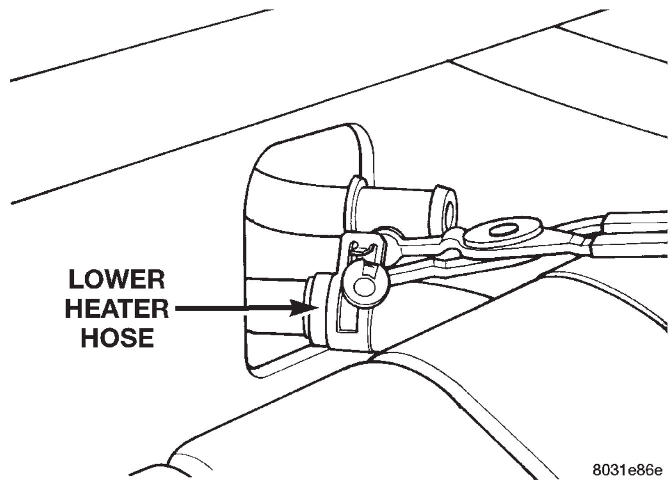


Fig. 44 Heater Hoses

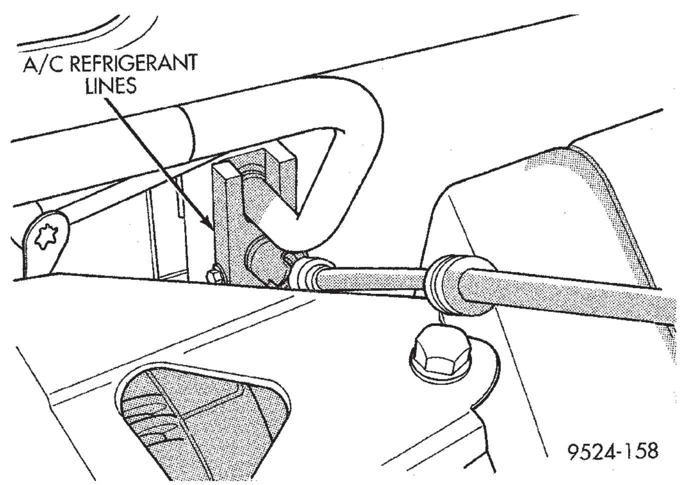


Fig. 45 Expansion Valve Plate

(8) Remove the Instrument Panel Assembly. Refer to Group 8E, Instrument Panel and Gauges.

(9) Remove heater ducts.

REMOVAL AND INSTALLATION (Continued)

(10) Disconnect the two upper mounts from the upper reinforcement and the lower mount from the tunnel.

(11) Remove the (3) nuts (in the engine compartment) securing the unit to the dash panel (Fig. 46).

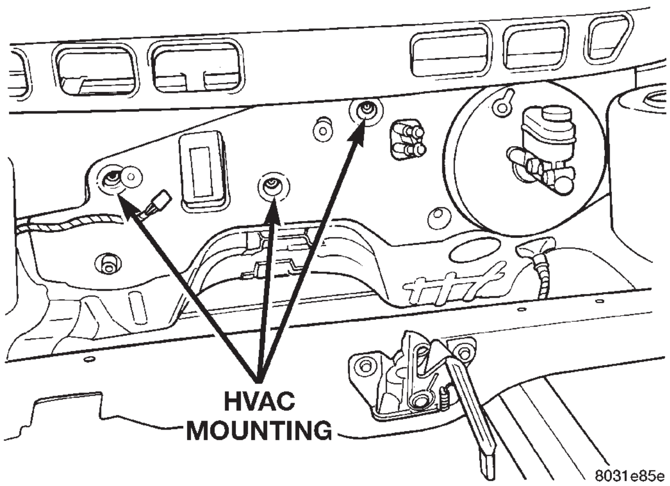


Fig. 46 HVAC Bolt-Up

(12) Disconnect the HVAC housing wiring harness.

(13) Pull the entire unit rearward until the studs on the unit clear the dash panel. Drop the unit down. Pull it rearward to remove it from vehicle.

INSTALLATION

(1) For installation of the assembly, reverse the above procedures. Install new O-rings on plumbing inlets

(2) Evacuate and recharge the A/C system.

(3) Perform HVAC control Calibration Diagnostic and Cooldown test.

HEATER CORE

REMOVAL

(1) Drain coolant system.

(2) Remove left side lower column cover.

(3) Remove steering column assembly. Refer to Group 19, Steering for service procedure.

(4) Remove ABS module, bracket and wiring (Fig. 47).

(5) Remove I/P to body harness interconnect and bracket (Fig. 48).

(6) Remove lower silencer boot at base of steering shaft (Fig. 49)

(7) Pinch off heater lines under the hood.

(8) Remove heater core cover. Insert a small amount of towels under the heater core tubes. Remove heater core plate and tubes (Fig. 50).

(9) Depress heater core retaining clips (Fig. 51).

(10) Pull up on accelerator pedal and slide heater core past (Fig. 52).

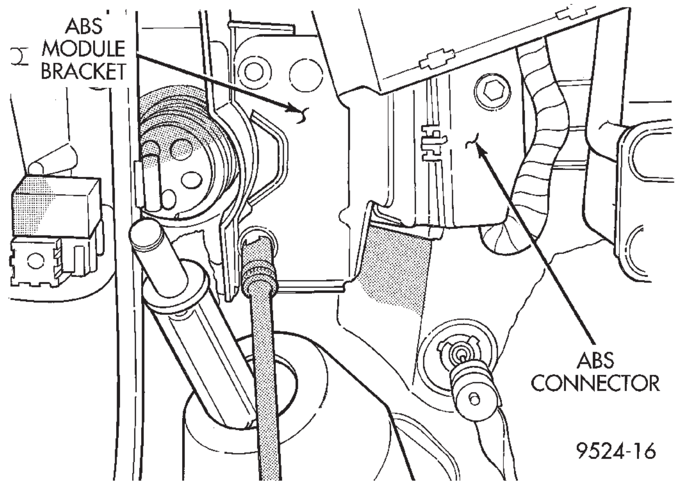


Fig. 47 ABS MODULE

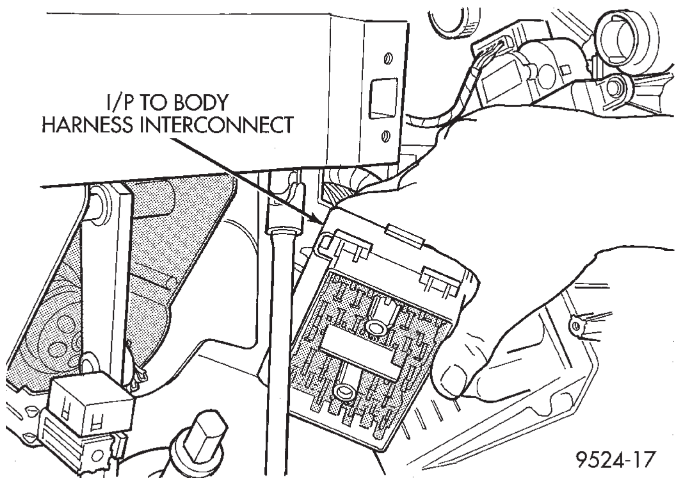


Fig. 48 Interconnect And Bracket

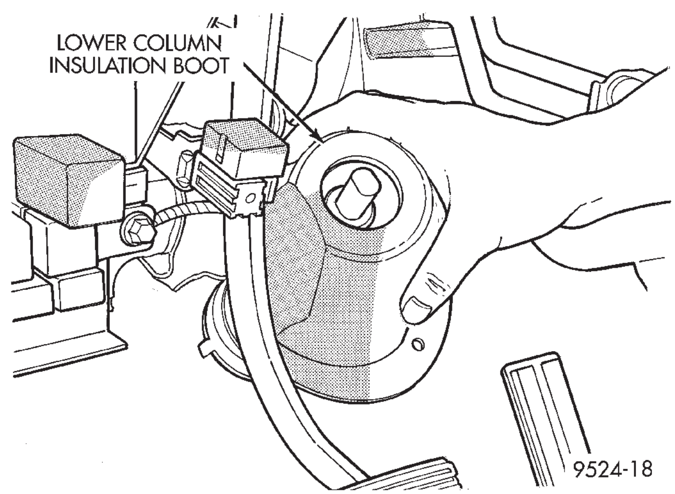


Fig. 49 Lower Silencer Boot

(11) Depress brake pedal (Fig. 53) and remove heater core from HVAC housing.

REMOVAL AND INSTALLATION (Continued)

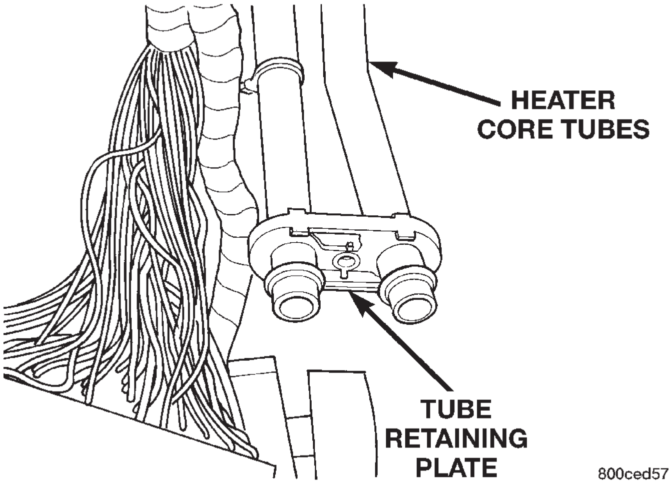


Fig. 50 Heater Core Plate And Tubes

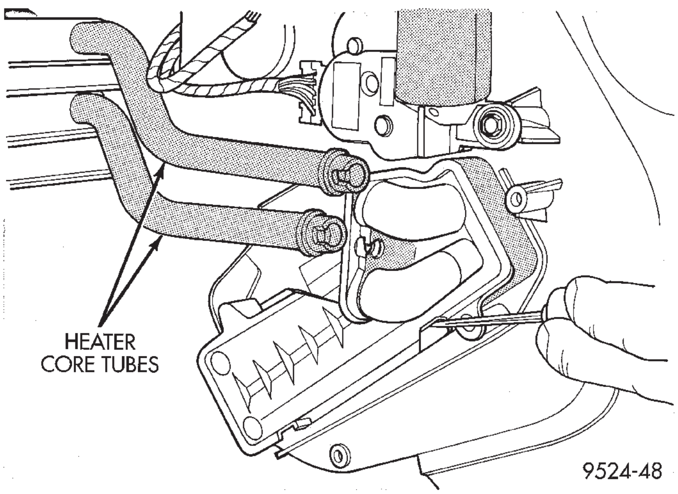


Fig. 51 Depress Clips

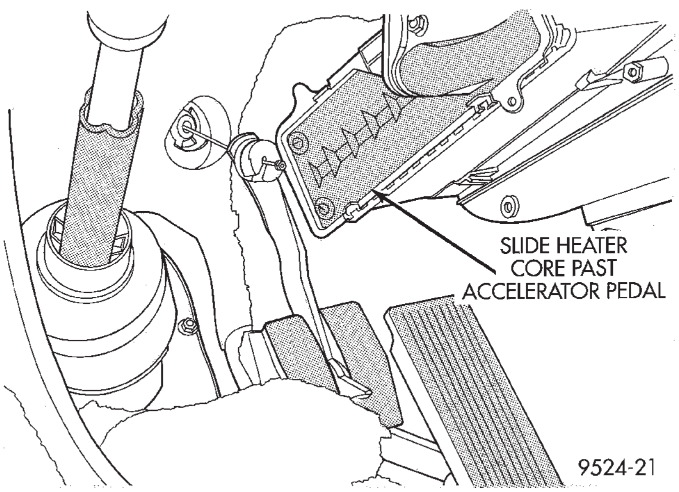


Fig. 52 Accelerator Pedal

INSTALLATION

For installation, reverse the above procedures. Install screws to retain heater core in housing. Replace heater core tube inlet O-rings. Tighten heater core tube retaining plate to 3 ± 1 N·m (27 ± 9 in. lbs.) torque.

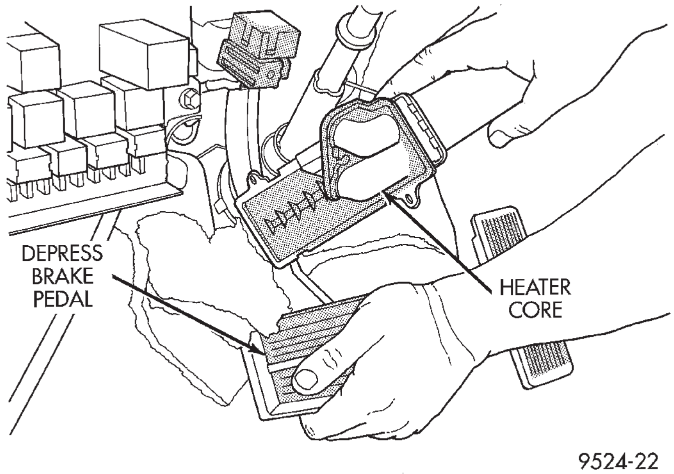


Fig. 53 Brake Pedal

HEATER HOSES

REMOVAL

NOTE: Review Safety Precautions and Warnings before proceeding with this operation.

(1) Drain engine cooling system. Refer to Group 7, Engine Cooling.

(2) Loosen clamps at each end of heater hose to be removed (Fig. 54) and (Fig. 55).

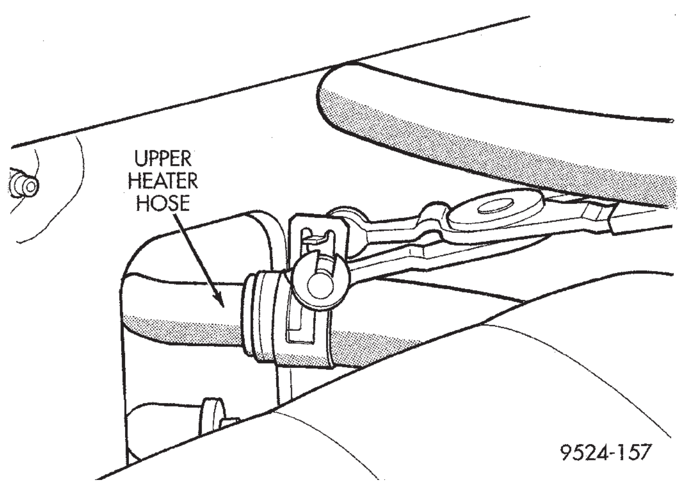


Fig. 54 Upper Heater Hose

REMOVAL AND INSTALLATION (Continued)

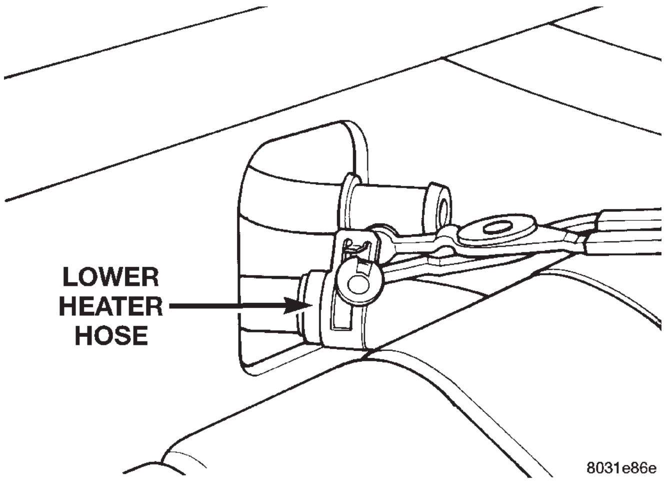


Fig. 55 Lower Heater Hose

CAUTION: When removing hoses from heater core inlet or outlet nipples, do not use excessive force. Heater core may become damaged and leak engine coolant.

(3) Carefully rotate hose back and forth while tugging slightly away from connector nipple. If the hose will not come off, slice the hose at the connector nipple and peel off heater hose. This method will require heater hose replacement.

INSTALLATION

For installation, reverse the above procedures.

LIQUID LINE

REMOVAL

(1) Disconnect the battery negative cable.
(2) Recover A/C system refrigerant.
(3) Remove the accessory drive belt.
(4) Remove upper generator bracket.
(5) Remove ground wire at dash panel.
(6) Remove the nut retaining the refrigerant line sealing plate to the expansion valve (Fig. 39).
(7) Remove the stud from the expansion valve (Fig. 40).
(8) Remove liquid line from expansion valve.
(9) Cover the openings to prevent contamination.
(10) Disconnect wire connector at pressure transducer.
(11) Remove liquid line mounting bracket at right frame rail.
(12) Using access slot between radiator crossmember and grille, loosen liquid line mounting plate at filter-drier. Remove liquid line from filter-drier. It may be necessary to bend liquid line in half to remove line. The replacement line is a two-piece assembly.
(13) Remove the old O-rings.

INSTALLATION

For installation, reverse the above procedures.

- Install the stud to the evaporator sealing plate and tighten 7 to 11 N·m (64 to 96 in. lbs.) torque.
- **Install new O-rings.**
- Install two-piece line in place of original part.
- Assemble line halves after it is installed on vehicle.
- Evacuate and recharge A/C system.

MODE DOOR ACTUATOR

REMOVAL

(1) Remove the lower left side steering column cover. Refer to Group 8E, Instrument Panel and Systems.
(2) Remove ABS control module (Fig. 56).

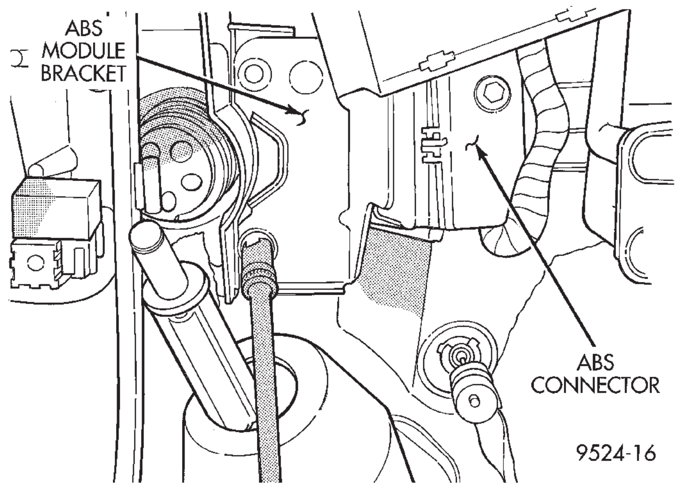


Fig. 56 ABS Control Module

(3) Remove mode actuator connector (Fig. 57).

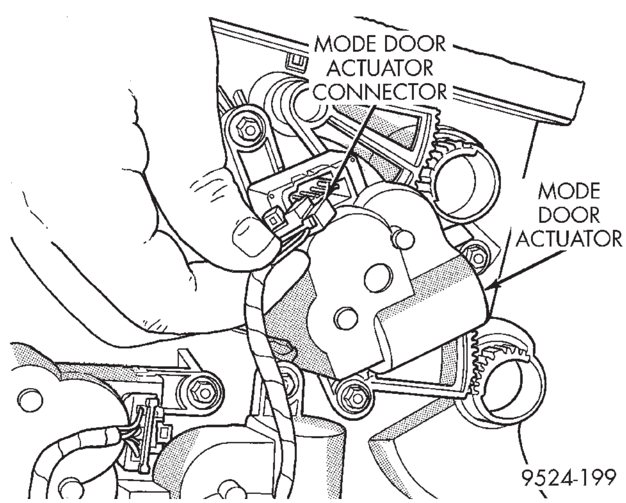


Fig. 57 Mode Door Actuator Connector

(4) Remove mode door actuator (Fig. 58).

INSTALLATION

(1) For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

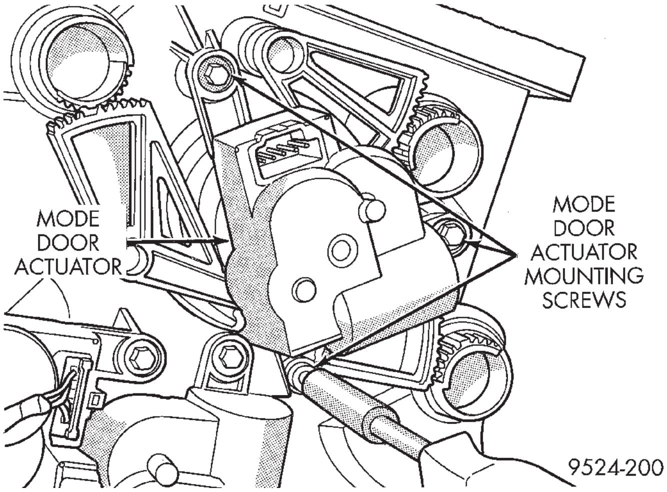


Fig. 58 Mode Door Actuator

(2) Perform the HVAC control Calibration Diagnostic and Cooldown test.

SIDE WINDOW DEMISTER DUCTS

LEFT SIDE

The LEFT side window demister duct is a two piece design. The left side has a long duct that attaches to an intermediate duct and then to the distribution housing. The duct is located on top of the instrument panel. To service the duct, remove the I/P cover and remove duct retainers/fasteners. (Fig. 59).

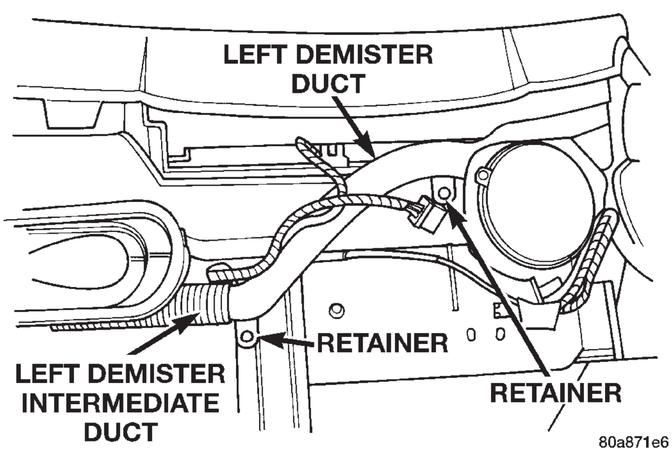


Fig. 59 Left Side Demister Duct

RIGHT SIDE

The demister duct on the right side is a one piece design. It is one long duct that attaches to the distribution housing. The duct is located on top of the instrument panel and it is not serviceable (Fig. 60).

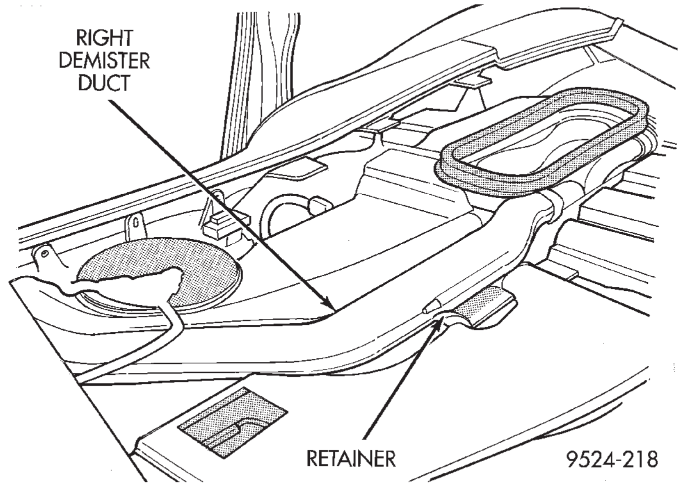


Fig. 60 Right Side Demister Duct

SUCTION LINE

REMOVAL

(1) Disconnect the battery negative cable.
(2) Recover A/C system refrigerant.
(3) Remove the accessory drive belt.
(4) Remove upper generator bracket.
(5) Remove ground wire at dash panel.
(6) Remove the nut retaining the refrigerant line sealing plate to the expansion valve (Fig. 39).
(7) Remove the stud from the expansion valve (Fig. 40).
(8) Remove suction line from expansion valve.
(9) Remove suction line mounting nut at compressor (Fig. 61).
(10) Remove suction line mounting bracket.
(11) Remove suction line.

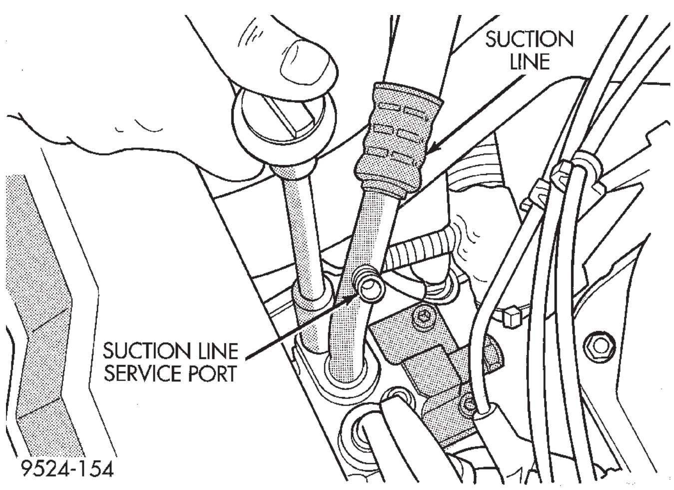


Fig. 61 Suction Line At Compressor

INSTALLATION

For installation, reverse the above procedures.

• Install the stud to the evaporator sealing plate and tighten 7 to 11 N·m (64 to 96 in. lbs.) torque.
• **Install new O-rings.**

REMOVAL AND INSTALLATION (Continued)

- Install two-piece line in place of original part.
- Assemble line halves after it is installed on vehicle.
- Evacuate and recharge A/C system.

RECIRC DOOR ACTUATOR

REMOVAL

(1) Pull back on carpeting on the right lower floor.

(2) Remove Recirc. door actuator connector.

(3) Remove (3) mounting screws for Recirc. actuator (Fig. 62).

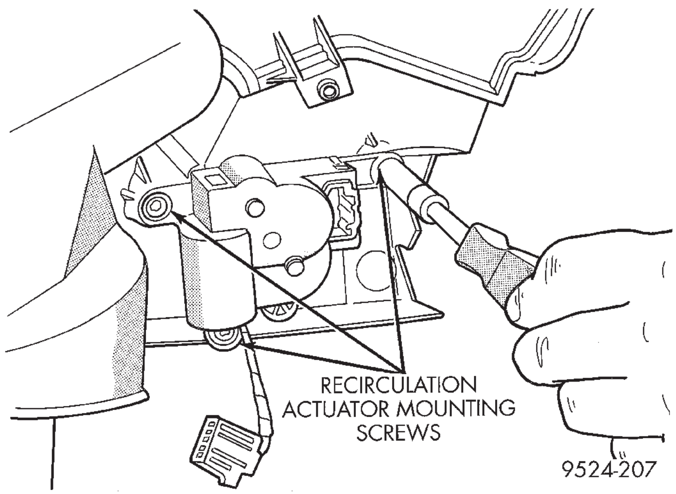


Fig. 62 Recirculation Door Actuator

(4) Remove Recirc. actuator.

(5) Disengage actuator linkage at Recirc. door.

(6) Remove actuator from vehicle.

INSTALLATION

(1) For installation, reverse the above procedures.

(2) Perform the HVAC control Calibration Diagnostic and Cooldown test.

DISASSEMBLY AND ASSEMBLY

HEATER A/C UNIT RECONDITION

Heater A/C Housing must be removed from vehicle before performing this operation. Refer to Heater A/C Unit Housing—Removal and Installation.

DISASSEMBLY—EVAPORATOR HOUSING

(1) Place HVAC unit assembly on workbench.

(2) Remove distribution housing mounting screws (Fig. 63).

(3) Remove blower motor cover (Fig. 64).

(4) Remove blower motor wiring grommet and feed wiring through blower housing (Fig. 65).

(5) Remove blower motor screws. Remove blower motor from housing (Fig. 66) and (Fig. 67).

(6) Remove recirculation door cover (Fig. 68).

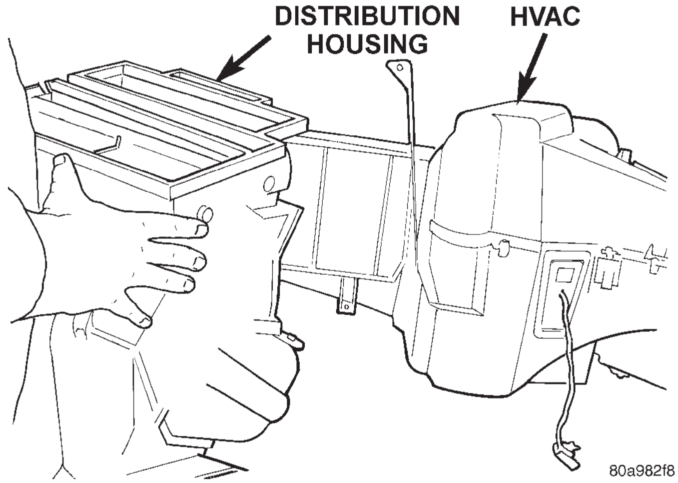


Fig. 63 Distribution Housing

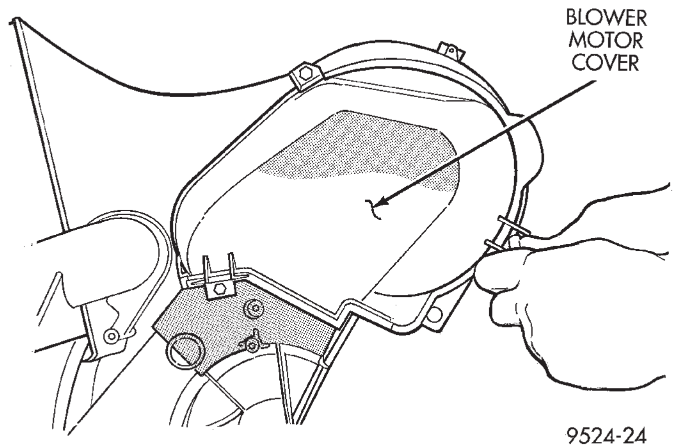


Fig. 64 Blower Motor Cover

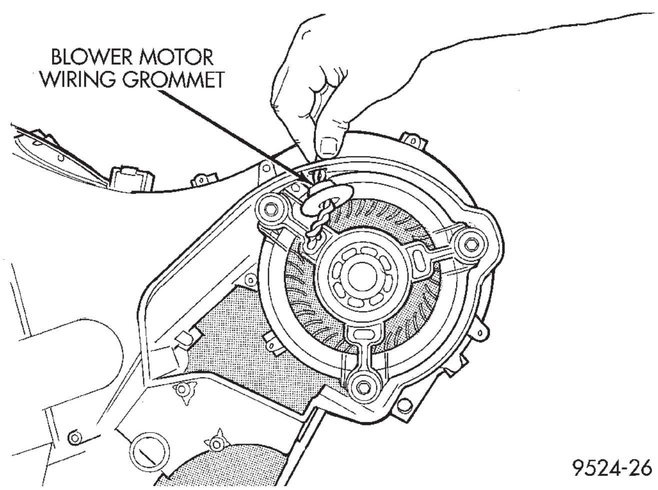


Fig. 65 Blower Motor Grommet

(7) Remove Recirc. door (Fig. 69).

(8) Remove screws around the perimeter of the upper HVAC housing (Fig. 70).

DISASSEMBLY AND ASSEMBLY (Continued)

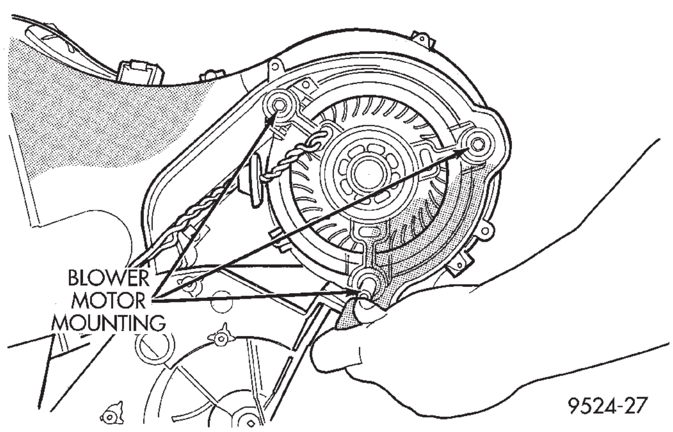


Fig. 66 Blower Motor Screws

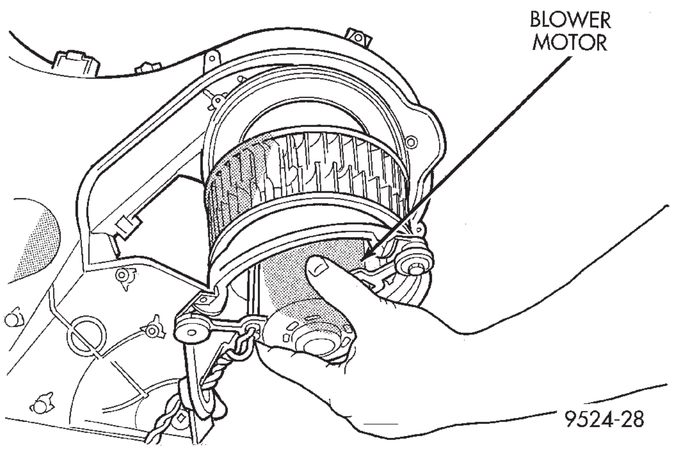


Fig. 67 Blower Motor

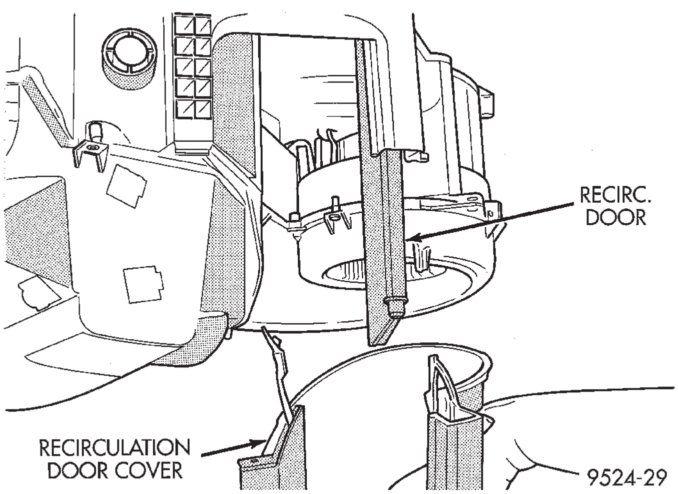


Fig. 68 Recirculation Door Cover

CAUTION: Do not damage the insulation barrier surrounding the evaporator.

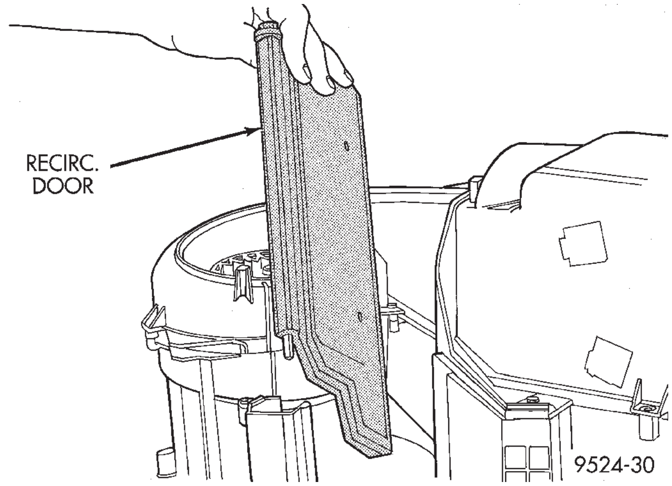


Fig. 69 Recirc. Door

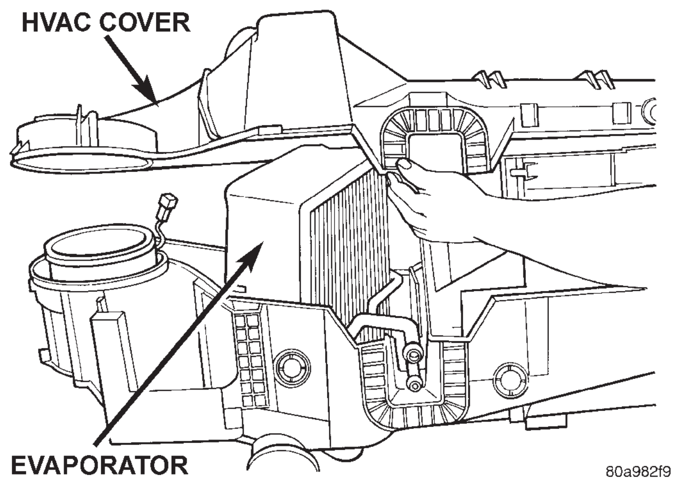


Fig. 70 HVAC Cover

(9) Carefully pull up on evaporator and remove from housing (Fig. 71).

(10) If replacing evaporator, drain and measure amount of oil from old evaporator and add new oil of the same amount (ND8 PAG) to the new evaporator before installing. Use SP 10 PAG oil for 2.5L diesel and 2.0L gasoline engine vehicles.

ASSEMBLY—EVAPORATOR HOUSING

(1) For reassembly of the evaporator housing, reverse the above procedures.

(2) Perform the HVAC control Calibration Diagnostic and Cooldown test.

DISASSEMBLY—DISTRIBUTION HOUSING

(1) Place distribution housing on workbench (Fig. 72).

(2) Remove heater core cover (Fig. 73).

(3) Remove heater core tube plate (Fig. 74) and (Fig. 75).

(4) Remove heater core tubes (Fig. 76).

DISASSEMBLY AND ASSEMBLY (Continued)

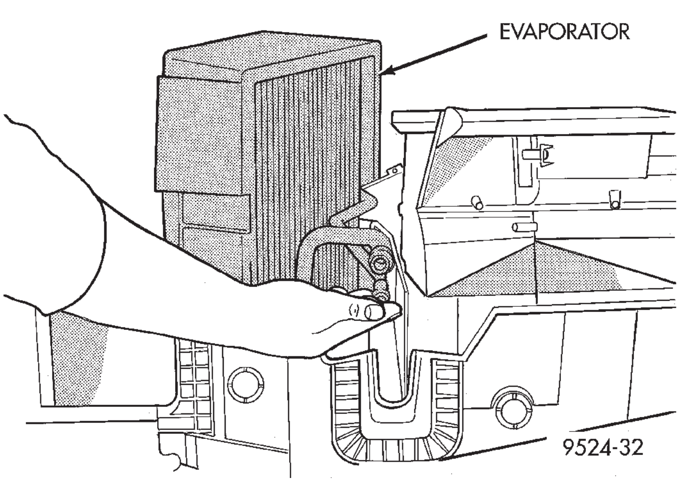


Fig. 71 Evaporator

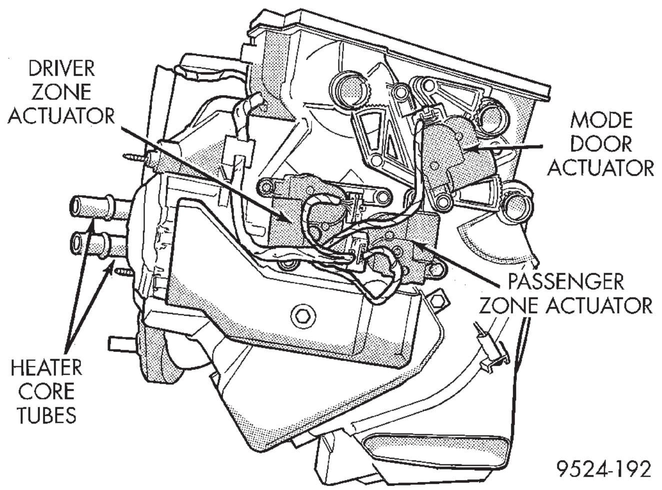


Fig. 72 Distribution Housing

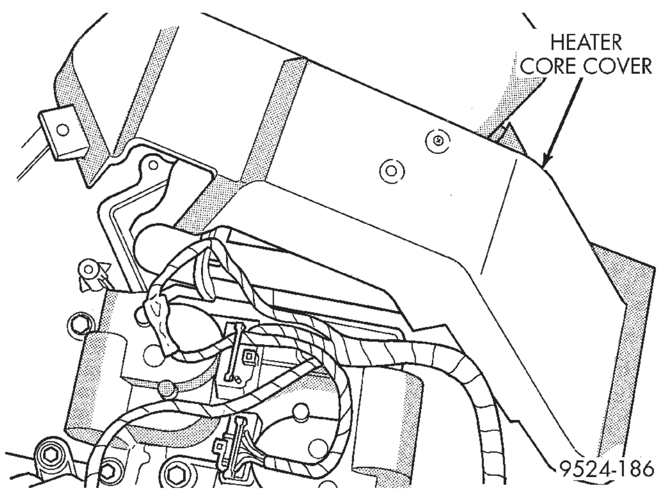


Fig. 73 Heater Core Cover

(5) Depress heater core retaining clips at housing. When reinstalling core use screws to fasten the heater core to the housing.

(6) Slide heater core out of the housing.

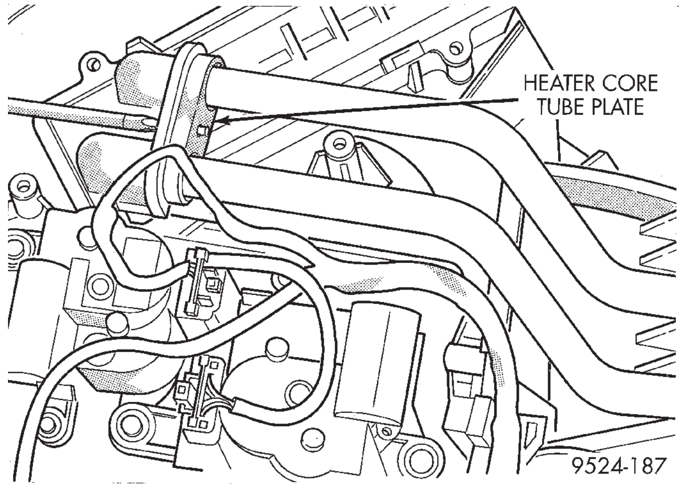


Fig. 74 Heater Core Tube Plate

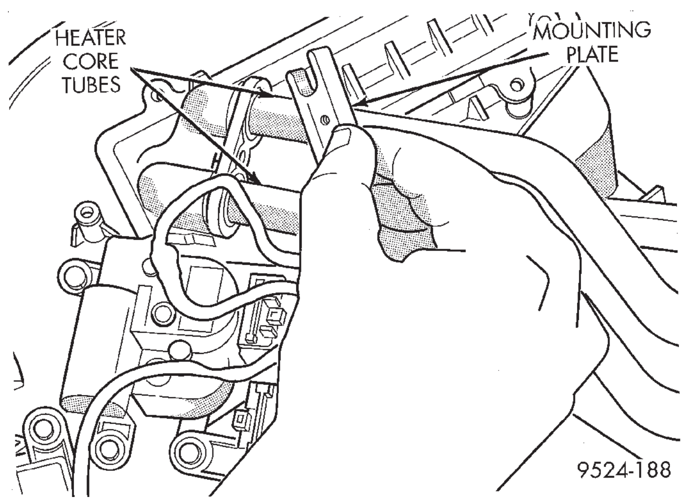


Fig. 75 Plate Removal

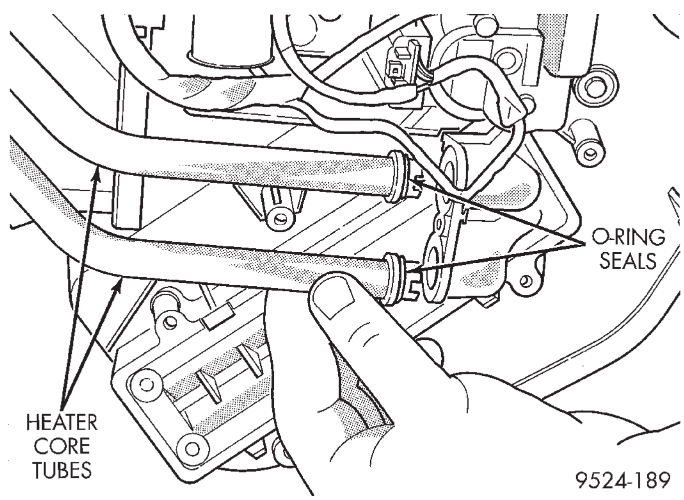


Fig. 76 Heater Core Tube Removal

(7) Remove driver's zone actuator from distribution housing (Fig. 77).

(8) Remove passenger zone actuator from distribution housing (Fig. 78).

DISASSEMBLY AND ASSEMBLY (Continued)

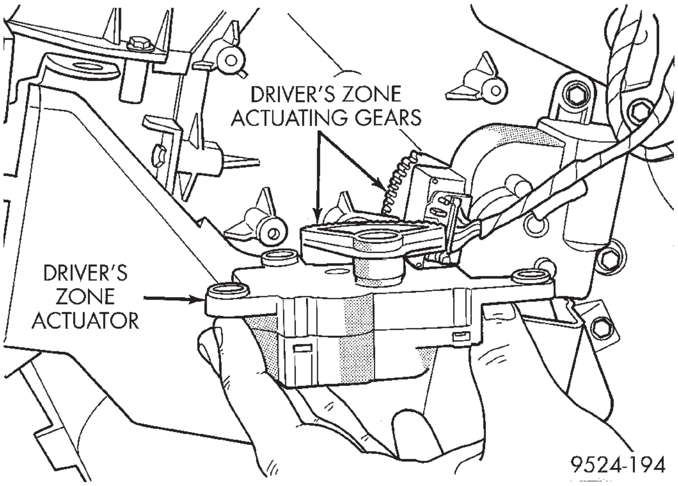


Fig. 77 Driver's Zone Actuator

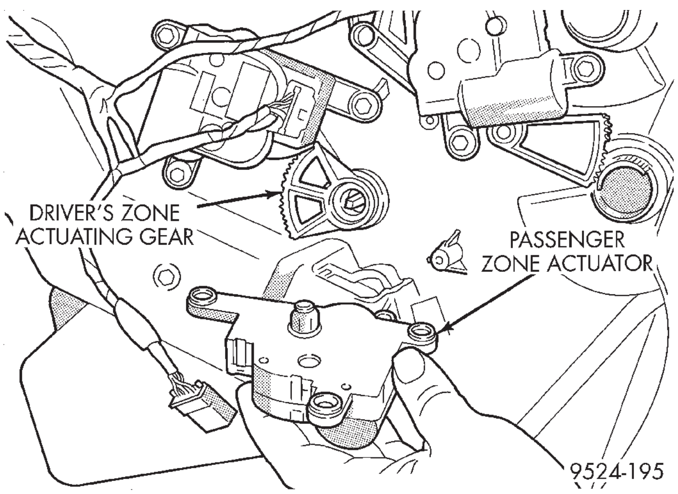


Fig. 78 Passenger Zone Actuator

(9) Using a long thin flat blade tool, insert tool through blend-air opening on top of distribution housing (Fig. 79). Depress clip retaining the driver's blend-air door drive gear. Pull out on gear and remove from the housing (Fig. 80).

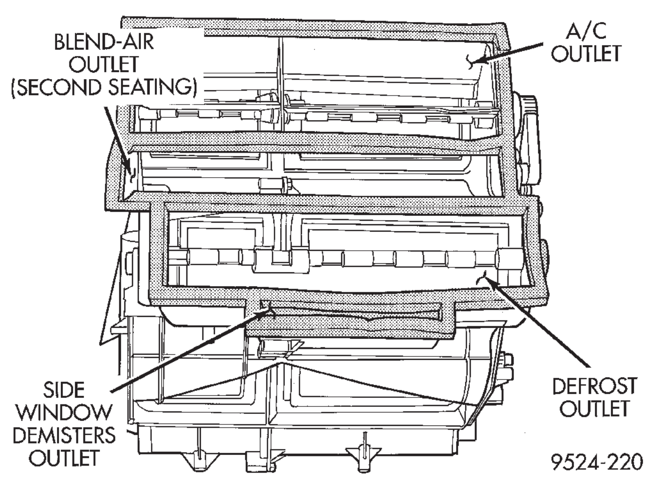


Fig. 79 Distribution Housing

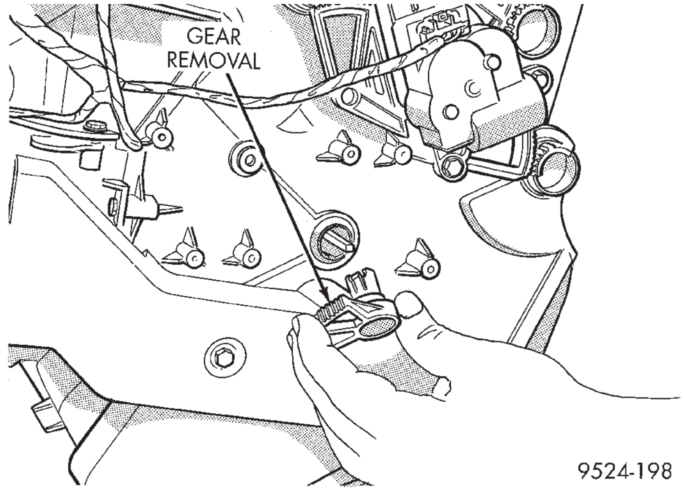


Fig. 80 Blend-Air Door Drive Gear

(10) Remove mode door motor.

(11) Remove Panel door actuator gear (Fig. 81).

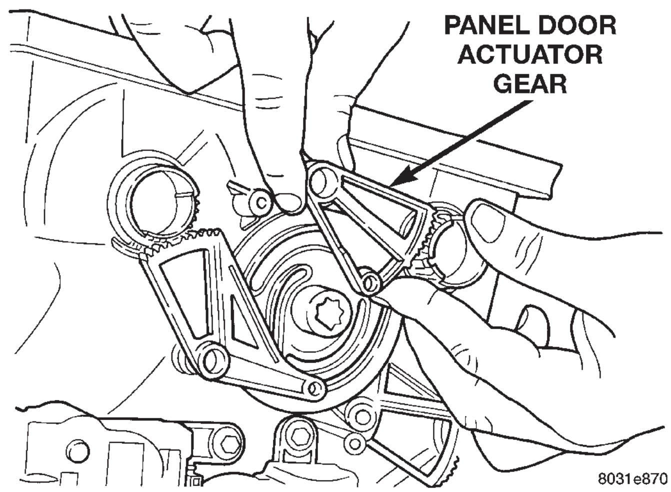


Fig. 81 Panel Door Gear

(12) Remove defrost door actuator gear (Fig. 82).

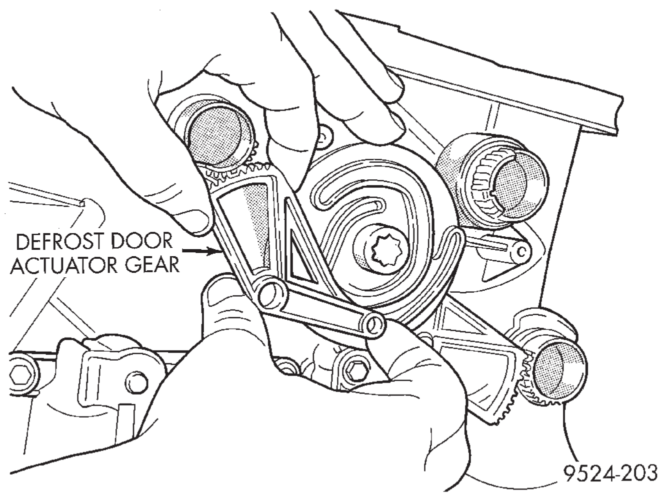


Fig. 82 Defrost Door Gear

DISASSEMBLY AND ASSEMBLY (Continued)

(13) Remove cam wheel (Fig. 83).

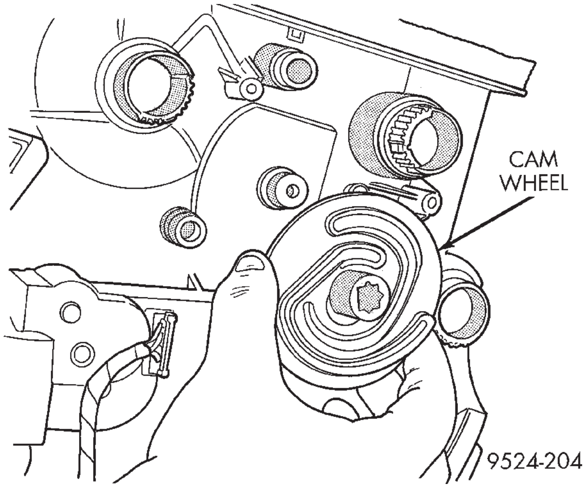


Fig. 83 Cam Wheel

(14) Remove heat door actuator gear (Fig. 84).

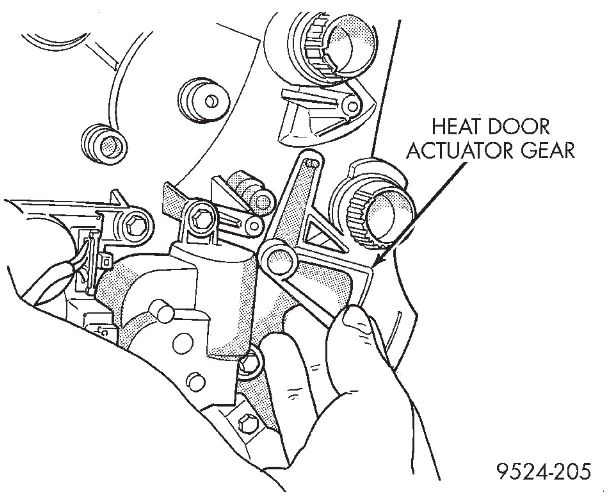


Fig. 84 Heat Door Gear

(15) Remove distribution housing lower cover screws (Fig. 85).

(16) Remove distribution housing half screws (Fig. 86).

(17) Remove distribution housing front cover (Fig. 87) and (Fig. 88).

(18) Remove weather-strip at fresh-air vent.

(19) Separate housing halves (Fig. 89).

(20) Pull up on separator plate and remove defrost door (Fig. 90).

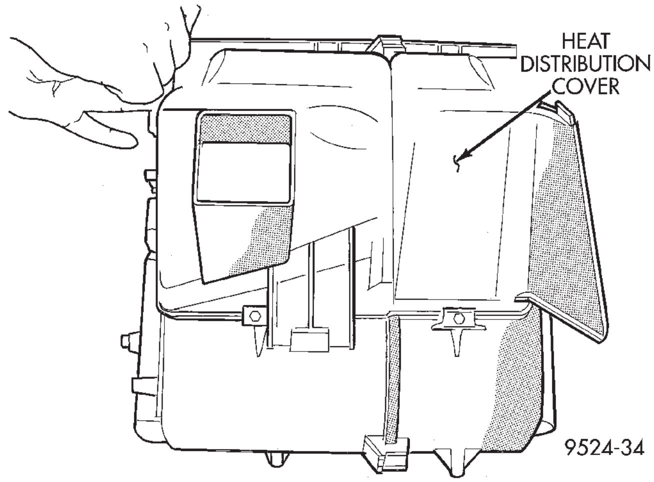


Fig. 85 Distribution Housing

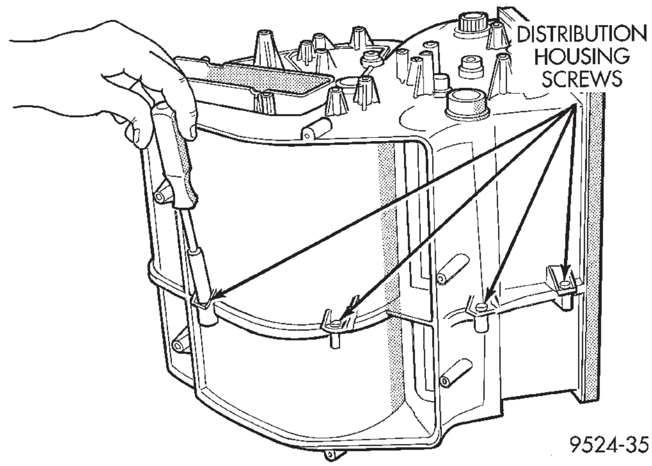


Fig. 86 Distribution Housing Half Screws

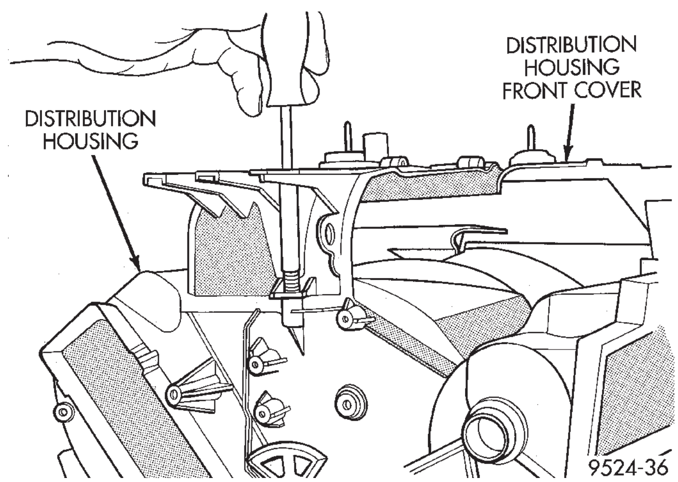


Fig. 87 Front Cover

DISASSEMBLY AND ASSEMBLY (Continued)

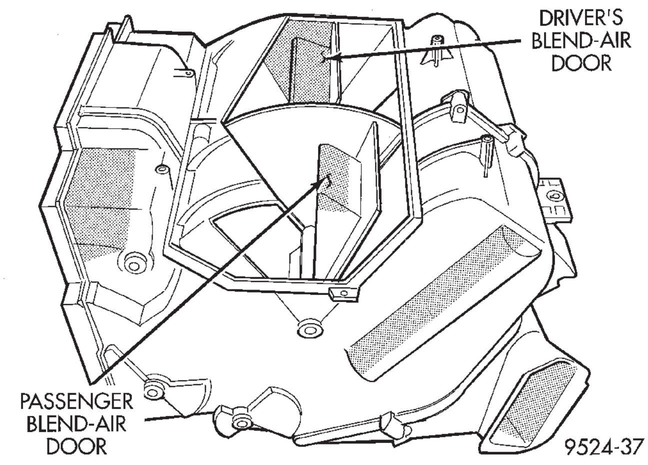


Fig. 88 View of Zone Control Doors

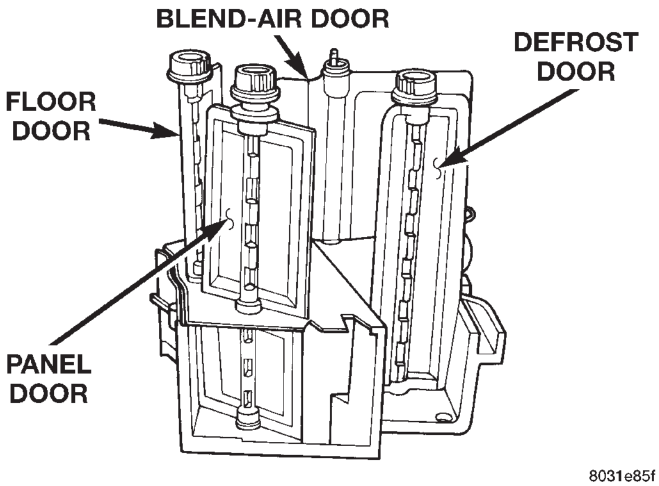


Fig. 89 Distribution Housing Halves

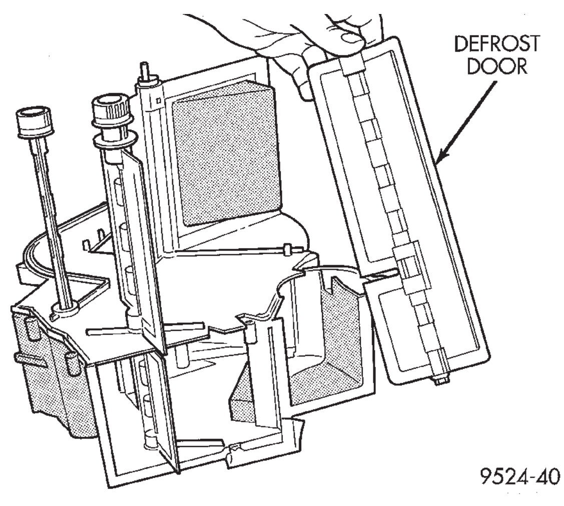


Fig. 90 Defrost Door

(21) Remove upper half Panel door (Fig. 91).

(22) Remove upper half of Floor door (Fig. 92).

(23) Remove upper half of the blend-air door (slide off of shaft) (Fig. 93).

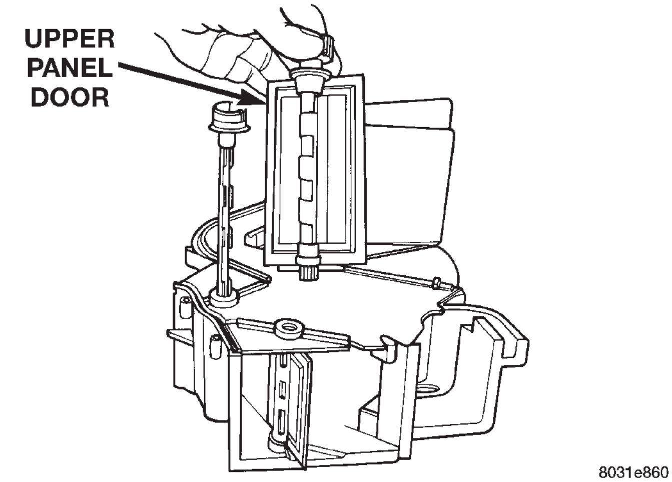


Fig. 91 Panel Door

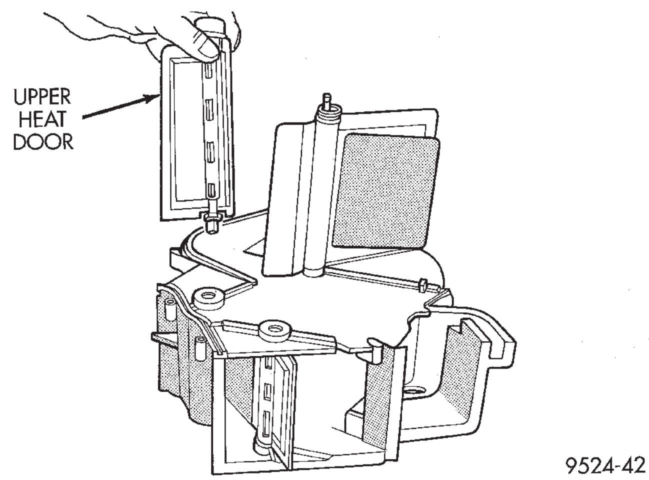


Fig. 92 Floor Door

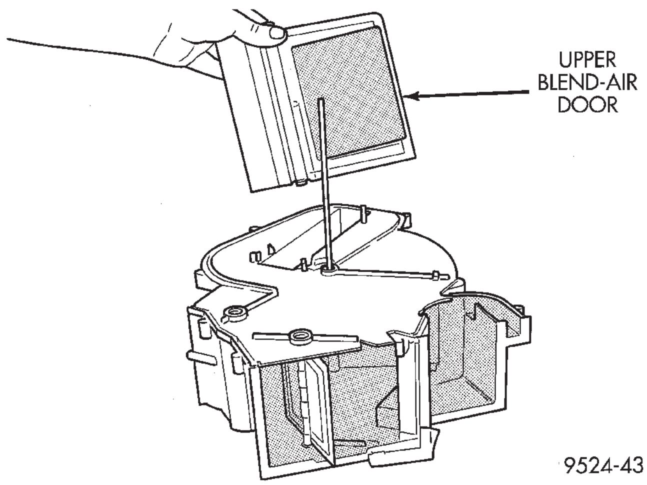


Fig. 93 Blend-Air Door

(24) Remove separator plate from distribution housing (Fig. 94).

(25) Remove lower half of the blend-air door (Fig. 95).

(26) Remove lower half of the Panel door (Fig. 96).

DISASSEMBLY AND ASSEMBLY (Continued)

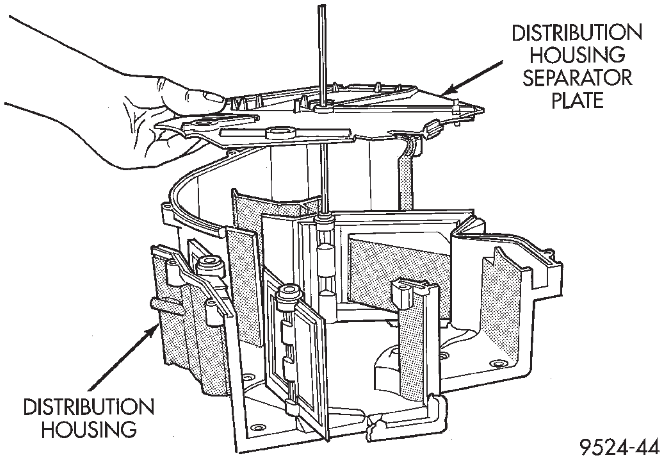


Fig. 94 Separator Plate

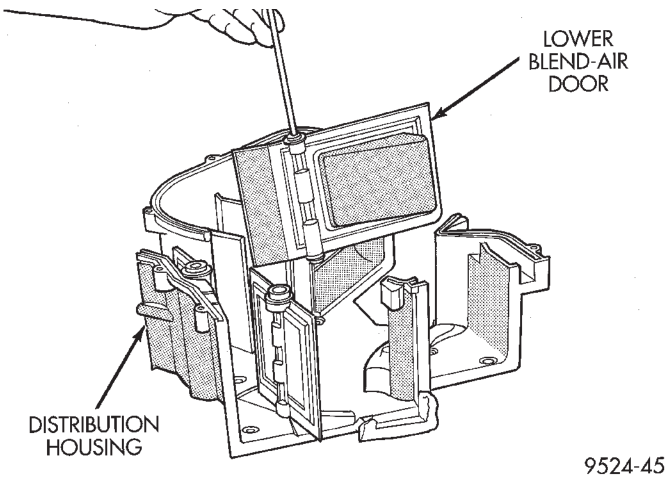


Fig. 95 Lower Blend-Air Door

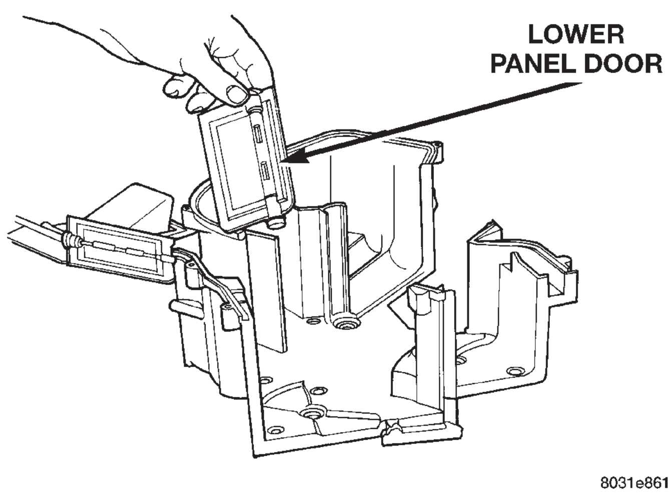


Fig. 96 Lower Panel Door

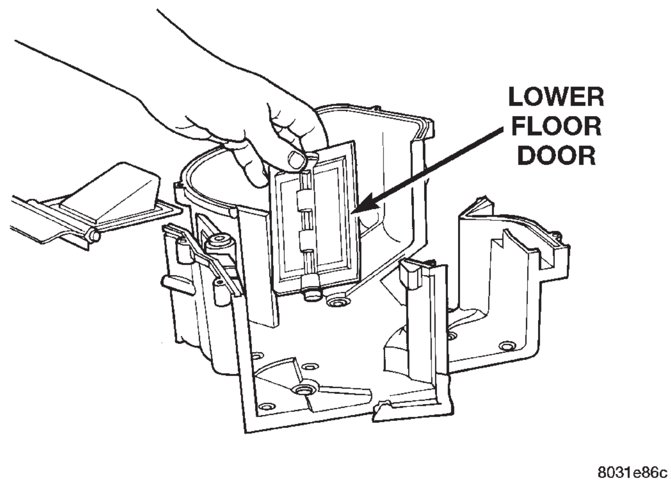


Fig. 97 Lower Floor Door

(27) Remove lower half of the Floor door (Fig. 97).

ASSEMBLY—DISTRIBUTION HOUSING

For reassembly of the distribution housing, reverse the above procedures.

To reassemble the distribution housing actuator gears an assembly procedure of the gears and cam is necessary.

ACTUATOR GEARS ALIGNMENT PROCEDURE

(1) Install lower FLOOR door actuator gear to housing. Match master spline of FLOOR door actuator gear to master spline on door.

(2) Install cam wheel. Align cam wheel track to FLOOR door actuator gear.

(3) Align cam wheel slot with the post on the distribution housing marked “1”.

(4) Install PANEL door actuator gear. Align master spline of PANEL door actuator gear to master spline on PANEL door. Position actuator gear within cam wheel track.

(5) Install DEFROST door actuator gear to housing. Match master spline of DEFROST door actuator to master spline on DEFROST door. Position actuator gear within cam wheel track.

(6) Reinstall housing in vehicle.

(7) Perform the HVAC control Calibration Diagnostic and Cooldown test.

REAR HEATING AND AIR CONDITIONING SYSTEM

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GENERAL INFORMATION

INTRODUCTION

For proper operation of the rear heating A/C system, refer to Owner's Manual supplied with the vehicle.

DESCRIPTION AND OPERATION

REAR BLOWER RESISTOR BLOCK

The rear blower motor resistor is not serviceable separately. The resistor is integral to the blower motor. If resistor is faulty, it is necessary to replace the complete blower motor.

REAR HEATER AND A/C LINES

The rear heater and A/C lines are all serviced as individual pieces. When disconnecting any line or block ensure that the area around it is clean of any contaminations that can get in to the system (Fig. 1), (Fig. 2), (Fig. 4), (Fig. 3) and (Fig. 5).

SYSTEM OPERATION

The auxiliary rear heating-air/conditioning unit is located in the right rear quarter panel. The rear heater A/C control operates in conjunction with the front heater A/C control. A four position two speed blower (override) switch is located on the front Heater A/C control panel (Fig. 6). The operator can use the rear heater A/C blower switch to operate the blower, regardless of the rear control setting. In the OFF position, the rear control will not function. In the ON (RR) position, the rear control will function normally providing three speeds (Fig. 7). The mode setting is controlled by the front A/C control panel.

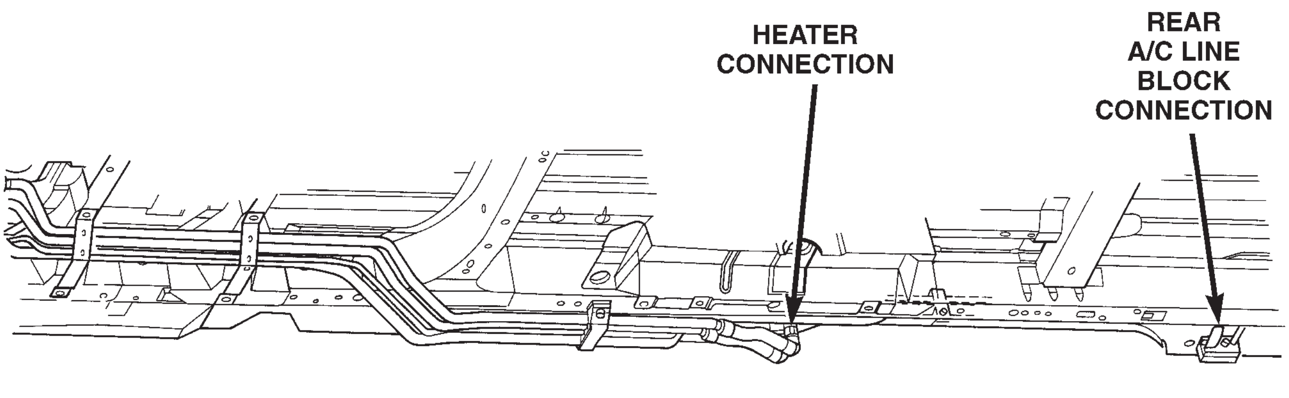

Fig. 1 Rear Heater and A/C Lines

DESCRIPTION AND OPERATION (Continued)

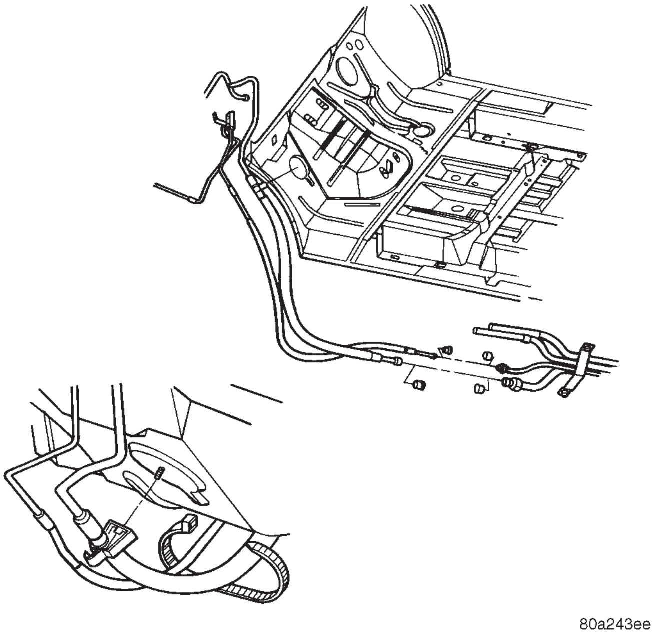

Fig. 2 Front Lines Connected to Rear Lines

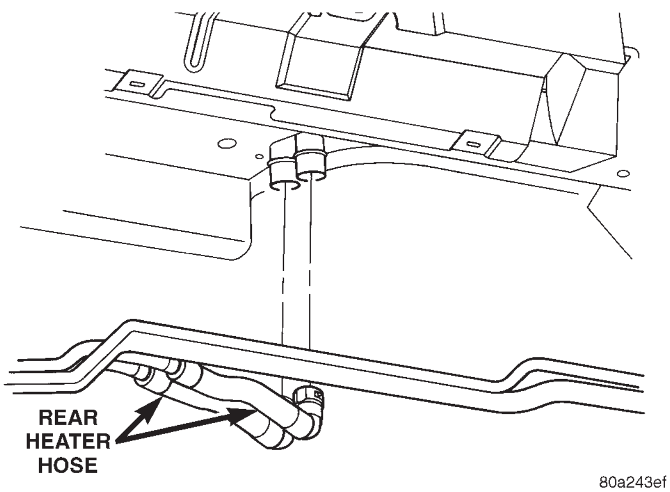

Fig. 3 Rear Heater Hose Connection

Air from inside the vehicle is drawn into the air intake grille in the right rear quarter trim panel. The air enters the blower and is pushed through the heater core and A/C evaporator coil. The air direction, floor or overhead, is determined by the position of the driver's temperature control lever on the front HVAC system control. If the temperature control lever is below 20% heat, the auxiliary HVAC system airflow will come from the overhead air outlets. In between 20% and 80%, the airflow will remain in the last position selected. In other words, if the driver started out in full heat and then adjusted their temperature lever to 30% heat as they became comfortable, the rear air would come out the floor outlets the whole time.

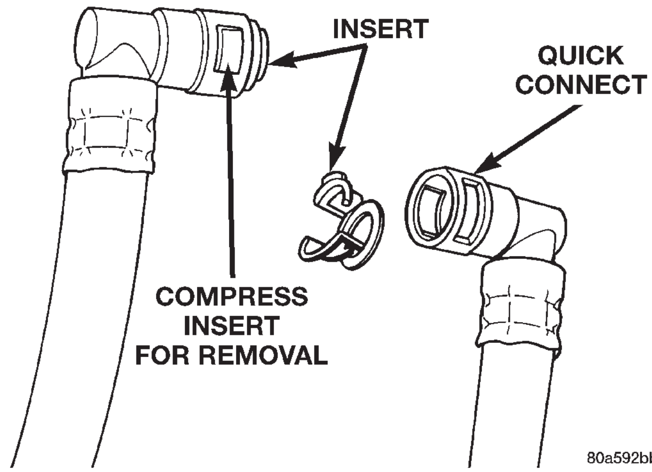

Fig. 4 Rear heater hose quick connects

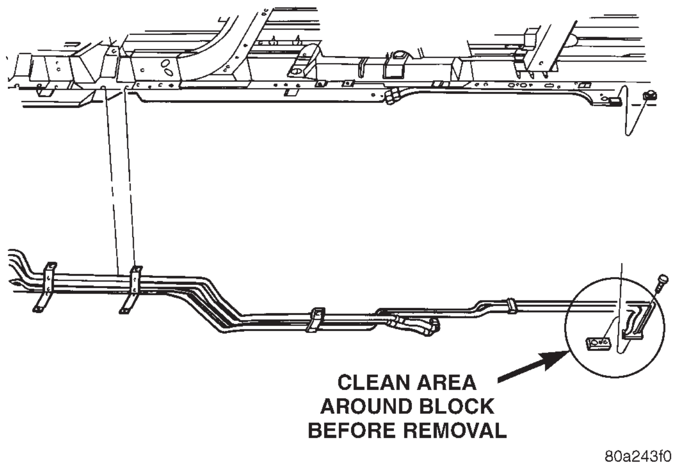

Fig. 5 Rear A/C Block Connection

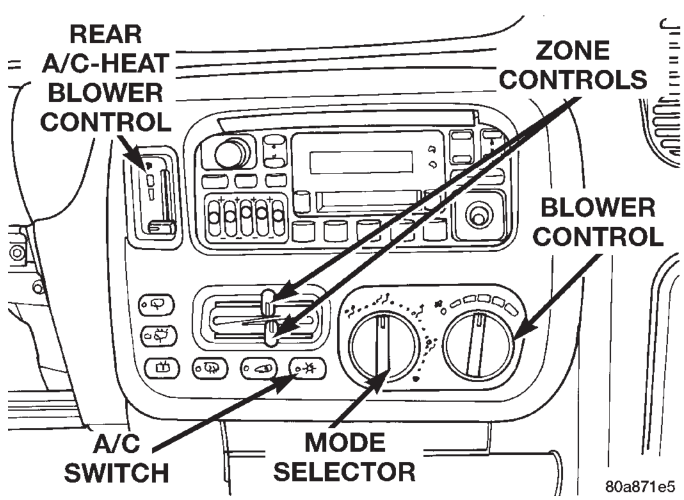

Fig. 6 A/C Control Panel

DESCRIPTION AND OPERATION (Continued)

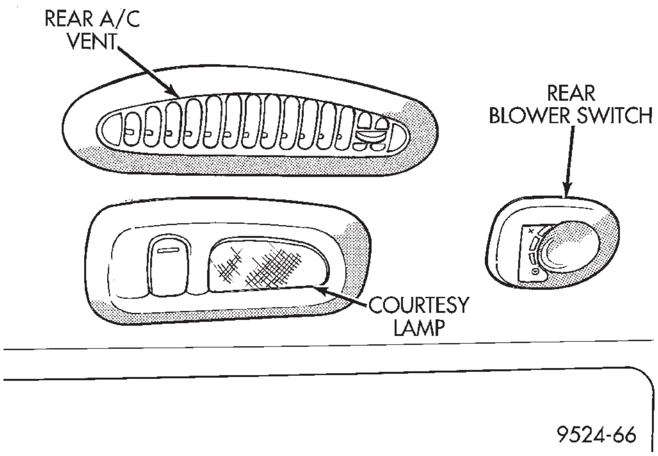

Fig. 7 Rear Blower Switch

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

When diagnosing electrical problems in the auxiliary rear heater or rear A/C system, refer to Group 8W, Wiring Diagrams.

When diagnosing problems in the auxiliary systems, refer to diagnostic sections for front heater A/C.

REMOVAL AND INSTALLATION

AIR DISTRIBUTION DUCT-A/C

REMOVAL

(1) Remove quarter trim panel, D-pillar, and headliner (Fig. 8). Refer to Group 23, Body.

(2) Remove screws securing D-pillar duct to quarter panel. Pull duct up and away from unit.

(3) Remove screws securing duct to rear header (Fig. 9).

(4) Remove screws securing duct to right and left rails (Fig. 10).

INSTALLATION

For installation, reverse the above procedures.

AIR DISTRIBUTION DUCT-HEATER

REMOVAL

(1) Remove quarter trim panel and D-pillar (Fig. 8) and (Fig. 11). Refer to Group 23, Body.

(2) Remove screws securing lower heat duct to housing.

INSTALLATION

For installation, reverse the above procedures.

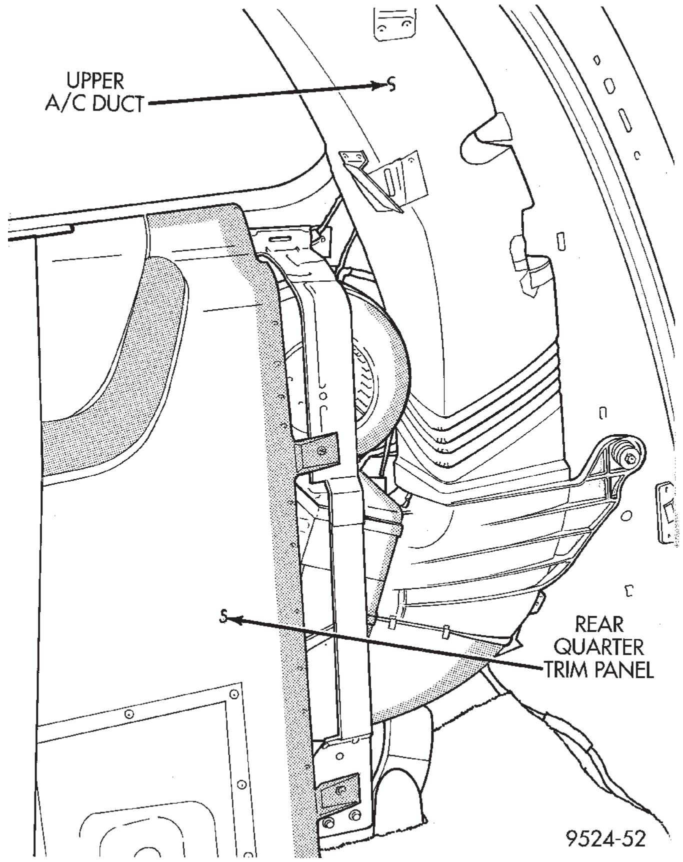

Fig. 8 Quarter Trim Panel

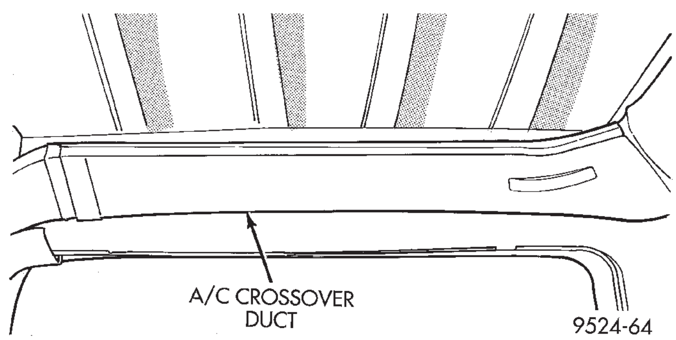

Fig. 9 Rear Crossover Duct

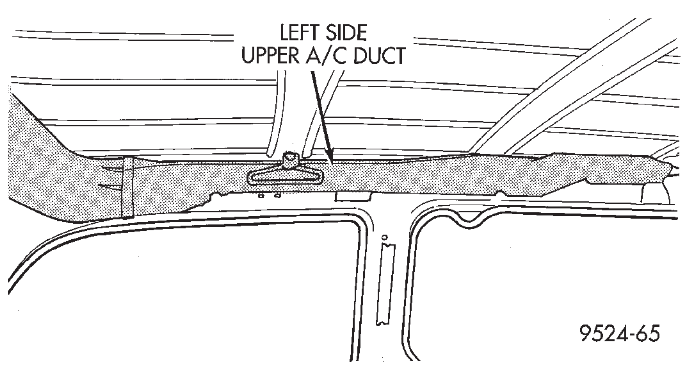

Fig. 10 Upper A/C Duct

REMOVAL AND INSTALLATION (Continued)

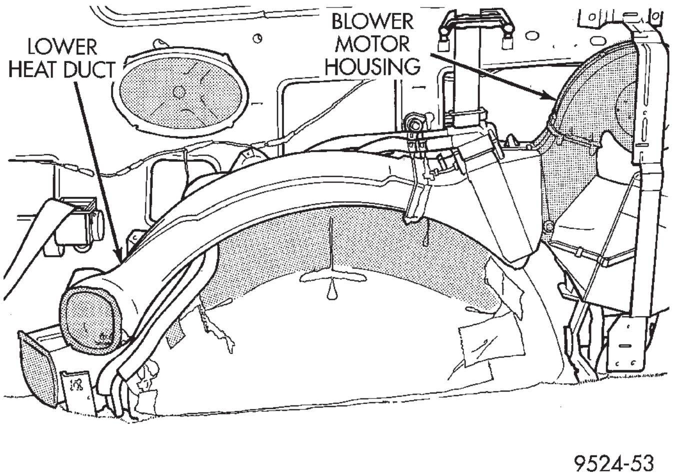

Fig. 11 Rear Heat-A/C Unit

EVAPORATOR AND EXPANSION VALVE

NOTE: 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.

REMOVAL

WARNING: THE REFRIGERANT SYSTEM MUST BE EMPTY BEFORE PERFORMING THE FOLLOWING OPERATION. THE ENGINE COOLING SYSTEM MUST ALSO BE RELIEVED OF ALL PRESSURE.

(1) Remove right quarter trim panel and D-pillar trim. Refer to Group 23, Body.

(2) Remove fan A/C distribution duct.

(3) Remove rear A/C unit.

(4) Remove blower scroll.

(5) Remove evaporator cover (Fig. 12).

(6) Remove the nut that mounts the refrigerant plumbing block to the expansion valve (Fig. 13).

(7) Carefully pull the evaporator and expansion valve straight out of unit (Fig. 14). Do not scratch the sealing surfaces with the plumbing extension tube pilots.

(8) Remove and discard the O-rings between the plumbing extension and the expansion valve.

(9) Cover the plumbing extension sealing surface to prevent contamination.

(10) Bring evaporator and expansion valve to a clean work space.

(11) Remove two 1/4-20 Torx Head screws.

(12) Remove expansion valve.

(13) Measure and record the amount of residual oil from the removed evaporator.

INSTALLATION

(1) Replace the O-rings.

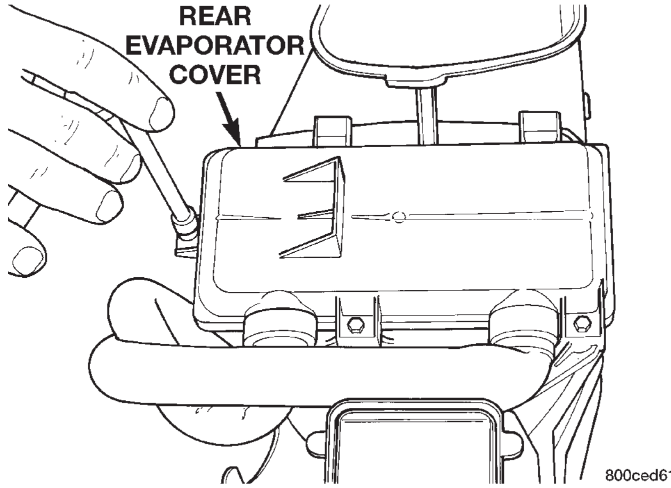

Fig. 12 Evaporator Cover

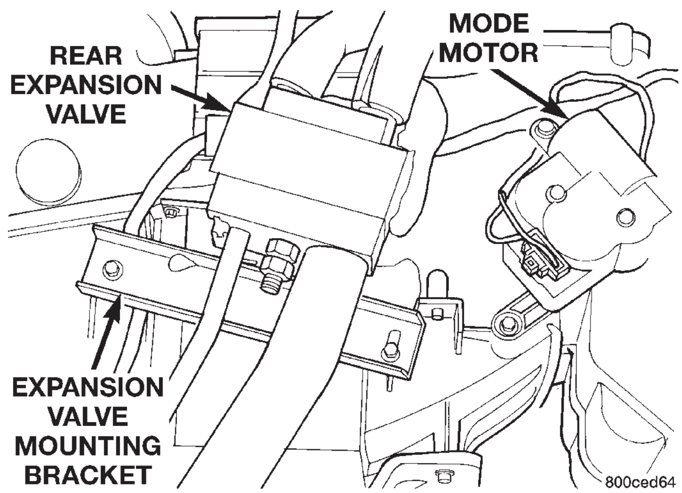

Fig. 13 Expansion Valve

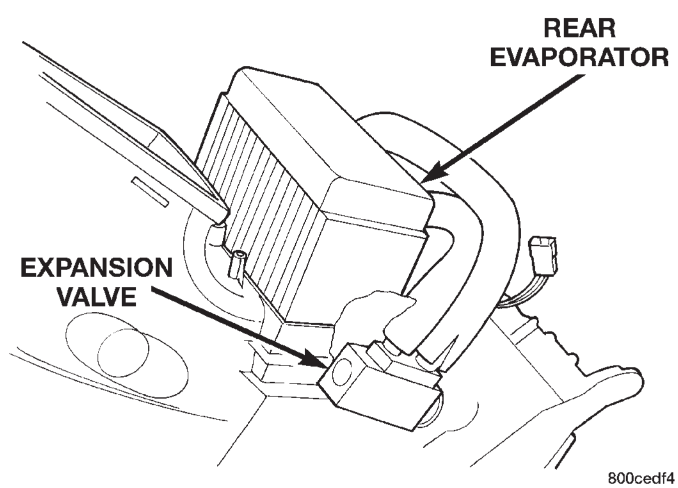

Fig. 14 Evaporator Removal

(2) Hold expansion valve against evaporator sealing plate (do not scratch the sealing surface). Install two screws and tighten to 11 ± 3 N·m (100 ± 30 inch pounds) torque.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Do not damage the evaporator insulation liner during installation.

(3) Carefully install the evaporator and expansion valve straight into the unit. Do not scratch the sealing surfaces with the plumbing extension tube pilots.
(4) Determine the amount of old refrigerant oil drained from the evaporator. Add this amount (of clean refrigerant oil) back into the system.
(5) Carefully align the expansion valve onto the pilot tubes of the plumbing extension (do not scratch the sealing surface). Install the bolt through the plumbing plate into the unit sealing plate. Tighten bolts to 23 ± 3 N·m (200 ± 30 inch pounds) torque.
(6) Install evaporator cover and blower scroll.
(7) Install quarter trim panel, evacuate/charge system, and perform the performance test.

REAR AIR CONDITIONING LINES

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

REMOVAL
(1) Hoist vehicle
(2) Remove compression fittings to the suction and liquid lines located on the right, outboard side of the underbody, rearward of the front crossmember. (Fig. 2)
(3) remove (1) bolt securing a/c lines to block located on the right, outboard side of the underbody, rearward of the rear wheel and tire. (Fig. 5)
(4) Remove (3) straps securing underbody lines. (Fig. 1)
(5) Separate and remove a/c lines from vehicle.

INSTALLATION
(1) Before installation, replace all O-rings and gaskets. Coat all sealing surfaces with approved wax-free refrigerant oil. Then, reverse the above procedures.
(2) Evacuate and recharge system.

REAR HEATER A/C AIR OUTLETS

REMOVAL
Separate barrel from bezel by pulling outward.

INSTALLATION
For installation, push the outlet firmly into the opening until it locks into place.

REAR HEATER-A/C AUXILIARY CONDENSER

If vehicle is equipped with a 3.3L or 3.8L engine with rear heater and air conditioning, it will be equipped with an auxiliary condenser. The auxiliary condenser is mounted on the primary condenser in front of the radiator. Both condenser must be removed as an assembly and then separated.

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

NOTE: 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.

The condenser assembly must first be removed from vehicle. Refer to CONDENSER ASSEMBLY removal and installation in this section for service procedures.

REMOVAL
(1) After condenser assembly removal, place on bench for disassembly.
(2) Remove (1) bolt to liquid line on auxiliary condenser.
(3) Remove (4) attaching bolts and separate auxiliary from primary condenser. (Fig. 15)

INSTALLATION
(1) Before installation, replace all O-rings and gaskets. Coat all sealing surfaces with approved wax-free refrigerant oil. Then, reverse the above procedures.
(2) Evacuate and recharge system.

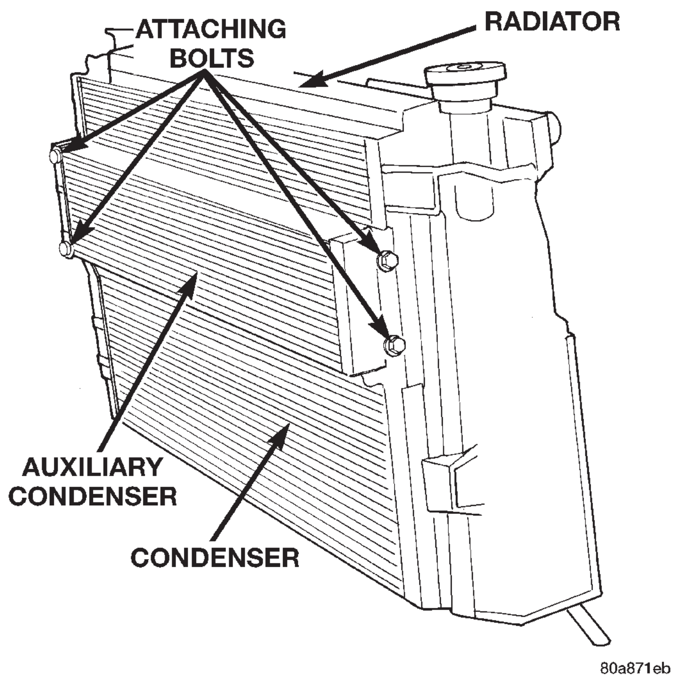

Fig. 15 3.3L/3.8L REAR HEAT-A/C AUXILIARY CONDENSER

REMOVAL AND INSTALLATION (Continued)

REAR HEATER A/C BLOWER MOTOR

REMOVAL

(1) Remove the right quarter trim panel and D-pillar trim. Refer to Group 23, Body for service procedures.

(2) Remove (5) screws securing the blower motor housing to the rear of the HVAC housing (one screw located on evaporator cover) (Fig. 16).

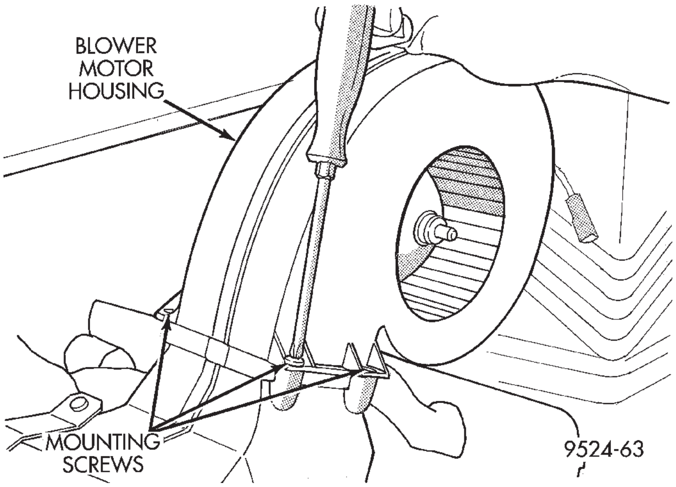

Fig. 16 Blower Motor

(3) Twist motor out of scroll housing.

(4) Disconnect blower motor wiring connector.

INSTALLATION

For installation, reverse the above procedures.

REAR HEATER-A/C CONTROL ILLUMINATION BULB

REMOVAL

(1) Remove rear heater-A/C control from trim panel.

(2) On the back of control opposite from the wire connectors, locate the bulb socket lug.

(3) Rotate the socket counterclockwise and pull the socket from the control.

INSTALLATION

For installation, reverse the above procedures. Refer to Group 8L, Lamps for bulb usage.

REAR HEATER A/C UNIT

NOTE: 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.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH REAR A/C, THE REFRIGERANT SYSTEM MUST BE EMPTIED BEFORE PERFORMING THE FOLLOWING OPERATION. THE ENGINE COOLING SYSTEM MUST ALSO BE RELIEVED OF ALL PRESSURE.

(1) Using a refrigerant recovery machine, remove refrigerant from the A/C system. Disconnect A/C plumbing from rear heater A/C unit.

(2) Hoist vehicle.

(3) Remove A/C lines at lower floor pan flange (Fig. 17).

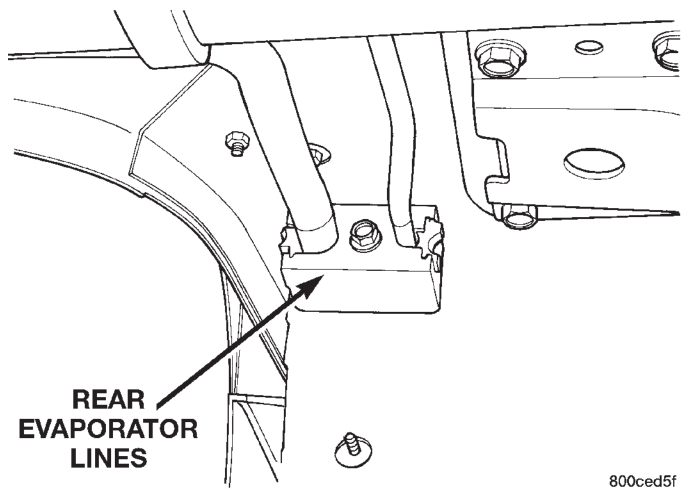

Fig. 17 A/C Lines

(4) Remove (3) A/C unit floor mounting nuts (Fig. 18).

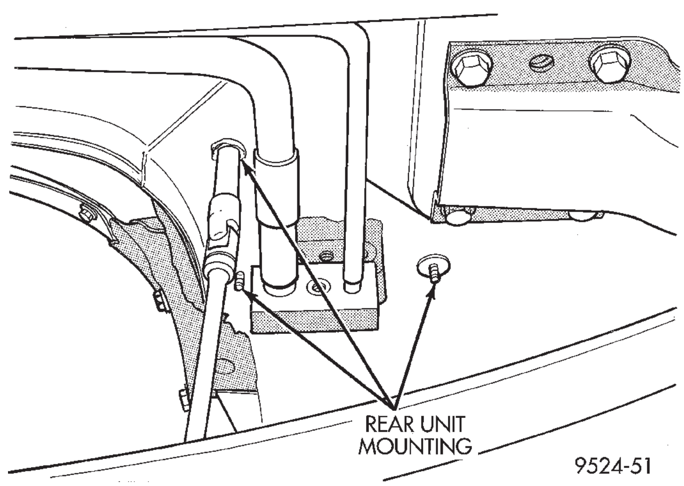

Fig. 18 A/C Mounting

(5) Lower vehicle.

(6) Remove right quarter trim panel and D-pillar trim (Fig. 8). Refer to Group 23, Body.

(7) Remove screws securing air distribution duct to the rear wheel housing (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

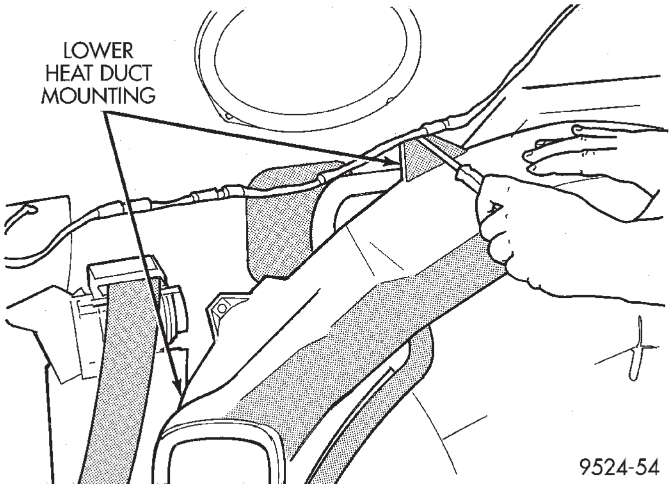

Fig. 19 Lower Heater Duct

(8) Pinch off heater lines at heater core hookup (Fig. 20).

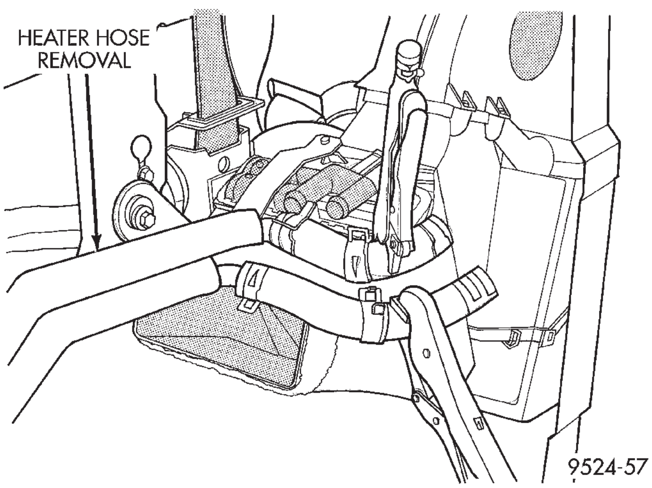

Fig. 20 Heater Core Lines

(9) Remove heater hoses at heater core (Fig. 21).

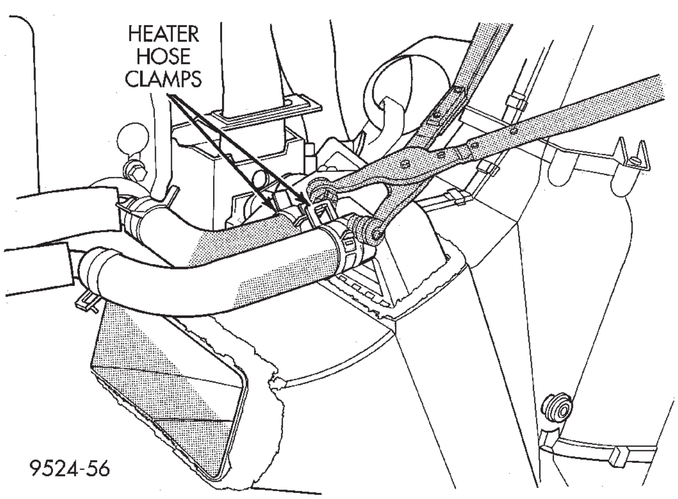

Fig. 21 Heater Hoses

(10) Remove quarter trim panel mounting bracket (Fig. 22).

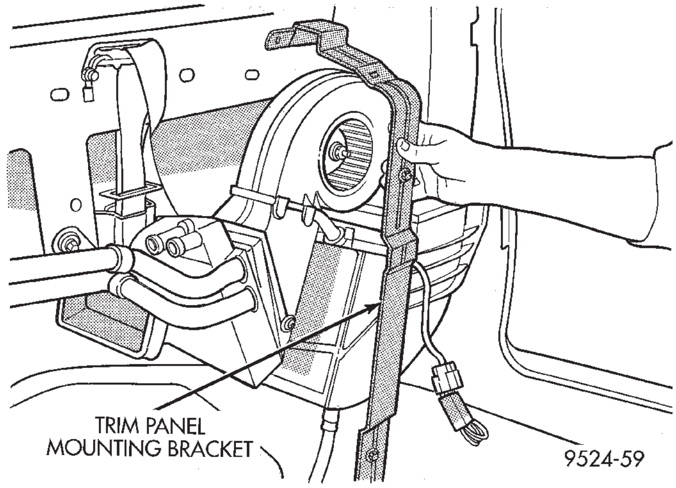

Fig. 22 Trim Panel Mounting Bracket

(11) Remove blower motor wiring harness connector.

(12) Remove rear upper duct trim screw (Fig. 23).

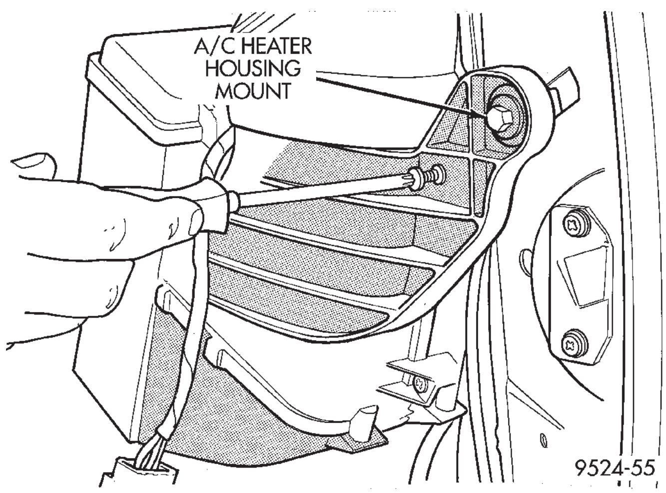

Fig. 23 Upper Duct Trim

(13) Remove (2) Heater-A/C housing mounting bolts (Fig. 24).

(14) Pull up on upper A/C duct. Tilt A/C unit outward (Fig. 25).

(15) Lift the unit enough to clear floor pan. Remove unit from the vehicle.

INSTALLATION

For installation, reverse the above procedures. Install new O-rings at refrigerant lines. Evacuate and charge the refrigerant system. Fill the heater core (Fig. 26). Test for leaks and overall performance.

REMOVAL AND INSTALLATION (Continued)

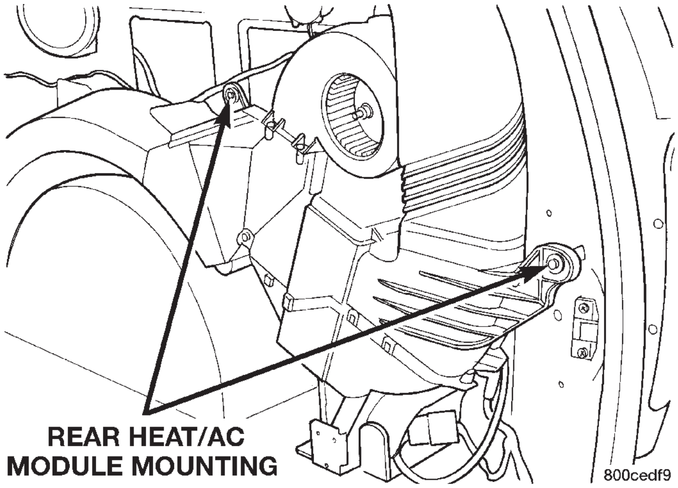

Fig. 24 Mounting Bolts

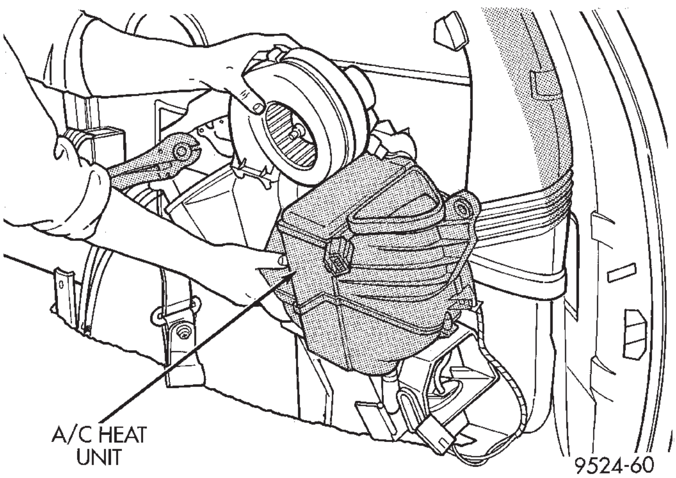

Fig. 25 A/C Unit Replacement

NOTE: If the heater core was emptied and was not prefilled, it is necessary to thermal cycle the vehicle TWICE. The heater core is positioned higher than the radiator fill cap. Therefore the heater core will not gravity fill to level. To thermal cycle the vehicle, it must be operated till the thermostat opens, then turned off and allowed to cool. In order to verify that the auxiliary unit is filled completely, the following procedure can be used:

- Vehicle at room temperature.
- Engine is brought up to operating temperature.
- Front unit is OFF, temperature slides are at full HEAT position.
- Engine is at idle.
- With rear blower motor ON HIGH.
- Discharge air temperature, measured at the dual register located on the C-pillar base, is between 135° and 145° F.

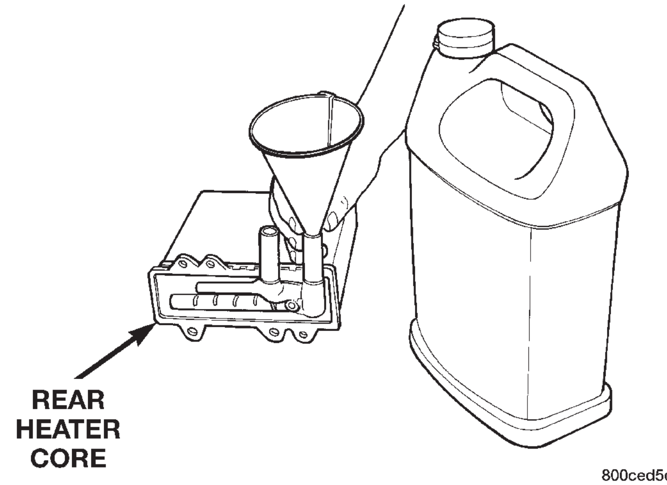

Fig. 26 Filling Heater Core

REAR HEATER CORE

REMOVAL

(1) Remove the lower right quarter trim panel. Refer to Group 23, Body.

(2) Isolate and disconnect lines from heater core (Fig. 27).

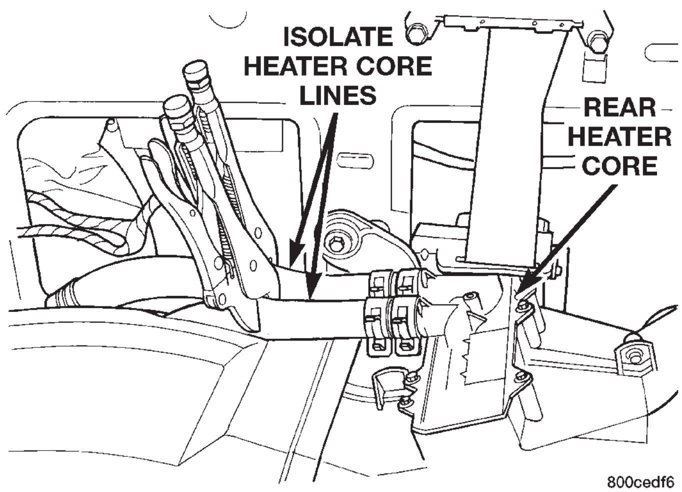

Fig. 27 Heater Core Lines

(3) Remove heater core retaining screws.

(4) Carefully pull the heater core and tubes up and straight out of the unit.

INSTALLATION

For installation, reverse the above procedures. Prefill the heater core (Fig. 26). Test for leaks and overall performance.

REMOVAL AND INSTALLATION (Continued)

NOTE: If the heater core was emptied and was not prefilled, it is necessary to thermal cycle the vehicle TWICE. The heater core is positioned higher than the radiator fill cap. Therefore the heater core will not gravity fill to level. To thermal cycle the vehicle, it must be operated till the thermostat opens, then turned off and allowed to cool. In order to verify that the auxiliary unit is filled completely, the following procedure can be used:

- Vehicle at room temperature.
- Engine is brought up to operating temperature.
- Front unit is OFF, temperature slides are at full HEAT position.
- Engine is at idle.
- With rear blower motor ON HIGH
- Discharge air temperature, measured at the dual register located on the C-pillar base, is between 57°C to 62°C (135° and 145° F).

REAR HEATER LINES

REMOVAL

NOTE: Review Safety Precautions and Warnings before proceeding with this operation.

(1) Partially drain engine cooling system. Refer to Group 7, Engine Cooling.

(2) Loosen clamp at the front end of the hose located at the right, outboard side of the underbody, rearward of the front crossmember. (Fig. 2)

(3) Carefully rotate hose back and forth while tugging slightly away from connector nipple. If the hose will not come off, slice the hose at the connector nipple and peel off heater hose. This method will require heater hose replacement.

CAUTION: When removing hoses from outlet nipples, do not use excessive force. Outlet nipples may become damaged and leak engine coolant.

(4) Compress insert in rear heater hose quick connection and pull downward on hose. (Fig. 4)

(5) Remove (3) straps securing underbody lines. (Fig. 1)

(6) Separate and remove rear heater lines from vehicle.

INSTALLATION

For installation, reverse the above procedures.

MODE DOOR

REMOVAL

(1) Remove A/C unit.

(2) Place unit on bench.

(3) Remove heater core.

(4) Remove blower scroll.

(5) Remove evaporator cover.

(6) Remove A/C line to expansion valve mounting nut.

(7) Carefully pull evaporator out of housing.

(8) Remove mode door actuator and gear extension.

(9) Remove Heater-A/C housing clips and screws.

(10) Separate housing halves.

(11) Remove mode door.

INSTALLATION

For installation, reverse the above procedures.

MODE DOOR ACTUATOR

REMOVAL

(1) Remove A/C unit.

(2) Place unit on bench.

(3) Remove mode door actuator connector.

(4) Remove mode door actuator mounting screws and remove actuator.

INSTALLATION

For installation, reverse the above procedures.

HEATING AND AIR CONDITIONING

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GENERAL INFORMATION

INTRODUCTION

The Heater, or Heater and Air Conditioning systems share many of the same components. This group will deal with both systems together when component function is common, and separately when they are not.

For proper operation of the instrument panel controls, refer to the Owner's Manual provided with the vehicle.

All vehicles are equipped with a common Heater A/C unit housing assembly. When the vehicle has only a heater system, the evaporator and recirculating air door are omitted.

An optional zone control HVAC unit is available. This unit has dual blend-air doors that can be regulated independently of each other. The temperature setting can be different from driver's side to passenger side.

GENERAL INFORMATION (Continued)

SAFETY PRECAUTIONS AND WARNINGS

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM EYE CONTACT WITH REFRIGERANT. IF EYE CONTACT IS MADE, SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC TYPE LEAK DETECTOR IS RECOMMENDED.

LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

THE EVAPORATION RATE OF REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH REFRIGERANT. R-134a SERVICE EQUIPMENT OR VEHICLE A/C 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 INJURY OR PROPERTY DAMAGE.

ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. SEEK MEDICAL ATTENTION IMMEDIATELY IF SWALLOWED OR INHALED. 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 AND PETS.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY CAN RESULT.

CAUTION: The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi). Allow the vehicle to cool a minimum of 15 minutes before opening the cooling system. Refer to Group 7, Cooling System.

DESCRIPTION AND OPERATION

AIR DISTRIBUTION DUCTS

The air distribution ducts for the A/C, Heater, Defroster, and Second Seating Air Distribution are not serviceable in vehicle. The procedures for service of these ducts are covered in Group 8E, Instrument Panel and Gauges.

The only ducts that are serviceable in the vehicle are the side window demister ducts and the ducts that feed the front door outlets for the first rear passenger(s) seating. To service the door ducts refer to Group 23, Body.

A/C PRESSURE TRANSDUCER

The A/C Pressure Transducer (Fig. 1) monitors the refrigerant gas pressure on the high side of the system. The transducer is located on the liquid line. The pressure transducer turns off the voltage to the compressor clutch coil when refrigerant gas pressure drops to levels that could damage the compressor. The transducer also is used to adjust condenser fan speeds and will turn off compressor at high refrigerant pressures. The pressure transducer is a sealed factory calibrated unit. It must be replaced if defective. O-ring replacement is required whenever the pressure transducer is serviced. Be sure to use the O-ring specified for the transducer.

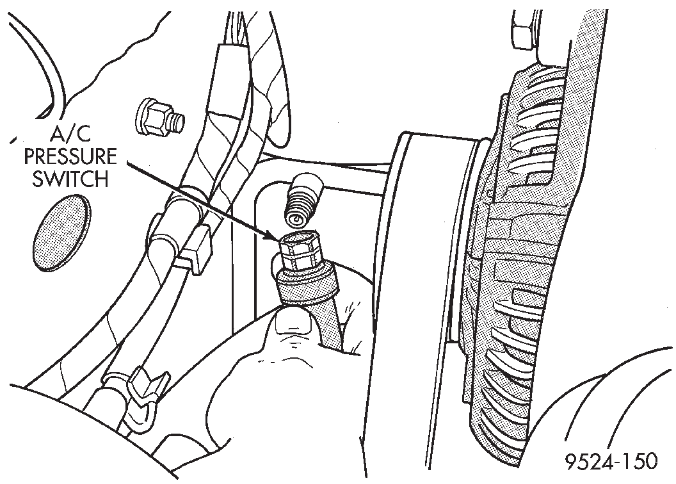

Fig. 1 A/C Pressure Transducer

A/C SERVICE PORTS

The A/C service port valve cores are located within the A/C lines. The High Side (Discharge) valve service port is located on the liquid line near the right strut tower. The Low Side (Suction) valve service port is located on the suction line near the compressor.

The High Side service port is a two piece port and is serviceable. The Low Side service port is not serviceable, and the suction line would have to be replaced.

COMPRESSOR

The A/C compressor for the 2.5L Turbo Diesel, is located on the front side of the engine block. It is mounted to the engine block by four bolts. The com-

DESCRIPTION AND OPERATION (Continued)

pressor is driven off the back of the power steering pump. A rubber flex coupling transfers the power from the power steering pump to the compressor clutch.

COMPRESSOR HIGH-PRESSURE RELIEF VALVE

The High Pressure Relief Valve prevents damage to the air conditioning system if excessive pressure develops. Excessive pressure can be caused by condenser air flow blockage, refrigerant overcharge, or air and moisture in the system.

The high pressure relief valve vents only a small amount of refrigerant necessary to reduce system pressure and then reseats itself. The majority of the refrigerant is conserved in the system. The valve is calibrated to vent at a pressure of 3450 to 4140 kPa (500 to 600 psi). If a valve has vented a small amount of refrigerant, it does not necessarily mean the valve is defective.

The High Pressure Relief Valve is located on the compressor manifold at the discharge passage.

NOTE: 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.

CONDENSATE DRAIN

Condensation from the evaporator housing is drained through the dash panel and on to the ground. This drain must be kept open to prevent water from collecting in the bottom of the housing.

If the drain is blocked condensate cannot drain, causing water to back up and spill into the passenger compartment. It is normal to see condensate drainage below the vehicle.

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain ample temperature levels from the heating-A/C system, the cooling system must be in proper working order. Refer to Group 0, Lubrication and Maintenance or Group 7, Cooling System of this manual.

The use of a bug screen is not recommended. Any obstructions forward of the condenser can reduce the effectiveness of the air conditioning system.

EVAPORATOR PROBE

The Evaporator probe is located on the HVAC. The probe prevents evaporator freeze-up by signaling the Powertrain Control Module to cycle the compressor ON and OFF. The probe monitors the temperature of the refrigerant after expansion.

The evaporator probe is inserted into the evaporator between the coils. The probe is a sealed unit and cannot be adjusted or repaired. It must be replaced if found defective.

HANDLING TUBING AND FITTINGS

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The refrigerant oil will absorb moisture readily out of the air. This moisture will convert into acids within a closed system.

CAUTION: The system must be completely empty before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been emptied. If any pressure is noticed as a fitting is loosened, retighten fitting and evacuate the system again.

A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 3 inches (80 mm) from the exhaust manifold. Inspect all flexible hose lines to make sure they are in good condition and properly routed.

The use of correct wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings.

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.

When opening a refrigeration system, have everything you will need to repair the system ready. This will minimize the amount of time the system must be opened. Cap or plug all lines and fittings as soon as they are opened. This will help prevent the entrance of dirt and moisture. All new lines and components should be capped or sealed until they are ready to be used.

All tools, including the refrigerant dispensing manifold, the manifold gauge set, and test hoses should be kept clean and dry.

HVAC CONTROL MODULE

The HVAC control module regulates the operation of the various actuator motors. The actuator motors are used to move the mode, blend- air, and recirc. doors (Fig. 2).

The control module is included in the A/C control head located on the instrument panel. The control head includes the blower speed switch, rear wiper

DESCRIPTION AND OPERATION (Continued)

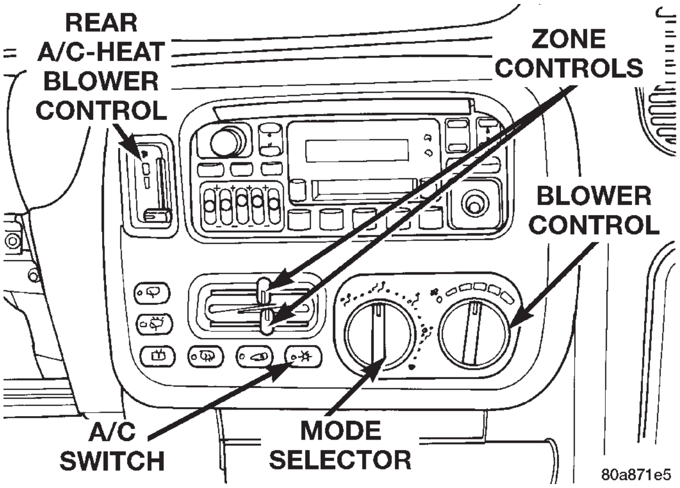

Fig. 2 HVAC Control Module

and washer operation, front & rear window defogger, recirculation door operation, and A/C compressor operation if equipped. Refer to Group 8E, Instrument Panel and Systems for service procedures.

The rear blower speed switch is serviced separately from the control head.

SIDE DOOR HEATER A/C OUTLETS

The driver's and passenger side doors have supplemental air outlets and duct work. The air is channeled from the instrument panel to the door duct and either to the lower floor or upper door outlets (Fig. 3). The air can be adjusted to blow on the first rear passenger seat(s).

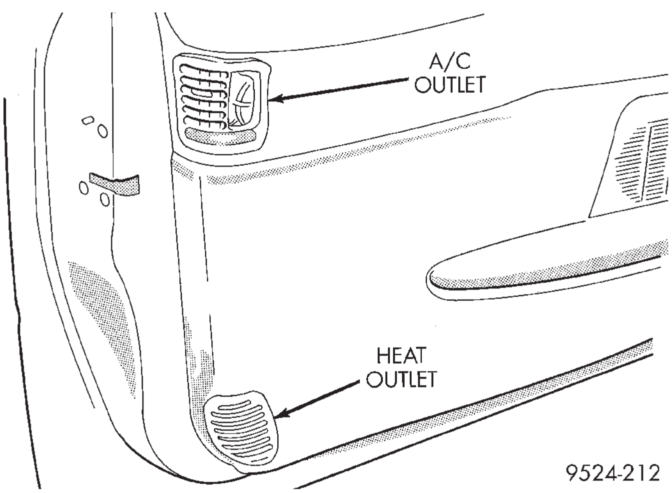

Fig. 3 Door Outlets

SIDE WINDOW DEMISTER

The side window demisters direct air from the heater assembly. The outlets are located on the top forward corners of the front door panels (Fig. 4). The demisters operate when the control mode selector is on FLOOR, MIX or DEFROST setting.

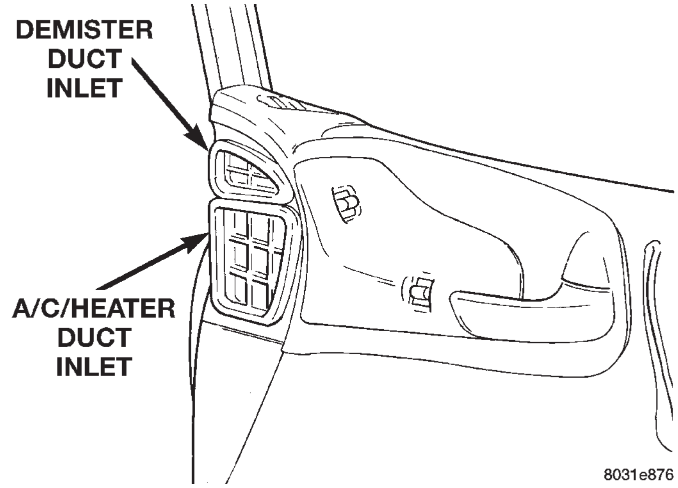

Fig. 4 Demister Inlet

SYSTEM AIRFLOW

The system pulls outside (ambient) air through the cowl opening at the base of the windshield. Then it goes into the plenum chamber above the heater—A/C unit housing. On air conditioned vehicles, the air passes through the evaporator. At this point the air flow can be directed either through or around the heater core. This is done by adjusting the blend- air door with the TEMP control on the control head. An optional zone control HVAC control module is available. This unit has dual blend-air doors that can be regulated independently of each other. The temperature setting can be different from driver's side to passenger side. After the air passes the blend-air door(s), the air flow can then be directed from the Panel, Floor, and Defrost outlets. Air flow velocity can be adjusted with the blower speed selector switch on the control head.

Ambient air intake can be shut off by closing the recirculating air door. This will recirculate the air that is already inside the vehicle. This is done by depressing the Recirc. button on the control head. On air conditioned vehicles, moving the control to Mix or Defrost depresses the A/C button and will engage the compressor. This will send refrigerant through the evaporator, and remove heat and humidity from the air before it goes through the heater core.

CAUTION: In cold weather, use of the Recirculation mode may lead to excessive window fogging. The Recirculation mode is automatically deactivated in Mix and Defrost modes to improve window clearing operation.

SYSTEM OIL LEVEL

It is important to have the correct amount of oil in the A/C system to ensure proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling

DESCRIPTION AND OPERATION (Continued)

capacity of the system and consequently result in higher discharge air temperatures.

NOTE: The oil used in the Denso 2.5L Turbo Diesel and the Denso 2.0L gasoline engine compressors is ND-8 PAG R134a 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 oil level in the compressor or to add oil unless there has been an oil loss. Oil loss at a leak point will be evident by the presence of a wet, shiny surface around the leak.

REFRIGERANT OIL LEVEL CHECK

When an air conditioning system is first assembled, all components (except the compressor) are refrigerant oil free. After the system has been charged with R134a refrigerant and operated, the oil in the compressor is dispersed through the lines and components. The evaporator, condenser, and filter-drier will retain a significant amount of oil, refer to the Refrigerant Oil Capacities chart. When a component is replaced, the specified amount of refrigerant oil must be added. When the compressor is replaced, the amount of oil that is retained in the rest of the system must be drained from the replacement compressor. When a line or component has ruptured and oil has escaped, the compressor should be removed and drained. The compressor is drained through the suction port or by removing the sump bolt on top of the compressor, refer to Compressor Removal and Installation procedures. The filter-drier must be replaced along with the ruptured part. The oil capacity of the system, minus the amount of oil still in the remaining components, can be measured and poured into the suction port of the compressor.

Example: The evaporator retains 50 ml (1.7 oz.). The condenser retains 30 ml (1 oz) of oil, and system capacity may be 220 ml (7.40 oz) of oil.

220 ml minus 90 ml = 130 ml (4.40 oz.).

CAUTION: The refrigerant oil used in a R-134a A/C system is unique. Use only oils which were designed to work with R-134a refrigerant. The oil designated for the Denso 2.5L Turbo Diesel and Denso 2.0L gasoline engine compressors is ND-8 PAG compressor oil. For gasoline vehicles still using R-12 refrigerant, use ND8 PAG compressor oil.

REFRIGERANT OIL CAPACITIES

REFRIGERANT OIL CAPACITIES		
COMPONENT	**ML**	**OZ**
Compressor	135 ml	4.5 oz
Filter-Drier	30 ml	1.0 oz
Condenser	30 ml	1.0 oz
Evaporator	50 ml	1.7 oz

SERVICING REFRIGERANT OIL LEVEL

(1) Using a refrigerant recovery machine, remove refrigerant from the A/C system.

(2) Remove refrigerant lines from A/C compressor.

(3) Remove compressor from vehicle.

(4) From suction port on top of compressor, drain refrigerant oil from compressor.

(5) Add system capacity minus the capacity of components that have not been replaced through suction port on compressor. Refer to the Refrigerant Oil Capacity Chart.

(6) Install compressor, connect refrigerant lines, evacuate, and charge refrigerant system.

DIAGNOSIS AND TESTING

ACTUATOR CALIBRATION/DIAGNOSTICS AND COOLDOWN TEST

GENERAL INFORMATION

If the HVAC control module is replaced, the Calibration Diagnostic and Cooldown tests will need to be performed. Once this group of tests have successfully passed, they can be performed individually. The engine must be running during the test to provide hot coolant for the heater, A/C compressor operation and to assure that the actuators are calibrated correctly. The HVAC control module is capable of troubleshooting the system in approximately 120 seconds. If a condition is detected, an error code is displayed. The error code cannot be erased until the condition is repaired and the diagnostic test is performed. Check wire before replacing components, refer to Group 8W, Wiring Diagrams.

CAUTION: Do not remove the actuators from the Heater-A/C unit assembly with power applied. Removal should only be done with the Ignition OFF. The actuators have no mechanical stops to limit the travel. If the actuator rotates and is not connected to the unit assembly, it will become out of calibration.

ACTUATOR CALIBRATION

Mode, Blend and Zone (if equipped) door calibration compensates for mechanical variations in the

DIAGNOSIS AND TESTING (Continued)

actuators, HVAC control module and its linkages. In-vehicle calibration can be entered from the control's front panel. If the REAR WIPE and INTERMITTENT LED's flash simultaneously when Ignition is cycled ON, the actuators have not been calibrated or during the previous calibration a failure occurred (Fig. 5) and (Fig. 6). Diagnostics will always occur during Calibration Diagnostic and Cooldown test.

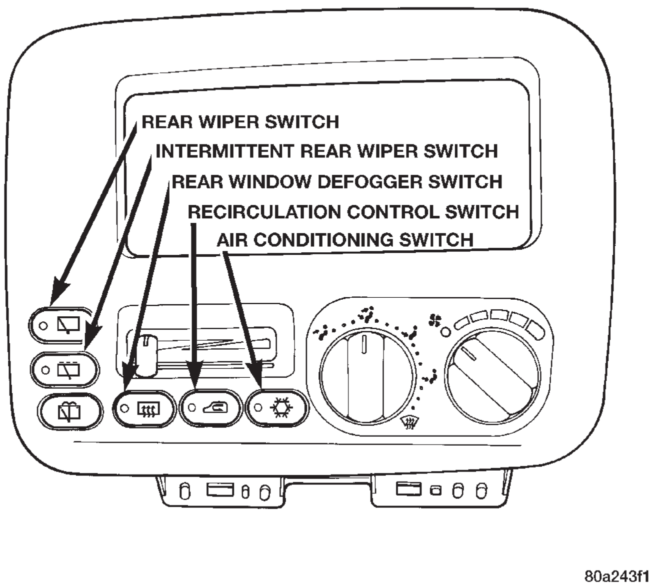

Fig. 5 Radio Bezel and HVAC Control

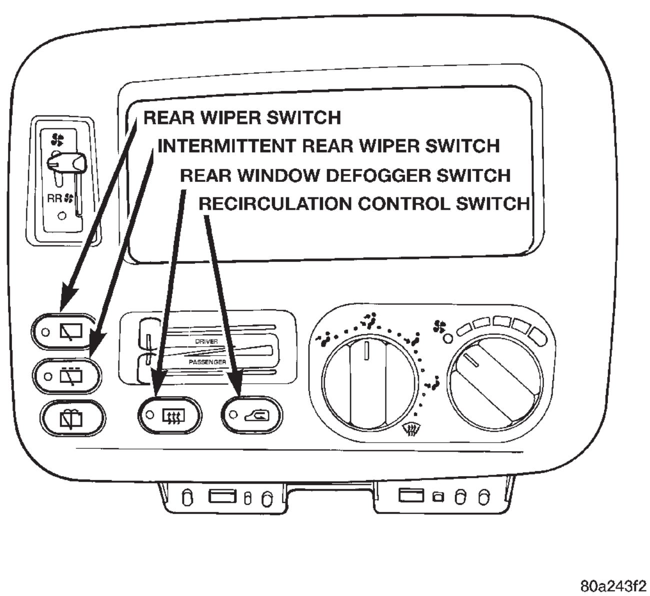

Fig. 6 Radio Bezel and HVAC Control, Rear Blower Motor Switch and Zone Control

DIAGNOSTICS

During the Actuator calibration, diagnostics are performed on the actuators and evaporator temperature Fin Sensor. Once diagnostics are completed the REAR WIPER and INTERMITTENT LED's will flash to indicate either a successful calibration or the appropriate fail code(s). At this time manual testing of the Blend, Mode and Driver (if equipped) potentiometers can be performed. If a failure is detected during Diagnostics a fault will be set in the control. When Ignition is cycled OFF and then ON or Diagnostics is aborted, the REAR WIPER and INTERMITTENT LED's will flash simultaneously showing that a failure has occurred. The control will not indicate the fail code, but only that a failure had occurred during the last diagnostics test. The only way to clear the failure codes is repeat the Calibration Diagnostic and Cooldown test, after all repairs are completed.

COOLDOWN TEST

This test has been designed for performance testing of the A/C system at the manufacturing facility. If the HVAC control module is replaced, the Cooldown test will occur during Calibration test. Cooldown will not occur on Heater Only units. During the Cooldown test the control will monitor the temperature of the Fin Sensor. The A/C system must be able to bring the evaporator temperature down a predetermined minimum amount in less than 2 minutes.

CALIBRATION/COOLDOWN LED DISPLAY CODES

See chart for definition of flashing LED's. If no problems are found, the control functions normally.

CALIBRATION/DIAGNOSTICS TEST ENTRY

TO INITIATE TESTS:

- Set Blower motor ON HIGH
- Set Mode position to Panel
- Open all A/C outlets
- Set Temperature to Cold (Both slide pots if equipped)
- Depress WASH and REAR WIPER button simultaneously for 5 Seconds (Until all LED's light)

RESULTS:

- All LED's will turn on for 5 Seconds
- Calibration Test is running when REAR WIPER and INTERMITTENT are alternately flashing. Cooldown test is running if A/C and RECIRC are alternately flashing.
- Acceptable results is REAR WIPER LED is the only LED flashing. Push Rear Wiper to exit.
- After all tests have passed, Calibration Diagnostics and Cooldown can be run separately.

DIAGNOSIS AND TESTING (Continued)

LED'S	PASS/FAIL	CORRECTIVE ACTION
NO LED'S FLASHING-NORMAL OPERATION	PASSED CALIBRATION, DIAGNOSTICS AND COOLDOWN	NONE
REAR WIPER AND INTERMITTENT LED'S FLASH SIMULTANEOUSLY	FAILED CALIBRATION DIAGNOSTICS	RUN CALIBRATION TEST
A/C AND RECIRC LED'S FLASH SIMULTANEOUSLY	FAILED COOLDOWN	RUN COOLDOWN TEST
REAR WIPER AND INTERMITTENT LED'S ARE FLASHING SIMULTANEOUSLY A/C AND RECIRC LED'S ARE FLASHING SIMULTANEOUSLY	FAILED CALIBRATION, DIAGNOSTICS AND FAILED COOLDOWN TEST	RUN CALIBRATION TEST

COOLDOWN TEST ENTRY

TO INITIATE TESTS:

- Set Blower motor ON HIGH
- Set Mode position to Panel
- Open all A/C outlets
- Set Temperature to Cold (Both slide pots if equipped)
- Depress WASH and A/C simultaneously for 5 Seconds

NOTE: Prior to start of test, If the evaporator is already cold, the system will fail test. To correct, operate system with A/C OFF and the blower motor ON high for three minutes prior to starting test.

RESULTS:

- All LED's will turn on for 5 Seconds
- Cooldown Test is running when A/C and RECIRC. are alternately flashing. If A/C and RECIRC. are flashing simultaneously, Cooldown has failed.

CALIBRATION DIAGNOSTICS AND COOLDOWN ABORT

Test can be aborted by doing one of the following:

- Depressing Rear Window Defogger, RECIRC and Rear Wiper buttons.
- Cycling Ignition OFF and then ON.
- Control will automatically abort after 15 minutes from the time Calibration Diagnostics and Cooldown was entered.

The HVAC control module will return to normal operation or may indicate unsuccessful Calibration Diagnostics or Cooldown test by LED's flashing simultaneously.

EEPROM DATA

Calibration Diagnostics, Cooldown Status and evaporator temperature Fin Sensor values are stored in an EEPROM memory internal to the control. The microcomputer within the HVAC control module uses this information:

- To determine if Cooldown needs to run
- For proper position of the Heater-A/C unit assembly doors

ACTUATOR CALIBRATION AND DIAGNOSTICS.

NOTE: Do not run actuators unless they are properly mounted on the HVAC control module.

Actuator end point calibration takes approximately 60 seconds. The REAR WIPER and INTERMITTENT LED's will flash alternately during the test. The control will cycle the Blend actuator(s) to the Heat stop first then back to Cold. After the Blend actuator(s) have been calibrated the Mode actuator will be cycled to Defrost and then to Panel. Successful calibration is defined as actuator travel falling within their minimum and maximum limits.

BLEND/PASSENGER ACTUATOR BACKGROUND

The Blend/Passenger Actuator can move the temperature door in two directions. When the voltage at Pin 12 of the control module is high, about 11.5 volts, and the voltage at Pin 17 is low, about 1.5 volts, the door will move towards the Heat position. When Pin 17 is High and Pin 12 is Low the door will move towards the Cold position. When both Pins are high or both Pins are low, the actuator will not move. The Blend/Passenger feedback signal is a voltage signal that is supplied by the actuator to the control. The signal will be about 4.0 volts in the Heat position and 1.0 volt in the Cold position. As the position of the Blend/Passenger actuator changes, so will the feedback signal. The feedback signal is necessary for the correct positioning of the temperature door.

DRIVER ACTUATOR BACKGROUND

The Driver Actuator can move the temperature door in two directions. When the voltage at Pin 15 of the control module is high, about 11.5 volts, and the voltage at Pin 13 is low, about 1.5 volts the door will

DIAGNOSIS AND TESTING (Continued)

move towards the Cold position. When Pin 13 is High and Pin 15 is Low the door will move towards the Heat position. When both Pins are high or when both Pins are low, the actuator will not move. The Driver feedback signal is a voltage signal that is supplied by the actuator to the control. The signal will be about 4.0 volts in the Heat position and 1.0 volt in the Cold position. As the position of the Driver Actuator changes, so will the feedback signal. The feedback signal is necessary for the correct positioning of the temperature door.

MODE ACTUATOR BACKGROUND

The Mode actuator can move the mode door in two directions. When the voltage at Pin 18 of the control module is high, about 11.5 volts, and the voltage at Pin 12 is low, about 1.5 volts the door will move towards the Panel position. When Pin 12 is High and Pin 18 is Low the door will move towards the Defrost position. When both Pin are high or when both Pins are low, the actuator will not move. The Mode door feedback signal is a voltage signal that is supplied by the actuator to the control. The signal will be about 4.5 volts in the Panel position and 0.5 volts in the Defrost position. As the position of the Mode actuator changes, so will the feedback signal. The feedback signal is necessary for the correct positioning of the mode door.

FAIL CODES/LEVEL DISPLAY

Fail Codes/Level are displayed using the REAR WIPER and INTERMITTENT LED's flashing in the sequence indicated below. The REAR WIPER LED represents the Level and the INTERMITTENT LED represents the Value. After Calibration/Diagnostics is completed, the control will begin flashing Level 1 codes. Depressing the WASH button will cycle to Level 2, depressing WASH again will cycle to Level 3. Each time the WASH button is depressed will cycle to the next level. After Level 5 is reached, you will cycle back to Level 1. If the Control is a Heater Only you will only cycle from Levels 1 to 3.

WIPE BUTTON LED

LEVEL	DISPLAY
1	FAIL CODES
2	MODE POTENTIOMETER TEST
3	BLEND/PASS. POTENTIOMETER TEST
4	EVAPORATOR PROBE (A/C AND ZONE UNITS ONLY)
5	DRIVER POTENTIOMETER (ZONE UNITS ONLY)

LEVEL 1–FAILURE CODE VALUES (INTERMITTENT WIPE BUTTON LED)

CODE	DEFINITION
0	PASSED ALL TESTS
1	MODE ACTUATOR DID NOT REACH DEFROST POSITION
2	MODE ACTUATOR DID NOT REACH PANEL POSITION
3	BLEND/PASS. ACTUATOR DID NOT REACH COLD STOP
4	BLEND PASS. ACTUATOR DID NOT REACH HEAT STOP
5	EVAPORATOR PROBE OPEN
6	EVAPORATOR PROBE SHORTED
7	DRIVER ACTUATOR DID NOT REACH COLD STOP
8	ZONE/DRIVER ACTUATOR DID NOT REACH HEAT STOP
9	CONTROL HEAD INTERNAL FAILURE

TEMPERATURE AND MODE POTENTIOMETER DIAGNOSTICS

The Temperature and Mode Potentiometer can be tested after calibration is complete by pressing the WASH button and cycling to Levels 2, 3 or 5 as displayed by the REAR WIPER LED. On Heater Only units you can only cycle to Levels 2 and 3. In each individual test the INTERMITTENT LED flash rate will change as the Temperature or Mode potentiometer is moved from one end to the other, see Potentiometer vs. Position and Flash Rate table.

POTENTIOMETER VS. POSITION AND FLASH RATE

POTENTIOMETER	INTERMITTENT LED FASTER FLASH RATE	INTERMITTENT LED SLOWER FLASH RATE
MODE	PANEL	DEFROST
BLEND/PASS.	HOT	COLD
DRIVER	HOT	COLD

EVAPORATOR PROBE TEMPERATURE DIAGNOSTICS

The evaporator probe can be tested by using the INTERMITTENT LED to display the actual temperature the sensor is reading. The HVAC control module can only display temperatures from 1 to 99 degrees. To read the temperature, perform the following:

- Set Blower motor to any speed other than OFF

DIAGNOSIS AND TESTING (Continued)

• Set A/C to ON, if A/C Clutch does not engage make sure Fail Codes 5 and 6 are cleared.To clear the error code 5 and 6 the evaporator probe and/or the wiring repair needs to be completed. Then, press and hold the intermittent wipe button for 5 seconds.
• Run Diagnostics (Depress REAR WIPER and REAR WASH)
• When Diagnostics is complete, Cycle to Level 4. Display Sequence is as follows:
• REAR WIPER LED will display the Level
• INTERMITTENT LED will display ten's digit
• Short Pause
• INTERMITTENT LED will display the one's digit.

The HVAC control module will continue to cycle the Level and then Temperature until the level is changed or Calibration Diagnostics and Cooldown test is exited.

HVAC CONTROL DIAGNOSTIC CONDITIONS

For wiring circuits, wiring connectors, and Pin numbers, refer to Group 8W, Wiring Diagrams.

After calibration, Rear Wiper LED flashing once, Intermittent LED not flashing.

The system has passed calibration. Press the Rear Wiper button to exit calibration.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing once. The mode actuator did not reach defrost position.

(1) Using a voltmeter, check the mode door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from the defrost to panel position, and check Pin 6 voltage it should change from 0.5 - 1 volts to 3.5 - 4.5 volts. If voltage is OK, go to Step 2. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(2) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 3. If not OK, repair as necessary.

(3) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(4) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing twice. The mode actuator did not reach panel position.

(1) Using a voltmeter, check the mode door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from panel to defrost position, and check Pin 6 voltage it should change from 3.5 - 4.5 volts to 0.5 - 1 volts. If voltage is OK, go to Step 2. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(2) Remove actuator, and check if the gear pins are in the correct cam track or binding. If OK, go to Step 3. If not OK, repair as necessary.

(3) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(4) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing three times. The main temperature actuator/passenger temperature actuator on a zone system did not reach cold stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check the temperature door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from the cold to hot position, and check Pin 5 voltage it should change from 0.5 - 4 volts to 3.5 - 4.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if gear pins are in the correct cam track or binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing four times. The main temperature actuator/passenger temperature actuator on a zone system did not reach hot stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check the temperature door actuator wiring connector. Check Pin 1 for battery voltage. Move the HVAC control from hot to cold position and check Pin 5 voltage it should change from 3.5 -4.5 volts 0.5 - 1.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 4. If not OK, repair as necessary.

DIAGNOSIS AND TESTING (Continued)

(4) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing five times. The evaporator probe is open.

(1) Using a voltmeter, check Pin 1 of the evaporator probe wiring connector for 0.1 - 4.75 volts. If OK, go to Step 2. If not OK, if greater than 4.75 volts check for loose or corroded connector, open circuit and repair as necessary.

(2) Using a ohmmeter, check Pin 2 for a good ground, If OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) If ground and power circuit are OK, replace Evaporator Probe.

(4) Once repairs are completed, press the intermittent button about 5 seconds until all LED's light to remove fault code from memory. Then repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing six times. The evaporator probe is shorted.

(1) Using a voltmeter, check Pin 1 of the evaporator probe wiring connector for 0.1 - 4.75 volts. If OK, go to Step 2. If less than 0.1 volts, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(2) Using a ohmmeter, check Pin 2 for a good ground, If OK, go to Step 3. If not OK, check for shorted circuit and repair as necessary.

(3) If ground and power circuit are OK, replace Evaporator Probe

(4) Once repairs are completed, press the intermittent button about 5 seconds until all LED's light to remove fault code from memory. Then repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing seven times. The Driver's temperature actuator on a zone system did not reach cold stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check at the temperature door actuator wiring connector, check Pin 1 for battery voltage. Move the HVAC control from cold to the hot position, check Pin 4 voltage it should change from 0.5 - 1.5 volts 3.5 - 4.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding doors, if door are binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing eight times. The Driver's temperature actuator on a zone system did not reach hot stop.

(1) Check if the correct HVAC control module was used.

(2) Using a voltmeter, check at the temperature door actuator wiring connector, check Pin 1 for battery voltage. Move the HVAC control from hot to cold position, Pin 4 voltage it should change from 3.5 - 4.5 volts to 0.5 - 1.5 volts. If voltage is OK, go to Step 3. If not OK, check for loose or corroded connector, open or shorted circuit and repair as necessary.

(3) Remove actuator, and check if the gear pins are in the correct track on cam or if they are binding. If OK, go to Step 4. If not OK, repair as necessary.

(4) Check for binding door, if door is binding repair as necessary. If gears and door are OK, replace actuator.

(5) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration, Rear Wiper LED flashing once, Intermittent LED flashing nine times. The HVAC control module, has a internal failure.

(1) Replace the HVAC control module.

(2) Once repairs are completed repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

After calibration and testing the A/C and RECIRC LED flashing simultaneously. Failed Cooldown test.

(1) Determine if the refrigerant system is operating correctly:

- Check the outlet air temperature
- Feel the compressor suction plumbing, is it hot?

(2) If not OK, go to Step 3. If OK, repeat the Calibration Diagnostic and Cooldown test.

(3) If system does not seem to be operating correctly, perform diagnostics for poor performance:

- Low refrigerant charge

DIAGNOSIS AND TESTING (Continued)

- No charge
- Compressor not operating

Verify that the test was done with the evaporator at room temperature. The test consists of starting the compressor and measuring the time it takes for the evaporator temperature to fall 7°C (20°F). If the compressor has been running, the evaporator is cold already and will not be capable of falling 7°C (20°F). If the test was run with a cold evaporator, turn A/C off and turn the blower motor switch to high position for 3 to 5 minutes till the evaporator is to room temperature. Then repeat the Calibration Diagnostic and Cooldown test.

If refrigerant system is performing properly and the system will not pass test. Repeat the Calibration Diagnostic and Cooldown test to determine if the evaporator temperature FIN sensor has developed an open or a short circuit. If the HVAC control module still passes Calibration test, verify Cooldown test manually with a pocket thermometer. The outlet air temperature must drop at least 7°C (20°F) within two minutes. If the vehicle passes with the manual thermometer, take HVAC control to level 4 (evaporator probe temperature readout) and repeat the Cooldown test. Ensure the evaporator is at room temperature before starting test. Check if evaporator probe will drop the temperature 7°C (20°F) in two minutes. If the Evaporator Probe is found to be faulty, check that the sensor is positioned in the evaporator fins properly. If not, correct and repeat test. If OK, replace the evaporator probe.

Once the repairs are completed, repeat the Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

A/C PERFORMANCE TEST

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 RECIRC, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels rise.

PERFORMANCE TEST PROCEDURE

Review Safety Precautions and Warnings in this group before proceeding with this procedure. 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 manifold gauge set.

(2) Set control to A/C, RECIRC, and PANEL, temperature lever on full cool and blower on high.

(3) Start engine and hold at 1000 rpm with A/C clutch engaged.

(4) Engine should be warmed up with doors and windows closed.

(5) Insert a thermometer in the left center A/C outlet and operate the engine for five minutes. The A/C clutch may cycle depending on ambient conditions.

(6) With the A/C clutch engaged, compare the discharge air temperature to the A/C Performance Temperatures chart (Fig. 7).

(7) If the discharge air temperature fails to meet the specifications in the performance temperature chart. Refer to the Refrigerant Service Procedures for further diagnosis.

A/C PRESSURE TRANSDUCER

The work area temperature must not be below 10°C (50°F) to test the compressor clutch circuit. Before starting to test the transducer ensure that the wire connector is clean of corrosion and connected properly.

(1) With gear selector in park or neutral and park brake set, start engine and allow to idle.

(2) Install scan tool (DRB):

- Go to main menu
- Select stand alone scan tool (DRB)
- Select refer to the proper year diagnostics
- Select climate control
- Select sensor display
- Select A/C high side volts

For A/C system to operate a voltage between .451 (Low Pressure Cutout) to 4.519 (High Pressure Cutout is required. Voltages outside this range indicate a low or high pressure condition and **will not** allow the compressor to cycle.

The following chart denotes voltages and the appropriate condition(s):

DIAGNOSIS AND TESTING (Continued)

Ambient Temperature	21°C (34-46°F)	26.5°C (80°F)	32°C (90°F)	37.5°C (100°F)	43°C (110°F)
Air Temperature at Left Center Panel Outlet	1-8°C (34-46°F)	3-9°C (37-49°F)	4-10°C (39-50°F)	6-11°C (43-52°F)	7-18°C (45-65°F)
Compressor Discharge Pressure After the Filter Drier	1034-1724 kPa (150-250 PSI)	1517-2275 kPa (220-330 PSI)	1999-2620 kPa (290-380 PSI)	2068-2965 kPa (300-430 PSI)	2275-3421 kPa (300-500 PSI)
Evaporator Suction Pressure	103-207 kPa (15-30 PSI)	117-221 kPa (17-32 PSI)	138-241 kPa (20-35 PSI)	172-269 kPa (25-39 PSI)	207-345 kPa (30-50 PSI)

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Fig. 7 A/C PERFORMANCE TEMPERATURES

VOLTAGE	CONDITION
0	Transducer faulty or no voltage from PCM
.150 to .450	Transducer good/Low Pressure Cutout condition
.451 to 4.519	Normal operating condition
4.520 to 4.850	Transducer good/High Pressure Cutout condition
5	Transducer faulty

BLOWER MOTOR AND WHEEL ASSEMBLY

VIBRATION AND/OR NOISE DIAGNOSIS

The blower speed switch, in conjunction with the resistor block, supplies the blower motor with varied voltage.

CAUTION: Stay clear of the blower motor and resistor block (Hot). Do not operate the blower motor with the resistor block removed from the heater A/C housing.

Refer to the Blower Motor Vibration/Noise chart in this section for diagnosis.

COMPRESSOR NOISE DIAGNOSIS

Excessive noise while the A/C is being used, can be caused by loose mounts, clutch, or high operating pressure. Verify compressor drive belt condition, proper refrigerant charge and head pressure before compressor repair is performed.

COMPRESSOR CLUTCH/COIL

The air conditioning compressor clutch electrical circuit is controlled by the Powertrain Control Module. It is located in the engine compartment outboard of the battery.

If the compressor clutch does not engage verify refrigerant charge.

If the compressor clutch still does not engage check for battery voltage at the pressure transducer located on the liquid line. If voltage is not detected, refer to:

- Group 8W, Wiring diagrams.
- Powertrain Diagnostic Procedures manual for diagnostic information.

If voltage is detected at the pressure transducer, connect pressure transducer and check for battery voltage between the compressor clutch connector terminals.

If voltage is detected, perform A/C Clutch Coil Tests.

TESTS

(1) Verify battery state of charge. (Test indicator in battery should be green).

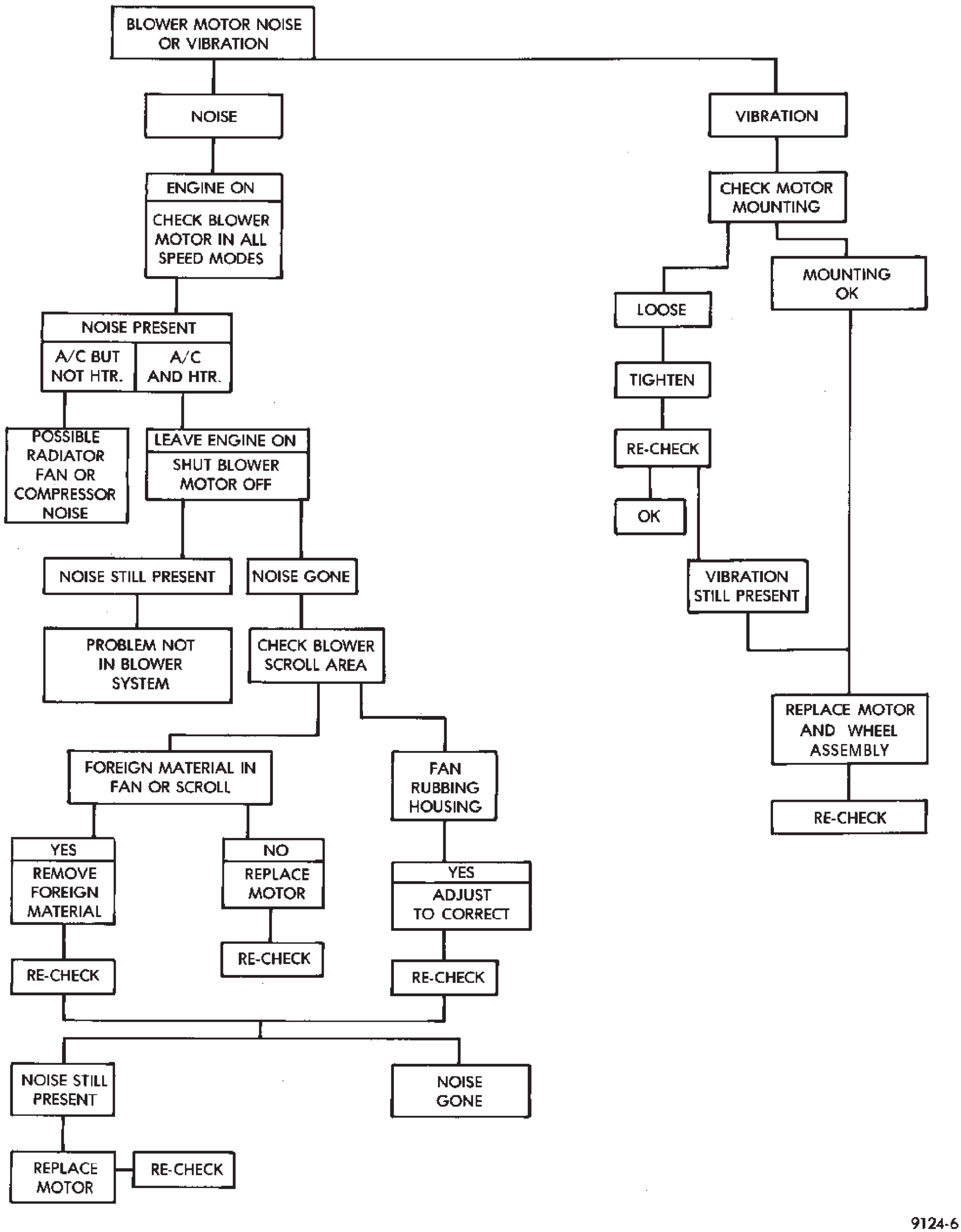
(2) Connect an ampmeter (0-10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0-20 volt scale) with clip leads measuring voltage across the battery and A/C clutch.

(3) With A/C control in A/C mode and blower at low speed, start the engine and run at normal idle.

(4) The A/C clutch should engage immediately and the clutch voltage should be within two volts of the battery voltage. If the A/C clutch does not engage, test the fuse.

(5) The A/C clutch coil is acceptable if the current draw is 2.0 to 3.7 amperes at 11.5-12.5 volts at clutch coil. This is with the work area temperature at 21°C (70°F). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.

DIAGNOSIS AND TESTING (Continued)



Blower Motor Noise/Vibration Diagnosis

DIAGNOSIS AND TESTING (Continued)

(6) If coil current reads zero, the coil is open and should be replaced. If the ammeter reading is 4 amperes or more, the coil is shorted and should be replaced. If the coil voltage is not within two volts of the battery voltage, test clutch coil feed circuit for excessive voltage drop.

EXPANSION VALVE

NOTE: 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.

TESTS

NOTE: Expansion valve tests should be performed after compressor tests.

Review Safety Precautions and Warnings in this group. The work area and vehicle temperature must be 21°C to 27°C (70°F to 85°F). To test the expansion valve:

NOTE: Liquid CO2 is required to test the expansion valve. It is available from most welding supply facilities. CO2 is also available from companies which service and sell fire extinguishers.

(1) Connect a charging station or manifold gauge set to the refrigerant system service ports. Verify the refrigerant charge level.

(2) Close all doors, windows and vents to the passenger compartment.

(3) Set heater A/C control to A/C, full heat, FLOOR, and high blower.

(4) Start the engine and allow to idle (1000 rpm). After the engine has reached running temperature, allow the passenger compartment to heat up. This will create the need for maximum refrigerant flow into the evaporator.

(5) If the refrigerant charge is sufficient, discharge (high pressure) gauge should read 965 to 1655 kPa (140 to 240 psi). Suction (low pressure) gauge should read 140 kPa to 207 kPa (20 psi to 30 psig). If system cannot achieve proper pressure readings, replace the expansion valve. If pressure is correct, proceed with test.

WARNING: PROTECT SKIN AND EYES FROM CONTACTING CO2 PERSONAL INJURY CAN RESULT.

(6) If suction side low pressure is within specified range, freeze the expansion valve control head for 30 seconds. Use a super cold substance (liquid CO2). **Do not spray R-134a Refrigerant on the expansion valve for this test.** Suction side low pressure should drop by 10 psi. If not, replace expansion valve.

(7) Allow expansion valve to thaw. The low pressure gauge reading should stabilize at 140 kPa to 240 kPa (20 psi to 30 psig). If not, replace expansion valve.

(8) When expansion valve test is complete, test A/C overall performance. Remove all test equipment before returning vehicle to use.

HEATER PERFORMANCE TEST

PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings in this group before performing the following procedures.

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 16 mm (5/8 inch inside diameter) heater hoses. With engine idling at normal running temperature, set the control to maximum heat, floor, and high blower setting. Using a test thermometer, check the air temperature coming from the floor outlets, refer to Temperature Reference chart.

TEMPERATURE REFERENCE CHART

AMBIENT TEMP.		MINIMUM FLOOR OUTLET TEMP.	
CELSIUS	FAHRENHEIT	CELSIUS	FAHRENHEIT
15.5°	60°	62.2°	144°
21.1°	70°	63.8°	147°
26.6°	80°	65.5°	150°
32.2°	90°	67.2°	153°

If the floor outlet air temperature is insufficient, refer to Group 7, Cooling Systems for specifications. Both heater hoses should be HOT to the touch (coolant return hose should be slightly cooler than the supply hose). If coolant return hose is much cooler than the supply hose, locate and repair engine coolant flow obstruction in heater system.

DIAGNOSIS AND TESTING (Continued)

POSSIBLE LOCATIONS OR CAUSE OF OBSTRUCTED COOLANT FLOW

(1) Pinched or kinked heater hoses.

(2) Improper heater hose routing.

(3) Plugged heater hoses or supply and return ports at cooling system connections, refer to Group 7, Cooling System.

(4) Plugged heater core.

(5) Air locked heater core.

(6) If coolant flow is verified and outlet temperature is insufficient, a mechanical problem may exist.

POSSIBLE LOCATION OR CAUSE OF INSUFFICIENT HEAT

(1) Obstructed cowl air intake.

(2) Obstructed heater system outlets.

(3) Blend-air door not functioning properly.

TEMPERATURE CONTROL

If temperature cannot be adjusted with the TEMP lever on the control panel, the following could require service:

(1) Blend-air door binding.

(2) Faulty blend-air door motor.

(3) Improper engine coolant temperature.

(4) Faulty Instrument Panel Control.

SYSTEM CHARGE LEVEL TEST

The procedure below should be used to check and/or fill the refrigerant charge in the air conditioning system.

NOTE: The amount of R134a refrigerant that the air conditioning system holds is 0.96 kg (34 oz. or 2.13 lbs.).

NOTE: Low Charge, condition may be described as:

- **Loss of A/C performance**
- **Fog from A/C outlets**
- **evaporator may have a HISS sound**

There are two different ways the system can be tested:

• With a scan tool (DRB), thermocouple and the Charge Determination Graph. Use the scan tool (DRB) diagnostic topic: Engine–System Monitors, A/C Pressure.

• Using a manifold gauge set, a thermocouple and the Charge Determination Graph.

It is recommended to use the gauges or reclaim/recycle equipment.

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. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

(1) Establish your preferred method of measuring liquid line pressure. Use a manifold gauge set or a DRB scan tool.

(2) Attach a clamp-on thermocouple (Professional Service Equipment 66-324-0014 or 80PK-1A) or equivalent to the liquid line. It must be placed as close to the A/C Pressure Transducer as possible to observe liquid line temperature. Refer to “Thermocouple Probe” in this section for more information on probe.

(3) The vehicle must be in the following modes:

• Transaxle in Park
• Engine Idling at 700 rpm
• A/C Controls Set to Outside Air
• Panel Mode
• Full Cool
• High Blower motor, (vehicle equipped with rear A/C turn rear blower motor ON HIGH)
• A/C Button in the ON position
• Vehicle Windows Open.
• Recirc. button turned OFF

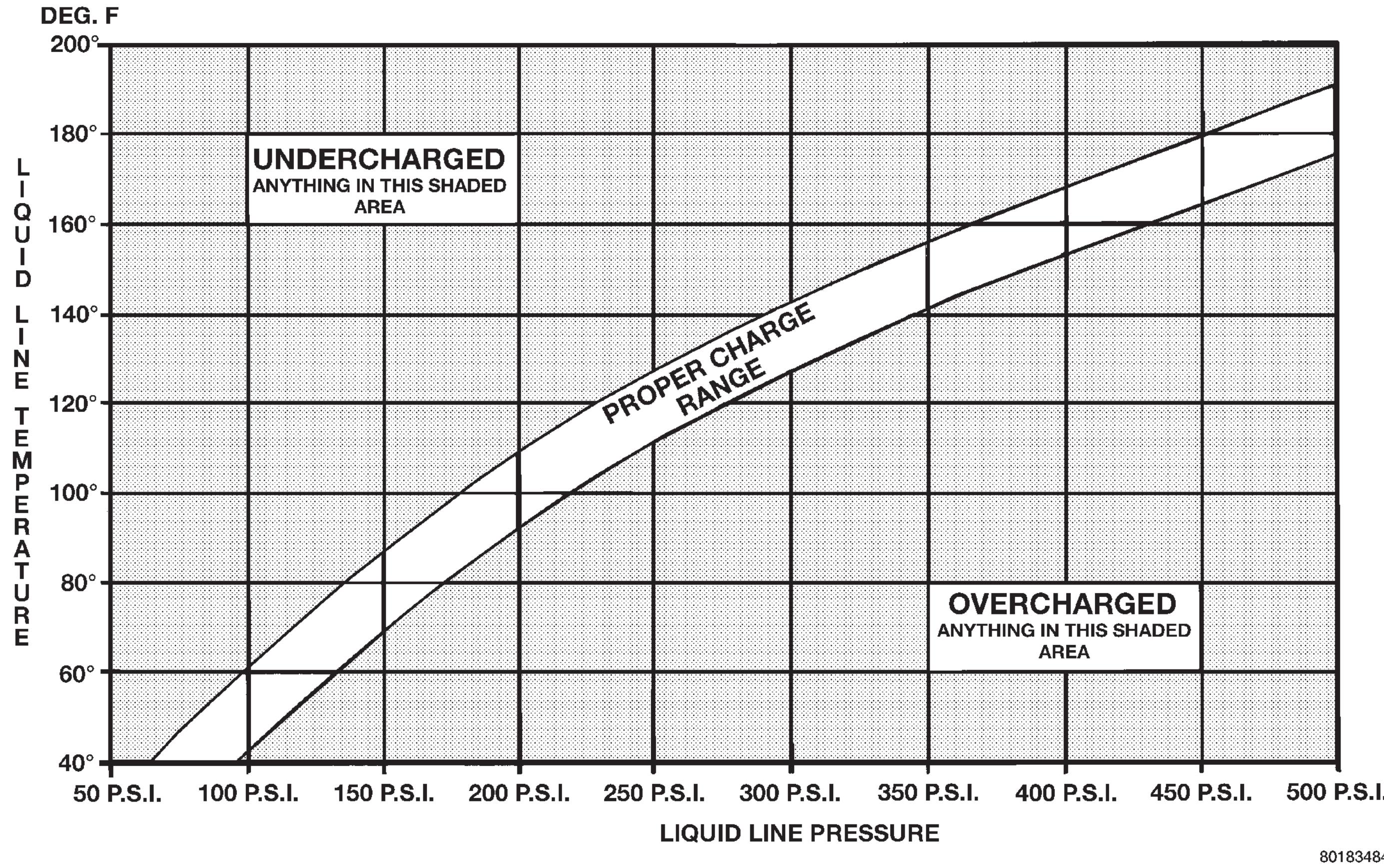
(4) Operate system for a couple of minutes to allow the system to stabilize.

(5) Set system pressure to about 1793 kPa (260 psi) by placing a piece of cardboard over part of the front side of the condenser. To place cardboard properly, remove the upper radiator-condenser cover. Insert cardboard between condenser and radiator front. This will maintain a constant pressure.

(6) Observe Liquid Line pressure and Liquid line temperature. Using the **Charge Determination Chart** determine where the system is currently operating. If the system is in the undercharged region, ADD 0.057 Kg. (2 oz.) to the system and recheck readings. If the system is in the overcharged region, RECLAIM 0.057 Kg. (2 oz.) from the system and recheck readings. Continue this process until the system readings are in the proper charge area on the **Charge Determination Chart**.

(7) The same procedure can be performed using the scan tool (DRB). To determine liquid line pressure, attach the scan tool, go to System Monitors–A/C Pressure. Observe liquid line pressure from A/C Pressure Transducer on digital display and digital thermometer. Refer to **Charge Determination Chart** and determine where the system is operating.

DIAGNOSIS AND TESTING (Continued)



Charge Determination Chart

SERVICE PROCEDURES

R-134a REFRIGERANT

This vehicle uses a new type of refrigerant called R-134a. It is a non-toxic, non-flammable, clear colorless liquefied gas.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 in a R-134a system could cause compressor failure, refrigerant oil to sludge and/or poor performance. **Never add any other type of refrigerant to a system designed to use R-134a refrigerant. System failure will occur.**

The high pressure service port is located on the liquid line near the strut tower. The low pressure service port is located on the suction line near the compressor manifold.

When servicing a system, it is required that an air conditioning charging recovery/recycling machine be used (Fig. 8). Contact an automotive service equipment supplier for proper equipment. Refer to the operating instructions provided with the equipment for proper operation.

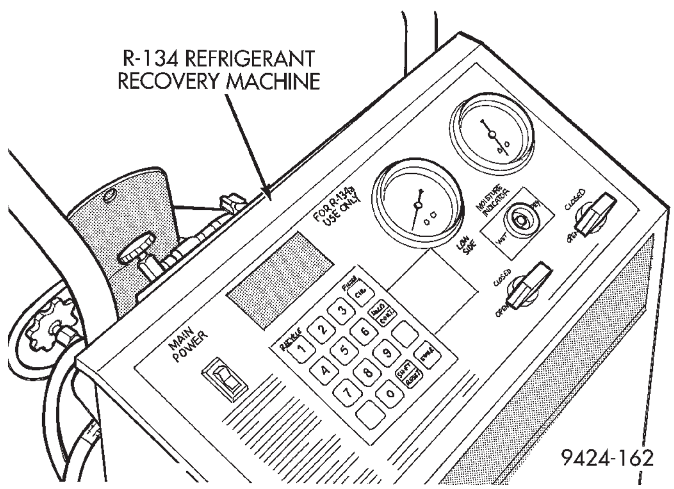


Fig. 8 Refrigerant Recovery/Recycling Station (Typical)

A manifold gauge set (Fig. 9) must also be used in conjunction with the charging and/or recovery/recycling device. Only use gauges that have not been used for R-12. The service hoses on the gauge set should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant R-134a from being released into the atmosphere.

R-134a refrigerant requires a special type of compressor oil. When adding oil, make sure to use the oil that is specified on the under hood label.

Due to the different characteristics of R-134a it requires all new service procedures.

SERVICE PROCEDURES (Continued)

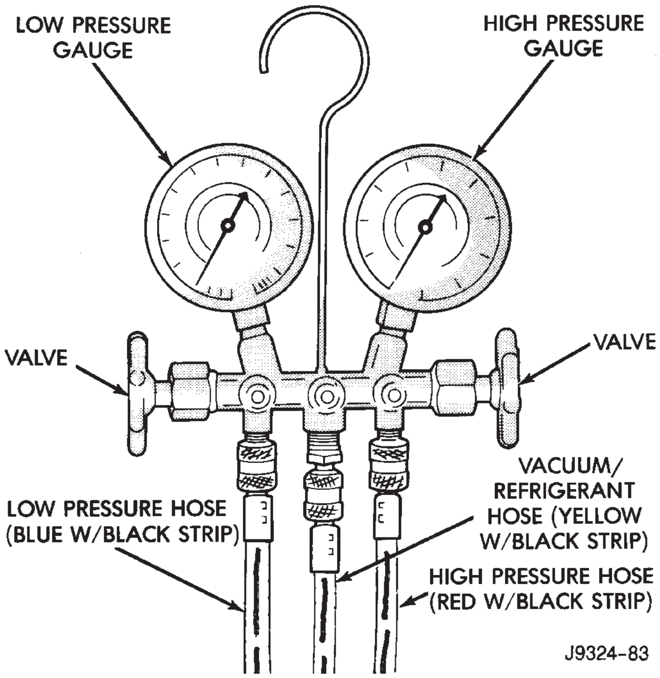


Fig. 9 Manifold Gauge Set- Typical

The use of R-134a will have a positive environmental impact due to it's zero ozone depletion and low global warming impact.

CHARGING REFRIGERANT SYSTEM

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.

(1) Connect manifold gauge set.

(2) Measure refrigerant 0.96 kg (34 oz. or 2.13 lb.) and heat to 52°C (125°F) with the charging station. Refer to the instructions provided with the equipment being used.

(3) Open the suction and discharge valves. Open the charge valve to allow the heated 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, run engine at a high idle (1400 rpm). Set the A/C control to A/C, low blower speed, and open windows. If the A/C compressor does not engage, test the compressor clutch control circuit and correct any failure. Refer to Group 8W, Wiring Diagrams.

(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.

EVACUATING REFRIGERANT SYSTEM

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.

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) Connect a suitable charging station, refrigerant recovery machine, or a manifold gauge set with vacuum pump to the service ports (Fig. 10).

(2) 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 45 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.

SERVICE PROCEDURES (Continued)

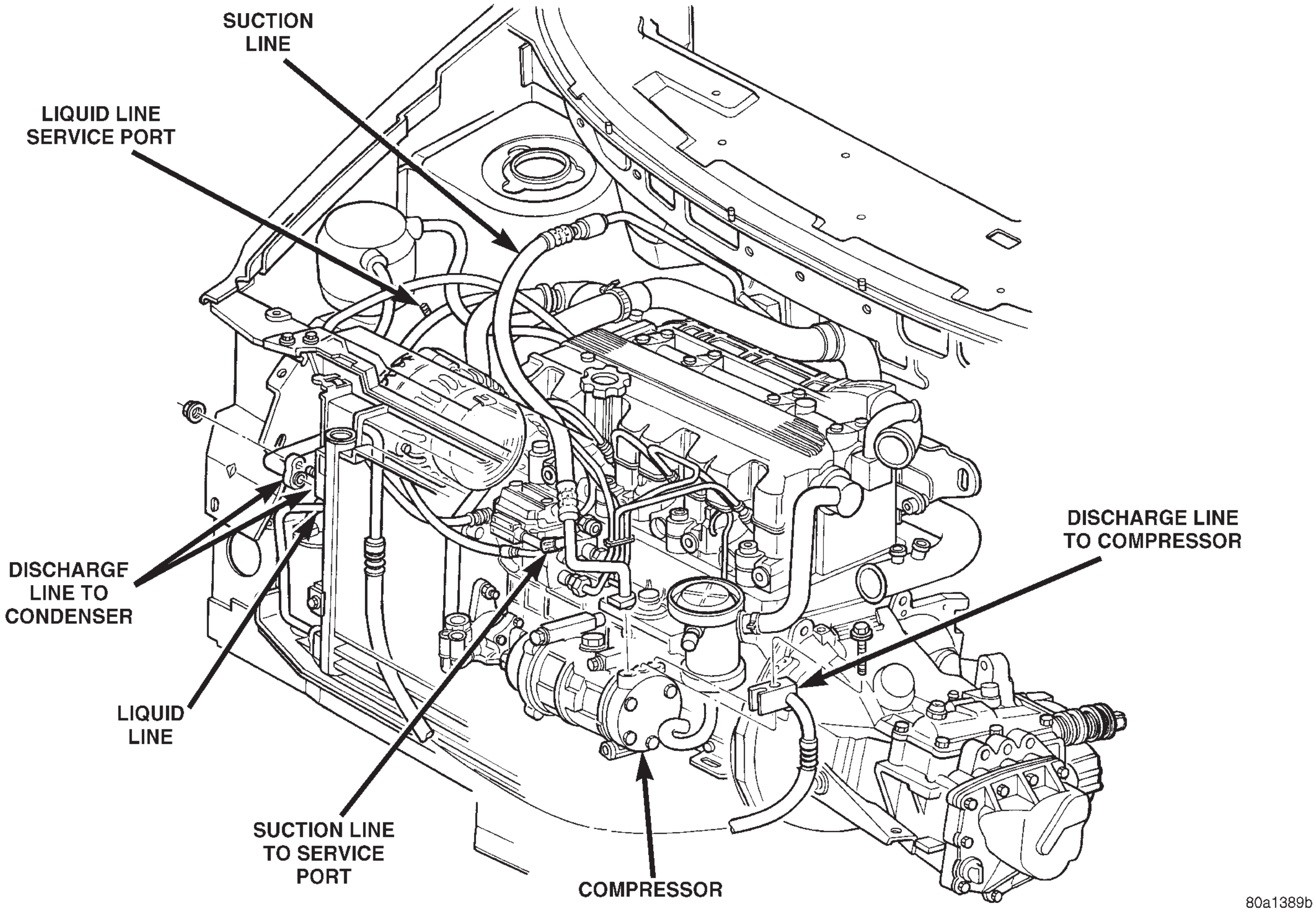


Fig. 10 Refrigerant Lines and Port Locations (2.5L Turbo Diesel engine)

(3) Close all valves. Turn off and disconnect the vacuum pump.

(4) The refrigerant system is prepared to be charged with refrigerant.

THERMOCOUPLE PROBE

To diagnose the A/C system, a temperature probe is required to measure liquid line temperature. The clamp-on type K probe shown in this manual is available through the Chrysler Professional Service Equipment (PSE) program. This probe is compatible with temperature-measuring instruments that accept Type K Thermocouples and have a miniature connector input. Other temperature probes are available through aftermarket sources. All references in this manual will reflect the use of the probe made available through the Professional Service Equipment program.

In order to use the temperature probe, a digital thermometer will be required. If a digital thermometer is not available, an adapter is available through the Professional Service Equipment program. It can convert any standard digital multimeter into a thermometer. This adapter is designed to accept any standard K-type thermocouple.

If a digital multimeter is not available, it to can be ordered through Professional Service Equipment program.

STICKING HVAC CONTROL MODULE PUSH BUTTONS

To service HVAC control module push buttons that are sticking, spray between the buttons with Mopar® MP-50. The MP-50 is a all purpose lubricant for mechanical and electrical uses. After spraying around the push buttons wipe any excess off the radio bezel and HVAC control module push buttons. Operate the buttons to ensure that they are operating freely.

SERVICE PROCEDURES (Continued)

SYSTEM LEAK CHECKING

WARNING: R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

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 207 kPa (30 psi) proceed to Empty Refrigerant System Leak Test. If liquid line pressure is greater than 207 kPa (30 psi) proceed to low refrigerant level leak test. 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.

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.

EMPTY REFRIGERANT SYSTEM LEAK TEST

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible (about 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 with this procedure.

(2) Prepare a .284 Kg. (10 oz.) refrigerant charge to be injected into the system.

(3) Connect and dispense .284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.

(4) Proceed to step two of Low Refrigerant Level Leak Test.

LOW REFRIGERANT LEVEL LEAK TEST

(1) Determine if there is any (R-134a) refrigerant in the system. Use the scan tool (DRB) under the menu Systems Sensors–A/C Pressure test or pressure gauge liquid line temperature partial charge check. See system charge level check or fill for procedure.

(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 system set to the following:

- Transaxle in Park
- Engine Idling at 700 rpm
- A/C Controls Set in 100 percent outside air
- Full Panel Mode
- Blower motor ON HIGH
- A/C in the ON position
- Front Windows Open.
- Rear Air Off (If Equipped)

CAUTION: A leak detector designed for R-12 refrigerant will not detect leaks in a R-134a refrigerant system.

(4) Shut off the vehicle and wait 2 to 7 minutes. Then use an Electronic Leak Detector that is designed to detect R-134a type refrigerant and search for leaks. Fittings, lines, or components that appear to be oily usually indicates a refrigerant leak. To inspect the evaporator core for leaks, insert the leak detector probe into the recirculating air door opening or a heat duct.

If a thorough leak check has been completed without indication of a leak, proceed to System Charge Level-Check or Fill.

REMOVAL AND INSTALLATION

A/C PRESSURE TRANSDUCER

REMOVAL

(1) Disconnect the wire connector at the pressure transducer.

(2) Using an open end wrench, remove the transducer from the liquid line (Fig. 11).

INSTALLATION

(1) Replace transducer O-ring.

(2) For installation, reverse the above procedures.

A/C SERVICE PORTS

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

The High Side service port is serviceable, the Low Side is not serviceable.

REMOVAL AND INSTALLATION (Continued)

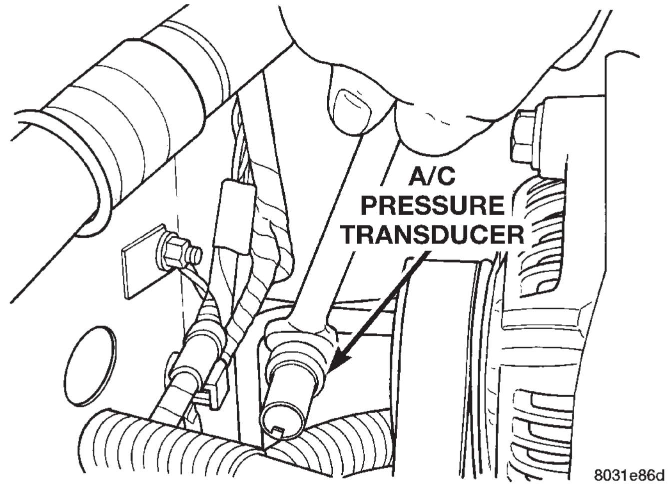


Fig. 11 A/C Pressure Transducer Removal

REMOVAL

(1) Disconnect the battery negative cable.
(2) Recover A/C system refrigerant.
(3) Unscrew the High Side service port from the liquid line.
(4) Remove O-ring

INSTALLATION

For installation, reverse the above procedures.
- **Install new O-ring.**
- Evacuate and recharge A/C system.

BLEND-AIR DOOR ACTUATOR

REMOVAL

The air conditioning system can be equipped with either a standard, single blend-air door actuator, or it can be equipped with dual actuators. The dual system has separate blend-air controls. This allows for separate control of the driver's side air, and the passenger side air (Fig. 12).

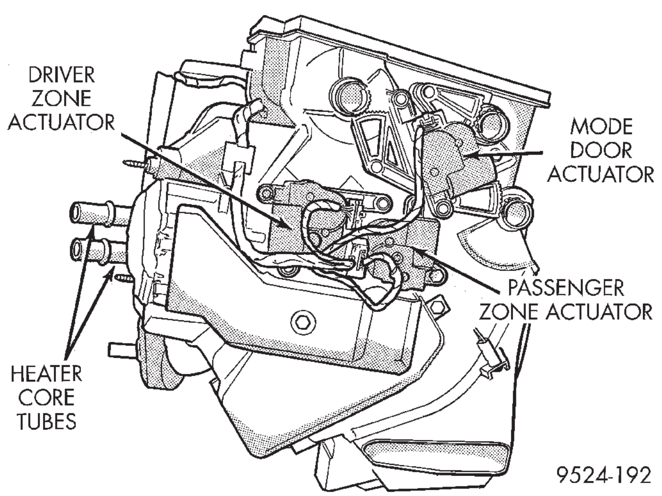


Fig. 12 Side View Of HVAC With Actuators

(1) Remove the lower left side steering column cover. Refer to Group 8E, Instrument Panel and Systems.
(2) Remove ABS control module (Fig. 13).

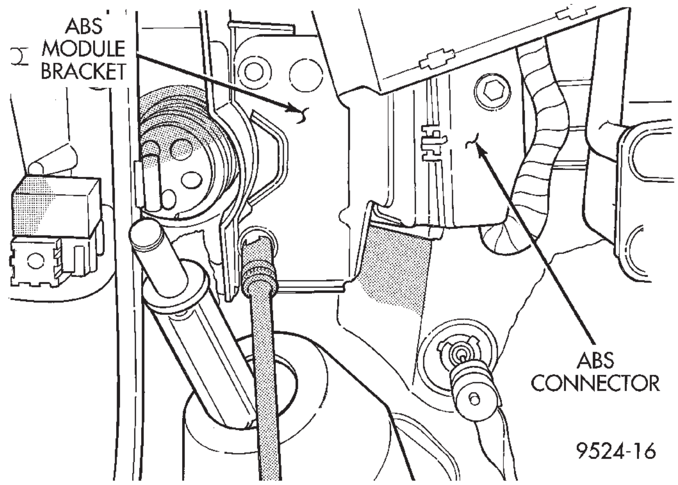


Fig. 13 ABS Control Module

(3) Remove blend-air actuator connector.
(4) Remove blend-air actuator (Fig. 14).

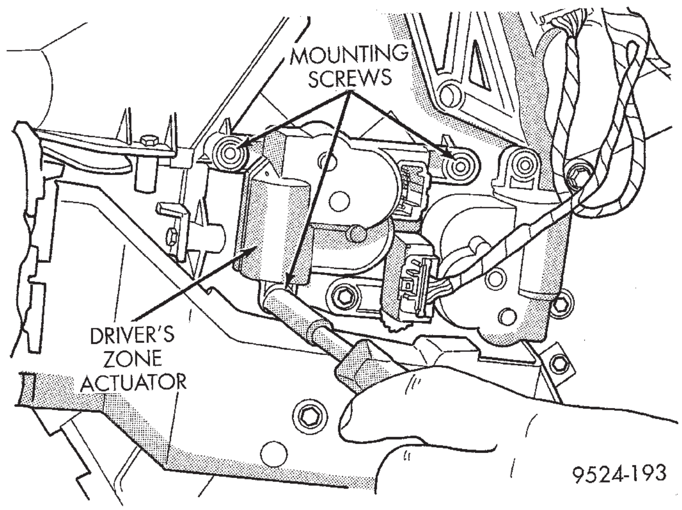


Fig. 14 Blend-Air Actuator

INSTALLATION

(1) For installation, reverse the above procedures.
(2) Perform the HVAC Control Calibration Diagnostic and Cooldown test. Repeating the test is necessary to clear the fault codes.

BLOWER MOTOR AND WHEEL ASSEMBLY

REMOVAL

(1) Remove glove box. Refer to Group 8E, Instrument Panel and Systems.
(2) Remove (4) hex head screws to blower motor cover (Fig. 15).
(3) Disconnect blower motor wiring.

REMOVAL AND INSTALLATION (Continued)

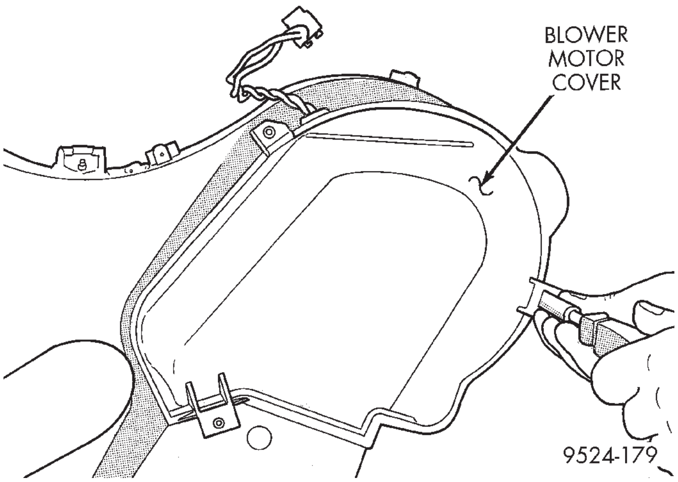


Fig. 15 Blower Motor Cover

(4) Remove grommet for wiring (Fig. 16). Feed wiring through blower housing (Fig. 17).

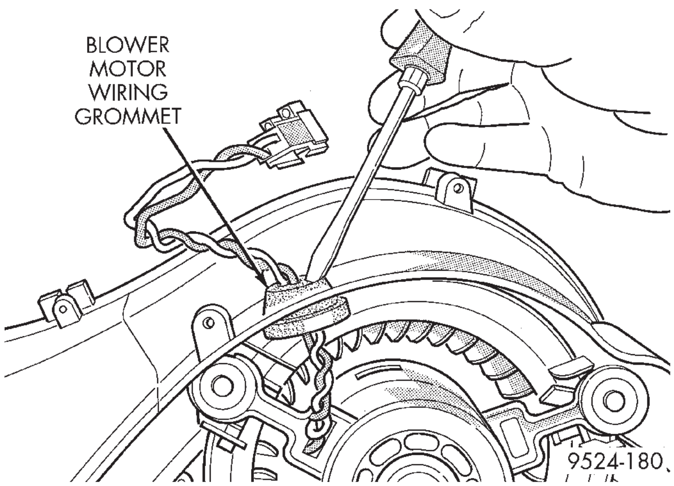


Fig. 16 Wiring Grommet

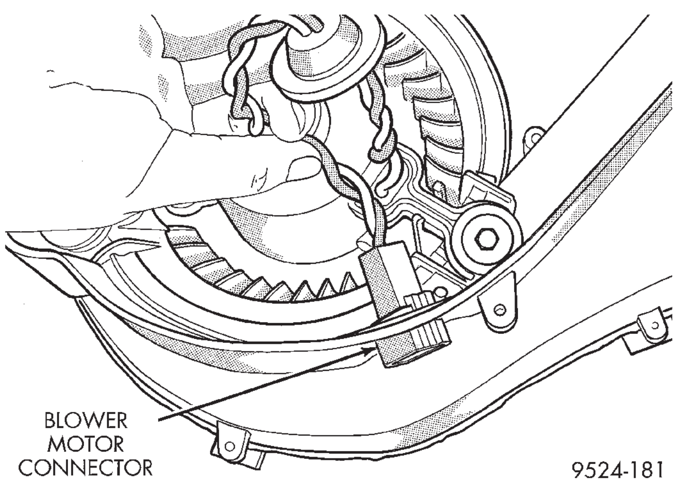


Fig. 17 Feeding Wiring Through Housing

(5) Remove mounting screws for blower motor (Fig. 18).

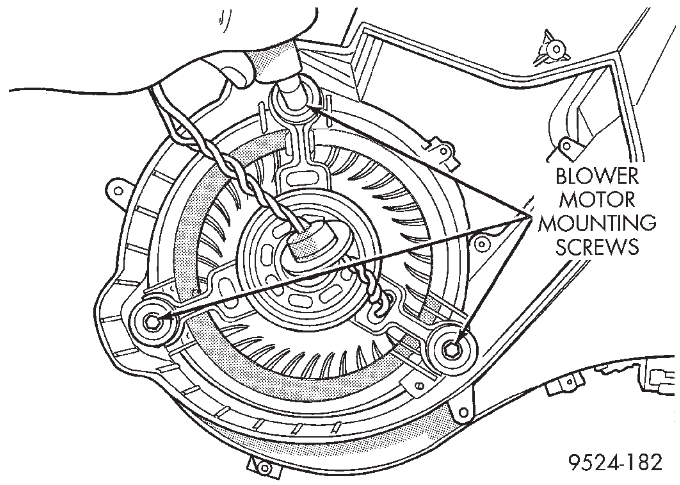


Fig. 18 Blower Motor Screws

(6) Allow the blower assembly to drop down, and remove assembly from vehicle.

INSTALLATION

For installation, reverse the above procedures.

BLOWER MOTOR RESISTOR BLOCK

REMOVAL

(1) Open hood.

(2) Locate and remove the wire connector from the blower resistor block. Block is located at the back of the engine compartment on the passenger side of the vehicle under the wiper module (Fig. 19).

NOTE: It is not necessary to remove the wiper module to access the resistor block.

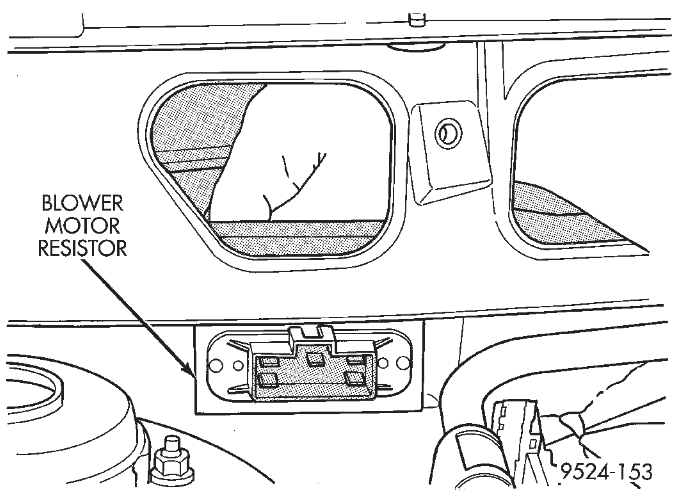


Fig. 19 Resistor Block Removal

WARNING: THE RESISTOR BLOCK MAY BE HOT. DO NOT ATTEMPT TO SERVICE THE RESISTOR BLOCK IF THE SYSTEM HAS BEEN RUNNING RECENTLY. LET THE SYSTEM COOL DOWN BEFORE REPAIRS ARE INITIATED.

REMOVAL AND INSTALLATION (Continued)

(3) Remove resistor block by inserting a flat blade pry tool on the side of the resistor block and pushing inward. Two guide lines are shown on the right hand edge of the resistor block to help guide the blade position. This will release the clips on the side of the resistor block. Pull resistor block out.

INSTALLATION

For installation, reverse the above procedures. Make sure the “TOP” lettering is on the top of the resistor. The coils on the Resistor Block should not be contacting one another. Before installation, gently separate the coils (with fingers only) if one coil is contacting another.

BLOWER MOTOR WHEEL

The blower motor wheel is not serviced separately. If the wheel needs to be replaced it is serviced as an assembly of the blower motor. For service procedure information, refer to Blower Motor Replacement in this group.

COMPRESSOR (2.5L TURBO DIESEL)

REMOVAL

WARNING: REFER TO REFRIGERANT SERVICE PROCEDURES FOR INFORMATION REGARDING PROPER RECOVERY OF THE REFRIGERANT BEFORE ATTEMPTING TO REMOVE THE COMPRESSOR.

(1) Disconnect negative battery cable.
(2) Reclaim refrigerant.
(3) Raise vehicle on hoist.
(4) Remove refrigerant lines from compressor and cap all lines (Fig. 10).
(5) Remove flex drive bolts from behind the power steering pump (Fig. 20).
(6) Remove compressor mounting bolts (Fig. 20).
(7) pry compressor off of the dowel pins and remove compressor.

INSTALLATION

(1) Transfer mounting spacer/bushings onto the new compressor.
(2) Lift compressor into place and start compressor mounting bolts. Do not tighten bolts at this time. The compressor may have to be moved slightly to align the flex drive bolts.
(3) Align compressor clutch with flex drive. Then start both flex drive bolts. Tighten the bolts after both flex drive bolts have been installed.
(4) Tighten compressor mounting bolts.
(5) Lower vehicle and install refrigerant lines. Always replace O-rings and gaskets.
(6) Evacuate refrigerant system. Charge system with the correct amount of R-134a refrigerant. The refrigerant capacity is .91 kg. ± 7 gm. (32 oz. ± 2.0 oz.).

REMOVAL AND INSTALLATION (Continued)

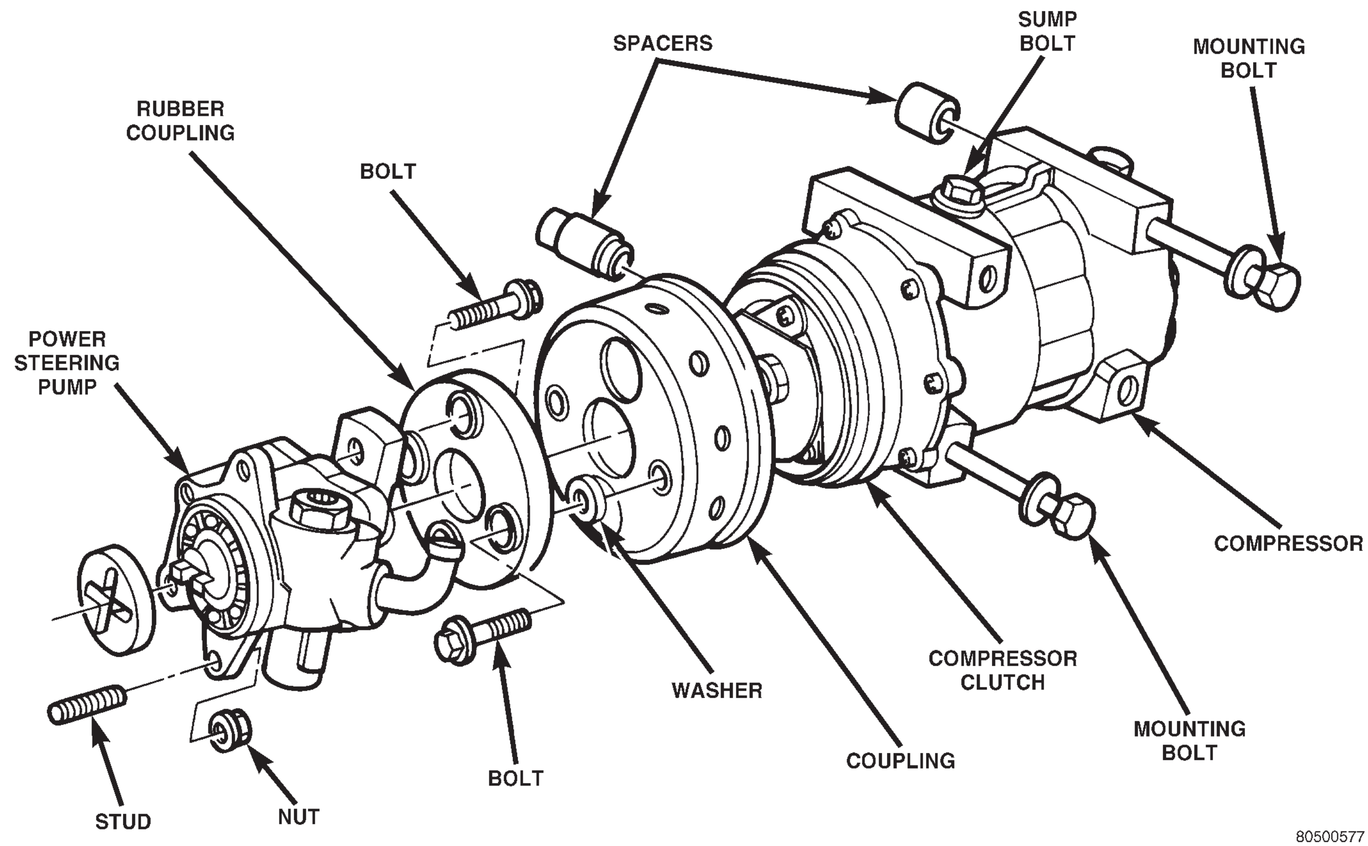


Fig. 20 Compressor Components (2.5L Turbo Diesel)

CONDENSER ASSEMBLY

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

NOTE: 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.

REMOVAL

(1) Recover A/C system refrigerant.
(2) Remove liquid line at filter-drier (Fig. 21).
(3) Remove (2) nuts attaching filter-drier to radiator module.
(4) Remove upper radiator crossmember.
(5) Tilt radiator rearward.
(6) Remove upper discharge line at condenser (Fig. 10).
(7) Through fascia, remove lower liquid line from filter-drier.
(8) Remove (2) lower condenser mounting bolts.
(9) Remove (2) upper mounting bolts.
(10) Remove condenser from vehicle (Fig. 22).

INSTALLATION

NOTE: Inspect Cooling Module for presence of seals. Verify seals are available for re-installation.

(1) Before installation, replace all O-rings and gaskets, coat all sealing surfaces with approved wax-free refrigerant oil. Then reverse the above procedures.
(2) Evacuate and charge system.

DISCHARGE LINE

REMOVAL

(1) Recover A/C system refrigerant.
(2) Remove discharge line mounting nut at compressor (Fig. 10).
(3) Remove discharge line at the top fitting on the condenser (Fig. 23).

INSTALLATION

(1) For installation, reverse the above procedures. Replace all O-rings.
(2) Evacuate and recharge A/C system.
(3) Perform the HVAC Control Calibration Diagnostic and Cooldown test.

REMOVAL AND INSTALLATION (Continued)

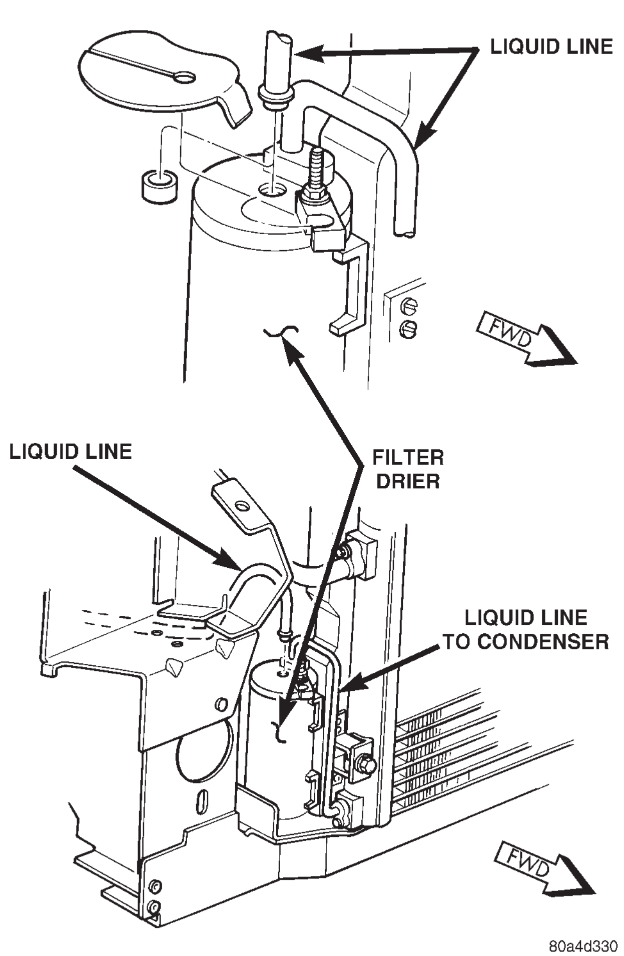


Fig. 21 Filter-Drier

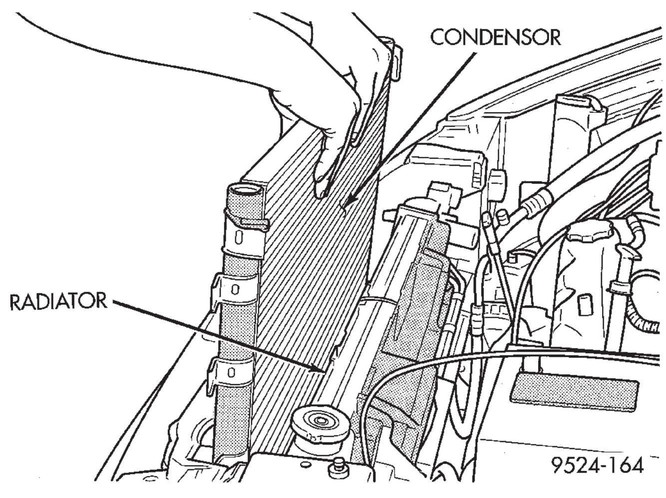


Fig. 22 Condenser Removal

EVAPORATOR PROBE

REMOVAL

(1) Remove the glove box. Refer to Group 8E, Instrument Panel and Systems.

(2) Disconnect the evaporator probe connector (Fig. 24).

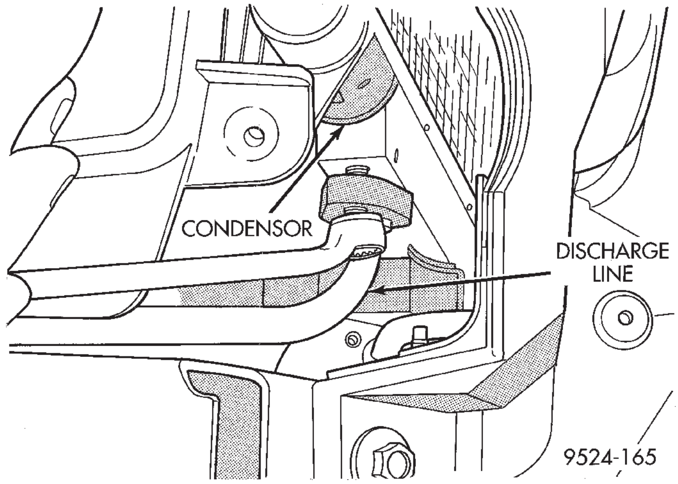


Fig. 23 Condenser Discharge Line

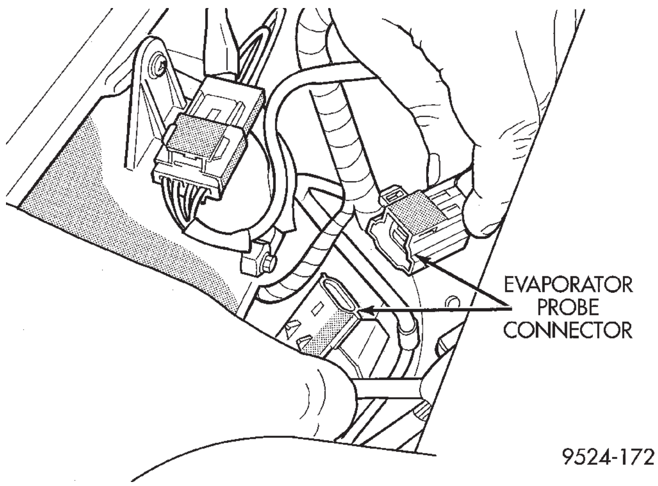


Fig. 24 Evaporator Probe Connector

(3) Using a flat blade pry tool, pry the evaporator probe grommet from the HVAC housing (Fig. 25).

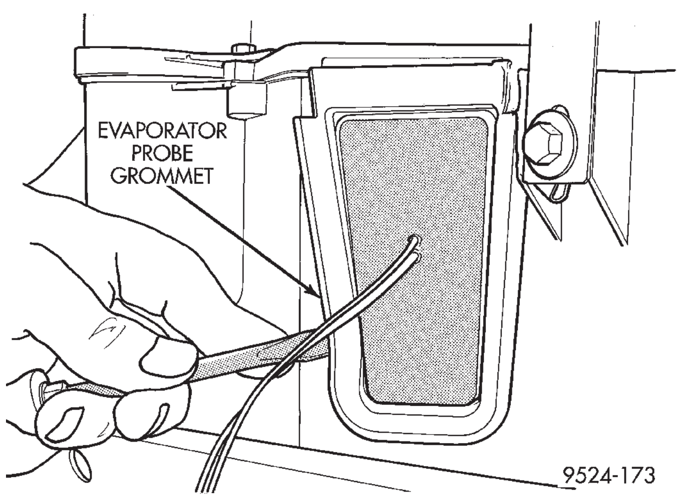


Fig. 25 Evaporator Probe Grommet

(4) Remove evaporator probe from evaporator (Fig. 26).

REMOVAL AND INSTALLATION (Continued)

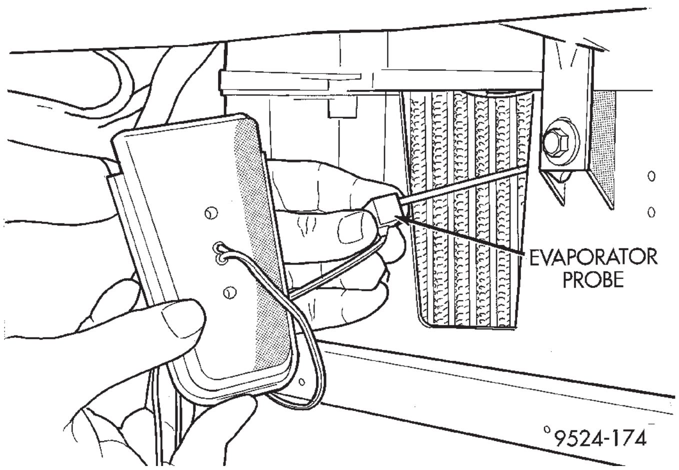


Fig. 26 Evaporator Probe

INSTALLATION

For installation, reverse the above procedures. Three holes are provided in evaporator for probe location. When reinstalling probe, use a different hole than original one. If a new evaporator is installed, insert the probe in the uppermost hole provided.

EXPANSION VALVE

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

REMOVAL

(1) Disconnect the battery negative cable.
(2) Recover A/C system refrigerant.
(3) Remove the accessory drive belt.
(4) Remove upper generator bracket.
(5) Disconnect generator field wire connector.
(6) Push generator forward.
(7) Remove ground wire at dash panel.
(8) Remove the nut retaining the refrigerant line sealing plate to the expansion valve (Fig. 27).
(9) Remove the stud from the expansion valve (Fig. 28).
(10) Carefully pull the refrigerant line sealing plate assembly from expansion valve towards the front of the vehicle. Use care not to scratch the expansion valve sealing surfaces with pilot tubes.
(11) Cover the openings to prevent contamination.
(12) Remove two screws securing the expansion valve to the evaporator sealing plate (Fig. 28).
(13) Carefully remove expansion valve (Fig. 29).
(14) Remove the old O-rings.

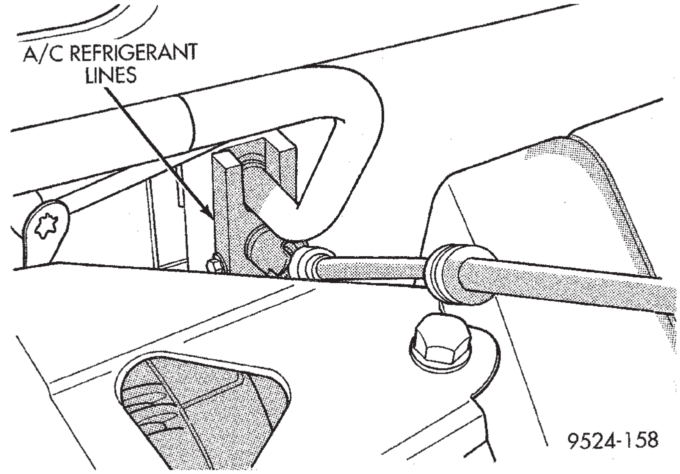


Fig. 27 A/C Refrigerant Line Plate

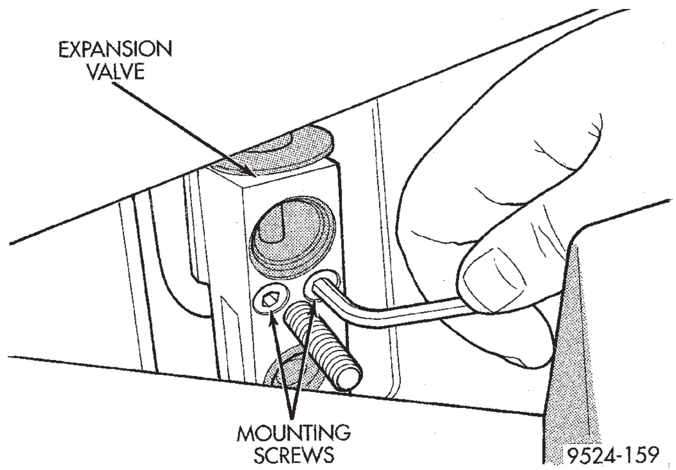


Fig. 28 Expansion Valve Stud and Mounting Screws

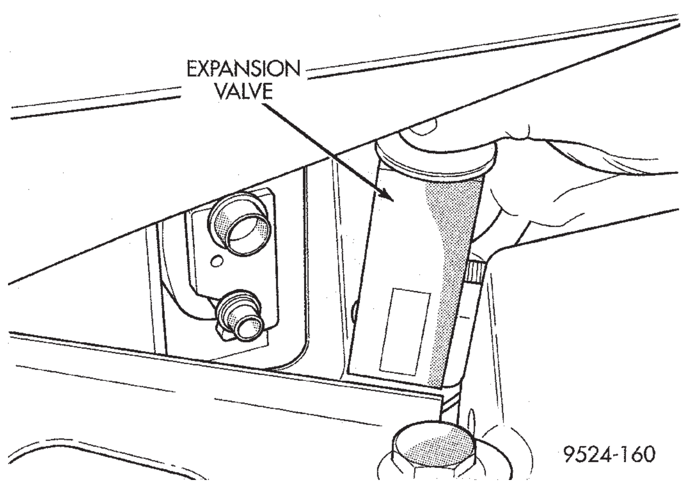


Fig. 29 Expansion Valve Removal

INSTALLATION

(1) Ensure old O-rings are removed. Install new O-rings on the refrigerant lines and evaporator sealing plate.

REMOVAL AND INSTALLATION (Continued)

(2) Hand-start the stud into the expansion valve and torque to 7 - 11 N·m (64 - 96 in. lbs.).

(3) Carefully install the expansion valve to the sealing plate. Install the two screws and tighten 8 to 14 N·m (70 to 130 in. lbs.) torque.

(4) Carefully install the refrigerant lines and sealing plate to the expansion valve. Install the nut and tighten 20 to 26 N·m (170 to 230 in. lbs.) torque.

(5) Install the ground wire at dash panel.

(6) Pull generator back into the proper position for bracket mounting.

(7) Install generator field wire connector.

(8) Install the upper generator bracket.

(9) Install accessory drive belt.

(10) Evacuate and recharge system.

(11) After expansion valve is installed, the system is charged, and leaks have checked repeat the A/C performance check.

FILTER-DRIER ASSEMBLY

REMOVAL

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

(1) Recover A/C system refrigerant.

(2) Remove liquid line at filter-drier (Fig. 21).

(3) Remove the (2) bolts holding filter-drier bracket to radiator fan module bracket.

(4) Remove the lower liquid line at condenser.

(5) Remove the upper radiator crossmember.

(6) Pull up on radiator and slide filter-drier from the mounting location.

INSTALLATION

(1) Before installation, replace both refrigerant line O-rings. Then reverse the above procedures.

(2) Evacuate and recharge system.

HEATER A/C UNIT HOUSING

REMOVAL

WARNING: IF EQUIPPED WITH AIR CONDITIONING, THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING.

(1) Set parking brake.

(2) Disconnect battery negative cable.

(3) Using a refrigerant recovery machine, remove refrigerant from the A/C system.

(4) Remove wiper module. Refer to Group 8K, Windshield Wipers and Washers.

(5) Drain engine coolant. Remove heater hoses at the heater core, refer to Heater Hoses Removal and Installation procedures. Plug coolant lines.

(6) Remove suction and liquid lines at the expansion valve (Fig. 27).

(7) Remove the Instrument Panel Assembly. Refer to Group 8E, Instrument Panel and Systems.

(8) Remove heater ducts.

(9) Disconnect the two upper mounts from the upper reinforcement and the lower mount from the tunnel.

(10) Remove the (3) nuts (in the engine compartment) securing the unit to the dash panel (Fig. 30).

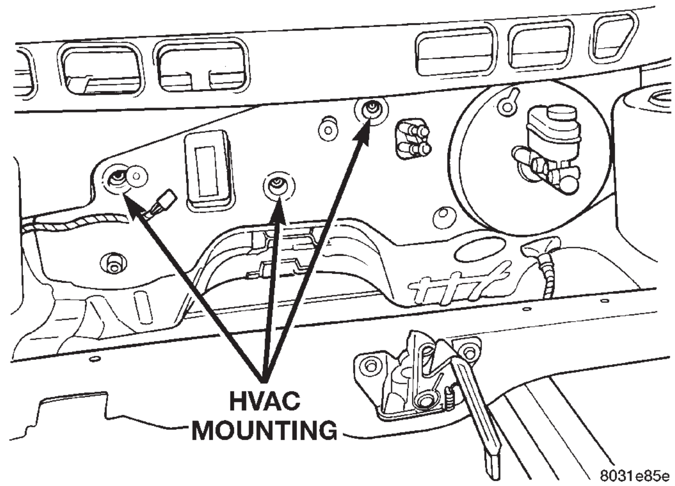


Fig. 30 HVAC Bolt-Up

(11) Disconnect the HVAC housing wiring harness.

(12) Pull the entire unit rearward until the studs on the unit clear the dash panel. Drop the unit down. Pull it rearward to remove it from vehicle.

INSTALLATION

(1) For installation of the assembly, reverse the above procedures. Install new O-rings on plumbing inlets

(2) Evacuate and recharge the A/C system.

(3) Perform HVAC control Calibration Diagnostic and Cooldown test.

HEATER CORE

REMOVAL

(1) Drain coolant system.

(2) Remove left side lower column cover.

(3) Remove steering column assembly. Refer to Group 19, Steering for service procedure.

(4) Remove ABS module, bracket and wiring (Fig. 31).

(5) Remove I/P to body harness interconnect and bracket (Fig. 32).

(6) Remove lower silencer boot at base of steering shaft (Fig. 33)

(7) Pinch off heater lines under the hood.

REMOVAL AND INSTALLATION (Continued)

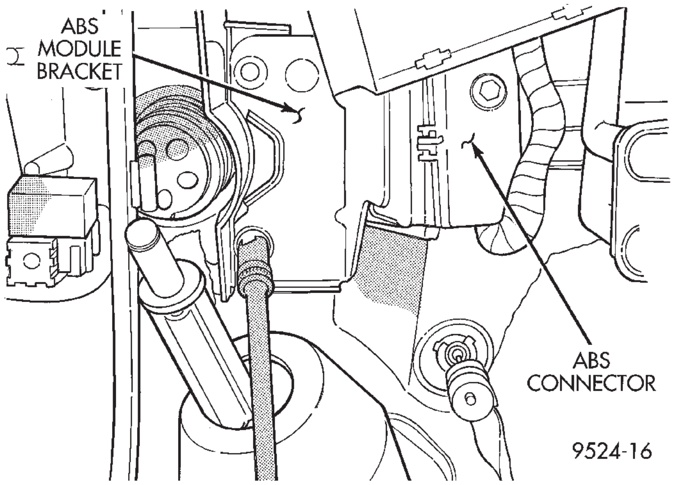


Fig. 31 ABS MODULE

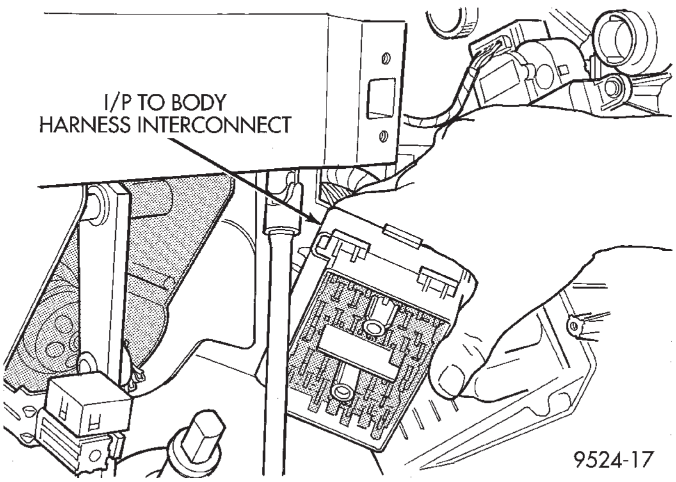


Fig. 32 Interconnect And Bracket

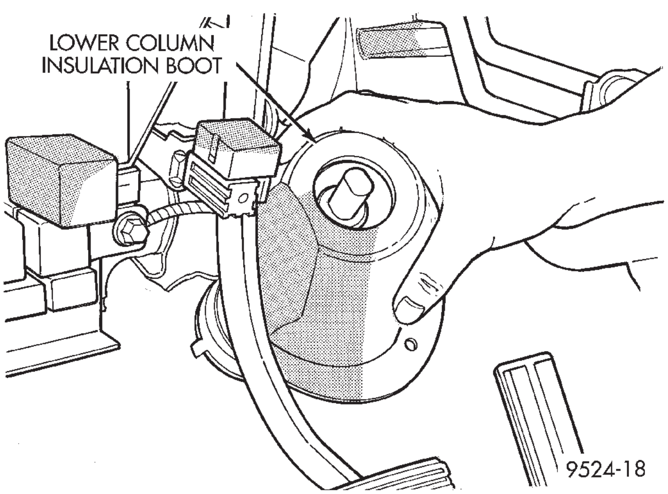


Fig. 33 Lower Silencer Boot

(8) Remove heater core cover. Insert a small amount of towels under the heater core tubes. Remove heater core plate and tubes (Fig. 34).

(9) Depress heater core retaining clips (Fig. 35).

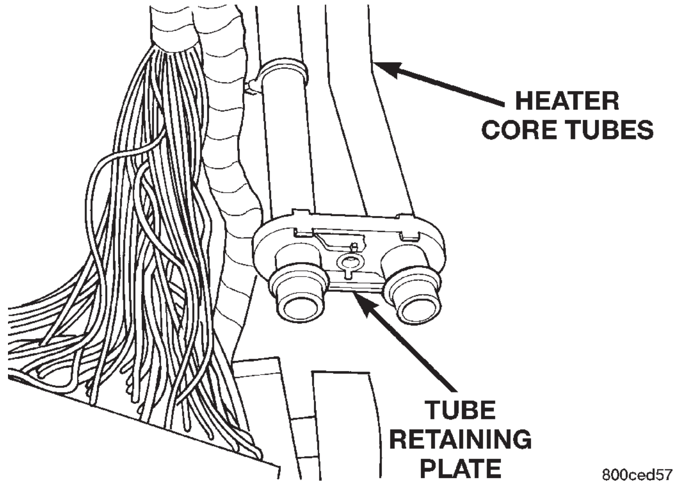


Fig. 34 Heater Core Plate And Tubes

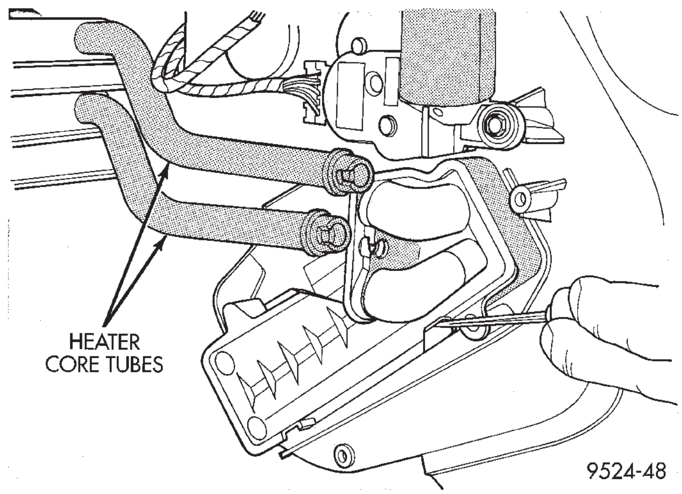


Fig. 35 Depress Clips

(10) Pull up on accelerator pedal and slide heater core past (Fig. 36).

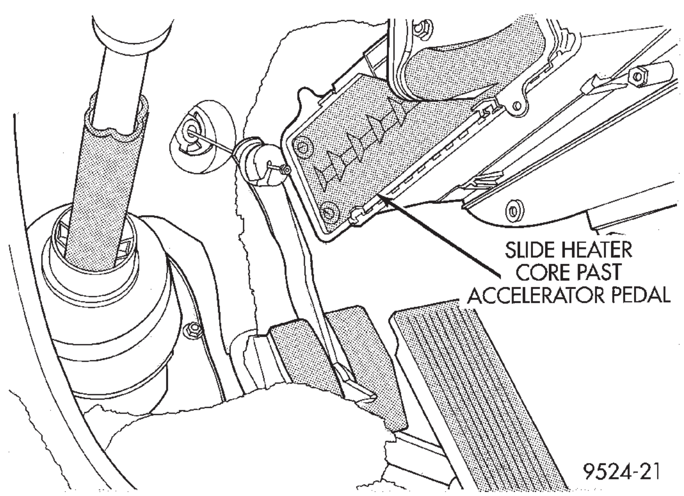


Fig. 36 Accelerator Pedal

(11) Depress brake pedal (Fig. 37) and remove heater core from HVAC housing.

REMOVAL AND INSTALLATION (Continued)

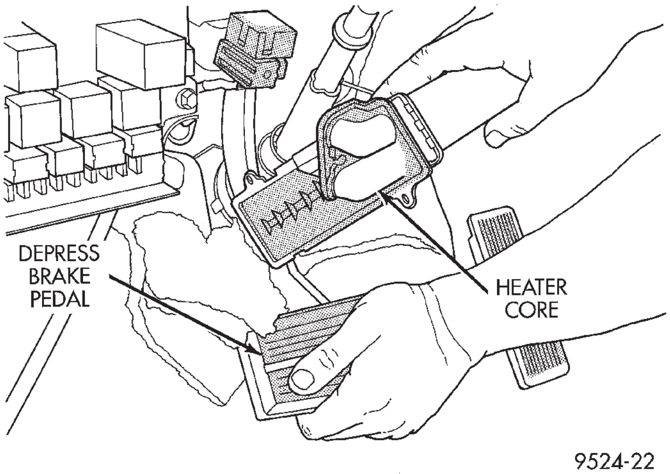


Fig. 37 Brake Pedal

INSTALLATION

For installation, reverse the above procedures. Install screws to retain heater core in housing. Replace heater core tube inlet O-rings. Tighten heater core tube retaining plate to 3 ± 1 N·m (27 ± 9 in. lbs.) torque.

HEATER HOSES

REMOVAL

NOTE: Review Safety Precautions and Warnings before proceeding with this operation.

(1) Drain engine cooling system. Refer to Group 7, Engine Cooling.

(2) Loosen clamps at each end of heater hose to be removed (Fig. 38) and (Fig. 39).

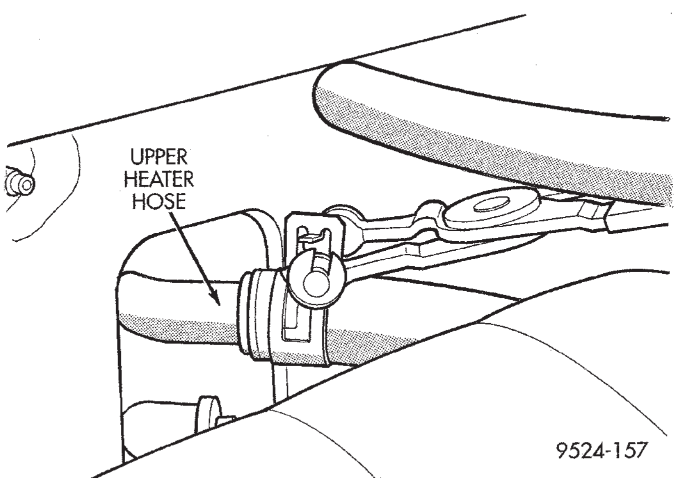


Fig. 38 Upper Heater Hose

CAUTION: When removing hoses from heater core inlet or outlet nipples, do not use excessive force. Heater core may become damaged and leak engine coolant.

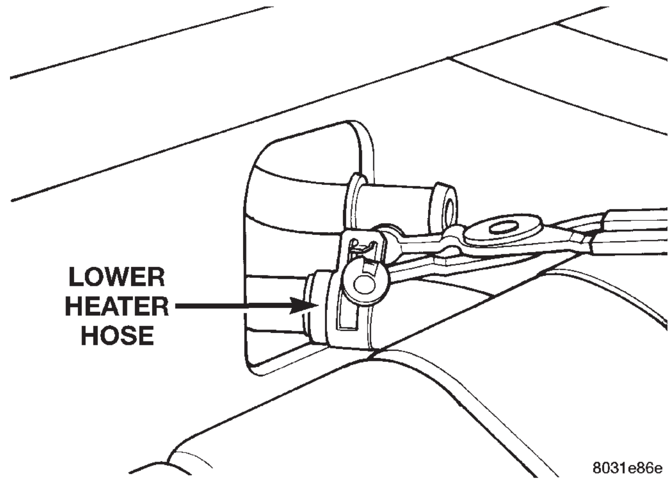


Fig. 39 Lower Heater Hose

(3) Carefully rotate hose back and forth while tugging slightly away from connector nipple. If the hose will not come off, slice the hose at the connector nipple and peel off heater hose. This method will require heater hose replacement.

INSTALLATION

For installation, reverse the above procedures.

LIQUID LINE

REMOVAL

(1) Disconnect the battery negative cable.

(2) Recover A/C system refrigerant.

(3) Remove ground wire at dash panel.

(4) Remove the nut retaining the refrigerant line sealing plate to the expansion valve (Fig. 27).

(5) Remove the stud from the expansion valve (Fig. 28).

(6) Remove liquid line from expansion valve.

(7) Cover the openings to prevent contamination.

(8) Disconnect wire connector at pressure transducer.

(9) Remove liquid line mounting clip at right strut tower.

(10) Using access slot between radiator crossmember and grille, loosen liquid line mounting plate at filter-drier. Remove liquid line from filter-drier.

(11) Remove the old O-rings.

INSTALLATION

For installation, reverse the above procedures.

- Install the stud to the evaporator sealing plate and tighten 7 to 11 N·m (64 to 96 in. lbs.) torque.
- **Install new O-rings.**
- Install two-piece line in place of original part.
- Assemble line halves after it is installed on vehicle.
- Evacuate and recharge A/C system.

REMOVAL AND INSTALLATION (Continued)

MODE DOOR ACTUATOR

REMOVAL

(1) Remove the lower left side steering column cover. Refer to Group 8E, Instrument Panel and Systems.

(2) Remove ABS control module (Fig. 40).

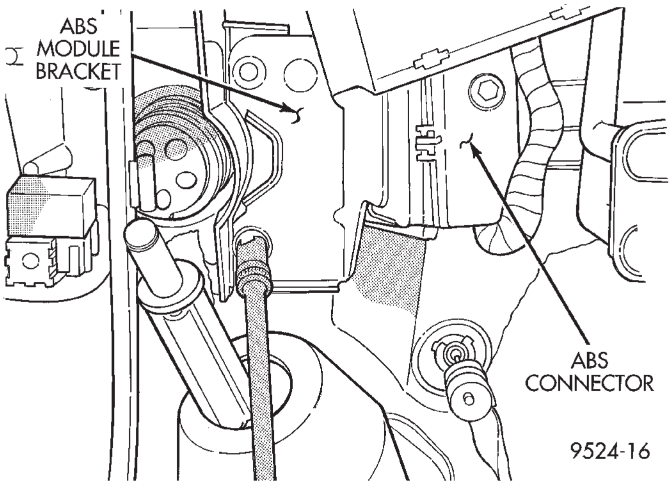


Fig. 40 ABS Control Module

(3) Remove mode actuator connector (Fig. 41).

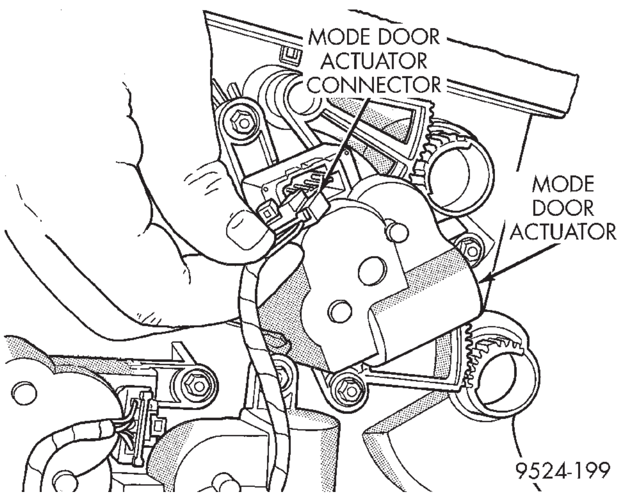


Fig. 41 Mode Door Actuator Connector

(4) Remove mode door actuator (Fig. 42).

INSTALLATION

(1) For installation, reverse the above procedures.

(2) Perform the HVAC control Calibration Diagnostic and Cooldown test.

SIDE WINDOW DEMISTER DUCTS

LEFT SIDE

The LEFT side window demister duct is a two piece design. The left side has a long duct that attaches to an intermediate duct and then to the distribution housing. The duct is located on top of the instrument panel. To service the duct, remove the I/P cover and remove duct retainers/fasteners. (Fig. 43).

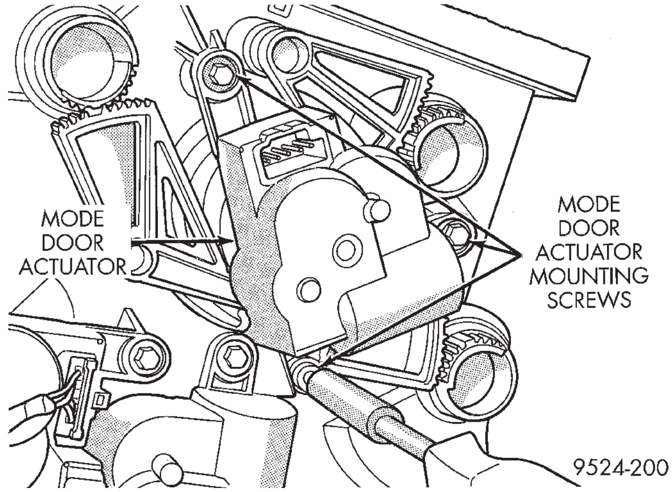


Fig. 42 Mode Door Actuator

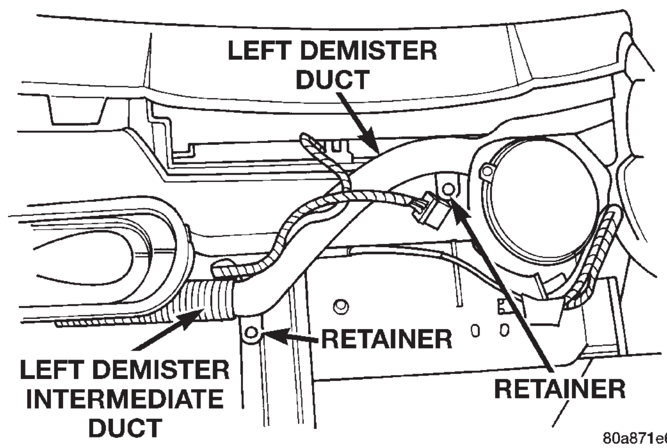


Fig. 43 Left Side Demister Duct

RIGHT SIDE

The demister duct on the right side is a one piece design. It is one long duct that attaches to the distribution housing. The duct is located on top of the instrument panel and it is not serviceable (Fig. 44).

SUCTION LINE

REMOVAL

(1) Disconnect the battery negative cable.

(2) Recover A/C system refrigerant.

(3) Remove ground wire at dash panel.

(4) Remove the nut retaining the refrigerant line sealing plate to the expansion valve (Fig. 27).

(5) Remove the stud from the expansion valve (Fig. 28).

(6) Remove suction line from expansion valve.

REMOVAL AND INSTALLATION (Continued)

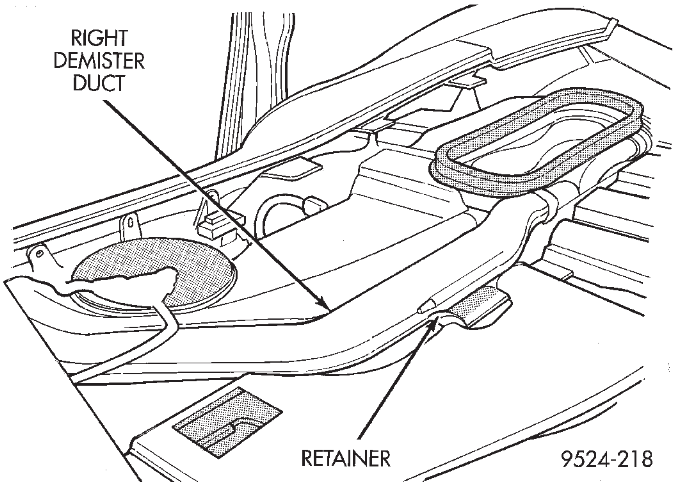


Fig. 44 Right Side Demister Duct

(7) Remove suction line mounting nut at compressor (Fig. 10).

(8) Remove suction line mounting bracket.

(9) Remove suction line.

INSTALLATION

For installation, reverse the above procedures.

- Install the stud to the evaporator sealing plate and tighten 7 to 11 N·m (64 to 96 in. lbs.) torque.
- **Install new O-rings.**
- Install two-piece line in place of original part.
- Assemble line halves after it is installed on vehicle.
- Evacuate and recharge A/C system.

RECIRC DOOR ACTUATOR

REMOVAL

(1) Pull back on carpeting on the right lower floor.

(2) Remove Recirc. door actuator connector.

(3) Remove (3) mounting screws for Recirc. actuator (Fig. 45).

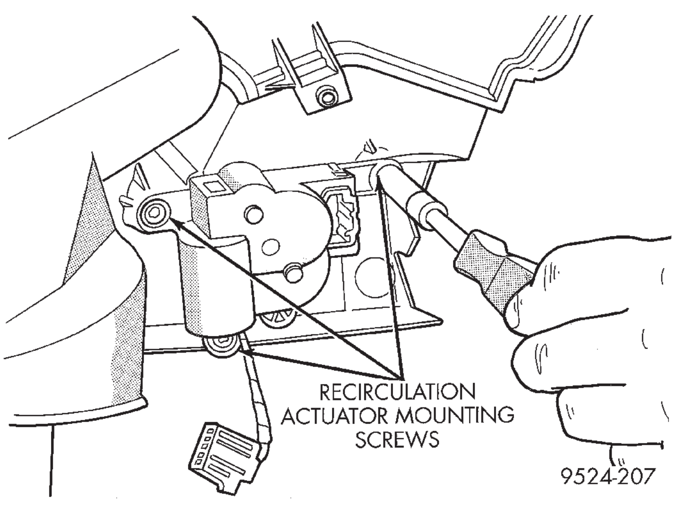


Fig. 45 Recirculation Door Actuator

(4) Remove Recirc. actuator.

(5) Disengage actuator linkage at Recirc. door.

(6) Remove actuator from vehicle.

INSTALLATION

(1) For installation, reverse the above procedures.

(2) Perform the HVAC control Calibration Diagnostic and Cooldown test.

DISASSEMBLY AND ASSEMBLY

HEATER A/C UNIT RECONDITION

Heater A/C Housing must be removed from vehicle before performing this operation. Refer to Heater A/C Unit Housing—Removal and Installation.

DISASSEMBLY—EVAPORATOR HOUSING

(1) Place HVAC unit assembly on workbench.

(2) Remove distribution housing mounting screws (Fig. 46).

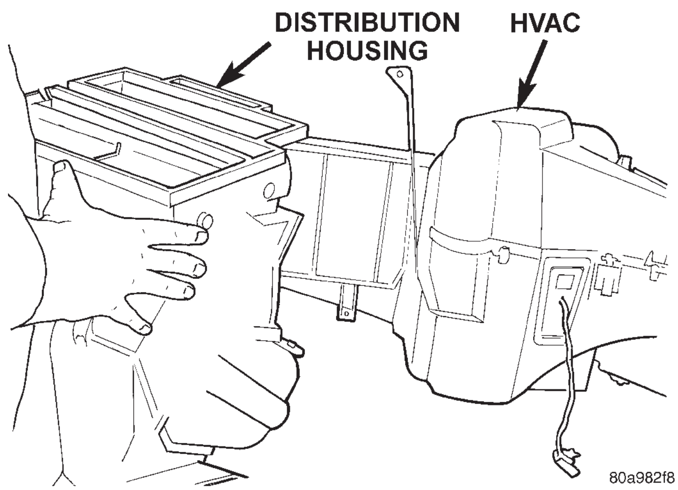


Fig. 46 Distribution Housing

(3) Remove blower motor cover (Fig. 47).

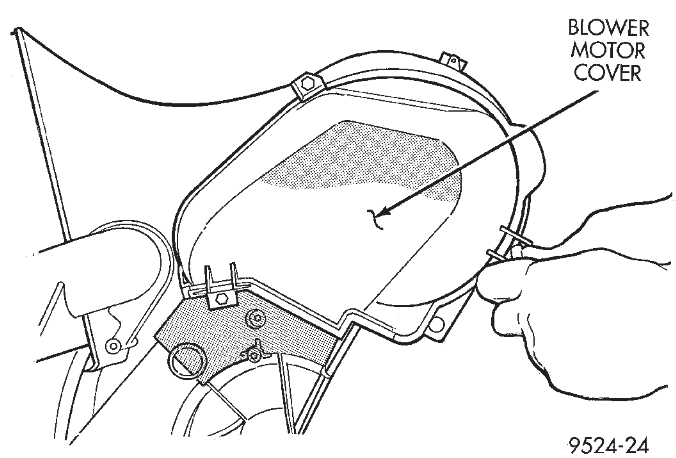


Fig. 47 Blower Motor Cover

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Remove blower motor wiring grommet and feed wiring through blower housing (Fig. 48).

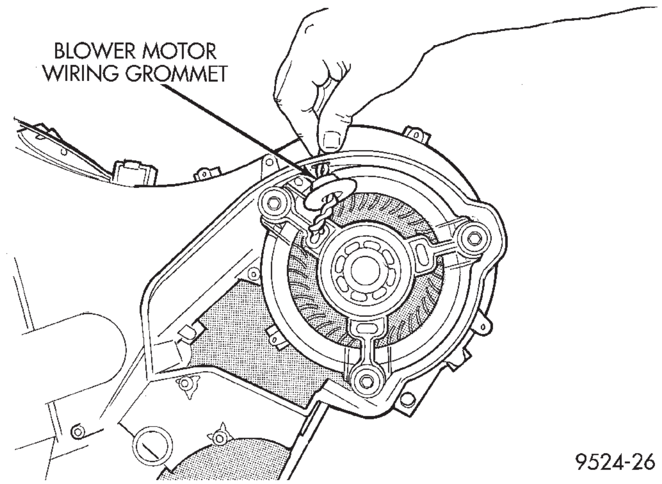


Fig. 48 Blower Motor Grommet

(5) Remove blower motor screws. Remove blower motor from housing (Fig. 49) and (Fig. 50).

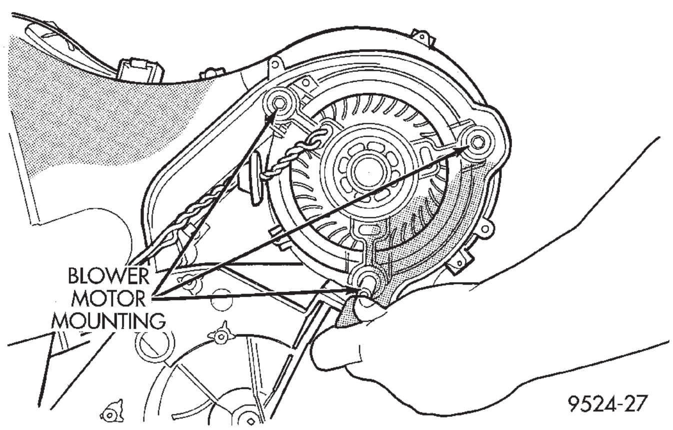


Fig. 49 Blower Motor Screws

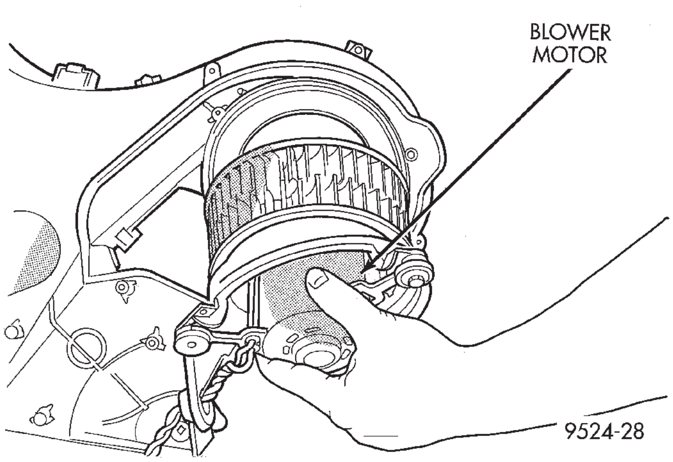


Fig. 50 Blower Motor

(6) Remove recirculation door cover (Fig. 51).

(7) Remove Recirc. door (Fig. 52).

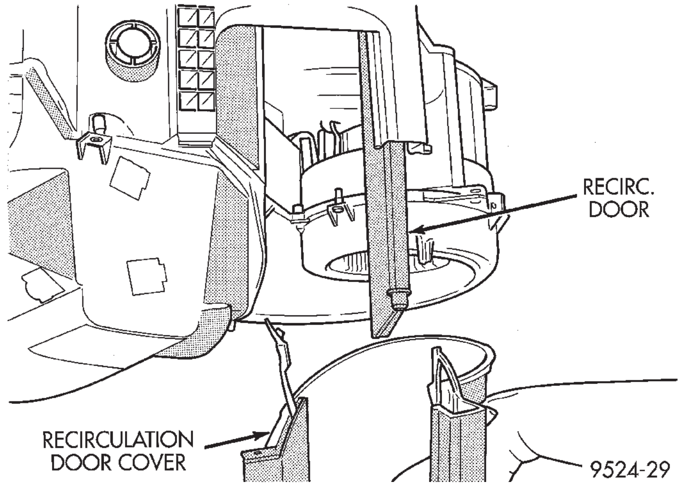


Fig. 51 Recirculation Door Cover

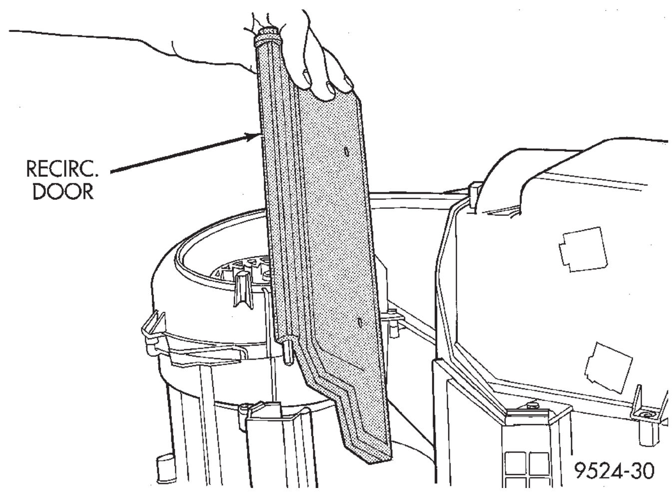


Fig. 52 Recirc. Door

(8) Remove screws around the perimeter of the upper HVAC housing (Fig. 53).

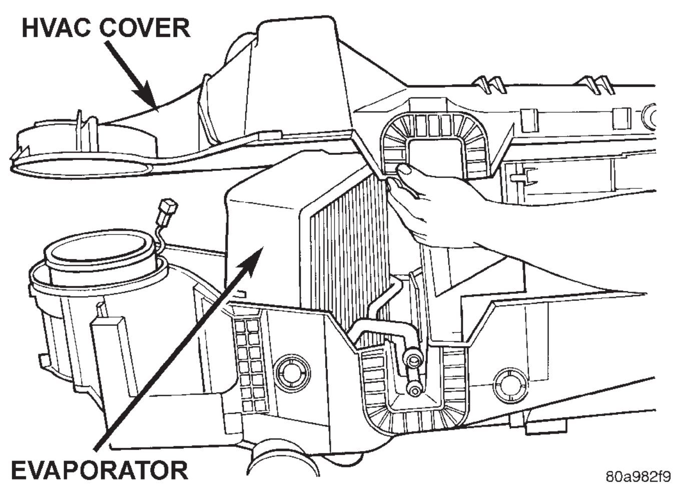


Fig. 53 HVAC Cover

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Do not damage the insulation barrier surrounding the evaporator.

(9) Carefully pull up on evaporator and remove from housing (Fig. 54).

(10) If replacing evaporator, drain and measure amount of oil from old evaporator and add new oil of the same amount (ND8 PAG) to the new evaporator before installing. Use SP 10 PAG oil for 2.5L diesel and 2.0L gasoline engine vehicles.

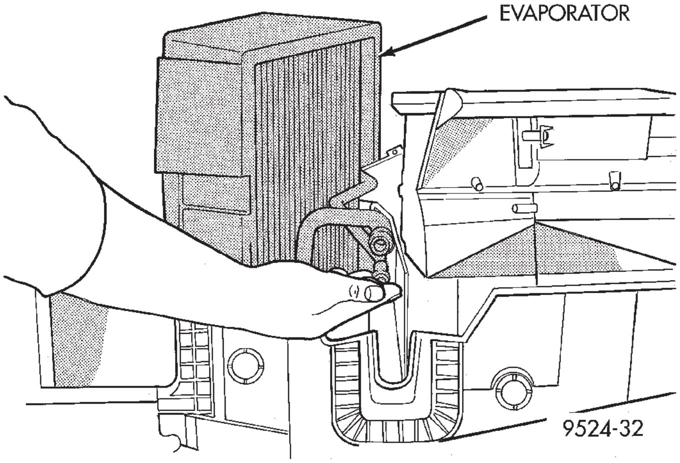


Fig. 54 Evaporator

ASSEMBLY—EVAPORATOR HOUSING

(1) For reassembly of the evaporator housing, reverse the above procedures.

(2) Perform the HVAC control Calibration Diagnostic and Cooldown test.

DISASSEMBLY—DISTRIBUTION HOUSING

(1) Place distribution housing on workbench (Fig. 55).

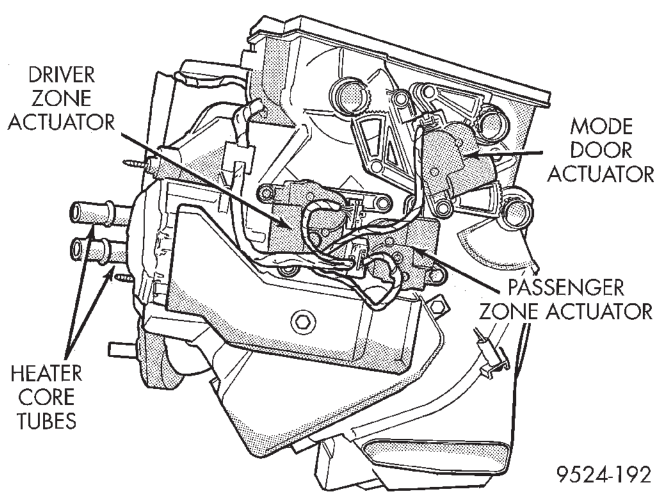


Fig. 55 Distribution Housing

(2) Remove heater core cover (Fig. 56).

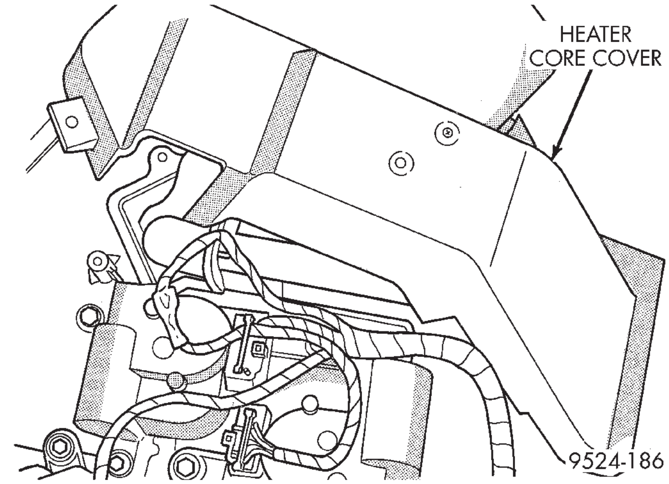


Fig. 56 Heater Core Cover

(3) Remove heater core tube plate (Fig. 57) and (Fig. 58).

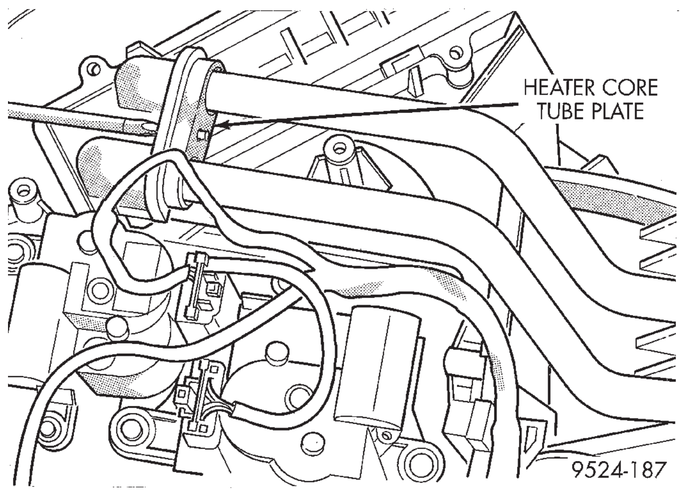


Fig. 57 Heater Core Tube Plate

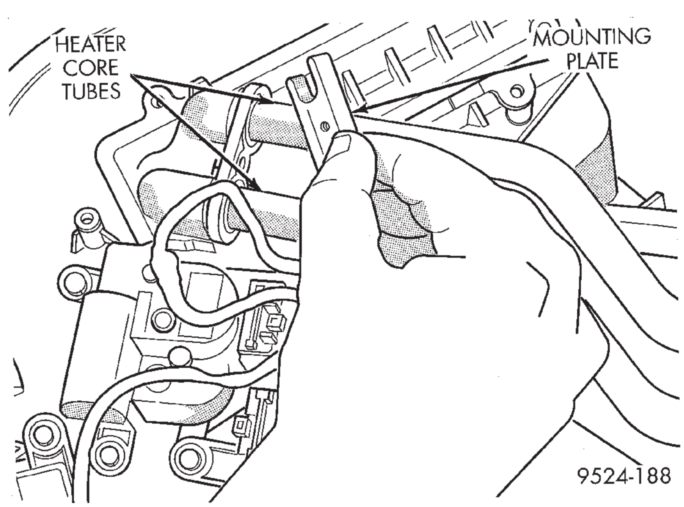


Fig. 58 Plate Removal

(4) Remove heater core tubes (Fig. 59).

DISASSEMBLY AND ASSEMBLY (Continued)

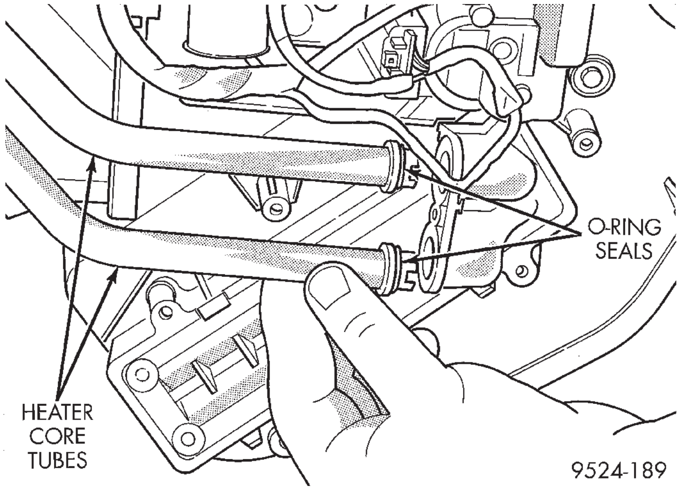


Fig. 59 Heater Core Tube Removal

(5) Depress heater core retaining clips at housing. When reinstalling core use screws to fasten the heater core to the housing.

(6) Slide heater core out of the housing.

(7) Remove driver's zone actuator from distribution housing (Fig. 60).

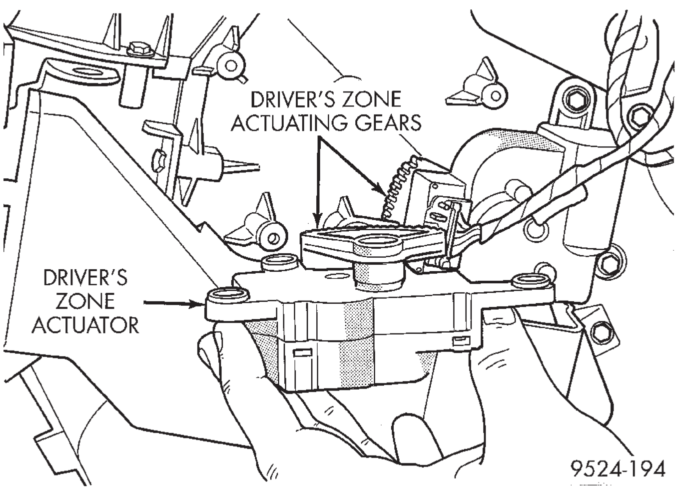


Fig. 60 Driver's Zone Actuator

(8) Remove passenger zone actuator from distribution housing (Fig. 61).

(9) Using a long thin flat blade tool, insert tool through blend-air opening on top of distribution housing (Fig. 62). Depress clip retaining the driver's blend-air door drive gear. Pull out on gear and remove from the housing (Fig. 63).

(10) Remove mode door motor.

(11) Remove Panel door actuator gear (Fig. 64).

(12) Remove defrost door actuator gear (Fig. 65).

(13) Remove cam wheel (Fig. 66).

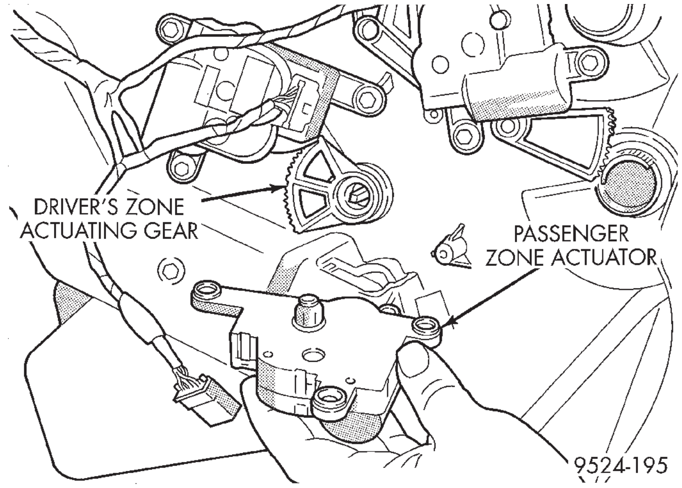


Fig. 61 Passenger Zone Actuator

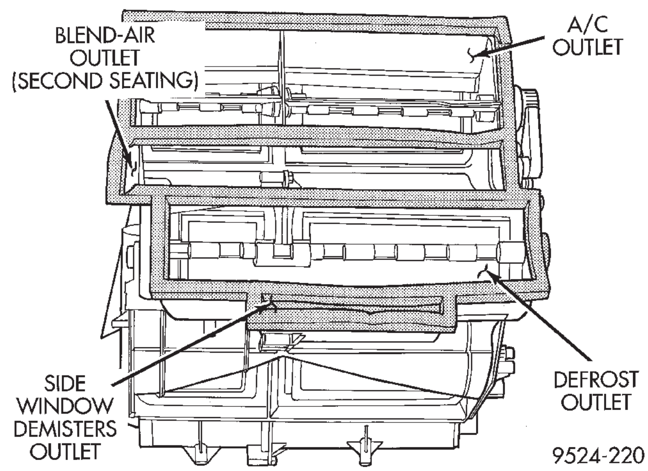


Fig. 62 Distribution Housing

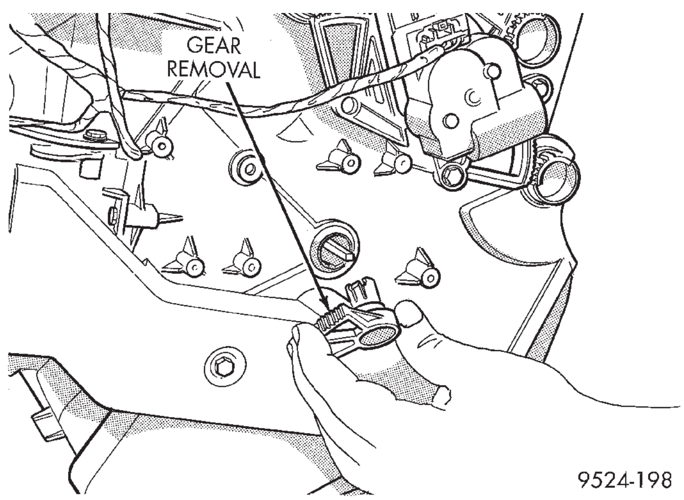


Fig. 63 Blend-Air Door Drive Gear

DISASSEMBLY AND ASSEMBLY (Continued)

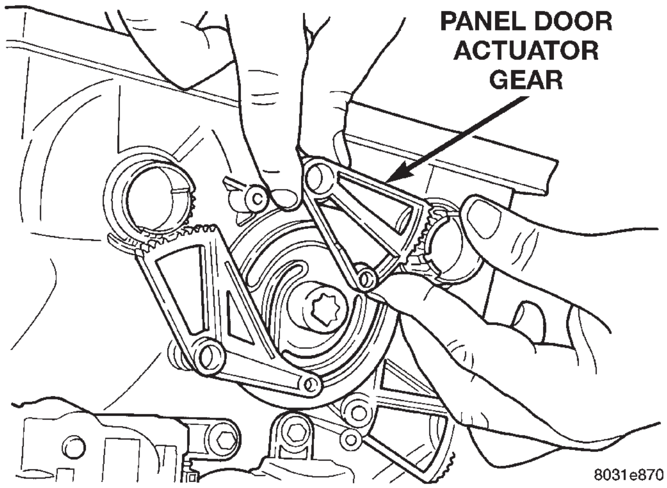


Fig. 64 Panel Door Gear

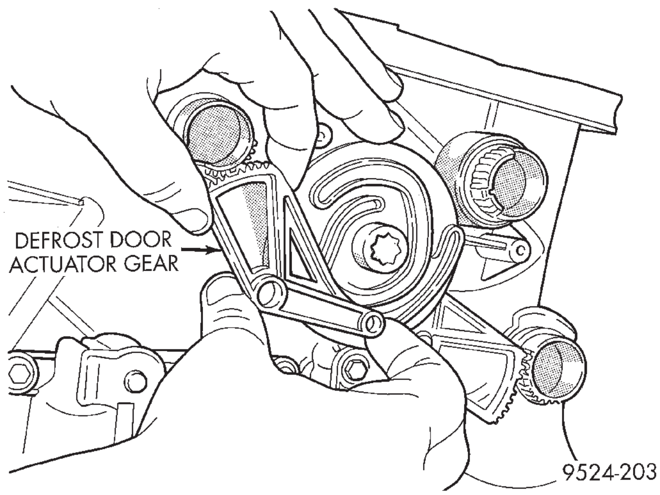


Fig. 65 Defrost Door Gear

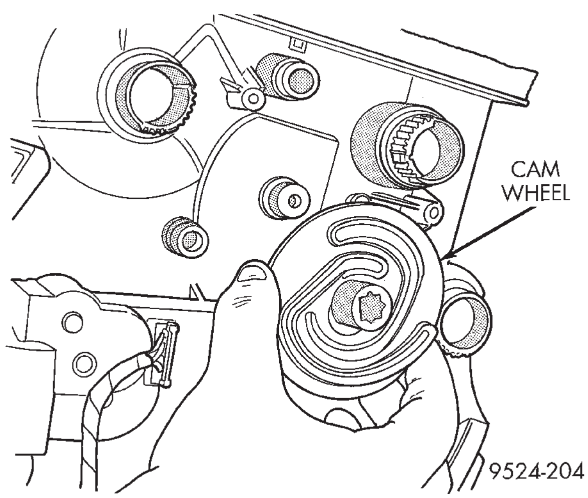


Fig. 66 Cam Wheel

(14) Remove heat door actuator gear (Fig. 67).

(15) Remove distribution housing lower cover screws (Fig. 68).

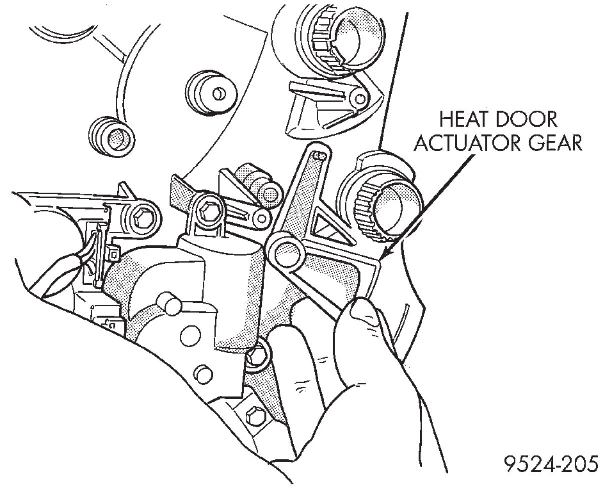


Fig. 67 Heat Door Gear

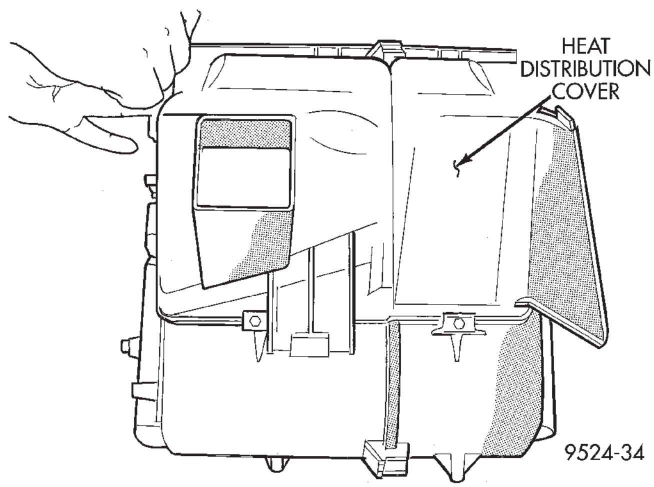


Fig. 68 Distribution Housing

(16) Remove distribution housing half screws (Fig. 69).

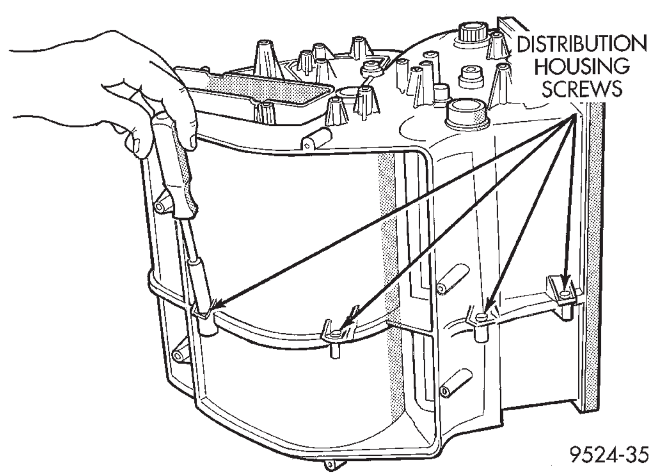


Fig. 69 Distribution Housing Half Screws

(17) Remove distribution housing front cover (Fig. 70) and (Fig. 71).

DISASSEMBLY AND ASSEMBLY (Continued)

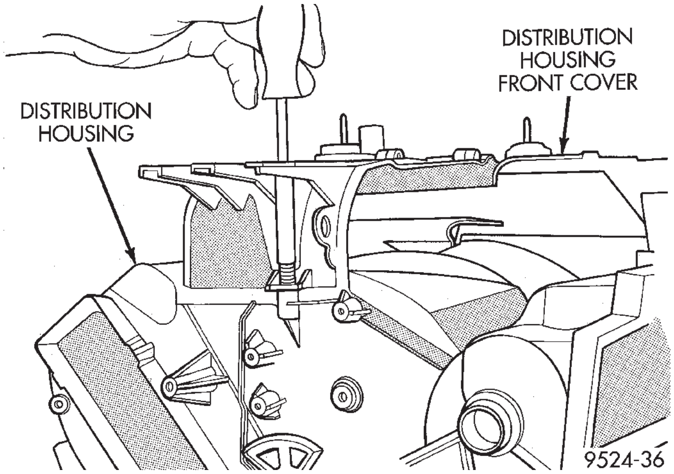


Fig. 70 Front Cover

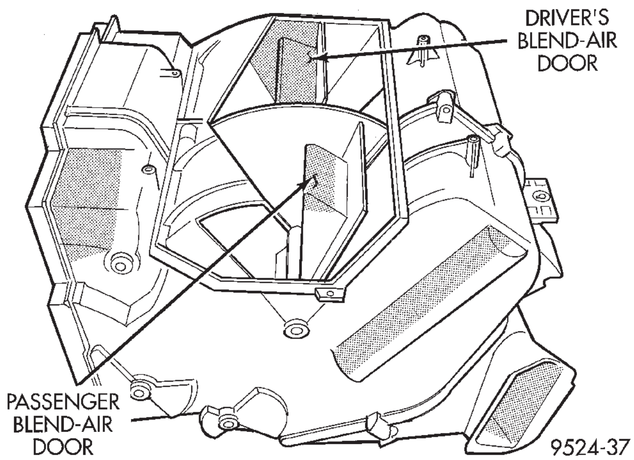


Fig. 71 View of Zone Control Doors

(18) Remove weather-strip at fresh-air vent.

(19) Separate housing halves (Fig. 72).

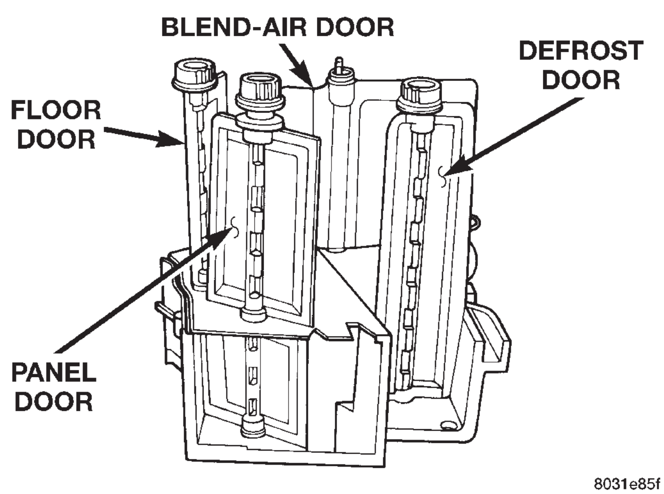


Fig. 72 Distribution Housing Halves

(20) Pull up on separator plate and remove defrost door (Fig. 73).

(21) Remove upper half Panel door (Fig. 74).

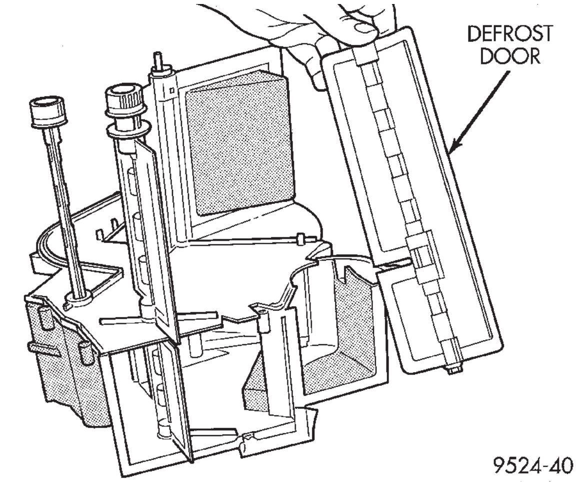


Fig. 73 Defrost Door

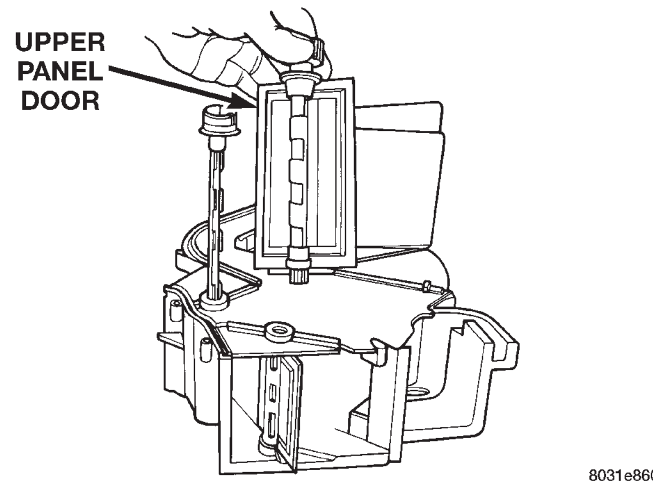


Fig. 74 Panel Door

(22) Remove upper half of Floor door (Fig. 75).

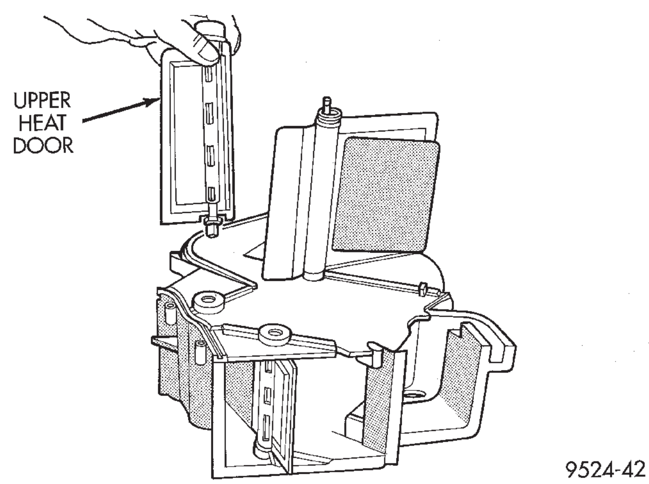


Fig. 75 Floor Door

(23) Remove upper half of the blend-air door (slide off of shaft) (Fig. 76).

DISASSEMBLY AND ASSEMBLY (Continued)

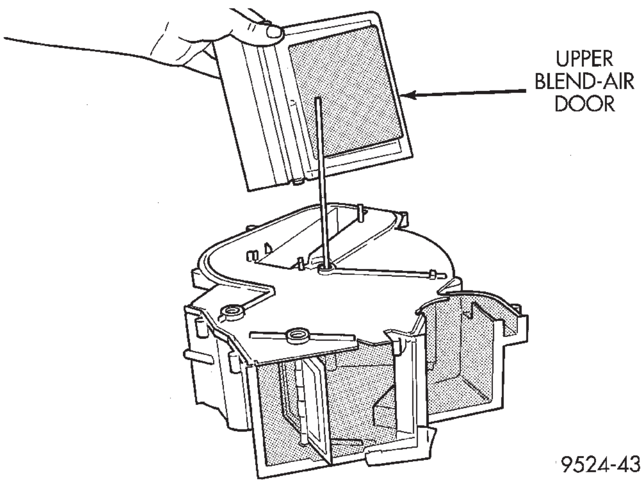


Fig. 76 Blend-Air Door

(24) Remove separator plate from distribution housing (Fig. 77).

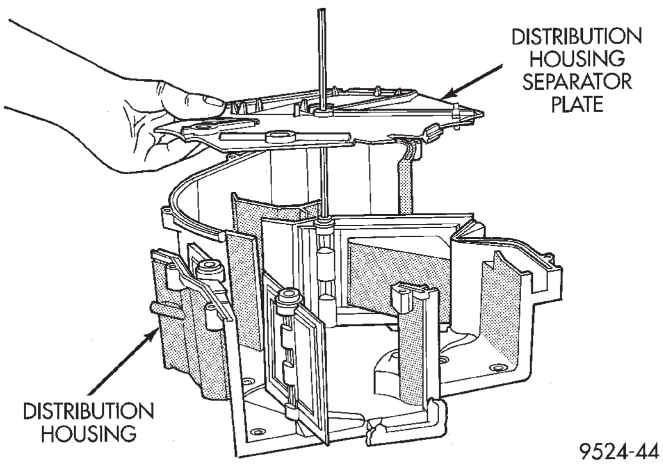


Fig. 77 Separator Plate

(25) Remove lower half of the blend-air door (Fig. 78).

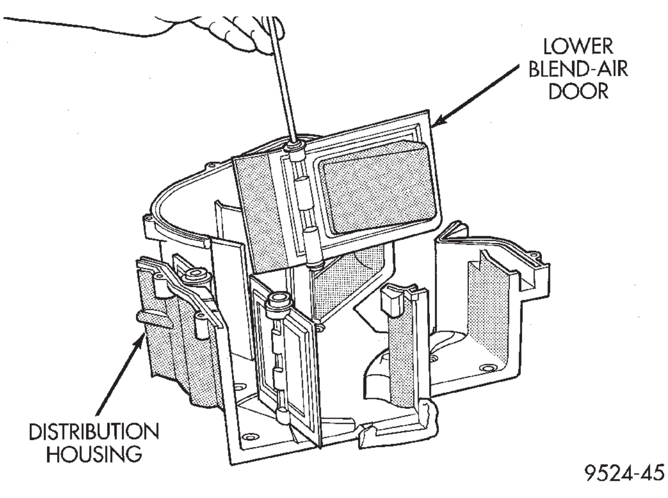


Fig. 78 Lower Blend-Air Door

(26) Remove lower half of the Panel door (Fig. 79).

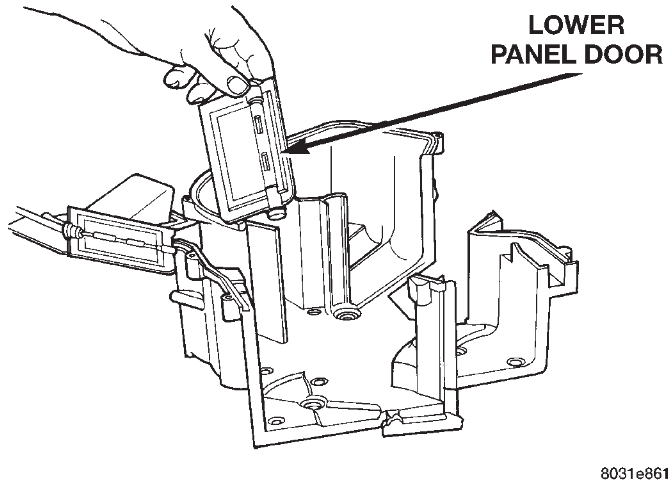


Fig. 79 Lower Panel Door

(27) Remove lower half of the Floor door (Fig. 80).

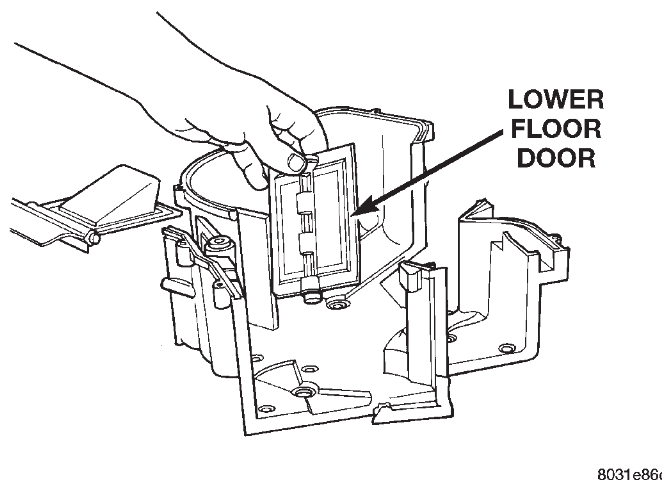


Fig. 80 Lower Floor Door

ASSEMBLY—DISTRIBUTION HOUSING

For reassembly of the distribution housing, reverse the above procedures.

To reassemble the distribution housing actuator gears an assembly procedure of the gears and cam is necessary.

ACTUATOR GEARS ALIGNMENT PROCEDURE

(1) Install lower FLOOR door actuator gear to housing. Match master spline of FLOOR door actuator gear to master spline on door.

(2) Install cam wheel. Align cam wheel track to FLOOR door actuator gear.

(3) Align cam wheel slot with the post on the distribution housing marked “1”.

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Install PANEL door actuator gear. Align master spline of PANEL door actuator gear to master spline on PANEL door. Position actuator gear within cam wheel track.

(5) Install DEFROST door actuator gear to housing. Match master spline of DEFROST door actuator to master spline on DEFROST door. Position actuator gear within cam wheel track.

(6) Reinstall housing in vehicle.

(7) Perform the HVAC control Calibration Diagnostic and Cooldown test.

EMISSION CONTROL SYSTEMS

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ON-BOARD DIAGNOSTICS

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GENERAL INFORMATION

SYSTEM DESCRIPTION

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 warmup cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). Refer to Malfunction Indicator Lamp 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.

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, use the DRB scan tool to erase all DTC's and extinguish the MIL.

Technicians can display stored DTC's by using the DRB scan tool. Refer to Diagnostic Trouble Codes in this section. For DTC information, refer to charts in this section.

DESCRIPTION AND OPERATION

MALFUNCTION INDICATOR LAMP (MIL)

As a functional test, the Malfunction Indicator Lamp (MIL) illuminates at key-on before engine

DESCRIPTION AND OPERATION (Continued)

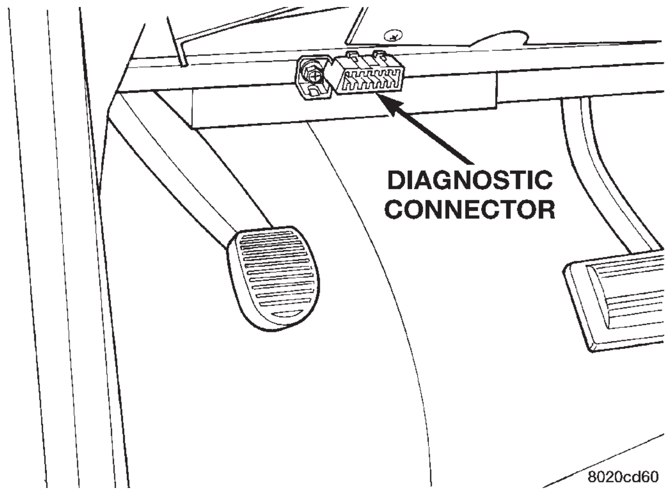

Fig. 1 Data Link (Diagnostic) Connector

cranking. Whenever the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) that affects vehicle emissions, it illuminates the MIL. If a problem is detected, the PCM sends a message over the CCD Bus to the instrument cluster to illuminate the lamp. The PCM illuminates the MIL only for DTC's that affect vehicle emissions. The MIL stays on continuously when the PCM has entered a Limp-In mode or identified a failed emission component or system. The MIL remains on until the DTC is erased. Refer to the Diagnostic Trouble Code charts in this group for emission related codes.

Also, the MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring in this section.

Additionally, the PCM may reset (turn off) the MIL when one of the following occur:

- PCM does not detect the malfunction for 3 consecutive trips (except misfire and fuel system monitors).
- PCM does not detect a malfunction while performing three successive engine misfire or fuel system tests. The PCM performs these tests while the engine is operating within ± 375 RPM of and within 10 % of the load of the operating condition at which the malfunction was first detected.

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. From the state display screen, access either State Display Inputs and Outputs or State Display Sensors.

STATE DISPLAY INPUTS AND OUTPUTS

Connect the DRB scan tool to the data link connector and access the State Display screen. Then access Inputs and Outputs. The following list contains the PCM system functions accessible through the Inputs and Outputs screen.

Park/Neutral Switch
Speed Control Resume
Brake Switch
Speed Control On/Off
Speed Control Set
S/C Vent Solenoid
Actual S/C Vent Sol.
S/C Vacuum Solenoid
Actual S/C Vacuum Sol.
S/C Cancel
S/C Last Cutout
S/C Working Status
S/C Denied Status
A/C Clutch Relay
Actual A/C Clutch Relay
EGR Solenoid
Actual EGR Sol.
Automatic Shutdown Relay
Actual Automatic Shutdown Relay
Automatic Shutdown Relay Sense
Radiator Fan Control Module
Actual Radiator Fan Control Module
Duty Cycle EVAP Purge Solenoid
Actual EVAP Purge Sol.
Torque Converter Clutch Solenoid
Power Steering Switch
Closed Loop State
Current CMP Edge
Current CKP State
Current Sync State
Fuel Pump Relay
Actual Fuel Pump Relay
Ignition Sense (A21)
Malfunction Lamp
Limp-in Reason

STATE DISPLAY SENSORS

Connect the DRB scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following list contains the PCM system functions accessible through the Sensor Display screen.

Battery Temperature
Engine Coolant Temperature
Engine Coolant Temp Sensor
Throttle Position Volts
Minimum Throttle
Knock Sensor Volts
Battery Voltage
MAP Sensor Reading
Idle Air Control Motor Position

DESCRIPTION AND OPERATION (Continued)

Adaptive Fuel Factor
Barometric Pressure
Engine Speed
Module Spark Advance
Speed Control Target
Intake Air Temp Degrees
Intake Air Temp Volts
Charging System Goal
Theft Alarm Status
Map Sensor Voltage
Vehicle Speed
Throttle Opening (percentage)
TPS Calculated
Cam Timing Position
Target Idle
Time From Start To Run
Run Time At Stall
Injector Pulse-width
Upstream O2S Volts
Downstream O2S Volts
Closed Loop Timer
Short Term Adaptive
Current Adaptive Cell
Adaptive Memory Cell 0
Adaptive Memory Cell 1
Adaptive Memory Cell 2
Adaptive Memory Cell 3
Adaptive Memory Cell 4
Adaptive Memory Cell 5
Adaptive Memory Cell 6
Adaptive Memory Cell 7
Adaptive Memory Cell 8
Adaptive Memory Cell 9
Adaptive Memory Cell 10
Adaptive Memory Cell 11
Adaptive Memory Cell 12
Adaptive Memory Cell 13
Adaptive Memory Cell 14
Adaptive Memory Cell 15
Purge Free Idle Cell
Purge Free Cell 2 (corresponds to memory cell 2)
Purge Free Cell 3 (corresponds to memory cell 5)
Target IAC Steps
Retard Cylinder (1)
Retard Cylinder (2)
Retard Cylinder (3)
Retard Cylinder (4)
Retard Cylinder (5)
Retard Cylinder (6)

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.

DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

The preferred and most accurate method of retrieving a DTC is by using the DRB scan tool. The scan tool supplies detailed diagnostic information which can be used to more accurately diagnose causes for a DTC.

Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

NOTE: For a list of DTC's, refer to the charts in this section.

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) 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.

(2) Turn the ignition switch on and access the "Read Fault" screen.

(3) Record all the DTC's and "freeze frame" information shown on the DRB scan tool.

(4) 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 AND OPERATION (Continued)

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

HEX CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
01	P0340	No Cam Signal at PCM	No camshaft signal detected during engine cranking.
02	P0601	Internal Controller Failure	PCM Internal fault condition detected.
05		Charging System Voltage Too Low	Battery voltage sense input below target charging during engine operation. Also, no significant change detected in battery voltage during active test of generator output circuit.
06		Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
0A*		Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
0B		Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
0C	P0743	Torque Converter Clutch Soleniod/ Trans Relay Circuits	An open or shorted condition detected in the torque converter part throttle unlock solenoid control circuit (3 speed auto RH trans. only).
0E	P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the low speed radiator fan relay control circuit.
0F*		Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
10*		A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay circuit.
11	P0403	EGR Solenoid Circuit	An open or shorted condition detected in the EGR transducer solenoid circuit.
12	P0443	EVAP Purge Solenoid Circuit	An open or shorted condition detected in the duty cycle purge solenoid circuit.
13	P0203	Injector #3 Control Circuit	Injector #3 output driver does not respond properly to the control signal.
14	P0202	Injector #2 Control Circuit	Injector #2 output driver does not respond properly to the control signal.
15	P0201	Injector #1 Control Circuit	Injector #1 output driver does not respond properly to the control signal.
19	P0505	Idle Air Control Motor Circuits	A shorted or open condition detected in one or more of the idle air control motor circuits.
1A	P0122	Throttle Position Sensor Voltage Low	Throttle position sensor input below the minimum acceptable voltage
1B	P0123	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
1E	P0117	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below minimum acceptable voltage.
1F	P0118	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above maximum acceptable voltage.

DESCRIPTION AND OPERATION (Continued)

HEX CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
20	P0134	Right Rear (or just) Upstream O2S Stays at Center	Neither rich or lean condition detected from the oxygen sensor.
21*		Engine Is Cold Too Long	Engine did not reach operating temperature within acceptable limits.
23	P0500	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
24	P0107	MAP Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
25	P0108	MAP Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
27	P1297	No Change in MAP From Start to Run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading from start-up.
28*		No Crank Reference Signal at PCM	No crank reference signal detected during engine cranking.
29	P0353	Ignition Coil #3 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
2A	P0352	Ignition Coil #2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
2B	P0351	Ignition Coil #1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
2C*		No ASD Relay Output Voltage at PCM	An Open condition Detected In The ASD Relay Output Circuit.
2E	P0401	EGR System Failure	Required change in air/fuel ratio not detected during diagnostic test.
30*	P1697	PCM Failure SRI Miles Not Stored	Unsuccessful attempt to update EMR mileage in the PCM EEPROM.
31	P1698	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
39	P0112	Intake Air Temp Sensor Voltage Low	Intake air temperature sensor input below the maximum acceptable voltage.
3A	P0113	Intake Air Temp Sensor Voltage High	Intake air temperature sensor input above the minimum acceptable voltage.
3C	P0106	Barometric Pressure Out Of Range	MAP sensor has a baro reading below an acceptable value.
3D	P0204	Injector #4 Control Circuit	Injector #4 output driver does not respond properly to the control signal.
3E	P0132	Right Rear (or just) Upstream O2S Shorted to Voltage	Oxygen sensor input voltage maintained above the normal operating range.
44	P0600	PCM Failure SPI Communications	PCM Internal fault condition detected.
45	P0205	Injector #5 Control Circuit	Injector #5 output driver does not respond properly to the control signal.
46	P0206	Injector #6 Control Circuit	Injector #6 output driver does not respond properly to the control signal.

DESCRIPTION AND OPERATION (Continued)

HEX CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
52*		SPD CTRL PWR RLY; or S/C 12v Driver CKT	Malfunction detected with power feed to speed control servo solenoids.
5A		A/C Pressure Sensor Volts Too High	Sensor input voltage is above 4.9 volts.
5B		A/C Pressure Sensor Volts Too Low	Sensor input voltage is below .098 volts.
60	P1698	No CCD Messages From TCM	No messages received from Transmission Control Module.
61		No CCD Message From Body Control Module	No messages received from Body Control Module.
65*		Fuel Pump Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
66	P0133	Right Bank Upstream O2S Slow Response	Oxygen sensor response slower than minimum required switching frequency.
67	P0135	Right Rear (or just) Upstream O2S Heater Failure	Upstream oxygen sensor heating element circuit malfunction.
69	P0141	Right Rear (or just) Downstream O2S Heater Failure	Oxygen sensor heating element circuit malfunction.
6A	P0300	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
6B	P0301	Cylinder #1 Mis-fire	Misfire detected in cylinder #1.
6C	P0302	Cylinder #2 Mis-fire	Misfire detected in cylinder #2.
6D	P0303	Cylinder #3 Mis-fire	Misfire detected in cylinder #3.
6E	P0304	Cylinder #4 Mis-fire	Misfire detected in cylinder #4.
70	P0420	Right Rear (or just) Catalyst Efficency Failure	Catalyst efficiency below required level.
71*	P0441	Evap Purge Flow Monitor Failure	Insufficient or excessive vapor flow detected during evaporative emission system operation.
72	P1899	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch, auto. trans. only.
76	P0172	Right Rear (or just) Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
77	P0171	Right Rear (or just) Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
7E	P0138	Right Rear (or just) Downstream O2S Shorted to Voltage	Oxygen sensor input voltage maintained above the normal operating range.
80	P0128	Closed Loop Temp Not Reached	Engine does not reach 20°F within 5 minutes with a vehicle speed signal.
81	P0140	Right Rear (or just) Downstream O2S Stays at Center	Neither reich or lean condition detected from the downstream oxygen sensor.
84	P0121	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor
89	P0700	EATX Controller DTC Present	An automatic transmission input DTC has been set in the transmission controller. Refer to Group 21.
8A	P1294	Target Idle Not Reached	Actual idle speed does not equal target idle speed.

DESCRIPTION AND OPERATION (Continued)

HEX CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
92	P1496	5 Volt Supply Output Too Low	5 volt output from regulator does not meet minimum requirement.
94*	P0740	Torq Conv Clu, No RPM Drop At Lockup	Relationship between engine speed and vehicle speed indicates no torque converter clutch engagement (auto. trans. only).
95*		Fuel Level Sending Unit Volts Too Low	Open circuit between PCM and fuel gauge sending unit.
96*		Fuel Level Sending Unit Volts Too High	Circuit shorted to voltage between PCM and fuel gauge sending unit.
97*		Fuel Level Unit No Change Over Miles	No movement of fuel level sender detected.
98	P0703	Brake Switch Stuck Pressed or Released	No release of brake switch seen after too many accelerations.
99	P1493	Ambient/Batt Temp Sen VoltsToo Low	Battery temperature sensor input voltage below an acceptable range.
9A	P1492	Ambient/Batt Temp Sensor VoltsToo High	Battery temperature sensor input voltage above an acceptable range.
9B	P0131	Right Rear (or just) Upstream O2S Shorted to Ground	O2 sensor voltage too low, tested after cold start.
9C	P0137	Right Rear (or just) Downstream O2S Shorted to Ground	O2 sensor voltage too low, tested after cold start.
9D	P1391	Intermittent Loss of CMP or CKP	Intermittent loss of either camshaft or crankshaft position sensor
A0	P0442	Evap Leak Monitor Small Leak Detected	A small leak has been detected by the leak detection monitor.
A1	P0455	Evap Leak Monitor Large Leak Detected	The leak detection monitor is unable to pressurize Evap system, indicating a large leak.
AE	P0305	Cylinder #5 Mis-fire	Misfire detected in cylinder #5.
AF	P0306	Cylinder #6 Mis-fire	Misfire detected in cylinder #6.
B7	P1495	Leak Detect ion Pump Solenoid Circuit	Leak detection pump solenoid circuit fault (open or short).
B8	P1494	Leak Detect Pump Sw or Mechanical Fault	Leak detection pump switch does not respond to input.
BA	P1398	Mis-fire Adaptive Numerator at Limit	CKP sensor target windows have too much variation
BB	P1486	Evap Leak Monitor Pinched Hose Found	Plug or pinch detected between purge solenoid and fuel tank.
BE	P1290	CNG System Pressure Too High	Compressed natural gas pressure sensor reading above acceptable voltage.
C0	P0133	Cat Mon Slow O2 Upstream	Oxygen sensor response slower than minimum required switching frequency during catalyst monitor.

* Check Engine Lamp (MIL) will not illuminate if this Diagnostic Trouble Code was recorded.

DESCRIPTION AND OPERATION (Continued)

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 (Check Engine) Lamp will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the check engine lamp or a scan tool.

The following is a list of the system monitors:

- EGR Monitor
- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Evaporative System Leak Detection Monitor

Following is a description of each system monitor, and its DTC.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

HEX 66, and 7A—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, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrous oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the EGR, Catalyst and Fuel Monitors.

The O2S may 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.

HEX 67, 69, 7C, and 7D—OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) DTC as well as a O2S heater DTC, the O2S fault MUST be repaired first. After the O2S fault is repaired, 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 are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S 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 must be tested to ensure that it is heating the sensor properly.

The O2S 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 output voltage from the other effects.

HEX 2E—EGR MONITOR

The Powertrain Control Module (PCM) performs an on-board diagnostic check of the EGR system.

The EGR system consists of two main components: a vacuum solenoid and a vacuum operated valve with a back pressure transducer. The EGR monitor is used to test whether the EGR system is operating within specifications. The diagnostic check activates only during selected engine/driving conditions. When the

DESCRIPTION AND OPERATION (Continued)

conditions are met, the EGR is turned off (solenoid energized) and the O2S compensation control is monitored. Turning off the EGR shifts the air fuel (A/F) ratio in the lean direction. The O2S data should indicate an increase in the O2 concentration in the combustion chamber when the exhaust gases are no longer recirculated. While this test does not directly measure the operation of the EGR system, it can be inferred from the shift in the O2S data whether the EGR system is operating correctly. Because the O2S is being used, the O2S test must pass its test before the EGR test.

HEX 6A,6B, 6C, 6D, 6E, AE, and AF—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.

HEX 76, 77, 78, and 79—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 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 air-fuel ratio with the O2S (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.

HEX 70, and B4—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. A meltdown of the ceramic core can cause a reduction of the exhaust passage. 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 O2Ss 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 downstraem 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 (check engine lamp) will be illuminated.

HEX A0, A1, B7, and B8—LEAK DETECTION PUMP MONITOR

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.

DESCRIPTION AND OPERATION (Continued)

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” H20. 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 .020” 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 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.

TRIP DEFINITION

A “Trip” means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system. The monitors must successfully pass before the PCM can verify that a previously malfunctioning component is meeting the normal operating conditions of that component. For misfire or fuel system malfunction, the MIL may be extinguished if the fault does not recur when monitored during three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first determined.

Anytime the MIL is illuminated, a DTC is stored. The DTC can self erase only when the MIL has been extinguished. Once the MIL is extinguished, the PCM must pass the diagnostic test for the most recent DTC for 40 warm-up cycles (80 warm-up cycles for the Fuel System Monitor and the Misfire Monitor). A warm-up cycle can best be described by the following:

- The engine must be running
- A rise of 40°F in engine temperature must occur from the time when the engine was started
- Engine coolant temperature must reach at least 160°F
- A “driving cycle” that consists of engine start up and engine shut off.

Once the above conditions occur, the PCM is considered to have passed a warm-up cycle. Due to the conditions required to extinguish the MIL and erase the DTC, it is most important that after a repair has been made, all DTC’s be erased and the repair verified.

COMPONENT MONITORS

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (Check Engine) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated

DESCRIPTION AND OPERATION (Continued)

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 and 1600 rpm.

Any component that has an associated limp in will set a fault after 1 trip with the malfunction present.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

NON-MONITORED CIRCUITS

The PCM does not monitor all circuits, systems and conditions that could have malfunctions causing driveability problems. 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.

The major non-monitored circuits are listed below along with examples of failures modes that do not directly cause the PCM to set a DTC, but for a system that is monitored.

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. It may set a EGR or Fuel system fault or O2S.

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.

THROTTLE BODY AIR FLOW

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.

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 AND OPERATION (Continued)

LOAD VALUE

ENGINE	IDLE/NEUTRAL	2500 RPM/NEUTRAL
2.4 Auto. Trans.	4.4% of Maximun Load	11.7% of Maximun Load
3.0L	4.2% of Maximun Load	11.5% of Maximun Load
3.3L	5% of Maximun Load	13.4% of Maximun Load
3.8L	4.7% of Maximun Load	13.3% of Maximun Load

EVAPORATIVE EMISSION CONTROLS

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DESCRIPTION AND OPERATION

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 Purge Solenoid in this section.

NOTE: The evaporative system uses specially manufactured hoses. If they need replacement, only use fuel resistant hose.

ROLLOVER VALVE

All vehicles have a rollover valve. The valve also prevents fuel flow through the fuel tank vent valve hoses should the vehicle rollover. All vehicles pass a 360° rollover.

The charcoal filled evaporative canister stores the vapors. The rollover valve is not a serviceable item.

EVAPORATIVE (EVAP) CANISTER

All vehicles use a sealed, maintenance free, evaporative (charcoal) canister. The canister is attached to the frame under the driver's seat (Fig. 1).

Fuel tank vapor vents into the canister. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the combustion chamber. The canister proportional purge solenoid allows the canister to be purged at predetermined intervals and engine conditions.

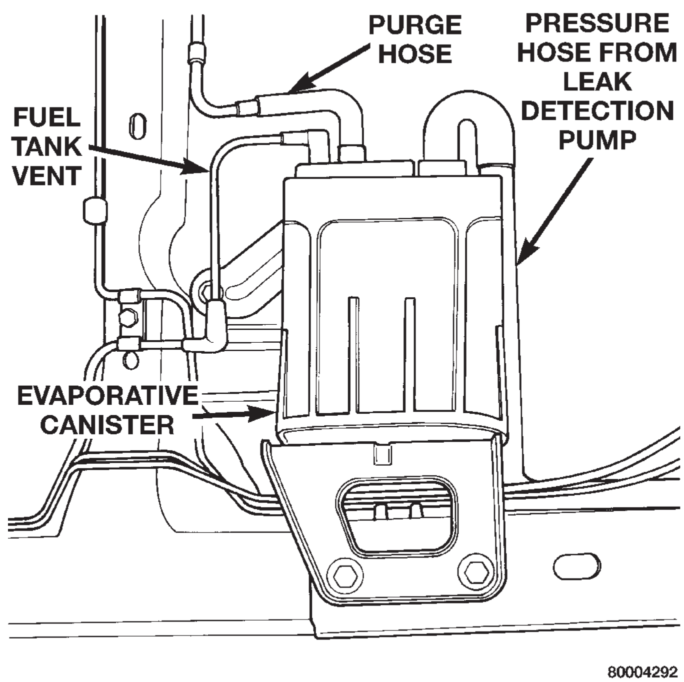

Fig. 1 Evaporative Canister

PROPORTIONAL PURGE SOLENOID

All vehicles use a Proportional purge solenoid. The solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

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.

DESCRIPTION AND OPERATION (Continued)

The proportional purge solenoid operates at a frequency of 200hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

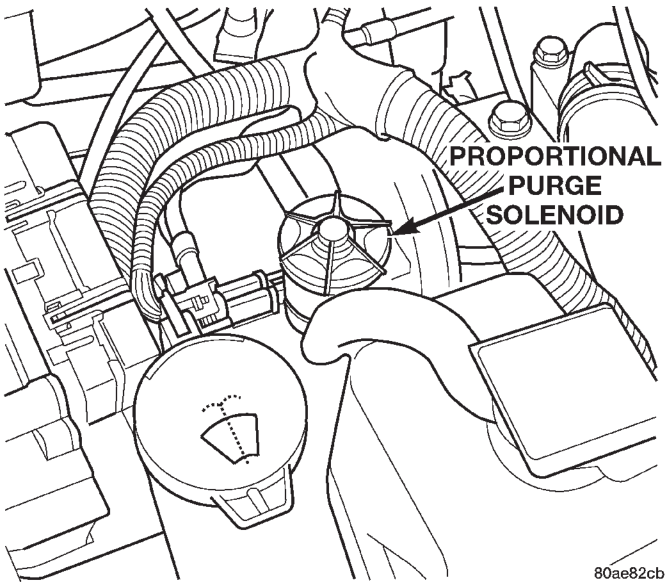

Fig. 2 Proportional Purge Solenoid

PRESSURE-VACUUM FILLER CAP

CAUTION: Remove the fuel filler cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or servicing the fuel tank.

A pressure-vacuum relief cap seals the fuel tank (Fig. 3). Tightening the cap on the fuel filler tube forms a seal between them. The relief valves in the cap are a safety feature. They prevent possible excessive pressure or vacuum in the tank. Excessive fuel tank pressure could be caused by a malfunction in the system or damage to the vent lines.

The seal between the cap and filler tube breaks when the cap is removed and relieves fuel tank pressure.

If the filler cap needs replacement, only use the correct part.

LEAK DETECTION PUMP

The leak detection pump is a device used to detect a leak in the evaporative system.

The pump contains a 3 port solenoid, a pump that contains a switch, a spring loaded canister vent valve seal, 2 check valves and a spring/diaphragm.

Immediately after a cold start, when the engine temperature is between 40°F and 86°F, the 3 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 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. This is due to the operation of the 3 port solenoid which 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. This permits 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:

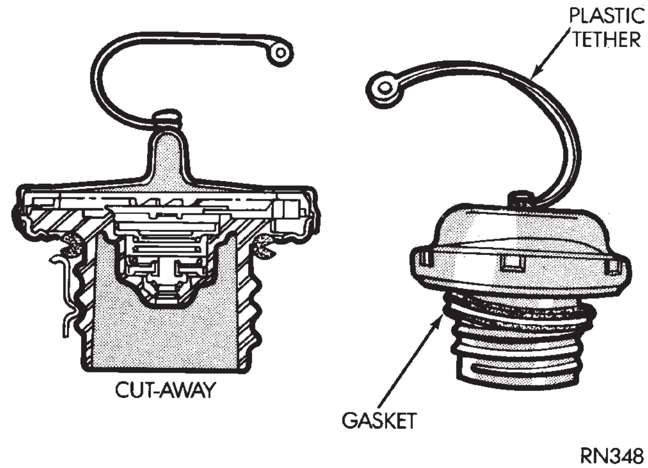

Fig. 3 Pressure Vacuum Filler Cap

PUMP MODE: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test time.

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 inches of water.

When the pump starts, the cycle rate is quite high. As the system becomes pressurized, pump rate drops. If there is no leak, the pump will quit. If there is a leak, the test is terminated at the end of the test mode.

If there is no leak, the purge monitor is run. If the cycle rate increases due to the flow through the purge system, the test is passed and 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.

DESCRIPTION AND OPERATION (Continued)

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEMS

Intake manifold vacuum removes crankcase vapors and piston blow-by from the engine. The vapors pass through the PCV valve into the intake manifold where they become part of the calibrated air-fuel mixture. They are burned and expelled with the exhaust gases. The air cleaner supplies make up air when the engine does not have enough vapor or blow-by gases. In this system, fresh filtered air enters the crankcase (Fig. 4), (Fig. 5) and (Fig. 6).

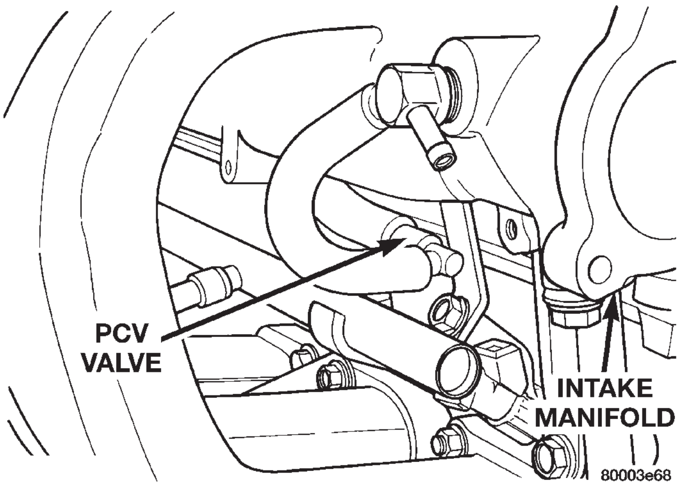

Fig. 4 PCV Valve—2.4L Engine

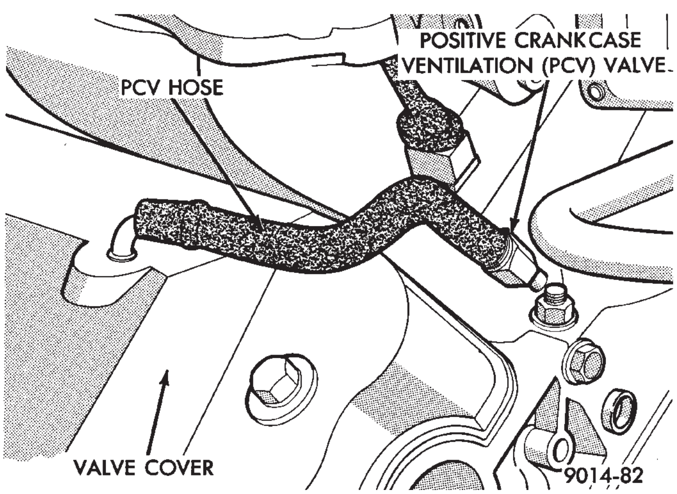

Fig. 5 PCV Valve —3.0L Engine

PCV VALVE

The PCV valve contains a spring loaded plunger. The plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

When the engine is not operating or during an engine backfire, the spring forces the plunger back against the seat. This prevents vapors from flowing through the valve (Fig. 7).

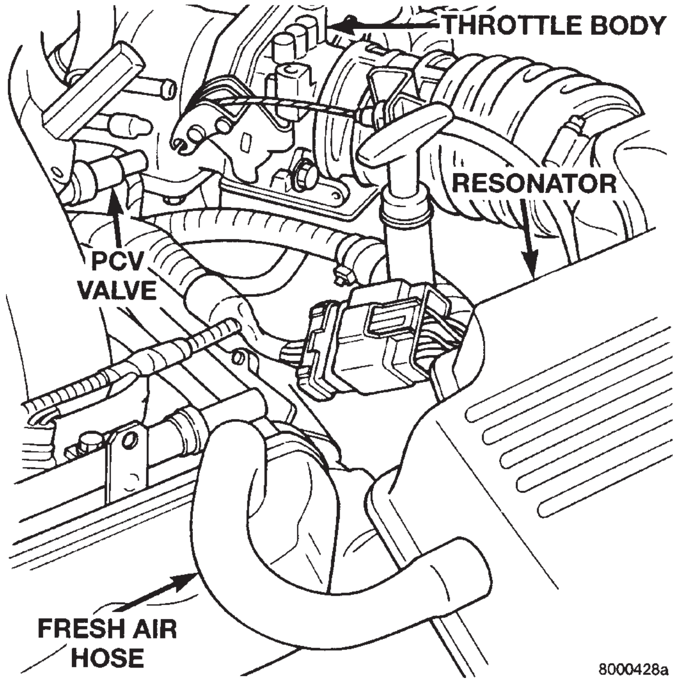

Fig. 6 PCV Valve and Fresh Air Hose— 3.3/3.8L Engines

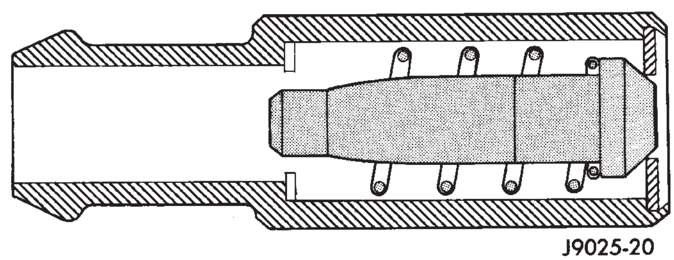

Fig. 7 Engine Off or Engine Backfire—No Vapor Flow

When the engine is at idle or cruising, high manifold vacuum is present. At these times manifold vacuum is able to completely compress the spring and pull the plunger to the top of the valve (Fig. 8). In this position there is minimal vapor flow through the valve.

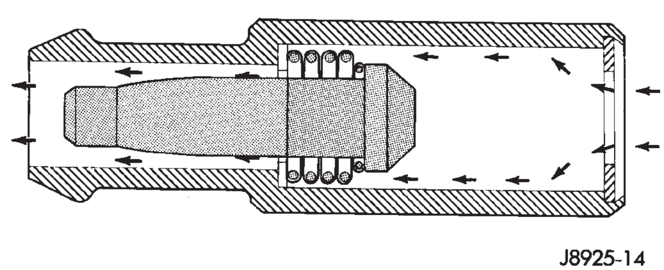

Fig. 8 High Intake Manifold Vacuum—Minimal Vapor Flow

During periods of moderate intake manifold vacuum the plunger is only pulled part way back from

DESCRIPTION AND OPERATION (Continued)

the inlet. This results in maximum vapor flow through the valve (Fig. 9).

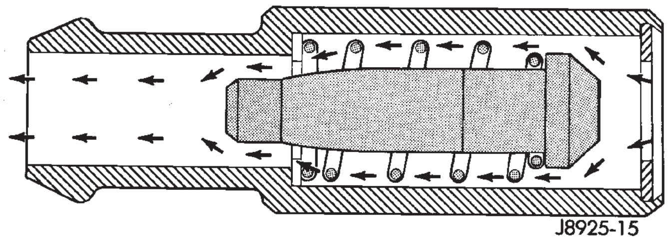

Fig. 9 Moderate Intake Manifold Vacuum—Maximum Vapor Flow

CRANKCASE VENT FILTER

All engines use filtered air to vent the crankcase. The filtered air is drawn through the resonator assembly located between the air cleaner and throttle body.

VEHICLE EMISSION CONTROL INFORMATION LABEL

All models have a Vehicle Emission Control Information (VECI) Label. Chrysler permanently attaches the label in the engine compartment. 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.

DIAGNOSIS AND TESTING

LEAK DETECTION PUMP

Refer to the appropriate Powertrain Diagnostic Procedures Manual for testing procedures.

PCV VALVE TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST OR ADJUSTMENT WITH THE ENGINE OPERATING.

With the engine idling, remove the PCV valve from its attaching point. If the valve is operating properly, a hissing noise will be heard and a strong vacuum felt when placing a finger over the valve inlet (Fig. 10). With the engine off, shake the valve. The valve should rattle when shaken. Replace the valve if it does not operate properly. **Do not attempt to clean the PCV valve.**

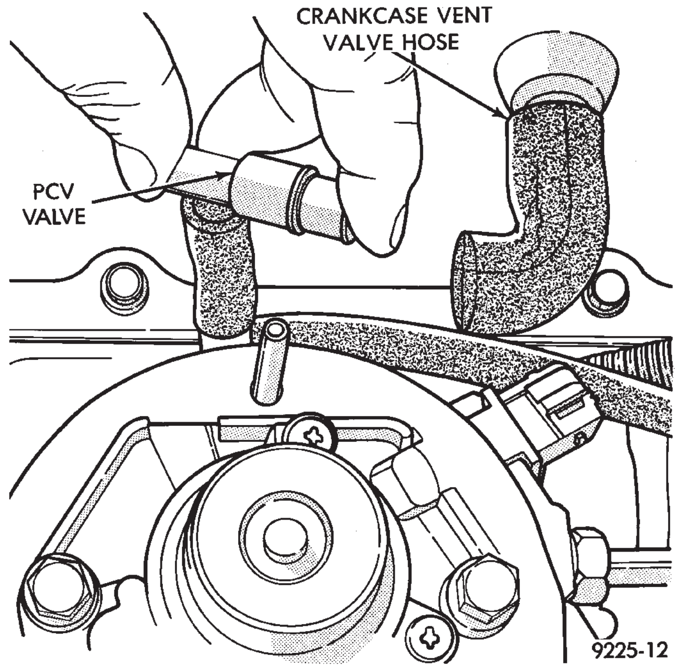

Fig. 10 PCV Test —Typical

REMOVAL AND INSTALLATION

LEAK DETECTION PUMP REPLACEMENT

REMOVAL

The Leak Detection Pump (LDP) is located under the driver's side in the cast cradle under the steering gear (Fig. 11).

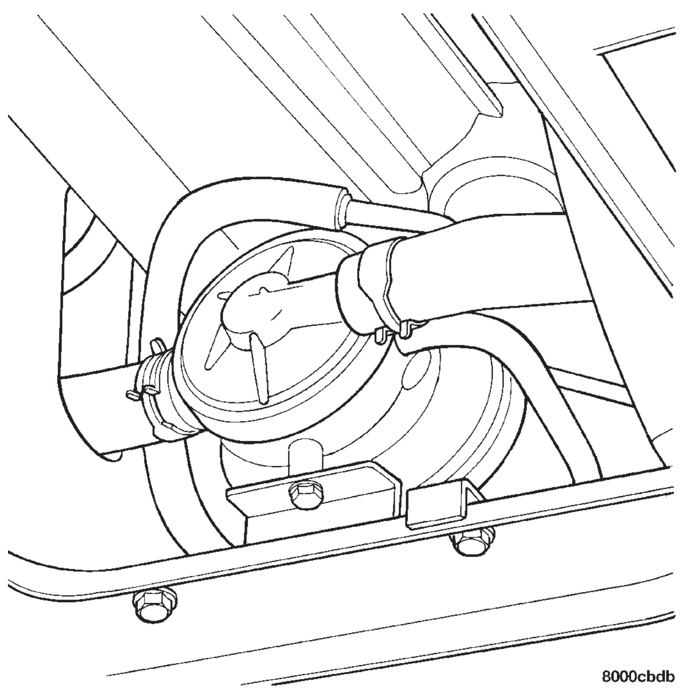

Fig. 11 Leak Detection Pump

(1) Raise and support vehicle on a hoist.

REMOVAL AND INSTALLATION (Continued)

(2) Push locking tab on connector to unlock (Fig. 12).

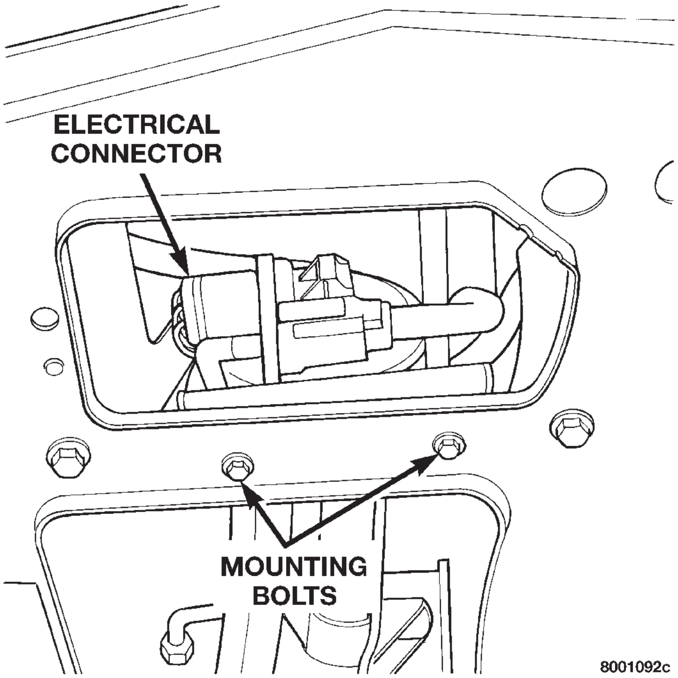

Fig. 12 Leak Detection Pump Connector Lock

(3) Push down on connector latch and pull connector from pump.

(4) Remove hoses.

(5) Remove bolts holding LDP and bracket to cradle.

(6) Remove bracket from LDP.

INSTALLATION

(1) Install LDP to bracket.

(2) Install LDP and bracket to cradle. Torque bolts to 9.5-14 N·m (85-125 in. lbs.). **Before installing hoses to LDP, make sure they are not cracked or split. If a hose leaks, it will cause the Check Engine Lamp to illuminate.**

(3) Install hoses to LDP.

(4) Plug electrical connector into LDP.

(5) Push connector locking tab into place.

(6) Using DRB scan tool, verify proper operation of LDP.

ROLLOVER VALVES

All vehicles have 2 rollover valves on top of the fuel tank. The valves prevent fuel flow through the fuel tank vent valve hoses should the vehicle rollover.

The rollover valves on the fuel tank are not serviceable.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

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DESCRIPTION AND OPERATION

GENERAL INFORMATION

Refer to Monitored Systems - EGR Monitor in this group for more information.

The 3.0, 3.3, and 3.8L engines use Exhaust Gas Recirculation (EGR) systems (Fig. 1) and (Fig. 2). The EGR system reduces oxides of nitrogen (NOx) in engine exhaust and helps prevent spark knock. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming air/fuel mixture. The diluted air/fuel mixture reduces peak flame temperature during combustion.

The EGR system consists of:

- EGR tube (connects a passage in the intake manifold to the exhaust manifold)
- EGR valve
- Electronic EGR Transducer
- Connecting hoses

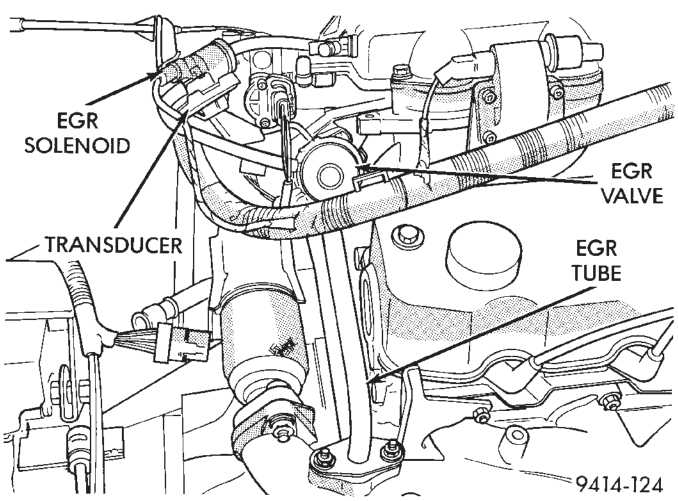


Fig. 1 EGR Mounting—3.0L Engine

The Electronic EGR Transducer contains an electrically operated solenoid and a back-pressure transducer (Fig. 3). The PCM operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back-pressure controls the transducer.

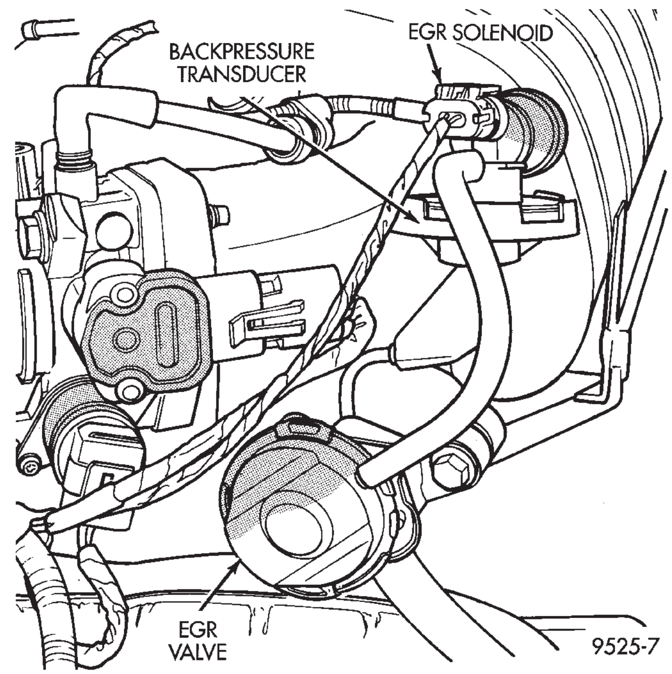


Fig. 2 EGR Mounting—3.3/3.8L Engines

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of vacuum applied to the EGR valve. Varying the strength of the vacuum changes

DESCRIPTION AND OPERATION (Continued)

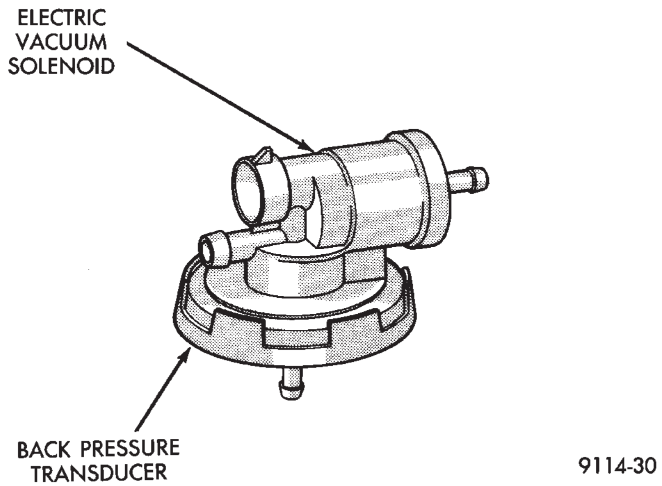


Fig. 3 Electric EGR Transducer Assembly

the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

This system does not allow EGR at idle. The EGR systems can operate at all coolant temperatures above 60°F as long as the battery ambient temperature is above 7°F.

DIAGNOSIS AND TESTING

EGR SYSTEM ON-BOARD DIAGNOSTICS

The PCM performs an on-board diagnostic check of the EGR system. The diagnostic system uses the electronic EGR transducer for the system tests.

The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the PCM energizes the transducer solenoid to disable the EGR. The PCM checks for a change in the heated oxygen sensor signal. If the air-fuel mixture goes lean, the PCM will attempt to enrichen the mixture. The PCM registers a Diagnostic Trouble Code (DTC) if the EGR system is not operating correctly. After registering a DTC, the PCM turns on the malfunction indicator (Check Engine) lamp after 2 consecutive trips. There are 2 types of failures sensed by the PCM. The first is a short or open in the electrical solenoid circuit. The second is a mechanical failure or loss of vacuum. The Malfunction Indicator Lamp (MIL) indicates the need for service.

If a problem is indicated by the MIL and a DTC for the EGR system is set, check for proper operation of the EGR system. Use the System Test, EGR Gas Flow Test. If the EGR system tests properly, check the system using the DRB scan tool. Refer to On-Board Diagnosis sections in this Group. Also, refer to the DRB scan tool and the appropriate Powertrain Diagnostics Procedure manual.

EGR SYSTEM TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE TESTING THE EGR SYSTEM.

(1) Check the condition of all EGR system hoses and tubes for leaks, cracks, kinks and hardening of rubber hoses. Repair and correct these conditions before performing any tests.

(2) Be sure the hoses at both the EGR valve and EGR valve control are connected to the proper fittings (Fig. 4).

(3) Be sure the electrical connector is firmly connected at the valve control.

(4) To check EGR system operation, connect the DRB scan tool to the 16–way data link connector. The data link connector is located on the lower edge of the instrument panel near the steering column. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool when diagnosing the EGR system.

(5) After checking the system with the DRB scan tool, proceed to the following EGR Valve Leakage and EGR Valve Control Tests and repair as necessary.

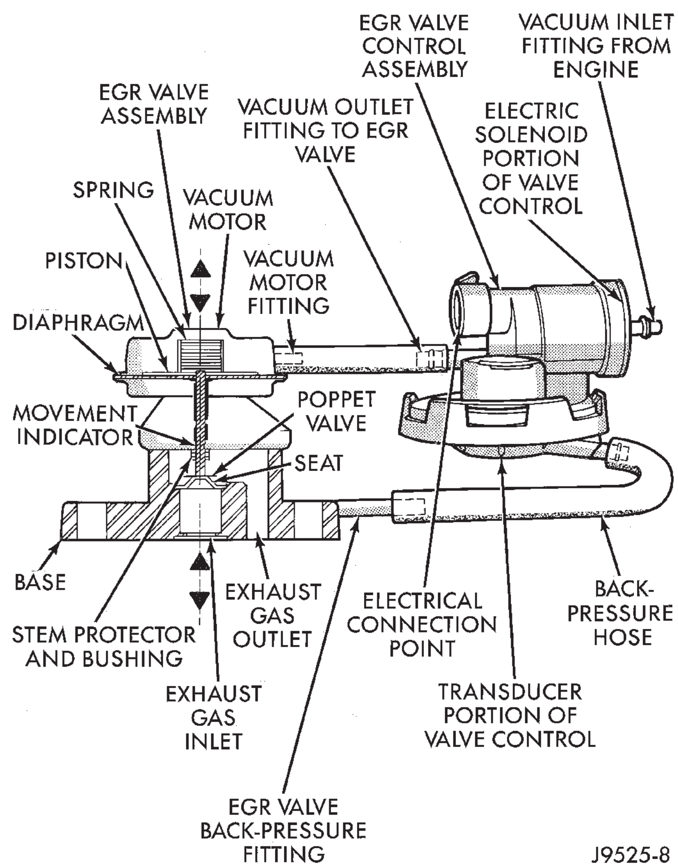


Fig. 4 EGR Value and EGR Value —Typical

DIAGNOSIS AND TESTING (Continued)

EGR GAS FLOW TEST

Use the following test procedure to determine if exhaust gas is flowing through the EGR valve. It can also be used to determine if the EGR tube is plugged, or the system passages in the intake or exhaust manifolds are plugged.

This is not to be used as a complete test of the EGR system.

The engine must be started, running and warmed to operating temperature for this test.

(1) All engines are equipped with two fittings located on the EGR valve (Fig. 5). The upper fitting (located on the vacuum motor) supplies engine vacuum to a diaphragm within the EGR valve for valve operation. The lower fitting (located on the base of the EGR valve) is used to supply exhaust back-pressure to the EGR valve control.

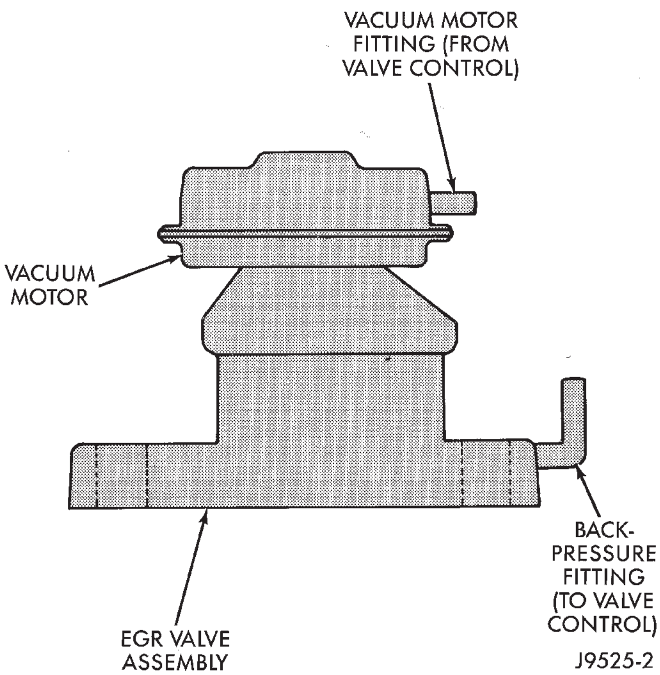


Fig. 5 Typical EGR Valve

(2) Disconnect the rubber hose at the vacuum motor fitting (Fig. 5) on the top of the EGR valve vacuum motor.

(3) Connect a hand-held vacuum pump to this fitting.

(4) Start the engine.

(5) Slowly apply 5 inches of vacuum to the fitting on the EGR valve motor.

(6) While applying vacuum, a minimum of 3 inches of vacuum, and with the engine running at idle speed, the idle speed should drop or the engine may even stall, if the vacuum is applied quickly. This is indicating that exhaust gas is flowing through the EGR tube between the intake and exhaust manifolds.

(7) If the engine speed did not change, the EGR valve may be defective, or EGR tube may be plugged with carbon, or the passages in the intake and exhaust manifolds may be plugged with carbon.

(a) Remove EGR valve from engine. Refer to EGR Valve Removal in this group.

(b) Apply vacuum to the vacuum motor fitting and observe the stem on the EGR valve. If the stem is moving, it can be assumed that the EGR valve is functioning correctly. The problem is in either a plugged EGR tube or plugged passages at the intake or exhaust manifolds, refer to step (c). If the stem will not move, replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one unit. Refer to EGR Valve Removal/Installation in this group.

(c) Remove the EGR tube between the intake and exhaust manifolds. Check and clean the EGR tube and its related openings on the manifolds. Refer to EGR Tube in this group for procedures.

(8) Do not attempt to clean the EGR valve. If the valve shows evidence of heavy carbon build-up near the base, replace it.

EGR VALVE LEAKAGE TEST

This is not to be used as a complete test of the EGR system.

If the engine will not idle, dies out on idle, or idle is rough or slow, the poppet valve (Fig. 4) at the base of the EGR valve may be leaking in the closed position.

(1) The engine should be off for the following test.

(2) Disconnect the rubber hose from the fitting (Fig. 4) at the top (vacuum motor) side of the EGR valve.

(a) Connect a hand-held vacuum pump to this fitting.

(b) Apply 15 inches of vacuum to the pump.

(c) Observe the gauge reading on the pump.

(d) If vacuum falls off, the diaphragm in the EGR valve has ruptured.

(e) Replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group.

(f) Proceed to the next step.

(3) A small metal fitting (back-pressure fitting) is located at the base of the EGR valve (Fig. 4). A rubber back-pressure hose connects it to the back-pressure fitting on the EGR valve control. Disconnect this rubber hose at the EGR valve fitting.

(4) Remove the air cleaner housing from the throttle body.

(5) Using compressed air, and using an air nozzle with a rubber tip, apply approximately 50 psi of reg-

DIAGNOSIS AND TESTING (Continued)

ulated shop air to the metal back- pressure fitting on the EGR valve.

(6) By hand, open the throttle to the wide open position. Air **SHOULD NOT BE HEARD** emitting from the intake manifold while applying air pressure at the back-pressure fitting.

(7) If air **CAN BE HEARD** emitting from the intake manifold, the poppet valve (Fig. 4) is leaking at the bottom of the EGR valve. Replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group. Do not attempt clean the old EGR valve.

EGR VALVE CONTROL (TRANSDUCER) TEST

TESTING ELECTRICAL SOLENOID PORTION OF VALVE

This is not to be used as a complete test of the EGR system.

Electrical operation of the valve should be checked with the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool. Replace solenoid if necessary, unit serviced only as an assembly.

TESTING VACUUM TRANSDUCER PORTION OF VALVE

The first part of this test will determine if the transducer diaphragm at the back-pressure side of the valve has ruptured or is leaking. The second part of the test will determine if engine vacuum (full-manifold) is flowing from the inlet to the outlet side of the valve. This is not to be used as a complete test of the EGR system.

(1) Disconnect the rubber back-pressure hose from the fitting at the bottom of EGR valve (Fig. 4).

(2) Connect a hand-held vacuum pump to this fitting.

(3) Apply 10 inches of vacuum to this fitting.

(4) If vacuum falls off, the valve diaphragm is leaking.

(5) Replace the EGR valve assembly. Proceed to next step for further testing.

(6) Remove the rubber hose at the vacuum **inlet** fitting (Fig. 4) on the EGR valve.

(7) Connect a vacuum gauge to this disconnected hose.

(8) Start the engine and bring to operating temperature. Hold engine speed at approximately 1500 rpm.

(9) Check for steady engine vacuum (full-manifold) at this hose.

(10) If engine vacuum (full-manifold) is not present, check vacuum line to engine and repair as necessary before proceeding to next step.

(11) Reconnect the rubber hose to the vacuum **inlet** fitting (Fig. 4) on the EGR valve.

(12) Disconnect the rubber hose at the vacuum **outlet** fitting (Fig. 4) on the EGR valve.

(13) Connect a vacuum gauge to this fitting.

(14) Disconnect the electrical connector (Fig. 4) at the valve control. This will simulate an open circuit (no ground from the PCM) at the valve.

(15) Start the engine and bring to operating temperature.

(16) Hold the engine speed to approximately 2000 rpm while checking for engine vacuum (full-manifold) at this fitting. **To allow full manifold vacuum to flow through the valve, exhaust back-pressure must be present at valve. It must be high enough to hold the bleed valve in the transducer portion of the valve closed.** Have a helper momentarily (a second or two) hold a rag over the tailpipe opening to build some exhaust back-pressure while observing the vacuum gauge. Heavy gloves should be worn. **Do not cover the tailpipe opening for an extended period of time as damage to components or overheating may result.**

(17) As temporary back-pressure is built, full manifold vacuum should be observed at the vacuum outlet fitting. Without back-pressure, and engine at approximately 2000 rpm, the gauge reading will be low. This low reading is normal. At idle speed, the gauge reading will be erratic. This is also normal.

(18) If full manifold vacuum is not present at the outlet fitting, but was present at the inlet fitting, replace the valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group.

REMOVAL AND INSTALLATION

EGR VALVE SERVICE—3.0L ENGINES

The EGR valve and Electrical EGR Transducer are serviced as an assembly.

REMOVAL

(1) Disconnect the electric and vacuum connectors from the electric EGR transducer (Fig. 6).

(2) Remove EGR valve mounting bolts.

(3) Clean all gasket surfaces and discard old gaskets. Check for any signs of leakage or cracked surfaces. Repair or replace as necessary.

INSTALLATION

(1) Install EGR valve and new gasket on intake manifold. Tighten mounting bolts to 22 N·m (200 in. lbs.) torque.

(2) Connect the electrical and vacuum connectors to the electric EGR transducer.

REMOVAL AND INSTALLATION (Continued)

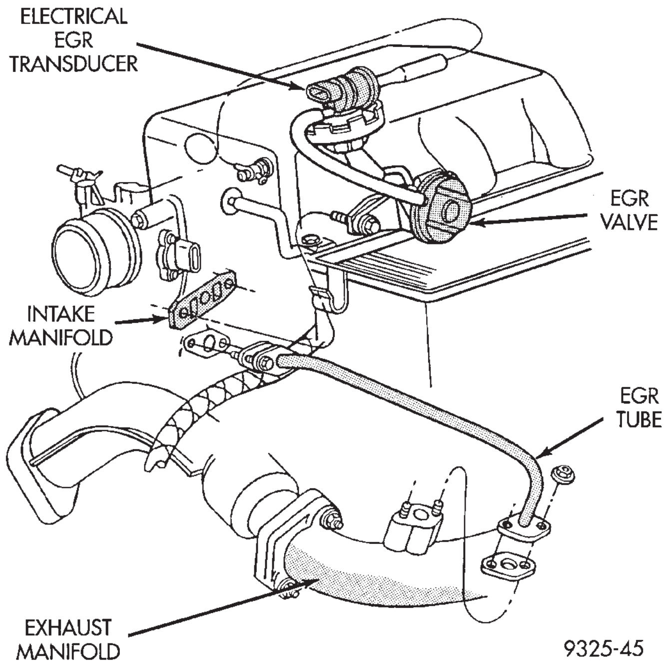


Fig. 6 EGR System Service—3.0L Engines

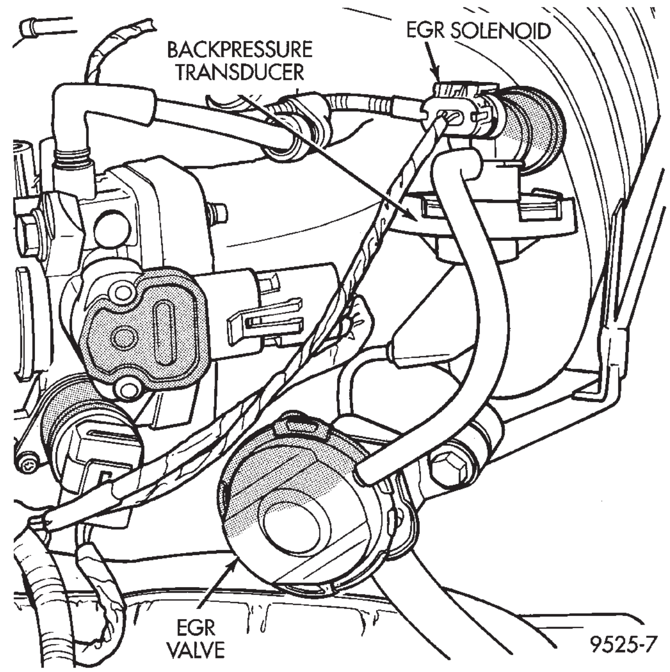


Fig. 7 EGR System—3.3/3.8L Engines

EGR VALVE SERVICE—3.3/3.8L ENGINES

The EGR valve and Electrical EGR Transducer are serviced as an assembly.

REMOVAL

(1) Disconnect vacuum tube from electric EGR transducer. Inspect vacuum tube for damage (Fig. 7).

(2) Remove electrical connector from solenoid.

(3) Remove EGR valve bolts from intake manifold.

(4) Open EGR transducer clip and remove electric EGR transducer.

(5) Remove EGR valve from intake manifold.

(6) Clean gasket surface and discard old gasket. Check for any signs of leakage or cracked surfaces. Repair or replace as necessary.

INSTALLATION

(1) Assemble EGR valve with new gasket onto the intake manifold.

(2) Install mounting bolts. Tighten bolts to 22 N·m (200 in. lbs.) torque.

(3) Install electric EGR transducer in clip with orientation tab in slot and snap closed.

(4) Reconnect vacuum hose and electrical connector to electrical EGR transducer.

EGR TUBE SERVICE—3.0L ENGINES

REMOVAL

(1) Remove EGR tube flange nuts from exhaust manifold (Fig. 6).

(2) Remove EGR valve nuts at intake manifold. Remove EGR tube.

(3) Clean all gasket surfaces and discard old gaskets. Check for any signs of leakage or cracked surfaces. Repair or replace as necessary.

INSTALLATION

(1) Loosely install the EGR tube on the intake and exhaust manifolds with new gaskets.

(2) Tighten EGR tube flange bolts at the intake manifold to 22 N·m (200 in. lbs.) torque.

(3) Tighten EGR tube to exhaust manifold nuts to 22 N·m (200 in. lbs.) torque.

EGR TUBE SERVICE—3.3/3.8L ENGINES

REMOVAL

(1) Remove EGR tube attaching bolts from intake and exhaust manifolds (Fig. 8).

(2) Clean intake and exhaust manifold gasket surfaces. Discard old gasket.

(3) Check for signs of leakage or cracked surfaces on either manifolds or tube. Repair or replace as necessary.

REMOVAL AND INSTALLATION (Continued)

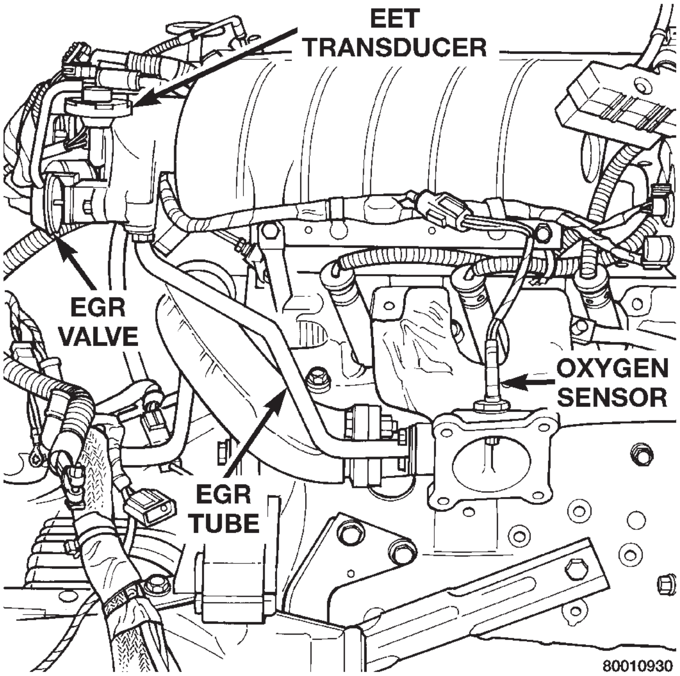


Fig. 8 EGR Tube—3.3/3.8L

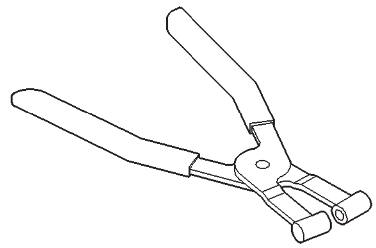
INSTALLATION

(1) Loosely assemble EGR tube and new gaskets into place on intake and exhaust manifolds.

(2) Tighten mounting bolts to 22 N·m (200 in. lbs.) torque.

SPECIAL TOOLS

EMISSION CONTROL SYSTEM



Hose Clamp Pliers 6094

EMISSION CONTROL SYSTEM

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ON-BOARD DIAGNOSTICS—2.5L DIESEL ENGINE

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GENERAL INFORMATION

SYSTEM DESCRIPTION—2.5L DIESEL ENGINE

The 2.5L diesel Powertrain Control Module (PCM) monitors and controls many different circuits in the fuel injection pump and engine systems. If the PCM senses a problem with a monitored circuit that indicates an actual problem, a Diagnostic Trouble Code (DTC) will be stored in the PCM's memory, and eventually will illuminate the Diesel Glow Plug lamp constantly while the key is on. If the problem is repaired, or is intermittent, the PCM will erase the DTC after 40 warm-up cycles. A warm-up cycle consists of starting the vehicle when the engine is cold, then the engine to warms up to a certain temperature, and finally, the engine temperature falls to a normal operating temperature, then the key is turned off.

Certain criteria must be met for a DTC to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine or fuel temperature and/or input voltage to the PCM. A DTC indicates that the PCM has identified an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

There are several operating conditions that the PCM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non–Monitored Circuits in this section.

MONITORED CIRCUITS

The PCM can detect certain problems in the electrical system.

Open or Shorted Circuit – The PCM can determine if sensor output (which is the input to PCM) is within proper range. It also determines if the circuit is open or shorted.

Output Device Current Flow – The PCM senses whether the output devices are electrically connected.

If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground (–), or shorted to (+) voltage.

NON–MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A DTC will not be displayed for these conditions.

Fuel Pressure: Fuel pressure is controlled by the fuel injection pump. The PCM cannot detect problems in this component.

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.

Fuel Injector Malfunctions: The PCM cannot determine if the fuel injector is clogged, or the wrong injector is installed. The fuel injectors on the diesel engine are **not controlled** by the PCM, although a

GENERAL INFORMATION (Continued)

defective fuel injector sensor **is monitored** by the PCM.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM.

PCM System Ground: The PCM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

PCM Connector Engagement: The PCM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device. It will establish high and low limits that are programmed into it for that device. If the input voltage is not within specifications and other DTC criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the PCM when it senses a high or low input voltage from the control system device in question.

DESCRIPTION AND OPERATION

DIAGNOSTIC TROUBLE CODES

On the following pages, a list of DTC's is provided for the 2.5L diesel engine. A DTC indicates that the PCM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but most likely will not identify the failed component directly.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored DTC can be displayed through the use of the DRB III scan tool. The DRB III connects to the data link connector. The data link connector is located under the instrument panel near bottom of the steering column (Fig. 1).

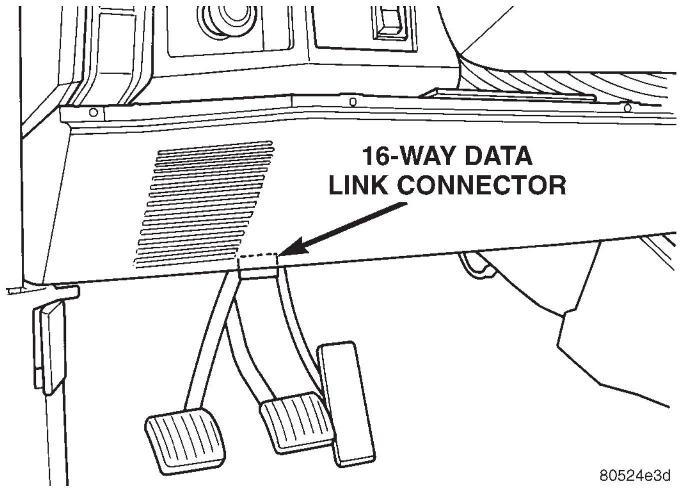

Fig. 1 Data Link Connector Location—Typical

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB III scan tool to erase a DTC.

Generic Scan Tool Code	DRB III Scan Tool Display
P1112	Boost Pressure Sensor Signal High Boost Pressure Sensor Signal Low Boost Pressure Sensor Supply High Boost Pressure Sensor Supply Low Boost Pressure Sensor Plausibility
P0110	Intake Air Temperature Sensor Signal High Intake Air Temperature Sensor Signal Low
P1685	Immobilizer Signal Lost Invalid SKIM Message
P0115	Temperature of Engine Coolant SRC High Exceeded Temperature of Engine Coolant SRC Low Exceeded
P0180	Fuel Temperature Sensor SRC High Exceeded Fuel Temperature Sensor SRC Low Exceeded
P0400	EGR Open Circuit EGR Short Circuit
P0500	Vehicle Speed Sensor PEC Frequency Too High Vehicle Speed Sensor Signal SRC High Exceeded

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	DRB III Scan Tool Display
P0725	Engine Speed Sensor Dynamic Plausibility Engine Speed Sensor Over Speed Recognition Engine Speed Sensor Static Plausibilty
P1105	Atmospheric Pressure Sensor SRC High Exceeded Atmospheric Pressure Sensor SRC Low Exceeded
P1201	Needle Movement Sensor SRC High Exceeded Needle Movement Sensor SRC Low Exceeded
P1220	Fuel Quantity Actuator Neg. Gov. Deviation Cold Fuel Quantity Actuator Neg. Gov. Deviation Warm Fuel Quantity Actuator Pos. Gov. Deviation Cold Fuel Quantity Actuator Pos. Gov. Deviation Warm
P1225	Control Sleeve Sensor Signal High Exceeded Control Sleeve Sensor Start End Pos. Not Attained Control Sleeve Sensor Stop End Pos. Not Attained
P1230	Timing Governing Negative Governor Deviation Timing Governing Positive Governor Deviation
P1515	Accelerator Pedal Sensor Signal High Exceeded Accelerator Pedal Sensor Signal Low Exceeded Accelerator Pedal Sensor Signal PWG Plaus With Low Idle Switch Accelerator Pedal Sensor Signal PWG Plaus With Potentiometer
P1600	Battery Voltage SRC High Exceeded
P1605	Terminal #15 Plausibility After Startup
P1610	Regulator Lower Regulator Limit Regulator Upper Regulator Limit
P1615	Microcontroller Gate-Array Monitoring Microcontroller Gate-Array Watchdog Microcontroller Prepare Fuel Quantity Stop Microcontroller Recovery Was Occurred Microcontrller Redundant Overrun Monitoring
P1630	Timing Solenoid Valve Controller Open Circuit Timing Solenoid Valve Controller Short Circuit
P1635	Glow Relay Controller Open Circuit Glow Relay Controller Short Circuit
P1650	Diagnostic Lamp Open Circuit Diagnostic Lamp Short Circuit
P1655	A/C Control Short Circuit A/C Control Open Circuit
P1660	Redundant Emer. Stop Plausibility In After-Run Redundant Emer Stop Powerstage Defective
P1665	Cruise Status Indicator Lamp Short Circuit
P1680	EEPROM Plausibility Checksum Error for Adj. EEPROM Plausibility Checksum Error in CC212 EEPROM Plausibility Communication With EEPROM EEPROM Plausibility Func. Switch Wrong or Missing

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	**DRB III Scan Tool Display**
	EEPROM Plausibility Ver Number Not Corresponding
P1685	Vehicle Theft Alarm Code Line Breakdown
P1690	Fan Control Open Circuit Fan #1 Fan Control Open Circuit Fan #2 Fan Control Short Circuit Fan #1 Fan Control Short Circuit Fan #2
P1695	A/C System Pressure Sensor Signal High Exceeded A/C System Pressure Sensor Signal Low Exceeded A/C System Pressure Supply Signal High Exceeded A/C System Pressure Supply Signal Low Exceeded
P1703	Brake Signal Plaus With Redundant Contact
P1740	Clutch Signal Plausibilty
P1725	Inductive Aux. Speed Sensor Dynamic Plausibilty Inductive Aux. Speed Sensor Overspeed Recognition Inductive Aux Speed Sensor Plausibilty Inductive Aux. Speed Sensor Static Plausibilty

EXHAUST EMISSION CONTROLS—2.5L DIESEL ENGINE

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DESCRIPTION AND OPERATION

VACUUM HOSE ROUTING SCHEMATIC

Vacuum for the EGR system is supplied by the internal engine mounted vacuum pump. Refer to EGR System Operation for vacuum pump information. Vacuum harness routing for emission related components is displayed in (Fig. 1).

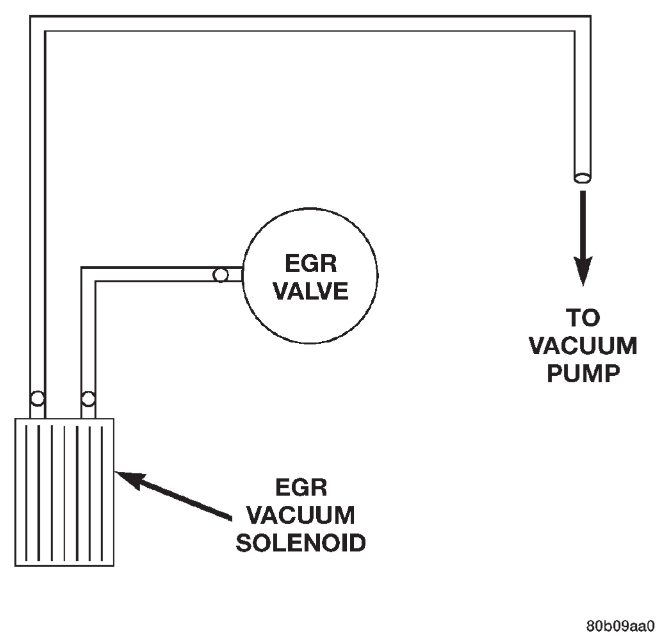

Fig. 1 Typical Hose Routing

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming fuel/air mixture.

A malfunctioning EGR system can cause engine stumble, sags or hesitation, rough idle, engine stalling and poor driveability.

EGR SYSTEM OPERATION

The system consists of:

- An EGR valve assembly. The valve is located behind the intake manifold (Fig. 2).

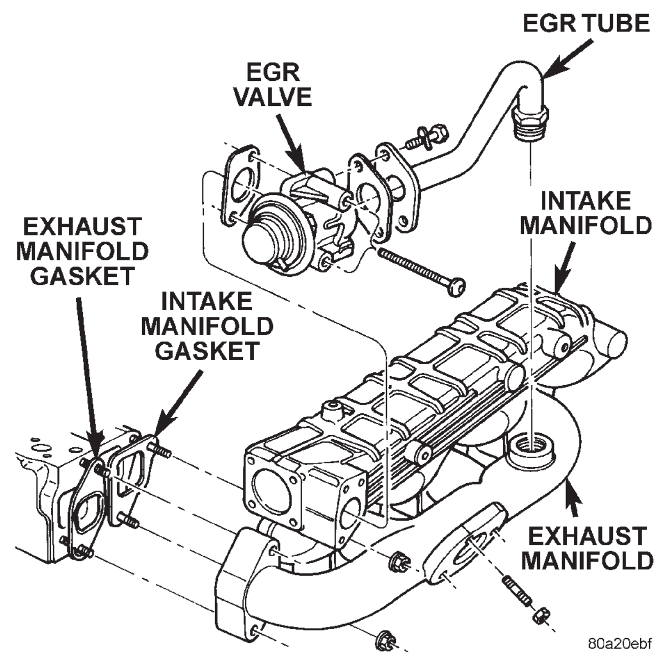

Fig. 2 EGR Valve and Tube Location

DESCRIPTION AND OPERATION (Continued)

• An EGR Solenoid. The EGR solenoid is located in the engine compartment next to the PDC (Fig. 3). The EGR solenoid opens and closes the vaccum supply that opens and closes the EGR valve. The amount of time the EGR solenoid is held open is controlled by the PCM. This is referred to as the "on time" of the EGR valve.

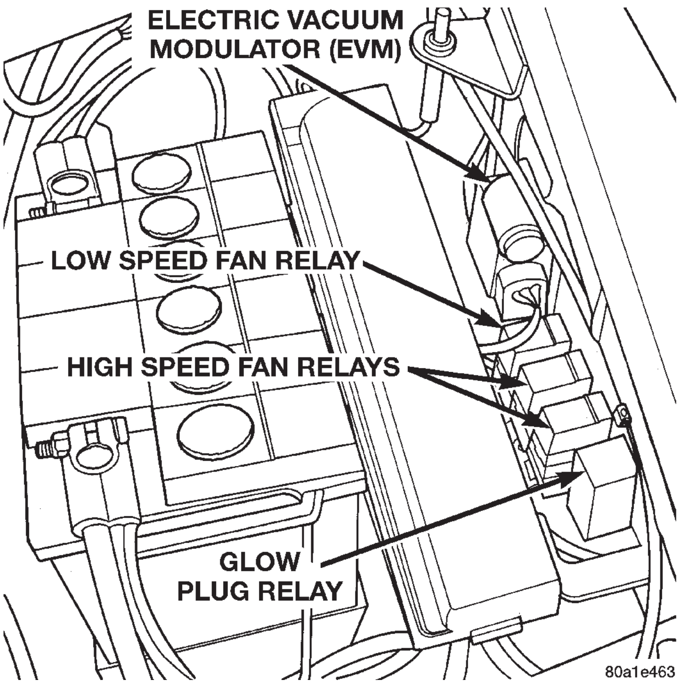

Fig. 3 EGR Solenoid

• An EGR tube (Fig. 2) connecting a passage in the EGR valve to the rear of the exhaust manifold.

• The vacuum pump, which supplies vacuum for the EGR Solenoid valve. This pump also supplies vacuum for operation of the power brake booster. The pump is located internally in the front of the engine block (Fig. 4) and is driven by the crankshaft gear.

• Vacuum lines and hoses to connect the various components.

When the PCM supplies a "on" or "off" signal to the EGR Solenoid by grounding the circuit, EGR system operation starts to occur. The PCM will monitor various engine conditions and determine when to supply and remove this ground signal. Some of the engine conditions that are monitored are the engine coolant temperature, throttle position and engine speed sensors.

When the ground signal is supplied to the EGR Solenoid, vacuum from the vacuum pump will be allowed to pass to the EGR valve via a connecting hose.

Exhaust gas recirculation will begin in this order when:

• The PCM determines that EGR system operation is necessary.

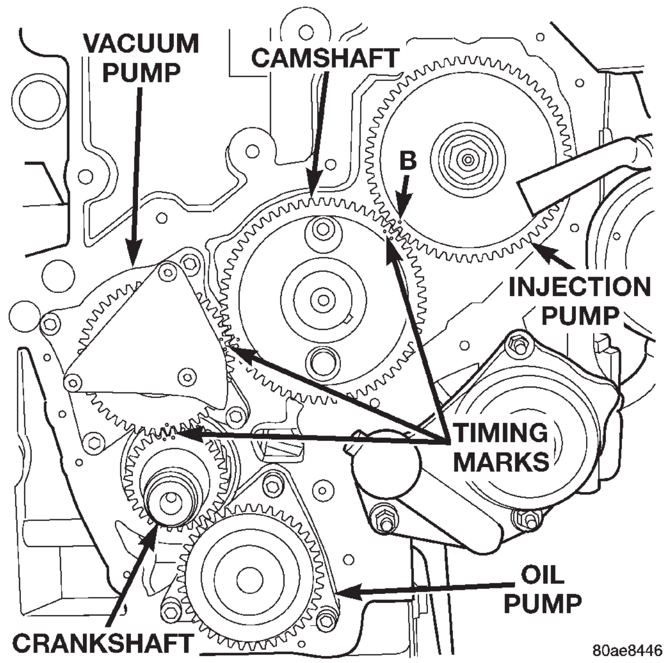

Fig. 4 Internal Vacuum Pump

• The engine is running to operate the vacuum pump.

• A ground signal is supplied to the EVM.

• Vacuum passes to the EGR valve.

• The inlet seat (poppet valve) at the bottom of the EGR valve opens to dilute and recirculate exhaust gas back into the intake manifold.

The EGR system will be shut down by the PCM after 60 seconds of continuous engine idling to improve idle quality.

DIAGNOSIS AND TESTING

EGR GAS FLOW TEST

Use the following test procedure to determine if exhaust gas is flowing through the EGR valve. It can also be used to determine if the EGR tube is plugged, or the system passages in the intake or exhaust manifolds are plugged.

This is not to be used as a complete test of the EGR system.

The engine must be started, running and warmed to operating temperature for this test.

(1) All EGR valves are equipped with a vacuum supply fitting located on the EGR valve vacuum motor (Fig. 2).

(2) Disconnect the rubber hose from the vacuum supply fitting (Fig. 2).

(3) Connect a hand–held vacuum pump to this fitting.

(4) Start the engine.

DIAGNOSIS AND TESTING (Continued)

(5) Slowly apply 10 inches of vacuum to the fitting on the EGR valve motor. Vacuum should hold steady at 10 inches. If not, replace the EGR valve. If vacuum holds steady at 10 inches, proceed to next step.

(6) While applying vacuum, and with the engine running at idle speed, the idle speed should drop, a rough idle may occur, or the engine may even stall. This is indicating that exhaust gas is flowing through the EGR tube between the intake and exhaust manifolds.

(7) If the engine speed did not change, the EGR valve may be defective, the EGR tube may be plugged with carbon, or the passages in the intake and exhaust manifolds may be plugged with carbon.

(a) Remove EGR valve from engine. Refer to EGR Valve Removal in this group.

(b) Apply vacuum to the vacuum motor fitting and observe the stem on the EGR valve. If the stem is moving, it can be assumed that the EGR valve is functioning correctly. The problem is in either a plugged EGR tube or plugged passages at the intake or exhaust manifolds. Refer to step (c). If the stem will not move, replace the EGR valve.

(c) Remove the EGR tube between the intake and exhaust manifolds. Check and clean the EGR tube and its related openings on the manifolds. Refer to EGR Tube in this group for procedures.

Do not attempt to clean the EGR valve. If the valve shows evidence of heavy carbon build–up near the base, replace it.

ELECTRIC VACUUM MODULATOR (EVM) TEST

VACUUM TEST

With the engine running, disconnect the vacuum supply line at the fitting on the EVM. Minimum vacuum should be no less than 20 inches. If vacuum is lower, check for leaks in vacuum supply line. If leaks cannot be found, check for low vacuum at vacuum pump. Refer to Group 5, Brake System for procedures.

REMOVAL AND INSTALLATION

EGR VALVE

REMOVAL

(1) Remove the rubber hose from turbocharger to metal tube.

(2) Disconnect vacuum line at EGR valve vacuum supply fitting (Fig. 2).

(3) Loosen the tube fitting at exhaust manifold end of EGR tube (Fig. 2).

(4) Remove the two bolts retaining the EGR tube to the side of EGR valve (Fig. 2).

(5) Remove the two EGR valve mounting bolts (Fig. 2) and remove EGR valve.

(6) Discard both of the old EGR mounting gaskets.

INSTALLATION

(1) Clean the intake manifold of any old gasket material.

(2) Clean the end of EGR tube of any old gasket material.

(3) Position the EGR valve and new gasket to the intake manifold.

(4) Install two EGR valve mounting bolts. Do not tighten bolts at this time.

(5) Position new gasket between EGR valve and EGR tube.

(6) Install two EGR tube bolts. Tighten all four mounting bolts to 23 N·m (204 in. lbs.).

(7) Tighten EGR tube fitting at exhaust manifold.

(8) Connect vacuum line to EGR valve.

(9) Install the rubber hose from turbocharger to metal tube.

EGR TUBE

The EGR tube connects the EGR valve to the rear of the exhaust manifold (Fig. 2).

REMOVAL

(1) Remove rubber hose from turbocharger to metal tube.

(2) Remove two EGR tube mounting bolts at EGR valve end of tube (Fig. 2).

(3) Loosen fitting at exhaust manifold end of tube (Fig. 2).

(4) Remove EGR tube and discard old gasket.

(5) Clean gasket mating surfaces and EGR tube flange gasket surfaces.

(6) Check for signs of leakage or cracked surfaces at both ends of tube, exhaust manifold and EGR valve.

INSTALLATION

(1) Install a new gasket to EGR valve end of EGR tube.

(2) Position EGR tube to engine.

(3) Loosely tighten fitting at exhaust manifold end of tube.

(4) Install 2 mounting bolts at EGR valve end of tube. Tighten bolts to 23 N·m (204 in. lbs.) torque.

(5) Tighten fitting at exhaust manifold end of tube.

(6) Install hose from turbocharger to metal tube.

ELECTRIC VACUUM MODULATOR (EVM)

The EVM (EGR Duty Cycle Purge Solenoid) is mounted to the side of the PDC (Fig. 6).

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect both cables from battery, negative cable first.

(2) Remove 2 screws holding PDC to bracket, swing out of way.

(3) Remove nut and clamp holding battery to battery tray (Fig. 5).

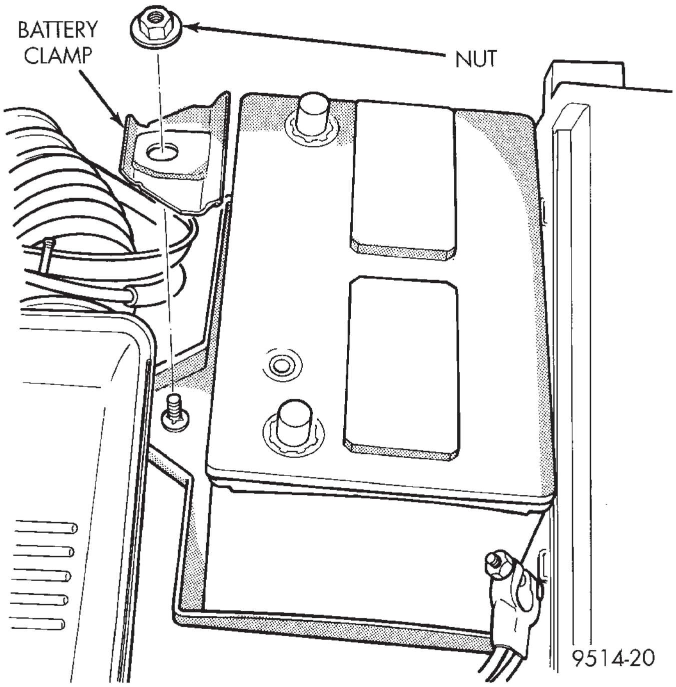

Fig. 5 Battery Clamp

(4) Remove battery from vehicle.

(5) Disconnect two vacuum hoses at EVM (Fig. 6).

(6) Remove mounting screws of EVM.

(7) Remove the EVM to gain access to the EVM electrical connector.

(8) Remove electrical connector at EVM.

INSTALLATION

(1) Install electrical connector to EVM.

(2) Install EVM and tighten mounting screws.

(3) Connect vacuum hoses.

(4) Install PDC to bracket and tighten mounting screws.

(5) Install battery.

(6) Connect battery cables positive first.

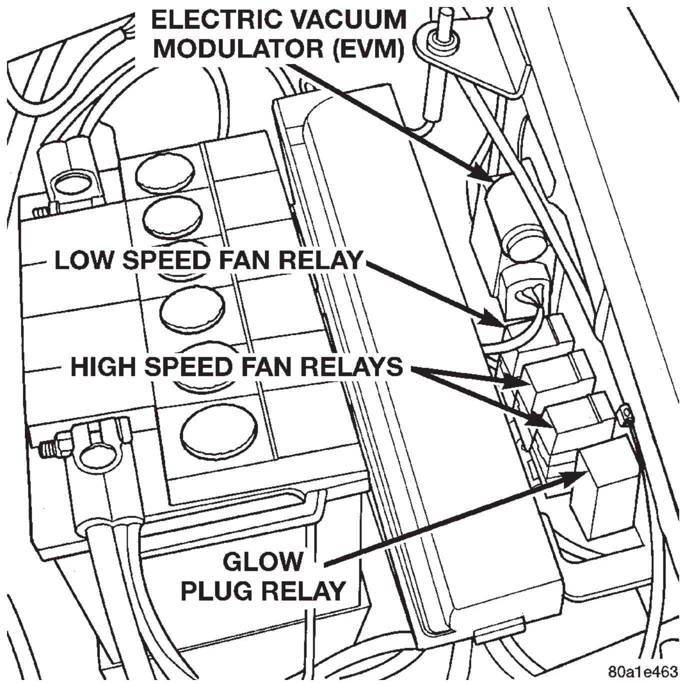

Fig. 6 EVM Location

SPECIFICATIONS

TORQUE CHART—2.5L DIESEL

Description	Torque
EGR Valve Mounting Bolts	23 N·m (204 in. lbs.)
EGR Tube Mounting Bolts	23 N·m (204 in. lbs.)
EVM (Electric Vacuum Modulator) Mounting Bolt	2 N·m (20 in. lbs.)

EMISSION CONTROL SYSTEM—2.0L ENGINE

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GENERAL INFORMATION

GENERAL INFORMATION

The emission control system for the 2.0L engine functions the same as the systems for the 2.4/3.0/3.3/3.8L engines. Refer to group 25 for more information about Diagnostic Trouble Codes and other system features.

POSITIVE CRANKCASE VENTILATION SYSTEM (PCV) SYSTEM—2.0L ENGINE

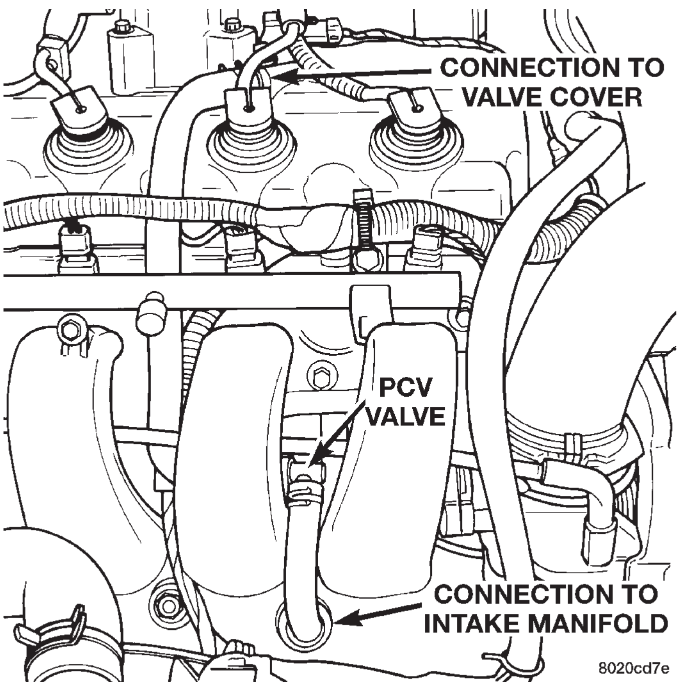

Fig. 1 PCV System—2.0L

The PCV System for 2.0L engines function the same as PCV systems for 2.4/3.0/3.3/3.8L engines. Refer to group 25 for more information.

REMOVAL AND INSTALLATION

EGR VALVE

If the EGR system operates incorrectly, replace the entire EGR valve and transducer together. The EGR valve and electrical transducer (EET) are calibrated together.

REMOVAL

The EGR valve attaches to the rear of the cylinder head (Fig. 2). EGR transducer is attached to the air inlet duct.

(1) Remove EGR transducer from air inlet duct.

(2) Disconnect vacuum supply tube from EGR transducer solenoid.

(3) Disconnect electrical connector from solenoid.

(4) Remove air inlet duct.

(5) Remove EGR tube to EGR valve screws.

(6) Remove EGR valve mounting screws. Remove EGR valve and transducer.

(7) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Loosely install EGR valve with new gaskets.
(2) Finger tighten EGR tube fasteners.
(3) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.
(4) Tightening EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.
(5) Install air inlet duct.
(6) Connect vacuum supply tube to solenoid.
(7) Attach electrical connector to solenoid.
(8) Install EGR transducer onto air inlet duct.

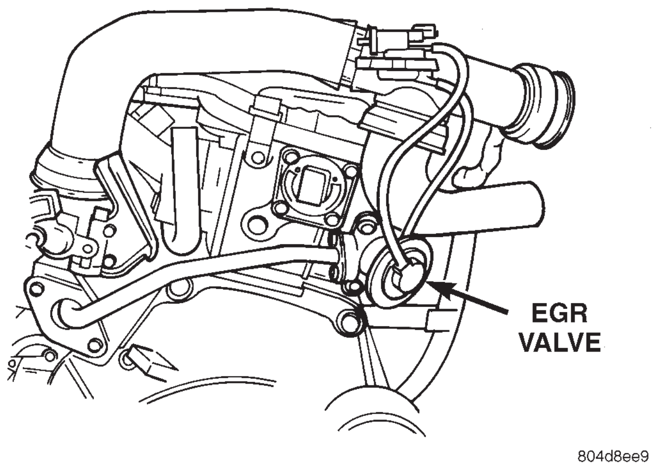

Fig. 2 EGR System

EGR TUBE

The EGR tube attaches to the intake manifold plenum below the throttle body and EGR valve.

REMOVAL

(1) Remove screws attaching EGR tube to intake manifold (Fig. 3).
(2) Remove EGR tube to EGR valve screws.
(3) Remove EGR tube. Clean gasket surface on the EGR valve. Wipe clean the grommet on the intake manifold.

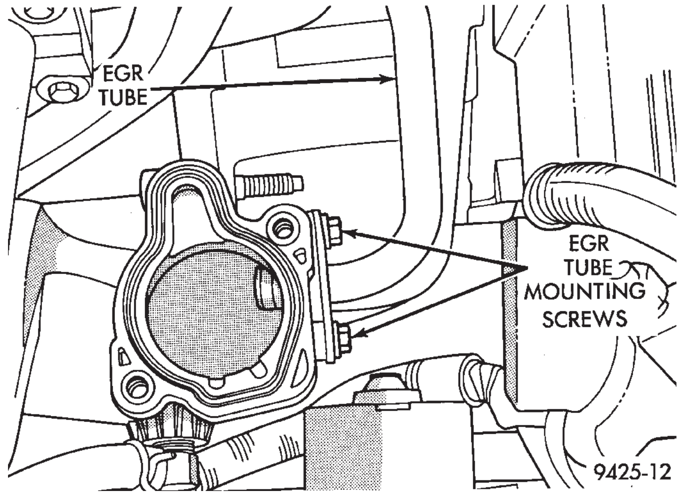

Fig. 3 EGR Tube Stud Bolts

INSTALLATION

The rubber grommet that seals the EGR tube to intake manifold connection is reusable.

(1) Loosely install the EGR tube and fasteners.
(2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.
(3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.

TORQUE

Description	Torque
EGR valve to cyl. head	22 N·m (200 in. lbs.)
EGR tube to EGR valve	11 (95 in. lbs.)
EGR tube to intake manifold	11 N·m (95 in. lbs.)