Welcome to the
1993 Front Wheel Drive
and Supplements
Electronic Service Manual

Click on logo to begin

DaimlerChrysler Corporation

CLICK HERE
FOR INSTRUCTIONS

DaimlerChrysler Corporation

UNITED STATES

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

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

MILLER SPECIAL TOOLS

OTC Division, SPX Corporation

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

CANADA

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

C & D Riley Enterprises Ltd., P.O. Box 243, Amherstburg, Ontario N9V 2Z4
Telephone (519) 736-4600 FAX (519) 736-8433

INTERNATIONAL

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

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

MILLER SPECIAL TOOLS

OTC Division, SPX Corporation

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

NEXT PAGE ▶

CAUTION

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

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

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

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

NEXT PAGE ▶

CHRYSLER CORPORATION

SERVICE MANUAL and SUPPLEMENTS

1993 FRONT WHEEL DRIVE PASSENGER VEHICLES

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

CHRYSLER
CORPORATION

Chrysler Corporation reserves the right to make changes in design or to make additions to or improvements in its products without imposing any obligations upon itself to install them on its products previously manufactured.

NEXT PAGE ▶

FOREWORD

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

These diagrams contain the latest information at the time of publication and incorporate the wiring schematic for the basic vehicle and available optional equipment.

The diagrams are grouped by body type and sales division. The body codes are explained in the General Information section. (Example—AP-D, P=Shadow, Sundance). To locate a system or component refer to the black index tabs on the next page. The tab will assist you in locating the desired area of the manual.

An alphabetical index is provided at the beginning of each section to help you in locating a system or component. All diagrams are identified by SHEET NUMBER which is found in the lower right- or left-hand corner of the page.

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

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

NOTE: The acronyms, terminology and nomenclature used to identify emissions related components in this manual may have changed from prior publications. These new terms are in compliance with S.A.E. recommended practice J1930. This terminology standard (J1930) is required to comply with the 1993 California Air Research Board (CARB) requirements.

NEXT PAGE ▶

GROUP TAB LOCATOR

CHRYSLER CORPORATION

ENGINE—CHASSIS—BODY SERVICE MANUAL

1993 FRONT WHEEL DRIVE PASSENGER VEHICLES

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

CHRYSLER CORPORATION
SERVICE & PARTS DIVISION

NEXT PAGE ▶

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 components.

The Component and System Index of this manual identifies the correct group for the component or system to be serviced. 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.

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

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

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

> NOTE: The acronyms, terminology and nomenclature used to identify emissions related components in this manual may have changed from prior publications. These new terms are in compliance with S.A.E. recommended practice J1930. This terminology standard (J1930) is required to comply with the 1993 California Air Research Board (CARB) requirements.

FOR INFORMATION NOT CONTAINED IN THIS MANUAL, REFER TO FRONT WHEEL DRIVE PASSENGER VEHICLES ELECTRICAL—FUEL—EMISSIONS OR WIRING DIAGRAMS SERVICE MANUALS.

NEXT PAGE ▶

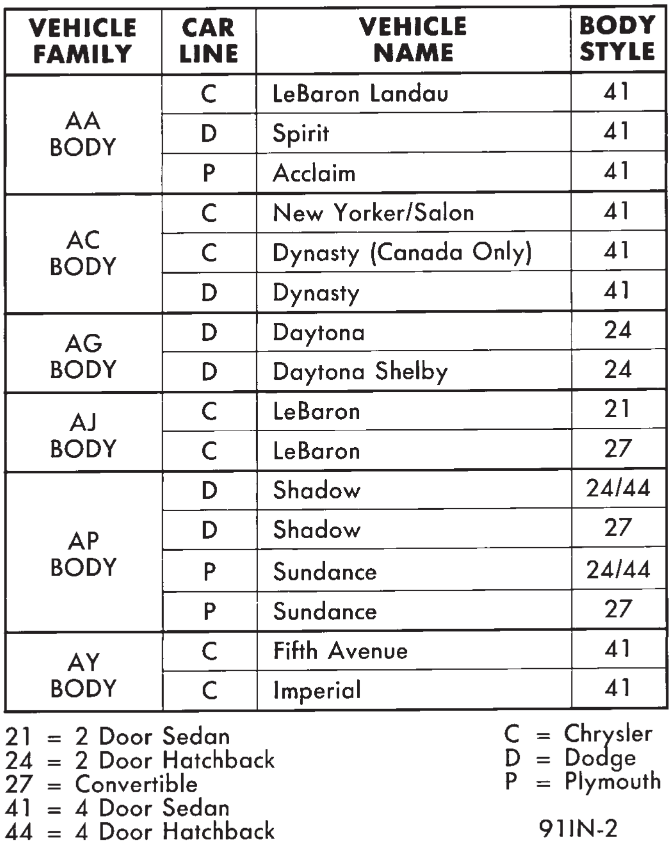
GROUP TAB LOCATOR

INTRODUCTION

CONTENTS

VEHICLE FAMILY IDENTIFICATION

Throughout this service manual references are made to Vehicle Family, Body Codes. The letters AA, AC, AG, AJ, AP, or AY are body codes that are assigned to a individual vehicle family (Fig. 1). Also digit boxes 34, 35 and 36 on the Body Code Plate indicate the Vehicle family.



VEHICLE FAMILY	CAR LINE	VEHICLE NAME	BODY STYLE
AA BODY	C	LeBaron Landau	41
	D	Spirit	41
	P	Acclaim	41
AC BODY	C	New Yorker/Salon	41
	C	Dynasty (Canada Only)	41
	D	Dynasty	41
AG BODY	D	Daytona	24
	D	Daytona Shelby	24
AJ BODY	C	LeBaron	21
	C	LeBaron	27
AP BODY	D	Shadow	24/44
	D	Shadow	27
	P	Sundance	24/44
	P	Sundance	27
AY BODY	C	Fifth Avenue	41
	C	Imperial	41

21 = 2 Door Sedan
24 = 2 Door Hatchback
27 = Convertible
41 = 4 Door Sedan
44 = 4 Door Hatchback

C = Chrysler
D = Dodge
P = Plymouth

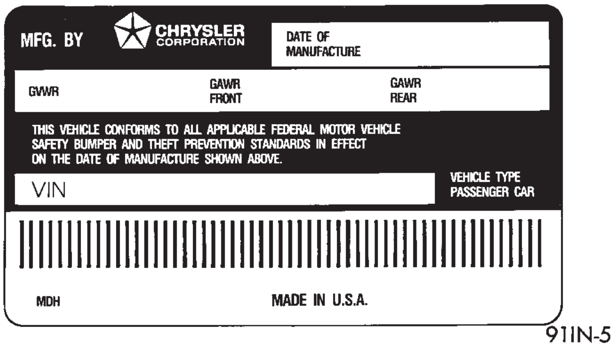
91IN-2

Fig. 1 Vehicle Family Identification

VEHICLE SAFETY CERTIFICATION LABEL

A vehicle safety certification label (Fig. 2) is attached to the rear facing 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.

All communications or inquiries regarding the vehicle should include the Month-Day-Hour and Vehicle Identification Number.



MFG. BY CHRYSLER CORPORATION

DATE OF MANUFACTURE

GVWR GAWR FRONT GAWR REAR

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY BUMPER AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN

VEHICLE TYPE PASSENGER CAR

MDH

MADE IN U.S.A.

91IN-5

Fig. 2 Vehicle Safety Certification Label

VEHICLE IDENTIFICATION NUMBER

The Vehicle Identification Number (VIN) is located on the upper left corner of the instrument panel, near the left windshield pillar. The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle (Fig. 3). Refer to VIN Code Breakdown Chart.

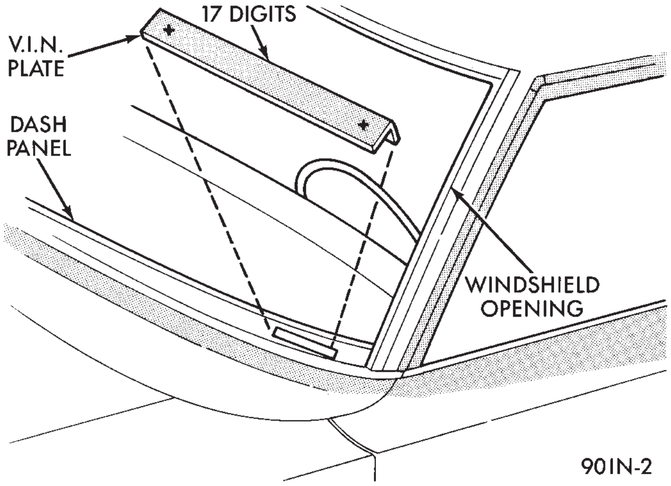
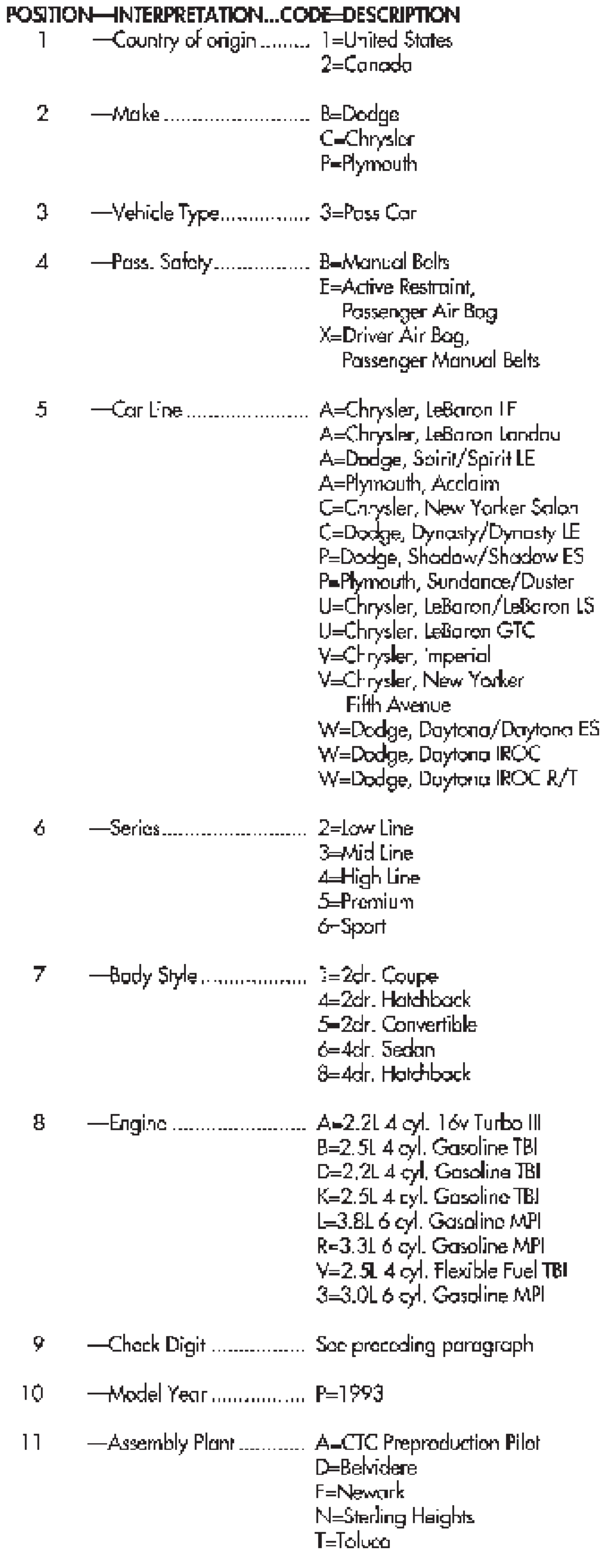


Fig. 3 Vehicle Identification Number (VIN Plate)

VIN CODE BREAKDOWN



POSITION	INTERPRETATION	CODE=DESCRIPTION
1	—Country of origin	1=United States 2=Canada
2	—Make	B=Dodge C=Chrysler P=Plymouth
3	—Vehicle Type	3=Pass Car
4	—Pass. Safety	B=Manual Belts E=Active Restraint, Passenger Air Bag X=Driver Air Bag, Passenger Manual Belts
5	—Car Line	A=Chrysler, LeBaron LE A=Chrysler, LeBaron Landau A=Dodge, Spirit/Spirit LE A=Plymouth, Acclaim C=Chrysler, New Yorker Salon C=Dodge, Dynasty/Dynasty LE P=Dodge, Shadow/Shadow ES P=Plymouth, Sundance/Duster U=Chrysler, LeBaron/LeBaron LS U=Chrysler, LeBaron GTC V=Chrysler, Imperial V=Chrysler, New Yorker Fifth Avenue W=Dodge, Daytona/Daytona ES W=Dodge, Daytona IROC W=Dodge, Daytona IROC R/T
6	—Series	2=Low Line 3=Mid Line 4=High Line 5=Premium 6=Sport
7	—Body Style	3=2dr. Coupe 4=2dr. Hatchback 5=2dr. Convertible 6=4dr. Sedan 8=4dr. Hatchback
8	—Engine	A=2.2L 4 cyl. 16v Turbo III B=2.5L 4 cyl. Gasoline TBI D=2.2L 4 cyl. Gasoline TBI K=2.5L 4 cyl. Gasoline TBI L=3.8L 6 cyl. Gasoline MPI R=3.3L 6 cyl. Gasoline MPI V=2.5L 4 cyl. Flexible Fuel TBI 3=3.0L 6 cyl. Gasoline MPI
9	—Check Digit	See preceding paragraph
10	—Model Year	P=1993
11	—Assembly Plant	A=CTC Preproduction Pilot D=Belvidere F=Newark N=Sterling Heights T=Toluca

12THRU17 Vehicle Build Sequence

93IN-12

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 INFORMATION

The Body Code Plate is attached to the top of the radiator closure panel in the engine compartment. 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

DIGIT BOXES 1,2 AND 3—Paint Procedure

DIGIT BOXES 4 THROUGH 7—Primary Paint

See Group 23, Body for color codes

DIGIT BOXES 8 THROUGH 11—Secondary Paint

DIGIT BOXES 12 THROUGH 15—Interior Trim Code

DIGIT BOXES 16, 17 AND 18—Engine Code

- EDB = 2,5 L, 4 cylinder EFI Gas—With Balance Shaft
- EDF = 2.2 L, 4 cylinder EFI Gas—Automatic or Manual Transaxle
- EDM = 2.5 L, 4 cylinder EFI Gas—Automatic or Manual Transaxle
- EDN = 2.5 L, 4 cylinder EFI Flexible Fuel—Automatic Transaxle
- EDS = 2.2 L, 4 cylinder, 16 valve Turbo III—Manual Transaxle
- EFA = 3.0 L, V6 Gas (EFI)—Automatic or Manual Transaxle
- EGA = 3.3 L, V6 Gas (EFI)—Automatic
- EGH = 3.8 L, V6 Gas (EFI)—Automatic

BODY CODE PLATE LINE 2

DIGIT BOXES 19 THROUGH 30—Vehicle Order Number

DIGIT BOXES 31, 32 AND 33—Vinyl Roof Code

DIGIT BOXES 34, 35 AND 36—Vehicle Shell Car Line

- APD = Shadow
- APP = Sundance
- AAC = Lebaron Sedan
- AAD = Spirit
- AAP = Acclaim
- AGV = Daytona, IROC R/T
- AJC = LeBaron Coupe/Convertible

- ACC = New Yorker—New Yorker Landau—Dynasty (Canada)
- ACD = Dynasty
- ACY = New Yorker Fifth Avenue—Imperial

DIGIT BOX 37—Price Class

- E = Economy
- H = High Line
- L = Low Line
- M = Maximum
- P = Premium
- S = Special/Sport
- X = Performance Image

DIGIT BOXES 38 AND 39—Body Type

- 21 = Two Door Sedan
- 24 = Two Door Hatchback
- 27 = Two Door Convertible
- 41 = Four Door Sedan
- 44 = Four Door Hatchback

BODY CODE PLATE LINE 1

DIGIT BOXES 40, 41, AND 42—Transaxle Codes

- DDM = 5-speed Manual Transaxle
- DDN = 5-speed Manual Transaxle
- DDV = 5-speed Manual Transaxle
- DGC = 3-speed Automatic Transaxle
- DGL = 4-speed Automatic Transaxle

DIGIT BOX 43—Market Code

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

DIGIT BOXES 44 THROUGH 60—Vehicle Identification Number (VIN)

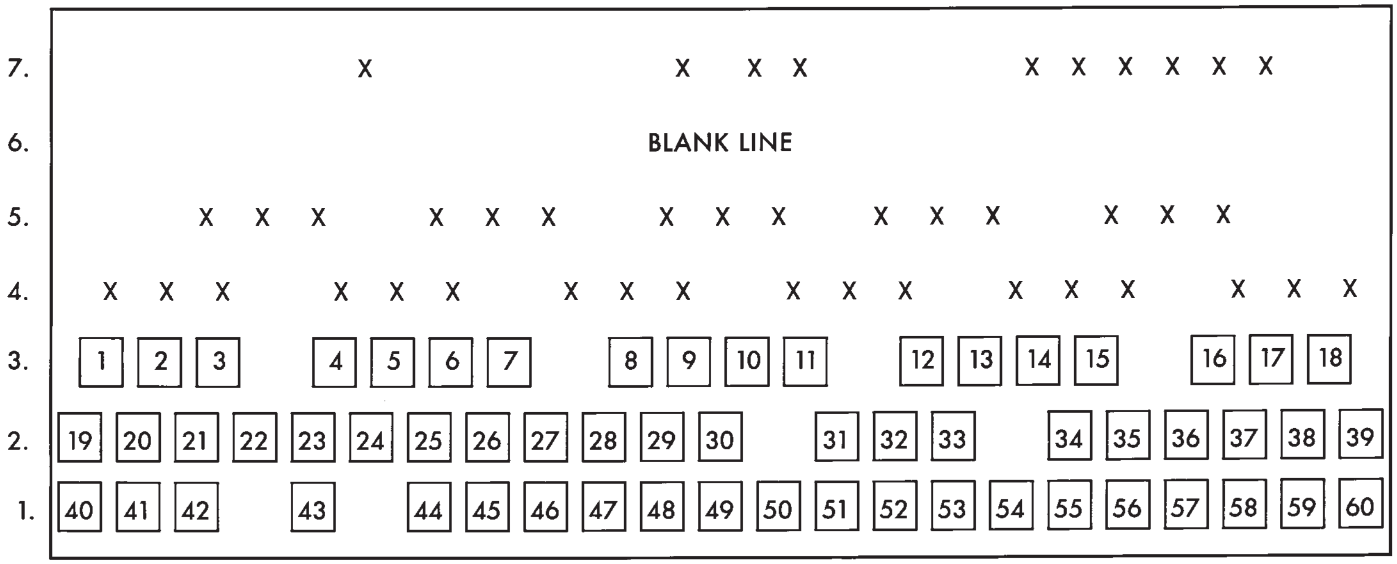
Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

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 show CTD (for continued).

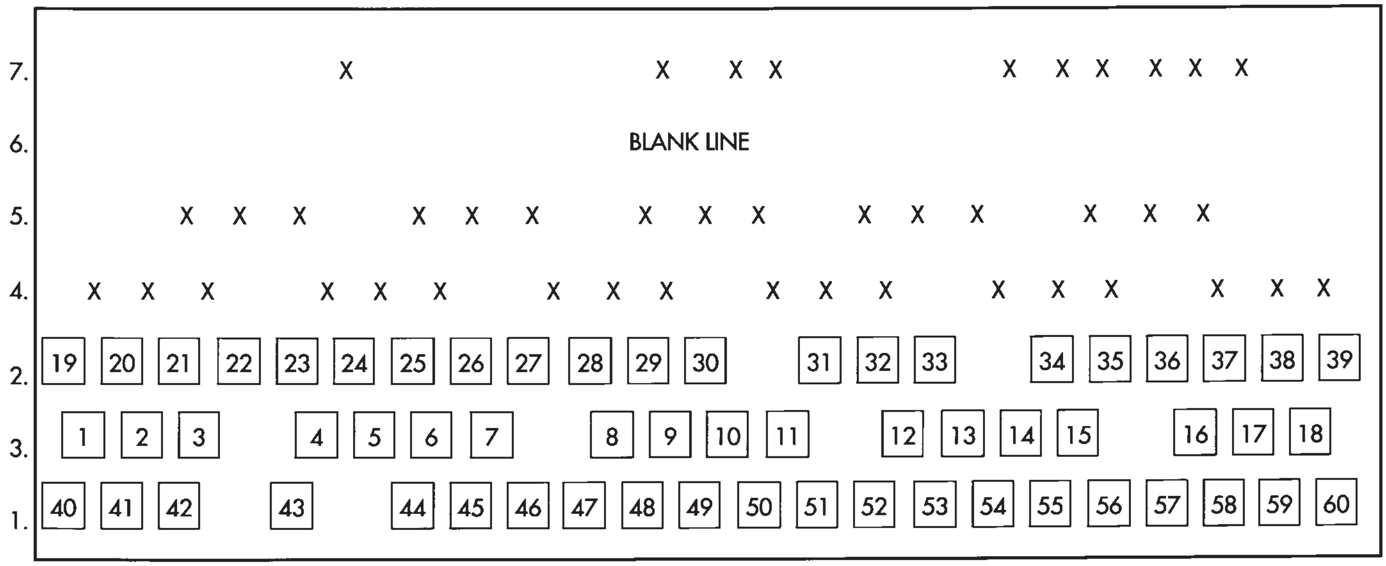
When a second plate is required, the first four spaces of each line will not be used due to overlap of the plates.

BODY CODE PLATE—AA, AC, AP AND AY VEHICLES



92IN-3

BODY CODE PLATE—AG AND AJ VEHICLES



92IN-5

STANDARD BODY DIMENSIONS

EXTERIOR DIMENSIONS

VEHICLE FAMILY	BODY STYLE	WHEELBASE	TRACK		OVERALL		
		mm/in.	FRONT mm/in.	REAR mm/in.	LENGTH mm/in.	WIDTH mm/in.	HEIGHT mm/in.
AA	C-41	2624/103.3	1463/57.6	1453/57.2	4620/182.7	1731/68.1	1420/56.0
AA	PD-41	2624/103.3	1463/57.6	1453/57.2	4602/181.2	1731/68.1	1410/55.5
AC	D-41	2649/104.3	1463/57.6	1464/57.6	4877/192.0	1750/68.9	1415/55.7
AC	C-41	2649/104.3	1463/57.6	1464/57.6	4918/193.6	1750/68.9	1415/55.7
AG	24	2465/97.0	1461/57.5	1464/57.6	4556/179.4	1759/69.3	1316/51.8
AJ	21	2547/100.3	1461/57.5	1464/57.6	4694/184.8	1738/68.4	1353/53.3
AJ	27	2547/100.3	1461/57.5	1464/57.6	4694/184.8	1738/68.4	1372/54.0
AP	24	2463/97.0	1462/57.6	1453/57.2	4361/171.7	1708/67.2	1395/54.9
AP	27	2463/97.0	1462/57.6	1453/57.2	4361/171.7	1708/67.2	1418/55.8
AP	44	2463/97.0	1462/57.6	1453/57.2	4361/171.7	1708/67.2	1395/54.9
AY	CS-41	2777/109.3	1463/57.6	1464/57.6	5045/198.6	1750/68.9	1419/55.9
AY	CP-41	2777/109.3	1463/57.6	1464/57.6	5155/203.0	1750/68.9	1430/56.3

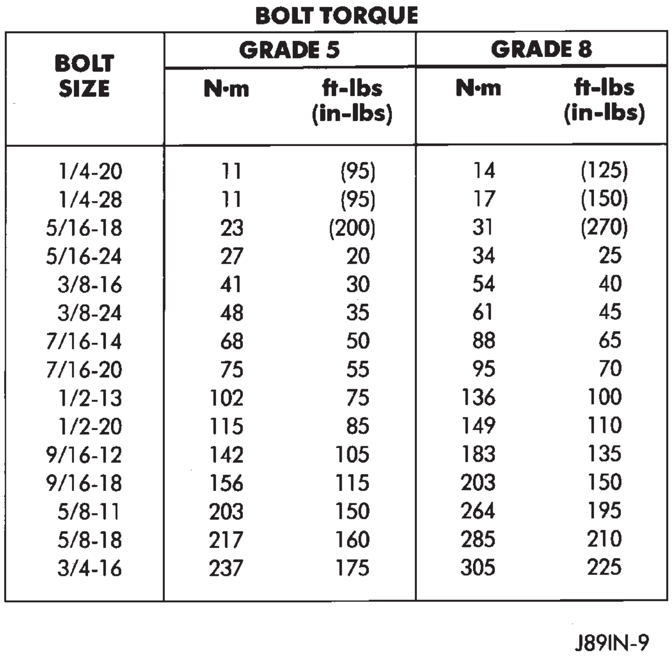
INTERIOR DIMENSIONS

VEHICLE FAMILY	BODY STYLE	HEAD ROOM		LEG ROOM		SHOULDER ROOM		HIP ROOM	
		FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR
AA	C-41	976 mm 38.4 in.	962 mm 37.9 in.	1063 mm 41.9 in.	973 mm 38.3 in.	1368 mm 53.9 in.	1377 mm 54.2 in.	1312 mm 51.7 in.	1320 mm 52.0 in.
AA	PD-41	976 mm 38.4 in.	962 mm 37.9 in.	1063 mm 41.9 in.	973 mm 38.3 in.	1380 mm 54.3 in.	1397 mm 55.0 in.	1312 mm 51.7 in.	1320 mm 52.0 in.
AC	D-41	973 mm 38.3 in.	959 mm 37.8 in.	1064 mm 41.9 in.	966 mm 38.0 in.	1432 mm 56.4 in.	1420 mm 55.9 in.	1300 mm 51.2 in.	1313 mm 51.7 in.
AC	C-41	973 mm 38.3 in.	959 mm 37.8 in.	1064 mm 41.9 in.	988 mm 38.9 in.	1432 mm 56.4 in.	1420 mm 55.9 in.	1300 mm 51.2 in.	1313 mm 51.7 in.
AG	24	944 mm 37.2 in.	872 mm 34.3 in.	1077 mm 42.4 in.	764 mm 30.1 in.	1384 mm 54.5 in.	1362 mm 53.6 in.	1363 mm 53.7 in.	1216 mm 47.9 in.
AJ	21	955 mm 37.6 in.	923 mm 36.3 in.	1077 mm 42.4 in.	839 mm 33.0 in.	1420 mm 55.9 in.	1430 mm 56.3 in.	1330 mm 52.4 in.	1217 mm 47.9 in.
AJ	27	972 mm 38.3 in.	940 mm 37.0 in.	1077 mm 42.4 in.	839 mm 33.0 in.	1420 mm 55.9 in.	1160 mm 45.7 in.	1330 mm 52.4 in.	954 mm 37.6 in.
AP	24	973 mm 38.3 in.	949 mm 37.4 in.	1055 mm 41.5 in.	864 mm 34.0 in.	1382 mm 54.5 in.	1334 mm 52.5 in.	1404 mm 55.3 in.	1206 mm 47.5 in.
AP	27	1013 mm 39.9 in.	982 mm 38.7 in.	1055 mm 41.5 in.	805 mm 31.7 in.	1384 mm 54.4 in.	1082 mm 42.6 in.	1344 mm 52.9 in.	1087 mm 42.8 in.
AP	44	973 mm 38.3 in.	949 mm 37.4 in.	1055 mm 41.5 in.	864 mm 34.0 in.	1390 mm 54.7 in.	1384 mm 54.5 in.	1408 mm 55.4 in.	1136 mm 44.7 in.
AY	41	977 mm 38.5 in.	959 mm 37.8 in.	1093 mm 43.0 in.	1090 mm 42.9 in.	1432 mm 56.4 in.	1411 mm 55.6 in.	1300 mm 51.2 in.	1317 mm 51.9 in.

91IN-6

TORQUE REFERENCES

Individual Torque Charts appear at the end of many Groups. Refer to the Standard Torque Specifications and Bolt Identification Chart in this Group for torques not listed in the individual torque charts (Fig. 4).



BOLT TORQUE

BOLT SIZE	GRADE 5 N·m	GRADE 5 ft-lbs (in-lbs)	GRADE 8 N·m	GRADE 8 ft-lbs (in-lbs)
1/4-20	11	(95)	14	(125)
1/4-28	11	(95)	17	(150)
5/16-18	23	(200)	31	(270)
5/16-24	27	20	34	25
3/8-16	41	30	54	40
3/8-24	48	35	61	45
7/16-14	68	50	88	65
7/16-20	75	55	95	70
1/2-13	102	75	136	100
1/2-20	115	85	149	110
9/16-12	142	105	183	135
9/16-18	156	115	203	150
5/8-11	203	150	264	195
5/8-18	217	160	285	210
3/4-16	237	175	305	225

J89IN-9

Fig. 4 Grade 5 and 8 Standard Torque Specifications

Torque specifications on the Bolt Torque chart are based on the use of clean and dry threads. Reduce the torque by 10% when the threads are lubricated with engine oil and by 20% if new plated bolts are used.

Various sizes of Torx head fasteners are used to secure numerous components to assemblies. Due to ever changing usage of fasteners, Torx head fasteners may not be identified in art or text.

METRIC THREAD AND GRADE IDENTIFICATION

Metric and SAE thread notations differ slightly. The difference is illustrated in Figure 5.

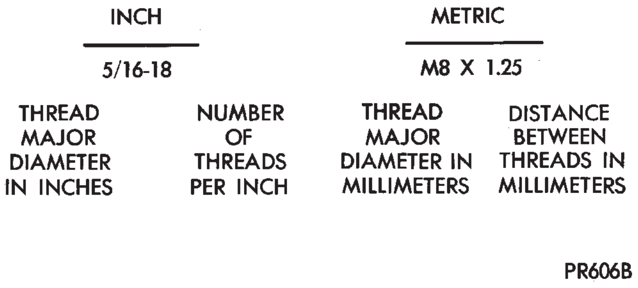


Fig. 5 Thread Notation (Metric and SAE)

Common metric fastener strength classes are 9.8 and 12.9 with the class identification embossed on the head of each bolt (Fig. 6). Some metric nuts will be marked with a single digit strength number on the nut face.

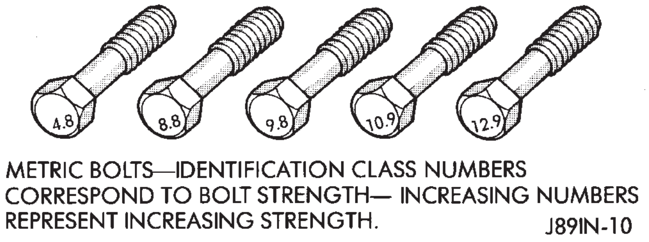


Fig. 6 Metric Bolt Identification

SAE strength classes range from grade 2 to 8 with line identification embossed on each bolt head. Markings corresponding to two lines less than the actual grade (Fig. 7). For Example: Grade 7 bolt will exhibit 5 embossed lines on the bolt head.

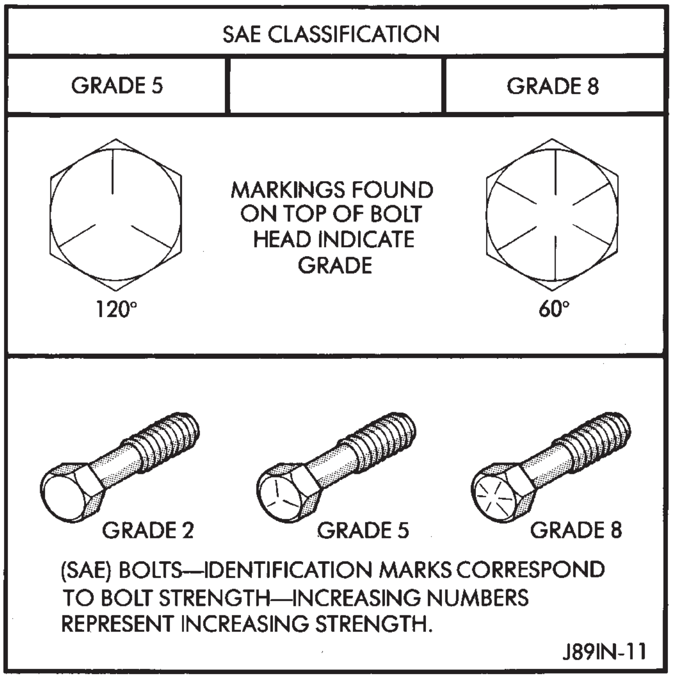


Fig. 7 SAE Bolt Identification

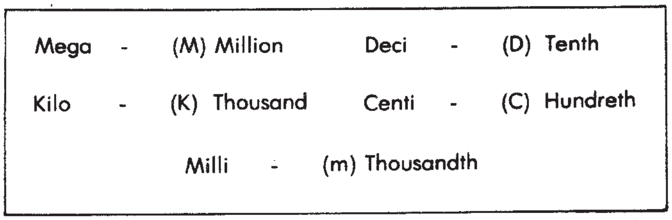
METRIC SYSTEM

Figure art, specifications, and tightening references in this Service Manual are identified in the metric system and in the SAE system.

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.

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

The metric system is based on quantities of one, ten, one hundred, one thousand, and one million (Fig. 8).

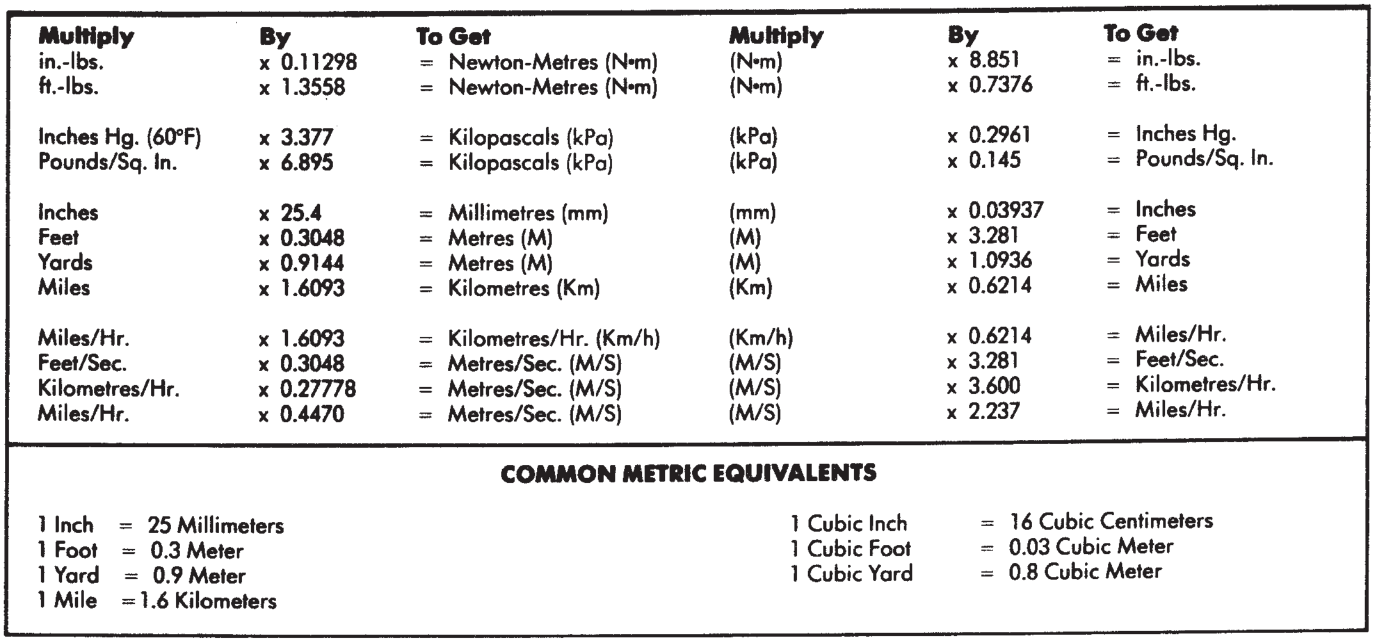


Mega - (M) Million
Kilo - (K) Thousand
Milli - (m) Thousandth
Deci - (D) Tenth
Centi - (C) Hundreth

J901N-2

Fig. 8 Metric Prefixes

CONVERSION TABLES



Multiply	By	To Get	Multiply	By	To Get
in.-lbs.	x 0.11298	= Newton-Metres (N•m)	(N•m)	x 8.851	= in.-lbs.
ft.-lbs.	x 1.3558	= Newton-Metres (N•m)	(N•m)	x 0.7376	= ft.-lbs.
Inches Hg. (60°F)	x 3.377	= Kilopascals (kPa)	(kPa)	x 0.2961	= Inches Hg.
Pounds/Sq. In.	x 6.895	= Kilopascals (kPa)	(kPa)	x 0.145	= Pounds/Sq. In.
Inches	x 25.4	= Millimetres (mm)	(mm)	x 0.03937	= Inches
Feet	x 0.3048	= Metres (M)	(M)	x 3.281	= Feet
Yards	x 0.9144	= Metres (M)	(M)	x 1.0936	= Yards
Miles	x 1.6093	= Kilometres (Km)	(Km)	x 0.6214	= Miles
Miles/Hr.	x 1.6093	= Kilometres/Hr. (Km/h)	(Km/h)	x 0.6214	= Miles/Hr.
Feet/Sec.	x 0.3048	= Metres/Sec. (M/S)	(M/S)	x 3.281	= Feet/Sec.
Kilometres/Hr.	x 0.27778	= Metres/Sec. (M/S)	(M/S)	x 3.600	= Kilometres/Hr.
Miles/Hr.	x 0.4470	= Metres/Sec. (M/S)	(M/S)	x 2.237	= Miles/Hr.

COMMON METRIC EQUIVALENTS

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

J901N-11

CONVERSION TABLES

in-lbs to N•m

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

N•m to in-lbs

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

ft-lbs to N•m

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

N•m to ft-lbs

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

in. to mm

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

mm to in.

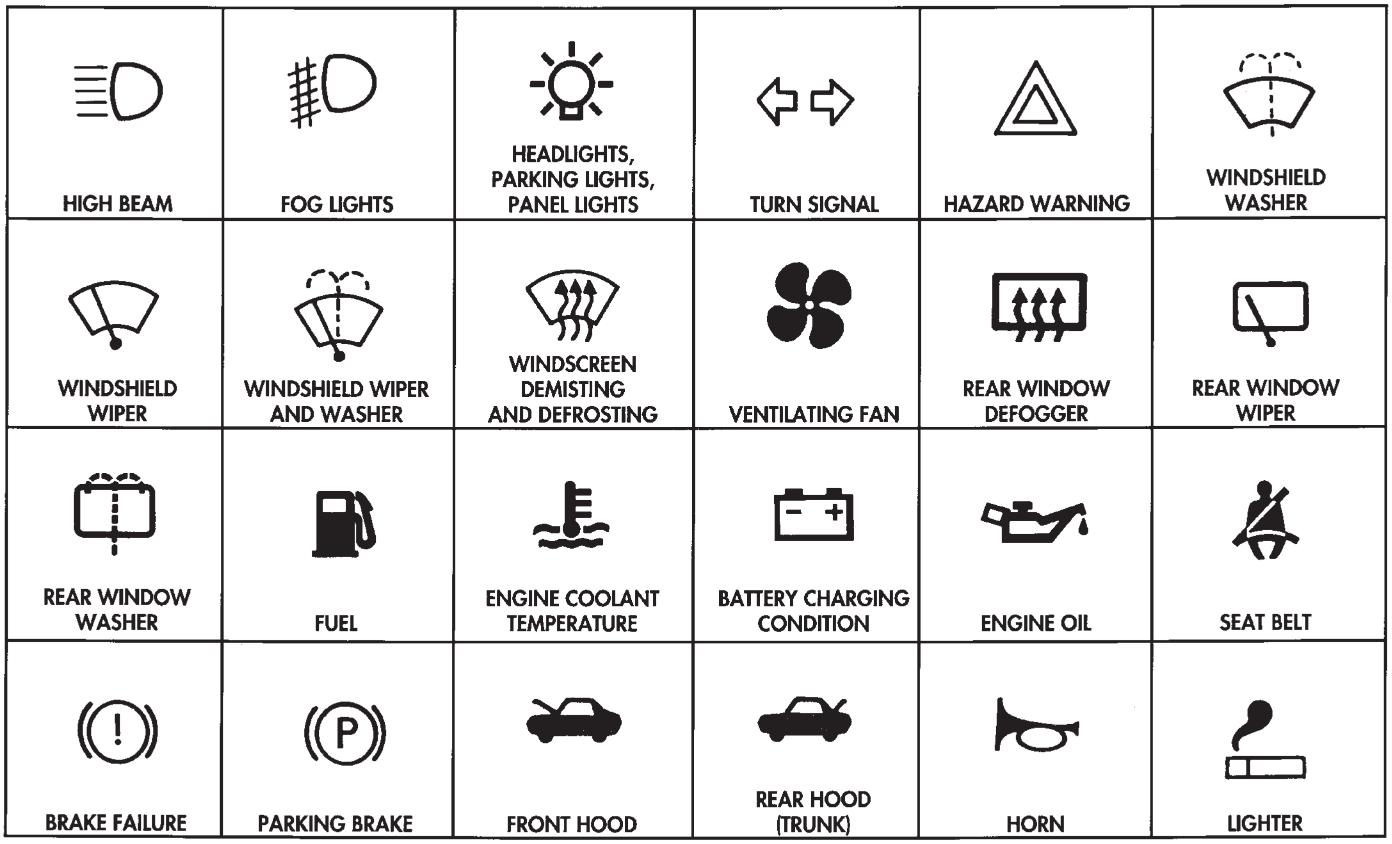
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85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

J901N-10

INTERNATIONAL SYMBOLS

International Symbols are used to identify controls, displays and indicators. The symbols are used on controls that are displayed on the instrument panel or in the immediate vicinity of the operator.

INTERNATIONAL SYMBOLS



93IN-9

LUBRICATION AND MAINTENANCE

CONTENTS

GENERAL INFORMATION

INDEX

INTRODUCTION

Chrysler Corporation has compiled recommended lubrication and maintenance schedules and procedures to help reduce premature wear or failure over a broad range of operating conditions. When selecting the proper maintenance schedule, the climate and operating conditions must be considered. A vehicle subjected to severe usage requires service more frequently than a vehicle used for general transportation.

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.

SEVERE SERVICE

If a vehicle is operated under any of the following conditions, it is considered severe service.

- Extremely dusty areas.
- 50% or more of vehicle operation in 32°C (90°F) or higher temperatures.
- Prolonged idling (such as, vehicle operation in stop and go traffic).
- Frequent short running periods. Not allowing engine to warm to operating temperatures.
- Police or taxi usage.

FUEL USAGE

All Chrysler Corporation engines require the use of unleaded fuel to reduce exhaust emissions. Use fuel with a minimum octane rating of 87,(R + M)/2. See Engine section of this group for Fuel Recommendations.

CLASSIFICATION OF LUBRICANTS

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

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

ENGINE OIL

SAE GRADE RATING INDICATES ENGINE OIL VISCOSITY

- SAE 30 = single grade engine oil.
- SAE 5W-30 = multiple grade engine oil.

API QUALITY CLASSIFICATION.

- SG service engine oil is a high quality crankcase lubricant designed for use in all naturally aspirated engines.
- SG/CD service engine oil is a high quality crankcase lubricant designed for use in most naturally aspirated and turbocharged gasoline or diesel engines.

GEAR LUBRICANTS

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

LUBRICATION AND MAINTENANCE SCHEDULES

ALL VEHICLES EXCEPT CALIFORNIA 2.5 L & 3.0 L ENGINE WITH AUTO TRANSAXLE

EMISSION RELATED COMPONENT MAINTENANCE

Where time and mileage are shown,	**miles X 1000**	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5
follow interval listed first.	**kilometers X 1000**	12	24	36	48	60	72	84	96	108	120	132	144	156
Air Cleaner Air Filter—Replace	AT				X				X				X	
Ignition Cables—Replace	AT								X					
PCV Valve—Check and Replace if Necessary	AT								X				0#	
Spark Plugs—Replace	AT				X				X				X	
Timing Belt 2.2-2.5 L Engine—Replace	AT												X	

NON-EMISSION RELATED COMPONENT MAINTENANCE

Where time and mileage are shown,	**miles X 1000**	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5
follow interval listed first.	**kilometers X 1000**	12	24	36	48	60	72	84	96	108	120	132	144	156
Engine Coolant Flush and Replace at 36 Months**	OR							X**						
Engine Coolant Level, Hoses and Clamps—Inspect	AT	X	X	X	X	X	X	X	X	X	X	X	X	X
Engine Oil—Change Every 6 Months (4)	OR	X	X	X	X	X	X	X	X	X	X	X	X	X
Engine Oil Filter—Replace Every Second Oil Change	*		X		X		X		X		X		X	
Crankcase Filter (if equipped)—Replace	AT				X				X				X	
Accessory Drive Belts—Adjust Tension	AT		X		X		X				X		X	
Replace	AT								X					
Accessory Drive Belts—Auto Tension, Inspect***	AT								X		X#		X#	
Exhaust System—Inspect Every		X	X	X	X	X	X	X	X	X	X	X	X	X
Tire Rotation	AT	X	X	X	X	X	X	X	X	X	X	X	X	X

SEVERE SERVICE MAINTENANCE

Severe service is defined as: Stop-and-go driving in dusty conditions, extensive idling, frequent short trips, operating at sustained high speeds during hot weather above +90°F (+32°C), police, taxi, limousine, commercial type operation, or trailer towing. Including California 2.5 L & 3.0 L Engines with Auto Transaxle.

Where time and mileage are shown,	**miles X 1000**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
follow interval listed first.	**kilometers X 1000**	5	10	15	20	24	29	34	39	43	48	53	58	62	67	72	77
Engine Oil	Refer to engine oil paragraph	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Engine Oil Filter	Replace every second oil change		X		X		X		X		X		X		X		X
Brake Linings—Front and Rear	Inspect every			X			X			X			X			X	
CV Joint & Front Suspension Ball Joints	Inspect every oil change	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tie Rod Ends & Steering Linkage	Lubricate every 18 months OR					X					X					X	
Air Cleaner Air Filter	Replace if required every					X					X					X	
Automatic Transaxle	Change filter and fluid every					X					X					X	
PCV Valve	Replace if required every										X						

0 = Recommended maintenance for proper performance.
X = Scheduled maintenance.
# = Not required if previously replaced.
* = If accumulated mileage is less than 7,500 miles for 12 months, replace oil filter at each oil change.
** = Flush and replace engine coolant every 24 months or 30,000 miles thereafter.
*** = Replace if required.
(4) = Flexible Fuel Vehicles — Change engine oil every 6 months or 8 000 km (5,000 miles).

9300-23

CALIFORNIA VEHICLES W/2.5 & 3.0 L ENGINES & AUTO TRANSAXLE

EMISSION RELATED COMPONENT MAINTENANCE

Where time and mileage are shown,	miles X 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5
follow interval listed first.	kilometers X 1000	12	24	36	48	60	72	84	96	108	120	132	144	156
Air Cleaner Air Filter—Replace	AT				X				X				X	
Ignition Cables—Replace	AT								X					
PCV Valve—Check and Replace if Necessary	AT								0(3)					
Spark Plugs—Replace	AT				X				X				X	
Timing Belt 2.5 L Engine, Replace if Required	AT												0(3)	
Timing Belt 3.0 L Engine, Replace if Required	AT								0(3)				0(3)#	

NON-EMISSION RELATED COMPONENT MAINTENANCE

Where time and mileage are shown,	miles X 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5
follow interval listed first.	kilometers X 1000	12	24	36	48	60	72	84	96	108	120	132	144	156
Engine Coolant Flush and Replace at 36 Months**	OR							X**						
Engine Coolant Level, Hoses and Clamps—Inspect	AT	X	X	X	X	X	X	X	X	X	X	X	X	X
Engine Oil—Change Every 6 Months	OR	X	X	X	X	X	X	X	X	X	X	X	X	X
Engine Oil Filter—Replace Every Second Oil Change	*		X		X		X		X		X		X	
Crankcase Filter (if equipped)—Replace	AT				X				X				X	
Accessory Drive Belts—Adjust Tension	AT		X		X		X				X		X	
Replace	AT								X					
Accessory Drive Belts—Auto Tension, Inspect***	AT								X		X#		X#	
Exhaust System—Inspect Every		X	X	X	X	X	X	X	X	X	X	X	X	X
Tire Rotation	AT	X	X	X	X	X	X	X	X	X	X	X	X	X

0 = Recommended maintenance for proper performance.
X = Scheduled maintenance.
# = Not required if previously replaced.
* = If accumulated mileage is less than 7,500 miles for 12 months, replace oil filter at each oil change.
** = Flush and replace engine coolant every 24 months or 30,000 miles thereafter.
*** = Replace if required.
(3) = Recommended by Chrysler but not required to maintain warranty on drive belts and PCV valve.

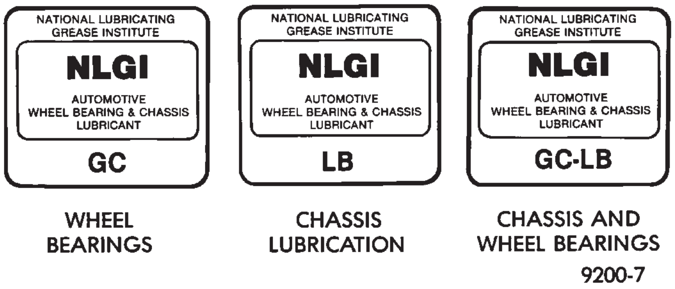
9300-24

LUBRICANTS AND GREASES

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol 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 letter "L". The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.

NLGI SYMBOL



FLUID CAPACITIES

Fuel Tank	
AP,AG and AJ	53 L (14 gal.)
AA,AC and AY	60 L (16 gal.)
AA-Flexible Fuel	68 L (18 gal.)
Engine Oil	
All	3.8 L (4.5 qts.)
Cooling System	
2.2L	8.5 L (9.0 qts.)
2.5L	8.5 L (9.0 qts.)
3.0L	9.0 L (9.5 qts.)
3.3L	9.0 L (9.5 qts.)
3.8L	9.0 L (9.5 qts.)
Includes heater and coolant recovery bottle	
Automatic Transaxle	
Estimated Service Fill	
ALL	3.8 L (4.0 qts.)
Overhaul Fill Capacity with Torque Converter Empty	
3-speed Fleet	8.7 L (9.2 qts.)
3-speed	8.2 L (8.8 qts.)
4-speed Electronic	9.4L (9.9 qts.)
Manual Transaxle	
All	9.4L (9.9 qts.)
Fill to bottom of fill hole.	
Power Steering	
All	75L (1.5 pts.)

PARTS REQUIRING NO LUBRICATION

Many components on a Chrysler Corporation vehicle require no periodic maintenance. Some components are sealed and permanently lubricated. Rubber bushings can deteriorate or limit damping ability if lubricated. The following list of components require no lubrication:

- Air Pump
- Generator Bushings
- Drive Belts
- Drive Belt Idler/Tensioner Pulley
- Front Wheel Bearings
- Rubber Bushings
- Starter Bearings/Bushings
- Suspension Strut Bearings
- Throttle Control Cable
- Throttle Linkage
- Water Pump Bearings

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 BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR.

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 ARCHING 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, turn off all accessories, place gear selector in park or neutral, set park brake and operate engine at 1200 rpm.

(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 (Fig. 1). 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).

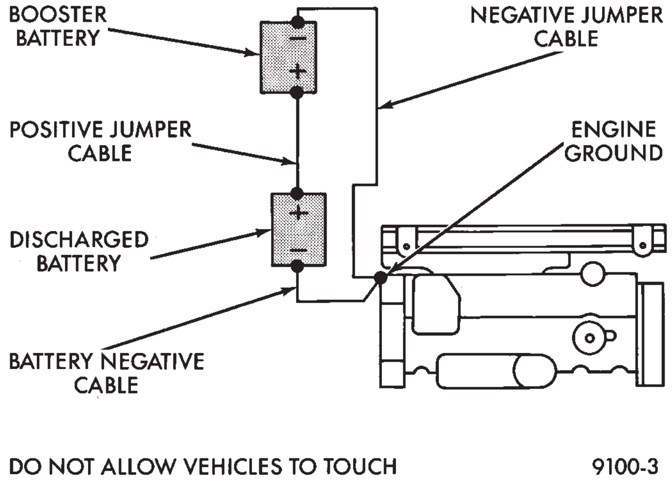


Fig. 1 Jumper Cable Clamp Connections

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

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

DISCONNECT CABLE CLAMPS AS FOLLOWS:

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

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.

TO HOIST OR JACK VEHICLE SEE FIG. 2 THROUGH 7:

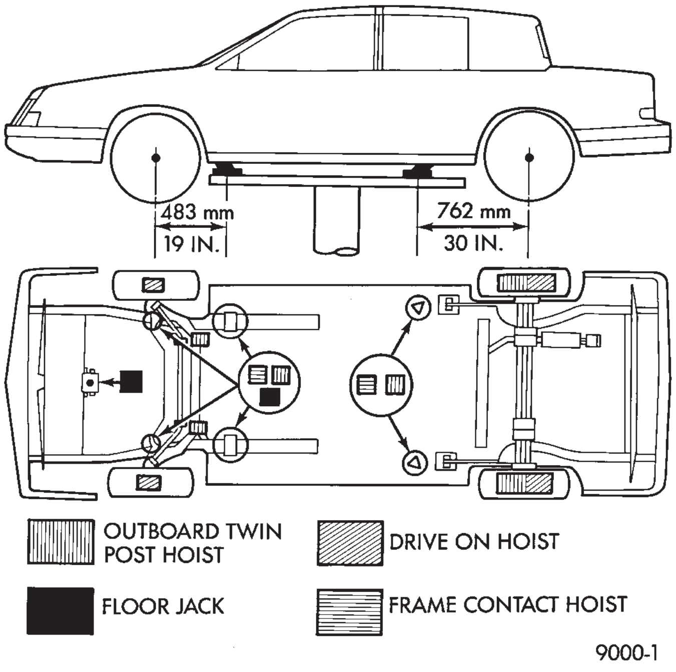


Fig. 2 Hoisting and Jacking Points—AY Body

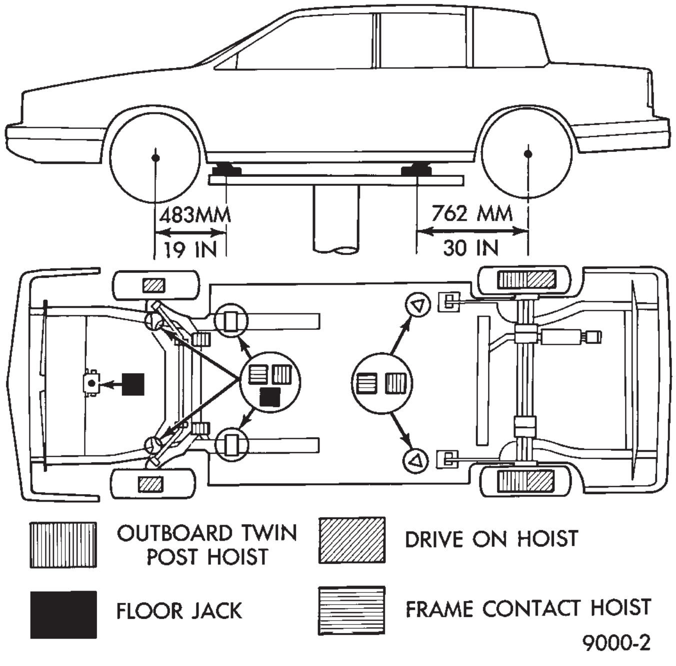


Fig. 3 Hoisting and Jacking Points—AC Body

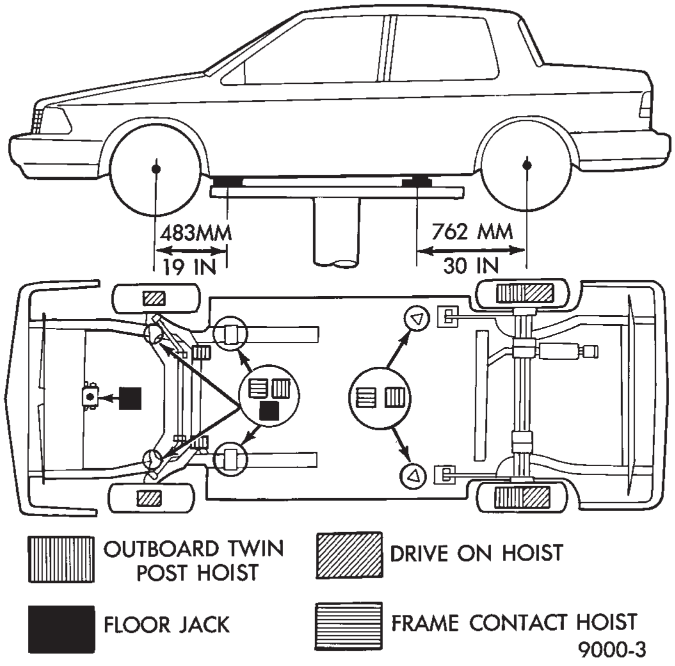


Fig. 4 Hoisting and Jacking Points—AA Body

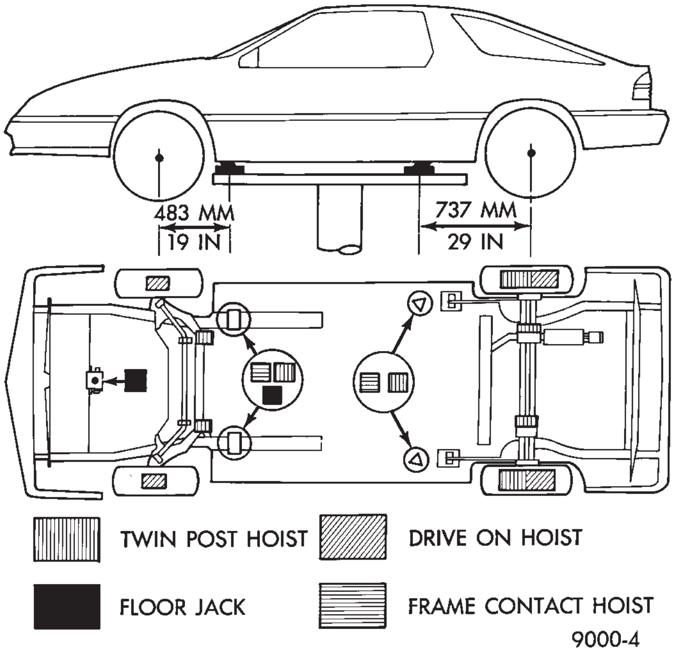


Fig. 5 Hoisting and Jacking Points—AG Body

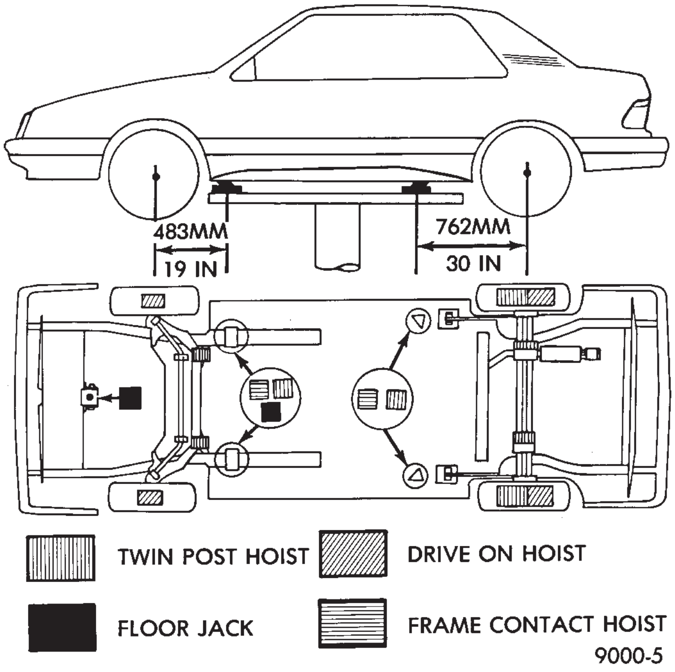


Fig. 6 Hoisting and Jacking Points—AJ Body

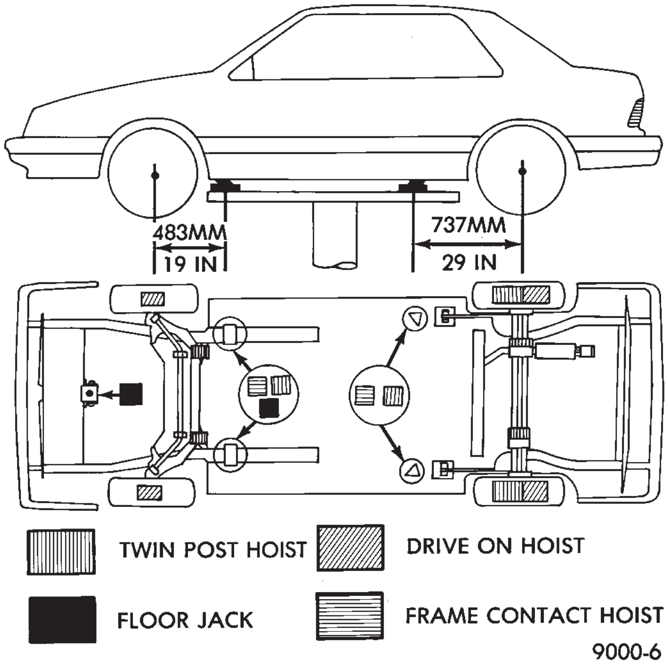


Fig. 7 Hoisting and Jacking Points—AP Body

TOWING RECOMMENDATIONS

RECOMMENDED TOWING EQUIPMENT

To avoid damage to bumper fascia and air dams use of a wheel lift or flat bed towing device (Fig. 8) is recommended. When using a wheel lift towing device, be sure the unlifted end of 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.

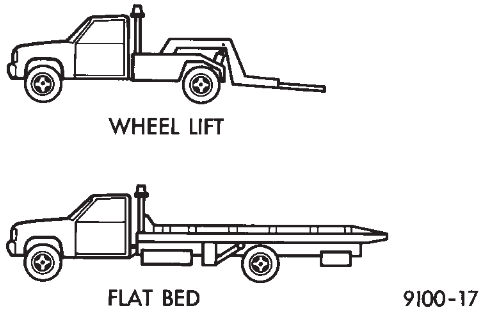


Fig. 8 Recommended Towing Devices

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 lifted wheels are a minimum 100 mm (4 in) from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or steep rises in the road. If necessary, remove the wheels from the lifted end of the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the opposite end of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums 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 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.
- 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.
- Manual transaxle vehicles can be flat towed at any legal highway speed with no distance restrictions. The steering column must be unlocked and gear selector in neutral.

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 VENTURE 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.

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.

TOWING—FRONT WHEEL LIFT

Chrysler Corporation recommends that a vehicle be towed with the front end lifted, whenever possible.

TOWING—REAR WHEEL LIFT

If a front wheel drive 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.

- Unlock steering column and secure steering wheel in straight ahead position with a clamp device designed for towing.
- Verify that front drive line and steering components are in good condition.
- 4-speed automatic transaxle vehicles can be towed at speeds not to exceed 72 km/h (44 mph) for not more than 160 km (100 miles). The gear selector must be in neutral position.
- 3-speed automatic transaxle vehicles can be towed at speeds not to exceed 40 km/h (25 mph) for not more than 25 km (15 miles). The gear selector must be in neutral position.
- 3-speed automatic transaxle vehicles can be towed at speeds not to exceed 40 km/h (25 mph) for not more than 25 km (15 miles). The gear selector must be in neutral position.

ENGINE

INDEX

FREQUENCY OF ENGINE OIL AND FILTER CHANGES

ENGINE OIL

Road conditions as well as your kind of driving affect the interval at which your oil should be changed. Check the following to determine if any apply to you:

- Frequent short trip driving less than 8 kilometers (5 miles)
- Frequent driving in dusty conditions
- Frequent trailer towing
- Extensive idling (such as vehicle operation in stop and go traffic)
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F)

If **any** of these apply to you then change your engine oil every 4 800 kilometers (3,000 miles) or 3 months, whichever comes first.

If none of these apply to you then change your oil every 12 000 kilometers (7,500 miles) or 6 months, whichever comes first.

If none of these apply and the vehicle is in commercial type service such as, Police, Taxi or Limousine and principally used for highway driving of 40 kilometers (25 miles) or more between stations, the engine oil should be changed every 8 000 kilometers (5,000 miles) or 6 months, whichever comes first.

FLEXIBLE FUEL VEHICLES

Flexible fuel is corrosive and contributes to engine oil contamination. When flexible fuel is being used, the engine oil should be changed every 8 000 kilometers (5,000 miles) or 6 months, whichever comes first.

OIL FILTER

The engine oil filter should be replaced with a new filter at every second oil change.

ENGINE OIL

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.

BREAK-IN PERIOD

CAUTION: Wide open throttle operation in low gears, before engine break-in period is complete, can damage engine.

On a Chrysler Corporation vehicle an extended break-in period is not required. Driving speeds of not over 80-90 km/h (50-55 mph) for the first 100 km (60 miles) is recommended. Hard acceleration and high engine rpm in lower gears should be avoided.

SELECTING ENGINE OIL

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine or Turbocharger failure can result.

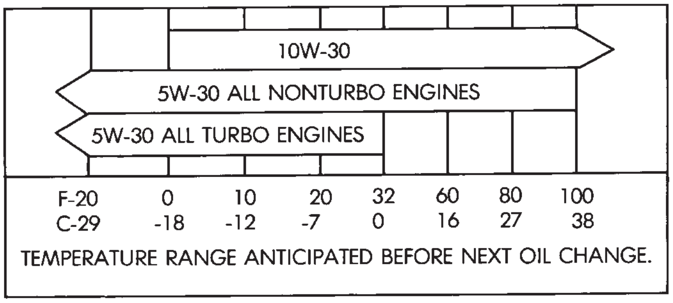
The factory fill engine oil is a high quality, energy conserving, crankcase lubricant. The Recommended SAE Viscosity Grades chart defines the viscosity grades that must be used based on temperature in the region where vehicle is operated and optional equipment.

NON-FLEXIBLE FUEL VEHICLES

Chrysler Corporation recommends that Mopar motor oil, or equivalent, be used when adding or changing crankcase lubricant. The API symbol (Fig. 1) on the container indicates the viscosity grade, quality and fuel economy ratings of the lubricant it contains. Use ENERGY CONSERVING II motor oil with API SERVICE SG or SG/CD classification.

- SG service engine oil is a high quality crankcase lubricant designed for use in all naturally aspirated engines. **If SG service engine oil is used in turbocharged engine, change engine oil at every 4 800 km (3,000 miles) or three months.**
- SG/CD service engine oil is a high quality crankcase lubricant designed for use in most naturally aspirated and turbocharged gasoline or diesel engines.

RECOMMENDED VISCOSITY GRADES



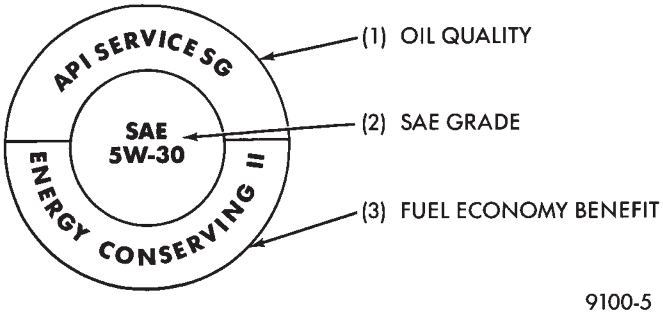


Fig. 1 API Symbol

FLEXIBLE FUEL VEHICLES

Vehicles operated using Flexible Fuel (M85) require engine oil that meet or exceed Chrysler Standard MS-9214. Mopar Flexible Fuel engine oil or equivalent should be used when adding or changing crankcase lubricant. The API symbol (Fig. 1) on the container indicates the viscosity grade, quality and fuel economy ratings of the lubricant it contains. Use ENERGY CONSERVING II motor oil with API SERVICE SG or SG/CD classification.

ENGINE OIL ADDITIVES

Chrysler Corporation recommends that Mopar Engine Oil Supplement or equivalent be used when friction and corrosion reducing materials added to the crankcase lubricant is desired.

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Position vehicle on level surface. With engine OFF, allow enough time for oil to settle to bottom of crankcase, remove engine oil level indicator (dipstick) and wipe clean. Install dipstick and verify it is seated in the tube. Remove dipstick, with handle above tip, take oil level reading (Fig. 2). Add oil only if level is below MIN or ADD mark on dipstick.

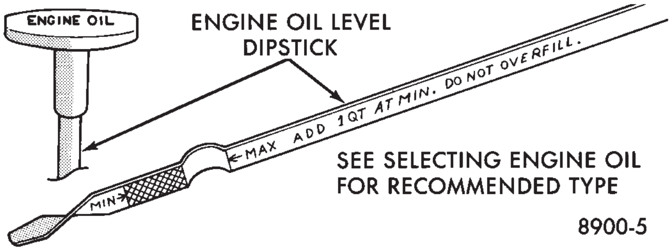


Fig. 2 Oil Level Indicator Dipstick—Typical

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Lubrication and Maintenance Schedules. Position the vehicle on a level surface. Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations in this group. Place a suitable 3.8 liter (4 qt.) drain pan under crankcase drain. Remove drain plug from crankcase. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged. Install drain plug in crankcase. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section. Start engine and inspect for leaks. Stop engine and inspect oil level.

ENGINE OIL FILTER

SELECTING OIL FILTER

Chrysler Corporation recommends a Mopar or equivalent oil filter be used when replacement is required. A replacement filter must be designed to withstand 1756 kPa (256 psi) of internal pressure.

OIL FILTER REPLACEMENT

Position a drain pan under the oil filter. Using a suitable oil filter wrench (Fig. 3) loosen filter. When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle. With a wiping cloth, clean the gasket sealing surface (Fig. 4) of oil and grime. Wipe off oil residue from below oil filter adapter.

TO INSTALL NEW OIL FILTER:

Lightly lubricate oil filter gasket with engine oil or chassis grease. Thread filter onto adapter nipple. When gasket makes contact with sealing surface, tighten filter one full turn. If necessary use a filter wrench, do not over tighten. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

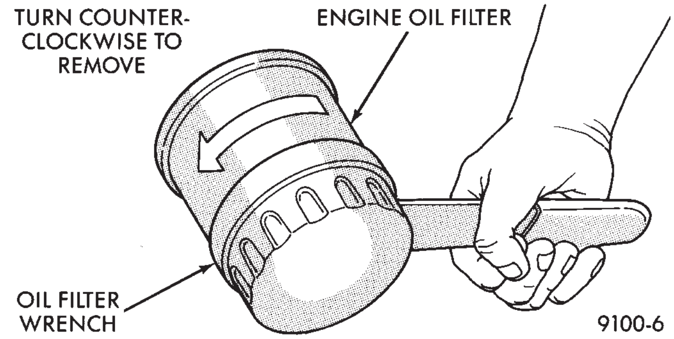


Fig. 3 Remove Oil Filter

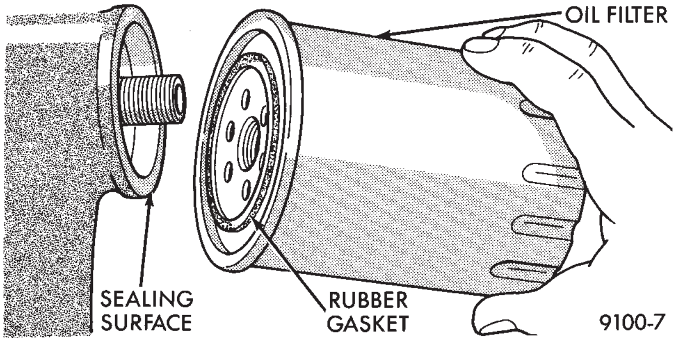


Fig. 4 Install Oil Filter

ENGINE COOLING SYSTEM

WARNINGS AND PRECAUTIONS

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN.

DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE, PERSONAL INJURY CAN RESULT.

AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

CAUTION: Do not use straight antifreeze as engine coolant, inadequate engine running temperatures can result.

Do not operate vehicle without proper concentration of recommended ethylene glycol coolant, high running temperatures and cooling system corrosion can result.

The engine cooling system will develop internal pressure of 97 to 123 kPa (14 to 18 psi) at normal operating temperature. Allow the vehicle approximately one half hour to cool off before opening the cooling system. As an indicator of pressure, squeeze the upper radiator hose between index finger and thumb. If it collapses with little effort the system would have low internal pressure and should be safe to open to the first safety notch of the radiator cap. Refer to Group 7, Cooling System.

COOLING SYSTEM INSPECTION

Coolant level (Fig. 5) should be inspected when other engine compartment service is performed or when coolant leak is suspected. Coolant recovery tank level should read between the MIN and MAX marks, located on the side of recovery tank, when the engine is at normal operating temperature. Normal coolant level maintenance does not require the removal of radiator cap. Cooling system freeze protection should be tested at the onset of the winter season or every 12 months. Service is required if coolant is low, contaminated, rusty or freeze protection is inadequate. To properly test cooling system, see Group 7, Cooling System.

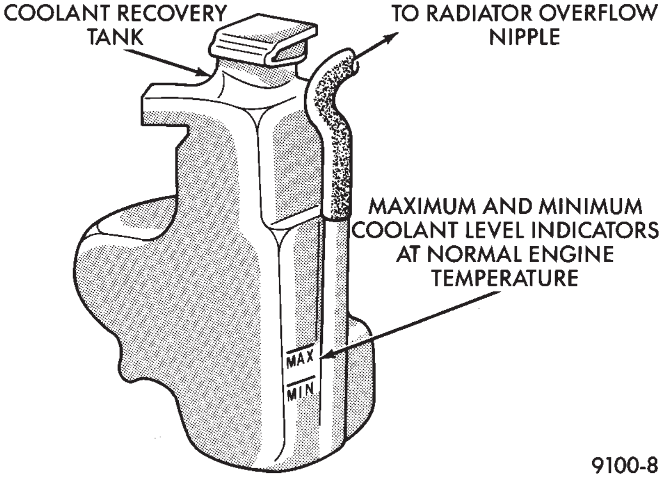


Fig. 5 Coolant Recovery Tank

The cooling system factory fill is a mixture of 50% Glycol based antifreeze and 50% water. Using a suitable hydrometer, measure antifreeze concentration in the radiator when the engine is cool. If the cooling system has recently been serviced, allow coolant to circulate for at least 20 minutes before taking hydrometer reading. Properly mixed coolant will protect the cooling system to -37°C (-35°F). If the freeze protection is above -28°C (-20°F), drain enough coolant from the cooling system to allow room to add antifreeze to achieve adequate protection. A mix table on the coolant container indicates the amount of antifreeze required to winterize the cooling system based on the capacity, see Capacity Chart in General Information section of this group.

SELECTING ANTIFREEZE

Chrysler Corporation recommends Mopar Antifreeze/Summer Coolant, or equivalent be used to winterize and protect cooling system.

RADIATOR CAP

The radiator cap must be secure to provide proper pressure release and coolant recovery. Inspect and test radiator cap when cooling system service is performed or when problem is suspected.

COOLING SYSTEM SERVICE

The cooling system should be drained, flushed and filled with the proper coolant mixture at the intervals described in the Lubrication and Maintenance Schedules. Refer to General Information section of this group. For proper service instructions see Group 7, Cooling System.

ENGINE AIR CLEANER

The engine air cleaner should be serviced at the intervals described in the Lubrication and Maintenance Schedules. Refer to General Information section of this group. Additional information can be found in Group 14, Fuel System and Group 25, Emission System. Inspect all air cleaner hoses or tubes for damage or leaks when other engine compartment service is performed. Replace faulty components.

AIR CLEANER SERVICE

CAUTION: The air cleaner cover must be installed properly for the emissions system and engine controller to function correctly.

Do not immerse paper air filter element or temperature sensor in cleaning solvents, damage can result.

TO SERVICE AIR CLEANER ASSEMBLY:

(1) Raise hood of vehicle and inspect all air cleaner components for damage or improper attachment.

(2) Remove air cleaner cover (Fig. 6, 7, 8, 9, or 10).

(3) Remove paper air filter element from air cleaner body. Hold a shop light on throttle body side of element. Inspect air intake side of element. If light is visible through element, blow dust from element (Fig. 11) and reuse. If element is saturated with oil or light is not visible, replace filter. If element is saturated with oil, perform crankcase ventilation system tests.

(4) Remove fiber crankcase filter (Fig. 6, 7, 8, 9, or 10) and clean with solvent, squeeze filter dry and apply small amount of engine oil. If a metallic mesh is used to retain fiber filter, clean mesh with solvent and reuse.

(5) Clean inside of air cleaner cover and body with vacuum or compressed air. If oily, wash with solvent.

To Install, reverse the preceding operation.

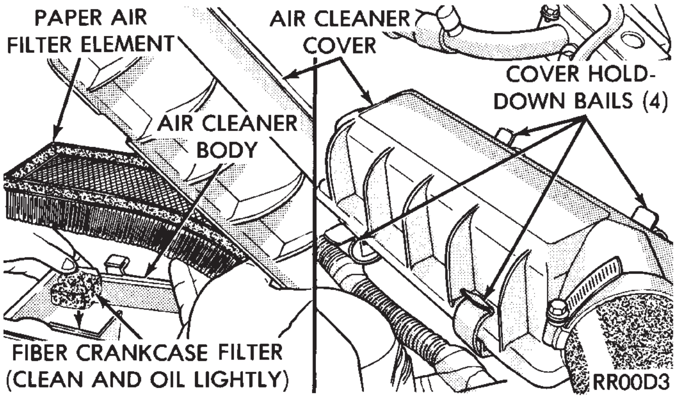


Fig. 6 Air Cleaner—3.0L Engine

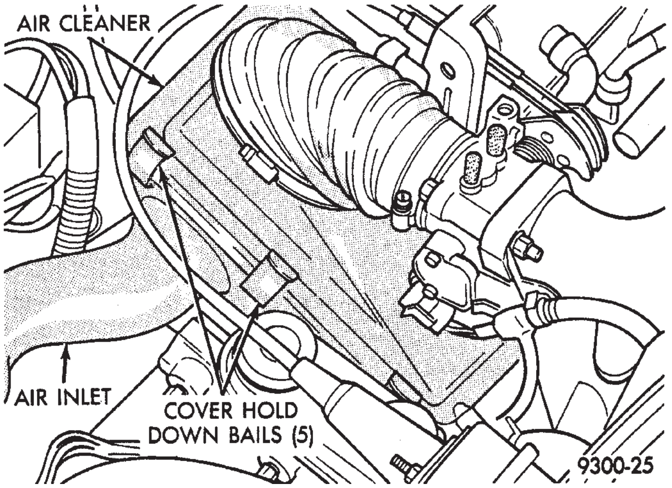


Fig. 7 Air Cleaner—Flexible Fuel Engine

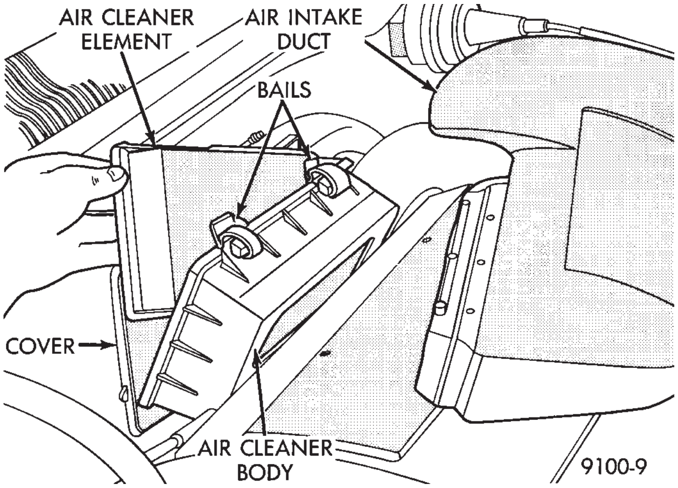


Fig. 8 Air Cleaner—16 Valve Engine

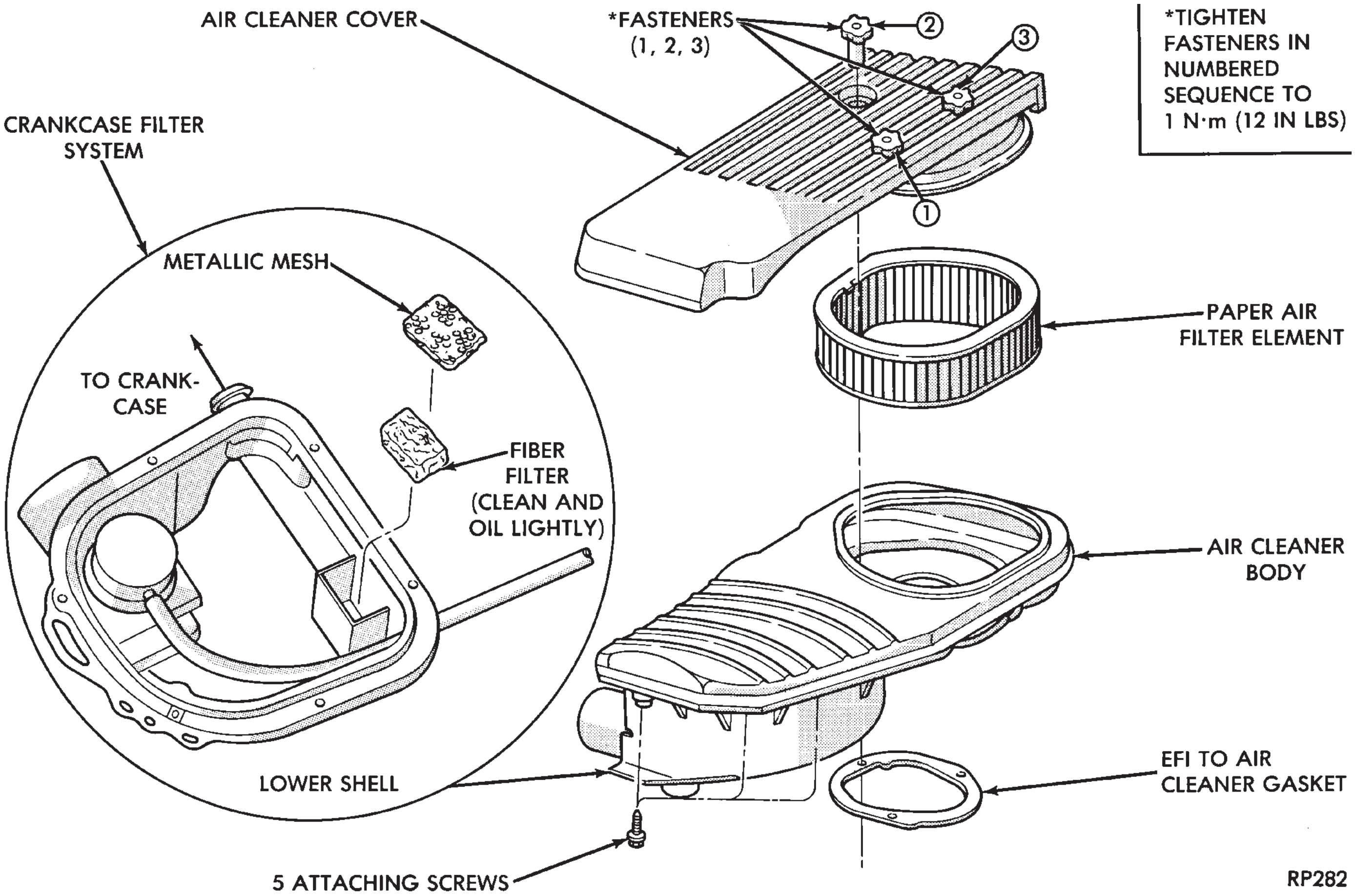


Fig. 9 Air Cleaner—2.2L or 2.5L EFI Engine

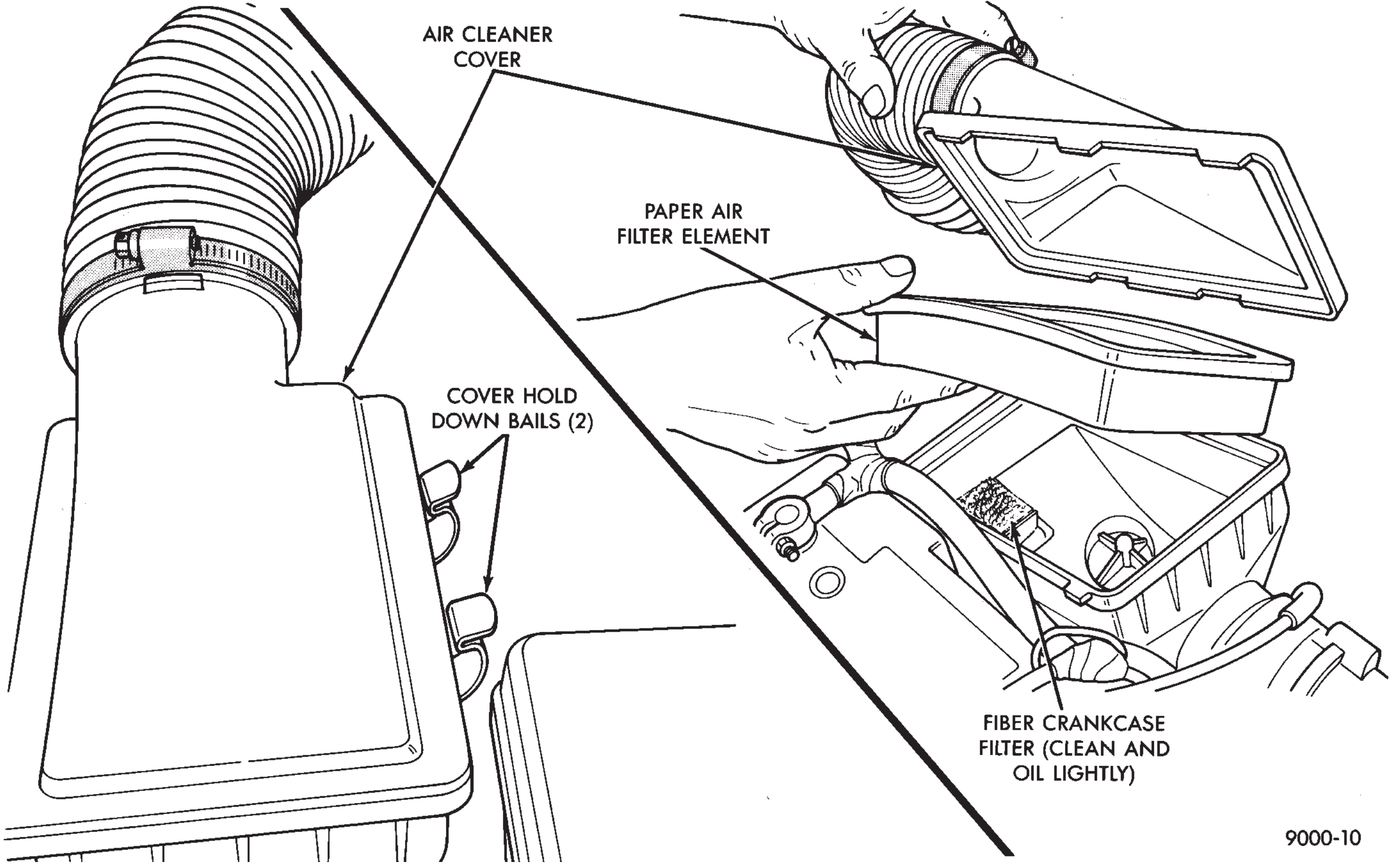


Fig. 10 Air Cleaner—3.3L or 3.8L Engine

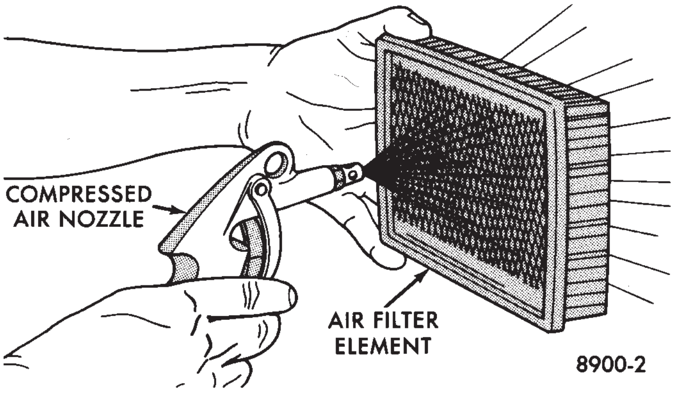


Fig. 11 Cleaning Air Filter Element

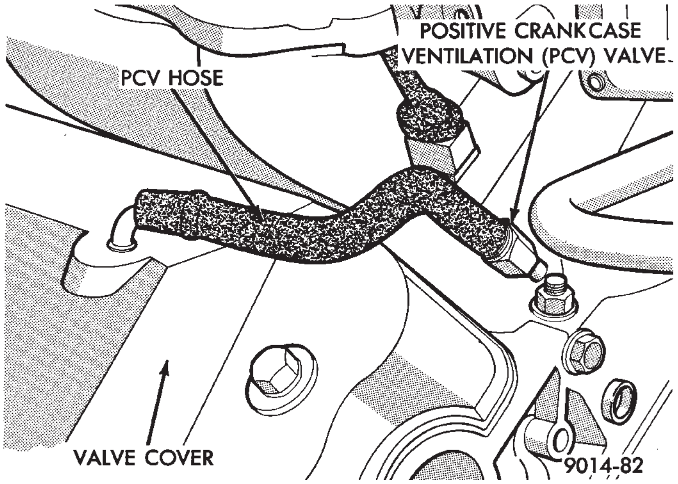


Fig. 12 PCV System—3.0L Engine

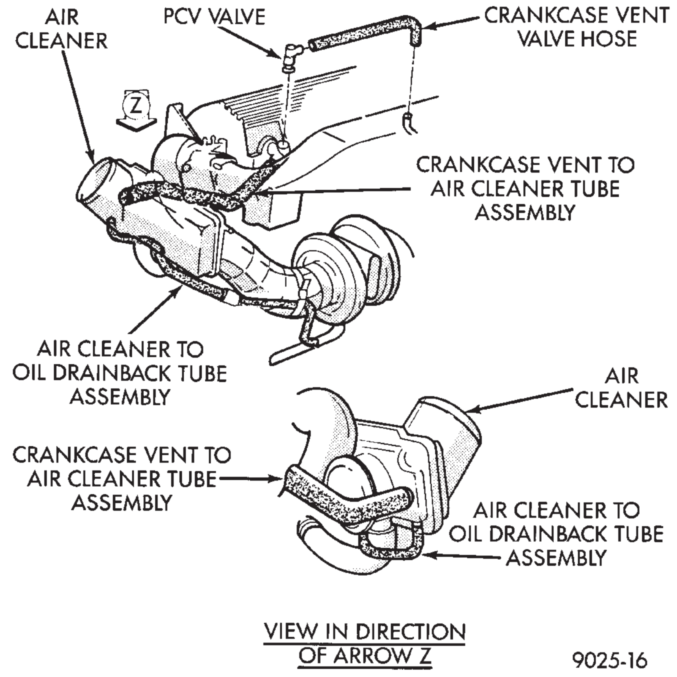


Fig. 13 PCV System—Flexible Fuel Engine

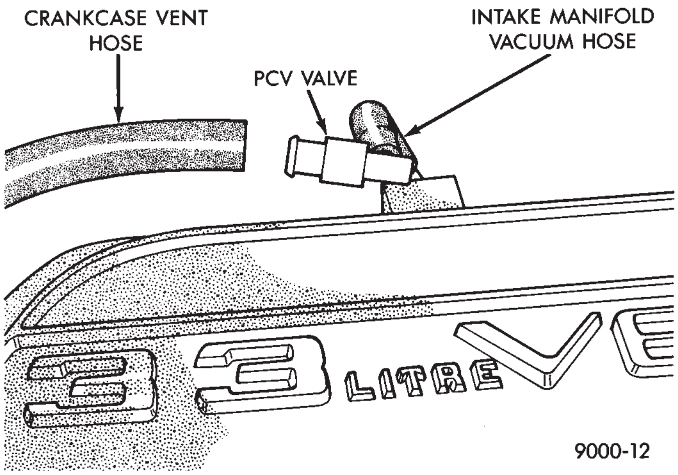


Fig. 14 PCV System—3.3L or 3.8L Engine

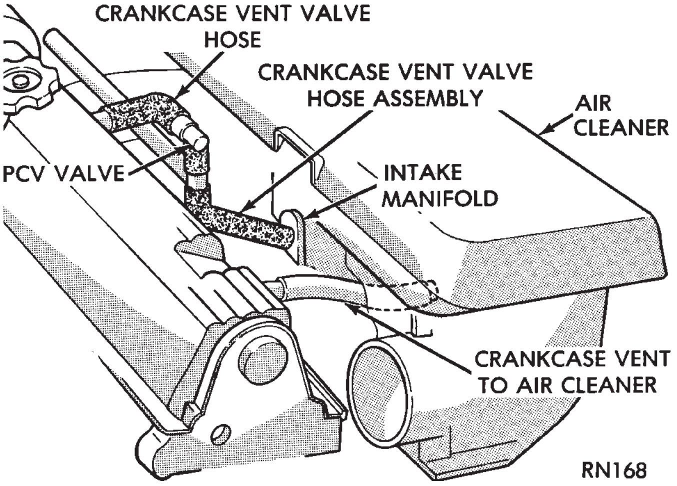


Fig. 15 PCV System—2.2L or 2.5L EFI Engine

CRANKCASE VENTILATION SYSTEM

Engine crankcase pressure and emissions are vented into combustion chambers through the positive crankcase ventilation (PCV) system. The PCV system consists of a crankcase filter (Fig. 6, 7, 8, 9, or 10), PCV valve (Fig. 12, 13, 14 or 15) and hoses to complete a vacuum circuit. The PCV system should have enough volume to overcome crankcase pressure created by piston backwash. If a PCV system becomes plugged, the crankcase pressure will increase and force engine oil past the piston rings creating oil consumption. Blockage of PCV system can occur at the vacuum source coupling, PCV valve, crankcase filter or a collapsed hose.

Chrysler Corporation recommends that a PCV valve not be cleaned. A new Mopar or equivalent PCV valve should be installed when servicing is required. Over a period of time, depending on the environment where vehicle is used, deposits build up in the PCV vacuum circuit. PCV system should be inspected at every oil change. Service PCV system if engine oil is discharged into air cleaner.

PCV SYSTEM TEST

Refer to group 25, Emission Control System for proper procedures to test PCV system.

FUEL RECOMMENDATIONS

Chrysler Corporation recommends that only fuel purchased from a reputable retailer be used. Use high quality, unleaded gasoline to provide satisfactory driveability and highest fuel economy. Gasoline containing detergent and corrosion control additives are desireable. If the engine develops spark knock (audible ping), poor performance, hard starting or stalling, purchase fuel from another source. Engine performance can vary when using different brands of gasoline with the same octane rating. Occasional light engine spark knock under heavy acceleration, at low speed or when vehicle is heavily loaded is not harmful. Extended periods of spark knock under moderate acceleration or at cruising speed can damage the engine. The cause of excessive spark knock condition must be diagnosed and corrected. For diagnostic procedures refer to Group 14, Fuel System and Powertrain Diagnostic Procedures manual.

SELECTING GASOLINE

CAUTION:Do not use fuel containing METHANOL (methyl or wood alcohol), damage to fuel system will result.

Do not use leaded gasoline, damage to catalytic converter will result and vehicle will not conform to emission control standards.

ETHANOL, MTBE OR ETBE BLENDS

All Chrysler Corporation vehicles are designed to use unleaded gasoline ONLY. Gasohol blends, containing 10% Ethanol (ethyl or grain alcohol) 90% unleaded gasoline can be used provided it has adequate octane rating.

Fuel blends containing up to 15% MTBE (Methyl Tertiary Butyl Ether) and 85% unleaded gasoline can be used. Fuel blends containing up to 17% ETBE (Ethyl Tertiary Butyl Ether) and 83% unleaded gasoline can also be used.

Fuel blended with ethanol, MTBE or ETBE are also referred to as reformulated or clean air gasoline. These fuels contribute less emissions to the atmosphere. Chrysler Corporation recommends that blended fuels be used when available

METHANOL BLENDS

Using gasoline blended with methanol can result in starting and driveability problems. Deterioration of fuel system components will result. Methanol induced problems are not the responsibility of Chrysler Corporation and may not be covered by the vehicle warranty.

NON-TURBOCHARGED ENGINES

Use regular unleaded gasoline having a minimum octane rating of 87 (R+M)/2. Higher octane premium unleaded gasoline can be used if desired.

2.2L 16 VALVE TURBOCHARGED ENGINE

Use premium unleaded gasoline having a minimum octane rating of 91 (R+M)/2. Gasoline with octane rating less than 91 (R+M)/2 can be used if recommended gasoline is not available. Low octane gasoline will reduce engine performance.

FLEXIBLE FUEL VEHICLES

CAUTION: Do not use 100% methanol, damage to fuel system can result.

Use unleaded regular gasoline having a minimum octane rating of 87 (R=M)/2 and M85 fuel that is 85% methanol and 15% unleaded gasoline, or a mixture of these two.

FUEL FILTER

The fuel filter requires service only when a fuel contamination problem is suspected. For proper diagnostic and service procedures refer to Group 14, Fuel System,

IGNITION CABLES, DISTRIBUTOR CAP, AND ROTOR

Inspect and test ignition cables, distributor cap and rotor when the spark plugs are replaced. Oil and grime should be cleaned from the ignition cables and distributor cap to avoid possible spark plug fouling. Mopar, Foamy Engine Degreaser, or equivalent is recommended for cleaning the engine compartment. For proper service and diagnostic procedures refer to Group 8D, Ignition System.

SPARK PLUGS

Ignition spark plugs should be replaced at the mileage interval described in the Lubrication and Maintenance Schedules. Refer to the General Information section of this group. For proper service procedures refer to Group 8D, Ignition Systems.

DRIVE BELTS

Inspect and adjust drive belts at the interval described in the Lubrication and Maintenance Schedules. Refer to General Information section of this group. For proper inspection and adjustment procedures, see Group 7, Cooling System.

EMISSION CONTROL SYSTEM

Inspect all emission control components and hoses when other under hood service is performed. Refer to emission system Vacuum Hose Label located on the inside of the hood in the engine compartment and Group 25, Emission Control Systems for proper service procedures.

BATTERY

Inspect battery tray, hold down and terminal connections when other under hood service is performed. For proper diagnostic procedures refer to Group 8A, Battery/Starting/Charging System Diagnostics. For service and cleaning procedures refer to Group 8B, Battery/Starter Service.

RUBBER AND PLASTIC COMPONENT INSPECTION

CAUTION: Plastic hoses or wire harness covers will melt or deform when exposed to heat from exhaust system or engine manifolds.

Position plastic or rubber components away from moving parts in engine compartment or under vehicle, or damage will result.

Do not allow rubber engine mounts or other components to become oil contaminated, repair cause of oil contamination and clean area.

All rubber and plastic components should be inspected when engine compartment or under vehicle service is performed. When evidence of deterioration exists, replacement is required. To reduce deterioration of rubber components, Chrysler Corporation recommends Mopar Foamy Engine Degreaser or equivalent be used to clean engine compartment of oil and road grime.

EXHAUST SYSTEM ISOLATOR AND HANGER

The exhaust system should be inspected when under vehicle service is performed. The exhaust system should not make contact with under body, brake cables, brake/fuel lines, fuel tank or suspension components. Slight cracking in rubber isolator or hanger is acceptable. Severely cracked or broken rubber components must be replaced. For proper service procedures see Group 11, Exhaust System and Intake Manifold.

DRIVETRAIN

INDEX

CLUTCH AND GEARSHIFT LINKAGE

If the clutch or gearshift begins to operate with difficulty, squeak or grunt, the cables and linkage should be lubricated before service replacement is performed. For proper lubrication and service procedures refer to Group 6, Clutch, or Group 21, Manual Transaxle.

MANUAL TRANSAXLE

The manual transaxle should be inspected for oil leaks and proper oil level when other under vehicle service is performed. To inspect the transaxle oil level, position the vehicle on a level surface. Remove fill plug (Fig. 1) from the transaxle side cover. The oil level should not be below 4 mm (3/16 in) from the bottom of the oil fill opening.

The manual transaxle does not require periodic maintenance. The oil should be changed only when water contamination is suspected. If oil has a foamy or milky appearance it probably is contaminated. A circular magnet located behind the differential cover collects metallic particles circulating in the oil. For proper diagnostic and service procedures, refer to Group 21, Manual Transaxle.

SELECTING MANUAL TRANSAXLE OIL

Chrysler Corporation recommends Mopar Engine Oil, SG or SG/CD SAE 5W-30, or equivalent, be used to fill a 5-speed transaxle.

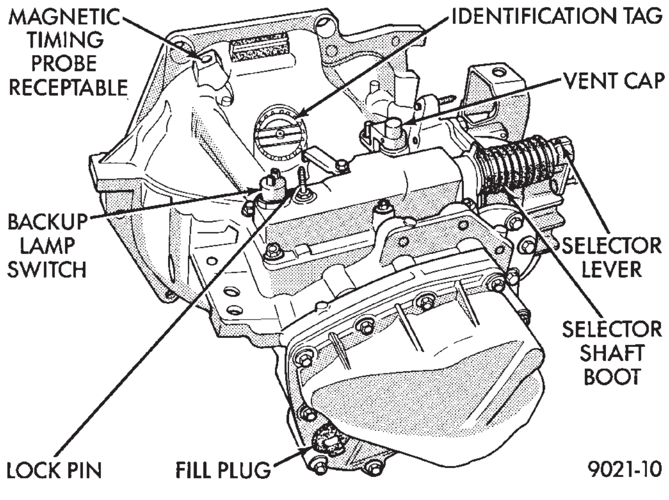


Fig. 1 Manual Transaxle Fill Plug

AUTOMATIC TRANSAXLE FLOOR SHIFT

If the automatic transaxle floor shift mechanism becomes difficult to operate or starts to make objectionable noise, the mechanism should be lubricated before service repair is performed. To lubricate the shift mechanism, remove console as necessary. Refer to Group 23, Body. Apply a film of Mopar Multipurpose Grease or equivalent, to slide surfaces and pawl spring. For additional information, refer to Group 21, Transaxle.

AUTOMATIC TRANSAXLE

The automatic transaxle should be inspected for fluid leaks and proper fluid level when other under hood service is performed.

CAUTION: To minimize fluid contamination, verify that dipstick is seated in the fill hole or tube after fluid level reading is taken.

TO INSPECT THE TRANSAXLE FLUID LEVEL:

(1) Position the vehicle on a level surface.

(2) Start engine and allow to idle in PARK for at least 60 seconds. The warmer the transaxle fluid, the more accurate the reading.

(3) While sitting in driver seat, apply brakes and place gear selector in each position. Return gear selector to park.

(4) Raise hood and remove transaxle fluid level indicator (dipstick) and wipe clean with a suitable cloth.

(5) Install dipstick and verify it is seated in fill hole or tube (Fig. 2 or 3).

CAUTION: Do not overfill automatic transaxle, leakage or damage can result.

(6) Remove dipstick, with handle above tip, take fluid level reading (Fig. 4). If the vehicle has been driven for at least 15 minutes before inspecting fluid level, transaxle can be considered hot and reading should be above the WARM mark. If vehicle has run for less than 15 minutes and more than 60 seconds transaxle can be considered warm and reading

should be above ADD mark. Add fluid only if level is below ADD mark on dipstick when transaxle is warm.

The automatic transaxle does not require periodic maintenance when used for general transportation. If the vehicle is subjected to severe service conditions, the automatic transaxle will require fluid/filter change and band adjustments every 24 000 km (15,000 miles). For additional information, refer to Severe Service paragraph and Lubrication and Maintenance Schedules in General Information section of this group. The fluid and filter should be changed when water contamination is suspected. If fluid has foamy or milky appearance, it is probably contaminated. If the fluid appears brown or dark and a foul odor is apparent, the fluid is burned, transaxle requires maintenance or service. A circular magnet located in the transaxle pan, collects metallic particles circulating in the oil. For proper diagnostic and service procedures, refer to Group 21, Automatic Transaxle.

SELECTING AUTOMATIC TRANSAXLE FLUID

Chrysler Corporation recommends Mopar ATF Plus (automatic transmission fluid type 7176) be used to add to or replace automatic transaxle fluid. If ATF Plus is not available use Mopar Dexron II® Automatic Transmission Fluid or equivalent.

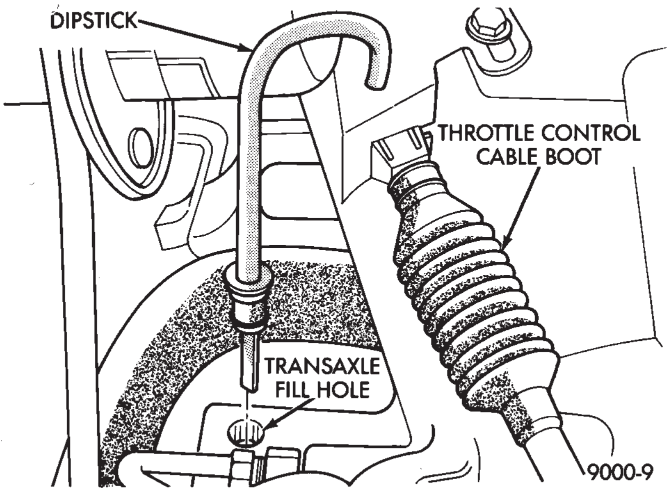


Fig. 2 3-speed Automatic Transaxle Fill hole

DRIVE SHAFT CV AND TRIPOD JOINT BOOTS

The front drive shaft constant velocity and tripod joint boots (Fig. 5) should be inspected when other under vehicle service is performed. Inspect boots for cracking, tears, leaks or other defects. If service repair is required, refer to Group 2, Suspension.

FRONT WHEEL BEARINGS

The front wheel bearings are permanently sealed, requiring no lubrication. For proper diagnostic and service procedures refer to Group 2, Suspension.

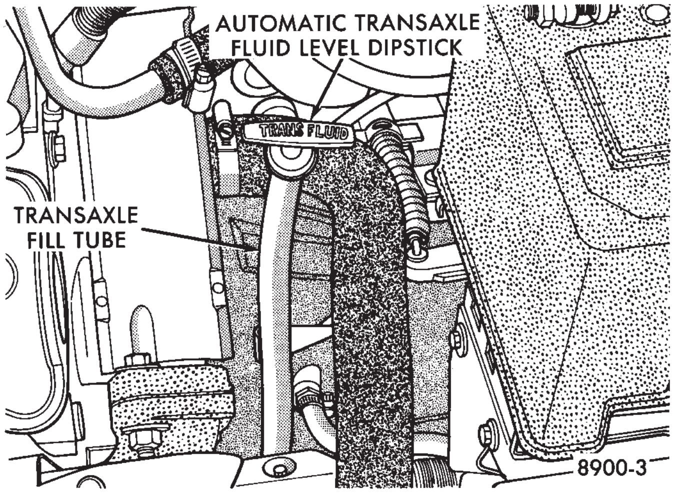


Fig. 3 4-speed Automatic Transaxle Fill tube

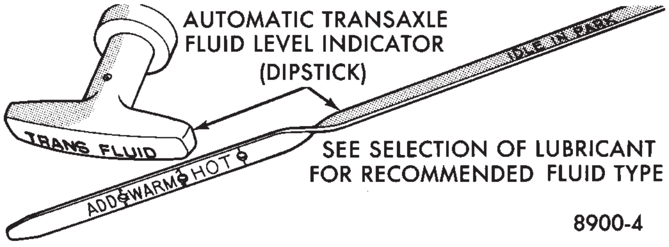


Fig. 4 Automatic Transaxle Dipstick—Typical

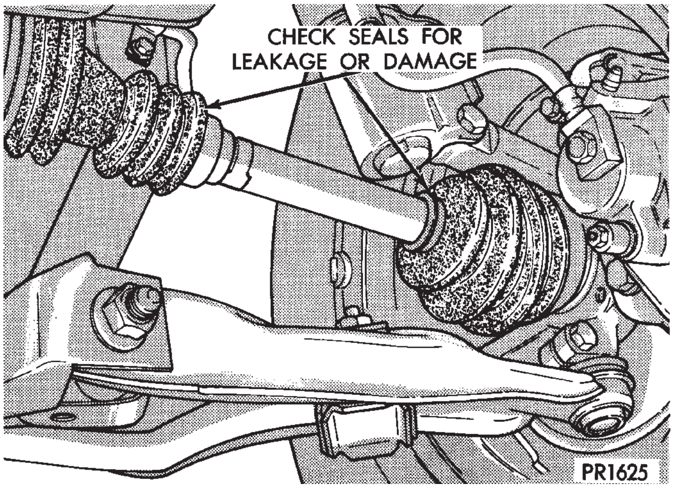


Fig. 5 Drive Shaft Boots

TIRES

The tires should be inspected at every engine oil change for proper inflation and condition. The tires should be rotated at the distance intervals described in the Lubrication and Maintenance Schedules of the General Information section in this group. For tire inflation specifications refer to the Owner's Manual. A Tire Inflation sticker is located in the driver door opening. For proper diagnostic procedures, see Group 22, Wheels and Tires.

TIRE ROTATION

The Forward Cross rotation method is recommended for use on Chrysler Corporation vehicles (Fig. 6). Other rotation methods can be used, but may not have the benefits of the recommended method. Only the four tire rotation method can be used if the vehicle is equipped with a space saver spare tire.

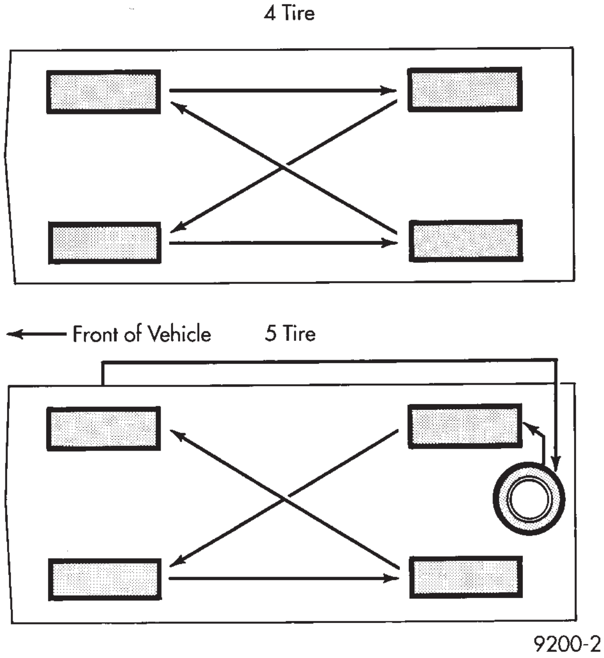


Fig. 6 Tire Rotation

CHASSIS AND BODY

INDEX

STEERING LINKAGE

INSPECTION

The steering linkage and steering gear should be inspected for wear, leaks or damage when other under vehicle service is performed. The rack and pinion steering gear end boots should not have excess oil or grease residue on the outside surfaces or surrounding areas (Fig.1). If boot is leaking, it should be repaired. For proper service procedures, see Group 19, Steering.

The tie rod end seal should fit securely between the steering knuckle and tie rod end (Fig.2). The steering linkage should be lubricated at the time and distance intervals described in the Lubrication and Maintenance Schedules. Refer to General Information section of this group.

TIE ROD END LUBRICATION

Lubricate the steering linkage with Mopar, Multi-mileage Lube or equivalent. Using a wiping cloth, clean grease and dirt from around grease fitting and joint seal. Using a grease gun, fill tie rod end until lubricant leaks from around the tie rod end side of the seal (Fig.2). When lube operation is complete, wipe off excess grease.

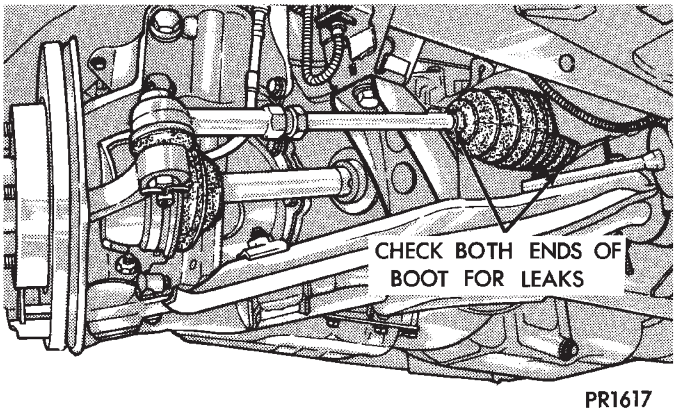


Fig. 1 Inspect Steering Linkage

LOWER BALL JOINTS

INSPECTION

The front suspension lower ball joints should be inspected for wear, leaks or damage when other under vehicle service is performed. The ball joint seal should fit securely between the steering knuckle and lower control arm (Fig. 3). The ball joints should be lubricated at the time and distance intervals described in the Lubrication and Maintenance Schedules. Refer to the General Information section of this group.

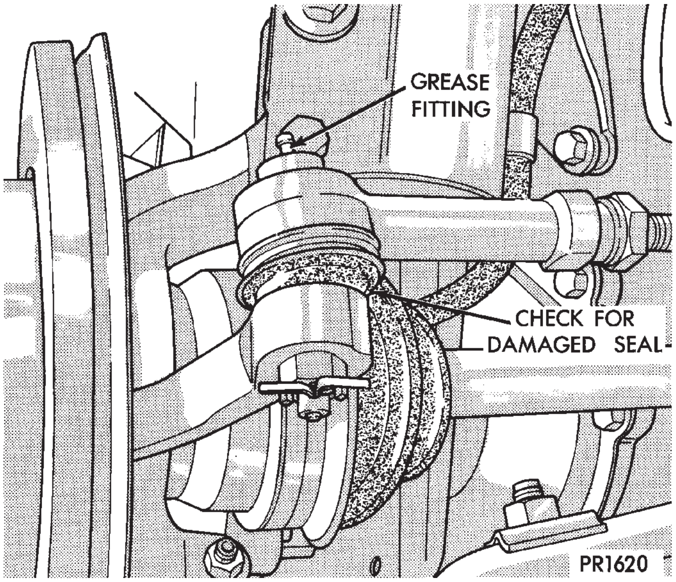


Fig. 2 Tie Rod End Lubrication

BALL JOINT LUBRICATION

CAUTION: Do not over fill ball joint with grease, damage to seal can result.

Lubricate the ball joints with Mopar, Multi-mileage Lube or equivalent. Using a wiping cloth, clean grease and dirt from around grease fitting and joint seal. Using a grease gun, fill ball joint until seal starts to swell (Fig. 3). When lube operation is complete, wipe off excess grease.

POWER STEERING

The power steering fluid level should be inspected when other under hood service is performed. If the fluid level is low and system is not leaking, use Mopar, Power Steering Fluid or equivalent. The power steering system should be inspected for leaks when other under vehicle service is performed. For proper service procedures, refer to Group 19, Steering.

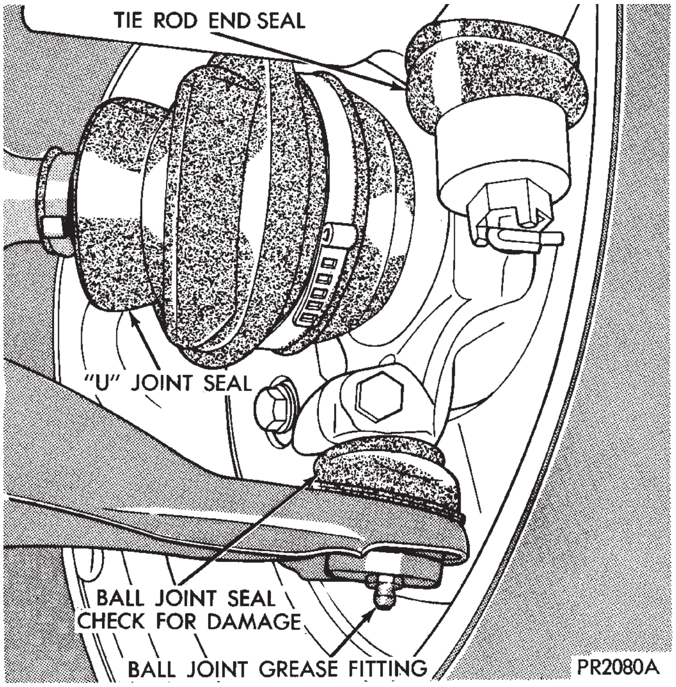


Fig. 3 Ball Joint Lubrication

The power steering pump drive belt should be inspected at the time and distance interval described in the Lubrication and Maintenance Schedules. Refer to the General Information section of this group.

POWER STEERING FLUID INSPECTION

WARNING: ENGINE MUST NOT BE RUNNING WHEN INSPECTING POWER STEERING FLUID LEVEL, PERSONAL INJURY CAN RESULT.

CAUTION: Do not over fill power steering reservoir when adding fluid, seal damage and leakage can result.

TO INSPECT FLUID LEVEL:

(1) Position vehicle on a level surface with engine at normal running temperature.

(2) Turn OFF engine and remove ignition key.

(3) Using a wiping cloth, clean oil and dirt residue from around power steering reservoir cap.

(4) Remove reservoir cap or dipstick and wipe off fluid.

(5) Install cap or dipstick.

(6) Remove cap or dipstick. Holding handle or cap above tip of dipstick, read fluid level (Fig. 4, 5, or 6). Add fluid if reading is below cold level mark on dipstick.

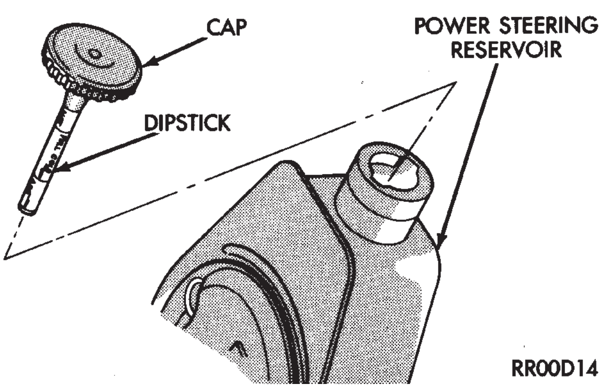


Fig. 4 Power Steering Reservoir Dipstick—2.2L or 2.5L Engine

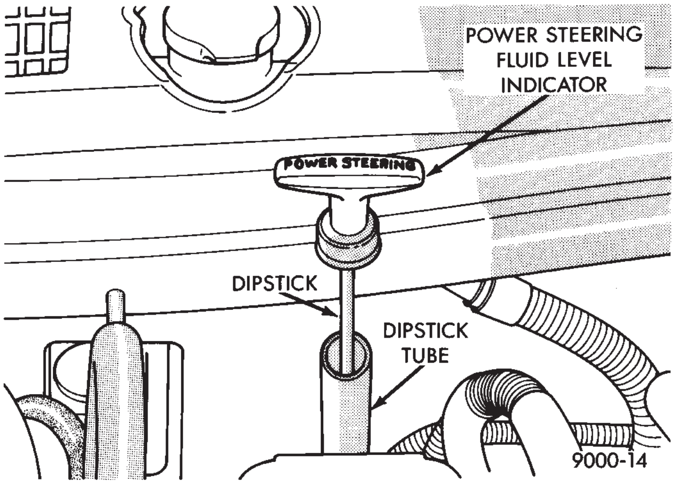


Fig. 5 Power Steering Reservoir Dipstick—3.0L Engine

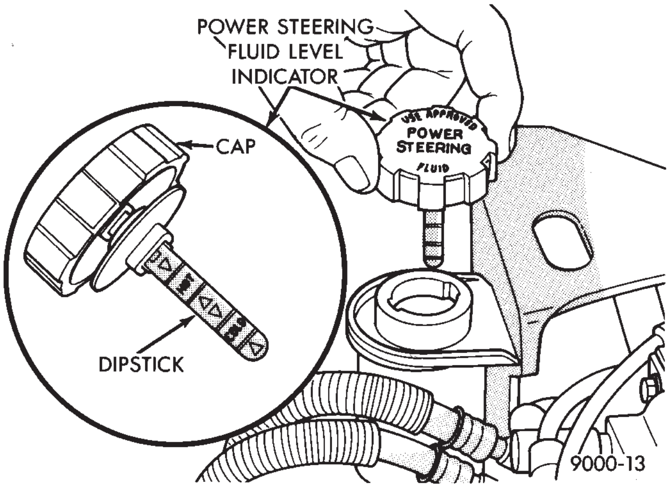


Fig. 6 Power Steering Reservoir Dipstick—3.3L or 3.8L Engine

REAR WHEEL BEARINGS

INSPECTION

The rear wheel bearings should be packed with new lubricant at the distance interval described in the Lubrication and Maintenance Schedules. Refer to the General Information section of this group. The bearings should be inspected for contamination and wear before they are cleaned. Slight discoloration of bearing rollers and race cup is normal. If metal flakes are visible in the used lubricant or the bearing rollers and race cup is discolored, the bearing and race cup should be replaced. For proper service procedures, see Group 5, Brakes. Replace the inner seal whenever the wheel bearings are serviced.

REAR WHEEL BEARING LUBRICATION

CAUTION: Combining two types of lubricant can cause bearing failure. Wash used or new bearings with a suitable solvent and blot dry with a lint free cloth before packing with new lubricant.

WARNING: DO NOT ALLOW BEARING TO SPIN AT HIGH RPM WHEN USING COMPRESSED AIR TO BLOW CLEANING SOLVENT FROM BEARING. BEARING CAGE CAN EXPLODE, CAUSING PERSONAL INJURY.

TO LUBRICATE REAR WHEEL BEARINGS:

(1) Hoist rear wheels off the ground and support vehicle on safety stands. Refer to Hoisting Recommendations in the General Information section of this group.

(2) Remove rear wheels.

(3) Remove brake caliper on vehicles with rear disc brakes. For proper procedure, see Group 5, Brakes.

(4) Remove rear wheel hub (drum) assembly and remove inner grease seal (Fig. 7). For proper service procedure, see Group 5, Brakes.

(5) Inspect bearings, refer to Inspection paragraph of this procedure. Wash used lubricant from bearings with solvent and blot or blow dry.

(6) Using a bearing packing device, lubricate the bearings with Mopar, Wheel Bearing Grease or equivalent.

(7) With a wiping cloth, clean used lubricant form wheel hub assembly and axle spindle.

(8) Install inner wheel bearing in the hub assembly, small end of bearing toward hub. With a finger, smooth out grease around the outside of bearing.

(9) Using a seal driver, install new inner hub seal.

(10) Install wheel hub (drum) assembly on axle spindle.

(11) Install outer wheel bearing over the spindle end, small end of bearing toward hub. With a finger, smooth out grease around the outside of bearing.

(12) Install washer and spindle nut. While rotating hub, tighten spindle nut to 27 to 34 N●m (240 to 300 in. lbs.) torque. Loosen spindle nut one quarter turn. Hand tighten spindle nut.

(13) Install spindle nut lock cover, cotter pin and grease cap.

(14) Install disc brake caliper on vehicles with disc brakes.

CAUTION: Pump brake pedal several times before driving vehicle to verify brake operation.

(15) Install wheel and lower vehicle.

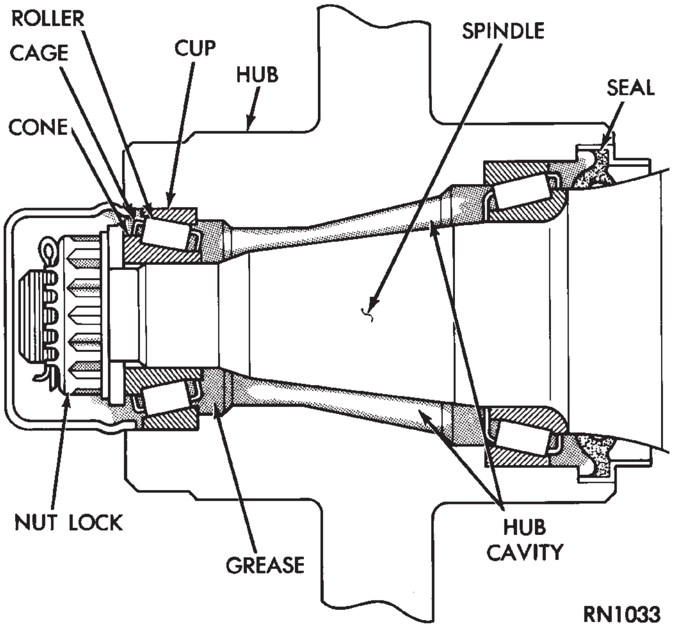


Fig. 7 Rear Wheel Bearings

BRAKES

BRAKE PAD AND LINING INSPECTION

The brake pads and linings should be inspected at distance intervals described in the Lubrication and Maintenance Schedules. Refer to the General Information section of this group. If brake pads or linings appear excessively worn, the brakes would require service. For proper service procedures, refer to Group 5, Brakes.

BRAKE HOSE INSPECTION

WARNING: IF FRONT WHEEL, REAR AXLE, OR ANTI-LOCK UNIT BRAKE HOSE OUTER COVER IS CRACKED, CHAFED, OR BULGED, REPLACE HOSE IMMEDIATELY. BRAKE FAILURE CAN RESULT.

The front wheel, rear axle and anti-lock unit (if equipped) brake hoses should be inspected at time and distance intervals described in the Lubrication and Maintenance Schedules. Refer to the General Information section of this group. A hose must be replaced if it has signs of cracking, chafing, fatigue or bulging. For proper service procedures, refer to Group 5, Brakes.

BRAKE LINE INSPECTION

The metal brake lines should be inspected when other under vehicle service is preformed. If a line is pinched, kinked, or corroded, it should be repaired. For proper service procedures, refer to Group 5, Brakes.

BRAKE RESERVOIR LEVEL INSPECTION

WARNING: DO NOT ALLOW PETROLEUM OR WATER BASE LIQUIDS TO CONTAMINATE BRAKE FLUID, SEAL DAMAGE AND BRAKE FAILURE CAN RESULT.

RELIEVE PRESSURE IN ANTI-LOCK BRAKE SYSTEM BEFORE ADDING BRAKE FLUID TO RESERVOIR. IF NOT, BRAKE FLUID COULD DISCHARGED FROM THE RESERVOIR POSSIBLY CAUSING PERSONAL INJURY.

The brake reservoir level should be inspected when other under hood service is performed. It is normal for the reservoir level to drop as disc brake pads wear. When fluid must be added, use Mopar, Brake Fluid or equivalent. Use only brake fluid conforming to DOT 3, Federal, Department of Transportation specification. To avoid brake fluid contamination, use fluid from a properly sealed container.

On vehicles with anti-lock brakes, depressurize the system before inspecting fluid level. Turn OFF the ignition and remove the key. Pump the brake pedal at least 50 times to relieve the pressure in the system.

On all vehicles, if fluid should become low after several thousand kilometers (miles), fill the reservoir to level marks on the side of the reservoir (Fig. 8 or 9).

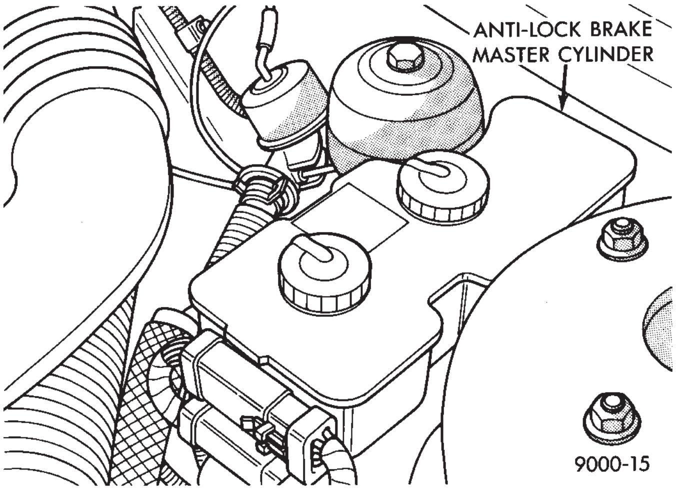


Fig. 8 Anti-lock Brake Reservoir

HEADLAMPS

The headlamps should be inspected for intensity and aim whenever a problem is suspected. When luggage compartment is heavily loaded, the headlamp aim should be adjusted to compensate for vehicle height change. For proper service procedures, refer to Group 8L, Lamps.

DRIVER SUPPLEMENTAL AIRBAG SYSTEM

If the AIRBAG indicator lamp does not light at all, stays lit or lights momentarily or continuously while driving, a malfunction may have occurred. Prompt service is required. Refer to Group 8M, Restraint Systems for proper diagnostic procedures.

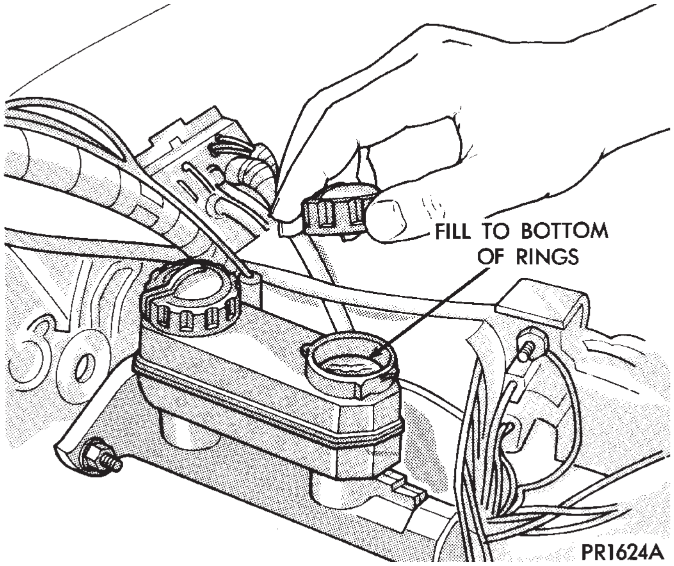


Fig. 9 Master Cylinder Brake Reservoir—Except Anti-lock

BODY LUBRICATION

Body mechanisms and linkages should be inspected, cleaned and lubricated as required to maintain ease of operation and to prevent corrosion and wear.

Before a component is lubricated, oil, grease and dirt should be wiped off. If necessary, use solvent to clean component to be lubricated. After lubrication is complete, wipe off excess grease or oil.

During winter season, external lock cylinders should be lubricated with Mopar, Lock Lubricant or equivalent to ensure proper operation when exposed to water and ice.

To assure proper hood latching component operation, use engine oil to lubricate the lock, safety catch and hood hinges when other under hood service is performed. Mopar, Multi-purpose Grease or equivalent should be applied sparingly to all pivot and slide contact areas.

USE ENGINE OIL ON:

- Door hinges—Hinge pin and pivot points.
- Hood hinges—Pivot points.
- Luggage compartment lid hinges—Pivot points.

USE MOPAR LUBRIPLATE OR EQUIVALENT ON:

- Door check straps.
- Hood counterbalance springs.
- Luggage compartment lid latches.
- Luggage compartment lid prop rod pivots.
- Ash tray slides.
- Fuel Fill Door latch mechanism.
- Park brake mechanism.
- Front seat tracks.

SUSPENSION AND DRIVESHAFTS

CONTENTS

GENERAL INFORMATION

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.

An independent MacPherson Type front suspension is used on these vehicles. Vertical shock absorbing struts attach to the upper fender reinforcement and the steering knuckle to provide upper steering knuckle position. Lower control arms are attached inboard to a crossmember and outboard to the steering knuckle through a ball joint to provide lower steering knuckle position. During steering maneuvers, the strut (through a pivot bearing in the upper retainer) and the steering knuckle turn as an assembly (Fig. 1).

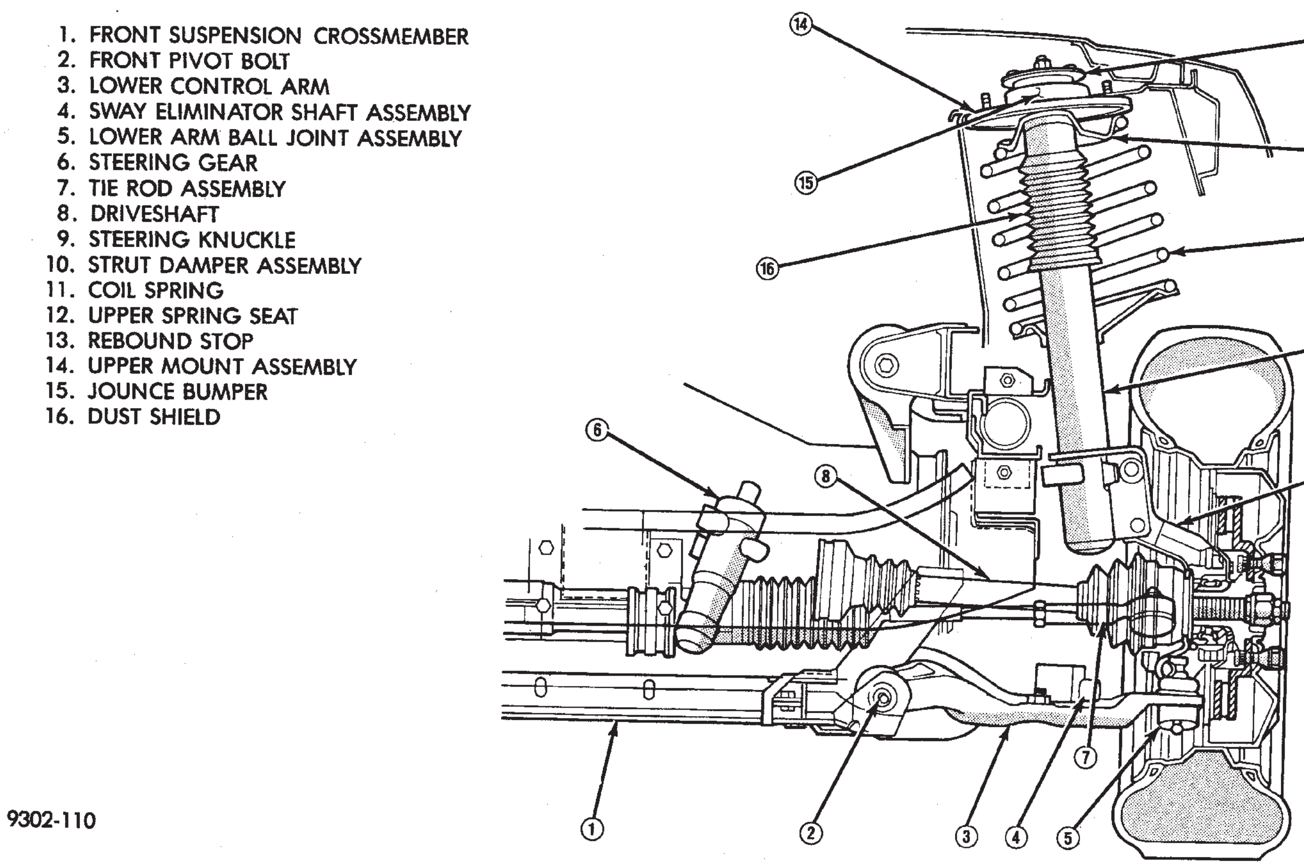


Fig. 1 Front Suspension (Typical)

FRONT SUSPENSION

FRONT SUSPENSION MAJOR COMPONENTS (FIG. 2)

STRUT SUPPORT

The system is supported by coil springs positioned offset around the struts. The springs are contained between an upper seat, located just below the top strut mount assembly (Fig. 2) and a lower spring seat on the strut lower housing.

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

The bottom attaches to the top of the steering knuckle with two through bolts. On some vehicles, one bolt has an eccentric cam located below the head of the bolt for camber adjustment. On the other vehicles the camber adjustment is done by manually moving the steering knuckle within the strut assembly. Caster is a fixed setting on all vehicles and is not adjustable.

STEERING KNUCKLE

The steering knuckle is a single casting with legs machined for attachment to the strut damper, steering linkage, brake adaptor, and lower control arm ball joint. The knuckle also holds the front drive hub bearing. The hub is positioned through the bearing and knuckle, with the constant velocity stub shaft splined through the hub.

LOWER CONTROL ARM

The lower control arm is a steel casting with 2 large spool type rubber pivot bushings. The lower control arm is bolted to the crossmember with pivot bolts through the center of the rubber pivot bushings.

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 lower control arms are inter-connected through a rubber isolated sway bar (Fig. 2).

DRIVESHAFTS

A left and right driveshaft is attached inboard to the transaxle differential side gears, and outboard to the driven wheel hub.

To deliver driving force from the transaxle to the front wheels during turning maneuvers and suspension movement. Both shafts are constructed with constant velocity universal joints at both ends.

Both shafts have a Tripod (sliding) joint at the transaxle end and Rzeppa joints (with splined stub shafts) on the hub ends. Due to the transaxle location the connecting shafts between the C/V joints are of different length and construction. The right shaft is longer and of tubular construction. The left shaft is solid.

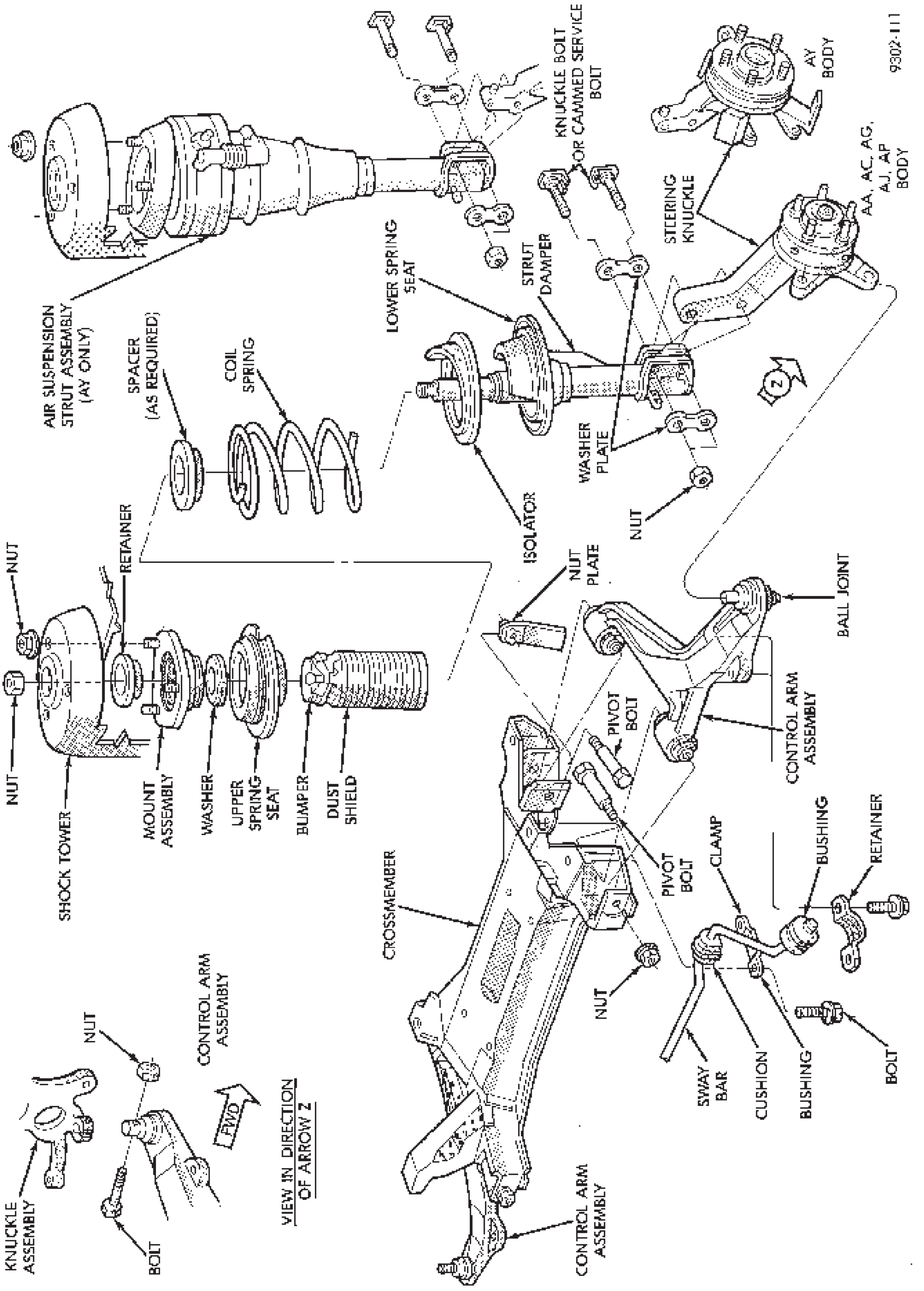
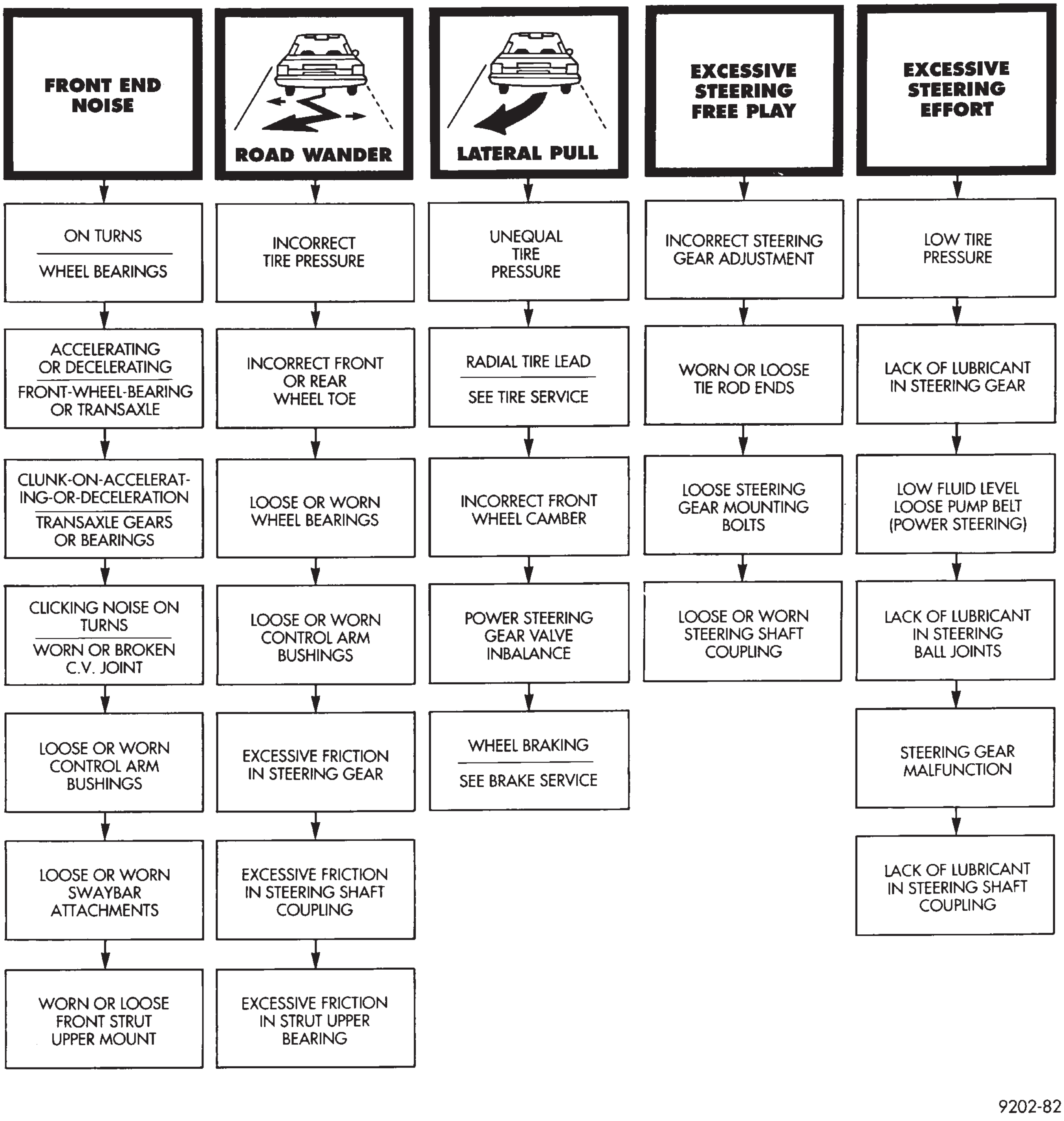


Fig. 2 Front Suspension Components

SUSPENSION/STEERING/DIAGNOSIS FRONT WHEEL DRIVE



FRONT SUSPENSION SERVICE PROCEDURES

INDEX

WHEEL ALIGNMENT

Front wheel alignment is the proper adjustment of all interrelated front suspension angles. These angles are what affects the running and steering of the front wheels of the vehicle.

The method of checking front 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 alignment specifications recommended by Chrysler Corporation be used.

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

CAUTION: Do not attempt to modify any suspension or steering components by heating or bending of the component.

Wheel alignment adjustments and checks should be made in the following sequence.

(1) Camber

(2) Toe

Camber is the number of degrees the top of the wheel is tilted inward or outward from true vertical. Inward tilt is negative camber. Outward tilt is positive camber.

Excessive camber is a tire wear factor: negative camber causes wear on the inside of the tire, while positive camber causes wear to the outside.

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.

PRE-ALIGNMENT

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

(1) Check and inflate tires to recommended pressure. All tires should be the same size and in good condition and have approximately the same wear. Note 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.

Front suspension must only be checked after the vehicle has had the following checked or adjusted. Tires set to recommended pressures, full tank of fuel, no passenger or luggage compartment load and is on a level floor or alignment rack.

Just prior to each alignment reading. The vehicle should be bounced (rear first, then front) by grasping bumper at center and jouncing each end an equal number of times. Always release bumpers at bottom of down cycle.

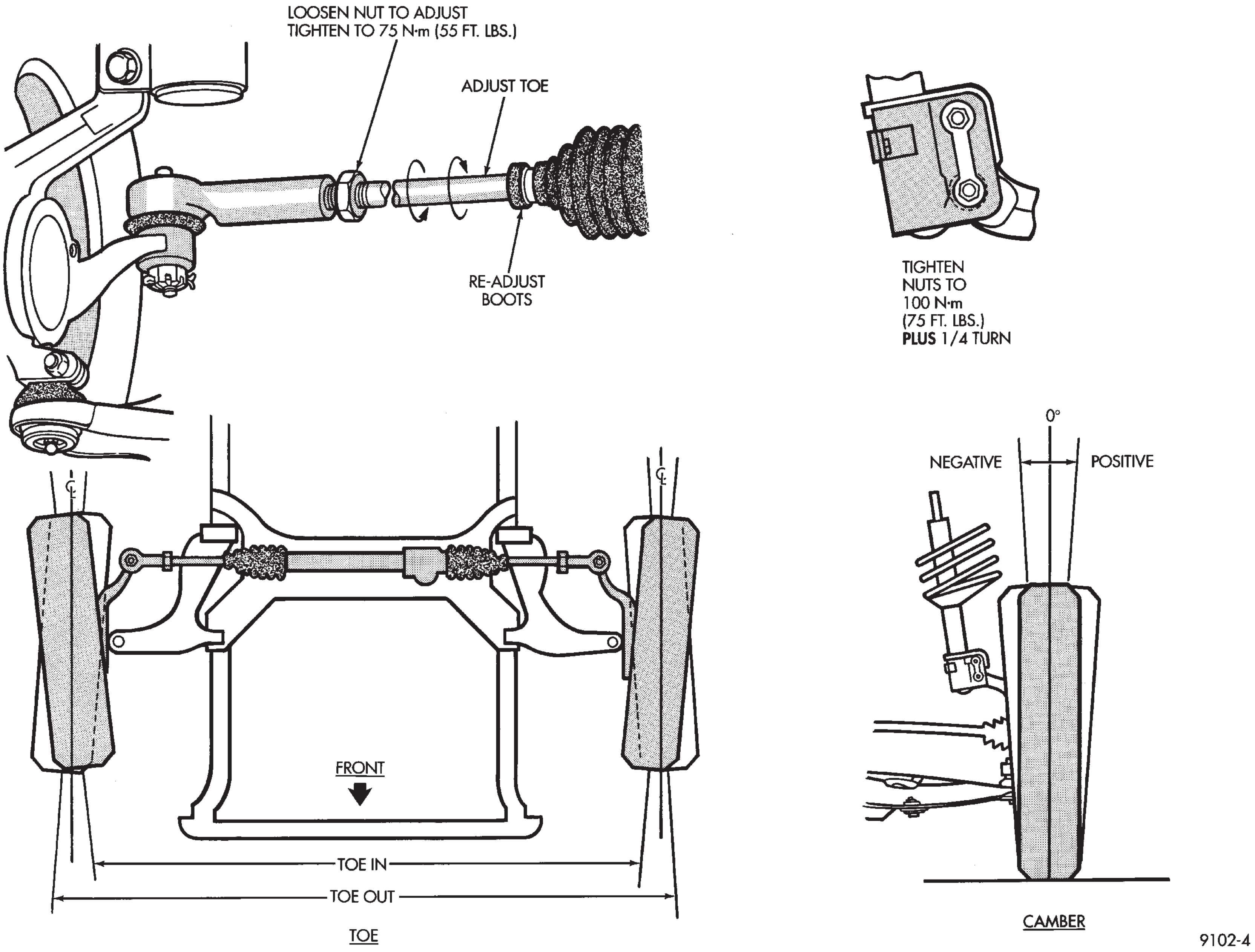


Fig. 1 Alignment Camber/Toe

WHEEL ALIGNMENT SERVICE PROCEDURE

CAMBER AA, AJ BODIES

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

(2) Loosen cam and knuckle bolts (each side) (Fig. 2).

(3) Rotate cam bolt (Fig. 2) to move top of wheel in or out to specified camber.

(4) Tighten the cam bolts and nuts to 100 N●m (75 ft. lbs.) **plus** 1/4 turn beyond specified torque.

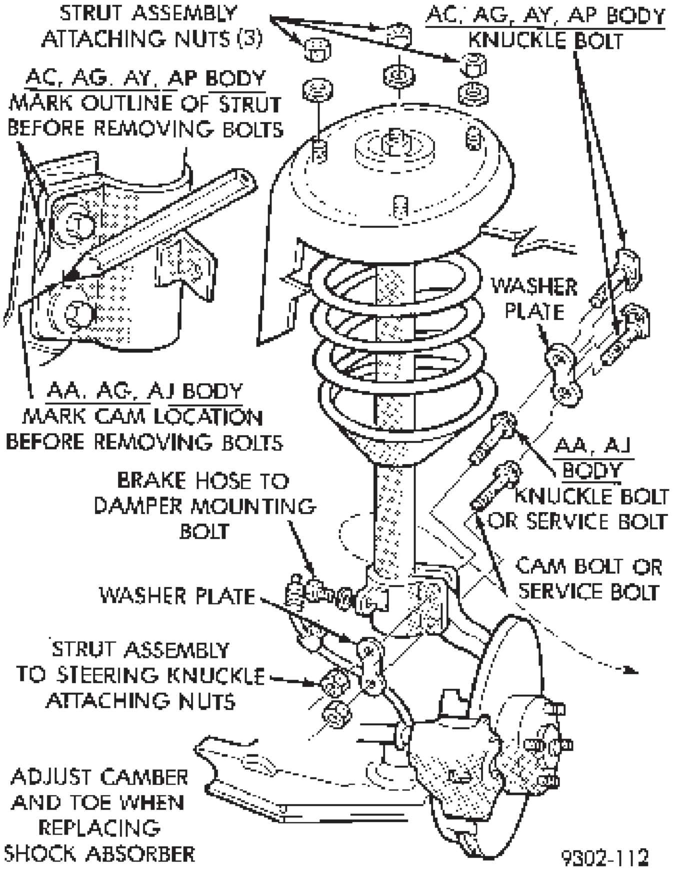


Fig. 2 Alignment Adjustment Locations

CAMBER AC, AG, AP, AY BODIES

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

(2) Position vehicle on alignment equipment and read camber as instructed by equipment manufacturer's procedure.

(3) Using extensions and appropriate tools. Remove the strut assembly to steering knuckle attaching bolts from vehicle (Fig. 2). Replace the original attaching bolts with the bolts provided in the alignment, Cam And Bolt Service Package.

(4) Rotate the alignment adjusting cam bolt, (Fig. 2) to obtain the specified camber setting for the vehicle. See the Specifications Section at the end of this group for the camber setting for the vehicle being serviced.

(5) Using the appropriate extensions and tools. Carefully reach around the tire and tighten the knuckle bolts enough to hold the camber setting. Finish by tightening the bolts to 100 N●m (75 ft.lbs.) **plus** 1/4 turn beyond specified torque.

TOE

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

(2) Center steering wheel and hold with steering wheel clamp.

(3) Loosen tie rod locknuts. Rotate rods to align toe to specifications (Fig. 3).

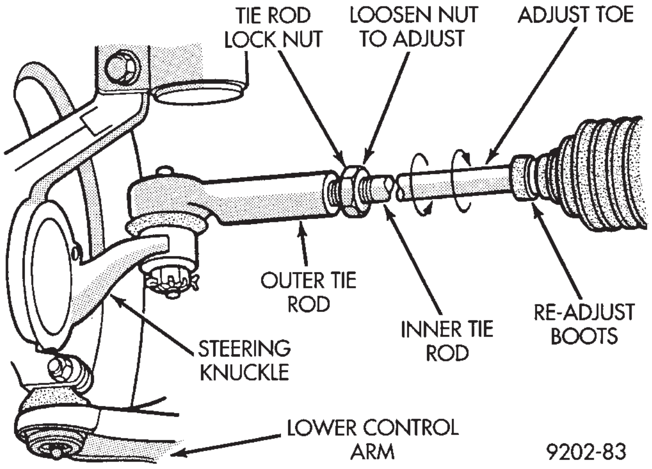


Fig. 3 Front Wheel Toe Adjustment

CAUTION: Do not twist tie rod to steering gear rubber boots during adjustment.

(4) Tighten tie rod locknuts to 75 N●m (55 ft.lbs.) torque.

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

(6) Remove steering wheel clamp.

STRUT DAMPER ASSEMBLY

REMOVAL

(1) Loosen wheel nuts.

(2) Raise vehicle, see Hoisting in Lubrication and Maintenance, Group 0.

(3) Remove wheel and tire assembly.

Where service procedure includes assembly of original strut (shock absorber) to original knuckle. Mark cam adjusting bolt (Fig. 4), on AA, and AJ bodies only. Mark outline of strut on knuckle as shown in (Fig. 1). on AC, AG, AP and AY bodies.

(4) Remove cam bolt, knuckle bolt(s), washer plate(s) and brake hose to damper bracket retaining screw (Fig. 4).

(5) Remove strut damper to fender shield mounting nut washer assemblies.

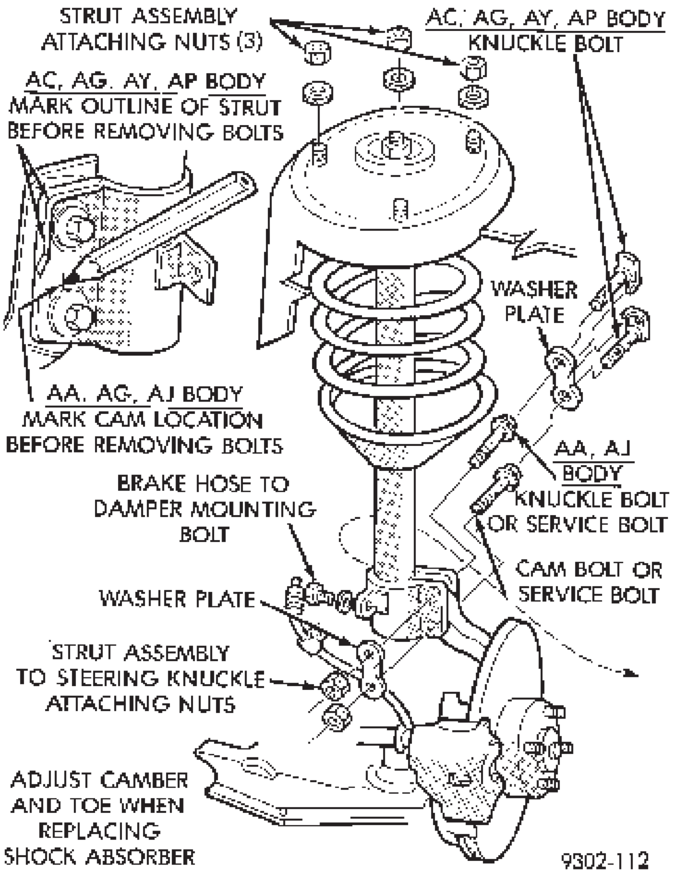


Fig. 4 Strut Damper Removal

INSPECTION

Inspect for evidence of fluid running from the upper end of the 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.

INSTALLATION

(1) Install unit into fender reinforcement and install retaining nuts and washer assemblies (Fig. 1). Tighten the 3 nuts to 27 N•m (20 ft. lbs.) torque.

(2) Position steering knuckle neck into strut assembly. Position washer plate and install cam and knuckle bolts (Fig. 4).

(3) Attach brake hose retainer to damper, tighten the screw to 13 N•m (10 ft. lbs.) torque (Fig. 4).

(4) Index strut to original outline on the knuckle neck, or align mark on cam bolt with the mark that was put on the strut to steering knuckle bracket (Fig. 4).

(5) Place a 4 inch (or larger) C clamp on the strut and knuckle as shown in (Fig. 5). Tighten the clamp just enough to eliminate any looseness between the knuckle and the strut. Check alignment of the index marks and tighten the bolts to 100 N•m (75 ft. lbs.) **plus** 1/4 turn beyond specified torque. Remove the (C) clamp.

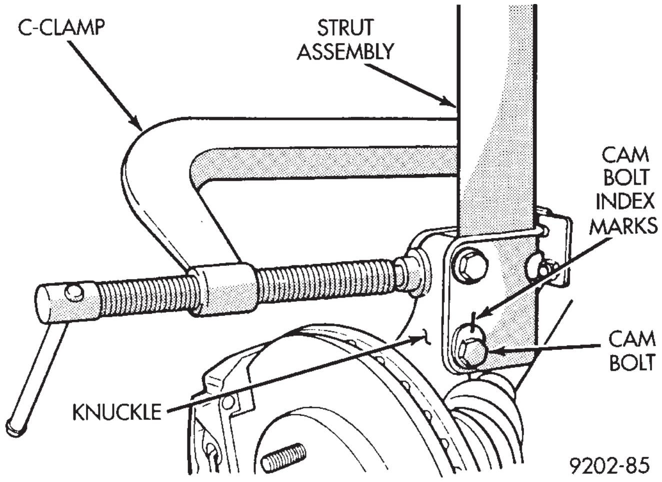


Fig. 5 Strut Damper Installation

(6) Install wheel and tire assembly. Tighten the wheel nuts to 129 N•m (95 ft. lbs.) torque.

DISASSEMBLY (STRUT DAMPER)

(1) Compress front coil spring with Spring Compressor, Special Tool C-4838 (Fig. 6).

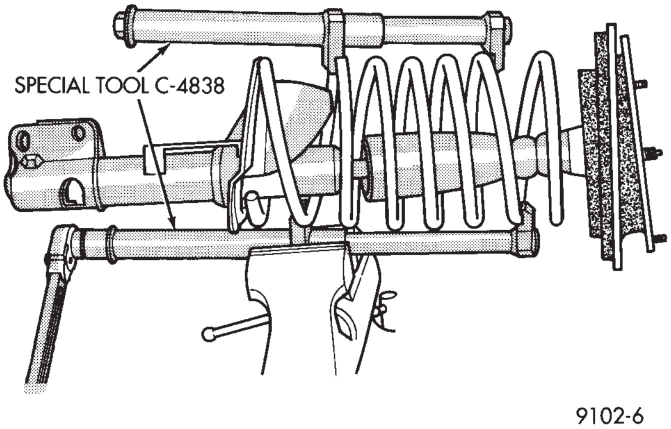


Fig. 6 Compressing Coil Spring

(2) Hold end of strut shaft from rotating with wrench, while loosening strut shaft nut. Remove nut from shaft (Fig. 7).

(3) Remove the upper strut mount from the strut assembly.

(4) Remove coil spring from the strut assembly. **Mark spring for installation back on the same side of the vehicle (Fig. 11).**

CAUTION: see Suspension Coil Springs before releasing coil from Tool C-4838.

(5) Inspect strut damper, mount assembly (Fig. 8) for:

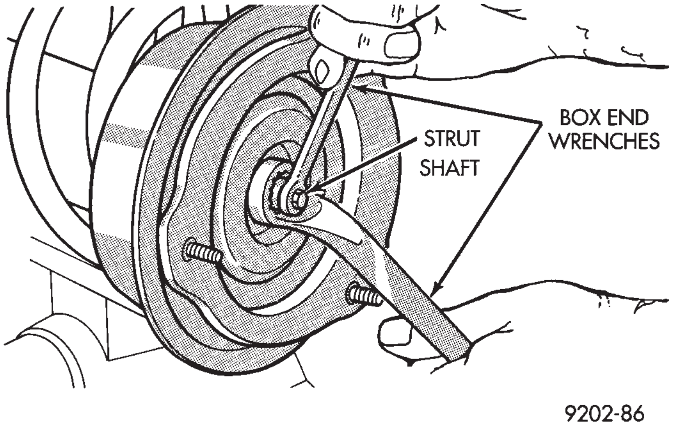


Fig. 7 Loosening Strut Assembly Shaft Nut

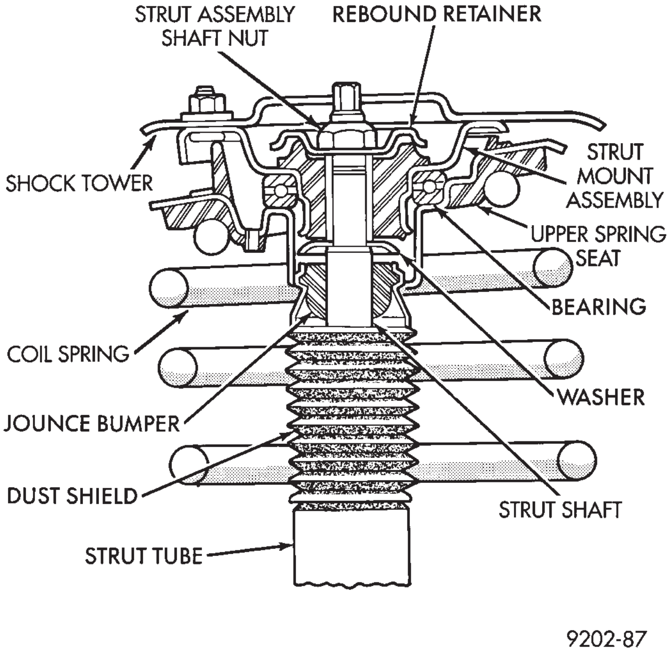


Fig. 8 Mount Assembly

(a) Severe deterioration of rubber isolator; retainers for cracks and distortion and bond failure of retainers and rubber isolators.

(b) Bearings for binding.

(c) Shock Absorber for flat spots over full stroke also see, Shock Absorbers, (strut damper).

ASSEMBLE (STRUT DAMPER)

(1) Mount the strut assembly in a vertical position.

(2) Place the compressed spring onto the strut assembly, so the end of the coil is seated in the seat recess in lower spring mount (Fig. 9).

(3) Install the dust shield, isolator (if so equipped) jounce bumper, spacer (as required), and spring seat onto the top of the strut shaft (Fig. 8).

(4) Position top spring seat alignment tab correctly with respect to bottom bracket (Fig. 9).

(5) Install the rebound retainer and shaft nut (Fig. 8).

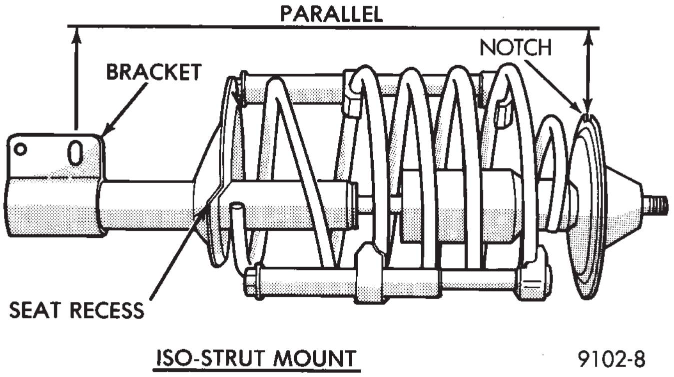


Fig. 9 Spring Seat Alignment Notch Position to Bracket

(6) Tighten the strut shaft nut using, Strut Rod Socket And Holder, Special Tool L-4558. Torque strut shaft nut to 75 N•m (55 ft. lbs.) plus 1/4 turn (Fig. 10).

WARNING: THIS STEP MUST BE DONE BEFORE SPRING COMPRESSOR, SPECIAL TOOL C-4838 IS RELEASED FROM THE COIL SPRING.

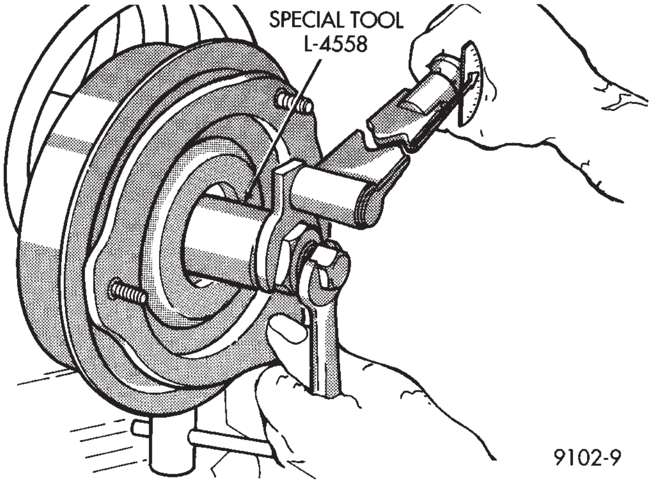


Fig. 10 Tighten Strut Rod Nut with Tool

(7) Verify coil spring is aligned correctly with respect to bottom bracket (Fig. 9).

(8) Release Spring Compressor Tool C-4838.

SUSPENSION COIL SPRINGS

Springs are rated separately for each side of vehicle depending on optional equipment and type of service. During service procedures where both springs are removed, mark springs (Chalk, Tape, etc.) (Fig. 11) to ensure installation in original position. If the coils 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.**

During service procedures requiring the removal or installation of a coil spring with Spring

Compressor, Special Tool C-4838. It is required that five coils be captured within the jaws of the tool (Fig. 11).

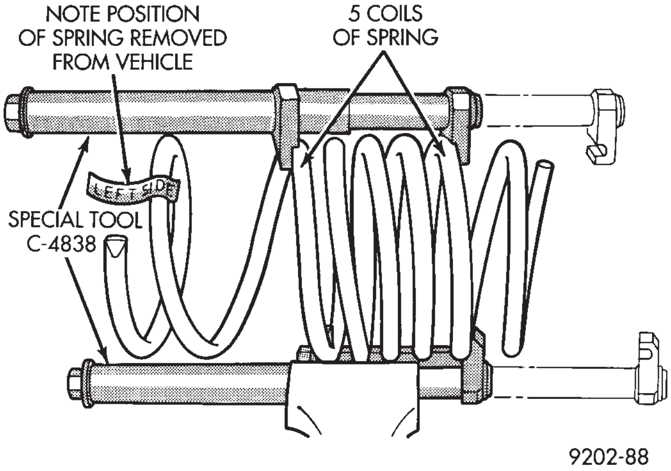


Fig. 11 Identifying Coil Springs

SPRING RETAINER UPPER

Ensure that upper spring retainer is positioned properly, see; step (4), Assemble (Strut Damper).

SPRING SEAT LOWER

During assembly of the coil spring to strut damper. Ensure that lower coil spring end is seated in strut damper spring seat recess refer to (Fig. 9) in assemble (Strut Damper) section.

SHOCK ABSORBERS (Strut Damper)

INSPECTION

Inspect for evidence of fluid leaking from around the strut assembly shaft seal at the upper end of the 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 around the strut rod is not unusual and does not affect performance.

LOWER CONTROL ARM

The lower control arm if damaged, is serviced only as a complete component. 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, and both pivot bushings. The service procedure to replace these components is detailed in the specific component sections of this group.

REMOVAL (ASSEMBLY)

(1) Raise vehicle. See Hoisting in Lubrication, Group 0 of this service manual.

(2) Remove the ball joint stud to steering knuckle clamp nut and bolt (Fig. 1).

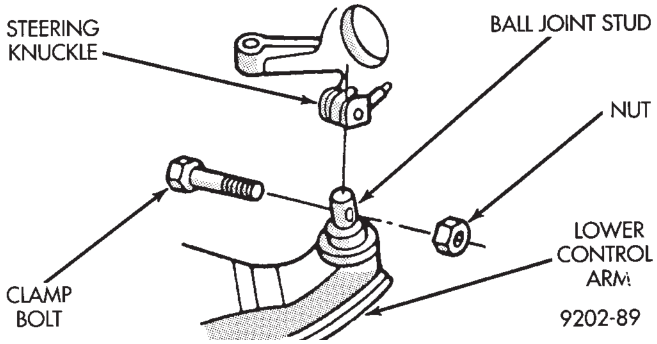


Fig. 1 Control Arm To Steering Knuckle Attachment

(3) Remove the sway bar to lower control arm retainer on both sides of the vehicle (Fig. 2). Then rotate the sway bar down away from the lower control arms.

(4) Separate the steering knuckle from the ball joint stud (Fig. 1).

(5) Remove the front and rear control arm pivot bushing to crossmember attaching nuts and bolts (Fig. 2). Then remove the lower control arm from the crossmember.

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

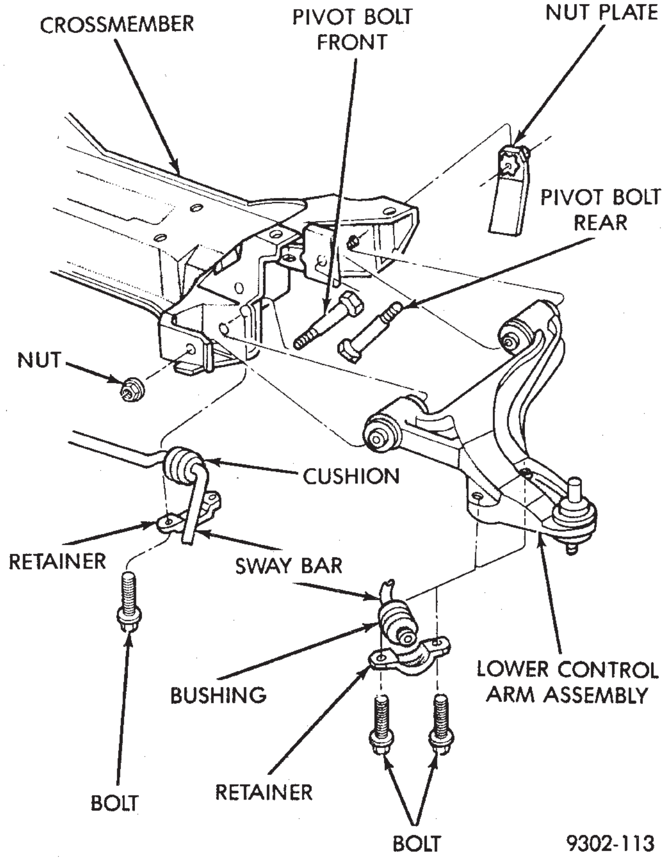


Fig. 2 Lower Control Arm Typical

Inspect lower control arm for distortion. Check bushings for severe deterioration.

INSTALLATION (ASSEMBLY)

(1) Position the lower control arm into the crossmember. Install front and rear pivot bushing to crossmember attaching bolts. Then loosely assemble nuts to bolts (Fig. 2).

(2) Install ball joint stud into steering knuckle and install clamp bolt (Fig. 1). Tighten clamp bolt to 145 N●m (105 ft. lbs.).

(3) Position sway bar and bushings against the lower control arms. Install sway bar to control arm retainers. Install retainer bolts and tighten to 70 N●m (50 ft. lbs.).

(4) Lower vehicle so the suspension is supporting vehicles weight (control arm at design height). Tighten the lower control arm to crossmember attaching bolts to 169 N●m (125 ft. lbs.) torque.

LOWER CONTROL ARM PIVOT BUSHINGS

When performing the replacement procedure on the lower control arm pivot bushings, the following sequence must be followed. When removing the pivot bushings from the lower control arm, the large bushing must be removed first then the small bushing. When installing the pivot bushings into the lower control arm, the small bushing must be installed first then the large bushing. This sequence must be used when removal and replacement of bushings is done using Bushing Remover/Installer, Special Tool 6602.

LARGE BUSHING

REMOVE

(1) Position and clamp lower control arm in a vise.

(2) Assemble the washer, thrust bearing and large bushing disk, Special tool 6602-5 onto the threaded rod from Bushing Remover/Installer, Special Tool 6602 (Fig. 3).

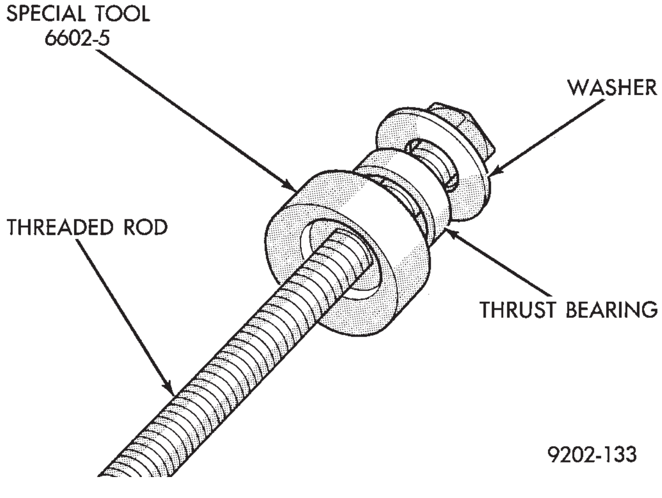


Fig. 3 Bushing Removal Tools

(3) Install the tools assembled in step 2 above into the large bushing of the lower control arm (Fig. 4). Then assemble the remaining Special Tools, Cup 6602-2, thrust bearing, washer and long nut onto the threaded rod (Fig. 4) from Bushing Remover/Installer, Special Tool 6602.

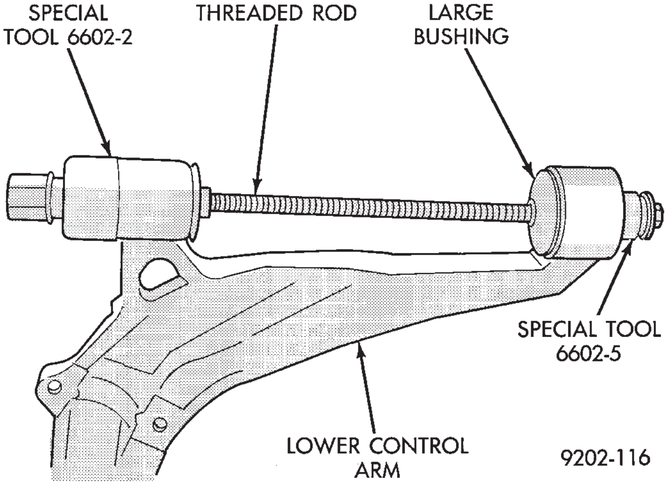


Fig. 4 Tool Assembled For Bushing Removal

(4) Hold the long nut stationary. Using a deep socket turn the long threaded rod until the large pivot bushing is pushed out of the lower control arm.

SMALL BUSHING

REMOVE

(1) Remove the special tools from the lower control arm that were used for the removal of the large pivot bushing.

(2) Remove the large Bushing Disc, Special Tool 6602-5 from the threaded rod. Leave the thrust bearing and washer on the threaded rod. Install the small Bushing Disc, Special Tool 6602-3 on the threaded rod and against thrust bearing (Fig. 5).

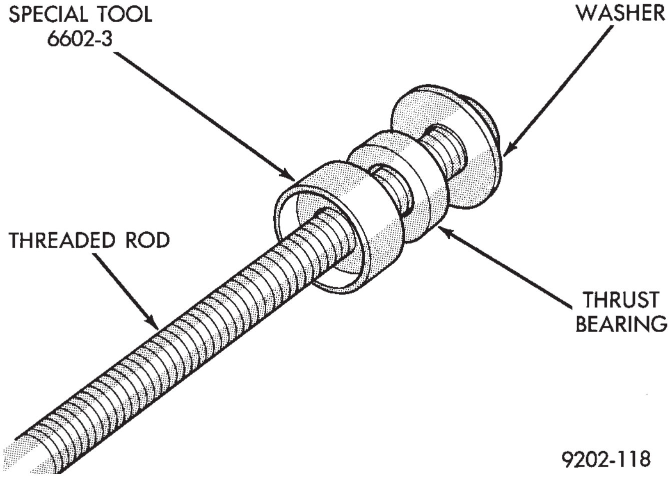


Fig. 5 Bushing Removal Tools

(3) Install the tools assembled in step 2 above through small lower control arm bushing and hole in lower control arm where large bushing was removed from (Fig. 6). Assemble the Cup, Special Tool 6602-2 thrust bearing, washer and long nut onto the threaded rod of Special Tool 6602 (Fig. 6). Cup, Special Tool 6602-2 is to be installed on threaded rod with cup facing out and undercut in large bushing hole of lower control arm (Fig. 6).

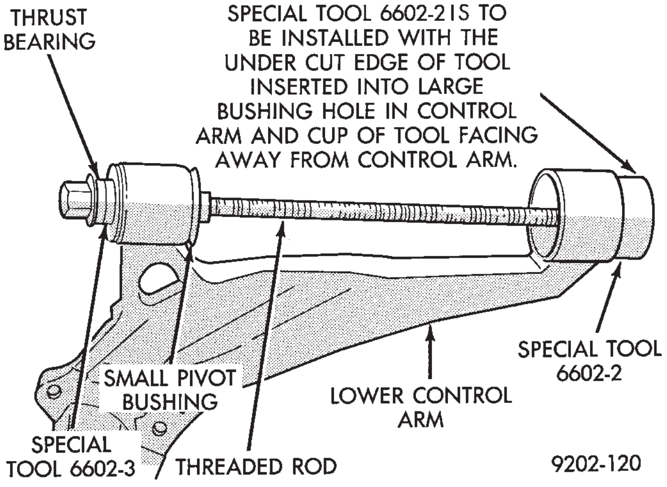


Fig. 6 Tool Assembled For Bushing Removal

(4) Hold the threaded rod stationary and turn the long nut until the small pivot bushing is pulled out of the lower control arm.

SMALL BUSHING

INSTALL

(1) Remove the special tools from the lower control arm that were used for the removal of the small pivot bushing.

(2) On the threaded rod from Remover/Installer, Special Tool 6602 assemble the following pieces. Washer, thrust bearing, small bushing disc Special Tool 6602-3, small lower control arm pivot bushing and small bushing sizer, Special Tool 6602 (Fig. 7).

(3) Install the pieces assembled in step 2 through the small and large pivot bushing holes in the lower control arm. At the large pivot bushing hole in the lower control arm, assemble Cup, Special Tool 6602-2, thrust bearing, washer and nut (Fig. 8). Cup, Special Tool 6602-2 is to be installed on threaded rod with cup facing out and undercut in large bushing hole of lower control arm (Fig. 8). Lubricate the installer cone and new bushing using Mopar®, Silicone Spray Lube or equivalent.

(4) Hold the threaded rod stationary and turn the long nut until the small pivot bushing is fully installed into the lower control arm. Be sure that the flanges of the bushing are fully expanded around the control arm bushing holes.

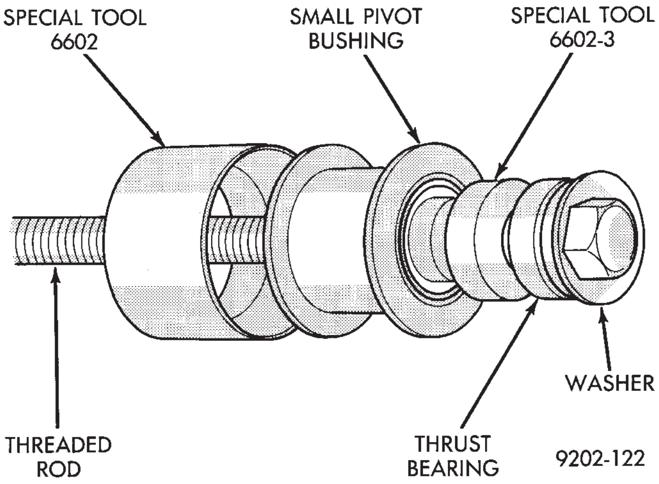


Fig. 7 Bushing Installing Tools Assembled

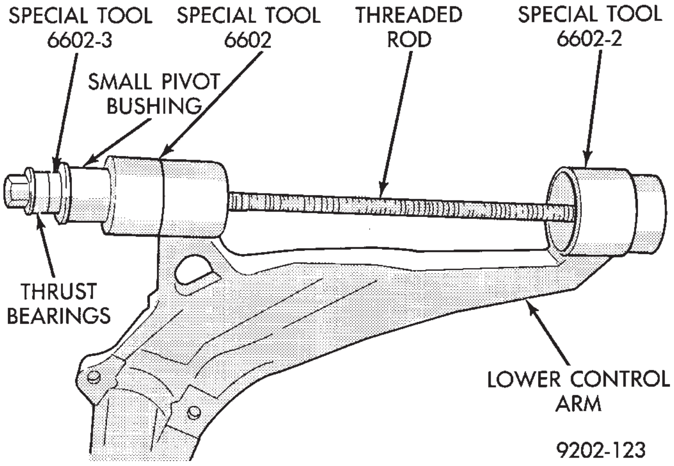


Fig. 8 Bushing And Tool Position For Installation In Control Arm

LARGE BUSHING

INSTALL

(1) Remove the special tools from the lower control arm that were used for installing the small pivot bushing.

(2) On the threaded rod from Remover/Installer, Special Tool 6602 assemble the following pieces. Washer, thrust bearing, Cup Special Tool 6602-2 (Fig. 9).

(3) Install the pieces assembled in step 2 through the hole in the small pivot bushing and the large pivot bushing hole in the lower control arm. At the large pivot bushing hole in the lower control arm assemble the following special tool pieces. Large Bushing Sizer, Special Tool 6602-4, large lower control arm pivot bushing, large bushing disc Special Tool 6602-5, thrust bearing, washer and nut (Fig. 10). Lubricate the installer cone and new bushing using Mopar® Silicone Spray Lube or equivalent.

(4) Hold the threaded rod stationary and turn the long nut until the bushing is fully installed into the

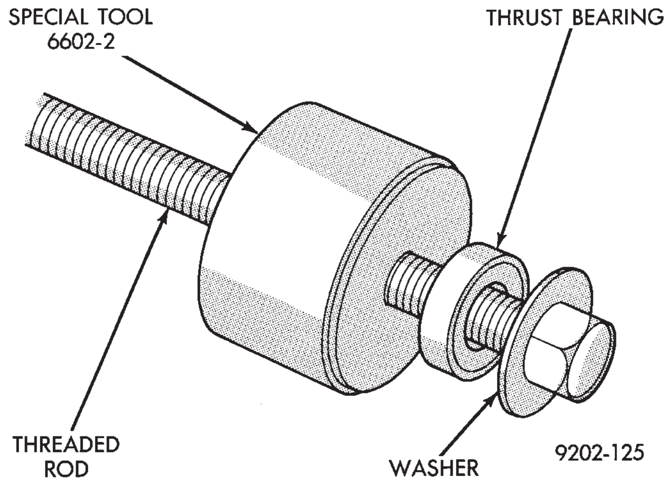


Fig. 9 Bushing Installer Tools

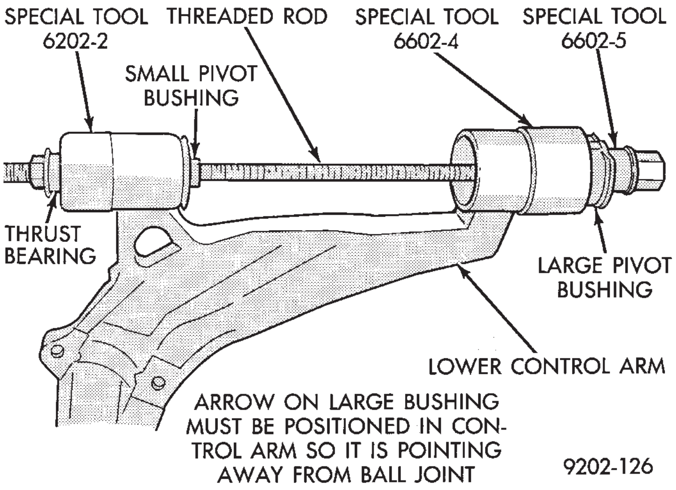


Fig. 10 Bushing And Tool Position For Installation In Control Arm

control arm. Be sure that the flanges of the bushing are fully expanded around the control arm bushing holes.

(5) If the position of the large lower control arm pivot bushing (Fig. 11) moved during bushing installation. Install a nut and bolt through the bushing sleeve and tighten it down (Fig. 11). Using a wrench rotate the bolt until the bushing is in the correct position (Fig. 10)

BALL JOINTS

The lower front suspension ball joints operate with no free play. See Inspection Ball Joint Wear to determine if the ball joint is worn and requires replacement.

The ball joints are replaceable as an assembly, do not attempt any type of repair on the ball joint assembly. The replacement procedure for the ball joint assembly is detailed in this section.

The ball joint housing is a pressed fit into the lower control arm with the joint stud retained in the steering knuckle by a (clamp) bolt.

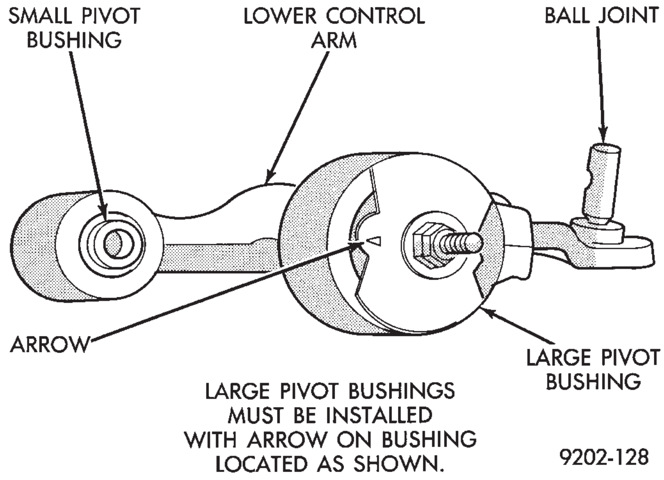


Fig. 11 Positioning Control Arm Bushing

INSPECTION BALL JOINT WEAR

With the weight of the vehicle resting on the road wheels. Grasp the grease fitting as shown in (Fig. 12) and with no mechanical assistance or added force attempt to move the grease fitting.

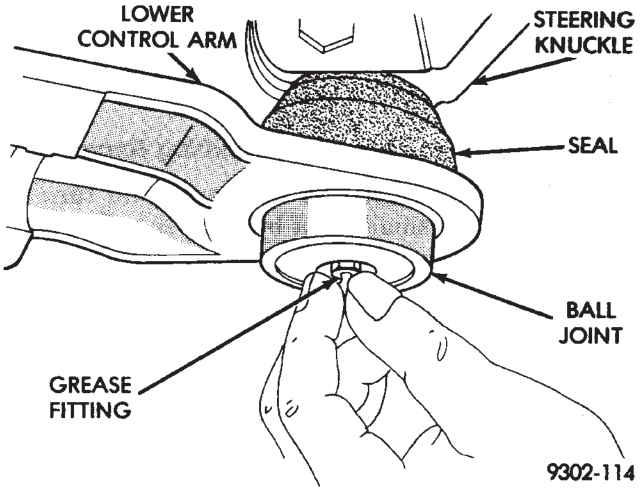


Fig. 12 Checking Ball Joint Wear

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

BALL JOINT REMOVAL

(1) Pry off seal.

(2) Position Receiving Cup Special Tool C-4699-2 to support lower control arm while receiving ball joint assembly (Fig. 13).

(3) Install Remover/Installer Special Tool, C-4699-1 (Fig. 13) over ball joint stud and against the ball joint upper housing.

(4) Press down against the ball joint upper housing, to remove ball joint assembly from lower control arm.

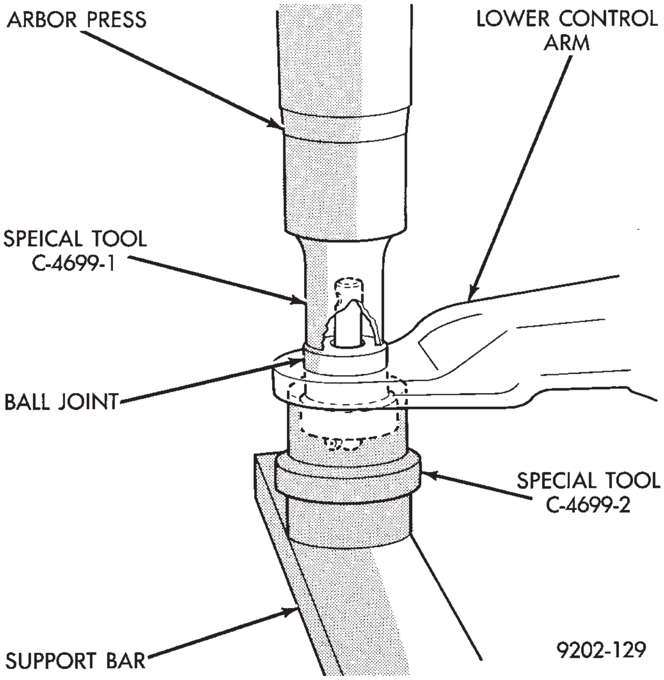


Fig. 13 Removing Ball Joint

BALL JOINT INSTALLATION

(1) By hand, position ball joint assembly into the ball joint bore of the lower control arm. Be sure the ball joint assembly is not cocked in the bore of the control arm, this will cause binding of the ball joint assembly.

(2) Position assembly in press with Installer Tool C-4699-2 supporting control arm (Fig. 14).

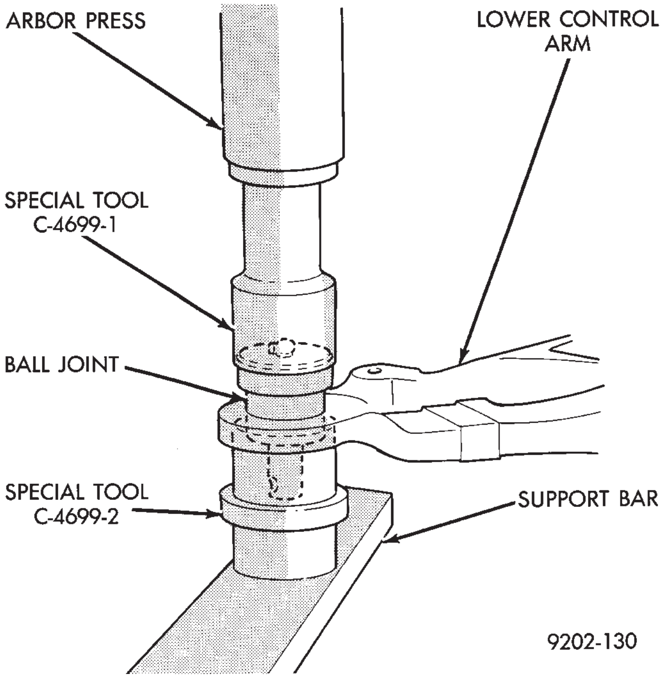


Fig. 14 Installing Ball Joint

(3) Install the Remover/Installer, Special Tool C-4699-1 over the ball joint stud and down on the lower body of the ball joint assembly (Fig. 14).

(4) Carefully align all pieces. Using an arbor press apply pressure against the ball joint assembly, until ball joint is fully seated against bottom surface of control arm. Do not apply excessive pressure against the control arm.

BALL JOINT SEAL INSTALLATION

(1) Support ball joint housing with Installer, Special Tool C-4699-1 (Fig. 15). Position new seal over ball joint stud and against ball joint housing.

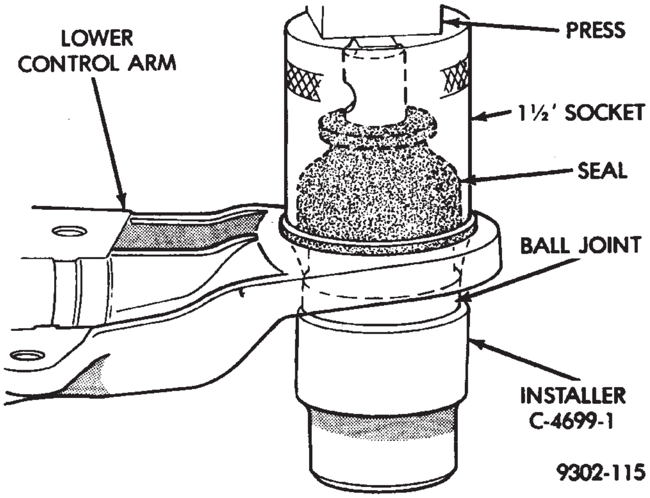


Fig. 15 Installing Ball Joint Seal

(2) With 1-1/2 inch socket, press seal onto ball joint housing until it is squarely seated against top surface of control arm as shown in (Fig. 15).

SWAY BAR

The sway bar interconnects the front lower control arms of the vehicle and attaches to the crossmember (Fig. 1).

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

Attachment to the crossmember, and front lower control arms is through rubber-isolated bushings. All parts are serviceable, and the sway bar to crossmember bushings are split for easy removal and installation. The split in the sway bar to crossmember bushing should be positioned toward the front of the vehicle.

LOWER CONTROL ARM SWAY BAR RETAINER ATTACHMENT HOLE THREAD REPAIR

If threaded holes in lower control arm, for attachment of sway bar retainers (Fig. 1) become damaged. The threaded holes are repairable and do not require replacement of lower control arm.

If threads are damaged or stripped on the lower control arm. An initial repair attempt should be

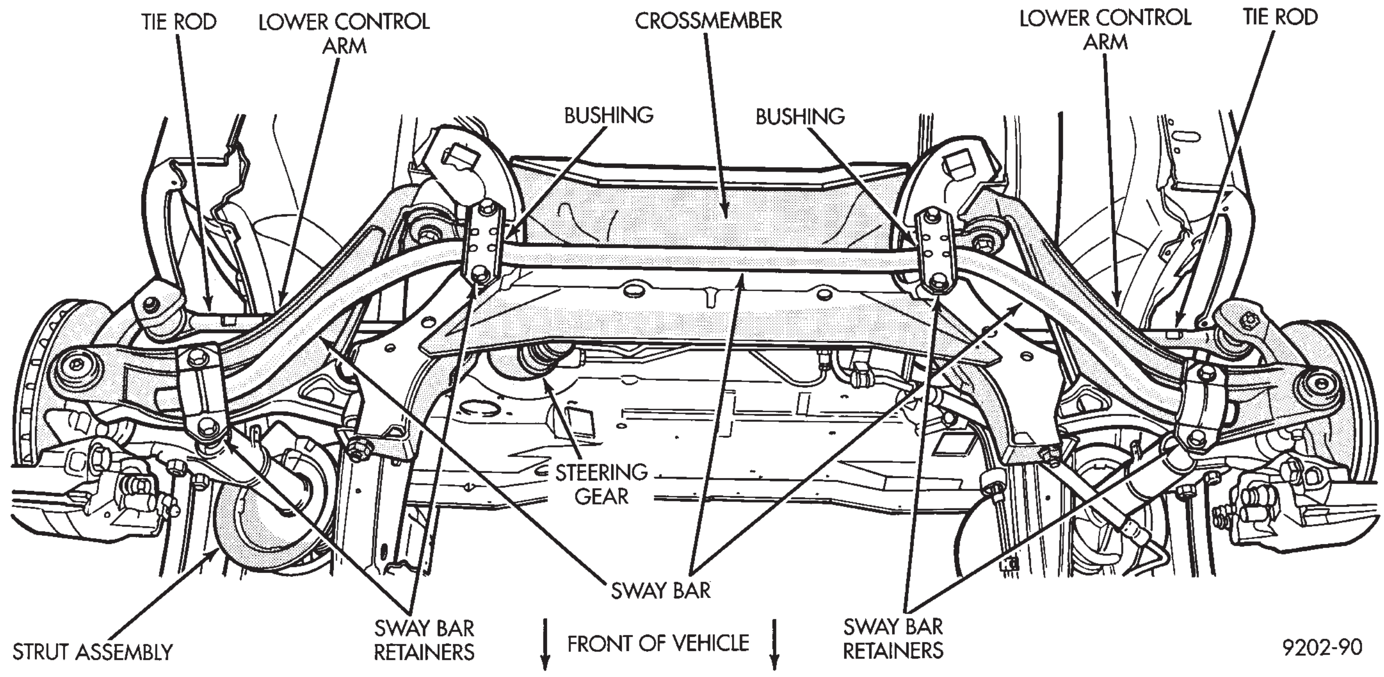


Fig. 16 Front Sway Bar

made by using a (M10 x 1.5 - 6H) thread chasing tap on the holes to restore the threads to a usable condition. If threads can be restored to a usable condition, install sway bar retainer attaching bolts and torque to 68 N•m (50 ft. lbs.).

CAUTION: When performing repair procedure listed below. Be sure replacement bolts and nuts meet the same requirements as the original equipment manufactures specifications.

If damage to threaded holes in lower control arm, can not be restored to a usable condition using the above procedure. Drill out holes in lower control arm using an 11 mm drill bit. Then use a bolt and nut for attachment of sway bar retainer to lower control arm. Torque the nut and bolt to 68 N•m (50 ft. lbs.).

REMOVAL

(1) Raise and support the vehicle. See Hoisting in Lubrication and Maintenance, Group 0.

(2) Remove the bolts and sway bar retainers at the front lower control arms (Fig. 16).

(3) Remove the bolts at sway bar crossmember clamps, and remove clamps and sway bar from vehicle (Fig. 16).

INSPECTION

Inspect for broken or distorted clamps, retainers, and bushings. If bushing replacement is required, the inner bushing can be removed by opening the split. The outer bushing must be cut or hammered off the bar. If replaced, the outer bushings should be forced on so that approximately 1/2 inch of the bar protrudes. The sway bar to crossmember bushings, should be positioned when installed, so the void on the bushing is positioned toward the rear of the vehicle (Fig. 17). Note that the control arm retainers are symmetric and bend slightly upon installation.

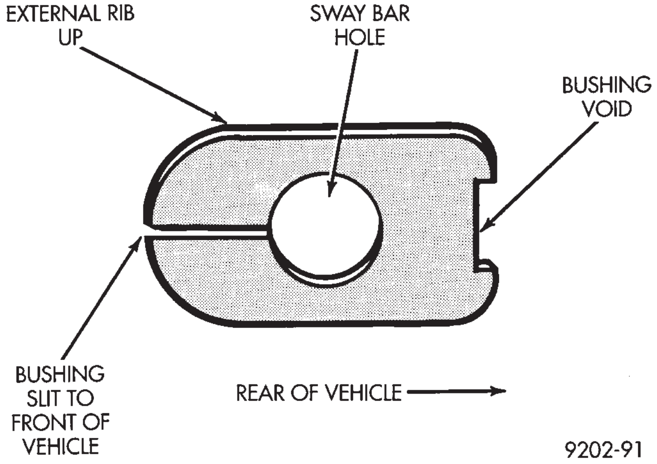


Fig. 17 Sway Bar To Crossmember Bushing Position

INSTALLATION

(1) If inspection of the sway bar assembly, determined that sway bar to lower control arm bushings require replacement. Install the new bushings, by forcing them onto sway bar using a rotating motion. Bushings should be installed on sway bar so that sway bar extends 1/2 inch out past the end of the bushing.

(2) If required position sway bar to crossmember bushings on sway bar with external rib up and void in the bushing facing the rear of vehicle (Fig. 17). Lift the bar assembly into the crossmember, and install

the lower clamps and bolts. The center offset in the sway bar should be oriented toward the front of the vehicle (Fig. 16)

(3) Position bushing retainers on lower control arms and install bolts (Fig. 16).

(4) With lower control arms raised to design height, tighten all retainer attaching bolts to 70 N●m (50 ft. lbs.) torque.

(5) Lower vehicle.

KNUCKLE (FRONT SUSPENSION)

The front suspension knuckle (Fig. 1) provides for steering control of the vehicle. Supports the brake caliper and absorbs the loads exerted during vehicle braking. It also supports the front (driving) hub and bearing and stub axle assembly.

The front suspension knuckle also provides the ability to align the front wheels of the vehicle. This is done by allowing for front wheel camber adjustment and the ability for front tire Toe adjustments

The front suspension knuckle is not a serviceable component. Do not attempt to straighten or repair the front suspension knuckle in any way.

Service repair or replacement of the front (drive) hub and bearing, can be done with the front suspension knuckle remaining on the vehicle.

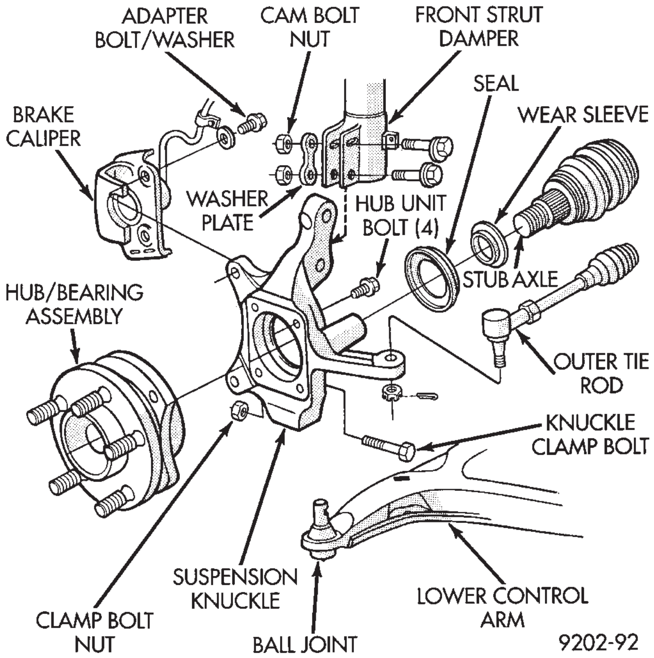


Fig. 1 Front Knuckle Assembly (Typical)

REMOVAL

(1) Remove the cotter pin, hub nut lock and spring washer from the front axle (Fig. 2).

(2) Loosen hub nut while the vehicle is on the floor with the brakes applied (Fig. 3). **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

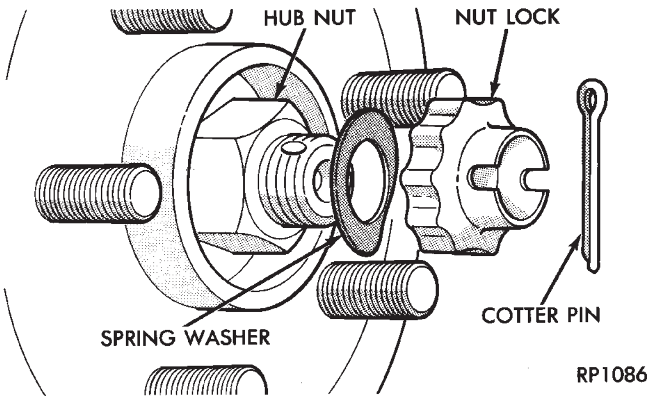


Fig. 2 Remove Cotter Pin, Hub Nut Lock, & Spring Washer

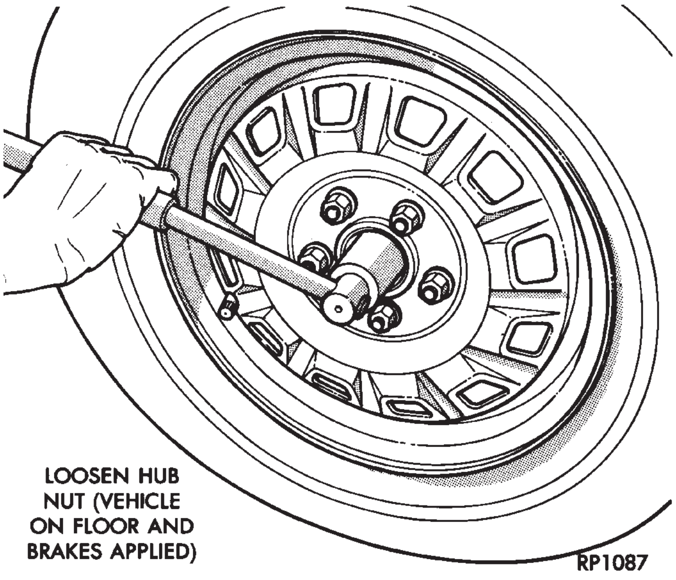


Fig. 3 Loosen Hub Nut

(3) Raise and support the vehicle. See Hoisting in Lubrication and Maintenance, Group 0.

(4) Remove the wheel lug nuts, front tire and wheel assembly and hub nut and washer.

(5) Remove the brake caliper adapter to steering knuckle attaching bolts and washers (Fig. 1). Remove the brake caliper and adapter from the steering knuckle and braking disc. Support brake caliper/adapter assembly using a wire hook and not by hydraulic hose (Fig. 4).

(6) Remove the braking disc from the front hub/bearing assembly (Fig. 5).

(7) Remove the cotter pin and nut from the tie rod end. Remove the tie rod end from the steering knuckle arm using Puller, Special Tool C-3894-A (Fig. 6).

(8) Remove the clamp nut and bolt (Fig. 7) securing the ball joint stud into the steering knuckle.

(9) Separate ball joint stud from knuckle assembly by prying down on lower control arm. Pull knuckle assembly out and away from driveshaft (Fig. 8).

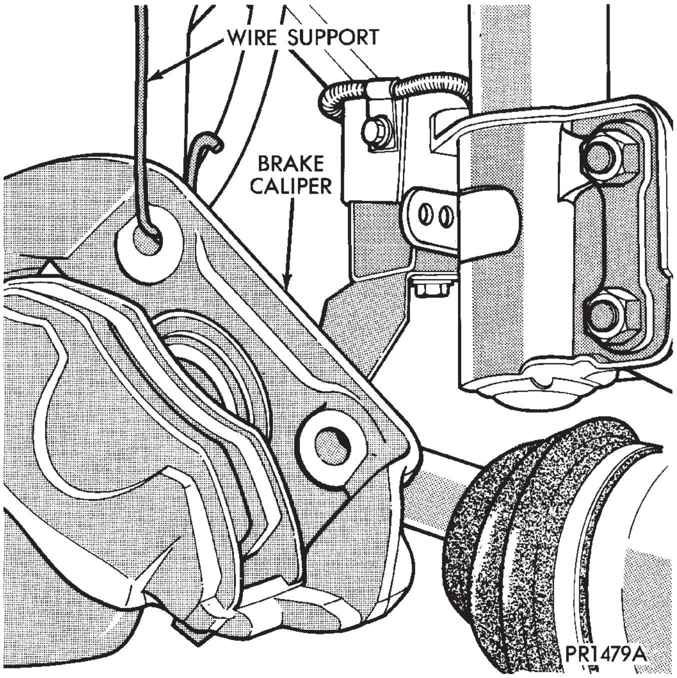


Fig. 4 Supporting Brake Caliper

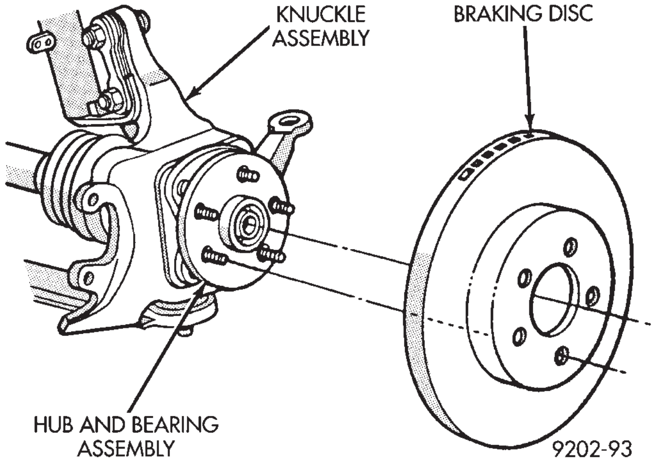


Fig. 5 Remove or Install Braking Disc

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, driveshaft must be supported.

(10) Remove the steering knuckle to strut damper attaching bolt and cam bolt (Fig. 9). **Note the location of the cam bolt, it must be installed in the same location when steering knuckle is installed back on strut damper.**

(11) Mount the steering knuckle in a vise and remove the 4 bolts on back of steering knuckle, attaching the hub and bearing assembly. Remove the hub and bearing assembly from the steering knuckle (Fig. 10).

Remove outer C/V joint seal from the steering knuckle.

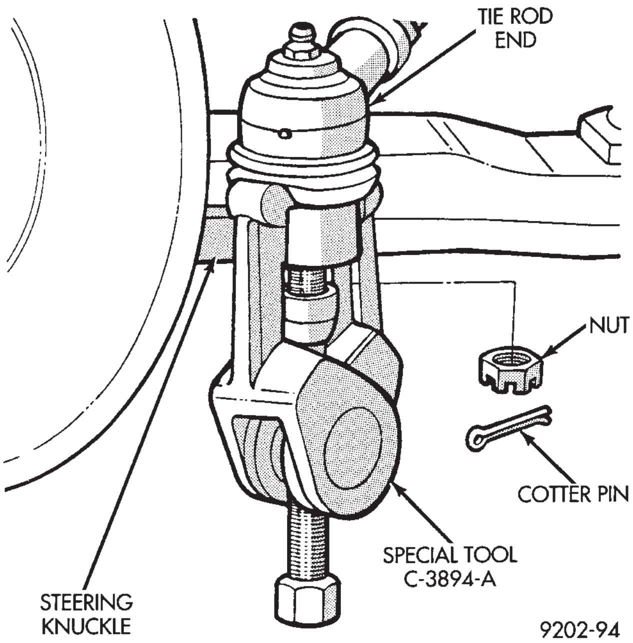


Fig. 6 Disconnect Tie Rod End

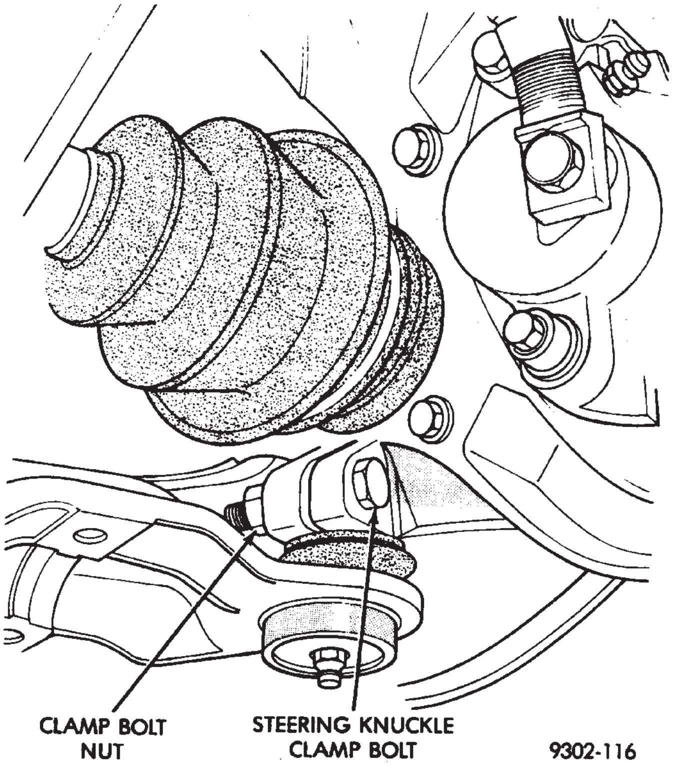


Fig. 7 Remove or Install Steering Knuckle Clamp Bolt

INSTALL

CAUTION: Knuckle and bearing mounting surfaces must be smooth and completely free of foreign material or nicks.

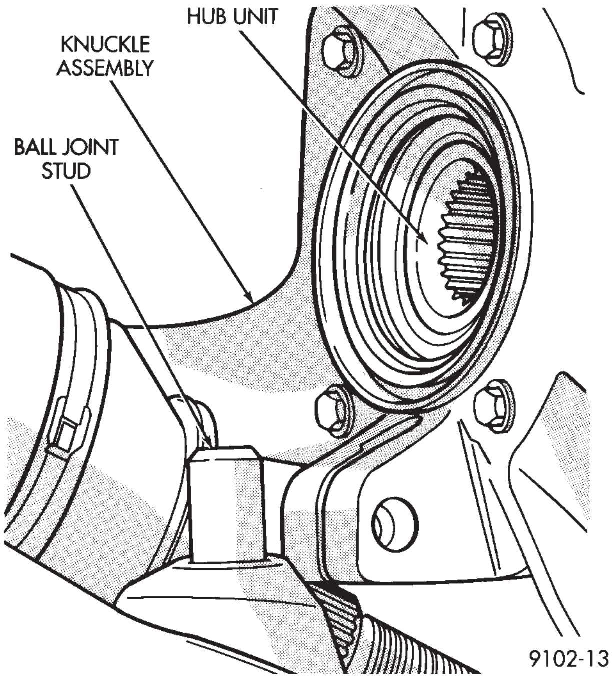


Fig. 8 Separate Ball Joint Stud from Knuckle Assembly

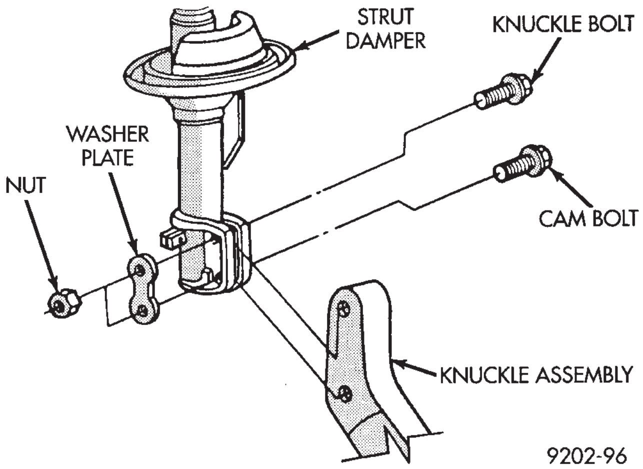


Fig. 9 Remove Or Install Steering Knuckle

(1) Install the hub and bearing assembly into the steering knuckle (Fig. 10). Install the 4 hub and bearing assembly to steering knuckle attaching bolts and torque in a criss-cross pattern to 65 N●m (45 ft.lbs.)

(2) Position new seal in recess on back of the steering knuckle. Assemble Installer, Special Tool C-4698. Then install seal into steering knuckle until it is fully seated into recess (Fig. 11). Inspect the wear sleeve on the C/V joint housing and replace if required.

(3) Install the steering knuckle back on the strut damper (Fig. 9). Install the strut damper to steering knuckle attaching bolt, cam bolt, washer plate and nuts. Torque bolts to 100 N●m (75 ft.lbs.) plus 1/4 turn.**Be sure the cam bolt is installed in same location it was removed from.**

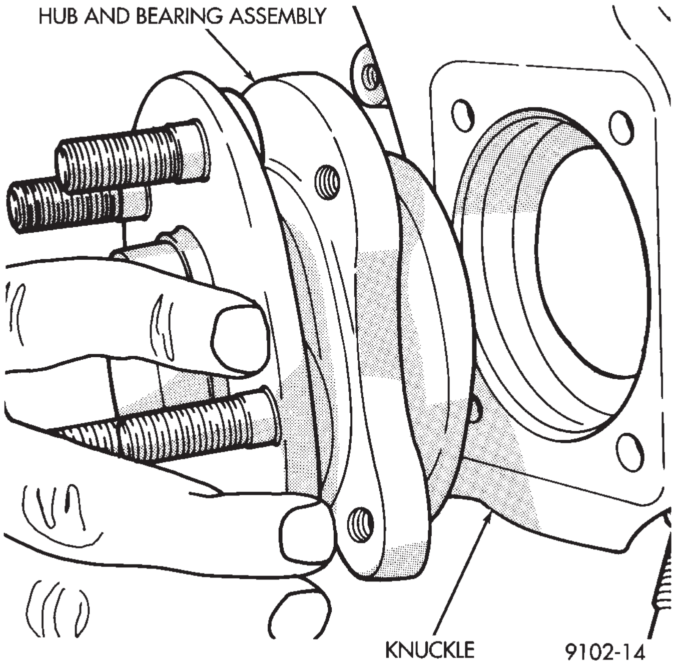


Fig. 10 Remove Or Install Hub and Bearing Assembly

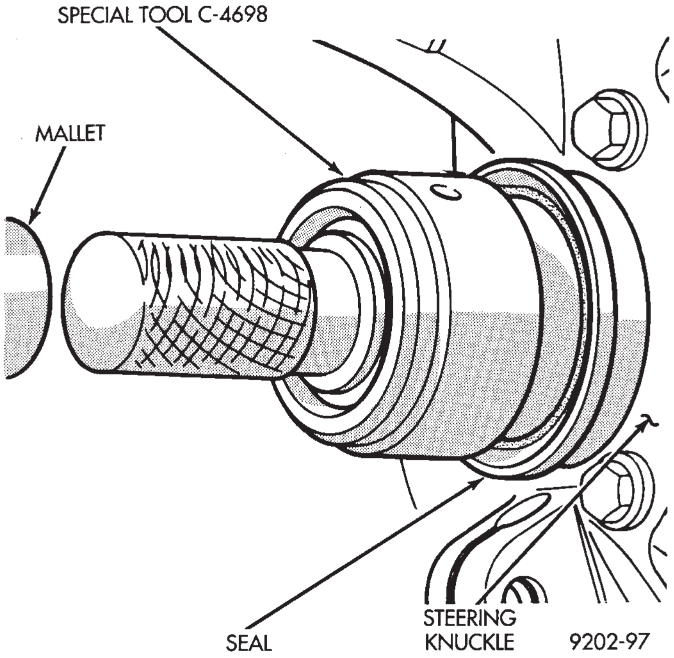


Fig. 11 Seal Installation In Steering Knuckle

(4) Lubricate the FULL circumference of the seal (and wear sleeve) with Mopar® Multi-Purpose Lubricant, or equivalent (Fig. 12).

(5) Slide the drive shaft back into the hub and bearing assembly and install the steering knuckle onto the ball joint stud (Fig. 13).

(6) Install the original (or equivalent) steering knuckle to ball joint stud, clamp bolt and nut (Fig. 14). Torque the clamp bolt to 145 N●m (105 ft. lbs.).

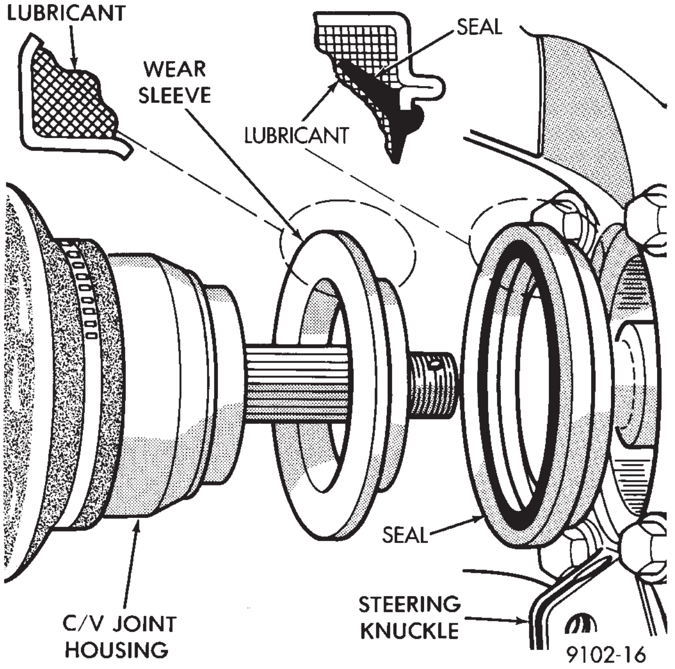


Fig. 12 Seal and Wear Sleeve Lubrication

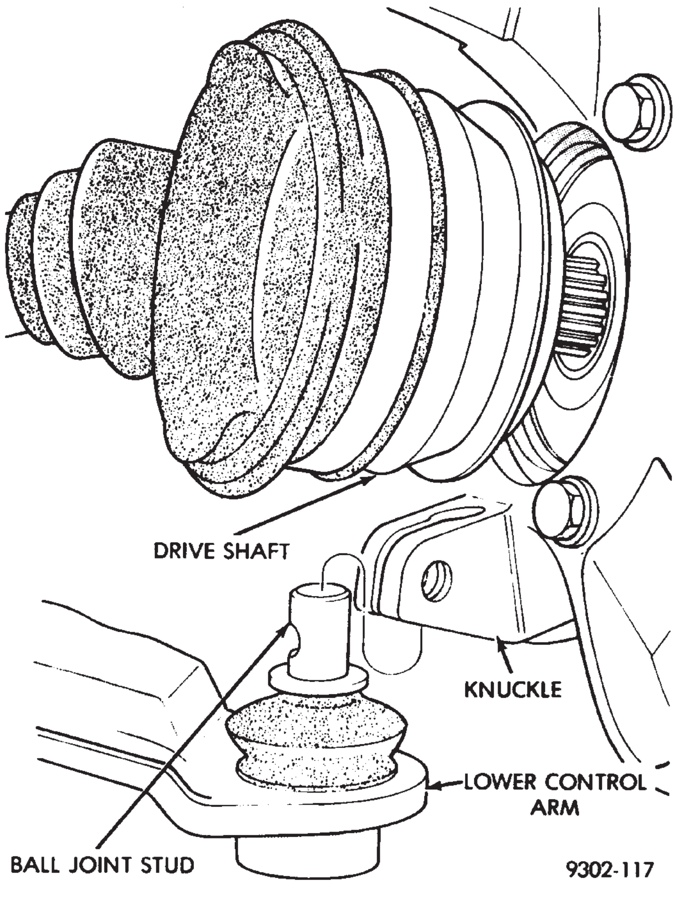


Fig. 13 Installing Knuckle Assembly

(7) Install the tie rod end into the arm of the steering knuckle. Install the tie rod end to steering knuckle attaching nut, and torque to 47 N●m (35 ft. lbs.). Install a new cotter pin into the tie rod end (Fig. 15).

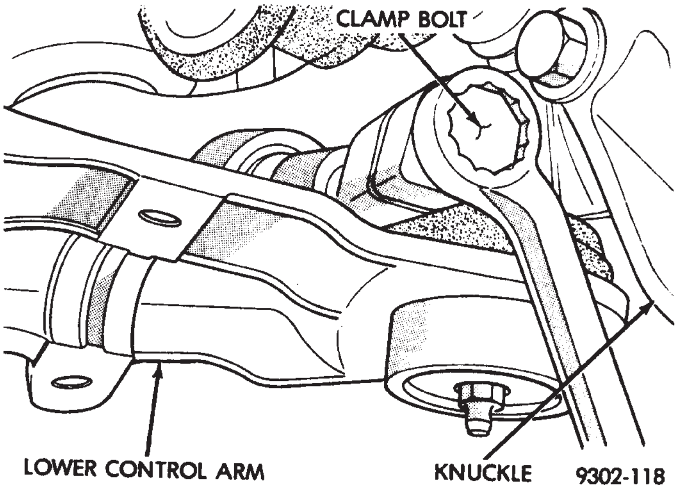


Fig. 14 Tighten Steering Knuckle Clamp Bolt

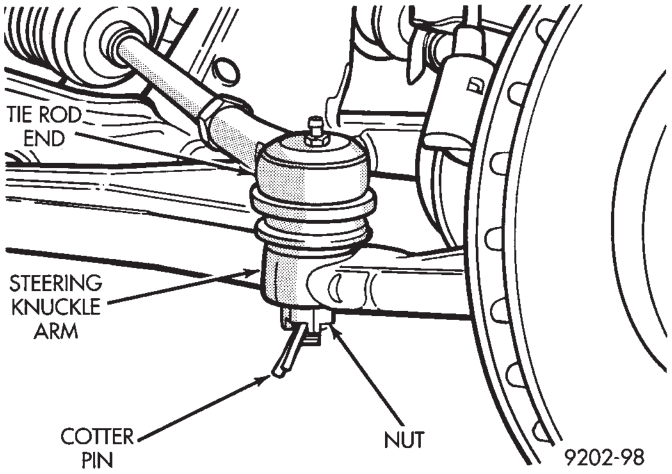


Fig. 15 Install Tie Rod End

(8) Install the braking disk back on the hub and bearing assembly (Fig. 5).

(9) Install the front brake caliper and adapter back over the braking disc and align with the adapter mounting holes on steering knuckle (Fig. 1). Install the caliper adapter to steering knuckle attaching bolts and torque to 217 N●m (160 ft. lbs.).

(10) Clean all foreign matter from the threads of the stub axle (Fig. 16). Install the washer and hub nut onto the threads of the stub axle and tighten nut.

(11) With the vehicles brakes applied to keep front braking disc and hub from turning. Tighten the hub nut to a torque of 244 N●m (180 ft. lbs.) (Fig. 17).

(12) Install the spring washer, hub nut lock, and new cotter pin. Wrap the cotter pin prongs tightly around the hub nut lock (Fig. 18).

(13) Install the front wheel and tire assembly. Install the front wheel lug nuts and torque to 129 N●m (95 ft.lbs.).

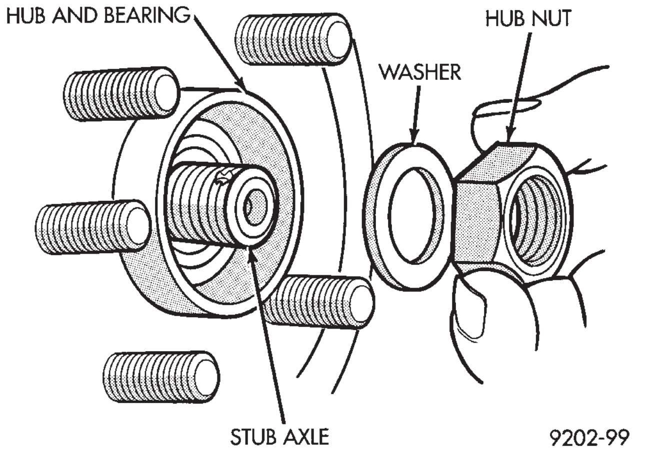


Fig. 16 Install Washer and Hub Nut

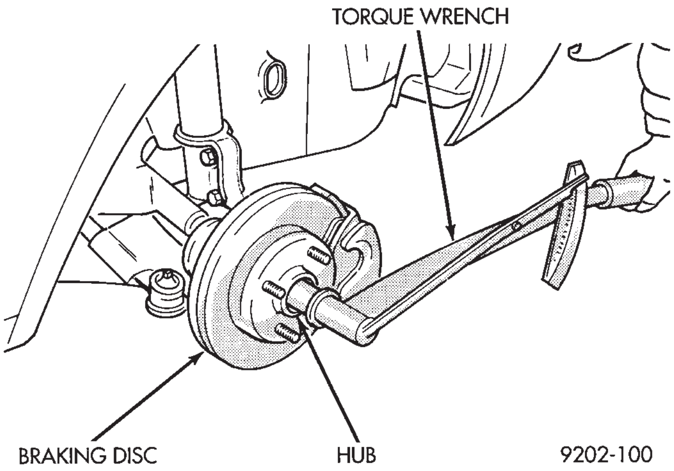


Fig. 17 Tighten Hub Nut

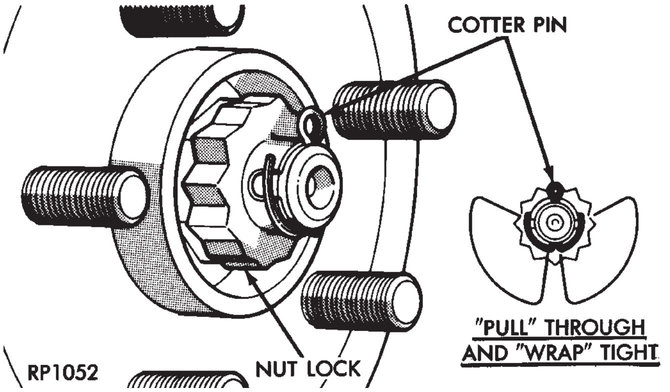


Fig. 18 Install Spring Washer, Nut Lock, & Cotter Pin

(14) Lower vehicle.

(15) Align the front wheels of the vehicle. Use the procedure listed under Wheel Alignment, in the Front Suspension Service Procedures section of this service manual.

HUB AND BEARING ASSEMBLY

The Unit III Front Hub and Bearing (Fig. 1) is used on all Front Wheel Drive Applications.

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.

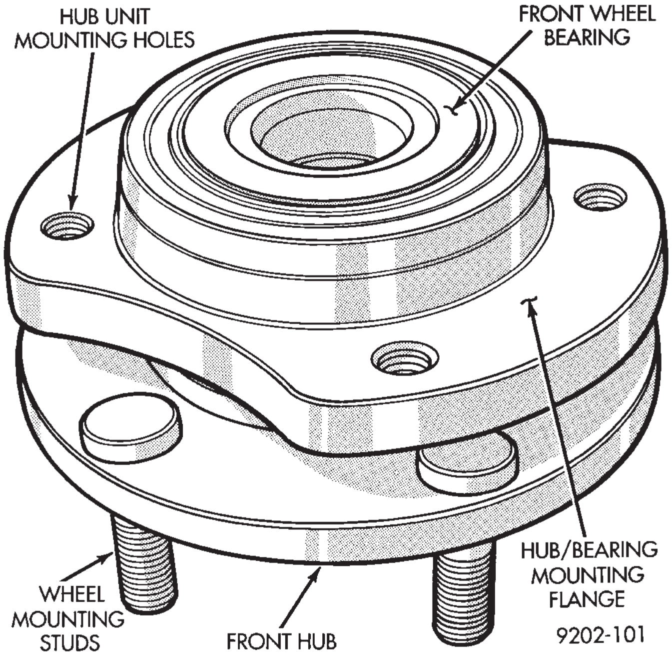


Fig. 1 Unit III Front Hub And Bearing Assembly

This unit is serviced only as a complete assembly (Fig. 1). It is mounted to the steering knuckle by four mounting bolts that are removed from the rear of the steering knuckle (Fig. 2).

REMOVAL

Replacement of the front (drive) hub and bearing assembly can be done without having to remove the steering knuckle from the vehicle.

(1) Remove cotter pin, hub nut lock, and spring washer (Fig. 3).

(2) Loosen hub nut while the vehicle is on the floor with the brakes applied (Fig. 4). **The hub and driveshaft are splined together through the knuckle (bearing assembly) and retained by the hub nut.**

(3) Raise vehicle, see Hoisting Recommendations in Group 0 of this service manual.

(4) Remove the hub nut and the washer from the stub axle (Fig. 3).

(5) Remove the wheel lug nuts, and tire and wheel assembly from the vehicle.

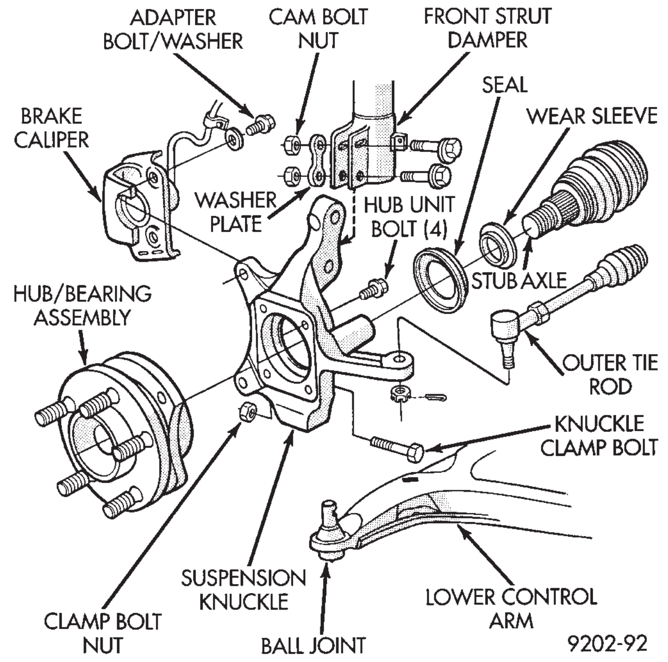


Fig. 2 Front Hub And Bearing Assembly Mounting

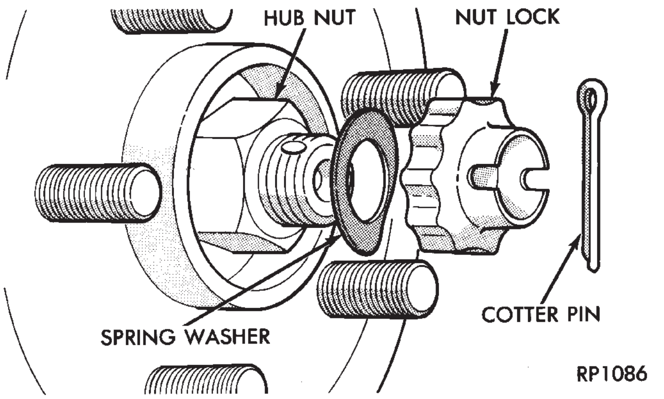


Fig. 3 Remove Cotter Pin, Nut Lock, & Spring Washer

(6) Disconnect tie rod end from steering arm with Puller Special, Tool C-3894-A (Fig. 5).

(7) Remove clamp bolt securing the ball joint stud into the steering knuckle (Fig. 6).

(8) Remove caliper guide pin bolts (Fig. 6) and separate caliper assembly from braking disc. **Support caliper with wire hook and not by hydraulic hose.** (Fig. 7) Remove braking disc from hub and bearing assembly (Fig. 8).

(9) Separate the steering knuckle assembly from the ball joint stud. Pull knuckle assembly out and away from driveshaft (Fig. 9).

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, driveshaft must be supported.

(10) Remove the four hub and bearing assembly mounting bolts from rear of steering knuckle (Fig. 9).

(11) Remove the hub and bearing assembly from the steering knuckle (Fig. 10). **Replacement of the grease seal is recommended whenever this service is performed.**

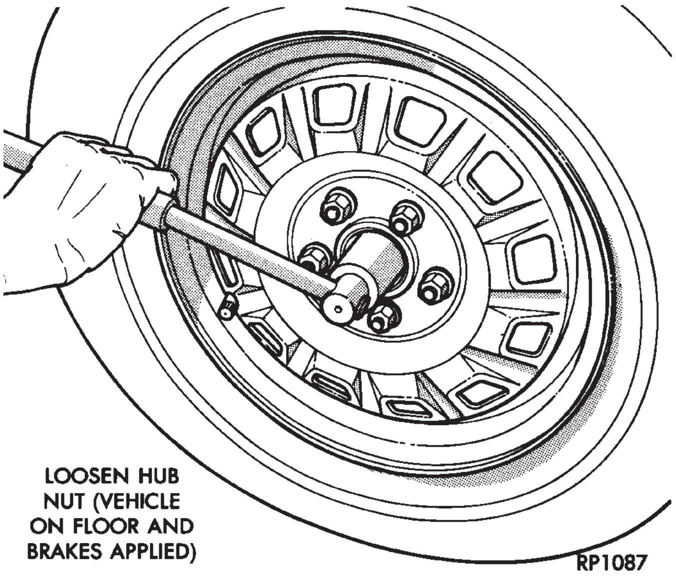


Fig. 4 Loosen Hub Nut

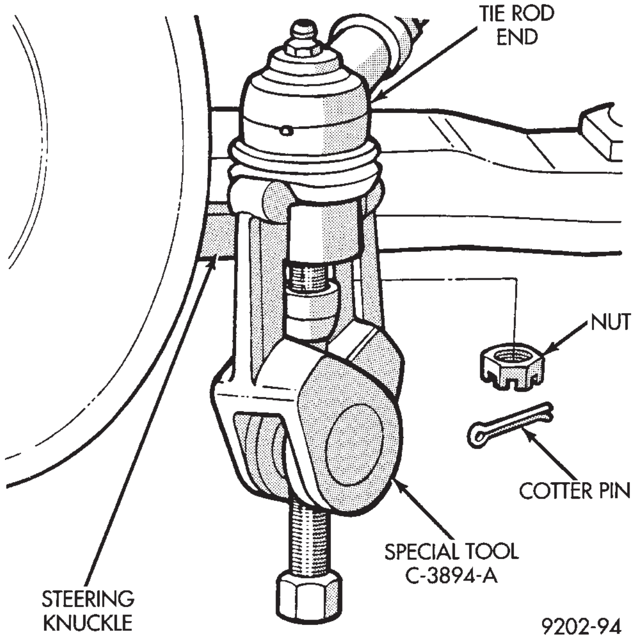


Fig. 5 Disconnect Tie Rod End

INSTALLATION

CAUTION: All steering knuckle and bearing mounting surfaces must be smooth and completely free of foreign material or nicks.

(1) Install new front hub and bearing assembly into the steering knuckle. Tighten the hub and bearing assembly to steering knuckle attaching bolts (Fig. 9), in a criss-cross pattern to 65 N•m (45 ft. lbs.) torque.

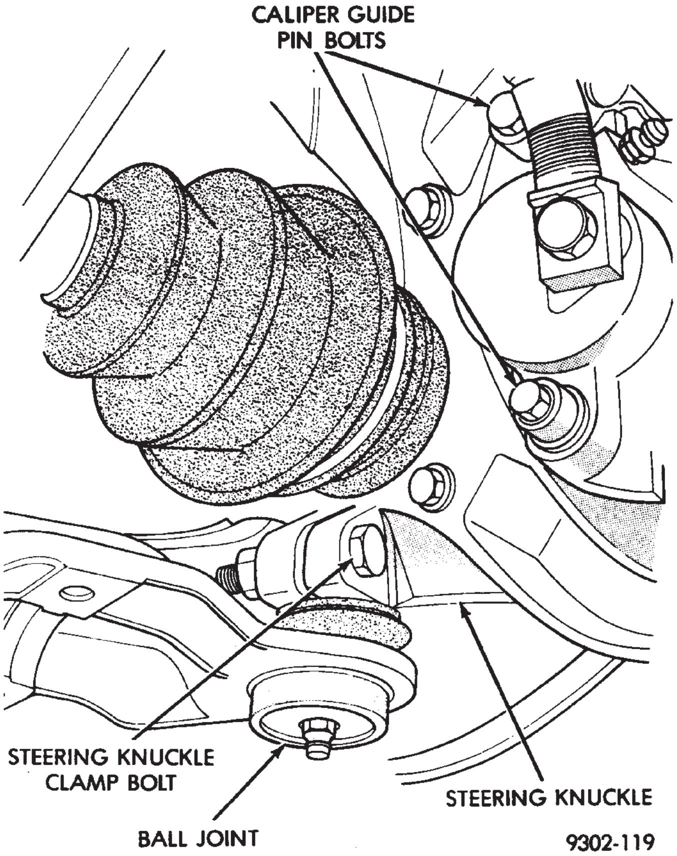


Fig. 6 Remove Clamp Bolt and Caliper Guide Pins

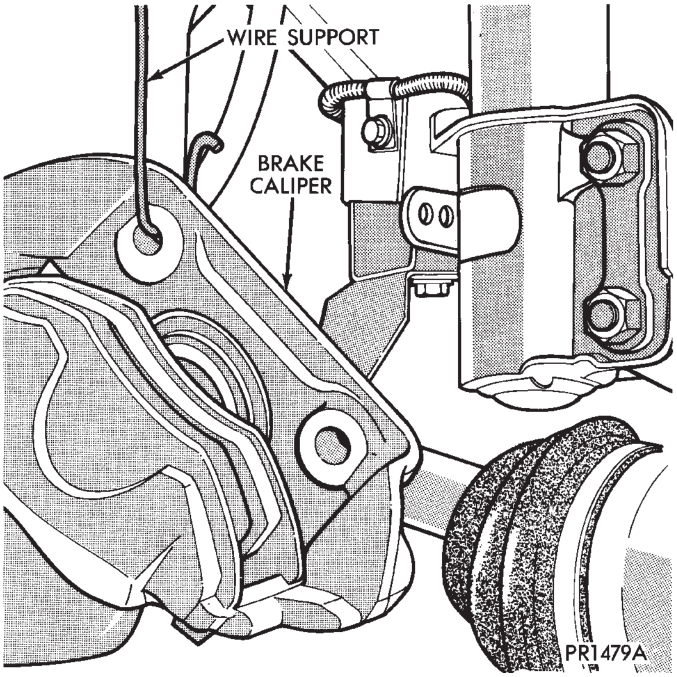


Fig. 7 Supporting Brake Caliper

(2) Position new hub and bearing assembly seal in recess of the steering knuckle (Fig. 11). Assemble Installer, Special Tool C-4698. Tool is provided with a handle and dual purpose drive head for installing seal into knuckle and (head reversed) for installing wear sleeve onto C/V joint housing.

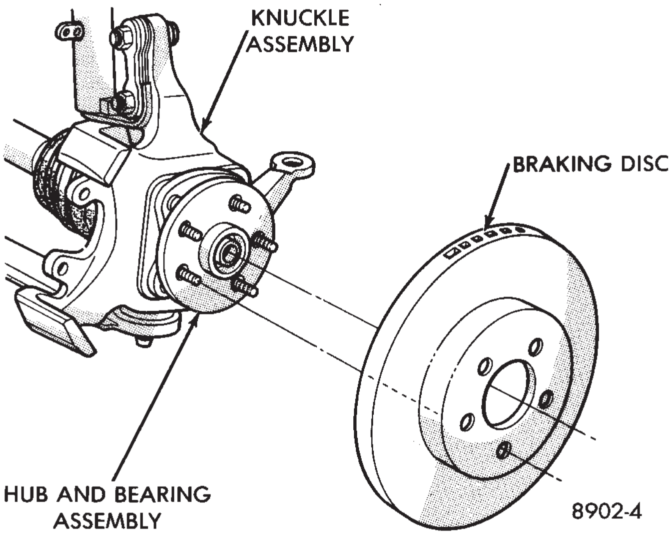


Fig. 8 Remove or Install Braking Disc

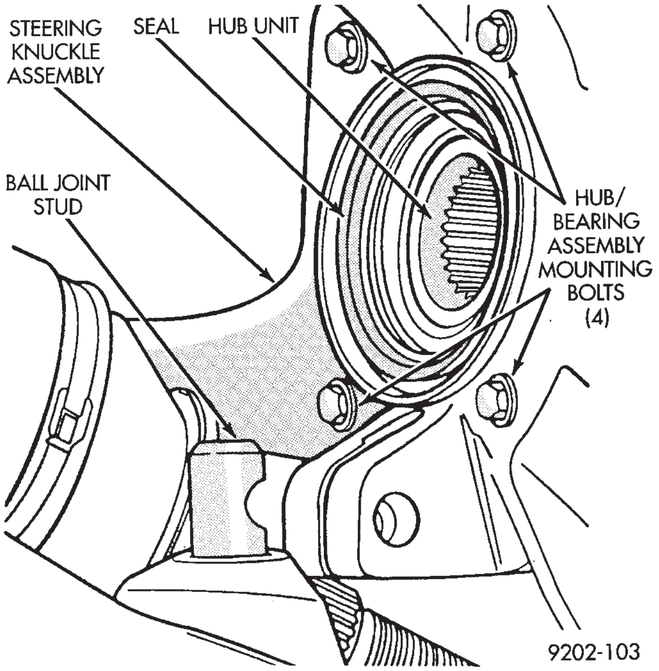


Fig. 9 Separate Ball Joint Stud from Steering Knuckle

(3) Using Special Tool C-4698 (Fig. 11) install the hub and bearing seal, until fully seated into the steering knuckle recess.

CAUTION: During any required service procedures that require steering knuckle and driveshaft to be separated. Both seal and wear sleeve must be throughly cleaned and lubricated.

(4) Lubricate the FULL circumference of the bearing seal (and wear sleeve) as shown in (Fig. 12). With Mopar® Multi-Purpose Lubricant, or equivalent.

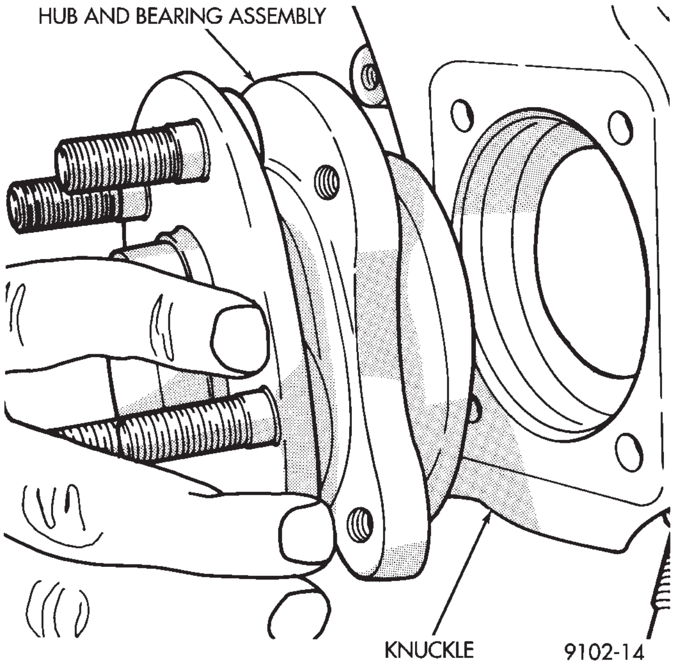


Fig. 10 Separate Hub and Bearing Assembly from Knuckle

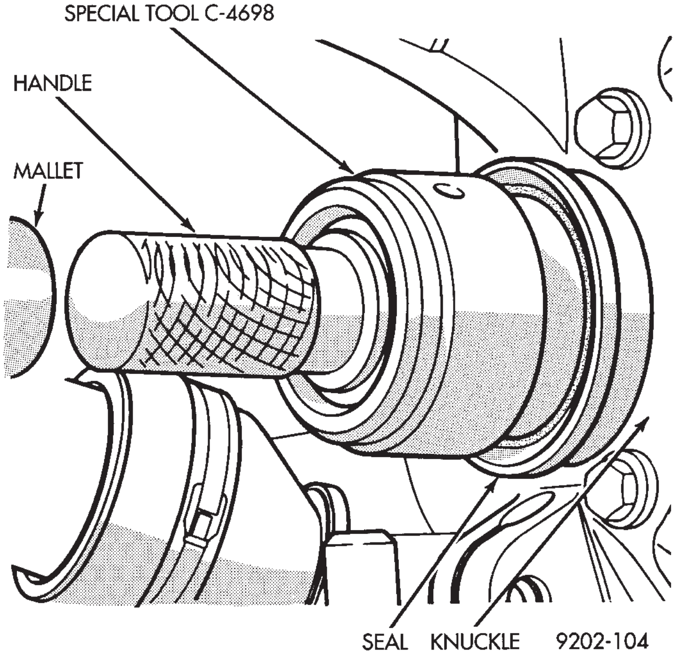


Fig. 11 Bearing Seal Installation

(5) Insert driveshaft through hub and bearing assembly, while installing steering knuckle assembly on lower control arm ball joint stud (Fig. 13).

(6) Install original (or equivalent) ball joint to knuckle clamp bolt (Fig. 14) into steering knuckle. Tighten clamp bolt to 145 N•m (105 ft. lbs.) torque.

(7) Install tie rod end into steering knuckle arm (Fig. 15). Tighten tie rod to steering knuckle arm attaching nut to 47 N•m (35 ft. lbs.) torque and install cotter pin.

(8) Install braking disc (Fig. 8).

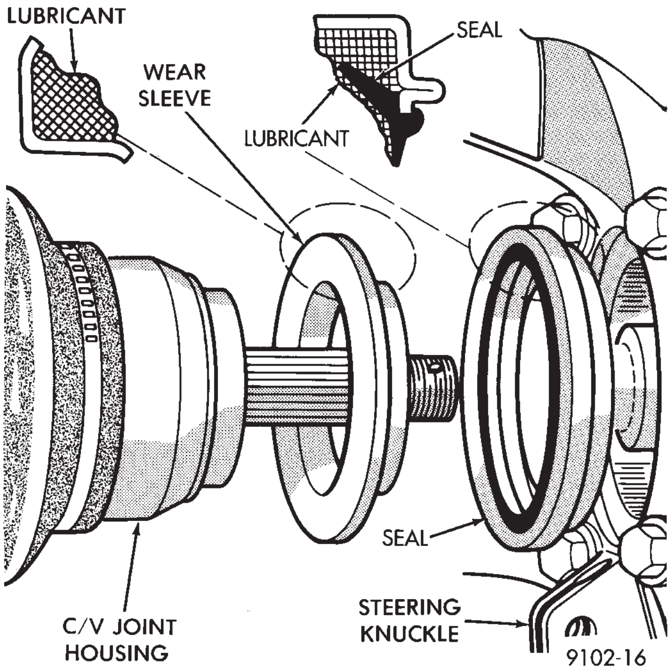


Fig. 12 Seal and Wear Sleeve Lubrication

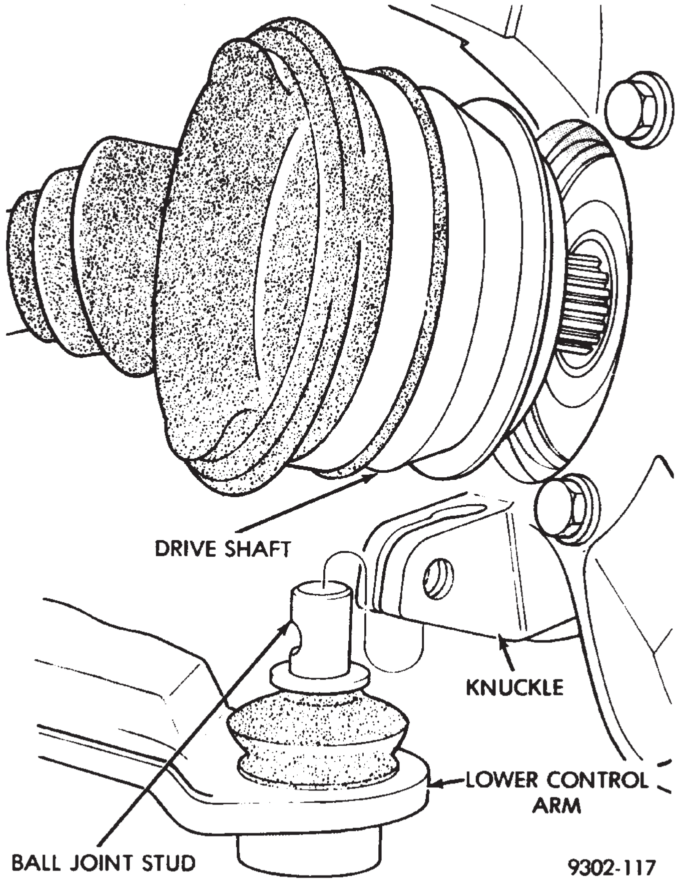


Fig. 13 Installing Knuckle Assembly

(9) Carefully lower brake caliper assembly over braking disc (Fig. 16).

(10) Install brake caliper assembly guide pin bolts. Tighten guide pin bolts to 25-35 N•m (18-26 ft. lbs.)

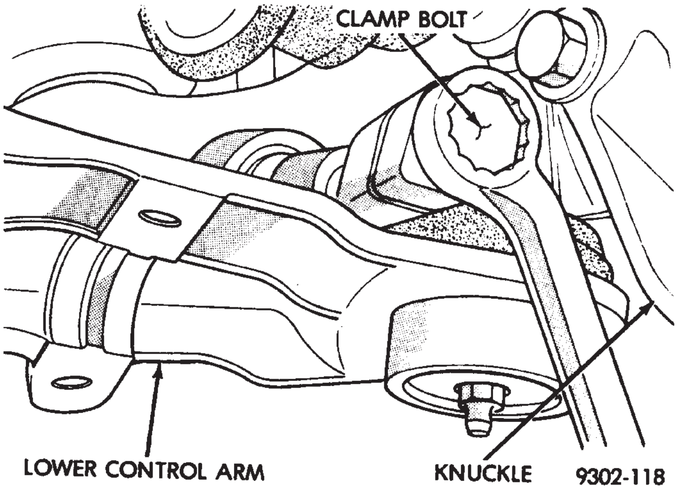


Fig. 14 Tighten Clamp Bolt

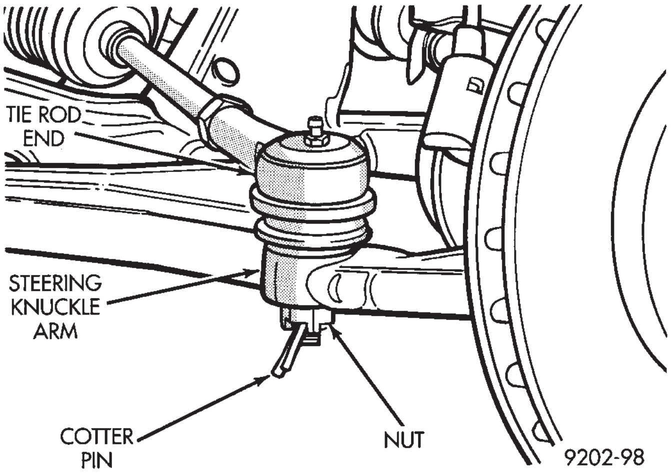


Fig. 15 Install Tie Rod End

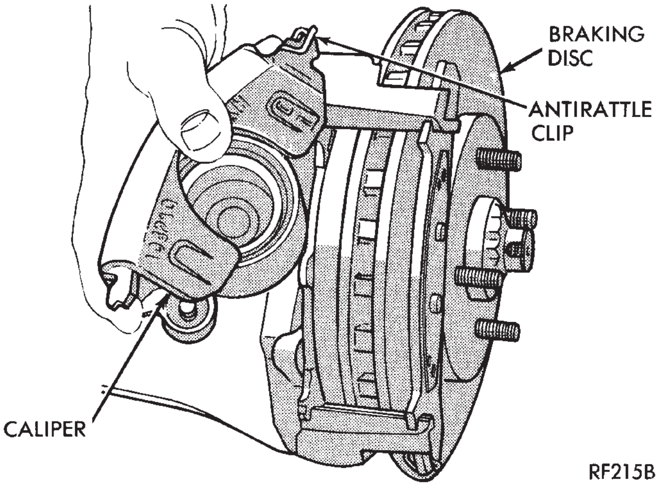


Fig. 16 Installing Family Caliper

torque. **When installing guide pins, use extreme caution not to cross the threads.**

(11) Clean all foreign matter from the threads of the stub axle (Fig. 17). Install the washer and hub nut (Fig. 17) onto the threads of the stub axle and tighten nut.

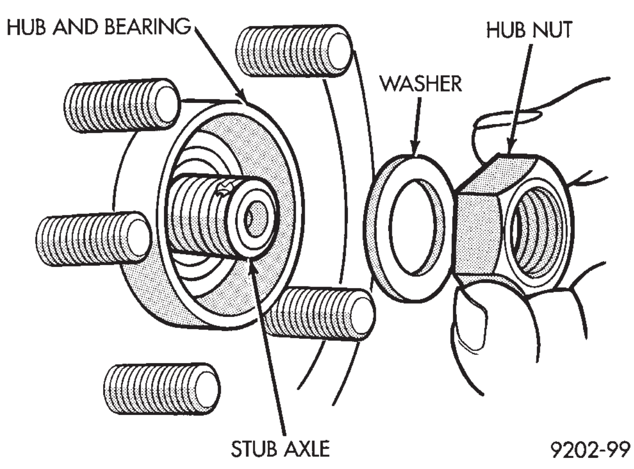


Fig. 17 Install Washer and Hub Nut

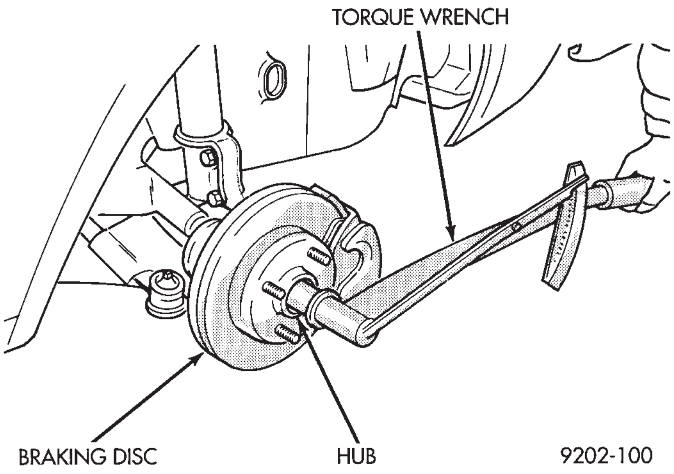


Fig. 18 Tighten Hub Nut

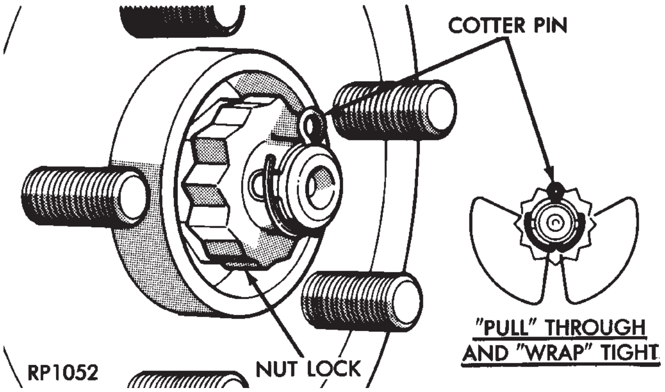


Fig. 19 Install Spring Washer, Nut Lock, & Cotter Pin

(12) With brakes applied, tighten front hub nut to (244 N•m) 180 ft. lbs. torque (Fig. 18).

(13) Install spring washer, nut lock, and new cotter pin. Wrap cotter pin prongs tightly around nut lock (Fig. 19).

Install wheel and tire assembly. Tighten wheel nuts to 129 N•m (95 ft. lbs.) torque.

DRIVESHAFTS

INDEX

GENERAL INFORMATION

Chrysler front wheel drive vehicles use two different driveshaft systems. Some vehicles use an equal length system while other vehicles use an unequal length system (Fig. 1).

The equal length system has short solid interconnecting shafts of equal length on the left and right sides. The unequal length system has a short solid interconnecting shaft on the left side with a longer tubular or solid interconnecting shaft on the right.

The driveshaft assemblies can be serviced in the same manner for both systems. With the exception of a rubber washer seal attached to the right inner (Constant Velocity) C/V joint, on an equal length installation. The equal length system also has an intermediate shaft attached to a cardan joint (U-joint). With a stub shaft splined into the right side of the transaxle with a bearing and bracket assembly fastened to the right rear of the engine block.

The driveshaft assemblies are three piece units. Each driveshaft has a Tripod Joint, an Interconnecting Shaft and a Rzeppa joint. The Tripod Joint is splined into the transaxle side gear, or into the intermediate shaft on the right side of an equal length system. The Rzeppa joint has a stub shaft that is splined into the wheel hub.

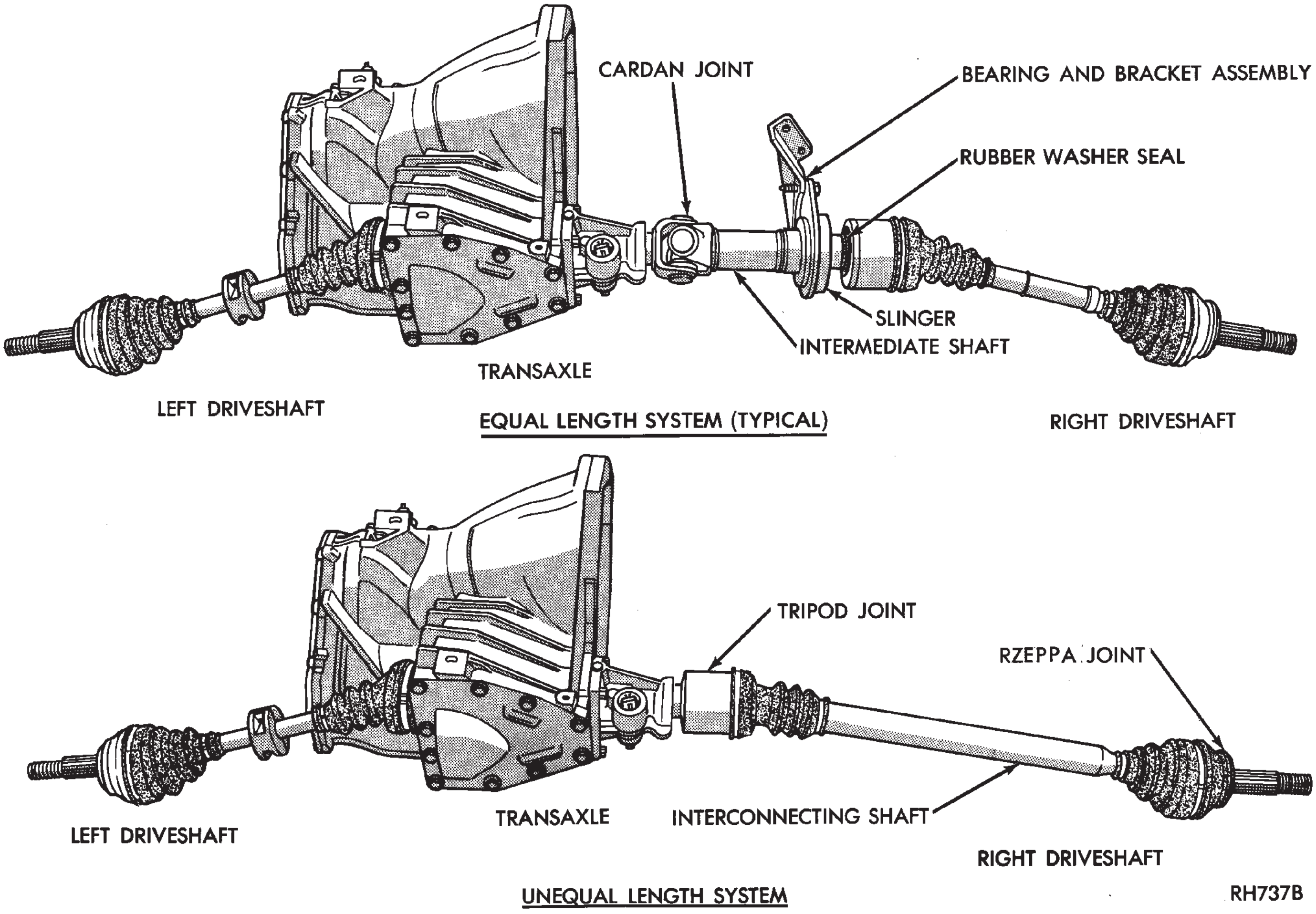


Fig. 1 Front-Wheel-Drive Driveshaft Systems

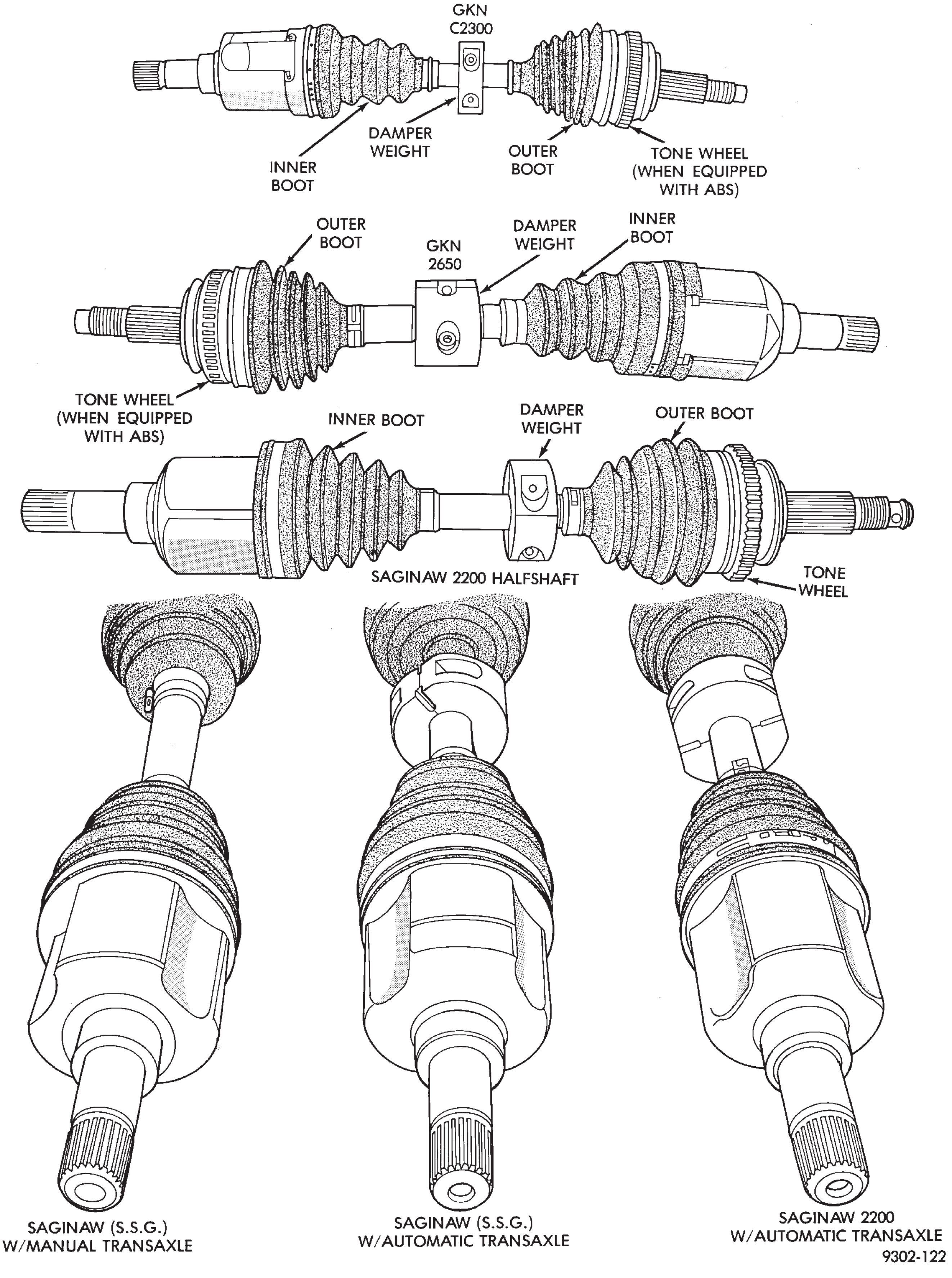


Fig. 2 Driveshafts Identification (Halfshafts)

DRIVESHAFT IDENTIFICATION

Driveshafts are identified by the manufacturer. Vehicles can be equipped with any of these driveshaft assemblies. Each assembly can be identified as shown in (Fig. 2).

SERVICE PROCEDURES

Procedures for the removal and installation of the driveshafts are essentially the same for all front wheel drive vehicles. Each driveshaft has a spring within the inboard Tripod C/V joint that maintains constant engagement with the transaxle. This allows the drive shaft to be removed without dismantling part of the transaxle.

CAUTION: Boot sealing is vital to retain special lubricants and to prevent foreign contaminants from entering the C/V joint. Mishandling, such as allowing the assemblies to dangle unsupported, pulling or pushing the ends can cut boots or damage C/V joints. During removal and installation procedures always support both ends of the driveshaft to prevent damage.

DRIVESHAFTS, REMOVE INSTALL

HUB NUT REMOVAL

Hub nut removal and installation is the same for all front wheel drive vehicles. For installation see **Hub Nut Assemblies Install.**

(1) Remove cotter pin, lock and spring washer (Fig. 3).

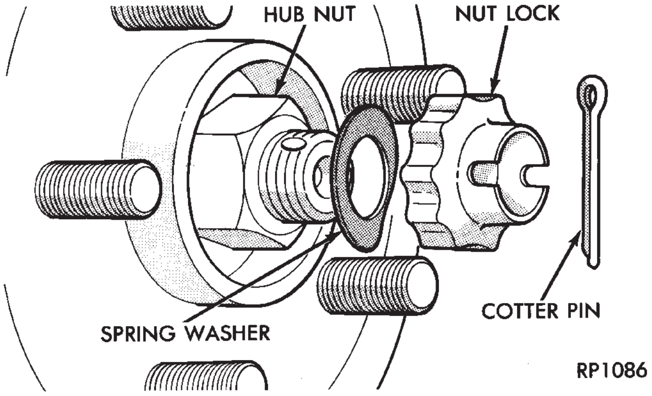


Fig. 3 Remove Cotter Pin, Nut Lock, & Spring Washer

(2) Loosen hub nut and wheel nuts while vehicle is on floor and brakes applied (Fig. 4).

(3) Raise vehicle, see Hoisting in Lubrication and Maintenance, Group 0 of this service manual.

(4) Remove hub nut, washer, wheel and tire assembly (Fig. 5).

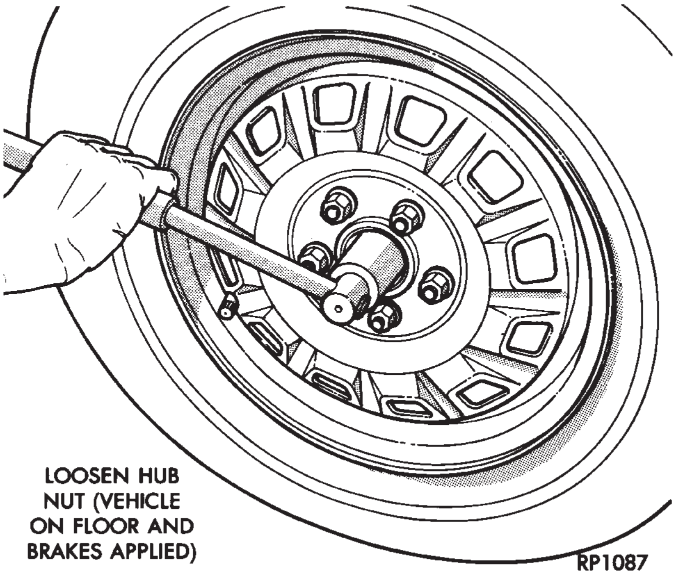


Fig. 4 Loosen Hub Nut & Wheel Nuts

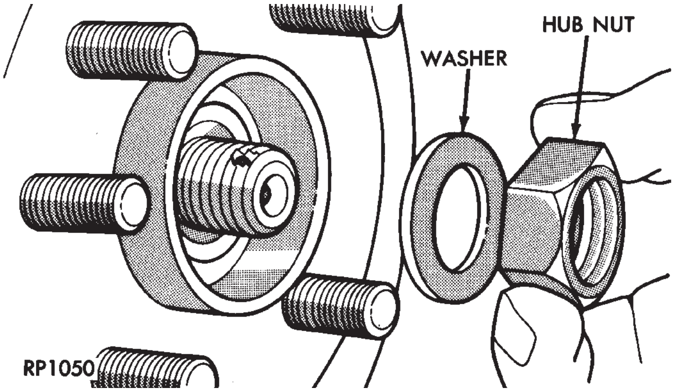


Fig. 5 Remove Hub Nut & Washer Loosen Shaft

DRIVESHAFT ASSEMBLIES REMOVE

Inboard C/V joints have stub shafts splined into the differential side gears, or splined into the intermediate shaft on the right side of an equal length system. Driveshafts are retained in the side gears by a constant spring force provided by a spring contained within the inboard C/V joints.

(1) For removal of right driveshaft, the speedometer pinion must be removed BEFORE shaft removal (Fig. 6).

(2) Remove clamp bolt securing ball joint stud into steering knuckle (Fig. 7).

(3) Separate ball joint stud from steering knuckle by prying against knuckle leg and control arm.

CAUTION: Do not damage ball joint or C/V joint boots (Fig. 8).

(4) Separate outer C/V joint splined shaft from hub by holding C/V housing while moving knuckle(hub) assembly away (Fig. 9).

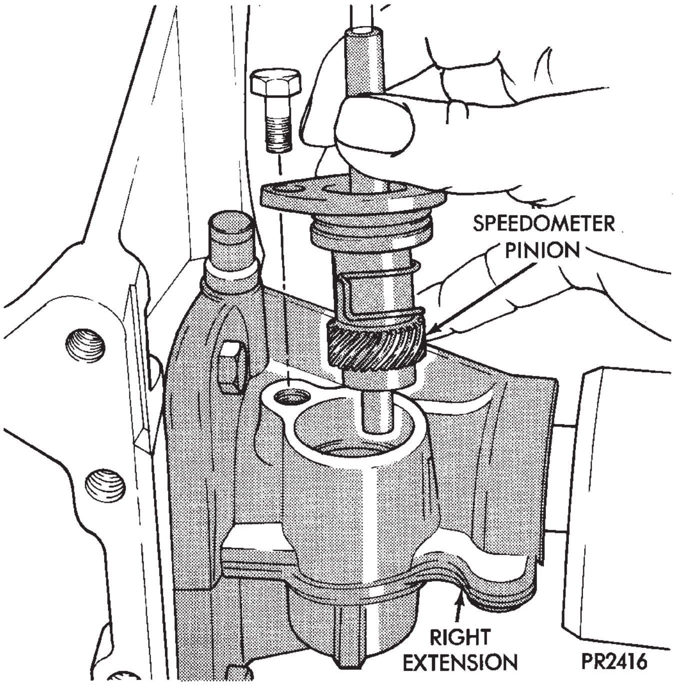


Fig. 6 Remove Speedometer Pinion Clamp (For Right Driveshaft).

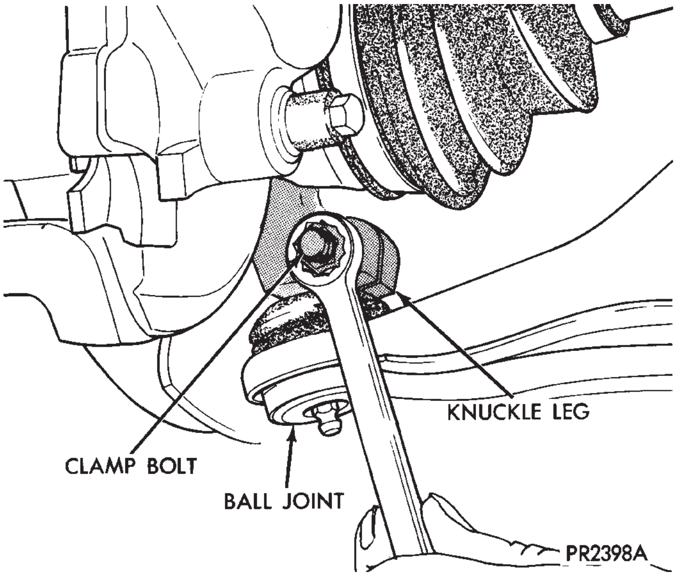


Fig. 7 Remove Ball Joint to Steering Knuckle Clamp Bolt

CAUTION: Do not pry on or otherwise damage wear sleeve on outer C/V joint.

(5) Support assembly at C/V joint housings. Remove by pulling outward on the inner joint housing. **DO NOT PULL ON SHAFT (Figs. 10 and 11).** The driveshaft, when installed, acts as a bolt and secures the hub/bearing assembly. If the vehicle is to be supported or moved on its wheels, install a bolt through the hub to ensure that the hub bearing assembly cannot loosen.

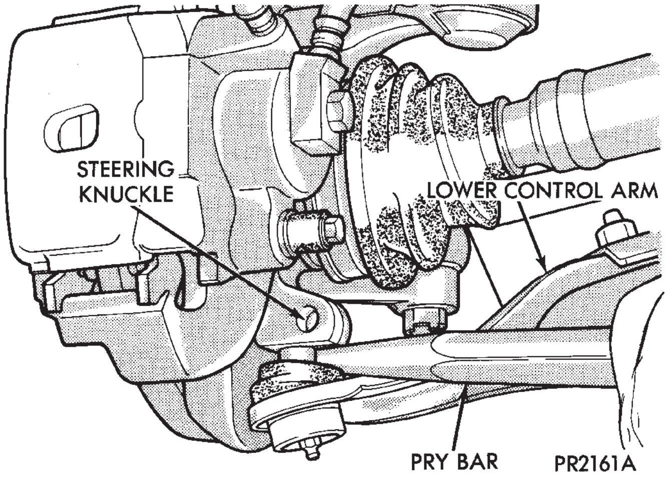


Fig. 8 Separate Ball Joint from Knuckle

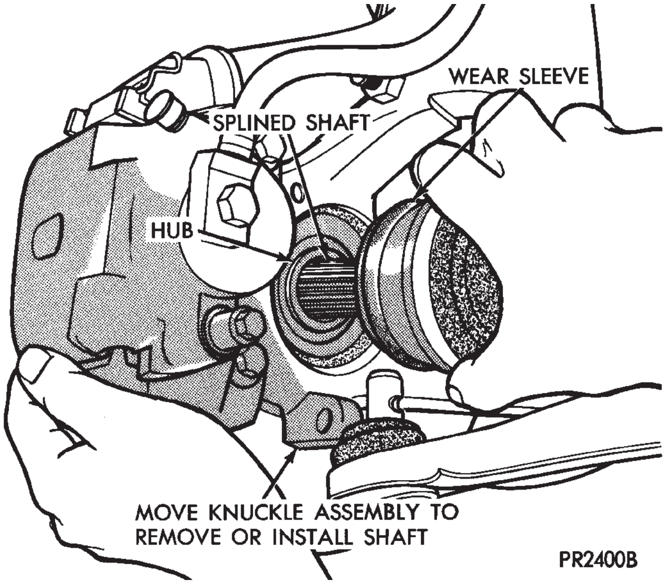


Fig. 9 Separate Outer C/V Joint Shaft from Hub

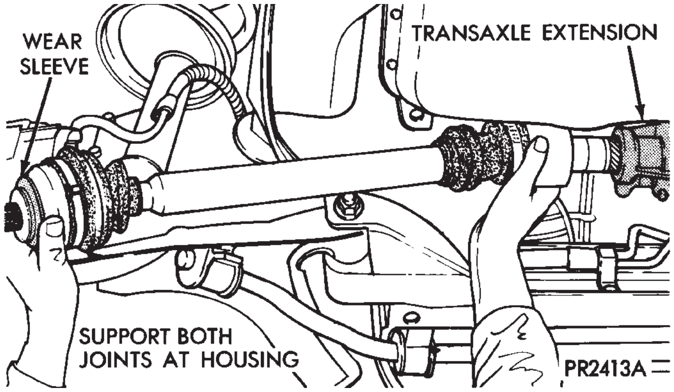


Fig. 10 Removing Driveshaft Assembly Unequal Length

DRIVESHAFT ASSEMBLIES INSTALL

CAUTION: See Wear Sleeve and Seal Lubrication in Front Suspension and at end of this Group BEFORE driveshaft installation.

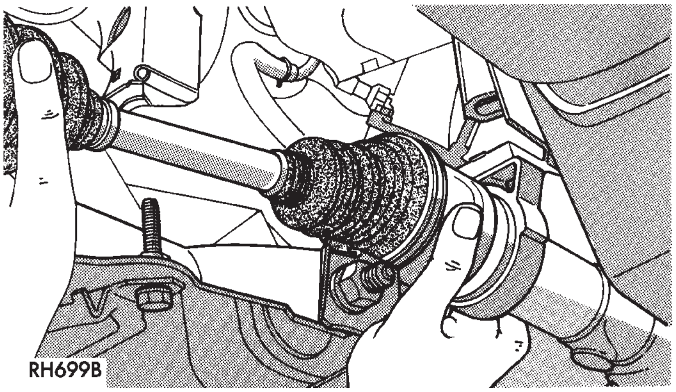


Fig. 11 Removing Driveshaft Assembly Equal Length

(1) Hold inner joint assembly at housing (Figs. 11 and 12) while aligning and guiding the inner joint spline into the transaxle or intermediate shaft assembly. **On Equal Length System vehicles only, be sure that the rubber washer seal is in place on the right inner C/V joint (Fig. 1).**

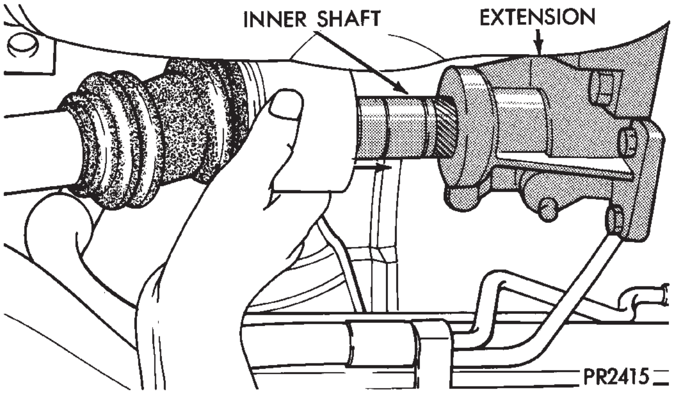


Fig. 12 Installing Inner Shaft into Transaxle

CAUTION: Seal/Wear Sleeve Lubrication During any service procedures where knuckle and driveshaft are separated. Thoroughly clean seal and wear sleeve with suitable solvent (solvent must not touch boot) and lubricate both components prior to installing driveshaft. Lubricate wear sleeve and seal with Mopar Multi-Purpose Lubricant, or equivalent.

Apply on the full circumference of the Wear Sleeve a bead of lubricant that is 6 mm (1/4 in.) wide to seal contact area (Fig. 13). Fill the seal lip to housing cavity on bearing seal with lubricant. Lubricant is to be applied around complete circumference of the seal, and seal lip should be wet with lubricant (Fig. 13). Use Mopar Multi-Purpose Lubricant or equivalent for lubrication of the Wear Sleeve and Bearing Seal.

(2) Push knuckle (hub) assembly out and install splined outer C/V joint shaft in hub (Fig. 14).

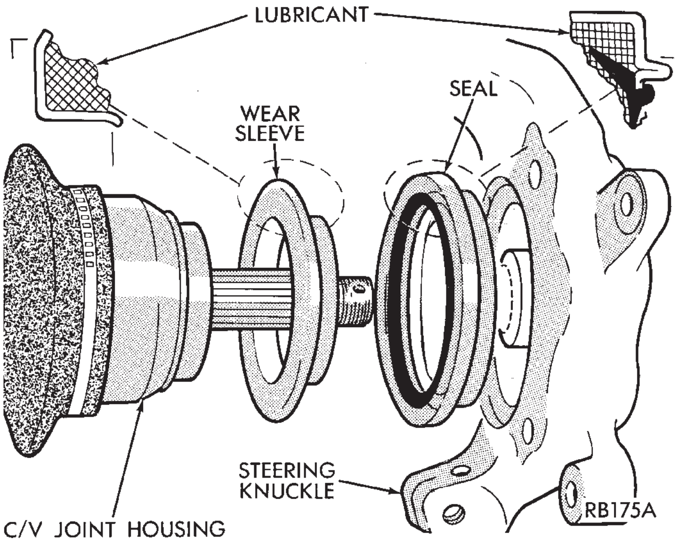


Fig. 13 Seal & Wear Sleeve Lubrication

CAUTION: Steering knuckle clamp bolt shown in (Figs. 14 and 15) is Prevailing Torque Type, original or equivalent bolt must be installed during assembly.

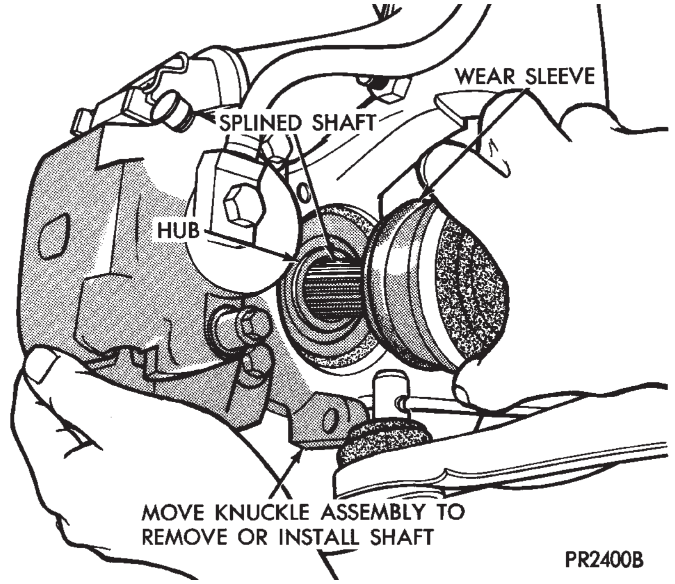


Fig. 14 Install Outer Shaft into Hub

(3) Install knuckle assembly on ball joint stud (Fig. 15).

(4) Install and tighten clamp bolt to 95 N•m (70 ft. lbs.) torque (Fig. 16).

(5) Install speedometer pinion (Fig. 17).

(6) Fill differential with proper lubricant (see Lubrication and Maintenance Group 0).

(7) Install hub nut assembly.

(8) If after installing the driveshaft assembly,the **inboard** boot appears collapsed or deformed. Vent the inner boot by inserting, a round tipped small diameter rod between the boot and shaft. If necessary, massage the boot to remove all puckers being careful

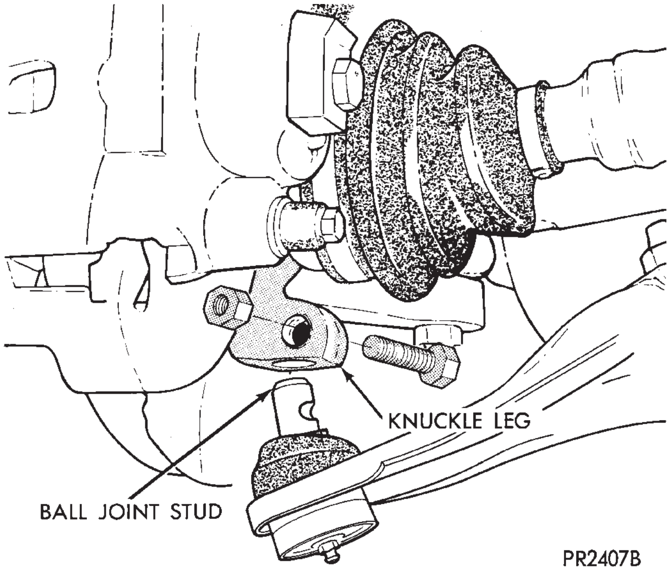


Fig. 15 Install Knuckle Assembly on Ball Joint Stud

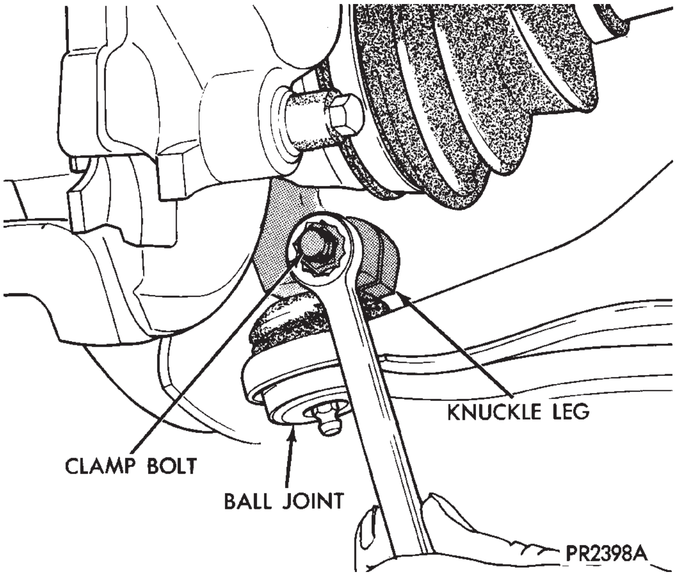


Fig. 16 Tighten Clamp Bolt

not to allow dirt to enter or grease to leave the boot cavity. The clamp must be removed and discarded before the rod can be inserted. After venting, install a **new** Service Clamp. (See Boots Install section at the end of this group for details).

HUB NUT INSTALL

The front wheel hub nuts use a lock and cotter pin to maintain proper wheel bearing preload and prevent the nut from backing off. Install the assembly as follows:

(1) Install washer and hub nut after cleaning foreign matter from threads (Fig. 18).

(2) With brakes applied, tighten hub nut to 245 N•m (180 ft. lbs.) torque (Fig. 19).

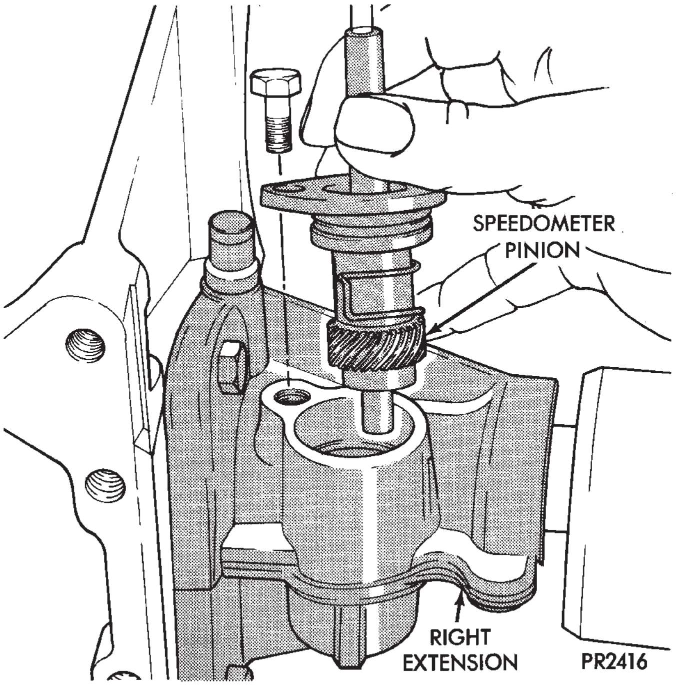


Fig. 17 Install Speedometer Pinion

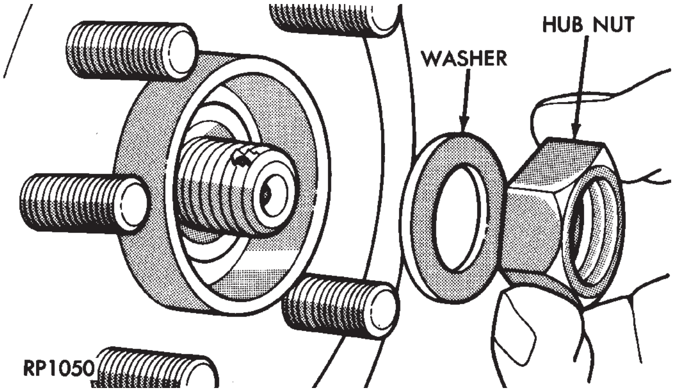


Fig. 18 Install Washer & Hub Nut

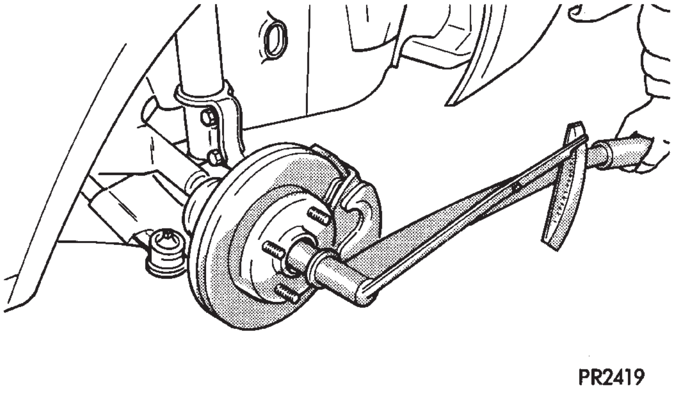


Fig. 19 Tighten Hub Nut

(3) Install lock, spring washer and **new** cotter pin. Wrap cotter pin prongs tightly around nut lock (Fig. 20).

(4) Install wheel and tire assembly. Tighten wheel nuts to 129 N•m (95 ft. lbs.) torque (Figs. 21).

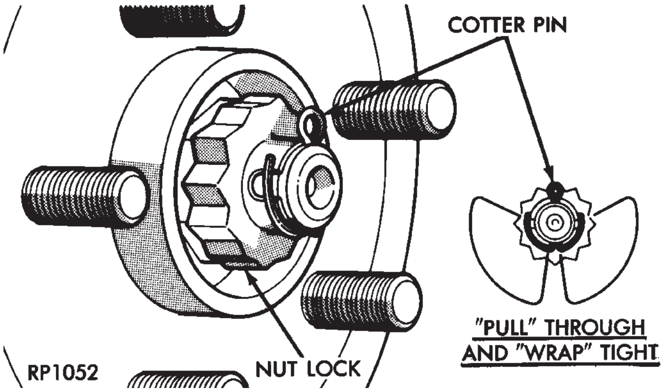


Fig. 20 Install Spring Washer, Nut Lock, & New Cotter Pin

DRIVESHAFT RECONDITIONING PROCEDURE

Driveshaft reconditioning and/or boot replacement for all front wheel drive vehicles is essentially the same per C/V joint.

Note: that lubricant requirements and quantities are different for Inner Joints than for Outer Joints, and type being serviced. Use only the recommended lubricants.

See (Fig. 1) for the exploded view of the front drive shaft components and there location in the assembly.

Driveshaft requirements are different for various vehicle models, engines, and transaxles, and often change from one model year to the next. Driveshaft parts will be different to accommodate this. Therefore, when replacing parts, be sure to use only those specified in the service parts catalog. For the exact model year, model, engine, transaxle, and type being serviced.

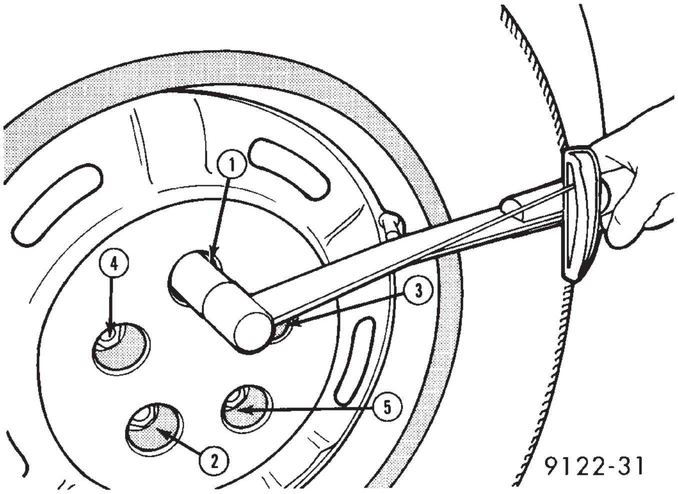


Fig. 21 Install Wheel And Tire Assembly

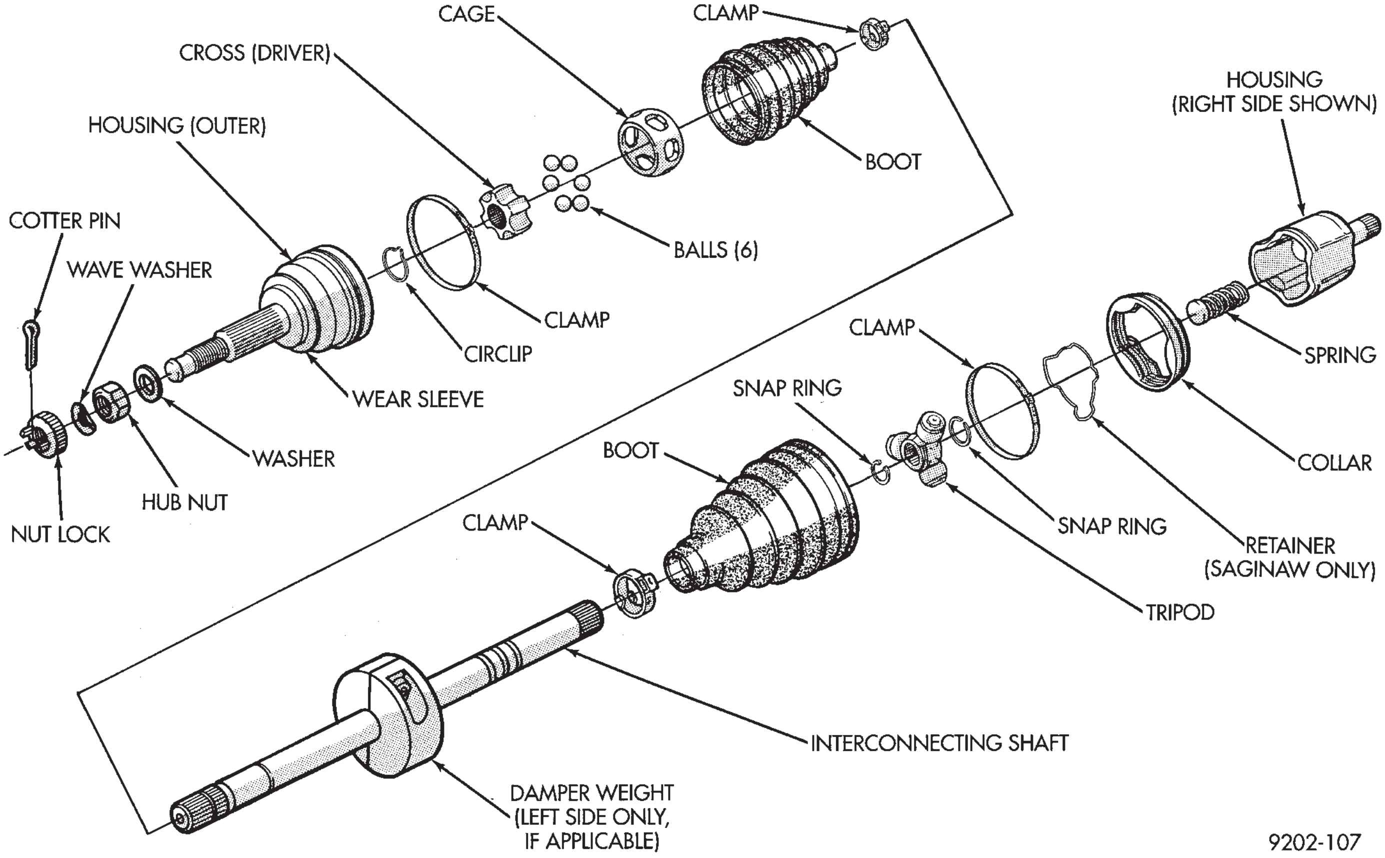


Fig. 1 Driveshaft Components

INNER C/V JOINT

DISASSEMBLE

With driveshaft assembly removed from vehicle, identify unit type (See Fig. 2 under Driveshafts Identification).

(1) Remove the boot clamps and pull back the boot to gain access to the tripod retention system, which prevents accidental separation from the C/V joint housing.

CAUTION: When removing the housing from the tripod, hold the rollers in place on the trunnion studs to prevent the rollers and needle bearings from falling away. After the tripod is out of the housing secure the rollers in place with tape (Fig. 4).

(2) Depending on the type of C/V joint assembly, separate the tripod from the housing as follows:

S.S.G. Utilizes a wire ring tripod retainer which expands into a groove around the top of the housing. Use a flathead screwdriver to pry the wire ring out of the groove and slide the tripod from the housing (Fig. 2). **Do not mangle or destroy retainer during disassembly.**

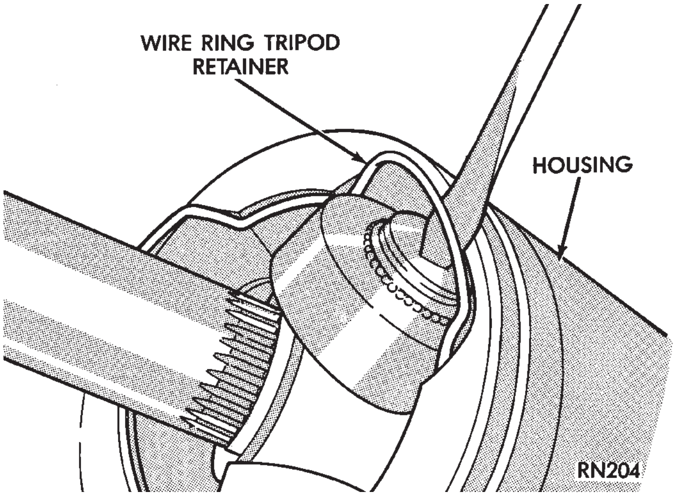


Fig. 2 Separate Tripod From Housing S.S.G.

G.K.N. The retention system on this assembly is a integral part of the plastic collar on the inside of the C/V joint housing. Clamp the stub shaft of the C/V joint housing in a vise, **use protective caps on jaws of vise to prevent damage to stub shaft.** Hold the interconnecting shaft on an angle, while gently pulling on the shaft until one of the tripod bearings is free of the retaining collar. Continue holding the interconnecting shaft on an angle and gently pull on the shaft until all rollers are free of the retaining collar. See (Fig. 3).

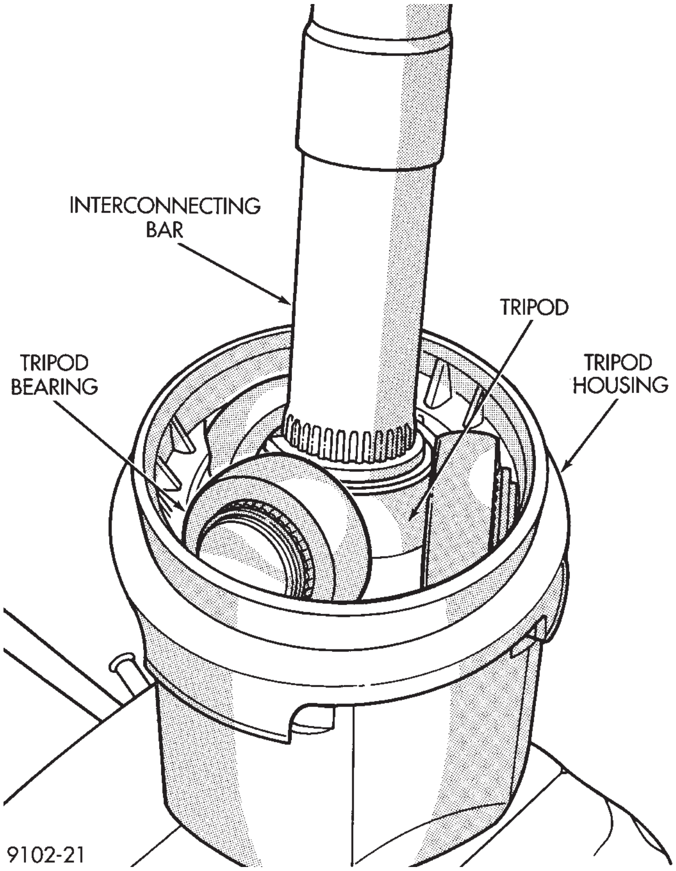


Fig. 3 Separate Tripod From Housing G.K.N.

TRIPOD REMOVAL FROM INTERCONNECTING BAR

S.S.G. Remove the snap ring from the shaft end groove. Remove the tripod by hand or by tapping the body with a brass punch (Fig. 4).

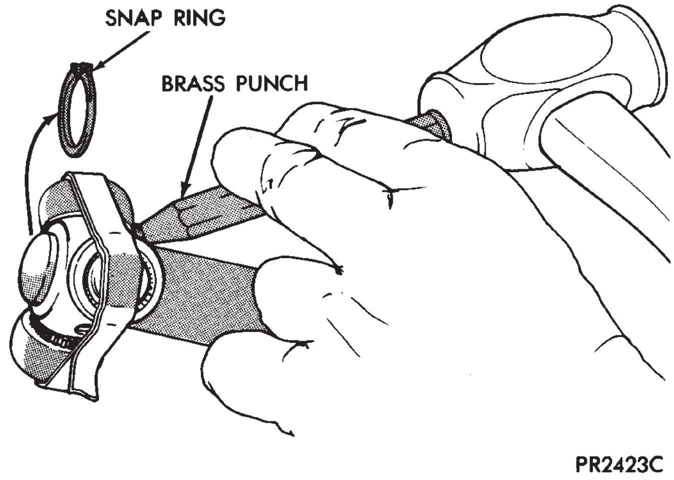


Fig. 4 Remove Snap Ring then Tripod

G.K.N. To remove the tripod from the interconnecting bar.

(1) Expand the stop ring behind the tripod and slide it back along the shaft (Fig. 5).

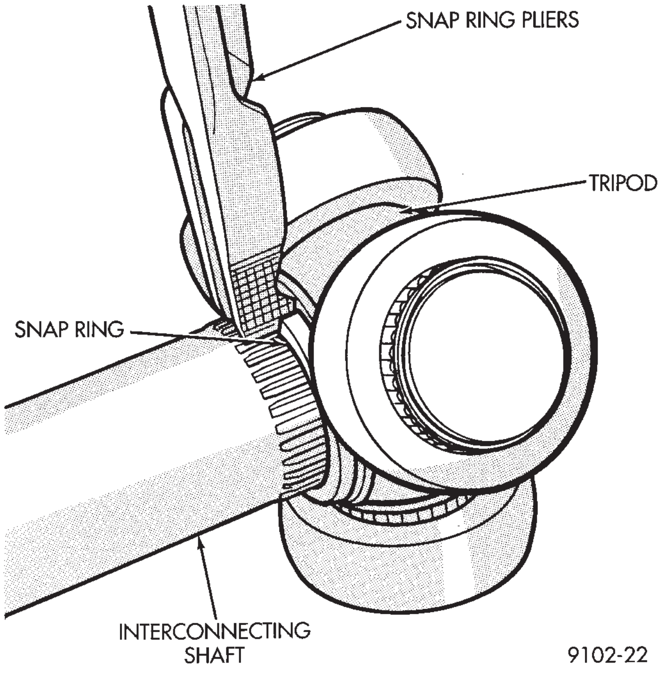


Fig. 5 Removing Stop Ring (G.K.N.)

(2) Slide the tripod back along the shaft, either by hand or by tapping the body with a brass drift. This will expose the circlip on the end of the interconnecting bar.

(3) Remove the circlip from the end of interconnecting bar (Fig. 6).

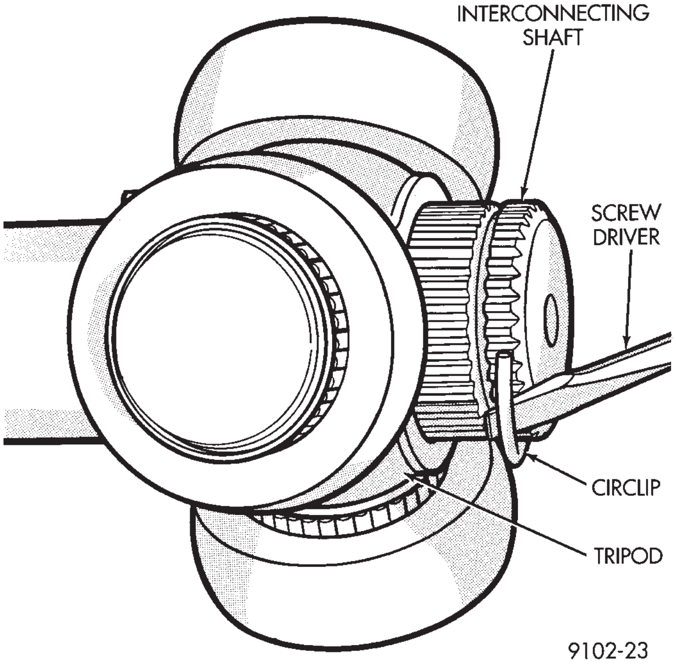


Fig. 6 Removing Circlip

(4) Remove the tripod from the interconnecting bar. It is not necessary to remove the stop ring from the interconnecting bar unless the bar is being replaced (Fig. 7).

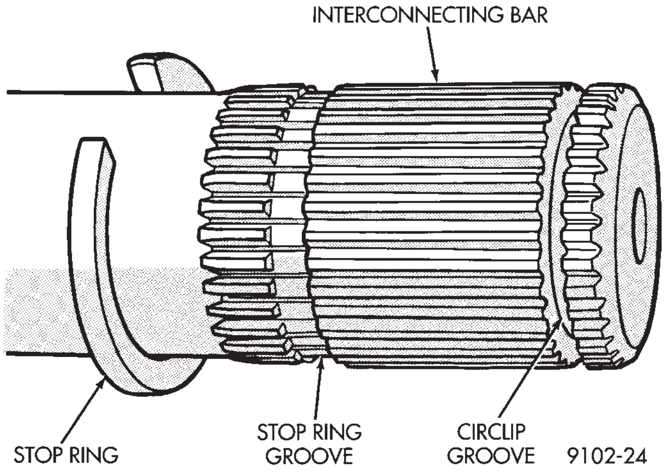


Fig. 7 Tripod Removed From The Interconnecting Bar

S.S.G. AND G.K.N. WITH SINGLE RING TRIPOD RETENTION.

Remove the tripod assembly to interconnecting shaft retaining snap ring from the interconnecting shaft end groove (Fig. 8). Remove the tripod assembly from the interconnecting shaft by hand or by tapping the body of the tripod assembly with a brass punch (Fig. 9).

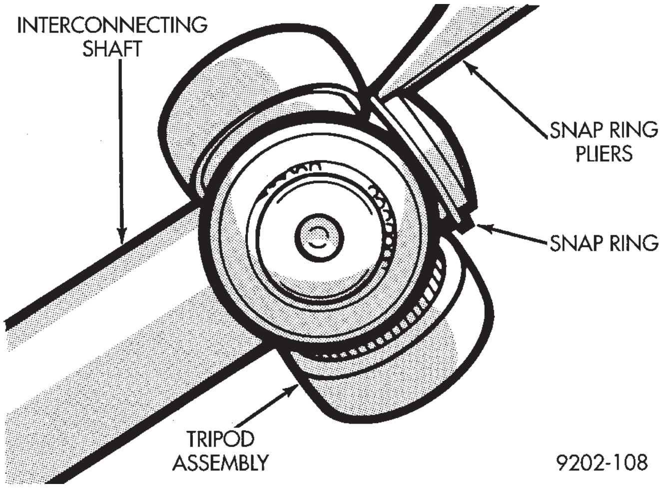


Fig. 8 Outer Tripod Retaining Snap Ring Removal

G.K.N. WITH DOUBLE RING TRIPOD RETENTION.

(1) Expand and remove the outer tripod assembly to interconnecting shaft, retaining snap ring (Fig. 10).

(2) Remove the tripod assembly from the interconnecting shaft. Tripod can be removed either by hand or by tapping the tripod body with a brass drift (Fig. 4). Do not hit the outer tripod bearings in an attempt to remove tripod assembly from interconnecting shaft.

(3) Remove inner tripod assembly to interconnecting shaft, retaining snap ring from interconnecting shaft (Fig. 11).

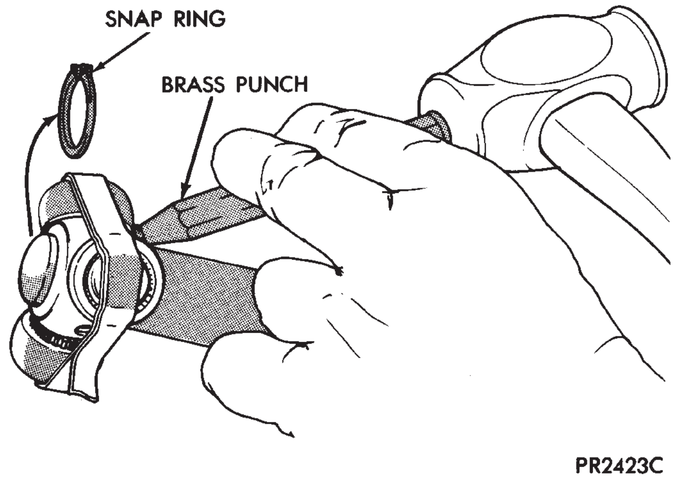


Fig. 9 Tripod Assembly Removal From Interconnecting Shaft

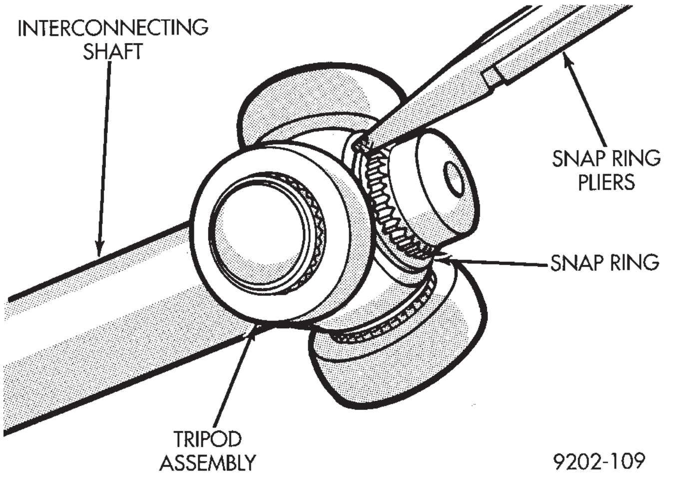


Fig. 10 Removing Outer Tripod Retaining Snap Ring (G.K.N.)

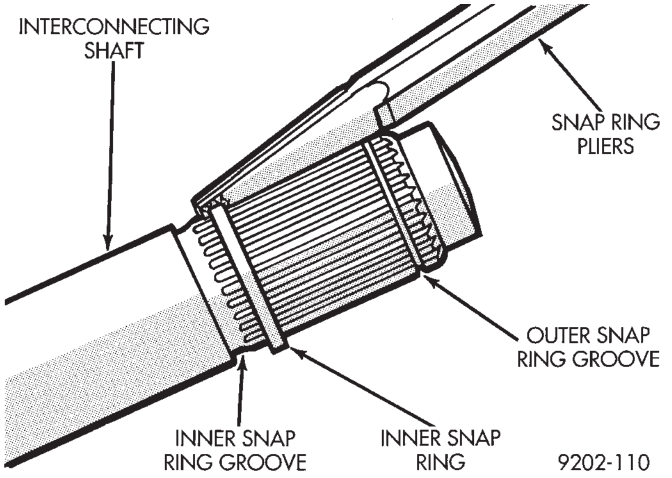


Fig. 11 Removing Inner Tripod Retaining Snap Ring (G.K.N.)

INSPECT TRIPOD AND HOUSING

Remove as much grease as possible from assembly and inspect joint housing ball raceway and tripod components for EXCESSIVE wear and replace if necessary.

Inspect the spring, spring cup, and the spherical end of the connecting shaft for EXCESSIVE wear or damage and replace, if necessary.

ASSEMBLE C/V JOINT

TRIPOD ASSEMBLY INSTALLATION G.K.N.

(1) Slide rubber washer seal over stub shaft and down into the groove provided (Fig. 12). **The rubber washer seal is used only on the right inner C/V joint on the Equal Length Drive Shaft Systems.**

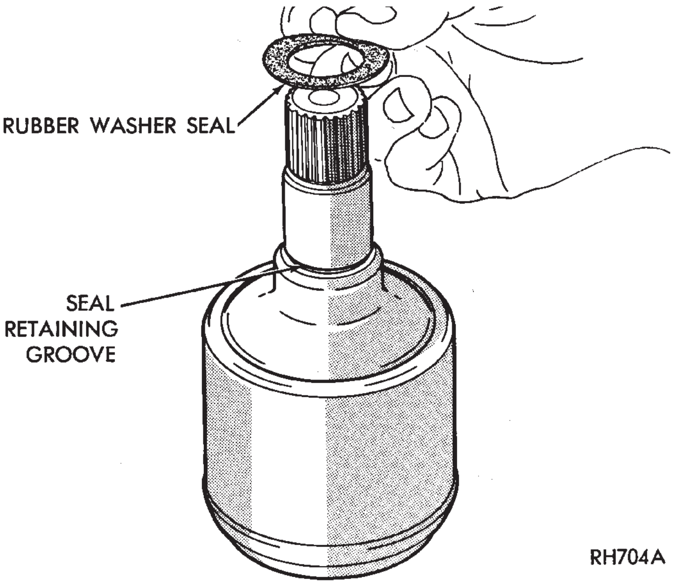


Fig. 12 Rubber Washer Seal Installation

(2) Fasten the (new) boot to the interconnecting shaft. See Boots Install.

(3) Slide the stop ring back into the stop ring groove on the interconnecting bar (Fig. 5).

(4) Install a new circlip in the circlip groove on the interconnecting bar (Fig. 6).

(5) With the chamfered end (Fig. 13 & 14) of the tripod facing the stop ring. Align the tripod splines and push or tap on the body of the tripod assembly with a SOFT drift, until tripod is seated on the shaft.**Check to make sure that the Tripod is Engaged by attempting to pull the tripod off of the shaft by hand.**

TRIPOD ASSEMBLY INSTALLATION S.S.G.

(1) Slide rubber washer seal over stub shaft and down into the groove provided (Fig. 12). **The rubber washer seal is used only on the right inner C/V joint on the Equal Length Drive Shaft Systems.**

(2) Fasten the (new) boot to the interconnecting shaft. See Boots Install.

(3) Install first wire ring tripod retainer over interconnecting shaft, slide tripod on the shaft, both ends are the same (Fig. 15).

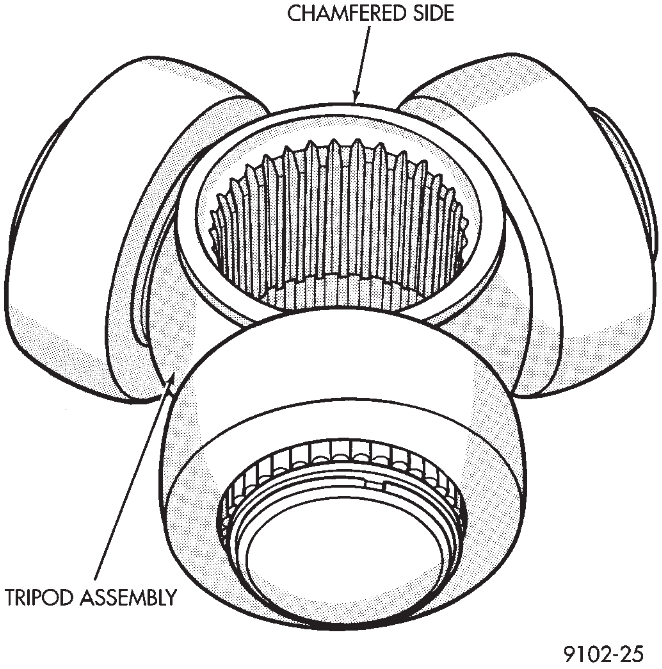


Fig. 13 G.K.N. Tripod Thick Ring Side

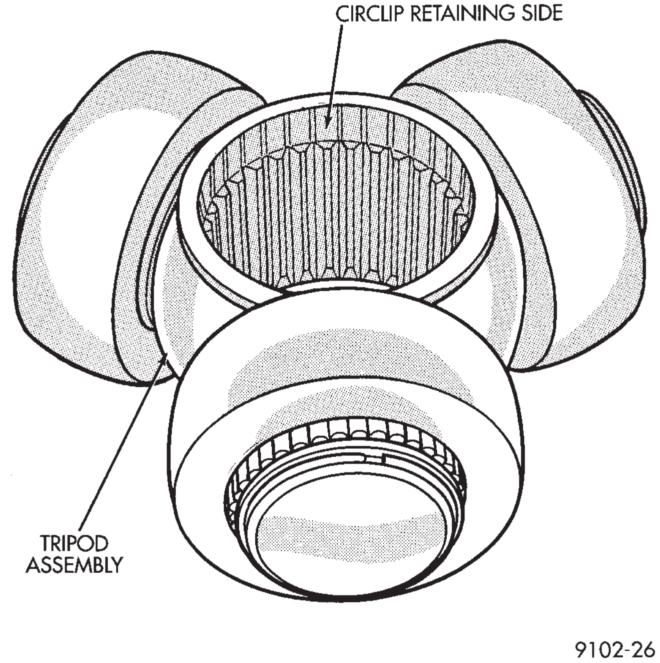


Fig. 14 G.K.N. Tripod Circlip Side

(4) Install the snap ring into the groove on the interconnecting shaft to lock the tripod in position (Fig. 16)

Should the wire ring tripod retainer not be suitable for reuse or a new one is not available,the following procedure should be used:

(1) Install tripod on the shaft.

(2) Install spring and cup assembly into inner joint housing.

(3) Position small end of boot in locating grooves on the interconnecting shaft.

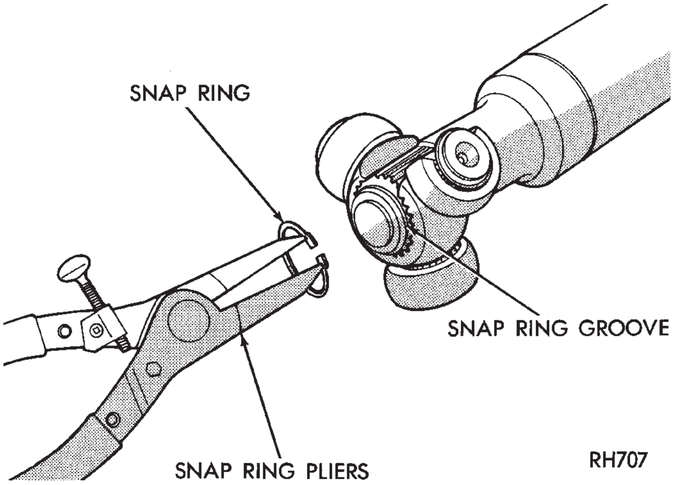


Fig. 15 Tripod Snap Ring Installation

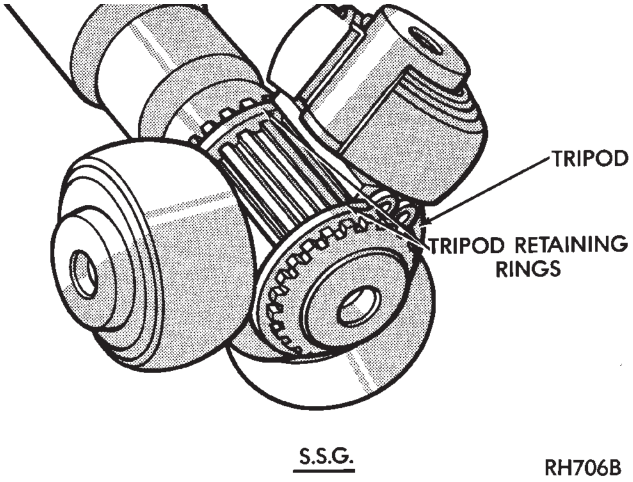


Fig. 16 Tripod Installation

(4) Clamp the small end boot clamp onto boot, retaining boot to the interconnecting shaft.

(5) Distribute 1/2 packet of grease into boot and 1/2 into housing.

(6) Install tripod into housing.

(7) Place large clamp over shaft.

(8) Install driveshaft into vehicle, see Driveshaft Install.

(9) Position large end of boot into locating groove.

(10) Slide large clamp into position.

(11) See Boot Install for clamping instructions.

TRIPOD ASSEMBLY INSTALLATION S.S.G. & G.K.N. WITH SINGLE RING RETENTION

(1) Fasten the (new) boot to the interconnecting shaft. See Boots Install.

(2) Install the tripod assembly onto the interconnecting shaft until it is past the snap ring groove on the shaft (Fig. 17). If required the tripod assembly can be tapped onto the interconnecting shaft using a brass drift, on the body of the tripod assembly (Fig. 4). Do not hit the outer tripod assembly bearings in an attempt to install tripod on interconnecting shaft.

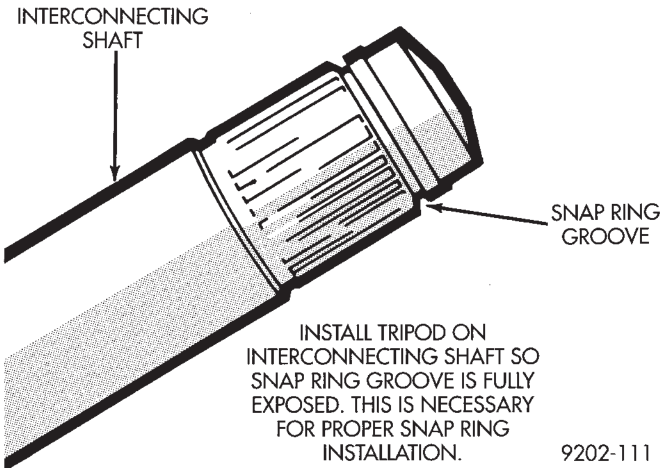


Fig. 17 Interconnecting Shaft Snap Ring Groove

(3) Install a **NEW** outer tripod assembly to interconnecting shaft retaining snap ring, into interconnecting shaft snap ring groove (Fig. 18). Be sure that the snap ring is fully seated into the snap ring groove around the entire interconnecting shaft.

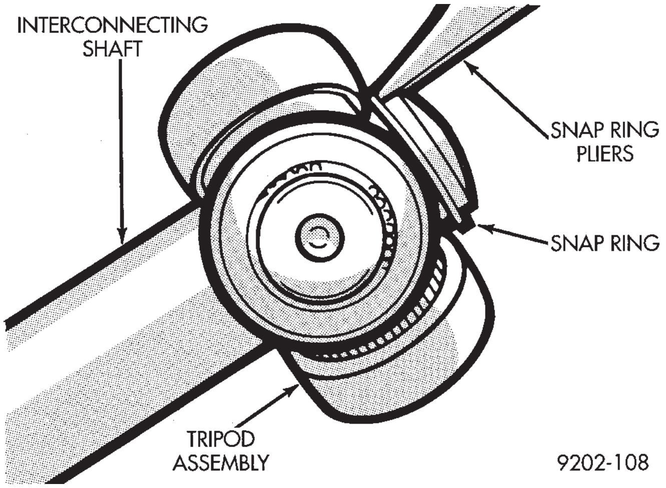


Fig. 18 Outer Tripod Retaining Snap Ring Installation

TRIPOD ASSEMBLY INSTALLATION G.K.N. WITH DOUBLE RING RETENTION

(1) Fasten the (new) boot to the interconnecting shaft. See Boots Install.

(2) Install the inner tripod assembly retaining snap ring into the retaining groove on the interconnecting shaft (Fig. 19).

(3) Install the tripod assembly onto the interconnecting shaft until it is past the outer snap ring groove on the shaft (Fig. 17). If required the tripod assembly can be tapped onto the interconnecting shaft using a brass drift, on the body of the tripod assembly (Fig. 4). Do not hit the outer tripod assembly bearings in an attempt to install tripod on interconnecting shaft.

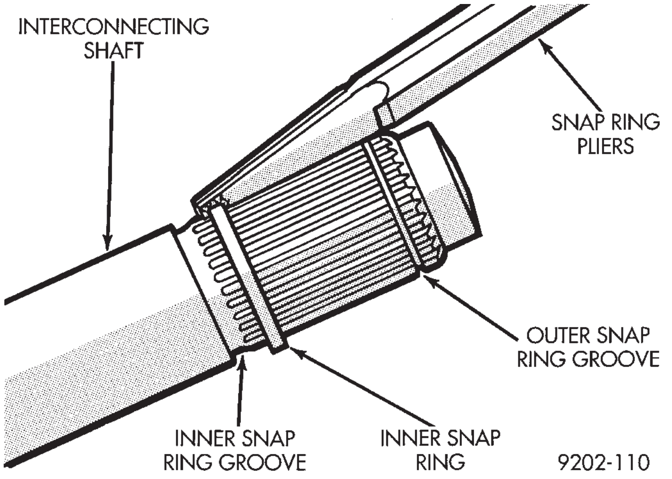


Fig. 19 Inner Snap Ring Installation

(4) Install outer tripod assembly to intermediate shaft retaining snap ring into snap ring groove on intermediate shaft (Fig. 20).

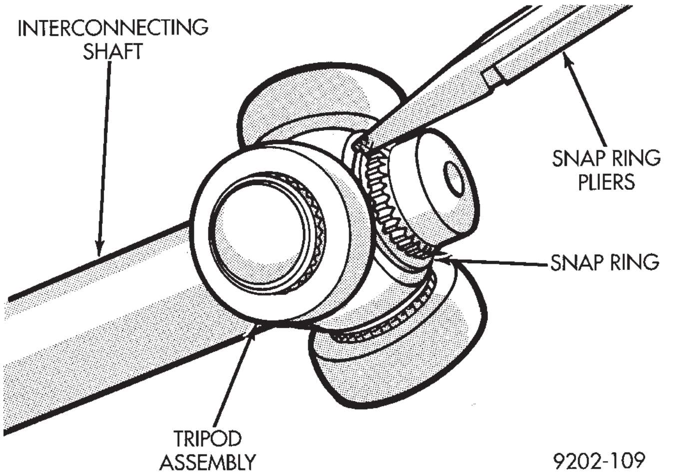


Fig. 20 Outer Snap Ring Installation

INNER C/V JOINT HOUSING INSTALLATION

G.K.N.

(1) Distribute 1/2 the amount of the grease provided into the housing and the remaining amount into the boot.

(2) Position the spring in the housing spring pocket with the spring cup attached to the exposed end of the spring (Fig. 21). Place a small amount of grease on the concave surface of the spring cup.

CAUTION: Care must be taken to ensure proper spring positioning. The spring must remain centered in the housing spring pocket when the tripod is installed and seated in the spring cup (Fig. 13).

(3) Clamp the stub shaft of the housing in a vise. **Use protective caps on jaws of vise so stub shaft does not get damaged by the vise.** Position the interconnecting shaft and the tripod assembly on top of

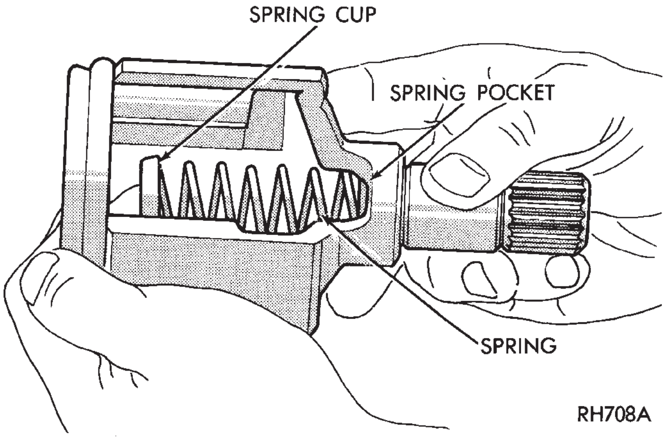


Fig. 21 Spring and Cup Installation

the plastic retaining collar. Carefully insert each of the tripod rollers into the retaining collar, one at a time while holding the interconnecting shaft on an angle. Carefully push down on the shaft until the rollers are locked into retaining collar in the housing.

(4) Position the boot over the boot retaining groove in the housing and clamp in place. See Boots Install.

S.S.G.

(1) Distribute 1/2 the amount of the grease provided into the housing and the remaining amount into the boot.

(2) Position the spring in the housing spring pocket with the spring cup attached to the exposed end of the spring (Fig. 21). Place a small amount of grease on the concave surface of the spring cup.

CAUTION: Care must be taken to ensure proper spring positioning. The spring must remain centered in the housing spring pocket when the tripod is installed and seated in the spring cup (Fig. 21).

(3) Slip tripod into housing and install the tripod wire retaining ring into position. Check for the ability of the retaining ring to hold the tripod in the housing.

(4) Position the boot over the boot retaining groove in the housing and clamp in place. See Boots Install.

OUTER C/V JOINT

DISASSEMBLE

(1) Remove boot clamps on boot and discard (Fig. 1).

(2) Wipe away grease to expose joint.

(3) G.K.N. Remove outer C/V Joint from shaft by supporting the interconnecting shaft in a vise. **Use protective caps on the jaws of the vise to prevent damage to the interconnecting shaft.** Give a sharp tap to the top of housing to dislodge joint from internal circlip installed in a groove at the outer end of the shaft (Fig. 2).

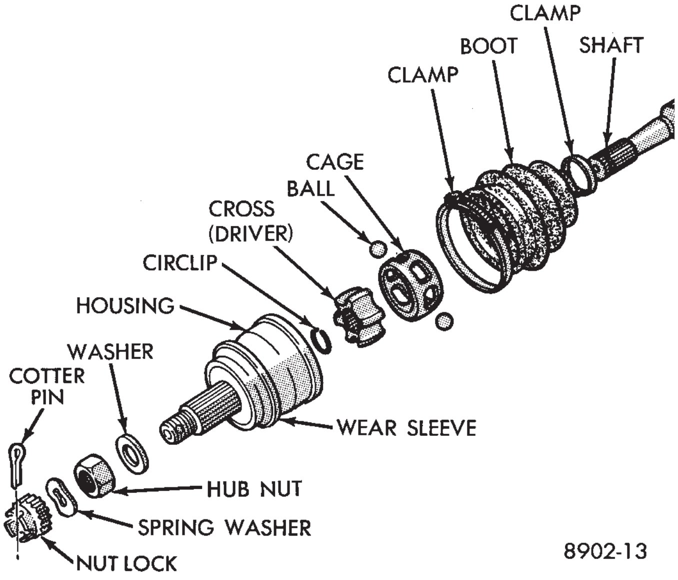


Fig. 1 Outer C/V Joint Components

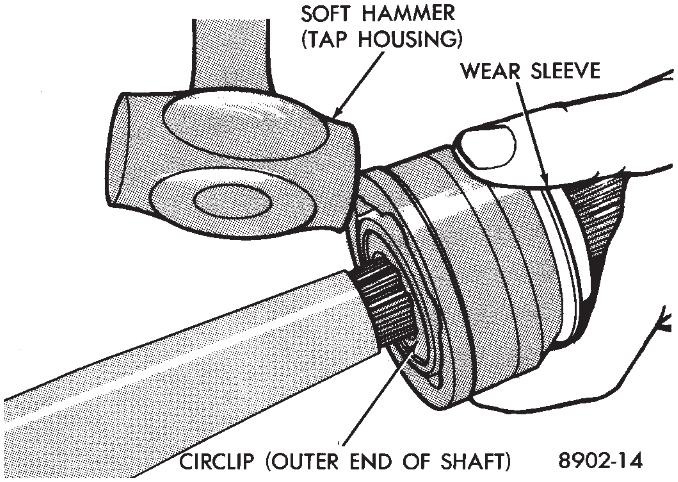


Fig. 2 Remove Joint from Shaft .

S.S.G. A single circlip located in a groove on the cross, is used to retain the cross to the shaft (Fig. 3). Loosen the damper weight bolts and slide it and the boot towards the inner joint. Expand the circlip with snap ring pliers and slide joint from shaft. Install damper weight, see Damper Weights.

WEAR SLEEVE

A wear sleeve installed on the outer C/V joint housing (Fig. 1) provides a wipe surface for the hub bearing seal (installed in the steering knuckle).

(4) If bent or damaged, carefully pry wear sleeve from C/V joint machined ledge.

(5) Remove circlip from shaft groove and discard (Fig. 4). A replacement boot package will include this circlip.

(6) Unless the shaft is damaged and needs replac-

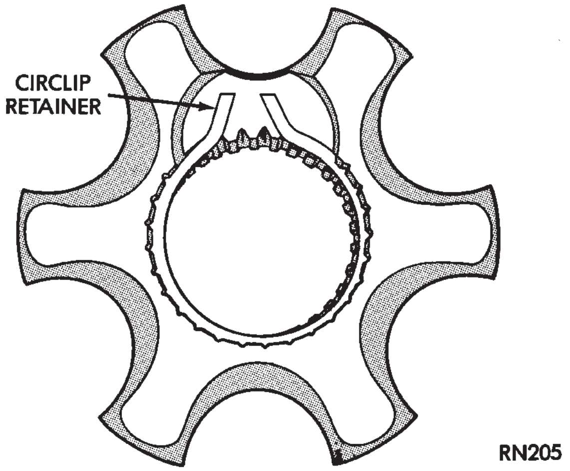


Fig. 3 Circlip Retainer in Cross S.S.G.

ing, **do not remove** the heavy spacer ring from the shaft, G.K.N. only (Fig. 4).

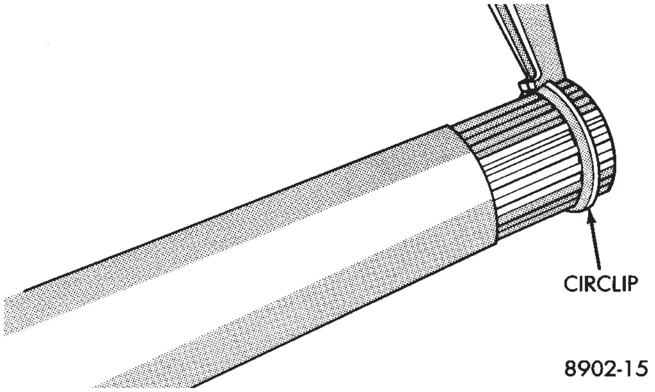


Fig. 4 Remove Circlip

(7) With joint separated from the interconnecting shaft proceed as follows:

- If outer C/V joint was operating satisfactorily and grease does not appear to be contaminated, just replace boot. Bypass the following disassembly procedure for the C/V joint assembly, See Boots Install.
- If outer joint is noisy or **badly** worn. Bypass the following disassembly and replace entire unit. It is also recommended that the boot be replaced. The Boot Package includes the boot, clamps, retaining ring (circlip), and lubricant. See boots install.

(8) Hold joint vertically in vise by clamping on splined shaft, using soft jaws to prevent damage.

(9) Wipe off surplus grease and mark relative position of inner cross, cage and housing with a dab of paint (Fig. 5).

(10) Press down on one side of inner race to tilt cage and remove ball from opposite side (Figs.5 and 6). If joint is tight, use a hammer and brass drift to tap inner race. **Do not hit the cage.** Repeat this step until **all 6** balls are removed. A screwdriver may be used to pry balls loose.

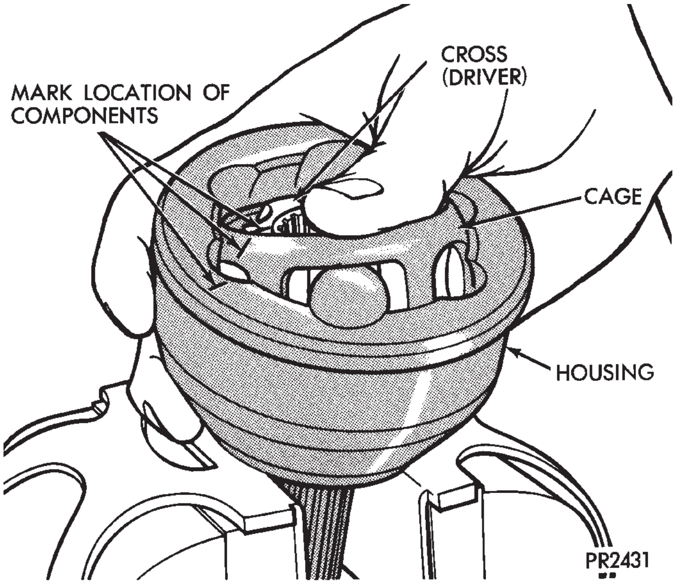


Fig. 5 Rotate Cage & Cross to Remove Balls

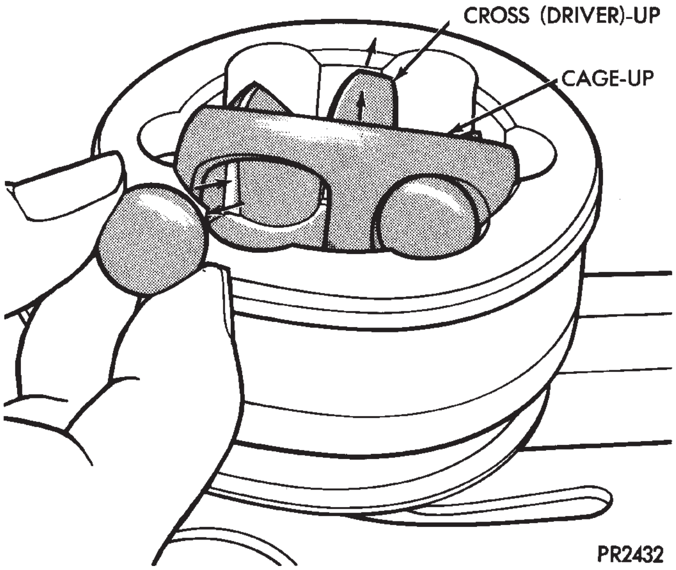


Fig. 6 Ball Released

(11) Tilt the cage and inner race assembly vertically and position two opposing cage windows in area between the ball grooves. Remove the cage and inner race assembly by pulling upward away from the housing (Fig. 7).

(12) Turn inner cross (driver) 90° to cage and align one of the race spherical lands with cage window. Raise land into cage window and remove inner race by swinging out (Fig. 8).

INSPECT

Check grease for contamination and all parts for defects as follows:

(1) Wash all parts in suitable solvent and dry, preferably with compressed air.

(2) Inspect housing ball races for excessive wear and scouring.

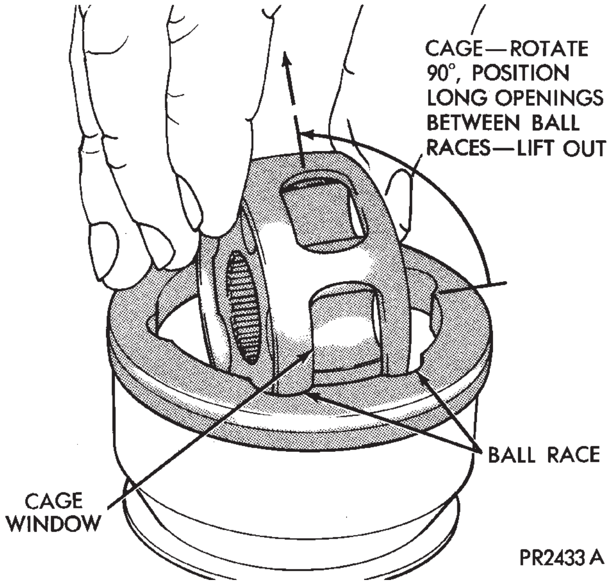


Fig. 7 Removing Cage & Cross Assembly from Housing

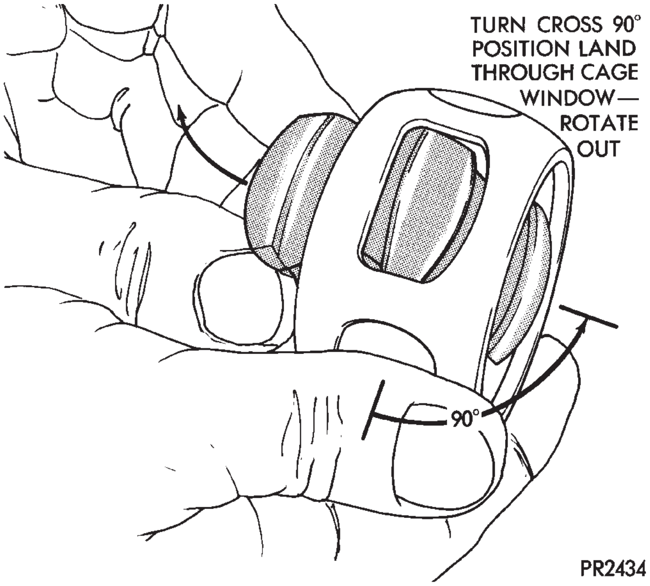


Fig. 8 Removing Cross from Cage

(3) Check splined shaft and nut threads for damage.

(4) Inspect all 6 balls for pitting, cracks, scouring and wear. Dulling of surface is normal.

(5) Inspect cage for excessive wear on inside and outside spherical surfaces, surface ripples on cage window, cracks, and chipping.

(6) Inspect inner race (cross) for **excessive** wear or scouring of ball races.

Any of the above defects will warrant replacing the C/V assembly as a unit.

Polished areas in races (cross and housing) and on cage spheres are normal and do not indicate need for joint replacement. Unless they are suspected of causing noise and vibration.

ASSEMBLE

If outer joint was not disassembled nor the wear sleeve damaged go to step 11.

(1) Position new wear sleeve on joint housing machined ledge (Fig. 1). Assemble Installer, Special Tool C-4698 (Tool is provided with handle and dual purpose drive head for installing wear sleeve onto C/V joint housing and (head reversed) seal into knuckle). See KNUCKLE BEARING SEAL.

(2) See (Fig. 1). Assemble tool and install wear sleeve.

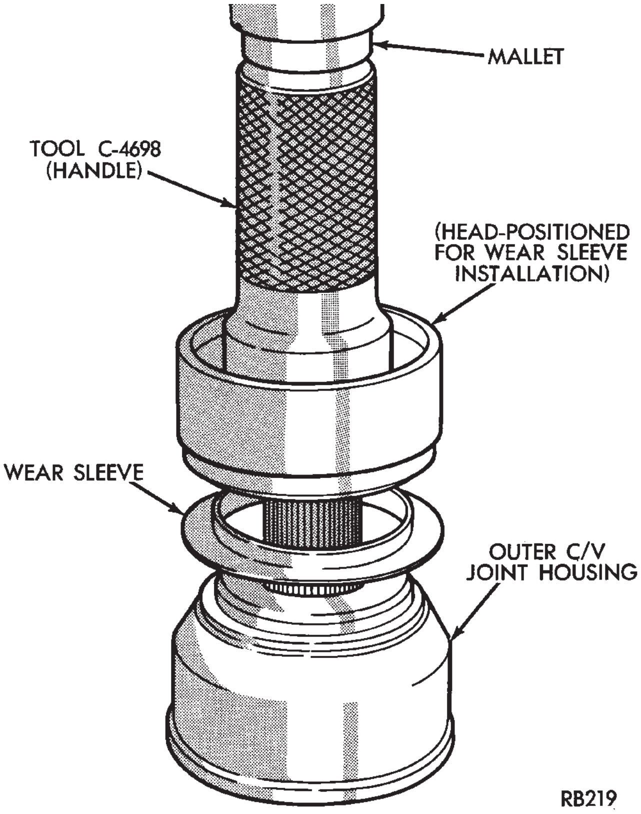


Fig. 1 Tool Set-Up for Wear Sleeve Installation

(3) Lightly oil all components before assembling outer joint.

(4) Align parts according to paint markings.

(5) Insert one of the inner race (cross) lands into cage window (Fig. 2) and feed race into cage. Pivot cross 90° to complete cage assembly (Fig. 3).

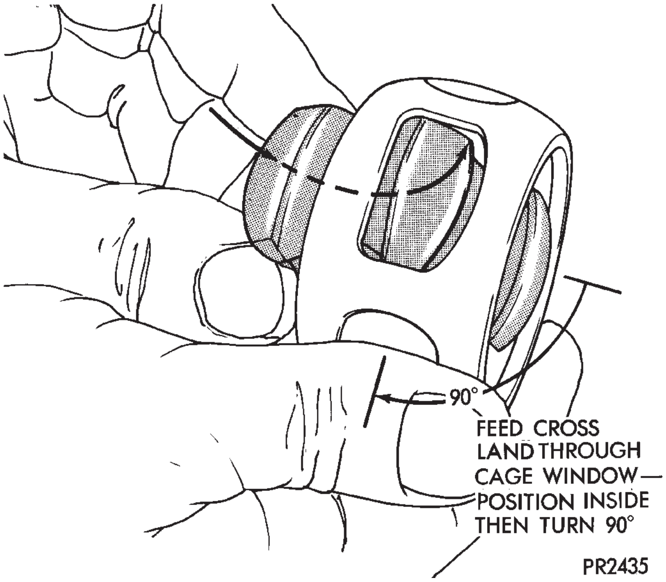


Fig. 2 Installing Cross into Cage

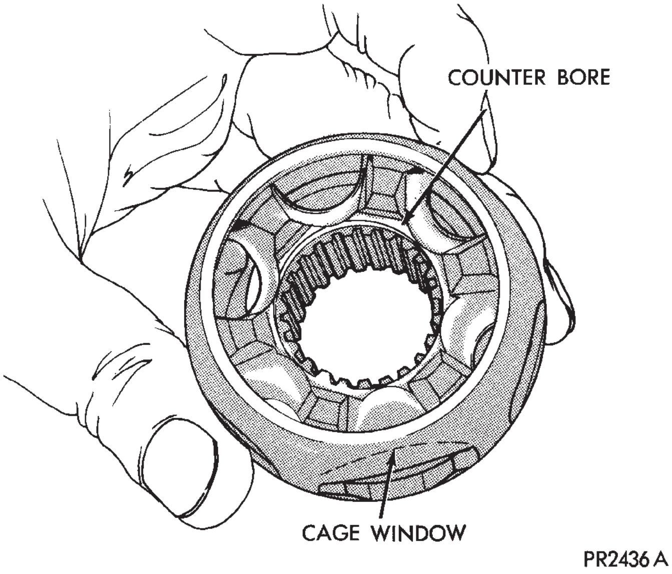


Fig. 3 Cage & Cross Assembled G.K.N.

(6) Align opposing cage windows with housing land and feed cage assembly into housing (Fig. 4). Pivot cage 90° to complete installation.

When properly assembled the large counterbore in the cross should be facing outward from the joint on G.K.N. units (Figs.3 and 6). On the S.S.G. joint the internal circlip in the cross will be facing outward from the housing (Fig. 5).

(7) Apply lubricant to ball races from packet provided in boot kit and distribute equally between all sides of ball grooves. One packet is sufficient to lubricate the joint.

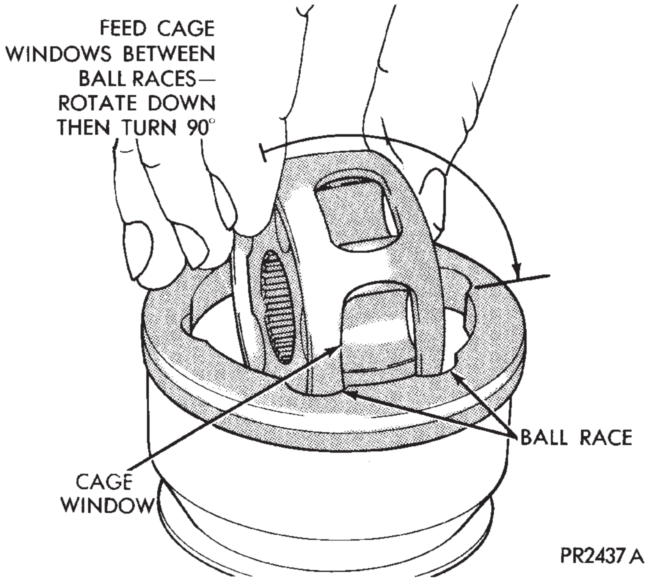


Fig. 4 Installing Cage & Cross into Housing

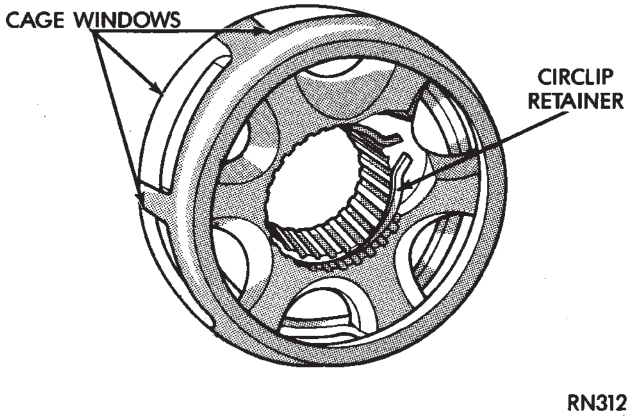


Fig. 5 Cage & Cross Assembled S.S.G.

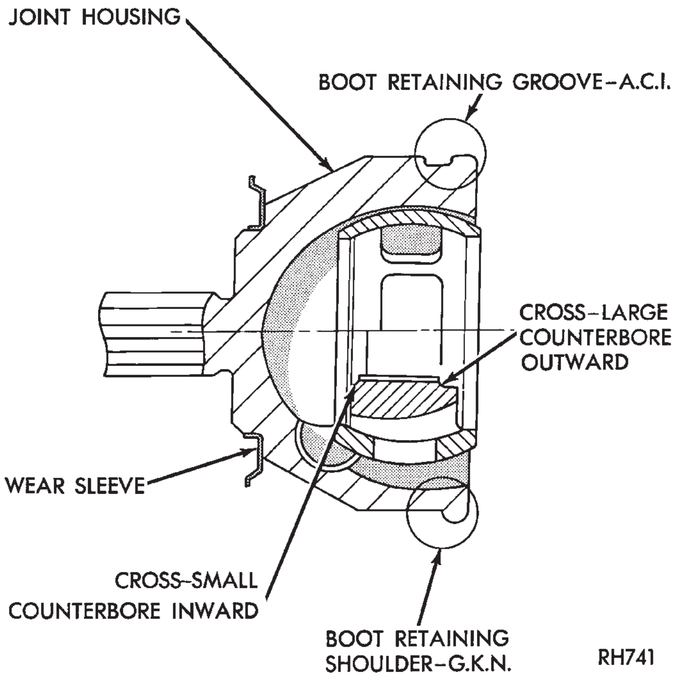


Fig. 6 Cage & Cross Installed in Housing G.K.N.

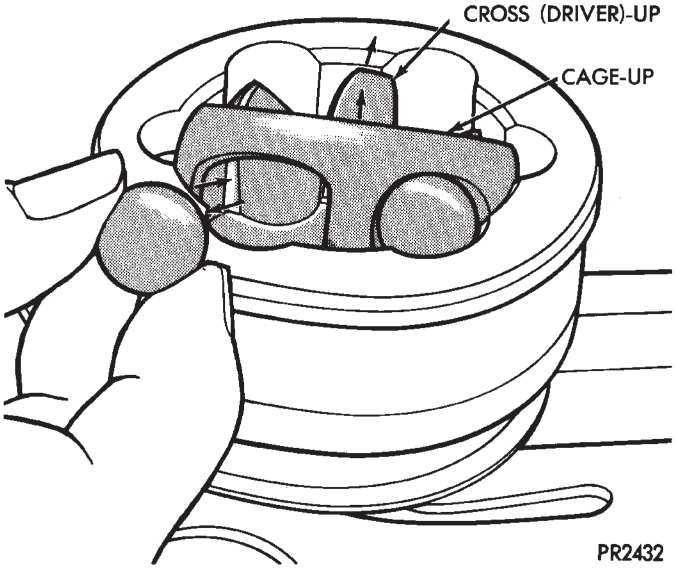


Fig. 7 Inserting Balls into Raceway

(8) Insert balls into raceway by tilting cage and inner race assembly (Fig. 7).

(9) Fasten boot to shaft. See **Boots Install.**

(10) On G.K.N. units insert the new circlip, provided with kit in shaft groove. **Do not over expand or twist** circlip during assembly (Fig. 8). The S.S.G. unit has a reusable circlip retainer that is an integral part of driver assembly.

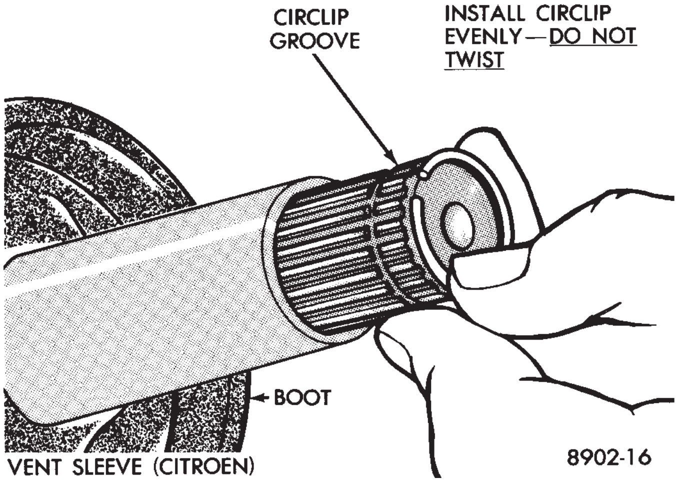


Fig. 8 Installing New Circlip

(11) Position outer joint on splined end with hub nut on stub shaft. Engage splines, and tap sharply with mallet (Fig. 9).

(12) Check that circlip is properly seated by attempting to pull joint from the shaft.

(13) Locate large end of boot over joint housing checking that boot is not twisted.

(14) Fasten boot to housing. See **Boots Install.**

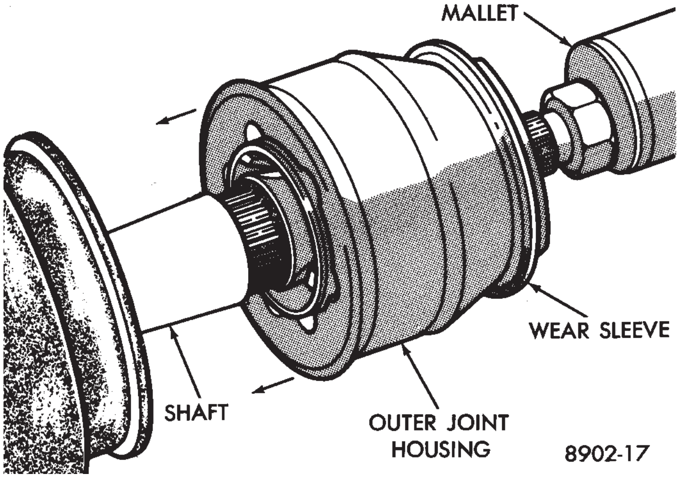


Fig. 9 Position Joint onto Shaft Splines

INTERMEDIATE SHAFT ASSEMBLY RECONDITION

Reconditioning of intermediate shaft assembly (Fig. 1), for Equal Length Drive Shaft System vehicles is the same for manual and automatic transaxles.

INTERMEDIATE SHAFT ASSEMBLY

REMOVE

(1) Remove right driveshaft. See Driveshaft Assemblies Remove.

(2) Remove speedometer pinion from the extension housing (Fig. 2).

(3) Remove the two bolts which mount the bearing assembly bracket to the engine block (Fig. 1).

(4) Remove assembly from transaxle extension by pulling outward on the yoke (Fig. 3).

UNIVERSAL JOINT AND ROLLER

Disassemble

(1) Mark relationship of shaft to shaft to ensure proper alignment at assembly. Apply penetrating oil to bushings and remove snap rings.

(2) Support yoke in vise and place a socket large enough to receive bushing on top of yoke. A 1-1/8 inch socket is suitable (Fig. 4).

(3) Striking socket with hammer will cause yoke to move down and bushing to move up out of yoke into socket.

(4) After removing one bushing, turn parts in a vise and remove other bushing in same manner.

Assemble

(1) Hold cross in position between yoke ears with one hand and start one bushing assembly into yoke with other hand (Fig. 5).

(2) Continue to hold cross in position, then hammer bushing assembly into yoke and install snap ring.

(3) Install opposite bushing and snap ring in the same manner.

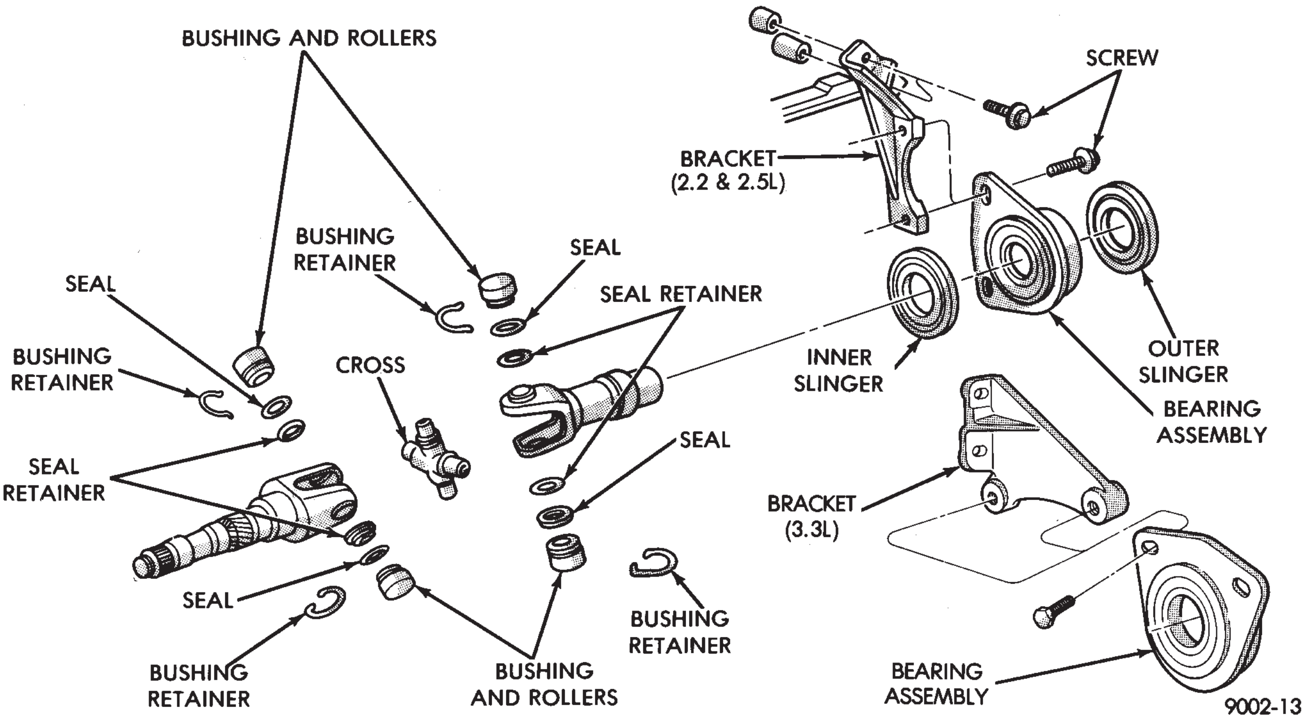


Fig. 1 Intermediate Shaft Assembly

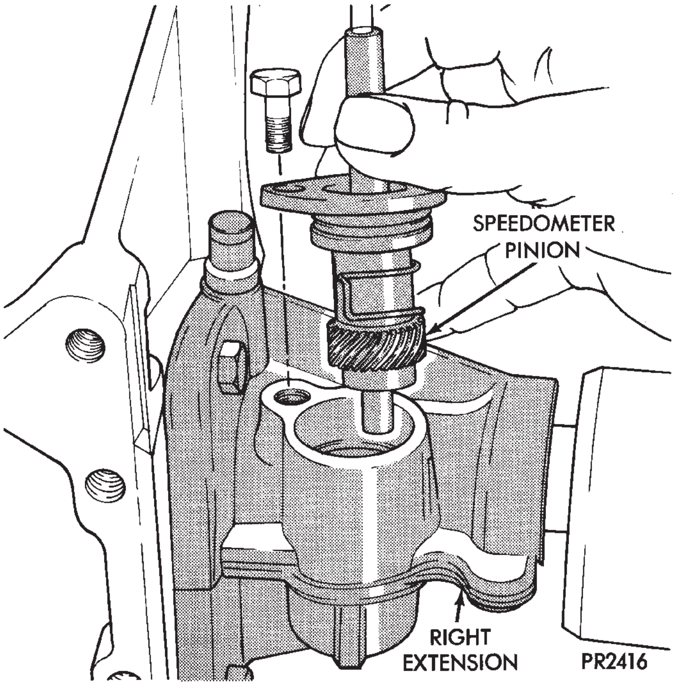


Fig. 2 Remove Speedometer Pinion

(4) Repeat process for stub shaft yoke after aligning marks on yoke and shaft.

BRACKET, BEARING, AND SLINGER ASSEMBLY

Disassemble

(1) Remove the two screws that hold the bearing assembly to the support bracket.

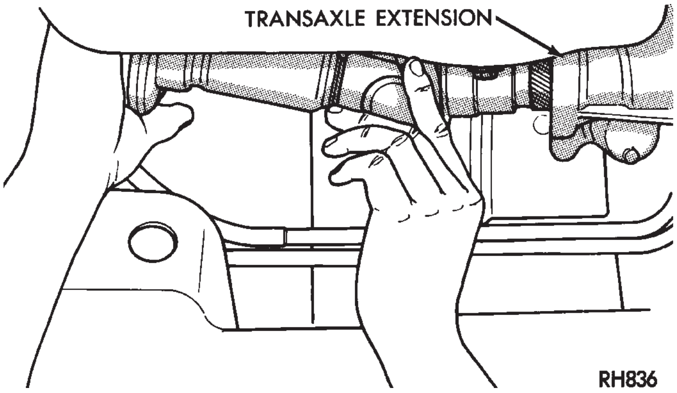


Fig. 3 Removing Intermediate Shaft Assembly

(2) Press the intermediate shaft out of the bearing assembly and outer slinger. Do not dent or damage the inner slinger. Also avoid damaging the end of the stub shaft, the rubber seal on the right driveshaft mates with this surface. Excessive wear to the rubber seal would result and allow moisture to enter, corroding the internal splines.

(3) If either slinger is damaged, it should be replaced. Carefully press the shaft through the slinger, discard the slinger.

The bearing assembly is not serviceable and must be replaced as an assembly.

Assemble

(1) Place new slinger on stub shaft and drive it on until it bottoms out on the shoulder of the shaft (Fig. 6). A tool for this purpose can be fabricated from a piece of pipe that has the dimensions noted in (Fig. 6).

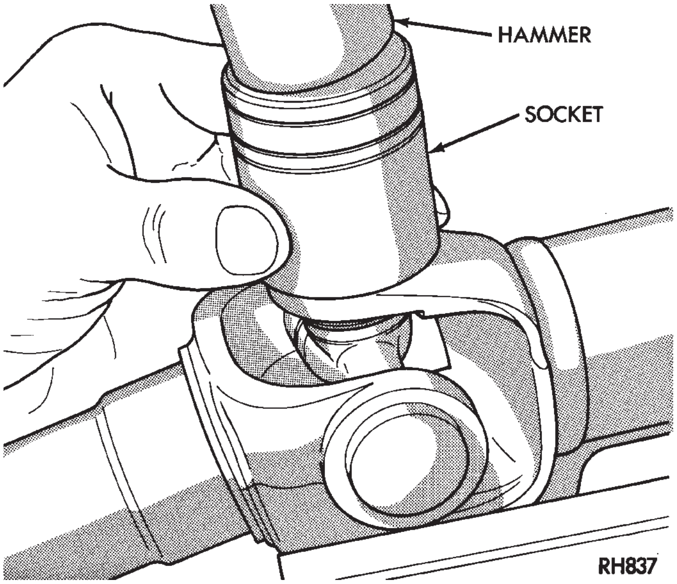


Fig. 4 Disassemble Universal Joint

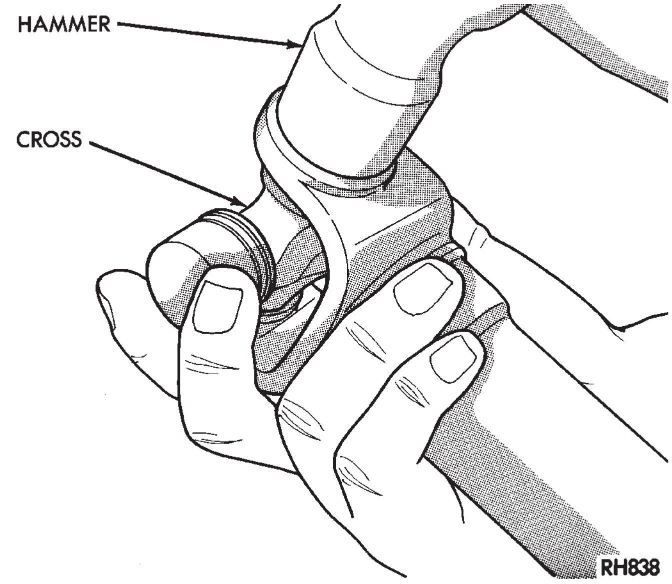


Fig. 5 Assemble Universal Joint

CAUTION: Do not dent or bend the slinger during this installation, since it could prevent the bearing assembly from seating properly.

(2) Press bearing assembly into position on the shaft, there should be a minimum of 1 mm (1/32 in.) clearance between slinger and bearing assembly when properly installed.

CAUTION: Apply pressure only to the inner race of the bearing during this procedure. Or damage may result which could cause premature bearing failure.

(3) Press the outer slinger into place with the same tool used for bearing installation. The slinger must bottom out on the shoulder of the shaft.

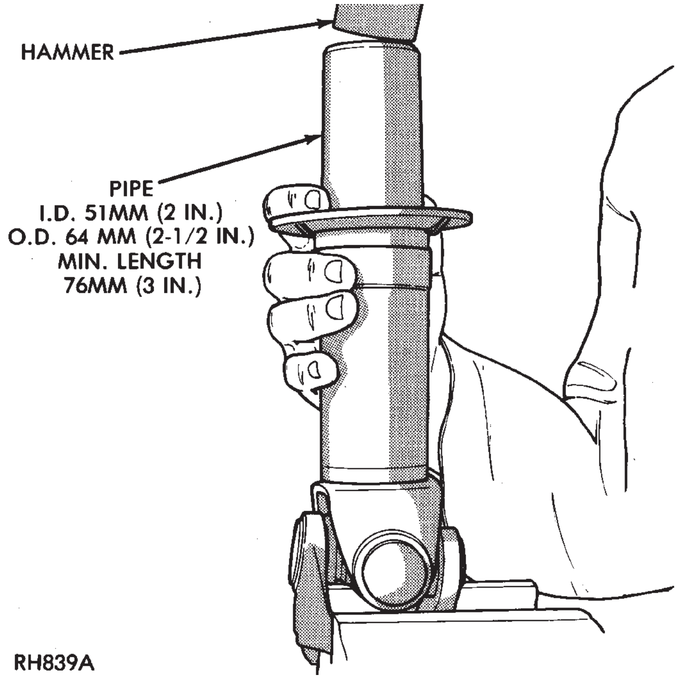


Fig. 6 Slinger Installation Intermediate Shaft

INTERMEDIATE SHAFT ASSEMBLY

Install

(1) Securely fasten bracket to bearing assembly and tighten to 28 N●m (21 ft. lbs.) torque (Fig. 7) (Also see Fig. 1).

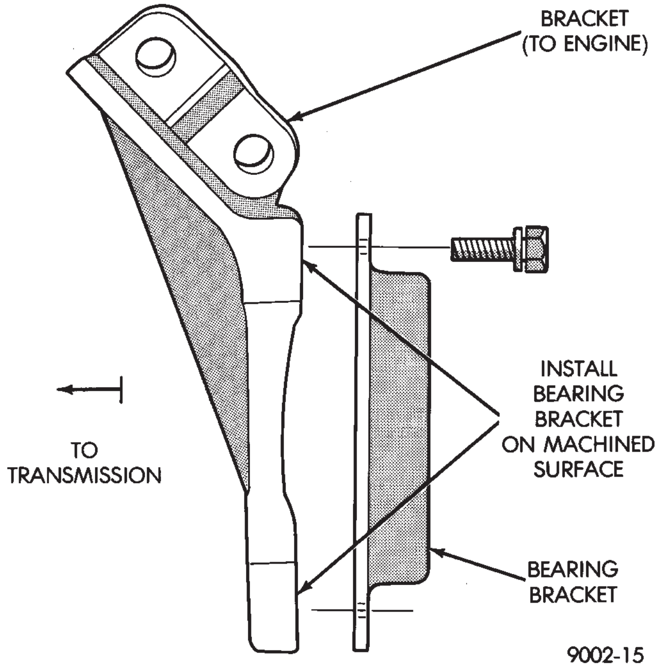


Fig. 7 2.5L Turbo III Intermediate Driveshaft Bracket

(2) Hold the stub yoke while aligning and guiding the splined end into the transaxle (Fig. 8).

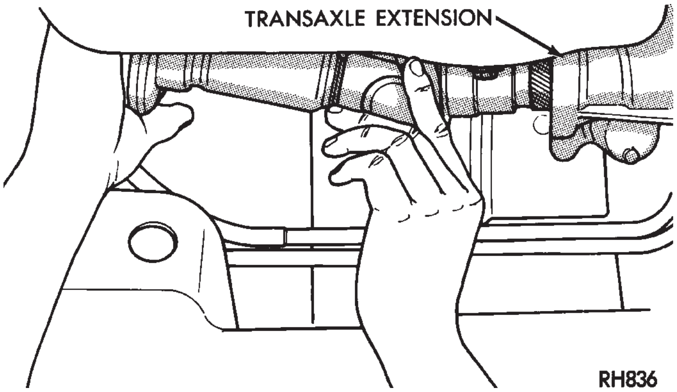


Fig. 8 Installing Intermediate Shaft Assembly

(3) Swing the bracket into position on the engine and loosely install the screws through the slotted holes.

(4) Push the intermediate shaft assembly into the transaxle as far as it can travel. Hold the assembly in this position and tighten the screws (bracket to engine block) to 54 N●m (40 ft. lbs.) torque. **This will ensure full seal engagement between the journal on the intermediate shaft and the seal in the transaxle extension.**

(5) Distribute a liberal amount of grease in side spline and pilot bore on bearing end of intermediate shaft. Use MOPAR Multi-Purpose Lubricant, or equivalent.

(6) Install speedometer pinion (Fig. 9).

(7) Install right driveshaft. See Driveshaft Assemblies Install.

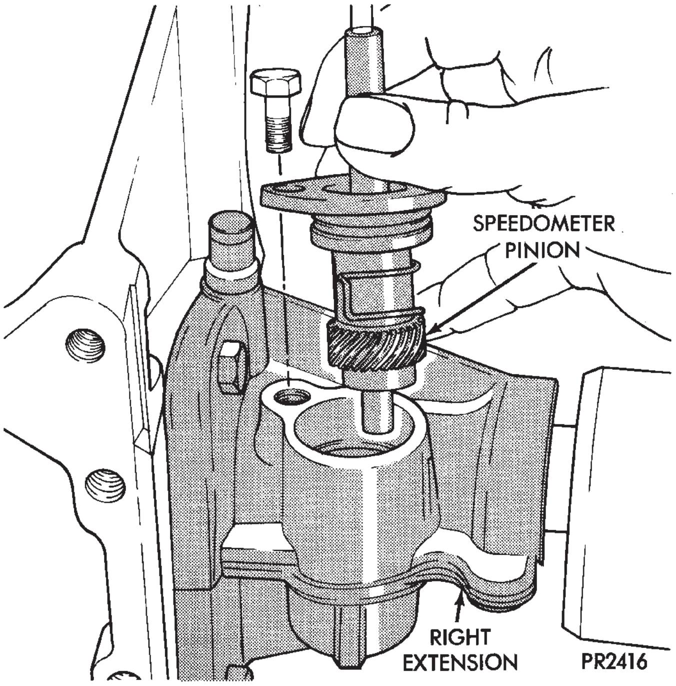


Fig. 9 Install Speedometer Pinion

C/V JOINT BOOTS Handling and Cleaning

It is vitally important during **any** service procedures requiring boot handling. That care be taken not to puncture or tear the boot by over tightening clamps, misuse of tool(s) or pinching the boot. Pinching can occur by rotating the C/V joints (especially the tripod) beyond normal working angles.

The driveshaft boots are not compatible with oil, gasoline, or cleaning solvents. Care must be taken that boots never come in contact with any of these liquids. **The only acceptable cleaning agent for driveshaft boots is soap and water. After washing, boot must be thoroughly rinsed and dried before reusing.**

BOOTS INSPECT

Noticeable amounts of grease on areas adjacent to or on the exterior of the C/V joint boot. Is the first indication that a boot is punctured, torn or that a clamp has loosened. When a C/V joint is removed for servicing of the joint. The boot should be properly cleaned and inspected for cracks, tears and scuffed areas on interior surfaces. If any of these conditions exist, boot replacement is recommended.

BOOTS INSTALL

THE HARD PLASTIC BOOTS REQUIRE APPROXIMATELY **100** TIMES THE CLAMPING FORCE OF THE RUBBER BOOT. THE CLAMPS USED ON THE RUBBER BOOTS DO NOT HAVE THE TYPE OF LOAD CAPACITY REQUIRED. TO SEAL THE HARD PLASTIC BOOTS AND SHOULD NOT BE USED FOR THIS PURPOSE.

Rubber boots appear only on the inner joints of certain driveshafts.

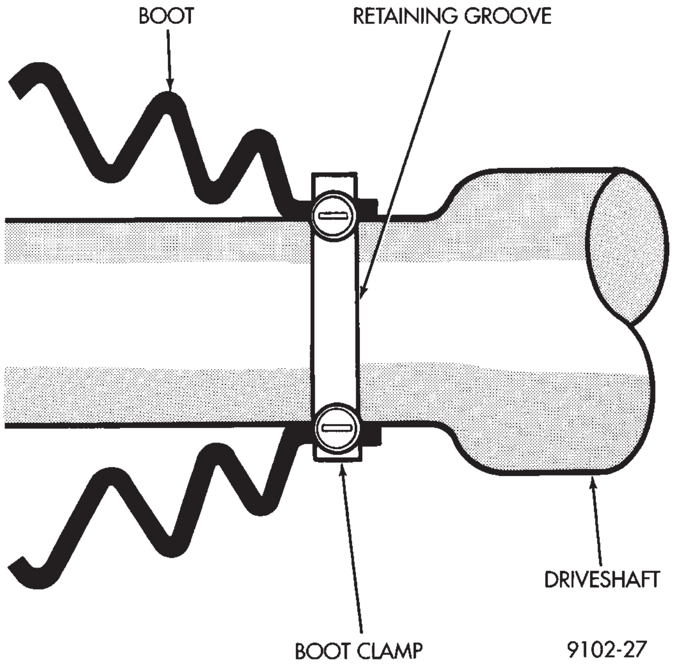


Fig. 1 C/V Joint Boot Positioning G.K.N.

Rubber boots must be serviced with the strap and buckle clamp. Use the Clamp Installer, Special Tool C-4653. Proceed with the boot installation as follows:

(1) Slide the small end of the boot over the shaft. Position the boot to the edge of the locating mark or groove, whichever is appropriate (Fig. 1).

(2) Install the C/V joint. See Inner or Outer C/V Joint Assemble.

(3) Slide the large diameter of the boot into the locating groove (Fig. 6).

(4) Wrap binding strap around boot **twice**, PLUS 63 mm (2-1/2 inches) (Fig. 2).

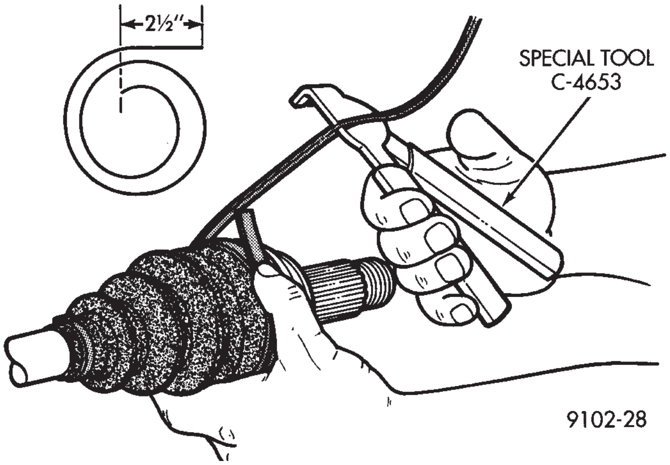


Fig. 2 Measure & Cut Binding Strap

(5) Pass the strap through the buckle and fold it back about 29 mm (1-1/8 inches) on the inside of the buckle (Fig. 3).

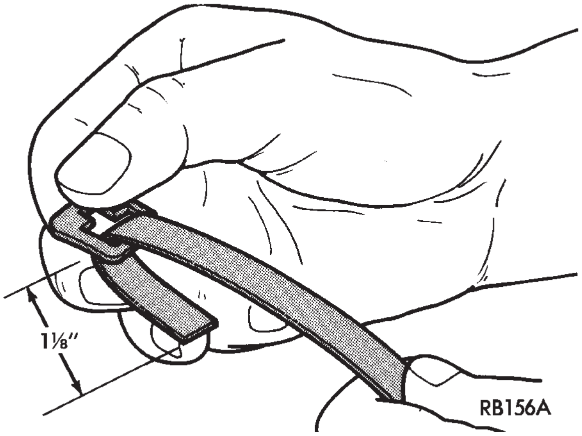


Fig. 3 Install Buckle on Strap

(6) Put the strap around the boot with the eye of the buckle toward you (Fig. 4). Wrap the strip around the boot once and pass it through the buckle, then wrap it around a second time also passing it through the buckle.

(7) Fold the strip back slightly to prevent it from slipping backwards (Fig. 5).

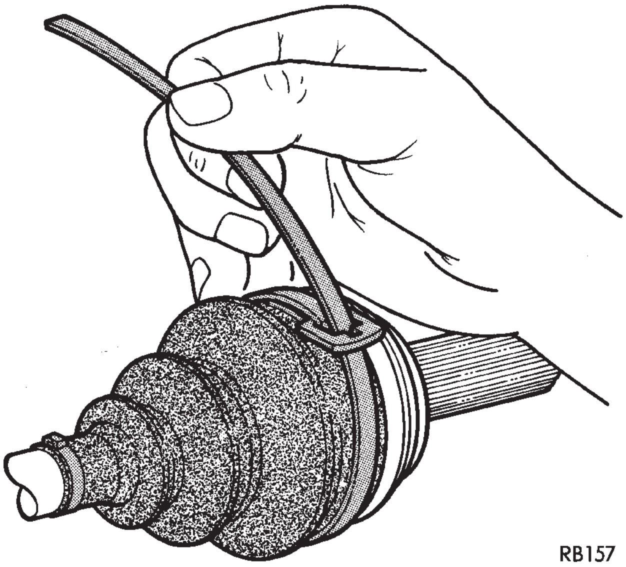


Fig. 4 Wrap Strap (through Buckle Eye) Twice

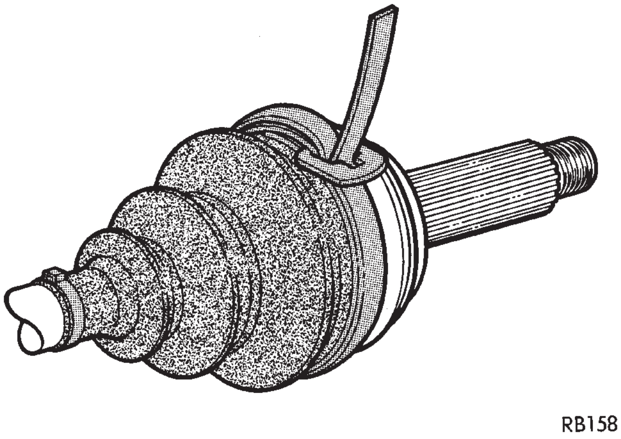


Fig. 5 Fold Strap Lightly to Keep Position

(8) Open the tool all the way and place strip in narrow slot approximately 13 mm (1/2 inch) from buckle (Fig. 6).

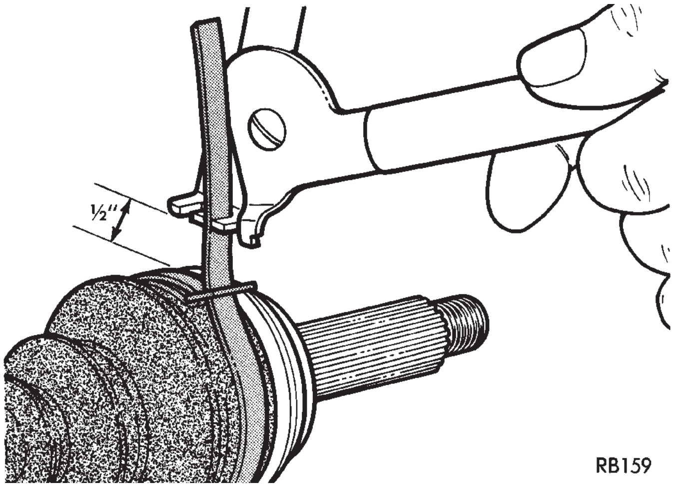


Fig. 6 Open Tool, Position Strap in Narrow Slot 1/2 Inch from Buckle

(9) Hold the binding strip with the left hand and push the Tool forward and slightly upward. Then fit the hook of the Tool into the eye of the buckle (Fig. 7).

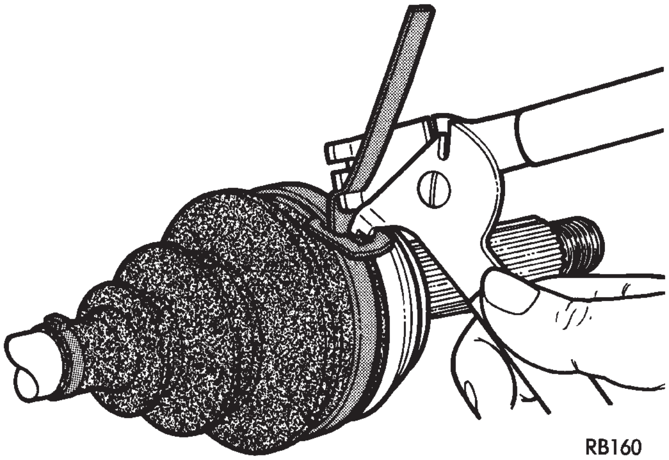


Fig. 7 Push Tool Forward & Fit into Buckle Eye

(10) Tighten the strip by closing the tool handles (Fig. 8). Then rotate the tool (handles) downward while slowly releasing the pressure on the tool handles. Allow the tool (handles) to open progressively. Then open the tool entirely and remove them sideways.

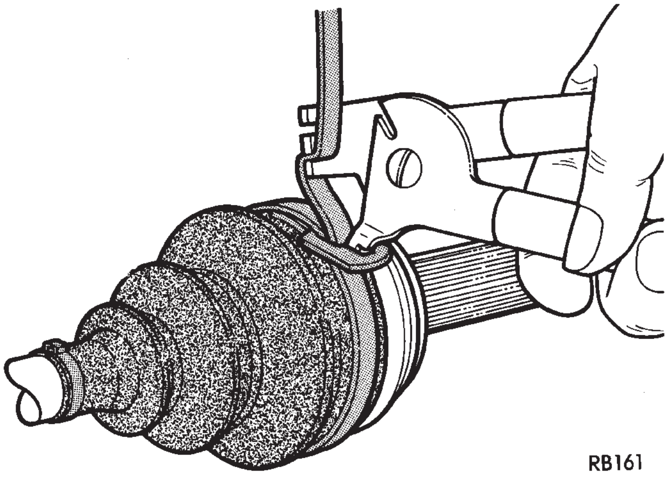


Fig. 8 Tighten Strap

(11) If the strap is not tight enough, engage the tool a second or even a third time, always about 13 mm (1/2 inch) from the buckle (Fig. 9). When tightening always be careful to see that the strap slides in a straight line and without resistance in the buckle, that is without making a fold. An effective grip will be obtained only by following the above instructions.

(12) Fig. 10 shows WHAT NOT TO DO, NEVER fold the strap back or bring the tool down while tightening, this action will break the strap.

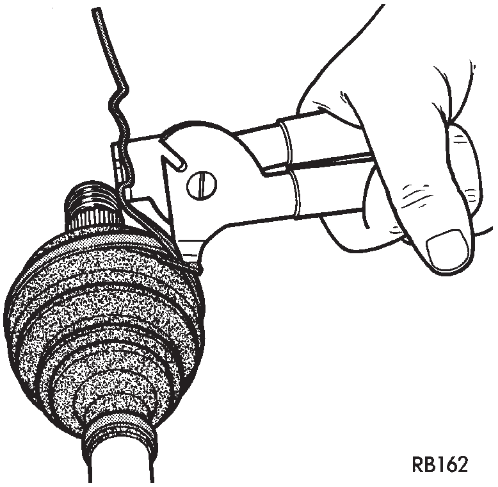


Fig. 9 Tighten Strap (if Required)

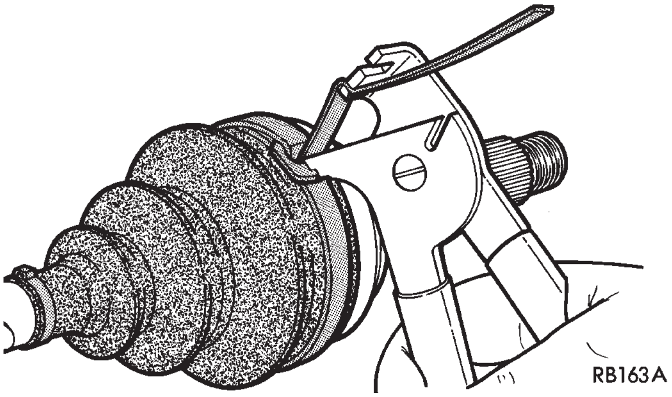


Fig. 10 What Not to Do

(13) Fig. 11 shows how to pull the tool down while releasing the pressure on the tool handle.

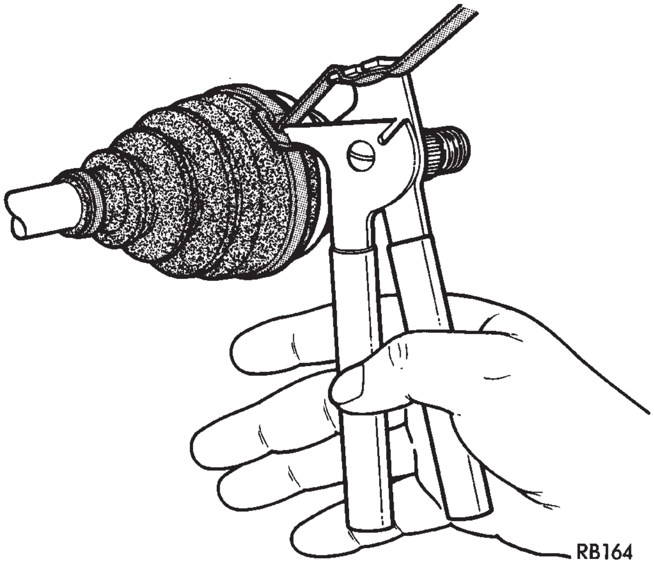


Fig. 11 Correct Tightening Procedure

(14) If the strip is tight enough. Remove the tool sideways and cut off the strap 3 mm (1/8 inch), so that it does not overlap the edge of the buckle. Complete job by folding the strip back neatly (Fig. 12).

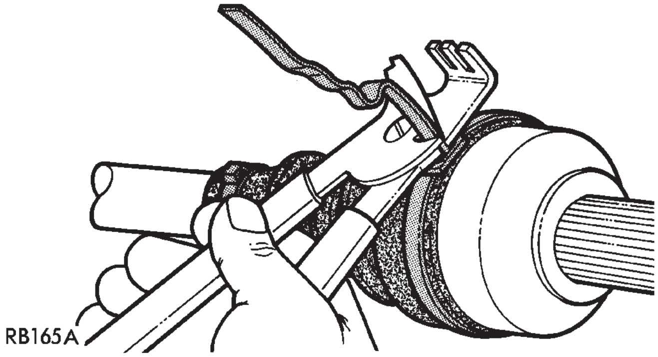


Fig. 12 Cut Strap 1/8 Inch from Buckle

(15) Fig. 13 shows the finished binding strap type clamp in position, correctly fitted and unable to come loose.

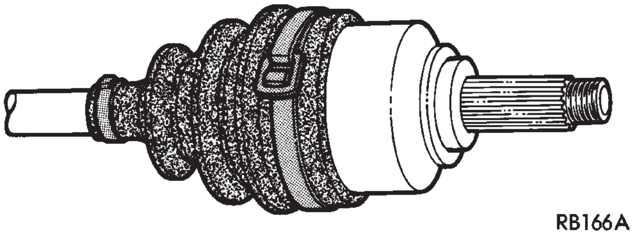


Fig. 13 Correctly Installed Clamp

(16) After attaching the C/V joint boot to the shaft. Install the inner or outer C/V joint following procedures under Inner C/V Joint Assemble or Outer C/V Joint Assemble.

(17) Slip the large end of the boot on the housing and align it in the boot groove.

(18) Repeat steps 2 - 13 for boot clamping.

S.S.G. C/V joints use two different type boots, one is made of plastic and the other of rubber. The plastic boot requires a heavy duty clamp and Installer, Special Tool C-4975. The soft boot requires a clamp with round edges that prevents the clamp from cutting the boot. Proceed with boot installation as follows.

The hard plastic boots used on the G.K.N. C/V Joints. Also use this procedure for installation of the boot clamp to C/V Joint.

LEFT INNER, LEFT AND RIGHT OUTER C/V JOINT WITH PLASTIC BOOTS

(1) Slide small clamp onto shaft.

(2) Position small end of boot over interconnecting shaft with lip of boot in third groove, towards center of interconnecting shaft (Fig. 14).

(3) Position clamp evenly over boot. Place clamp installer Tool C-4975 over bridge of clamp and tighten the nut until the jaws of the tool are closed completely, face to face (Fig. 15).

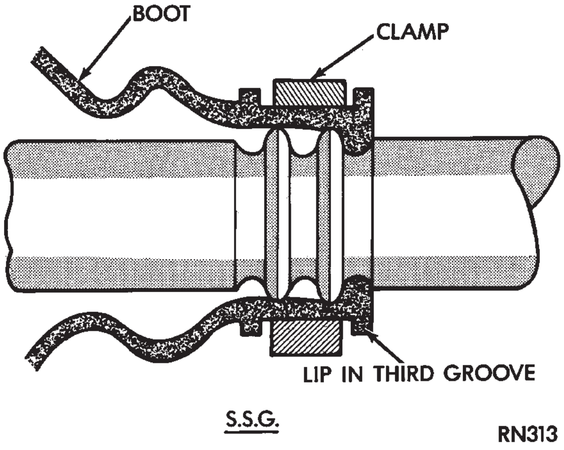


Fig. 14 Boot and Clamp Positioning S.S.G.

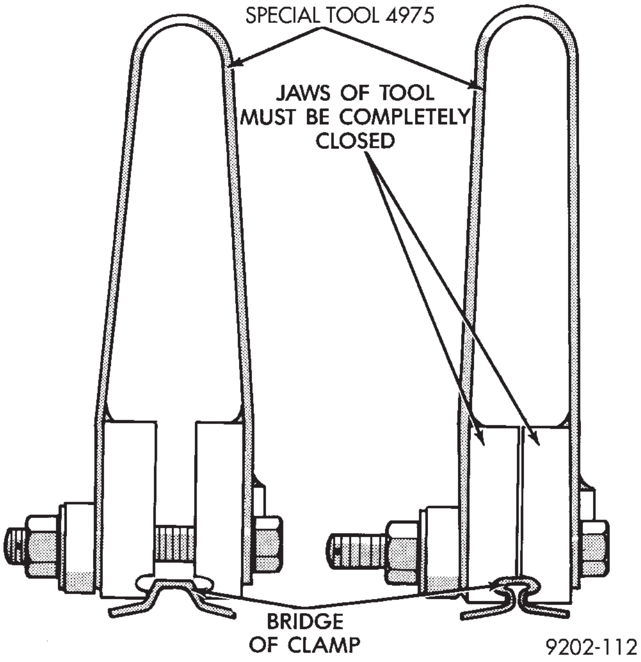


Fig. 15 Closing Clamp Bridge

(4) After attaching the boot to the shaft. Install the C/V joint following the procedure outlined under **Inner C/V Joint Assemble** or **Outer C/V Joint Assemble.**

(5) Position the large end of boot on housing and install clamp, crimp bridge of clamp with Crimper, Special Tool C-4975.

CAUTION: Use only the clamps provided in the boot package for this application, otherwise damage to the boot or C/V joint may occur.

RIGHT INNER C/V JOINT WITH RUBBER BOOT

(1) Slide small end boot clamp onto interconnecting shaft.

(2) Install boot onto interconnecting shaft, position boot on the flat between the locating shoulders (Fig. 16).

(3) Position clamp on boot and crimp bridge of clamp with Crimper Special Tool C-4124.

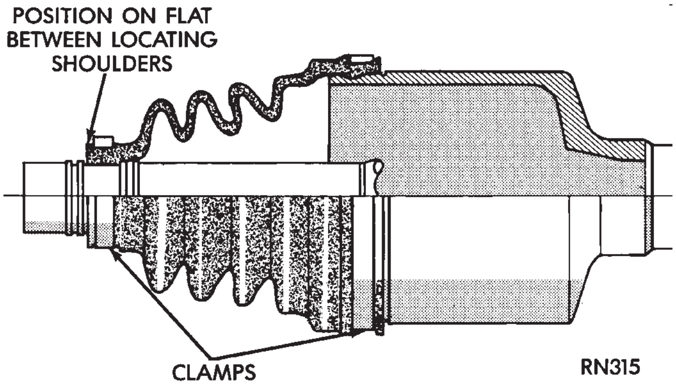


Fig. 16 Right Inner C/V Joint S.S.G.

(4) Install the C/V Joint following the procedure outlined under **Inner C/V Joint Assemble**.

(5) Position the large end of boot on housing and install clamp, crimp bridge of clamp with Crimper, Special Tool C-4124.

CAUTION: During any service procedures where knuckle and driveshaft are separated, thoroughly clean seal and wear sleeve with suitable solvent and lubricate BOTH components at assembly. Do not allow solvent to contact boot.

Lubricate wear sleeve (and seal) with Mopar Multi-Purpose Lubricant, or equivalent, as follows:

Wear Sleeve: Apply a full circumference 6 mm (1/4 inch) bead of lubricant to seal contact area. See (Fig. 11), Driveshaft Assemblies Install.

Seal: Fill lip to housing cavity (full circumference) and wet seal lip with lubricant.

S.S.G INNER C/V JOINT LARGE CLAMP (MANUAL TRANS ONLY)

(1) Install small clamp and inner C/V joint housing according to the procedures outlined in this manual.

(2) Position the boot over the outer C/V joint.

(3) Slide the large band clamp over the boot and position it evenly in the groove on the inner C/V joint boot. (Fig. 17).

(4) Use Clamp Locking Tool Snap-On YA3050 or equivalent shown in (Fig. 18) to install the clamp on the boot.

(5) Place the prongs of the clamp locking tool in the holes on the clamp and squeeze together until the two ends meet (Fig. 18).

DAMPER WEIGHTS

Damper weights are used on the left driveshaft assemblies of all front wheel drive vehicles (Fig. 19). These weights are attached to the interconnecting shaft and are available as a separate service part. They should be removed from the driveshaft assembly during driveshaft positioning specification procedures. When the weights are attached between the locating shoulders, tighten the fasteners to the following specifications:

- S.S.G. — 28 N•m (21 ft. lbs.)
- G.K.N. — 30 N•m (23 ft. lbs.)

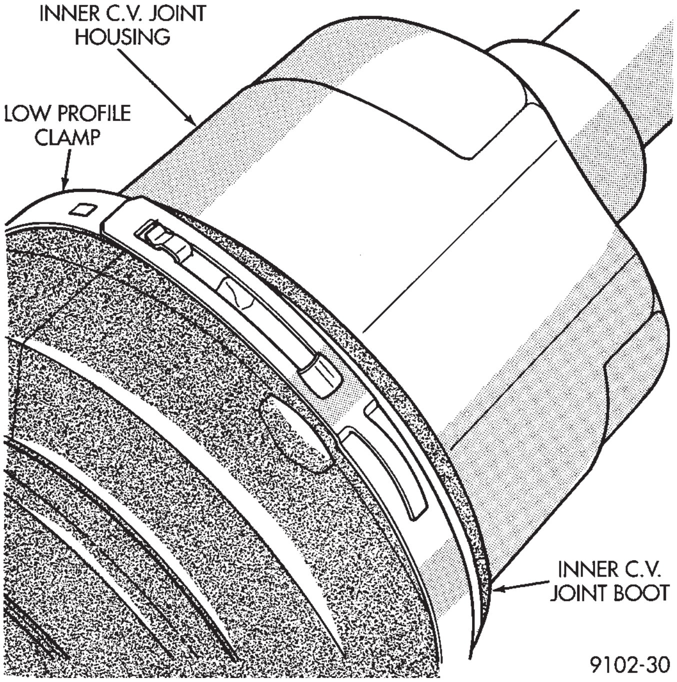


Fig. 17 Boot Clamp Installed

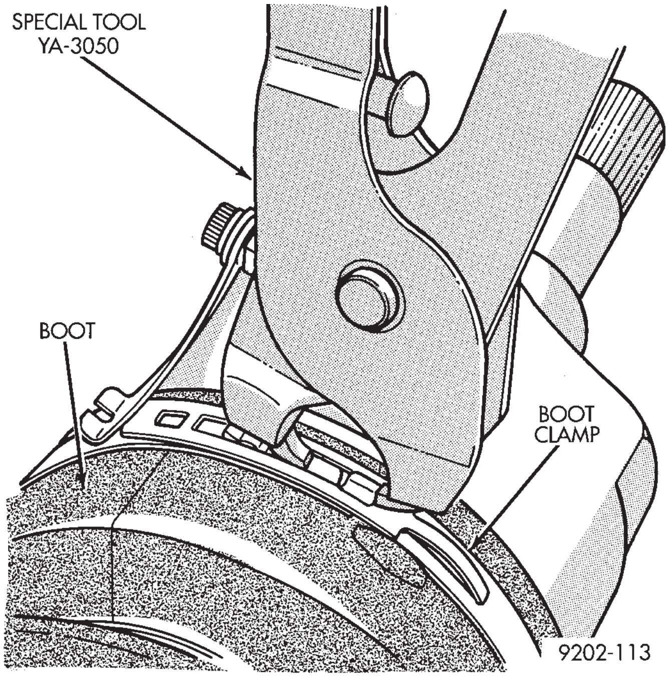


Fig. 18 Locking Boot Clamp

DRIVESHAFT POSITIONING SPECIFICATIONS

Front wheel drive vehicles have engine mounts with slotted holes allowing for side to side positioning of the engine. If the vertical bolts on right or left upper engine

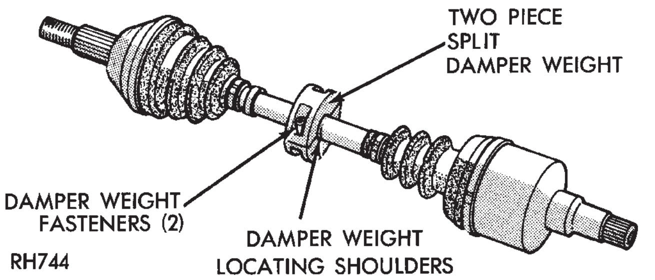


Fig. 19 Left Driveshaft with Damper Weight

mount have been loosened for any reason, or if vehicle has experienced front structural damage, driveshaft lengths must be checked and corrected, if required. A shorter than required driveshaft length can result in objectionable noise. A longer than required driveshaft length may result in potential damage.

Use of the following procedure will ensure satisfactory driveshaft engagement under all normal vehicle operating conditions.

(1) The vehicle must be completely assembled. Front wheels must be properly aligned and in the straight ahead position. The vehicle must be in a position so that the full weight of the body is distributed to all four tires. A platform hoist, or front end alignment rack, is recommended.

(2) Using a tape measure or other suitable measuring device. Measure the direct distance from the inner edge of the outboard boot to the inner edge of the inboard boot on both driveshafts. This measurement must be taken at the bottom (six o'clock position) of the driveshafts (Fig. 1).

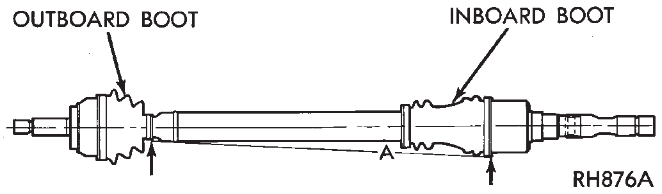


Fig. 1 Driveshaft Positioning

Note that the required dimension varies with car-line, engine, transaxle, and driveshaft manufacturer (Fig. 2).

(3) If the lengths of both shafts are within the range specified, no further action is required.

If either left or right driveshaft length is not within the specified range. Refer to Group 09, Engine Removal and Installation to properly position engine according to specified driveshaft lengths.

(4) If proper driveshaft lengths cannot be achieved within the travel limits available in the slotted engine mounts. Check for any condition that could effect the side to side position of the measurement locations (e.g., engine support brackets, siderail alignment, etc.).

(5) After ensuring proper driveshaft lengths the transmission shift linkage must be adjusted to ensure proper operation. Refer to Transaxle, Group 21.

BODY	ENGINE	SIDE	TRANSAXLE	MILLIMETERS	INCHES
AC AG AJ AP	2.2-L/2.5-L	RIGHT	AUTOMATIC	452-460	17.8-18.1
		LEFT	AUTOMATIC	188-196	7.4-7.7
		RIGHT	MANUAL	453-461	17.8-18.1
		LEFT	MANUAL	196-204	7.7-8.0
AC AG AJ AP	3.0-L	RIGHT	AUTOMATIC	453-461	17.8-18.1
		LEFT	AUTOMATIC	189 197	7.4-7.7
AC AY	3.3-L/3.8-L	RIGHT	AUTOMATIC	453-461	17.8 18.1
		LEFT	AUTOMATIC	189-197	7.4-7.7
AA	2.5-L	RIGHT	MANUAL	442-452	17.4-17.8
		LEFT (SSG)	MANUAL	165-175	6.5-6.9
		LEFT (GKN)	MANUAL	168-178	6.8-7.0
		LEFT	AUTOMATIC	166-176	6.5-6.9
		RIGHT	AUTOMATIC	442-452	17.4-17.8
	3.0-L	RIGHT	AUTOMATIC	171-181	6.7-7.1
		LEFT	AUTOMATIC	442-452	17.4-17.8
AG AJ	3.0-L	RIGHT	MANUAL	453-461	17.8-18.1
		LEFT	MANUAL	196-204	7.7-8.0

9302-123

Fig. 2 Driveshaft Identification and Dimensions

REAR SUSPENSION

INDEX

GENERAL INFORMATION

All front wheel drive passenger cars. Utilize a Trailing Arm Twist Beam type rear axle in conjunction with coil (or air) springs (Fig. 1). The blade type Trailing Arms, attached to body mounted pivots, provide fore and aft location of the suspension while a Track Bar provides lateral location.

Located in line with the spindles. An open channel section beam axle assures that the rear tires remain parallel to each other, and essentially perpendicular

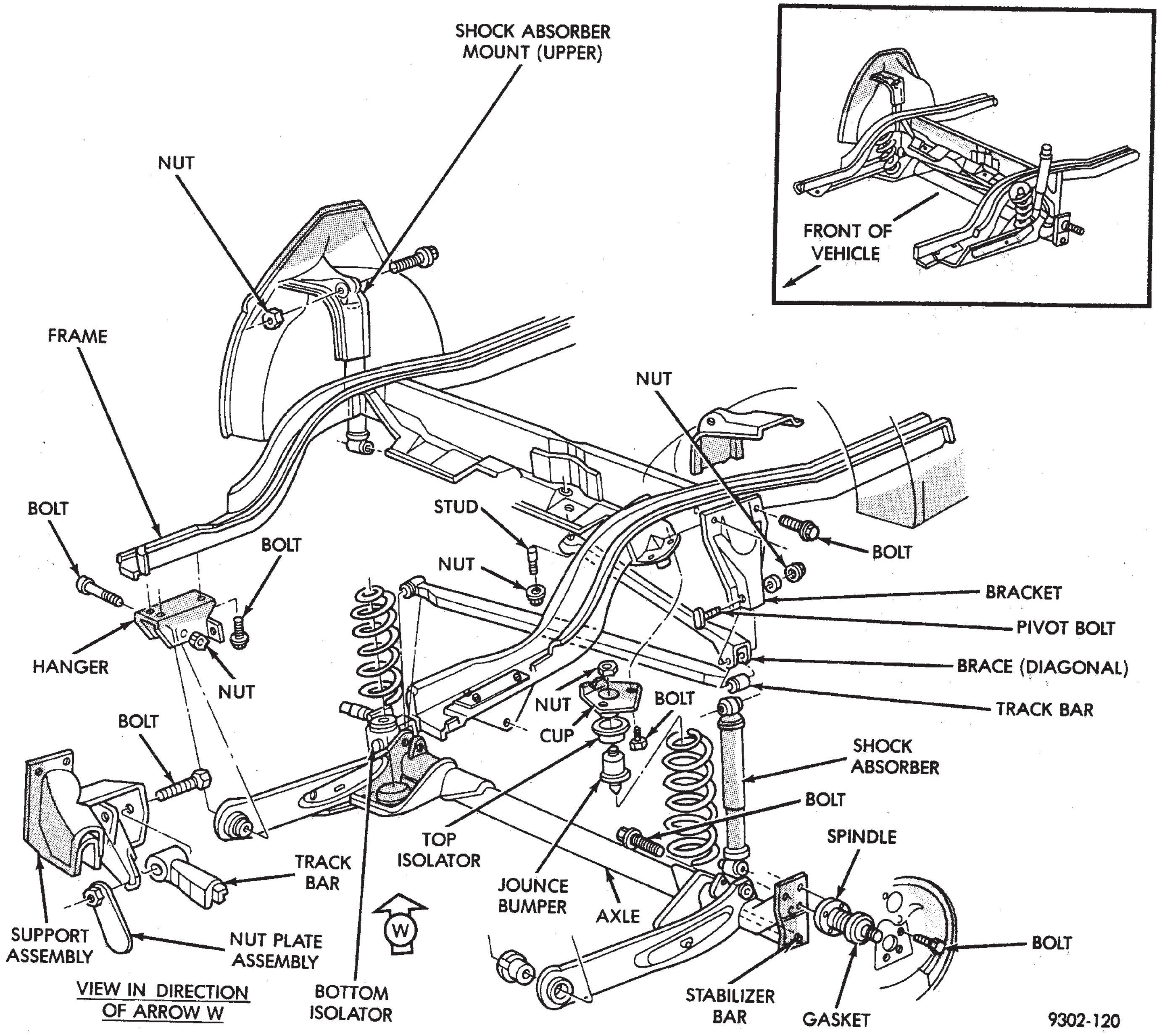


Fig. 1 Trailing Arm Rear Suspension

to the road surface. While being able to twist as one wheel moves vertically with respect to the other.

Roll resistance is provided partly by the axle's resistance to twist. But primarily by a torque tube or rod (depending on the suspension option called for) running through the channel and attached rigidly to its end plates by welding. Because the torque tube/rod is an integral part of the axle assembly, it cannot be individually replaced.

The spindles are bolted to the axle end (spindle mounting) plates and can be individually replaced if required. Rear wheel alignment changes require the use of shims between the spindle and axle end plates.

SHOCK ABSORBERS

REMOVAL

(1) Raise vehicle, see Hoisting, Group 0.

(2) Support axle and remove wheel and tire assembly.

(3) If equipped with air shocks, disconnect air lines.

(4) Remove upper and lower shock absorber fasteners, remove shock absorbers (Fig. 2).

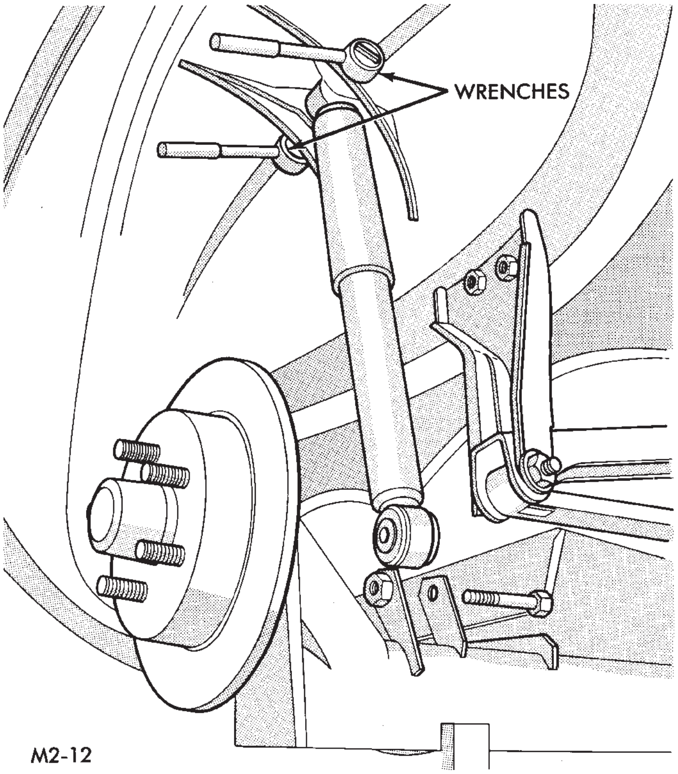


Fig. 2 Remove/Install Shock Absorber Fasteners

INSPECTION

Inspect for evidence of fluid leakage from upper end of reservoir. (Actual leakage will be a stream of fluid running down and leaking off lower end). Slight seepage is not unusual and will not effect performance.

INSTALLATION

(1) Position shock absorber on car. Install upper and lower fasteners loosely to hold shock absorber in place.

(2) Tighten upper fastener to 61 N•m (45 ft. lbs.) torque. Connect air line, if so equipped.

(3) Install wheel and tire assembly, tighten wheel stud nuts to 129 N•m (95 ft. lbs.) torque. Lower vehicle to ground.

(4) With suspension supporting the weight of the vehicle. Tighten lower shock absorber fastener to 54 N•m (40 ft. lbs.) torque.

COIL SPRINGS AND JOUNCE BUMPER

REMOVAL

(1) Lift vehicle see hoisting Group 0.

(2) Support axle assembly and remove both lower shock absorber attaching bolts.

(3) Lower axle assembly until spring and spring upper isolator can be removed (Fig. 3). **Do not stretch brake hose.**

(4) Remove two screws holding cup to rail (Fig. 1). Remove assembly.

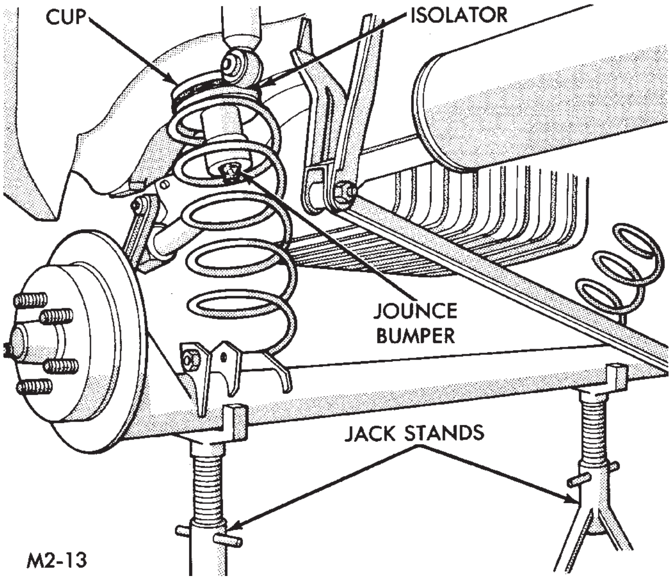


Fig. 3 Coil Spring & Jounce Bumper

INSTALLATION

(1) Position cup to rail. Install and tighten attaching bolts to 8 N•m (70 in. lbs.) torque.

(2) Install isolator over jounce bumper and install spring.

(3) Raise axle and loosely assemble both shock absorber to axle mounting bolts. Remove axle support and lower vehicle.

(4) With suspension supporting the weight of the vehicle. Tighten both shock absorber attaching bolts to 61 N•m (45 ft. lbs.) torque.

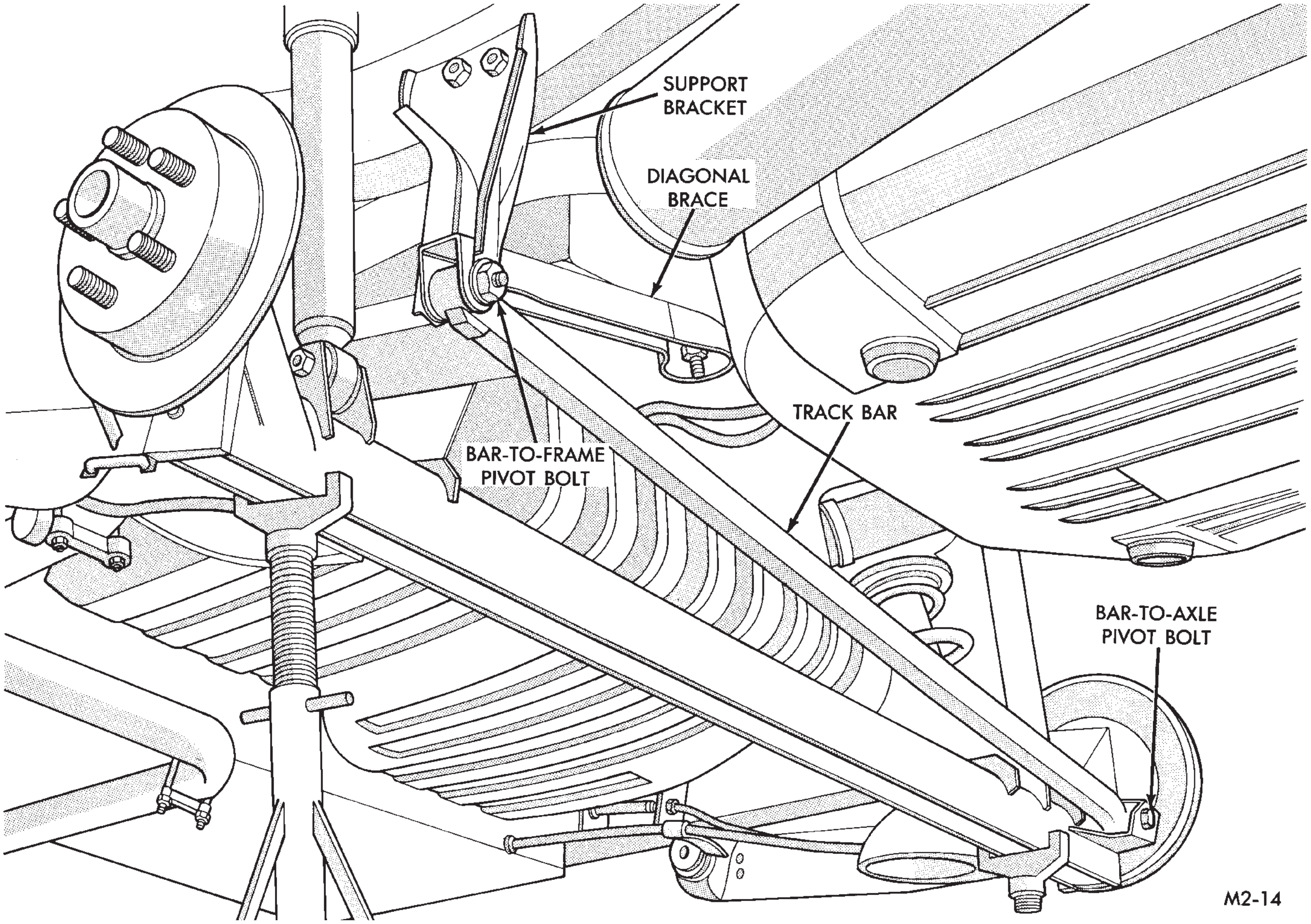


Fig. 4 Track Bar Brace Bracket

TRACK BAR-BRACE-BRACKET (FIG. 4)

REMOVAL

(1) Raise vehicle, see Hoisting, Group 0.

(2) Raise rear axle to curb height, with jack stands (Fig. 5).

(3) Remove track bar-to-axle pivot bolt. And remove track bar-to-frame pivot bolt. Remove track bar.

(4) Remove diagonal brace-to-underbody stud nut. Remove diagonal brace.

(5) Remove two track bar bracket-to-frame rail bolts. Remove bracket.

INSTALLATION

(1) Position support bracket on frame rail, install and tighten (2) bolts to 54 N●m (40 ft. lbs.) torque.

(2) Fit diagonal brace into support bracket and over underbody stud, tighten stud nut to 75 N●m (55 ft. lbs.) torque.

(3) Fit track bar to diagonal brace, loose assemble pivot bolt with nut and washer on rear side. Attach the other end of track bar to bracket on axle and tighten to 95 N●m (70 ft. lbs.) torque. Tighten nut on track bar-to-frame bolt to 75 N●m (55 ft. lbs.) torque.

PIVOT BUSHING AC AND AY BODY

REMOVE FROM VEHICLE

(1) Raise vehicle (see Hoisting, Group 0). Remove brake hose mounting bracket screw (Fig. 5).

(2) Detach park brake cable at connector and from hanger bracket (Fig. 5).

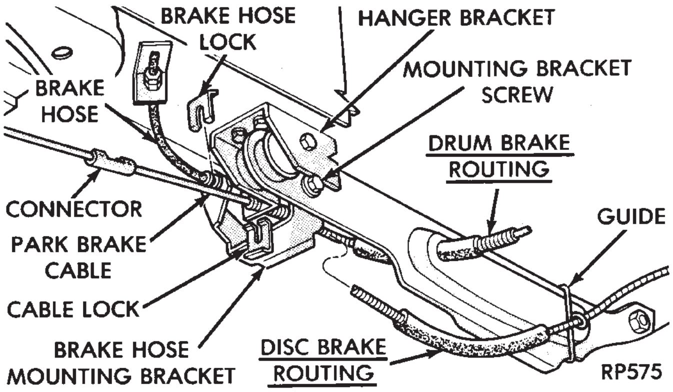


Fig. 5 Remove Brake Hose Mounting Bracket Screw and Park Brake Cable

WARNING: WHEN REMOVING THE REAR AXLE PIVOT BUSHING ON VEHICLES EQUIPPED WITH EITHER REAR COIL SPRINGS OR AIR SUSPENSION. THE REAR AXLE MUST BE SUPPORTED BY THE AXLE AND TRAILING ARM TO ENSURE ADEQUATE SUPPORT OF REAR AXLE.

(3) Support the rear axle assembly at both the axle channel and the trailing arm (Fig. 6). Then remove lower shock absorber to rear axle mounting bolt (Fig. 6).

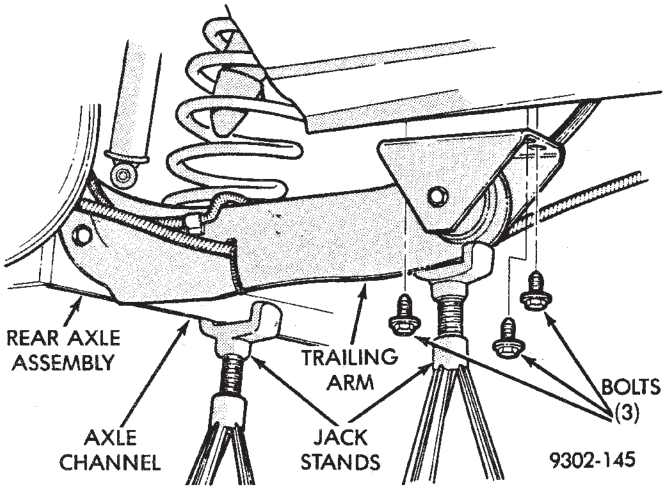


Fig. 6 Remove Pivot Bushing Hanger Bracket Bolts

(4) Remove hanger bracket to frame rail bolts (Fig. 7).

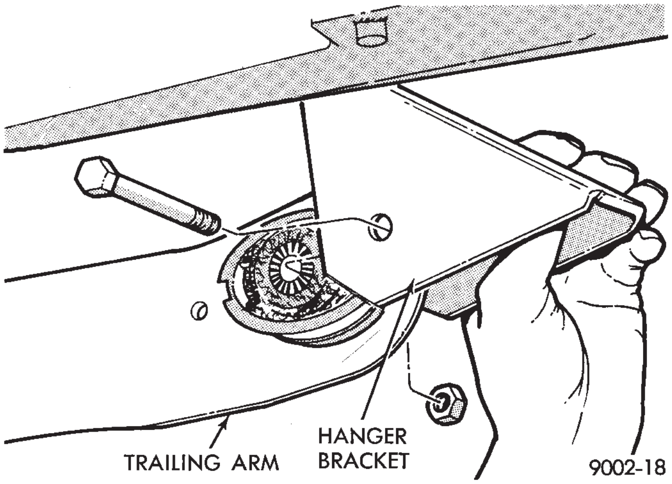


Fig. 7 Remove Hanger Bracket

(5) Lower axle assembly down enough to remove pivot bolt and hanger bracket (Fig. 7). Right side trailing arm shown.

PIVOT BUSHING REMOVAL FROM AXLE ASSEMBLY

Remove bushing with Remover/Installer Special Tool C-4212-L (Press) and 3 piece set, Special Tool 6122 (Receiver Support Bridge, Bushing Remover/Installer and Bushing Remover).

(1) Install receiver (support) bridge into base of press C-4212-L and bushing Remover/Installer disc onto screw.

(2) Position assembly with receiver bridge supporting trailing arm while turning screw to begin bushing removal.

(3) After bushing has begun to move replace bushing remover/installer (round disc) with bushing remover (oval shaped disc). Use this assembly to finish pressing bushing out of trailing arm (Fig. 8).

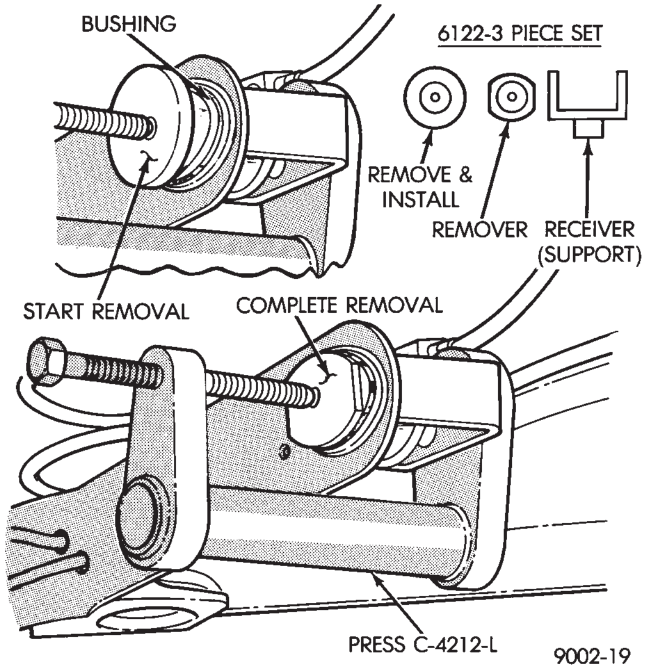


Fig. 8 Tools Installed To Remove Bushing

PIVOT BUSHING INSTALLATION

(1) Align the bushing with the bushing mounting hole in the trailing arm bracket (Fig. 9). Tap bushing in slightly to hold position.

(2) Assemble bushing installer Tool onto press screw and support bridge into press base. **Position assembly as shown in (Fig. 10) and press bushing into arm to depth shown in (Fig. 9).**

(3) Position hanger bracket on pivot bushing, and install through bolt, loose assemble nut (Fig. 11). Right side trailing arm shown.

(4) Position hanger to frame rail (a suitable drift will aid in guiding hanger bracket into position). Install and tighten screws to 75 N●m (55 ft. lbs.) torque (Fig. 12). Install lower shock absorber mounting bolt, **but do not tighten.**

(5) Position brake hose mounting bracket to trailing arm, install and tighten retaining screw to 11 N●m (95 in. lbs.) torque (Fig. 13).

(6) Attach park brake cable housing to hanger bracket and cable to connector.

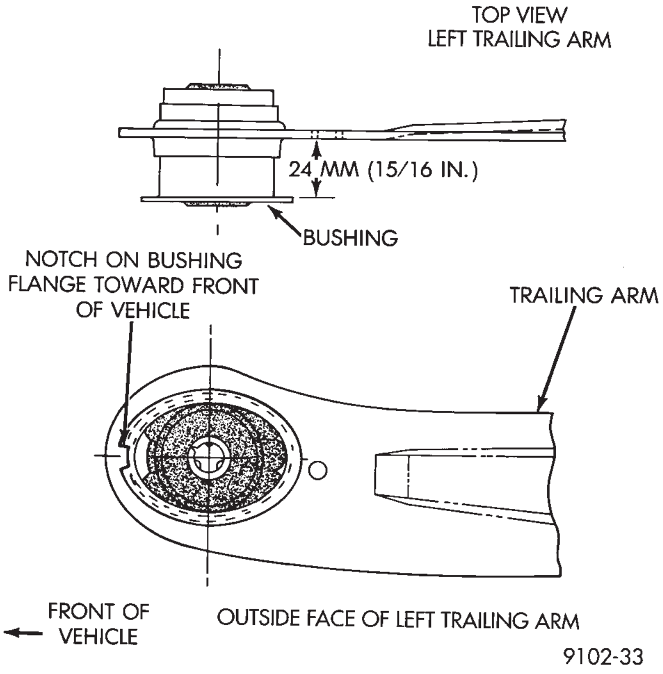


Fig. 9 Proper Position of Pivot Bushing

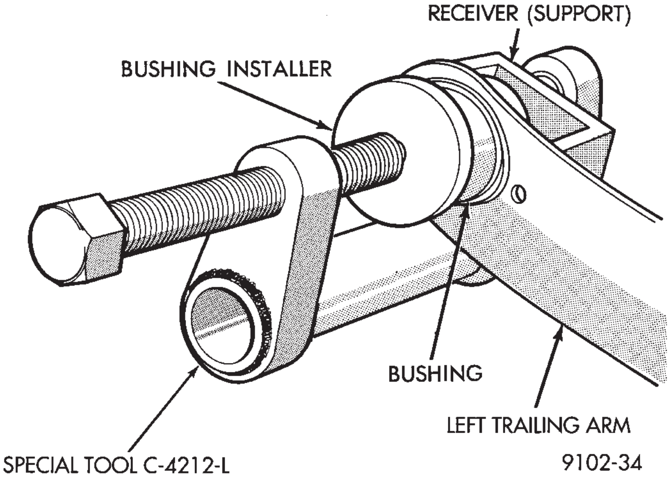


Fig. 10 Tools Assembled for Bushing Installation

(7) Lower vehicle with suspension supporting vehicle weight, trailing arm at design height. Tighten pivot bolt nut and lower shock absorber mounting bolt to 61 N•m (45 ft. lbs.) torque.

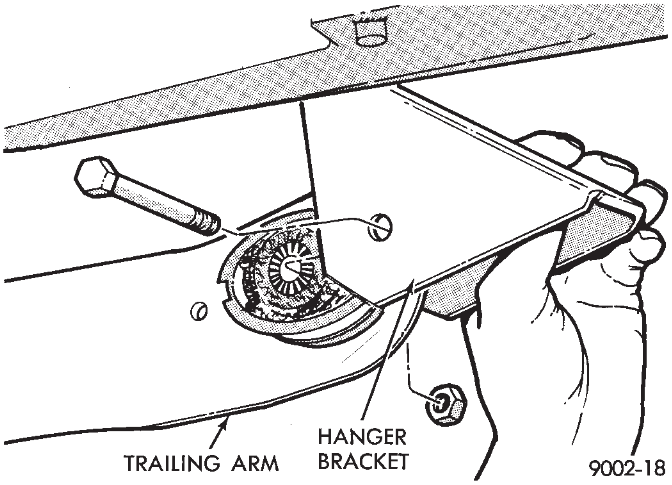


Fig. 11 Install Hanger Bracket to Pivot Bushing

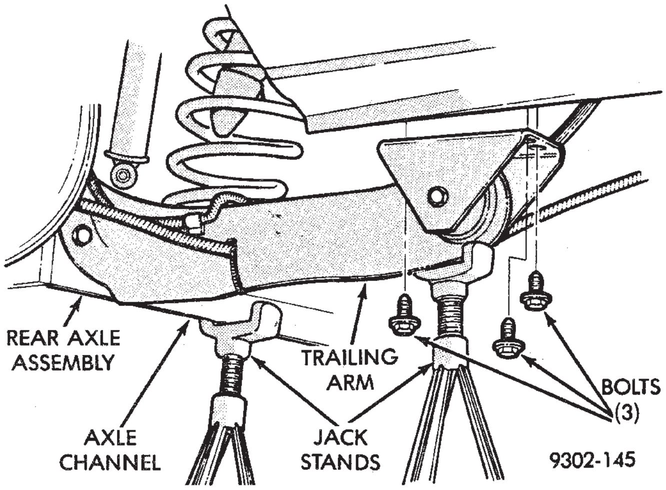


Fig. 12 Install Hanger Bracket on Frame

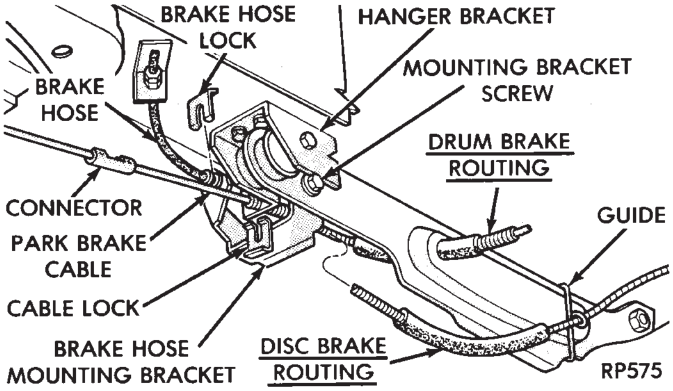


Fig. 13 Brake Hose Bracket & Park Brake Cable

PIVOT BUSHING AC AG AJ AP BODY

REMOVE FROM VEHICLE

(1) Raise vehicle (see Hoisting, Group 0). Remove brake hose mounting bracket screw (Fig. 1).

(2) Detach park brake cable at connector and from hanger bracket (Fig. 1).

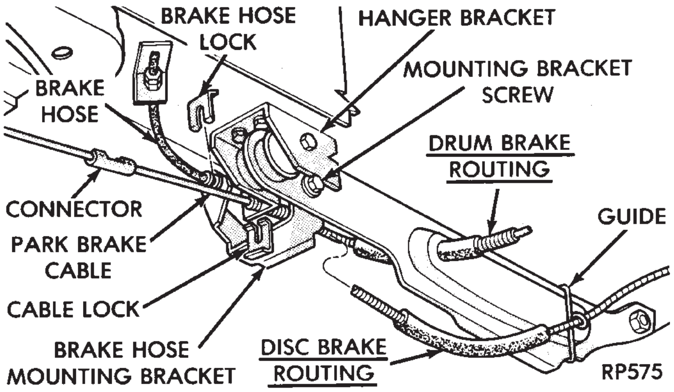


Fig. 1 Remove Brake Hose Mounting Bracket Screw and Park Brake Cable

WARNING: WHEN REMOVING THE REAR AXLE PIVOT BUSHING ON VEHICLES EQUIPPED WITH EITHER REAR COIL SPRINGS OR AIR SUSPENSION. THE REAR AXLE MUST BE SUPPORTED BY THE AXLE AND TRAILING ARM TO ENSURE ADEQUATE SUPPORT OF REAR AXLE.

(3) Support the rear axle assembly at both the axle channel and the trailing arm with jack stands (Fig. 2). Then remove lower shock absorber to rear axle mounting bolt (Fig. 2).

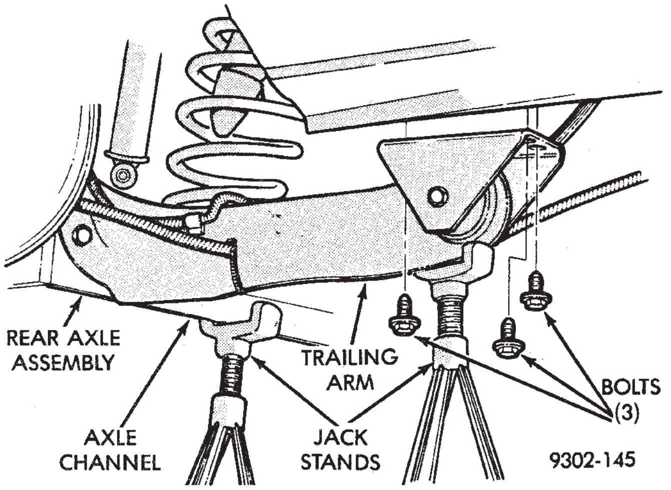


Fig. 2 Remove Pivot Bushing Hanger Bracket Bolts

(4) Remove hanger bracket to frame rail bolts (Fig. 3).

(5) Lower axle assembly down enough to remove pivot bolt and hanger bracket (Fig. 3). Right side trailing arm shown.

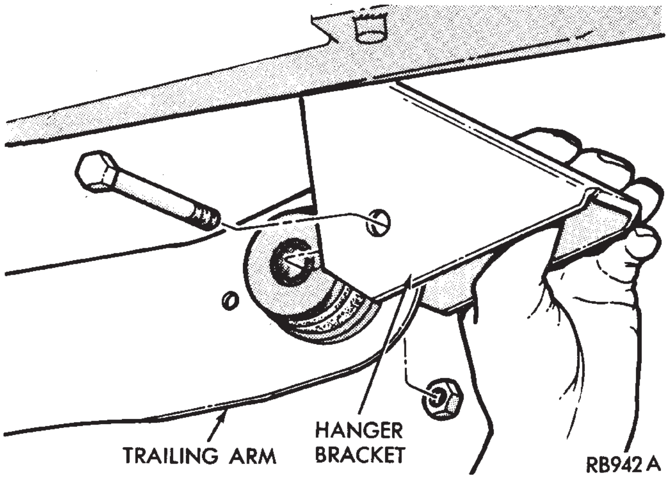


Fig. 3 Remove Hanger Bracket

PIVOT BUSHING REMOVAL FROM AXLE ASSEMBLY

Remove bushing with Remover/Installer Special Tool C-4702-7 Press. And 3 piece set, Special Tool C-4212 and C-4366-1 (Receiver Support Bridge, Bushing Remover/Installer and Bushing Remover).

(1) Install receiver (support) cup C-4366-1 into base of press C-4212 and Bushing Remover Cup C-4702-7 onto screw.

(2) Position assembly with receiver bridge supporting trailing arm while turning screw to begin bushing removal.

(3) After bushing has begun to move replace bushing remover/installer (round disc) with bushing remover (oval shaped disc). Use this assembly to finish pressing bushing out of trailing arm (Fig. 4).

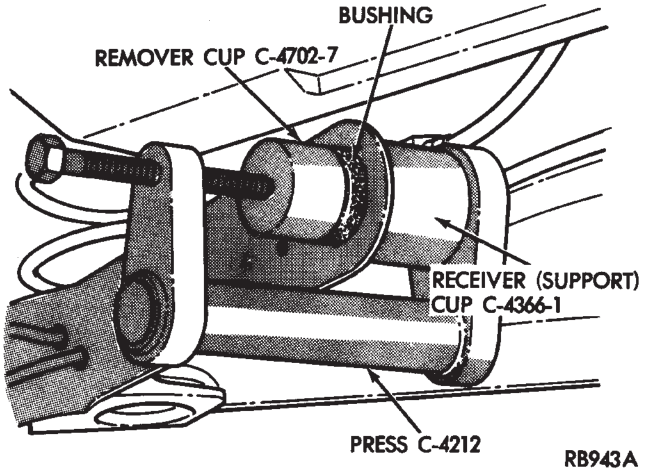


Fig. 4 Tools Installed To Remove Bushing

PIVOT BUSHING INSTALLATION

(1) Align the bushing with the bushing mounting hole in the trailing arm bracket (Fig. 5). Tap bushing in slightly to hold it in position on trailing arm.

(2) Assemble Bushing Installer Special Tool C-4702-2 onto press screw and Support Cup Special

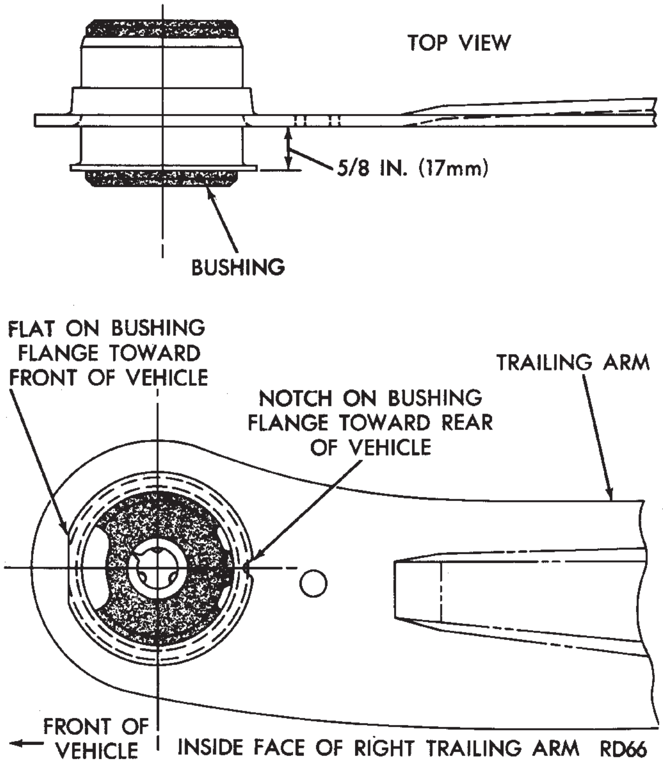


Fig. 5 Proper Position of Pivot Bushing

Tool C-4366-1 into press base. **Position assembly as shown in (Fig. 6) and press bushing into arm to depth shown in (Fig. 5).**

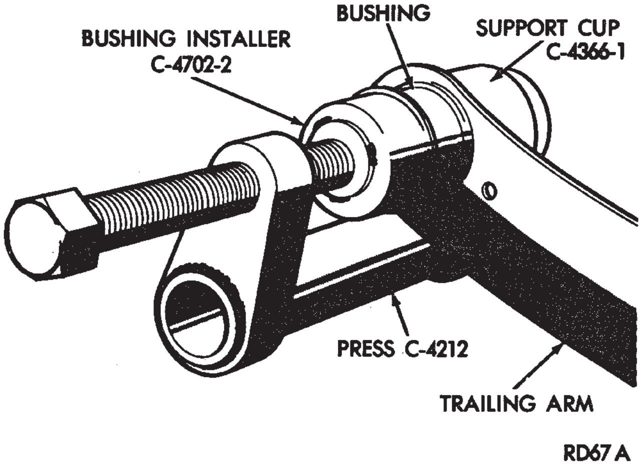


Fig. 6 Tools Assembled for Bushing Installation

(3) Position hanger bracket on pivot bushing, and install through bolt, loose assemble nut (Fig. 7). Right side trailing arm shown.

(4) Position hanger to frame rail (a suitable drift will aid in guiding hanger bracket into position). Install and tighten screws to 75 N●m (55 ft. lbs.) torque (Fig. 8). Install lower shock absorber mounting bolt, **but do not tighten.**

(5) Position brake hose mounting bracket to trailing arm, install and tighten retaining screw to 11 N●m (95 in. lbs.) torque (Fig. 9).

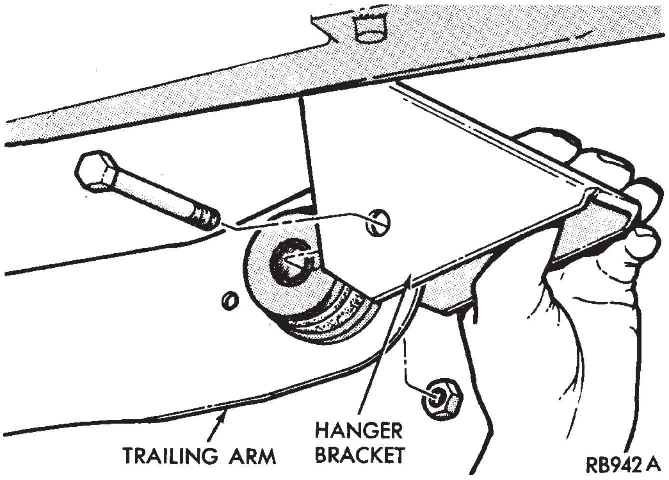


Fig. 7 Install Hanger Bracket to Pivot Bushing

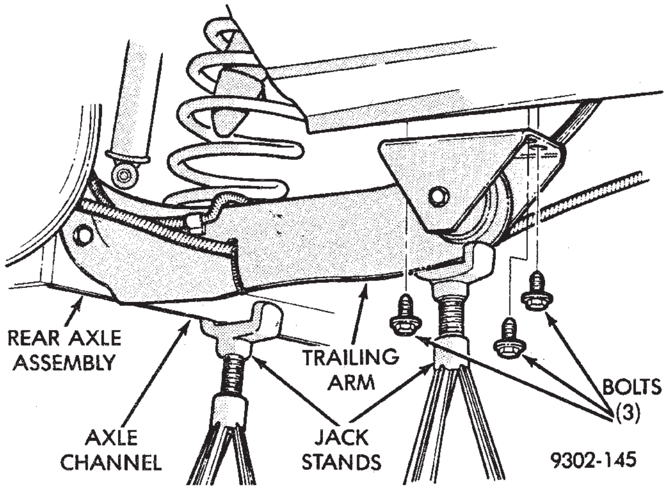


Fig. 8 Install Hanger Bracket on Frame

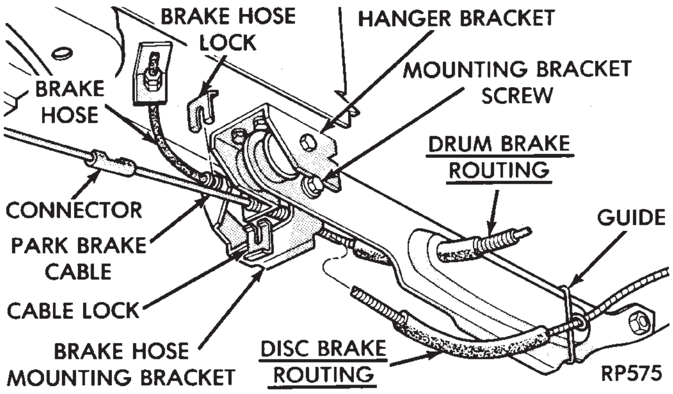


Fig. 9 Brake Hose Bracket & Park Brake Cable

(6) Attach park brake cable housing to hanger bracket and cable to connector.

(7) Lower vehicle with suspension supporting vehicle weight, trailing arm at design height. Tighten pivot bolt nut and lower shock absorber mounting bolt to 61 N●m (45 ft. lbs.) torque.

REAR AXLE ASSEMBLY

REMOVE

(1) Raise vehicle (see Hoisting, Group 0). Support axle with jack stands and remove wheel and tire assembly.

(2) Separate park brake cable at connector. Detach cable housing from hanger bracket (Fig. 1).

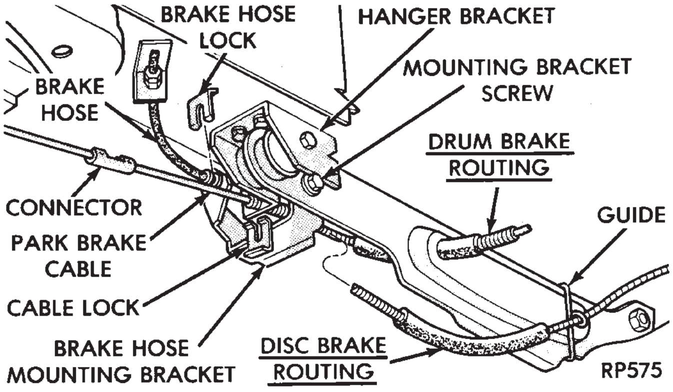


Fig. 1 Remove Brake Hose Mounting Bracket Screw and Park Brake Cable

(3) Remove lock and separate brake tube assembly from brake hose mounting bracket (Fig. 1).

(4) Remove lower shock absorber through bolts and track bar to axle pivot bolt. Support track bar end with wire (Fig. 2).

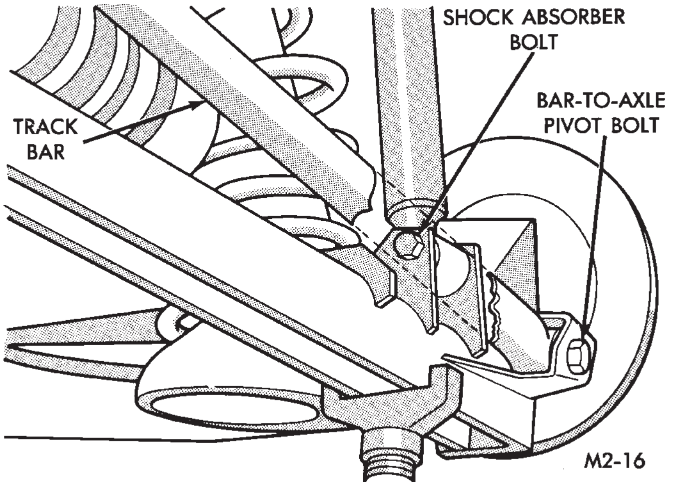


Fig. 2 Remove Shock Absorber and Track Bar Bolts

(5) Lower axle until spring and isolator assemblies can be removed. Remove spring and isolator assemblies (Fig. 3).

(6) Support pivot bushing end of the trailing arms. (as well as axle beam with jack stands) Remove pivot bushing hanger bracket to frame screws. Lower and remove axle assembly from vehicle.

(7) Remove rear brake assemblies, see Group 5 for proper procedure.

(8) For pivot bushing removal and installation see PIVOT BUSHING this group.

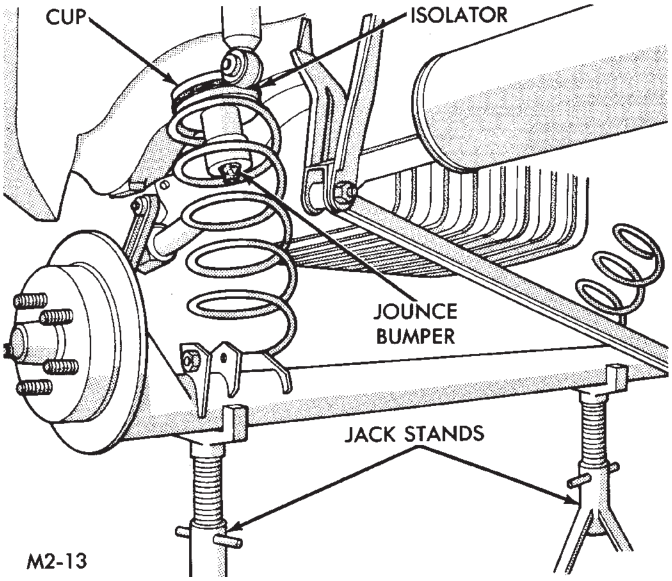


Fig. 3 Remove/Install Coil Spring and Isolator Assembly

INSTALLATION

(1) Raise and support axle on jack stands.

(2) Attach pivot bushing hanger brackets to frame rail (Fig. 4). Tighten screws to 61 N●m (45 ft. lbs.) torque.

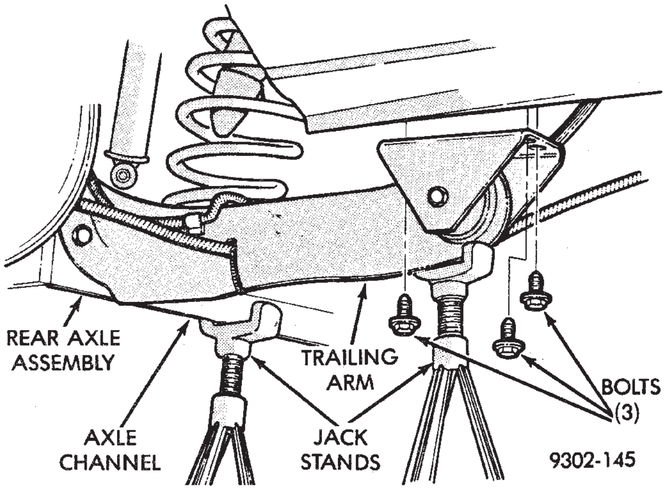


Fig. 4 Attach Hanger Brackets to Frame

(3) Install springs and isolators (Fig. 5).

(4) Raise axle and install shock absorber and track bar through bolts **loose assemble only** (Fig. 6).

(5) Install brake assembly as follows:

DRUM BRAKE ASSEMBLY

(1) Position spindle, seal, and brake support to axle after routing park brake cable through trailing arm opening and brake tube over arm (Figs. 1). Install the 4 spindle mounting bolts finger tight. Then torque the 4 spindle mounting bolts to 75 N●m (55 ft. lbs.) torque.

(2) Install brake drum and bearings.

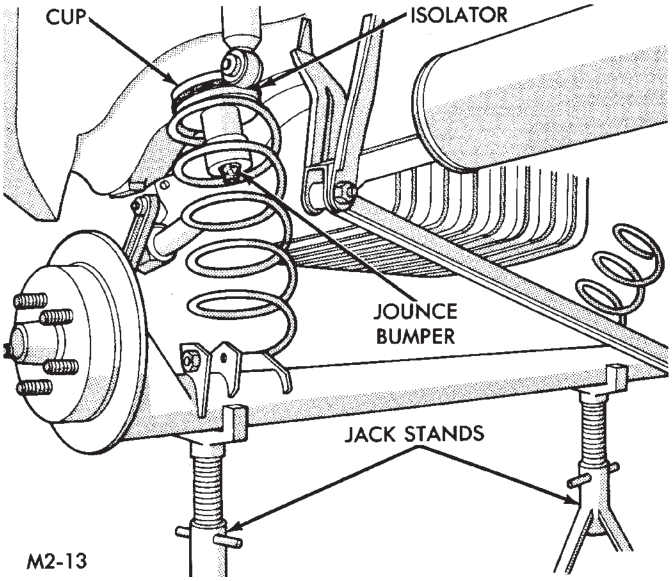


Fig. 5 Install Springs and Isolators

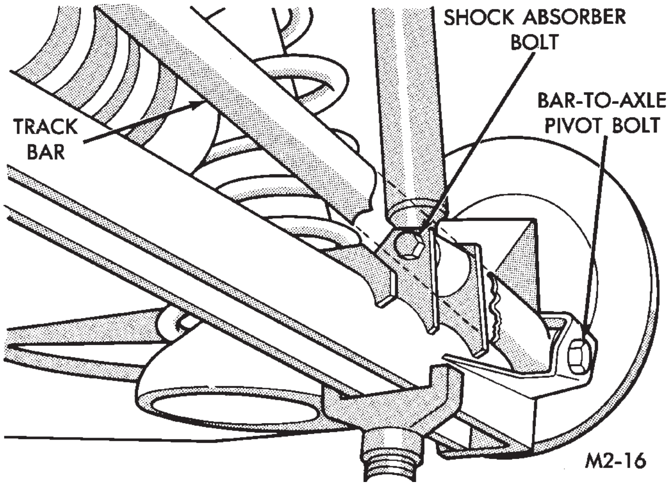


Fig. 6 Install Shock Absorber and Track Bar Fasteners (Bolts)

(3) Install washer and nut. Tighten nut to 27-34 N●m (240-300 in. lbs.) torque while rotating brake drum. Then back off nut to completely release preload. Finger tighten nut.

(4) Position nut lock with one pair of slots in-line with cotter pin hole. Install cotter pin. Clean and install grease cap.

DISC BRAKE ASSEMBLY

(1) Position caliper support and spindle to axle. Install the 4 spindle mounting bolts finger tight. Then torque the 4 spindle mounting bolts to 75 N●m (55 ft. lbs.) torque.

(2) Install hub and bearings.

(3) Install washer and nut. Tighten to 27-34 N●m (240-300 in. lbs.) torque while rotating hub. Then back off nut to completely release preload. Finger tighten nut.

(4) Position nut lock with one pair of slots in-line with cotter pin hole. Install cotter pin. Clean and install grease cap.

(5) Install braking disc and adapter. Install caliper assembly (see Rear Disc Brake) in Brakes Section, Group 5.

(6) Attach brake hose and parking brake cable to caliper and suspension arm (Fig. 7). Install brake hose mounting bracket to caliper support.

(7) Route park brake cable through hanger bracket and lock housing end into bracket. Install cable end into (intermediate) connector (Fig. 7).

(8) Install brake hose and fitting into bracket and install lock. Attach brake tube assembly to hose fitting and tighten to 16 N●m (140 in. lbs.) torque (Fig. 7).

(9) Install wheel and tire assemblies and tighten wheel stud nuts to 129 N●m (95 ft. lbs.) torque. Remove jacks and lower vehicle.

(10) With suspension supporting vehicle, torque lower shock absorber bolts to 61 N●m (45 ft. lbs.). Then torque track bar bolt to 95 N●m (70 ft. lbs.).

(11) Bleed brake system. See BRAKES, Group 5.

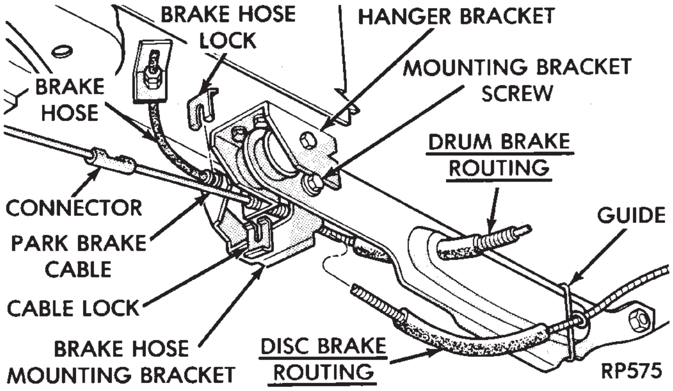


Fig. 7 Reconnect Brake Tube and Park Brake Cable

AUTOMATIC AIR LOAD LEVELING SYSTEM

INDEX

GENERAL INFORMATION

The automatic air load leveling system includes the following (Fig. 1).:

- Compressor Assembly
- Control Module Wiring Harness
- Air Lines
- Compressor Relay
- Air Shock Absorbers
- Air Dryer

This system is used to supplement standard suspension systems on vehicles so equipped.

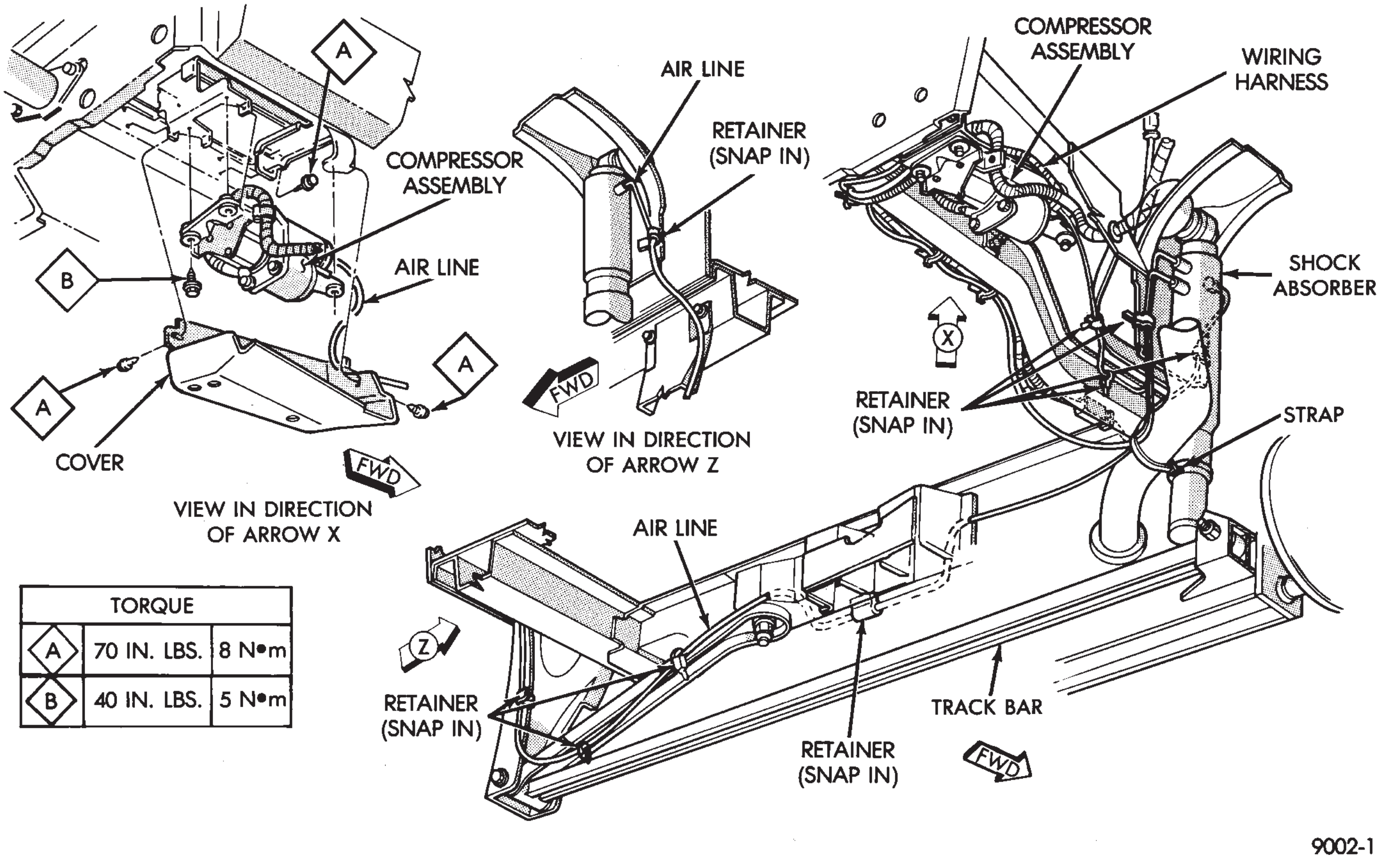
MAJOR COMPONENTS

COMPRESSOR ASSEMBLY

The compressor assembly is driven by an electric motor and supplies air pressure between 1172 to 1516 kPa (170 to 220 psi) (Fig. 2). A solenoid operated exhaust valve, located in the compressor head assembly, releases air when energized.

CONTROL MODULE

The Control Module (CM) is a device that controls the ground circuits for the compressor relay and the exhaust valve solenoid. A microprocessor within the module limits the compressor pump operation time to 140 to 160 seconds. To prevent damage to the compressor motor.



TORQUE		
A	70 IN. LBS.	8 N•m
B	40 IN. LBS.	5 N•m

Fig. 1 Automatic Air Load Leveling System

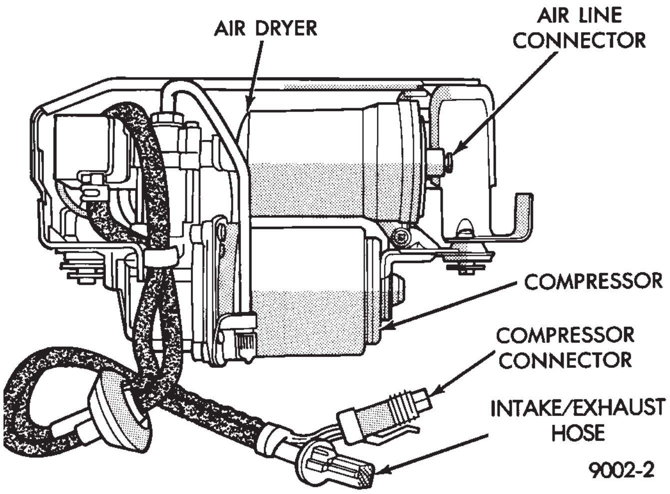


Fig. 2 Compressor Assembly

In addition, there is an air regeneration cycle that is controlled by the Control Module (CM). If the height sensor signal is in the neutral or high position. When the ignition switch is turned to the ON position, after a 22 to 28 second delay, the compressor will run from 2 to 6 seconds.

To prevent excessive cycling between the compressor and the exhaust solenoid circuits during normal ride conditions. A 12 to 18 second delay is incorporated in the microprocessor.

HEIGHT SENSOR

A magnetic switch type sensor, located in the right air shock absorber, monitors rear vehicle height. The sensor sends signals to the (CM) relating to vehicle rear suspension status (low, trim, high).

AIR LINES AND FITTINGS

To release an air supply line from a rear shock absorber assembly. Push in (toward shock absorber) on the plastic ring of the shock absorber air line fitting. Then while holding in the plastic ring on shock absorber fitting pull the air supply line strait out of fitting (Fig. 3).

The fitting has a unique push-in feature. A brass type collet locks the air line in place. One rubber O-ring seals the air line to prevent air leakage. To attach air line, push into fitting (Fig. 4).

COMPRESSOR RELAY

The relay is mounted to a bracket on the Control Module (CM). When the relay is energized, it allows the compressor to operate. This unit is controlled by the CM.

AIR ADJUSTABLE SHOCK ABSORBERS

Air shock absorbers are essentially hydraulic shock absorbers with a neoprene bladder sealing upper and lower sections together. This creates an air cylinder inside of the shock absorber.

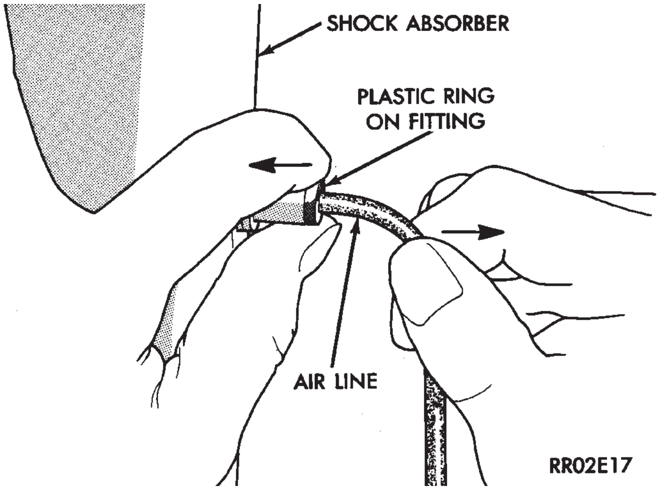


Fig. 3 Release Air Line from Fitting

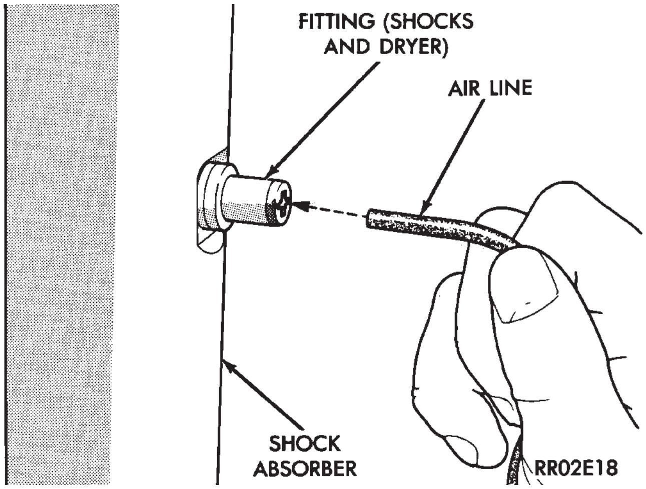


Fig. 4 Push Air Line into Fitting

AIR DRYER

The air dryer is attached to the compressor. This component serves two purposes; it absorbs moisture from the atmosphere before it enters the system. And with the internal valves maintains a residual system pressure of 69 to 152 kPa (10 to 22 psi).

AIR CHECK, RESIDUAL (FIG. 5).

The air dryer has a valves arrangement that maintains 69 to 152 kPa (10 to 22 psi) in the air shocks. This is to improve the ride characteristics of the vehicle under light load conditions. To test this function, perform the following procedure:

(1) Remove the air line from the dryer and right shock absorber. Attach a piece of bulk nylon tubing to one side of a Pressure Gauge (0-300 psi), and to the right shock absorber (Fig. 5).

(2) Attach another piece of nylon tubing from the dryer (compressor) to other side of the pressure gauge.

A compression ball sleeve nut and sleeve for 3/16 inch tubing with ball sleeve connector and an internal pipe T-fitting. Can be used to attach the tubing to the pressure gauge.

(3) Cycle ignition from OFF to ON.

(4) Apply a load to the rear of the vehicle (two assistants or approximately 300-325 lbs.) to run compressor and raise the vehicle.

(5) Remove the load applied in Step 4. Allow the system to exhaust and lower the vehicle.

(6) When no more air can be exhausted, the gauge should indicate 69 to 152 kPa (10 to 22 psi).

(7) Remove the pressure gauge and nylon tubing. Attach the air line between the dryer and shock absorber. Repeat Steps 3, 4, and 5 to ensure system air pressure is in the shocks.

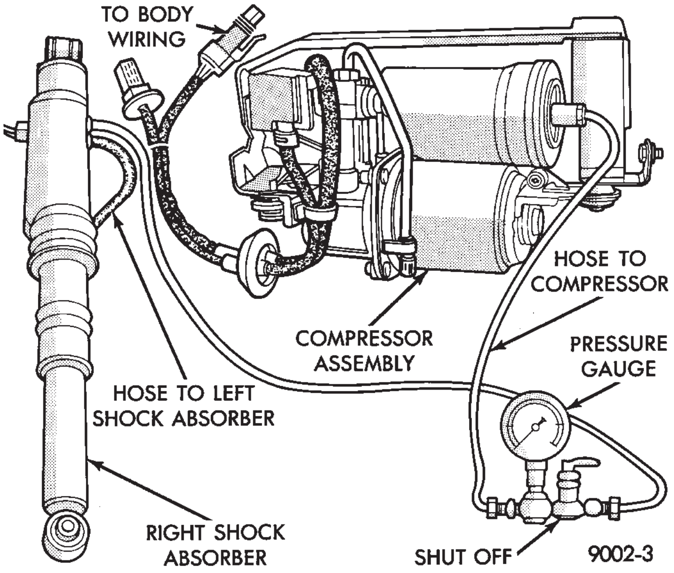


Fig. 5 Pressure Gauge Installed in System

LEAK CHECKS

(1) Repeat Residual Air Check Steps 1, 2, 3, and 4. Allow the system to fill until gauge reads 483 to 621 kPa (70 to 90 psi).

If compressor is permitted to run until it reaches its maximum output pressure, the vent solenoid valve will function as a relief valve. The resulting leak down, when compressor shuts off, will indicate a false air leak.

(2) With load still applied, disconnect wire harness connector from the control module, then remove applied load. Vehicle should rise. Cycle ignition switch to OFF.

(3) Observe if pressure leaks down or holds steady (wait approximately 15 minutes).

(A) If system will not inflate beyond 345 kPa (50 psi). A severe leak may be indicated. Check for a pinched pressure line between compressor and shocks.

(B) The standard soap solution check procedure is acceptable.

(C) If pressure holds steady, perform the diagnosis procedures.

SYSTEM OPERATION

RAISING VEHICLE HEIGHT

When weight is added to the rear suspension. The body of the vehicle is lowered, moving the height sensor down.

This action will activate the internal time delay circuit. After a time delay of 12 to 18 seconds. The control module (CM) activates the ground circuit to the compressor relay.

With the relay energized, the compressor motor runs and air is sent through the system. As the shock absorbers inflate, the body moves upward to a corrected position. When the body reaches the correct height, the control module (CM) stops the compressor operation.

LOWERING VEHICLE HEIGHT

When the weight is removed from the vehicle. The body moves upward, which allows the height sensor to move upward and activate the internal time delay circuit.

After a time delay of 12 to 18 seconds. The (CM) activates the exhaust solenoid circuit. Air is exhausted from the shock absorbers through the air dryer and exhaust solenoid to the atmosphere.

As the body lowers, the height sensor is lowered toward its original position. When the body reaches the original vehicle height, the (CM) opens the exhaust solenoid valve circuit.

COMPRESSOR PERFORMANCE TEST

This test can be performed on the vehicle. It is used to evaluate compressor current draw, pressure output, and leak down.

(1) Disconnect the compressor motor wiring harness connector.

(2) Disconnect air line between dryer and right shock absorber.

(3) Connect an air pressure gauge into the system (Fig. 5).

(4) Connect an ammeter in series between the red wire terminal on compressor connector and a 12 volt power source. Also, connect a ground wire from the black wire terminal on the compressor connector to a good ground on the frame (Fig. 6).

(5) If the current draw to the compressor motor exceeds 21 amperes, replace the compressor assembly.

(6) When the air pressure stabilizes at 827 kPa (120 psi), disconnect the (+) wire lead from the connector. Replace the compressor assembly if any of the following conditions exists:

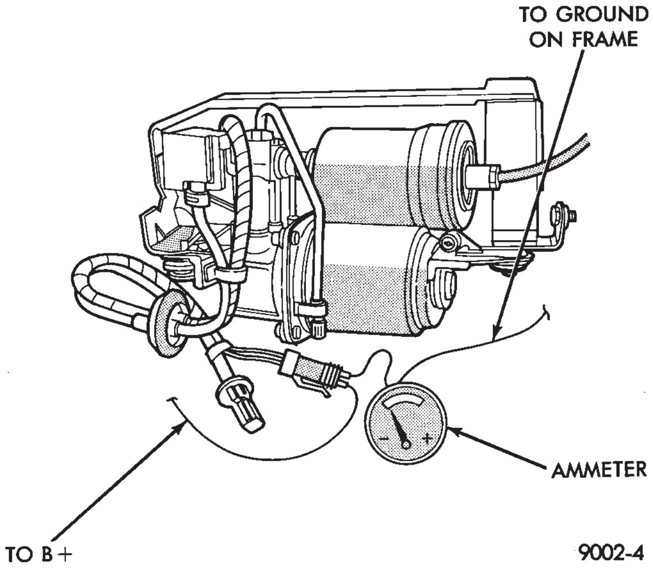


Fig. 6 Compressor Current Draw Test

- Air pressure leaks down below 621 kPa (90 psi), before it remains steady.
- Output pressure builds up to less than 758 kPa (110 psi) when it stabilizes.

If the compressor is allowed to run during this test until it reaches its maximum output pressure of 1516 kPa (220 psi). The solenoid exhaust valve will act as a pressure relief valve. The resulting leak-down, after the compressor is shut off, will indicate a false leak.

SERVICE PROCEDURES

COMPRESSOR ASSEMBLY

REMOVAL

(1) Disconnect negative battery cable.

(2) Raise vehicle, see Hoisting, Group 0.

(3) Remove cover from compressor assembly. Remove air hose and electrical connectors (Figs. 1 and 2).

(4) Remove compressor assembly mounting bolts and lower assembly from vehicle.

(5) Remove mounting bracket bolts and slide mounting bracket away from compressor.

INSTALLATION

(1) Slide mounting bracket on compressor and install bolts and tighten to 8 N●m (70 in. lbs.) torque.

(2) Install compressor assembly to frame rail and tighten bolts to 8 N●m (70 in. lbs.) torque.

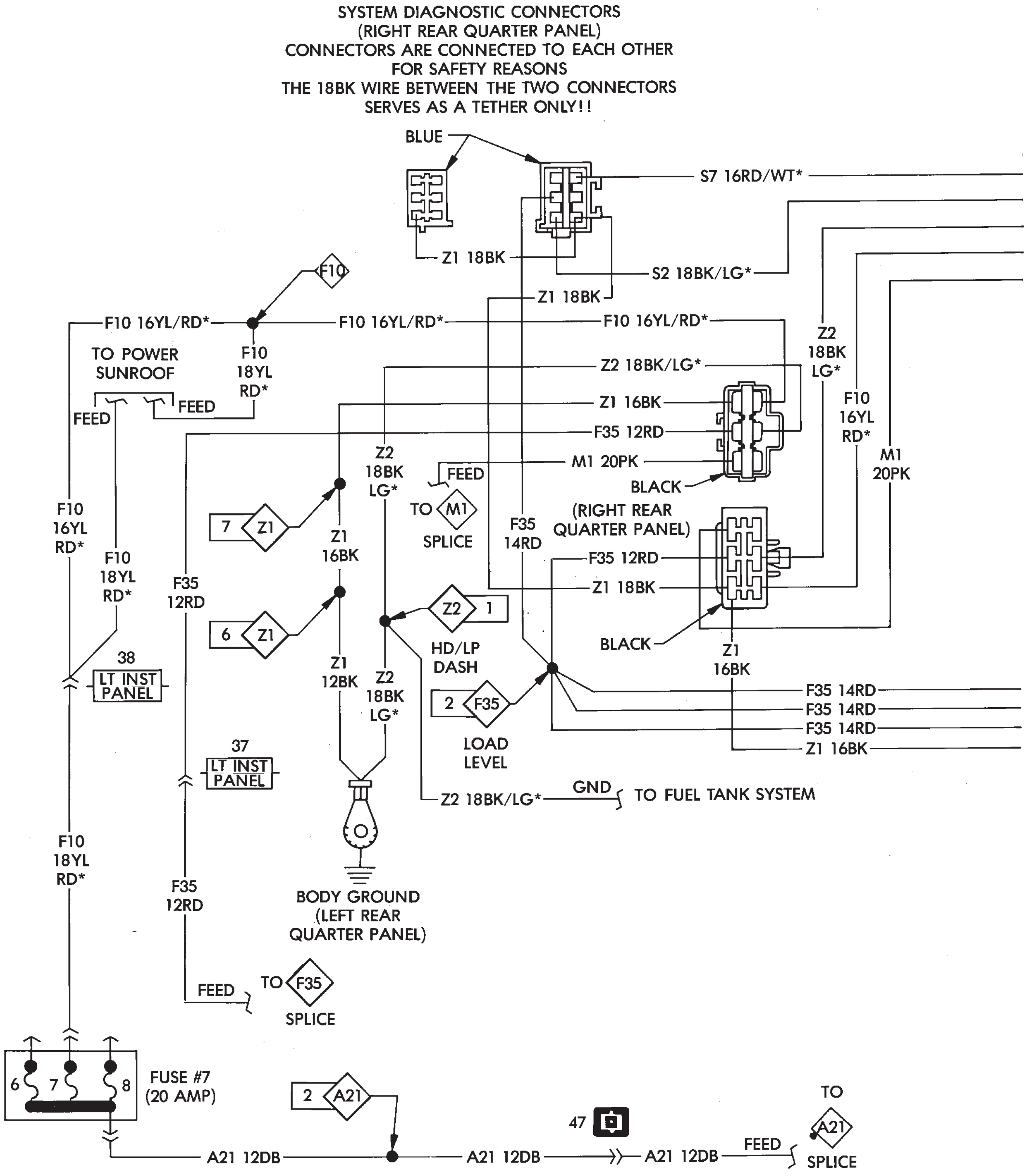
(3) Connect air hose and electrical connector to compressor assembly.

(4) Install cover on compressor assembly and tighten bolts to 8 N●m (70 in. lbs.) torque.

(5) Lower vehicle and connect negative battery cable.

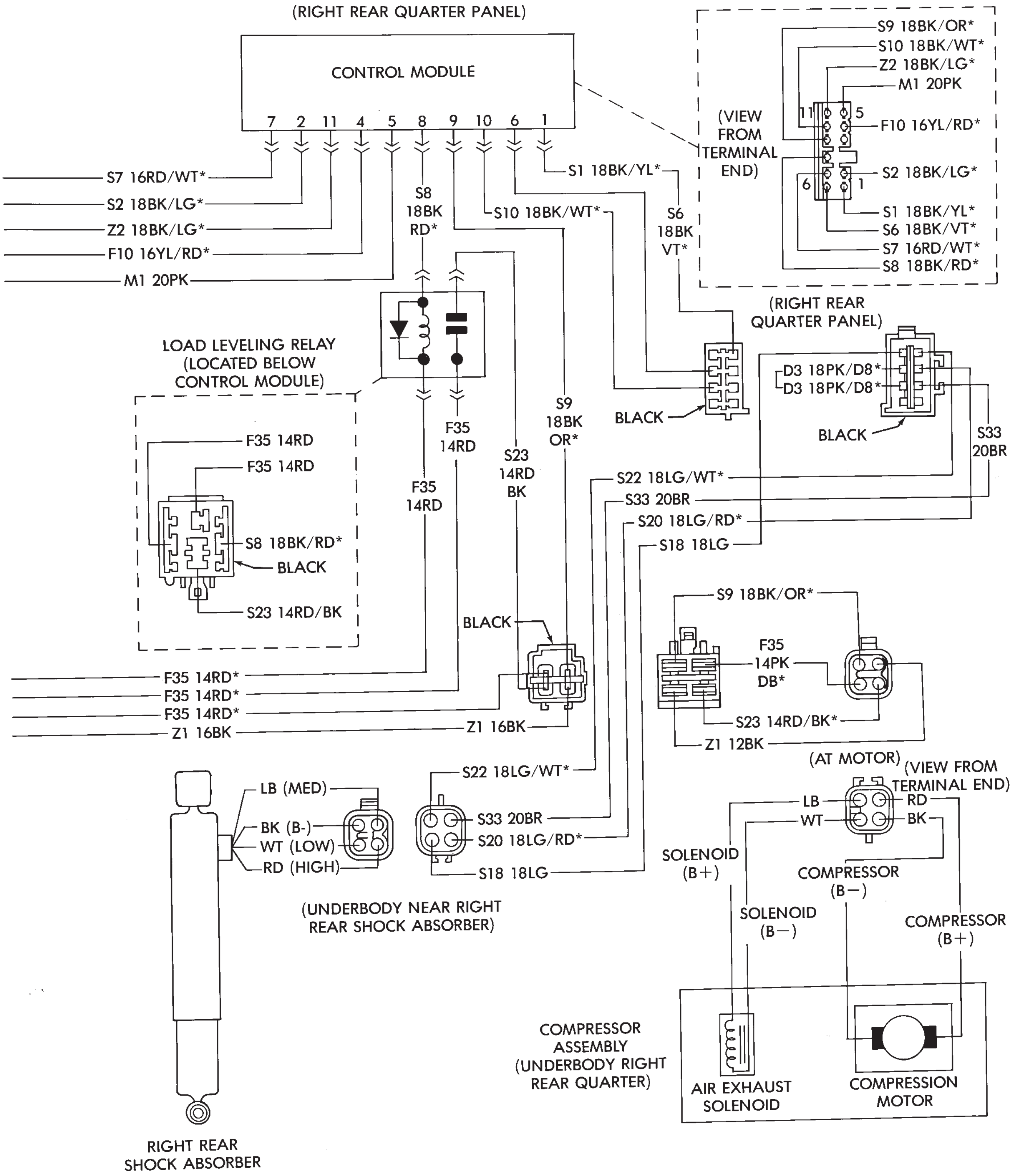
(6) Check operation of the system.

AUTOMATIC AIR LOAD LEVELING SYSTEM WIRING SCHEMATIC



9202-143

AUTOMATIC AIR LOAD LEVELING SYSTEM WIRING SCHEMATIC



9202-144

REAR LEVELING DIAGNOSTIC PROCEDURES

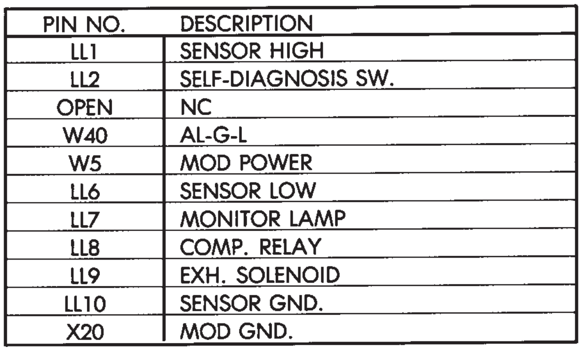
SELF-DIAGNOSTICS

A self-diagnostic procedure is available for the service technician to use to detect system malfunctions.

BEFORE DIAGNOSTICS TEST

Check the 20 amp fuse (position W40) and the 30 amp circuit breaker (position W5) to be assured they are functional components.

Check all connectors that link the system into the main body wiring harness. These include compressor, height sensor, control module, (Fig. 7) and relay. Also check the underbody to in trunk and leveling harness to main body harness connectors. Also, check all air lines, connectors, and other components for correct installation.



PIN NO.	DESCRIPTION
LL1	SENSOR HIGH
LL2	SELF-DIAGNOSIS SW.
OPEN	NC
W40	AL-G-L
W5	MOD POWER
LL6	SENSOR LOW
LL7	MONITOR LAMP
LL8	COMP. RELAY
LL9	EXH. SOLENOID
LL10	SENSOR GND.
X20	MOD GND.

9002-8

Fig. 7 Control Module Connector

TEST LAMP PIN OPERATION

The monitor lamp pin output will be activated (test lamp on) if the detection of abnormal system operation is determined by the CM.

AFTER COMPLETION OF REPAIRS

To initiate diagnostics, disconnect the test ground wire then reconnect for repair verification.

TERMINATION OF SELF-DIAGNOSTICS

The self-diagnostic operation is terminated when any of the following takes place:

- Disconnecting the diagnostic input from the ground circuit.
- Turn the ignition switch to the off position.

When the self-diagnostic operation is terminated. The control module resumes normal operation unless it ceases operation. Due to it detecting a system malfunction.

TEST WEIGHT

Weight between 275-300 lbs. must be added to rear of vehicle before diagnostic testing begins.

DIAGNOSTICS (TO START PROCESS)

(1) Remove protective connector cover from diagnostic connector.

(2) Insert wire into diagnostic ground pin. Then attach to compressor ground pin, or as an alternate, insert wire into diagnostic ground pin. Then ground other end of test wire to body structure or a control module fastener.

IGNITION

The following self diagnostic operation is initiated by connecting the diagnostic ground pin to ground after ignition switch is turned ON. A monitor lamp must be connected between the Test Lamp Ground Pin and the Test Lamp Feed Pin to display the control module diagnostics status. See (Fig. 8) for diagnostic test pin locations.

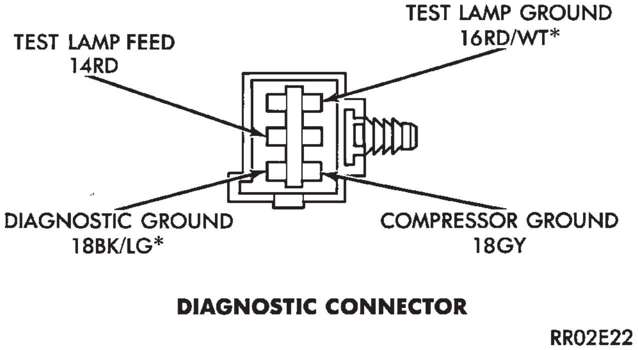


Fig. 8 Diagnostic Test Pin Location

OPERATION

(1) The compressor relay output. From the control module (CM), is activated until the vehicle is in the high position. The maximum relay output operation time is 150 ±10 seconds. If the expected position is not obtained, the CM ceases self-diagnostics and any further operation. (I.e. neither operates the compressor relay or exhaust outputs). The monitor lamp output is continuously activated until ignition is cycled from OFF to ON or 60 ±1 minutes has elapsed after ignition was turned off. See Diagnostics Chart 1.

(2) The monitor lamp output should flash to indicate the position of the height sensor. The sensor should be in the high position. A continuously lighted monitor lamp will indicate a system failure. Such as the compressor relay output has operated for 150 ±10 seconds but the height sensor did not move to the high position within the right shock absorber). See Diagnostic Chart 1.

(3) Next the exhaust solenoid output is activated until the vehicle is in the low position. The maximum exhaust solenoid operation time is 120 ±10 seconds. If the expected position is not obtained, the module ceases self-diagnostics and any further operation. The monitor lamp output is lighted continuously until ignition is cycled from OFF to ON or 60 ±1 minutes has elapsed after ignition is turned off. See Diagnostic Chart 4.

(4) The monitor lamp should flash to indicate the height sensor is in the low position. A continuously

lighted monitor lamp will indicate a system failure. Such as the exhaust solenoid operated for 120 ±10 seconds but the height sensor did not move to the low position. See Diagnostic Chart 4.

(5) The compressor relay output is activated to return the vehicle to the neutral (leveled) position. The maximum operation time of the relay output is 150 ±10 seconds. If the expected position is not obtained. The control module ceases self-diagnostics and any further operation. The monitor lamp is continuously lighted until the ignition is cycled from OFF to ON or 60 ±1 minutes has elapsed after ignition is turned off.

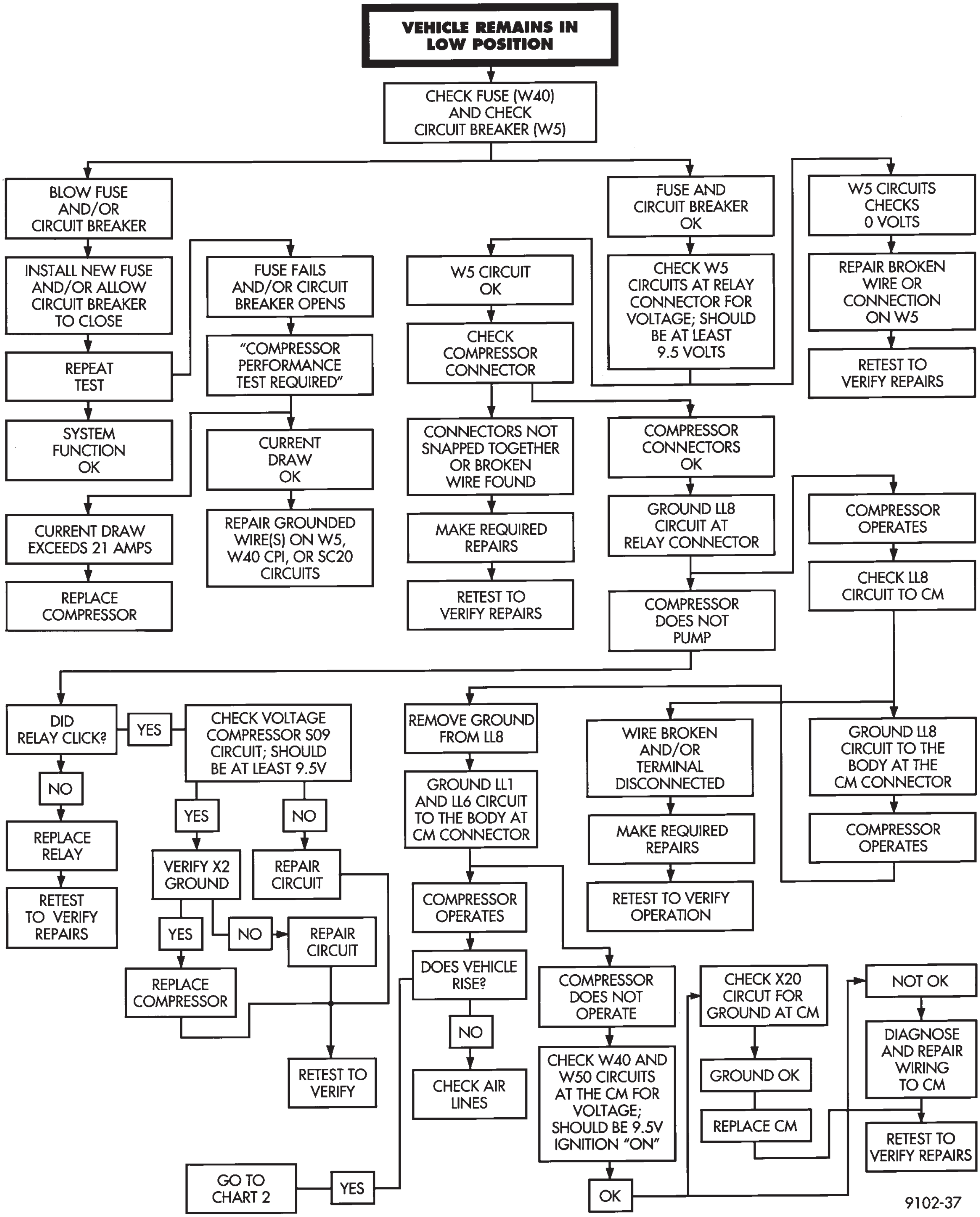
The sensor will move to the neutral position. If not, a continuously lighted monitor lamp will indicate a system failure. Such as the compressor relay output operated for 150 ±10 seconds but the sensor did not move to or sense the neutral position. See Diagnostic Chart 1.

(6) Completion of diagnostics, is when self diagnostic procedure is successfully completed and control module resumes normal operation. The diagnostic test is now complete. Throughout the testing the vehicle load must be maintained at a specific level. No loads are allowed to be added/removed to/from the vehicle once the self diagnosis tests have been initiated.

The Diagnostic connector cover must be installed after completion of the test.

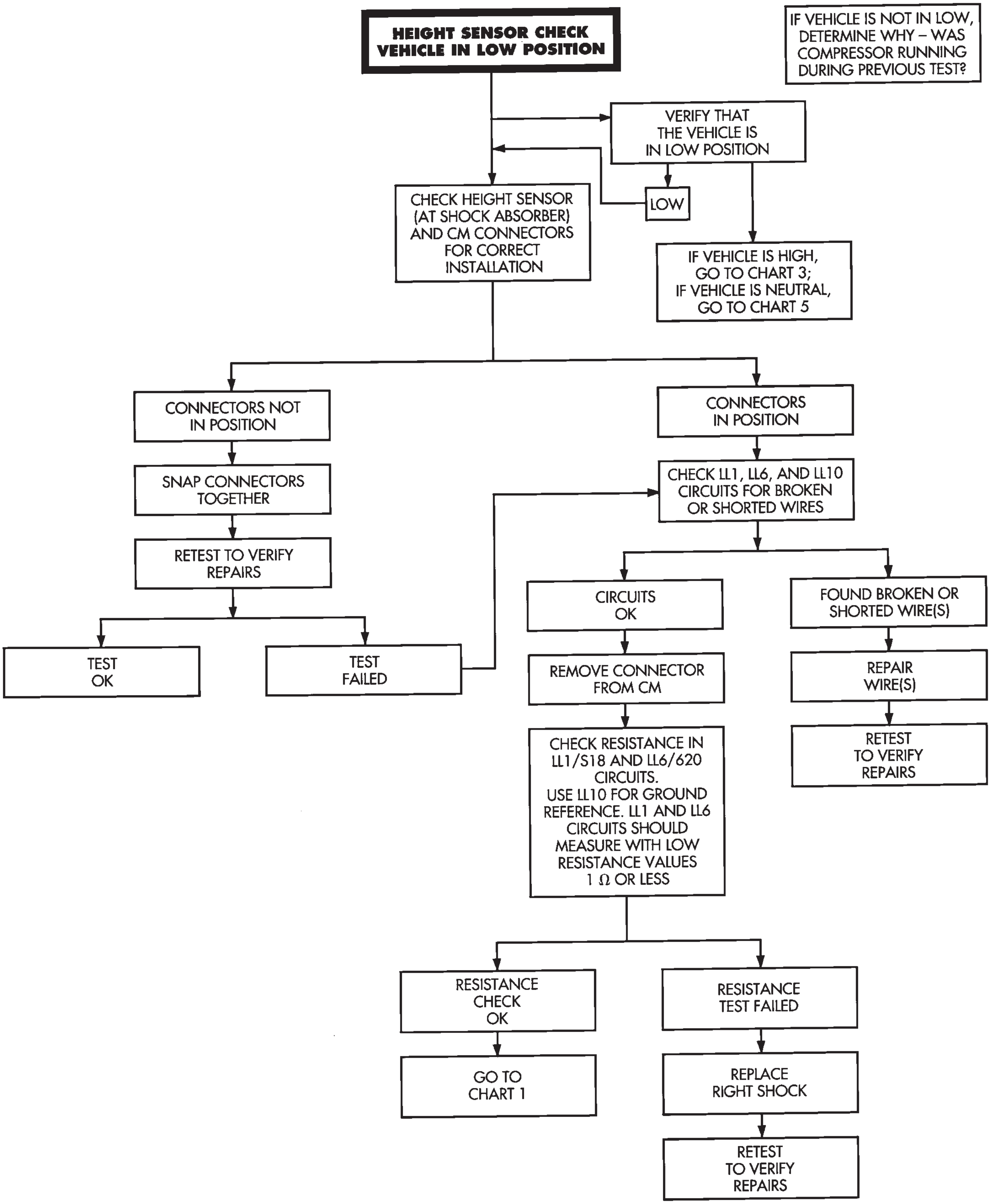
AUTOMATIC AIR LOAD LEVELING DIAGNOSTICS

CHART 1



AUTOMATIC AIR LOAD LEVELING DIAGNOSTICS

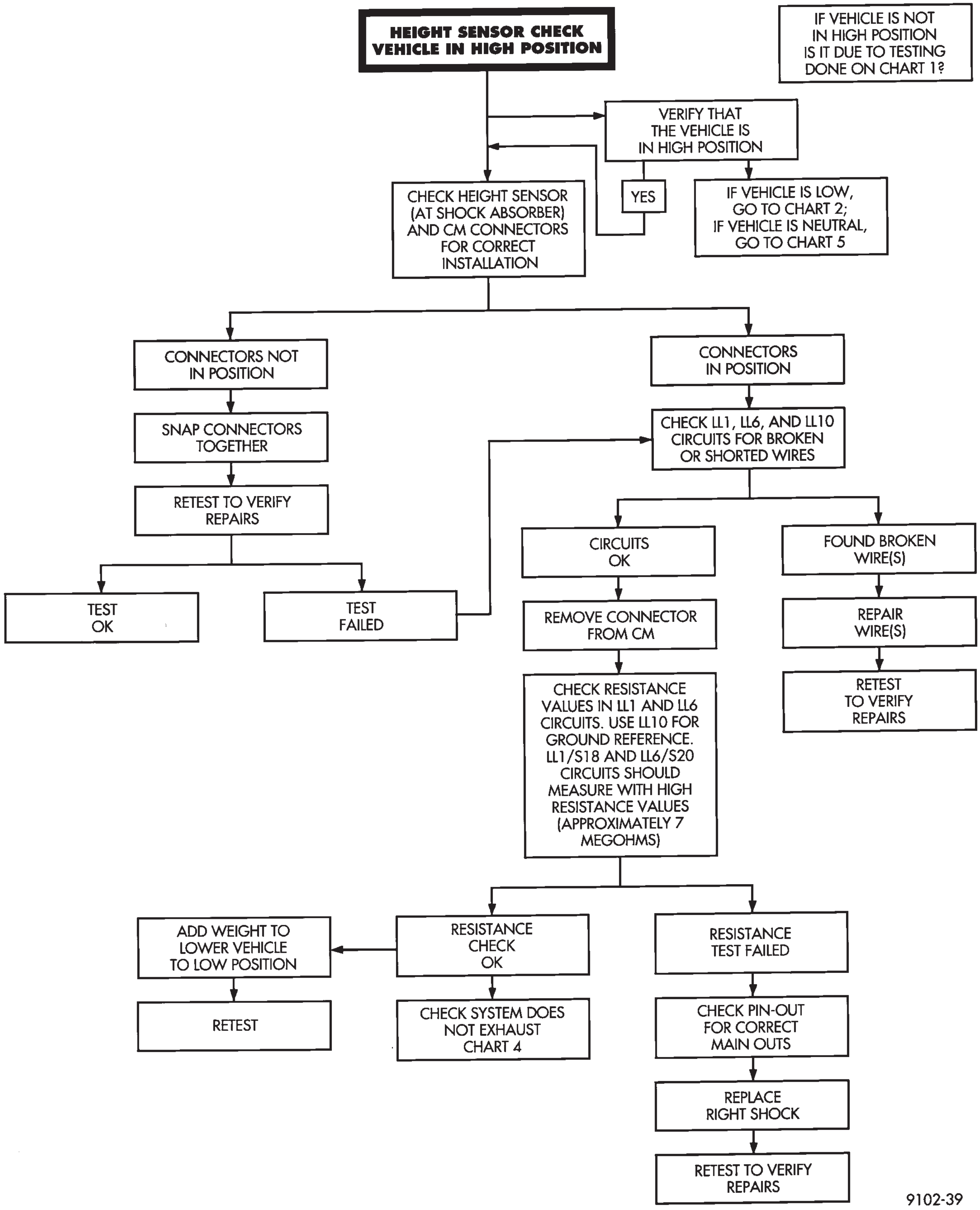
CHART 2



9102-38

AUTOMATIC AIR LOAD LEVELING DIAGNOSTICS

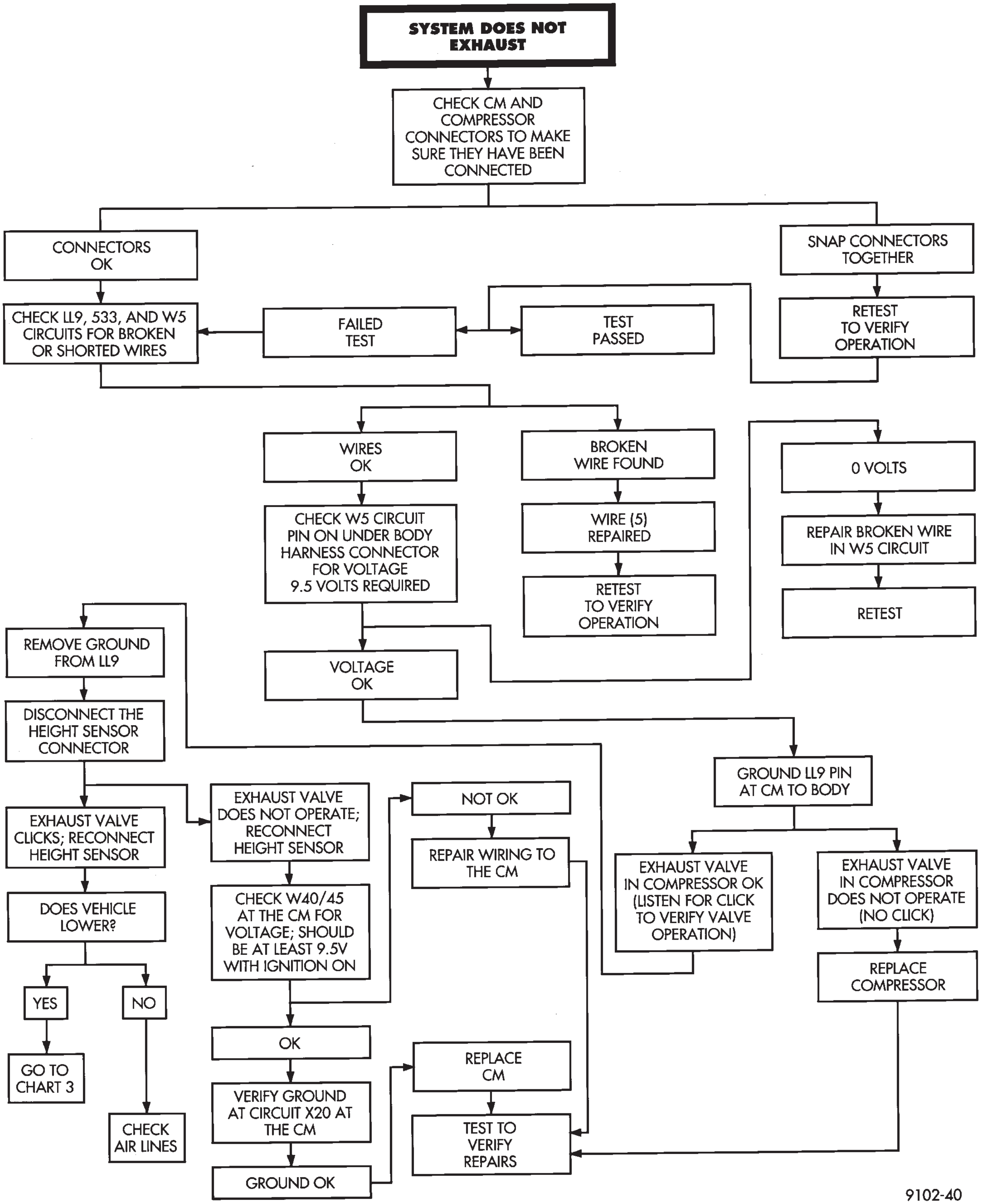
CHART 3



9102-39

AUTOMATIC AIR LOAD LEVELING DIAGNOSTICS

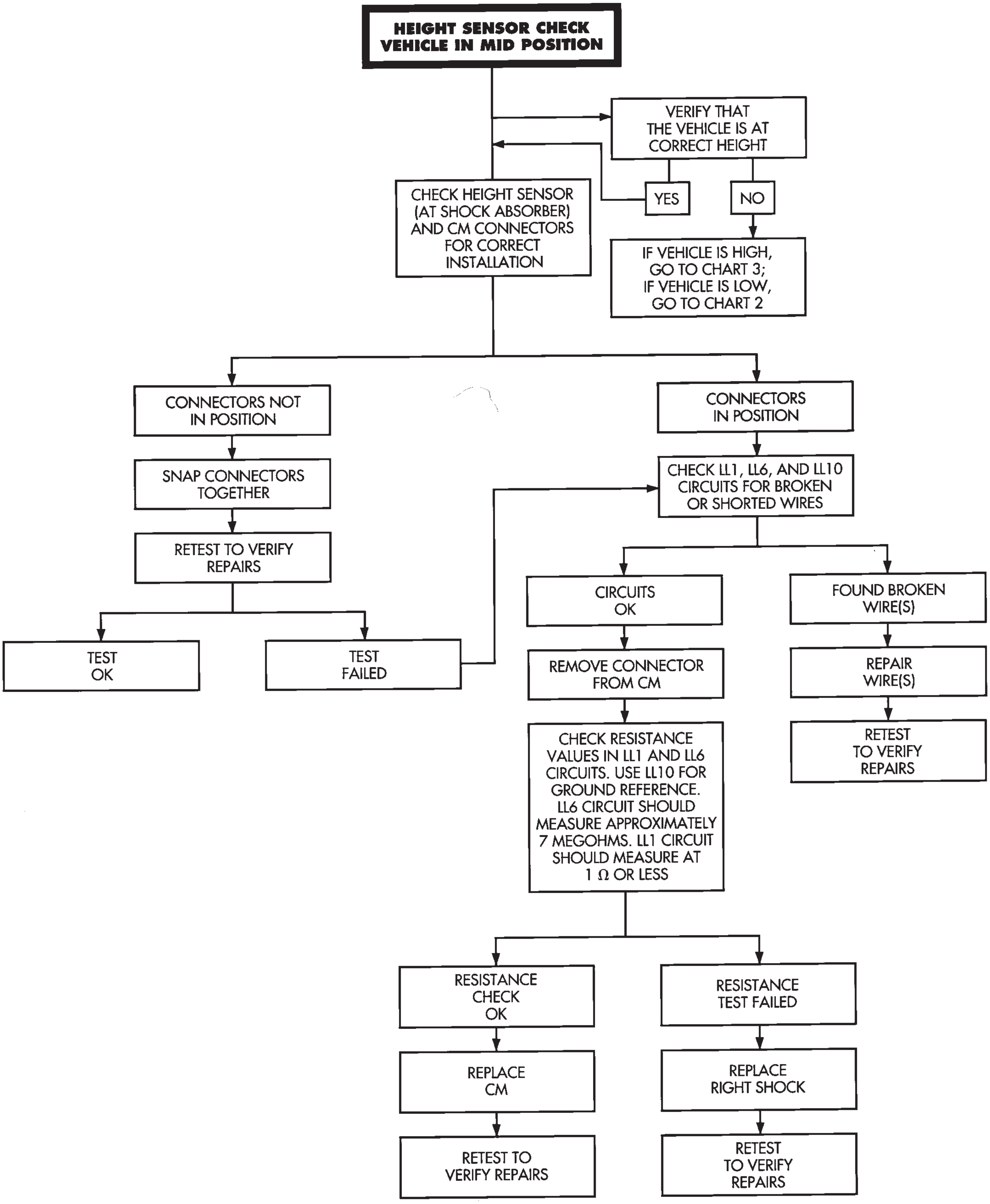
CHART 4



9102-40

AUTOMATIC AIR LOAD LEVELING DIAGNOSTICS

CHART 5



9102-41

CONTROL MODULE

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove right side trunk trim panel.

(3) Remove electrical connectors from control module and relay (Fig. 9).

(4) Remove control module mounting screws and remove assembly.

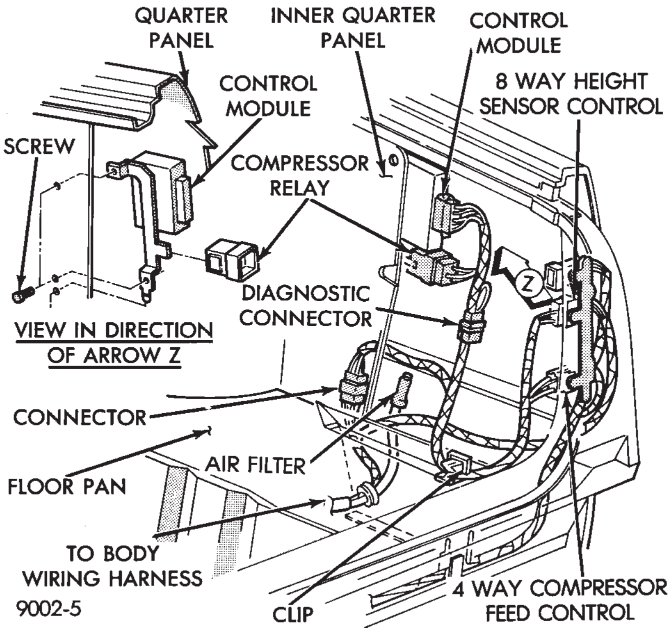


Fig. 9 Control Module and Relay Wiring

INSTALLATION

(1) Install relay on the control module mounting bracket (if required).

(2) Place control module in mounting position.

(3) Install mounting screws and tighten to 2-3 N•m (19-29 in. lbs.).

(4) Install control module and relay wiring connectors (Fig. 9).

(5) Install right side trunk trim panel.

(6) Connect negative battery cable.

COMPRESSOR RELAY

REMOVAL

(1) Remove right side trunk trim panel.

(2) Remove electrical connector from relay.

(3) Remove relay from control module mounting bracket by prying out on locating clip (Fig. 10).

INSTALLATION

(1) Push relay onto bracket (relay will Lock into position).

(2) Install electrical connector.

(3) Install trim panel.

RIGHT SHOCK ABSORBER (WITH HEIGHT SENSOR)

REMOVAL

(1) Disconnect negative battery cable.

(2) Raise vehicle, see Hoisting, Group 0.

(3) Remove tire assembly.

(4) Disconnect height sensor connector, located on right rear frame rail.

(5) Remove both air lines connected to shock absorber ports.

(6) Remove shock, see Shock Absorbers, Removal.

INSTALLATION

(1) Install shock assembly, see Shock Absorbers, Installation.

(2) Route height sensor wire through clip on shock bracket, then tie strap to fuel filler tube.

(3) Snap height sensor connector into underbody harness connector.

(4) Insert air lines.

(5) Install wheel/tire assembly.

PIN NO.	DESCRIPTION
LL1	SENSOR HIGH
LL2	SELF-DIAGNOSIS SW.
OPEN	NC
W40	AL-G-L
W5	MOD POWER
LL6	SENSOR LOW
LL7	MONITOR LAMP
LL8	COMP. RELAY
LL9	EXH. SOLENOID
LL10	SENSOR GND.
X20	MOD GND.

9002-8

Fig. 10 Control Module Connector

AUTOMATIC AIR SUSPENSION

INDEX

GENERAL INFORMATION

This system provides automatic height control and low spring rates to improve suspension characteristics of the vehicle. And it will automatically level the front and rear of the vehicle. It will also maintain the optimum vehicle attitude from one passenger through full vehicle load.

The automatic air suspension system includes the following components:

- Compressor/air dryer assembly
- Compressor relay
- Front struts
- Rear springs
- Rear shocks
- Control module
- Air lines
- Compressor
- Rear height sensor
- Wiring harness assembly
- Compressor cover

Front springs (and height sensors) are integral with the shock absorber strut assemblies. While rear air springs replace conventional steel units. Rear height is controlled via a height sensor contained within the right rear shock absorber. Solenoids (integral with each air spring) control air volume/pressure requirements. Pressurized air is distributed from the air compressor/dryer assembly and routed to each air spring by four separate air lines. The air lines start at the dryer and terminate at the individual air springs. The system is monitored and controlled by the Air Suspension Control Module (ASCM) (Fig. 1).

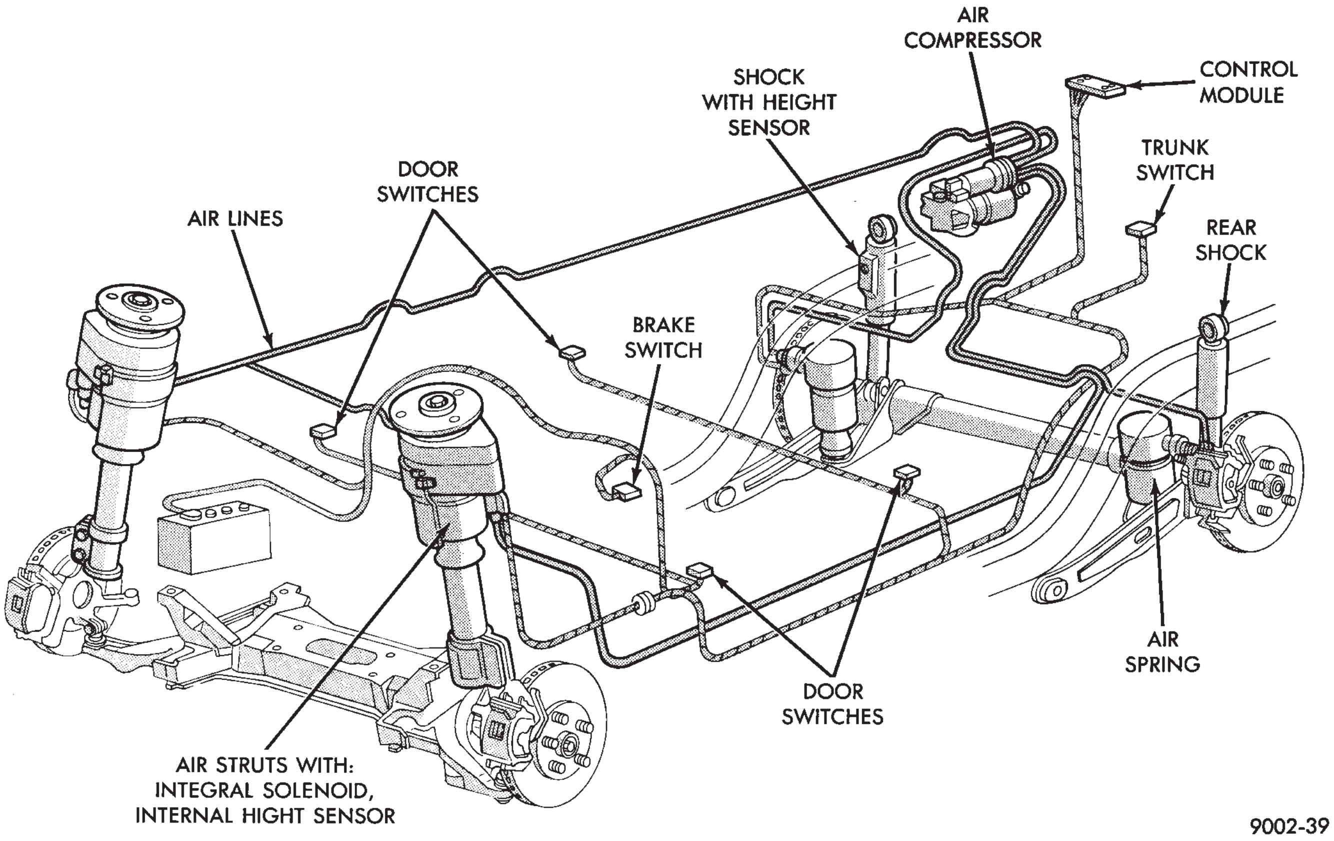


Fig. 1 Automatic Air Suspension

FRONT AND REAR AIR SPRINGS

The front and rear air springs are essentially pneumatic cylinders that replace the steel coil springs. The air filled springs allow the vehicle suspension height to be adjusted for all weight conditions.

The air springs allow for the reduction of spring rates to improve vehicle ride characteristics.

FRONT/REAR SPRING SOLENOIDS

The front and rear solenoids control air flow in and out of the front and rear springs. The Air Suspension Control Module (ASCM) opens the solenoids when the system requires air to be added to or exhausted from the air springs. The solenoids operate at a current draw range of 0.6 to 1.5 amps.

HEIGHT SENSOR

A magnetic switch type sensor. Located in the right rear shock absorber and left and right front struts, (Fig. 2) monitors vehicle height. The sensors transmit signals to the (ASCM) relating to vehicle height status (low, trim, medium, high).

CONTROL MODULE

The Air Suspension Control Module (ASCM). Is a device that controls the ground circuits for the Compressor Relay, Compressor Exhaust Solenoid Valve and Front and Rear Solenoid Valves. The (ASCM) limits the compressor pump operation time to 170 to 190 seconds. This controlled operation time is to prevent damage to the compressor motor.

To prevent excessive cycling between the compressor and the exhaust solenoid circuits during normal ride conditions. A 14 to 16 second delay is incorporated in the microprocessor logic.

The system is non-operation when one of the following conditions exists. A door(s) is/are open, the trunk is open, the service brake is applied or the throttle position sensor is 65% to 100% open. System operation is inhibited during high speed cornering activities or if there is a charging system failure. **The control module is on the CCD bus system.**

COMPRESSOR ASSEMBLY

The compressor assembly is driven by an electric motor and supplies air pressure between 930 to 1241 kPa (135 to 180 psi) (Fig. 3). A solenoid operated exhaust valve. Located in the compressor head assembly, releases air when energized.

A heat actuated circuit breaker. Located inside the compressor motor housing. Is used to prevent damage to the compressor motor in case of control module failure.

COMPRESSOR AIR DRYER

The air dryer is attached to the compressor (Fig. 3). This component serves two purposes. It absorbs moisture from the atmosphere before it enters the system

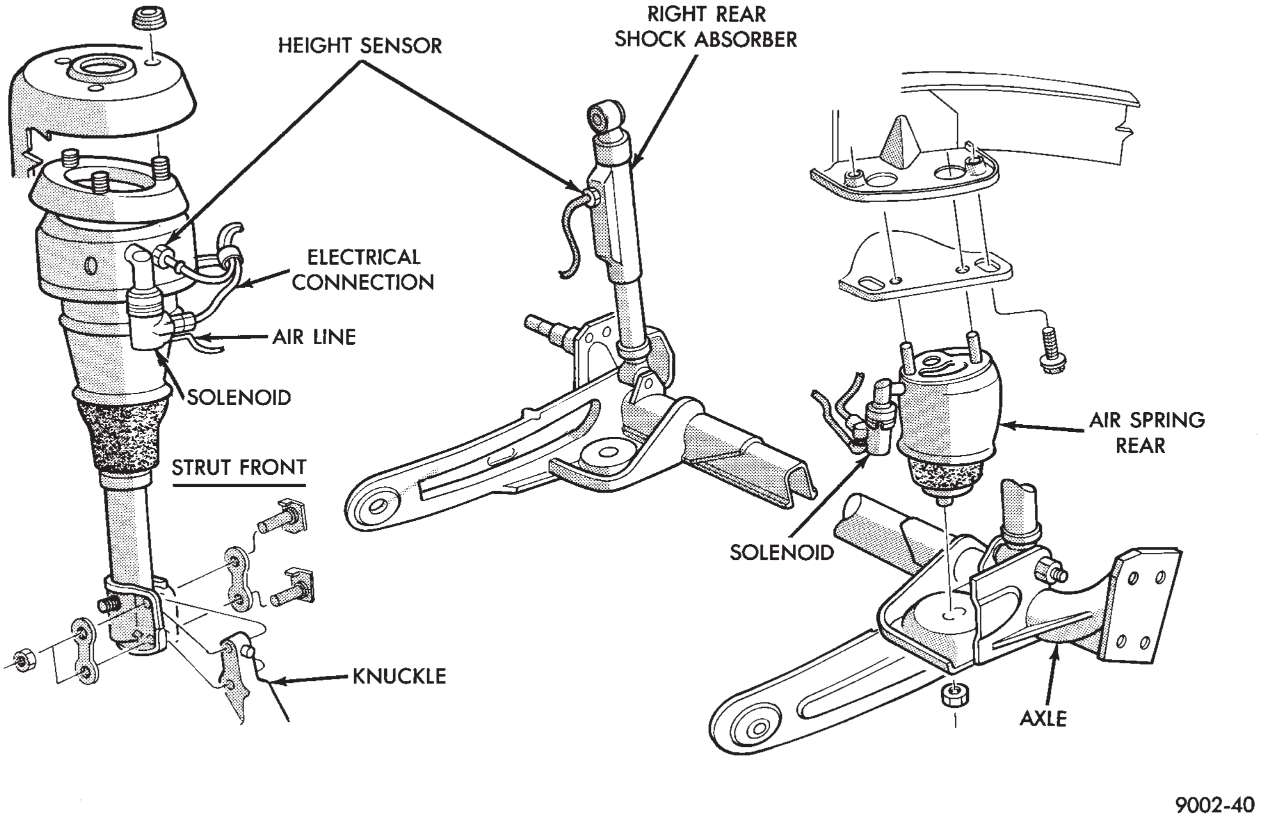


Fig. 2 Front and Rear Air Springs

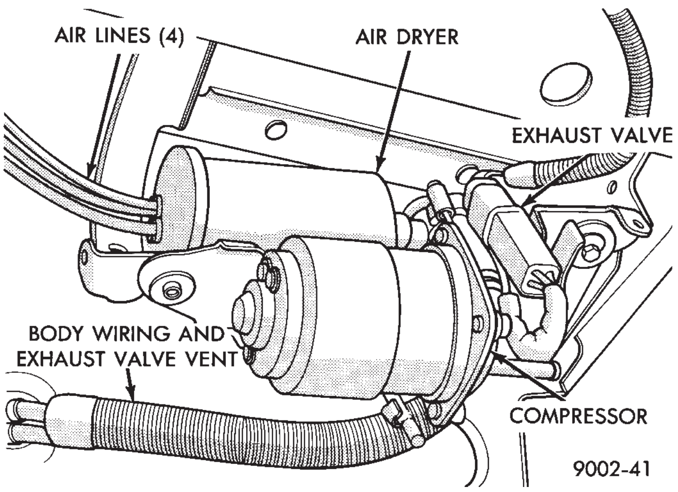


Fig. 3 Air Compressor/Dryer Assembly

and with internal valving maintains a residual pressure of 172 to 276 kPa (25 to 40 psi).

AIR LINES

Nylon air lines (4) are routed from the compressor (air dryer) to each strut/spring assembly. **Right** side strut and air spring air lines are routed with the fuel lines. **Left** side strut and air spring air lines are routed across the vehicle (forward of the fuel tank). And to the front of the vehicle with the brake lines (Figs. 4 and 5).

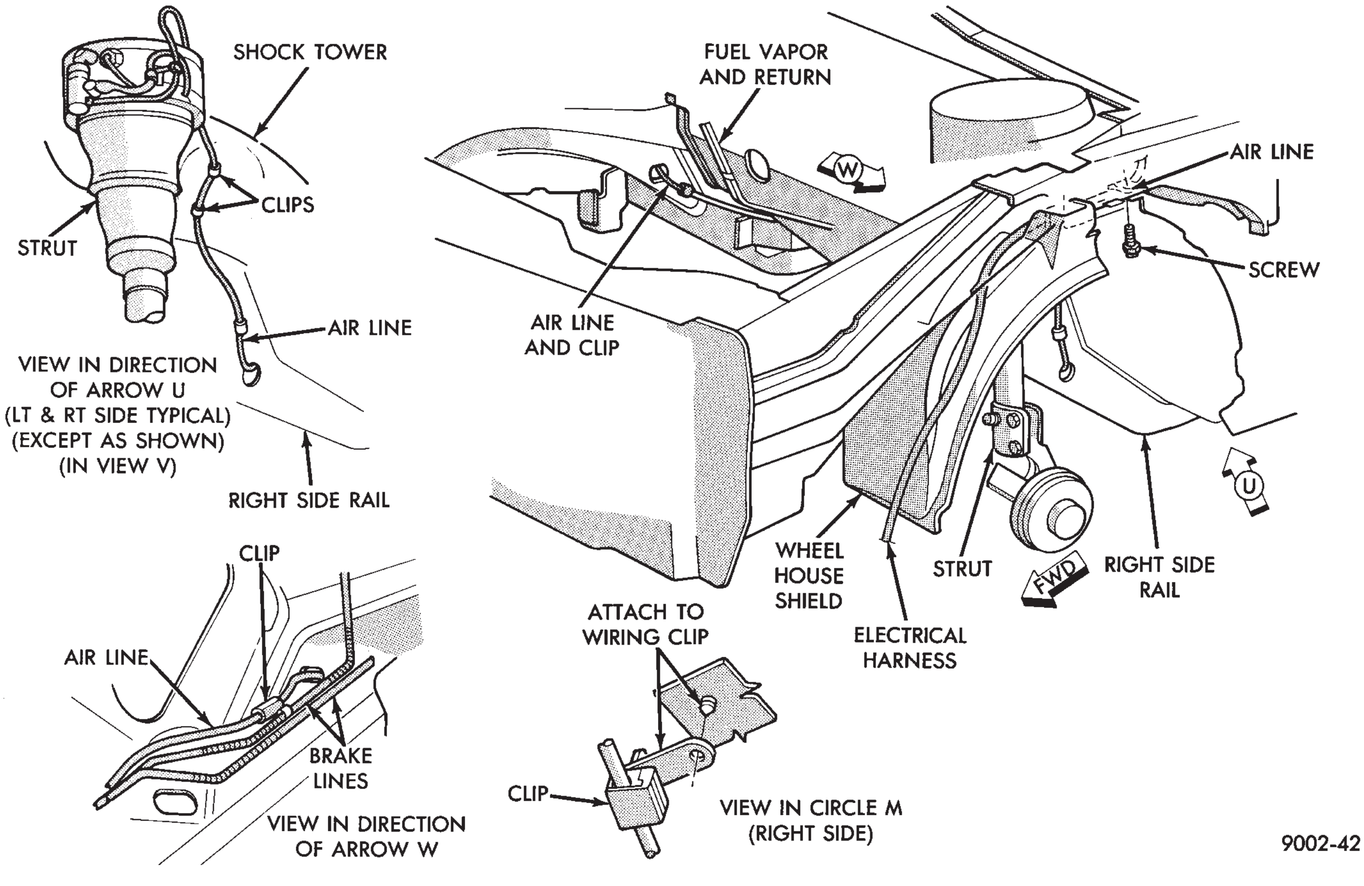


Fig. 4 Air Lines Front

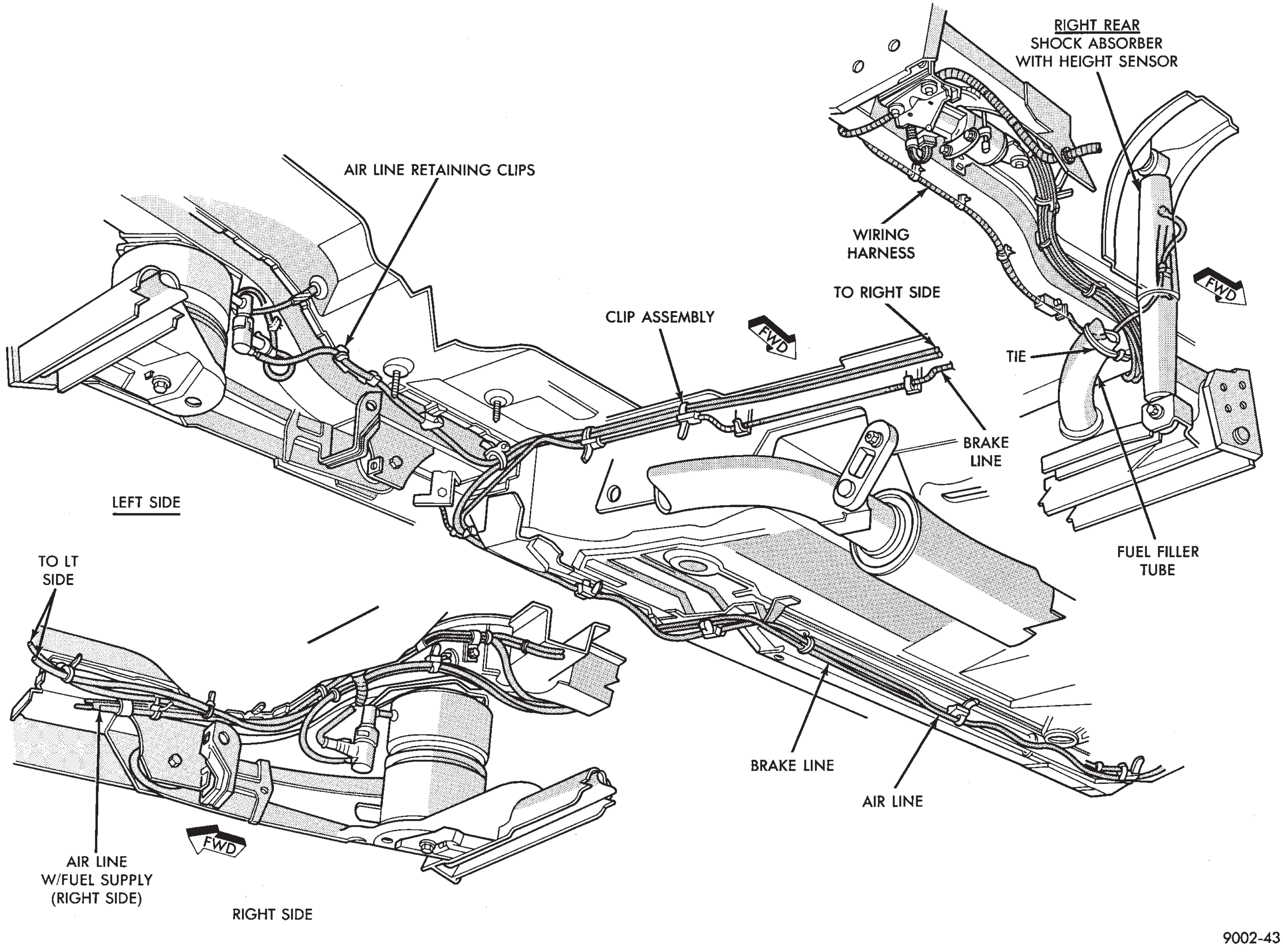


Fig. 5 Air Lines Rear, and Rear Height Sensor

AIR LINE FITTINGS

To remove an air supply line from an air compressor assembly air line fitting. Push in (toward receiver dryer) on the plastic ring of the receiver dryer air supply air line fitting. While holding in the air line fitting on the receiver dryer pull the air supply line strait out of the fitting (Fig. 6).

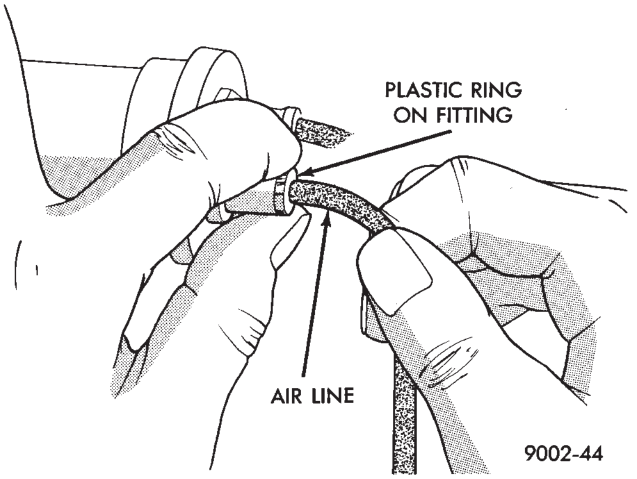


Fig. 6 Release Air Line from Fitting

The fitting has a unique push-in feature. A brass type collet locks the air line in place. One rubber O-Ring seals the air line to prevent air leakage. To attach air line, just push into fitting (Fig. 7).

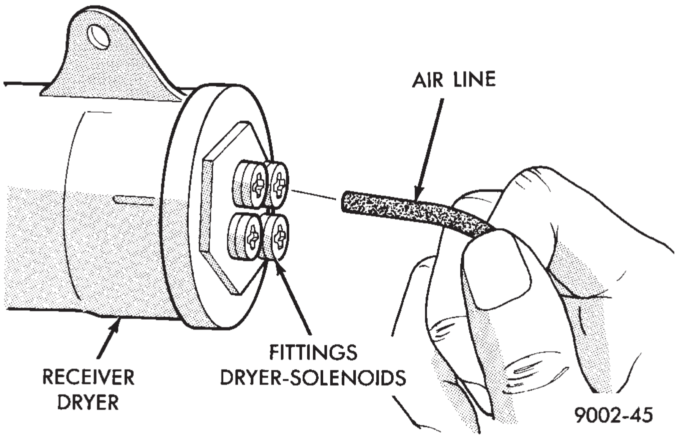


Fig. 7 Push Air Line into Fitting

AIR CHECK, RESIDUAL

The air dryer has a valving arrangement that maintains 172 to 276 kPa (25 to 40 psi).

To test this function, perform the following procedure:

(1) Remove the air line from the dryer and strut or spring. Attach a piece of bulk nylon tubing to one side of a Pressure Gauge (0-300 psi), and to the strut/spring solenoid (Fig. 8).

(2) Attach another piece of nylon tubing from the dryer (compressor) to other side of the pressure gauge.

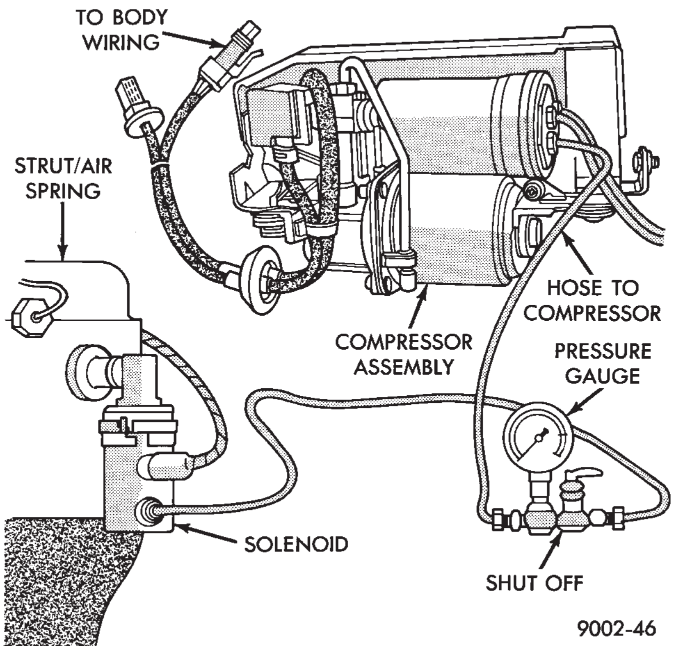


Fig. 8 Pressure Gauge Installed in System

A compression ball sleeve nut and sleeve for 3/16 inch tubing with ball sleeve connector and an internal pipe T-fitting. Can be used to attach the tubing to the pressure gauge.

(3) Activate compressor by grounding pin 508 to pin x 20 (See Control Module Connector), cycle unit and read actual air pressure. Pressure of 172 to 276 kPa (25 to 40 psi) indicates that the system and compressor is acceptable.

COMPRESSOR PERFORMANCE TEST

This test can be performed on the vehicle to evaluate compressor current draw, pressure output, and leak down.

(1) Disconnect the compressor motor wiring harness connector.

(2) Disconnect air line between dryer and strut or spring solenoid.

(3) Connect an air pressure gauge into the system (Fig. 8).

(4) Connect an ammeter in series between the red wire terminal on compressor connector and a 12 volt power source. Also, connect a ground wire from the black wire terminal on the compressor connector to a good ground on the frame (Fig. 9)

(5) If the current draw to the compressor motor exceeds 30 amperes, replace the compressor assembly.

AIR LEAK CHECK

(1) Check all air line to connector joints.

- Air line to compressor connectors.
- Air line to solenoid.

(2) Check the rubber membranes.

- Front struts.
- Rear springs.

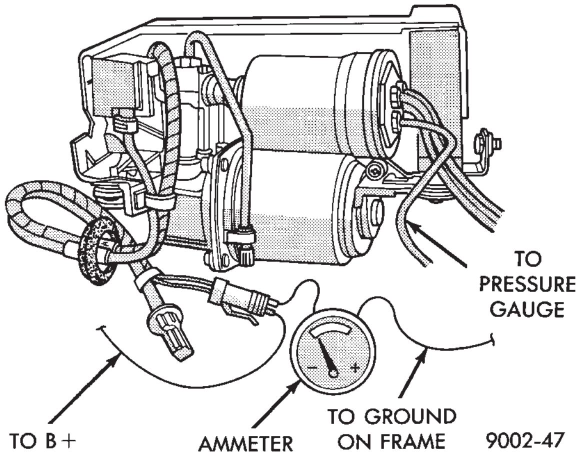


Fig. 9 Compressor Current Draw Test

(3) Check solenoid to volume canister joint.
- Front strut to solenoid valve connection.
- Rear spring to solenoid valve connection.

(4) Check air line for ruptures, cuts, splits or heat damage.

Use a soap and water solution or a liquid developed for leak detection.

SYSTEM OPERATION

ENGINE RUN OPERATION

The system will compensate for load addition/removal when.
- The trunk and all doors are closed.
- The engine speed exceeds 600 R.P.M.
- Throttle angle is less than 65 degrees.
- The brake is not applied.
- You are not cornering above 10 mph.
- There is not a charging system problem with the vehicle.

ENGINE OFF OPERATION

After passengers/load is removed from the vehicle the system will correct the vehicle attitude after:
- The trunk and all doors are closed.
- The ignition switch is in the OFF position.

Opening the a door or trunk wakes up the body computer and the air suspension module. The air suspension system is now capable of leveling, if required.

LONG TERM IGNITION OFF OPERATION

The system is capable of one an additional leveling cycle. After 2 continuous hours of ignition key off and no door open or trunk open activities. This feature is implemented to eliminate possible ice freeze-up between the tire and the inner fender shield.

SYSTEM OPERATION INHIBITORS

The air suspension system is inhibited when:
- The trunk is open.
- A door(s) is/are open.
- The brake pedal is engaged.
- The throttle is at the wide open position.
- The charging system fails.

The maximum compressor pump or exhaust time is 3 minutes.

SYSTEM FAILURES

Vehicles equipped with air suspension and overhead console. Will alert the driver of an air suspension system malfunction. A warning Check Air Suspension will appear on the overhead console screen.

SAFETY CONCERNS

WARNING: REAR AIR SPRINGS MUST BE DEFLATED BEFORE BEING REMOVED FROM THE VEHICLE.

WARNING: OPEN TRUNK, OR DOOR(S) OR REMOVE GROUND STRAP FROM BATTERY BEFORE HOISTING OR JACKING A VEHICLE DURING MECHANICAL REPAIRS.

WARNING: IF THE VEHICLE NEEDS SERVICE OR REPAIR OF THE REAR SHOCK ABSORBERS OR REAR AXLE PIVOT BUSHINGS. THE REAR AIR SPRINGS MUST HAVE THE AIR PRESSURE REMOVED BEFORE THE VEHICLE CAN BE SERVICED SAFELY.

SHIPPING MODE

(1) Removing shipping height signal for customer use.
- Use DRB II tester and 1991 Chassis (Air Suspension) service cartridge.
- Follow DRB II requirements to cancel shipping height message in the body computer.
- Connect the Ignition Off Draw (I.O.D.) circuit.

The connection of the IOD circuit will cancel the Shipping height signal.

(2) Return to shipping height.
- Set shipping command in the body computer using the DRB II and the 1991 Chassis (Air suspension) service cartridge.
- Disconnect the I.O.D. connector.

DIAGNOSIS

INITIAL DIAGNOSTIC CHECK

(1) Check for blown or missing fuses.

(2) Check all connectors for correct assembly. **Check all connectors for incorrectly installed terminals.**

(3) Check pin #21 for minimum of 9.5 volts.

(4) Check pin #20 for minimum of 9.5 volts (with ignition key on).

(5) Check voltage at pins #5 and #16. The measurement should exceed 0 volts.

(6) Check pin #19 for continuity.

(7) The engine speed should exceed 680 rpm during idle.

All doors and trunk must be closed for the system to function.

DIAGNOSTICS PROCEDURES

(1) Use the D.R.B. II tester and the 1991 air suspension diagnostic service cartridge to begin the troubleshooting process.

(2) Use the D.R.B. mating connector under the dash (drivers side) to plug-in the D.R.B. II test connector (Fig. 10).

(3) The tester will conduct a complete check of the suspension system status.

(4) The tester will list the steps to follow to access and diagnose the failure.

(5) A Volt/Ohm meter can be used for some diagnostic testing.

HEIGHT SENSOR CHECK

If a sensor signal/signals are missing. Follow the repair procedure listed below.

(1) Check ground circuit continuity. (Remember front and rear grounds are on different circuits.

(2) For front ground circuit continuity check circuit S 33.

(3) For rear ground circuit continuity check circuit X20.

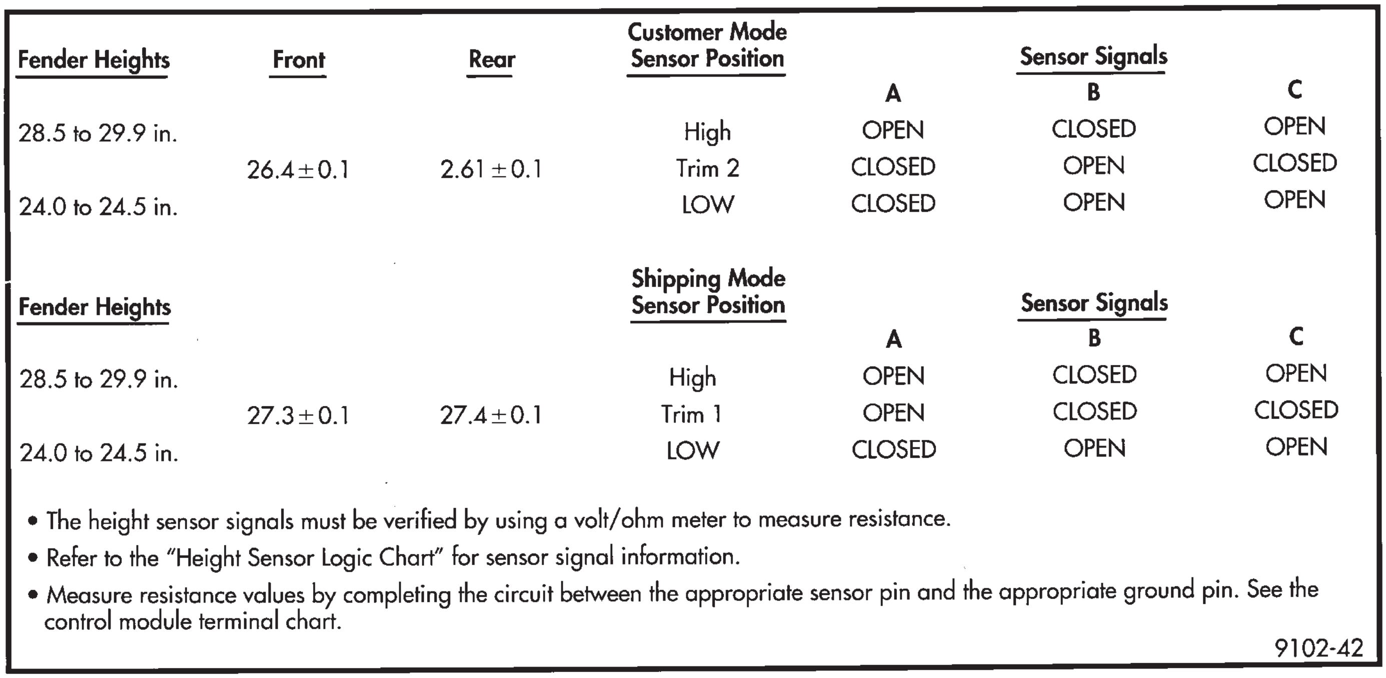
(4) Refer to control module pin out chart and wiring diagram (see Group 8F in wiring diagram manual) for individual circuit details.

(5) If open circuits are not found replace the component.

Complete circuit testing and connector assemblies before replacing a strut or right rear shock.

(6) To measure resistance values, see Height Sensor Logic Chart and Initial Diagnostic Check in System Operation.

HEIGHT SENSOR LOGIC CHART



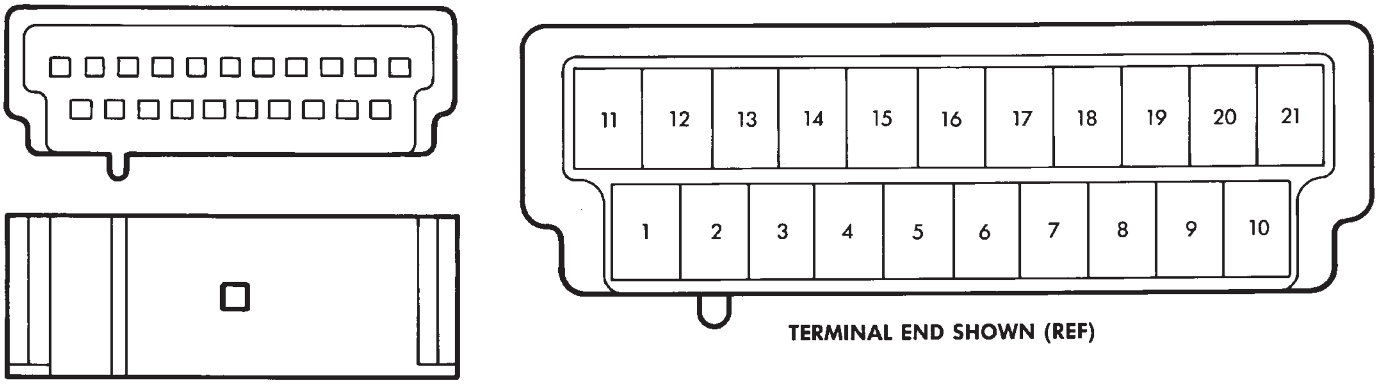
Fender Heights	Front	Rear	Customer Mode Sensor Position		Sensor Signals	
				A	B	C
28.5 to 29.9 in.			High	OPEN	CLOSED	OPEN
	26.4±0.1	2.61±0.1	Trim 2	CLOSED	OPEN	CLOSED
24.0 to 24.5 in.			LOW	CLOSED	OPEN	OPEN

Fender Heights			Shipping Mode Sensor Position		Sensor Signals	
				A	B	C
28.5 to 29.9 in.			High	OPEN	CLOSED	OPEN
	27.3±0.1	27.4±0.1	Trim 1	OPEN	CLOSED	CLOSED
24.0 to 24.5 in.			LOW	CLOSED	OPEN	OPEN

- The height sensor signals must be verified by using a volt/ohm meter to measure resistance.
- Refer to the "Height Sensor Logic Chart" for sensor signal information.
- Measure resistance values by completing the circuit between the appropriate sensor pin and the appropriate ground pin. See the control module terminal chart.

9102-42

CONTROL MODULE CONNECTOR



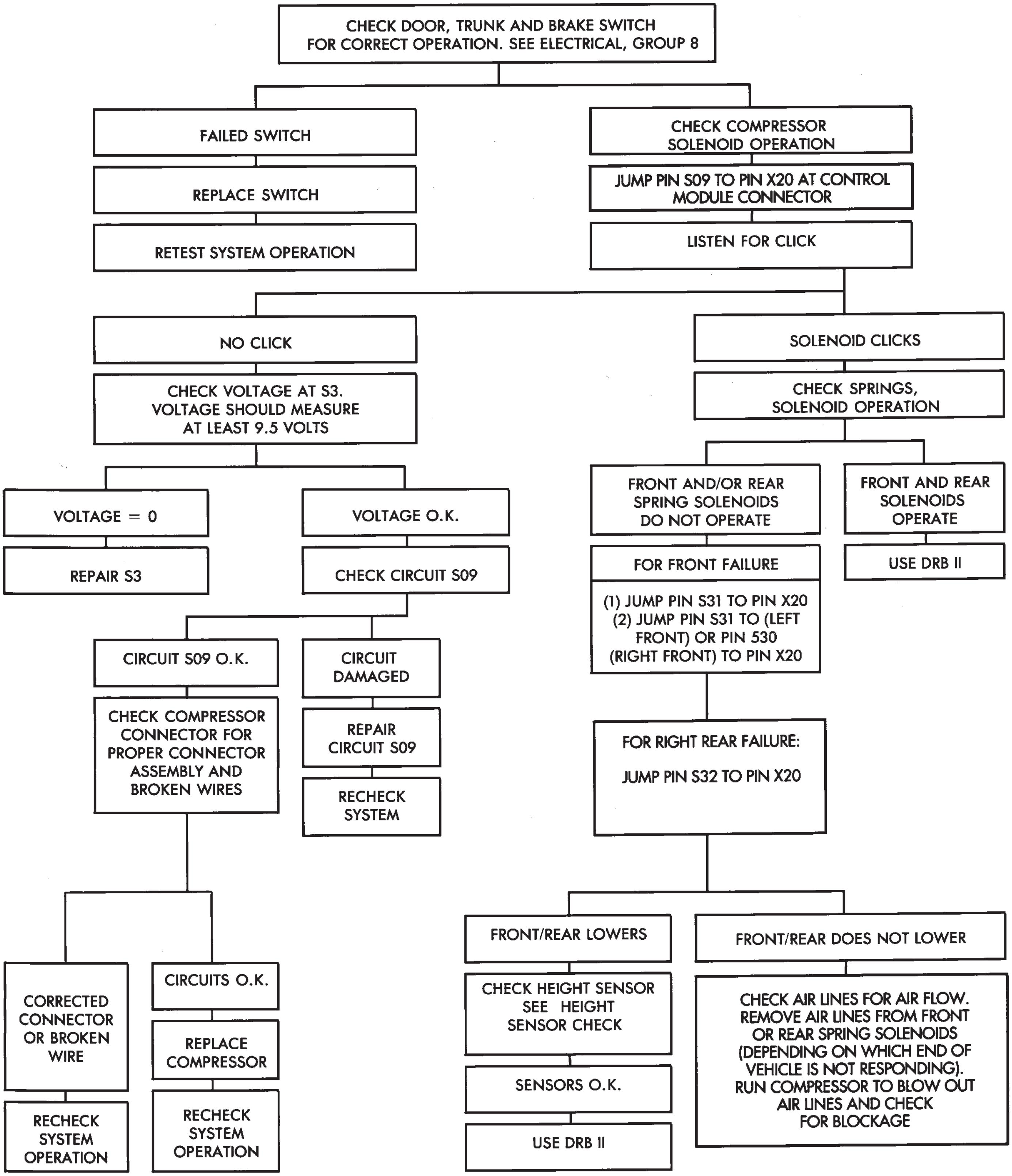
CAVITY	CIR	COLOR	GA	DESCRIPTION
1	S14	DB/RD*	20a	FR HEIGHT SENSOR SIG-B
2	S11	DG	20a	FL HEIGHT SENSOR SIG-A
3	S15	DG/WT*	20a	FL HEIGHT SENSOR SIG-C
4	S20	LG/RD*	18	RR HEIGHT SENSOR SIG-B
5	MX1	BK	20	CCD BUS (+)
6	S30	DB/OR*	20a	FR HEIGHT CONTROL SOL (B−)
7	S31	DG/OR*	20a	FL HEIGHT CONTROL SOL (B−)
8	S09	BK/OR*	20a	COMPRESSOR EXHAUST SOL (B−)
9	S08	BK/RD*	20a	COMPRESSOR RELAY (B−)
10	S32	LG/CR*	18	RR HEIGHT CONTROL SOL (B−)
11	S12	DB	20a	FR HEIGHT SENSOR SIG-A
12	S16	DB/WT*	20a	FR HEIGHT SENSOR SIG-C
13	S13	DG/RD*	20a	FL HEIGHT SENSOR SIG-B
14	S18	LG	18	RR HEIGHT SENSOR SIG-A
15	S22	LG/WT*	18	RR HEIGHT SENSOR SIG-C
16	MX2	WT/BK*	20	CCD BUS (−)
17	S33	BR	18	FRT HEIGHT SENSOR COMMON (B−)
18	—	—	—	OPEN CAVITY
19	X20	GY*	20	MODULE GROUND (B−) RR HEIGHT SENSOR COMMON (B−)
20	W40	YL/RD*	18	IGNITION
21	S3	PK/WT*	18	MODULE POWER (B+)

9002-48

Fig. 10 Control Module Connector

AUTOMATIC AIR SUSPENSION DIAGNOSTICS

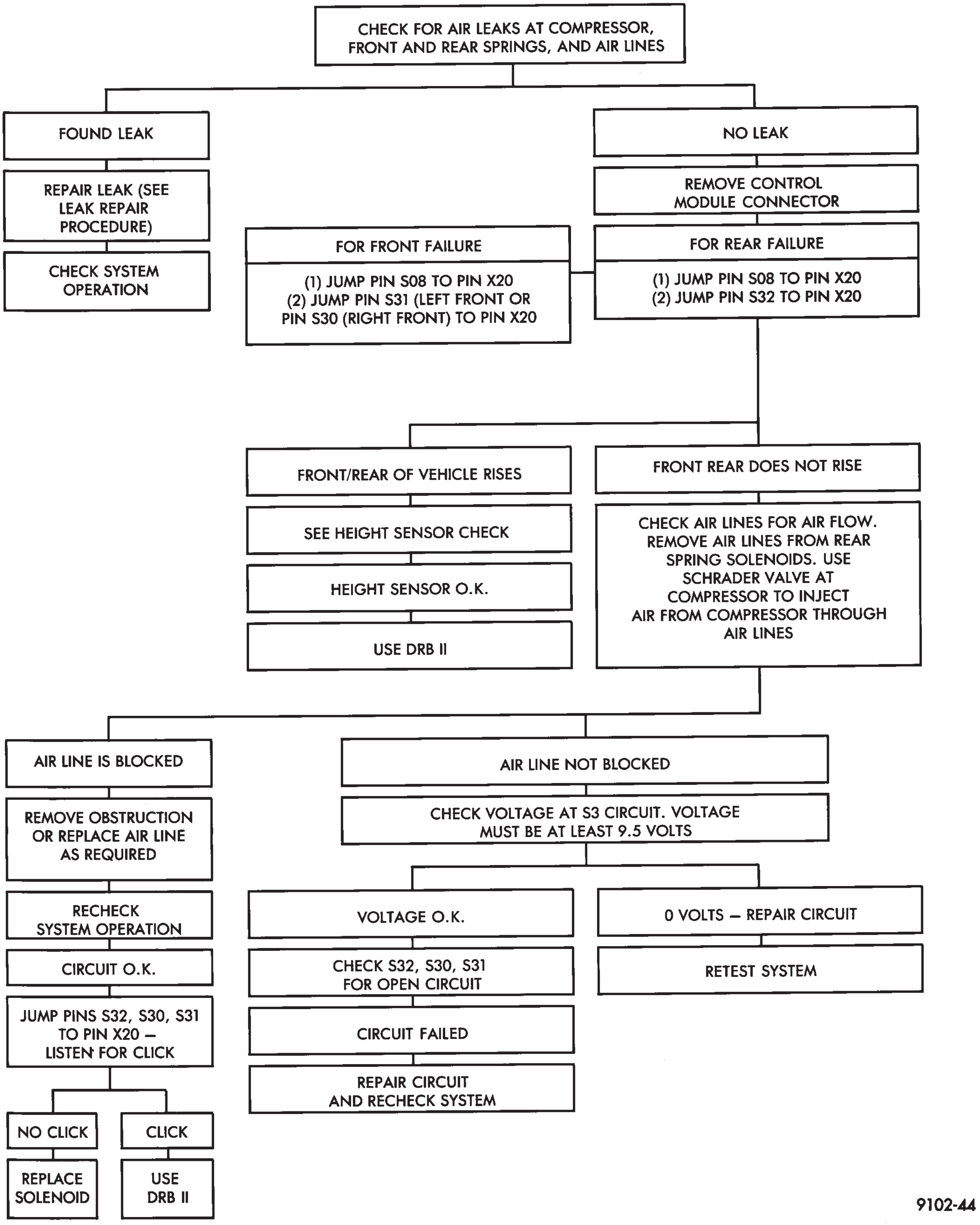
VEHICLE REMAINS IN HIGH POSITION



9102-43

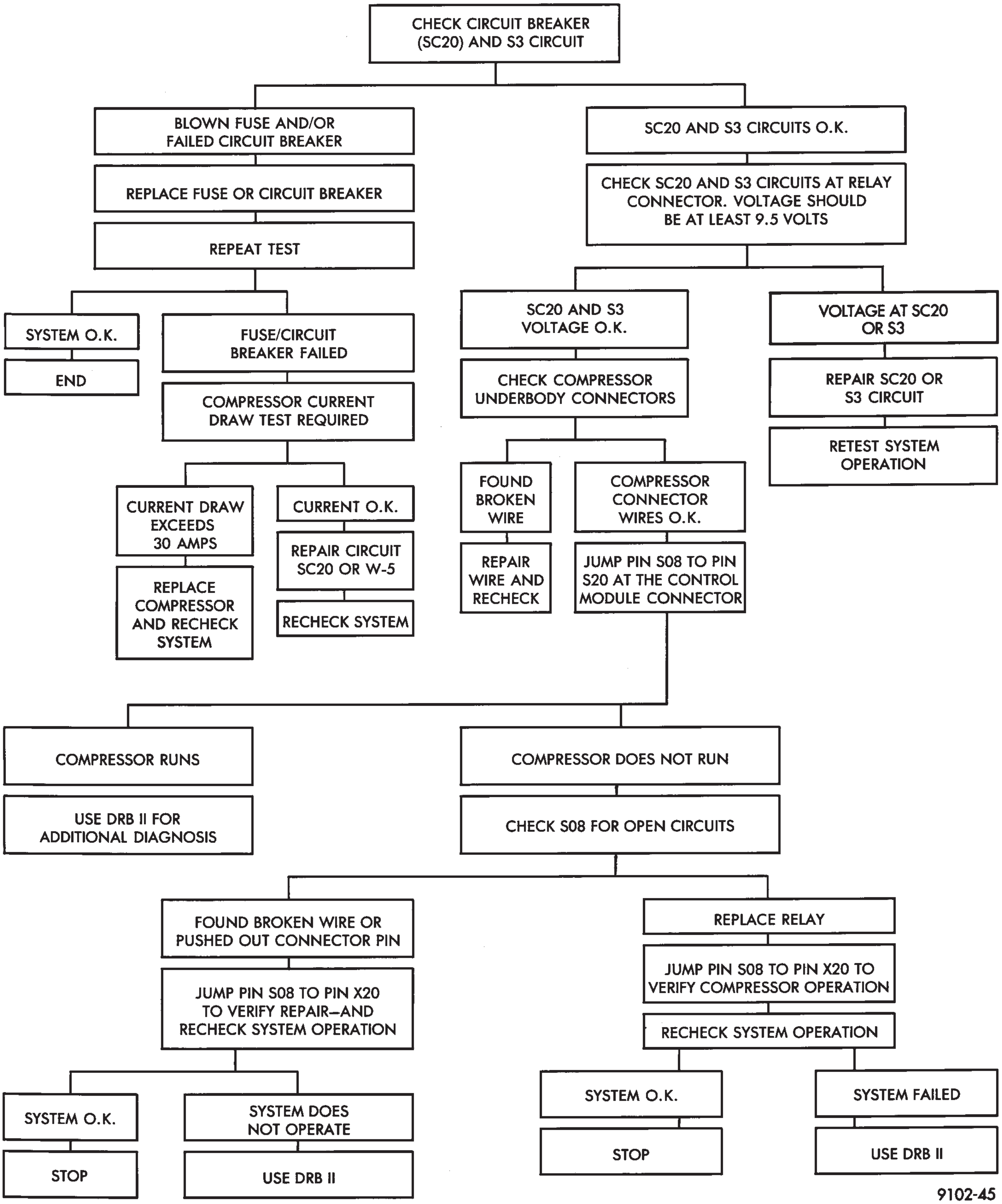
AUTOMATIC AIR SUSPENSION DIAGNOSTICS

VEHICLE REMAINS LOW AT FRONT OR REAR
– COMPRESSOR OPERATES –



AUTOMATIC AIR SUSPENSION DIAGNOSTICS

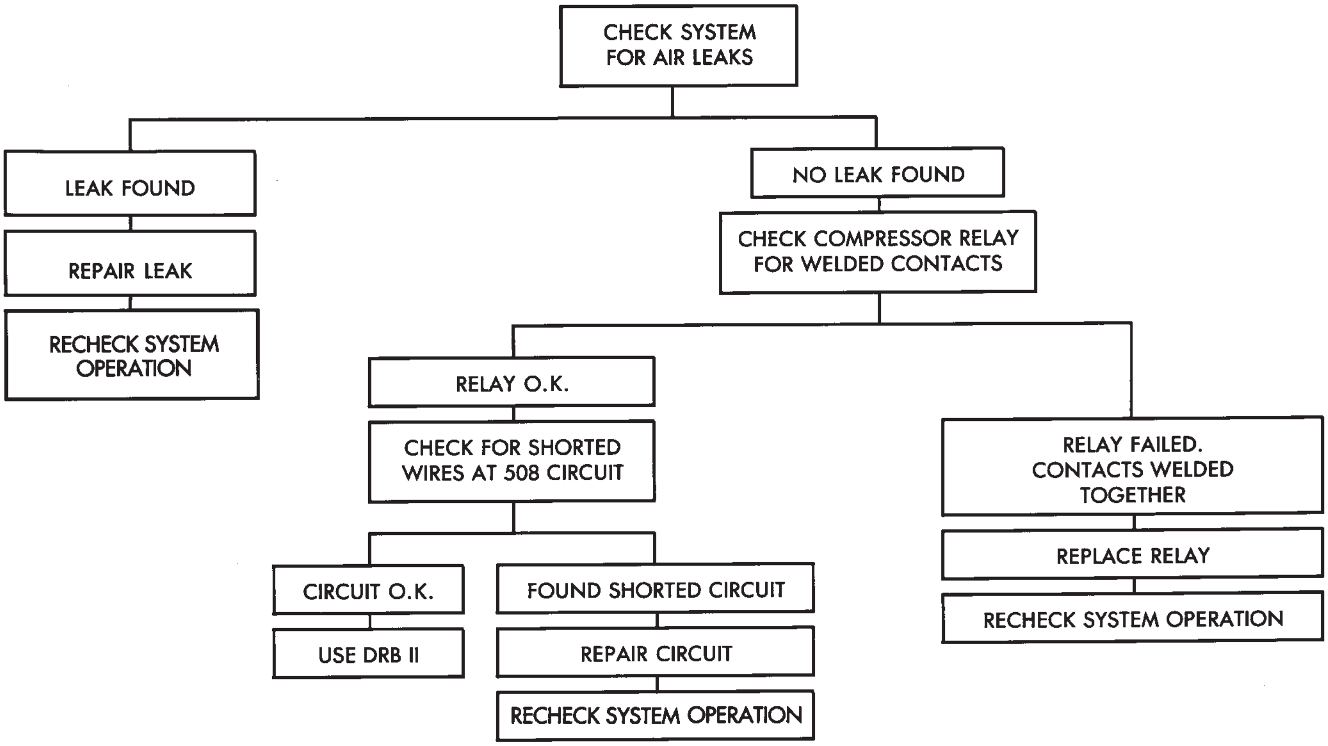
VEHICLE REMAINS LOW
– COMPRESSOR DOES NOT PUMP –



9102-45

AUTOMATIC AIR SUSPENSION DIAGNOSTICS

COMPRESSOR OVERRUN



9102-47

SERVICE PROCEDURES

CONTROL MODULE (ASCM)

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove right side trunk trim panel.

(3) Remove electrical connectors from control module and relay (Fig. 11).

(4) Remove control module mounting screws and remove assembly.

INSTALLATION

(1) Install relay on the control module mounting bracket (if required).

(2) Place control module in mounting position.

(3) Install mounting screws and tighten to 2-3 N●m (19-29 in. lbs.) torque.

(4) Install control module and relay wiring connectors (Fig. 11).

(5) Install right side trunk trim panel.

(6) Connect negative battery cable.

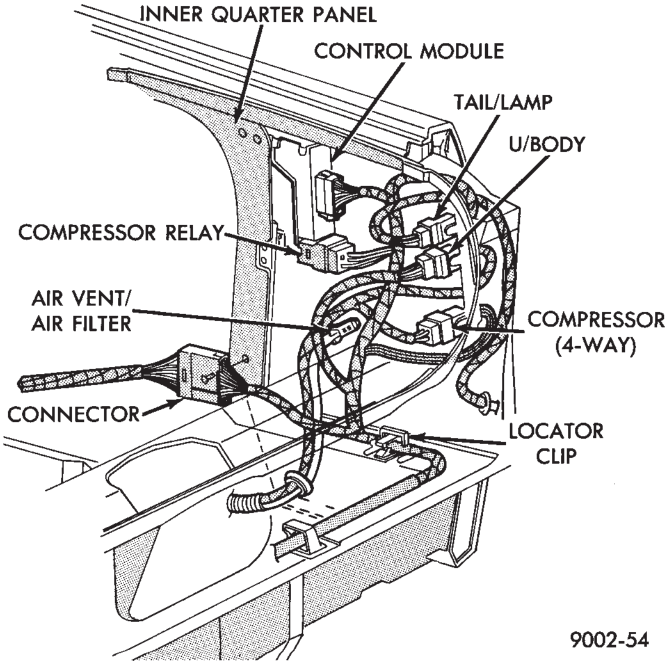


Fig. 11 Control Module and Relay Wiring

COMPRESSOR RELAY

REMOVAL

(1) Remove right side trunk trim panel.

(2) Remove electrical connector from relay.

(3) Remove relay from control module mounting bracket by prying out on locating clip (Fig. 11)

INSTALLATION

(1) Push relay onto bracket (relay will Lock into position.)

(2) Install electrical connector.

(3) Install trim panel.

COMPRESSOR ASSEMBLY

REMOVAL

(1) Disconnect battery negative cable.

(2) Raise vehicle, see Hoisting, Group 0.

(3) Remove cover from compressor assembly. Remove air hose (see AIR LINES) and electrical connectors (Fig. 12)

(4) Remove compressor assembly mounting screws and lower assembly from vehicle.

(5) Remove mounting bracket screws and slide mounting bracket away from compressor.

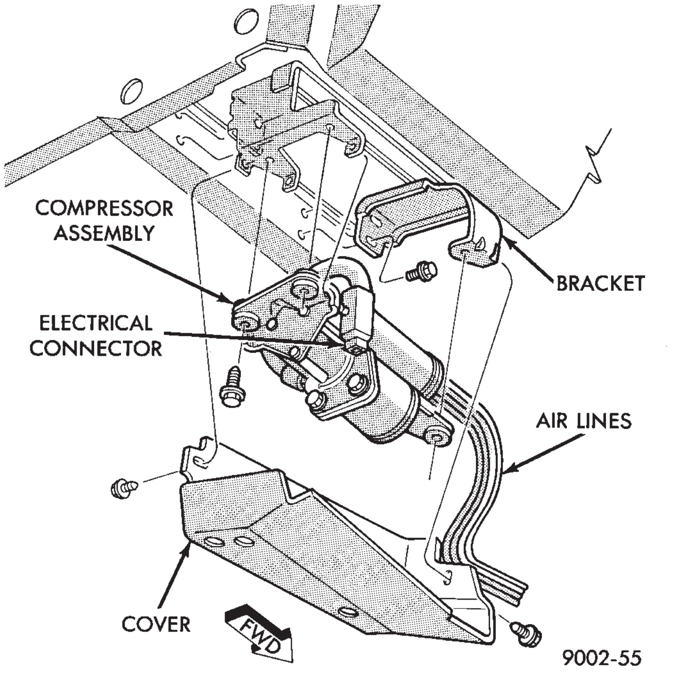


Fig. 12 Compressor Assembly

INSTALLATION

(1) Slide mounting bracket on compressor and install screws and tighten to 8 N●m (70 in. lbs.) torque. **DO NOT OVER TORQUE THESE SCREWS.**

(2) Install compressor assembly to frame rail and tighten screws to 8 N●m (70 in. lbs.) torque. **DO NOT OVER TORQUE THESE SCREWS.**

(3) Connect air hose and electrical connector to compressor assembly.

(4) Install cover on compressor assembly and tighten screws to 6 N●m (40 in. lbs.) torque.

(5) Lower vehicle and connect battery negative cable.

(6) Check operation of the system.

AIR DRYER

REMOVAL

Remove compressor assembly. See COMPRESSOR ASSEMBLY.

(1) Remove dryer-to-compressor retaining screw (Fig. 13).

(2) Rotate dryer assembly 90° to release retaining tangs from exhaust solenoid housing and withdraw unit.

INSTALLATION

Inspect O-Ring for damage and location on dryer assembly.

(1) Insert and index air dryer locking tangs into exhaust solenoid outlet.

(2) Rotate air dryer assembly to lock position and install air dryer-to-compressor retaining screw (Fig. 13).

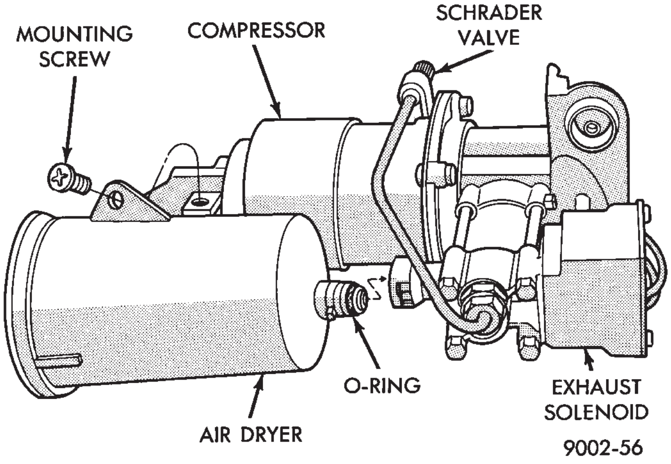


Fig. 13 Air Dryer Remove/Install

SOLENOIDS (STRUTS AND AIR SPRINGS)

Front struts and rear springs are equipped with solenoids that control air pressure and volume within the assemblies. The solenoids are electrically operated to allow air input, contain air, or release air pressure, depending on control module commands.

REMOVAL

WARNING: DO NOT ATTEMPT TO REMOVE OR INSTALL SOLENOIDS WHILE AIR SUSPENSION (FRONT STRUTS AND REAR AIR SPRINGS) ARE SUPPORTING VEHICLE.

Disconnect negative battery cable. Raise vehicle and remove wheel and tire assembly then remove solenoid(s) as follows:

(1) Separate electrical connection to solenoid.

(2) Disconnect air line, see Air Lines and Fittings. Solenoids have molded square tangs to fit into stepped notches of the air spring housing. The notches provide an air relief position and a retaining position. The retaining position is locked with a retaining clip.

(3) Remove retaining clip (Fig. 14).

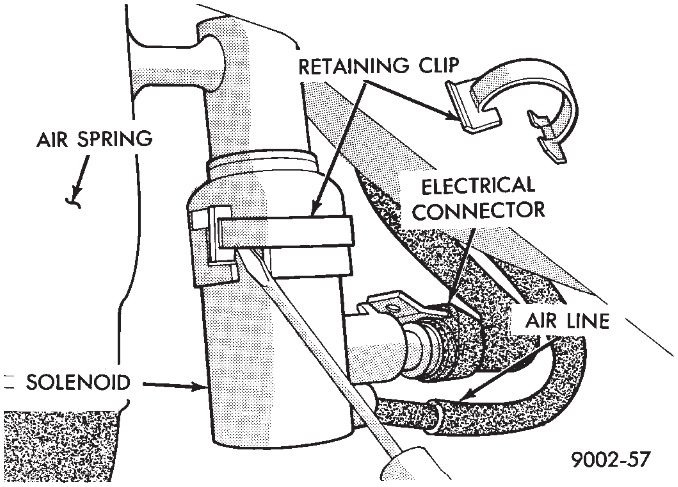


Fig. 14 Remove Retaining Clips

(4) Rotate solenoid to first step in housing and allow air pressure to vent (Fig. 15).

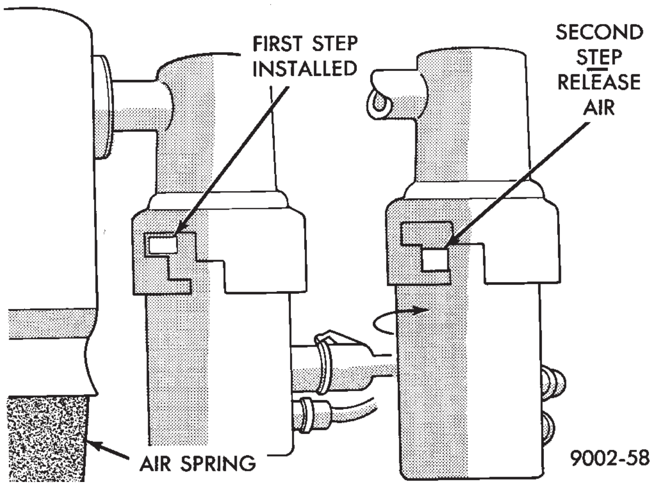


Fig. 15 Release Air Pressure

(5) Rotate solenoid to release slot and remove (Fig. 16).

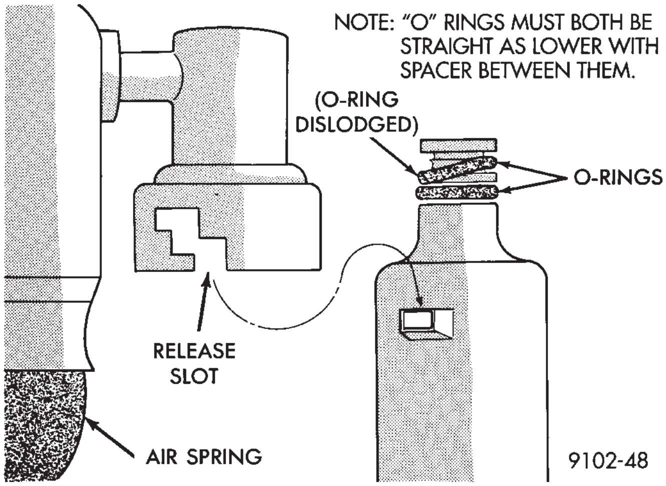


Fig. 16 Remove Solenoid (Inspect O Ring)

INSTALL

(1) Inspect O-Ring condition and position on solenoid stem. (O-Ring can become dislodged during removal (Fig. 16).

(2) Install solenoid with tangs to top ledge of housing and install retaining clip.

(3) Reconnect air line and electrical connection.

STRUT (AIR SUSPENSION) DAMPER ASSEMBLY

Service procedures for removal and installation for (air or steel spring) assemblies are essentially the same. Except for air venting/recharging and disconnecting/connecting air lines and electrical connection.

REMOVAL

(1) Disconnect battery negative cable.

(2) Hoist vehicle and remove wheel and tire assembly.

(3) See AIR LINES AND FITTINGS and disconnect air line.

(4) Disconnect electrical leads, solenoid and height sensors.

(5) See SOLENOIDS (STRUT AND AIR SPRING) and vent air spring and remove solenoids.

(6) See STRUT DAMPER ASSEMBLY in FRONT SUSPENSION and remove strut.

DISASSEMBLY/ASSEMBLE

Disassembly is restricted to upper mount and bearing housing. The strut shock absorber, air spring with integral height sensor, solenoid and wiring harness are serviced as an assembly.

(1) Hold retaining plate locking washer and remove strut rod nut.

(2) Remove locking washer, retainer plate, spacer, flat washer and mount/bearing housing assembly (Fig. 17).

(3) Assemble in reverse order. Hold retainer plate locking washer with suitable tool and tighten strut rod nut to 75 N●m (55 ft. lbs.) torque.

INSTALLATION

(1) See STRUT DAMPER ASSEMBLY in FRONT SUSPENSION and install strut.

(2) Install solenoid, see: SOLENOIDS (STRUT AND AIR SPRINGS).

(3) Connect electrical leads, solenoid and height sensor.

(4) Charge (inflate) air spring. See RECHARGE-AIR SPRING to activate spring solenoid and air compressor. Add air for 60 seconds.

RECHARGE AIR SPRING

To activate compressor; Ground Pin S08 to Pin X20.

To Activate Spring Solenoid:

- LF: Ground Pin S31 to X20

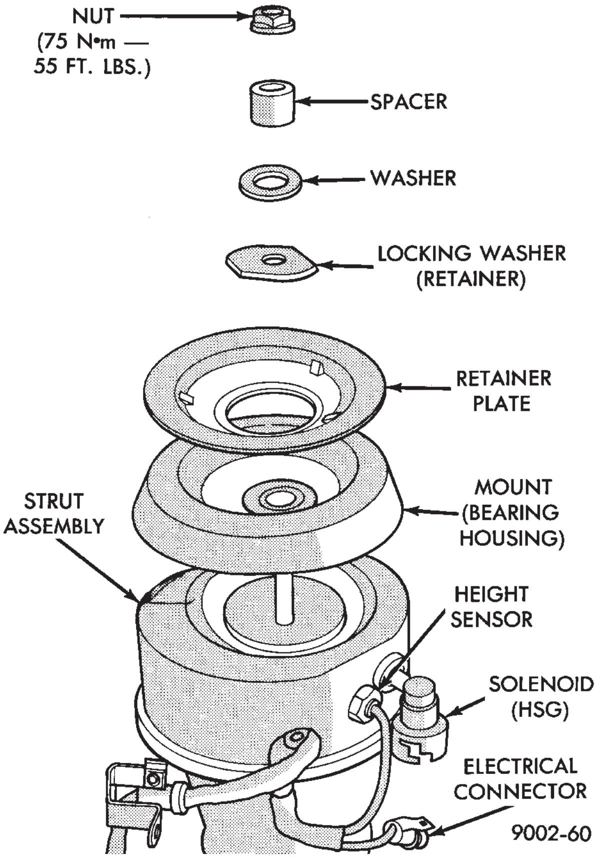


Fig. 17 Air Strut Upper Mount Assembly

- RF: Ground Pin S30 to X20
- RR: Ground Pin S32 to X20

AIR SPRINGS REAR

REMOVAL

(1) Disconnect battery negative cable, hoist vehicle and remove wheel and tire assembly.

(2) See AIR LINES AND FITTINGS and disconnect air line and electrical connector from solenoid.

(3) See SOLENOIDS (STRUT AND AIR SPRINGS) and vent air from spring. Remove solenoid.

(4) Release upper air spring alignment/retainer clips. (Fig. 18)

(5) Remove lower spring to axle nut (Fig. 19).

(6) Pry assembly down to pull alignment studs through retaining clips (Fig. 20). Remove assembly.

INSTALLATION

(1) Position assembly lower stud into axle seat and upper alignment pins through frame rail adaptor.

(2) Install upper retaining clips.

(3) Install lower spring to axle nut: LOOSE ASSEMBLE.

(4) Install solenoid and connect air line and electrical connector.

(5) Charge (inflate) air spring. See RECHARGING AIR SPRING and add air for 60 seconds.

(6) AFTER partial air recharge tighten lower nut

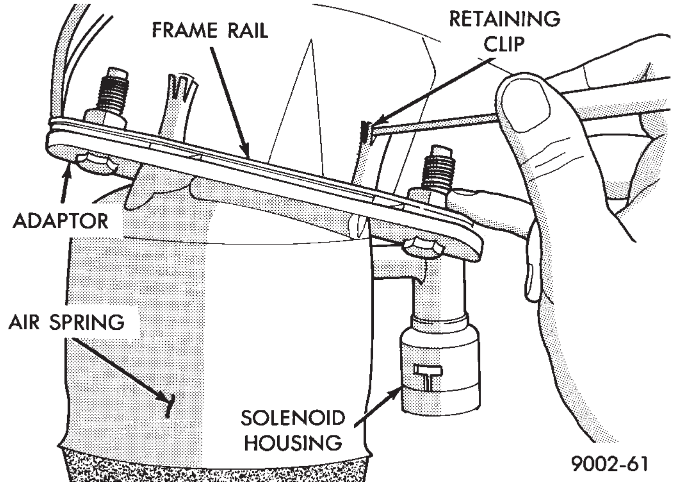


Fig. 18 Release Retaining Clips

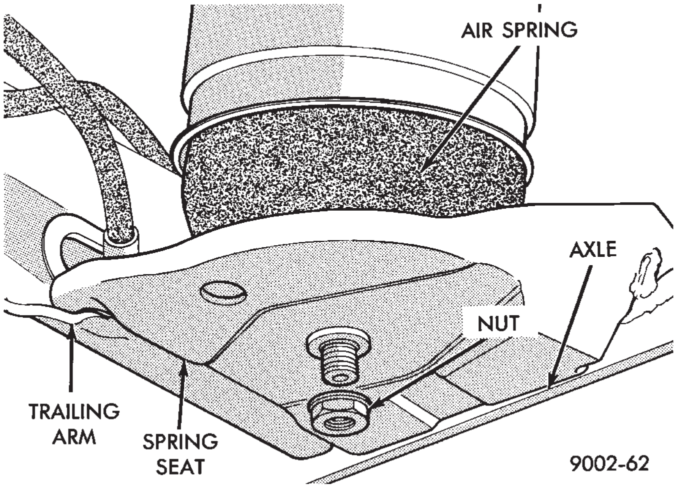


Fig. 19 Remove/Install Lower Spring to Axle Nut

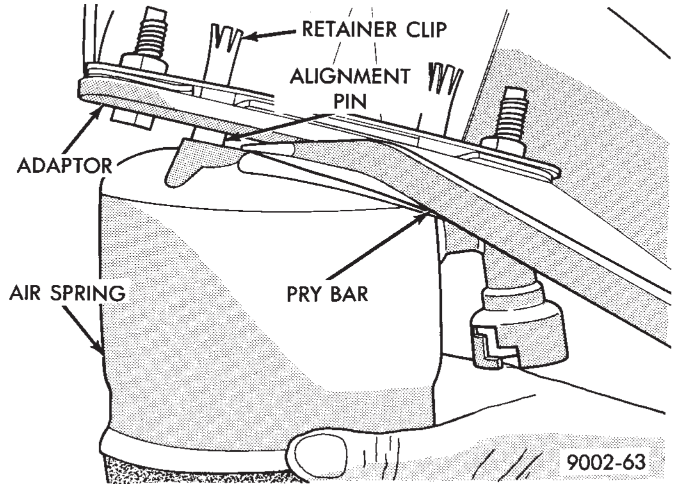


Fig. 20 Pry Assembly Out of Retaining Clips

to 68 N●m (50 ft. lbs.) torque.

(7) Install wheel and tire assembly. Lower vehicle, install wheel and tire assembly and connect battery negative cable.

RIGHT SHOCK ABSORBER (WITH HEIGHT SENSOR)

REMOVAL

(1) Disconnect battery negative cable.

(2) Raise vehicle, see Hoisting, Group 0.

(3) Remove tire assembly.

(4) Disconnect height sensor connector located on right rear frame rail.

(5) Remove shock, see Shock Absorbers, Removal.

INSTALLATION

(1) Install shock assembly, see Shock Absorbers, Installation.

(2) Route height sensor wire through retaining clips and then tie strap to fuel filler tube.

(3) Snap height sensor connector into underbody harness connector.

(4) Install wheel/tire assembly.

(5) Height sensor wiring harness and white paint mark on bottom shock eye must face to the front of the vehicle (Fig. 21).

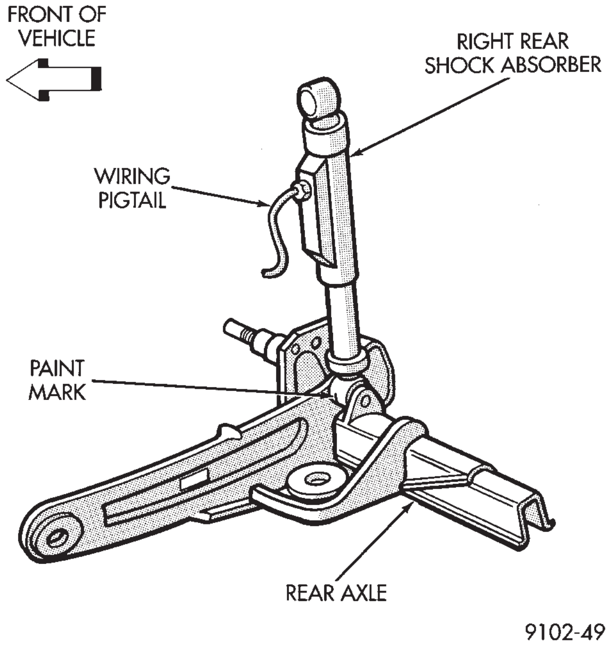


Fig. 21 Right Rear Shock Absorber Installation

REAR (STUB) AXLE ALIGNMENT ALL MODELS

INDEX

GENERAL INFORMATION

Because front wheel drive vehicles are equipped with rear suspension incorporating stub axles (or wheel spindles). It is possible to align both the camber and toe of the rear wheels.

REAR WHEEL ALIGNMENT

Alignment adjustment if required. Is made by adding 0.010 inch shims (from the service package kit) between the spindle mounting surface and axle mounting plate. Each shim equals wheel change by .3° as shown (for all car lines) in (Figs. 3 to 6).

If rear wheel alignment is required, place vehicle on alignment rack and check alignment specifications. **When recording rear toe-in (vehicle backed onto alignment rack) REMEMBER to reverse sign convention; a total toe-in on direct reading charts is actually toe-out while driving.** Maintain rear alignment within Chrysler Motors recommendations, found in Specifications.

INSTALLATION OF REAR ALIGNMENT SHIMS

(1) Block front tires so vehicle will not move.

(2) Release parking brake.

(3) Hoist vehicle so that rear suspension is in full rebound and tires are off the ground. See Hoisting in Lubrication and Maintenance, Group 0.

(4) Remove wheel and tire assembly.

(5) Pry off grease cap.

(6) Remove cotter pin and castle lock.

(7) Remove adjusting nut.

(8) Remove brake drum (Fig. 1).

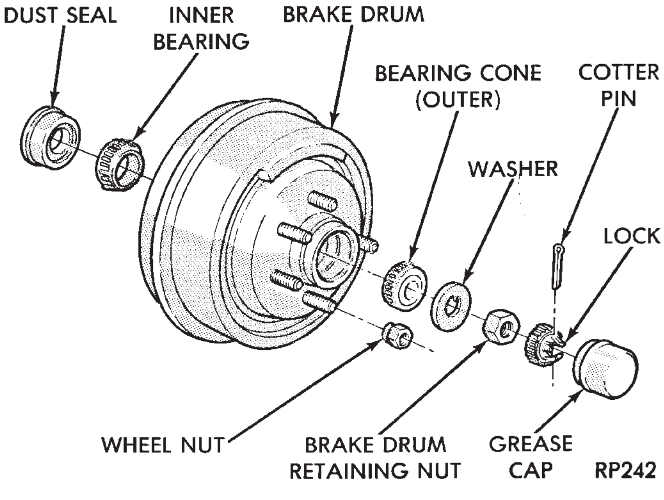


Fig. 1 Remove Brake Drum

(9) Loosen four (4) brake assembly and spindle mounting bolts enough to allow clearance for shim installation (Fig. 2). **Do not remove mounting bolts.**

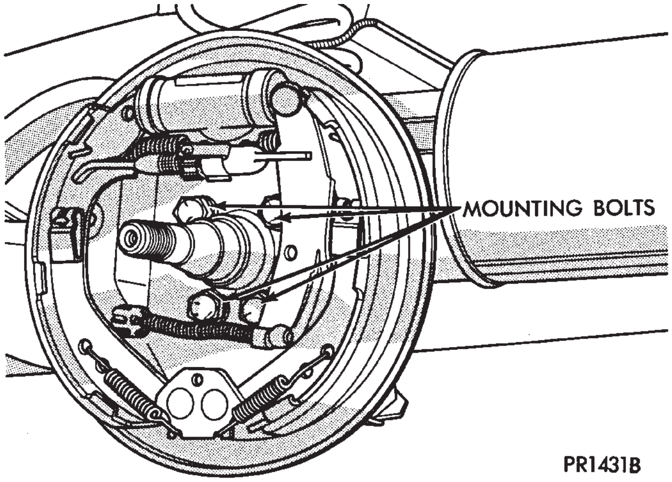


Fig. 2 Loosen Mounting Bolts

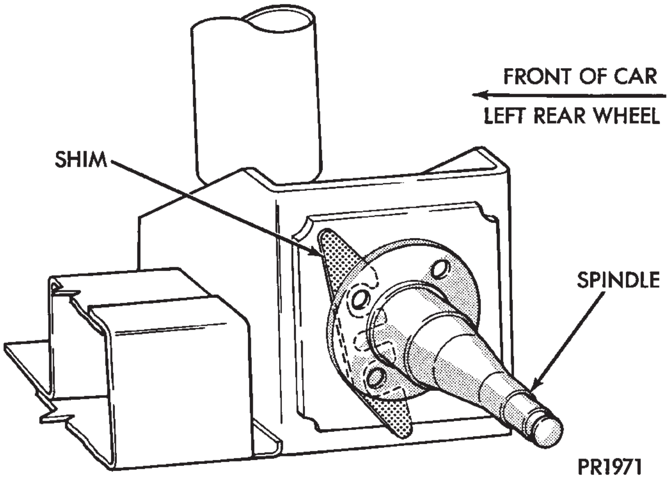


Fig. 3 Shim Installation for Toe-Out

(10) Install shims as shown in Figs. 3, 4, 5 and 6 for desired wheel change. No more than two shims on each spindle should be used to bring alignment within acceptable range.

Wheel change by .3° per shim.

(11) Tighten down the 4 brake support plate and spindle to axle mounting bolts until they are snug. Then tighten the 4 bolts to the torque values listed for the vehicle line which is being serviced.

- AA, AG, AJ, AP Bodies 75 N•m (55 ft. lbs.)

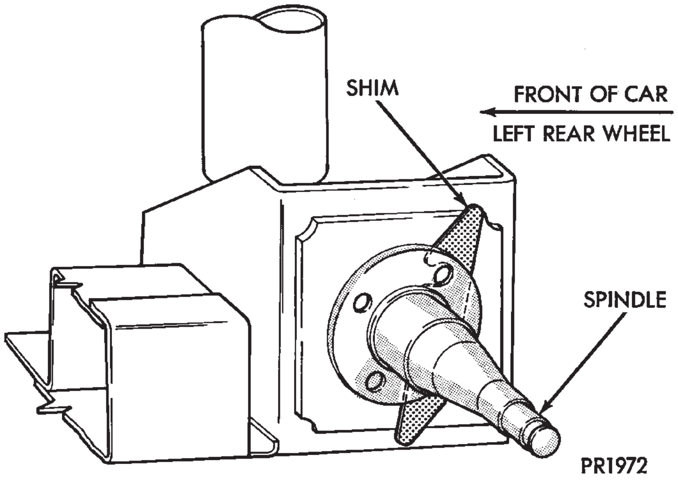


Fig. 4 Shim Installation for Toe-In

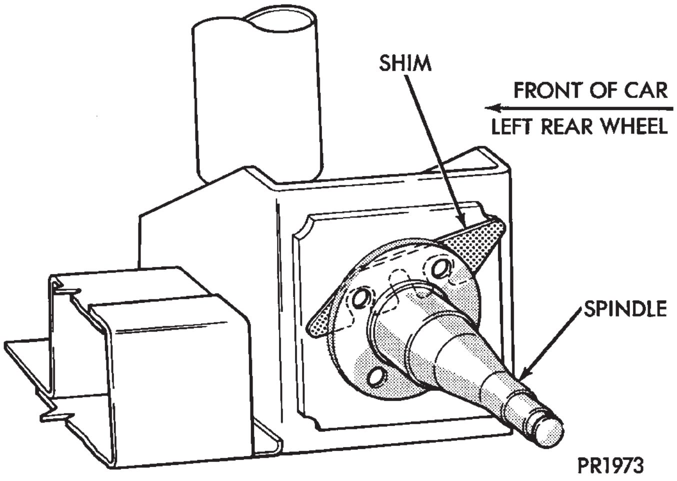


Fig. 5 Shim Installation for Positive Camber

- AC, AY Bodies 108 N•m (80 ft. lbs.)

(12) Install brake drum (Fig. 1).

(13) Install washer and nut. Tighten adjusting nut to 27-34 N•m (240-300 in. lbs.) torque while rotating wheel. Back off adjusting nut with wrench to completely release bearing preload. Finger tighten adjusting nut.

(14) Position nut lock with one pair of slots in-line with cotter pin hole. Install cotter pin. The end play should be 0.025-0.076 mm (0.001-0.003 inch). Clean and install grease cap.

(15) Install wheel and tire assembly. Tighten wheel nut to 129 N•m (95 ft. lbs.) torque.

(16) Lower vehicle.

(17) Check alignment specifications.

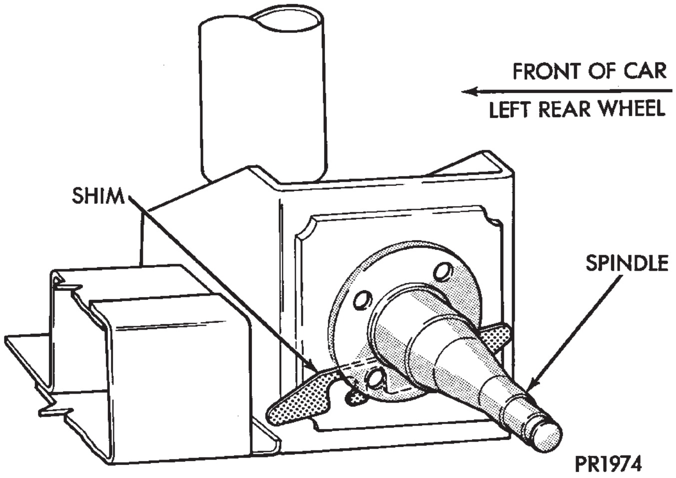
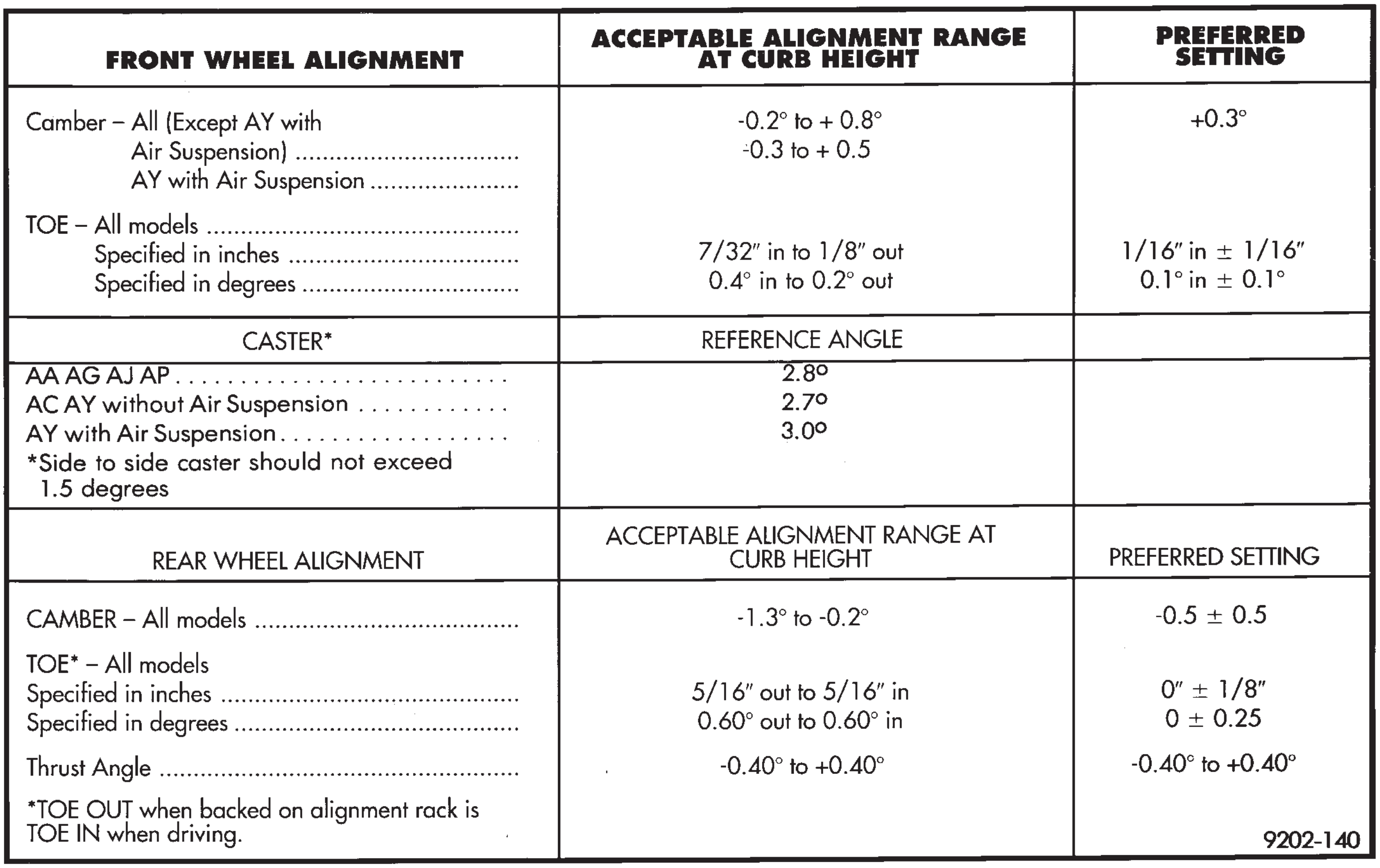


Fig. 6 Shim Installation for Negative Camber

SPECIFICATIONS

ALIGNMENT SPECIFICATIONS AT CURB HEIGHT



FRONT WHEEL ALIGNMENT	**ACCEPTABLE ALIGNMENT RANGE AT CURB HEIGHT**	**PREFERRED SETTING**
Camber – All (Except AY with Air Suspension)	-0.2° to + 0.8°	+0.3°
AY with Air Suspension	-0.3 to + 0.5	
TOE – All models		
Specified in inches	7/32″ in to 1/8″ out	1/16″ in ± 1/16″
Specified in degrees	0.4° in to 0.2° out	0.1° in ± 0.1°
CASTER*	REFERENCE ANGLE	
AA AG AJ AP	2.8°	
AC AY without Air Suspension	2.7°	
AY with Air Suspension	3.0°	
*Side to side caster should not exceed 1.5 degrees		
REAR WHEEL ALIGNMENT	ACCEPTABLE ALIGNMENT RANGE AT CURB HEIGHT	PREFERRED SETTING
CAMBER – All models	-1.3° to -0.2°	-0.5 ± 0.5
TOE* – All models		
Specified in inches	5/16″ out to 5/16″ in	0″ ± 1/8″
Specified in degrees	0.60° out to 0.60° in	0 ± 0.25
Thrust Angle	-0.40° to +0.40°	-0.40° to +0.40°
*TOE OUT when backed on alignment rack is TOE IN when driving.		

9202-140

REAR SUSPENSION TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Spring Hanger Bracket To Frame Rail Mounting Bolts	81 N•m (60 ft. lbs.)
Trailing Arm To Hanger Bracket Nuts	95 N•m (70 ft. lbs.)
Brake Assembly Support Plate Mounting Bolts	75 N•m (55 ft. lbs.)
Shock Absorber Upper Mounting Bolts	54 N•m (40 ft. lbs.)
Shock Absorber Lower Mounting Bolts	61 N•m (45 ft. lbs.)
Wheel Stud Lug Nuts	109 - 150 N•m (80 - 110 ft. lbs.)
Track Bar To Rear Axle Attaching Bolts	95 N•m (70 ft. lbs.)
Track Bar Mounting Bracket To Frame Rail Bolts	55 N•m (40 ft. lbs.)
Track Bar Brace To Body Mounting Stud	55 N•m (40 ft. lbs.)
Track Bar To Mounting Bracket Nut	75 N•m (55 ft. lbs.)
Track Bar Brace To Body Stud Nut	75 N•m (55 ft. lbs.)
Jounce Bumper To Cup Attaching Nuts	55 N•m (40 ft. lbs.)
Jounce Bumper Cup To Frame Rail Attaching Bolts	95 N•m (70 ft. lbs.)

9302-121

FRONT SUSPENSION TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Wheel Stud Lug Nut (All)	109-150 N•m
Strut Damper To Steering Knuckle Leg	*100 N•m
Lower Control Arm Pivot Nut And Bolt	129 N•m
Sway Bar Cushion Bracket Attaching Bolts	70 N•m
Sway Bar End Bushing Bracket Attaching Bolts	70 N•m
Ball Joint Stud To Steering Knuckle Attaching Bolt	145 N•m
Strut Damper Rod To Upper Strut Mount Attaching Nut	75 N•m
Upper Strut Mount To Shock Tower Attaching Nuts	28 N•m
Front Crossmember To Frame Rail Attaching Bolts	122 N•m
Crossmember To Frame Rail Attaching Studs	54 N•m
Crossmember Attaching Nut To Frame Rail Stud	122 N•m

*Plus 1/4 90° Turn.

9302-124

BRAKES

CONTENTS

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the break down of these designations is included in the Introduction Section at the front of this service manual.

Standard brake equipment consists of:

- Double pin floating caliper disc front brakes.
- Rear automatic adjusting drum brakes.
- Differential valve with a brake warning switch.
- Master cylinder.
- Vacuum power booster.
- Double pin floating caliper rear disc brakes are available on some models.

The Bendix Anti-Lock 10 braking system, uses the standard power brake system caliper assemblies, braking discs, pedal assembly, brake lines and hoses. The unique parts of the Bendix Anti-Lock 10 braking system consists of the following components. Proportioning valves, wheel speed sensors, tone wheels, electronic control unit, modulator assembly and hydraulic assembly. These components replace the conventional master cylinder and power booster. The components will be described in detail in the Bendix Anti-Lock 10 brake section in this group of the service manual.

The Bendix Anti-Lock 6 braking system, uses the following standard brake system components. Master cylinder, power booster, caliper assemblies, braking discs, pedal assembly, brake lines and hoses. The unique parts of the Bendix Anti-Lock 6 braking system consists of the following components. Modulator assembly, unique proportioning valves, wheel speed sensors, tone wheels, and electronic control unit. These components will be described in detail in the Bendix Anti-Lock 6 brake section in this group of the service manual.

The front disc brake shoes have semi-metallic linings.

The hydraulic brake system (Fig. 1 2 3 and 4) is diagonally split on both the Non-ABS and ABS braking system. With the left front and right rear brakes on one hydraulic system and the right front and left rear on the other.

The Non-ABS and ABS brake system may use different types of brake line fittings and tubing flares. The Non-ABS brake system uses double wall tubing flares and fittings at all tubing joint locations. Some ABS brake systems use both ISO style tubing flares and double wall tubing flares and corresponding fittings at different joint locations. See (Figs. 2 3 and 4) for specific joint locations and type of tubing flare.

The front disc brakes consist of two different types of caliper assemblies. A double pin Kelsey-Hayes caliper (family caliper) with a bolt-on adapter attached to the steering knuckle. Or a double pin Kelsey-Hayes caliper (non-family caliper) which mounts directly to rails on the steering knuckle. The non-family caliper is only used on the AY Body (Imperials).

CAUTION: Caliper pistons, boots and seals for the different caliper assemblies used on the front and rear disc brake assemblies are not interchangeable. Misusage could result in a complete brake system failure. Be sure that the parts are replaced with the correct replacement parts, refer to the parts book for the type and model year of the vehicle being worked on.

The master cylinder is anodized, lightweight aluminum, with a bore size of 24.0mm, 21.0mm or 7/8 inch.

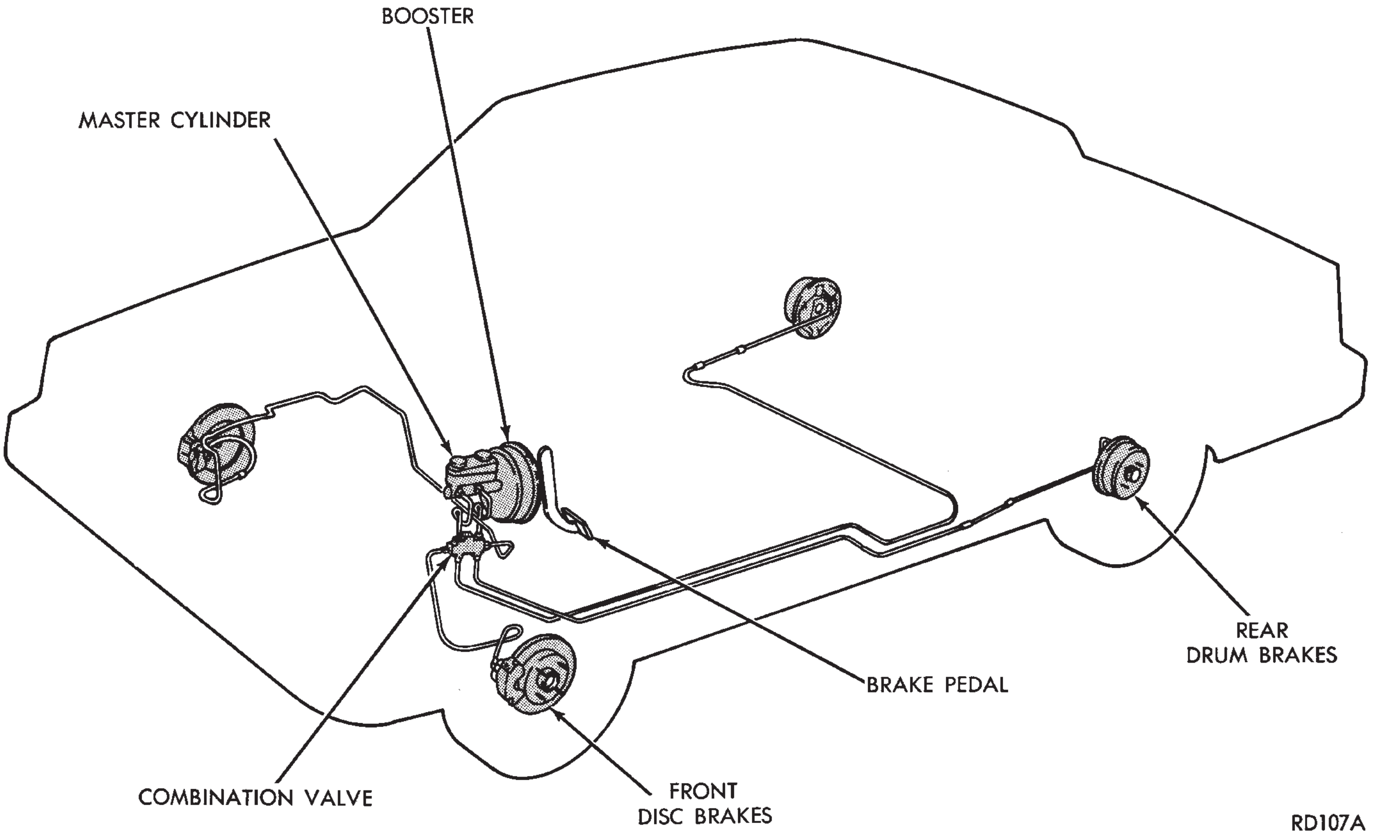


Fig. 1 Diagonally Split Braking System (Typical Non-ABS System)

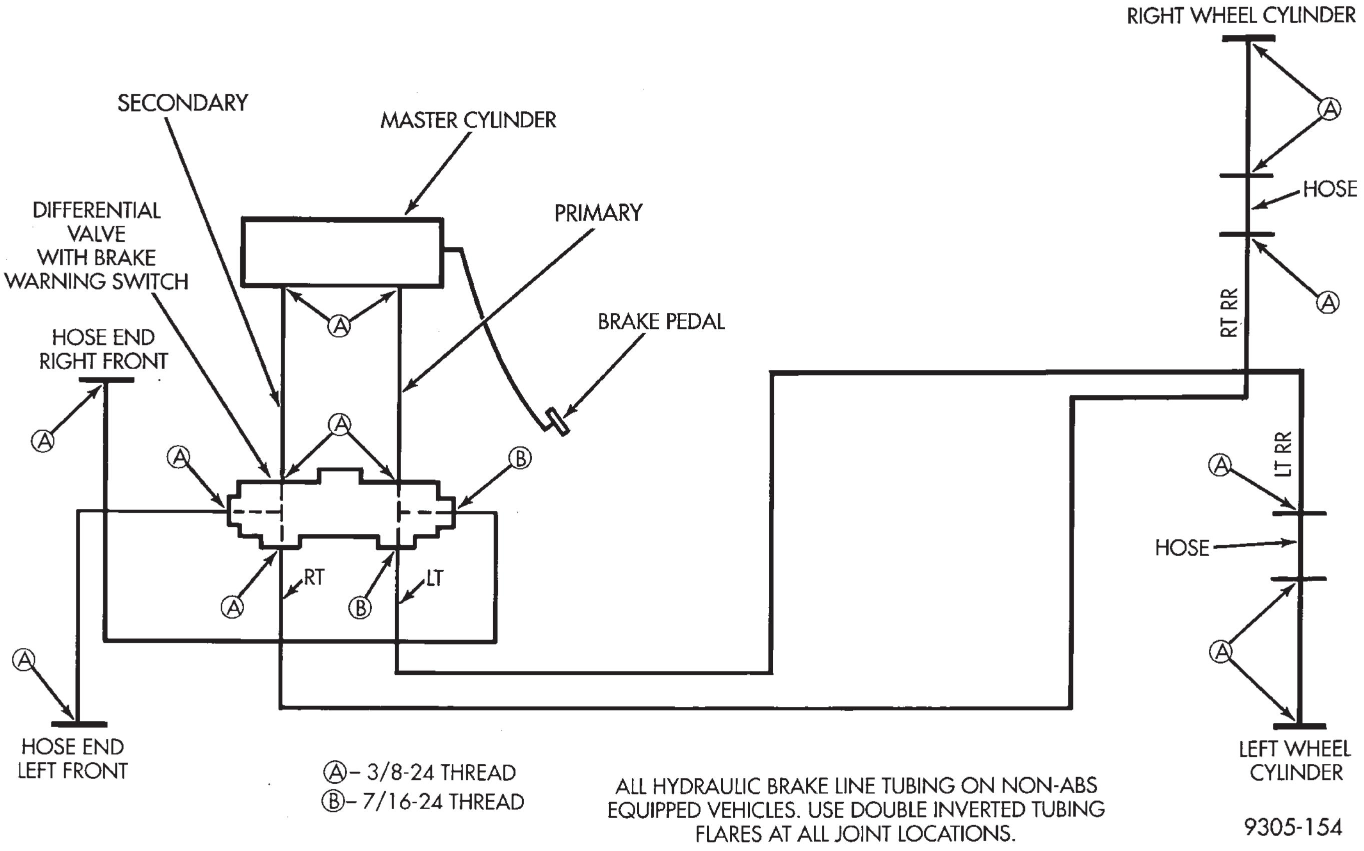
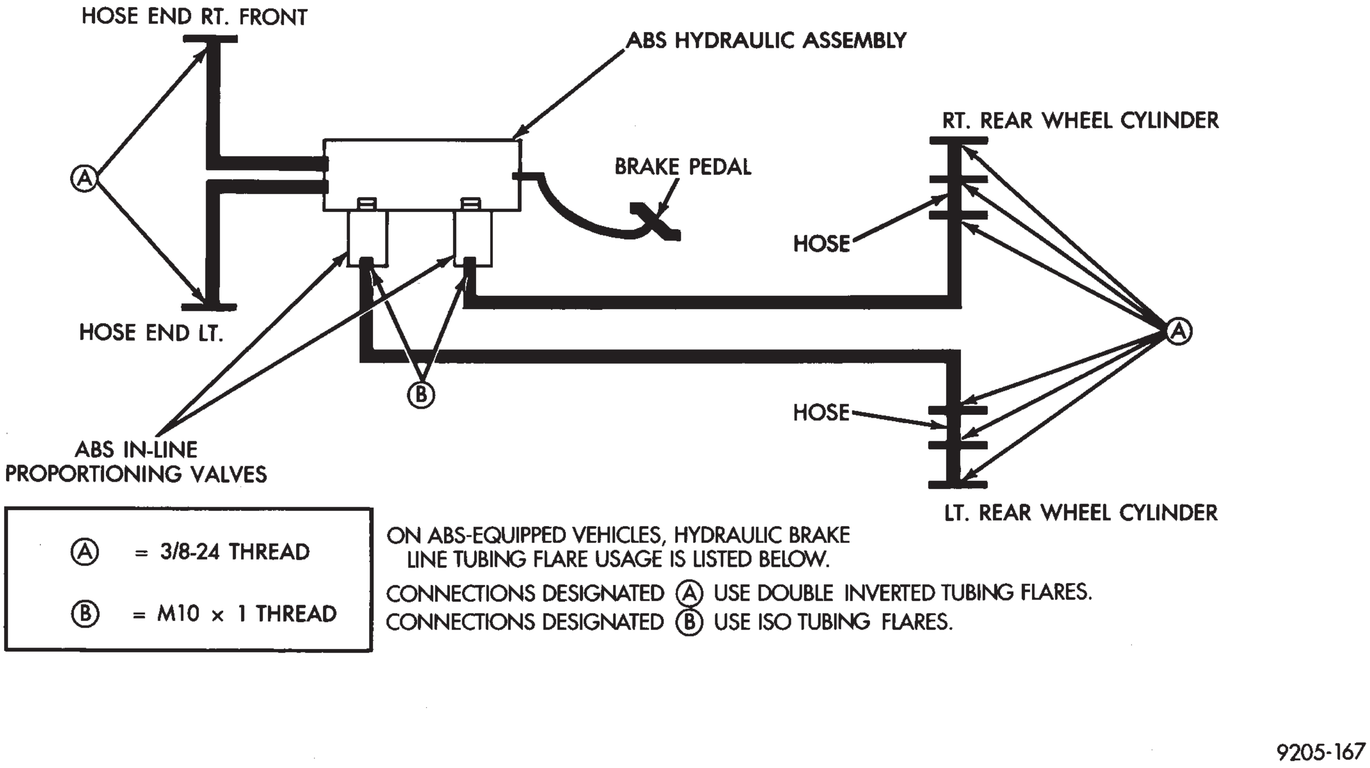


Fig. 2 Proper Nut Thread Size And Tube Routing (Non-ABS Equipped)

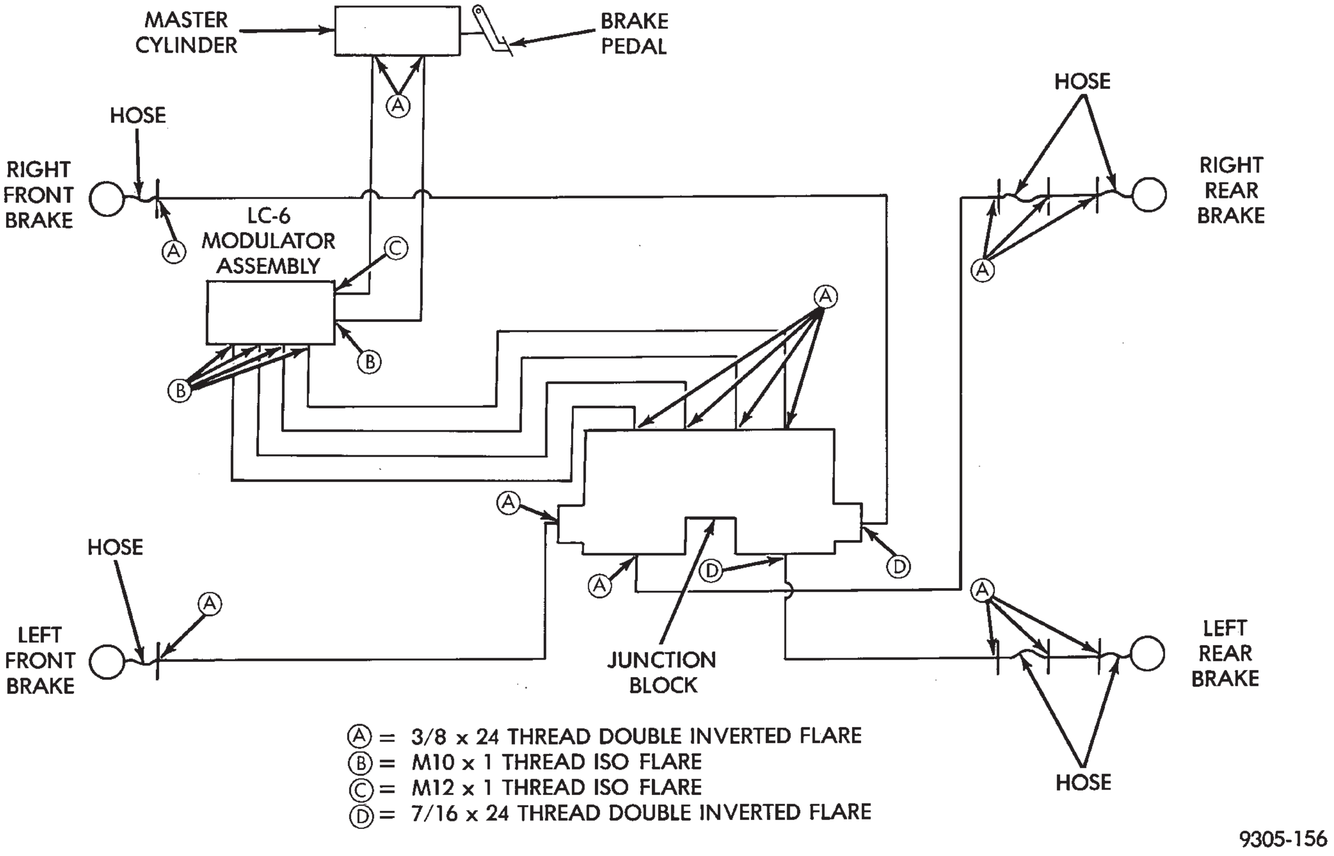


ON ABS-EQUIPPED VEHICLES, HYDRAULIC BRAKE LINE TUBING FLARE USAGE IS LISTED BELOW.

CONNECTIONS DESIGNATED Ⓐ USE DOUBLE INVERTED TUBING FLARES.

CONNECTIONS DESIGNATED Ⓑ USE ISO TUBING FLARES.

Fig. 3 Proper Nut Thread Size And Tube Routing (AC & AY Body With ABS)



Ⓐ = 3/8 x 24 THREAD DOUBLE INVERTED FLARE
Ⓑ = M10 x 1 THREAD ISO FLARE
Ⓒ = M12 x 1 THREAD ISO FLARE
Ⓓ = 7/16 x 24 THREAD DOUBLE INVERTED FLARE

Fig. 4 Proper Nut Thread Size And Tube Routing (AG AJ AP AA Body) W/ABS)

SERVICE ADJUSTMENTS

INDEX

MASTER CYLINDER FLUID LEVEL

ALL EXCEPT AC/AY BODY WITH ABS

Check master cylinder reservoir brake fluid level a minimum of twice a year.

Master cylinder reservoirs are marked with the words fill to bottom of rings indicating proper fluid level (Fig. 1).

If necessary, add fluid to bring the level to the bottom of the primary reservoir split ring.

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 in the brake system will result.

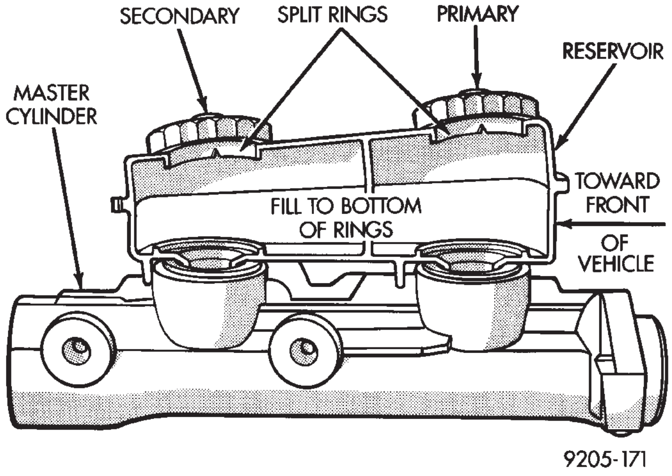


Fig. 1 Master Cylinder Fluid Level (All Except AC/AY Body W/ABS)

AC AND AY BODY WITH ANTI-LOCK BRAKES

The hydraulic assembly is equipped with a plastic fluid reservoir with a filter/strainer in the filler neck of the reservoir.

The Anti-Lock brake system requires that the hydraulic accumulator be de-pressurized whenever checking the brake fluid level. To check the brake fluid level, the following procedure should be used:

(1) With the ignition switch turned to the off position and key removed. De-pressurize hydraulic accumulator by applying brake pedal approximately 40 times, using a pedal force of approximately 220 N (50 lbs.). A noticeable change in pedal feel will occur when accumulator is de-pressurized. Continue to apply brake pedal several times after this change in pedal feel occurs to insure that brake system is fully de-pressurized.

(2) Thoroughly clean both reservoir caps and surrounding area of reservoir, (Fig. 2) before removing caps. This is to avoid getting dirt into the reservoir and contaminating the brake fluid.

(3) Inspect the brake fluid to see if it is at the proper level, see instructions on top of reservoir. (FILL TO TOP OF WHITE SCREEN ON FRONT FILTER/STRAINER.)

(4) Fill reservoir with brake fluid to top of screen (Fig. 3) on the filter/strainer located in brake fluid reservoir. Only use brake fluid conforming to DOT 3 specifications such as Mopar® or equivalent.

(5) Replace brake fluid reservoir caps.

ADJUSTING REAR SERVICE BRAKES

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 all wheels are free to turn. See Hoisting Recommendations in the Lubrication And Maintenance Section, at the front of this service manual.

(2) Remove rear brake adjusting hole rubber plug (Fig. 4), from the rear brake shoe support plate.

(3) **Be sure parking brake lever is fully released. Then back off parking brake cable adjustment so there is slack in the cable.**

(4) Insert Brake Adjuster, Special Tool C-3784, (Fig. 5) 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 the road wheel is rotated.

(5) Insert a thin screwdriver or piece of welding rod into brake adjusting hole (Fig. 5). Push adjusting lever out of engagement with star wheel. **Care**

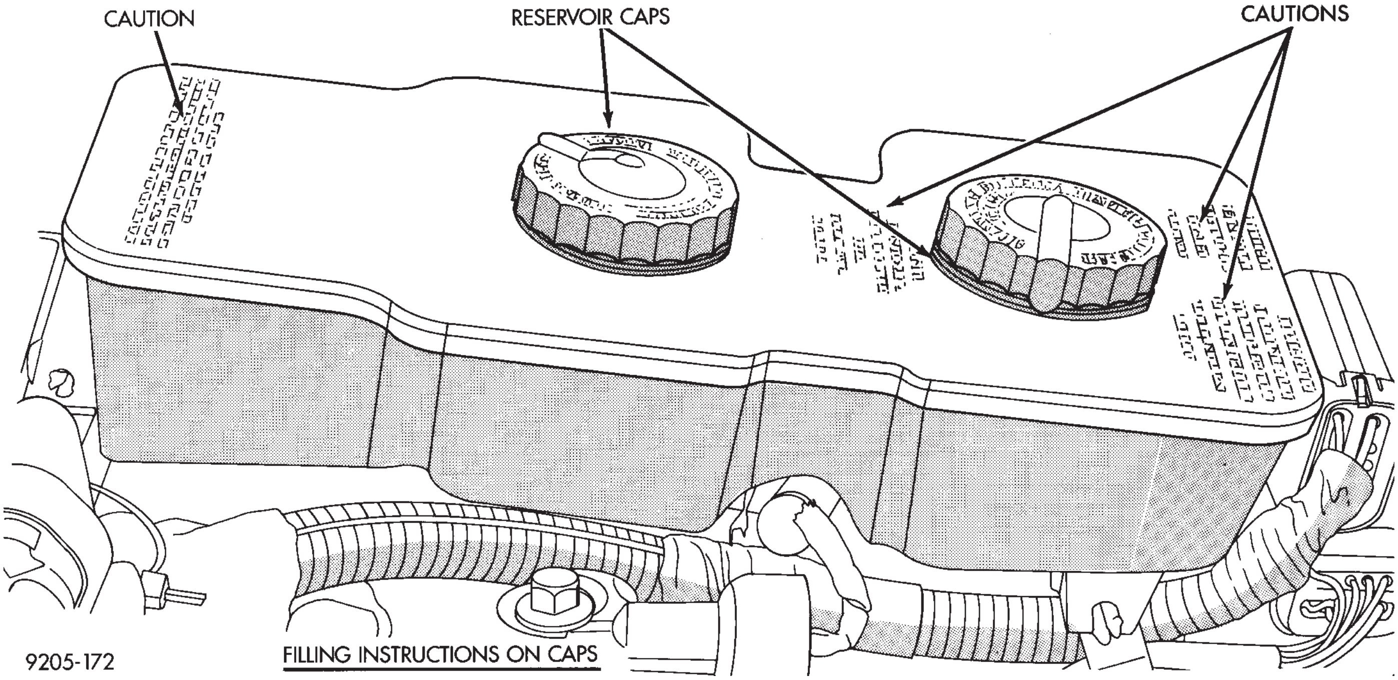


Fig. 2 Master Cylinder Fluid Level (W/ABS)

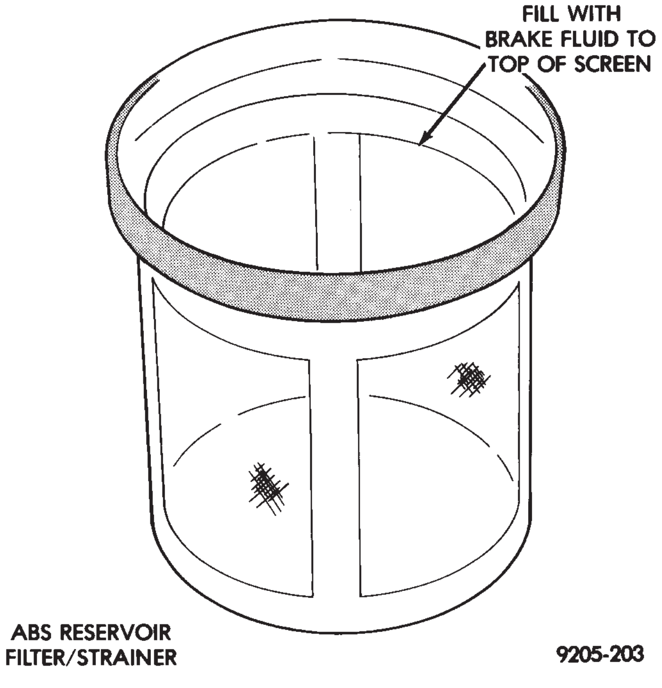


Fig. 3 ABS Reservoir Fill Level On Filter/Strainer

should be taken so as not to bend adjusting lever or distort lever spring. While holding adjusting lever out of engagement with star wheel, back off star wheel to ensure a free wheel with no brake shoe drag.

(6) Repeat above adjustment at the other rear wheel. Install adjusting hole rubber plugs (Fig. 4) in rear brake supports.

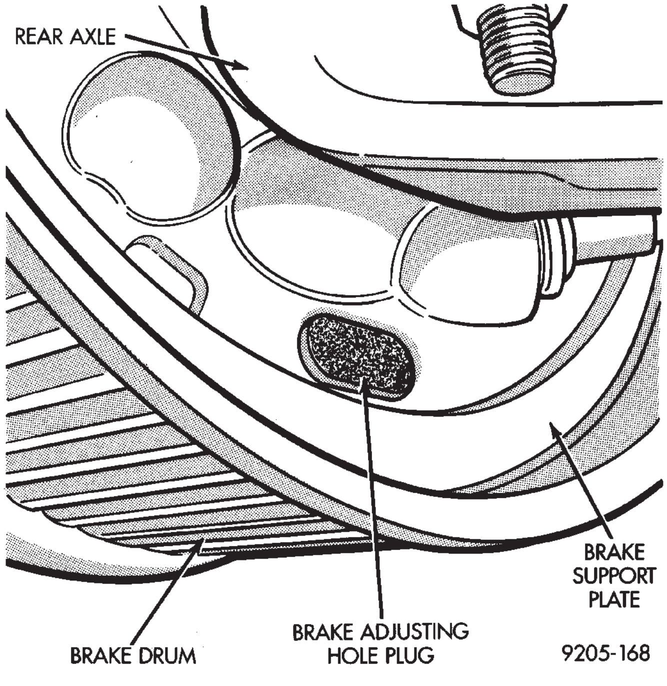


Fig. 4 Brake Adjusting Hole Plug

(7) Adjust parking brake **after** wheel brake adjustment. See parking brake adjustment, under Parking Brakes in this group of the service manual.

It is important to follow the above sequence to avoid the possibility of the parking brake system causing brake drag. This could occur if the parking brakes are adjusted before the service brakes.

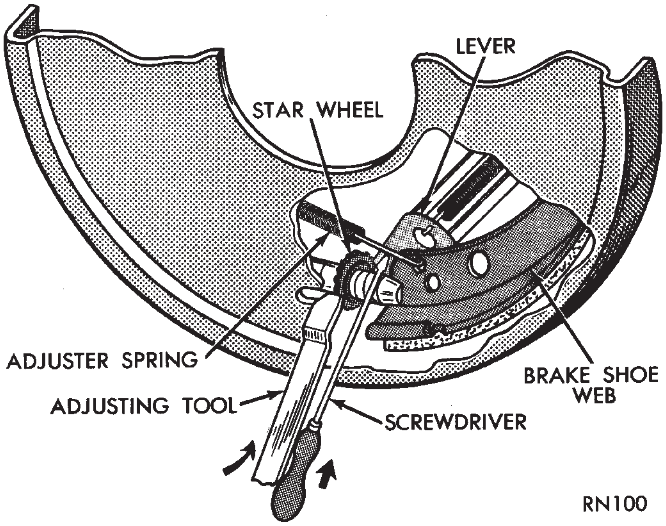


Fig. 5 Brake Drum Adjustment With Tool C-3784

TESTING APPLICATION ADJUSTER OPERATION

Place the vehicle on a hoist with a helper in the driver's seat to apply the brakes. Remove the access plug from the rear adjustment slot in each brake support plate (Fig. 4) to provide access to the adjuster star wheel. Then, to eliminate the possibility of maximum adjustment, where the adjuster does not operate because the closest possible adjustment has been reached. 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.

Spin the wheel and brake drum in the reverse direction, and with a greater than normal force apply the brakes suddenly. This sudden application of force will cause the secondary brake shoe to leave the anchor. The wrap up effect will move the secondary shoe, and the cable will pull the adjuster lever up. Upon application of the brake pedal, the lever should move upward, turning the 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.

BLEEDING BRAKE SYSTEM

CAUTION: For bleeding of the Anti-Lock brake hydraulic system. See the Anti-Lock Brake system service procedures in this group which refers to the particular Anti-Lock brake system being serviced.

PRESSURE BLEEDING

Before removing the master cylinder cover, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder.

CAUTION: Use bleeder tank Special Tool C-3496-B with adapter Special Tool C-4578 to pressurize the system for bleeding.

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. 6). 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.

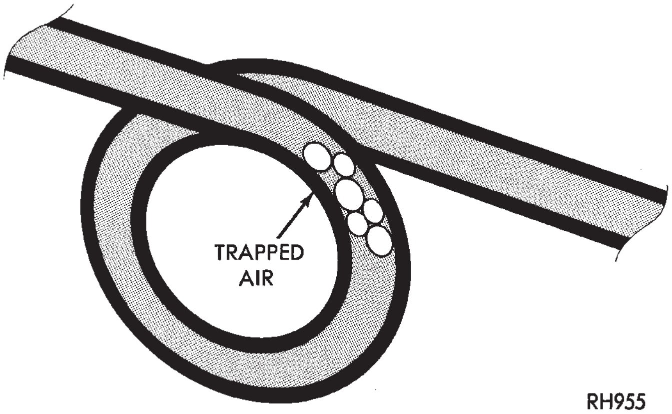


Fig. 6 Trapped Air in Brake Line

The following wheel sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

- Right rear wheel
- Left front wheel
- Left rear wheel
- Right front wheel

To bleed the brake system. Attach a clear plastic hose to the bleeder screw starting at the right rear wheel and feed the hose into a clear jar containing fresh brake fluid (Fig. 7).

Next, open the bleeder screw at least **one full turn** or more to obtain an adequate flow of brake fluid (Fig. 8).

CAUTION: Just cracking the bleeder screw often restricts fluid flow, and a slow, weak fluid discharge will NOT get all the air out.

After 4 to 8 ounces of fluid has been bled through the brake system at this wheel. And an air-free flow is maintained in the clear plastic hose and jar, this will indicate a good bleed.

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

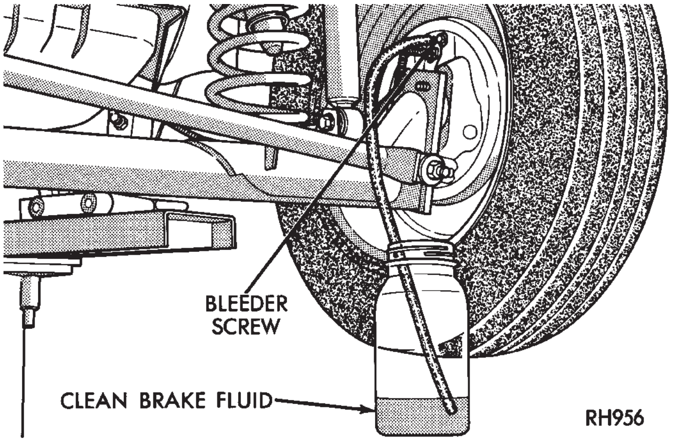


Fig. 7 Proper Method for Purging Air From Brake System (Typical)

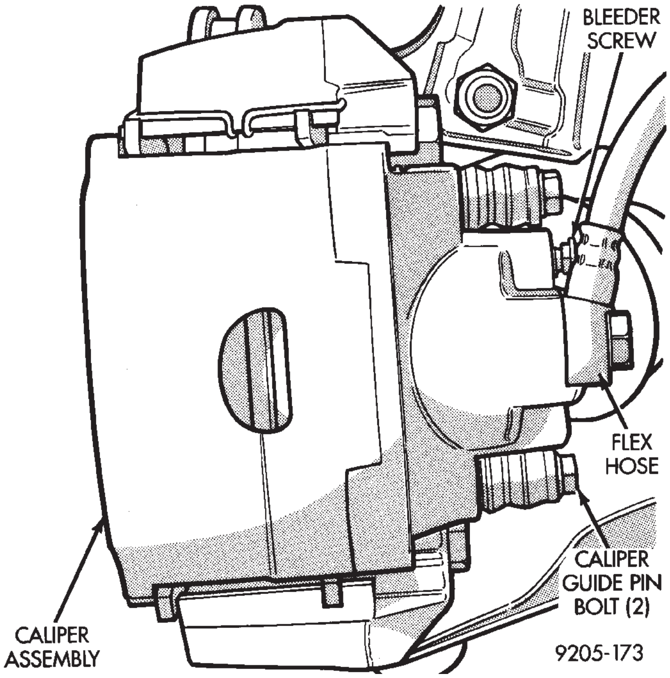


Fig. 8 Open Bleeder Screw at Least One Full Turn (Typical)

expel all the trapped air. Be sure to monitor the fluid level in the pressure bleeder. It must stay at the proper level so air will not be allowed to reenter the brake system through the master cylinder.

BLEEDING WITHOUT A PRESSURE BLEEDER

If a pressure bleeder is not available. A good brake fluid flow can be obtained by manual bleeding of the brake hydraulic system, following these steps.

Manual bleeding of the brakes hydraulic system will require the aid of a helper to correctly perform manual brake bleeding procedure.

The following wheel sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

- Right rear wheel
- Left front wheel
- Left rear wheel
- Right front wheel

(1) Pump the brake pedal three or four times and hold it down before the bleeder screw is opened.

(2) Then open the 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. 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 reenter the brake system through the master cylinder.

Test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

TEST FOR 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 small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil contamination.

If contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals and all hoses.

WHEEL STUD NUT TIGHTENING

When tightening wheel stud nuts, a criss-cross tightening sequence should be followed (Fig. 9).

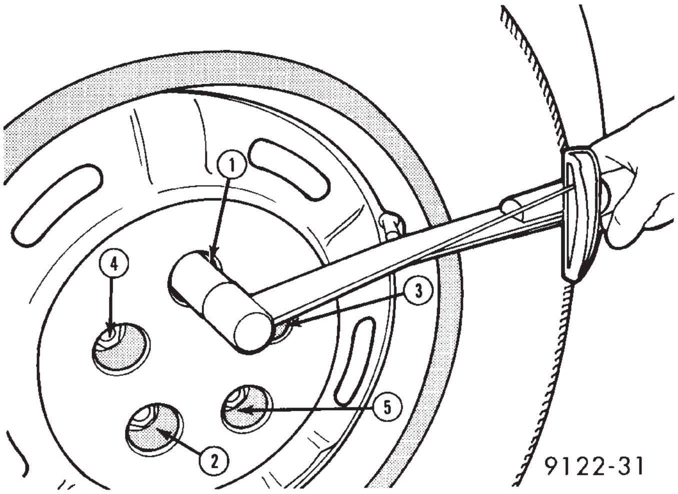


Fig. 9 Wheel Stud Nut Tightening Sequence

Tighten all stud nuts to one-half specified torque. Repeat, fully tightening to 129 N•m (95 ft. lbs.).

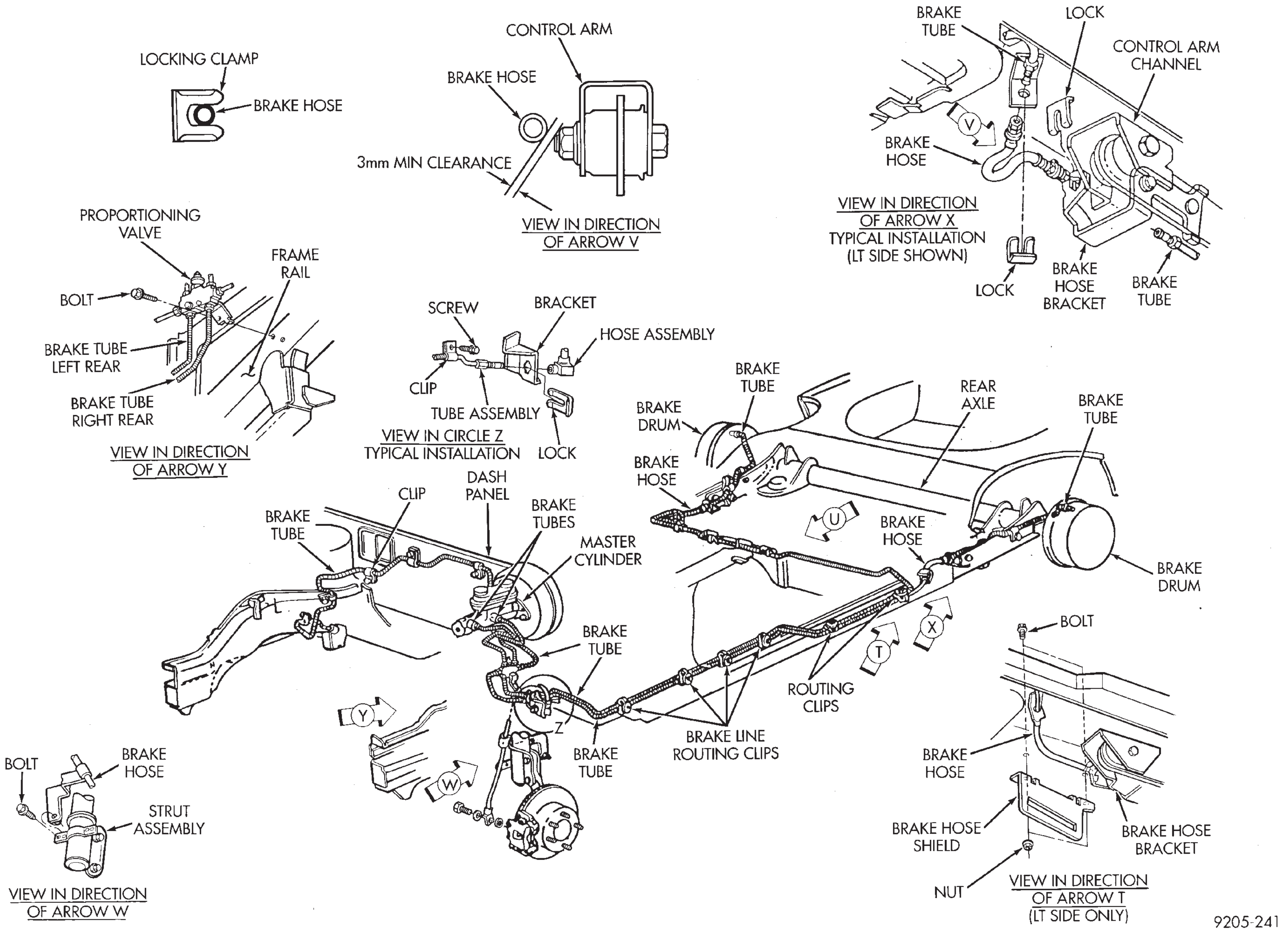


FIG. 10 BRAKE LINE ROUTING NON ABS BRAKES

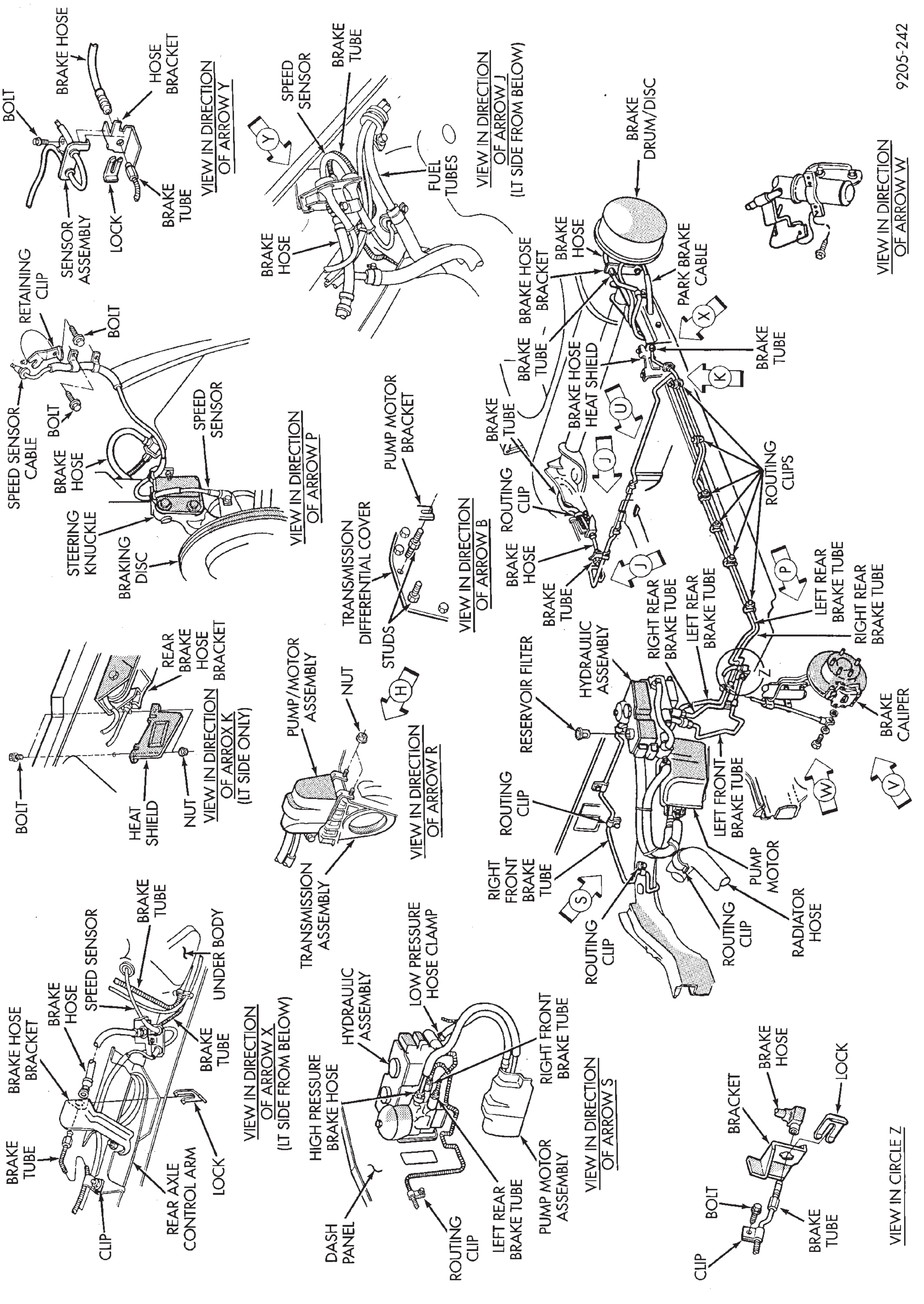


FIG. 11 BRAKE LINE ROUTING WITH ANTI-LOCK 10 BRAKES

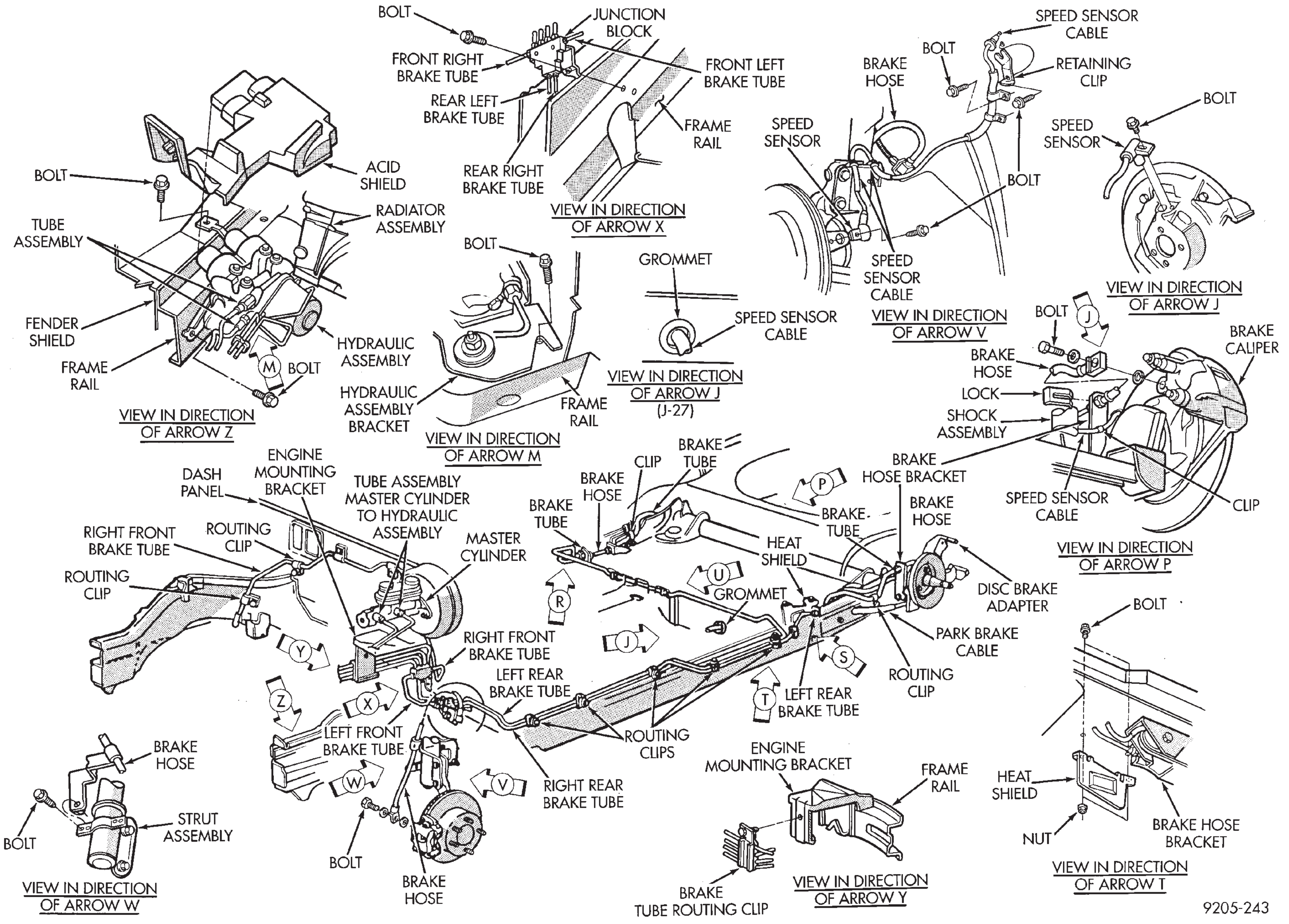


FIG. 12 BRAKE LINE ROUTING WITH ANTI-LOCK 6 BRAKES

BRAKE HOSE AND TUBING

INSPECTION OF BRAKE HOSE AND TUBING

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 severe surface cracking, scuffing, or worn spots. Should the fabric casing of the rubber hose be 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 and 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.

INSTALLATION OF BRAKE HOSE

Always use factory recommended brake hose to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks and burrs. **Front right and left side hoses are not interchangeable.**

Connections should be correct and properly made. Use new copper seal washers on all connections using Banjo Bolts and tighten all fittings to their specified torques.

The flexible front hydraulic brake hose should always be installed on the vehicle by first attaching the Banjo connector to the caliper assembly. Then bolt the intermediate hose bracket to the strut assembly allowing the bracket to position the hose to prevent twisting. Attach the hose to the body bracket and steel brake tubing. Tighten all fittings to specified torque. The body bracket and hose end are keyed so that they will only fit one way.

Install rear brake hoses first to the trailing arm tubes and then to the floor pan tubes. Minimize hose twisting. Vehicles equipped with rear disc brakes have brake hoses attached to the caliper on each side. The brake hose should be first attached by the Banjo bolt to the caliper and then secured to the hose bracket with the retaining clip. The attach the steel brake tubing to the hose fitting.

REPAIR AND INSTALLATION OF BRAKE TUBING

Only double wall 4.75mm (3/16 in.) steel tubing should be used for replacement. 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.

TYPES OF TUBING FLARES

Two different tubing flares (Fig. 13) are used on 93 M.Y. vehicles. On some ABS brake systems the tubing connections made to the hydraulic assembly use an ISO flare. All other ABS brake system component, tubing connections are made using a double inverted flare. On non-ABS brake systems all component tubing connections use only the double inverted flare. No ISO flares are used.

CAUTION: ALWAYS USE THE PROPER FLARING TOOL AND PROCEDURE, FOR THE TYPE OF BRAKE SYSTEM THAT IS BEING SERVICED TO INSURE THE INTEGRITY OF THE HYDRAULIC SYSTEM.

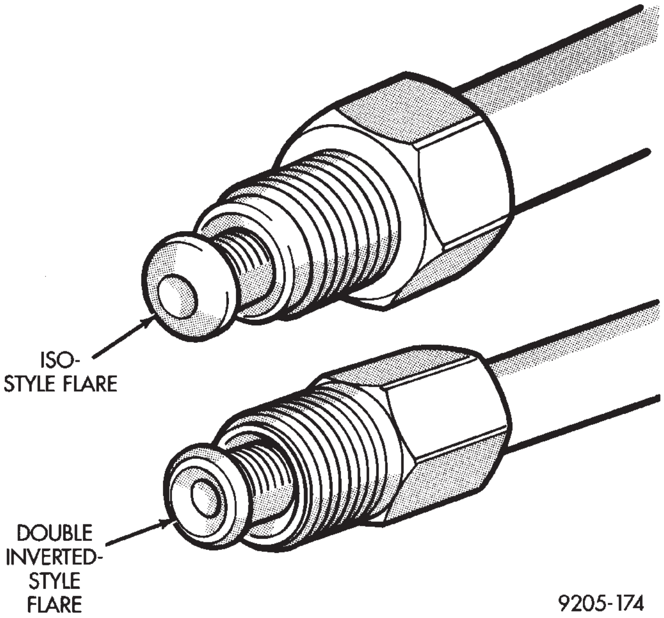


Fig. 13 Identifying Hydraulic Brake Tubing Flares

TO REPAIR OR FLARE TUBING

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 14). Ream out any burrs or rough edges showing on inside of tubing (Fig. 15). This will make the ends of tubing square (Fig. 15) and ensure better seating of flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**

DOUBLE INVERTED TUBING FLARES.

To make a double inverted tubing flare (Fig. 13 & 16). 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 tub-

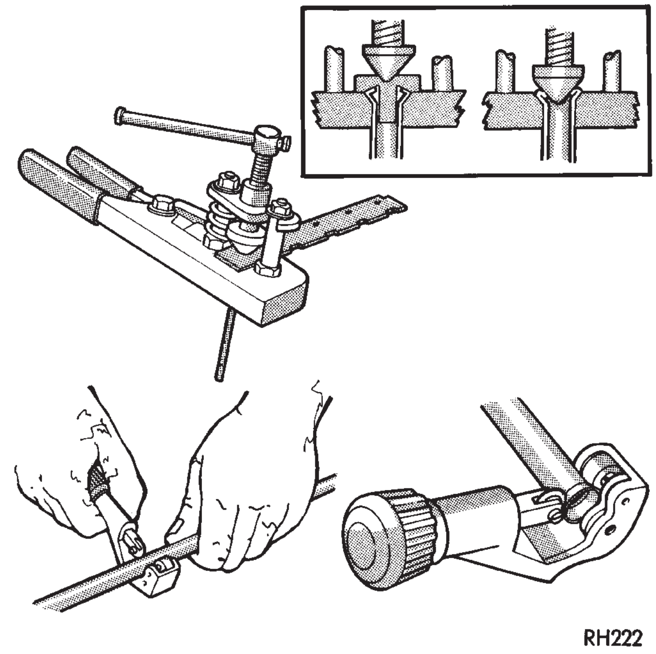


Fig. 14 Cutting and Flaring of Brake Line Tubing

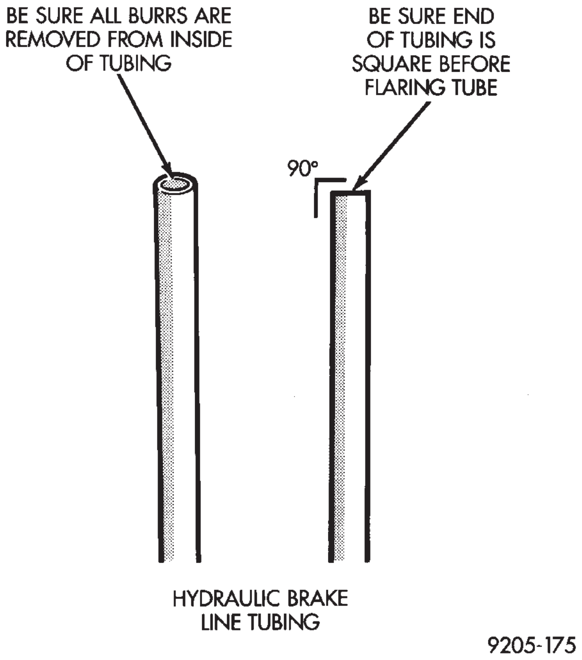


Fig. 15 Brake Tube Preparation For Flaring

ing 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 routing diagrams (Figs. 18 to 21) for proper routing and clip location. Replace any damaged tube routing clips.

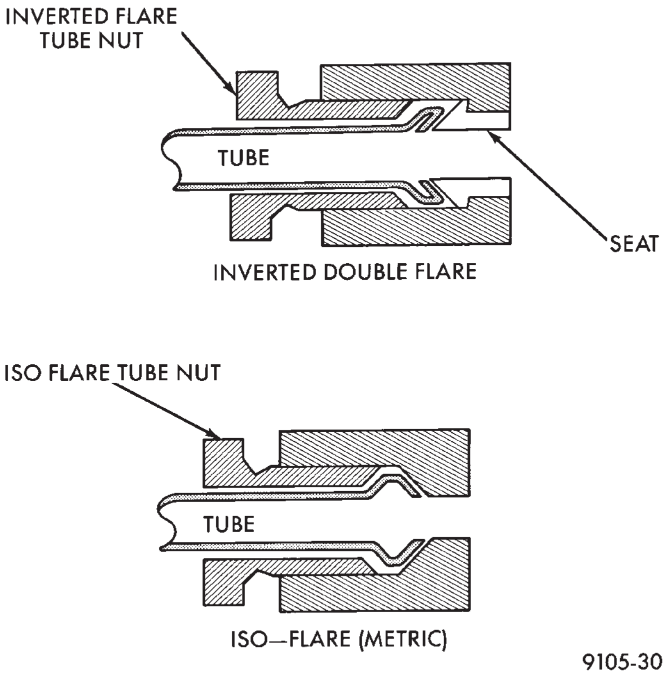


Fig. 16 Double Flare And ISO-Flare Tubing Connections

ISO TUBING FLARES

CAUTION: All ISO style tubing flares (Fig. 13 & 16) 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. 17) 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. 15). **This preparation is essential to obtain the correct form of a (metric) ISO tubing flare.**

(2) Open the 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. 17)

(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. (See Fig. 17).

(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. 17). This process has created the (metric) ISO tubing flare.

STOP LAMP SWITCH ADJUSTMENT (ALL VEHICLES)

The stop lamp switch incorporates a self adjusting feature. If adjustment or replacement is required, proceed as follows: Install the switch in the retaining bracket and push the switch forward as far as it will go. The brake pedal will move forward slightly (Fig. 18). Gently pull back on the brake pedal bringing the striker back toward the switch until the brake pedal will go back no further. This will cause the switch to ratchet backward to the correct position. Very little movement is required, and no further adjustment is necessary.

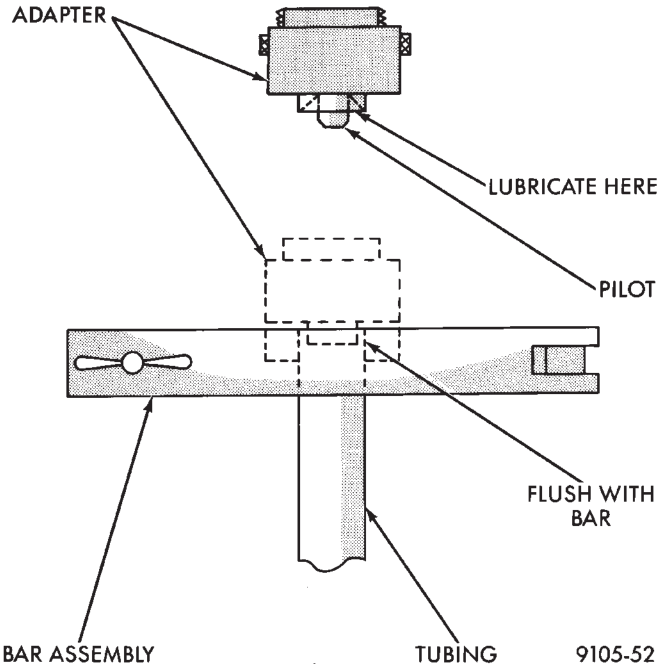


Fig. 17 ISO Tubing Flare Process

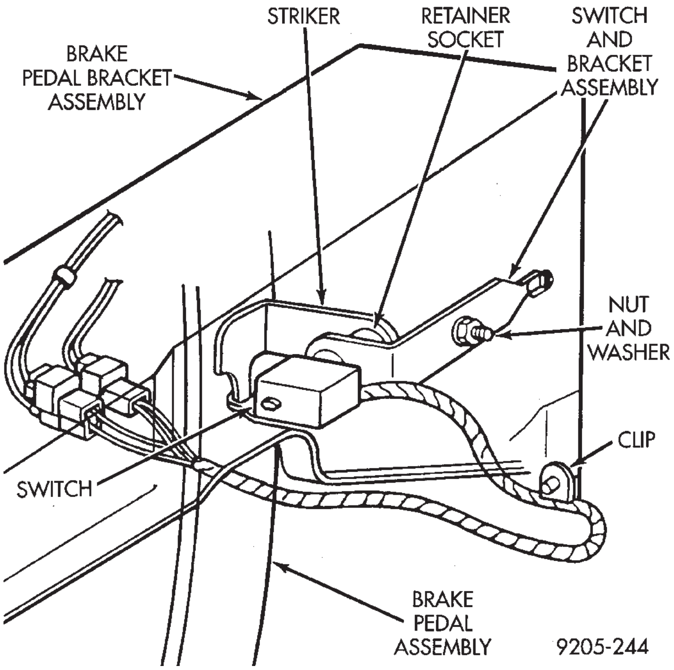


Fig. 18 Stop Lamp Switch

BASIC DIAGNOSIS GUIDE

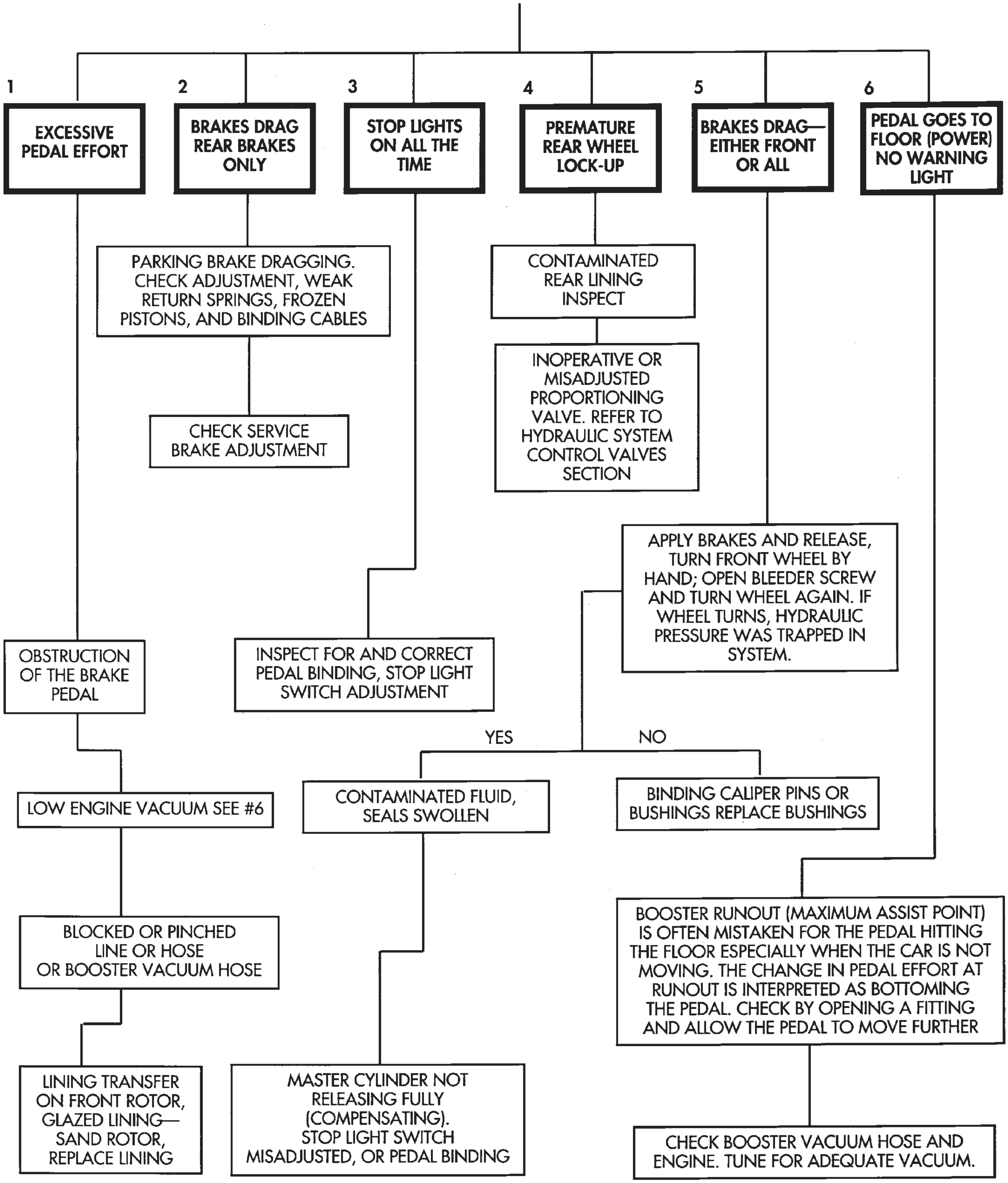
SYMPTOM	CHART 1 MISC. COND.	CHART 2 WARNING LIGHT	CHART 3 POWER BRAKES	CHART 4 BRAKE NOISE	CHART 5 WHEEL BRAKES
BRAKE WARNING LIGHT ON		X	NO		
EXCESSIVE PEDAL TRAVEL	6	X	NO		O
PEDAL GOES TO FLOOR	6	X			
STOP LIGHT ON WITHOUT BRAKES	3				
ALL BRAKES DRAG	5				
REAR BRAKES DRAG	2	NO	NO		
GRABBY BRAKES			O		X
SPONGY BRAKE PEDAL		X	NO		
PREMATURE REAR 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 POSSIBLE CAUSE X: MOST LIKELY CAUSE O: POSSIBLE CAUSE

9205-245

BRAKE SYSTEM DIAGNOSTICS

CHART 1 MISCELLANEOUS CONDITIONS



1 **EXCESSIVE PEDAL EFFORT**

OBSTRUCTION OF THE BRAKE PEDAL

LOW ENGINE VACUUM SEE #6

BLOCKED OR PINCHED LINE OR HOSE OR BOOSTER VACUUM HOSE

LINING TRANSFER ON FRONT ROTOR, GLAZED LINING—SAND ROTOR, REPLACE LINING

2 **BRAKES DRAG REAR BRAKES ONLY**

PARKING BRAKE DRAGGING. CHECK ADJUSTMENT, WEAK RETURN SPRINGS, FROZEN PISTONS, AND BINDING CABLES

CHECK SERVICE BRAKE ADJUSTMENT

3 **STOP LIGHTS ON ALL THE TIME**

INSPECT FOR AND CORRECT PEDAL BINDING, STOP LIGHT SWITCH ADJUSTMENT

4 **PREMATURE REAR WHEEL LOCK-UP**

CONTAMINATED REAR LINING INSPECT

INOPERATIVE OR MISADJUSTED PROPORTIONING VALVE. REFER TO HYDRAULIC SYSTEM CONTROL VALVES SECTION

5 **BRAKES DRAG—EITHER FRONT OR ALL**

APPLY BRAKES AND RELEASE, TURN FRONT WHEEL BY HAND; OPEN BLEEDER SCREW AND TURN WHEEL AGAIN. IF WHEEL TURNS, HYDRAULIC PRESSURE WAS TRAPPED IN SYSTEM.

YES: CONTAMINATED FLUID, SEALS SWOLLEN

MASTER CYLINDER NOT RELEASING FULLY (COMPENSATING). STOP LIGHT SWITCH MISADJUSTED, OR PEDAL BINDING

NO: BINDING CALIPER PINS OR BUSHINGS REPLACE BUSHINGS

6 **PEDAL GOES TO FLOOR (POWER) NO WARNING LIGHT**

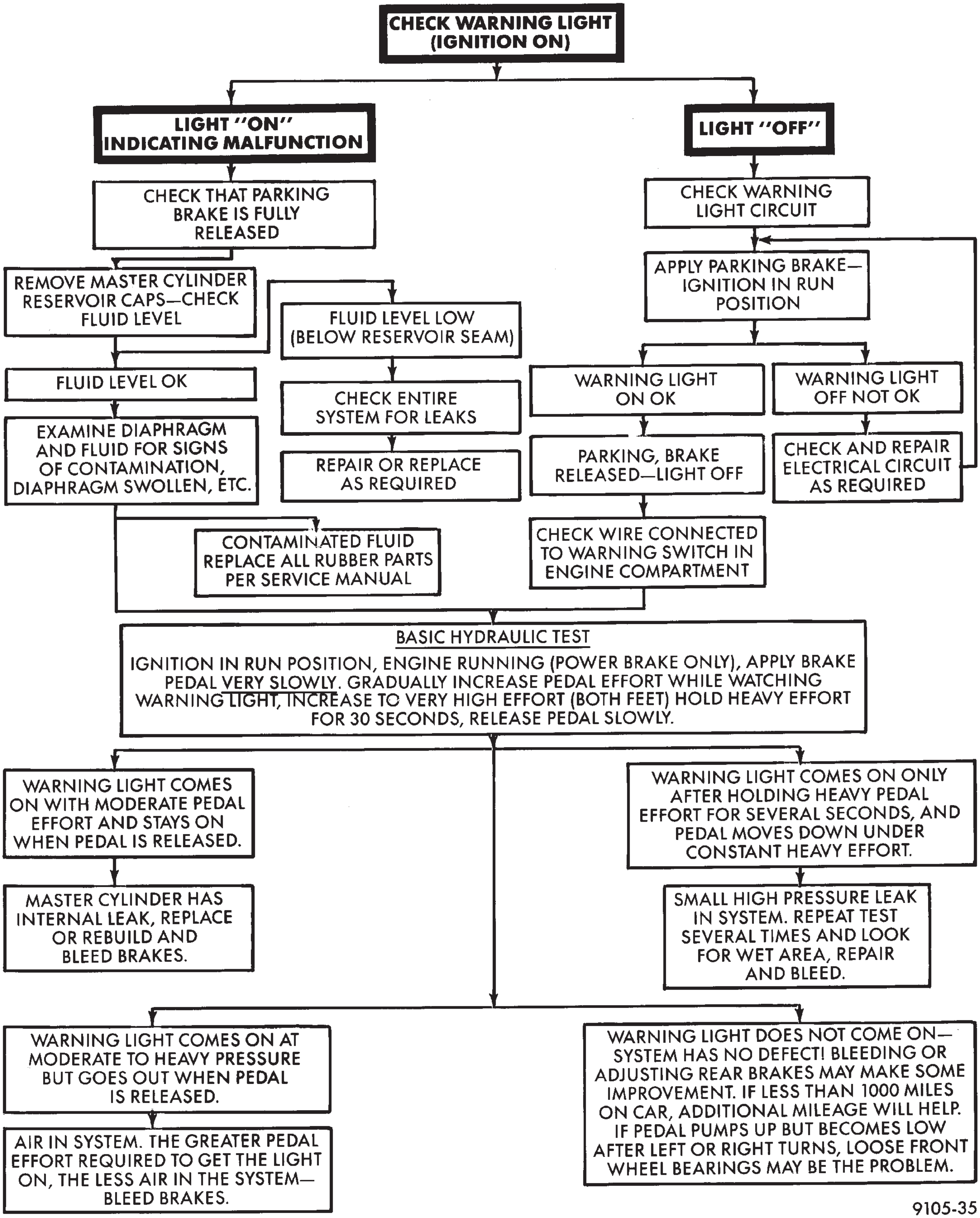
BOOSTER RUNOUT (MAXIMUM ASSIST POINT) IS OFTEN MISTAKEN FOR THE PEDAL HITTING THE FLOOR ESPECIALLY WHEN THE CAR IS NOT MOVING. THE CHANGE IN PEDAL EFFORT AT RUNOUT IS INTERPRETED AS BOTTOMING THE PEDAL. CHECK BY OPENING A FITTING AND ALLOW THE PEDAL TO MOVE FURTHER

CHECK BOOSTER VACUUM HOSE AND ENGINE. TUNE FOR ADEQUATE VACUUM.

9305-171

BRAKE SYSTEM DIAGNOSTICS

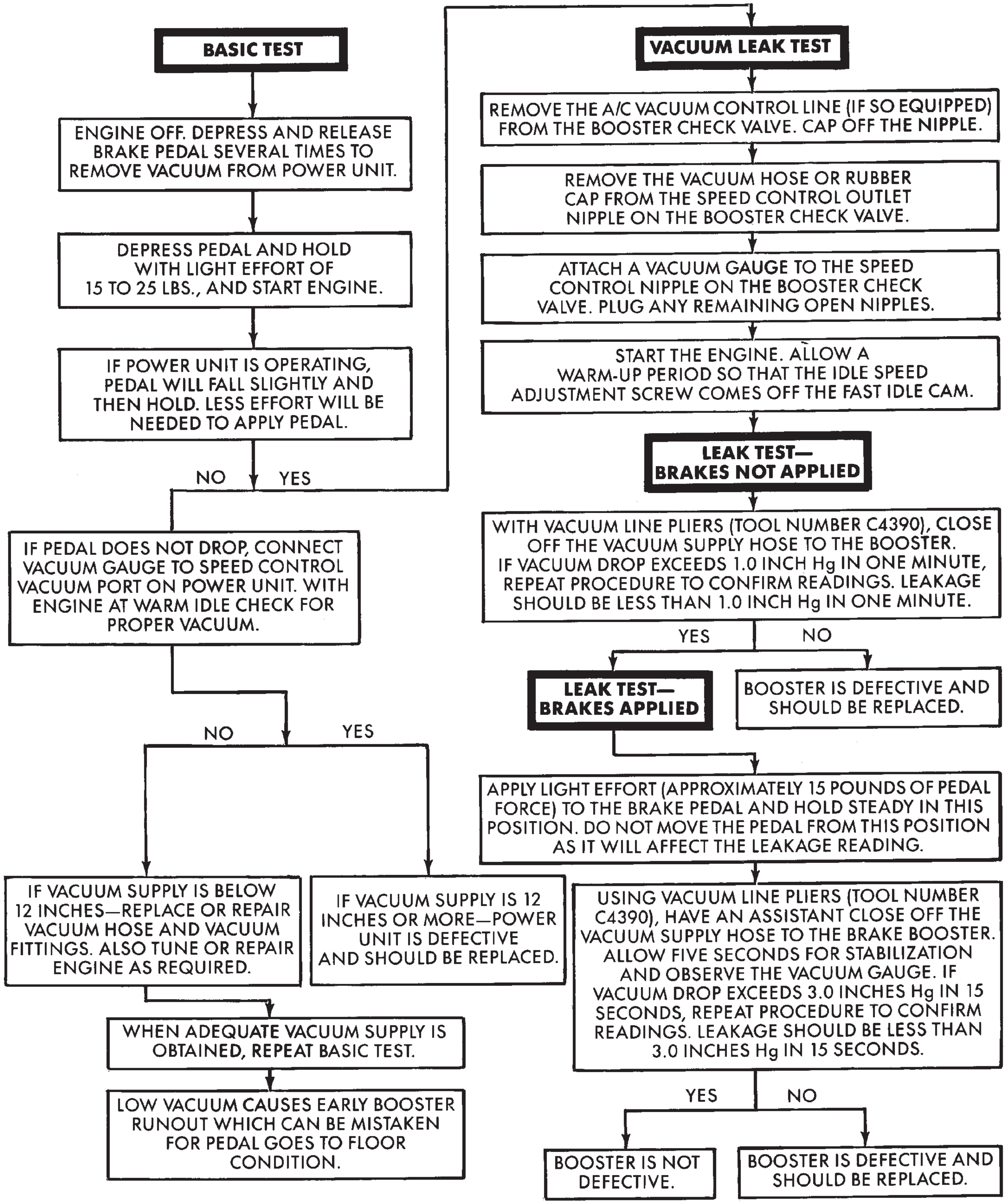
CHART 2 ACTUATION



9105-35

BRAKE SYSTEM DIAGNOSTICS

CHART 3 POWER BRAKES



BASIC TEST

ENGINE OFF. DEPRESS AND RELEASE BRAKE PEDAL SEVERAL TIMES TO REMOVE VACUUM FROM POWER UNIT.

DEPRESS PEDAL AND HOLD WITH LIGHT EFFORT OF 15 TO 25 LBS., AND START ENGINE.

IF POWER UNIT IS OPERATING, PEDAL WILL FALL SLIGHTLY AND THEN HOLD. LESS EFFORT WILL BE NEEDED TO APPLY PEDAL.

IF PEDAL DOES NOT DROP, CONNECT VACUUM GAUGE TO SPEED CONTROL VACUUM PORT ON POWER UNIT. WITH ENGINE AT WARM IDLE CHECK FOR PROPER VACUUM.

IF VACUUM SUPPLY IS BELOW 12 INCHES—REPLACE OR REPAIR VACUUM HOSE AND VACUUM FITTINGS. ALSO TUNE OR REPAIR ENGINE AS REQUIRED.

IF VACUUM SUPPLY IS 12 INCHES OR MORE—POWER UNIT IS DEFECTIVE AND SHOULD BE REPLACED.

WHEN ADEQUATE VACUUM SUPPLY IS OBTAINED, REPEAT BASIC TEST.

LOW VACUUM CAUSES EARLY BOOSTER RUNOUT WHICH CAN BE MISTAKEN FOR PEDAL GOES TO FLOOR CONDITION.

VACUUM LEAK TEST

REMOVE THE A/C VACUUM CONTROL LINE (IF SO EQUIPPED) FROM THE BOOSTER CHECK VALVE. CAP OFF THE NIPPLE.

REMOVE THE VACUUM HOSE OR RUBBER CAP FROM THE SPEED CONTROL OUTLET NIPPLE ON THE BOOSTER CHECK VALVE.

ATTACH A VACUUM GAUGE TO THE SPEED CONTROL NIPPLE ON THE BOOSTER CHECK VALVE. PLUG ANY REMAINING OPEN NIPPLES.

START THE ENGINE. ALLOW A WARM-UP PERIOD SO THAT THE IDLE SPEED ADJUSTMENT SCREW COMES OFF THE FAST IDLE CAM.

LEAK TEST— BRAKES NOT APPLIED

WITH VACUUM LINE PLIERS (TOOL NUMBER C4390), CLOSE OFF THE VACUUM SUPPLY HOSE TO THE BOOSTER. IF VACUUM DROP EXCEEDS 1.0 INCH Hg IN ONE MINUTE, REPEAT PROCEDURE TO CONFIRM READINGS. LEAKAGE SHOULD BE LESS THAN 1.0 INCH Hg IN ONE MINUTE.

LEAK TEST— BRAKES APPLIED

BOOSTER IS DEFECTIVE AND SHOULD BE REPLACED.

APPLY LIGHT EFFORT (APPROXIMATELY 15 POUNDS OF PEDAL FORCE) TO THE BRAKE PEDAL AND HOLD STEADY IN THIS POSITION. DO NOT MOVE THE PEDAL FROM THIS POSITION AS IT WILL AFFECT THE LEAKAGE READING.

USING VACUUM LINE PLIERS (TOOL NUMBER C4390), HAVE AN ASSISTANT CLOSE OFF THE VACUUM SUPPLY HOSE TO THE BRAKE BOOSTER. ALLOW FIVE SECONDS FOR STABILIZATION AND OBSERVE THE VACUUM GAUGE. IF VACUUM DROP EXCEEDS 3.0 INCHES Hg IN 15 SECONDS, REPEAT PROCEDURE TO CONFIRM READINGS. LEAKAGE SHOULD BE LESS THAN 3.0 INCHES Hg IN 15 SECONDS.

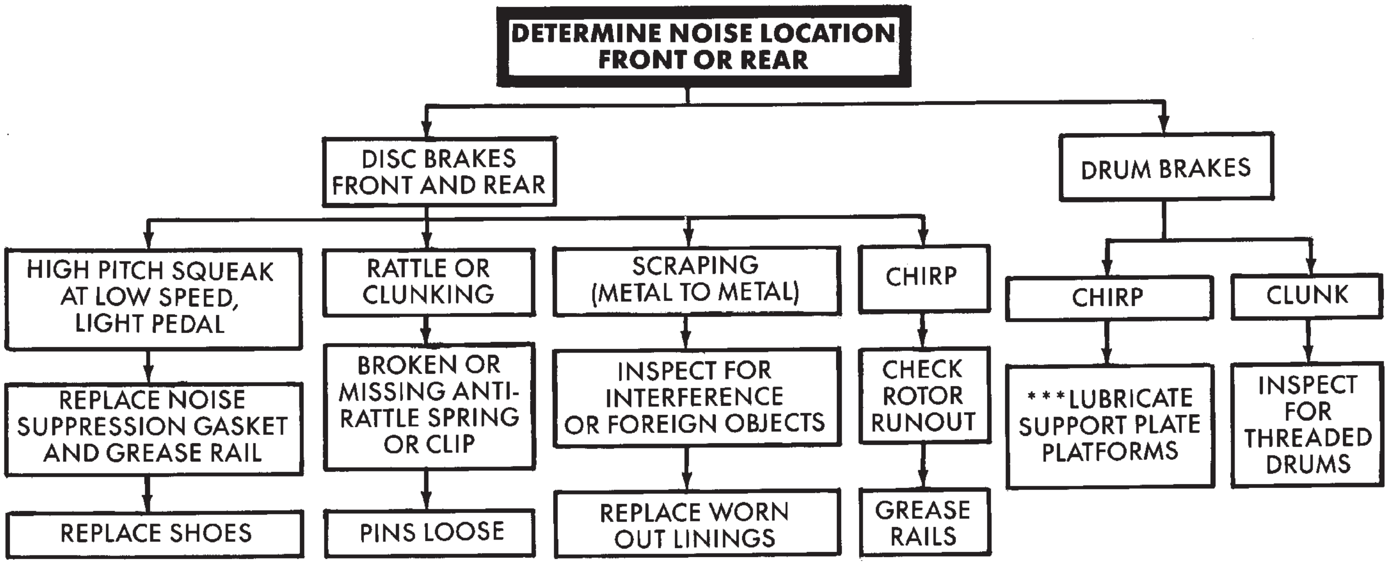
BOOSTER IS NOT DEFECTIVE.

BOOSTER IS DEFECTIVE AND SHOULD BE REPLACED.

9105-36

BRAKE SYSTEM DIAGNOSTICS

CHART 4 BRAKE NOISE

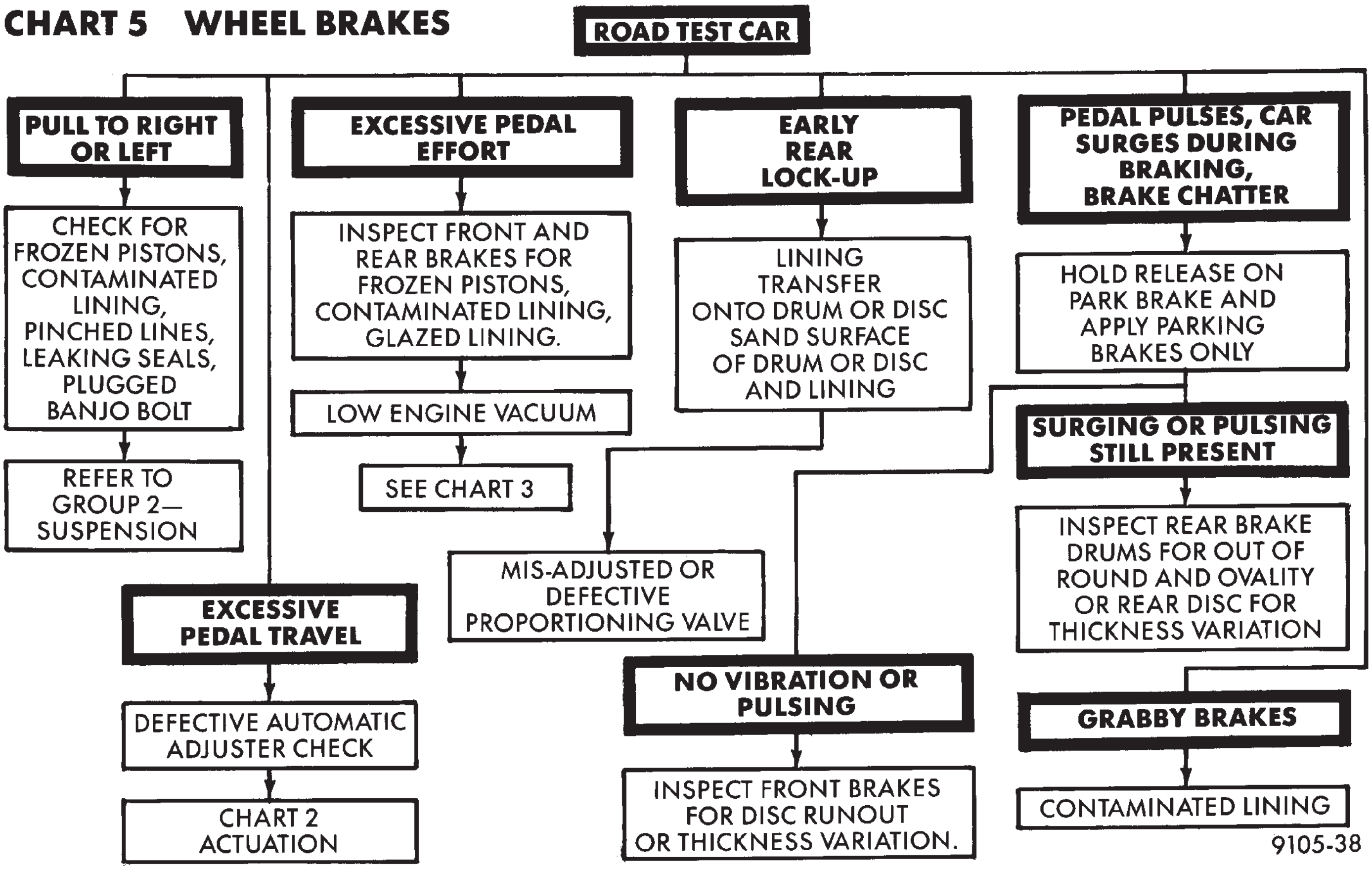


***MOPAR MULTIPURPOSE LUBRICANT, OR EQUIVALENT.

9105-37

BRAKE SYSTEM DIAGNOSTICS

CHART 5 WHEEL BRAKES



9105-38

REAR WHEEL DRUM BRAKES

INDEX

DESCRIPTION

Rear wheel drum brakes (Fig. 2 & 3) are two shoe, internal expanding type with an automatic adjuster screw assembly that is activated each time the brakes are applied. The automatic adjuster screw is located directly below the wheel cylinder as shown in figure (Fig. 2 & 3).

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS MAY CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING, AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY. FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

IT IS RECOMMENDED NOT TO BREATH ANY TYPE OF BRAKE LINING MATERIAL DUST EVEN ASBESTOS FREE, DUE TO THE FIBROUS NATURE OF THE MATERIALS BEING USED.

SERVICE PROCEDURES

REAR BRAKE DRUM REMOVAL

If the rear brake drum is difficult to remove, further clearance can be obtained by backing off the brake automatic adjuster screw. Remove rubber plug from the top of the support plate and rotate the automatic adjuster screw assembly with an upward motion, using the Brake Adjuster, Special Tool C-3784.

See adjusting rear service brakes in the Service Adjustments section in this group of the service manual for the specific adjustment procedure.

Remove wheel bearing grease cap (Fig. 1).

Remove cotter pin, nut lock, retaining nut, thrust washer and outer bearing cone (Fig. 1).

Remove brake drum and hub and bearing assembly from the rear spindle (Fig. 1).

Inspect brake linings for wear, shoe alignment and contamination.

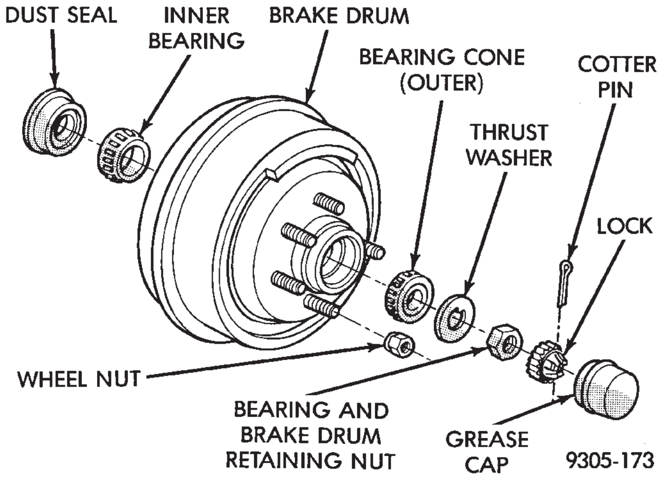


Fig. 1 Brake Drum and Hub Assembly

BRAKE DRUM INSTALLATION

Install brake drum and hub and bearing assembly on rear spindle.

Install outer wheel bearing, thrust washer and nut.

Tighten wheel bearing adjusting nut to 27 to 34 N•m (240 to 300 in. lbs.) torque while rotating hub. This seats the bearings.

Back off adjusting nut 1/4 turn (90°) then tighten adjusting nut finger tight.

Position lock on nut with one pair of slots in-line with cotter pin hole. Install cotter pin.

Install grease cap and wheel and tire assemblies. Tighten wheel stud nuts to 115 N•m (85 ft. lbs.) torque on all models. Install wheel covers.

BRAKE SHOE ASSEMBLIES

Three brake shoe assemblies are used on the front wheel drive passenger cars. Vehicles will have axle sets of either 200 or 220 mm Kelsey Hayes (Fig. 2), or Varga (Fig. 3). Varga brake shoes are HANDED for right or left side.

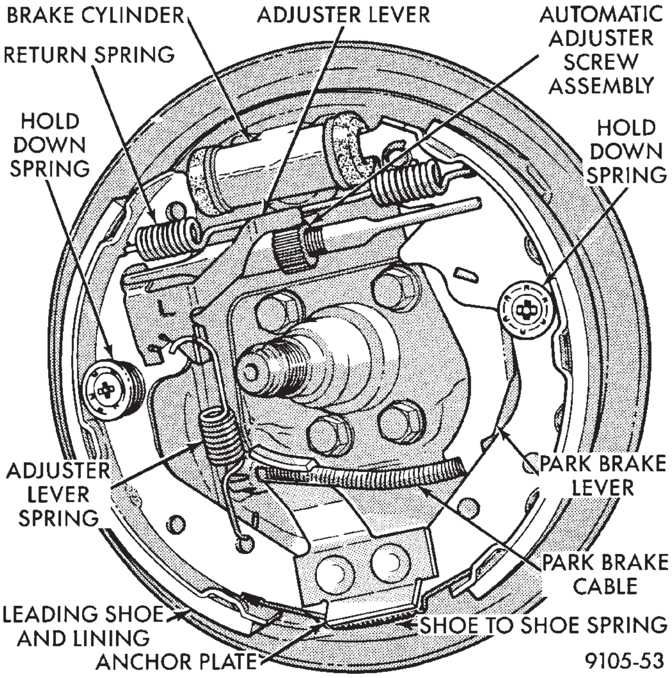


Fig. 2 Kelsey Hayes 200 And 220 (Left) Rear Wheel Brake

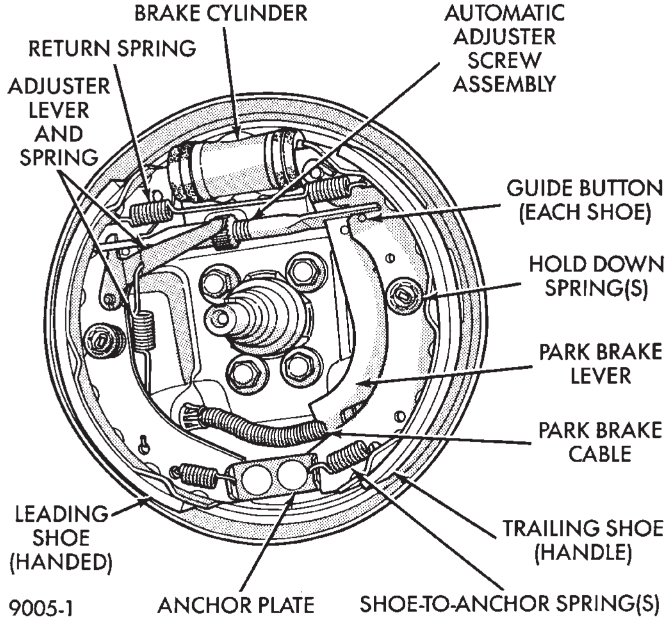


Fig. 3 Varga (Left) Rear Wheel Brake

Except for brake shoe to support plate, park brake lever retention and automatic adjuster positioning guide buttons, service procedures for either assembly are essentially the same.

REMOVAL

Remove automatic adjuster spring and lever (Fig. 4).

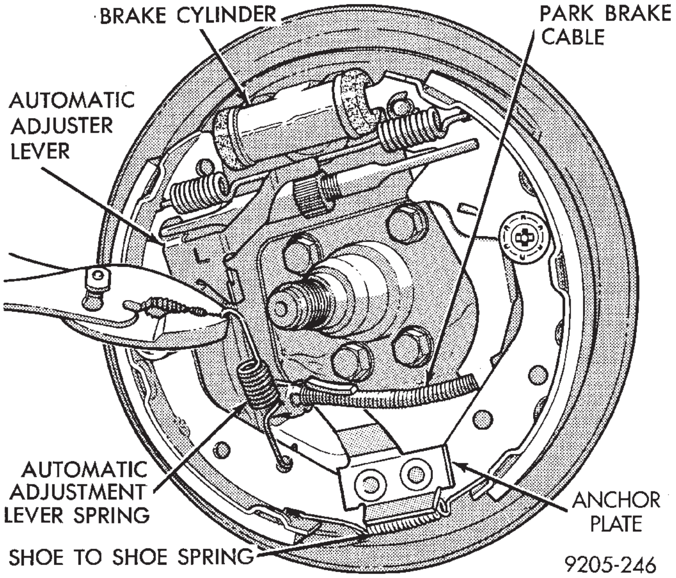


Fig. 4 Remove or Install Adjuster Lever Spring

Rotate the automatic adjuster screw assembly so that each shoe assembly moves out far enough to be free from the wheel cylinder boots (Fig. 5).

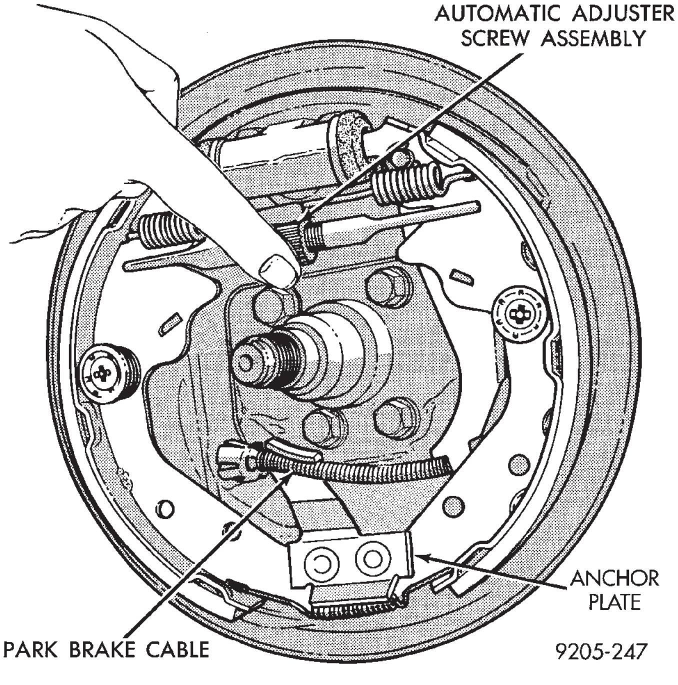


Fig. 5 Expand or Retract Adjuster Screw

Disconnect the parking brake cable from the parking brake lever (Fig. 6).

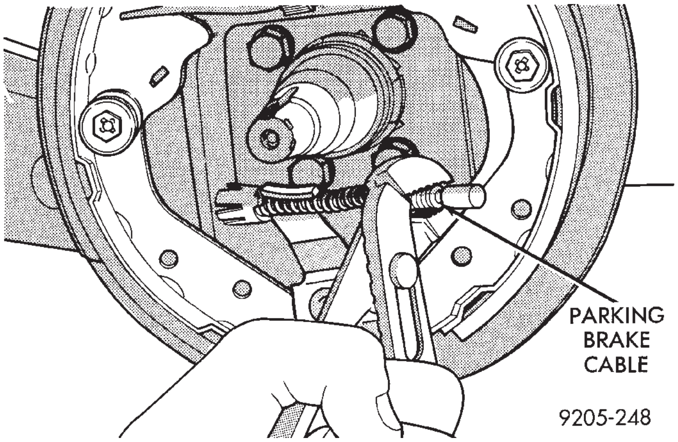


Fig. 6 Disconnect Parking Brake Cable

Kelsey Hayes—Leading/trailing shoes; Remove holddown springs (Fig. 7). Pull assembly down and away to remove shoes from support plate (Fig. 8). Remove brake shoe springs and adjusting screw assembly.

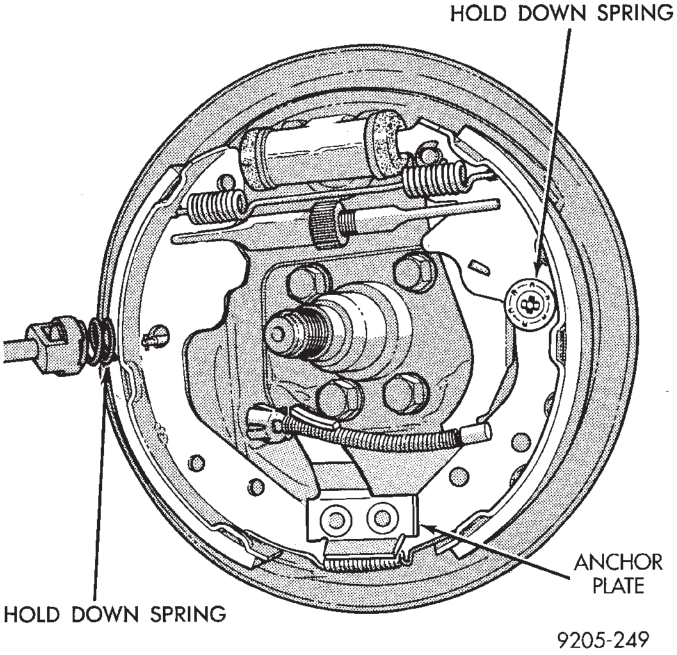


Fig. 7 Remove or Install Holddown Springs

Varga—Leading shoe; Remove the upper shoe to shoe return spring (Fig. 3). The leading shoe hold down spring (Fig. 7). And the shoe to shoe spring at the anchor plate (Fig. 3). Remove shoe and adjuster assembly.

Varga—Trailing shoe; Remove holddown spring and lower shoe-to-anchor plate spring.

Kelsey Hayes: Remove park brake lever from trailing brake shoe by disengaging the retainer clip (Fig. 9). Be sure not to lose park brake lever wave washer.

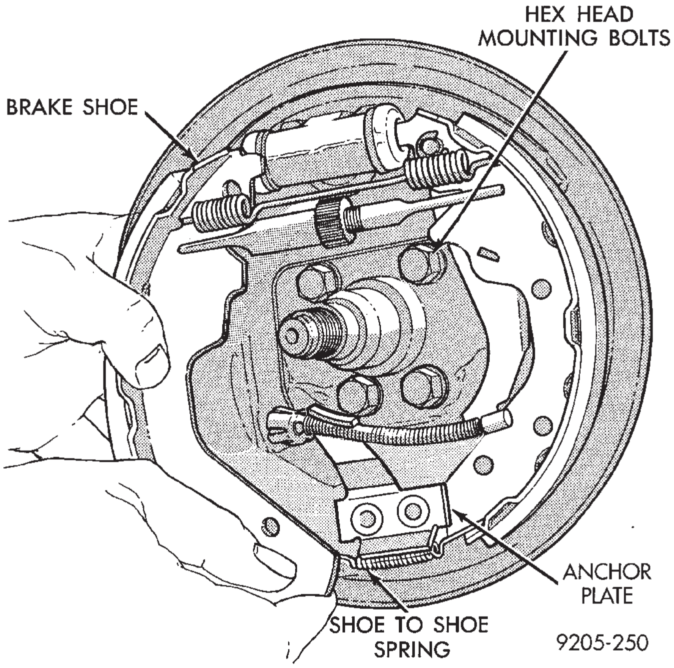


Fig. 8 Remove or Install Brake Shoes

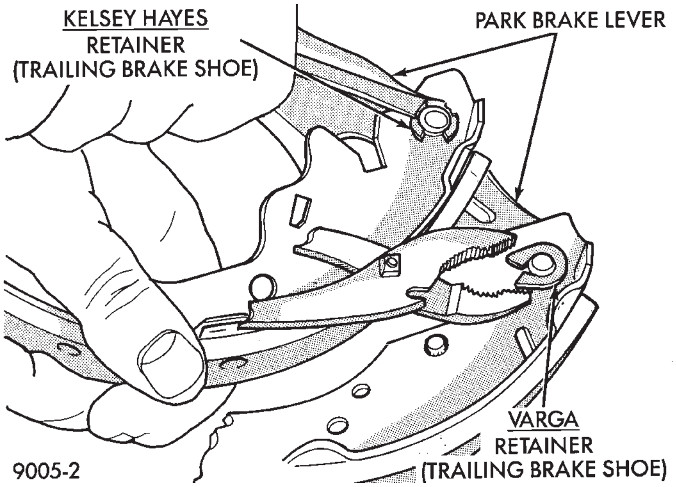


Fig. 9 Remove or Install Park Brake Lever Retainer

CLEANING AND INSPECTION

Clean metal portion of brake shoes. Check to see if shoes are bent.

Lining should show contact across entire width and from heel to toe, otherwise replace.

Shoes with lack of contact at toe or heel maybe improperly ground.

Clean and inspect support and adjusting screws. Apply a thin coat of Mopar Multi-Purpose Lubricant or equivalent to the threads of the self adjuster (Fig. 10). Replace adjusting screw if corroded.

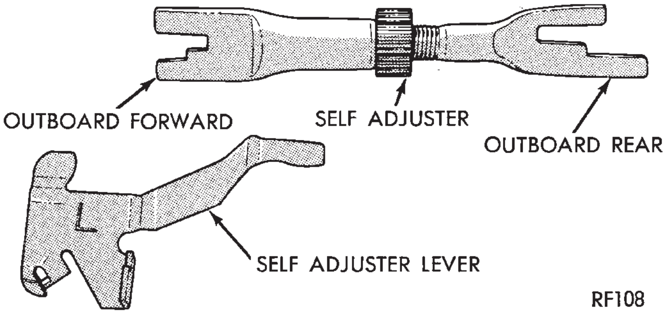


Fig. 10 Adjuster Screw and Lever (Typical)

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils. Varga brake springs are not painted but overheating of the brake springs will be noted by any Blueing of the springs.

BRAKE SHOE INSTALLATION

Lubricate the eight shoe contact areas on the support plate and anchor using Mopar Multi-Purpose Lubricant or equivalent (Fig. 11).

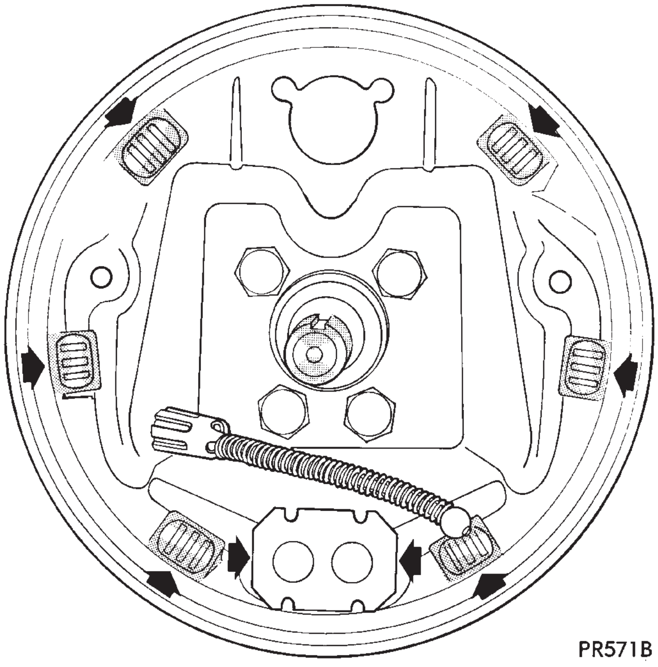


Fig. 11 Shoe Contact Areas on Support Plate

KELSEY HAYES REASSEMBLE

Assemble the park brake lever and wave washer to the new replacement shoe (Fig. 9).

Attach upper return spring between the two new shoe assemblies.

Apply a small amount of Mopar Multi-Purpose Lubricant or equivalent to the automatic adjuster screw assembly. Install adjuster with the two stepped forks facing toward the outboard side of the shoes (Fig. 10). The longer fork will be pointing to the rear.

Connect the lower shoe to shoe spring.

Expand the automatic adjuster so that the end of the shoes will clear the wheel cylinder boots. Position the brake shoe assemblies on support plate and install holddown springs (Fig. 7).

Install self adjuster lever and spring.

Connect park brake cable.

Adjust brake shoes so that they will not interfere with the drum installation.

CAUTION: Make sure the adjuster screw nut contacts the adjuster tubular strut.

Install the drums and pump the brake pedal several times to partially complete the shoe adjustment.

After adjusting the Parking brake cable (see Adjusting Parking Brake), road test vehicle. The automatic adjuster will continue the brake adjustment during the test.

VARGA REASSEMBLE

(1) Install park brake cable in park brake lever of trailing shoe.

(2) Attach trailing shoe, then leading shoe lower springs to shoes and anchor plate.

(3) Position shoes on support plate and install holddown springs.

(4) Install automatic adjusters. **Left side adjuster has left hand threads and right side adjuster has right-hand threads. Do not interchange sides.** Make sure adjuster is installed correctly. (Adjuster ends must be above extruded pins in web of shoe as shown in Fig. 3).

(5) Install upper shoe to shoe spring. Ensure that the spring terminal ends are fully engaged in the shoe webs.

(6) Rotate serrated adjuster nut to remove free play from the adjuster assembly.

(7) Install the adjuster lever on the leading shoe pivot pin. Then attach the short end of the adjuster spring into the hole on the lever. Then install the long end of the spring in the leading shoe hole.

(8) Connect park brake cable and adjust brake shoes so as not to interfere with drum installation.

BRAKE DRUM REFACING

Measure drum runout and diameter. If not to specification, reface drum. (Runout should not exceed 0.1524 mm or 0.006 inch). The diameter variation (oval shape) of the drum braking surface must not exceed either 0.0635 mm (0.0025 inch) in 30° or 0.0889 mm (0.0035 inch) in 360°.

All drums will show markings of maximum allowable diameter (Fig. 12).

Using suitable tool, remove grease seal from drum hub. Clean, inspect and pack wheel bearings. Install new seal (Fig. 13). See Wheel Bearings section in this group of the service manual for detailed information on the wheel bearings, and service procedures.

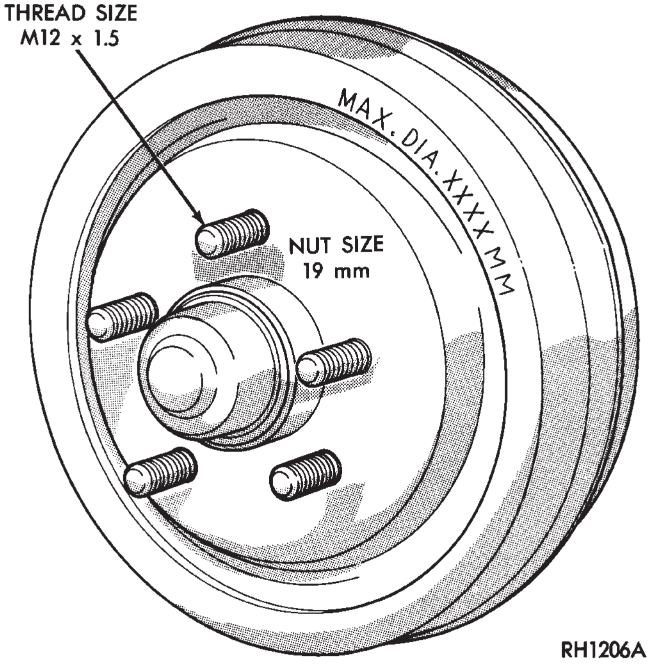


Fig. 12 Maximum Drum Diameter Identification

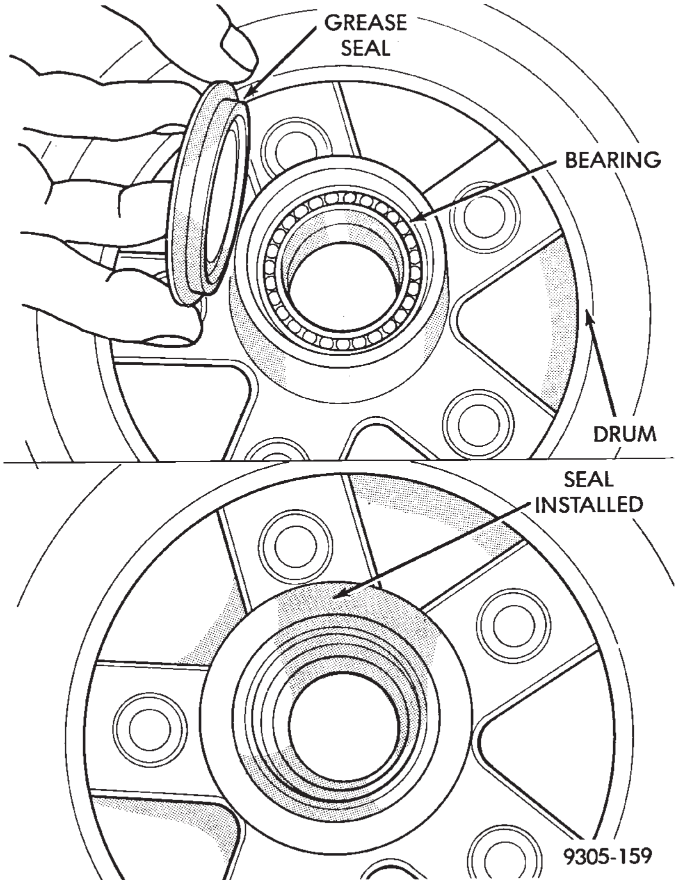


Fig. 13 Installing Grease Seal

WHEEL CYLINDERS

INDEX

GENERAL INFORMATION

The piston boots are of the push-on type and prevent moisture from entering the wheel cylinder.

To perform service operations or inspections of the rear wheel brake cylinders. It will be necessary to remove the cylinders from the support plate and disassemble on the bench.

CAUTION: Wheel cylinders with cup expanders must have cup expanders after any service procedures (reconditioning or replacement).

SERVICE PROCEDURES

REMOVING WHEEL CYLINDERS FROM BRAKE SUPPORT PLATES

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Then block the brake pedal in the stroke position, and 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. (A slight amount of fluid on the boot may not be a leak, but may be preservative fluid used at assembly.)

(1) In case of a leak, remove brake shoes, (replace if soaked with grease or brake fluid.)

(2) Thoroughly clean area of wheel cylinder, where hydraulic brake line connects to wheel cylinder. Disconnect hydraulic brake tube from wheel cylinder (Fig. 1).

(3) Remove the rear wheel cylinder attaching bolts (Fig. 1). Then pull wheel cylinder assembly off the brake support plate (Fig. 2).

(4) Clean the surface sealant off the support plate and wheel cylinder surfaces.

DISASSEMBLING WHEEL CYLINDERS

To disassemble the wheel cylinders, (Fig. 3) proceed as follows:

(1) Pry boots away from cylinders and remove.

(2) Press **IN** on one piston to force out opposite piston, cup and spring (with cup expanders). 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 in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect

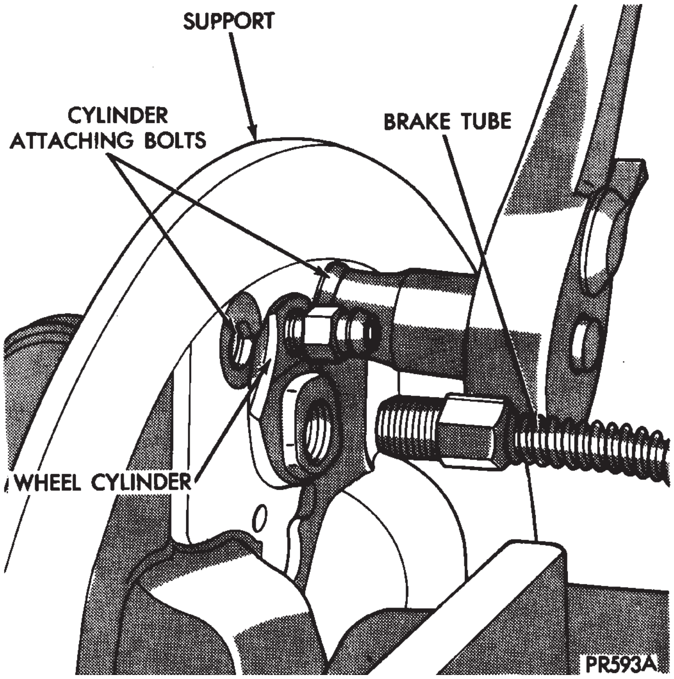


Fig. 1 Brake Tube Disconnected

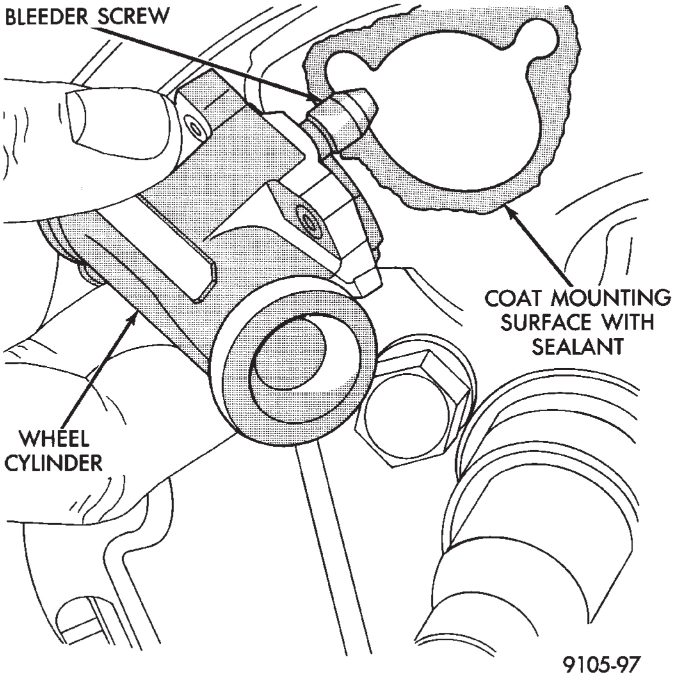


Fig. 2 Remove or Install Wheel Cylinder

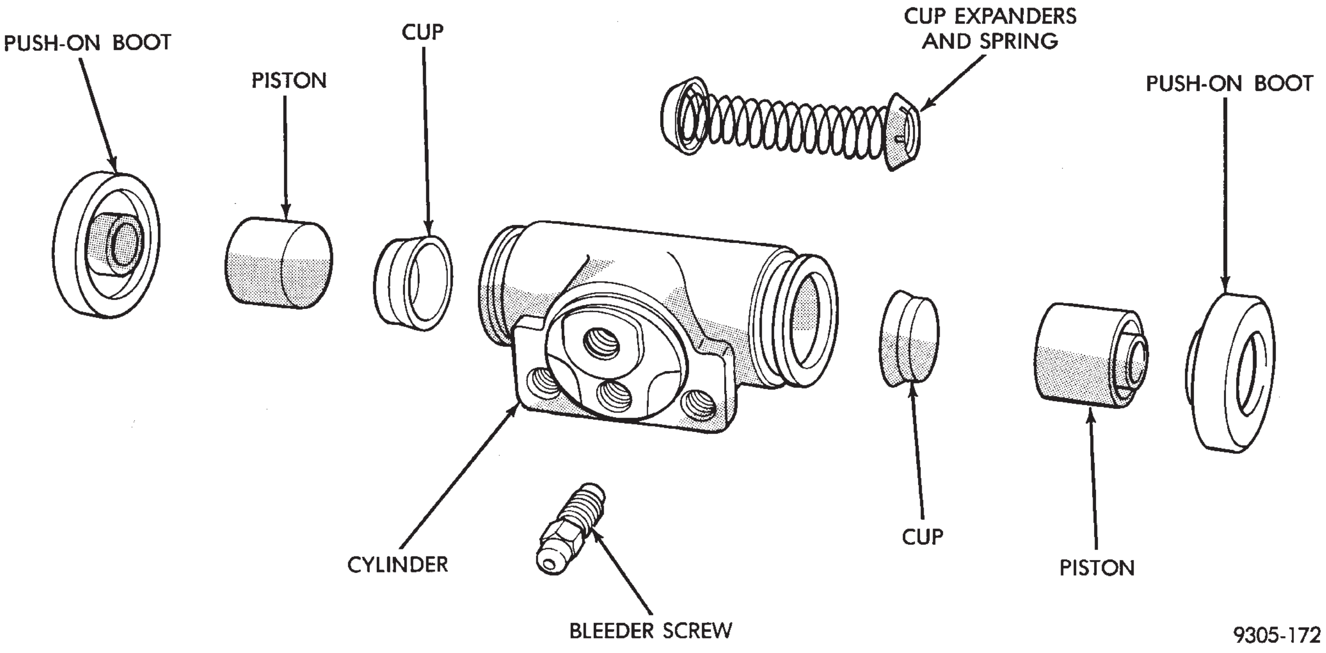


Fig. 3 Rear Wheel Cylinder

cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

Wheel cylinder bores and pistons that are scored or pitted in any way 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.

ASSEMBLING WHEEL CYLINDERS

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) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 3).

(3) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 3).

(4) Install a boot over each end of cylinder. **Be careful not to damage boot during installation.**

INSTALLING WHEEL CYLINDERS

(1) Apply Mopar® Gasket In-A-Tube or equivalent sealant around wheel cylinder mounting surface (Fig. 4).

(2) Install wheel cylinder onto brake support, and tighten the wheel cylinder to brake support plate attaching bolts to 8 N●m (75 in. lbs.).

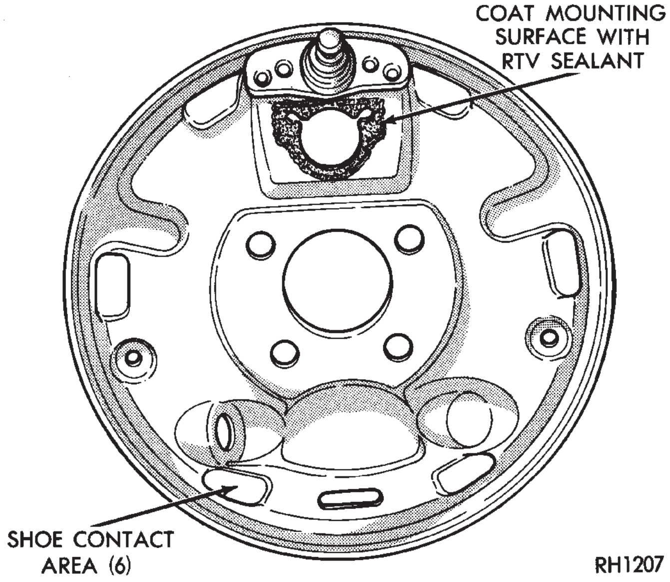


Fig. 4 Apply Sealant on Support Plate

(3) Attach hydraulic brake tube to wheel cylinder, and tighten tube to wheel cylinder fitting to 17 N●m (145 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 115 N●m (85 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.

BRAKE SUPPORT ASSEMBLY

REMOVAL

Back off parking brake adjusting nut to provide slack in cable.

With wheel and brake drum removed, disconnect hydraulic tube from wheel cylinder.Disconnect parking brake cable and adjuster lever spring (Fig. 1).

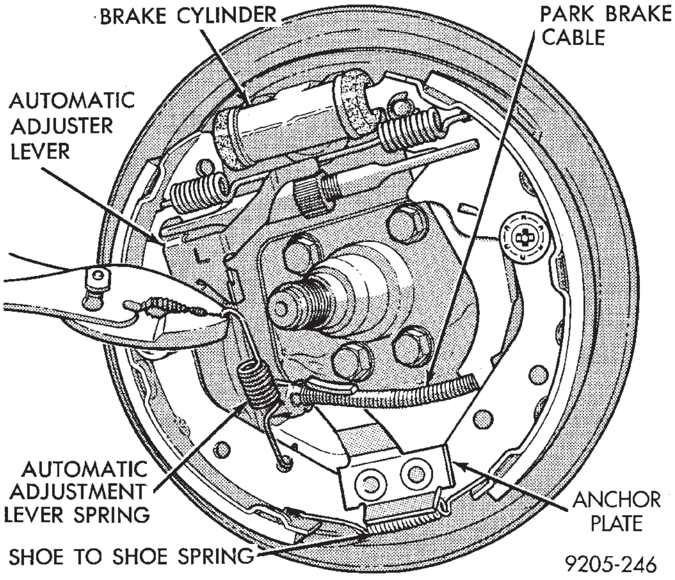


Fig. 1 Removing Adjuster Lever Spring

Using a suitable tool such as an aircraft type hose clamp, install the clamp over the retainer on the end of the parking brake cable (Fig. 2). Compress cable housing retainer and start housing out of support plate (Fig. 2). Remove clamp when retainer is free from the park brake cable mounting hole in the rear brake support plate. Alternate method is to slide a 14 mm box wrench over housing end fitting compressing the three fingers.

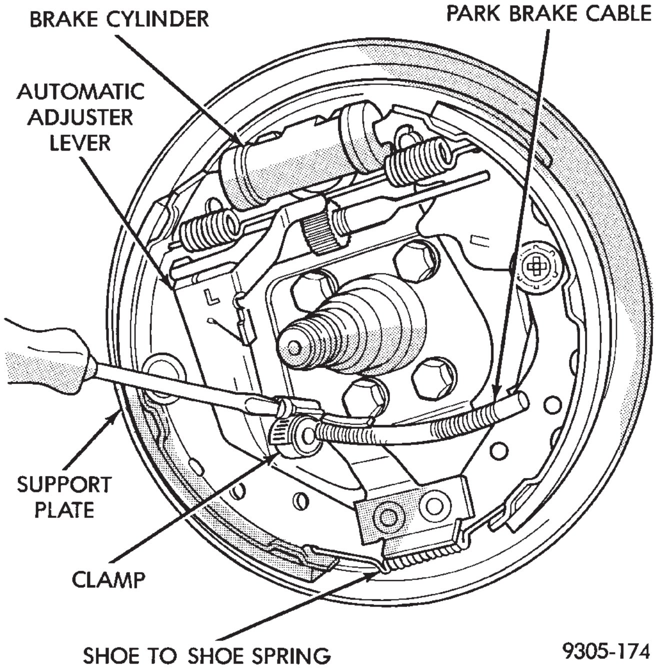


Fig. 2 Removing Park Brake Cable From Support Plate

Remove attaching bolts and washers and separate brake support and spindle from rear support trailing arm.

INSTALLATION

Insert parking brake cable and housing into support plate.

Install support plate, spindle and gasket between support plate and spindle on to rear suspension member. Tighten support plate attaching bolts to 71 N•m (53 ft. lbs) torque.

Attach cable to parking brake lever.

Connect brake tube to wheel cylinder. Tighten brake tube to wheel cylinder fitting to 17 N•m (145 in. lbs.).

Install brake drum and wheel. Adjust and bleed service brakes. Adjust parking brake.

HYDRAULIC SYSTEM CONTROL VALVES

INDEX

GENERAL INFORMATION

Most models not equipped with an Anti-Lock braking system have a combination hydraulic system control valve in the brake hydraulic system (Fig. 1). The valve is attached to the frame rail below the master cylinder.

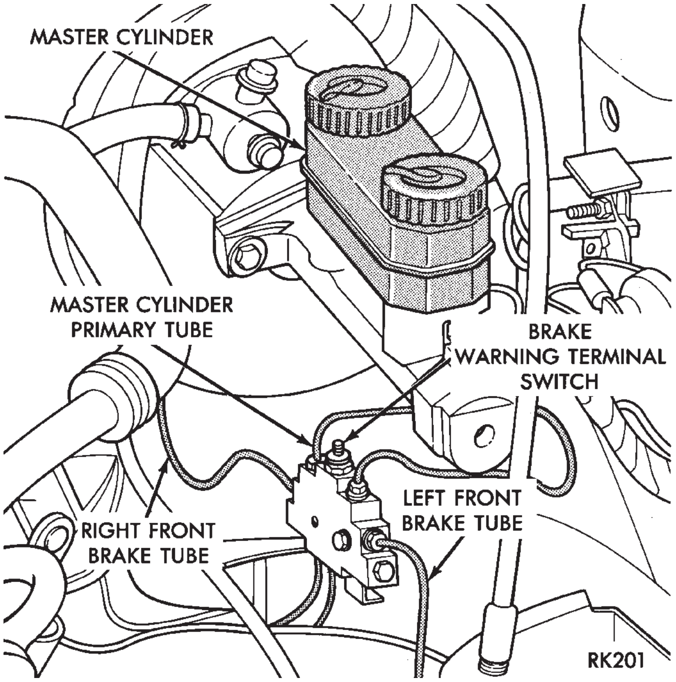


Fig. 1 Brake Combination Valve And Warning Switch Location

The control valve assembly combines a warning switch with a dual proportioning valve (Fig. 2)

Proportioning valves balance front to rear braking by controlling at a given ratio, the increase in rear system hydraulic pressure above a preset level. Under light pedal application, the valve allows full hydraulic pressure to the rear brakes.

There is only one valve assembly in each vehicle, see Valve Application Chart. During any service procedures identify valve assemblies by part number as well as split point (PSI) and slope.

PRESSURE DIFFERENTIAL WARNING LIGHT SWITCH

The hydraulic brake system, on non-ABS vehicles, is split diagonally. The left front and right rear brakes are part of one system. And the right front and left rear are part of another. Both systems are routed through, but hydraulically separated by a Pressure Differential Switch. The function of the Pressure Differential Switch is to alert the driver of a malfunction in the brake system.

If hydraulic pressure is lost in one system, the warning light switch will activate a red light on the instrument panel, when the brake pedal is depressed. At this point the brakes require service. However, since the brake systems are split diagonally the vehicle will retain 50% of its stopping capability in the event of a failure in either half.

The warning light switch is the latching type. It will automatically center itself after the repair is made and the brake pedal is depressed.

The instrument panel bulb can be checked each time the ignition switch is turned to the start position or the parking brake is set.

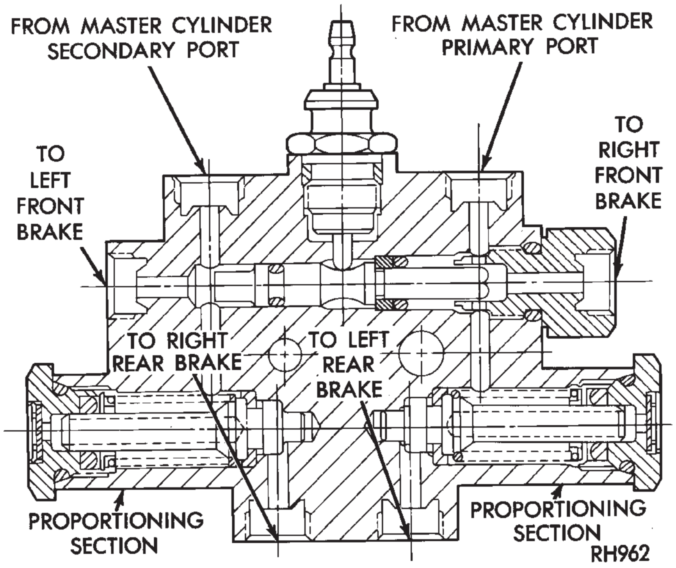


Fig. 2 Switch and Valve Assembly

NON-ABS PROPORTIONING UNIT OPERATION

The proportioning valve section operates by transmitting full input pressure to the rear brakes up to a certain point. This is called the split point. Beyond this point it reduces the amount of pressure increase to the rear brakes according to a certain ratio.

On light pedal applications equal brake pressure will be transmitted to the front and rear brakes. On heavier pedal applications the pressure transmitted to the rear will be lower than the front brakes. This will prevent premature rear wheel lock-up and skid. If hydraulic pressure is lost in one half of the diagonally split system, the operation of the proportioning valve in the remaining half is not effected.

ABS BRAKE PROPORTIONING VALVE OPERATION

On vehicles using the ABS braking system, screw in proportioning valves are used in place of the conventional differential pressure/proportioning valve.

Each rear brake circuit has its own screw-in proportioning valve which is attached to the rear brake outlet ports of the hydraulic assembly. These valves limit brake pressure to the rear brakes after a certain pressure is reached. This improves front to rear brake balance during normal braking.

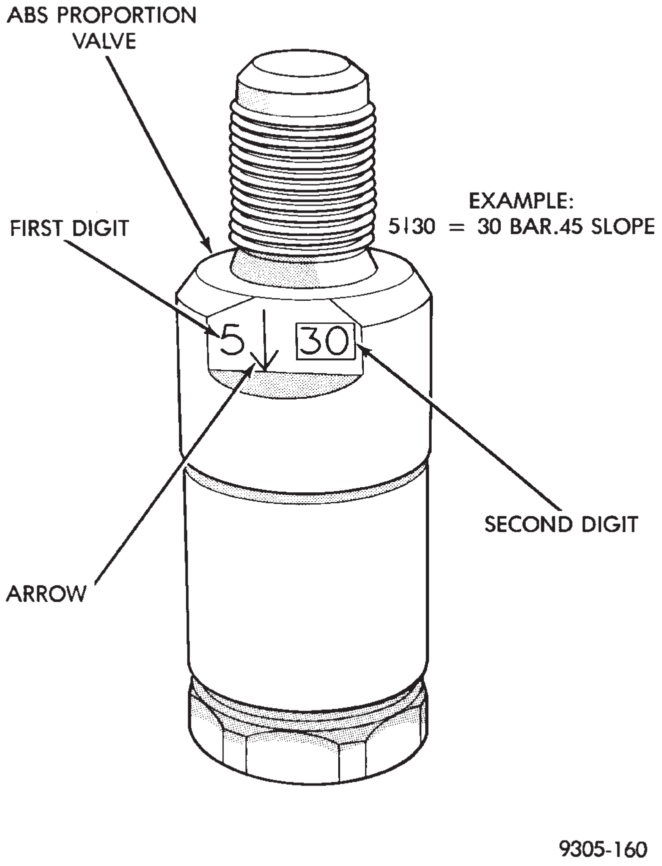


Fig. 3 ABS PROPORTIONING VALVE IDENTIFICATION

Screw in proportioning valves can be identified by the numbers stamped on the body of the valve. The first digit represents the slope, the second digit represents the split (cut-in) point, and the arrow represents the flow direction of the valve. **Be sure that the numbers listed on the replacement valve are the same as on the valve that is being removed.** See (Fig. 3) for detail of the valve identification.

HYDRAULIC SYSTEM SERVICE PROCEDURES

BRAKE WARNING SYSTEM

CHECKING BRAKE WARNING SWITCH UNIT

The Red Brake Warning light will come on when the parking brake is applied with the ignition key turned ON. The same light will also illuminate should one of the two service brake hydraulic systems fail.

CAUTION:Make sure air does not enter the hydraulic system during this test procedure. See bleeding without a pressure bleeder at the beginning of this section for master cylinder fluid level checking procedures.

To test the service brake warning system lamp. Raise the vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light.

If the light fails to light, inspect for a burned out bulb, disconnected socket, or a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is uninterrupted. Check the service brake warning switch operation with a test lamp between the switch terminal and a known good ground. Be sure to fill master cylinder and bleed brake system after correction has been made, if necessary.

PROPORTIONING VALVES

TESTING PROPORTIONING VALVE UNIT

If premature rear wheel skid occurs on hard brake application, it could be an indication that a malfunction has occurred with the proportioning valve unit.

The proportioning valve is designed with two **separate** systems. One half controls the right rear brake, and the other half controls the left rear brake. Therefore, a road test to determine which rear brake slides first is essential.

RIGHT REAR WHEEL SLIDES FIRST

To test the proportioning valve when the right rear wheel slides first, leave the front brakes connected to the valve, proceed as follows:

(1) Install one gauge and (TEE) of set C-4007-A between the brake line from the master cylinder secondary port and the brake valve assembly.

(2) Install the second gauge of set C-4007-A to the right rear brake outlet port (Fig. 4). Using an adapter tube, made from a short piece of brake tube and (2) 3/8 x 24 tube nuts. Connect the hose to the valve. Bleed the hose and gauge.

(3) Have a helper exert pressure on the brake pedal (holding pressure) to get a reading on the valve inlet gauge and check the reading on the outlet

PROPORTIONING VALVE APPLICATIONS

NON-ABS BRAKES

VEH FAM	VALVE FUNCTION	MATERIAL	PROPORTIONING SPLIT	SLOPE	IDENT.
AA	14″ DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AA	14″ DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.27	WHITE
AP	14″ DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AP	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	500 PSI	.43	YELLOW
AY	14″ DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	500 PSI	.59	BLACK
AG	14″ DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AG	15" DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.27	WHITE
AJ	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW

ABS BRAKES

VEH FAM	VALVE FUNCTION	MATERIAL	PROPORTIONING SPLIT	SLOPE	IDENT.
AA	14″ DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	20 BAR 290 PSI	.45	20↓.5
AJ	14" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	30 BAR 435 PSI	.45	5↓30
AC	14″ DISC-DRUM SCREW IN PROPORTIONING	PLATED BLACK	20 BAR 290 PSI	.3	20↓.3
AY	14″ DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	20 BAR 290 PSI	.3	20↓.3
AG	15″ DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	30 BAR 435 PSI	.45	5↓30
AP	14" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	30 BAR 435 PSI	.45	5↓30

9305-161

gauge. If the inlet and outlet pressures do not agree with the values on the following chart, replace the valve.

LEFT REAR WHEEL SLIDES FIRST

To test the proportioning valve when the left rear wheel slides first, leave the front brakes connected to the valve, proceed as follows:

(1) Install one gauge and (TEE) of set C-4007-A between brake line from the master cylinder primary port and the brake valve assembly.

(2) Install the second gauge of set C-4007-A to the left rear brake outlet port (Fig. 5). An adapter tube, made up from a 7/16 x 24 tube nut, a short piece of brake tube and 3/8 x 24 tube nut. Will be required to connect the hose to the valve. Bleed the gauge and hose.

(3) Have a helper exert pressure on the brake pedal. Hold pressure steady to get a reading on the valve inlet gauge and check the reading on the outlet gauge. If the inlet and outlet pressures do not agree with the values on the following chart, replace the valve.

TESTING ABS PROPORTIONING VALVES

All ABS components use an ISO type tubing flare. Use the correct adapters with ISO type tubing flares when installing gauges to test ABS proportioning valves.

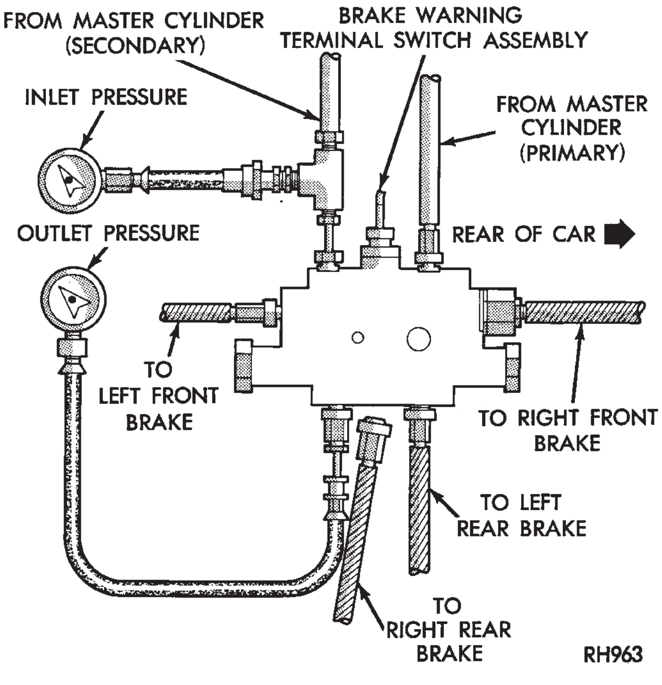


Fig. 4 Tube Connection for Right Rear Skidding

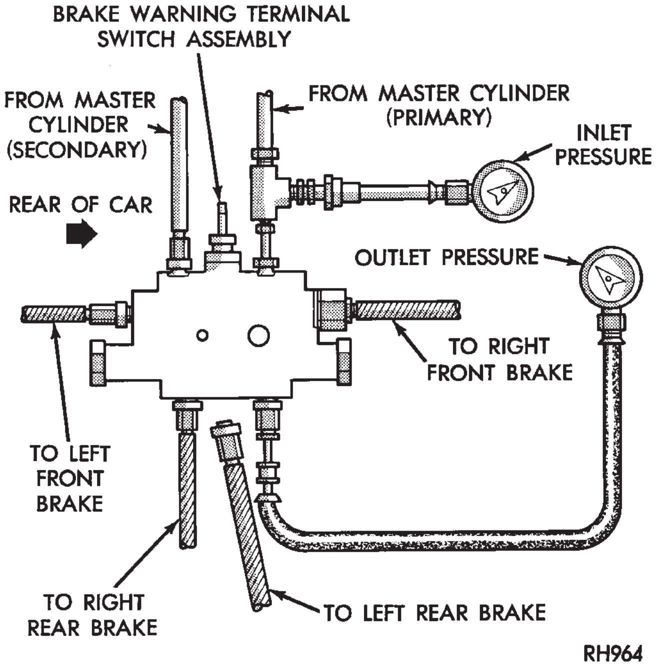


Fig. 5 Tube Connection for Left Rear Skidding

(1) Install one gauge and (TEE) between the hydraulic assembly and the male end (Inlet) of the valve.

(2) Install the second gauge at the female end (Outlet) of the valve (Fig. 6).

(3) Have a helper exert pressure on the brake pedal (holding pressure) to get a reading on the valve inlet gauge.

(4) Check the reading on the outlet gauge. If the inlet and outlet pressures do not agree with the following chart, replace the valve. See (Fig. 3) for proportioning valve identification.

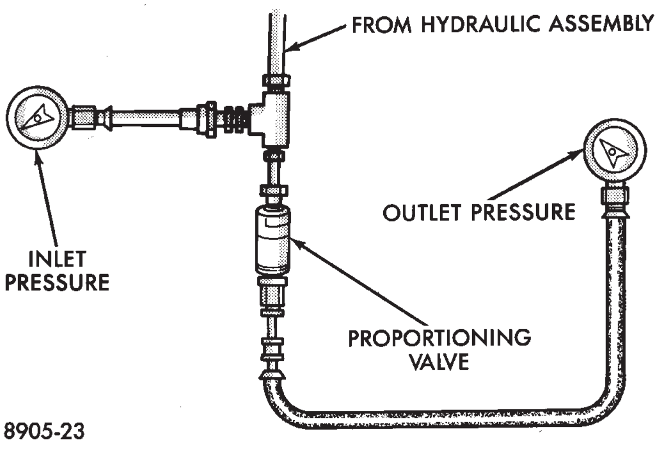
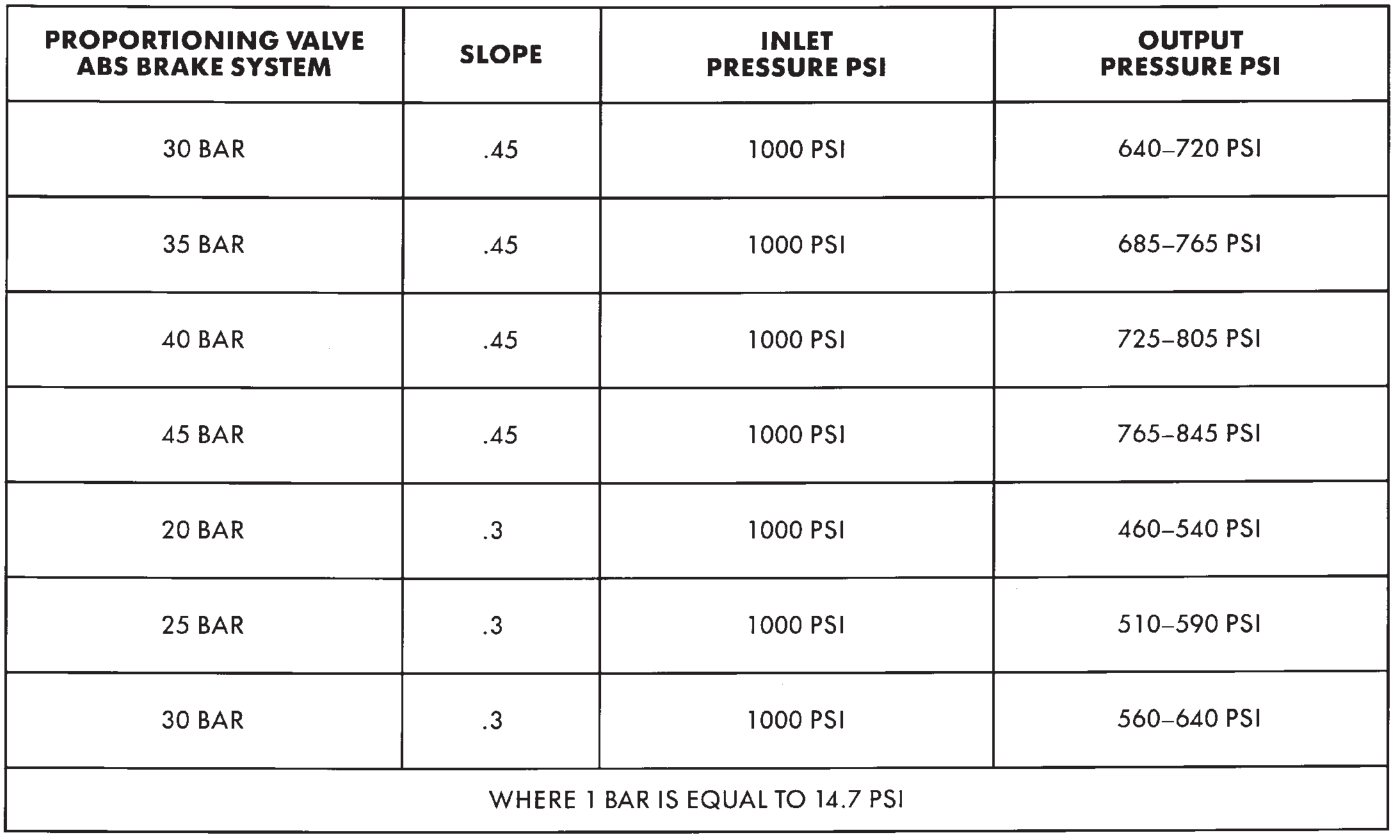


Fig. 6 Tube Connections for ABS

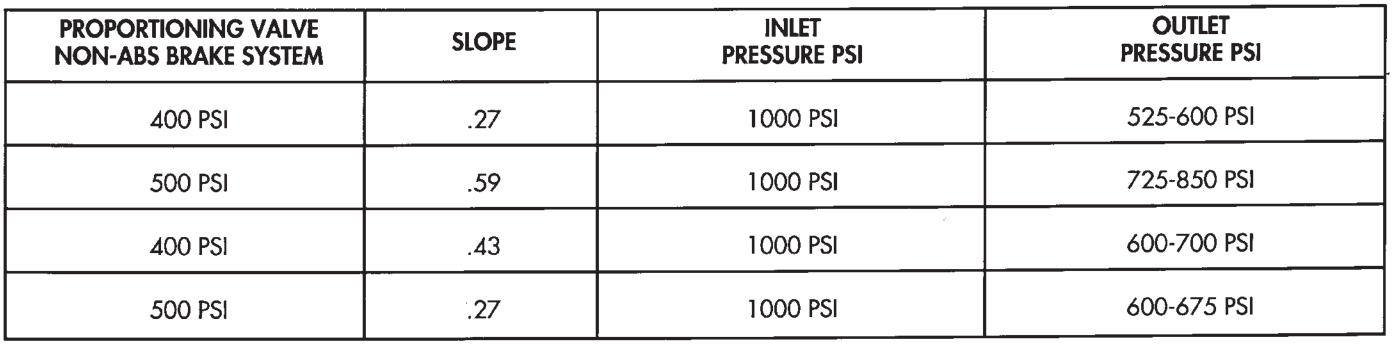
PROPORTIONING VALVE PRESSURES ABS-BRAKES



PROPORTIONING VALVE ABS BRAKE SYSTEM	SLOPE	INLET PRESSURE PSI	OUTPUT PRESSURE PSI
30 BAR	.45	1000 PSI	640–720 PSI
35 BAR	.45	1000 PSI	685–765 PSI
40 BAR	.45	1000 PSI	725–805 PSI
45 BAR	.45	1000 PSI	765–845 PSI
20 BAR	.3	1000 PSI	460–540 PSI
25 BAR	.3	1000 PSI	510–590 PSI
30 BAR	.3	1000 PSI	560–640 PSI
WHERE 1 BAR IS EQUAL TO 14.7 PSI			

9105-49

PROPORTIONING VALVE PRESSURES NON-ABS BRAKES



PROPORTIONING VALVE NON-ABS BRAKE SYSTEM	SLOPE	INLET PRESSURE PSI	OUTLET PRESSURE PSI
400 PSI	.27	1000 PSI	525-600 PSI
500 PSI	.59	1000 PSI	725-850 PSI
400 PSI	.43	1000 PSI	600-700 PSI
500 PSI	.27	1000 PSI	600-675 PSI

9305-162

FRONT DISC BRAKES

INDEX

GENERAL INFORMATION

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

- The driving hub
- Braking disc (rotor)
- Caliper assembly
- Shoes and linings
- Adapter for mounting the caliper assembly to the steering knuckle

WARNING: THE PISTONS THAT ARE USED IN THE 2 DIFFERENT CALIPER ASSEMBLIES ARE UNIQUE TO THE CALIPER THEY ARE USED IN. THE DIMENSIONS OF THESE PISTONS ARE DIFFERENT, DO NOT INTERCHANGE THE CALIPER PISTONS. IMPROPER USE COULD CAUSE A COMPLETE FAILURE OF THE BRAKE SYSTEM.

The double pin Kelsey-Hayes Family Caliper, is mounted to the adapter using bushings, sleeves and 2 through bolts threaded into the adapter (Fig. 3 and 5). The adapter is then mounted to the steering knuckle using 2 attaching bolts.

The double pin Kelsey-Hayes Non-Family Caliper, is mounted directly to the steering knuckle of the vehicle using bushings, sleeves and 2 through bolts (Fig. 4). The adapter is not used on the vehicles equipped with the Non-Family caliper assembly.

Two machined abutments on the caliper mounting adapter or steering knuckle, (Fig. 3 and 4) position the caliper fore and aft. The guide pin bolts, sleeves and bushings control the float, side to side movement of the caliper. The piston seal, is designed to pull the piston back into the bore of the caliper when the brake pedal is released. This maintains proper brake shoe to rotor clearance (Fig. 6).

Vehicles equipped with Kelsey-Hayes double pin family calipers, have 1 anti-rattle clip attached to the top of the adapter (Fig. 1).

All of the braking force is taken up directly by the adapter or the steering knuckle depending on the type of caliper assembly the vehicle is equipped with.

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

The front disc brake caliper phenolic piston is 2 different sizes depending on the vehicle that the caliper assembly is used on. The AC, AG & AY body use a 60 mm piston, and the AA, AP, AG & AJ body use a 54 mm piston.

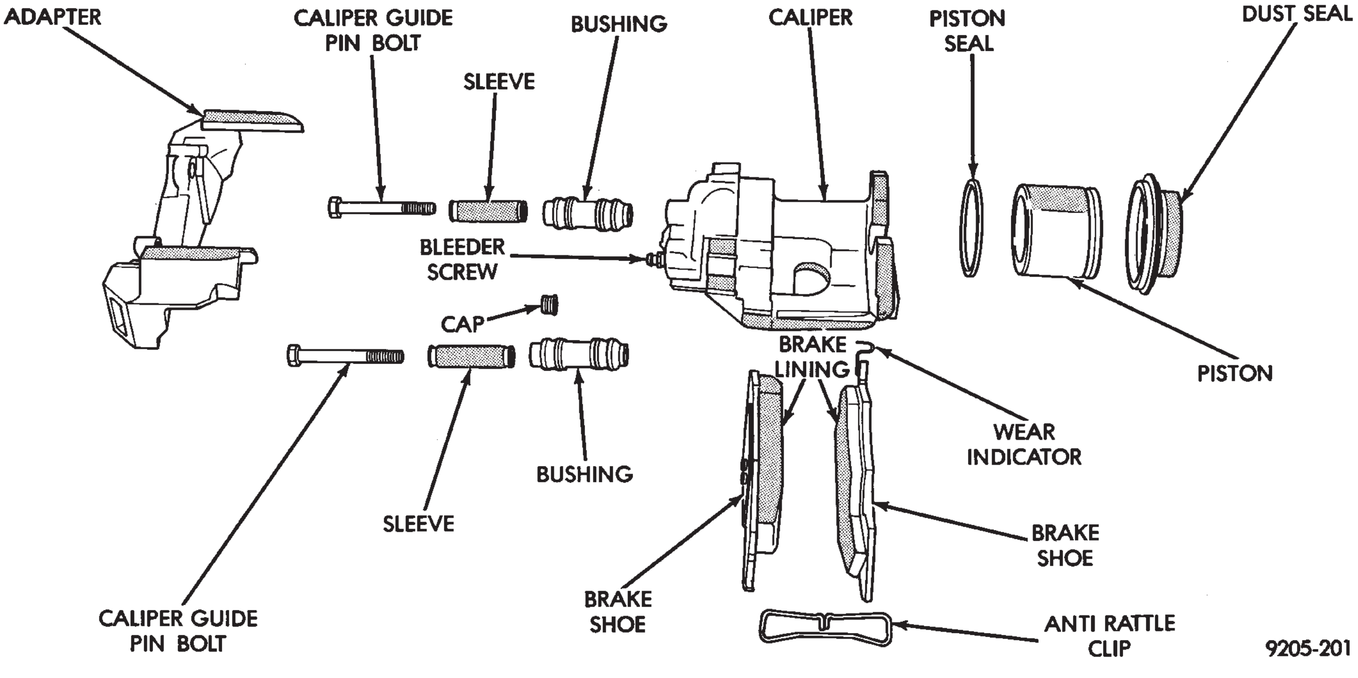


Fig. 1 Front Disc Brake Assembly (Family Caliper Typical)

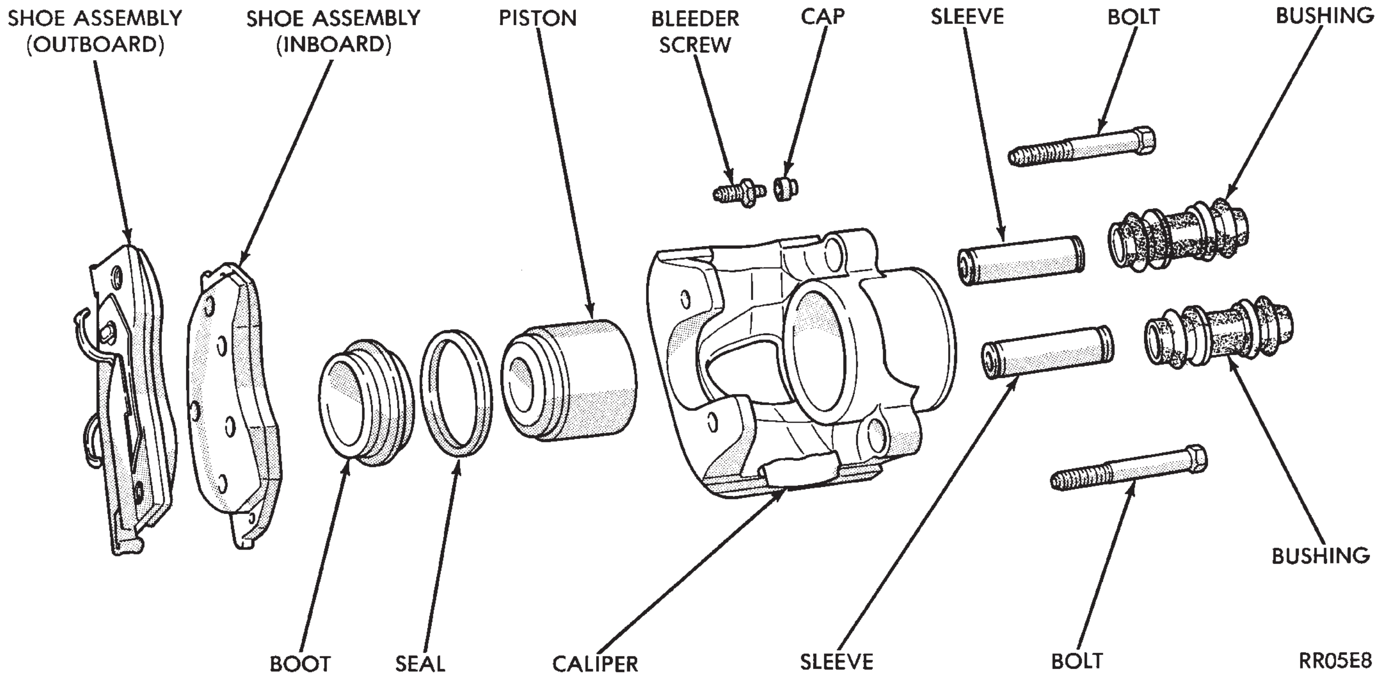


Fig. 2 Front Disc Brake Assembly (Non-Family Caliper Typical)

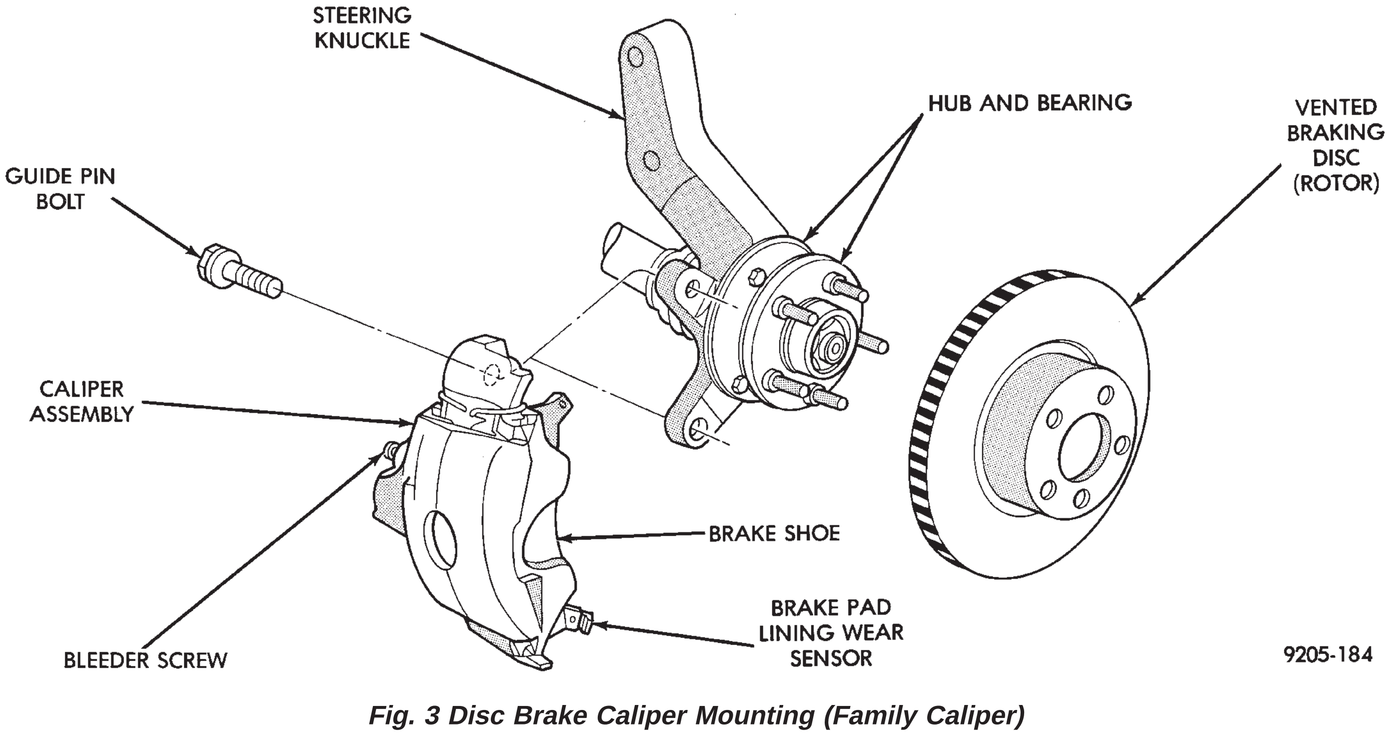


Fig. 3 Disc Brake Caliper Mounting (Family Caliper)

A square cut rubber piston seal is located in a machined groove in the cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 6).

A molded rubber dust boot is installed in a groove of the caliper assembly piston bore. This prevents contamination in the bore area of the caliper assembly.

The boot mounts in the cylinder bore opening and in a groove in the piston (Fig. 6). This prevents contamination in the bore area.

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

All Vehicles, are equipped with an audible wear sensor on the outboard pad of the front disc brake as-

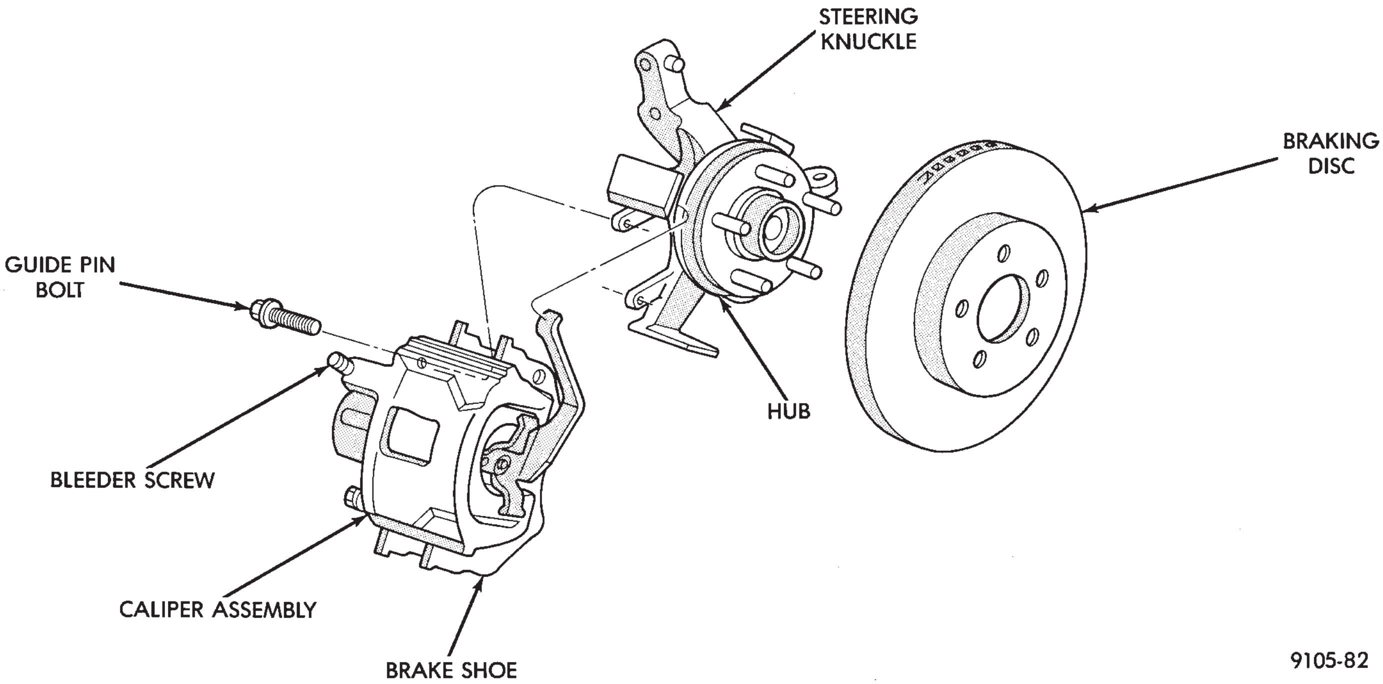


Fig. 4 Disc Brake Caliper Mounting (Non-Family Caliper)

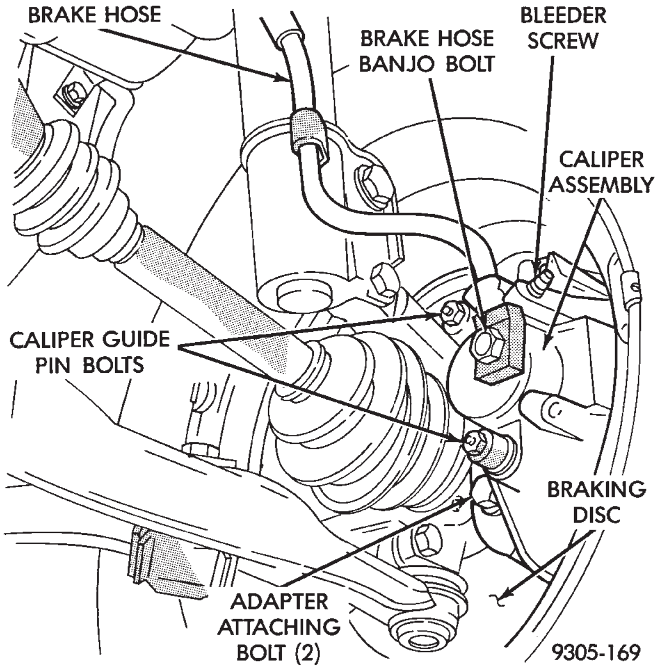


Fig. 5 Disc Brake Caliper Mounting (Typical)

semblies. This sensor when emitting a sound signals that brake lining may need inspection and/or replacement.

SHOE AND 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.

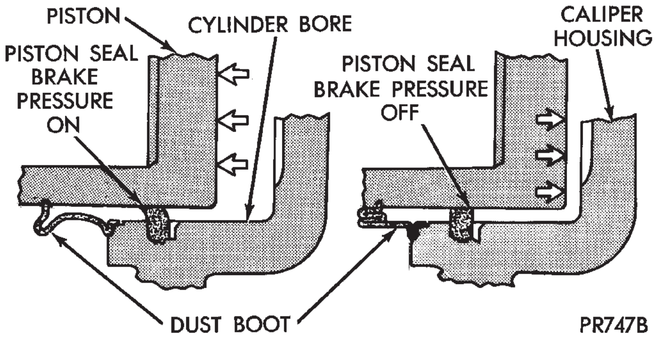


Fig. 6 Piston Seal Function for Automatic Adjustment

Remove the shoe and lining assemblies. (See Brake Shoe Removal paragraph).

Combined shoe and lining thickness should be measured at the thinnest part of the assembly.

When a shoe and lining assembly is worn to a thickness of approximately 7.95 mm (5/16 inch) it should be replaced.

Replace **both** shoe assemblies (inboard and outboard) on the front wheels. It is necessary that **both** front wheel sets be replaced whenever shoe assemblies on either side are replaced.

If a shoe assembly does not require replacement. Reinstall, the shoe assemblies making sure each shoe assembly is returned to the original position. (See Brake Shoe Installation).

SERVICE PRECAUTIONS

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING, AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY. FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

IT IS RECOMMENDED NOT TO BREATH ANY TYPE OF BRAKE LINING MATERIAL DUST EVEN ASBESTOS FREE, DUE TO THE FIBROUS NATURE OF THE MATERIALS BEING USED.

Grease or any other foreign material must be kept off caliper assembly, surfaces of braking disc and external surfaces of hub, during service procedures.

Handling of the braking disc and caliper. Should be done in such a way as to avoid deformation of the disc and scratching or nicking of the brake linings.

If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

Before vehicle is moved after any brake service work, be sure to obtain a firm brake pedal.

KELSEY HAYES DOUBLE PIN FAMILY CALIPER

BRAKE SHOE SERVICE PROCEDURES

BRAKE SHOE REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting Information in the Lubrication and Maintenance section of this manual.

(2) Remove front wheel and tire assemblies.

(3) Remove caliper guide pin bolts (Fig. 1).

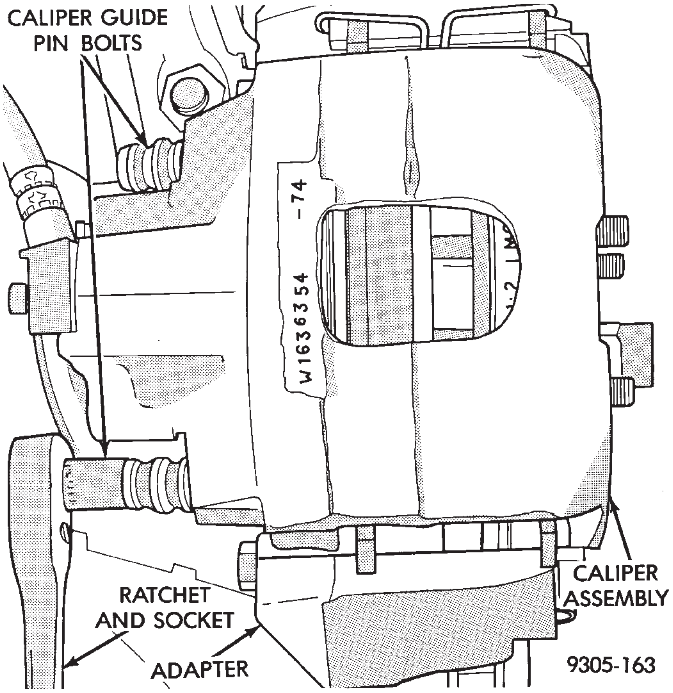


Fig. 1 Removing or Installing Caliper Guide Pin Bolts

(4) After removing caliper guide pin bolts. Lift caliper away from braking disc using a pry bar or screwdriver (Fig. 2).

(5) Remove caliper assembly from braking disc and adapter by sliding the assembly out and away from the braking disc and adapter (Fig. 3).

(6) Support caliper firmly to prevent weight of caliper from damaging the flexible brake hose (Fig. 4).

(7) Remove the outboard brake shoe assembly from the caliper adapter (Fig. 5).

(8) Remove the braking disk (rotor) from the hub by pulling it straight off the wheel mounting studs (Fig. 6).

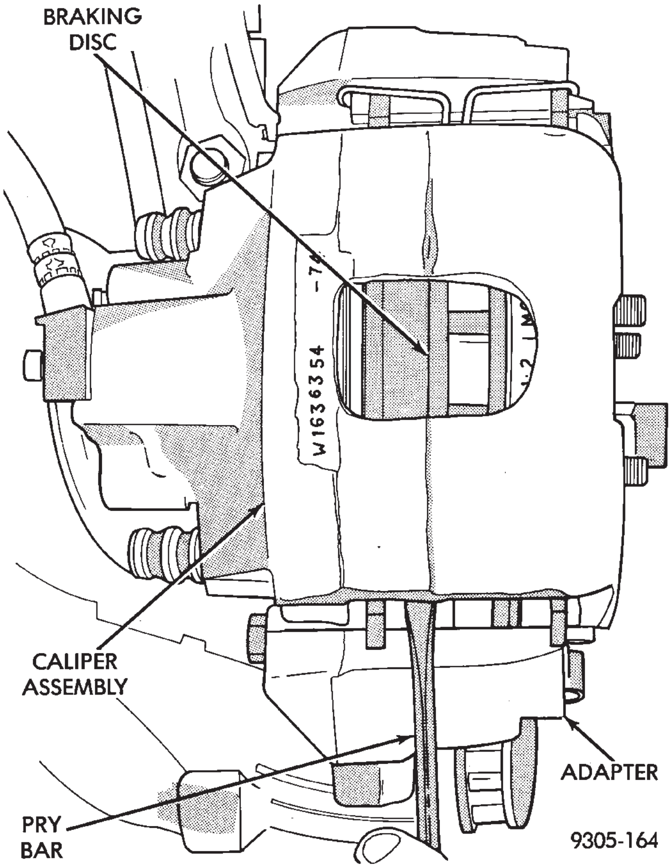


Fig. 2 Loosening Family Caliper Assembly From Adapter And Rotor

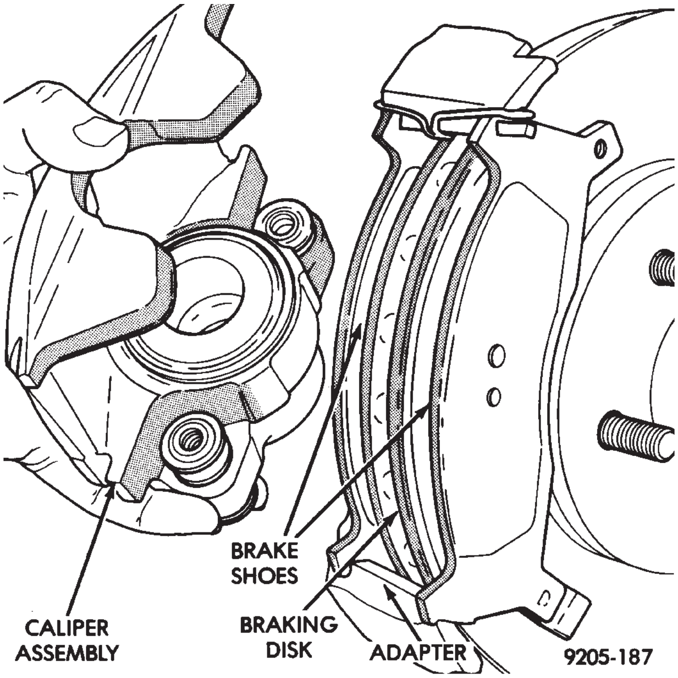


Fig. 3 Removing or Installing Caliper Assembly

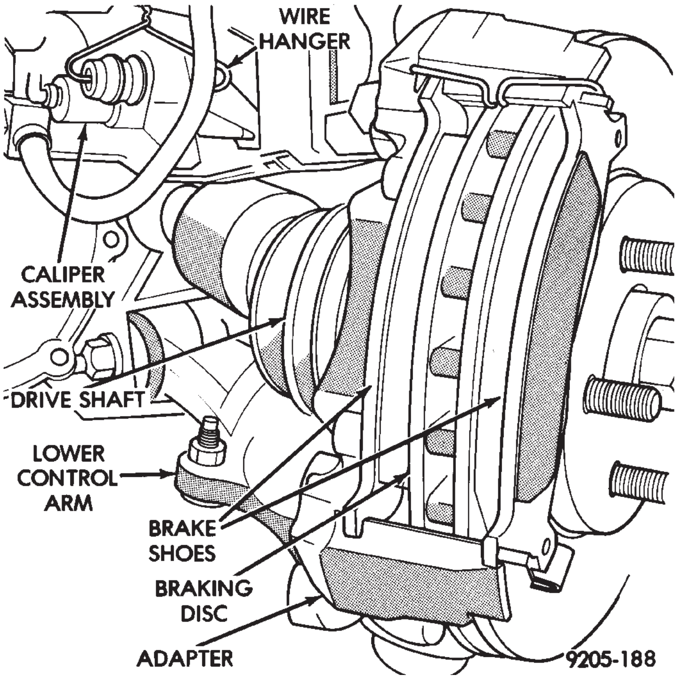


Fig. 4 Storing Caliper

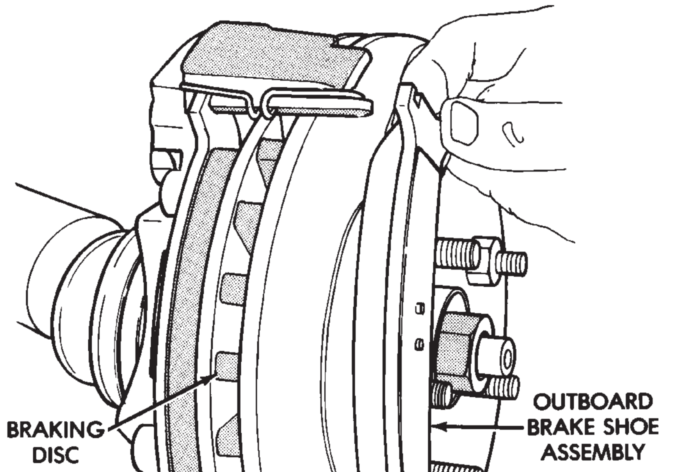


Fig. 5 Removing and Installing Outboard Shoe Assembly

(9) Remove the inboard brake shoe assembly by sliding it out along the bottom adapter abutment until brake shoe assembly loosens from anti-rattle clip (Fig. 7).

(10) Remove the anti-rattle clip from the top adapter abutment (Fig. 8).

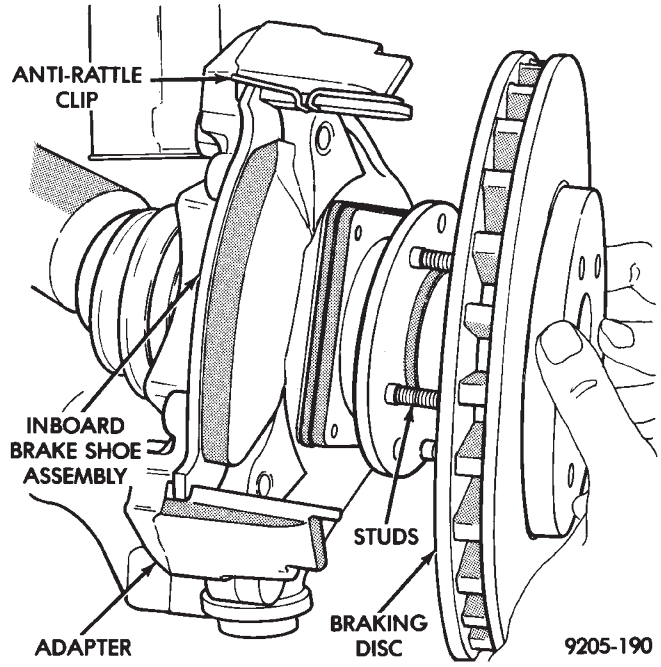


Fig. 6 Removing or Installing Braking Disc

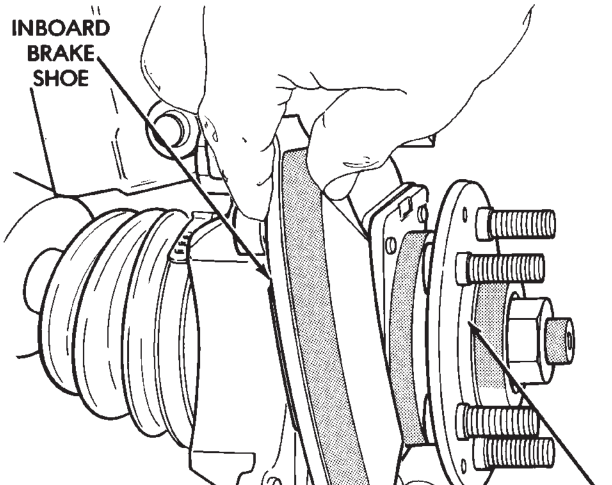


Fig. 7 Removing or Installing Inboard Shoe Assembly

BRAKE SHOE INSTALLATION

(1) Thoroughly clean and lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(2) Install the anti-rattle clip on the upper abutment of the caliper mounting adapter (Fig. 8).

(3) Install the new inboard brake shoe assembly on the adapter by sliding it along the adapter abutments. Be careful not to get any grease from the adapter abutment on the surface of the brake lining

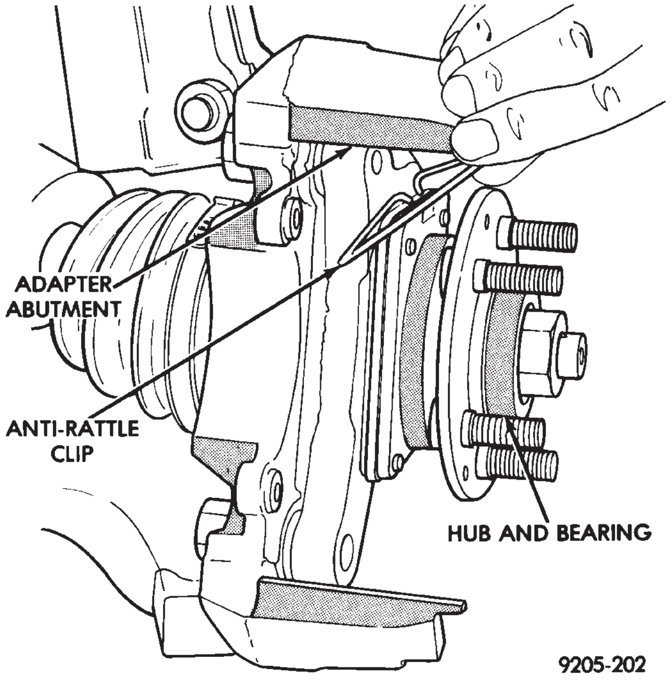


Fig. 8 Remove Or Replace Anti-Rattle Clip

material, (Fig. 7). Be sure inboard brake shoe assembly is correctly positioned against anti-rattle clip (Fig. 6).

(4) Reinstall the Braking Disk on the hub, by installing it over the wheel studs until it is seated against the face of the hub (Fig. 6).

(5) Slide the new outboard brake shoe assembly on the adapter abutment, (Fig. 5).

(6) Carefully lower caliper over the braking disk and brake shoe assemblies (Fig. 3). Make sure that the caliper guide pin bolt, bushings and sleeves are clear of the adapter.

(7) Install the caliper guide pin bolts and tighten to 34 to 37 N•m (25 to 35 ft. lbs.). **Extreme caution should be taken not to cross the threads of the caliper guide pin bolts.**

(8) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence (Fig. 9) until all nuts are torqued to half specification. This is important. Then repeat the tightening sequence to the full specified torque of 129 N•m (95 ft. lbs.).

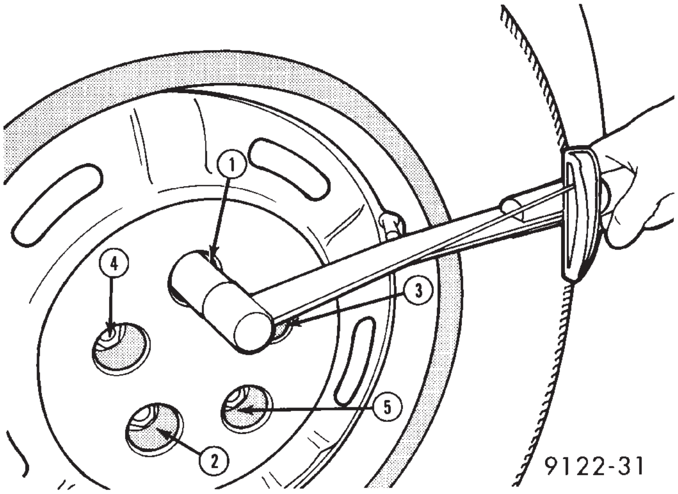


Fig. 9 Tightening Wheel Nuts

(9) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop vehicle.**.

(10) Road test the vehicle and make several stops to wear off any foreign material on the brake linings and to seat the brake shoe linings.

KELSEY HAYES DOUBLE PIN NON-FAMILY CALIPER

INDEX

SERVICE PROCEDURES

BRAKE SHOES REMOVE

(1) Raise the vehicle on jackstands or centered on a hoist.

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

(3) Remove the brake caliper assembly to steering knuckle attaching guide pin bolts (Fig. 1)

(4) Pull lower end of brake caliper out from the machined abutment on the steering knuckle (Fig. 2). Then roll caliper out and away from braking disc (Fig. 2). The brake shoe assemblies will remain with the brake caliper.

(5) When the caliper is removed from the vehicle to service the brake shoes. **SUPPORT CALIPER FIRMLY TO PREVENT WEIGHT OF CALIPER FROM DAMAGING THE FLEXIBLE HOSE.** (See Fig. 3).

(6) Remove the outboard brake shoe by prying between the top of the outboard shoe and the top of the caliper assembly as shown in (Fig. 4).

(7) Remove the inboard brake shoe from the caliper, by pulling the inboard shoe assembly away from the piston (Fig. 5).

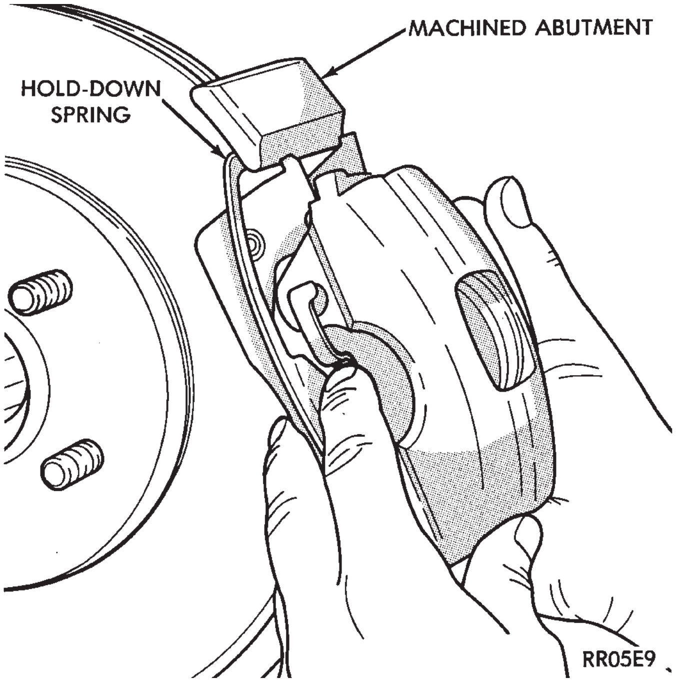


Fig. 2 Removing Caliper and Brake Shoes as an Assembly

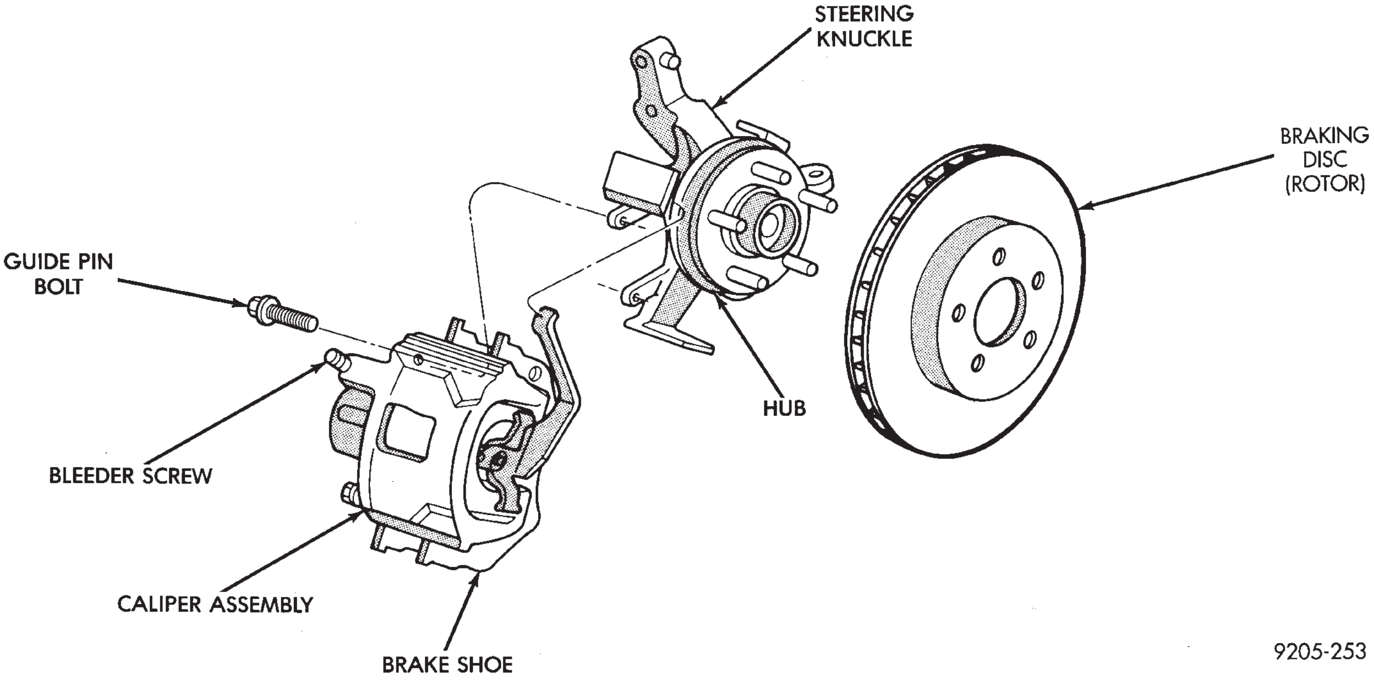


Fig. 1 Non-Family Disc Brake Assembly

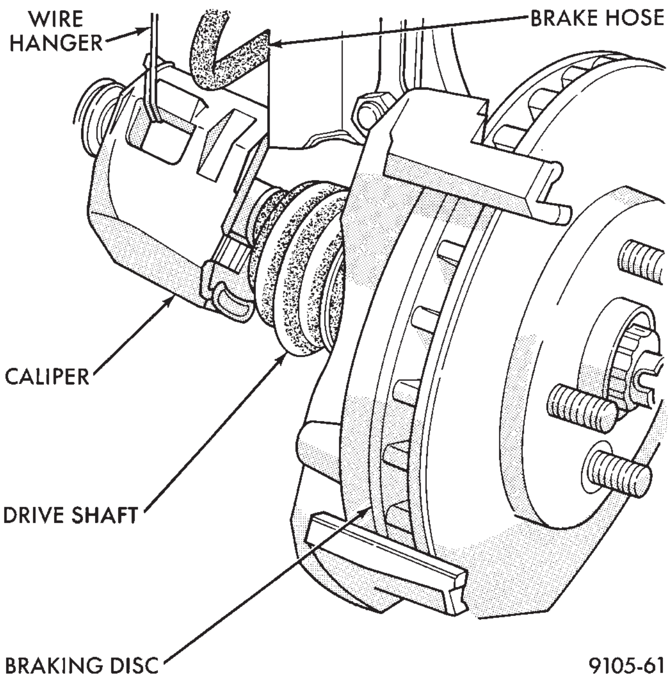


Fig. 3 Storing Caliper

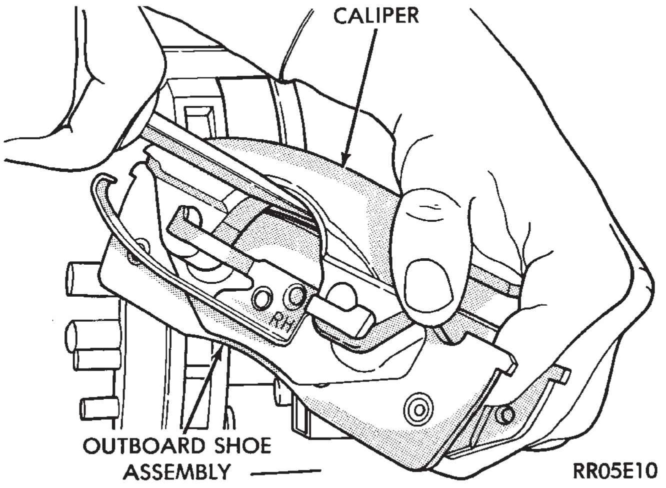


Fig. 4 Prying Outboard Shoe Assembly Away from Caliper

CLEANING AND 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.

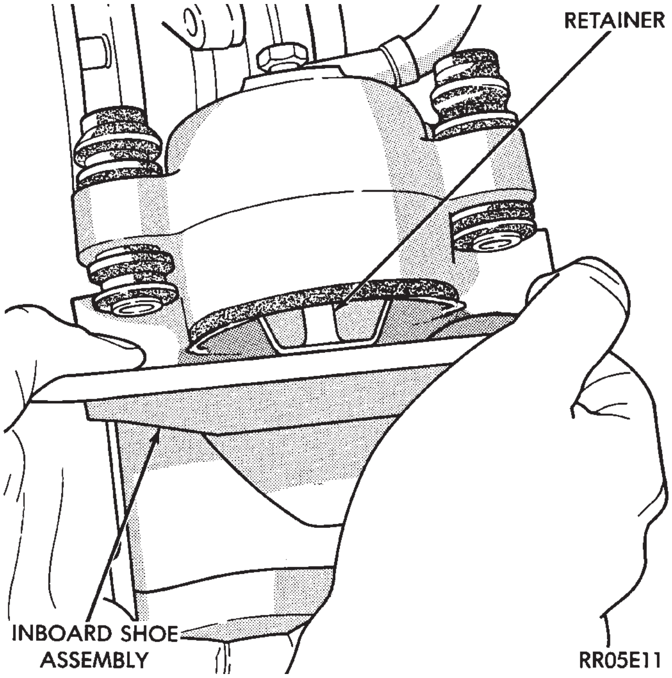


Fig. 5 Removing or Installing Inboard Shoe Assembly

BRAKE SHOES INSTALL

(1) Thoroughly clean and lubricate both adapter ways on the steering knuckle, with a liberal amount of Mopar Multi-purpose Lubricant, or equivalent.

(2) The inboard brake shoes are common. The outboard brake shoes are marked with an (LH) or (RH) to denote which side of the vehicle to be installed on (Fig. 6).

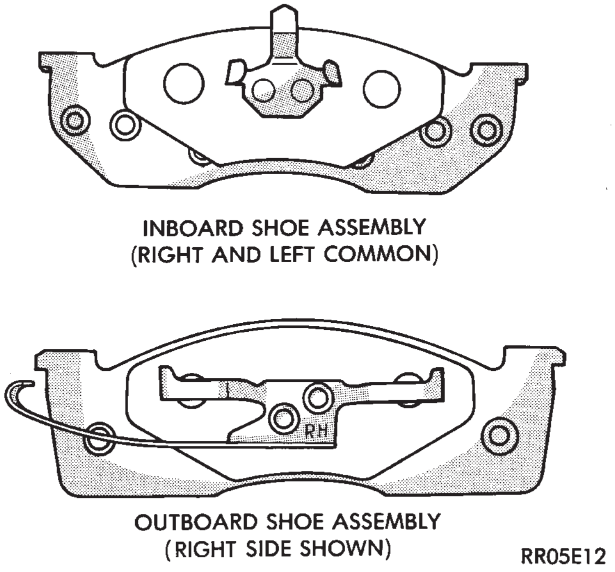


Fig. 6 Brake Shoe Identification

(3) Remove protective paper from the noise suppression gasket and position the properly marked outboard brake shoe assembly onto the caliper (Fig. 7).

(4) Install new inboard brake shoe assembly in cal-

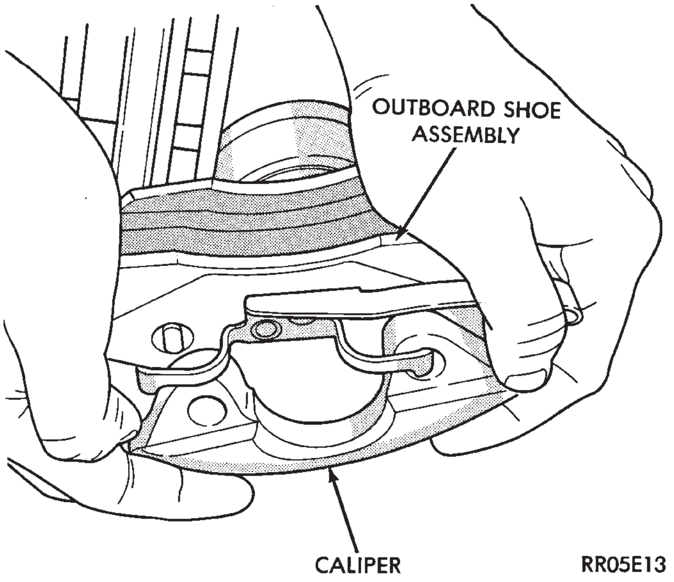


Fig. 7 Installing Outboard Shoe Assembly onto Caliper

iper, by installing retaining clip into the bore of the piston (Fig. 5).

CAUTION: Use care when installing the caliper assembly onto the steering knuckle, so the seal on the sealed for life bushings does not get damaged.

(5) Carefully lower caliper over braking disc and guide holddown spring under machined abutment on knuckle assembly (Fig. 8).

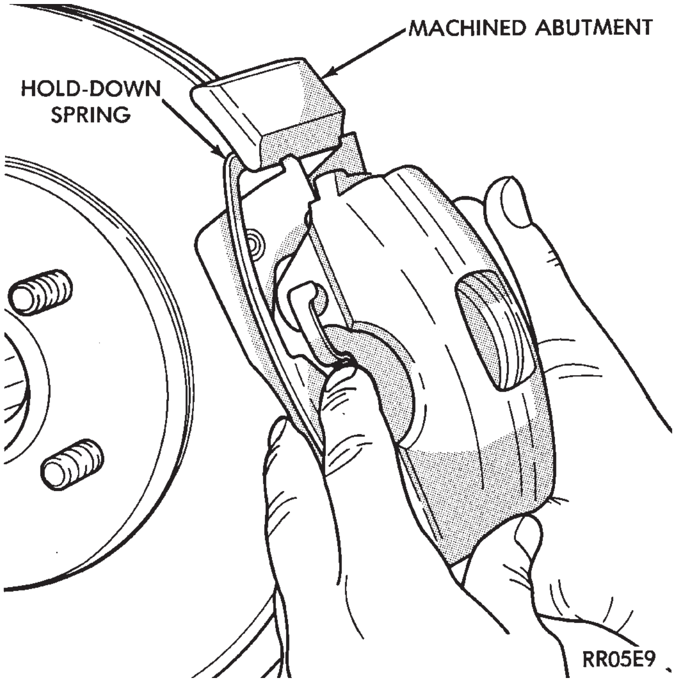


Fig. 8 Guiding Holddown Spring Under Machined Abutment

(6) Install caliper guide pin bolts and tighten to 24-34 N●m (18-25 ft. lbs.) torque. **When installing guide pin bolts, use extreme caution not to cross thread the guide pin bolts.**

(7) Install wheel and tire assembly. Tighten stud nuts in proper sequence until all nuts are torqued to half specification. **This is important.** Then repeat sequence to full specification.

(8) Remove jackstands or lower hoist. **Before moving vehicle be sure it has a firm pedal, pump pedal several times.**

(9) Road test vehicle and make several stops to wear off any foreign material on the brakes and to seat the linings.

DISC BRAKE CALIPER DISASSEMBLY

CLEANING AND INSPECTION

Check for piston fluid seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of 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.

(1) Remove caliper from braking disc (See Brake Shoe Removal). Hang assembly on a wire hook away from braking disc, so hydraulic fluid cannot get on braking disc (See Fig. 3 in Brake Shoe Removal). Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. (Brake pedal will fall away when piston has passed bore opening.) Then prop up the brake pedal to any position below 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 flexible brake line at frame bracket after removing piston. Plug brake tube and remove piston from opposite caliper. Using the same process as above for the first piston removal.

WARNING: UNDER NO CONDITION SHOULD AIR PRESSURE BE USED TO REMOVE PISTON FROM CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

(4) Disconnect brake flexible hose from the caliper. To disassemble, mount caliper assembly in a vise equipped with protective jaws.

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(5) Clamp caliper in vise (with protective caps on vise jaws).

(6) Remove dust boot from the brake caliper and discard (Fig. 1).

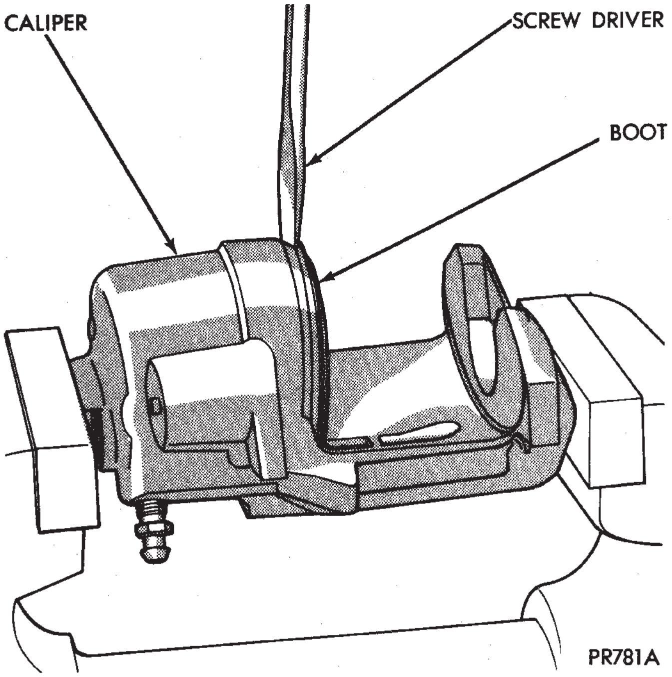


Fig. 1 Removing Piston Dust Boot

(7) Using a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 2). Discard old seal. **Do not use a screwdriver or other metal tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.**

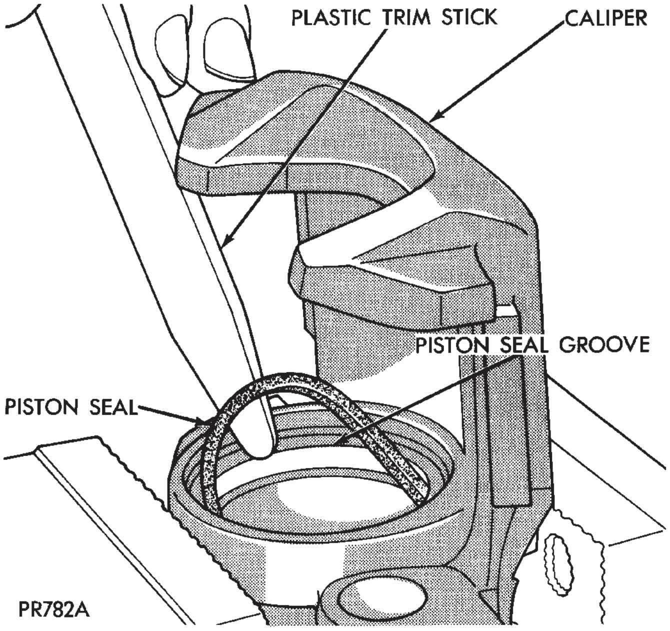


Fig. 2 Removing Piston Seal

The double pin caliper uses a sealed for life bushing and sleeve assembly. If required this assembly can be serviced using the following procedure.

(1) Push out and then pull the inner sleeve from inside of the bushing using your fingers as shown in (Fig. 3)

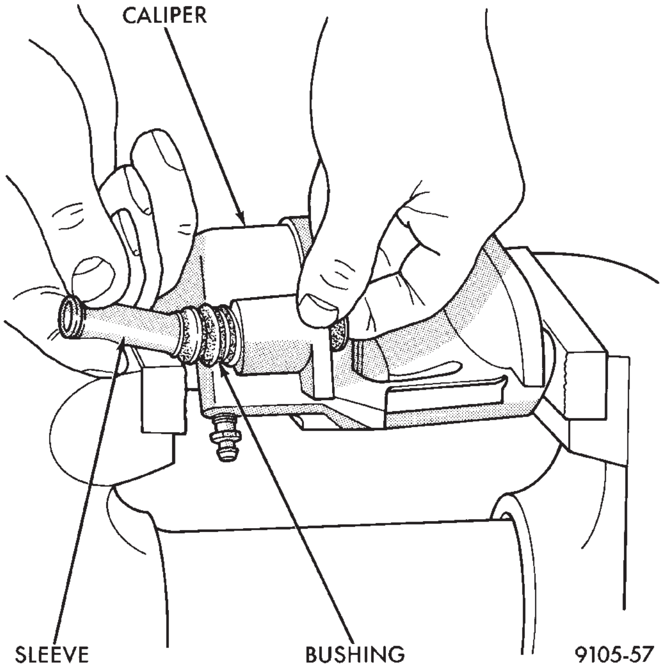


Fig. 3 Removing Inner Sleeve

(2) Using your fingers collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the brake caliper assembly (Fig. 4).

CLEANING AND INSPECTION OF BRAKE CALIPER

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).**

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. 5).

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.

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.

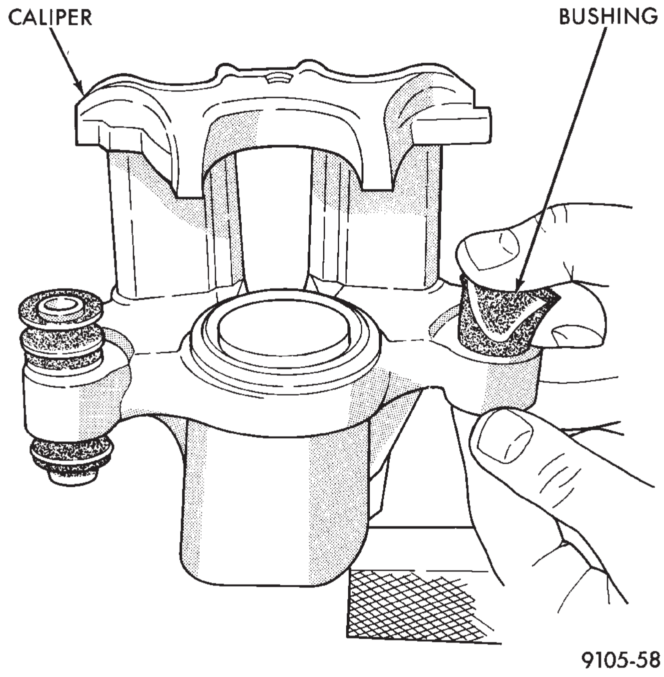


Fig. 4 Removing Bushings From Caliper

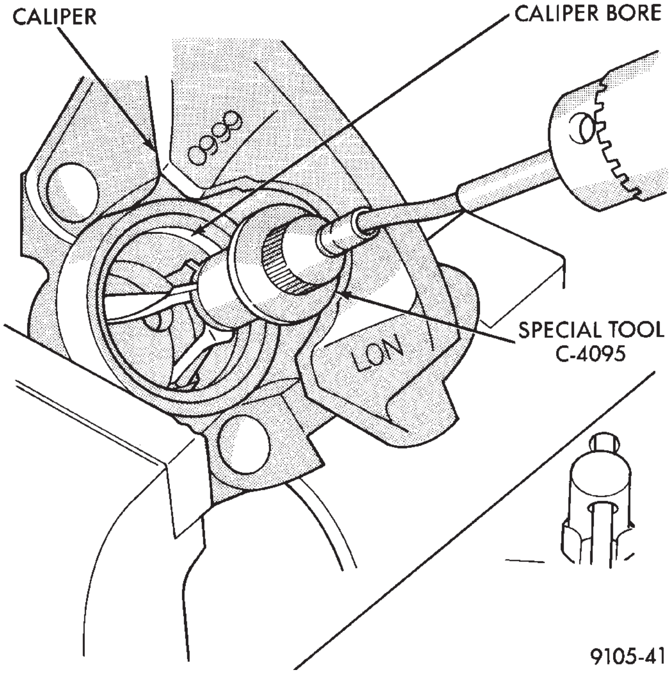


Fig. 5 Honing Piston Bore

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.

ASSEMBLING DISC BRAKE CALIPER

Clamp caliper in vise (with protective caps on vise jaws).

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

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. 1), 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. 1).

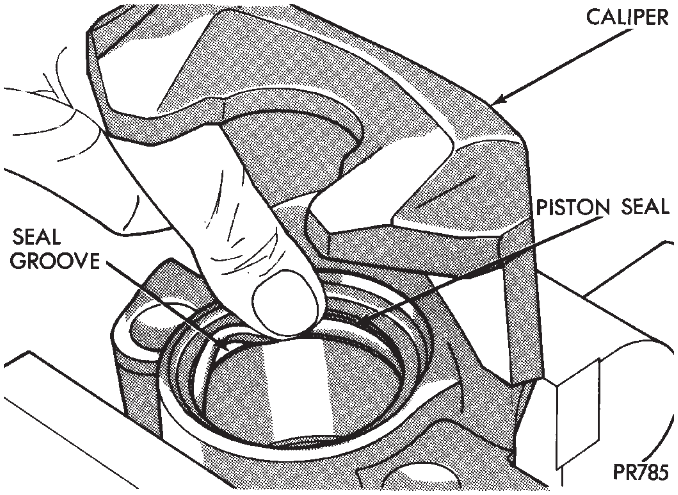


Fig. 1 Installing New Piston Seal

Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

Position dust boot over piston after coating with brake fluid.

Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 2).

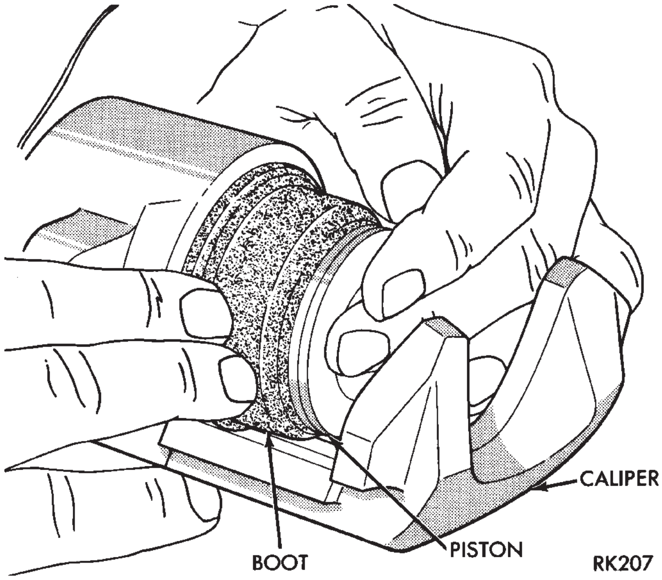


Fig. 2 Pushing Piston into Bore

CAUTION: Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

Position dust boot in counterbore of the caliper piston bore.

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. 3).

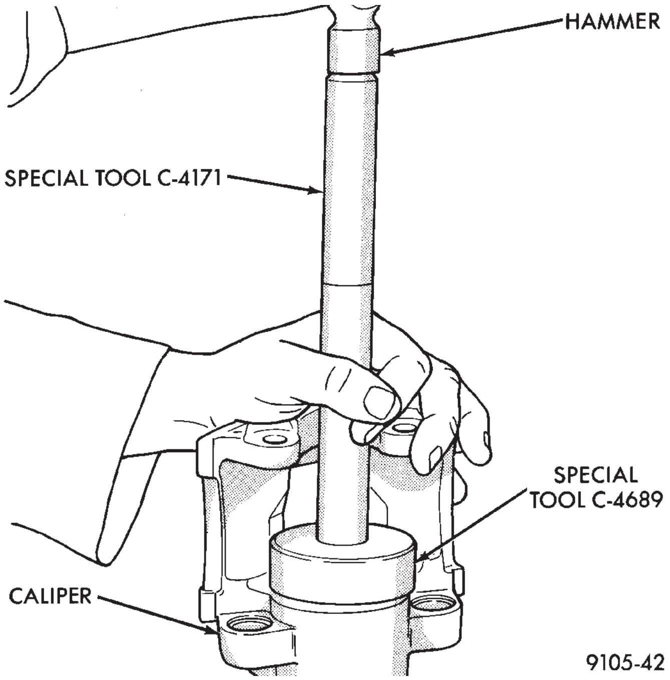


Fig. 3 Installing Dust Boot in Caliper Counterbore

Use the following steps, to install the Guide Pin Sleeve Bushings into the caliper assembly.

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 4).

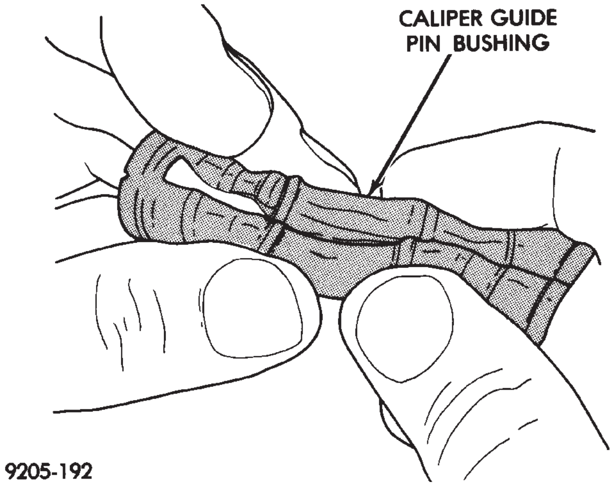


Fig. 4 Folded Caliper Guide Pin Bushing

(2) Using your fingers insert the folded bushing into the caliper assembly (Fig. 5). **Do not use a sharp object to perform this step do to possible damage to the bushing.**

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper assembly. Flanges should be seated evenly on both sides of the bushing hole in the caliper assembly (Fig. 6).

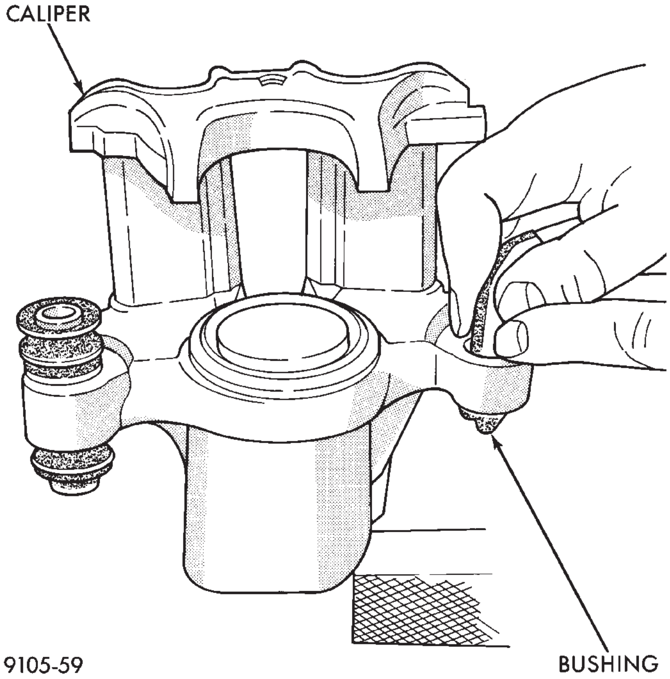


Fig. 5 Installing Caliper Guide Pin Sleeve Bushings

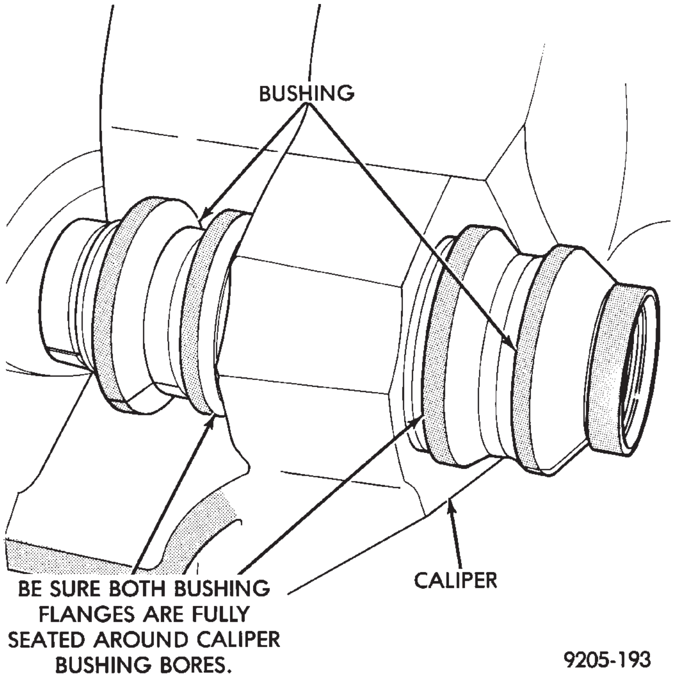


Fig. 6 Bushing Correctly Installed In Caliper

Install the Guide Pin Sleeve into the guide bushing using the following procedure.

(1) Install the sleeve into one end of the bushing until the seal area of the bushing is past the seal groove in the sleeve (Fig. 7).

(2) Holding the convoluted end of the bushing with one hand. Push the sleeve through the bushing (Fig.

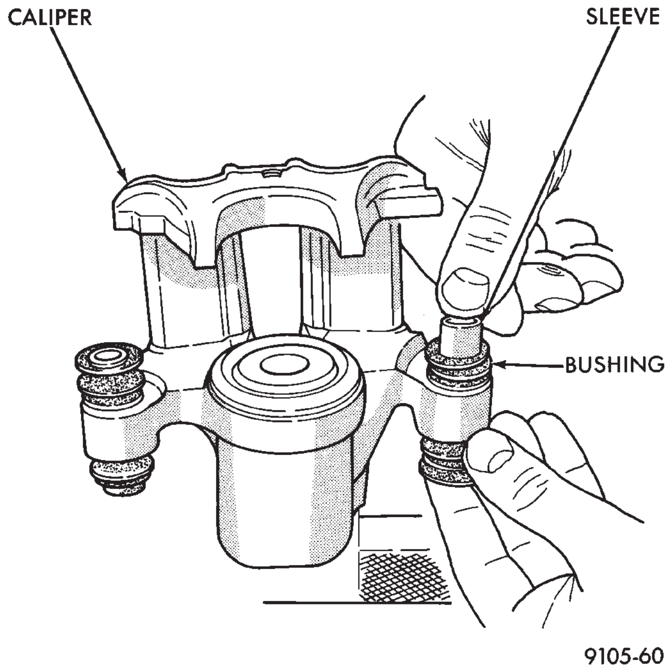


Fig. 7 Installing Caliper Sleeves

7) until the one end of the bushing is fully seated into the seal groove on the one end of the sleeve.

(3) Holding the sleeve in place work the other end of the bushing over the end of the sleeve and into the seal grove (Fig. 8). Be sure the other end of the bushing did not come out of the seal grove in the sleeve.

(4) When the sleeve is seated properly into the bushing. The sealed for life bushing can be held between your fingers and easily slid back and forth without the bushing seal unseating from the sleeve.

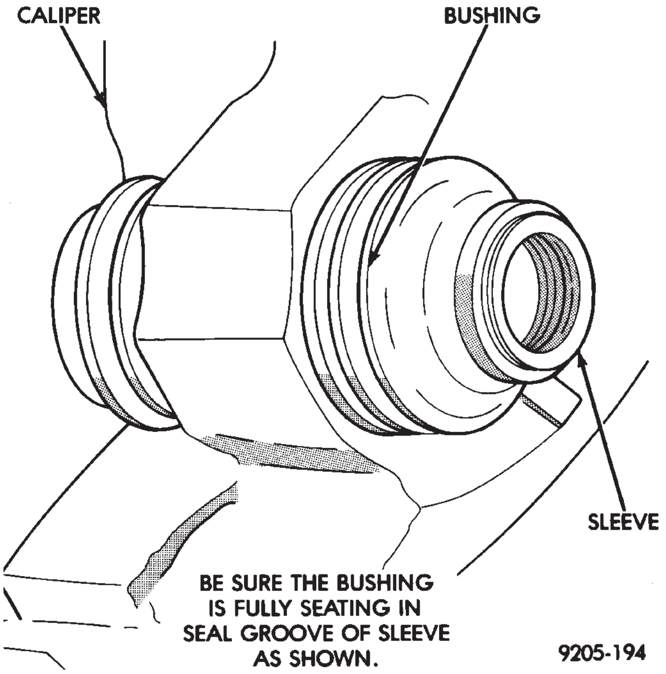


Fig. 8 Installed Caliper Bushing Sleeve

Before installing caliper assembly on vehicle, inspect braking disc. If any conditions as described in Checking Braking Disc for Runout and Thickness are present the braking disc, must be replaced or refaced. If the braking disc does not require any servicing, install caliper assembly.

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 MUST always be used when installing brake hose to caliper.**

Bleed the brake system (see Bleeding Brake System).

REAR DISC BRAKES

INDEX

GENERAL INFORMATION

The rear disc brakes are similar to front disc brakes, however, there are several distinctive features that require different service procedures. This single piston, floating caliper rear disc brake assembly includes a hub assembly, adapter, braking disc (rotor), caliper, shoes and linings. The parking brake system on all 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 braking disk (rotor).

The AC and AY body vehicles are equipped with a caliper assembly that has a 36 mm (1.42 inch) piston, and utilizes a 14 inch solid braking disc (rotor).

The AA body vehicle are equipped with a caliper assembly that uses a 34 mm (1.34 inch) piston. The AA body uses the same 14 inch solid braking disc (rotor) as on the AC and AY applications. Also available on the AA body is a caliper assembly with a 36 mm (1.42 inch) piston, with a 15 inch vented braking disc (rotor).

The AG AJ and AP body vehicles are also equipped with different size caliper pistons depending on the size and type of braking disk used on the vehicle. The 14″ solid braking disk (rotor) applications use a 34 mm (1.34 inch) piston, and the 15″ vented braking disk (rotor) applications use a 36 mm (1.42 inch) piston.

The caliper assembly on all applications float on rubber bushings using internal metal sleeves which are attached to the adapter using threaded guide pin bolts.

The adapter is mounted to the rear axle of the vehicle and is used to mount the brake shoes and actuating cables for the parking brake system. The adapter also mounts the rear caliper assembly to the vehicle. The adapter has two machined abutments which are used to position and align the caliper and brake shoes for movement for and aft (Fig. 1)

LINING WEAR

To check the amount of lining wear, remove the wheel and tire assemblies. If a visual inspection does not adequately determine the condition of the lining,

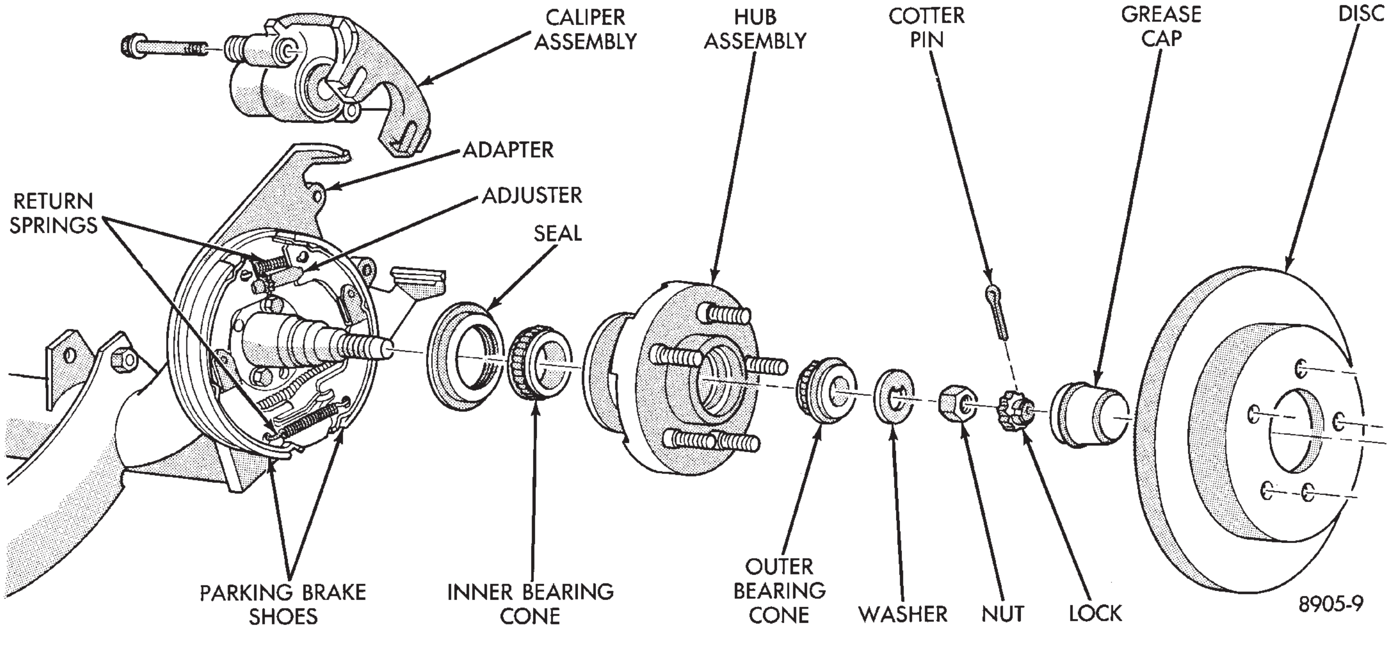


Fig. 1 Rear Disc Brake Assembly

removal will be necessary. Remove the shoe and lining assemblies (see Brake Shoe Removal).

Combined shoe and lining thickness should be measured at the thinnest part of the assembly.

When a shoe and lining assembly is worn to a thickness of approximately 7.0 mm (9/32 inch) it should be replaced.

Replace both shoe assemblies (inboard and outboard) on both wheels whenever shoe assemblies on either side are replaced.

If a shoe assembly does not require replacement. Reinstall it, making sure each shoe assembly is returned to its original position on the wheel of the vehicle from which it was removed. (See Brake Shoe Installation).

SERVICE PRECAUTIONS

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING,AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY. FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

IT IS RECOMMENDED NOT TO BREATH ANY TYPE OF BRAKE LINING MATERIAL DUST EVEN ASBESTOS FREE, DUE TO THE FIBROUS NATURE OF THE MATERIALS BEING USED.

Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures.

Handling the braking disc and caliper should be done in such a way as to avoid deformation of the disc and scratching or nicking the brake linings (pads).

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

Before vehicle is moved after any brake service work, be sure to obtain a firm brake pedal.

BRAKE SHOE REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist.

(2) Remove rear wheel and tire assemblies.

(3) Remove caliper attaching bolts (Fig. 2).

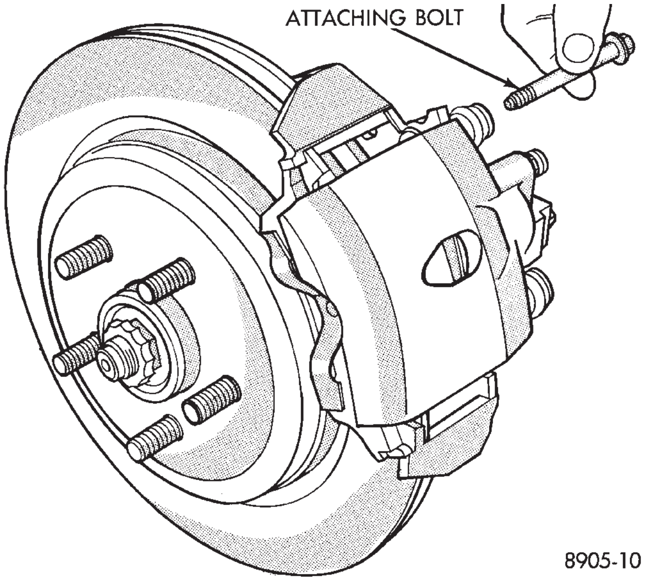


Fig. 2 Removing Caliper Attaching Bolts

(4) Lift caliper away from adapter rails (Fig. 3).

(5) Remove outboard shoe. By prying the shoe retaining clip over the raised area on the caliper. Then slide the shoe down and off the caliper (Fig. 4).

(6) Pull inboard shoe away from piston, until the retaining clip is free from the cavity in the piston. (Fig. 5).

CLEANING AND INSPECTION

Check for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If the boot is damaged, or fluid leak is visible, disassemble caliper assembly and install a new seal and boot (and piston if scored). Refer to procedure titled Disc Brake Caliper Disassembly.

BRAKE SHOE INSTALLATION

(1) Retract piston.

If the originally removed brake shoe assemblies are to be replaced back on vehicle. Be sure

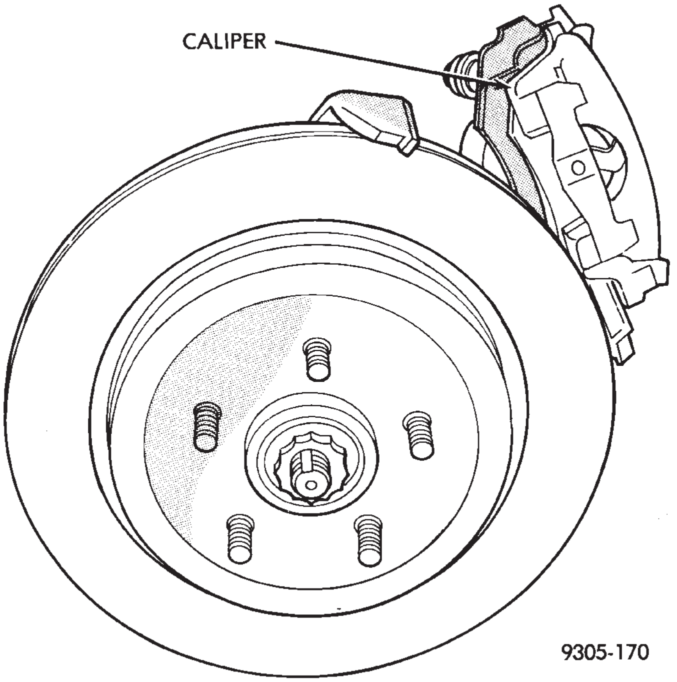


Fig. 3 Removing Caliper

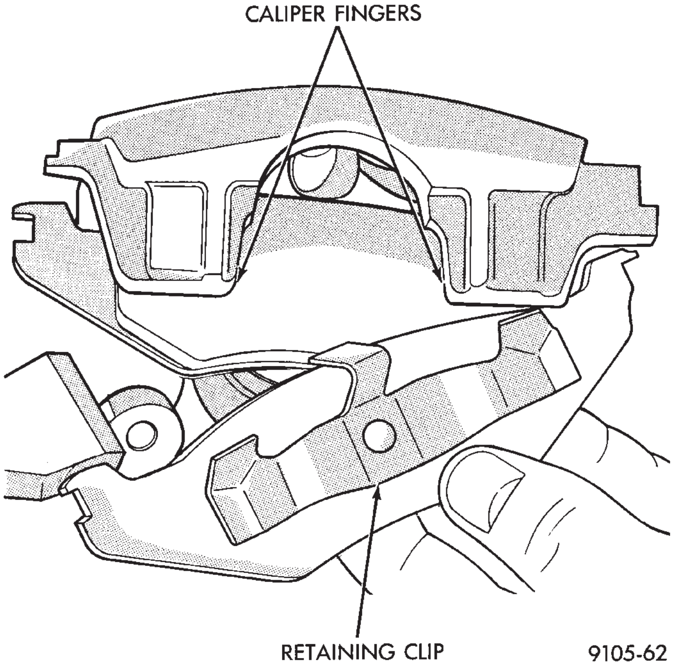


Fig. 4 Removing Outboard Shoe

each brake shoe assembly is returned to its original position on the wheel of the vehicle from which it was removed.

(2) Install inboard brake shoe by inserting shoe retaining clip into piston cavity. Be sure brake shoe is seated squarely on the face of the piston. (Fig. 5).

(3) Install outboard shoe by sliding retaining clip over caliper fingers. Be sure the brake shoe is installed on the caliper, so the retaining clip is past the raised area on the caliper fingers (Fig. 6).

(4) Install lower end of caliper on to adapter. Make sure the lower tabs on the brake shoes and the casting projections on the caliper are under the adapter rail (Fig. 7).

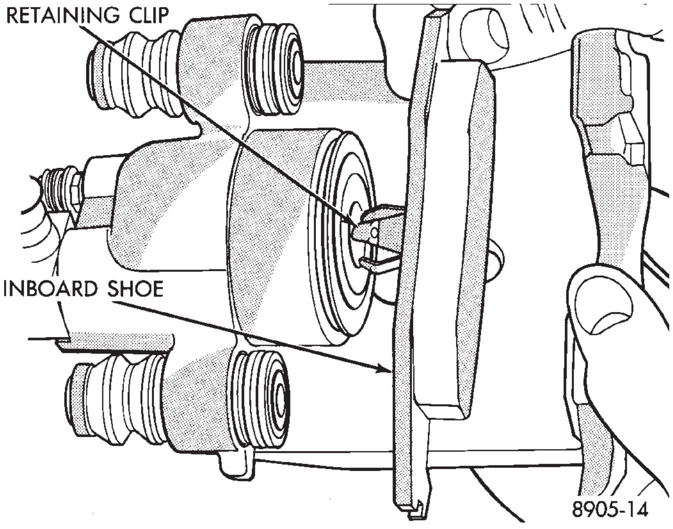


Fig. 5 Remove and Install Inboard Brake Shoe

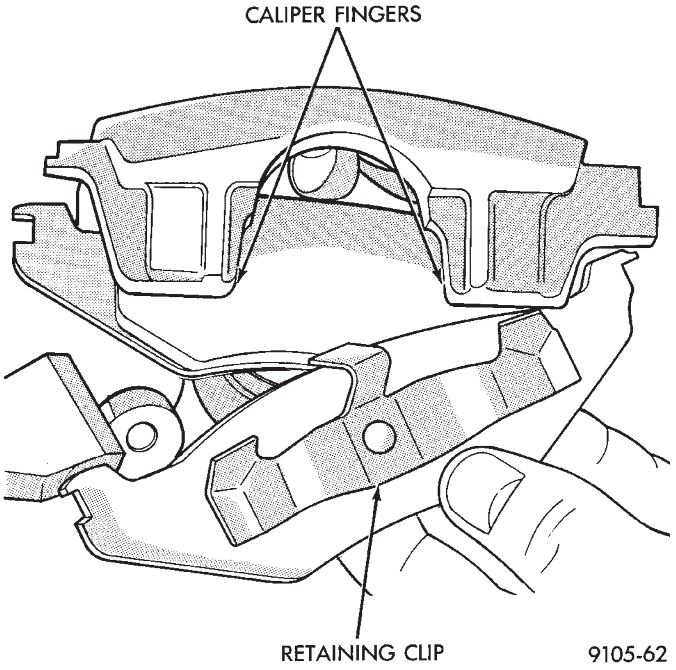


Fig. 6 Installing Outboard Shoe

(5) Rotate caliper down over rotor.

(6) Install caliper attaching bolts and tighten to 22 N●m (193 in. lbs.) torque (Fig. 8).

(7) Install wheel and tire assembly. Tighten stud nuts in proper sequence until all nuts are torqued to half specification. **This is important.** Then repeat sequence to full specification.

(8) Remove jackstands or lower hoist. **Before moving vehicle be sure it has a firm pedal.**

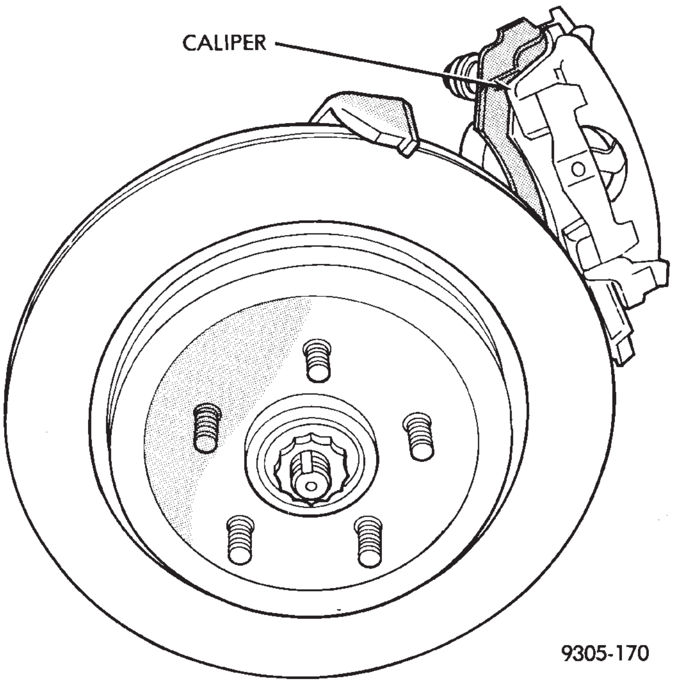


Fig. 7 Installing Caliper

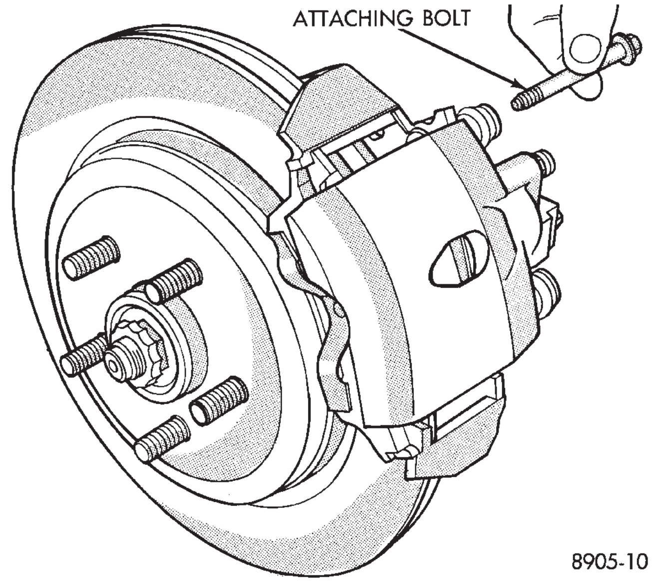


Fig. 8 Installing Attaching Bolts

DISASSEMBLING REAR CALIPER ASSEMBLY

CLEANING AND INSPECTION

Check for piston fluid seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of 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.

(1) Remove caliper from braking disc (See Brake Shoe Removal). Hang assembly on a wire hook away from braking disc, so hydraulic fluid cannot get on braking disc (See Fig. 4 in Brake Shoe Removal). Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. (Brake pedal will fall away when piston has passed bore opening.) Then prop up the brake pedal to any position below 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 flexible brake line at frame bracket after removing piston. Plug brake tube and remove piston from opposite caliper. Using the same process as above for the first piston removal.

WARNING: UNDER NO CONDITION SHOULD AIR PRESSURE BE USED TO REMOVE PISTON FROM CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

(4) Disconnect brake flexible hose from the caliper. To disassemble, mount caliper assembly in a vise equipped with protective jaws.

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

Support rear caliper assembly in a vise. Then remove caliper to piston dust boot and discard (Fig. 1).

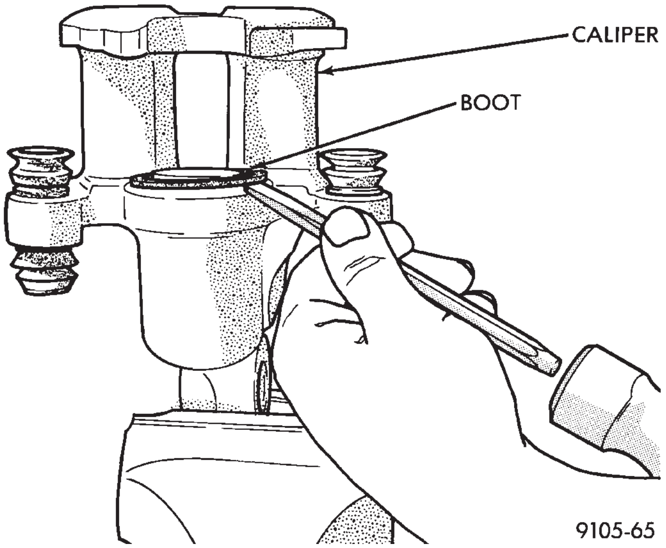


Fig. 1 Removing Piston Dust Boot

Using a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 2). Discard old seal. **Do not use a screwdriver or other metal**

tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.

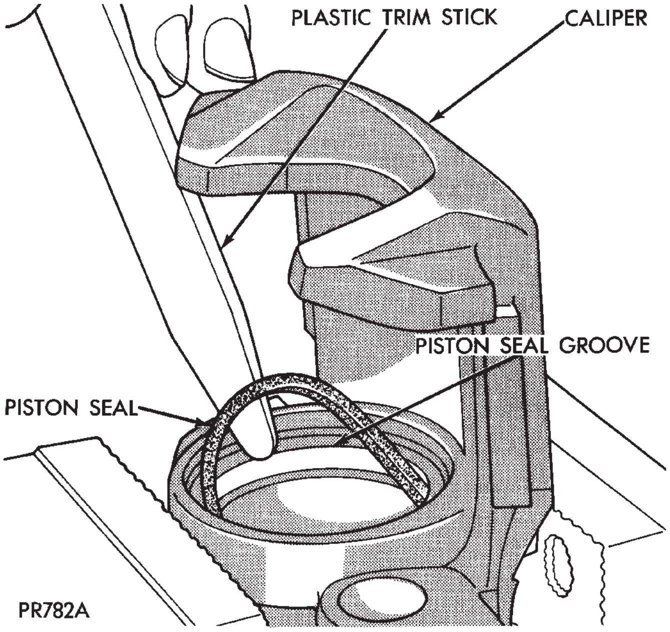


Fig. 2 Removing Piston Seal

The double pin caliper uses a sealed for life bushing and sleeve assembly. If required this assembly can be serviced using the following procedure.

(1) Using your fingers push on one end the inner sleeve until it pops out of the bushing. Then grasp the inner sleeve with your fingers and pull the inner sleeve out from the inside of the bushing (Fig. 3).

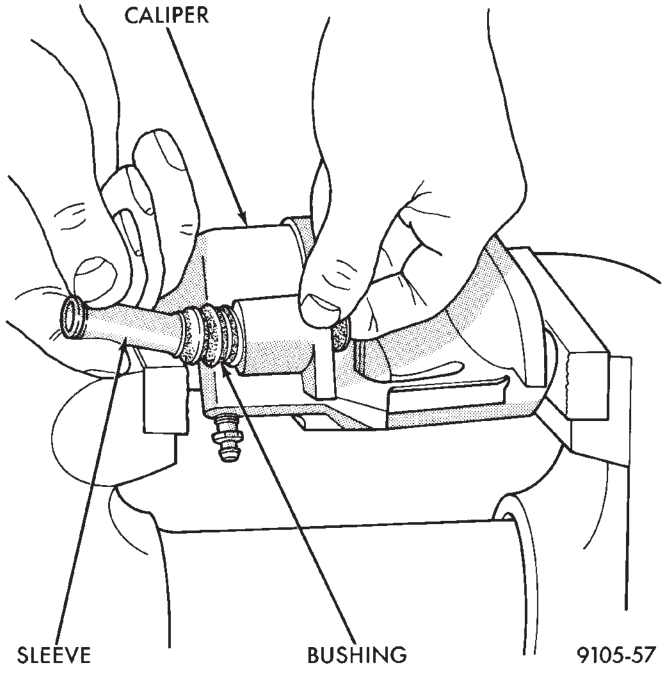


Fig. 3 Removing Inner Sleeve From Bushing

(2) Using your fingers collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the caliper assembly (Fig. 4).

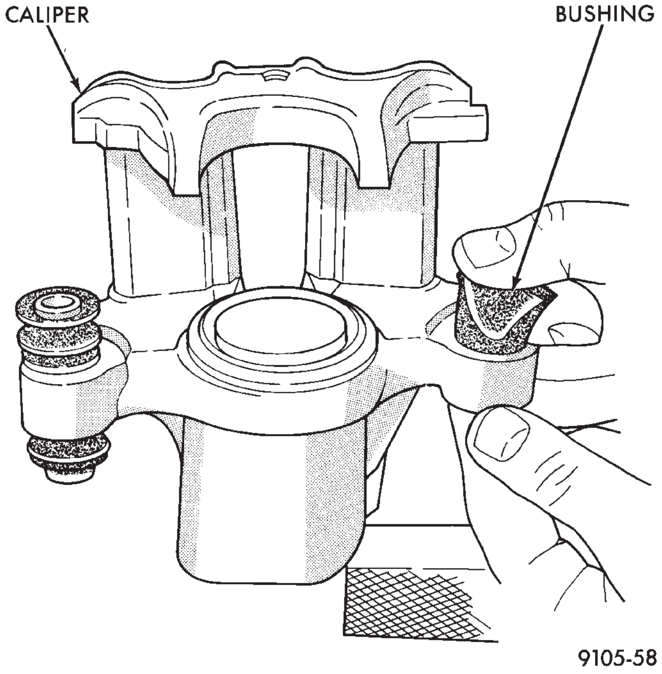


Fig. 4 Removing Bushings From Caliper

CLEANING AND INSPECTION

Clean all parts using alcohol or a suitable solvent and wipe dry. Clean out all drilled passages and bores on the caliper assembly body. **(Whenever a caliper has been disassembled, a new boot and seal must be installed at assembly).**

Inspect the caliper assembly piston bore for scoring or pitting. Bores that show light scratches or corrosion, can usually have the scratches or corrosion removed 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. 5).

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.

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.

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.

ASSEMBLING REAR DISC BRAKE CALIPER

Clamp caliper in vise (with protective caps on vise jaws).

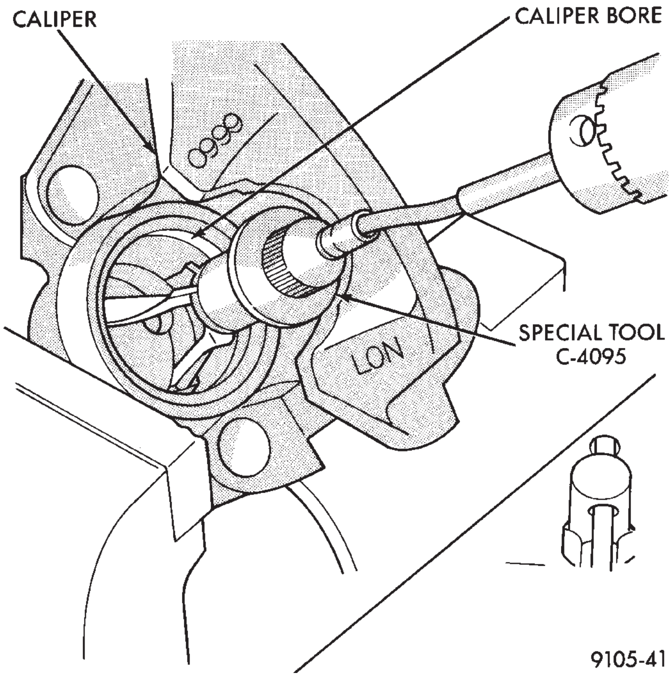


Fig. 5 Honing Piston Bore

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

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. 6), 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. 6).

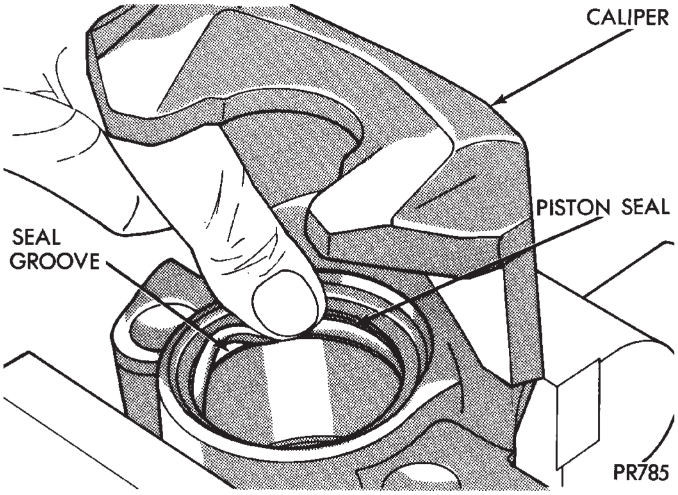


Fig. 6 Installing New Piston Seal

Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

Position dust boot over piston after coating with brake fluid.

Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 7).

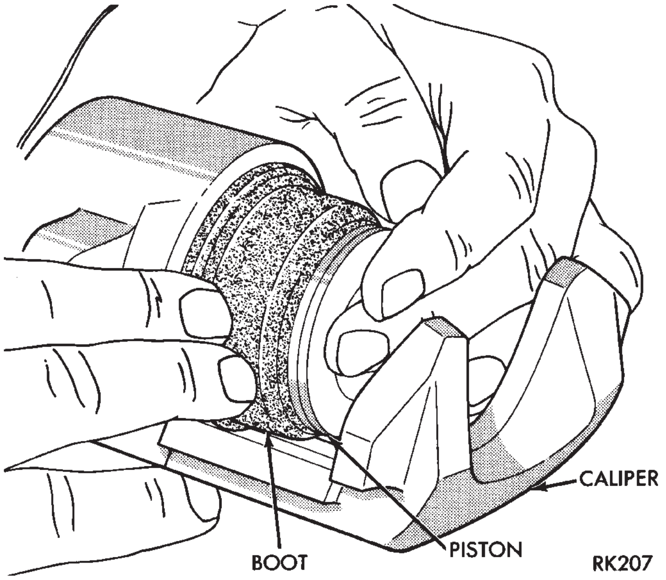


Fig. 7 Pushing Piston into Bore

CAUTION: Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

Position dust boot in counterbore of the caliper piston bore.

Using a hammer and Installer Piston Caliper Boot, Special Tool C-4383-7 and Handle, Special Tool C-4171, drive boot into counterbore of the caliper (Fig. 8).

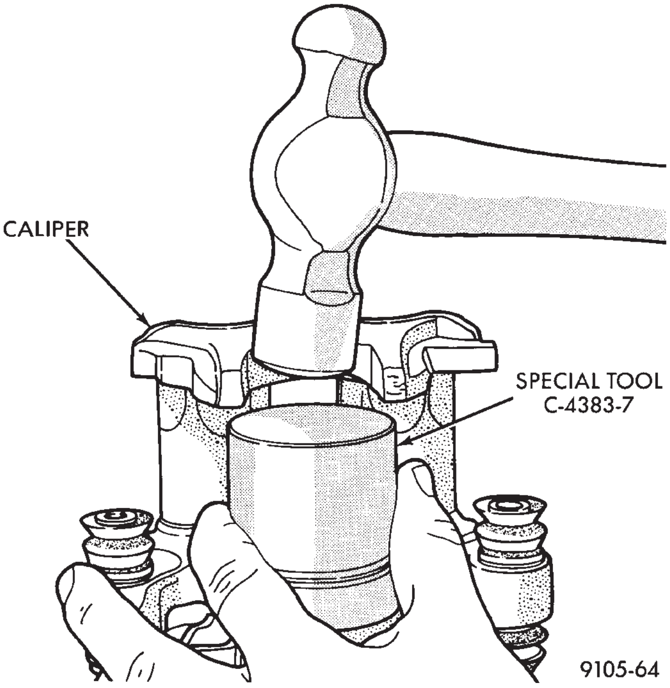


Fig. 8 Installing Boot in Caliper

Use the following steps, to install the Guide Pin Sleeve Bushings into the caliper assembly.

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 9).

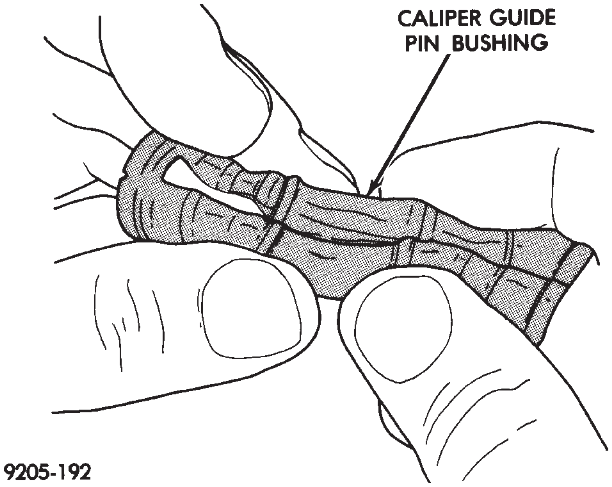


Fig. 9 Folded Caliper Guide Pin Bushing

(2) Using your fingers insert the folded bushing into the caliper assembly (Fig. 10). **Do not use a sharp object to perform this step do to possible damage to the bushing.**

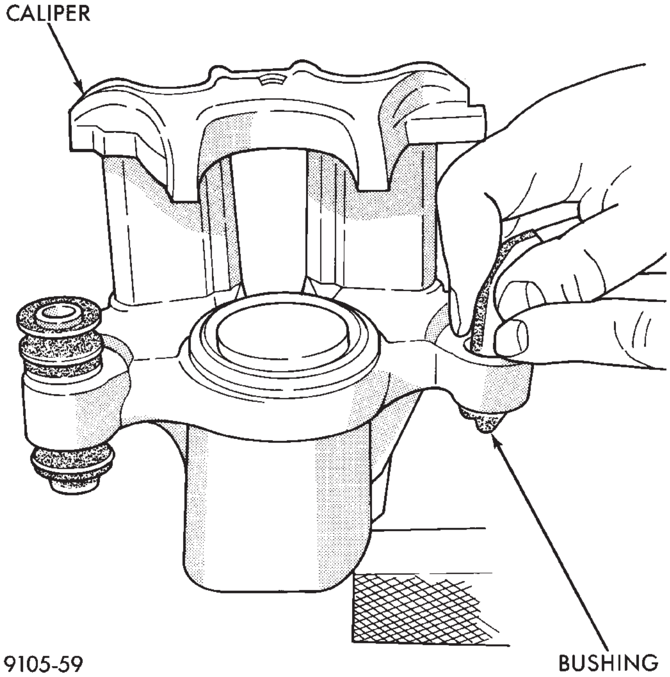


Fig. 10 Installing Caliper Guide Pin Sleeve Bushings

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper assembly. Flanges should be seated evenly on both sides of the bushing hole in the caliper assembly (Fig. 11).

Install the Guide Pin Sleeve into the guide bushing using the following procedure.

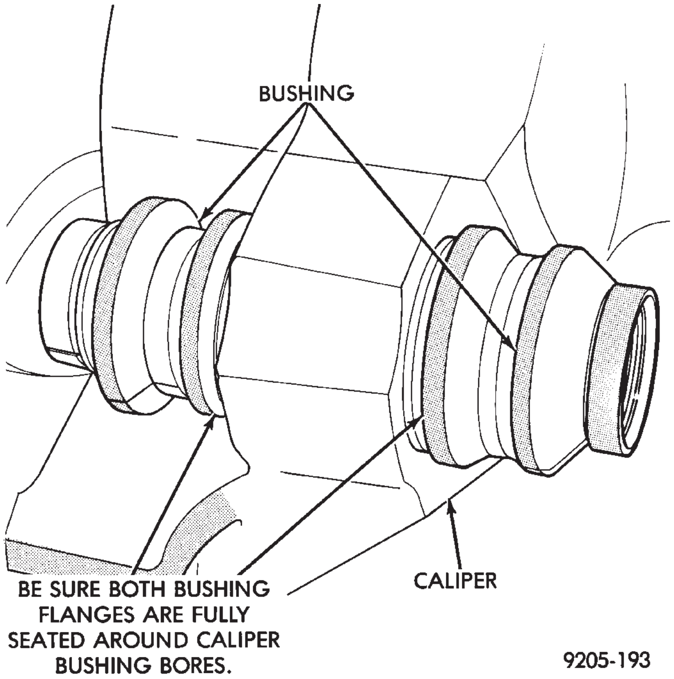


Fig. 11 Bushing Correctly Installed In Caliper

(1) Install the sleeve into one end of the bushing until the seal area of the bushing is past the seal groove in the sleeve (Fig. 12).

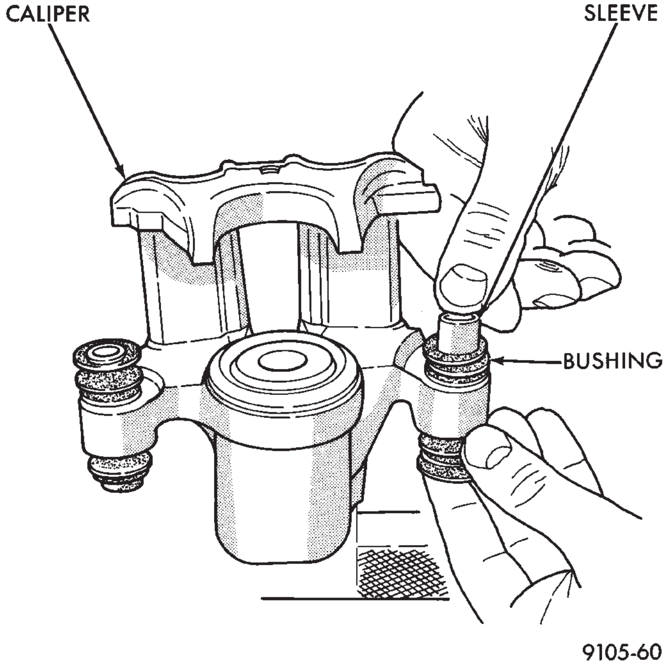


Fig. 12 Installing Caliper Sleeves

(2) Holding the convoluted end of the bushing with one hand. Push the sleeve through the bushing (Fig. 13) until the one end of the bushing is fully seated into the seal groove on the one end of the sleeve.

(3) Holding the sleeve in place work the other end of the bushing over the end of the sleeve and into the

seal grove (Fig. 13). Be sure the other end of the bushing did not come out of the seal grove in the sleeve.

(4) When the sleeve is seated properly into the bushing. The sealed for life bushing can be held between your fingers and easily slid back and forth without the bushing seal unseating from the sleeve.

Before installing caliper assembly on vehicle, inspect braking disc. If any conditions as described in Checking Braking Disc for Runout and Thickness are present the braking disc, must be replaced or refaced. If the braking disc does not require any servicing, install caliper assembly.

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 MUST always be used when installing brake hose to caliper.**

Bleed the brake system (see Bleeding Brake System). Pump the brake pedal several times to be sure that the vehicle has a firm pedal, before the vehicle is moved or driven.

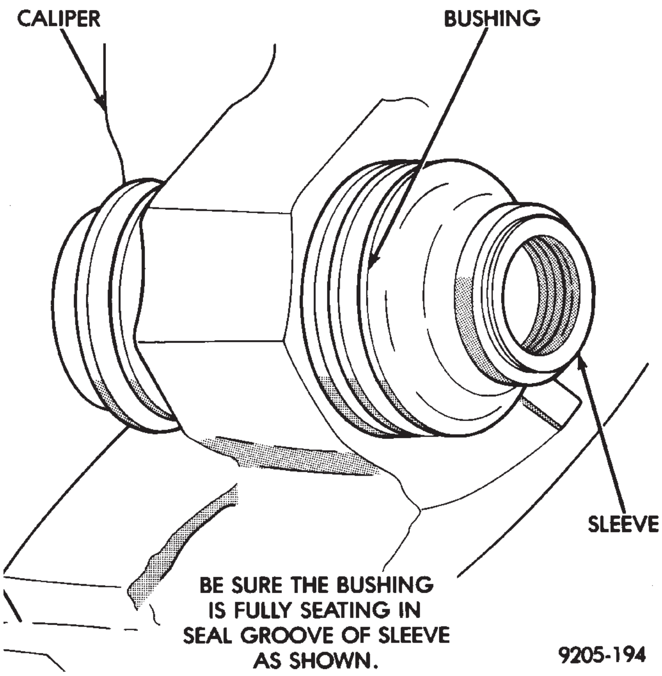


Fig. 13 Installed Caliper Bushing Sleeve

BRAKE DISC (ROTOR)

INDEX

GENERAL INFORMATION

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

CAUTION: If the braking disk (rotor) needs to be replaced with a new part. The protective coating on the braking surfaces of the rotor MUST BE REMOVED with an appropriate solvent, to avoid contamination of the brake shoe linings.

When replacing a rotor with a new part do NOT reface the new rotor. Rotor already has the required micro finish when manufactured, only remove the protective coating.

INSPECTION DIAGNOSIS

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

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

Excessive lateral rotor runout or wobble.

Thickness variation (Parallelism).

Dishing or distortion (Flatness).

If a vehicle has not been driven for a period of time. The discs 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 disc can cause temporary improper lining contact if ridges are not removed before installation of new brake shoe assemblies.

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

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

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

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

SERVICE PROCEDURES

CHECKING BRAKING DISC FOR RUNOUT AND THICKNESS

On vehicle, braking disc (rotor) runout is the combination of the individual runout of the hub face and the runout of the disc. (The hub and disc are separable). To measure runout on the vehicle, remove the wheel and reinstall the lug nuts tightening the disc 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 disc (braking surface) approximately one inch from edge of disc (See Fig. 1). Check lateral runout (both sides of disc) runout should not exceed 0.13 mm (0.005 inch).

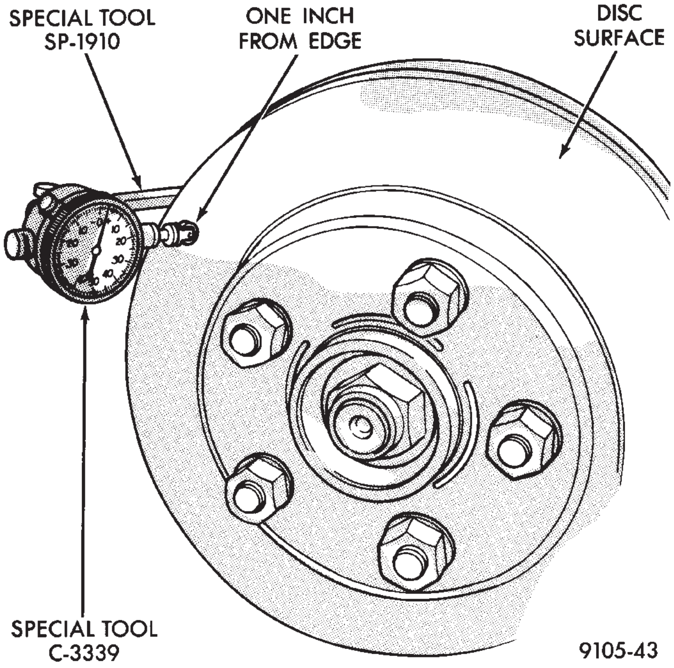


Fig. 1 Checking Braking Disc for Runout

If runout is in excess of the specification, check the lateral runout of the hub face. Before removing disc from hub, make a chalk mark across both the disc and one wheel stud on the high side of runout. So you'll know exactly how the disc and hub was originally mounted (Fig. 2). Remove disc from hub.

Install Dial Indicator, Special Tool C-3339 and Mounting Adaptor, Special Tool SP-1910 on steering

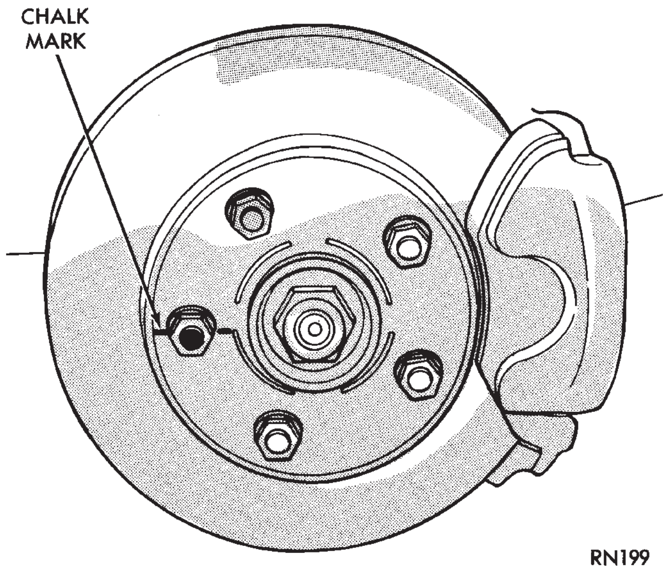


Fig. 2 Marking Braking Disc and Wheel Stud

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 rim. **Clean hub surface before checking.** (See Fig. 3)

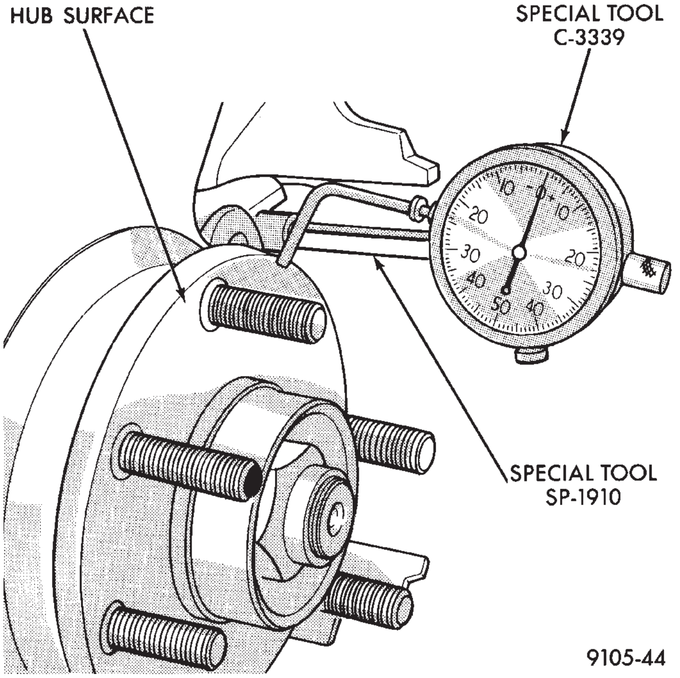


Fig. 3 Checking Hub for Runout

Runout should not exceed 0.08 mm (0.003 inch). If runout exceeds this specification, hub must be replaced. See Suspension Group 2. If hub runout does not exceed this specification, install disc on hub with chalk marks two wheel studs apart (Fig. 4). Tighten nuts in the proper sequence and torque to specifications. Finally, check runout of disc to see if runout is now within specifications.

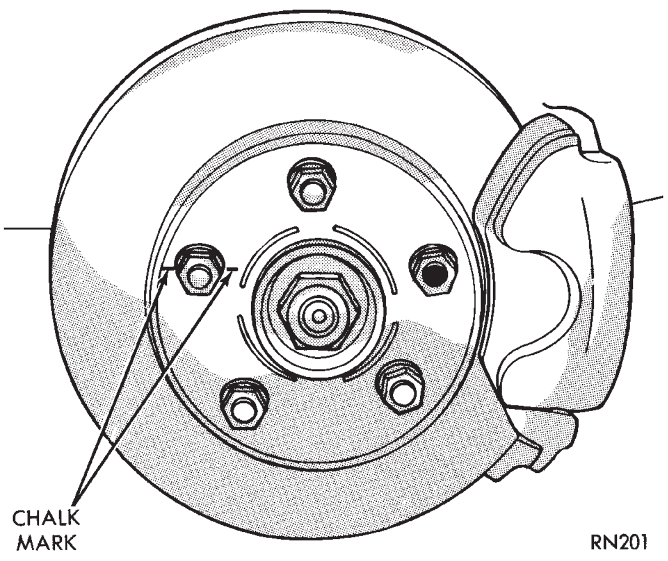


Fig. 4 Index Braking Disc and Wheel Stud

If runout is not within specifications. Install a new braking disc or reface disc, being careful to remove as little as possible from each side of disc. Remove equal amounts from each side of disc. Do not reduce thickness below minimum thickness cast into the unmachined surface of the rotor.

Thickness variation measurements of disc should be made in conjunction with runout. Measure thickness of disc at 12 equal points with a micrometer at a radius approximately 25.4 mm (1 inch) from edge of disc (Fig. 5). If thickness measurements vary by more than 0.013 mm (0.0005 inch) disc should be removed and resurfaced (Figs. 6 and 7), or a new disc installed. If cracks or burned spots are evident in the disc, disc must be replaced.

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

BRAKING DISC REMOVAL

(1) Raise vehicle on hoist or jackstands. Remove wheel and tire assembly.

(2) Remove caliper assembly, as described under Brake Shoe Removal in this Group, (but do not disconnect brake line). Suspend caliper from wire hook or loop to avoid strain on flexible hose.

(3) Remove braking disc from the hub.

INSTALLING BRAKING DISC

(1) Slide braking disc on hub. Clean both sides of braking disc with alcohol or suitable solvent.

(2) Install caliper assembly, as described in Brake Shoe Installation paragraph.

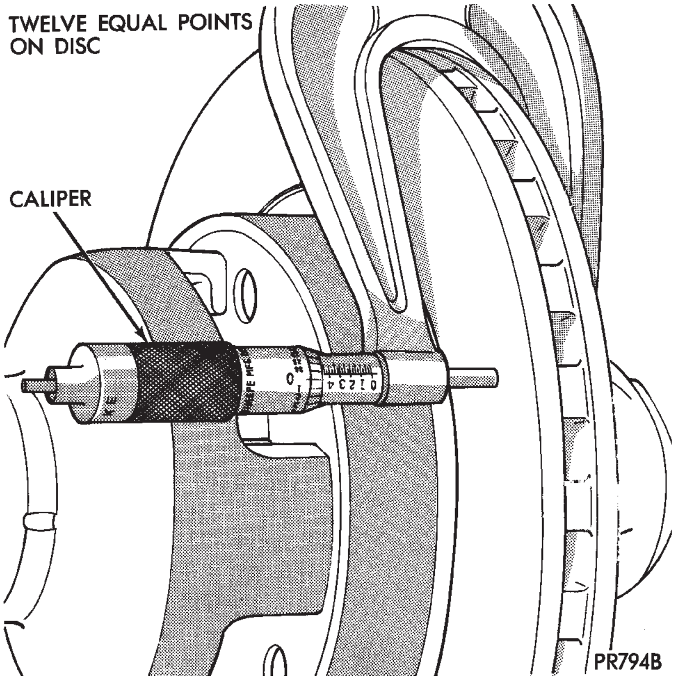


Fig. 5 Checking Disc for Thickness

REFINISHING BRAKING DISC

REFACING BRAKING DISC

Refacing of the braking disc is not required each time the shoe assemblies are replaced.

If the braking disc surface is deeply scored or warped or there is a complaint of brake roughness or pulsation the rotor should be resurfaced or refaced (Figs. 6 and 7).

When refacing a braking disc the required 0.10 mm (0.004 inch) TIR (Total Indicator Reading) and 0.013 mm (0.0005 inch) thickness variation limits MUST BE MAINTAINED. **Extreme care** in the operation of braking disc turning equipment is required.

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 disc on the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

If the disc is not mounted properly the run-out will be worse after refacing than before refacing.

The use of a double straddle cutter (Fig. 6) that machines both sides of the disc at the same time is highly recommended.

RESURFACING BRAKING DISC

This operation can be used when disc surface is rusty, has lining deposits or excessive runout or thickness variation is evident.

A sanding disc attachment will remove surface contamination without removing much braking disc material.

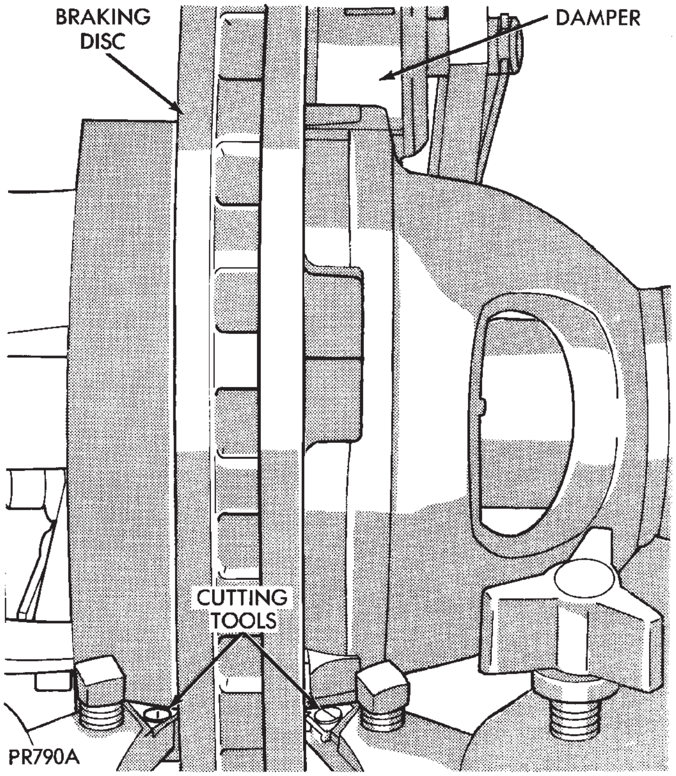


Fig. 6 Refacing Braking Disc

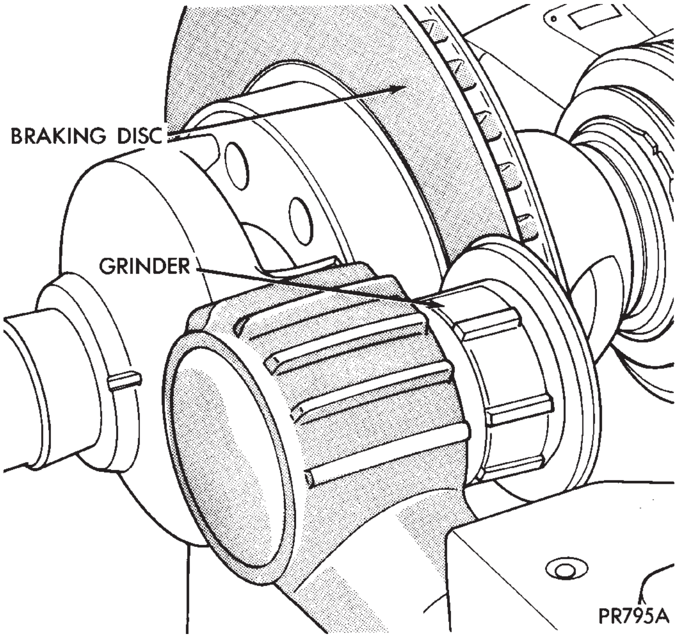


Fig. 7 Resurfacing Braking Disc (Final Finish)

It will generally follow variations in thickness that are in the disc.

The following chart shows the location of measurements and specifications when servicing the braking disc.

All braking discs have markings for minimum allowable thickness cast on an un-machined surface of the braking disc (Fig. 8). The thickness

markings may be located on the disc as shown in (Fig. 8) or on an alternate surface.

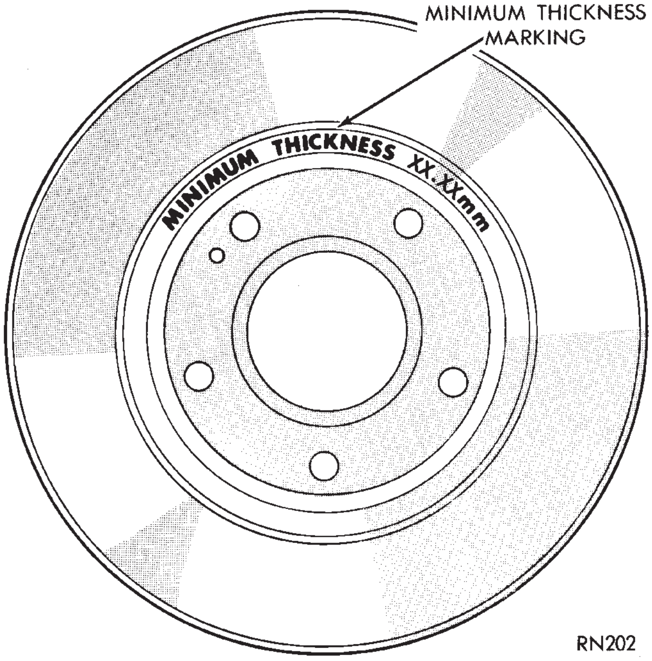


Fig. 8 Minimum Thickness Markings

This marking includes 0.76 mm (0.030 inch) allowable disc wear beyond the recommended 0.76 mm(0.030 inch) of disc refacing.

BRAKING DISC (ROTOR) REFINISHING LIMITS

BRAKING DISC	THICKNESS	MINIMUM THICKNESS	THICKNESS VARIATION	DISC RUNOUT*	MICRO FINISH
ALL FRONT DISC BRAKES	23.62-23.8 mm .930-.940 in.	22.4 mm .882 in.	.013 mm .0005 in.	.13 mm .005 in.	15-80 RMS
AA, AJ, AP BODY. SOLID REAR DISC	11.87-12.13 mm .467-.478 in.	10.4 mm .490 in.	.013 mm .0005 in.	.13 mm .005 in.	15-80 RMS
AG BODY VENTED REAR DISC	21.75-22.25 mm .856-.876 in.	20.25 mm .797 in.	.013 mm .0005 in.	.13 mm .005 in.	15-80 RMS
AC & AY BODY REAR DISC ALL	11.87-12.13 mm .467-.478 in.	10.4 mm .490 in.	.013 mm .0005 in.	.13 mm .005 in.	15-80 RMS

*TIR TOTAL INDICATOR READING (MEASURED ON VEHICLE)

9305-165

PARKING BRAKES

INDEX

GENERAL INFORMATION

The parking brake mechanism on vehicles with rear disc brake applications. Consists of a small duo-servo brake which is mounted to the adapter. The hat (center) section (Fig. 1) of the rear rotor serves as the braking surface (drum) for the parking brakes. On AA, AC, AP, AY body vehicles with rear disc brake applications, the parking brake cable system is similar in design to the drum brake parking brake system.

The parking brake system on the AG and AJ body vehicles is a 2 cable design. One individual park brake cable operates each rear park brake mechanism, and brake application is balanced by an equalizer at the park brake lever.

On rear drum brake applications, the rear wheel service brakes also act as parking brakes. The rear drum brake shoes are mechanically operated by an internal lever and strut connected to a flexible steel cable. The wheel brake cables are joined to an intermediate cable which attaches to the front cable leading to the foot lever (Figs. 2, 3 and 4).

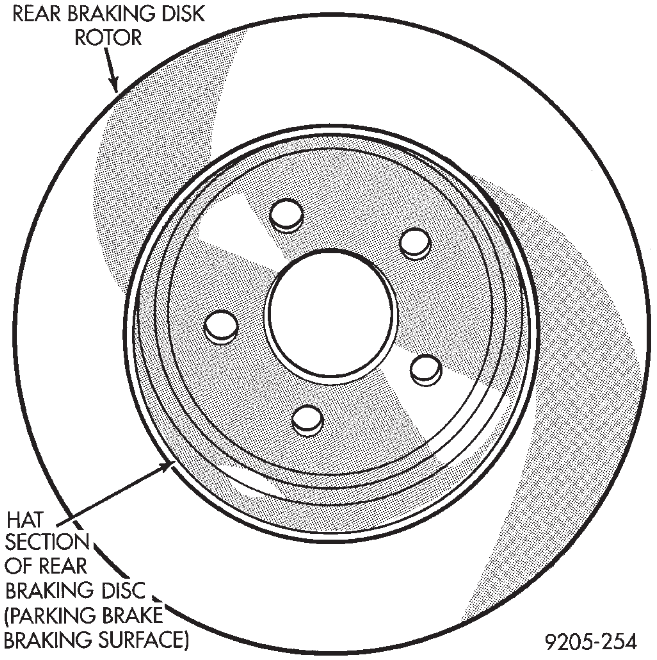


Fig. 1 Drum In Hat Braking Disc

SERVICE PROCEDURES

ADJUSTING PARKING BRAKE

AP, AA, AC & AY (WITH FOOT LEVER)

The service brakes must be properly adjusted before adjusting the parking brake.

Release the parking brake lever then back-off parking brake cable adjustment so there is slack in the cable (Figs. 2 and 3).

Before loosening cable adjusting nut, clean threads with a wire brush, and lubricate with Mopar Multi-Purpose grease on equivalent.

The rear brakes adjust every time you depress the brake pedal.

Adjust the parking brake after service brake adjustment by tightening the adjusting nut until a slight drag is felt while rotating the wheels.

Loosen the cable adjusting nut until both rear wheels can be rotated freely, then back-off the cable adjusting nut two full turns.

Apply and release the parking brake several times to see that the rear wheels rotate freely without dragging.

AG AND AJ BODY (WITH HAND LEVER)

The parking brake hand lever assembly contains a self adjuster for the cable system. Routine parking brake adjustment is no longer required (Fig. 5).

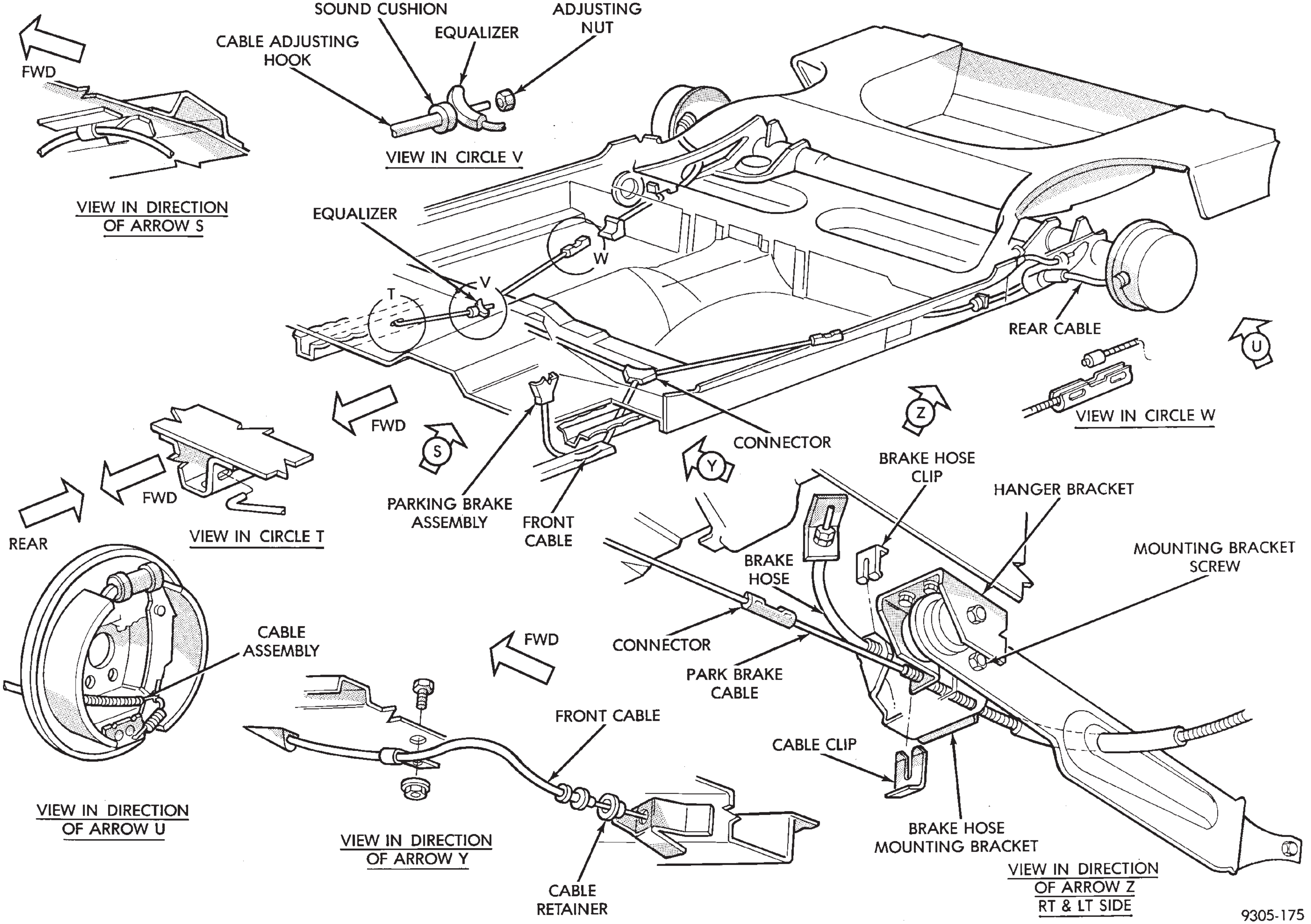


FIG. 2 PARKING BRAKE CABLE ROUTING AA AND AP BODY

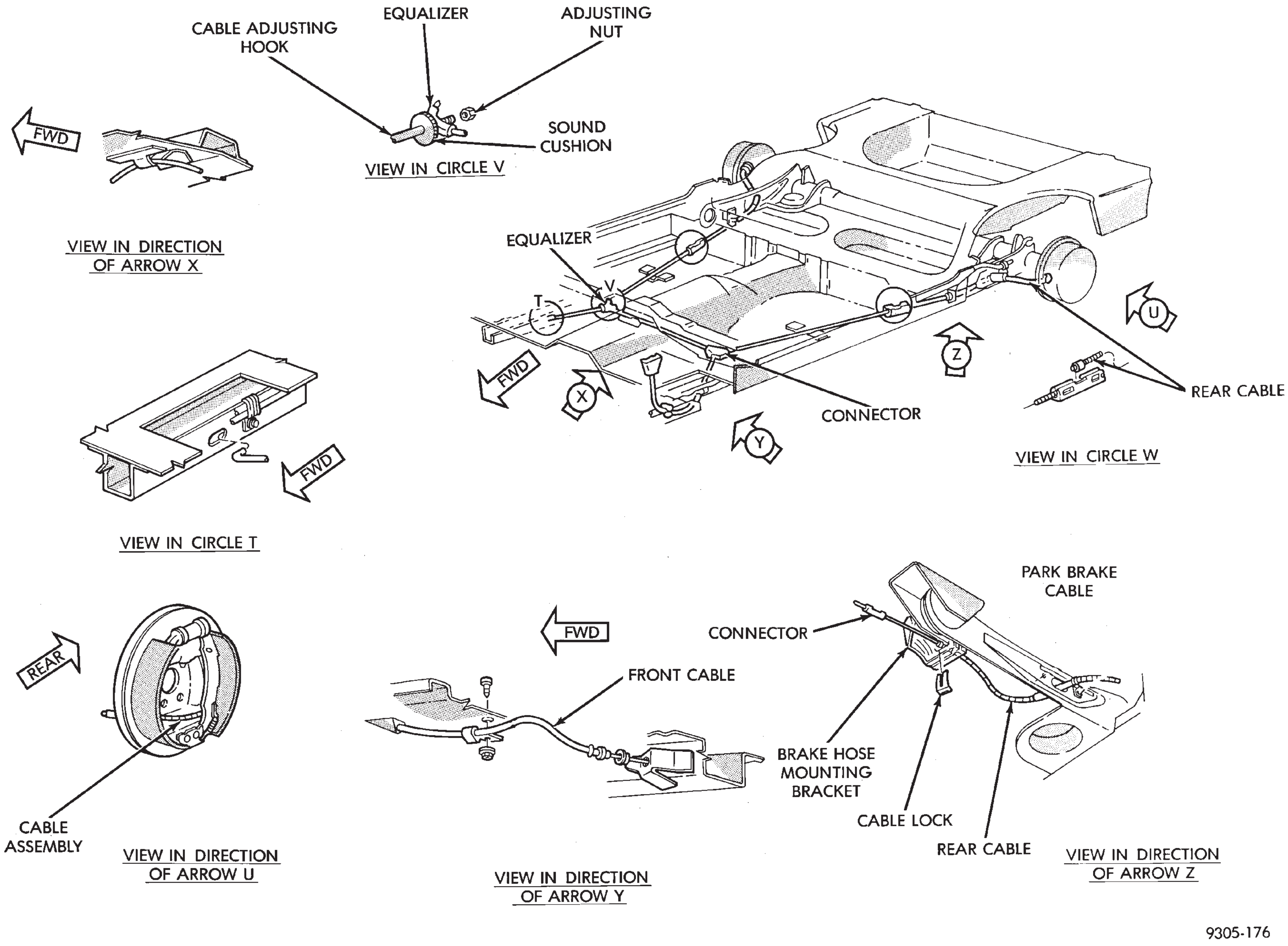


FIG. 3 PARKING BRAKE CABLE ROUTING AC AND AY-BODY

TORQUE		
LET	N·m	In. Lb.
A	28	250
B	5	50
C	4	45
D	11	95

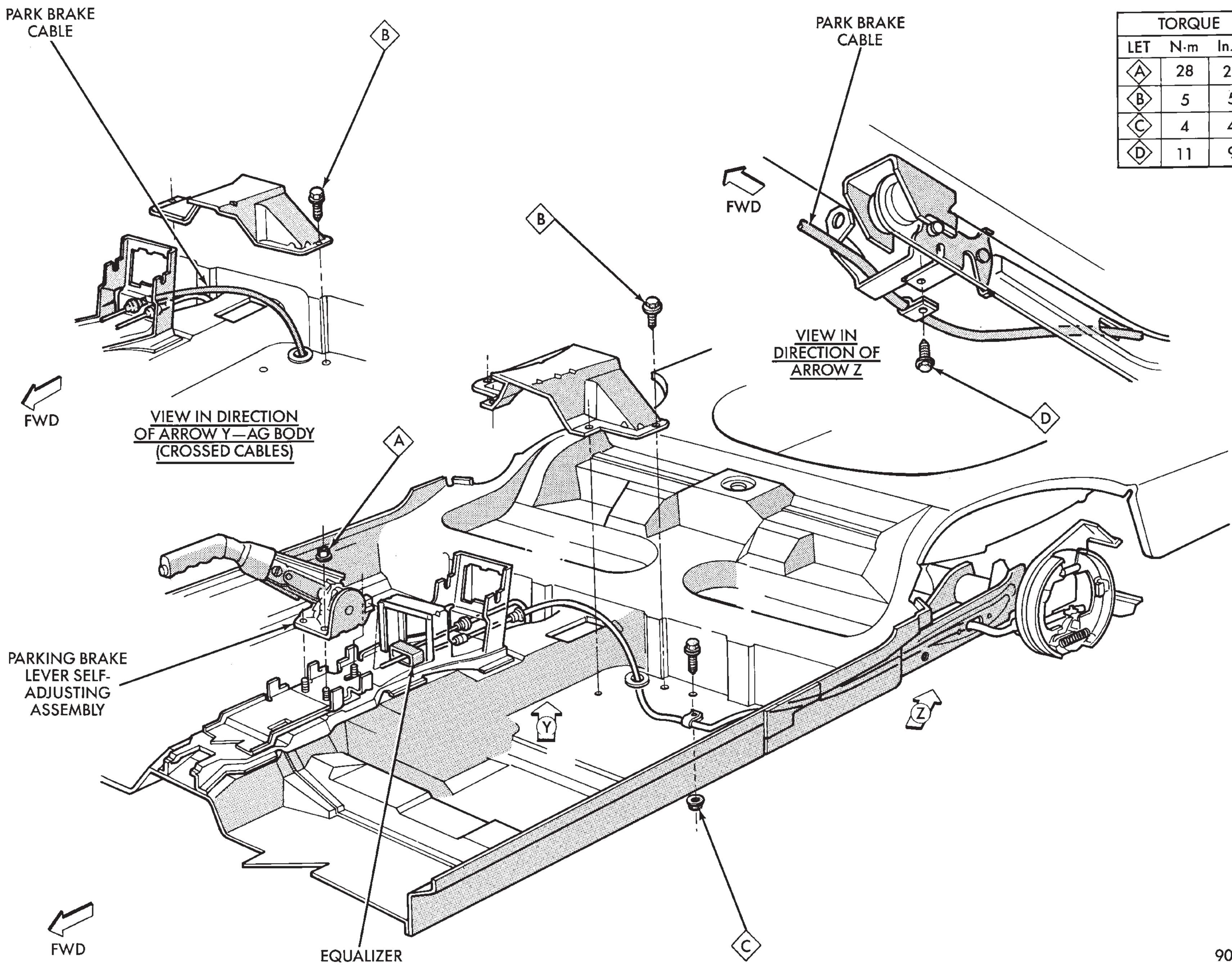


FIG. 4 PARKING BRAKE CABLE ROUTING AG AND AJ BODY

WARNING: THE SELF ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER ASSEMBLY CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 30 POUNDS. CARE MUST BE TAKEN TO PREVENT EXCESSIVE JARRING OF THE ASSEMBLY. DO NOT RELEASE THE SELF ADJUSTER LOCKOUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF SELF ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

When repairs to the hand lever assembly or cable system are required the self adjuster must be reloaded and locked out.

SELF ADJUSTING PROCEDURES (AG & AJ BODY)

TO RELOAD SELF ADJUSTER

(1) Remove ash receiver or courtesy light from rear of center console to gain access to self adjuster. Also, remove carpet from sides of console.

(2) Pull on equalizer/output cable to wind up spring(requires greater than 30 pounds effort). Continue until self adjuster lockout pawl is positioned about midway on the self adjuster sector (Fig. 6). Rotate lockout pawl into self adjuster sector by turning allen screw clockwise. **Rotating lockout device requires very little effort. Do not force or failure of lockout device will occur.**

(3) When repairs are complete, adjust rear brakes before adjusting parking brake. On drum-in-hat type of rear disc brake adjust shoe diameter to 171.5 mm (6.75 inch).

ADJUST PARKING BRAKE (AG & AJ BODY)

Be sure that the cables are properly assembled to the equalizer bracket prior to cable adjustment.

(1) Insert a 7/32 inch allen wrench into hex socket and turn counter-clockwise through approximately 15° of rotation (Fig. 4). In turning lockout device, self adjuster release is a loud snapping noise followed by reaching a more felt than heard detent. Very light effort is required to seat lockout arm into detent. Follow through to the detent is important in preventing the lockout rod from rattling.

Note: The parking brake handle can be in any position when releasing self adjuster.

(2) Cycle lever to position cables. Rear wheels should rotate freely without dragging.

REAR PARKING BRAKE CABLE REMOVAL (AA, AC, AP, AY BODY)

The rear brake cables are attached to rear connectors.

Should it become necessary to remove either parking brake cable for installation of a new cable, proceed as follows:

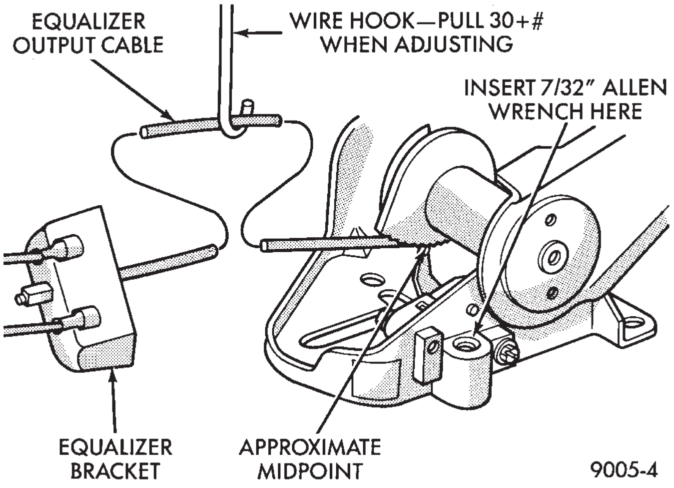


Fig. 5 Self Adjusting Parking Brake Lever Assembly

With vehicle jacked up on a suitable hoist, remove wheel and tire assembly (Fig. 6).

Back off cable adjusting nut to provide slack and disconnect rear brake cable from connector.

DRUM BRAKES

(1) Disconnect park brake cable from park brake lever in rear wheel brakes.

(2) Using an aircraft type hose clamp compress retainers on end of cable housing and start cable out of retaining hole in the support plate. Remove clamp when retainers are free of the mounting hole in the support plate, (Fig. 6).

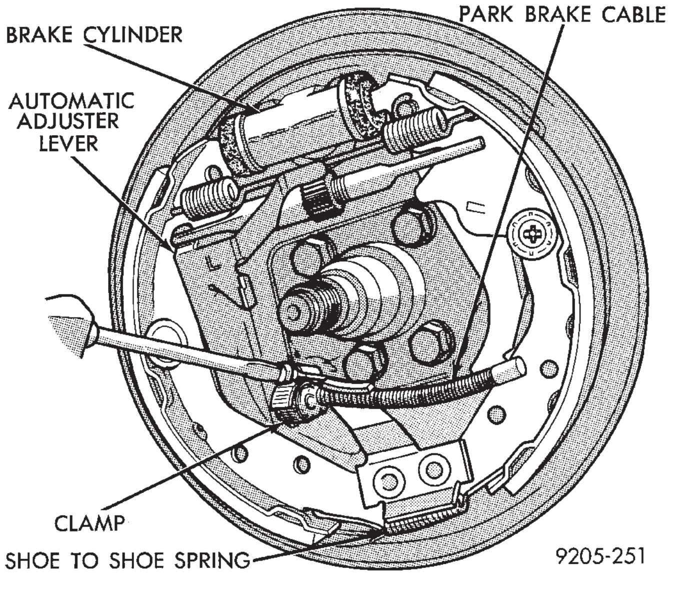


Fig. 6 Removing Brake Cable from Support Plate

(3) Remove clip from brake cable at support bracket and pull cable away from trailing arm assembly (Figs. 3 and 4).

DISC BRAKES

(1) Remove disc brake caliper from adapter, and brake disc (rotor) from rear hub.

(2) Disconnect parking brake cable from brake shoe lever.

(3) Using an aircraft type hose clamp compress retainers on end of cable housing and start cable out of retaining hole in the adapter. Remove clamp when retainers are free of mounting hole in the adapter (Fig. 6).

(4) Remove clip from parking brake cable at hanger bracket and pull cable away from trailing arm.

REAR PARKING BRAKE CABLE INSTALLATION

DRUM BRAKES (AA, AC, AP, AY BODY)

(1) Route parking brake cable assembly through trailing arm and hanger bracket.

(2) Install parking brake cable retaining clip.

(3) Install parking brake cable into rear brake support plate. Be sure all retainers are expanded around mounting hole in brake support plate, and then connect parking brake cable end to brake shoe lever.

(4) Insert forward end of parking brake cable into connector.

(5) Install brake drum, and wheel and tire assembly.

DRUM BRAKES (AG & AJ BODY)

(1) Route each parking brake cable assembly through trailing arm and mounting bracket.

(2) Install parking brake cable retaining clip.

(3) Install parking brake cable into rear brake support plate. Be sure the retainers are expanded around mounting hole in the brake support plate and connect parking brake cable end to brake shoe lever.

(4) Insert forward end of parking brake cable into floor pan of vehicle. Then connector park brake cable to equalizer at park brake hand lever.

(5) Install brake drum, and wheel and tire assembly.

DISC BRAKES (AA, AC, AP, AY BODY)

(1) Route parking brake cable assembly through trailing arm and parking brake cable hanger bracket.

(2) Install parking brake cable to hanger bracket retaining clip.

(3) Install parking brake cable into rear brake adapter. Be sure all cable retainers on parking brake cable are expanded around mounting hole in adapter and connect cable end to brake shoe lever.

(4) Insert forward end of cable into connector.

(5) Adjust parking brake shoe diameter to 171 mm (6.75 inch).

(6) Install rear braking disc, caliper assembly and wheel and tire assembly.

DISC BRAKES (AG & AJ BODY)

(1) Route each individual parking brake cable assembly through trailing arm and parking brake cable mounting bracket.

(2) Install parking brake cable to mounting bracket retaining clip.

(3) Install parking brake cable into rear disc brake adapter. Be sure all cable retainers on parking brake cable are expanded around mounting hole in adapter, and then connect cable end to brake shoe lever.

(4) Insert forward end of parking brake cable into floor pan of vehicle. Then connector park brake cable to equalizer at park brake hand lever.

(5) Adjust parking brake shoe diameter to 171 mm (6.75 inch).

(6) Install rear braking disc, caliper assembly and wheel and tire assembly.

REMOVING PARKING BRAKE FRONT CABLE (AA, AC, AP, AY BODY)

(1) Loosen parking brake cable adjusting nut under car. Disengage front cable from intermediate cable connector (Fig. 2).

(2) Remove park brake cable retaining clip from floor pan of vehicle.

(3) Lift floor mat for access to floor pan.

(4) Remove floor pan seal.

(5) Pull parking brake cable strand end forward and disconnect from foot lever clevis. Separate parking brake cable from parking brake foot lever and bracket on body rail.

(6) Pull parking brake cable assembly through hole in floor pan and up into vehicle.

INSTALLING PARKING BRAKE FRONT CABLE (AA, AC, AP AY Body)

(1) Insert parking brake cable housing retainers into hole in rail bracket and parking brake foot lever assembly (Fig. 2).

(2) Feed parking brake cable end through holes in floor pan and rail bracket, from the interior of the vehicle.

(3) Install floor pan seal.

(4) Engage parking brake cable strand end in foot lever clevis. Seat cable ends in parking brake assembly and parking brake cable rail bracket.

(5) Replace floor mat.

(6) Attach park brake cable retaining clip to floor pan of vehicle.

(7) Engage rear parking brake cable end to intermediate cable connector.

(8) Adjust service and parking brakes.

PARKING BRAKE HAND LEVER ASSEMBLY REMOVAL AND INSTALLATION

REMOVAL (AG AND AJ BODY)

Remove ash receiver or courtesy light from rear of console. Remove carpet from sides of console. Remove parking brake trim cover from passenger side of console (pulls off).

Load and lockout parking brake self adjuster (Fig. 6). Disconnect rear cables from equalizer bracket.

Remove the 3 hold down nuts and remove hand lever assembly through opening created by removing console trim cover. Passenger seat might have to be removed. Also, if metal tab at bottom of console prevents removal of hand brake assembly, bend tab out of the way. (Bend the tab back to original position after R & R of hand brake).

INSTALLATION (AG AND AJ BODY)

Install hand lever assembly through side opening in console and bolt into place.

Connect rear parking brake cables to equalizer.

Adjust parking brakes.

Install console trim cover, carpet, passenger seat and rear ash receiver or courtesy light.

REMOVAL AND INSTALLATION PARKING BRAKE SHOES

ALL WITH REAR DISK BRAKES

(1) Remove rear disc brake caliper assembly from adapter and braking disc (See Disc Brake Shoe Removal).

(2) Remove rear braking disc from rear hub (See Removing Braking Disk).

(3) Remove grease cap.

(4) Remove cotter pin, lock nut, hub bearing retaining nut, and washer.

(5) Remove hub and bearings.(See Wheel Bearing Section)

(6) Remove forward brake shoe assembly hold down clip (Fig. 1).

(7) Turn parking brake, brake shoe adjuster wheel until adjuster is at shortest length.

(8) Remove the parking brake, shoe adjuster assembly (Fig. 2).

(9) Remove upper parking brake, shoe to shoe spring (Fig. 3).

(10) Pull front parking brake shoe, away from anchor. Then remove front parking brake shoe and lower spring (Fig. 4).

(11) Remove rear parking brake shoe hold-down clip. Then remove rear parking brake shoe assembly (Fig. 5).

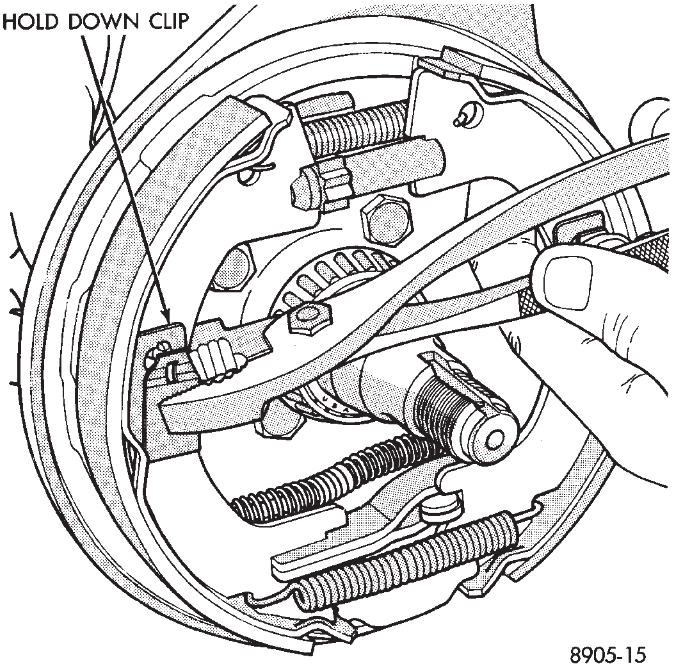


Fig. 1 Removing Brake Shoe Hold-Down Clip

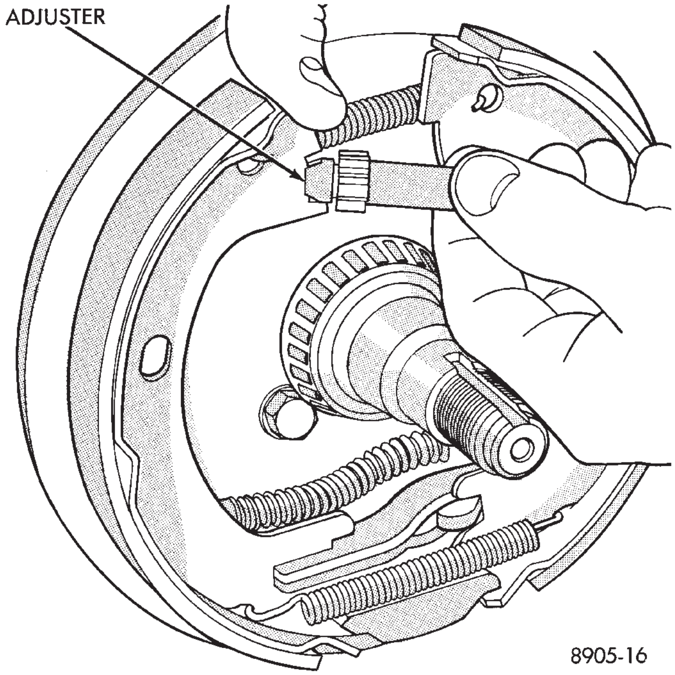


Fig. 2 Removing Adjuster Assembly

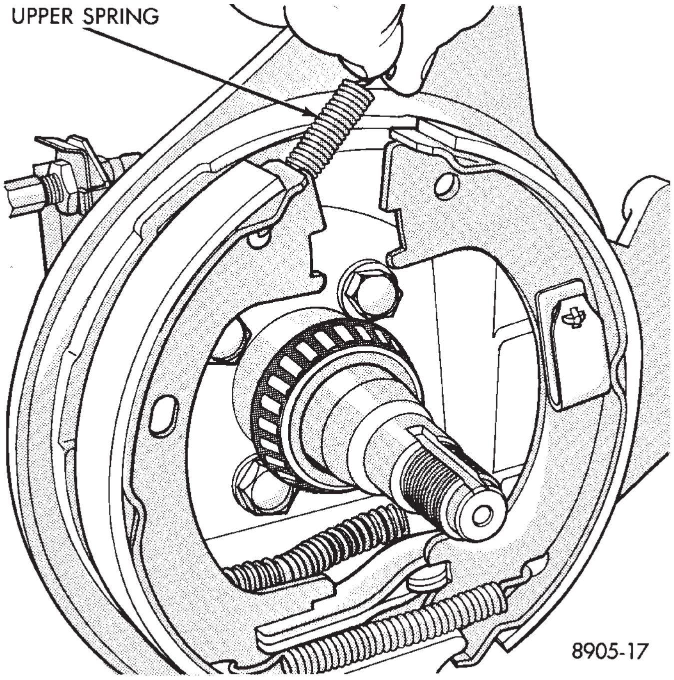


Fig. 3 Removing Upper Spring

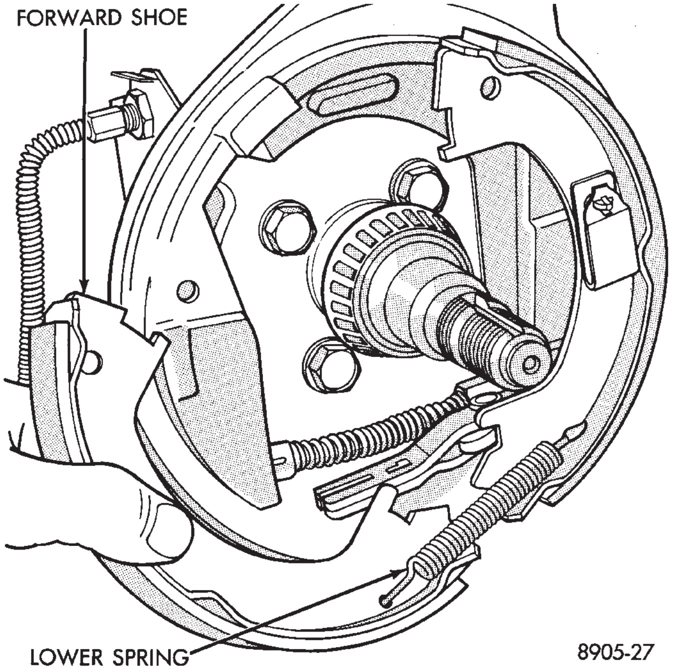


Fig. 4 Removing Shoe and Lower Spring

INSTALLING PARKING BRAKE SHOES

(1) Install rear parking brake shoe and holddown clip (Fig. 6).

(2) Install lower parking brake, shoe to shoe return spring (Fig. 7).

(3) Pull forward parking brake shoe over anchor block until properly located on adapter.

(4) Install upper parking brake, shoe to shoe return spring (Fig. 8).

(5) Install parking brake shoe adjuster assembly with star wheel forward (Fig. 9).

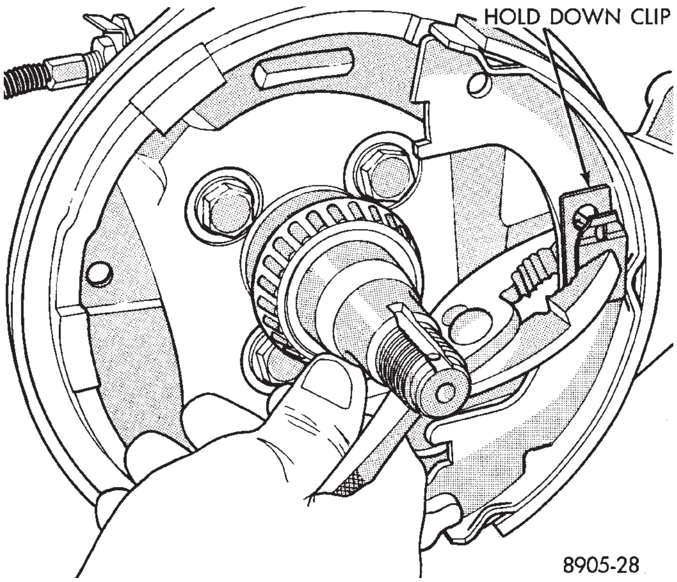


Fig. 5 Removing Rear Holddown Clip and Shoe

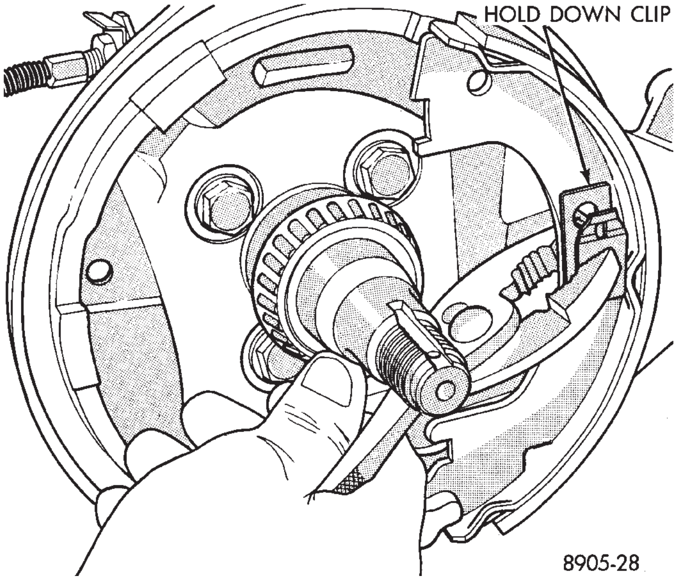


Fig. 6 Installing Rear Shoe and Hold-Down Clip

(6) Install front, parking brake shoe holddown clip (Fig. 10).

(7) Adjust parking brake shoes to a diameter to 171 mm (6.75 inch).

(8) Install hub assembly on spindle.

(9) Install outer bearing, thrust washer and nut.

(10) Tighten wheel bearing adjusting nut to 27 to 34 N●m (240 to 300 in. lbs.) torque while rotating hub. This seats the bearings.

(11) Back off adjusting nut 1/4 turn (90°) then tighten adjusting nut finger tight.

(12) Position lock on nut with one pair of slots in line with cotter pin hole. Install cotter pin.

(13) Install grease cap.

(14) Install rear braking disc.

(15) Install rear, disc brake caliper on the adapter (See Brake Shoe Removal).

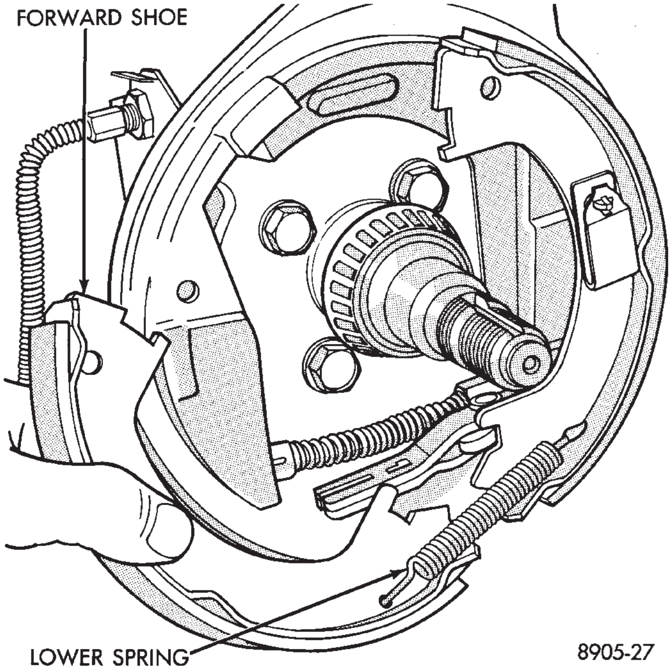


Fig. 7 Installing Lower Spring

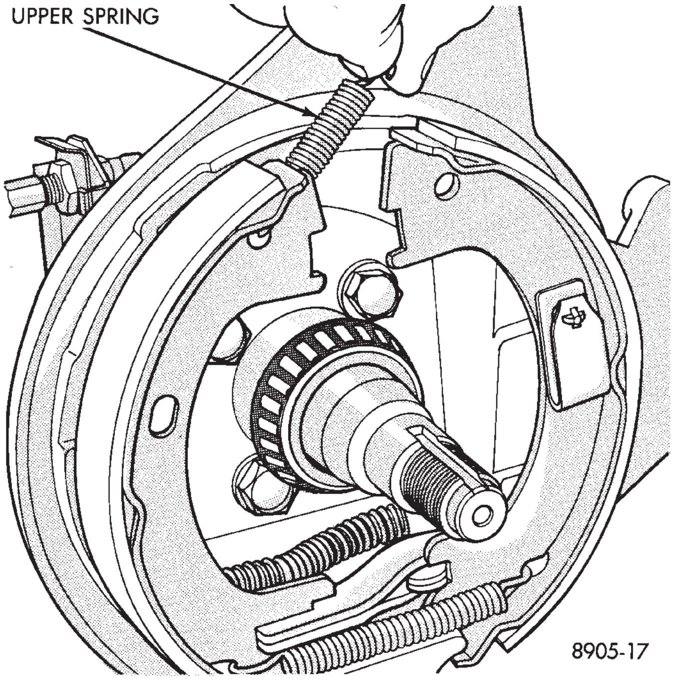


Fig. 8 Installing Upper Spring

(16) Install wheel and tire assemblies.

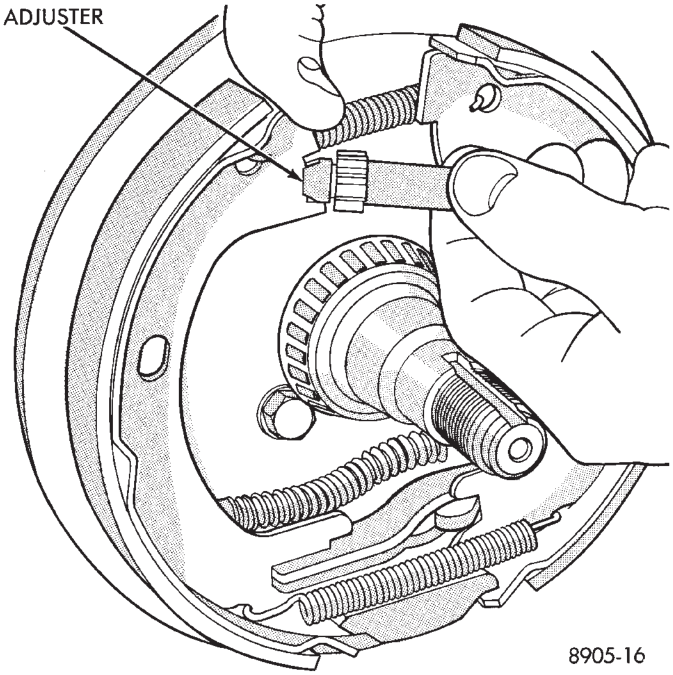


Fig. 9 Installing Adjuster Assembly

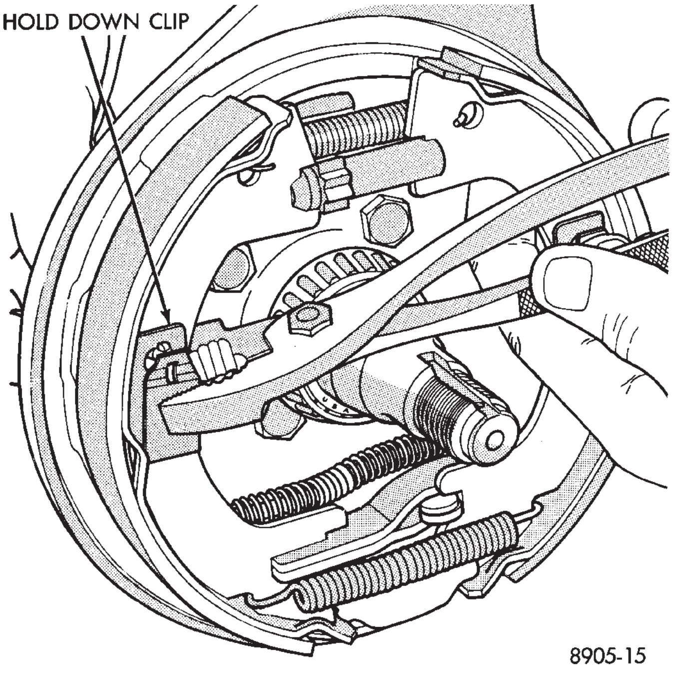


Fig. 10 Installing Front Parking Brake Shoe Hold-Down Clip

(17) Tighten wheel stud nuts to 129 N●m (95 ft-.lbs.).

MASTER CYLINDER

INDEX

GENERAL INFORMATION

The tandem master cylinder (Fig. 1) has a glass reinforced nylon reservoir and an anodized aluminum body.

Do not hone the bore of the cylinder, as this will remove the anodized surface.

The reservoir is indexed to prevent installation in the wrong direction (Fig. 2). The cap diaphragms are slit to allow atmospheric pressure to equalize on both sides of the diaphragm.

The primary and secondary outlet tubes from the master cylinder are connected to the valve mounted under the master cylinder. The front part of this block connects to the secondary outlet tube and supplies the right rear and left front brakes. The rear portion of the block connects to the primary outlet tube and supplies the right front and left rear brakes.

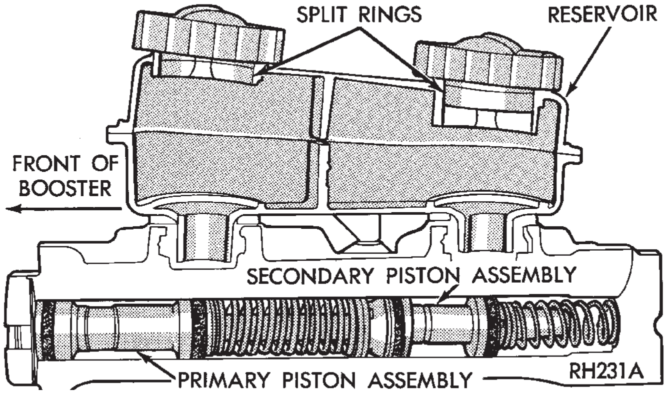


Fig. 1 Aluminum Master Cylinder (Cutaway View)

BRAKE FLUID LEVEL SENSOR

The Brake Fluid Level sensor is found only in the AJ body vehicles with the visual electronic message center. The purpose of the sensor is to provide the driver with an early warning message that brake fluid in master cylinder reservoir has dropped to a below normal.

As the fluid drops below the design level the sensor closes the warning message circuit. Approximately 15 seconds later the message BRAKE FLUID LOW appears on the instrument panel. At this time the master cylinder reservoir should be checked and filled to the bottom of the rings with DOT 3 brake fluid.

To check the operation of the Brake Fluid Level sensor, with ignition on and wiring still attached,remove sensor from master cylinder and hold in upright position. Within 30 seconds the instrument panel message BRAKE FLUID LOW should appear. Next invert the sensor. The instrument panel message should turn off immediately. If the above sequence occurs the sensor is operating properly. If the message does not appear remove the wiring from the sensor and using a jumper wire connect both sides of the plug. The instrumental panel message BRAKE FLUID LOW should appear within 30 seconds. If the message does not appear a problem exists in the wiring or instrumentation. If the message does appear the sensor is faulty and must be replaced. **The Brake Fluid Level sensor is not a repairable item (Fig. 2).**

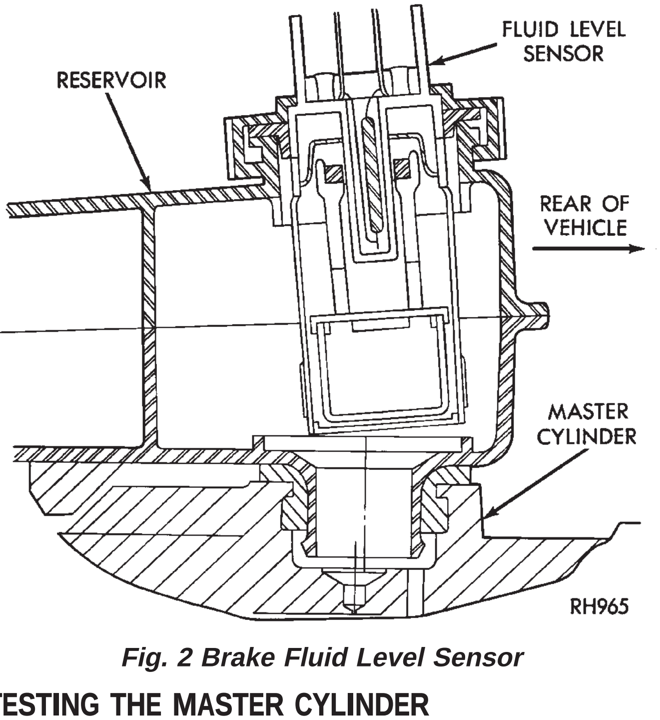


Fig. 2 Brake Fluid Level Sensor

TESTING THE MASTER CYLINDER

Be sure master cylinder vents at both ports.

Apply pedal lightly with engine running and look for fluid squirting or swirling into reservoirs.

In this master cylinder, a special baffle reduces the amount of fluid entering the secondary reservoir only a small disturbance may be seen.

MASTER CYLINDER SERVICE PROCEDURES

MASTER CYLINDER REMOVAL

Disconnect primary and secondary brake tubes from master cylinder housing. Install plugs at brake tube outlets.

Remove 2 nuts (Fig. 3) attaching master cylinder housing to power brake booster unit.

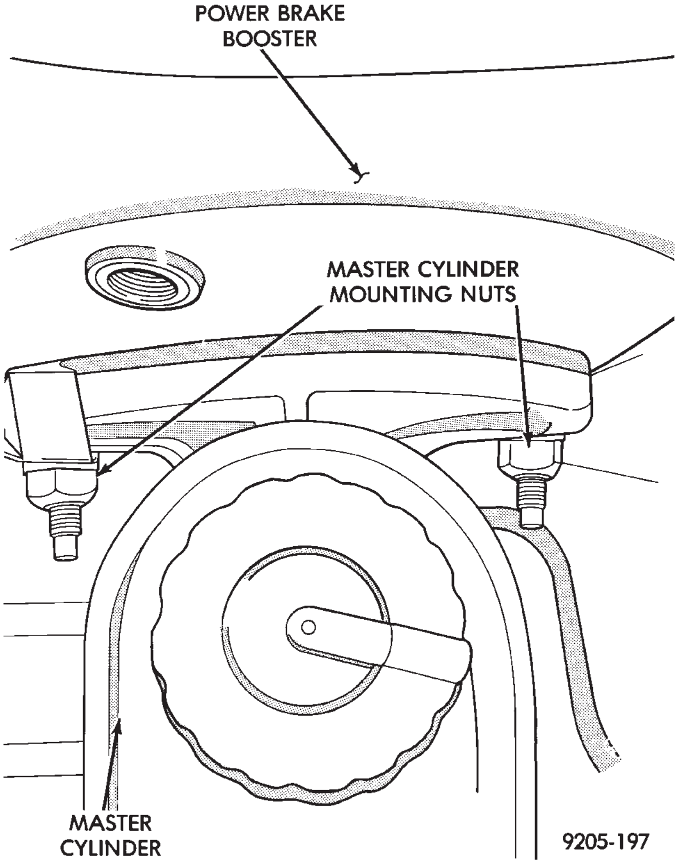


Fig. 3 Master Cylinder Mounting

Slide master cylinder straight out, and away from power brake booster unit.

BRAKE FLUID RESERVOIR REPLACEMENT

Clean master cylinder housing and brake fluid reservoir.

Remove the brake fluid reservoir caps. Using a syringe or equivalent empty brake fluid from reservoir.

Position master cylinder in vise.

Rock reservoir from side to side and remove from master cylinder housing (Fig. 4).

Do not pry off with tool, damage to reservoir may result.

Remove housing-to-reservoir grommets (Fig. 5).

Install new housing-to-reservoir grommets in master cylinder housing.

Lubricate reservoir mounting area with clean brake fluid. Place reservoir in position over grommets. Seat reservoir with a rocking motion onto master cylinder housing.

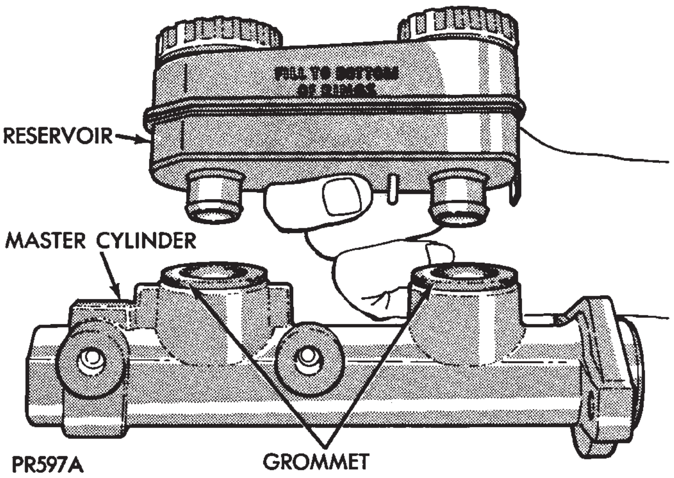


Fig. 4 Removing Reservoir

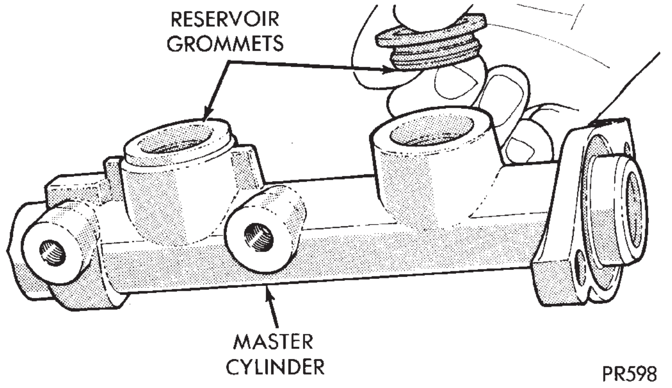


Fig. 5 Removing Grommets

Be sure reservoir is positioned properly. All lettering should be properly read from the left side of the master cylinder (Fig. 4).

Make sure bottom of reservoir touches top of grommet.

BLEEDING MASTER CYLINDER

Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool C-4546 to the master cylinder. Position tubes so the outlet of the Bleeding Tubes will be below the surface of the brake fluid when the reservoir is filled to the proper level.

Fill both reservoirs with brake fluid conforming to DOT 3 specifications such as Mopar or Equivalent.

Using a wooden dowel per (Fig. 6). Depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled (Fig. 6).

Remove bleeding tubes from cylinder, plug outlets and install caps.

Remove master cylinder from vise and install on power brake vacuum booster.

It is not necessary to bleed the entire hydraulic system after replacing the master cylinder. But the master cylinder must have been bled and filled upon installation.

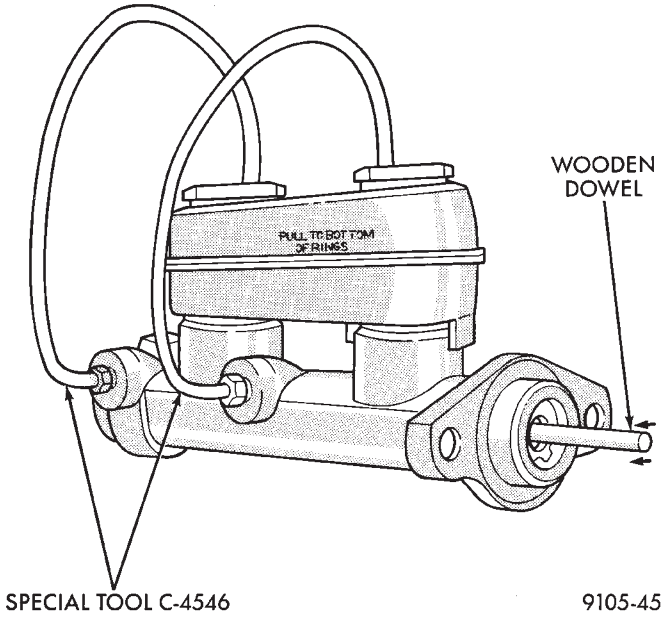


Fig. 6 Bleeding Master Cylinder

INSTALLING MASTER CYLINDER

Position master cylinder over studs of power brake unit, align push rod with master cylinder piston.

Install the master cylinder to power brake unit mounting nuts (Fig. 4) and tighten to 28 N●m (250 in. lbs.) torque.

Connect brake tubes to master cylinder primary and secondary ports. Tighten fittings to 17 N●m (145 in-.lbs.) torque.

POWER BRAKES

GENERAL INFORMATION

All vehicles, except non turbo charged AP bodies, equipped with manual transmissions use a 205 mm tandem booster. The non turbo charged manual transmission equipped AP body application use a 230 mm non-tandem booster.

The purpose of the vacuum operated power brake booster. Is to reduce the amount of force applied to the brake pedal by the drivers foot. To obtain the required hydraulic pressure in the brake system to stop the vehicle.

The power brake booster can be identified if required, by the tag attached to the body of the booster assembly (Fig. 1). This tag contains the following information. The production part number of the power booster assembly, the date it was built and who manufactured it.

The power brake booster assembly is not a repairable part and must be replaced as a complete unit if it is found to be faulty in any way. The power booster vacuum check valve is not repairable but can be replaceable as an assembly.

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. 2).

As the brake pedal is depressed, the power boosters input rod moves forward. This opens and closes valves in the power booster, creating a vacuum on one side of a diaphragm and allowing atmospheric pressure to enter on the other. This difference in pressure forces the output rod of the power booster 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.

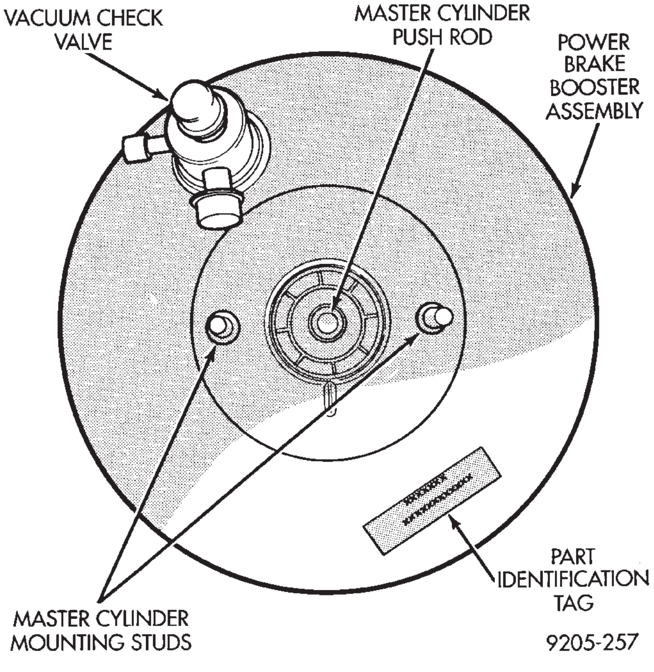


Fig. 1 Power Brake Booster Identification

Different systems and engine combinations require different vacuum hose routings.

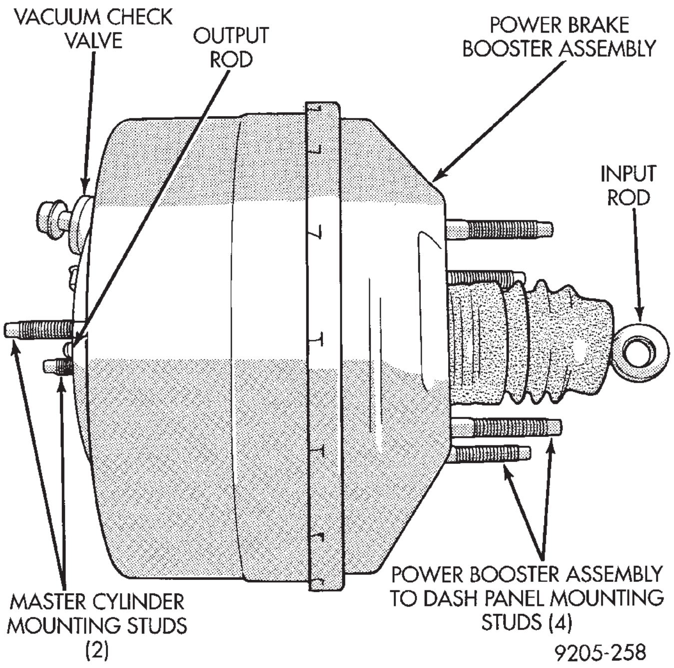


Fig. 2 Power Brake Booster Assembly

The power brake booster assembly mounts on the engine side of the dash panel. It is externally connected to the brake system by an input push rod to the brake pedal. A vacuum line connects the power booster to the intake manifold. The master cylinder is bolted to the front of the power brake booster assembly (Fig. 3).

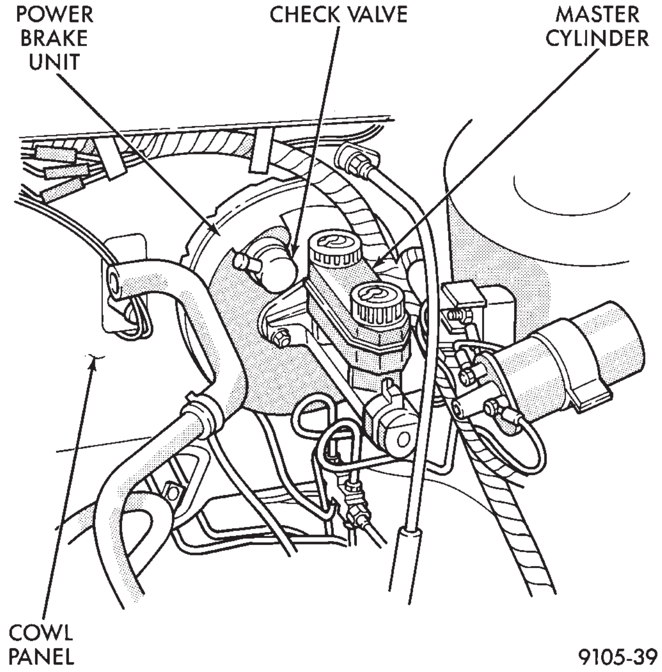


Fig. 3 Power Brake Mounting

SERVICE PROCEDURES

POWER BRAKE BOOSTER ASSEMBLY

REMOVE

(1) Remove the 2 nuts (Fig. 4) attaching master cylinder assembly to power brake unit.

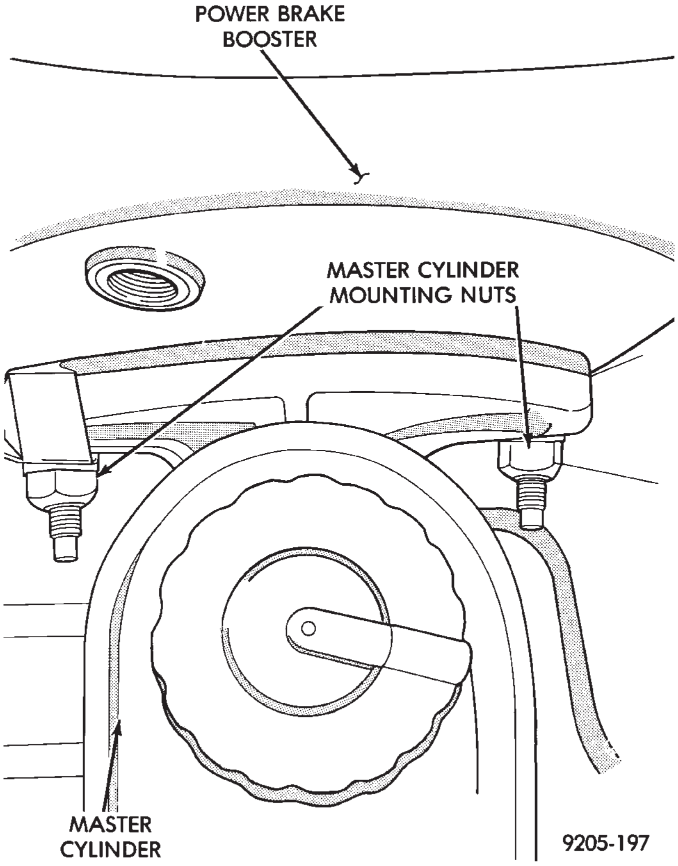


Fig. 4 Master Cylinder Mounting

(2) Carefully slide master cylinder off mounting studs with brake lines attached, and allow the assembly to rest against fender shield.

(3) Disconnect vacuum hose from power brake booster check valve (Fig. 1). **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(4) From under instrument panel, position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip.

(5) Rotate screwdriver enough to allow retainer clip center tang to pass over end of brake pedal pin and pull retainer clip off pin. **Discard retainer clip it is not to be reused, replace only with a new retainer clip.**

(6) Remove the four nuts that attach the power brake booster to the vehicle dash panel. Nuts are accessible from under the dash panel in the area of the steering column and pedal bracket (Fig. 5).

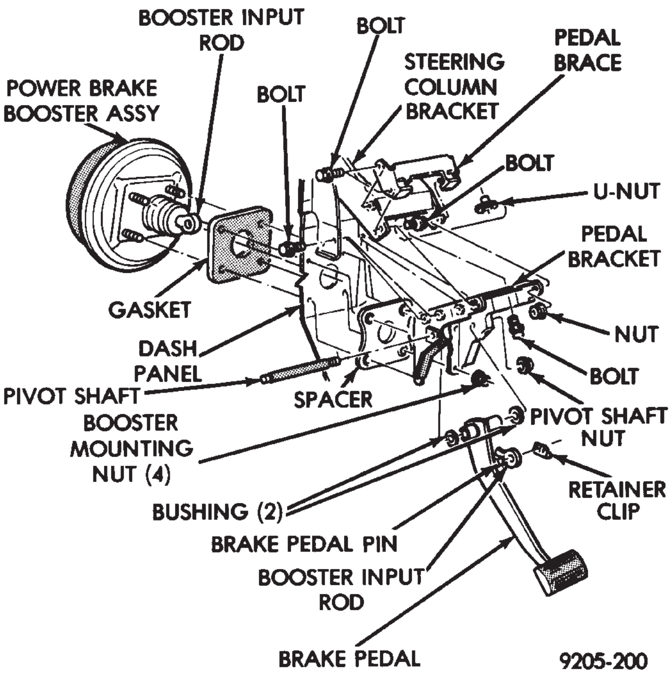


Fig. 5 Power Brake Booster Mounting

(7) Unfasten brackets on steel heater water line at dash panel and left frame rail. **On Manual Transmission vehicles,** unfasten clutch cable bracket at shock tower and move aside.

(8) Slide the power brake unit up and to the left (mounting holes are slotted) on the dash panel, then tilt inboard and up to remove.

CAUTION: Do not attempt to disassemble power brake unit as this booster is serviced ONLY as a complete assembly.

INSTALL

(1) Position power brake booster onto dash panel.

(2) Install and tighten the 4 power brake booster to dash panel mounting nuts (Fig. 5) to 29 N•m (250 in. lbs.) torque.

(3) Install steel heater water line and clutch cable bracket, if so equipped.

(4) Carefully position master cylinder on power brake unit.

(5) Install and tighten the 2 master cylinder to power booster mounting nuts (Fig. 4) to 29 N•m (250 in. lbs.) torque.

(6) Connect vacuum hose onto the check valve, located on the power brake unit.

(7) Using lubriplate, or equivalent, coat the bearing surface of pedal pin (Fig. 5).

(8) Connect power brake booster input rod to brake pedal pin and install a NEW retainer clip. **Use only a new retainer clip DO NOT USE the old clip.**

(9) Check stop light operation.

WHEEL BEARINGS

FRONT WHEEL BEARINGS

Front wheel drive vehicles are equipped with permanently sealed front wheel bearings. There is no periodic lubrication or maintenance recommended for these units. However if during servicing of the brake system, service to the front wheel bearing is required refer to Group 2, Suspension in this service manual.

REAR WHEEL BEARINGS

NORMAL SERVICE

The lubricant in the rear wheel bearings should be inspected whenever the hubs are removed to inspect or service the brake system. Or at least every 30,000 miles (48,000 km). The bearings should be cleaned and repacked with a High Temperature Multipurpose E.P. Grease whenever the disc brake rotors are resurfaced.

INSPECTION

Check lubricant to see that it is adequate in quantity and quality. If the grease is low in quantity, contains dirt, appears dry or has been contaminated with water, it will appear milky. The bearings then must be cleaned and repacked. **Do not add grease to a wheel bearing that already has grease packed in it. Relubricate completely. Mixing of different types of greases in wheel bearings should be avoided since it may result in excessive thinning and leakage of the grease.**

REMOVAL AND INSTALLATION

For the servicing, removal and installation of the rear wheel bearings follow the procedure listed below.

(1) Remove the rear tire and wheel assembly.

(2) On rear disc brake equipped vehicles remove the caliper and rotor. Support the caliper out of the way. **Do not allow the caliper to hang by the hydraulic hose.** See disc brake section in this group for caliper removal procedure.

(3) Remove grease cap, cotter pin, nut lock, nut, thrust washer and outer wheel bearing.

(4) Carefully slide hub or drum from spindle. Do not drag inner bearing or grease seal over stub axle (thread, bearing, and oil seal may be damaged.) Using an appropriate tool remove the grease seal and inner bearing from the drum or hub. Discard grease

seal, a new seal should be used when reinstalling the inner bearing. (See Fig. 1)

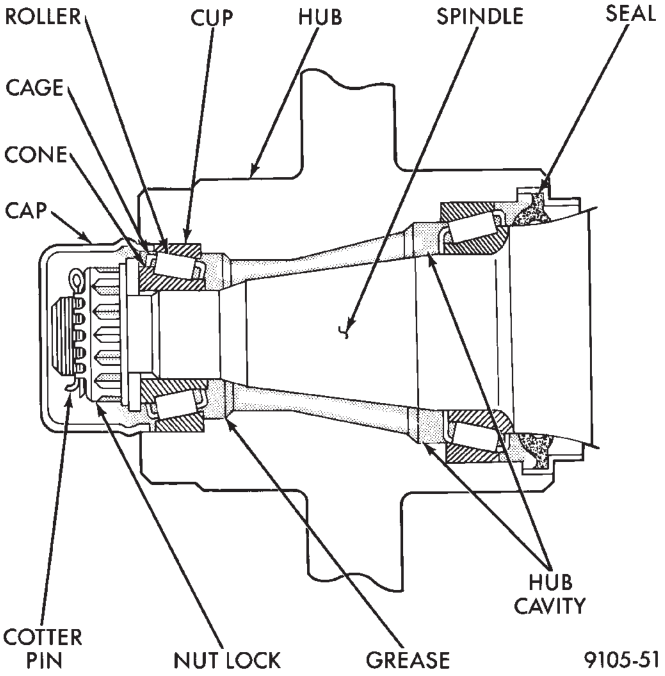


Fig. 1 Rear Wheel Bearings

(5) Thoroughly clean all old grease from the outer and inner bearings, bearing cups and hub cavity (See Fig. 1). **To clean bearings, soak them in an appropriate cleaning solvent. Strike the flat surface of the bearing inner race against a hardwood block several times. Immerse the bearings in solvent between the blows to jar grease loose and wash old particles of hardened grease from bearings. Repeat this operation until bearings are clean. Bearings can be dried using compressed air but do not spin the bearings. After cleaning, oil the bearings with engine oil. Insert the bearing into its appropriate cup, apply pressure to the bearing while rotating it to test them for pitting and roughness. Replace all worn or defective bearings. If bearing shows signs of pitting or roughness they should be replaced. Bearings must be replaced as a set, both the cup and the bearing need to be replaced at the same time. If bearings are suitable for further use, remove engine oil from bearings using appropriate solvent and dry bearings. Repack the bearings using a Multi-Purpose NLGI. Grade 2 EP Grease such as Mopar or equivalent, and place them in a clean covered container until ready for installation. If a bearing packer is not available, hand pack grease into all cavities between bearing cage and rollers.**

(6) If bearings and cups are to be replaced, remove cups from the drum or hub using a brass drift or suitable remover.

(7) Replace bearing cups with appropriate installing tool.

(8) Install inner bearing in grease coated hub and bearing cup, and install new grease seals using the appropriate seal installer.

(9) Coat hub cavity and cup with grease.

(10) Before installing hub or drum assembly, inspect stub axle and seal surface for burrs or roughness, and smooth out all rough surfaces.

(11) Coat the stub axle with Multi-Purpose NLGI, Grade 2 EP grease such as Mopar or equivalent.

(12) Carefully slide the hub of drum assembly onto the stub axle. **Do not drag seal or inner bearing over the threaded area of the stub axle.**

(13) Install outer bearing, thrust washer and nut.

(14) Tighten the wheel bearing adjusting nut to 27 to 34 N●m (240 to 300 in. lbs.) while rotating hub or drum assembly. This seats the bearings.

(15) Back off adjusting nut 1/4 turn (90°) then tighten adjusting nut only finger tight.

(16) Position the nut lock over the bearing adjusting nut with one pair of slots in line with the cotter pin hole in the stub axle, and install cotter pin.

(17) Install the grease caps and the wheel and tire assemblies. Tighten wheel stud nuts to 115 N●m (85 ft. lbs.) on all models. reinstall wheel covers if so equipped.

ANTI-LOCK BRAKE SYSTEM—BENDIX ANTI-LOCK 10 AC/Y BODY

INDEX

GENERAL INFORMATION

The purpose of the Anti-Lock Brake System (ABS) is to prevent wheel lock-up under heavy braking conditions on virtually any type of road surface. Anti-Lock 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 heavy braking.

ANTI-LOCK BRAKE SYSTEM DEFINITIONS

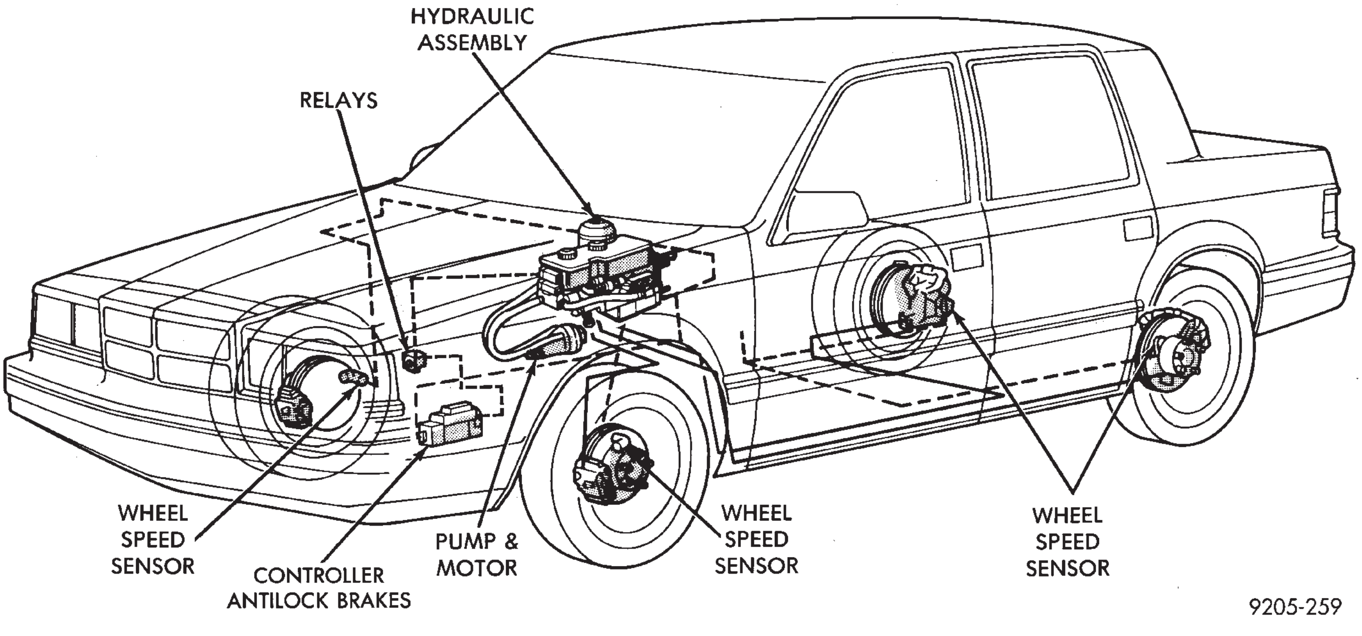
In this section of the manual several abbreviations are used for the components that are in the Anti-Lock Braking System They are listed below for your reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions much the same as a standard brake system with a diagonally split master cylinder. The primary difference is that power assist is provided by hydraulic power assist instead of the conventional vacuum assist.

If a wheel locking tendency is noticed during a brake application, the system will enter Anti-Lock mode. During Anti-Lock braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel of the vehicle has a set of electrical solenoid valves and hydraulic line to provide hydraulic modulation. For vehicle stability, though both rear wheel valves receive the same electrical signal. The system can build, hold or reduce pressure at each wheel of the vehicle. This is determined by the signals generated by the wheel



Four-Wheel Anti-Lock Brake System

speed sensors (WSS) at each wheel and received at the Controller-Anti-Lock Brake (CAB).

MAJOR ABS COMPONENTS

The following is a list of major system components. Details of all components can be found later in this section.

HYDRAULIC ASSEMBLY

The Hydraulic Assembly (Fig. 1) provides the function of an integral master cylinder and hydraulic booster assembly. The hydraulic assembly contains the wheel circuit valves used for brake pressure modulation.

WHEEL SPEED SENSORS

A Wheel Speed Sensor (Fig. 2) is located at each wheel to transmit wheel speed information to the Controller Anti-Lock Brake (CAB).

CONTROLLER-ANTI-LOCK BRAKE (CAB)

The (CAB) (Fig. 3) is a small control computer that receives wheel speed information, controls Anti-Lock operation and monitors system operation.

PUMP/MOTOR ASSEMBLY

The Pump/Motor Assembly (Fig. 4) is an electrically driven pump. It takes low pressure brake fluid from the hydraulic assembly reservoir and pressurizes it for storage in the accumulators for power assist and Anti -Lock braking.

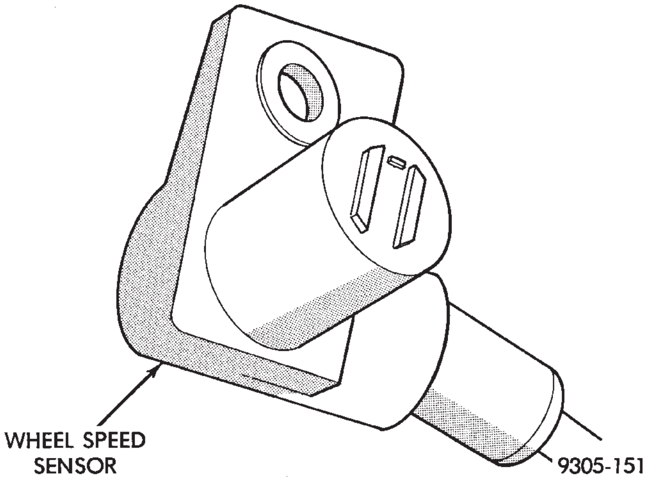


Fig. 2 Wheel Speed Sensor

ANTI-LOCK OPERATION AND PERFORMANCE

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions much the same as a standard brake system with a diagonally split master cylinder. The primary

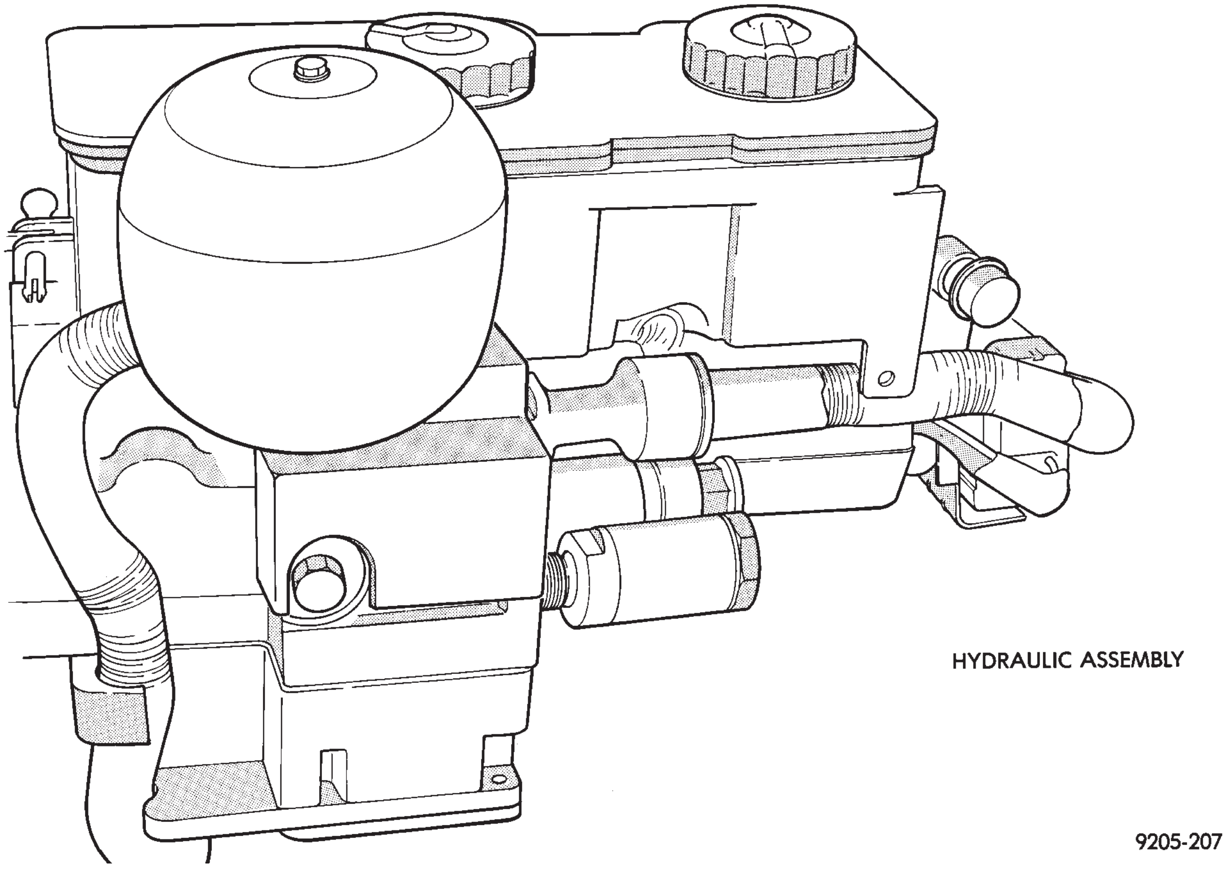


Fig. 1 ABS Hydraulic Assembly

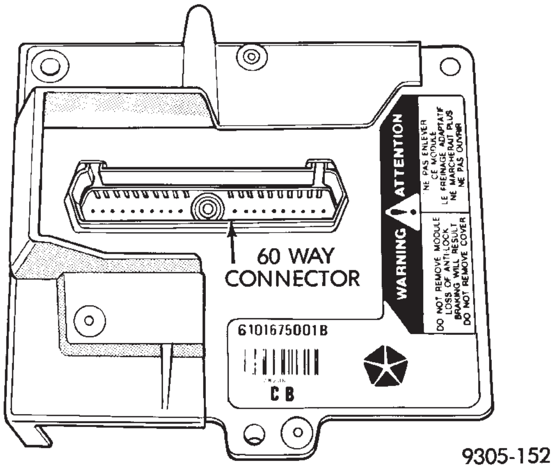


Fig. 3 (CAB) Controller Anti-Lock Brake Module

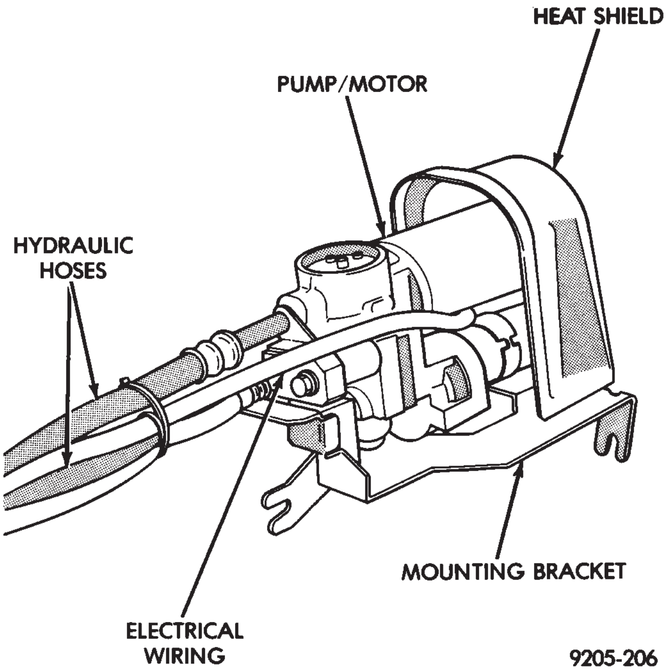


Fig. 4 ABS Pump/Motor Assembly

difference is that power assist is provided by hydraulic power assist instead of the conventional vacuum assist.

If a wheel locking tendency is noticed during a brake application, the system will enter Anti-Lock mode. During Anti-Lock braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel has a set of electrical solenoid valves and a hydraulic line to provide hydraulic modulation. For vehicle stability, though both rear wheel valves receive the same electrical signal. The system can build, hold or reduce pressure at each wheel. Depending on the signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller-Anti-Lock Brake (CAB).

The ABS system represents current state-of-the-art in vehicle braking systems. The ABS system offers the driver increased safety and vehicle control during hard braking. This is accomplished by a sophisticated system of electrical and hydraulic components. That differ from conventional vacuum boosted hydraulic actuation systems. Because, there are several performance characteristics that may at first seem different but should be considered normal. These characteristics are discussed below. More technical details are discussed further in this section.

PEDAL FEEL

The ABS System uses hydraulic power assist for both normal power assisted braking and to provide a source of high pressure hydraulic fluid during Anti-Lock Braking. In general, pedal feel will be similar to that of a conventional vacuum boosted brake system. If during an Anti-Lock stop additional force is applied to the brake pedal, or the brake pedal is released and reapplied rapidly. The driver may notice a very hard pedal feel. This is due to normal isolation of the master cylinder during A.B.S. operation as wheel brake pressure is fed from the hydraulic booster.

ANTI-LOCK OPERATION

During Anti-Lock Braking, brake pressures are modulated by cycling electric valves. The cycling of these valves can be heard as a series of popping or ticking noises. In addition, the cycling may be felt as a pulsation in the brake pedal, although no pedal movement will be noticed. If Anti-Lock operation occurs during hard braking. Some pulsation may be felt in the vehicle body due to fore and aft movement of the vehicles suspension as brake pressures are modulated.

Although ABS operation is available at virtually all vehicle speeds. It will automatically turn off at speeds below 3 to 5 mph. Therefore wheel lock-up may be perceived at the very end of an Anti-Lock stop and should be considered normal.

TIRE NOISE & MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired to achieve optimum braking performance. During brake pressure modulation, as brake pressure is increased, wheel slip is allowed to reach up to 30%. This means that the wheel rolling velocity is 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 payment. However, Anti-Lock Braking will not leave dark black tire marks since the wheel never reaches a locked condition. Tire marks may however be noticeable as light patched marks.

ABS EQUIPPED VEHICLE PERFORMANCE

Anti-Lock Brakes provide the driver with some steering control during hard braking. However there are conditions where the system does not provide any benefit. In particular, hydroplaning is still possible when the tires ride on a film of water. Hydroplaning results in the vehicle tires leaving the road surface rendering the vehicle almost uncontrollable. In addition, extreme steering maneuvers at high speed or high speed cornering beyond limits of tire adhesion to the road surface may cause vehicle skidding. So, the ABS system is termed Anti-Lock instead of Anti-Skid.

One of the significant benefits of the ABS system is that of maintaining steering control during hard braking or during braking on slippery surfaces. It is therefore possible to steer the vehicle while braking on almost any road surface.

ABS SYSTEM SELF-DIAGNOSTICS

The ABS system has been designed with Self Diagnostic Capability. There are two self checks the systems performs every time the vehicle is started. First, when the key is turned on the system performs an electrical check called Start-Up Cycle. During this check, the Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp are illuminated. Then turned off at the end of the test, after about 1 to 2 seconds. When the vehicle reaches a speed of about 3 to 4 miles per hour. The system performs a functional check called Drive-Off. During Drive-Off. hydraulic valves are activated briefly to test their function. Drive-Off can be detected as a series of rapid clicks upon driving off the first time the car is started. If the brake pedal is applied during Drive-Off, the test is by-passed. Both of these conditions are a normal part of the system self test. Most fault conditions will set a ABS Fault Code in the (CAB), which can be retrieved to aid in fault diagnosis. Details can be found in Diagnosis Section.

ABS WARNING SYSTEMS OPERATION

The ABS system uses two methods for notifying the driver of a system malfunction. These include the standard Red Brake Warning Lamp and an Amber Anti-Lock Warning Lamp, both located in the instrument cluster. The purpose of these two lamps are discussed in detail below.

RED BRAKE WARNING LAMP

The Red Brake Warning Lamp, located in the instrument cluster, will Turn On to warn the driver of brake system conditions that may result in reduced braking ability. The lamp is also turned on when the parking brake is not fully released. Conditions which may cause the Red Brake Warning Lamp to Turn On include:

- Parking brake not fully released. If the parking brake is applied or not fully released. The switch on the parking brake pedal assembly will ground the Red Brake Warning Lamp circuit and cause the lamp to turn on. On vehicles equipped with mechanical instrument clusters, the Amber Anti-Lock Lamp will turn on if the vehicle is driven above 3 miles per hour with the Parking Brake applied.
- Low brake fluid. The fluid level sensor in the hydraulic assembly reservoir will ground the Red Brake Warning Lamp circuit if low brake fluid level is detected. In addition, ABS will be deactivated above 3 miles per hour and the Amber Anti-Lock Warning Lamp will be illuminated. If the vehicle is equipped with EVIC, a low fluid condition will also cause the Low Brake Fluid message to appear.
- Low Accumulator Pressure. In the event of low accumulator pressure, the dual function pressure switch in the hydraulic assembly will signal the (CAB) to ground the Red Brake Warning Lamp circuit. This will cause the Red Brake Warning Lamp to turn on. Low accumulator pressure also results in the activation of the Yellow Anti-Lock Warning Lamp. Low accumulator pressure may result in loss of power assist.
- Modulator Or (CAB) Faults. The modulator assembly or (CAB) may turn on the Yellow Anti-Lock Warning Lamp, if certain faults are detected in either the modulator assembly or the (CAB).
- Bulb check. As a bulb check, the Red Brake Warning Lamp will illuminate whenever the ignition switch is placed in the crank position.

Illumination of the red Brake Warning Lamp may indicate reduced braking ability. A vehicle that has the Red Brake Warning Lamp ON should not be driven except to do diagnostic procedures described in Section 2 of this manual. Most conditions that turn on the Red Brake Warning Lamp will also turn on the Amber Anti-Lock Warning Lamp, consequently disabling the Anti-Lock function.

ANTI-LOCK WARNING LAMP

The Anti-Lock Warning Lamp is located in the instrument cluster and is Amber in color. The Amber Anti-Lock Warning Lamp is illuminated when the (CAB) detects a condition that results in a shutdown of Anti-Lock function. The Amber Anti-Lock Warning Lamp is normally on until the (CAB) completes its self tests and turns the lamp off. For example, if the (CAB) is disconnected, the lamp is on.

Display of the Amber Anti-Lock Warning Lamp without the Red Brake Warning Lamp indicates only that Anti-Lock function has been disabled. Power assisted normal braking is unaffected.

NORMAL OPERATION OF WARNING LAMPS

With the ignition in the Crank position, the Red Brake Warning Lamp will turn on as a bulb check. The Amber Anti-Lock Warning Lamp will turn on for as little as 1 second to as long as 30 seconds.

If the car has not been started for several hours, for example after sitting overnight. The Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp may both be turned on for as long as 60 seconds after turning the ignition on. This condition is caused by the loss of accumulator charge when the vehicle is parked for extended periods, particularly in cold weather. When the key is then turned on. The Pump/Motor assembly must recharge the hydraulic accumulator to its normal operating pressure. As recharging is completed, both warning lamps will turn off when accumulator pressure reaches about (1,000 psi). Both lamps should remain off at all other times, indicating normal operation.

ANTI-LOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the Anti-Lock Brake System components. For information on servicing the other Non-ABS related components that may be referred to in this section. See the Standard Brakes Section that refers to the specific component.

HYDRAULIC ASSEMBLY

The ABS system uses an integral Hydraulic Assembly (Fig. 1). The hydraulic assembly includes a Booster/Master Cylinder, Modulator, Hydraulic Bladder Accumulator and Fluid Reservoir. The Hydraulic Assembly is located on the dash panel cowl on the drivers side of the vehicle. The following is a description of the components that make up the Hydraulic Assembly.

HYDRAULIC ASSEMBLY BRAKE FLUID RESERVOIR

A one piece Fluid Reservoir is attached to the hydraulic assembly with rubber seals. The Fluid Reservoir (Fig. 1) is internally separated into three fluid sections. Most of the brake fluid is contained in the Fluid Reservoir and hydraulic bladder accumulator (Fig. 1). Additional fluid is contained in the pump/motor assembly accumulator.

BOOSTER/MASTER CYLINDER

The Booster/Master Cylinder portion of the hydraulic assembly is an integral component and should never be disassembled.

The Booster/Master Cylinder uses a diagonally split configuration during normal braking. The two

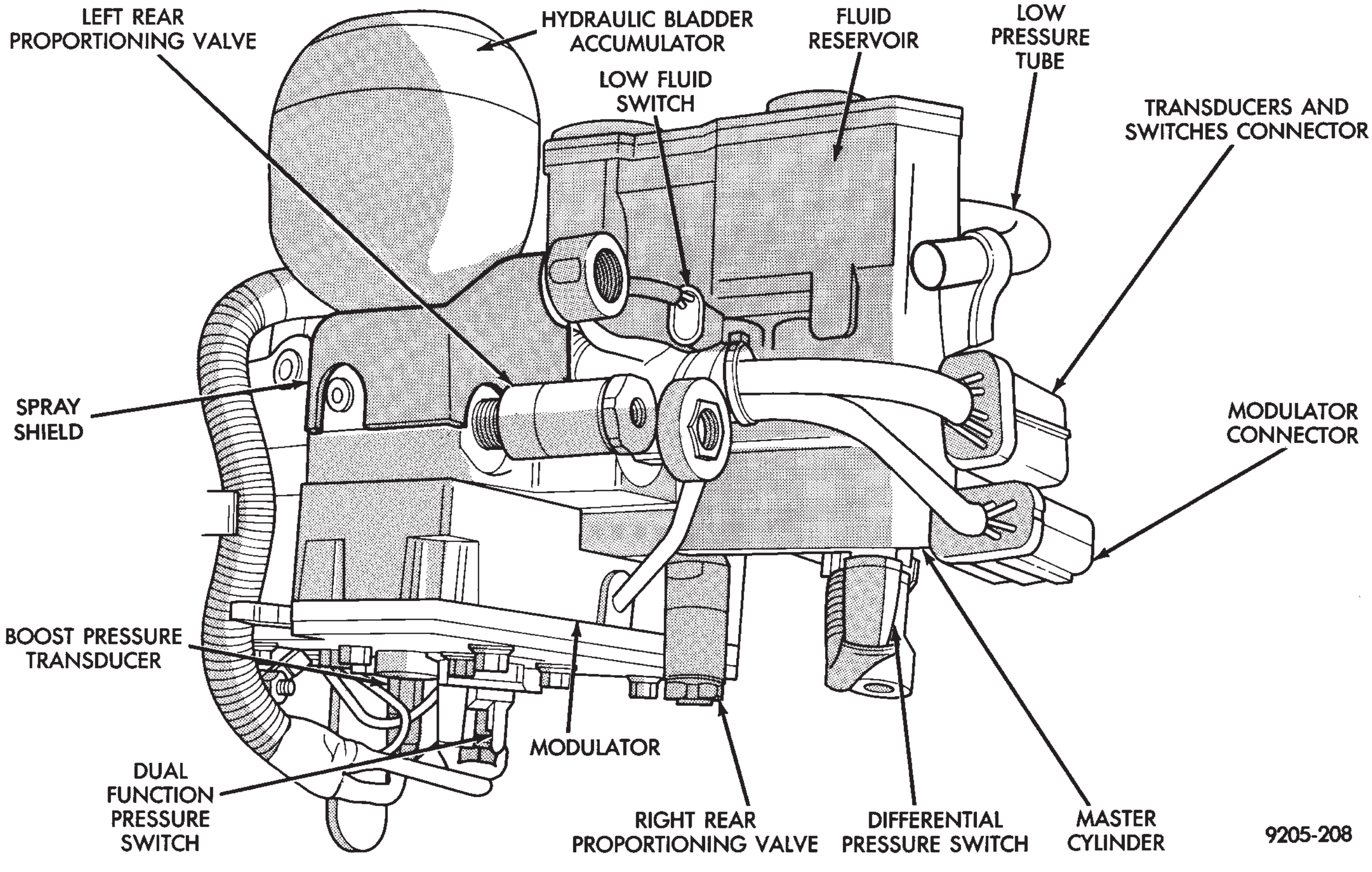


Fig. 1 Hydraulic Assembly

circuits are hydraulically isolated so a leak or malfunction in one circuit will allow continued braking ability in the other.

When force is applied to the brake pedal, the input pushrod applies force to the boost control valve. As the boost control valve is moved, it allows the pressurized fluid from the accumulator to flow into the master cylinder booster chamber. The pressure generated in the booster chamber is directly proportioned to the brake pedal force exerted by the driver. This pressure in the booster servo in turn applies pressure to the primary master cylinder piston that in turn applies pressure to the secondary master cylinder piston. The pressure generated in the primary and secondary circuits are used to apply the brakes during normal braking.

WARNING: THE HYDRAULIC ACCUMULATORS CONTAIN BRAKE FLUID AND NITROGEN GAS AT HIGH PRESSURE. CERTAIN PORTIONS OF THE BRAKE SYSTEM ALSO CONTAIN BRAKE FLUID AT HIGH PRESSURE. REMOVAL OR DISASSEMBLY MAY RESULT IN PERSONAL INJURY AND IMPROPER SYSTEM OPERATION. REFER TO THE APPROPRIATE SERVICE MANUAL FOR PROPER SERVICE PROCEDURES.

HYDRAULIC BLADDER ACCUMULATOR

A Hydraulic Bladder Accumulator (Fig. 2) is used to store brake fluid at high pressure. The pressurized fluid is used for Anti-Lock operation and for power assisted normal braking. The accumulator uses an elastomeric bladder configuration with a nitrogen pre-charge of about 6,895 kPa (1,000 psi.) With no brake fluid in the system, the nitrogen gas precharge applies approximately 6,895 kPa (1,000 psi.) to one side of the diaphragm (Fig. 2)

Under normal operation, the Pump/Motor assembly charges the accumulator to an operating pressure of between 11,032 and 13,790 kPa (1600 psi to 2,000 psi.) As pressurized brake fluid enters the accumulator, pushing against the opposite side of the diaphragm, (Fig. 2) the nitrogen gas is compressed and increases in pressure.

DUAL FUNCTION PRESSURE SWITCH

The Dual Function Pressure Switch is located on the bottom of the hydraulic assembly (Fig. 1) and monitors Accumulator Pressure. The Dual Function Pressure Switch, if found to be functioning improperly using the ABS diagnostics, can be replaced. See service procedure in Electronic Components area of On Car ABS Service in this section of the service manual. The primary function is to control operation of the Pump/Motor assembly and thus maintain proper accumulator operating pressure. When accumulator pressure falls to or below 11,032 kPa (1600 psi.) the pump motor switch (internal to the dual function pressure switch) will close. This provides a ground, through Pin 1 of the Transducer and Switch, 10 way electrical connector to the Pump/Motor relay coil. The energized coil pulls the relay contacts closed, providing battery voltage to run the Pump/Motor. When Accumulator Pressure reaches 13,790 kPa (2,000 psi.) the switch opens, de-energizing the Pump/Motor Relay that turns off the Pump/Motor.

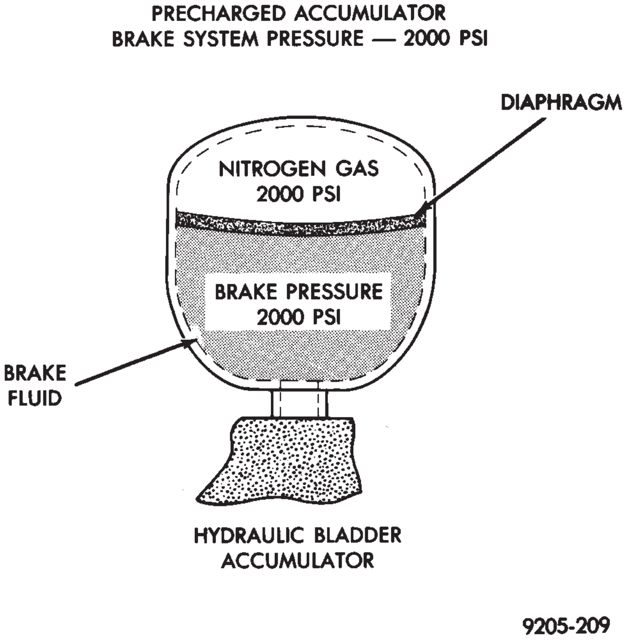


Fig. 2 Hydraulic Fluid Accumulator

NOTE: THE (CAB) DOES NOT REGULATE OR CONTROL ACCUMULATOR PRESSURE.

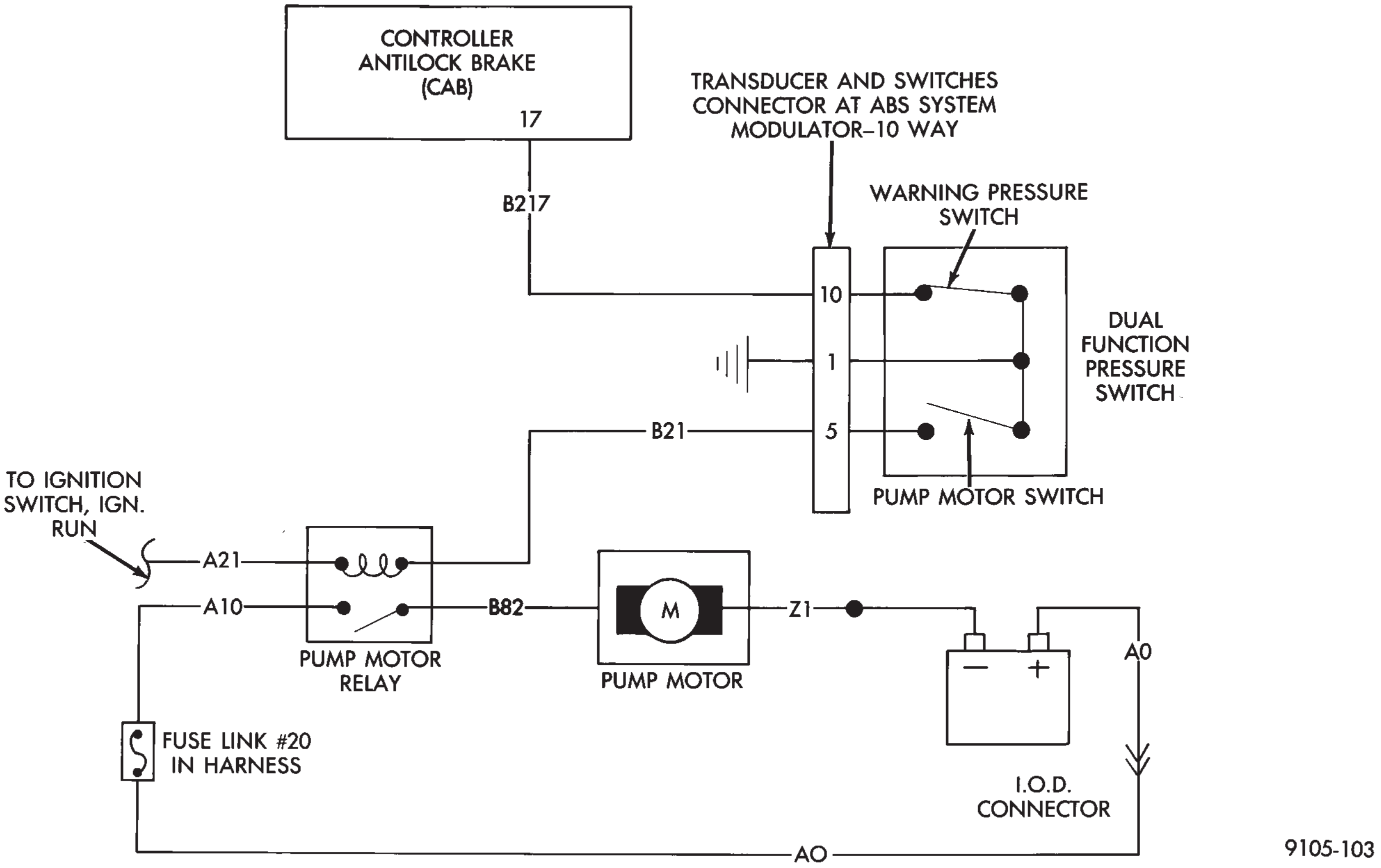
The second purpose of the Dual Function Pressure Switch is to provide a signal to the (CAB) when the Accumulator Pressure falls below 6,895 kPa (1,000 psi). A Warning Pressure Switch, internal to the Dual Function Pressure Switch, is normally closed above 6,895 kPa (1,000 psi.) This sends a ground signal to pin 17 at the (CAB). At or below 6,895 kPa (1,000 psi.) the Warning Pressure Switch opens. Internally, the (CAB) (pin 17) detects 12 volts and thus low pressure. At this warning pressure, the (CAB) will disable the Anti-Lock Braking functions, light the Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp. After two minutes of continuous detection, a low accumulator fault is stored.

Grounding for the Dual Function Pressure Switch. Is provided through Pin 1 of the Transducer and Switch, 10 way electrical connector and the Modulator Assembly.

PRESSURE TRANSDUCERS

Two Pressure Transducers are used for brake system fault detection. Both transducers generate a voltage signal (between 0.25 volts and 5.0 volts) that is proportional to pressure. These signals are com-

DUAL FUNCTION PRESSURE SWITCH WIRING DIAGRAM



pared by the (CAB) and used to detect brake system faults that would require Anti -Lock Braking to be disabled.

The Boost Pressure Transducer is mounted on the bottom of the hydraulic assembly, (Fig. 1) and monitors booster servo pressure. The Primary Pressure Transducer is mounted on the left side of the hydraulic assembly and monitors primary master cylinder pressure.

DIFFERENTIAL PRESSURE SWITCH

A non-latching Differential Pressure Switch is used to detect a pressure difference greater than 2,068 kPa (300 psi.) between the primary and secondary master cylinder hydraulic circuits. If detected, the Differential Pressure Switch grounds the output of the primary pressure transducer (circuit B-218). This results in a 0.0 volt signal from the Primary Pressure Transducer that is sensed by the (CAB) as a differential pressure fault. The (CAB) will then light the Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp and disable the Anti-Lock braking function. See Fig. 1 for location of the differential pressure switch.

PROPORTIONING VALVES

The ABS system uses screw-in Proportioning Valves in place of the conventional Height Sensing Proportioning Valve. Each rear brake circuit has its own screw-in Proportioning Valve that is attached to the rear brake outlet ports of the hydraulic assembly (Fig. 1). These valves limit brake pressure to the rear brakes after a certain brake pressure is reached. This improves front to rear wheel brake balance during normal braking.

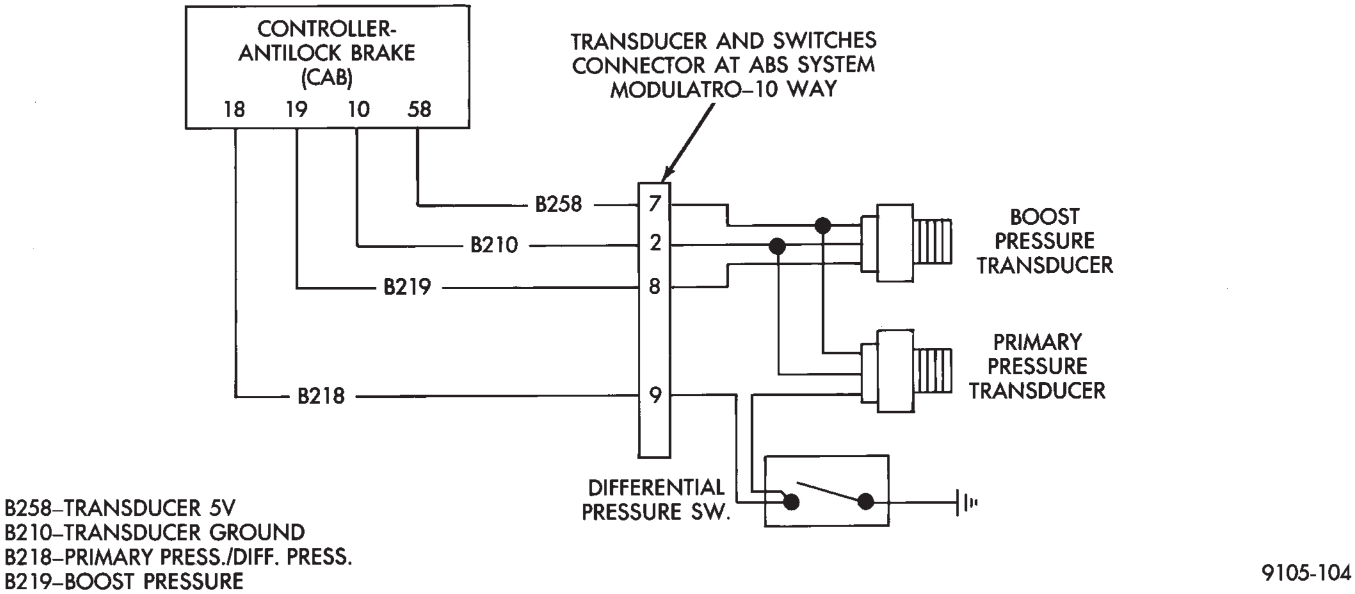
FILTERS-SERVICEABILITY

There is a screen filter in each of the two master cylinder fill ports. There is also a low pressure filter for the pump/motor. The filter is integral to the Pump/Motor low pressure hose.

FLUID LEVEL SWITCH

A Low Fluid Switch is located in the hydraulic assembly fluid reservoir, (Fig. 1). The switch consists of a float and magnetic reed switch that closes when low fluid is detected. The Low Fluid Switch is used as an input, to the Red Brake Warning Lamp, the (CAB), and the EVIC (if so equipped). When a low fluid condition exists the switch will close, grounding the low fluid circuit and illuminating the Red Brake Warning Lamp. The (CAB) will disable the Anti-Lock Function and light the Amber Anti-Lock Warning Lamp if vehicle is in motion above 3 mph. If vehicle is not in motion, the Amber Anti-Lock Warning Lamp will NOT be lit.

PRESSURE SWITCH AND PRESSURE TRANSDUCER WIRING



PUMP/MOTOR ASSEMBLY

NOTE: The (CAB) does not control the operation of the pump/motor assembly.

The Pump/Motor Assembly is mounted to the transaxle below the hydraulic assembly,(Fig. 3). Integral to the Pump/Motor Assembly is an accumulator using a sliding piston configuration with a nitrogen pre-charge of 3,172 kPa (460 psi.) The Pump/Motor is an electrically driven pump that takes low pressure brake fluid from the hydraulic assembly fluid reservoir and pressurizes it. The pressurized fluid is then stored in the piston accumulator and hydraulic bladder accumulator for power assist and Anti-Lock Braking. Operation of the Pump/Motor is controlled by the Dual Function Pressure Switch through the Pump/Motor Relay. **The (CAB) does NOT control the Pump/Motor activation.** Rubber isolators are used to mount the pump to its bracket for noise isolation. The Pump/Motor Assembly is connected to the Hydraulic Assembly with a low pressure return hose and a high pressure hose. A filter is located in the low pressure return line.

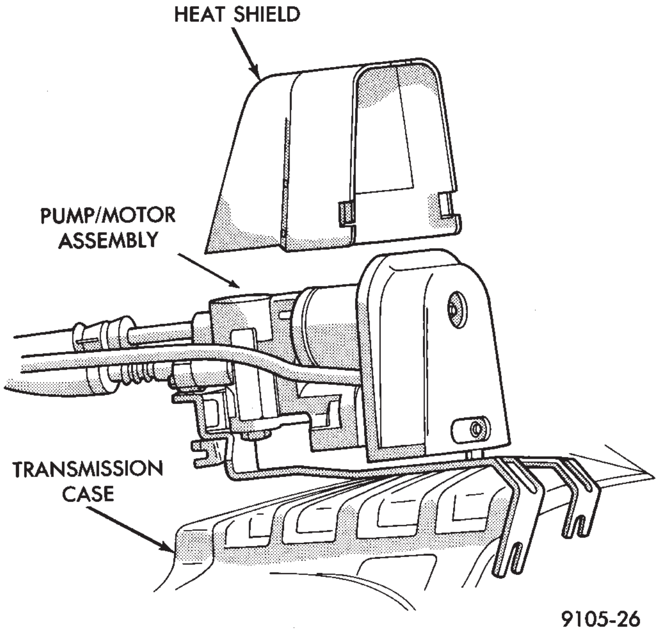


Fig. 3 Pump/Motor Assembly And Heat Shield

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS), is located at each wheel (Fig. 4, 5 and 6) and sends a small (AC) electrical signal to the control module (CAB). This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (Tone Wheel) passes by the stationary magnetic (Wheel Speed Sensor). The (CAB) converts the (AC) electrical signal generated at each wheel into a digital signal. If a wheel locking tendency is detected, the (CAB) will then modulate hydraulic pressure to prevent the wheel(s) from locking.

The front Wheel Speed Sensor (Fig. 4) is mounted to a boss on the steering knuckle, for both the Front Wheel Drive and All Wheel Drive applications. The Tone Wheel is part of the outboard constant velocity joint housing.

The Rear Wheel Speed Sensor, is mounted to the caliper mounting adapter (Fig. 5). The rear Tone Wheel is an integral part of the rear disc brake rotor hub (Fig. 6).

The speed sensor, to tone wheel air gap on all applications is NOT adjustable.

All 4 of the vehicles, Wheel Speed Sensors are serviced individually as replaceable components.

The Front Wheel Drive front Tone Wheels are serviced as an assembly with the front outboard con-

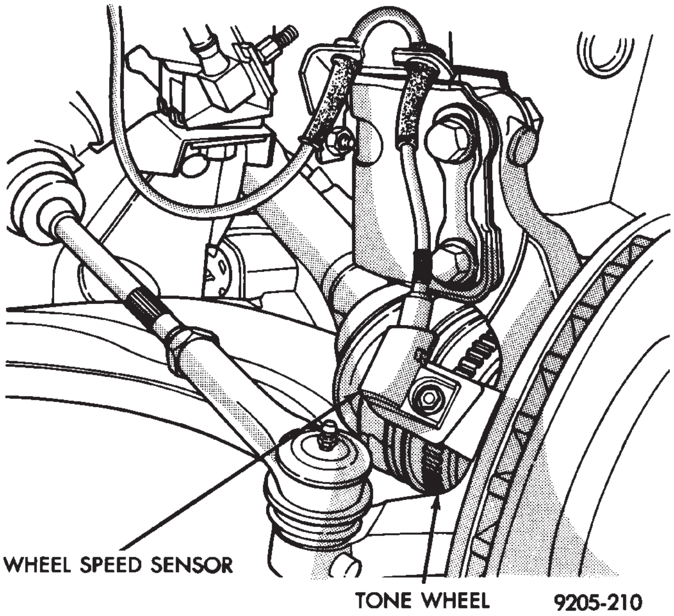


Fig. 4 Front Wheel Speed Sensor

stant velocity joint housings. The rear Tone Wheels are serviced as an assembly with the rear disc brake rotor hub.

Correct Anti-Lock System operation is dependent on wheel speed signals from the wheel speed sensors. The vehicles' wheels and tires must all be the same size and type to generate accurate signals. In addition, the tires must be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals.

CONTROLLER ANTI-LOCK BRAKE (CAB)

The Anti-Lock Brake Controller is a small microprocessor based device that monitors the brake system and controls the system while it functions in Anti-Lock Mode. The CAB is located under the battery tray and is mounted to the left frame rail (Fig. 7) and uses a 60-way system connector. The power source for the CAB is through the ignition switch to pin 60 of the controller. With the ignition in the RUN or ON position. **IF THE (ABS) CONTROLLER NEEDS TO BE REPLACED BE SURE THE CORRECT CONTROLLER IS USED. THE CONTROLLER ANTI-LOCK BRAKE (CAB) IS NOT ON THE CCD BUS**

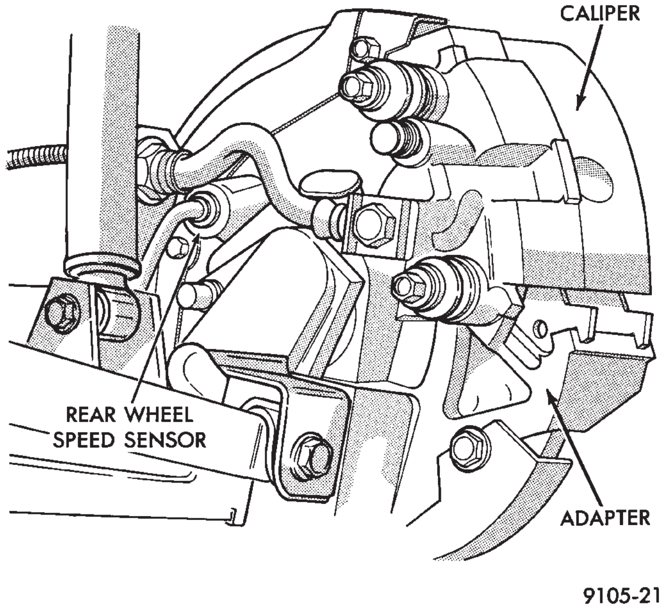


Fig. 5 Rear Wheel Speed Sensor

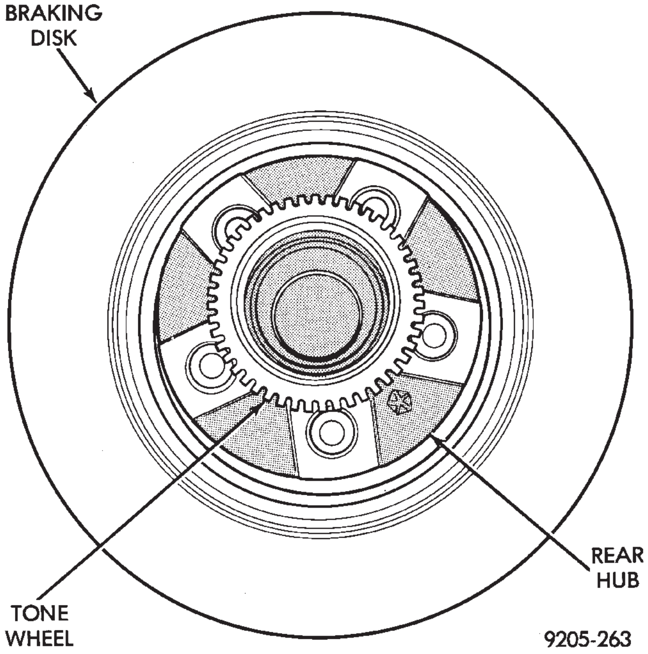


Fig. 6 Rear Tone Wheel

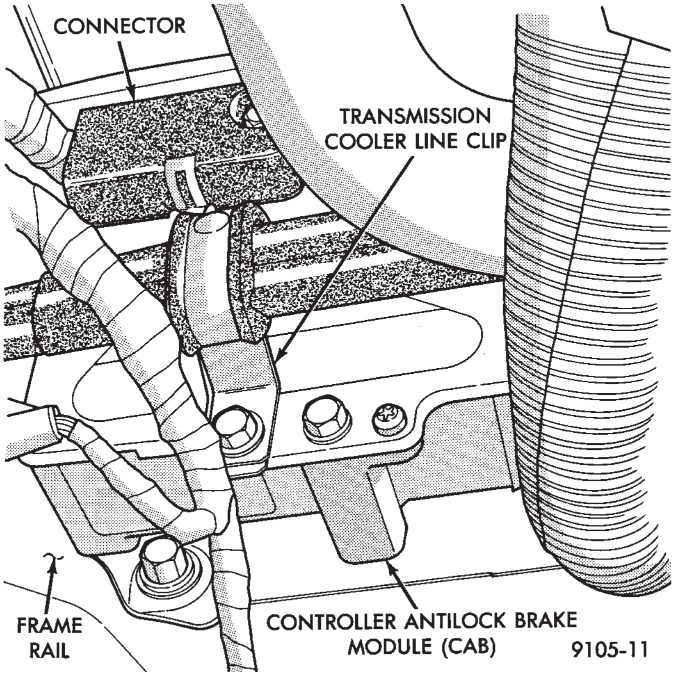
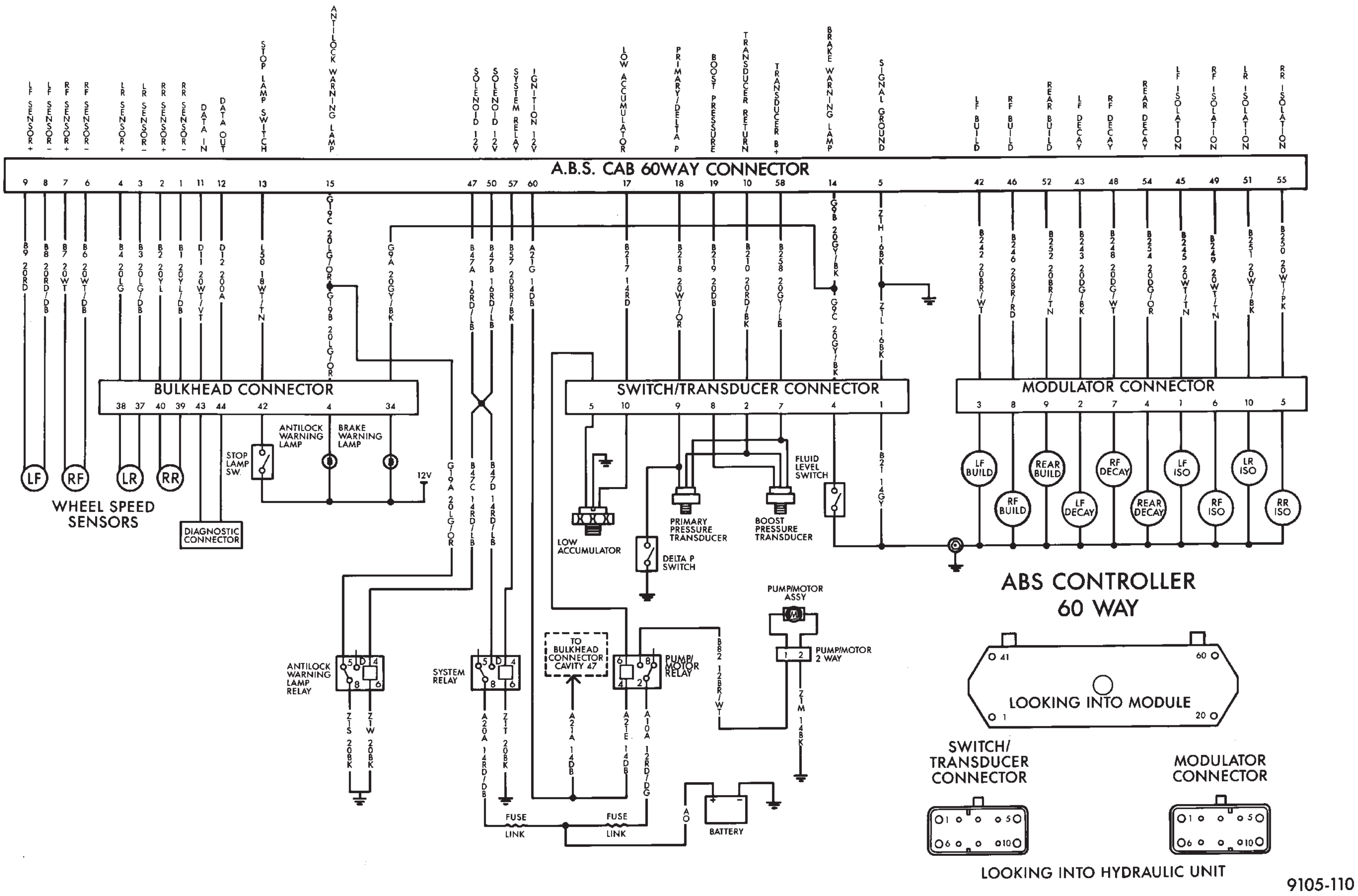


Fig. 7 Location Controller Anti-Lock Brake (CAB)



ABS SYSTEM WIRING SCHEMATIC

The primary functions of the (CAB) are:

- (1) Detect wheel locking tendencies.
- (2) Control fluid modulation to the brakes while in Anti-Lock mode.
- (3) Monitor the system for proper operation.
- (4) Provide communication to the DRB II while in diagnostic mode.

The (CAB) continuously monitors the speed of each wheel, through the signals generated at the Wheel Speed Sensors, to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the (CAB) will isolate the master cylinder from the wheel brakes. This is done by activating the Isolation Valves. The (CAB) then commands the appropriate Build or Decay valves to modulate brake fluid pressure in some or all of the hydraulic circuits. The fluid used for modulation comes from the booster servo circuit. 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 can disable the Anti-Lock braking function. Depending on the fault, the (CAB) will light one or both of the brake warning lamps.

The (CAB) contains a System Diagnostic Program which triggers the brake system warning lamps when a system fault is detected. Faults are stored in a diagnostic program memory. There are 19 fault codes that may be stored in the (CAB) and displayed through the DRB II. These fault codes will remain in the (CAB) memory even after the ignition has been turned off. These fault codes will remain in memory until they are cleared with the DRB II, or automatically erased from the memory after (50) ignition switch on/off cycles.

CONTROLLER ANTI-LOCK BRAKE (INPUTS)

- Four wheel speed sensors.
- Boost pressure transducer.
- Primary pressure transducer.
- Low fluid level switch.
- Differential pressure switch.
- Parking brake switch.
- Dual function pressure switch (warning pressure only)
- Stop lamp switch.
- Ignition switch.
- System relay voltage.
- Ground.
- Low Accumulator

CONTROLLER ANTI-LOCK BRAKE (OUTPUTS)

- Ten modulator valves-3 decay, 3 build and 4 isolation.
- Red Brake warning lamp.
- Amber Anti-Lock Warning Lamp.
- System relay actuation.
- Diagnostic communication.

ABS SYSTEM DIAGNOSTIC CONNECTOR

The Bendix Anti-Lock system diagnostic connector is located under the lower dash panel or in the area of the fuse box (Fig. 8). The fuse box is located behind the access panel that is on the bottom portion of the dash panel, left of the steering column. The diagnostics connector is a blue 6 way connector.

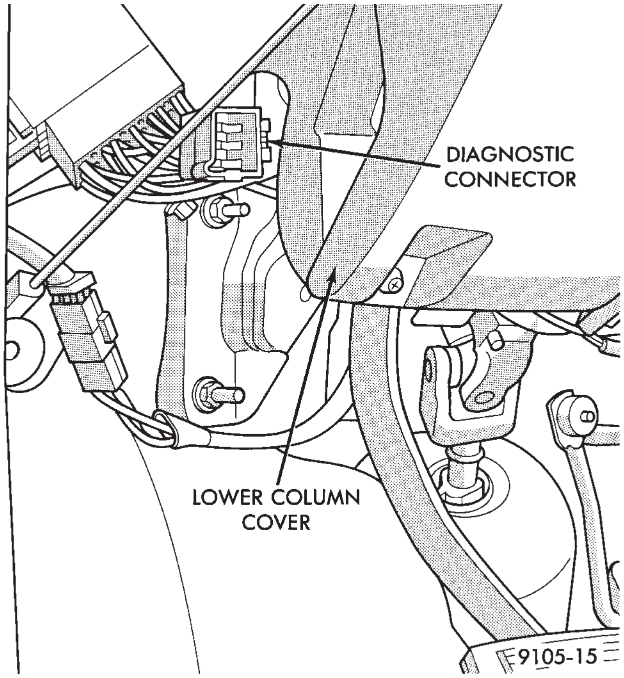


Fig. 8 A.B.S. Diagnostic Connector Location

ANTI-LOCK SYSTEM RELAYS AND WARNING LAMPS

PUMP/MOTOR RELAY

Pump/Motor power is supplied by the Pump/Motor Relay. The Pump/Motor relay is located inside the Power Distribution Center (PDC). The relay coil is energized by a ground from the Dual Function Pressure Switch. See (Fig. 9) for the location of the pump/motor relay in the (PDC).

SYSTEM RELAY

The (ABS) Modulator Valves and Anti-Lock Warning Lamp Relay are controlled through a System Relay. The System relay is located on the top left inner fender behind the headlight (Fig. 10). The system relay provides power to the (CAB) for modulator valve operation (pins 47 and 50) after the start-up cycle when the ignition is turned on.

ANTI-LOCK WARNING LAMP RELAY

The Anti-Lock Warning Lamp is controlled by the Yellow Light Relay. See (Fig. 10) for location behind the left headlight. With the relay de-energized, the lamp is lit. When the system relay is energized by the (CAB), the Anti-Lock Warning Lamp relay is energized, and the lamp is turned off. Thus, the lamp will be lit if the (CAB) is disconnected or if a system fault causes (ABS) function to be turned off, or if the system relay fails open.

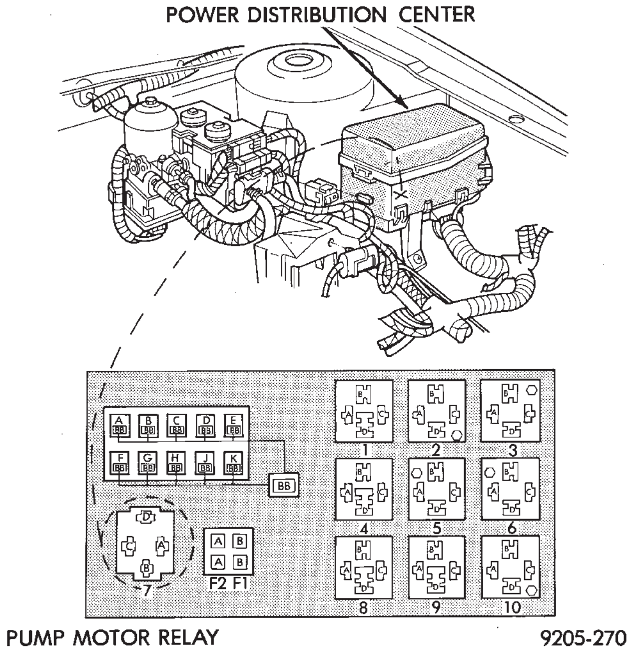


Fig. 9 Pump/Motor

ANTI-LOCK WARNING LAMP OFF

System Relay (normally open) and Yellow Light Relay (normally closed) Energized.

When the (CAB) energizes the system relay by providing 12 volts to pin 57. The voltage flow in the coil closes the system relay. Electrical current is then provided to pins 47 and 50 of the (CAB) to provide power to the modulator valves. This voltage also energizes the Anti-Lock Warning Lamp Relay Switch. This breaks the ground path to the Anti-Lock Warning Lamp and the lamp is turned off.

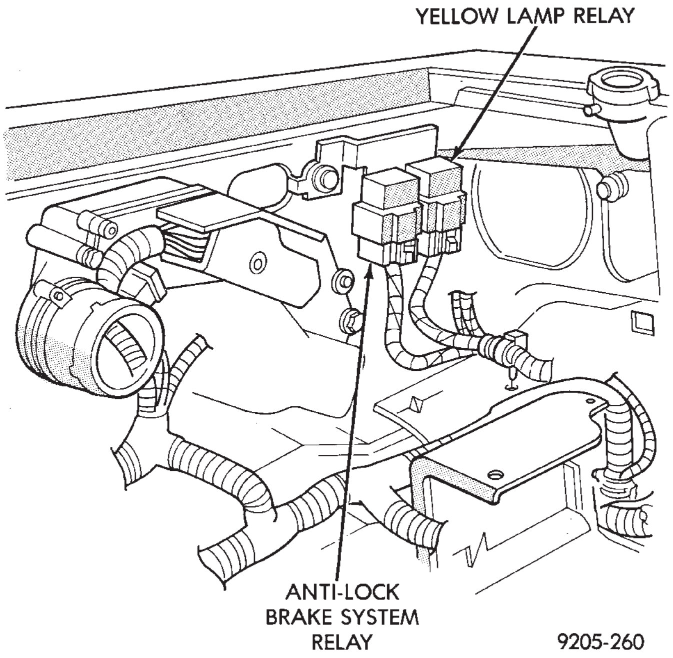


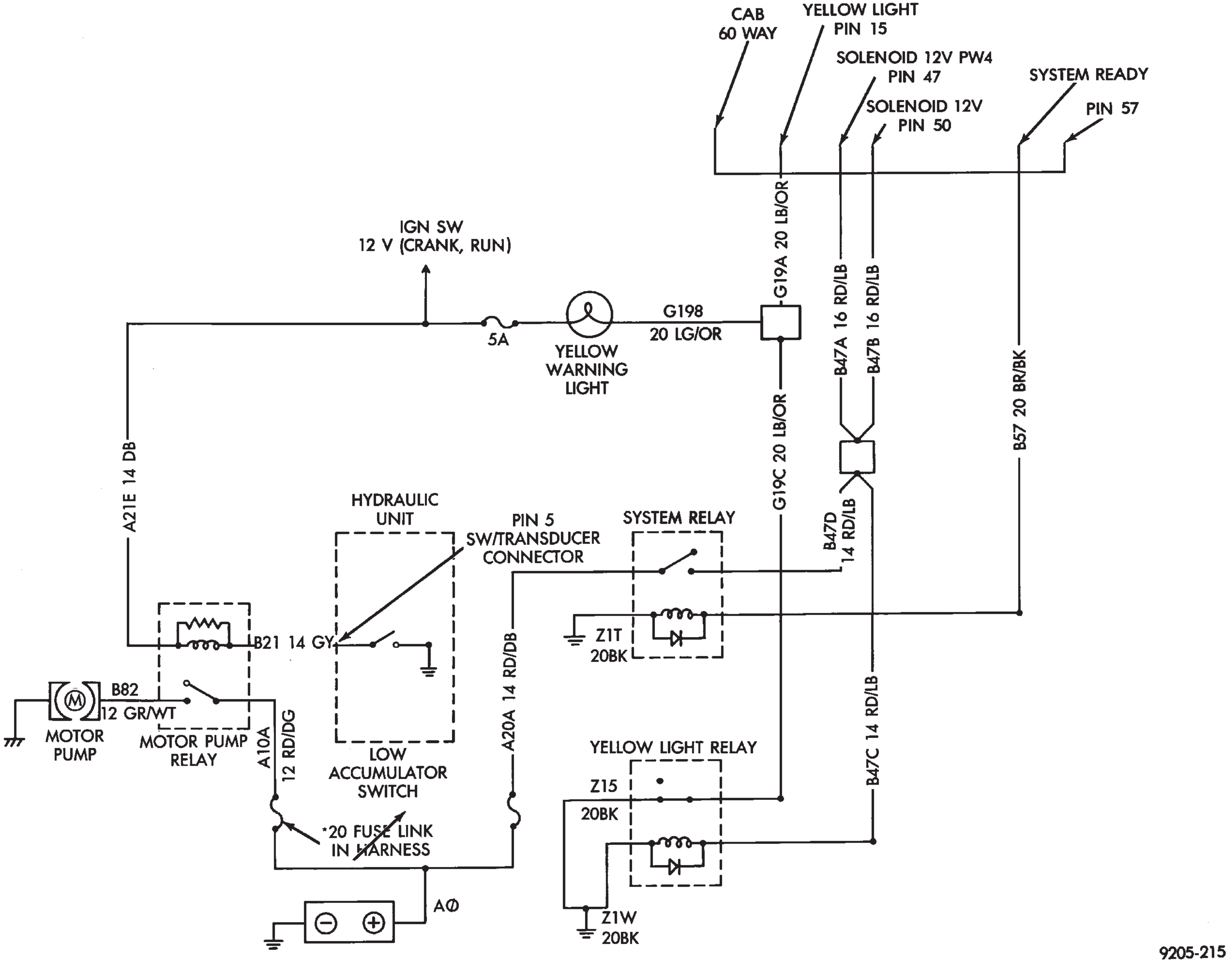
Fig. 10 ABS System Relay And Yellow Lamp Relay Location

The (CAB) by itself, also can turn on the Anti-Lock Warning Lamp. The (CAB) can turn on the Anti-Lock Warning Lamp by providing a ground at pin 15.

ANTI-LOCK WARNING LAMP ON

System Relay and Anti-Lock Warning Lamp Relay De-Energized.

When the Amber Anti-Lock Warning Lamp is on, there is no current flow from the (CAB) at pin 57. The system relay coil is NOT energized. No electrical current flows to pins 47 and 50 (modulator valve power), or to the Anti-Lock Warning Lamp relay coil. Thus, the Anti-Lock Warning Lamp Relay is not energized. The Anti-Lock Warning Lamp is grounded through the Anti-Lock Warning Lamp relay contacts. The Anti-Lock Warning Lamp is illuminated.



ANTI-LOCK SYSTEM RELAY WIRING SCHEMATIC

ABS HYDRAULIC CIRCUITS AND VALVE OPERATION

Through the following operation descriptions and diagrams. The function of the various hydraulic control valves in the ABS system 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 Anti-Lock Braking.

NORMAL BRAKING

ISOLATION VALVES

Open to primary and secondary master cylinder brake fluid supply (Fig. 11)

DECAY AND BUILD VALVES

Closed, not allowing for the build-up or release of brake fluid supply (Fig. 11).

The brake pedal is applied. The travel of the brake pedal closes primary, secondary and booster servo circuits from fluid supply at the fluid reservoir. Brake fluid from the primary and secondary circuits flows through the open isolation valves and applies the wheel brakes. Fluid from the booster servo circuit does not flow to the wheel brakes. The fluid flow is blocked by the closed build valves and check valves.

POWER ASSIST

The boost control valve shuttles between its three positions to provide power assisted braking (Fig. 11).

ABS BRAKING-BUILD PRESSURE

ISOLATION VALVES

Closed, isolating wheel brakes from master cylinder primary and secondary fluid supplies and open to booster servo circuit pressure through open build valves (Fig. 12)

DECAY VALVES

Closed, not allowing the escape of pressurized fluid supply from the hydraulic system (Fig. 12).

BUILD VALVES

Open, allowing booster servo circuit pressure to flow to the wheel brakes through the isolation valves (Fig. 12).

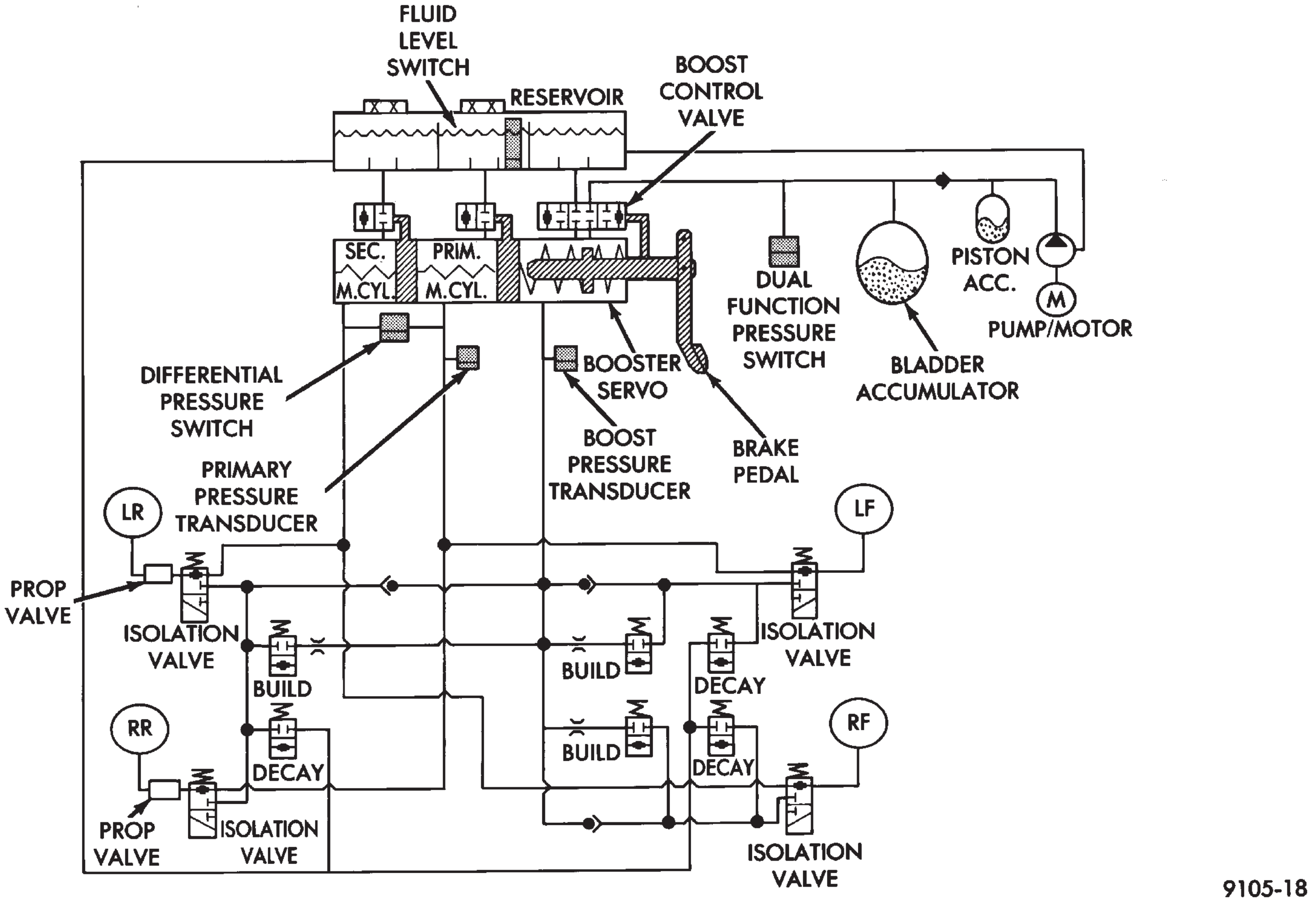


Fig. 11 Normal Braking - Hydraulic Control

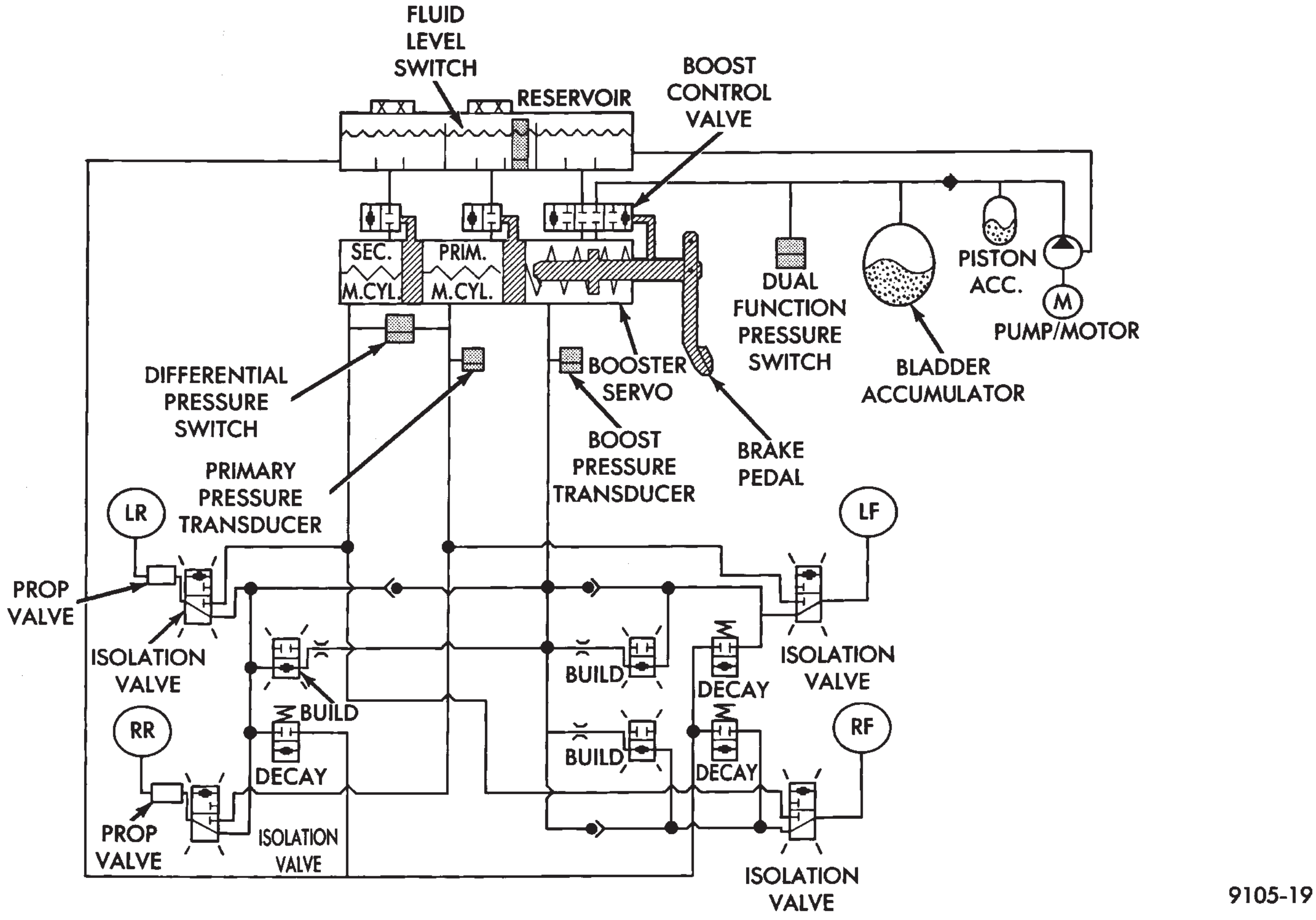


Fig. 12 Build Pressure - Hydraulic Control

POWER ASSIST

The boost control valve shuttles between its three positions to provide power assisted braking (Fig. 12).

ABS BRAKING-HOLD PRESSURE

For explanation purposes we will assume all speed sensors are sending the same wheel speed information, requiring the same modulation at the same rate.

ISOLATION VALVES

Closed, isolating the wheel brakes from the master cylinder primary and secondary fluid supplies. Build and decay valves are closed preventing any fluid from reaching the open isolation valves (Fig. 13).

DECAY AND BUILD VALVES

Closed, not allowing fluid supply to reach the open isolation valves (Fig. 13).

ABS BRAKING-DECAY PRESSURE

ISOLATION VALVES

Closed, isolating the wheel brakes from the master cylinder primary and secondary fluid supplies (Fig. 14)

DECAY VALVES

Open, allowing release of fluid pressure through decay valve to the fluid reservoir (Fig. 14)

BUILD VALVE

Closed, blocking booster servo circuit fluid to wheel brakes (Fig. 14).

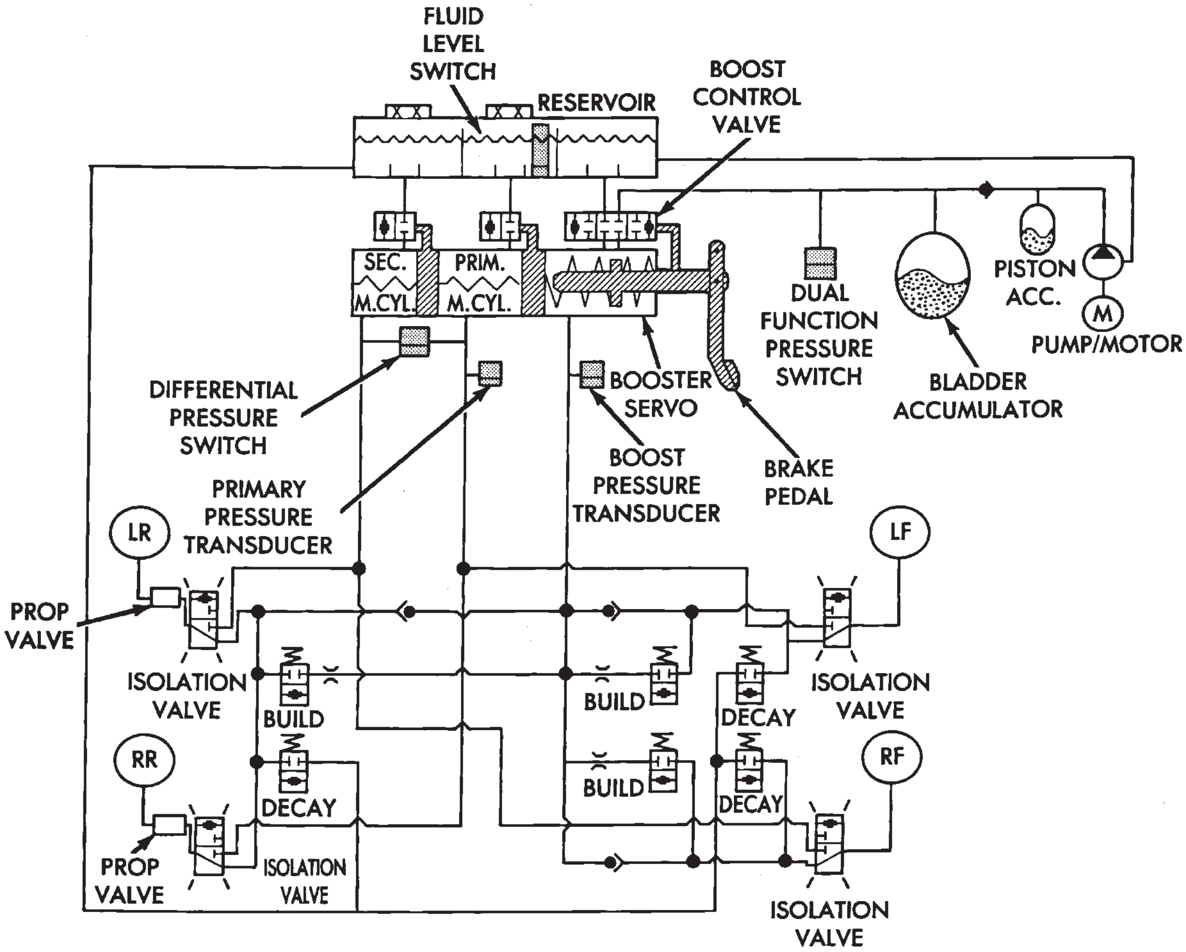


Fig. 13 Hold Pressure - Hydraulic Control

ABS BRAKING SYSTEM DIAGNOSIS

WARNING: SOME OPERATIONS IN THIS SECTION REQUIRE THAT HYDRAULIC TUBES, HOSES AND FITTINGS BE DISCONNECTED FOR INSPECTION OR TESTING PURPOSES. THIS BRAKE SYSTEM USES A HYDRAULIC ACCUMULATOR THAT, WHEN FULLY CHARGED, CONTAINS BRAKE FLUID AT HIGH PRESSURE. BEFORE DISCONNECTING ANY HYDRAULIC TUBE, HOSE OR FITTING. BE SURE THAT THE ACCUMULATOR IS FULLY DE-PRESSURIZED AS DESCRIBED IN THIS SECTION. FAILURE TO DE-PRESSURIZE THE ACCUMULATOR MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

CAUTION: Certain components of the Anti-Lock Brake System (ABS) are not intended to be serviced individually. Attempting to remove or disconnect certain system components, may result in personal injury and/or improper system operation. Only those components with approved removal, service and installation procedures described in this manual should be serviced.

GENERAL INFORMATION

This section contains information necessary to diagnosis mechanical conditions that can affect operation of the Bendix Anti-Lock 10 Brake System. Specifically, this section should be used to help diagnose mechanical conditions that result in any of the following:

CAUTION: Review this entire section before performing any mechanical work on a vehicle equipped with the Bendix Anti-Lock 10 brake system. For information on precautions pertaining to potential component damage, vehicle damage and personal injury.

(1) Anti-Lock warning lamp illuminated
(2) BRAKE warning lamp on
(3) Lack of Power Assist or Excessive Pedal Travel
(4) Brakes Lock on Hard Application

Diagnosis of conditions that are obviously mechanical in nature. Such as brake noise, brake pulsation, or vehicle vibration during normal braking. Should be directed to Group 5 Brakes in the service manual. This also pertains to problems involving the parking brake system.

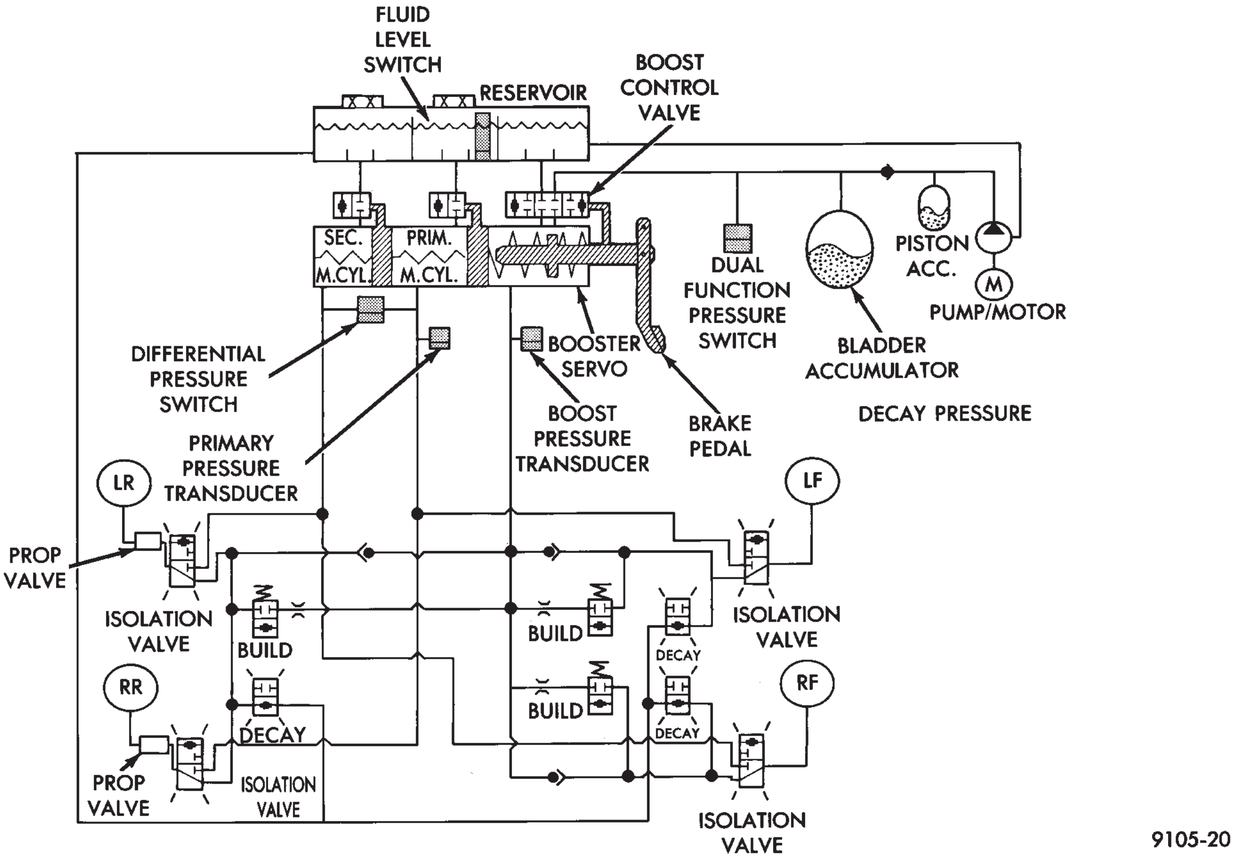


Fig. 14 Decay Pressure - Hydraulic Control

In order to effectively diagnose an Anti-Lock Brake System (ABS) condition. It is important to read Section 1 of this manual, Anti-Lock Brake System Description. This section will give you information on the function of the ABS components. Then follow the diagnostic procedures outlined in this section.

Many conditions that generate customer complaints of the ABS system may be normal operating conditions. These conditions though are judged to be a problem due to unfamiliarity with the ABS system. These conditions can be recognized without performing extensive diagnostic work, given adequate understanding of operating principles and performance characteristics of the ABS system. See Section 1 of this manual to familiarize yourself with the operating principles of the ABS system.

DEFINITIONS

Several abbreviations are used in this manual. They are presented here for reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

ABS CONTROLLER ANTI-LOCK BRAKE (CAB) SERVICE PRECAUTIONS

The ABS system uses an electronic control module, the (CAB). This module is designed to withstand normal current draws associated with vehicle operation. However 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 by the appropriate diagnostic procedure. These circuits should only be tested using a high impedance multi-meter, special tools or the DRB II 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.

ABS SYSTEM GENERAL SERVICE PRECAUTIONS

TEST DRIVING ABS COMPLAINT VEHICLES

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.

Before test driving a brake complaint vehicle, especially if the Red Brake Warning Lamp is on. Test the brake function at low speed to be sure that the car will stop normally. Remember that conditions that result in illumination of the Red

Brake Warning Lamp may indicate reduced braking ability. The following procedure should be used to test drive an ABS complaint:

(1) Ignition on. Turn the ignition to the ON position without starting the car and wait until the Red Brake Warning Lamp and Amber Anti-Lock Warning Lamp turn off. This will allow the pump to charge the accumulator to operating pressure. If the warning lamp(s) do not turn off, go to step 3.

(2) Ignition off for 15 seconds.

(3) Start car. Wait for displays to return to normal operating mode before proceeding.

(4) With Shift lever in PARK, slowly depress brake pedal and release.

(5) Drive vehicle a short distance. During this test drive, be sure that the vehicle achieves at least 20 mph. Then brake to at least one complete stop and accelerate slowly back up to at least 20 mph.

(6) If a functional problem with the A.B.S. system is determined while test driving a vehicle. Refer to the Bendix Anti-Lock 10 Diagnostics Manual for required test procedures and proper use of the DRB II tester.

CAUTION: The following are general precautions that should be observed when servicing and diagnosing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS system damage.

(1) If welding work is to be performed on the vehicle using an arc welder, the (CAB) should be disconnected before the welding operation begins.

(2) The (CAB) and hydraulic assembly 10 way connectors should never be connected or disconnected with the ignition on.

(3) Some components of the ABS system are not serviced separately and must be serviced as complete assemblies. Do not disassemble any component which is designated as non-serviceable.

(4) **Always de-pressurize the Hydraulic Accumulator when performing any work that requires disconnecting any hydraulic tube, flex hose or fitting. The ABS system uses brake fluid at high pressure. Failure to de-pressurize the accumulator may result in personal injury and/or damage to painted surfaces.**

Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

DE-PRESSURIZING HYDRAULIC ACCUMULATOR

The ABS pump/motor assembly keeps the hydraulic accumulator charged between approximately 11,032 and 13,790 kPa (1600 and 2000 psi) anytime key is in the ON position. The pump/motor assembly cannot run if the ignition is off or either battery cable is disconnected.

Unless otherwise specified, the hydraulic accumulator should be de-pressurized before disassembling any portion of the hydraulic system. The following procedure should be used to de-pressurize the hydraulic accumulator:

(1) With ignition off, or either battery cable disconnected, pump the brake pedal a minimum of 40 times using approximately 50 pounds of pedal force. A noticeable change in pedal feel will occur when the accumulator becomes discharged.

(2) When a definite increase in pedal effort is felt, pump the pedal a few additional times. This will insure removal of all hydraulic pressure from the brake system.

WHEEL SPEED SENSOR CABLES

Proper installation of wheel speed sensor cables is critical to continued ABS system operation. Be sure that cables are installed and routed properly. Failure to install cables in their retainers, as shown in Section 3 of this manual. May result in contact with moving parts or over extension of cables, resulting in an open circuit.

MECHANICAL DIAGNOSTICS AND SERVICE PROCEDURES

SPECIAL SERVICE TOOLS

Some diagnostic procedures in this section require the use of special service tools. Each of these tools is described below.

DRB II DIAGNOSTIC TESTER

Some of the diagnostic procedures that are explained in this section require the use of the DRB II DIAGNOSTICS TESTER to insure that proper diagnostics are performed. Refer to those sections for proper testing procedures and the DRB II manual for its proper operational information.

MST-6163 PRESSURE TESTER

Some diagnostic procedures in this manual require the use of the MST-6163 pressure gauge and adaptor (Fig. 2). Pressure Gauge, Special Tool MST-6163 is required to measure accumulator pressure during certain phases of ABS operation. The pressure gauge and adaptor should be installed as follows:

(1) De-pressurize the accumulator by pumping the brake pedal a minimum of 40 times with the ignition off. The procedure is fully explained under De-Pressurizing Hydraulic Accumulator which is described earlier in this System Diagnosis Section.

WARNING: FAILURE TO DE-PRESSURIZE THE ACCUMULATOR PRIOR TO PERFORMING THIS OPERATION MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove hydraulic assembly accumulator port plug,located on right hand side of hydraulic assembly (Fig. 1).

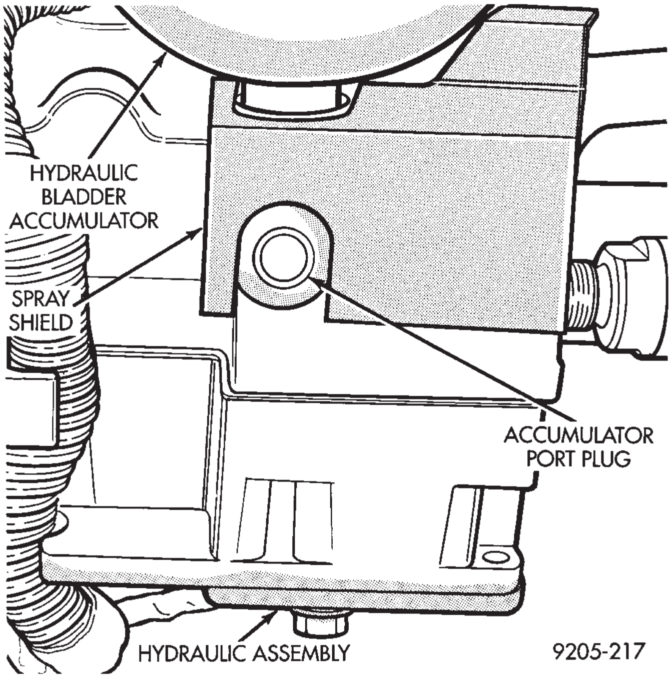


Fig. 1 Hydraulic Assembly Accumulator Port Plug Location

(3) Install pressure gauge to hydraulic assembly adaptor into accumulator port of hydraulic assembly (Fig. 2). Then torque adaptor to 10 N●m (7.5 ft. lbs.).

(4) Install adaptor onto the pressure gauge hose (Fig. 2) and tighten the fitting to 15 N●m (11 ft. lbs.) torque.

(5) Install pressure gauge and hose adaptor assembly onto the adaptor installed in the hydraulic assembly accumulator port. Then install the retaining clip into the grove on the accumulator port adaptor (Fig. 2). **MAKE SURE THAT THE RETAINING CLIP IS INSTALLED ON THE ACCUMULATOR PORT ADAPTOR BEFORE RE-PRESSURIZING THE HYDRAULIC SYSTEM.**

WARNING: BEFORE REMOVING PRESSURE GAUGE AND ADAPTOR, BE SURE TO DE-PRESSURIZE THE HYDRAULIC ASSEMBLY. THEN INSTALL AND TIGHTEN ACCUMULATOR PORT PLUG TO 12 N●M (9 FT. LBS.).

It is not necessary to bleed the hydraulic assembly or brake system after installation and removal of the pressure gauge. Unless additional tubes, hoses, or fittings were removed or loosened.

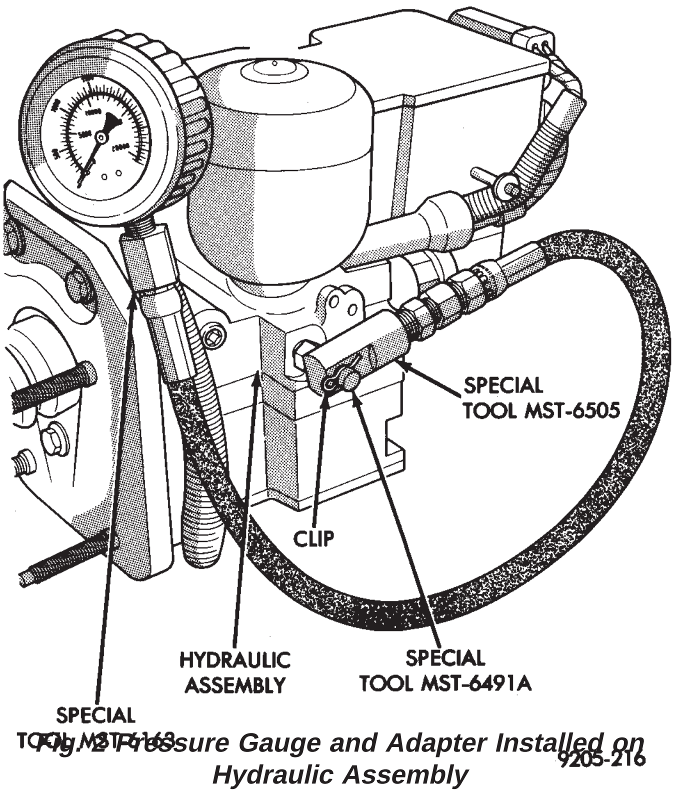


Fig. 2 Pressure Gauge and Adapter Installed on Hydraulic Assembly

HYDRAULIC ASSEMBLY INTERNAL LEAK CHECK

If an internal leak is suspected in the ABS hydraulic circuit, Test Gauge, Special Tool 6685 has been developed to assist in the diagnostics. This fixture will assist in determining if there is an internal leak; and if the leak is in the hydraulic unit or the pump motor assembly. It can be used whether the pump shuts off or not.

Test Gauge, Special Tool 6685 installation and operation procedure is detailed below. Refer to the Hydraulic Pressure Performance Test in the 1993 Bendix Anti-Lock 10 Diagnostic Manual for the required test procedures.

WARNING: FAILURE TO DE-PRESSURIZE THE ACCUMULATOR PRIOR TO PERFORMING THIS OPERATION MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(1) De-pressurize the accumulator by pumping the brake pedal a minimum of 40 times with the ignition off. The procedure is fully explained under De-Pressurizing Hydraulic Accumulator which is described earlier in this System Diagnosis Section.

(2) Remove wiring harness connector from dual function pressure switch on bottom of hydraulic assembly. Connect wiring harness from Test Gauge, Special Tool 6685 into wiring harness connector removed from dual function pressure switch.

(3) Locate high pressure brake fluid hose going from hydraulic assembly to pump/motor. Remove high pressure hose tube nut from fitting on hydraulic assembly.

CAUTION: When installing Test Gauge, Special Tool 6685, ensure that pressure gauge is on high pressure hose side of shut off valve (Fig. 3).

(4) Verify shut off valve on Test Gauge, Special Tool 6685 is in the open position. Then install Test Gauge, Special Tool 6685 in-line with high pressure hose (Fig. 3). Screw male end of Test Gauge, Special Tool 6685 into high pressure adapter on hydraulic assembly and torque nut to 16 N•m (145 in. lbs.).

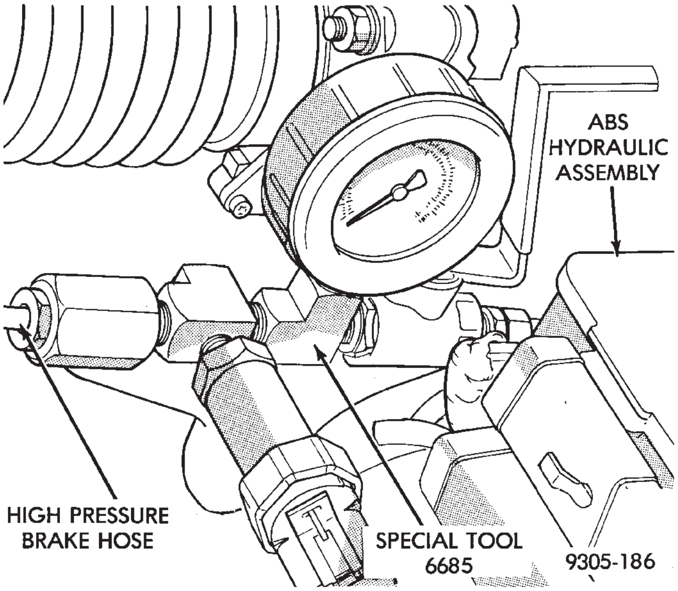


Fig. 3 Test Gauge 6685 Installed

(5) Install high pressure brake fluid hose (Fig. 3) into Test Gauge, Special Tool 6685 and torque tube nut to 16 N•m (145 in. lbs.).

(6) Remove hydraulic assembly accumulator port plug,located on right hand side of hydraulic assembly (Fig. 4).

(7) Install pressure gauge to hydraulic assembly adaptor, for Pressure Tester, Special Tool MST-6163 (Fig. 5) into accumulator port of hydraulic assembly. Tighten adapter to 10 N•m (7.5 ft. lbs.) torque.

(8) Install Pressure Tester, Special Tool MST-6163 and hose adaptor assembly, onto adaptor in hydraulic assembly accumulator port. Then install retaining clip into grove on accumulator port adaptor (Fig. 5). **MAKE SURE THAT THE RETAINING CLIP IS INSTALLED ON ACCUMULATOR PORT ADAPTOR BEFORE RE-PRESSURIZING THE HYDRAULIC SYSTEM.**

(9) Run the required diagnostic tree per the 1993 Bendix Anti-Lock 10 Diagnostic Manual to diagnose the failure and make required repairs.

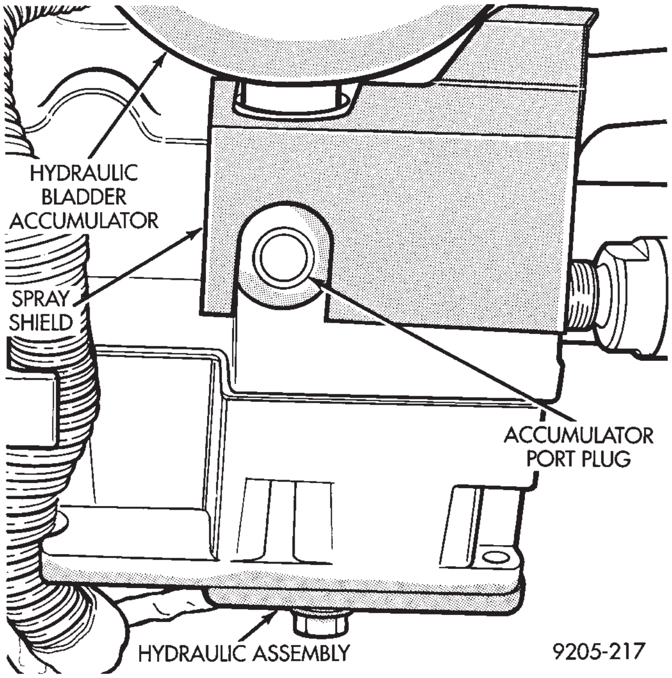


Fig. 4 Hydraulic Assembly Accumulator Port Plug Location

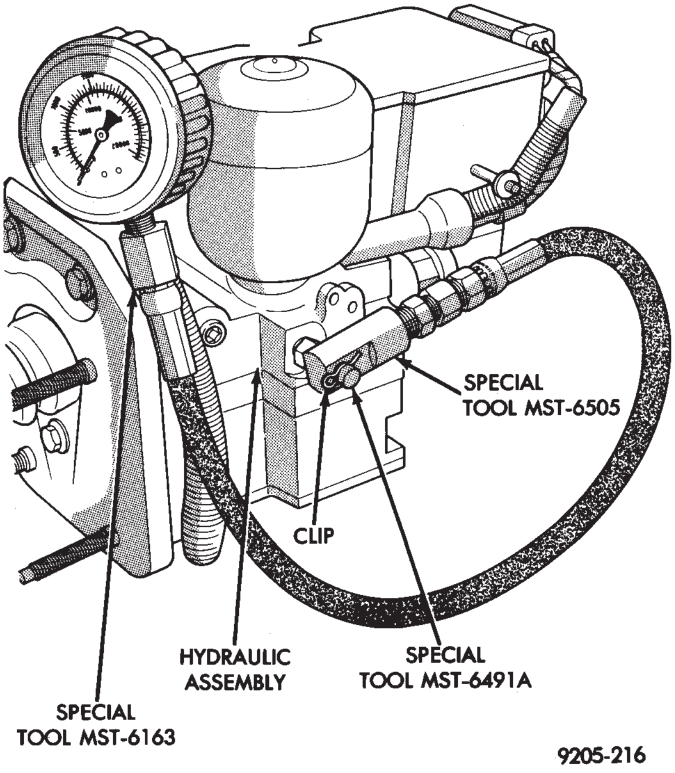


Fig. 5 Pressure Gauge and Adapter Installed on Hydraulic Assembly

(10) De-pressurize hydraulic accumulator by pumping brake pedal a minimum of 40 times with the ignition off. The procedure is fully explained under De-Pressurizing Hydraulic Accumulator which is described earlier in this System Diagnosis Section.

(11) Remove all special tools previously installed, from the ABS hydraulic assembly.

(12) Install accumulator port plug into hydraulic assembly. Torque accumulator port plug to 12 N●m (9 ft. lbs.).

(13) Install high pressure brake hose from the pump motor assembly into hydraulic fitting on ABS hydraulic assembly. Torque high pressure brake hose tube nut to 16 N●m (145 in. lbs.).

(14) Turn ignition switch to the run position to energize the pump/motor assembly and pressurize hydraulic system. Check for leakage at the hydraulic assembly to hydraulic bladder accumulator fitting.

(15) Again de-pressurize accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator in this section of the service manual.

(16) Then check the brake fluid level in the hydraulic assembly reservoir. If brake fluid level is low, fill reservoir to proper level with Mopar® brake fluid or equivalent conforming to DOT 3 requirements.

INTERMITTENT FAULTS

As with almost any electronic system, intermittent faults in the ABS system may be difficult to accurately diagnose.

Most intermittent faults are caused by faulty electrical connections or wiring. When an intermittent fault is encountered, check suspect circuits for:

(1) Poor mating of electrical connector halves, or electrical terminals not fully seated in the connector body.

(2) Improperly formed or damaged electrical terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(3) Poor terminal to wire connection. This requires removing the terminal from the connector body and inspecting for proper terminal to wire connection.

If a visual check does not find the cause of the problem, operate the vehicle in an attempt to duplicate the condition and record the Fault Code.

Most failures of the ABS system will disable the Anti-Lock function for the entire ignition cycle even if the fault clears before ignition 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 Red Brake Warning Lamp and/or Amber Anti-Lock Warning Lamp. All other failures will cause the lamp(s) to remain on until the ignition switch is turned off. Circuits and or components involving these inputs to the (CAB) should be investigated if a complaint of intermittent warning system operation is encountered.

- Low system voltage. If low system voltage is detected by the (CAB), the (CAB) will turn on the Amber Anti-Lock Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the (CAB), normal operation resumes.
- Low Brake Fluid. A low brake fluid condition will cause the Red Brake Warning Lamp to illuminate. When the fluid sensor again indicates an acceptable fluid level, the Red Brake Warning Lamp will go out. This condition may exist during hard cornering or while the vehicle is on a grade. If the vehicle is in motion above 3 M.P.H. the Amber Anti-Lock Warning Lamp will also be turned on.
- Low Accumulator Pressure. Low Accumulator Pressure will cause both the Red Brake Warning and Amber Anti-Lock Warning Lamps to illuminate. Once normal operating pressure is achieved, the lamps will extinguish and the system will return to normal operation.

Additionally, any condition that results in an interruption of power to the (CAB) or hydraulic assembly. May cause the Red Brake Warning and Amber Anti-Lock Warning Lamps to illuminate intermittently.

All the conditions (or faults) mentioned above, can store a fault code in the (CAB) module.

ABS BRAKE SYSTEM DIAGNOSTIC FEATURES

SYSTEM SELF DIAGNOSIS

The ABS system is equipped with a diagnostic capability that may be used to assist in isolation of ABS faults. The features of the diagnostics system are described below.

CONTROLLER ANTI-LOCK BRAKE (CAB)

Fault codes are kept in a Non-Volatile memory until either erased by the technician using the DRB II or erased automatically after 50 ignition cycles (key ON-OFF cycles). The only fault that will not be erased after 50 (KEY CYCLES) is the (CAB) fault. The (CAB) fault can only be erased by using the DRB II diagnostic tester. More than one fault can be stored at a time. The number of key cycles since the most recent fault was stored is also displayed. Most functions of the (CAB) and (ABS) system can be accessed by the technician for testing and diagnostic purposes by using the DRB II Diagnostic Tester.

START-UP CYCLE

The START-UP CYCLE takes place immediately after the ignition switch is turned on. It is an electrical check of basic electrical functions such as the System Relay and Anti-Lock Warning Lamp Relay. During this check, the Amber Anti-Lock Warning Lamp is turned on, then turned off at the end of the test. The test takes approximately 1 - 2 seconds to complete.

DRIVE-OFF CYCLE

The DRIVE-OFF CYCLE takes place when the vehicle reaches about 3 miles per hour the first time after an ignition reset. During this test, the modulator solenoid valves are activated briefly to test their function. The DRIVE-OFF CYCLE will be bypassed if you drive-off with the service brake pedal depressed.

LATCHING VERSUS NON-LATCHING FAULTS

Some faults detected by the (CAB) are latching. The fault is latched and (ABS) function is disabled until the ignition switch is reset (turned OFF/ON). Thus (ABS) function is disabled even if the original fault has disappeared during the ignition cycle in which it occurred. Other faults are non-latching; any warning lights that are turned on are only on as long as the fault condition exists. As soon as the condition goes away. The Amber Anti-Lock Warning Light is turned off. Although a fault code will be set in most cases. (Example:low accumulator fault will not be stored for a time of 2 minutes after the fault is detected).

BENDIX ABS SYSTEMS DIAGNOSTICS

The Bendix Anti-Lock 10 Brake System diagnostics. Beyond the basic mechanical diagnostics, systems and components covered earlier in this section, is accomplished by using the DRB II diagnostic tester. See testing procedures outlined in the Bendix Anti-Lock 10 Diagnostics Manual for the 1993 M.Y.

Please reference the above mentioned manual. For any further diagnostic service procedures that are required on the Bendix Anti-Lock 10 Brake System, requiring the use of the DRB II diagnostic tester.

ON CAR HYDRAULIC ABS COMPONENT SERVICE

WARNING: FAILURE TO FULLY DE-PRESSURIZE THE HYDRAULIC ACCUMULATOR BEFORE PERFORMING HYDRAULIC SYSTEM SERVICE OPERATIONS. COULD RESULT IN INJURY TO SERVICE PERSONNEL AND OR DAMAGE TO PAINTED SURFACES. SEE SECTION 2 FOR ADDITIONAL WARNINGS AND CAUTIONS.

GENERAL SERVICE PRECAUTIONS

The following are general precautions that should be observed when servicing the Anti-Lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-Lock brake system 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) or hydraulic assembly connector should never be connected or disconnected with the ignition switch in the **ON** position.

Many components of the Anti-Lock brake system are not serviceable and must be replaced as an assembly. **Do not attempt to disassemble any component that is not designed to be a serviced component.**

DE-PRESSURIZING HYDRAULIC ACCUMULATOR

The pump/motor assembly will keep the hydraulic accumulator charged to approximately 11,032 and 13,790 kPa (1600 and 2000 psi) any time that the ignition is in the ON position. The pump/motor assembly cannot run if the ignition is off or if either battery cable is disconnected.

Unless otherwise specified, the hydraulic accumulator should be de-pressurized before disassembling any portion of the hydraulic system. The following procedure should be used to relieve the pressure in the hydraulic accumulator:

(1) With ignition off, or either battery cable disconnected, pump the brake pedal a minimum of 40 times, using approximately 222 N (50 lbs.) pedal force. A noticeable change in pedal feel will occur, when the accumulator is discharged.

(2) When a definite increase in pedal effort is felt, pump pedal a few additional times. This will insure removal of all hydraulic pressure from the brake system.

CHECKING BRAKE FLUID LEVEL

CAUTION: Use only brake fluid conforming to DOT 3 specifications such as Mopar® or Equivalent. Do not use any fluid in the brake hydraulic system, which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container that is wet with water. Petroleum based fluids will cause swelling and distortion of rubber parts in the hydraulic brake system and water will mix with brake fluid, lowering the fluid boiling point. Keep all brake fluid containers tightly capped to prevent contamination.

The hydraulic assembly is equipped with a plastic fluid reservoir, with a filter/strainer located in the filler neck of each reservoir section.

The Anti-Lock brake system requires that the hydraulic accumulator be de-pressurized when checking the fluid level. To check the brake fluid level, the following procedure should be used:

(1) With the ignition off, de-pressurize the hydraulic accumulator by applying the brake pedal approximately 40 times, using a pedal force of approximately 220 N (50 lbs.). A noticeable change in pedal feel will occur when the accumulator is de-

pressurized. When a definite increase in pedal effort is felt, pump pedal a few additional times. This will insure removal of all hydraulic pressure from the brake system.

(2) Thoroughly clean both reservoir caps and surrounding area of reservoir before cap removal. This will avoid getting dirt into the reservoir and brake fluid.

(3) Inspect the fluid level, see instructions on top of reservoir (Fill To Top Of The White Screen In Front Filter/Strainer).

(4) Fill reservoir to top of white screen on filter/strainer (Fig. 1) as required. Use only brake fluid conforming to DOT 3 specifications such as Mopar® or an Equivalent.

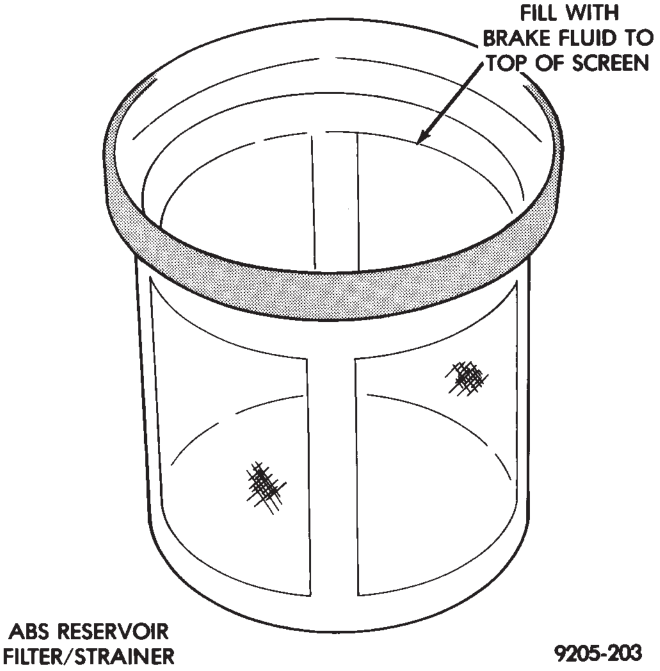


Fig. 1 ABS Fill Level On Filter/Strainer

(5) Replace reservoir cap.

BLEEDING ABS BRAKE SYSTEM

The Anti-Lock brake system must be bled anytime air is permitted to enter the brake hydraulic system, due to disconnection of brake lines or hoses for service. It is important to note that excessive air in the brake system may set a primary pressure/delta P fault in the (CAB). Refer to Diagnosis, for further information.

Pressure bleeding or manual bleeding procedures can be used when bleeding the (ABS) hydraulic system, after brake lines or hoses have been disconnected. Bleeding the (ABS) hydraulic system is also necessary after the replacement of the hydraulic assembly or wheel brakes.

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 only DOT 3 brake fluid to the reservoir as required.

PRESSURE BLEEDING (FIG. 2)

The brake lines may be pressure bled, using a standard diaphragm type pressure bleeder. Only diaphragm type pressure bleeding equipment should be used to prevent air, moisture, and other contaminants from entering the system. The following procedure should be used for pressure bleeding of the master cylinder and wheel circuits (Fig. 2)

(1) Ignition should be turned off and remain off throughout this procedure.

(2) Fully de-pressurize hydraulic accumulator by pumping brake pedal a minimum of 40 times. The procedure is fully described in this section of the service manual under De-Pressurizing Hydraulic Accumulator.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(3) Remove both reservoir caps (Fig. 2).

(4) Install pressure bleeder adapter, on front reservoir port and a dummy cap on the rear port of the reservoir (Fig. 2)

(5) Attach bleeding equipment to bleeder adapter (Fig. 2). Charge pressure bleeder to approximately 138 kPa (20 psi).

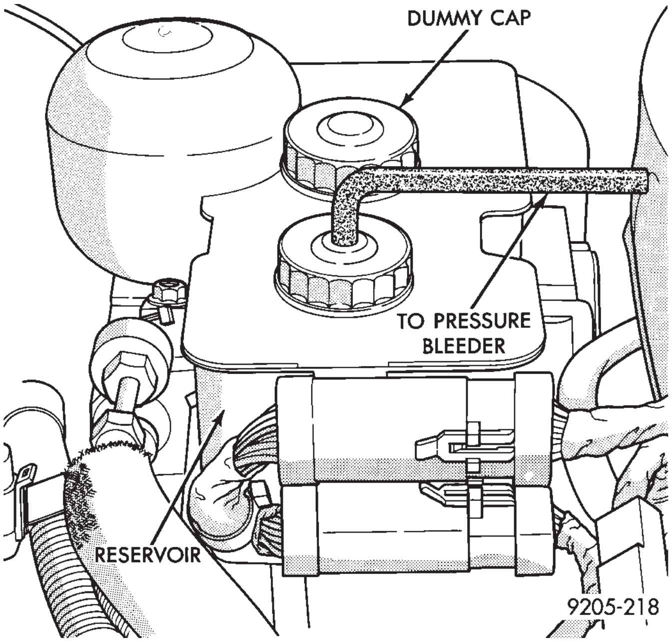


Fig. 2 Pressure Bleeding Brake System

(6) Connect a transparent hose to the caliper bleed screw (Fig. 3). Submerge the free end of the hose in a clear glass container, which is partially filled with clean, fresh brake fluid.

(7) With the pressure bleeder turned on, open the caliper bleed screw 3/4 to one full turn allowing brake fluid to flow into the container. Leave bleed screw open until a clear, bubble-free flow of brake fluid is coming from the hose in the container. If the reservoir has been drained or the hydraulic assembly removed from the car before the bleeding operation. Slowly pump the brake pedal one or two times while the bleed screw is open and fluid is flowing. This will help purge any trapped air from the hydraulic assembly. Tighten bleeder screw to 10 N●m (7.5 ft. lbs.) torque.

(8) Step 7 above should be done at all wheel brakes, following the order wheel by wheel as listed below.

a) Left rear.
b) Right rear.
c) Left front.
d) Right front.

(9) After bleeding is completed at all four wheel brakes. Remove pressure bleeding equipment and adapter by closing pressure bleeder valve and slowly unscrewing bleeder adapter from hydraulic assembly reservoir. **Failure to release pressure in the reservoir will cause spillage of brake fluid, and could result in personal injury or damage to painted surfaces.**

(10) Using a syringe or equivalent method, remove excess fluid from the reservoir to bring the brake fluid to the required fill level (Fig. 1). If brake fluid is below the proper level add Mopar® brake fluid or equivalent conforming to DOT 3, requirements.

(11) Install the reservoir caps and turn on the ignition to allow the (ABS) pump to charge the accumulator.

MANUAL BLEEDING

Brake lines can be bled, using the manual bleeding method. Manual bleeding is a two person operation, one to pump the brake pedal and the other to bleed each wheel brake. The following procedure should be used:

De-pressurizing the hydraulic accumulator is done by following the steps described below.

(1) Verify that the ignition switch is in the off position.

(2) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, PRIOR TO PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(3) Connect a transparent hose to the bleed screw on the wheel cylinder or brake caliper that is to be bled (Fig. 3). Submerge the free end of the hose in a clear glass container, which is partially filled with clean, fresh brake fluid.

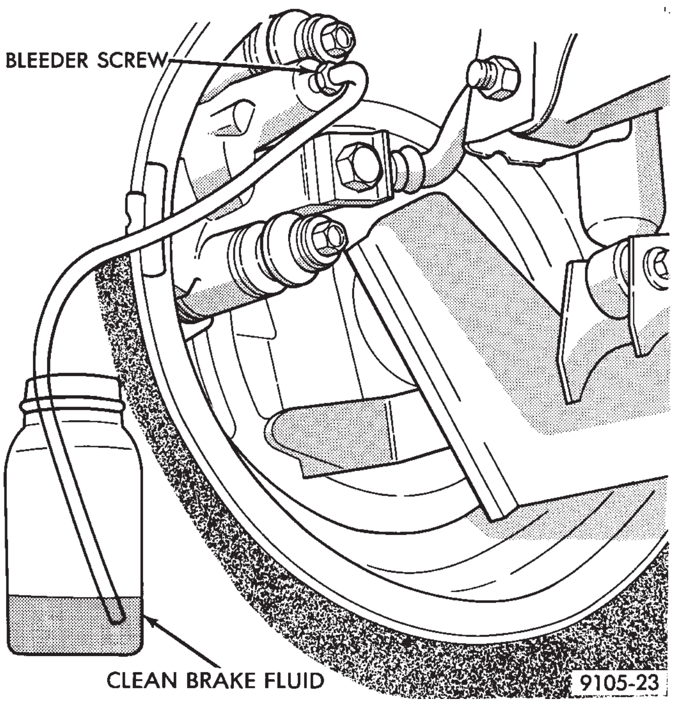


Fig. 3 Bleeding Brake System

(4) Slowly pump the brake pedal several times, using full strokes of the pedal and allowing approximately five seconds between pedal strokes. After two or three strokes, continue to hold pressure on the pedal, keeping it at the bottom of its travel.

(5) With pressure on the pedal, open the bleed screw 3/4 to 1 full turn. Leave bleed screw open until fluid no longer flows from the hose. Tighten the bleed screw and release the pedal. **Be sure that the bleed screw it tightened before brake pedal is released, or air may be drawn back into hydraulic system.**

(6) Repeat Steps 3, 4 and 5 on each wheel brake, until clear, bubble-free fluid flows from the hose.

(7) Repeat the above sequence at each wheel brake, in the following order:

a) Left rear.
b) Right rear.
c) Left front.
d) Right front.

(8) Fill the hydraulic assembly to the proper fill level (Fig. 1) using Mopar® or equivalent brake fluid meeting DOT 3, requirements.

(9) Install both reservoir caps on reservoir.

(10) Turn the ignition switch to the RUN position to allow the Pump/Motor to turn on and recharge the accumulator.

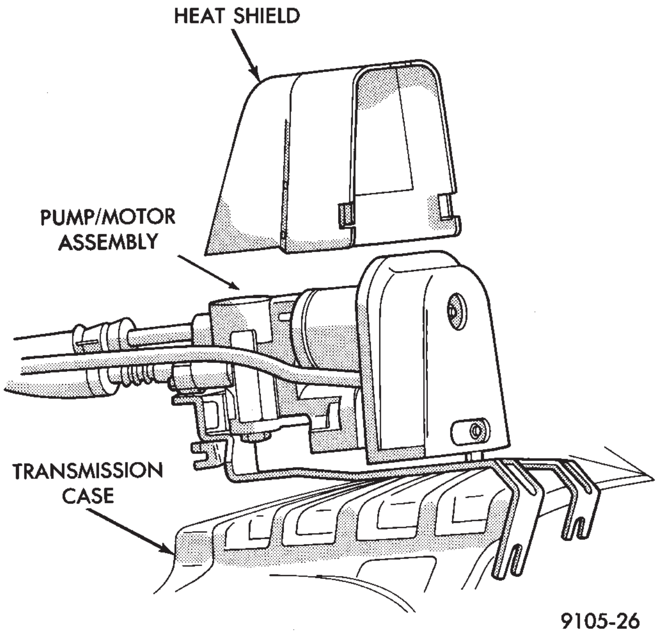


Fig. 4 Pump/Motor Assembly Mounting

PUMP/MOTOR SERVICE (FIG. 4)

REMOVE

(1) Fully de-pressurize the hydraulic accumulator by pumping the pedal a minimum of 40 times. Use the procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove the fresh air intake ducts from the engine induction system.

(3) Loosen the low pressure hose clamp (Fig. 5) at the hydraulic assembly.

(4) Disconnect any routing clips which attach the high and low pressure fluid lines to the body or components of the vehicle (Fig. 5).

(5) Unclip the pump/motor assembly wiring harness electrical connector from the left side engine mount (Fig. 5). Disconnect the pump/motor assembly wiring harness from the underhood wiring harness.

(6) Loosen the high pressure hose tube nut at the hydraulic assembly fitting (Fig. 5).

(7) Remove the high and low pressure hose assembly (Fig. 5) from the hydraulic assembly. Cap all open ports on reservoir and hydraulic assembly to prevent brake fluid from leaking out.

(8) Remove the pump/motor assembly front heat shield to mounting bracket attaching bolt, from front of pump/motor bracket (Fig. 5).

(9) Remove front heat shield from the pump/motor assembly.

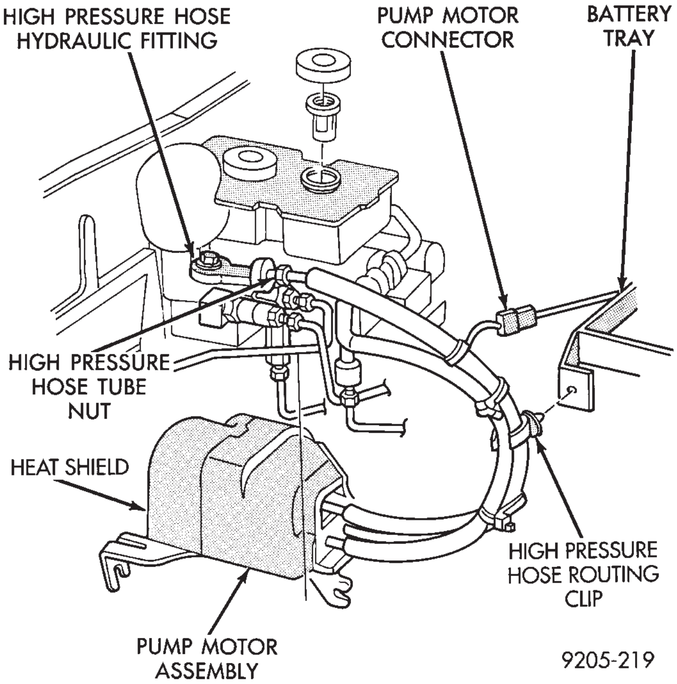


Fig. 5 Brake Tube and Hose Routing

(10) Lift pump/motor assembly from mounting bracket and remove assembly from the vehicle.

INSTALL

CAUTION:Be sure all high and low pressure hose routing clips. Are securely fastened to the vehicle body or component they were removed from when hose assembly is reinstalled (Fig. 5).

(1) Install pump/motor assembly in reverse order of removal.

(2) Tighten the pump/motor assembly fluid lines to the torque values shown below.

- Low pressure hose clamp. 1 N•m (10 in. lbs.)
- High pressure hose fitting to pump/motor assembly. 16 N•m (145 in. lbs.) Fig. 5.

Note: It is not necessary to bleed the foundation brakes of the vehicle when the pump/motor assembly and high and low pressure fluid hoses are serviced. Any other service to the brake system unless stated otherwise will require bleeding of the complete brake system.

BRAKE FLUID PRESSURE AND RETURN HOSES (FIG. 6)

REMOVE

(1) Remove the pump/motor assembly from its mounting bracket, see Pump/Motor Service.

(2) Cut the 4 tie straps that secure the high and low pressure hoses and pump/motor assembly wiring harness together Fig. 6.

(3) Remove the banjo bolt and spray shield from the pump/motor assembly Fig. 6.

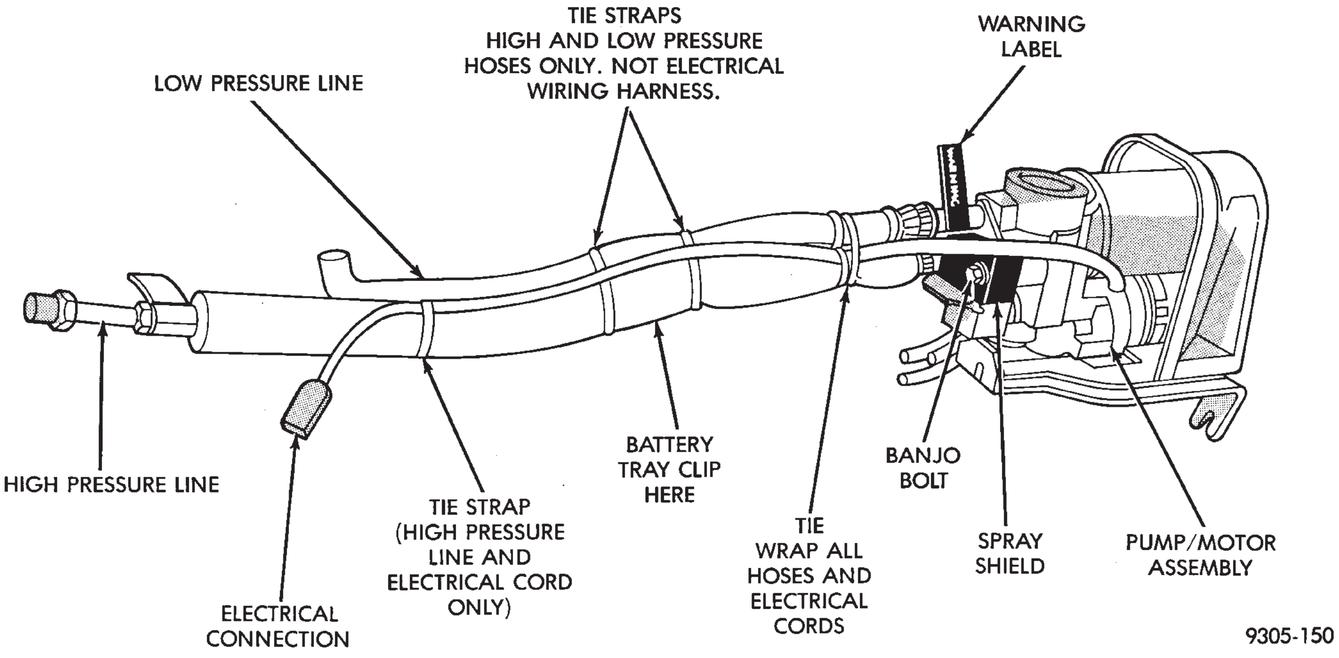


Fig. 6 Positioning Tie Straps On High And Low Pressure Hose Assembly

(4) Remove the high and low pressure hose assembly from the pump/motor assembly Fig. 6.

INSTALL

(1) The rubber O-Ring seals used on the high and low pressure hose connections to the pump/motor assembly. Should be lubricated with clean brake fluid before connecting hoses to the pump/motor assembly.

(2) Position the high and low pressure hose assembly and spray shield on the pump/motor assembly (Fig. 6). Then install the banjo bolt and torque to 14 N•m (120 in.lbs.)

(3) Carefully route pump/motor assembly wiring harness along the side of the high and low pressure hose assembly Fig. 6.

(4) Install the 4 tie straps around the hose assembly and wiring harness per the sequence and locations shown in (Fig. 6).

(5) Install the pump/motor assembly back on mounting bracket, See Pump/Motor Service.

(6) Turn the ignition switch to the RUN position. This will turn on the pump/motor assembly to charge the high pressure system.

(7) Pump the brake system down as detailed in Depressurizing Hydraulic Accumulator in this section of the service manual.

(8) Fill the hydraulic assembly to the proper level with Mopar® brake fluid or an equivalent meeting DOT 3 specifications. See Master Cylinder Fluid Level in the Service Adjustments section of this group.

HYDRAULIC ASSEMBLY

REMOVE

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove fresh air intake duct and air cleaner from vehicle.

(3) Remove the windshield washer fluid bottle from the vehicle.

(4) Disconnect all electrical connectors from the hydraulic assembly.

(5) Remove as much fluid as possible from the reservoir on the hydraulic assembly.

(6) Remove pump high pressure hose fitting (Fig. 7) from hydraulic assembly.

(7) Disconnect pump return hose from steel tube. Cap the end of the steel tube.

(8) Disconnect the 4 brake tubes from the hydraulic assembly (Fig. 7).

(9) From under the instrument panel, position a small screwdriver between the center tang on the retainer clip and the pin in the brake pedal. Rotate the screwdriver enough to allow the retainer clip center tang to pass over the end of the brake pedal pin. **Dis-**

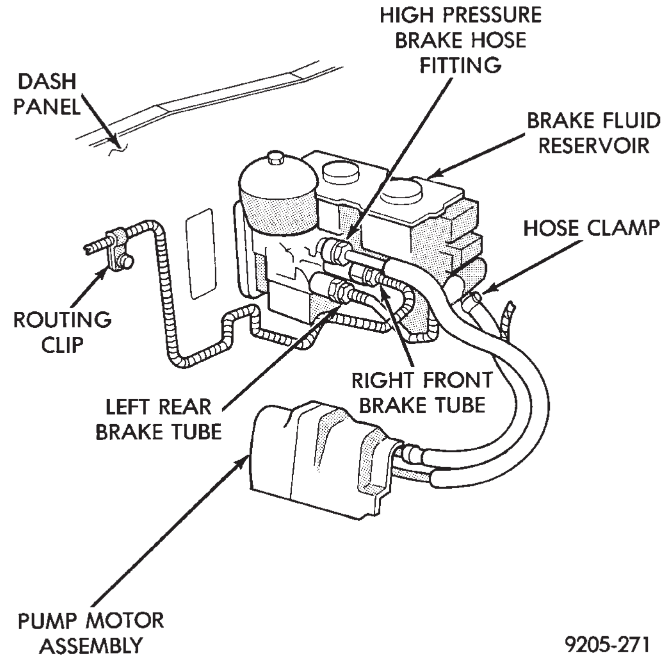


Fig. 7 Brake Tube and Hose Routing at Hydraulic Unit

card the old retainer clip, a new clip must be used when hydraulic assembly is reinstalled (Fig. 8).

(10) Remove the 4 hydraulic assembly to dash panel mounting nuts from the hydraulic assembly mounting studs, located under instrument panel (Fig. 8).

(11) Remove hydraulic assembly from vehicle.

INSTALL

(1) Position the hydraulic assembly into its mounting holes on the dash panel of the vehicle.

(2) Install and tighten the 4 hydraulic assembly to dash panel mounting stud nuts (Fig. 8) to 28 N●m (250 in. lbs.) torque.

(3) Using lubriplate or equivalent, coat the bearing surface of the brake pedal pin.

(4) Connect push rod to pedal pin and install a **NEW** retainer clip. **HYDRAULIC ASSEMBLY PUSH ROD MUST BE ASSEMBLED TO BRAKE PEDAL PIN IN THE POSITION AS SHOWN IN (FIG. 8).**

(5) If proportioning valves were removed from the hydraulic assembly, install and torque to 40 N●m (30 ft. lbs.) torque. Then install all 4 brake tubes on the hydraulic assembly (Fig. 7). Torque the brake tubes to hydraulic assembly fittings to 16 N●m (145 in. lbs.).

(6) Install return hose on steel tube. Tighten the return hose clamp to 1 N●m (10 in.lbs.)

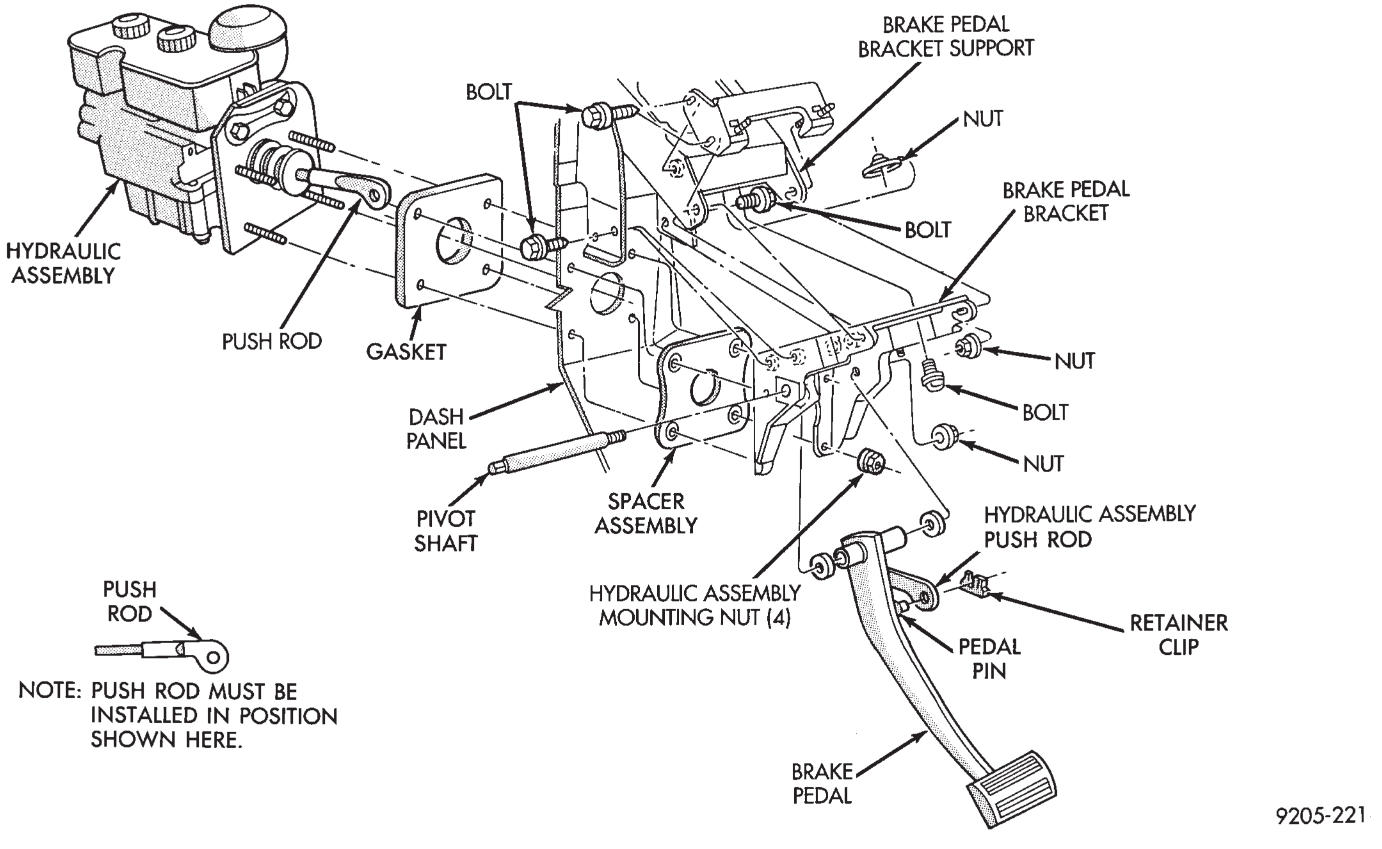


Fig. 8 Removing or Installing Hydraulic Assembly

(7) Install high pressure hose to hydraulic assembly (Fig. 7). Tighten the hose, to hydraulic assembly fitting to 16 N●m (145 in. lbs)

(8) Fill hydraulic assembly brake fluid reservoir to top of screen on the reservoir filter/strainer Fig. 9.

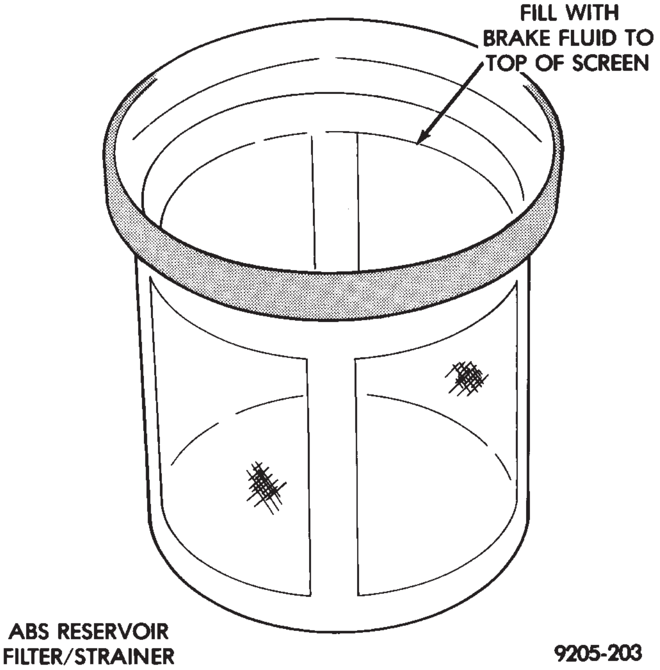


Fig. 9 ABS Fill Level On Filter/Strainer

(9) Connect all electrical connectors to the hydraulic assembly.

(10) Bleed the entire brake system, see Bleeding Brake System in this section of the Service Manual.

(11) Replace all fresh air intake ducts, air cleaner and washer bottle.

(12) Check that the brake fluid in the hydraulic assembly is at the correct level before moving vehicle (Fig. 9). (See Checking Brake Fluid Level in this section of the service manual).

BRAKE FLUID RESERVOIR

REMOVE

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove as much brake fluid as possible from the fluid reservoir, using a syringe or equivalent method.

(3) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent loosen bladder accumulator. Then remove the bladder accumulator and brake fluid spray shield from the hydraulic assembly (Fig. 10). Remove high pressure banjo fitting from hydraulic assembly.

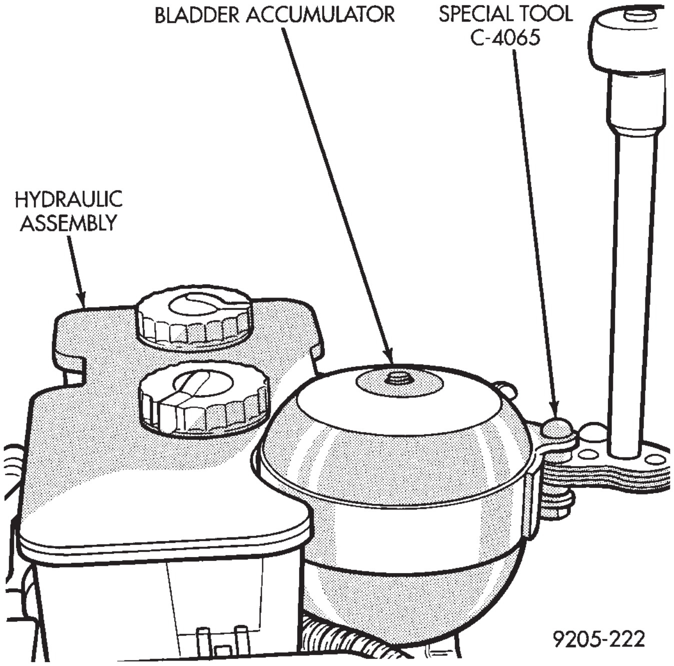


Fig. 10 Removing Bladder Accumulator

(4) Using needle nose pliers, remove the three fluid reservoir retaining pins from the hydraulic assembly (Fig. 11). Compress the barb on the opposite side of retaining pin to prevent pin from breaking.

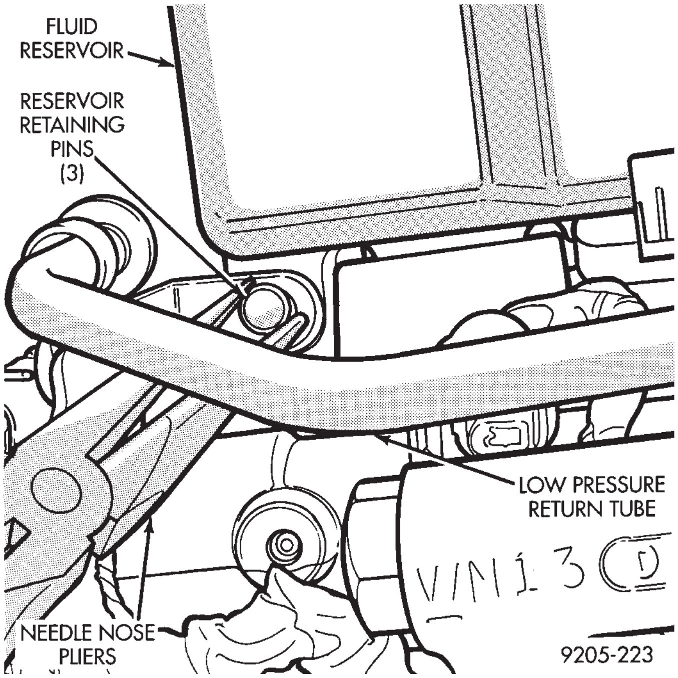


Fig. 11 Remove Reservoir Retaining Pins

(5) Remove reservoir from hydraulic assembly by CAREFULLY prying between reservoir and hydrau-

lic assembly with a blunt prying tool (Fig. 12). Use a rocking motion to help disengage reservoir from grommets while prying. **BE EXTREMELY CAREFUL TO AVOID DAMAGING OR PUNCTURING RESERVOIR DURING THIS PROCEDURE.**

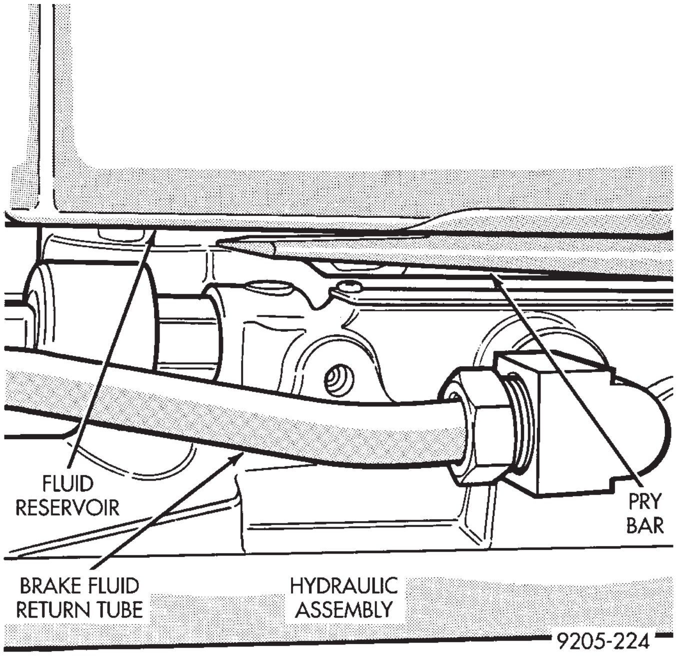


Fig. 12 Remove Reservoir From Hydraulic Assembly

(6) Remove the brake fluid level sensor switch from the reservoir. Remove switch by compressing the retaining barbs (Fig. 13) on the end of the switch and then slide switch out of the brake fluid reservoir (Fig. 14)

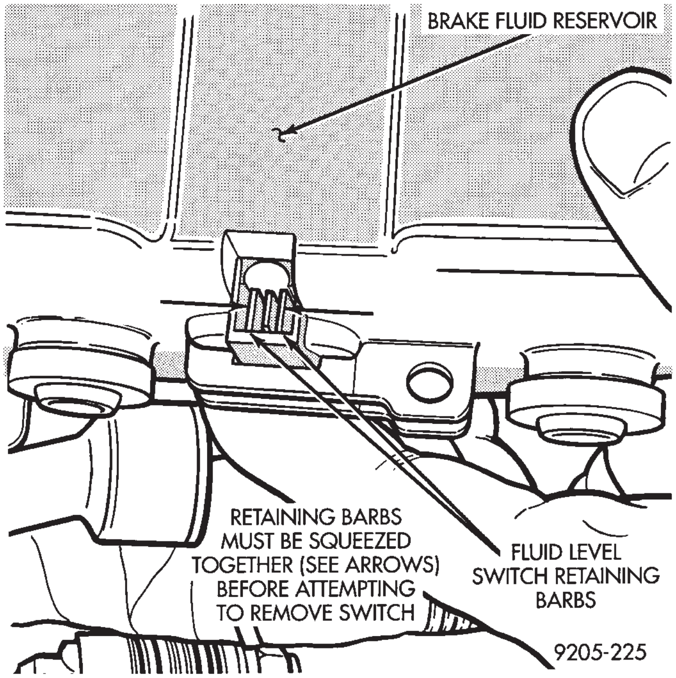


Fig. 13 Fluid Switch Retaining Barbs

(7) Using fingers, remove the 3 reservoir grommets (Fig. 14) from the hydraulic assembly or reservoir, and discard. **Grommets must not to be reused when reservoir is installed on hydraulic assembly.**

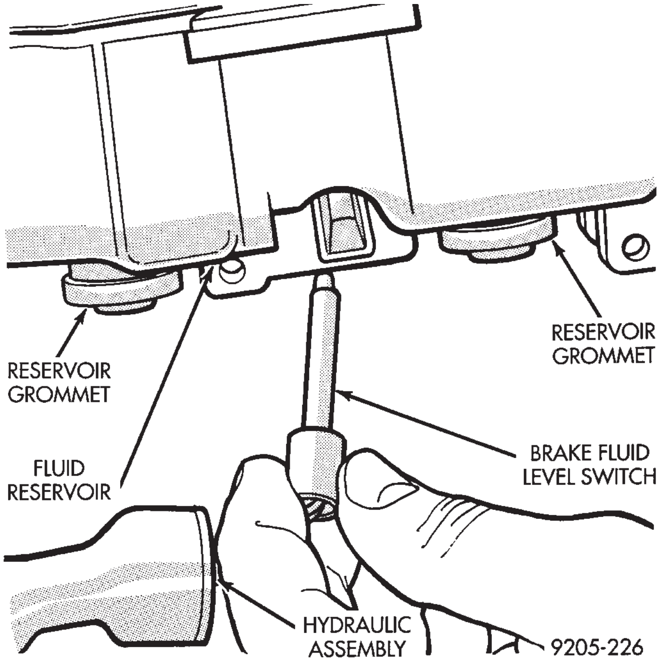


Fig. 14 Remove Brake Fluid Level Switch

INSTALL

(1) Thoroughly lubricate the new reservoir grommets with clean brake fluid and install on reservoir outlet ports (Fig. 14). **The new reservoir grommets supplied with reservoir, must ALWAYS be used.**

(2) Install brake fluid level switch into brake fluid reservoir (FIG. 14).

(3) Press reservoir into hydraulic assembly **BY HAND**, using a rocking motion to help seat reservoir into hydraulic assembly. Be sure that grommets are fully seated in the hydraulic assembly. **DO NOT ATTEMPT TO POUND RESERVOIR INTO HYDRAULIC ASSEMBLY, USING A HAMMER.**

(4) Using needle nose pliers, install the 3 brake fluid reservoir to hydraulic assembly retaining pins (Fig. 11). Make sure that pins are fully installed with barbs extending past reservoir on opposite side.

(5) Reinstall the high pressure hose, banjo fitting onto the hydraulic assembly and torque the fitting to 13 N●m (10.0 ft.lbs).

(6) Install the brake fluid spray shield and bladder accumulator onto the hydraulic assembly. Install the bladder accumulator by hand to be sure it does not bet cross threaded. **Be sure that the O-Ring on the bladder accumulator is fully seated into the hydraulic assembly.**

(7) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent, (Fig. 10) torque the bladder accumulator to 48 N●m (35 ft. lbs.)

(8) Fill the hydraulic assembly reservoir to the top of the screen on the filter/strainer (Fig. 15). Using fresh clean brake fluid such as Mopar® or equivalent, conforming to DOT 3 requirements.

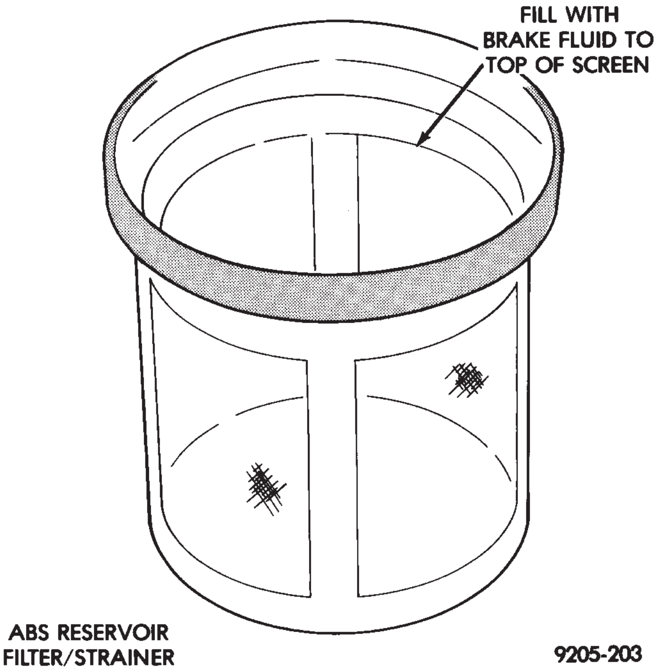


Fig. 15 ABS Reservoir Fill Level On Filter/Strainer

PUMP SUPPLY FILTER

REMOVE

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove and then reinstall one filler cap from brake fluid reservoir on hydraulic assembly.

(3) Remove brake fluid supply hose from hydraulic assembly master cylinder at the pump supply filter (Fig. 16). After hose is removed from pump supply filter, plug end of hose to stop brake fluid from draining out of fluid reservoir.

(4) Remove brake fluid supply hose (Fig. 16), from pump supply filter going to the pump motor assembly.

(5) Remove pump supply filter (Fig. 16) from attaching bracket on front of hydraulic assembly.

INSTALL

(1) Attach pump supply filter to attaching bracket on front of hydraulic assembly (Fig. 16).

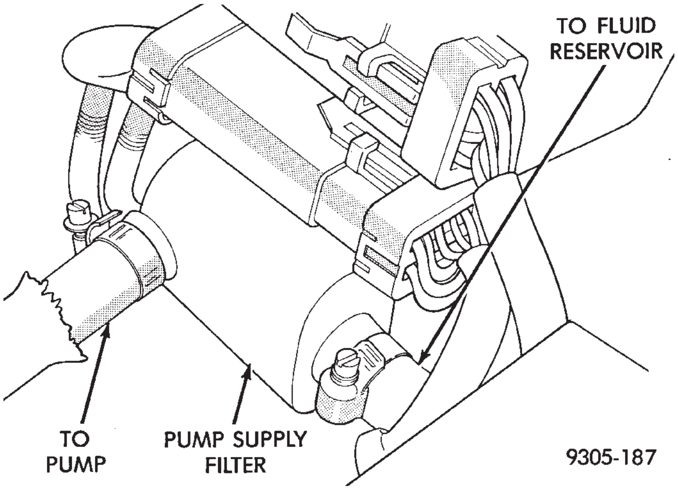


Fig. 16 Pump Supply Filter

(2) Install replacement hose clamp, on brake fluid supply hose to pump motor assembly.

(3) Install the brake fluid supply hose to pump motor assembly, onto the nipple of the pump supply filter. Position hose clamp on brake fluid supply hose so that it is past upset bead on nipple, then torque hose clamp to 1.5 N●m (13.5 in. lbs.).

(4) Remove plug from brake fluid supply hose coming from hydraulic assembly. Install the brake fluid supply hose from hydraulic assembly, onto the nipple of the pump supply filter. Position hose clamp on brake fluid supply hose so that it is past upset bead on nipple, then torque hose clamp to 1.5 N●m (13.5 in. lbs.).

(5) Turn ignition switch to the run position to energize the pump/motor assembly and pressurize hydraulic system. Check for leakage at the hydraulic assembly to hydraulic bladder accumulator fitting.

(6) Again de-pressurize accumulator by pumping brake pedal a minimum of 40 times as described. Use procedure in De-Pressurizing Hydraulic Accumulator in this section of the manual.

(7) Then check the brake fluid level in the hydraulic assembly reservoir. If brake fluid level is low, fill reservoir to proper level (Fig. 15) with Mopar® brake fluid or equivalent conforming to DOT 3 requirements.

HYDRAULIC BLADDER ACCUMULATOR

REMOVE

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ASSEMBLY/ACCUMULATOR PRIOR PERFORMING THIS OPERATION. MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

(2) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent loosen bladder accumulator. Then remove the bladder accumulator and brake fluid shield from the hydraulic assembly (Fig. 17).

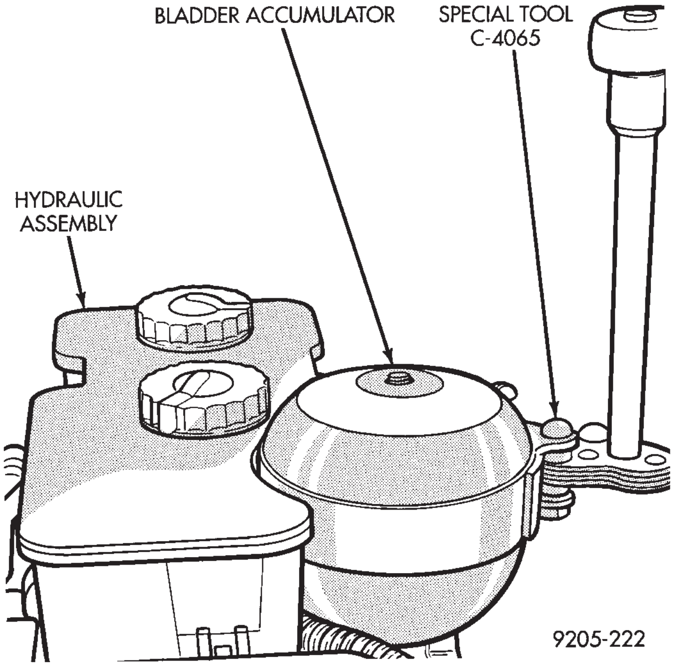


Fig. 17 Remove And Install Bladder Accumulator

INSTALL

(1) Install the brake fluid spray shield onto the hydraulic accumulator (Fig. 1).

(2) Install the bladder accumulator onto the hydraulic assembly by hand. Be sure that the O-Ring on the bladder accumulator is fully seated into the hydraulic assembly.

(3) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent, (Fig. 17) torque the bladder accumulator to 48 N●m (35 ft. lbs.)

(4) Turn ignition switch to the run position to energize the pump/motor assembly and pressurize hydraulic system. Check for leakage at the hydraulic assembly to hydraulic bladder accumulator fitting.

(5) Again de-pressurize accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator in this section of the service manual.

(6) Then check the brake fluid level in the hydraulic assembly reservoir. If brake fluid level is low, fill reservoir to proper level (Fig. 15) with Mopar® brake fluid or equivalent conforming to DOT 3 requirements.

PROPORTIONING VALVES (FIG. 18)

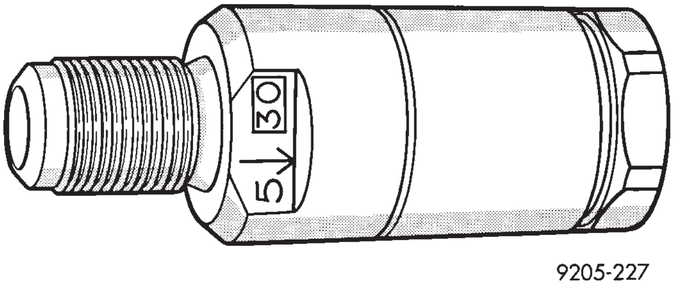


Fig. 18 ABS Proportioning Valve

CAUTION: Proportioning valves should never be disassembled or repaired in any way, repair is by replacement only.

REMOVE

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO FULLY DE-PRESSURIZE THE HYDRAULIC ASSEMBLY/ACCUMULATOR PRIOR TO REMOVING THE PROPORTIONING VALVE. MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

(2) Remove fresh air intake ducts and air cleaner.

(3) Remove pressure and return hose (Fig. 5) from hydraulic unit. (See Pressure and Return Hose Section For Proper Removal Procedure).

(4) Remove brake tube from the proportioning valve that requires servicing.

(5) Remove proportioning valve requiring service from the hydraulic assembly (Fig. 19).

INSTALL

(1) Install proportioning valve on hydraulic assembly and tighten to 40 N●m (30 ft. lbs.) torque.

(2) Install brake tube on proportioning valve. Tighten tube nut to 16 N●m (145 in. lbs.) torque.

(3) Install hydraulic pressure and return hoses. Torque pressure hose to hydraulic assembly fitting to 16 N●m (145 in. lbs). Torque return hose to metal tube hose clamp to 1 N●m (10 in. lbs.).

(4) Install fresh air intake duct and air cleaner.

(5) Bleed the affected brake line, see Bleeding Brake System in this section.

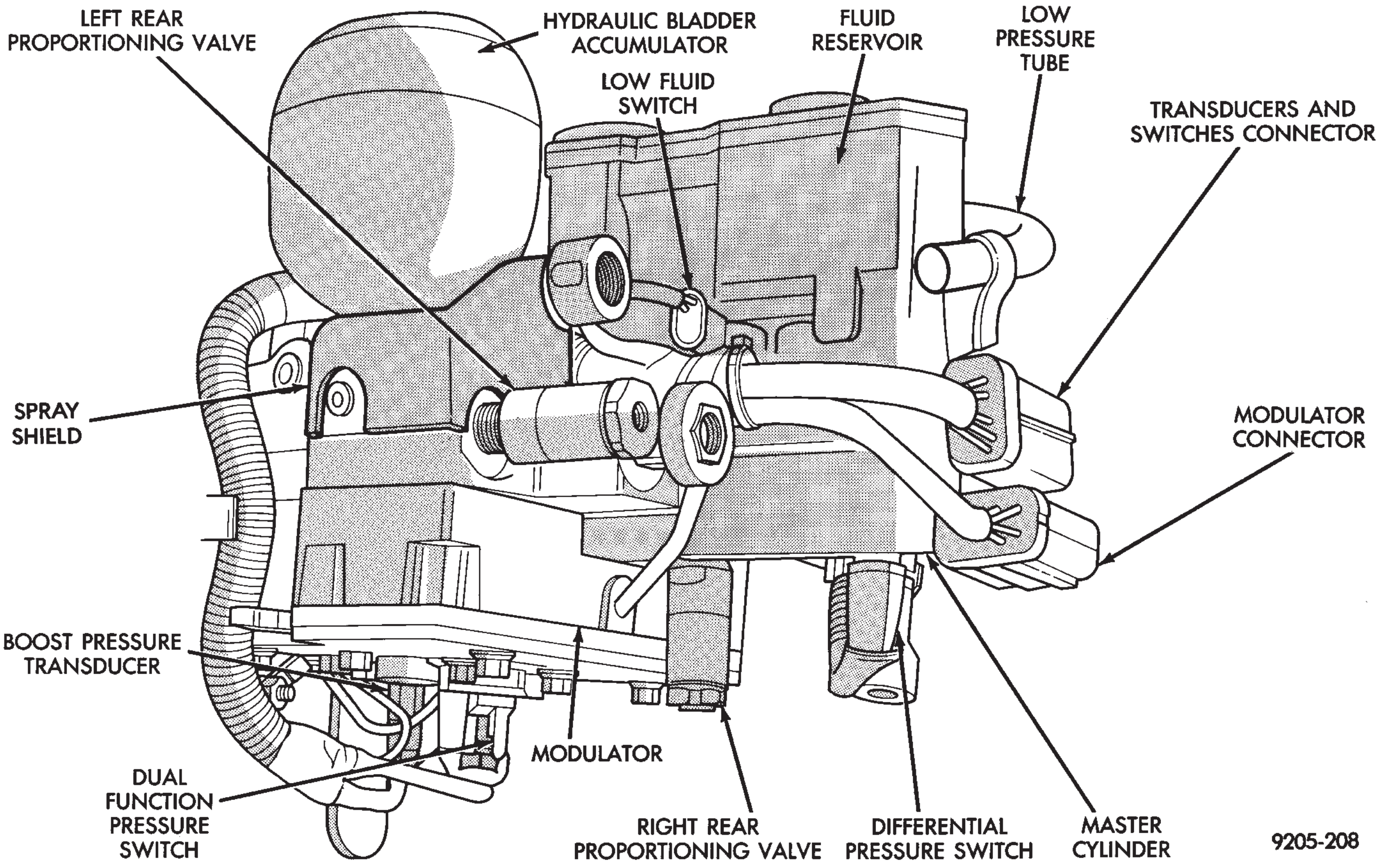


Fig. 19 Hydraulic Assembly

ELECTRONIC COMPONENTS

CONTROLLER ANTI-LOCK BRAKE (CAB)

REMOVAL

(1) Turn vehicle ignition off.

(2) Raise vehicle on hoist, (CAB) access for removal is from the underside of the vehicle (Fig. 1)

(3) Remove transmission oil cooler line routing clip.

(4) Disconnect the wiring harness 60 way connector from the Controller Anti-Lock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

(5) Remove the 3 (CAB) module to frame rail mounting bolts.

(6) Remove the (CAB) module from the vehicle.

INSTALLATION

(1) Install the (CAB) module back in the vehicle.

(2) Install the 3 (CAB) module to frame rail attaching bolts. Torque the 3 (CAB) module to frame rail attaching bolts to 5 N•m (40 in. lbs.).

(3) **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE CONNECTING THE 60 WAY CONNECTOR.** Connect the wiring harness 60 way connector into the (CAB) module until it is fully seated. Torque the 60 way connector to (CAB) module retaining bolt to 12 N•m (105 in. lbs.).

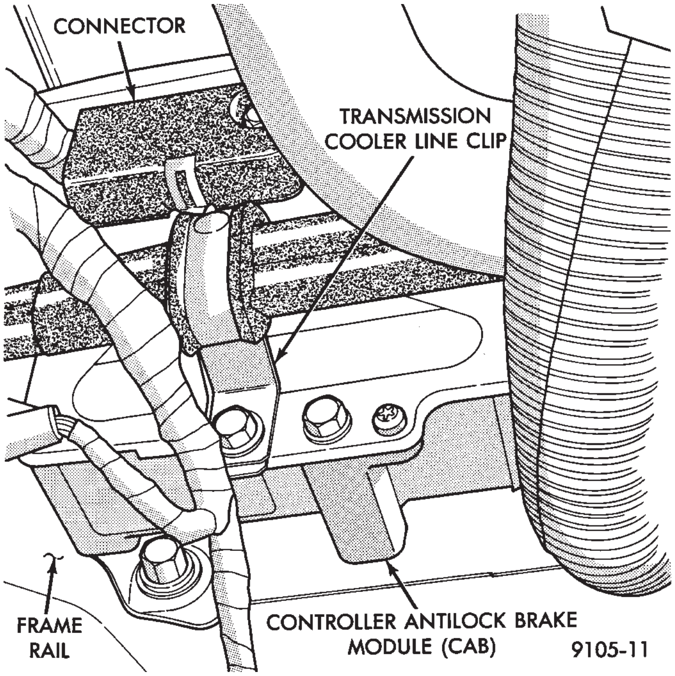


Fig. 1 Location Controller Anti-Lock Brake (CAB)

SYSTEM RELAY, ANTI-LOCK WARNING LAMP RELAY AND PUMP/MOTOR RELAYS (FIG. 2)

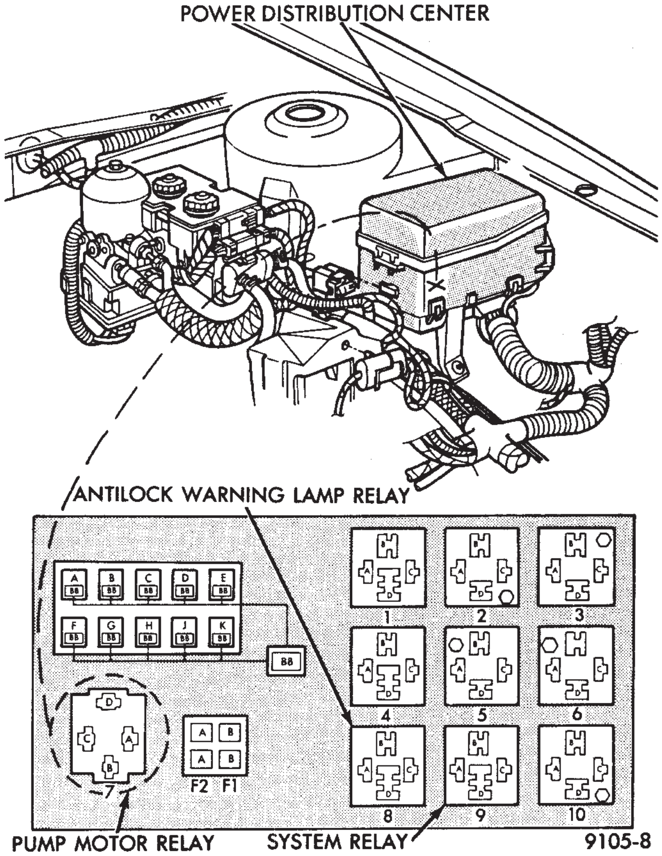


Fig. 2 Pump/Motor and Anti-Lock System Relays

REMOVE

See (Fig. 2) Power Distribution Center. Find the location of the pump/motor relay in the (PDC). Remove pump/motor relay by pulling upward and install by pushing firmly into position. Do not twist the relay when removing or installing it.

See (Fig. 10) in the Relay And Warning Lamp Section of this group, for the location of the Anti-Lock system relay and the Yellow Lamp relay. Remove the relay from the vehicle using the following procedure.

(1) Disconnect the wiring harness connectors from the relays. Connectors are removed from the relays by disengaging the connector locking tab from relay and pulling strait off relay, do not twist.

(2) Then remove the relay pack to inner fender attaching bolt.

INSTALL

The Anti-Lock system and Yellow Lamp relay are installed using the following procedure.

(1) Mount the relay pack to the inner fender with the anti-rotation tab on the bracket around lip of inner fender hole (Fig. 10).

(2) Install the relay pack to inner fender mounting bolt and torque to 4 N●m (35 in. lbs.).

(3) Connect the wiring harness connectors onto the relays until the locking tabs on the connectors and relays are fully engaged. Do not twist connectors when installing them on the relays.

WHEEL SPEED SENSORS

INSPECTION

Inspect tone wheels (Fig. 3) for any missing or broken teeth, this can cause erratic speed sensor signals.

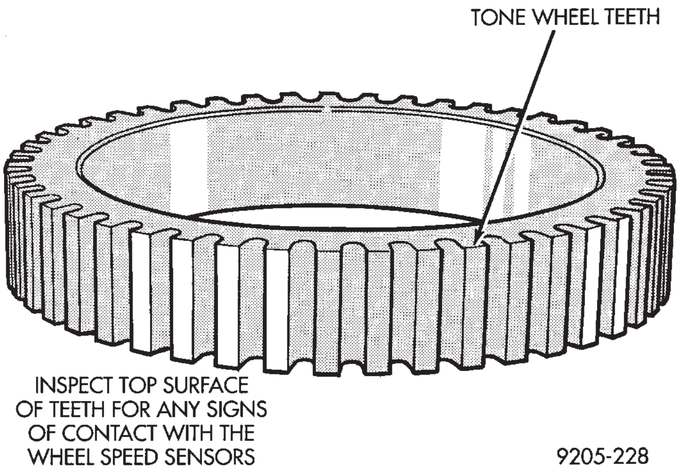


Fig. 3 Tone Wheel (Typical)

Tone wheels should show no evidence of contact with the wheel speed sensor. If contact was made, determine cause and correct.

Excessive runout of the tone wheels can cause erratic wheel speed sensor signals. Replace assembly if runout exceeds approximately 0.25 mm (0.010 inch).

FRONT WHEEL SPEED SENSOR

REMOVAL

(1) Raise vehicle and remove front wheel and tire assembly.

(2) Remove screw from clip (Fig. 4) that holds sensor assembly grommet into fender shield.

(3) Carefully, pull sensor assembly grommet from fender shield. **When removing grommet from fender shield, do not pull on speed sensor cable.**

(4) Unplug speed sensor cable connector, from vehicle wiring harness.

(5) Remove the 2 screws (Fig. 4) that secure the speed sensor cable, routing tube to the fender well.

(6) Remove the 2 sensor assembly grommets from the retainer bracket, on the strut damper (Fig. 4).

(7) Remove speed sensor assembly to steering knuckle attaching bolt (Fig. 4).

(8) Carefully, remove sensor head from steering knuckle. If the sensor has seized, due to corrosion, use a hammer and punch to tap edge of sensor ear

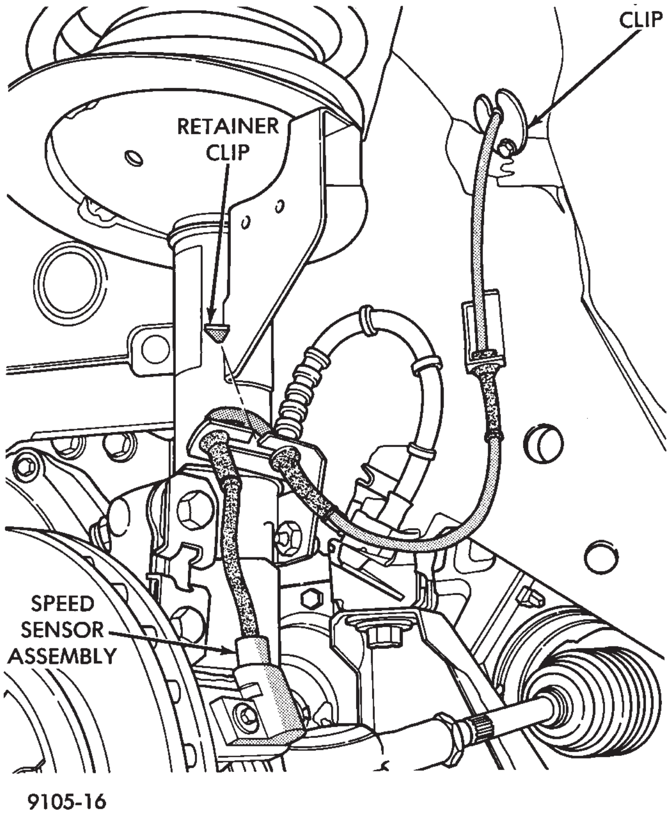


Fig. 4 Front Wheel Speed Sensor Routing

(Fig. 5), rocking the sensor side to side until free. **DO NOT USE PLIERS ON SENSOR HEAD.**

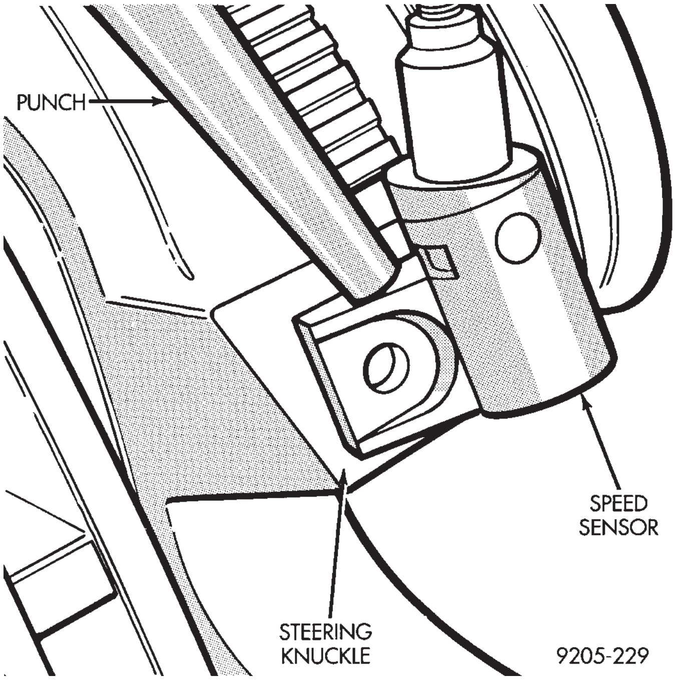


Fig. 5 Removing Speed Sensor (Typical)

INSTALLATION

(1) Connect the wheel speed sensor cable connector, to the vehicle wiring harness.

(2) Push sensor assembly grommet into hole in fender shield. Install clip and screw (Fig. 4). Torque screw to 4 N●m (35 in. lbs.).

(3) Install speed sensor cable grommets in bracket on strut damper (Fig. 4).

(4) Install speed sensor cable routing tube to fender well (Fig. 4). Torque both screws to 4 N●m (35 in. lbs.).

(5) Coat the speed sensor with High Temperature Multi-purpose E.P. Grease before installing into the steering knuckle. Install speed sensor attaching screw and tighten to 7 N●m (60 in. lbs.)

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are routed correctly and installed in all retainers. Failure to properly route and 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.

REAR WHEEL SPEED SENSOR (FIGS. 6 AND 8)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove sensor assembly grommet from underbody and pull harness through hole in underbody.

(3) Unplug connector from harness.

(4) Remove sensor grommet bracket screw from body hose bracket, just forward of trailing arm bushing.

(5) Remove sensor assembly clip, located on the inboard side of trailing arm.

(6) Remove sensor wire fastener from rear brake hose bracket.

(7) Remove outboard sensor assembly retainer nut.

(8) Remove sensor head screw.

(9) Carefully, remove sensor head from adapter assembly. If the sensor has seized, due to corrosion, DO NOT USE PLIERS ON SENSOR HEAD. Use a hammer and a punch (Fig. 7) and tap edge of sensor ear, rocking the sensor side to side until free.

INSTALLATION

Installation is reverse order of removal. Be sure to coat sensor with High Temperature Multi-purpose E.P. Grease before installing into adapter assembly. Tighten screw to 7 N●m (60 in. lbs.) torque. Avoid getting grease on the pickup area of the speed sensor assembly.

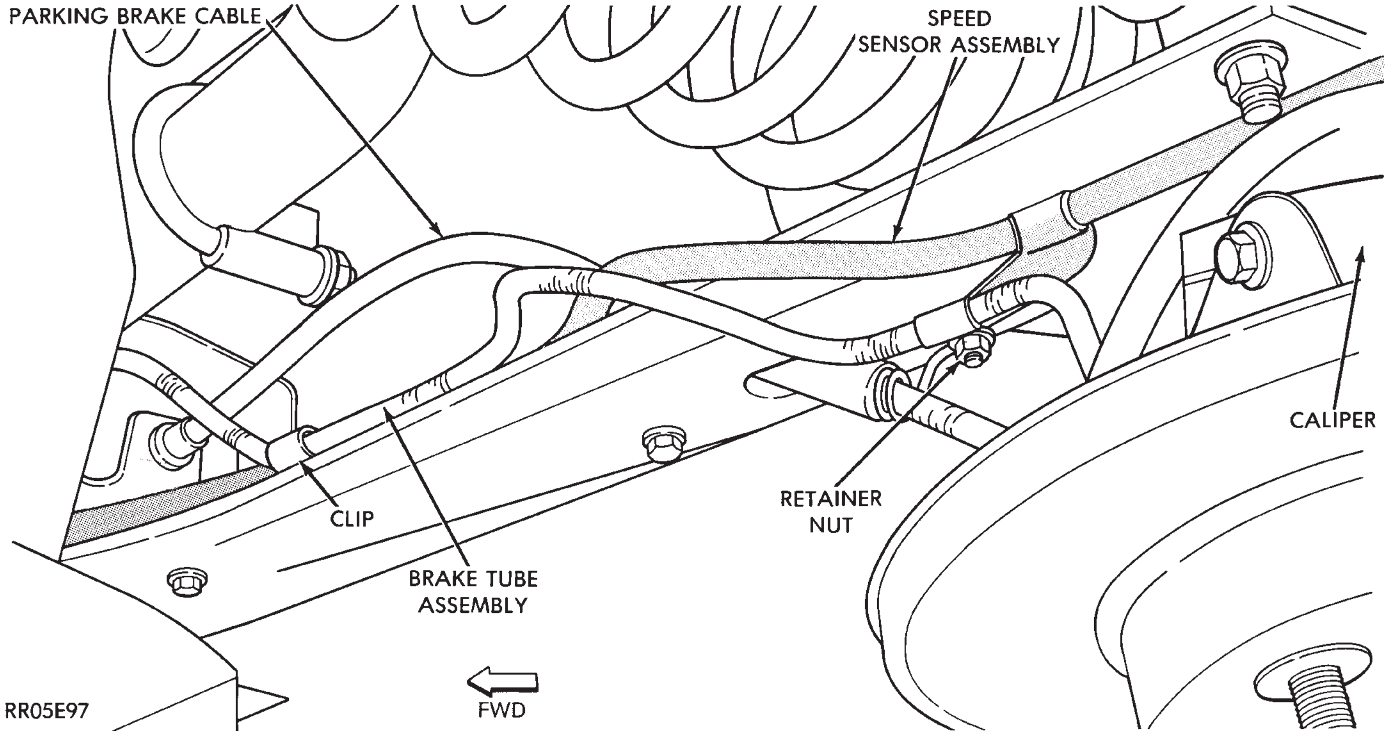


Fig. 6 Rear Wheel Speed Sensor Routing at Trailing Arm

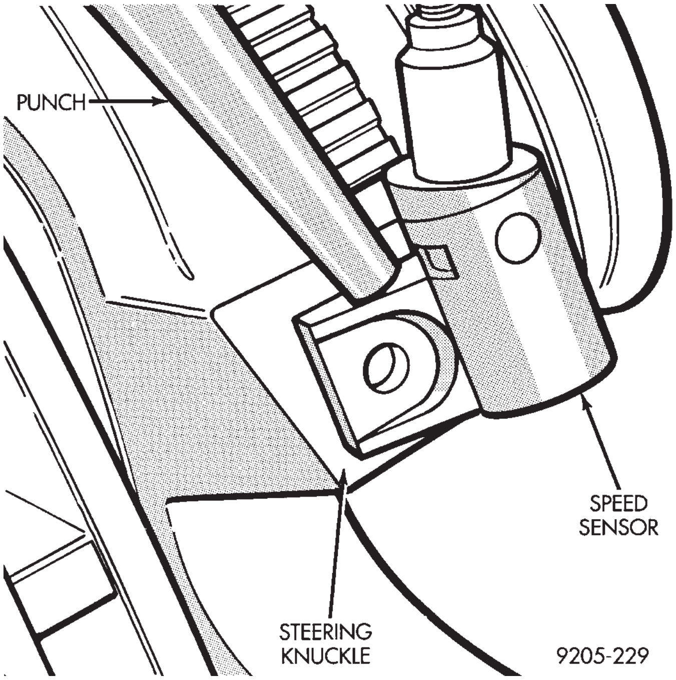


Fig. 7 Removing Speed Sensor (Typical)

DUAL FUNCTION PRESSURE SWITCH

REMOVE

WARNING: FAILURE TO DE-PRESSURIZE THE HYDRAULIC ACCUMULATOR PRIOR TO REMOVING DUAL FUNCTION PRESSURE SWITCH. WILL RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

CAUTION: THOROUGHLY CLEAN THE BOTTOM OF THE HYDRAULIC ASSEMBLY IN THE AREA OF THE DUAL FUNCTION PRESSURE SWITCH, BEFORE REMOVING THE SWITCH FROM HYDRAULIC ASSEMBLY. USE MOPAR BRAKE PARTS CLEANER OR AN EQUIVALENT. EXTREME CARE MUST BE USED SO NO DIRT IS ALLOWED TO ENTER THE HYDRAULIC ASSEMBLY THROUGH WHERE THE DUAL FUNCTION PRESSURE SWITCH IS MOUNTED. ANY DIRT ENTERING HYDRAULIC ASSEMBLY MAY PLUG INTERNAL PASSAGES CAUSING A HYDRAULIC ASSEMBLY FAILURE.

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

(2) Raise vehicle See Hoisting, Group 0.

(3) From under vehicle, disconnect wiring harness connectors from dual function pressure switch and boost pressure transducer (Fig. 9) on the bottom of hydraulic assembly.

WARNING: WEAR EYE PROTECTION WHEN PERFORMING THE FOLLOWING PROCEDURE. SERIOUS EYE INJURY CAN RESULT FROM BRAKE FLUID CONTACTING THE EYES.

(4) **Be sure that the hydraulic system is de-pressurized.** Remove the dual function pressure switch from the hydraulic assembly using Socket, Special Tool 6607 (Fig. 10). Access to the switch is from under the vehicle using a long extension.

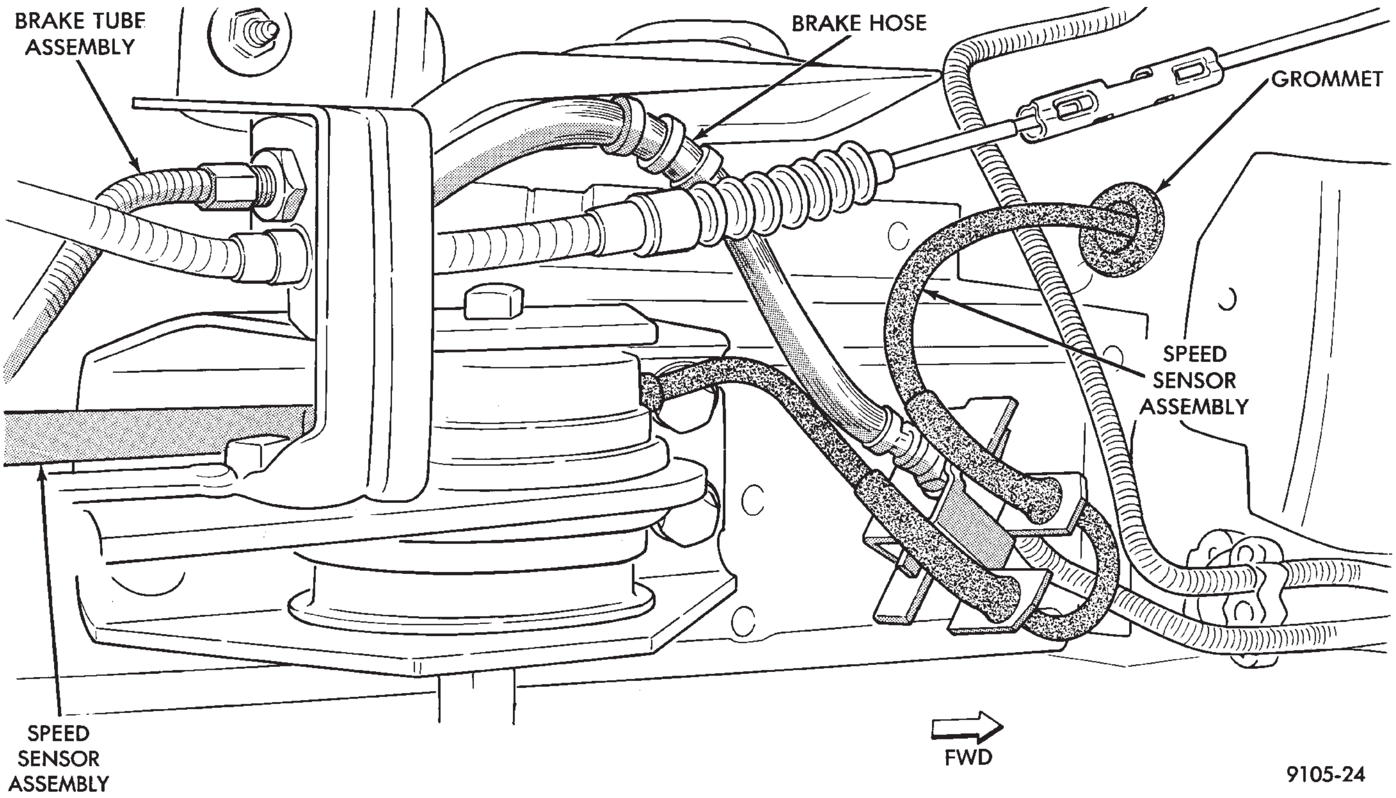


Fig. 8 Body Routing of Rear Speed Sensor Wiring

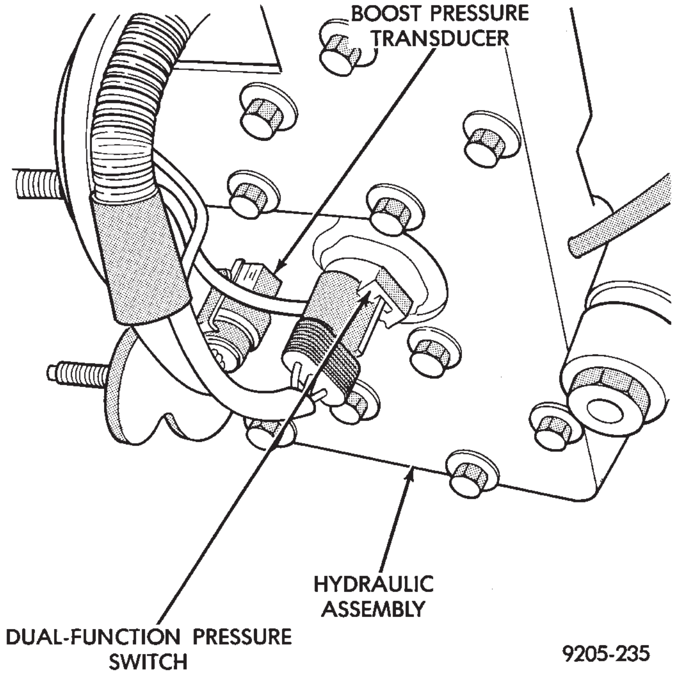


Fig. 9 Dual Function Pressure Switch And Pressure Transducer Wiring

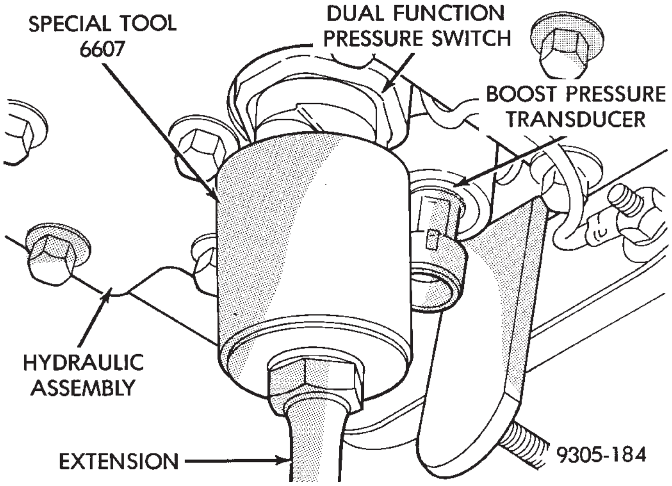


Fig. 10 Dual Function Pressure Switch Remove/ Install

INSTALL

CAUTION: Be sure that the dual function pressure switch is thoroughly cleaned using Mopar Brake Parts Cleaner or an equivalent before installing it into the hydraulic assembly. Wet the O-ring seals on the switch with fresh clean brake fluid before installing it into the hydraulic assembly.

CAUTION: Do not insert dual function pressure switch into hydraulic assembly using the socket and ratchet. Cross threading of the switch may occur.

(1) Install the dual function pressure switch into the hydraulic assembly by hand until the O-ring seals are seated.

(2) Using Socket, Special Tool 6607, (Fig. 10) torque the dual function pressure switch into the hydraulic assembly to 12 N•m (9 ft. lbs.).

(3) Connect the wiring harness connectors (Fig. 9) onto the dual function pressure switch and the boost pressure transducer. Be sure the locking tabs on the connectors are fully engaged on the switches.

(4) Lower the vehicle.

(5) Turn the ignition switch to the on position and let the system pressurize. Check for any leaks at the dual function pressure switch.

(6) Fully de-pressurize the hydraulic assembly a second time. This will purge any air out that may have entered hydraulic assembly when the switch was removed. Turn the ignition switch to the on position and let the system pressurize again.

(7) Road test vehicle to insure that the brake system is performing correctly.

PRIMARY PRESSURE TRANSDUCER

REMOVE

WARNING: FAILURE TO FULLY DE-PRESSURIZE THE HYDRAULIC BLADDER ACCUMULATOR PRIOR TO REMOVING PRIMARY PRESSURE TRANSDUCER. WILL RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

To remove primary pressure transducer (Fig. 11), from hydraulic assembly, removal of hydraulic assembly from vehicle is **not** required.

(1) Fully de-pressurize the hydraulic accumulator by pumping brake pedal a minimum of 40 times. Use procedure described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

(2) Remove as much brake fluid as possible from the brake fluid reservoir, using a syringe or equivalent method.

(3) Using oil filter band wrench, Special Tool C-4065 or equivalent, (Fig. 12) loosen bladder accumulator. Then remove bladder accumulator and brake fluid spray shield from hydraulic assembly.

(4) Remove high pressure banjo fitting (Fig. 13) from hydraulic assembly.

(5) Using needle nose pliers, remove the 3 fluid reservoir retaining pins from the hydraulic assembly (Fig. 14). Compress barb on opposite side of retaining pin, to prevent pin from breaking.

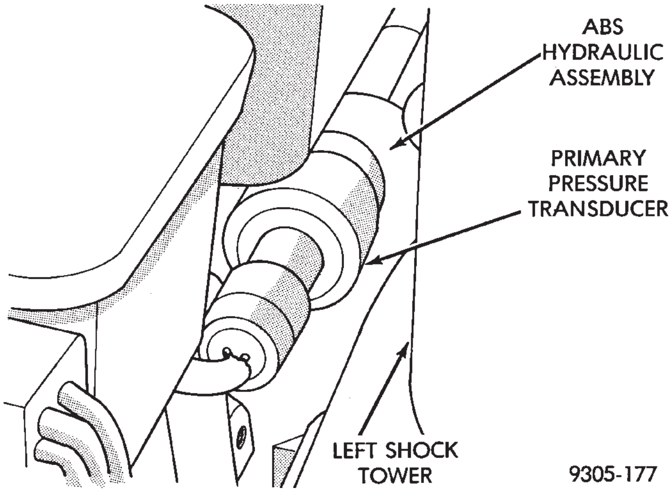


Fig. 11 Primary Pressure Transducer Location On Hydraulic Assembly

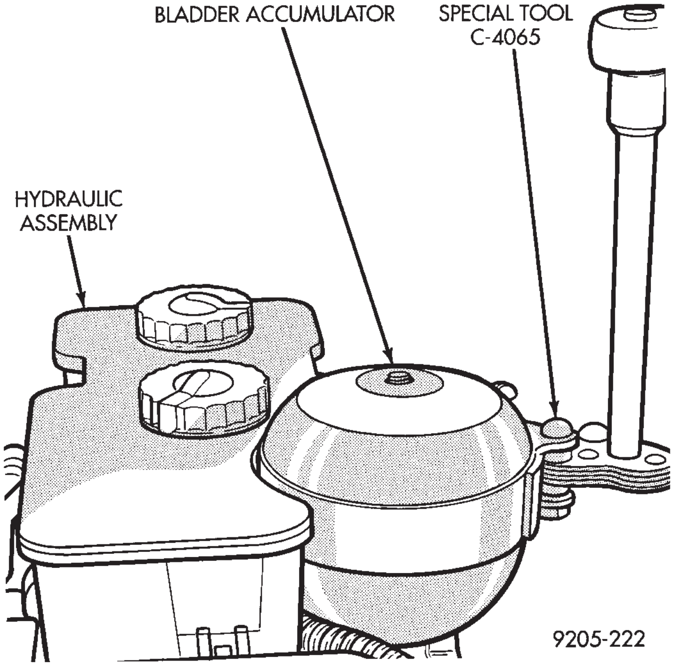


Fig. 12 Removing Bladder Accumulator

CAUTION: Be extremely careful during the following procedure to avoid damaging or puncturing brake fluid reservoir during its removal.

(6) Remove brake fluid reservoir from hydraulic assembly by **carefully** prying between reservoir and hydraulic assembly using a blunt pry bar (Fig. 15). Use a rocking motion to help disengage reservoir from grommets while prying.

(7) Remove brake fluid level sensor from reservoir and remove fluid reservoir from vehicle.

(8) Remove hydraulic assembly wiring harness connector from the primary pressure transducer (Fig. 16).

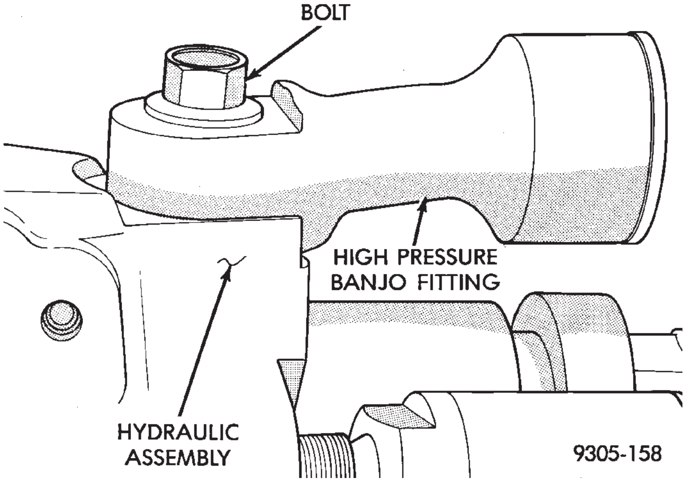


Fig. 13 High Pressure Banjo Fitting

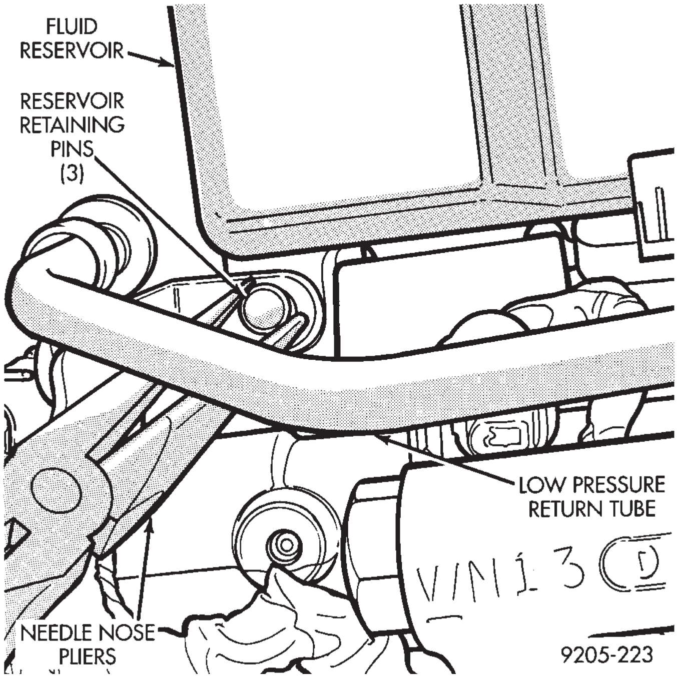


Fig. 14 Reservoir Retaining Pin Removal

(9) Using Socket, Special Tool 6684 loosen and remove primary pressure transducer from hydraulic assembly (Fig. 17)

INSTALL

(1) Install primary pressure transducer into hydraulic assembly by hand, until O-ring is fully seated into hydraulic assembly. Then torque primary pressure transducer, into hydraulic assembly, using Socket, Special Tool 6684, to 12 N●m (106 in. lbs.).

(2) Connect vehicle wiring harness connector, onto primary pressure transducer (Fig. 16). Be sure latch on vehicle wiring harness connector is fully engaged with locking tab on primary pressure transducer.

(3) Using fingers, remove the 3 reservoir sealing grommets from hydraulic assembly or reservoir and discard. **Sealing grommets must not be reused, when brake fluid reservoir is installed back on hydraulic assembly.**

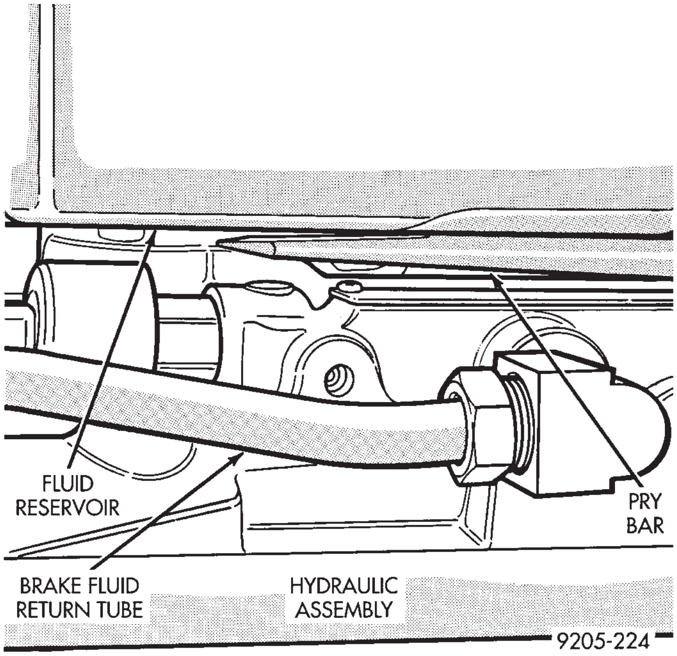


Fig. 15 Reservoir Removal From Hydraulic Assembly

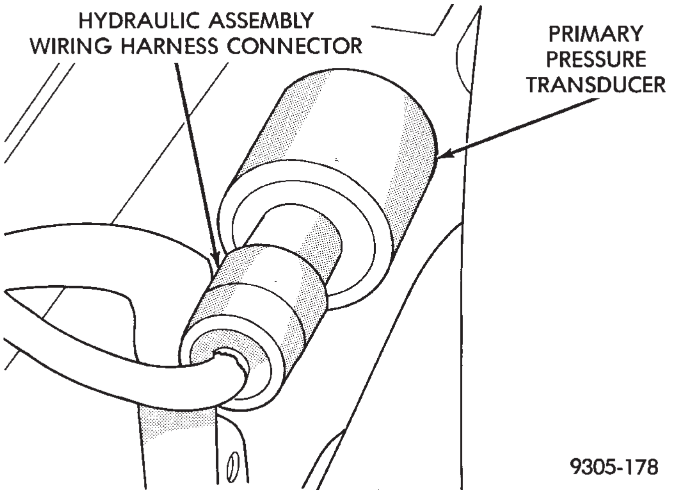


Fig. 16 Wiring Harness Connection To Primary Pressure Transducer

(4) Thoroughly lubricate new reservoir sealing grommets, using fresh clean brake fluid, and install on fluid reservoir outlet ports.

(5) Install brake fluid level switch into brake fluid reservoir.

(6) Press brake fluid reservoir into hydraulic assembly **by hand**, using a rocking motion to help seat fluid reservoir into hydraulic assembly. Be sure that sealing grommets are fully seated into the hydraulic assembly. **Do not attempt to pound fluid reservoir into hydraulic assembly using a hammer.**

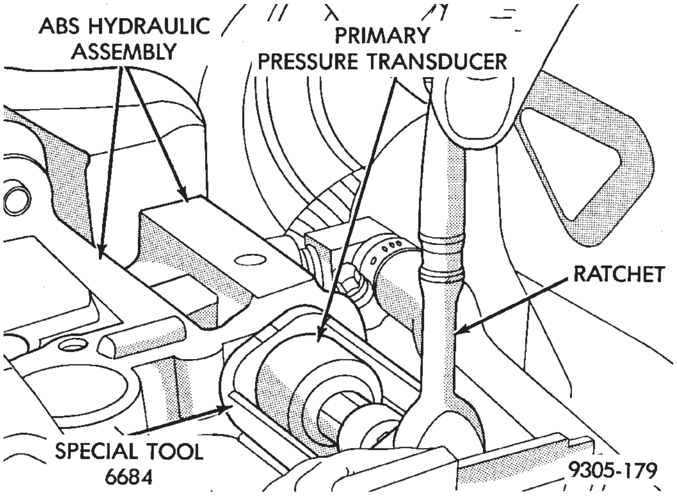


Fig. 17 Primary Pressure Transducer Removal And Replacement

(7) Using needle nose pliers, install the 3 brake fluid reservoir to hydraulic assembly retaining pins (Fig. 14). **Be sure retaining pins are fully installed with barbs extending out past reservoir on opposite side.**

(8) Install high pressure hose banjo fitting onto hydraulic assembly and install banjo fitting attaching bolt. Torque banjo fitting to hydraulic assembly banjo bolt to 13 N•m (10 ft. lbs.).

(9) Install brake fluid spray shield onto hydraulic assembly. Install bladder accumulator into hydraulic assembly by hand (using care not to cross thread accumulator) until O-ring seal is fully seated into hydraulic assembly.

(10) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent, (Fig. 12) torque bladder accumulator to 48 N•m (35 ft. lbs.).

(11) Fill hydraulic assembly fluid reservoir to the top of the screen on the filter\trainer. Use only fresh clean brake fluid conforming to DOT 3 requirements, such as Mopar® or equivalent.

(12) Bleed the brake hydraulic system using procedure shown in Bleeding Brake System in this section of the service manual.

DIFFERENTIAL PRESSURE SWITCH

REMOVE

WARNING: FAILURE TO FULLY DE-PRESSURIZE THE HYDRAULIC BLADDER ACCUMULATOR PRIOR TO REMOVING DIFFERENTIAL PRESSURE SWITCH. WILL RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

To remove the differential pressure switch (Fig. 18), from the hydraulic assembly, removal of the hydraulic assembly from the vehicle is **not** required.

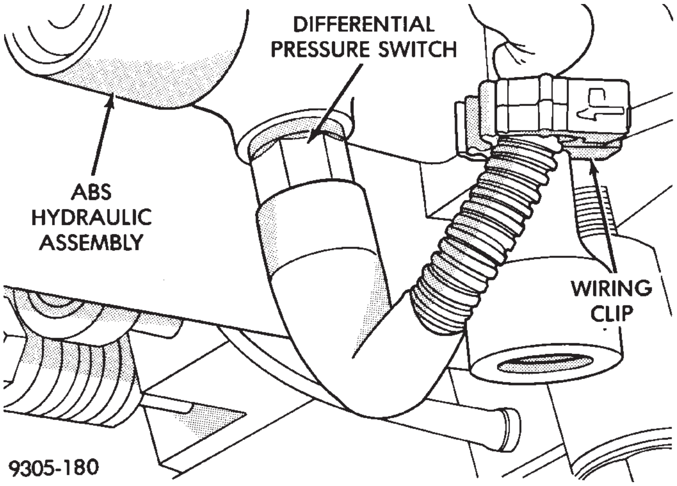


Fig. 18 Differential Pressure Switch Location

(1) De-pressurize hydraulic bladder accumulator on hydraulic assembly by pumping the brake pedal a minimum of 40 times. Refer to the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

(2) Disconnect the hydraulic assembly wiring harness connector from the primary pressure transducer (Fig. 19).

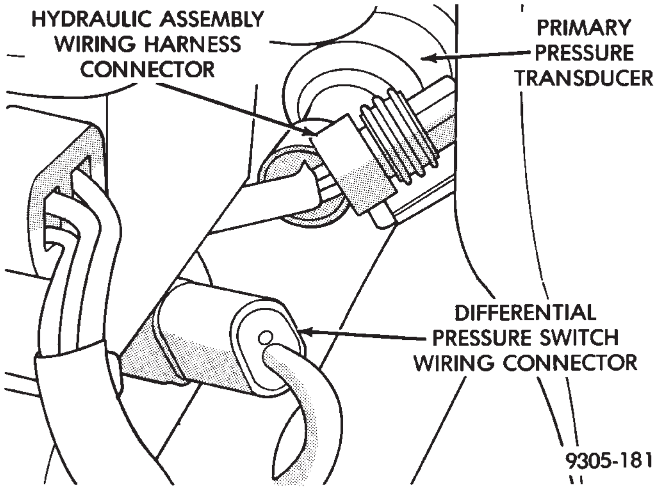


Fig. 19 Primary Pressure Transducer And Differential Pressure Switch Wiring Harness Connectors

(3) Disconnect differential pressure switch wiring harness connector from hydraulic assembly wiring harness (Fig. 19). **Do not attempt to remove wiring harness from differential pressure switch.**

(4) Raise vehicle 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) Using a long extension and Socket, Special Tool 6684 loosen and remove differential pressure switch from bottom of hydraulic assembly (Fig. 20)

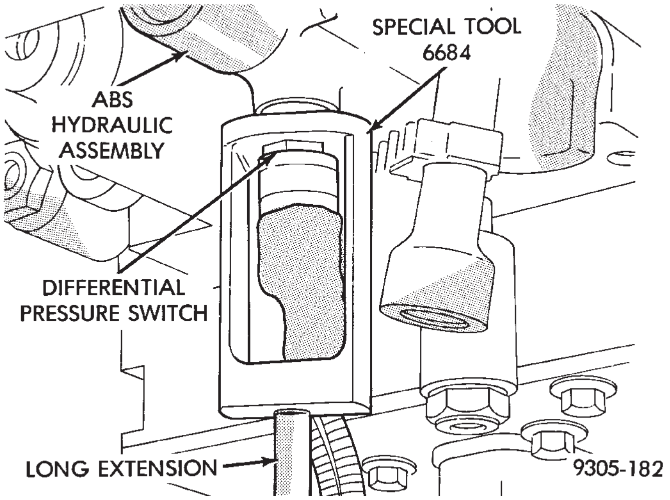


Fig. 20 Differential Pressure Switch Removal And Replacement

INSTALL

(1) Install differential pressure switch into hydraulic assembly by hand, until fully threaded into hydraulic assembly. Then torque differential pressure switch, into hydraulic assembly, using Socket, Special Tool 6684, to 1.5 N●m (13 in. lbs.).

(2) Lower vehicle

(3) Connect differential pressure switch wiring harness connector into hydraulic assembly wiring harness (Fig. 19).

(4) Connect the hydraulic assembly wiring harness connector into the primary pressure transducer (Fig. 19).

(5) Turn the ignition switch to the on position and let the system pressurize. Check for any signs of leakage at the differential pressure switch.

(6) Fully de-pressurize the hydraulic assembly a second time to purge any air out that may have entered hydraulic assembly when the differential pressure switch was removed. Turn the ignition switch to the on position and let the system pressurize again.

(7) Fill hydraulic assembly fluid reservoir to the top of the screen on the filter\trainer. Use only fresh clean brake fluid conforming to DOT 3 requirements, such as Mopar® or equivalent.

(8) Road test vehicle to insure that the brake system is performing correctly.

BOOST PRESSURE TRANSDUCER

REMOVE

WARNING: FAILURE TO FULLY DE-PRESSURIZE THE HYDRAULIC BLADDER ACCUMULATOR PRIOR TO REMOVING BOOST PRESSURE TRANSDUCER. MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

To remove the boost pressure transducer (Fig. 21), from the hydraulic assembly, removal of the hydraulic assembly from the vehicle is **not** required.

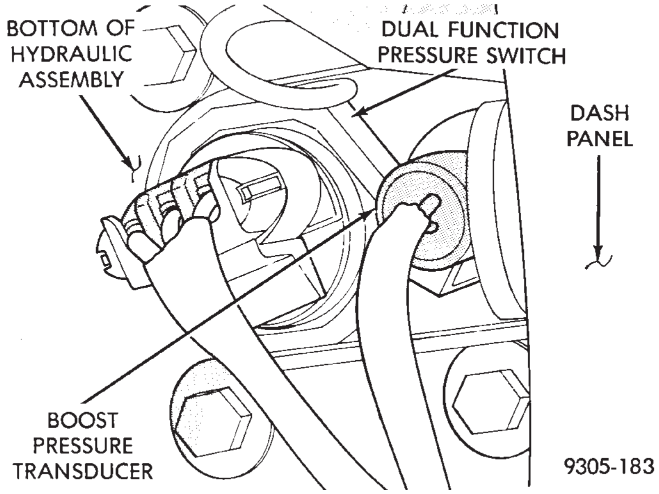


Fig. 21 Boost Pressure Transducer Location

(1) De-pressurize hydraulic bladder accumulator on hydraulic assembly by pumping the brake pedal a minimum of 40 times. Refer to the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

(2) Raise vehicle 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.

(3) Disconnect hydraulic assembly wiring harness connectors from the dual function pressure switch and boost pressure transducer (Fig. 21).

(4) Using a long extension and Socket, Special Tool 6607, remove dual function pressure switch from bottom of hydraulic assembly (Fig. 22)

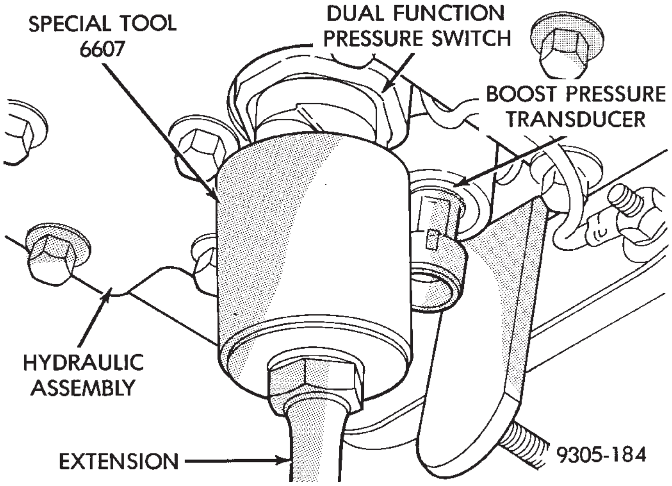


Fig. 22 Remove And Install Dual Function Pressure Switch

(5) Remove boost pressure transducer from hydraulic assembly, from under vehicle using a long extension and Socket, Special Tool 6684 (Fig. 23).

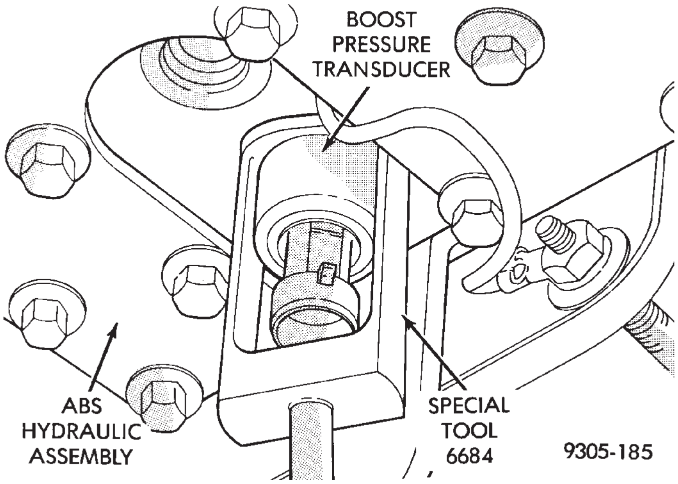


Fig. 23 Remove And Install Boost Pressure Transducer

INSTALL

(1) Install boost pressure transducer (Fig. 23) into hydraulic assembly by hand, until O-ring is fully seated into hydraulic assembly. Then torque boost pressure transducer, into hydraulic assembly, using Socket, Special Tool 6684, to 12 N●m (106 in. lbs.).

(2) Install Dual Function Pressure Switch (Fig. 22) into hydraulic assembly by hand, until O-ring is fully seated into hydraulic assembly. Then torque dual function pressure switch, into hydraulic assembly, using Socket, Special Tool 6607, to 12 N●m (106 in. lbs.).

(3) Connect hydraulic assembly wiring harness connectors, onto the dual function pressure switch and boost pressure transducer (Fig. 21).

(4) Turn the ignition switch to the on position and let the system pressurize. Check for any signs of leakage at the differential pressure switch.

(5) Fully de-pressurize the hydraulic assembly a second time to purge any air out that may have entered hydraulic assembly when the differential pressure switch was removed. Turn the ignition switch to the on position and let the system pressurize again.

(6) Fill hydraulic assembly fluid reservoir to the top of the screen on the filter\trainer. Use only fresh clean brake fluid conforming to DOT 3 requirements, such as Mopar® or equivalent.

(7) Road test vehicle to insure that the brake system is performing correctly.

ANTI-LOCK BRAKE SYSTEM—BENDIX ANTI-LOCK 6 AA,AG,AJ,AP BODY

INDEX

GENERAL INFORMATION

The purpose of the Anti-Lock Brake System (ABS) is to prevent wheel lock-up under heavy braking conditions on virtually any type of road surface. Anti-Lock 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 heavy braking.

This section of the service manual covers the description, diagnostics, and on car service for the Bendix Anti-Lock 6 Brake System. 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 manual for the specific service procedure required.

ANTI-LOCK BRAKE SYSTEM DEFINITIONS

In this section of the manual several abbreviations are used for the components that are in the Anti-Lock Braking System They are listed below for your reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System

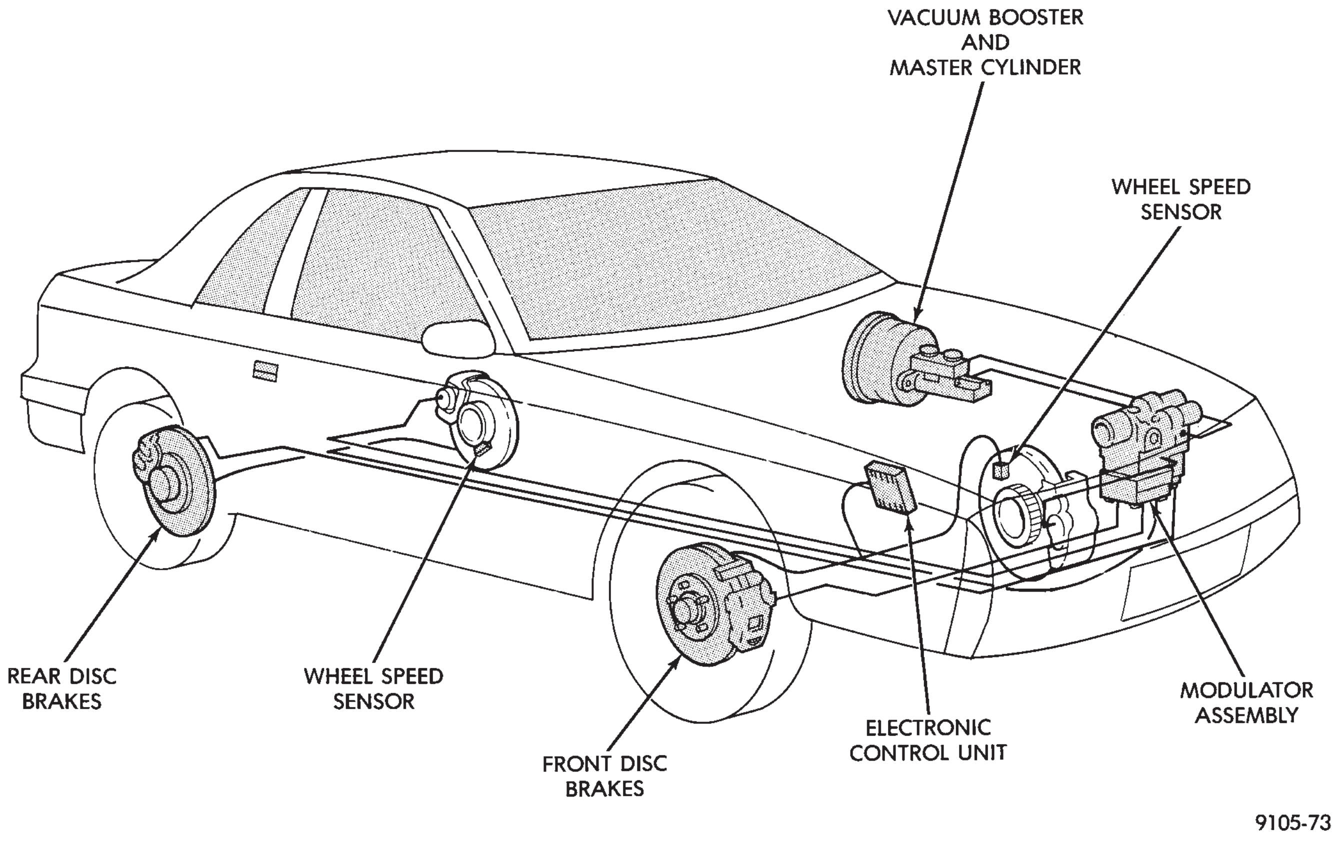


Fig. 1 Four-Wheel Anti-Lock Brake System Components AA/AG/AJ Body

- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

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.

If a wheel locking tendency is detected during a brake application, the system will enter Anti-Lock mode. During Anti-Lock 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 electrical valves and hydraulic line to provide modulation, although for vehicle stability, both rear wheel valves receive the same electrical signal. The system can build or reduce pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller Anti-Lock Brake (CAB).

MAJOR COMPONENTS

The following is a list of major system components. Details of all components can be found later in this section. See (Fig. 1) for the general location of the components in the vehicle.

MASTER CYLINDER AND VACUUM BOOSTER

The Bendix Anti-Lock 6 Brake System uses the vehicles standard Master Cylinder/Reservoir and Vacuum Booster (Fig. 2). The master cylinder primary and secondary outputs go directly to the Modulator Assembly.

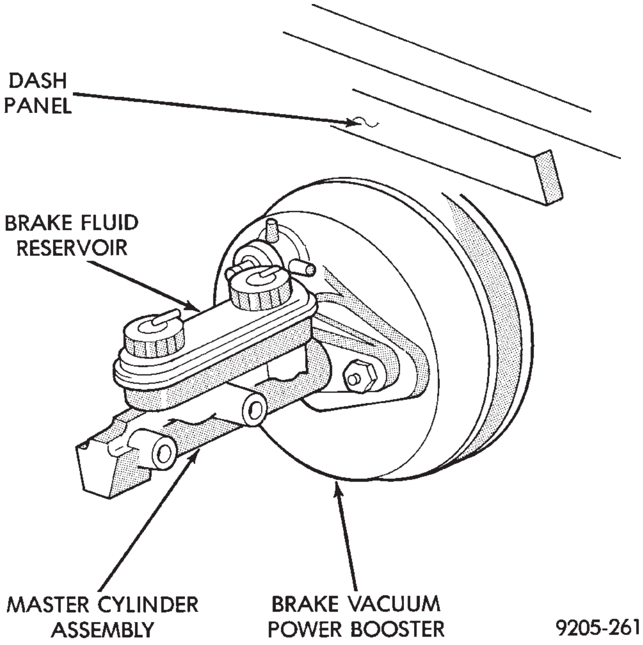


Fig. 2 Master Cylinder Brake Booster Assemble

MODULATOR AND PUMP MOTOR/ASSEMBLY

The Modulator Assembly (Fig. 3) contains the wheel circuit valves used for brake pressure modulation and the Pump/Motor.

The Pump/Motor function, as part of the Modulator Assembly. Is to pump low pressure brake fluid from the brake fluid sump into the ABS Accumulator. During a stop which requires the ABS system to become operational.

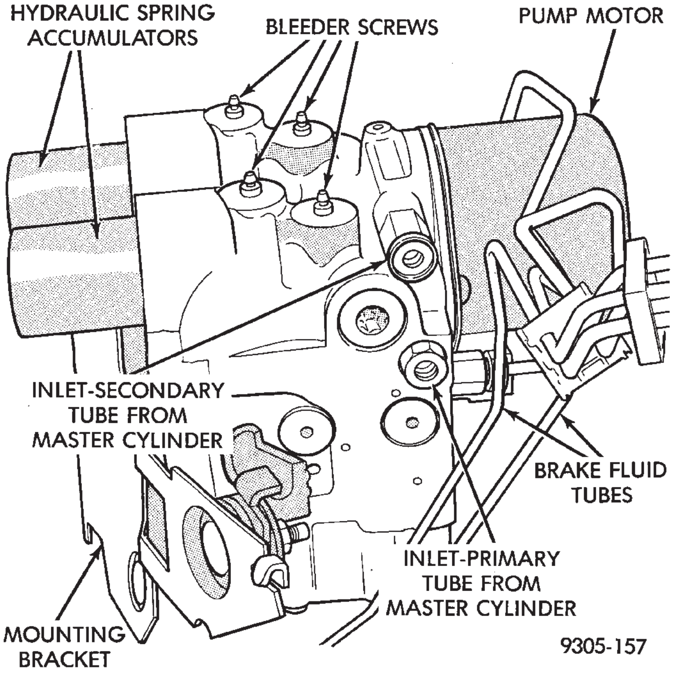


Fig. 3 Modulator And Pump/Motor Assembly

WHEEL SPEED SENSORS

A Wheel Speed Sensor (Fig. 4) is located at each wheel to transmit wheel speed information to the Controller Anti-Lock Brake (CAB).

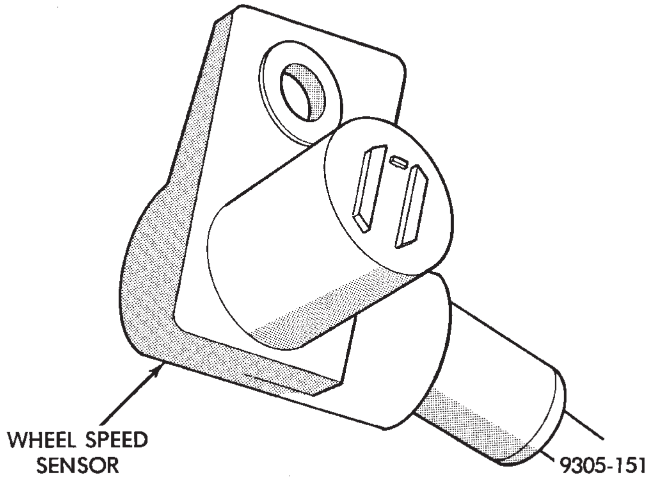


Fig. 4 Wheel Speed Sensor

CONTROLLER ANTI-LOCK BRAKE (CAB)

The (CAB) (Fig. 5) is a small control computer which receives wheel speed information, controls Anti-Lock operation and monitors system operation.

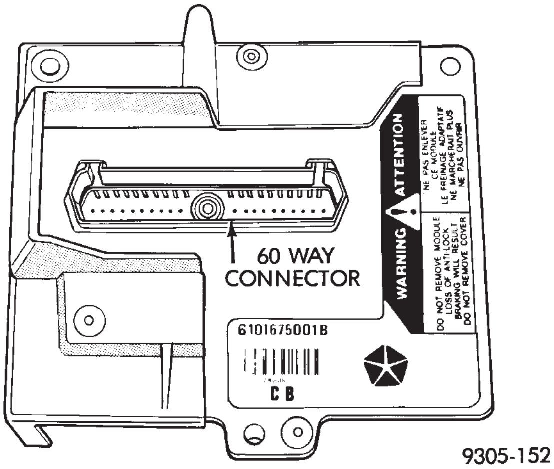


Fig. 5 Controller Anti-Lock Brake (CAB)

ANTI-LOCK BRAKES OPERATION AND PERFORMANCE

This Anti-Lock Braking 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. More technical details are discussed further in this section.

PEDAL FEEL

Since the Bendix Anti-Lock 6 Braking System uses the conventional Booster/Master Cylinder. The brake pedal feel during normal braking is the same as conventional Non ABS equipped cars.

When Anti-Lock is activated during hard braking due to a wheel lockup tendency. Brake pedal effort will increase do to the master cylinder pressure being isolated from the brake system. Some brake pedal movement and associated noises may be felt and herd by the driver. This is normal of a Anti-Lock Braking System due to pressurized fluid being transferred to and from the wheel brakes.

ANTI-LOCK BRAKE SYSTEM OPERATION

During Anti-Lock Braking, brake pressures are modulated by cycling electric solenoid valves. The cycling of these valves can be faintly heard as a series of popping or ticking noises. In addition, the cycling may be felt as a pulsation in the brake pedal, although no pedal movement will be noticed. If Anti-Lock 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.

Although ABS operation is available at virtually all vehicle speeds. It will automatically turn off at speeds below 3 to 5 mph. Wheel lockup may be perceived at the very end of an anti lock stop and is considered normal.

TIRE NOISE & MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired in order to achieve optimum braking performance. During brake pressure modulation, as brake pressure is increased, wheel slip is allowed to reach up to 30%. This means that the wheel rolling velocity is 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 Anti-Lock Braking System will not leave dark black tire marks since the wheel never reaches a locked condition. Tire marks may however be noticeable as light patched marks.

VEHICLE PERFORMANCE

Anti-Lock Brakes provide the driver with some steering control during hard braking, however there are conditions 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 Anti-Lock instead of Anti-Skid.

SYSTEM SELF-DIAGNOSTICS

The Bendix Anti-Lock 6 Brake System has been designed with the following self diagnostics capability.

The self diagnostic ABS startup cycle begins when the ignition switch is in the on position. An electrical check is completed on the ABS components such as Wheel Speed Sensor Continuity and System and other Relay continuity. During this check the Amber Anti-Lock Light is on for approximately 1-2 seconds.

Further Functional testing is accomplished once the vehicle is set in motion.

(1) The solenoid valves and the pump/motor are activated briefly to verify function.

(2) The voltage output from the wheel speed sensors is verified to be within the correct operating range.

If the vehicle is not set in motion within 3 minutes from the time the ignition switch is set in the on position. The solenoid test is bypassed but the pump/motor is activated briefly to verify that it is operating correctly.

WARNING SYSTEMS OPERATION

The ABS system uses an Amber Anti-Lock Warning Lamp, located in the instrument cluster. The purpose of the warning lamp is discussed in detail below.

The Amber Anti-Lock Warning Light will turn on when the (CAB) detects a condition which results in a shutdown of the Anti-Lock function. The Amber Anti-Lock Warning Lamp is normally on until the (CAB) completes its self tests and turns the lamp off (approximately 1-2 seconds). When the Amber Anti-Lock Warning Light is on only the Anti-Lock function of the brake system if affected. The standard brake system and the ability to stop the car will not be affected when only the Amber Anti-Lock Warning Light is on.

NORMAL OPERATION OF WARNING LAMP

With the ignition in the Crank position, the Red Brake Warning Lamp will turn on as a bulb check. The Amber Anti-Lock Warning Lamp will stay on for 1-2 seconds then turn off. Once verification of the self diagnosis is completed.

ANTI-LOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the Anti-Lock Brake System components. For information on servicing the Four Wheel Disk Brake System, see the standard Brake section of this Service Manual.

MODULATOR ASSEMBLY

WARNING: THE ONLY PART OF THE MODULATOR ASSEMBLY THAT IS A SERVICEABLE COMPONENT IS THE DELTA P SWITCH. THE REMAINING COMPONENTS OF THE MODULATOR ASSEMBLY ARE NOT SERVICEABLE ITEMS. NO ATTEMPT SHOULD BE MADE TO REMOVE OR SERVICE ANY OTHER PARTS OF THE MODULATOR ASSEMBLY.

The Modulator Assembly (Fig. 1) is located under the battery tray and is covered with an acid shield. The Modulator Assembly contains the following components for controlling the Anti-Lock braking system. 2 Isolation Valves, 4 Build/Decay Valves, 4 Shuttle Orifices, 2 Fluid Sumps, 2 Accumulators, a Pump/Motor and a Pressure Differential Valve/Switch. Also attached to the Modulator Assembly are 4 brake tubes which are connected to an 8 way connector block. The connector block is mounted to the left frame rail below the master cylinder in the same location as the non ABS equipped combination valve. The wheel brake lines are attached to the system via the connector block.

ISOLATION VALVES

The Isolation Valves are used to isolate the master cylinder from the rest of the brake hydraulic circuit during an Anti-Lock stop. Two Isolation Valves are used, one for the primary circuit and one for the secondary circuit. The Isolation Valves are spring loaded in the released position. In the released position the Isolation Valves provide a fluid path from the master cylinder outputs to the wheel brakes via the Build/Decay valves. When actuated it provides a fluid path from the accumulator (which was charged by the Pump/Motor during ABS operation) to the Build/Decay valves through the Shuttle Orifices.

BUILD/DECAY VALVES

There are 4 Build/Decay valves, one for each wheel. In the released position they provide a fluid path from the wheel brakes to the Isolation Valve through the shuttle orifices. In the actuated (decay) position, they provide a fluid path from the wheel brakes to the sump. The Build/Decay valves are spring loaded in the released (build) position.

SHUTTLE ORIFICE

There are 4 Shuttle Orifice Valves, one for each wheel. The Shuttle Orifice Valve is a hydraulically actuated valve which shuttles when the Build/Decay valve is actuated. Actuating of the Build/Decay valve causes a pressure differential to be created across the Shuttle Orifice Valve. This acts like placing an orifice (restriction) in the line between the Isolation Valve and the Build/Decay Valve. This restriction provides a controlled build rate to each wheel brake during an Anti-Lock stop. The Shuttle Orifice Valve will remain in the orificed position until the ABS cycle is complete. When the ABS cycle has been completed the Isolation and Build/Decay valves will return to their released position which will equalize the pressure across the Shuttle Orifice Valves. When the pressure equalizes, the spring loaded Shuttle Orifice valves will return to the unrestricted position.

FLUID SUMPS

There are two Fluid Sumps in the Hydraulic Assembly, one each for the primary and secondary hydraulic circuits. The Fluid Sumps store the brake fluid that is decayed from the wheel brakes during ABS cycle. This fluid is then pumped to an accumulator and/or the hydraulic system in order to provide build pressure. The typical pressure in the sumps is 50 psi, During ABS operation only.

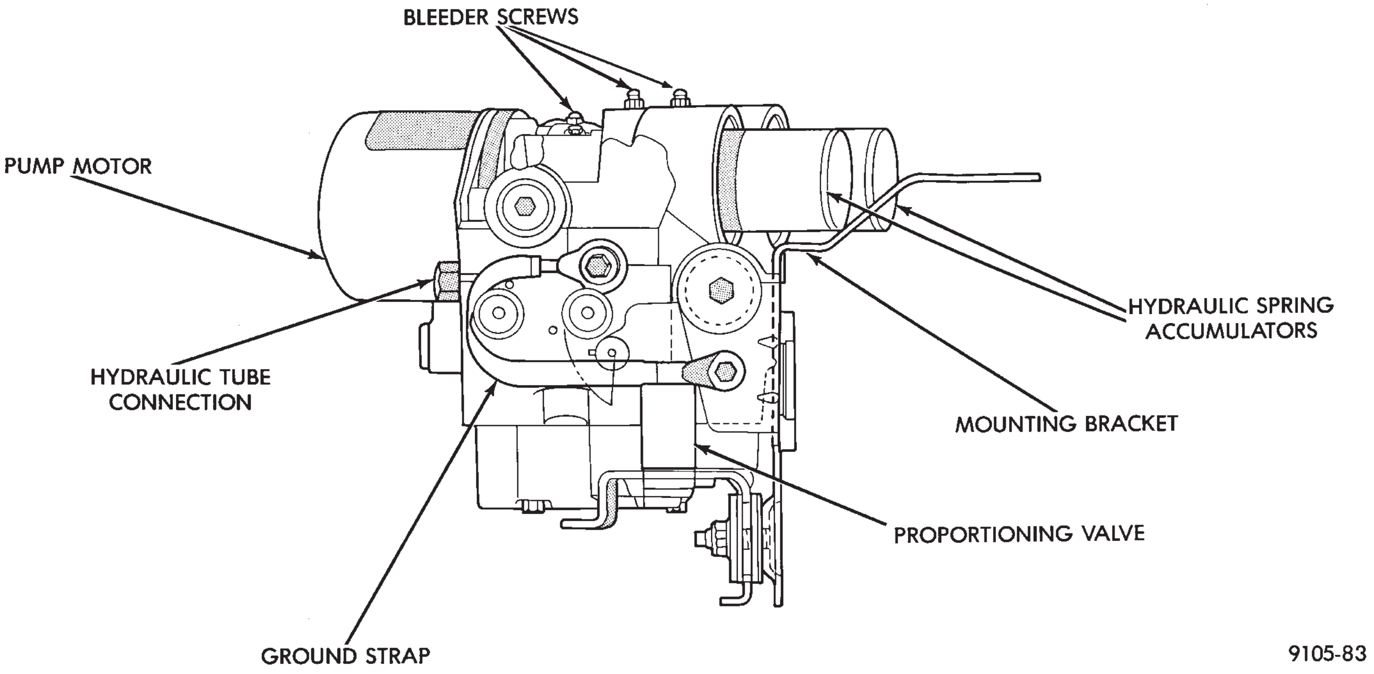


Fig. 1 Modulator Assembly

HYDRAULIC SPRING ACCUMULATOR

The Hydraulic Spring Accumulators (Fig. 2) (one on each circuit) are used to store pressurized hydraulic brake fluid during ABS operation only. This fluid is used during hard braking when the ABS system is activated, to supplement brake pressure when required. During normal Non ABS braking operation there is NO pressurized brake fluid stored in the accumulators. The Hydraulic Spring Accumulators are not a serviceable part of the Modulator Assembly and should never be removed from the assembly.

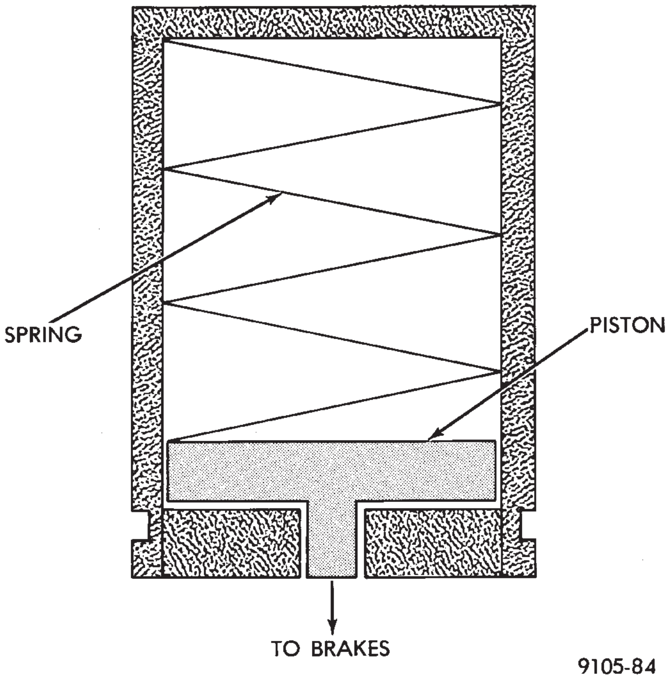


Fig. 2 Hydraulic Spring Accumulator

PRESSURE DIFFERENTIAL VALVE/SWITCH (DELTA P SWITCH)

The Pressure Differential Valve/Switch is located inside the hydraulic assembly. This valve/switch functions the same as the Pressure Differential Valve/Switch located in the combination valve on standard brake systems. The delta P switch monitors the primary and secondary hydraulic circuits for a difference in pressure. A pressure difference greater than 225 psi. Will move and latch the shuttle to ground the Red Brake Warning Light circuit. This will in turn, turn on the Red Brake Warning Light in the instrument panel to warn the driver of a hydraulic system problem. This Pressure Differential Valve Switch is a replaceable item of the Modulator Assembly. **The Red Brake Warning Light indicates a problem with the foundation brake system and not the Anti-Lock system.**

PUMP/MOTOR ASSEMBLY

The Modulator Assembly contains 2 Pump Assemblies, one each for the primary and secondary hydraulic circuits. Both pumps are driven by a common electric motor which is part of the Modulator Assembly. The pumps pick up fluid from the sumps to supply pressure to the accumulators or hydraulic system via the isolation valves during an Anti-Lock stop. The motor only runs during an ABS stop and is controlled by the (CAB) via the Pump/Motor Relay. The Pump/Motor Assembly is not a serviceable item. If it requires service the Modulator Assembly must be replaced.

PROPORTIONING VALVES

Two Proportioning Valves (Fig. 3) are used in the system, one for each rear brake hydraulic circuit. The Proportioning Valves function the same as in a standard brake system. The Proportioning Valves are located on the bottom of the hydraulic assembly (Fig. 1). They are the same screw in type as the ones used on the Bendix Anti-Lock 10 and Bosh Anti-Lock Brake systems.

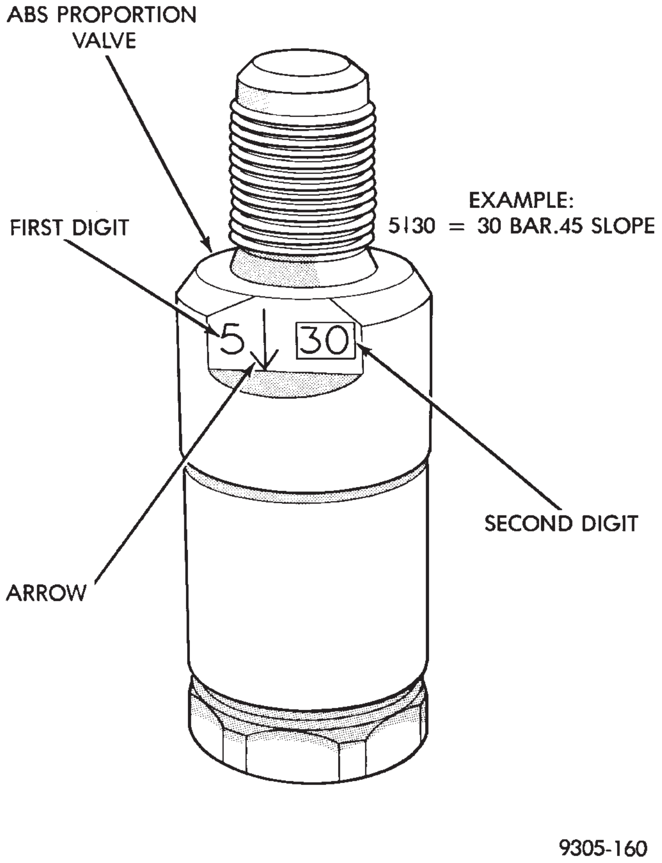


Fig. 3 Proportioning Valve Identification

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS), is located at each wheel (Fig. 4 and 5), and sends a small (AC) signal to the control module (CAB). This signal is generated by magnetic induction. The magnetic induction is created, when a toothed sensor ring Tone Wheel (Fig. 6) passes a 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, the (CAB) will then modulate hydraulic pressure to prevent the wheel(s) from locking.

The front Wheel Speed Sensor is attached to a boss in the steering knuckle (Fig. 4). The tone wheel is part of the outboard constant velocity joint. The rear Wheel Speed Sensor is mounted to the caliper adaptor (Fig. 5) and the rear tone wheel is an integral part of the rear wheel hub (Fig. 6). The speed sensor air gap is NOT adjustable.

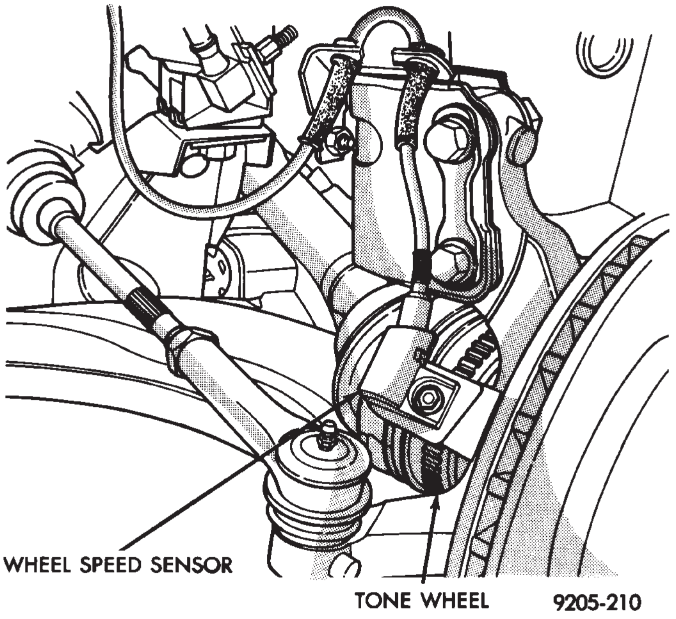


Fig. 4 Front Wheel Speed Sensor

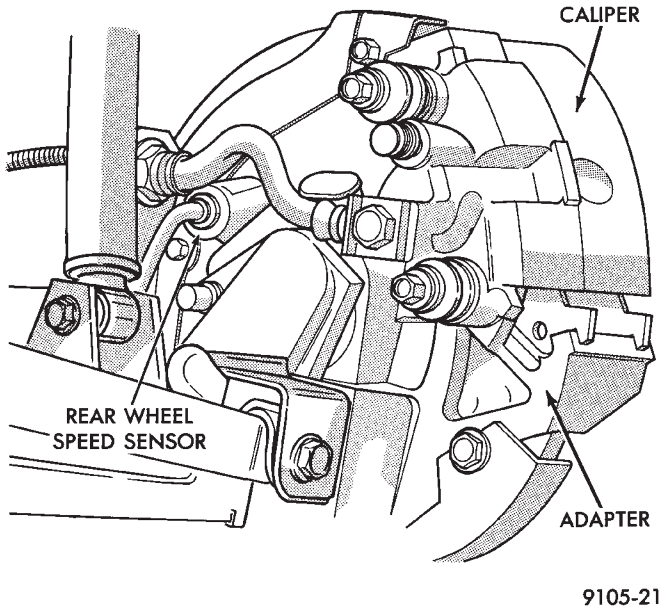


Fig. 5 Rear Wheel Speed Sensor

The four Wheel Speed Sensors are serviced individually. The front Tone Wheels are serviced as an assembly with the outboard constant velocity joint. The rear Tone Wheels are serviced as an assembly with the rear brake hub.

Correct Anti-Lock system operation is dependent on the vehicle's wheel speed signals, that are generated by the Wheel Speed Sensors. The vehicle's wheels and tires must all be the same size and type to generate accurate signals. In addition, the tires must be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals.

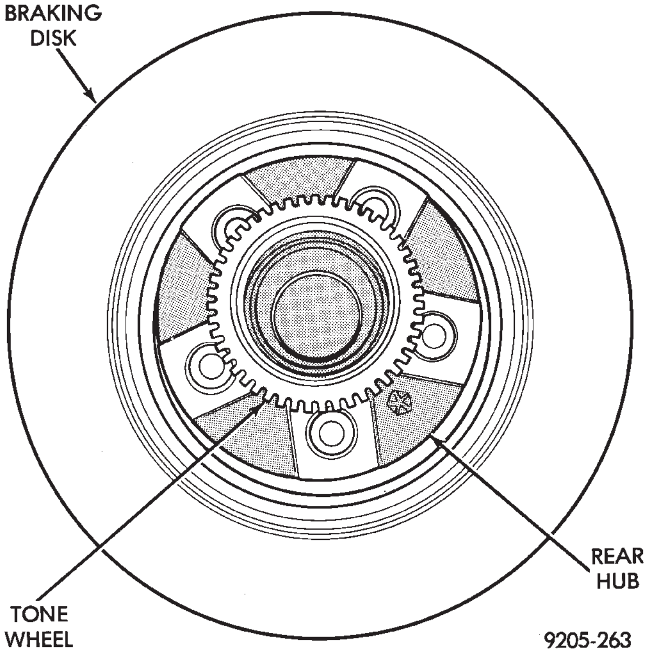


Fig. 6 Tone Wheel (Typical)

CONTROLLER ANTI-LOCK BRAKE (CAB)

The Anti-Lock Brake Controller is a small microprocessor based device which monitors the brake system and controls the system while it functions in Anti-Lock mode. The CAB is mounted on the top of the right front frame rail and uses a 60-way system connector (Fig. 7). The power source for the CAB is through the ignition switch in the Run or On position. **THE CONTROLLER ANTI-LOCK BRAKE (CAB) IS NOT ON THE CCD BUS**

The primary functions of the (CAB) are:

(1) Detect wheel locking tendencies.

(2) Control fluid modulation to the brakes while in Anti-Lock mode.

(3) Monitor the system for proper operation.

(4) Provide communication to the DRB II while in diagnostic mode.

The (CAB) continuously monitors the speed of each wheel, through the signals generated at the Wheel Speed Sensors, to determine if any wheel is beginning to lock. When a front wheel locking tendency is detected, the (CAB) will isolate the master cylinder from the wheel brakes. This is done by activating the Isolation Valves. The (CAB) then commands the appropriate Build/Decay valves to 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 Anti-Lock Warning Lamp and disable the ABS braking system. The normal Non ABS braking system will remain operational.

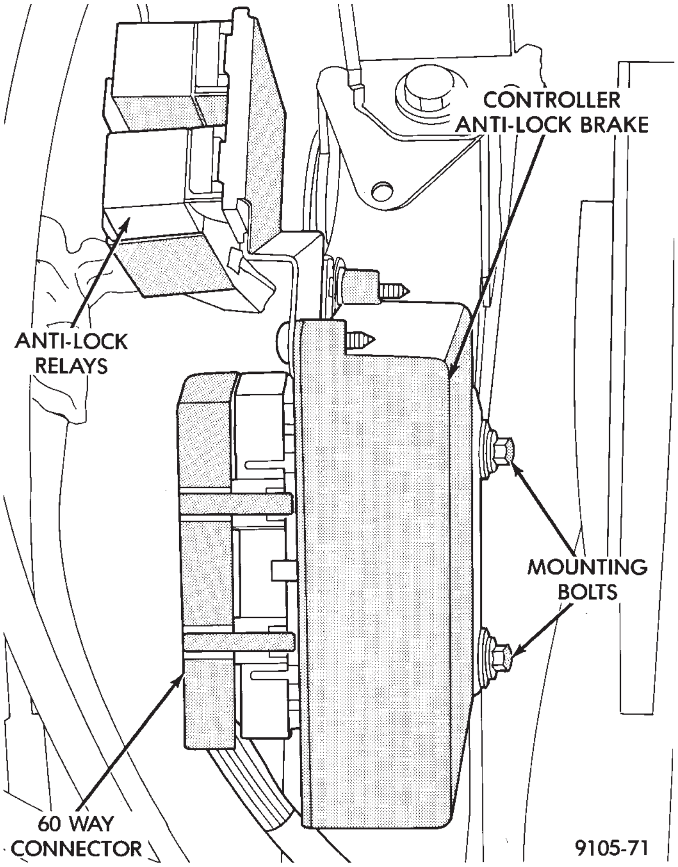


Fig. 7 Location Controller Anti-Lock Brake (CAB)

The (CAB) contains a self-diagnostic program which will turn on the Amber Anti-Lock Warning Lamp when a system fault is detected. Faults are stored in a diagnostic program memory. There are 16 fault codes which may be stored in the (CAB) and displayed through the DRB II. These fault codes will remain in the (CAB) memory even after the ignition has been turned off. The fault codes can be cleared by using the DRB II diagnostics tester, or they will be automatically cleared from the memory after (50) ignition switch on/off cycles.

CONTROLLER ANTI-LOCK BRAKE (INPUTS)

- Four wheel speed sensors.
- Stop lamp switch.
- Ignition switch.
- System relay voltage.
- Ground.
- Pump/Motor Relay Monitor
- Diagnostics Communications

CONTROLLER ANTI-LOCK BRAKE (OUTPUTS)

- 6 modulator valves, 4 Build/Decay and 2 isolation valves.
- Anti-Lock warning lamp.
- System relay actuation.
- Diagnostic communication.
- Pump motor relay actuation

DIAGNOSTIC CONNECTOR

On the AA, AG, AJ and AP bodies, the Bendix Anti-Lock System diagnostic connector is located under the fuse panel access cover. The access cover is located on the lower section of the instrument panel on the left side of the steering column. The diagnostics connector is a blue 6 way connector see (Fig. 8).

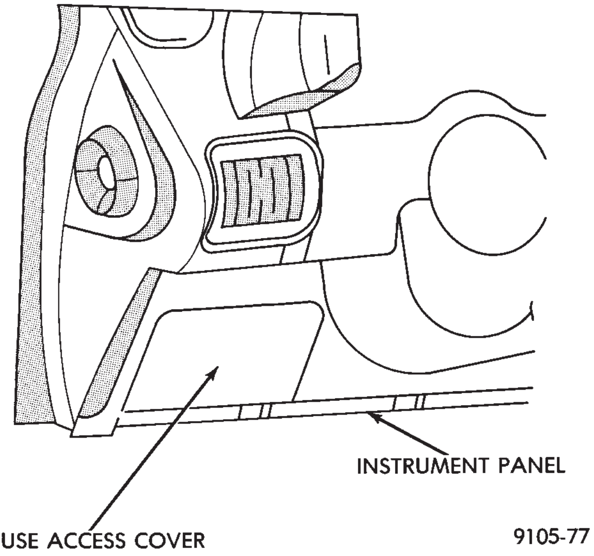


Fig. 8 A.B.S. Diagnostic Connector Location

ANTI-LOCK SYSTEM RELAYS AND WARNING LAMPS

SYSTEM RELAY

The (ABS) Modulator Valves and Anti-Lock Warning Lamp Relay. Are powered through a System Relay located on a bracket mounted to the (CAB) see (Fig. 9) for location of the relay. The System Relay provides power to the (CAB) for modulator valve operation (pins 47 and 41) after the startup cycle when the ignition is turned on.

ANTI-LOCK WARNING LAMP RELAY

The Amber Anti-Lock Warning Lamp is controlled by the Anti-Lock Warning Lamp relay. The relay is mounted to the same bracket as the system relay at the (CAB) see (Fig. 9). With the relay de-energized, the lamp is lit. When the System Relay is energized by the (CAB), the Anti-Lock warning lamp relay is energized, and the lamp is turned off. Thus, the lamp will be lit if the (CAB) is disconnected or if a system fault causes the (ABS) function to be turned off.

PUMP/MOTOR RELAY

Pump/Motor power is supplied by the Pump/Motor Relay. The Pump/Motor Relay is either mounted on the left front inner fender shield, or the front of the left shock tower. The mounting location is dependent on whether the vehicle is or is not equipped with a power distribution center. See (Fig. 10 and 11) for specific mounting locations.

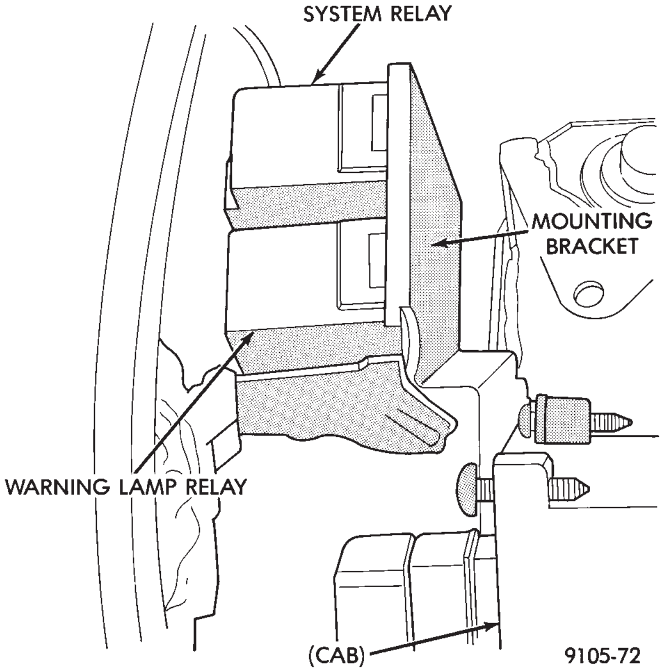


Fig. 9 System Relay/Warning Lamp Relay

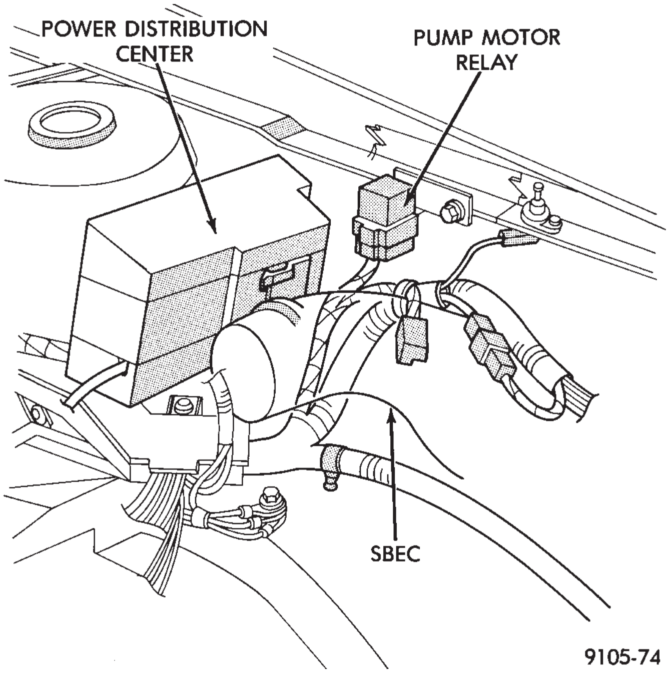


Fig. 10 Pump Motor Relay With Power Distribution Center

ANTI-LOCK WARNING LAMP OFF

System Relay and Anti-Lock Warning Lamp Relay Energized

From pin 57 the (CAB) energizes the system relay coil. The electrical current flow in the coil closes the system relay. Then electrical current is provided to pins 47 and 41 of the (CAB) to provide power to the modulator valves. This electrical current also energizes the Amber Anti-Lock Warning Lamp Relay coil. The current flow in the Anti-Lock Warning

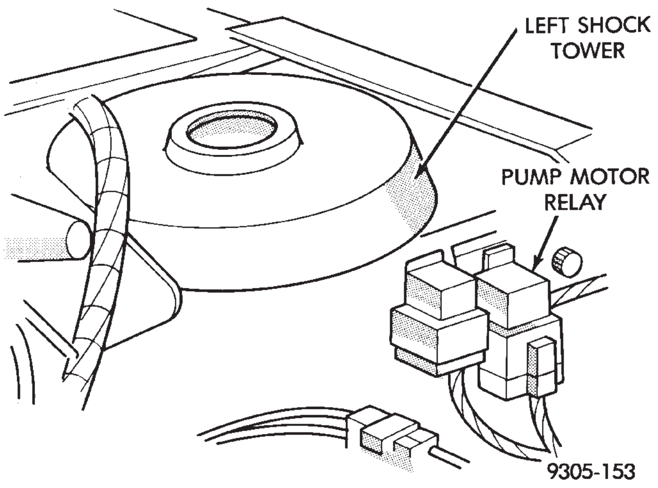


Fig. 11 Pump Motor Relay W/O Power Distribution Center

Lamp Relay opens the Anti-Lock Warning Lamp Relay switch. This breaks the ground path to the Amber Anti-Lock Warning Lamp and the light is turned off.

The (CAB) by itself, also has the ability to turn on the Amber Anti-Lock Warning Lamp. The (CAB) can turn on the Amber Anti-Lock Warning Lamp by providing a ground at pin 15.

ANTI-LOCK WARNING LAMP ON

System Relay and Anti-Lock Warning Lamp Relay De-Energized.

When the Amber Anti-Lock Warning Lamp is on, there is no electrical current flow from the (CAB) at pin 57. The System Relay coil is NOT energized. No electrical current flows to pin 47 and 41 (modulator valve power), or to the Anti-Lock Warning Lamp Relay coil. Thus, the Amber Anti-Lock Warning Lamp is not energized. The Amber Anti-Lock Warning Lamp is grounded through the Anti-Lock Warning Lamp Relay contacts. The Amber Anti-Lock Warning Lamp is turned on.

HYDRAULIC CIRCUITS AND VALVE OPERATION

Through the following operation descriptions and diagrams. The function of the various hydraulic control valves in the ABS system 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 Anti-Lock braking.

For explanation purposes we will assume all speed sensors are sending the same wheel speed information, requiring the same hydraulic fluid modulation at the same rate.

NORMAL BRAKING

ISOLATION VALVES

Open to primary and secondary master cylinder fluid supply (Fig. 1)

BUILD/DECAY VALVES

Closed (Fig. 1)

The brake pedal is applied. The travel of the brake pedal closes primary and secondary circuits from the master cylinder fluid supply. Brake fluid from the primary and secondary circuits flows through the open isolation valves, through the build/decay valves to the wheel brakes.

ABS BRAKING-BUILD PRESSURE

ISOLATION VALVES

Closed, isolating wheel brakes from master cylinder primary and secondary fluid supply. Through open build valves (Fig. 2).

BUILD/DECAY VALVES

Open (Fig. 2)

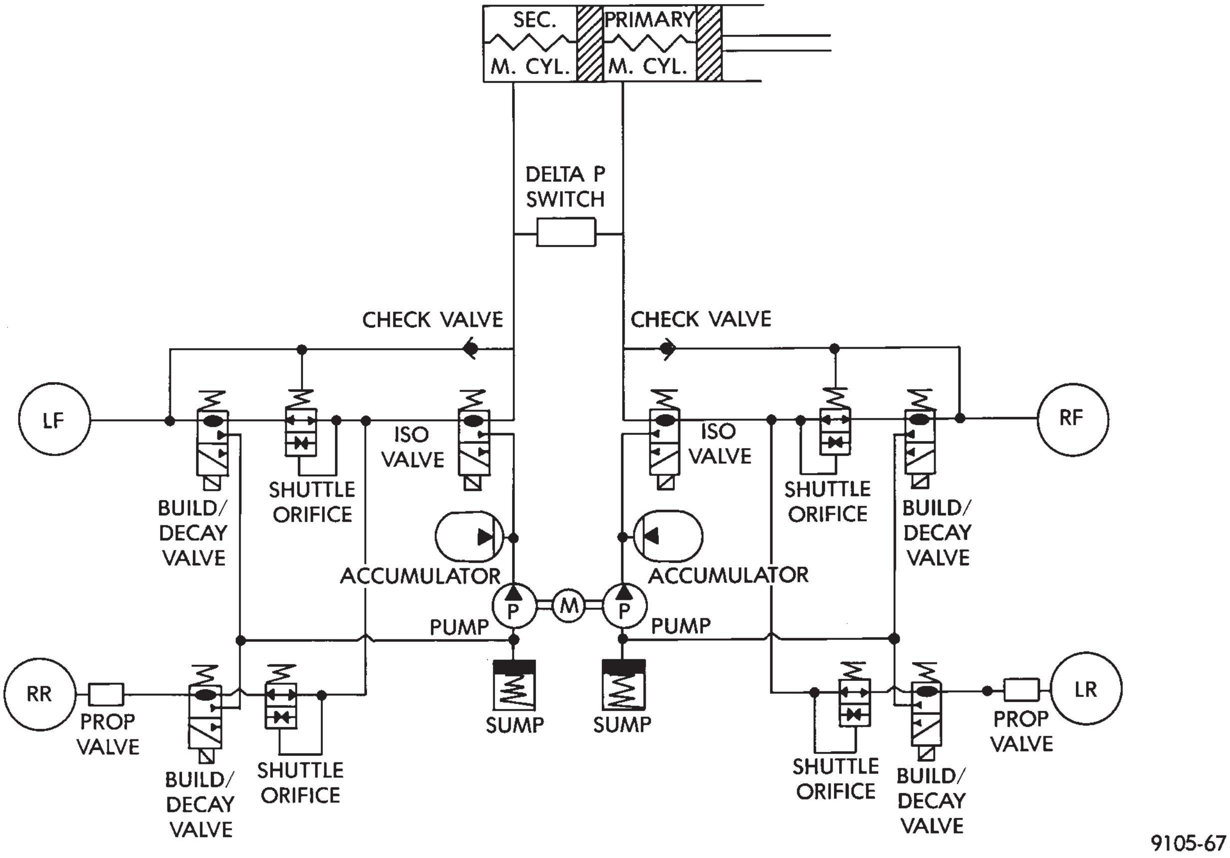


Fig. 1 Normal Braking - Hydraulic Control

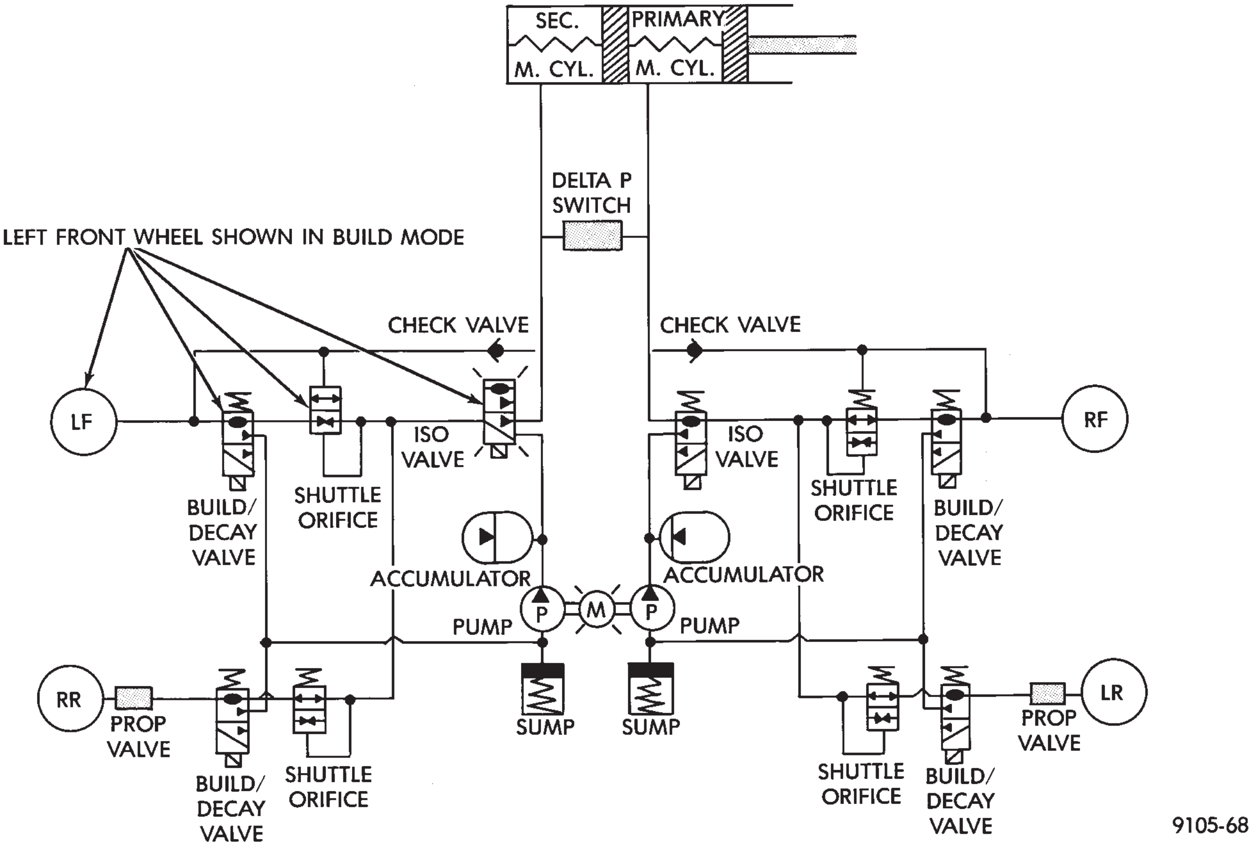


Fig. 2 Build Pressure - Hydraulic Control

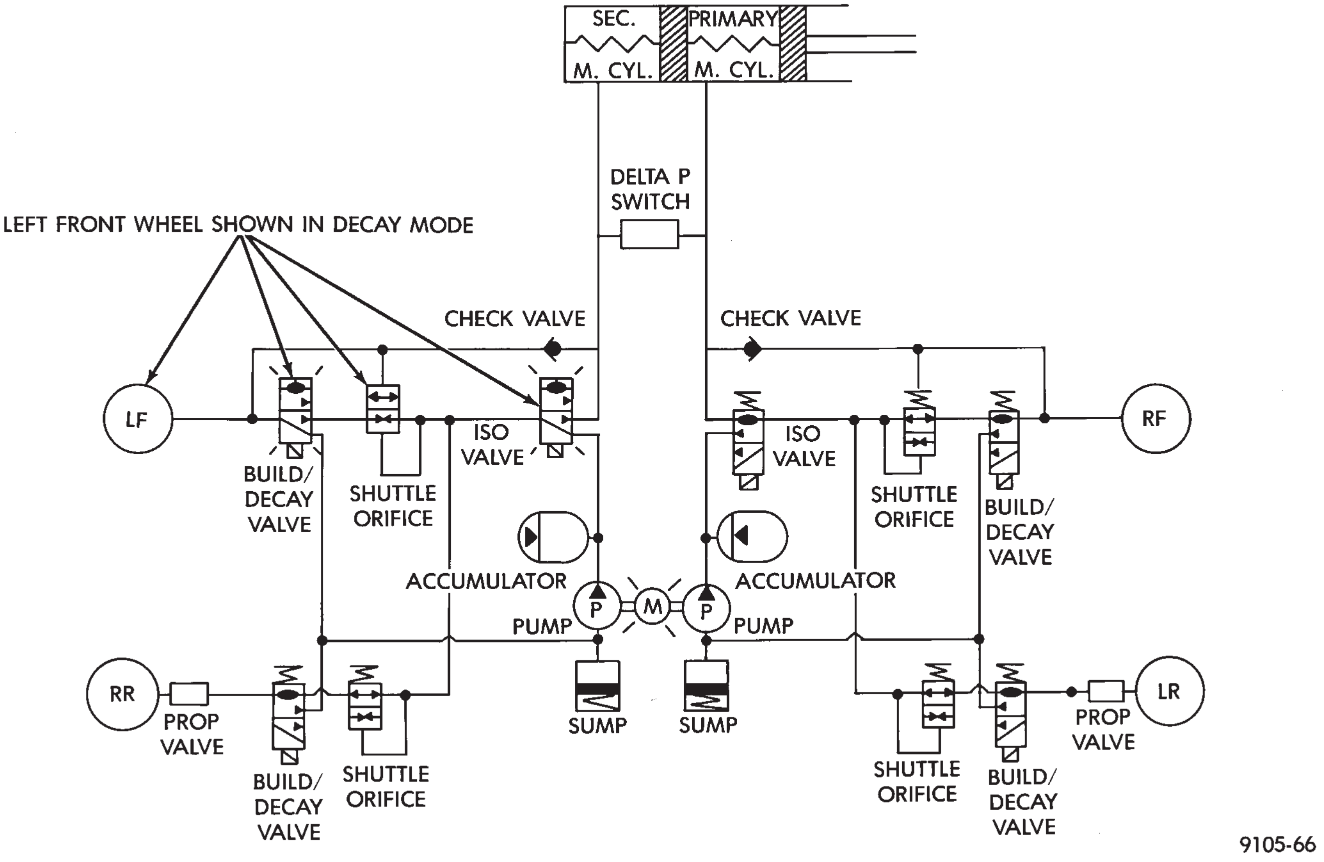


Fig. 3 Decay Pressure - Hydraulic Control

ABS BRAKING-DECAY PRESSURE

ISOLATION VALVES

Closed, isolating the wheel brakes from the master cylinder primary and secondary fluid supplies (Fig. 3)

BUILD/DECAY VALVES

Open, allowing release of fluid pressure through decay valve to the fluid reservoir. Which gets pumped into the accumulator for the build pressure cycle (Fig. 3).

ABS BRAKE SYSTEM DIAGNOSIS

GENERAL INFORMATION

WARNING: SOME OPERATIONS IN THIS SECTION REQUIRE THAT HYDRAULIC TUBES, HOSES AND FITTINGS BE DISCONNECTED FOR INSPECTION OR TESTING PURPOSES.

CAUTION: REVIEW THIS ENTIRE SECTION PRIOR TO PERFORMING ANY MECHANICAL WORK ON A VEHICLE EQUIPPED WITH THE BENDIX ANTI-LOCK 6 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: Certain components of the Anti-Lock Brake System (ABS) are not intended to be serviced individually. Attempting to remove or disconnect certain system components, may result in personal injury and/or improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

This section contains information necessary to diagnosis mechanical conditions which can affect operation of the Bendix Anti-Lock 6 Brake System. Specifically, this section should be used to help diagnose mechanical conditions which result in any of the following:

(1) Anti-Lock Warning Lamp turned on.
(2) Brakes Lock on Hard Application

Diagnosis of conditions which are obviously mechanical in nature. Such as brake noise, brake pulsation, lack of power assist, turning on of the Red Brake Warning Lamp or vehicle vibration during normal braking. Should be directed to Group 5 Brakes in this service manual. This also pertains to problems involving the parking brake system.

In order to effectively diagnose an Anti-Lock Brake System (ABS) condition. It is important to read Anti-Lock Brake System Description. And to follow the diagnostic procedures outlined in this section.

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 system. See Section 1 of this manual to familiarize yourself with the operating principles of the ABS system.

DEFINITIONS

Several abbreviations are used in this manual. They are presented here for reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

ABS COMPUTER SYSTEM SERVICE PRECAUTIONS

The ABS system uses an electronic control module, the (CAB). This module is designed to withstand normal current draws associated with vehicle operation. However 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 by the appropriate diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter, special tools or the DRB II 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.

ABS GENERAL SERVICE PRECAUTIONS

TEST DRIVING ABS COMPLAINT VEHICLES

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.

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.

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 standard brake, Control Valves Section in the brake group of this manual. If the Amber Anti-Lock Warning light was/is on, read record and erase the fault. While the Amber ABS Warning Lamp is on the ABS system is not functional. When the Amber Anti-Lock Warning Lamp is on only the Anti-Lock function of the brake system if affected. The standard brake system and the ability to stop the car is not be affected if only the Amber Anti-Lock Warning Lamp is on.

(1) Turn the key to the off position and then back to the on position. Note whether the Amber ABS Warning Lamp continues to stay on. If it does refer to the 1993 M.Y. Bendix Anti-Lock 6 Diagnostic Manual for the required test procedures.

(2) If the Amber ABS Warning Lamp goes out, shift into gear and drive the car to a speed of 5 mph to complete the ABS start up cycle. If at this time the Amber ABS Warning Lamp goes on refer to the Bendix Anti-Lock 6 Diagnostic Manual.

(3) If the Amber ABS Warning Lamp remains OUT, drive the vehicle a short distance. During this test drive be sure that the vehicle achieves at least 25 mph. Brake to at least one complete stop and again accelerate to 25 mph.

(4) If a functional problem with the A.B.S. system is determined while test driving a vehicle. Refer to the Bendix Anti-Lock 6 Diagnostics Manual for required test procedures and proper use of the DRB II tester.

ABS BRAKE SYSTEM ON VEHICLE SERVICE

The following are general precautions which should be observed when servicing and diagnosing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS system damage.

(1) If welding work is to be performed on a vehicle using an arc welder, the (CAB) should be disconnected before the welding operation begins.

(2) The (CAB) and modulator assembly 10 way connector should never be connected or disconnected with the ignition in the on position.

(3) Some components of the ABS system are not serviced separately and must be serviced as complete assemblies. Do not disassemble any component which is designated as non-serviceable.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

WHEEL SPEED SENSOR CABLES

Proper installation of the Wheel Speed Sensor Cables is critical to continued system operation. Be sure that cables are installed, routed and clipped properly. Failure to install speed sensor cables as shown in the on car service section of this manual. May result in contact with moving parts or over extension of cables, resulting in component failure and an open circuit.

MECHANICAL DIAGNOSTICS AND SERVICE PROCEDURES

SPECIAL SERVICE TOOL

Some diagnostic procedures in this section require the use of the DRB II diagnostics tester. The proper application and procedures for the use of this tool are described below.

DRB II DIAGNOSTIC TESTER

Some of the diagnostic procedures that are explained in this section require the use of the DRB II Diagnostics Tester to insure that proper diagnostics are performed. Refer to those sections for proper testing procedures and the DRB II operators manual for its proper operational information.

INTERMITTENT FAULTS

As with virtually any electronic system, intermittent faults in the ABS system may be difficult to accurately diagnose.

Most intermittent faults are caused by faulty electrical connections or wiring. When an intermittent fault is encountered, check suspect circuits for:

(1) Poor mating of connector halves or terminals not fully seated in the connector body.

(2) Improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(3) Poor terminal to wire connection. This requires removing the terminal from the connector body to inspect.

(4) Pin presence in the connector assembly

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 Fault code.

Most failures of the ABS system will disable Anti-Lock 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 Amber Anti-Lock Warning Lamp. All other failures will cause the lamp to remain on until the ignition switch is turned off. Circuits involving these inputs to the (CAB) should be investigated if a complaint of intermittent warning system operation is encountered.

(1) Low system voltage. If Low System Voltage is detected by the (CAB), the (CAB) will turn on the Amber Anti-Lock Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the (CAB), normal operation resumes.

(2) Anti-Lock relay. If the relay fails to make the ground circuit connection or is an intermittent ground. The (CAB) will turn on the Amber Anti-Lock Warning Light.

(3) Excess decay, an extended pressure decay period, will turn on the Amber Anti-Lock Warning Light until the vehicle comes to a complete stop.

Additionally, any condition which results in interruption of electrical current to the (CAB) or modulator assembly. May cause the Amber Anti-Lock Warning Lamp to turn on intermittently.

ABS BRAKE SYSTEM DIAGNOSTIC FEATURES

ABS SYSTEM SELF DIAGNOSIS

The ABS system is equipped with a self diagnostic capability which may be used to assist in isolation of ABS faults. The features of the self diagnostics system are described below.

START-UP CYCLE

The self diagnostic ABS start up cycle begins when the ignition switch is turned to the on position. An electrical check is completed on the ABS components. Such as Wheel Speed Sensor Continuity and System and other Relay continuity. During this check the Amber Anti-Lock Light is turned on for approximately 1- 2 seconds.

Further Functional testing is accomplished once the vehicle is set in motion.

- The solenoid valves and the pump/motor are activated briefly to verify function.
- The voltage output from the wheel speed sensors is verified to be within the correct operating range.

If the vehicle is not set in motion within 3 minutes from the time the ignition switch is set in the on position. The solenoid test is bypassed but the pump/motor is activated briefly to verify that it is operating correctly.

CONTROLLER ANTI-LOCK BRAKE (CAB)

Fault codes are kept in a Non-Volatile memory until either erased by the technician using the DRB II or erased automatically after 50 ignition cycles (key ON-OFF cycles). The only fault that will not be erased after 50 (KEY CYCLES) is the (CAB) fault. A (CAB) fault can only be erased by the technician using the DRB II diagnostic tester. More than one fault can be stored at a time. The number of key cycles since the most recent fault was stored is also displayed. Most functions of the (CAB) and ABS system can be accessed by the technician for testing and diagnostic purposes by using the DRB II.

LATCHING VERSUS NON-LATCHING ABS FAULTS

Some faults detected by the (CAB) are latching; the fault is latched and (ABS) is disabled until the ignition switch is reset. Thus ABS is disabled even if the original fault has disappeared. Other faults are non-latching; any warning lights that are turned on, are only turned on as long as the fault condition exists.

As soon as the condition goes away, the Anti-Lock Warning Light is turned off. Although a fault code will be set in most cases.

BENDIX ABS SYSTEMS DIAGNOSTICS

Bendix Anti-Lock 6 Brake System Diagnostics, beyond basic mechanical diagnostics, covered earlier in this section. Are accomplished by using the DRB II scan tool. See testing procedures outlined in the Bendix Anti-Lock 6 Diagnostics Manual for the 1992 M.Y. vehicles.

Please refer to the above mentioned manual for any further electronic diagnostics and service procedures that are required on the Bendix Anti-Lock 6 Brake System.

ON-CAR ABS BRAKE SYSTEM SERVICE

GENERAL SERVICE PRECAUTIONS

The following are general cautions which should be observed when servicing the Anti-Lock brake system and/or other vehicle systems. Failure to observe these precautions may result in Anti-Lock Brake 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) connector should never be connected or disconnected with the ignition switch in the ON position.

Many components of the Anti-Lock Brake System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

CHECKING BRAKE FLUID LEVEL

CAUTION: Only use brake fluid conforming to DOT 3 specifications, such as Mopar or Equivalent. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluids will cause swelling and distortion of rubber parts in the hydraulic brake system. Water will mix with brake fluid, lowering the fluid boiling point. Keep all brake fluid containers capped to prevent contamination. Remove the front cap of the master cylinder reservoir and fill to the bottom of the split ring.

For the specific procedure for the inspection of brake fluid level and adding of brake to the reservoir. Refer to the Service Adjustments Section in this group of the service manual.

BLEEDING BENDIX ANTI-LOCK 6 BRAKE SYSTEM

The Anti-Lock Brake System must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake lines, hoses of components.

If the Modulator Assembly is removed from the vehicle, both the Base Brake System and the Anti-Lock Brake System must be bled using the appropriate procedures. 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 Bendix Anti-Lock 6 Brake 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 Anti-Lock portion of brake system MUST be bled separately. This bleeding procedure requires the use of the DRB II Diagnostic tester and the bleeding sequence procedure outlined below.

ABS BLEEDING PROCEDURE (FIG. 1)

(1) Assemble and install all brake system components on vehicle making sure all hydraulic fluid lines are installed and properly torqued.

(2) Bleed the base brake system. Using the standard pressure or manual bleeding procedure as outlined in the Service Adjustments section of this service manual.

To perform the bleeding procedure on the ABS unit. The battery and acid shield must be removed from the vehicle. Reconnect the vehicles battery, to the vehicles positive and negative battery cables using jumper cables. This is necessary to allow access to the 4 bleeder screws located on the top of the Modulator assembly.

(3) Connect the DRB II Diagnostics Tester to the diagnostics connector. Located behind the Fuse Panel access cover on the lower section of the dash panel to the left of the steering column. (It is a blue 6 way connector).

(4) Using the DRB II check to make sure the (CAB) does not have any fault codes stored. If it does remove them using the DRB II.

WARNING: WHEN BLEEDING THE MODULATOR ASSEMBLY 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.

When bleeding the Modulator Assembly. The following bleeding sequence **MUST** be followed to insure complete and adequate bleeding of the brakes hydraulic system. The Modulator Assembly can be bled using a Manual bleeding procedure or standard Pressure Bleeding Equipment.

If the brake system is to be bled using pressure bleeding equipment. Refer to Bleeding Brake System, in the Service Adjustments section at the beginning of this group, for proper equipment usage and procedures.

MODULATOR ASSEMBLY BLEEDING SEQUENCE

1 SECONDARY SUMP

(1) Put a bleeder tube on the Secondary Sump bleeder screw (Fig. 1).

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Secondary Sump bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the LF Build/Decay Valve.

(4) Bleed the Secondary Sump. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Secondary Sump bleeder screw.

(7) Next select and actuate the RR Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Secondary Sump bleeder screw.

2 PRIMARY SUMP

(1) Put a bleeder tube on the Primary Sump bleeder screw (Fig. 1).

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Primary Sump bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the RF Build/Decay Valve.

(4) Bleed the Primary Sump. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Primary Sump bleeder screw.

(7) Next select and actuate the LR Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Primary Sump bleeder screw.

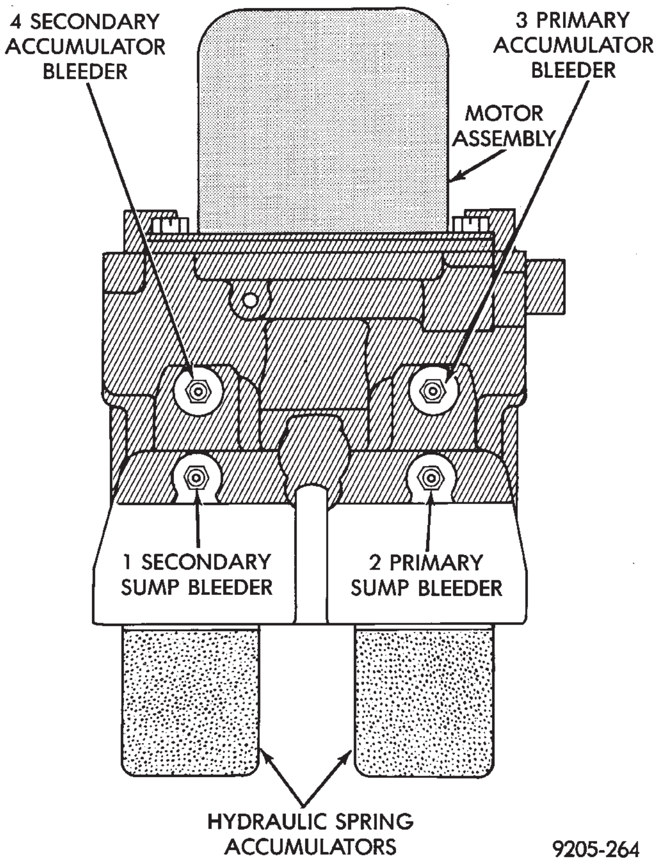


Fig. 1 Bleeding ABS Modulator Assembly

3 PRIMARY ACCUMULATOR

(1) Put a bleeder tube on the Primary Accumulator bleeder screw. (Fig. 1)

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Primary Accumulator bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the RF/LR Isolation Valve.

(4) Bleed the Primary Accumulator. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Primary Accumulator bleeder screw.

(7) Next select and actuate the RF Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Primary Accumulator bleeder screw.

4 SECONDARY ACCUMULATOR

(1) Put a bleeder tube on the Secondary Accumulator bleeder screw. (Fig. 1)

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Secondary Accumulator bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the LF/RR Isolation Valve.

(4) Bleed the Secondary Accumulator. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Secondary Accumulator bleeder screw.

(7) Next select and actuate the LF Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Primary Accumulator bleeder screw.

PUMP/MOTOR SERVICE

On the Bendix Anti-Lock 6 Brake System the Pump/Motor assembly can only be serviced as part of Modulator Assembly.

MODULATOR ASSEMBLY (FIG. 2)

REMOVAL

(1) Center vehicle on hoist, or raise front of vehicle on jack stands.

(2) Disconnect and remove the battery, battery tray and acid shield covering the modulator assembly (Fig. 2).

(3) Disconnect the delta (P) switch electrical connector from the Modulator Assembly (Fig. 3). Remove the top Modulator Assembly bracket to fender shield mounting bolt (Fig. 2).

(4) Disconnect the 2 master cylinder supply tubes at the Modulator Assembly. Loosen the 2 tubes at the Master Cylinder so the tubes can be swung out of the way without kinking them (Fig. 4)

(5) Raise the vehicle on the hoist.

(6) From under the vehicle disconnect the Modulator Assembly 10 way connector (Fig. 3). Remove the 4 remaining hydraulic brake tubes from the Modulator Assembly.

(7) Remove Modulator Assembly bracket mounting bolt closest to junction block.

(8) Loosen but do not fully remove bracket mounting bolt nearest the radiator.

(9) Lower the vehicle, the Modulator Assembly and bracket can now be lifted out of the vehicle (Fig. 1)

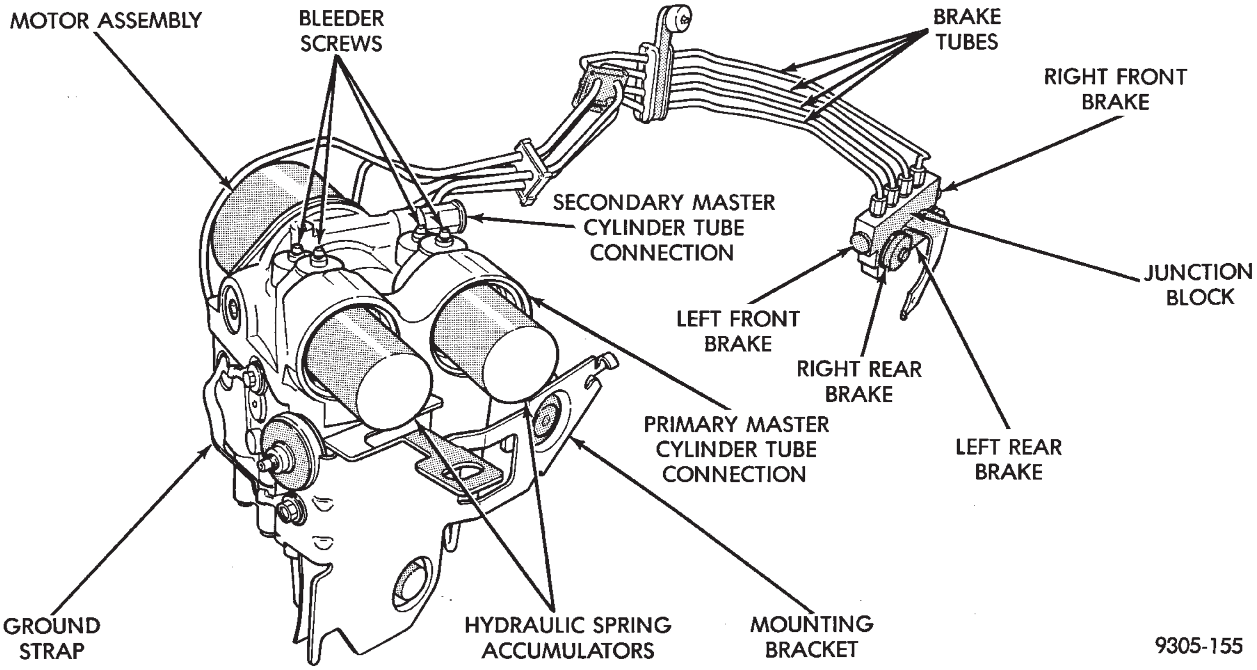


Fig. 2 Modulator Assembly

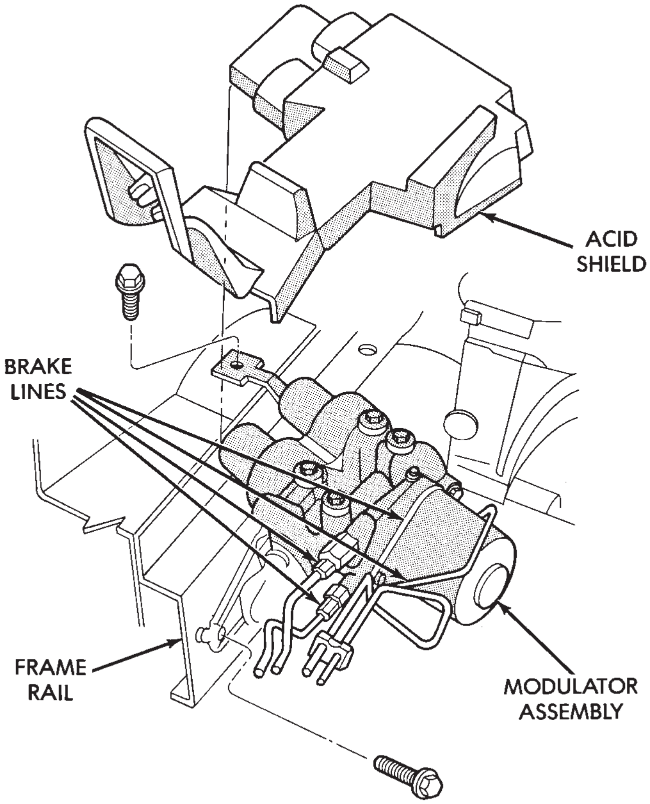


Fig. 2 Modulator Assembly Removal

INSTALLATION

(1) Install the Modulator Assembly in the vehicle. Use the protruding tab on the Modulator Assembly to locate and hold the assembly in place in the vehicle. Make sure the bracket is held by the front mounting bolt.

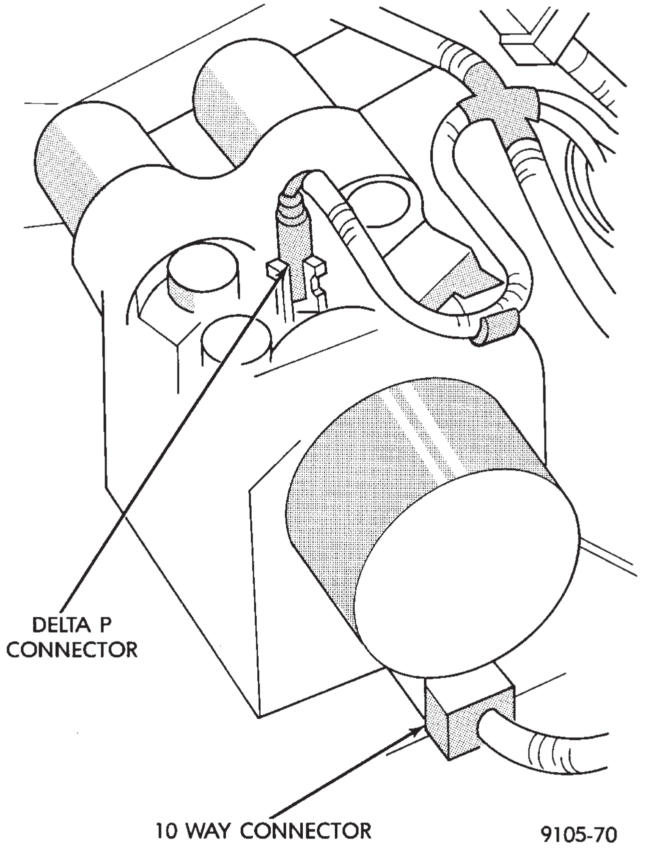


Fig. 3 Modulator Assembly Electrical Connections

(2) Install but do not tighten the Modulator Assembly bracket to fender shield attaching bolt.

(3) Raise the vehicle on the hoist. Install the Modulator Assembly bracket mounting bolt near the

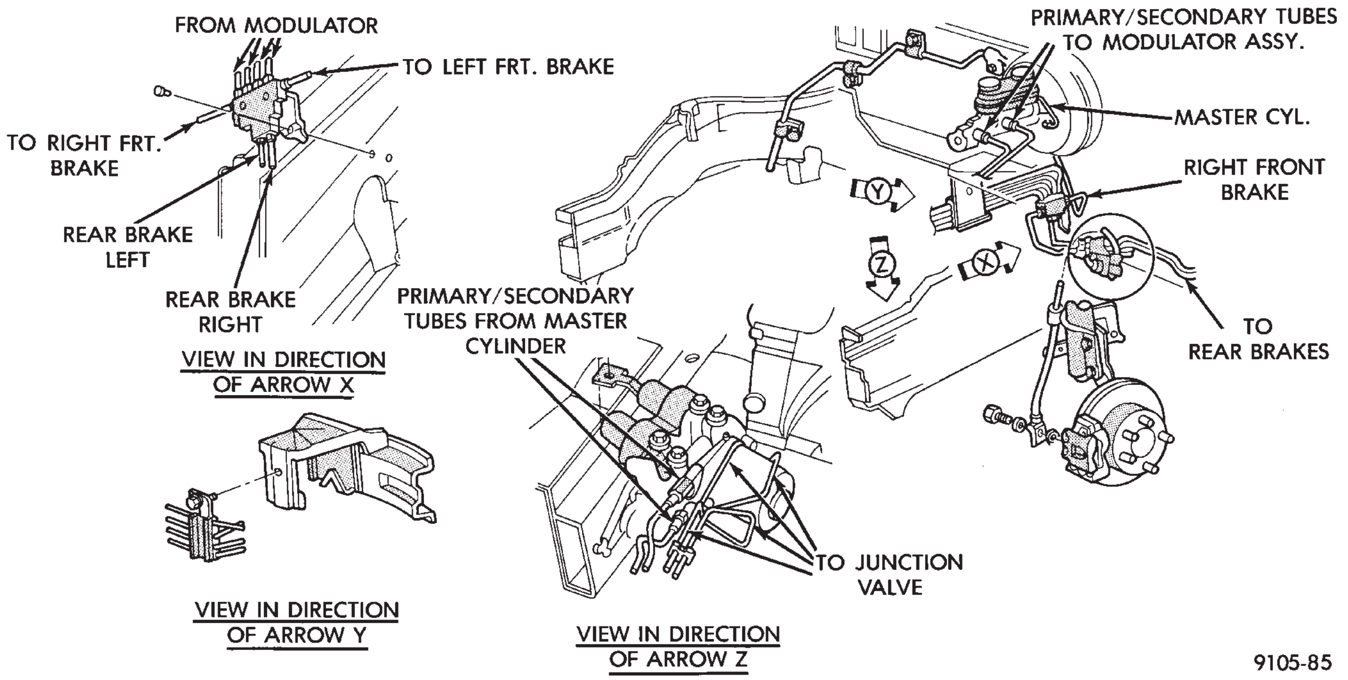


Fig. 4 Brake Tube and Hose Routing at Modulator Assembly

junction block. Torque both lower mounting bracket bolts to 28 N●m (250 in. lbs.)

(4) Reinstall the 4 hydraulic brake tubes to the Modulator Assembly and torque the fittings to 16 N●m (145 in. lbs.).

(5) Reconnect the 10 way Modulator assembly connector, and the delta P switch connector.

(6) Lower the vehicle and install the 2 master cylinder supply tubes to the Modulator Assembly. Torque the Modulator Assembly fittings and the master cylinder fittings to 16 N●m (145 in.lbs.).

(7) Torque the Modulator to fender splash shield attaching bolt to 28 N●m (250 in. lbs.)

(8) Bleed the brake system. Refer to the Bleeding Bendix Anti 6 Brake System in this section of the manual for proper bleeding procedure.

(9) Reinstall the acid shield and battery tray. Reinstall battery and connect battery cables.

MASTER CYLINDER AND POWER BOOSTER

REMOVAL AND INSTALLATION

If the Master Cylinder or the Power Booster need to be serviced or replaced. Refer to Master Cylinder or Power Brake Service section in this group of the service manual.

After servicing the Master Cylinder. Refer back to this section of the service manual. For the appropriate procedure and sequence, used to bleed the base and ABS portion of the brake system

PROPORTIONING VALVES (FIG. 5)

CAUTION: Proportioning valves should never be disassembled.

REMOVAL

(1) Remove brake tube and fitting from proportioning valve.

(2) Remove proportioning valve from Modulator Assembly.

INSTALLATION

(1) Install proportioning valve on Modulator Assembly and tighten to 40 N●m (30 ft. lbs.) torque.

(2) Install brake tube on proportioning valve. Tighten tube nut to 15 N●m (11 ft. lbs.) torque.

(3) Bleed the affected brake line, see Bleeding Bendix Anti Lock 6 Brake System in this section of the manual.

ELECTRONIC COMPONENTS

CONTROLLER ANTI-LOCK BRAKE (CAB)

REMOVAL

(1) Turn vehicle ignition off.

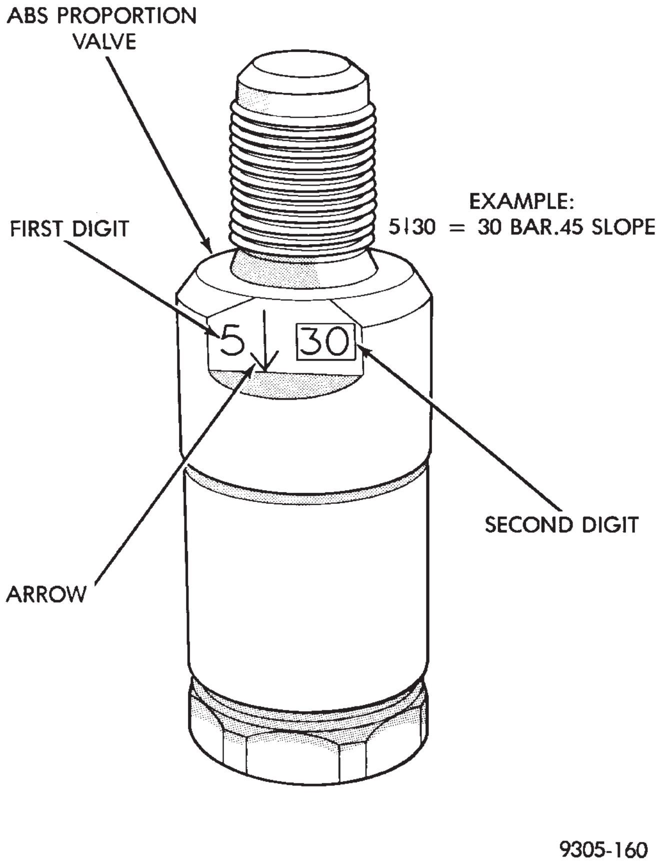


Fig. 5 ABS Proportioning Valve Identification

(2) Disconnect the wiring harness connectors from the Anti-Lock relays (Fig. 6). Relays will be removed as part of the (CAB) bracket.

(3) Disconnect the wiring harness 60 way connector (Fig. 6) from the Controller Anti-Lock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

(4) Remove the 2 (CAB) module bracket, to frame rail mounting bolts (Fig. 6)

(5) Remove the (CAB) module from the vehicle.

(6) Remove the 3 (CAB) to bracket mounting screws and remove the (CAB) from the mounting bracket (Fig. 7).

INSTALLATION

The Controller Anti-Lock Brake (CAB) module installation is done in the reverse order of removal.

REMOVAL/INSTALLATION OF SYSTEM AND WARNING LAMP RELAY

The System and Warning Lamp relay are both serviced together as an assembly, with the mounting bracket. They are mounted to a separate bracket that is attached to the (CAB) bracket assembly (Fig. 8).

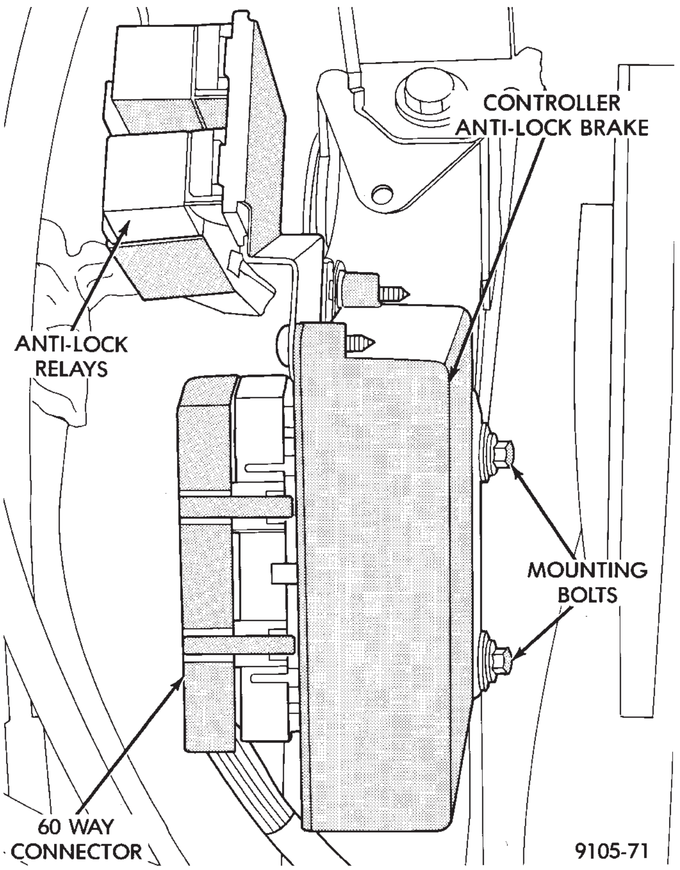


Fig. 6 Location Controller Anti-Lock Brake (CAB)

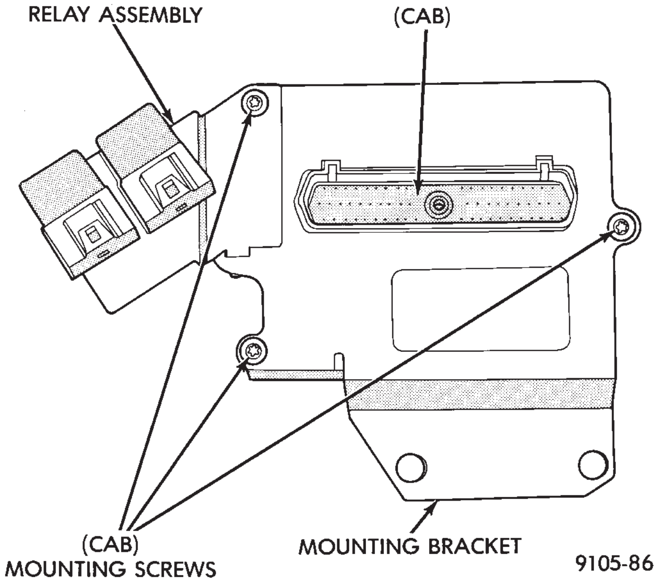


Fig. 7 (CAB) Removal From Mounting Bracket

REMOVE

(1) Hold the relays with one hand, while pulling strait down on the wiring harness connector. Until the connectors are free from the relays **(do not twist the connectors).**

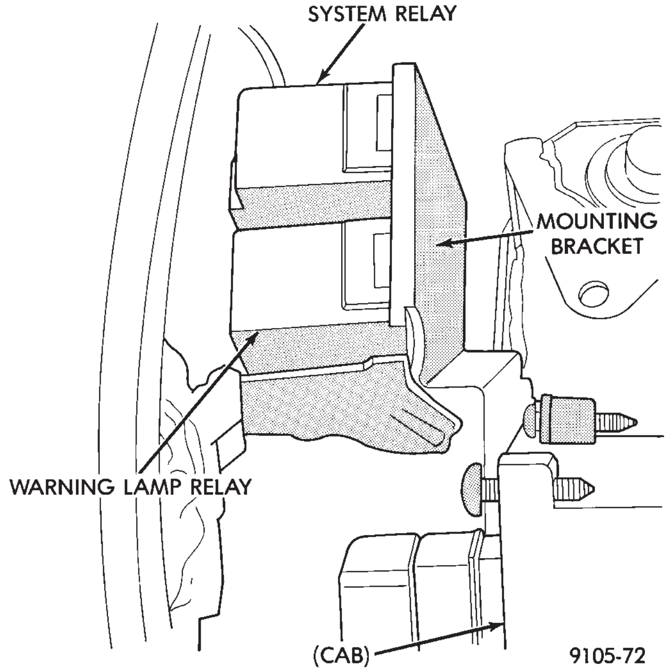


Fig. 8 System Relay/Warning Lamp Relay Location

(2) Remove the screw (Fig. 9) holding the relay bracket to the (CAB) bracket. Remove the relays and bracket assembly

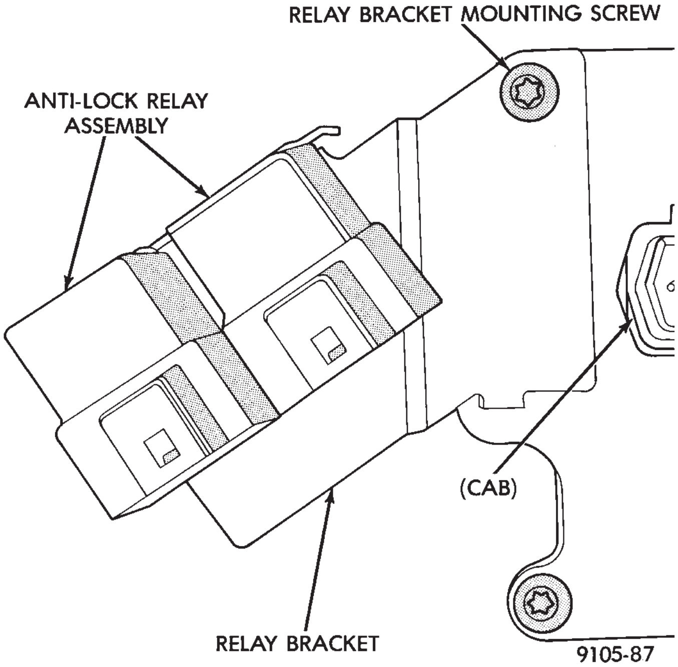


Fig. 9 Relay And Bracket Removal

INSTALL

(1) Mount the relay and bracket assembly to the (CAB) bracket, with the mounting screw (Fig. 9).

(2) Holding the relays with one hand, push the wiring harness connector strait onto the terminals of the relay. Make sure the connector is fully seated onto the terminals of the relay.

REMOVE/INSTALL PUMP MOTOR RELAY

Find the location of the Pump Motor Relay (Fig. 10 & 11), depending on whether the vehicle has or does not have a Power Distribution Center.

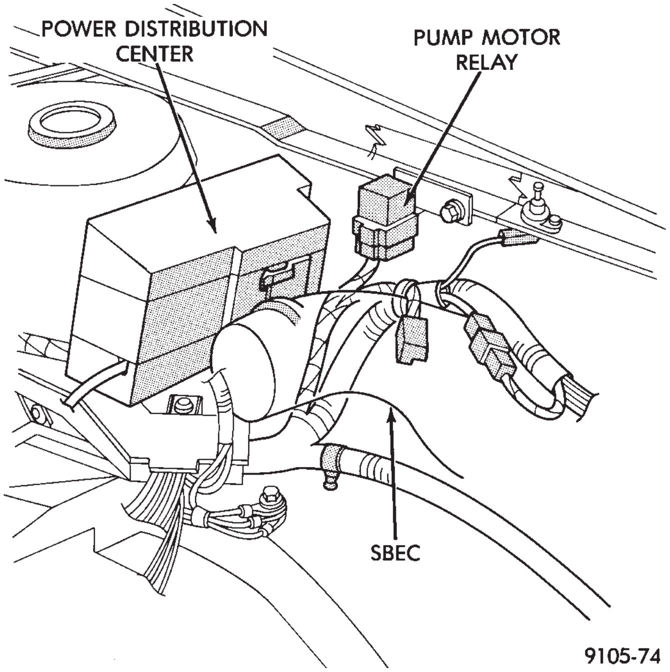


Fig. 10 Pump Motor Relay Location With Power Distribution Center

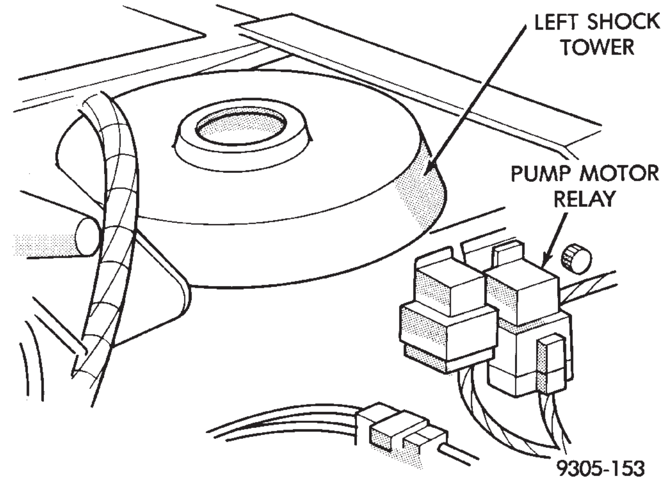


Fig. 11 Pump Motor Relay Location W/O Power Distribution Center

(1) Hold the relay with one hand. While pulling the relay connector strait off the relay terminals.

(2) Remove the relay from the vehicle.

(3) Installation is done in the reverse order off removal. Be sure that the wiring harness connector is fully seated onto the terminals of the Pump Motor Relay.

WHEEL SPEED SENSORS

INSPECTION

Inspect tonewheel for missing or broken teeth, this can cause erratic sensor signals.

Tonewheel should show no evidence of contact with the wheel speed sensor. If contact was made, determine cause and correct.

Excessive runout of the tonewheel can cause erratic wheel speed sensor. Replace assembly if runout exceeds approximately 0.25 mm (0.010 inch).

FRONT WHEEL SPEED SENSOR (FIG. 12)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove screw from grommet retainer clip that holds the grommet into fender shield (Fig. 12).

(3) Remove the 2 screws that fasten the sensor routing tube to the frame rail.

(4) Carefully, pull sensor assembly grommet from fender shield.

(5) Unplug speed sensor connector from vehicle wiring harness.

(6) Remove the sensor assembly grommets from the retainer brackets.

(7) Remove sensor head screw.

(8) Carefully, 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.

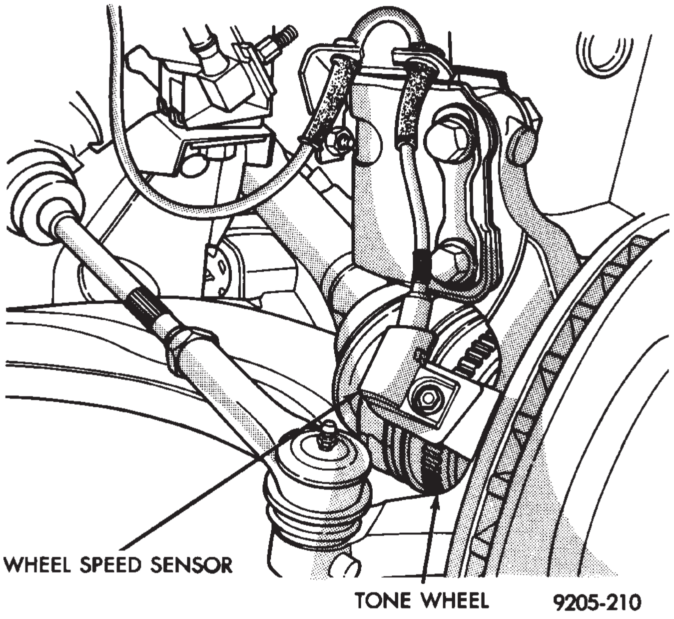


Fig. 12 Front Wheel Speed Sensor Routing

INSTALLATION

(1) Connect the wheel speed sensor connector to the wiring harness.

(2) Push sensor assembly grommet into hole in fender shield. Install clip and screw.

(3) Install the 2 screws that fasten the speed sensor routing tube to the frame rail.

(4) Install sensor grommets in brackets on fender shield and strut damper.

(5) Coat the speed sensor with High Temperature Multi-purpose E.P. Grease before installing into the steering knuckle. Install screw tighten to 7 N●m (60 in. lbs.)

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.

REAR WHEEL SPEED SENSOR (FIGS. 13 AND 14)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove sensor assembly grommet from underbody and pull harness through hole in underbody.

(3) Unplug connector from harness.

(4) Remove sensor assembly grommets from bracket which is screwed into the body hose bracket, just forward of trailing arm bushing (batwing bracket.)

(5) Remove sensor and brake tube assembly clip, located on the inboard side of trailing arm.

(6) Remove sensor wire fastener from rear brake hose bracket.

(7) Remove outboard sensor assembly retainer nut. This nut also is used to capture the brake tube clip.

(8) Remove sensor head screw.

(9) Carefully, remove sensor head from adapter assembly. 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.

INSTALLATION

Installation is reverse order of removal. Be sure to coat sensor with High Temperature Multi-purpose E.P. Grease before installing into adapter assembly. Tighten screw to 7 N●m (60 in. lbs.) torque.

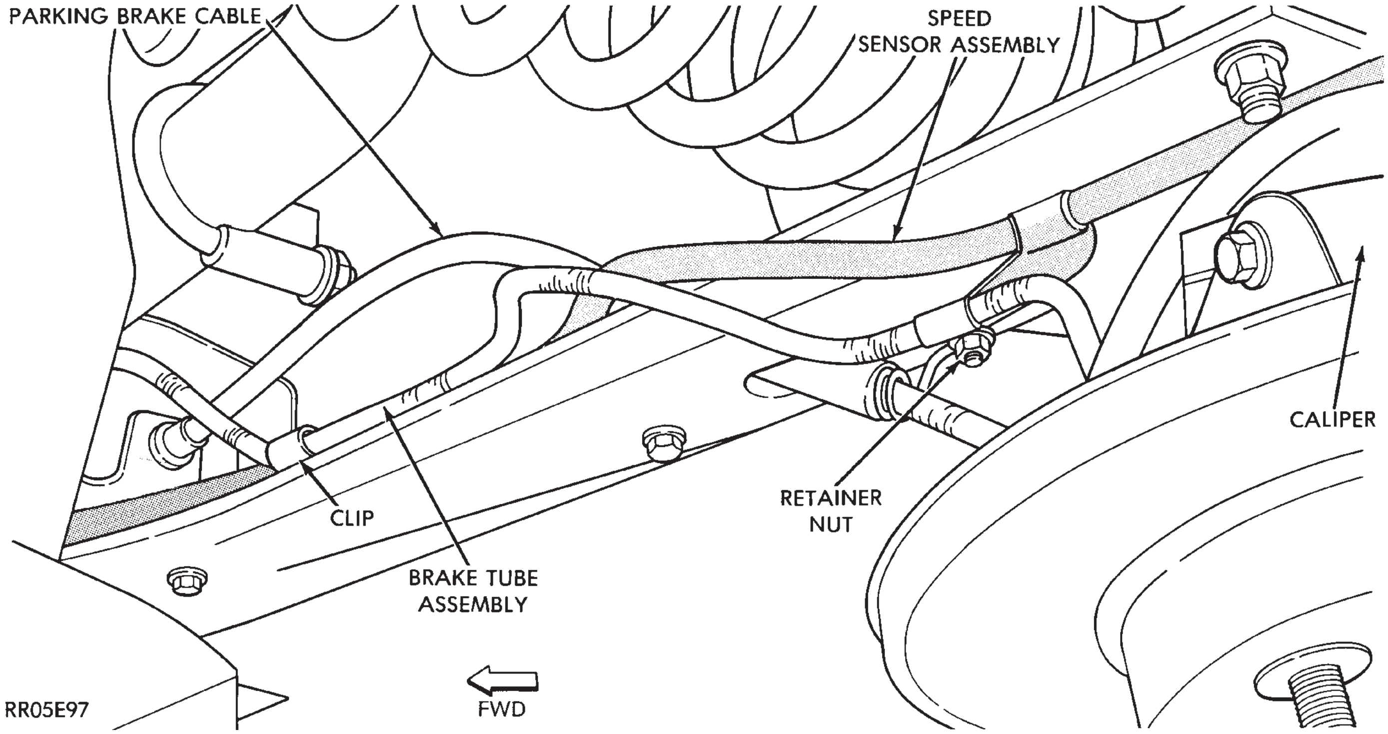


Fig. 13 Rear Wheel Speed Sensor Routing at Trailing Arm

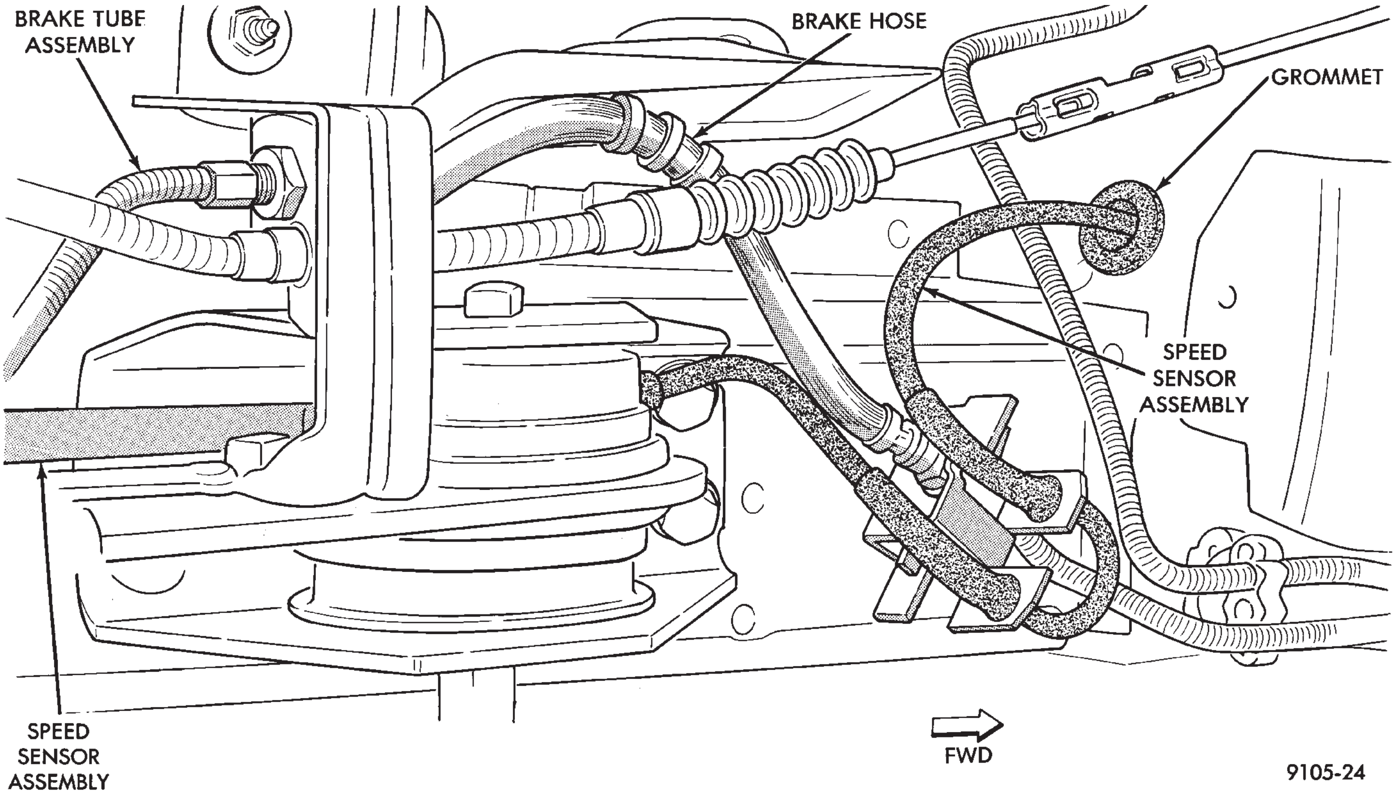


Fig. 14 Body Routing of Rear Speed Sensor Wiring

SPECIFICATIONS

SPECIFICATIONS METRIC

FRONT BRAKES—DISC

Type	Single Piston-Dual Pin Slider
Caliper Bore Diameter	54 mm AA, AG, AJ, AP 60 mm AC, AG, AY
Adjustment	Automatic
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press In EPDM Rubber
Disc Type All Bodies	Vented
Disc Diameter—Outside AA, AC,	
AG, AJ, AP, AY	240 mm std.
AG	260 mm opt.
Runout — Maximum Allowable T.I.R.*	.10 mm (.004 in.)
Parallelism—Total Variation in Thickness in 360 of Rotation	.013 mm (.0005 in.)
Brake Shoes And Linings	Rivited

*Measured On The Vehicle

REAR BRAKES—DISC WITH SEPARATE PARKING BRAKE

Type	Single Piston With Internal Park Brake (Drum In Hat)
Caliper Bore Diameter AA, AJ, AP	34 mm 14 in. Wheel
AG	36 mm 15 in. Wheel
AC, AY	36 mm 14 in. Wheel
Adjustment	Disc Brake—Automatic Parking Brake—Manual
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press in EPDM Rubber
Disk Type	Solid-14 in. Wheel Vented-15 in. Wheel
Disc Diameter—Outside	270 mm 14 in. Wheel 286 mm-15 in. Wheel
Diameter—Parking Brake Drum	171.9mm to 172.15mm

REAR BRAKES—DRUM

Type	Leading Trailing
Adjustment	Automatic
Drum Diameter AP Body	220 mm (8 in.) Standard
AA, AG, AJ Body	220 mm (8.5 in.) Standard
AC, AY Body	220 mm (8.5 in.) Heavy Duty And C-45 Ribbed And Flared
Wheel Cylinder Diameter AA, AC, AG, AP, AY	15.9 mm
Brake Shoes And Linings	Rivited

9305-166

BRAKE ACTUATION SYSTEM

ACTUATION:	Power Brakes Standard
Hydraulic System	Dual-Diagonally Split
MASTER CYLINDER:	
Type	Dual-Tandem-Chrysler
Body Material	Anodized Aluminum
Reservoir Material	Glass Reinforced Nylon
Bore and Stroke	21 mm x 33.4 mm 23.8 mm x 39.5 mm .875 in. x 33.4 mm
Displacement Split	50/50
Outlet Port Threads	ABS M-12 Pri. and Sec. W/O ABS M-12 Sec. M-10 Pri.
Outlet Fitting Type	ISO Flare
ABS Hydraulic Assembly Fitting Type	ISO Style Flare
Pedal Ratio AY & AY W/ABS	5.10
AA, AC, AG, AJ, AP, AY W/O ABS	3.28
BOOSTER:	
Make	Bendix Vacuum/Hyd. W/O ABS Teves Vacuum/Hyd. W/ABS
Mounting Studs	M8 x 1.25
Type	230 mm Single 205 mm Tandem
Boost @ 20" HG	2675 N All Vehicles
COMBINATION HYDRAULIC VALVE:	
Material	Brass
Function	Proportioning Valve And Warning Light Switch (Latching)

9305-167

TIGHTENING REFERENCE

DESCRIPTION	TORQUE
Hydraulic Brake Tubes To All Fittings (If Not Specified)	17 N•m (145 in. lbs.)
Brake Hoses To Calipers (Banjo Bolts)	48 N•m (35 ft. lbs.)
Brake Hose Intermediate Bracket	12 N•m (105 in. lbs.)
Master Cylinder To Brake Booster Mounting Nuts	28 N•m (250 in. lbs.)
Brake Booster Assembly To Dash Panel	28 N•m (250 in. lbs.)
Wheel Cylinder to Rear Brake Support Plate	8 N•m (75 in. lbs.)
Wheel Cylinder Bleed Screw	10 N•m (80 in. lbs.)
Brake Support Plate To Rear Axle Mounting Bolts (All Except AG, AJ, AP Body)	109 N•m (80 ft. lbs.)
Brake Support Plate To Rear Axle Mounting Bolts (AG, AJ, AP Body	72 N•m (53 ft. lbs.)
Wheel Stud Lug Nuts	109 - 150 N•m (80 - 110 ft. lbs.)
Caliper Adapter To Steering Knuckle Mounting Bolts	224 N•m (165 ft. lbs.)
Caliper Guide Pin Bolts	31 N•m (23 ft. lbs.)
Bearing Retainer Mounting Bolt	168 N•m (124 ft. lbs.)
Caliper Bleed Screw	15 N•m (125 in. lbs.)
Brake Light Switch Mounting Bracket Screw	8 N•m (75 in. lbs.)
Parking Brake Assembly Mounting	28 N•m (250 in. lbs.)

9305-168

MANUAL TRANSAXLE CLUTCH

CONTENTS

GENERAL INFORMATION

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 clutch used in all models are a single, dry disc type with no adjustment for wear being provided in the clutch itself.

The clutch pedal is connected to the release shaft through a cable and lever.

The upper end of the clutch pedal pivots in the pedal bracket on two nylon bushings. These bushings do not require periodic lubrication.

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.

(3) Check for loose connections in drive train. Correct any problems and determine if clutch chatter complaints has 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 bushings. Replace all worn parts. A small amount of bearing grease between the release shaft bushings and the shaft is beneficial, but not required.

(7) Check flywheel and clutch pressure plate for contamination (dirt, oil) or scored. Replace flywheel and/or pressure plate, if required.

(8) Check to see if the clutch disc hub splines are damaged. Replace with new disc.

(9) Check input shaft splines for damage. Replace if necessary.

(10) Check for uneven wear on clutch fingers.

EXCESSIVE CLUTCH SPIN TIME/CLASH INTO REVERSE COMPLAINTS

For all excessive clutch spin time/clash into reverse complaints, do the following:

(1) Depress clutch pedal to floor and hold. After three seconds, shift to reverse. If clash is present, clutch has excessive spin time.

(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.

(4) Check to see if the clutch disc hub splines are damaged, replace with new disc if required.

(5) Check the input shaft for damaged splines. Replace as necessary.

(6) Check for excessive clutch disc runout or warpage.

(7) Install clutch assembly and transaxle.

CLUTCH CABLE MECHANISM

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 pedal. 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.

When the pedal is depressed, teeth on the adjuster and the positioner engage and pull the release cable. A spring located behind the adjuster ensures proper tooth engagement.

When the pedal is released, the adjuster contacts the bumper. This separates the adjuster and positioner teeth, allowing the preload spring to function.

CLUTCH PEDAL NOISE/POP

The mechanism which automatically adjusts the clutch cable to compensate for clutch wear may emit a loud clicking or pop noise under certain circumstances.

The cause of this noise in most cases is the clutch cable auto-adjust spring being below design load specifications. The condition can be corrected by either bending the auto-adjust spring to bring it back to specifications or replacing the spring (Fig. 1).

The auto-adjust spring is located on the back of the clutch pedal.

CLUTCH CABLE REPLACEMENT

(1) Remove retainer from clutch release lever at transaxle by pulling on the tail of the ball stud (Fig. 2).

(2) Pry out ball end of cable from positioner adjuster and remove cable, passing it through the hoop in the shock tower mounting bracket.

(3) Inspect cable for wear and contamination. The inner cable strand should move smoothly inside the cable housing. If cable is worn or damaged, replace the cable. **Do not lubricate.**

(4) Inspect the clutch pedal and adjuster mechanism for wear. Apply a multipurpose lubricant on parts indicated (Fig. 2).

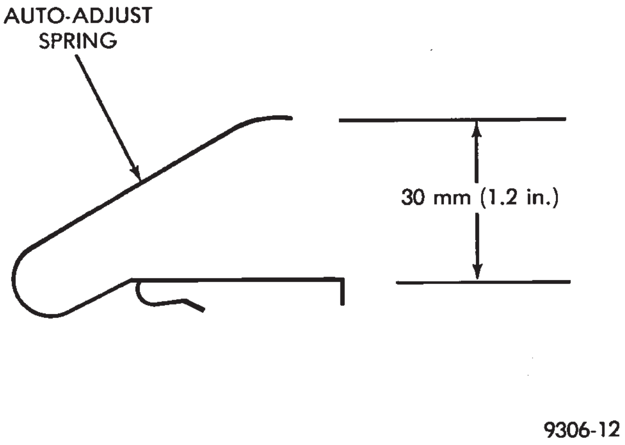


Fig. 1 Clutch Cable Auto-Adjust Spring

(5) To install, reverse procedure of steps (3) through (1).

(6) After installation, push and lift the clutch pedal 2 or 3 times to allow adjuster mechanism to function.

(7) Check clutch pedal position switch operation.

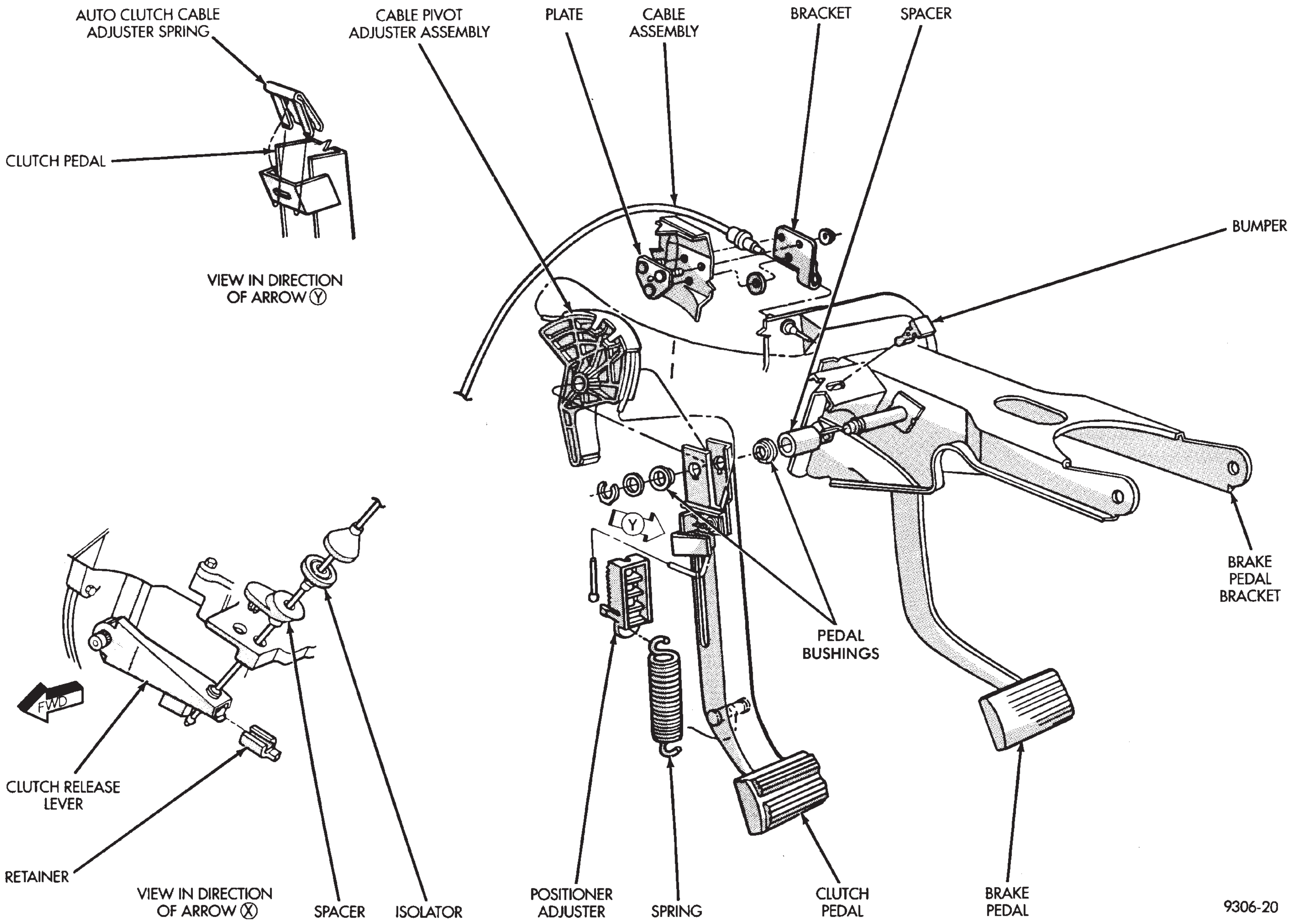


Fig. 2 Self-Adjusting Clutch Release Mechanism

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 next to the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch has an adjustable striker plate. The striker plate is located on the left side of the clutch pedal (Fig. 3).

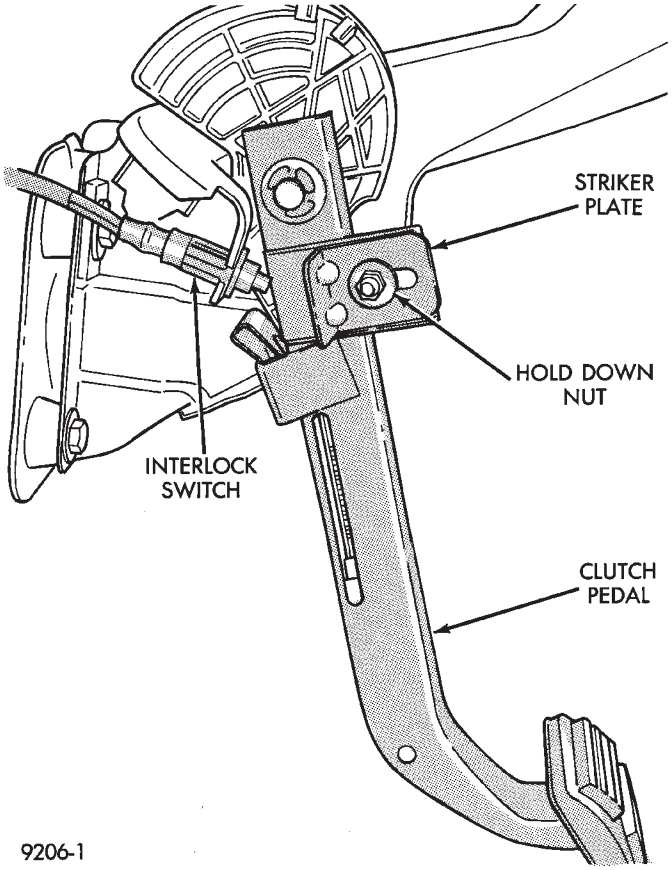


Fig. 3 Clutch Pedal Position Switch and Components

DIAGNOSIS

Disconnect clutch pedal position switch harness from instrument panel wiring harness. Using a ohm meter, check for continuity between the two terminals in the connector on the switch harness. There should be no continuity between the terminals when the switch is in its neutral (fully extended) position. When the switch is depressed more than 1.25 mm (0.050) the ohm meter should show continuity.

If all ohm meter readings are correct and the switch does not operate correctly, adjustment is required. Refer to Switch Adjustment Procedure to adjust switch.

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) After installation, the switch must be adjusted and checked for proper operation. Refer to Switch Adjustment Procedure.

ADJUSTMENT PROCEDURE

When performing switch adjustment, the floor mat should be removed before beginning adjustment procedures.

(1) Set the park brake.

(2) Disconnect clutch cable at the transaxle end of the cable.

(3) Depress clutch pedal, loosen adjusting nut and slide the striker plate forward to fully compress the clutch pedal position switch plunger.

(4) Tighten adjusting nut to 12 N●m (105 in. lbs.).

(5) Reconnect clutch cable.

The clutch pedal position switch is now adjusted. A final check is required to insure that the switch is “made” below the clutch release point.

(1) 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 do not continue with this test.** Recheck the switch and switch adjustment to determine the cause. If the vehicle does not crank proceed to step 2.

(2) With the park brake set and the vehicle **IN GEAR** turn the key to the start position.

WARNING: BEFORE PERFORMING STEP THREE BE SURE THAT THE AREA IN FRONT OF THE VEHICLE IS CLEAR OF OBSTRUCTIONS AND PEOPLE. VEHICLE MAY MOVE WHEN PERFORMING THIS TEST.

(3) Slowly depress the clutch pedal and feel for any vehicle motion when the starter is energized. If there is no motion the switch is properly adjusted. If motion is felt, repeat the adjustment procedure.

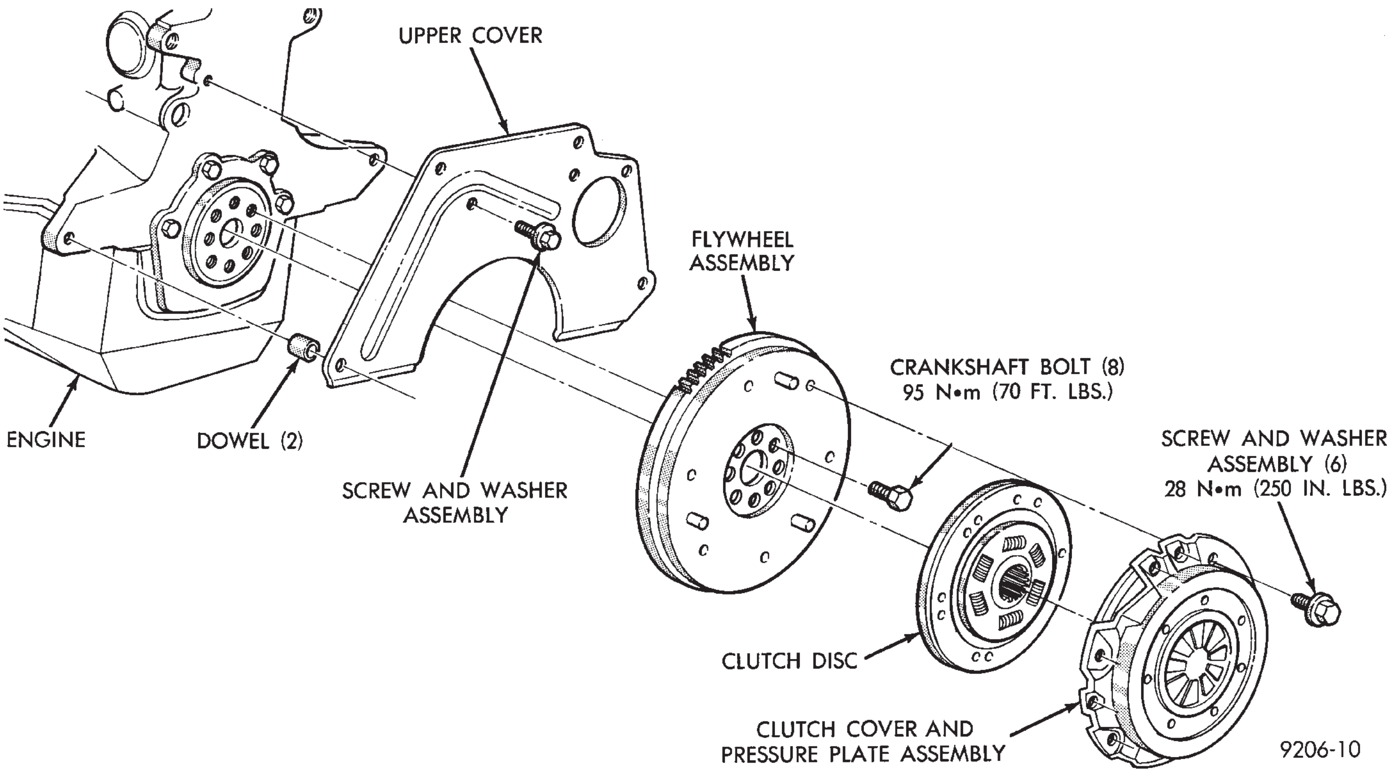


Fig. 4 Manual Transaxle Clutch

CLUTCH DISC REPLACEMENT

REMOVAL

(1) Remove transaxle. See Group 21, Manual Transaxle, for procedure.

(2) Mark clutch cover and flywheel, to maintain their same relative positions when installing clutch assembly (Fig. 4).

(3) Insert Clutch Disc Aligning Tool C-4676 through the clutch disc hub to prevent the clutch disc from falling and damaging the facings (Fig. 5).

(4) Loosen clutch cover attaching bolts, one or two turns at a time, in a crisscross pattern, to release spring pressure evenly and avoid cover damage.

CAUTION: Do not touch the clutch disc facing with oily or dirty hands. Oil or dirt transferred from your hands onto the clutch disc facing may cause clutch chatter.

(5) Remove the clutch pressure plate and cover assembly and disc from flywheel. Handle carefully to avoid contaminating the friction surfaces.

INSPECTION

(1) 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.

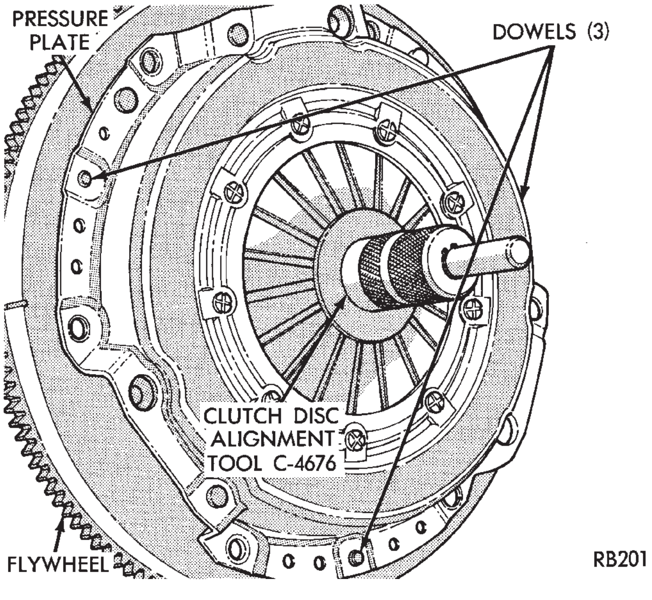


Fig. 5 Clutch Disc Aligning Tool

(2) The friction faces of the flywheel and pressure plate should not have excessive discoloration, burned areas, small cracks, deep grooves, or ridges. Replace parts as required.

CAUTION: Do not polish flywheel to a ‘‘mirror like’’ surface.

(3) 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 tapered.

(4) The heavy side of the flywheel is indicated by a daub of white paint near the outside diameter. To **minimize** the effects of flywheel unbalance, perform the following installation procedure:

(a) Loose assemble the flywheel to the crankshaft. Use new flywheel attaching bolts which have sealant on the threads. If new bolts are not available, apply Loctite sealant to the threads of the original bolts. This sealant is required to prevent engine oil leakage.

(b) Rotate the flywheel and crankshaft until the daub of white paint (heavy side) is at the 12 o'clock position.

(c) Torque flywheel attaching bolts to 95 N●m(70 ft. lbs.). Use a crisscross pattern when tightening bolts.

(5) 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.

(6) Wipe the friction surface of the pressure plate with mineral spirits.

(7) Using a straight edge, check clutch cover (pressure plate) for flatness. The clutch cover (pressure plate) 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.

(8) Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch.

(9) 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) Mount clutch assembly on flywheel,being careful to properly align dowels and the alignment marks made before removal. The flywheel side of the clutch disc is marked for proper installation. If new clutch or flywheel is installed, align cover balance spot as close as possible to flywheel balance orange spot. Apply pressure to the alignment tool. Center the tip of the tool into the crankshaft and the sliding cone into the clutch fingers. Tighten the clutch attaching bolts sufficiently to hold the disc in position.

(2) To avoid distortion of the clutch cover, bolts should be tightened a few turns at a time, in a crisscross pattern, until they are all seated. Tighten bolts to 28 N●m (250 in. lbs.) following a crisscross pattern sequence. Remove clutch disc alignment tool.

(3) Install transaxle. See group 21, Manual Transaxle, for procedures.

RELEASE BEARING AND FORK

Remove the transaxle from the vehicle. See group 21 for removal and installation procedures.

REMOVAL AND INSTALLATION

(1) Remove clutch release shaft E-clip.

(2) Remove the clutch release shaft and then slide the fork and bearing assembly off the bearing pilot.

(3) Remove the fork from the bearing thrust plate.

(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.

(8) Before assembling the fork, lubricate the rounded thrust pads and the spring clip cavities with multipurpose grease.

(9) 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.

(10) Slide the bearing and fork assembly onto the input shaft bearing retainer.

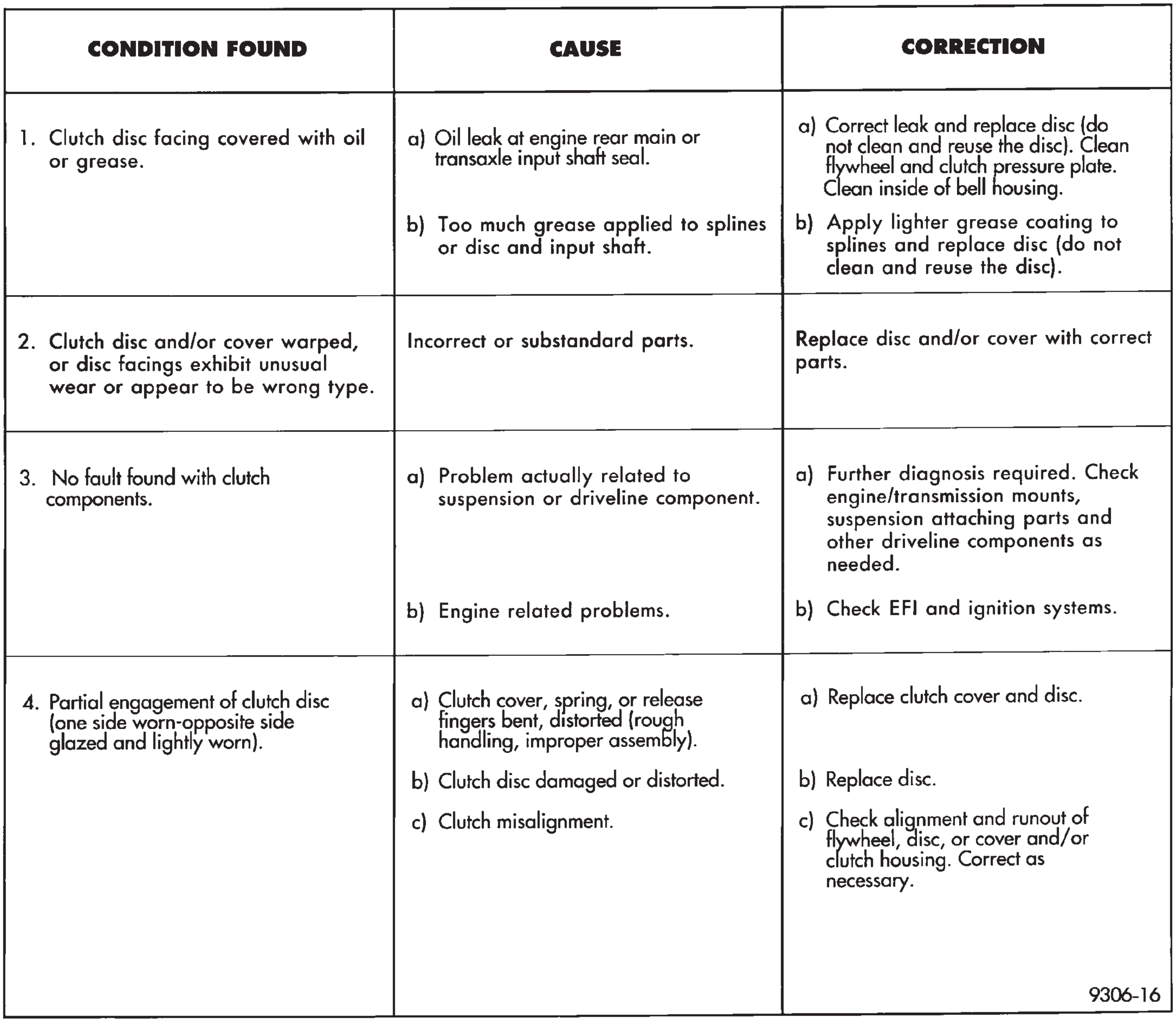
(11) Position the release shaft bushings in the housing and install the release shaft. A small amount of bearing grease between the release shaft bushing and the shaft is beneficial but not required. Install the retainer clip in the shaft groove near the large bushing.

(12) Install the release lever and retaining clip on the outer end of the release shaft.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. The facing of the disc will absorb moisture. The force exerted by the pressure plate will bond the facings to flywheel and/or, pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, it will require replacement of disc assembly, flywheel, and/or clutch assembly. After cleaning, drive the vehicle to its normal clutch operating temperature. This will dry off disc assembly, pressure plate, and flywheel.

SERVICE DIAGNOSIS—CLUTCH GRAB/CHATTER



CONDITION FOUND	CAUSE	CORRECTION
1. Clutch disc facing covered with oil or grease.	a) Oil leak at engine rear main or transaxle input shaft seal. b) Too much grease applied to splines or disc and input shaft.	a) Correct leak and replace disc (do not clean and reuse the disc). Clean flywheel and clutch pressure plate. Clean inside of bell housing. b) Apply lighter grease coating to splines and replace disc (do not clean and reuse the disc).
2. Clutch disc and/or cover warped, or disc facings exhibit unusual wear or appear to be wrong type.	Incorrect or substandard parts.	Replace disc and/or cover with correct parts.
3. No fault found with clutch components.	a) Problem actually related to suspension or driveline component. b) Engine related problems.	a) Further diagnosis required. Check engine/transmission mounts, suspension attaching parts and other driveline components as needed. b) Check EFI and ignition systems.
4. Partial engagement of clutch disc (one side worn-opposite side glazed and lightly worn).	a) Clutch cover, spring, or release fingers bent, distorted (rough handling, improper assembly). b) Clutch disc damaged or distorted. c) Clutch misalignment.	a) Replace clutch cover and disc. b) Replace disc. c) Check alignment and runout of flywheel, disc, or cover and/or clutch housing. Correct as necessary.

9306-16

SERVICE DIAGNOSIS—CLUTCH SLIPS

CONDITION FOUND	CAUSE	CORRECTION
1. Disc facing worn out.	a) Normal wear. b) Driver frequently "rides" (slips) clutch. Results in rapid wear overheating. c) Insufficient clutch cover diaphragm spring tension.	Replace clutch disc. Also replace cover if pressure plate surface is damaged.
2. Clutch disc facing contaminated with oil or grease.	a) Leak at rear main seal or at transmission input shaft seal. b) Excessive amount of grease applied to input shaft splines. c) Road splash, water entering housing.	a), b), c), d) Replace leaking seals. Apply less grease to input shaft splines. Replace clutch disc (do not clean and reuse) and clutch cover.
3. Clutch is running partially disengaged.	a) Release bearing sticking-binding. Does not return to normal running position. b) Self-adjust mechanism sticking or binding.	a) Verify that bearing is actually binding, then replace bearing and transmission front bearing retainer if sleeve surface is damaged. b) Verify that self adjuster block in pedal is free to move up and down.
4. Flywheel height incorrect.	Flywheel surface improperly machined. Too much stock removed or surface is excessively tapered.	Replace flywheel.
5. Wrong disc or pressure plate installed.	Incorrect parts order or model number.	Replace with correct parts.
6. Clutch disc, cover and/or diaphragm spring, warped, distorted.	a) Rough handling (impact) bent cover, spring, or disc. b) Incorrect bolt tightening sequence and method caused warped cover.	Install new disc or cover as needed. Follow installation/tightening instructions.
7. Facing on flywheel side of disc torn, gouged, worn.	Flywheel surface scored and nicked.	Reduce scores and nicks by sanding or surface grinding. Replace flywheel if scores-nicks are deeper than .002-.004 inch.
8. Clutch disc facing burnt (charred). Flywheel and cover pressure plate surfaces heavily glazed.	a) Frequent operation under high loads or hard acceleration conditions. b) Driver frequently "rides" (slips) clutch. Results in rapid wear and overheating of disc and cover.	Scuff sand flywheel. Replace clutch cover and disc. Alert driver to problem cause.
9. One or both clutch disc facings have fractured into small pieces.	a) Driver performs a 5-1 downshift at vehicle speed in excess of 60 mph. b) Leak of rear main seal or transaxle input shaft seal. c) Excessive heat from slippage.	Alert driver to problem cause. Replace clutch cover and disc. Make sure flywheel surface is not damaged. If so, replace.

9306-17

SERVICE DIAGNOSIS—IMPROPER CLUTCH RELEASE

CONDITION FOUND	CAUSE	CORRECTION
1. Clutch components damaged or worn out prematurely.	Incorrect or sub-standard clutch parts.	Replace with parts of correct type and quality.
2. Release shaft bushings in transaxle binding or seized.	a) Dirt or contamination. b) Corrosion.	a, b) Wipe shaft, replace or lube bushings.
3. Loose components.	Attaching bolts loose at flywheel, cover, or clutch housing.	Tighten bolts to specific torque. Replace any clutch bolts that are damaged.
4. Contact surface of release bearing damaged.	a) Clutch cover incorrect, or release fingers are bent or distorted causing damage. b) Release bearing defective.	a) Replace clutch cover and bearing. b) Replace bearing.
5. Release bearing is noisy.	Release bearing defective.	Replace bearing.
6. Clutch pedal squeak.	a) Pedal bushings worn out or cracked. b) Inadequate lubrication.	a) Replace bushings if worn or damaged. b) Lubricate bushings, adjuster and positioner.
7. Clutch pedal clicks loudly when pedal is depressed (may be an intermittent problem).	Auto-adjust clutch cable spring bent or missing.	Bend spring to dimension shown in figure 1 or replace spring.

9306-19

SERVICE DIAGNOSIS—CLUTCH NOISE

CONDITION FOUND	CAUSE	CORRECTION
1. Clutch components damaged or worn out prematurely.	Incorrect or sub-standard clutch parts.	Replace with parts of correct type and quality.
2. Release shaft bushings in transaxle binding or seized.	a) Dirt or contamination. b) Corrosion.	a, b) Wipe shaft, replace or lube bushings.
3. Loose components.	Attaching bolts loose at flywheel, cover, or clutch housing.	Tighten bolts to specific torque. Replace any clutch bolts that are damaged.
4. Contact surface of release bearing damaged.	a) Clutch cover incorrect, or release fingers are bent or distorted causing damage. b) Release bearing defective.	a) Replace clutch cover and bearing. b) Replace bearing.
5. Release bearing is noisy.	Release bearing defective.	Replace bearing.
6. Clutch pedal squeak.	a) Pedal bushings worn out or cracked. b) Inadequate lubrication.	a) Replace bushings if worn or damaged. b) Lubricate bushings, adjuster and positioner.
7. Clutch pedal clicks loudly when pedal is depressed (may be an intermittent problem).	Auto-adjust clutch cable spring bent or missing.	Bend spring to dimension shown in figure 1 or replace spring.

9306-19

COOLING SYSTEM

CONTENTS

GENERAL INFORMATION

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.

COOLING SYSTEM

The 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 motor, shroud, radiator pressure cap, coolant reserve system, transmission oil cooler, hoses, clamps, air condition condenser, transmission oil lines and charge air cooler.

- 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 2.2L and 2.5L engine equipped vehicles are shown in (Fig 1). Turbocharged equipped engines coolant routing and plumbing are shown in (Fig 2). The 3.0L engine coolant routing is shown in (Fig 3). The 3.3L and 3.8L engine coolant routing is shown in (Fig 5).

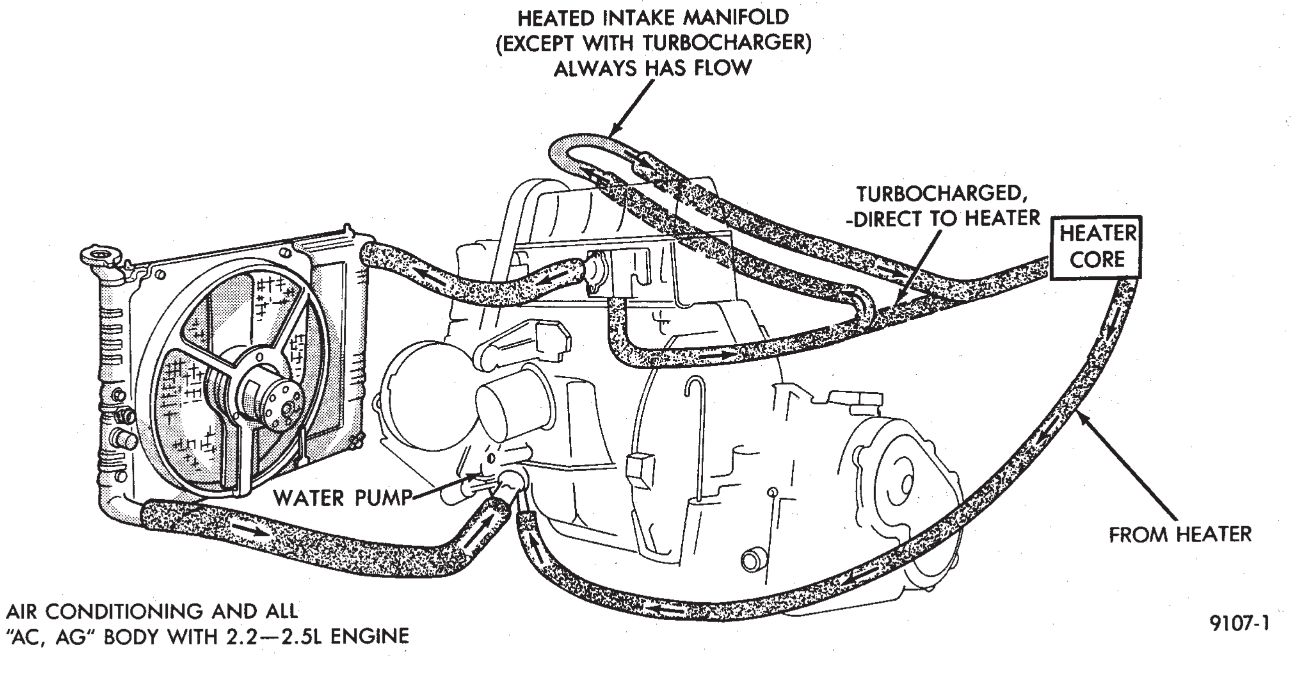


Fig. 1 Cooling System Operation—2.2/2.5L Engines

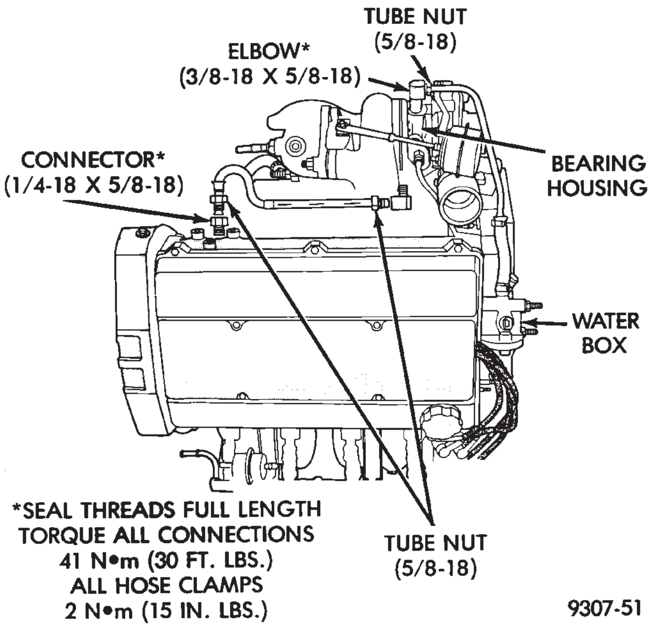


Fig. 2 Turbocharger-Tube Hose Assemblies—Turbo III Engine

TURBOCHARGER COOLANT ROUTING

Engines equipped with a Turbocharger maintain a continuous engine coolant flow through the Turbocharger bearing housing water jacket. Hose and tube assemblies provide a closed loop coolant flow **from** the cylinder block water jacket to the turbocharger housing and back to the cylinder head waterbox (Fig. 2).

Excluding heated intake manifold hose routing (hose is routed from waterbox directly to heater), all other system functions are essentially the same as shown for standard engines.

During any reassembly procedures all pipe fittings in water jacket, bearing housing and waterbox require cleaning and application of thread sealant for entire length of threads. Tighten all fittings to torque specified in (Fig 2).

WATER PIPES—3.0L

The 3.0L engines use metal piping beyond the lower radiator hose to route coolant to the suction side of water pump, located in the V of the cylinder banks.

These pipes are also 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. 4).

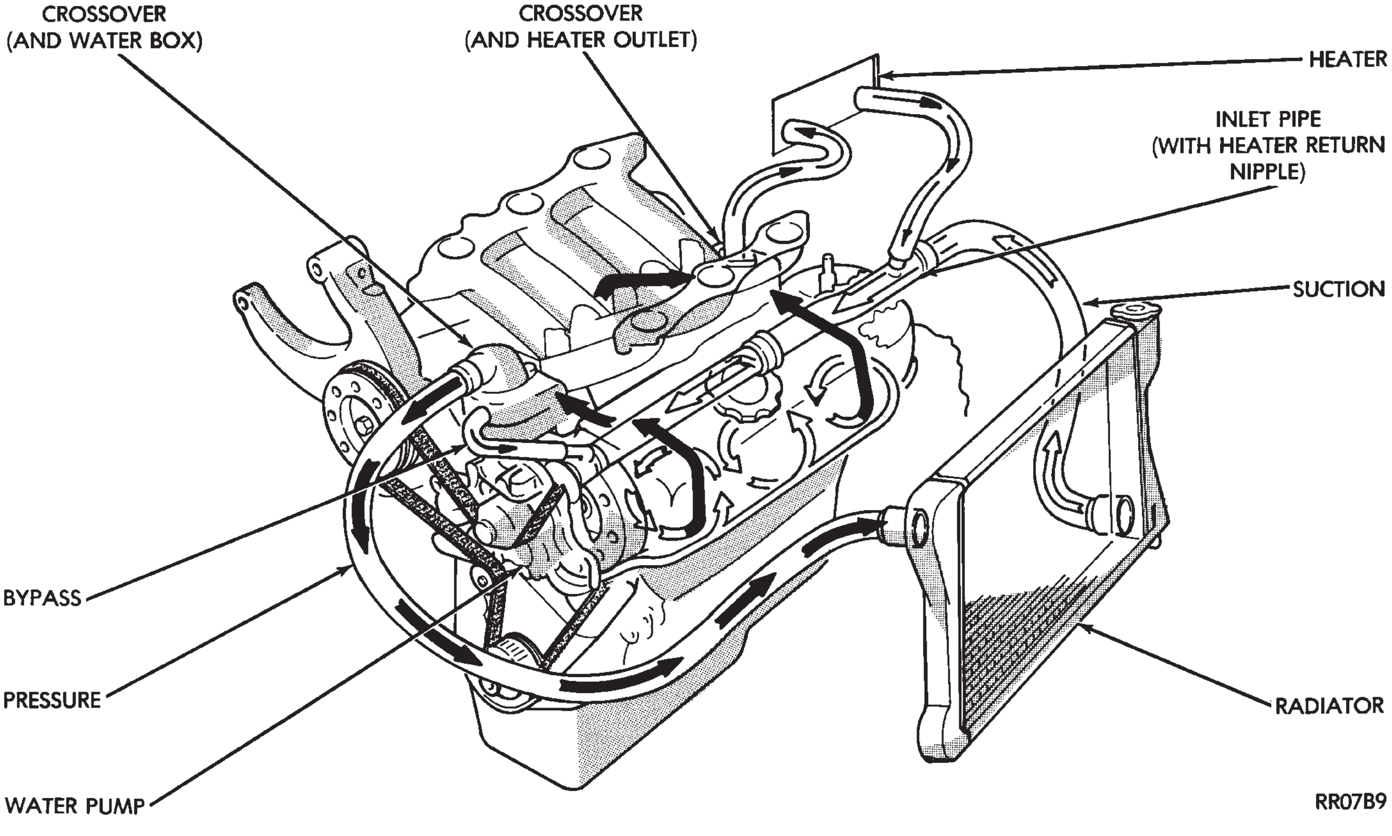


Fig. 3 Cooling System Operation—3.0L Engine

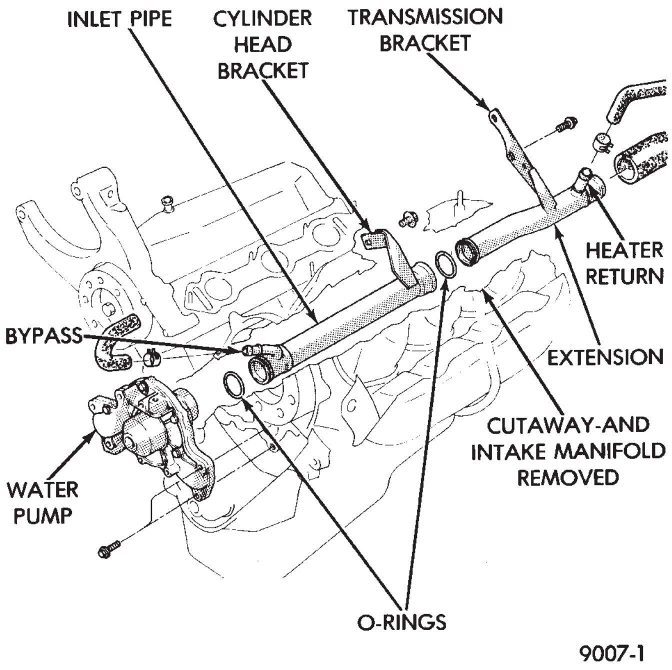


Fig. 4 Engine Inlet Coolant Pipes

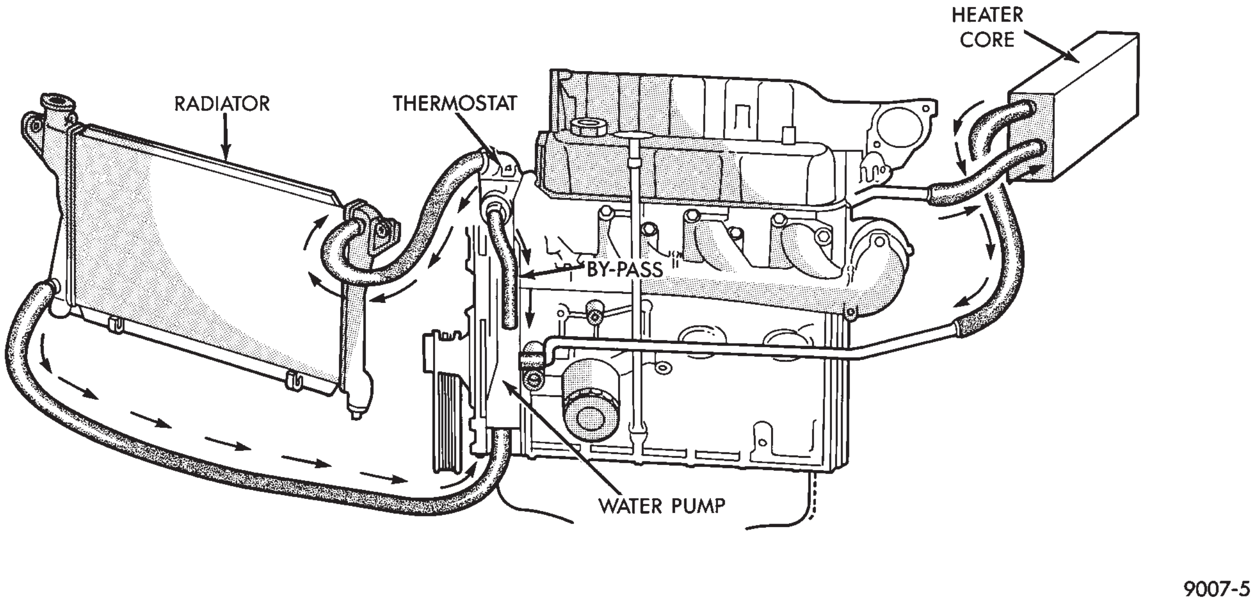


Fig. 5 Cooling System Operation—3.3/3.8L Engines

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:

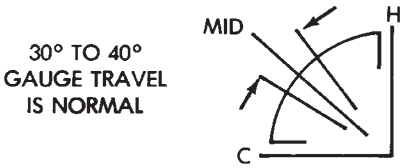
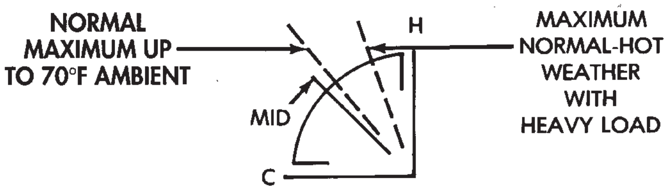
Determine if any recent service has been performed on the vehicle that may affect the cooling system such as engine adjustment (wrong timing), loose or slipping water pump belt, brakes (possibly dragging), changed parts (possibly wrong), recored radiator or cooling system refilling (possibly under-filled 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. Subsequent operation of the pressure cap and coolant recovery system will deaereate 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	Consult Electrical, Group 8.
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—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.

9207-1

COOLING SYSTEM DIAGNOSIS

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 and gauge. Repair or replace sending unit or 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 that 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—Assure cap seals at top and bottom.

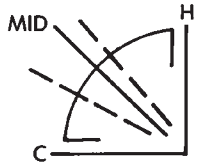
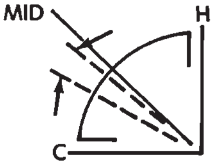
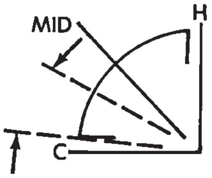
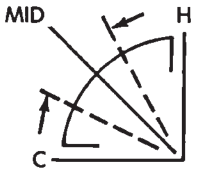
9207-19

COOLING SYSTEM DIAGNOSIS

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 (6) 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.
Temperature 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.
(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.

9207-3

COOLING SYSTEM DIAGNOSIS

CONDITION—AND CHECKS	DIAGNOSIS
Temperature Gauge is Inconsistent Cycles—Erratic	
(1) Is cycle normal?	 **Fig. 3—Normal Reaction to Fan Cycle** (1) a—Normal Fan Cycle Due to Temperature. Rises 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 Normally Builds Up at Stop After Heavy Use (Fig. 6).
(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).	(2) Fill System, Vent Air and Inspect for Leaks.

9107-6

COOLING SYSTEM DIAGNOSIS

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, 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. 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.

9207-5

COOLING SYSTEM DIAGNOSIS

CONDITION - AND CHECKS	DIAGNOSIS
Inadequate Air Conditioning Performance – Cooling Systems 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 compressor clutch is engaged.	(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. b – See Charging System in Electrical, Group B.
Hot Smell – Suspect Cooling System	
(1) Was temperature gauge high?	(1) a – Yes, See "Gauge Reads High." b – No, See 2, 3, 4, and 5.
(2) Heat shields all in place?	(2) a – Yes, See 3, 4, and 5. b – Repair as required.
(3) Fan control operating properly?	(3) a – Yes, See 4 and 5. b – No, See "Fan," this Group.
(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?	(1) If yes, change thermostat.
Poor Heater Performance – Suspect Failed Open Thermostat	
(1) Does gauge read low?	(1) See 3a.
(2) Check coolant level.	(2) See 3a.
(3) Check diagnostics – is code 17 set?	(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 water 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.

9207-17

SERVICE PROCEDURES

INDEX

WATER PUMPS

A quick test to tell whether or not the pump is working is to see if the heater warms properly. A defective pump will not be able to circulate heated coolant through the long heater hose.

The water pump on all models can be replaced without discharging the air conditioning system.

WATER PUMP—2.2/2.5L ENGINE

The 2.2/2.5L engine water pump has a diecast aluminum body and housing with a stamped steel impeller. The 2.2/2.5L pump uses an O-ring gasket between body and housing. The assembly bolts directly to the block. Cylinder block to water pump sealing is provided by a rubber O-ring.

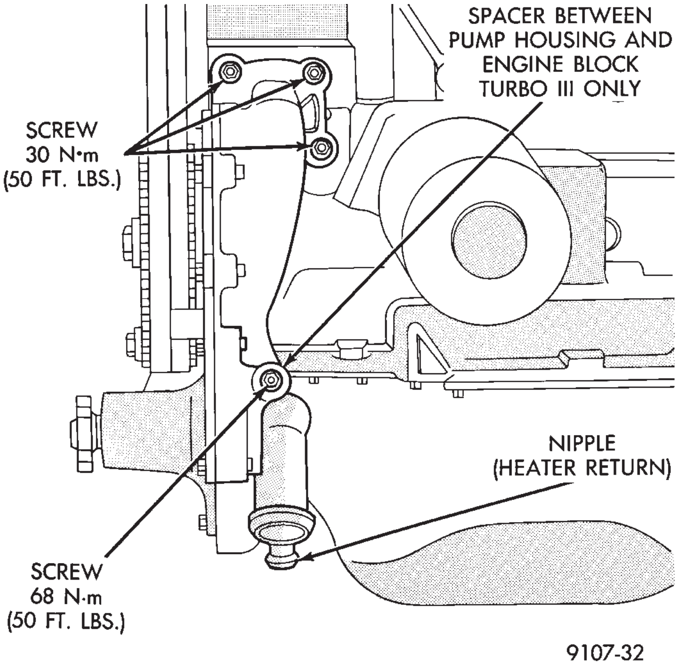


Fig. 1 Water Pump—2.2/2.5L Engines

REMOVAL

(1) Drain cooling system. Refer to Draining Cooling System in this group.

(2) If equipped with air conditioning, see Solid Mount Accessory Bracket in (Standard Service Procedures) Group 9, Engine:

(a) Remove air conditioning compressor and generator from solid mount bracket and set aside.It is not necessary to discharge the a/c system.

(b) Remove solid mount bracket.

(3) If the vehicle is not equipped with air conditioning, remove generator and mounting bracket.

(4) Disconnect lower radiator and heater hoses from pump.

(5) Remove water pump attaching screws to engine (Fig. 1). Turbo III has a spacer between the water pump and block on the lower screw.

DISASSEMBLY

(1) Remove three screws holding pulley to water pump.

(2) Remove nine screws holding water pump body to housing. Remove the pump body from housing (Fig. 2).

(3) Clean gasket surfaces on water pump housing and engine block.

(4) Remove and discard O-ring gaskets and clean O-ring grooves.

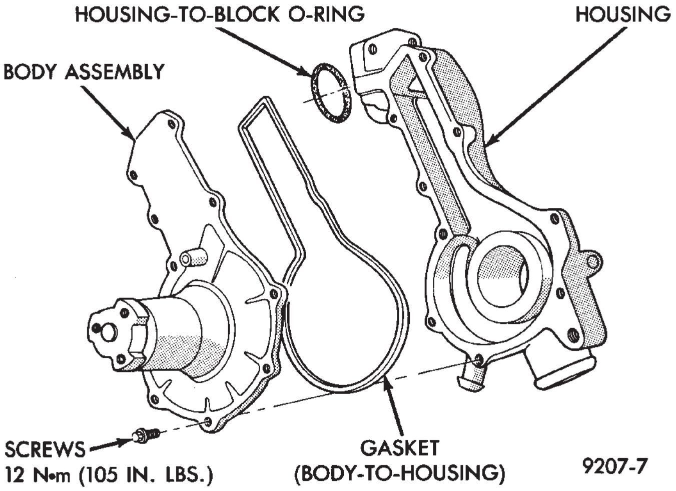


Fig. 2 Water Pump Components—2.2/2.5L

INSPECTION

Replace water pump body assembly if it has any of these defects:

(1) Cracks or damage on the body.

(2) Water leaks from the shaft seal, evident by coolant traces below the vent hole.

(3) Loose or rough turning bearing.

(4) Impeller rubs either the pump body or the housing.

ASSEMBLY

Body assembly and housing are serviced as separate components.

(1) Install new O-ring gasket in body O-ring groove.

(2) Assemble pump body to housing and tighten nine screws to 12 N•m (105 in. lbs.) (Fig. 2).

(3) Rotate pump by hand to check for freedom of movement.

(4) Position water pump pulley to water pump.Install three screws and tighten to 30 N•m (250 in. lbs.).

(5) Position new O-ring in housing to block O-ring groove.

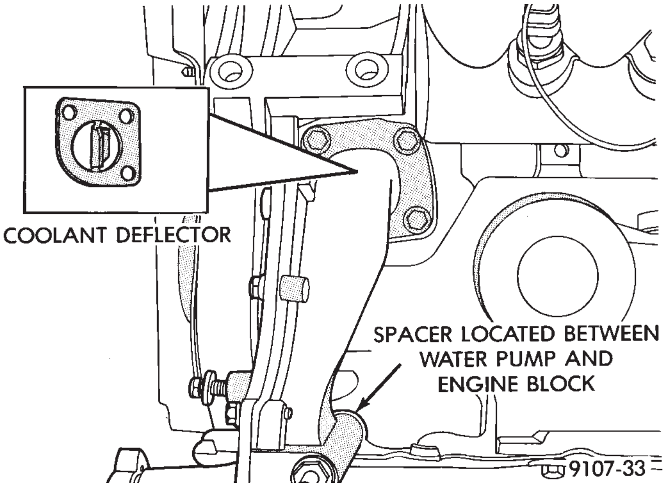


Fig. 3 Coolant Deflector—Turbo III

INSTALLATION

(1) On Turbo III engines install the coolant deflector into the block before installing pump on engine (Fig. 3). **Install spacer between the pump and block for Turbo III only before tightening pump to specifications.** Tighten three top screws (Fig. 1) to 28 N•m (250 in. lbs.) and lower screw to 68 N•m (50 ft. lbs.).

(2) Install bypass/heater hose and lower radiator hose.

(3) Install generator and air conditioning compressor bracket(s). For solid mount bracket see standard service procedures in Group 9 Engine.

(4) Install generator and air conditioning compressor.

(5) Refill cooling system. See **Refilling Cooling System.**

(6) Install drive belt, See Accessory Drive Belts, this Group.

WATER PUMP—3.0L ENGINE

The 3.0L pump bolts directly to the engine block, using a gasket for pump to block sealing (Fig. 4). The pump is serviced as a unit.

The water pump is driven by the timing belt. See Timing System in Group 9, Engine for component removal providing access to water pump.

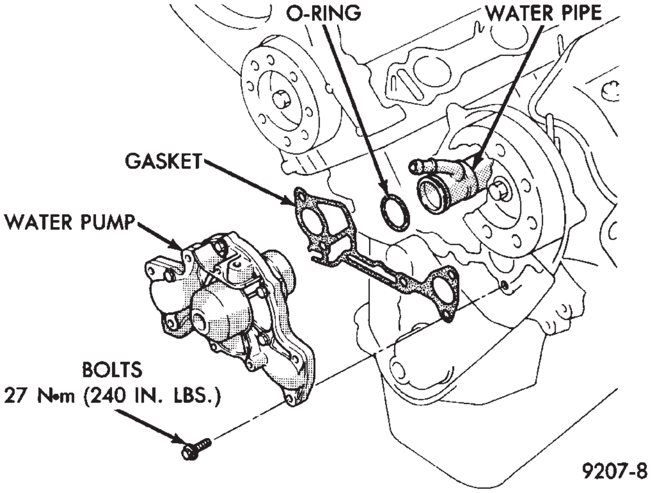


Fig. 4 Water Pump—3.0L Engine

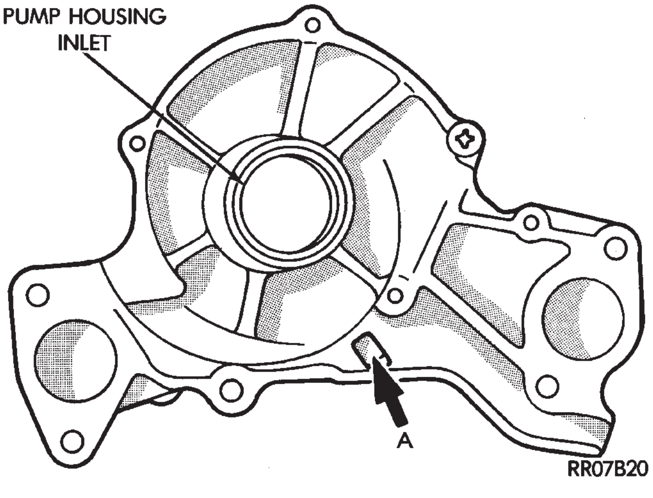


Fig. 5 Water Pump Inspection

REMOVAL

(1) Drain cooling system. Refer to Draining Cooling System in this group.

(2) Remove mounting bolts.

(3) Separate pump from water inlet pipe (Figs. 4 and 5) 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. 5).

(3) Impeller rubs inside of pump.

(4) Excessively loose or rough turning bearing.

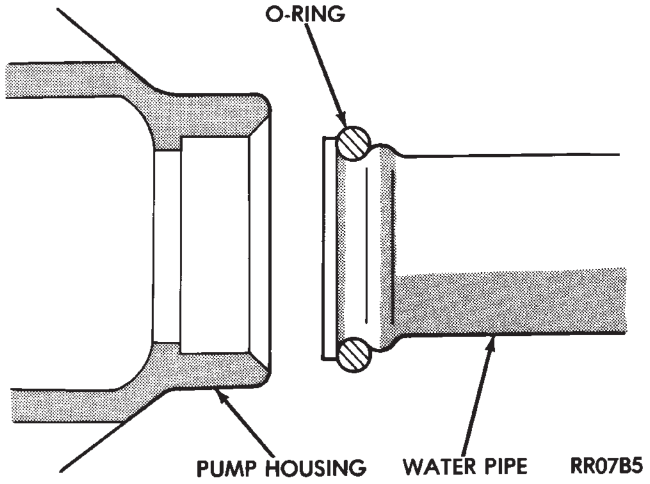


Fig. 6 Water Pipe O-Ring

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. 6). Wet the O-ring with water to facilitate 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 System in Engine, Group 9 and install timing belt. Reassemble engine.

(6) Fill cooling system. See Refilling Cooling System.

WATER PUMP—3.3L AND 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.

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. 7). Remove pump.

(6) Remove and discard O-ring seal.

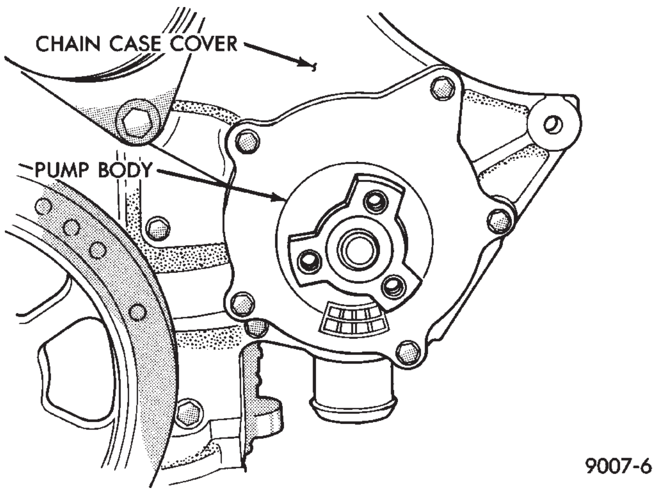


Fig. 7 Water Pump—3.3L and 3.8L Engines

(7) Clean O-ring groove and O-ring surfaces on pump and chain case cover. Take care not to scratch or gouge sealing surface.

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 seal is leaking, evident by traces of coolant leaks from vent hole.

(3) Loose or rough turning bearing.

(4) Impeller rubs either the pump body or chaincase cover.

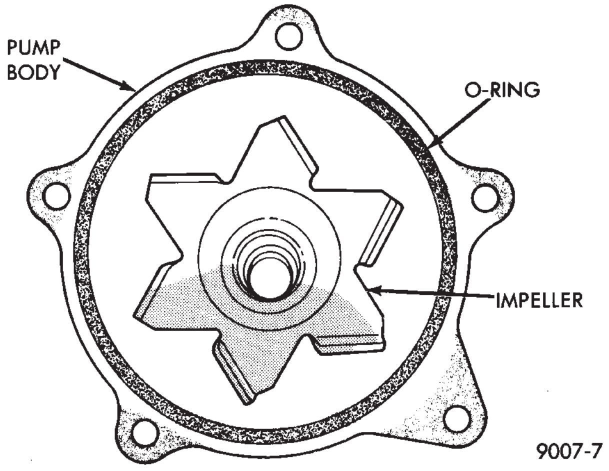


Fig. 8 Water Pump Body

INSTALLATION

(1) Install new O-ring in O-ring groove (Fig. 8).

(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.

(4) Position pulley on pump. Install screws and torque to 30 N●m (250 in. lbs.).

(5) Install drive belt. See Accessory Drive Belts this group.

(6) Install right front lower fender shield.

(7) Refill Cooling System. See Refilling Cooling System in this section.

ENGINE THERMOSTATS

The 2.2 and 2.5L engine thermostats are located on the front of the engine (radiator side) in the water box which is part of the cylinder head construction (Fig. 9). Turbo III thermostat is located in the water box located on the driver side of the cylinder head (Fig. 10).

These thermostats do not have an air bleed notch.

The 3.0L engine thermostat is located in a water box, formed in the timing belt end of the intake manifold. This thermostat has an air bleed valve, located in the thermostat flange (Fig. 11).

The 3.3/3.8L engine thermostat is located in a water box, formed in the drive belt side of the intake manifold (Fig. 13).

DESCRIPTION AND OPERATION

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 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 radiator, fan, and ambient temperature, not the thermostat.

OPERATION AND TESTING

The thermostat is operated by a wax filled container (pellet) which is sealed so that when heated to a predetermined temperature. The wax expands enough to overcome the closing spring and water pump pressure, which forces the valve to open. Coolant leakage into the pellet will cause a thermostat to fail open. Do not attempt to free up a thermostat with a screwdriver.

The open too soon type failure mode is included in the onboard diagnosis. The check engine light will not be lit by an open too soon condition. If it has failed open, code 17 will be set. Do not change a thermostat for lack of heat by gauge or heater performance, unless code 17 is present, see diagnosis for other probable causes. Failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will indicate this, Refer to diagnosis in this section.

REMOVAL

(1) Drain cooling system down to thermostat level or below.

(2) Remove thermostat housing bolts and housing (Figs. 9, 10, 11 and 13).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

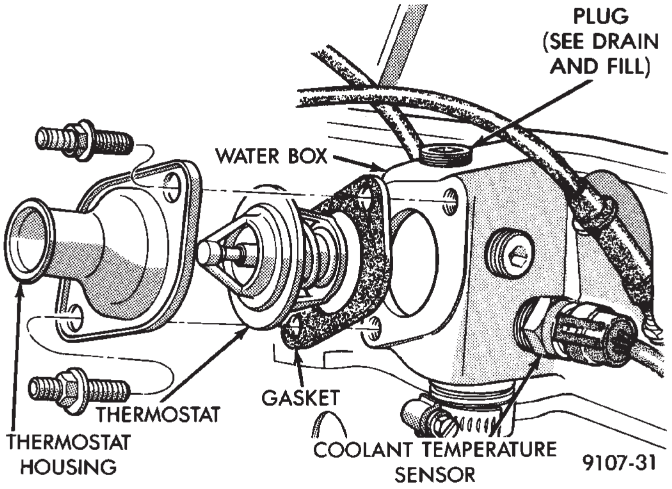


Fig. 9 Thermostat, Housing, and Water Box—2.2/2.5L Engine

INSTALLATION—2.2/2.5L AND TURBO III ENGINES

Place a new gasket (dipped in clean water) on water box surface, center thermostat in water box on gasket. Place housing over gasket and thermostat, making sure thermostat is in the thermostat housing. Bolt housing to water box (Figs. 9 and 10). Tighten bolts to 28 N●m (250 in. lbs.). Refill cooling system (see **Refilling System**).

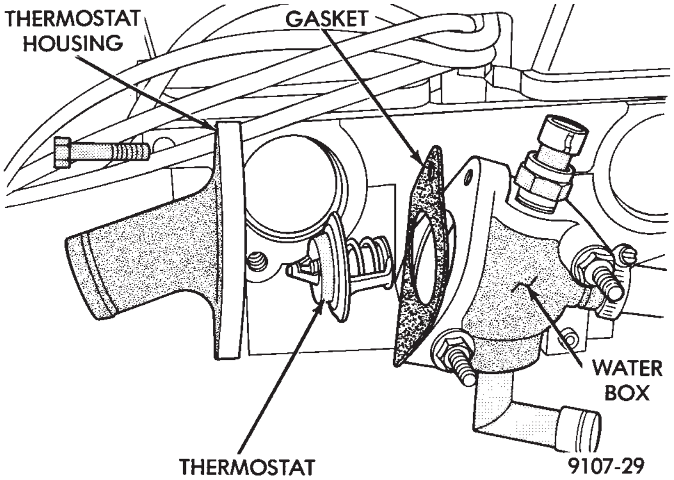


Fig. 10 Thermostat, Housing, and Water Box—Turbo III

INSTALLATION—3.0L ENGINE

Center thermostat in water box pocket. Check that the flange is seated correctly in the countersunk portion of the intake manifold water box (Figs. 11 and 12). Install new gasket on water box. Install housing over gasket and thermostat and tighten bolts to 12 N●m (133 in. lbs. torque).

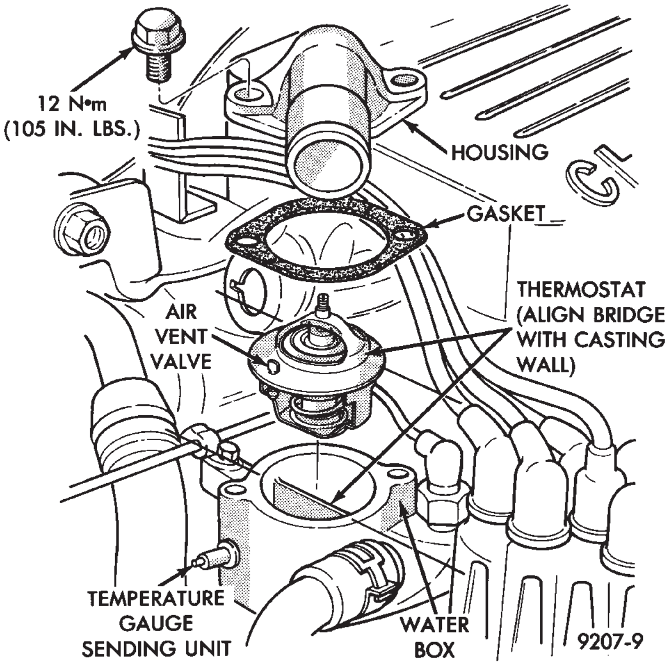


Fig. 11 Thermostat, Housing, and Water Box—3.0L Engine

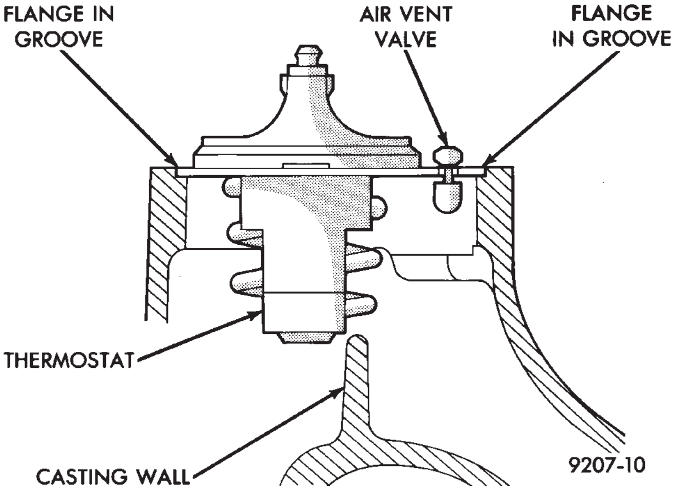


Fig. 12 Thermostat Installed—3.0L Engine

INSTALLATION—3.3L AND 3.8L ENGINE

Place a new gasket (dipped in water) on the water box surface, center thermostat into opening in the intake manifold. Place housing over gasket and thermostat, making sure thermostat is in recess provided (Fig. 13). Bolt housing to intake manifold, tighten bolts to 28 N●m (250 in. lbs.). Refill cooling system (see **Refilling 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. Then carry this heat to the radiator where the tube/fin assemblies of these components can give it up to the air.

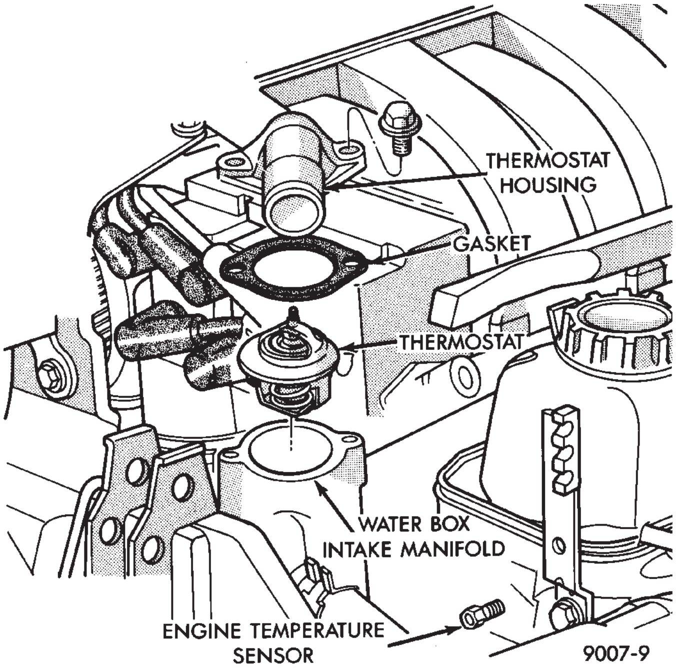


Fig. 13 Thermostat, Housing and Waterbox—3.3L and 3.8L Engine

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 raise 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.

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 which can lead to problems associated with 100 percent glycol.

SELECTION AND ADDITIVES

The use of aluminum cylinder heads, intake manifolds, and water pumps requires special corrosion protection. Mopar Antifreeze, Prestone II, Peak or antifreeze containing Alugard 340-2, or their equivalent are 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 looses color or becomes contaminated, drain, flush, and replace with fresh properly mixed solution.

SERVICE

Coolant should be changed at 52,500 miles or three years, whichever occurs first, then every two years or 30,000 miles.

ROUTINE LEVEL CHECK

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. Simply observe, with the engine idling and warmed up to normal operating temperature, that the level of the coolant in the reserve tank (Figs. 5 and 6) is between the minimum and maximum marks.

ADDING ADDITIONAL COOLANT

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 concentration of ethylene glycol type antifreeze and water.

SERVICE COOLANT LEVEL

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 drain cock 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 a 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.

LOW COOLANT LEVEL AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine at running operating temperature the high pressure inlet tank runs full and the low pressure outlet tank drops. If this level drops below the top of the transmission oil cooler, air will be sucked into the water pump:

- Transmission oil will become hotter.
- High reading shown on the temperature gauge.
- Air in the coolant will also cause loss of flow through the heater.
- Exhaust gas leaks into the coolant can also 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.

COOLING SYSTEM DRAIN, CLEAN, FLUSH AND REFILL

Drain, flush, and fill the cooling system at the mileage or time intervals specified in the Maintenance Schedule in this Group. If the solution is dirty or rusty or contains a considerable amount of sediment, clean and flush with a reliable cooling system cleaner. Care should be taken in disposing of the used engine coolant from your vehicle. Check governmental regulations for disposal of used engine coolant.

DRAINING

To drain cooling system move temperature selector for heater to full heat with engine running (to provide vacuum for actuation). **Without removing radiator pressure cap and with system not under pressure,** Shut engine off and open draincock. The coolant reserve tank (Fig. 5) should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks). To vent 2.2/2.5L engines remove the plug above thermostat housing (Fig. 1). For Turbo III engines remove coolant temperature sensor in the thermostat housing (Fig. 2). For 3.3L /3.8L engine remove the engine temperature sending unit (Fig. 3).

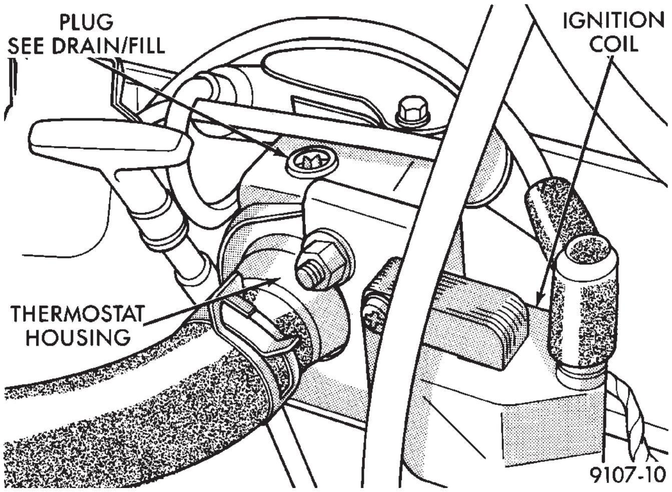


Fig. 1 Thermostat Housing Drain/Fill Plug—2.2/2.5L Engines

Removal of a plug or other component is required because the thermostat has no air vent and prevents air flow through it. This allows the coolant to drain from the engine block.

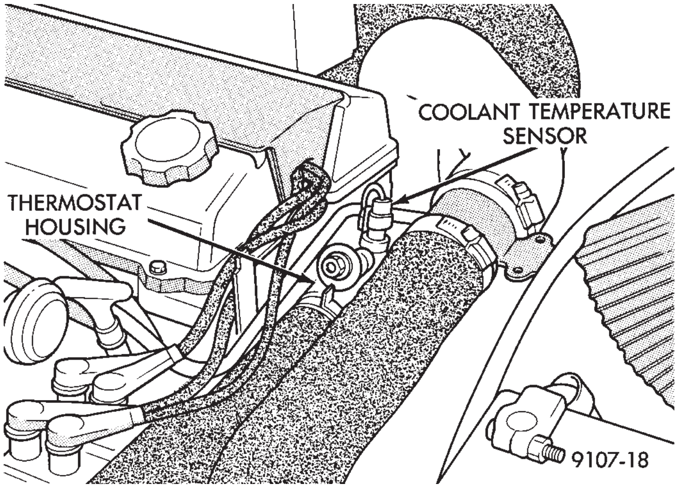


Fig. 2 Coolant Temperature Sensor—Turbo III Drain/Fill

CLEANING

Drain cooling system (see: **Draining Cooling System**) and refill with clean water (see: **Refilling Cooling System**). 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

Reverse flushing of the cooling system is the forcing of water through the cooling system, using air pressure in a direction opposite to that of the normal flow of water. This is only necessary with dirty systems and evidence of partial plugging.

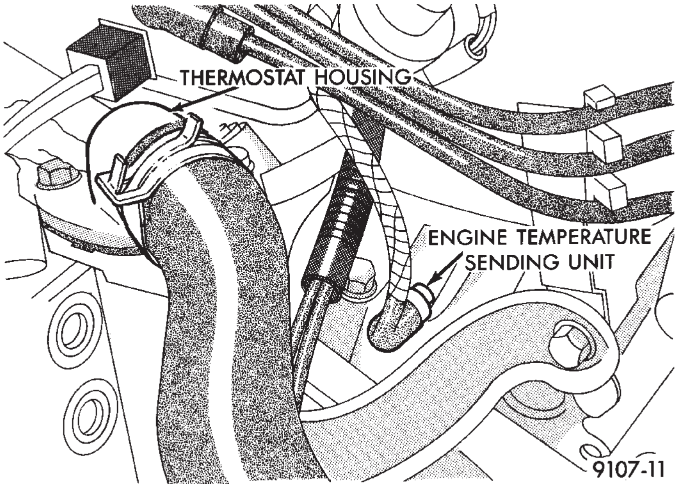


Fig. 3 Engine Temperature Sending Unit—3.3L and 3.8L Drain/Fill

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.

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. Install thermostat using a new housing gasket. Fill cooling system (See **Refilling Cooling System**).

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.

REFILLING

First clean system to remove old glycol, see Cooling System Cleaning.

Fill system using antifreeze described in Coolant section. Fill 50 percent of capacity with 100 percent glycol. Then complete filling system with water. The 2.2/2.5L engines require venting by removal of the plug on top of the water box (Fig. 1). Turbo III engines require venting by removing the coolant temperature sensor on top of the thermostat housing (Fig. 2). The 3.3/3.8L Engines require removal of the Engine Temperature Sending Unit on the front of the cylinder head (Fig. 3). The thermostat in these engines do not allow air flow through them. When coolant reaches the vent holes;

- Install vent plug and tighten to 20 N•m (15 ft. lbs.) for 2.2/2.5L Engines.
- Install Coolant Temperature Sensor and tighten to 27 N•m (20 ft. lbs.) for Turbo III Engine.
- Install Engine Temperature Sending Unit and tighten to 7 N•m (60 in. lbs.) for 3.3/3.8L Engines.

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 to maintain coolant level between the MAX and MIN mark after three or four warm-up, cool down cycles and trapped air has been removed.

TESTING SYSTEM FOR LEAKS

With engine not running, wipe the radiator filler neck sealing seat clean. The radiator should be full.

Attach a radiator pressure tester to the radiator, as shown in (Fig. 4) 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 hoses, radiator and heater, should be moved while at 15 psi since some leaks occur while driving due to engine rock, etc.

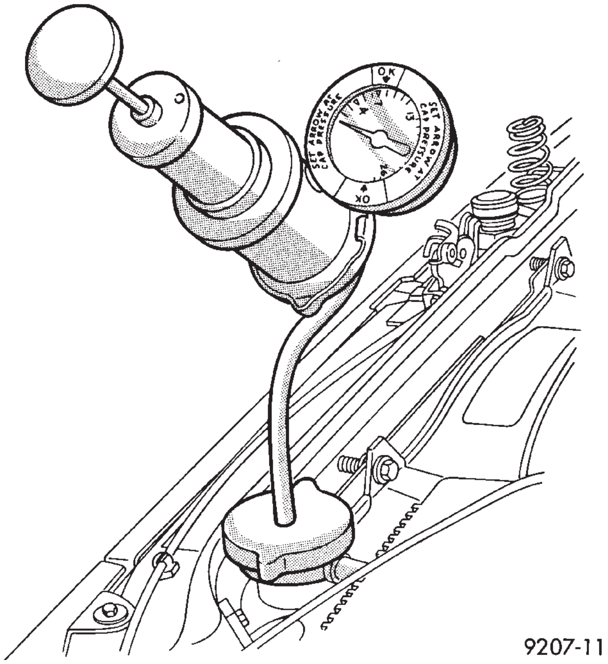


Fig. 4 Pressure Testing Cooling System

If there are no external leaks after the gauge dial shows a drop in pressure, detach the tester. Start engine and run the engine to normal operating temperature in order to open the thermostat and allow the coolant to expand. Re-attach the tester. If the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

WARNING: WITH TOOL IN PLACE PRESSURE BUILDS UP FAST. ANY EXCESSIVE AMOUNT OF 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 is emitted from the tail pipe, it may indicate a faulty head gasket, cracked engine block or cylinder head.

There may be internal leaks which can be determined by removing the oil dip-stick. If water globules appear intermixed with the oil it will indicate a internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

COOLANT RECOVERY SYSTEM (CRS)

This system works in conjunction with the radiator pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides a volume for expansion and contraction, 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 minor leaks and evaporation or boiling losses. All vehicles are equipped with this system (Figs. 5 and 6).

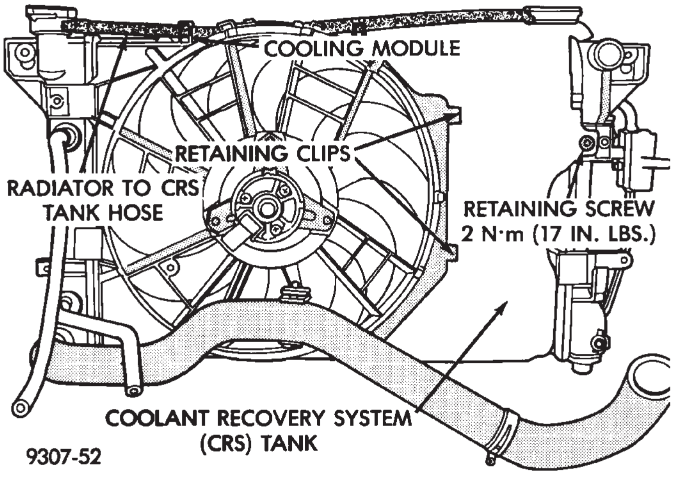


Fig. 5 Coolant Recovery System Typical

See Coolant Level Check Service, Deaeration and Pressure Cap sections for operation and service. Vehicles equipped with the electric monitor system use a level sensor in the CRS tank, see Group 8E Electrical for service.

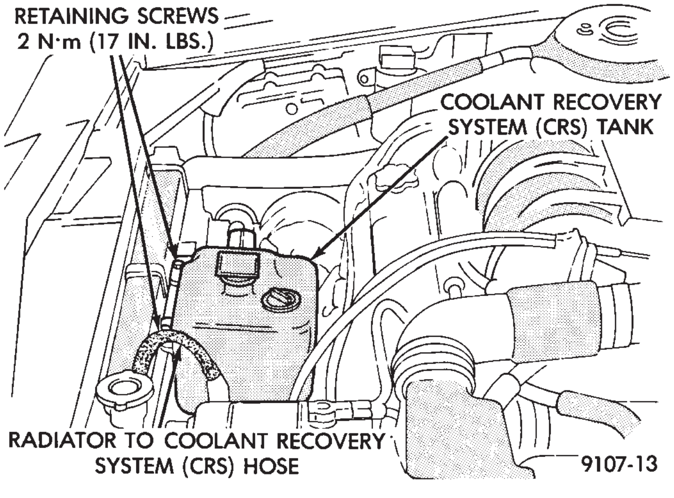


Fig. 6 Coolant Recovery System—AC-AY Models

RADIATOR PRESSURE CAP

Radiators are equipped with a pressure cap which releases pressure at some point within a range of 97-124 kPa (14-18 psi) (Fig. 7).

The system will operate at higher than atmospheric pressure which raises the coolant boiling point allowing increased radiator cooling capacity.

There is also a vent valve in the center of the cap that allows a small coolant flow to the CRS tank. **If valve is stuck shut, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 7) to ensure proper sealing when boiling point is reached.**

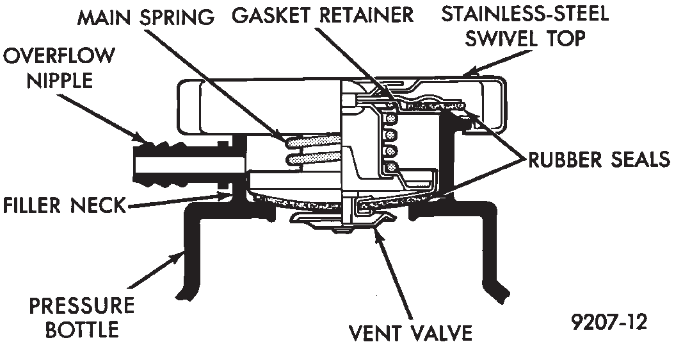


Fig. 7 Radiator Pressure Cap Filler Neck

There is also a gasket in the cap to seal to the top of the filler neck so that vacuum can be maintained for drawing coolant back into the radiator from the coolant reserve system tank.

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. 7). 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.

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 AND/OR UNDER PRESSURE.

There is no need to remove the radiator cap at any time **except** for the following purposes:

(1) Check and adjust antifreeze freeze point.
(2) Refill system with new antifreeze.
(3) Conducting service procedures.
(4) Checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. THEN PLACE A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE IT 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 CAPS

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, 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 which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.

INSPECTION

Hold the cap in hand, **right side up** (Fig. 7). 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 can be seen 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 systems. This design assures coolant return to radiator.

RADIATORS

The radiators are crossflow types (horizontal tubes) with design features that provide greater strength as well as sufficient heat transfer capabilities to keep the engine satisfactorily cooled.

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches.

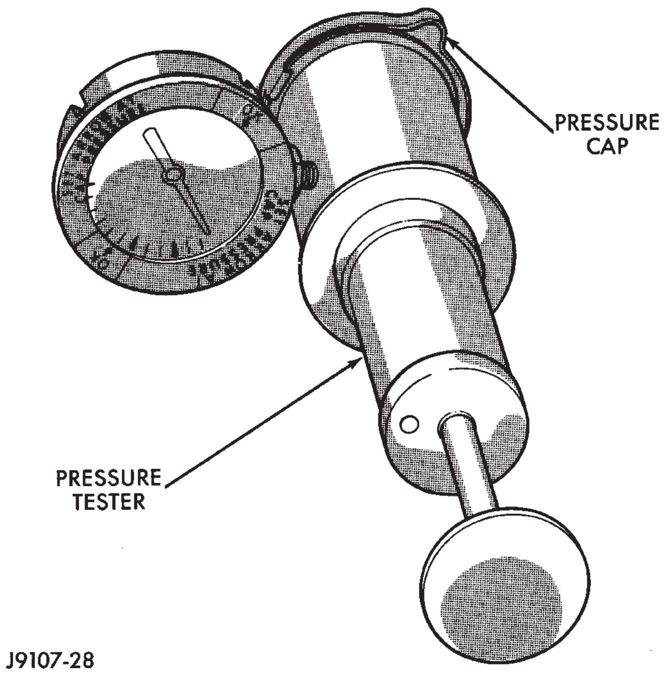


Fig. 8 Pressure Testing Radiator Cap

RADIATOR DRAINCOCK SERVICE

REMOVAL

(1) Turn the drain cock stem counterclockwise to unscrew the stem. When the stem is unscrewed to the end of the threads, pull the stem (Fig. 10) from the radiator tank.

INSTALLATION

(1) Push the draincock assembly body into the tank opening until it snaps into place.

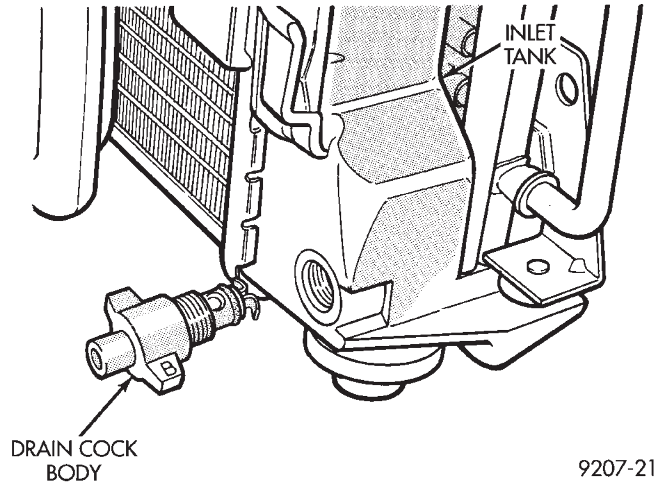


Fig. 10 Draincock Assembly—Typical

(2) Tighten the draincock stem by turning clockwise to 2.0-2.7 N●m (18-25 in. lbs.) torque.

RADIATOR COOLANT FLOW CHECK

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.

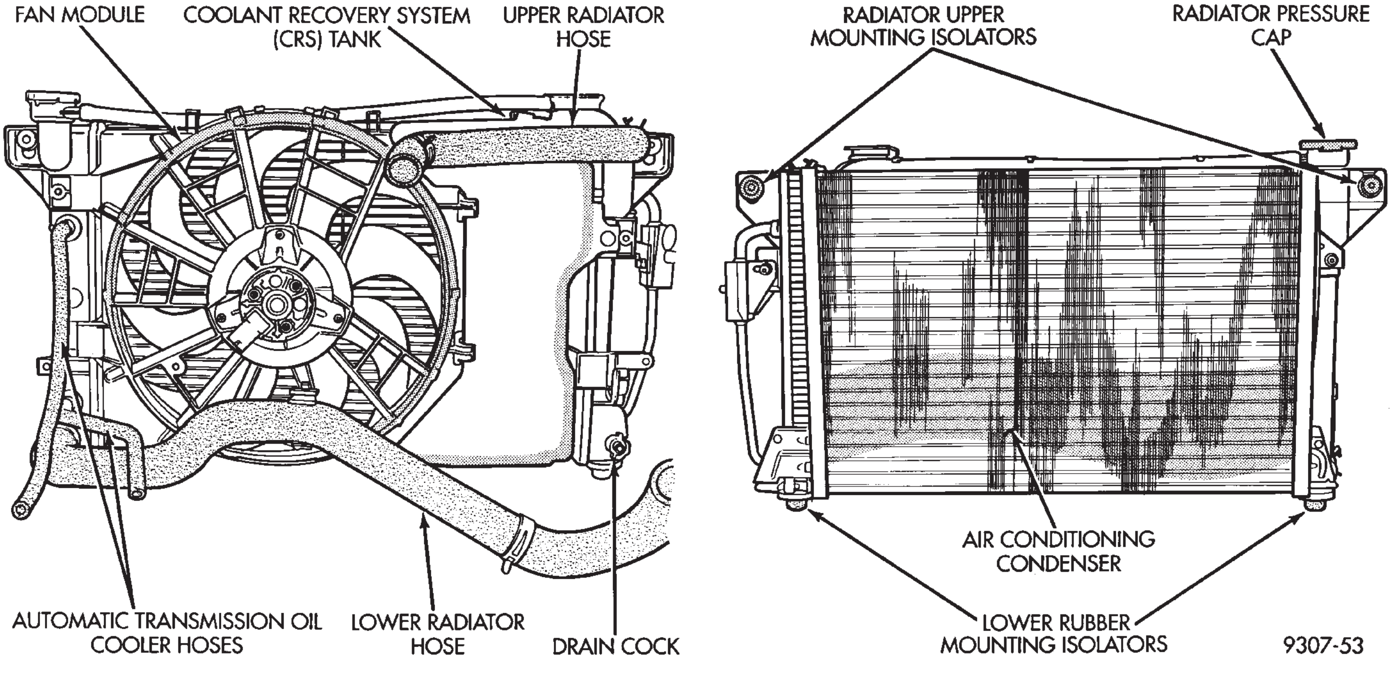


Fig. 9 Cooling Module—Typical

(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

REMOVAL

(1) Disconnect negative battery 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 hose clamps and hoses from the radiator (Fig. 11). Remove coolant reserve system tank to filler neck tube.

(4) Remove automatic transmission hoses, if equipped.

(5) Remove fan and fan support assembly by disconnecting fan motor electrical connector. Remove fan shroud retaining clips, located on the top and bottom of the shroud for AA, AG, AJ and AP vehicles. AC/AY vehicle retainer clips are located on the top only. Lift shroud up and out of bottom shroud attachment clips separating shroud from radiator. Fan damage should always be avoided.

(6) Remove upper radiator mounting screws. Disconnect the engine block heater wire if equipped.

(7) Remove the air conditioning condenser attaching screws located at the top front of the radiator,if equipped.

Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

INSTALLATION

(1) Slide radiator down into position behind radiator support (yoke).

(2) Attach air conditioning condenser to radiator, if equipped, with a force of approximately 10 lbs. to seat the radiator assembly lower rubber isolators in the mount holes provided.

(3) Tighten radiator mounting screws to 11.9N●m (105 in. lbs.).

(4) Connect automatic transmission hoses, if equipped. Tighten hose clamps to 4 N●m (35 in. lbs.).

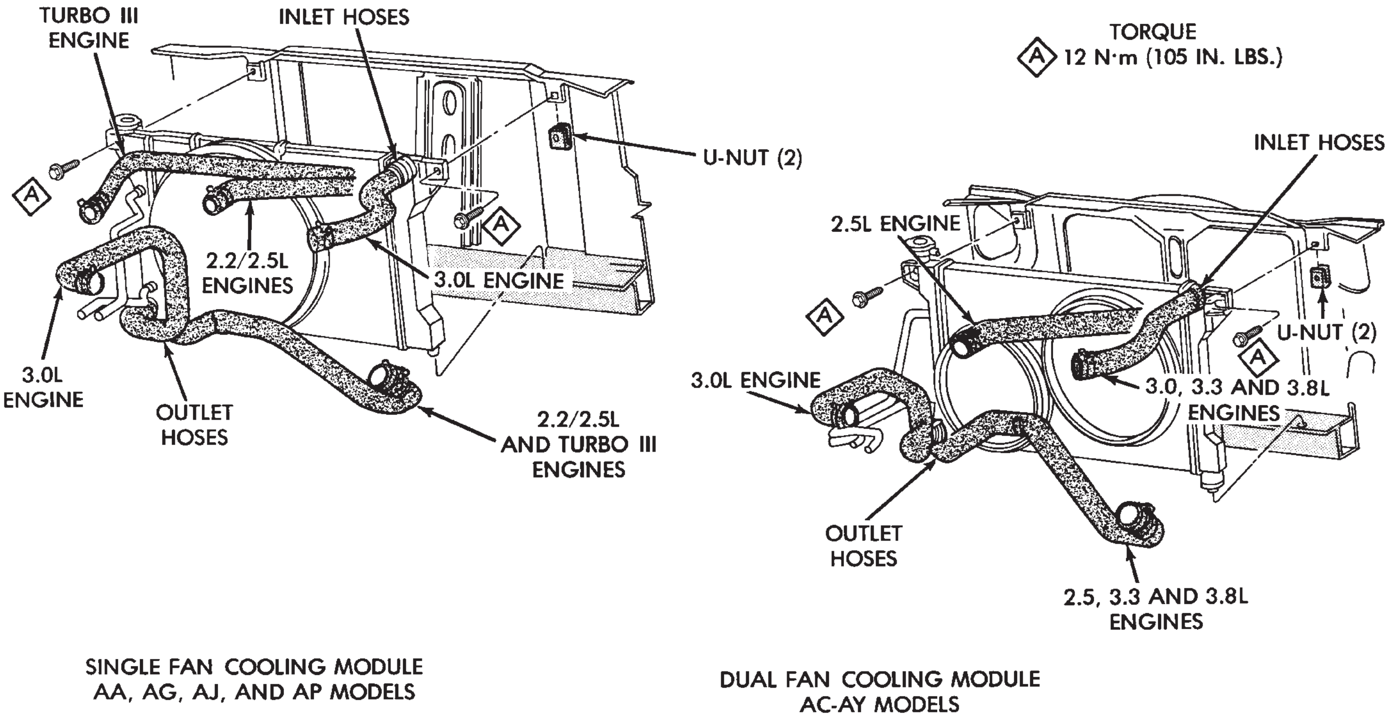
(5) Slide fan shroud, fan and motor down into clips on lower radiator flange. Replace shroud retaining clips.

(6) Install upper and lower radiator hoses (including coolant reserve hose).

(7) Connect fan motor electrical connection and connect negative battery cable.

(8) Fill cooling system with coolant. Refer to **Refilling Cooling Systems.** in this group.

(9) Operate engine until it reaches normal operating temperature. Check cooling system and automatic transmission for correct fluid levels.



SINGLE FAN COOLING MODULE AA, AG, AJ, AND AP MODELS

DUAL FAN COOLING MODULE AC-AY MODELS

Fig. 11 Cooling Modules—All Models

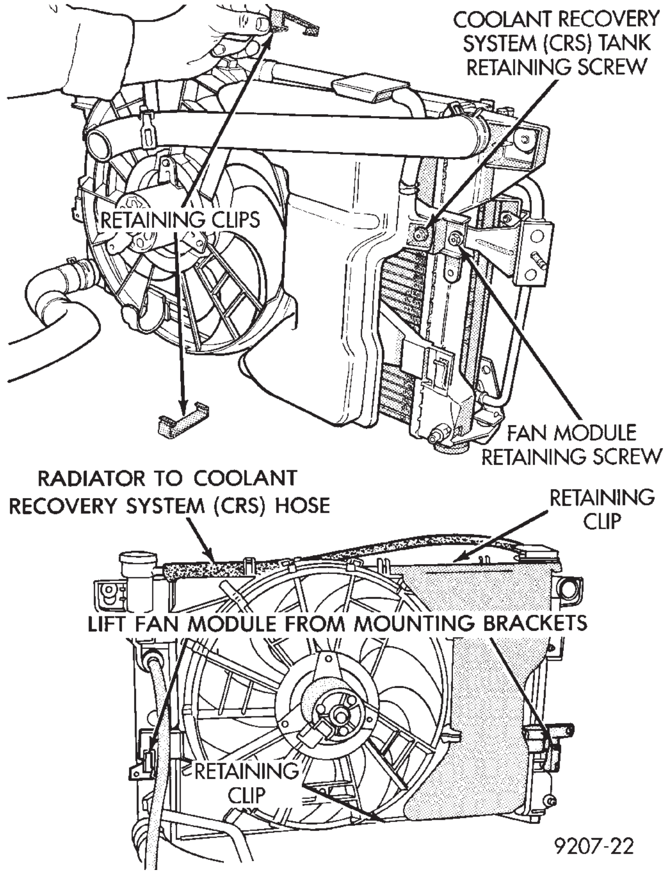


Fig. 12 Servicing Fan Module

RADIATOR HOSES

The hoses are removed using Constant Tension Clamp pliers to compress 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 style spring type clamp.

FANS

All models use electric motor driven cooling system fans. The fan modules include a motor support which may (depending on model) include a shroud. The module is fastened to the radiator by screws with U-nuts and retaining clips (Fig. 12).

All fan motors are one speed. Attempts to reduce high temperature gauge reading by increasing engine speed, at the same vehicle speed, can increase high temperature.

SINGLE FAN

There are no repairs to be made to the fan. If the fan is warped, cracked, or otherwise damaged, it must be replaced with **only** the recommended part for adequate strength, performance and safety (Fig. 13).

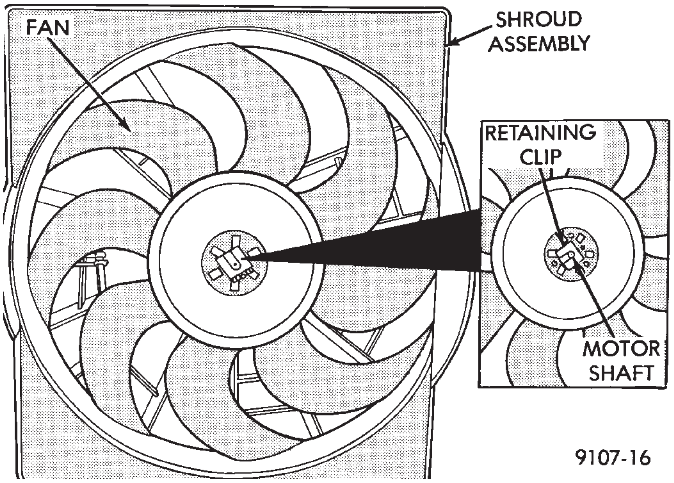


Fig. 13 Radiator Fan Retaining Clip—Typical

DUAL FAN MODULE—AC/AY BODY

The dual fan module (Fig. 11) is a combination of 2 fans mounted in a one piece shroud which are simultaneously activated. The dual fan system improves engine cooling and air conditioning performance in hot weather and severe driving conditions, while reducing fan noise and power consumption.

REMOVAL

Disconnect electric motor lead. Remove fan module to radiator fasteners and retaining clips. Remove assembly from radiator support.

To remove fan from motor shaft, bench support the motor and motor shaft, while removing the fan retaining clip, so that the shaft and motor will not be damaged by excessive force. **Surface or burr removal may be required to remove fan from motor shaft.** (Fig. 13). Do not permit the fan blades to touch the bench.

INSTALLATION

Slide the fan on motor shaft. Support motor and shaft as above while installing fan retaining clip. Install assembly into pocket on lower radiator tank. Attach retaining clips and fasteners to radiator tank. **Right side fastener is longer on A/C equipped vehicles**. Connect fan motor lead. **For wiring diagrams of fan motor systems see Wiring Diagrams Manual**

RADIATOR FAN CONTROL—ALL EXCEPT V-6 ENGINE

Fan control is accomplished two ways. The fan always runs when the air conditioning compressor clutch is engaged. 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 Engine Controller. The Engine Controller turns on the fan through the fan relay. See Wiring Diagrams Manual for circuity and diagnostics provided.

Switching through the Engine Controller provides fan control for the following conditions.

- The fan will not run during cranking until the engine starts no matter what the coolant temperature is.
- Fan will run when the air conditioning clutch is engaged and low pressure cutout switch is closed.
- For 4 cylinder application the fan will run at vehicle speeds above about 40 mph only if coolant temperature reaches 110°C (230°F). It will turn off when the temperature drops to 104°C (220°F). At speeds below 40 mph the fan switches on at 102°C (215°F) and off at 93°C (200°F).
- This is to help prevent steaming. The fan will run only below 16°C (60°F) ambient. Between 38°C (100°F) to 97°C (195°F) coolant temperature, at idle and then only for three minutes.

RADIATOR FAN CONTROL—AC/AY BODY V-6 ONLY

For this application, fan control is accomplished based on coolant temperature, and on A/C head pressure. These vehicles receive the variable displacement compressor. The fan will go on when;

- Coolant temperature reaches 102°C (215°F) and off at 93.4°C (200°F) regardless of vehicle speed.
- When the head pressure reaches 1516.9 kPa (220 psi) and turn off when the pressure reaches 1103 kPa (160 psi).

TEMPERATURE GAUGE INDICATION

At idle the temperature gauge will rise slowly to about 5/8 gauge travel. The fan will come on and the gauge will drop to about 1/2 gauge travel, this is normal.

ELECTRIC FAN MOTOR

To check out the electric fan motor, disconnect the fan motor wire connector and connect it with #14 gauge wires to a good 12-volt battery observing correct polarity per (Fig. 14). If the fan runs normally, the motor is functioning properly. If not, replace fan module using the removal and installation instructions contained in the Fan Section. If the motor is noticeably overheated (i.e.; wire insulation melted, motor charred) the system voltage may be too high. Check charging system, see Group 8A, Battery/Starting/Charging System Diagnostics.

ELECTRIC FAN MOTOR TEST

Equipment required

- Diagnostic Tool DRB II or equivalent
- Volt/Ohm Meter
- Wiring Diagram Manual

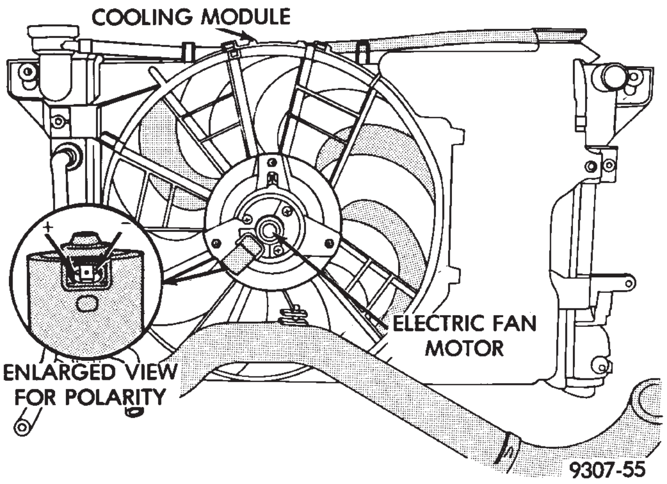


Fig. 14 Electric Fan Motor—Typical

(1) Run the engine to normal operating temperature.

(2) Check wiring connector in C25, C9, and C26 for proper engagement, see Wiring Diagram Manual

(3) Using a diagnostic tool, plugged into the diagnostic connector rearward of the battery, check the On-Board Diagnostics (OBD) in the Engine Controller for fault codes, see Group 14, Fuel Injection for instructions.

(4) If fault code 88-12-35-55 is detected, proceed to Step 5.

(5) With the ignition switch in the run position, test for battery voltage (single pin connector) at the fan relay. Voltage reading OK, proceed to Step 6a. Voltage at 0-1 volt, proceed to Step 6b.

6(a) With the ignition off, disconnect the 60-way connector from the Engine Controller (outboard of battery) and return the ignition to the run position. Test for battery voltage at cavity 31 of the 60-way connector (Fig. 15). Voltage reading OK and female terminal is not damaged, replace the Engine Controller. Voltage reading 0, repair open or short in C27 circuit.

(b) With the ignition off, disconnect the 60-way connector from the Engine Controller (outboard of battery) and return the ignition to the run position. Test for battery voltage at the single pin connector at the fan relay. Voltage reading OK, replace the Engine Controller. Voltage reading 0-1 volt, proceed to Step 7.

(7) With ignition in the run position, test for battery voltage at the wire (C27) in the 3-way connector of the fan relay. Voltage reading OK, replace the fan relay. Voltage reading 0, repair open or short in C27 circuit.

(8) Turn ignition off, connect the 60-way connector at the Engine Controller and test the system.

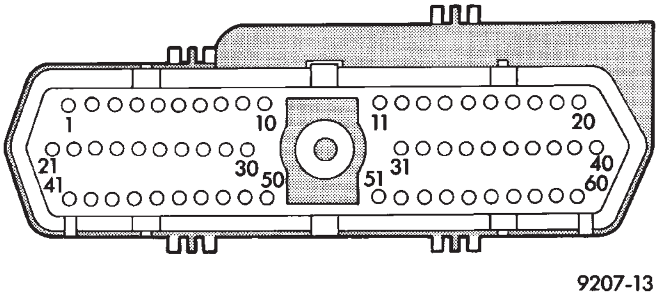


Fig. 15 Engine Controller 60-Way Connector from Terminal End

FAN SHROUD

All vehicles have fan shrouds to improve fan air flow efficiency. These fan shrouds cover less than full radiator frontal area to prevent the shroud from restricting air flow at high speeds.

The shroud supports the electric fan motor and fan. For removal and installation see Radiator Section.

AUTOMATIC TRANSMISSION OIL COOLERS

Oil coolers are internal oil to coolant type, mounted in the radiator left tank (Fig. 16). 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. Tighten Oil Cooler Hose Clamps to 4 N●m (35 in. lbs.).

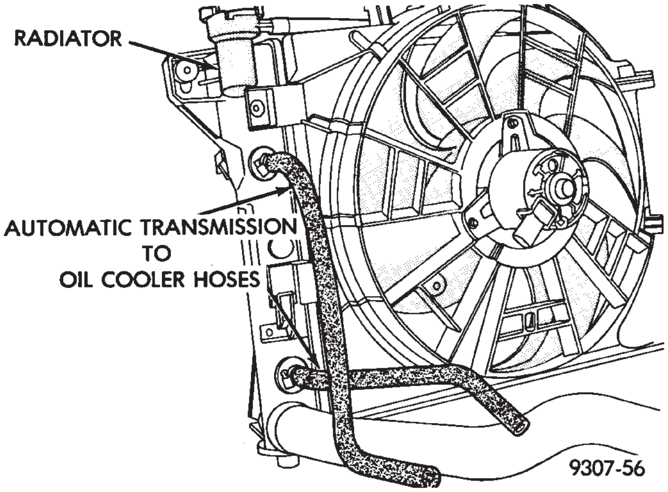


Fig. 16 Transmission Oil Cooler

ACCESSORY DRIVE BELTS

INDEX

GENERAL INFORMATION

PROPER BELT TENSION

Satisfactory performance of the belt driven accessories depends on belt condition (Fig. 1) and proper belt tension. Two tensioning methods are given in order of preference:

- Belt tension gauge method.
- Torque equivalent method.

The belt tension gauge method is usually restricted to use after the vehicle has been raised on a hoist and the splash shield has been removed.

BELT TENSION GAUGE METHOD

Use belt tensioning Special Tool Kit C-4162 for:

- For conventional belts and Poly-V belts.

Adjust the belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart.

TORQUE EQUIVALENT METHOD

Adjustable accessory brackets provided with a 13mm (1/2 in.) square hole for a torque wrench can use an equivalent torque value for belt adjustment.

Equivalent torque values for adjusting these accessory drive belts are specified on the Belt Tension Charts .

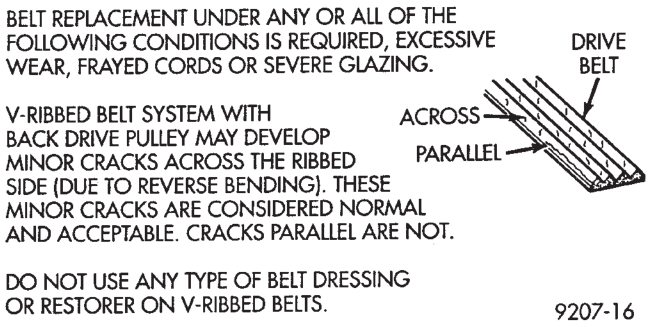


Fig. 1 Drive Belt Inspection

2.2/2.5L ENGINE BELTS REMOVE/INSTALL-ADJUST

AIR CONDITIONING COMPRESSOR

(1) Loosen the idler bracket pivot screw A and locking screws B (Fig. 2) to remove and install belt and/or adjust belt tension.

ACCESSORY DRIVE BELTS DIAGNOSIS

Condition	Possible Cause	Correction
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	(a) Belt too loose. (b) Belt excessively glazed or worn.	(a) Adjust belt tension. (b) Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	(a) Belts too loose. (b) Belts glazed.	(a) Adjust belt tension. (b) Replace belts.
BELT SQUEAK AT IDLE	(a) Belts too loose. (b) Dirt and paint imbedded in belt. (c) Non-uniform belt. (d) Misaligned pulleys. (e) Non-uniform groove or eccentric pulley.	(a) Adjust belt tension. (b) Replace belt. (c) Replace belt. (d) Align accessories. (e) Replace pulley.
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	(a) Broken cord in belt. (b) Belt too loose, or too tight. (c) Misaligned pulleys. (d) Non-uniform groove or eccentric pulley.	(a) Replace belt. (b) Adjust belt tension. (c) Align accessories. (d) Replace pulley.

9307-41

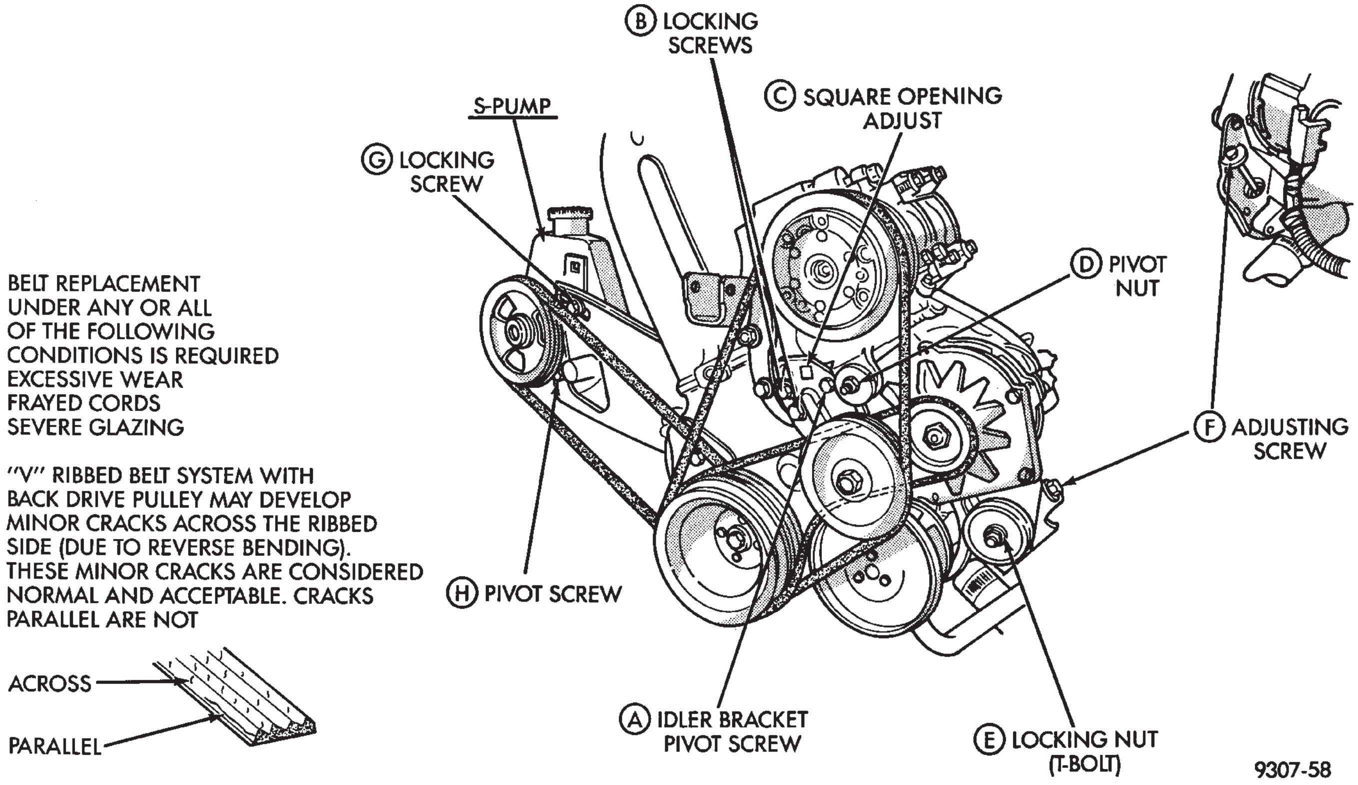


Fig. 2 Accessory Drive Belts—2.2 and 2.5L Engines

(2) Adjust belt tension by applying torque to square hole C on idler bracket. Adjust tension to specification given in Belt Tension Chart.

(3) Tighten in order, first, locking screws B then pivot screw A to 54 N•m (40 ft. lbs.).

POWER STEERING PUMP—S TYPE

(1) From on top of the vehicle loosen locking screw G.

(2) From under the vehicle loosen the pivot screw and pivot nut H .

(3) After installing a new belt adjust belt tension with 1/2 in. breaker bar installed in adjusting bracket. See tension specification in chart.

(4) Tighten locking screw G to 54 N•m (40 ft. lbs.).

(5) Tighten pivot screw H and the pivot nut to 54 N•m (40 ft. lbs.)

GENERATOR BELT

(1) Loosen T-Bolt locking nut E and adjusting screw F to remove and install Poly V belt and/or adjust belt tension.

(2) Tighten adjusting screw F to adjust belt tension to specification shown in Belt Tension Chart.

(3) Tighten T-Bolt locking nut E to 54 N•m (40 ft. lbs.).

3.0L ENGINE BELTS REMOVE/INSTALL AND ADJUST

AIR CONDITIONING BELT

To remove and install the air conditioning compressor drive belt, first loosen the idler pulley lock nut, then turn the adjusting screw to raise or lower the idler pulley (Figs. 3 and 4).

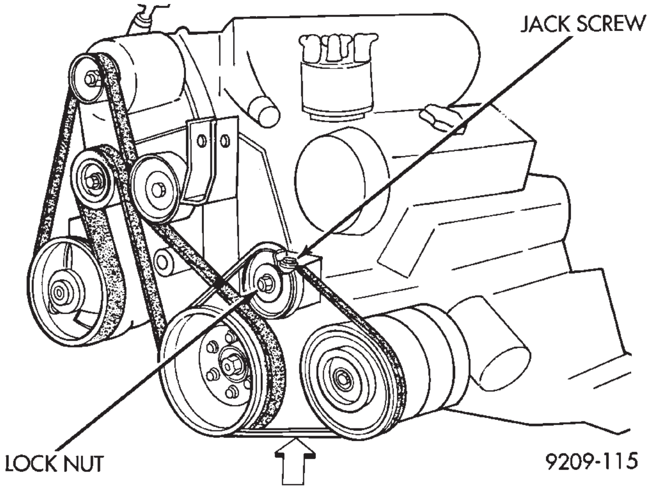


Fig. 3 Accessory Drive Belts—3.0L Engine

To adjust the air conditioning drive belt, loosen the idler pulley nut (Fig. 3) and adjust belt tension

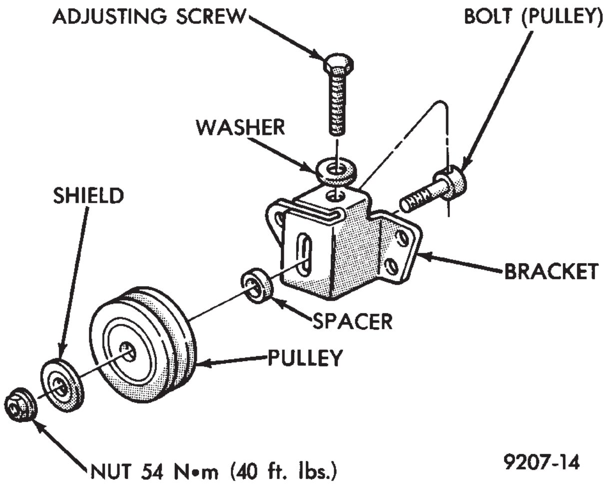


Fig. 4 Air Conditioning Belt Idler

by tightening adjusting screw (Figs. 3 and 4). Tighten pulley nut to 54 N●m (40 ft. lbs.) after adjustment.

GENERATOR/POWER STEERING PUMP BELT

The Poly-V generator/power steering pump belt is provided with a dynamic tensioner (Fig. 5) to maintain proper belt tension. To remove or install this belt, Release tension by rotating the tensioner clockwise

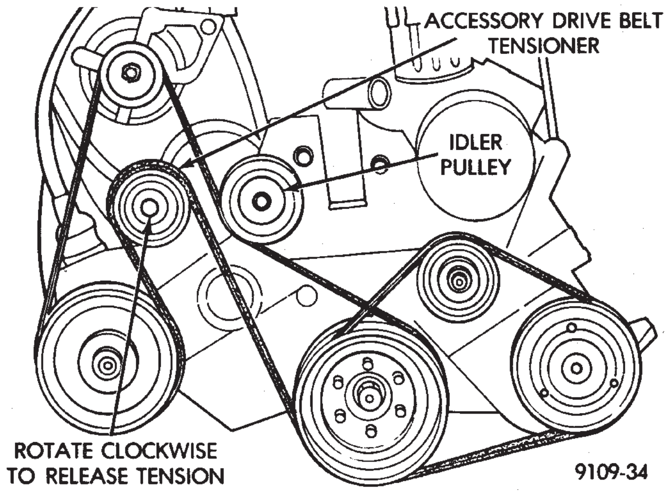


Fig. 5 Release Belt Tensioner

3.3/3.8L AND TURBO III ENGINE ACCESSORY DRIVE BELT REMOVE AND INSTALL

GENERATOR, POWER STEERING PUMP, AIR CONDITIONING COMPRESSOR AND WATER PUMP DRIVE BELT

The Poly-V Drive belt is provided with a dynamic tensioner (Figs. 7 and 8) 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 (Figs. 7 and 8).

(4) Reverse above procedure to install.

ACCESSORY DRIVE BELT		GAUGE	TORQUE
2.2/2.5L ENGINE			
AIR CONDITIONING COMPRESSOR	NEW	135 LB.	47 N·m (35 FT. LBS.)
	USED	80 LB.	27 N·m (20 FT. LBS.)
ALTERNATOR/WATER PUMP POLY "V"	NEW	135 LB.	
	USED	80 LB.	
POWER STEERING PUMP	NEW	105 LB.	58 N·m (43 FT. LBS.)
	USED	80 LB.	43 N·m (32 FT. LBS.)
3.0L ENGINE			
AIR CONDITIONING COMPRESSOR	NEW	125 LB.	
	USED	80 LB.	
ALTERNATOR/WATER PUMP/POWER STEERING PUMP	NEW USED	DYNAMIC TENSIONER	
2.2L TURBO III 3.3L AND 3.8L ENGINE			
AIR CONDITIONING COMPRESSOR ALTERNATOR/WATER PUMP/POWER STEERING PUMP	NEW USED	DYNAMIC TENSIONER	

9307-59

Fig. 6 Belt Tension Chart

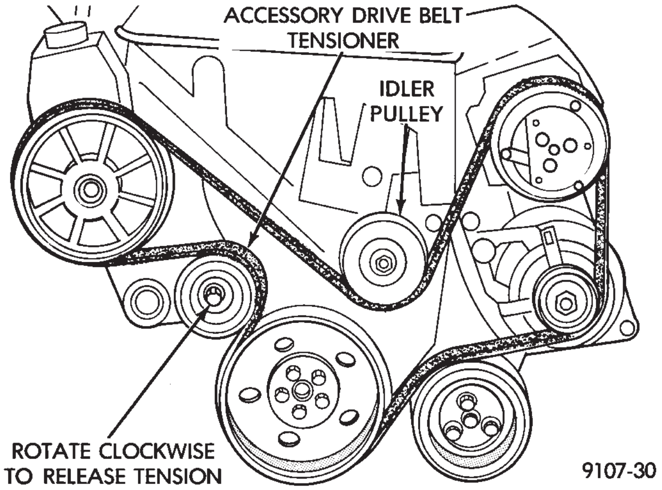


Fig. 7 Accessory Drive Belt—2.2L Turbo III Engine

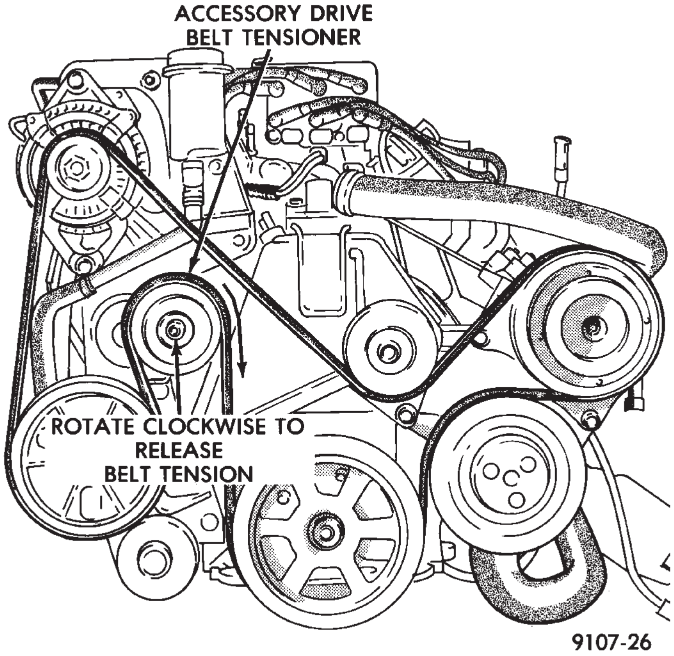


Fig. 8 Accessory Drive Belt—3.3/3.8L Engines

ENGINE BLOCK HEATER

DESCRIPTION AND OPERATION

On all models an engine block heater is available as an optional accessory. The heater, operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille, 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).

The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.

If unit does not operate, trouble can be in either the power cord or the heater element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Drain, Clean, Flush and Refill of this section for procedure.

(2) Detach 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.

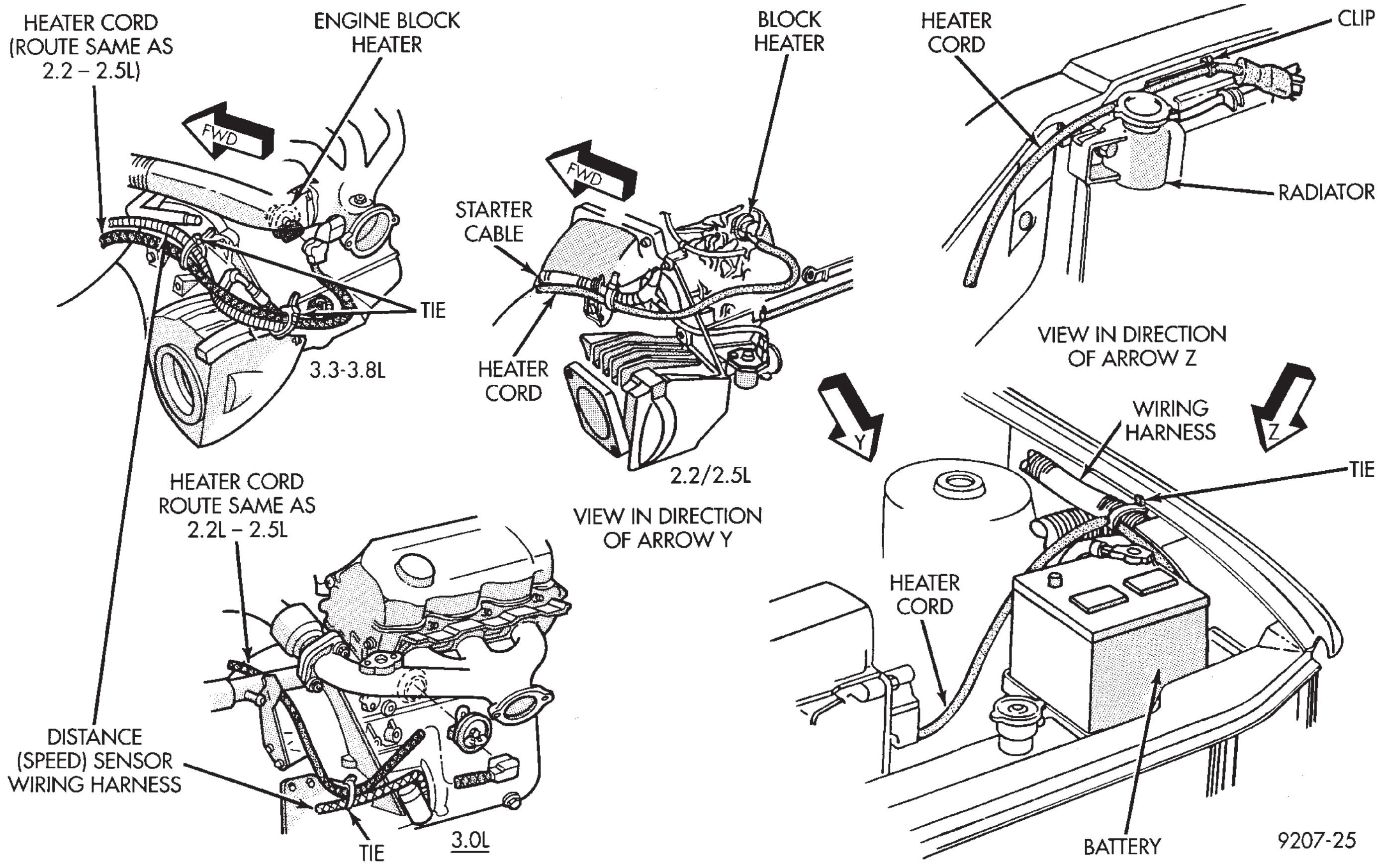
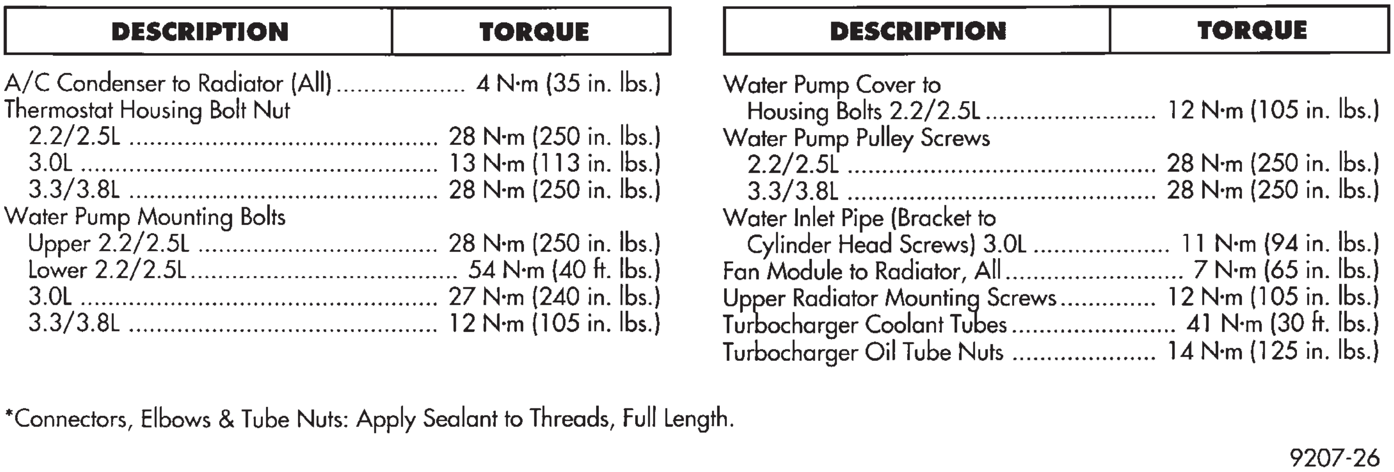


Fig. 9 Engine Block Heater

SPECIFICATIONS

TORQUE



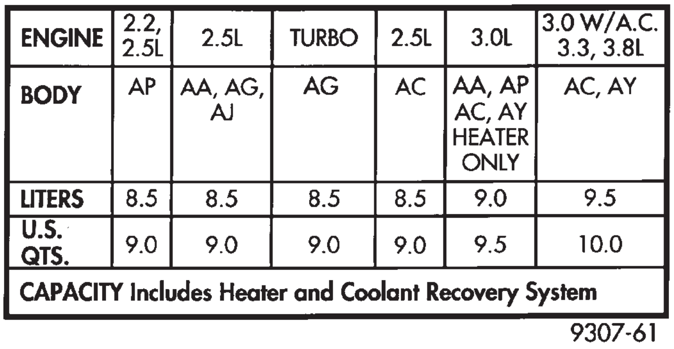
DESCRIPTION	TORQUE
A/C Condenser to Radiator (All)	4 N·m (35 in. lbs.)
Thermostat Housing Bolt Nut	
2.2/2.5L	28 N·m (250 in. lbs.)
3.0L	13 N·m (113 in. lbs.)
3.3/3.8L	28 N·m (250 in. lbs.)
Water Pump Mounting Bolts	
Upper 2.2/2.5L	28 N·m (250 in. lbs.)
Lower 2.2/2.5L	54 N·m (40 ft. lbs.)
3.0L	27 N·m (240 in. lbs.)
3.3/3.8L	12 N·m (105 in. lbs.)

DESCRIPTION	TORQUE
Water Pump Cover to Housing Bolts 2.2/2.5L	12 N·m (105 in. lbs.)
Water Pump Pulley Screws	
2.2/2.5L	28 N·m (250 in. lbs.)
3.3/3.8L	28 N·m (250 in. lbs.)
Water Inlet Pipe (Bracket to Cylinder Head Screws) 3.0L	11 N·m (94 in. lbs.)
Fan Module to Radiator, All	7 N·m (65 in. lbs.)
Upper Radiator Mounting Screws	12 N·m (105 in. lbs.)
Turbocharger Coolant Tubes	41 N·m (30 ft. lbs.)
Turbocharger Oil Tube Nuts	14 N·m (125 in. lbs.)

*Connectors, Elbows & Tube Nuts: Apply Sealant to Threads, Full Length.

9207-26

COOLING SYSTEM CAPACITY



ENGINE	2.2, 2.5L	2.5L	TURBO	2.5L	3.0L	3.0 W/A.C. 3.3, 3.8L
BODY	AP	AA, AG, AJ	AG	AC	AA, AP AC, AY HEATER ONLY	AC, AY
LITERS	8.5	8.5	8.5	8.5	9.0	9.5
U.S. QTS.	9.0	9.0	9.0	9.0	9.5	10.0
CAPACITY Includes Heater and Coolant Recovery System						

9307-61

ENGINE

CONTENTS

STANDARD SERVICE PROCEDURES

INDEX

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 to assure obtaining the desired results. Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine area. Mopar Silicone Rubber Adhesive Sealant and anaerobic gasket materials, each have different properties and cannot be used interchangeably.

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 used on flexible metal flanges.

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 removing all loose material. Inspect stamped parts to assure gasket rails are flat. Flatten rails with a hammer on a flat plate if required. Gasket surfaces must be free of oil and dirt. Make sure 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 1mm(0.040 inch.) 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 3mm (0.120 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 inch.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop 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 proper size socket, extension and rachet, when crankshaft rotation is necessary.

ENGINE PERFORMANCE

If a loss of performance is noticed, ignition timing should be checked. If ignition timing is retarded by 9, 18 or 27° indicating 1, 2 or 3 (timing belt or chain) teeth may have skipped, then, camshaft and accessory shaft timing with the crankshaft should be checked. Refer to Engine Timing Sprockets and Oil Seals of the Engine Section.

To provide best vehicle performance and lowest vehicle emissions, it is most important that the tune-up be done accurately. Use the specifications listed on the Vehicle Emission Control Information label found in the engine compartment.

(1) Test cranking amperage draw. See Starting Motor Cranking Amperage Draw Electrical Section of this manual.

(2) Tighten the intake manifold bolts to specifications.

(3) Perform cylinder compression test.

(a) Check engine oil level and add oil if necessary.

(b) Drive the vehicle until engine reaches normal operating temperature.

(c) Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

CAUTION: Do not overspeed the engine. The higher engine speed may help clean out valve seat deposits which can prevent accurate compression readings.

(d) 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.

(e) 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.

(f) Be sure throttle blade is fully open during the compression check.

(g) 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.

(h) Repeat Step G for all remaining cylinders.

(i) Compression should not be less than (689kPa) 100 psi and not vary more than 25 percent from cylinder to cylinder.

(j) If one or more cylinders have abnormally low compression pressures, repeat steps 3b through 3h.

(k) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question.

The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.

(4) Clean or replace spark plugs as necessary and adjust gap as specified in Electrical Group 8. Tighten to specifications.

(5) Test resistance of spark plug cables. Refer to Ignition System Secondary Circuit Inspection Electrical Section Group 8.

(6) Inspect the primary wire. Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to Ignition System and make necessary adjustment.

(7) Ignition timing should be set to specifications. (See Specification Label in engine compartment).

(8) Test fuel pump for pressure and vacuum. Refer to Fuel System Group 14, Specifications.

(9) The air filter elements should be replaced as specified in Lubrication and Maintenance, Group 0.

(10) Inspect crankcase ventilation system as out lined in Lubrication and Maintenance, Group 0. For emission controls see Emission Controls Group 25 for service procedures.

(11) Inspect and adjust accessory belt drives referring to Accessory Belt Drive in Cooling System, Group 7 for proper adjustments.

(12) Road test vehicle as a final test.

HONING CYLINDER BORES

Before honing, stuff plenty of clean shop towels under the bores, over the crankshaft to keep abrasive materials from entering crankcase area.

(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 (C-3501-3810) 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 available from major oil distributors. **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. 1).

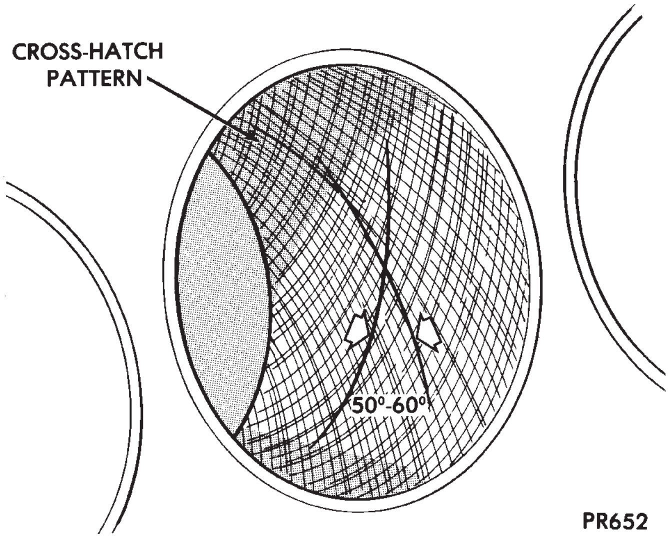


Fig. 1 Cylinder Bore Cross-Hatch Pattern

(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: Be sure all abrasive 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.

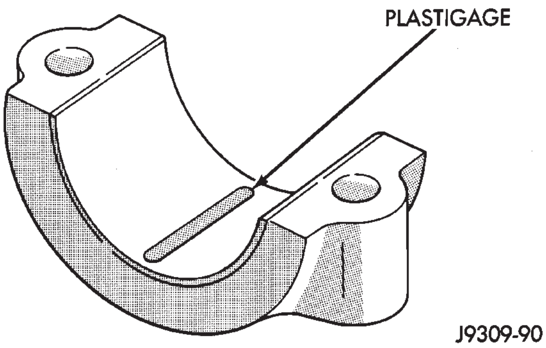


Fig. 2 Plastigage Placed in Lower Shell

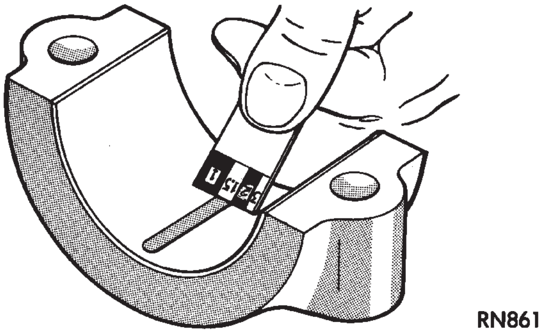


Fig. 3 Clearance Measurement

MEASURING MAIN BEARING CLEARANCE AND CONNECTING ROD BEARING CLEARANCE

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:

(1) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(2) 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 0.254mm (.010 inch) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and snugging bolts to 14-20 N•m (10-15 ft.lb.)

- When checking #1 main brg shim #2 main brg
- When checking #2 main brg shim #1 & 3 main brg
- When checking #3 main brg shim #2 & 4 main brg
- When checking #4 main brg shim #3 & 5 main brg
- When checking #5 main brg shim #4 main brg

REMOVE ALL SHIMS BEFORE REASSEMBLING ENGINE

ALTERNATIVE METHOD — With the weight of the crankshaft being supported by a jack under the counterweight adjacent to the bearing being checked.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 inch) off center and away from the oil holes (Fig. 2). (In addition, suspect areas can be checked by placing the Plastigage in the suspect area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.

(4) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 3) 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. **Plastic-Gage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

(5) Plastigage is available in a variety of clearance ranges. The 0.025-0.076mm (.001-.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

CONNECTING ROD BEARING CLEARANCE

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) 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 inch.) off center and away from the oil hole (Fig. 2). In addition, suspect areas can be checked by placing plastigage in the suspect area.

(4) Before assembling the rod cap with Plastigage in place, the crankshaft must be rotated until the connecting 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. 3) 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.**

(6) Plastigage is available in a variety of clearance ranges. The 0.025-0.076mm (.001-.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

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.

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.

(3) Low oil pressure.

(4) The oil restrictor pressed into the vertical oil passage to the cylinder head of Balance Shaft Engines Only is plugged with debris.

(5) Air ingested into oil due to broken or cracked oil pump pick up.

(6) Worn valve guides.

(7) Rocker arm ears contacting valve spring retainer (2.2/2.5L engines).

(8) Rocker arm loose, adjuster or tappet stuck or at maximum extension and still leaves lash in the system.

(9) Faulty lash adjuster or tappet.

(a) Check for sponginess while still installed in engine. Depress part of rocker arm just over adjuster or pushrod . Normal adjusters should feel very firm. Spongy adjusters can be depressed to the bottomed position easily.

(b) Remove suspected lash adjuster or tappet, pry off retainer cap or snap ring 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.

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 (or equivalent) Tap, and installing an insert into the tapped hole. This brings the hole back to its original thread size.

CAUTION: Be sure that the tapped holes maintain the original centerline.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostaticly 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 DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT START	1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Moisture on ignition wires and distributor cap. 5. Faulty ignition cables. 6. Faulty coil or control unit. 7. Incorrect spark plug gap. 8. Incorrect ignition timing. 9. Dirt or water in fuel system. 10. Faulty fuel pump, relay or wiring.	1. Test battery specific gravity. Charge or replace as necessary. 2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals. 3. Refer to Group 8A, Battery/Starter/Charging System Diagnostics. 4. Wipe wires and cap clean and dry. 5. Replace any cracked or shorted cables. 6. Test and replace, if necessary (refer to Group 8D, Ignition System). 7. Set gap (refer to Group 8D, Ignition System). 8. Refer to Group 8D, Ignition System. 9. Clean system and replace fuel filter. 10. Refer to Group 14, Fuel System.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set too low. 2. Idle mixture too lean or too rich. 3. Leak in intake manifold. 4. Worn or burned distributor rotor. 5. Incorrect ignition wiring. 6. Faulty coil. 7. EGR valve leaking. 8. Incorrect cam timing.	1. Refer to Group 14, Fuel System. 2. Refer to Group 14, Fuel System. 3. Inspect intake manifold gasket and vacuum hoses. Replace, if necessary (refer to Group 11, Exhaust System & Intake Manifold). 4. Install new distributor rotor. 5. Install correct wiring. 6. Test and replace, if necessary (refer to Group 8D, Ignition System). 7. Test and replace, if necessary (refer to Group 25, Emissions Control System). 8. Refer to Timing Belt Service.
ENGINE LOSS OF POWER	1. Incorrect ignition timing. 2. Worn or burned distributor rotor. 3. Worn distributor shaft. 4. Dirty or incorrectly gapped spark plugs. 5. Dirt or water in fuel system. 6. Faulty fuel pump. 7. Incorrect valve timing. 8. Blown cylinder head gasket. 9. Low compression. 10. Burned, warped or pitted valves. 11. Plugged or restricted exhaust system. 12. Faulty ignition cables. 13. Faulty coil. 14. Incorrect cam timing.	1. Refer to Group 8D, Ignition System. 2. Install new distributor rotor. 3. Remove and repair distributor (refer to Group 8D, Ignition System). 4. Clean plugs and set gap (refer to Group 8D, Ignition System). 5. Clean system and replace fuel filter. 6. Install new fuel pump. 7. Correct valve timing. 8. Install new cylinder head gasket. 9. Test compression of each cylinder. 10. Install new valves. 11. Install new parts, as necessary. 12. Replace any cracked or shorted cables. 13. Test and replace, as necessary (refer to Group 8D, Ignition System). 14. Refer to Timing Belt Service.
ENGINE MISSES ON ACCELERATION	1. Dirty or gap set too wide in spark plug. 2. Incorrect ignition timing. 3. Dirt in fuel system. 4. Burned, warped or pitted valves. 5. Faulty coil. 6. Incorrect cam timing.	1. Clean spark plugs and set gap (refer to Group 8D, Ignition System). 2. Refer to Group 8D, Ignition System. 3. Clean fuel system. 4. Install new valves. 5. Test and replace, if necessary, (refer to Group 8D, Ignition System). 6. Refer to Timing Belt Service.
ENGINE MISSES AT HIGH SPEED	1. Dirty or gap set too wide in spark plug. 2. Worn distributor shaft. 3. Worn or burned distributor rotor. 4. Faulty coil. 5. Incorrect ignition timing. 6. Dirty injector in throttle body. 7. Dirt or water in fuel system. 8. Incorrect cam timing.	1. Clean spark plugs and set gap (refer to Group 8D, Ignition System). 2. Remove and repair distributor (refer to Group 8D, Ignition System). 3. Install new distributor rotor. 4. Test and replace, as necessary (refer to Group 8D, Ignition System). 5. Refer to Group 8D, Ignition System. 6. Clean injector. 7. Clean system and replace fuel filter. 8. Refer to Timing Belt Service.

9309-227

ENGINE DIAGNOSIS—MECHANICAL

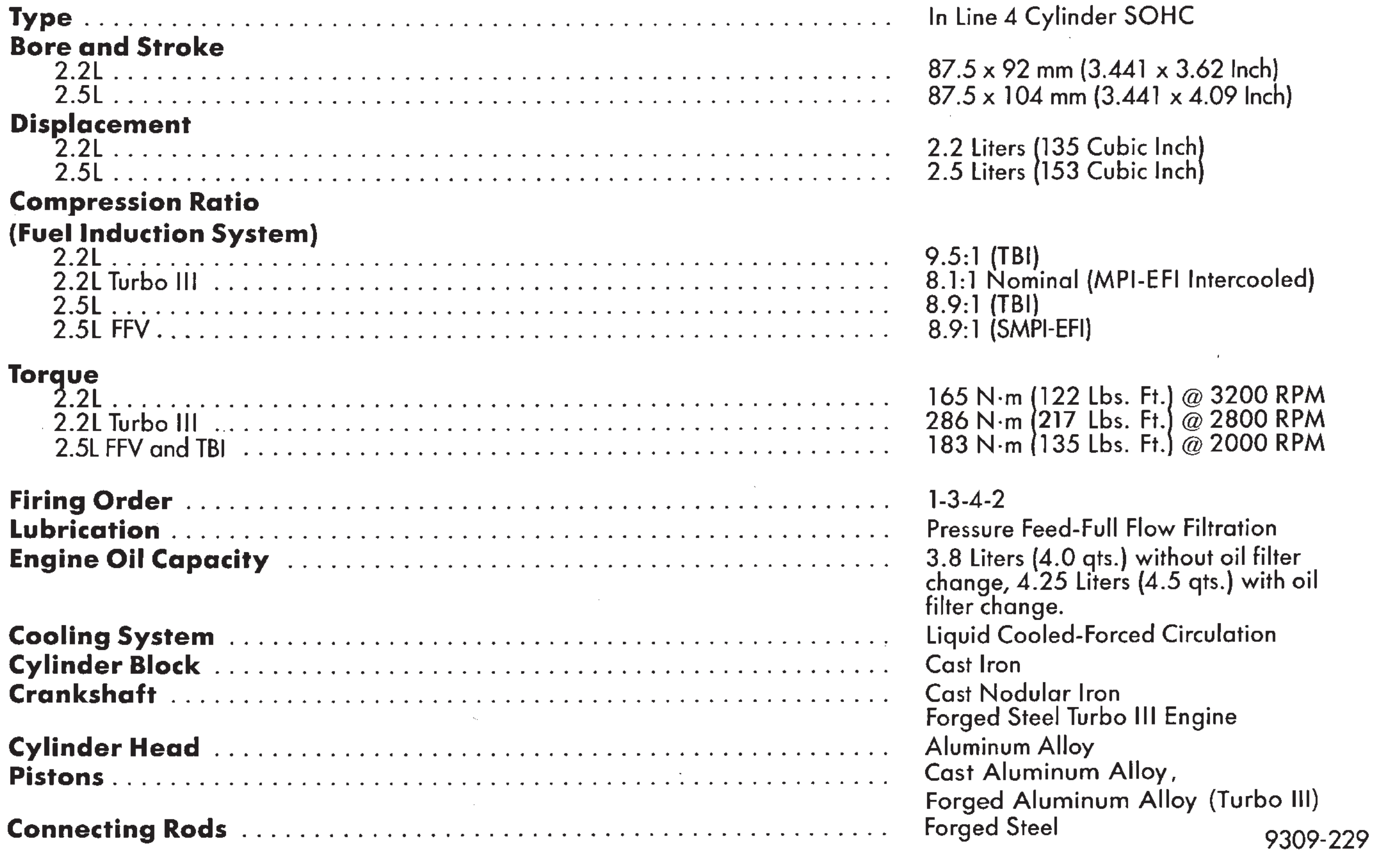
CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase. 2. Thin or diluted oil. 3. Low oil pressure. 4. Dirt in tappets/lash adjusters. 5. Bent push rods. 6. Worn rocker arms. 7. Worn tappets/lash adjusters. 8. Worn valve guides. 9. Excessive runout of valve seats on valve faces.	1. Check for correct oil level (refer to Group 0, Lubrication and Maintenance). 2. Change oil (refer to Group 0, Lubrication and Maintenance). 3. Check engine oil level. 4. Clean hydraulic tappets/hydraulic lash adjusters. 5. Install new push rods. 6. Inspect oil supply to rocker arms. 7. Install new hydraulic tappets/hydraulic lash adjusters. 8. Ream and install new valves with oversize stems. 9. Grind valve seats and valves.
CONNECTING ROD NOISE	1. Insufficient 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 (refer to Group 0, Lubrication and Maintenance). 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 journals. 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, worn. 7. Loose flywheel or torque converter.	1. Check engine oil level (refer to Group 0, Lubrication and Maintenance). 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. Grind journals or replace crankshaft. 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, bent cracked, or blocked. 10. Oil pump cover warped or cracked.	1. Check engine oil level. 2. Install new sending unit. 3. Check sending unit and check 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 and install. 9. Remove oil pan and install new tube, or clean if necessary. 10. Install new oil pump.
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 the gasket. 2. Tighten, repair or replace the part. 3. Replace.
OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. PCV system malfunction. 2. Worn, scuffed or broken rings. 3. Carbon in oil ring slot. 4. Rings fitted too tightly in grooves. 5. Worn valve guides. 6. Valve stem seal unseated or defective.	1. Check system. Clean and repair, as necessary (refer to Group 25, Emissions Control System). 2. Hone cylinder bores. Install new rings. 3. Install new rings. 4. Remove the rings. 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.

9309-228

2.2/2.5L ENGINES

INDEX

2.2/2.5L ENGINE SPECIFICATION



Type	In Line 4 Cylinder SOHC
Bore and Stroke	
2.2L	87.5 x 92 mm (3.441 x 3.62 Inch)
2.5L	87.5 x 104 mm (3.441 x 4.09 Inch)
Displacement	
2.2L	2.2 Liters (135 Cubic Inch)
2.5L	2.5 Liters (153 Cubic Inch)
Compression Ratio (Fuel Induction System)	
2.2L	9.5:1 (TBI)
2.2L Turbo III	8.1:1 Nominal (MPI-EFI Intercooled)
2.5L	8.9:1 (TBI)
2.5L FFV	8.9:1 (SMPI-EFI)
Torque	
2.2L	165 N·m (122 Lbs. Ft.) @ 3200 RPM
2.2L Turbo III	286 N·m (217 Lbs. Ft.) @ 2800 RPM
2.5L FFV and TBI	183 N·m (135 Lbs. Ft.) @ 2000 RPM
Firing Order	1-3-4-2
Lubrication	Pressure Feed-Full Flow Filtration
Engine Oil Capacity	3.8 Liters (4.0 qts.) without oil filter change, 4.25 Liters (4.5 qts.) with oil filter change.
Cooling System	Liquid Cooled-Forced Circulation
Cylinder Block	Cast Iron
Crankshaft	Cast Nodular Iron Forged Steel Turbo III Engine
Cylinder Head	Aluminum Alloy
Pistons	Cast Aluminum Alloy, Forged Aluminum Alloy (Turbo III)
Connecting Rods	Forged Steel

9309-229

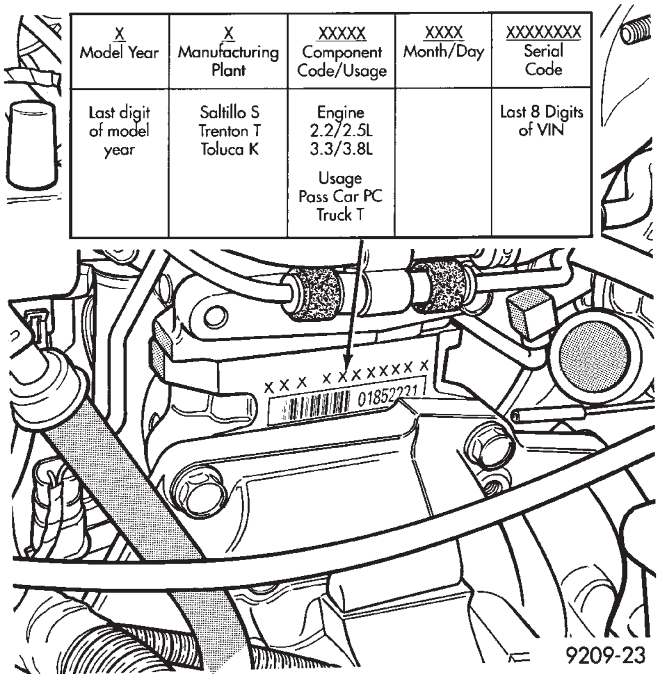
GENERAL INFORMATION

ENGINE IDENTIFICATION NUMBER OR CODE

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 1).

METHANOL FUEL COMPATIBILITY IDENTIFICATION

Beginning this model year, Chrysler began producing AA-Body vehicles designed to operate on a mixture of gasoline and methanol. These automobiles are referred to as Flexible Fuel vehicles.



X Model Year	X Manufacturing Plant	XXXXX Component Code/Usage	XXXX Month/Day	XXXXXXXX Serial Code
Last digit of model year	Saltillo S Trenton T Toluca K	Engine 2.2/2.5L 3.3/3.8L Usage Pass Car PC Truck T		Last 8 Digits of VIN

Fig. 1 Engine Identification

Flexible fuel vehicles can operate on a mixture of up to 85 percent methanol, 15 percent unleaded gasoline. These vehicles also operate on mixtures containing a lower percentage of methanol or just pure unleaded gasoline.

Engine components which are required for safe operation using fuel containing methanol alcohol are identified by a standard green color and/or display the statement methanol compatible imprinted on the component. To ensure continued safe operation, these components must be serviced only with genuine MOPAR replacement parts.

Methanol compatible parts for the 2.5L FFV (Flexible Fuel Vehicle) engine include, but are not limited to; the valve stem oil seals, all piston rings, the oil fill cap, the fuel injectors, fuel rail, fuel pressure regulator, hoses and the vacuum control harness hose.

BLOCK: All four cylinder cast iron blocks have cast-in recesses in the bottom of each cylinder bore to provide connecting rod clearance; especially needed for 2.5L engines. The bores are also siamese to minimize engine length. A coolant passage is drilled cross-ways through the siamese section to enhance between the bore cooling on some engine types. A partial open deck is used for cooling and weight reduction with oil filter, water pump, and distributor mounting bosses molded into the front (radiator side) of the block. Nominal wall thickness is 4.5 mm. Five main bearing bulkheads and a block skirt extending 3 mm below the crankshaft center line add to the blocks high rigidity with light weight.

CRANKSHAFT: A nodular cast iron crankshaft is used in TBI engines. A forged steel crankshaft is used in the Turbo III engine. All engines have 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 radiuses fillets that are deep rolled for added strength. To optimize bearing loading 4 counterweights are used. Hydrodynamic seals (installed in diecast aluminum retainers) provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for retainer-to-block sealing. No vibration damper is used. A sintered iron (TBI engine and steel billet Turbo III engines) timing belt sprocket is mounted on the crankshaft nose. This sprocket provides motive power; via timing belt to the camshaft and intermediate shaft sprockets (also sintered iron (TBI engine and steel billet Turbo III engines) providing timed valve, distributor, and oil pump actuation.

PISTONS: Some Chrysler pistons have cast-in steel struts at the pin bosses for autothermic control. All 2.2L and 2.5L piston tops have cuts to provide valve clearance. Some pistons are dished to provide various compression ratios. Standard 2.2L and 2.5L engines are designed for 9.5:1 and 8.9:1 compression ratios respectively. The 2.5L piston is dished and is a lightweight design to enhance engine smoothness. The 2.2L turbo III uses dished pistons providing a 8.3:1 compression ratio. All standard 2.2/2.5L and 2.5L FFV engines use pressed-in piston pins to attach forged steel connecting rods, 2.2L turbo III engine uses a full floating piston pin and connecting rod assembly.

PISTONS RINGS: The 2.2/2.5L engines share common piston rings throughout, including molybdenum filled top ring for reliable compression sealing and a tapered faced intermediate ring for additional cylinder pressure control. The 2.5L FFV engine feature all chrome rings for enhanced long term durability under multi-fueled conditions.

CYLINDER HEAD: The cylinder head is cast aluminum with in-line valves. The 2.2/2.5L and 2.5L FFV valves are arranged with alternating exhaust and intake. The intake and exhaust ports are located in the rearward, facing side of the head. The Turbo III 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 valve per cylinder facing toward the dash panel. The intake ports feed fast-burn design combustion chambers (2.2/2.5L and 2.5L FFV only) with the spark plug located close to the center line of the combustion chamber for optimum efficiency. An integral oil gallery within the cylinder head supplies oil to the hydraulic lash adjusters, camshaft, and valve mechanisms.

CAMSHAFT: The nodular iron camshaft has five bearing journals (2.2/2.5L and 2.5L FFV). The Turbo III employs dual camshafts that have nine bearing journals. Flanges at the rear journal control camshaft end play. A sintered iron (TBI engine and steel billet Turbo III engines) timing belt sprocket is mounted on the cam nose, and a hydrodynamic oil seal is used for oil control at the front of the camshaft.

ACCESSORY SHAFT: The iron accessory shaft has two bearing journals and is housed in the forward facing side of the block. A hydrodynamic seal, installed in an aluminum housing attached to the block, provides retention, shaft thrust, and oil control. The accessory shaft is driven by the timing belt through a sintered iron (TBI engine and steel billet Turbo III engines) sprocket mounted on the nose of the accessory shaft. The accessory shaft in turn drives the oil pump and distributor on 2.2/2.5L and 2.5L FFV and the oil pump only on Turbo III.

VALVES: The valves are actuated by roller cam followers which pivot on stationary hydraulic lash adjusters. The valve train with 40.6 mm (1.60 inch) diameter intake valves and 35.4 mm (1.39 inch) diameter exhaust valves employ viton rubber valve stem seals except 2.5L FFv . the 2.5L FFV valve stem seals are made of special rubber compound which resist the deteriorating effects of methanol fuel by-products that enter the oil during combustion. Valve springs, spring retainers, and locks are conventional. For Turbo III engines the valves are actuated by roller tipped rocker arms with hydraulic lash adjusters which pivot on a shaft. The valve train with 33.88 mm (1.33 in.) diameter intake valves are arranged in line opposite of the 29.26 mm (1.15 in.) diameter exhaust valves employ locking valve stem seals. Valve springs, spring retainers, and locks are not interchangeable with other engines.

BALANCE SHAFTS: 2.2 Turbo III and 2.5L engines are equipped with two counter rotating balance shafts installed in a carrier attached to the lower crankcase. The shafts are interconnect through gears. These gears are driven by a short chain from the crankshaft, to rotate at two times crankshaft speed. This counterbalances certain engine reciprocating forces.

INTAKE MANIFOLDS: All intake manifolds are aluminum castings, attached to the cylinder head with eight bolts. N.A. engines use a four branch design. This long branch fan design enhances low and midspeed torque. It also features an integrally cast water crossover passage to warm incoming fuel/air mixture, plus an EGR mounting boss and PCV inlet.

The Turbo III engine intake manifold is a log type with tuned runners. The manifold is machined to accept fuel injectors near the ports of each cylinder.

EXHAUST MANIFOLDS: The exhaust manifolds are made of nodular cast iron for strength and high temperatures. All naturally aspirated (N.A.) and turbocharged engines exit exhaust gasses through a machined, articulated joint connection to the exhaust pipe. 2.2/2.5L and 2.5L FFV manifolds intermesh with the intake manifold at the cylinder head.

N.A. engines use a four branch design with cylinders one and four joined and cylinder two and three joined to exit at the outlet.

The Turbo III engine exhaust manifold also carries the turbocharger. This manifold has a modified log type collector with exhaust gasses directed to and through the turbocharger to exit the conical (articulated joint) outlet machined into the turbocharger exhaust elbow.

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 within the crankcase and driven by the accessory shaft. 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 (for 2.2L turbo III and 2.5L engines) to the lower balance shaft assemblies. Pistons are lubricated from directed holes in 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.

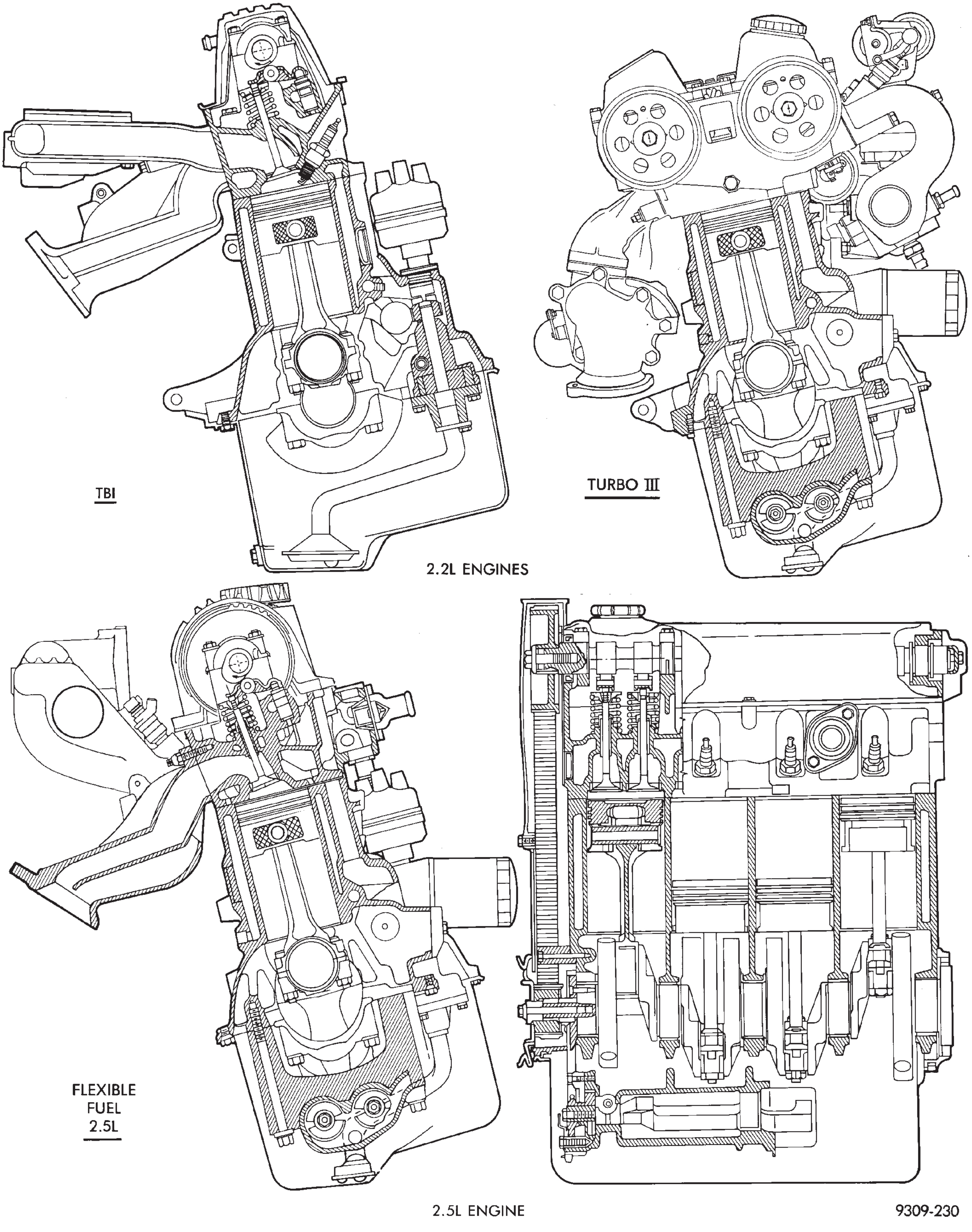


Fig. 2 Engines

ENGINE MOUNTS

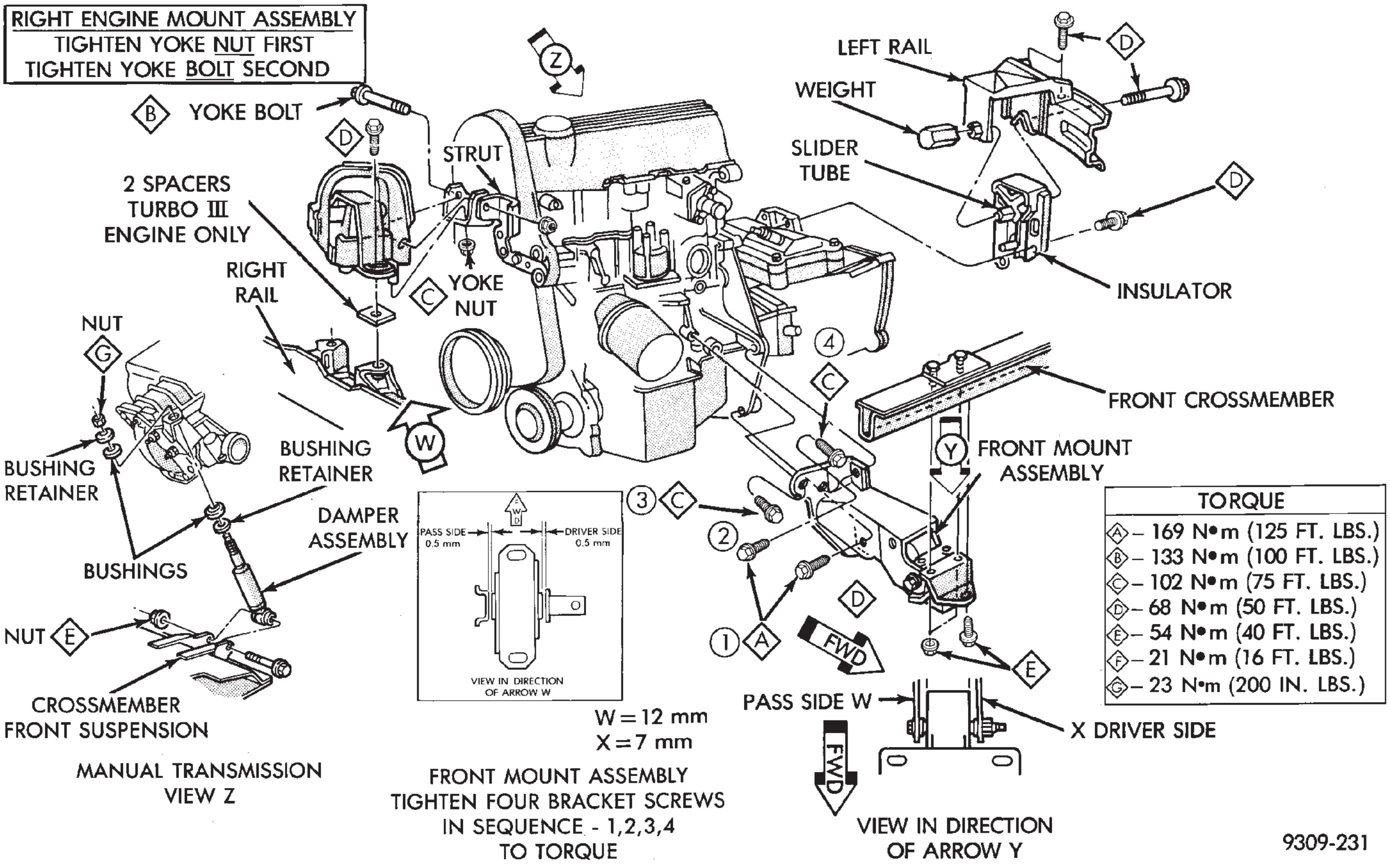


Fig. 3 Engine Mounting

REMOVAL AND INSTALLATION

RIGHT SIDE MOUNT

(1) Remove the right engine mount insulator vertical fasteners from frame rail.

(2) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(3) Remove the thru bolt from the insulator assembly. Remove insulator.

(4) Reverse removal procedure for installation. Refer to (Fig. 3) for bolt tightening specifications.

(5) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

FRONT MOUNT

(1) Support the engine and transmission assembly with a floor jack so it will not rotate.

(2) Remove the thru bolt from the insulator and front crossmember mounting bracket.

(3) Remove the front engine mount bracket to front crossmember screws and nuts. Remove the insulator assembly.

(4) Reverse removal procedure for installation. Refer to (Fig. 3) for bolt tightening specifications.

(5) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

LEFT SIDE MOUNT

(1) Raise vehicle on hoist and remove left front wheel.

(2) Remove inter splash shield.

(3) Support the transmission with a transmission jack.

(4) Remove the insulator thru bolt from the mount.

(5) Remove the transmission mount fasteners and remove mount.

(6) Reverse removal procedure for installation. Ensure that the slide tube is seated into the rail bracket guides. Refer to (Fig. 3) for bolt tightening specifications.

(7) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

ENGINE MOUNT RUBBER INSULATORS

Insulator location on frame rail (right side) and transmission bracket (left side) are adjustable to allow right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right engine mount insulator (left engine mount insulator is floating type and will adjust automatically (Fig. 4). Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Driveshafts in Suspension, Group 2.
- Any front end structural damage (after repair).
- Insulator replacement.

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 fasteners, and the front engine mount bracket to front crossmember screws and nuts.

Left engine mount insulator is sleeved over shaft and long support bolt to provide lateral movement adjustment with engine weight removed or not.

(3) Pry the engine right or left as required to achieve the proper drive shaft assembly length. See Drive Shaft in Suspension Group 2 for driveshaft identification and related assembly length measuring.

(4) Tighten right engine mount insulator vertical bolts to 68 N•m (50 ft. lbs.). Then tighten front engine mount screws and nuts to 54 N•m (40 ft. lbs.) and center left engine mount insulator.

(5) Recheck drive shaft length.

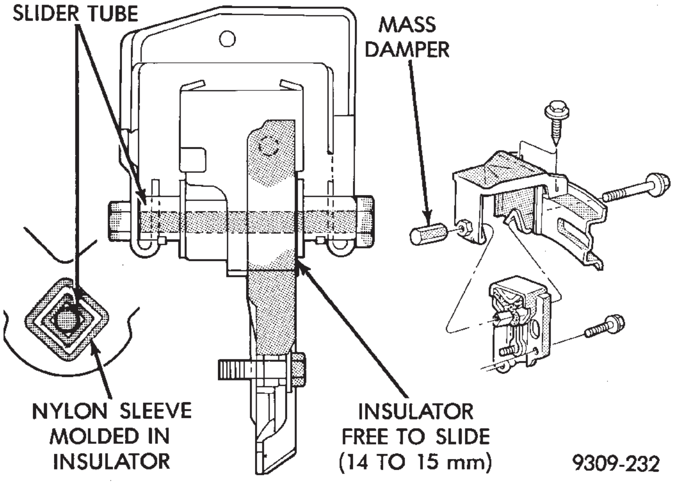


Fig. 4 Left Insulator Movement

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect battery.

(2) Scribe hood hinge outline on hood and remove hood.

(3) Drain cooling system.

(4) Remove hoses from radiator and engine.

(5) Remove radiator and fan assembly.

(6) Remove air cleaner and hoses.

(7) Remove air conditioning compressor mounting bolts and set compressor aside, if equipped.

(8) Remove power steering pump mounting bolts and set pump aside

(9) Remove oil filter.

(10) Disconnect fuel line, heater hose and accelerator cable.

(11) Disconnect all electrical connections and harnesses at throttle body and engine.

(12) **Manual Transmission**

(a) Disconnect clutch cable.

(b) Remove transmission case lower cover.

(c) Disconnect exhaust pipe at manifold.

(d) Disconnect starter and lay aside.

(e) Install transmission holding fixture.

(13) **Automatic Transmission**

(a) Disconnect exhaust pipe at manifold.

(b) Disconnect starter and lay aside.

(c) Remove transmission case lower cover.

(d) Mark flex plate to torque converter.

(e) Remove screws holding torque converter to flex plate.

(14) Attach C clamp on front bottom of torque converter housing to prevent torque converter from coming out.

(15) Install transmission holding fixture.

(16) Remove right inner splash shield (Fig. 5).

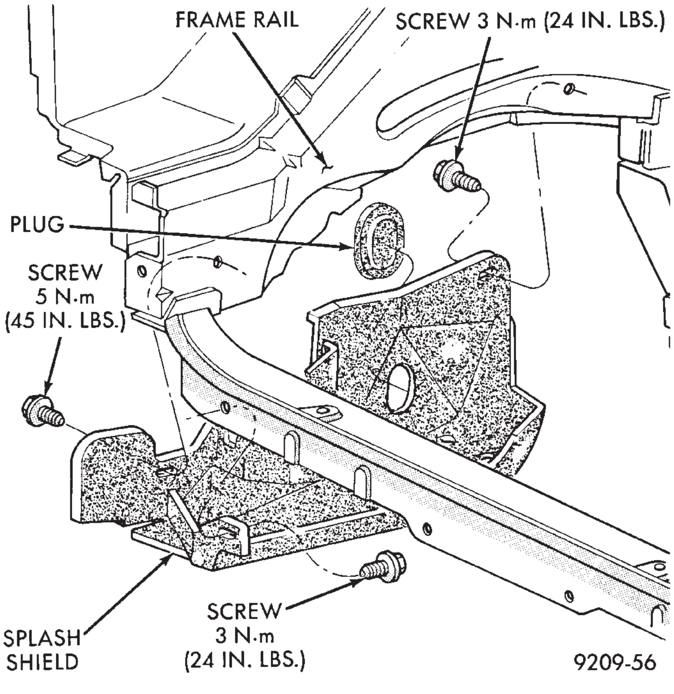


Fig. 5 Right Inner Splash Shield

(17) Remove ground strap.

(18) To **lower** engine separate right engine bracket from yoke bracket To **raise** engine remove long bolt through yoke and insulator. IF INSULATOR TO RAIL SCREWS ARE TO BE REMOVED, MARK INSULATOR POSITION ON SIDE RAIL TO INSURE EXACT INSTALLATION (Fig. 4).

(19) Remove transmission case to cylinder block mounting screws.

CAUTION: Make sure clutch cable has been disconnected.

(20) Remove front engine mount screw and nut.

(21) Remove manual transmission damper.

(22) Remove left insulator through bolt from inside wheelhouse or insulator bracket to transmission screws.

(23) Remove engine from vehicle.

INSTALLATION

(1) Install hoist to the engine and lower engine into the engine compartment.

SEE: ENGINE MOUNT RUBBER INSULATORS, THIS GROUP.

(2) Align engine mounts and install but **do not tighten** until all mounting bolts have been installed.

(3) Install transmission case to cylinder block mounting screws. Tighten to 95 N●m (70 ft. lbs.) torque.

(4) Remove engine hoist and transmission holding fixture.

(5) Install ground strap.

(6) Install right inner splash shield.

(7) Connect starter. See Electrical Group 8 for installation.

(8) Connect exhaust system. See Exhaust Systems Group 11 for installation.

(9) **Manual Transmission:** Install transmission case lower cover.

Automatic Transmission: Remove C clamp from torque converter housing. Align flexplate to torque converter and install mounting screws. Tighten to 75 N●m (55 ft. lbs.) torque.

(10) **Manual Transmission:** Connect clutch cable. See Clutch Group 6.

(11) Install power steering pump. Refer to Cooling System Group 7, Accessory Drive Section for belt tension adjustment.

(12) Connect fuel line, heater hose, and accelerator cable.

(13) Connect all electrical connections and harnesses at throttle body and engine.

(14) Install oil filter. Fill engine crankcase with proper oil to correct level.

(15) Install air conditioning compressor (if equipped). See Heater and Air Conditioning, Group 24 for installation.

(16) Install air cleaner and hoses.

(17) Install radiator and shroud assembly . Install radiator hoses. Fill cooling system. See Cooling System Group 7 for filling procedure.

(18) Install hood.

(19) Connect battery.

(20) Start engine and run until operating temperature is reached.

(21) Adjust transmission linkage, if necessary.

SOLID MOUNT COMPRESSOR BRACKET SERVICE

When service procedures require solid mount bracket removal and installation for example: cylinder head removal, etc., it is important that bracket fasteners numbered 1 through 7 (Fig. 4) be removed and installed in sequence, as instructed in Remove and Install.

ACCESSORIES REMOVAL

(1) Remove (and install/adjust) belts,see Accessory Drive Belts in Cooling System,Group 7.

(2) Remove air conditioning compressor (in vehicle with lines and set aside) (Fig. 6).

(3) Remove generator pivot bolt and remove generator (in vehicle: turn wiring side up and disconnect, then rotate generator, pulley end towards engine and remove).

(4) Remove air conditioner compressor belt idler.

SOLID MOUNT BRACKET—REMOVAL (FIG. 4)

(1) Remove right engine mount yoke screw (see Engine Remove Fig. 3) securing engine mount support strut to engine mount bracket.

(2) Remove five side mounting bolts #1, #4 , #5, #6, and #7 (Fig. 4).

(3) Remove front mounting nut, #2, and remove front bolt #3*.

(4) Remove front mounting bolt and strut, rotate solid mount bracket away from engine and slide bracket on stud until #2 nut mounting stud until free. Remove spacer from stud.

SOLID MOUNT BRACKET—INSTALLATION

(1) Put spacer onto stud, then install bracket on front (#2 nut) mounting stud and slide bracket over timing belt cover into position.

(2) Loosen assembly bracket to engine fasteners (numbered #1 through #7 in Fig. 6).

(3)

CAUTION: Fasteners MUST BE TIGHTENED IN SEQUENCE and to specified torque as follows :

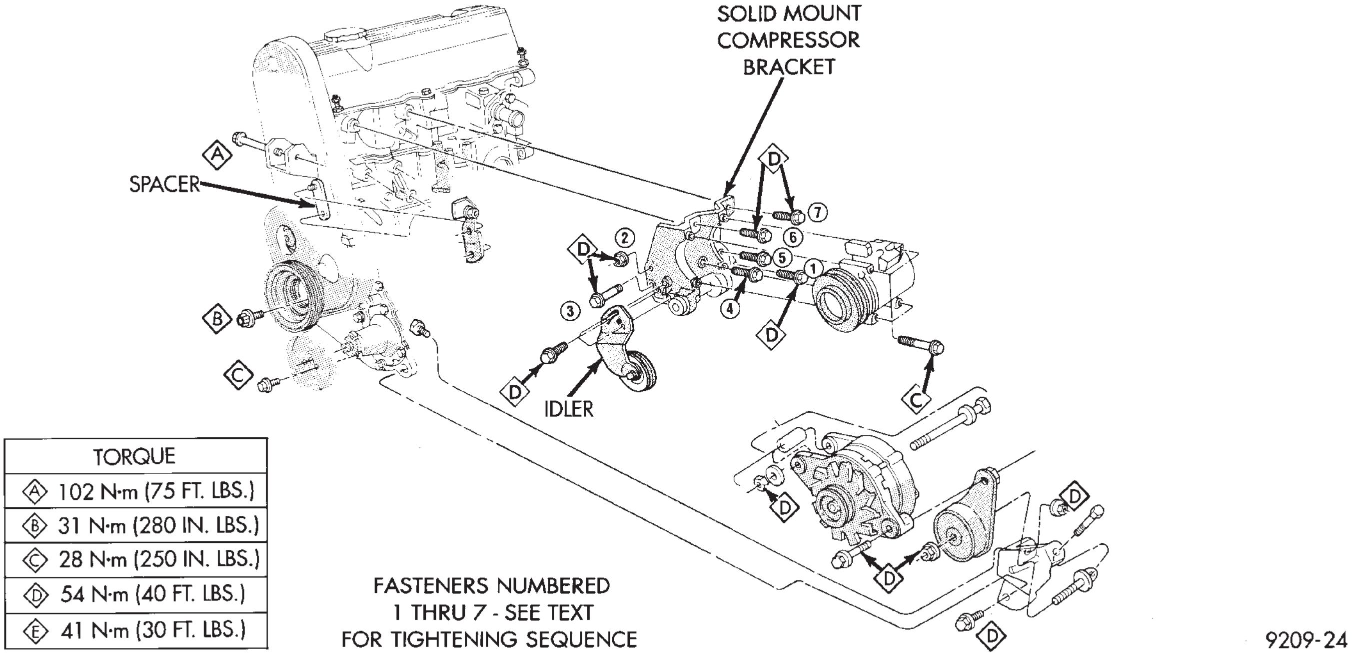
- First Bolt #1 to 3.3 N●m (30 in. lbs.)
- Second Nut #2 and Bolt #3 to 54 N●m (40 ft. lbs.).
- Third Bolts #1 (second tightening) #4 and #5 to 54 N●m (40 ft. lbs.).
- Fourth Bolts #6 and #7 to 54 N●m (40 ft. lbs.).

(4) Install generator and compressor. Tighten compressor mounting bracket bolts to 54 N●m (40 ft. lbs.).

SOLID MOUNT COMPRESSOR BRACKET SERVICE—TURBO III ENGINE

REMOVAL

(1) Disconnect negative battery cable



TORQUE
A 102 N·m (75 FT. LBS.)
B 31 N·m (280 IN. LBS.)
C 28 N·m (250 IN. LBS.)
D 54 N·m (40 FT. LBS.)
E 41 N·m (30 FT. LBS.)

Fig. 6 Solid Mount Compressor Bracket 2.2 & 2.5L Engines

(2) Remove Accessory Drive Belt. Refer to Cooling System Group 7 for procedure.

(3) Remove accessory drive belt idler pulley (Fig. 7).

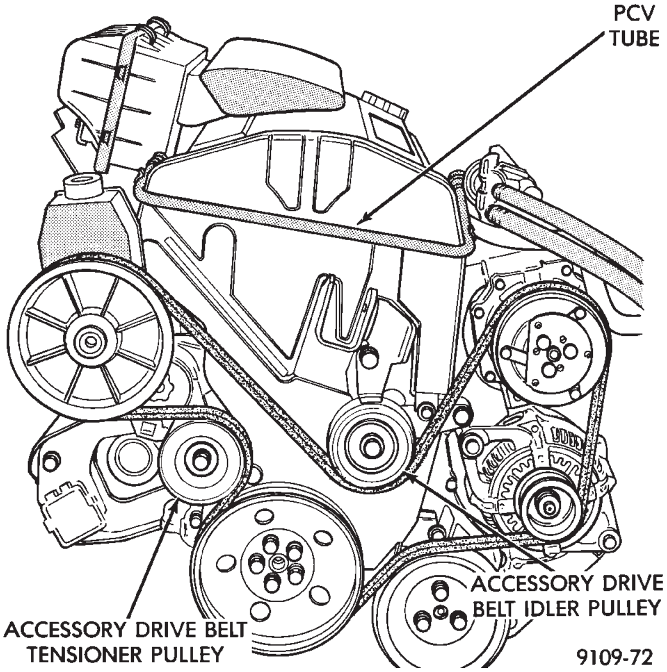


Fig. 7 Accessory Drive System

(4) Remove air conditioning compressor and set aside (Fig. 8).

(5) Remove generator attaching bolts set aside (Fig. 8).

(6) Remove timing belt covers. Refer to procedure outlined in this section.

(7) Remove right engine mount yoke bolt. Remove the fasteners holding the strut into place. Remove strut from engine (Fig. 9).

(8) Remove accessory drive belt idler pulley bracket (Fig. 9).

(9) Remove timing belt. Refer to procedure outlined in this section.

(10) Remove 2 bolts holding solid mount compressor into place, Rotate bracket off engine (Fig. 7).

INSTALLATION

(1) Loosely assemble the bracket to engine with #1 and #2 bolts tighten to 3.3 N●m (30 in. lbs.) (Fig. 8).

(2) Install timing belt. Refer to procedure outlined in this section. Install timing belt covers. Refer to procedure outlined in this section.

(3) Install strut on stud. Tighten nut #3 and bolt #4, torque to 54 N●m (40 ft. lbs.) (Fig. 9). Loosen #1 and #2 bolts, then torque to 54 N●m (40 ft. lbs.) (Fig. 10).Install yoke bolt and torque to 102 N●m (75 ft. lbs.).

(4) Install accessory drive belt idler pulley and bracket (Fig. 8).

(5) Install accessory drive belt tensioner pulley (Fig. 7).

(6) Install generator (Fig. 8).

(7) Install air conditioning compressor (Fig. 8).

(8) Install accessory drive belt. Refer to Cooling System Group 7 for procedure.

(9) Connect negative battery cable.

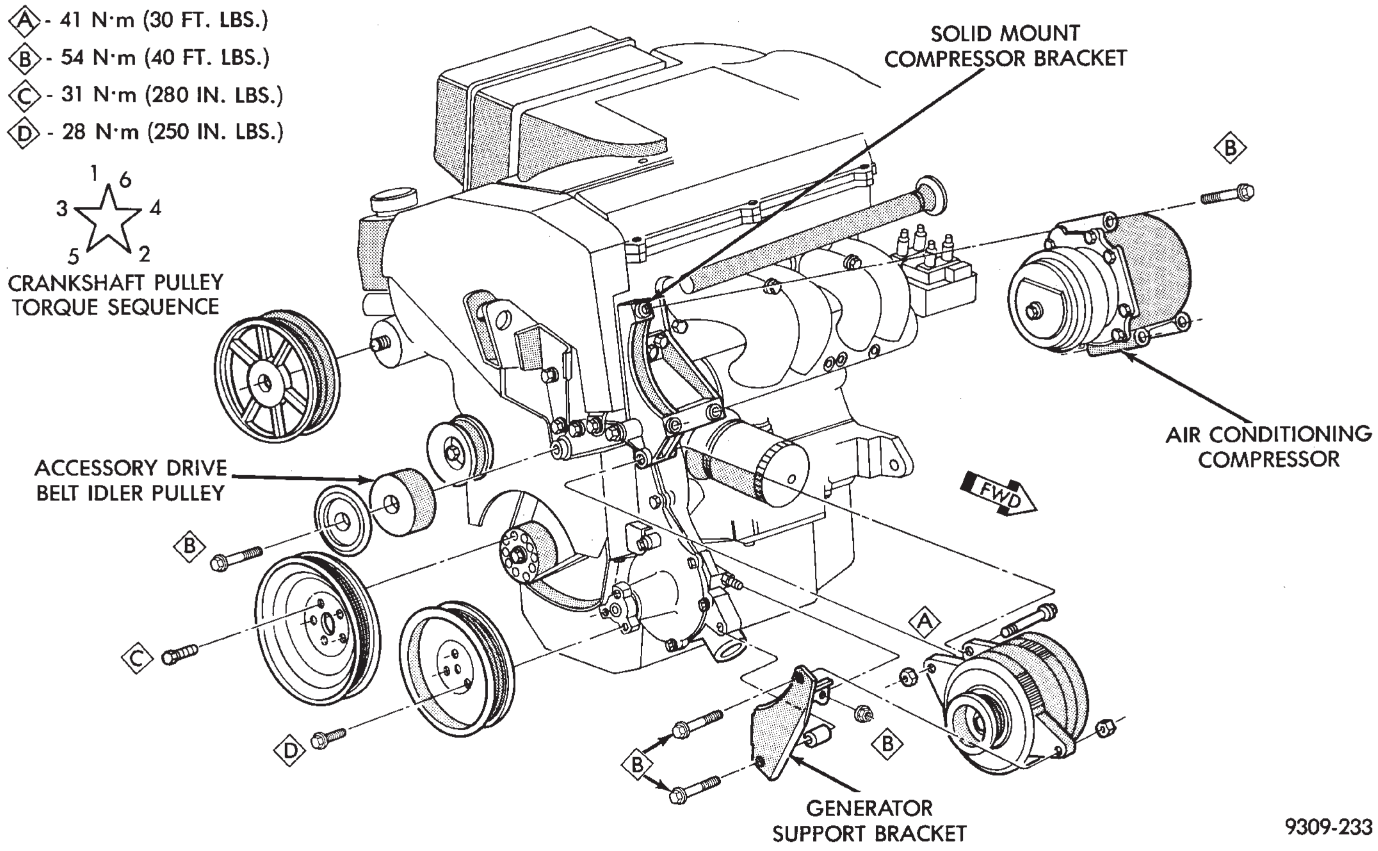


Fig. 8 Solid Mount Compressor Bracket—Turbo III Engine

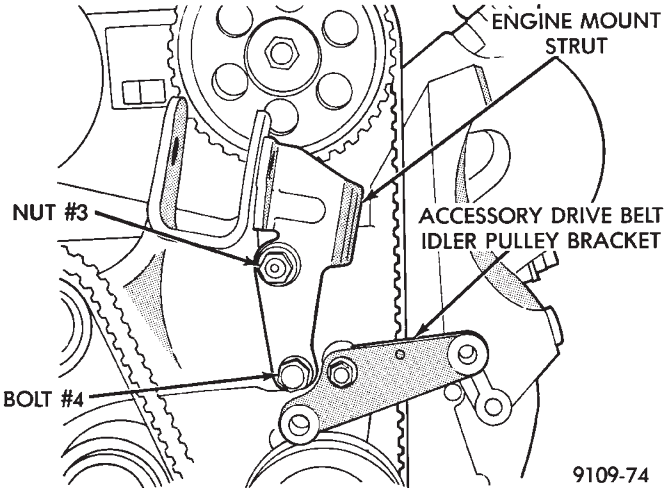


Fig. 9 Accessory Drive Idler Pulley Bracket and Engine Strut

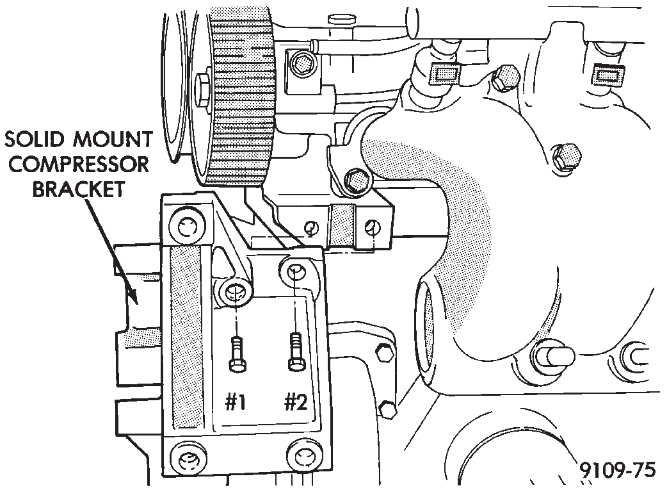


Fig. 10 Compressor Bracket to Cylinder Head Attaching Bolts

POWER STEERING/ACCESSORY DRIVE BELT TENSIONER BRACKET

REMOVAL

(1) Remove Accessory Drive Belt. Refer to Cooling System Group 7 for procedure.

(2) Remove accessory drive belt tensioner pulley (Fig. 7).

(3) Remove Timing Belt covers. Refer to procedure outlined in this section.

(4) Remove Power Steering Pump bolts set pump aside (Fig. 11).

(5) Loosen timing belt tension. Refer to Camshaft and Crankshaft Timing Service for procedure. Remove timing belt idler pulley bolt (Fig. 12).

CAUTION: Camshaft and Crankshaft Timing may have to be reset when procedure is completed Refer to procedure outlined in this section.

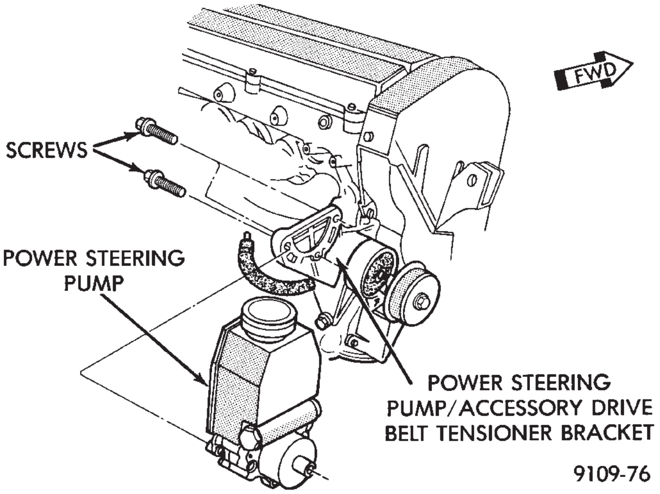


Fig. 11 Power Steering Pump Attaching Bolts

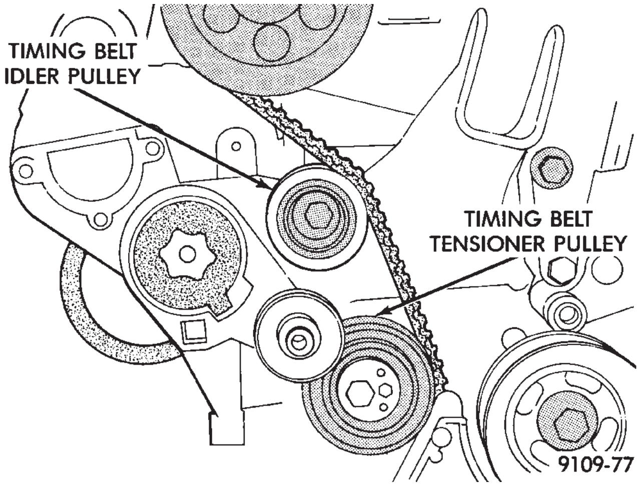


Fig. 12 Power Steering Pump Bracket and Timing Belt Idler Bolt

(6) Remove Bracket bolts #2 and #3 from rear of engine. Remove Bracket (Fig. 13).

INSTALLATION

(1) Loose assemble bracket to engine.

(2) Tighten bolts #2 and #3 to 3.3 N●m (30 in. lbs.) (Fig. 13).

(3) Tighten timing belt idler pulley and tighten to 54 N●m (40 ft. lbs.) (Fig. 12).

(4) Tighten bolts 32 and #3 to 54 N●m (40 ft. lbs.) (Fig. 13).

(5) Camshaft and Crankshaft timing should be checked at this time.

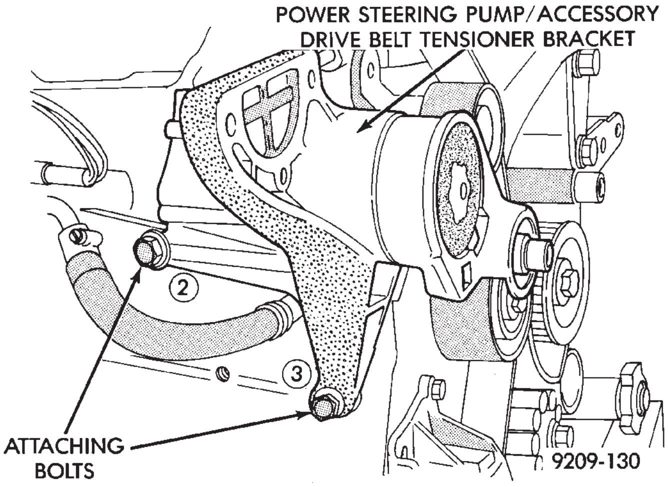


Fig. 13 Power Steering Pump/Accessory Drive Belt Tensioner Bracket Attaching Bolts

Adjust as necessary following procedure outlined in this section.

(6) Install power steering pump on bracket tighten bolts to 28 N●m (250 in. lbs.) torque (Fig. 11).

(7) Install timing belt covers. Refer to procedure outlined in this section.

CAUTION: Do not use impact wrench on accessory drive belt tensioner bolt. It may cause damage to tensioner arm.

(8) Install accessory drive belt tensioner pulley bolt finger tight. Then tighten bolt to 54 N●m (40 ft. lbs.) torque. Install accessory drive belt, Refer to Cooling System Group 7 for procedure.

TIMING SYSTEM AND SEALS SERVICE—EXCEPT TURBO III

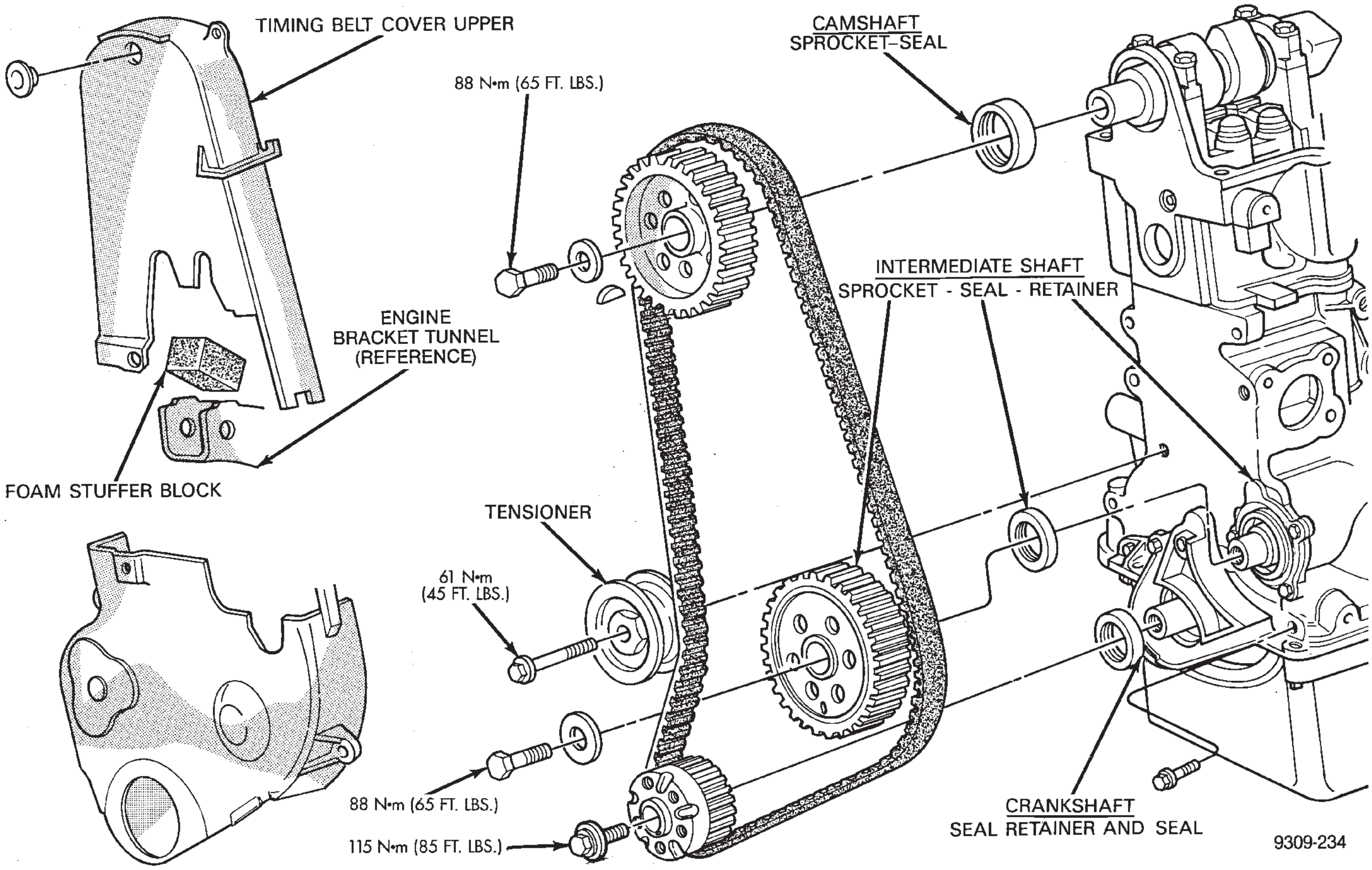


Fig. 1 Timing System and Seals

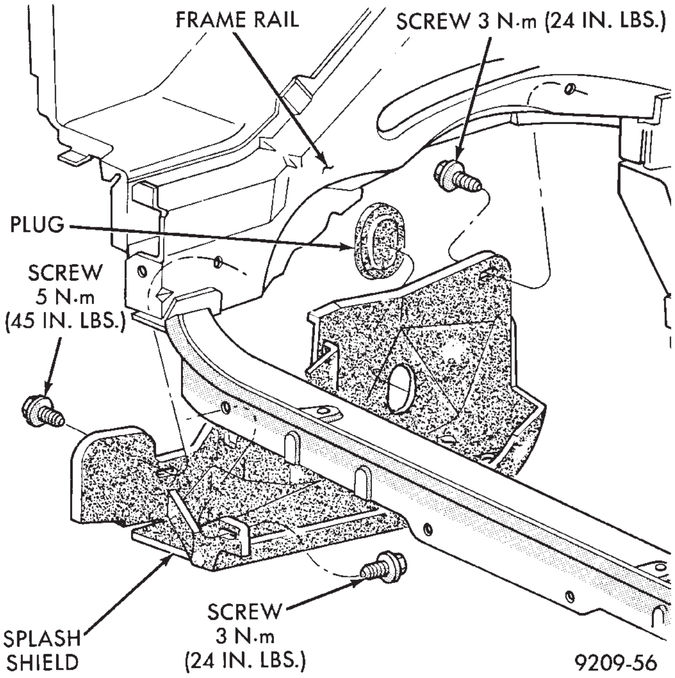


Fig. 2 Right Inner Splash Shield

Refer to (Fig. 1) for parts identification and torque specifications

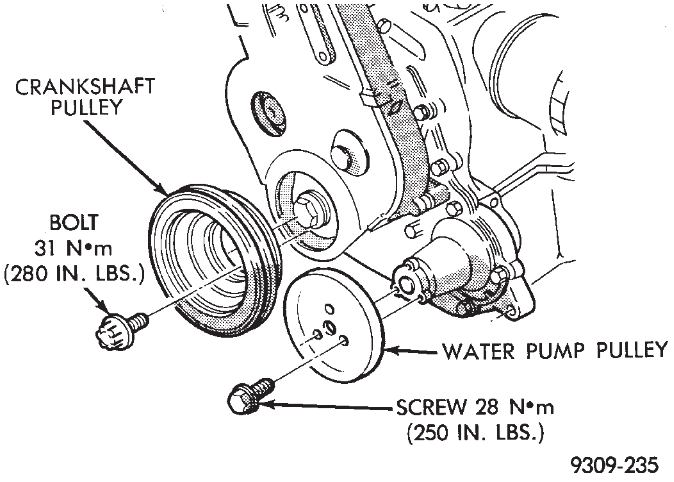


Fig. 3 Crankshaft and Water Pump Pulley

TIMING BELT SERVICE

(1) Remove Solid Mount Compressor Bracket. Refer to procedure outlined in this section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 2).

(3) Remove screws retaining water pump pulley and bolts retaining crankshaft pulley (Fig. 3) and lay pullies aside.

(4) Remove nuts holding cover to cylinder head.

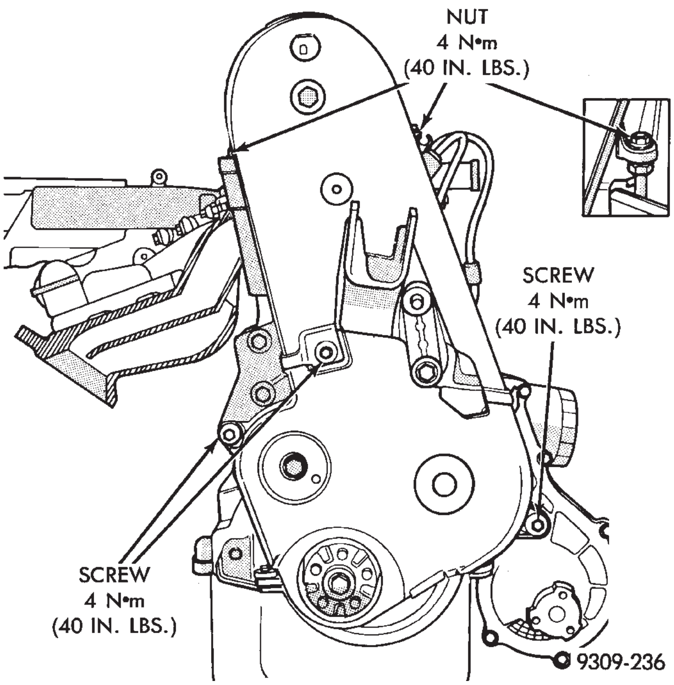


Fig. 4 Timing Belt Cover

(5) Remove screws holding cover to cylinder block.

(6) Remove both halves of timing belt cover and lay aside (Fig. 4)

(7) Place a jack under engine.

(8) Separate right engine mount (Fig. 5) and raise engine slightly.

(9) Loosen timing belt tensioner screw (Fig. 6) and remove timing belt.

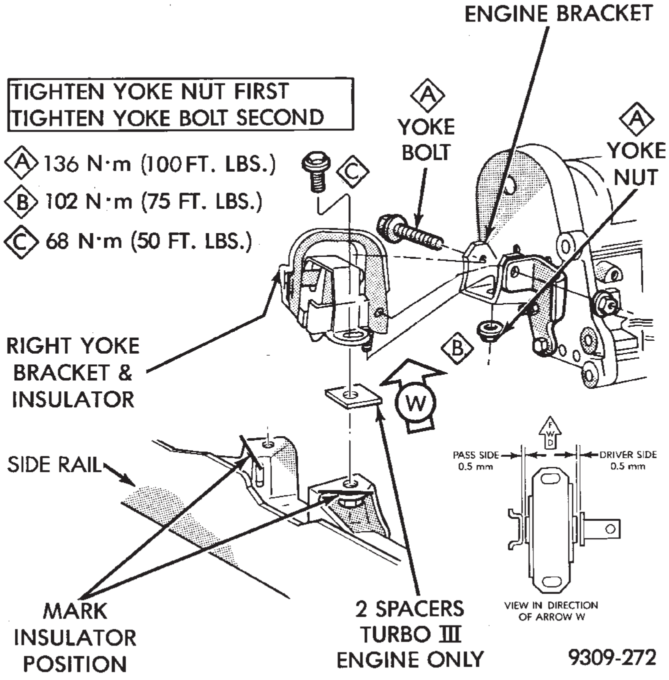


Fig. 5 Right Engine Mount

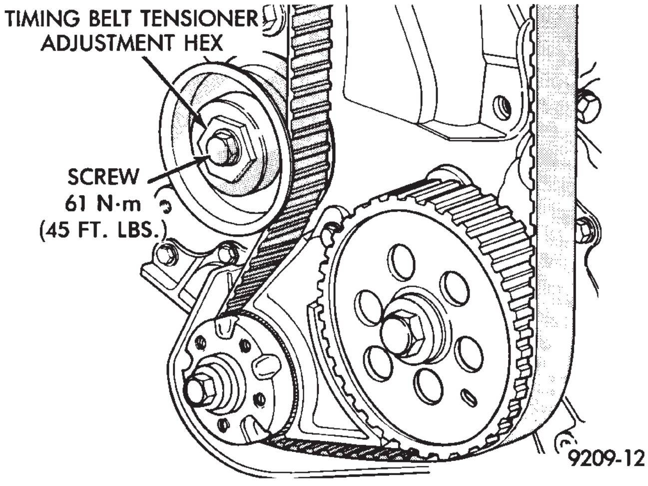


Fig. 6 Remove Timing Belt

SERVICING FRONT OIL SEALS—REPLACEMENT

(1) With timing belt removed, remove crankshaft sprocket bolt.

(2) Remove crankshaft sprocket using Special Tool C-4685, Insert and 5.9 inch long screw (Fig. 7).

(3) Install crankshaft sprocket using plate L-4524, Thrust Bearing/washer and 5.9 inch long screw (Fig. 7).

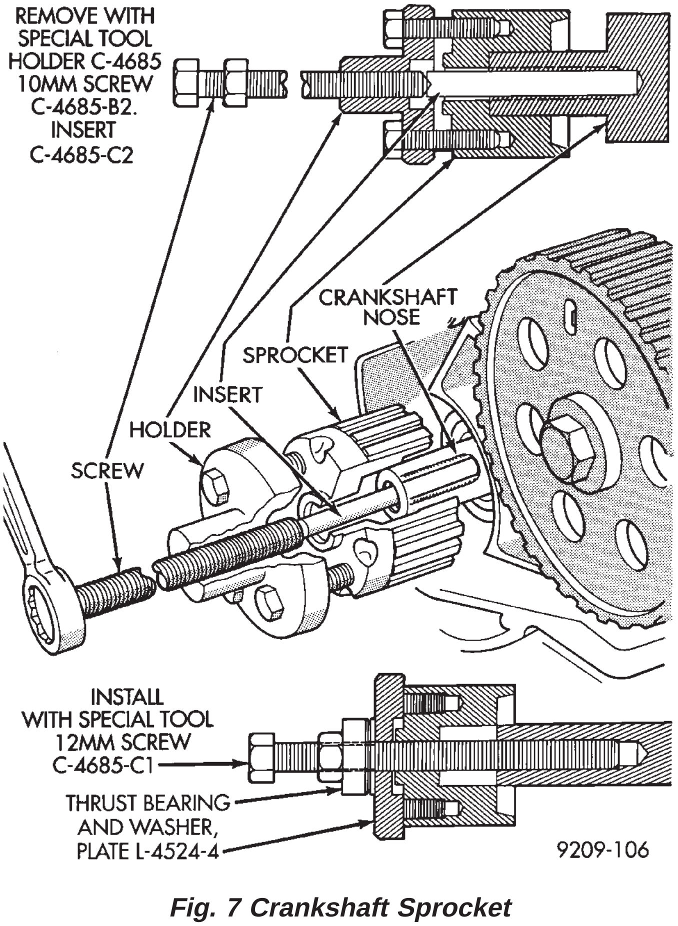


Fig. 7 Crankshaft Sprocket

(4) Hold engine sprocket with Special Tool C-4687 (with adaptor Tool C-4687-1) while removing/installing screw (Fig. 8). The 2.5L Engine camshaft/intermediate shaft sprockets have an off-set hub and are identified with a six-hole pattern .

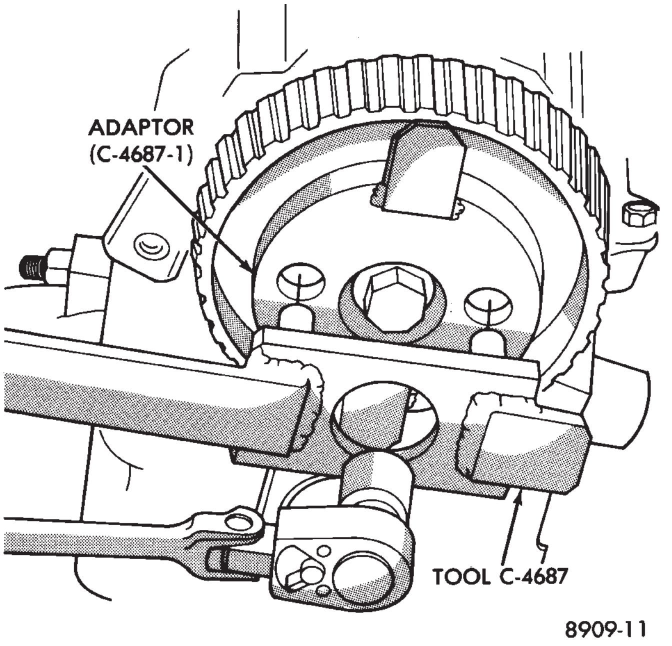


Fig. 8 Removing/Installing Camshaft or Intermediate Shaft Sprocket Screw

(5) Remove crankshaft seal using Special Tool 6341. Remove intermediate and camshaft seals using Special Tool C-4679 (Fig. 10).

CAUTION: Do not nick shaft seal surface or seal bore.

(6) Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

(7) Install engine crankshaft seal into retainer using Special Tool 6342 and 6343. Install Intermediate and Camshaft seals using Special Tool C-4680. Install seals until flush (Fig. 10).

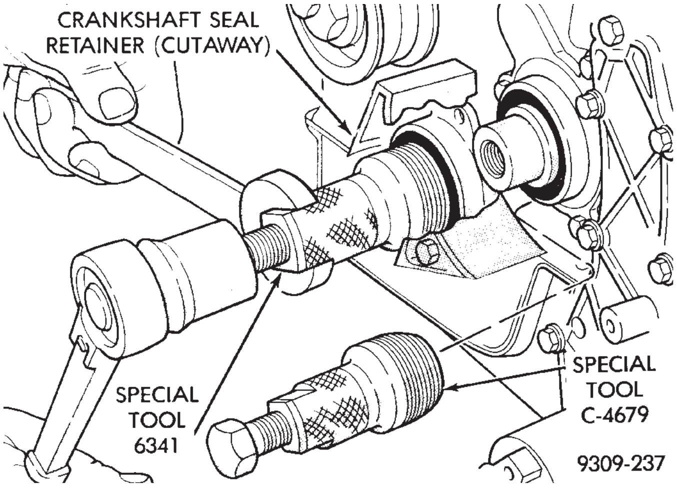


Fig. 9 Removing Crankshaft, Intermediate Shaft and Camshaft Oil Seal

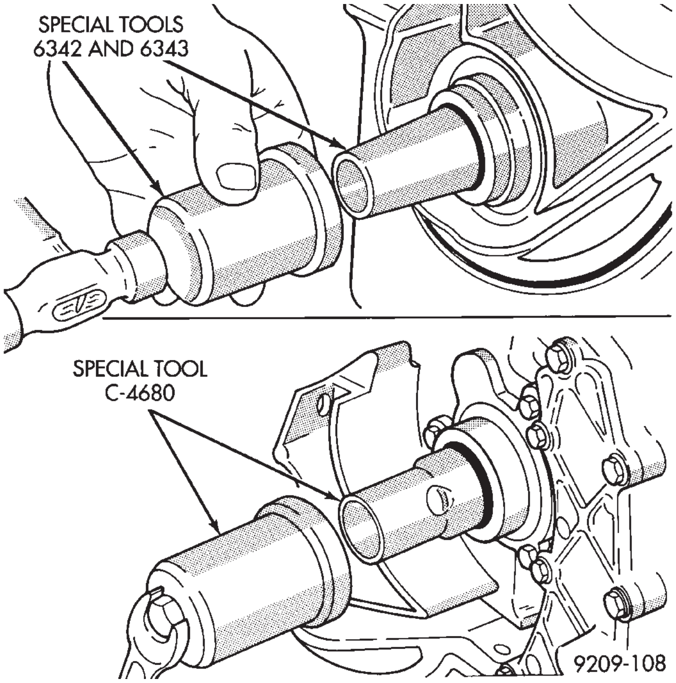


Fig. 10 Installing Crankshaft,Intermediate Shaft, and Camshaft Seal

CAMSHAFT, CRANKSHAFT AND INTERMEDIATE SHAFTS TIMING PROCEDURE

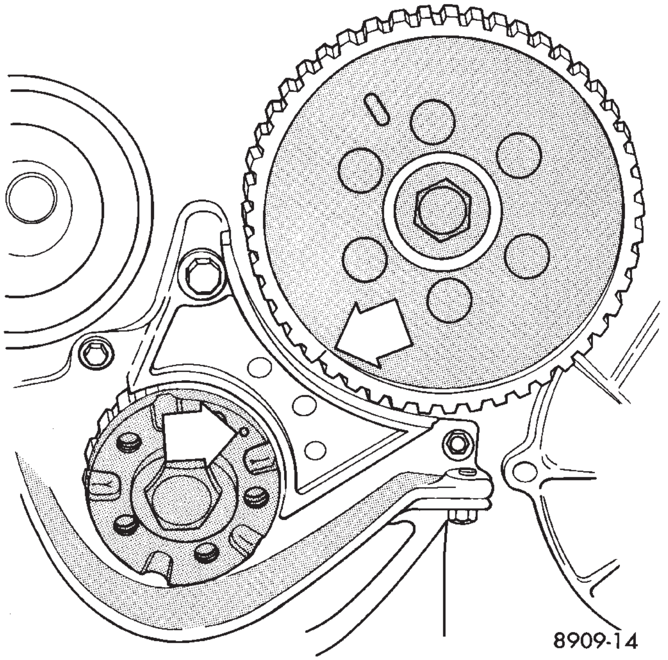


Fig. 11 Crankshaft and Intermediate Shaft Timing

(1) Remove all spark plugs. Turn crankshaft and intermediate shaft until markings on sprockets are in line, see arrows (Fig. 11).

(2) Turn camshaft until arrows on hub are inline with No. 1 camshaft cap to cylinder headline. Small hole (arrow Fig. 12) must be in vertical center line.

(3) Install timing belt.

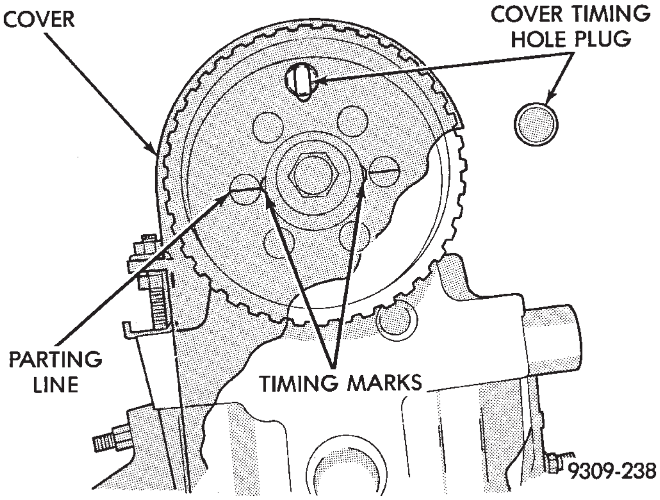


Fig. 12 Camshaft Timing

(4) Rotate crankshaft two full revolutions and recheck timing.

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(5) Rotate crankshaft till number 1 cylinder is at the TDC position.

(6) Put belt tension Special Tool C-4703 horizontally on large hex of timing belt tensioner pulley and loosen tensioner lock nut.

(7) Reset belt tension Special Tool C-4703 index if necessary to have axis within 15° of horizontal. (Fig. 13)

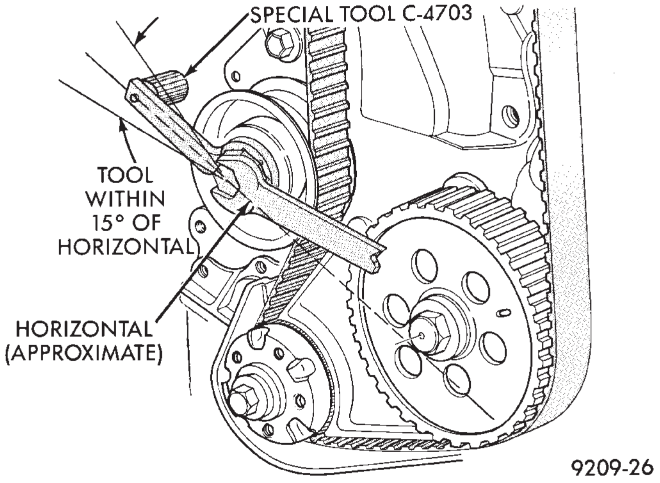


Fig. 13 Adjusting Drive Belt Tension

(8) Turn engine clockwise from TDC two crank revolutions to TDC. **Do not reverse rotate crankshaft or attempt to rotate engine using cam or accessory shaft attaching screw.**

(9) Hold weighted wrench in position while tightening bolt on tensioner to 61 N●m (45 ft. lbs.) torque.

(10) Lower engine onto engine mount install mounting bolts and tighten to specifications refer to (Fig. 3).

(11) Remove jack from under engine.

(12) Inspect foam stuffer block condition and position (Fig. 14). Stuffer block should be intact and secure within the engine bracket tunnel.

(13) Position both halves of timing belt cover together (Fig. 4).

(14) Install fasteners holding cover to cylinder head and block. Tighten fasteners to 4 N●m (40 in. lbs.) torque.

(15) Valve Timing Check; (timing belt cover installed). With number one cylinder at TDC, small hole in sprocket must be centered in timing belt cover hole (Fig. 12). If hole is not aligned correctly perform procedure again.

(16) Install spark plugs.

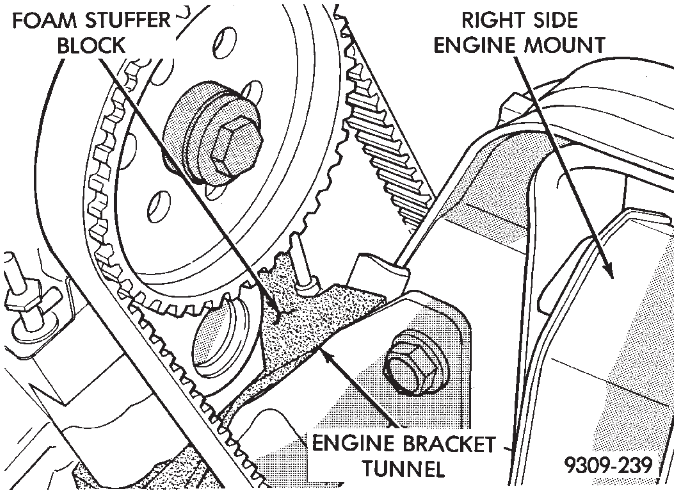


Fig. 14 Foam Stuffer Block Location

CYLINDER HEAD AND VALVE ASSEMBLY SERVICE—EXCEPT TURBO III

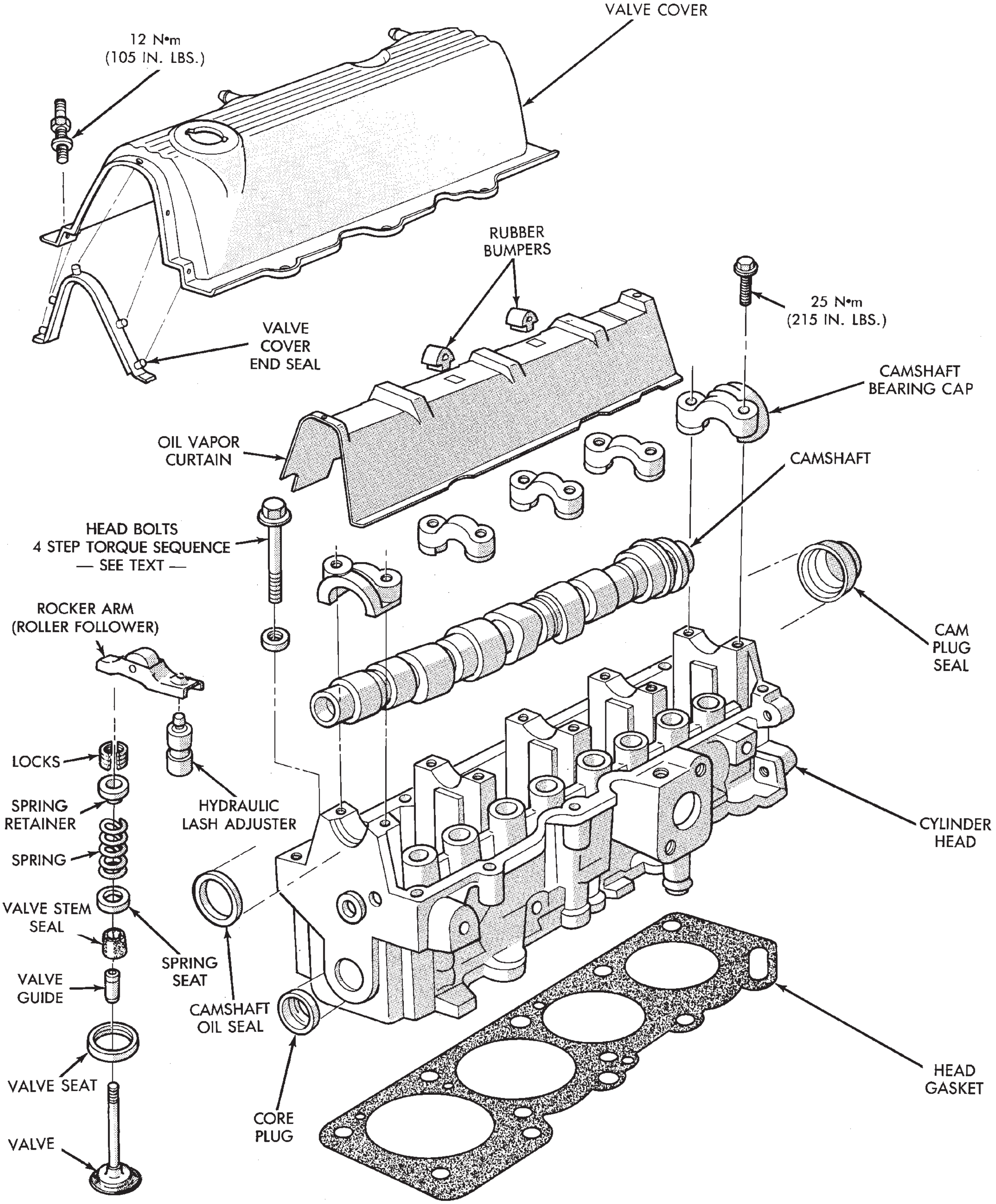


Fig. 1 Cylinder Head and Valve Assembly Service

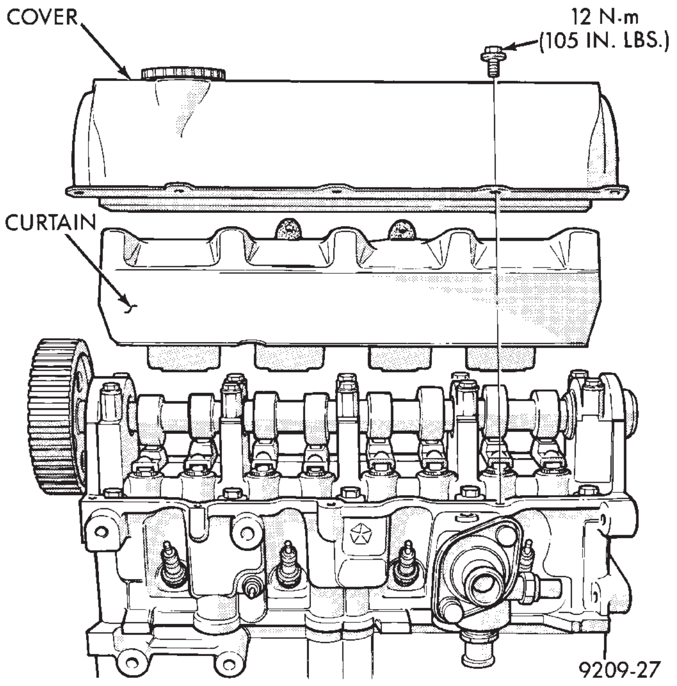


Fig. 2 Cylinder Head Cover and Curtain

CYLINDER HEAD COVER AND CURTAIN

A curtain aiding air/oil separation is installed on the cylinder head below the cylinder head cover (Figs. 1 and 2).

REMOVAL

(1) Remove the cylinder head cover bolts (Fig. 2).

(2) Remove cylinder head cover and curtain from cylinder head. Do not misplace the rubber bumpers on curtain.

CLEANING

Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

CURTAIN INSTALLATION

Install curtain manifold side first with cutouts over cam towers and contacting cylinder head floor, then press opposite distributor side into position below cylinder head rail. Curtain is retained in position with rubber bumpers (Fig. 1).

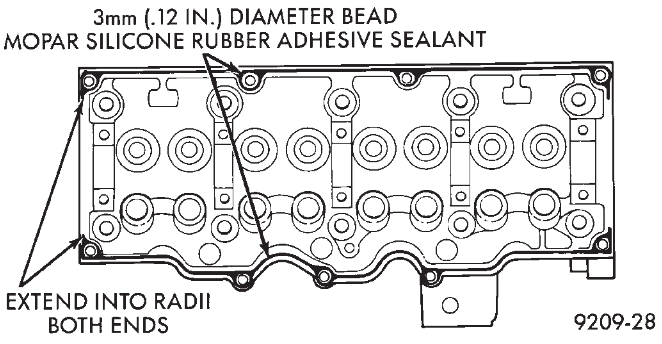


Fig. 3 Cylinder Head Valve Cover Rail Sealing

COVER SEALING AND INSTALLATION

Before installation, clean cylinder head and cover mating surfaces. Make certain rails are flat.

(1) Install new end seals on valve cover.

(2) Apply form-in-place Mopar Silicone Rubber Adhesive Sealant or equivalent gasket material to cylinder head cover rail (Fig. 3). Refer to procedure detailed in form-in-place gasket section of Standard Service Procedures, in this Group.

Caution: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(3) Install curtain, cover and end seal assembly to head and tighten to 12 N•m (105 in.lbs.) torque.

CYLINDER HEAD COMPONENTS—IN-VEHICLE SERVICE

Removal and installation of cylinder head or camshaft require separation of camshaft timing sprocket from camshaft. To maintain camshaft, intermediate shaft, and crankshaft timing during service procedures, the timing belt is left indexed on the sprocket while the assembly is suspended under light tension (Fig. 4).

When removing the sprocket from the camshaft, you must maintain adequate tension on the sprocket and belt assembly to prevent the belt from disengaging with the intermediate or crankshaft timing sprockets. Refer to Timing System and Seals for re-

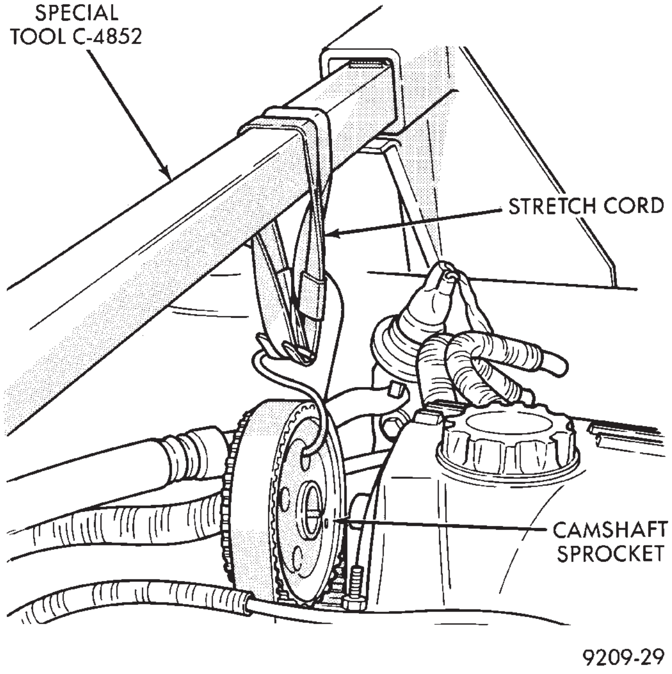


Fig. 4 Suspending Camshaft Sprocket

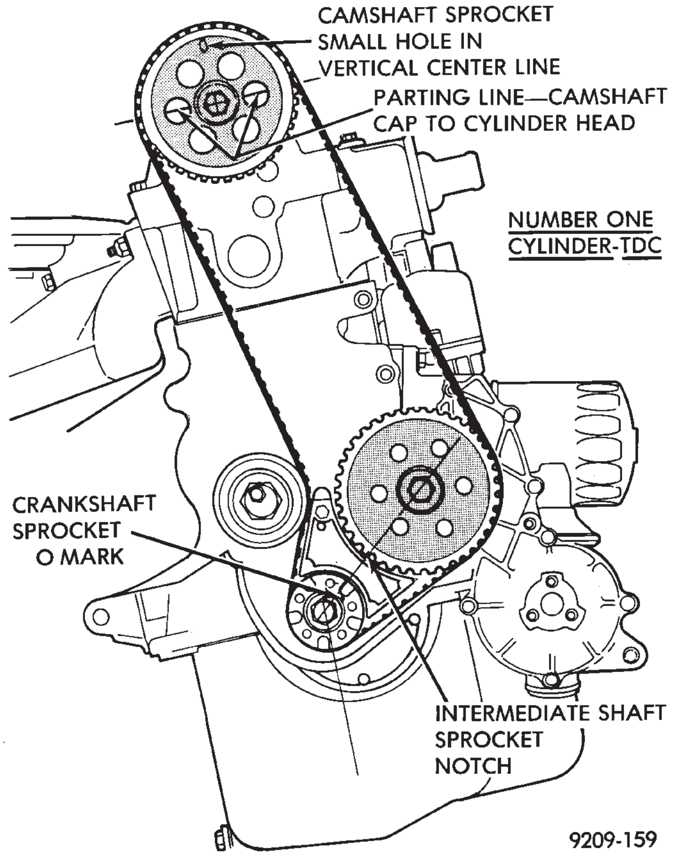


Fig. 5 Engine Sprocket Timing

moval and installation of camshaft sprocket procedure and to Camshaft Service for removal and installation of camshaft procedures.

CAUTION: Failure to maintain adequate tension on camshaft, intermediate, and crankshaft sprocket belt can result in lost engine timing. If timing is lost, refer to Timing System and Seals and (Fig. 4).

CAMSHAFT SERVICE

Refer to TIMING SYSTEM AND SEALS for camshaft timing belt and sprocket removal and installation, and CYLINDER HEAD In Vehicle Service.

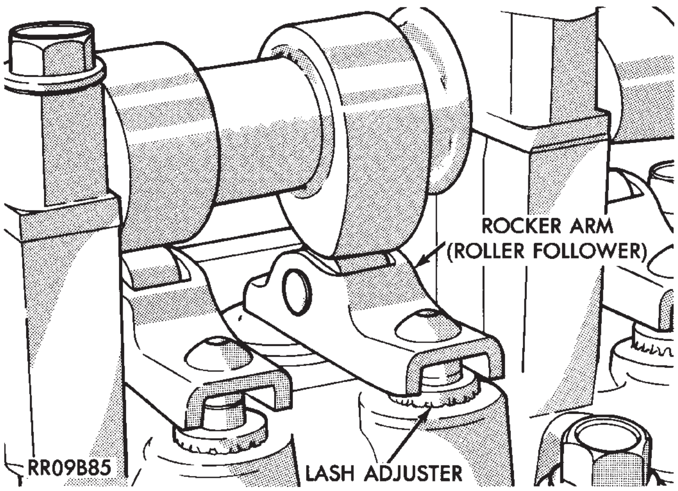


Fig. 6 Rocker Arm and Lash Adjuster

REMOVAL

(1) Remove the cylinder head cover and curtain.

(2) Mark rocker arms for reinstallation in the same position (Fig. 6).

(3) Loosen camshaft bearing cap screws several revolutions (Fig. 7).

(4) Jar camshaft at rear of cam to loosen (break free) the bearing caps. **Use a soft faced mallet.**

CAUTION: Care should be exercised not to cock the camshaft during removal. Cocking of the camshaft could cause damage to the cam or bearing thrust surfaces.

(5) Remove screws and caps such that cam does not cock.

INSPECTION

Check bearing cap and oil feed holes for blockage.

Inspect bearing cap and cylinder head journals for wear and/or oversize, Refer to CYLINDER HEAD, **Inspect** and Specifications.

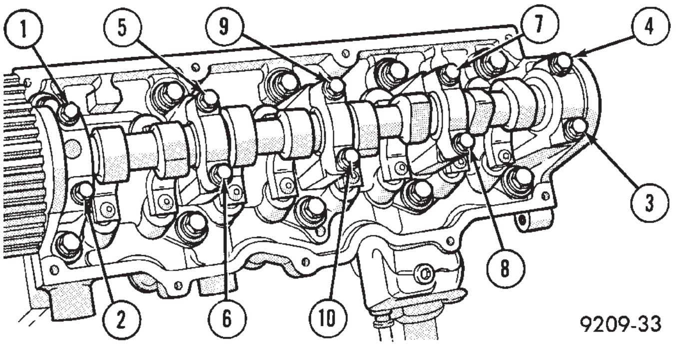


Fig. 7 Camshaft Cap Removal Sequence

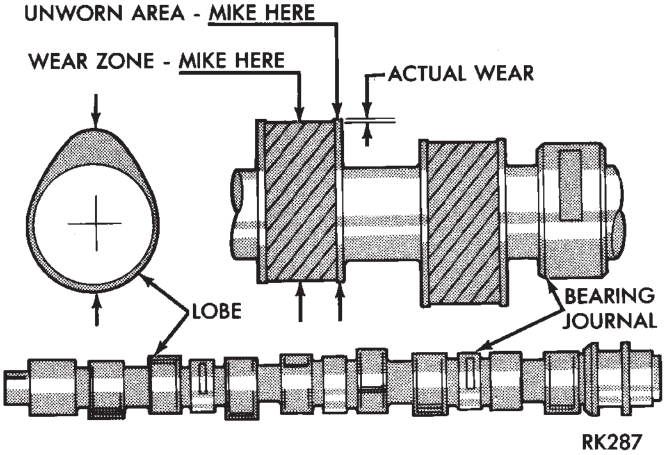


Fig. 8 Camshaft

Camshaft bearing journals and lobe wear. Lobe wear should not exceed .25mm (.010 inch). To measure cam lobe wear (Fig. 8), measure lobe diameter in two places at the largest diameter (over the nose). Take first reading with micrometer in unworn area at the edge of the lobe. Take second reading in the worn area where rocker arm contacts the lobe. Subtract second reading from the first. The difference is the cam lobe wear.

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft without cam followers. Tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 9).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.13 - 0.33mm (0.005 - 0.013 inch.).

(6) Remove bearing caps and camshaft.

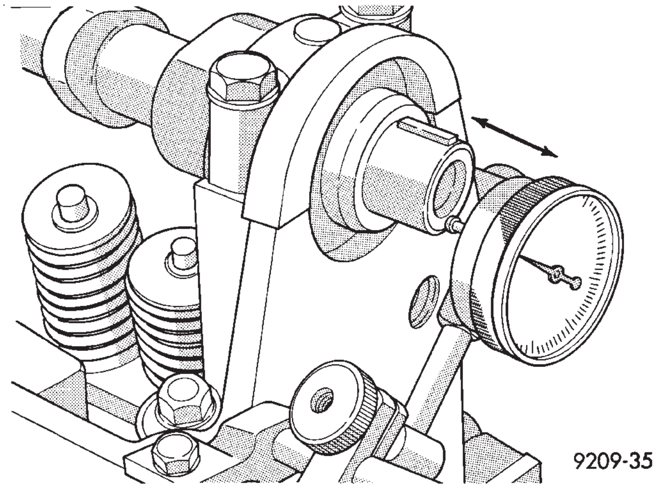


Fig. 9 Camshaft End Play

INSTALLATION

(1) Install cam followers in correct order as removed.

(2) Align camshaft bearing caps in proper sequence with Cap No. 1 at timing belt end and Cap No. 5 at transmission end. Arrows on Caps No. 1, 2, 3, 4 **must** point toward timing belt to prevent cap breakage (Fig. 11).

(3) Apply Mopar Gasket Maker to No.1 and No.5 bearing cap (Fig. 10).

(4) Caps must be installed before camshaft seals are installed.

LASH ADJUSTER (TAPPET) NOISE

A tappet-like noise may be produced from several items. Refer to Lash Adjuster and Tappet Noise - Diagnosis in Standard Service Procedures, this Group.

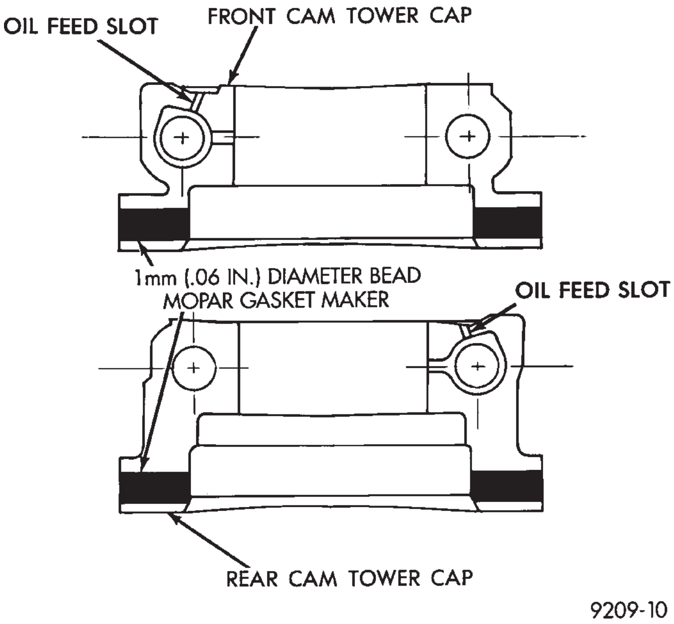


Fig. 10 Cam Tower Cap Sealing

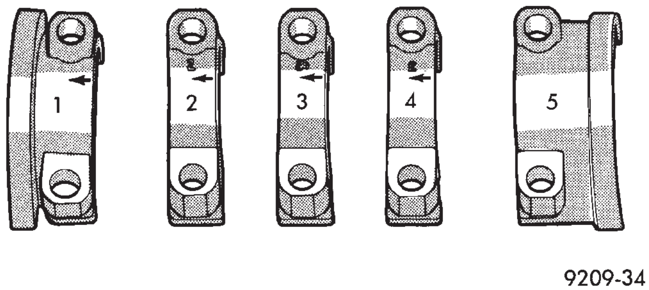


Fig. 11 Camshaft Bearing Caps Installation

VALVE COMPONENTS REPLACE—CYLINDER HEAD NOT REMOVED

ROCKER ARM AND HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove valve cover.

(2) For each rocker arm, rotate cam until base circle is in contact with rocker arm. Depress valve spring using Special Tool C-4682 (Fig. 12) and slide rocker arm out. Keep rocker arms in order for reassembly.

(3) Remove hydraulic lash adjuster.

INSTALLATION

(1) Install hydraulic lash adjusters 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.

(2) Rotate cam until base circle is in contact position with rocker arm. Depress valve spring with Special Tool C-4682 (Fig. 12) and slide rocker arm in place. Keep rockers in order. It is possible for the

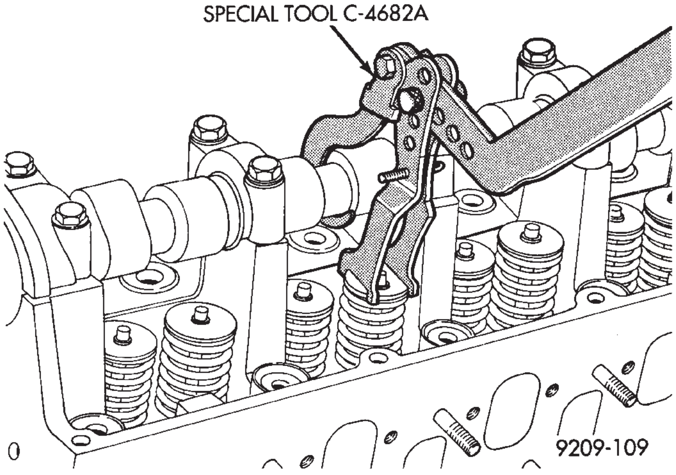


Fig. 12 Removing and Installing Valve Spring

valve spring retainer locks to become dislocated when depressing the valve spring.**Check and make sure the locks are in their proper location.**

(3) Install valve cover as previously outlined in this section.

VALVE SPRINGS AND VALVE STEM SEALS

REMOVAL

(1) Remove rocker arms 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 C-4682 (Fig. 12) compress valve springs and remove valve locks.

(5) Remove valve spring.

(6) Remove valve stem seal by gently prying side-to-side with a screwdriver blade. Once dislodged from guide post, seal may be easily removed.

INSTALLATION

CAUTION: Flexible Fuel Vehicle Valve use unique valve stem oil seals they are green in color. Standard valve stem oil seals are NOT to be interchanged with Flexible Fuel Vehicles engines.

(1) Install valve seals (Fig. 13) as outlined in step (2) of **Valve Gear Reassembly - After Valve Service** in this section.

(2) Using Special Tool C-4682 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.

(3) Install rocker arms as previously outlined in this section.

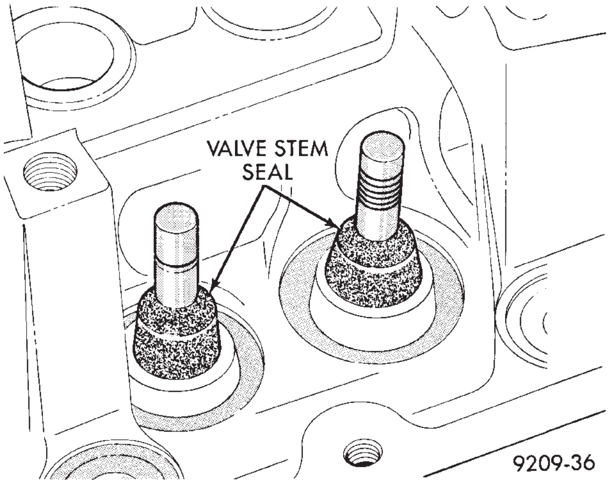


Fig. 13 Valve Stem Seals

CYLINDER HEAD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**Refer to Fuel System Group 14

(2) Disconnect negative battery cable. Drain cooling system. Refer to Cooling System, Group 7.

(3) Remove air cleaner and disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.

(4) Remove throttle linkage.

(5) Loosen power steering pump and remove belt.

(6) Remove power brake vacuum hose from intake manifold.

(7) Remove water hoses from water crossover.

(8) Raise vehicle and remove exhaust pipe from manifold.

(9) Remove power steering pump assembly and set aside.

(10) Disconnect coil wiring connector and coil wire from coil.

(11) Disconnect dipstick tube from thermostat housing and **ROTATE** bracket from stud.**DO NOT** bend the bracket or tube.

(12) See Solid Mount Compressor Bracket in STANDARD SERVICE PROCEDURES, this Group.

(13) Remove cylinder head bolts.

INSPECT HEAD AND CAMSHAFT BEARING JOURNALS

(1) Cylinder head must be flat within 0.1mm (.004 inch) (Fig. 14).

(2) Inspect camshaft journals for scoring and journal caps for oversize markings. When servicing cylinder head or camshaft, it is necessary to be certain that oversized camshafts are used only in oversized heads.

Identify oversize components as follows:

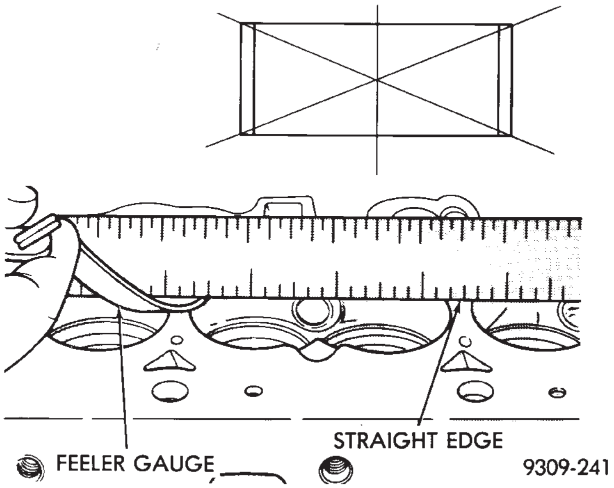


Fig. 14 Checking Cylinder Head Flatness

Cylinder Head: Top of bearing caps painted **green** and O/SJ stamped rearward of oil gallery plug on end of head.

Camshaft: Barrel of camshaft painted **green** and O/SJ stamped on end of shaft.

CLEANING

Remove all gasket material from cylinder head and block. Be careful not gouge or scratch the aluminum head sealing surface.

INSTALLATION

CAUTION: Head bolt diameter is 11mm. These bolts are identified with 11 on the head of the bolt. 10mm bolts will thread into the 11mm hole but will strip the cylinder block bolt hole.

Since the Cylinder head bolts are torqued using a new procedure they should be examined BEFORE reuse. If the threads are necked down the bolts should be replaced (Fig. 16).

Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale the bolt should be replaced.

(1) Before installing the bolts the threads should be oiled with engine oil.

(2) Install both bolts in each cap finger tight, then alternately torque each bolt to assemble the cap properly.

(3) Tighten the cylinder head bolts in the sequence shown in (Fig. 17). Using the 4 step torque turn method, tighten according to the following values:

- First All to 61 N●m (45 ft. lbs.)
- Second All to 88 N●m (65 ft. lbs.)
- Third All (again) to 88 N●m (65 ft., lbs.)
- Fourth + 1/4 Turn **Do not use a torque wrench for this step.**

Bolt torque after 1/4 turn should be over 90 ft. lbs. If not, replace the bolt.

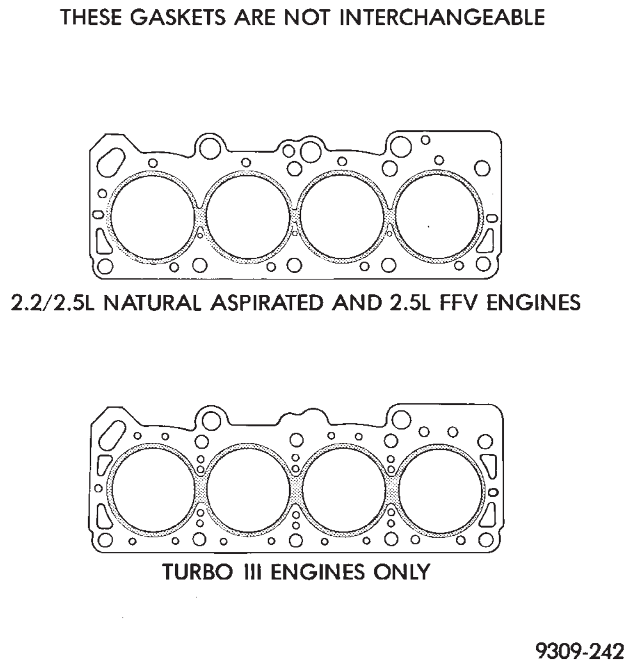


Fig. 15 Cylinder Head Gaskets

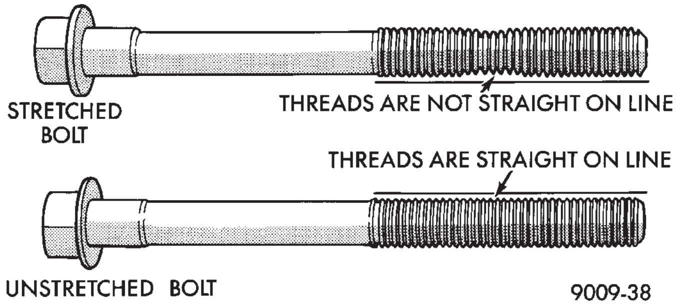


Fig. 16 Checking Bolts for Stretching (Necking)

(4) Rotate dipstick tube or bracket onto stud. Tighten bracket retaining nut to 23 N●m (200 in. lbs.)

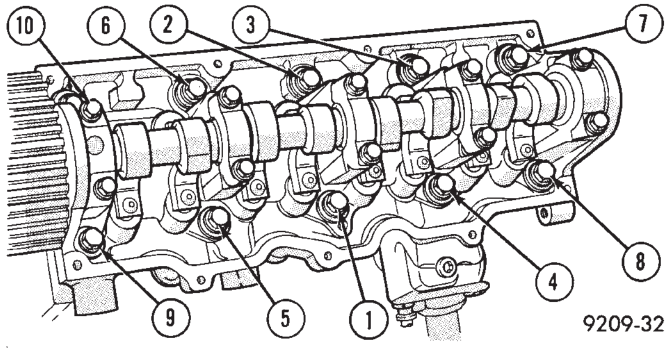


Fig. 17 Cylinder Head Tightening Sequence

VALVE SERVICE—CYLINDER HEAD REMOVED

VALVES AND VALVE SPRINGS

REMOVAL

(1) With cylinder head removed, compress valve

springs using Tool C-3422-B.

(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.

(3) If valve stems are worn more than 0.05 mm (.002 inch.) replace valve.

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Checking Valve Guide Wear:

- Insert valve with valve head positioned 10 mm (.400 inch) above cylinder head gasket surface.
- Move valve to and from the indicator (Fig. 17). The total dial indicator reading should not exceed the amount specified in (Fig. 18). Readings should be taken for lengthwise and crosswise (with respect to cylinder head) movement for each valve. Ream the guides for valves with oversize stems if dial indicator reading is excessive or if the stems are scuffed or scored.

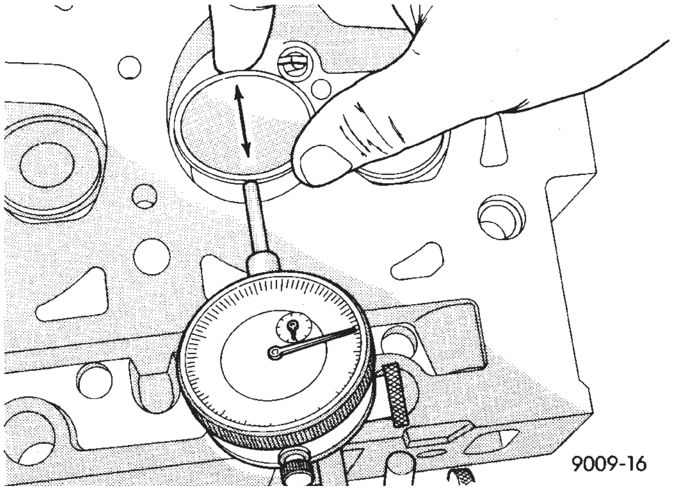


Fig. 18 Checking Wear on Valve Guide—Typical

(3) Service valves with oversize stems and oversize seals are available in 0.15mm, (.005 inch) 0.40mm, (.015 inch) and 0.80mm(.031 inch) oversize.

Oversize seals must be used with oversize valves.

Reamers sizes to accommodate the oversize valve stem are shown in (Fig. 18)

(4) 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 0.80mm (.030 inch). Use step procedure of 0.15mm (.005 inch), 0.40mm (.015 inch) and 0.80mm (.030 inch) 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. Refer to Refacing Valves and Valve Seats.**

Replace cylinder head if guide does not clean up with 0.80 mm (.030 inch) oversize reamer, or if guide is loose in cylinder head.

Valve Guide Dial Indicator Reading, Maximum	Intake Valve	Exhaust Valve
	0.5 mm (0.020 in.)	0.7 mm (0.027 in.)

Valve Guide Reamer Oversize	Valve Guide Size
0.15 mm (.005 in.)	8.125-8.150 mm (.3198-.3208 in.)
0.40 mm (.015 in.)	8.375-8.400 mm (.3297-.3307 in.)
0.80 mm (.030 in.)	8.775-8.800 mm (.3454-.3464 in.)

9109-8

Fig. 19 Valve Guide Specification

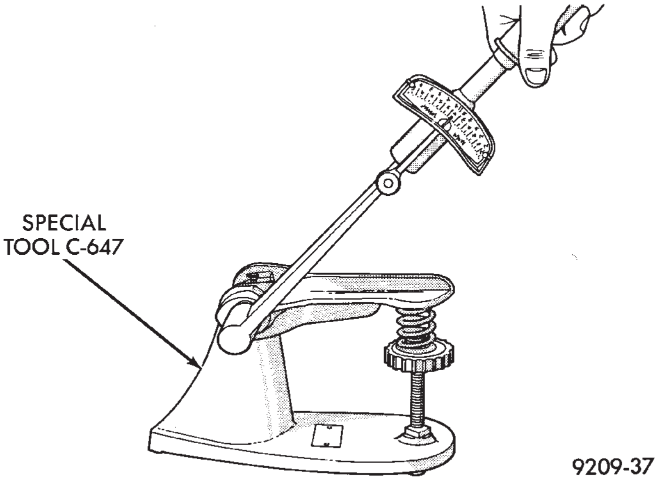


Fig. 20 Testing Valve Spring with Tool C-647

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 33.34mm (1-5/16 inches). Turn table of Tool C-647 until surface is in line with the 33.34mm (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. 20). 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.

(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 1.5mm (1/16 inch) out of square, install a new spring.

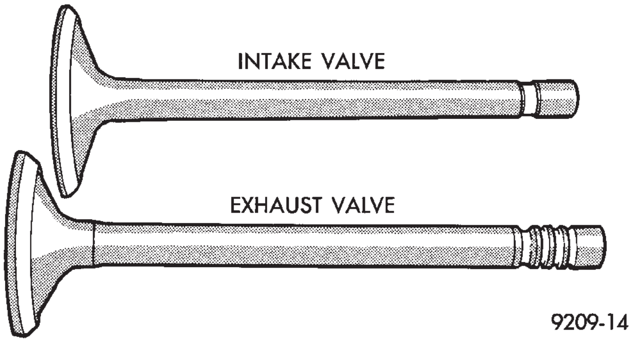
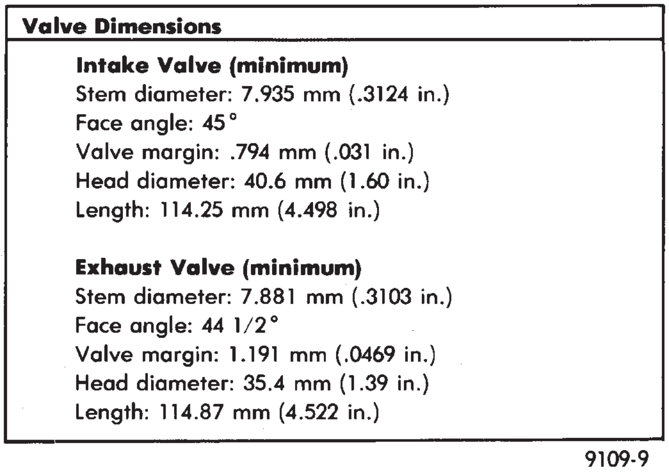


Fig. 21 Intake and Exhaust Valves



Valve Dimensions

Intake Valve (minimum)
Stem diameter: 7.935 mm (.3124 in.)
Face angle: 45°
Valve margin: .794 mm (.031 in.)
Head diameter: 40.6 mm (1.60 in.)
Length: 114.25 mm (4.498 in.)

Exhaust Valve (minimum)
Stem diameter: 7.881 mm (.3103 in.)
Face angle: 44 1/2°
Valve margin: 1.191 mm (.0469 in.)
Head diameter: 35.4 mm (1.39 in.)
Length: 114.87 mm (4.522 in.)

Fig. 22 Valve Dimensions

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. 23). Exhaust valves with less than 1.191mm (3/64 inch) margin and intake valves with less than .794mm (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 using a valve seat dial indicator. Total runout should not exceed. 051mm (.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 40.45mm (1.593 inch)
- Exhaust valve seat diameter 34.84mm (1.371 inch)

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.

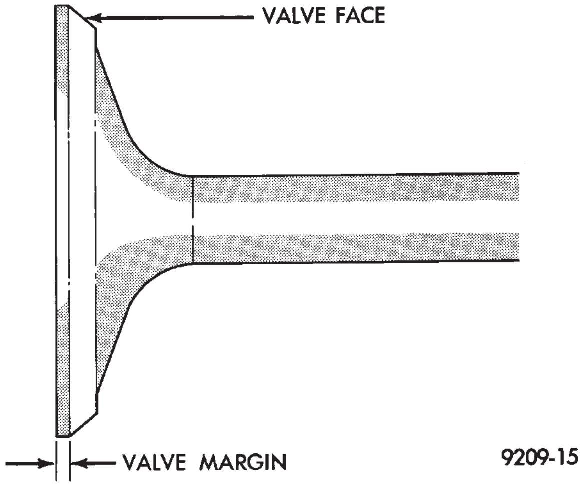


Fig. 23 Refacing Intake and Exhaust Valves

(6) When seat is properly positioned the width of intake seats should be 1.75 to 2.25mm (0.69 to .088 inch) The width of the exhaust seats should be 1.50 to 2.00mm (.059 to .078 inch) (Fig. 24 Dimension 1).

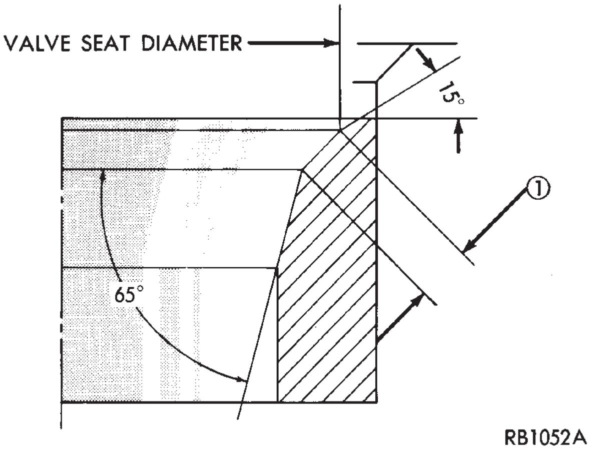


Fig. 24 Refacing Valve Seats

(7) Check valve tip to spring seat dimensions after grinding the valve seats or faces. Grind valve tip to get 49.76 to 51.04mm (1.960 to 2.009 inch) over spring seat when installed in the head (Fig. 25). The valve tip diameter should be no less than 7.0mm (0.275 inch), if necessary, the tip chamfer should be reground to prevent seal damage when the valve is installed.

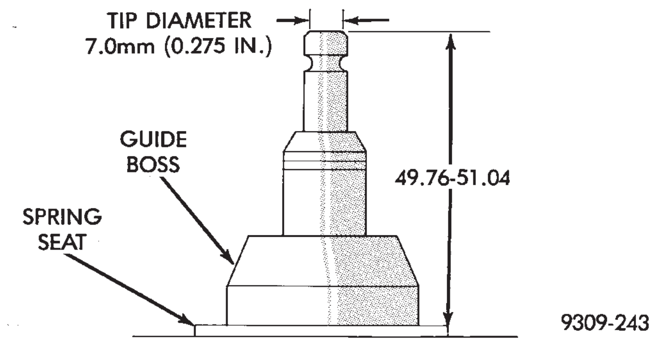


Fig. 25 Valve Tip to Spring Seat Dimensions

(8) Check the valve spring installed height after refacing the valve and seat (Fig. 26).

CAUTION: If more than .5mm (.020 inch) must be ground from the valve tip, check the clearance between the rocker arm and the valve spring retainer if below 1.25mm (.050 inch), grind the rocker arm ears according to the procedure described in Refacing Valves and Valve Seats.

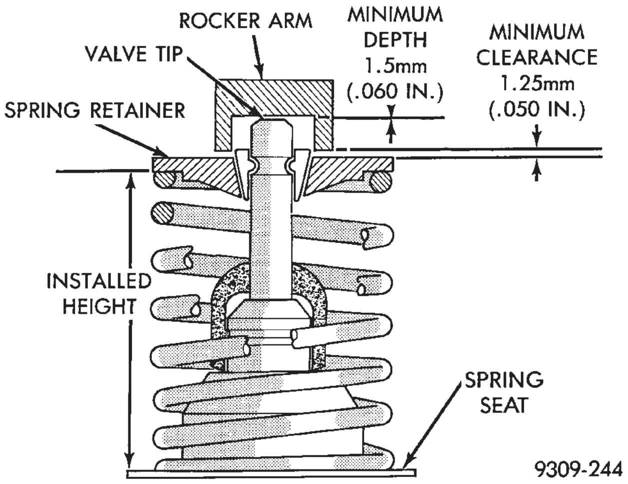


Fig. 26 Checking Spring Installed Height and Spring Retainer Clearance

CLEANING

Clean all valve guides, valves and valve spring assemblies thoroughly with suitable cleaning solution before reassembling.

VALVE GEAR REASSEMBLY AFTER VALVE SERVICE

(1) Coat valve stems with lubrication oil and insert in cylinder head.

CAUTION: Flexible Fuel Vehicles use unique valve stem oil seals they are green in color. Standard valve stem oil seals are NOT to be interchanged with Flexible Fuel Vehicles engines.

(2) Install new valve stem seals on all valves. The valve stem seals should be pushed firmly and squarely over valve guide. The lower edge of the seal should be resting on the valve guide boss.

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 spring seats and 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 Tool C-3422-B the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check installed height of springs. Measurement is to be taken from the spring seat to the bottom of the spring retainer. Correct height is 41.2mm to 42.7mm (1.62 to 1.68 inches). If seats have been reground an additional spring seat may be required to maintain correct installed spring height.

(5) Install adjusters, rocker arms in order, and camshaft as previously described, see Camshaft-Install. Check for clearance between the projecting ears (either side of valve tip) of the rocker arms and the valve spring retainers. At least 1.25 mm (.050 inch) clearance must be present, if necessary, the rocker arm ears may be ground to obtain this clearance (Fig. 26).

(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 0.62 to 1.52 mm (.024 to .060 inch). To completely collapse adjuster for dry lash measurement, pry off retainer cap, disassemble, drain the adjuster of oil, reassemble, and install. After performing dry lash check, refill adjuster with oil (do not reuse retainer cap/s) and allow 10 minutes for adjuster/s to bleed down before rotating cam.

CYLINDER HEAD AND VALVE ASSEMBLY SERVICE—TURBO III

CYLINDER HEAD COVER SEALING

(1) Before installation, clean cylinder head and cover mating surfaces. Make certain rails are flat.

Caution: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

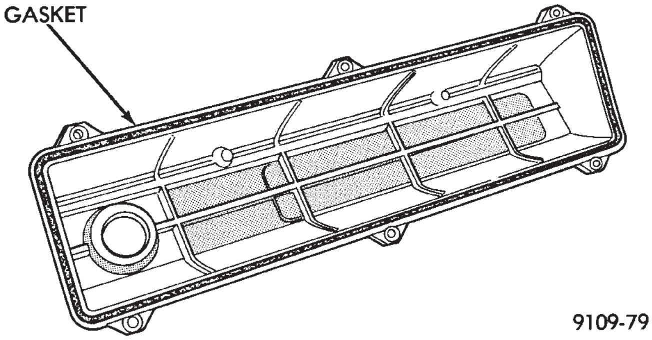


Fig. 1 Cylinder Head Valve Cover and Gasket Assembly

(2) Install covers and gasket assembly to head and torque to 12 N●m (105 in.lbs.).

CYLINDER HEAD

REMOVAL

Refer to Intake and Exhaust Manifold Service in Exhaust Systems and Intake Manifold Group 11 for removal procedure for the intake and exhaust manifolds.

(1) The Timing Belt and Solid Mount Compressor Mount Bracket must be removed before the cylinder head can be removed. Refer to procedure outlined in this group for service procedures.

(2) Remove cylinder head bolts.

(3) Cylinder head must be flat within 0.1mm (.004 inch) (Fig. 2).

INSTALLATION

CAUTION: The Turbo III head gasket is not the same as any other engine head gasket (Fig. 3).

CAUTION: Head bolt diameter is 11mm. These bolts are Unique to this engine application they are not interchangeable with other engines.

The Cylinder head bolts are torqued using a new procedure they should be examined BEFORE reuse. If the threads are necked down the bolts should be replaced. (Fig. 4).

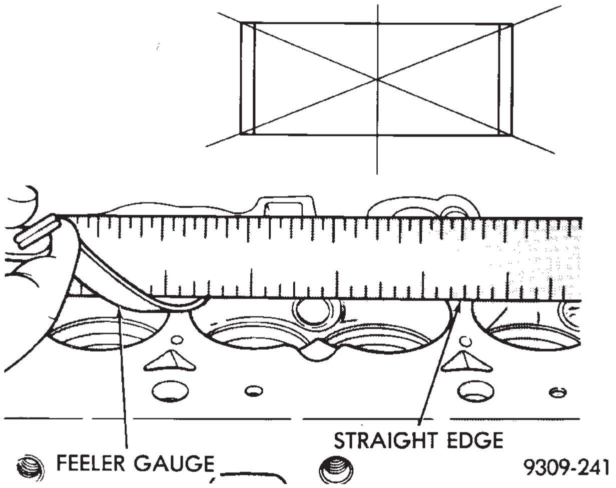


Fig. 2 Checking Cylinder Head Flatness

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.

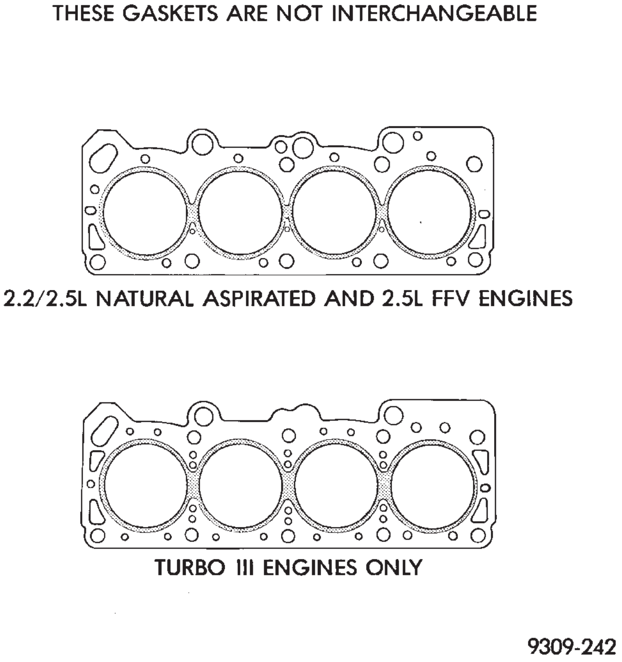


Fig. 3 Cylinder Head Gaskets

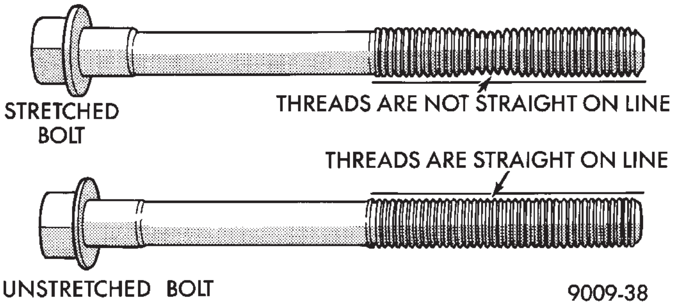


Fig. 4 Checking Bolts for Stretching—Necking

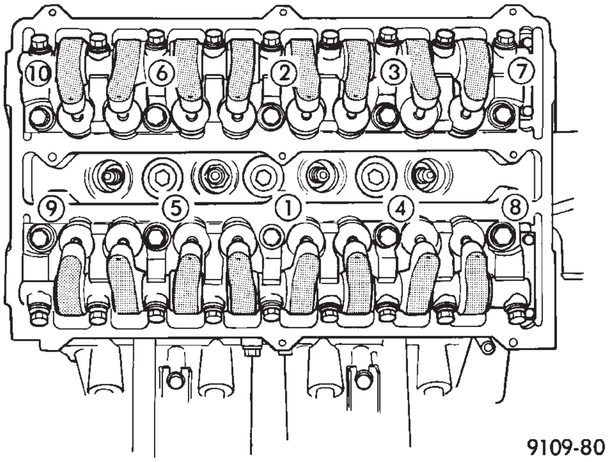


Fig. 5 Cylinder Head Tightening Sequence

Before installing the bolts, the threads should be cleaned and oiled.

Tighten the cylinder head bolts in the sequence shown in (Fig. 5). Using the 4 step torque turn method, tighten according to the following values:

- First All to 61 N●m (45 ft. lbs.)
- Second All to 88 N●m (65 ft. lbs.)
- Third All (again) to 88 N●m (65 ft., lbs.)
- Fourth + 1/4 Turn **Do not use torque wrench for this step.**
- Bolt torque after 1/4 turn should be over 90 ft. lbs. If not, replace the bolt.

Refer to Intake and Exhaust Manifold Service in Exhaust Systems and Intake Manifold Group 11 for installation procedure.

Refer to the Timing Belt and Solid Mount Compressor Mount Bracket service procedures in this group for installations procedures.

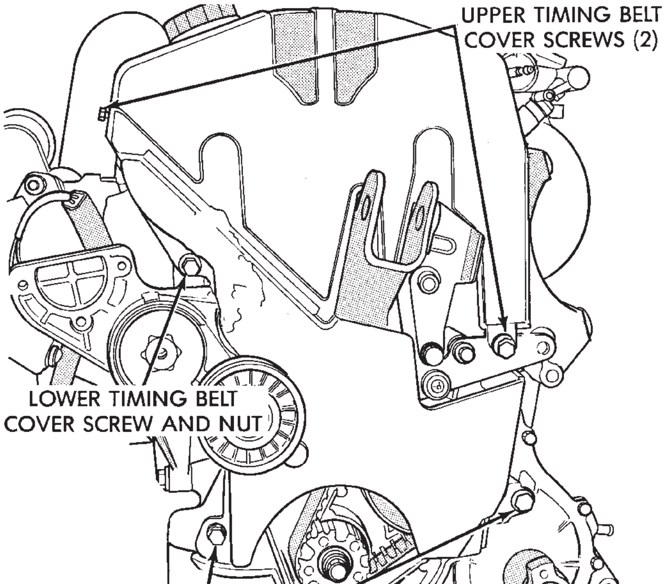


Fig. 1 Timing Belt Cover Screws

TIMING BELT COVER SERVICE—TURBO III ENGINE

REMOVAL

(1) Remove PCV tube and upper timing belt cover screws (Fig. 1). Remove upper cover.

(2) Remove accessory drive belt. Refer to Cooling System Group 7 for procedure.

(3) Raise vehicle on a hoist and remove right wheel and inner splash shield (Fig. 2).

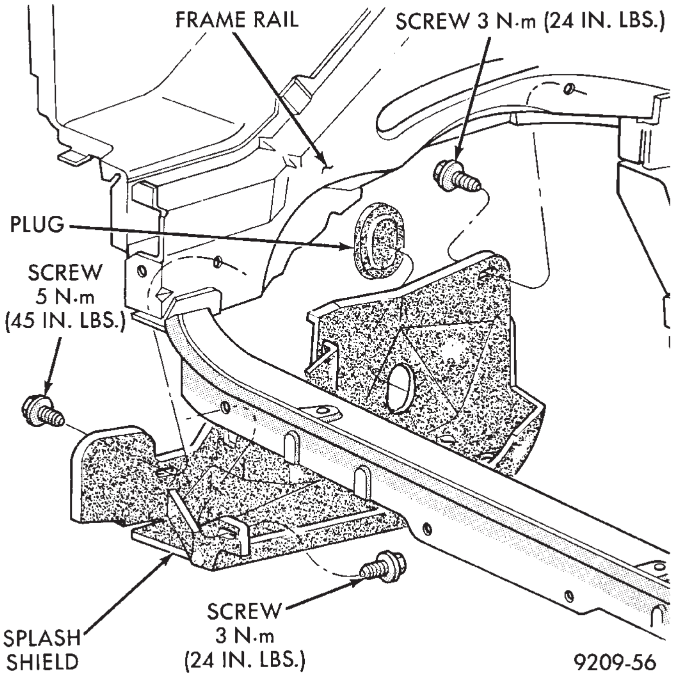


Fig. 2 Right Inner Splash Shield

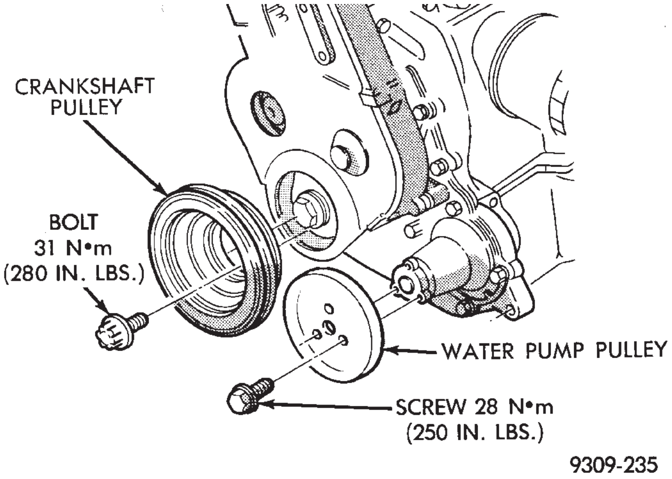


Fig. 3 Crankshaft and Water Pump Pulleys

(4) Remove water pump pulley and crankshaft pulley retaining bolts (Fig. 3), remove pulleys.

(5) Remove lower accessory drive belt idler and tensioner pulley (Fig. 4).

CAUTION: Do not use a impact wrench to remove pulley bolts.

(6) Remove lower timing belt cover fasteners (Fig. 1). Remove cover.

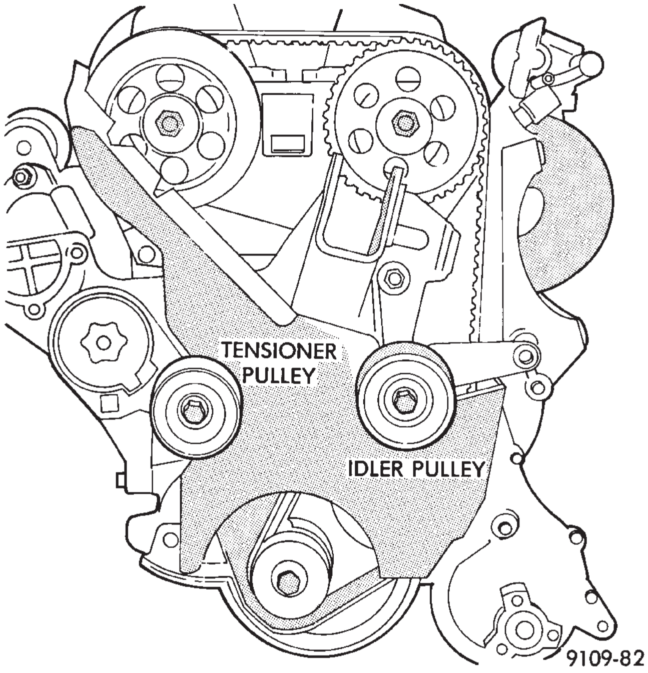


Fig. 4 Timing Belt Cover and Tensioner

INSTALLATION

(1) Raise vehicle on hoist. Install lower timing belt cover and tighten fasteners to 12 N●m (105 in. lbs.) torque (Fig. 4).

CAUTION: Do not use impact wrench on accessory drive belt tensioner bolt. It may cause damage to tensioner arm. Accessory drive belt tensioner pulley bolt must be installed finger tight.

(2) Install accessory drive belt tensioner pulley bolt finger tight. Then tighten bolt to 54 N●m (40 ft. lbs.) torque (Fig. 4).

(3) Install crankshaft and water pump pulleys (Fig. 3).

(4) Install inner splash shield and wheel (Fig. 2).

(5) Install accessory drive belt. Refer to Cooling System Group 7 for procedure.

(6) Install upper timing belt cover and tighten screws to 4 N●m (36 in. lbs.) torque. Install PCV tube (Fig. 1).

TIMING BELT

REMOVAL

(1) Remove timing belt cover refer to timing belt cover service of this section for procedure.

(2) Lift engine with Engine Support Tool C-4852. Separate right engine mount (Fig. 5).

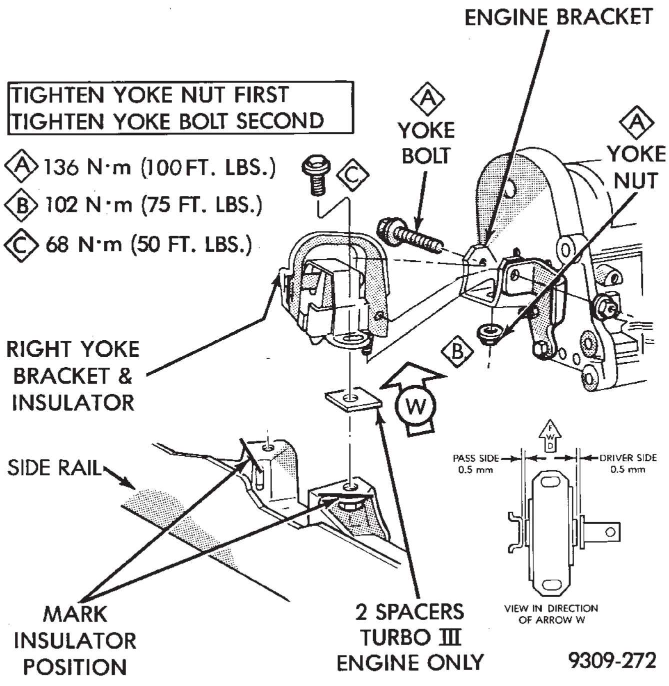


Fig. 5 Right Engine Mount—Typical

(3) Raise vehicle on a hoist. Remove lower accessory drive belt idler pulley bracket assembly (Fig. 6).

(4) Loosen timing belt tensioner, remove timing belt and idler pulley (Fig. 6).

(5) Lower vehicle

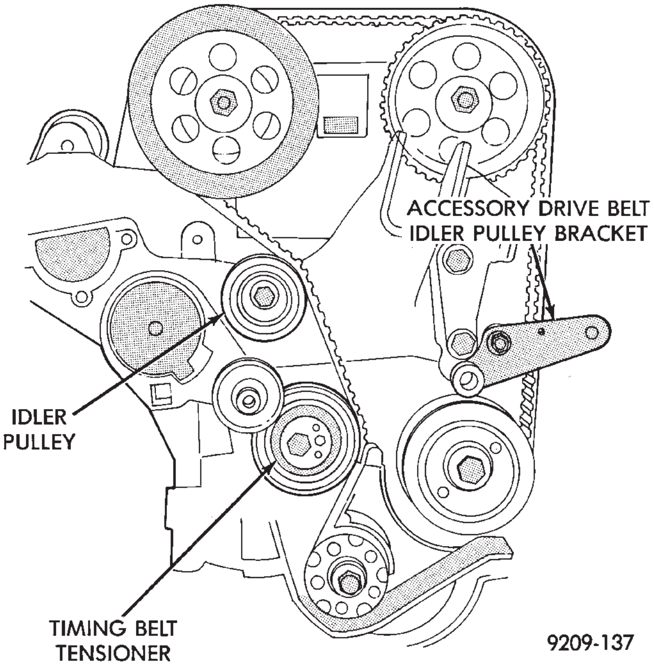


Fig. 6 Remove Timing Belt

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE

INSTALLATION

(1) Remove air cleaner fresh air duct.

(2) Remove ignition cable cover (Fig. 7).

(3) Remove valve covers and loosen rocker arm assemblies about 3 turns as shown in (Fig. 8).

CAUTION: Check lash adjuster for loose or missing retainers before continuing service procedure.

(4) Align and pin both intake and exhaust cam sprockets with 3/32 drills or pin punches (Fig. 9). **Accessory Shaft does not need to be timed.**

(5) Remove spark plugs.

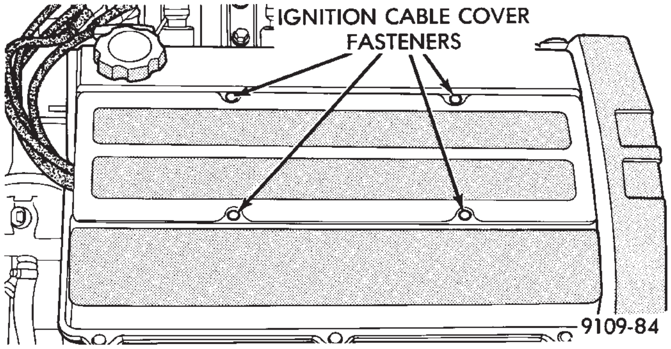


Fig. 7 Ignition Cable Cover

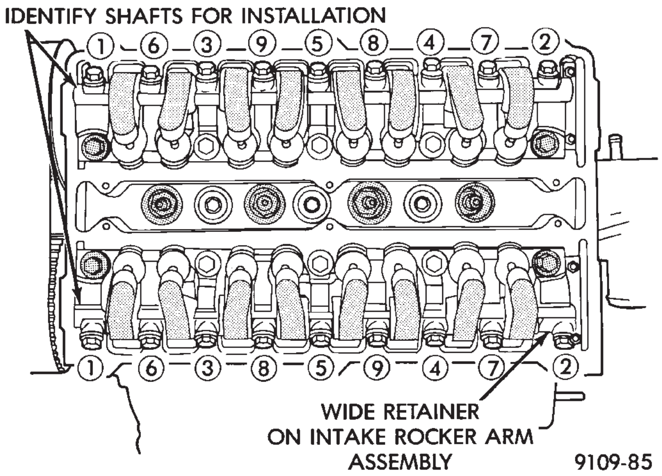


Fig. 8 Rocker Arm Shaft Assemblies

(6) Install a dial indicator in Number 1 spark plug hole (Fig. 10).

(7) Rotate crankshaft till number 1 piston is at Top Dead Center. Mark the engine block for TDC reference.

(8) Install timing belt and idler pulley in sequence shown in (Fig. 11).

(9) Remove dial indicator from cylinder head (Fig. 10). Remove drills or pins from camshaft sprockets (Fig. 11).

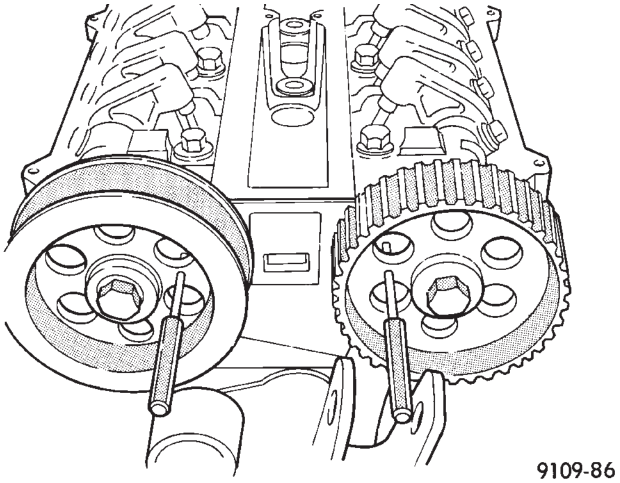


Fig. 9 Camshafts Pinned Into Position

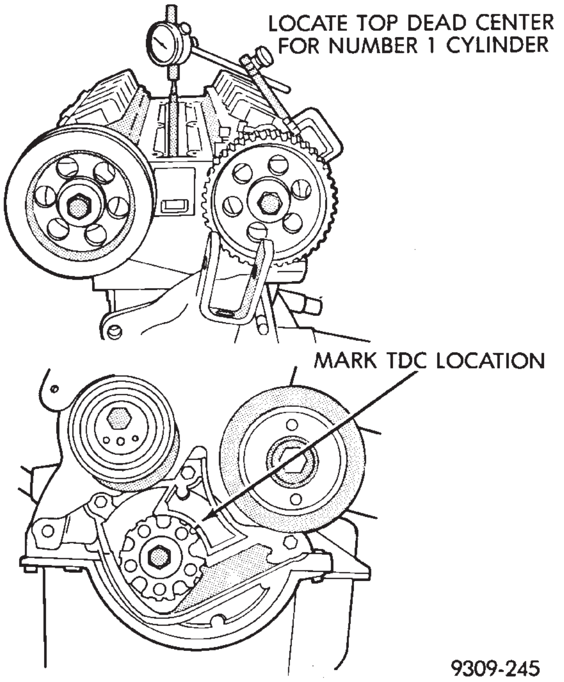


Fig. 10 Dial Indicator Located in Number 1 Cylinder

(10) Adjust tension to 445 N (110 lbs.) **New belt** or 311 N (70 lbs.) **Used belt** . Install belt tension gauge on timing belt (Fig. 12) adjust tensioner until specified tension is achieved.

CAUTION: Belt tension gauge must be installed between the belt teeth to get a accurate reading.

(11) Rotate crankshaft clockwise 2 full revolutions and check alignment of camshaft and crankshaft timing marks. **Do not reverse rotate crankshaft or attempt to rotate engine using cam or accessory shaft attaching screw.**

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

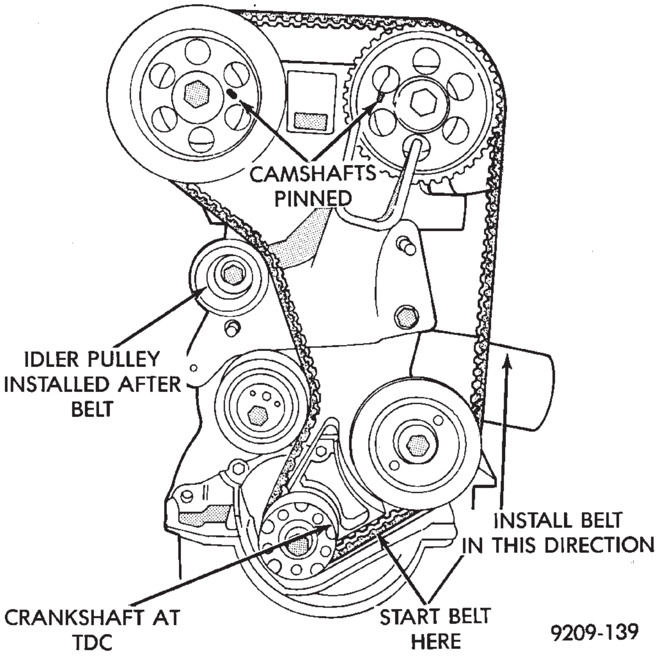


Fig. 11 Camshafts and Crankshaft Timing Marks

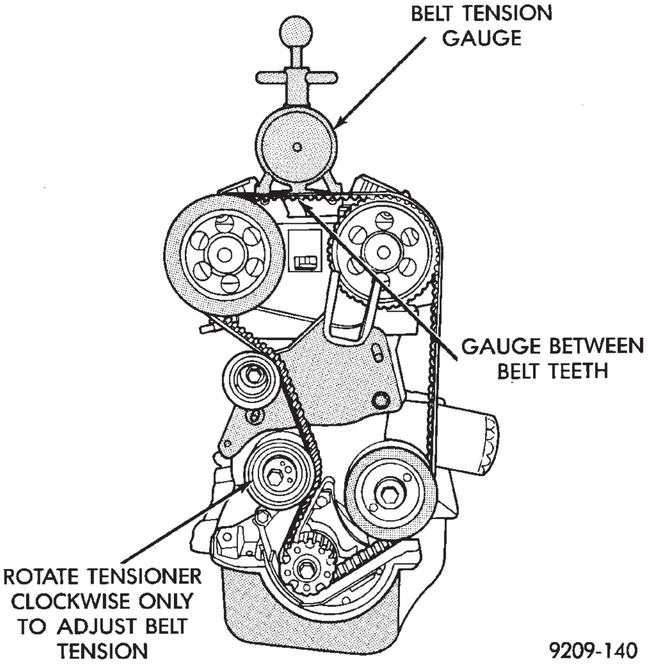


Fig. 12 Belt Tension Gauge Location

(12) Recheck belt tension, adjust if necessary.

(13) Torque rocker arm shafts in sequence shown (Fig. 13) to 12 N●m (105 in. lbs.) then to 24 N●m (210 in. lbs.).

(14) Install valve covers, spark plugs, ignition cables and ignition cable cover.

(15) Install air cleaner fresh air duct.

(16) Raise vehicle. Install lower timing belt cover and accessory drive belt tensioner pulley. Refer to procedure in this section.

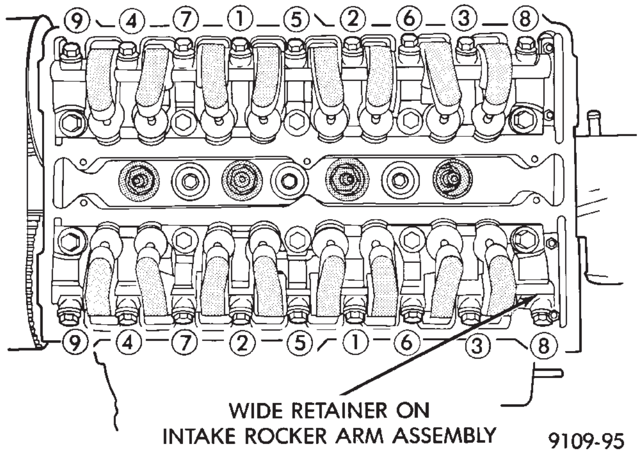


Fig. 13 Rocker Arm Shaft—Installation

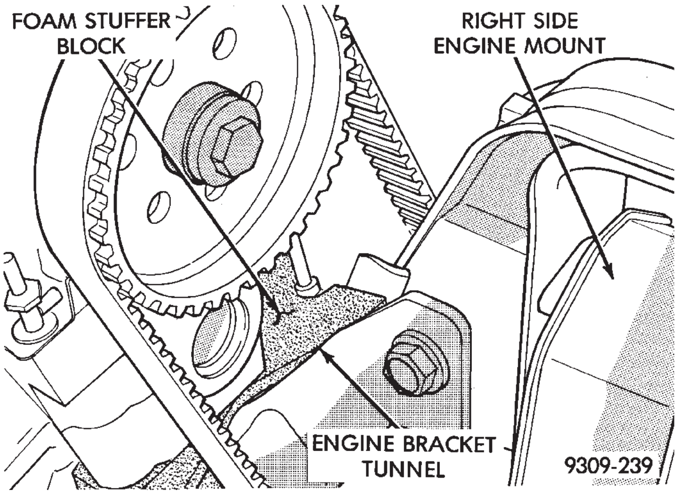


Fig. 14 Foam Stuffer Block Location

(17) Lower vehicle. Install right engine mount (Fig. 5).

(18) Inspect foam stuffer block condition and position (Fig. 14). Stuffer block should be intact and secure within the engine bracket tunnel.

(19) Install upper timing belt cover and PCV tube. Refer to procedure in this section.

(20) Install accessory drive belt. Refer to procedure in this section.

SERVICING OIL SEALS

Refer to servicing oil seals in this group for procedures.

To service the intake cam seal (Turbo III) the right engine mount must be removed. Refer to engine mount removal of this Group.

CAMSHAFTS SERVICE

Cylinder Head must be removed from vehicle. Refer to cylinder head removal for procedure.

REMOVAL

(1) Mark rocker arms shafts for reinstallation in the same position (Fig. 1).

(2) Remove rocker arm assembly attaching bolts in sequence (Fig. 1).

(3) Remove thrust plates from rear of camshafts (Fig. 2).The intake camshaft uses a wider thrust plate than exhaust camshaft.

CAUTION: Thrust plates are not the same thickness and cannot be interchanged.

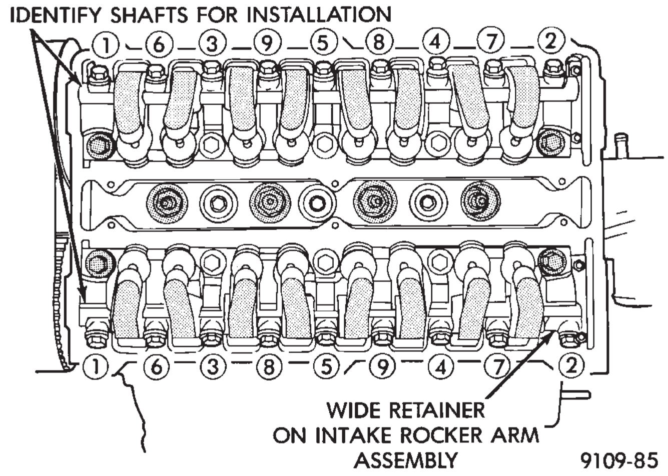


Fig. 1 Rocker Arm Shaft Removal Sequence

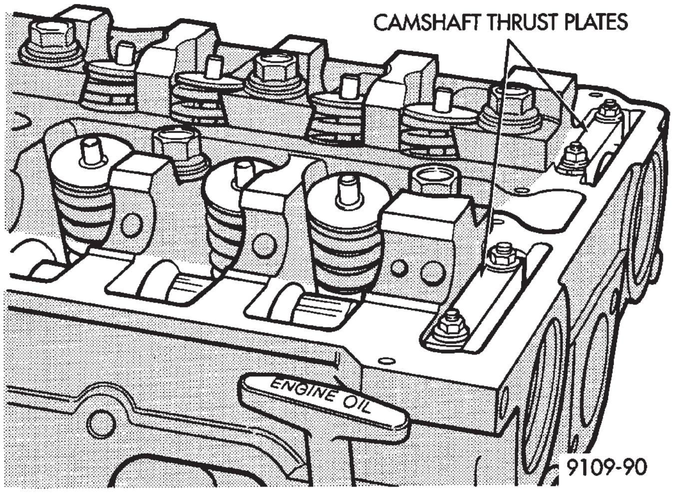


Fig. 2 Camshaft Thrust Plates

(4) Before camshaft can be removed from cylinder head the cam seal must be removed first. Becareful not to damage seal surface of the camshaft.

(5) Using a screwdriver place it against the side of the cam lobe push the cam out of the head. The cam seal will be pushed out by the cam (Fig. 3).

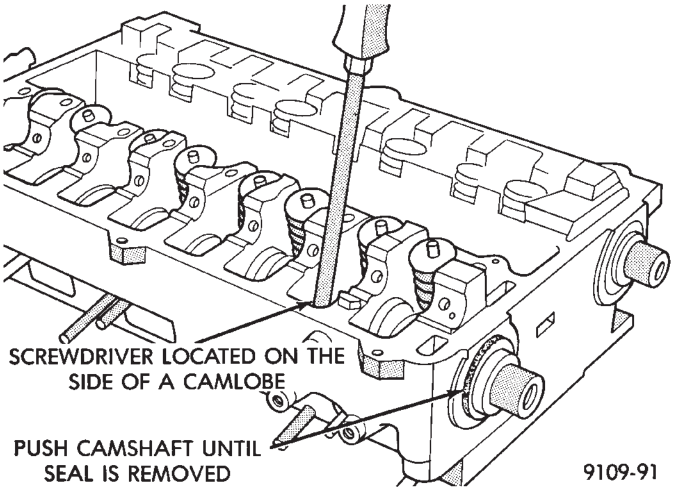


Fig. 3 Removing Camshaft Oil Seal

(6) Slide the camshaft out of the cylinder head. Becareful not scratch the bearing surfaces in the head (Fig. 4).

CAUTION: Intake and Exhaust camshafts are not interchangeable.

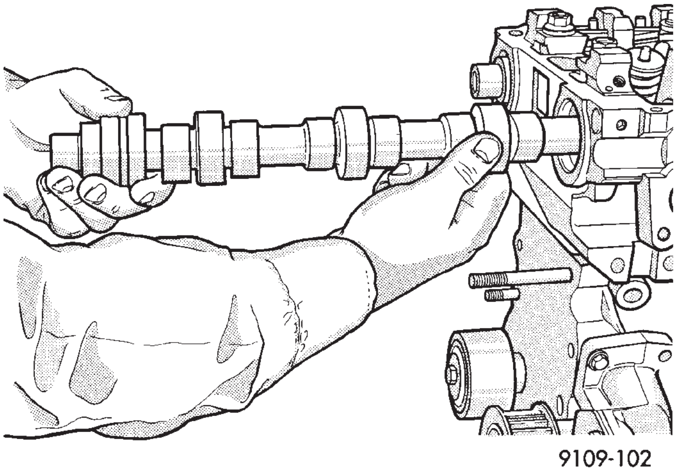


Fig. 4 Camshaft—Removal or Installation

INSPECTION

Camshaft lobe wear should not exceed .25mm (.010 inch). To measure cam lobe wear (Fig. 4), measure lobe diameter in two places at the largest diameter (over the nose). Take first reading with micrometer in unworn area at the edge of the lobe. Take second reading in the worn area where rocker arm contacts the lobe. Subtract second reading from the first. The difference is the cam lobe wear.

INSTALLATION

(1) Lubricate camshaft journals with clean engine oil. Carefully install camshaft into the head.

CAUTION: Camshafts are not interchangeable. The intake cam has a wider thrust plate groove.

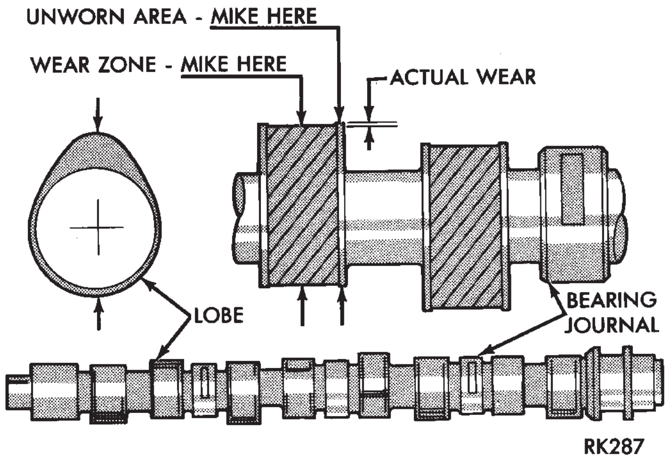


Fig. 5 Measuring Camshaft Lobe Wear

(2) Install thrust plates and tighten retaining nuts to 6 N●m (55 in. lbs.).

(3) Install new camshaft oil seals flush with cylinder head surface.

Using seal installing special tool C-4680.

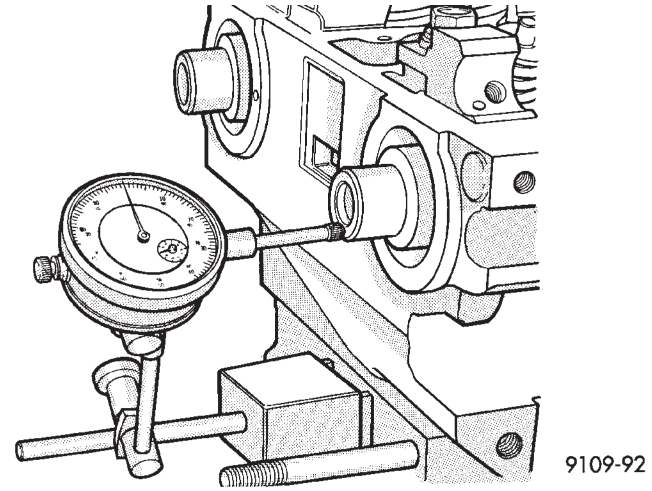


Fig. 6 Checking Camshaft End Play

CAMSHAFT END PLAY

(1) Using a suitable tool, move camshaft as far rearward as it will go.

(2) Zero dial indicator (Fig. 6).

(3) Move as far forward and backward as camshaft will go.

(4) End play travel: 0.025-0.200mm (.001-.008 inch).

LASH ADJUSTER (TAPPET) NOISE

A tappet-like noise may be produced from several items. See Lash Adjuster and Tappet Noise-DIAGNOSIS in STANDARD SERVICE PROCEDURES, this Group.

VALVE COMPONENTS REPLACE—CYLINDER HEAD NOT REMOVED

ROCKER ARM AND HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove valve cover. Refer to procedure previously outlined in this section.

(2) Remove rocker arm shaft(s) in sequence shown in (Fig. 6). Slide rocker off the shaft. Keep rocker arms in order for reassembly.

CAUTION: Check lash adjusters for loose or missing retainers before continuing service procedure.

(3) Remove hydraulic lash adjuster.

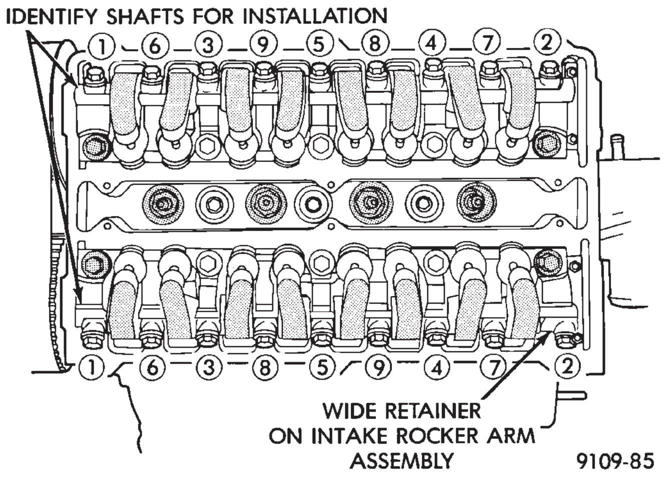


Fig. 7 Rocker Arm Shaft—Removal

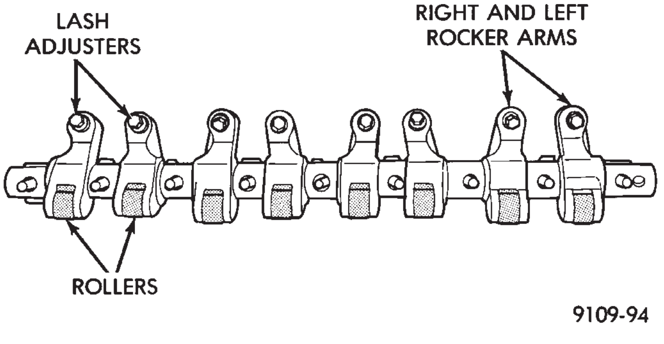


Fig. 8 Rocker Arm and Lash Adjuster Assembly—Right and Left

INSTALLATION

(1) Install rocker arm on the shaft in there original position (Fig. 9).

(2) Install hydraulic lash adjusters 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.

(3) Install rocker arm shaft assembly tighten in sequence shown in (Fig. 10).

(4) Install valve cover as previously outlined.

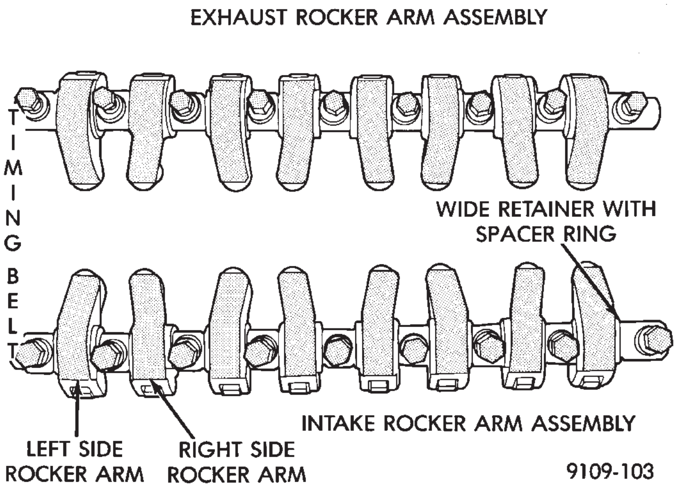


Fig. 9 Intake and Exhaust Rocker Arm Assemblies

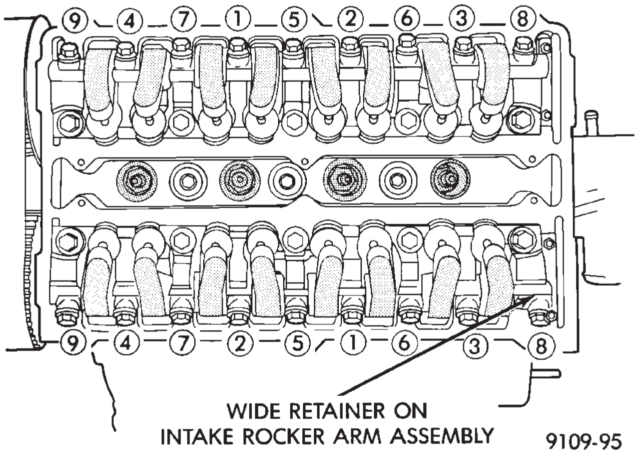


Fig. 10 Rocker Arm Shaft—Installation

VALVE SPRINGS AND VALVE STEM SEALS

VALVE SERVICE

• CYLINDER HEAD MUST BE REMOVED TO SERVICE VALVE SPRINGS AND VALVE STEM SEALS.

VALVES AND VALVE SPRINGS

REMOVAL

(1) With cylinder head removed, compress valve springs using Valve Spring Compressor Tool C-3422-B with adopters 6537 and 6526 (Fig. 11).

(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.

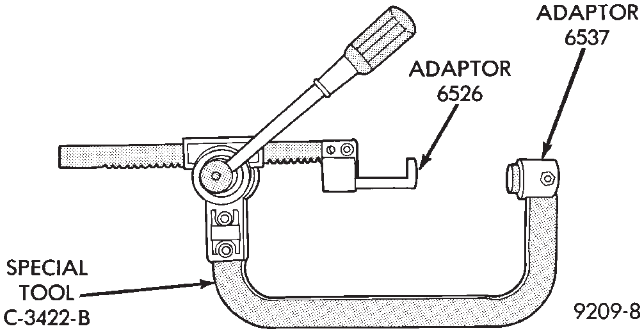
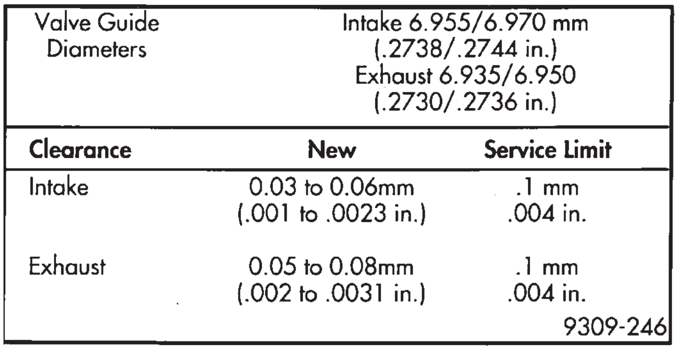


Fig. 11 Valve Spring Compressor



Valve Guide Diameters	Intake 6.955/6.970 mm (.2738/.2744 in.) Exhaust 6.935/6.950 (.2730/.2736 in.)	
Clearance	**New**	**Service Limit**
Intake	0.03 to 0.06mm (.001 to .0023 in.)	.1 mm .004 in.
Exhaust	0.05 to 0.08mm (.002 to .0031 in.)	.1 mm .004 in.

9309-246

Fig. 12 Valve Guide Specification

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Refer to (Fig. 14) for specifications.

(3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

VALVE GUIDES

Measure valve guides in 3 places top, middle and bottom (Fig. 13). Using a small hole gauge and a micrometer, refer to (Fig. 12) for specifications.

Replace cylinder head if guides are not within specifications.

TESTING VALVE SPRINGS

(1) Refer to Testing Valve previously described in this Group for procedure. Test springs at 36.8 mm (1-7/16 to 1-15/32 in.) 1000 N (225 lbs.) ± 40 N (9 lbs.). Discard the springs that do not meet specifications.

(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 1.65mm (1/16 inch) out of square, install a new spring. Spring free length is 53.2 mm ±.25 mm (2.094 in. ±.010 in.)

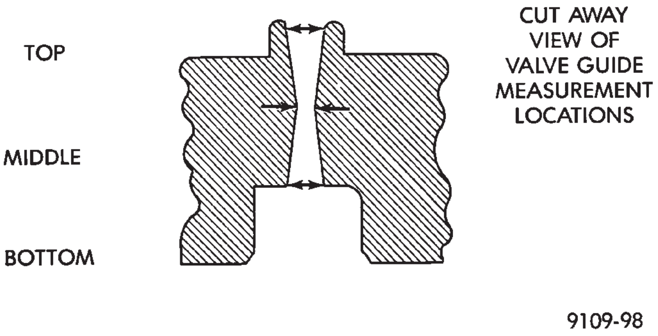
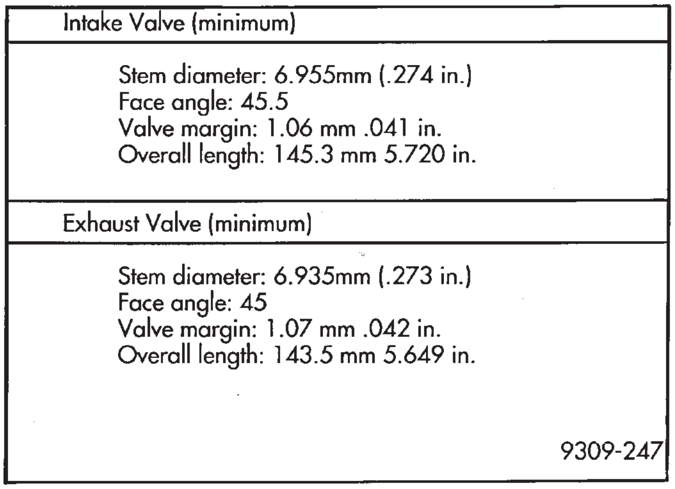


Fig. 13 Measuring Valve Guides



Intake Valve (minimum)

Stem diameter: 6.955mm (.274 in.)
Face angle: 45.5
Valve margin: 1.06 mm .041 in.
Overall length: 145.3 mm 5.720 in.

Exhaust Valve (minimum)

Stem diameter: 6.935mm (.273 in.)
Face angle: 45
Valve margin: 1.07 mm .042 in.
Overall length: 143.5 mm 5.649 in.

9309-247

Fig. 14 Valve Dimensions

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. 11). Exhaust valves with less than 1.07mm (3/64 inch) margin and intake valves with less than 1.06mm (3/64 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 using a valve seat dial indicator. Total runout should not exceed. 0.1 mm (.004 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 34.0mm (1.338 inch)
- Exhaust valve seat diameter 29.4mm (1.157 inch)

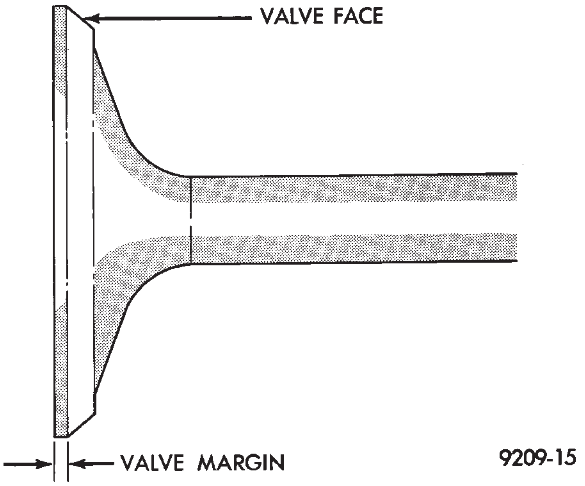


Fig. 15 Refacing Intake and Exhaust Valves

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.

(6) When seat is properly positioned the width of intake seats should be 1.87mm (0.73 inch) The width of the exhaust seats should be 2.00mm (.078 inch) (Fig. 16 Dimension 1).

(7) Check valve tip to spring seat dimensions A after grinding the valve seats or faces. Grind valve tip to give 55.62 to 55.88 mm (2.190 to 2.200 inch.) over spring seat when installed in the head (Fig. 17). Check valve tip for scoring, if necessary, the tip chamfer should be reground to prevent seal damage when the valve is installed.

(8) Check the valve spring installed height B after refacing the valve and seat (Fig. 17). Measurement B is to be taken from the spring seat to the bottom of the spring retainer. Correct height is 44.0mm (1.73 inches).

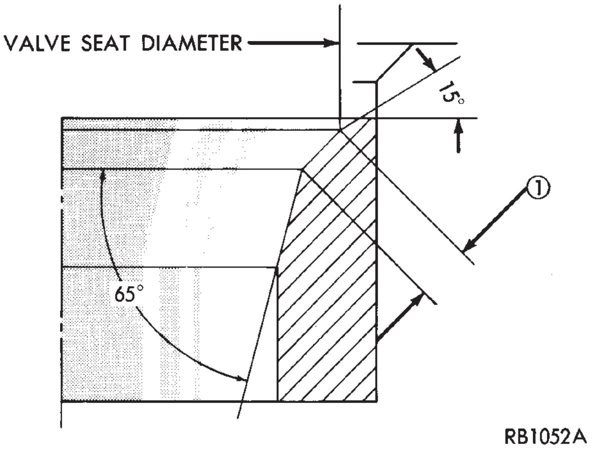


Fig. 16 Refacing Valve Seats

VALVE GEAR REASSEMBLY AFTER VALVE SERVICE

(1) Coat valve stems with lubrication oil and insert in cylinder head.

(2) Install new valve stem seals on all valves. The valve stem seals should be pushed firmly and squarely over valve guide. The lower edge of the seal should be resting on the valve guide boss.

(3) Install valve spring seats and 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 Tool C-3422-B with adopters 6537 and 6526 (Fig. 11) the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check installed height of springs. Measurement B is to be taken from the spring seat to the bottom of the spring retainer. Correct height is 44.0mm (1.73 inches). If seats have been ground an additional spring seat may be required to maintain correct installed spring height (Fig. 17).

(5) Install camshaft and rocker arms as previously described, see Camshaft-Install.

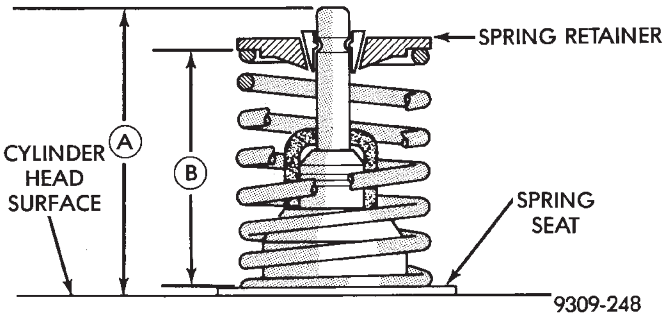
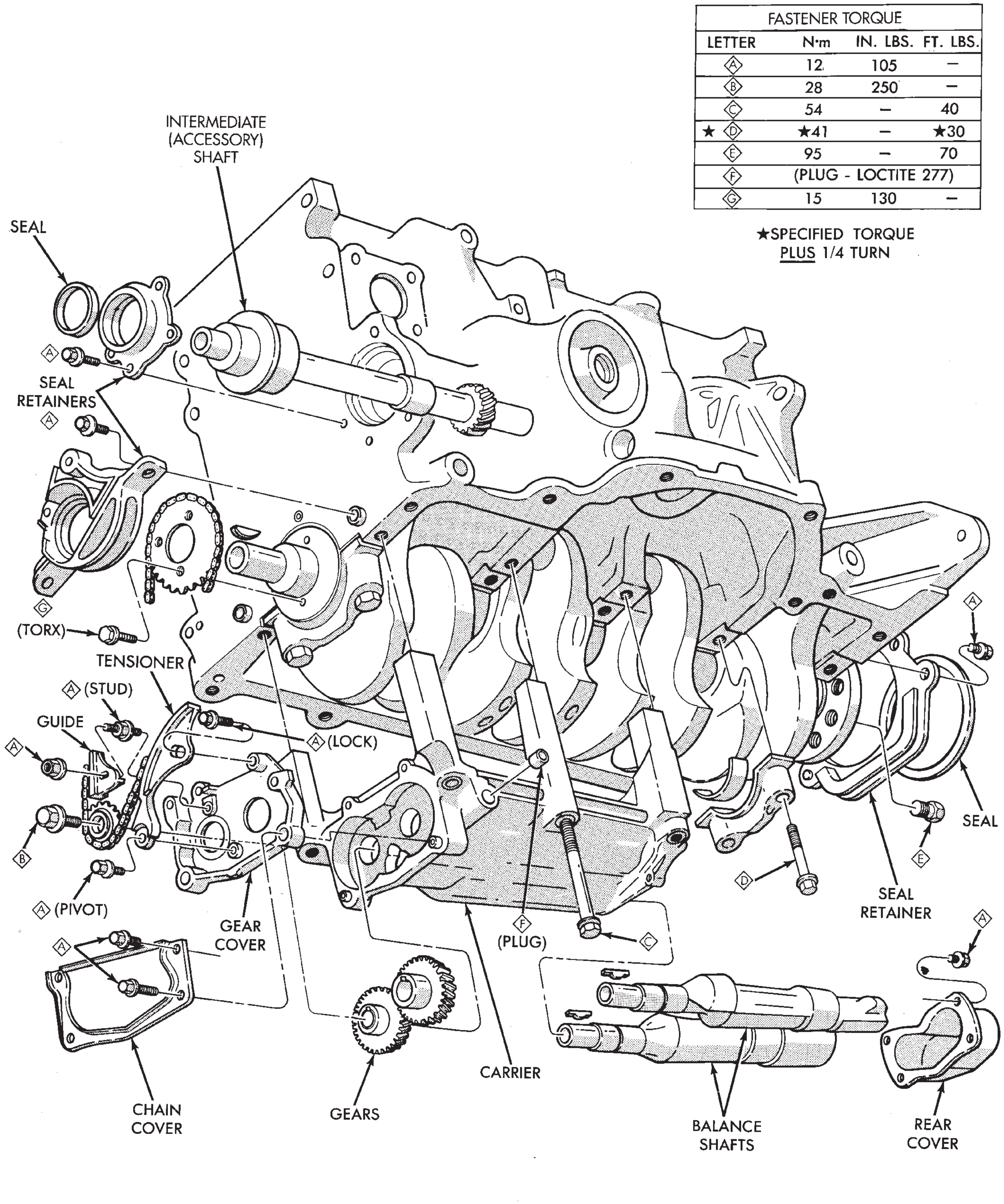


Fig. 17 Checking Valve Tip Height and Spring Installed Height

CRANKSHAFT, INTERMEDIATE AND BALANCE SHAFT SERVICE



FASTENER TORQUE			
LETTER	N·m	IN. LBS.	FT. LBS.
Ⓐ	12	105	—
Ⓑ	28	250	—
Ⓒ	54	—	40
★ Ⓓ	★41	—	★30
Ⓔ	95	—	70
Ⓕ	(PLUG - LOCTITE 277)		
Ⓖ	15	130	—

★SPECIFIED TORQUE PLUS 1/4 TURN

Fig. 1 Crankshaft Intermediate and Balance Shaft Assemblies and Oil Seals

CRANKSHAFT OIL SEALS SERVICE

(1) Pry out rear seal with screwdriver. Be careful not to nick or damage crankshaft flange seal surface or retainer bore (Fig. 2).

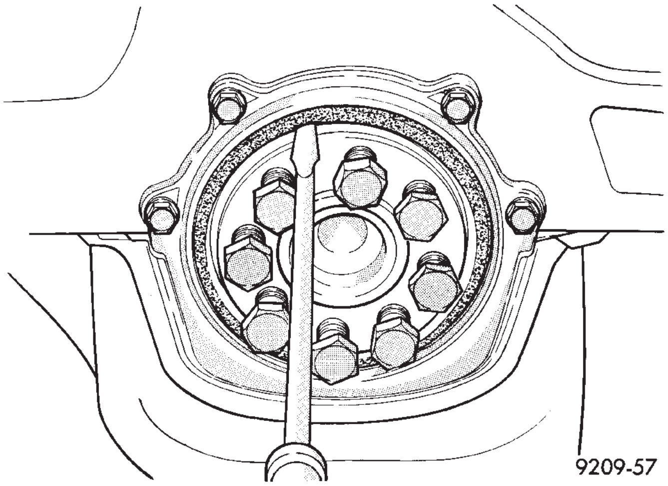


Fig. 2 Removing Rear Crankshaft Oil Seal

(2) Place Special Tool C-4681 on crankshaft (Fig. 3).

(3) Lightly coat seal O.D. with Loctite Stud N' Bearing Mount or equivalent.

(4) Place seal over Tool C-4681 and tap in place with a plastic hammer.

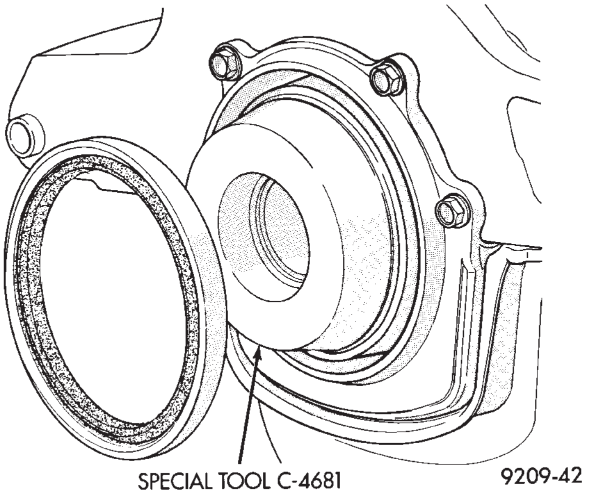


Fig. 3 Installing Rear Crankshaft Oil Seal

REAR CRANKSHAFT SEAL RETAINER AND OIL SEAL

When retainer removal is required, use Mopar Gasket Maker applied as shown in (Fig. 4) to provide retainer to block sealing during re-installation.

FRONT CRANKSHAFT SEAL RETAINER

See Timing System and Seals Section for timing belt covers, belt, crankshaft sprocket and oil seals removal and installation.

(1) Remove retainer screws (Fig. 5).

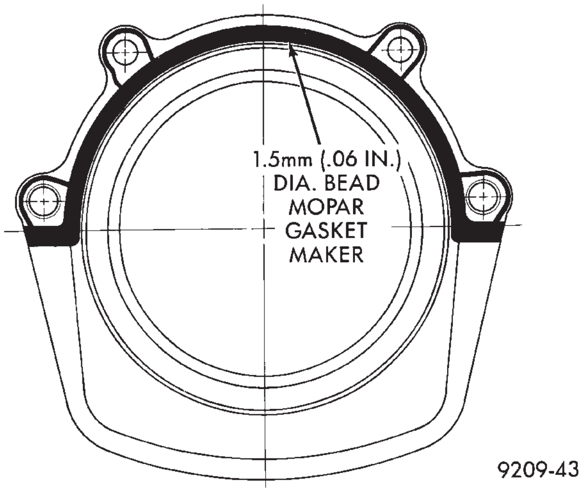


Fig. 4 Rear Crankshaft Seal Retainer Sealing

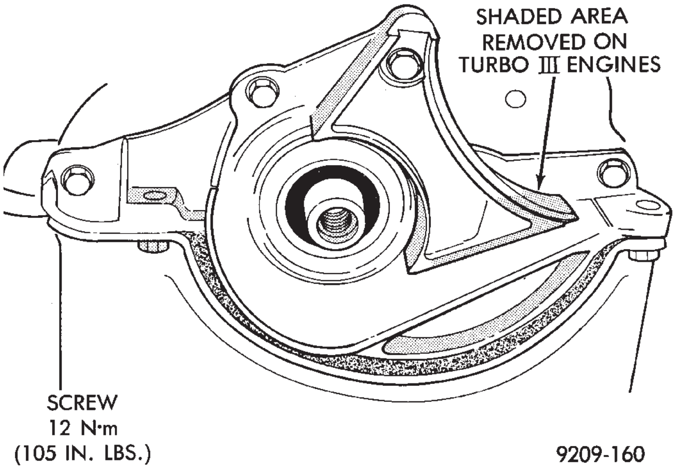


Fig. 5 Front Crankshaft Oil Seal Retainer

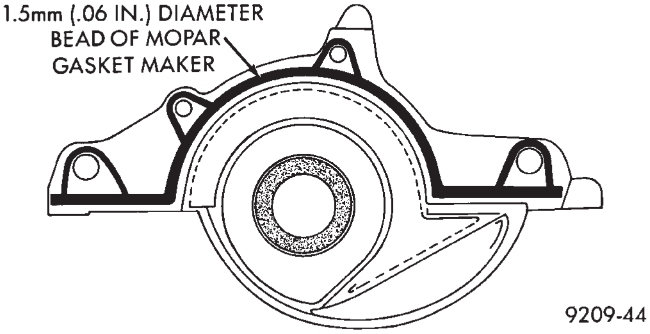


Fig. 6 Front Crankshaft Seal Retainer Sealing

For reassembly Mopar Gasket Maker is applied to the retainer as shown in (Fig. 6). This material cures in the absence of air providing retainer to block sealing.

(2) Install retainer and tighten screws to 12 N●m (105 in. lbs.).

CRANKSHAFT SERVICE

CRANKSHAFT MAIN BEARINGS

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of 1, 2, 4 and 5 are interchangeable. Upper main bearing halves of 1, 2, 4 and 5 are interchangeable (Fig. 7).

CRANKSHAFT MAIN JOURNALS

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 .025mm (.001 inch). Journal grinding should not exceed .305mm (.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. 7). 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: 0.025mm (.001 inch), .051mm (.002 inch), .076mm (.003 inch), .254mm (.010 inch), and .305mm (.012 inch). Never install an undersize bearing that will reduce clearance below specifications.

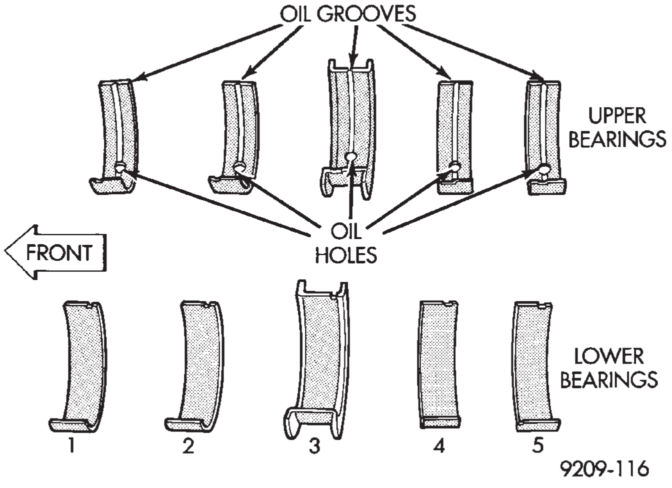


Fig. 7 Main Bearing Identification

MAIN BEARING SERVICE—CRANKSHAFT NOT REMOVED

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. 8) into the oil hole of crankshaft.

(3) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

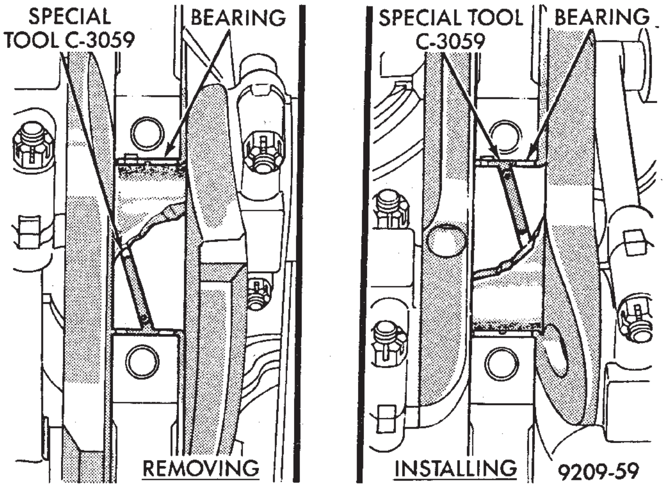


Fig. 8 Removing and Installing Upper Main Bearing With Special Tool C-3059

INSTALLATION

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. 8).

(2) Slowly rotate crankshaft counter-clockwise sliding the bearing into position. Remove Special Main Bearing Tool C-3059.

CHECKING CRANKSHAFT END PLAY

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 9).

(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 (Fig. 10) for specifications.

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

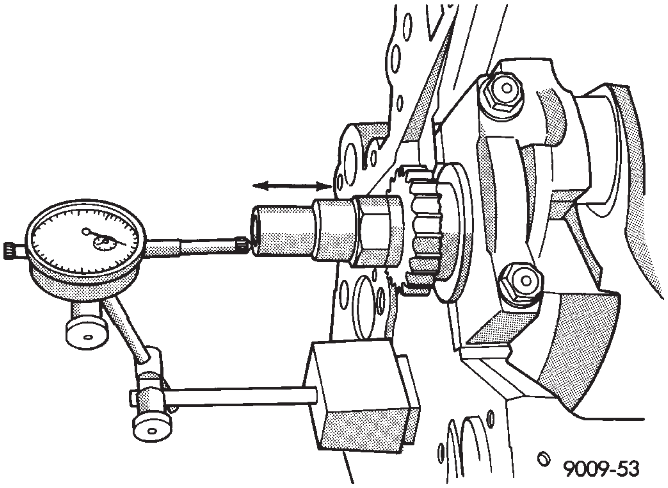
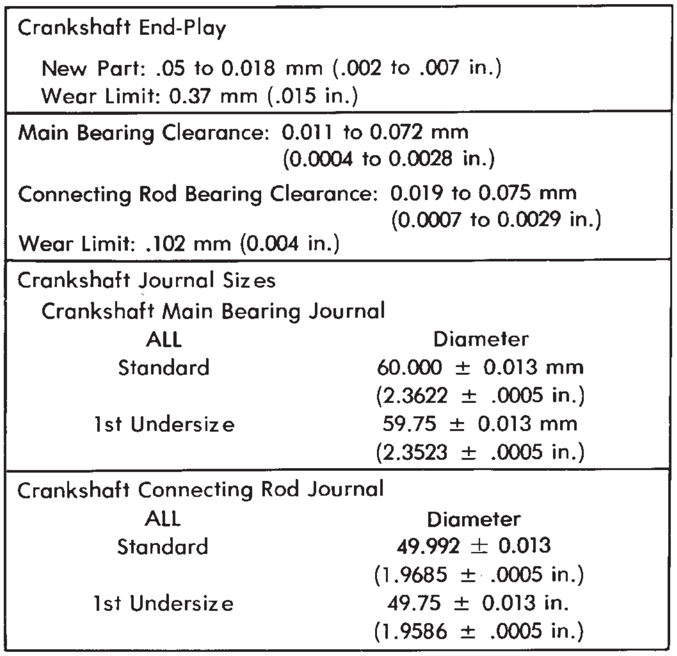


Fig. 9 Checking Crankshaft End Play

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.



Crankshaft End-Play	
New Part:	.05 to 0.018 mm (.002 to .007 in.)
Wear Limit:	0.37 mm (.015 in.)
Main Bearing Clearance:	0.011 to 0.072 mm (0.0004 to 0.0028 in.)
Connecting Rod Bearing Clearance:	0.019 to 0.075 mm (0.0007 to 0.0029 in.)
Wear Limit:	.102 mm (0.004 in.)
Crankshaft Journal Sizes	
Crankshaft Main Bearing Journal	
ALL	Diameter
Standard	60.000 ± 0.013 mm (2.3622 ± .0005 in.)
1st Undersize	59.75 ± 0.013 mm (2.3523 ± .0005 in.)
Crankshaft Connecting Rod Journal	
ALL	Diameter
Standard	49.992 ± 0.013 (1.9685 ± .0005 in.)
1st Undersize	49.75 ± 0.013 in. (1.9586 ± .0005 in.)

9209-141

Fig. 10 Crankshaft Specifications

CRANKSHAFT BEARING CLEARANCE

(1) Refer to Measuring Main, Connecting Rod Bearing Clearance in Standard Service Procedures. Refer to (Fig. 10) for specifications.

CAUTION: Do not rotate crankshaft or the Plastigage maybe smeared.

(2) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 12). **The 1, 2, 4 and 5 main bearings are full groove to provide full time oiling to the connecting rod. Only the number 3 is half-groove.**

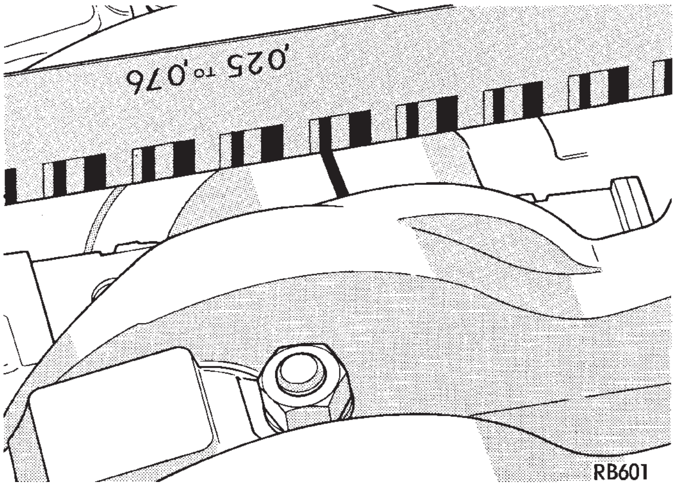


Fig. 11 Checking Crankshaft Oil Clearance with Plastigage

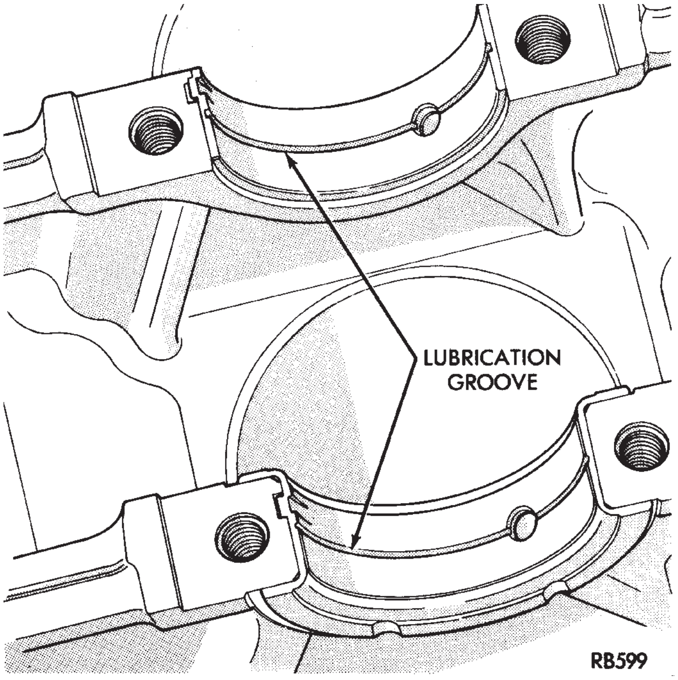


Fig. 12 Installing Main Bearing Upper Shell

(3) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

(4) Oil the bearings and journals and install crankshaft.

(5) Install main bearing cap No. 1 on timing belt end.

(6) Install main bearing cap No. 5 on transmission end.

Since the main bearing bolts are torqued using a new procedure they should be examined BEFORE reuse. If the threads are necked down the bolts should be replaced (Fig. 15).

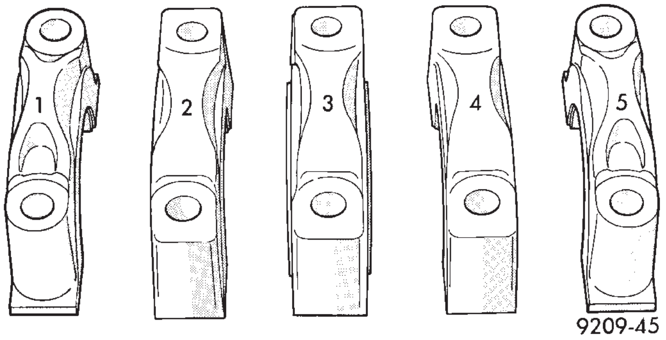


Fig. 13 Main Bearing Caps

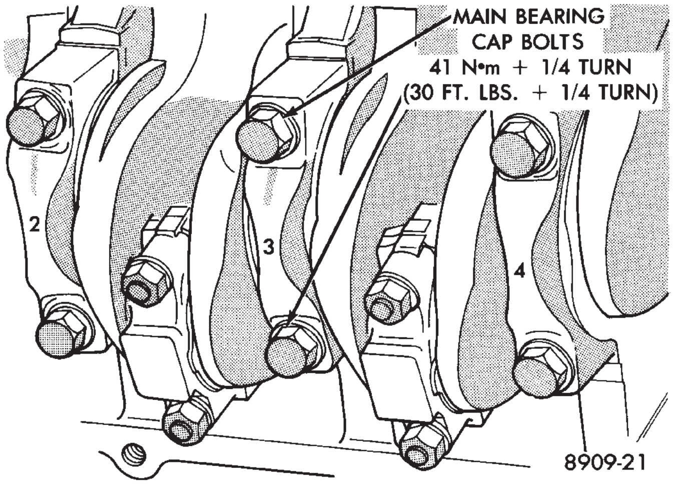


Fig. 14 Installing Main Bearing Caps

Necking can be checked by holding a scale or straight edge against the threads or by running a **M11 x 1.50 nut the full length of the thread. If all the threads do not contact the scale or if the nut does not run down smoothly the bolt should be replaced.**

(7) Before installing the bolts the threads should be oiled with engine oil.

(8) Install both bolts in each cap finger tight, then alternately torque each bolt to assemble the cap properly.

(9) Tighten the bolts to 41 N•m plus 1/4 turn (30 ft.lbs. plus 1/4 turn). (Fig. 14)

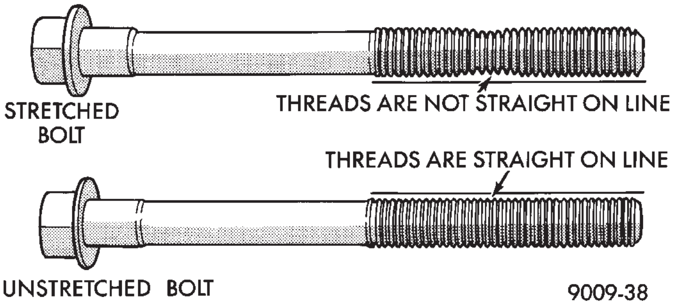


Fig. 15 Checking Bolts For Stretching (Necked down)

BALANCE SHAFTS

2.2L Turbo III and 2.5L engines are equipped with two counter rotating balance shafts installed in a carrier attached to the lower crankcase (Fig. 1).

The shafts are interconnected through gears. These gears are driven by a short chain from the crankshaft, to rotate at two times crankshaft speed. This counterbalances certain engine reciprocating forces.

REMOVAL

Refer to Engine Lubrication and Timing System and Seals Service of this group for removal procedure of necessary components to repair balance shafts.

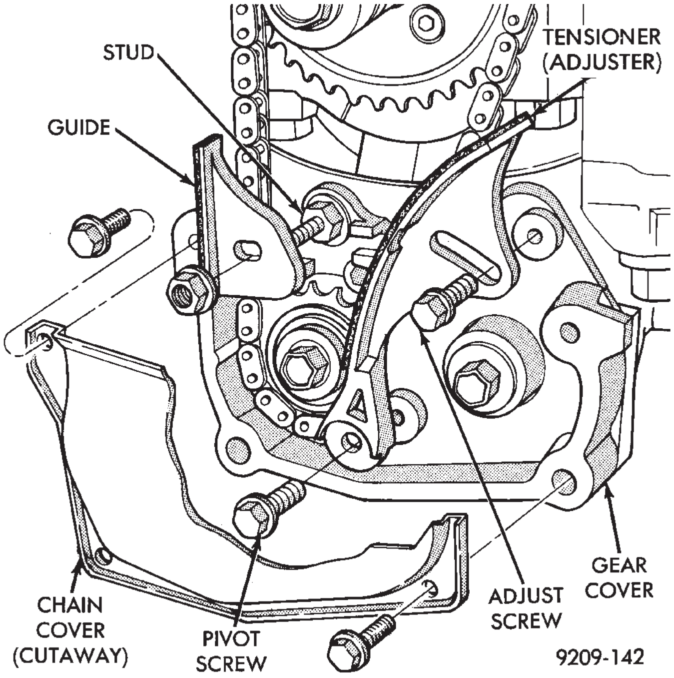


Fig. 16 Chain Cover, Guide and Tensioner

(1) Remove chain cover, guide and tensioner (Fig. 16). Also see Carrier Assembly Removal for service procedures requiring only temporary relocation of assembly.

(2) Remove balance shaft gear and chain sprocket retaining screws and crankshaft chain sprocket torx screws. Remove chain and sprocket assembly. (Fig. 17)

(3) Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears (Fig. 18).

(4) Remove carrier rear cover and balance shafts. (Fig. 19).

(5) Remove six carrier to crankcase attaching bolts to separate carrier (Fig. 1).

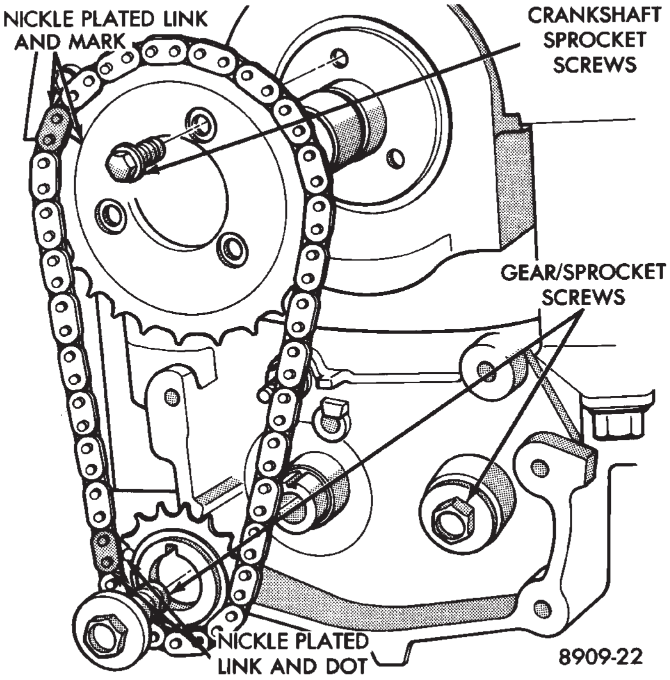


Fig. 17 Drive Chain and Sprockets

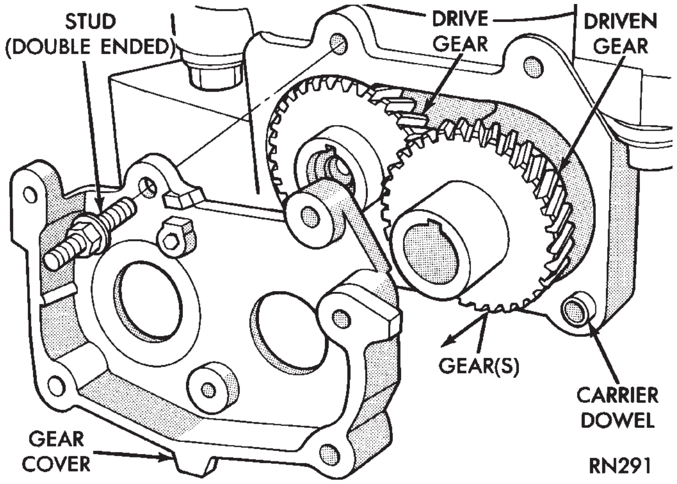


Fig. 18 Gear Cover and Gears

BALANCE SHAFTS CARRIER ASSEMBLY

REMOVAL

The following components will remain intact during carrier removal. Gear cover, gears, balance shafts and the rear cover.

(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.

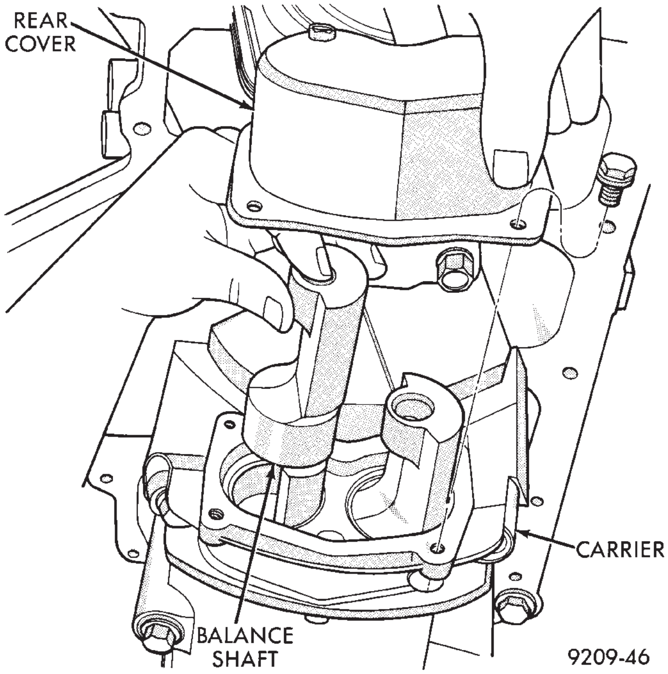


Fig. 19 Balance Shaft(s) Remove/Install

INSTALLATION

Balance shaft and carrier assembly installation is the reverse of the removal procedure. **During installation crankshaft to balance shaft timing must be established.**

TIMING

(1) With balance shafts installed in carrier (Fig. 19) position carrier on crankcase and install six 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. 20).

(3) Install gear cover and tighten double ended stud/washer fastener to 12 N●m (105 in. lbs.).

(4) Install crankshaft sprocket and tighten socket head torx screws to 13 N●m (130 in. lbs.).

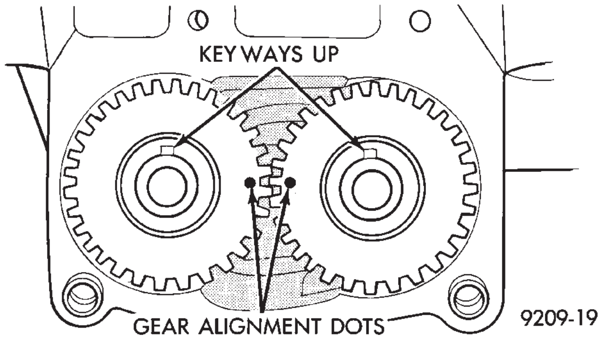


Fig. 20 Gear Timing

(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. 21).

(6) Place chain over crankshaft sprocket so that the nickel plated link of the chain is over the timing mark on the crankshaft sprocket (Fig. 21).

(7) Place balance shaft sprocket into the timing chain (Fig. 17) 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 of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance.

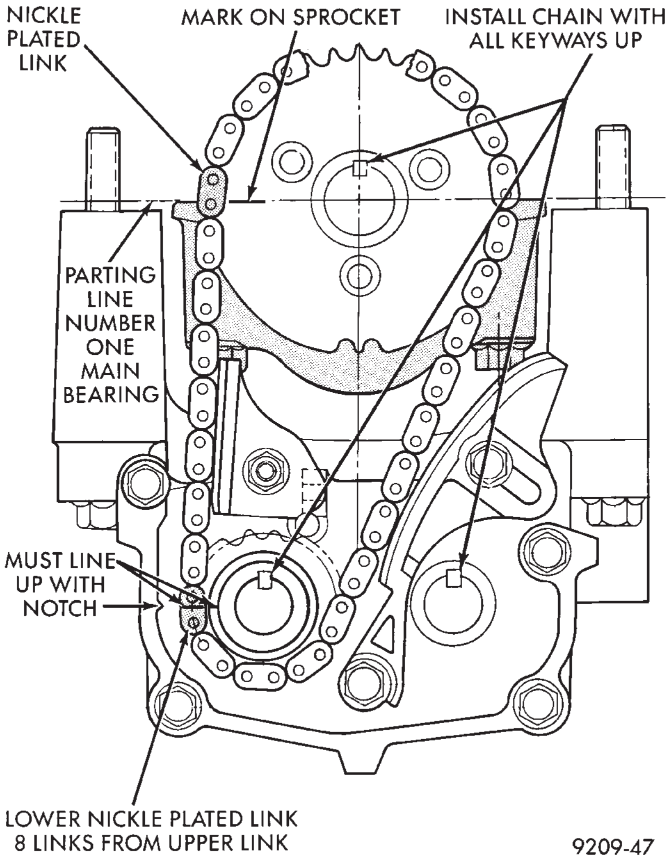


Fig. 21 Balance Shaft Timing

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 1mm (.039 inch) thick x 70mm (2.75 inch) 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. 22).

(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.).

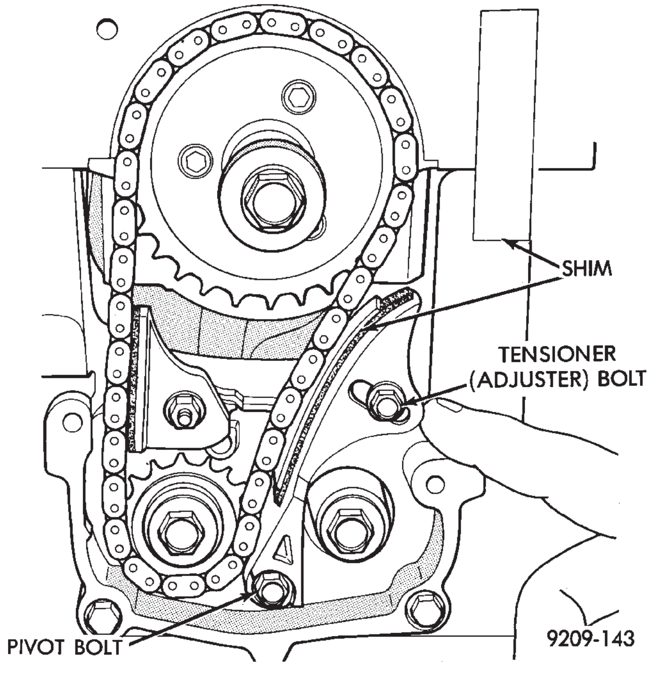


Fig. 22 Chain Tension Adjustment

INTERMEDIATE SHAFT SERVICE

REMOVAL

CAUTION: The oil pump and distributor must be removed before attempting to remove intermediate shaft.

(1) Hold sprocket with Tool C-4687 and adaptor Tool C-4687-1 when removing or installing screw (Fig. 23).

(2) See Timing System and Seals for intermediate seal removal and replacement.

(3) Remove retainer screws (Fig. 24).

(4) Remove retainer and lay aside.

(5) Remove intermediate shaft.

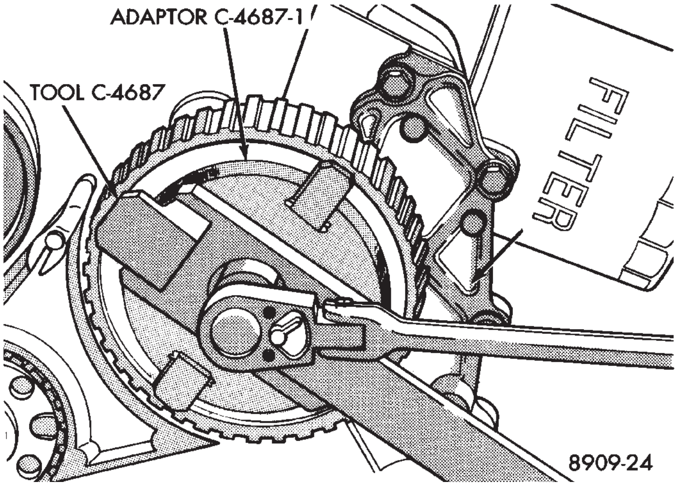


Fig. 23 Removing/Installing Intermediate Shaft Sprocket

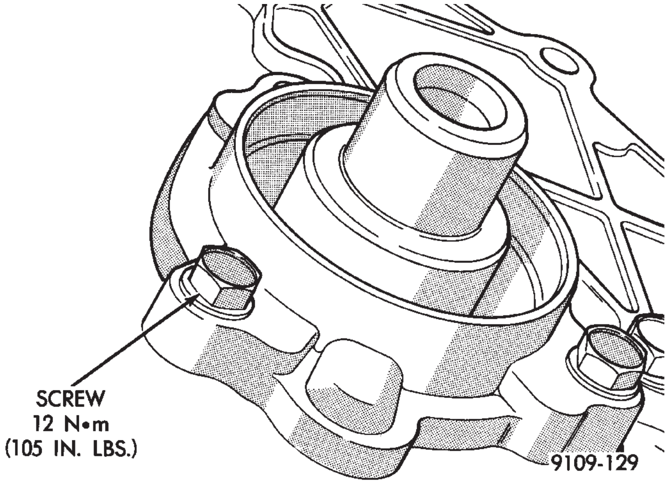


Fig. 24 Intermediate Shaft Retainer

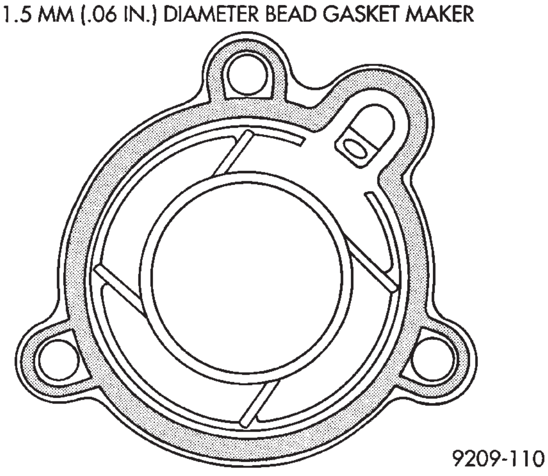


Fig. 25 Intermediate Shaft Retainer Sealing

INSTALLATION

(1) Lubricate distributor drive gear when installing.

(2) Apply Mopar Gasket Maker as shown in (Fig. 25) and install intermediate shaft retainer.

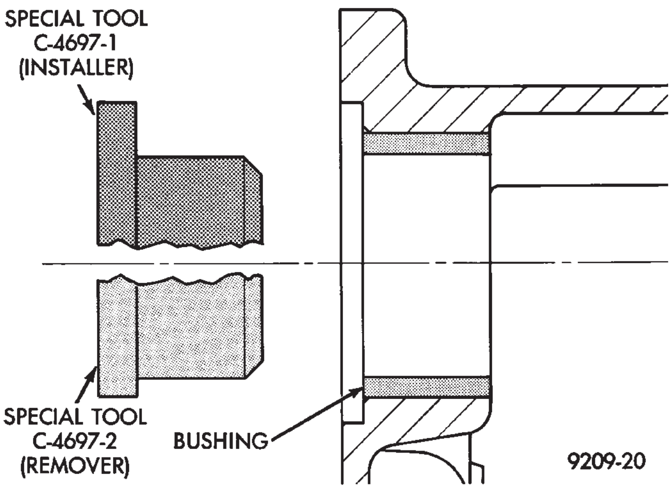


Fig. 26 Intermediate Shaft Bushing, Front

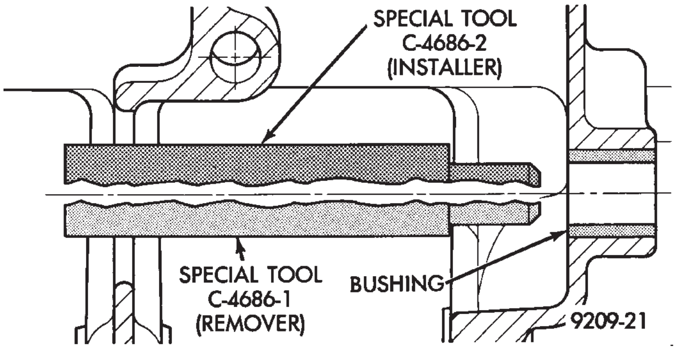


Fig. 27 Intermediate Shaft Bushing—Rear

Intermediate Shaft Journal and Bushing Sizes	
Intermediate Shaft	
Large Journal	42.670/42.703 mm (1.679/1.681 in.)
Small Journal	19.670/19.703 mm (.774/.776 in.)
Bushing-Bore Diameter	
Large Bushing	42.720/42.750 mm (1.682/1.683 in.)
Small Bushing	19.720/19.750 mm (.776/.777 in.)
Clearance Allowed	
Large	.017/.080 mm (.0006/.003 in.)
Small	.017/.080 mm (.0006/.003 in.)

9209-144

Fig. 28 Intermediate Shaft Journal Specifications

(3) Install retaining screws and torque to 12 N•m (105 in. lbs.).

INTERMEDIATE SHAFT BUSHING SERVICE

(1) Remove front bushing using Special Tool C-4697-2 with Special Tool Handle C-4171 (Fig. 26).

(2) Install front bushing using Special Tool C-4697-1 and Special Tool Handle C-4171 until tool is flush with block.

(3) Remove rear bushing using Special Tool C-4686-2 and Special Tool Handle C-4171 (Fig. 27).

(4) Install rear bushing using Special Tool C-4686-1 and Special Tool Handle C-4171 until tool is flush with block.

CYLINDER BLOCK, PISTON AND CONNECTING ROD ASSEMBLY SERVICE

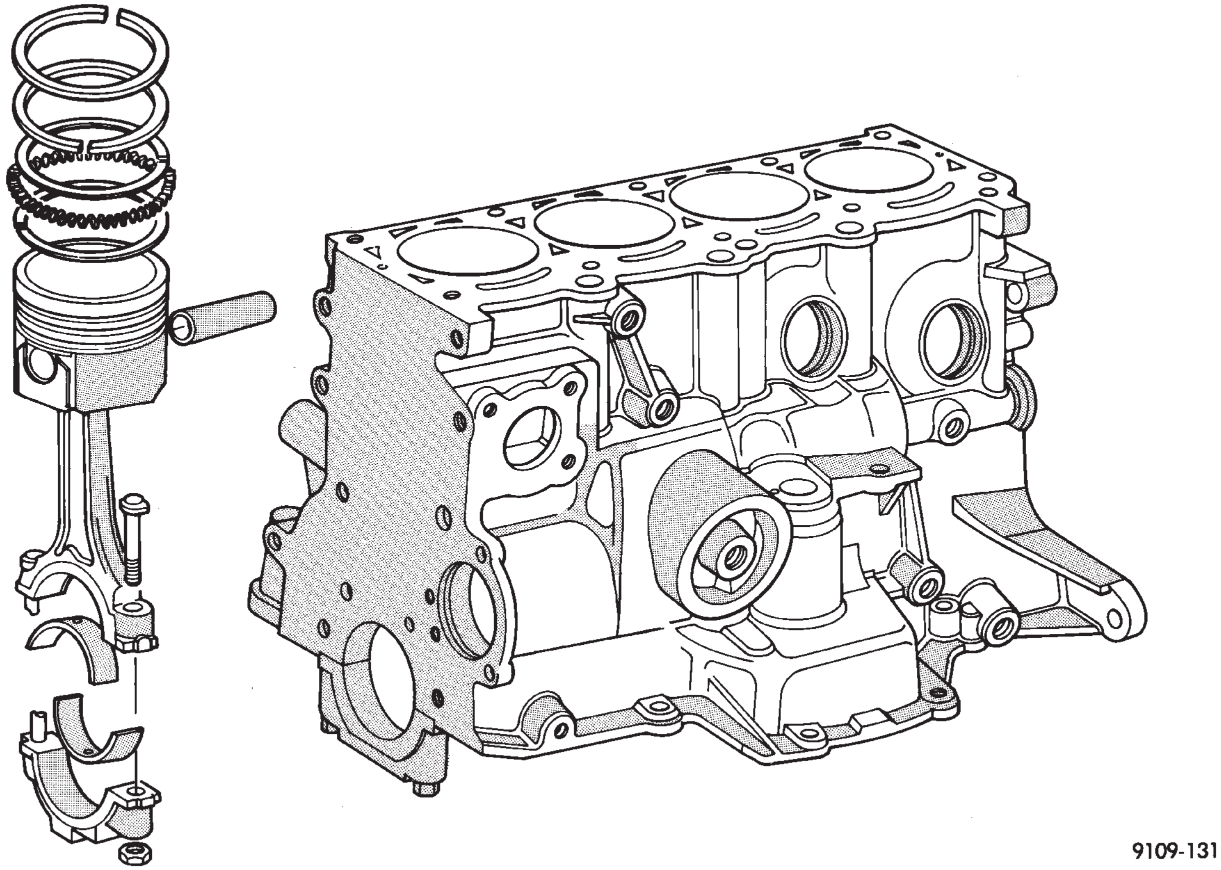


Fig. 1 Cylinder Block, Piston and Connecting Rod Assembly

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. 2).

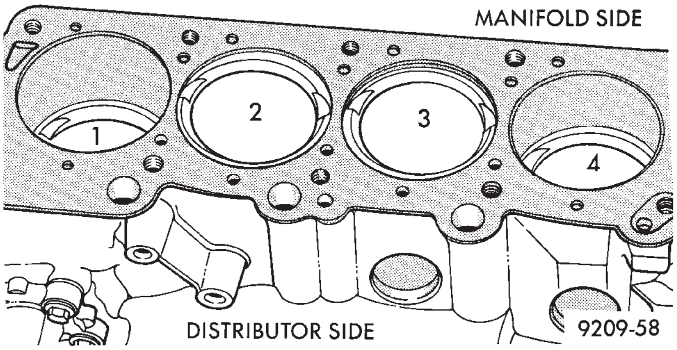


Fig. 2 Piston Marking

(2) Remove oil pan. Ensure connecting rods and connecting rod caps for cylinder identification. Identify them if necessary (Fig. 3).

(3) Valve relief toward manifold side of engine. Turbocharged engine pistons will have arrow towards **front** of engine.

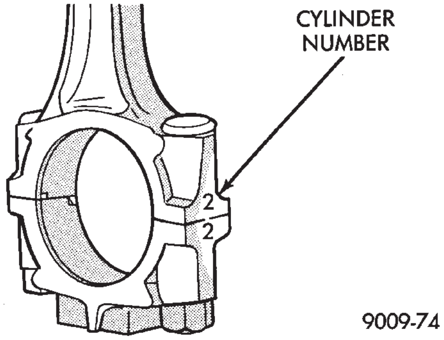


Fig. 3 Identify Connecting Rod to Cylinder

(4) Squirt hole on connecting rod must face timing belt end of engine.

(5) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(6) Remove connecting rod cap. Install connecting rod bolt protectors on connecting rod bolts (Fig. 4). Push each piston and rod assembly out of cylinder bore.

Be careful not to nick crankshaft journals.

(7) After removal, install bearing cap on the mating rod.

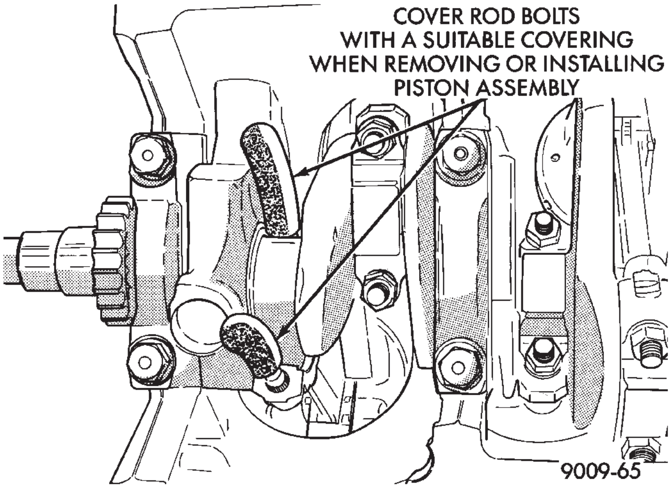


Fig. 4 Connecting Rod Protectors

CYLINDER BLOCK CLEANING AND INSPECTION

(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 Oil and Cam Plugs.

(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. 5). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is .125 mm (.005 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.**

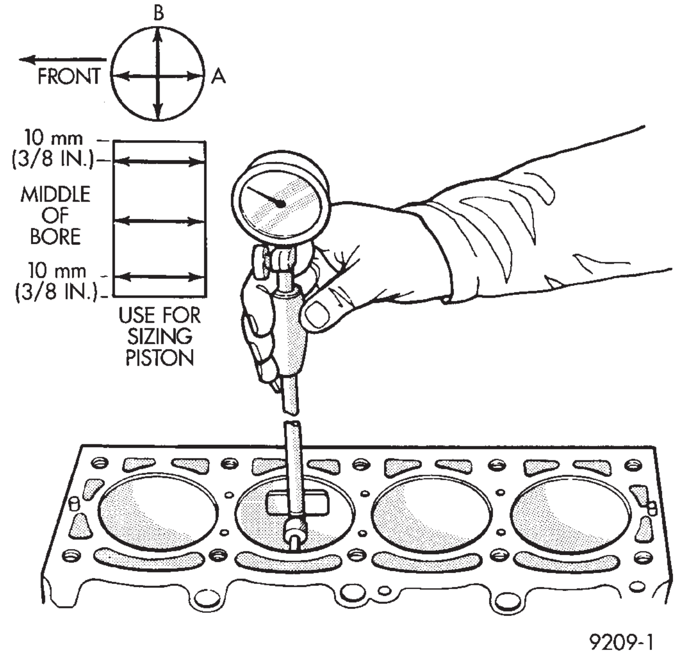
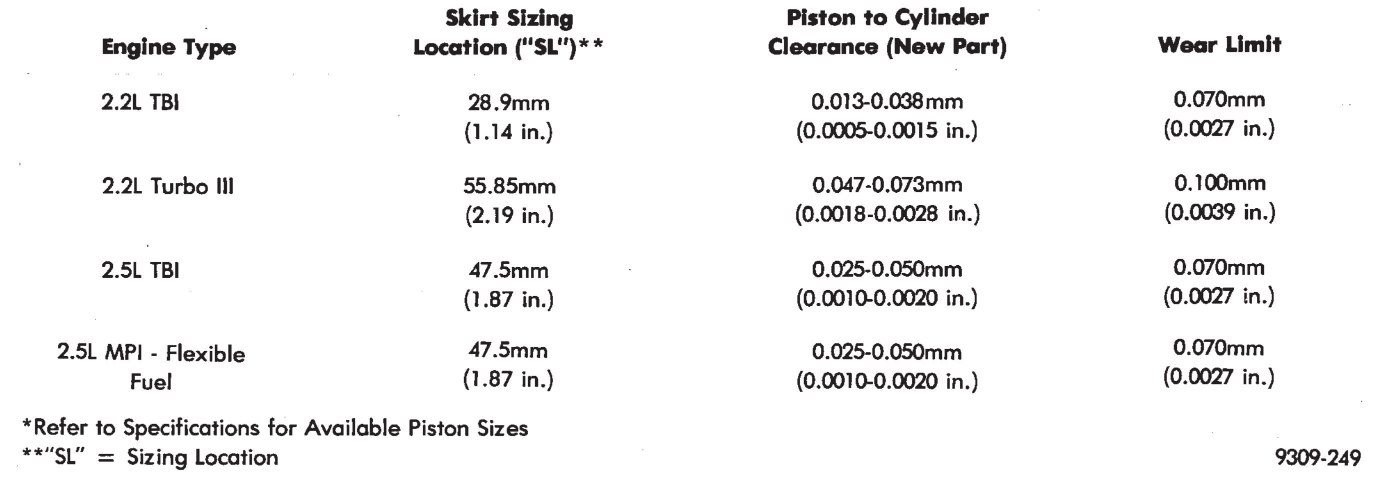


Fig. 5 Checking Cylinder Bore Size

Measure the cylinder bore at three levels in directions A and B (Fig. 5). Top measurement should be 10mm (3/8 inch) down and bottom measurement should be 10mm (3/8 inch.) up from bottom of bore. Refer to (Fig. 6) for specifications.

SIZING PISTONS

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. 7). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 5). Refer to (Fig. 6) for specifica-



Engine Type	Skirt Sizing Location ("SL")**	Piston to Cylinder Clearance (New Part)	Wear Limit
2.2L TBI	28.9mm (1.14 in.)	0.013-0.038mm (0.0005-0.0015 in.)	0.070mm (0.0027 in.)
2.2L Turbo III	55.85mm (2.19 in.)	0.047-0.073mm (0.0018-0.0028 in.)	0.100mm (0.0039 in.)
2.5L TBI	47.5mm (1.87 in.)	0.025-0.050mm (0.0010-0.0020 in.)	0.070mm (0.0027 in.)
2.5L MPI - Flexible Fuel	47.5mm (1.87 in.)	0.025-0.050mm (0.0010-0.0020 in.)	0.070mm (0.0027 in.)

*Refer to Specifications for Available Piston Sizes
**"SL" = Sizing Location

9309-249

Fig. 6 Piston Size Location and Clearance Chart

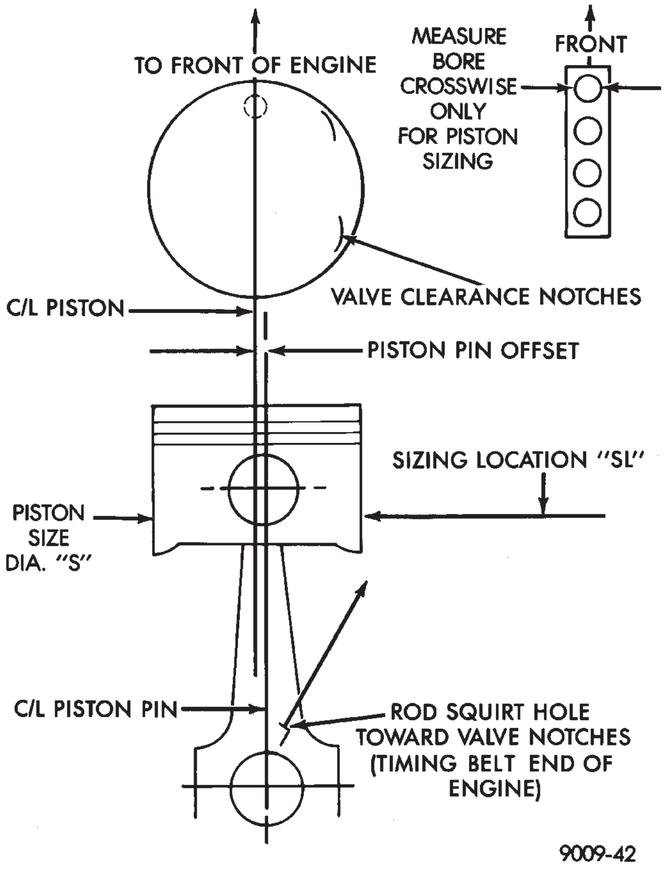


Fig. 7 Piston Installation and Sizing Information

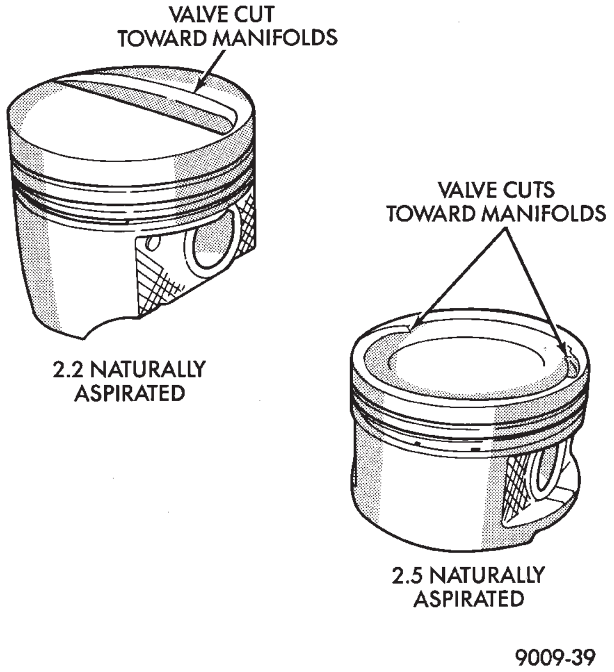


Fig. 8 N.A. (Naturally Aspirated) Pistons

tions. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

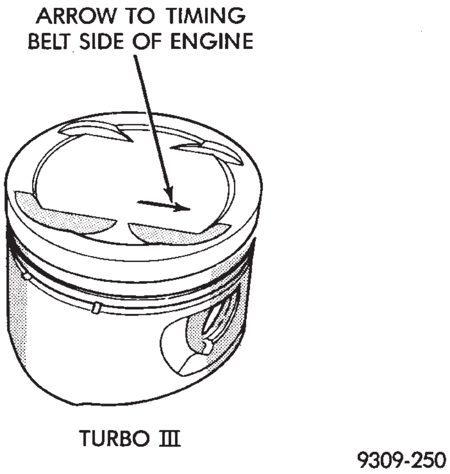


Fig. 9 2.2L Turbo III Piston

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

Pistons and cylinder bores should be measured at normal room temperature, 70°F. (21°C).

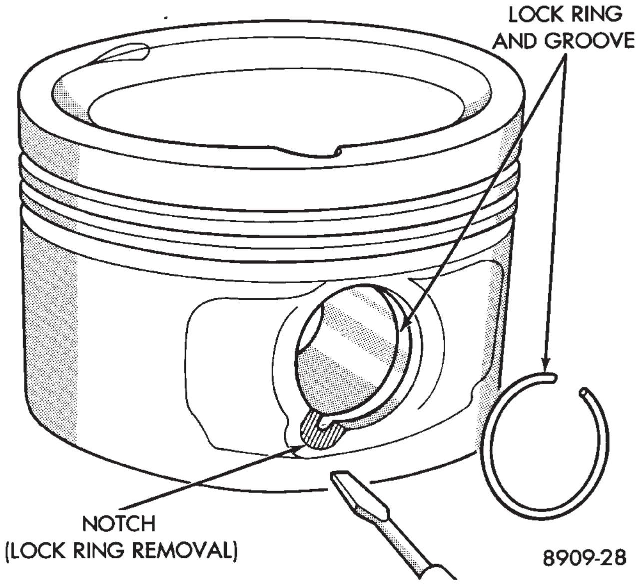


Fig. 10 Piston Pin Lock Ring Removal Notch—Turbo III Engine

PISTON PINS

DISASSEMBLY

Turbo III engine piston-pin-connecting rod assemblies should not be disassembled unless a malfunction is present or a damaged assembly component is to be replaced.

WARNING: APPROVED SAFETY GLASSES MUST BE WORN DURING PISTON LOCK RING REMOVAL OR INSTALLATION TO PREVENT POSSIBLE INJURY FROM FLYING PARTS.

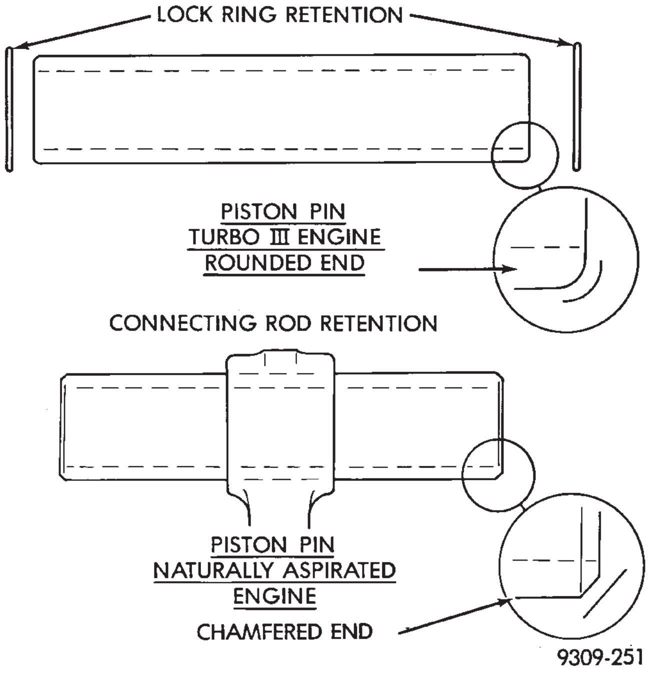


Fig. 11 Engine Piston Pins—Turbo III, Naturally Aspirated and Flexible Fuel Vehicles

(1) Carefully, remove piston pin lock rings from piston, using a small screwdriver in removal notch (Fig. 10).

(2) Discard used lock ring.

(3) Following lock ring removal, attempt to slide pin out of piston. If pin does not slide out freely by hand;

- Check for burr on outer edge of lock ring groove. If one is present, carefully scrape burr away with a knife or other hand tool, being careful not to damage lock ring retaining groove.

(4) Slide out piston pin to complete disassembly.

(5) Inspect components, discard damaged or excessively worn parts refer to specifications (Fig. 12). If a piston is replaced, a new pin should be used.

PISTON PINS

REASSEMBLY

(1) Different lock rings are used for turbocharged engine applications. Consult the Service Note, provided with the lock ring service package, to select the correct lock rings from the package for your application.

(2) Carefully, install one **NEW** lock ring with gap towards piston top in lock ring groove. Do not reinstall used lock rings.

(3) Position connecting rod and slide in lightly oil piston pinch

(4) Install second **NEW** lock ring with gap towards piston top in lock ring groove, use small screwdriver if needed.

CAUTION: BOTH lock rings must be FULLY SEATED in lock ring grooves or engine failure will occur.

(5) Check piston pin end play pin movement between lock rings in assembly.

Piston Pin End Play	New Part	Wear Limit
Turbo III	0.04 - 1.02 mm (0.0015 - 0.040 in.)	1.20 mm (0.047 in.)

9309-252

Fig. 12 Piston Pin Specifications

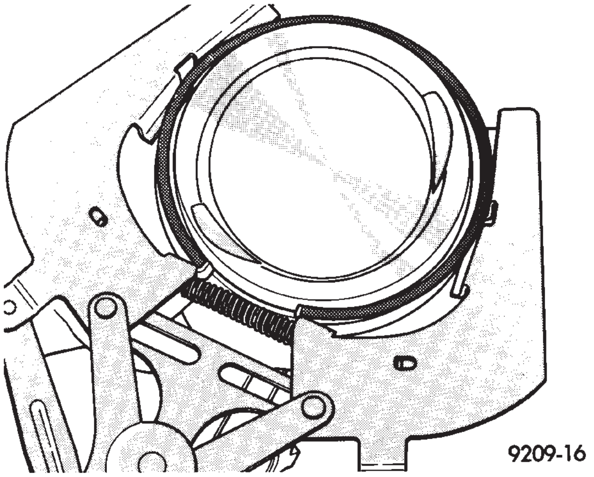


Fig. 13 Piston Rings—Removing and Installing

PISTON RING—REMOVAL

(1) 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. 13).

(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.

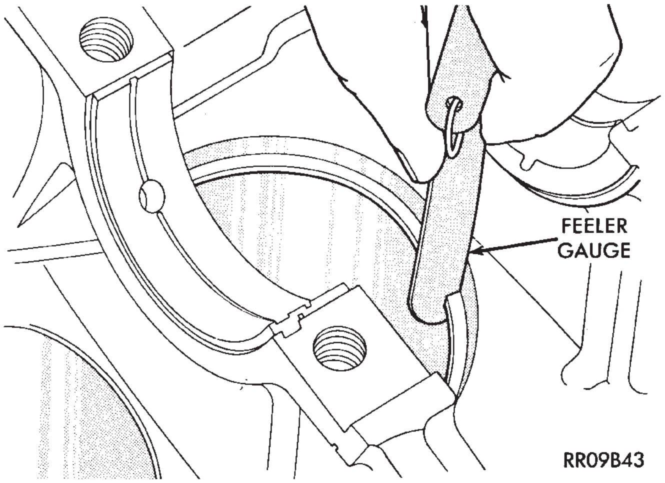


Fig. 14 Piston Ring Gap

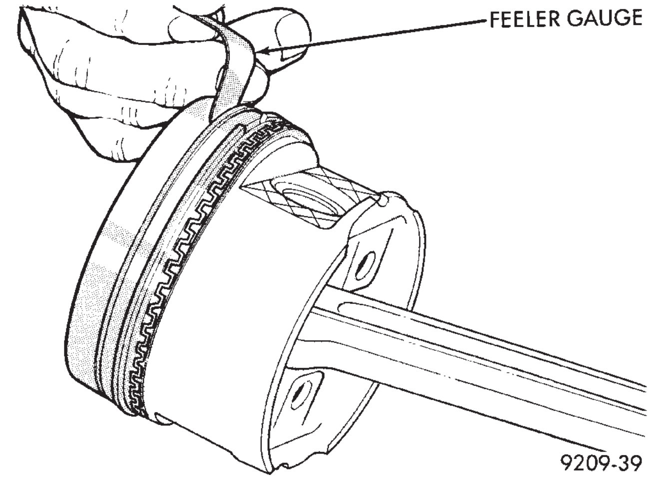


Fig. 15 Piston Ring Groove Clearance

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 12mm (.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 14). Refer to specifications (Fig. 16 and 17).

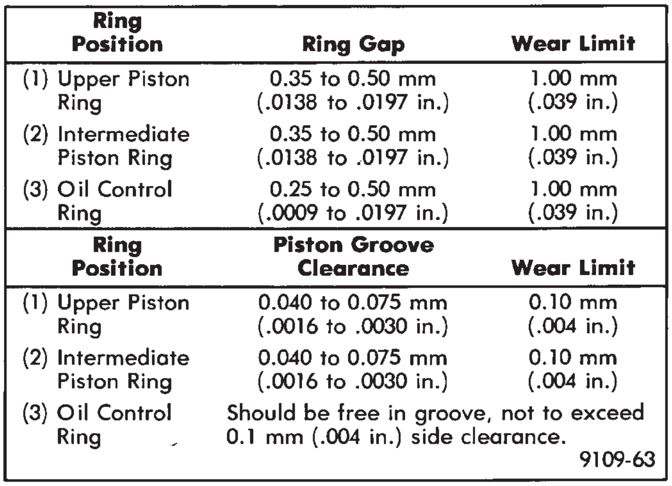
(2) Check piston ring to groove clearance: (Fig. 15). Refer to specification (Figs. 16 and 17).

PISTON RINGS—INSTALLATION

(1) The No. 1 and No. 2 piston rings have a different cross section. Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 13).

CAUTION: Install piston rings in the following order:

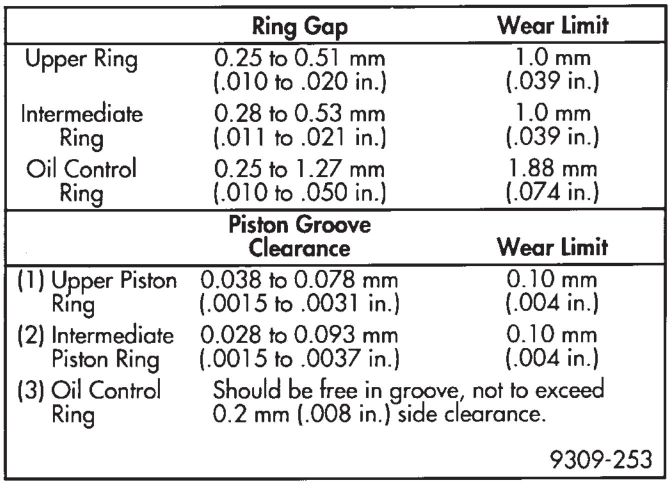
(a) Oil ring expander.
(b) Upper oil ring side rail.
(c) Lower oil ring side rail.
(d) No. 2 Intermediate piston ring.
(e) No. 1 Upper piston ring.



Ring Position	Ring Gap	Wear Limit
(1) Upper Piston Ring	0.35 to 0.50 mm (.0138 to .0197 in.)	1.00 mm (.039 in.)
(2) Intermediate Piston Ring	0.35 to 0.50 mm (.0138 to .0197 in.)	1.00 mm (.039 in.)
(3) Oil Control Ring	0.25 to 0.50 mm (.0009 to .0197 in.)	1.00 mm (.039 in.)
Ring Position	**Piston Groove Clearance**	**Wear Limit**
(1) Upper Piston Ring	0.040 to 0.075 mm (.0016 to .0030 in.)	0.10 mm (.004 in.)
(2) Intermediate Piston Ring	0.040 to 0.075 mm (.0016 to .0030 in.)	0.10 mm (.004 in.)
(3) Oil Control Ring	Should be free in groove, not to exceed 0.1 mm (.004 in.) side clearance.	

9109-63

Fig. 16 Piston Ring Specifications—Turbo III



	Ring Gap	Wear Limit
Upper Ring	0.25 to 0.51 mm (.010 to .020 in.)	1.0 mm (.039 in.)
Intermediate Ring	0.28 to 0.53 mm (.011 to .021 in.)	1.0 mm (.039 in.)
Oil Control Ring	0.25 to 1.27 mm (.010 to .050 in.)	1.88 mm (.074 in.)
	Piston Groove Clearance	**Wear Limit**
(1) Upper Piston Ring	0.038 to 0.078 mm (.0015 to .0031 in.)	0.10 mm (.004 in.)
(2) Intermediate Piston Ring	0.028 to 0.093 mm (.0015 to .0037 in.)	0.10 mm (.004 in.)
(3) Oil Control Ring	Should be free in groove, not to exceed 0.2 mm (.008 in.) side clearance.	

9309-253

Fig. 17 Piston Ring Specifications— Naturally Aspirated and Flexible Fuel Vehicles

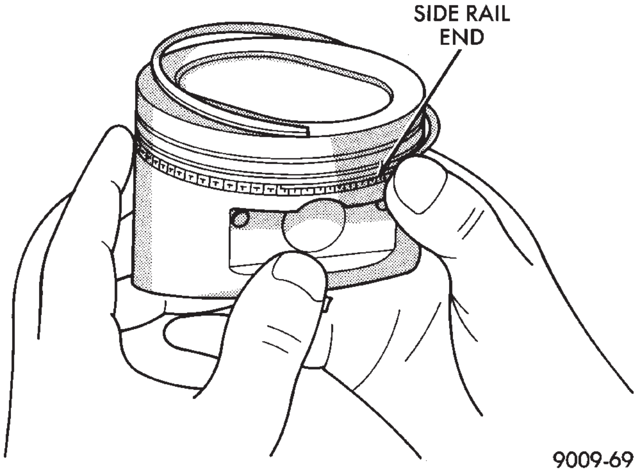


Fig. 18 Installing Side Rail

(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. 19).

(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. 8).

(5) Position piston ring end gaps as shown in (Fig. 19).

(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.

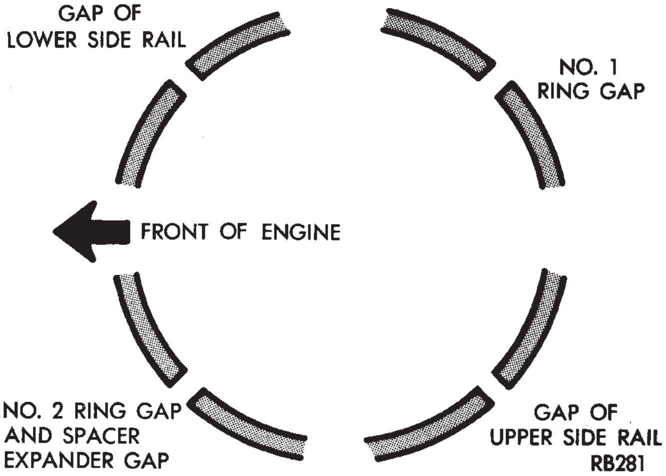


Fig. 19 Piston Ring End Gap Position

PISTON AND CONNECTING ROD ASSEMBLY INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, besure 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. 19).

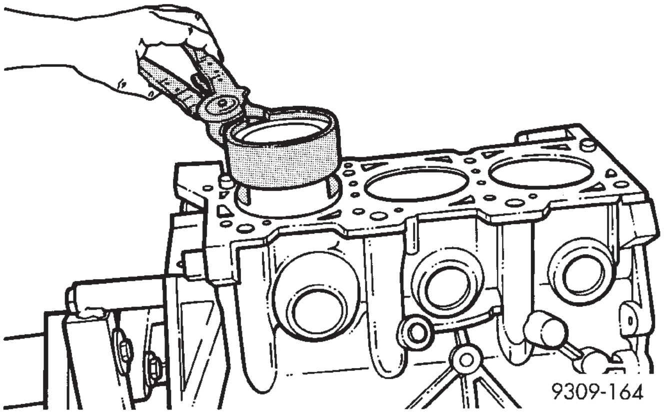


Fig. 20 Installing Piston

(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. 20). **Be sure position of rings does not change during this operation** .

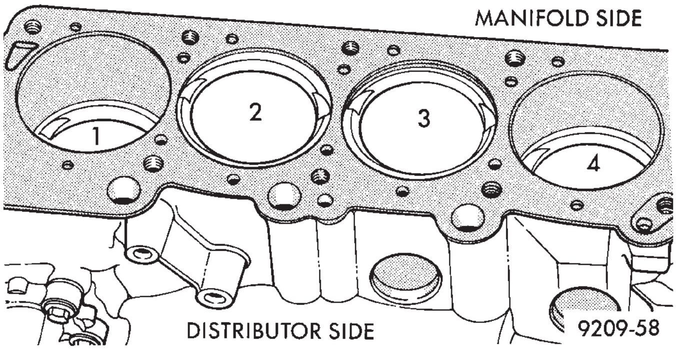


Fig. 21 Piston Markings

(4) The valve cut should be toward the manifold side of the engine (Fig. 21).

(5) Install connecting rod bolt protectors on rod bolts (Fig. 4).

(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.

(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 54 N●m (40 ft. lb.) Plus 1/4 turn for N/A engines and 68 N●m (50 ft. lbs.) for turbo III engines.

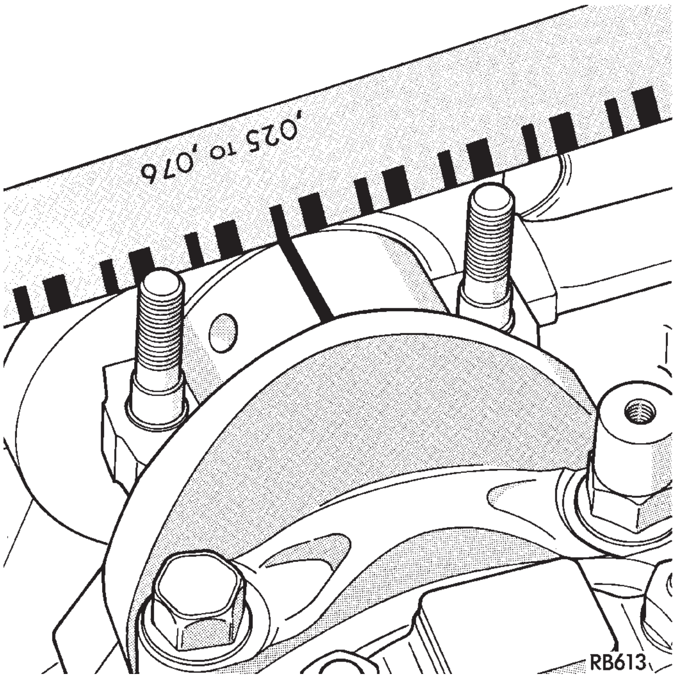


Fig. 22 Checking Connecting Rod Bearing Clearance

CONNECTING RODS

(1) Follow procedure specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 22). Refer to specifications (Fig. 25).

CAUTION: Do not rotate crankshaft or the Plastic-Gage may be smeared.

The rod bearing bolts should be examined before reuse. If the threads are necked down the bolts should be replaced (Fig. 23).

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.

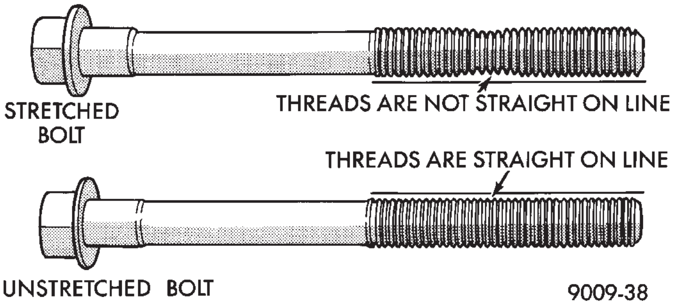


Fig. 23 Checking Bolts for Stretching (Necked)

(2) Before installing the nuts the threads should be oiled with engine oil.

(3) Install nuts on each bolt finger tight than 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) for N/A engines **Do not use a torque wrench for last step.** and 68 N•m (50 ft. lbs.) for Turbo III engines.

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 24). Refer to connecting rod specifications (Fig. 25).

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. 26). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 26).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

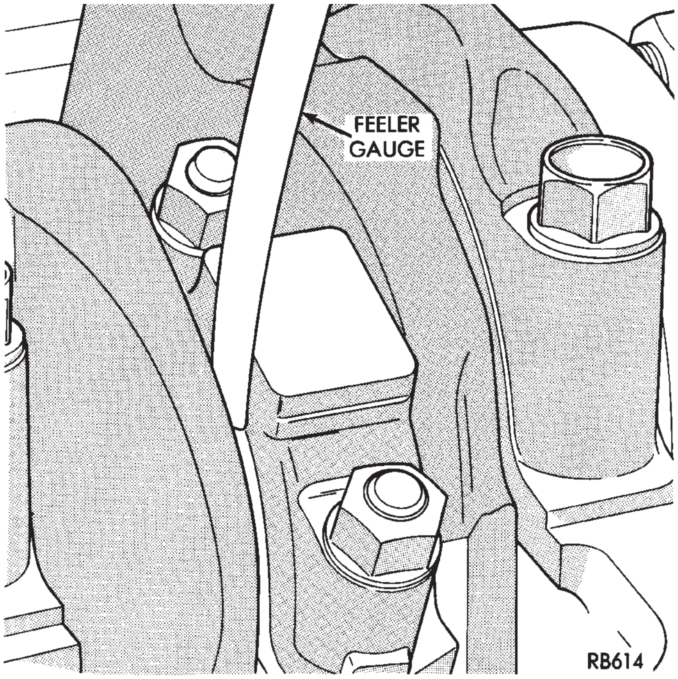


Fig. 24 Checking Connecting Rod Side Clearance

Connecting Rod Bearing Clearance	
New Part	.019 to .075 mm (.0008 to .0034 in.)
Wear Limit	.107 mm (.0042 in.)
Connecting Rod Side Clearance	
New Part	0.13 to 0.38 mm (.005 to .013 in.)
Wear Limit	0.37 (.015 in.)

9209-149

Fig. 25 Connecting Rod Specifications

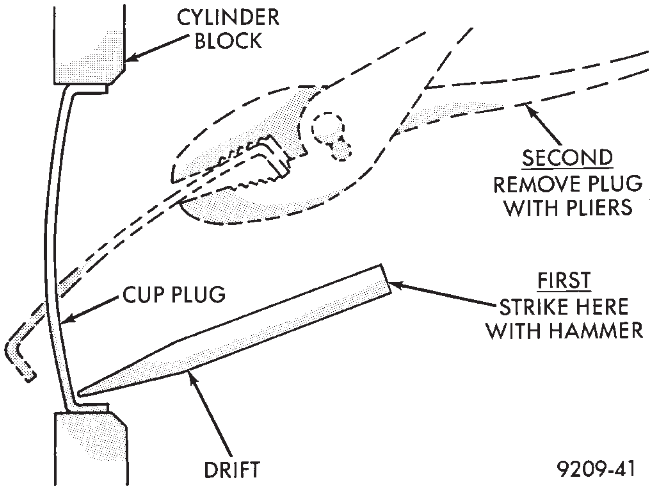


Fig. 26 Core Hole Plug Removal

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 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 0.5mm (.020 inch) inside the lead-in chamfer (Fig. 26).

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 LUBRICATION SYSTEM

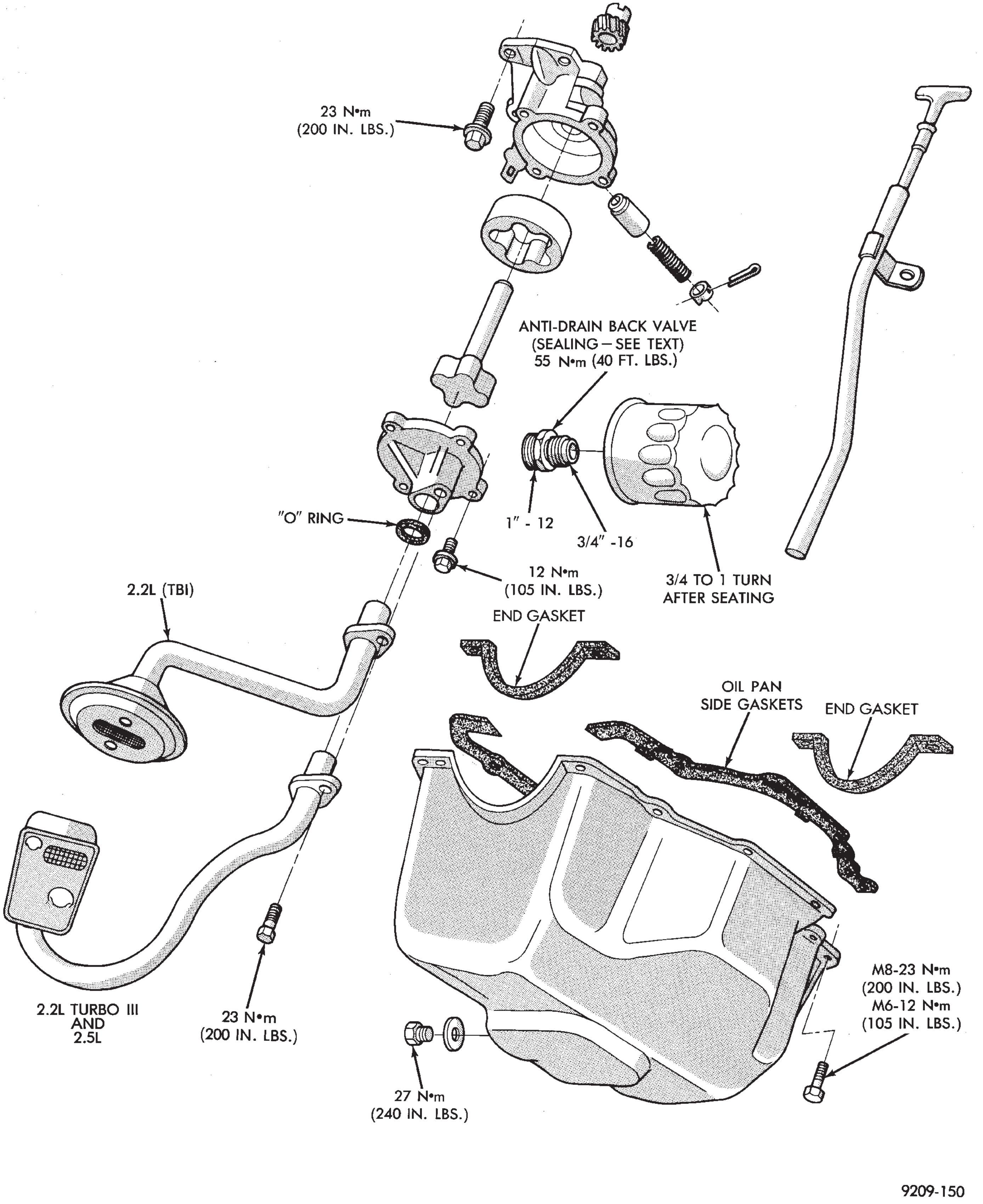


Fig. 1 Engine Lubrication Components

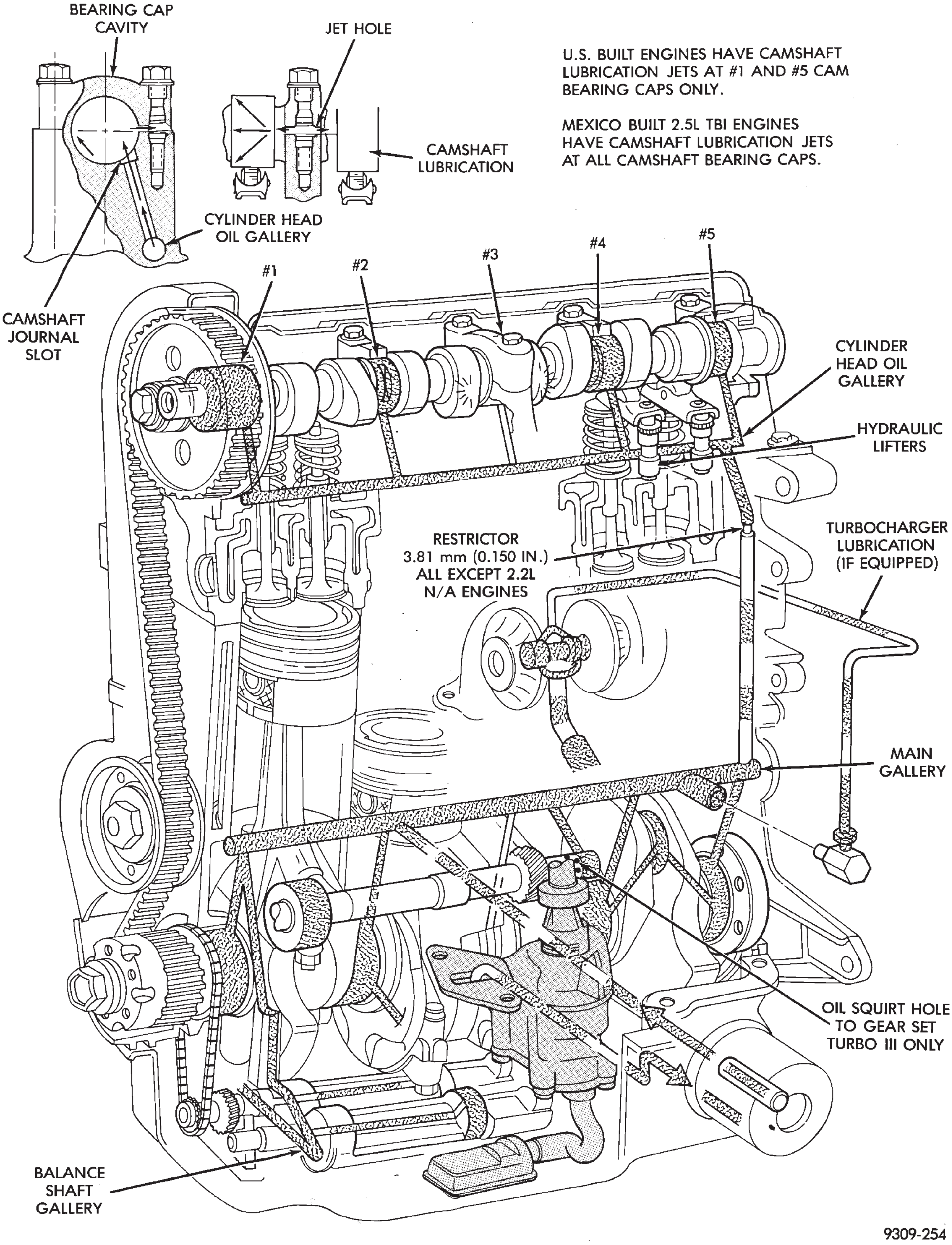


Fig. 2 Engine Lubrication System

OIL PAN

A formed steel oil pan provides lower engine protection as well as serving as the engine oil reservoir (Fig. 1). Pan side flanges to block are sealed with gaskets. The oil pickup tube for some 2.2L engines have a circular strainer and cover. The 2.5L engine pickup is also unsupported and the lower end has a box type strainer (Fig. 4).

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 (Fig. 2). Modified oil pickup, pump and check valve provide increased 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 crankpin journals.

ACCESSORY SHAFT

Two separate holes supply the accessory shaft for the N/A engines. For Turbo III engines there is a slot in the rear shaft bushing that squirts oil onto the oil pump drive gears (Fig. 2).

BALANCE SHAFTS

The engine balance shafts are lubricated by an additional hole that interconnects a passage in one leg of the balance shaft carrier to route oil down to the carrier oil gallery. This gallery directly supplies the balance shafts front bearings and internal machined passages in the shafts routes oil from front to rear shaft bearing journals.

TURBOCHARGER (WHERE EQUIPPED)

If turbocharger equipped, pressurized oil from the main gallery to sending unit hex fitting is piped from the fitting to the turbocharger bearing housing. From the housing a hose and tube connection to a machined hole in the block provides drainback.

CAMSHAFT/HYDRAULIC LIFTERS

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. For 2.2/2.5L and 2.5L FFV engines hydraulic adjusters are supplied directly from this gallery while diagonal holes supply oil to the camshaft journals. 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. For Turbo III engines oil is supplied thru oil galleries in the head to the camshafts and rocker arm shafts which feed oil to the lash adjusters. Oil is feed thru the rocker arms to lubricate the rollers and the camshaft lobes.

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 holes in the connecting rods.

OIL PAN

REMOVAL

(1) Drain engine oil and remove oil pan.

(2) Clean oil pan and all gasket surfaces.

OIL PAN RAIL TO BLOCK SEALING

For all engines side gaskets (Fig. 1) are employed for rail sealing.

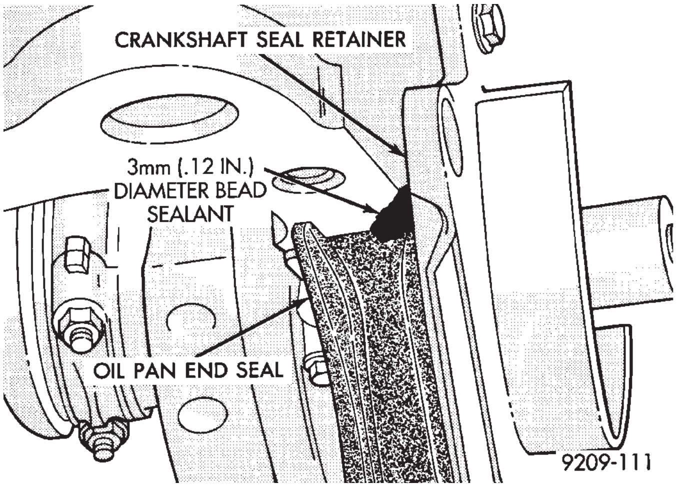


Fig. 3 Sealing, Front and Rear End Seals

INSTALLATION

(1) Apply Mopar Silicone Rubber Adhesive Sealant or equivalent at the front seal retainer parting line (Fig. 3).

(2) Install the oil pan side gaskets to the block. Use heavy grease or Mopar Silicone Rubber Adhesive Sealant or equivalent to hold in place.

(3) Apply Mopar Silicone Rubber Adhesive Sealant or equivalent to ends of new oil pan end seals at junction of cylinder block pan rail gasket (Fig. 3).

(4) Install pan and tighten to (12) M8 screws to 23 N●m (200 in. lbs.) and 1 M6 screws to 12 N●m (105 in. lbs.).

OIL PUMP SERVICE

OIL PICKUP

(1) Remove screw on pump cover holding oil pick-up tube to oil pump (Fig. 4).

(2) Remove oil pick-up tube. **When reinstalling make sure to use a new O-Ring on pickup tube**.

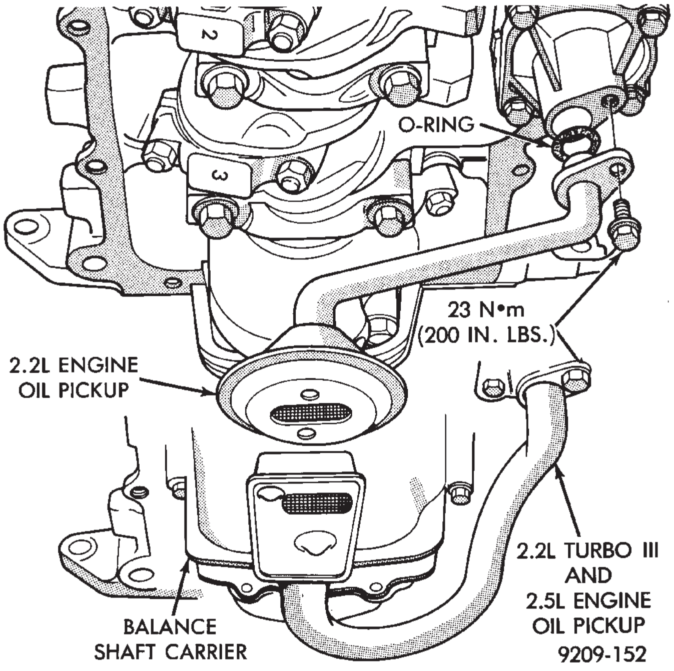


Fig. 4 Oil Pick-Up

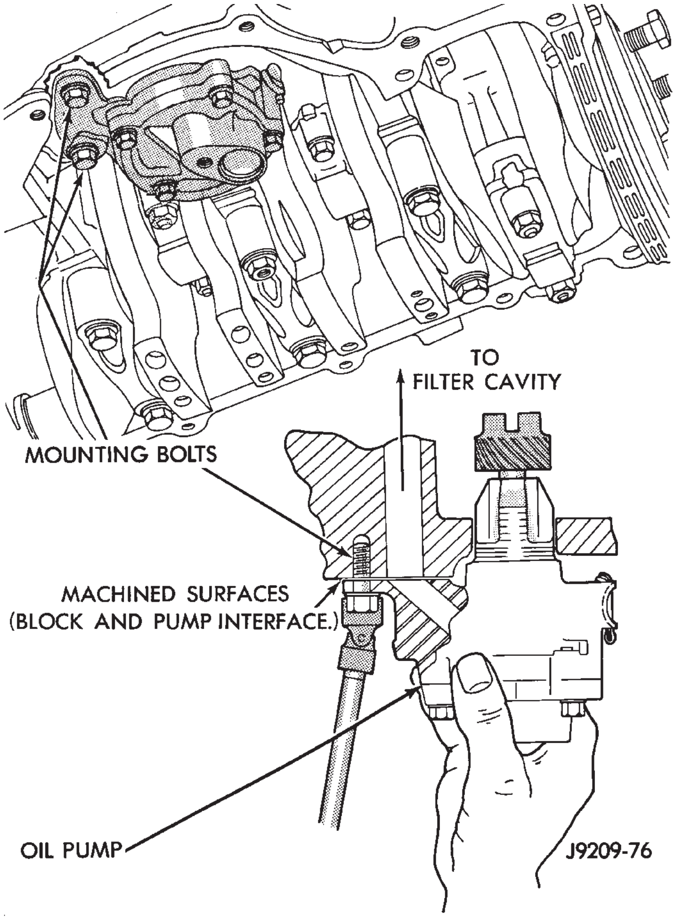


Fig. 5 Oil Pump Assembly

OIL PUMP

REMOVAL

(1) Remove two (2) screws holding oil pump to cylinder block assembly (Fig. 5).

INSTALLATION

(1) Apply Mopar Gasket Maker to pump body-to-block interface (machined surface).

(2) Lubricate oil pump rotor & shaft and drive gear.

(3) Turn crankshaft and intermediate shaft until markings on sprockets are in line (arrows Fig. 6).

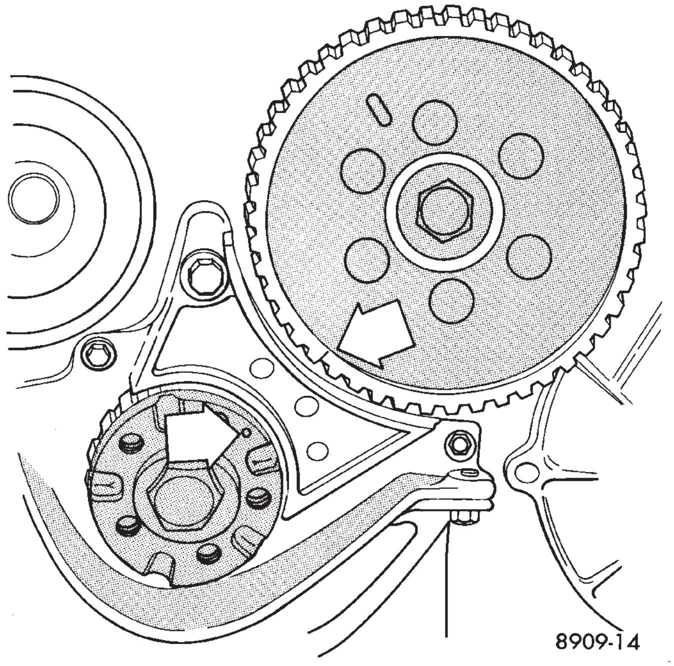


Fig. 6 Crankshaft and Intermediate Shaft Timing

(4) Slot in oil pump shaft **must** be parallel to center line of crankshaft when intermediate shaft and crankshaft are properly timed (Fig. 7).

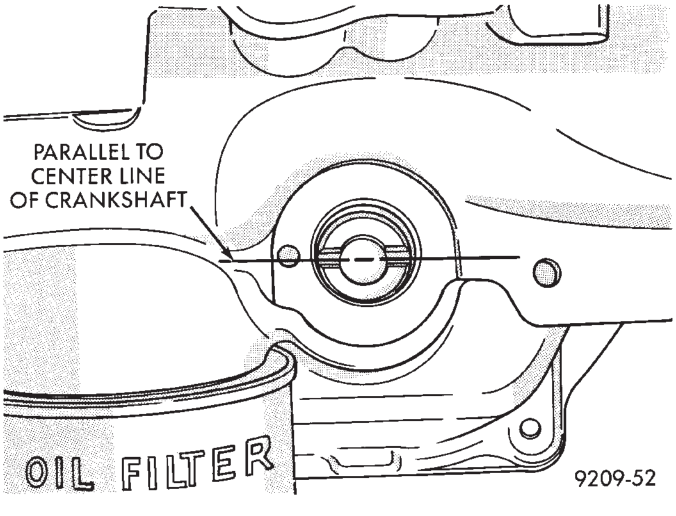


Fig. 7 Oil Pump Shaft Alignment

(5) Install pump full depth and rotate back and forth slightly to ensure proper positioning and alignment through full surface contact of pump and block machined interface surfaces (Fig. 5).

CAUTION: Pump must be held in fully seated position (described above) while installing screws.

(6) Tighten screws to 23 N●m (200 in. lbs.).

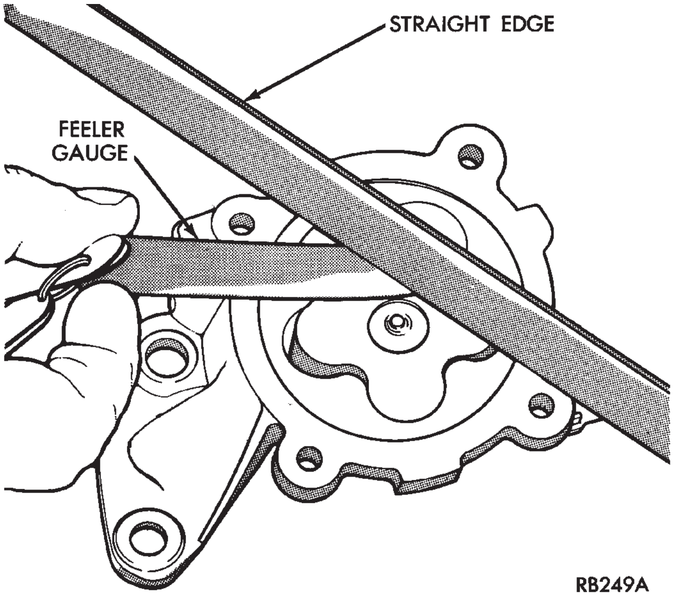


Fig. 8 Checking Rotor End Clearance

INSPECTION

(1) Check rotor end clearance with feeler gauge as shown in (Fig. 8).

(2) Limits:

- 0.03mm (.001 inch) minimum.
- 0.09mm (.0035 inch) maximum.

(3) Thickness: 23.96mm (.9435 inch) minimum. Outer Diameter: 62.7mm (2.469 inch) minimum (Fig. 9).

(4) Install with large chamfered edge in pump body (Fig. 9).

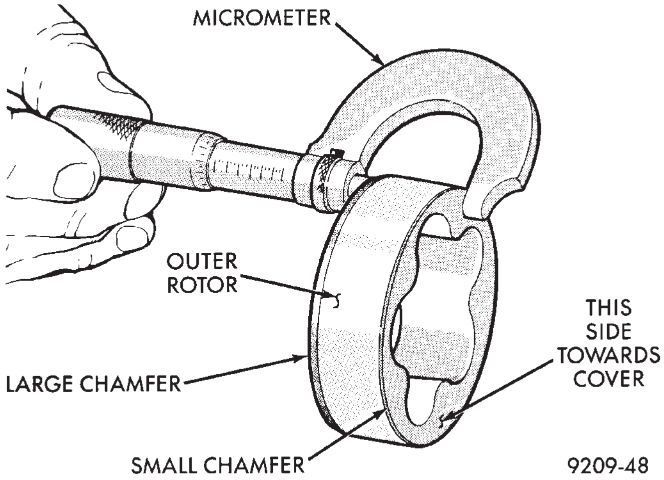


Fig. 9 Measuring Outer Rotor

Clearance: 0.20mm (.008 inch) maximum (Fig. 10).

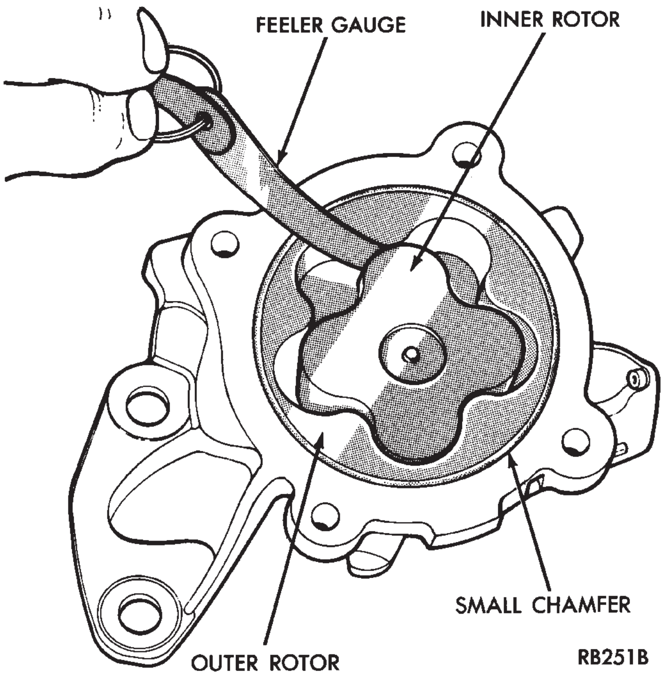


Fig. 10 Clearance Between Rotors

Clearance: 0.35mm (.014 inch) maximum (Fig. 11).

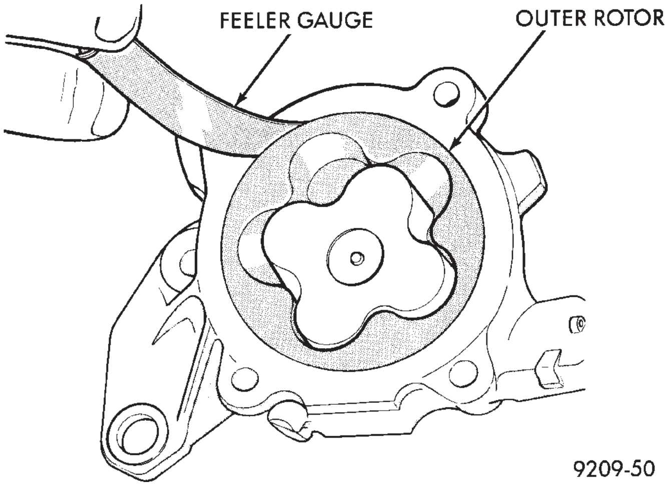


Fig. 11 Outer Rotor Clearance

Clearance: 0.076mm (.003 inch) maximum (Fig. 12).

Oil pressure relief valve spring: Free length: 49.5mm (1.95 inch). Load: 89 N at 34mm. Load: (20 lbs. at 1.34 inch) (Fig. 13).

Thickness: 23.96mm (.9435 inch) Minimum (Fig. 14).

CHECKING ENGINE OIL PRESSURE

(1) Remove pressure sending unit and install Special Tool S-94 with gauge assembly C-3292 (Fig. 15).

(2) Warm engine at high idle until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM

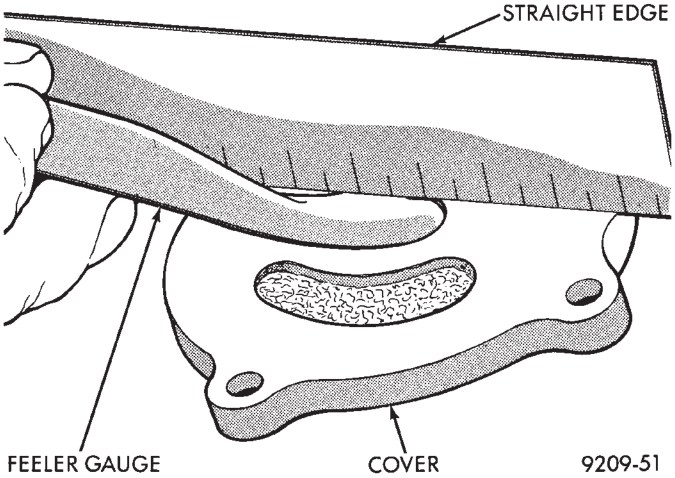


Fig. 12 Oil Pump Cover

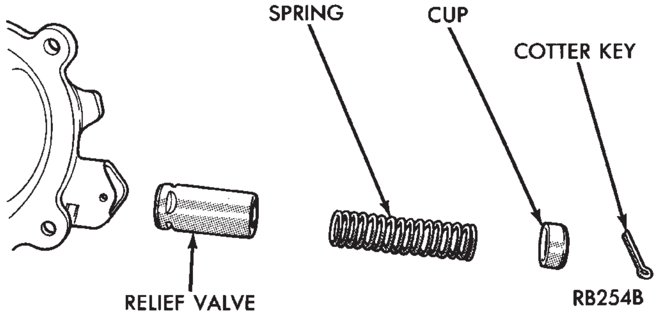


Fig. 13 Oil Pressure Relief Valve

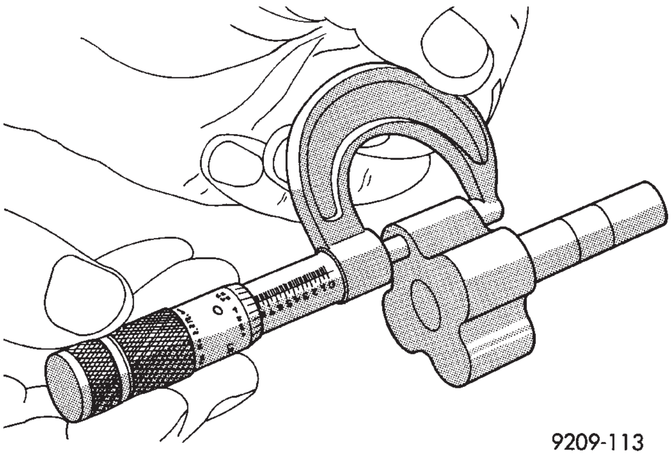


Fig. 14 Measuring Inner Rotor Thickness

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170-550 kPa (25-80 psi).

OIL FILTER

ANTI-DRAIN BACK VALVE

Installation: Apply liquid (Teflon Type) sealant to valve-to-block threads (Fig. 16). Tighten assembly to 55 N•m (40 ft. lbs.).

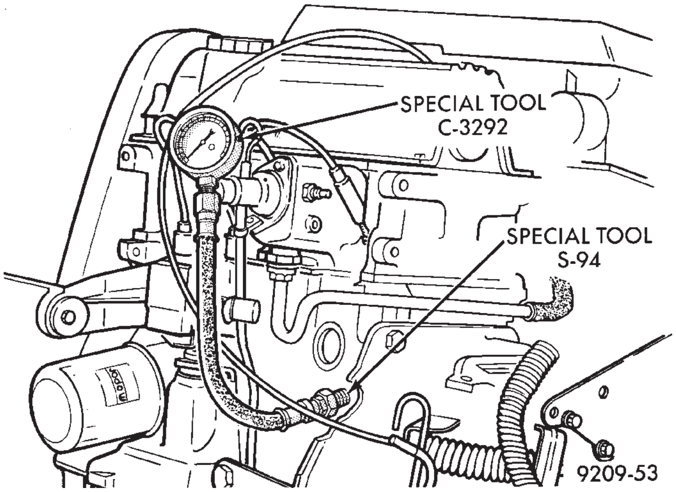


Fig. 15 Checking Oil Pump Pressure—Typical

FILTER

CAUTION: When servicing the oil filter (Fig. 16) avoid deforming the filter can by installing the remove/install tool band strap against the can-to-base lockseam. The lockseam joining the can to the base is reinforced by the base plate.

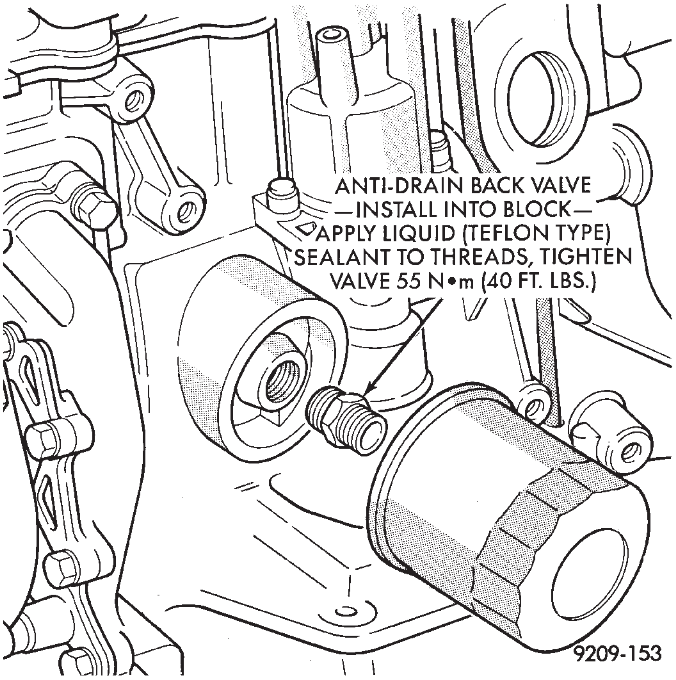


Fig. 16 Engine Oil Filter and Antidrain Back Valve

(1) Turn counter clockwise 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 gasket contacts base. Tighten to 3/4 to 1 turn.

ENGINE SPECIFICATIONS

	2..2L STANDARD	**2.2L TURBO III**	**2.5L STANDARD AND 2.5L SMPI FLEXIBLE FUEL**
Type	In-line OHV, SOHC	DOHC	SOHC
Number of Cylinders	4	*	*
Bore	87.5mm (3.4441/3.4456 in.)	*	* *
Stroke	92mm (3.62 in.)	*	104mm (4.09 in.)
Compression Ratio (Nominal)	9.5:1	8.1:1	8.9:1
Firing Order	1-3-4-2	*	*
Basic Ignition Timing	Refer to Emission Control Information Label on Vehicle		
Valve Timing			
Intake Valve			
Opens (BTDC)	0°	—	4°
Opens (ATDC)	—	25°	—
Closes (ABDC)	56°	35°	60°
Exhaust Valve			
Opens (BBDC)	44°	16°	40°
Closes (ATDC)	8°	7.5°	12°
Valve Overlap	8°		8°
Intake Valve Duration	236°		236°
Exhaust Valve Duration	232°		232°

*Same as STANDARD

DESCRIPTION	**STANDARD DIMENSION**	**SERVICE LIMIT**
Compression Pressure	—	Minimum 689.5 kPa (100 psi)
Maximum Variation Between Cylinders	—	25%
Valve Clearance — Hot Engine	Hydraulic Lash Adjusters	
Flatness of Cylinder Head Gasket Surface	0.1mm (0.004 in.)	
Cylinder Head Gasket (Thickness Compressed)	1.73mm (0.068 in.)	
Camshaft:		
Journal Diameter 2.2/2.5L	34.939/34.960mm (1.395/1.396 in.)	
Oversize 2.2/2.5L	35.439/35.460mm (1.395/1.396 in.)	
Turbo III Journal Diameter	47.925/47.950mm (1.886/1.887 in.)	
Cam Lobe Wear (all)		0.25mm (0.010 in.)
End Play 2.2/2.5L	0.13/0.33mm (0.005/0.013 in.)	0.25mm (0.010 in.)
Turbo III	0.025/0.200mm (0.001/0.008 in.)	0.50mm (0.020 in.)
Valve Margin:		
Intake 2.2/2.5L	1.5mm (0.060 in.)	0.793mm (0.030 in.)
Exhaust 2.2/2.5L	1.5mm (0.060 in.)	1.19mm (0.050 in.)
Turbo III		
Intake	1.06mm (0.041 in.)	
Exhaust	1.07mm (0.042 in.)	
Valve Stem-to-Guide Clearance:		
Intake	0.022/0.065mm (0.0009/0.0026 in.)	
Exhaust	0.076/0.119mm (0.003/0.0047 in.)	
Turbo III		
Intake	0.03/0.06mm (0.001/0.0023 in.)	0.1mm (0.004 in.)
Exhaust	0.05/0.08mm (0.002/0.0031 in.)	0.1mm (0.004 in.)
Valve Spring Free Length:		
2.2/2.5L	60.8mm (2.39 in.)	
Turbo III	53.2mm (2.094 in.)	
Valve Spring Load Intake and Exhaust:		
Valve Open at 31.00 mm (1.22 in.) all	890/961 N (195/215 lbs.)	
Turbo III at 34.20 mm (1-11/32 in.)	1133/1227 N (255/275 lbs.)	
Valve Closed at 41.90 mm (1.65 in.) all	480/534 N (108/120 lbs.)	
Turbo III at 44 mm (1.73 in.)	513/567 N (115/127 lbs.)	
Valve Spring Perpendicularity:		
Intake and Exhaust (all)	2.0mm (0.079 in.)	
Intake and Exhaust (Turbo III)	1.65mm (0.065 in.)	

*At minimum cranking speed (130 rpm) - starter speed, also See "ENGINE PERFORMANCE" in STANDARD SERVICE PROCEDURES.

9309-255

ENGINE SPECIFICATIONS (CONT.)

DESCRIPTION	STANDARD DIMENSION	SERVICE LIMIT
Intermediate Shaft:		
Large Journal Diameter	42.670/42.703mm (1.679/1.680 in.)	
Bushing (large) inside diameter	42.720/42.750mm (1.682/1.683 in.)	
Small Journal Diameter	19.670/19.703mm (0.774/0.775 in.)	
Bushing (small) inside diameter	19.720/19.750mm (0.776/0.777 in.)	
Piston Outside Diameter:	A thru E sizes	
2.2L Standard	87.442/87.507mm (3.443/3.445 in.)	
2.5L All	87.455/87.520mm (3.443/3.445 in.)	
2.2L Turbo III	87.407/87.472mm (3.441/3.444 in.)	
Piston Pin End Play		
Turbo III Engine Only	0.04/1.02mm (0.0015/0.040 in.)	1.20mm (0.047 in.)
Piston Rings		
Ring Side Clearance:		
No. 1 Ring - 2.2/2.5L		
Standard and Flexible Fuel	0.038/0.078mm (0.0015/0.0031 in.)	0.10mm (0.004 in.)
No. 2 Ring - 2.2/2.5L Standard	0.028/0.093mm (0.0015/0.0037 in.)	0.10mm (0.004 in.)
No. 2 Ring - Flexible Fuel	0.040/0.090mm (0.0016/0.0035 in.)	
Oil Control Ring (Except Turbo III)	0.000/0.2mm (0.000/0.008 in.)	
No. 1 Ring - Turbo III	0.040/0.075mm (0.0016/0.0030 in.)	
No. 2 Ring - Turbo III	0.040/0.075mm (0.0016/0.0030 in.)	
Oil Control Ring - Turbo III	0.020/0.055mm (0.0007/0.0002 in.)	
Piston Ring End Gap		
No. 1 Ring - 2.2/2.5L and 2.5L Flexible Fuel	0.25/0.51mm (0.010/0.020 in.)	1.0mm (0.039 in.)
No. 2 Ring - 2.2/2.5L	0.28/0.48mm (0.011/0.021 in.)	1.0mm (0.039 in.)
No. 2 Ring - 2.5L Flexible Fuel	0.23/0.48mm (0.009/0.019 in.)	1.0mm (0.039 in.)
Oil Control Ring (Except Turbo III)	0.25/1.27mm (0.010/0.050 in.)	1.88mm (0.074 in.)
No. 1 Ring - Turbo III	0.30/0.50mm (0.011/0.020 in.)	1.0mm (0.039 in.)
No. 2 Ring - Turbo III	0.30/0.50mm (0.011/0.020 in.)	1.0mm (0.039 in.)
Oil Control Ring - Turbo III	0.25/0.50mm (0.010/0.020 in.)	1.0mm (0.039 in.)
Connecting Rod:		
Parallelism and Twist Combined 2.2/2.5L	0.08mm (0.003 in.)	0.08mm (0.003 in.)
Turbo III		
Sm. End Raw	24.587 - 24.638mm (.967-.969 in.)	
Sm. End Finished Bushed I.D.	22.895 - 22.903mm (.9013 - .9016 in.)	
Big End Finished I.D.	52.992 - 53.008 mm (2.0862 - 2.0869 in.)	
Parallelism	0.02mm (.0007 in.)	
Twist	0.04mm (.0015 in.)	
Connecting Rod Side Clearance	0.13/0.38mm (0.005/0.015 in.)	0.10mm (0.004 in.)
Bearing Clearance - All	0.019/0.075mm (0.0008/0.003 in.)	

9309-256

SPECIFICATIONS

DESCRIPTION	STANDARD DIMENSION	SERVICE LIMIT
Cylinder Bore:		
Out-of-Round	—	0.050mm (0.002 in.)
Bore Taper	—	0.125mm (0.005 in.)
Crankshaft:		
Connecting Rod Journal O.D.	49.979/50.005mm (1.968/1.969 in.)	
Main Bearing Journal O.D.	59.987/60.013mm (2.362/2.363 in.)	
Bearing Surface Out-of-Round	0.008mm (0.0003 in.)	0.013mm (0.005 in.)
Bearing Surface Taper	0.008mm (0.0003 in.)	0.01mm (0.0004 in.)
Main Bearing Clearance (All)	0.011/0.072mm (0.0004/0.0028 in.)	0.10mm (0.004 in.)
End Play	0.05/0.18mm (0.002/0.007 in.)	0.35mm (0.014 in.)
Oil Pump:		
Relief Valve Opening Pressure	414 kPa (60 psi)	550 kPa (80 psi)
Outer Rotor O.D.-to-Housing Bore Clearance	0.177/0.331mm (.007-.013 in.)	0.35mm (0.014 in.)
Outer Rotor Thickness	23.98/24.00mm (0.944/0.945 in.)	23.96mm (0.9435 in.)
Inner Rotor-to-Outer Rotor Tip Clearance	0.10mm (0.004 in.)	0.20mm (0.008 in.)
Inner and Outer Rotor-to-Housing Clearance	0.03/0.08mm (0.001/0.003 in.)	0.09mm (0.0035 in.)
Pump Cover Flatness	0.05mm (0.002 in. max.)	0.076mm (0.003 in.)
Relief Spring Free Length	49.5mm (1.95 in.)	49.5mm (1.95 in.)
Relief Spring Load	89 N at 34mm (20 lbs. at 1.34 in.)	
Oil Pressure Switch:		
Minimum Actuating Pressure	14 kPa (2-4 psi)	
Oil Pressure (all)		
Minimum Values — **Engine Fully Warmed**		
At Curb Idle	30 kPa (4 psi)	
At 3000 rpm	170-550 kPa (25-80 psi)	

*At minimum cranking speed (130 rpm) - starter speed, also see "Engine Performance" in Standard Service Procedures.

9309-257

DESCRIPTION	TORQUE
Balance Shaft Carrier;	
Front Chain Cover Screw	12 N·m (105 in. lbs.)
Chain Tensioner Adjustment Screw	12 N·m (105 in. lbs.)
Chain Tensioner Pivot Screw	12 N·m (105 in. lbs.)
Chain Snubber Stud and Washer	12 N·m (105 in. lbs.)
Chain Snubber Nut	12 N·m (105 in. lbs.)
Gear Cover Screw	12 N·m (105 in. lbs.)
Gear (and Sprocket) to Balance Shaft	28 N·m (250 in. lbs.)
Sprocket to Crankshaft-Torx Drive Cap Screw	15 N·m (130 in. lbs.)
Rear Cover Screw	12 N·m (105 in. lbs.)
Carrier-to-Block Bolt	54 N·m (40 ft. lbs.)
Cup Plug; Sealant Loctite 277	
Camshaft Bearing Cap Bolt	25 N·m (215 in. lbs.)
Camshaft Sprocket Bolt	89 N·m (65 ft. lbs.)
Connecting Rod Bearing Cap Nut	54 N·m (40 ft. lbs.) +1/4 Turn
Crankshaft Sprocket Bolt	115 N·m (85 ft. lbs.)
Cylinder Head Cover Screw	12 N·m (105 in. lbs.)
Cylinder Head Bolt-4 Step Torque Sequence	61 N·m (45 ft. lbs.) 89 N·m (65 ft. lbs.) 89 N·m (65 ft. lbs.) +1/4 Turn
Exhaust Manifold Bolt	23 N·m (200 in. lbs.)
Front Crankshaft Oil Seal Retainer Screw	12 N·m (105 in. lbs.)
Intake Manifold Bolt	23 N·m (200 in. lbs.)
Intermediate Shaft Retainer Screw	12 N·m (105 in. lbs.)
Intermediate Shaft Sprocket Screw	88 N·m (65 ft. lbs.)
Lower Timing Belt Cover Screw	4 N·m (40 in. lbs.)
Main Bearing Cap Bolt	41 N·m (30 ft. lbs.) +1/4 Turn
Oil Pan Screw (M8 Screws)	23 N·m (200 in. lbs.)
Oil Pan Screw (M6 Screws)	12 N·m (105 in. lbs.)
Oil Pump Cover Screw	12 N·m (105 in. lbs.)
Oil Pan Drain Plug	27 N·m (240 in. lbs.)
Oil Pump Strainer-to-Cover Screw	23 N·m (200 in. lbs.)
Oil Pump Mounting Screw	23 N·m (200 in. lbs.)
Rear Crankshaft Oil Seal Retainer Screw	12 N·m (105 in. lbs.)
Spark Plug	27 N·m (20 ft. lbs.)
Timing Belt Tensioner Bolt	61 N·m (45 ft. lbs.)
Thermostat Housing Screw	23 N·m (200 in. lbs.)
Upper Timing Belt Cover Screw	4 N·m (40 in. lbs.)
Water Pump Housing Screw-Upper	28 N·m (250 in. lbs.)
Water Pump Housing Screw-Lower	54 N·m (40 ft. lbs.)
Turbo III	
Camshaft Thrust Plate Retaining Nut	2 N·m (53 in. lbs.)
Connecting Rod Bearing Cap Nut	68 N·m (50 ft. lbs.)
Camshaft Sprocket Bolt	65 N·m (47 ft. lbs.)
Crankshaft Sprocket Bolt	115 N·m (85 ft. lbs.)
Intermediate Shaft Sprocket Bolt	89 N·m (65 ft. lbs.)
Lower Timing Belt Cover	8 N·m (72 in. lbs.)
Intake Manifold Bolts	24 N·m (210 in. lbs.)
Exhaust Manifold Studs	24 N·m (210 in. lbs.)
Rockershaft Retaining Bolts	24 N·m (210 in. lbs.)
Rocker Cover Bolts	12 N·m (105 in. lbs.)
Thermostat Housing Bolts	24 N·m (210 in. lbs.)
Timing Belt Idler Pulley Bolt	54 N·m (40 ft. lbs.)
Timing Belt Tensioner Pulley Bolt	54 N·m (40 ft. lbs.)

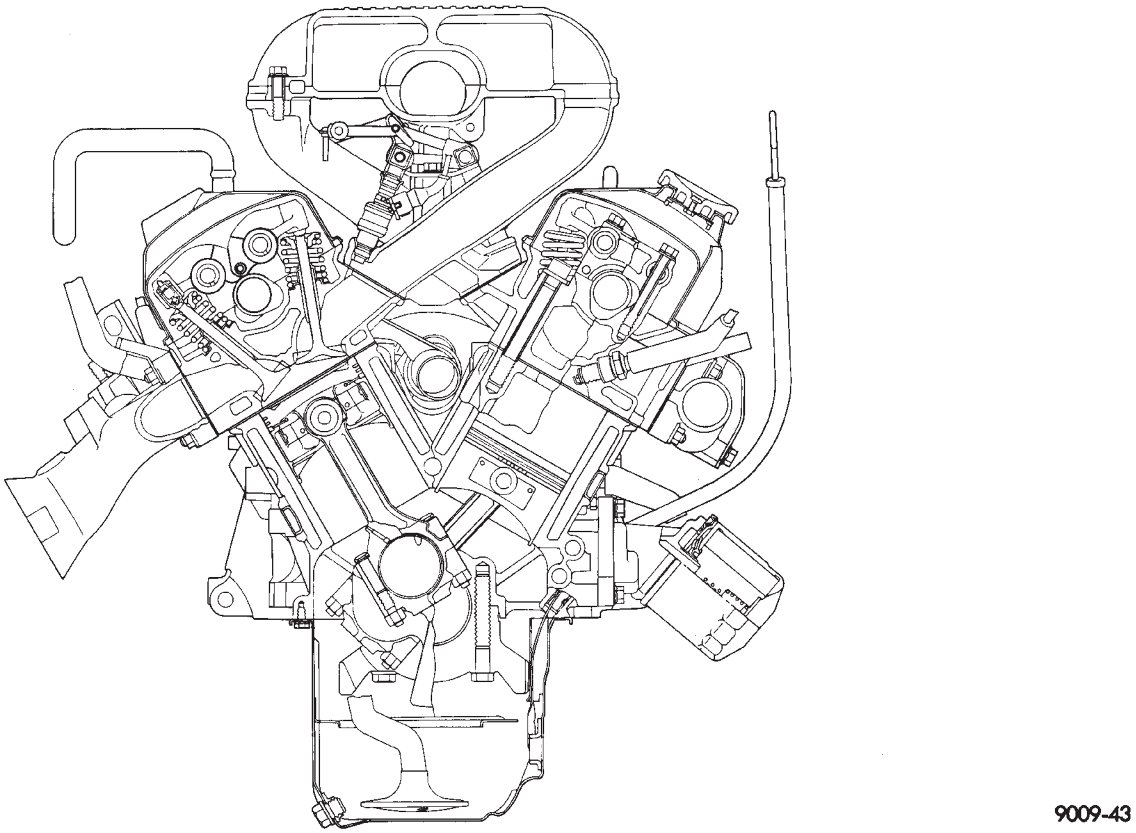
All fasteners should be thoroughly cleaned and lightly oiled

9309-258

3.0L ENGINE

INDEX

3.0L ENGINE



GENERAL INFORMATION

ENGINE IDENTIFICATION NUMBER OR CODE

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 1).

BLOCK: The cylinder block is a light weight design created by reducing thickness in many parts and a short 10 mm (3/8 inch) block skirt. High rigidity is provided with ribs cast in the outer wall, a full length water jacket, and a monoblock 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 front seal is retained in the oil pump case and the rear is retained in a block-mounted housing.

SPECIFICATIONS

3.0L V-6 ENGINE	
Type	60°V SOHC (Per Bank)
Bore	91.1 mm (3.587 Inch)
Stroke	76.0 mm (2.992 Inch)
Compression Ratio	8.85:1
Displacement	3.0 Liters (181 Cubic Inch)
Torque	170 Lb. Ft. @ 2800 RPM
Firing Order	1-2-3-4-5-6
Lubrication	Pressure Feed-Full Flow Filtration (Direct Crankshaft Driven Pump)
Engine Oil Capacity	4.25 Liter (4.5 Qts.) Including Oil Filter, 3.8 Liter (4.0 Qts.) Without Oil Filter.
Cooling System	Liquid Cooled-Forced Circulation (Pump-Timing Belt Driven)
Cylinder Block	Cast Iron
Crankshaft	Cast (Ductile Cast Iron)
Cylinder Head	Aluminum Alloy
Connecting Rods	Forged Steel
Pistons	Aluminum Alloy (w/Strut)

9209-61

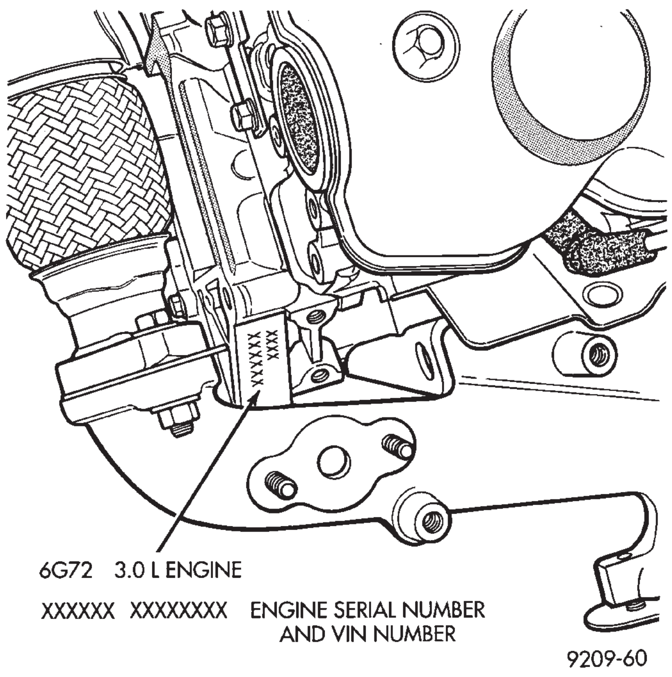


Fig. 1 Engine Identification

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, press-fitted 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.

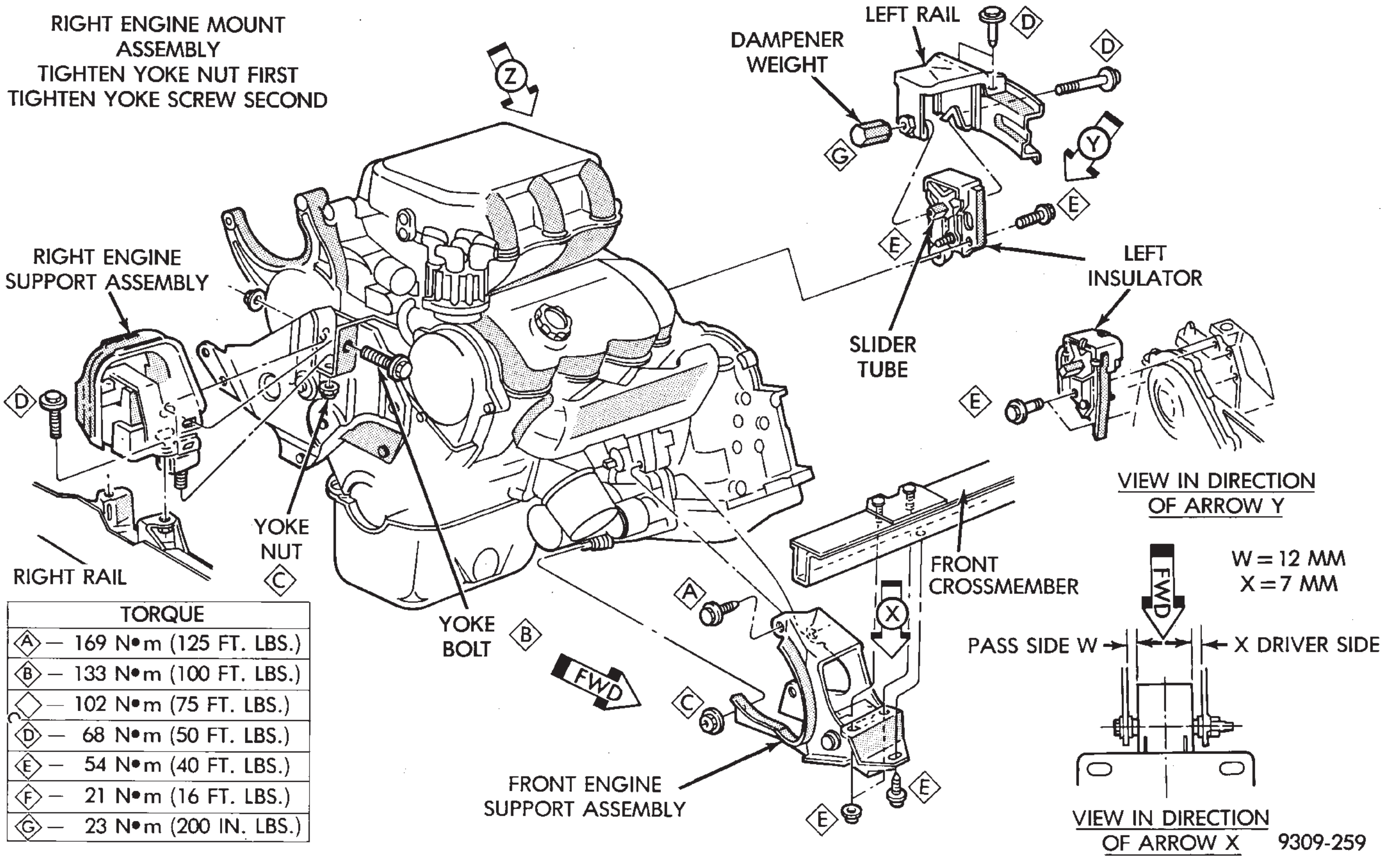
CAMSHAFTS: Two overhead camshafts provide valve actuation, one front (radiator side of cylinder bank) and one rear. The front camshaft is provided with a distributor drive and is longer. Both camshafts are supported by four bearing journals, thrust for the front camshaft is taken at journal two and the 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 and are further treated to resist heat.

VALVE SPRINGS: Are especially designed to be short. The valve spring wire cross-section is oval



TORQUE
A — 169 N•m (125 FT. LBS.)
B — 133 N•m (100 FT. LBS.)
C — 102 N•m (75 FT. LBS.)
D — 68 N•m (50 FT. LBS.)
E — 54 N•m (40 FT. LBS.)
F — 21 N•m (16 FT. LBS.)
G — 23 N•m (200 IN. LBS.)

Fig. 2 Engine Mounting

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.

ENGINE LUBRICATION: System is a full flow filtration, pressure feed type. The oil pump is mounted in the chaincase 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 MOUNTS

REMOVAL AND INSTALLATION

RIGHT SIDE MOUNT

(1) Remove the right engine mount insulator vertical fasteners from frame rail.

(2) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(3) Remove the thru bolt from the insulator assembly. Remove insulator.

(4) Reverse removal procedure for installation. Refer to (Fig. 2) for bolt tightening specifications.

(5) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

FRONT MOUNT

(1) Support the engine and transmission assembly with a floor jack so it will not rotate.

(2) Remove the thru bolt from the insulator and front crossmember mounting bracket.

(3) Remove the front engine mount bracket to front crossmember screws and nuts. Remove the insulator assembly.

(4) Reverse removal procedure for installation. Refer to (Fig. 2) for bolt tightening specifications.

(5) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

LEFT SIDE MOUNT

(1) Raise vehicle on hoist and remove left front wheel.

(2) Remove inter splash shield.

(3) Support the transmission with a transmission jack.

(4) Remove the insulator thru bolt from the mount.

(5) Remove the transmission mount fasteners and remove mount.

(6) Reverse removal procedure for installation. Ensure that the slide tube is seated into the rail bracket guides. Refer to (Fig. 3) for bolt tightening specifications.

(7) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

ENGINE MOUNT RUBBER INSULATORS

Insulator location on (right side) and transmission bracket (left side) are adjustable to allow right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right engine mount insulator (left engine mount insulator is floating type and will adjust automatically (Fig. 3). Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Driveshafts in Suspension, Group 2.
- Any front end structural damage (after repair).
- Insulator replacement.

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 yoke screw and two turns on yoke nut, then loosen the front engine mount bracket to front crossmember screws and nuts.

Left engine mount insulator is sleeved over shaft and long support bolt to provide lateral movement adjustment with engine weight removed or not.

(3) Pry the engine right or left as required to achieve the proper drive shaft assembly length. See Drive Shaft in Suspension Group 2 for driveshaft identification and related assembly length measuring.

(4) Tighten right engine mount insulator yoke nut to 102 N•m (75 ft. lbs.). Then tighten front engine mount screws and nuts to 54 N•m (40 ft. lbs.) and center left engine mount insulator.

(5) Recheck drive shaft length.

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect battery.

(2) Mark hood position at hinges and remove hood.

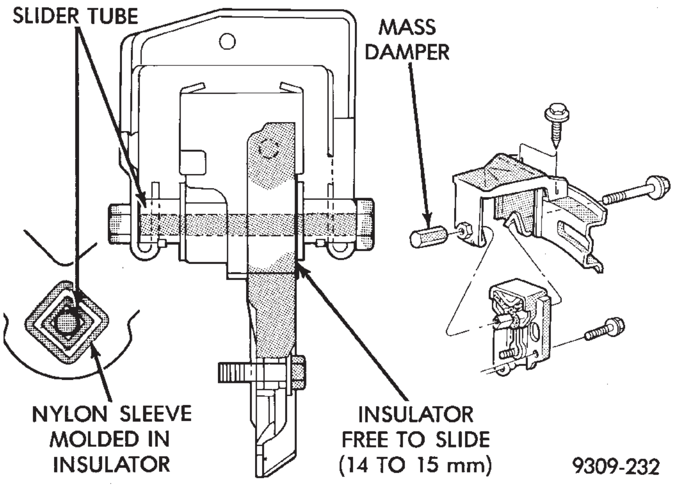


Fig. 3 Left Insulator Movement

(3) Drain cooling system. Refer to Cooling System Group 7 for draining procedure.

(4) Disconnect all electrical connections.

(5) Remove coolant hoses from radiator and engine.

(6) Remove radiator and fan assembly.

(7) See Fuel System Group 14, For procedures to release fuel pressure, disconnect fuel lines and accelerator cable.

(8) Remove air cleaner assembly.

(9) Hoist vehicle and drain engine oil.

(10) Remove air conditioning compressor mounting bolts and set compressor aside.

(11) Disconnect exhaust pipe at manifold.

(12) Remove transmission inspection cover and mark flex plate to torque converter position.

(13) Remove screws holding torque converter to flex plate and attach C-clamp on bottom of converter housing to prevent torque converter from coming out.

(14) Remove power steering pump mounting bolts and set pump aside.

(15) Remove two lower transmission to block screws.

(16) Remove starter.

(17) Lower vehicles and disconnect vacuum lines and ground strap.

(18) Install transmission holding fixture.

(19) Attach engine lifting hoist and support engine.

(20) Remove upper transmission case to block bolts.

(21) See Engine Mounting in (Fig. 2) and separate mount/insulators as follows:

(a) Mark RIGHT insulator on right yoke and engine plate supports. Remove insulator to rails screws.

(b) Remove FRONT engine mount through bolt and nut.

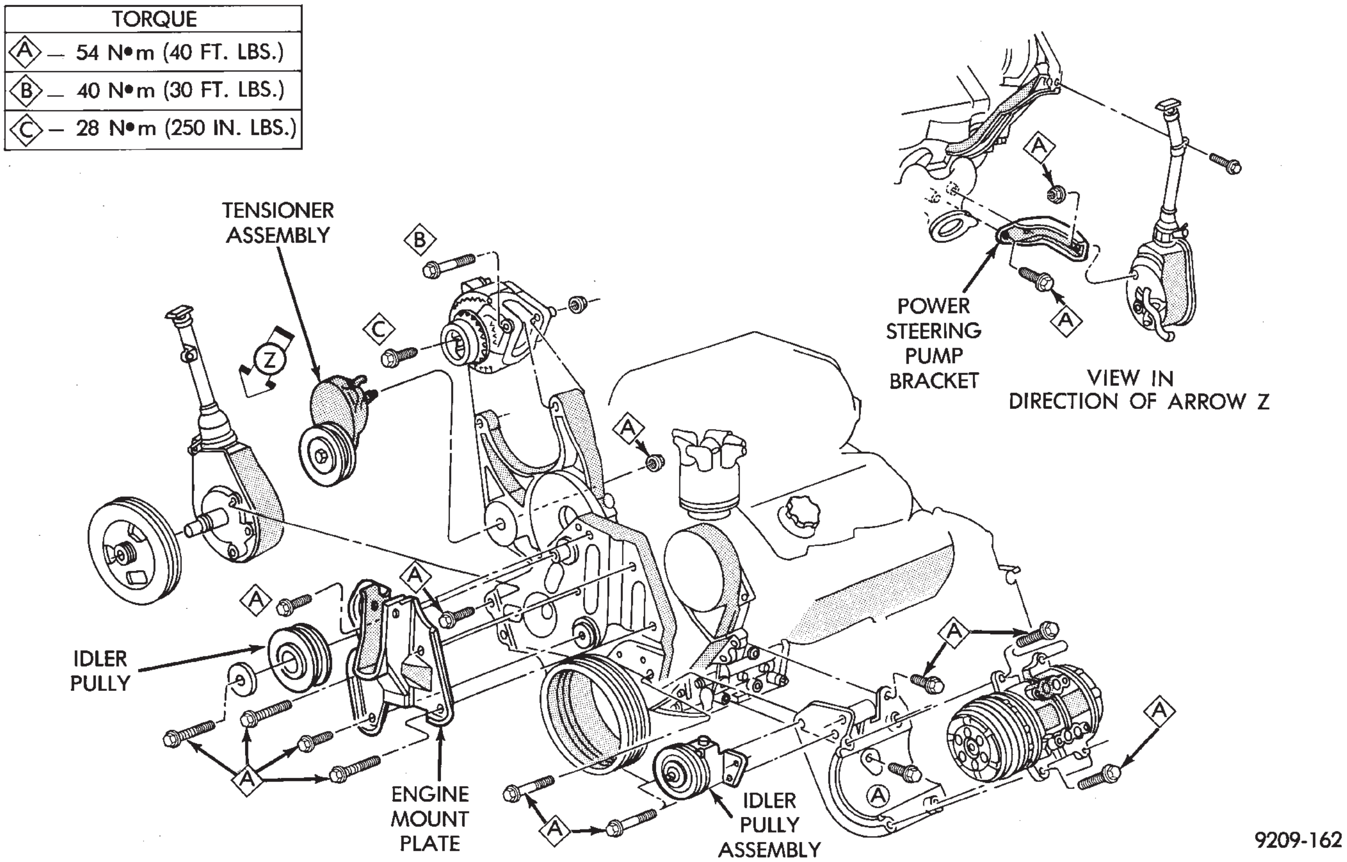


Fig. 4 Accessories Mounting Brackets

(c) Remove LEFT insulator through bolt from inside wheelhouse or insulator bracket to transmission screws.

(22) Remove engine.

INSTALLATION

(1) Attach hoist and lower engine into engine compartment.

(2) Align engine mounts and install but **do not tighten** until all mounting bolts have been installed. Tighten bolts to torque specified in (Fig. 2).

(3) Install transmission case to cylinder block, tighten bolts to 102 N●m (75 ft. lbs.) torque.

(4) Remove engine hoist and transmission holding fixture.

(5) Remove C clamp from torque converter housing. Align flex plate to torque converter and install mounting screws. Tighten to 75 N●m (55 ft. lbs.)

(6) Install transmission inspection cover.

(7) Connect exhaust system at manifold.

(8) Install starter.

(9) Install power steering pump and air conditioning compressor. For belt installation Refer to Accessory Belt Drive in Cooling System Group 7.

(10) Lower vehicle and connect all vacuum lines.

(11) Connect all electrical connections including ground strap.

(12) Connect fuel lines and accelerator cable.

(13) Install radiator and fan assembly. Connect fan motor electrical lead. Install radiator hoses. Fill cooling system. Refer to Cooling System Group 7 for filling procedure.

(14) Fill engine crankcase with proper oil to correct level.

(15) Install hood.

(16) Connect battery.

(17) Start engine and run until operating temperature is reached.

(18) Adjust transmission or linkage if necessary.

ACCESSORY DRIVE BELT SERVICE

REMOVAL

(1) Loosen Adjusting Lock Nut (Fig. 6).

(2) Turn adjusting jack screw counterclockwise to reduce belt tension. Remove belt.

(3) Inspect drive belt for wear and damage (Fig. 5).

(4) Installation: Adjust belt tension to 5/16 deflection between pulleys (Fig. 6).

(5) Install breaker bar into 1/2 square opening in tensioner.

(6) Rotate tensioner clockwise to remove and install belt (Fig. 7).

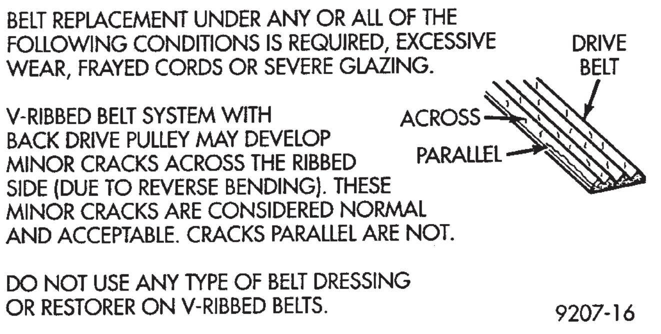


Fig. 5 Drive Belt Inspection

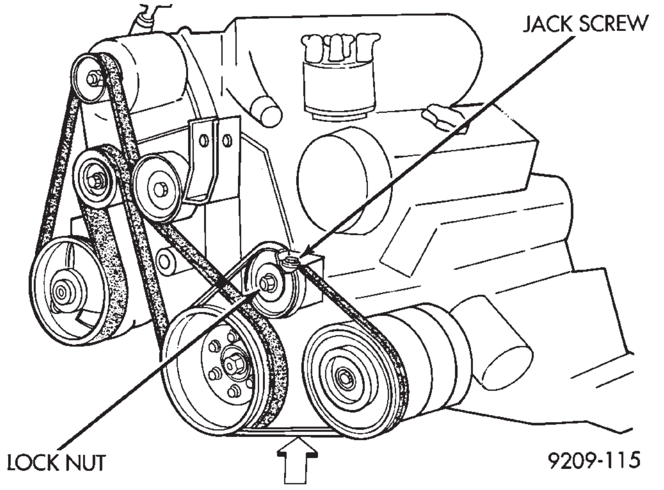


Fig. 6 Air Conditioning Belt

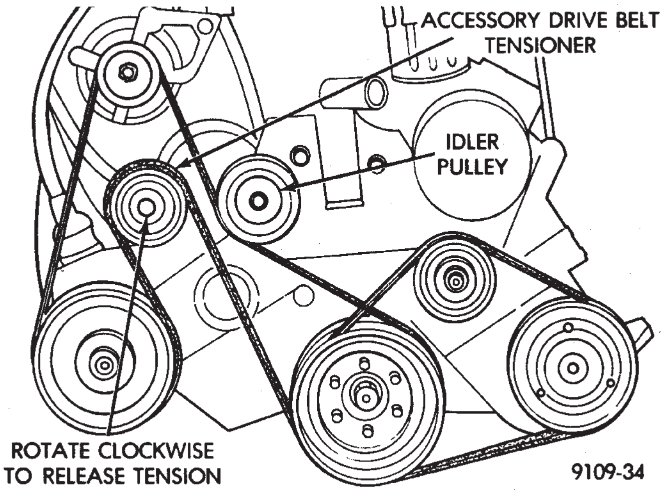


Fig. 7 Generator/Power Steering Belt

ENGINE MOUNT BRACKET

REMOVAL

(1) Remove air conditioning compressor to mounting bracket screws and lay compressor aside (Fig. 4).

(2) Remove screws attaching air conditioning compressor mounting bracket and adjustable drive belt tensioner from block and engine mounting bracket. Remove both assemblies.

(3) Remove steering pump/generator belt tensioner mounting bolt and remove automatic belt tensioner.

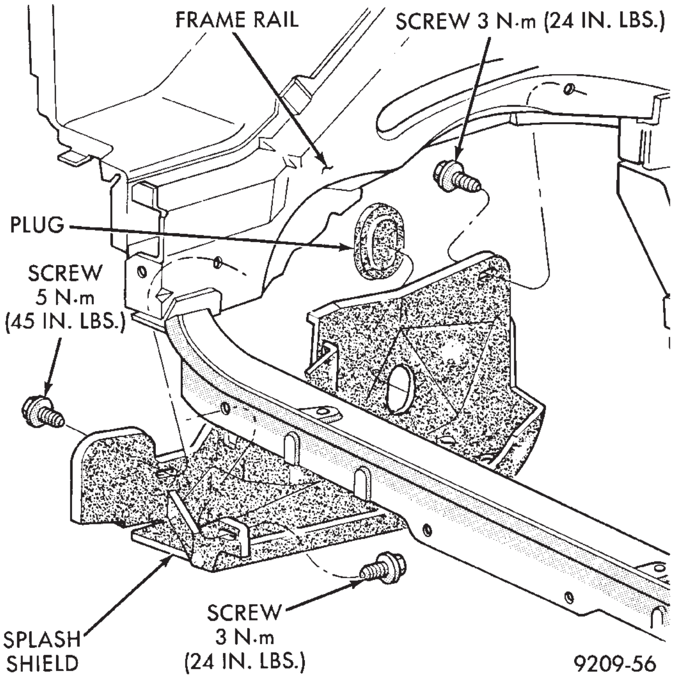


Fig. 8 Right Inner Splash Shield—Typical

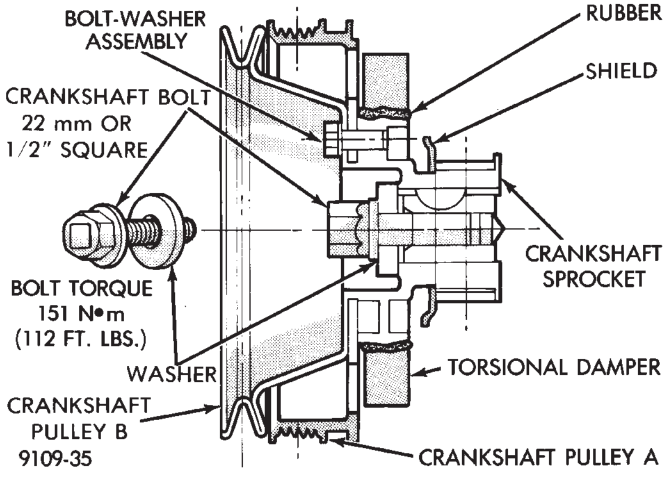


Fig. 9 Crankshaft Drive Pulleys

(4) Remove two steering pump to engine mounting bracket screws and one rear support lock nut.

(5) Lay power steering pump aside.

(6) Raise vehicle and remove right inner splash shield (Fig. 8).

(7) Remove crankshaft drive pulleys and torsional damper (Fig. 9).

(8) Lower vehicle and place a jack under engine.

(9) Mark support assembly to engine bracket if assembly is to be used again. Separate engine mount insulator from engine mount bracket (Fig. 10). Raise engine slightly.

(10) Remove engine mount bracket (Fig. 10).

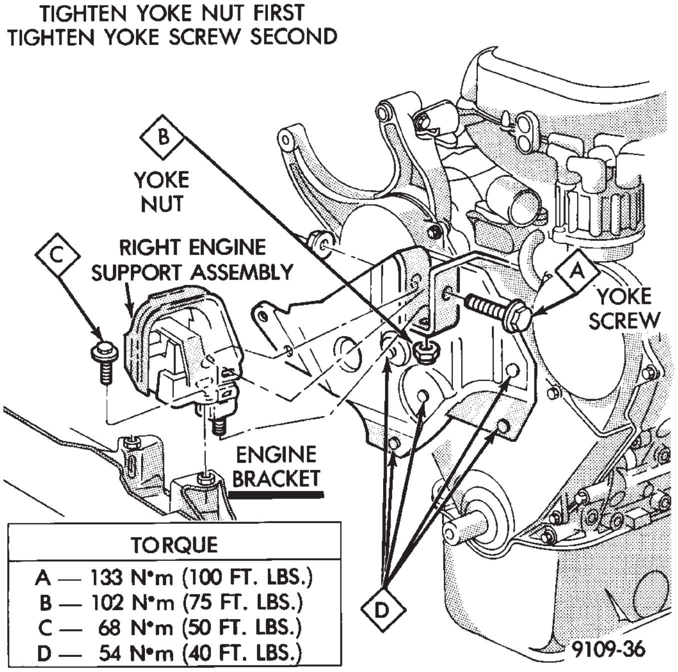


Fig. 10 Right Engine Mount and Engine Mount Bracket

(11) Remove timing belt covers (Fig. 11).

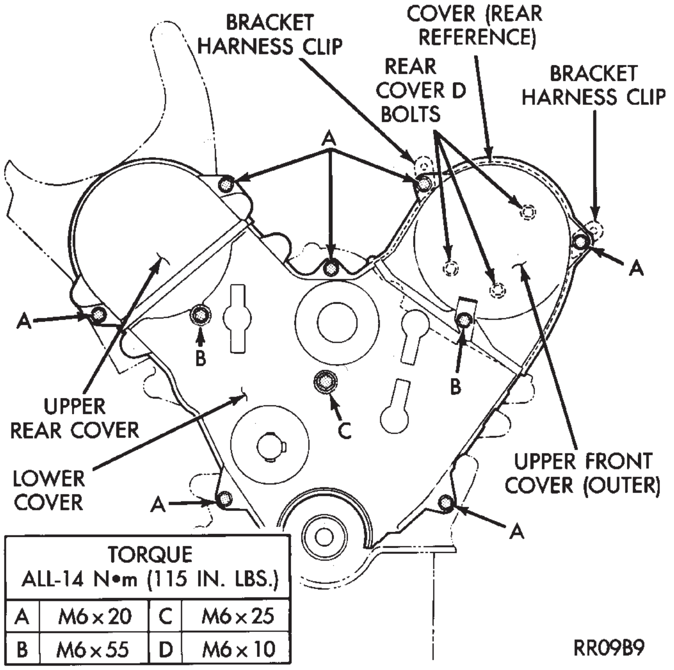


Fig. 11 Timing Belt Covers

TIMING BELT INSPECTION—IN VEHICLE

(1) Remove the upper front outer timing belt cover by loosening the three attaching bolts. (Fig. 11).

(2) Inspect both sides of the timing belt drive & back. Replace belt if any of the following conditions exist.

- Hardening of back rubber back side is glossy without resilience and leaves no indent when pressed with fingernail.
- Cracks on rubber back.
- Cracks or peeling of canvas.
- Cracks on rib root.
- Cracks on belt sides.
- Missing teeth.
- Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife (Fig. 12).

(3) If none of the above conditions are seen on the belt, the belt cover can be reinstalled.

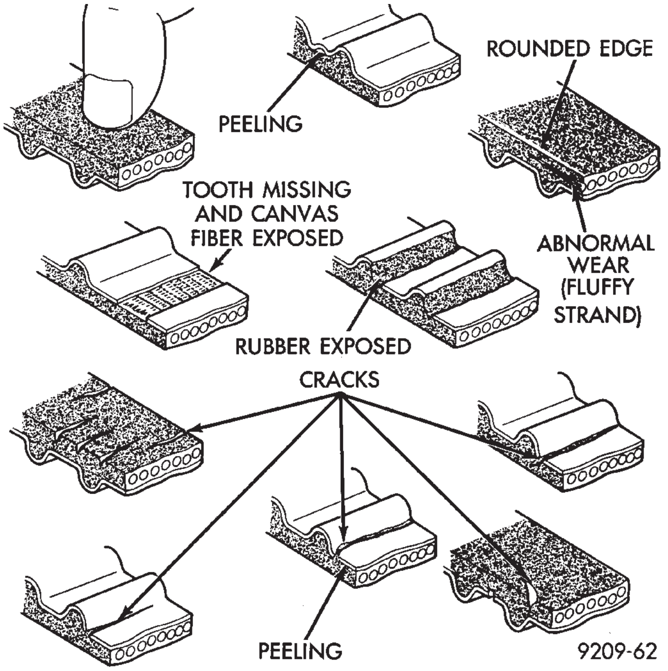


Fig. 12 Timing Belt Inspection

TIMING BELT SERVICE

REMOVAL

(1) Mark belt running direction for installation (Fig. 14).

(2) Loosen timing belt tensioner bolt (Fig. 16) and remove timing belt.

(3) Remove crankshaft sprocket flange shield (Fig. 9).

CAMSHAFT SPROCKETS

REMOVAL

(1) Hold camshaft sprocket with Spanner Tool MB990775 loosen and remove bolt and washer (Fig. 15).

(2) Remove camshaft sprocket from camshaft.

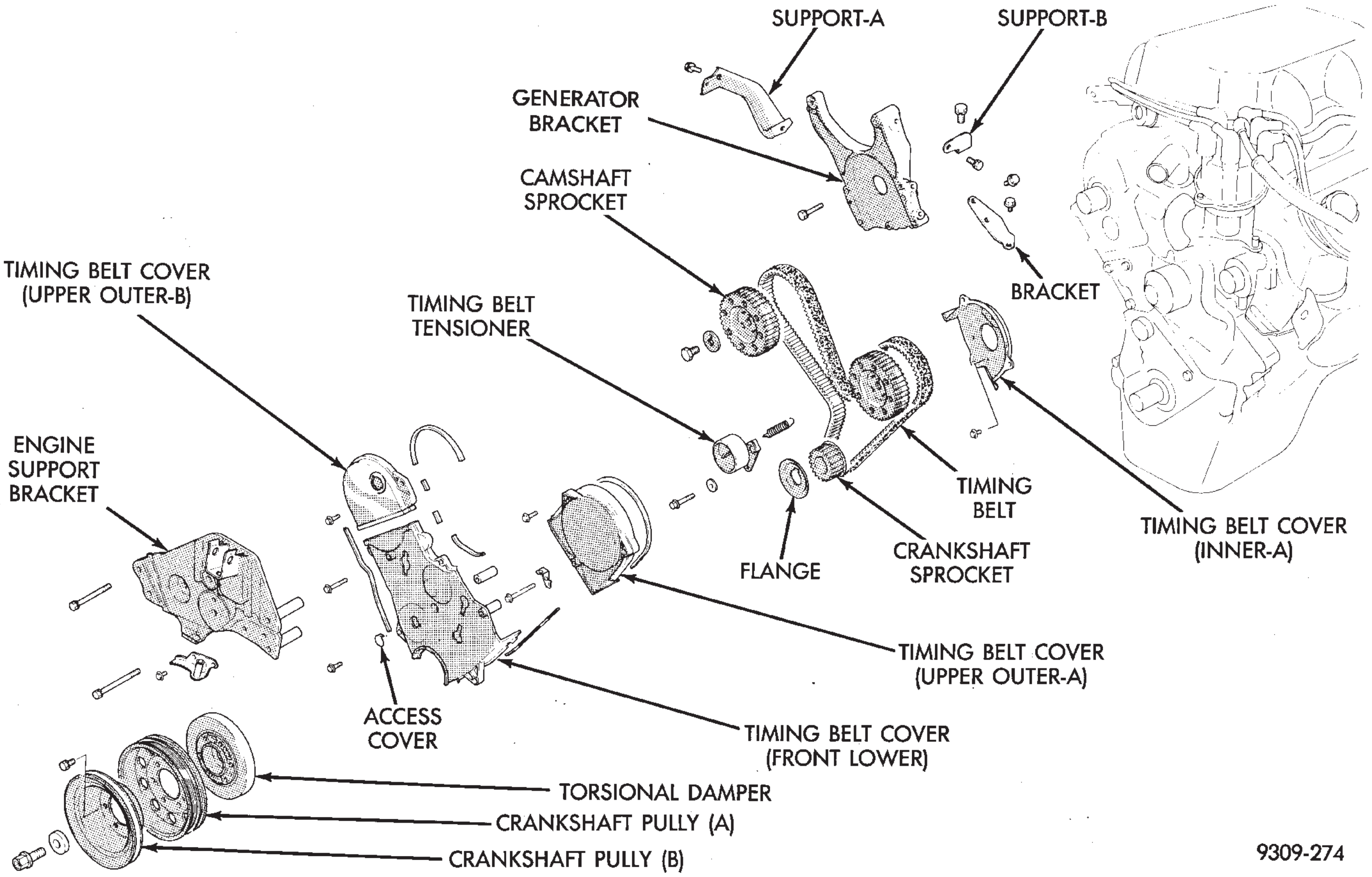


Fig. 13 Timing Belt System

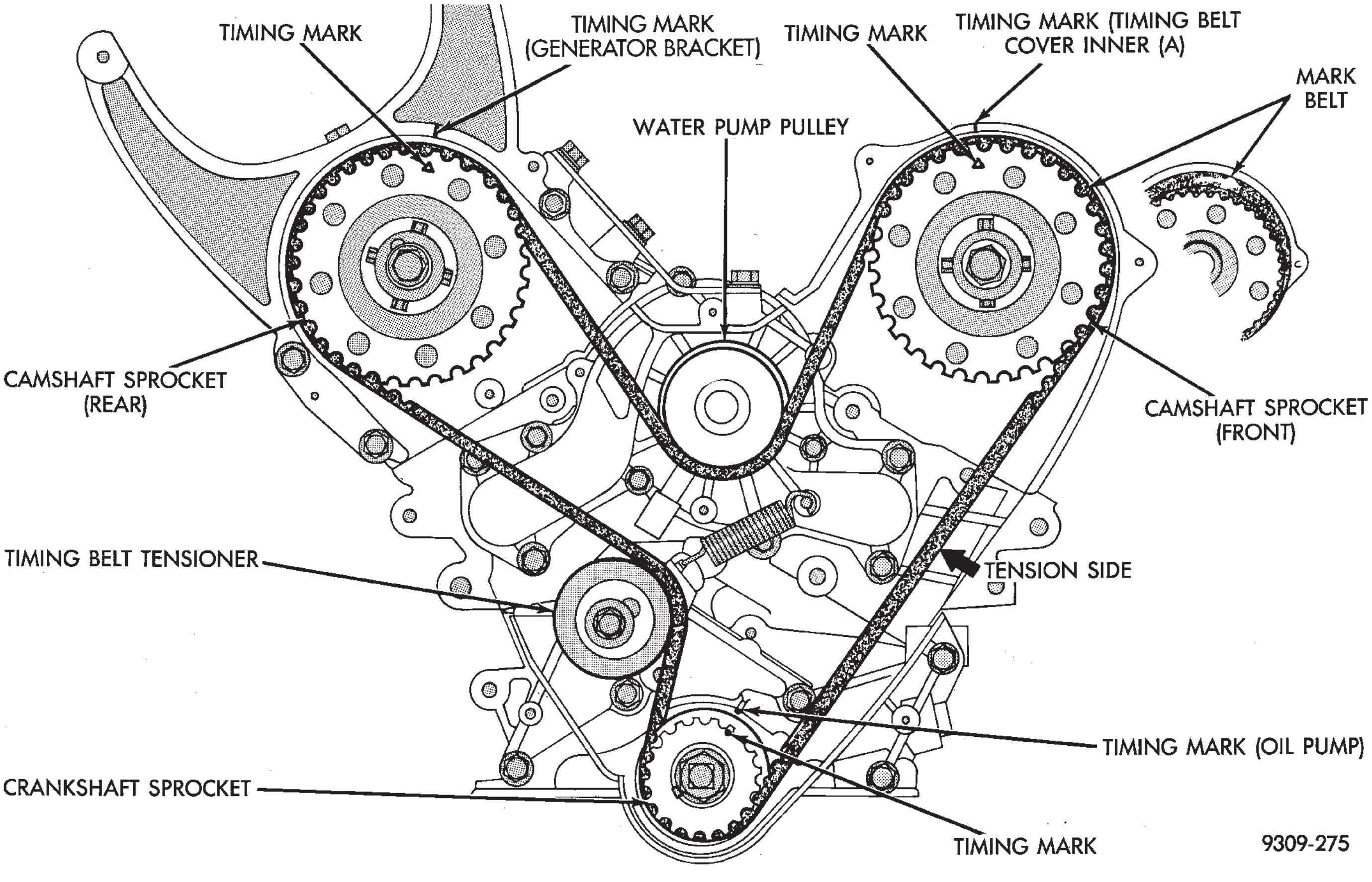


Fig. 14 Timing Belt Engine Sprocket Timing

INSTALLATION

(1) Place camshaft sprocket on camshaft.

(2) Install bolt and washer to camshaft. Using Spanner Tool MB990775 hold camshaft sprocket and torque bolt to 95 N●m (70 ft. lbs.) (Fig. 15).

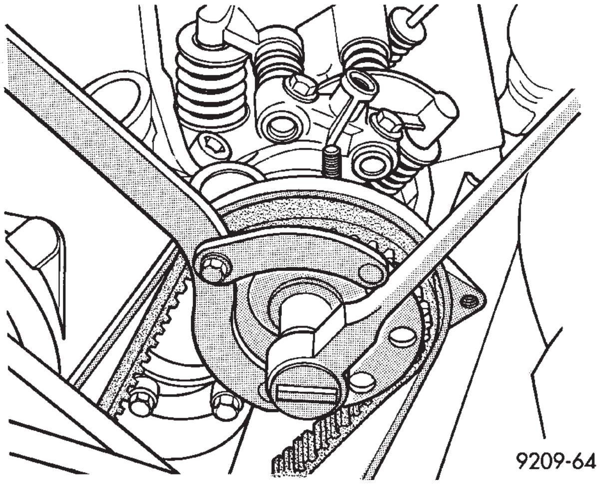


Fig. 15 Camshaft Sprockets

TIMING BELT TENSIONER

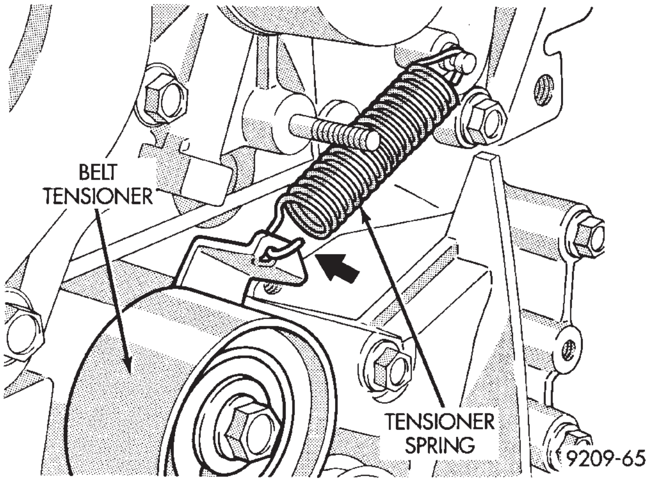


Fig. 16 Timing Belt Tensioner

(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. 16).

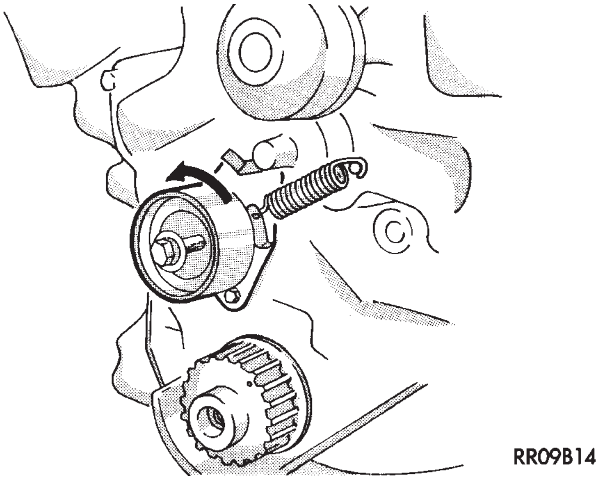


Fig. 17 Positioning Belt Tensioner

(3) Turn timing belt tensioner counter-clockwise full travel in adjustment slot and tighten bolt to temporarily hold this position (Fig. 17).

INSTALLATION—TIMING BELT

(1) Install timing belt on crankshaft sprocket first and while keeping belt tight on tension side (Fig. 14) install belt on the front (radiator side) camshaft sprocket.

(2) Then, install on the water pump pulley and on the rear camshaft sprocket and finally on the timing belt tensioner.

(3) Apply rotating force to the front camshaft sprocket in opposite direction to tension the belt tension side, check that all timing marks are lined up (Fig. 14).

(4) Install crankshaft sprocket flange (Fig. 12).

(5) Loosen tensioner bolt and allow spring to tension timing belt.

(6) Turn crankshaft two full turns in clockwise direction. **Turn smoothly and in clockwise direction ONLY.**

(7) Again line up the timing marks on the sprockets and tighten the timing belt tensioner locking bolt to 25 N●m (250 in. lbs.) torque.

(8) Reassembly belt covers, engine bracket, insulator, crankshaft pulleys, accessories and accessory drive belts in reverse order.

CYLINDER HEAD AND CAMSHAFT SERVICE

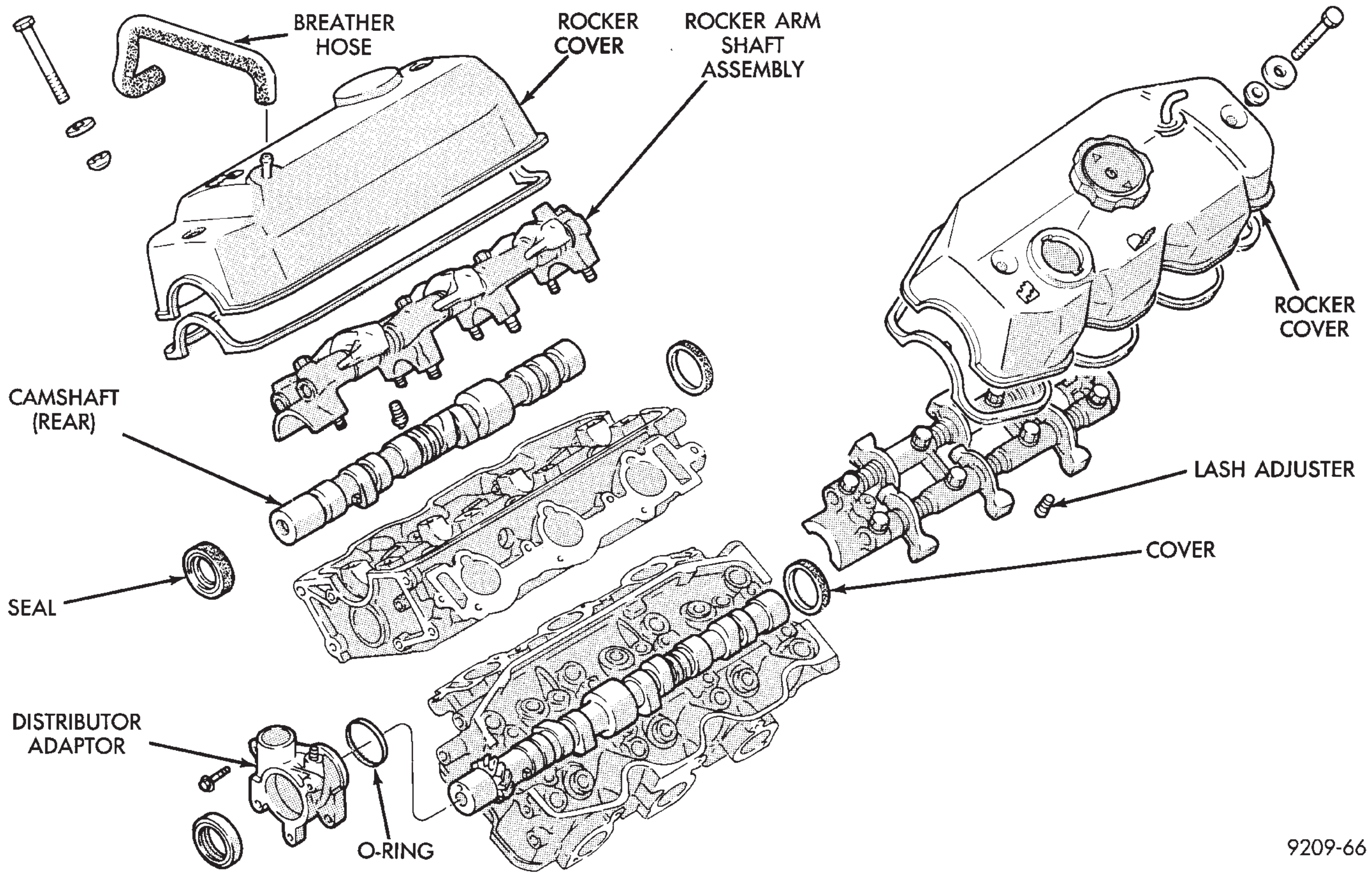


Fig. 1 Cylinder Head-Camshaft-Valves

CYLINDER HEAD COVER

REMOVE

(1) Remove air cleaner assembly.

(2) Disconnect battery and relocate spark plug wires.

(3) Remove vacuum connections.

(4) Remove rocker cover screws and remove cover (Fig. 2).

INSTALL

(1) Clean cylinder head and cover mating surfaces. Install new gasket.

(2) See (Fig. 2) 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.).

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.

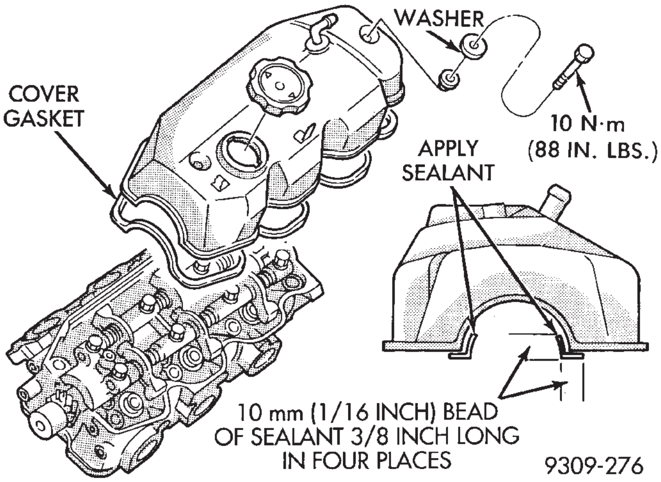


Fig. 2 Rocker Cover

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.

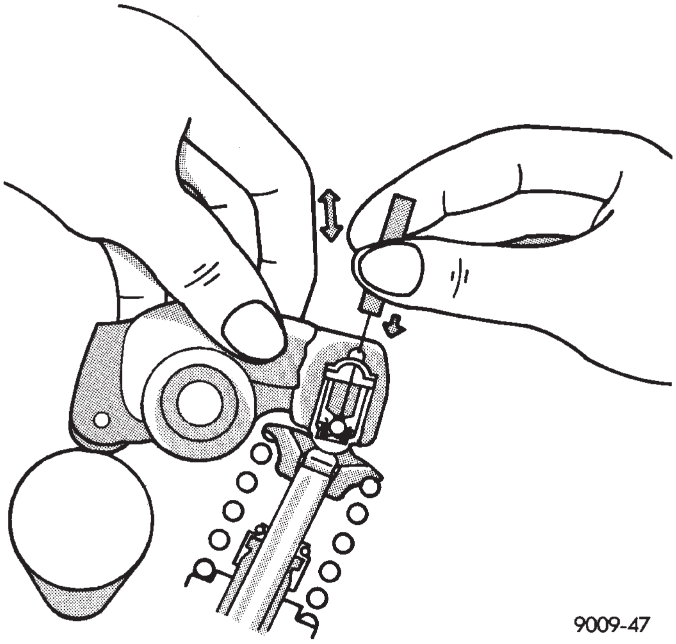


Fig. 3 Auto Lash Adjuster Check

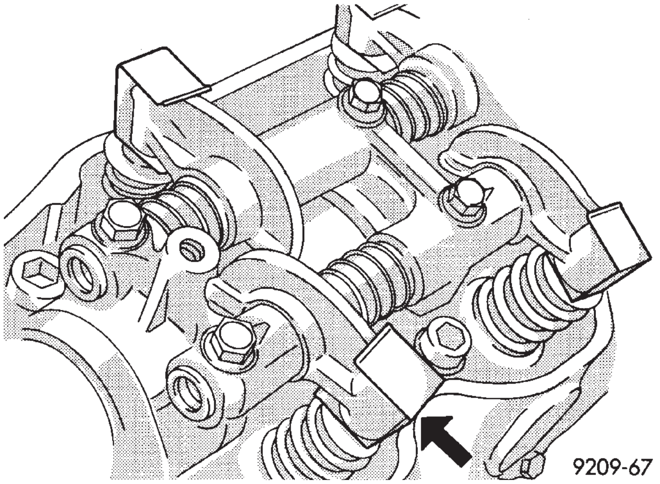


Fig. 4 Auto Lash Adjuster Retainers

CAMSHAFT SERVICE

SEE AUTO LASH ADJUSTER FUNCTION CHECK BEFORE DISASSEMBLY

REMOVAL

(1) Install auto lash adjuster retainers. (Fig. 4).

(2) Remove distributor extension (Fig. 1).

(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.

CAMSHAFT INSPECTION

(1) Inspect camshaft bearing journals for damage and binding (Fig. 5). If journals are binding,also check the cylinder head for damage (Fig. 1). Also check cylinder head oil holes for clogging.

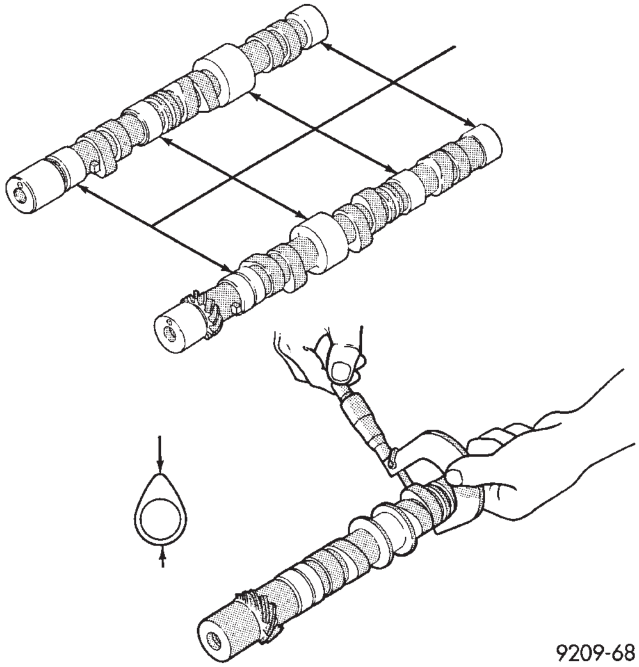


Fig. 5 Check Camshafts

(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. 5).

(3) Check the cam surface for abnormal wear and damage and replace if defective. Also measure the cam height (Fig. 5) and replace if out of limit, standard value is 41.25 mm (1.624 inch), wear **limit** is 40.75 mm (1.604 inch).

CAMSHAFT INSTALL

Lubricate camshaft journals and cams with engine oil and install camshaft on cylinder head.

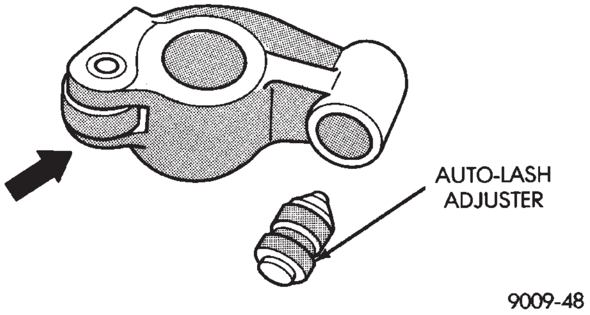


Fig. 6 Inspect Rocker Arms

ROCKER ARMS

(1) Check rocker arms for wear or damage (Fig. 6). Replace as necessary. Also see Auto Lash Adjuster.

ROCKER ARM SHAFTS

The rocker arm shaft is hollow and is used as a lubrication oil duct. The rocker arm shaft on the **inlet**

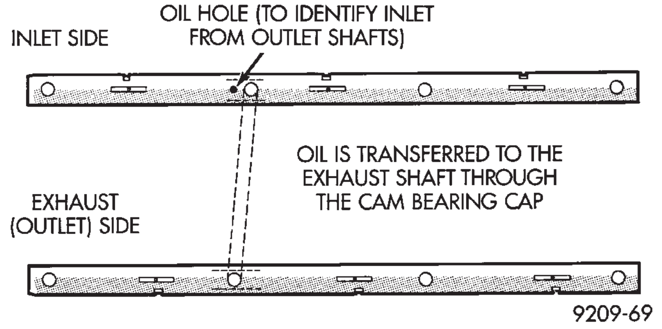


Fig. 7 Rocker Arm Shaft Identification

side has a 3mm diameter oil passage hole from the cylinder head. The **exhaust** side **does not** have this oil passage (Fig. 7).

(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. 7).

REASSEMBLE

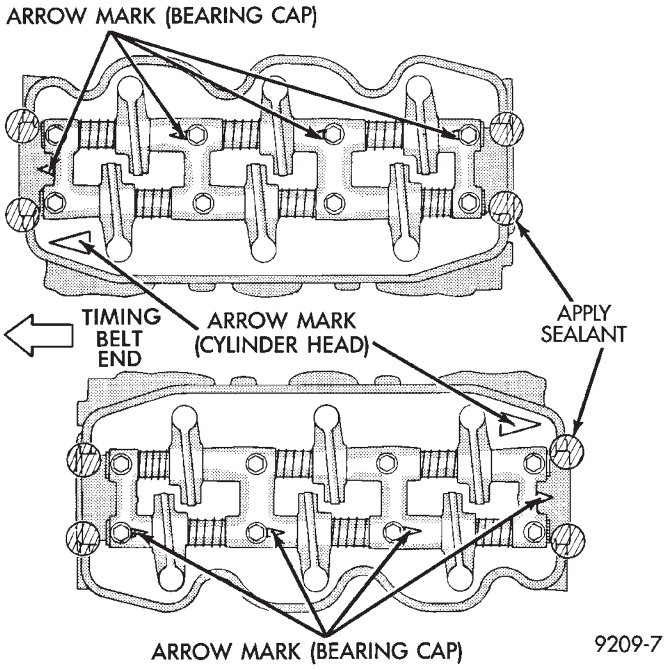


Fig. 8 Camshaft Bearing Caps Position

(1) Align the camshaft bearing caps with arrows (depending on cylinder bank) directed as shown in (Fig. 8) and in numerical order.

Identify number one bearing cap number one and number four caps are similar (Fig. 9).

(2) Install rocker shafts so that bearing cap number one with end notches positioned as shown in Figure 9 that the machined portion of the rocker shaft is facing down.

(3) Insert attaching bolts to retain assembly.

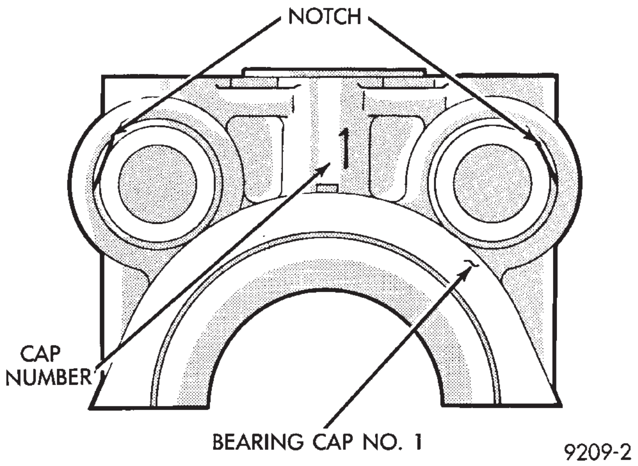


Fig. 9 Number One Camshaft Bearing Cap

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 (Figs. 8 and 10). Insert bolts in number four bearing cap to retain assembly.

INSTALL ROCKER ARM SHAFT ASSEMBLY

(1) Apply Mopar Silicone Rubber Adhesive Sealant at bearing cap ends as shown in (Fig. 8).

(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. 8).

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. 11).

CAMSHAFT OIL SEAL SERVICE— ENGINE OUT OF VEHICLE

(1) Apply light coat of engine oil to the camshaft oil seal lip.

(2) Install the oil seal using camshaft oil seal installer tool MD998713 (Fig. 12).

CAMSHAFT END SEAL (PLUG) SERVICE— 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.

(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,

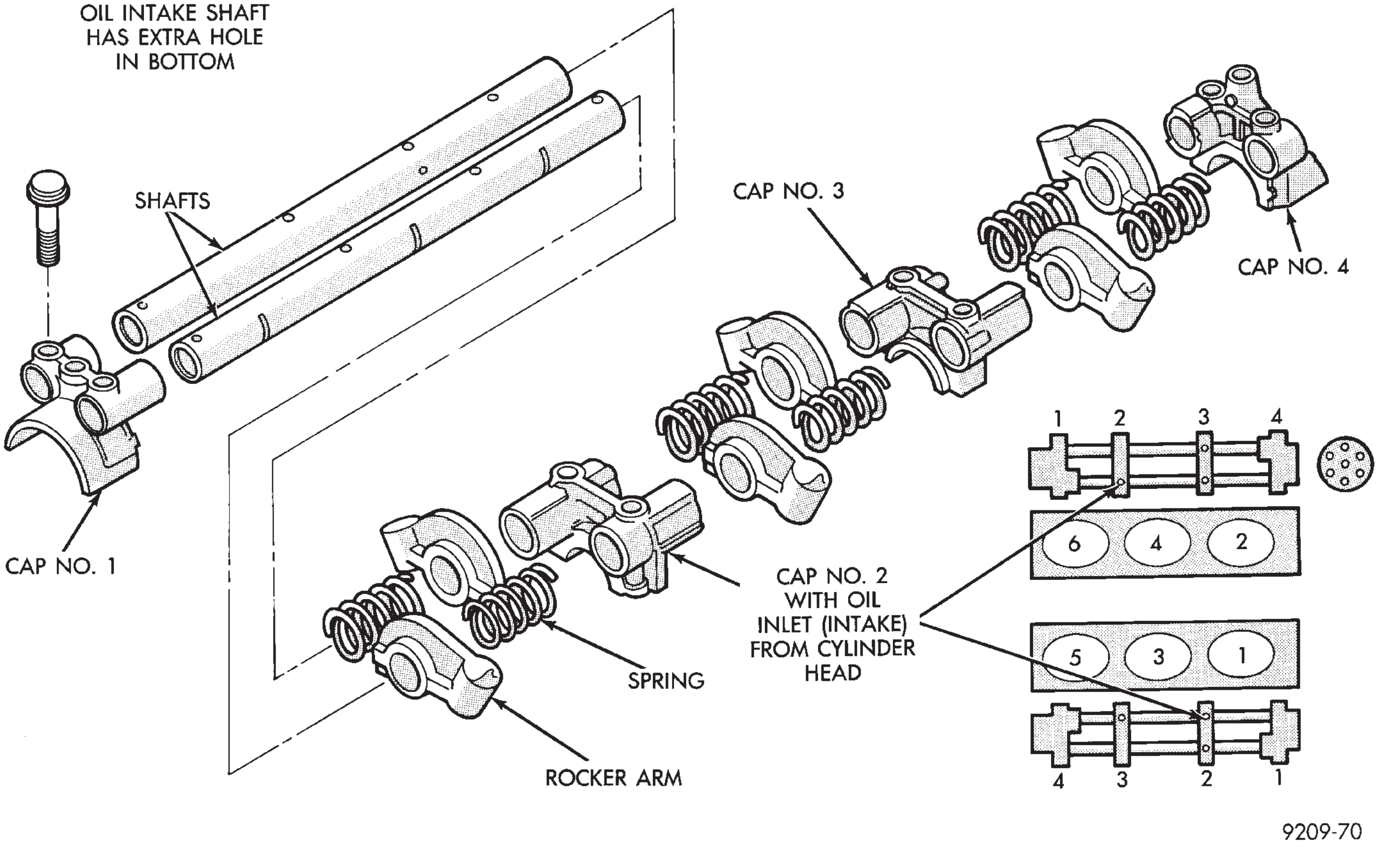


Fig. 10 Assemble Rocker Arm and Shafts

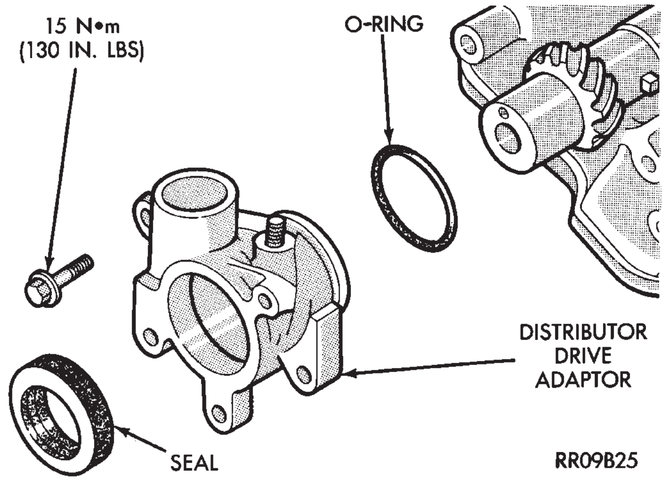


Fig. 11 Distributor Drive

install the new cam plug to a depth of 0.5mm (0.020 inch) below the surface of the cylinder head.

(6) Replace air cleaner assembly.

CAMSHAFT END SEAL (PLUG) SERVICE — OUT OF VEHICLE SERVICE

Install end seal plug with Special Tool MD998306. (Fig. 13).

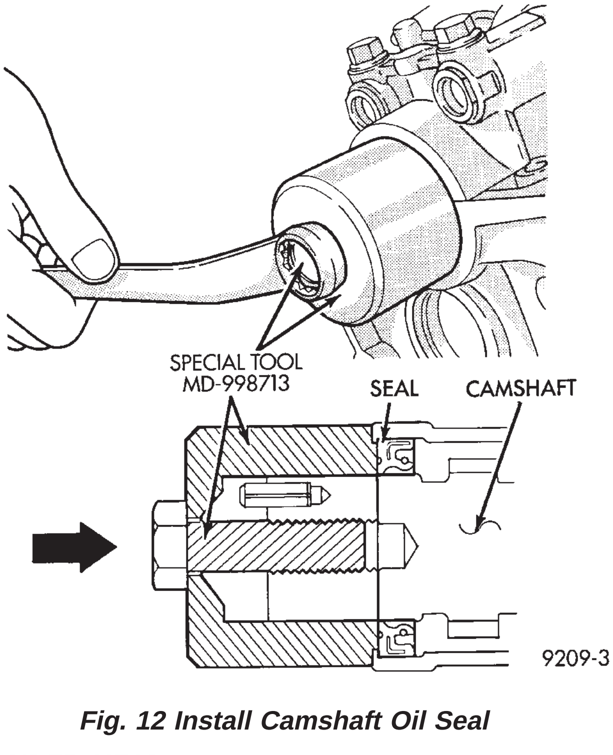


Fig. 12 Install Camshaft Oil Seal

CYLINDER HEAD

REMOVAL

(1) See Timing System this group for disassembly and remove camshaft sprockets.

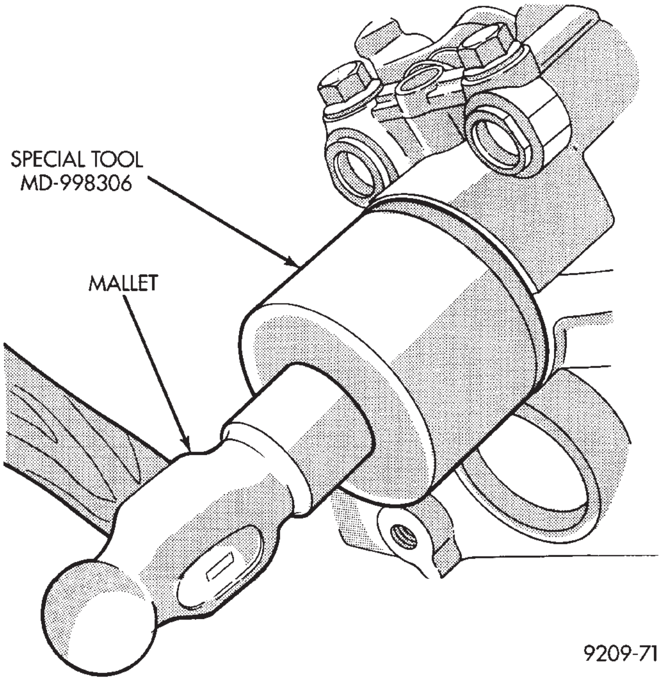


Fig. 13 Install Camshaft End Seal—Plug

(2) See Camshaft Rocker Arms Removal.

(3) Remove upper intake manifold assembly. 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.

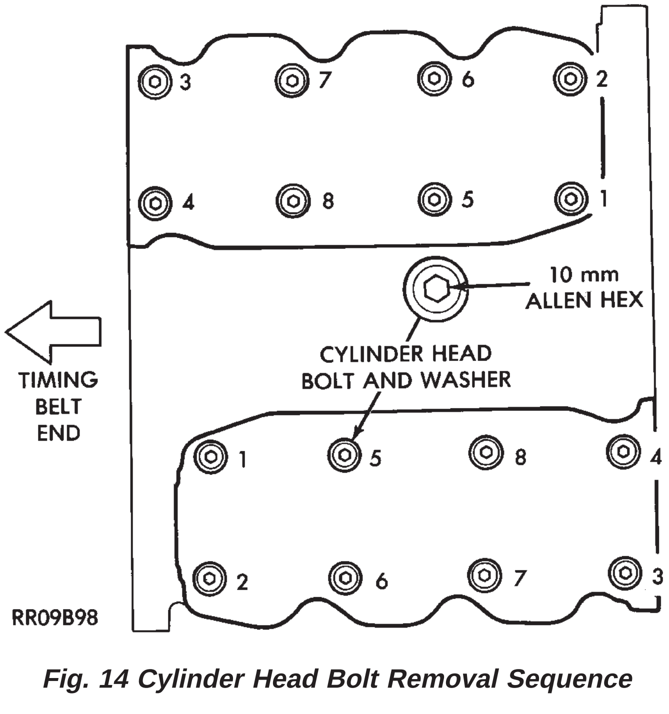


Fig. 14 Cylinder Head Bolt Removal Sequence

(6) Remove cylinder head bolts in sequence shown in (Fig. 14) and remove cylinder head.

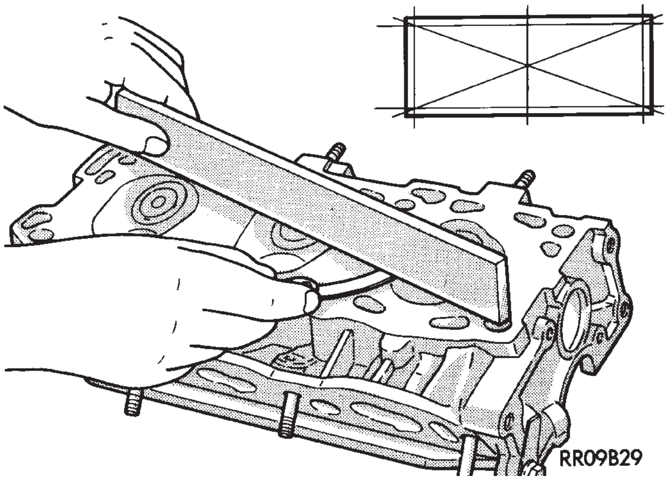


Fig. 15 Check Cylinder Head

INSPECTION

(1) Before cleaning, check for leaks, damage and cracks.

(2) Clean cylinder head and oil passages.

(3) Check cylinder head for flatness (Fig. 15).

(4) Cylinder head must be flat within;

- Standard dimension = less than 0.05mm (.002 inch)
- Service Limit = 0.2mm (.008 inch)
- Grinding Limit = Maximum of 0.2 mm (.008 inch) is permitted.

CAUTION: This is a combined total dimension of stock removal from cylinder head if any and block top surface.

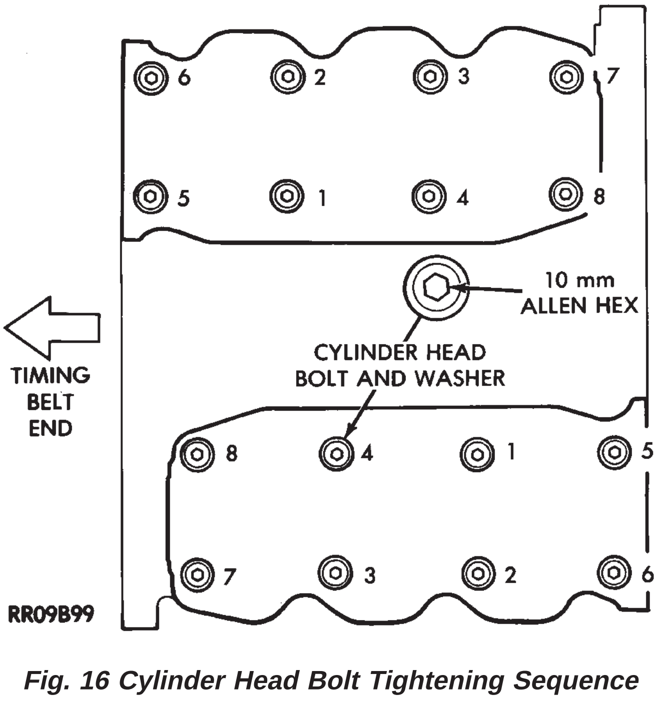


Fig. 16 Cylinder Head Bolt Tightening Sequence

INSTALLATION

(1) Clean surfaces of head and block, install head gasket over locating dowels.

(2) Install head on locating dowels.

(3) Install 10mm allen hex head bolts with washers.

(4) Tighten bolts in the order shown in (Fig. 16). 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.).

VALVE SERVICE

VALVE AND VALVE SPRINGS

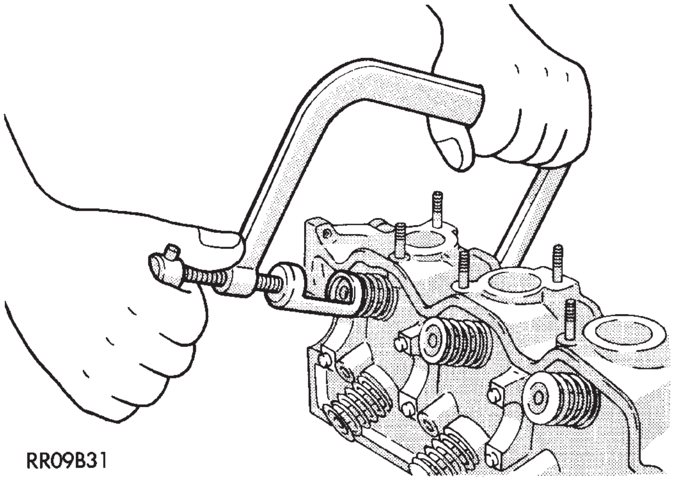


Fig. 17 Remove Valves

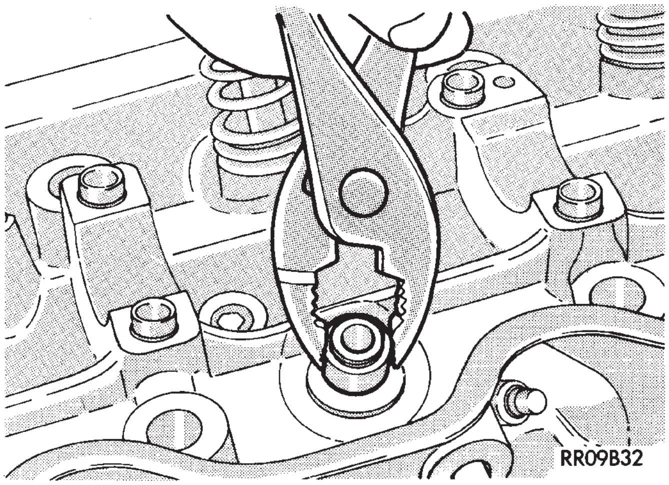


Fig. 18 Remove Valve Stem Seals

(1) With suitable valve spring compressor, remove spring retainer locks, retainer, valve spring, spring seat and valve (Fig. 17).

(2) Remove valve stem seals with suitable tool (Fig. 18). Do not reuse valve stem seals.

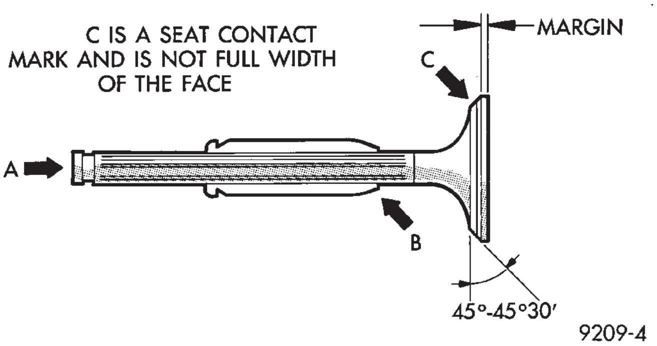


Fig. 19 Valve Inspection

VALVES

(1) Check valve stem tip for pitting or depression at point A (Fig. 19).

(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. Replace valve if margin is out of specification (Fig. 20).

(5) Check valve guide height (Fig. 20).

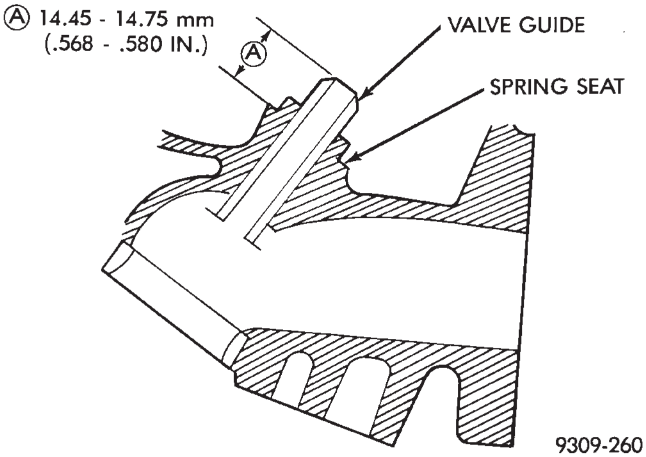


Fig. 20 Valve Guide Height

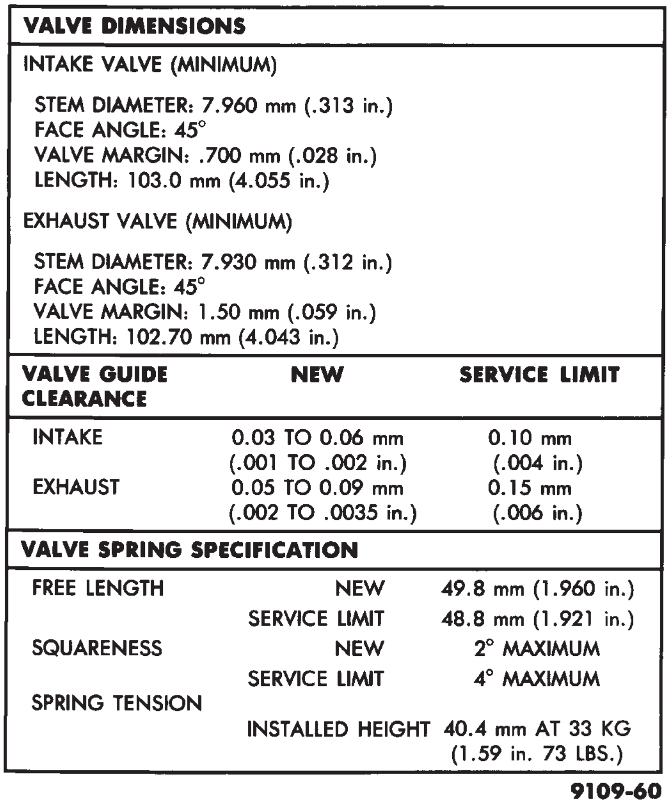
(6) Measure valve stem to guide clearance. Refer to specification (Fig. 21).

(7) Measure Valve spring free length and squareness (Fig. 22). Refer to (Fig. 21) for specifications.

VALVE SEAT INSPECTION

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.

(1) Install valve spring seat.



VALVE DIMENSIONS

INTAKE VALVE (MINIMUM)

STEM DIAMETER: 7.960 mm (.313 in.)
FACE ANGLE: 45°
VALVE MARGIN: .700 mm (.028 in.)
LENGTH: 103.0 mm (4.055 in.)

EXHAUST VALVE (MINIMUM)

STEM DIAMETER: 7.930 mm (.312 in.)
FACE ANGLE: 45°
VALVE MARGIN: 1.50 mm (.059 in.)
LENGTH: 102.70 mm (4.043 in.)

VALVE GUIDE CLEARANCE	**NEW**	**SERVICE LIMIT**
INTAKE	0.03 TO 0.06 mm (.001 TO .002 in.)	0.10 mm (.004 in.)
EXHAUST	0.05 TO 0.09 mm (.002 TO .0035 in.)	0.15 mm (.006 in.)

VALVE SPRING SPECIFICATION		
FREE LENGTH	NEW	49.8 mm (1.960 in.)
	SERVICE LIMIT	48.8 mm (1.921 in.)
SQUARENESS	NEW	2° MAXIMUM
	SERVICE LIMIT	4° MAXIMUM
SPRING TENSION		
	INSTALLED HEIGHT	40.4 mm AT 33 KG (1.59 in. 73 LBS.)

9109-60

Fig. 21 Valve Specification

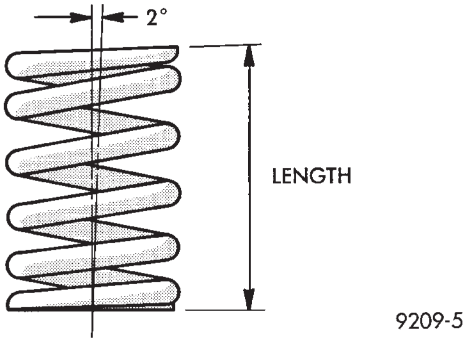


Fig. 22 Valve Spring

(2) Using suitable tool install seal by tapping lightly until seal is in place. (Fig. 24).

(3) Install valve spring with the enamelled ends facing the rocker arms (Fig. 25).

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.

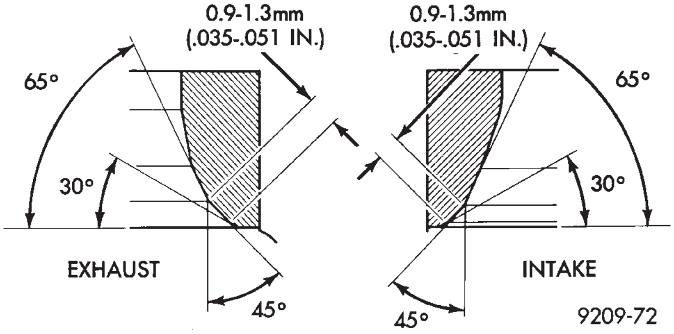


Fig. 23 Valve Seat Reconditioning

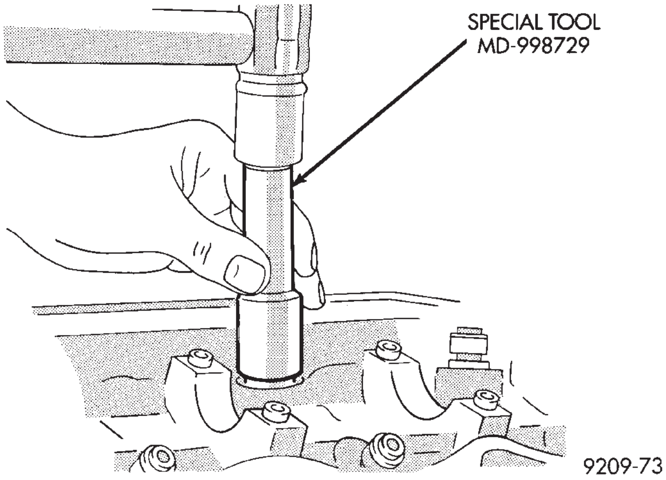


Fig. 24 Install Valve Stem Seals

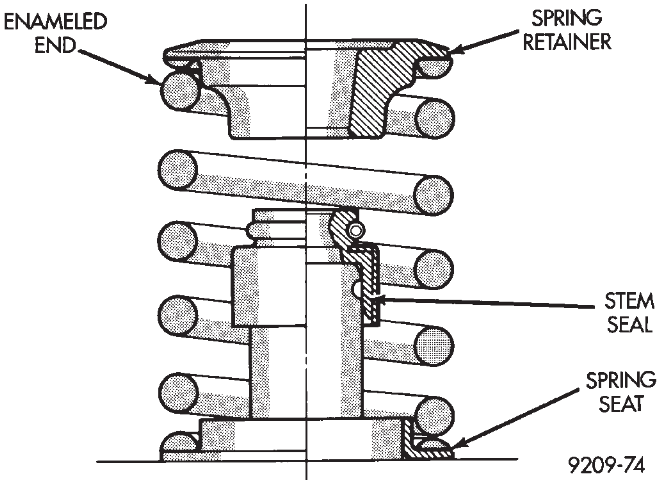


Fig. 25 Installed Valve Spring Position

PISTON AND CONNECTING ROD ASSEMBLY SERVICE

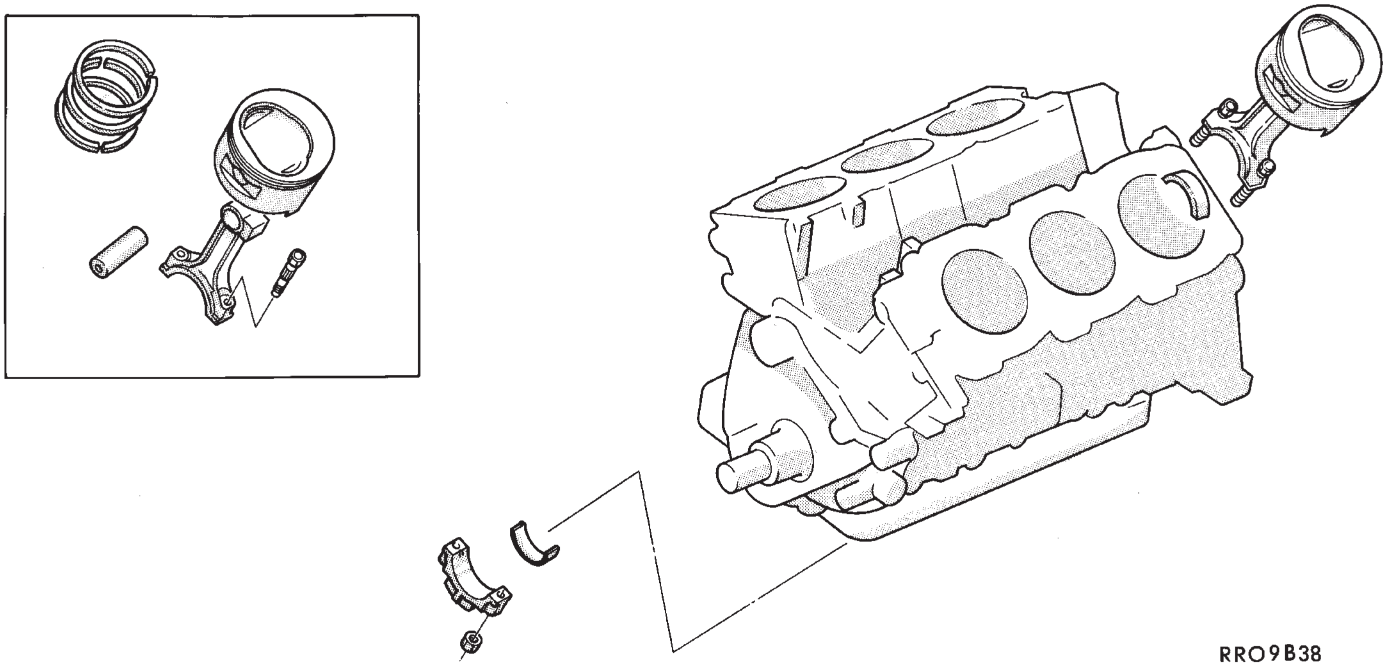


Fig. 1 Pistons, Connecting Rods

(1) Mark Identify Pistons.**The pistons are not interchangeable from bank to bank**(Fig. 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.

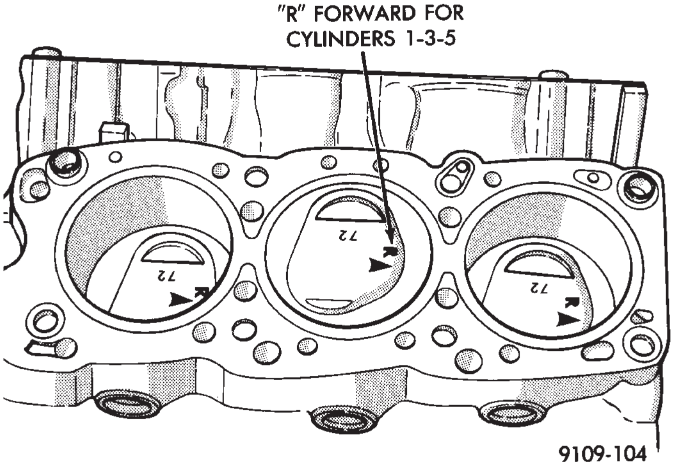


Fig. 2 Mark Pistons

(2) Mark connecting rod and cap with cylinder number (Fig. 3).

(3) Remove piston rings (Fig. 4).

CYLINDER BORE INSPECTION

(1) Measure the cylinder bore at three levels in directions A and B (Fig. 5). Top measurement should be 12mm (.50 inch) down and bottom measurement should be 10mm (.38 inch) up.

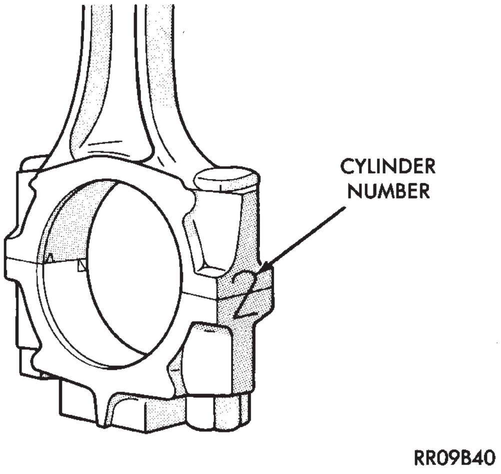


Fig. 3 Mark Matching Parts

(2) Standard bore dimension: 91.1mm (3.587 inch)

(3) Maximum out-of-round or taper: 0.02mm (.0008 inch)

FITTING PISTONS

Measure approximately 2mm (.080 inch) above the bottom of the piston skirt and across the thrust face. (Fig. 6), See Boring Cylinder in Cylinder Block.

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 16mm (0.63 inch) from bottom of

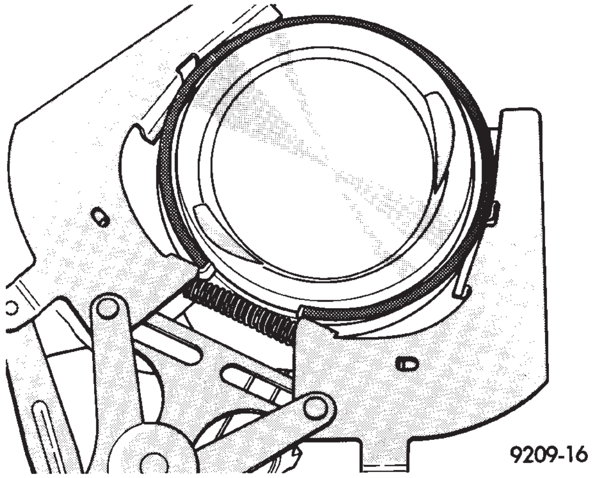


Fig. 4 Remove Piston Rings

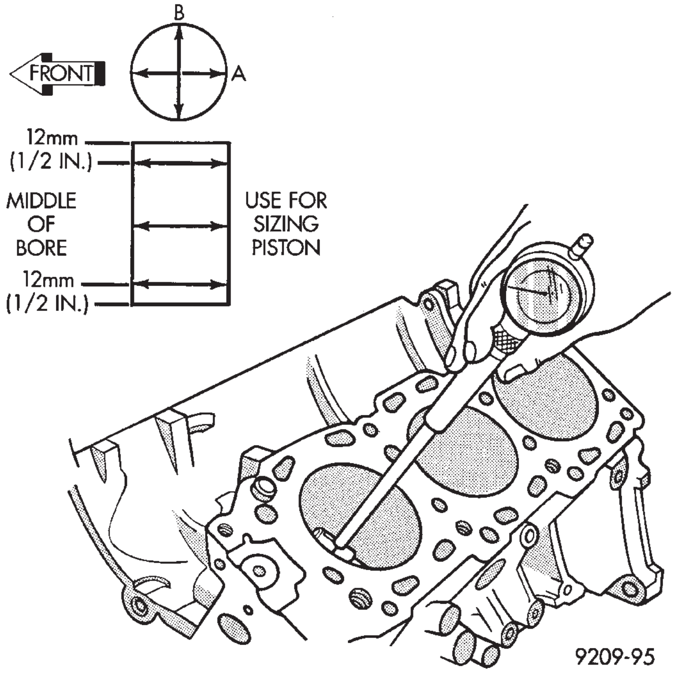


Fig. 5 Checking Cylinder Bore Size

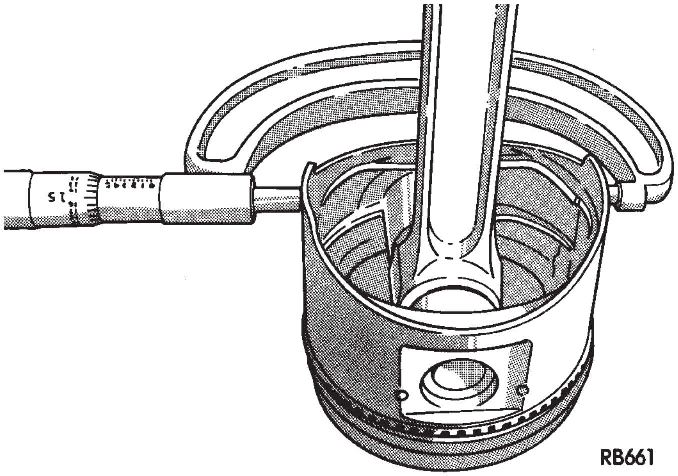


Fig. 6 Piston Clearance and Wear

cylinder bore. Check gap with feeler gauge (Fig. 7). Refer to (Fig. 8) for specification.

(2) Check piston ring to groove clearance; Refer to Piston Ring Specification Chart (Fig. 8).

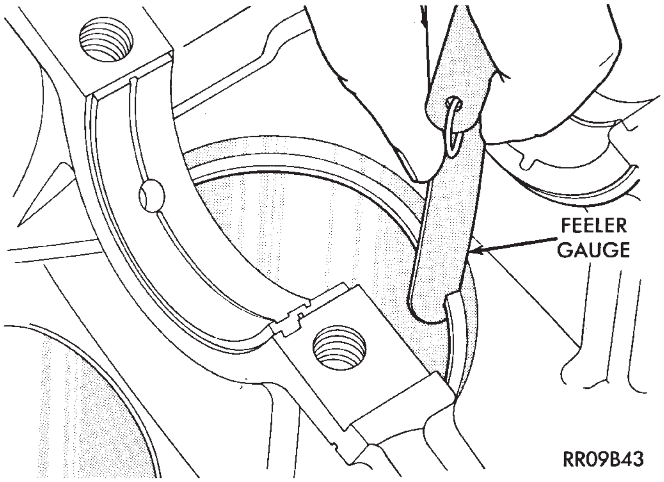


Fig. 7 Check Gap on Piston Rings

RING POSITION	RING GAP	WEAR LIMIT
UPPER RING	0.30 TO 0.45 mm (.012 TO .018 in.)	0.8 mm (.031 in.)
INTERMEDIATE RING	0.25 TO 0.40 mm (.010 TO .016 in.)	0.8 mm (.031 in.)
OIL CONTROL RING	0.30 TO 0.90 mm (.012 TO .035 in.)	1.0 mm (.039 in.)

RING POSITION	GROOVE CLEARANCE	MAXIMUM CLEARANCE
UPPER RING	0.05 TO 0.09 mm (.002 TO .0035 in.)	.10 mm (.004 in.)
INTERMEDIATE RING	0.02 TO 0.06 mm (.0007 TO .002 in.)	.10 mm (.004 in.)

OIL CONTROL RING-THREE PIECE. OIL RING SIDE RAILS MUST BE FREE TO ROTATE AFTER ASSEMBLY.

9109-37

Fig. 8 Piston Ring Specification Chart

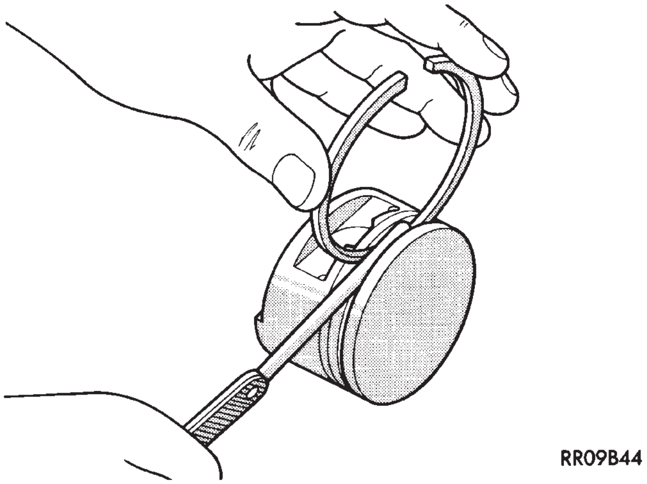


Fig. 9 Piston Ring Clearance

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. 10).

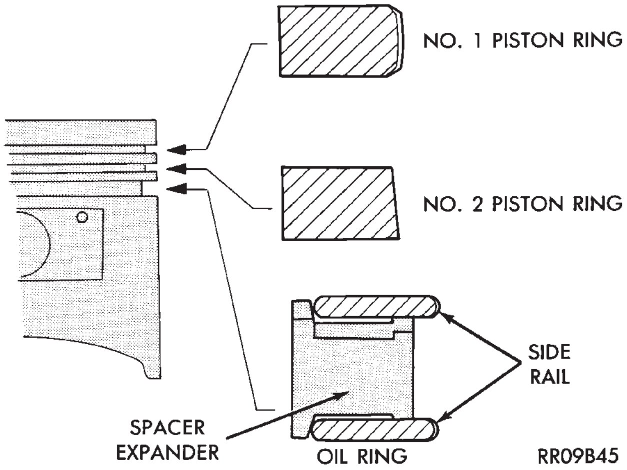


Fig. 10 Piston Ring Installation

CAUTION: Install piston rings in the following order:

(a) Oil ring expander.
(b) Upper oil ring side rail.
(c) Lower oil ring side rail.
(d) No. 2 Intermediate piston ring.
(e) No. 1 Upper piston ring.

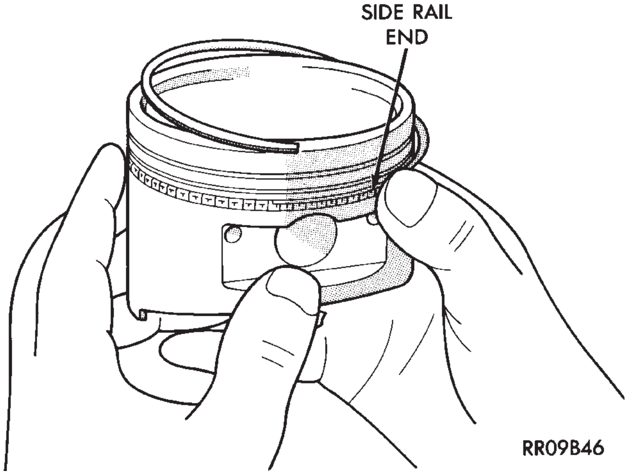


Fig. 11 Installing Side Rail

(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. 11).

(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. 12).

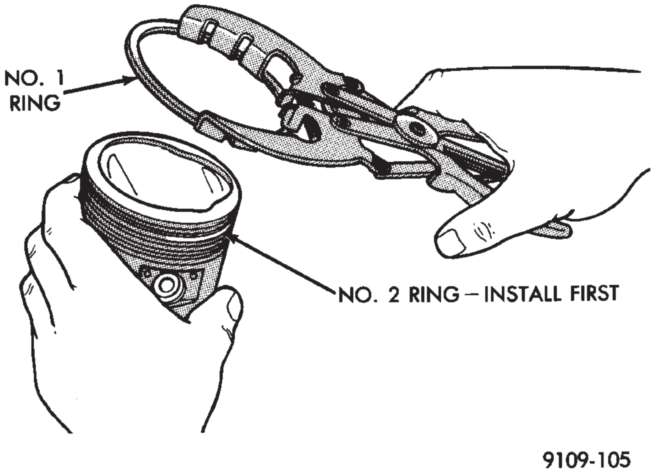


Fig. 12 Installing Upper and Intermediate Rings

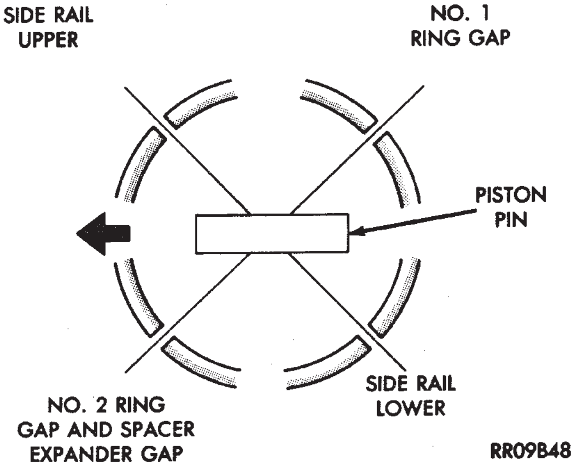


Fig. 13 Piston Ring End Gap Position

(5) Position piston ring end gaps as shown in (Fig. 13).

(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. 14)

(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.

(9) Check alignment marks made during disassembly and that bearing position notches new or used are on the same side as shown in (Fig. 15).

CONNECTING ROD CLEARANCE

(1) Following procedures specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance. (Fig. 16). Refer to (Fig. 18) for specifications.

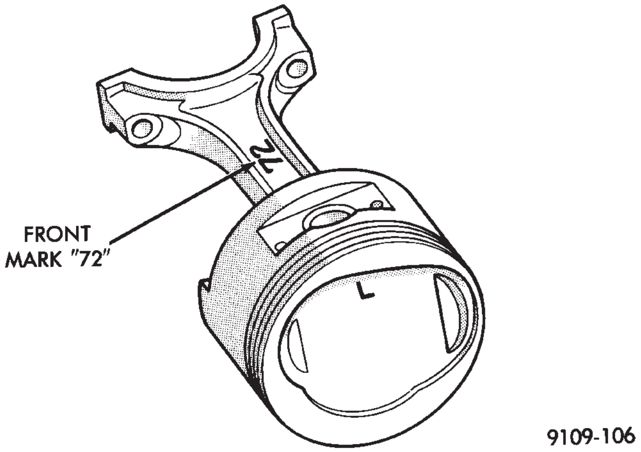


Fig. 14 Identify Piston/Rod Assembly for Cylinder Installation

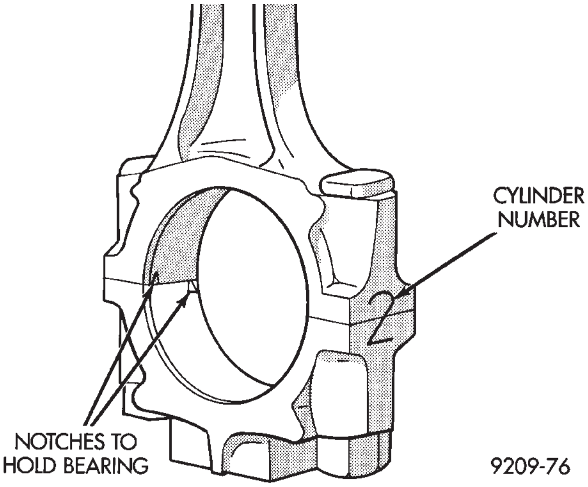


Fig. 15 Connecting Rod and Cap

(2) Tighten nuts to 52 N●m (38 ft. lbs.).

(3) Remove connecting rod cap and measure Plastigage (Fig. 16).

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

CONNECTING ROD SIDE CLEARANCE

Using a feeler gauge, check connecting rod side clearance (Fig. 17). Refer to (Fig. 18) for specification.

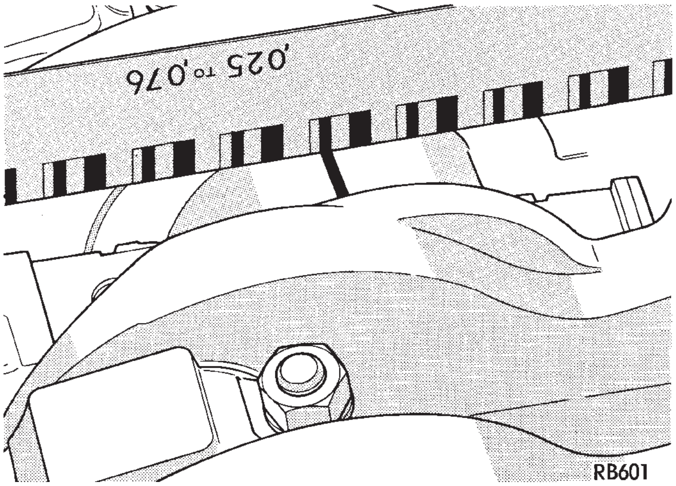


Fig. 16 Connecting Rod Checking Bearing Clearance

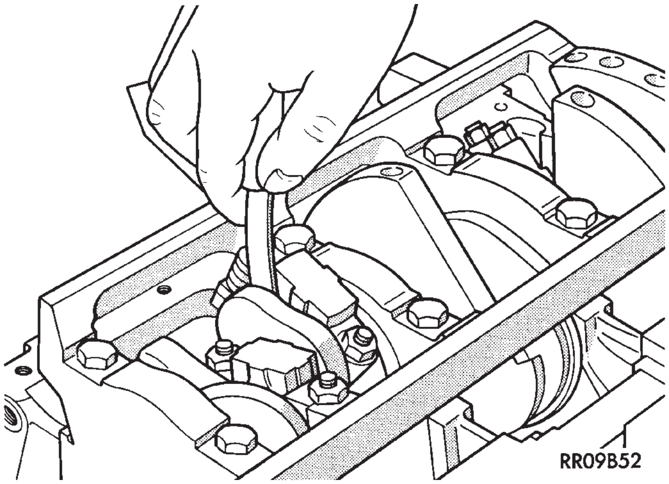
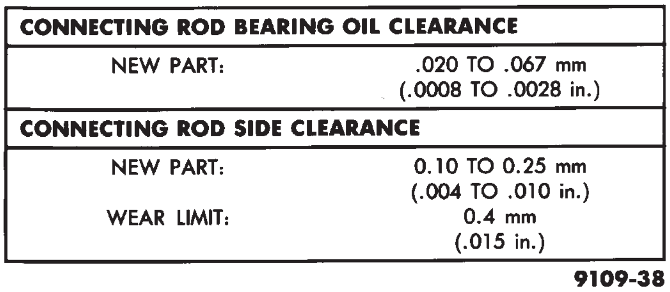


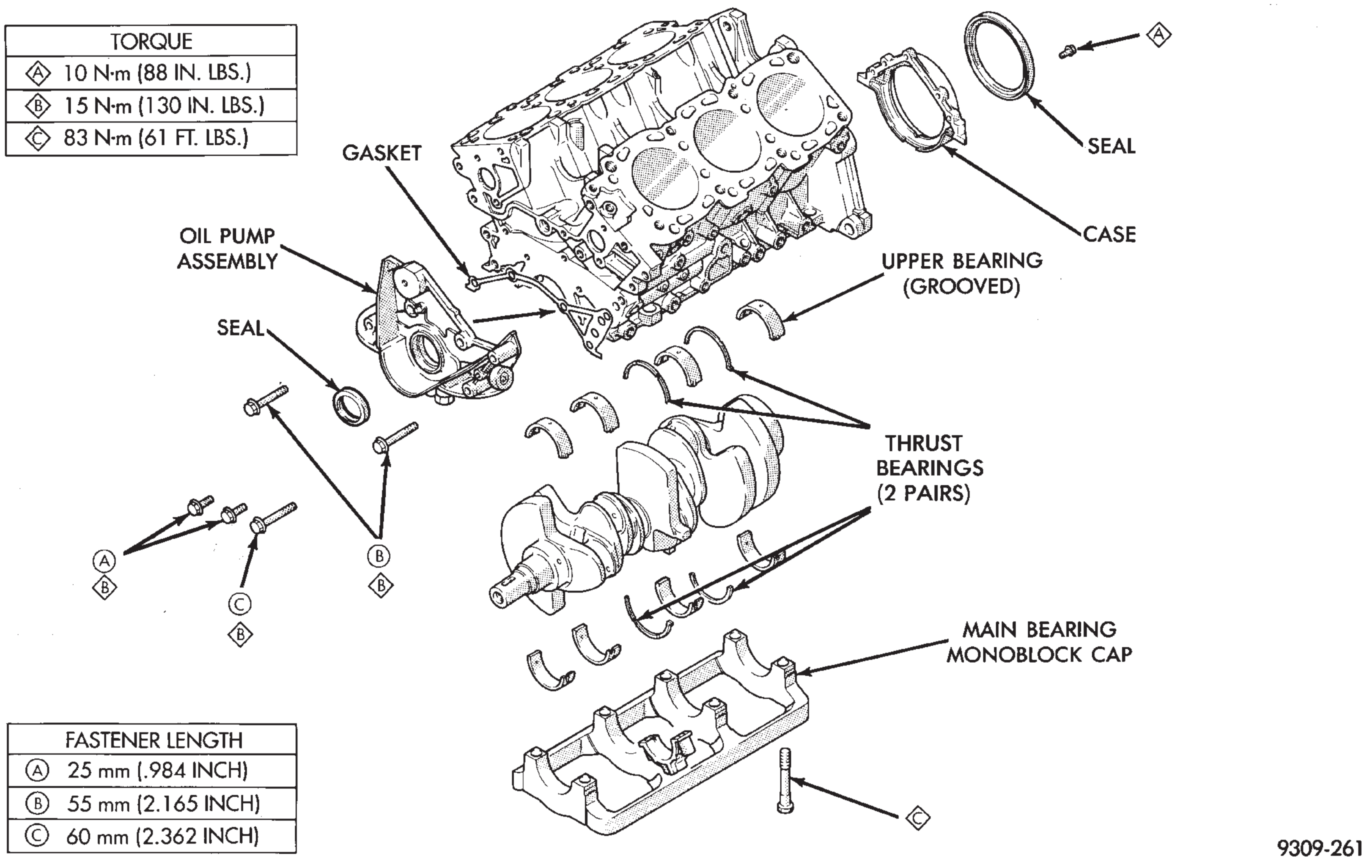
Fig. 17 Checking Connecting Rod Side Clearance



CONNECTING ROD BEARING OIL CLEARANCE	
NEW PART:	.020 TO .067 mm (.0008 TO .0028 in.)
CONNECTING ROD SIDE CLEARANCE	
NEW PART:	0.10 TO 0.25 mm (.004 TO .010 in.)
WEAR LIMIT:	0.4 mm (.015 in.)

Fig. 18 Connecting Rod Clearance Specifications

CRANKSHAFT AND CYLINDER BLOCK, ASSEMBLY SERVICE



TORQUE
◇A 10 N·m (88 IN. LBS.)
◇B 15 N·m (130 IN. LBS.)
◇C 83 N·m (61 FT. LBS.)

FASTENER LENGTH
Ⓐ 25 mm (.984 INCH)
Ⓑ 55 mm (2.165 INCH)
Ⓒ 60 mm (2.362 INCH)

Fig. 1 Crankshaft and Cylinder Block

CRANKSHAFT SERVICE

The crankshaft is supported in four main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells in stalled in the monoblock main bearing cap are plain. Crankshaft end play is controlled by thrust washers on the number three main bearing journal.

CRANKSHAFT—REMOVAL

(1) Remove front mounted oil pump assembly and gasket (Figs. 1 and 2).

(2) Remove rear oil seal retainer and seal as assembly (Fig. 3).

(3) Release monoblock 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. 1).

INSPECTION

Visually check the main and connecting rod bearing journals for wear, scuffs or scoring and replace if necessary.

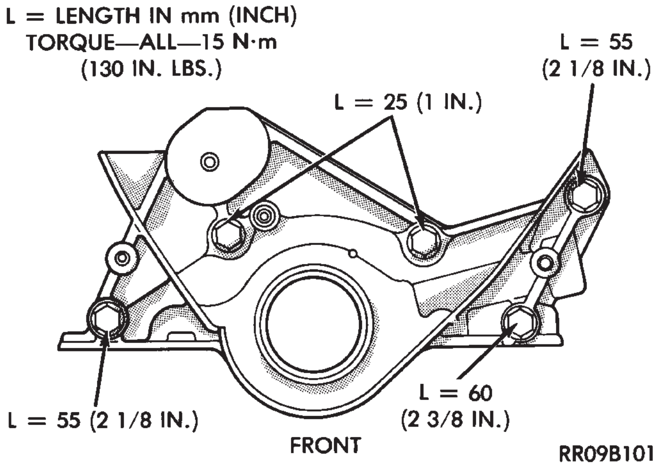


Fig. 2 Oil Pump Assembly

CRANKSHAFT OIL CLEARANCE

MECHANICAL MEASUREMENT

Measure the journal outside diameter and the main bearing inside diameter (Figs. 4 and 5). If the clearance exceeds the specifications limit (Fig. 6). Replace the main bearing(s) and if necessary replace the crankshaft.

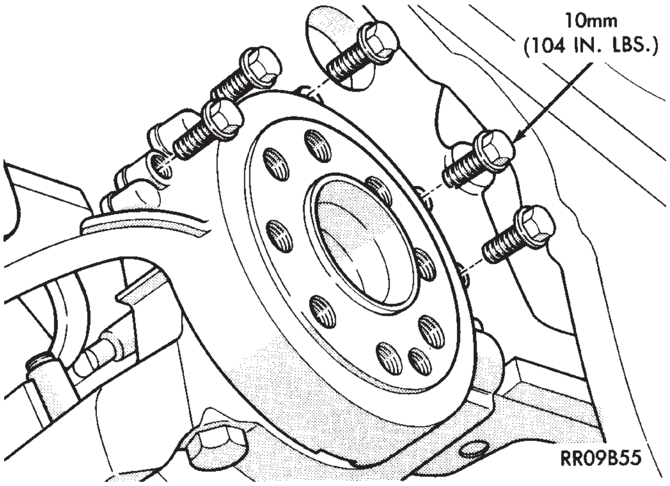


Fig. 3 Rear Seal Assembly

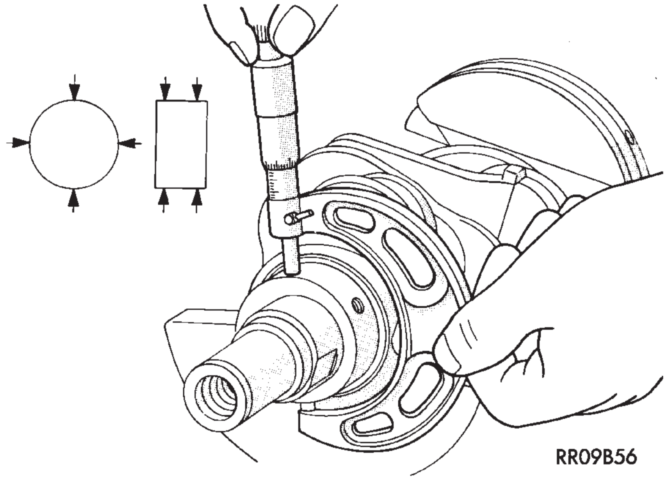


Fig. 4 Measure Crankshaft Journal O.D.

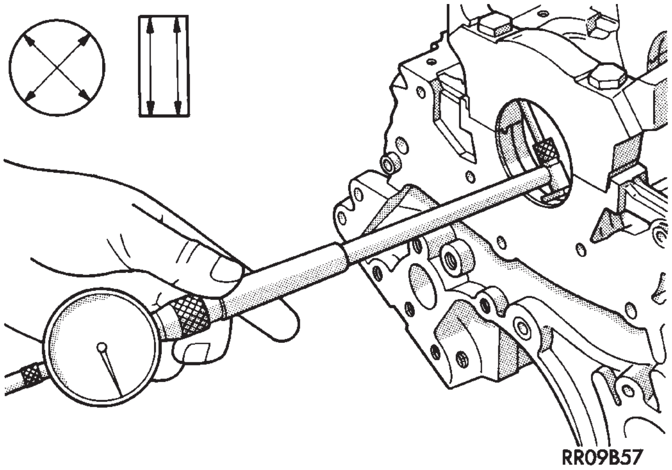


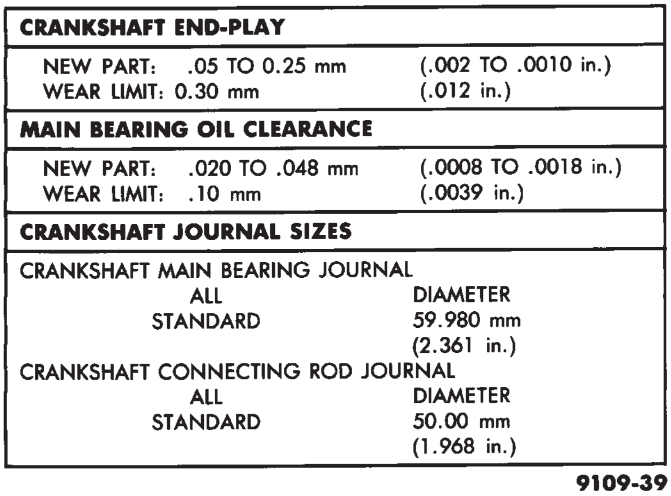
Fig. 5 Measure Main Bearing I.D.

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. 7).



CRANKSHAFT END-PLAY		
NEW PART:	.05 TO 0.25 mm	(.002 TO .0010 in.)
WEAR LIMIT:	0.30 mm	(.012 in.)
MAIN BEARING OIL CLEARANCE		
NEW PART:	.020 TO .048 mm	(.0008 TO .0018 in.)
WEAR LIMIT:	.10 mm	(.0039 in.)
CRANKSHAFT JOURNAL SIZES		
CRANKSHAFT MAIN BEARING JOURNAL		
	ALL	DIAMETER
	STANDARD	59.980 mm (2.361 in.)
CRANKSHAFT CONNECTING ROD JOURNAL		
	ALL	DIAMETER
	STANDARD	50.00 mm (1.968 in.)

9109-39

Fig. 6 Crankshaft Clearance Specification

(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.

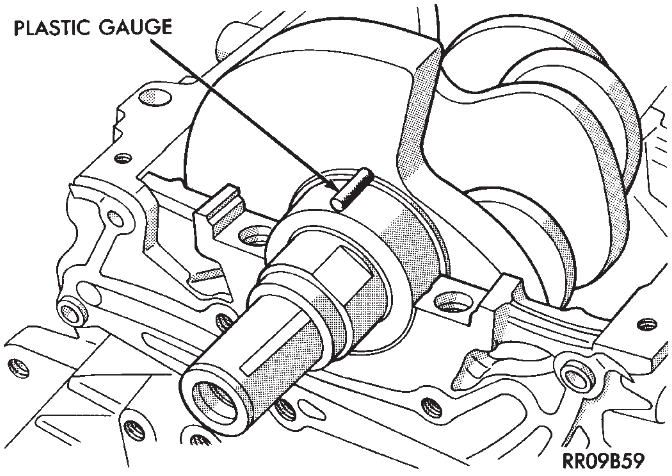


Fig. 7 Measure Oil Clearance with Plastigage

(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. 8). Refer to specification (Fig. 6) for proper clearances. Also see Measuring Main and Connecting Rod Bearing Clearance in Standard Service Procedures.

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. 9).

THRUST BEARINGS. Crankshaft thrust bearings (washers) are installed at journal #3 separately from the radial bearings. Thrust bearings shown in

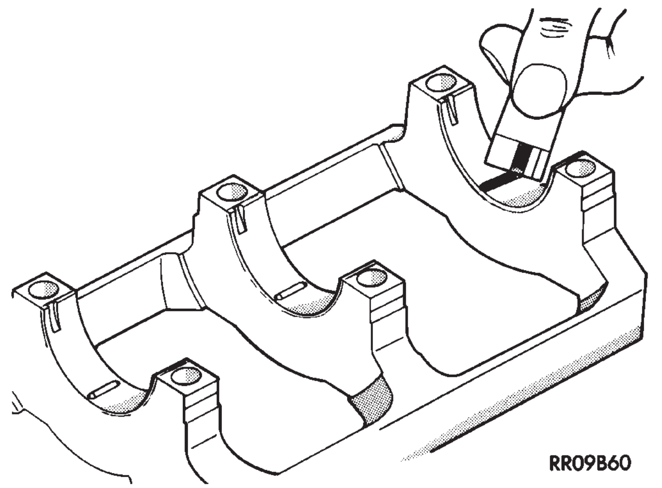


Fig. 8 Measuring Clearance

(Fig. 9) 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. 9).

(2) 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.

(3) Oil the bearings and journals and install crankshaft.

(4) Install lower main bearing shells without oil grooves in monoblock cap.

(5) Install one pair of thrust washers in cap. Refer to Thrust Bearings (Fig. 9).

(6) Carefully install bearing cap with arrows (Fig. 10) toward timing belt end.

(7) Oil the bearing cap bolt threads, install and tighten bolts progressively in sequence shown in (Fig. 9) to 80 N●m (60 ft. lbs.) torque.

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 (Fig. 6) for specification.

CRANKSHAFT OIL SEALS SERVICE

REAR CRANKSHAFT SEAL RETAINER

(1) Install rear crankshaft oil seal in housing with Special Tool MD998718 (Fig. 12).

(2) Apply (Mopar Silicone Rubber Adhesive Sealant or equivalent) to oil seal housing (Fig. 13) per procedure detailed in form-in-place gasket section in Standard Service Procedures.

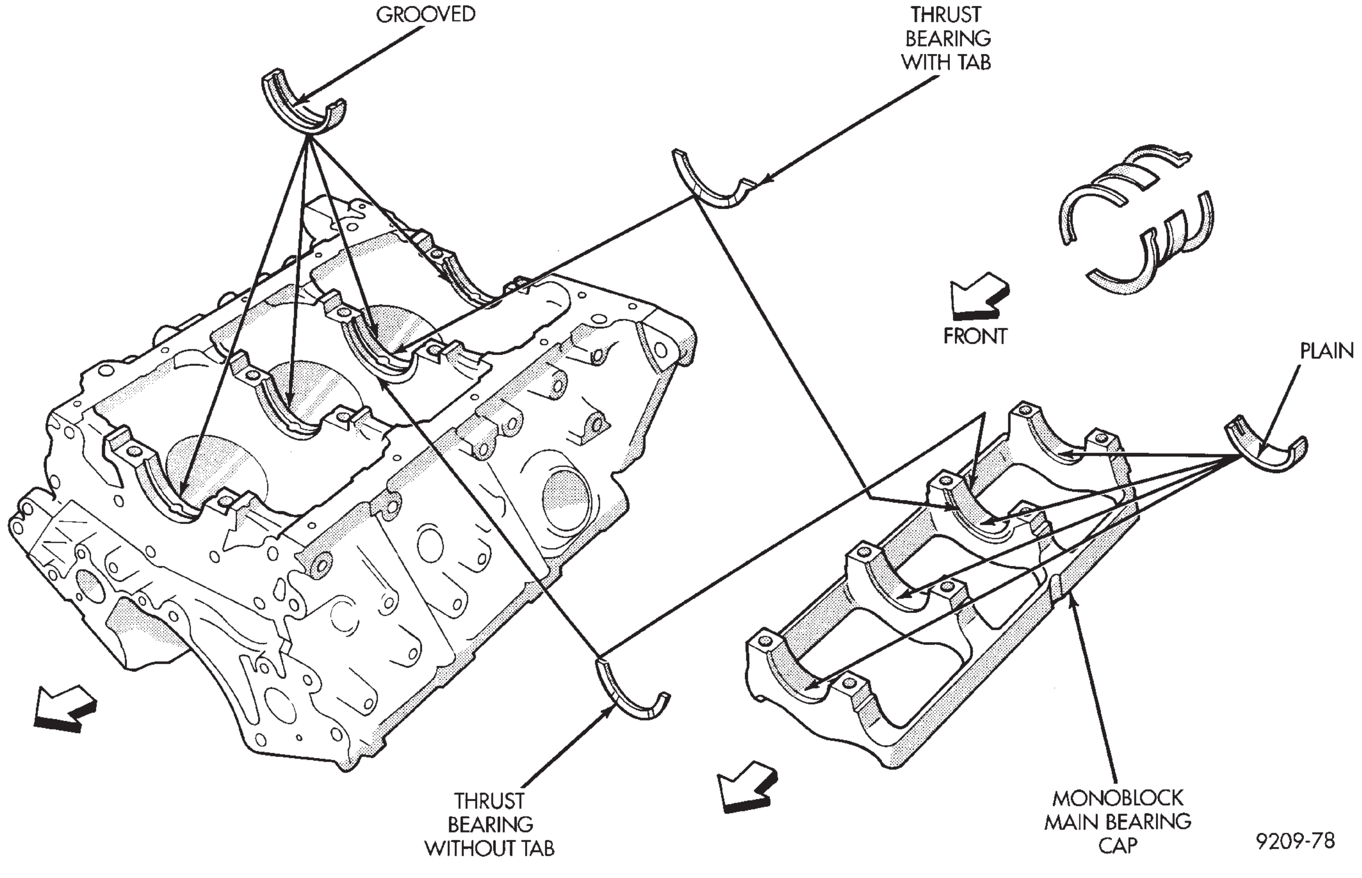


Fig. 9 Install Main Bearings

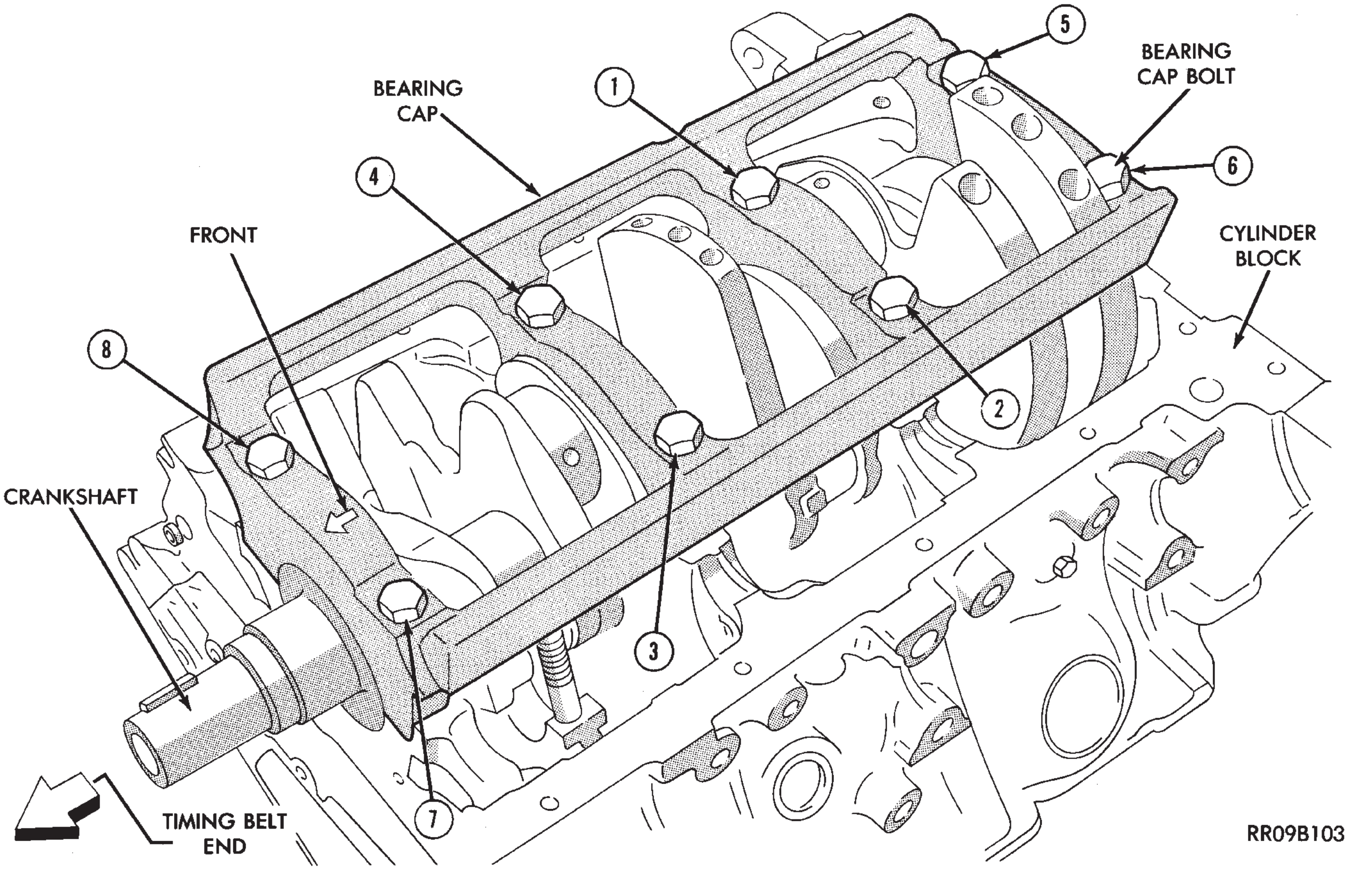


Fig. 10 Crankshaft Main Bearing Cap

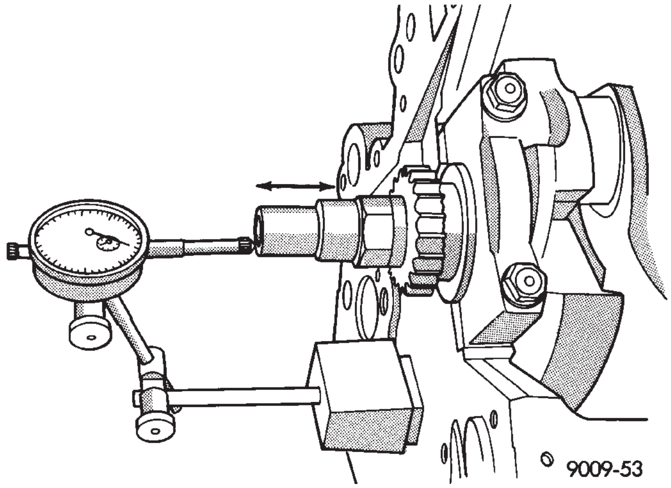


Fig. 11 Checking Crankshaft End Play

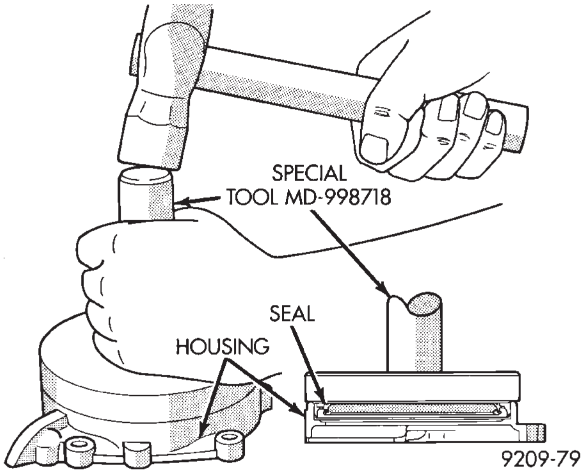


Fig. 12 Install Crankshaft Rear Oil Seal

(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.)

FRONT CRANKSHAFT OIL PUMP AND OIL SEAL

(1) Install oil pump gasket and oil pump case (Figs. 1 and 14).

CAUTION: Install bolts, depending on length in locations shown in (Fig. 14).

(2) Using front crankshaft oil seal installer Special Tool MB998306 install oil seal in oil pump (Fig. 15).

CYLINDER BLOCK

Inspect cylinder block for scratches, cracks and rust or corrosion, and repair or replace as required.

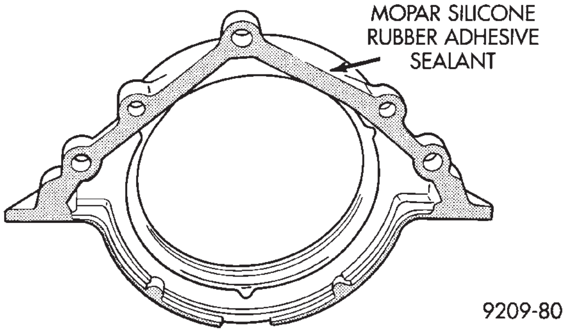


Fig. 13 Apply Sealant to Oil Seal Housing

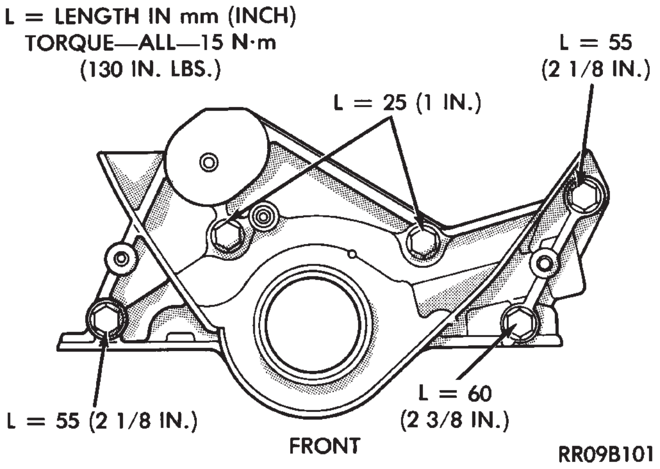


Fig. 14 Oil Pump

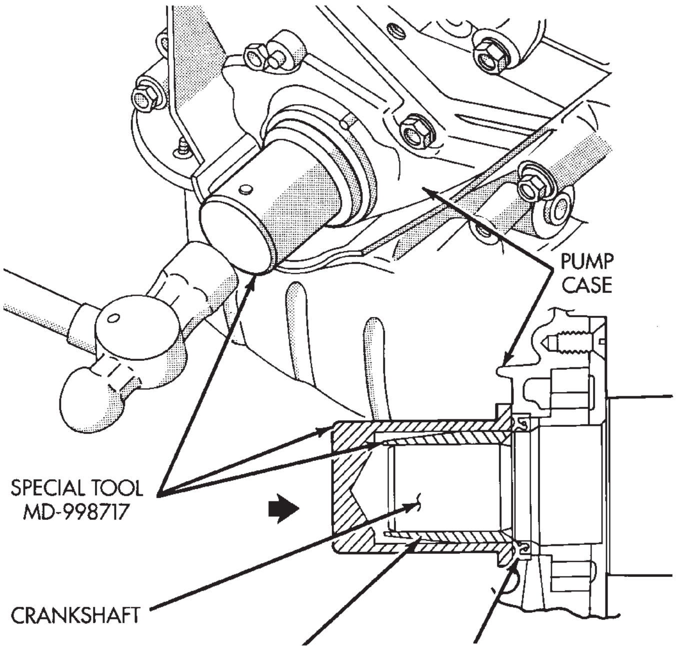


Fig. 15 Crankshaft Front Oil Seal

(1) Clean cylinder block and check top surface for distortion with a straight edge and thickness gauge (Fig. 16).

(2) Top surface must be flat within:

- Standard Value: 0.05 mm (.002 inch)
- Service Limit 0.1 mm (.003 inch)

CAUTION: Maximum of 0.2mm (.008 inch) is permitted. This is a combined total dimension of stock removal from cylinder head (if any) and block top surface.

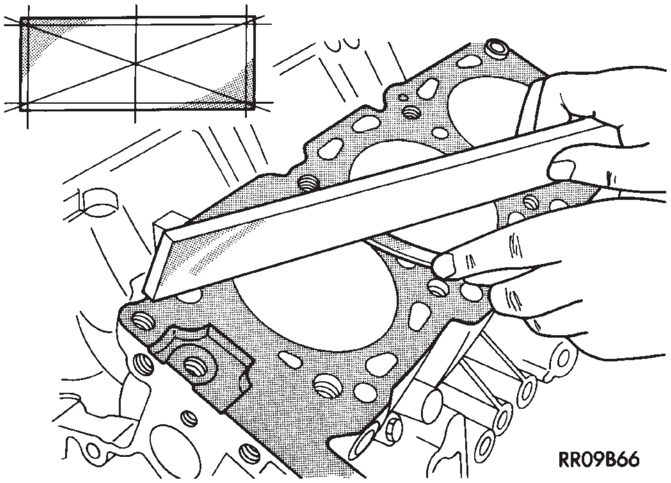


Fig. 16 Distortion Check

BORING CYLINDER

Examine cylinder walls for scuffs, scoring and measure cylinder bore for out-of-round or taper. If defective, bore cylinder to oversize. Measure at points shown in (Fig. 17).

Four oversize pistons are available (0.25mm (.010 inch) 0.50mm (.020 inch) 0.75mm (.030 inch) and 1.0mm (.039 inch). Determine oversize piston on basis of largest cylinder bore.

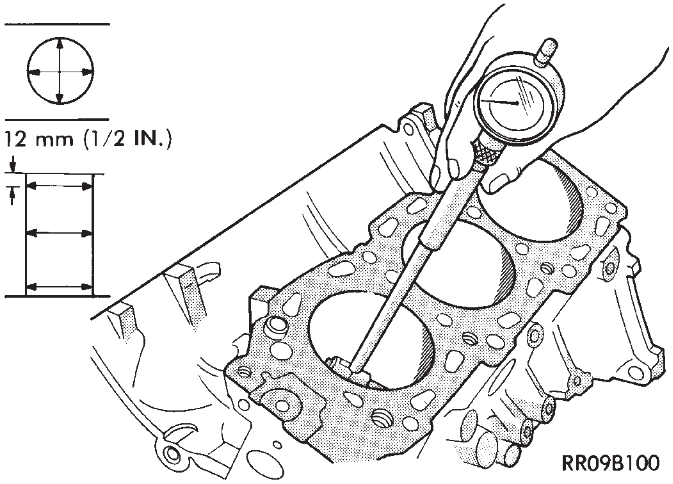


Fig. 17 Measure Cylinder Bore

(1) Bore to specified clearance between the piston O.D. and cylinder. The measuring point of the piston O.D. is shown in (Fig. 18).

(2) Based on measured piston O.D., calculate boring finish dimension. Boring finish dimension equals piston O.D. plus 0.03 to 0.05 mm (.0012 to .002 inch)

(clearance between piston O.D. and cylinder) minus 0.02 mm which is the boring margin.

(3) Bore all cylinders to calculated boring finish dimension. Then bore the final finish dimension (piston O.D. plus cylinder clearance).

(4) Check clearance between piston and cylinder, clearance should be 0.03 to 0.05 mm (.0012 to .002 inch).

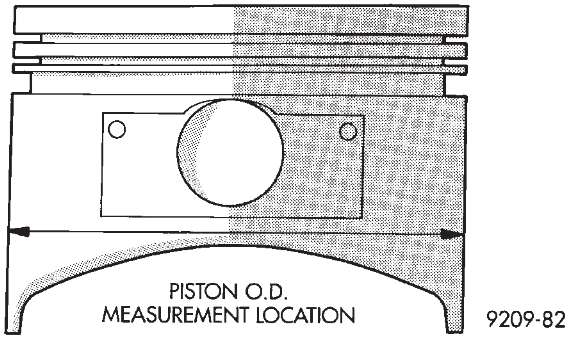


Fig. 18 Measure Piston

ENGINE LUBRICATION SYSTEM

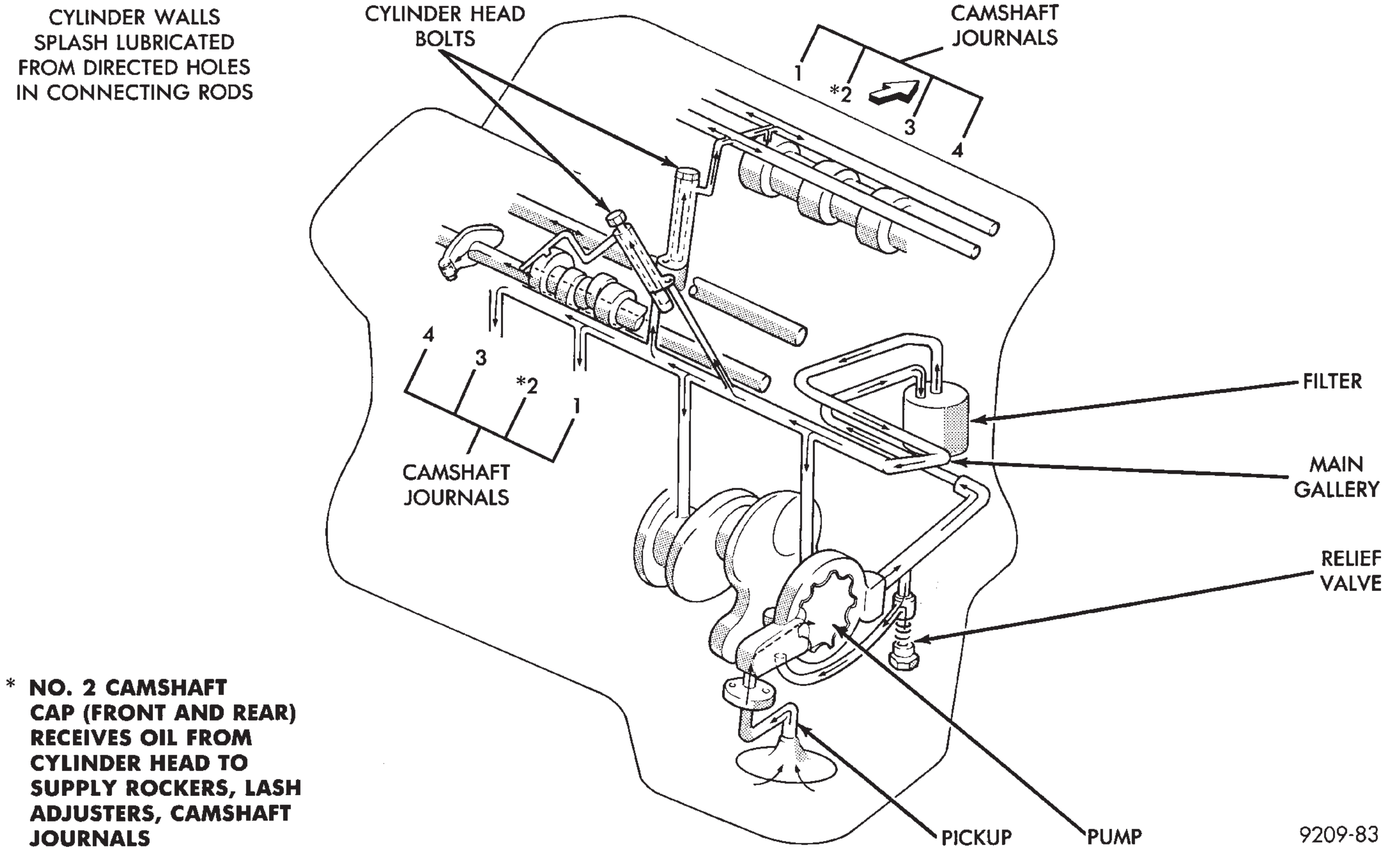


Fig. 1 Engine Oiling

The lubrication system is a full flow filtration pressure feed type. Oil, stored in the oil pan, is taken in and discharged by a internal gear type oil pump directly coupled to the crankshaft and its pressure is regulated by a relief valve. The oil is fed through an oil filter and to the crankshaft journals from the oil gallery in the cylinder block. This gallery also feeds oil under pressure to the cylinder heads. It then flows from a camshaft bearing cap on each cylinder head through passages in the rocker shafts to the rocker arm pivots, auto lash adjusters, and camshaft journals (Fig. 1).

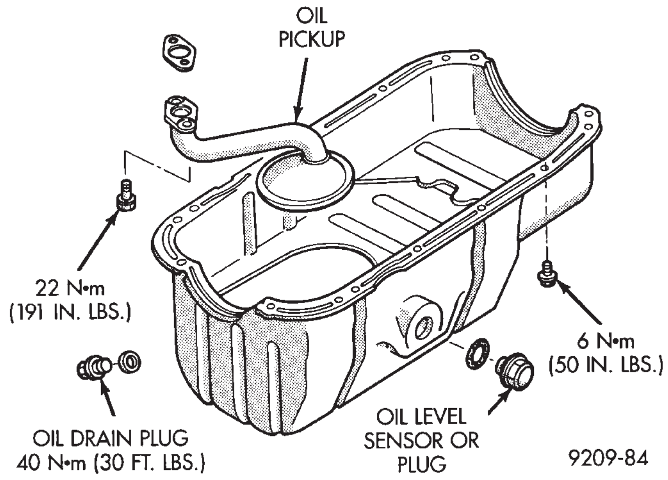


Fig. 2 Oil Pan

OIL PAN

The oil pan is made of sheet metal and is provided with a baffle-plate to prevent fluctuations in the oil level while the vehicle is running (Fig. 2).

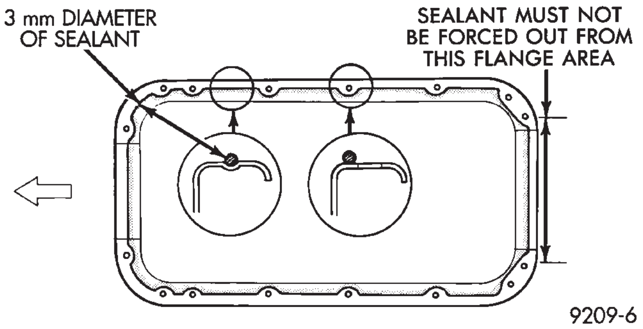


Fig. 3 Oil Pan Sealing

OIL PAN SEALING AND INSTALLATION

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. 3).

(2) Install pan and tighten screws to 6 N●m (50 in. lbs.) in sequence shown in (Fig. 4).

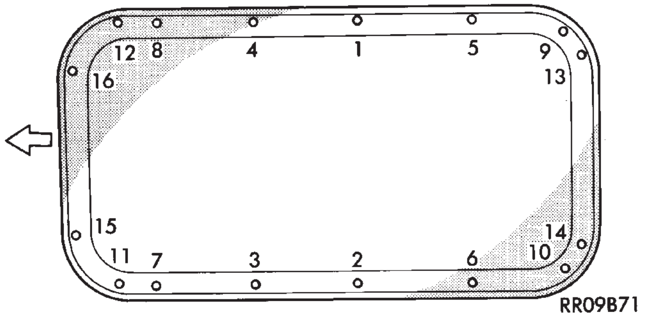


Fig. 4 Oil Pan Screw Tightening Sequence

OIL PUMP SERVICE

The oil pump assembly is mounted on the timing belt end of the cylinder block with the inner pump rotor indexed and installed on the crankshaft nose. (Fig. 5).

The oil pump case also retains the crankshaft front oil seal and provides oil pan front end closure.

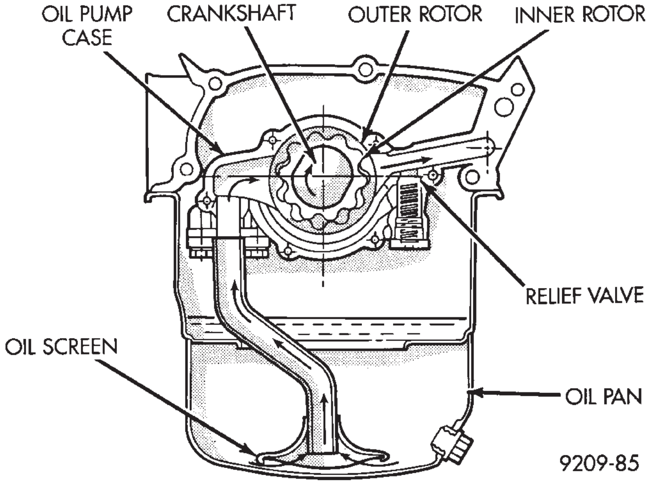


Fig. 5 Oil Pump-Installed

REMOVAL

Remove accessory drive system. Refer to Accessory Drive Service in this group.

Remove 5 bolts that attach oil pump to block (Fig. 6).

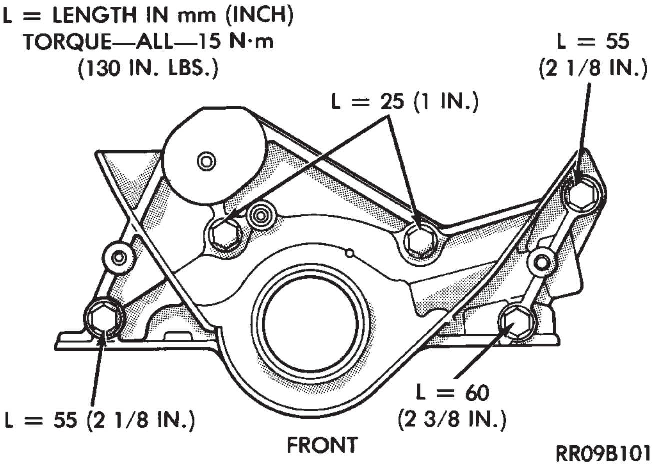


Fig. 6 Oil Pump Assembly

INSPECTION OIL PUMP

(1) Check oil pump case for damage and remove rear cover.

(2) Remove pump rotors and inspect case for excessive wear.

(3) Measure clearance between case and inner rotor (Fig. 8).

(4) Insert the rotor into the oil pump case (Figs. 9 and 10) and measure clearance with a feeler gauge as indicated.

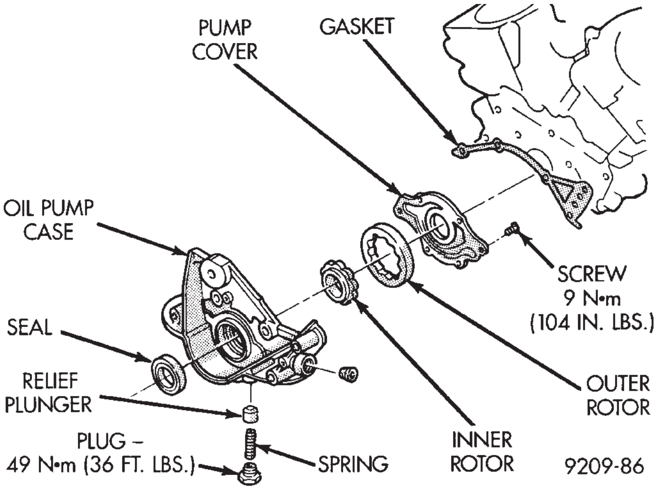


Fig. 7 Oil Pump Components

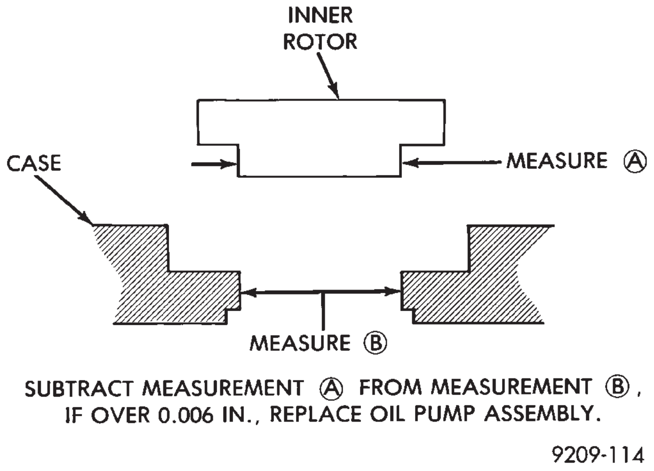


Fig. 8 Inner Rotor to Case

(5) Replace if out of limits.

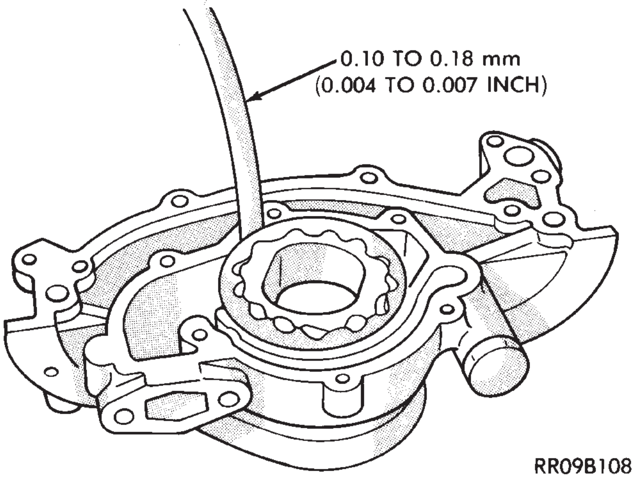


Fig. 9 Checking Clearance-Between Outer Rotor and Case

OIL RELIEF PLUNGER

(1) Check that the oil relief plunger slides smoothly.

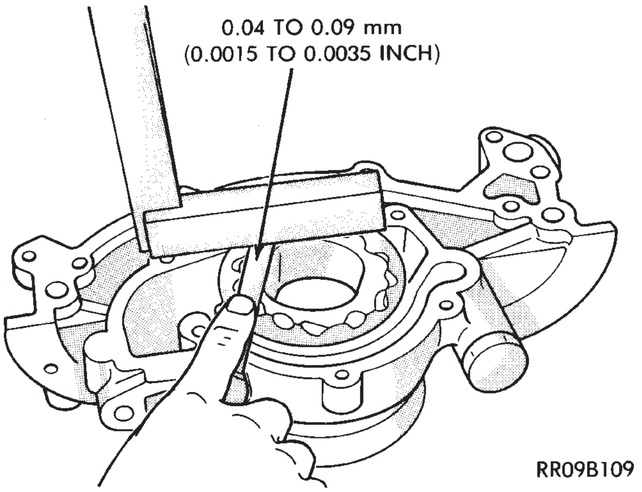


Fig. 10 Checking Rotor End Clearance

(2) Check for broken relief spring.

INSTALLATION

(1) Clean block and pump surfaces.

(2) Install new gasket (Fig. 7) make sure correct length bolts are used (Fig. 6).

(3) Torque bolts to 13 N●m (120 in. lbs.).

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. 11)

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

(2) Warm engine at high idle until thermostat opens.

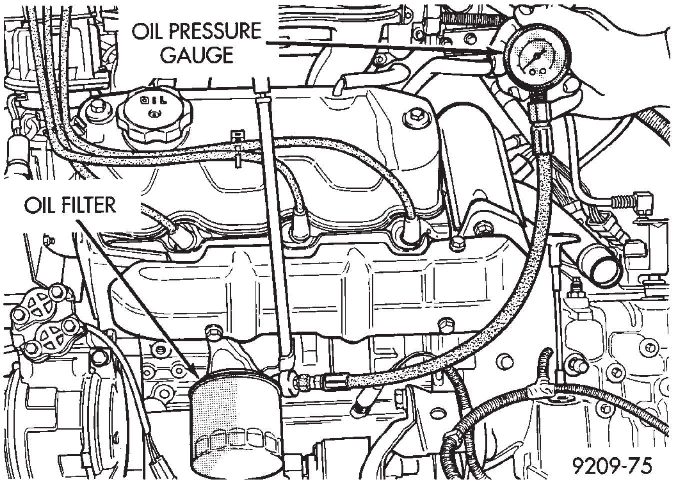


Fig. 11 Checking Oil Pump Pressure

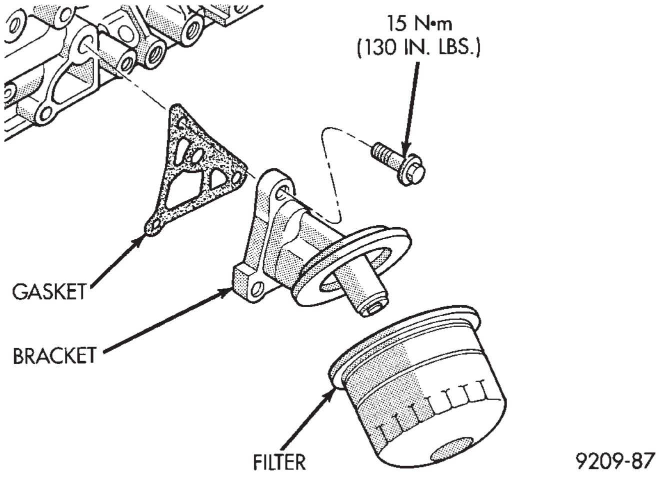


Fig. 12 Oil Filter and Bracket

OIL FILTER AND BRACKET

BRACKET

INSPECTION

(1) Check the oil filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber (Fig. 12).

(2) Check bracket for cracks and oil leaks.

OIL FILTER

CAUTION: When servicing the oil filter (Fig. 16) avoid deforming the filter can by installing the remove/install tool band strap against the can-to-base lockseam. The lockseam joining the can to the base is reinforced by the base plate.

(1) Turn counter clockwise to remove.

(2) To install, lubricate new filter gasket. Screw filter on until gasket contacts base. Tighten 1 turn.

ENGINE SPECIFICATIONS

	Standard
Type	60° V SOHC (Per Bank)
Number of Cylinders	6
Bore	91.1 mm (3.587 inches)
Stroke	76 mm (2.992 inches)
Compression Ratio	8.85:1
Displacement	3.0 Liters (181 Cubic inches)
Firing Order	1-2-3-4-5-6
Basic Ignition Timing	Refer to Emission Control Information on Label in Vehicle
Valve Timing	
Intake —Open	19° BTDC
—Close	59° ABDC
Exhaust —Open	59° BBDC
—Close	19° ATDC

Description	Standard Dimension	Service Limit
Compression Pressure	178 psi @ 250 RPM	—
Maximum Variation Between Cylinders	1.0 Kg/cm² (14 PSI)	25%
Valve Clearance—Hot Engine	Hydraulic Lash Adjusters	—
Cylinder Head		
Flatness of Gasket Surface	0.05 mm (0.002 inch)	—
Grinding Limit of Gasket Surface	—	0.2 mm (0.008 inch)
Manifold—Flatness of Installing Surface		
Intake	0.10 mm (0.004 inch)	0.2 mm (0.0008 inch)
Exhaust	0.15 mm (0.006 inch)	0.3 mm (0.001 inch)
Valves		
Thickness of Valve Head (Margin)		
Intake	1.2 mm (0.047 inch)	0.7 mm (0.027 inch)
Exhaust	2.0 mm (0.079 inch)	1.5 mm (0.059 inch)
Valve Stem to Guide Clearance		
Intake	0.03 to 0.06 mm (0.001 to 0.002 inch)	0.10 (0.004 inch)
Exhaust	0.05 to 0.09 mm (0.0019 to 0.003 inch)	0.15 mm (0.006 inch)
Valve Face Angle	45° to 45° 30′	—
Valve Overall Length		
Intake	103.0 mm (4.055 inches)	—
Exhaust	102.7 mm (4.043 inches)	—
Valve Stem Diameter		
Intake	7.960 to 7.975 mm (0.313 to 0.314 inch)	—
Exhaust	7.930 to 7.950 mm (0.312 to 0.3125 inch)	—
Valve Guide		
Overall Length		
Intake	44 mm (1.732 inches)	—
Exhaust	48 mm (1.889 inches)	—
O.D.	13.055 to 13.065 mm (0.514 to 0.5143 inch)	—
I.D.	8.000 to 8.018 mm (0.314 to 0.315 inch)	—
Height	11.43 to 11.68 mm (.450 to .460 in.)	—
Valve Seat		
Seat Surface Angle	44° to 44°.3′	—
Contact Width	0.9 to 1.3 mm (0.035 to 0.051 inch)	—
Sinkage	—	0.2 mm (0.078 inch)
Valve Spring		
Free Height	49.8 mm (1.960 inches)	48.8
Loaded Height	40.4 mm at 33 kg (1.59 inch at 73 lbs.)	—
Perpendicularity		
Intake and Exhaust	2° Maximum	4° Maximum

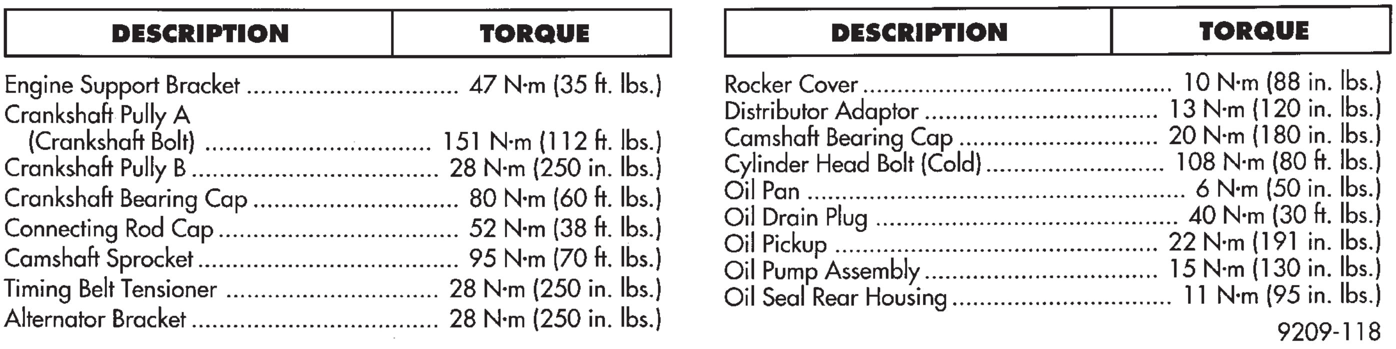
9309-262

ENGINE SPECIFICATIONS (CONT.)

Description	Standard Dimension	Service Limit
Piston		
O.D.	91.06 to 91.09mm (3.585 to 3.586 inches)	—
Piston to Cylinder Clearance	0.03 to 0.05mm (0.0012 to 0.002 inch)	—
Ring End Gap		
No. 1	0.30 to 0.45mm (0.012 to 0.018 inch)	0.8mm (0.03 inch)
No. 2	0.25 to 0.40mm (0.010 to 0.016 inch)	0.8mm (0.03 inch)
Oil	0.30 to 0.90mm (0.012 to 0.035 inch)	1.0mm (0.039 inch)
Ring Side Clearance		
No. 1	0.05 to 0.09mm (0.002 to 0.0035 inch)	0.1mm (0.0039 inch)
No. 2	0.02 to 0.06mm (0.0008 to 0.002 inch)	0.1mm (0.0039 inch)
Oversize Service Pistons	0.25 to 0.50mm (0.010 to 0.020 inch) 0.75 to 1.00mm (0.030 to 0.039 inch)	
Connecting Rod		
Length—Center to Center	140.9 to 141.0mm (5.547 to 5.551 inches)	—
Parallelism—Twist	0.05mm (0.0019 inch)	—
Torsion	0.1mm (0.0039 inch)	—
Big End Thrust Clearance	0.10 to 0.25mm (0.004 to 0.010 inch)	0.4mm (0.016 inch)
Crankshaft		
End Play	0.05 to 0.25mm (0.002 to 0.010 inch)	0.3mm (0.012 inch)
Main Journal Diameter	59.980 to 60.000mm (2.361 to 2.362 inches)	—
Pin Diameter	49.980 to 50.000mm (1.968 to 1.969 inches)	—
Bearing Surface Out-of-Round	0.03mm Max. (0.001 inch) Max.	—
Bearing Surface Taper	0.005mm Max. (0.0002 inch) Max.	—
Bearing Oil Clearance	(0.015 to 0.050 mm) (0.0006 to 0.002 inch)	—
Undersize Service Bearings	0.25 to 0.50—0.75mm (0.010 to 0.020—0.030 inch)	
Cylinder Block		
I.D. (Bore)	91.1 mm (3.587 inches)	—
Flatness of Top Surface	0.05mm (0.002 inch)	0.1mm (0.0039 inch)
Grinding Limit of Top Surface	0.2mm* (0.008 inch)	0.2mm* (0.008 inch)
*Includes/Combined With Cylinder Head Grinding		
Oil Pump		
Relief Valve Opening Pressure	5.0 to 6.0 kg/cm² (71.45 to 85.75 psi)	—
Outer Rotor to Case Clearance	0.10 to 0.18mm (0.004 to 0.007 inch)	0.18mm (0.007 inch)
Rotor End Clearance	0.04 to 0.09mm (0.0015 to 0.0035 inch)	0.09mm (0.0035 inch)
Inner Rotor Pilot to Case Clearance	0.03 to 0.07mm (0.001 to 0.0028 inch)	0.15mm (0.006 inch)
Minimum Pressure, Engine Fully Warmed Up at Idle	41 kPa (6 psi)	
3000 RPM	241-517 kPa (35-75 psi)	

9309-263

TORQUE



DESCRIPTION	TORQUE
Engine Support Bracket	47 N·m (35 ft. lbs.)
Crankshaft Pully A (Crankshaft Bolt)	151 N·m (112 ft. lbs.)
Crankshaft Pully B	28 N·m (250 in. lbs.)
Crankshaft Bearing Cap	80 N·m (60 ft. lbs.)
Connecting Rod Cap	52 N·m (38 ft. lbs.)
Camshaft Sprocket	95 N·m (70 ft. lbs.)
Timing Belt Tensioner	28 N·m (250 in. lbs.)
Alternator Bracket	28 N·m (250 in. lbs.)

DESCRIPTION	TORQUE
Rocker Cover	10 N·m (88 in. lbs.)
Distributor Adaptor	13 N·m (120 in. lbs.)
Camshaft Bearing Cap	20 N·m (180 in. lbs.)
Cylinder Head Bolt (Cold)	108 N·m (80 ft. lbs.)
Oil Pan	6 N·m (50 in. lbs.)
Oil Drain Plug	40 N·m (30 ft. lbs.)
Oil Pickup	22 N·m (191 in. lbs.)
Oil Pump Assembly	15 N·m (130 in. lbs.)
Oil Seal Rear Housing	11 N·m (95 in. lbs.)

9209-118

3.3/3.8L ENGINE

INDEX

SPECIFICATIONS

	3.3L Engine	3.8L Engine
Type	60° V-6 Engine	
Bore	93.0 mm (3.661 Inch)	96.0 mm (3.779 Inch)
Stroke	81.0 mm (3.188 Inch)	87.0 mm (3.425 Inch)
Compression Ratio	8.9:1	
Displacement	3.3 Liters (201 Cubic Inch)	3.8 Liters (231 Cubic Inch)
Brake Horsepower	147 @ 4800 RPM	151 @ 4400 RPM
Torque	183 Lb. Ft. @ 3600 RPM	204 Lb. Ft. @ 3200 RPM
Firing Order	1-2-3-4-5-6	
Lubrication	Pressure Feed-Full Flow Filtration (Direct Crankshaft Driven Pump)	
Engine Oil Capacity	4.25 Liters (4.5 Qts.) Including Oil Filter, 3.8 Liter (4.0 Qts.) Without Oil Filter	
Cooling System	Liquid Cooled-Forced Circulation	
Cylinder Block	Cast Iron	
Crankshaft	Nodular Iron	
Cylinder Head	Aluminum Alloy	
Connecting Rods	Forged Steel	
Pistons	Aluminum Alloy	

9309-264

GENERAL INFORMATION

ENGINE IDENTIFICATION NUMBER OR CODE

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 2).

ENGINE: The 3.3L (201 Cubic. Inches.) and 3.8L (231 Cubic. Inches.) displacement engines are 60° V type six cylinder power plant with cast iron cylinder block and aluminum cylinder heads (Fig. 1). 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 seal.

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 crankshaft seal, provides front oil pan closure, water pump mounting.

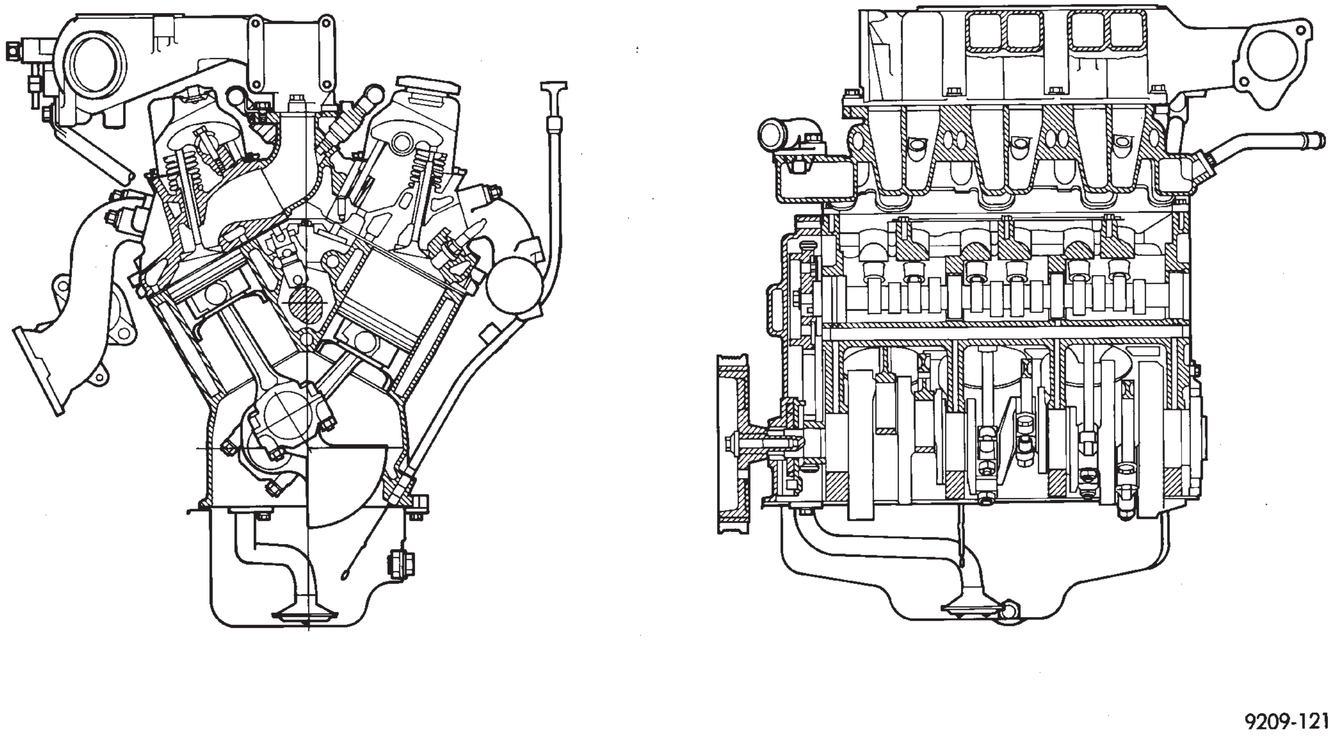
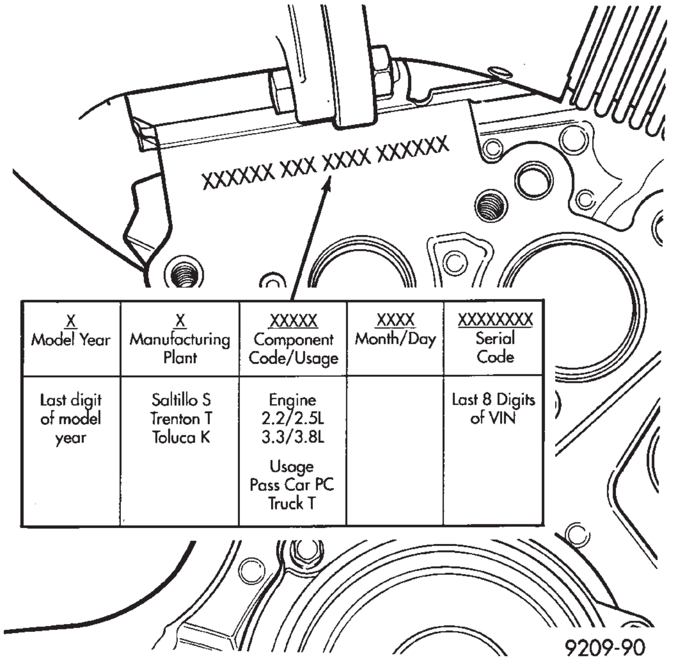


Fig. 1 3.3/3.8L V-6 Engine



X Model Year	X Manufacturing Plant	XXXXX Component Code/Usage	XXXX Month/Day	XXXXXXXX Serial Code
Last digit of model year	Saltillo S Trenton T Toluca K	Engine 2.2/2.5L 3.3/3.8L Usage Pass Car PC Truck T		Last 8 Digits of VIN

Fig. 2 Engine Identification

CYLINDER HEADS: Cylinder heads incorporate valve shrouding to create turbulence-producing combustion chambers, described as fast burn. Valve seat and guides are inserts. A steel flanged composition type gasket is used between head and block.

VALVE 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.

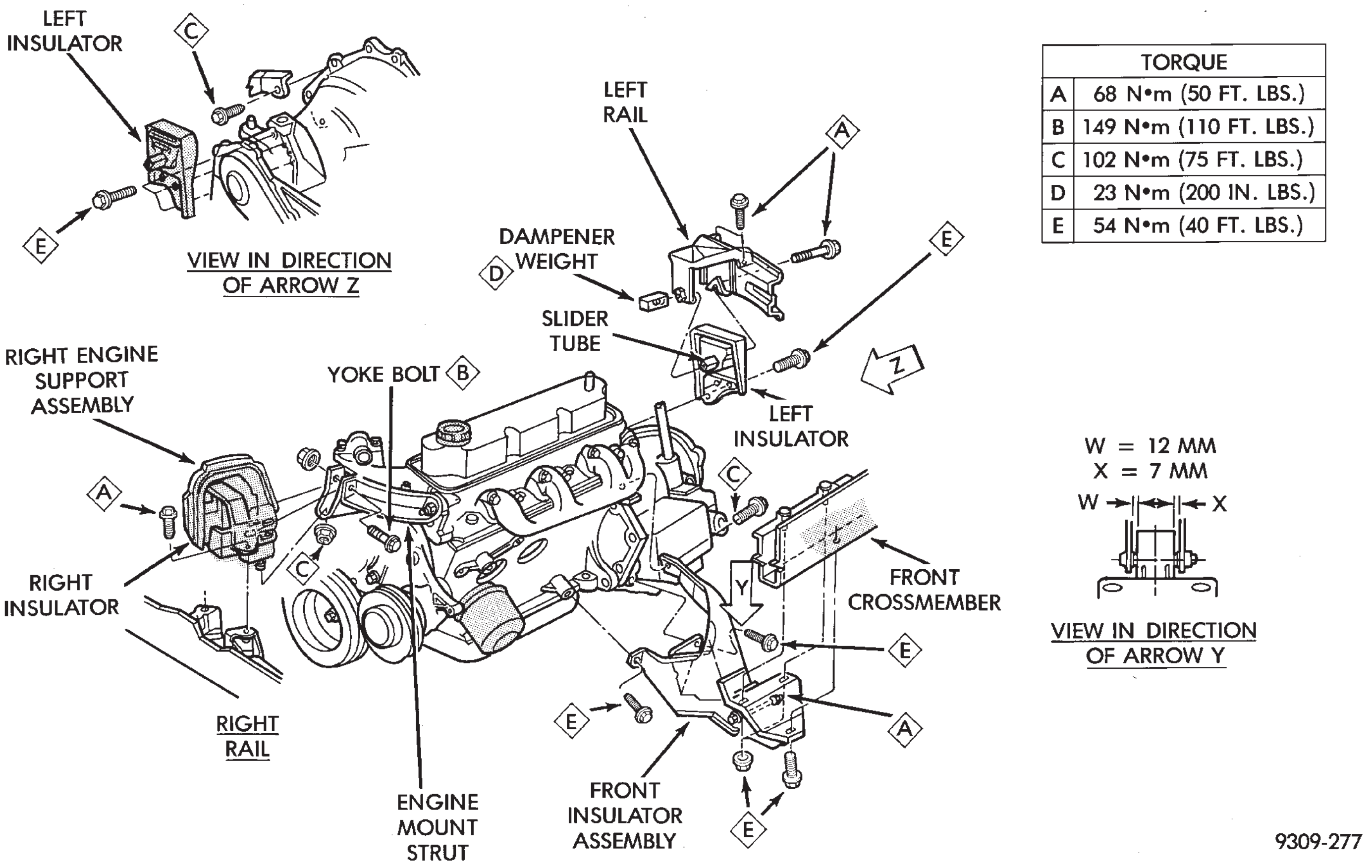
ENGINE MOUNTS

REMOVAL AND INSTALLATION

RIGHT SIDE MOUNT

(1) Remove the right engine mount insulator vertical fasteners from frame rail.

(2) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.



	TORQUE
A	68 N•m (50 FT. LBS.)
B	149 N•m (110 FT. LBS.)
C	102 N•m (75 FT. LBS.)
D	23 N•m (200 IN. LBS.)
E	54 N•m (40 FT. LBS.)

Fig. 3 Engine Mounting

(3) Remove the thru bolt from the insulator assembly. Remove insulator.

(4) Reverse removal procedure for installation. Refer to (Fig. 3) for bolt tightening specifications.

(5) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

FRONT MOUNT

(1) Support the engine and transmission assembly with a floor jack so it will not rotate.

(2) Remove the thru bolt from the insulator and front crossmember mounting bracket.

(3) Remove the front engine mount bracket to front crossmember screws and nuts. Remove the insulator assembly.

(4) Reverse removal procedure for installation. Refer to (Fig. 3) for bolt tightening specifications.

(5) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

LEFT SIDE MOUNT

(1) Raise vehicle on hoist and remove left front wheel.

(2) Remove inter splash shield.

(3) Support the transmission with a transmission jack.

(4) Remove the insulator thru bolt from the mount.

(5) Remove the transmission mount fasteners and remove mount.

(6) Reverse removal procedure for installation. Ensure that the slide tube is seated into the rail bracket guides. Refer to (Fig. 3) for bolt tightening specifications.

(7) Engine mount adjustment, Refer to Engine Mount Insulator Adjustment of this section.

ENGINE MOUNT RUBBER INSULATORS

Insulator location on yoke bracket to engine plate (right side) and transmission bracket (left side) are adjustable to allow right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right engine mount insulator (left engine mount insulator is floating type and will adjust automatically (Fig. 4). Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Driveshafts in Suspension, Group 2.
- Any front end structural damage (after repair).
- Insulator replacement.

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 yoke screw and 2 turns on yoke nut, then loosen the front engine mount bracket to front crossmember screws and nuts.

Left engine mount insulator is sleeved over shaft and long support bolt to provide lateral movement adjustment with engine weight removed or not.

(3) Pry the engine right or left as required to achieve the proper drive shaft assembly length. See Drive Shaft in Suspension Group 2 for driveshaft identification and related assembly length measuring.

(4) Tighten right engine mount insulator yoke nut to 102 N●m (75 ft. lbs.). Then tighten front engine mount screws and nuts to 54 N●m (40 ft. lbs.) and center left engine mount insulator.

(5) Recheck drive shaft length.

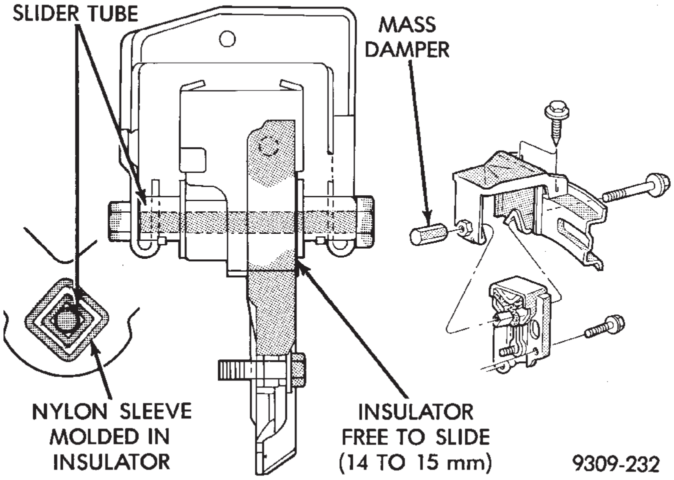


Fig. 4 Left Insulator Movement

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect battery.

(2) Mark hood position at hinges and remove hood.

(3) Drain cooling system. Refer to Cooling System, Group 7 for procedure.

(4) Disconnect all electrical connections.

(5) Remove coolant hoses from radiator and engine.

(6) Remove radiator and fan assembly.

(7) See Fuel System, Group 14, to release fuel pressure. Disconnect fuel lines and accelerator cable.

(8) Remove air cleaner assembly.

(9) Hoist vehicle and drain engine oil.

(10) Remove air conditioning compressor mounting bolts and set compressor aside.

(11) Disconnect exhaust pipe at manifold.

(12) Remove transmission inspection cover and mark flex plate to torque converter position. For disassembly procedure for the all wheel drive vehicle refer to Group 21 Transaxle.

(13) Remove screws holding torque converter to flex plate and attach C-clamp on bottom of converter housing to prevent torque converter from counting out.

(14) Remove power steering pump mounting bolts and set pump aside.

(15) Remove two lower transmission to block screws.

(16) Remove starter.

(17) Lower vehicles and disconnect vacuum lines and ground strap.

(18) Install transmission holding fixture.

(19) Attach engine lifting hoist and support engine.

(20) Remove upper transmission case to block bolts.

(21) See Engine Mounting in (Fig. 3) and separate mount/insulators as follows:

(a) Mark RIGHT insulator on right rails supports. Remove insulator to rails screws.

(b) Remove FRONT engine mount through bolt and nut.

(c) Remove LEFT insulator through bolt from inside wheelhouse or insulator bracket to transmission screws.

(22) Remove engine.

INSTALLATION

(1) Attach hoist and lower engine into engine compartment.

(2) Align engine mounts and install but **do not tighten** until all mounting bolts have been installed. Tighten bolts to torque specified in (Fig. 3).

(3) Install transmission case to cylinder block, tighten bolts to 102 N●m (75 ft. lbs.) torque.

(4) Remove engine hoist and transmission holding fixture.

(5) Remove C-clamp from torque converter housing. Align flex plate to torque converter and install mounting screws. Tighten to 75 N●m (55 ft. lbs.)torque. Refer to Group 21 transaxle for the all wheel drive installation procedure.

(6) Install transmission inspection cover.

(7) Connect exhaust system at manifold.

(8) Install starter.

(9) Install power steering pump and air conditioning compressor. For belt installation see Accessory Belt Drive in Cooling System Group 7.

(10) Lower vehicle and connect all vacuum lines.

(11) Connect all electrical connections including ground strap.

(12) Connect fuel lines and accelerator cable.

(13) Install radiator and fan assembly. Reconnect fan motor electrical lead. Reinstall radiator hoses. Fill cooling system. See Cooling System Group 7 for filling procedure.

(14) Fill engine crankcase with proper oil to correct level.

(15) Install hood.

(16) Connect battery.

(17) Start engine and run until operating temperature is reached.

(18) Adjust transmission or linkage if necessary.

ROCKER ARMS AND SHAFT ASSEMBLY

REMOVAL

(1) Remove upper intake manifold assembly. Refer to Intake and Exhaust Manifolds, Group 11.

(2) Disconnect spark plug wires by pulling on the boot straight out in line with plug.

(3) Disconnect closed ventilation system and evaporation control system from cylinder head cover.

(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. 5) for rocker arm for positioning on the shaft.

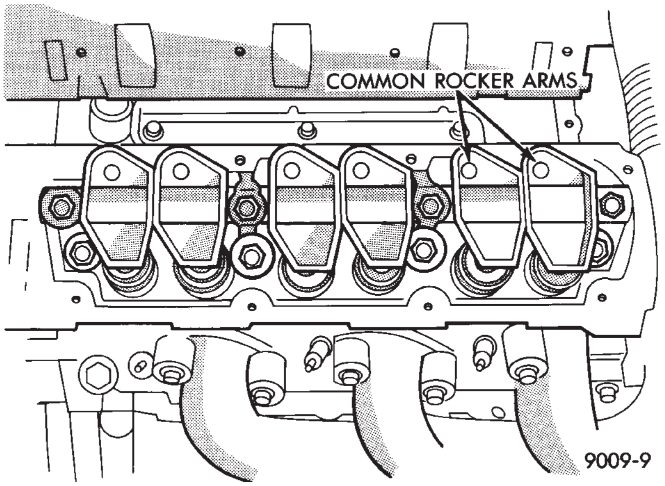


Fig. 5 Rocker Arm Location Left Blank

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. 5).

WARNING: THE ROCKER ARM SHAFT SHOULD BE TORQUED DOWN SLOWLY, STARTING WITH THE CENTERMOST 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 and evaporation control system.

(5) Install spark plug wires.

(6) Install upper intake manifold assembly. Refer to Exhaust Systems and Intake Manifolds Group 11.

CYLINDER HEADS

The alloy aluminum cylinder heads shown in (Fig. 6) are held in place by 9 bolts. The spark plugs are located in peak of the wedge between the valves.

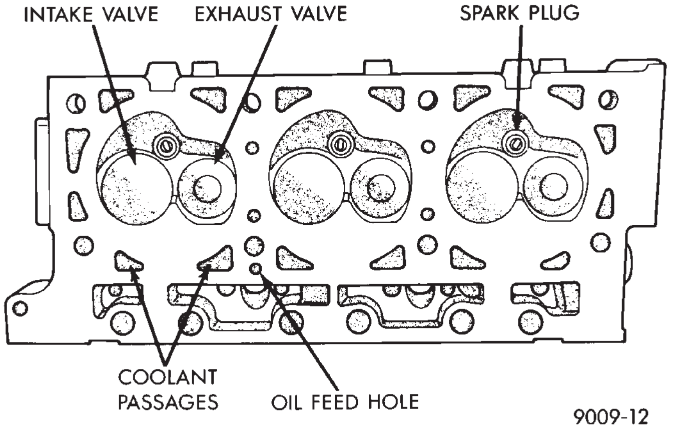


Fig. 6 Cylinder Head Assembly

REMOVAL

(1) Drain cooling system refer to Cooling System Group 7 for procedure and disconnect negative battery cable.

Remove intake manifold, and throttle body. Refer to Group 11 Exhaust System and Intake Manifold.

(2) Disconnect coil wires, sending unit wire, heater hoses and by-pass hose.

(3) Remove closed ventilation system, evaporation control system and cylinder head covers.

(4) Remove exhaust manifolds.

(5) Remove rocker arm and shaft assemblies. Remove push rods and **identify to insure installation in original locations.**

(6) Remove the 9 head bolts from each cylinder head and remove cylinder heads (Fig. 7).

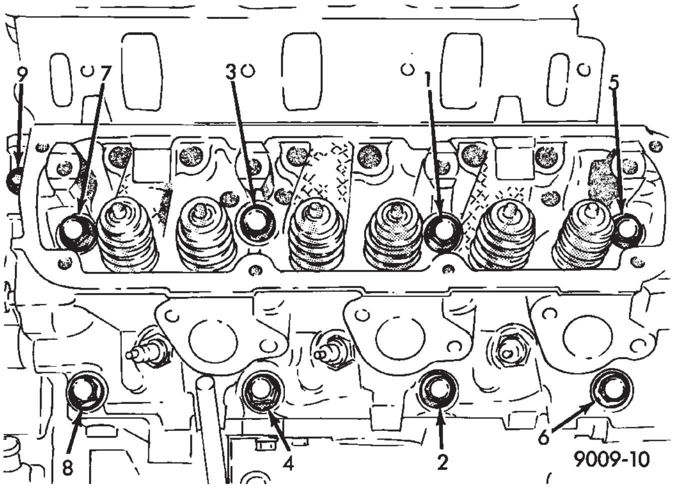


Fig. 7 Cylinder Head Bolts Location

INSPECTION

(1) Before cleaning, check for leaks, damage and cracks.

(2) Clean cylinder head and oil passages.

(3) Check cylinder head for flatness (Fig. 8).

(4) Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out of flatness exceeds .019mm (.00075 inch). 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 1mm (.004 inch) out of flat, allowable is 12 x .019mm (.00075 inch) equals .22mm (.009 in.) This amount of out of flat is acceptable.

*Maximum of 0.2 mm (.008 inch) for grinding is permitted.

CAUTION: This is a combined total dimension of stock removal from cylinder head and block top surface.

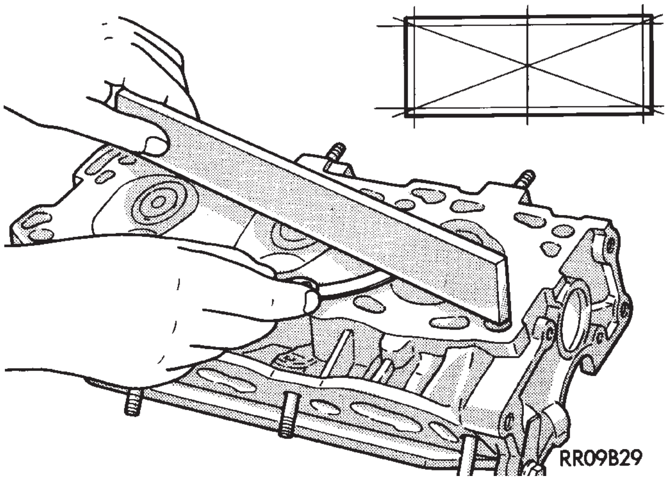


Fig. 8 Check Cylinder Head

INSTALLATION

(1) Clean all surfaces of cylinder block and cylinder heads.

(2) Install new gaskets on cylinder block (Fig. 9).

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. 10).

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.

(3) Tighten the cylinder head bolts 1 thru 8 in the sequence shown in (Fig. 11). Using the 4 step torque turn method, tighten according to the following values:

- First-All to 61 N•m (45 ft. lbs.)
- Second-All to 88 N•m (65 ft. lbs.)
- Third-All (again) to 88 N•m (65 ft. lbs.)
- Fourth + 1/4 Turn **Do not use a torque wrench for this step**

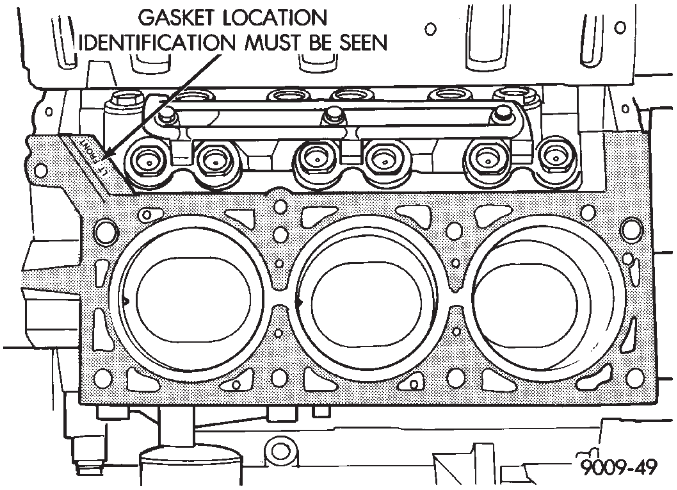


Fig. 9 Head Gasket Installation

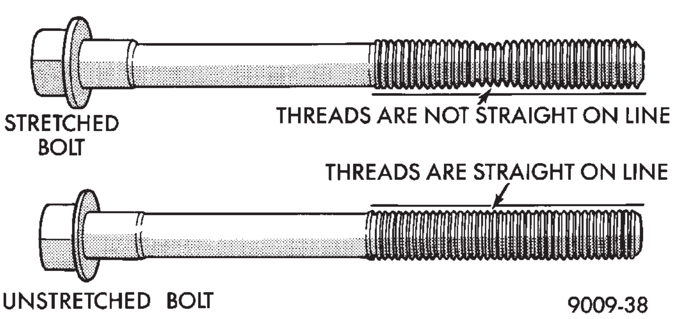


Fig. 10 Checking Bolts for Stretching (Necking)

(4) Bolt torque after 1/4 turn should be over 122 N•m(90 ft. lbs.). If not, replace the bolt.

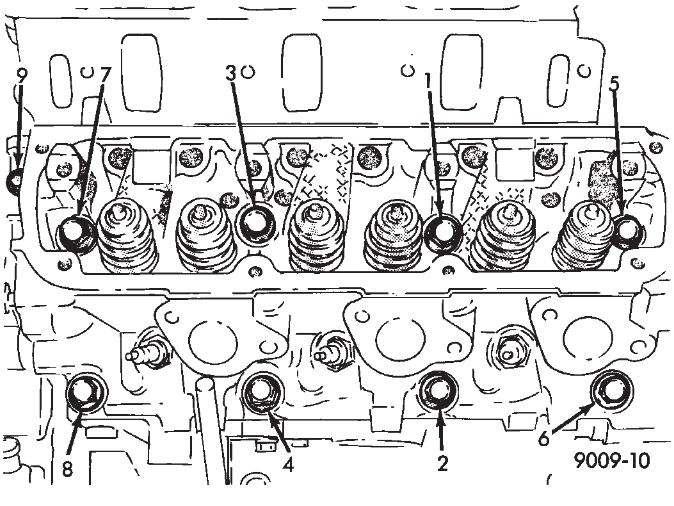


Fig. 11 Cylinder Head Tightening Sequence

(5) Tighten head bolt number 9 (Fig. 11) to 33 N•m (25 ft. lbs.) after head bolts 1 thru 8 have been tighten to specifications.

(6) Inspect push rods and replace worn or bent rods.

(7) 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. 12).

(8) Place new cylinder head cover gaskets in position and install cylinder head covers. Tighten to 12 N●m (105 in. lbs.).

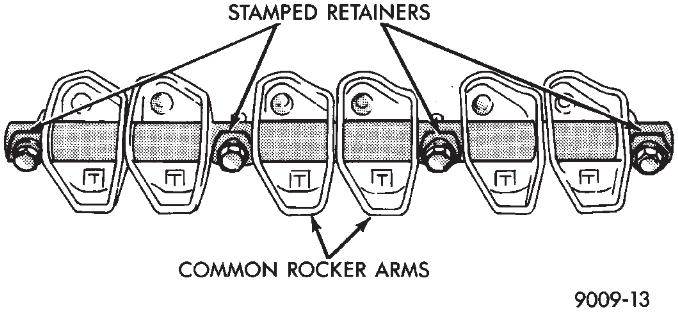


Fig. 12 Rocker Arm Shaft Retainers

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. 13).

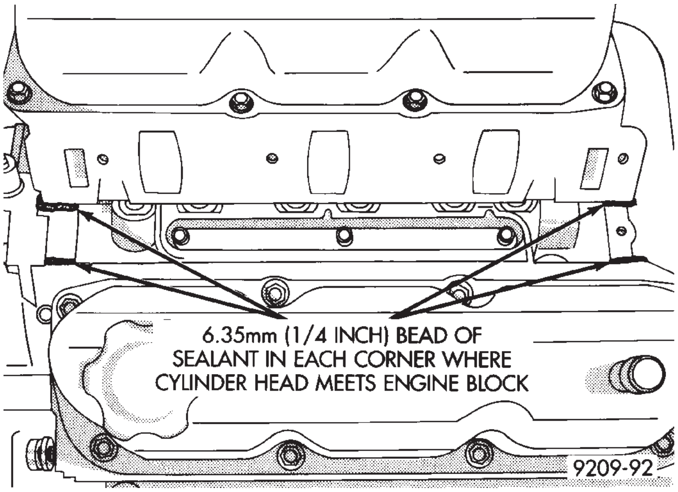


Fig. 13 Intake Manifold Gasket Sealing

(3) Carefully install the intake manifold gasket (Fig. 14). 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. 15). 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 Assembly.

(5) Install exhaust manifolds and tighten bolts to 27 N●m (20 ft. lb.) and nuts to 20 N●m (15 ft. lbs.).

(6) Adjust spark plugs to specification in Electrical Section, Group 8, and install the plugs.

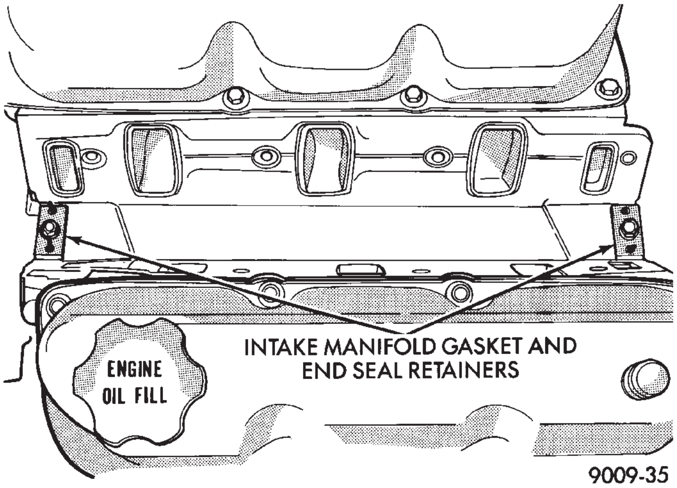


Fig. 14 Intake Manifold Gasket Retainers

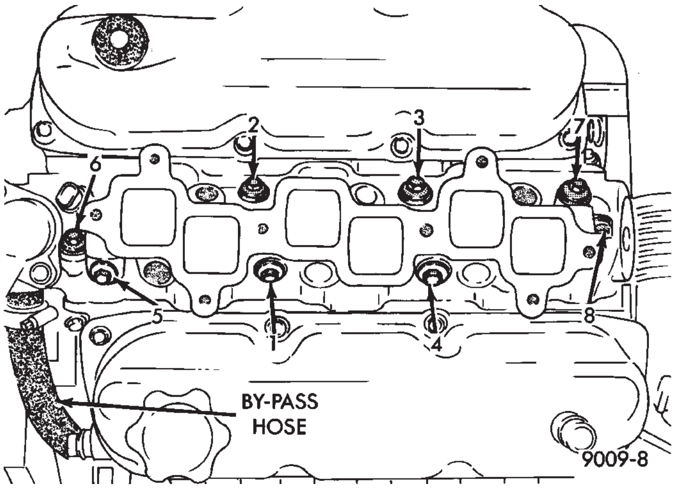


Fig. 15 Intake Manifold Removal and Installation

VALVE SERVICE

VALVES AND VALVE SPRINGS

The valves are arranged in line in the cylinder heads and inclined 18 degrees. The rocker shaft support are cast integral with the heads.

REMOVAL

(1) With cylinder head removed, compress valve springs using Valve Spring Compressor Tool C-3422-B with adapter 6412 as shown in (Fig. 16).

(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.

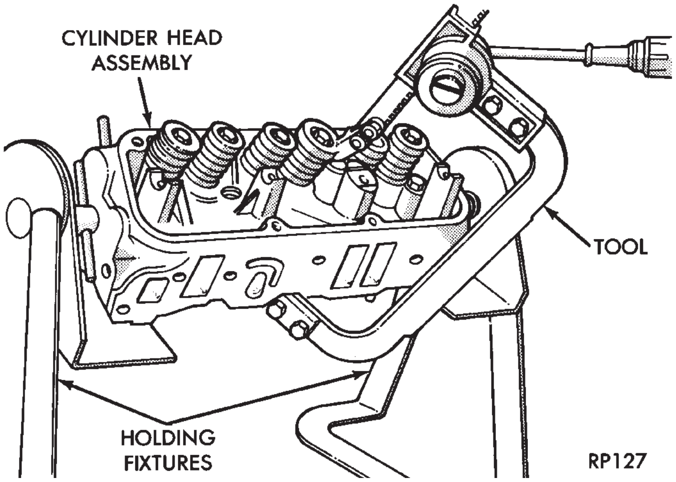


Fig. 16 Compress Valve Springs with Special Tool C-3422B with adapter 6412

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Refer to specifications (Fig. 19).

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 14mm (.551 inch) 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).

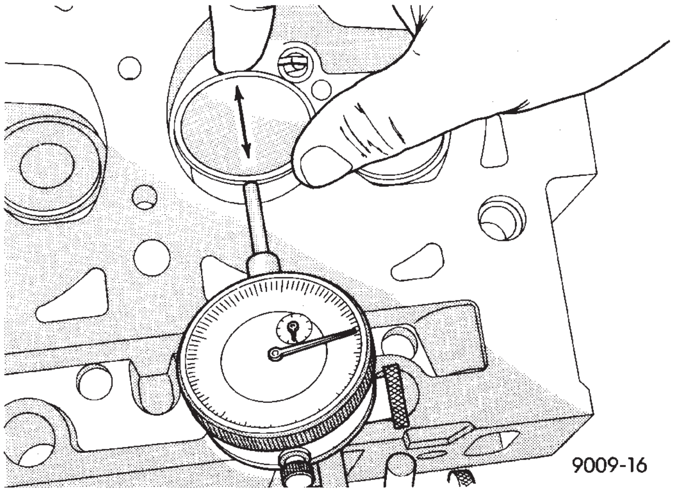


Fig. 17 Measuring Valve Guide Wear

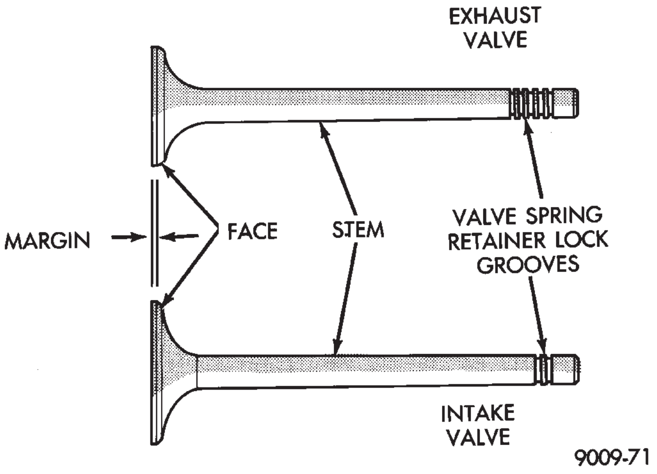


Fig. 18 Intake and Exhaust Valves

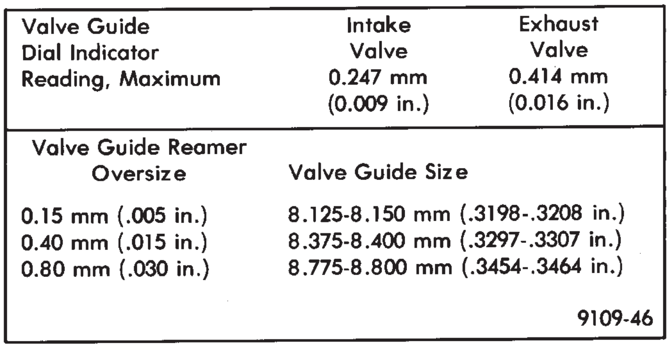
(c) Move valve to and from the indicator. Refer to specifications (Fig. 19).

Ream the guides for valves with oversized stems if dial indicator reading is excessive or if the stems are scuffed or scored.

(5) Service valves with oversize stems and over size seals are available in 0.15mm (.005 inch), 0.40mm, (.015 inch) and 0.80mm (.030 inch) oversize.

Oversize seals must be used with oversize valves.

Reamers to accommodate the oversize valve stem are as follows:



Valve Guide Dial Indicator Reading, Maximum	Intake Valve	Exhaust Valve
	0.247 mm (0.009 in.)	0.414 mm (0.016 in.)

Valve Guide Reamer Oversize	Valve Guide Size
0.15 mm (.005 in.)	8.125-8.150 mm (.3198-.3208 in.)
0.40 mm (.015 in.)	8.375-8.400 mm (.3297-.3307 in.)
0.80 mm (.030 in.)	8.775-8.800 mm (.3454-.3464 in.)

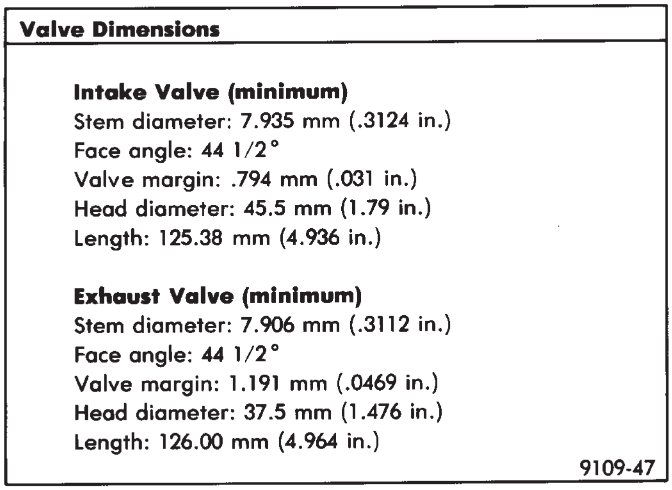
9109-46

Fig. 19 Valve Guide Specifications

(6) 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 0.80mm (.030 inch) Use step procedure of 0.15mm (.005 inch), 0.40mm (.015 inch) and 0.80mm (.030 inch) 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 GUIDES

Replace cylinder head if guide does not clean up with 0.80mm (.030 inch) oversize reamer, or if guide is loose in cylinder head.


Valve Dimensions

Intake Valve (minimum)
Stem diameter: 7.935 mm (.3124 in.)
Face angle: 44 1/2°
Valve margin: .794 mm (.031 in.)
Head diameter: 45.5 mm (1.79 in.)
Length: 125.38 mm (4.936 in.)

Exhaust Valve (minimum)
Stem diameter: 7.906 mm (.3112 in.)
Face angle: 44 1/2°
Valve margin: 1.191 mm (.0469 in.)
Head diameter: 37.5 mm (1.476 in.)
Length: 126.00 mm (4.964 in.)

9109-47

Fig. 20 Valve Dimensions

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. 21).

VALVES

(1) Inspect the remaining margin after the valves are refaced Refer to specifications (Fig. 20).

VALVE SEATS

CAUTION: Do not un-shroud cylinder head from around the valve during valve seat refacing (Fig. 22).

(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 .051mm (.002 inch) total indicator reading.

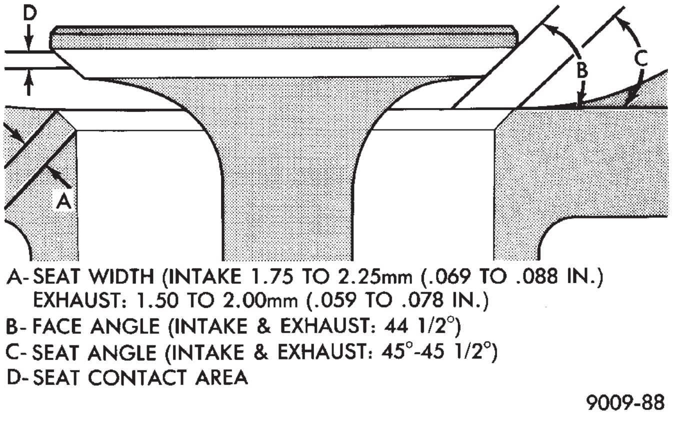


Fig. 21 Valve Seats

(3) 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 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.

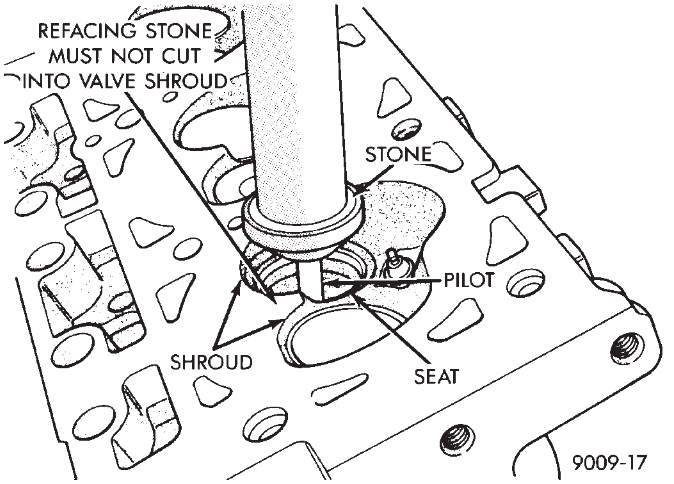


Fig. 22 Refacing Valve Seats

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 2.25mm (0.69 to .088 inch) The width of the exhaust seats should be 1.50 to 2.00mm (.059 to .078 inch) (Fig. 21)

(5) Check the valve spring installed height after refacing the valve and seat (Fig. 24).

TESTING VALVE SPRINGS

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested (Fig. 23). **As an example;** the compression

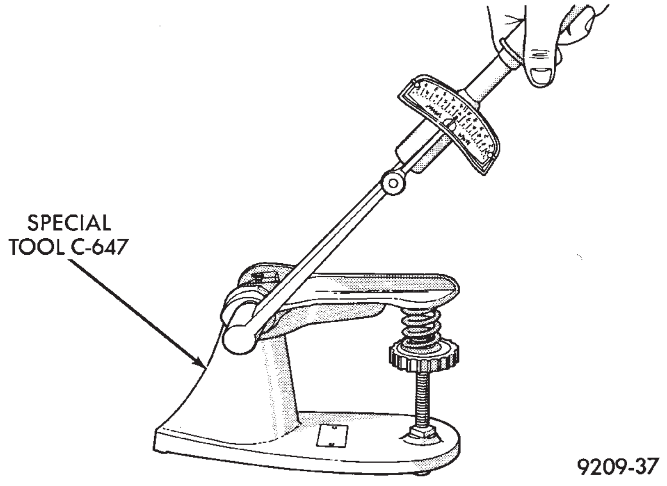


Fig. 23 Testing Valve Spring with Tool C-647

length of the spring to be tested is 33.34mm (1-5/16 inches). Turn table of Tool C-647 until surface is in line with the 33.34mm (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.

VALVE INSTALLATION

(1) Coat valve stems with clean engine oil and insert them in cylinder head.

(2) Check valve tip to spring seat dimension A after grinding the valve seats or faces. Grind valve tip to give 49.541 to 51.271 mm (1.950 to 2.018 inch.) over spring seat when installed in the head (Fig. 17). Check valve tip for scoring, if necessary, the tip chamfer should be reground to prevent seal damage when the valve is installed.

(3) Install new cup seals on all valve stems and over valve guides (Fig. 24). Install valve springs and valve retainers.

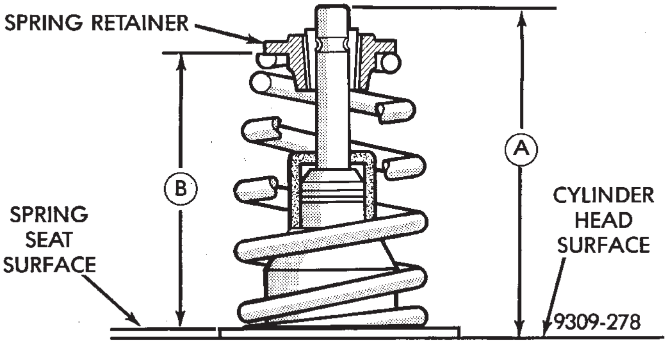


Fig. 24 Checking Valve Installed Height

(4) 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 is taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 1-19/32 inches, (40.6mm), install a 1/32 inch (.794mm) spacer in head counterbore to bring spring height back to normal 1-17/32 to 1-19/32 inch (39.1 to 40.6mm)**.

REPLACE VALVE STEM SEALS OR VALVE SPRINGS, CYLINDER HEAD NOT REMOVED

(1) Perform fuel system pressure release procedure **before attempting any repairs**

(2) Disconnect negative battery cable.

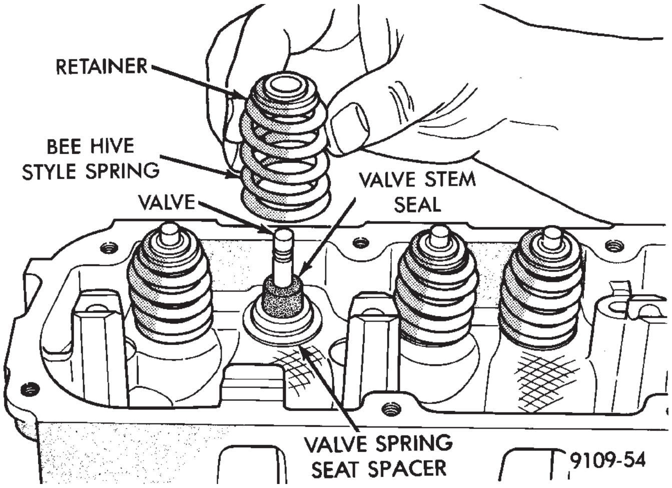


Fig. 25 Installing Valve, Cup Seal, Spring and Retainer

(3) Remove Air Cleaner Cover and hose assembly.

(4) Remove Intake Manifold; Refer to Intake/Exhaust Manifold 3.3/3.8L Engine Group 11 Exhaust System and Intake Manifolds of this manual for removal procedure.

(5) Remove cylinder head covers and spark plugs.

(6) Remove connector wire 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 into 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 rocker arm covers tighten screws to 14 N●m (120 in. lbs.) and connector to ignition coils.

(16) Install Intake Manifold; Refer to Intake Manifold Installation 3.3/3.8L Engine, Group 11 Exhaust System and Intake Manifold.

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 aligning yokes. The yokes are secured by an alignment yoke retainer (Fig. 26).

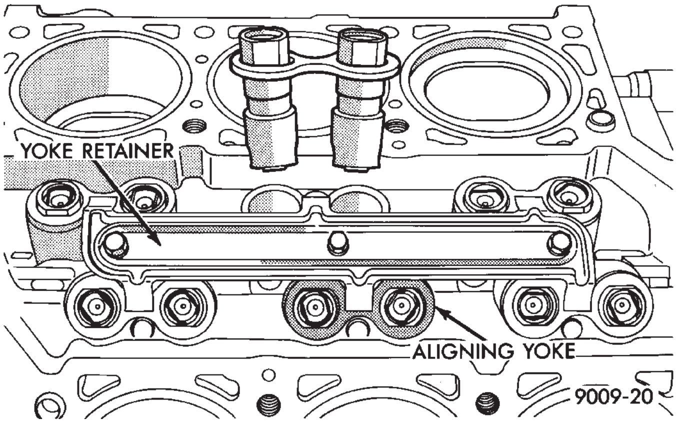


Fig. 26 Roller Tappets Aligning Yoke and Retainer

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.

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 leakdown 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.

TAPPET REMOVAL

(1) Refer to Cylinder Head Removal of this section to remove intake manifold and cylinder heads for 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.

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.

DISASSEMBLY (FIG. 27)

(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, flat or ball check valve, check valve spring, check valve retainer and plunger spring. Check valve could be flat or ball.

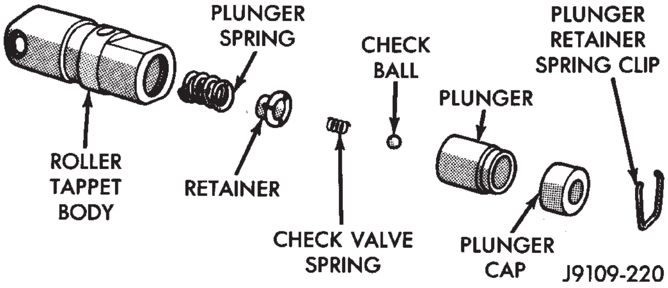


Fig. 27 Hydraulic Roller Tappet Assembly

CLEANING AND 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.

(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. 27).

INSTALLATION

(1) Lubricate tappets.

(2) Install tappets in their original positions.

(3) With roller tappets, install aligning yokes with (Fig. 26).

(4) Install yoke retainer and torque screws to 12 N•m (105 in. lbs.) (Fig. 26).

(5) Install cylinder heads. Refer to cylinder head installation of this section for procedure.

(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.

VALVE TIMING

(1) Remove front valve 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 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 5.08mm (.200 inch) 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 in take valve has lifted .254mm (0.010 inch).

CAUTION: Do not turn crankshaft any further clockwise as intake valve might bottom and result in serious damage.

(10) Degree wheel should read 3 degrees BTDC to 4 degrees ATDC.

TIMING CHAIN COVER, OIL SEAL AND CHAIN

COVER

REMOVAL

(1) Disconnect 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 transmission 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 pulley (Fig. 1).

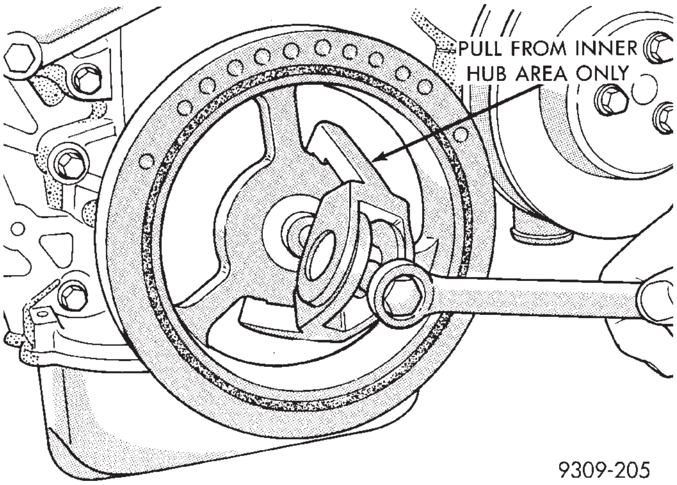


Fig. 1 Removing Crankshaft Pulley

(11) Remove idler pulley from engine bracket.

(12) Remove engine bracket (Fig. 2).

(13) Remove cam sensor from chain case cover (Fig. 3).

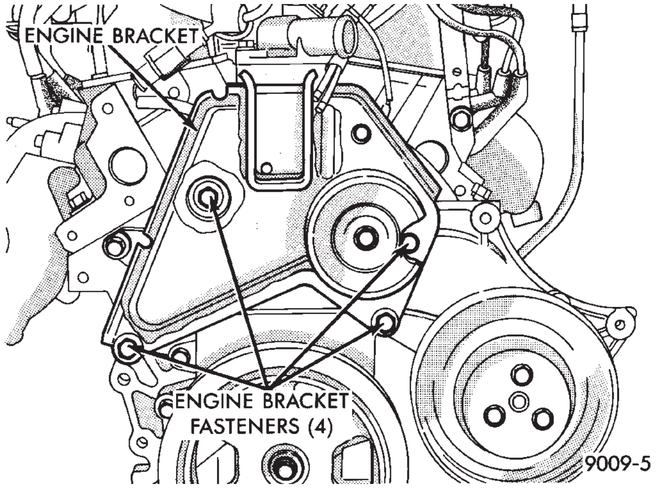


Fig. 2 Engine Bracket

(14) Remove chain case cover (Fig. 3).

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. 4), 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 (Fig. 4).

(4) Install a new timing chain, if its movement exceeds 3.175mm (1/8 inch) (Fig. 4).

(5) If chain is not satisfactory, remove camshaft sprocket attaching bolt, and remove timing chain with camshaft sprocket.

(6) Using a suitable puller remove the crankshaft sprocket. Be careful not to damage the crankshaft surface.

(7) Position a new crankshaft sprocket on the shaft, install sprocket with suitable tool and mallet. Be sure sprocket is seated into position.

(8) Rotate crankshaft so the timing arrow is to the 12 O'clock position.

(9) Place timing chain around camshaft sprocket and place the timing mark to the 6 O'clock position.

(10) 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.

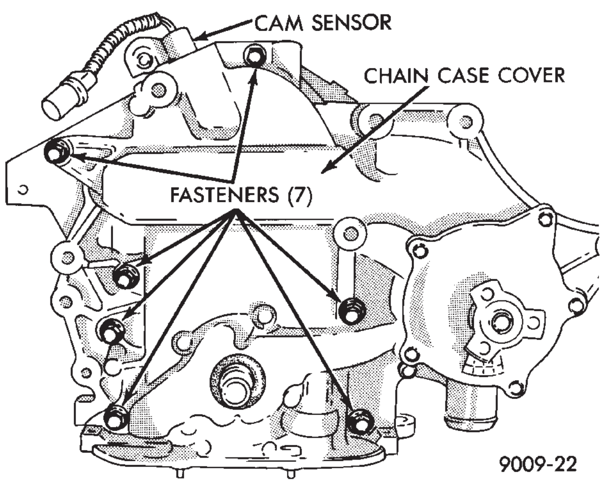


Fig. 3 Timing Chain Case Cover

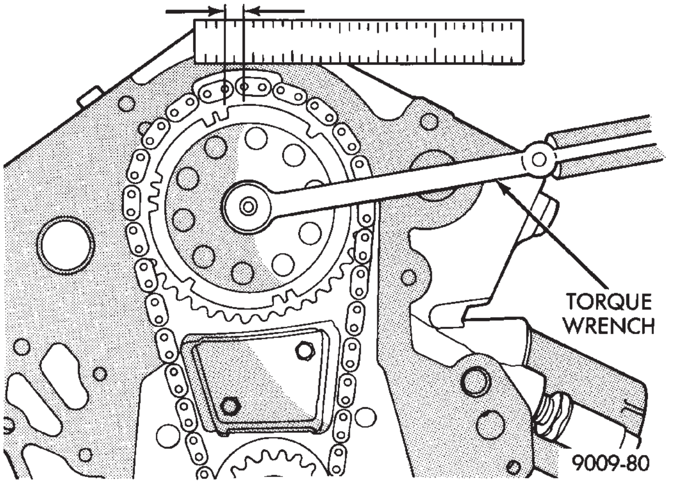


Fig. 4 Measuring Timing Chain Wear and Stretch

(11) Using straight edge to check alignment of timing marks (Fig. 5).

(12) Install camshaft bolt and washer. Tighten to 54 N●m (40 ft. lbs.).

(13) Rotate crankshaft 2 revolutions. Timing marks should line up. If timing marks do not line up remove cam sprocket and realign.

(14) Check camshaft endplay. With new thrust plate specification is .0127 to .304 mm (.005 to .012 inches.). Old thrust plate specification is .31 mm (.012 inch.) maximum. If not within these limits install new thrust plate.

(15) Install timing chain snubber. Tighten retaining screws to 12 N●m (105 in. lbs.). **These bolts are 20mm long for this model year, they should not be interchanged with previous year engines**.

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.

(2) Use a new cover gasket, O-rings. (Fig. 6).

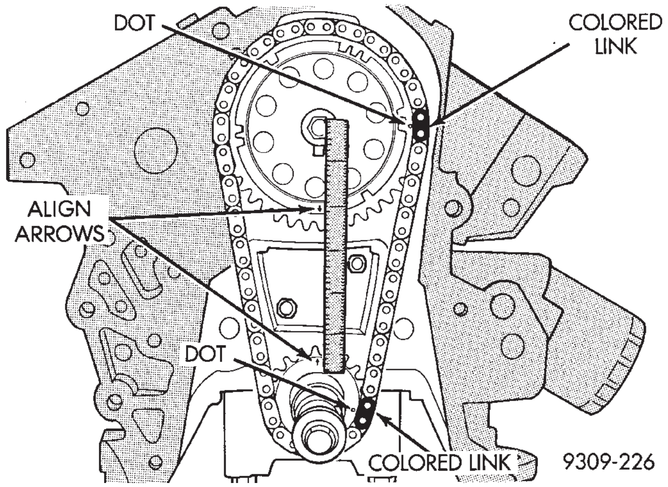


Fig. 5 Alignment of Timing Marks

(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. 6).

(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. 7).

(8) Install crankshaft pulley (Fig. 8).

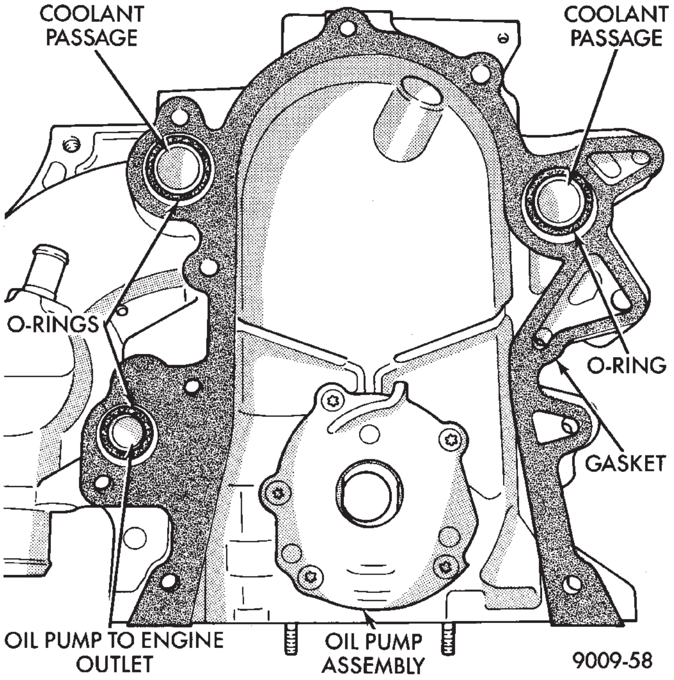


Fig. 6 Timing Chain Case Cover Gaskets and O-Rings

(9) Install engine bracket (Fig. 2) torque screws to 54 N●m (40 ft. lbs.).

(10) Install idler pulley on engine bracket.

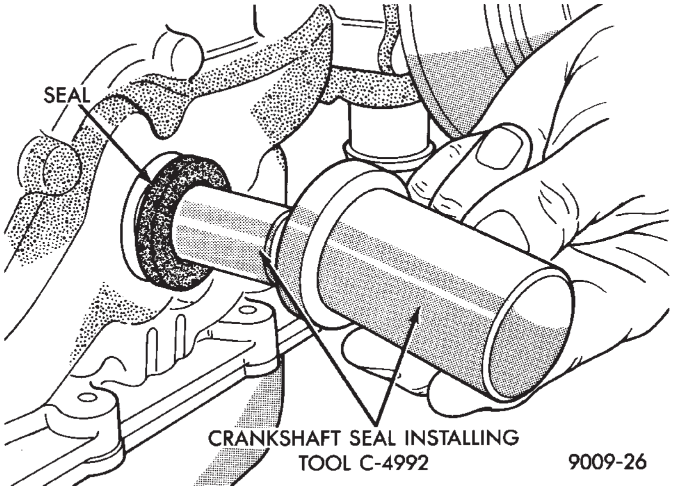


Fig. 7 Install Crankshaft Oil Seal

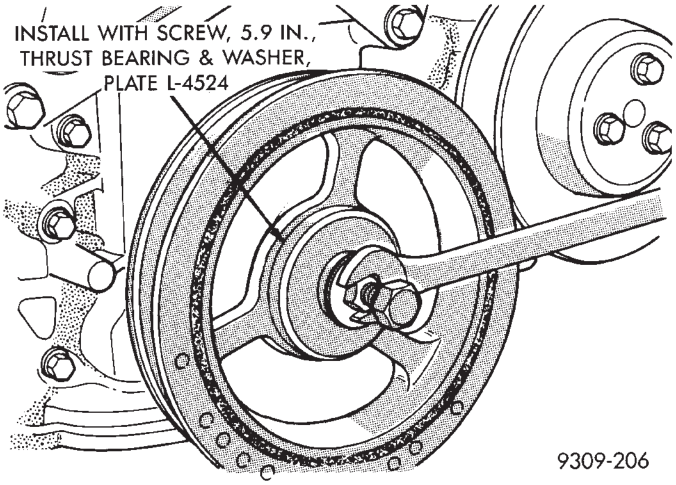


Fig. 8 Installing Crankshaft Pulley

(11) Install cam sensor Refer to Ignition System Group 8D for installation procedure.

(12) Install A/C compressor mounting bracket.

(13) Install A/C compressor.

(14) Install drive belt Refer to Cooling System Group 7 for installation procedure.

(15) Install inner splash shield and wheel.

(16) Install oil pump pick-up and oil pan and transmission inspection cover if removed.

(17) Install engine mount.

(18) Fill crankcase with oil to proper level.

(19) Fill cooling system Refer to Cooling System Group 7 for procedure.

(20) Connect battery.

TIMING CHAIN COVER EXTERNAL OIL SEAL

REMOVAL

(1) Raise vehicle on hoist. Remove right wheel and inner splash shield.

(2) Remove drive belt. (Refer to Cooling System Group 7) for procedure.

(3) Remove crankshaft pulley (Fig. 1).

(4) Using Tool C-4991 to remove oil seal (Fig. 9). Be careful not to damage that crankshaft seal surface of cover.

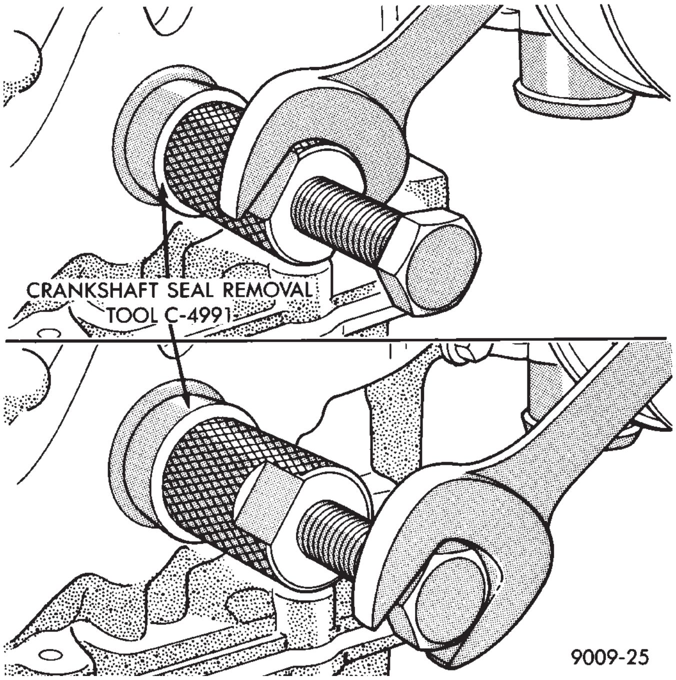


Fig. 9 Removing Crankshaft Oil Seal

INSTALLATION

(1) Install new seal by using Tool C-4992 (Fig. 7).

(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. 8).

(4) Install drive belt (Refer to Cooling System Group 7) for installation procedure.

(5) Install inner splash shield and wheel.

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. 10).

(4) Install a long bolt into front of camshaft to facilitate removal of the camshaft; remove camshaft, being careful not to damage cam bearing 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.

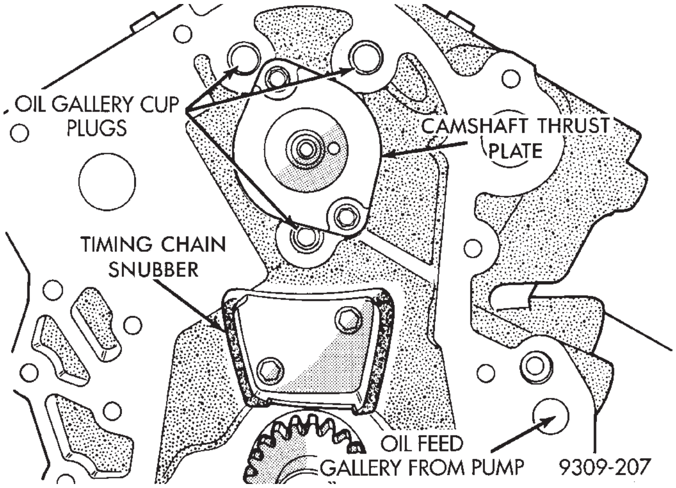


Fig. 10 Camshaft Thrust Plate

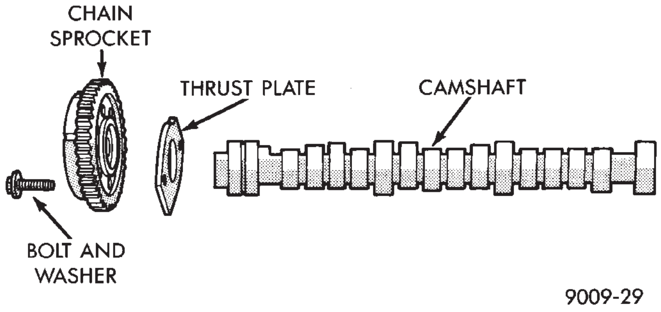


Fig. 11 Camshaft and Sprocket Assembly

Whenever an engine has been rebuilt or a new camshaft or tappets have been installed, add one pint of Chrysler Crankcase Conditioner or equivalent to engine oil to aid in break in. The oil mixture should be left in engine for a minimum of 805km (500 miles) and drained at the next normal oil change.

(2) Install camshaft thrust plate with two screws as shown in (Fig. 10). Tighten to 12 N●m (105 in. lbs.) torque.

(3) Rotate crankshaft so the timing arrow is to 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. 5).

(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 .0127 to .304 mm (.005 to .012 inches.) .310 mm (.012 inch. 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**.

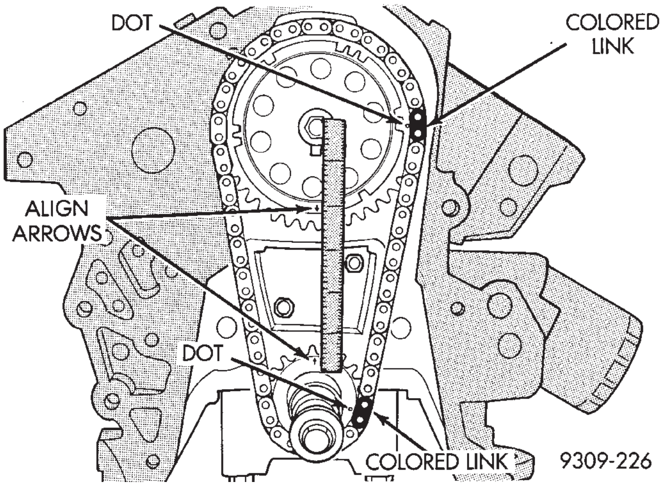


Fig. 12 Alignment of Timing Marks

CAMSHAFT BEARINGS—ENGINE REMOVED FROM 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 Tool C-3132-A) at back of each bearing shell to be removed and drive out bearing shells (Fig. 13).

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.**

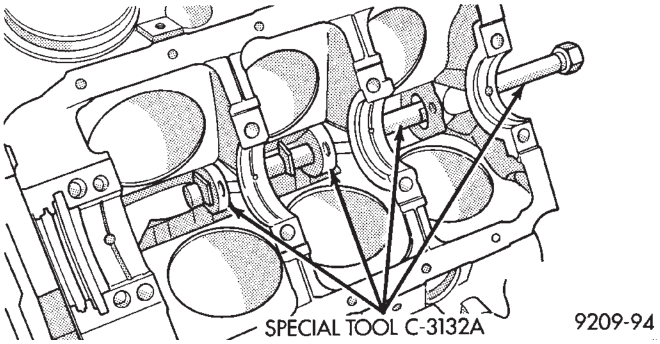


Fig. 13 Removed Installation of Camshaft Bearings with Tool C-3132A—Typical

ENGINE CORE OIL AND CAM 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. 14).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

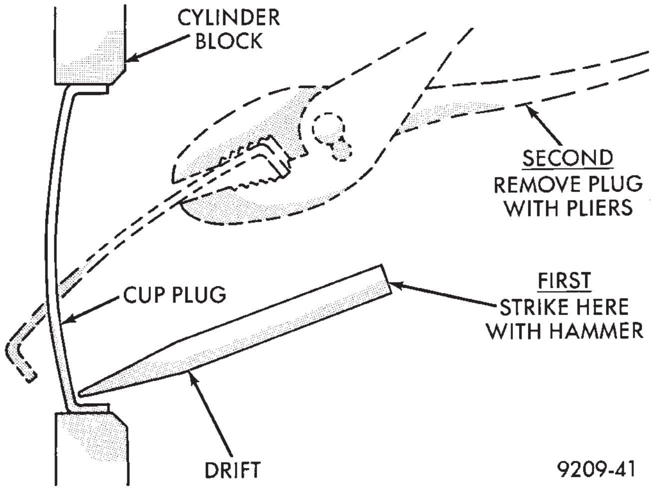


Fig. 14 Core Hole Plug Removal

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 0.5mm (.020 inch) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

CYLINDER BLOCK, PISTON AND CONNECTING ROD ASSEMBLY SERVICE

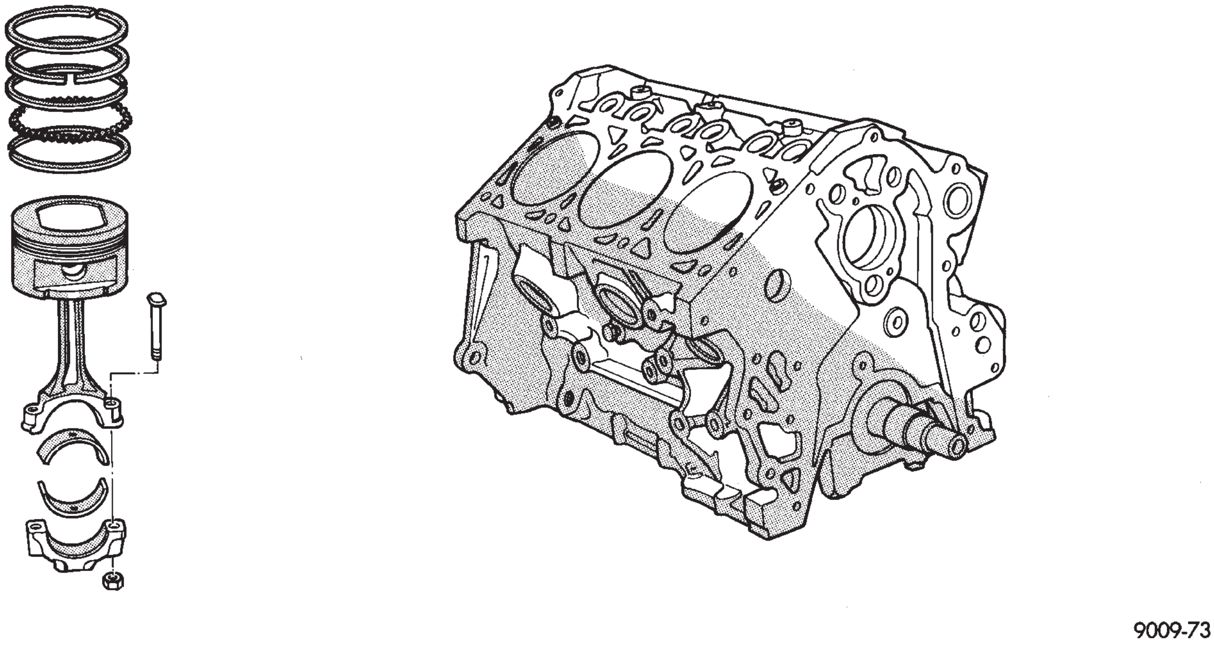


Fig. 1 Cylinder Block, Piston and Connecting Rod Assembly

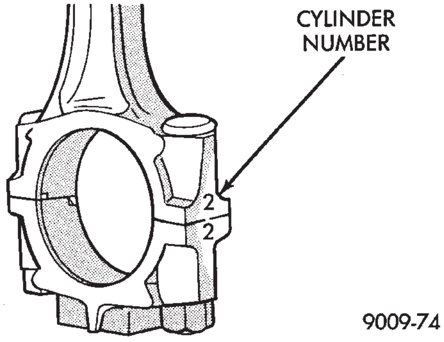


Fig. 2 Identify Connecting Rod to Cylinder

CYLINDER BLOCK

PISTON—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. 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.**

(2) Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary. (Fig. 2)

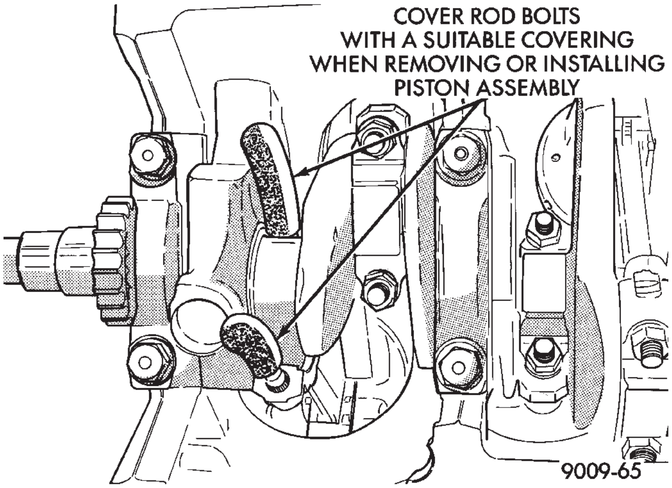


Fig. 3 Connecting Rod Protectors

(3) Remove connecting rod cap. Install connecting rod bolt protectors on connecting rod bolts (Fig. 3). Push each piston and rod assembly out of cylinder bore.

Be careful not to nick crankshaft journals.

(4) After removal, install bearing cap on the mating rod.

CLEANING AND INSPECTION

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, see Engine Core Oil and Cam Plugs.

(3) Examine block for cracks or fractures.

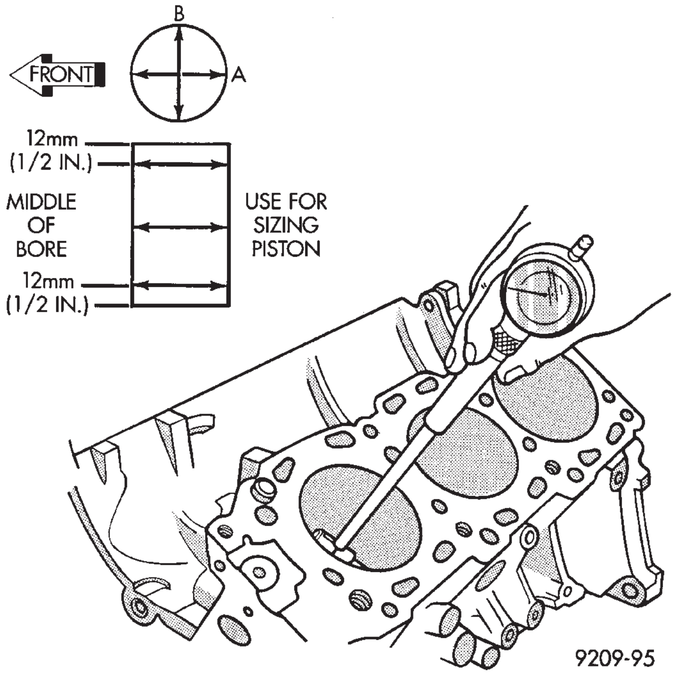


Fig. 4 Checking Cylinder Bore Size

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out- of-round and taper with Tool C-119 (Fig. 4). 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. 4). Top measurement should be 12mm (.50 inch) down and bottom measurement should be 12mm (.50 inch.) up from bottom of bore. Refer to (Fig. 5) for specifications.

FINISHED PISTONS

All pistons are machined to the same weight in grams, to maintain piston balance. For cylinder bores which have been honed, new pistons and connecting rod assemblies are available for service.

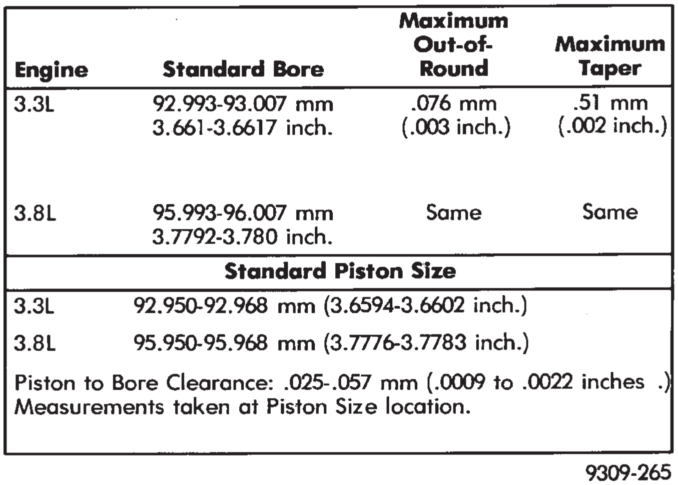
FITTING PISTONS

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. 6). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 4). Refer to (Fig. 5) for specifications.

Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C)

PISTON PINS

The piston pin rotates in the piston only, and is retained by the press interference fit of the piston pin in the connecting rod. **The piston pin is not to be removed damage to the piston may result.**



Engine	Standard Bore	Maximum Out-of-Round	Maximum Taper
3.3L	92.993-93.007 mm 3.661-3.6617 inch.	.076 mm (.003 inch.)	.51 mm (.002 inch.)
3.8L	95.993-96.007 mm 3.7792-3.780 inch.	Same	Same

Standard Piston Size	
3.3L	92.950-92.968 mm (3.6594-3.6602 inch.)
3.8L	95.950-95.968 mm (3.7776-3.7783 inch.)

Piston to Bore Clearance: .025-.057 mm (.0009 to .0022 inches .)
Measurements taken at Piston Size location.

9309-265

Fig. 5 Cylinder Bore and Piston Specifications

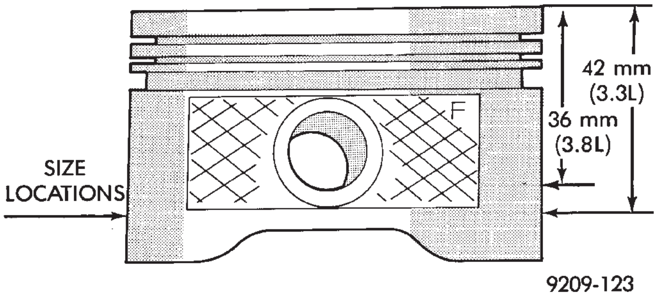


Fig. 6 Piston Measurements

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 12mm (.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 7).

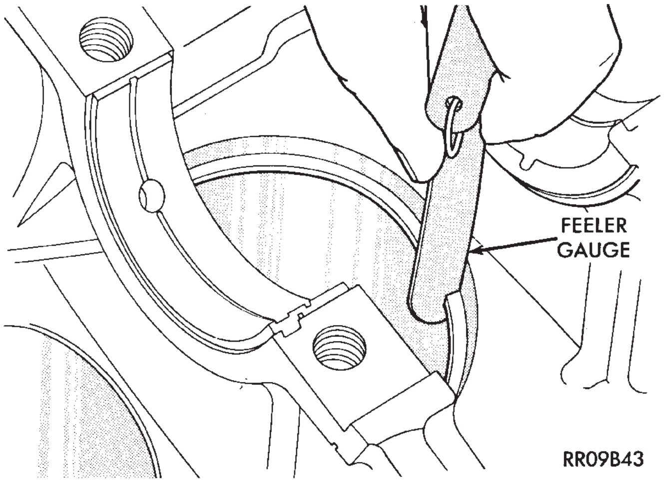
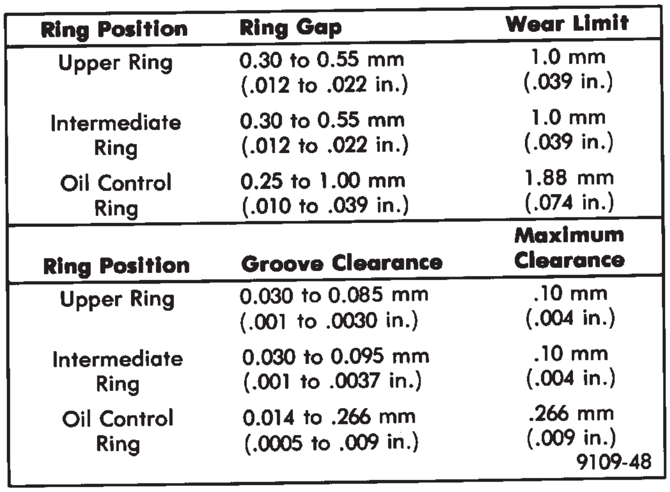


Fig. 7 Check Gap on Piston Rings

Refer to specifications (Fig. 8).



Ring Position	Ring Gap	Wear Limit
Upper Ring	0.30 to 0.55 mm (.012 to .022 in.)	1.0 mm (.039 in.)
Intermediate Ring	0.30 to 0.55 mm (.012 to .022 in.)	1.0 mm (.039 in.)
Oil Control Ring	0.25 to 1.00 mm (.010 to .039 in.)	1.88 mm (.074 in.)

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	0.030 to 0.085 mm (.001 to .0030 in.)	.10 mm (.004 in.)
Intermediate Ring	0.030 to 0.095 mm (.001 to .0037 in.)	.10 mm (.004 in.)
Oil Control Ring	0.014 to .266 mm (.0005 to .009 in.)	.266 mm (.009 in.)

Fig. 8 Piston Ring Specifications

(2) Check piston ring to groove clearance: (Fig. 9). Refer to specification (Fig. 8).

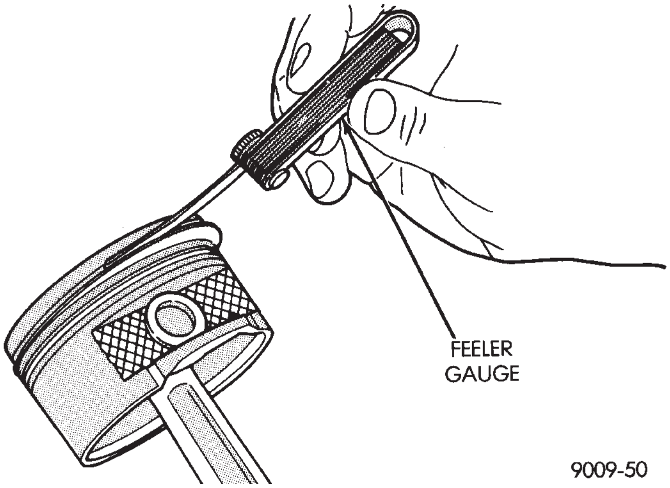


Fig. 9 Measuring Piston Ring Side Clearance

PISTON RINGS—INSTALLATION

(1) The No. 1 and No. 2 piston rings have a different cross section. Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 10).

CAUTION: Install piston rings in the following order:

(a) Oil ring expander.
(b) Upper oil ring side rail.
(c) Lower oil ring side rail.
(d) No. 2 Intermediate piston ring.
(e) No. 1 Upper piston ring.

(2) Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander.** (Fig. 11).

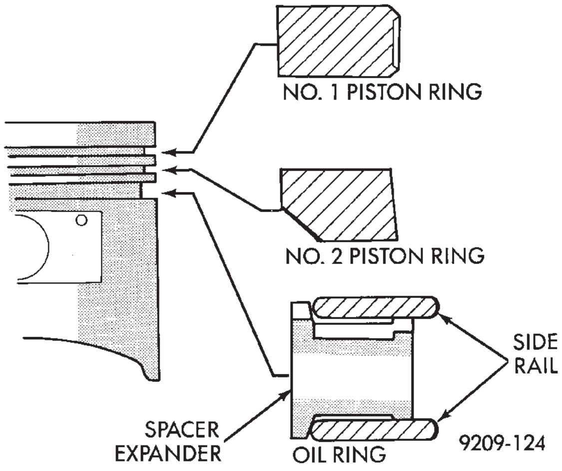


Fig. 10 Piston Ring Installation

(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. 12).

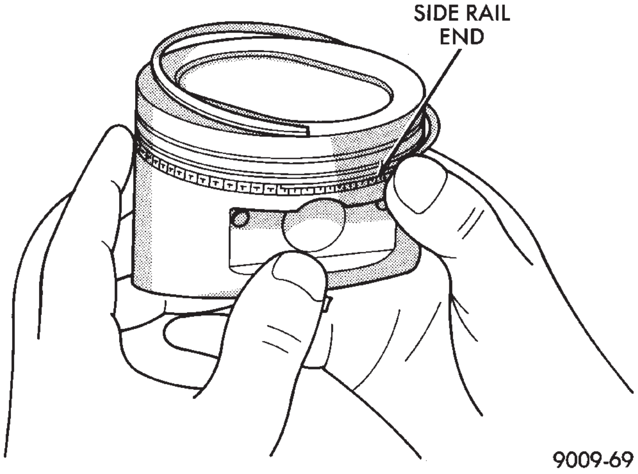


Fig. 11 Installing Side Rail

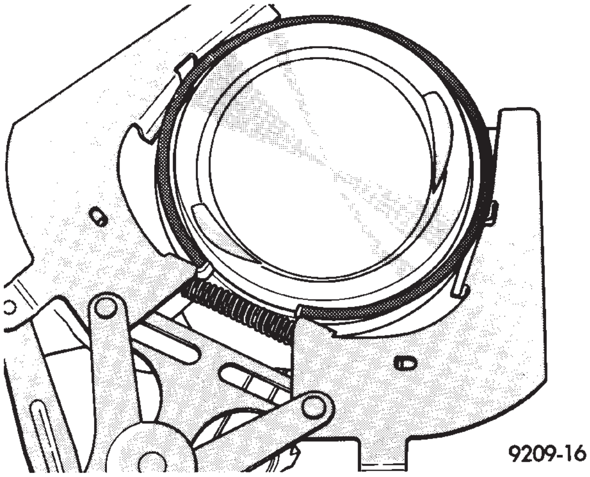


Fig. 12 Installing Upper and Intermediate Rings

(5) Position piston ring end gaps as shown in (Fig. 13).

(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.

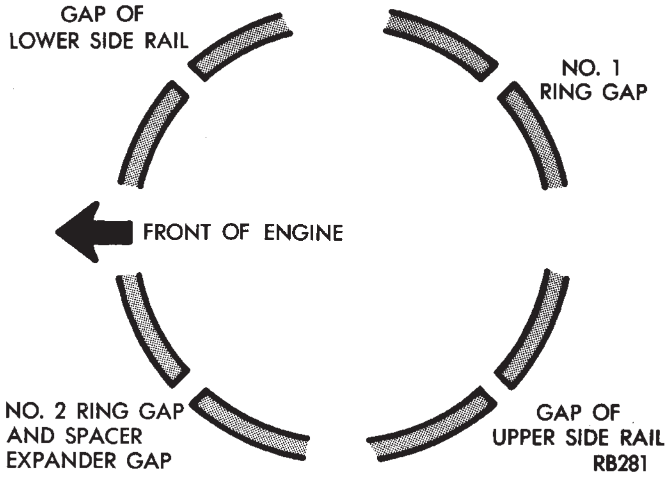


Fig. 13 Piston Ring End Gap Position

INSTALLING PISTON AND CONNECTING ROD ASSEMBLY

(1) Before installing pistons and connecting rod assemblies into the bore, besure 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. 14).

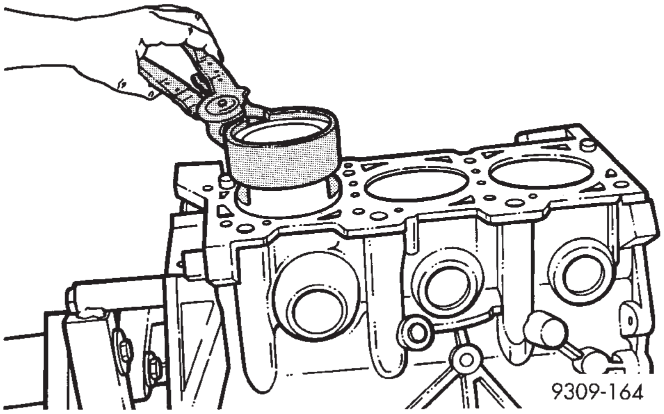


Fig. 14 Installing Piston

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten with the special wrench. **Be sure position of rings does not change during this operation.**

(4) Install connecting rod bolt protectors on rod bolts. (Fig. 3)

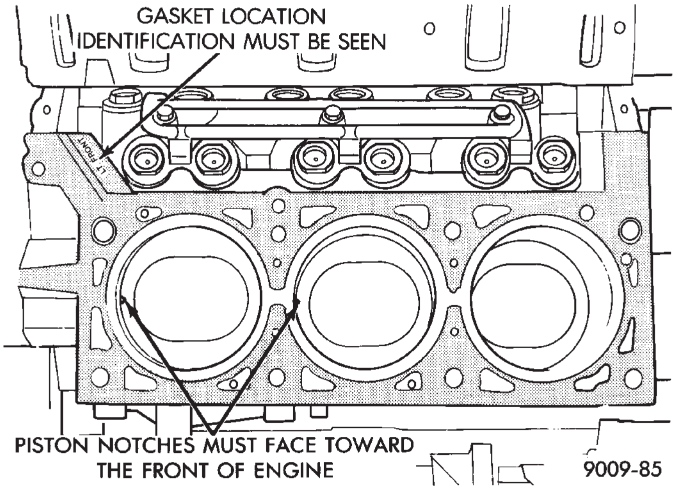


Fig. 15 Piston I.D. Notches

(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.

(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. 15).

(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.

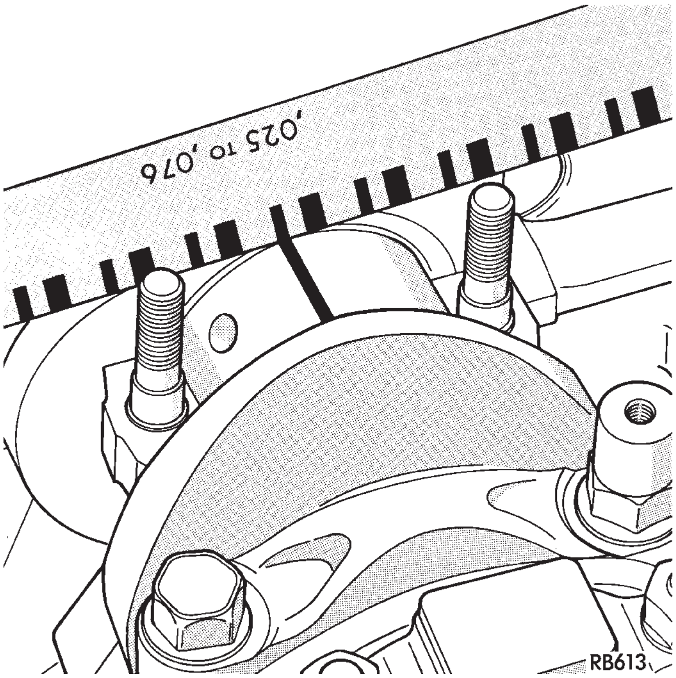


Fig. 16 Checking Connecting Rod Bearing Clearance

CONNECTING RODS

INSTALLATION OF 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 .025mm (.001 inch). Bearings are available in .025mm (.001 inch), .051mm (.002 inch),.076mm (.003 inch), .254mm (.010 inch) and .305mm (.012 inch) undersize. **Install the bearings in pairs. Do not use a new bearing half 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. 16).

The rod bearing bolts should be examined before reuse. If the threads are necked down the bolts should be replaced (Fig. 19).

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.

(2) Before installing the nuts the threads should be oiled with engine oil.

(3) Install nuts on each bolt finger tight 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. 17). Refer to (Fig. 18) for specifications.

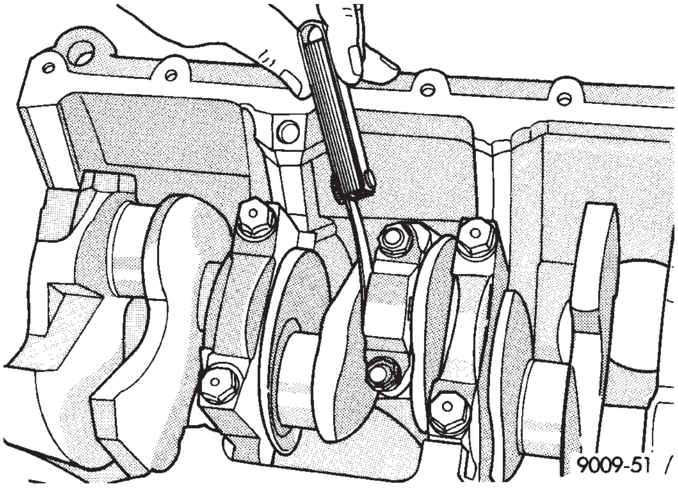


Fig. 17 Checking Connecting Rod Side Clearance

Connecting Rod Bearing Clearance	
New Part:	.019 to .087 mm (.0008 to .0034 in.)
Wear Limit:	.104 mm (.0041 in.)
Connecting Rod Side Clearance	
New Part:	0.13 to 0.32 mm (.005 to .013 in.)
Wear Limit:	0.38 mm (.015 in.)

9109-49

Fig. 18 Connecting Rod Specifications

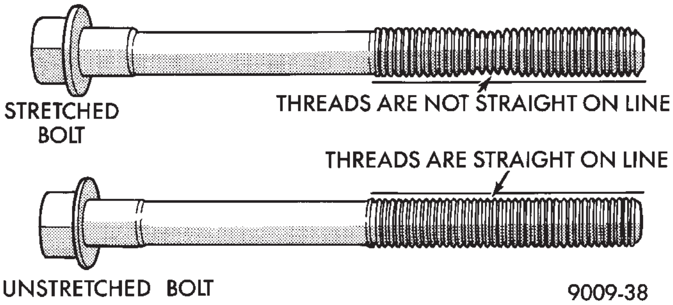


Fig. 19 Check for Stretched (Necked) Bolts

CRANKSHAFT SERVICE

CRANKSHAFT MAIN BEARINGS

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly. (Fig. 1) 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. 6) Limits of taper or out-of-round on any crankshaft journals should be held to .025mm (.001 inch). Journal grinding should not exceed .305mm (.012 inch) 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.

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. 2). All bearing cap bolts removed during service procedures are to be cleaned and oiled

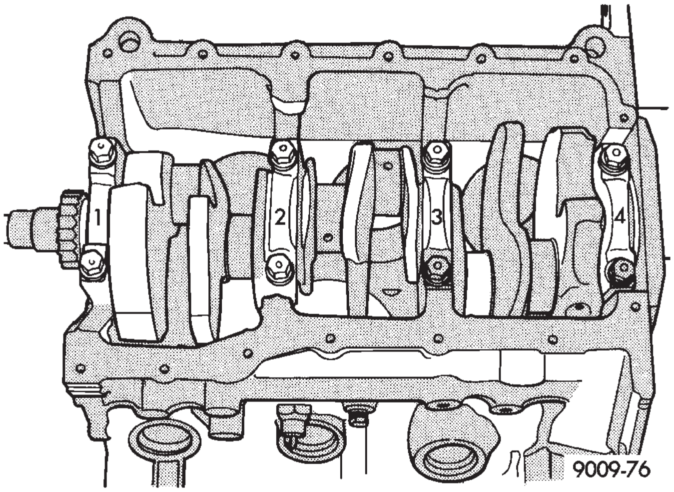


Fig. 1 Main Bearing Cap Identification

before installation. Bearing shells are available in standard and the following undersizes: 0.025mm (.001 inch), .051mm (.002 inch), .076mm (.003 inch), .254mm (.010 inch), and .305mm (.012 inch). Never install an undersize bearing that will reduce clearance below specifications.

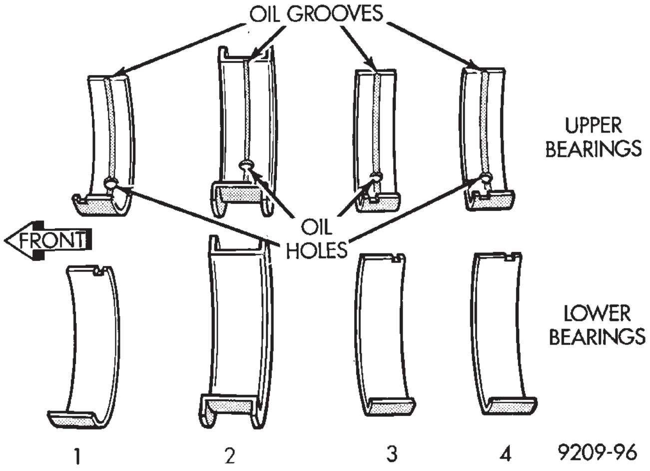


Fig. 2 Main Bearing Identification

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. 3) into the oil hole of crankshaft.

(3) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

INSTALLATION

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.

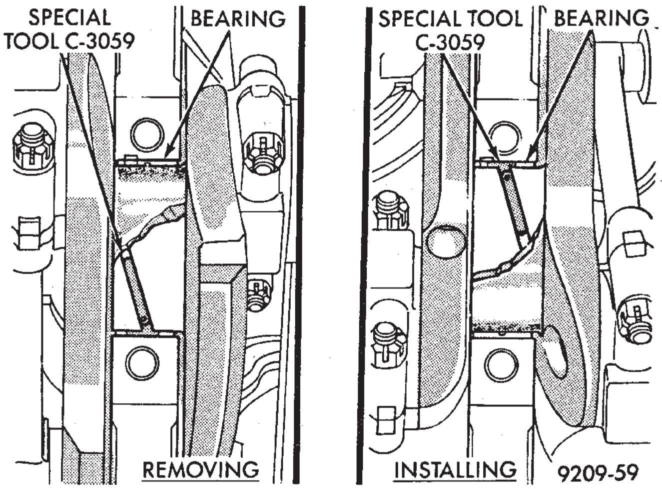


Fig. 3 Removing and Installing Upper Main Bearing With Special Tool C-3059

(1) Start bearing in place, and insert Main Bearing Tool C-3059 into oil hole of crankshaft (Fig. 3).

(2) Slowly rotate crankshaft counter-clockwise 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.

CHECKING CRANKSHAFT END PLAY

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 4).

(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 (Fig. 5) for specification.

CRANKSHAFT END PLAY CHECK—OPTIONAL

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing

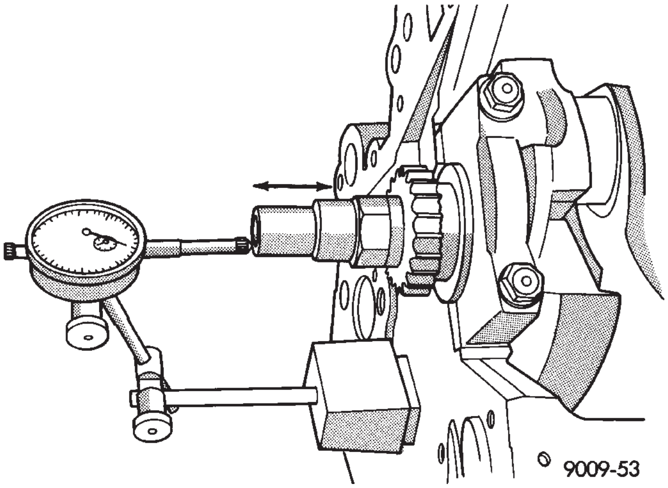


Fig. 4 Checking Crankshaft End Play

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 (Fig. 5) for specification.

Crankshaft End-Play

New Part: 0.10 to 0.30 mm (.004 to .012 in.)
Wear Limit: 0.43 mm (.017 in.)

Main and Connecting Rod Bearing Clearance

New Part: .019 to .077 mm (.0007 to .0030 in.)
Wear Limit: .102 mm (.004 in.)

Crankshaft Journal Sizes

Crankshaft Main Bearing Journal

ALL	Diameter
Standard	64.00 ± 0.013 mm (2.519 ± .0005 in.)

Crankshaft Connecting Rod Journal

ALL	Diameter
Standard	58.00 ± 0.013 (2.283 ± .0005 in.)

9309-211

Fig. 5 Crankshaft specification

CRANKSHAFT OIL CLEARANCE

(1) Measure the journal outside diameter as shown in (Fig. 6). Refer to specification (Fig. 5).

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. 7).

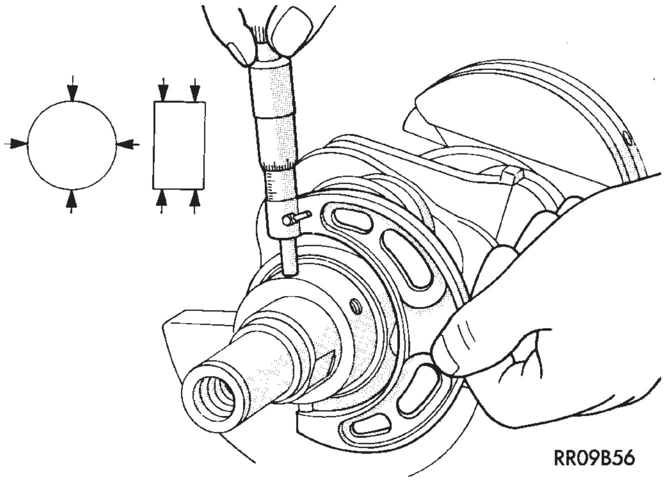


Fig. 6 Measure Crankshaft Journal O.D.

(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.

(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. 7). Refer to specification (Fig. 5) 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. Also see Measuring Main and Connecting Rod Bearing Clearance in Standard Service Procedures.

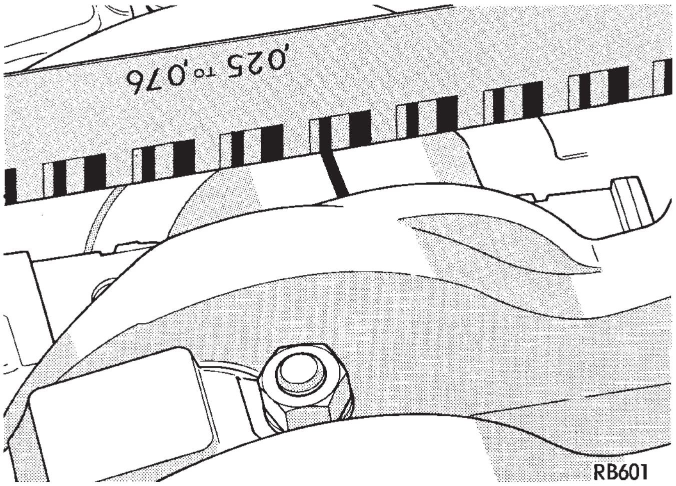


Fig. 7 Measuring Bearing Clearance with Plastigage

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

CRANKSHAFT OIL SEALS SERVICE

REMOVAL

Pry out rear seal with screwdriver. Be careful not to nick or damage crankshaft flange seal surface or retainer bore (Fig. 8).

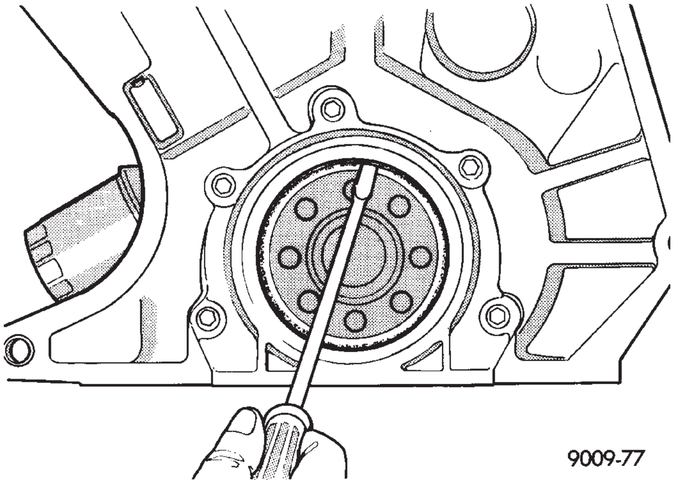


Fig. 8 Removing Rear Crankshaft Oil Seal

INSTALLATION

(1) Place Special Seal Pilot Tool C-4681 on crankshaft (Fig. 9).

(2) Lightly coat seal O.D. with Loctite Stud N' Bearing Mount or equivalent.

(3) Place seal over Special Seal Pilot Tool C-4681 and tap in place with a plastic hammer.

REAR CRANKSHAFT SEAL RETAINER

When retainer removal is required, remove retainer clean engine block and retainer of old gasket. Make sure surfaces are clean and free of oil. Install new gasket and tighten screws to 12 N•m (105 in. lbs.).

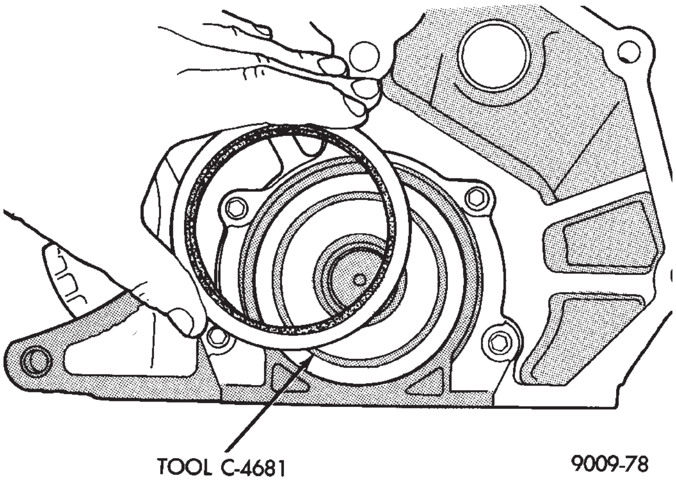


Fig. 9 Installing Rear Crankshaft Oil Seal

ENGINE LUBRICATION SYSTEM

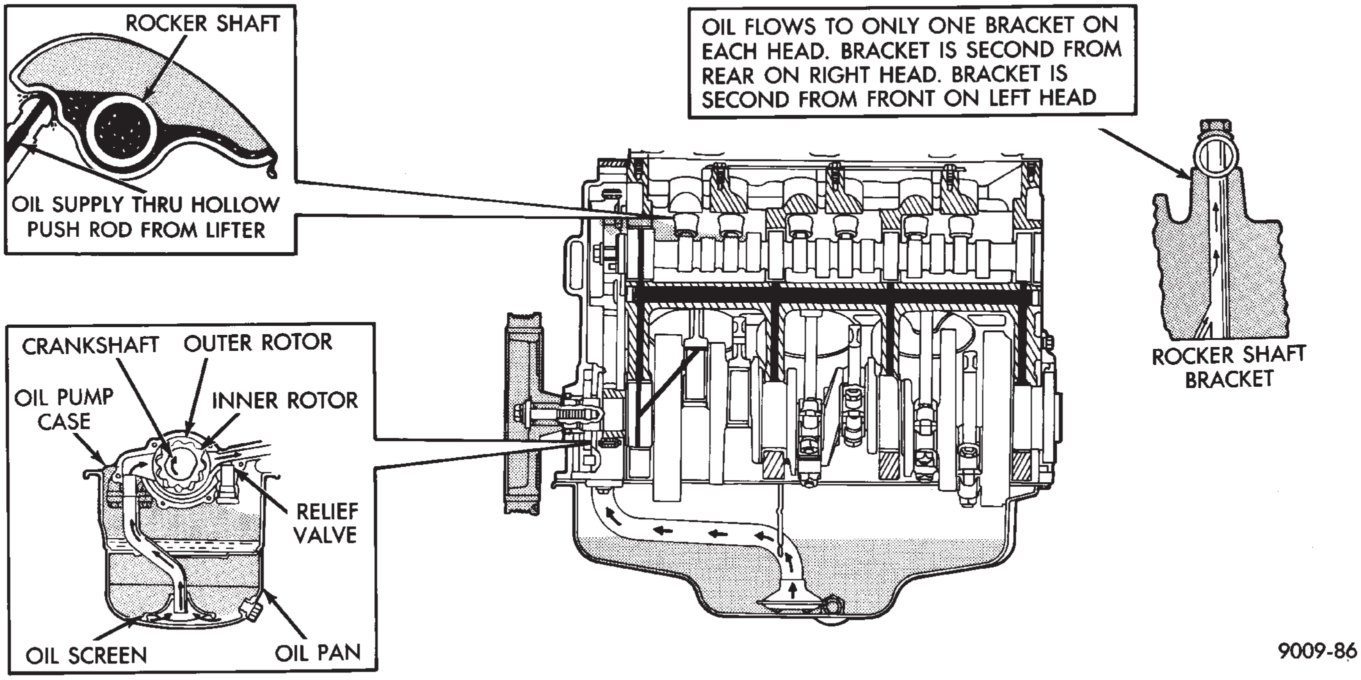


Fig. 1 Engine Oiling System

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. Its 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. 1).

OIL PAN SERVICE

REMOVAL

(1) Disconnect negative battery cable, remove engine oil dipstick.

(2) Raise vehicle. Drain engine oil.

(3) Remove oil pan screws and remove oil pan.

CLEANING AND INSPECTION

(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. lb.).

(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.

INSTALLATION

(1) Install oil pick-up tube into Chain Case Cover tighten screw to 28 N●m (250 in. lbs.) (Fig. 2).

(2) 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. 3).

(3) Use a new pan gasket (Fig. 4).

(4) Install pan and tighten screws to 23 N●m (200 in. lb.).

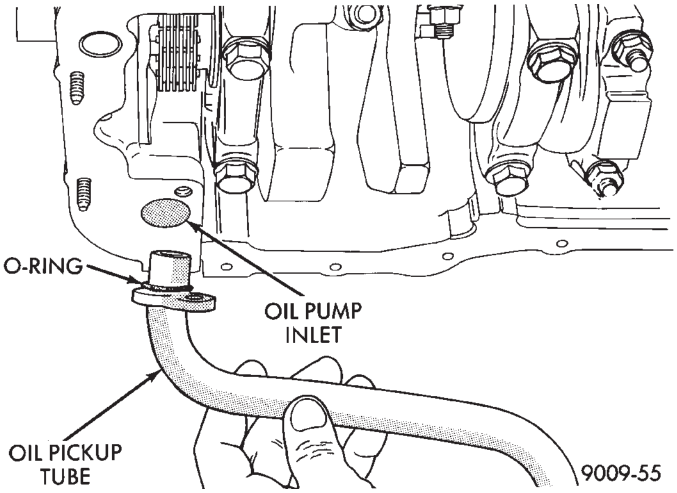


Fig. 2 Oil Pump Pick-up Tube Service

(5) Lower vehicle and install oil dipstick.

(6) Connect negative battery cable.

(7) Fill crankcase with oil to proper level.

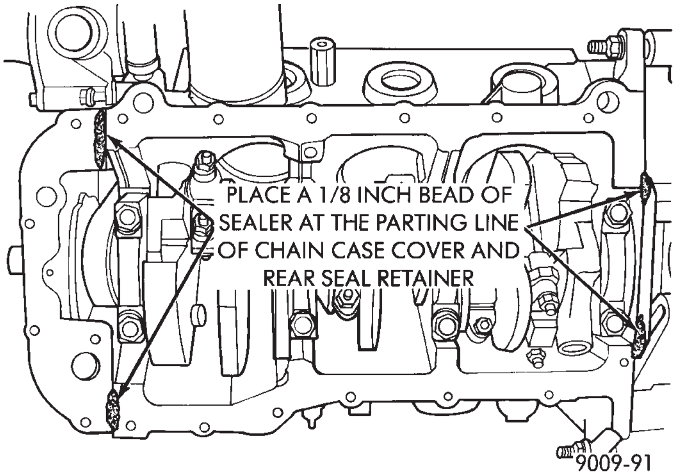


Fig. 3 Oil Pan Sealing

OIL PUMP SERVICE

It is necessary to remove the oil pan, oil pickup and chain case cover (CCC) 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:

(a) Drill a 3.175mm (1/8 inch) hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.

(b) Clamp screw into a vise and while supporting chain case cover (CCC), remove cap by tapping CCC using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 5).

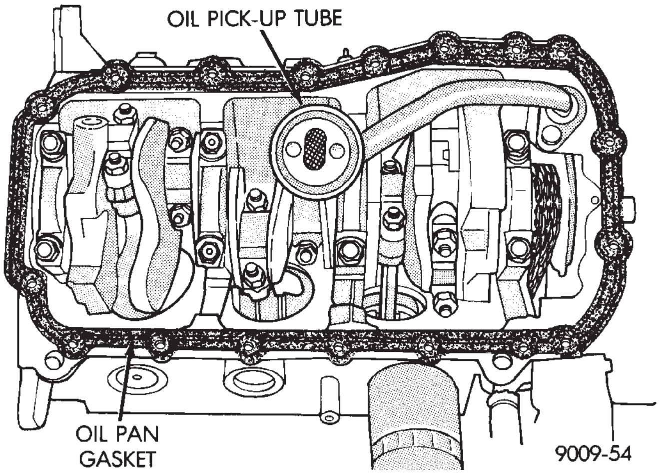


Fig. 4 Oil Pan Gasket Installation

(2) Remove oil pump cover screws, and lift off cover.

(3) Remove pump rotors.

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 6).

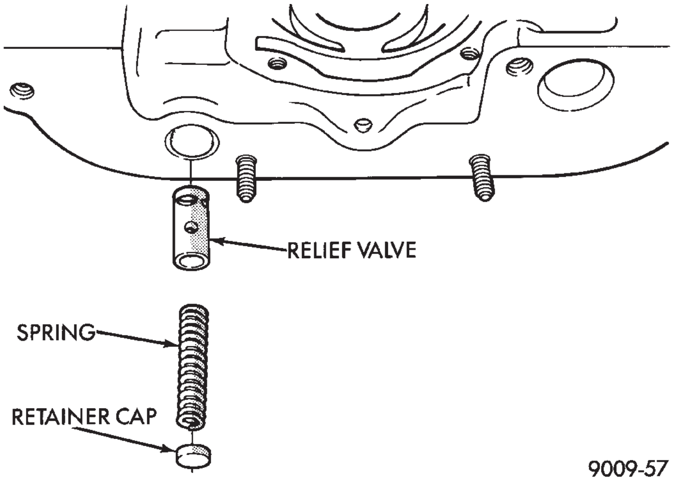


Fig. 5 Oil Pressure Relief Valve

INSPECTION AND REPAIR

(1) Clean all parts thoroughly. Mating surface of the chain case cover (CCC) should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 7). If a .076mm (.003 inch) 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 7.64mm (0.0301 inch.) or less (Fig. 8), or if the diameter is 79.95mm (3.148 inches.) or less, replace outer rotor.

(4) If inner rotor measures 7.64mm (.301 inch) or less replace inner rotor (Fig. 9).

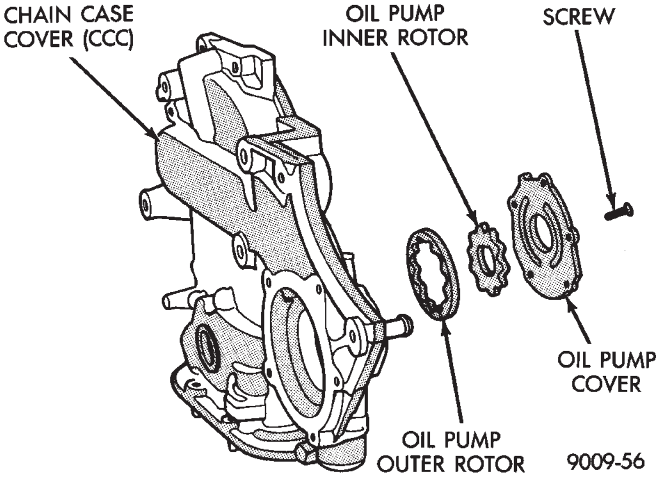


Fig. 6 Oil Pump

(5) Slide outer rotor into CCC, press to one side with fingers and measure clearance between rotor and CCC (Fig. 10). If measurement is .39mm (.015 inch) or more, replace CCC only if outer rotor is in specification.

(6) Install inner rotor into CCC. If clearance between inner and outer rotors (Fig. 11) is .203mm (.008 inch) or more, replace both rotors.

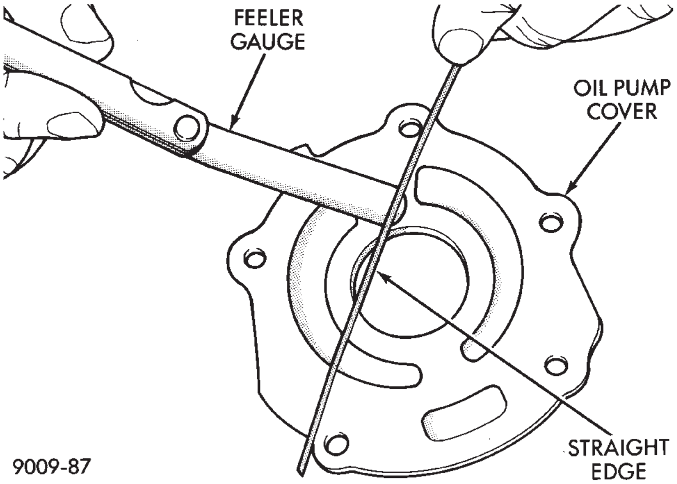


Fig. 7 Checking Oil Pump Cover Flatness

(7) Place a straightedge across the face of the CCC, between bolt holes. If a feeler gauge of .102mm (.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 12). **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 49.5mm (1.95 inches) it should test between 19.5 and 20.5 pounds when compressed to 34mm (1-11/32 inches). Replace spring that fails to meet specifications (Fig. 5).

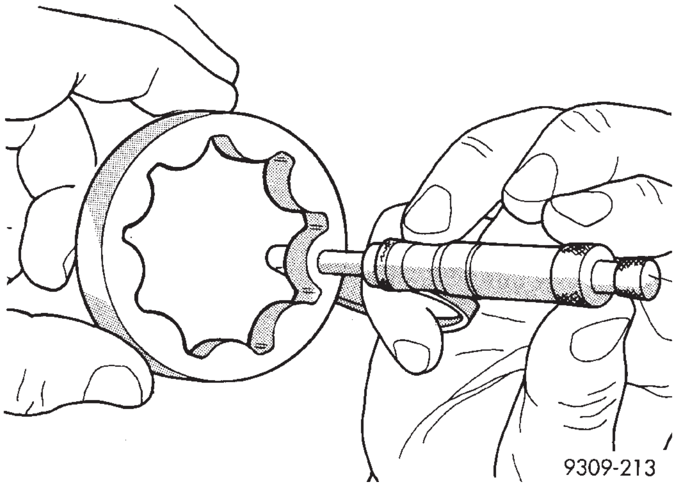


Fig. 8 Measuring Outer Rotor Thickness

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

OIL PUMP ASSEMBLY AND INSTALLATION

(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.).

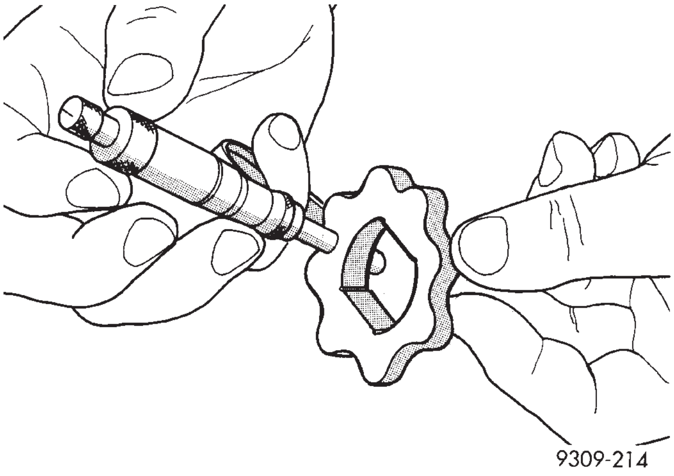


Fig. 9 Measuring Inner Rotor Thickness

(3) Prime oil pump before installation by filling rotor cavity with engine oil.

(4) Install chain case cover slowly refer to Timing Chain Cover Installation of this section.

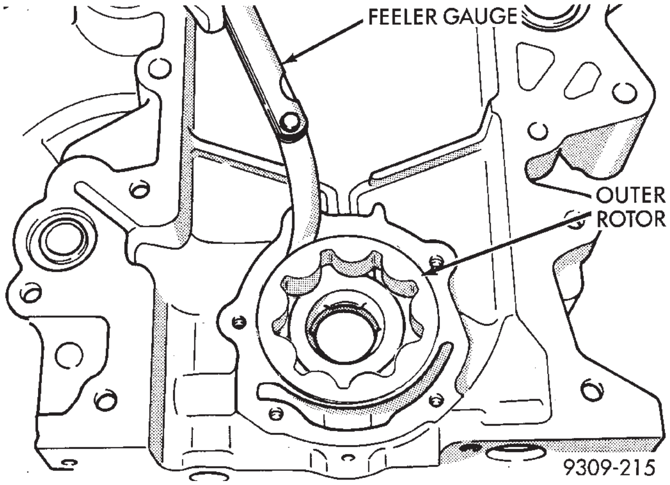


Fig. 10 Measuring Outer Rotor Clearance in Housing

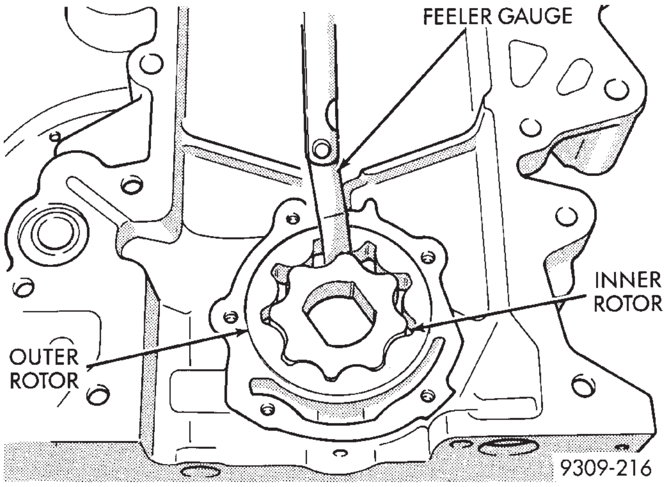


Fig. 11 Measuring Clearance Between Rotors

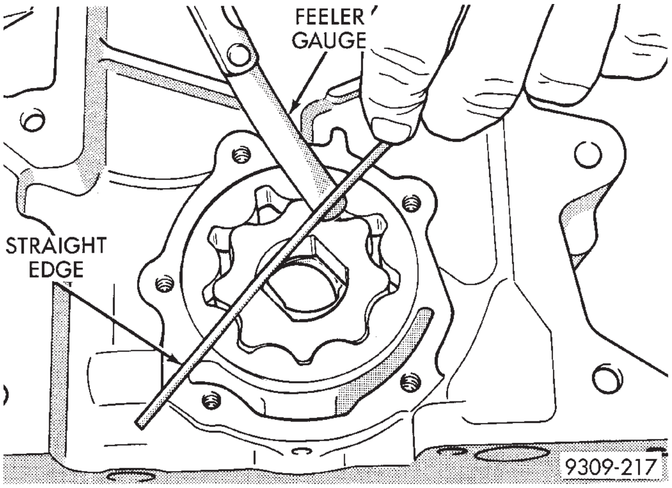


Fig. 12 Measuring Clearance Over Rotors

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. 13).

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

(2) Warm engine at high idle until thermostat opens.

OIL FILTER

CAUTION: When servicing the oil filter (Fig. 16) avoid deforming the filter can by installing the remove/install tool band strap against the can-to-base lockseam. The lockseam joining the can to the base is reinforced by the base plate.

(1) Using Tool C-4065, unscrew filter from base and discard (Fig. 14).

(2) Wipe base clean, then inspect gasket contact surface.

(3) Lubricate gasket of new filter with clean engine oil.

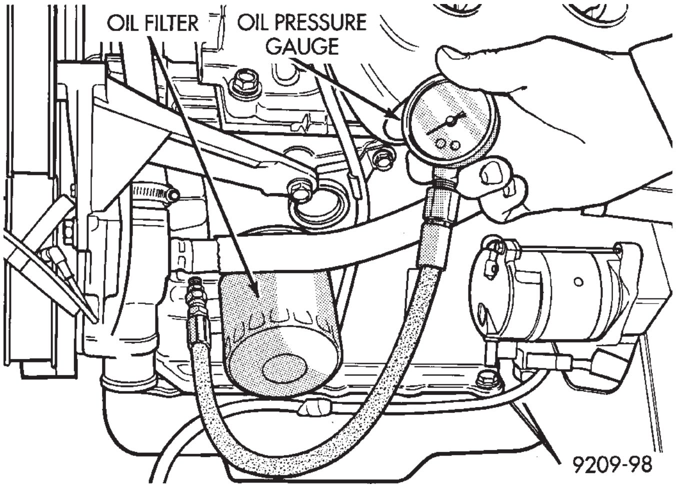


Fig. 13 Checking Oil Pump Pressure

(4) Install and tighten filter to 20 N●m (15 ft. lbs.) torque after gasket contacts base. Use filter wrench if necessary.

(5) Start engine and check for leaks.

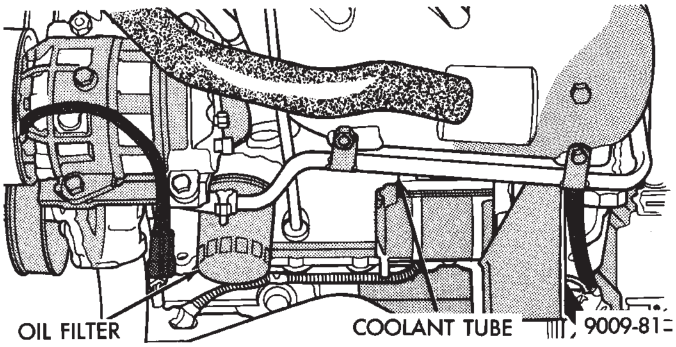


Fig. 14 Oil Filter

ENGINE SPECIFICATIONS

	3.3L Engine	3.8L Engine
Type	60° V-6 Engine	
Bore	93.0 mm (3.661 inches)	96.0 mm (3.779 inches)
Stroke	81.0 mm (3.188 inches)	87.0 mm (3.425 inches)
Compression Ratio	8.9:1	
Displacement	3.3 Liters (201 cubic inches)	3.8 Liters (231 cubic inches)
Brake Horsepower	147 @4800 RPM	151 @4400 RPM
Torque	183 lbs.-ft. @3600 RPM	204 lbs.-ft. @3200 RPM
Firing Order	1-2-3-4-5-6	
Minimum Compression Pressure, see "Engine Performance" in Standard Service Procedures	689.5 kPa (100 psi)	
Maximum Variation Between Cylinders	25%	
Cylinder Number (Front to Rear)		
Front Bank	2, 4, 6	
Rear Bank	1, 3, 5	
Cylinder Block		
Cylinder Bore (Standard)	93.0 mm (3.660 inches)	96.0 mm (3.779 inches)
Cylinder Bore Out-of-Round (Maximum Allowable Before Reconditioning)	0.076 mm (0.003 inch)	
Cylinder Bore Taper (Maximum Allowable Before Reconditioning)	0.051 mm (0.002 inch)	
Reconditioning Working Limits (For Taper and Out-of-Round)	0.001 inch	
Maximum Allowable Oversize (Cylinder Bores)	0.020 inch	
Tappet Bore Diameter	0.9051 inch–0.9059 inch	
Pistons		
Type Material	Aluminum Alloy Tin Coated	
Clearance at Size Location	0.025–0.057 mm (0.001 to 0.0022 inch)	
Weight (Std. Only)	381±5 gms	438 ± 5 gms
Pistons For Service	Standard Only	
Piston Pins		
Type	Press Fit in Rod (Serviced as an Assembly)	
Diameter	22.88 mm (0.9009–0.9007 inch)	
Length	67.25–67.75 mm (2.648–2.667 inches)	71.25–71.75 mm (2.805–2.824 inches)
Clearance in Piston (Light Thumb Push @70°F)	0.006–0.019 mm (0.0002–0.0007 inch)	
Clearance in Rod	(Interference)	
Piston Rings		
Number of Rings Per Piston	3	
Compression	2	
Oil	1	
Oil Ring Type	3-Piece, Steel Rail, Chrome-Face	
Ring Width		
Compression	1.46–1.5 mm (0.0575–0.0591 inch)	
Oil—Steel Rails	0.510 mm (0.0201 inch)	
Ring Gap		
Compression	0.300–0.550 mm (0.0118–0.0217 inch)	
Oil—Steel Rails	0.250–1.00 mm (0.0098–0.0394 inch)	
Ring Side Clearance		
Compression	0.030–0.095 mm (0.0012–0.0037 inch)	
Oil—Steel Rails	0.014–0.226 mm (0.0005–0.0089 inch)	
Service Rings		
Ring Gap		
Compression	0.300–0.550 mm (0.0018–0.0217 inch)	
Oil—Steel Rails	0.250–1.00 mm (0.0098–0.0394 inch)	
Ring Side Clearance		
Compression	0.030–0.095 mm (0.0012–0.0037 inch)	
Oil—Steel Rails	0.014–0.226 mm (0.0005–0.0089 inch)	

9309-266

ENGINE SPECIFICATIONS (CONT.)

CONNECTING RODS

Side Clearance	0.127–0.381mm (0.005–0.015 inch)

CONNECTING ROD BEARINGS

Type	Aluminum Lead (Bi-Metal)
Clearance Desired	0.019–0.076mm (0.00075–0.003 inch.)
Maximum Allowable (wear limit)	0.102mm (0.004 inch.)
Bearings for Service	Std., 0.025mm (0.001), 0.051mm (0.002) 0.076mm (0.003), 0.254mm (0.010), 0.305 mm (0.012 inches.)

CRANKSHAFT

Type	Cast Nodular Iron
Bearings	Aluminum Lead (Bi-Metal)
Thrust Taken By	No. 2 Main Bearing
End Play	0.076–0.228mm (0.003–0.009 inch.)
Maximum Allowable (wear limit)	0.381mm (0.015 inch.)
Diametral Clearance Desired #1, 2, 3 and 4	0.018-0.076mm (0.0007-0.003 inch.)
Maximum Diametral Clearance #1, 2, 3 and 4 (wear limit)	0.102mm (0.004 inch.)

MAIN BEARING JOURNALS

Diameter	64mm (2.519 inch.)
Maximum Allowable Out-of-Round and/or Taper	0.025mm (0.001 inch.)
Bearings for Service	Std., 0.025mm (0.001), 0.051mm (0.002) 0.076mm (0.003), 0.254mm (0.010), 0.305mm (0.012 inches.)

CONNECTING ROD JOURNALS

Diameter	58mm (2.283 inch.)
Maximum Allowable Out-of-Round and/or Taper	0.025mm (0.001 inch.)

CAMSHAFT

Drive	Chain
Bearings	Steel Backed Babbitt
Number	4
Diametral Clearance	0.025–0.101mm (0.001–0.004 inch.)
Maximum Allowable Before Reconditioning	0.127mm (0.005 inch.)
Thrust Taken By	Thrust Plate
End Play	0.127–0.304mm (0.005–0.012 inch.)
Maximum Allowable	0.304mm (0.012 inch.)

CAMSHAFT JOURNALS

Diameter	
No. 1	50.724-50.775 (1.9970-1.9990 inch.)
No. 2	50.317-50.368 (1.9809-1.9829 inch.)
No. 3	49.936-49.987 (1.9659-1.9679 inch.)
No. 4	49.530-49.581 (1.9499-1.9520 inch.)

9309-267

ENGINE SPECIFICATIONS (CONT.)

Camshaft Bearings

Diameter	
No. 1	50.825-50.800 (2.0009-1.9999 inch.)
No. 2	50.419-50.393 (1.9849-1.9839 inch.)
No. 3	50.038-50.013 (1.9699-1.9690 inch.)
No. 4	49.632-49.606 (1.9540-1.9529 inch.)
Oil Clearance	.0254-.0762 mm (.001-.003 inch.)

Valve Timing

Intake Opens (BTC)	2°
Intake Closes (ABC)	58°
Exhaust Opens (BBC)	48°
Exhaust Closes (ATC)	12°
Valve Overlap	14°
Intake Valve Duration	240°
Exhaust Valve Duration	240°

Timing Chain

Number of Links	64
Pitch	.375 inch
Width	.750 inch

Tappets

Type	Roller Hydraulic
Body Diameter	22.94–22.96 mm (0.9035–0.9040 inch)
Clearance to Block	0.027–0.060 mm (0.0011–0.0024 inch)
Service Tappets Available	Std., 0.025 mm (0.001), 0.20 mm (0.008), 0.762 mm (0.030 inches)

Cylinder Head

Valve Seat Type	Powdered Metal Inserts
Valve Seat Run-Out (Maximum)	0.760 mm (0.003 inch)
Intake Valve Seat Angle	45–45-1/2°
Seat Width (Finished)	1.75–2.25 mm (0.069–0.088 inch)
Exhaust Valve Seat Angle	45–45-1/2°
Seat Width (Finished)	1.50–2.00 mm (0.057–0.078 inch)
Cylinder Head Gasket (Thickness Compressed)	1.78 mm (0.070 inch)

Valve Guides

Type	Powdered Metal Inserts
Guide Bore Diameter	7.795–8.000 mm (0.313–0.3149 inch)

Valves—(Intake)

Head Diameter	45.5 mm (1.79 inches)
Length Overall (New)	125.385–126.025 mm (4.936–4.961 inches)
Stem Diameter (Standard)	7.935–7.953 mm (0.312–0.313 inch)
Stem to Guide Clearance	0.025–0.095 mm (0.001–0.003 inch)
Maximum Allowable (By Rocking Method)	0.247 mm (0.010 inch)
Face Angle	44-1/2°
Valves for Service (Oversized Stem Diameter)	Std., 0.015 mm (0.005), 0.40 mm (0.015), 0.80 mm (0.030 inches)
Lift (Zero Lash)	10.16 mm (0.400 inch)
Minimum Valve Length After Grinding Tip	124.892 (4.916 inches)
Valve Tip Height	49.541-51.271 mm (1.950-2.018 inch)

9309-268

ENGINE SPECIFICATIONS (CONT.)

VALVES (EXHAUST)

Head Diameter	37.5mm (1.476 inch.)
Length Overall (New)	126.095–126.645mm (4.964–4.986 inch.)
Stem Diameter (Standard)	7.906–7.924mm (0.3112–0.3119 inch.)
Stem to Guide Clearance	0.051–0.175mm (0.002–0.006 inch.)
Maximum Allowable by Rocking Method	0.414mm (0.016 inch.)
Face Angle	44-1/2°
Valves for Service (Oversize Stem Diameter)	Std., 0.015mm (0.005), 0.40mm (0.015), 0.80mm (0.030 inches.)
Lift (Zero Lash)	10.16mm (0.400 inch.)
Minimum Valve Length After Grinding Tip	125.512mm (4.941 inch.)
Valve Tip Height (From Cylinder Head Surface)	49.541–51.271 mm (1.950–2.018 inch.)

ENGINE VALVE SPRINGS

	Intake/Exhaust
Number	12
Free Length (Approx.)	48.5mm (1.909 inch.)
Wire Diameter	4.75mm (0.187 inch.)
Number of coils	6.8
Load When Compressed to—Valve Closed	58–63 lbs. @ 1.570 inch.
—Valve Open	136–145 lbs. @ 1.14 inch.
Valve Spring Installed Height (Spring Seat to Retainer)	39.1–40.6mm (1-17/32–1-19/32 inch.)

ENGINE LUBRICATION

Pump Type	Rotary Full Pressure
Capacity	4.3 Liters (4.5 qts.) Without Oil Filter Change, 4.7 Liters (5.0 qts.) With Oil Filter Change.
Pump Drive	Crankshaft
Minimum Pressure, Engine Fully Warmed Up at Idle	34.47 kPa (5 psi)
3000 RPM	205–551 kPa (30–80 psi)
Oil Filter Bypass Valve Setting	62–103 kPa (9–15 psi)
Oil Pressure Switch Minimum Actuating Pressure	14–28 kPa (2–4 psi)
Oil Filter Type	Full Flow

OIL PUMP—INSPECTION LIMITS FOR REPLACEMENT

Oil Pump Cover Out of Flat	0.076mm (0.003 inch or more)
Outer Rotor Thickness	7.63mm (0.3005 inch or less)
Outer Rotor Diameter	79.78 (3.141 inch or less)
Inner Rotor Thickness	7.64mm (0.301 inch or less)
Clearance Over Rotors—Outer	0.10mm (0.004 inch or more)
—Inner	0.10mm (0.004 inch or more)
Outer Rotor Clearance	0.56mm (0.022 inch or more)
Tip Clearance Between Rotors	0.20mm (0.008 inch or more)

9309-221

TORQUE

DESCRIPTION	TORQUE
A/C Compressor Bracket to Water Pump Bolt	41 N·m (30 ft. lbs.)
A/C Compressor to Bracket Bolt	68 N·m (50 ft. lbs.)
A/C Compressor Support Bolts	41 N·m (30 ft. lbs.)
Generator Adjusting Strap Bolt	23 N·m (200 in. lbs.)
Generator Adjusting Strap Mounting Bolt	41 N·m (30 ft. lbs.)
Generator Bracket Bolt	41 N·m (30 ft. lbs.)
Generator Mounting Pivot Nut	41 N·m (30 ft. lbs.)
Camshaft Sprocket Bolt	54 N·m (40 ft. lbs.)
Camshaft Thrust Plate	12 N·m (105 in. lbs.)
Chain Case Cover Bolt	
M8x1.25	27 N·m (20 ft. lbs.)
M10x1.5	54 N·m (40 ft. lbs.)
Connecting Rod Nut	54 N·m (40 ft. lbs.) +1/4 Turn
Crankshaft Pulley Screw to Crankshaft	54 N·m (40 ft. lbs.)
Cylinder Head Bolt	33 N·m (25 ft. lbs.)
Cylinder Head Bolt	61, 88, 88 N·m (45, 65, 65 ft. lbs.) +1/4 Turn
Cylinder Head Covers – Bolt	12 N·m (105 in. lbs.)
Exhaust Manifold Screw	23 N·m (200 in. lbs.)
Exhaust Crossover Pipe Flange Nut/Bolt	33 N·m (25 ft. lbs.)
Intake Manifold Bolt	23 N·m (200 in. lbs.)
Intake Manifold Gasket Retaining Screws	12 N·m (105 in. lbs.)
Intake Manifold Plenum Bolt	28 N·m (250 in. lbs.)
Main Bearing Cap Bolt	41 N·m (30 ft. lbs.) +1/4 Turn
Oil Filter Attaching Nipple	41 N·m (30 ft. lbs.)
Oil Lever Sensor Plug	27 N·m (20 ft. lbs.)
Oil Pan Drain Plug	27 N·m (20 ft. lbs.)
Oil Pan Screw	12 N·m (105 in. lbs.)
Oil Pressure Gauge Sending Unit	7 N·m (60 in. lbs.)
Oil Pump Cover Bolt T-30	12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Screw	28 N·m (250 in. lbs.)
Rocker Shaft Bracket Bolt	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 Toke Screw	12 N·m (105 in. lbs.)
Temperature Gauge Sending Unit	7 N·m (60 in. lbs.)
Timing Chain Snubber Screw	12 N·m (105 in. lbs.)
Water Pump to (Chain Case Cover) Bolt	12 N·m (105 in. lbs.)

9309-270

EXHAUST SYSTEM AND INTAKE MANIFOLD

CONTENTS

GENERAL INFORMATION

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.

EXHAUST SYSTEMS

The exhaust systems are produced in several configurations, depending on engine and car line (Fig. 1). One system has an underfloor catalytic converter, other systems require front mounted catalytic converters. The Turbo III engine requires, a underfloor converter/resonator assembly. Tail pipes, mufflers, and resonators are sized and tuned to each vehicle/ powertrain combination (Fig. 2).

EXHAUST BALL JOINT COUPLING

A exhaust ball joint coupling (Fig. 3) is used to secure the exhaust pipe 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 ball joint consists of two bolts, two springs, and a ball joint seal ring which is a separate part from the exhaust pipe.

CATALYTIC CONVERTER

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 is internal converter differences required in some parts of the country (particularly California vehicles). The 2.2/2.5L engines equipped with a manual transmission will have an adaptor for a air injection tube.

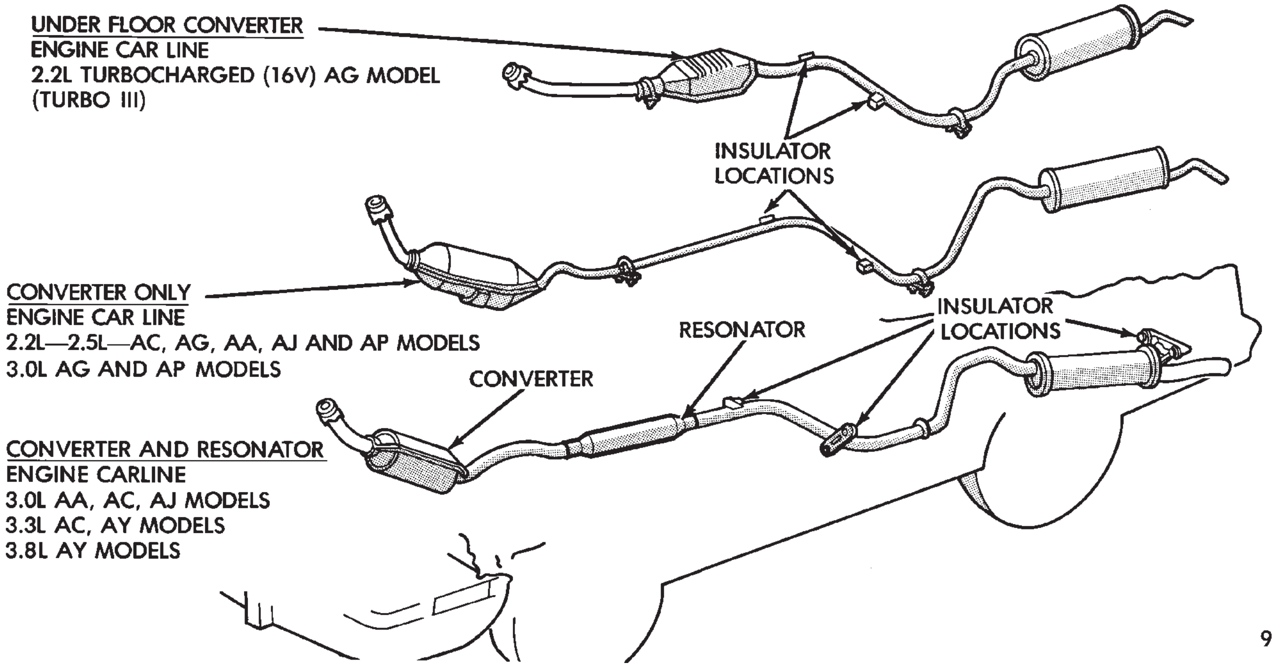


Fig. 1 Exhaust System

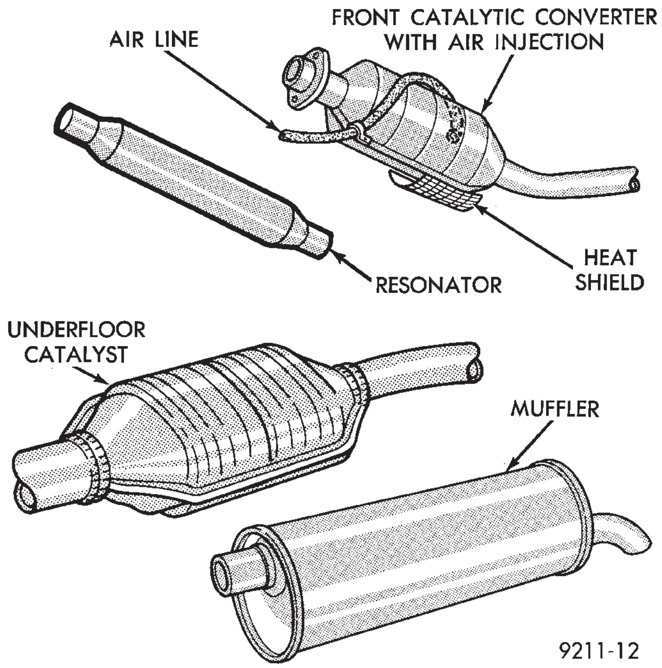


Fig. 2 Exhaust System Components

HEAT SHIELDS

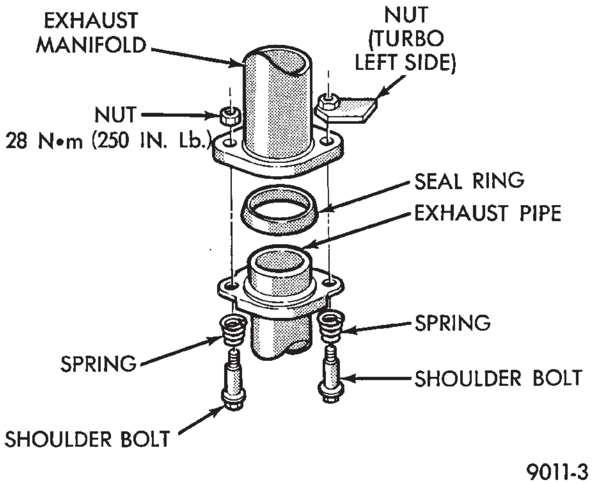


Fig. 3 Ball Joint Connection

Heat shields (Fig. 4) are needed to protect both the car and the environment from the high temperatures developed in the vicinity of the catalytic converters. 2.2/2.5L engines equipped with manual transmission where air is injected into the catalytic converter's, a heat shield is welded on the lower bottom of the front converter.

Refer to Body and Sheet Metal, Group 23 for service procedures.

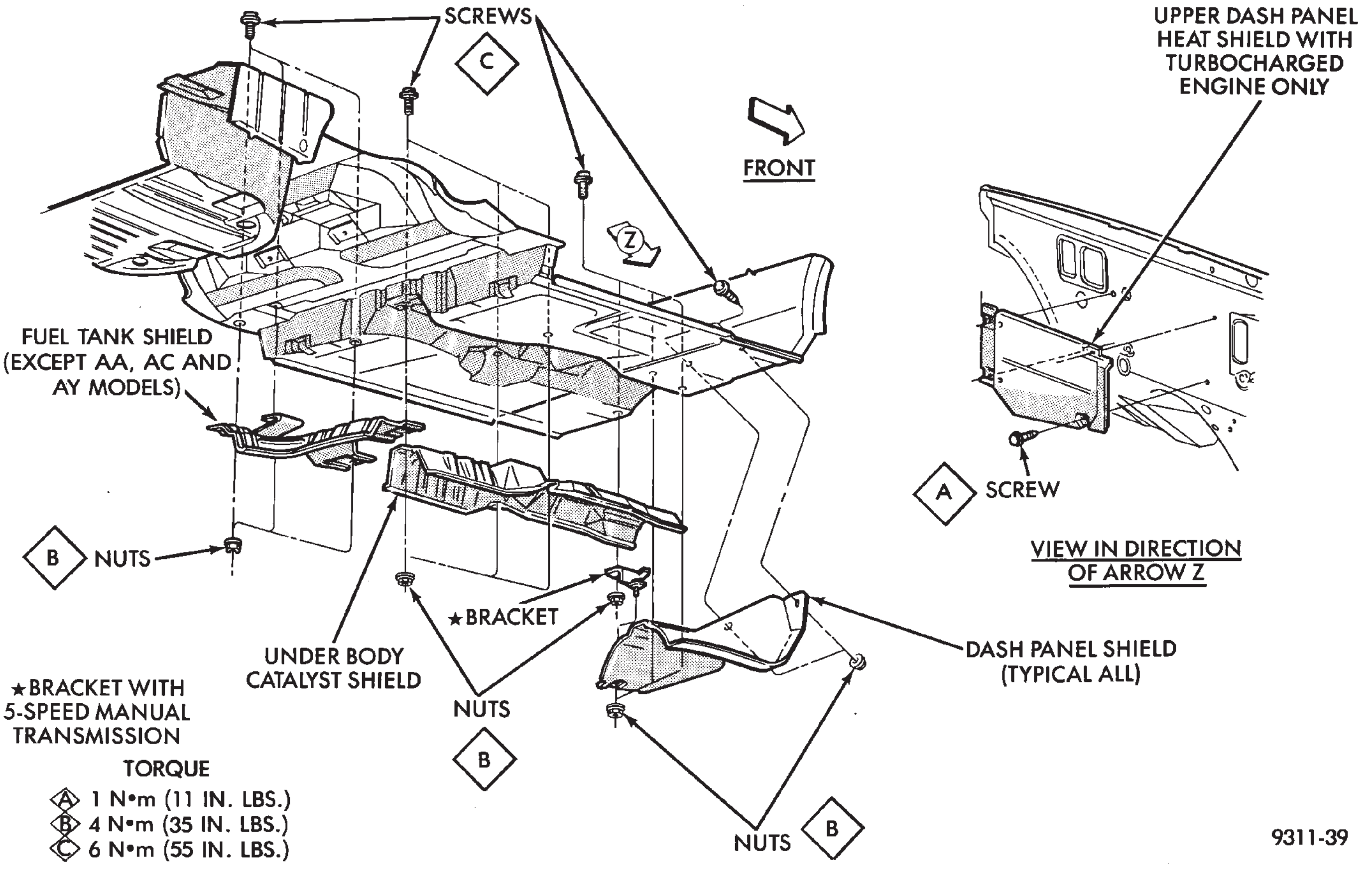


Fig. 4 Heat Shield Installation

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields on cars if equipped. Light overspray 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.

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 if exhaust system is equipped with catalytic converter. Failure of the catalytic converter can occur due to temperature increases caused by unburned fuel passing through the converter.

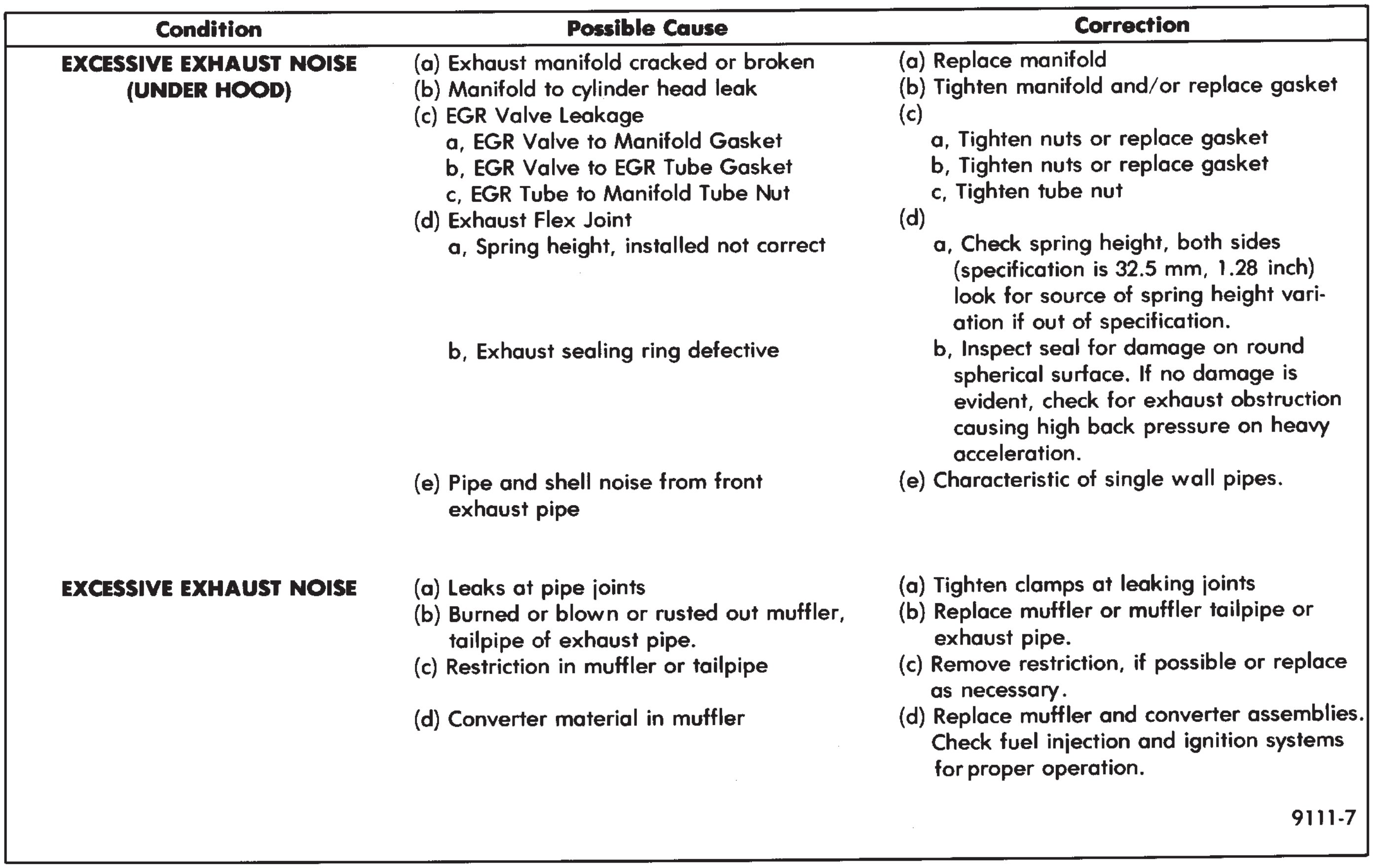
The use of the catalysts also involves some non-automotive problems. Unleaded gasoline must be used to avoid poisoning the catalyst core. Do not allow engine to operate above 1200 RPM in neutral for extended periods over 5 minutes. This condition may result in excessive exhaust system/floor pan temperatures because of no air movement under the vehicle.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

To assist in the control of oxides of nitrogen (NOx) in engine exhaust, some 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 openings in the exhaust gas crossover passage in the intake manifold. REFER TO SECTION 25 EMISSION SYSTEMS FOR A COMPLETE DESCRIPTION, DIAGNOSIS AND SERVICE PROCEDURES ON THE EXHAUST GAS RECIRCULATION SYSTEM AND COMPONENTS.

EXHAUST SYSTEM DIAGNOSIS



Condition	Possible Cause	Correction
EXCESSIVE EXHAUST NOISE (UNDER HOOD)	(a) Exhaust manifold cracked or broken	(a) Replace manifold
	(b) Manifold to cylinder head leak	(b) Tighten manifold and/or replace gasket
	(c) EGR Valve Leakage	(c)
	a, EGR Valve to Manifold Gasket	a, Tighten nuts or replace gasket
	b, EGR Valve to EGR Tube Gasket	b, Tighten nuts or replace gasket
	c, EGR Tube to Manifold Tube Nut	c, Tighten tube nut
	(d) Exhaust Flex Joint	(d)
	a, Spring height, installed not correct	a, Check spring height, both sides (specification is 32.5 mm, 1.28 inch) look for source of spring height variation if out of specification.
	b, Exhaust sealing ring defective	b, Inspect seal for damage on round spherical surface. If no damage is evident, check for exhaust obstruction causing high back pressure on heavy acceleration.
	(e) Pipe and shell noise from front exhaust pipe	(e) Characteristic of single wall pipes.
EXCESSIVE EXHAUST NOISE	(a) Leaks at pipe joints	(a) Tighten clamps at leaking joints
	(b) Burned or blown or rusted out muffler, tailpipe of exhaust pipe.	(b) Replace muffler or muffler tailpipe or exhaust pipe.
	(c) Restriction in muffler or tailpipe	(c) Remove restriction, if possible or replace as necessary.
	(d) Converter material in muffler	(d) Replace muffler and converter assemblies. Check fuel injection and ignition systems for proper operation.

9111-7

SERVICE PROCEDURES

INDEX

EXHAUST PIPES, MUFFLERS AND TAILPIPES

REMOVAL

(1) Raise vehicle on hoist and apply penetrating oil to clamp bolts and nuts of component being removed.

(2) Tail pipes are integral with the muffler (Fig. 5). Remove clamp at slip joint. Separate at slip joint.

(3) Remove clamps and supports (Figs. 6, 7, 8, and 9) from exhaust system to permit alignment of parts during assembly.

(4) When removing tailpipe, raise rear of vehicle to relieve body weight from rear springs to provide clearance between pipe and rear axle parts.

(5) Clean ends of pipes and/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 most 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 affect emissions and performance.

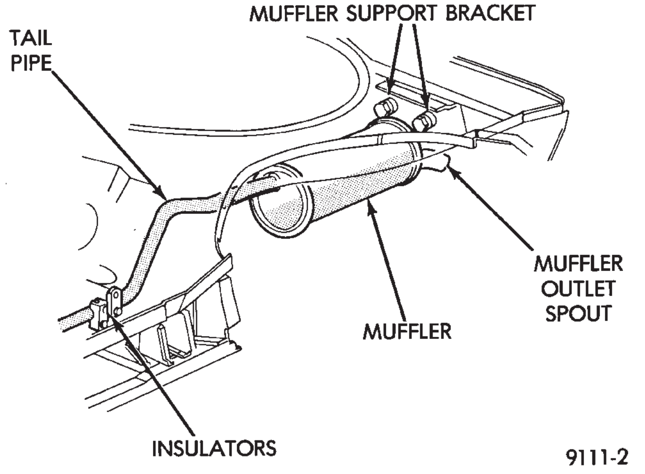


Fig. 5 Tail Pipe with Muffler—Typical

INSTALLATION

(1) Assemble ball joint connection pipes, supports and clamps loosely to permit alignment of all parts.

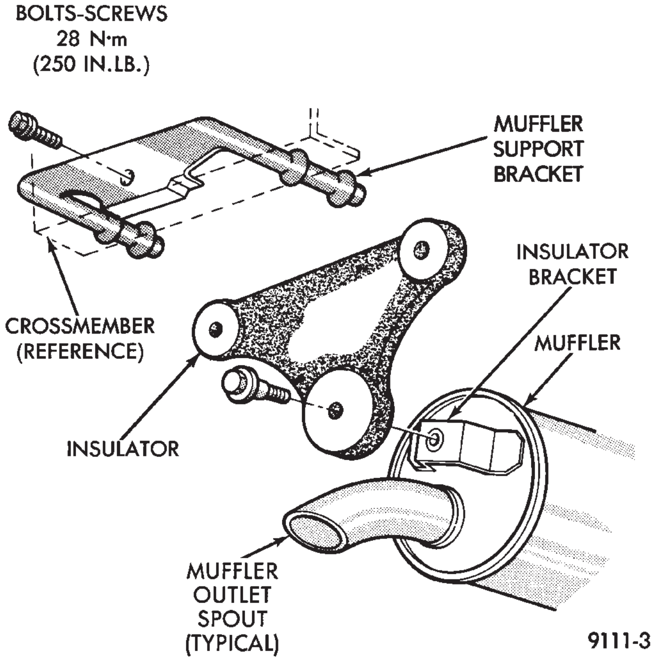


Fig. 6 Insulator Tail Pipe and Muffler Support

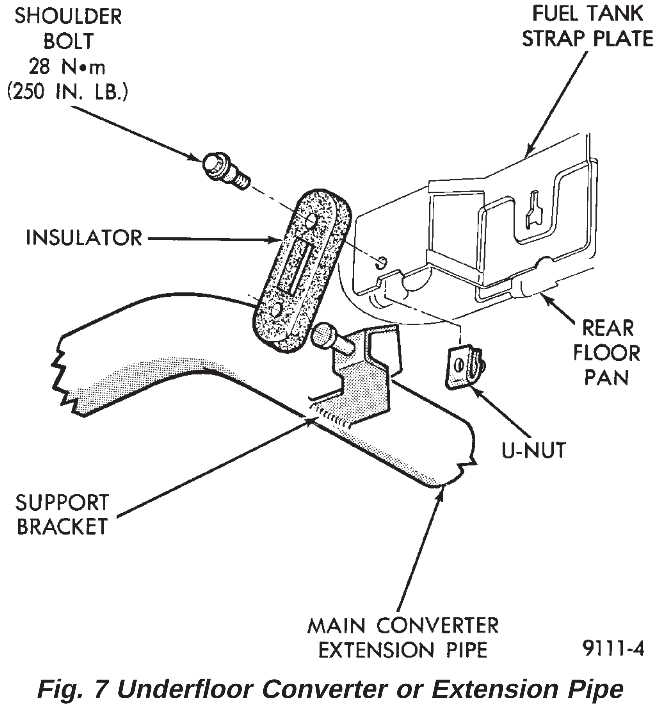


Fig. 7 Underfloor Converter or Extension Pipe Support—2 Places

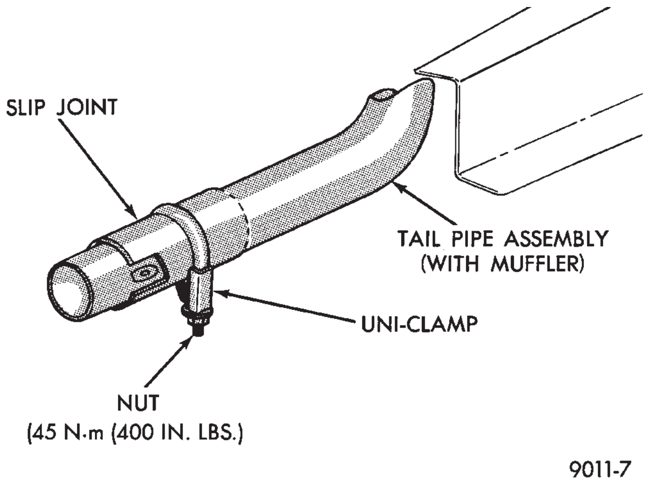


Fig. 8 Front Tail Pipe Uni-Clamp

(2) Beginning at the ball joint, align and torque shoulder bolts (Fig. 3).

(3) Working from the front of system, align and clamp each component to maintain position and proper clearance with underbody parts (Fig. 10).

(4) Tighten all clamps and supports to the proper torques and clearances.

INTAKE AND EXHAUST MANIFOLDS—TBI ENGINE

INTAKE MANIFOLD

Naturally Aspirated Die-cast aluminum long-branch fan design with remote plenum. The throttle body is installed on the upper plenum of the manifold.

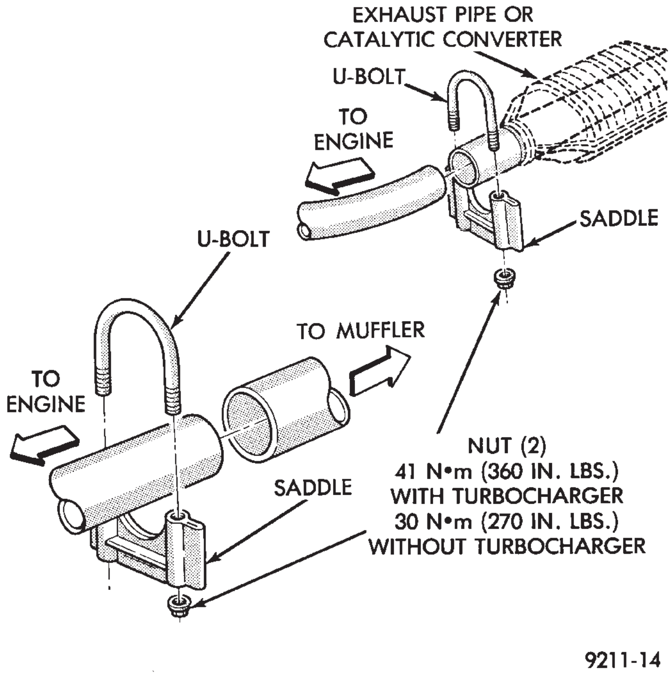


Fig. 9 First Slip Joint Connection

EXHAUST MANIFOLD

All high strength iron casting that intermesh with the intake manifold. For standard engines a four branch design collects and directs exhaust gases to the conical (articulated joint connection) outlet.

THROTTLE BODY AIR HEATER

The throttle body air heater (Fig. 1) is attached to the exhaust manifold and is removable.

Inspect air heater connector tube; replace if damaged. Refer to Emission Control Systems Group 25,

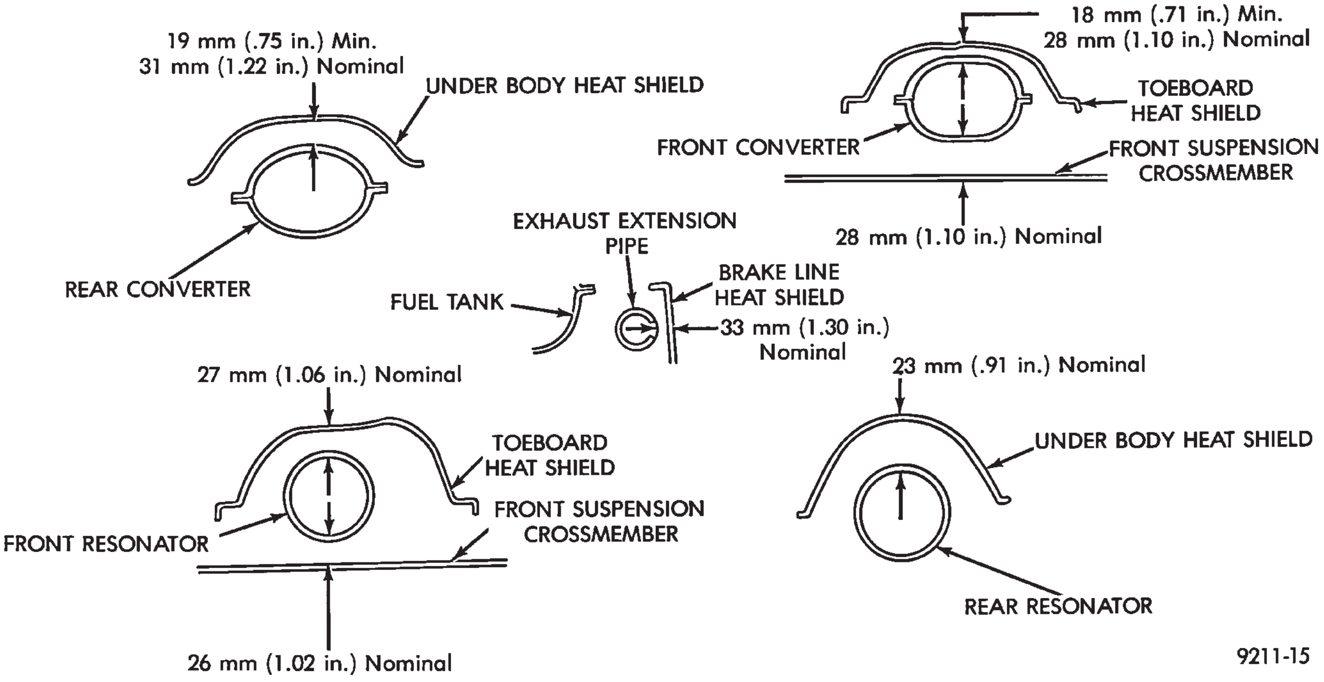


Fig. 10 Exhaust Clearance

for diagnostic and service procedures on the air control valve and temperature sensor located in the air cleaner.

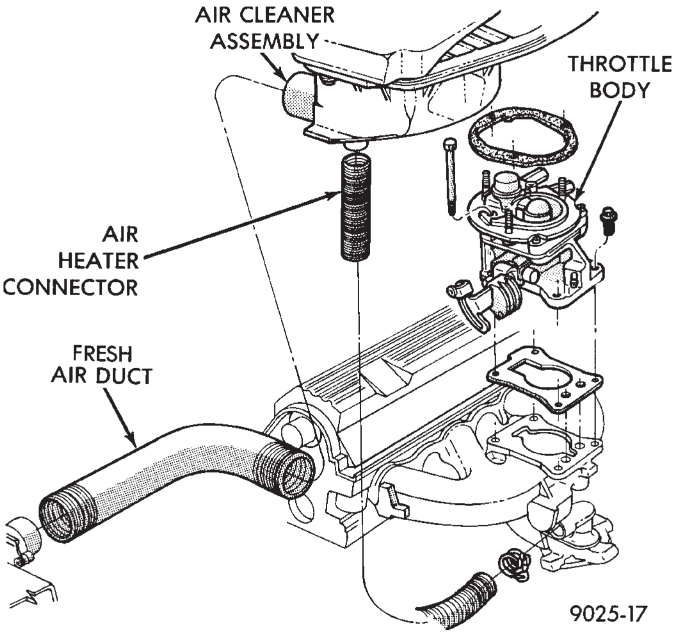


Fig. 1 Air Heater—TBI Engine

INTAKE AND EXHAUST MANIFOLDS SERVICE—TBI ENGINE

Intake and exhaust manifolds use a one piece gasket. Service procedures requiring removal and installation (of either) must include both manifolds.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

The Fuel System is under a constant pressure of at least 265 kPa (39 psi). Before servicing the fuel pump, fuel lines, fuel filter, throttle body or fuel injector, the fuel system pressure must be released.

(a) Loosen fuel filler cap to release fuel tank pressure.

(b) Disconnect injector wiring harness from engine harness.

(c) Connect a jumper wire to ground terminal Number 1 of the injector harness (Fig. 2) to engine ground.

(d) Connect a jumper wire to the positive terminal Number 2 of the injector harness (Fig. 2) and touch the battery positive post for no longer than 5 seconds. This releases system pressure.

(e) Remove jumper wires.

(f) Continue fuel system service.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

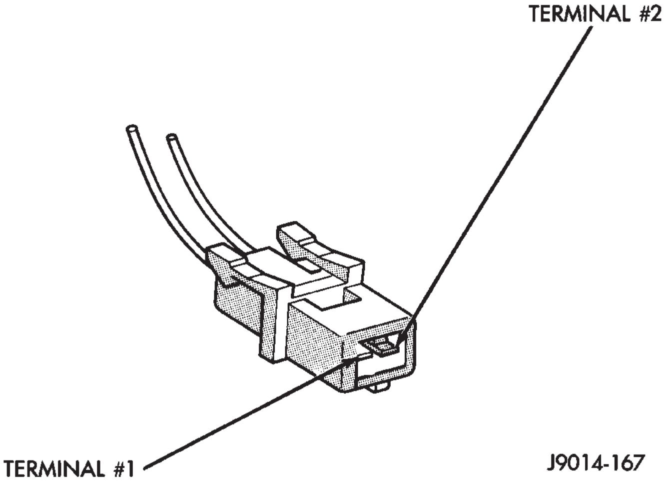


Fig. 2 Injector Harness Connector

(2) Disconnect negative battery cable. Drain cooling system. Refer to Cooling System, Group 7 for procedure.

(3) Remove air cleaner and disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.

(4) Remove throttle linkage.

(5) Loosen power steering pump and remove belt.

(6) Remove power brake vacuum hose from intake manifold.

(7) Disconnect EGR tube from intake manifold and remove water hoses from water crossover.

(8) Raise vehicle and remove exhaust pipe from manifold.

(9) Remove power steering pump assembly and set aside.

(10) Remove intake manifold retaining screws (Fig. 3).

(11) Lower vehicle and remove intake manifold.

(12) Remove exhaust manifold retaining nuts (Fig. 3).

(13) Remove exhaust manifold.

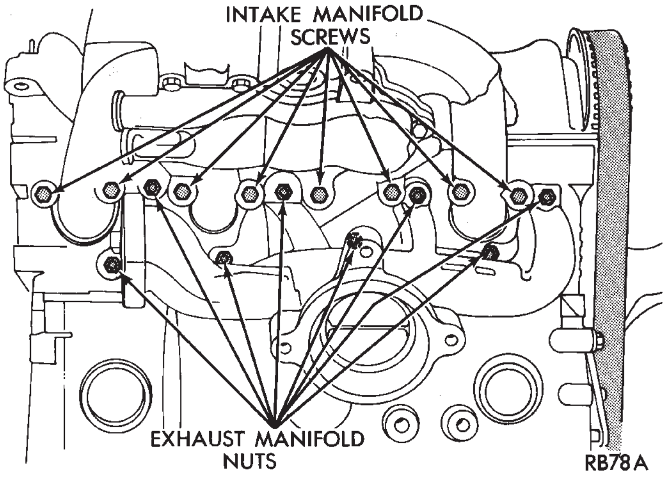


Fig. 3 Intake and Exhaust Manifold Attaching Points—2.2/2.5L Engines

CLEANING AND INSPECTION

(1) Discard gaskets and clean all gasket surfaces on both manifolds and on cylinder head.

(2) Test gasket surfaces of manifolds for flatness with a straight edge. Surfaces must be flat within 0.15mm per 300mm (.006 in. per foot) of manifold length.

(3) Inspect manifolds for cracks and distortion.

INSTALLATION

(1) Install a new intake and exhaust manifold gasket. Coat steel gasket lightly with Gasket Sealer on manifold side. **Do not** coat composition gasket with (any) sealer.

(2) Set exhaust manifold in place. Tighten retaining nuts starting at center and progressing outward in both directions to 23 N●m (200 in. lbs.) torque. Repeat this procedure until all nuts are at specified torque.

(3) Set intake manifold in place.

(4) Raise vehicle and tighten retaining screws starting at center and progressing outward in both directions to 23 N●m (200 in. lbs.) torque (Fig. 3). Repeat this procedure until all screws are at specified torque.

(5) Reverse removal procedures 1-9 for installation.

(6) With the DRBII 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.

INTAKE AND EXHAUST MANIFOLDS—FLEXIBLE FUEL ENGINE

INTAKE MANIFOLD

The manifold is die-cast aluminum with upper plenum and 4 tubes lower runners. These attach to the cylinder head, with each runner leading directly to a cylinder.

The manifold is also machined for fuel rail attachment and injector installation. The throttle body is installed on the upper plenum of the manifold.

EXHAUST MANIFOLD

All high strength iron casting that intermesh with the intake manifold. For standard engines a four branch design collects and directs exhaust gases to the conical (articulated joint connection) outlet.

INTAKE/EXHAUST MANIFOLDS SERVICE—FLEXIBLE FUEL ENGINES

Intake and exhaust manifolds use a one piece gasket. Service procedures requiring removal and installation of either must include both manifolds.

SERVICE PRECAUTIONS

Methanol is more toxic than gasoline. Always release fuel system pressure before servicing fuel system components and wear methanol resistant gloves and eye protection.

Avoid breathing methanol vapors or ingesting methanol. Headaches, dizziness and even unconsciousness could result from breathing these vapors. Serious injury, blindness and even death could result from ingesting methanol.

Methanol vapors are extremely flammable and can travel along the ground. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle.

Do not allow methanol to contact skin. Prolonged contact with methanol can cause dry skin or an allergic skin reaction. Also, prolonged contact could result in absorption through the skin.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION WHILE SERVICING THE FUEL SYSTEM.

(a) Disconnect negative cable from battery.

(b) Remove fuel filler cap.

(c) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 4).

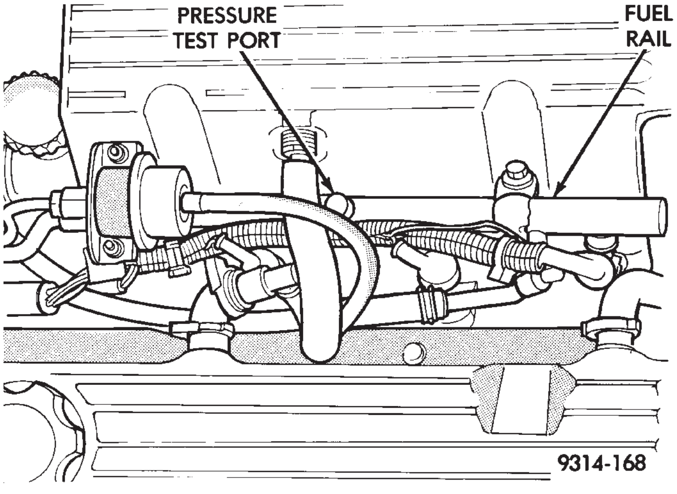


Fig. 4 Fuel Pressure Test Port

(d) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 5). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

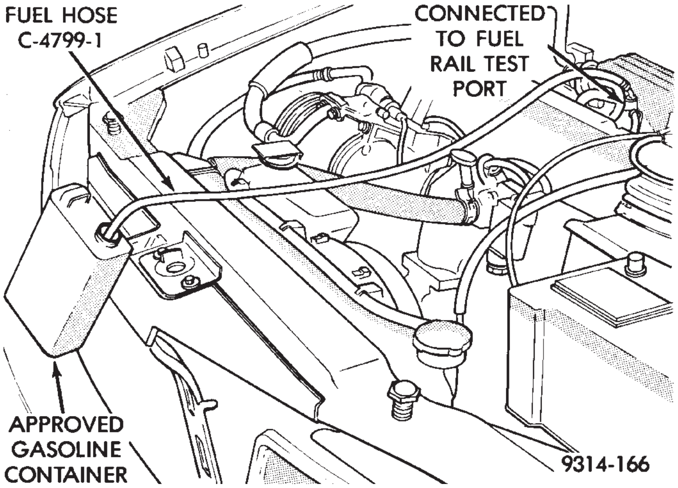


Fig. 5 Releasing Fuel Pressure

INTAKE MANIFOLD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Disconnect negative battery cable.

(3) Remove air cleaner hose to throttle body (Fig. 6).

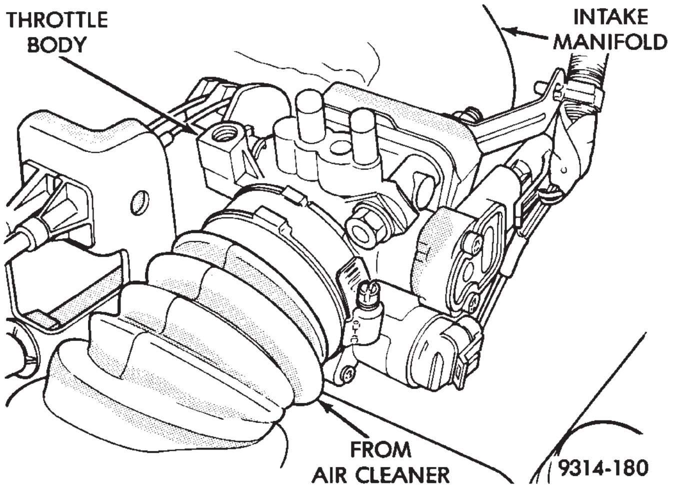


Fig. 6 Air Cleaner Hose to Throttle Body Assembly

(4) Remove accelerator and speed control cables.

(5) Disconnect automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors (Fig. 7).

(6) Disconnect fuel injectors wiring connector.

(7) Remove supply and return lines from the fuel tube assembly quick connect at frame rail. Open fuel tube clip around fuel tubes.

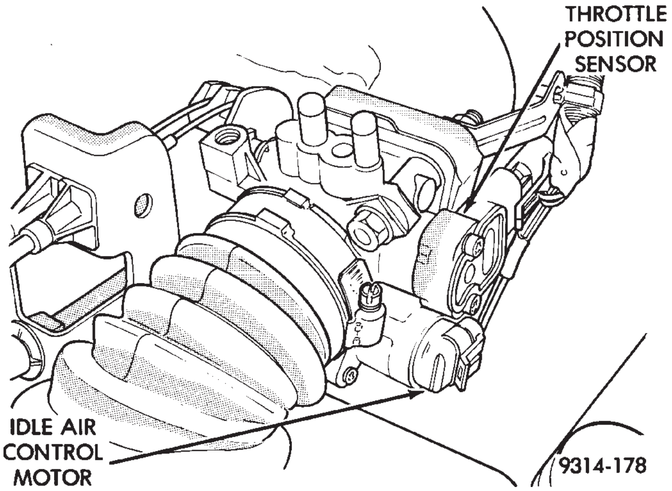


Fig. 7 Throttle Position Sensor and Air Idle Control Motor Electrical Connections

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY FUEL SPILLAGE.

(8) Disconnect fuel pressure regulator vacuum hose from regulator (Fig. 8).

(9) Remove PCV vacuum harness, brake booster, and vacuum vapor harness from intake manifold (Fig. 8).

(10) Remove 8 intake manifold screws and washer assemblies and remove intake manifold assembly (Fig. 9).

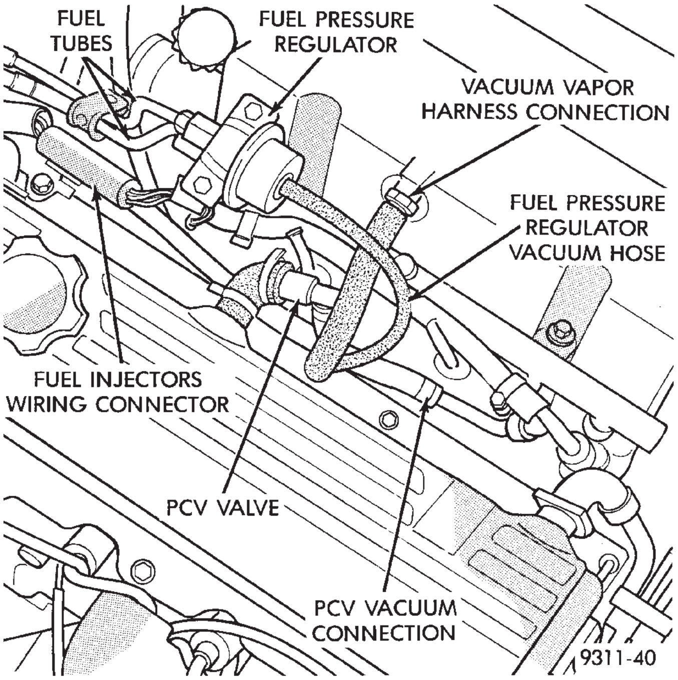


Fig. 8 Electrical and Vacuum Hose Connection

EXHAUST MANIFOLD

REMOVAL

(1) Disconnect exhaust pipe from manifold articulate joint.

(2) Disconnect the heated oxygen sensor electrical connection.

(3) Remove 8 exhaust manifold retaining nuts and remove exhaust manifold (Fig. 9).

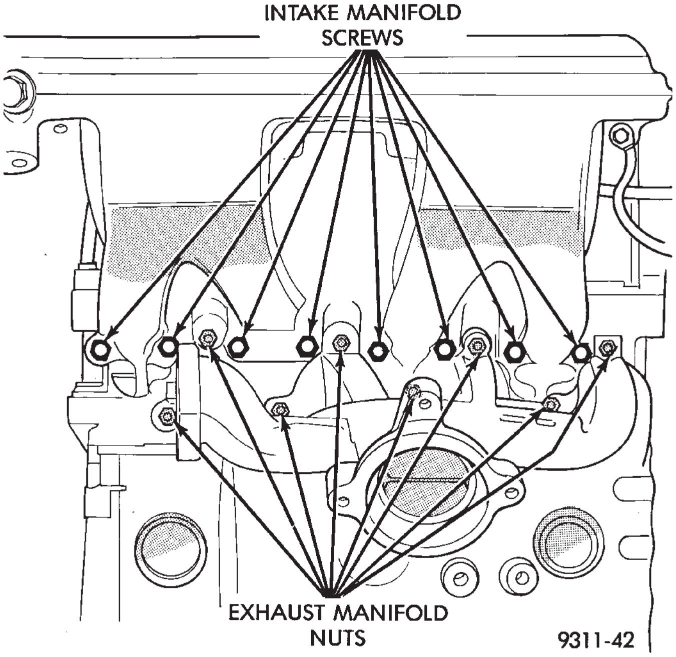


Fig. 9 Intake and Exhaust Manifolds Attaching Points

CLEANING AND INSPECTION

(1) Discard gasket and clean all gasket surfaces of manifolds and cylinder head.

(2) Test gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (.006 in. per foot) of manifold length.

(3) Inspect manifolds for cracks or distortion.

EXHAUST MANIFOLD

INSTALLATION

(1) Install new two-sided grafoil or equivalent intake/exhaust manifold gasket. DO NOT APPLY SEALER.

(2) Set exhaust manifold in place. Install and tighten retaining nuts, starting at center and progressing outward in both directions to 23 N●m (200 in. lbs.) torque. Repeat this procedure until all nuts are at specified torque.

INTAKE MANIFOLD

INSTALLATION

(1) Position intake manifold, install, and tighten 8 retaining screws starting at center and progressing outward in both directions to 23 N●m (200 in. lbs.) torque. Repeat this procedure until all screws are at specified torque (Fig. 9).

(2) Install PCV vacuum harness and vacuum vapor harness (Fig. 8).

(3) Connect vacuum hose from fuel pressure regulator.

(4) Connect fuel injector wiring connector (Fig. 8).

(5) Close fuel tube clip around fuel tubes and install fastener.

(6) Lubricate the ends of the chassis fuel tubes with 30 wt oil. Connect fuel supply and return hoses to chassis fuel tube assembly. pull back on the quick connect fitting to ensure complete insertion. (Refer to Fuel Hoses, Clamps and Quick Connect Fittings in Group 14 Fuel Systems).

(7) Connect automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors (Fig. 7).

(8) Connect accelerator and speed control cables. Install brake booster vacuum supply hoses.

(9) Reconnect negative battery cable.

(10) Install air cleaner hose to throttle body assembly (Fig. 6).

(11) With the DRBII 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.

INTAKE/EXHAUST MANIFOLDS AND TURBOCHARGER SERVICE—TURBO III ENGINE

INTAKE MANIFOLD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Disconnect negative battery cable. Drain cooling system. Refer to Cooling System, Group 7.

(3) Remove fresh air duct from air filter housing. Remove inlet hose from the intercooler (Fig. 1).

(4) Remove radiator hose to cylinder head (Fig. 2).

(5) Remove DIS Ignition Coils from intake manifold (Fig. 3).

(6) Remove accelerator and speed control cables (Fig. 4).

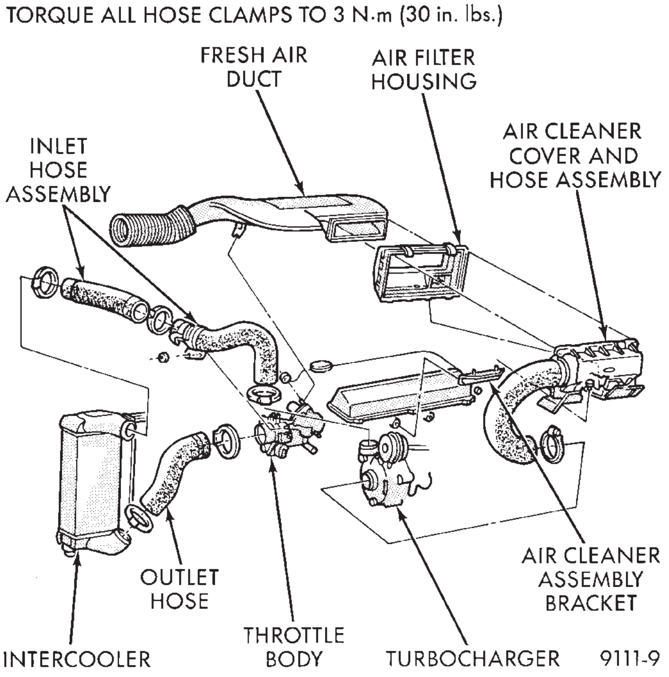


Fig. 1 Air Cleaner and Throttle Body Assembly—Turbo III Engine

(7) Disconnect Intercooler to throttle body outlet hose. Disconnect vacuum hoses from throttle body and remove harness (Fig. 5).

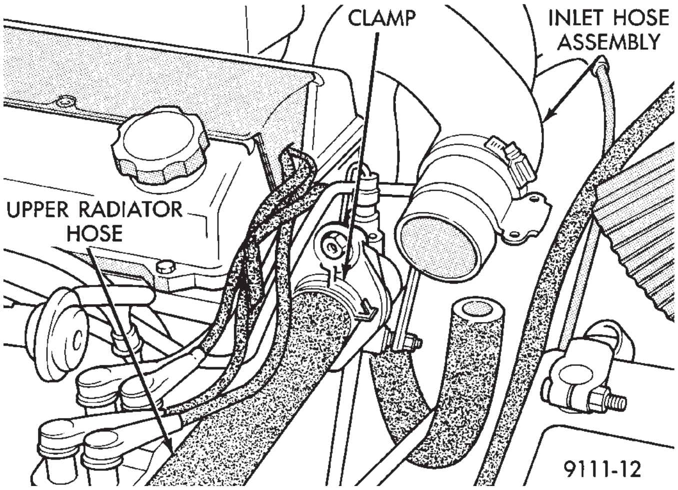


Fig. 2 Radiator to Cylinder Head Hose

(8) Disconnect automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors (Fig. 6).

(9) Remove PCV Breather/Separator box and vacuum harness assembly. Remove brake booster, vacuum vapor harness and fuel pressure regulator harness from intake manifold (Fig. 7).

(10) Disconnect Fuel Injector Wiring Connector (Fig. 8). Charge Temperature Wiring Connector (Fig. 7).

(11) Remove fuel supply and return hose quick connect at fuel tube assembly (Fig. 9).

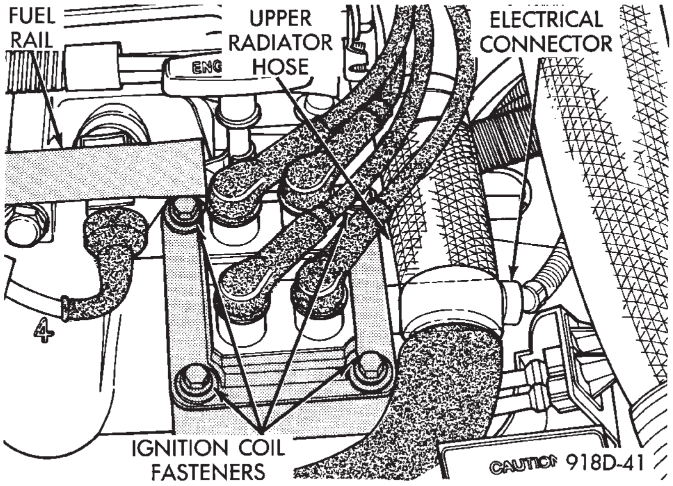


Fig. 3 Distributorless Ignition Coil (DIS) Location

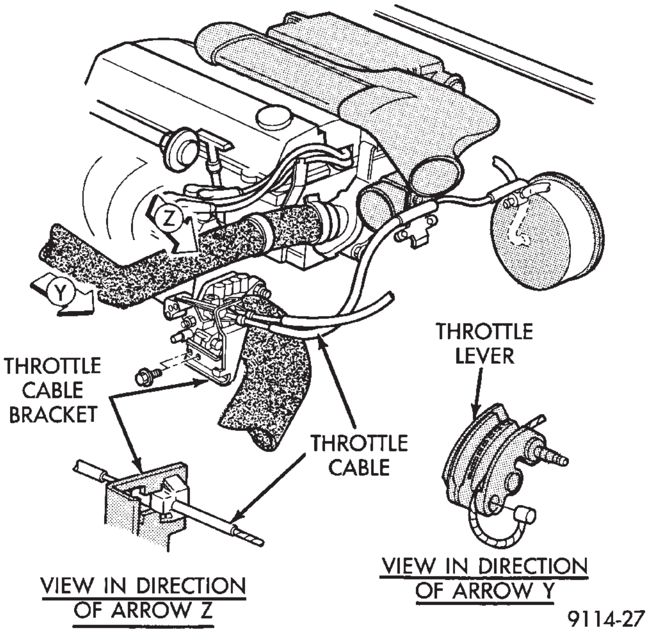


Fig. 4 Accelerator and Speed Control Cables

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(12) Remove 8 intake manifold screws and washer assemblies and remove intake manifold (Fig. 10).

INSTALLATION

Before installing manifold. Refer to Cleaning and Inspection of this section to check manifold for damage.

(1) Install new intake manifold gasket and intake manifold onto cylinder head and tighten fasteners to 23 N•m (200 in. lbs.) torque (Fig. 10).

(2) Install PCV Breather/Separator box and vacuum harness assembly. Connect brake booster, vacuum vapor harness and vacuum hose to fuel pressure regulator (Fig. 7).

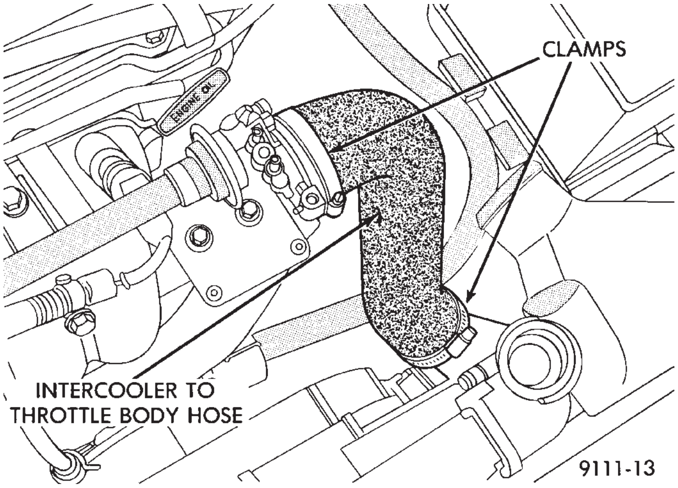


Fig. 5 Intercooler to Throttle Body Hose

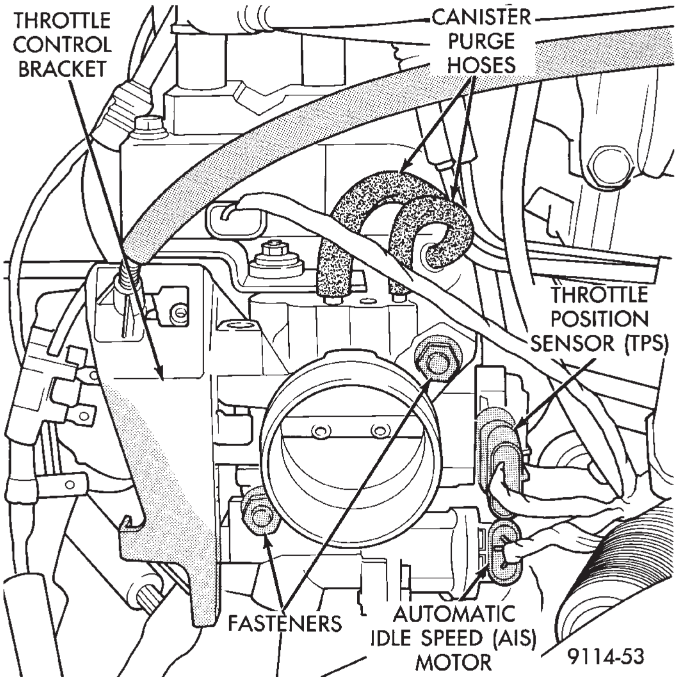


Fig. 6 Automatic Idle Speed (AIS) Motor and Throttle Position Sensor (TPS) Wiring Connectors

(3) Inspect quick connect fittings for damage, replace if necessary Refer to Fuel System, Group 14 for procedure. Lube tube with clean 30w engine oil, Connect fuel supply and return hoses to chassis tube assembly. Check connection by pulling on connector to insure it locked into position (Fig. 9).

(4) Connect Fuel Injector (Fig. 8), and Charge Temperature Sensor wiring connectors (Fig. 7).

INTAKE MANIFOLD

(5) Connect Automatic Idle Speed (AIS) and Throttle Position Sensor (TPS) wiring connectors (Fig. 6).

(6) Connect vacuum hoses to throttle body (Fig. 5).

(7) Install intercooler to throttle body hose and clamp. Torque clamp to 3 N●m (30 in. lbs.) (Fig. 5).

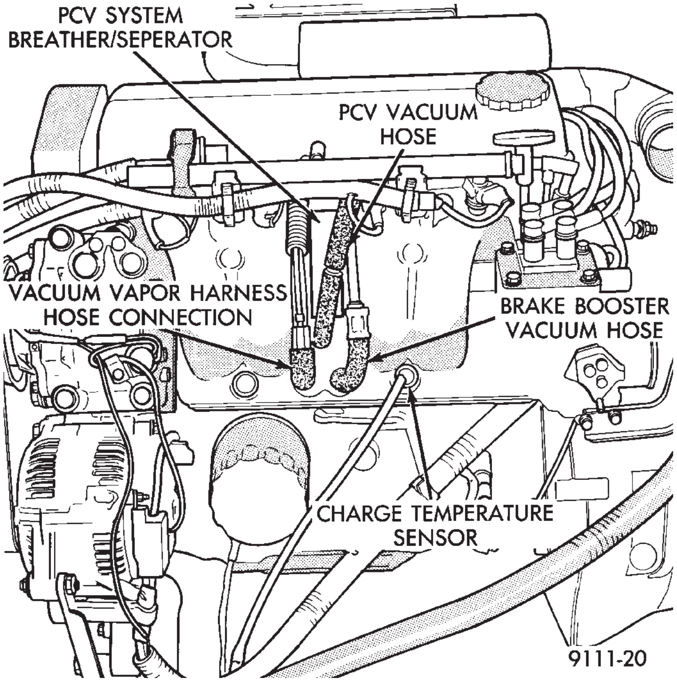


Fig. 7 Intake Manifold Electrical and Vacuum Hose Connections

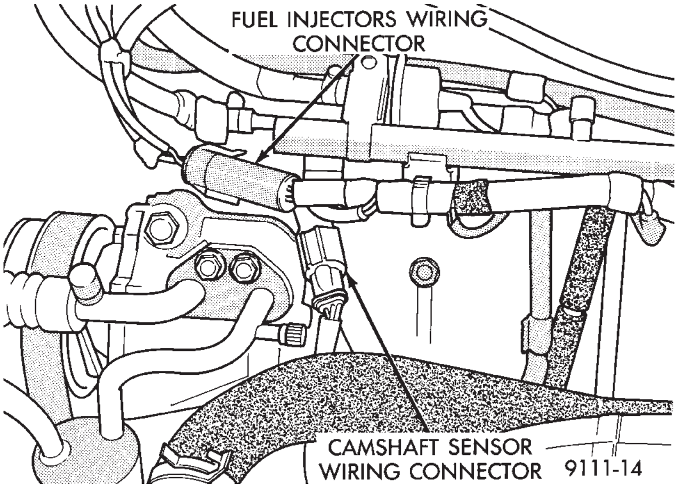


Fig. 8 Camshaft Sensor and Fuel Injectors Wiring Connectors

(8) Connect accelerator and speed control cables (Fig. 4).

(9) Install DIS ignition coil pack. Tighten fasteners to 12 N●m (105 in. lbs.) torque (Fig. 3).

(10) Install upper radiator hose and spring clamps (Fig. 2). Fill cooling system, Refer to Cooling System, Group 7.

(11) Install fresh air duct to air filter housing. Install inlet hose assembly to Intercooler. Tighten clamp to 3 N●m (30 in. lbs.) torque (Fig. 1).

(12) Connect negative battery cable.

(13) With the DRBII Scan Tool use ASD Fuel System Test to pressurize system to check for leaks.

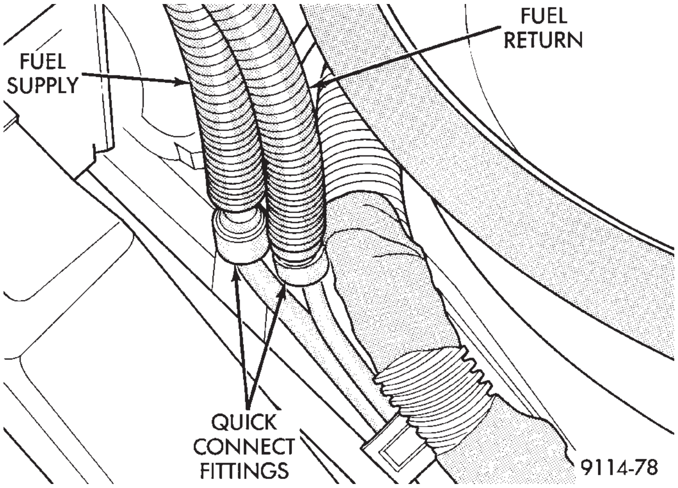


Fig. 9 Fuel Supply and Return Hose Connections

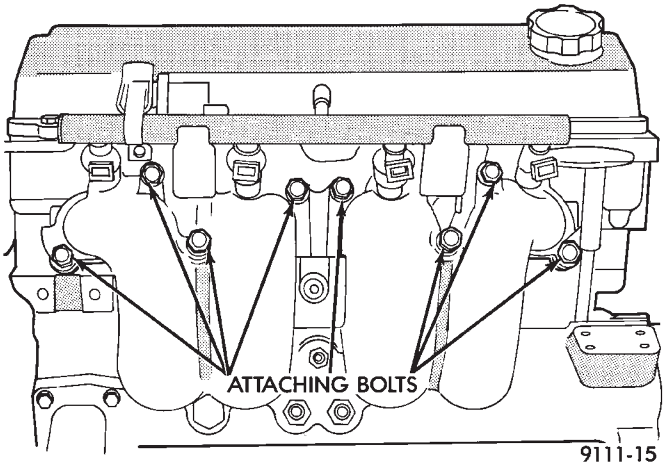


Fig. 10 Intake Manifold Attaching Bolts.

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.

TURBOCHARGER

REMOVAL

The turbocharger is removed from below the vehicle. Cylinder head removal for component accessibility is not required.

(1) Disconnect negative battery cable. Remove Air Cleaner assembly (Fig. 1).

(2) **From Above:** Remove front engine mount through bolt and rotate engine (Top) forward away from cowl. Refer to Engine Removal in Engine, Group 9.

(3) Remove Air Cleaner Support (Fig. 1).

(4) Disconnect Heated Oxygen sensor lead wire and vacuum lines.

(5) Separate coolant return line from water box and turbocharger housing (Fig. 11). Remove return line from turbocharger.

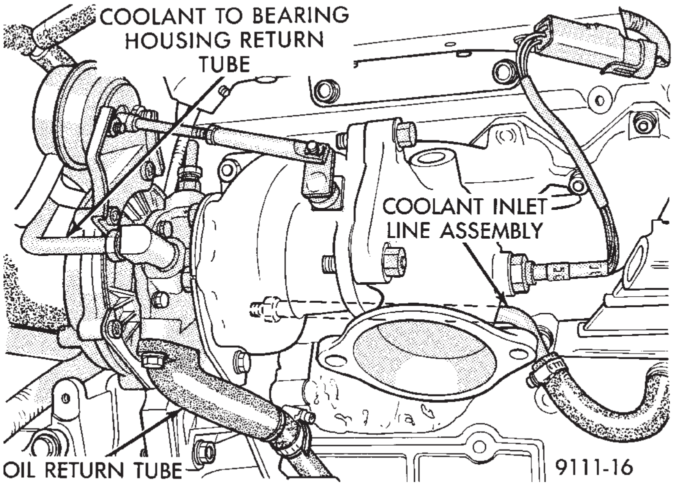


Fig. 11 Coolant Tube Routing

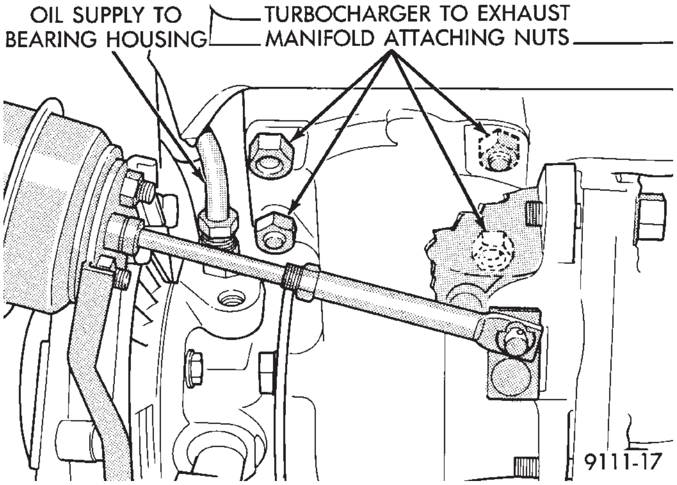


Fig. 12 Turbocharger Attaching Nuts

(6) Separate oil feed line from turbocharger housing (Fig. 12).

(7) Remove three (two upper and one lower driver's side) nuts retaining turbocharger to manifold (Fig. 12).

(8) **From Below:** Remove right front wheel and tire assembly.

(9) See Suspension, Group 2, and remove right driveshaft assembly.

Air deflector may need to be removed from crossmember.

(10) Separate oil drain back tube fitting from turbocharger housing and remove fitting and hose (Fig. 13).

(11) Remove turbocharger to block support bracket (Fig. 13).

(12) Remove one remaining turbocharger to manifold retaining nut (Fig. 12).

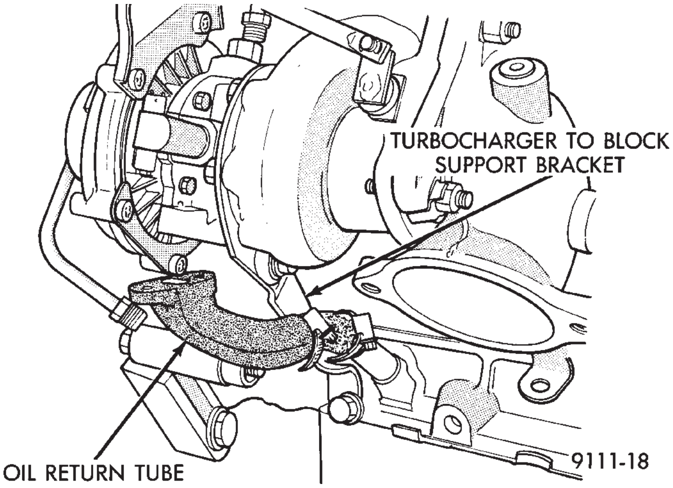


Fig. 13 Oil Return Tube and Support Bracket

(13) Disconnect articulated exhaust pipe joint from turbocharger housing.

(14) Remove turbocharger coolant inlet line assembly from engine (Fig. 11).

(15) Lift turbocharger off manifold mounting studs and lower assembly down and out of vehicle.

EXHAUST MANIFOLD

REMOVAL

Remove 9 exhaust manifold retaining fasteners and remove exhaust manifold (Fig. 14).

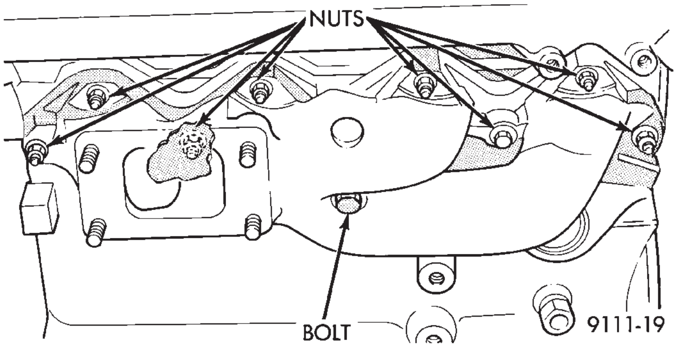


Fig. 14 Exhaust Manifold—Turbo III Engine

CLEANING AND INSPECTION

(1) Discard gasket and clean all gasket surfaces of manifolds and cylinder head.

(2) Test manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (.006 in. per foot) of manifold length.

(3) Inspect manifolds for cracks or distortion. Replace manifold if necessary.

EXHAUST MANIFOLD

INSTALLATION

(1) Install new manifold gasket. **DO NOT APPLY SEALER**.

(2) Set exhaust manifold in place. Tighten retaining nuts and bolt, starting at center and progressing outward in both directions to 23 N●m (200 in. lbs.) torque. Repeat this procedure until all fasteners are at specified torque (Fig. 14).

TURBOCHARGER

INSTALLATION

(1) Position turbocharger on exhaust manifold. Apply antiseize compound to threads and install the lower (passenger side) retaining nut (Fig. 12). Tighten nut to 54 N●m (40 ft. lbs.) torque.

(2) Apply thread sealant to lower (inlet) coolant line fitting and install fitting into turbocharger housing (Fig. 11).

(3) Install lower coolant line assembly to engine (Fig. 11).

(4) Install oil drain back tube and fitting (with new gasket) to turbocharger housing (Fig. 13).

(5) Install turbocharger to block support bracket and install screws finger tight (Fig. 13). Tighten block screw FIRST to 54 N●m (40 ft. lbs.) torque, then tighten screw to turbocharger housing to 27 N●m (20 ft. lbs.) torque.

(6) Reposition exhaust pipe. Tighten articulated joint shoulder bolts to 28 N●m (250 in. lbs.) torque.

(7) See Suspension, Group 2, and install right driveshaft and wheel and tire assembly. Install air deflector on crossmember.

(8) **From Above:** Install three turbocharger to manifold retaining nuts. Tighten to 54 N●m (40 ft. lbs.) torque (Fig. 12).

(9) Reconnect Heated Oxygen sensor electrical connection and vacuum lines.

(10) Attach oil feed line to turbocharger bearing housing. Tighten fitting to 14 N●m (125 in. lbs.) torque (Fig. 12).

(11) Install coolant line and tighten fittings to 41 N●m (30 ft. lbs.) torque (Fig. 11).

(12) Install air cleaner support (Fig. 1).

(13) Align front engine mount in crossmember bracket. Install through bolt and tighten to 54 N●m (40 ft. lbs.) torque.

(14) Install air cleaner assembly (Fig. 1).

(15) Fill cooling system. Refer to Cooling System, Group 7 for procedure.

INTAKE/EXHAUST MANIFOLD SERVICE—3.0L ENGINE

The intake system has a large air intake plenum of aluminum alloy and a cross type intake manifold (Fig. 2).

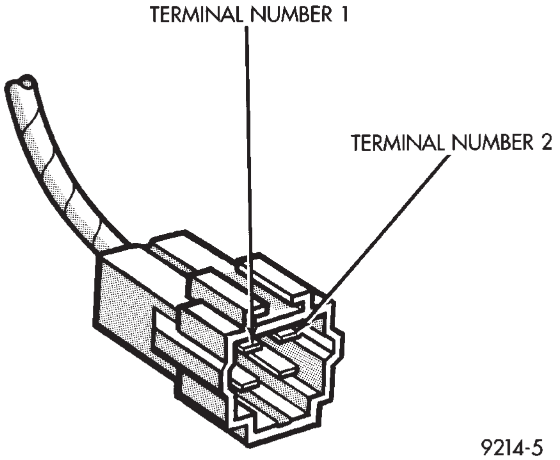


Fig. 1 Injector Harness Connector

The exhaust manifolds are made of ductile cast iron with the front bank and rear bank independent of each other. The exhaust from the front bank exhaust manifold is led through on exhaust crossover pipe to be combined with the rear bank exhaust at the exhaust outlet to the exhaust pipe (Fig. 2).

INTAKE PLENUM/MANIFOLD

REMOVAL

(1) Perform fuel system pressure release procedure **(before attempting any repairs).**

(2) Disconnect negative battery cable. Drain cooling system. See Cooling System, Group 7.

(3) Remove air cleaner to throttle body hose (Fig. 3).

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

The MPI fuel system is under a constant pressure of about 330 kPa (48 psi). Before servicing the fuel pump, fuel lines, fuel filter, throttle body or fuel injector, the fuel system pressure must be released.

(a) Loosen fuel filler cap to release fuel tank pressure.

(b) Disconnect injector wiring harness from engine harness.

(c) Connect a jumper wire to ground terminal Number 1 of the injector harness (Fig. 1) to engine ground.

(d) Connect a jumper wire to the positive terminal Number 2 of the injector harness (Fig. 1) and touch the battery positive post for no longer than 5 seconds. This releases system pressure.

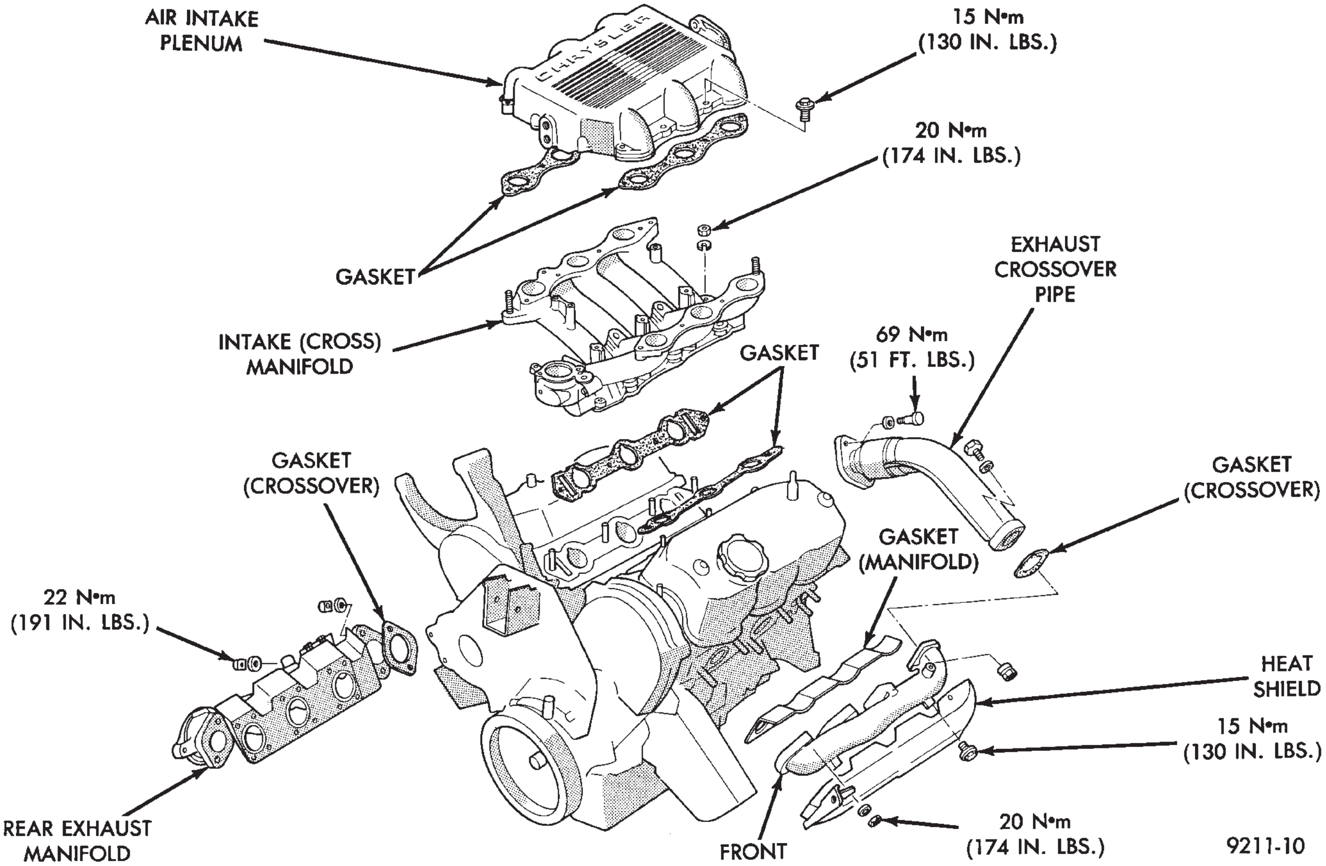


Fig. 2 Intake and Exhaust Manifolds— 3.0L Engine

(e) Remove jumper wires.

(f) Continue fuel system service.

(4) Remove throttle cable and transaxle kickdown linkage (Fig. 4).

(5) Remove automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors from throttle body (Fig. 5).

(6) Remove vacuum hose harness from throttle body (Fig. 5).

(7) Remove PCV and Brake booster hoses from Air Intake Plenum.

(8) Remove ignition coil from intake plenum (Fig. 6).

(9) Remove wiring connectors from coolant temperature sensor (Fig. 7).

(10) Remove vacuum connections from air intake plenum vacuum connector.

(11) Remove fuel hoses from fuel rail (Fig. 7).

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(12) Remove (8) Fasteners from Air Intake Plenum to Intake Manifold (Fig. 8).

(13) Remove air intake plenum (Fig. 9).

(14) Cover intake manifold with suitable cover when servicing.

(15) Remove vacuum hoses from fuel rail and fuel pressure regulator (Fig. 10).

(16) Disconnect Fuel Injector wiring harness from engine wiring harness (Fig. 11).

(17) Remove fuel pressure regulator attaching bolts and remove regulator from rail (Fig. 12). **Be careful not to damage the rubber injector O-rings upon removal from the ports.**

(18) Remove fuel rail attaching bolts and lift fuel rail assembly from intake manifold.

(19) Separate radiator hose from thermostat housing and heater hose from heater pipe.

(20) Remove (8) nut and washer assemblies and remove intake manifold (Fig. 2).

INSPECTION

Check for:

- Damage and cracks of each section (Fig. 13).
- Clogged water passages in end cross overs.
- Check for distortion of the cylinder head mounting surface using a straightedge and thickness gauge (Fig. 14). Refer to (Fig. 15) for Specifications.

INSTALLATION

(1) Position new intake manifold gaskets on cylinder head and install intake (cross) manifold.

(2) Install (8) nuts and washers and tighten in several steps in order shown in (Fig. 16) to 20 N●m (174 in. lbs.).

(3) Make sure the injector holes are clean and all plugs have been removed.

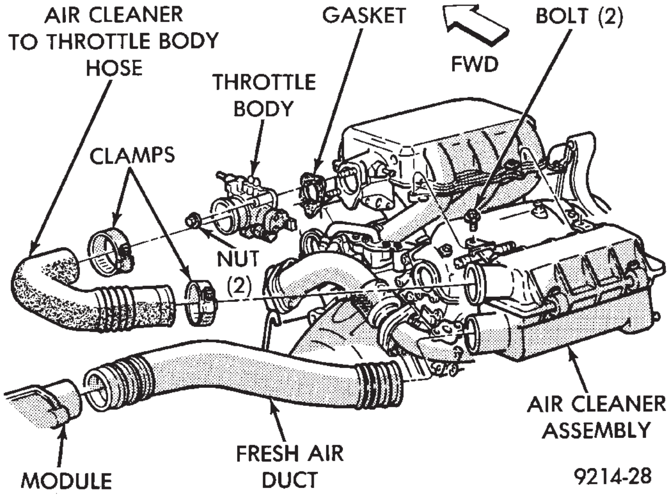


Fig. 3 Throttle Body Assembly 3.0L

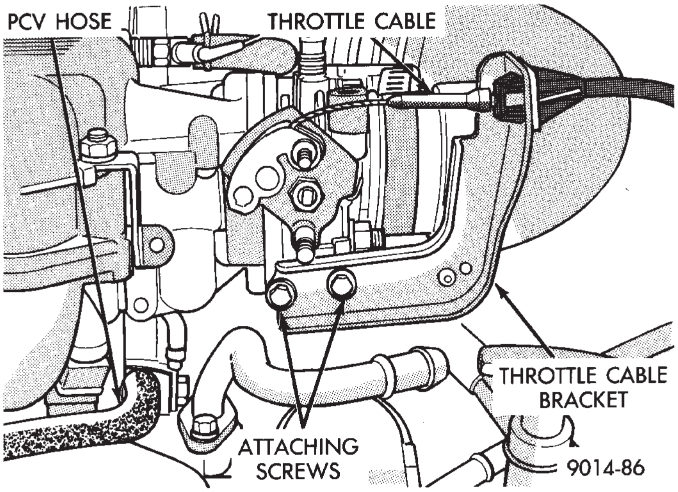


Fig. 4 Throttle Cable Attachment

(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 (3) fuel rail attaching bolts and torque to 13 N●m (115 in. lbs.).

(7) Install fuel pressure regulator onto fuel rail. Install attaching bolts to intake manifold. Torque regulator nuts and bracket bolts to 10 N●m (95 in. lbs.) (Fig. 12).

(8) Install fuel supply and return tube hold-down bolt and the vacuum crossover tube hold-down bolt and torque to 10 N●m (95 in. lbs.).

(9) Connect fuel injector wiring harness to engine wiring harness (Fig. 11).

(10) Connect vacuum harness to fuel pressure regulator and fuel rail assembly (Fig. 10).

(11) Remove covering from lower intake manifold and clean surface.

(12) Place intake manifold gaskets **with beaded sealant side up** on lower manifold. Put air intake in

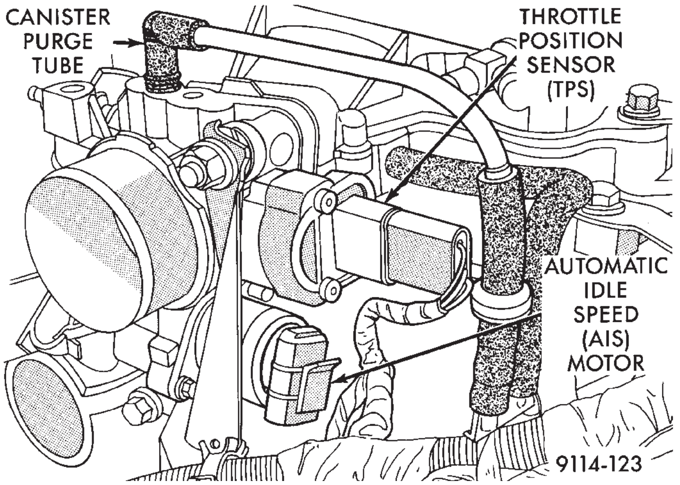


Fig. 5 Electrical and Vacuum Connections to Throttle Body

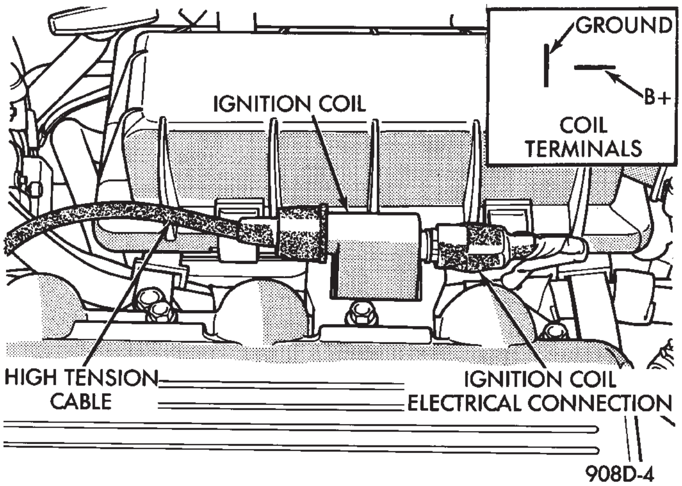


Fig. 6 Ignition Coil Removal

place. Install attaching fasteners (8) and tighten in several steps in sequence shown (Fig. 17) to 13 N●m (115 in. lbs.).

(13) Connect fuel line to fuel rail (Fig. 7). Torque hose clamps to 1 N●m (10 in. lbs.).

(14) Connect vacuum harness to air intake plenum.

(15) Connect coolant temperature sensor electrical connector to sensor (Fig. 7).

(16) Connect PCV and brake booster supply hose to intake plenum.

(17) Connect automatic idle speed (AIS) motor and throttle position sensor (TPS) electrical connectors (Fig. 5).

(18) Connect vacuum vapor harness to throttle body (Fig. 5).

(19) Install throttle cable and transaxle kickdown linkage (Fig. 4).

(20) Install air inlet hose assembly (Fig. 3).

(21) Install radiator to thermostat housing hose and heater hose to heater pipe nipple.

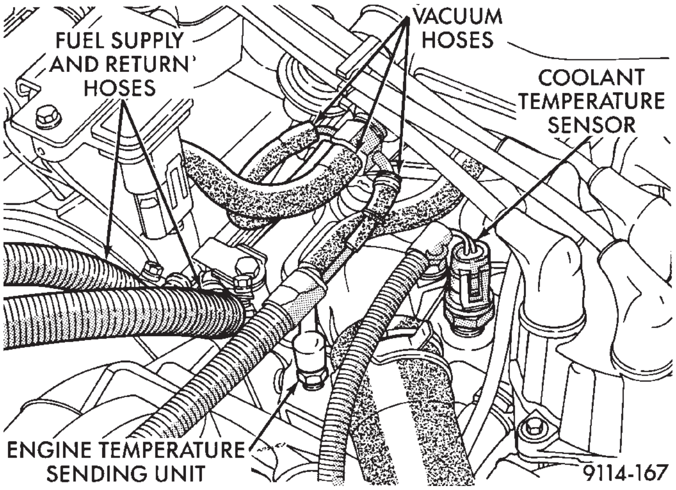


Fig. 7 Coolant Temperature Sensor Electrical Connections

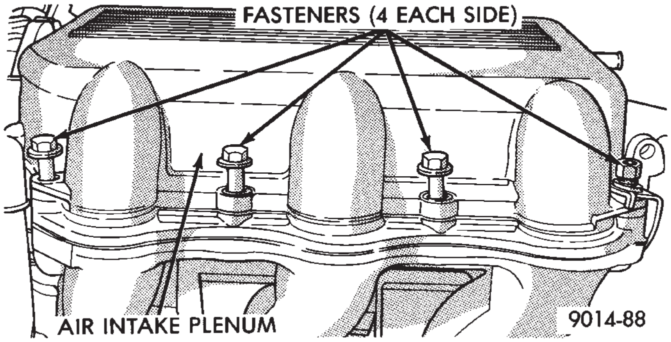


Fig. 8 Air Intake Plenum to Intake Manifold Attaching Bolts

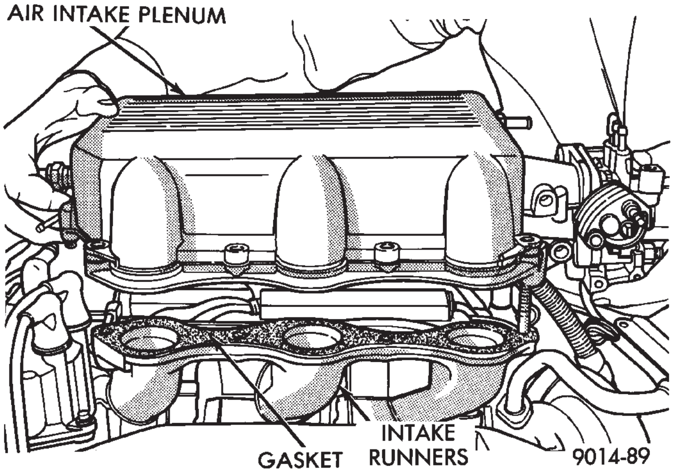


Fig. 9 Removing Air Intake Plenum

(22) Fill cooling system, see Refilling System in Cooling, Group 7.

(23) Connect negative battery cable.

(24) With the DRBII Scan Tool use ASD Fuel System Test to pressurize system to check for leaks.

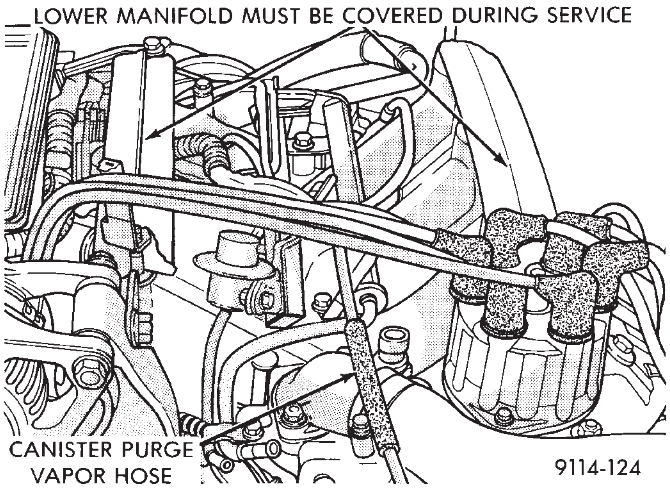


Fig. 10 Vacuum Connections for Fuel Rail and Fuel Pressure Regulator

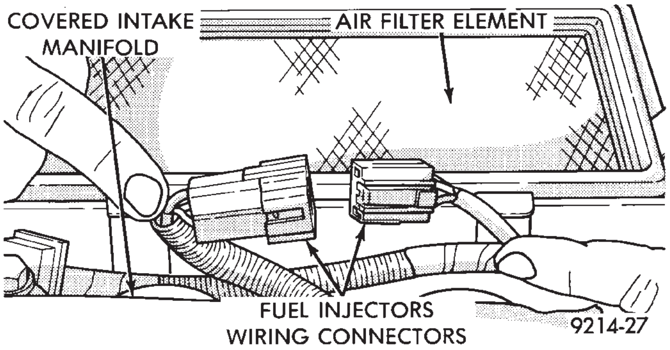


Fig. 11 Fuel Injector Wiring Harness

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.

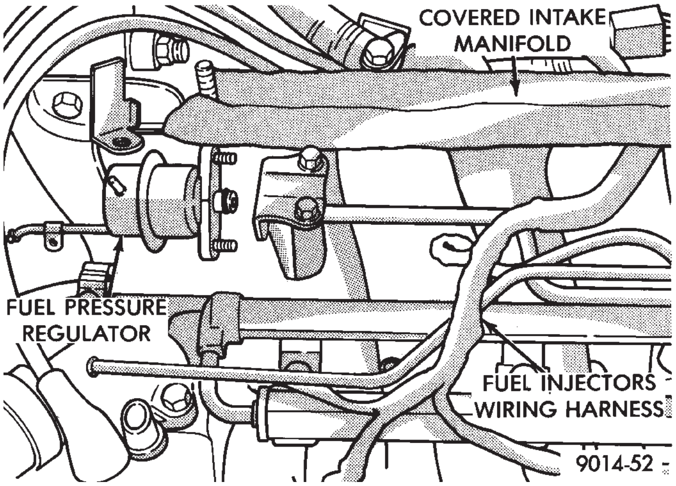


Fig. 12 Fuel Pressure Regulator to Fuel Rail Assembly

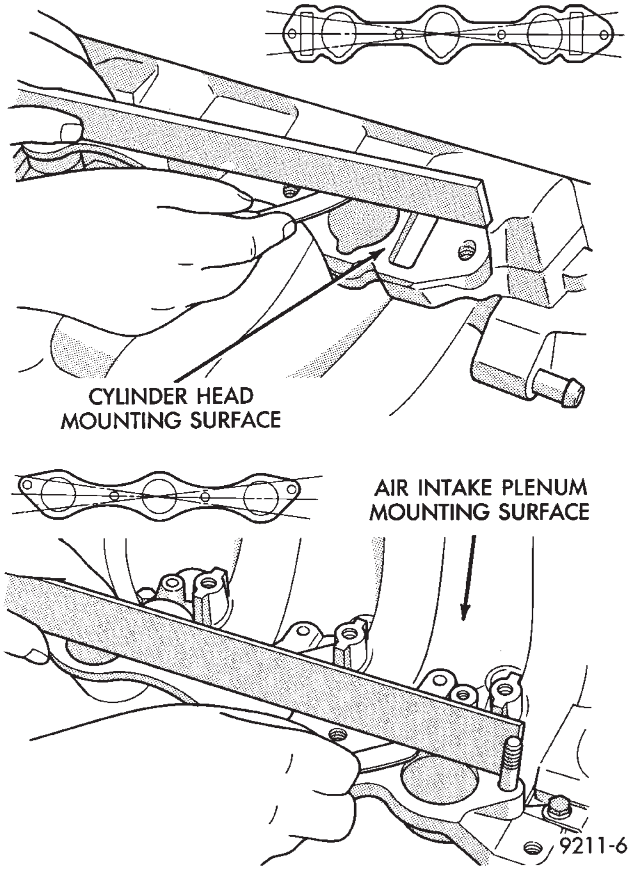


Fig. 13 Check Intake (Cross) Manifold Mounting Surface

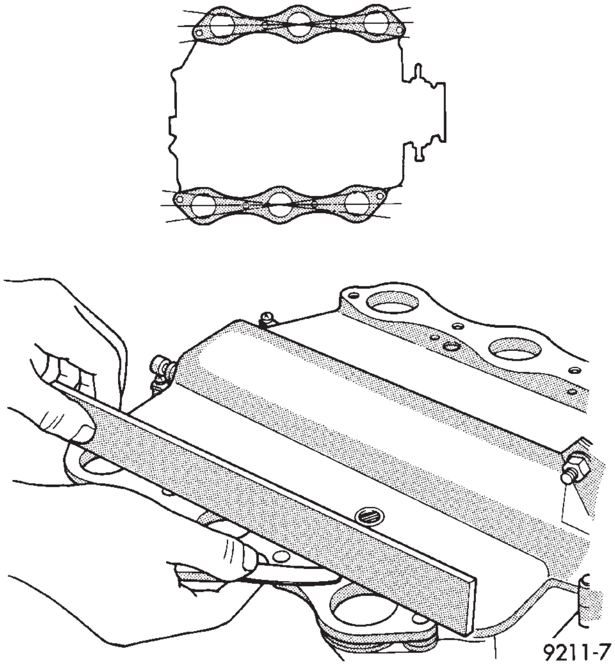
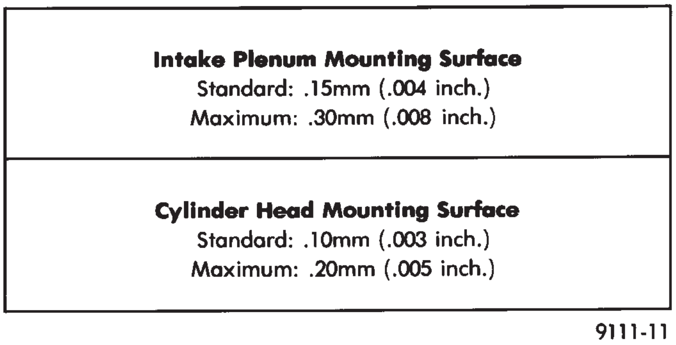


Fig. 14 Check Intake Plenum Mounting Surfaces



Intake Plenum Mounting Surface
Standard: .15mm (.004 inch.)
Maximum: .30mm (.008 inch.)

Cylinder Head Mounting Surface
Standard: .10mm (.003 inch.)
Maximum: .20mm (.005 inch.)

9111-11

Fig. 15 Intake Plenum and Cylinder Head Mounting Surface Specifications

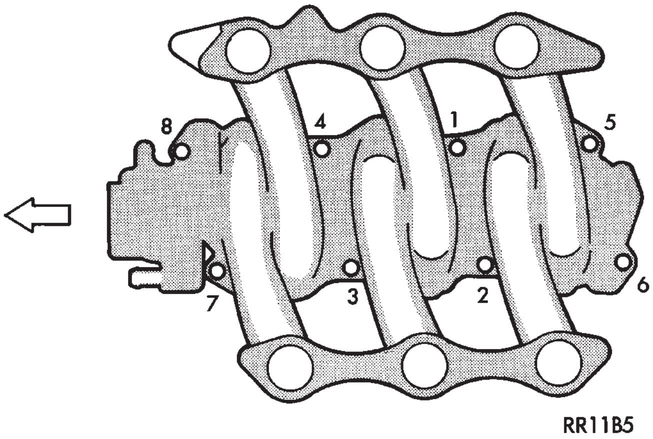


Fig. 16 Nut Tightening Sequence for Intake (Cross) Manifold

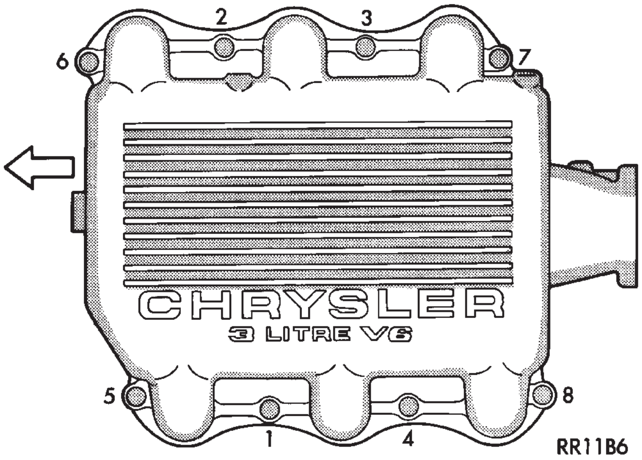


Fig. 17 Intake Plenum Tightening Sequence

EXHAUST MANIFOLDS

REMOVAL

(1) Raise vehicle and disconnect exhaust pipe from rear (cowl side) exhaust manifold at articulated joint.

(2) Disconnect Oxygen Sensor lead wire at the rear exhaust manifold (Fig. 18).

(3) Remove bolts attaching cross-over pipe to manifold (Figs. 2 and 19).

(4) Remove nuts attaching rear manifold to cylinder head and remove manifold.

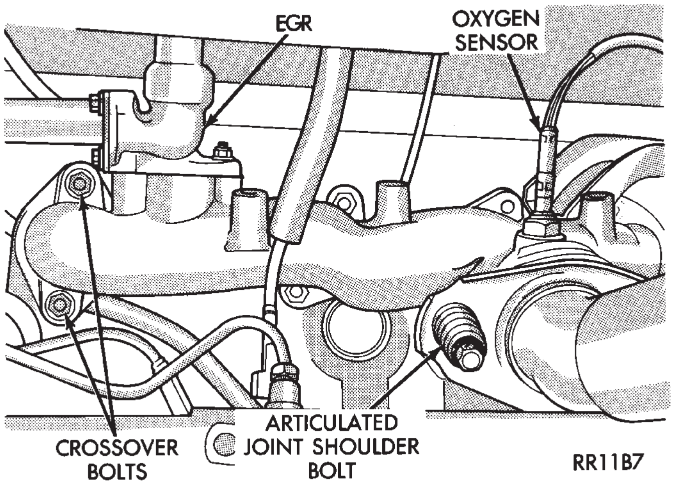


Fig. 18 Separate Articulated Joint, Disconnect Oxygen Sensor Wire

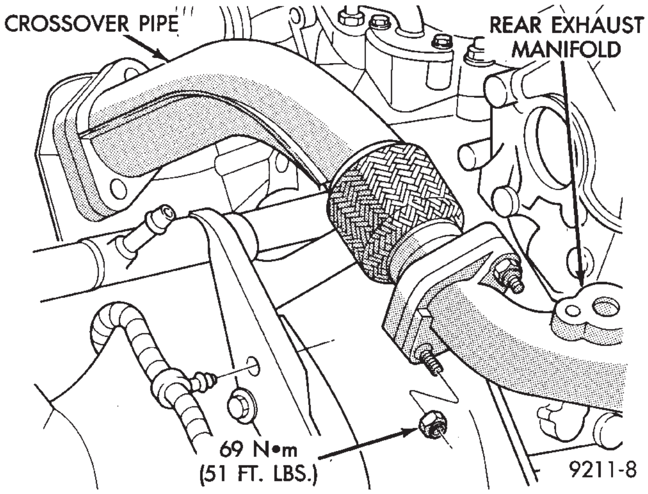


Fig. 19 Crossover Pipe

(5) Lower vehicle and remove screws attaching front heat shield to front manifold (Fig. 2).

(6) Remove bolts fastening crossover pipe to front exhaust manifold and nuts fastening manifold to cylinder head. Remove assemblies.

INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge (Fig. 20).

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. 21).

(1) Install rear exhaust manifold and tighten attaching nuts to 20 N●m (175 in. lbs.).

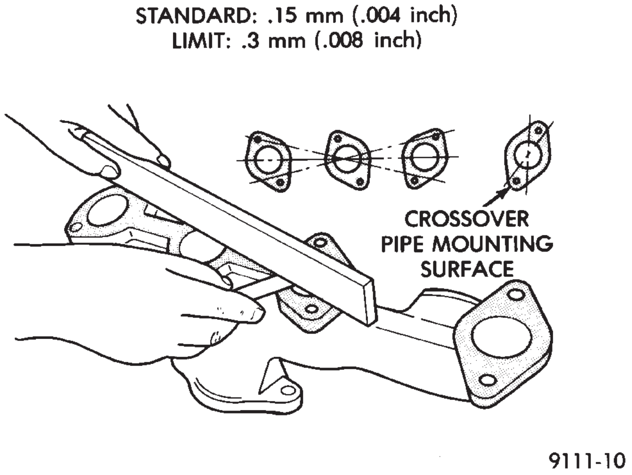


Fig. 20 Check Exhaust Manifold Mounting Surface

(2) Attach exhaust pipe to exhaust manifold and tighten shoulder bolt 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) Connect heated oxygen sensor lead (Fig. 18).

(5) Install front exhaust manifold and attach exhaust crossover.

(6) Install front manifold heat shield and tighten attaching screws to 15 N●m (130 in. lbs.) (Fig. 2).

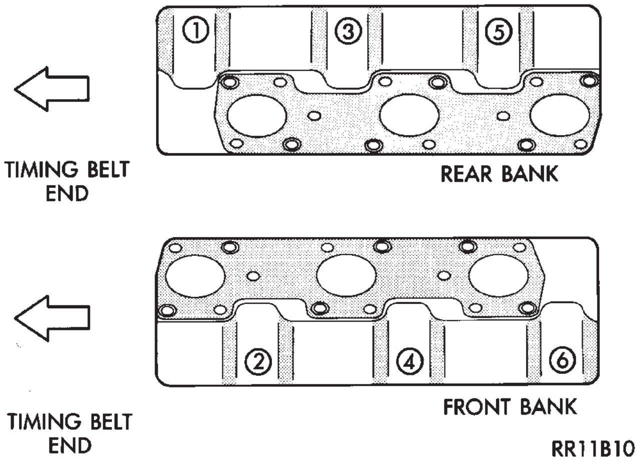


Fig. 21 Identify Exhaust Manifold Gaskets

INTAKE/EXHAUST MANIFOLD SERVICE—3.3/3.8L ENGINES

INTAKE MANIFOLD

REMOVAL

(1) Perform fuel system pressure release procedure, **Before attempting any repairs.**

(2) Disconnect negative battery cable. Drain cooling system. Refer to Cooling System, Group 7.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

The MPI fuel system is under a constant pressure of about 330 kPa (48 psi). Before servicing the fuel pump, fuel lines, fuel filter, throttle body or fuel injector, the fuel system pressure must be released.

(a) Loosen fuel filler cap to release fuel tank pressure.

(b) Disconnect injector wiring harness from engine harness.

(c) Connect a jumper wire to ground terminal Number 1 of the injector harness (Fig. 1) to engine ground.

(d) Connect a jumper wire to the positive terminal Number 2 of the injector harness (Fig. 1) and touch the battery positive post for no longer than 5 seconds. This releases system pressure.

(e) Remove jumper wires.

(f) Continue fuel system service.

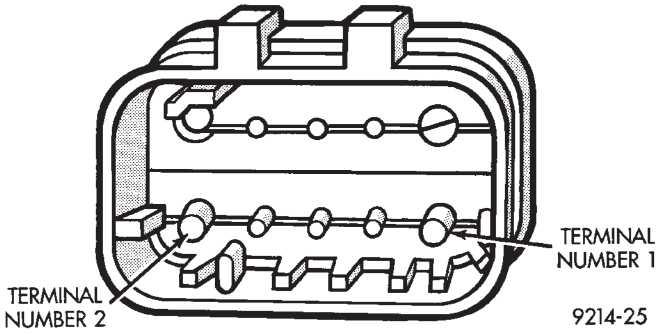


Fig. 1 Injector Harness Connectors

(3) Remove air cleaner to throttle body hose assembly (Fig. 2).

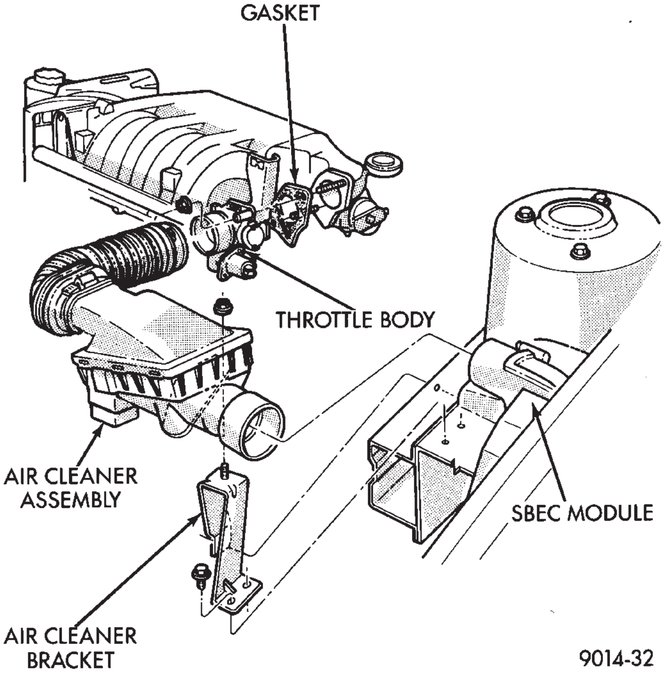


Fig. 2 Throttle Body Assembly—3.3/3.8L Engines

(4) Remove throttle cable (Fig. 3). Remove wiring harness from throttle cable bracket.

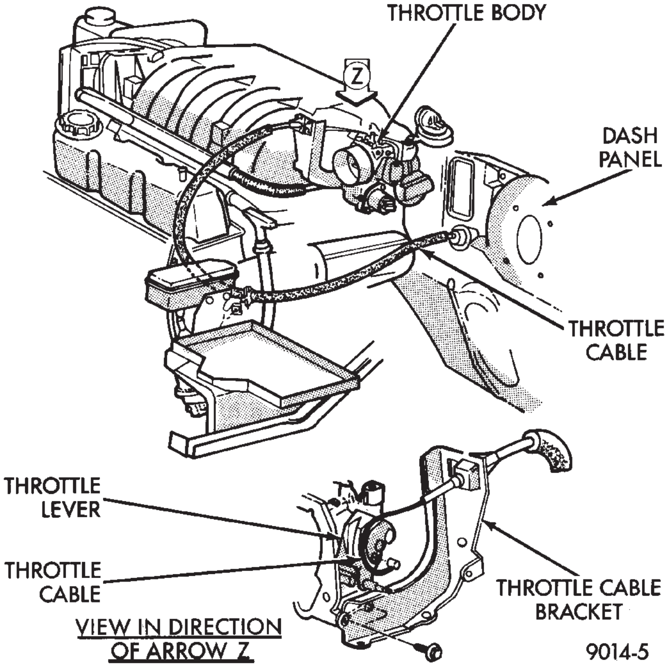


Fig. 3 Throttle Cable Attachment

(5) Remove automatic idle speed (AIS) motor and throttle position sensor (TPS) wiring connectors from throttle body (Fig. 4).

(e) Remove jumper wires.

(f) Continue fuel system service.

(6) Remove vacuum hose harness from throttle body (Fig. 4).

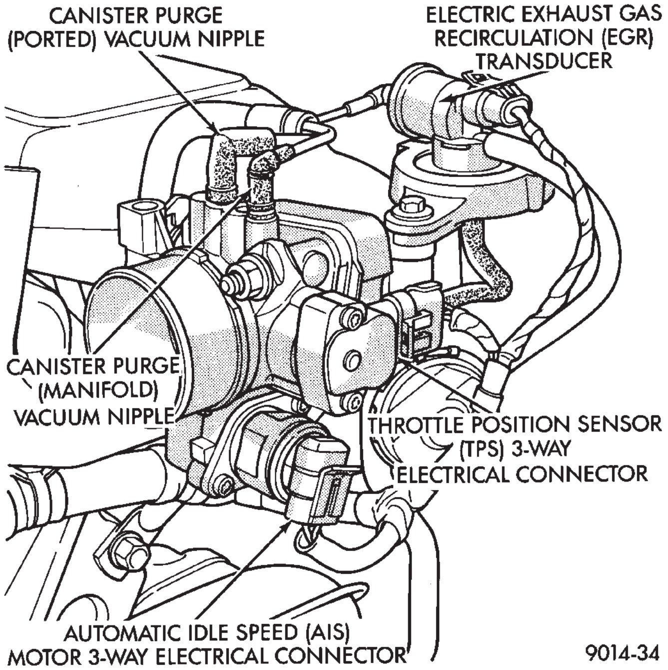


Fig. 4 Electrical and Vacuum Connection to Throttle Body

(7) Remove PCV and brake booster hoses from air intake plenum (Fig. 5).

(8) Remove EGR tube flange from intake plenum (Fig. 5).

(9) Disconnect Charge Temperature Sensor electrical connector. Remove vacuum harness connectors from Intake Plenum (Fig. 5).

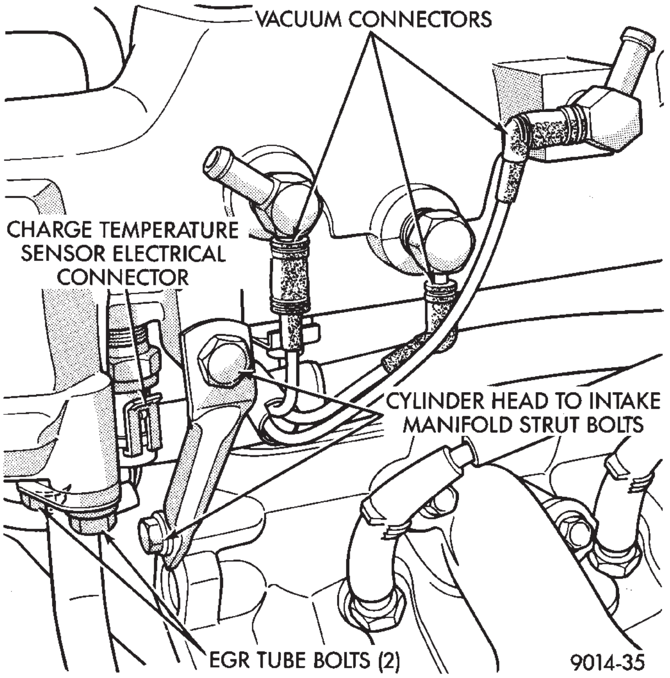


Fig. 5 Electrical and Vacuum Connections To Intake Manifold

(10) Remove cylinder head to intake plenum strut (Fig. 5).

(11) Disconnect MAP Sensor and heated Oxygen Sensor electrical connection. Remove the engine mounted ground strap (Fig. 6).

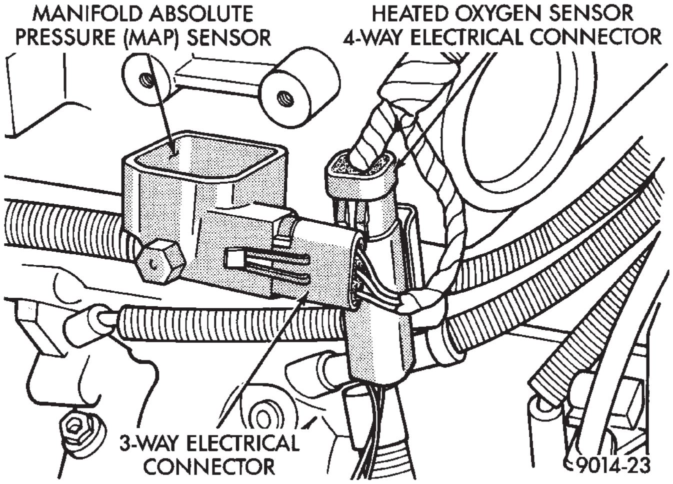


Fig. 6 MAP Sensor Electrical Connector

(12) Remove the fuel hose quick connect fittings from the fuel rail using an open end wrench to push in on the plastic ring located on the end of the fittings. Gently pull the fittings from the fuel rail (Fig. 7).

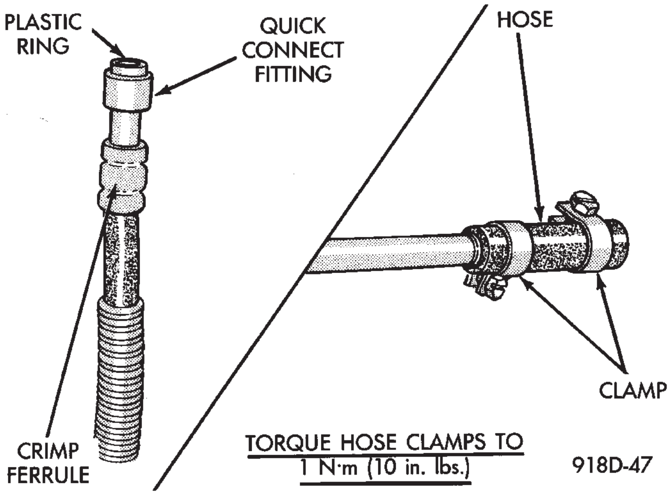


Fig. 7 Quick Connect Fuel Fittings to Fuel Rail

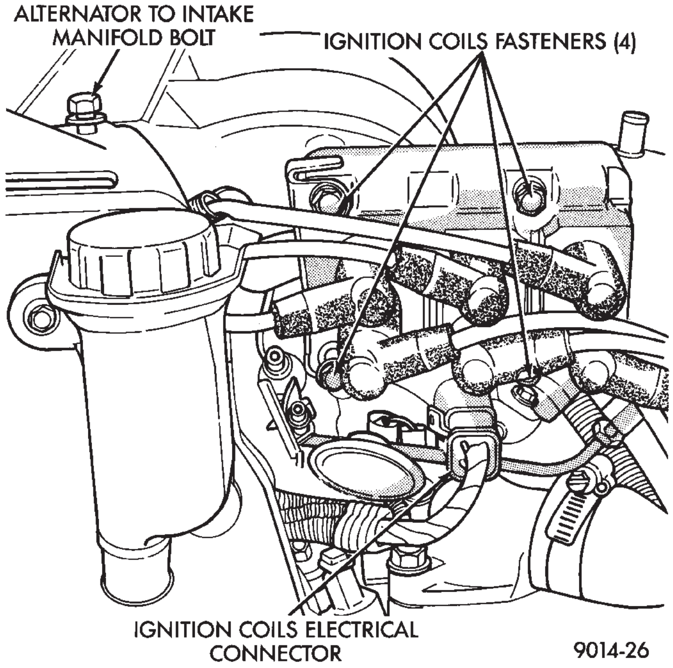


Fig. 8 Ignition Coils

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(13) Remove direct ignition system (DIS) coils and generator bracket to intake manifold bolt (Fig. 8).

(14) Remove intake manifold bolts and rotate manifold back over rear valve cover (Fig. 9).

(15) Cover intake manifold with suitable cover when servicing (Fig. 10).

(16) Remove vacuum harness connector from Fuel Pressure Regulator.

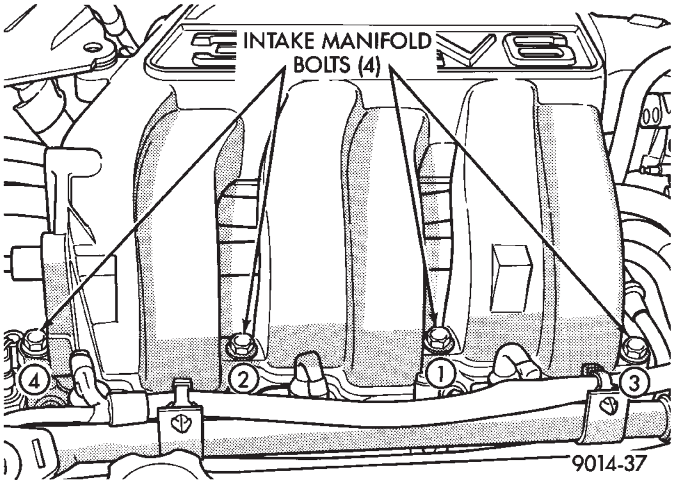


Fig. 9 Intake Manifold Bolts

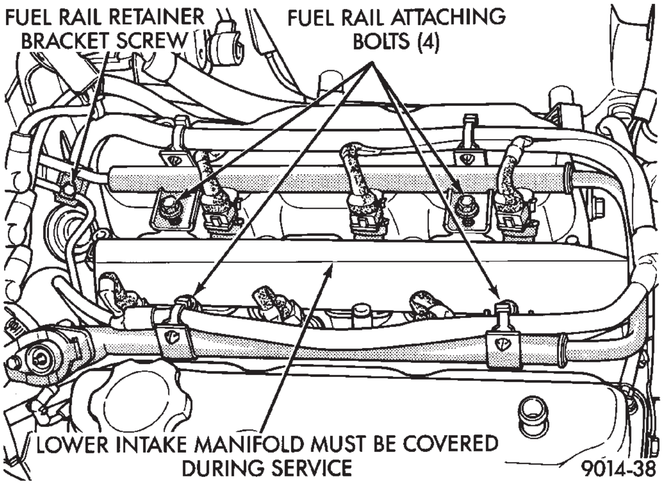


Fig. 10 Fuel Rail Attaching Bolts

(17) Remove fuel tube retainer bracket screw and fuel rail attaching bolts (Fig. 10). Spread the retainer bracket to allow fuel tube removal clearance.

(18) Remove fuel rail injector wiring clip from the generator bracket (Fig. 11).

(19) Disconnect cam sensor, coolant temperature sensor, and engine temperature sensors.

(20) Remove fuel injector wiring clip from intake manifold water tube.

(21) Remove fuel rail. Be careful not to damage the rubber injector O-rings upon removal from their ports (Fig. 12).

(22) Remove upper radiator hose, bypass hose and rear intake manifold hose (Fig. 13).

(23) Remove intake manifold bolts. Remove intake manifold.

(24) Remove intake manifold seal retainers screws (Fig. 14). Remove intake manifold gasket.

INSPECTION

Check for:

- Damage and cracks of each section.

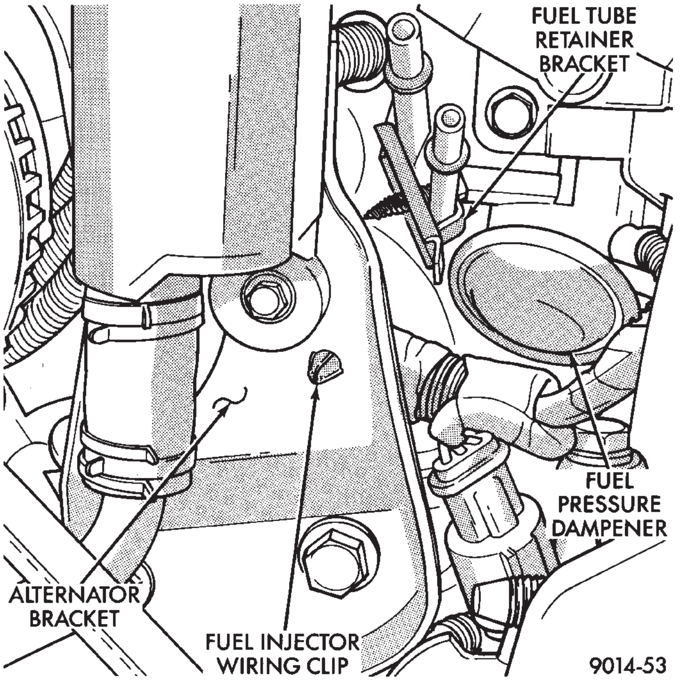


Fig. 11 Fuel Injector Wiring Clip

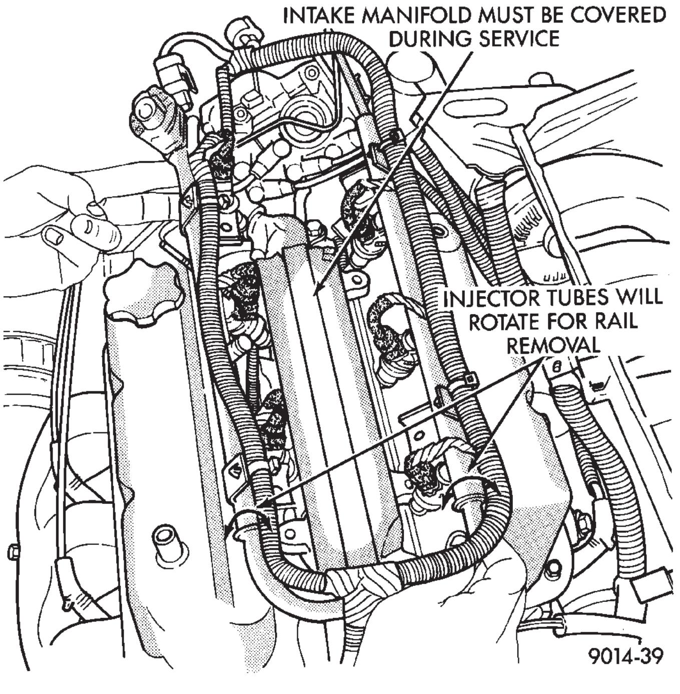


Fig. 12 Fuel Rail Removal

- Clogged water passages in end cross overs and clogged gas passages.

INTAKE MANIFOLD

INSTALLATION

(1) Clean all surfaces of cylinder block and cylinder heads.

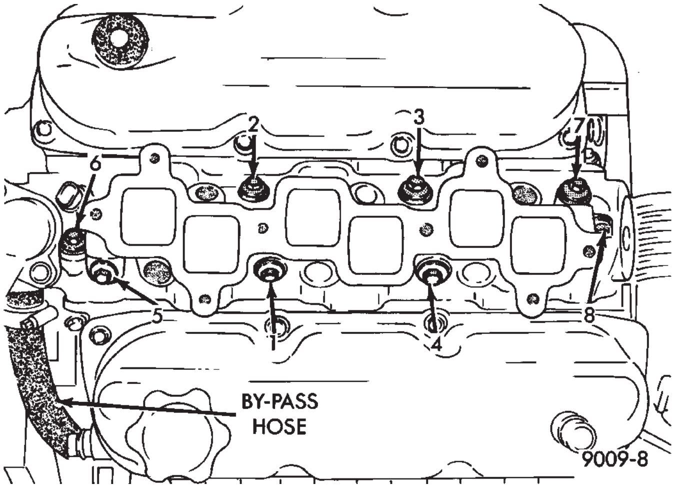


Fig. 13 Intake Manifold Removal and Installation

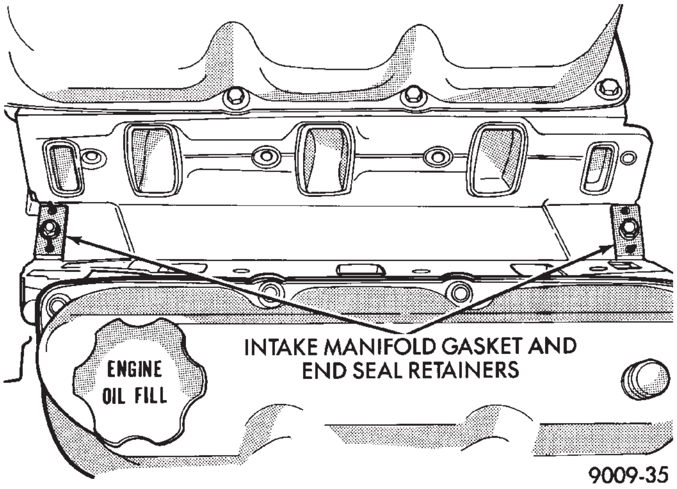


Fig. 14 Intake Manifold Gasket

(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. 15).

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

(3) Carefully install the intake manifold gasket (Fig. 14). Tighten end seal retainer screws to 12 N•m (105 in. lbs.) torque.

(4) Install intake manifold and (8) bolts and tighten to 1 N•m (10 in. lbs.) torque. Then retighten bolts to 22 N•m (200 in. lbs.) torque in sequence shown in (Fig. 13). Then retighten again to 22 N•m (200 in. lbs.)torque. After intake manifold is in place, **inspect to make sure seals are in place.**

(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.

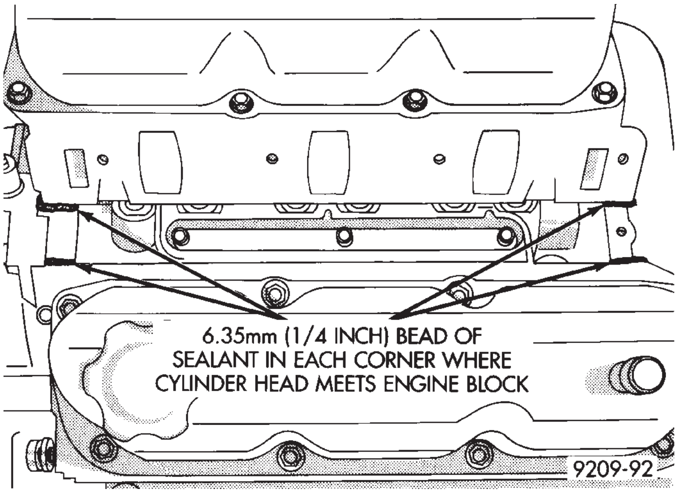


Fig. 15 Intake Manifold Gasket Sealing

(7) Put the tip of each injector into their ports. Push the assembly into place until the injectors are seated in the ports (Fig. 12).

(8) Install the (4) fuel rail attaching bolts and tighten to 22 N●m (200 in. lbs.) torque (Fig. 10).

(9) Install fuel tube retaining bracket screw and tighten to 4 N●m (35 in. lbs.) torque (Fig. 10).

(10) Reconnect cam sensor, coolant temperature sensor and engine temperature sensors (Fig. 11).

(11) Install fuel injector harness wiring clips on the generator bracket and intake manifold water tube (Fig. 11).

(12) Connect fuel pressure regulator vacuum line.

(13) Remove covering on lower intake manifold and clean surface.

(14) Place intake manifold gasket on lower manifold. Put upper manifold into place and install bolts finger tight.

(15) Install the generator bracket to intake manifold bolt and the cylinder head to intake manifold strut bolts. **Do not torque.**

(16) Tighten intake manifold bolts to 28 N●m (250 in. lbs.) torque in the sequence shown in (Fig. 9).

(17) Tighten generator bracket to intake manifold bolt to 54 N●m (40 ft. lbs.) torque (Fig. 8).

(18) Tighten the cylinder head to intake manifold strut bolts to 54 N●m (40 ft. lbs.) torque (Fig. 5).

(19) Connect ground strap, MAP and heated oxygen sensor electrical connectors (Fig. 6).

(20) Connect charge temperature sensor electrical connector (Fig. 5).

(21) Connect vacuum harness to intake plenum (Fig. 5).

(22) Using a new gasket, connect the EGR tube flange to the intake manifold and tighten to 22 N●m (200 in. lbs.) torque.

(23) Clip wiring harness into the hole in the throttle cable bracket.

(24) Connect the wiring connectors to the throttle position sensor TPS and automatic idle speed AIS motor (Fig. 4).

(25) Connect vacuum harness to throttle body (Fig. 4).

(26) Install the direct ignition system DIS coils. Tighten fasteners to 12 N●m (105 in. lbs.) torque (Fig. 8).

(27) Lubricate the ends of the chassis fuel tubes with 30 wt oil. Connect fuel supply and return hoses to chassis fuel tube assembly. pull back on the quick connect fitting to ensure complete insertion (Fig. 7). (Refer to Fuel Hoses, Clamps and Quick Connect Fittings in Group 14 Fuel Systems).

(28) Install throttle cable (Fig. 3).

(29) Connect fuel injector wiring harness.

(30) Install air cleaner and hose assembly (Fig. 2).

(31) Connect negative battery cable. Fill Cooling System. See Cooling System, Group 7.

(32) With the DRBII 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 MANIFOLDS

REMOVAL

(1) Raise vehicle and disconnect exhaust pipe from rear cowl side exhaust manifold at articulated joint.

(2) Separate EGR tube from rear manifold and disconnect Heated Oxygen Sensor lead wire (Fig. 16).

(3) Remove Generator/Power Steering Support Strut (Fig. 16).

(4) Remove bolts attaching cross-over pipe to manifold (Fig. 16).

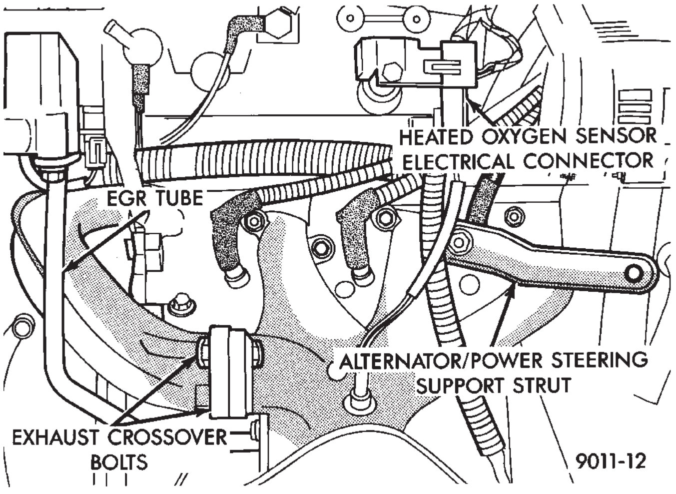


Fig. 16 EGR Tube, Heated Oxygen Sensor and Generator/Power Steering Strut

(5) Remove bolts attaching rear manifold to cylinder head and remove manifold.

(6) Lower vehicle and remove screws attaching front heat shield to front manifold (Fig. 17).

(7) Remove bolts fastening crossover pipe to front exhaust manifold and nuts fastening manifold to cylinder head. Remove assemblies (Fig. 18).

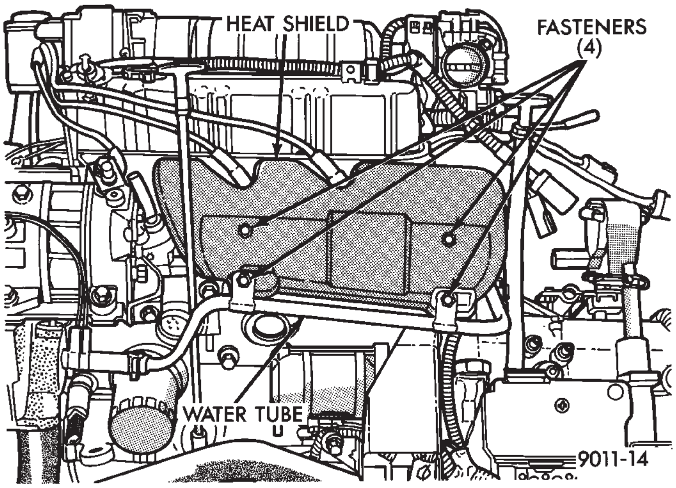


Fig. 17 Heat Shield

INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge (Fig. 19).

EXHAUST MANIFOLD

INSTALLATION

(1) Install rear exhaust manifold and tighten attaching bolts to 23 N●m (200 in. lbs.) torque.

(2) Attach exhaust pipe to exhaust manifold and tighten shoulder bolt to 28 N●m (250 in. lbs.) torque.

(3) Attach crossover pipe to exhaust manifold and tighten bolt to 33 N●m (25 ft. lbs.) torque and connect heated oxygen sensor lead (Fig. 16).

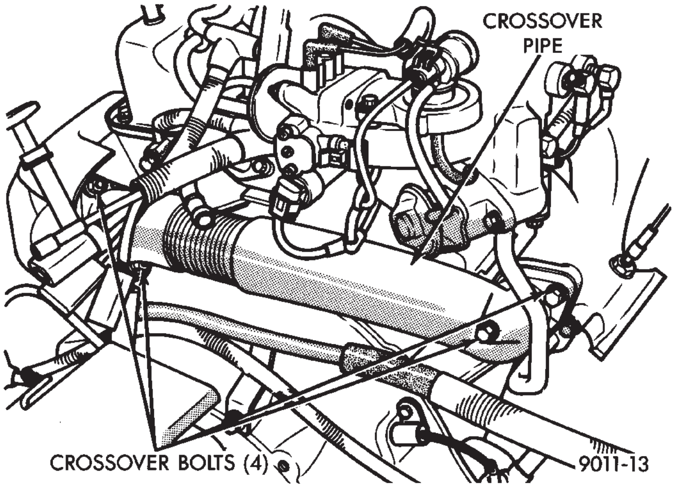


Fig. 18 Crossover Pipe

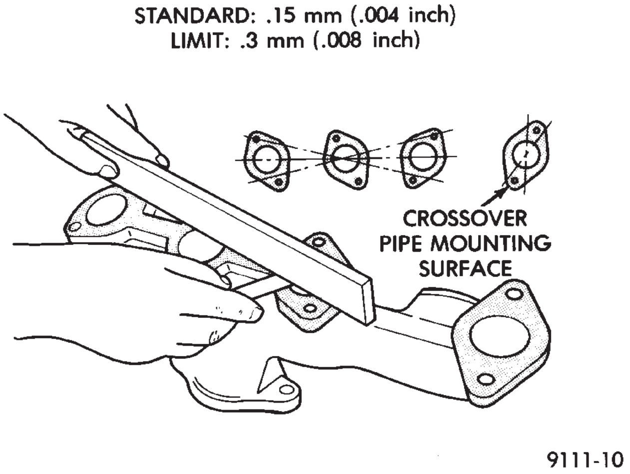


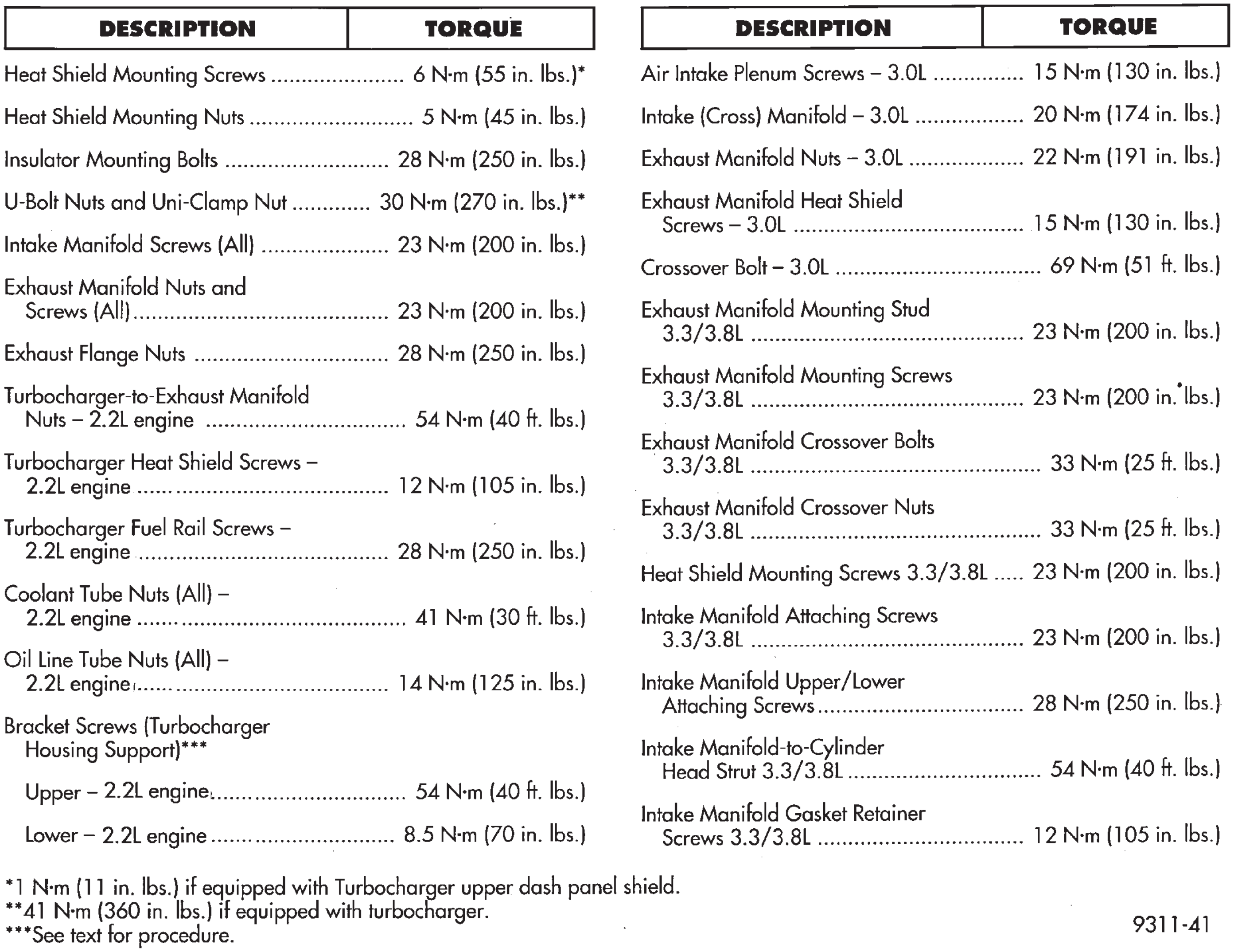
Fig. 19 Check Exhaust Manifold Mounting Surface

(4) Install EGR Tube and Generator/Power Steering Strut (Fig. 16).

(5) Install front exhaust manifold and attach exhaust crossover (Fig. 18).

(6) Install front manifold heat shield and tighten attaching screws to 23 N●m (200 in. lbs.) torque (Fig. 17).

TORQUE SPECIFICATION



DESCRIPTION	TORQUE
Heat Shield Mounting Screws	6 N·m (55 in. lbs.)*
Heat Shield Mounting Nuts	5 N·m (45 in. lbs.)
Insulator Mounting Bolts	28 N·m (250 in. lbs.)
U-Bolt Nuts and Uni-Clamp Nut	30 N·m (270 in. lbs.)**
Intake Manifold Screws (All)	23 N·m (200 in. lbs.)
Exhaust Manifold Nuts and Screws (All)	23 N·m (200 in. lbs.)
Exhaust Flange Nuts	28 N·m (250 in. lbs.)
Turbocharger-to-Exhaust Manifold Nuts – 2.2L engine	54 N·m (40 ft. lbs.)
Turbocharger Heat Shield Screws – 2.2L engine	12 N·m (105 in. lbs.)
Turbocharger Fuel Rail Screws – 2.2L engine	28 N·m (250 in. lbs.)
Coolant Tube Nuts (All) – 2.2L engine	41 N·m (30 ft. lbs.)
Oil Line Tube Nuts (All) – 2.2L engine	14 N·m (125 in. lbs.)
Bracket Screws (Turbocharger Housing Support)***	
Upper – 2.2L engine	54 N·m (40 ft. lbs.)
Lower – 2.2L engine	8.5 N·m (70 in. lbs.)
Air Intake Plenum Screws – 3.0L	15 N·m (130 in. lbs.)
Intake (Cross) Manifold – 3.0L	20 N·m (174 in. lbs.)
Exhaust Manifold Nuts – 3.0L	22 N·m (191 in. lbs.)
Exhaust Manifold Heat Shield Screws – 3.0L	15 N·m (130 in. lbs.)
Crossover Bolt – 3.0L	69 N·m (51 ft. lbs.)
Exhaust Manifold Mounting Stud 3.3/3.8L	23 N·m (200 in. lbs.)
Exhaust Manifold Mounting Screws 3.3/3.8L	23 N·m (200 in. lbs.)
Exhaust Manifold Crossover Bolts 3.3/3.8L	33 N·m (25 ft. lbs.)
Exhaust Manifold Crossover Nuts 3.3/3.8L	33 N·m (25 ft. lbs.)
Heat Shield Mounting Screws 3.3/3.8L	23 N·m (200 in. lbs.)
Intake Manifold Attaching Screws 3.3/3.8L	23 N·m (200 in. lbs.)
Intake Manifold Upper/Lower Attaching Screws	28 N·m (250 in. lbs.)
Intake Manifold-to-Cylinder Head Strut 3.3/3.8L	54 N·m (40 ft. lbs.)
Intake Manifold Gasket Retainer Screws 3.3/3.8L	12 N·m (105 in. lbs.)

*1 N·m (11 in. lbs.) if equipped with Turbocharger upper dash panel shield.
**41 N·m (360 in. lbs.) if equipped with turbocharger.
***See text for procedure.

9311-41

FRAME AND BUMPERS

CONTENTS

BUMPER AND FASCIA

INDEX

SAFETY PRECAUTIONS AND WARNINGS

WARNING: BUMPER ENERGY ABSORBER UNITS CONTAIN PRESSURIZE GAS. DO NOT PUNCTURE OR HEAT ABSORBER UNIT FOR ANY REASON. PERSONAL INJURY CAN RESULT.

DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.

CAUTION: To avoid damaging a bright metal or painted finish bumper or fascia, use a padded work surface.

AA-VEHICLE FRONT BUMPER

REMOVAL (FIG. 1)

(1) Remove socket and bulb from park and turn lamp.

(2) Disconnect horn and fog lamp connectors (if equipped).

(3) Remove push-in fasteners holding sight shield to vertical support in front of radiator.

(4) Remove nuts holding fascia to fender, from behind forward flange of fender.

(5) Support front bumper assembly on suitable lifting device and remove bolts holding bumper reinforcement to energy absorber units.

INSTALLATION

Reverse the preceding operation. Align bumper height to approximately 3 mm (1/8 in.) gap to bottom of head lamp assemblies and flush to front fenders below the side marker lamps.

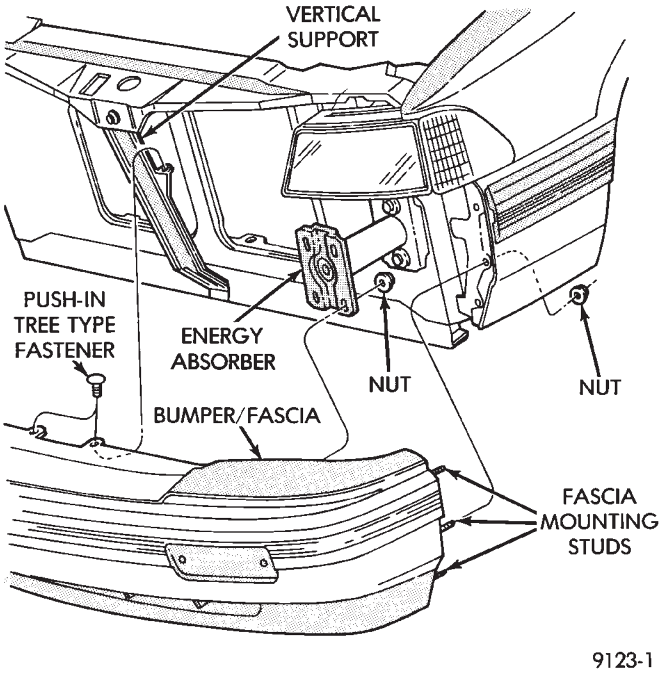


Fig. 1 Standard Front Bumper—AA-Vehicle

BUMPER AND WRAP-AROUND FASCIA REMOVAL (FIG. 2)

(1) Remove socket and bulb from park and turn lamp.

(2) Disconnect horn and fog lamp connectors (if equipped).

(3) Remove push-in plastic fasteners at forward edge of front wheel opening.

(4) Remove pal-nut fasteners from behind front fenders rearward of the side marker lamp.

(5) Remove push-in, fasteners holding sight shield to vertical support in front of radiator.

(6) Remove nuts holding fascia to fender, from behind forward flange of fender.

(7) Support front bumper on suitable lifting device and remove bolts holding bumper reinforcement to energy absorber units.

INSTALLATION

Reverse the preceding operation. Align bumper height to approximately 3 mm (1/8 in.) gap to bottom of head lamp assemblies and flush to front fenders below the side marker lamps.

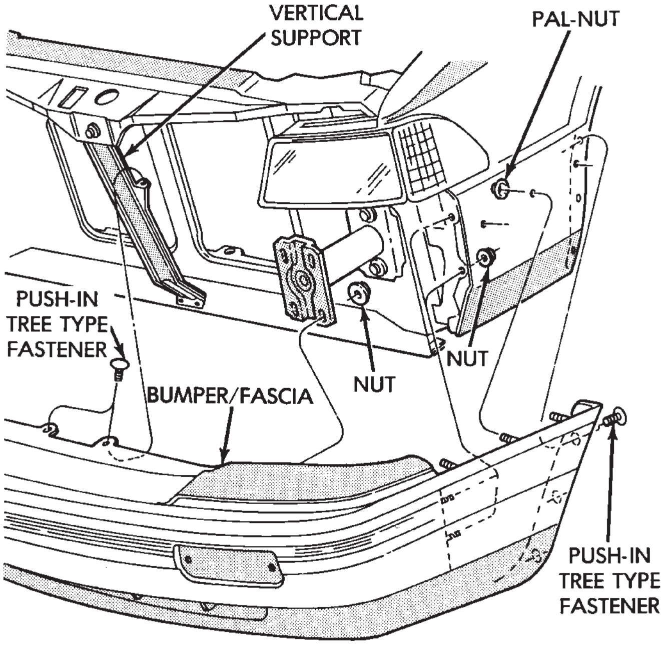


Fig. 2 Wrap-around Front Bumper—AA-Vehicle

BUMPER OVERHAUL (FIG. 3)

(1) Position bumper assembly on a suitable padded work surface to avoid damage to painted fascia.

(2) Remove sight shield push-in, fasteners and separate shield from assembly.

(3) Remove air dam screws and push-in fasteners and lift dam out of retaining channels at ends of fascia. Remove dam retaining channels and reinforcements from fascia (if equipped).

(4) Remove park and turn signal lamp assemblies, see Group 8L, Lamps

(5) Remove fog lamp bracket from bottom of bumper reinforcement (if equipped).

(6) Remove horns from back of bumper reinforcement.

(7) Remove lower air intake louver screws and push-in fastener and separate louver from fascia.

(8) Remove upper reinforcement to fascia attaching bolts and separate reinforcement from fascia.

(9) Straighten toy-tab fasteners holding horizontal moulding to fascia and separate moulding from two sided adhesive tape behind moulding. Remove moulding from fascia.

BUMPER ASSEMBLY

Reverse the preceding operation.

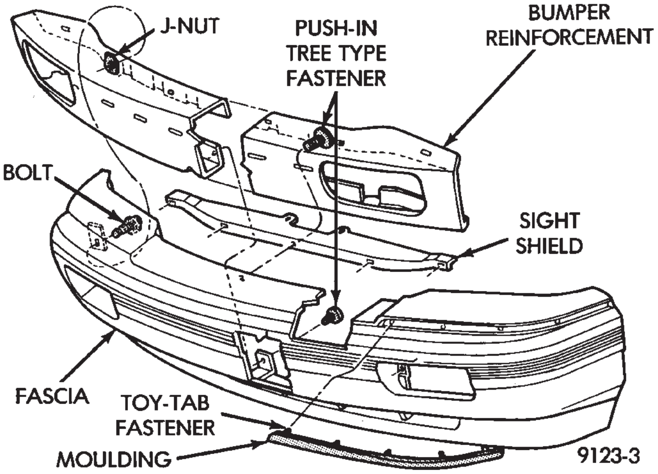


Fig. 3 Front Bumper Overhaul—AA-Vehicle

AC-VEHICLE FRONT BUMPER

FRONT BUMPER AND STANDARD FASCIA REMOVAL—AC/D OR AC/C-H- BODY (FIG. 4)

(1) Remove nuts holding fascia to fender, from behind forward flange of fender.

(2) Support front bumper assembly on suitable lifting device and remove bolts holding bumper reinforcement to energy absorber units.

(3) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation. Align bumper height to fit flush to bottom of head lamp assemblies and grille.

FRONT BUMPER OVERHAUL—AC\ OR AC/C-H-BODY (FIG. 4)

(1) Position bumper assembly on a suitable padded work surface to avoid damage to painted fascia.

(2) Remove push-in fasteners holding fascia to reinforcement.

(3) Remove upper reinforcement to fascia attaching bolts and separate reinforcement from fascia.

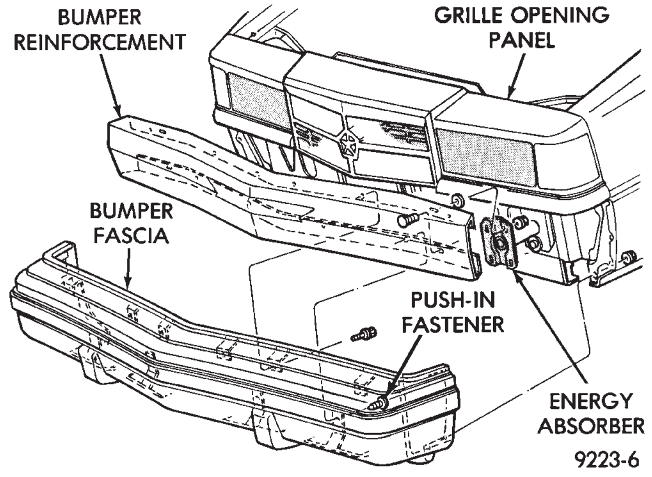


Fig. 4 Front Bumper—AC| or AC/C-H-Body

FRONT BUMPER ASSEMBLY

Reverse the preceding operation.

FRONT BUMPER AND FASCIA REMOVAL—AC/C-BODY (FIG. 5)

(1) Raise vehicle and support on safety stands.

(2) Remove push-in fasteners holding bumper fascia to front wheel opening lip.

(3) Support bumper on a suitable lifting device.

(4) Remove nuts holding bumper reinforcement to energy absorbers.

(5) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

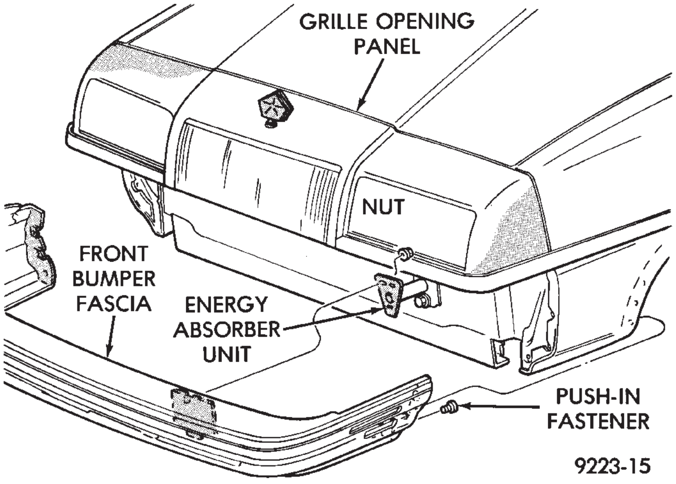


Fig. 5 Front Bumper—AC/C-Body

BUMPER OVERHAUL—AC/C-BODY

(1) Position bumper assembly on a suitable padded work surface to avoid damage to painted fascia.

(2) Remove bolts holding bumper face bar to reinforcement.

(3) Remove push-in fasteners holding fascia to reinforcement.

(4) Separate reinforcement from fascia.

BUMPER ASSEMBLY

Reverse the preceding operation.

AG-VEHICLE FRONT BUMPER

FRONT BUMPER FASCIA REMOVAL (FIG. 6)

(1) Remove headlamp and fog lamp (if equipped) assemblies, refer to Group 8L, Lamps.

(2) Raise vehicle and support on safety stands.

(3) Remove radiator closure panel sight shield.

(4) Remove push-in fasteners holding fascia to front fender wheel opening flange.

(5) Remove nuts holding fascia to fender from above side marker reflectors. Remove fender splash shields if necessary.

(6) Remove nuts holding front fascia headlamp mounting panel to forward edge of fenders.

(7) Remove bolts holding fascia headlamp mounting panel to radiator closure panel brace.

(8) Remove push-in fasteners holding fascia to bottom of bumper reinforcement.

(9) Separate front bumper fascia and headlamp mounting panel from vehicle.

INSTALLATION

Reverse the preceding operation. If headlamps require aiming, refer to Group 8L, Lamps.

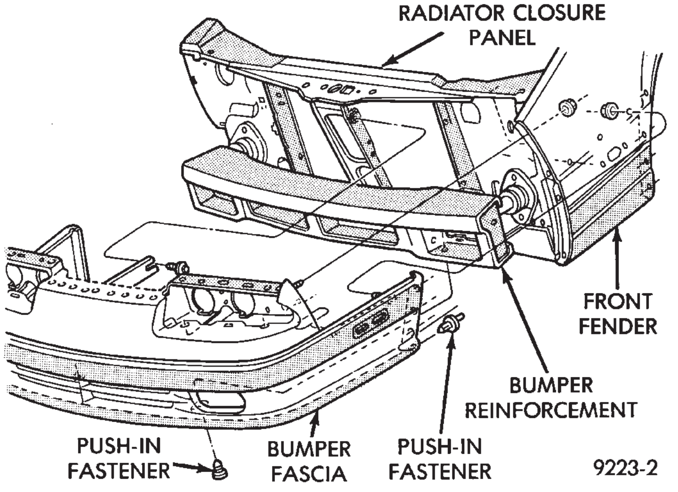


Fig. 6 Front Bumper Fascia—AG-Vehicle

HEADLAMP MOUNTING PANEL REMOVAL—AG-VEHICLE (FIG. 7)

(1) Remove all lamp assemblies, refer to group 8L, Lamps.

(2) Remove front bumper fascia.

(3) Remove bolts holding fascia to headlamp mounting panel ends.

(4) Remove push-in fasteners holding fascia to headlamp mounting panel.

(5) Separate headlamp mounting panel from fascia.

INSTALLATION

Reverse the preceding operation

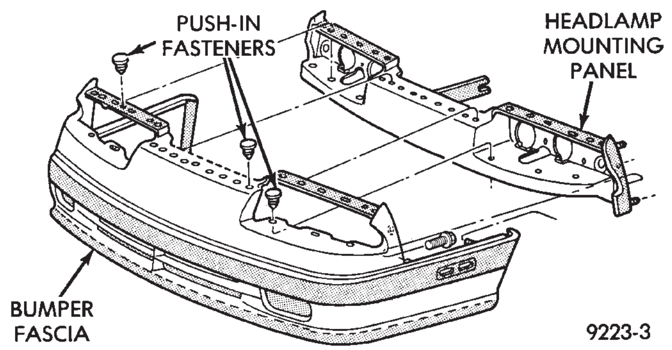


Fig. 7 Headlamp Mounting Panel—AG-Vehicle

FRONT BUMPER REINFORCEMENT REMOVAL—AG-VEHICLE (FIG. 8)

(1) Remove bumper fascia as necessary to gain clearance to remove bumper reinforcement.

(2) Remove nuts holding bumper reinforcement to energy absorber units.

(3) Separate bumper reinforcement from vehicle. carriage

INSTALLATION

Reverse the preceding operation

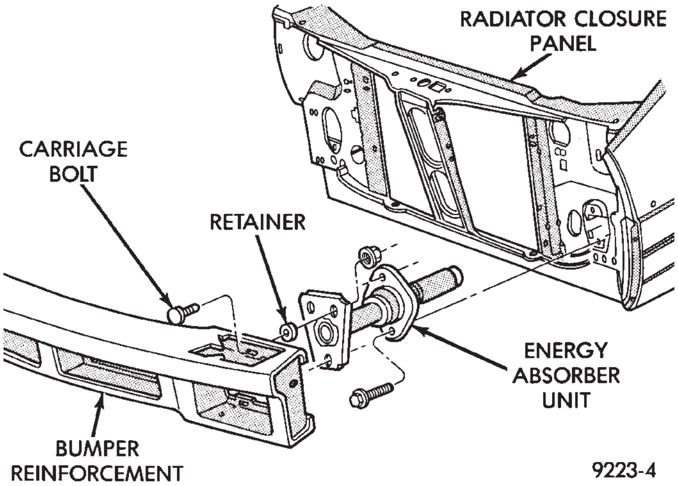


Fig. 8 Front Bumper Reinforcement and Energy Absorber Unit—

FRONT BUMPER ENERGY ABSORBER REMOVAL—AG-VEHICLE (FIG. 8)

(1) Remove front fascia and bumper reinforcement as necessary to remove absorber unit.

(2) Remove bolts holding energy absorber unit to front closure panel.

(3) Separate energy absorber from vehicle.

FRONT BUMPER ENERGY ABSORBER INSTALLATION

Reverse the preceding operation.

AJ-VEHICLE FRONT BUMPER AND FASCIA

REMOVAL (FIG. 9)

(1) Remove socket and bulb from park and turn lamp.

(2) Remove nuts holding fascia to fender, from behind forward flange of fender.

(3) Support front bumper assembly on suitable lifting device and remove bolts holding bumper reinforcement to energy absorber units.

INSTALLATION

Reverse the preceding operation. Align bumper height to approximately 5 mm (0.200 in.) gap to bottom of grille and flush to front fenders on the sides.

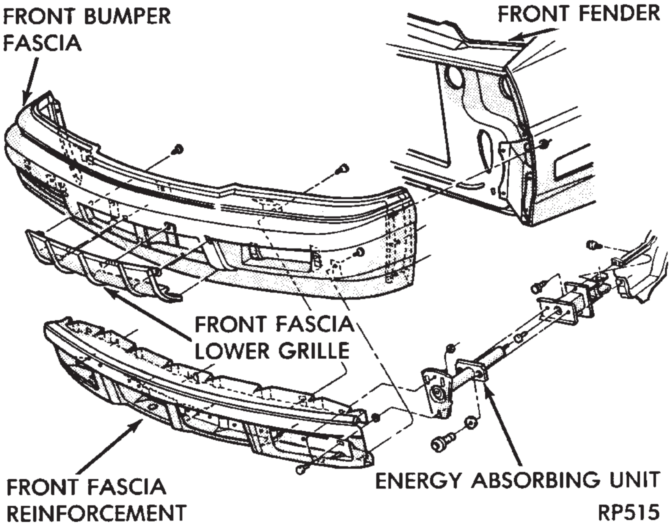


Fig. 9 Front Bumper and Fascia—AJ-Vehicle

AP-VEHICLE FRONT BUMPER

REMOVAL (FIG. 10)

(1) Raise vehicle and support on safety stands.

(2) Disconnect front park and turn signal lamp wire connector.

(3) Remove front side marker lamp socket from lamp assembly and position socket out of the way.

(4) Remove bolt holding front bumper fascia to wheelhouse splash shield.

(5) Remove nuts holding fascia to front fender.

(6) Support front bumper on lifting device.

(7) Remove bolts holding front bumper reinforcement to energy absorber units.

(8) Separate front bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

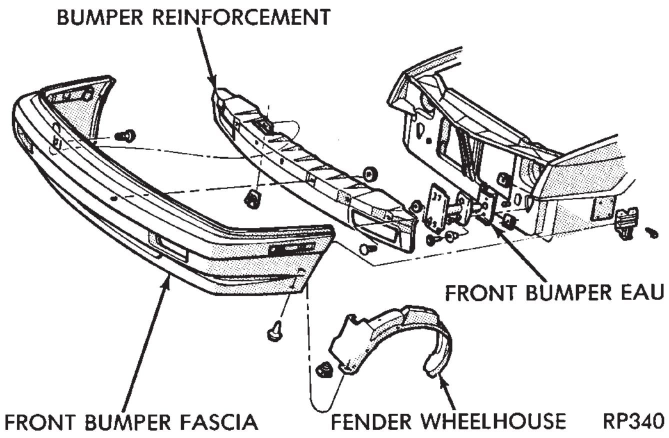


Fig. 10 Front Bumper—AP-Vehicle

AY-VEHICLE FRONT BUMPER

BUMPER AND FASCIA REMOVAL—AY/P-BODY (FIG. 11)

(1) Remove wheel house splash shields as necessary to gain access to fascia attaching nuts.

(2) Remove lower fascia bottom extension cover.

(3) Remove nuts holding fascia to fender, from behind forward flange of fender.

(4) Support front bumper assembly on suitable lifting device.

(5) Remove nuts holding bumper to energy absorber units.

(6) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation. Align bumper height to fit flush to bottom of filler panel.

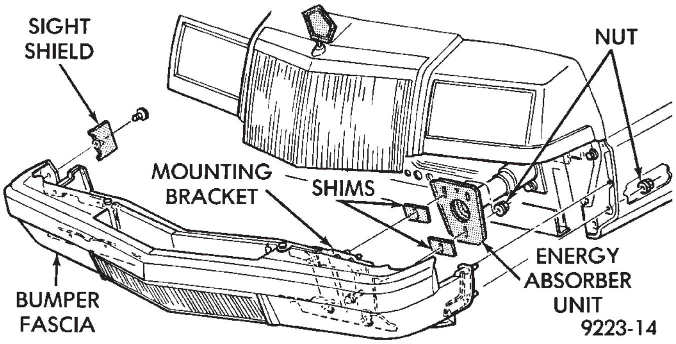


Fig. 11 Front Bumper and Fascia—AY/P-Body

FRONT BUMPER AND FASCIA REMOVAL—AY/S-BODY (FIG. 12)

(1) Raise vehicle and support on safety stands.

(2) Remove push-in fasteners holding bumper fascia to front wheel opening lip.

(3) Support bumper on a suitable lifting device.

(4) Remove nuts holding bumper reinforcement to energy absorbers.

(5) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

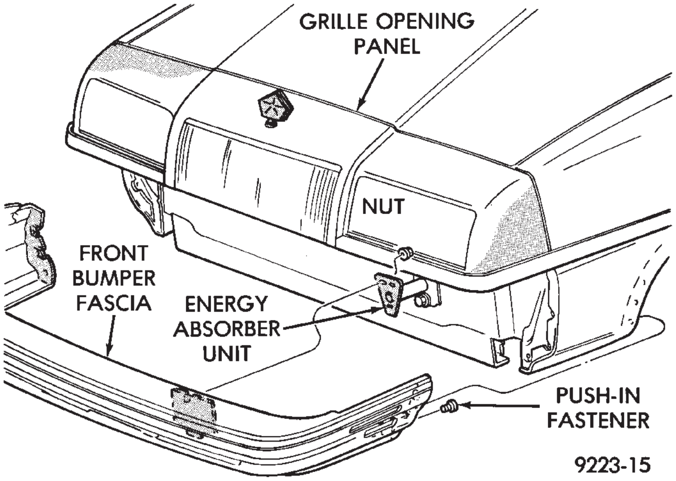


Fig. 12 Front Bumper—AY/S-Body

BUMPER OVERHAUL—AY/S BODY

(1) Position bumper assembly on a suitable padded work surface to avoid damage to painted fascia.

(2) Remove bolts holding bumper face bar to reinforcement.

(3) Remove push-in fasteners holding fascia to reinforcement.

(4) Separate reinforcement from fascia.

BUMPER ASSEMBLY

Reverse the preceding operation.

AA-VEHICLE REAR BUMPER

REAR BUMPER AND STANDARD FASCIA REMOVAL (FIG. 13)

(1) Open trunk lid and separate quarter panel liners (if equipped) from tail panel area.

(2) Remove rear fascia attaching nuts at rear of inner quarter panel drop-down wells.

(3) Remove lower fascia push-in fasteners holding fascia to bottom of bumper reinforcement.

(4) Remove fascia nuts holding fascia to trunk opening panel.

(5) Remove fascia bolts holding fascia to ends of bumper reinforcement.

(6) Separate fascia from reinforcement and separate fascia from vehicle.

(7) Support bumper reinforcement. Remove reinforcement attaching bolts and separate assembly from energy absorbers.

INSTALLATION

Reverse the preceding operation.

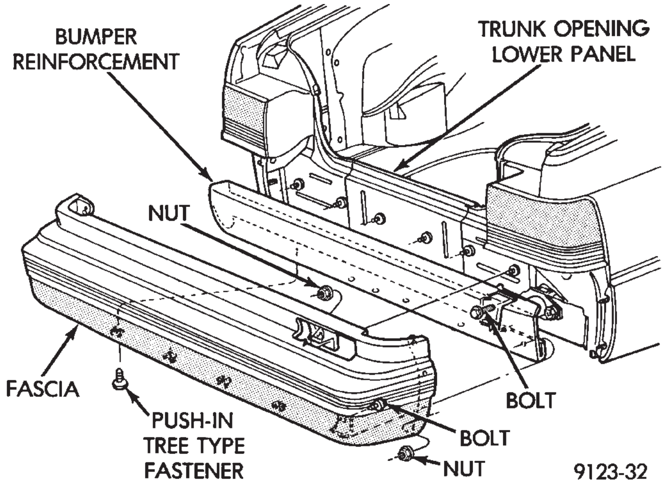


Fig. 13 Standard Rear Bumper—AA-Vehicle

REAR BUMPER AND WRAP-AROUND FASCIA REMOVAL (FIG. 14)

(1) Remove push-in fasteners holding rear fascia to rearward edge of wheel opening.

(2) Open trunk lid and separate quarter panel liner from tail panel area ,if equipped.

(3) Remove pal-nut fasteners located behind quarter panel, holding fascia to quarter panel.

(4) Perform steps 2 through 7 of Rear Bumper and Standard Fascia Removal/Installation procedure.

INSTALLATION

Reverse the preceding operation.

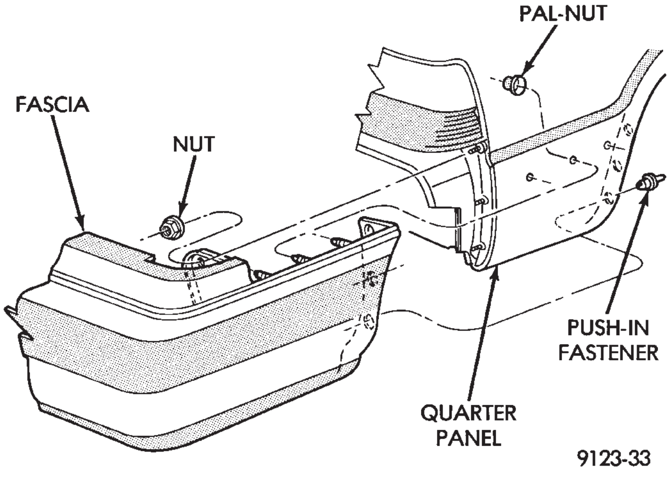


Fig. 14 Wrap-around Rear Bumper—AA-Vehicle

AC-VEHICLE REAR BUMPER

REAR BUMPER REMOVAL—AC/D-BODY (FIG. 15)

(1) Disconnect license plate lamps wire connectors.

(2) Remove nuts holding fascia to quarter panel ends.

(3) Support bumper assembly on suitable lifting device and remove bolts holding bumper reinforcement to energy absorber units.

(4) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation. Align bumper height to fit flush to bottom of tail lamp.

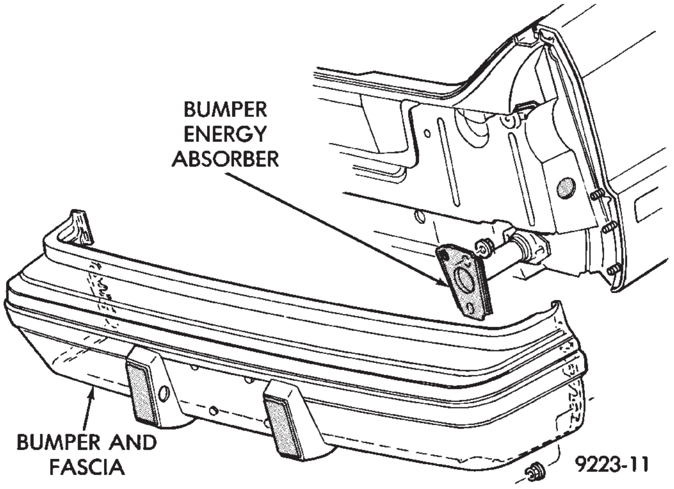


Fig. 15 Rear Bumper—AC/D-Body

REAR BUMPER OVERHAUL—AC/D-BODY (FIG. 16)

(1) Position bumper assembly on a suitable padded work surface to avoid damage to painted fascia.

(3) Remove push-in fasteners holding fascia to bottom of reinforcement.

(4) Remove bolts holding fascia to reinforcement and separate fascia from reinforcement.

(5) Remove bolts holding bumper guards to fascia and separate guards from fascia.

REAR BUMPER ASSEMBLY

Reverse the preceding operation.

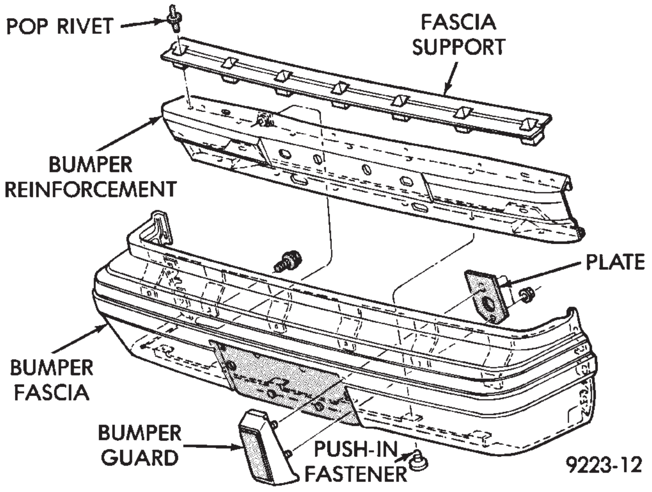


Fig. 16 Rear Bumper Overhaul—AC/D-Body

REAR BUMPER REMOVAL AC/C-BODY (FIG. 17)

(1) In luggage compartment, separate liners from quarter panels to gain access to fascia nuts.

(2) Remove nuts holding bumper fascia to quarter panels.

(3) Remove fasteners holding bumper fascia to wheel opening flange.

(4) Disconnect license plate lamp wire connectors.

(5) Remove bolts holding bumper to rear closure panel.

(6) Remove nuts holding bumper to energy absorber units.

(7) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

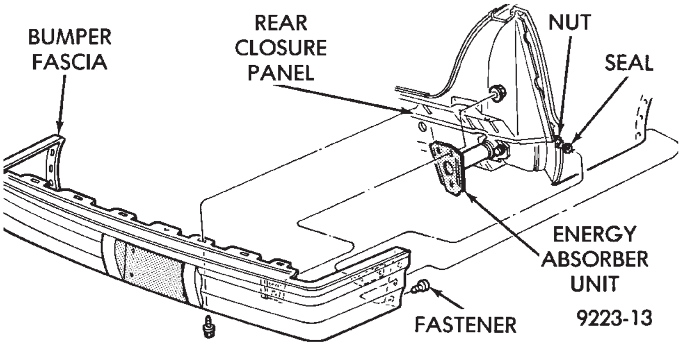


Fig. 17 Rear Bumper—AC/C-Body

AG-VEHICLE REAR BUMPER

REMOVAL (FIG. 18)

(1) Raise vehicle and support on safety stands.

(2) Remove nuts holding rear fascia to luggage compartment tail panel.

(3) Remove nuts holding fascia ends to quarter panel end flanges.

(4) Remove pop-rivets holding bumper fascia to wheel lip flanges.

(5) Remove nuts holding bumper fascia to quarter panel along belt line.

(6) Support rear bumper assembly on lifting device.

(7) Remove nuts holding rear bumper reinforcement to energy absorbers.

(8) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

AJ-VEHICLE REAR BUMPER

REMOVAL (FIG. 19)

(1) Remove nuts holding rear fascia to quarter panel ends.

(2) Remove push-in fasteners holding fascia to bottom of bumper reinforcement.

(3) Remove nuts holding fascia to trunk tail panel.

(4) Remove bolts holding fascia to ends of bumper reinforcement.

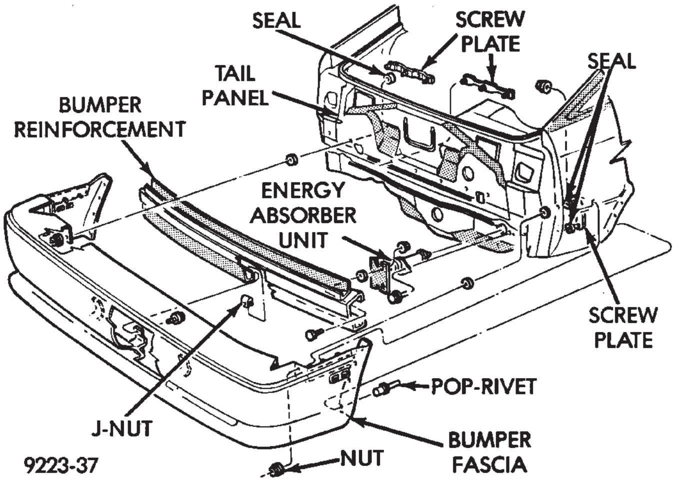


Fig. 18 Rear Bumper Fascia and Reinforcement—AG-Vehicle

(5) Separate fascia from reinforcement and separate fascia from vehicle.

(6) Support bumper reinforcement on a lifting device. Remove bolts holding reinforcement to energy absorbers. Separate reinforcement from energy absorbers.

INSTALLATION

Reverse the preceding operation.

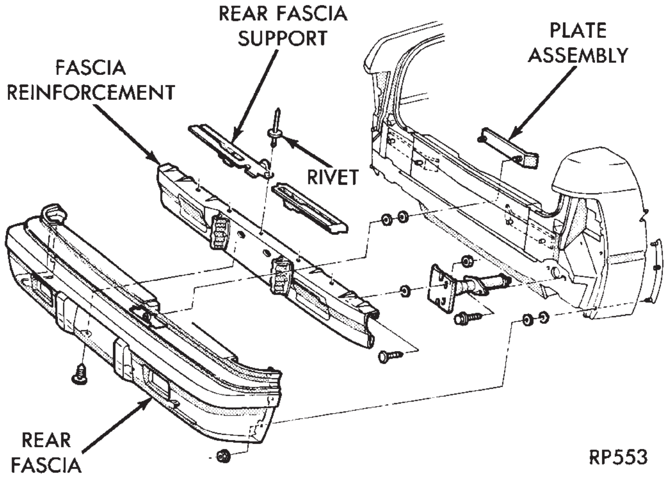


Fig. 19 Rear Bumper and Fascia—AJ-Vehicle

AP-VEHICLE REAR BUMPER

REMOVAL (FIG. 20)

(1) Raise vehicle and support on safety stands.

(2) Support rear bumper on lifting device.

(3) Remove bolts holding rear bumper reinforcement to energy absorber units.

(4) Pull rear bumper assembly rearward to disengage retainers from quarter panel.

(5) Separate front bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

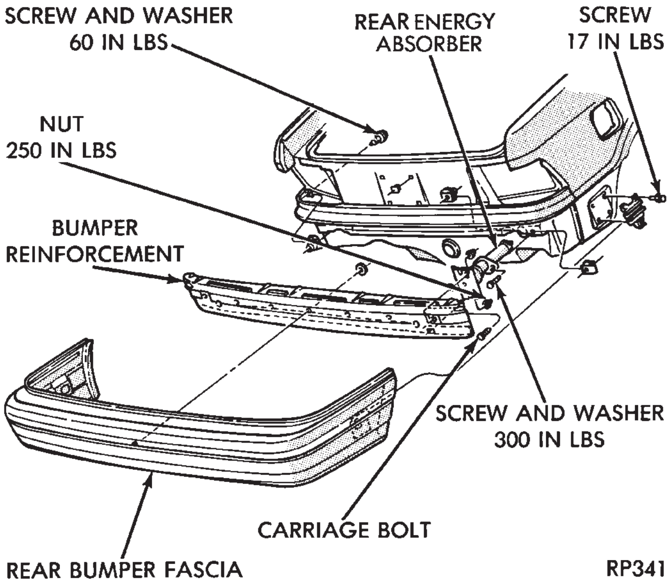


Fig. 20 Rear Bumper—AP-Vehicle

AY-VEHICLE REAR BUMPER

REAR BUMPER REMOVAL—AY/P-BODY (FIG. 21)

(1) Remove nuts holding fascia to quarter panel ends.

(2) Support bumper assembly on suitable lifting device and remove bolts holding bumper reinforcement to energy absorber units.

(3) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation. Align bumper height to fit flush to bottom of tail lamp.

REAR BUMPER OVERHAUL—AY/P-BODY

(1) Position bumper assembly on a suitable padded work surface to avoid damage to painted fascia.

(2) Remove bolts holding bumper face bar to reinforcement and separate face bar from assembly.

(3) Remove push-in fasteners holding fascia to reinforcement.

(4) Remove upper reinforcement to fascia attaching bolts and separate reinforcement from fascia.

REAR BUMPER ASSEMBLY

Reverse the preceding operation.

REAR BUMPER REMOVAL—AY/S-BODY (FIG. 22)

(1) In luggage compartment, separate liners from quarter panels to gain access to fascia nuts.

(2) Remove nuts holding bumper fascia to quarter panels.

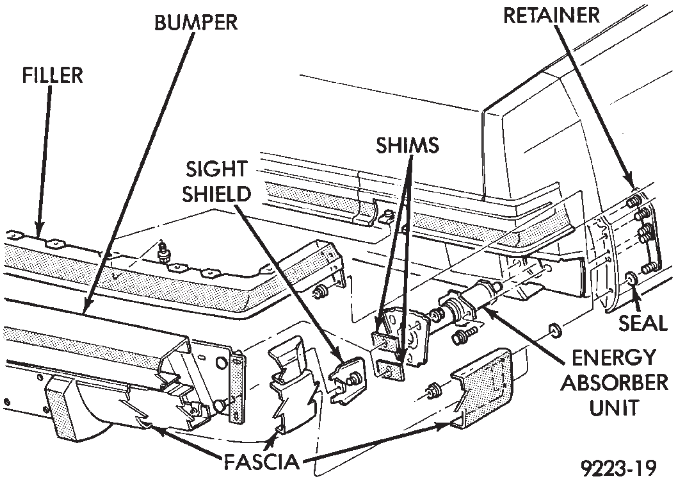


Fig. 21 Rear Bumper—AY/P-Body

(3) Remove fasteners holding bumper fascia to wheel opening flange.

(4) Disconnect license plate lamp wire connectors.

(5) Remove bolts holding bumper to rear closure panel.

(6) Remove nuts holding bumper to energy absorber units.

(7) Separate bumper from vehicle.

INSTALLATION

Reverse the preceding operation.

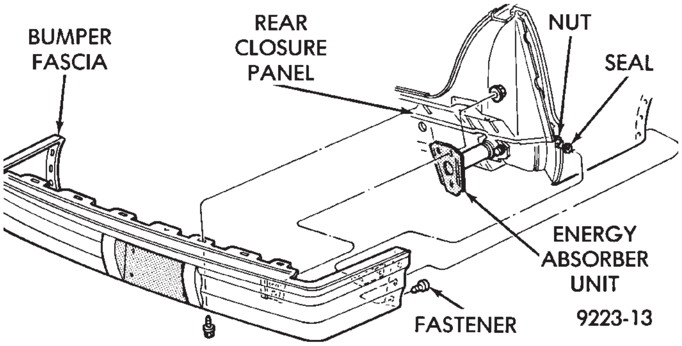


Fig. 22 Rear Bumper—AY/S-Body

FRAME

INDEX

GENERAL INFORMATION

In this section, references are made to Vehicle Family (Body) codes. To determine the vehicle family identification code, refer to the Introduction Group at the front of this manual.

FRAME DIMENSIONS

Frame dimensions are listed in metric scale then converted to inch scale listed in parenthesis. Engine compartment charts include front suspension upper strut damper mounting tower location. 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 level work surface. Using screw or bottle jacks, adjust the vehicle height to the specified PLP dimension above the Datum Line (work surface). Vertical dimensions can be taken from the datum line to the PLP.

ENGINE COMPARTMENT DIMENSIONS

Refer to Fig. 1, 2, 3, 4 or 5.

FRONT FRAME DIMENSIONS

Refer to Fig. 6

REAR FRAME DIMENSIONS

Refer to Fig. 7, 8, 9, 10 or 11.

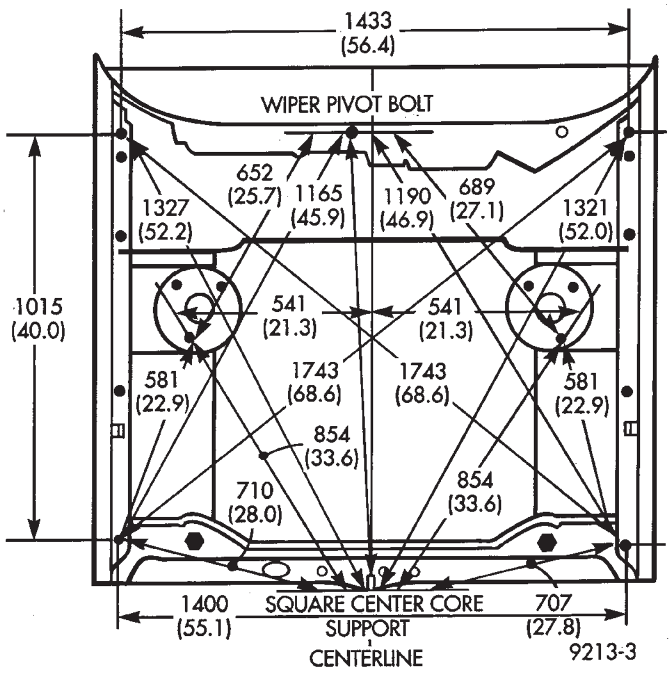


Fig. 1 Engine Compartment Dimensions—AA-Body

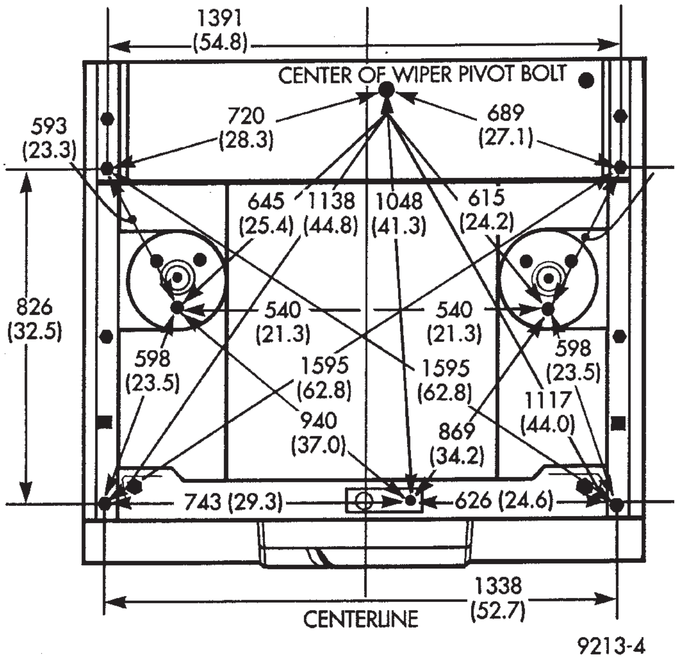


Fig. 2 Engine Compartment Dimensions—AC-Body

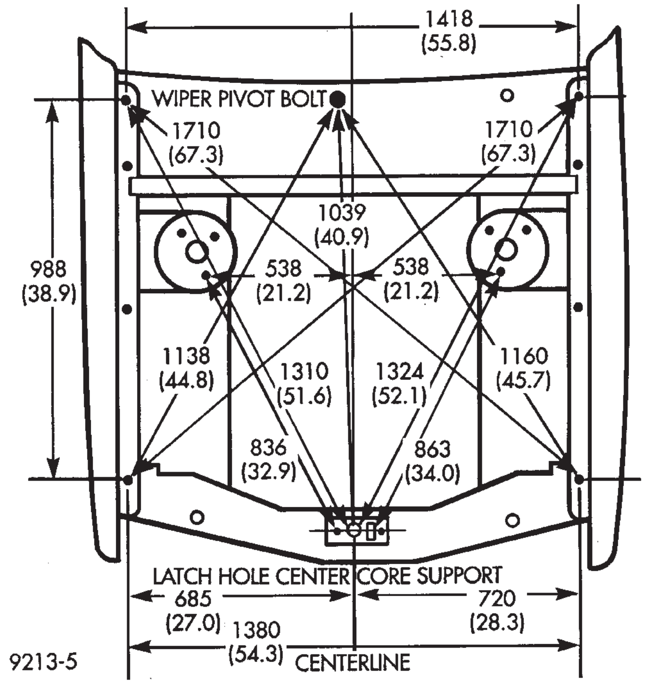


Fig. 3 Engine Compartment Dimensions—AG-Body

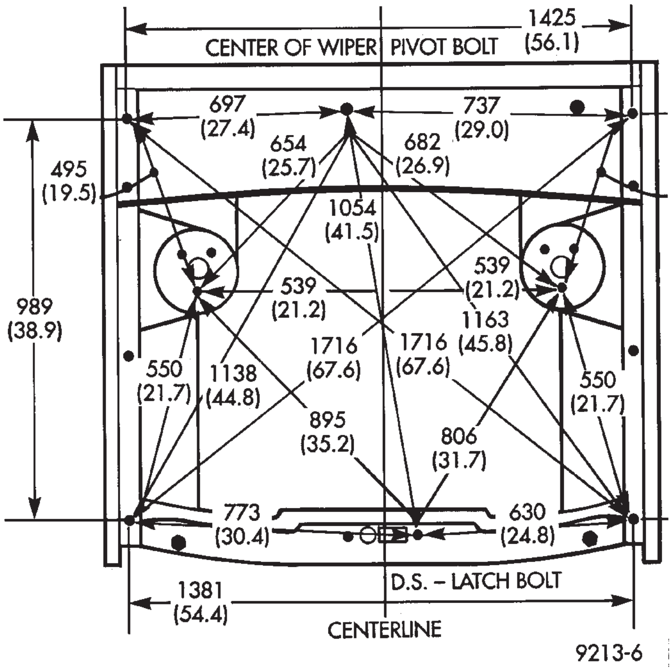


Fig. 4 Engine Compartment Dimensions—AJ-Body

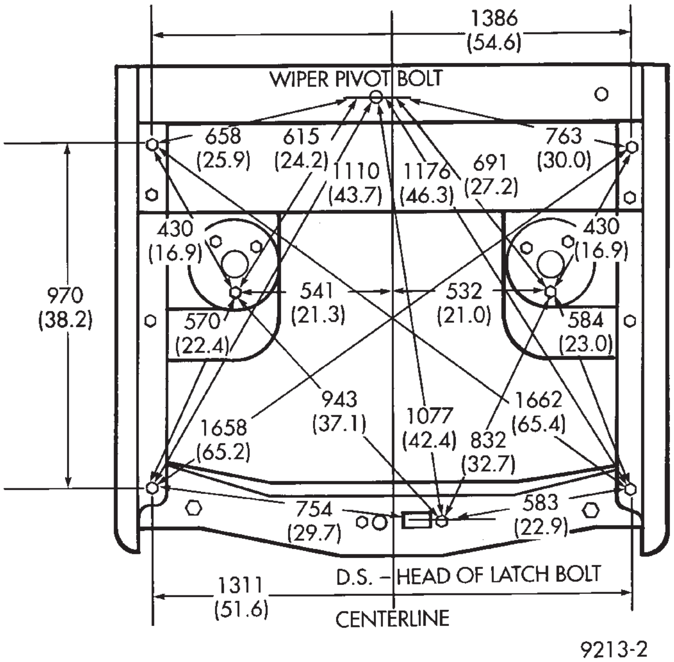
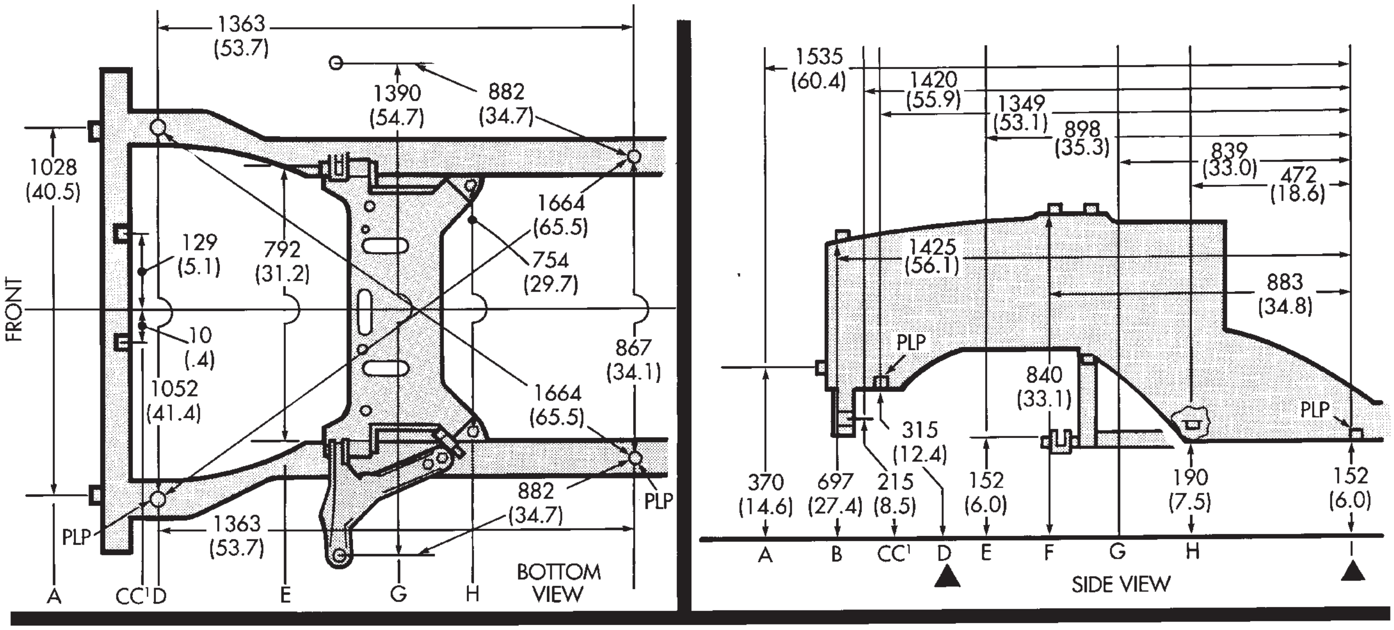


Fig. 5 Engine Compartment Dimensions—AP-Body

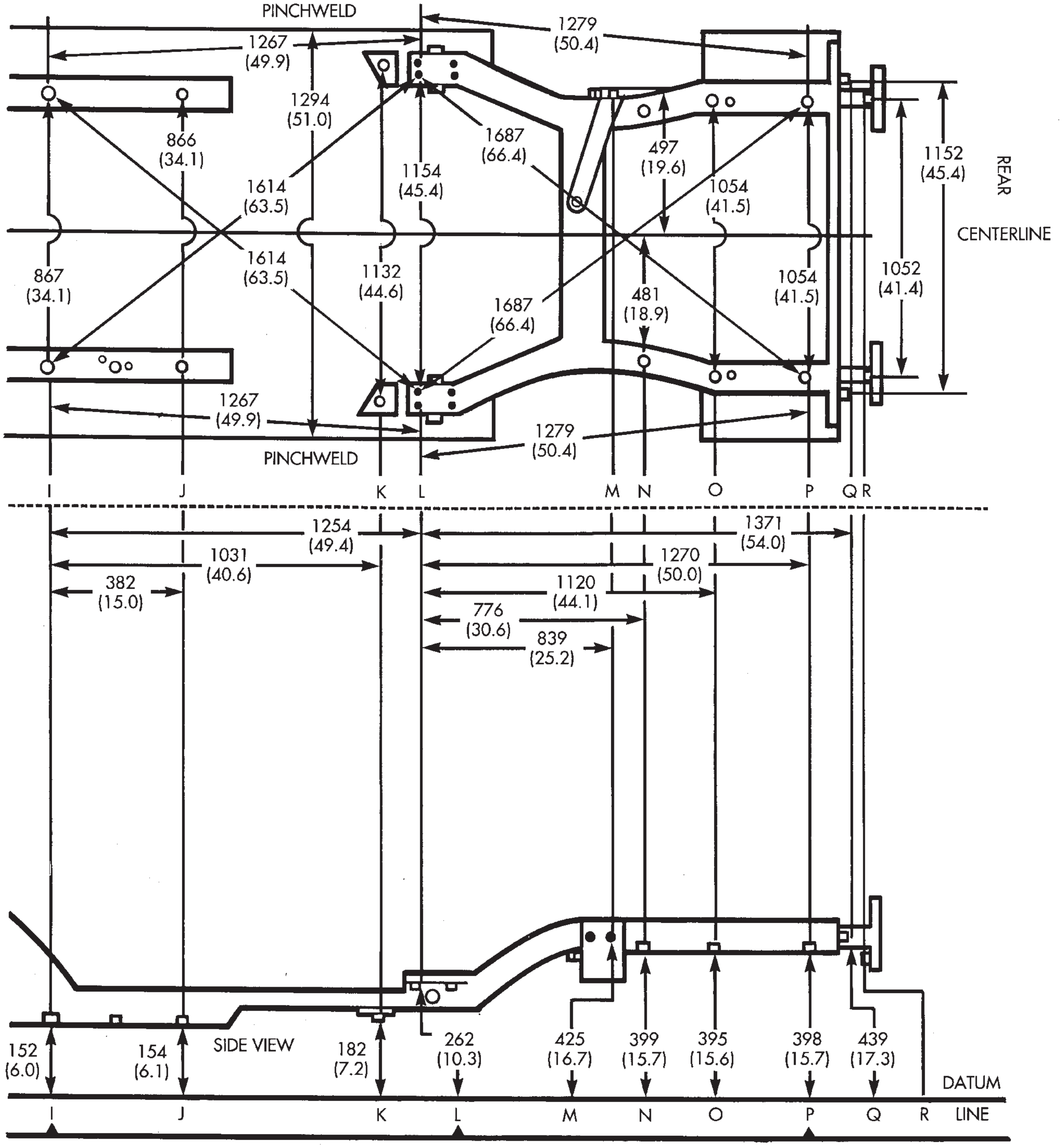


MEASURING POINT DESIGNATIONS

A – Tip of Lower Bolt – Front Bumper Bracket
B – Head of Front Fender Bolt
C – D.S. – Center of Threaded Hole for Front Motor Mount
C¹– P.S. – Center of Threaded Hole for Front Motor Mount
D – Center of 25 mm (1") Round Hole (PLP)
E – Front Tip of Bolt – Front Pivot on Control Arm
F – Tip of Front Stud on Strut Tower
G – Center of Lower Ball Joint
H – Head of Rear Bolt – Front Subframe Mount
I – Center of 25 mm (1") Round Hole (PLP)
▲ – Datum Line Control Points

9213-1

Fig. 6 Front Frame Dimensions—All

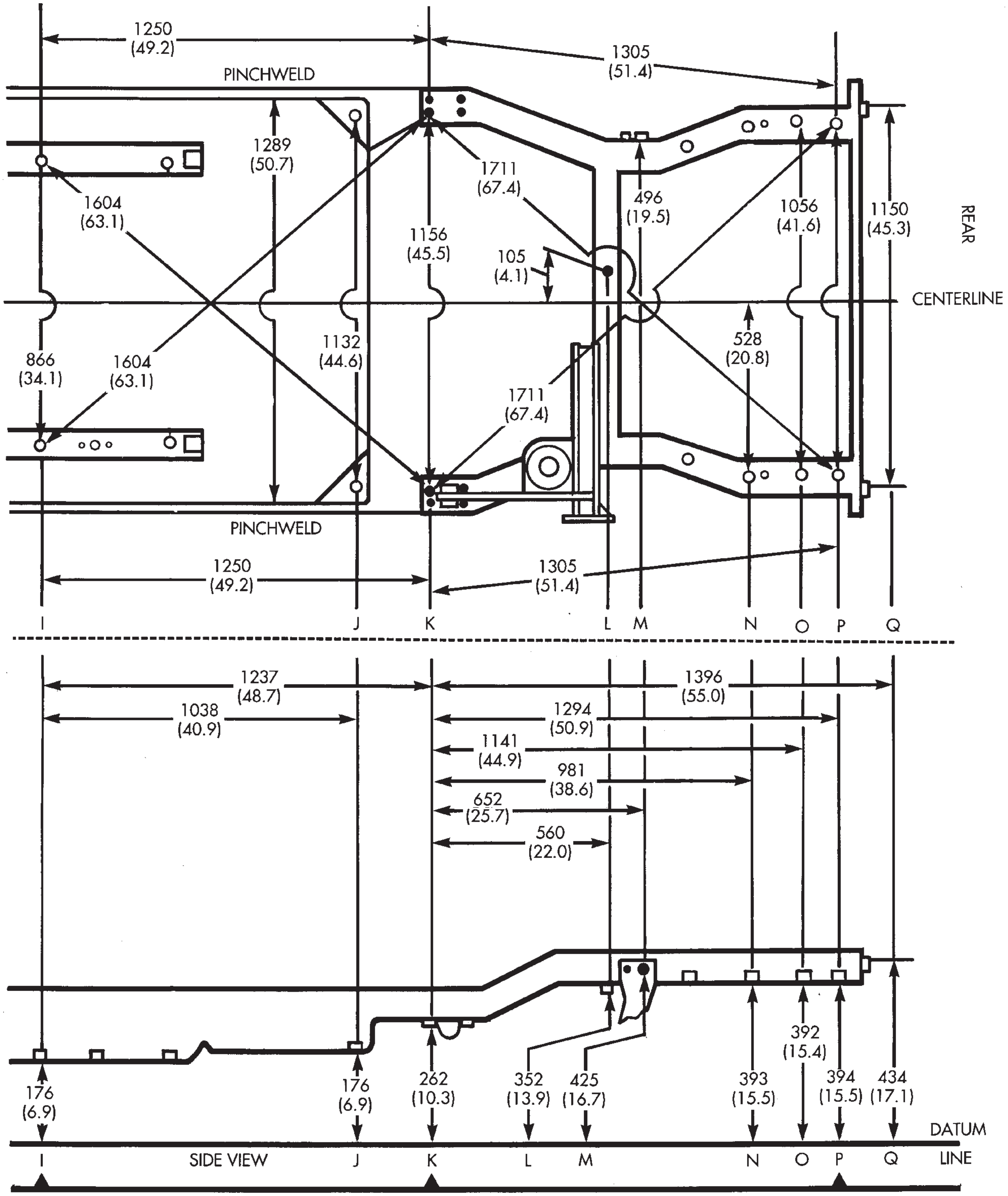


MEASURING POINT LOCATIONS

I - Center of 25 mm Round Hole
J - Center of 15 mm Round Hole
K - Center of 19 mm Round Hole
L - Center of Front Inner Bolt – Rear Suspension Mount
M - Head of Rear Bolt – Panhard Rod Bracket
N - P.S. – Center of 25 mm Round Hole
O - Center of 25 mm Round Hole – Third From Rear
P - Center of 25 mm Round Hole – Rear of Frame
Q - End of Outer Bolt – Bumper Bracket at Frame
R - End of Outer Bolt – Bumper Bracket at Bumper
D.S. - DRIVER SIDE
P.S. - PASSENGER SIDE
● - BOLTS
○ - HOLES
▲ - DATUM LINE CONTROL POINT

9213-7

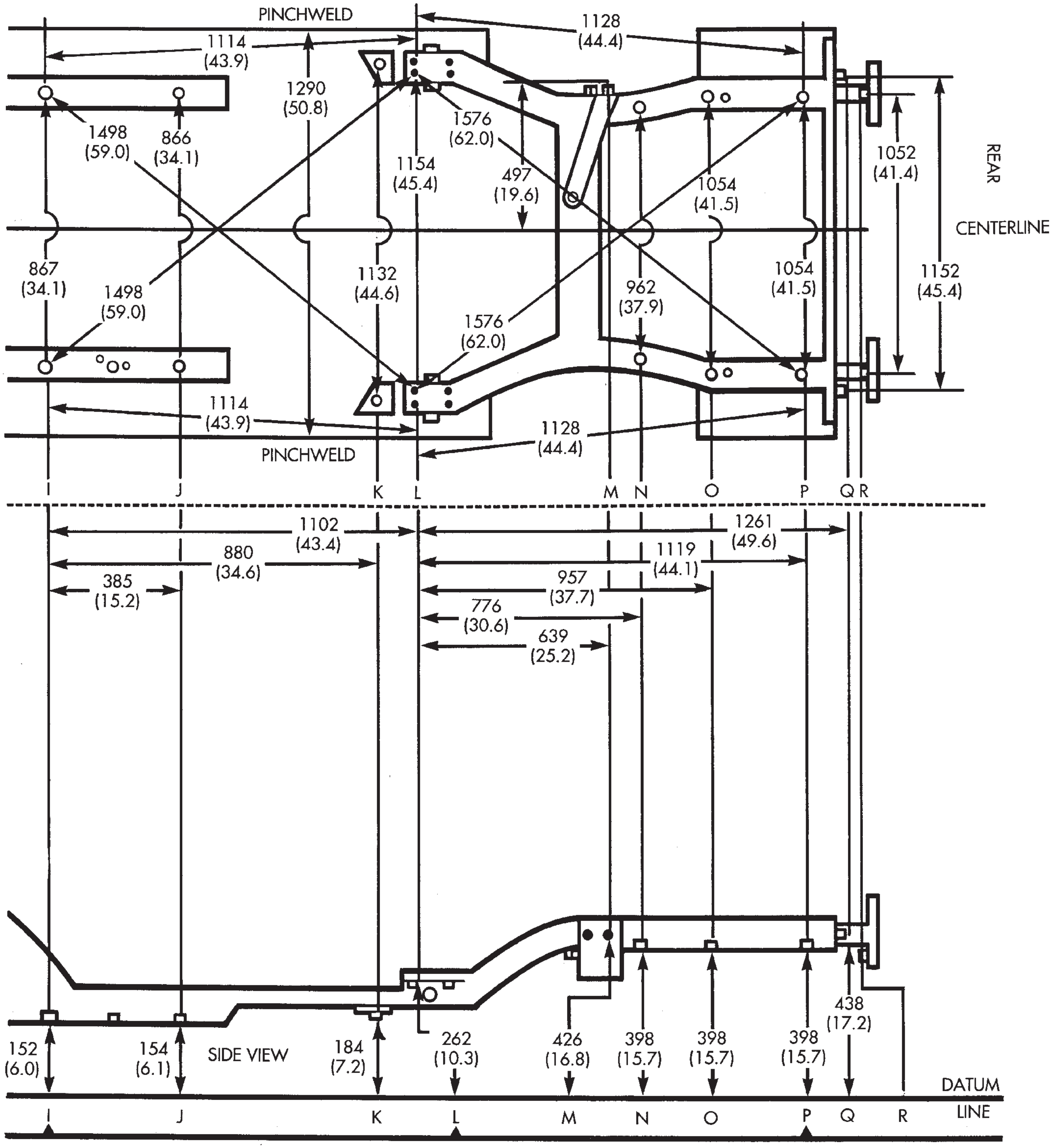
Fig. 7 Rear Frame Dimensions—AA-Body



MEASURING POINT LOCATIONS
I - Center of 25 mm Round Hole
J - Center of 25 mm Round Hole
K - Head of Front Inner Bolt – Rear Suspension Mount
L - Tip of Stud – Inner End of Brace for Panhard Rod
M - Head of Rear Bolt – Panhard Rod Bracket
N - P.S. – Center of 25 mm Round Hole – Fifth From Rear
O - Center of 25 mm Round Hole
P - Center of 25 mm Round Hole – Rear of Frame
Q - End of Outer Bolt – Rear Bumper Bracket
D.S. - DRIVER SIDE
P.S. - PASSENGER SIDE
● - BOLTS
○ - HOLES
▲ - DATUM LINE CONTROL POINT

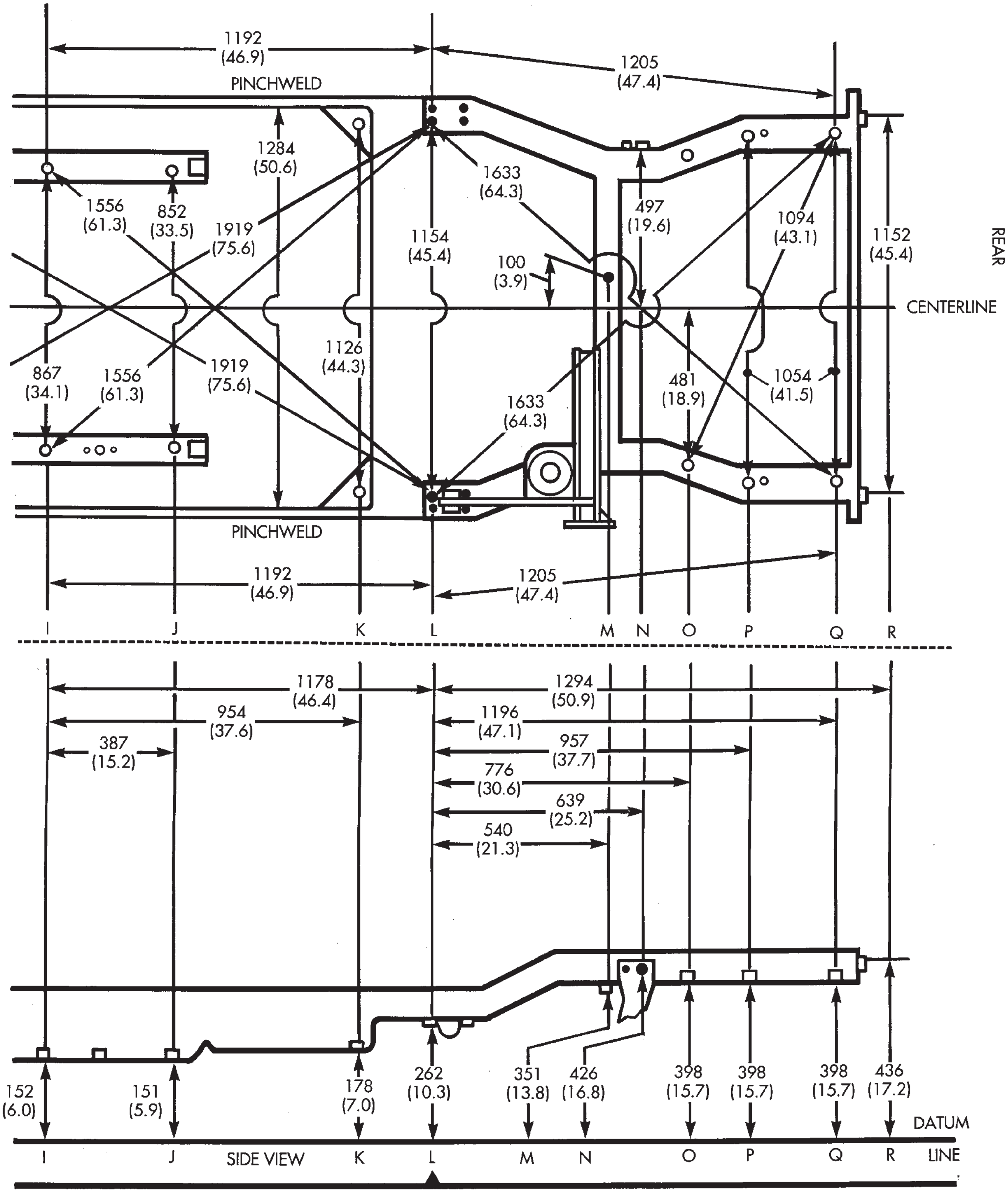
9213-8

Fig. 8 Rear Frame Dimensions—AC, AY-Body



MEASURING POINT LOCATIONS
I - Center of 25 mm Round Hole
J - Center of 15 mm Round Hole
K - Center of 19 mm Round Hole
L - Head of Front Inner Bolt – Rear Suspension Mount
M - D.S. – Head of Rear Bolt – Panhard Rod Bracket
N - Center of 25 mm Round Hole
O - Center of 25 mm Round Hole – Third From Rear
P - Center of 25 mm Round Hole – Rear of Frame
Q - Tip of Outer Bolt – Bumper Bracket at Frame
R - Tip of Outer Bolt – Bumper Bracket at Bumper
D.S. - DRIVER SIDE
P.S. - PASSENGER SIDE
● - BOLTS
○ - HOLES
▲ - DATUM LINE CONTROL POINT

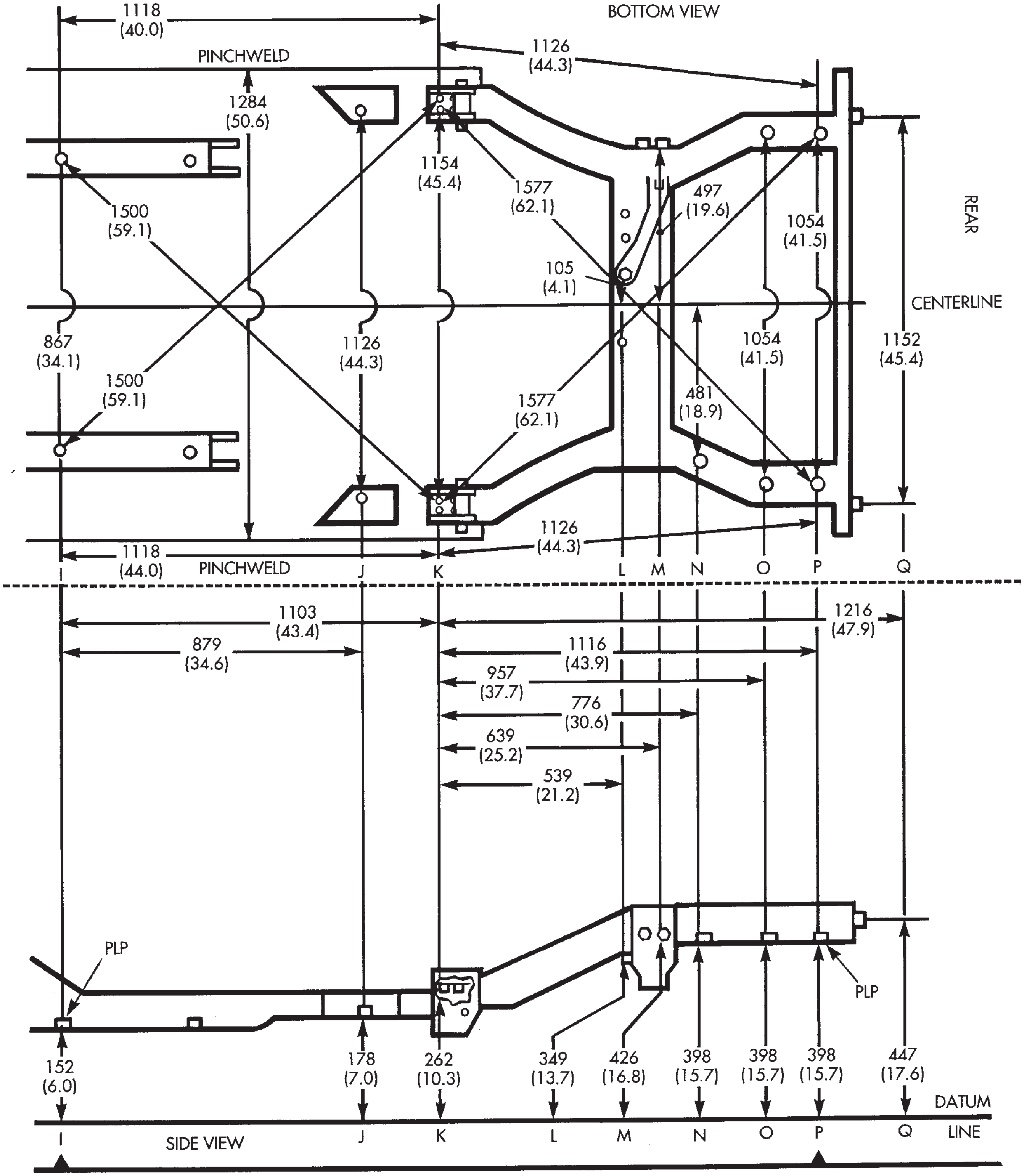
Fig. 9 Rear Frame Dimensions—AG-Body



MEASURING POINT LOCATIONS
- I - Center of 25 mm Round Hole
- J - Center of 16 mm Round Hole
- K - Center of 25 mm Round Hole
- L - Center of Front Inner Bolt – Rear Suspension Mount
- M - End of Stud – Inner End of Brace for Panhard Rod
- N - Head of Rear Bolt – Panhard Rod Bracket
- O - P.S. – Center of 25 mm Round Hole
- P - Center of 25 mm Round Hole – Third From Rear
- Q - Center of 25 mm Round Hole – Rear of Frame
- R - End of Outer Bolt – Rear Bumper Bracket
- D.S. - DRIVER SIDE
- P.S. - PASSENGER SIDE
- ● - BOLTS
- ○ - HOLES
- ▲ - DATUM LINE CONTROL POINT

9213-10

Fig. 10 Rear Frame Dimensions—AJ-Body



MEASURING POINT LOCATIONS
J - Center of 25 mm Round Hole
K - Center of Front Inner Bolt – Rear Suspension Mount
L - D.S. – End of Stud – Inner End of Brace for Panhard Rod
M - D.S. – Head of Rear Bolt – Panhard Rod Bracket
N - P.S. – Center of 25 mm Round Hole
O - Center of 25 mm Round Hole
P - Center of 25 mm Round Hole
Q - End of Outer Bolt – Rear Bumper Bracket
D.S. - DRIVER SIDE
P.S. - PASSENGER SIDE
● - BOLTS
○ - HOLES
▲ - DATUM LINE CONTROL POINT

9213-11

Fig. 11 Rear Frame Dimensions—AP-Body

CROSSMEMBER

REMOVAL (FIG. 12)

(1) Hoist vehicle and support on safety stands. Refer to Group 0, Lubrication and Maintenance for proper procedures.

(2) Remove front wheels.

(3) Disconnect lower ball joints from the knuckle assembly. Refer to Group 2, Suspension for proper procedures.

(4) Disconnect power steering hose tie-down from rear upper edge of crossmember, if equipped.

(5) Remove bolts holding steering gear to crossmember. Refer to Group 19, Steering for proper procedures.

(6) Remove bolt holding engine damper strut to crossmember, if equipped with manual transaxle.

(7) Support crossmember on a suitable lifting device.

(8) Remove nuts holding rear of crossmember to the frame.

(9) Remove bolts holding crossmember to frame from above lower control arms.

(10) Separate the crossmember from the vehicle.

(11) Transfer lower control arms and sway eliminator shaft to new crossmember, if crossmember is being replaced. Refer to Group 2, Suspension for proper procedure.

CROSSMEMBER INSTALLATION

Reverse the preceding operation.

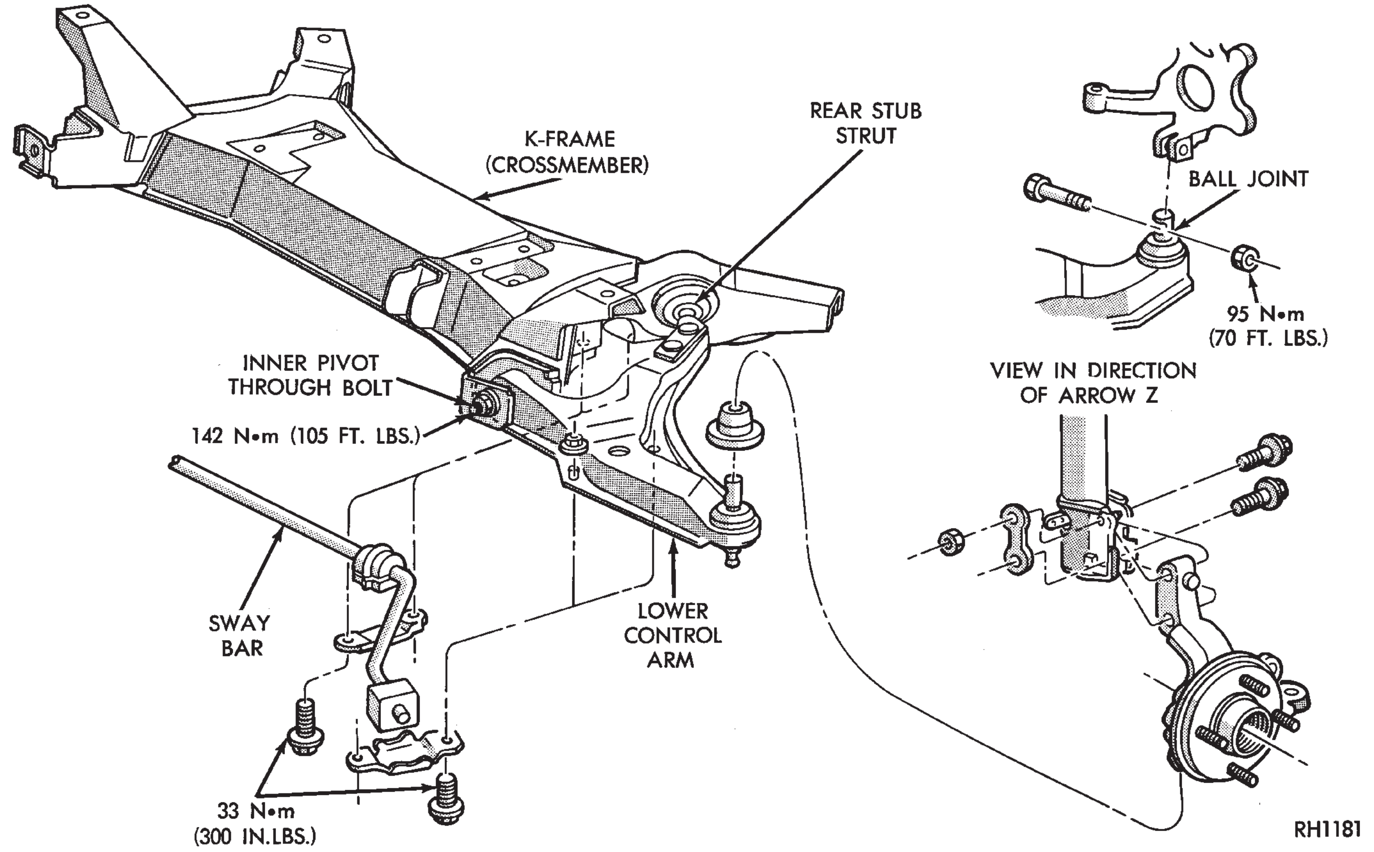


Fig. 12 Crossmember

STEERING

CONTENTS

GENERAL INFORMATION

Safety goggles should be worn at all times when working on any steering gear or pump.

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 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 power steering 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 steering effort increases as in a turn, the torsion bar twists, causing relative rotary motion between the rotary valve body and valve spool. This movement directs oil behind the integral rack piston, which in turn, builds up hydraulic pressure and assists in the turning effort.

POWER STEERING PUMPS

INDEX

GENERAL INFORMATION

Hydraulic pressure for operation of the power steering gear is provided by a belt driven power steering pump. The power steering pump is a constant flow rate and displacement, vane type pump. Different styles of Saginaw power steering pumps are used depending on the engine application of the vehicle.

On all four cylinder and 3.0-liter V-6 applications the Saginaw Ham Can power steering pump is used (Fig. 1).

On the 3.3 & 3.8-liter V-6 and Turbo III applications, different versions of the Saginaw T/C style power steering pump is used (Fig. 2). The 3.3 & 3.8 liter V-6 engine application uses the T/C style power steering pump with a remote mounted reservoir for the power steering fluid. On the Turbo III application of the T/C style power steering pump, the power steering fluid reservoir is integral to the power steering pump.

On the integral reservoir type pump (Fig. 1) the pump housing and internal components are combined with the reservoir to form a one-piece mechanism.

The Saginaw T/C style power steering pump (Fig. 2), consists of the power steering pump internal components and pump housing. The Saginaw T/C style power steering pump though has no internal reservoir for the power steering fluid. Depending on vehi-

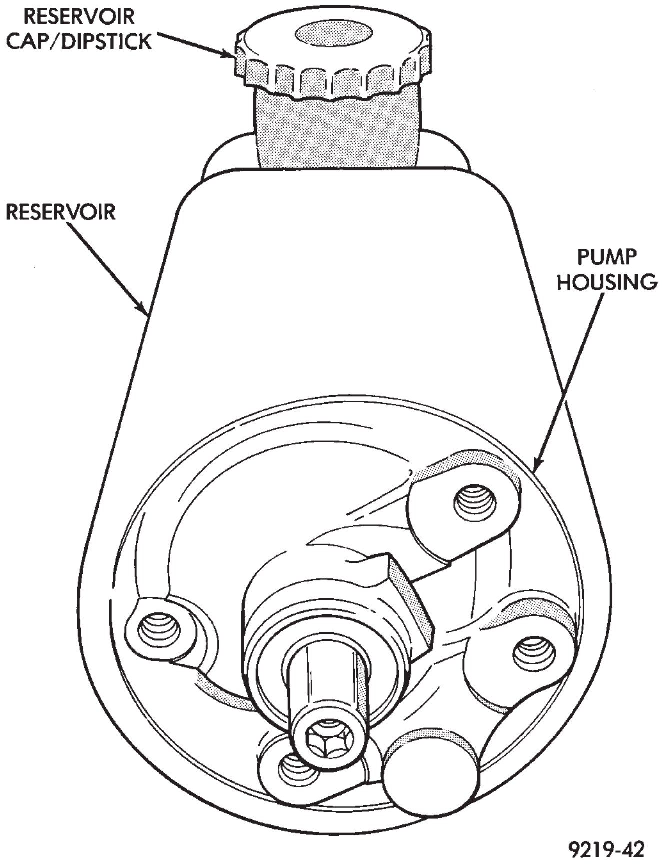


Fig. 1 Saginaw Ham Can Power Steering Pump

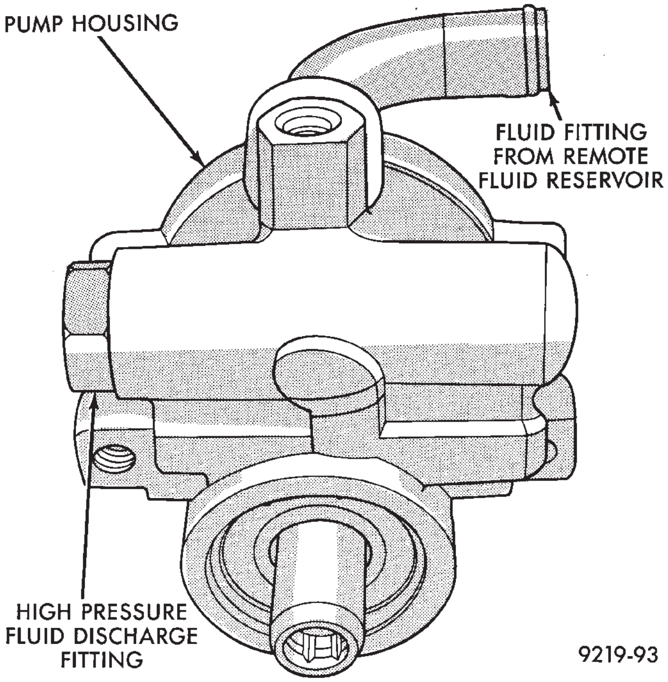


Fig. 2 Saginaw T/C Style Power Steering Pump

cle and or engine application the Saginaw T/C style power steering pump is used on, it will be equipped with a plastic integral or remote mounted power steering fluid reservoir.

Drive tangs on the power steering gear pinion, mate loosely with the stub shaft of the steering gear. This will 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.

STEERING COMPONENTS SERVICE DIAGNOSIS

POWER STEERING PUMP SERVICE

The service procedures for the Saginaw power steering pump are limited to the areas and components listed below. **No repair procedures are to be done on internal components of the Saginaw power steering pumps.**

- Repair of power steering fluid leaks from areas of the power steering pump sealed by O-rings is allowed (See Pump Leak Diagnosis). However power steering pump shaft seal leakage will require replacement of the pump.
- Power steering fluid reservoirs, related components and attaching hardware.
- Power steering fluid reservoir filler cap/dipstick assemblies.

Because of unique shaft bearings, flow control levels or pump displacements, power steering pumps may be used only on specific vehicle applications. Be sure that all power steering pumps are only replaced with a pump that is the correct replacement for that specific application.

Hydraulic pressure is provided for operation of the power steering gear by the belt driven power steering pumps (Fig. 1 & 2). It is a constant displacement, vane type pump. The power steering pump is connected to the steering gear by a power steering fluid pressure hose and return hose.

Rectangular pumping vanes in the shaft driven rotor, move power steering fluid from the intake to the cam ring pressure cavities of the power steering pump. As the rotor begins to turn, centrifugal force throws the vanes against the inside surface of the cam ring to pickup residual oil. This oil is then forced into the high pressure area. As more oil is picked up by the vanes. That additional oil is forced into the cavities of the thrust plate through two crossover holes in the cam ring and pressure plate. The crossover holes empty into the high pressure area between the pressure plate and the housing end cover.

As the high pressure area is filled, oil flows under the vanes in the rotor slots, forcing the vanes to follow the inside surface of the cam ring. As the vanes reach the restricted area of the cam ring, oil is forced out from between the vanes. When excess oil flow is generated during high-speed operation, a regulated amount of oil returns to the pump intake side through a flow control valve. The flow control valve reduces the power required to drive the pump and holds down temperature build-up.

POWER STEERING SERVICE DIAGNOSIS

STEERING NOISES

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 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 valve orifice edges. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.

CONDITION	POSSIBLE CAUSE	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Noisy valve in gear	1. Check for proper seal between steering column coupling and dash seal. 2. Ensure steering column lower coupling has no metal-to-metal contact within the coupling by performing an electrical continuity check. (Remove coupling for check.) 3. If hiss is still extremely objectionable, replace steering gear.
RATTLE OR CLUNK	1. Gear loose on front crossmember	1. Check gear-to-crossmember mounting bolts. Tighten to specification.
	2. Crossmember-to-frame bolts or studs loose	2. Torque bolts and studs to specifications.
	3. Tie rod looseness (outer or inner)	3. Check tie rod pivot points for wear. Replace if necessary.
	4. Pressure hose touching other parts of vehicle	4. Adjust hose to proper position by loosening, repositioning, and retightening fitting. Do not bend tubing.
	5. Noise internal to gear	5. Replace gear.
CHIRP OR SQUEAL (IN THE AREA OF PUMP) PARTICULARLY NOTICEABLE AT FULL WHEEL TRAVEL AND DURING STANDSTILL PARKING	1. Loose belt	1. Adjust belt tension to specification.

9219-44

POWER STEERING SERVICE DIAGNOSIS

<table>
<tr><th colspan="3">STEERING NOISES — Continued</th></tr>
<tr><td colspan="3">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 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 valve orifice edges. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.</td></tr>
<tr><th>CONDITION</th><th>POSSIBLE CAUSES</th><th>CORRECTION</th></tr>
<tr><td colspan="3">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 hoses touching the vehicle body, can create a noise level that could bring complaints.</td></tr>
<tr><td>WHINE OR GROWL (PUMP NOISE)</td><td>1. Low fluid level.
2. Hose touching vehicle body or frame.
3. Extreme wear of pump internal parts.</td><td>1. Fill to proper level and perform leakage diagnosis. (Recheck after system is free of aeration.)
2. Reposition hose. Replace hose if tube ends are bent.
3. Replace pump and flush system.</td></tr>
<tr><td>SUCKING AIR SOUND</td><td>1. Loose return line clamp.
2. Missing O-ring on hose connection.
3. Low fluid level.
4. Air leak between reservoir and pump.</td><td>1. Tighten or replace clamp.
2. Inspect connection and replace O-ring as required.
3. Fill to proper level and perform leakage diagnosis.
4. Inspect and replace reservoir as required.</td></tr>
<tr><td>SQUEAK OR RUB SOUND</td><td>1. Sound from steering column.
2. Sound internal to steering gear.</td><td>1. Check for squeak in steering column. Inspect for contact between shroud intermediate shaft, column, and wheel. (Realign if necessary.)
(a) Check for lack of grease on steering column, dash to lower coupling seal.
2. Replace gear.</td></tr>
<tr><td>SCRUBBING/KNOCKING</td><td>1. Incorrect tire size.
2. Check clearance between tires and other vehicle components, through full travel.
3. Check for interference between steering gear and other components.
4. Incorrect gear supplied.</td><td>1. Verify tire size is the same as originally supplied.
2. Correct as necessary.
3. Correct as necessary.
4. Replace gear.</td></tr>
</table>

9219-45

POWER STEERING SERVICE DIAGNOSIS

BINDS STICKS SEIZED

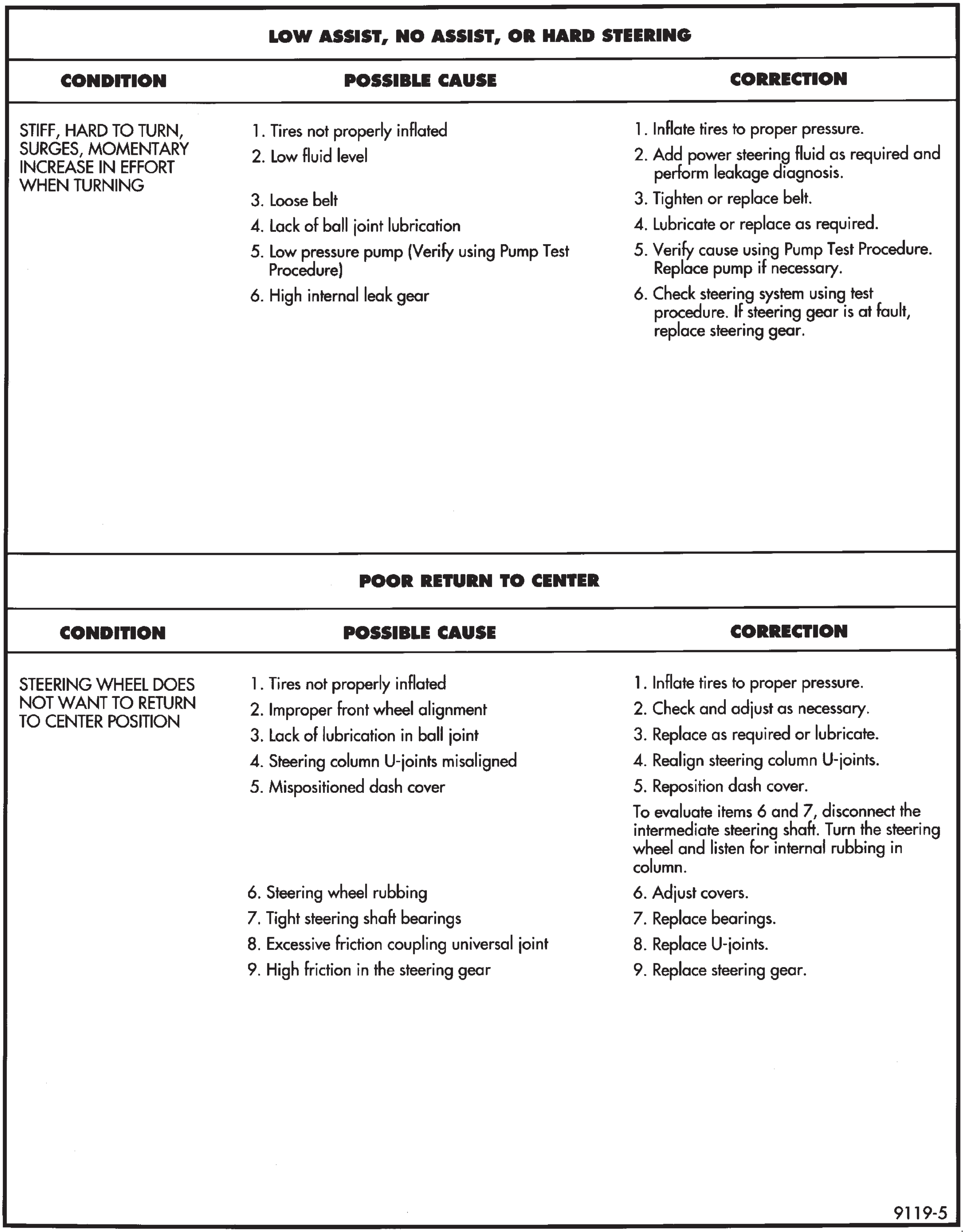
CONDITION	POSSIBLE CAUSE	CORRECTION
CATCHES, STICKS IN CERTAIN POSITIONS OR DIFFICULT TO TURN	1. Low fluid level	1. Fill to proper level and perform leakage diagnosis.
	2. Tires not properly inflated	2. Inflate tires to proper pressure.
	3. Lack of lube in ball joints	3. Lubricate where possible.
	4. Lack of lube in outer tie rod ends	4. Lubricate where possible.
	5. Loose pump belt	5. Tighten or replace belt.
	6. Faulty pump flow control (Verify cause using Pump Test Procedure)	6. Replace pump.
	7. Excessive friction in steering column or intermediate shaft	7. Correct condition. (See Steering Column Service Procedure.)
	8. Steering column coupling binding	8. Realign as necessary.
	9. Excessive friction in gear	9. Replace gear.

SHAKE SHUDDER VIBRATION

CONDITION	POSSIBLE CAUSE	CORRECTION
VIBRATION OF THE STEERING WHEEL AND/ OR DASH DURING DRY PARK OR LOW SPEED STEERING MANEUVERS	1. Air in the power steering 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. Tires not properly inflated	2. Inflate tires to proper pressure.
	3. Excessive engine vibration	3. Make sure that engine is running properly.
	4. Loose tie rod end	4. Check inner and outer tie rod and jam nut for excessive free play.
	5. Faulty accessory drive belt tensioner. (Poly-V belt systems only)	5. Check dynamic belt tensioner for abnormal vibration. (See Drive Belt Adjustments.)
	6. Overcharged air conditioner	6. Check air conditioning pump head pressure. (See Air Conditioning Refrigerant System Diagnosis.)

9219-46

POWER STEERING SERVICE DIAGNOSIS



LOW ASSIST, NO ASSIST, OR HARD STEERING

CONDITION	POSSIBLE CAUSE	CORRECTION
STIFF, HARD TO TURN, SURGES, MOMENTARY INCREASE IN EFFORT WHEN TURNING	1. Tires not properly inflated	1. Inflate tires to proper pressure.
	2. Low fluid level	2. Add power steering fluid as required and perform leakage diagnosis.
	3. Loose belt	3. Tighten or replace belt.
	4. Lack of ball joint lubrication	4. Lubricate or replace as required.
	5. Low pressure pump (Verify using Pump Test Procedure)	5. Verify cause using Pump Test Procedure. Replace pump if necessary.
	6. High internal leak gear	6. Check steering system using test procedure. If steering gear is at fault, replace steering gear.

POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSE	CORRECTION
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tires not properly inflated	1. Inflate tires to proper pressure.
	2. Improper front wheel alignment	2. Check and adjust as necessary.
	3. Lack of lubrication in ball joint	3. Replace as required or lubricate.
	4. Steering column U-joints misaligned	4. Realign steering column U-joints.
	5. Mispositioned dash cover	5. Reposition dash cover.
		To evaluate items 6 and 7, disconnect the intermediate steering shaft. Turn the steering wheel and listen for internal rubbing in column.
	6. Steering wheel rubbing	6. Adjust covers.
	7. Tight steering shaft bearings	7. Replace bearings.
	8. Excessive friction coupling universal joint	8. Replace U-joints.
	9. High friction in the steering gear	9. Replace steering gear.

9119-5

POWER STEERING SERVICE DIAGNOSIS

LOOSE STEERING

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE WHEEL KICKBACK OR TOO MUCH STEERING WHEEL PLAY	1. Air in system	1. Add fluid.
	2. Gear loose on crossmember	2. Check gear to crossmember mounting bolts. Tighten to specification.
	3. Worn/broken intermediate shaft	3. Check for worn universal joint and broken isolator. Replace intermediate shaft if worn.
	4. Free play in steering column	4. Check and replace as required.
	5. Loose ball joints	5. Check and replace as required.
	6. Pinch bolt loose on ball joint	6. Check pinch bolts and tighten as required to specified torque.
	7. Front wheel bearings loose or worn	7. Tighten hub nut or replace with new parts as necessary.
	8. Loose outer tie rod ends	8. Check and replace as required.
	9. Loose inner tie rod ends	9. Replace gear.
	10. Defective steering gear rotary valve	10. Replace gear.

VEHICLE LEADS TO THE SIDE

CONDITION	POSSIBLE CAUSE	CORRECTION
WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Radial tire lead	1. Rotate tires as recommended in Tire Service.
	2. Front end misaligned	2. Align front end as recommended in Wheel Alignment Service Procedure.
	3. Wheel braking	3. Check for dragging brakes as directed in Brake Service Procedure.
	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. Checking for pull with outer tie rod end disconnected. If verified, replace gear.

9219-47

POWER STEERING SERVICE DIAGNOSIS

FLUID LEAK

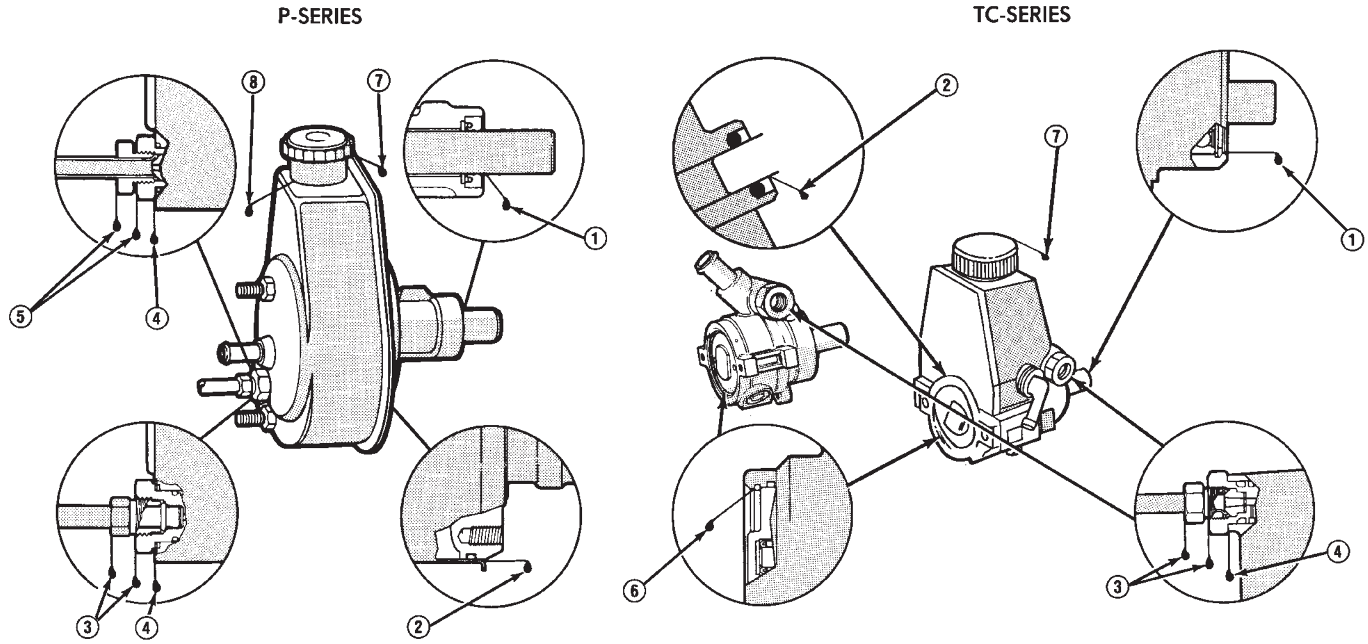
CONDITION	POSSIBLE CAUSES	CORRECTION
LOW FLUID LEVEL WITH: • NO VISIBLE SIGNS OF LEAKS ON THE STEERING GEAR, PUMP, ON FLOOR, OR ANYWHERE ELSE	1. Overfilled reservoir. 2. Hose connections at pump or gear.	1. Adjust fill level. 2. Check for loose fittings and tighten to specifications. If fittings are tight, examine for damaged or missing O-ring and replace as required.
LOW FLUID LEVEL WITH: • VISIBLE LEAK ON STEERING GEAR, PUMP, FLOOR, OR ANYWHERE ELSE	3. Pump or gear leak.	3. Identify location of leak and repair or replace as indicated in Power Steering Pump and/or Gear sections of this service manual.

FOAMY OR MILKY FLUID

CONDITION	POSSIBLE CAUSES	CORRECTION
AERATION AND OVERFLOW OF FLUID	1. Air leaks.	1. Check for air leak as described under sucking air and correct.
	2. Low fluid level.	2. Extremely cold temperatures may cause system aeration if the oil level is low. Add fluid as required.
	3. Cracked pump housing.	3. Remove pump from vehicle and separate reservoir from housing. Check expansion plug and housing for cracks. Replace pump as required.
	4. Water contamination.	4. Drain and refill fluid if there is evidence of contamination.

9119-7

PUMP LEAKAGE DIAGNOSIS



1. Bushing (bearing) worn, seal worn. Replace pump.
2. Replace reservoir O-ring seal.
3. Torque hose fitting nut to 35 N•m (25 ft. lbs.). If leakage persists, replace O-ring seal.
4. Torque fitting to 75 N•m (55 ft. lbs.). If leakage persists, replace O-ring seal.
5. Torque hose fitting nut to 48 N•m (35 ft. lbs.). If leakage persists, replace pump.
6. Replace pump.
7. Check oil level; if leakage persists with the level correct and cap tight, replace the cap.
8. If a cracked or bent reservoir is detected, replace reservoir.

J9219-34

When steering conditions exceed maximum pressure requirements, such as when the wheels are turned against the stops. The pressure built up in the steering gear exerts pressure on the spring end of the flow control valve. The high pressure lifts the relief valve ball from its seat and allows oil to flow through a trigger orifice located in the outlet fitting. This reduces pressure on the spring end of the flow control valve which then opens and allows the oil to return to the intake side of the pump. This action limits maximum pressure output of the pump to a safe level.

Under normal power steering pump operating conditions, pressure requirements of the pump are below maximum, causing the pressure relief valve to remain closed.

CHECKING POWER STEERING FLUID LEVEL

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, before checking power steering fluid level. The dipstick should indicate FULL 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 to obtain proper level, using only **Mopar® Power Steering Fluid, or equivalent. DO NOT USE ANY TYPE OF AUTOMATIC TRANSMISSION FLUID.**

POWER STEERING PUMP PRESSURE TEST

The following procedure can be used to test the operation of the power steering system on the vehicle.

(1) Check power steering pump drive belt tension and adjust as necessary.

(2) Disconnect power steering fluid pressure hose, at steering gear or power steering pump. Use a container for dripping fluid.

(3) Connect Pressure Gauge, Special Tool C-3309-E (Fig. 1) to both hoses using adapter fittings. Connect spare pressure hose to gear or pump.

(4) Completely open valve on Special Tool C-3309-E (Fig. 1).

(5) Start engine and let idle.

(6) Check power steering fluid level, and add fluid as necessary.

(7) Gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure should be in the range of 345-552 kPa (50-80 psi).

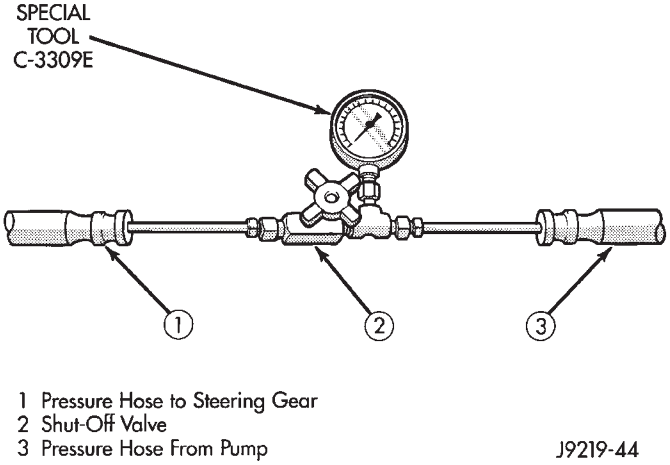


Fig. 1 Pressure Test Gauge

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 above specifications and within 345 kPa (50 psi) of each other.**

Power steering pump maximum relief pressure is 8275 to 8975 kPa (1200 to 1300 psi.).

- Power steering pump pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
- Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.

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.

POWER STEERING PRESSURE SWITCH

New for 1993 M.Y., is the use of an idle quality power steering pressure switch on some front wheel drive passenger car applications.

The purpose of this switch is to signal the power train control module, that the power steering system is putting additional load on the engine. This type of condition exists when turning the front tires of the vehicle, when the vehicle is stationary and the engine is at idle speed. When this condition is sensed by the power train control module, through a signal from the power steering pressure switch, engine idle speed is increased. This increase in engine idle speed compensates for the additional load, thus maintaining the require engine idle speed and idle quality.

The power steering pressure switch is mounted to the power steering pressure hose on the applications that require its usage. Refer to (Fig. 1 and 2) below for the pressure switch location on the different engine applications.

REMOVE

(1) Locate power steering pressure switch on power steering pressure hose. Refer to (Fig. 1 and 2) for the engine application showing the location of the power steering switch.

(2) Remove vehicle wiring harness connector from the power steering pressure switch.

(3) Remove power steering pressure switch, from power steering pressure hose.

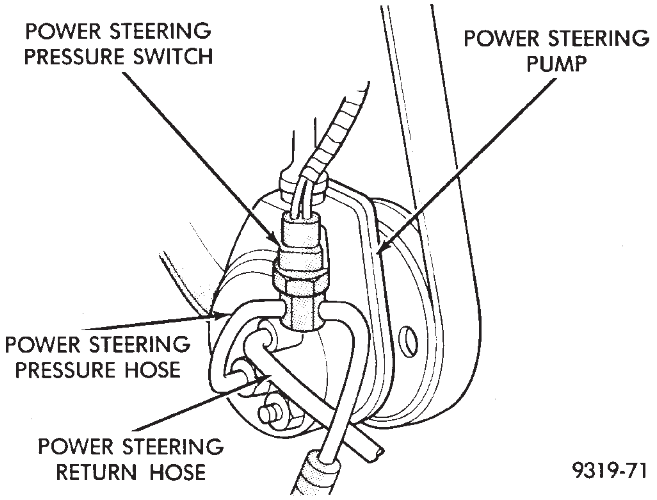


Fig. 1 Power Steering Pressure Switch Location 3.0L

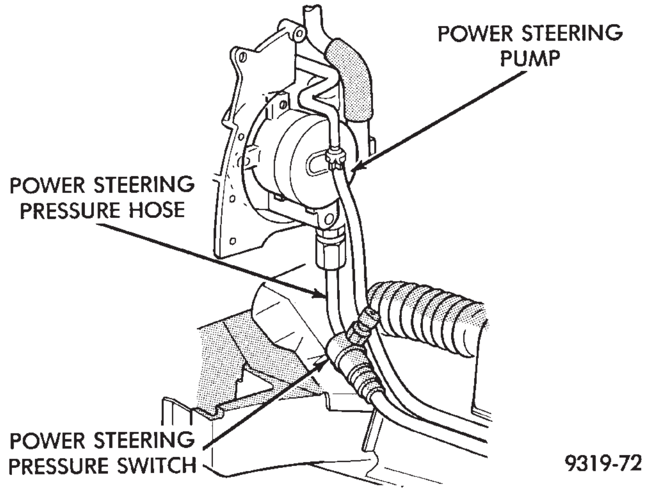


Fig. 2 Power Steering Pressure Switch Location 3.3 & 3.8L

INSTALL

(1) Install power steering pressure switch into fitting on power steering pressure hose by hand until fully seated. Then torque power steering pressure switch to 12 N●m (106 in. lbs.).

(2) Install vehicle wiring harness connector onto power steering pressure switch. Be sure latch on wiring harness connector is fully engaged with locking tab on power steering pressure switch.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(3) Fill power steering pump reservoir to correct fluid level.

(4) Connect negative cable back on negative post of battery.

(5) 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 HOSES

Service all power steering hoses with the vehicle raised on a 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 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 on the vehicle being serviced, refer to Figs. 3 to 6. 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.

REMOVAL

(1) Remove vehicle's wiring harness connector (if applicable to vehicle being serviced) from the power steering pressure switch (Fig. 1 & 2).

(2) Remove bolts from power steering hose routing brackets to crossmember attachment points.

(3) Disconnect power steering hose at opening closest to power steering gear assembly. Drain power steering fluid from power steering pump and hose through open end of hose.

(4) Disconnect opposite end of hose and remove power steering hose assembly from vehicle.

(5) Discard O-ring or sealing washer located at end of tube.

(6) Remove power steering pressure switch, from the removed power steering hose for installation into the replacement power steering hose.

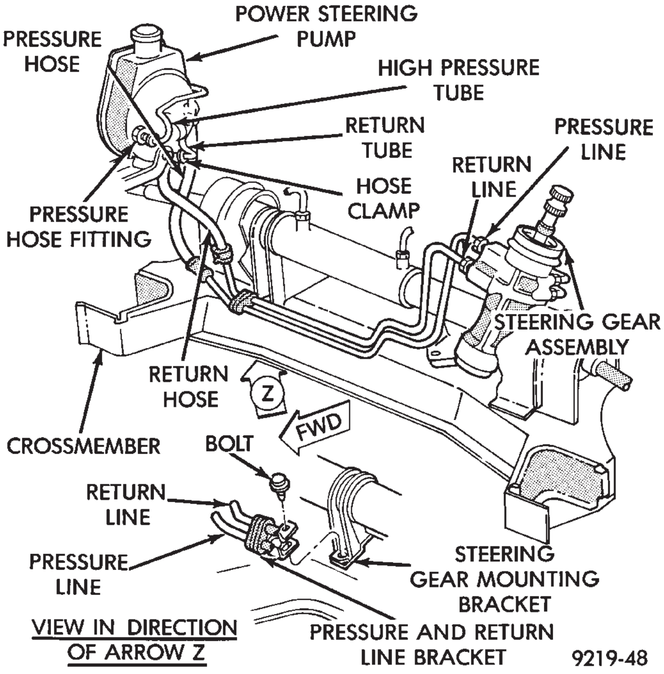


Fig. 3 Power Steering Hose Routing 2.2 & 2.5L

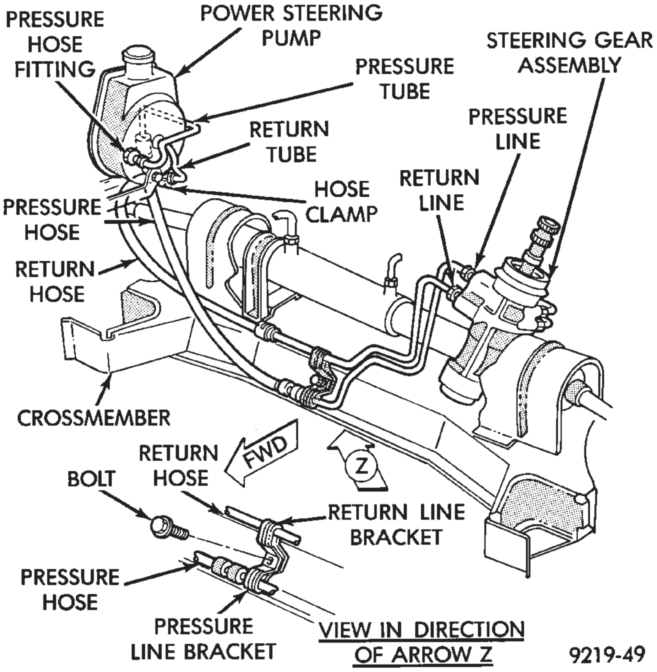


Fig. 4 Power Steering Hose Routing 3.0L

INSTALLATION

(1) Install the removed power steering pressure switch into replacement power steering pressure hose. Torque power steering pressure switch to 12 N●m (106 in. lbs.).

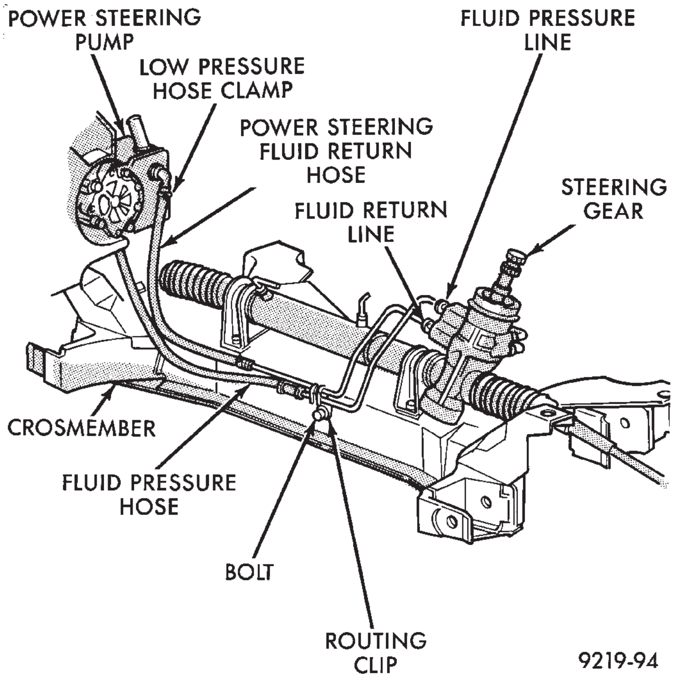


Fig. 5 Power Steering Hose Routing 3.3 & 3.8L

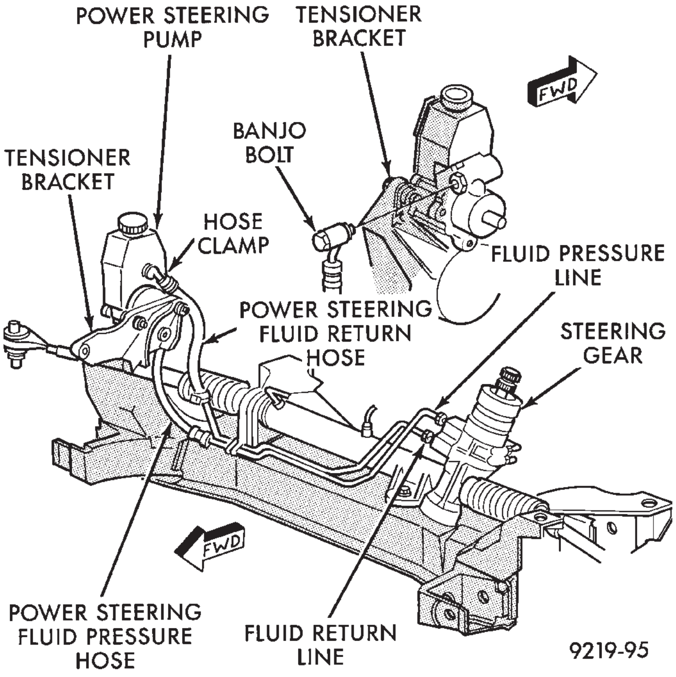


Fig. 6 Power Steering Hose Routing Turbo III

(2) Using a lint free towel, wipe clean open power steering hose ends, power steering pump and steering gear ports.

(3) Install new O-rings or sealing washers on the ends of the power steering hoses. Lubricate O-rings or sealing washers using clean power steering fluid.

(4) Attach power steering hose to proper connections at power steering pump and steering gear. Correctly route power steering hoses avoiding tight bends or kinking of the hose. Install power steering hose to crossmember routing bracket. **Hoses must remain away from exhaust system, vehicle components and unfriendly surfaces causing possible damage to power steering hoses.**

(5) Tighten all fasteners shown for specific applications in (Fig. 1 to 4) to their correct torques listed below:

- Pump End Banjo Bolt — 34 N●m (25 ft. lbs.)
- Pump End Tube Nut — 34 N●m (25 ft. lbs.)
- Gear End Tube Nuts (2) — 34 N●m (25 ft. lbs.)
- Crossmember Bracket Bolt — 23 N●m (17 ft. lbs.)
- Pump Bracket Nut — 40 N●m (30 ft. lbs.)
- Gear Bracket Bolt — 68 N●m (50 ft. lbs.)

(6) Install vehicle's wiring harness connector (if applicable to vehicle being serviced) onto the power steering pressure switch (Fig. 1 & 2).

(7) When used, protective sponge sleeves must be properly positioned on power steering hoses. This is to prevent hose contact with other components.

(8) After hose is installed, check for leaks. (See Pump Installation).

POWER STEERING PUMP REMOVAL

WARNING: POWER STEERING OIL, ENGINE COMPONENTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES, OR ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

2.2 & 2.5 LITER

REMOVE

(1) Remove battery cable from (-) negative post on battery and isolate cable.

(2) Loosen power steering pump adjustment bolt and rotate power steering pump forward in bracket. Remove power steering pump drive belt from power steering pump (Fig. 1). It is not necessary to remove power steering pump drive belt from engine.

(3) Raise vehicle See Hoisting, Group 0. Remove hose clamp and low pressure fluid hose from power steering pump (Fig. 2).

(4) Remove power steering fluid pressure line (Fig. 2) from power steering pump. Drain excess power steering fluid from line.

(5) Loosen but do not remove nut, holding back of power steering pump to its mounting bracket (Fig. 3). Then remove bolt attaching pulley side of power steering pump to the mounting bracket (Fig. 3).

(6) Lower Vehicle. Then remove bolt, retaining power steering pump in adjusting slot of power steering pump mounting bracket (Fig. 3).

(7) Remove power steering pump from top of engine compartment, using the following procedure. Lifting power steering pump out of mounting

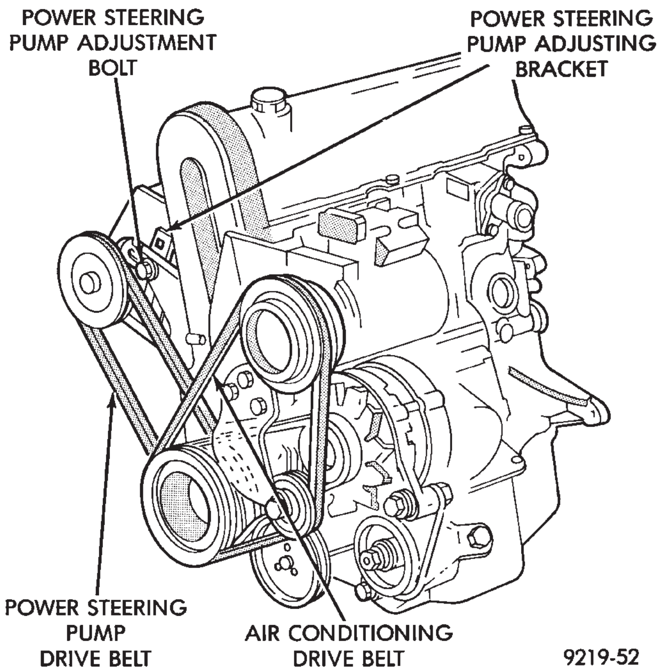


Fig. 1 Power Steering Pump Drive Belt Removal

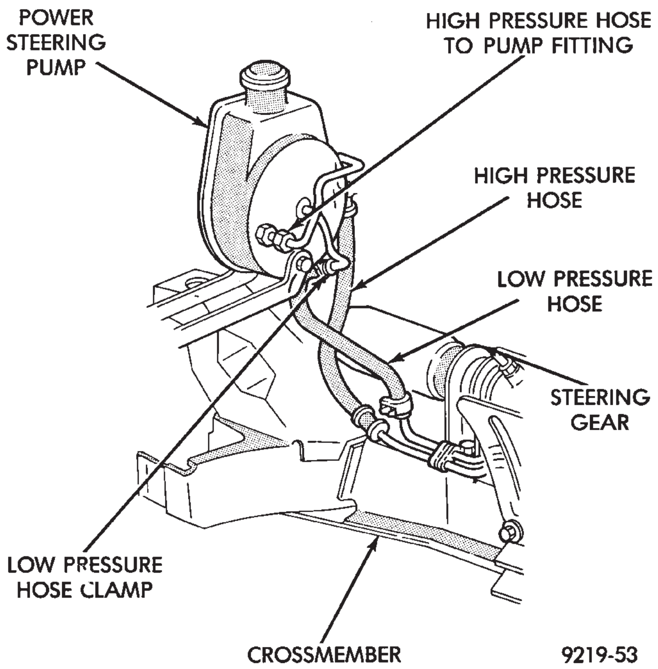


Fig. 2 Power Steering Fluid Hoses

bracket, rotating pump 90° and remove it out between engine and dash panel.

(8) Transfer required parts from removed power steering pump, to replacement power steering pump.

INSTALL

(1) Install power steering pump back in vehicle in the reverse order of removal.

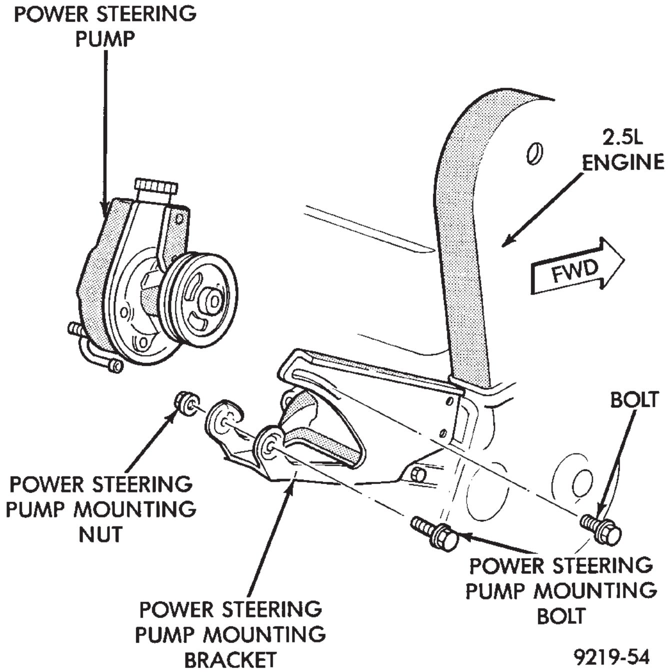


Fig. 3 Power Steering Pump Remove And Install

(2) Install power steering pump back on mounting bracket, being sure stud on back of power steering pump is in slotted hole in mounting bracket. Install bolt attaching power steering pump to adjusting slot in bracket (Fig. 3), **but do not tighten nut or bolt.**

(3) Raise vehicle See Hoisting, Group 0.

(4) Install bolt attaching pulley side of power steering pump to power steering pump mounting bracket (Fig. 3). **Do not fully tighten power steering pump mounting bolts at this time.**

(5) Install power steering fluid pressure line into output fitting on power steering pump (Fig. 2). Torque power steering pressure line tube nut to 31 N●m (275 in. lbs.). **Before connecting pressure line to power steering pump inspect O-ring on pressure line for damage and replace if required.**

(6) Install power steering fluid, low pressure return hose on power steering pump low pressure fitting (Fig. 2). Install hose clamp on low pressure return hose, being sure hose clamp is installed on hose past upset bead on power steering pump tube.

(7) Lower vehicle.

(8) Install power steering pump drive belt on power steering pump pulley. Using power steering pump adjusting bracket (Fig. 1), rotate pump in bracket to obtain correct belt tension. Tighten bolt at power steering pump mounting bracket adjusting slot (Fig. 1) to 54 N●m (40 ft. lbs.). Torque the power steering pump to mounting bracket pivot, nut and bolt (Fig. 1) to 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.

(9) Fill power steering pump reservoir to correct fluid level.

(10) Connect negative cable back on negative post of battery.

(11) 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

REMOVE

(1) REMOVE THE (-) NEGATIVE BATTERY CABLE FROM THE BATTERY AND ISOLATE CABLE.

(2) Remove the serpentine accessory drive belt from engine (Fig. 4). See Cooling, Group 7 for detailed removal procedure.

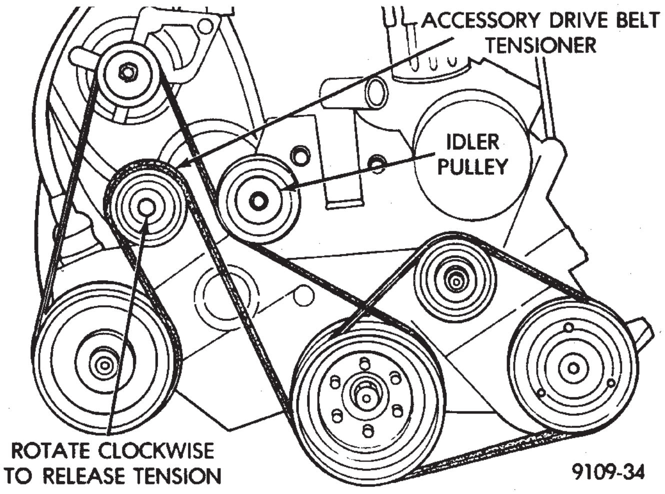


Fig. 4 3.0L Serpentine Drive Belt Routing

(3) Remove the hose clamp and bolt mounting the power steering pump filler tube and dipstick assembly (Fig. 5) to power steering pump and generator bracket. Remove filler tube and dipstick assembly from power steering pump.

(4) Raise vehicle See Hoisting, Group 0.

(5) Remove the 2 nut, bolt and spring assemblies attaching the exhaust pipe to exhaust manifold. Remove exhaust pipe from exhaust manifold and move to left side of vehicle. **This is required for clearance to remove power steering pump from vehicle.**

(6) Remove vehicle's wiring harness connector (if applicable to vehicle being serviced) from the power steering pressure switch (Fig. 6).

(7) Put oil drain pan under vehicle to catch power steering fluid. Remove hose clamp and low pressure fluid hose, from power steering gear fluid tube (Fig. 7). Allow excess power steering fluid to drain from power steering pump and hose.

(8) Loosen the high pressure power steering fluid line fitting at the power steering pump (Fig. 7). Then remove high pressure power steering fluid line from power steering pump.

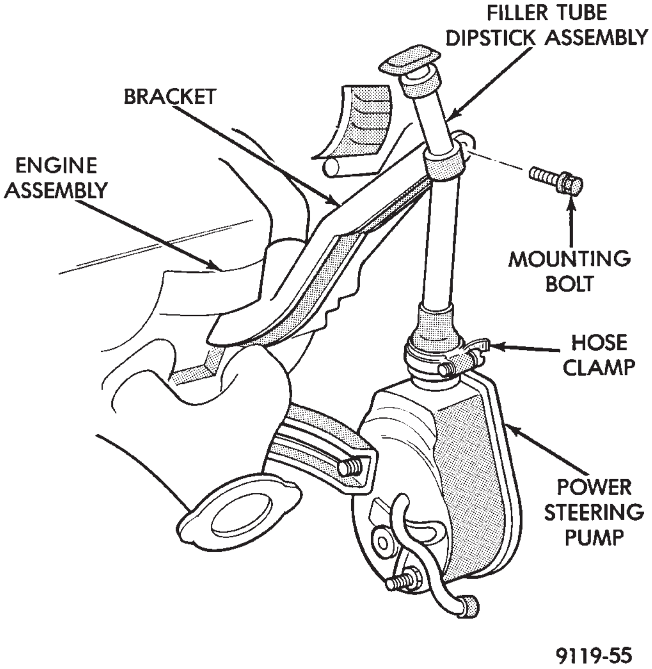


Fig. 5 Power Steering Pump Filler Tube/Dipstick Assembly

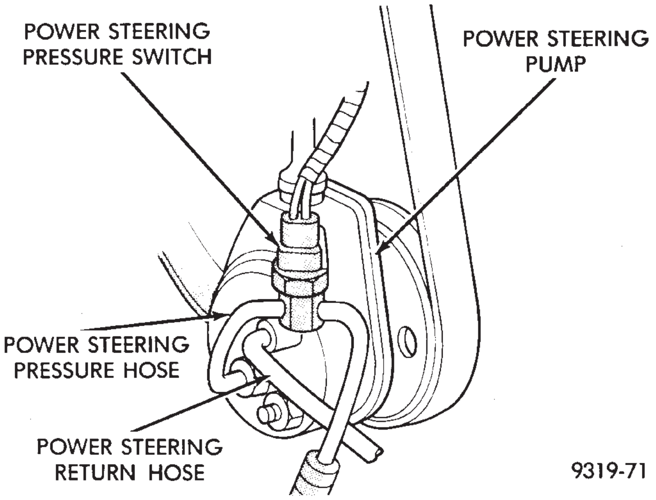


Fig. 6 Power Steering Pressure Switch Location 3.0L

(9) Remove nut holding the power steering pump rear support bracket to pump (Fig. 8). Then remove the 2 bolts (Fig. 7) mounting the power steering pump support bracket to engine and remove bracket from vehicle.

(10) Remove the 2 bolts that mount the front of the power steering pump to the mounting plate (Fig. 9). Access to the mounting bolts is through the holes in power steering pump pulley using a deep well socket.

(11) Remove the power steering pump and pulley assembly from vehicle. Remove pump assembly from vehicle in area between floor pan and front suspension crossmember. Pump will fit through area of exhaust pipe tunnel in floor pan.

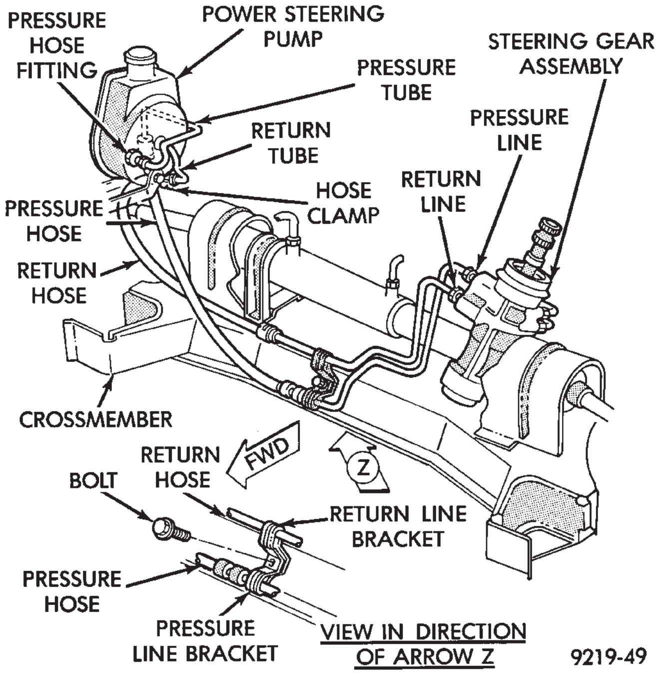


Fig. 7 Power Steering Hose Remove/Replace

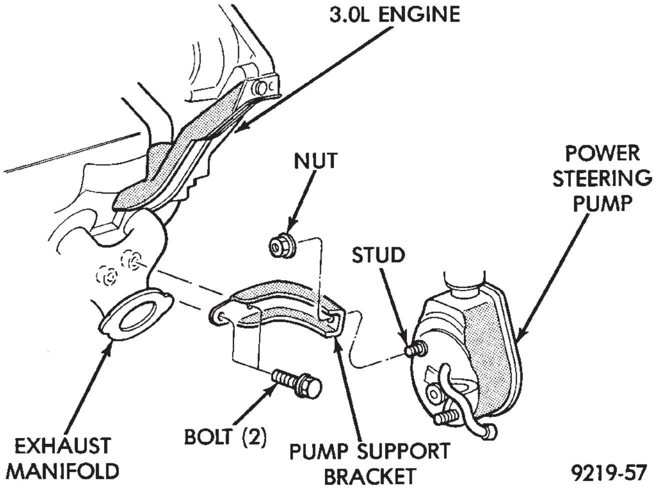


Fig. 8 Power Steering Support Bracket

(12) Transfer Required parts to the new power steering pump assembly before installing in vehicle.

INSTALL

(1) Install the power steering pump assembly back in vehicle in reverse order of removal.

(2) Hold power steering pump against mounting plate. Align power steering pump mounting holes with mounting holes in plate and install bolts (Fig. 9). Torque the 2 power steering pump to mounting plate bolts to 54 N●m (40 ft. lbs.).

(3) Install the rear power steering pump to engine block support bracket, onto the stud on back of power steering pump (Fig. 8). Then install the 2 bolts mounting the support bracket to the engine block. Torque the 2 support bracket to engine block mounting bolts to 54 N●m (40 ft. lbs.).

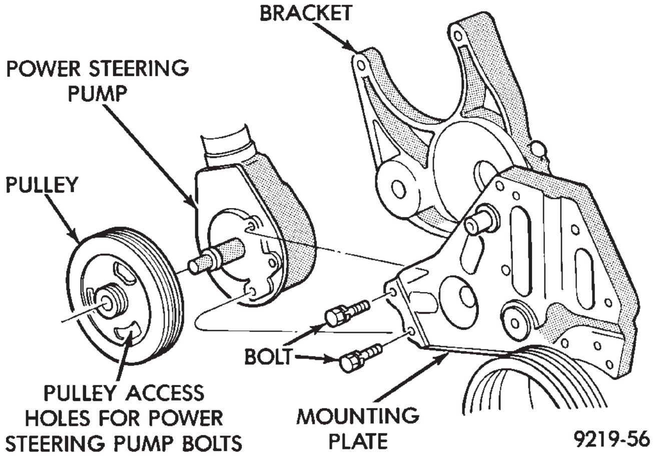


Fig. 9 Power Steering Pump Mounting 3.0L

(4) Install the nut on stud of power steering pump attaching pump to rear support bracket (Fig. 8). Torque nut to 54 N●m (40 ft. lbs.)

(5) Install the high pressure power steering fluid line on the power steering pump outlet fitting (Fig. 7). Torque the high pressure fluid line to power steering pump fitting to 31 N●m (275 in. lbs.).

(6) Install the low pressure power steering fluid hose onto the power steering gear fluid tube (Fig. 7). Install hose clamp on hose. **Be sure hose clamp is installed beyond upset bead on tube.**

(7) Install the exhaust pipe back on the exhaust manifold. Install the nut, bolt and spring assemblies and torque bolts to 28 N●m (250 in. lbs.).

(8) Install vehicle's wiring harness connector (if applicable to vehicle being serviced) onto the power steering pressure switch (Fig. 6).

(9) Lower vehicle.

(10) Install the power steering pump filler tube and dip stick assembly on the neck of the power steering pump (Fig. 5). Install the bolt (Fig. 5) attaching the filler tube/dip stick assembly to the generator bracket, then torque bolt to 11 N●m (100 in. lbs.).

(11) Position the hose clamp on the filler tube assembly rubber boot and adequately tighten hose clamp.

(12) Install the serpentine accessory drive belt on engine (Fig. 4). See Cooling, Group 7 for detailed installation procedure.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(13) Fill power steering pump reservoir to correct fluid level.

(14) Connect the negative battery cable back on the negative battery post.

(15) 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

REMOVE

(1) Remove the (-) negative battery cable from the battery and isolate cable.

(2) Remove the serpentine accessory drive belt from engine (Fig. 10). See Cooling, Group 7 for detailed removal procedure.

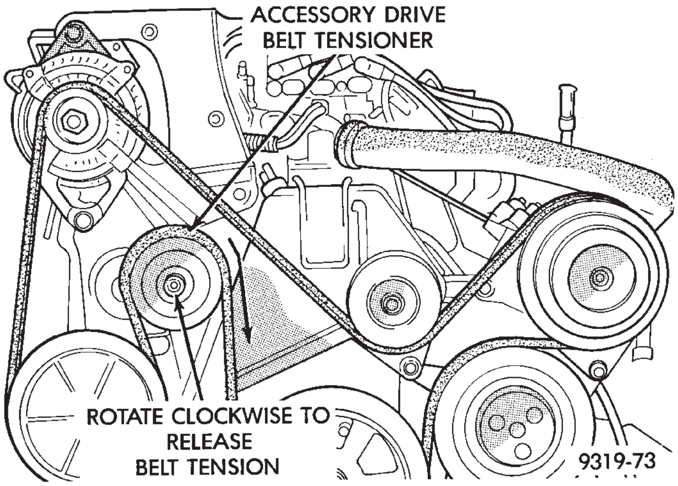


Fig. 10 Serpentine Drive Belt Routing

(3) Raise vehicle See Hoisting, Group 0.

(4) Remove vehicle's wiring harness connector (if applicable to vehicle being serviced) from the power steering pressure switch (Fig. 11).

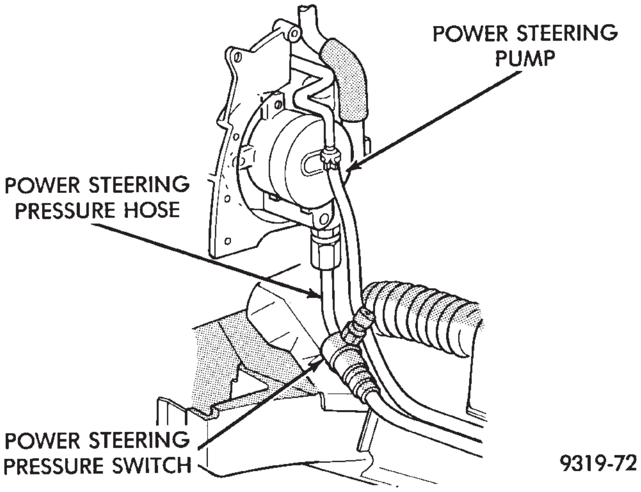


Fig. 11 Power Steering Pressure Switch Location 3.3 & 3.8L

(5) Put oil drain pan under vehicle to catch power steering fluid. Remove hose clamp and low pressure fluid hose from power steering pump (Fig. 12).

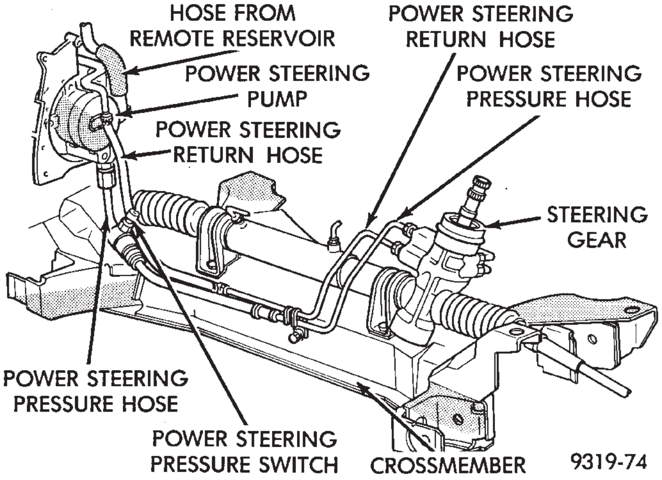


Fig. 12 Power Steering Hose Routing 3.3 & 3.8L

(6) Remove hose clamp and hose to the power steering pump, from the remote fluid reservoir (Fig. 13). Drain off excess power steering fluid from hoses.

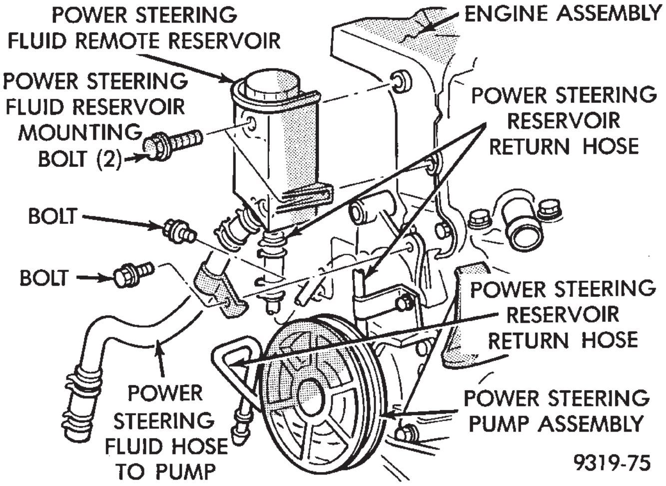


Fig. 13 Power Steering Remote Fluid Reservoir And Tube

(7) Remove the power steering, fluid pressure line (Fig. 12) from the power steering pump. Drain excess power steering fluid from tube.

(8) Remove right front wheel and tire from vehicle. This will aid in access to the power steering pump mounting bolts.

(9) Remove the 3 bolts holding the power steering pump to the generator, power steering and belt tensioner mounting bracket (Fig. 14).

(10) Remove nut and bolt holding the engine block, to power steering pump support strut. Remove strut from engine and power steering pump (Fig. 14) **Lay the power steering pump assembly down on top of the steering gear. It will be removed later from the top.**

(11) Remove nut which holds serpentine drive belt tensioner to its mounting bracket (Fig. 15). Remove tensioner assembly from bracket.

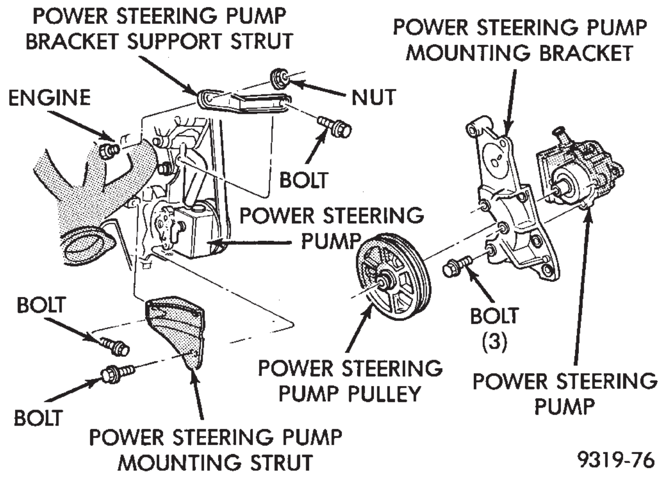


Fig. 14 Power Steering Pump Mounting 3.3 & 3.8 ltr.

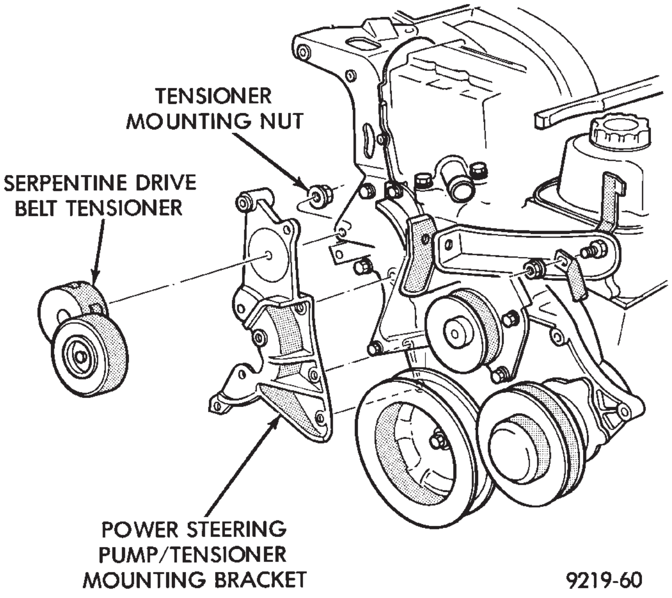


Fig. 15 Serpentine Belt Tensioner

(12) Remove nut and bolt attaching the generator/power steering pump bracket, support strut (Fig. 16).

(13) Lower vehicle.

(14) Remove the 2 bolts holding the power steering fluid reservoir to the generator bracket. Remove the bolt attaching the tube/hose assemblies to the power steering pump bracket (Fig. 17). Then remove the fluid reservoir and tube/hose as an assembly from vehicle.

(15) Remove the engine wiring harness routing clip from the generator bracket.

(16) Loosen but **DO NOT REMOVE** the bolt (Fig. 18) holding the engine bracket assembly to the engine support assembly.

(17) Remove upper generator to generator bracket mounting bolt (Fig. 19). Rotate the generator assembly back toward the dash panel.

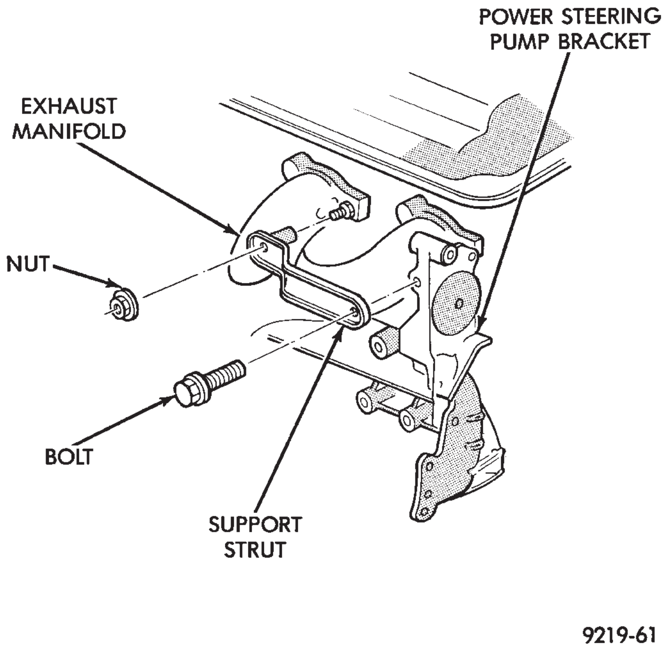


Fig. 16 Bracket Support Strut

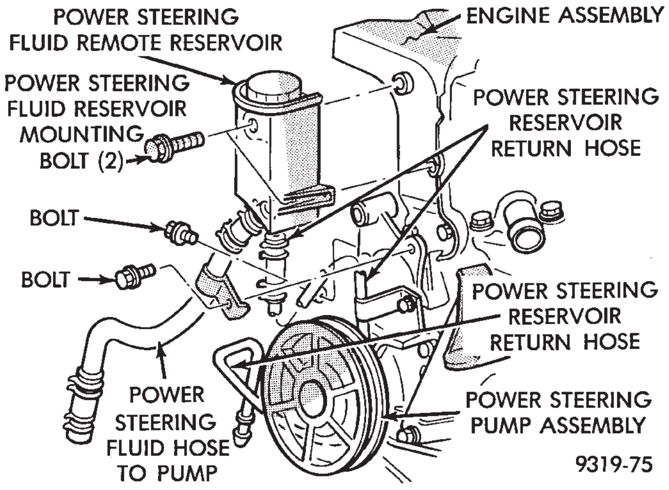


Fig. 17 Power Steering Fluid Reservoir Mounting

(18) Remove the 4 bolts holding the generator bracket to the engine and intake manifold (Fig. 19). Remove generator bracket from engine.

(17) Remove the generator assembly, to lower generator bracket bolt (Fig. 19). Without removing wiring harness from generator. Remove generator from bracket and lay generator on top of intake manifold.

(18) Remove the power steering pump out through the top, in the area between engine and dash panel where the generator was mounted.

(19) Transfer the required parts from the removed power steering pump, to the replacement power steering pump.

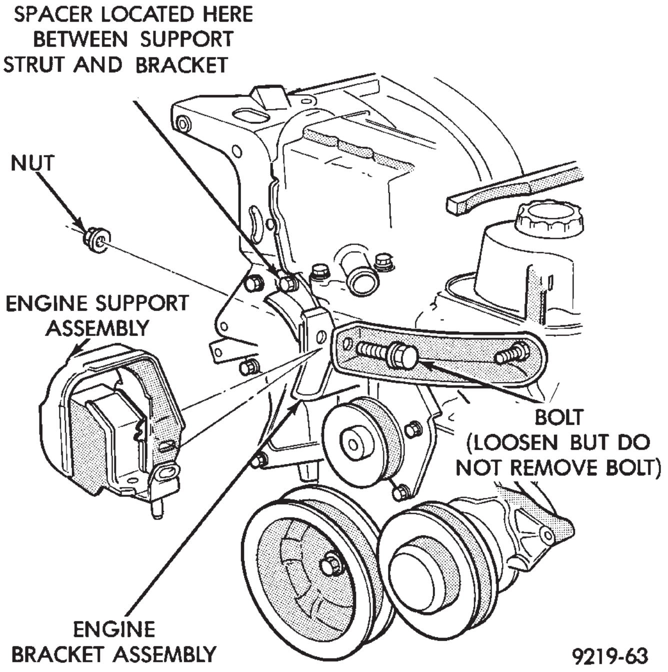


Fig. 18 Engine Bracket Support Assembly

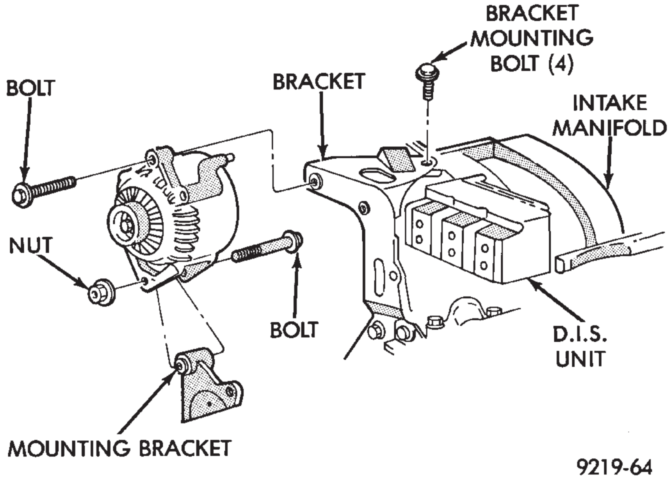


Fig. 19 Generator Mounting

INSTALL

(1) Install power steering pump back in vehicle, laying it on the steering gear. Do not mount it to the power steering pump bracket.

(2) Install generator back on the lower generator bracket and install bolt and nut (Fig. 19). Do not tighten bolt at this time.

(3) Install the generator bracket back on engine and intake manifold. Loosely install the 4 generator bracket to engine attaching bolts (Fig. 19). **Be sure the SPACER (Fig. 18) is installed between the engine mounting strut and the generator bracket.**

(4) Temporarily install the serpentine belt tensioner bolt through both generator brackets. This will align all generator bracket mounting holes (Fig. 15). Then torque the 4 generator bracket to engine and intake manifold mounting bolts to 54 N●m (40 ft. lbs.). Then remove the serpentine belt tensioner from bracket. **It will be installed on the bracket in a later step.**

(5) Tighten the bolt holding the engine bracket assembly to the engine support assembly (Fig. 18) to 150 N●m (110 ft. lbs.).

(6) Attach the engine wiring harness routing clip to the generator bracket.

(7) Install the generator to generator bracket attaching bolt (Fig. 19). Torque bolt to 54 N●m (40 ft. lbs.). Tighten the lower generator pivot bolt to 54 N●m (40 ft. lbs.).

(8) Install the power steering pump fluid reservoir and tube/hose assembly onto the power steering pump bracket and generator bracket (Fig. 17). Torque the 2 bolts holding the reservoir to the generator bracket to 5 N●m (45 in. lbs.). Torque the 1 bolt holding the tube/hose assembly to the power steering pump bracket to 12 N●m (105 in. lbs.).

(9) Raise vehicle See Hoisting, Group 0.

(10) Install the strut assembly power steering/generator bracket to engine (Fig. 16). Torque the nut and bolt holding the strut assembly to bracket and the exhaust manifold stud to 54 N●m (40 ft. lbs).

(11) Install the serpentine drive belt tensioner onto the power steering/generator bracket (Fig. 15). Install the tensioner to bracket retaining nut and torque to 54 N●m (40 ft. lbs.).

(12) Install the power steering pump on bracket, by aligning the 3 mounting holes in pump with mounting holes in bracket (Fig. 14). Install the 3 power steering pump to bracket mounting bolts. Torque power steering pump mounting bolts to 54 N●m (40 ft. lbs.).

(13) Install the support strut, engine block to power steering pump on pump stud (Fig. 14). Install the nut and bolt holding the strut to the power steering pump and engine block and torque to 54 N●m (40 ft. lbs.).

(14) Install the power steering fluid pressure line onto the output fitting of the power steering pump (Fig. 12). Torque the pressure line pump fitting nut to 31 N●m (275 in. lbs.). **Before connecting the pressure line to power steering pump inspect the O-ring on the pressure line for damage.**

(15) Install vehicle's wiring harness connector (if applicable to vehicle being serviced) onto the power steering pressure switch (Fig. 11).

(16) Install the power steering fluid, low pressure return hose on the power steering pump low pressure fitting (Fig. 12). Then install the hose from the remote reservoir onto the power steering pump (Fig. 13). Be sure all hose clamps are properly reinstalled.

(17) Install right front tire and wheel on vehicle. Install the wheel stud nuts and torque to 129 N●m (95 ft. lbs.).

(18) Lower vehicle.

(19) Install the serpentine drive belt. Refer to (Fig. 10) for correct serpentine belt routing. See Cooling, Group 7 for detailed installation procedure.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(20) Fill power steering pump reservoir to correct fluid level.

(21) Connect the negative battery cable on the negative battery post.

(22) 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.

TURBO III

REMOVE

(1) Disconnect the battery (-) negative cable from the battery and isolate cable.

(2) Raise vehicle See Hoisting, Group 0. Put oil drain pan under vehicle to catch power steering fluid.

(3) Remove the right front underhood splash shield for access to the serpentine belt tensioner.

(4) Release the tension on the serpentine drive belt tensioner and remove drive belt from power steering pump pulley (Fig. 20). Drive belt does not have to be fully removed from engine.

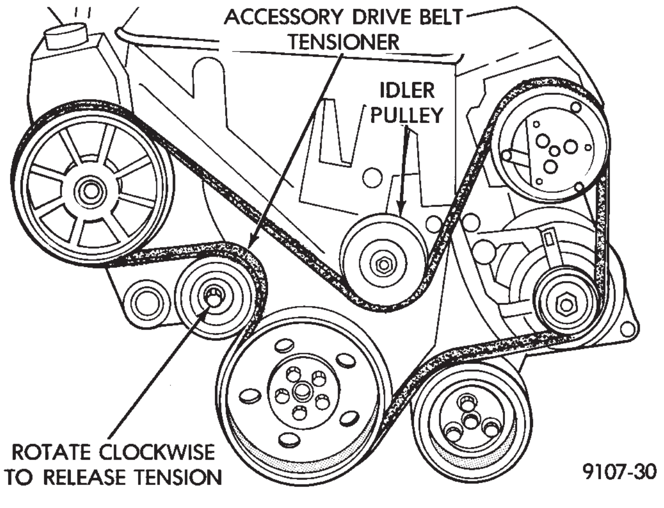


Fig. 20 Turbo III Accessory Drive Belt Routing

(5) Remove the power steering fluid return hose at the steering gear metal tube. Let power steering fluid drain from the hose and power steering pump into drain pan.

(6) Remove the high pressure fluid line banjo bolt fitting from the power steering pump. Remove high pressure power steering fluid line from the power steering pump.

(7) Remove the lower power steering pump to bracket mounting nut and fluid hose routing clip. Remove the 2 bolts and the stud attaching the power steering pump to its mounting bracket (Fig. 21).

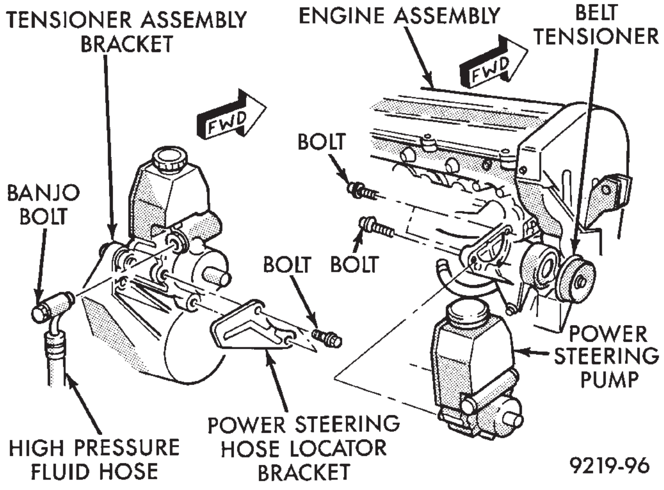


Fig. 21 Power Steering Pump Mounting

(8) Lower vehicle.

(9) Remove the wiring harness electrical connector from the H-valve on the air conditioning fluid lines.

(10) Remove the power steering pump from the vehicle out through the area between the cylinder head and the dash panel (Fig. 22).

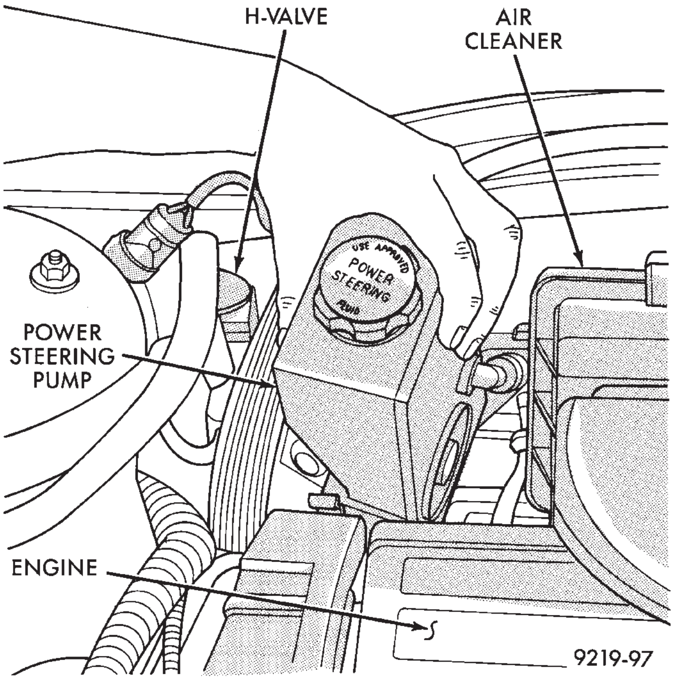


Fig. 22 Power Steering Pump Removal From Vehicle

(11) Transfer the required components from the failed power steering pump to the replacement power steering pump. See the appropriate area of this service manual section for the component replacement procedures.

INSTALL

(1) Install the power steering pump back into the vehicle in the reverse order of removal, between cylinder head and dash panel (Fig. 20).

(2) Install the wiring harness connector back on the H-valve located on the air conditioning fluid lines (Fig. 20).

(3) Raise vehicle See Hoisting, Group 0.

(4) Install the power steering pump on its mounting bracket, and the hose locator bracket. Install the bolt/stud and 2 bolts attaching the power steering pump to its mounting bracket, and the bolts attaching the hose locator bracket (Fig. 19). Torque all fasteners to 31 N●m (280 in. lbs.).

(5) Install the power steering fluid pressure hose, banjo bolt and seal washer onto power steering pump (Fig. 4). Pressure hose is to be installed so it is routed to the left of the hose locator bracket (Fig. 19). Torque the banjo bolt to 31 N●m (275 in. lbs.). **Inspect the O-rings on the banjo bolt to ensure they are not damaged and located correctly.**

(6) Install the low pressure fluid return hose from the power steering pump back on the steel tube on the steering gear (Fig. 4). Install hose clamp, be sure the hose clamp is installed past the retaining bead the steel tube. Install the hose routing clip on the power steering pump bolt/stud, install clip retaining nut and tighten.

(7) Install the serpentine accessory drive belt (Fig. 18). **Be sure the belt is correctly installed and aligned on all pulleys before starting engine.**

(8) Install the right front underhood splash shield.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(9) Fill power steering pump reservoir to correct fluid level.

(10) Connect the negative battery cable on the negative battery post.

(11) 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 PUMP PULLEY SERVICE

SAGINAW VANE SUBMERGED PUMP

REMOVE

(1) Remove the pulley with Puller C-4333 (C-4068) (Fig. 1).

CAUTION: Do not hammer on power steering pump pulley. This will damage the pulley and the power steering pump.

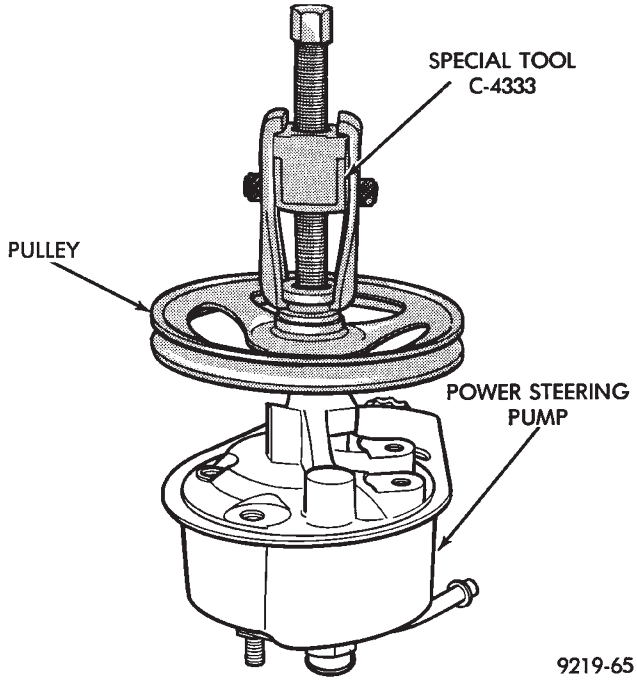


Fig. 1 Pulley Removal (Typical)

(2) Replace pulley if bent, cracked, or loose.

INSTALLATION

(1) Install the pulley with Installer C-4063 (Fig.2). Do not use the tool adapters.

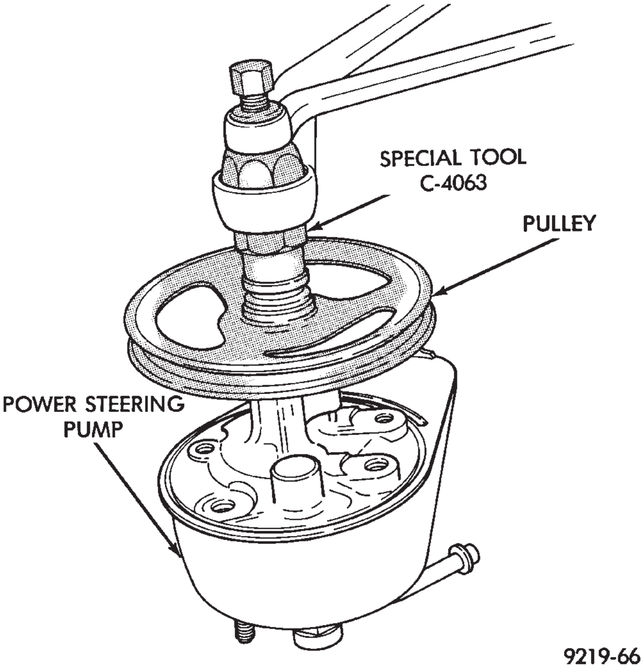


Fig. 2 Pulley Installation (Typical)

(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 shaft.

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 1.0mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**

SAGINAW T/C STYLE PUMP

REMOVE

(1) Mount power steering pump assembly in a vise using one of the pump mounting bosses (Fig. 3). **Do not clamp the body of the power steering pump in vise.**

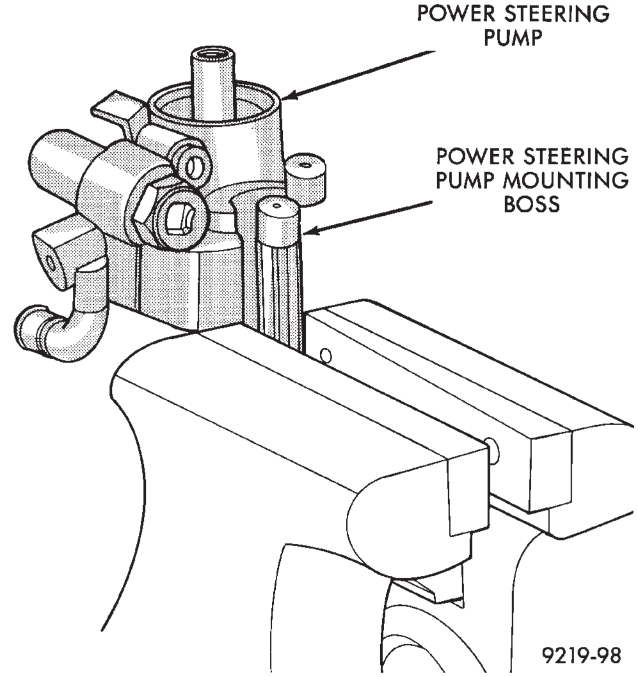


Fig. 3 Power Steering Pump Mounted In Vise

Do not press or hammer on the shaft of the power steering pump in an attempt to remove the pulley. This will damage the internal components of the power steering pump.

(2) Remove the power steering pump pulley from the power steering pump shaft using Puller, Special Tool C-4333 (Fig. 4).

INSTALL

Do not press or hammer on the shaft of the power steering pump in an attempt to install the pulley. This will damage the internal components of the power steering pump.

(1) Place the power steering pump pulley on the end of the power steering pump shaft. Make sure the pulley is installed squarely on the end of the shaft (Fig. 5).

CAUTION: When installing the pulley on the Saginaw T/C style power steering pump. The spacer that is provided with either the replacement power steering pump or pulley MUST be used when the pulley is installed on the pump. The spacer provides for the correct pulley location on the power steering pump to provide correct accessory drive belt alignment. The alignment is critical in controlling accessory drive belt noise. It also prevents the pulley from contacting the power steering pump when it is installed, causing power steering pump or pulley damage.

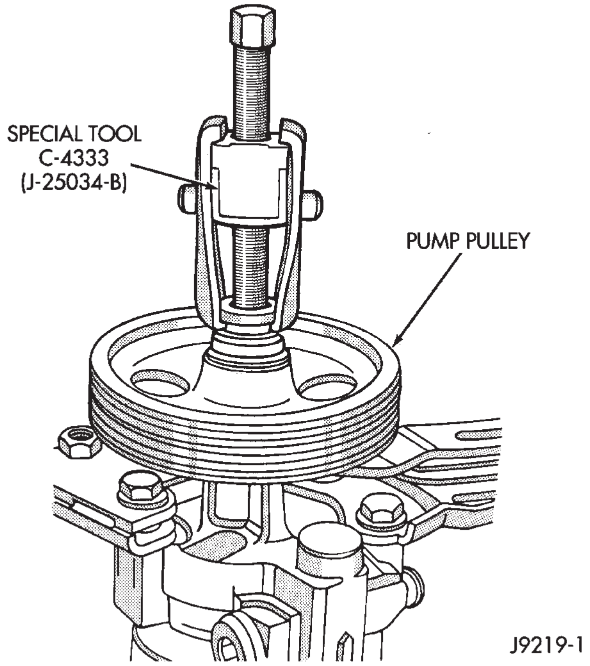


Fig. 4 Removing Power Steering Pump Pulley

(2) Install the spacer provided with the replacement power steering pump or power steering pulley into the hub of the power steering pump pulley (Fig. 5).

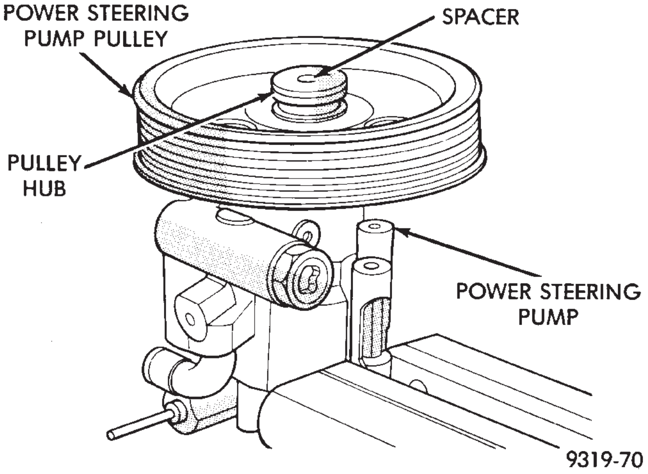


Fig. 5 Pulley And Spacer Installed On Pump

(3) Insert the Pulley Installer, Special Tool C-4063, (without adapters) through hole in spacer. Then thread it into the end of the power steering pump shaft (Fig. 6). Tighten the installer into shaft.

(4) Hold the Pulley Installer with one wrench so it will not rotate. Turn hex (Fig. 6) down threaded rod of installer pushing the pulley onto the shaft of the power steering pump (Fig. 6). Ensure that the tool and the pulley remain aligned with the pump shaft so pulley does not become cocked on shaft.

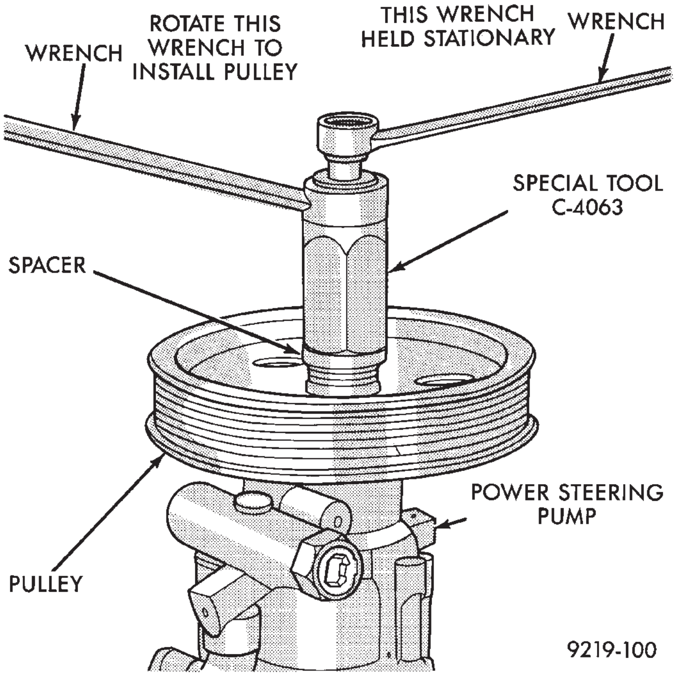


Fig. 6 Installing Power Steering Pump Pulley

(5) Continue to push pulley onto shaft of power steering pump until Pulley Installer, Special Tool C-4063 will no longer turn. This will ensure the spacer provided is fully seated against the front of the power steering pump shaft (Fig. 7).

(6) Remove the Pulley Installer, Special Tool C-4063 from the shaft of the power steering pump. Remove the supplied spacer from the hub of the power steering pump pulley and discard.

POWER STEERING PUMP FLUID RESERVOIRS

VANE SUBMERGED PUMP (HAM CAN)

REMOVE

Discard all O-ring seals during disassembly, they are not re-usable.

(1) Remove the filler cap and drain the fluid from reservoir before removing parts.

(2) Remove mounting studs and pressure fitting (Fig. 1). Rock reservoir by hand or use a soft face mallet to remove.

(3) Remove O-ring seals from housing and reservoir (Fig.1).

(4) Remove flow control valve and spring from housing.

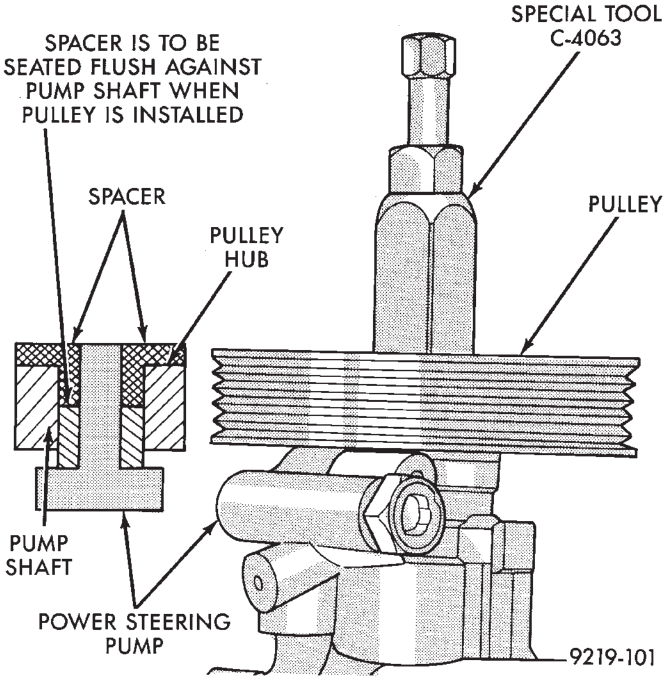


Fig. 7 Power Steering Pump Pulley Installed

INSTALL

Clean all parts before installation. Lubricate new O-ring seals with Mopar® Power Steering Fluid or equivalent.

(1) Install flow control valve and spring (Fig. 2).

(2) Install new O-ring seals in housing (Fig.1). Install the pump housing assembly into the fluid reservoir. Tighten mounting studs to 48 N●m (35 ft. lbs.) torque.

(3) Install fitting in flow control valve bore. Tighten the fitting to 75 N●m (55 ft. lbs.) torque.

SAGINAW T/C STYLE PUMP WITH INTEGRAL RESERVOIR

REMOVAL

Discard all O-ring seals during disassembly, they are not re-usable.

(1) Remove pump and clean exterior of pump with solvent.

(2) Remove the filler cap and drain the fluid from reservoir.

(3) Clamp the front hub of the pump in a soft jaw vice.

(4) Pry up tab and slide the retaining clip off (Fig. 3).

(5) Remove fluid reservoir from pump body. Remove and discard O-ring seal (Fig. 4).

INSTALLATION

(1) Lubricate new O-ring Seal with Mopar Power Steering Fluid or equivalent.

(2) Install seal in housing (Fig. 4).

(3) Install reservoir onto housing (Fig. 4).

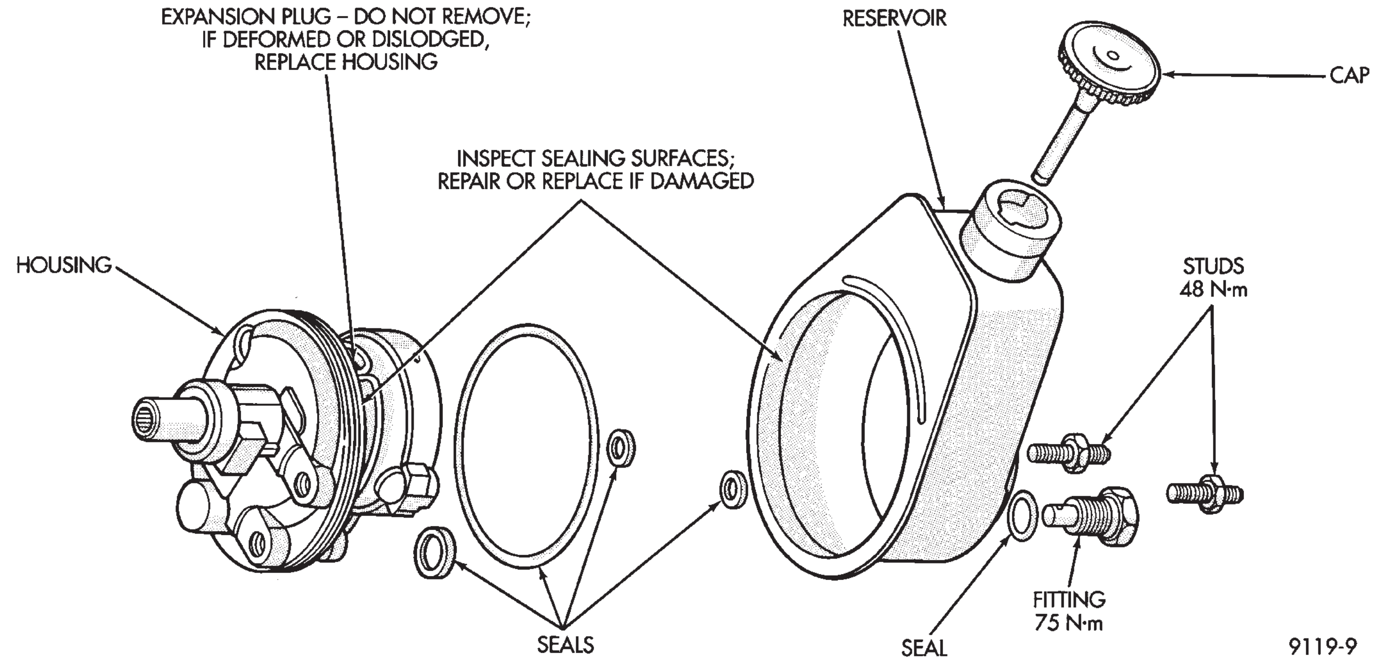


Fig. 1 Pump and Reservoir

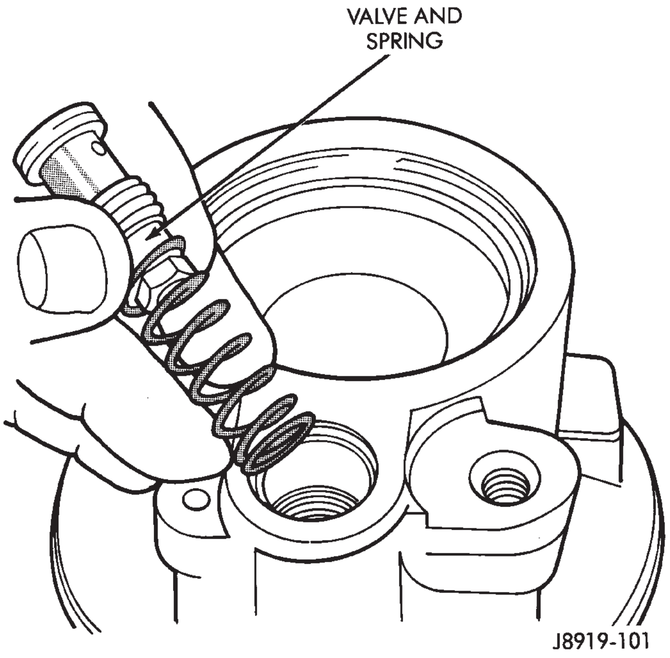


Fig. 2 Flow Control Valve/Spring Installation

(4) Slide and tap in reservoir retainer clips until tab locks to housing (Fig. 4).

(5) Install pump. Refill reservoir with Mopar Power Steering Fluid or equivalent.

FLOW CONTROL VALVE FITTING O-RING SEAL

REMOVAL

(1) Remove pressure hose from pump fitting. Remove pump and pulley if necessary.

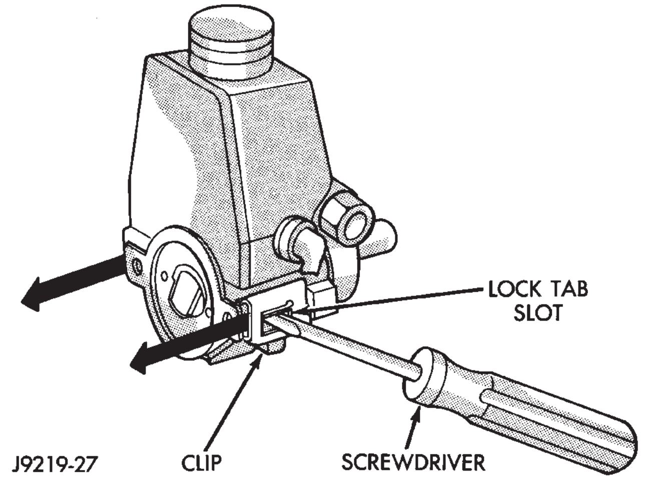


Fig. 3 Remove Reservoir Clips (Typical)

(2) Remove fitting from pump housing (Fig. 5). **Prevent flow control valve and spring from sliding out of housing bore.**

(3) Remove and discard O-ring seal (Fig. 5).

INSTALLATION

(1) If necessary, clean and install flow control valve and spring in pump housing bore (Fig. 5). **Be sure the hex nut end of the valve is facing the in toward the pump.**

(2) Install O-ring seal onto fitting (Fig. 5).

(3) Install fitting in pump housing and tighten to 75 N●m (55 ft. lbs.)

(4) Install pump and pulley if necessary. Install pressure hose to fitting.

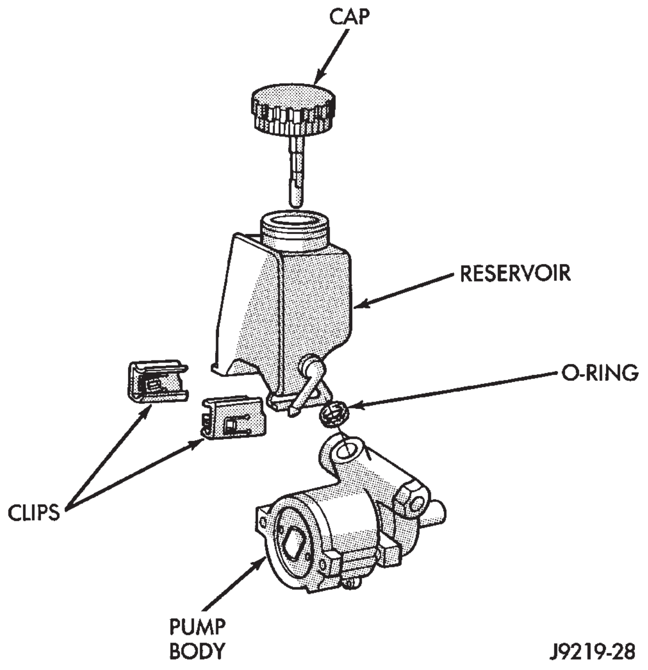


Fig. 4 Remove Reservoir (Typical)

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 power steering pump fluid reservoir to the proper level.

(2) Start the engine and let run for a few seconds. Then turn the engine off.

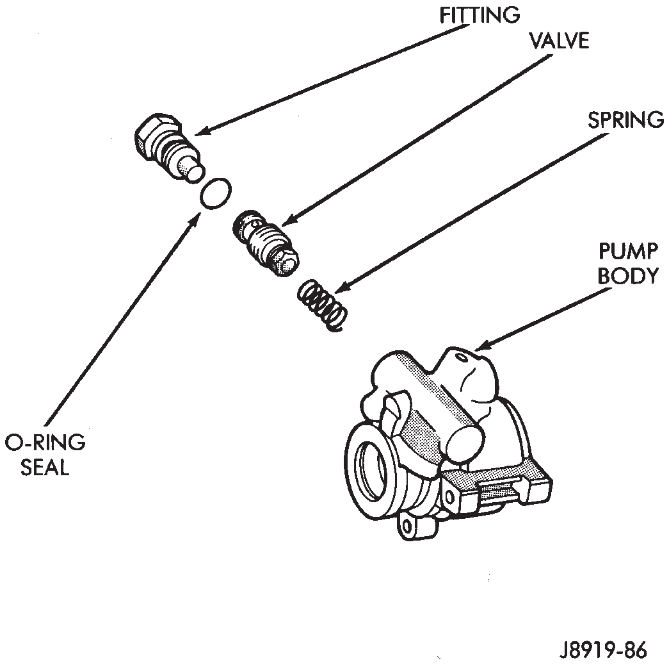


Fig. 5 Flow Control Valve Fitting Removal/Installation

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise front wheels of vehicle off the ground.

(5) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(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.

POWER STEERING GEAR

INDEX

GENERAL INFORMATION

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.

The drive tangs on the pinion of the power steering pump mate loosely with a stub shaft. This is 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.

STEERING GEAR SERVICE

The power steering gear should NOT be serviced or adjusted. If a malfunction or oil leak occurs. The complete steering gear should be replaced.

REMOVAL

(1) Raise vehicle See Hoisting, Group 0. Put oil drain pan under vehicle to catch power steering fluid.

(2) Remove front road wheels.

(3) Remove both tie rod ends from steering knuckles, using Puller Special Tool C-3894-A (Fig. 1).

(4) Disconnect engine damper strut from crossmember (if so equipped).

(5) Remove the 3 front suspension crossmember attaching bolts and the nut (Fig. 2) from the locating stud. Lower front suspension crossmember, using

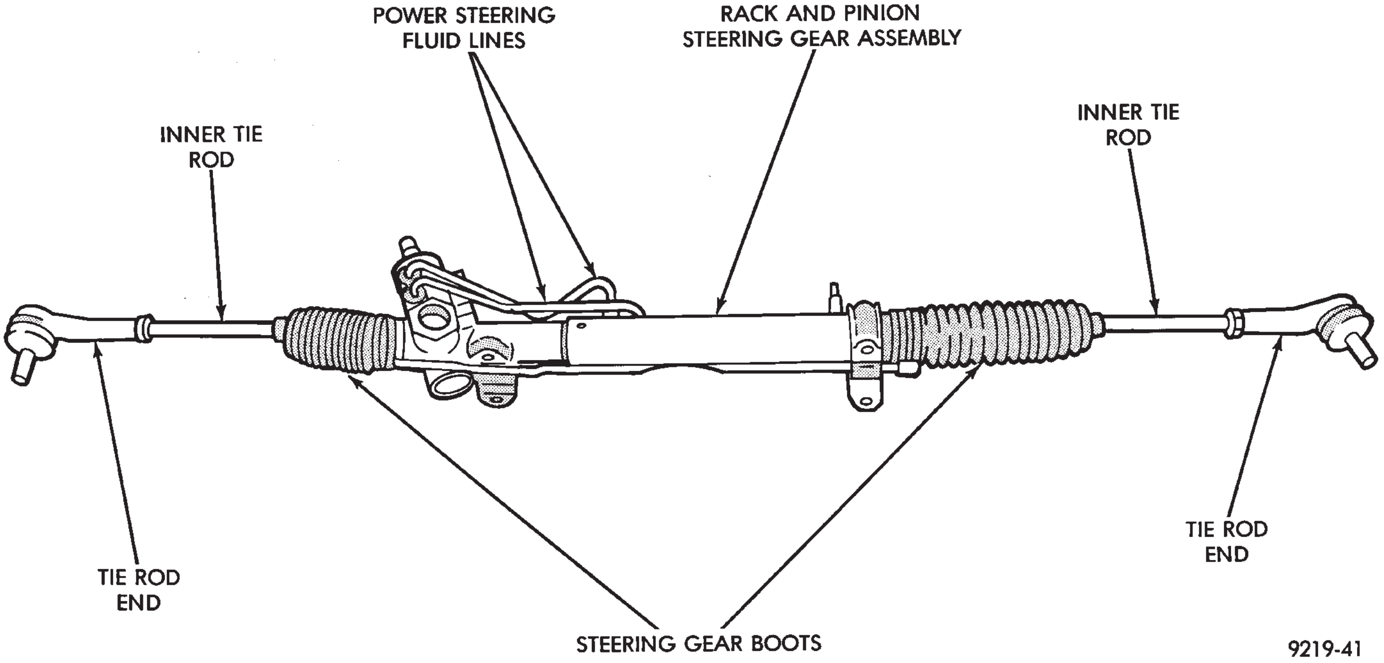


Fig. 1 Power Steering Gear Assembly

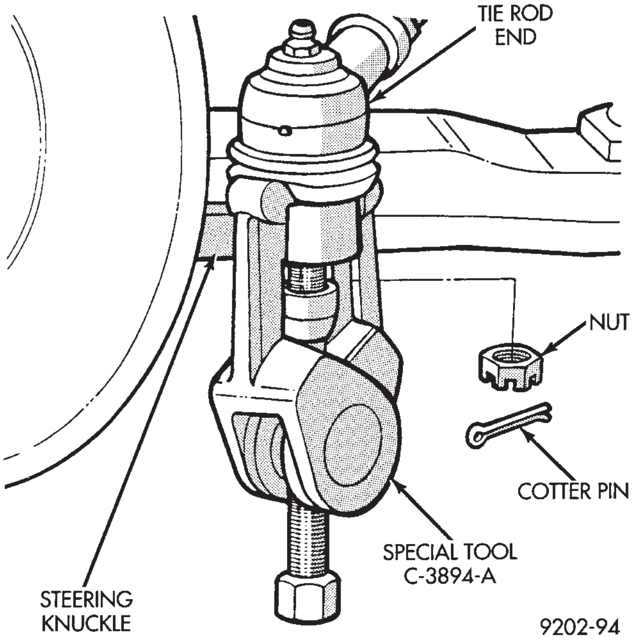


Fig. 1 Tie Rod End Removal

transmission jack, so that the steering gear can be disconnected from the steering column.

(6) Remove fluid tubes (Fig. 3) from the power steering pump to the steering gear. See hose removal procedure.

(7) Remove the 4 bolts (Fig. 3) attaching steering gear to front suspension crossmember.

(8) Remove steering gear assembly from crossmember.

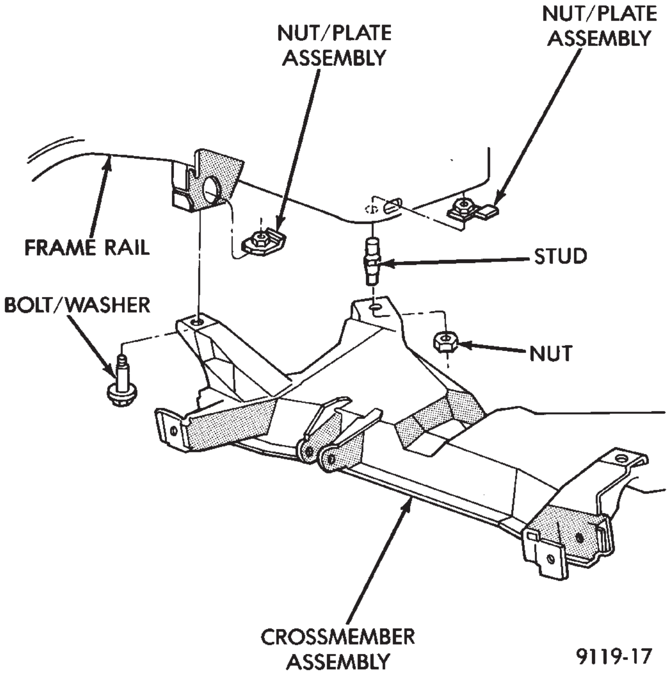


Fig. 2 Crossmember Remove/Replace

INSTALLATION

An assistant will be required in the vehicle, at the time of steering gear replacement. To help guide the steering column coupling onto the steering gear assembly.

(1) Install steering gear assembly on the front crossmember. Install the 4 steering gear to front crossmember mounting bolts (Fig. 3).

(2) Using a transmission jack raise the front crossmember and steering gear against the frame rails. Install the 3 crossmember to frame rail attaching

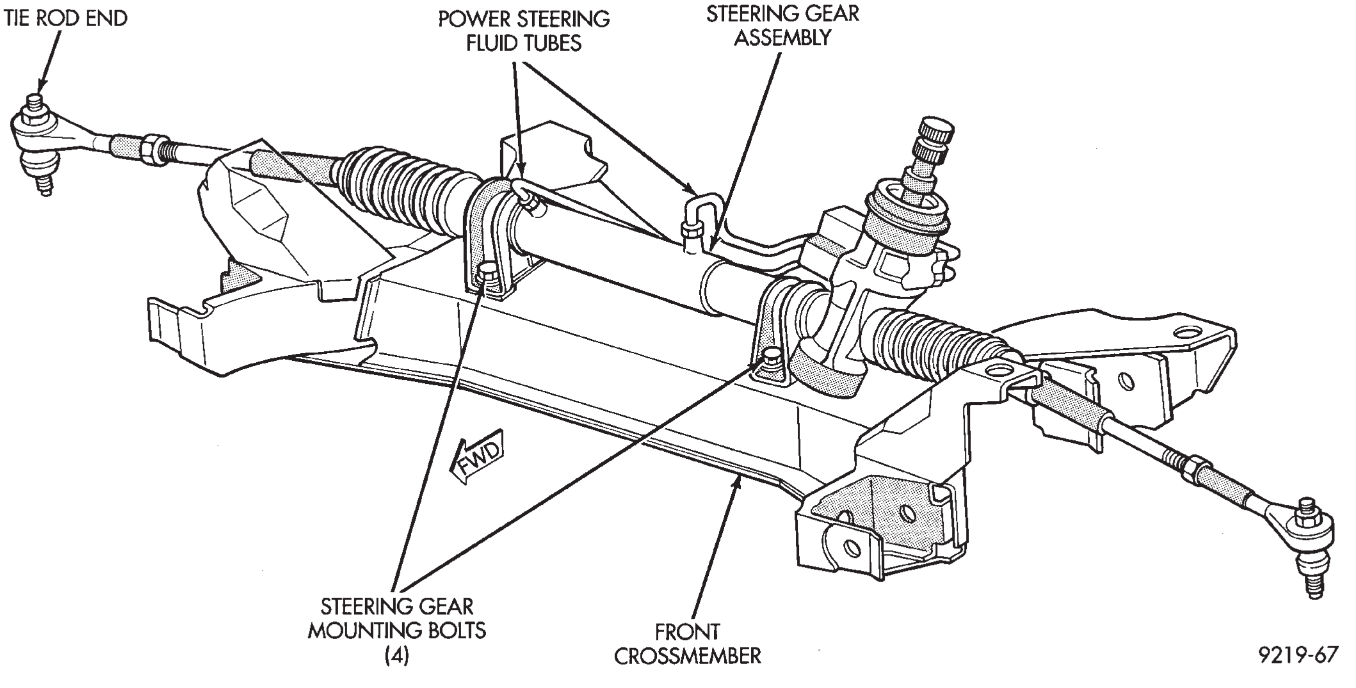


Fig. 3 Steering Gear And Crossmember

bolts and nut on locating stud (Fig. 2). **The right rear crossmember stud is a pilot that correctly locates the crossmember. Tighten down this bolt first, then torque all 4 crossmember fasteners to 122 N●m (90 ft. lbs.).**

CAUTION: Proper torque on the crossmember to frame rail mounting bolts is very important.

(3) Torque the 4 bolts (Fig. 3) attaching the steering gear assembly to front crossmember, to 68 N●m (50 ft. lbs.). **To ensure proper alignment of the steering gear tighten left front bolt first.**

(4) Attach the engine damper strut from the engine to the crossmember (if so equipped).

(5) Attach the fluid tubes (Fig. 3) from the power steering pump to the fittings on the steering gear. Torque the fluid pressure line to steering gear tube nut to 31 N●m (275 in. lbs.).

(6) Mount the outer tie rod ends to the steering knuckles. Install the tie rod end to steering knuckle attaching nuts. Torque the tie rod end to steering knuckle nuts to 52 N●m (38 ft. lbs.). Install cotter pin in tie rod end.

(7) Install the front tire and wheel assemblies on vehicle. Install the wheel lug nuts and torque to 129 N●m (95 ft. lbs.).

(8) Lower vehicle.

CAUTION: Do not use automatic transmission fluid.

(9) Fill power steering pump fluid reservoir to the (Full-Cold) proper level.

(10) Start the engine and let run for a few seconds. Then turn the engine off.

(11) Add fluid if necessary.

(12) Raise front wheels of vehicle off the ground.

(13) 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. **Fill pump reservoir to correct level with Mopar®, Power Steering Fluid, or equivalent.** See Checking Fluid Level.

(14) Lower front wheels of vehicle back on the ground.

(15) Adjust toe (Refer to Group 2 Suspension).

OUTER TIE ROD

REMOVAL

(1) Loosen inner tie rod to outer tie rod jam nut (Fig. 4).

(2) Remove outer tie rod to steering knuckle cotter pin and attaching nut (Fig. 4).

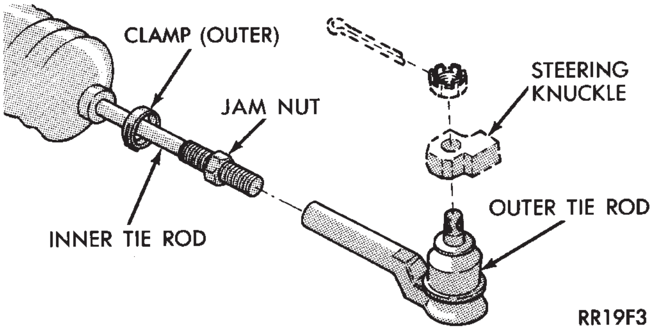


Fig. 4 Outer Tie Rod

(4) Remove the tie rod end from steering knuckles, using Puller Special Tool C-3894-A (Fig. 5).

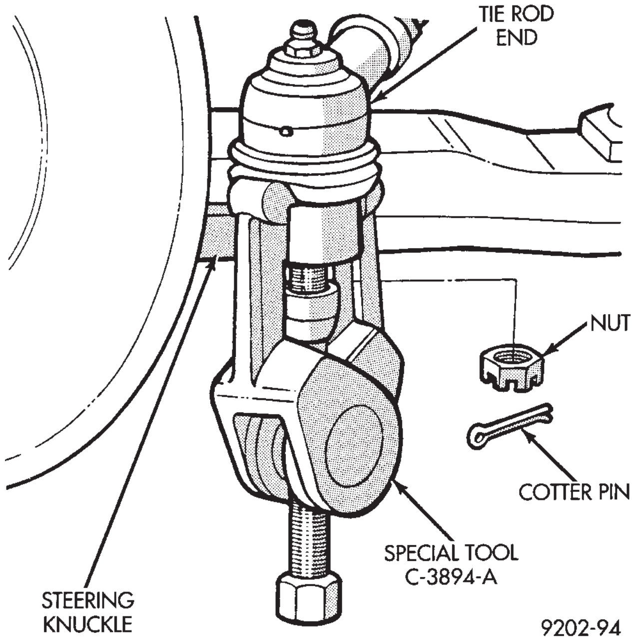


Fig. 5 Tie Rod End Removal

(5) Remove outer tie rod from inner tie rod.

INSTALLATION

(1) Install outer tie rod onto inner tie rod. **Make sure jam nut is on inner tie rod (Fig. 4).**

(2) Do not tighten jam nut.

(3) Install outer tie rod onto steering knuckle. Install tie rod to steering knuckle attaching nut and torque to 52 N●m (38 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) Make toe adjustment by turning inner tie rod.

(5) 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.

ACUSTAR STANDARD AND TILT STEERING COLUMN

INDEX

GENERAL INFORMATION

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.

Safety goggles should be worn at all times when working on steering columns.

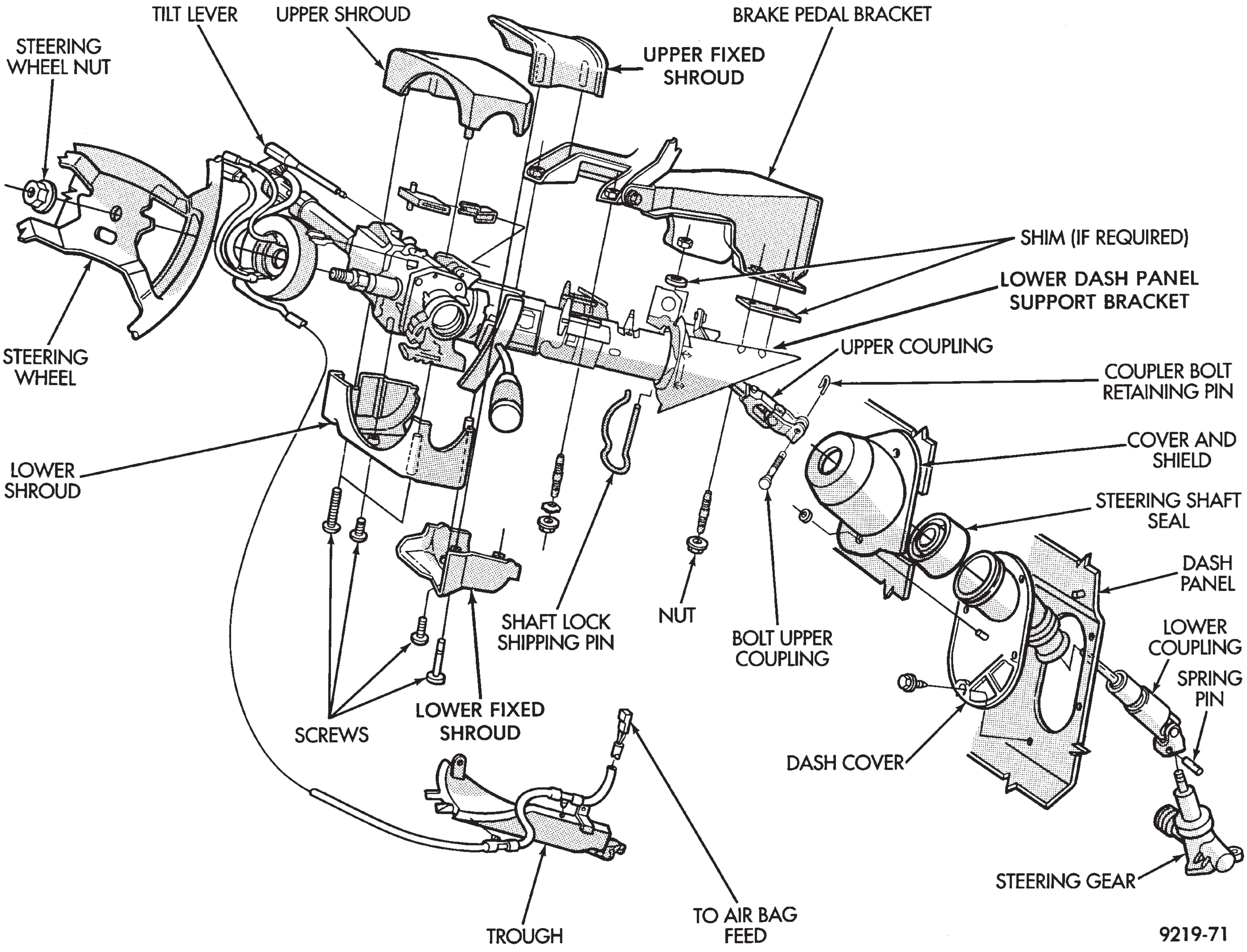


Fig. 1 Acustar Standard and Tilt Steering Column

The Acustar tilt and standard column (Fig. 1) has been designed to be serviced as an assembly; less wiring, switches, shrouds, steering wheel, etc. Also, most steering column components can be serviced without removing the steering column from the vehicle.

CAUTION: Disconnect negative (ground) cable from battery, before servicing any column component.

CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Damage will occur.

STEERING COLUMN SERVICE PROCEDURES

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. For location of components referred to in the procedure see (Fig. 1).

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM COMPONENT INSTALLATION OR REMOVAL PROCEDURES. 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.

STEERING COLUMN REMOVAL

(1) Make sure the front wheels of the vehicle are in the **straight ahead** position.

(2) Disconnect the negative (ground) cable from the battery and isolate cable.

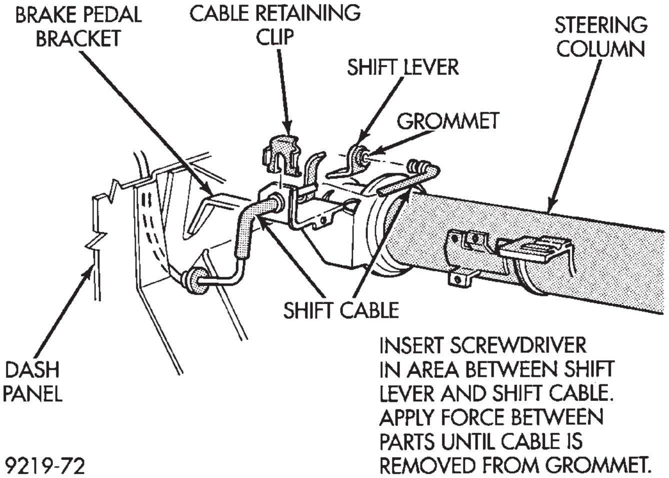
(3) For vehicles equipped with a column shift. Disconnect the transmission shift cable from the steering column by prying it out of the grommet in the shift lever (Fig. 2).

(4) Remove the steering wheel center pad. Disconnect electrical components such as horn lead, air bag lead and speed control switch lead (if equipped) from center pad (Fig. 3).

(5) Remove the steering wheel retaining nut from the steering column shaft. Remove steering wheel from shaft using Puller, Special Tool C-3428-B (Fig. 4). **Do not bump or hammer on steering column shaft to remove wheel.**

(6) Remove the lower steering column cover (Fig. 5).

(7) Remove the retaining pin in the upper to lower steering coupler retaining bolt (Fig. 6).



INSERT SCREWDRIVER IN AREA BETWEEN SHIFT LEVER AND SHIFT CABLE. APPLY FORCE BETWEEN PARTS UNTIL CABLE IS REMOVED FROM GROMMET.

Fig. 2 Shift Cable Removal From Grommet

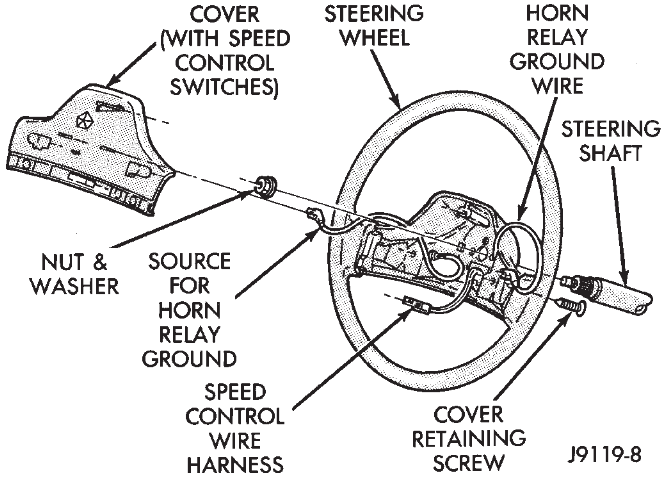


Fig. 3 Horn Pad Removal (Typical)

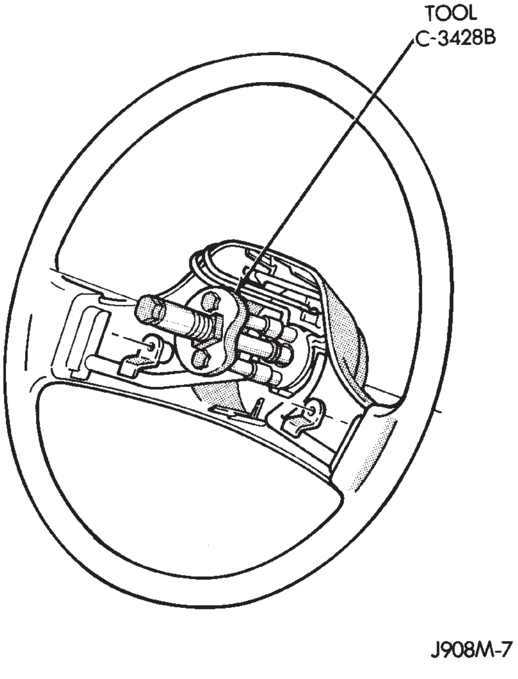


Fig. 4 Removing Steering Wheel (Typical)

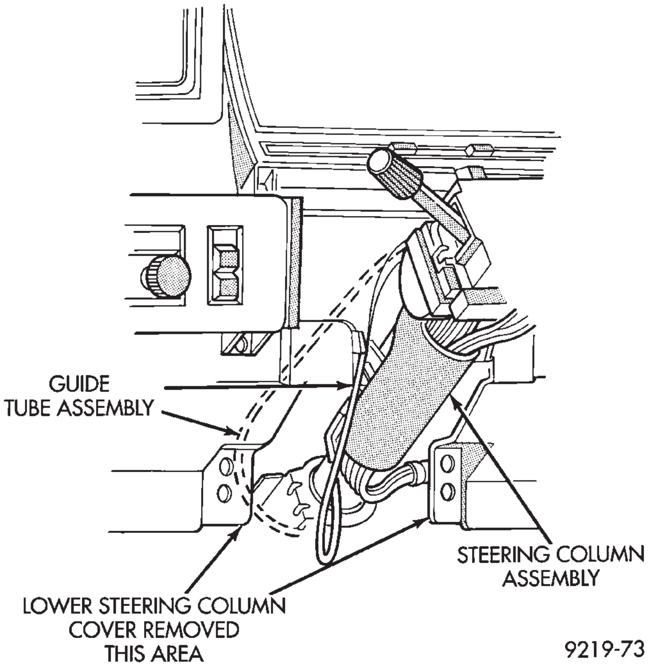


Fig. 5 Steering Column Cover Removed

(8) Remove the upper to lower steering coupler retaining nut and pinch bolt (Fig. 6). Remove the upper steering coupler from the lower steering coupler shaft.

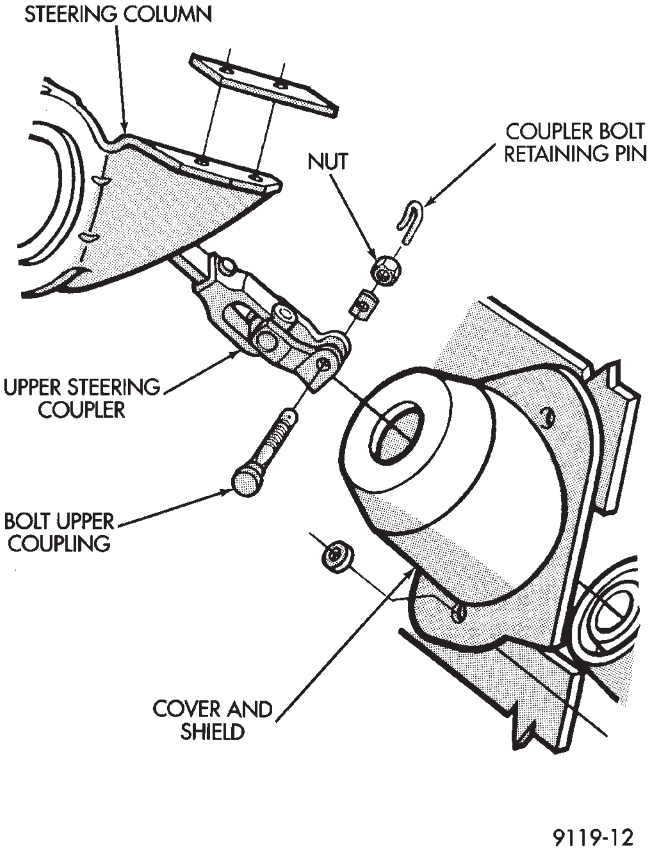


Fig. 6 Steering Column Coupler Remove and Install

(9) Place the gear shift lever in either the neutral or park position.

(10) Remove the PRNDL indicator actuation cable from the steering column actuating arm (Fig. 7).

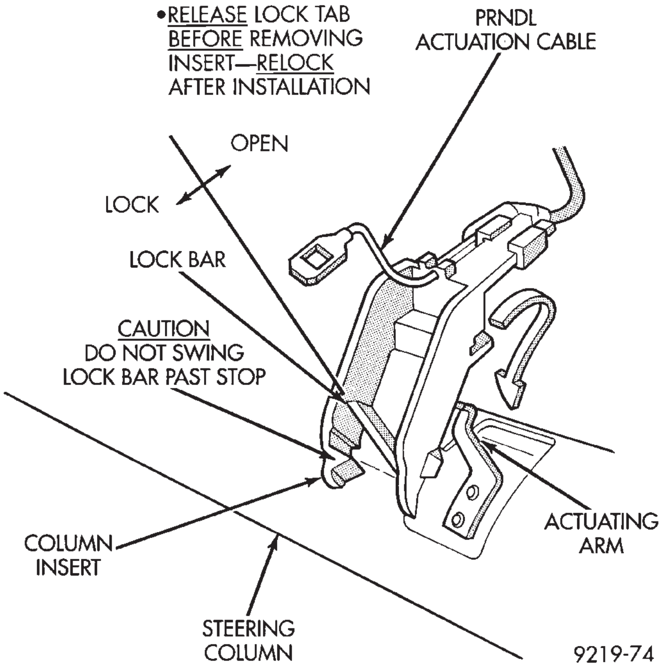


Fig. 7 PRNDL Cable Removal

(11) Release the lock bar on the column insert. Squeeze the legs of the column insert together and remove insert from steering column assembly (Fig. 7).

(12) Secure the insert and actuation cable out of the way.

(13) Remove tilt lever (if equipped) from steering column.

(14) Remove the upper and lower lock housing shrouds (Fig. 1) from the steering column assembly. Remove the lower fixed shroud from the steering column assembly. The shroud fasteners are **Torx-head** screws.

(15) Remove the wiring harness connector to the turn signal/multi-function switch using a 7mm socket as shown in (Fig. 8).

(16) Remove the electrical connections from the Key-in Switch & Halo Light, Main Ignition Switch, Horn connection or Clock Spring (Speed Control Equipped) (Fig. 9).

(17) Loosen the upper steering column support bracket nuts (Fig.10) to allow some slack. This will aid in removal of the upper fixed shroud.

(18) Remove the upper fixed shroud (Fig. 1) from the steering column assembly. Remove the wiring harness from the steering column assembly by prying out the plastic retainer buttons (Fig. 8).

(19) Remove the lower dash panel and support bracket standoff fasteners (Fig. 1).

(20) Remove the steering column assembly out through the passenger compartment. Use care to avoid damaging the paint or interior trim.

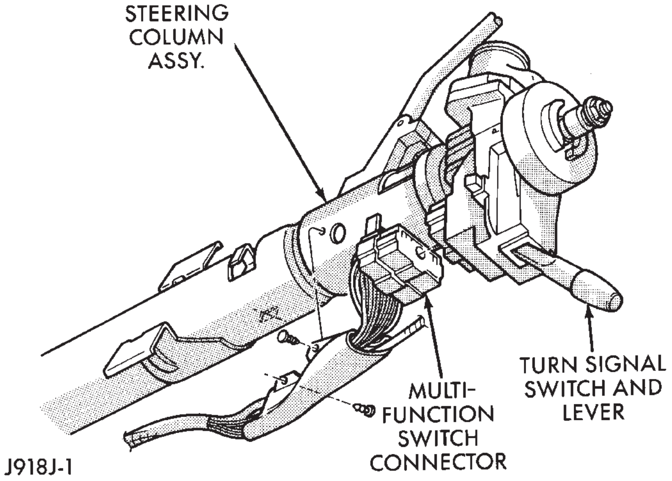


Fig. 8 Multi-function Switch Wiring Harness Connector

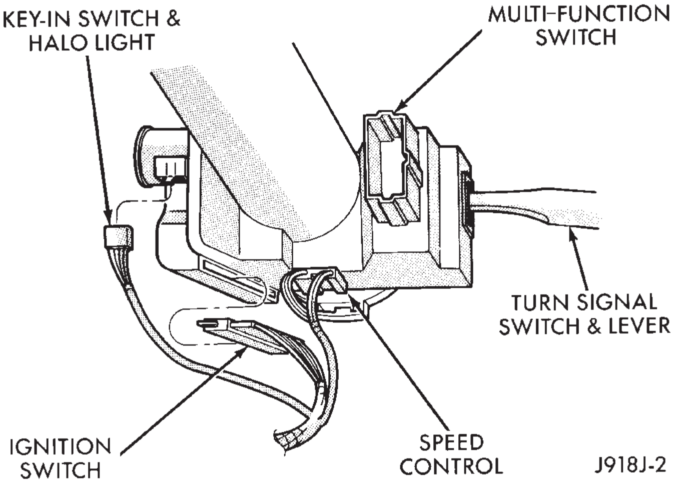


Fig. 9 Steering Column Wiring

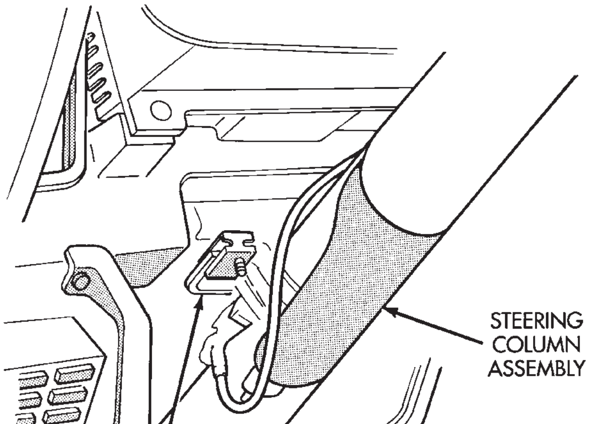


Fig. 10 Steering Column Support Bracket

STEERING COLUMN INSTALLATION

(1) For column shift vehicles, install a **new cable attaching grommet into the steering column shift lever (Fig. 11). Install grommet from the cable side of the lever.** Use pliers and a back-up washer to snap the grommet into place (Fig. 11).

Use Mopar® Multipurpose Lubricant, or equivalent, to aid installation of the grommet. **A replacement grommet should be used whenever the rod is disconnected from the lever.**

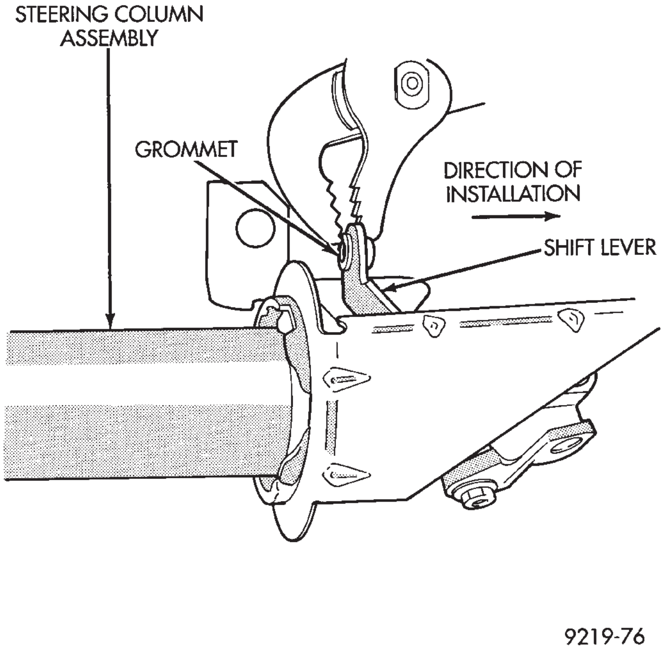


Fig. 11 Replacement Cable Grommet Installation

(2) Install the ground clip on the left capsule slot (Fig. 12). The plastic capsules should be pre-assembled in the bracket slots. **Remove the shipping lock pin (Fig. 1) located on lower column jacket when installing a new steering column.** Insert the column through the floor pan opening while being careful to avoid damaging the interior paint and trim.

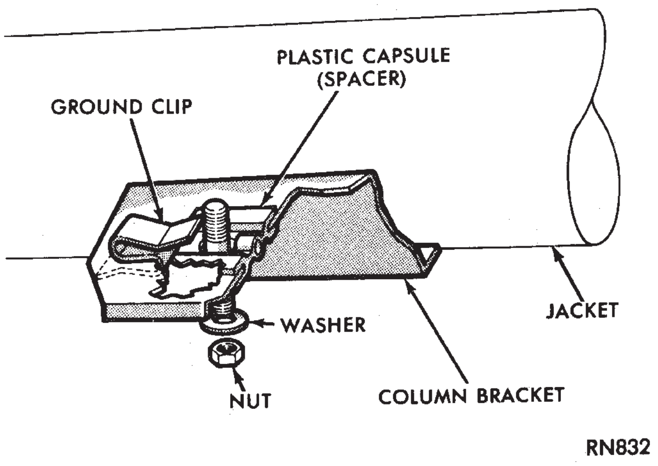


Fig. 12 Ground Clip & Spacer Installation

(3) Position the steering column assembly in the vehicle. Align the steering column assembly mounting bracket slots on the brake pedal bracket attaching studs (Fig. 13). Install, but **loose assemble** the two upper column bracket, washers and nuts.

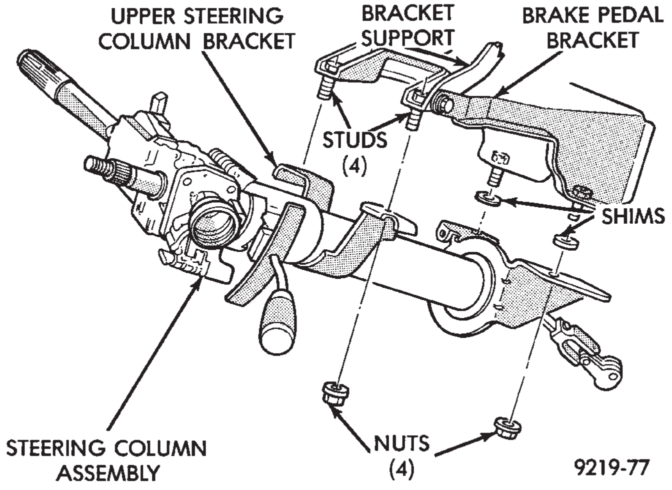


Fig. 13 Steering Column Mounting

(4) Make sure the front wheels are in the straight-ahead position. Align and assemble the upper steering coupler to lower steering coupler. Install the upper to lower steering coupler retaining bolt and nut. Torque the retaining bolt nut to 28 N●m (250 in. lbs.). **Be sure to install the upper to lower steering coupler retaining bolt retention pin (Fig. 6).**

(5) Install the buttons which retain the multi function switch wiring harness to the steering column. Connect the multi-function switch wiring harness connector to the multi-function switch. Torque the connector retaining bolt to 2 N●m (17 in. lbs) using a 7 mm socket (Fig. 8).

(6) Install the upper fixed shroud onto the steering column assembly.

(7) Be sure both breakaway capsules are fully seated in the slots of the steering column upper support bracket. Torque the 2 upper steering column assembly to support bracket nuts to 12 N●m (105 in. lbs.). Torque the 2 lower steering column assembly to mounting bracket nuts to 12 N●m (105 in. lbs.).

(8) Complete the wiring harness connections to the remaining steering column switches (Fig. 9). Install the lower fixed shroud onto the steering column.

(9) Route the PRNDL actuator assembly under left steering column wing and along left side of steering column. Insert the flange of the PRNDL actuator steering column insert into the steering column jacket (Fig. 7). Squeeze the legs of the steering column insert together and install tabs under steering column jacket. Engage lock bar to secure the actuator assembly into the steering column jacket (Fig. 7).

(10) Hook the PRNDL actuator cable eyelet to the steering column actuator arm (Fig. 7). Move the shift lever to neutral, check pointer location, should indicate neutral. If pointer does not indicate neutral adjust actuator with tool (Fig. 14) to center pointer on N (Neutral) and then check pointer location in other gears.

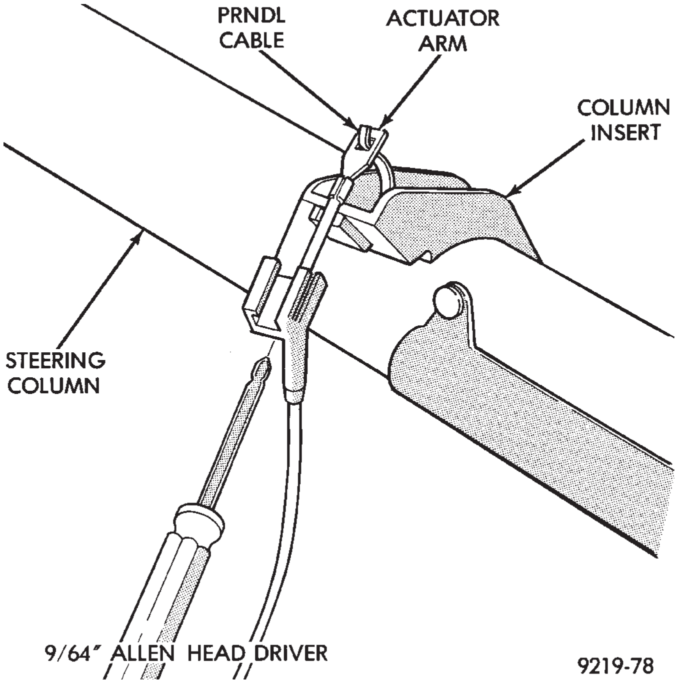


Fig. 14 PRNDL Actuator Cable Adjustment

(11) Install the lock housing shrouds. The shroud fasteners are **Torx-head** screws. Install the tilt lever (if equipped).

(12) Install the lower dash panel cover.

(13) For steering wheel installation with speed control refer to Group 8 Electrical. For non-speed control, place the steering wheel on the steering column shaft with the master splines aligned. Install the steering wheel to column shaft retaining nut. Tighten retaining nut to 61 N●m (45 ft. lbs.) torque. **Do not force the steering wheel onto the column shaft by driving it on with a heavy object. Pull steering wheel down onto column shaft using ONLY the steering wheel retaining nut.**

(14) For vehicles equipped with a column shift. Pass the transmission shift cable through its mounting bracket on the steering column assembly. Connect the transmission shift cable to the shift lever on the steering column assembly. Install the shift cable to mounting bracket retaining clip (Fig. 2). **The grommet must be installed in the shift lever (Fig. 11) before the cable is inserted into the grommet.** Use Mopar® Multipurpose Lubricant, or an equivalent product, to aid installation of shift link rod into grommet.

(15) Re-adjust the transmission shift linkage. **Whenever the steering column is loosened or removed, the shift linkage MUST be adjusted and tested.** Refer to Group 21 Transmission for the shift linkage adjustment procedure.

(16) Connect the battery ground (negative) cable. Test the operation of the lights and horns. If applicable, reset the clock and radio.

STEERING COLUMN COMPONENT SERVICE

The Acustar tilt and standard steering columns (Fig.1) have been designed to be serviced as an assembly; less wiring, switches, shrouds, steering wheel, etc. Also most steering column components can be serviced without removing the steering column from the vehicle. For additional information on electrical components refer to **Group 8H Electrical**.

GEAR SHIFT LEVER

The gear shift lever (if equipped) is a serviceable component of the Acustar steering column assembly.

REMOVE

(1) Support the steering column assembly as shown in (Fig. 1) using a suitable size socket.

(2) Using a drift of the appropriate size drive the roll pin out of the steering column and gear shift lever (Fig. 1). Remove the gear shift lever from the steering column assembly.

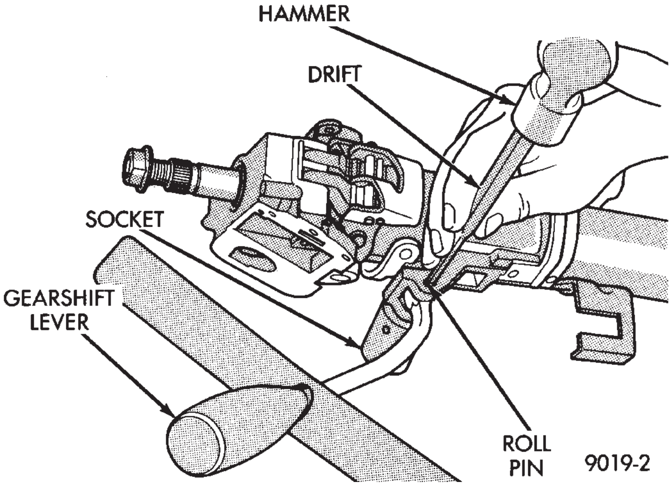


Fig. 1 Gear Shift Lever Removal

INSTALL

(1) Support the steering column assembly as shown in (Fig. 1) using a suitable size socket.

(2) Install the gear shift lever into the steering column assembly. Align the roll pin holes in the gear shift lever and the steering column assembly.

(3) Carefully Install the roll pin into the steering column assembly and through the shift lever. If the roll pin binds check the alignment on the holes. Be sure roll pin is fully installed into the steering column assembly.

IGNITION SWITCH SERVICE

TEST AND REPAIR

If the ignition switch effort seems to be excessive due to binding. Follow the procedure outlined below to determine the cause.

When service procedures are performed on the Acustar steering column there are certain areas of the column that can not be tampered with. If a problem related to these areas of the steering column are detected. The entire steering column (less the removable components) should be replaced see (Fig. 2 and 3).

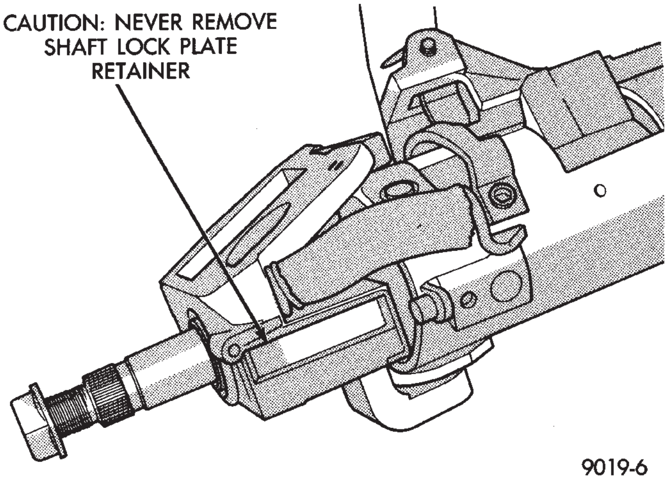


Fig. 2 Steering Column Non-Serviceable Components

(1) Remove ignition switch from steering column. Refer to **Group 8H Electrical.**

(2) Using a key cylinder, check the turning effort of the switch.

- If the ignition switch binds look for the following conditions.

(1) Look for rough areas or flash in the casting and if found remove with a file (Fig. 3).

(2) Remove the link and slider.

(3) Check the link to see if it has been bent and if so replace with a new part.

Put the slider in its slot in the sleeve and verify a loose fit over the length of the slot. If the slider binds in the slot at any point lightly file the slider until clearance is achieved.

- If no binding is found.

Lightly file the ramp on the ignition switch, (The ramp fits into the casting) until binding no longer occurs.

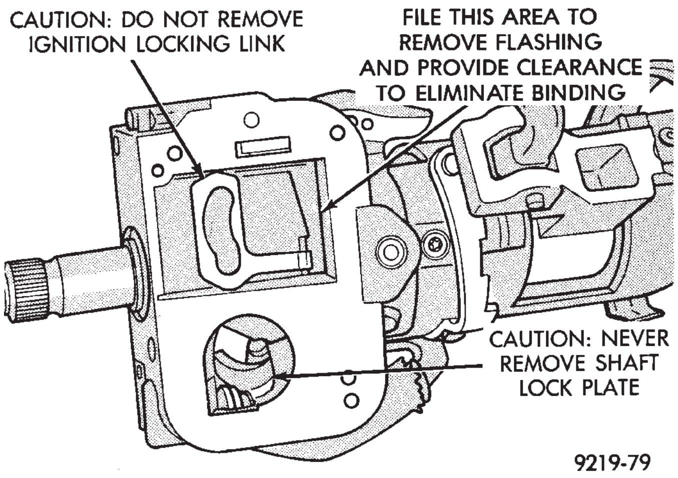


Fig. 3 Steering Column Flash Removal And Non-Serviceable Components

AUTOMATIC TRANSMISSION SHIFTER/IGNITION INTERLOCK

INDEX

GENERAL INFORMATION

The automatic transmission Shifter/Ignition Interlock, is a mechanically cable operated system (Fig. 1). It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch. The interlock system locks the floor mounted shifter on automatic transmission equipped vehicles into the PARK position. The Interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. When the key is in the OFF or RUN position the shifter is unlocked and will move into any position. The interlock system also prevents ignition switch from being turned to the OFF or ACCESSORY position, unless shifter is fully locked into the PARK position.

INTERLOCK SYSTEM OPERATION CHECK

(1) With the shifter in PARK, and the shifter knob pushbutton in its full up position, the ignition switch should rotate freely from OFF to LOCK position. When the shifter is moved to the DRIVE (or OVERDRIVE) position if so equipped the ignition switch should not rotate from OFF to LOCK.

(2) Moving shifter out of PARK should only be possible when ignition switch is in the OFF or RUN position. Movement of the shifter from the PARK position should not be possible, when the ignition switch is in the LOCK position.

(3) If the automatic transmission Shifter/Ignition Interlock System operates in any way other than as described above, diagnosis, adjustment or repair of the system is required. See Adjustment and Repair procedures in this section of the service manual.

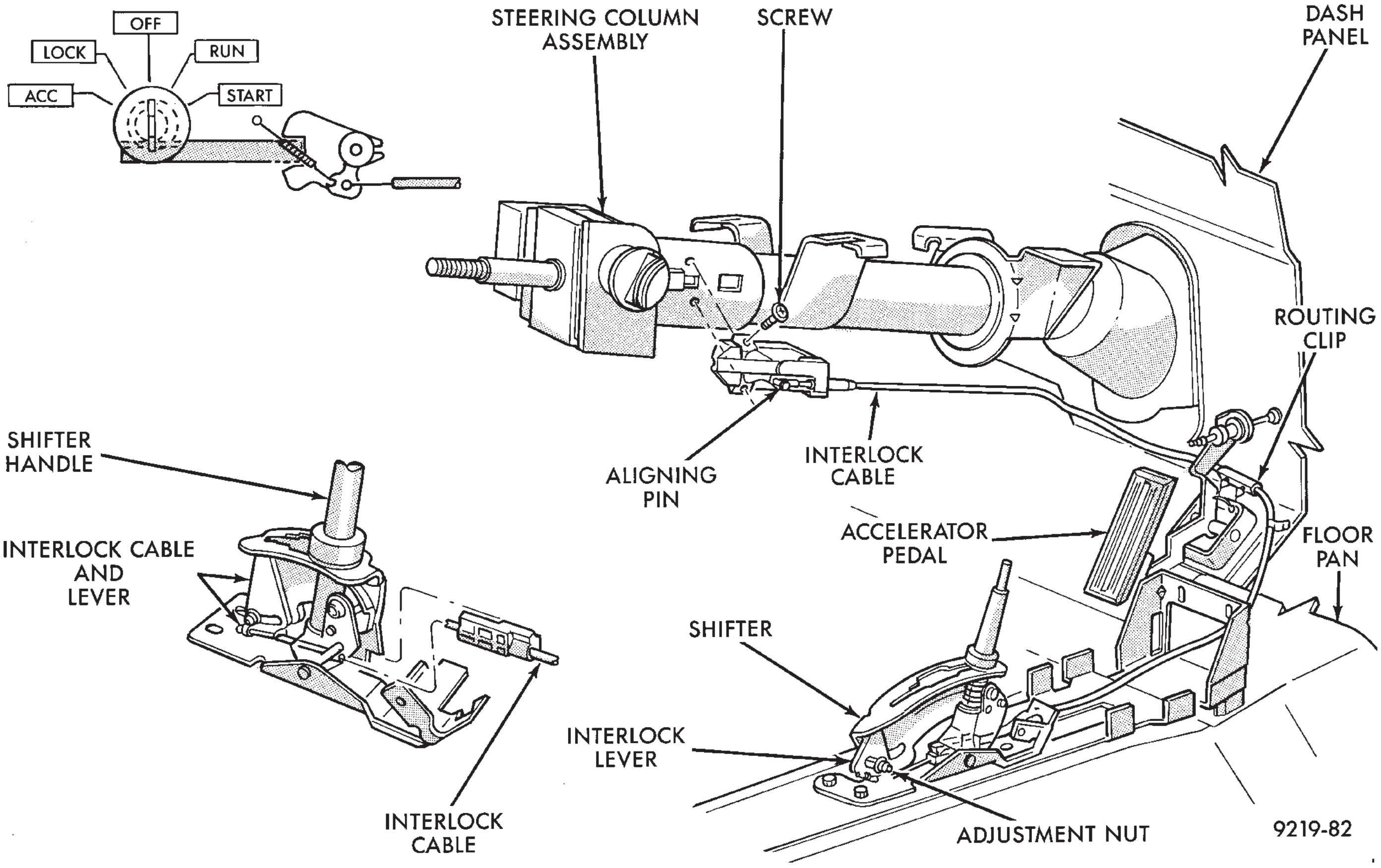


Fig. 1 Shifter Ignition Interlock System Components

INTERLOCK SYSTEM ADJUSTMENT

If ignition switch is binding, operating effort high or can not

be turned to the LOCK position, with shifter locked in PARK, adjustment of Interlock System may be required. To adjust Interlock System, follow procedure listed below.

(1) Remove the shift knob to shifter retaining screw and shift knob from shifter (Fig. 2). Leave the shifter release button in shifter handle.

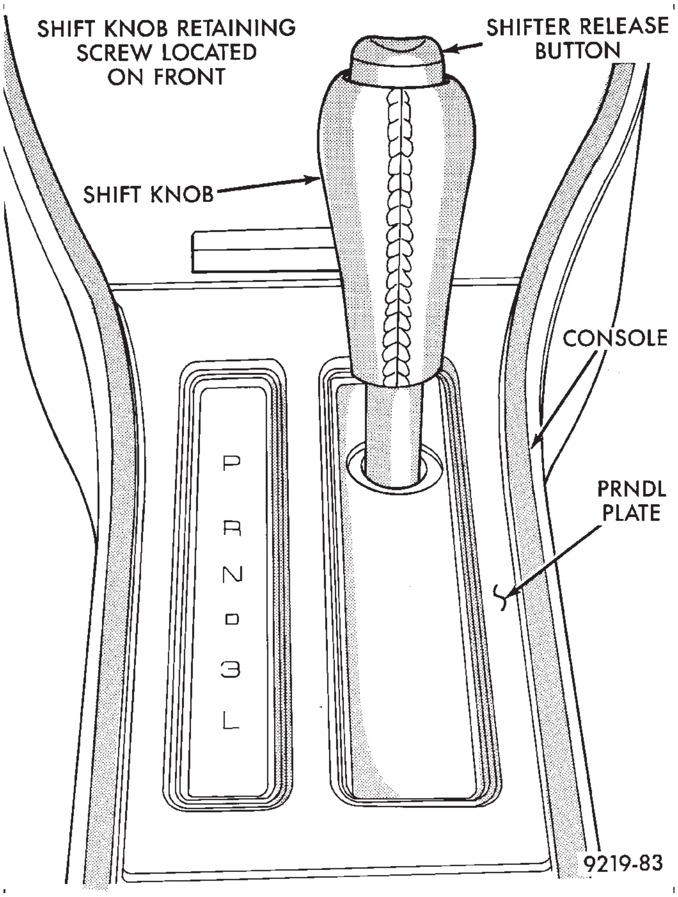


Fig. 2 Removing Shift Knob And PRNDL Plate

(2) On the **AA and AP bodies,** remove PRNDL plate (Fig. 2) from center console for adjustment of interlock cable. PRNDL plate is removed by gently prying between plate and console with a screw driver. Use care so not to damage plate or console assembly.

(3) On the **AG and AJ bodies,** the center console (Fig. 3) requires removal from vehicle for adjustment of interlock cable. Refer to the AG or AJ section of Group 23 Body, in this service manual for detailed center console removal procedure.

(4) Place shifter in PARK, and ensure that the plunger (Fig. 4) on shifter mechanism is in the full up position.

(5) Turn ignition switch to the ACCESSORY position. **The Interlock System will not adjust properly if the ignition switch is in the LOCK position.** If interlock cable has lost its adjustment, it will be necessary to manually position cable to get key into Accessory position. Grasp slug on interlock cable (Fig. 5) with needle nose pliers and pull back on cable. This will allow the ignition switch to be turned to the ACCESSORY position.

(5) Check that the interlock cable slug is completely seated into the shifter interlock lever (Fig. 4).

(6) Check that the ignition switch is still in the accessory position (Fig. 1). Loosen the shifter interlock

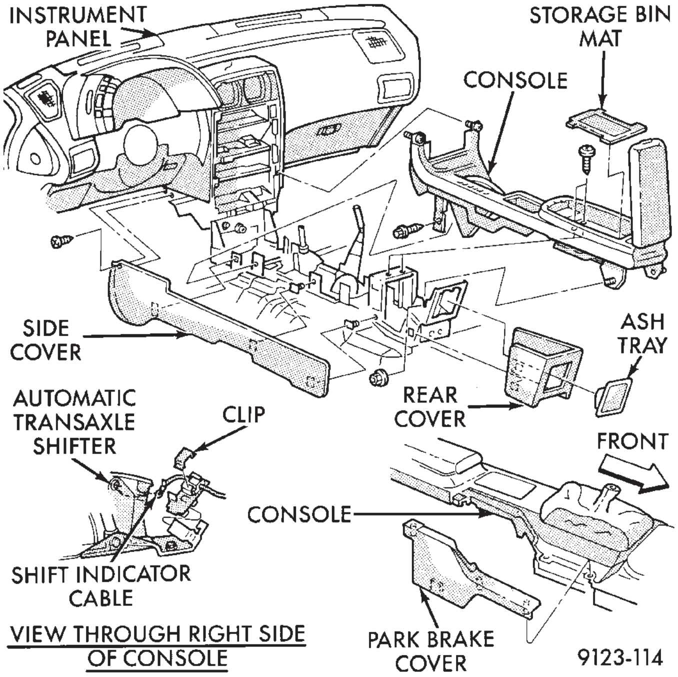


Fig. 3 AG & AJ Center Console

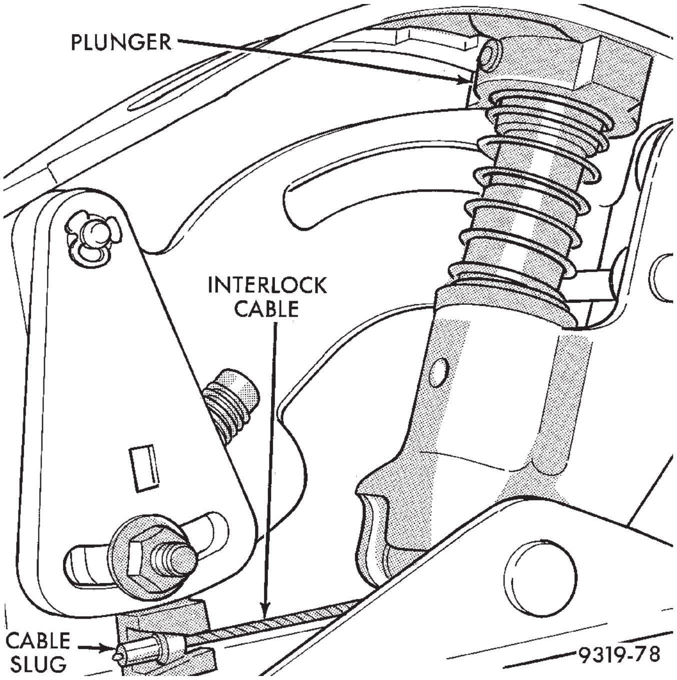


Fig. 4 Plunger Position For Interlock Adjustment

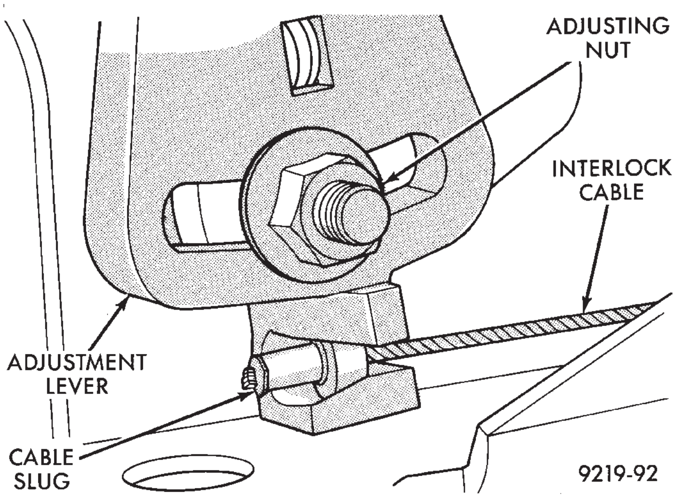


Fig. 5 Interlock Cable Slug

lever adjustment nut, (Fig. 6) enough to allow the spring to correctly position the interlock lever on the shifter assembly.

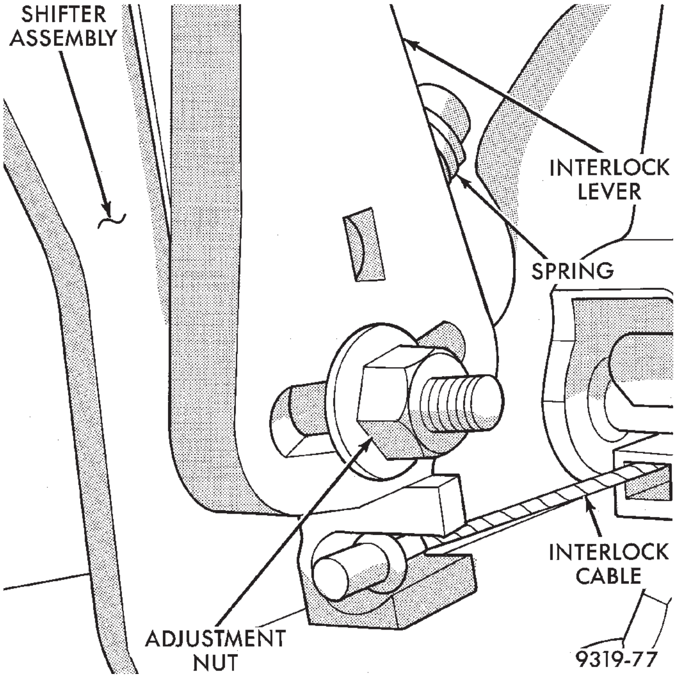


Fig. 6 Adjusting Interlock Lever

(7) Then torque the interlock lever adjustment nut to 2 N•m (15 in. lbs.) minimum 3 N•m (25 in. lbs.) maximum.

(8) On the AA and AP bodies, install the PRNDL plate (Fig. 2) back into the center console.

(9) On the **AG and AJ bodies,** install the center console (Fig. 3) back into the vehicle. Refer to the AG or AJ section of Group 23 Body, in this service manual for detailed center console installation procedure.

(10) Install the shift knob onto the shifter assembly. Install the shift knob to shifter retaining screw and torque to 3 N•m (25 in.lbs.) (Fig. 2).

(11) After adjusting the interlock system, perform the interlock system operation check. See Interlock System Operation Check in this section of the service manual.

SHIFTER/IGNITION INTERLOCK CABLE

REMOVE

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove the lower dash panel bolster and inside hood release lever, (Fig. 5) from the vehicle instrument panel.

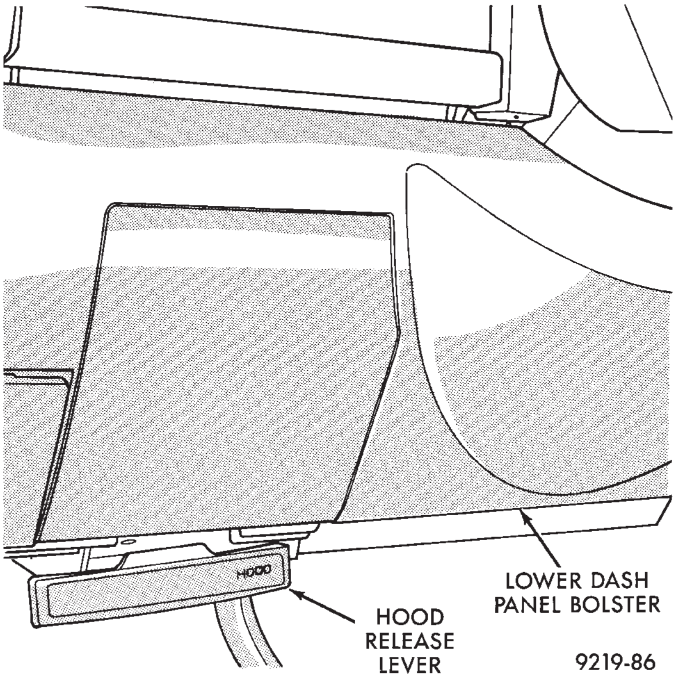


Fig. 5 Remove Hood Release lever And Dash Panel Bolster

(3) Remove the tilt lever (Fig. 6) (if so equipped) from the steering column assembly.

(4) Remove the 3 screws mounting upper steering column shrouds to steering column assembly and then remove the shrouds (Fig. 6).

(5) Remove the 2 nuts holding the upper steering column mounting bracket, to the steering column support bracket (Fig. 7). Lower steering column for clearance when removing lower shrouds from steering column.

(6) Remove the 3 screws mounting the lower steering column shroud to the steering column assembly and remove shroud (Fig. 8).

(7) Remove shift knob to shifter retaining screw and remove knob from shifter assembly. Remove PRNDL plate from the console assembly (Fig. 9).

(8) Remove center console assembly. Refer to Group 23 Body, in this service manual for the appropriate procedure for body style being serviced.

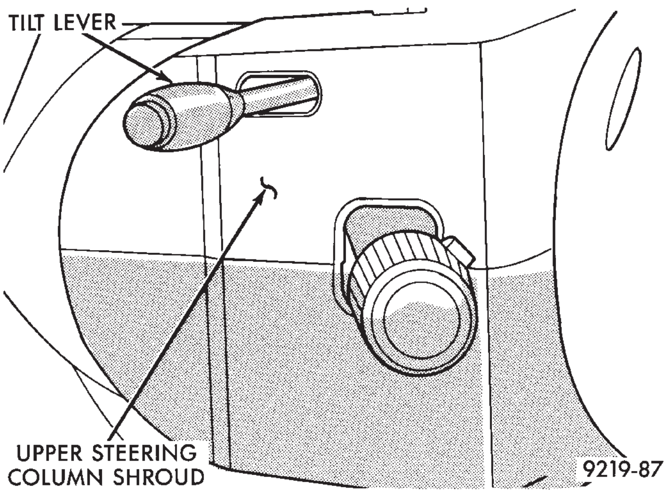


Fig. 6 Upper Steering Column Shroud And Tilt Lever

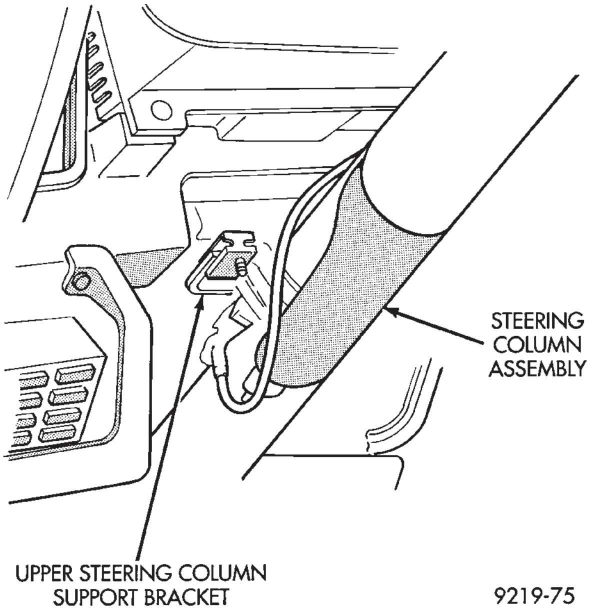


Fig. 7 Steering Column Mounting Bracket

(9) Loosen but do not remove the interlock lever adjusting nut (Fig. 10) on the shifter assembly.

(10) Remove interlock cable slug, from interlock lever on shifter assembly (Fig. 10). Remove interlock cable from shifter assembly by grasping cable and pulling straight out from front of shifter assembly (Fig. 11).

(11) Remove the interlock cable routing clip from the throttle pedal bracket (Fig. 12). Removal of the clip can be done by using needle nose pliers to compress barbs on clip and removing from holes in bracket.

(12) Remove the 2 screws holding the interlock mechanism to the steering column (Fig. 13). Mechanism is held to column by clips on back of mechanism, then pull mechanism straight out from steering column.

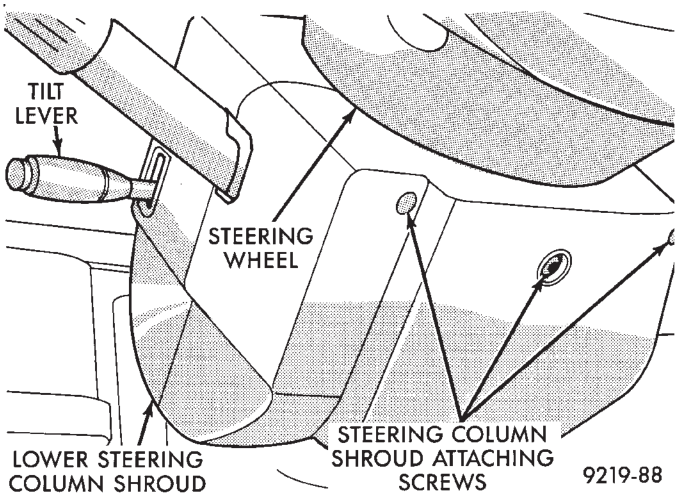


Fig. 8 Lower Steering Column Shroud

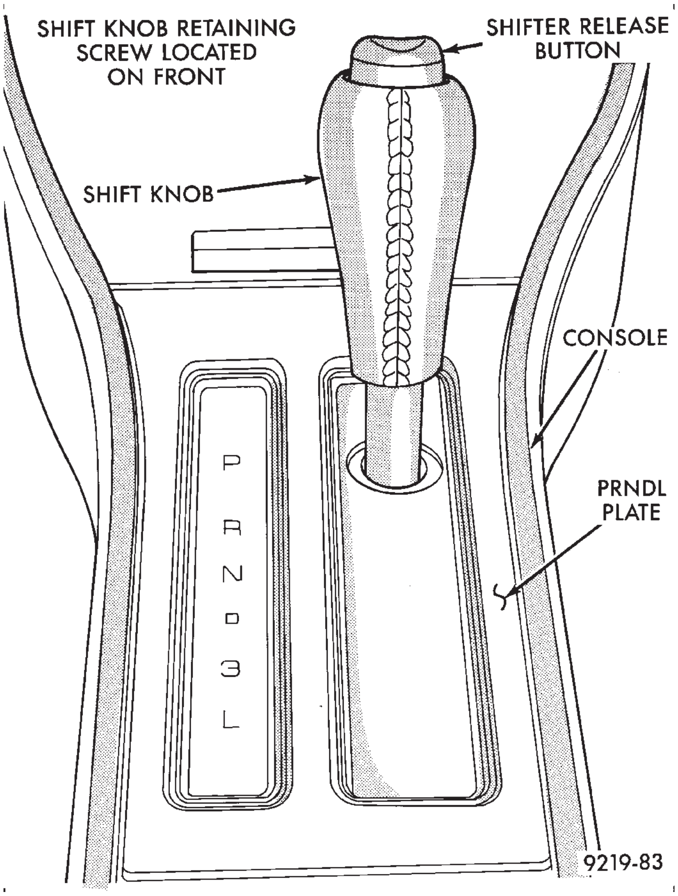


Fig. 9 Shift Knob And PRNDL Plate Removal

(13) Remove interlock cable from routing clip on lower steering column mounting bracket.

(14) Route interlock cable from under center console mounting bracket and out front of dash panel.

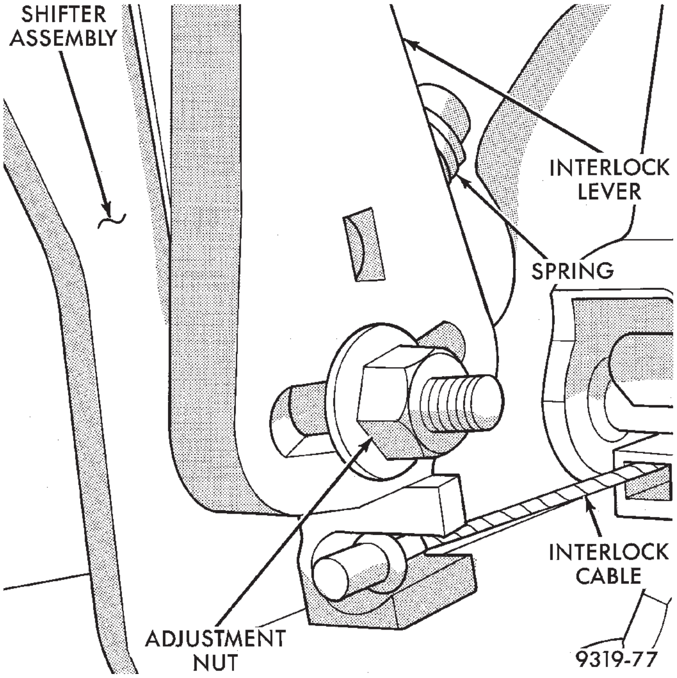


Fig. 10 Interlock Adjusting Nut

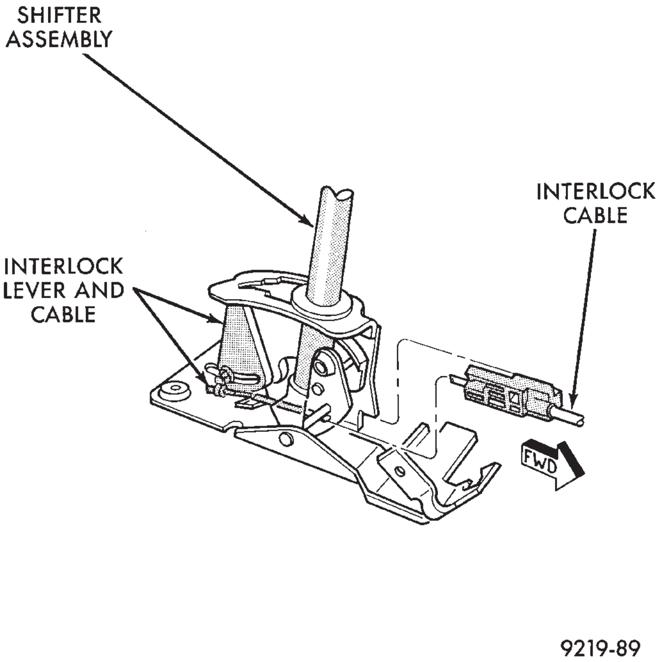


Fig. 11 Interlock Cable Removal

INSTALL

CAUTION: When installing interlock cable assembly, care must be taken not to bend exposed cable wire and slug at shifter end of cable.

(1) Route interlock cable into lower dash panel and down under the center console mounting bracket (Fig. 1). Cable must be routed above the lower dash panel support bracket and above throttle pedal base.

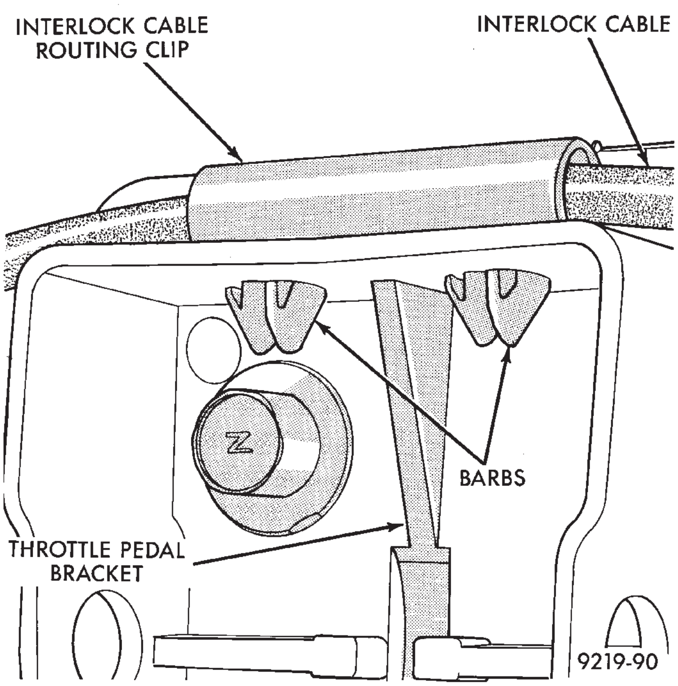


Fig. 12 Remove Interlock Routing Clip

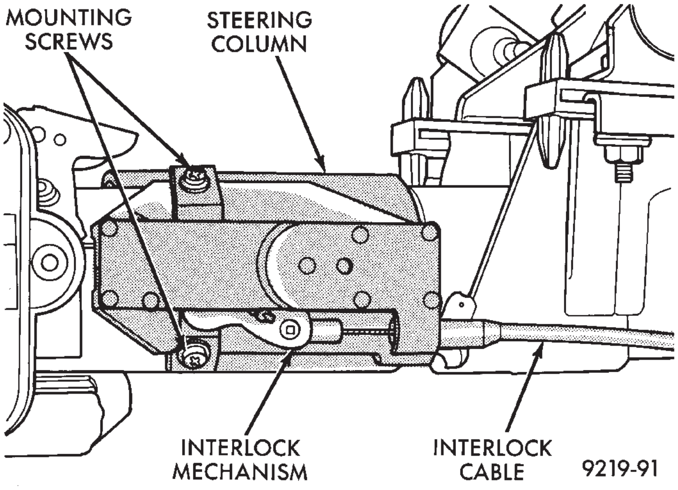


Fig. 13 Removing Interlock Mechanism

(2) Turn the ignition switch to the RUN position (Fig. 1). Install the interlock mechanism on the steering column, by locking tabs on back of mechanism into large square opening on steering column.

(3) Move cam on interlock mechanism by hand, allowing slider to move into cam and ignition switch to rotate to the ACCESSORY position. Then turn the ignition switch to the ACCESSORY position (Fig. 1).

(4) Install the 2 interlock mechanism to steering column attaching screws (Fig. 13) and torque to 3 N●m (21 in. lbs.).

(5) Install interlock cable into routing clip on lower steering column mounting bracket.

CAUTION: Interlock cable must by completely clipped to the throttle pedal bracket with both barbs of clip fully installed through mounting holes. This is to prevent interference with throttle pedal.

(6) Snap the interlock cable routing clip into the 2 holes on the throttle pedal mounting bracket (Fig. 12).

(7) Snap the end fitting of the interlock cable into the corner of the shifter assembly (Fig. 14). The cable end and clip must pass under and clip to the shifter pivot.

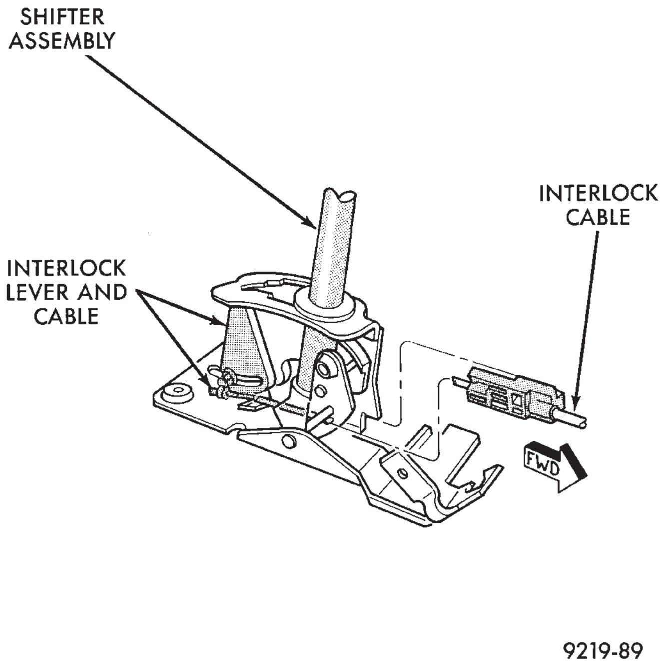


Fig. 14 Interlock Cable Installation

(8) Install slug on end of interlock cable into notch, on shifter lockout spring loaded lever (Fig. 15). Make sure that cable slug is fully seated in cup of lever assembly.

(9) Adjust the Shifter/Ignition Interlock System. See Interlock System Adjustment, in this section of service manual.

(10) Perform the Shifter/Ignition Interlock System operation check, as described in the beginning of this section.

(11) Install center console assembly. Refer to Group 23 Body, in this service manual for the appropriate procedure for the body style

being serviced.

(12) Install PRNDL plate in center console. Install the shift knob onto the shifter assembly. Install the shift knob to shifter retaining screw and torque to 3 N●m (25 in.lbs.) (Fig. 2).

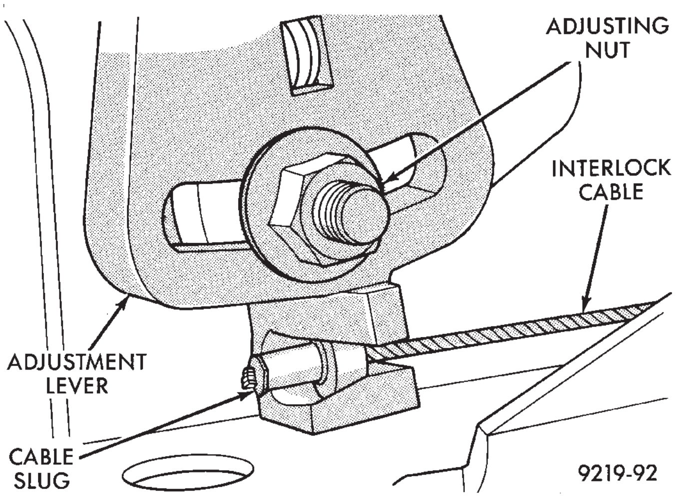


Fig. 15 Install Interlock Cable In Shifter

(13) Install the lower steering column shrouds on the steering column (Fig. 8). Tighten the 2 lower shroud to steering column screws.

(14) Make sure ground clip is on left breakaway capsule. Make sure that both breakaway capsules are fully seated in the upper steering column bracket. Install the upper steering column mounting bracket onto the steering column support bracket (Fig. 7). Install the 2 upper steering column bracket to support bracket nuts and torque to 12 N●m (105 in. lbs.).

(15) Install the upper steering column shrouds on the steering column (Fig. 6). Tighten the 3 upper shroud to steering column attaching screws.

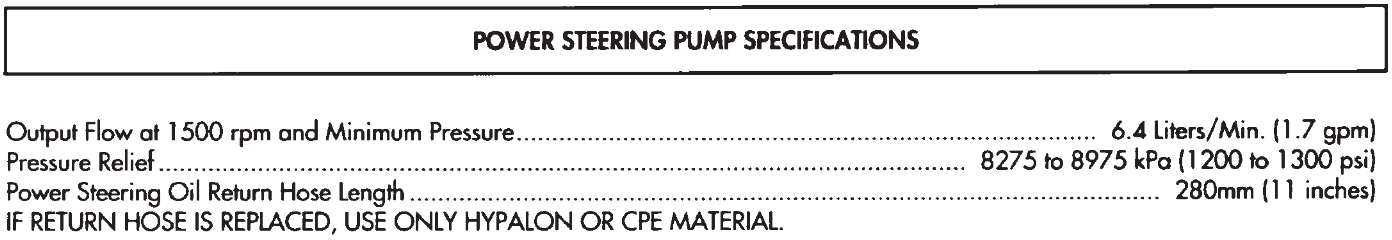
(16) Install the tilt lever (Fig. 6) (if so equipped) back on the steering column assembly.

(17) Install the lower dash panel bolster. Install bolster attaching screws and torque to 3 N●m (24 in. lbs.). Install the inside hood release lever and torque screws to 3 N●m (24 in. lbs.) (Fig. 5).

(18) Reconnect the battery negative (-) cable to the vehicle battery.

SPECIFICATIONS AND TIGHTENING REFERENCE

POWER STEERING PUMP SPECIFICATIONS



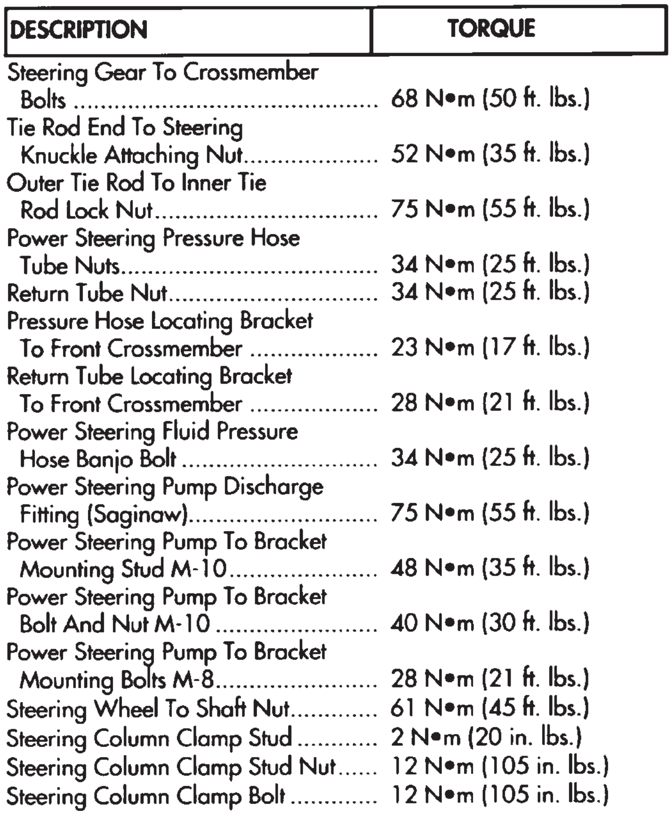
POWER STEERING PUMP SPECIFICATIONS

Output Flow at 1500 rpm and Minimum Pressure	6.4 Liters/Min. (1.7 gpm)
Pressure Relief	8275 to 8975 kPa (1200 to 1300 psi)
Power Steering Oil Return Hose Length	280mm (11 inches)

IF RETURN HOSE IS REPLACED, USE ONLY HYPALON OR CPE MATERIAL.

9219-81

TORQUE SPECIFICATIONS



DESCRIPTION	TORQUE
Steering Gear To Crossmember Bolts	68 N•m (50 ft. lbs.)
Tie Rod End To Steering Knuckle Attaching Nut	52 N•m (35 ft. lbs.)
Outer Tie Rod To Inner Tie Rod Lock Nut	75 N•m (55 ft. lbs.)
Power Steering Pressure Hose Tube Nuts	34 N•m (25 ft. lbs.)
Return Tube Nut	34 N•m (25 ft. lbs.)
Pressure Hose Locating Bracket To Front Crossmember	23 N•m (17 ft. lbs.)
Return Tube Locating Bracket To Front Crossmember	28 N•m (21 ft. lbs.)
Power Steering Fluid Pressure Hose Banjo Bolt	34 N•m (25 ft. lbs.)
Power Steering Pump Discharge Fitting (Saginaw)	75 N•m (55 ft. lbs.)
Power Steering Pump To Bracket Mounting Stud M-10	48 N•m (35 ft. lbs.)
Power Steering Pump To Bracket Bolt And Nut M-10	40 N•m (30 ft. lbs.)
Power Steering Pump To Bracket Mounting Bolts M-8	28 N•m (21 ft. lbs.)
Steering Wheel To Shaft Nut	61 N•m (45 ft. lbs.)
Steering Column Clamp Stud	2 N•m (20 in. lbs.)
Steering Column Clamp Stud Nut	12 N•m (105 in. lbs.)
Steering Column Clamp Bolt	12 N•m (105 in. lbs.)

9219-80

TRANSAXLE

CONTENTS

A-523, A-543, and A-568 MANUAL TRANSAXLE

INDEX

GENERAL INFORMATION

Safety goggles should be worn at all times when working on these transaxles. All manual transaxles use SAE 5W-30 engine oil, meeting SG and/or SG-CC qualifications, as the lubricant in order to reduce wear.

This 5-speed manual transaxles combine gear reduction, ratio selection, and differential functions in one unit. It is housed in a die-cast aluminum case (Fig. 1).

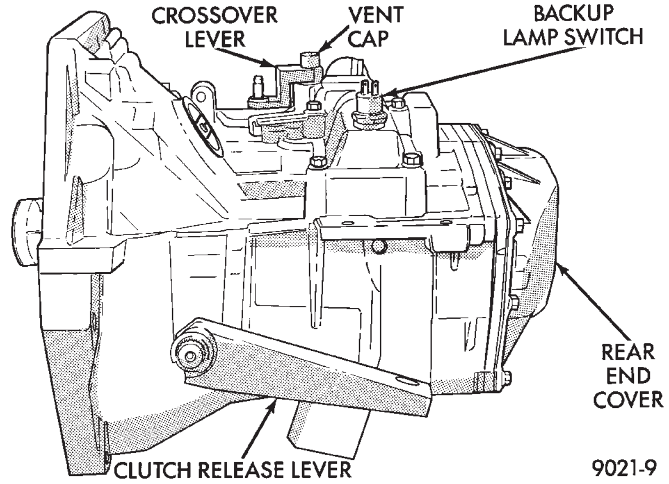


Fig. 1 External Transaxle Components

All shift forks are cast iron. **Do not interchange 1-2 or 5th shift fork pads with the 3-4 shift fork pads.** All synchronizers use a **winged strut** design that prevents the struts from popping out of position.

If any synchronizer is to be disassembled, mark all parts so that they will be reassembled in the same position.

CAUTION: 1-2 synchronizer assembly components must NOT be interchanged with any other synchronizer assembly. Do not interchange with previous model years transaxles; they will NOT function correctly.

A-523 AND A-543 MANUAL TRANSAXLE

The A-523 manual transaxle is used in all 4-cylinder applications, except high output turbocharged engines. The A-543 manual transaxle is used only with V-6 engines.

To reduce wear, the manual transaxle uses SAE 5W-30 engine oil as the lubricant.

Gear ratios for the A-523 and A-543 are as follows: 1st—3.31, 2cd—2.06, 3rd—1.36, 4th—0.97, 5th—0.71, Reverse—3.14. The final drive ratio is 3.77.

CAUTION: All gears and shafts must not be interchanged with previous model years; they will not function correctly.

A-568 HEAVY—DUTY MANUAL TRANSAXLE

The greater torque of the high output turbo engines require a stronger transmission. It includes a die-cast aluminum case and a stronger, coarse-pitch gear set. It has five forward speed ratios and reverse. Gear ratios are as follows: 1st—3.31, 2nd—1.89, 3rd—1.28, 4th—0.94, 5th—0.71, Reverse—3.14. Final drive ratio of 3.85 was selected for maximum performance. All forward gears are synchronized.

To reduce wear, this transaxle, in common with other manual transaxles, uses SAE 5W-30 engine oil as the lubricant.

IDENTIFICATION

A-523, A-543, and A-568: the 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).

Certain transaxle assemblies utilize high-strength Steel in various gears to provide adequate life in heavy-duty applications. **Therefore, it is imperative that the correct transaxle assembly number is utilized when ordering service parts.** Also, be sure to reinstall this tag whenever it is removed, so the information is available for future service.

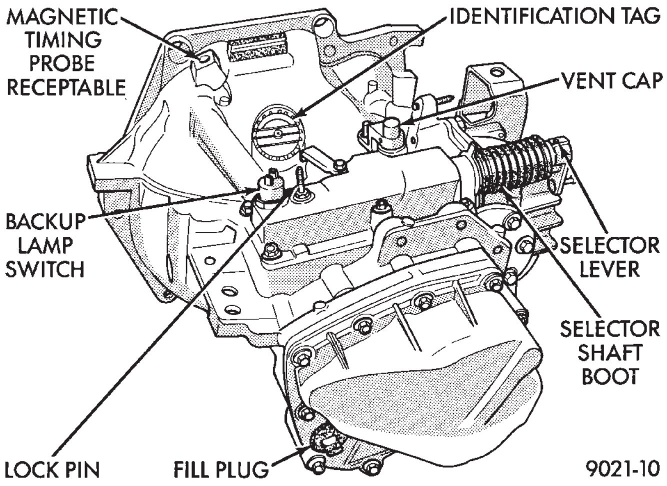


Fig. 2 A-523, A-543, and A-568 Transaxle Identification

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.

GEARSHIFT LINKAGE ADJUSTMENT (CABLE OPERATED)

Before replacing the gearshift selector cable or crossover cable for a **hard-shifting** complaint, disconnect both cables at the transaxle (Fig. 3). Then, from the driver's seat, manually operate the gear-

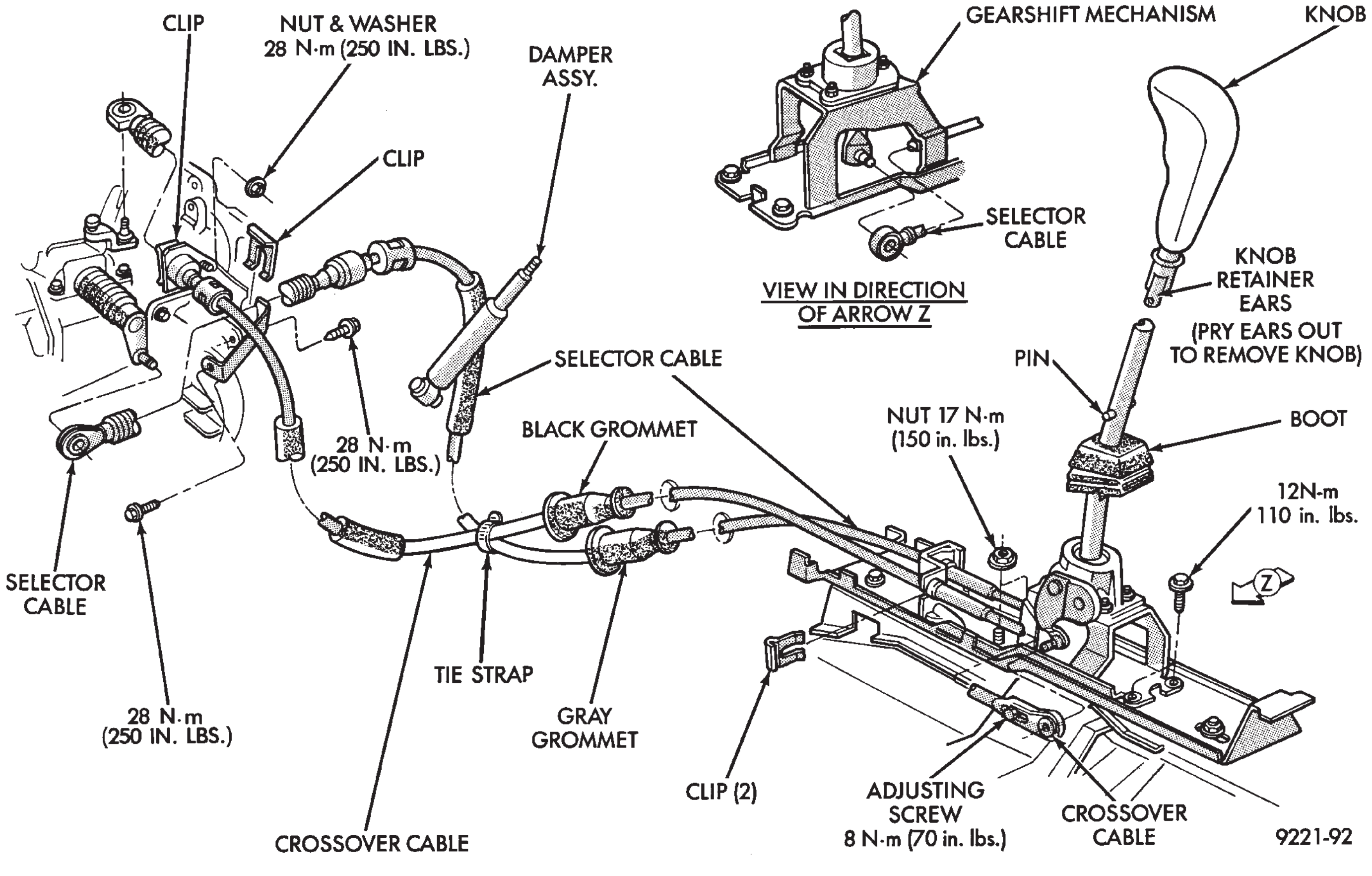


Fig. 3 Gearshift Mechanism

shift 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.

(1) Working over the left front fender, remove the lock pin from the transaxle gearshift (selector shaft) housing (Fig. 4).

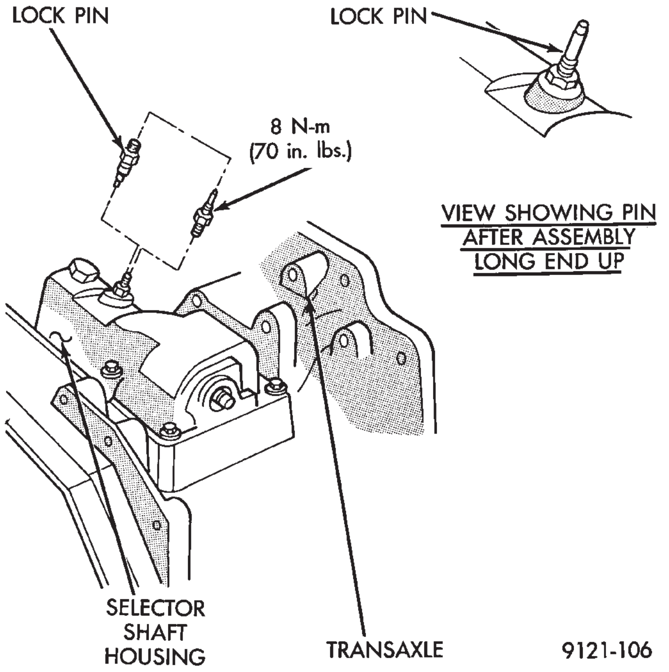


Fig. 4 Manual Transaxle Pinned in the Neutral Position to Adjust Gearshift

(2) Reverse the lock pin (so long end is down) and insert lock pin into same threaded hole. 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.

(3) Remove or install gearshift knob (Fig. 5 or 6).

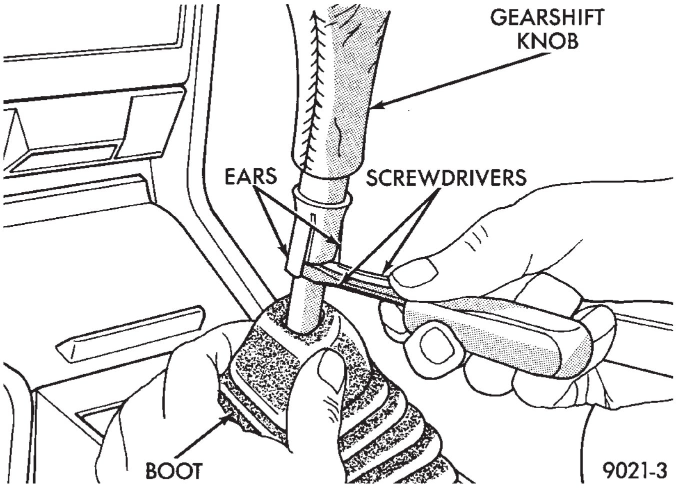


Fig. 5 Remove Gearshift Knob

(4) Remove or install boot (Fig. 7) or console.

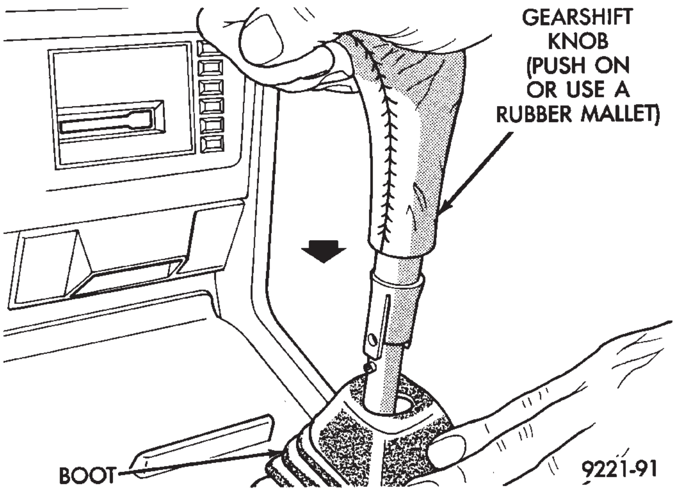


Fig. 6 Install Gearshift Knob

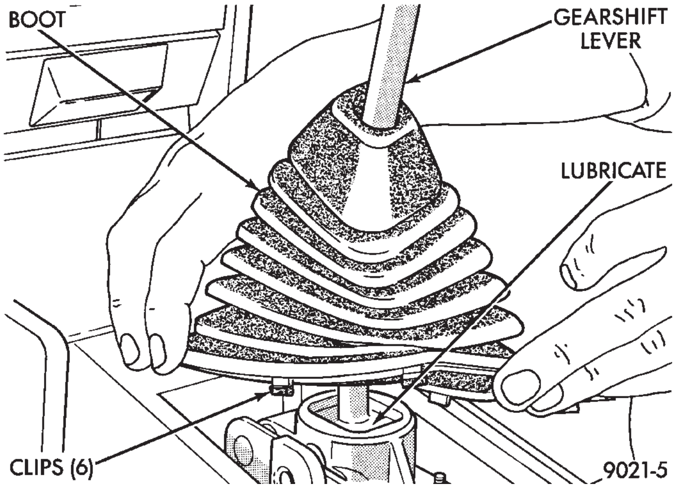


Fig. 7 Remove or Install Boot

(5) Remove or install selector and crossover cables (Fig. 8 or 9).

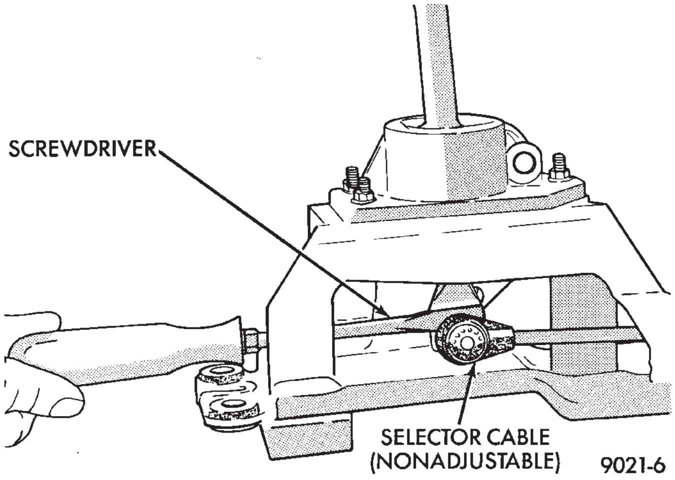


Fig. 8 Remove Cables

Cable attachment clips must be installed from the side. Install cable fittings to shifter pins by pushing with thumb.

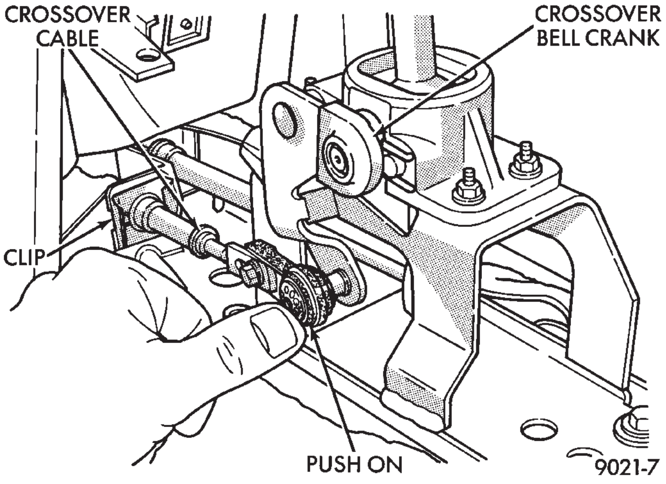


Fig. 9 Install Cables

CAUTION: Be sure crossover bellcrank does NOT move when tightening adjusting screw (Fig. 10).

CAUTION: Proper torque to the crossover cable adjusting screw is very important (Fig. 10).

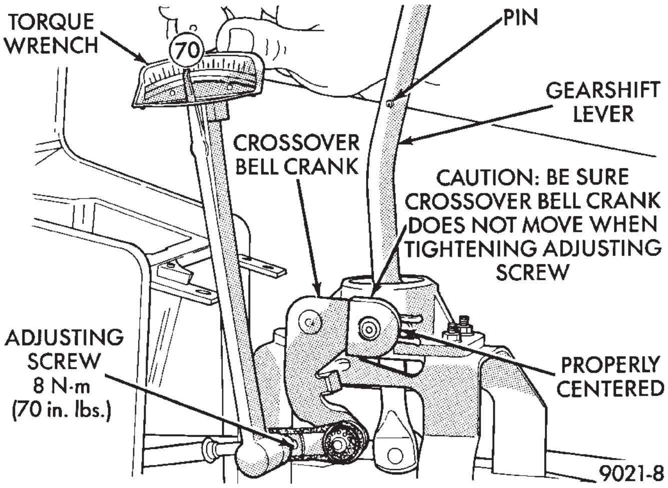


Fig. 10 Adjusting Crossover Cable

(6) Remove lock pin from gearshift housing and reinstall lock pin (so long end is up) in gear shift housing. Tighten lock pin to 8 N●m (70 in. lbs.).

(7) Check for shift into first and reverse.

(8) Gearshift mechanism and cables are now functioning properly.

IN-CAR TRANSAXLE DISASSEMBLE/ASSEMBLE

The following items can be serviced without removing the transaxle from the vehicle:

- Gear shift housing
- Synchronizers
- Intermediate shaft speed gears
- Input shaft
- Reverse idler gear and shaft
- Shift forks and pads
- Shift rails
- Roller detents
- Speedometer pinion
- All external covers

Observe following procedure:

(1) Disconnect negative cable from battery.

(2) Remove both shift cables from shift cover levers.

(3) Remove left front wheel and tire assembly and left splash shield.

(4) Place drain pan under transaxle and remove transaxle rear end cover.

(5) Push out the fifth fork roll pin and slide the fifth fork and synchronizer sleeve off the rail/hub.

(6) Remove the fifth hub snap ring, hub assembly and speed gear.

(7) Remove fifth gear nut and fifth input gear.

(8) Remove the bearing retainer plate, interlock plate and shuttles.

CAUTION: Before removing the gearshift housing assembly, reverse the lock pin (so the long end is down) and insert lock pin into the same threaded hole. This procedure will save time when the gear shift housing assembly is reinstalled.

(9) Remove selector shaft housing bolts (note the two pilot bolts) and remove housing.

(10) Remove roller detents and springs, noting that the rollers align with the shift rails.

(11) Push out the 1-2 and 3-4 lug roll pins, remove the reverse pivot lever and fifth rail C-Clip. **If a roll pin or C-Clip falls, be sure to remove it from the bottom of the case.**

(12) Pull out the fifth shift rail and remove the fifth shift lug and interlock pin.**If the pin falls, be sure to remove it from the bottom of the case.**

(13) Remove the intermediate shaft ball bearing snap ring and the bearing support plate.

(14) Remove reverse shift rail and lug assembly.

(15) Remove the reverse idler shaft and gear assembly.

(16) Rotate the 1-2 shift lug and rail, and 3-4 shift lug towards the front of the vehicle.

(17) Firmly grasp both the input and intermediate shaft assemblies and pull them out of the transmission with the 1-2 and 3-4 shift rails, lugs and forks.

The differential assembly can only be serviced by removing the complete transaxle from the vehicle because bearing preload must be reset.

The components listed in the first paragraph can now be serviced. Refer to the appropriate **subassembly recondition** section.

To reassemble the transaxle in the vehicle, reverse the above procedure using the proper sealants. Fill the transaxle with SAE 5W-30 engine oil to the bottom of the fill hole in the end cover.

TRANSAXLE REMOVAL AND INSTALLATION

Transaxle removal does not require engine removal.

After installing transaxle, fill transaxle to bottom of fill plug hole with SAE 5W-30 engine oil before lowering vehicle to floor.

(1) Disconnect or connect **negative** battery cable.

(2) Install a **lifting eye** on battery ground strap bolt on left side of engine. Then install the engine support fixture as shown in Figure 1.

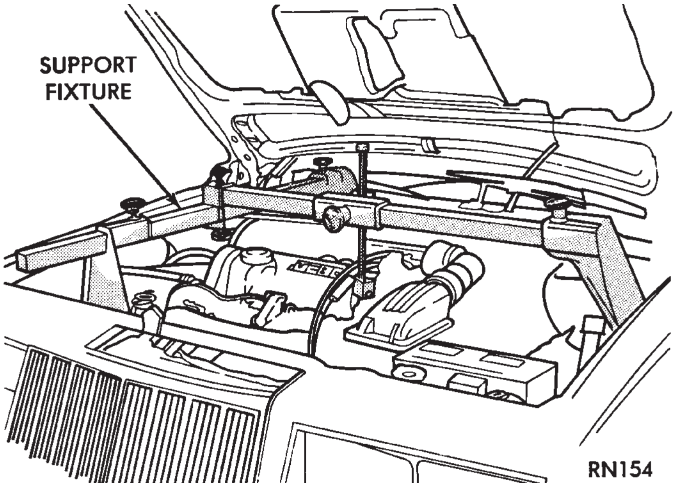


Fig. 1 Engine Support Fixture

(3) Disconnect or connect gearshift cables at transaxle. Disconnect speedometer. Disconnect or connect gearshift cables bracket at transaxle.

(4) Remove or install both front wheel and tire assemblies.

(5) Remove or install left front splash shield.

(6) Remove or install engine left mount from transaxle.

CAUTION:Left engine mounting bolts used in position number 1 and number 3 are the same length. The bolt in the number 2 position is longer. If bolt number 2 is used in position number 3 it can damage the selector shaft housing when the bolt is seated (Fig. 2).

(7) Remove or install anti-rotational link (or anti-hop damper) from crossmember bracket. **Do not remove bracket from transaxle**.

(8) Refer to Group 2 **Suspension**, to remove or install both drive shafts.

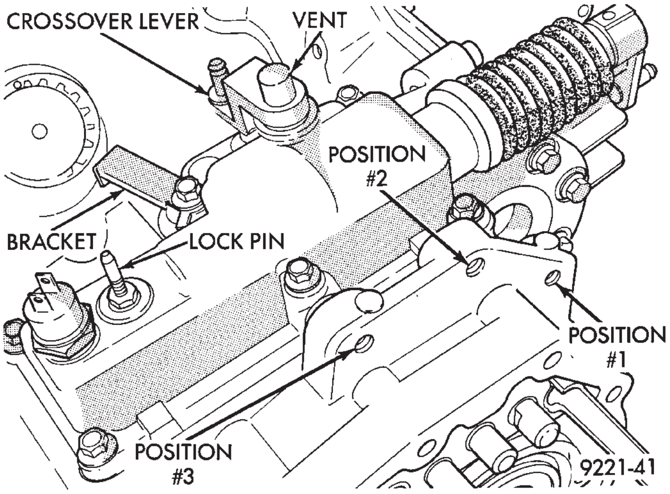


Fig. 2 Left Engine Mount Bolt Location

When removing or installing the transaxle, it may be helpful to use locating pins in place of the top transaxle to engine bolts (Fig. 3).

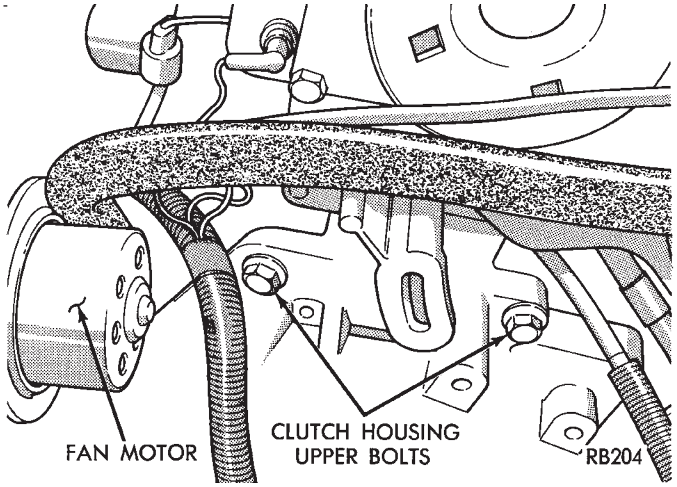


Fig. 3 Remove or Install Bolts

Make the locating pins from two stock (transaxle case to engine block) bolts as follows: Using a hacksaw, remove bolt heads, cut slot in end of bolts for a screw driver, and remove burrs with a grinding wheel.

Install the locating pins into the engine block and proceed with transaxle installation. After transaxle is in place, install bolts and remove locating pins before removing transmission jack.

OUT OF CAR TRANSAXLE—DISASSEMBLE AND ASSEMBLE

DIFFERENTIAL

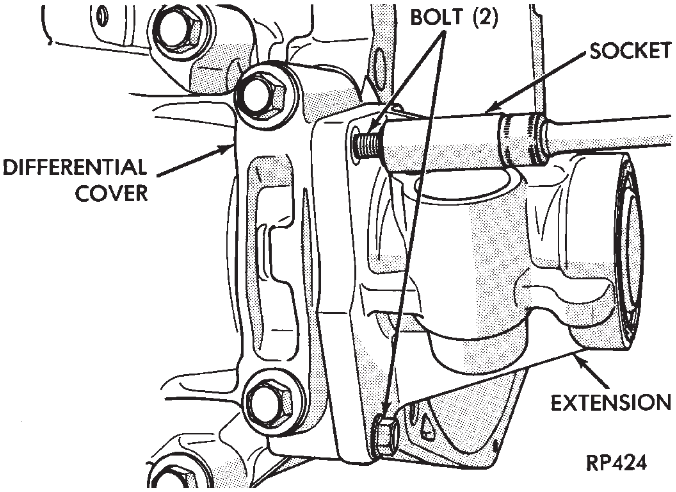


Fig. 1 Remove or Install 2 Extension Outer Bolts

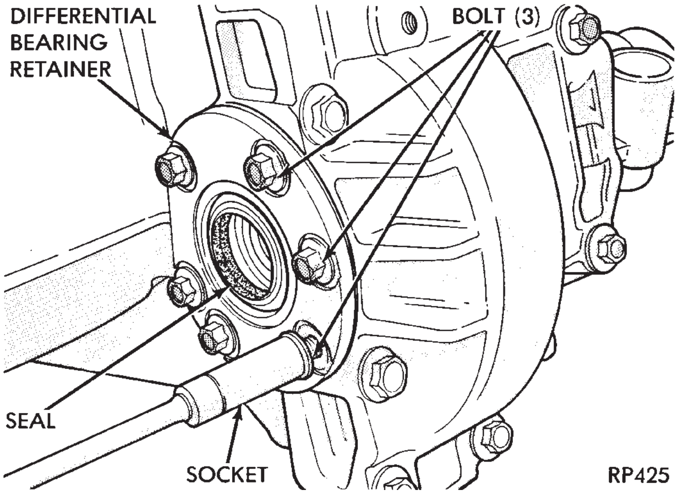


Fig. 2 Remove or Install 3 Differential Bearing Retainer Outer Bolts

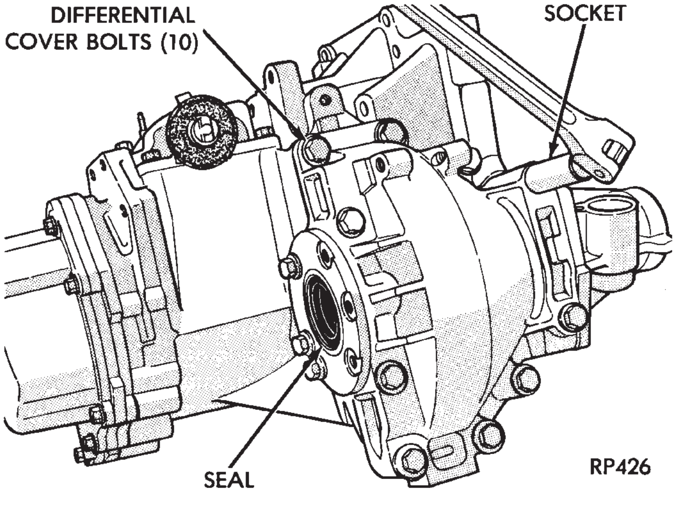


Fig. 3 Remove or Install Differential Cover Bolts

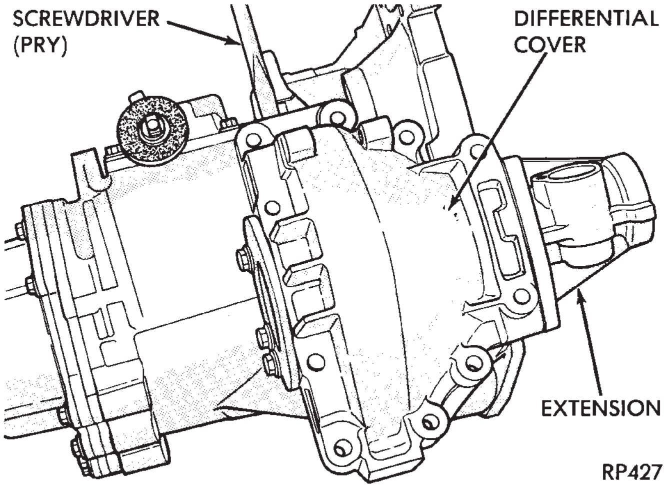


Fig. 4 Remove Differential Cover

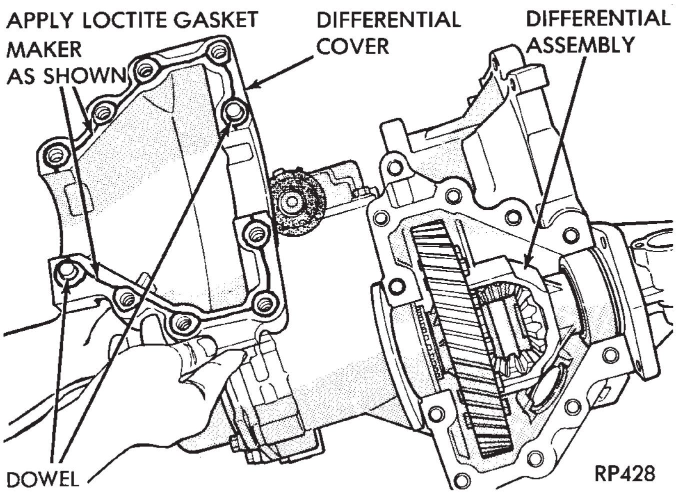


Fig. 5 Differential Cover Removed

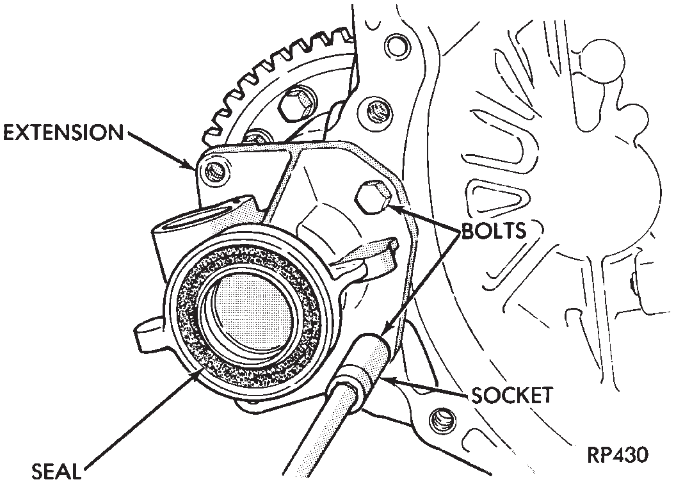


Fig. 6 Remove or Install 2 Extension Bolts

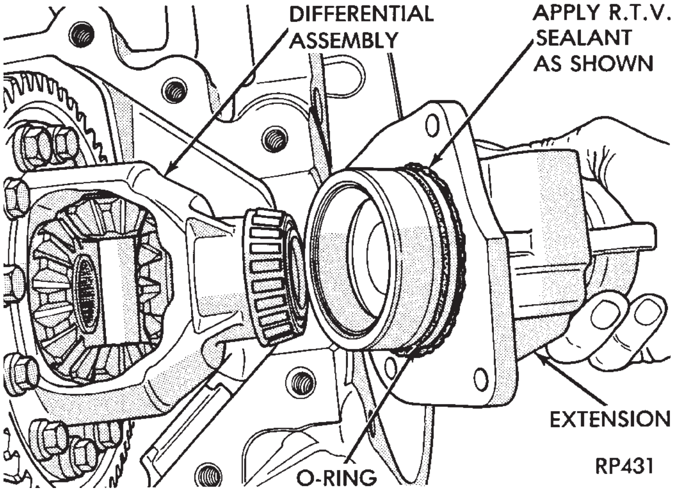


Fig. 7 Remove or Install Extension

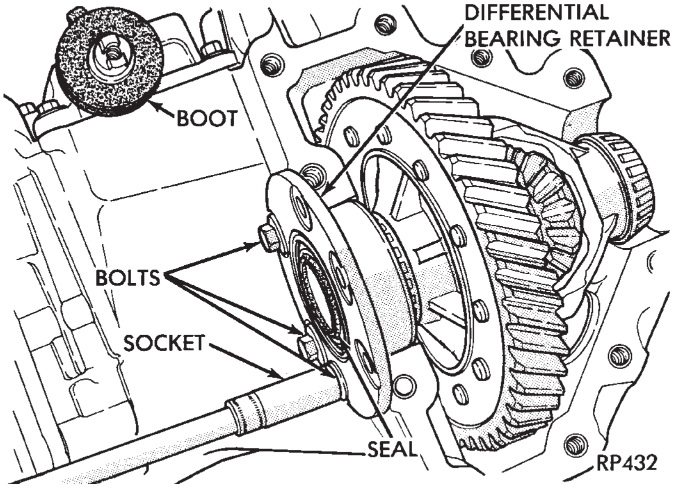


Fig. 8 Remove or Install 3 Differential Bearing Retainer Bolts

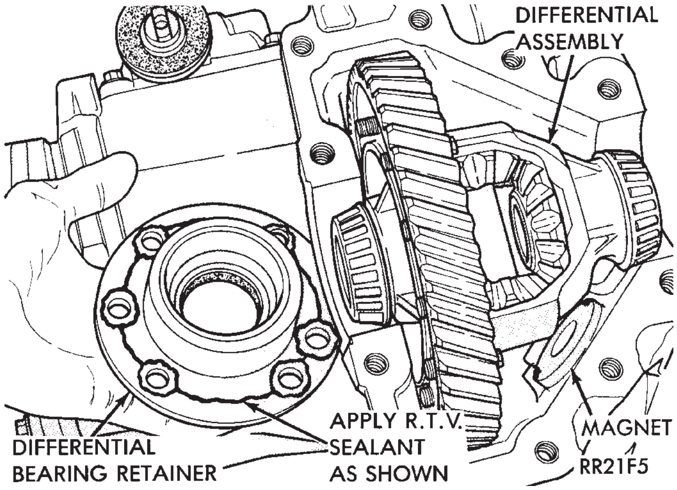


Fig. 9 Remove or Install Differential Bearing Retainer

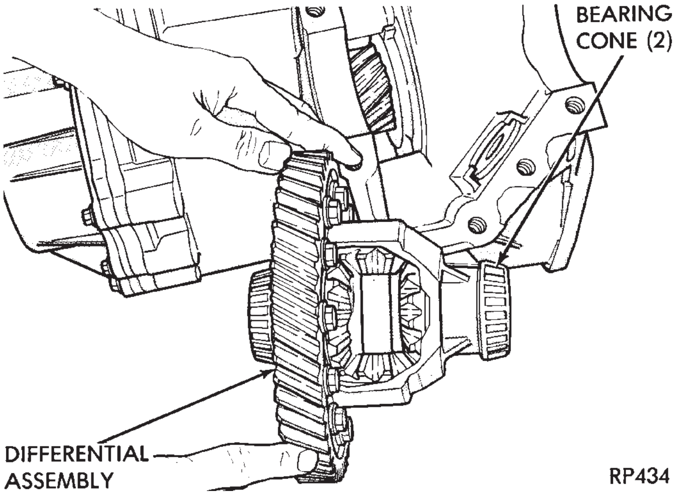


Fig. 10 Differential Assembly Removed

GEAR SET

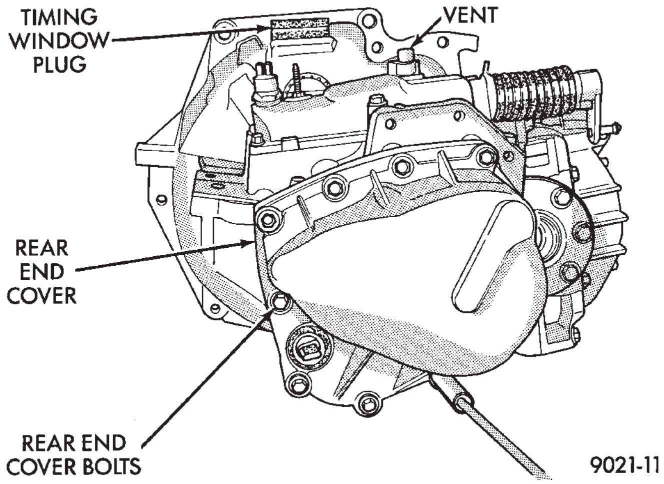


Fig. 1 Rear End Cover Bolts

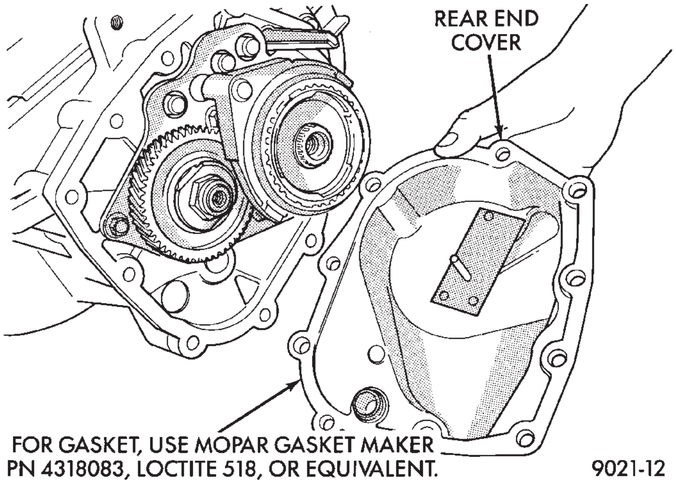


Fig. 2 Rear End Cover Removed

CAUTION: Tool 6252 must be used to remove or install this nut. Always install a NEW nut and tighten to 258 N•m (190 ft. lbs.).

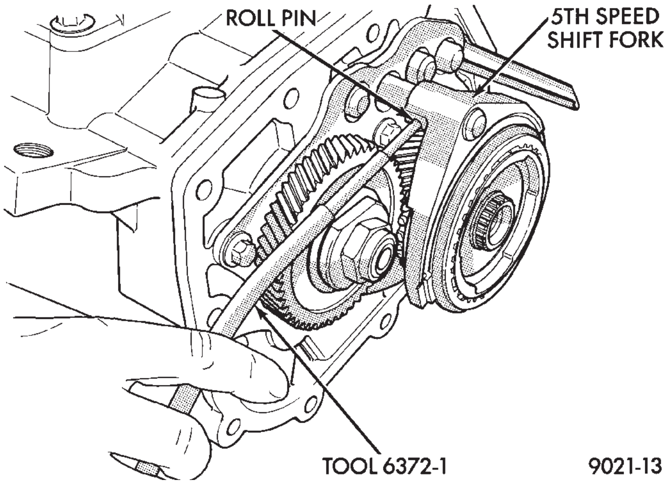


Fig. 3 Remove 5th Fork Roll Pin

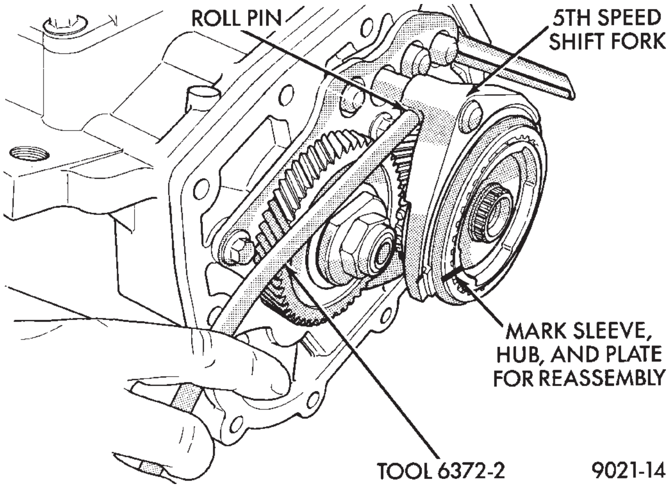


Fig. 4 Install 5th Fork Roll Pin

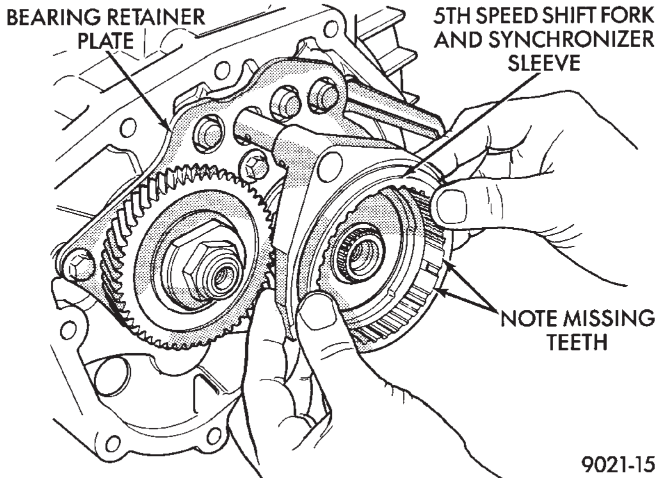


Fig. 5 5th Fork and Sleeve

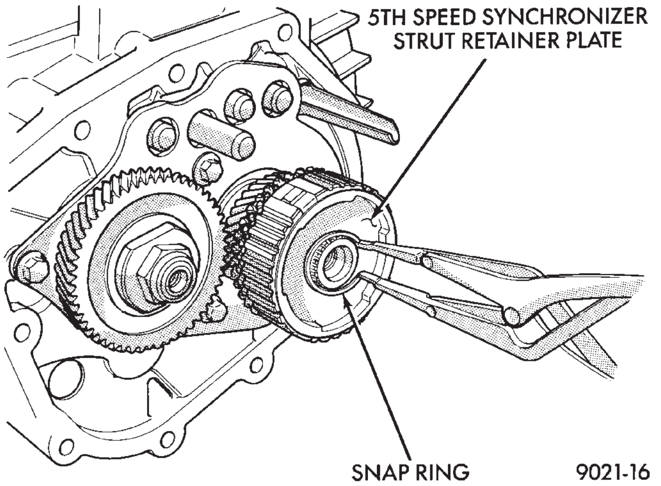


Fig. 6 Snap Ring

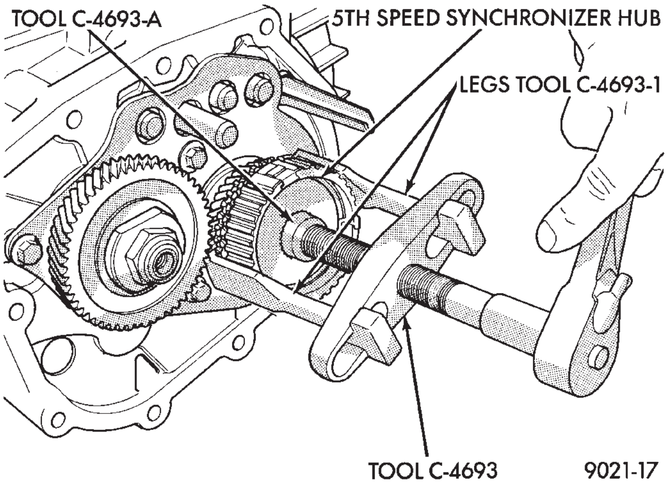


Fig. 7 Remove 5th Synchronizer Hub

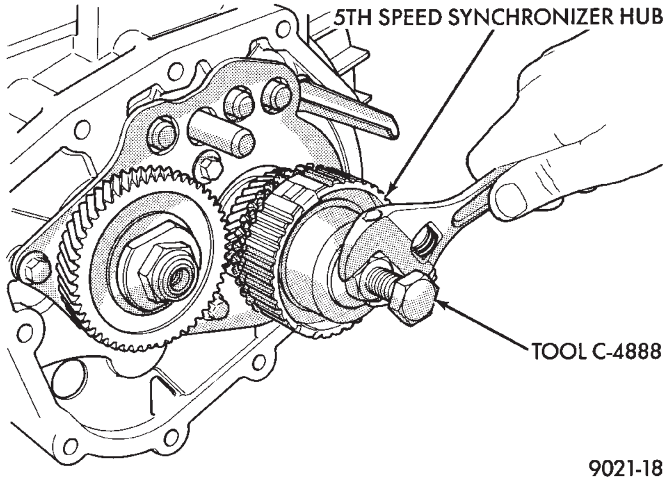


Fig. 8 Install 5th Synchronizer Hub

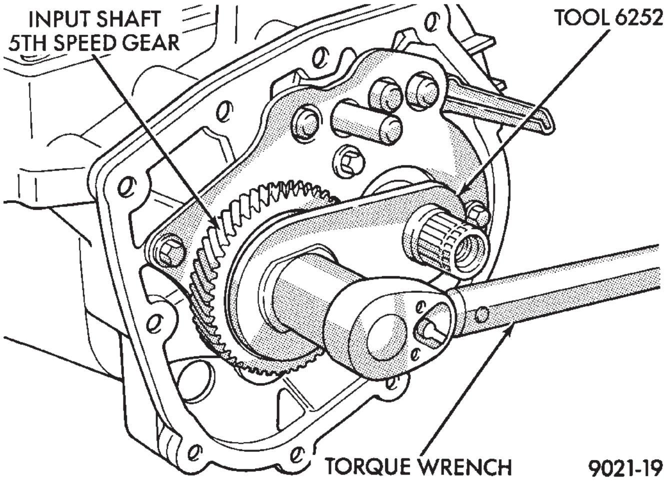


Fig. 9 Remove or Install 5th Gear Nut

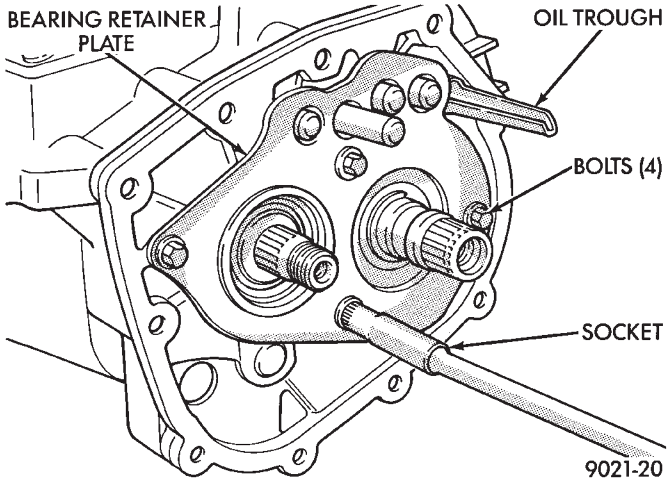


Fig. 10 Bearing Retainer Plate Bolts

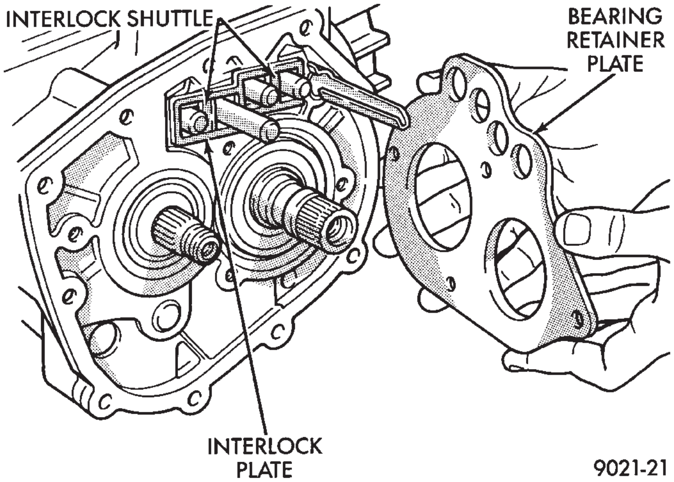


Fig. 11 Bearing Retainer Plate

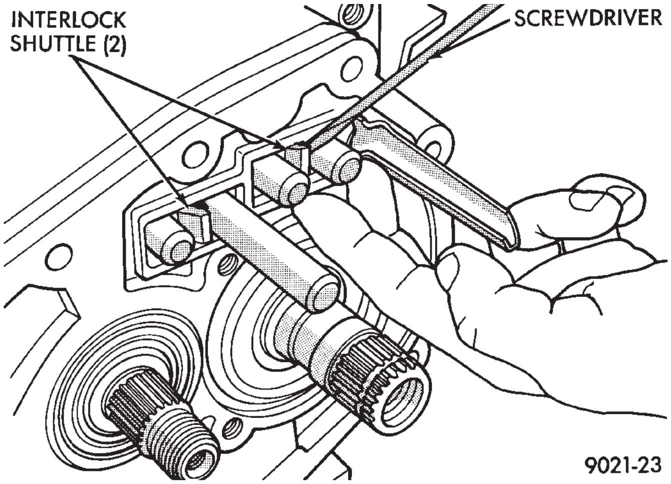


Fig. 12 Interlock Shuttles

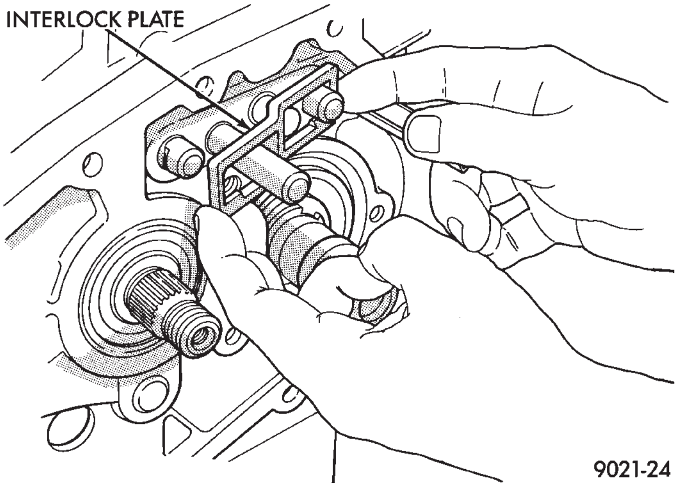


Fig. 13 Interlock Plate

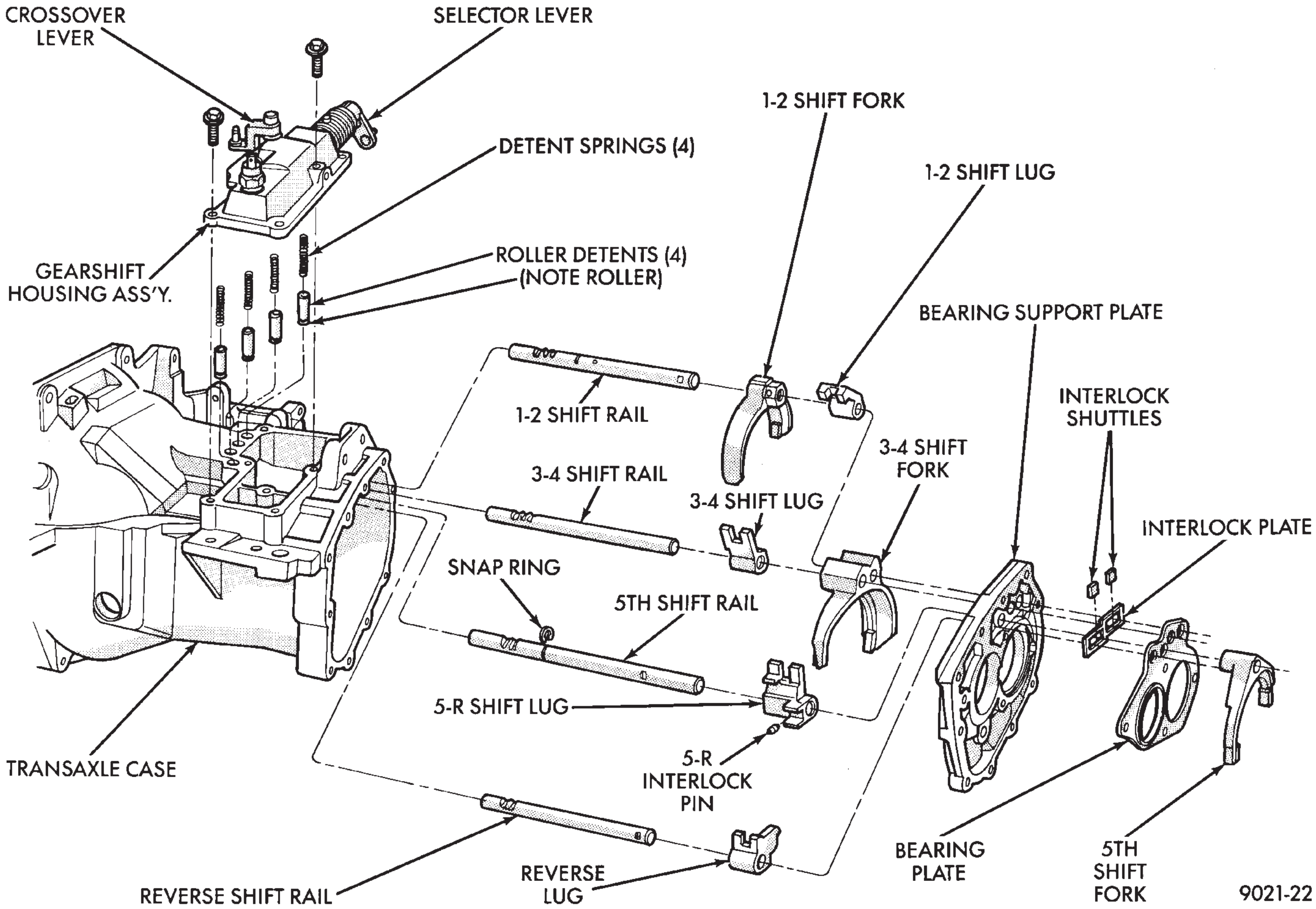


Fig. 14 A-523/A-543/A-568 Shift Forks and Shift Rail Components

CAUTION: Before removing the gearshift housing, reverse the lock pin (so the long end is down) and insert lock pin into the same threaded hole. This procedure will save time when the gearshift housing assembly is reinstalled.

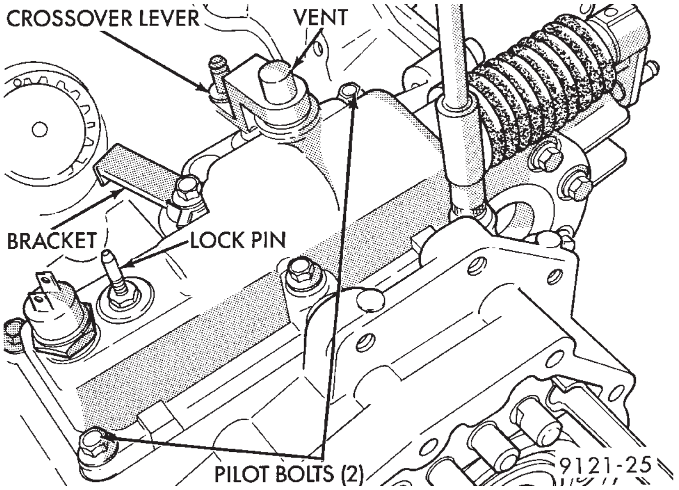


Fig. 15 Gearshift Housing Bolts

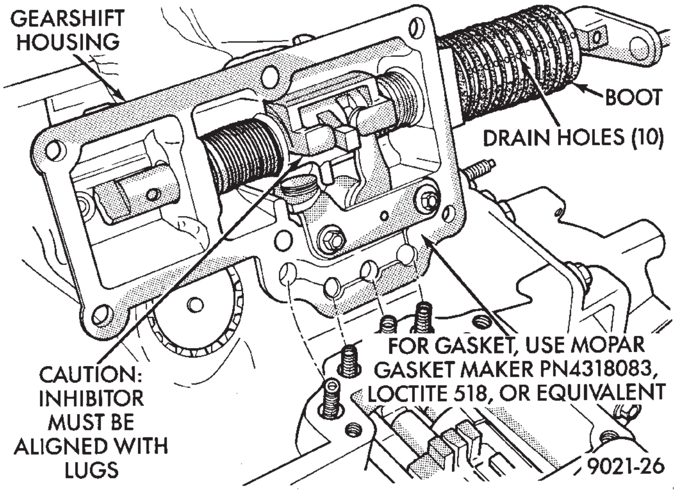


Fig. 16 Gearshift Housing Removed

To install gearshift housing, be sure to reverse the lock pin in the housing to lock the selector shaft in the 3-4 neutral position.

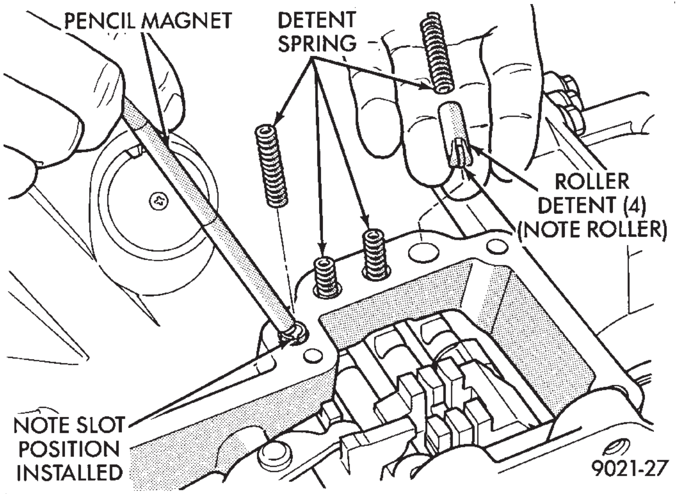


Fig. 17 Remove Roller Detents

CAUTION: Install roller detents so roller and slots are parallel with shift rails.

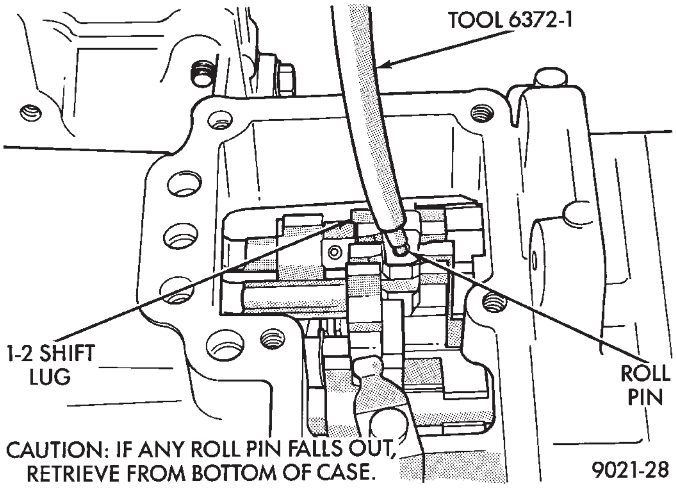


Fig. 18 Remove 1-2 shift Lug Roll Pin

Remove or install 3-4 lug roll pin, 3-4 fork roll pin, and reverse lug roll pin using the above procedure.

CAUTION: If any roll pin falls out, retrieve roll pin from bottom of case.

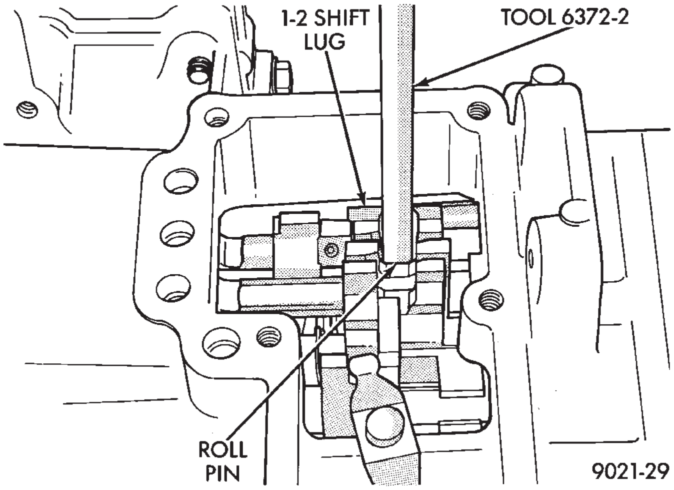


Fig. 19 Install 1-2 Shift Lug Roll Pin

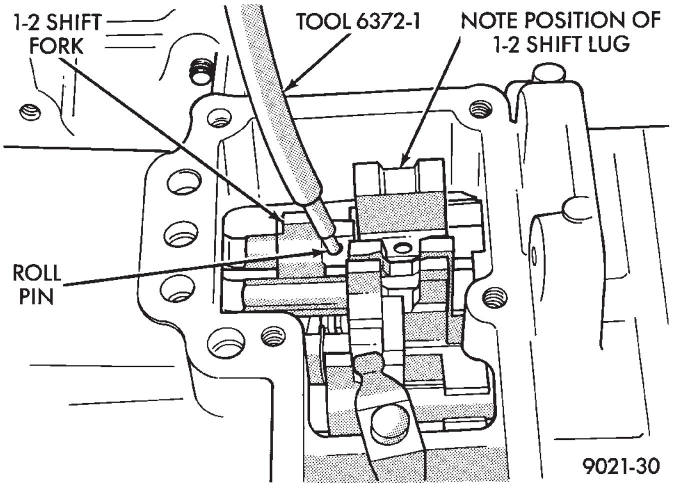


Fig. 20 Remove 1-2 Shift Fork Roll Pin

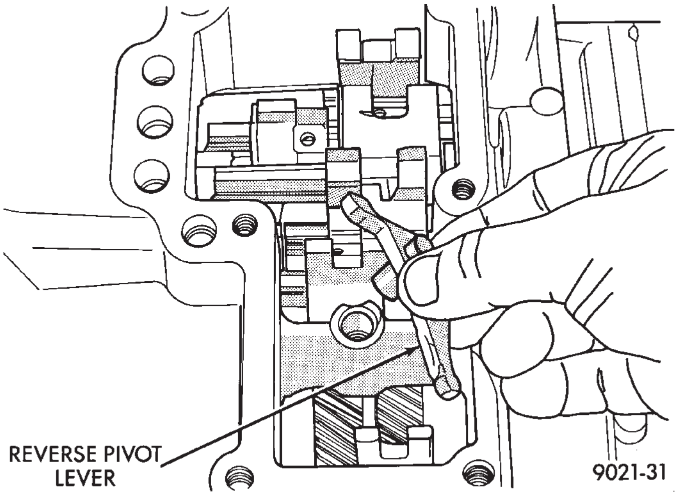


Fig. 21 Reverse Pivot Lever

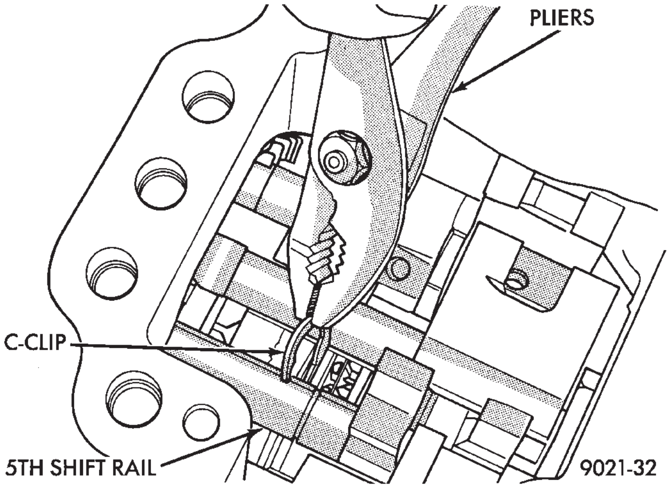


Fig. 22 5th Shift Rail C-Clip

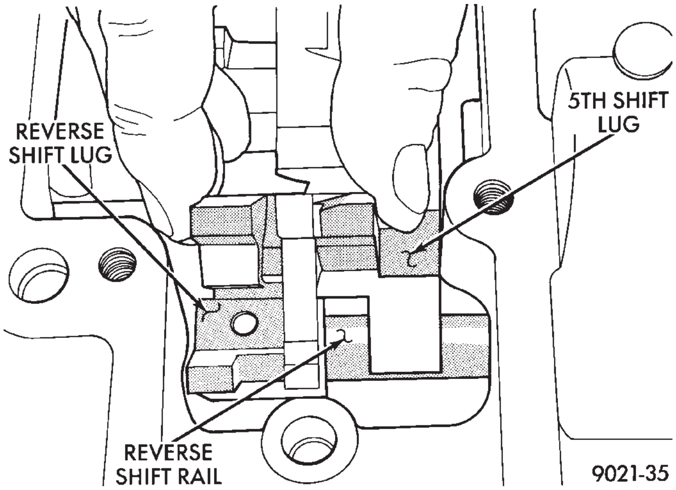


Fig. 25 5th Shift Lug Properly Installed

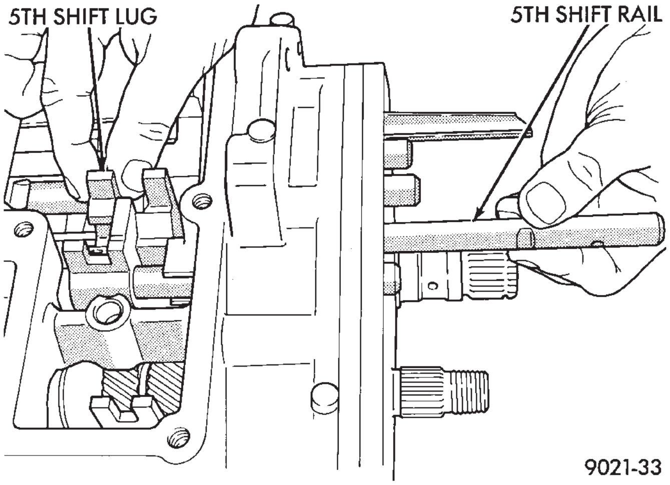


Fig. 23 5th Shift Rail and Shift Lug

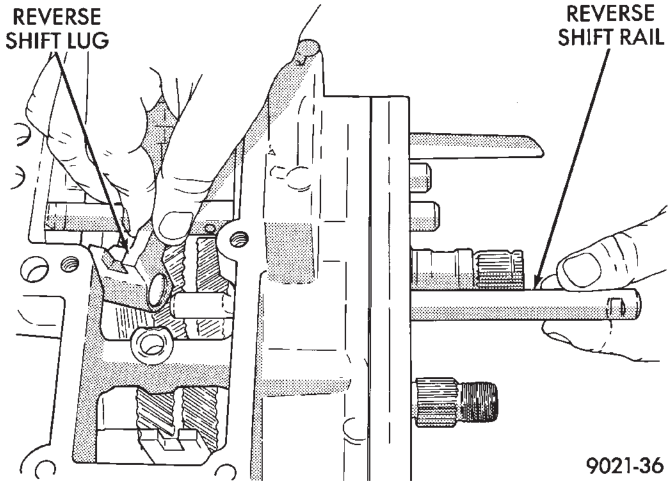


Fig. 26 Reverse Shift Rail and Shift Lug

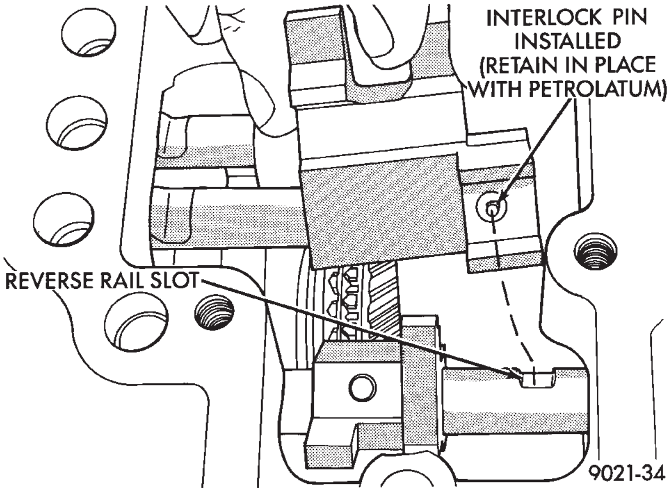


Fig. 24 5th Shift Lug with Interlock Pin

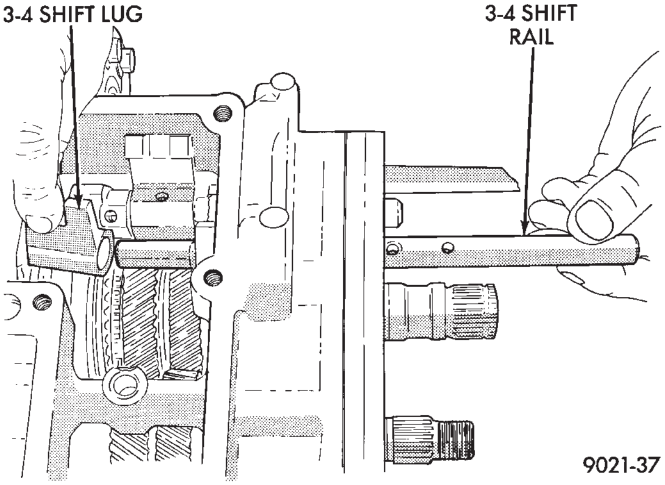


Fig. 27 3-4 Shift Rail and Shift Lug

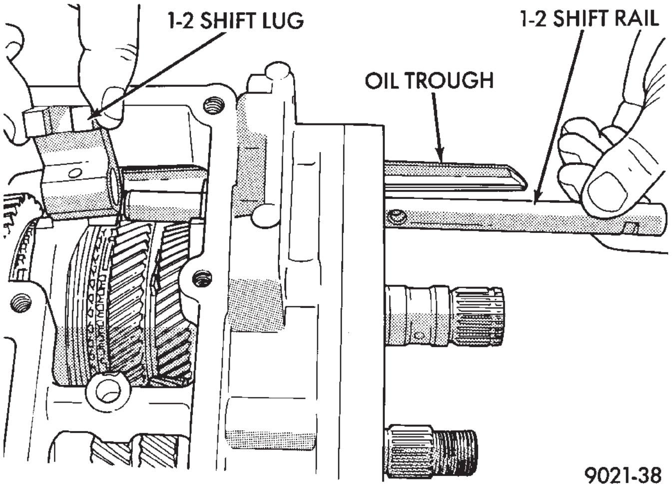


Fig. 28 1-2 Shift Rail and Shift Lug

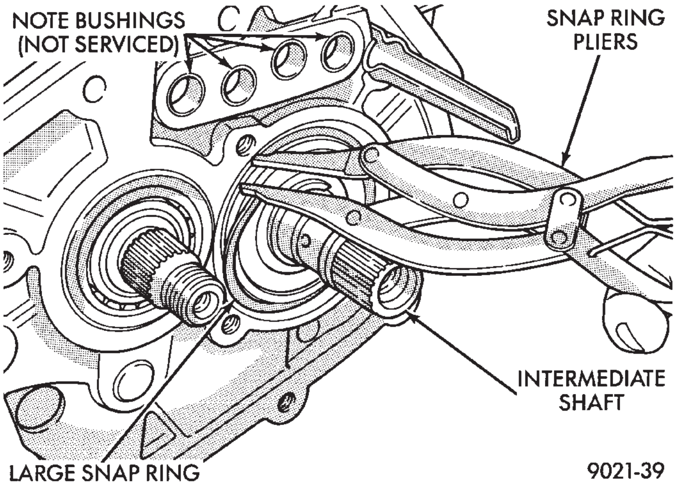


Fig. 29 Remove or Install Large Snap Ring

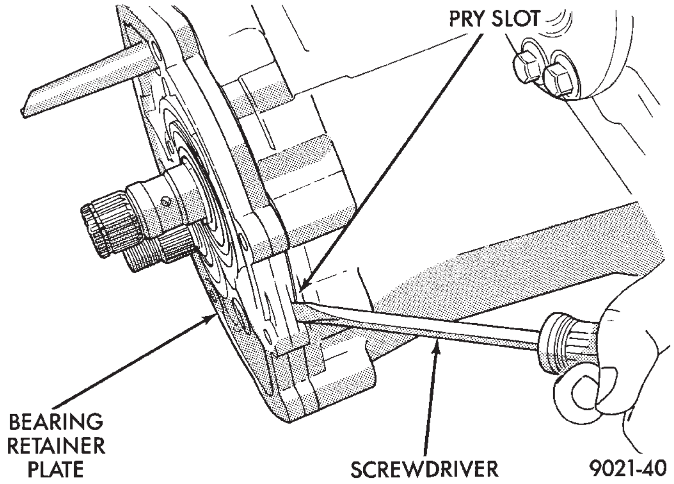


Fig. 30 Pry Bearing Retainer Plate to Remove

CAUTION: Pry only at slot as shown (Fig. 30).

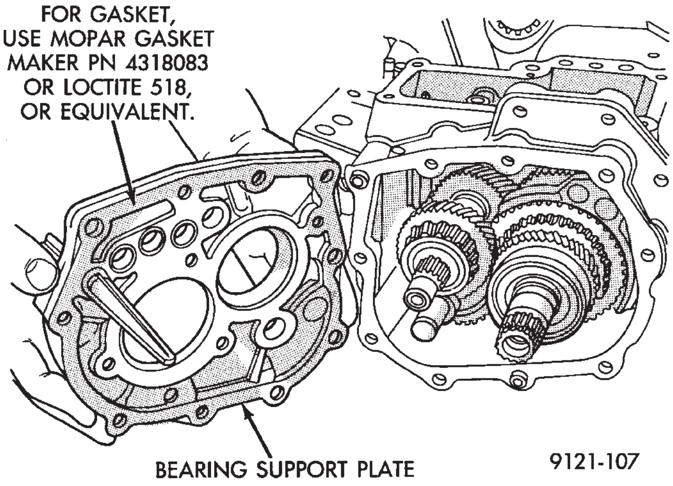


Fig. 31 Bearing Support Plate

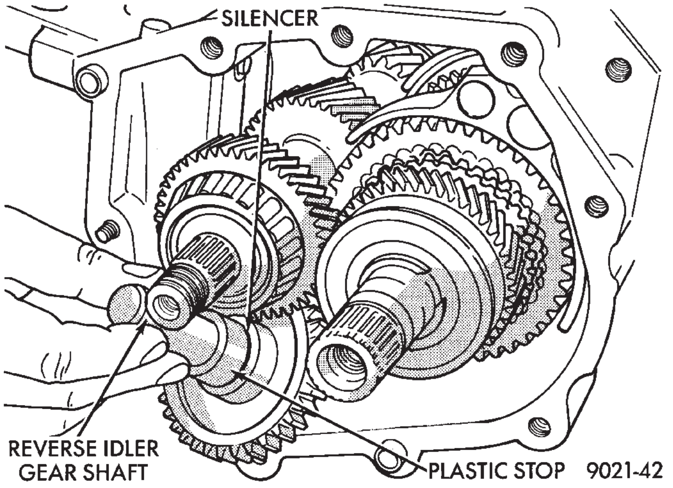


Fig. 32 Remove or Install Reverse Idler Gear

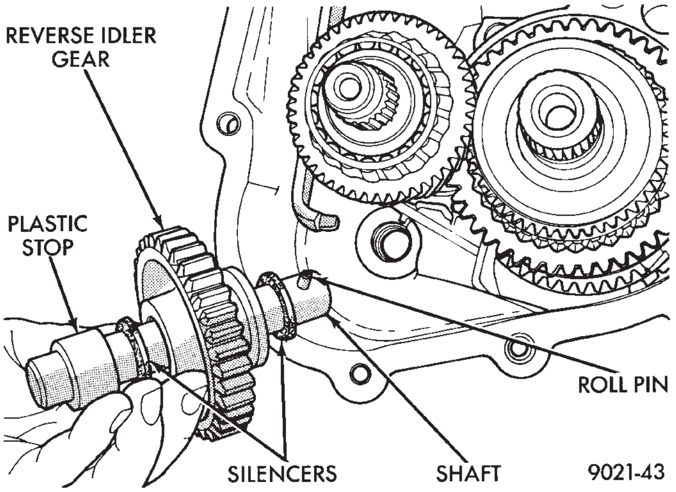


Fig. 33 Reverse Idler Gear Assembly

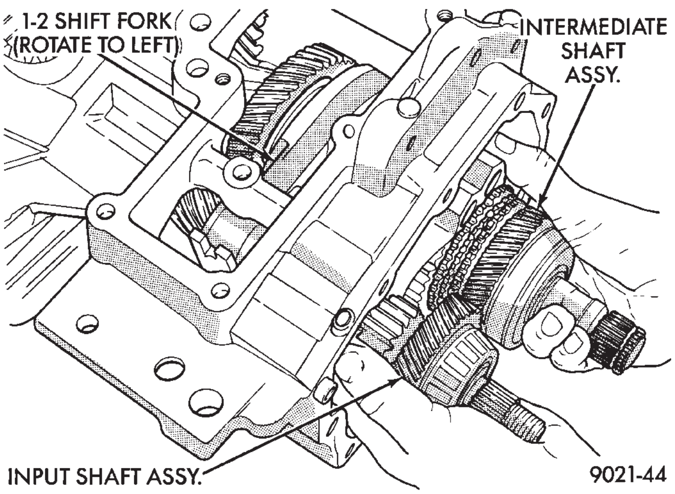


Fig. 34 Remove or Install Gear Set

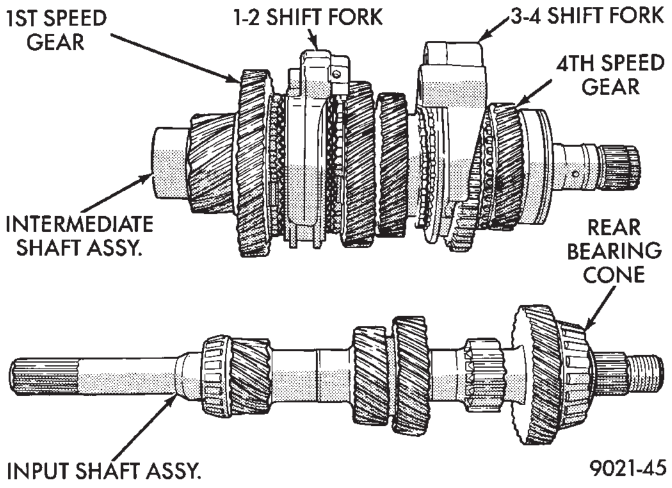


Fig. 35 Gear Set

CLUTCH RELEASE BEARING

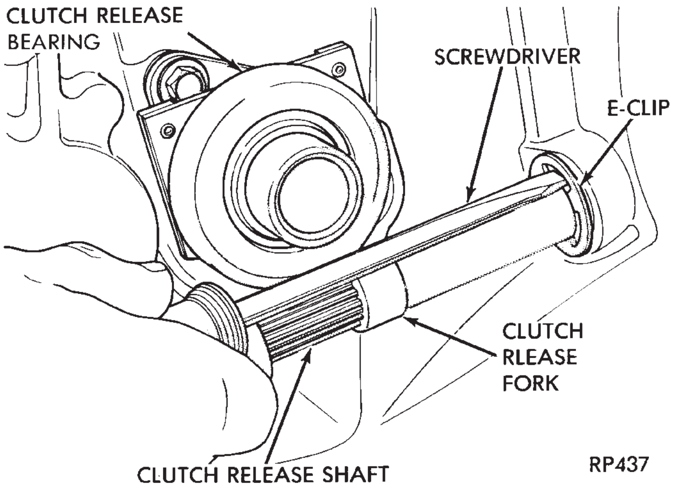


Fig. 1 Remove Retaining E-Clip

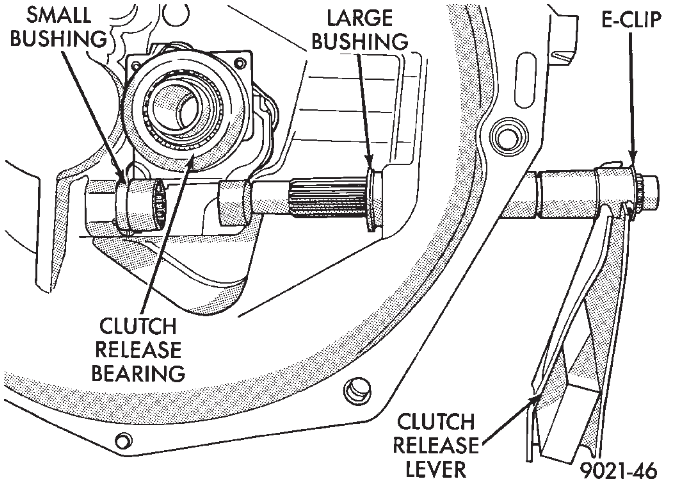


Fig. 2 Remove or Install Clutch Release Shaft

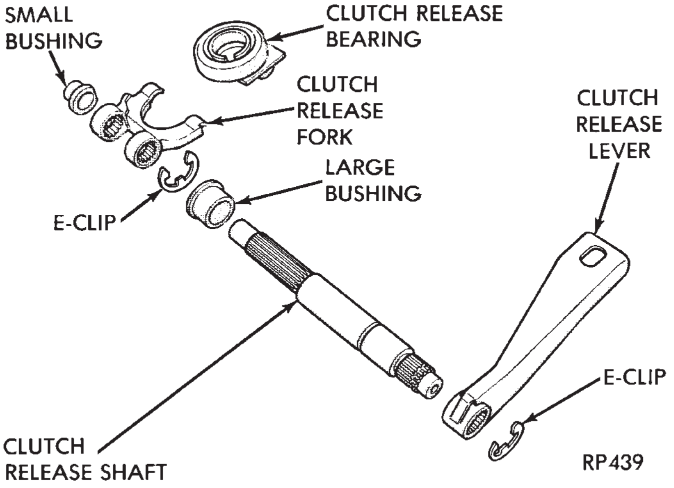


Fig. 3 Clutch Release Shaft Components

INPUT SHAFT OIL SEAL

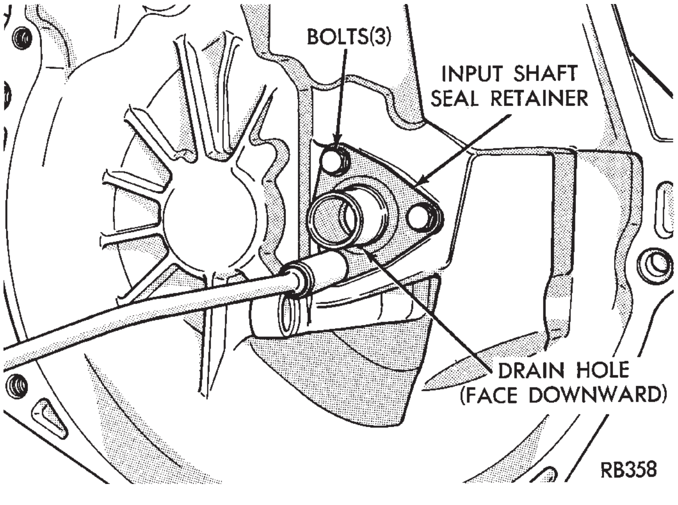


Fig. 4 Remove or Install Input Shaft Seal Retainer

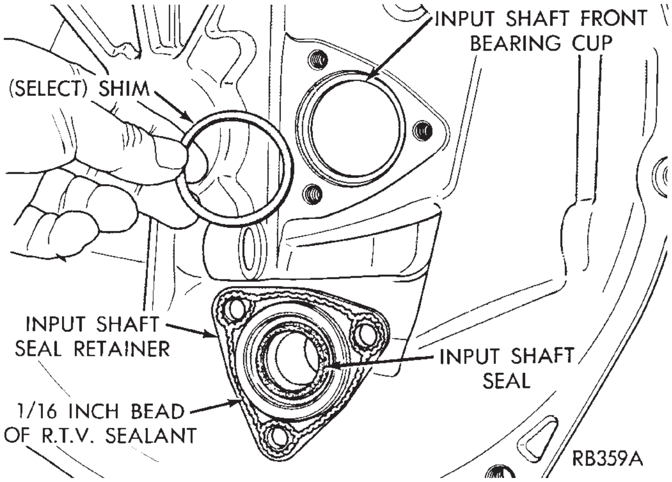


Fig. 5 Input Shaft Seal Retainer

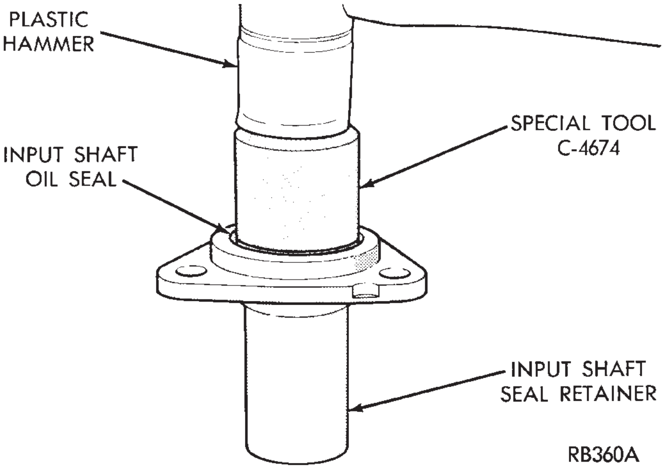


Fig. 6 Install New Input Shaft Seal

REVERSE SHIFT LEVER

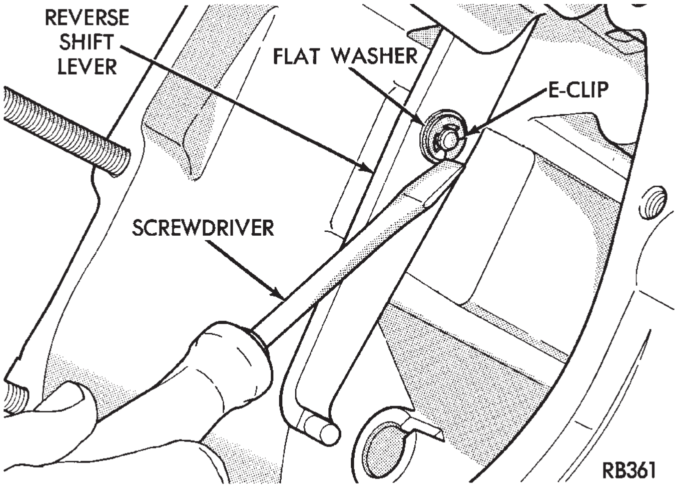


Fig. 7 Remove or Install Reverse Shift Lever E-Clip

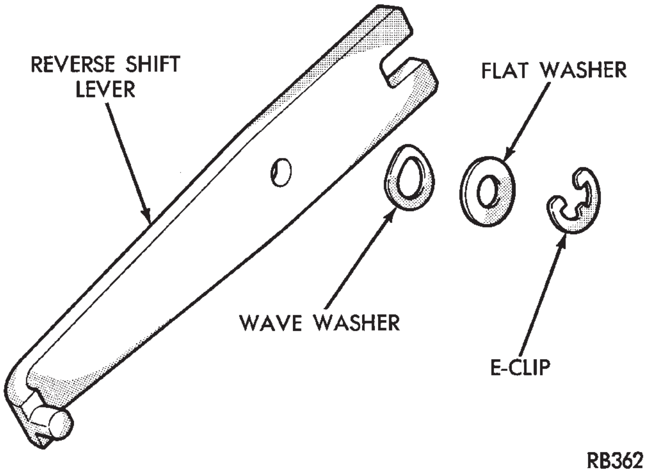


Fig. 8 Reverse Shift Lever Components

SUBASSEMBLY-RECONDITION

TRANSAXLE CASE

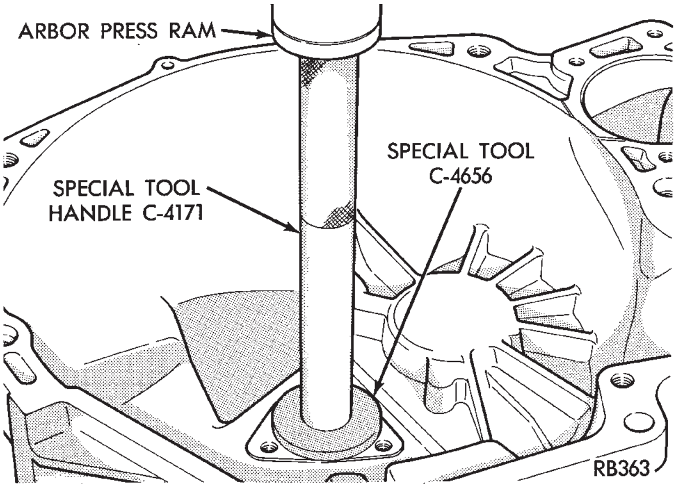


Fig. 1 Remove Input Shaft Front Bearing Cup

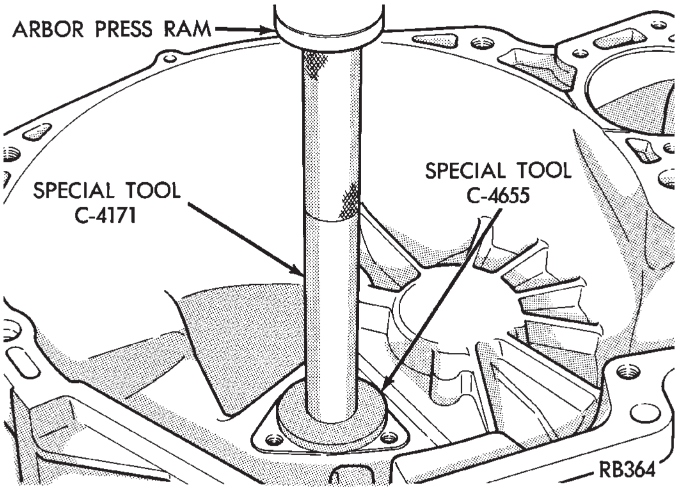


Fig. 2 Install Input Shaft Front Bearing Cup

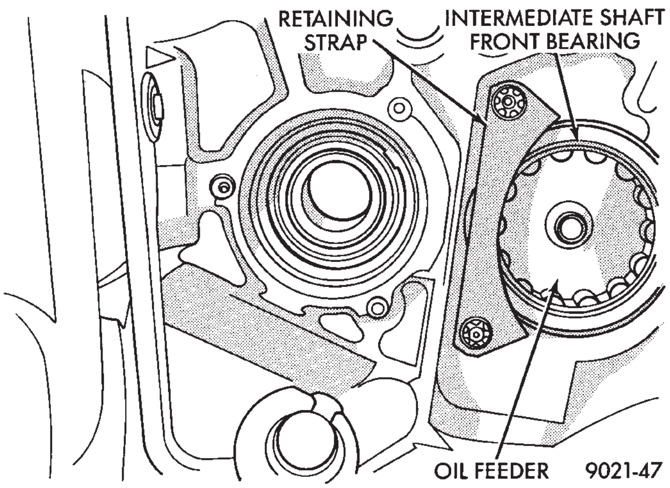


Fig. 3 Remove or Install Bearing Retaining Strap

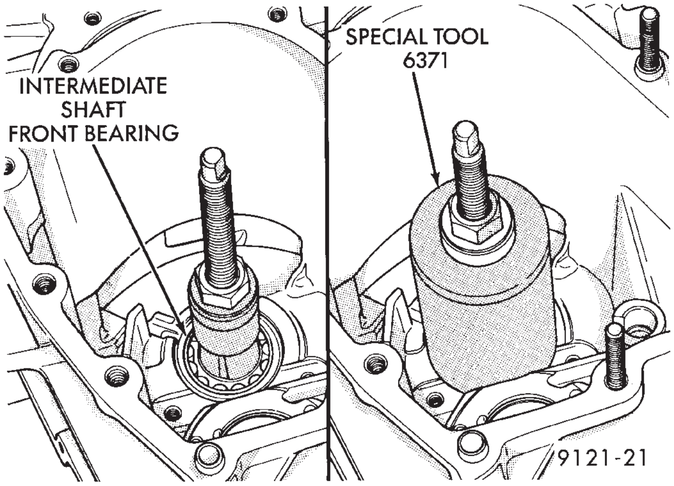


Fig. 4 Remove Intermediate Shaft Front Bearing

Use Tool C-4660-2A Screw. The screw has a larger hole in the lower end to fit over the larger oil feeder nipple (Fig. 5).

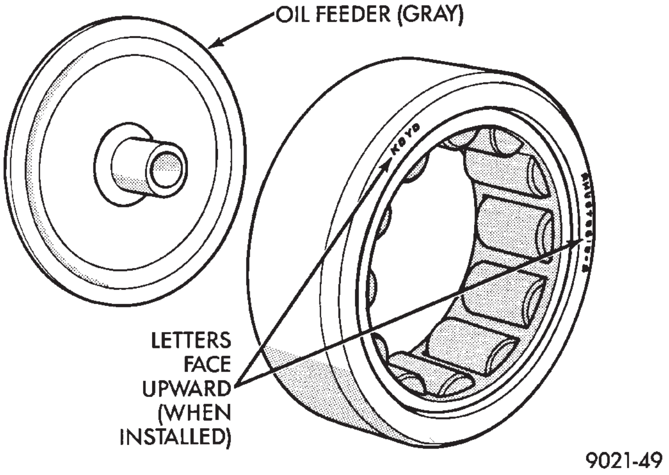


Fig. 5 Oil Feeder

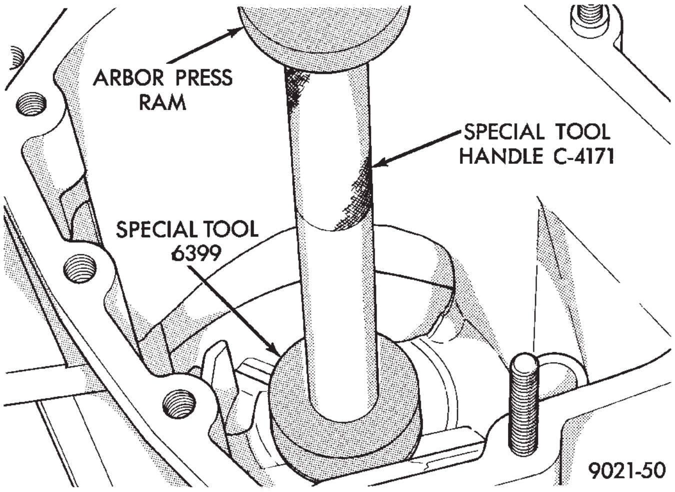


Fig. 6 Install Intermediate Shaft Front Bearing

INTERMEDIATE SHAFT ASSEMBLY

Intermediate shaft ball bearing seal color: A-525/A-523/A-543 Black, A-568 Blue.

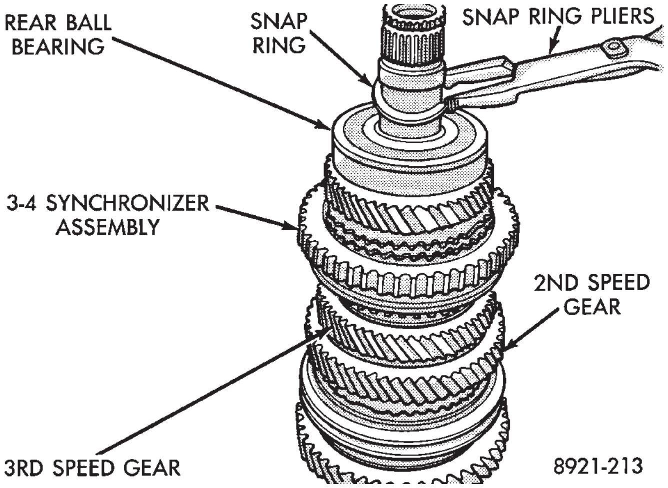


Fig. 1 Intermediate Shaft Bearing Snap Ring

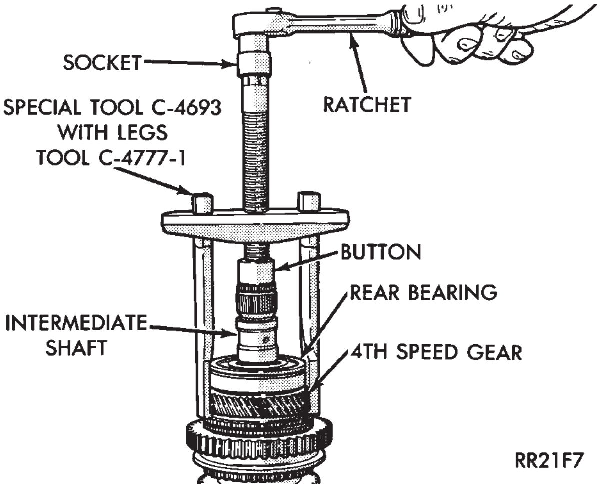


Fig. 2 Remove Intermediate Shaft Rear Bearing

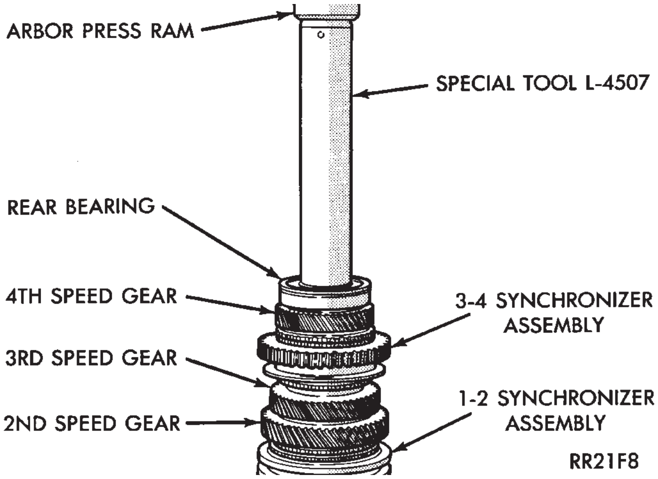


Fig. 3 Install Intermediate Shaft Rear Bearing

When assembling intermediate shaft, make sure all speed gears turn freely.

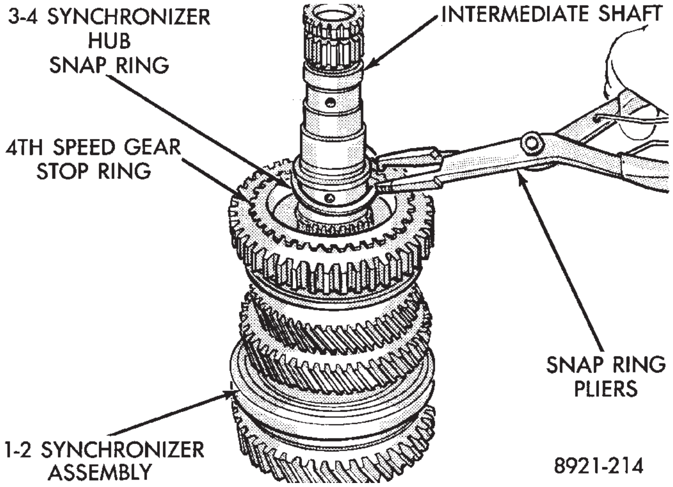


Fig. 4 3-4 Synchronizer Hub Snap Ring

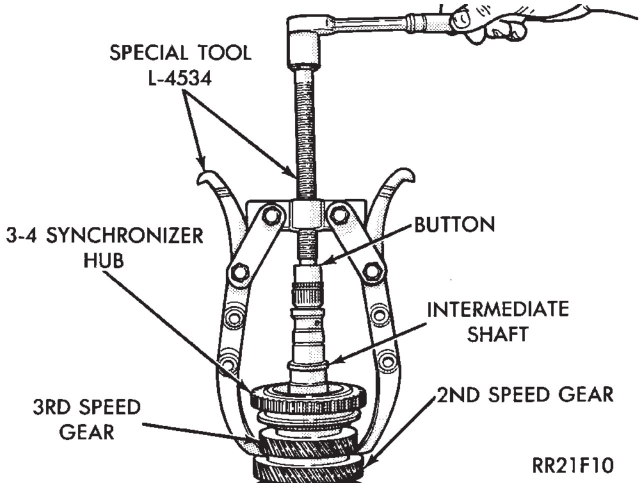


Fig. 5 Remove 3-4 Synchronizer Hub and 3rd Speed Gear

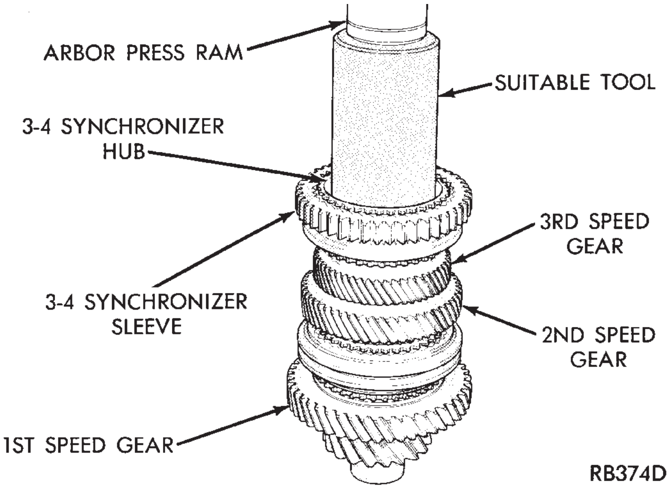


Fig. 6 Install 3-4 Synchronizer Hub and 3rd Speed Gear

1-2 SYNCHRONIZER (DUAL-CONE)

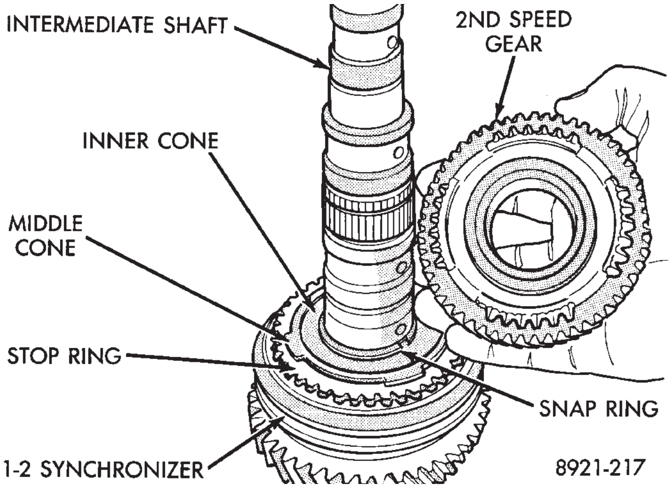


Fig. 1 2nd Speed Gear

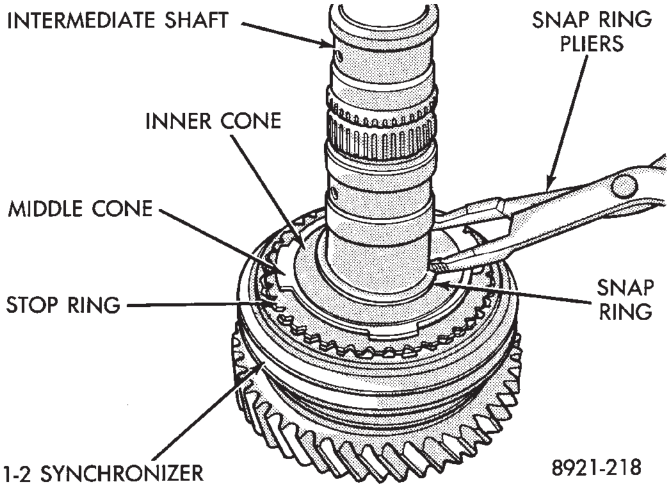


Fig. 2 1-2 Synchronizer Hub Snap Ring

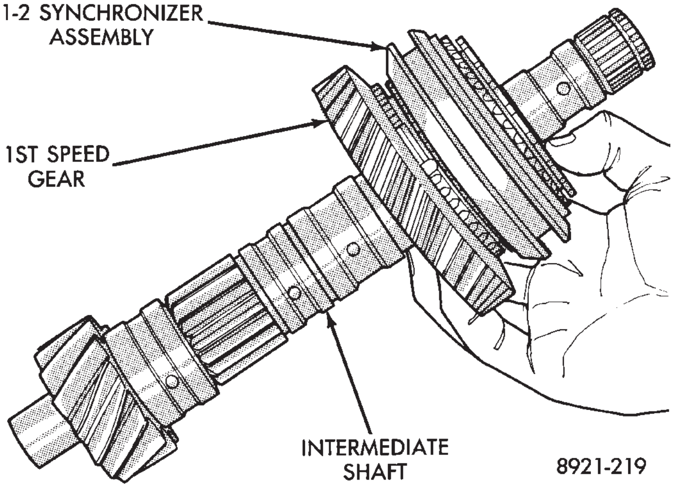


Fig. 3 1st Speed Gear and 1-2 Synchronizer Assembly

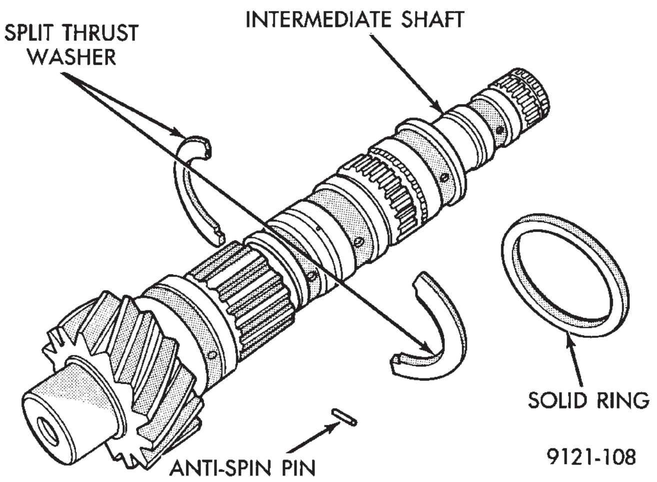


Fig. 4 Split Thrust Washer

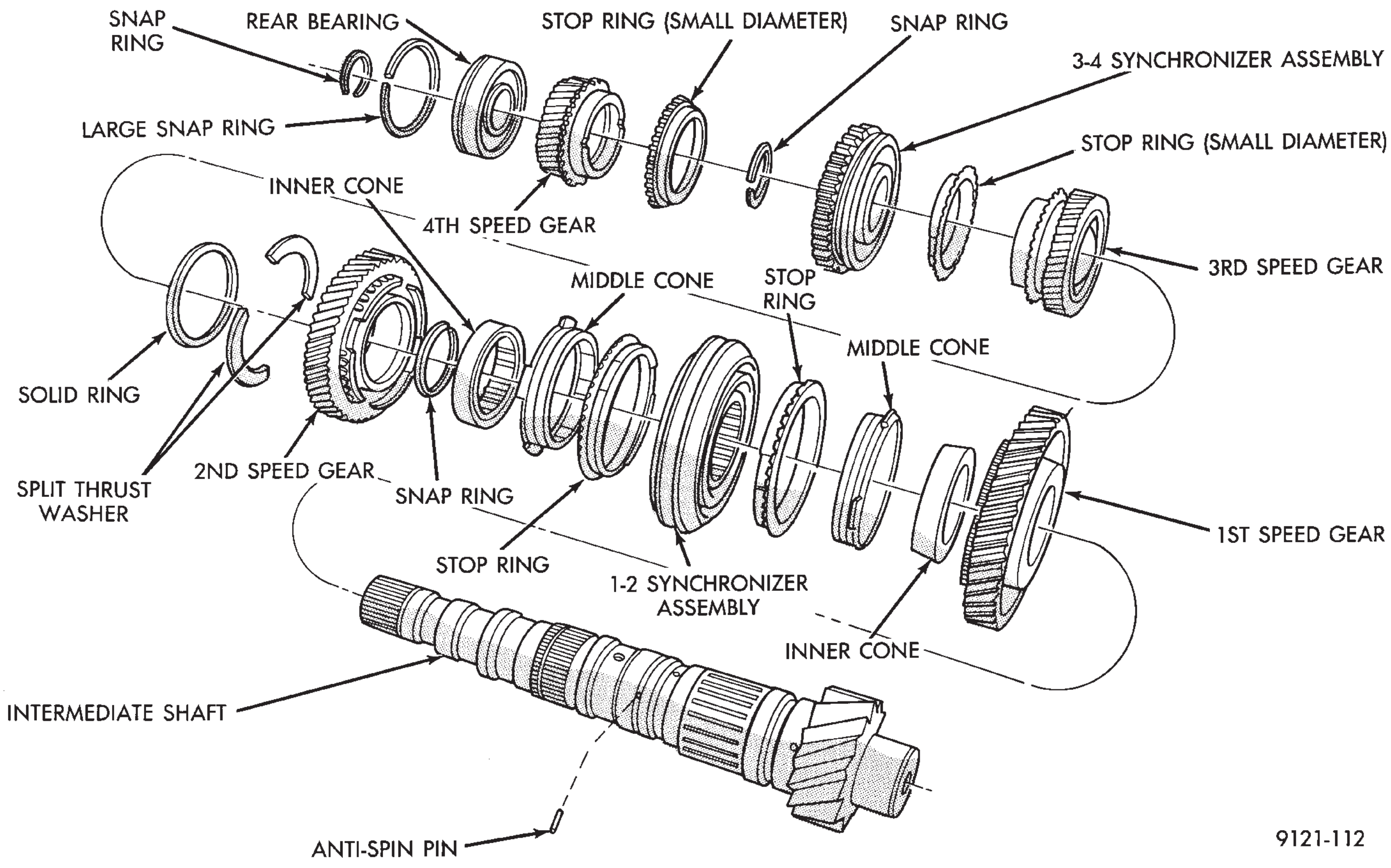


Fig. 5 Intermediate Shaft Assembly

SYNCHRONIZERS

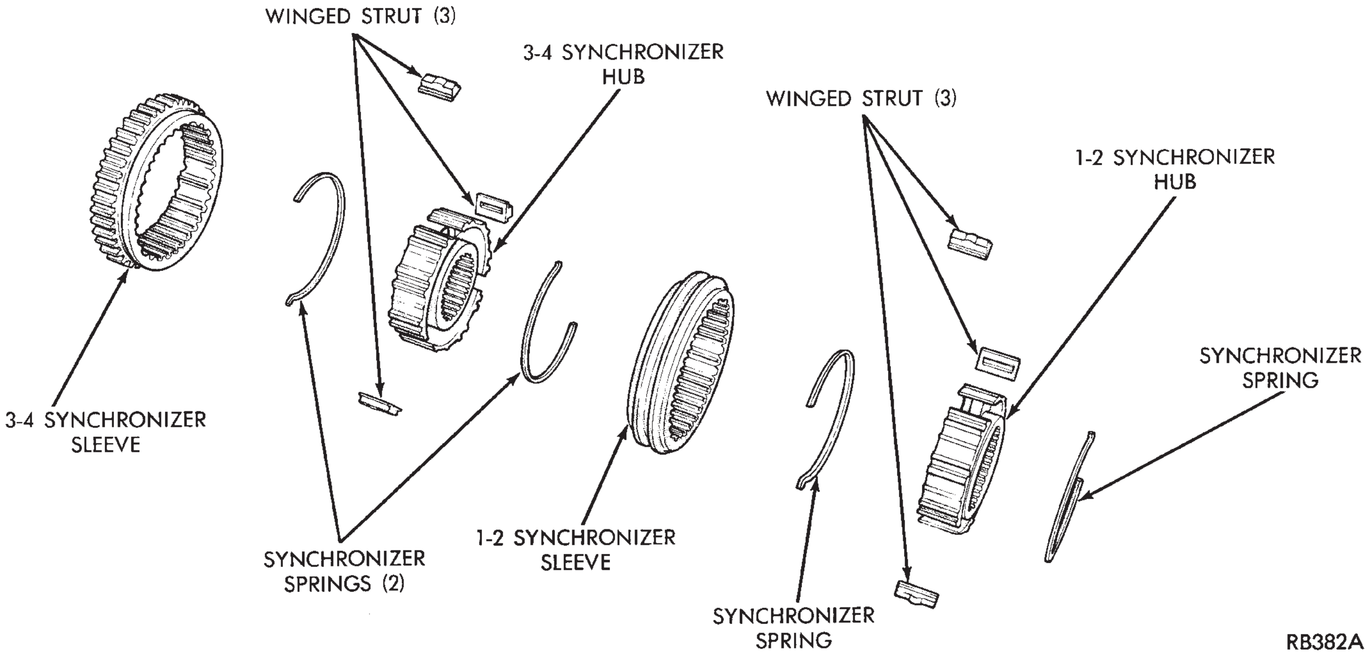


Fig. 1 1-2 and 3-4 Synchronizer Sleeves and Hubs

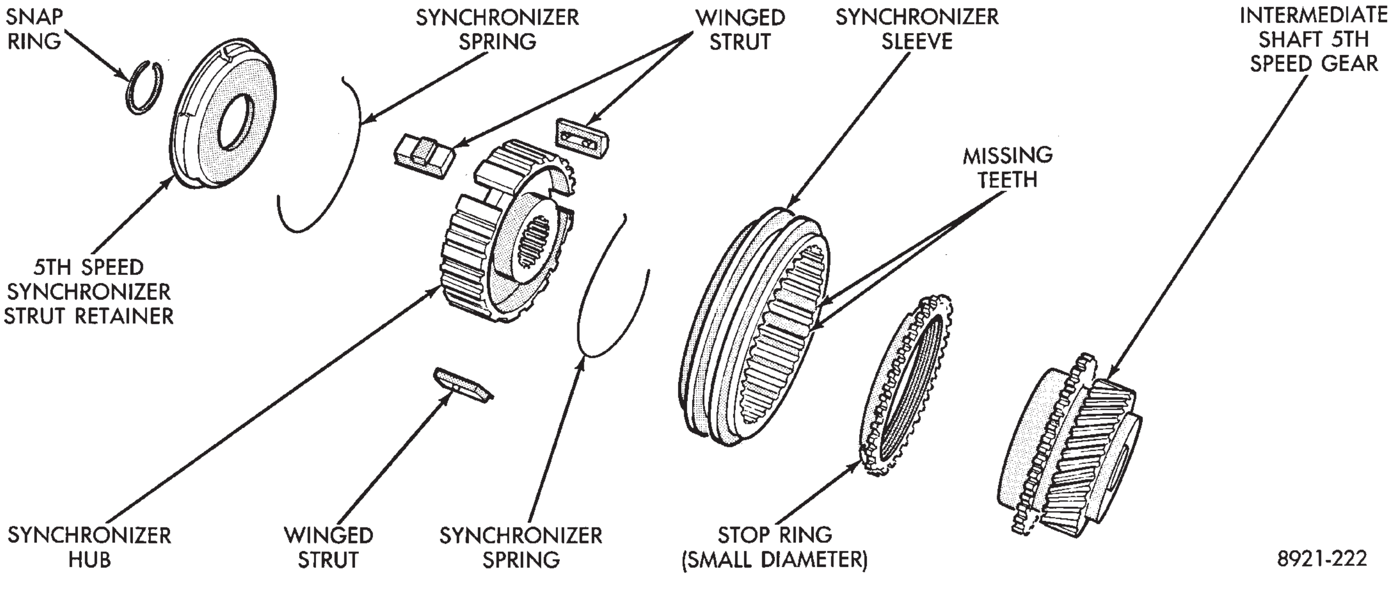


Fig. 2 5th Speed Synchronizer

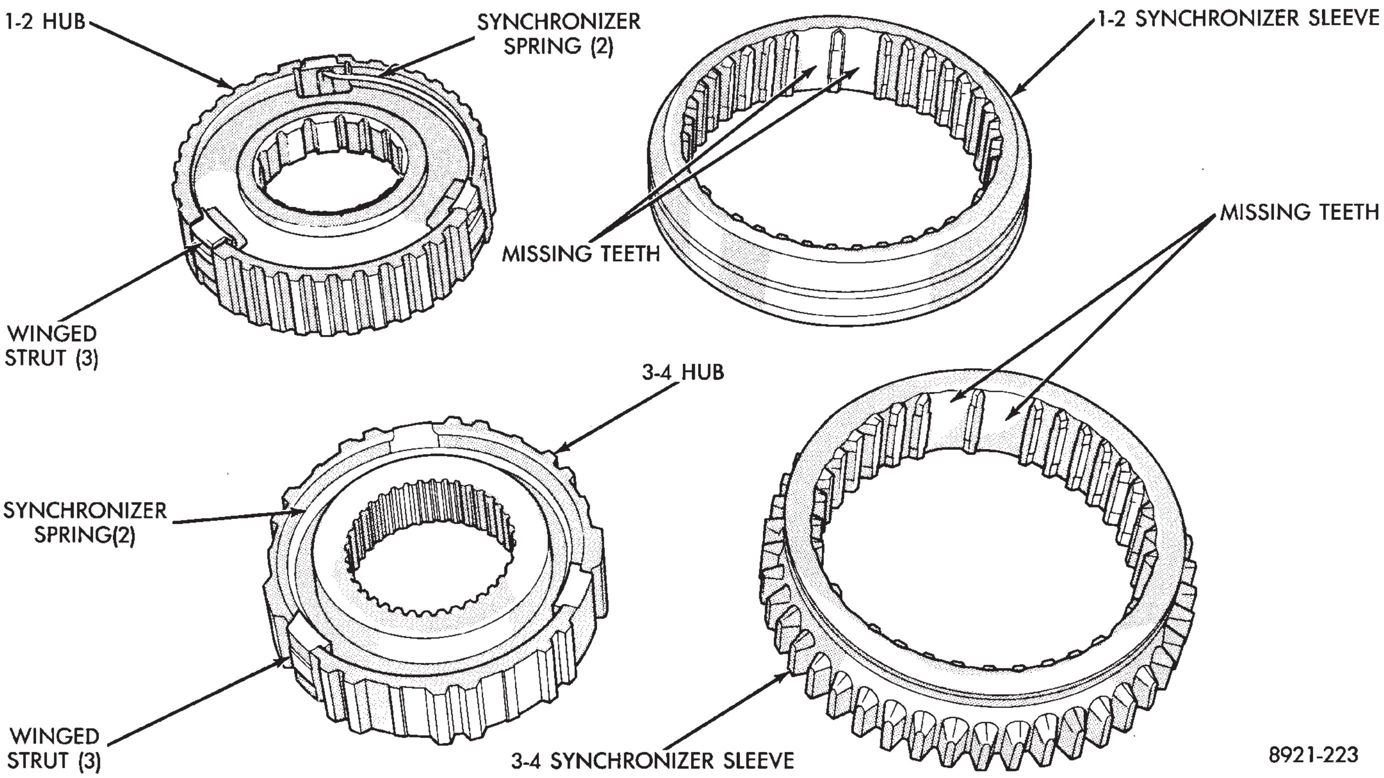


Fig. 3 Synchronizer Identification

CAUTION: 1-2 synchronizer assembly components must NOT be interchanged with any other synchronizer assembly, or with previous model years transaxles; they will NOT function correctly.

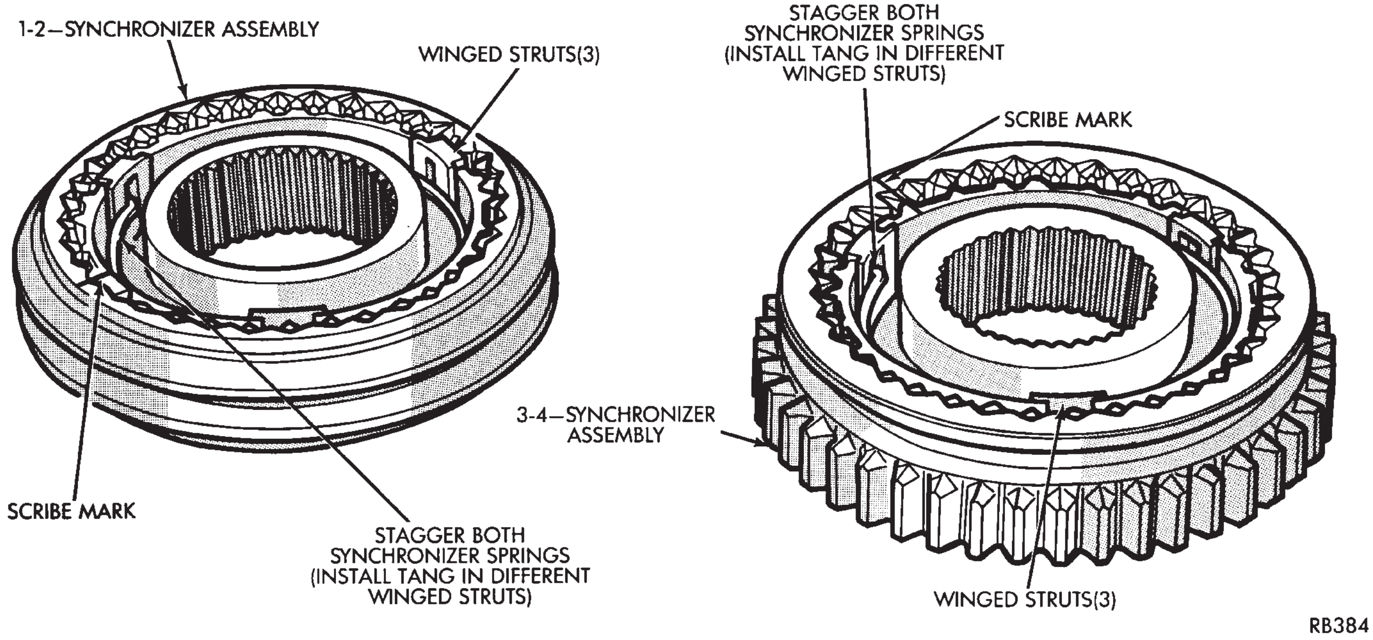


Fig. 4 Synchronizers

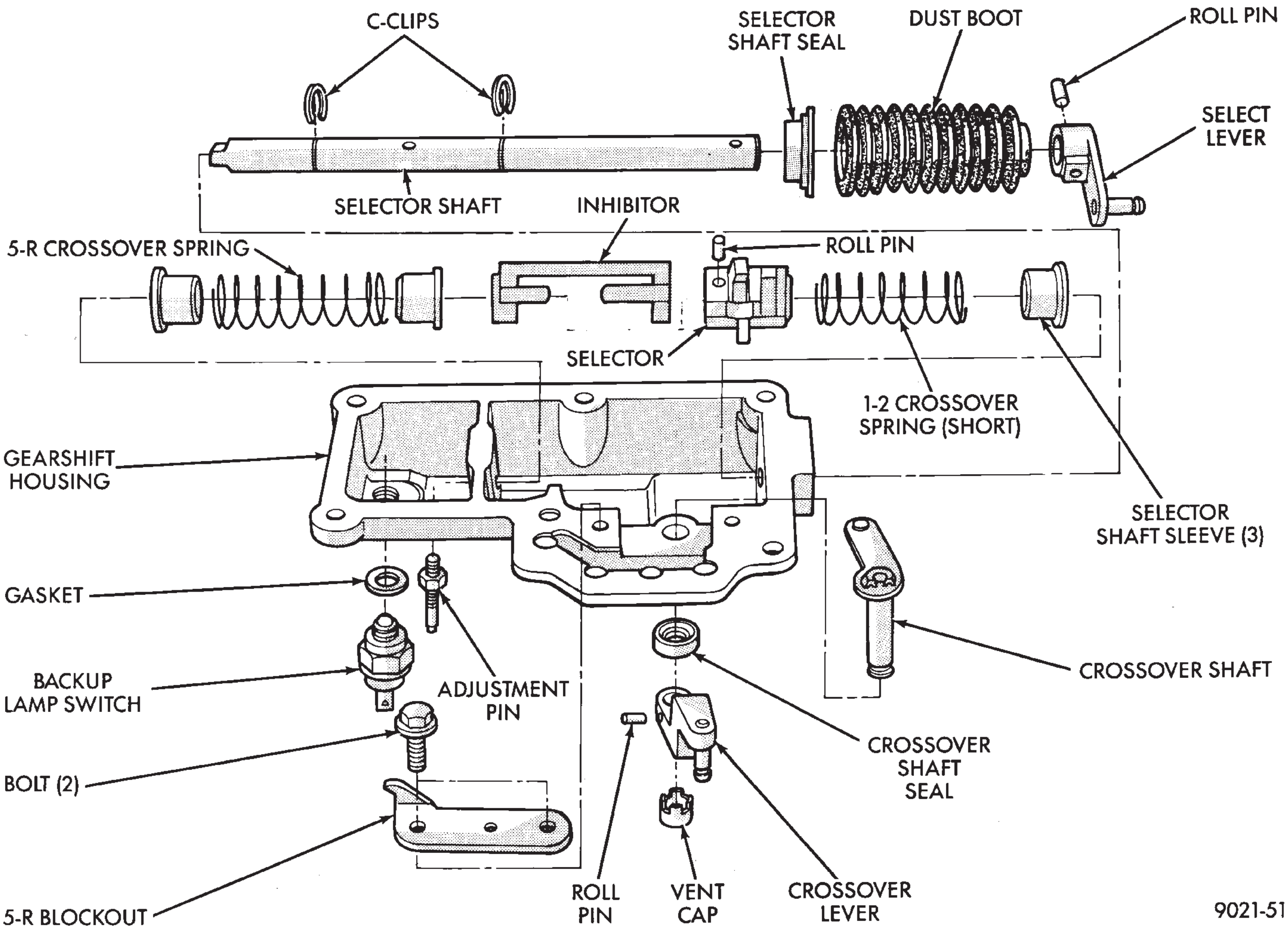


Fig. 1 Gearshift Housing Disassembled

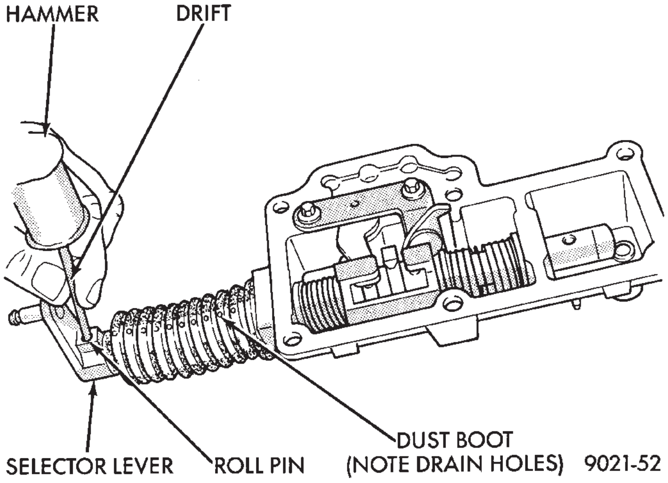


Fig. 2 Remove or Install Roll Pin and Lever

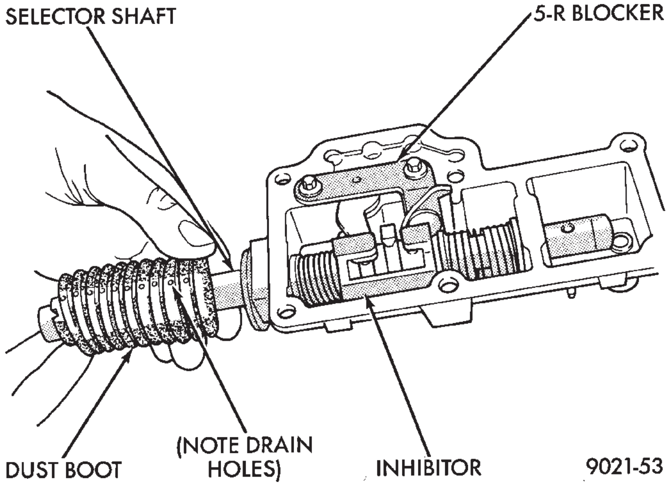


Fig. 3 Dust Boot

GEARSHIFT HOUSING

Roll pin must be flush with top of lever.

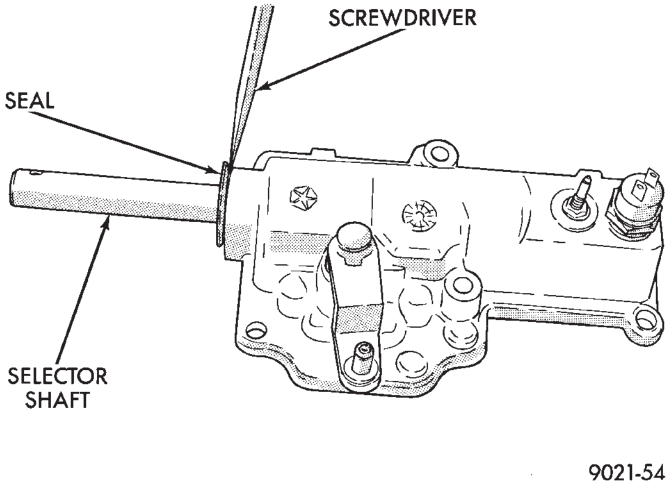


Fig. 4 Remove Oil Seal

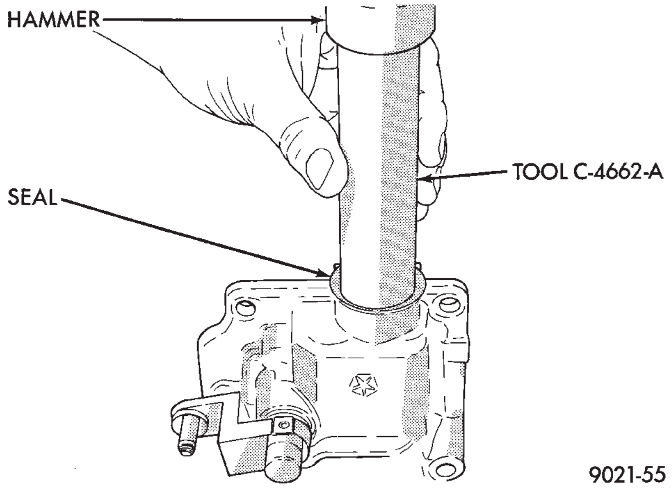


Fig. 5 Install Oil Seal

The C-Clip groves 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.

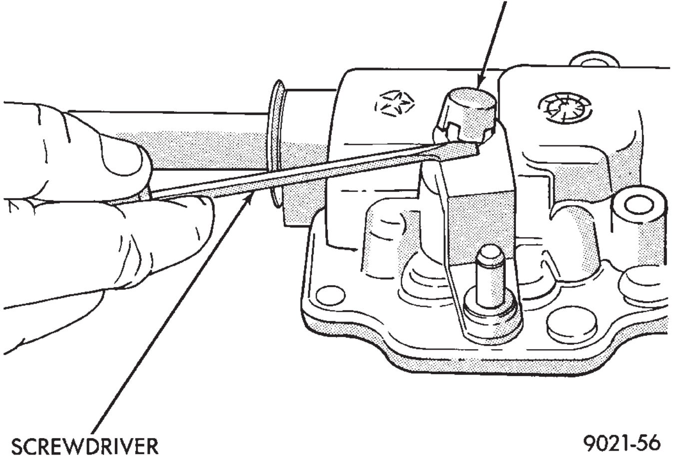


Fig. 6 Remove Vent Cap

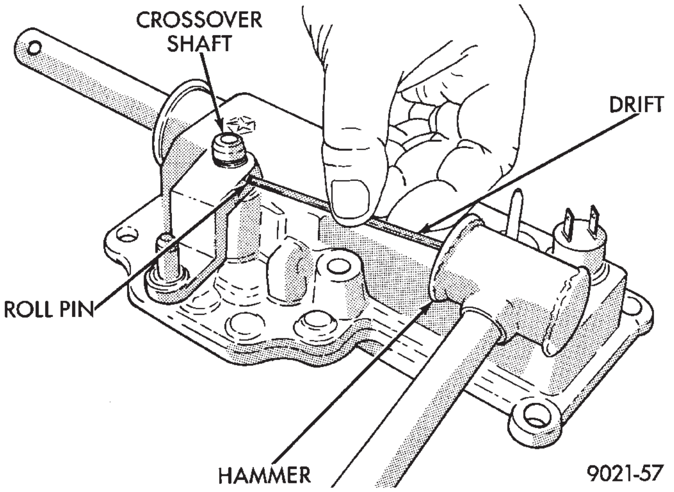


Fig. 7 Crossover Shaft Roll Pin

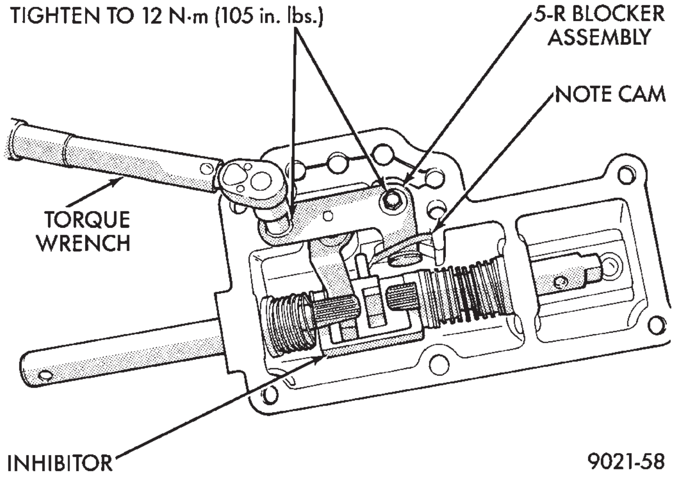


Fig. 8 5-R Blocker Attaching Bolts

Proper torque to the 5-R blocker attaching bolts is very important (Fig. 8).

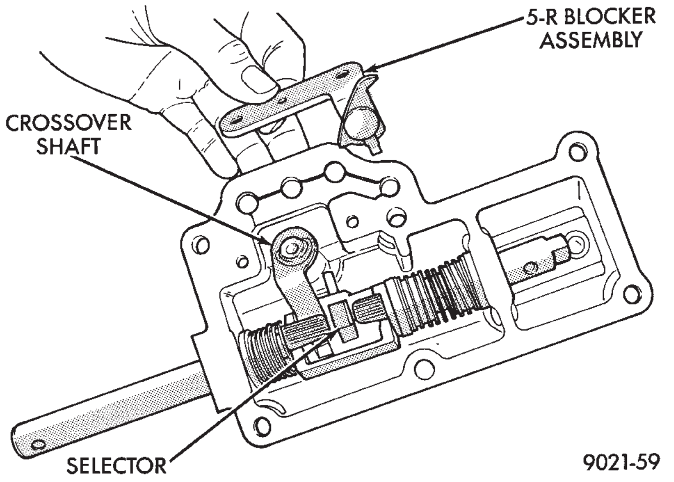


Fig. 9 5-R Blocker Assembly

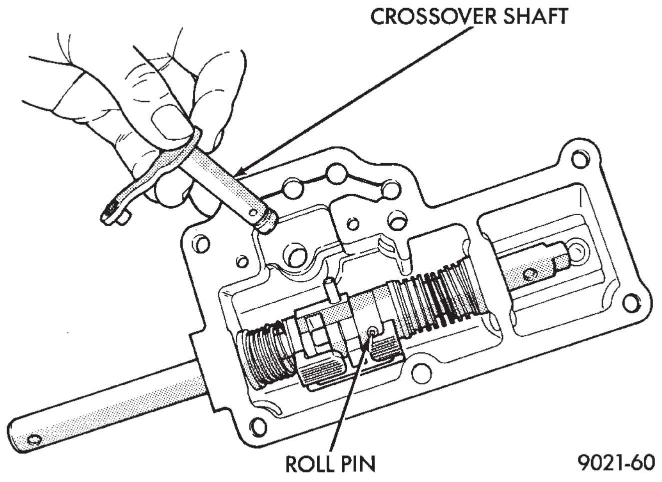


Fig. 10 Crossover Shaft

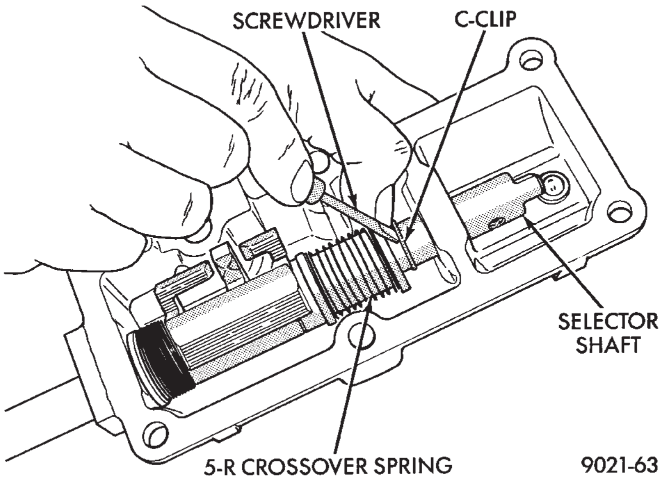


Fig. 11 Selector Shaft C-Clip

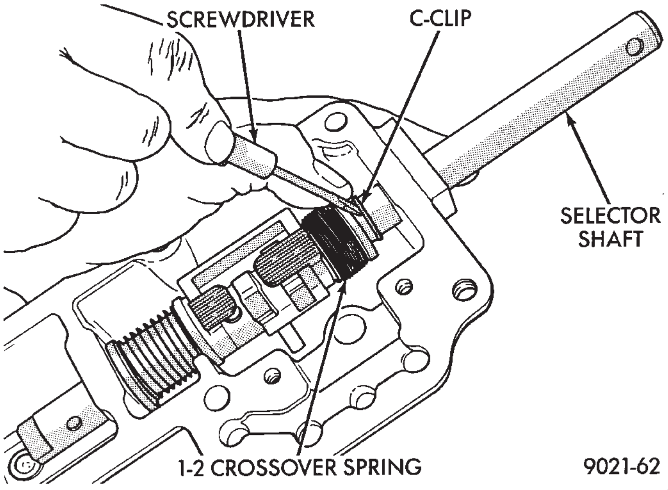


Fig. 12 Selector Shaft C-Clip

For Disassembly: 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.

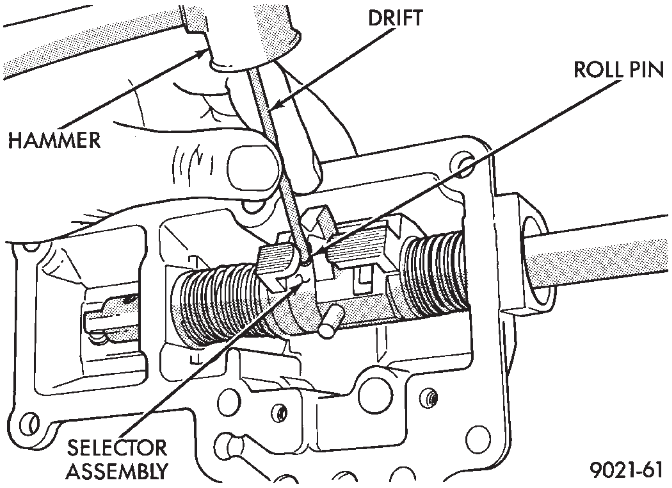


Fig. 13 Selector Assembly Roll Pin

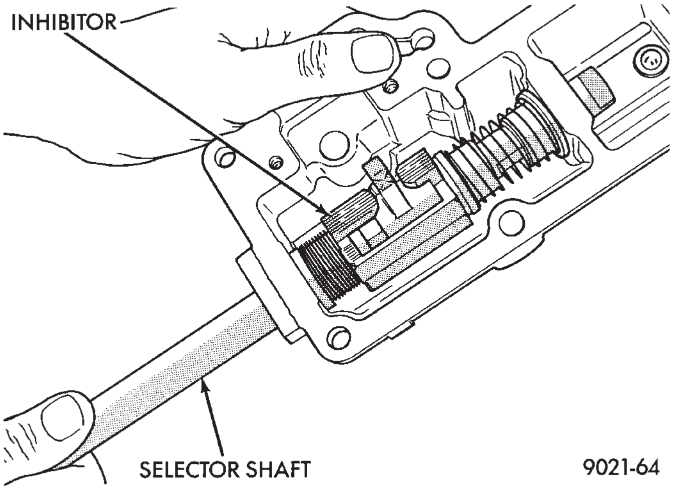


Fig. 14 Remove or Install Selector Shaft

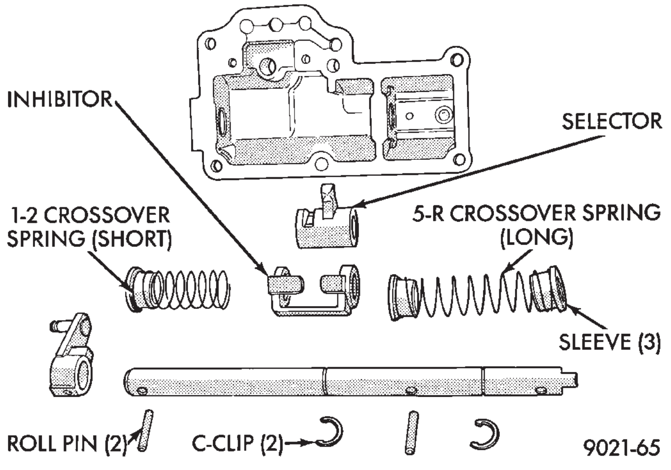


Fig. 15 Disassembled View

DIFFERENTIAL BEARING RETAINER

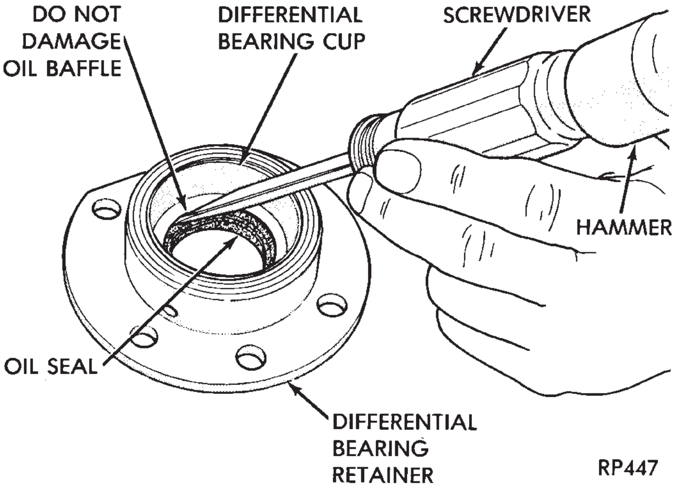


Fig. 1 Remove Differential Bearing Retainer Seal

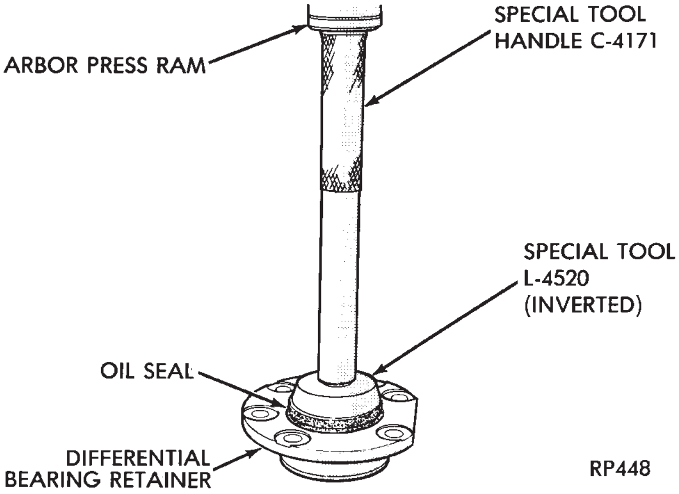


Fig. 2 Install Differential Bearing Retainer Seal

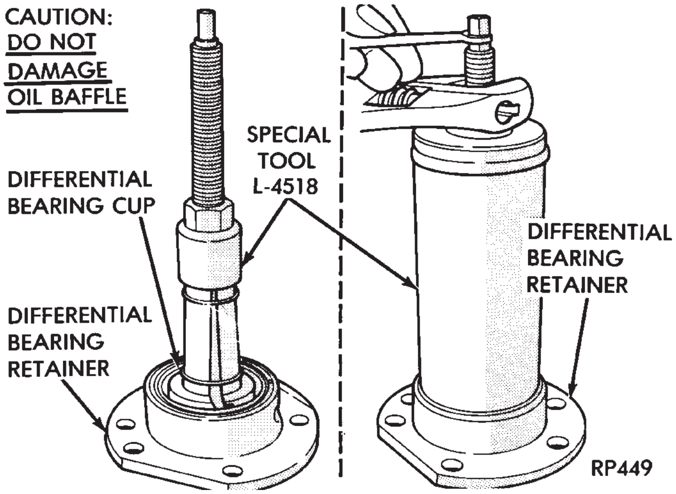


Fig. 3 Remove Differential Bearing Retainer Cup

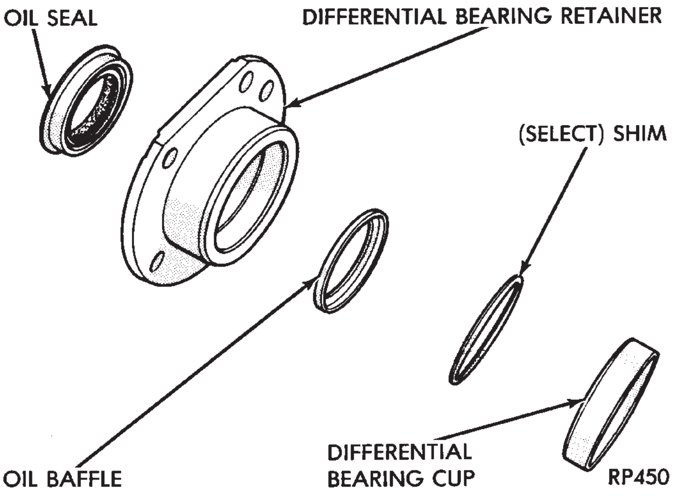


Fig. 4 Differential Bearing Retainer

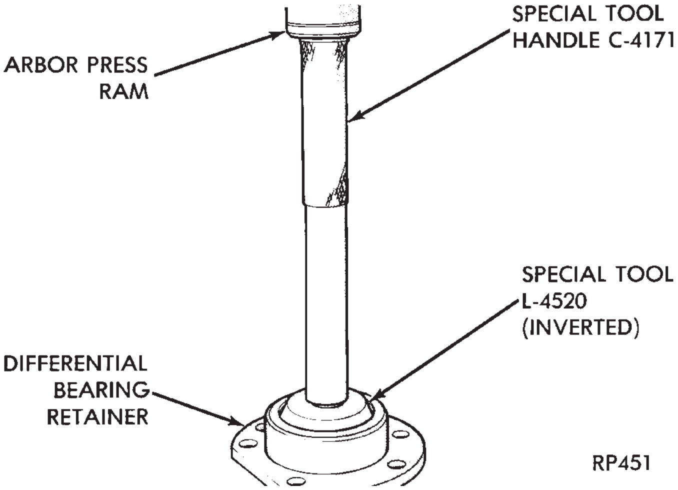


Fig. 5 Install Oil Baffle

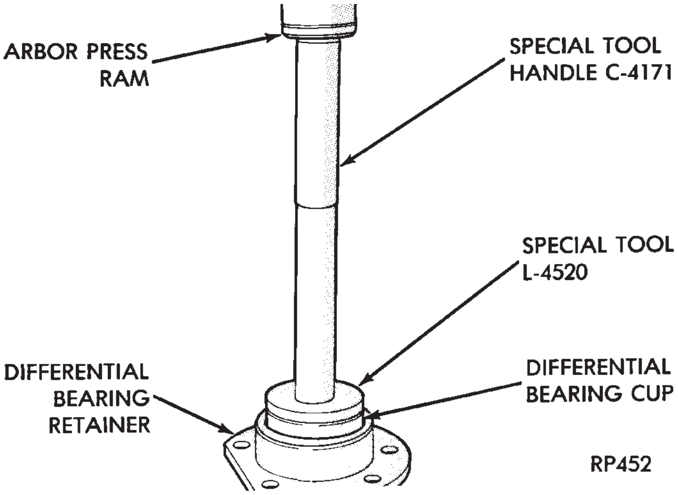


Fig. 6 Insert (Select) Shim and Differential Bearing Retainer Cup

EXTENSION HOUSING

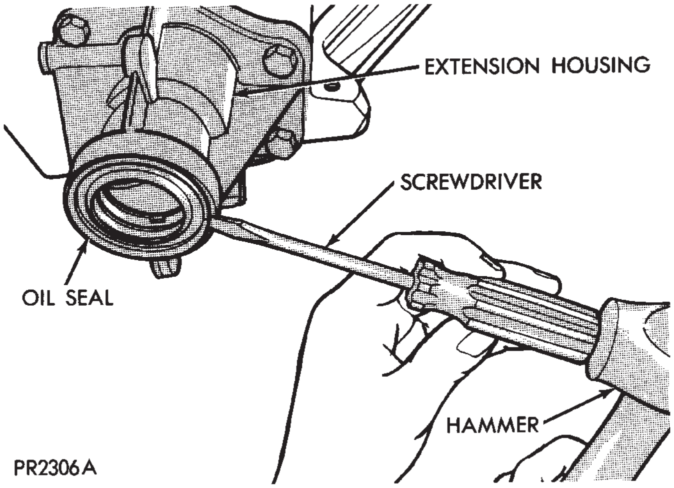


Fig. 1 Remove Extension Seal

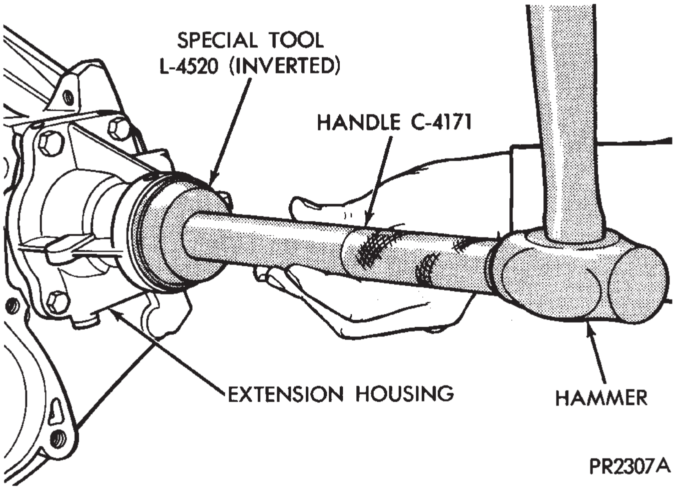


Fig. 2 Install New Seal into Extension

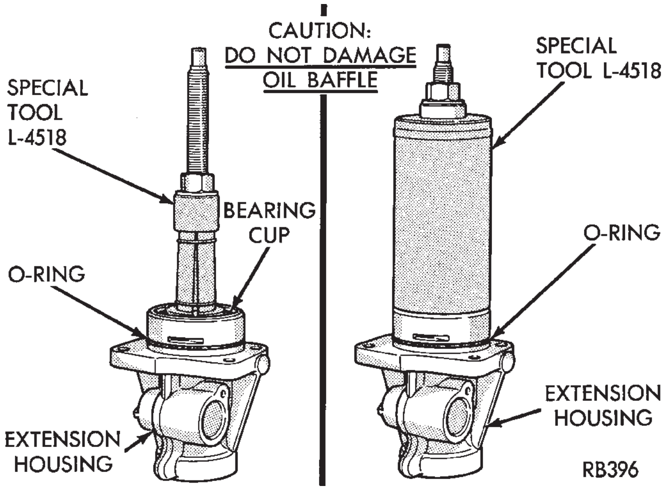


Fig. 3 Remove Extension Bearing Cup

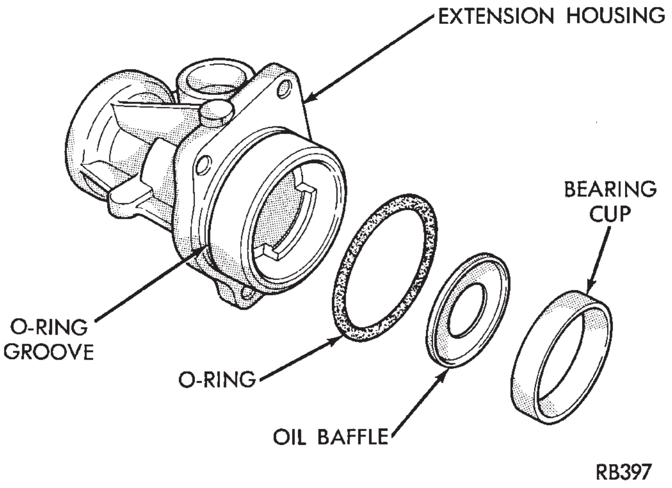


Fig. 4 Extension

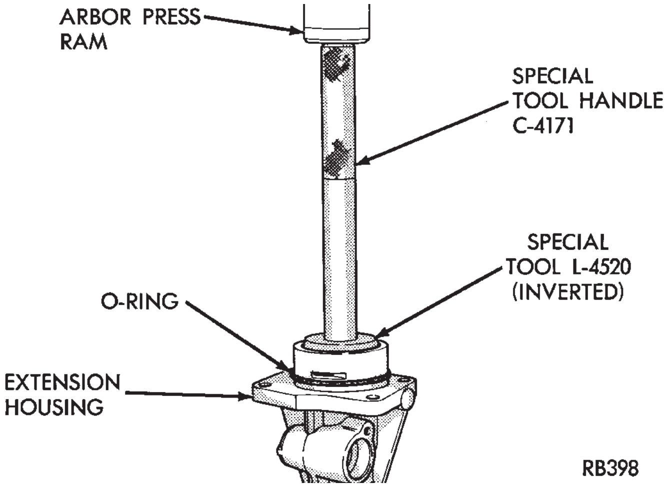


Fig. 5 Install Extension Oil Baffle

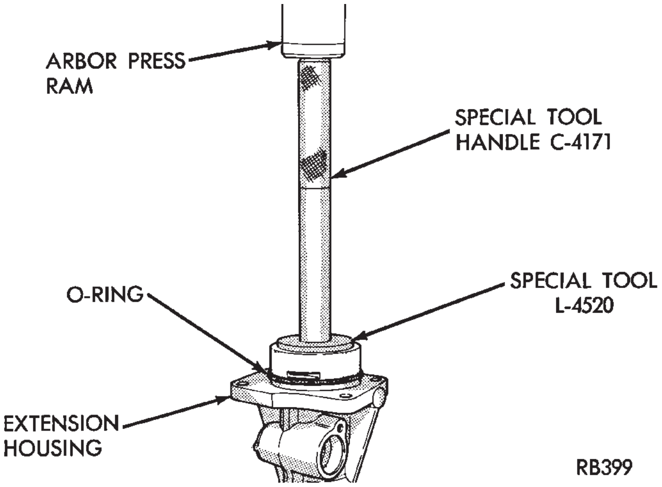


Fig. 6 Install Extension Bearing Cup

INPUT SHAFT

Shim thickness need only be determined if any of the following parts are replaced:

- Transaxle case
- Input shaft seal retainer
- Bearing retainer plate
- Rear end cover
- Input shaft
- Input shaft bearings

Refer to **Bearing Adjustment Procedure** in rear of this section to determine proper shim thickness for correct bearing end play and proper turning torque.

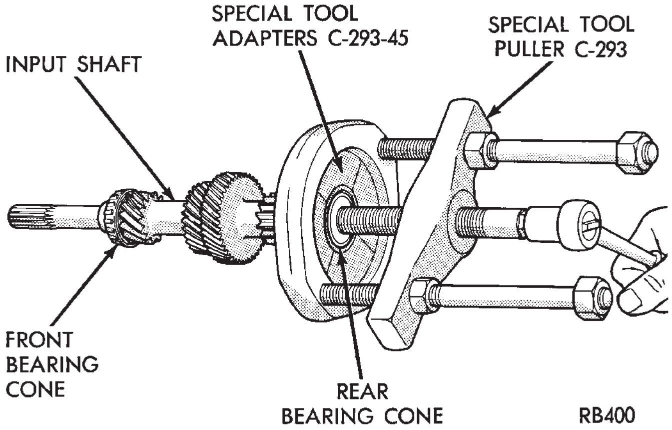


Fig. 1 Remove Input Shaft Rear Bearing Cone

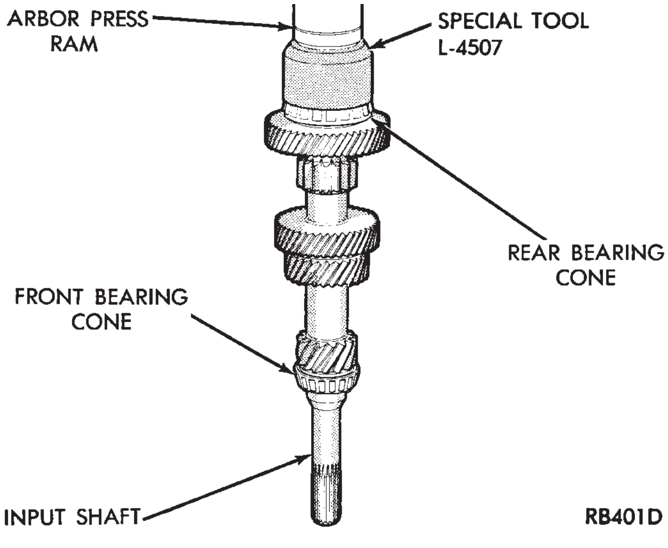


Fig. 2 Install Input Shaft Rear Bearing Cone

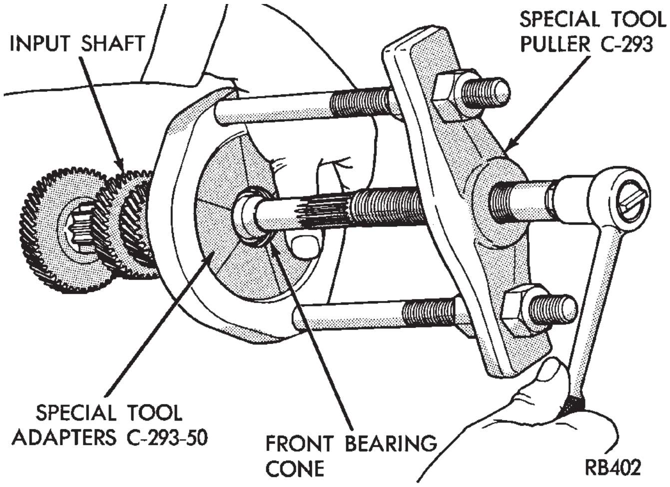


Fig. 3 Remove Input Shaft Front Bearing Cone

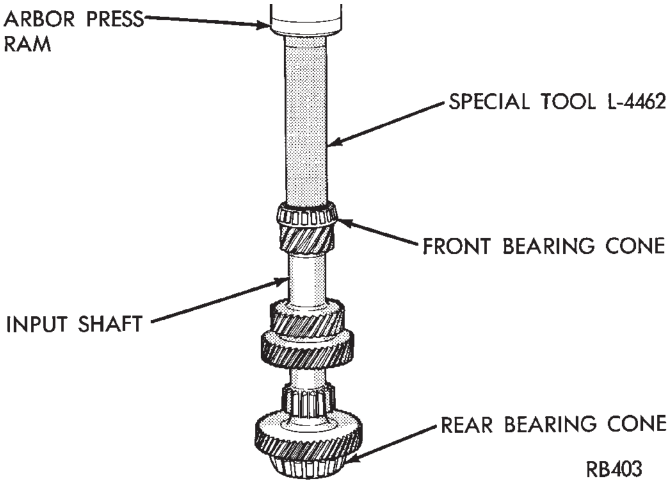


Fig. 4 Install Input Shaft Front Bearing Cone

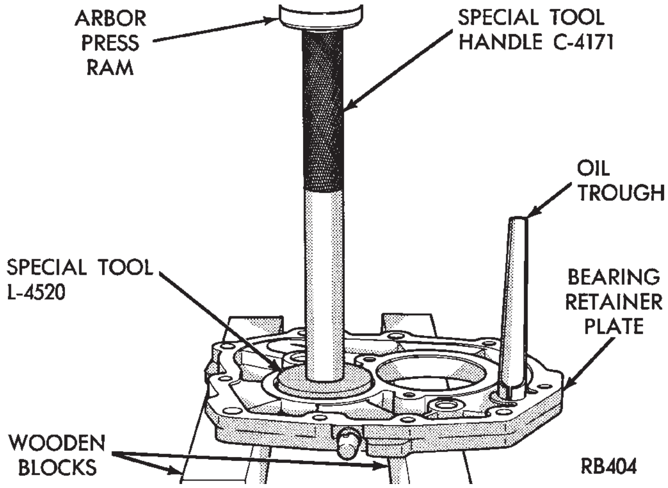


Fig. 5 Remove Input Shaft Rear Bearing Cup

CAUTION: Bolt on bearing support plate before installing input shaft rear bearing cup.

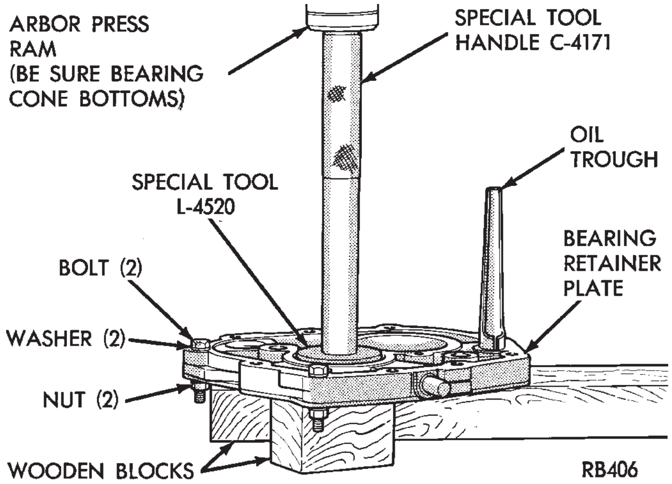


Fig. 6 Install Input Shaft Rear Bearing Cup

A-523, A-543 DIFFERENTIAL

Shim thickness need only be determined if any of the following parts are replaced:

- Transaxle case
- Differential bearing retainer
- Extension housing
- Differential case
- Differential bearings

CAUTION: Differential covers are not interchangeable from case to case.

Refer to **Bearing Adjustment Procedure** in rear of this section to determine proper shim thickness for correct bearing preload and proper bearing turning torque.

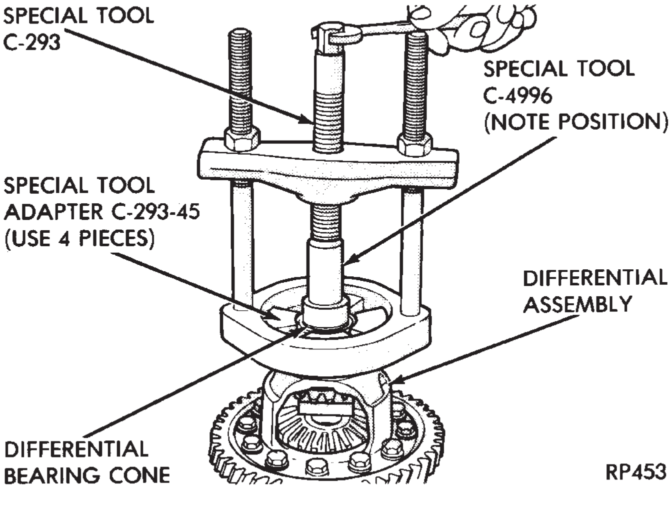


Fig. 1 Remove Differential Bearing Cone

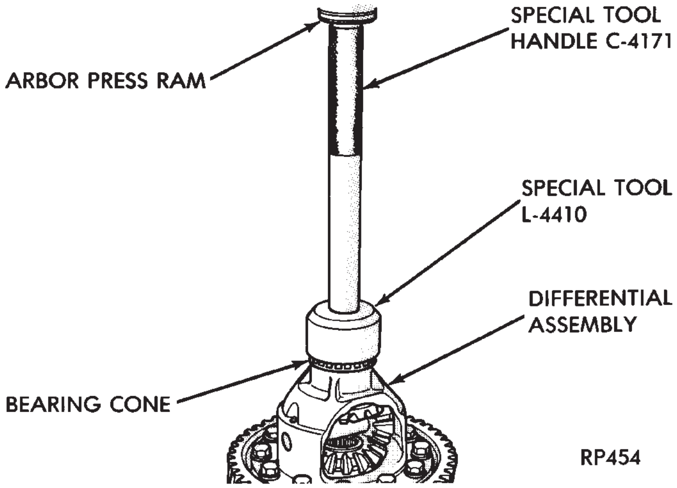


Fig. 2 Install Differential Bearing Cone

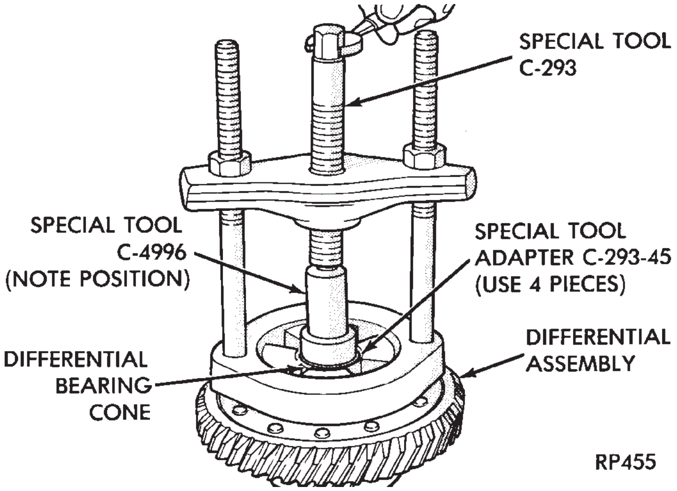


Fig. 3 Remove Differential Bearing Cone

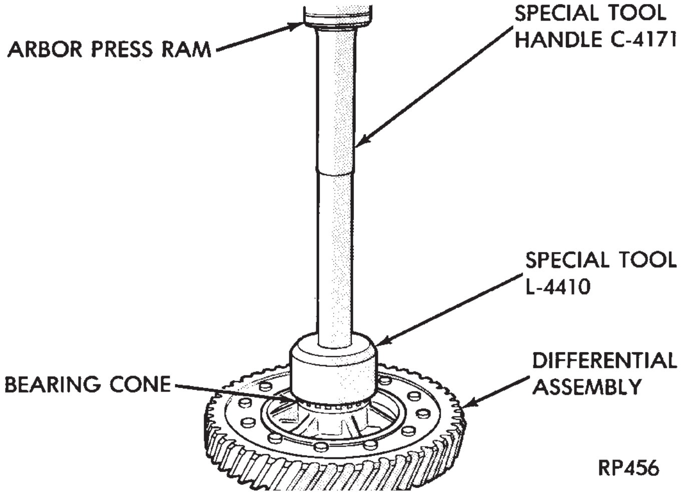


Fig. 4 Install Differential Bearing Cone

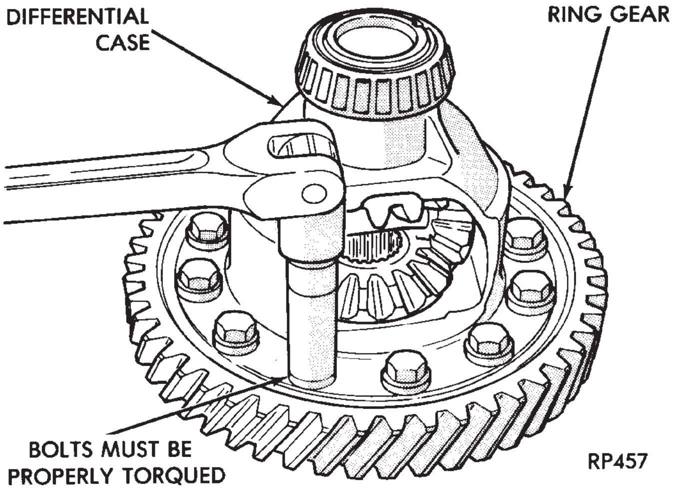


Fig. 5 Remove or Install Ring Gear Bolts and Ring Gear

CAUTION: Always install new ring gear bolts. Bolts must be properly torqued (See Tightening Reference).

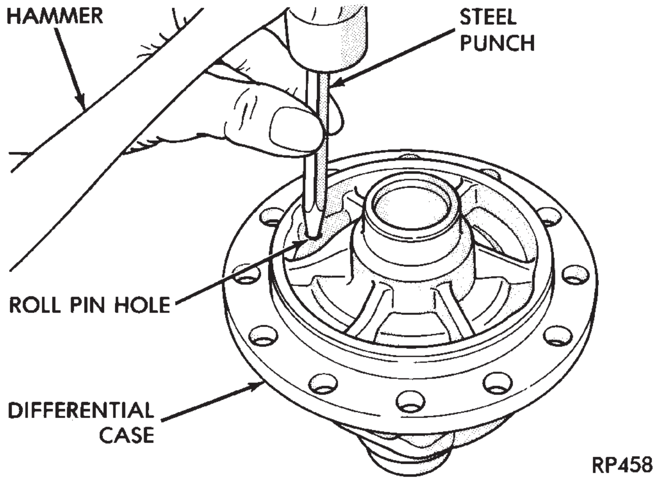


Fig. 6 Remove Pinion Shaft Roll Pin

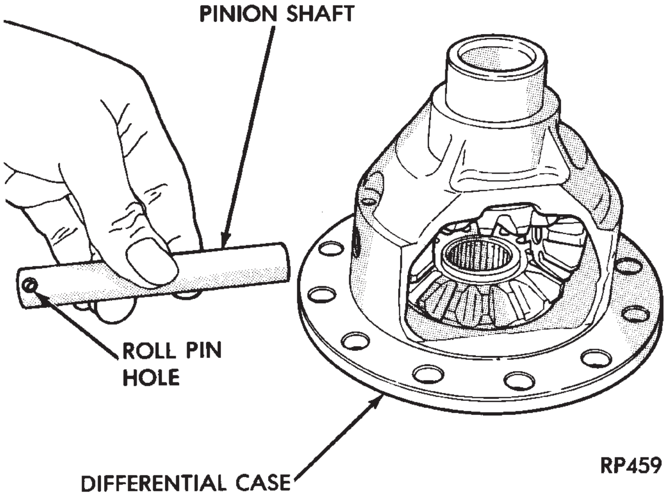


Fig. 7 Remove or Install Pinion Shaft

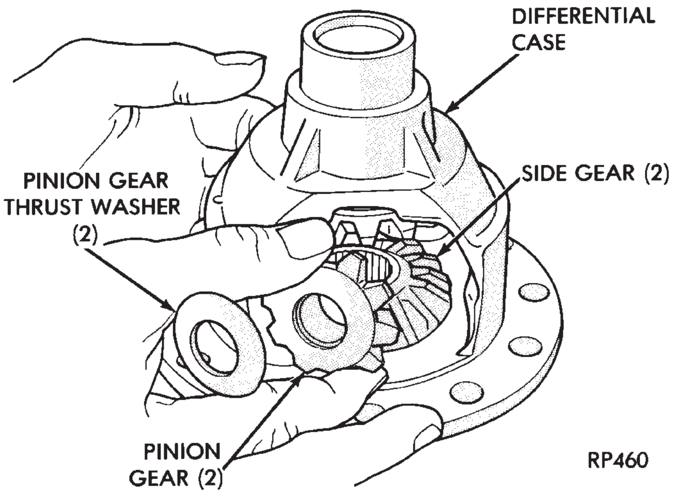


Fig. 8 Remove or Install Pinion Gears, Side Gears, and Thrust Washers by Rotating Side Gears to Opening in Case

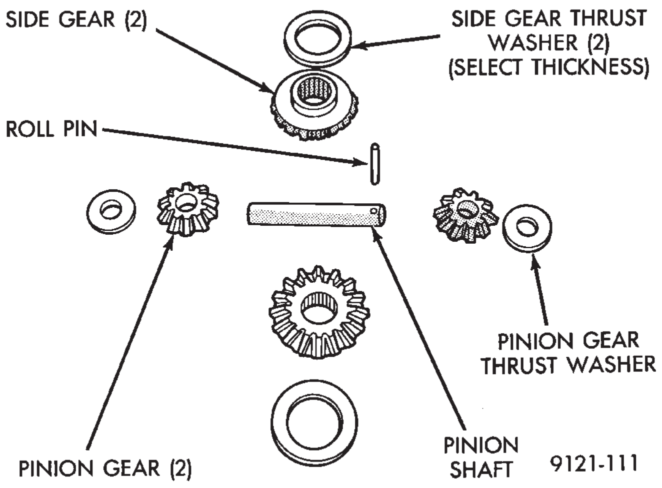


Fig. 9 Differential Gears

After assembling the differential side gears, pinion gears and pinion gears **with** the pinion gear washers, but **without** the side gear thrust washers. Rotate the assembly two full revolutions both clockwise and counterclockwise.

Set up dial indicator as shown and record end play. Rotate side gear 90 degrees and record another end play. Again, rotate side gear 90 degrees and record a final end play.

Using the smallest end play recorded, shim that side gear to within .001 to .013 inch. The other side gear should be checked using the same procedure.

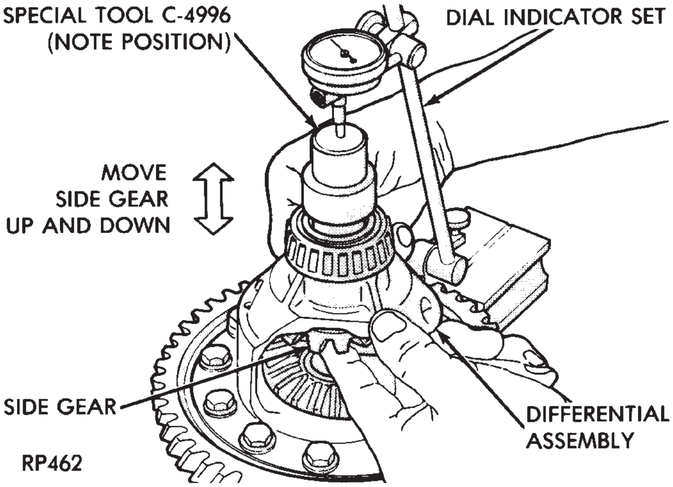


Fig. 10 Checking Side Gear End Play

CAUTION: Side gear end play must be within .001 to .013 inch. Four select thrust washers are available: .032, .037, .042, and .047 inch.

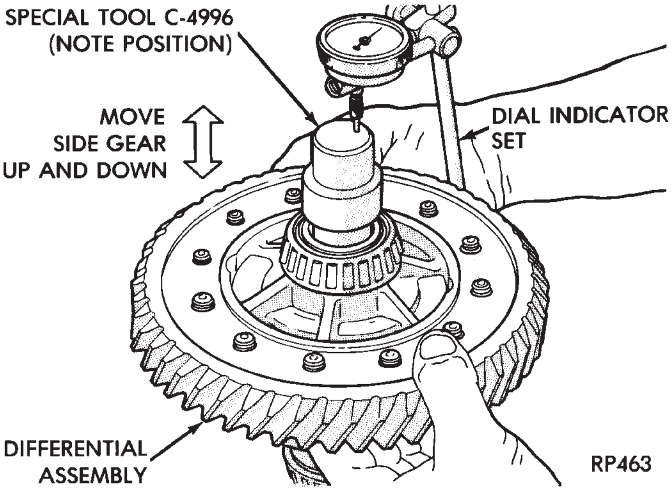


Fig. 11 Checking Side Gear End Play

A-568 DIFFERENTIAL

Shim thickness need only be determined if any of the following parts are replaced:

- Transaxle case
- Differential bearing retainer
- Extension housing
- Differential case
- Differential bearings

Refer to **Bearing Adjustment Procedure** in rear of this section to determine proper shim thickness for correct bearing preload and proper bearing turning torque.

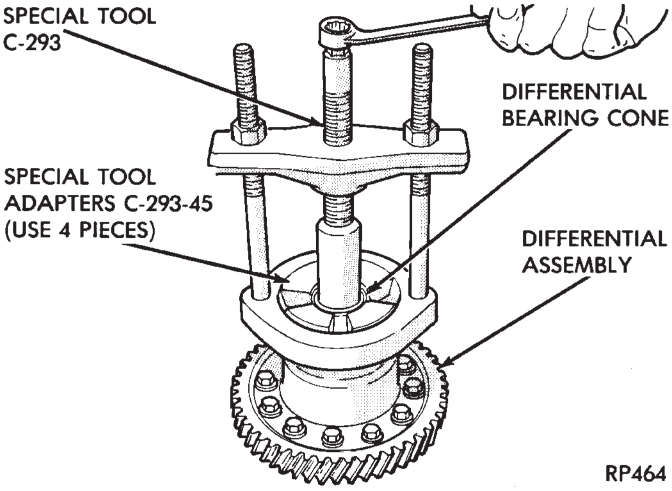


Fig. 1 Remove Differential Bearing Cone

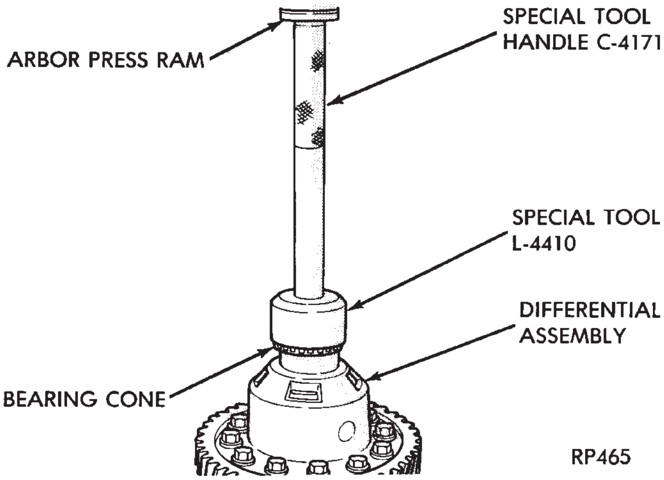


Fig. 2 Install Differential Bearing Cone

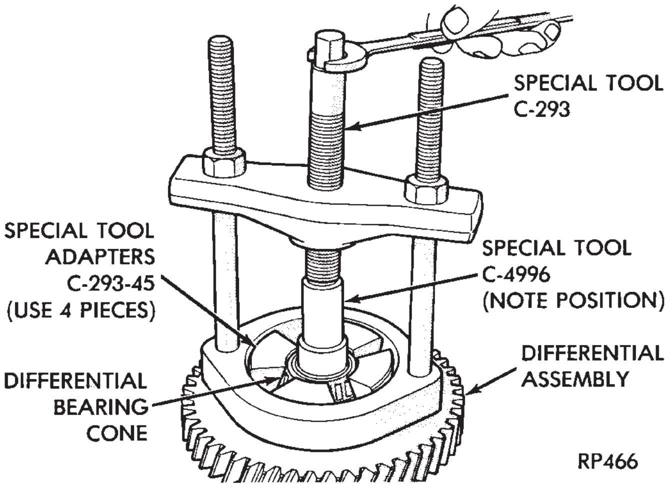


Fig. 3 Remove Differential Bearing Cone

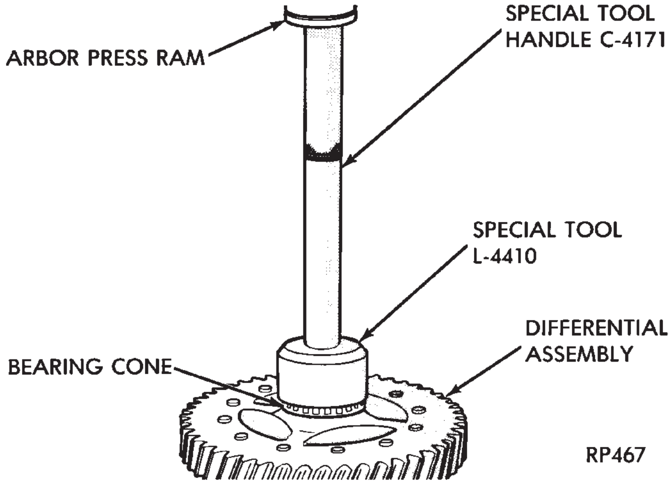


Fig. 4 Install Differential Bearing Cone

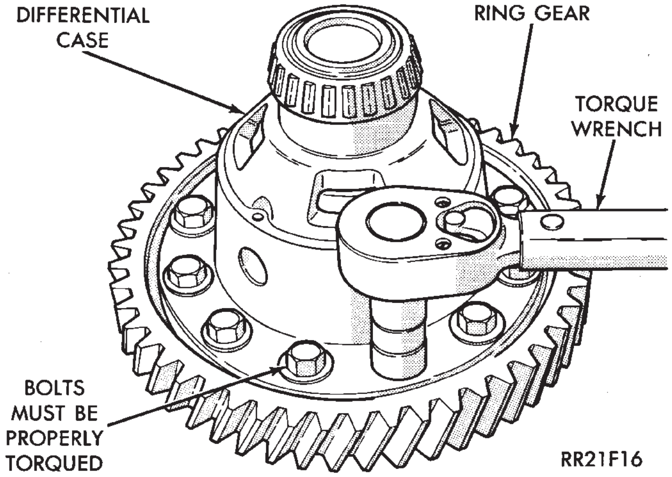


Fig. 5 Remove or Install Ring Gear Bolts

CAUTION: Always install new ring gear bolts. Bolts must be properly torqued (See Tightening Reference).

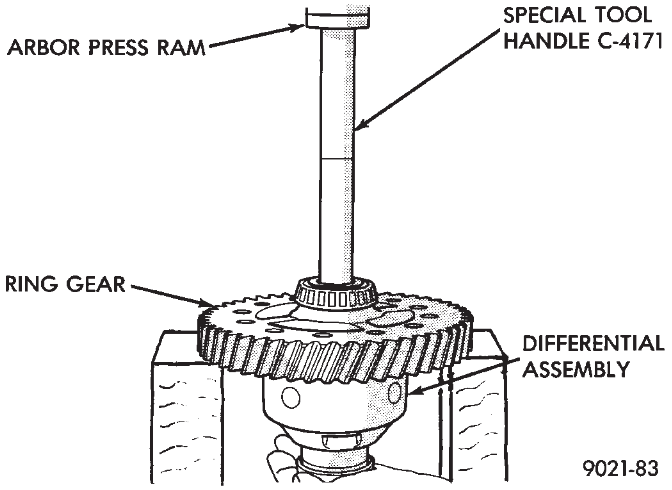


Fig. 6 Remove Ring Gear

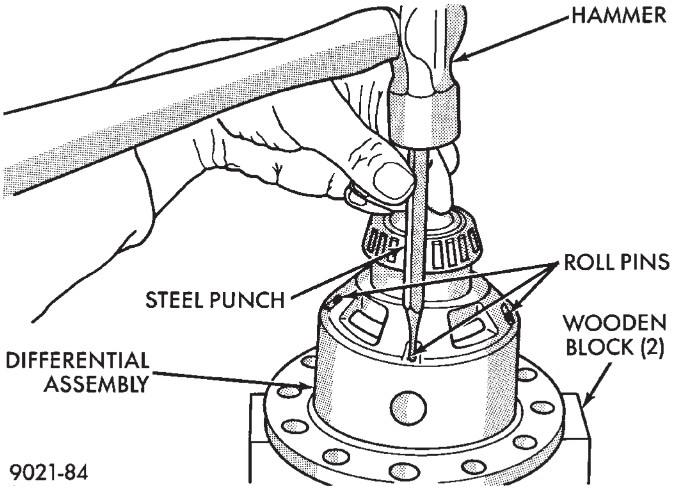


Fig. 7 Remove 3 Roll Pins

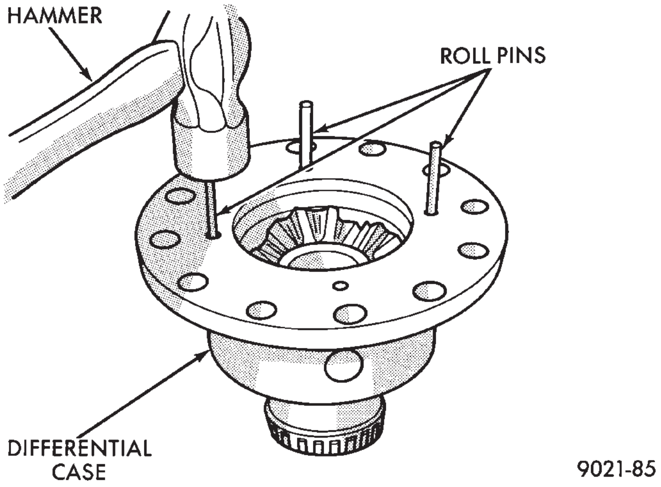


Fig. 8 Install 3 Roll Pins

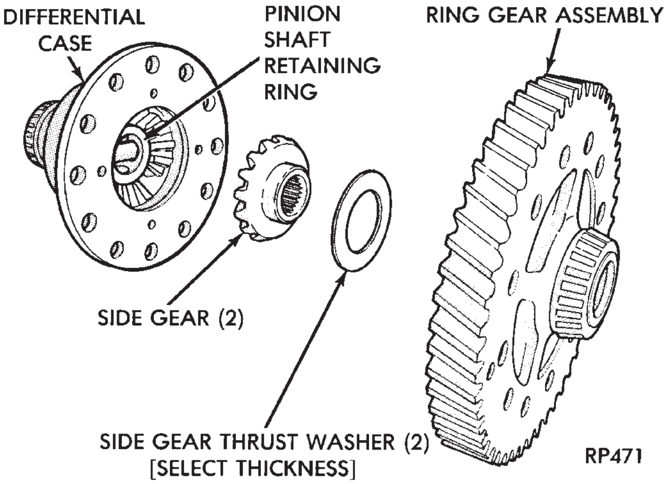


Fig. 9 Ring Gear and Side Gear Removed

CAUTION: See Figure 14 to determine side gear thrust washer thickness. Side gear end play must be within.001 to .013 inch.

Four select thrust washes are available: .032, .037, .042, and .047 inch.

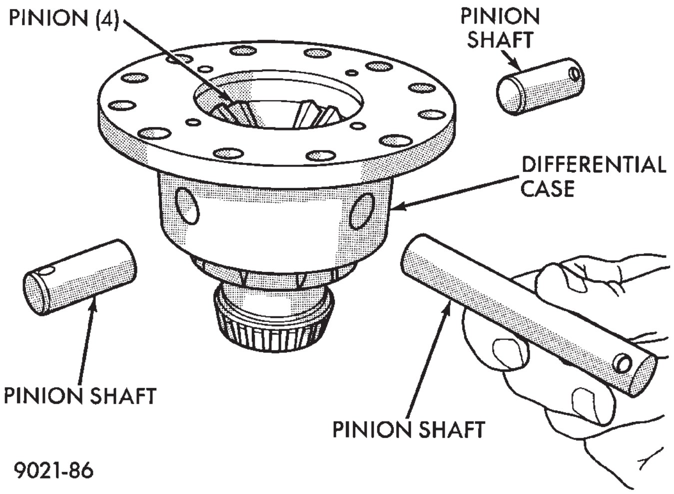


Fig. 10 Remove or Install Pinion Shafts

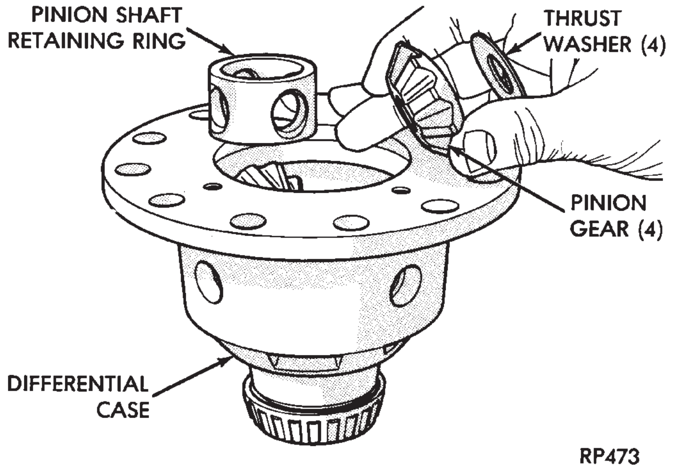


Fig. 11 Remove or Install 4 Pinion Gears and 2 Side Gears

Side gear thrust washers are available in 4 select thicknesses: .032, .037, .042, and .047 inch.

Measure the depth from the differential case to the machined surface in 3 places, as shown in Figure 13. Then measure the height of raised **step** on the ring gear. The difference, minus the proper side gear end play (.001 to .013 inch) is the proper thrust washer thickness.

For the other side gear: After assembling the differential side gears, pinion gears, and pinion gears **with** the pinion gear washers but **without** the side gear thrust washers. Rotate the assembly two full revolutions both clockwise and counterclockwise.

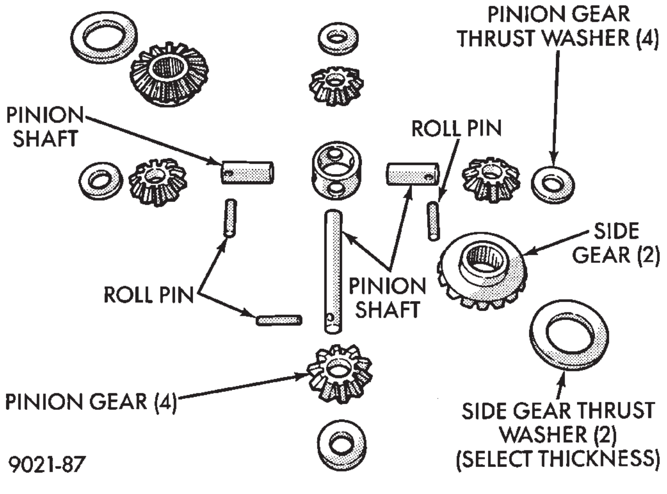


Fig. 12 Differential Gears

Set up dial indicator as shown in Figure 14 and record end play. Rotate side gear 90 degrees and record another end play. Again, rotate side gear 90 degrees and record a final end play.

Using the smallest end play recorded, shim that side gear to within .001 to .013 inch.

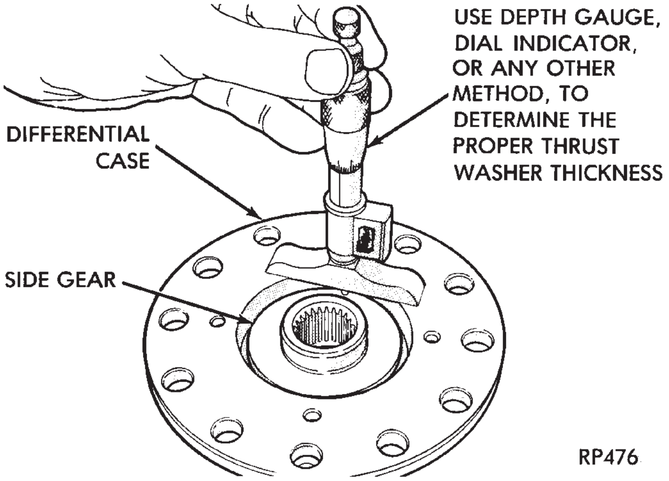


Fig. 13 Determine Proper Side Gear Thrust Washer Thickness

CAUTION: After reassembly of the differential assembly, insert the inner joint housing spline from a drive shaft into the side gear. By hand, turn the side gear with the joint housing spline. If the side gear will NOT turn, or it feels very tight, remove the ring gear and install a thinner side gear thrust washer.

Side gear thrust washers are available in four select thicknesses: .032, .037, .042, and .047 inch.

BEARING ADJUSTMENT PROCEDURE

GENERAL RULES ON SERVICING BEARINGS

(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 bear-

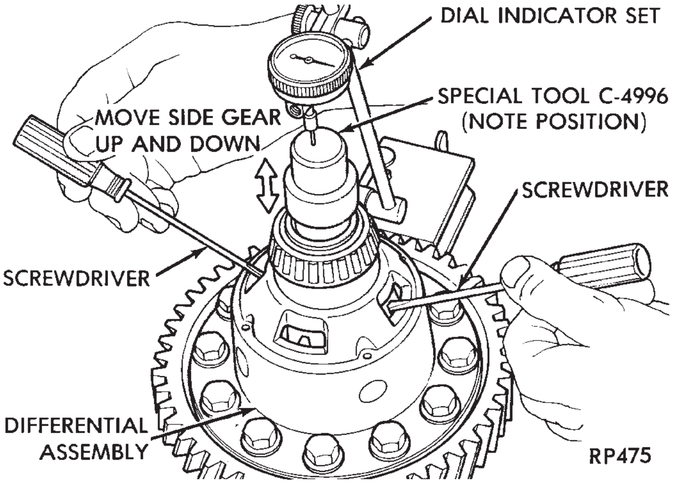


Fig. 14 Checking Side Gear End Play

ing 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) bearing may lose up to 50% of the 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. For example, if one differential bearing is defective, replace both differential bearings. If one input shaft bearing is defective, replace both input shaft bearings.

(5) Bearing cones **must not** be reused if removed.

(6) Turning torque readings should be obtained while smoothly rotating in either direction (breakaway reading is not indicative of the true turning torque).

(7) Replace oil baffle, if damaged.

INPUT SHAFT BEARING END PLAY ADJUSTMENT

(1) Using Tool C-4656 with Handle C-4171, press input shaft front bearing cup slightly forward in case. Then, using Tool C-4655 with Handle C-4171, press bearing cup back into case from the front. Properly position bearing cup, before checking input shaft end play (see input shaft front bearing cup replace in **Subassembly Recondition** section). **This step is not necessary if Tool C-4655 was previously used to install input shaft front bearing cup in the case. Also no input shaft shim has been installed since pressing cup into case.**

(2) Select a gauging shim which will give 0.025 to 0.254mm (.001 to .010 inch) end play. **SUGGESTION: Measure original shim from input shaft seal retainer and select a shim 0.254mm (.010 inch) thinner than original for the gauging shim.**

(3) Install gauging shim on bearing cup and install input shaft seal retainer.

CAUTION: The input shaft seal retainer is used to draw the input shaft front bearing cup the proper distance into the case bore during this step. Alternately tighten input shaft seal retainer bolts until input shaft seal retainer is bottomed against case. Tighten bolts to 28 N●m (21 ft. lbs.).

(4) Oil input shaft bearings with SAE 5W-30 engine oil and install input shaft in case. Install bearing retainer plate with input shaft rear bearing cup pressed in and bearing support plate installed. Tighten all bolts and nuts to 28 N●m (21 ft. lbs.).

(5) Position dial indicator to check input shaft end play. Apply moderate load, by hand, to input shaft splines (Fig. 1). Push toward rear while rotating input shaft back and forth a number of times to settle out bearings. Zero dial indicator. Pull input shaft toward the front while rotating input shaft back and forth a number of times to settle out bearings. Record end play.

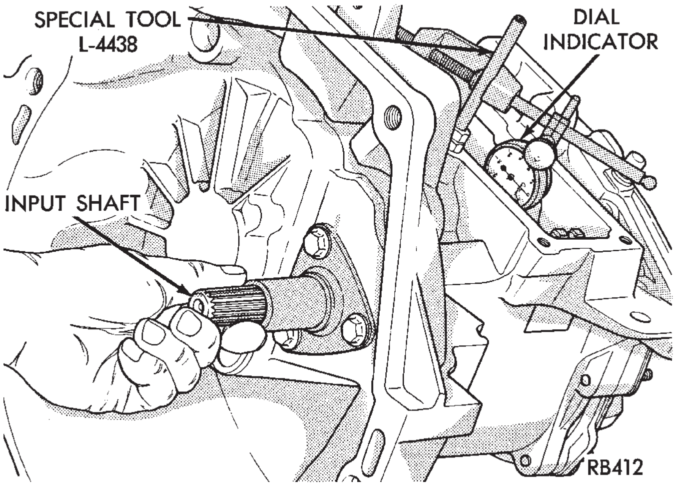


Fig. 1 Checking Input Shaft Bearing End Play to Determine Shim Thickness

(6) The shim required for proper bearing end play is the total of the gauging shim thickness, plus end play, minus (constant) end play of 0.051mm (.002 inch). Combine shims, if necessary, to obtain a shim within .04mm (.0016 inch) of the required shim (see Shim Chart for proper shim).

(7) Remove input shaft seal retainer and gauging shim. Install shim(s) selected in step (6). Then reinstall input shaft seal retainer with a 1/16 inch bead of MOPAR® Gasket Maker, Loctite, or equivalent for a gasket. Record end play. Observe the **CAUTION** in step (3). Tighten input shaft seal retainer bolts to 28 N●m (21 ft. lbs.).

(8) Verify that a preload condition does not exist. Use Special Tool L-4508 and an inch-pound torque wrench to check input shaft turning torque (Fig. 2). **The turning torque should be less than 5 in. lbs.**

CAUTION: Step (1) MUST be repeated every time a thinner shim is installed. This will assure that the input shaft bearing cup is pressed the proper distance into the case. If the turning torque is too high, install a .04mm (.0016 inch) thinner shim.

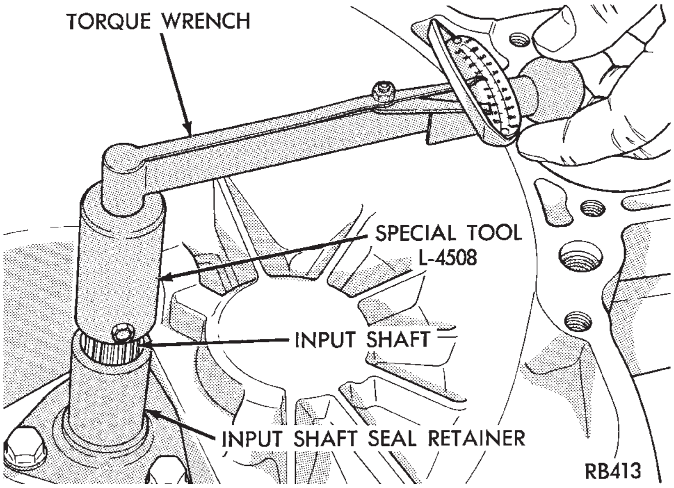


Fig. 2 Checking Input Shaft Bearing Turning Torque

(9) Recheck input shaft turning torque. Repeat step (8) until the proper bearing turning torque is obtained. Observe **CAUTION** in step (8).

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

(1) Remove bearing cup and existing shim from differential bearing retainer. (See Differential Bearing Retainer in **Subassembly Recondition** section).

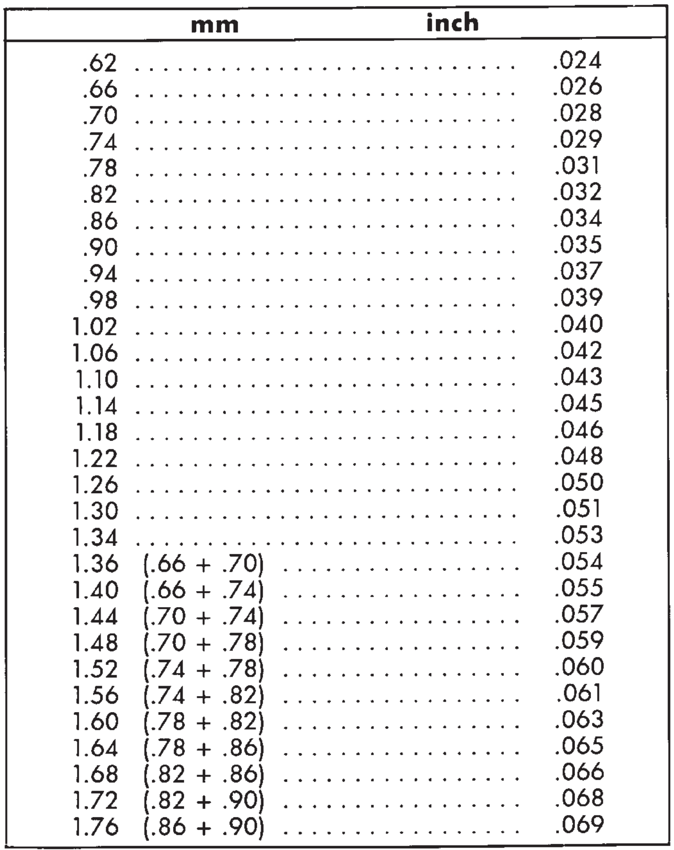
(2) Select a gauging shim which will give 0.025 to 0.254mm (.001 to .010 inch) end play. **SUGGESTION: Measure original shim from differential bearing retainer and select a shim 0.381mm (.015 inch-)thinner than original for the gauging shim.** Install gauging shim in differential bearing retainer and press in bearing cup. **Installation of oil baffle is not necessary when checking differential assembly end play.**

(3) Oil differential bearings with SAE 5W-30 engine oil and install differential assembly in transaxle case. Check extension housing O-ring for damage (replace if necessary). Add a 1/16 inch bead of MOPAR® Gasket Maker, Loctite 518, or equivalent to extension flange. Install extension housing and differential bearing retainer. Torque bolts (see Tightening Reference).

(4) Position transaxle with bell housing facing down on workbench with C-clamps. Position dial indicator.

(5) Apply a medium load to differential with Tool C-4995 and a T-Handle, in the downward direction. Roll differential assembly back and forth a number of times. This will settle the bearings. Zero dial indicator. To obtain end play readings, apply a medium load in the upward direction while rolling differential assembly back and forth (Fig. 3). Record end play.

INPUT SHAFT SHIM CHART



mm	inch
.62	.024
.66	.026
.70	.028
.74	.029
.78	.031
.82	.032
.86	.034
.90	.035
.94	.037
.98	.039
1.02	.040
1.06	.042
1.10	.043
1.14	.045
1.18	.046
1.22	.048
1.26	.050
1.30	.051
1.34	.053
1.36 (.66 + .70)	.054
1.40 (.66 + .74)	.055
1.44 (.70 + .74)	.057
1.48 (.70 + .78)	.059
1.52 (.74 + .78)	.060
1.56 (.74 + .82)	.061
1.60 (.78 + .82)	.063
1.64 (.78 + .86)	.065
1.68 (.82 + .86)	.066
1.72 (.82 + .90)	.068
1.76 (.86 + .90)	.069

9121-19

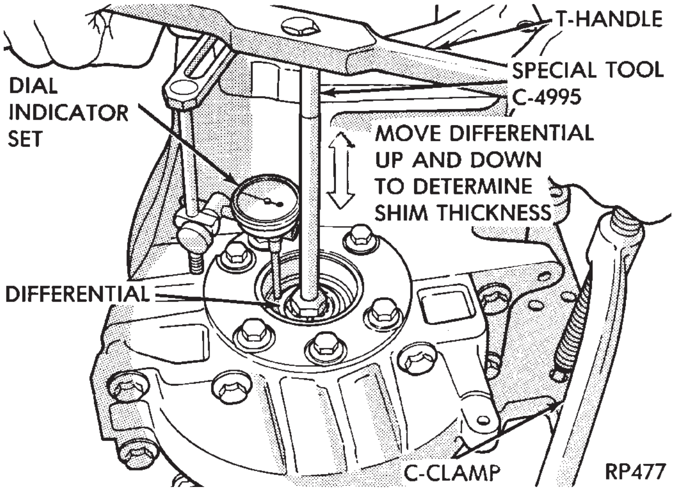


Fig. 3 Checking Differential Bearing End Play to Determine Shim Thickness

(6) The shim required for proper bearing preload is **total of gauging shim thickness, plus end play,**

plus (constant) preload of 0.254mm (.010 in.). Combine shims, if necessary, to obtain a shim within .05mm (.002 inch) of the required shim (see Shim Chart for proper shims).

(7) Remove differential bearing retainer. Remove bearing cup and gauging shim. Properly install oil baffle. **Be sure oil baffle is not damaged.** Install shim(s) selected in step (6). Then press in the bearing cup into differential bearing retainer.

(8) Using a 1/16 inch bead of MOPAR® Gasket Maker, Loctite 518, or equivalent for gasket, install differential bearing retainer. Torque all bolts (See Tightening Reference).

(9) Using Special Tool C-4995 and an inch-pound torque wrench, check turning torque of the differential assembly in clockwise and counterclockwise directions (Fig. 4). **The turning torque should be 9 to 14 in. lbs. for new bearings or a minimum of 6 in. lbs. for used bearings. If the turning torque is too high, install a .05mm (.002 inch) thinner shim. If the turning torque is too low, install a .05mm (.002 inch) thicker shim.**

(10) Recheck turning torque. Repeat Step (9) until the proper turning torque is obtained.

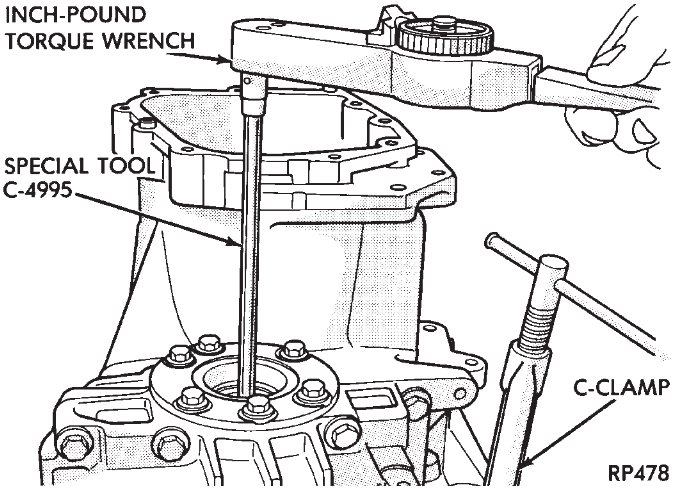
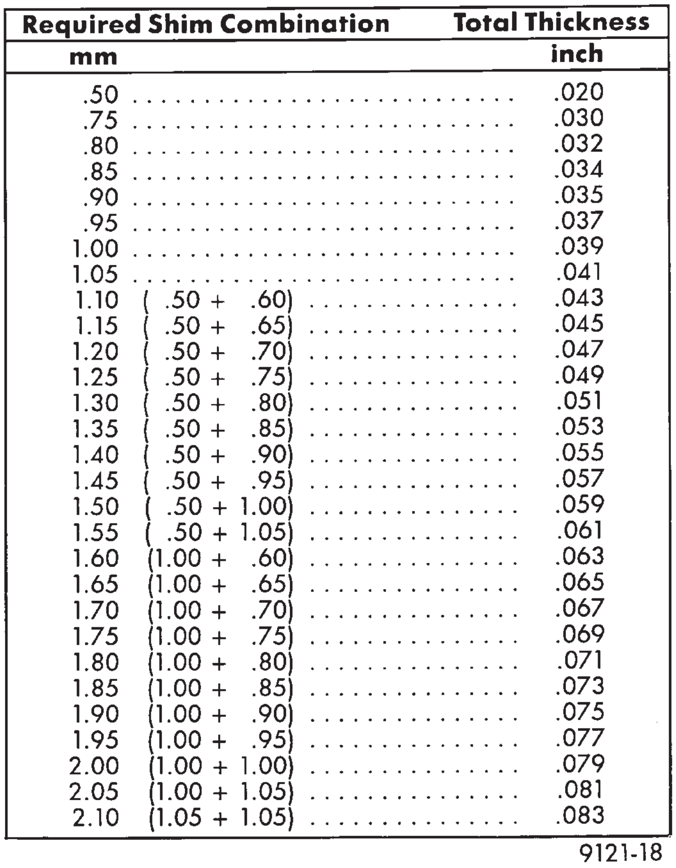


Fig. 4 Checking Differential Bearing Turning Torque

DIFFERENTIAL BEARING SHIM CHART



Required Shim Combination		Total Thickness
mm		inch
.50		.020
.75		.030
.80		.032
.85		.034
.90		.035
.95		.037
1.00		.039
1.05		.041
1.10	(.50 + .60)	.043
1.15	(.50 + .65)	.045
1.20	(.50 + .70)	.047
1.25	(.50 + .75)	.049
1.30	(.50 + .80)	.051
1.35	(.50 + .85)	.053
1.40	(.50 + .90)	.055
1.45	(.50 + .95)	.057
1.50	(.50 + 1.00)	.059
1.55	(.50 + 1.05)	.061
1.60	(1.00 + .60)	.063
1.65	(1.00 + .65)	.065
1.70	(1.00 + .70)	.067
1.75	(1.00 + .75)	.069
1.80	(1.00 + .80)	.071
1.85	(1.00 + .85)	.073
1.90	(1.00 + .90)	.075
1.95	(1.00 + .95)	.077
2.00	(1.00 + 1.00)	.079
2.05	(1.00 + 1.05)	.081
2.10	(1.05 + 1.05)	.083

9121-18

THREE SPEED TORQUEFLITE AUTOMATIC TRANSAXLE

INDEX

GENERAL INFORMATION

Safety goggles should be worn at all times when working on these transaxles.

This transaxle combines a fully automatic 3 speed transmission, final drive gearing, and differential into a front wheel drive system. The unit is a **Metric** design. The identification markings and usage of the transaxle are charted in Diagnosis and Tests.

Transaxle operation requirements are different for each vehicle and engine combination and 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 3 primary areas:

(1) Main center line plus valve body.

(2) Transfer shaft center line (includes governor and parking sprag).

(3) Differential center line. Center distances between the main rotating parts in these 3 areas are held precise. This maintains a low noise level through smooth accurate mesh of the gears.

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.

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 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.

The transaxle fluid is filtered by an internal filter attached to the lower side of the valve body assembly.

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. The transaxle consists of two multiple-disc clutches, an overrunning clutch, two servos, a hydraulic accumulator, two bands, and two planetary gear sets. They provide 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 to the 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 three gear sets producing overall top gear ratios of 2.78, 3.02, or 3.22 depending on model and application.

TORQUE CONVERTER CLUTCH

The torque converter clutch is standard on all vehicles. It 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 circuits show the position of the various valves. They indicate those under hydraulic pressure for all operations of the transaxle.

The hydraulic control system makes the transaxle fully automatic, and has four important functions to perform. In a general way, 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 provides fast release of the kickdown band, and smooth front clutch engagement, when the driver makes a **lift-foot** upshift from second to third. The second function of the shuttle valve 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 clutch inside the torque converter. It also disengages the torque converter at closed throttle, during engine warm-up, and during part-throttle acceleration.

The switch valve directs oil to apply the torque converter clutch in one position and releases the torque converter clutch in the other position.

CLUTCH, BAND SERVO, 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.

GEARSHIFT AND PARKING LOCK CONTROLS

The transaxle is controlled by a **lever type** gearshift incorporated within the console or 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 banging noise will occur.**

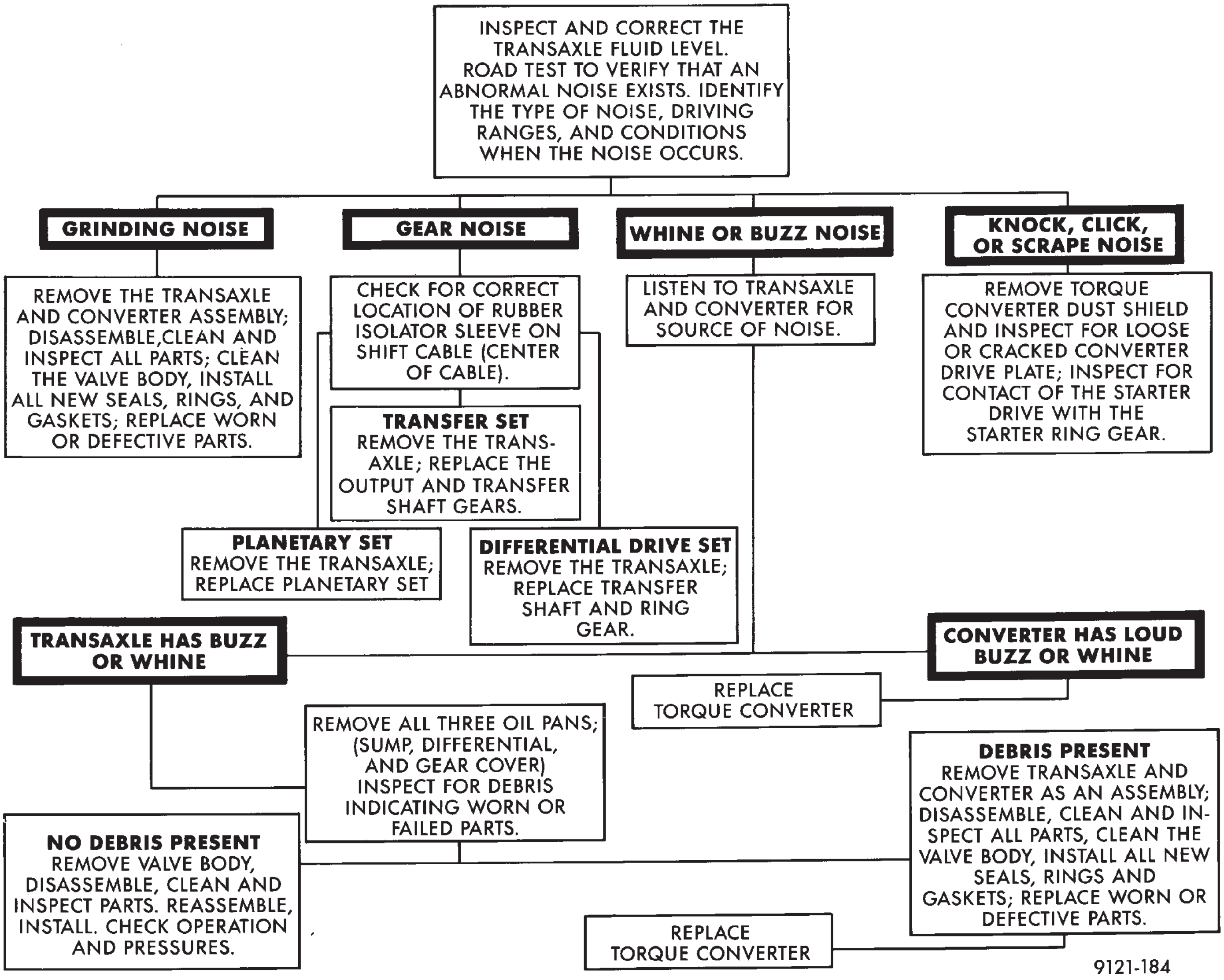
THREE SPEED TORQUEFLITE GENERAL DIAGNOSIS

Automatic transaxle malfunctions may be caused by four general conditions:

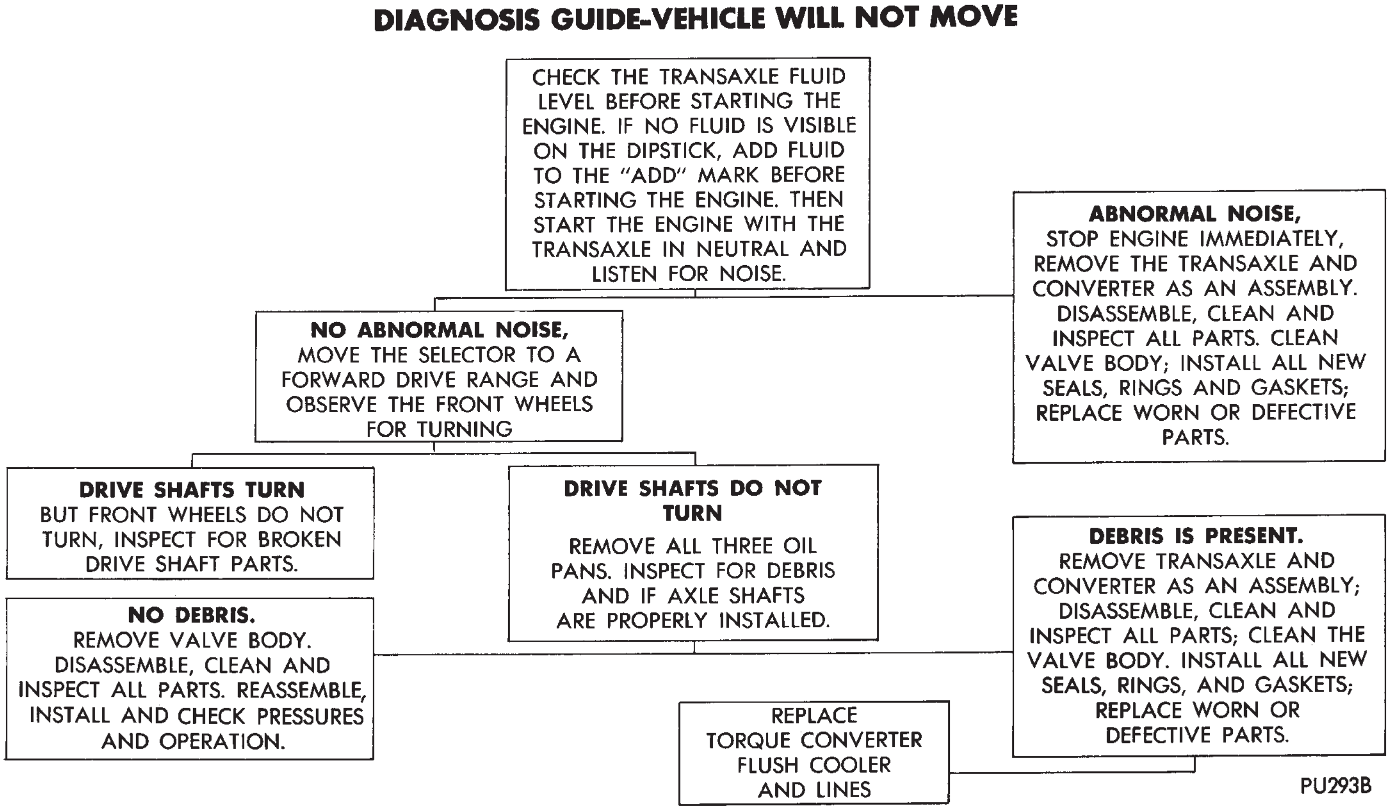
- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions.

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.

DIAGNOSIS GUIDE—ABNORMAL NOISE



DIAGNOSIS GUIDE—VEHICLE WILL NOT MOVE



DIAGNOSIS GUIDE-VEHICLE WILL NOT MOVE

CHECK THE TRANSAXLE FLUID LEVEL BEFORE STARTING THE ENGINE. IF NO FLUID IS VISIBLE ON THE DIPSTICK, ADD FLUID TO THE "ADD" MARK BEFORE STARTING THE ENGINE. THEN START THE ENGINE WITH THE TRANSAXLE IN NEUTRAL AND LISTEN FOR NOISE.

ABNORMAL NOISE, STOP ENGINE IMMEDIATELY, REMOVE THE TRANSAXLE AND CONVERTER AS AN ASSEMBLY. DISASSEMBLE, CLEAN AND INSPECT ALL PARTS. CLEAN VALVE BODY; INSTALL ALL NEW SEALS, RINGS AND GASKETS; REPLACE WORN OR DEFECTIVE PARTS.

NO ABNORMAL NOISE, MOVE THE SELECTOR TO A FORWARD DRIVE RANGE AND OBSERVE THE FRONT WHEELS FOR TURNING

DRIVE SHAFTS TURN BUT FRONT WHEELS DO NOT TURN, INSPECT FOR BROKEN DRIVE SHAFT PARTS.

DRIVE SHAFTS DO NOT TURN

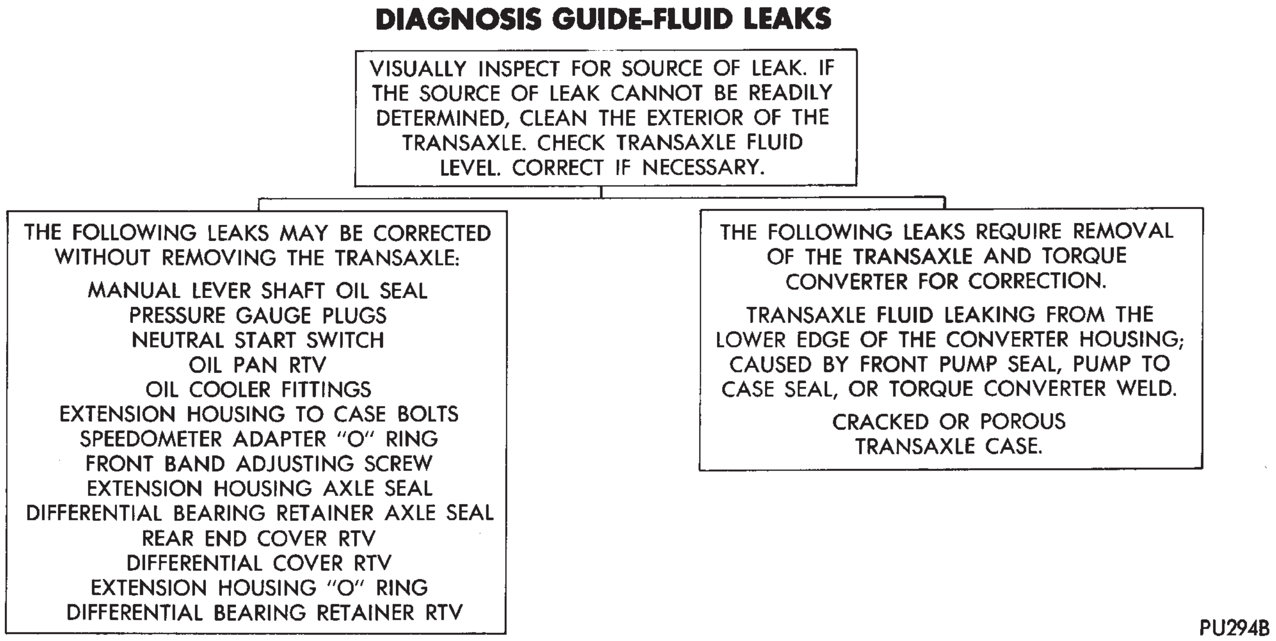
REMOVE ALL THREE OIL PANS. INSPECT FOR DEBRIS AND IF AXLE SHAFTS ARE PROPERLY INSTALLED.

NO DEBRIS. REMOVE VALVE BODY. DISASSEMBLE, CLEAN AND INSPECT ALL PARTS. REASSEMBLE, INSTALL AND CHECK PRESSURES AND OPERATION.

DEBRIS IS PRESENT. REMOVE TRANSAXLE AND CONVERTER AS AN ASSEMBLY; DISASSEMBLE, CLEAN AND INSPECT ALL PARTS; CLEAN THE VALVE BODY. INSTALL ALL NEW SEALS, RINGS, AND GASKETS; REPLACE WORN OR DEFECTIVE PARTS.

REPLACE TORQUE CONVERTER FLUSH COOLER AND LINES

DIAGNOSIS GUIDE—FLUID LEAKS



DIAGNOSIS GUIDE-FLUID LEAKS

VISUALLY INSPECT FOR SOURCE OF LEAK. IF THE SOURCE OF LEAK CANNOT BE READILY DETERMINED, CLEAN THE EXTERIOR OF THE TRANSAXLE. CHECK TRANSAXLE FLUID LEVEL. CORRECT IF NECESSARY.

THE FOLLOWING LEAKS MAY BE CORRECTED WITHOUT REMOVING THE TRANSAXLE:

MANUAL LEVER SHAFT OIL SEAL
PRESSURE GAUGE PLUGS
NEUTRAL START SWITCH
OIL PAN RTV
OIL COOLER FITTINGS
EXTENSION HOUSING TO CASE BOLTS
SPEEDOMETER ADAPTER "O" RING
FRONT BAND ADJUSTING SCREW
EXTENSION HOUSING AXLE SEAL
DIFFERENTIAL BEARING RETAINER AXLE SEAL
REAR END COVER RTV
DIFFERENTIAL COVER RTV
EXTENSION HOUSING "O" RING
DIFFERENTIAL BEARING RETAINER RTV

THE FOLLOWING LEAKS REQUIRE REMOVAL OF THE TRANSAXLE AND TORQUE CONVERTER FOR CORRECTION.

TRANSAXLE FLUID LEAKING FROM THE LOWER EDGE OF THE CONVERTER HOUSING; CAUSED BY FRONT PUMP SEAL, PUMP TO CASE SEAL, OR TORQUE CONVERTER WELD.

CRACKED OR POROUS TRANSAXLE CASE.

DIAGNOSTIC CHART

	POSSIBLE CAUSE	CONDITION: HARSH ENGAGEMENT FROM NEUTRAL TO D	R	DELAYED ENGAGEMENT FROM NEUTRAL TO D	R	RUNAWAY UPSHIFT	NO UPSHIFT	3-2 KICKDOWN RUNAWAY	NO KICKDOWN OR NORMAL DOWNSHIFT	SHIFTS ERRATIC	SLIPS IN FORWARD DRIVE POSITIONS	SLIPS IN REVERSE ONLY	SLIPS IN ALL POSITIONS	NO DRIVE IN ANY POSITION	NO DRIVE IN FORWARD DRIVE POSITIONS	NO DRIVE IN REVERSE	DRIVES IN NEUTRAL	DRAGS OR LOCKS	GRATING, SCRAPING GROWLING NOISE	BUZZING NOISE	HARD TO FILL, OIL BLOWS OUT FILLER HOLE	TRANSAXLE OVERHEATS	HARSH UPSHIFT	DELAYED UPSHIFT	NO TORQUE CONVERTER CLUTCH APPLICATION
34	Engine performance.	X	X				X			X													X	X	
33	Overrunning clutch inner race damaged.																			X					
32	Overrunning clutch worn, broken or seized.										X				X			X	X						
31	Planetary gear sets broken or seized.													X	X	X		X	X						
30	Rear clutch dragging.																X								
29	Worn or faulty rear clutch.	X	X	X							X				X	X	X								
28	Insufficient clutch plate clearance.																X					X			
27	Faulty cooling system.																					X			
26	Kickdown band adjustment too tight.																	X				X			
25	Hydraulic pressure too high.	X	X																				X		
24	High fluid level.																				X				
23	Worn or faulty front clutch.				X	X	X	X		X		X				X								X	
22	Kickdown servo band or linkage malfunction.					X	X	X	X	X														X	
21	Governor malfunction.						X		X	X														X	
20	Worn or broken reaction shaft support seal rings.				X	X	X			X		X				X								X	
19	Governor support seal rings broken or worn.						X	X		X														X	
18	Driveshaft(s) bushing(s) damaged.																		X						
17	Overrunning clutch not holding.										X				X										
16	Kickdown band out of adjustment.							X											X				X	X	
15	Incorrect throttle linkage adjustment.					X	X	X	X	X	X												X	X	
14	Engine idle speed too low.			X	X																				
13	Aerated fluid.			X	X	X		X		X	X	X	X							X	X				X
12	Worn or broken input shaft seal rings.			X	X						X		X		X										X
11	Faulty oil pump.			X	X					X	X	X	X	X								X			X
10	Oil filter clogged.			X	X	X				X	X		X	X							X				
9	Incorrect gearshift control linkage adjustment.			X	X		X			X	X	X				X	X					X			
8	Low fluid level.			X	X	X	X	X		X	X	X	X	X	X					X		X			X
7	Low-reverse servo, band or linkage malfunction.		X		X							X				X									
6	Valve body malfunction or leakage.	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			X					X
5	Low-reverse band worn out.		X		X							X				X		X	X						
4	Hydraulic pressures too low.			X	X	X	X	X		X	X	X	X	X	X	X						X	X		X
3	Engine idle speed too high.	X	X																			X			
2	Stuck switch valve.																					X			X
1	Low-reverse band misadjusted.		X		X							X													

9321-201

FLUID LEVEL AND CONDITION

The transmission and differential sump have a common oil sump with a communicating opening between the two.

Before removing the dipstick, wipe all dirt off of the protective disc and the dipstick handle.

The torque converter will fill in both the **P** Park or **N** Neutral positions. Place the selector lever in **P** Park to check fluid level.

Inspect fluid level on dipstick every six months. **Allow the engine to idle for at least one minute with vehicle on level ground. This will assure complete oil level stabilization between differential and transmission.** A properly filled transaxle will read near the **add** mark when fluid temperature is 21 degrees Celsius (70 degrees Fahrenheit). When the transaxle reaches operating temperature the fluid should be in the **HOT** region.

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, which can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transaxle vent (dipstick handle) 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 these transmissions. MOPAR® ATF PLUS (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 should be used only if the recommended fluid is not available. 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 the automatic transmission 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.

FLUID AND FILTER CHANGE

When the factory fill fluid is changed, only fluids of the type labeled MOPAR® ATF PLUS (Automatic Transmission fluid) Type 7176 should be used. A band adjustment and filter change should be made at the time of the oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.

If the transaxle is disassembled for any reason, the fluid and filter should be changed, and the band(s) adjusted.

FLUID DRAIN AND REFILL

(1) Raise vehicle on a hoist (See Lubrication, Group 0). 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 in. lbs.).

(4) Clean the oil pan and magnet. Reinstall pan using new MOPAR® Adhesive sealant. Tighten oil pan bolts to 19 N●m (165 in. lbs.).

(5) Pour four quarts of MOPAR® ATF PLUS (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.

Recheck fluid level after transaxle is at normal operating temperature. The level should be in the HOT region (Fig. 1).

To prevent dirt from entering transaxle, make certain that dipstick is full seated into the dipstick opening.

TORQUE CONVERTER CLUTCH SOLENOID WIRING CONNECTOR

If wiring connector is unplugged, the torque converter clutch will not operate (Fig. 2).

ROAD TEST

Prior to performing a road test, be certain that the fluid level and condition, and control cable adjustments have been checked and approved.

During the road test, the transaxle should be operated in each position to check for slipping and any variation in shifting.

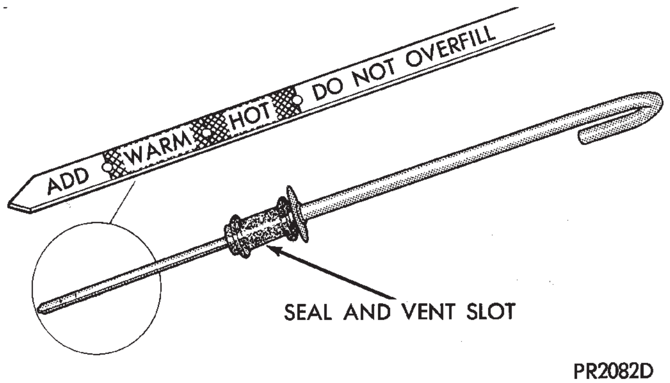


Fig. 1 Dipstick and Transaxle Vent

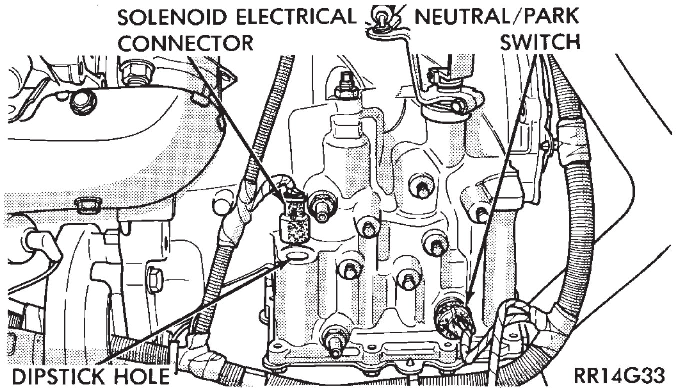


Fig. 2 Torque Converter Clutch Solenoid Wiring Connector

If vehicle operates properly at highway speeds, but has poor acceleration, the torque converter stator overrunning clutch may be slipping. If through-gear acceleration is normal, but high throttle opening is required to maintain highway speeds, the torque converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter.

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.

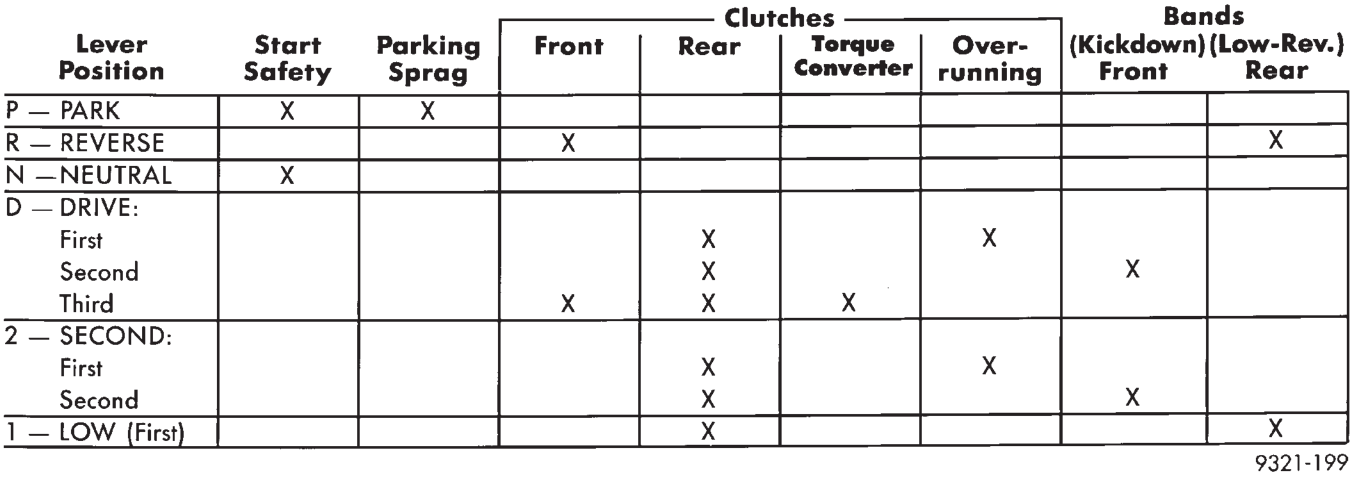
The clutch or band that is slipping can be determined by noting the transaxle operation in all selector positions. Then comparing which internal units are applied in those positions. The **Elements in Use Chart** provides a basis for road test analysis.

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 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, but the actual cause of the malfunction usually cannot be decided. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER



Lever Position	Start Safety	Parking Sprag	Clutches				Bands	
			Front	Rear	Torque Converter	Over-running	(Kickdown) Front	(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

9321-199

Unless the condition is obvious, like no drive in **D** range first gear only. 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. 3).

TEST ONE (SELECTOR IN 1)

(1) Attach gauges to **line** and **low-reverse** ports (Fig. 3).

(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 and 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 you to read **lubrication** pressure (Fig 3).

(2) Operate engine at 1000 rpm for test.

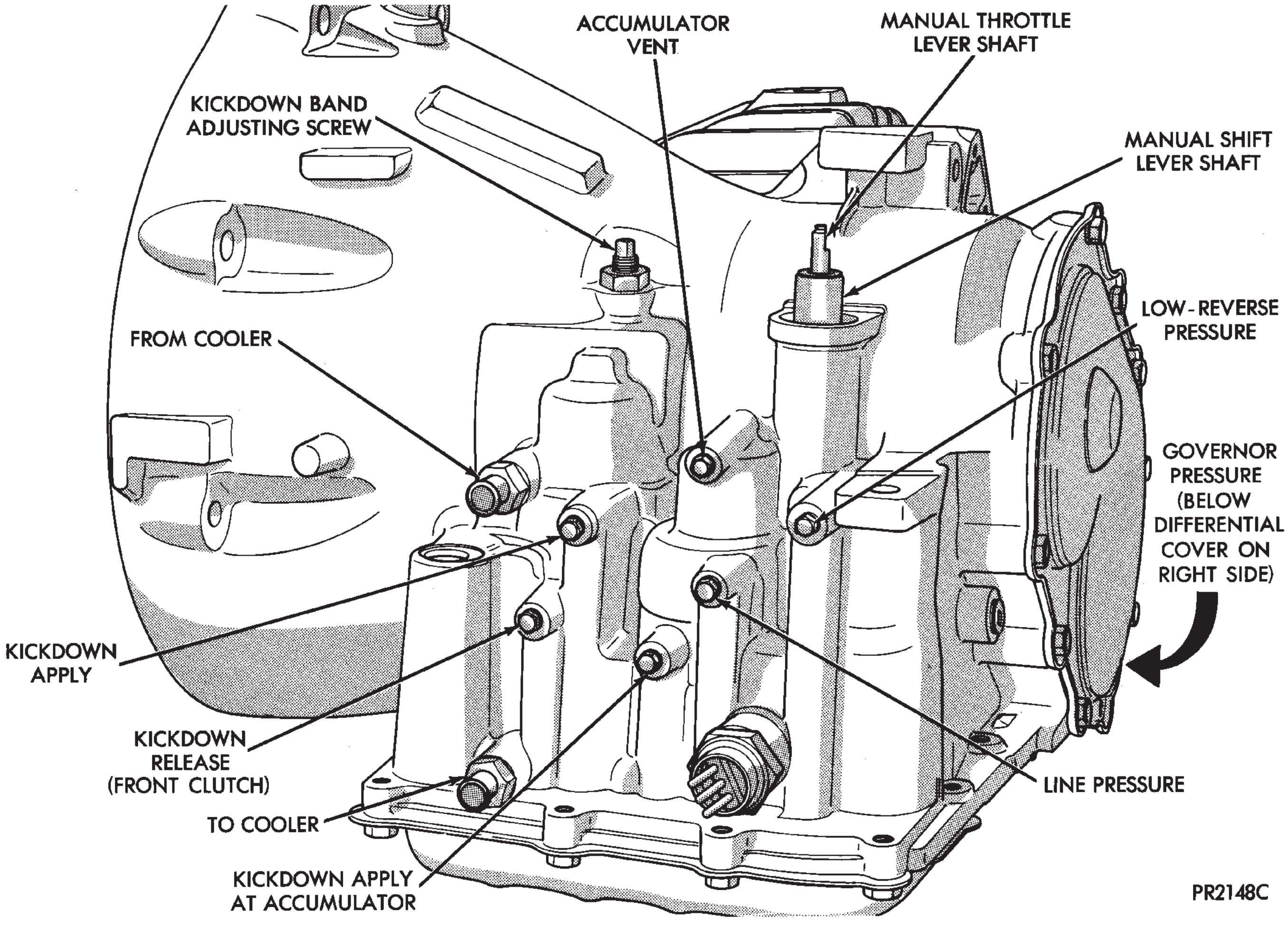


Fig. 3 Transaxle (Left Side)

(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 and 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 (Fig. 3).

(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 and gradually 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 (Fig. 3).

(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 and 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.

(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, located at lower right side of case, below differential cover (Fig. 3).

(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 only be suspected if part throttle upshift speeds are either delayed or occur too early, with a correctly adjusted throttle cable. Engine runaway on either upshifts or downshifts can also be an indicator of incorrect (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 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 after the valve body assembly has been removed. To make air pressure tests, proceed as follows:

Compressed air supply must be free of all dirt or moisture. Use a pressure of 30 psi.

Remove oil pan and valve body See **Disassembly-Subassembly Removal**.

FRONT CLUTCH

Apply air pressure to front clutch **apply** passage and listen for a dull **thud** which indicates that front

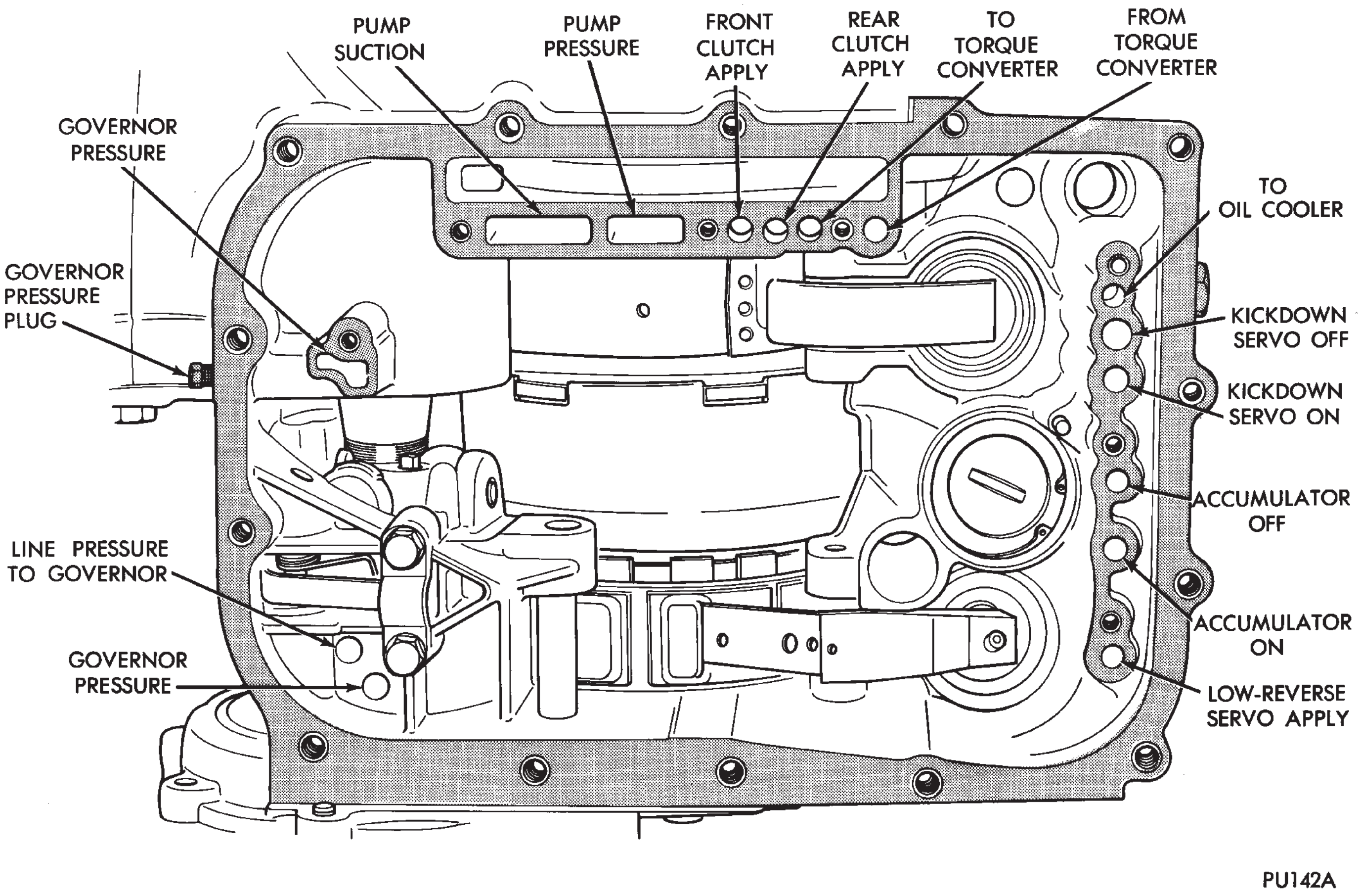


Fig. 4 Air Pressure Tests

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** or **erratic shift** conditions indicate that malfunctions exist in the valve body.

FLUID LEAKAGE-TRANSAXLE TORQUE CONVERTER HOUSING AREA

(1) Check for Source of Leakage.

Since 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 dyed red and, therefore, can be distinguished from engine oil.

(2) Prior to removing the transaxle, perform the following checks:

- When leakage is determined to originate from the transaxle, check fluid level prior to removal of the transaxle and torque converter.
- High oil level can result in oil leakage out the vent in the dipstick. If the fluid level is high, adjust to proper level.

After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle to determine if it is the torque converter or transaxle that is leaking.

LEAKAGE TEST PROBE

(1) Remove torque converter housing dust shield.

(2) Clean the inside of torque converter housing (lower area) as dry as possible. A solvent spray followed by compressed air drying is preferable.

(3) Fabricate and fasten test probe (Fig. 5) securely to convenient dust shield bolt hole. Make certain torque converter is cleared by test probe. Tool must be clean and dry.

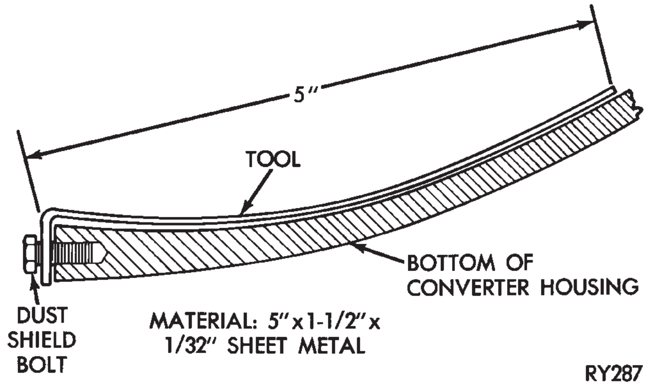


Fig. 5 Leak Locating Test Probe Tool

(4) Run engine at approximately 2,500 rpm with transaxle in neutral, for about 2 minutes. Transaxle must be at operating temperature.

(5) Stop engine and carefully remove tool.

(6) If upper surface of test probe is dry, there is no torque converter leak. A path of fluid across probe indicates a torque converter leak. Oil leaking under the probe is coming from the transaxle pump area.

(7) Remove transaxle and torque converter assembly from vehicle for further investigation.The fluid should be drained from the transaxle. Reinstall oil pan (with MOPAR® Adhesive Sealant) at specified torque.

Possible sources of transaxle torque converter area fluid leakage are:

(1) Torque converter hub seal.

(a) Seal lip cut, check torque converter hub finish.

(b) Bushing moved and/or worn.

(c) Oil return hole in pump housing plugged or omitted.

(d) Seal worn out (high-mileage vehicles).

(2) Fluid leakage at the outside diameter from pump housing O-ring.

(3) Fluid leakage at the pump to case bolts. Check condition of washers on bolts and use new bolts if necessary.

(4) Fluid leakage due to case or pump housing porosity.

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.

Hub weld is inside and not visible. Do not attempt to repair. Replace torque converter.

AIR PRESSURE TEST OF TRANSAXLE

Fabricate equipment needed for test as shown in figures 6 and 7.

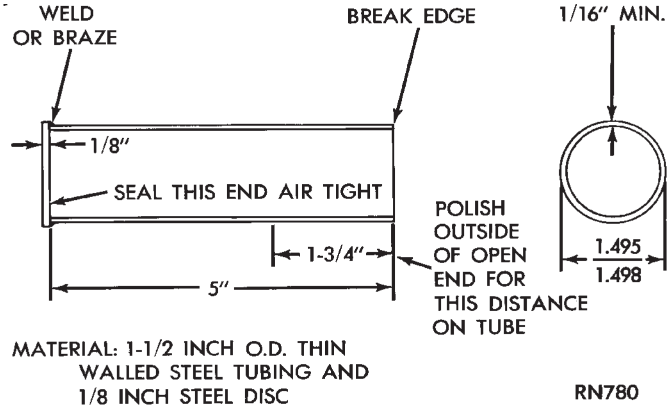


Fig. 6 Torque Converter Hub Seal Cup

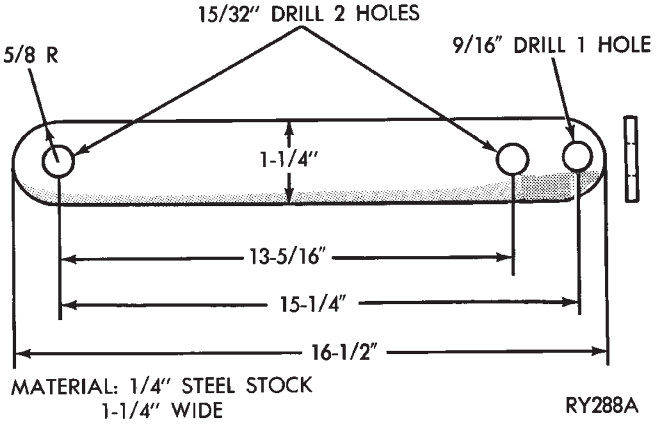


Fig. 7 Hub Seal Cup Retaining Strap

The transaxle should be prepared for pressure test as follows after removal of the torque converter:

(1) Install a dipstick bore plug and plug oil cooler line fitting (lower fitting).

(2) With rotary motion, install converter hub seal cup over input shaft. It must go through the converter hub seal until the cup bottoms against the pump gear lugs. Before use, inspect hub seal cup (Fig. 6) for nicks or burrs that could damage seal. Secure with cup retainer strap (Fig. 7) using starter upper hole and opposite bracket hole.

(3) Attach and clamp hose from nozzle of Tool C-4080 to the upper cooler line fitting position in case.

CAUTION: Do not, under any circumstances, pressurize a transaxle to more than 10 psi.

(4) Pressurize the transaxle using Tool C-4080 until the pressure gauge reads 8 psi. Position transaxle

so that pump housing and case front may be covered with soapy solution or water. Leaks are sometimes caused by porosity in the case or pump housing.

If a leak source is located, that part and all associated seals, O-rings, and gaskets should be replaced with new parts.

GEARSHIFT LINKAGE ADJUSTMENT

Normal operation of the Park/Neutral Position Switch provides a quick check to confirm proper manual linkage adjustment.

Move the selector level slowly upward until it clicks into the “P” Park notch in the selector gate. If the starter will operate the “P” position is correct.

After checking “P” position, move selector slowly toward “N” Neutral position until lever drops in the “N” stop. If the starter will also operate at this point the gearshift linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

CAUTION: When it is necessary to disassemble linkage cable from levers, which use plastic grommets as retainers, the grommets should be replaced with new grommets. Use a prying tool to force rod from grommet in lever, then cut away old grommet. Use pliers to snap new grommet into lever and rod into grommet.

(1) Set parking brake.

(2) Place gearshift lever in **P** (PARK) position.

(3) Loosen clamp bolt on gearshift cable bracket.

(4) Column shift: Insure that preload adjustment spring engages fork on transaxle bracket.

(5) Pull the shift lever by hand to the front detent position (PARK) and tighten lock. Tighten screw to 11 N•m (100 in. lbs.). Gearshift linkage should now be properly adjusted.

(6) Check adjustment as follows:

  (a) Detent position for neutral and drive should be within limits of hand lever gate stops.

  (b) Key start must occur only when shift lever is in park or neutral positions.

THROTTLE PRESSURE LINKAGE ADJUSTMENT

The throttle pressure cable 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 long, early shifts and slippage between shifts may occur. If the setting is too short, shifts may be delayed and part throttle downshifts may be very sensitive.

CABLE ADJUSTMENT PROCEDURE (4-CYL.)

(1) Perform transaxle throttle pressure cable adjustment while engine is at normal operating temperature.

(2) Loosen cable mounting bracket lock screw.

(3) Bracket should be positioned with both bracket alignment tabs touching the transaxle cast surface. Tighten lock screw to 12 N•m (105 in. lbs.) see Figure 8.

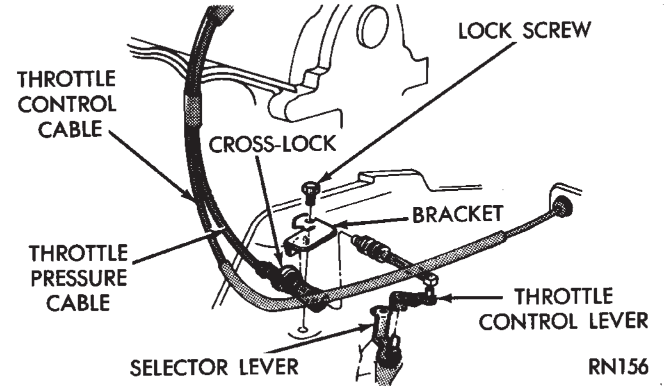


Fig. 8 Throttle Pressure Cable—Typical

(4) Release cross-lock on the cable assembly (pull cross-lock upward) see Figure 7.

(5) To insure proper adjustment, the cable must be free to slide all the way toward the engine, against its stop, after the cross-lock is released.

(6) Move transaxle throttle control lever fully clockwise, against its internal stop, and press cross-lock downward into locked position (Fig. 7).

(7) The adjustment is complete and transaxle throttle cable backlash was automatically removed.

(8) Test cable freedom of operation by moving the transaxle throttle lever forward (counterclockwise). Then slowly release it to confirm it will return fully rearward (clockwise).

(9) No lubrication is required for any component of the throttle cable system.

ROD ADJUSTMENT PROCEDURE (6-CYL.)

(1) Perform transaxle throttle pressure cable 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 so that preload spring action is not restricted. Disassemble and clean or repair parts to assure free action, if necessary.

(4) Hold transaxle throttle lever firmly toward engine, against its internal stop and tighten swivel lock screw to 11 N•m (100 in. lbs.)

(5) The adjustment is finished and linkage back lash was automatically removed by the preload spring.

(6) If lubrication is required see Lubrication, Group 0.

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, Tool C-3880-A with adapter Tool C-3705, tighten band adjusting screw to 5 N●m (47 to 50 in. lbs.). If adapter C-3705 is not used, tighten adjusting screw to 8 N●m (72 in. lbs.) which is the true torque.

(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 (35 ft. 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** in the rear of the Transaxle Section in this service manual.

(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.

VEHICLE SPEED SENSOR PINION GEAR

When the speed sensor is removed for any reason, a NEW O-ring must be installed on its outside diameter.

REMOVAL AND INSTALLATION

(1) Remove speedometer cable (if so equipped).

(2) Remove harness connector from sensor. Make sure weatherseal stays on harness connector.

(3) Remove bolt securing the distance sensor in the extension housing.

(4) Carefully pull sensor and pinion gear assembly out of extension housing.

(5) Remove pinion gear from sensor.

(6) 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.

(7) Tighten securing bolt to 7 N●m (60 in. lbs.). Tighten speedometer cable to 4 N●m (35 in. lbs.).

PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH

REPLACEMENT AND TEST

The Park/Neutral 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.

(3) Unscrew switch from transaxle case allowing fluid to drain into a container. Move selector lever to Park and then to Neutral positions. Inspect to see that the switch operating lever fingers are centered in switch opening in the case.

(4) 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.

(5) Add fluid to transaxle to bring up to proper level.

(6) The back-up lamp switch circuit is through the two outside terminals of the 3 terminal switch.

(7) To test switch, remove wiring connector from switch and test for continuity between the two outside pins.

(8) Continuity should exist only with transaxle in Reverse position.

(9) No continuity should exist from either pin to the case.

GOVERNOR

To service the governor assembly in the vehicle, it is not necessary to remove the transfer gear cover, transfer gear, and governor support. The governor may be serviced by removing the transaxle oil pan and valve body assembly. With the oil pan and valve body removed, the governor may be unbolted from the governor support and removed.

When cleaning or assembling the governor, make sure the governor valves move freely in the bores of the governor body.

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.

OIL COOLERS AND TUBES REVERSE FLUSHING

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must be replaced with an exchange unit. This will insure that metal particles or sludged oil are not transferred back into the reconditioned (or replaced) transaxle.

CAUTION: If vehicle is equipped with two oil coolers (one in the radiator tank, one in front of the radiator) they must be flushed separately. Do not attempt to flush both coolers at one time.

(1) Disconnect the cooler lines at the transmission.

(2) Using a hand suction gun filled with mineral spirits, reverse flush the cooler. Force mineral spirits into the **From Cooler** line of the cooler (Fig. 9) and catch the exiting spirits from the **To Cooler** line. Observe for the presence of debris in the exiting fluid. Continue until fluid exiting is clear and free from debris.

(3) Using compressed air in intermittent spurts, blow any remaining mineral spirits from the cooler, again in the reverse direction.

(4) To remove any remaining mineral spirits from the cooler, one (1) quart of automatic transmission fluid should be pumped through the cooler before reconnecting.

(5) If at any stage of the cleaning process, the cooler does not freely pass fluid, the cooler must be replaced.

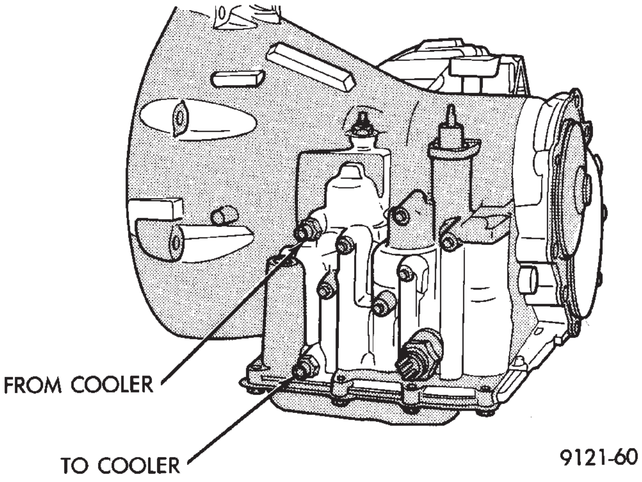


Fig. 9 Cooler Line Identification

OIL COOLER FLOW CHECK

After the new or repaired transmission has been installed and filled to the proper level with automatic transmission fluid. The flow 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.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If the fluid flow is intermittent or it takes more than 20 seconds to collect one quart of automatic transmission fluid, the cooler should be replaced.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(4) If flow is found to be within acceptable limits, reconnect the cooler line. Then fill transmission to the proper level, using the approved type of automatic transmission fluid.

TRANSAXLE AND TORQUE CONVERTER REMOVAL

Transaxle removal does NOT require engine removal.

(1) 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.

(2) Disconnect **battery negative cable**.

(3) Disconnect throttle linkage and shift linkage from transaxle.

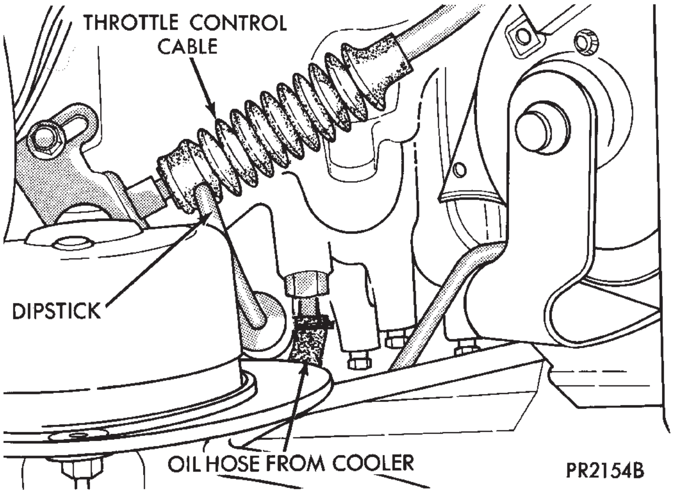


Fig. 1 Remove Upper and Lower Oil Cooler Hoses

If equipped, unplug torque converter clutch plug, located near the dipstick.

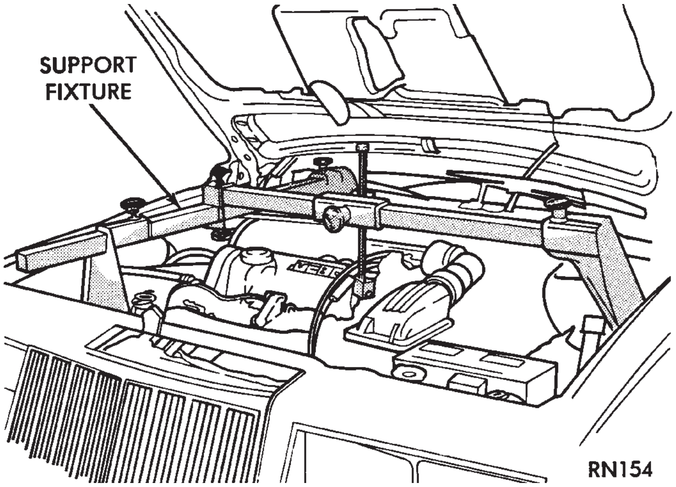


Fig. 2 Engine Support Fixture

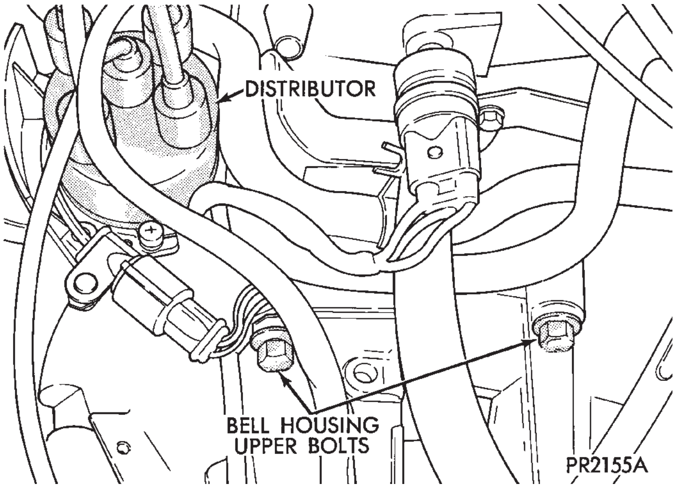


Fig. 3 Remove Bell Housing Upper Bolts

CAUTION: Raise vehicle. Remove front wheels. Refer to Suspension, Group 2 to remove or install wheel hub nut and both drive shafts.

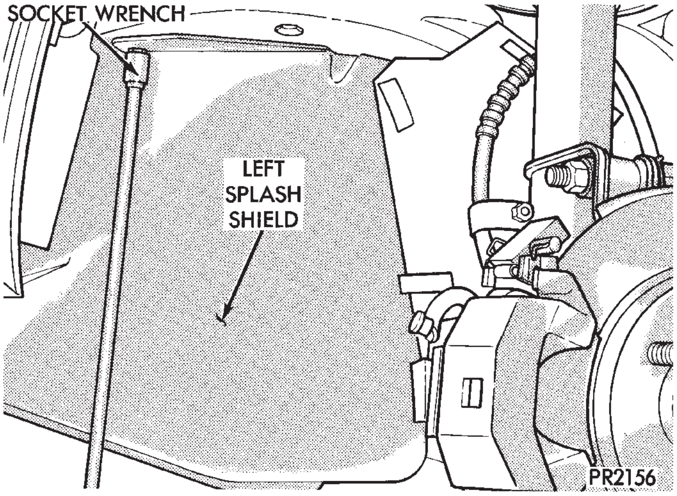


Fig. 4 Remove or Install Left Splash Shield

Remove torque converter dust cover. Mark torque converter and drive plate with chalk, for reassembly. Remove torque converter mounting bolts.

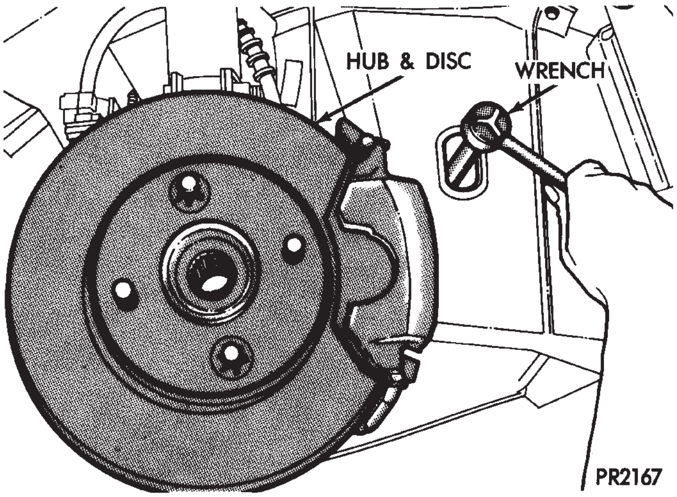


Fig. 5 Remove or Install Access Plug in Right Splash Shield to Rotate Engine Crankshaft

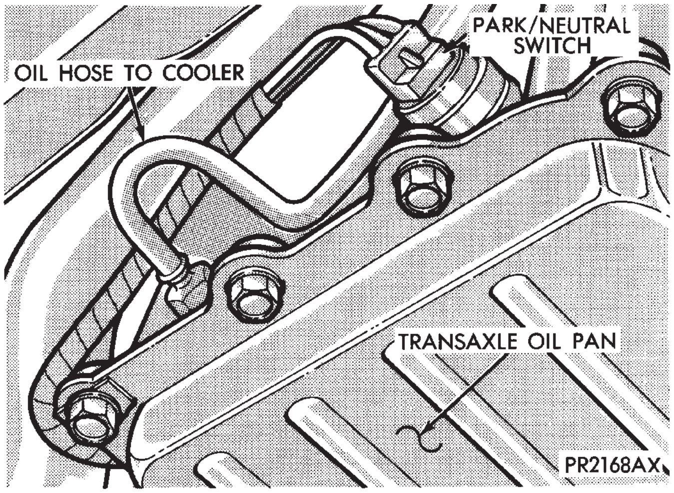


Fig. 6 Remove or Install Wire to Neutral/Park Safety Switch

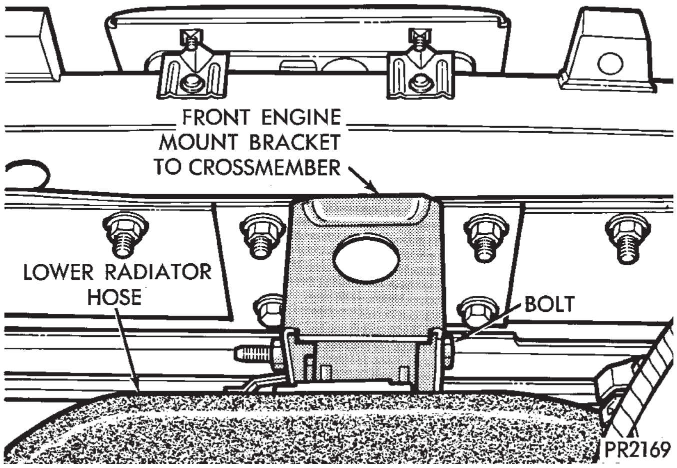


Fig. 7 Remove or Install Engine Mount Bracket from Front Crossmember

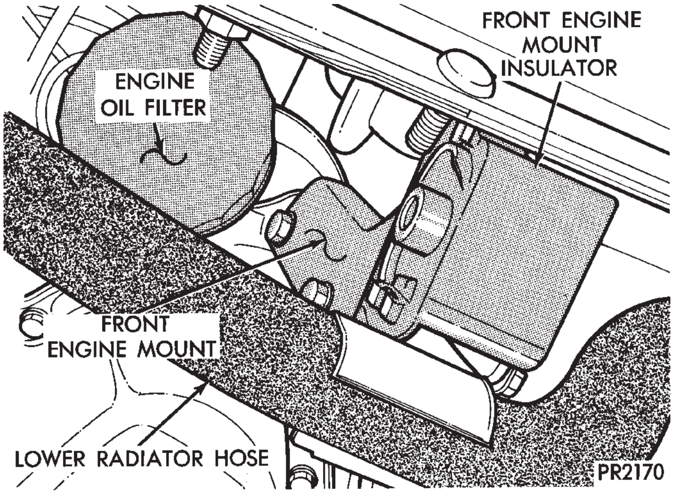


Fig. 8 Remove or Install Front Mount Insulator Through-Bolt and Bell Housing Bolts

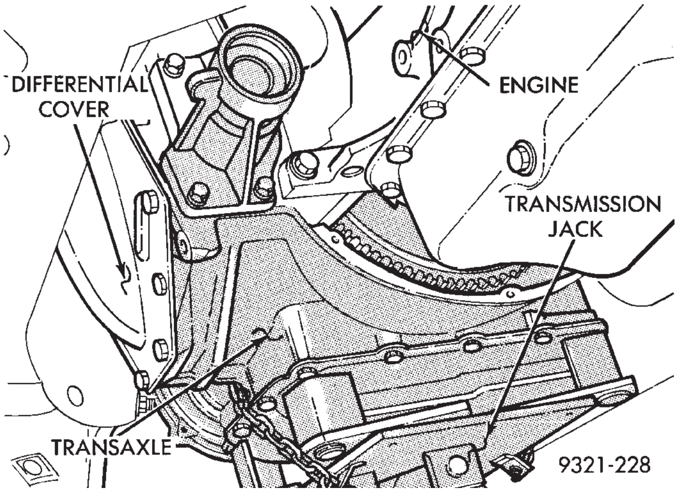


Fig. 9 Positioning Transmission Jack

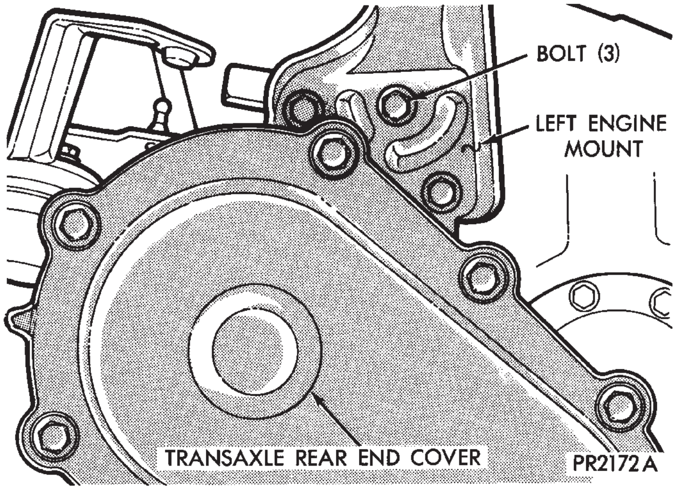


Fig. 10 Remove or Install Left Engine Mount

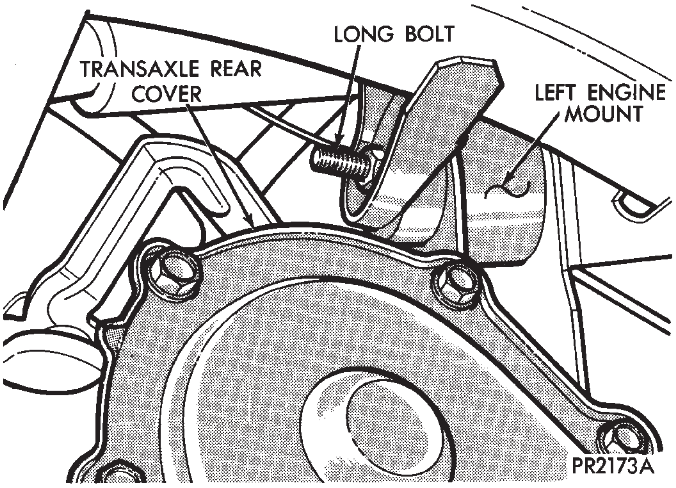


Fig. 11 Remove or Install Left Engine Mount from Engine

Remove or install starter. Remove or install lower bell housing bolts.

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.

When installing transaxle, reverse the above procedure.

If torque converter was removed from transaxle be sure to align pump inner gear pilot flats with torque converter impeller hub flats.

Adjust gearshift and throttle cables.

Refill transaxle with MOPAR® ATF PLUS (Automatic Transmission Fluid) Type 7176.

DISASSEMBLY SUBASSEMBLY REMOVAL

Prior to removing any transaxle subassemblies, plug all openings and thoroughly clean exterior of the unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be overemphasized. When disassembling, each part should be

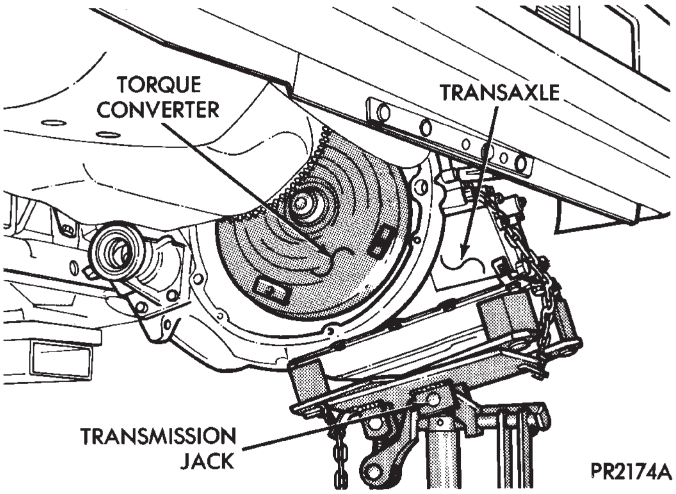


Fig. 12 Raise or Lower Transaxle

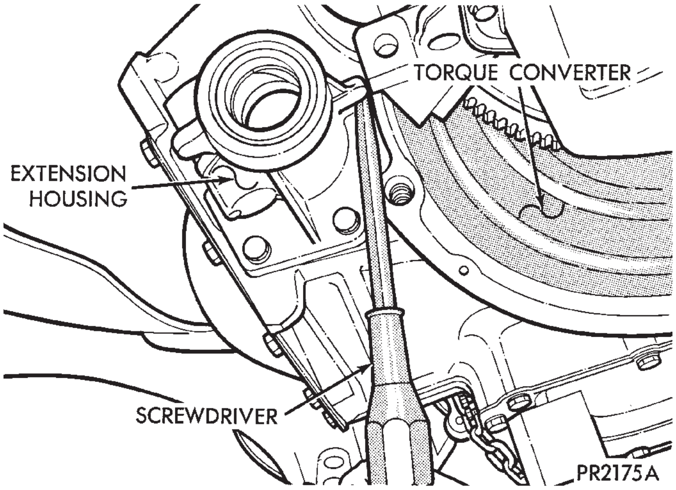


Fig. 13 Pry Engine for Clearance

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.

Remove all old sealant before applying new MOPAR® Adhesive Sealant.

Use only MOPAR® Adhesive Sealant when installing oil pan.

Put MOPAR® Adhesive Sealant on the oil pan flange (Fig. 2) and on all oil pan bolts (underside of bolt head).

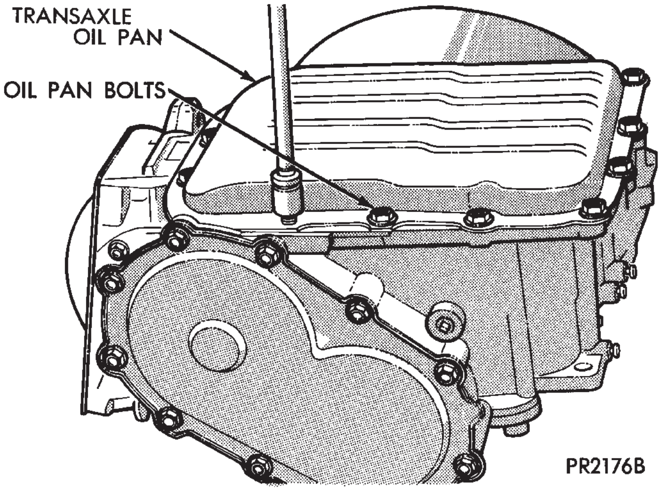


Fig. 1 Transaxle Oil Pan Bolts

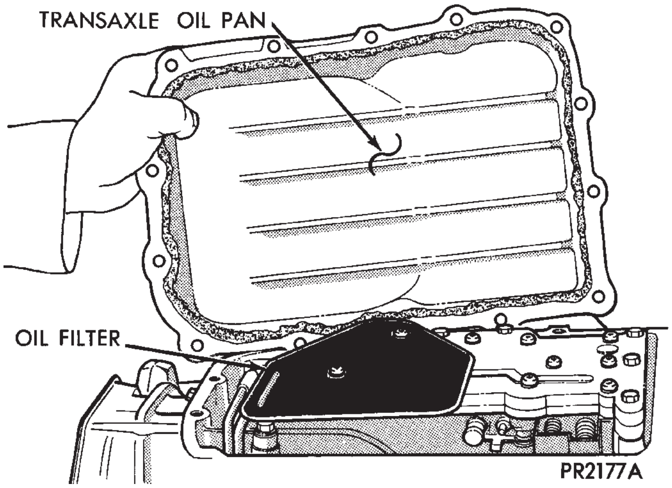


Fig. 2 Transaxle Oil Pan

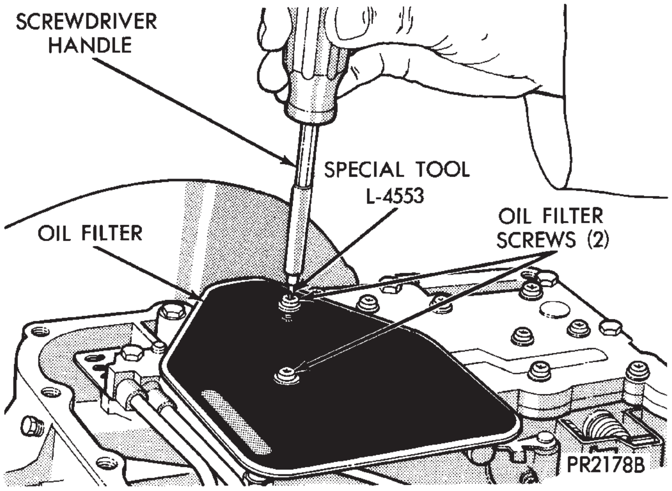


Fig. 3 Oil Filter Screws

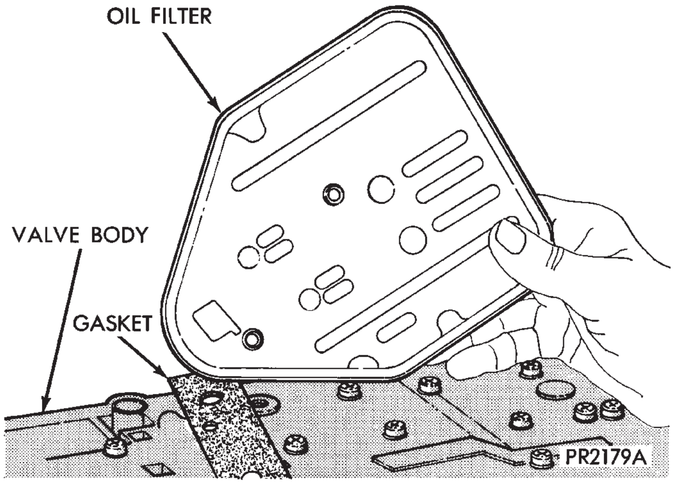


Fig. 4 Oil Filter

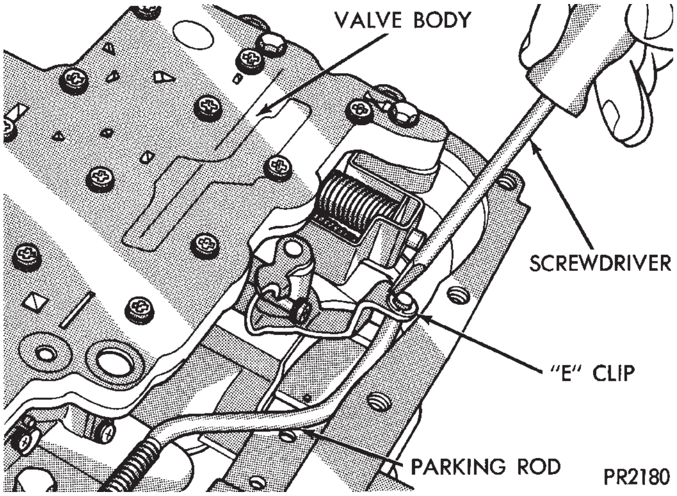


Fig. 5 Remove or Install Parking Rod E-Clip

Remove or install neutral starting and back-up lamp switch.

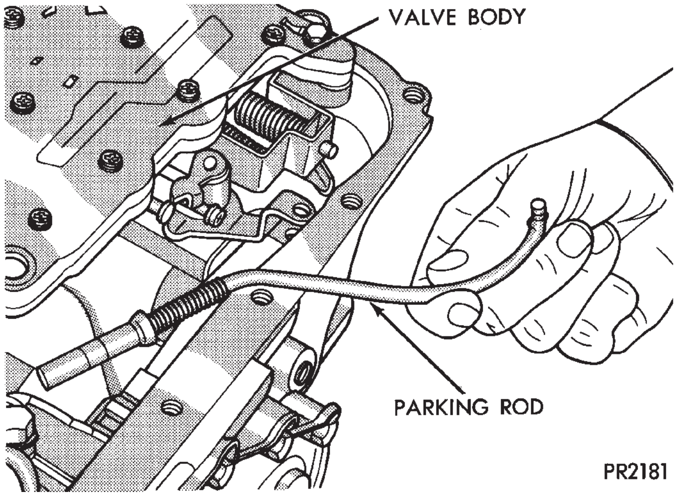


Fig. 6 Parking Rod

Measuring input shaft end play before disassembly will usually indicate when a thrust washer change is required, (except when major parts are replaced). The thrust washer is located between input and output shafts.

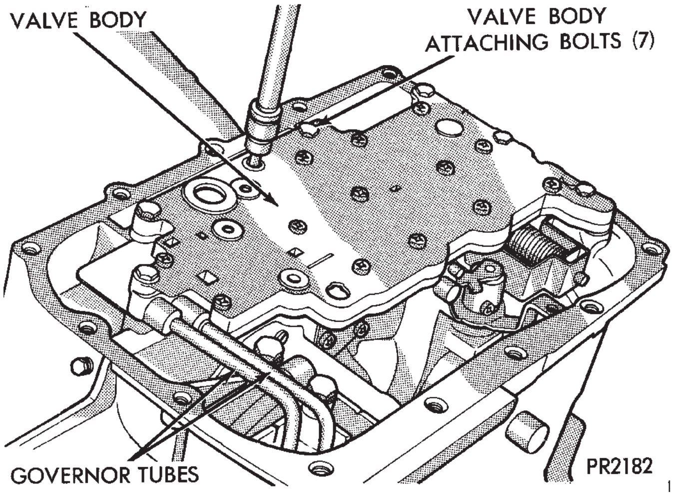


Fig. 7 Valve Body Attaching Bolts

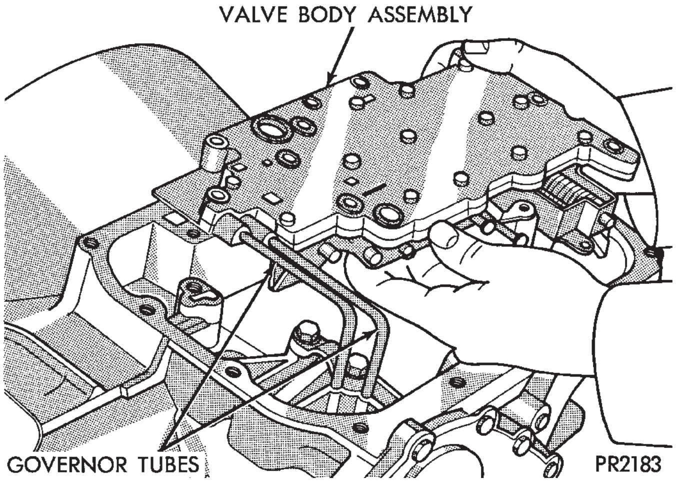


Fig. 8 Valve Body and Governor Tubes

Attach a dial indicator to transaxle bell housing with its plunger seated against end of input shaft (Fig. 9).

Move input shaft in and out to obtain end play reading. End play specifications are 0.19 to 1.50 mm (.008 to .060 inch).

Record indicator reading for reference when reassembling the transaxle.

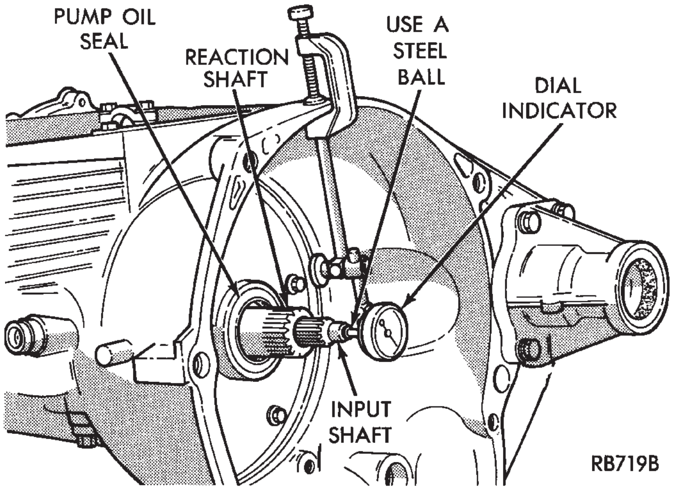


Fig. 9 Measure Input Shaft End Play

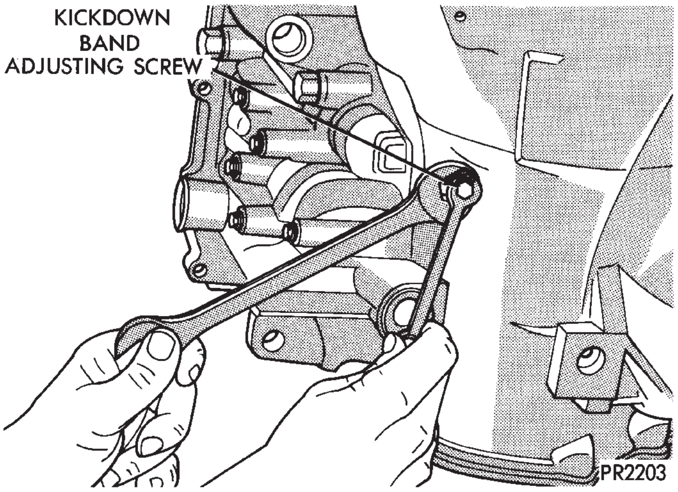


Fig. 10 Loosen Lock Nut and Tighten Kickdown Band Adjusting Screw

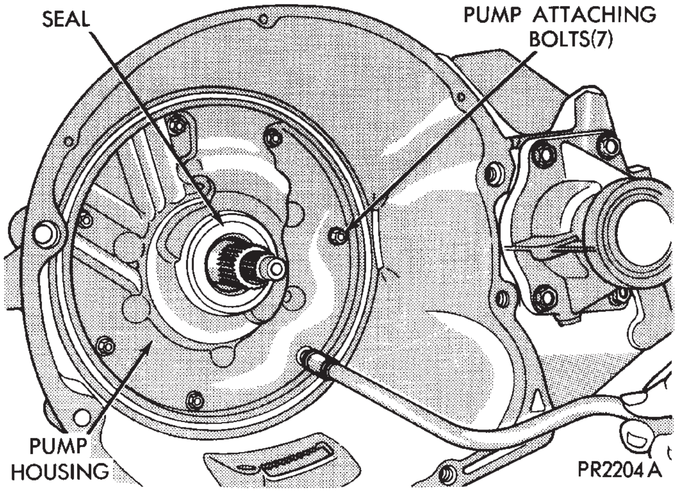


Fig. 11 Pump Attaching Bolts

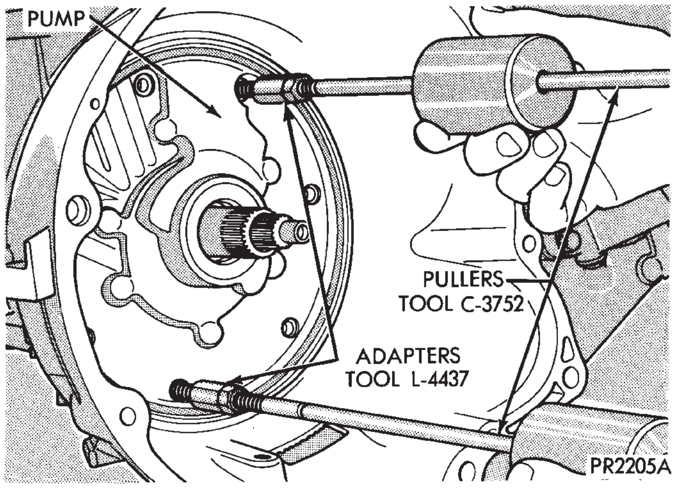


Fig. 12 Install Tool C-3752 with Adapters L-4437

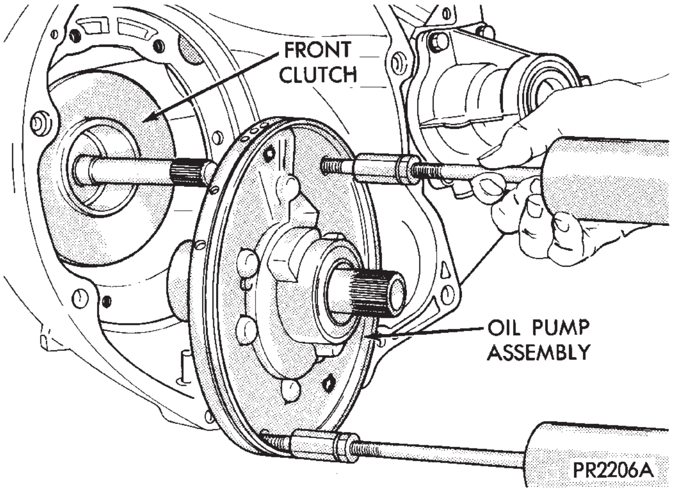


Fig. 13 Oil Pump with No. 1 Thrust Washer

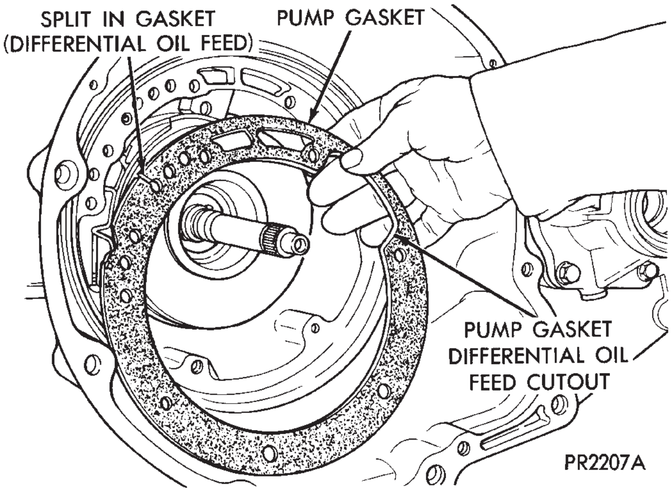


Fig. 14 Oil Pump Gasket

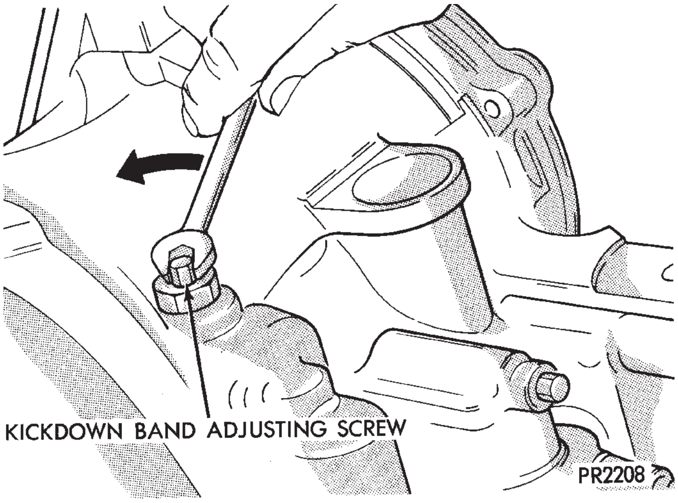


Fig. 15 Loosen Kickdown Band Adjusting Screw

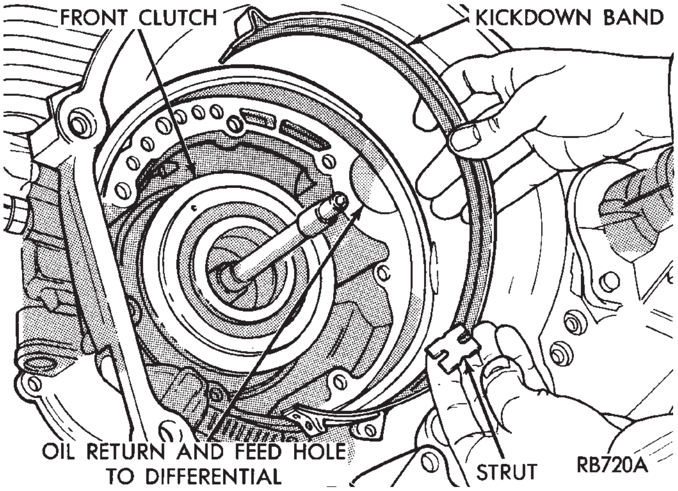


Fig. 16 Kickdown Band and Strut

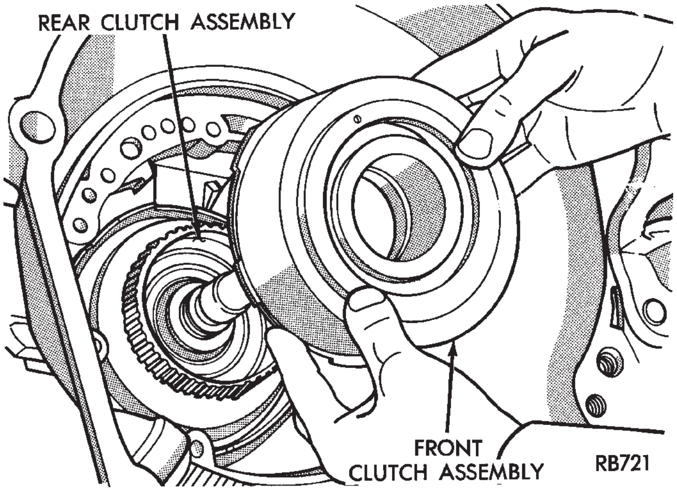


Fig. 17 Front Clutch Assembly

CAUTION: The input shaft for transaxles without a torque converter clutch has 2 seal rings. The input shaft for a transaxle with a torque converter clutch has three seal rings.

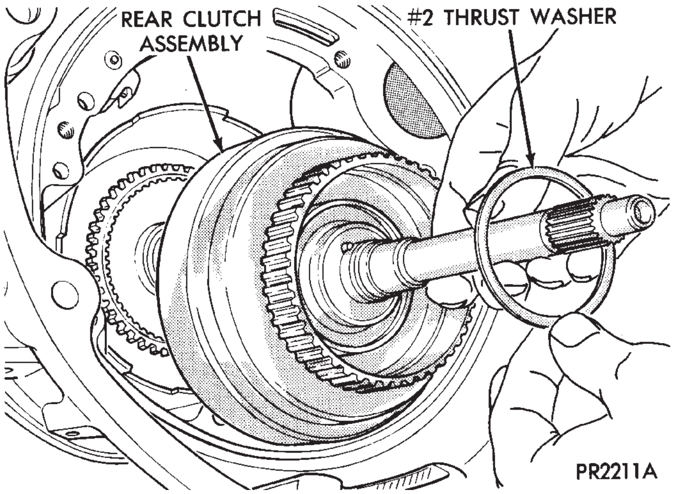


Fig. 18 No. 2 Thrust Washer and Rear Clutch

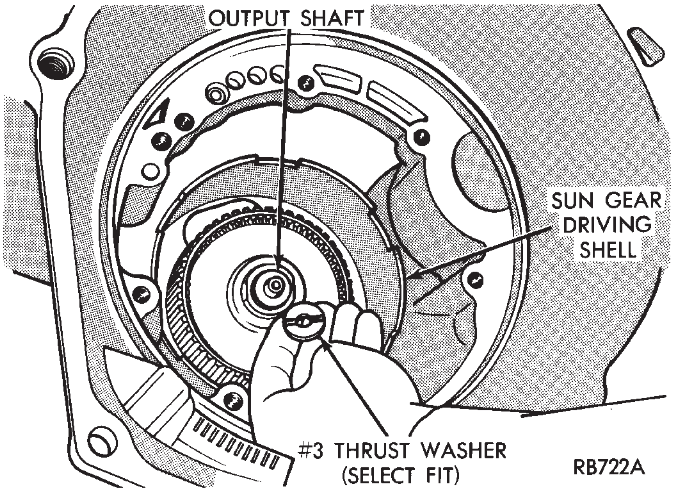


Fig. 19 No. 3 Thrust Washer

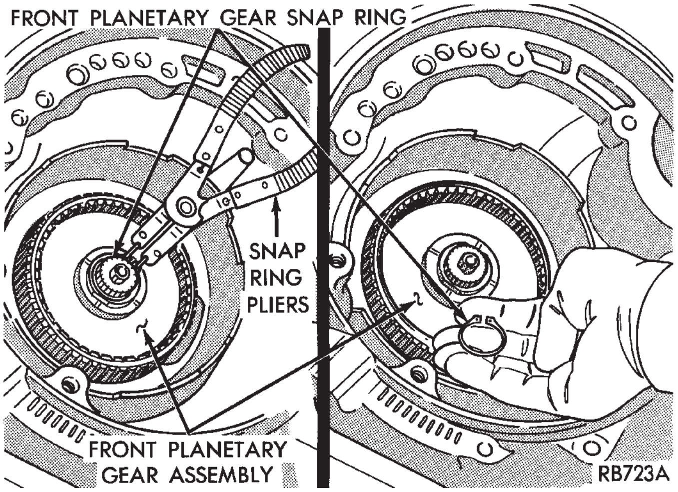


Fig. 20 Front Planetary Gear Snap Ring

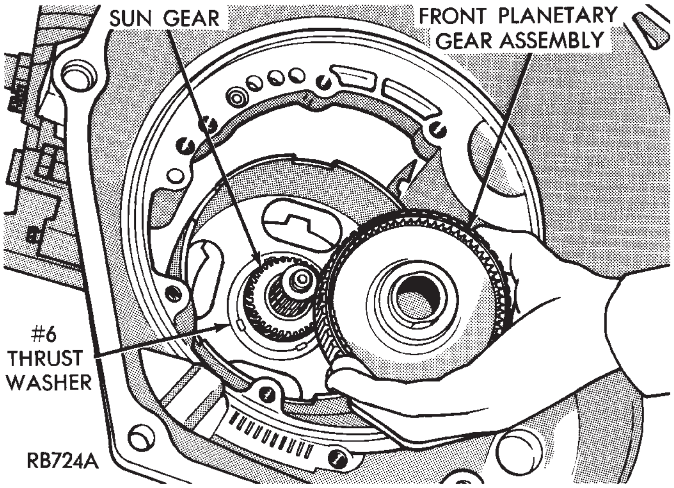


Fig. 21 Front Planetary Gear Assembly

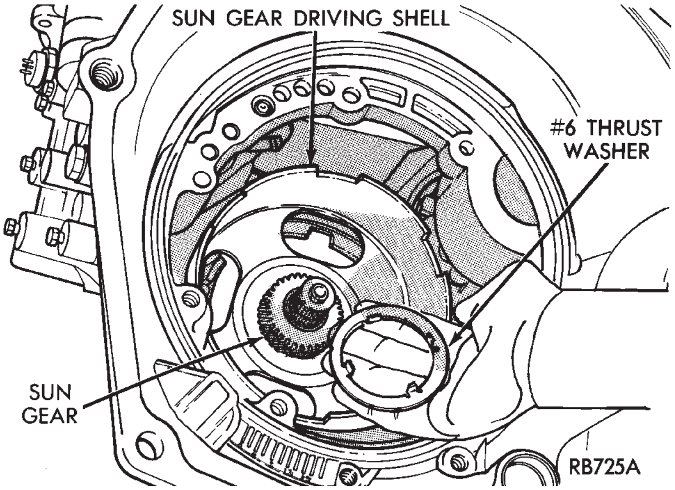


Fig. 22 No. 6 Thrust Washer

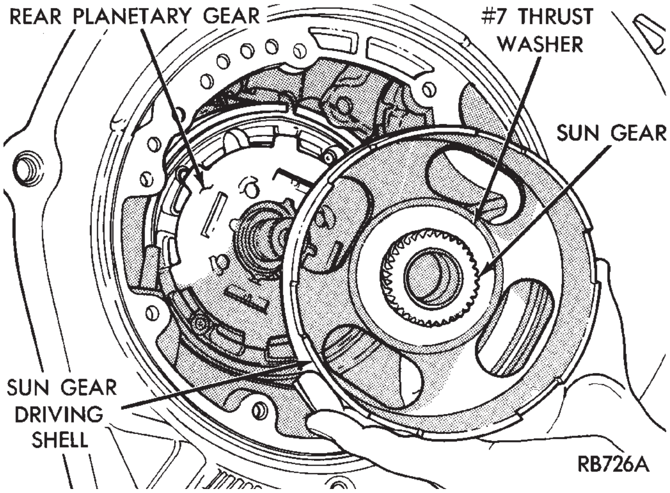


Fig. 23 Sun Gear Driving Shell

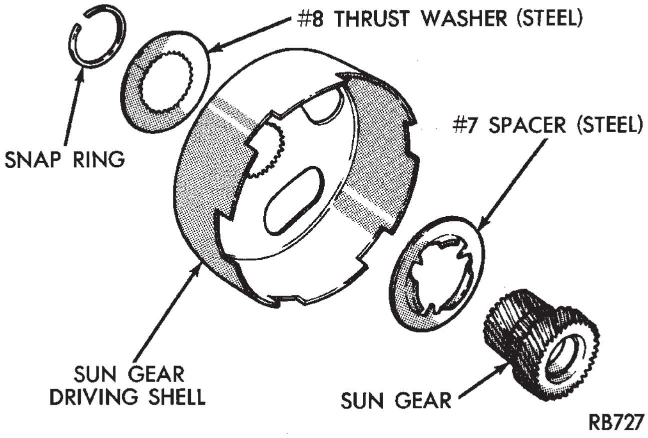


Fig. 24 Sun Gear Driving Shell Components

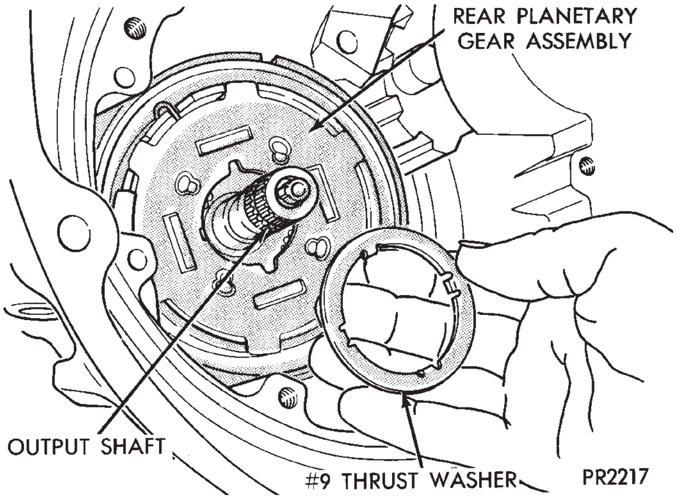


Fig. 25 No. 9 Thrust Washer

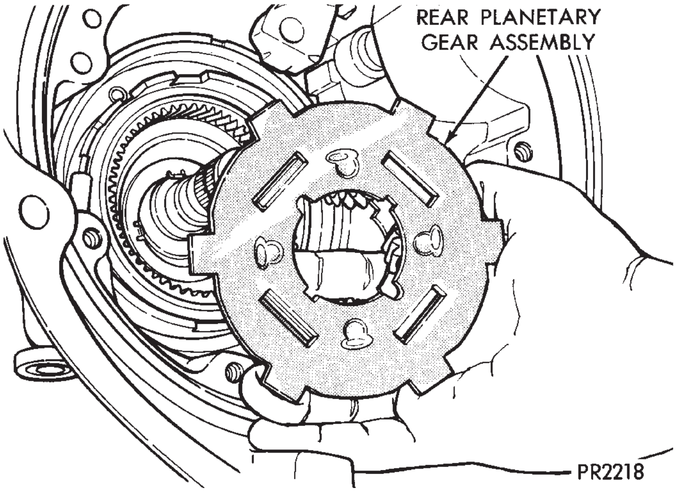


Fig. 26 Rear Planetary Gear Assembly

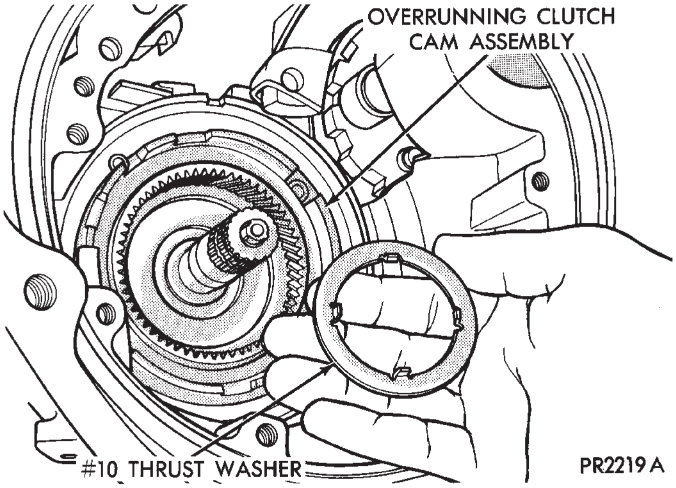


Fig. 27 No. 10 Thrust Washer

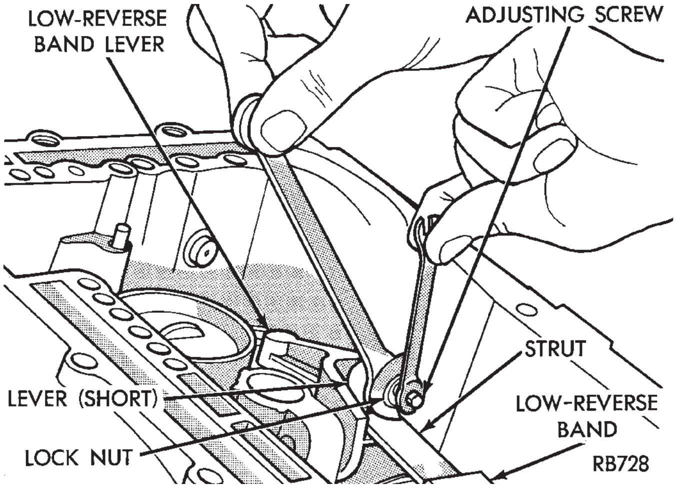


Fig. 30 Loosen or Adjust Low-Reverse Band

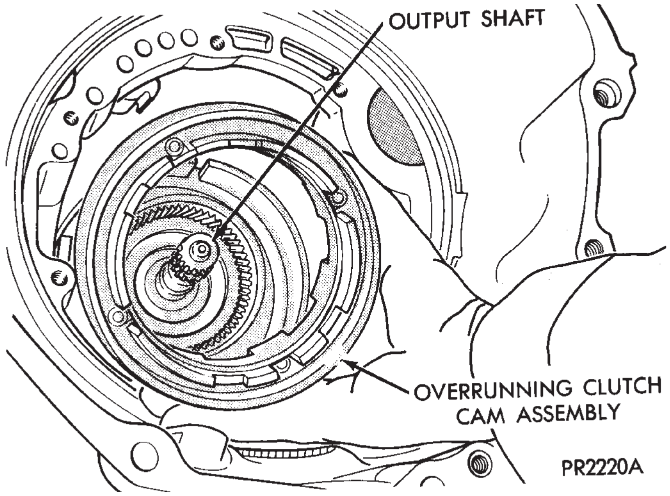


Fig. 28 Overrunning Clutch Cam Assembly

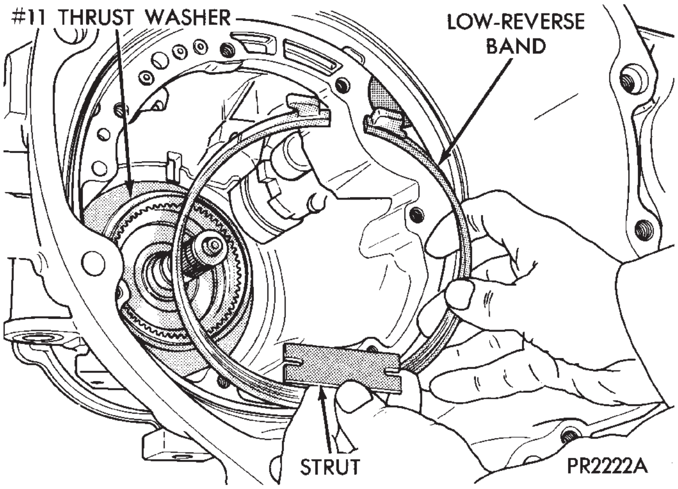


Fig. 31 Low-Reverse Band and Strut

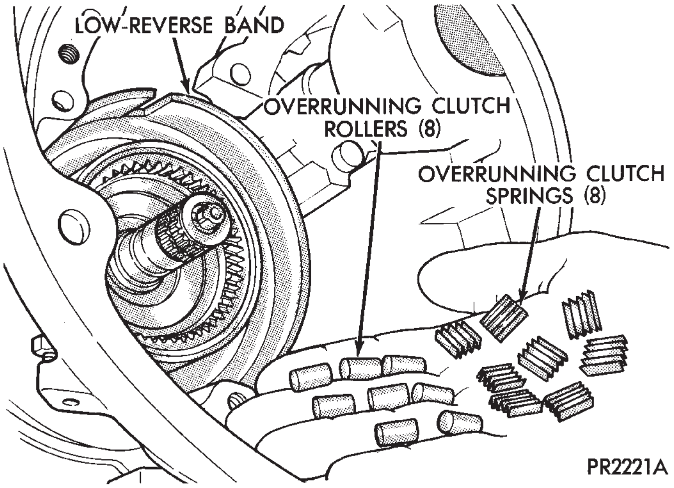


Fig. 29 Overrunning Clutch Rollers and Springs

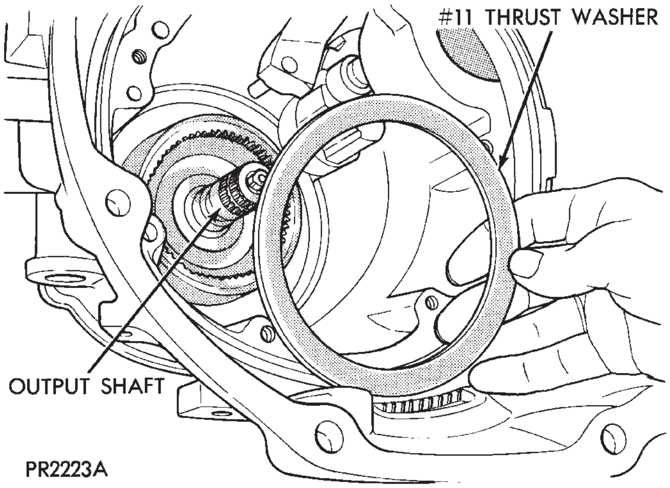


Fig. 32 No. 11 Thrust Washer

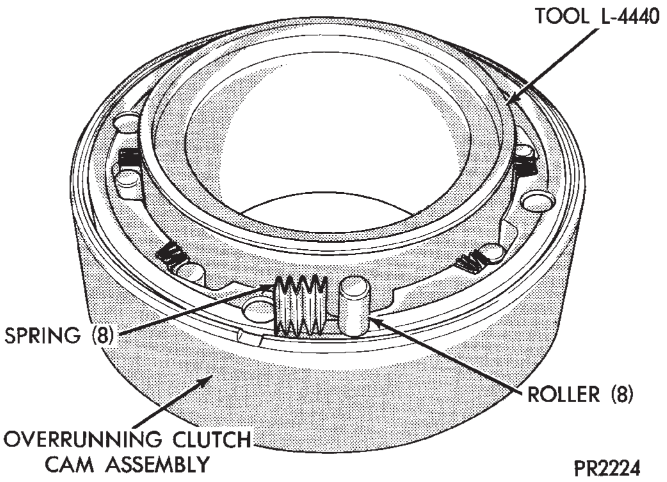


Fig. 33 Install Overrunning Clutch Rollers and Springs

All subassemblies should be inspected and/or reconditioned when transaxle recondition is performed. Refer to appropriate subassembly in this section for recondition procedure.

ASSEMBLY SUBASSEMBLY INSTALLATION

When rebuilding, reverse the above procedure.

VALVE BODY-RECONDITION

Tighten all valve body screws to 5 Newton-meters (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.**

TAG ALL SPRINGS AS THEY ARE REMOVED FOR REASSEMBLY IDENTIFICATION.

CLEANING AND INSPECTION

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.

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 important. They prevent foreign matter from lodging between valve and valve body, thus reducing 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 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.

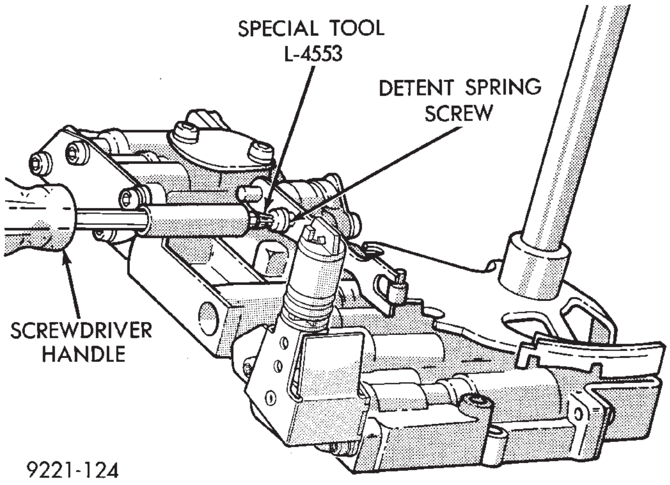


Fig. 1 Detent Spring Attaching Screw and Spring

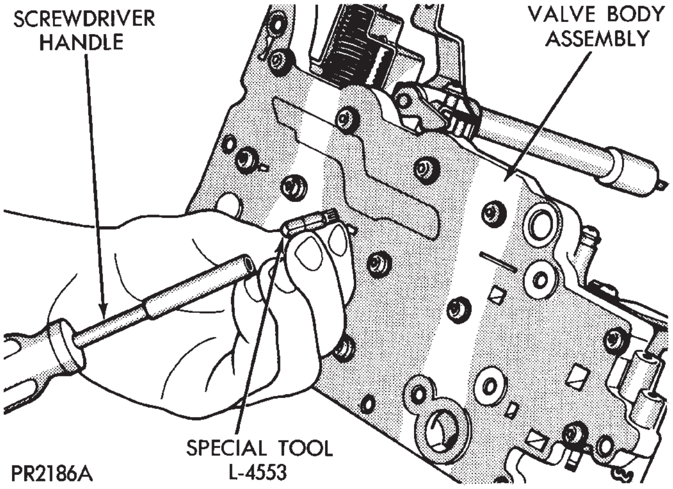


Fig. 2 Remove Valve Body Screws

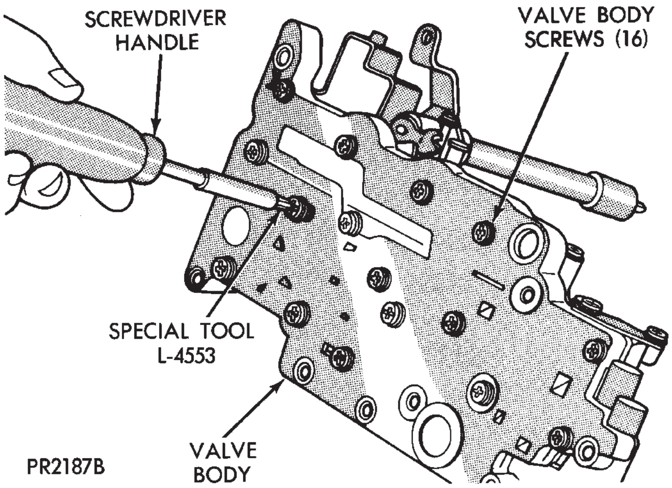


Fig. 3 Remove or Install Valve Body Screws

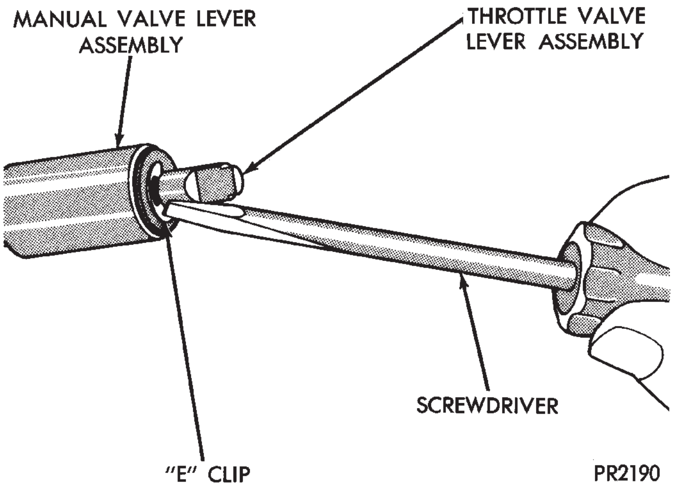


Fig. 6 Remove or Install Throttle Shaft E-Clip

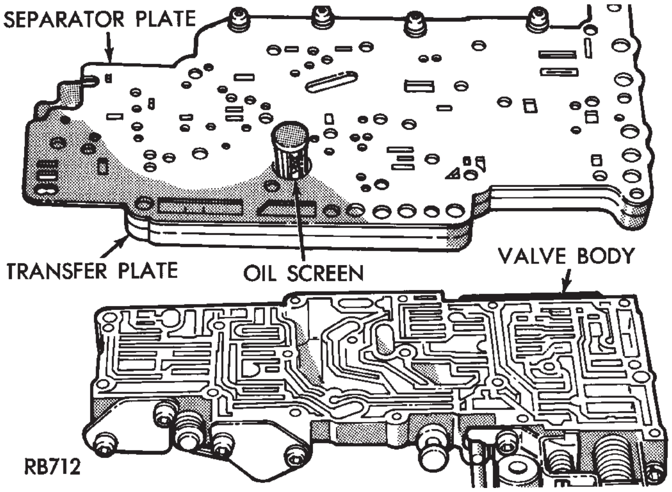


Fig. 4 Transfer Plate and Separator Plate

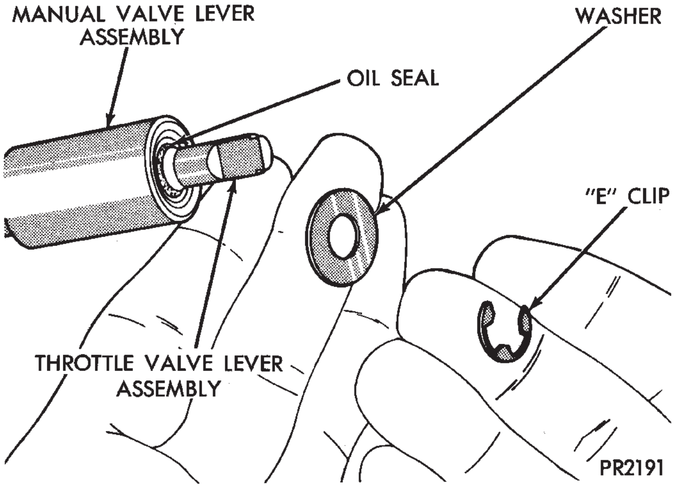


Fig. 7 Throttle Shaft E-Clip, Washer, and Seal

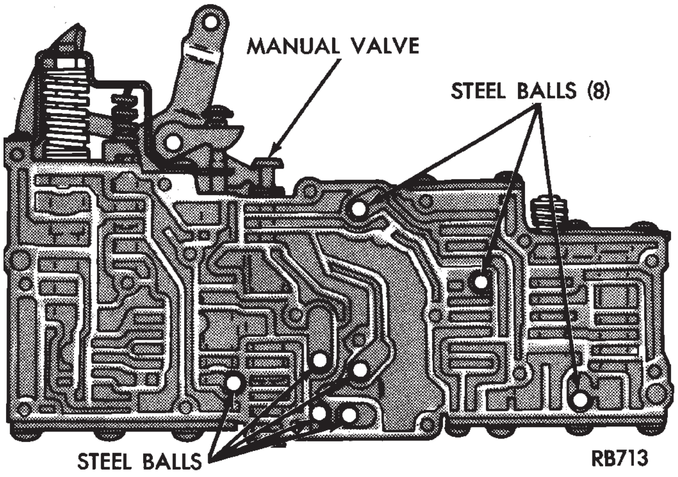


Fig. 5 Steel Ball Locations

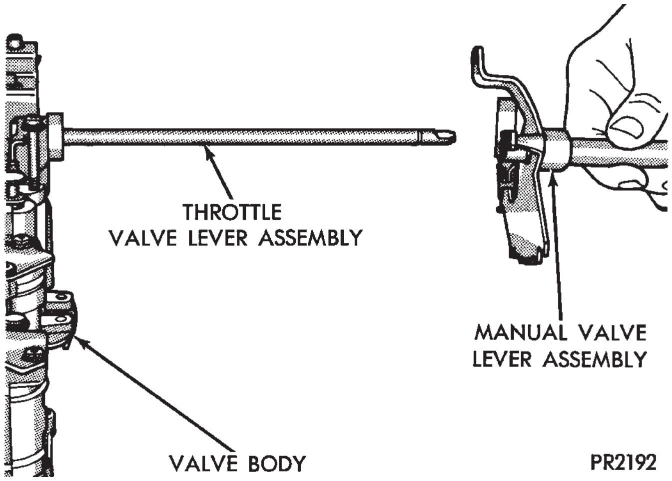


Fig. 8 Manual Valve Lever Assembly

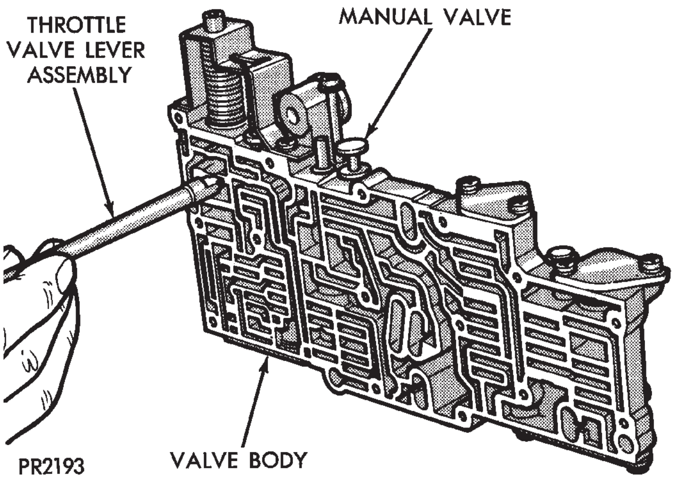


Fig. 9 Throttle Valve Lever Assembly

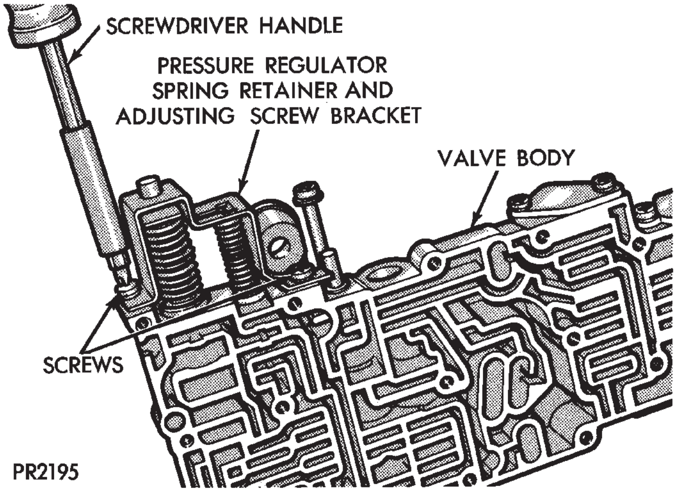


Fig. 11 Pressure Regulator and Adjusting Screw Bracket

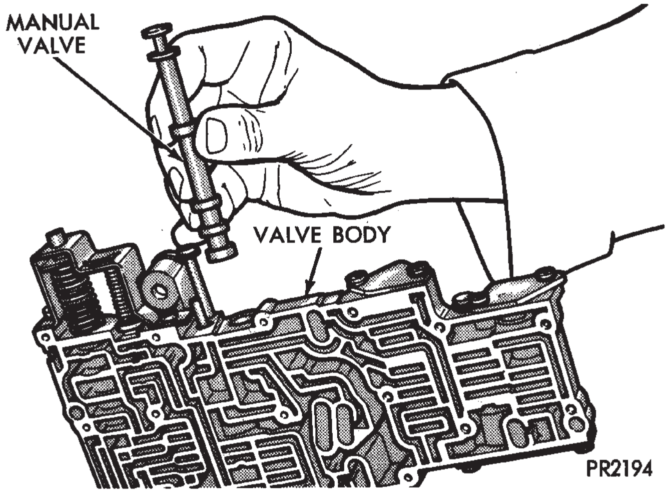


Fig. 10 Manual Valve

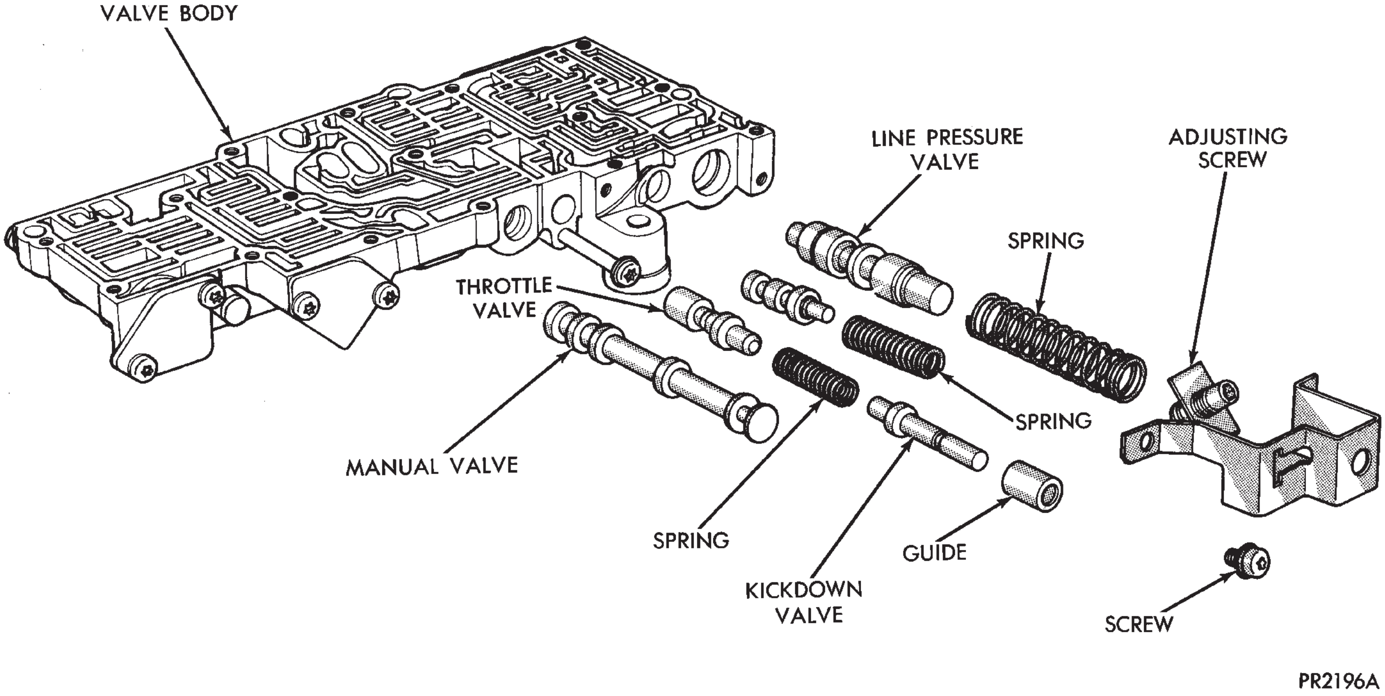


Fig. 12 Pressure Regulators and Manual Controls

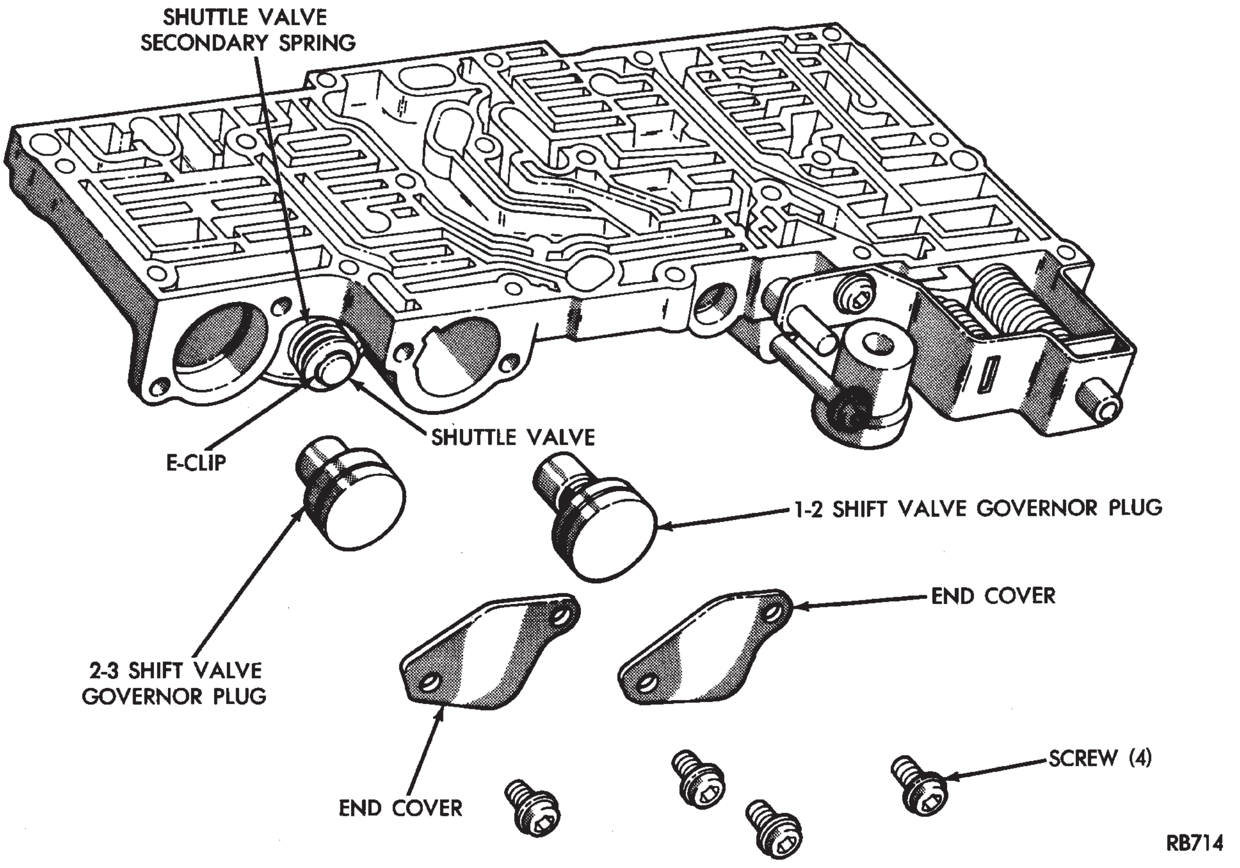


Fig. 13 Governor Plugs

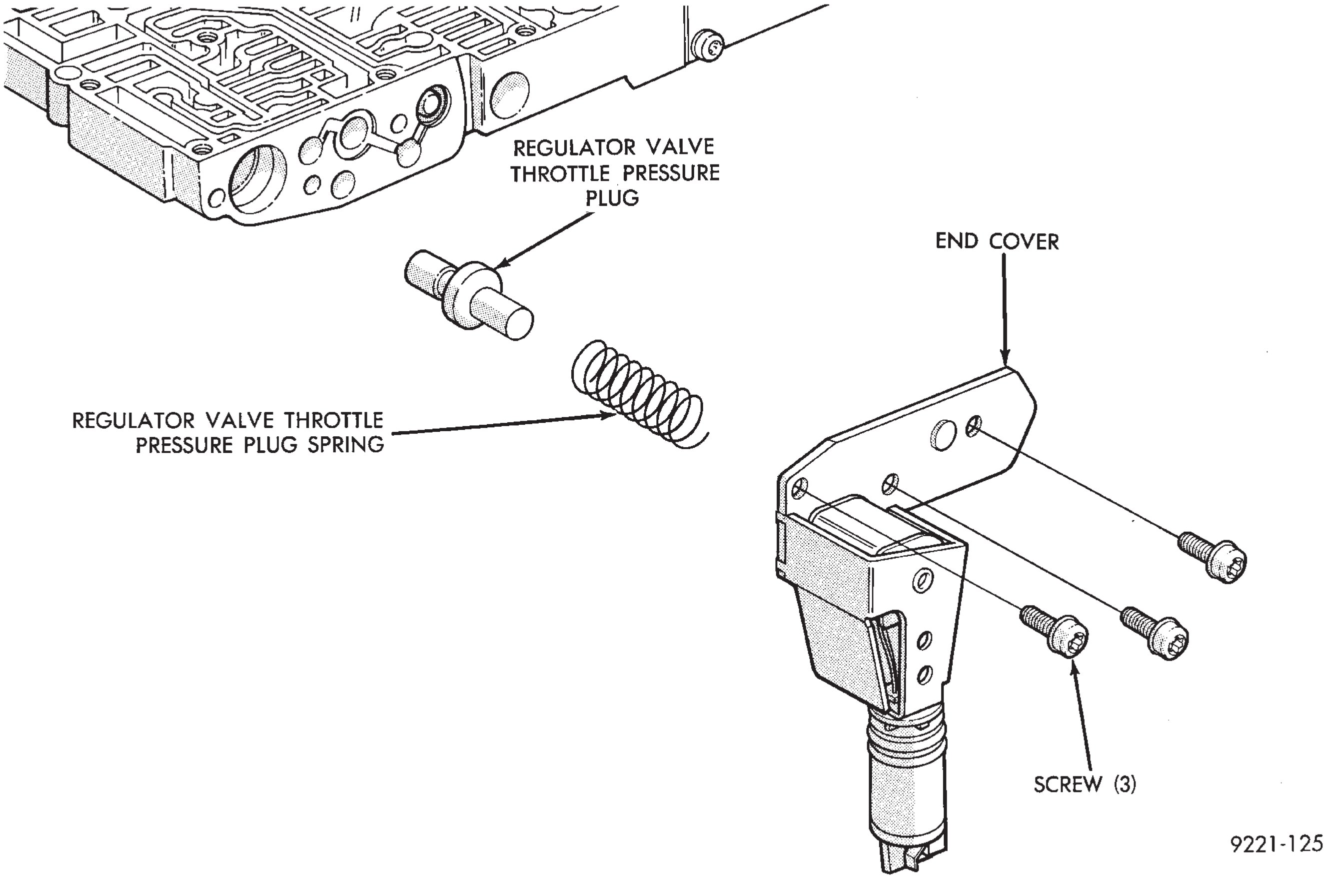


Fig. 14 Pressure Regulator Valve Plugs

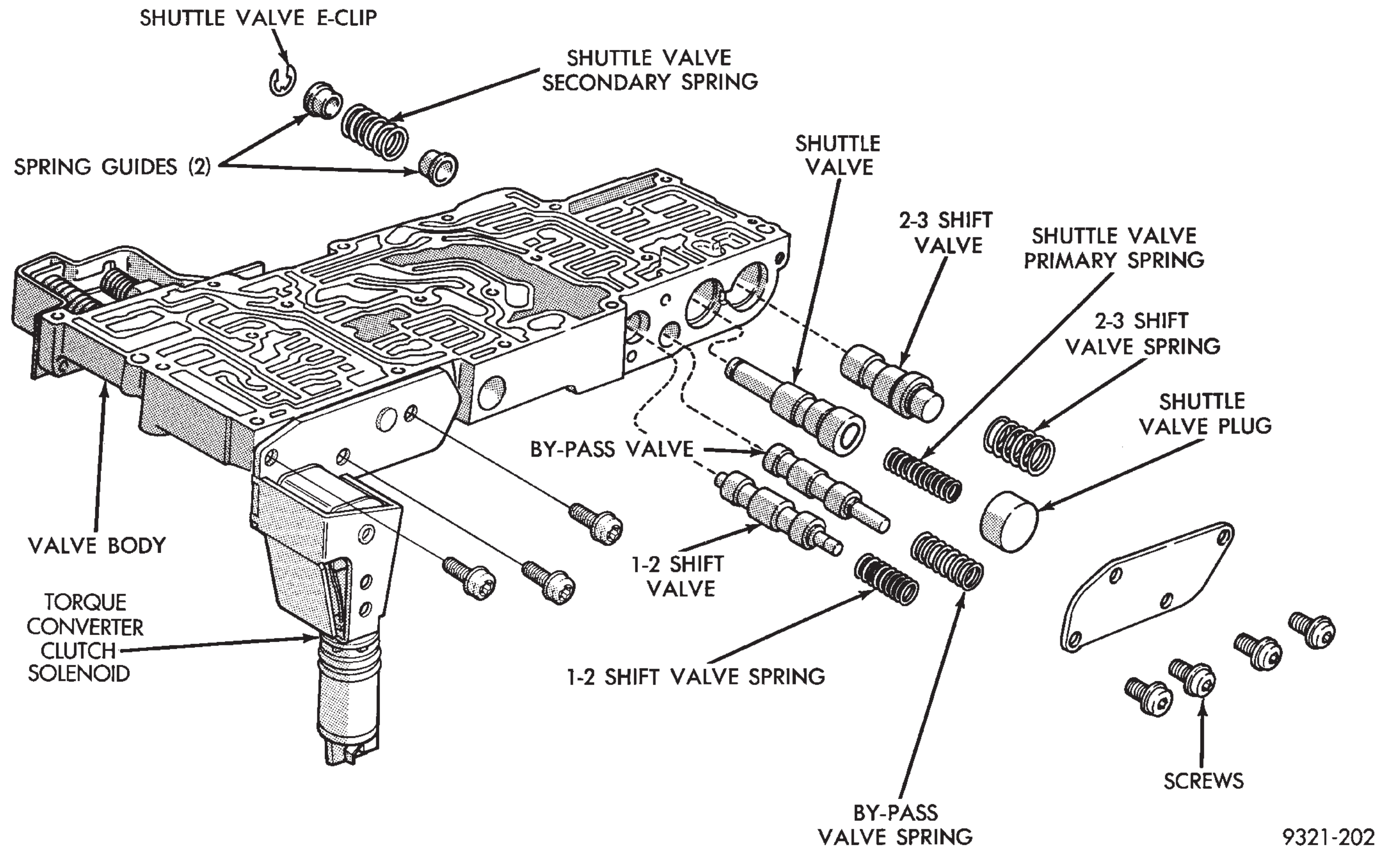


Fig. 15 Shift Valves and Shuttle Valve

PUMP OIL SEAL-REPLACEMENT

The pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transaxle case.

(1) Screw seal remover Tool C-3981 into seal (Fig. 1), then tighten screw portion of tool to withdraw the seal.

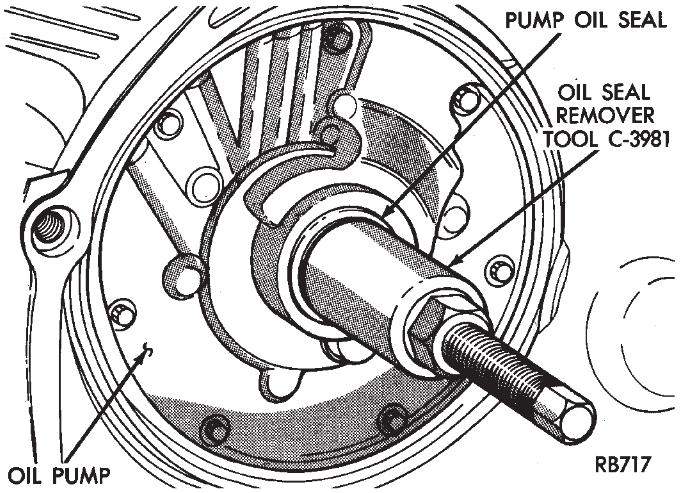


Fig. 16 Remove Pump Oil Seal

(2) 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-4, drive new seal into housing until tool bottoms (Fig. 2).

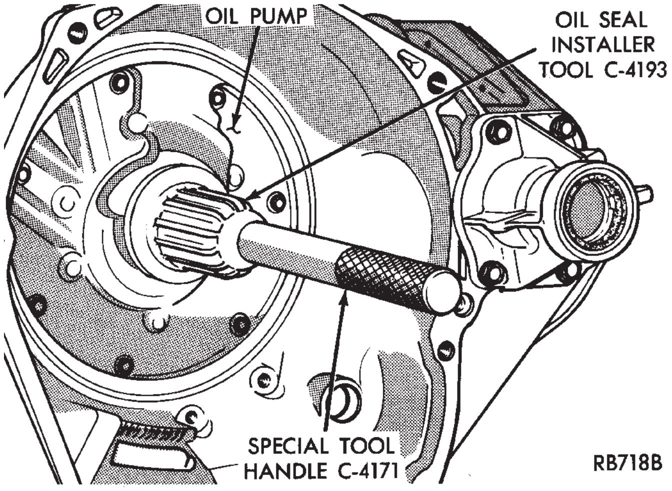


Fig. 17 Install Pump Oil Seal

OIL PUMP-RECONDITION

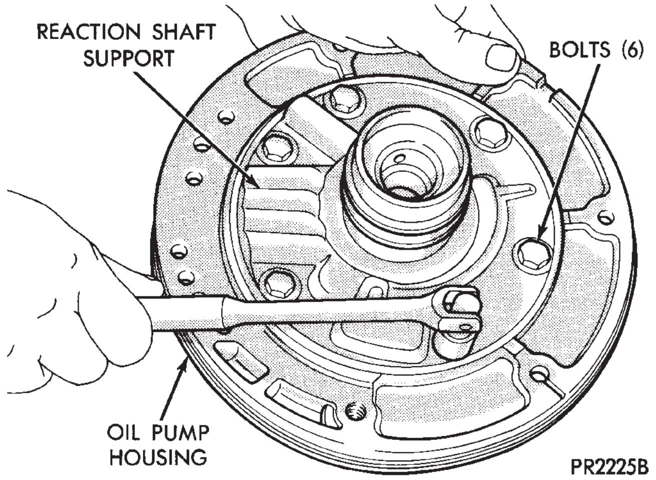


Fig. 1 Reaction Shaft Support Bolts

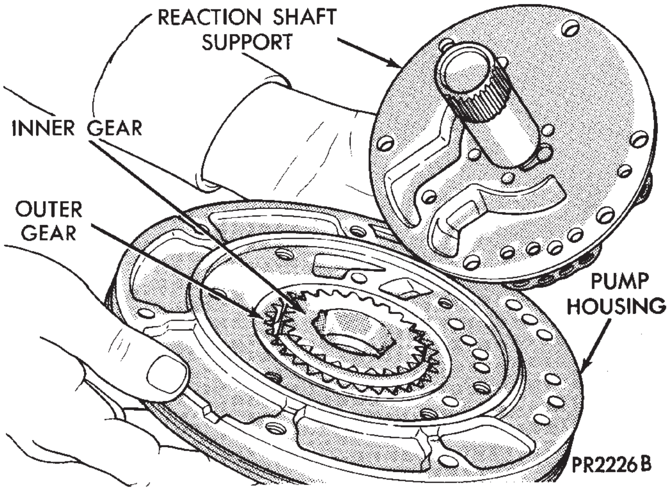


Fig. 2 Reaction Shaft Support

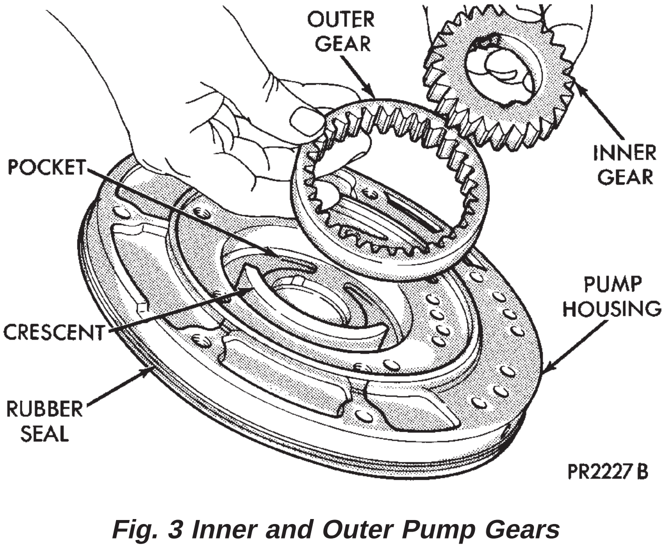


Fig. 3 Inner and Outer Pump Gears

Also, check gear side clearance with a straight edge and a feeler gauge (See Specifications).

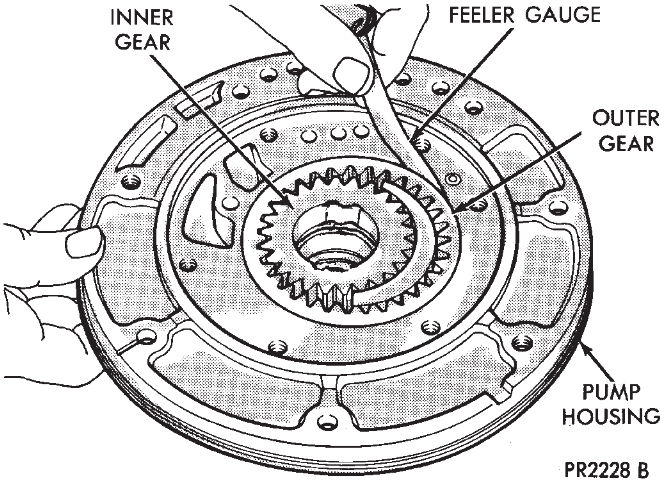


Fig. 4 Measuring Pump Clearance (Gear to Pocket)

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.

DISASSEMBLE/ASSEMBLE

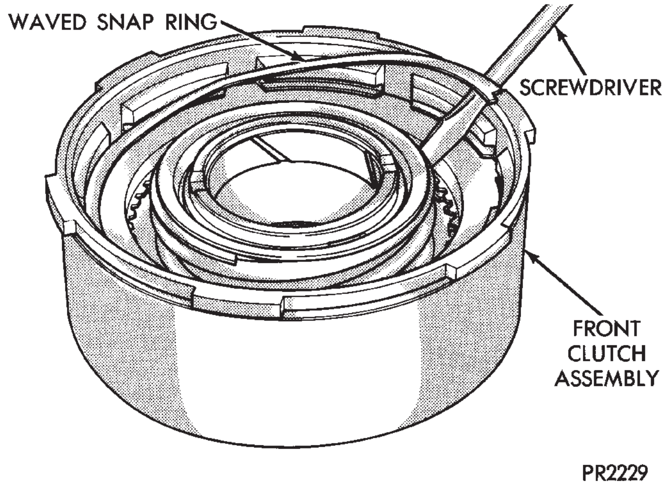


Fig. 1 Front Clutch Waved Snap Ring

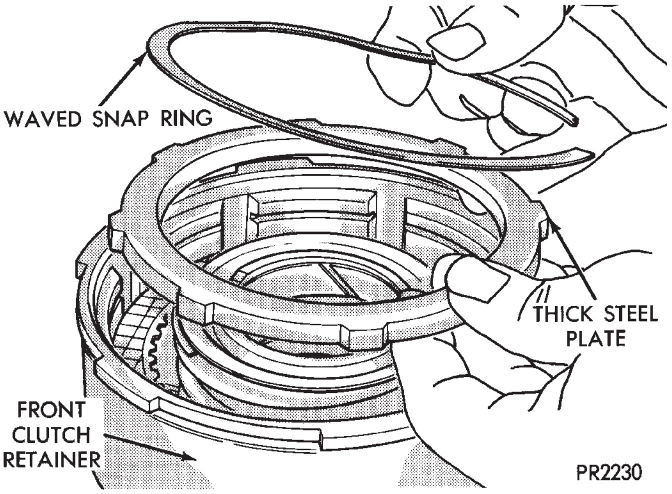


Fig. 2 Thick Steel Plate and Waved Snap Ring

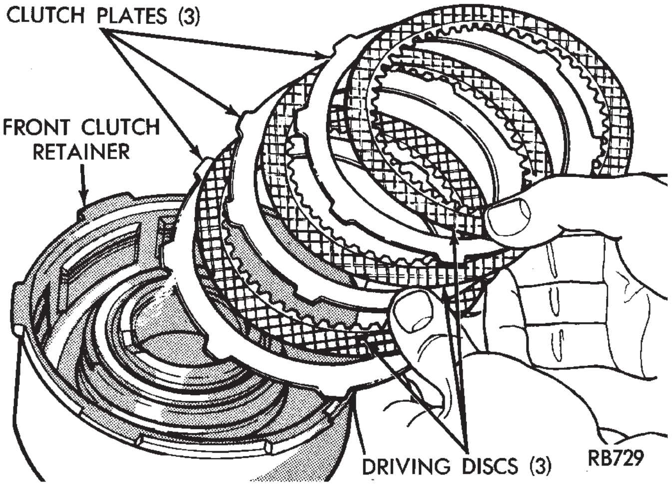


Fig. 3 Front Clutch—Three-Disc Shown

To reassemble, reverse the above procedure.

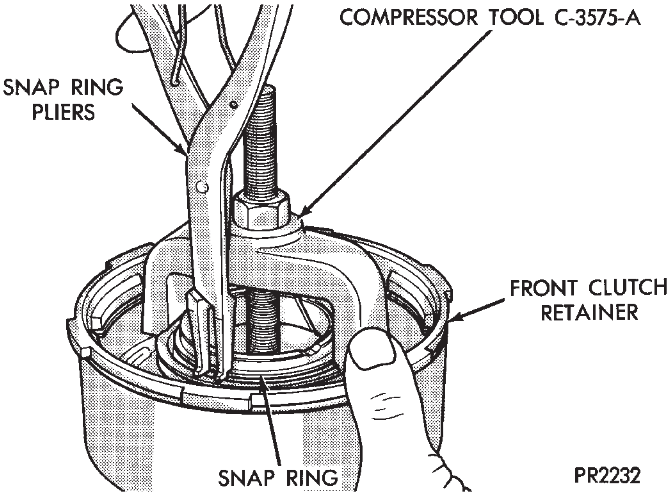


Fig. 4 Front Clutch Return Spring Snap Ring

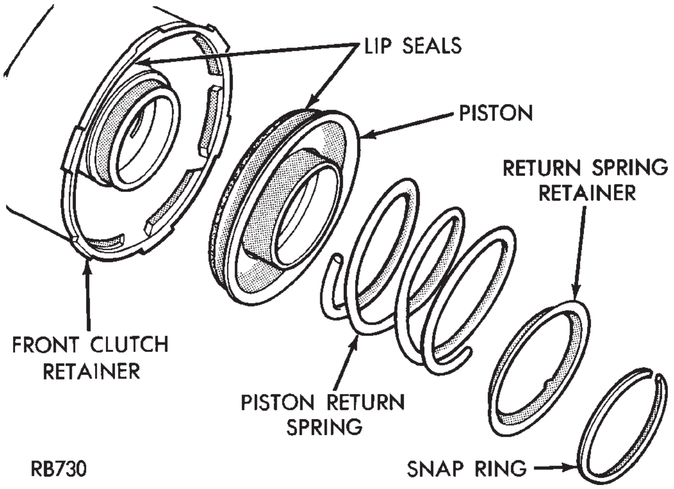


Fig. 5 Front Clutch Return Spring and Piston

MEASURING PLATE CLEARANCE

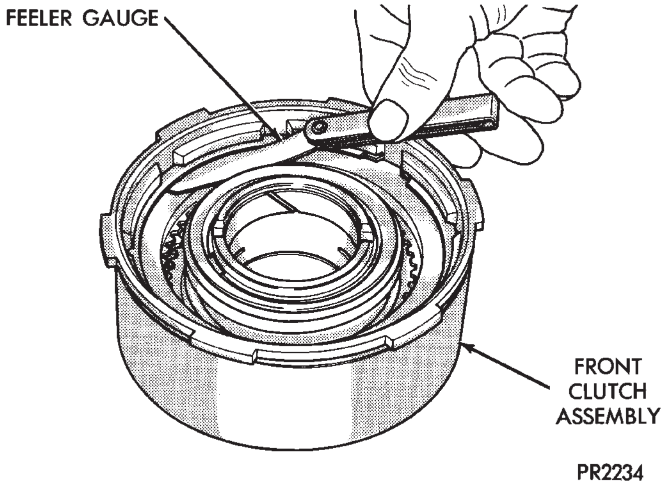


Fig. 6 Measuring Front Clutch Plate Clearance

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.

DISASSEMBLE/ASSEMBLE

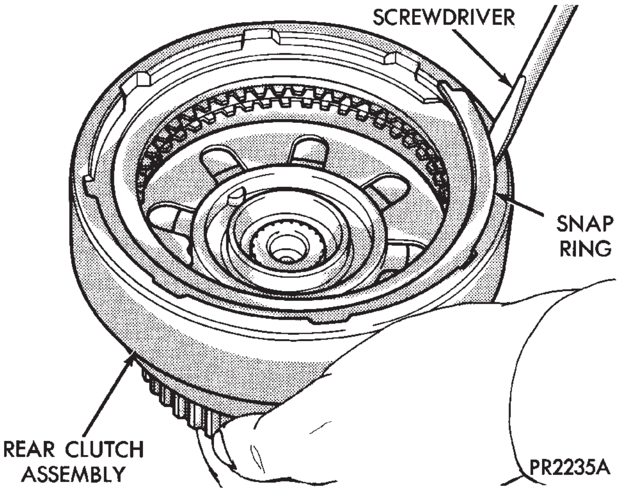


Fig. 1 Rear Clutch Outer Snap Ring

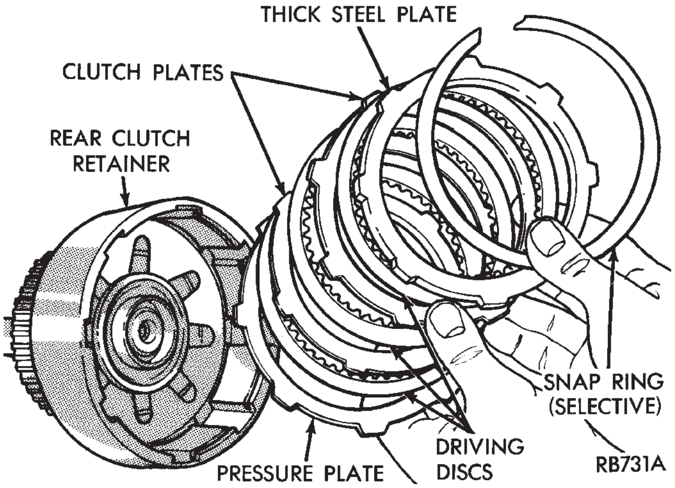


Fig. 2 Rear Clutch—Three-Disc Shown

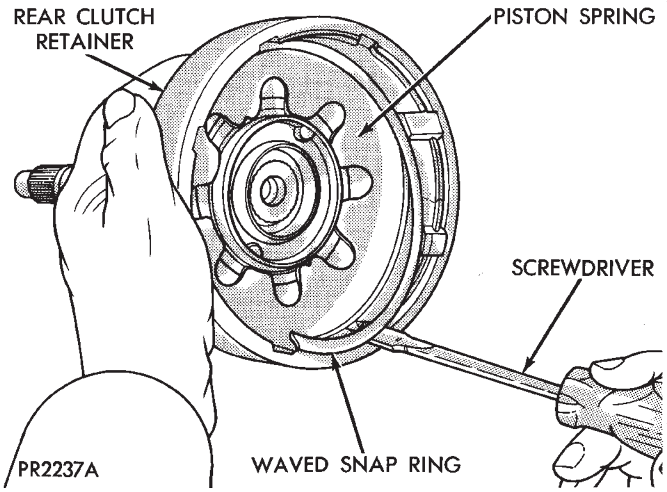


Fig. 3 Piston Spring Waved Snap Ring

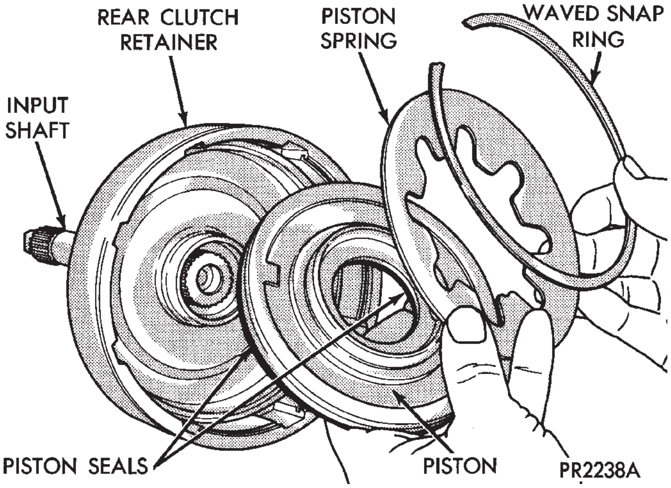


Fig. 4 Rear Clutch Piston and Piston Spring

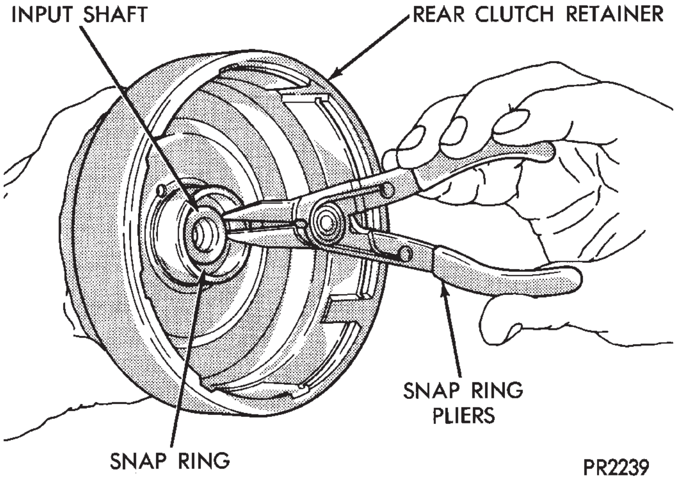


Fig. 5 Remove or Install Input Shaft Snap Ring

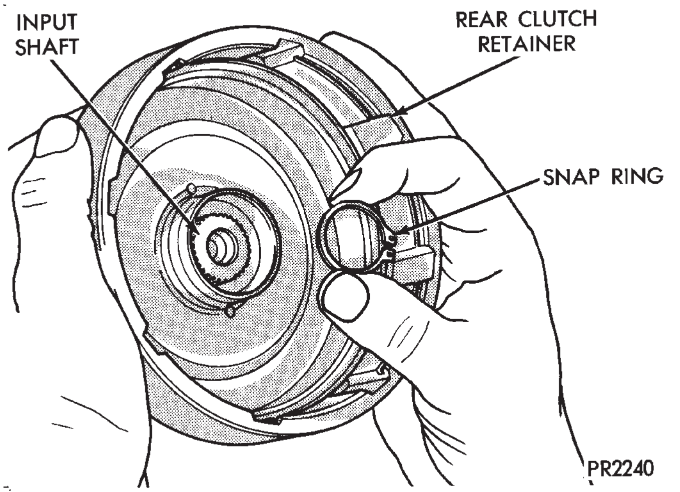


Fig. 6 Input Shaft Snap Ring

Press out input shaft, if required.

To reassemble, reverse the above procedure.

MEASURING PLATE CLEARANCE

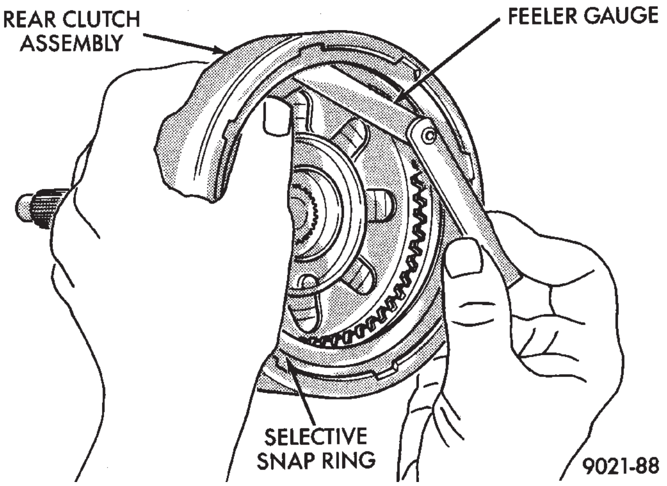


Fig. 7 Measuring Rear Clutch Plate Clearance

FRONT PLANETARY & ANNULUS GEAR-RECONDITION

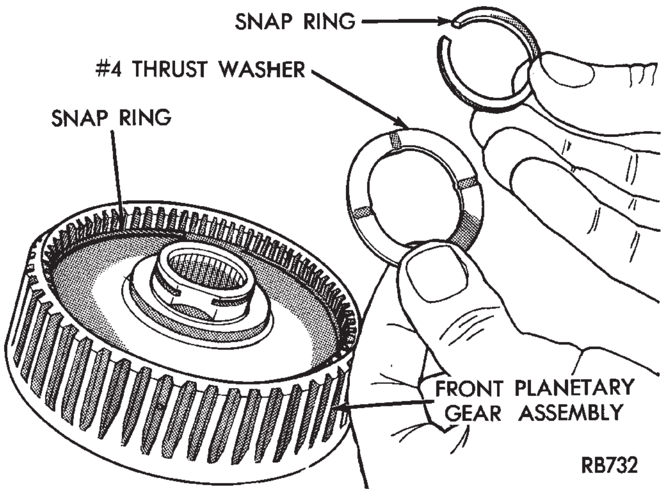


Fig. 1 Front Planetary Gear Snap Ring and No. 4 Thrust Washer (Always Install a New Snap Ring)

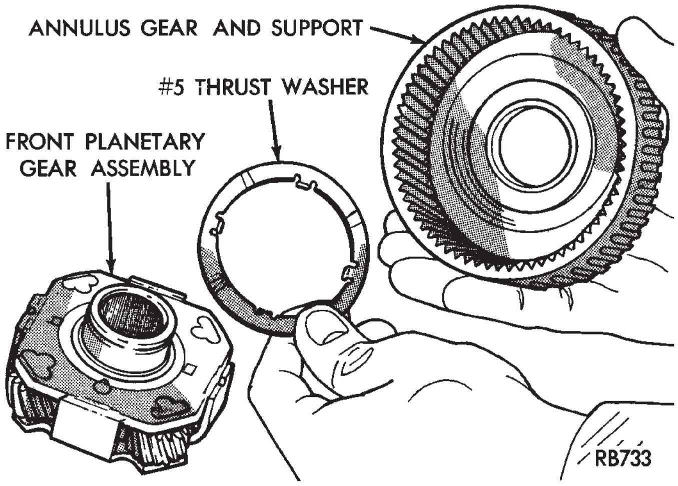


Fig. 2 Front Planetary Gear

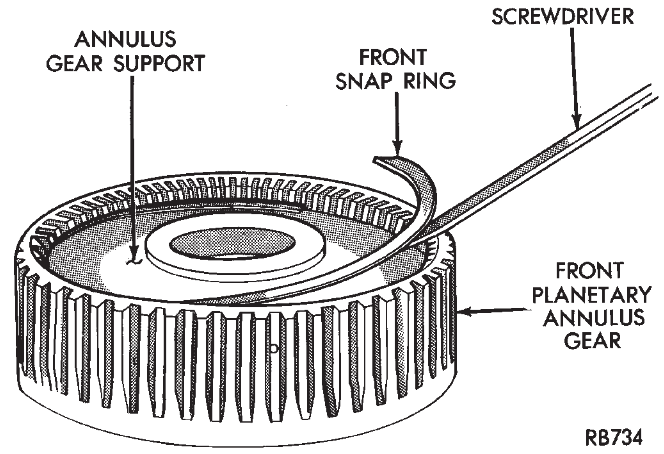


Fig. 3 Annulus Gear Support Front Snap Ring

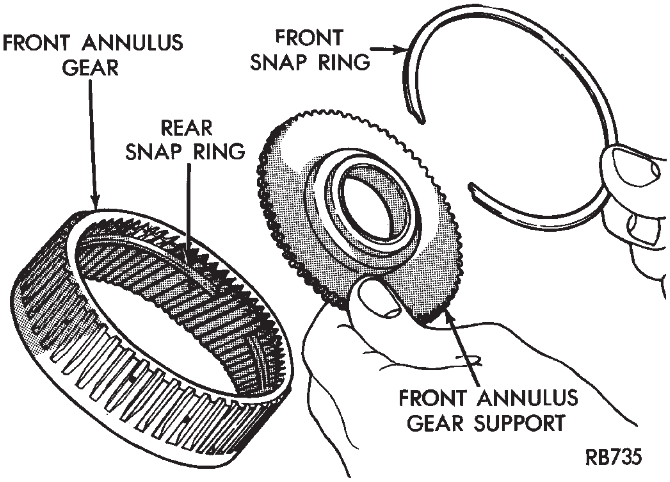


Fig. 4 Front Annulus Gear Support and Snap Ring

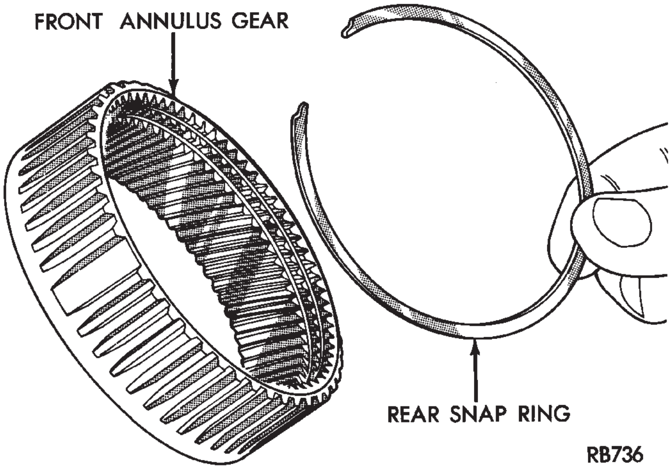


Fig. 5 Front Annulus Gear Support Snap Ring

LOW/REVERSE SERVO-RECONDITION

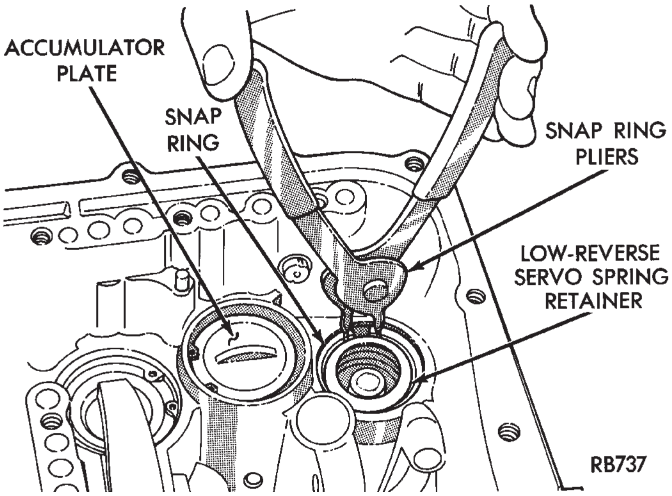


Fig. 1 Low/Reverse Servo Snap Ring

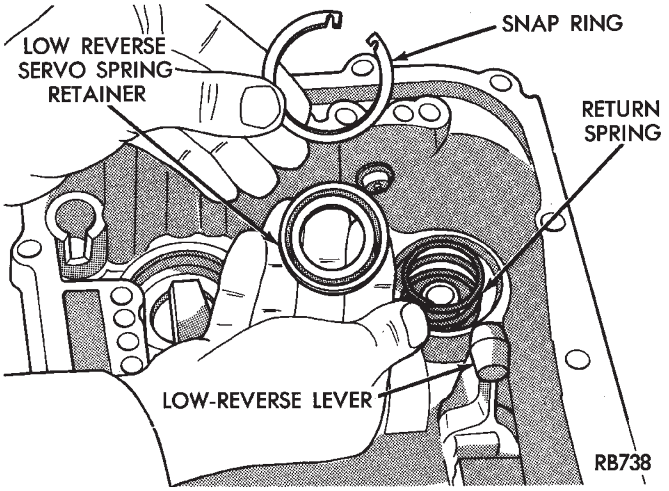


Fig. 2 Snap Ring and Retainer

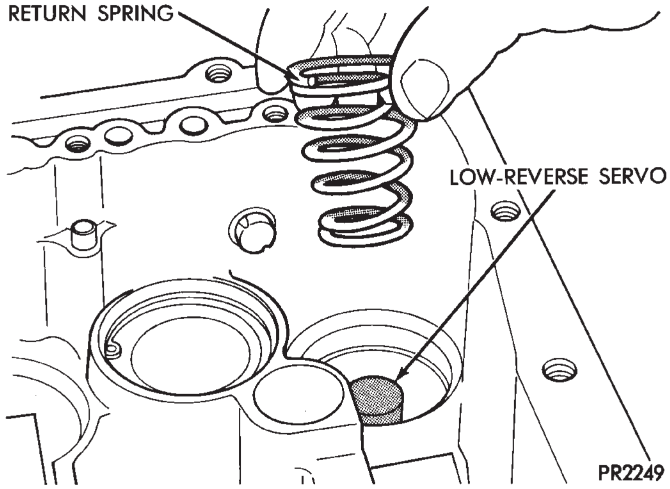


Fig. 3 Low/Reverse Servo Return Spring

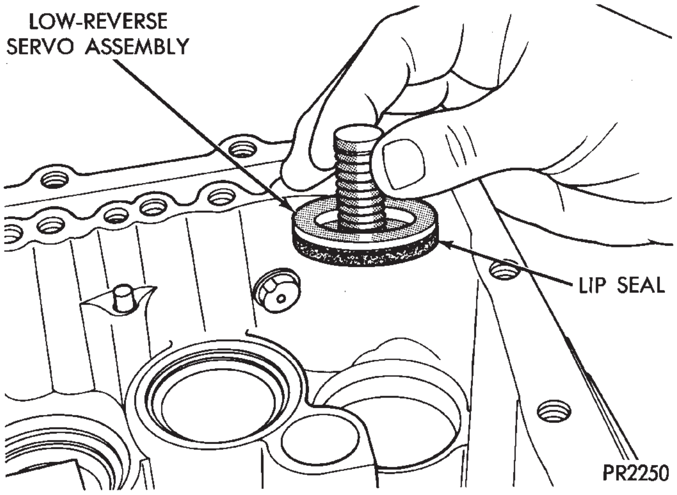


Fig. 4 Low/Reverse Servo Assembly

To assemble, reverse the above procedure.

ACCUMULATOR-RECONDITION

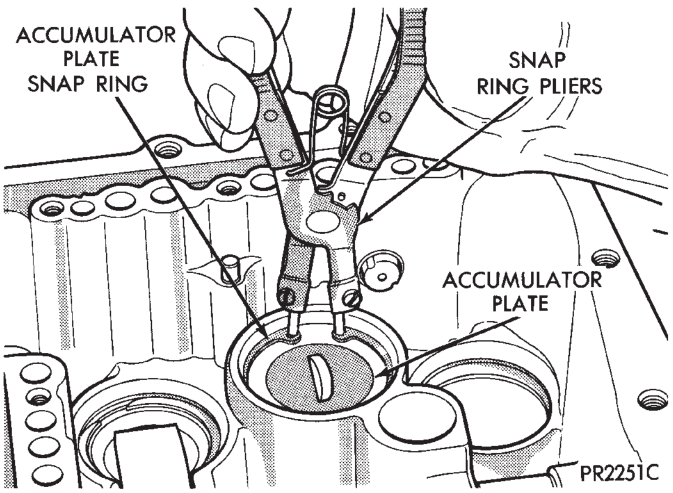


Fig. 5 Accumulator Snap Ring

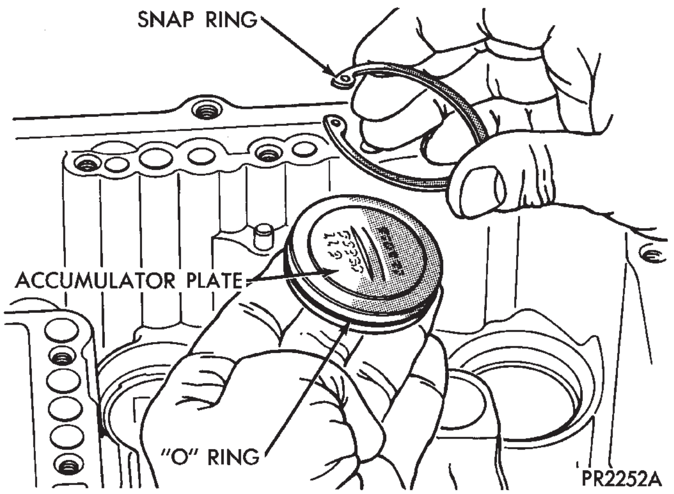


Fig. 6 Accumulator Plate and Snap Ring

To assemble, reverse the above procedure.

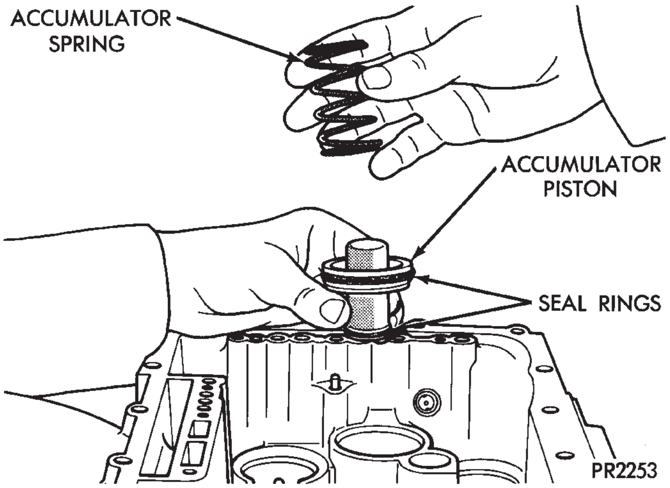


Fig. 7 Accumulator Spring and Piston

KICKDOWN SERVO (CONTROLLED LOAD)-RECONDITION

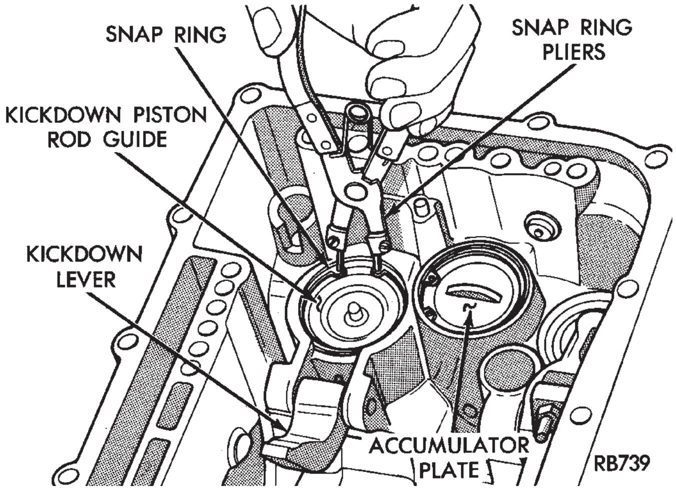


Fig. 1 Kickdown Servo Snap Ring

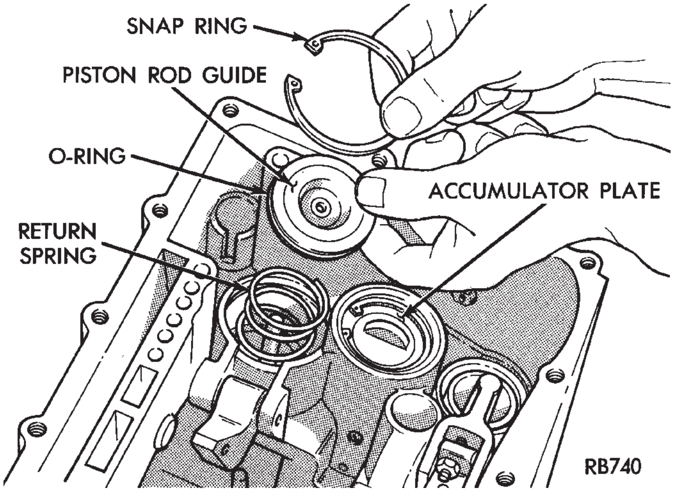


Fig. 2 Kickdown Servo Rod Guide and Snap Ring

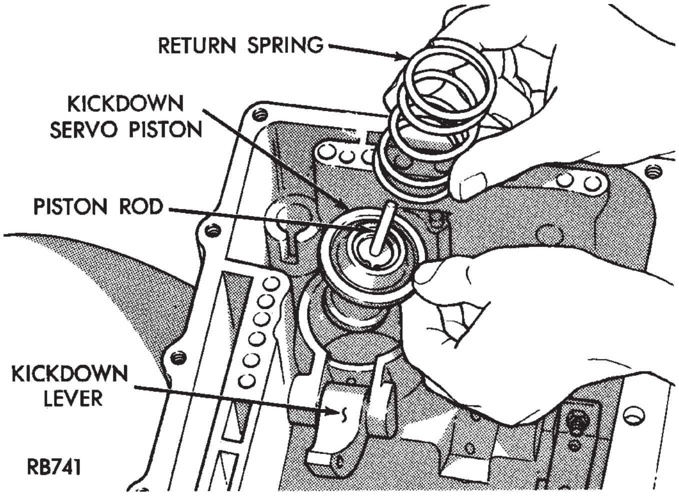


Fig. 3 Kickdown Piston Return Spring and Piston

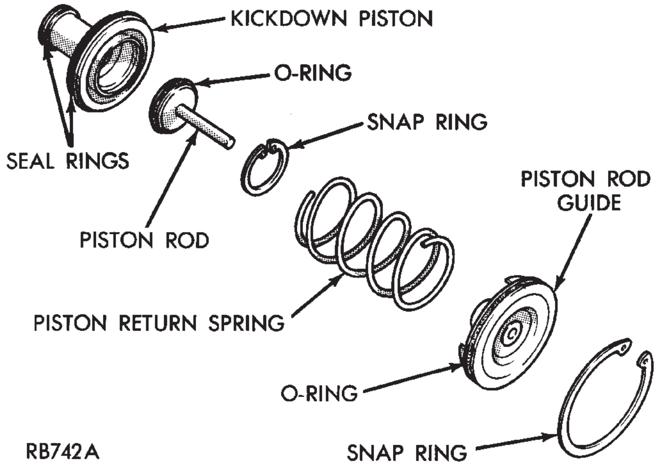


Fig. 4 Controlled Load Kickdown Servo

To assemble, reverse the above procedure.

TRANSFER SHAFT REPAIR

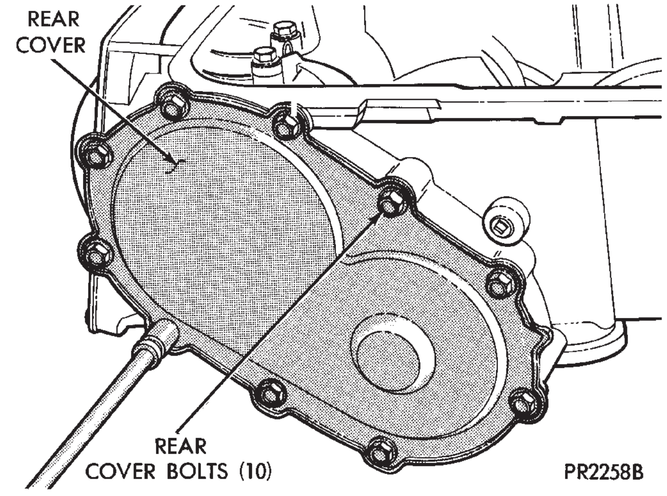


Fig. 5 Rear Cover Bolts

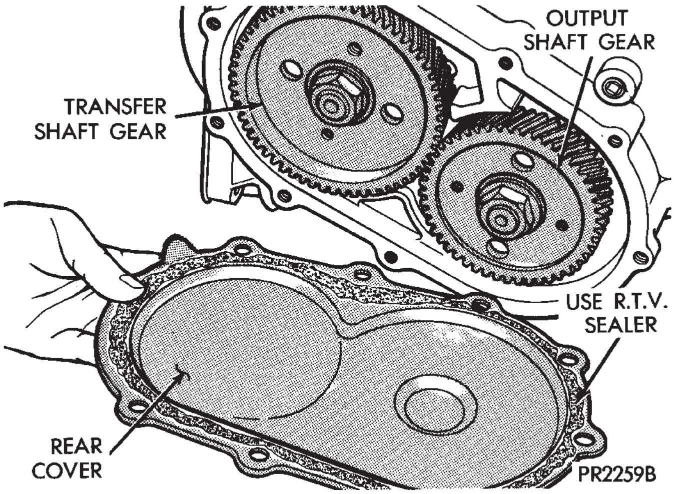


Fig. 6 Remove or Install Rear Cover

Remove old sealant before applying new sealant. Use MOPAR® Adhesive Sealant when installing cover.

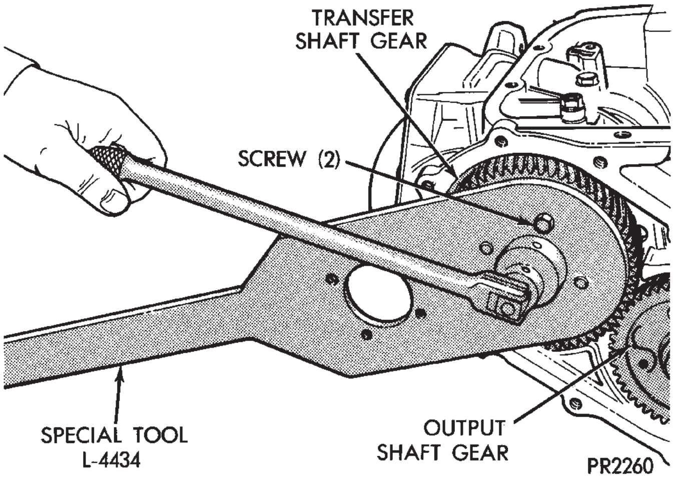


Fig. 7 Remove Transfer Shaft Gear Retaining Nut

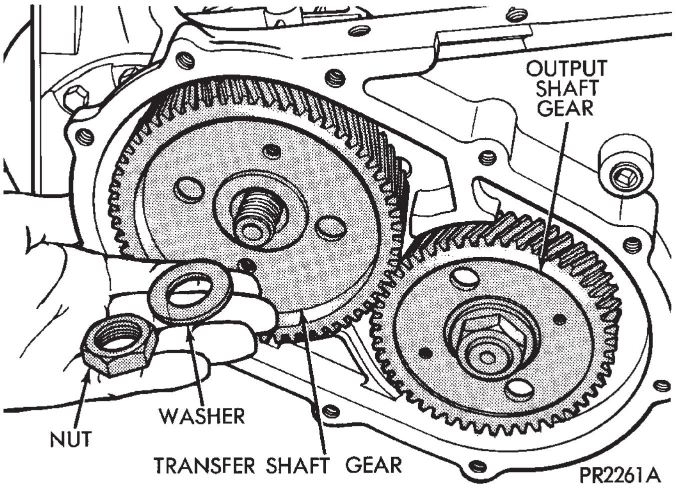


Fig. 8 Transfer Shaft Gear Nut and Washer

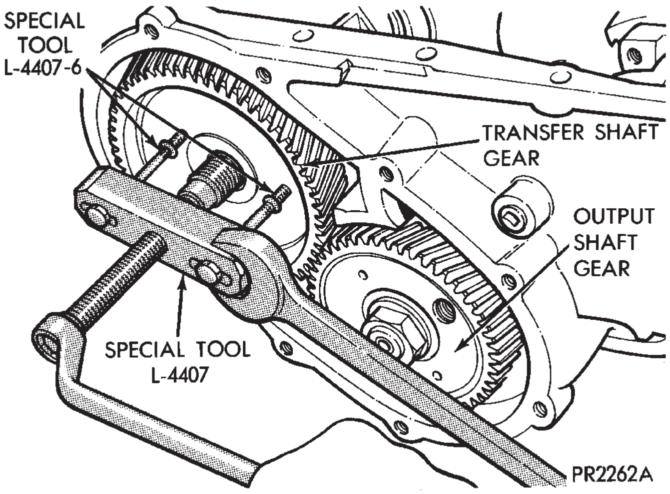


Fig. 9 Remove Transfer Shaft Gear

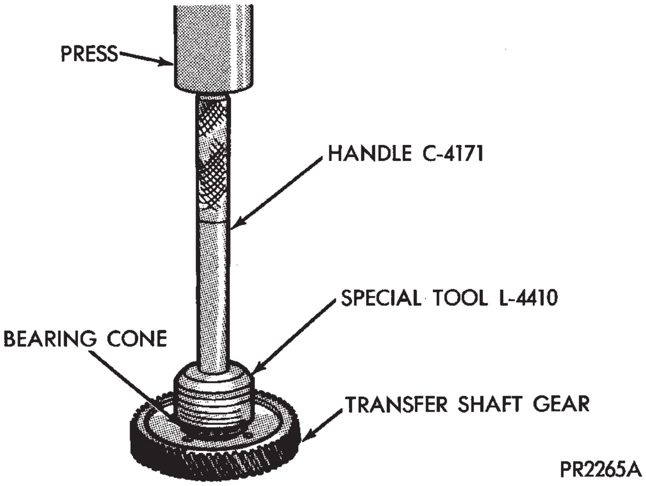


Fig. 12 Install Transfer Shaft Gear Bearing Cone

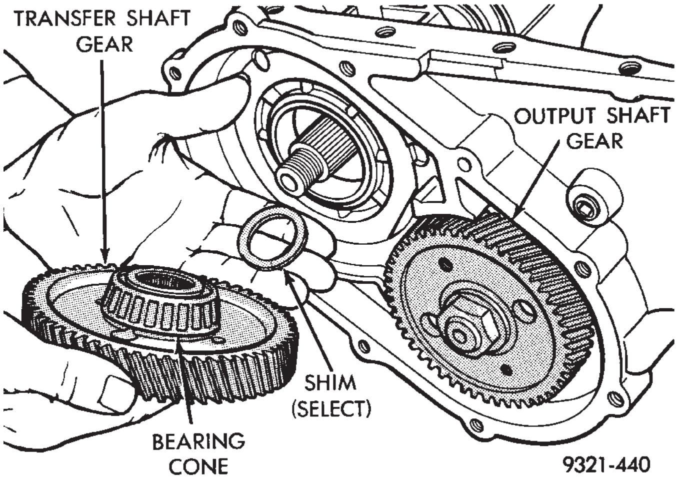


Fig. 10 Transfer Shaft Gear and (Select) Shim

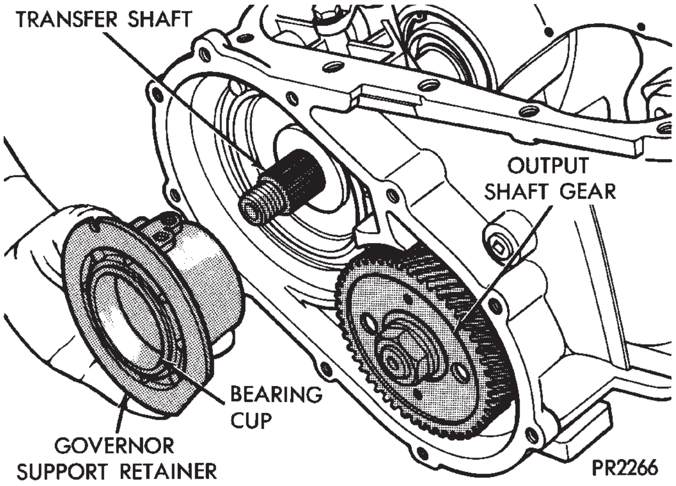


Fig. 13 Governor Support Retainer

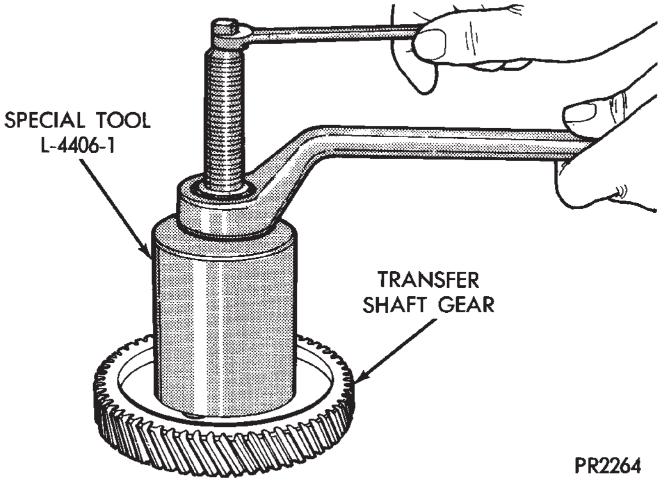


Fig. 11 Using Tool L-4406-1 with Adapter L-4406-3, Remove Transfer Shaft Gear Bearing Cone

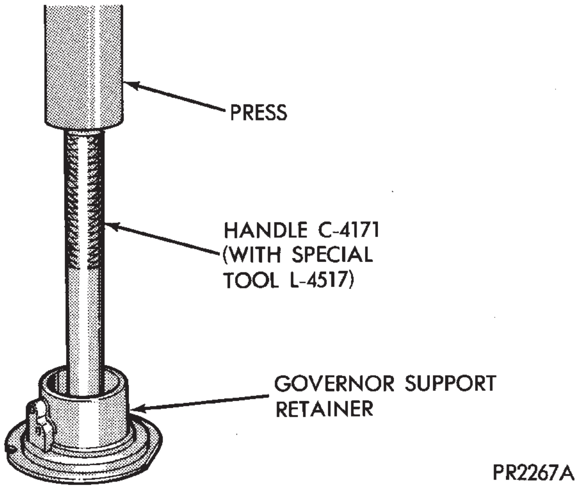


Fig. 14 Remove Governor Support Retainer Bearing Cup

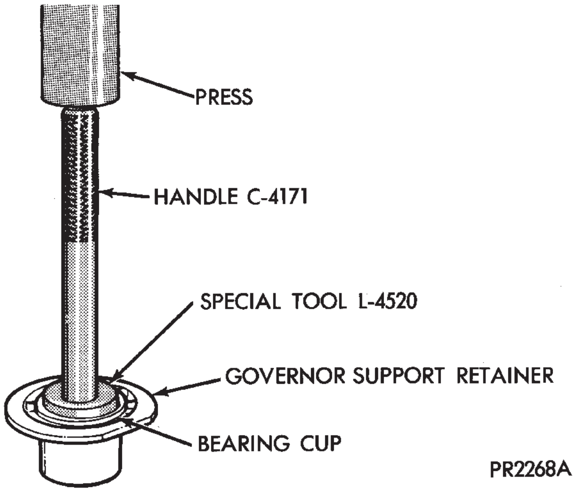


Fig. 15 Install Governor Support Retainer Bearing Cup

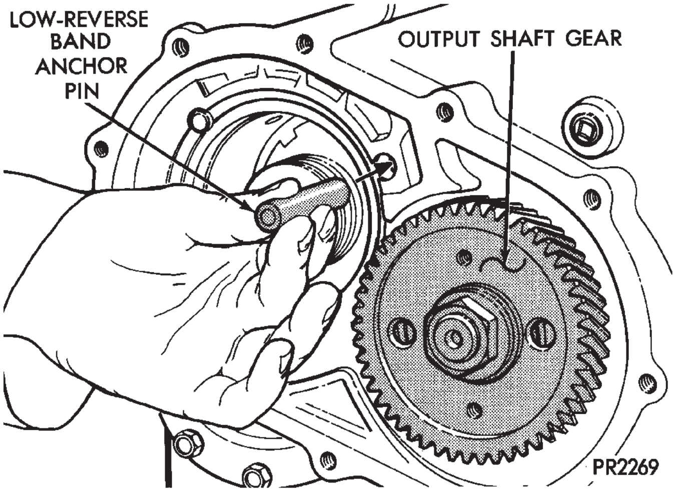


Fig. 16 Low-Reverse Band Anchor Pin

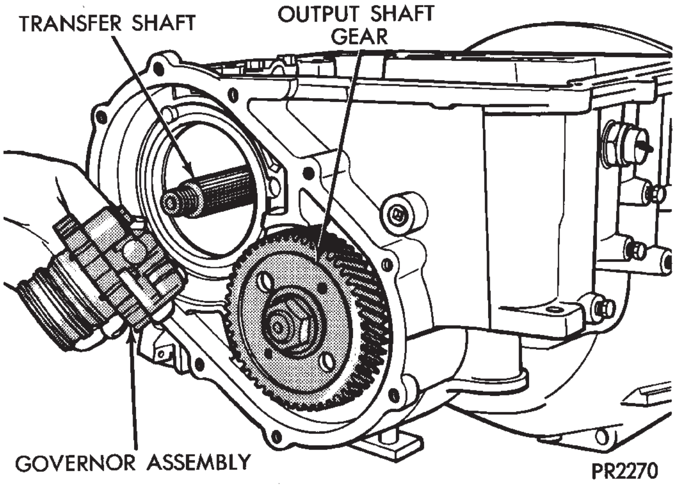


Fig. 17 Governor Assembly

Remove or install both governor valves and governor body.

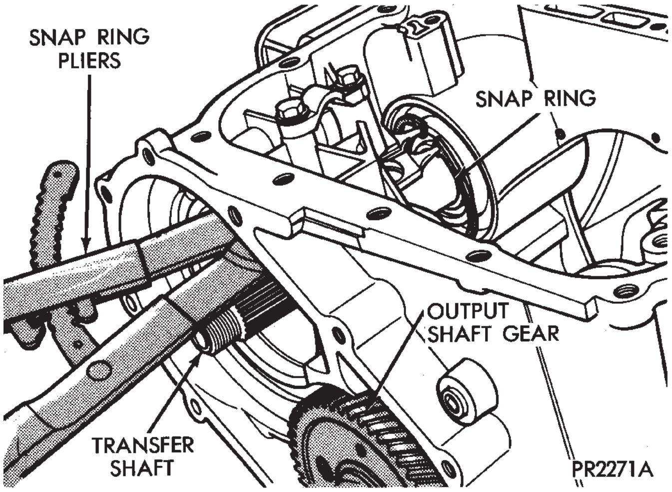


Fig. 18 Transfer Shaft Bearing Snap Ring

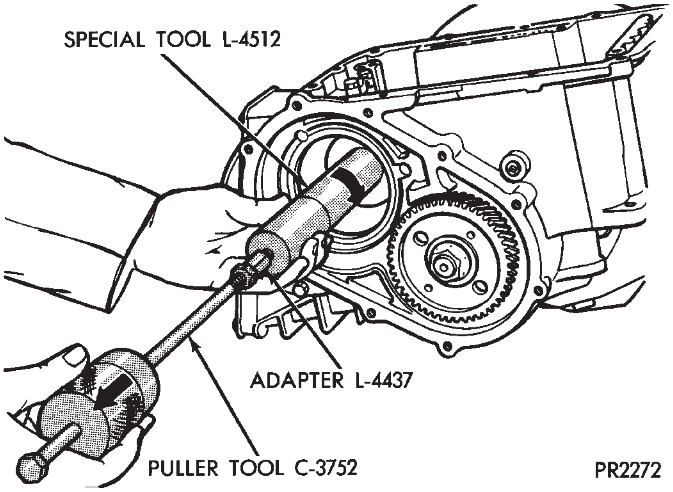


Fig. 19 Remove Transfer Shaft and Bearing Retainer Assembly

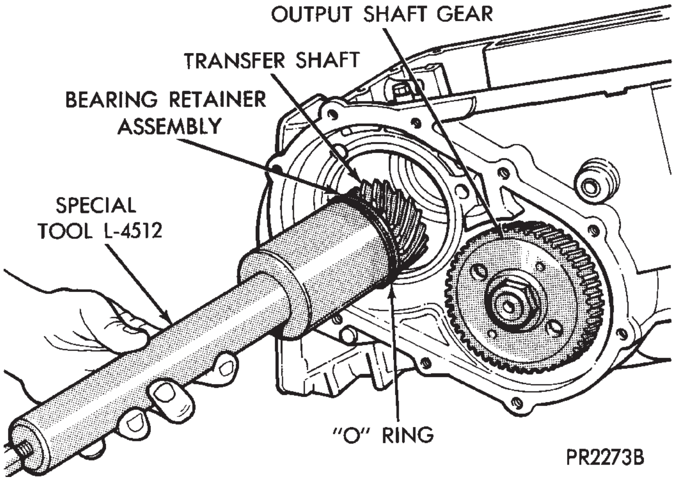


Fig. 20 Remove or Install Transfer Shaft and Bearing Retainer Assembly Using Tool L-4512

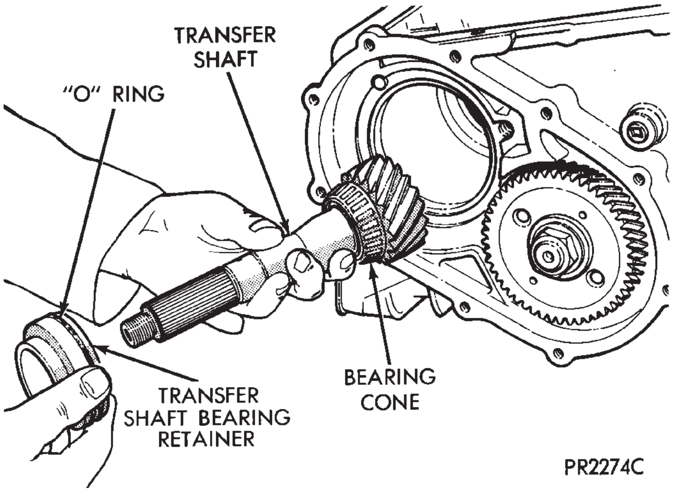


Fig. 21 Transfer Shaft and Bearing Retainer

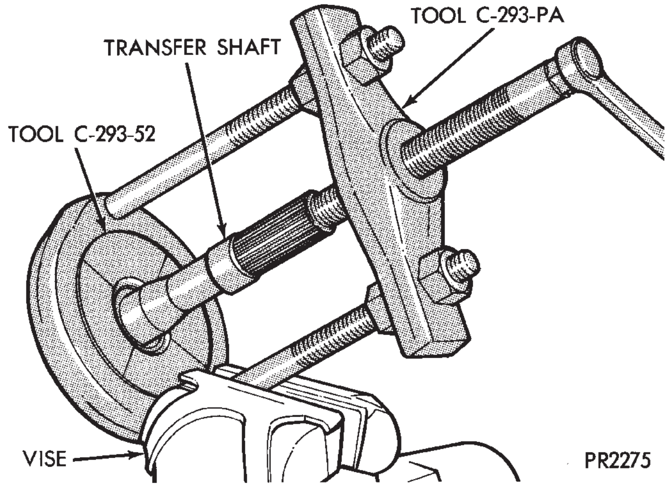


Fig. 22 Remove Transfer Shaft Bearing Cone

To install transfer shaft, reverse the above procedure.

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 for correct end play.

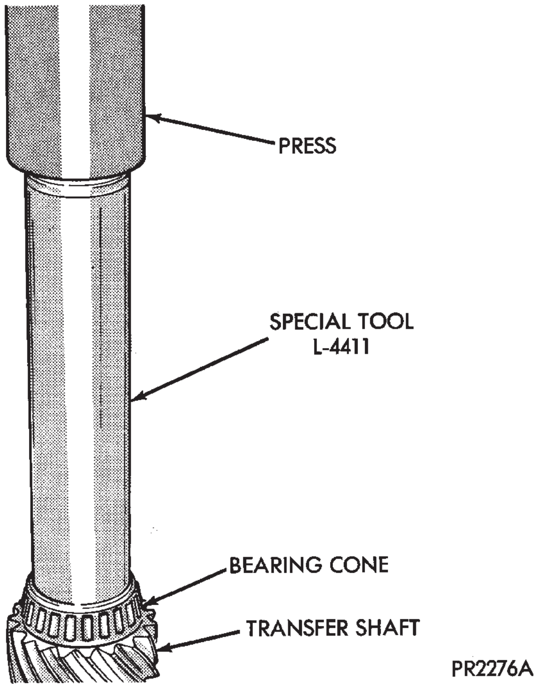


Fig. 23 Install Transfer Shaft Bearing Cone

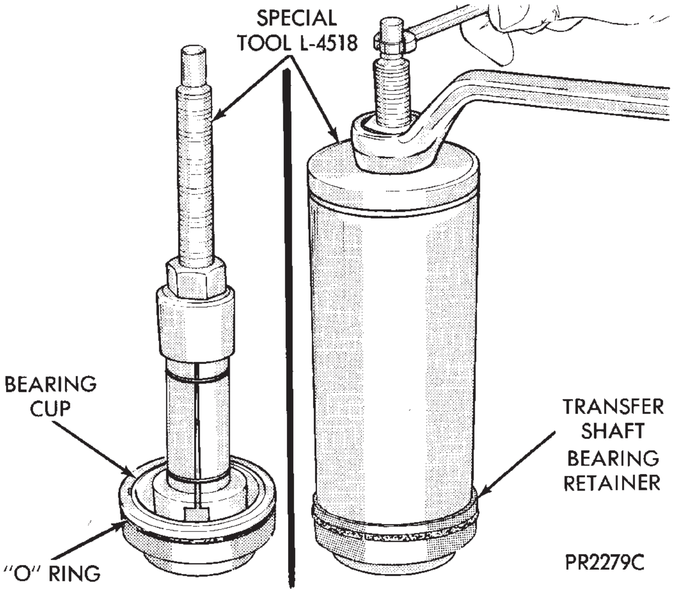


Fig. 24 Remove Transfer Shaft Bearing Cup

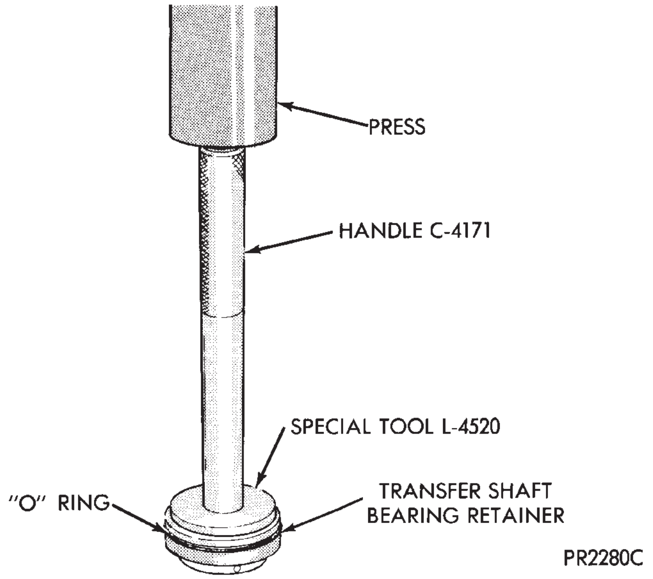


Fig. 25 Install Transfer Shaft Bearing Cup

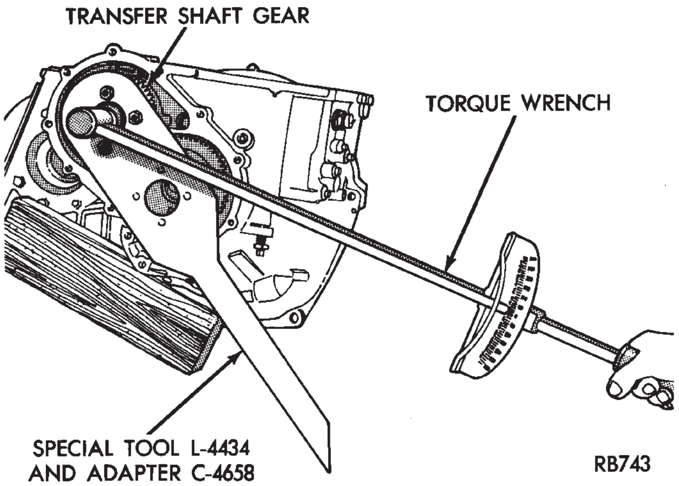


Fig. 26 Tighten Transfer Shaft Gear Retaining Nut to 271 N•m (200 ft. lbs.)

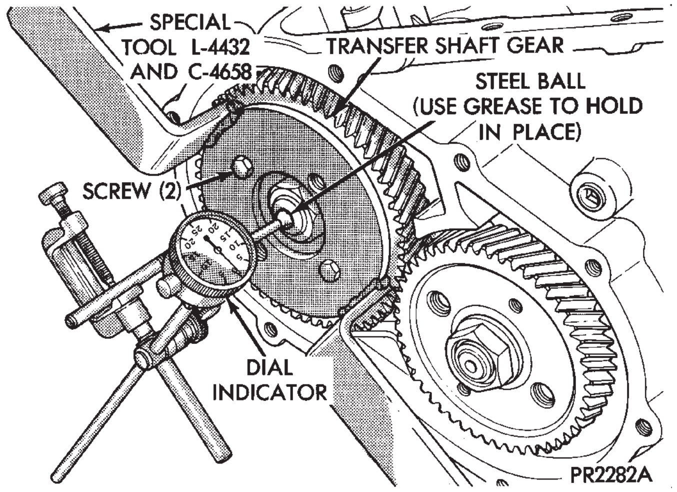


Fig. 27 Checking Transfer Shaft End Play

PARKING PAWL

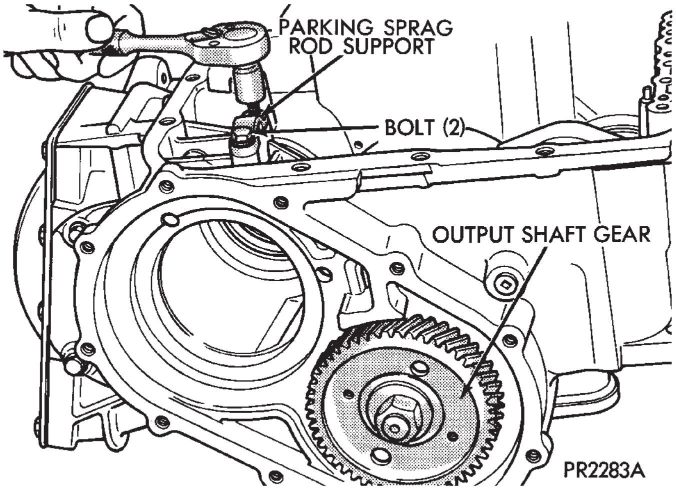


Fig. 28 Parking Sprag Rod Support Bolts

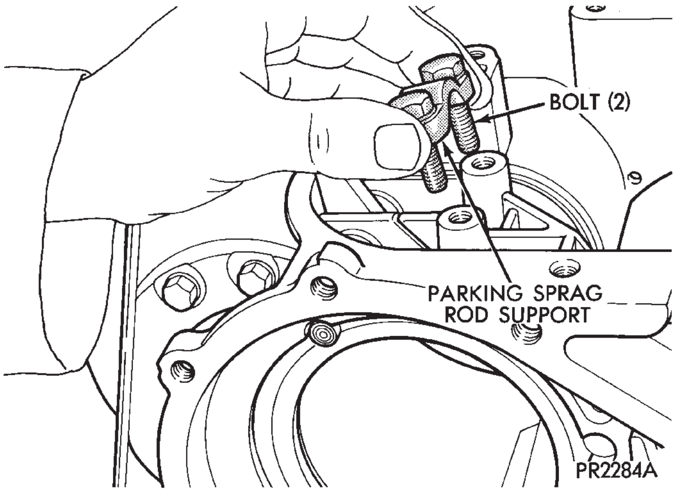


Fig. 29 Support and Bolts

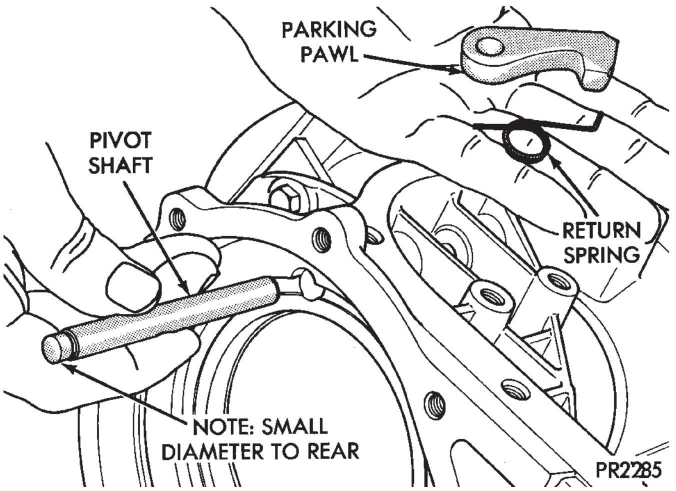


Fig. 30 Parking Pawl, Return Spring, and Pivot Shaft

To install, reverse the above procedure.

OUTPUT SHAFT REPAIR

Transfer shaft should be removed for repair of output shaft. Planetary gear sets must be removed to accurately check output shaft bearing turning torque.

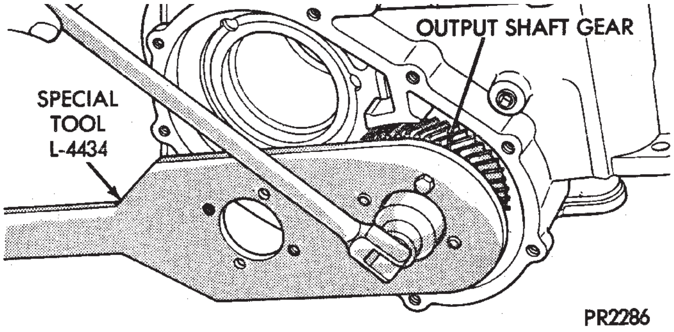


Fig. 1 Remove Output Shaft Retaining Nut and Washer

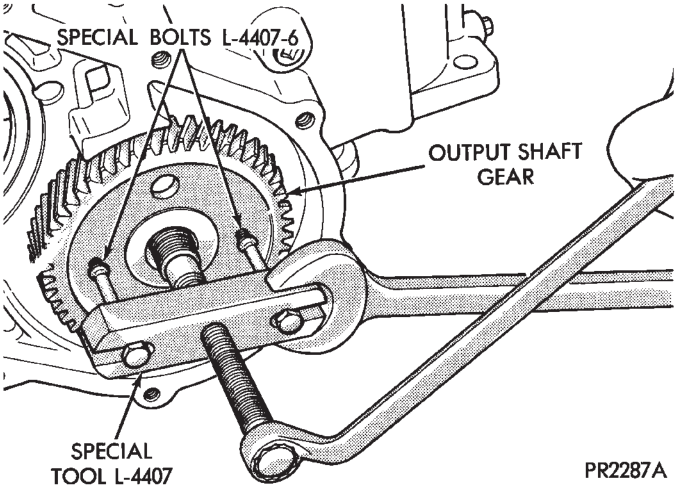


Fig. 2 Remove Output Shaft Gear

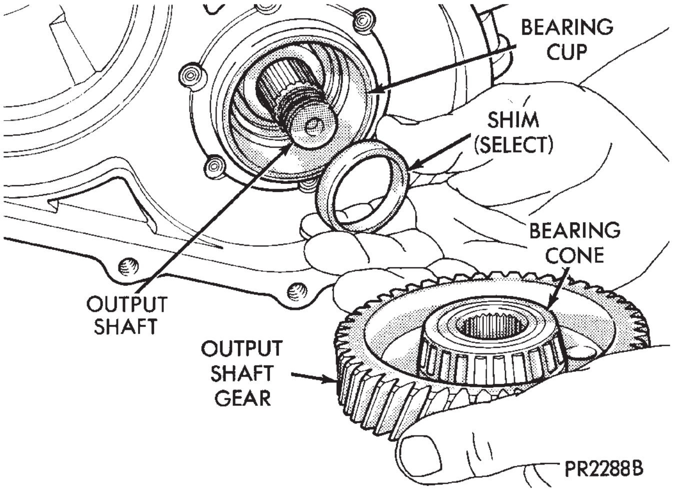


Fig. 3 Output Shaft Gear and Select Shim

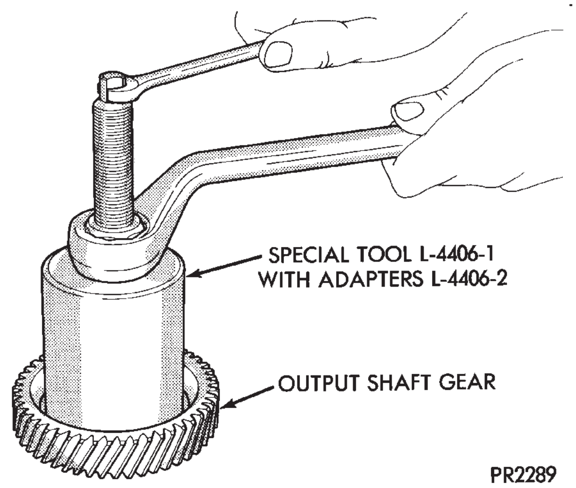


Fig. 4 Remove Output Shaft Gear Bearing Cone

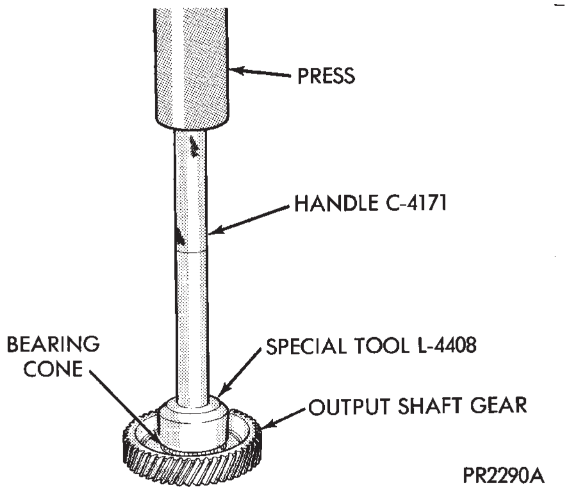


Fig. 5 Install Output Shaft Gear Bearing Cone

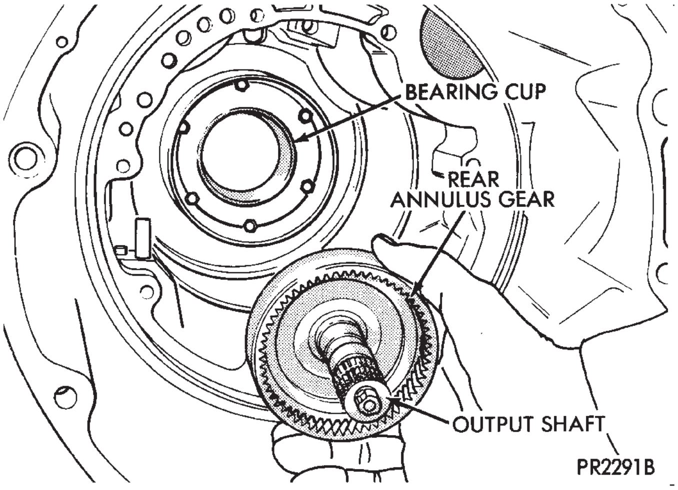


Fig. 6 Remove Output Shaft and Rear Annulus Gear Assembly

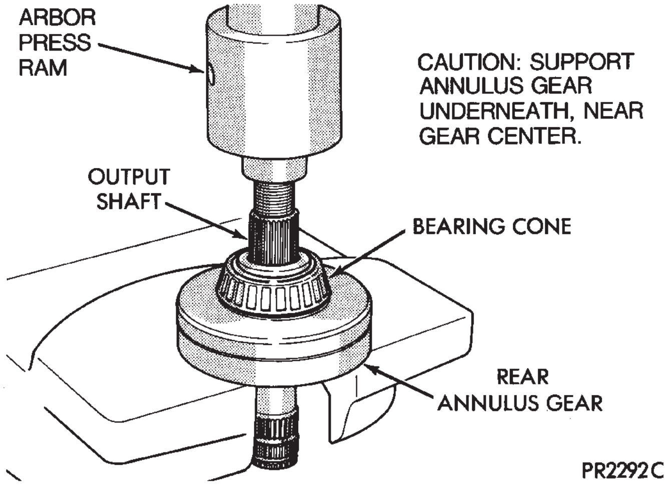


Fig. 7 Remove Output Shaft

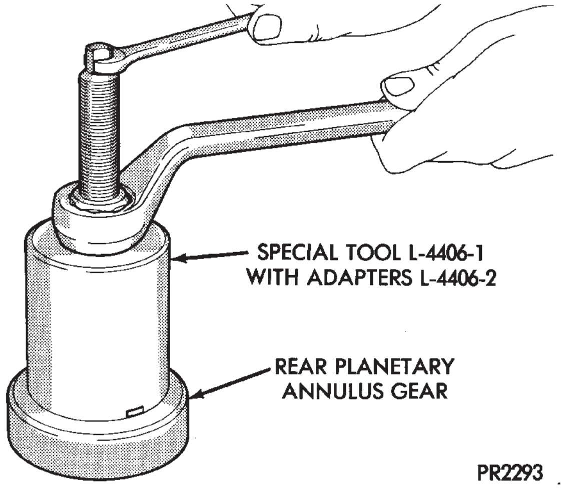


Fig. 8 Remove Rear Planetary Annulus Gear Bearing Cone

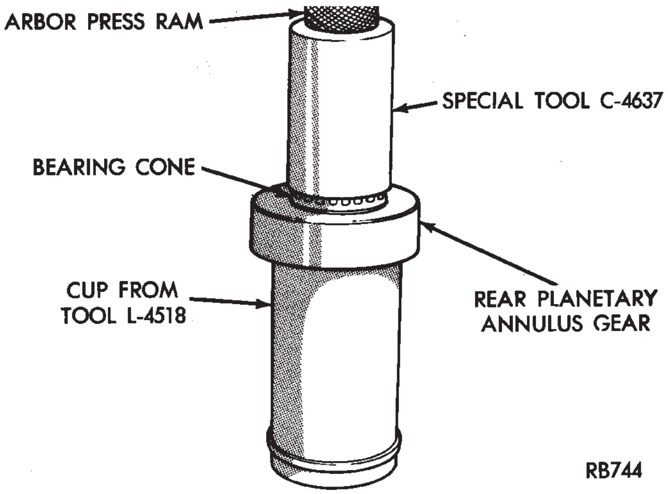


Fig. 9 Install Rear Planetary Annulus Gear Bearing Cone

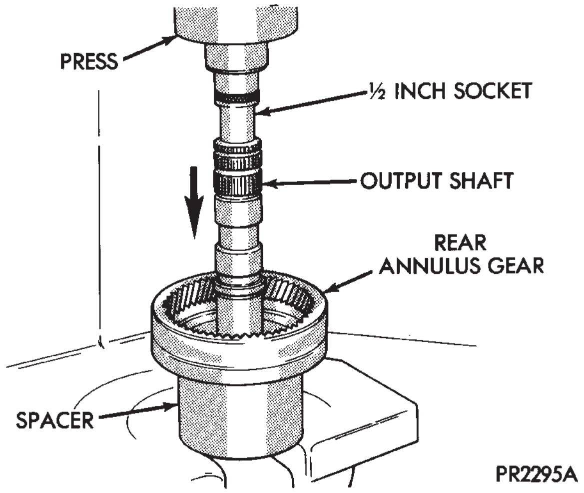


Fig. 10 Install Output Shaft into Rear Planetary Annulus Gear

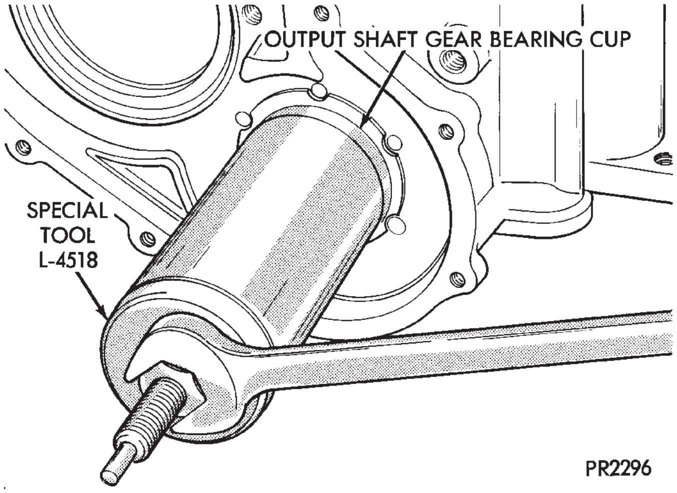


Fig. 11 Remove Output Shaft Gear Bearing Cup

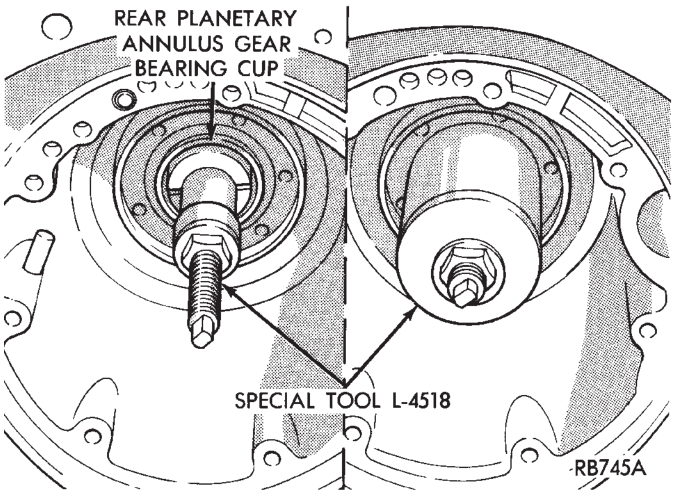


Fig. 12 Remove Rear Planetary Annulus Gear Bearing Cup

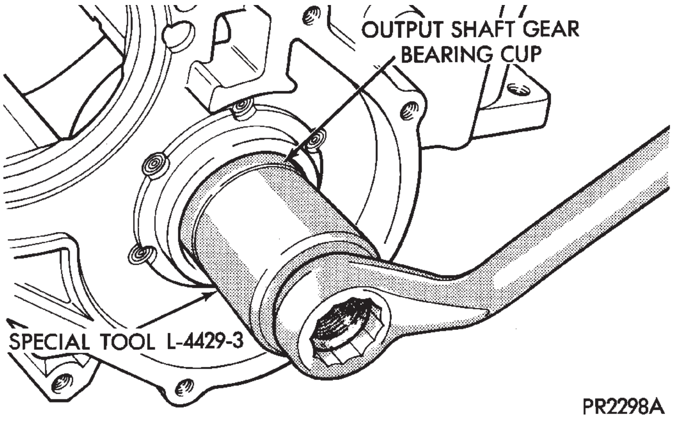


Fig. 13 Install Output Shaft Gear Bearing Cup

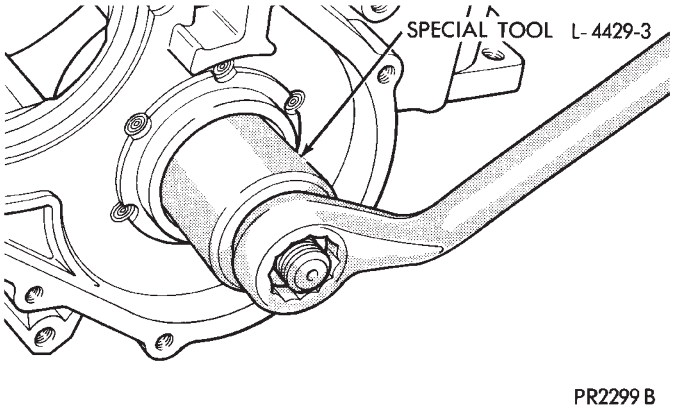


Fig. 14 Install Rear Planetary Annulus Gear Bearing Cup

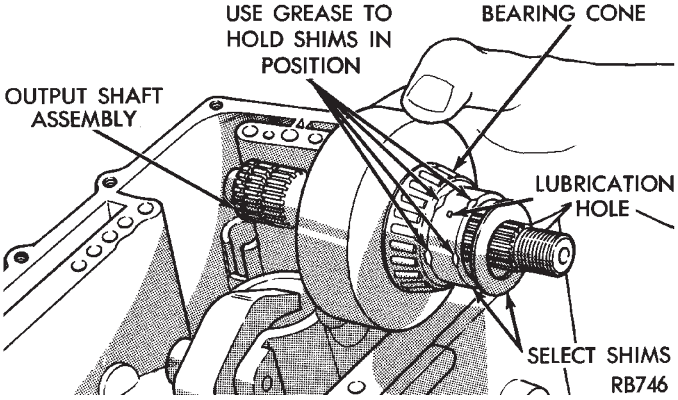


Fig. 15 Install Output Shaft Assembly

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 for correct bearing 'preload' and turning torque. **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.**

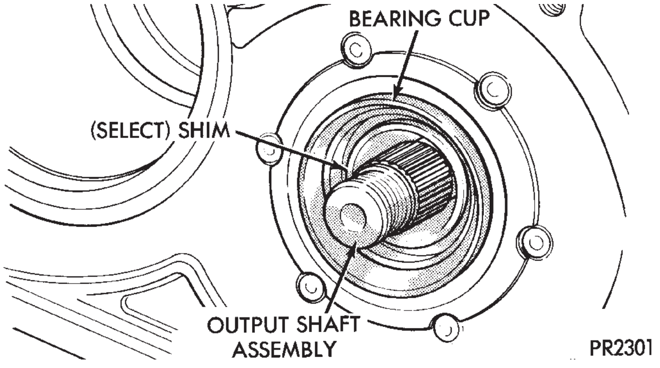


Fig. 16 Output Shaft and Select Shims in Position

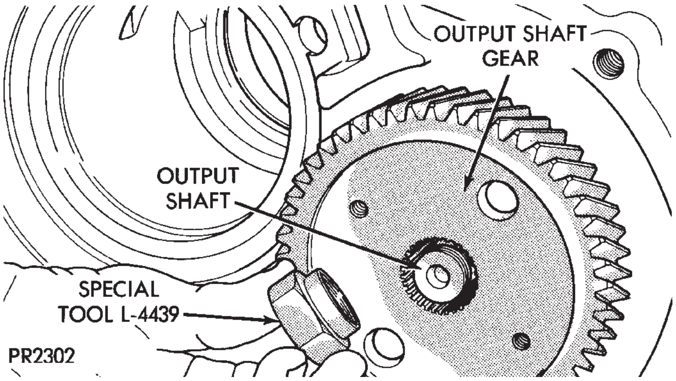


Fig. 17 Start Output Shaft Gear onto Output Shaft

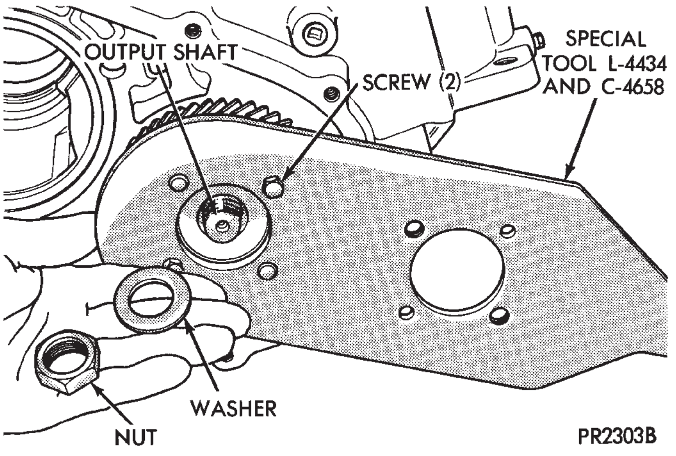


Fig. 18 Holding Output Shaft Gear

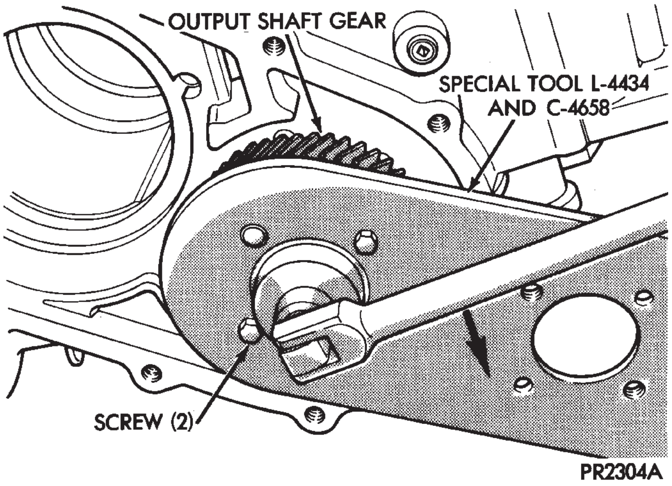


Fig. 19 Tighten Output Shaft Retaining Nut to 271 N•m (200 ft. lbs.)

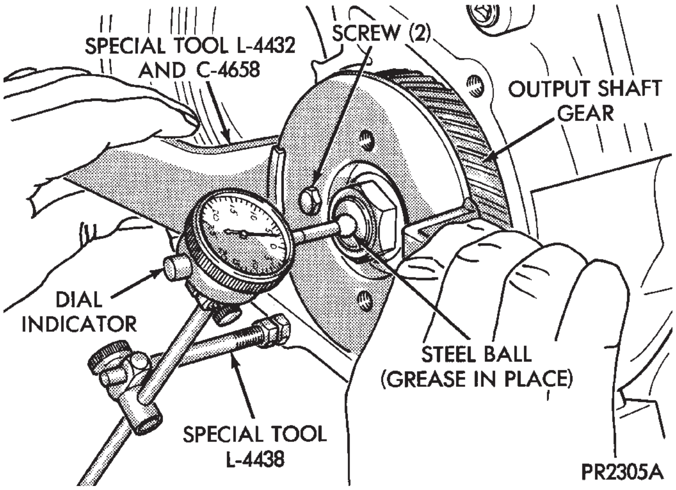


Fig. 20 Checking Output Shaft End Play

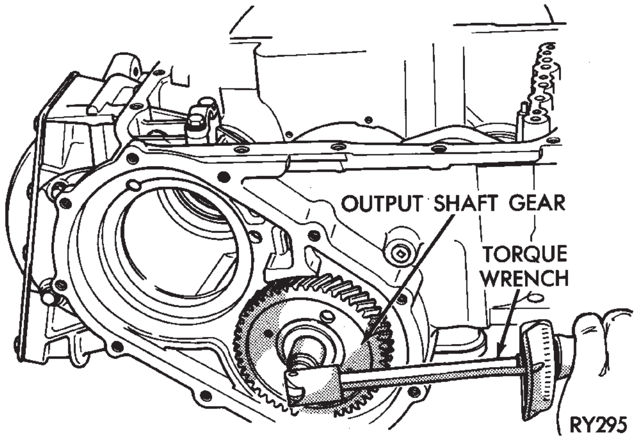


Fig. 21 Checking Bearings Turning Torque

DIFFERENTIAL REPAIR

The transfer shaft should be removed for differential repair and bearing turning torque checking.

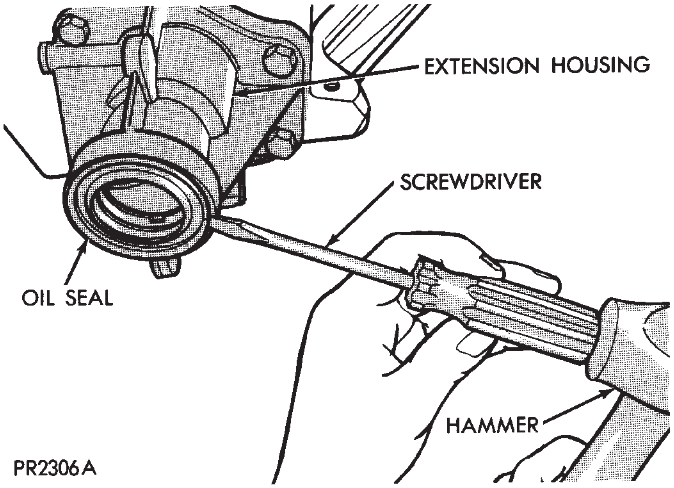


Fig. 1 Remove Extension Seal

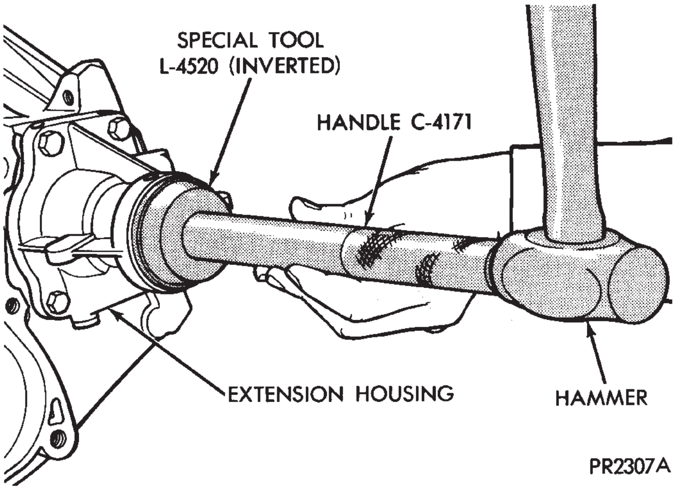


Fig. 2 Install New Seal into Extension

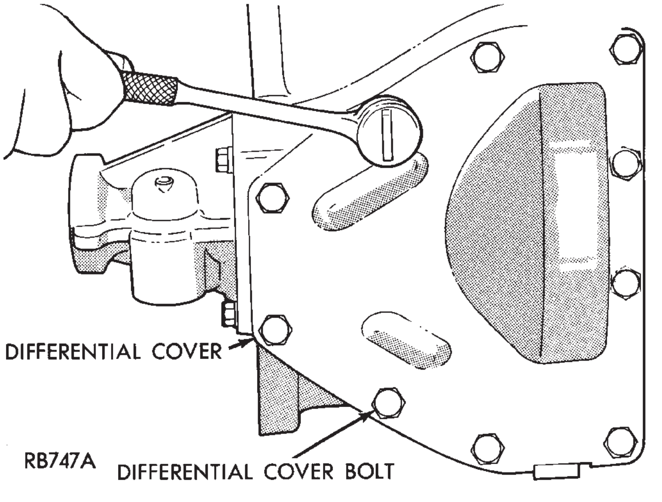


Fig. 3 Differential Cover Bolts

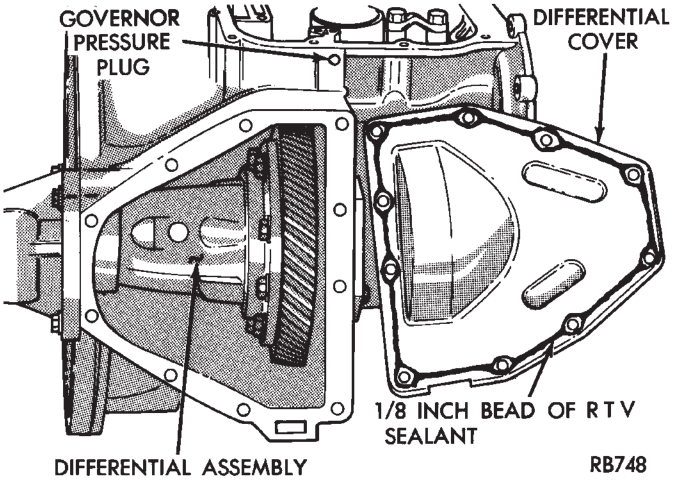


Fig. 4 Remove or Install Differential Cover

Use MOPAR® Adhesive Sealant when installing differential cover.

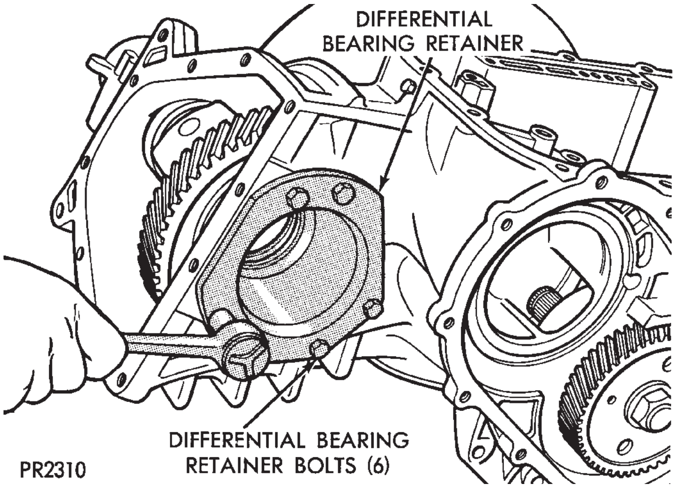


Fig. 5 Differential Bearing Retainer Bolts

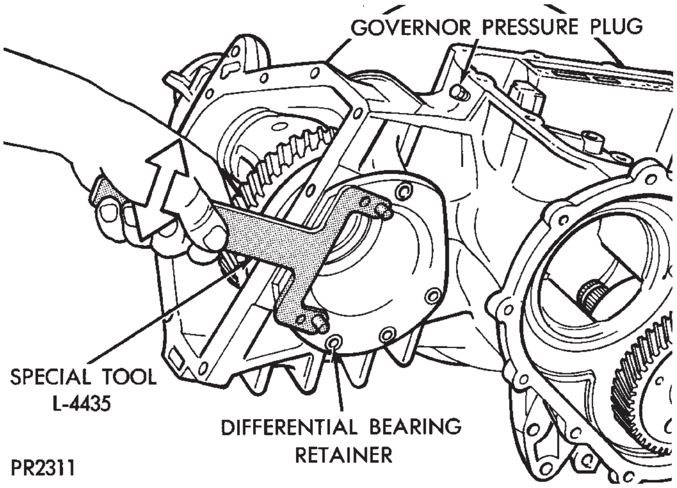


Fig. 6 Remove or Install Bearing Retainer

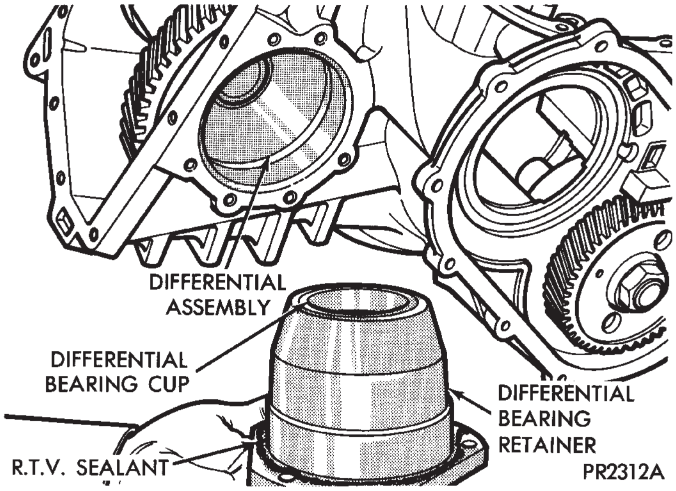


Fig. 7 Differential Bearing Retainer—Typical

Use MOPAR® Adhesive Sealant when installing differential bearing retainer.

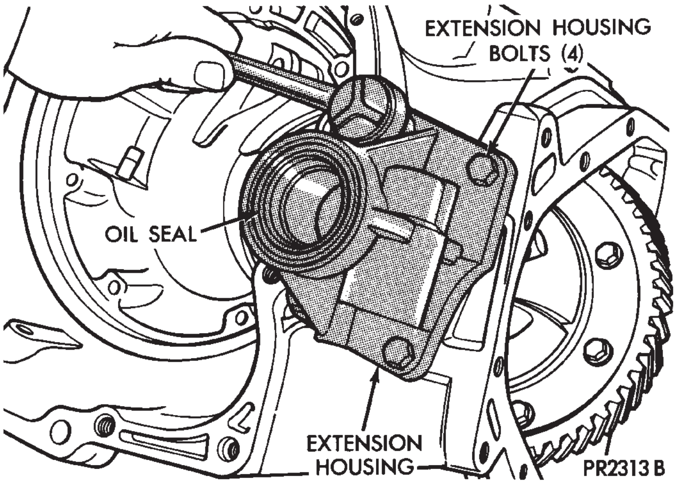


Fig. 8 Extension Bolts

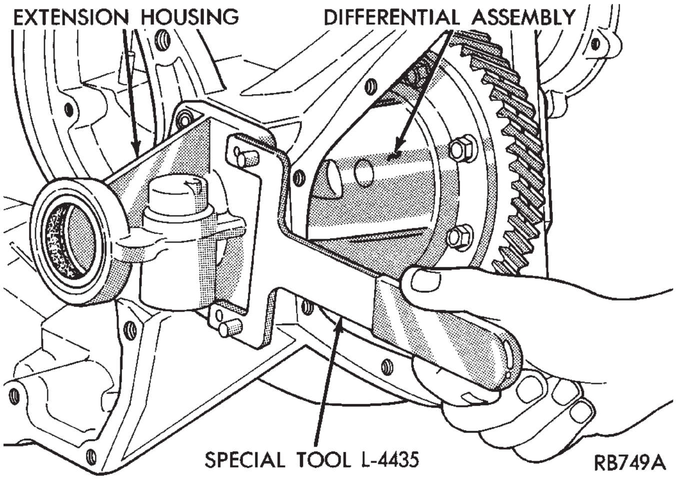


Fig. 9 Remove or Install Extension Housing

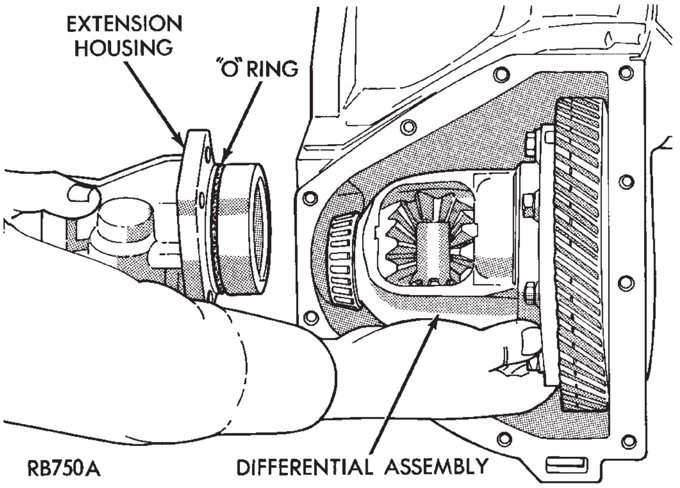


Fig. 10 Differential and Extension

WARNING: HOLD ONTO DIFFERENTIAL ASSEMBLY TO PREVENT IT FROM ROLLING OUT OF HOUSING.

Use MOPAR® Adhesive Sealant when installing extension housing.

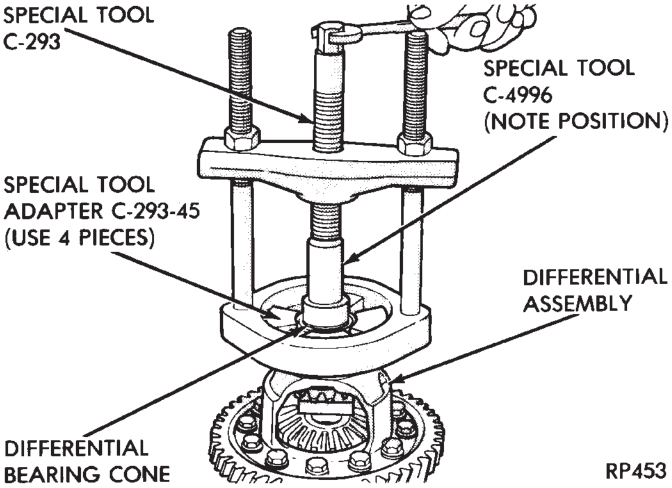


Fig. 11 Remove Differential Bearing Cone

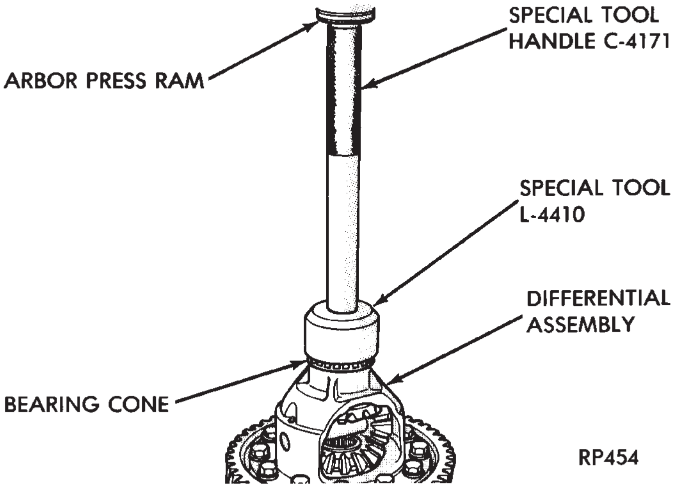


Fig. 12 Install Differential Bearing Cone

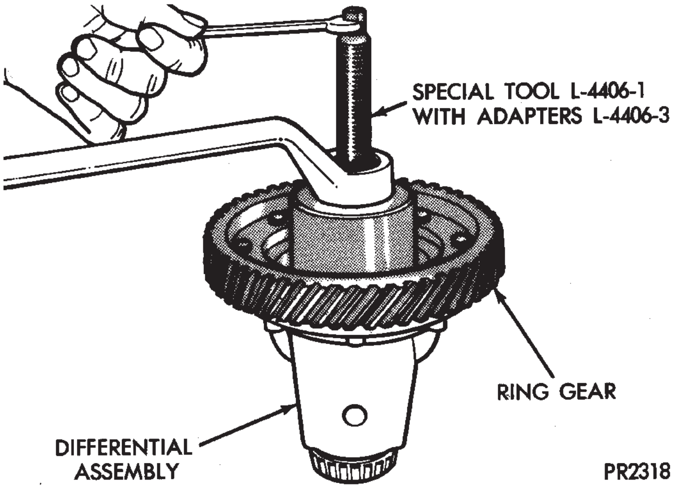


Fig. 13 Remove Differential Bearing Cone

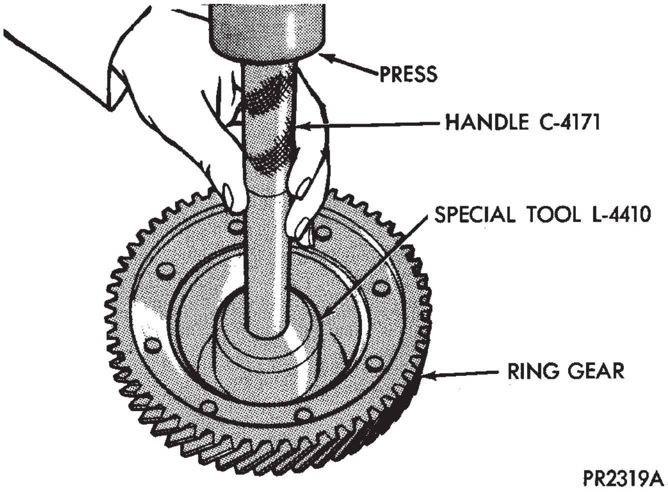


Fig. 14 Install Differential Bearing Cone

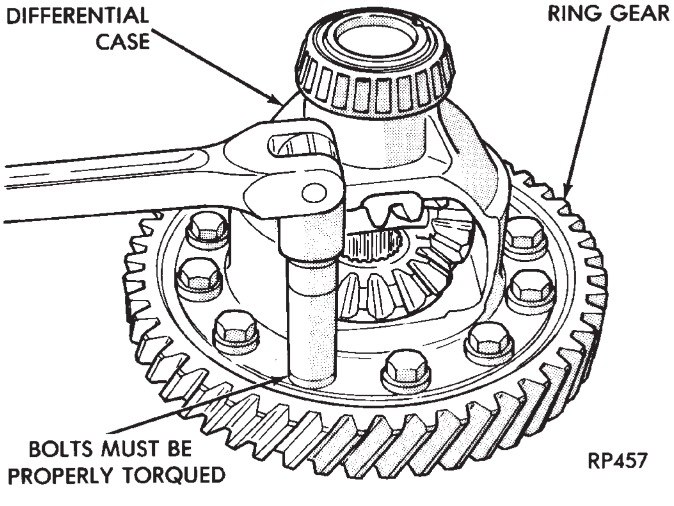


Fig. 15 Remove or Install Ring Gear Bolts and Ring Gear

CAUTION: Always install new ring gear bolts. Bolts must be properly torqued.

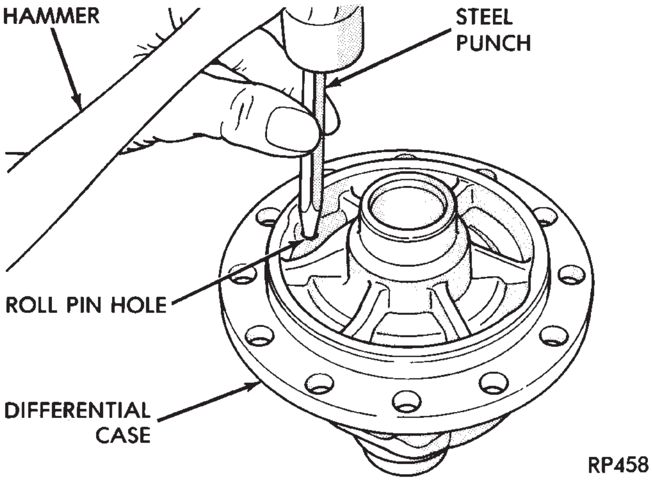


Fig. 16 Remove Pinion Shaft Roll Pin

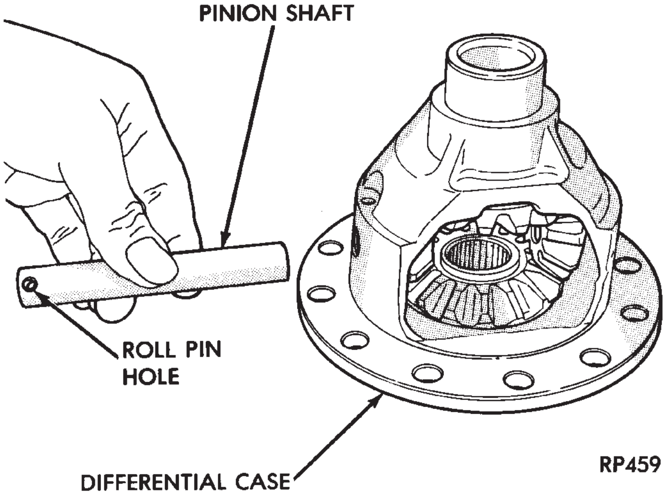


Fig. 17 Remove or Install Pinion Shaft

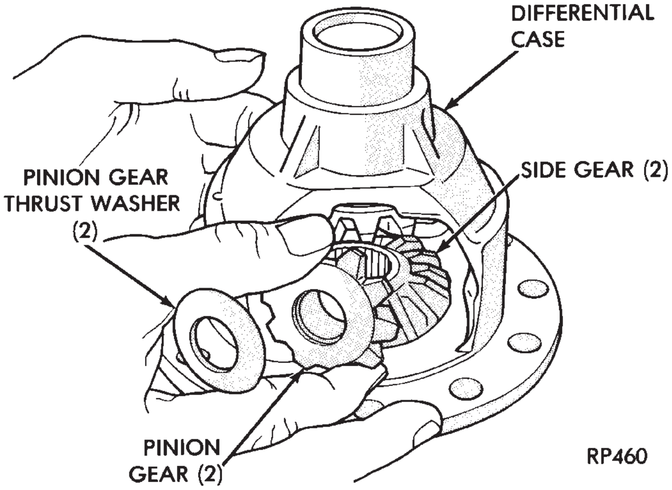


Fig. 18 Remove or Install Pinion Gears, Side Gears, and Tabbed Thrust Washers, by Rotating Pinion Gears to Opening in Differential Case

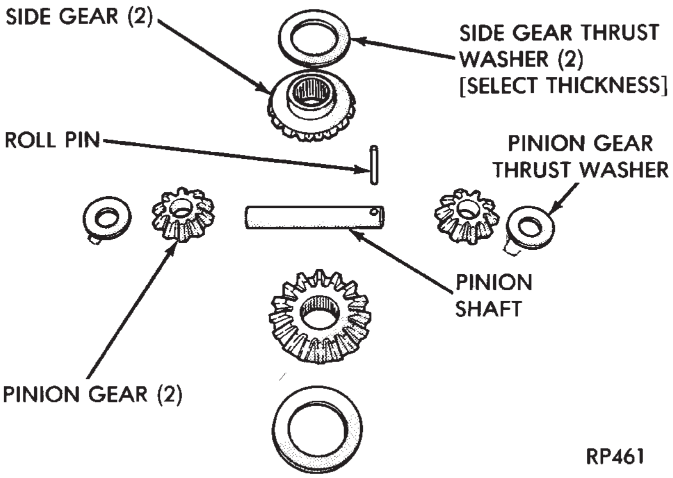


Fig. 19 Differential Gears

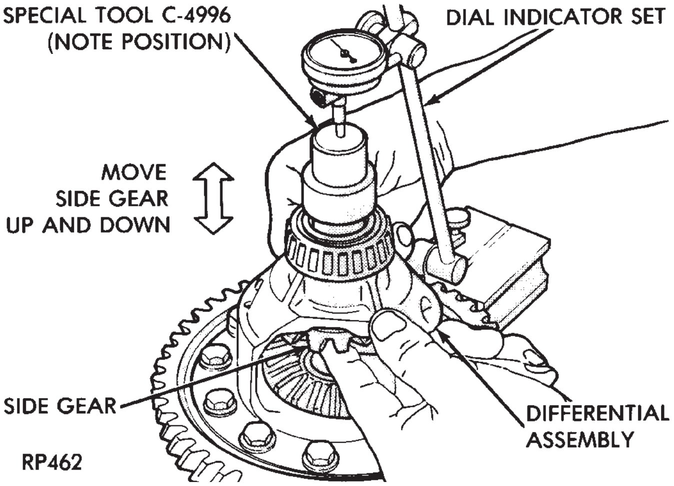


Fig. 20 Checking Side Gear End Play

CAUTION: Side gear end play must be within .001 to .013 inch.

Four select thrust washers are available: .032, .037, .042, and .047 inch.

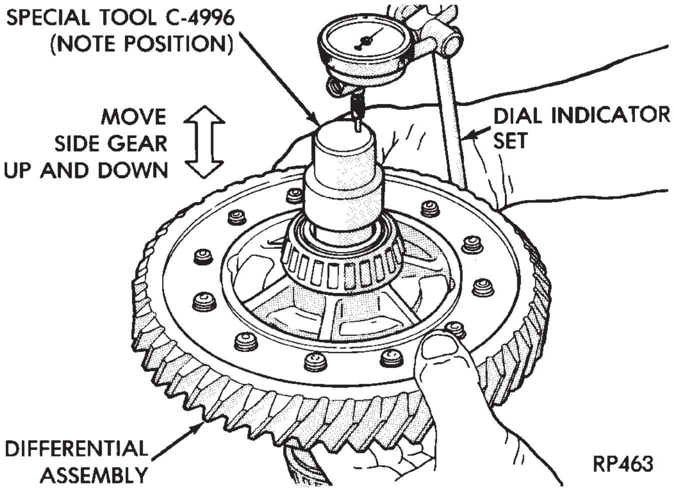


Fig. 21 Checking Side Gear End Play

CAUTION: Side gear end play must be within .001 to .013 inch.

Four select thrust washers are available: .032, .037, .042, and .047 inch.

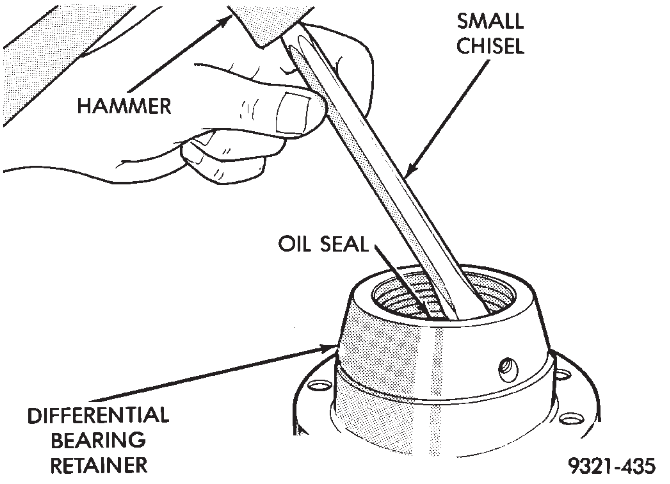


Fig. 22 Remove Oil Seal

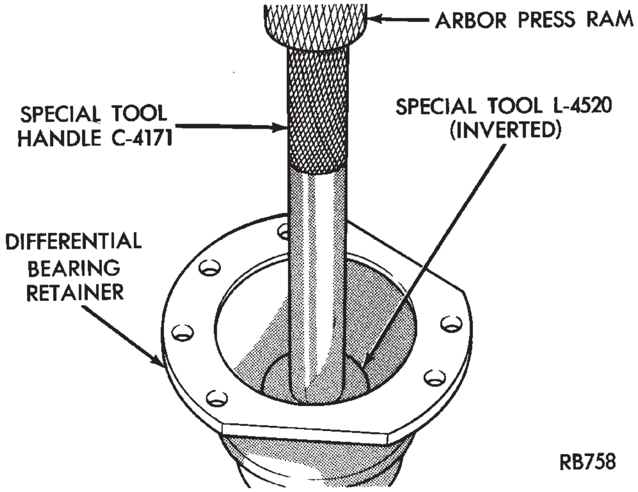


Fig. 23 Install New Oil Seal

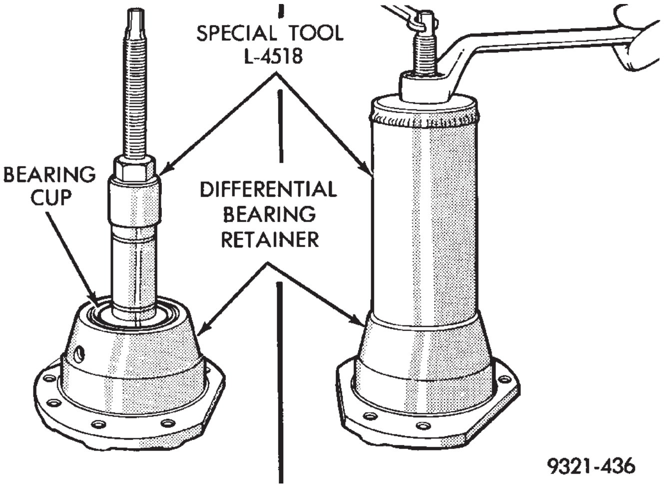


Fig. 24 Remove Bearing Cup

DETERMINING SHIM THICKNESS

Shim thickness need only be determined 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 for correct bearing preload and proper bearing turning torque.

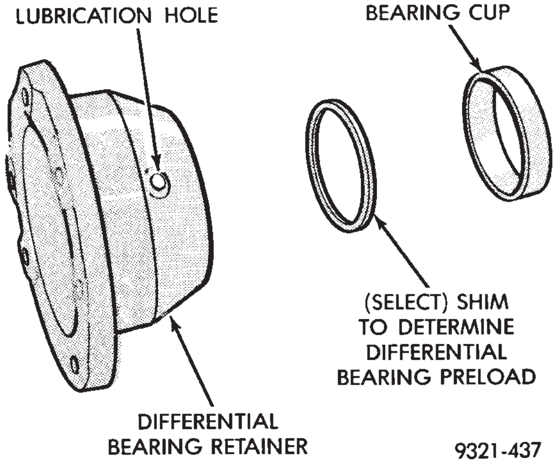


Fig. 25 Differential Bearing Retainer

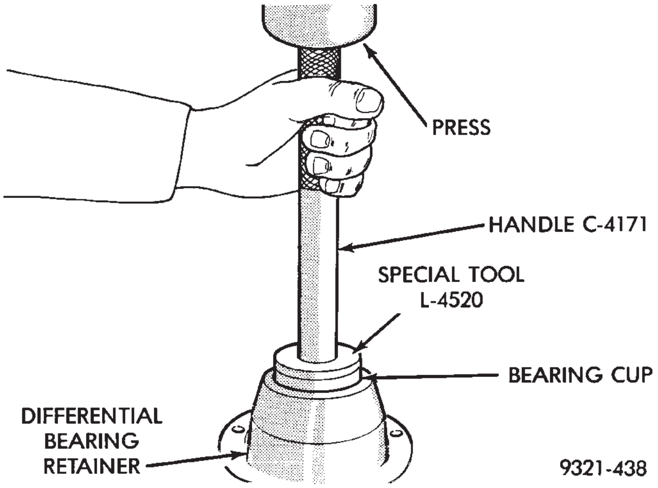


Fig. 26 Install Bearing Cup

When rebuilding, reverse the above procedure.

Remove old sealant before applying new sealant. Use MOPAR® Adhesive Sealant on retainer to seal retainer to case.

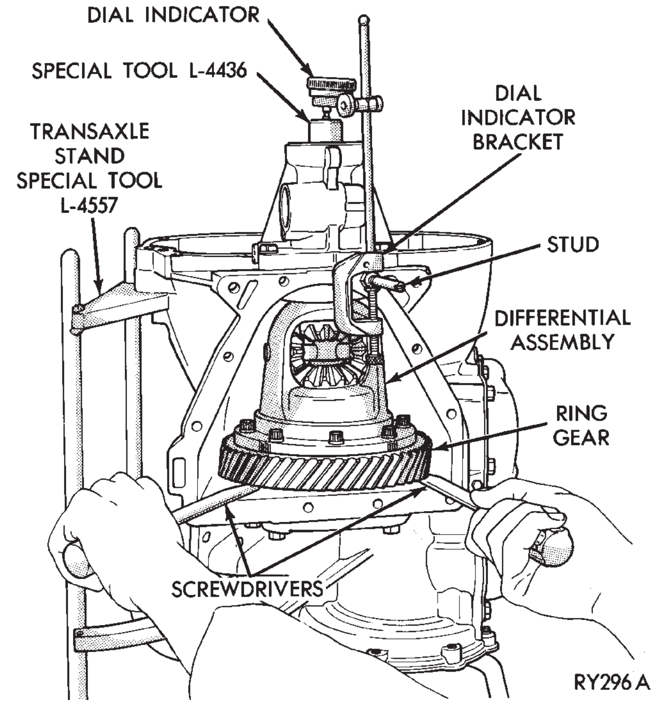


Fig. 27 Checking Differential End Play

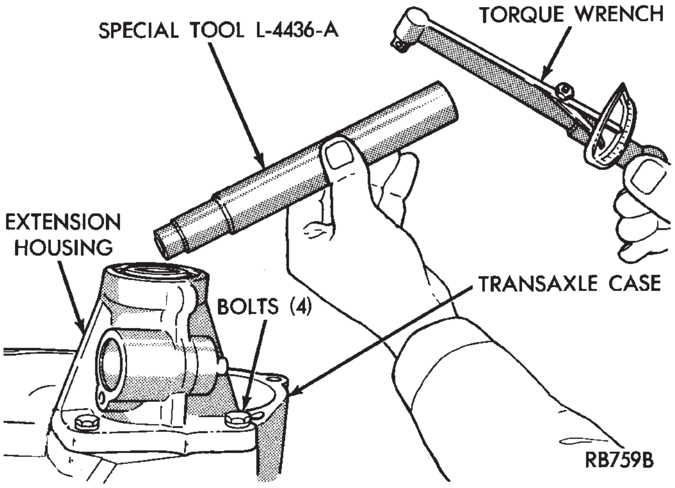


Fig. 28 Tool L-4436 and Torque Wrench

BEARING ADJUSTMENT PROCEDURES

GENERAL RULES ON SERVICING BEARINGS

(1) Take extreme care when removing and in stalling 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.

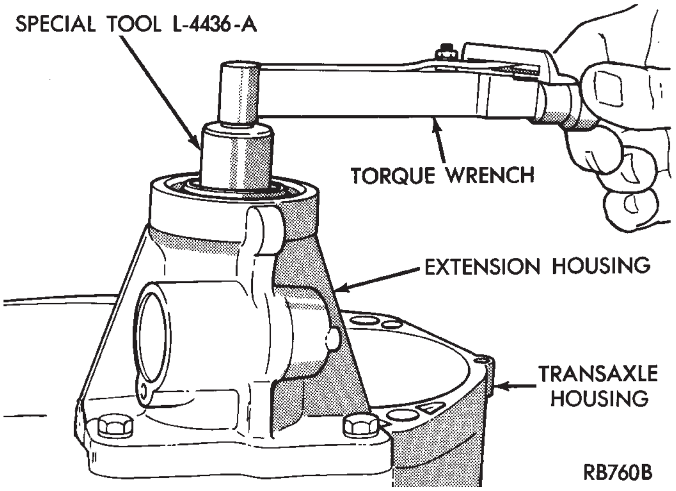


Fig. 29 Checking Differential Bearings Turning Torque

(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.

Bearing end play and drag torque specifications must be maintained to avoid premature bearing failures.

Used (original) bearing may lose up to 50 of the original drag torque after break-in.

All bearing adjustments must be made with no other component interference or gear intermesh, except the transfer gear bearing.

OUTPUT SHAFT BEARING

With output shaft gear removed.

(1) 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:

(a) Attach Tool L-4432 to the output shaft gear.

(b) Mount a steel ball with grease into the end of the output shaft.

(c) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(d) Using a dial indicator, mounted to the transaxle case, measure output shaft end play.

(4) Once bearing end play has been determined, refer to the output shaft bearing shim chart for the required shim combination to obtain proper bearing setting.

(a) 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.**

(b) Shims thinner than 12.65 mm listed in the chart are common to both the transfer shaft and output shaft bearings.

(5) Use Tool L-4424 to remove the retaining nut and washer. To remove the output shaft gear use Tool L-4407.

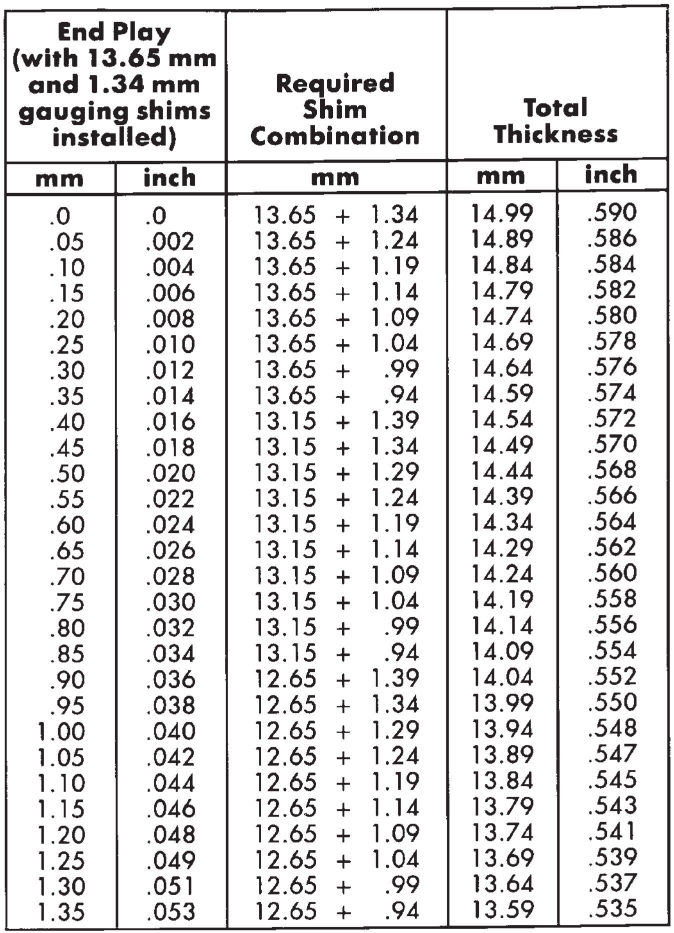
(6) Remove the two gauging shims and install the proper shim combination, making sure to install the 12.65, 13.15, or 13.65 mm shim first. Use grease to hold the shims in place. Install the output shaft gear and bearing assembly.

(7) Install the retaining nut and washer and torque to 271 N●m (200 ft. lbs.).

(8) Using an inch-pound torque wrench, check the turning torque. **The torque should be between 3 and 8 inch-pounds.**

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.

OUTPUT SHAFT BEARING SHIM



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

DIFFERENTIAL BEARING

(1) Remove the bearing cup from the differential bearing retainer using Tool L-4518, and remove the existing shim from under the cup.

(2) Install a .50 mm (.020 inch) gauging shim and reinstall the bearing cup into the retainer. Use an arbor press to install the cup.

Oil Baffle is not required when making shim selection.

(3) Install the bearing retainer into the case and torque bolts to 28 N●m (250 in. lbs.).

(4) Position the transaxle assembly vertically on the support stand and install Tool L-4436 into the extension.

(5) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(6) Attach a dial indicator to the case and zero the dial indicator. Place the indicator tip on the end of Tool L-4436.

(7) Place a large screwdriver to each side of the ring gear and lift. Check the dial indicator for the amount of end play.

CAUTION: Do not damage the transaxle case and/or differential cover sealing surface.

(8) When the end play has been determined, refer to the Differential Bearing Shim Chart for the correct shim combination to obtain the proper bearing setting.

(9) Remove the differential bearing retainer. Remove the bearing cup and the .50 mm (.020 inch) gauging shim.

(10) Install the proper shim combination under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(11) Install the differential bearing retainer. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N●m (250 in. lbs.).

(12) Using special Tool L-4436 and an inch-pound torque wrench, check the turning torque of the differential. **The turning torque should be between 5 and 18 inch-pounds.**

If the turning torque is too high, install a .05 mm (.002 inch) thinner shim. If the turning torque is too low, install a .05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained.

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.

DIFFERENTIAL BEARING SHIM

End Play (with .50 mm gauging shim installed)		Required Shim Combination	Total Thickness	
mm	inch	mm	mm	inch
.0	.0	.50	.50	.020
.05	.002	.75	.75	.030
.10	.004	.80	.80	.032
.15	.006	.85	.85	.034
.20	.008	.90	.90	.035
.25	.010	.95	.95	.037
.30	.012	1.00	1.00	.039
.35	.014	1.05	1.05	.041
.40	.016	.50 + .60	1.10	.043
.45	.018	.50 + .65	1.15	.045
.50	.020	.50 + .70	1.20	.047
.55	.022	.50 + .75	1.25	.049
.60	.024	.50 + .80	1.30	.051
.65	.026	.50 + .85	1.35	.053
.70	.027	.50 + .90	1.40	.055
.75	.029	.50 + .95	1.45	.057
.80	.031	.50 + 1.00	1.50	.059
.85	.033	.50 + 1.05	1.55	.061
.90	.035	1.00 + .60	1.60	.063
.95	.037	1.00 + .65	1.65	.065
1.00	.039	1.00 + .70	1.70	.067
1.05	.041	1.00 + .75	1.75	.069
1.10	.043	1.00 + .80	1.80	.071
1.15	.045	1.00 + .85	1.85	.073
1.20	.047	1.00 + .90	1.90	.075
1.25	.049	1.00 + .95	1.95	.077
1.30	.051	1.00 + 1.00	2.00	.079
1.35	.053	1.00 + 1.05	2.05	.081
1.40	.055	1.05 + 1.05	2.10	.083

9121-16

(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:

(a) Attach Tool L-4432 to the transfer gear.

(b) Mount a steel ball with grease into the end of the transfer shaft.

(c) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(d) Using a dial indicator, measure transfer shaft end play.

(5) Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

(6) Use Tool L-4424 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

TRANSFER BEARING SHIM

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

9121-15

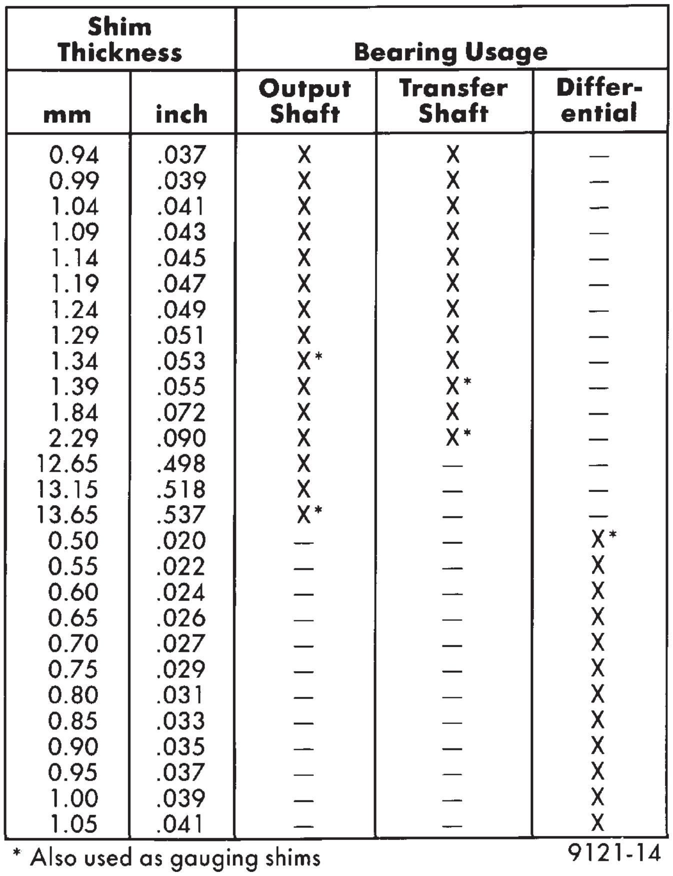
(7) Remove the two gauging shims and install the correct shim combination. Install the transfer gear and bearing assembly.

(8) 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).

(9) Measure bearing end play as outlined in Step (4). End play should be between .05 mm and .25 mm (.002 to .010 inch).

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.

BEARING SHIM



Shim Thickness		Bearing Usage		
mm	inch	Output Shaft	Transfer Shaft	Differ-ential
0.94	.037	X	X	—
0.99	.039	X	X	—
1.04	.041	X	X	—
1.09	.043	X	X	—
1.14	.045	X	X	—
1.19	.047	X	X	—
1.24	.049	X	X	—
1.29	.051	X	X	—
1.34	.053	X*	X	—
1.39	.055	X	X*	—
1.84	.072	X	X	—
2.29	.090	X	X*	—
12.65	.498	X	—	—
13.15	.518	X	—	—
13.65	.537	X*	—	—
0.50	.020	—	—	X*
0.55	.022	—	—	X
0.60	.024	—	—	X
0.65	.026	—	—	X
0.70	.027	—	—	X
0.75	.029	—	—	X
0.80	.031	—	—	X
0.85	.033	—	—	X
0.90	.035	—	—	X
0.95	.037	—	—	X
1.00	.039	—	—	X
1.05	.041	—	—	X

* Also used as gauging shims

9121-14

41TE FOUR SPEED AUTOMATIC TRANSAXLE

INDEX

GENERAL INFORMATION

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).

Refer to Figure 2 for an internal view of the transaxle assembly.

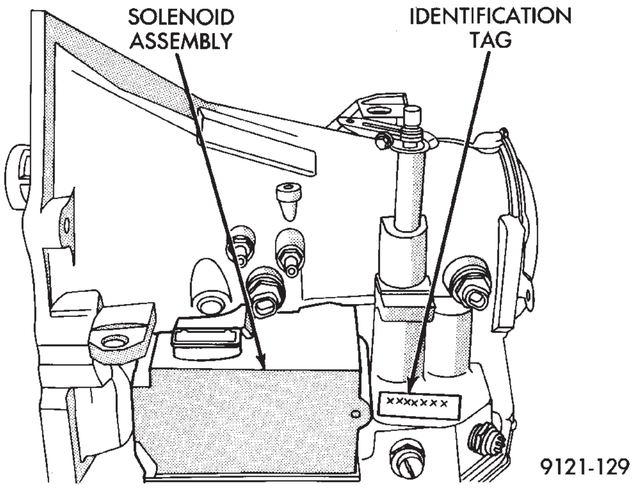


Fig. 1 Identification Tag Location

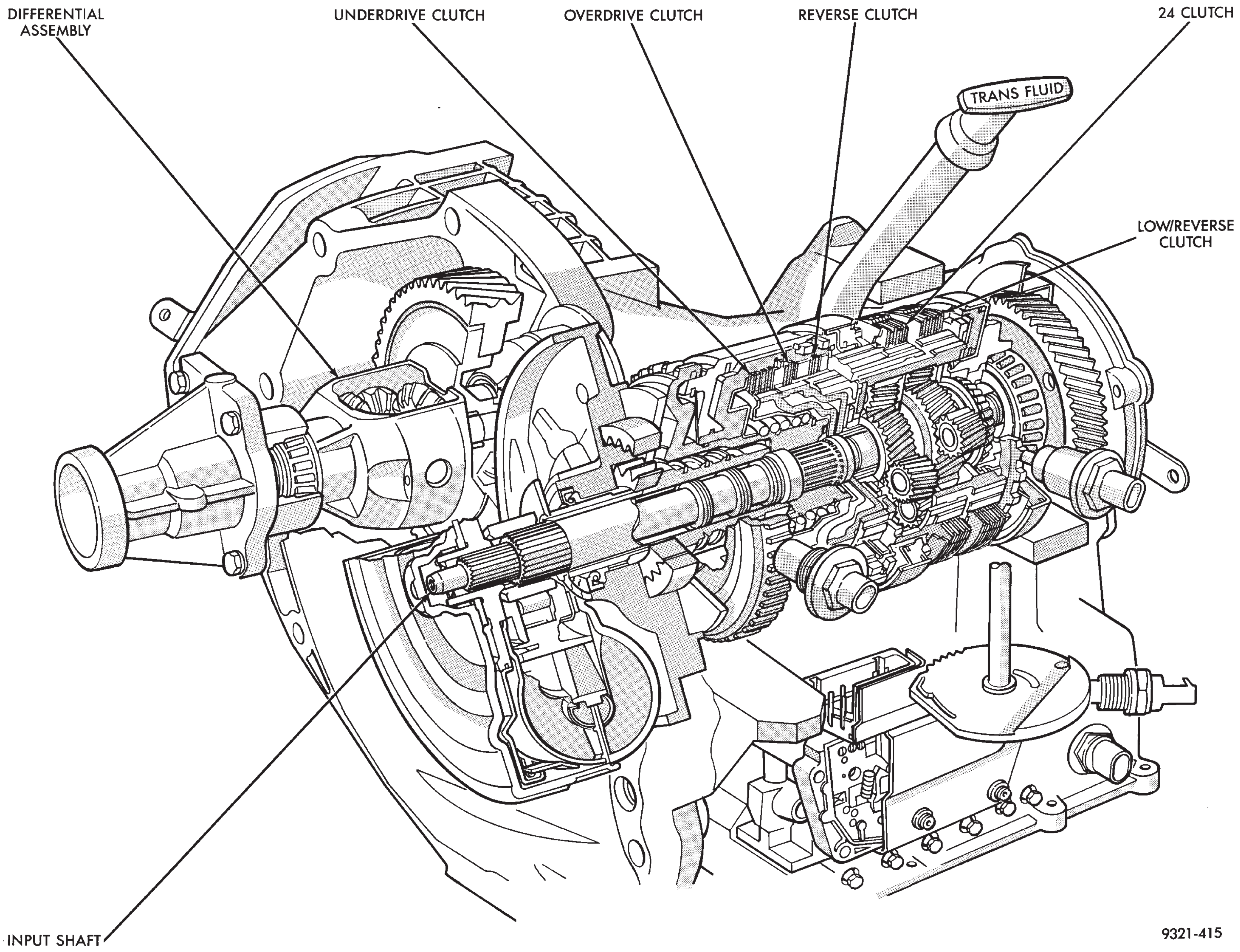


Fig. 2 Internal View of Transaxle

OPERATION

The 41TE transaxle provides forward ratios of 2.84, 1.57, 1.00, and 0.69 with torque converter clutch available in 2nd, direct, or overdrive gear; the Reverse ratio is 2.21. The shift lever is conventional with six positions: P, R, N, OD, 3, and L. When OD is selected the transaxle shifts normally 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 for improved 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.

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 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.

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 the manual shift lever select function, main line pressure regulation, and 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 special sequence of solenoid commands must be used to unlock and move the solenoid torque converter clutch 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

Since the solenoid valves perform virtually all control functions, these valves must be extremely durable and tolerant of normal dirt particles. For that reason hardened-steel poppet and ball valves are used. These are free from any close operating clearances, and the solenoids operate the valves directly without any intermediate element. Direct operation means that these units must have very high output so that they can 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 and two speed sensors to read input (torque converter turbine) and output (parking sprag) speeds. There is also a position switch 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 is located underhood in a potted, die-cast aluminum housing with a sealed, 60-way connector.

ELECTRONIC MODULATED CONVERTER CLUTCH (EMCC)

The EMCC enables the torque converter clutch to partially engage between 23 to 47 MPH before full engagement at about 50 MPH and beyond. This feature is on all vehicles equipped with the 41TE transaxle.

ADAPTIVE CONTROLS

These controls function by reading the input and output speeds over 140 times a second and respond-ing 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 back wards slightly to ensure that it does not have excess capacity; the apply element is filled until it begins to make the speed change to the higher gear; its apply pressure is then controlled to maintain the desired rate of speed change until the shift is complete. The key to providing excellent shift quality is precision; for example, as mentioned, 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 transmission control module learns the characteristics of the particular 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 example, altitude, temperature, engine output, etc.

For kickdown shifts, the control logic allows the releasing element to slip and 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 and 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 in creasing 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.

ON-BOARD DIAGNOSTICS

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.

41TE TRANSAXLE GENERAL DIAGNOSIS

CAUTION: Before attempting any repair on a 41TE four speed automatic transaxle, check for diagnostic trouble codes with the DRB II 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 exists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

DIAGNOSTIC TROUBLE CODE CHART "A"

Possible Cause	21 OD clutch—pressure too low	22 2/4 clutch—pressure too low	23 2/4 clutch and OD clutch—pressures too low	24 L/R clutch—pressure too low	25 L/R clutch and OD clutches—pressures too low	26 L/R clutch and 2/4 clutches—pressures too low	27 OD, 2/4, and L/R clutches—pressures too low	31 OD clutch pressure switch response failure	32 2/4 pressure switch response failure	33 2/4 and O/D clutch pressure response failures	37 Solenoid switch valve stuck in the LO position	38 Partial torque converter clutch out of range	47 Solenoid switch valve stuck in the LR position	50 Speed ratio default in reverse	51 Speed ratio default in 1st	52 Speed ratio default in 2nd	53 Speed ratio default in 3rd	54 Speed ratio default in 4th	60 Inadequate LR element volume	61 Inadequate 2/4 element volume	62 Inadequate OD element volume
Low fluid level	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X			
Aeroled fluid (high fluid level)	X	X	X	X	X	X	X	X	X	X											
Worn or damaged reaction shaft support seal rings	X													X	X	X	X	X			
Worn or damaged input shaft seal rings												X		X	X	X	X	X			
Worn pump	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X			
Damaged or failed clutches:																					
UD clutch															X	X	X				
OD clutch	X							X									X	X			X
Reverse clutch														X							
2/4 clutch		X							X							X		X		X	
L/R clutch				X										X	X				X		
Damaged clutch seals	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X
Worn or damaged accumulator seal rings	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X
Plugged filter	X	X	X	X	X	X	X			X				X	X						
Stuck/sticky valves	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X			
Solenoid switch valve											X		X								
Torque converter clutch switch valve												X									
Torque converter control valve												X									
Regulator valve	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X
Valve body leakage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Pressures too high	X	X	X	X	X	X	X					X		X	X	X	X	X			
Internal solenoid leak	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Torque converter clutch failure	X	X	X	X	X	X	X	X				X									
Faulty cooling system	X	X	X	X	X	X	X							X	X	X	X	X			
Planetary gear sets broken or seized														X	X	X	X	X	X	X	X

NOTE:
Code 36 is not stored alone. It is stored if a speed error (codes 50 through 58) is detected immediately after a shift. Look at the possible causes associated with the speed error code.

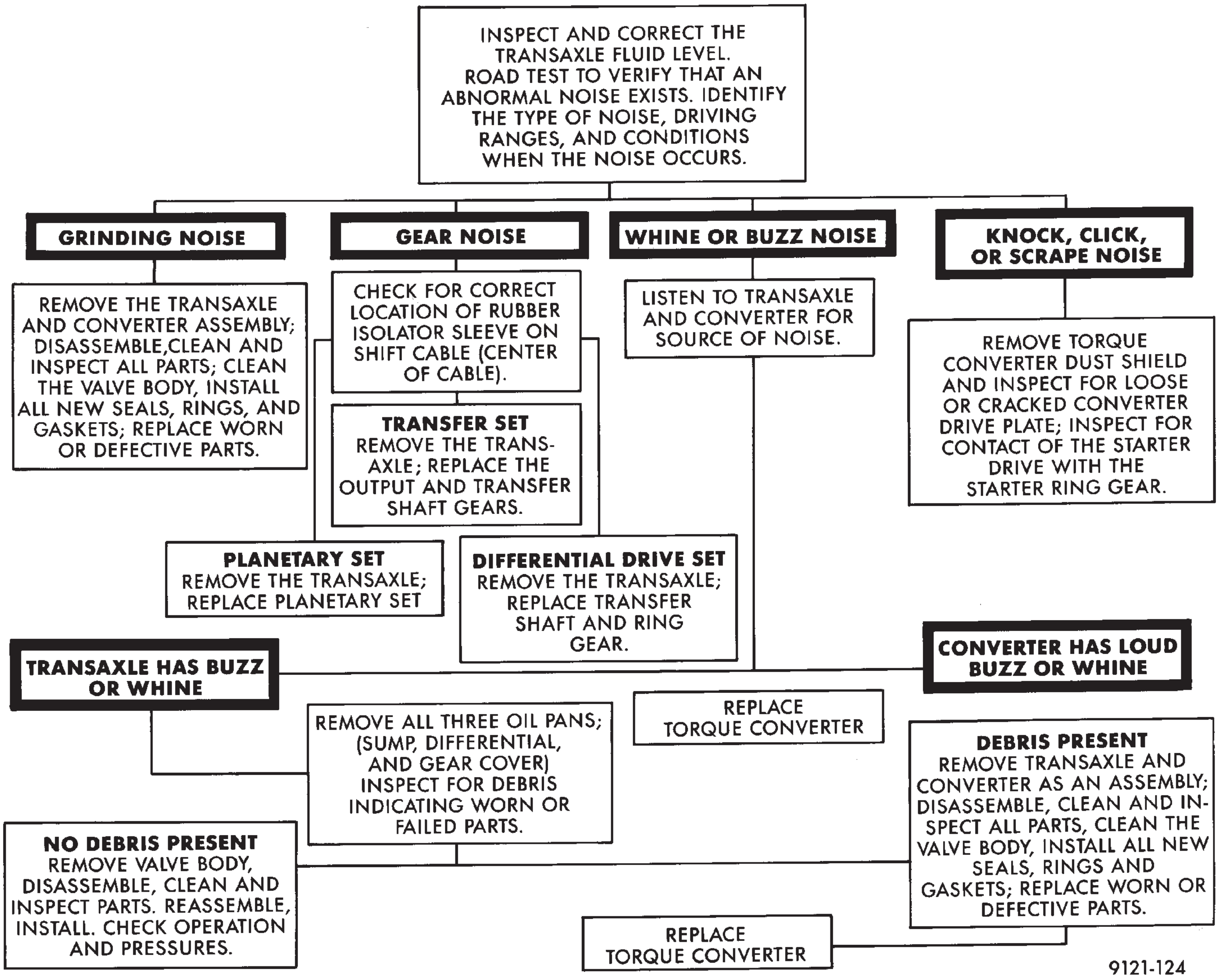
9321-232

DIAGNOSIS CHART "B"

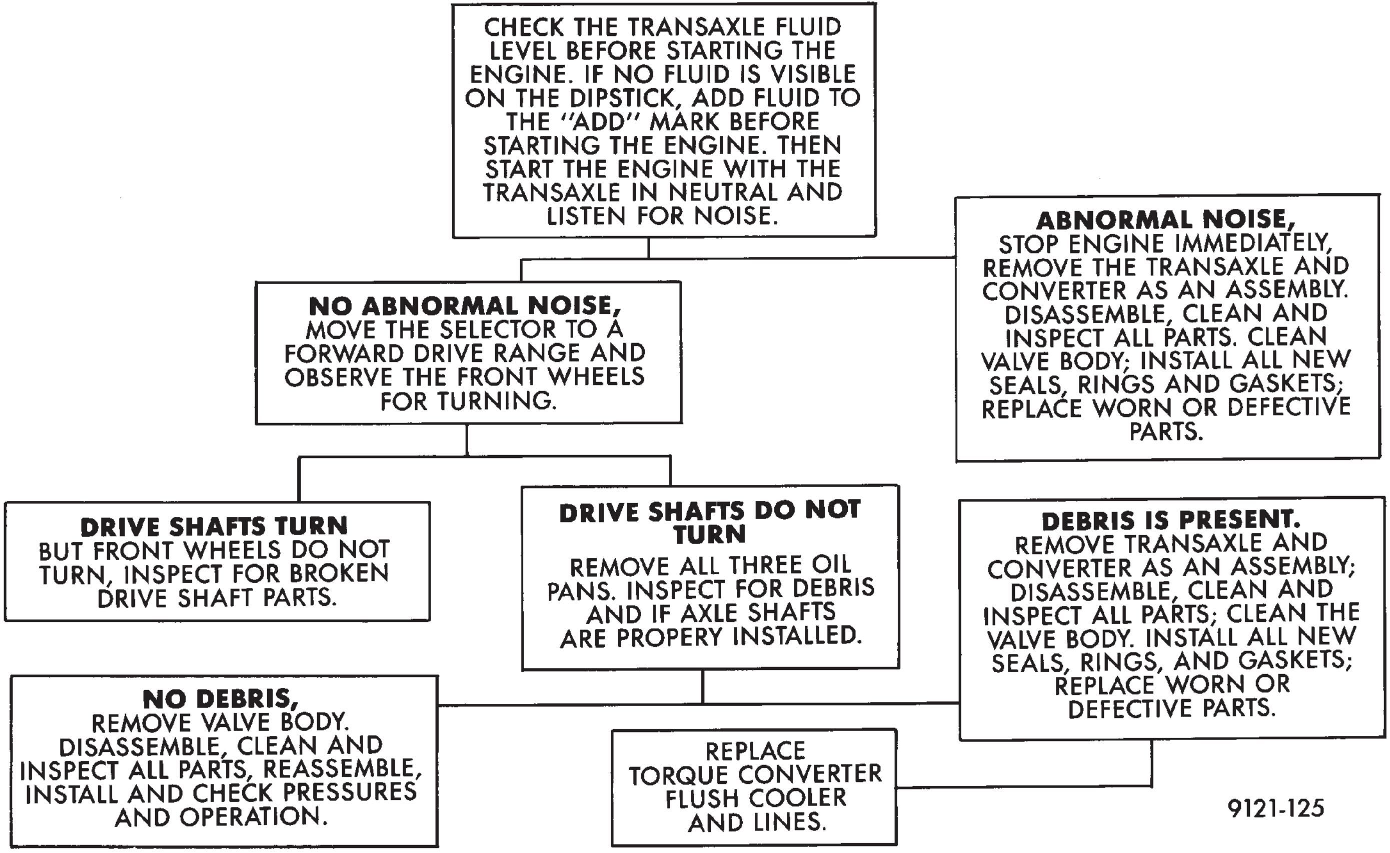
POSSIBLE CAUSE \ CONDITION	HARSH ENGAGEMENT FROM NEUTRAL TO D	R	DELAYED ENGAGEMENT FROM NEUTRAL TO D	R	POOR SHIFT QUALITY	SHIFTS ERRATIC	DRIVES IN NEUTRAL	DRAGS OR LOCKS	GRATING, SCRAPING, GROWLING NOISE	KNOCKING, NOISE	BUZZING NOISE	BUZZING NOISE DURING SHIFTS ONLY	HARD TO FILL OIL BLOWS OUT FILLER TUBE	TRANSAXLE OVERHEATS	HARSH UPSHIFT	NO UPSHIFT INTO OVERDRIVE	NO TORQUE CONVERTER CLUTCH	HARSH DOWNSHIFTS	HIGH SHIFT EFFORTS	HARSH TORQUE CONVERTER CLUTCH
Engine Performance	X	X				X									X			X		
Worn or faulty clutch(es)	X	X	X	X		X	X	X							X	X		X		
— Underdrive clutch	X		X			X	X	X										X		
— Overdrive clutch						X	X	X							X	X				
— Reverse clutch		X		X			X	X												
— 2/4 clutch						X		X							X			X		
— Low/reverse clutch	X	X				X		X										X		
Clutch(es) dragging							X													
Insufficient clutch plate clearance							X							X						
Damaged clutch seals			X	X														X		
Worn or damaged accumulator seal ring(s)	X	X	X	X														X		
Faulty cooling system														X						
Engine coolant temp. too low																X	X			
Incorrect gearshift control linkage adjustment			X	X		X	X							X						
Shift linkage damaged																			X	
Chipped or damaged gear teeth								X	X											
Planetary gear sets broken or seized								X	X											
Bearings worn or damaged								X	X											
Driveshaft(s) bushing(s) worn or damaged									X											
Worn or broken reaction shaft support seal rings			X	X	X	X												X		
Worn or damaged input shaft seal rings			X	X													X			
Valve body malfunction or leakage	X	X	X	X	X	X	X				X						X	X	X	
Hydraulic pressures too low			X	X	X	X								X	X		X			
Hydraulic pressures too high	X	X													X			X		
Faulty oil pump			X	X		X								X			X			
Oil filter clogged			X	X	X	X							X							
Low fluid level			X	X	X	X					X			X			X	X		
High fluid level													X	X						
Aerated fluid			X	X	X	X					X		X	X			X	X		
Engine idle speed too low			X	X																
Engine idle speed too high	X	X												X				X		
Normal solenoid operation												X								
Solenoid sound cover loose												X								
Sticking torque converter clutch position																				X
Torque Converter Failure	X													X			X			

9321-233

DIAGNOSIS GUIDE-ABNORMAL NOISE



DIAGNOSIS GUIDE-VEHICLE WILL NOT MOVE



CHECK THE TRANSAXLE FLUID LEVEL BEFORE STARTING THE ENGINE. IF NO FLUID IS VISIBLE ON THE DIPSTICK, ADD FLUID TO THE "ADD" MARK BEFORE STARTING THE ENGINE. THEN START THE ENGINE WITH THE TRANSAXLE IN NEUTRAL AND LISTEN FOR NOISE.

ABNORMAL NOISE, STOP ENGINE IMMEDIATELY, REMOVE THE TRANSAXLE AND CONVERTER AS AN ASSEMBLY. DISASSEMBLE, CLEAN AND INSPECT ALL PARTS. CLEAN VALVE BODY; INSTALL ALL NEW SEALS, RINGS AND GASKETS; REPLACE WORN OR DEFECTIVE PARTS.

NO ABNORMAL NOISE, MOVE THE SELECTOR TO A FORWARD DRIVE RANGE AND OBSERVE THE FRONT WHEELS FOR TURNING.

DRIVE SHAFTS TURN BUT FRONT WHEELS DO NOT TURN, INSPECT FOR BROKEN DRIVE SHAFT PARTS.

DRIVE SHAFTS DO NOT TURN

REMOVE ALL THREE OIL PANS. INSPECT FOR DEBRIS AND IF AXLE SHAFTS ARE PROPERY INSTALLED.

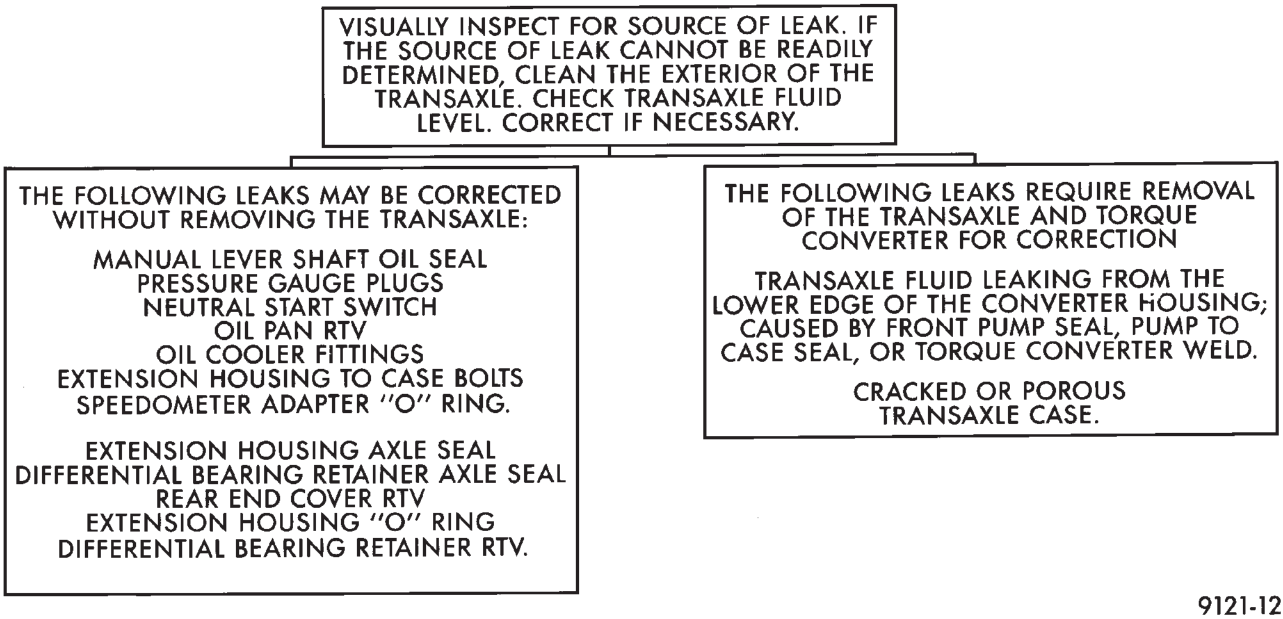
DEBRIS IS PRESENT. REMOVE TRANSAXLE AND CONVERTER AS AN ASSEMBLY; DISASSEMBLE, CLEAN AND INSPECT ALL PARTS; CLEAN THE VALVE BODY. INSTALL ALL NEW SEALS, RINGS, AND GASKETS; REPLACE WORN OR DEFECTIVE PARTS.

NO DEBRIS, REMOVE VALVE BODY. DISASSEMBLE, CLEAN AND INSPECT ALL PARTS, REASSEMBLE, INSTALL AND CHECK PRESSURES AND OPERATION.

REPLACE TORQUE CONVERTER FLUSH COOLER AND LINES.

9121-125

DIAGNOSIS GUIDE—FLUID LEAKS



VISUALLY INSPECT FOR SOURCE OF LEAK. IF THE SOURCE OF LEAK CANNOT BE READILY DETERMINED, CLEAN THE EXTERIOR OF THE TRANSAXLE. CHECK TRANSAXLE FLUID LEVEL. CORRECT IF NECESSARY.

THE FOLLOWING LEAKS MAY BE CORRECTED WITHOUT REMOVING THE TRANSAXLE:

MANUAL LEVER SHAFT OIL SEAL
PRESSURE GAUGE PLUGS
NEUTRAL START SWITCH
OIL PAN RTV
OIL COOLER FITTINGS
EXTENSION HOUSING TO CASE BOLTS
SPEEDOMETER ADAPTER "O" RING.

EXTENSION HOUSING AXLE SEAL
DIFFERENTIAL BEARING RETAINER AXLE SEAL
REAR END COVER RTV
EXTENSION HOUSING "O" RING
DIFFERENTIAL BEARING RETAINER RTV.

THE FOLLOWING LEAKS REQUIRE REMOVAL OF THE TRANSAXLE AND TORQUE CONVERTER FOR CORRECTION

TRANSAXLE FLUID LEAKING FROM THE LOWER EDGE OF THE CONVERTER HOUSING; CAUSED BY FRONT PUMP SEAL, PUMP TO CASE SEAL, OR TORQUE CONVERTER WELD.

CRACKED OR POROUS TRANSAXLE CASE.

9121-126

FLUID LEVEL AND CONDITION

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 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 over heating, fluid oxidation, and varnishing, which 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 (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**. DEXRON II can be used only if the recommended fluid is not available. If more than a small amount of DEXRON II is used shudder or shift quality problems may result. 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 automatic transmission 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.

FLUID AND FILTER CHANGES

When the factory fill fluid is changed, only fluids labeled MOPAR® ATF PLUS (Automatic Transmission fluid) Type 7176 should be used. A filter change should be made at the time of the oil change. Also the magnet (on the inside of the oil pan) should be cleaned with a clean, dry cloth.

If the transaxle is disassembled for any reason, the fluid and filter should be changed.

FLUID DRAIN AND REFILL

(1) Raise vehicle on a hoist (See Lubrication, Group 0). 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® Adhesive Sealant. Tighten oil pan bolts to 19 N•m (165 in. lbs.).

(5) Pour four quarts of MOPAR® ATF PLUS (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.

Recheck fluid level after transaxle is at normal operating temperature. The level should be in the HOT region (Fig. 3).

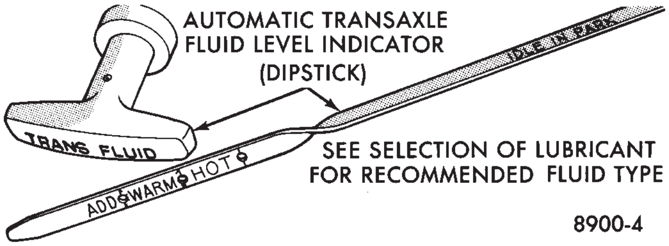


Fig. 3 Oil Level Indicator

To prevent dirt from entering transaxle, make certain that dipstick is seated into the dipstick fill tube (Fig. 4).

ROAD TEST

Prior to performing a road test, be certain that the fluid level and condition, and control cable adjustment have been checked and approved.

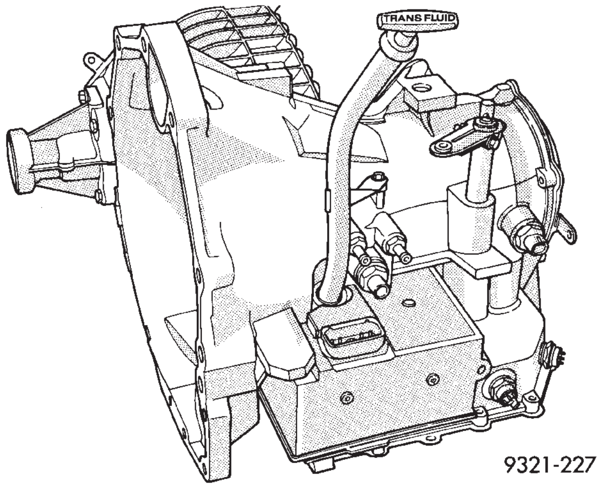


Fig. 4 Oil Level Indicator Location

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 highway speeds, but has poor acceleration, the torque converter stator overrunning clutch may be slipping. If through-gear acceleration is normal, but high throttle opening is required to maintain highway speeds, the torque converter stator 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, but the actual cause of the malfunction usually can not be decided. 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 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.

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 (Figure 1).

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.

ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER

Shift Lever Position	Start Safety	Park Sprag	CLUTCHES				
			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.

9221-93

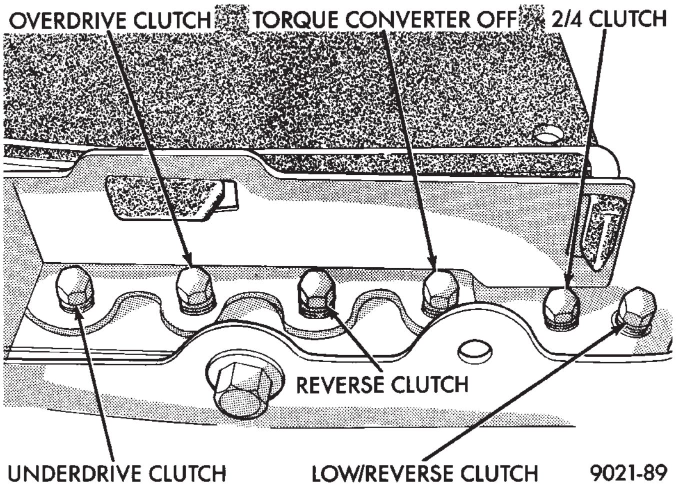


Fig. 1 Pressure Taps

(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

(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) Underdrive clutch pressure should read 110 to 145 psi.

(5) This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

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 clutch tap.

(2) Move selector lever to the reverse position.

(3) Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.

(4) Reverse 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 (6) of Test Three, a worn reaction shaft seal ring is indicated.

CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure (Figs. 2 and 3). The clutches may be tested by applying air pressure to their respective passages after the valve body has been removed and Tool 6056 has been installed. To make air pressure tests, proceed as follows:

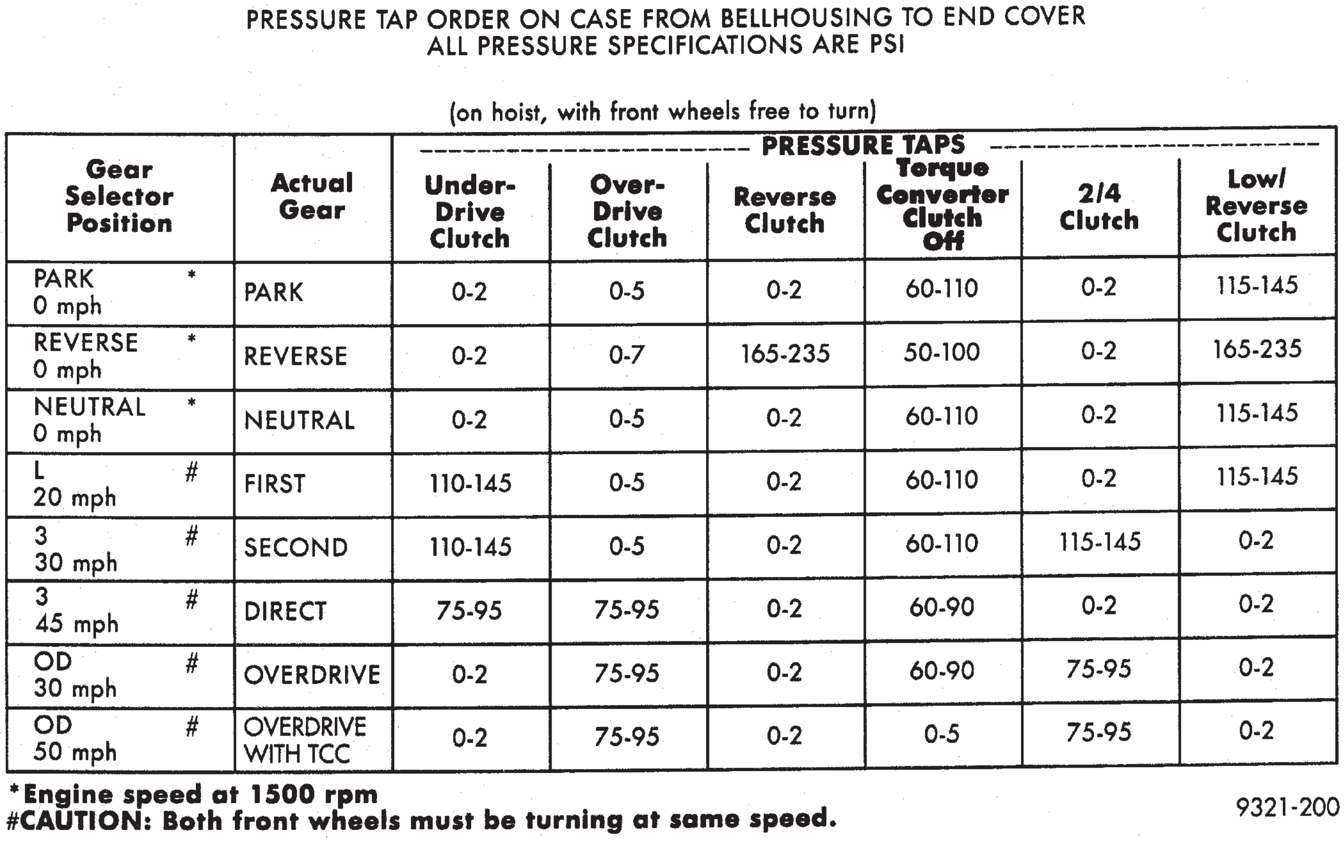
The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

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

PRESSURE CHECK SPECIFICATIONS



PRESSURE TAP ORDER ON CASE FROM BELLHOUSING TO END COVER
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

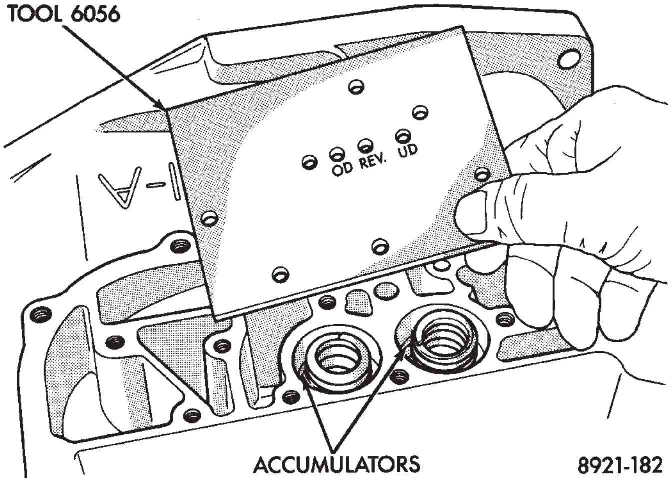


Fig. 2 Air Pressure Test Plate

forward. The piston should return to its starting position when the air pressure is removed.

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.

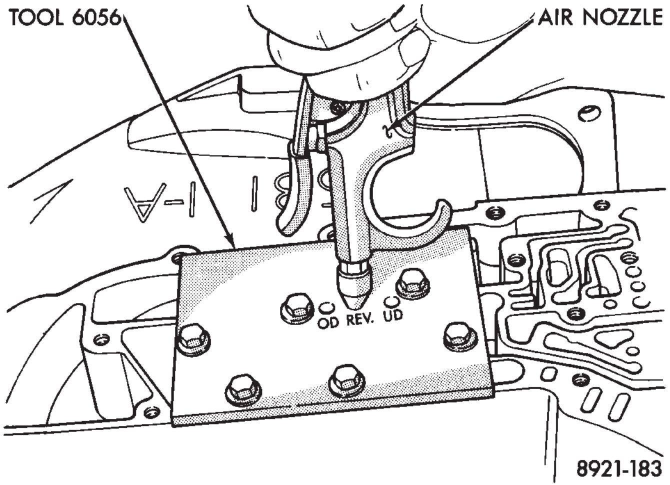


Fig. 3 Testing Reverse Clutch

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 and 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.

Since 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 dyed red and, therefore, can be distinguished from engine oil.

(2) Prior to removing the transaxle, perform the following checks:

When leakage is determined to originate from the transaxle, check fluid level prior to removal of the transaxle and torque converter.

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.

After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle to determine if it is the torque converter or transaxle that is leaking.

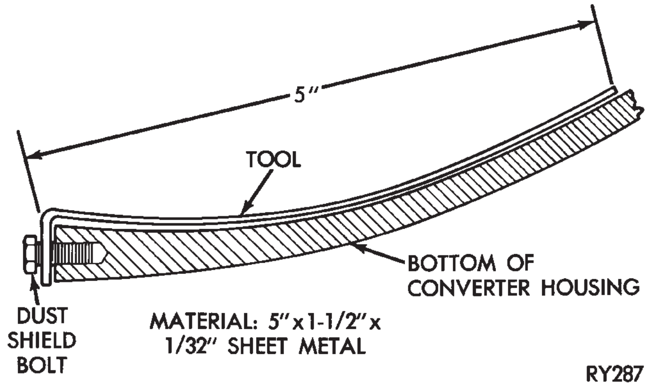


Fig. 4 Leak Locating Test Probe Tool

LEAKAGE TEST PROBE

(1) Remove torque converter housing dust shield.

(2) Clean the inside of torque converter housing (lower area) as dry as possible. A solvent spray followed by compressed air drying is preferable.

(3) Fabricate and fasten test probe (Fig. 4) securely to convenient dust shield bolt hole. Make certain torque converter is cleared by test probe. Tool must be clean and dry.

(4) Run engine at approximately 2,500 rpm with transaxle in neutral, for about 2 minutes. Transaxle must be at operating temperature.

(5) Stop engine and carefully remove tool.

(6) If upper surface of test probe is dry, there is no torque converter leak. A path of fluid across probe indicates a torque converter leak. Oil leaking under the probe is coming from the transaxle torque converter area.

(7) Remove transaxle and torque converter assembly from vehicle for further investigation. The fluid should be drained from the transaxle. Re install oil pan (with MOPAR® Adhesive Sealant) at specified torque.

Possible sources of transaxle torque converter area fluid leakage are:

(1) Torque converter hub seal.

- Seal lip cut, check torque converter hub finish.
- Bushing moved and/or worn.
- Oil return hole in pump housing plugged or omitted.
- Seal worn out (high-mileage vehicles).

(2) Fluid leakage at the outside diameter from pump housing O-ring.

(3) Fluid leakage at the front pump to case bolts. Check condition of washers on bolts and use new bolts, if necessary.

(4) Fluid leakage due to case or front pump housing porosity.

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the out side (peripheral) weld.
- Torque converter hub weld.

Hub weld is inside and not visible. Do not attempt to repair. Replace torque converter.

If the torque converter must be replaced, refer to Torque Converter Clutch Break-in Procedure in this section. This procedure will reset the transmission control module break-in status. Failure to perform this procedure may cause transaxle shutter.

AIR PRESSURE TEST OF TRANSAXLE

Fabricate equipment needed for test as shown in Figures 5 and 6.

The transaxle should be prepared for pressure test as follows after removal of the torque converter:

(1) Plug dipstick tube and plug oil cooler line fitting. Remove vent from manual shaft and in stall a 1/8 inch pipe plug.

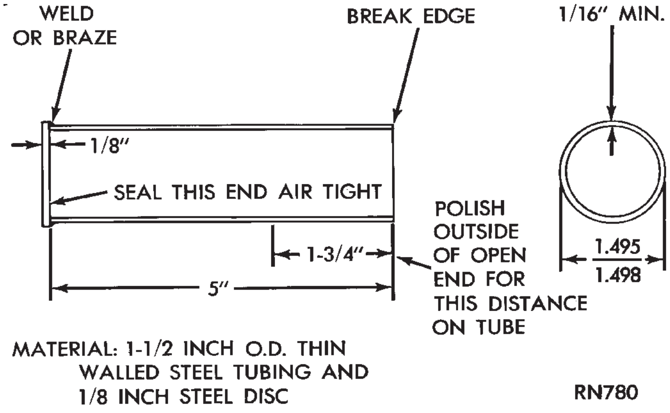


Fig. 5 Torque Converter Hub Seal Cup

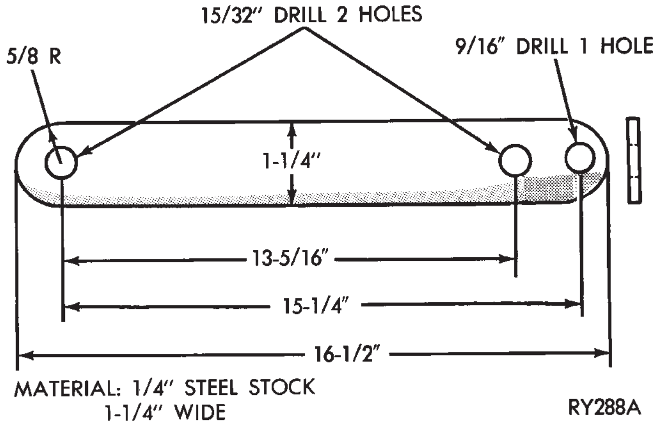


Fig. 6 Hub Seal Cup Retaining Strap

CAUTION: Prevent manual shaft rotation during installation and removal.

(2) With rotary motion, install converter hub seal cup over input shaft. It must go through the converter hub seal until the cup bottoms against the pump gear lugs. Secure with cup retainer strap using starter upper hole and opposite bracket hole.

(3) Attach and clamp hose from nozzle of Tool C-4080 to the upper cooler line fitting position in case.

CAUTION: Do not, under any circumstances, pressurize a transaxle to more than 10 psi.

(4) Pressurize the transaxle using Tool C-4080 until the pressure gauge reads 8 psi. Position transaxle so that pump housing and case front may be covered with soapy solution of water. Leaks are sometimes caused by porosity in the case or pump housing.

If a leak source is located, that part and all associated seals, O-rings, and gaskets should be replaced with new parts.

GEARSHIFT LINKAGE ADJUSTMENT

Normal operation of the transmission range switch (PRNDL) and park/neutral position switch provides a quick check to confirm proper manual linkage adjustment.

Move the selector level slowly upward until it clicks into the "P" Park notch in the selector gate. If the starter will operate the "P" position is correct.

After checking "P" position, move selector toward "N" Neutral position until lever drops in the "N" stop. If the starter will also operate at this point the gearshift linkage is properly adjusted.

CAUTION:When it is necessary to disassemble linkage cable from levers, which use plastic grommets as retainers, the grommets should be replaced with new grommets. Use a prying tool to force rod from grommet in lever, then cut away old grommet. Use pliers to snap new grommet into lever and rod into grommet.

(1) Set parking brake.

(2) Place gearshift lever in **P** (PARK) position.

(3) Loosen clamp bolt on gearshift cable bracket.

(4) Column shift: Insure that preload adjustment spring engages fork on transaxle bracket.

(5) Pull the shift lever by hand to the front detent position (PARK) and tighten lock screw to 11 N●m (100 in. lbs.). Gearshift linkage should now be properly adjusted.

(6) Check adjustment as follows:

(a) Detent position for neutral and drive should be within limits of hand lever gate stops.

(b) Key start must occur only when shift lever is in park or neutral positions.

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.

COOLERS AND TUBES REVERSE FLUSHING

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed and the cooler bypass valve in the transaxle must be replaced. 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.

CAUTION: If the vehicle is equipped with two oil coolers (one in the radiator tank, one in front of the radiator) they must be flushed separately. Do not attempt to flush both coolers at one time.

(1) Disconnect the cooler lines at the transmission.

(2) Using a hand suction gun filled with mineral spirits, reverse flush the cooler. Force mineral spirits into the **From Cooler** line of the cooler (Fig. 7) and catch the exiting spirits from the **To Cooler** line. Observe for the presence of debris in the exiting fluid. Continue until fluid exiting is clear and free from debris.

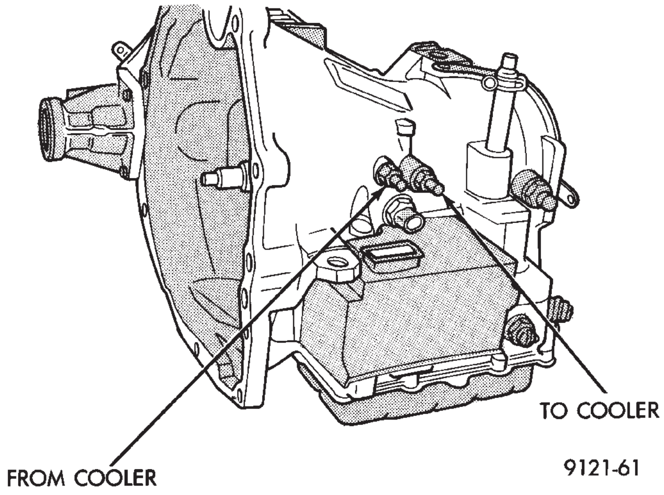


Fig. 7 Cooler Line Location

(3) Using compressed air in intermittent spurts, blow any remaining mineral spirits from the cooler, again in the reverse direction.

(4) To remove any remaining mineral spirits from the cooler, one (1) quart of automatic transmission fluid should be pumped through the cooler before reconnecting.

(5) If at any stage of the cleaning process, the cooler does not freely pass fluid, the cooler must be replaced.

OIL COOLER FLOW CHECK

After the new or repaired transmission has been installed, filled to the proper level with automatic transmission fluid. The flow 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.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If the fluid flow is intermittent or it takes more than 20 seconds to collect one quart of automatic transmission fluid, the cooler should be replaced.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(4) If flow is found to be within acceptable limits, reconnect the cooler line. Then fill transmission to the proper level, using the approved type of automatic transmission fluid.

TRANSAXLE REMOVAL AND INSTALLATION

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).

(1) 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.

(2) Disconnect negative battery cable.

(3) Disconnect transaxle shift linkage.

(4) Install engine support fixture and support engine (Fig.1).

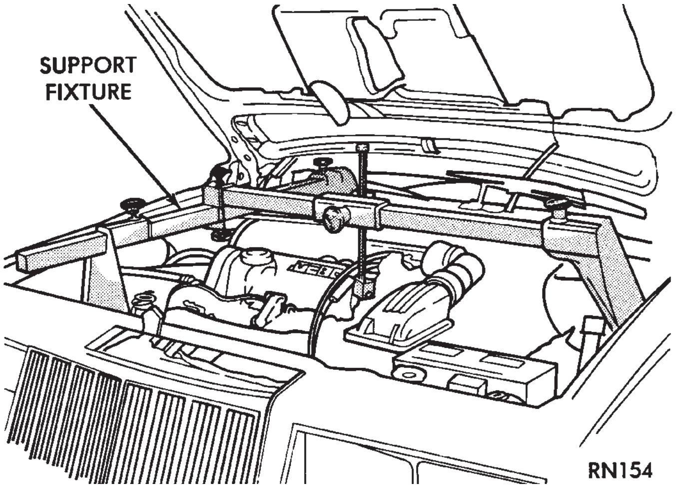


Fig. 1 Engine Support Fixture (Typical)

(5) Remove upper bell housing upper bolts.

(6) Raise vehicle. Remove front wheels. Refer to Suspension, Group 2 to remove wheel hub nut and both drive shafts.

(7) Remove left plastic splash to gain access to the transaxle (Fig. 2).

(8) Remove torque converter dust shield to gain access to torque converter bolts (Fig. 3).

(9) Mark torque converter and drive plate with chalk, for reassembly. Remove torque converter mounting bolts.

(10) Disconnect electrical connectors at transmission range switch and Park/Neutral Position Switch (Fig. 4).

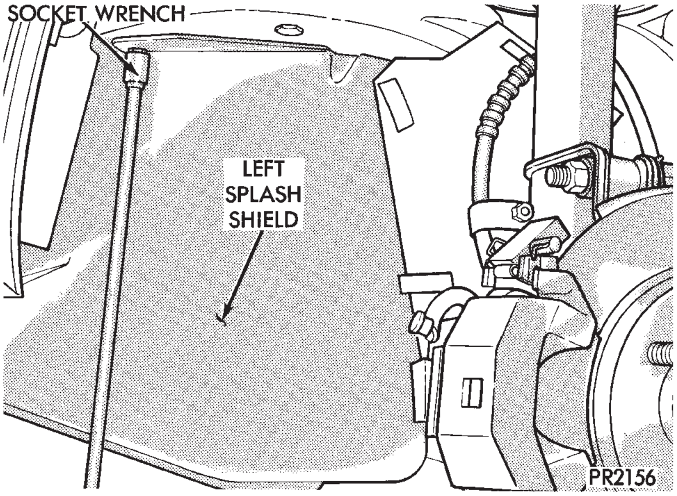


Fig. 2 Remove Left Splash Shield

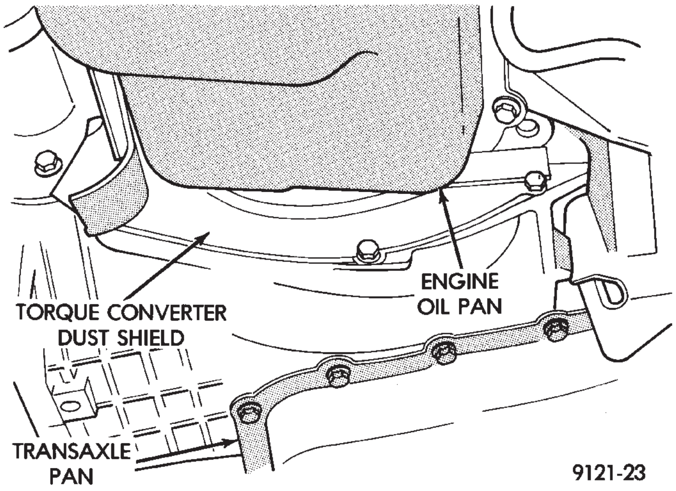


Fig. 3 Remove Torque Converter Dust Shield

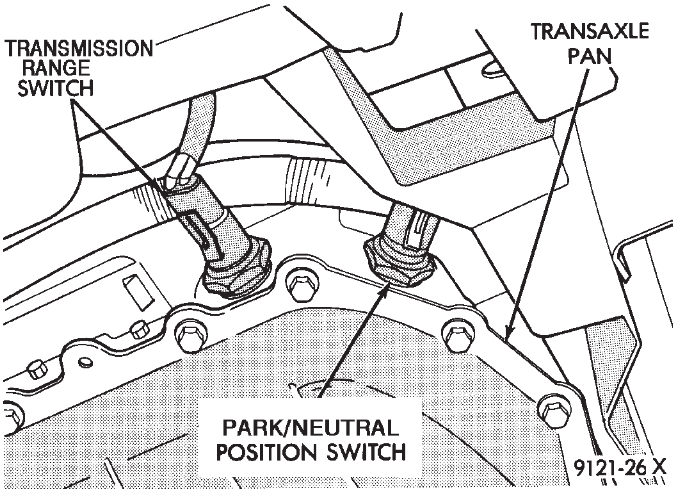


Fig. 4 Disconnect transmission range switch and Park/Neutral Position Switch

(11) Remove front engine mount insulator and bracket (Fig. 5).

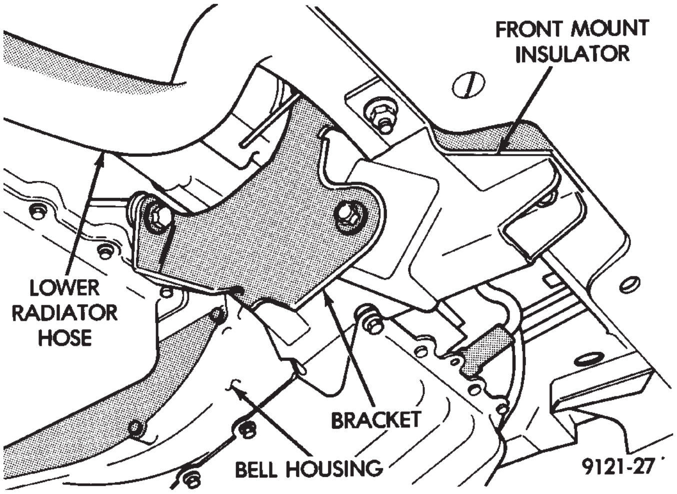


Fig. 5 Remove Front Engine Mount

(12) On vehicles equipped with D.I.S. ignition system, remove crankshaft position sensor from bell housing. For installation procedure refer to section 8D of this service manual.

CAUTION: Failure to remove the crankshaft position sensor from the bell housing could damage the sensor or torque converter drive plate during transmission removal or installation.

(13) Remove starter bolts and set starter aside. Do not allow the starter to hang from battery cable (Fig. 6).

(14) Position transmission jack securely under transaxle (Fig. 7).

(15) With transmission jack in position, remove the left transmission mount (Fig. 8).

(17) Carefully lower the transaxle assembly from vehicle (Fig. 9).

When installing transaxle, reverse the above procedure.

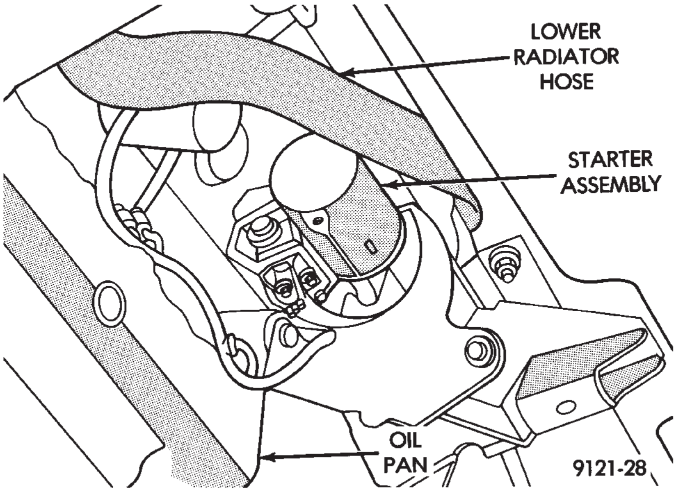


Fig. 6 Remove Starter Assembly

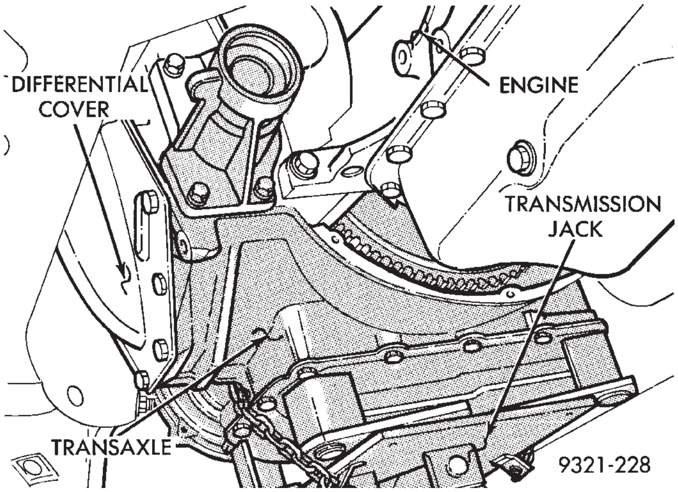


Fig. 7 Position Transmission Jack

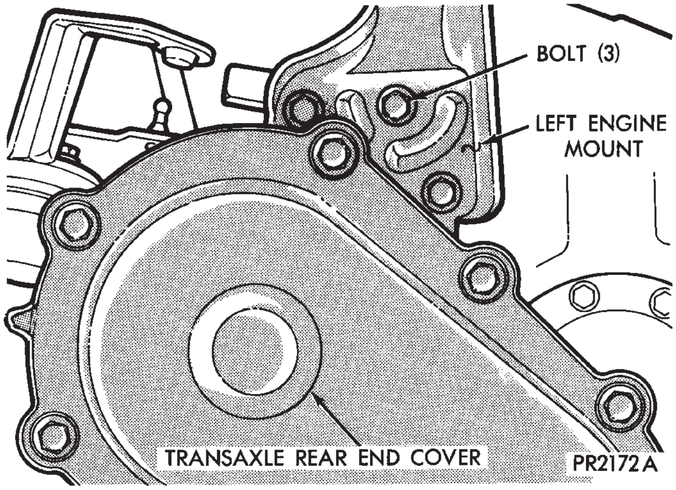


Fig. 8 Remove Left Transmission Mount

If the torque converter has been replaced, refer to Torque Converter Clutch Break-in Procedure in this section. This procedure will reset the transmission control module break-in status. Failure to perform this procedure may cause transaxle shutter.

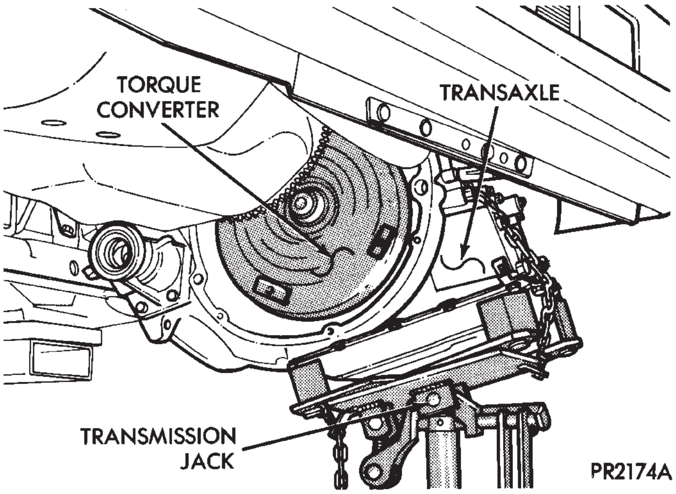


Fig. 9 Lower Transaxle Assembly

Check and/or adjust gear shift cable.

Refill transaxle with MOPAR® ATF PLUS (Automatic Transmission Fluid) Type 7176.

SOLENOID ASSEMBLY-REPLACE

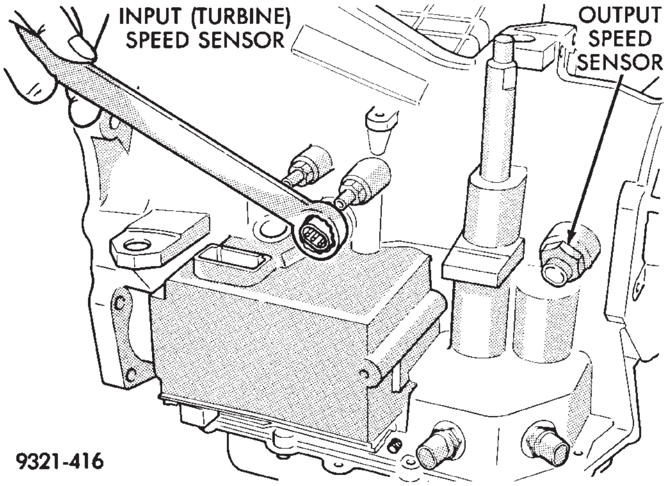


Fig. 1 Input Speed Sensor

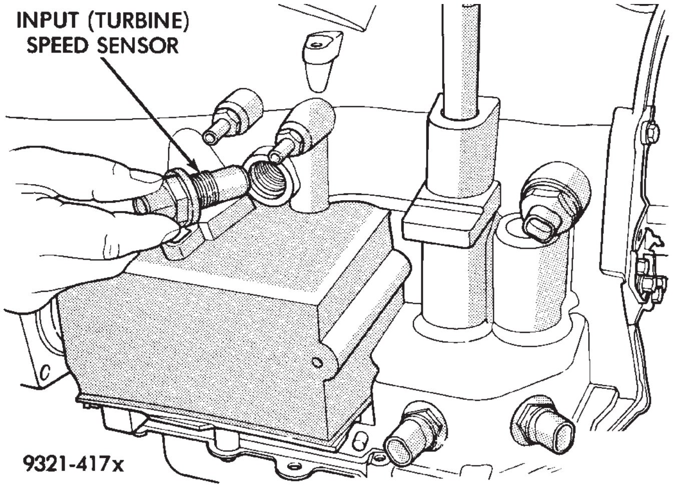


Fig. 2 Input Speed Sensor Removed

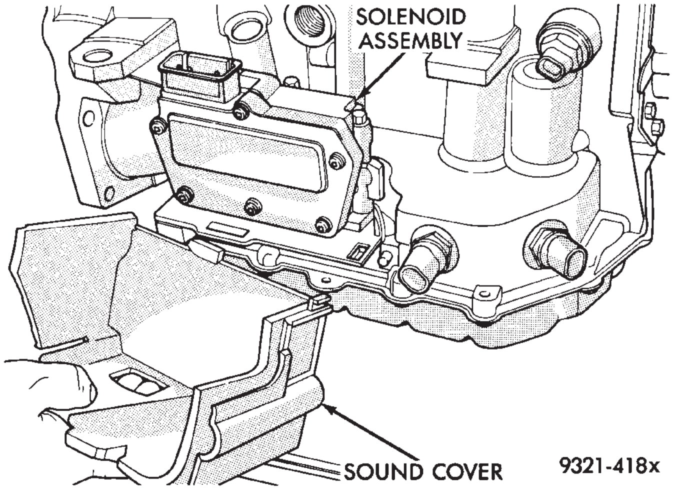


Fig. 3 Sound Cover

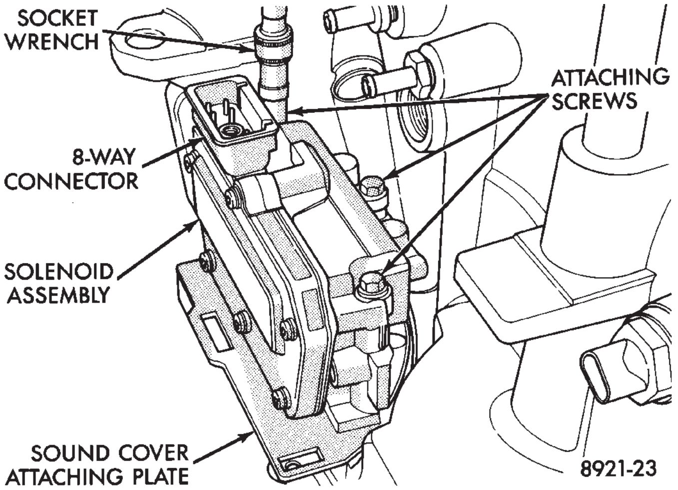


Fig. 4 Attaching Screws

TRANSMISSION RANGE SWITCH

The transmission range switch is the white switch located on the front of the transaxle, just above the transaxle oil pan.

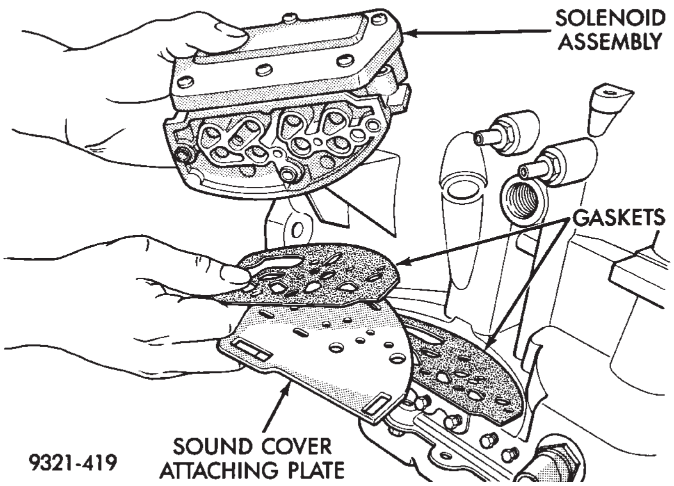


Fig. 5 Solenoid Assembly

CAUTION: Switch seal washer must be seated properly before tightening switch. Failure to do so may result in leakage of transmission fluid (Fig. 6).

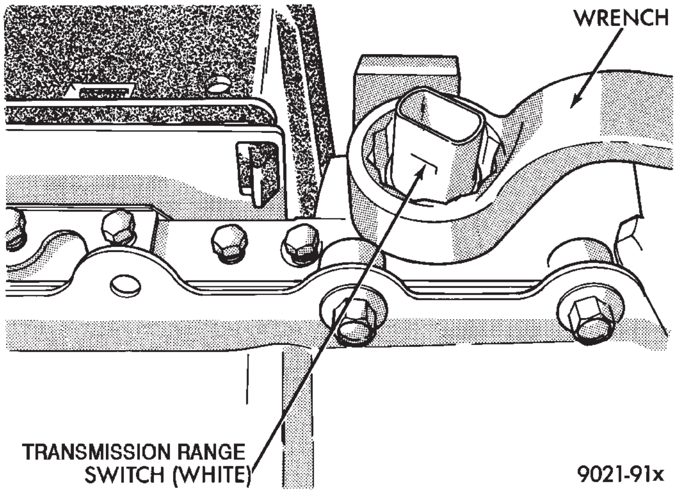


Fig. 6 Transmission Range Switch

PARK/NEUTRAL POSITION SWITCH

The Park/Neutral Position Switch is the black switch located to the right of the transmission range switch.

CAUTION: Switch seal washer must be seated properly before tightening switch. Failure to do so may result in leakage of transmission fluid (Fig. 7).

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 right of the manual shift lever.

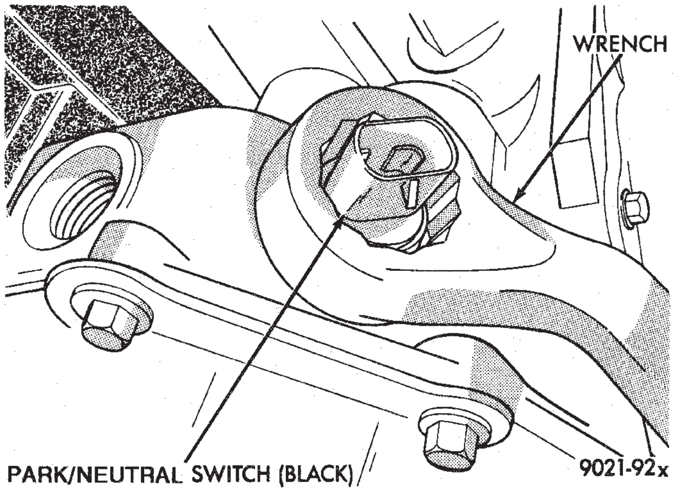


Fig. 7 Park/Neutral Position Switch

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 left of the manual shift lever (Fig. 8).

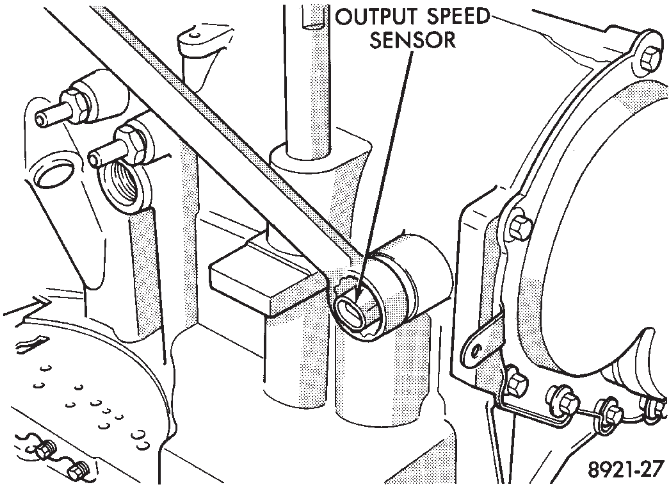


Fig. 8 Output Speed Sensor

TRANSMISSION CONTROL MODULE

When replacing a transmission control module, do not interchange transmission control modules with previous year transmission control modules. If a same year transmission control module is being used from a different vehicle, the following procedures must be performed before operating the transaxle:

- Quick Learn Procedure
- Torque Converter Clutch Break-in Procedure
- Electronic Pinion Procedure

The transmission control module is located on the passenger side of the engine compartment. It is held in place by four mounting screws.

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 Procedure". This procedure will reprogram settings within the transmission control module to compensate for different tire sizes and final drive ratios.
- "Converter Clutch Break-In Procedure" This procedure will reset the torque converter clutch status.

REMOVAL AND INSTALLATION

(1) Loosen 60 way retaining screw, located in the center of the 60 way connector. Then disconnect the 60 way connector on transmission control module.

(2) Remove transmission control module mounting screws and lift module from vehicle.

To install, reverse removal procedure.

TRANSAXLE QUICK LEARN PROCEDURE

The quick learn procedure requires the use of the DRB II scan tool and the 1993 DRB II scan tool cartridge.

This program allows the electronic transaxle system to recelebrate itself to 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

(1) Plug the DRB II scan tool into the blue CCD Buss connector. The connector is located under the instrument panel on the drivers side of the vehicle.

(2) Insert the 1993 DRB II scan tool cartridge into the DRB II scan tool.

(3) The red and green lights on the DRB II scan tool will light up and then begin flashing. Wait until the lights stop flashing before continuing with this procedure.

(4) Press the number 4 key on the DRB II scan tool key pad. Item number 4 will not appear on the DRB II scan tool screen unless you scroll down. It is not necessary to scroll down to be able to choose item 4.

(5) Press the number 2 on the DRB II scan tool key pad (Transmission).

(6) Press the number 1 on the DRB II scan tool key pad. Wait for the DRB II scan tool to perform the following three tests before continuing (These tests are done automatically by the DRB II scan tool).

- Buss Test
- Initialize
- Controller Part Number

(7) Press the number 5 on the DRB II scan tool key pad (Adjustments).

(8) Press the number 3 on the DRB II scan tool key pad (Quick Learn). Then follow the instructions on the DRB II scan tool screen.

PINION FACTOR PROCEDURE

The vehicle speed readings for the speedometer are taken from the output speed sensor. Because of different tire sizes and final drive ratios, the transmission control module must be calibrated to reflect the different combinations of equipment. 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 DRB II scan tool. Perform the following steps with the DRB II scan tool to read or reset the Pinion Factor:

(1) Plug the DRB II scan tool into the blue CCD Bus connector. The connector is located under the instrument panel on the drivers side of the vehicle.

(2) Insert the 1993 DRB II scan tool cartridge into the DRB II scan tool.

(3) The red and green lights on the DRB II scan tool will light up and then begin flashing. Wait until the lights stop flashing before continuing with this procedure.

(4) Press the number 4 key (Select System) on the DRB II scan tool key pad. Item number 4 will not appear on the DRB II scan tool screen unless you scroll down. It is not necessary to scroll down to be able to choose item 4.

(5) Press the number 2 on the DRB II scan tool key pad (Transmission).

(6) Press the number 1 on the DRB II scan tool key pad. Wait for the DRB II scan tool to perform the following three tests before continuing (These tests are done automatically by the DRB II scan tool).

- Bus Test
- Initialize
- Transmission Control Module Part Number

(7) Press the number 5 on the DRB II scan tool key pad (Adjustments).

(8) Press the number 2 on the DRB II scan tool key pad (Pinion Factor). Then follow the instructions on the DRB II scan tool screen.

TORQUE CONVERTER CLUTCH BREAK-IN PROCEDURE

A torque converter clutch break-in program is being used on all models with a 41TE. This program will properly condition the torque converter clutch. This will eliminate shudder during partial torque converter clutch operation on a new torque converter.

If the torque converter is replaced, the new clutch within the torque converter will require break-in. The current break-in status stored in the transmission control module will have to be reset to the start of break-in with the DRB II scan tool.

If a new transmission control module is put on the vehicle, the status will be at the start of break-in. This status is acceptable regardless of the mileage on the torque converter. No modification of the break-in status is required.

To properly service these vehicles, it is necessary to use a DRB II scan tool to read or reset the break-in status. Perform the following steps with the DRB II scan tool to reset the break-in status:

(1) Plug the DRB II scan tool into the blue CCD Bus connector. The connector is located under the instrument panel on the drivers side of the vehicle.

(2) Insert the 1993 DRB II scan tool cartridge into the DRB II scan tool.

(3) The red and green lights on the DRB II scan tool will light up and then begin flashing. Wait until the lights stop flashing before continuing with this procedure.

(4) Press the number 4 key (Select System) on the DRB II scan tool key pad. Item number 4 will not appear on the DRB II scan tool screen unless you scroll down. It is not necessary to scroll down to be able to choose item 4.

(5) Press the number 2 on the DRB II scan tool key pad (Transmission).

(6) Press the number 1 on the DRB II scan tool key pad. Wait for the DRB II scan tool to perform the following three tests before continuing (These tests are done automatically by the DRB II scan tool).

- Bus Test
- Initialize
- Transmission Control Module Part Number

(7) Press the number 5 on the DRB II scan tool key pad (Adjustments).

(8) Press the number 1 on the DRB II scan tool key pad (Reset LU Clutch). The DRB II scan tool will display one of three screens.

(a) LU Clutch Break-in Status: **Start**

(b) LU Clutch Break-in Status: **In-progress** Press ENTER to Reset Break-in status

(c) LU Clutch Break-in Status: **Complete** Press ENTER to Reset Break-in status

If screen (a) appears, the transmission control module is at the beginning of its break-in program. No further action is required.

If screen (b) appears, the transmission control module is in the middle of a its break-in program. Press the enter key on the DRB II scan tool key pad to return the status to the start of break-in.

If screen (c) appears, the transmission control module has completed its break-in status program. Press the enter key on the DRB II scan tool key pad to return the status to the start of break-in.

(9) After pressing the enter key a second time in step 8 a screen will appear that says "RESET LU CLUTCH ARE YOU SURE ?". Press the enter key on the DRB II scan tool key pad. The DRB II scan tool will then carry out the reset command.

(10) After the DRB II scan tool completes the reset command, a screen will appear saying "LU Clutch Break-in Status has been RESET to Start". This screen will indicate that the reset procedure has been successfully completed.

(11) Disconnect the DRB II scan tool from the blue CCD Bus connector.

TRANSAXLE RECONDITION

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.

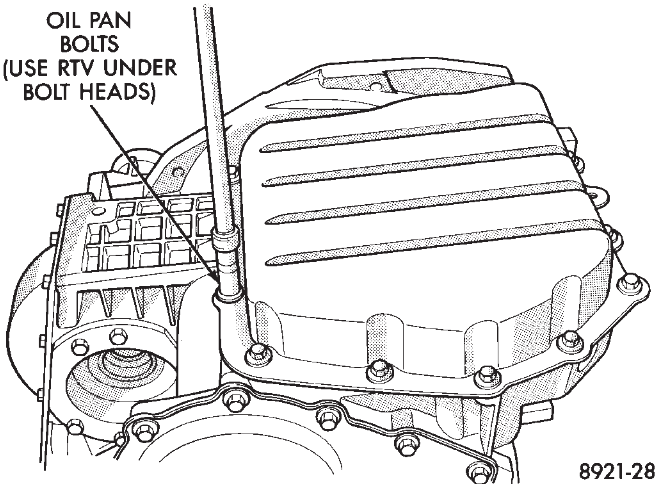


Fig. 1 Oil Pan Bolts

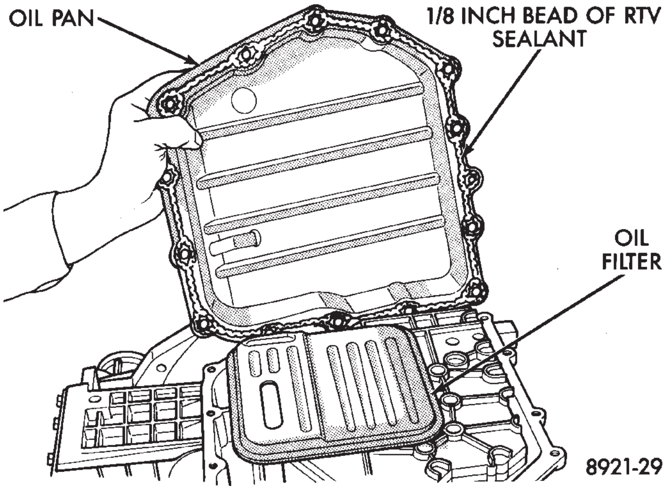


Fig. 2 Oil Pan

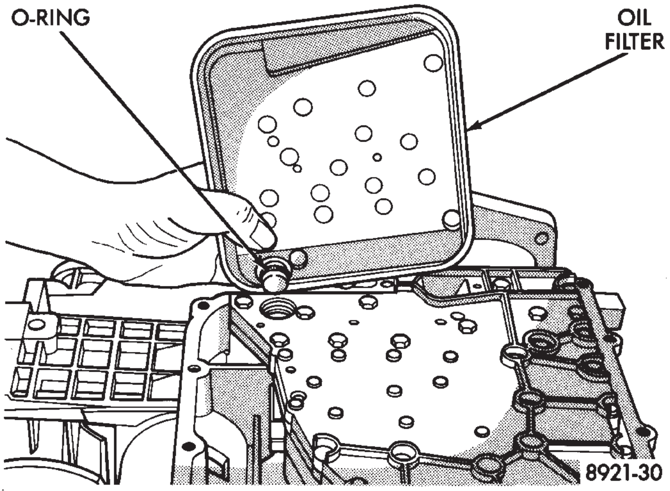


Fig. 3 Oil Filter

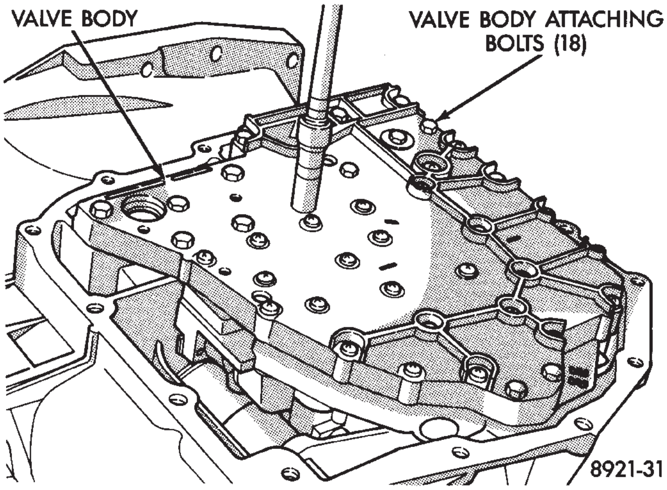


Fig. 4 Valve Body Attaching Bolts

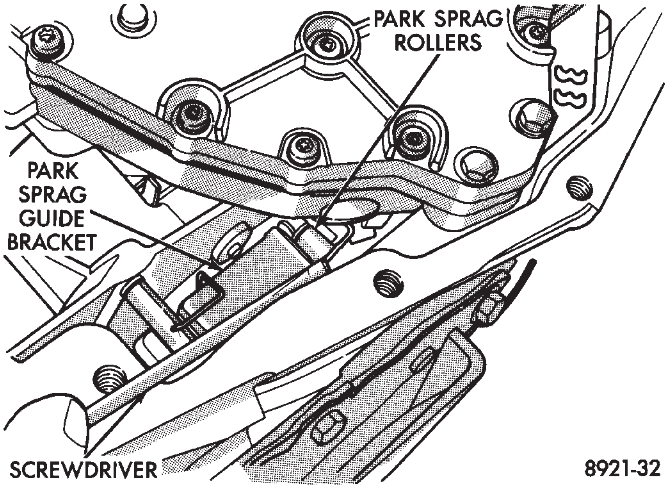


Fig. 5 Push Park Rod Rollers from Guide Bracket

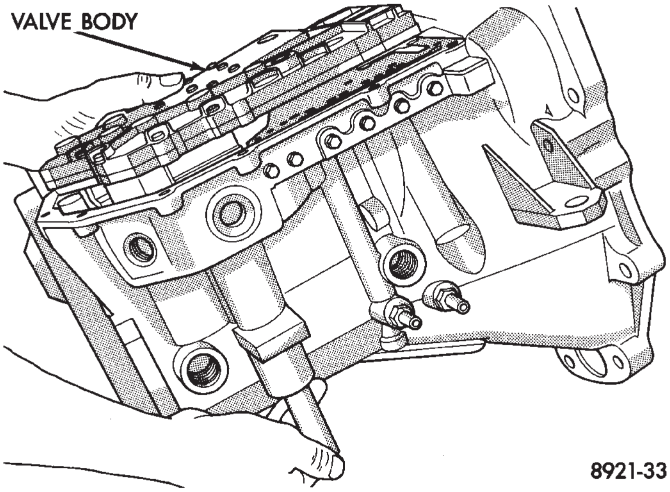


Fig. 6 Remove or Install Valve Body

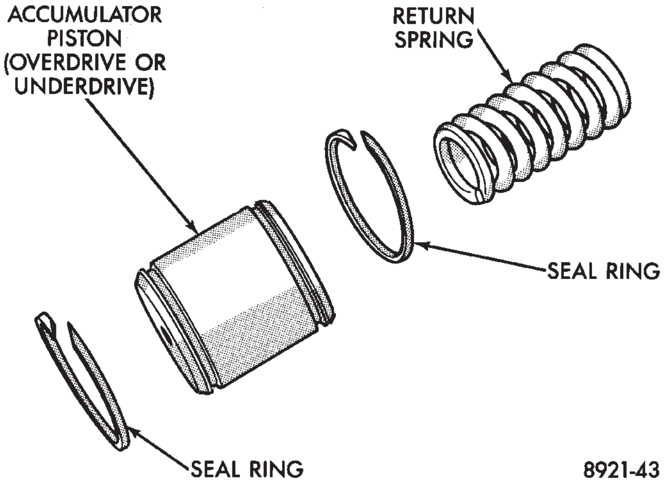


Fig. 9 Accumulator

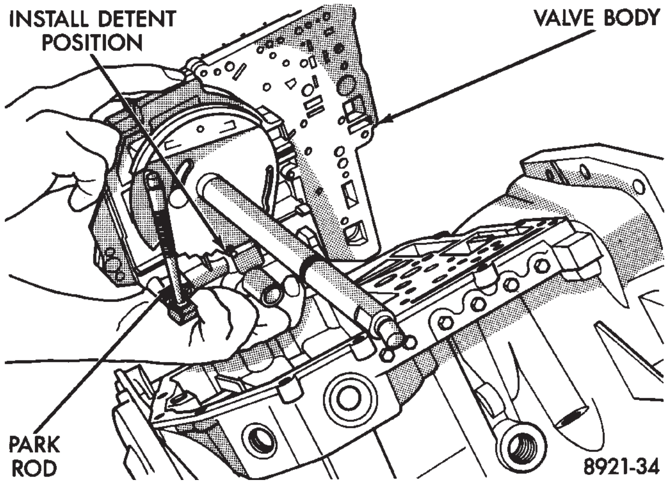


Fig. 7 Valve Body Removed

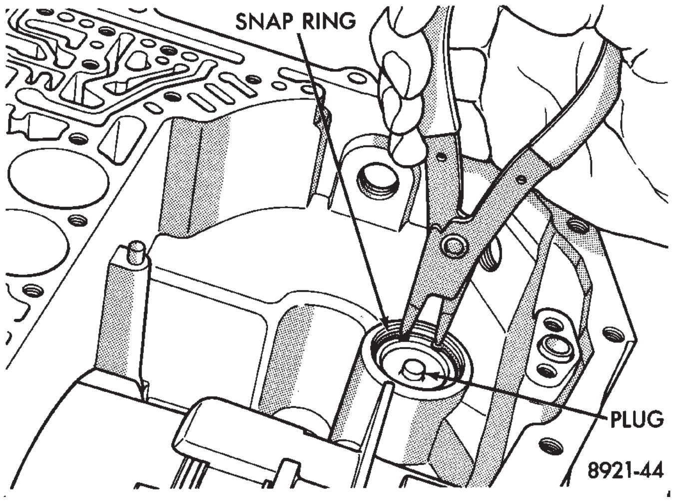


Fig. 10 Low/Reverse Accumulator Snap Ring

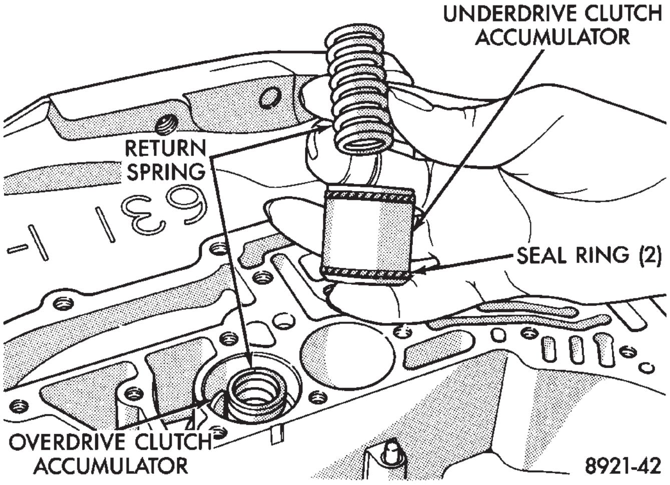


Fig. 8 Accumulators

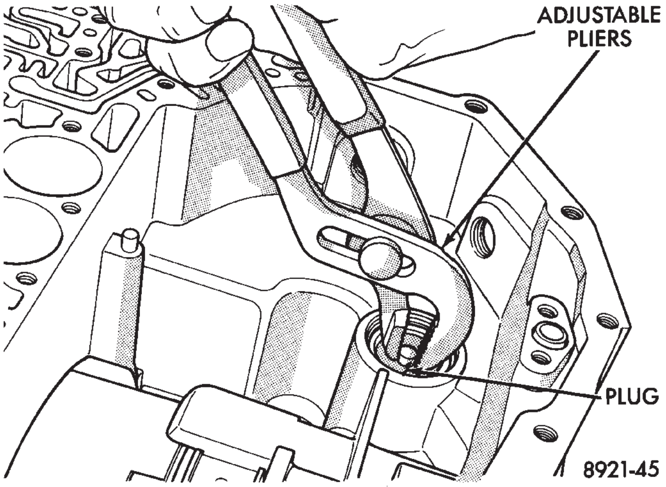


Fig. 11 Low/Reverse Accumulator Plug (Cover)

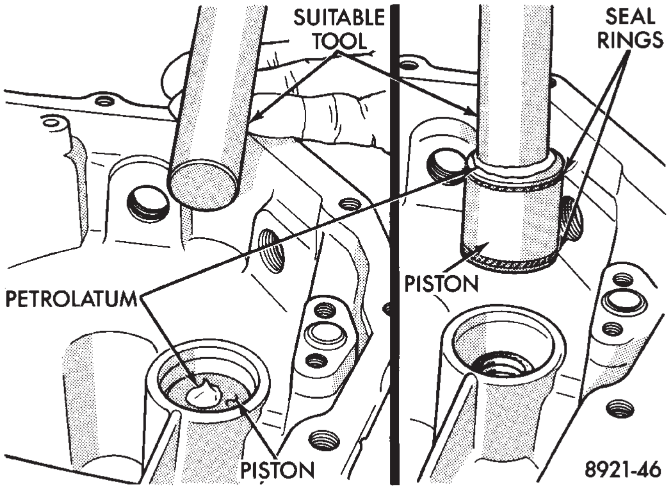


Fig. 12 Low/Reverse Accumulator Piston

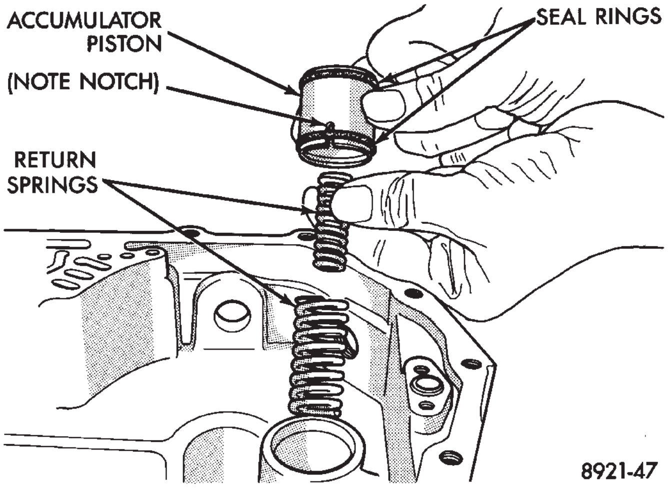


Fig. 13 Low/Reverse Accumulator

Measuring input shaft end play before disassembly will usually indicate when a #4 thrust plate change is required, (except when major parts are replaced). 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. 14).

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.

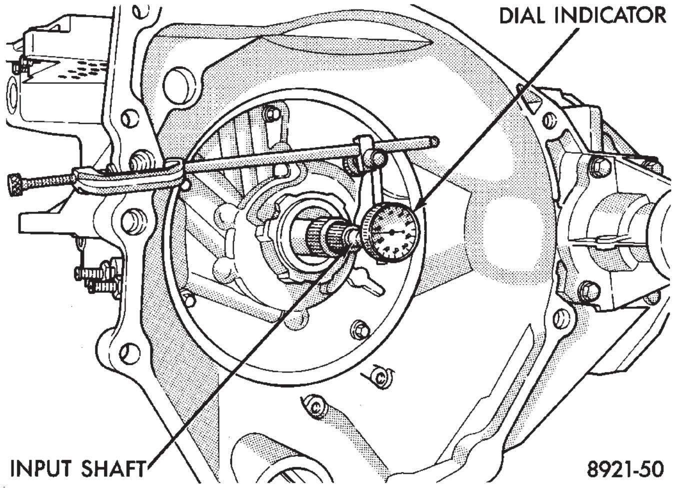


Fig. 14 Measure Input Shaft End Play

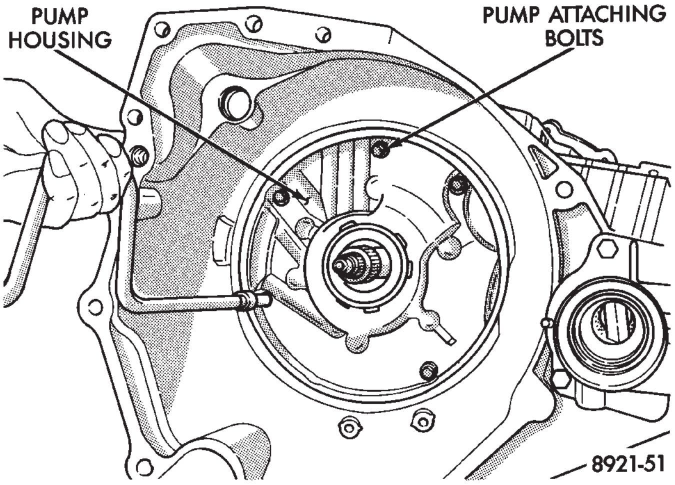


Fig. 15 Pump Attaching Bolts

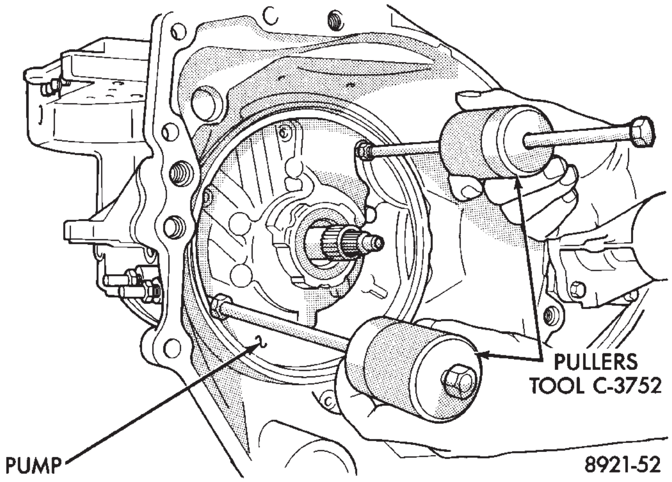


Fig. 16 Install Tool C-3752

CAUTION: Be sure input speed sensor is removed before removing oil pump.

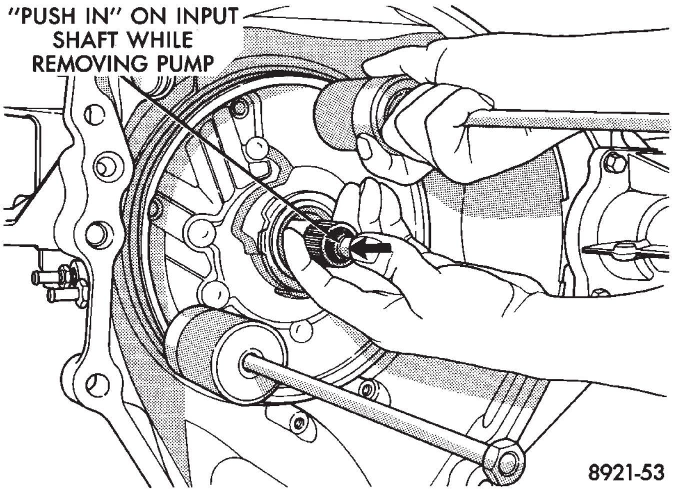


Fig. 17 Remove Oil Pump

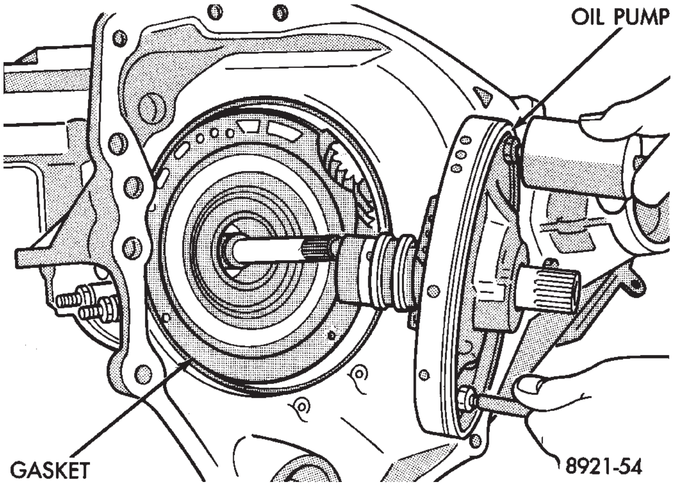


Fig. 18 Oil Pump Removed

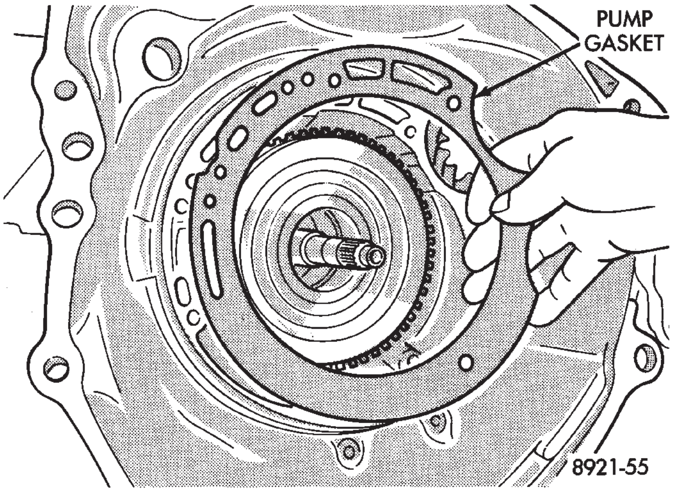


Fig. 19 Oil Pump Gasket

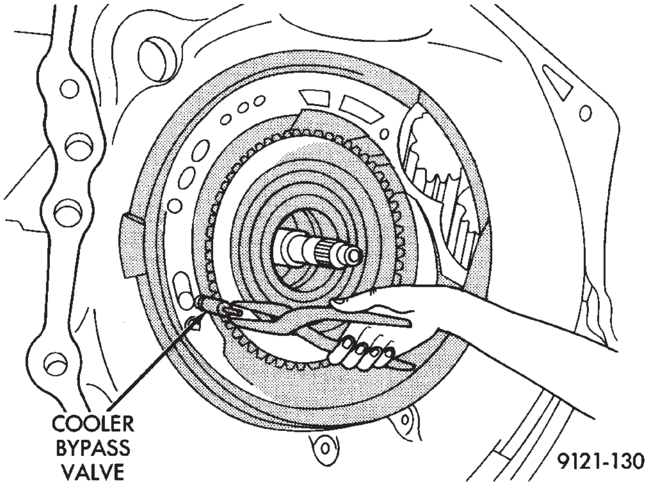


Fig. 20 Remove Bypass Valve

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.

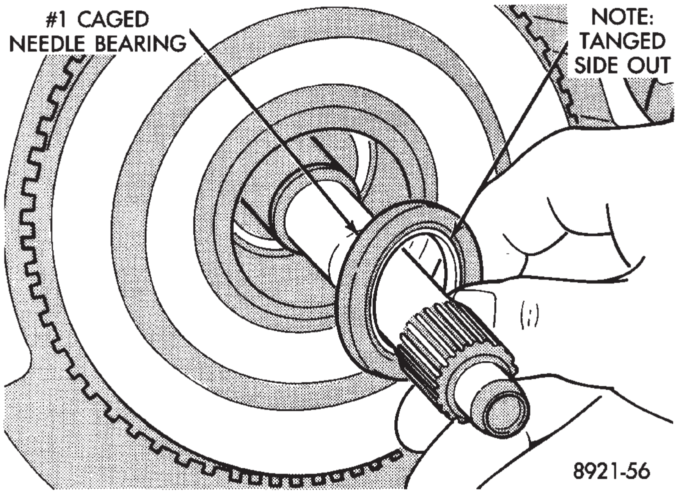


Fig. 21 No.1 Caged Needle Bearing

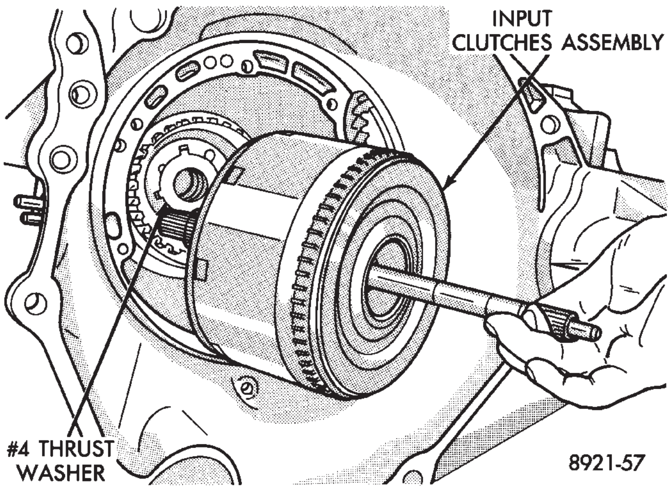


Fig. 22 Input Clutches Assembly

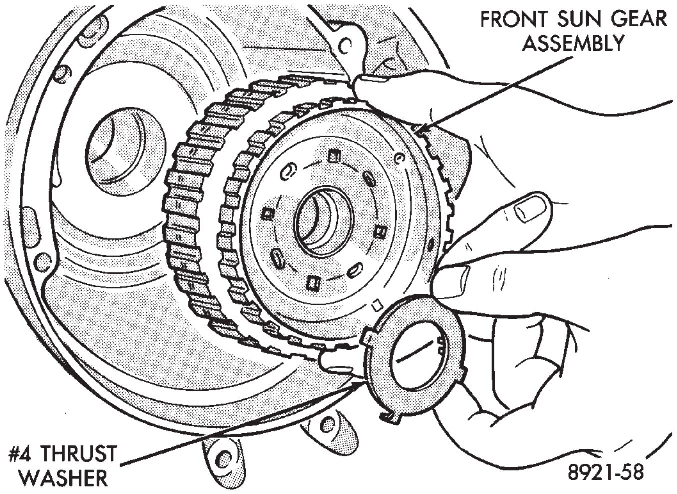


Fig. 23 Front Sun Gear Assembly

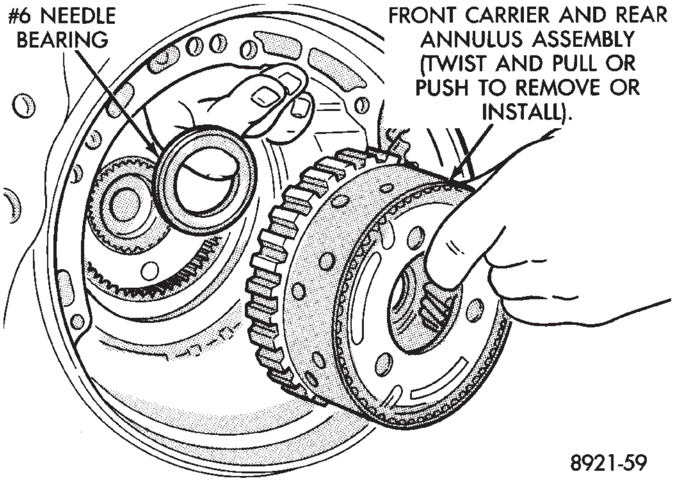


Fig. 24 Front Carrier and Rear Annulus Assembly

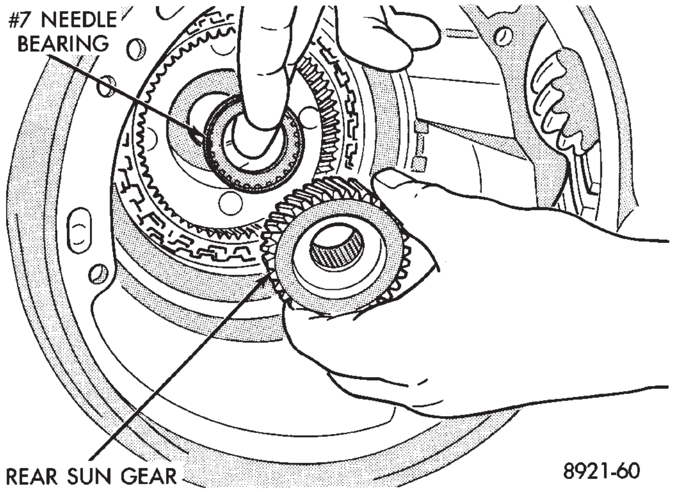


Fig. 25 Rear Sun Gear

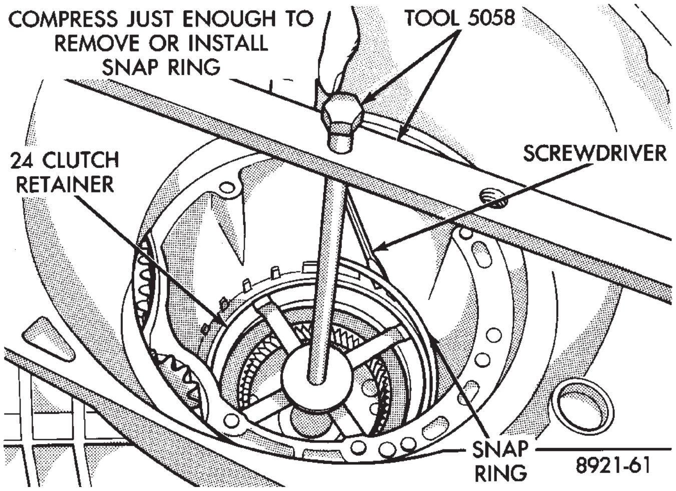


Fig. 26 2/4 Clutch Retainer Snap Ring

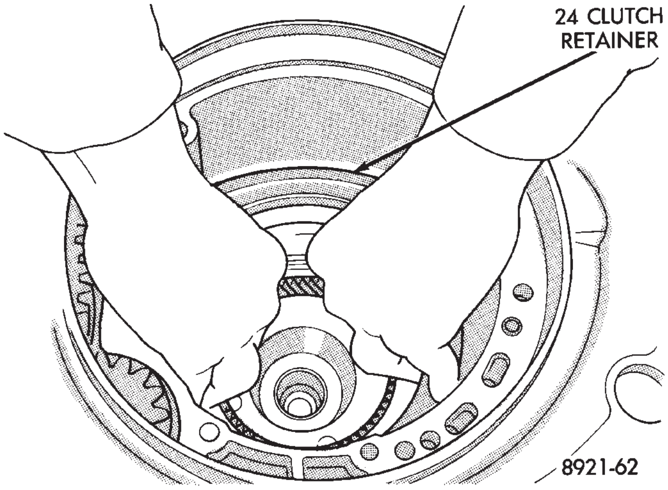


Fig. 27 Remove 2/4 Clutch Retainer

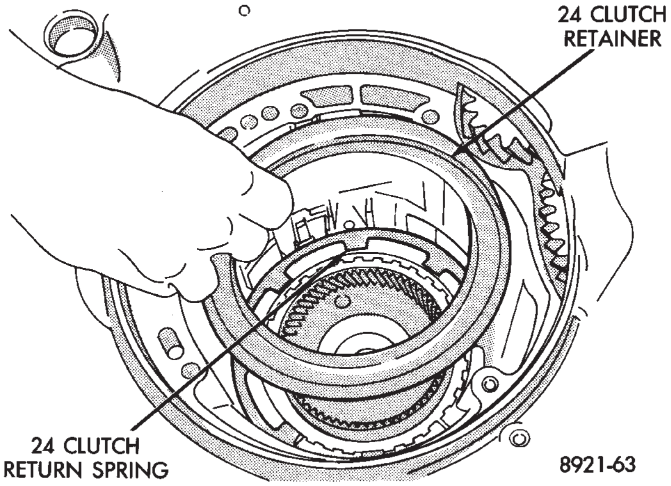


Fig. 28 2/4 Clutch Retainer

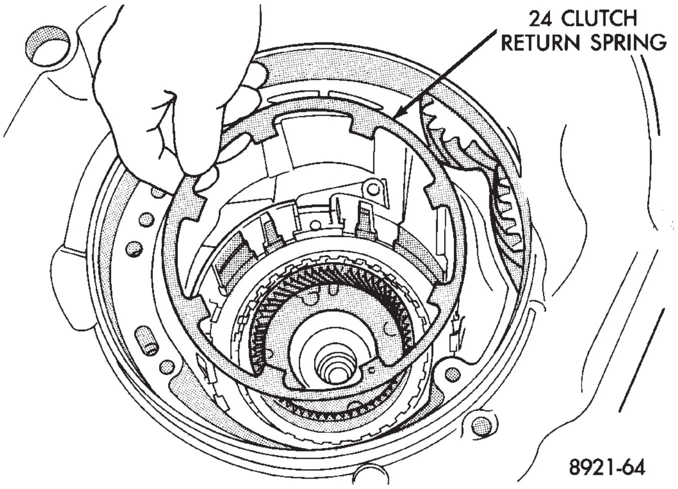


Fig. 29 2/4 Clutch Return Spring

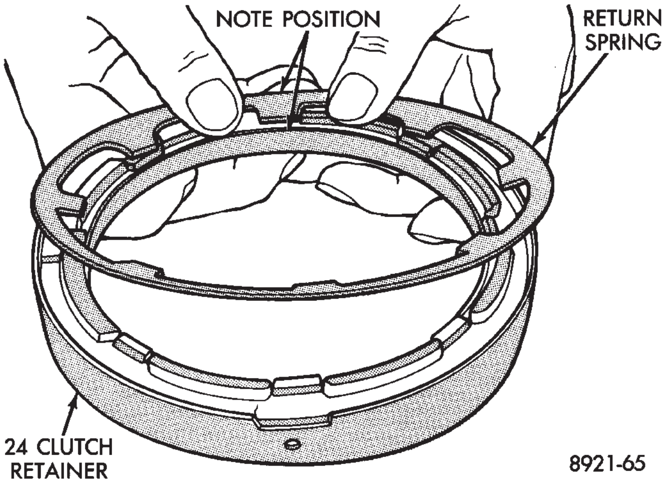


Fig. 30 2/4 Retainer and Spring Indexed

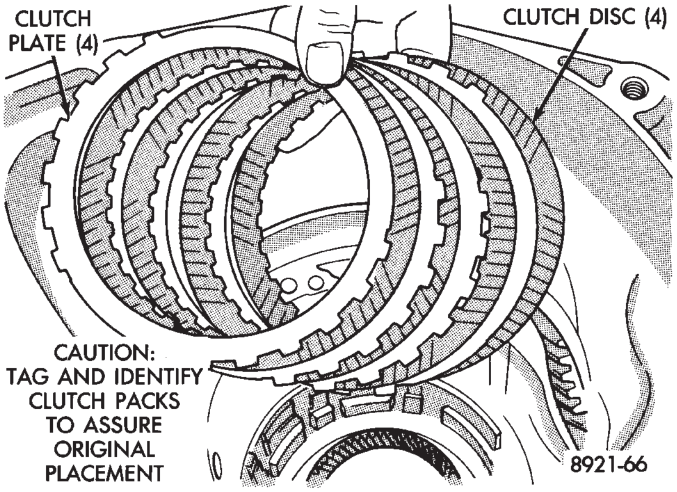


Fig. 31 2/4 Clutch Pack

Tag 2/4 clutch pack for reassembly identification.

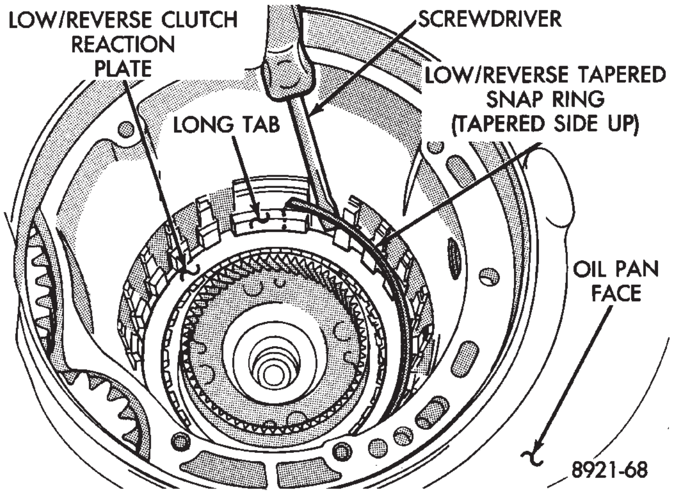


Fig. 32 Tapered Snap Ring

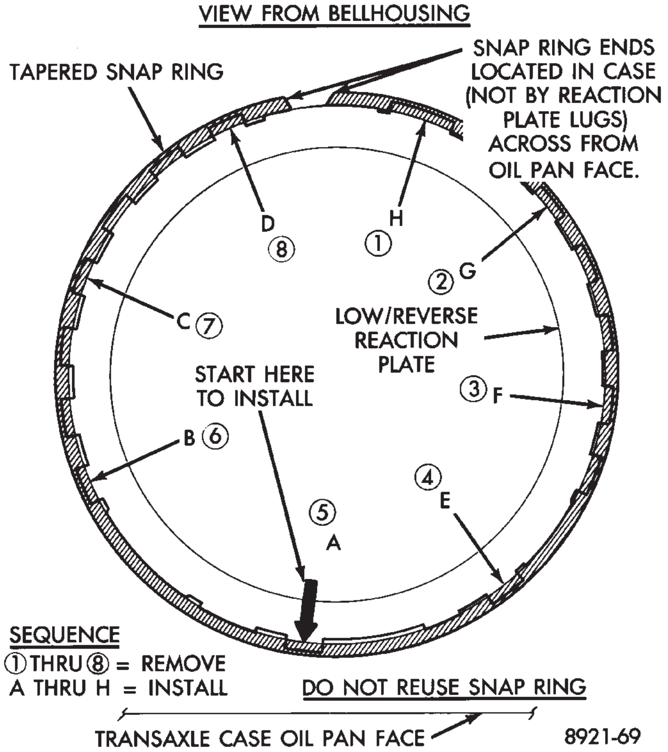


Fig. 33 Tapered Snap Ring Instructions

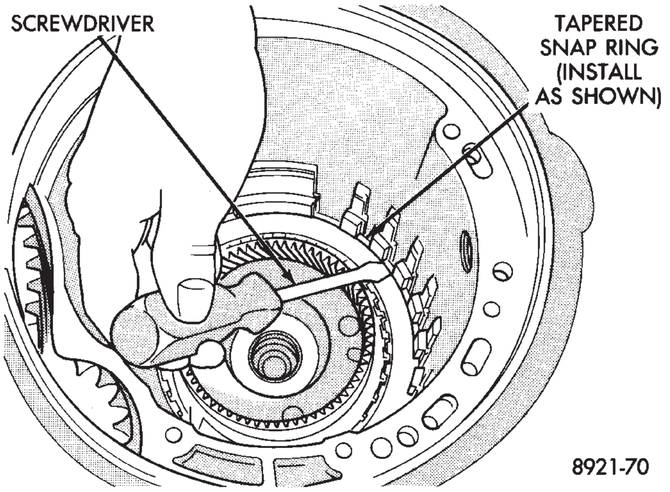


Fig. 34 Snap Ring Installed

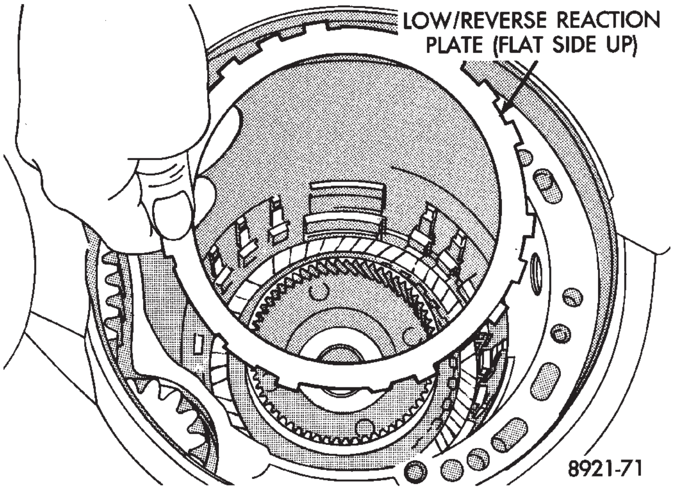


Fig. 35 Low/Reverse Reaction Plate

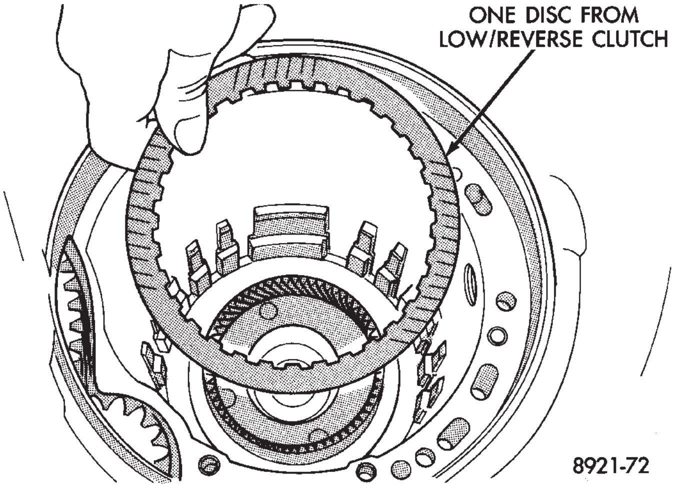


Fig. 36 Remove One Disc

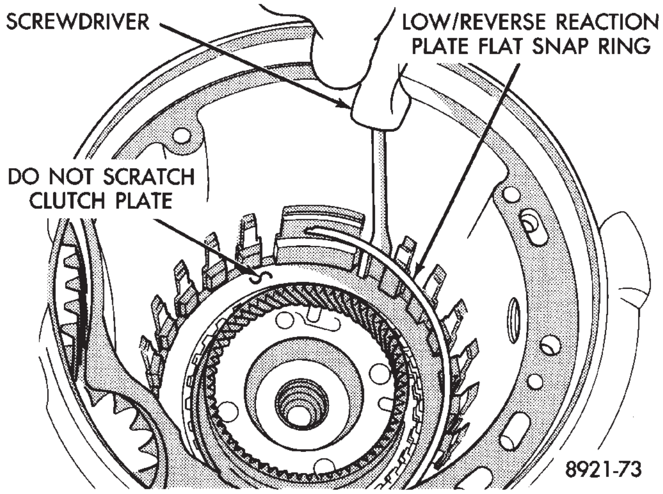


Fig. 37 Low/Reverse Reaction Plate Snap Ring

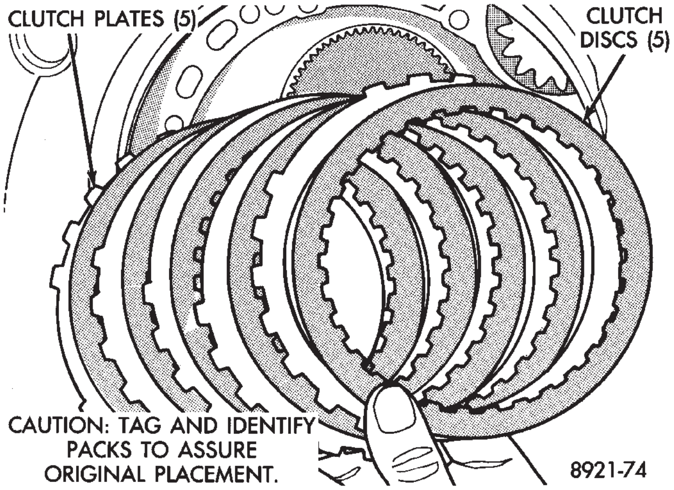


Fig. 38 Low/Reverse Clutch Pack

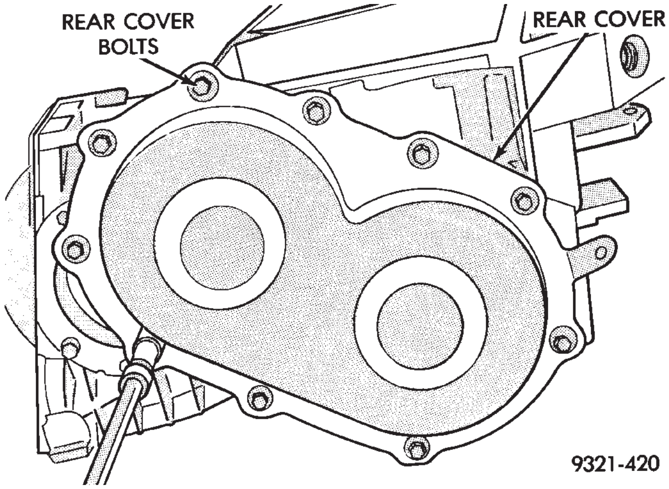


Fig. 39 Rear Cover Bolts

Tag low/reverse clutch pack for reassembly identification.

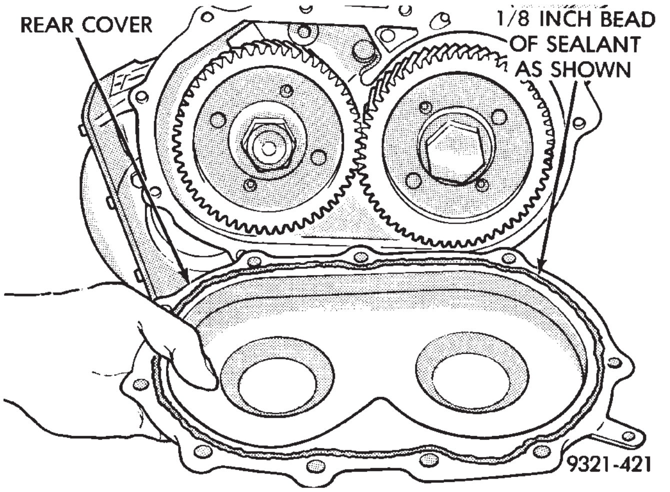


Fig. 40 Rear Cover

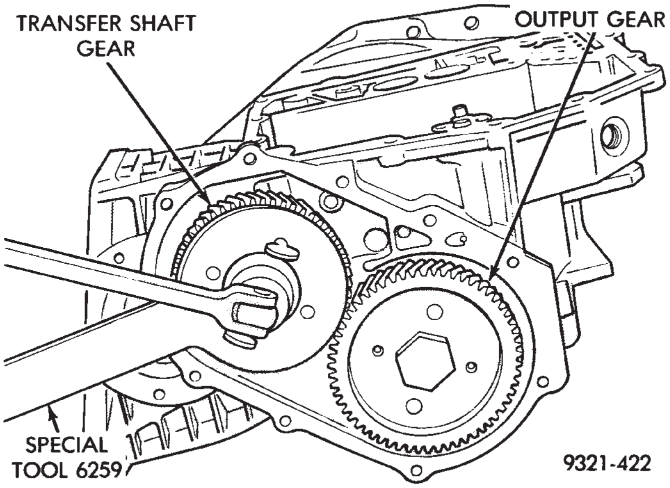


Fig. 41 Remove Transfer Shaft Gear Nut

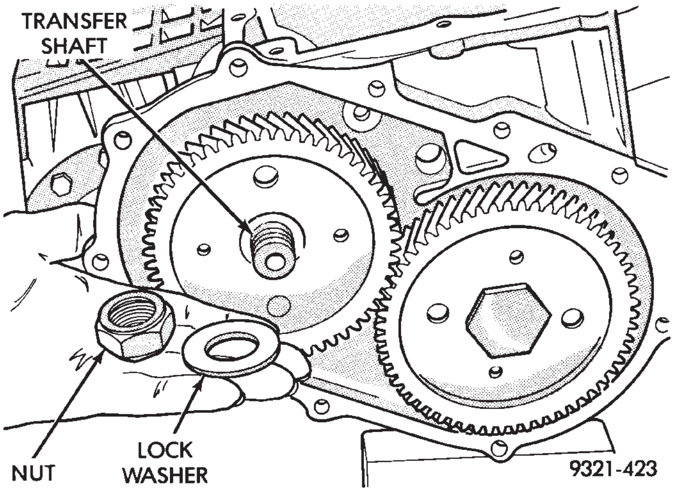


Fig. 42 Transfer Shaft Gear Nut and Washer

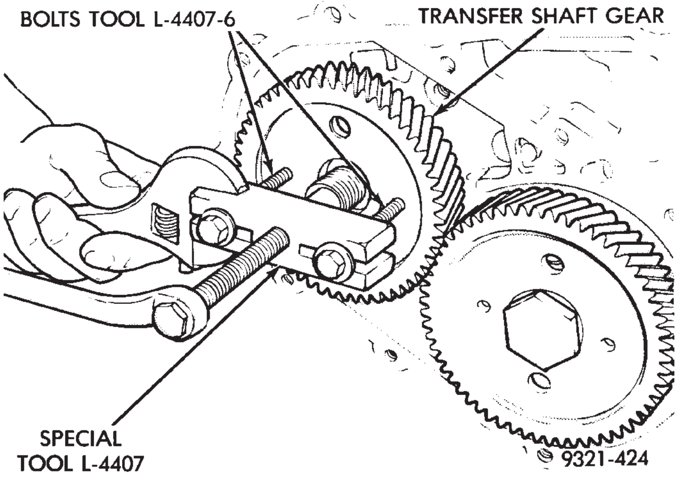


Fig. 43 Remove Transfer Shaft Gear

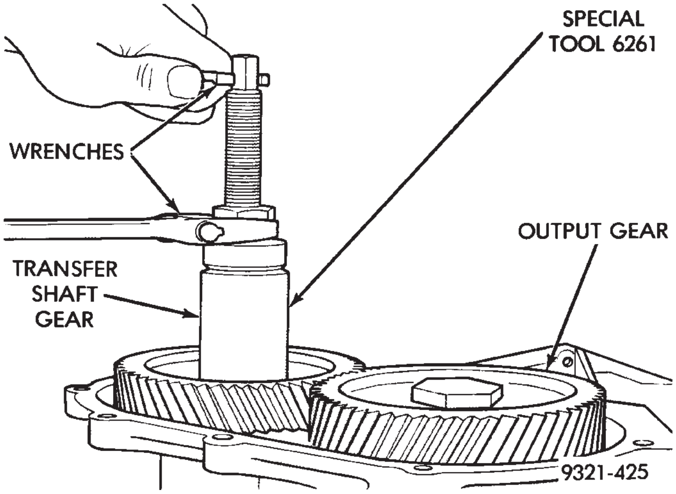


Fig. 44 Install Transfer Shaft Gear

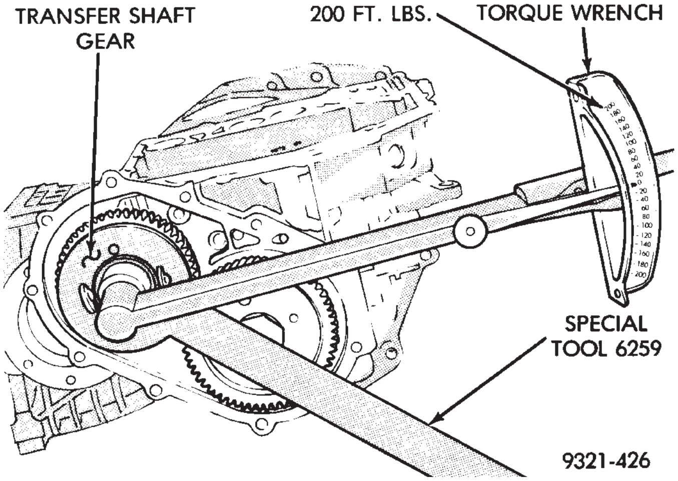


Fig. 45 Tighten Nut to 271 N•m (200 Ft. Lbs.)

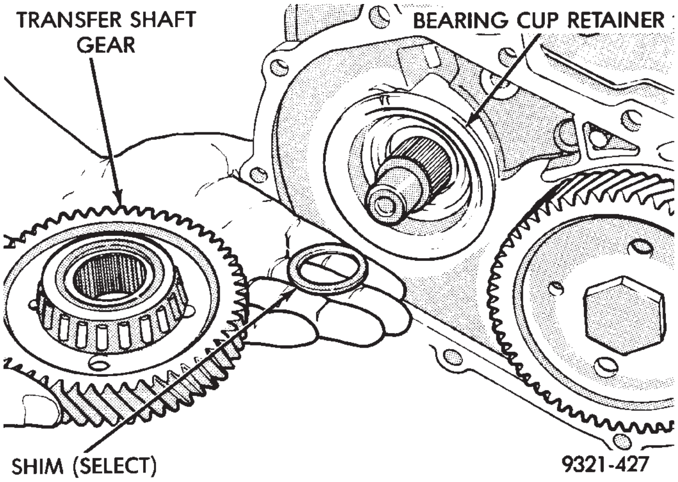


Fig. 46 Transfer Shaft Gear and (Select) Shim

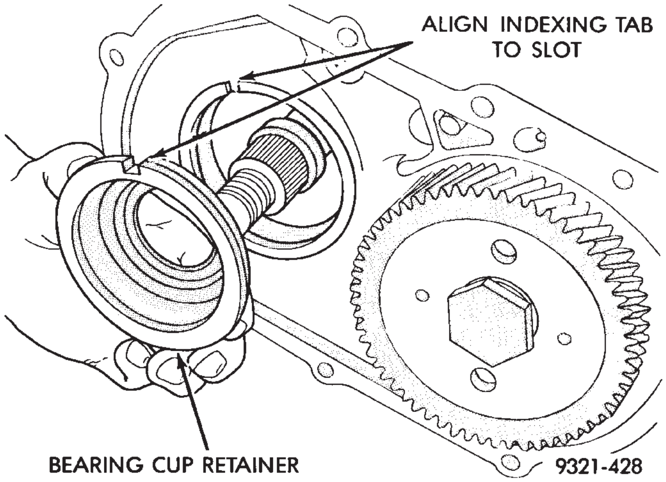


Fig. 47 Bearing Cup Retainer

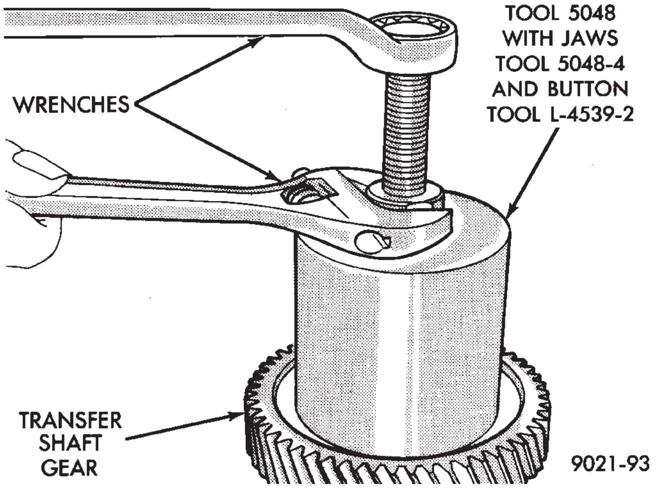


Fig. 48 Remove Transfer Shaft Bearing Cone

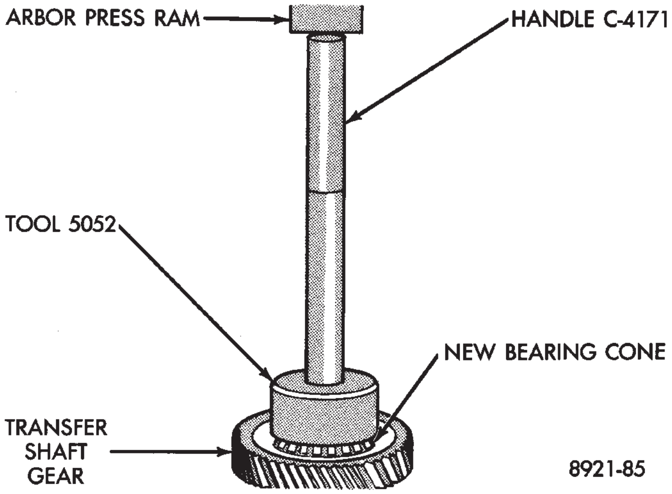


Fig. 49 Install Transfer Shaft Bearing Cone

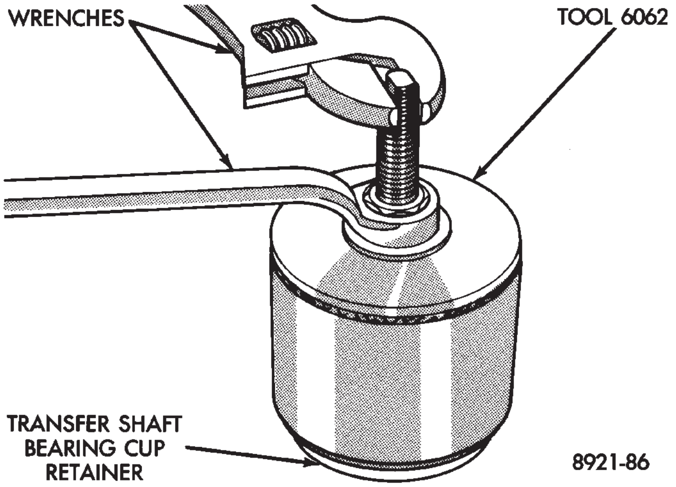


Fig. 50 Remove Transfer Shaft Bearing Cup

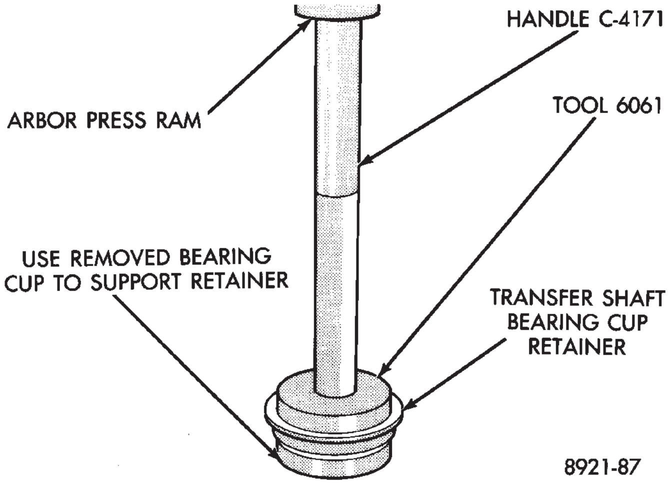


Fig. 51 Install New Bearing Cup

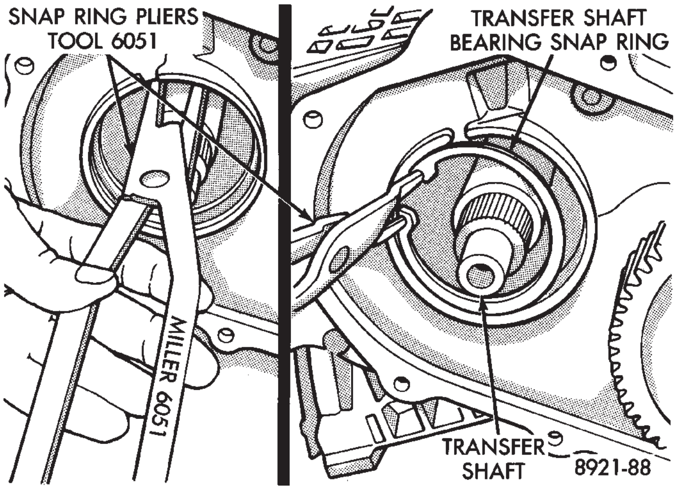


Fig. 52 Transfer Shaft Bearing Snap Ring

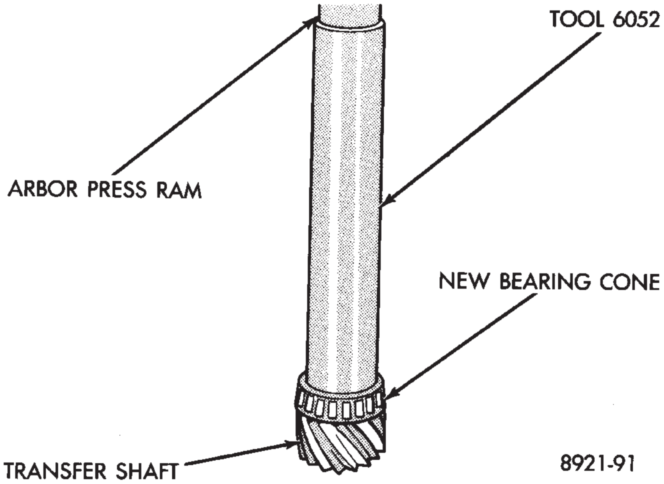


Fig. 55 Install Bearing Cone

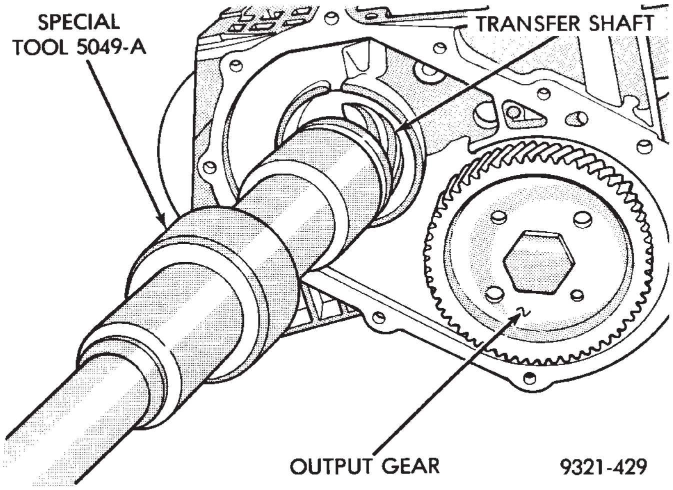


Fig. 53 Transfer Shaft

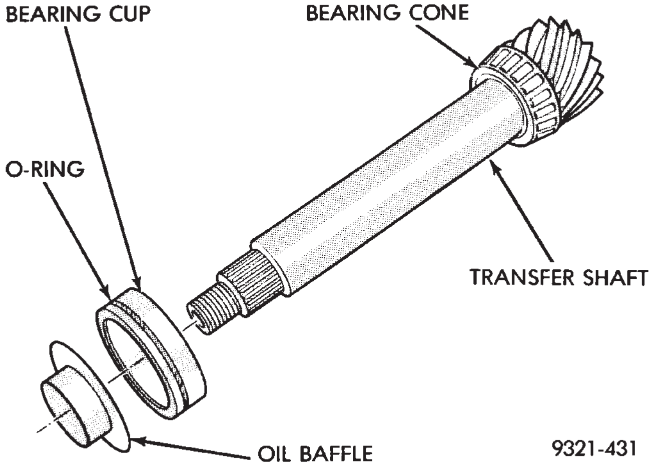


Fig. 56 Bearing Cup Removed

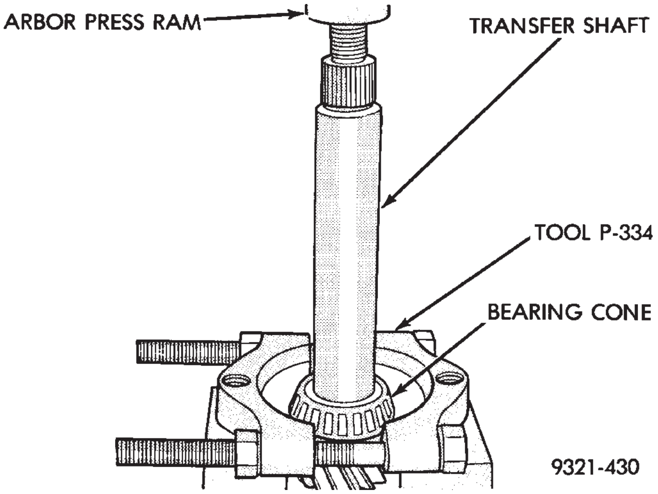


Fig. 54 Remove Transfer Shaft Bearing Cone

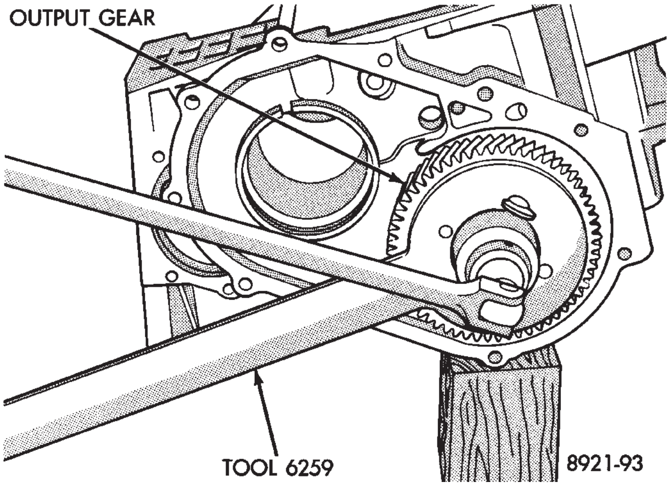


Fig. 57 Remove Output Gear Bolt

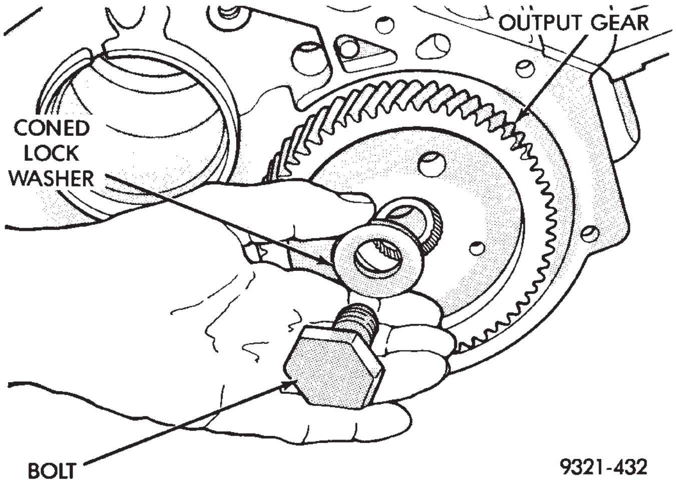


Fig. 58 Output Gear Bolt and Washer

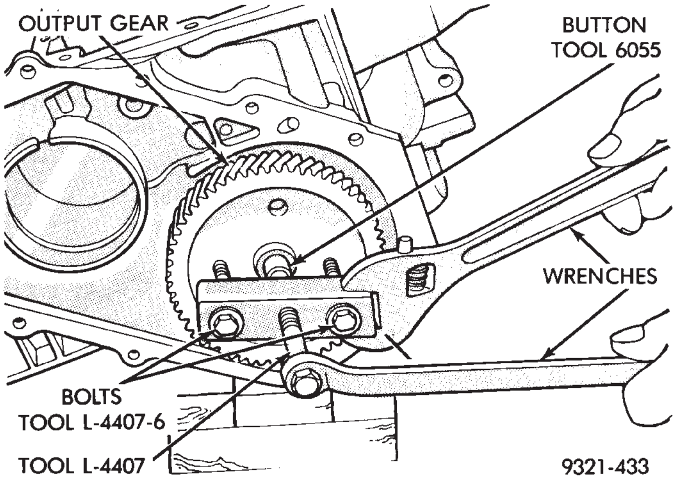


Fig. 59 Remove Output Gear

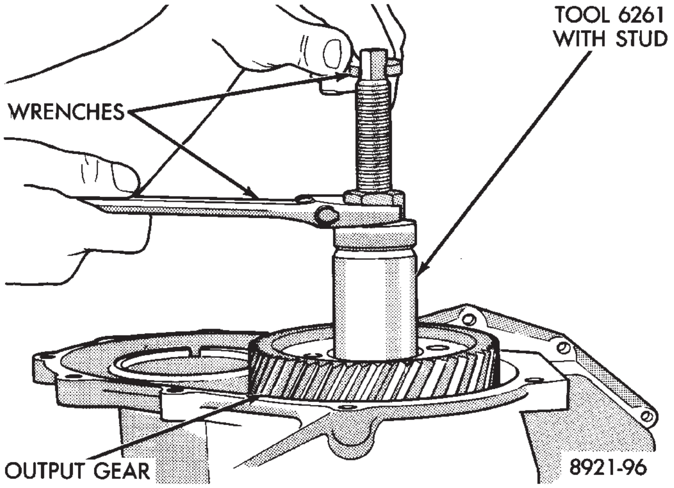


Fig. 60 Install Output Gear

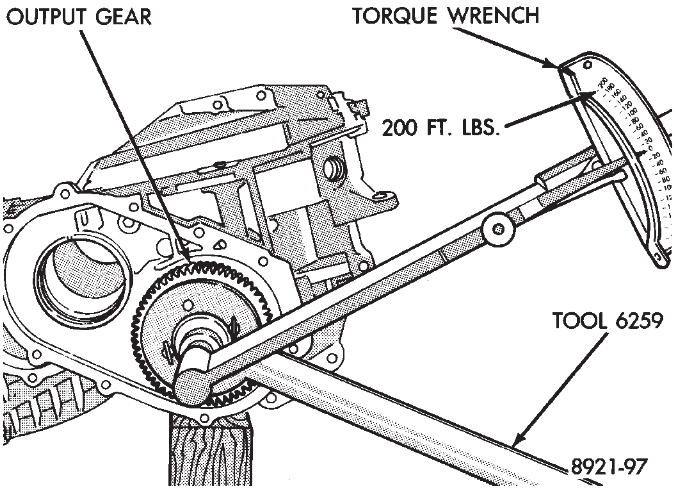


Fig. 61 Tighten Output Gear to 271 N●m (200 ft. lbs.)

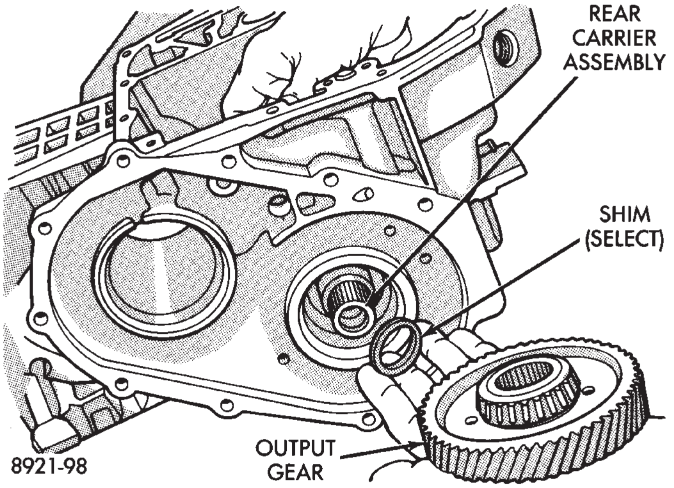


Fig. 62 Output Gear and (Select) Shim

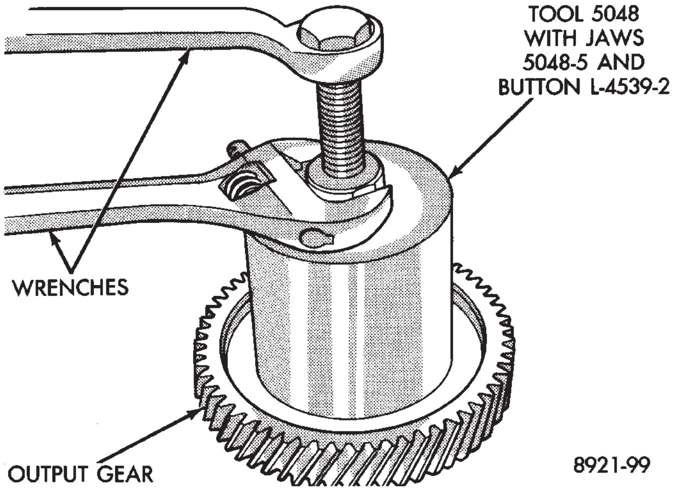


Fig. 63 Remove Bearing Cone

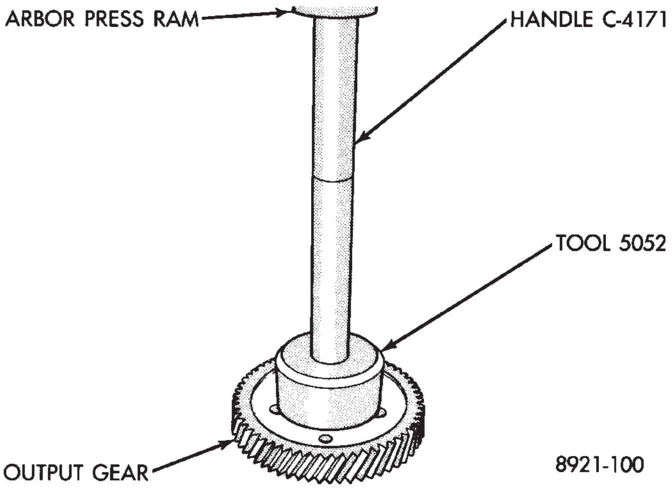


Fig. 64 Install New Bearing Cone

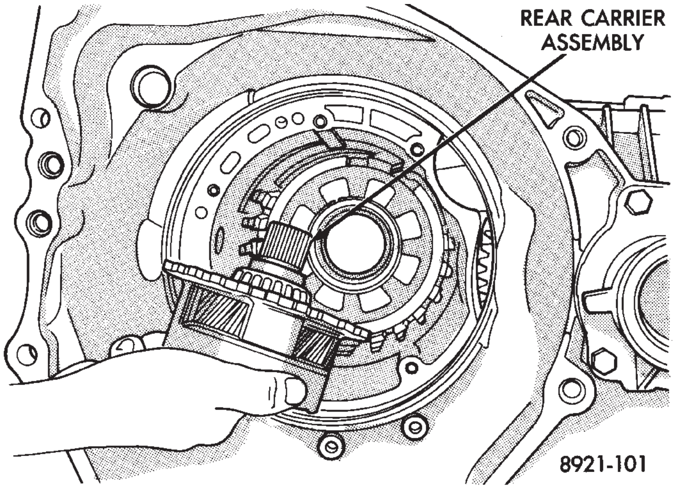


Fig. 65 Rear Carrier Assembly

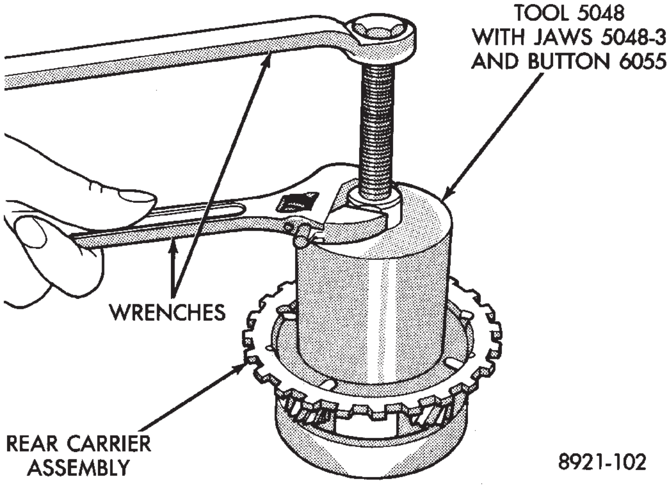


Fig. 66 Remove Rear Carrier Bearing Cone

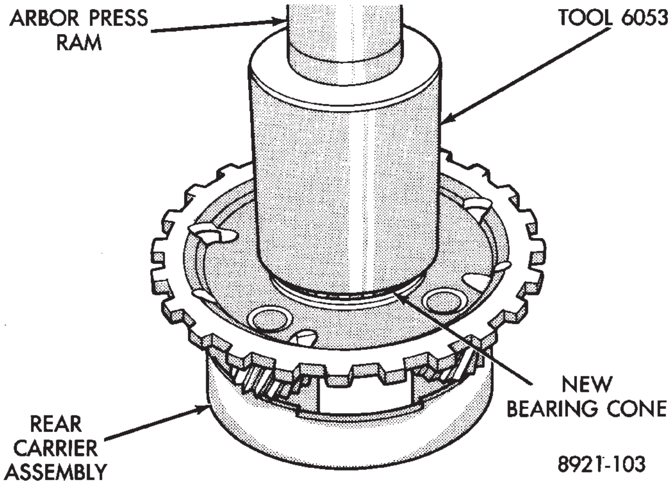


Fig. 67 Install Rear Carrier Bearing Cone

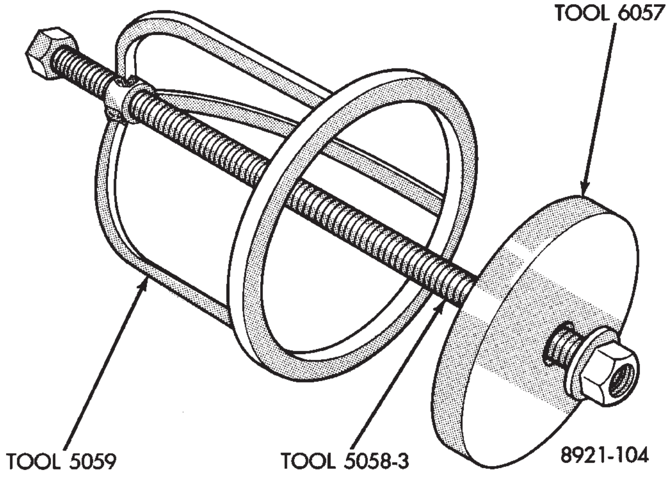


Fig. 68 Low/Reverse Spring Compressor Tool

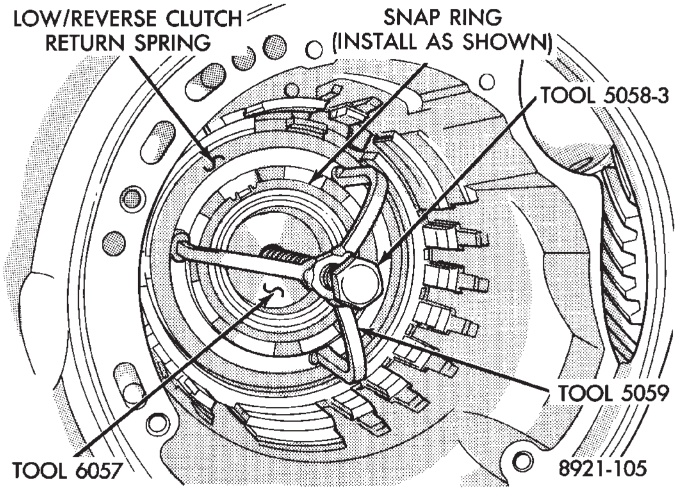


Fig. 69 Compressor Tool in Use

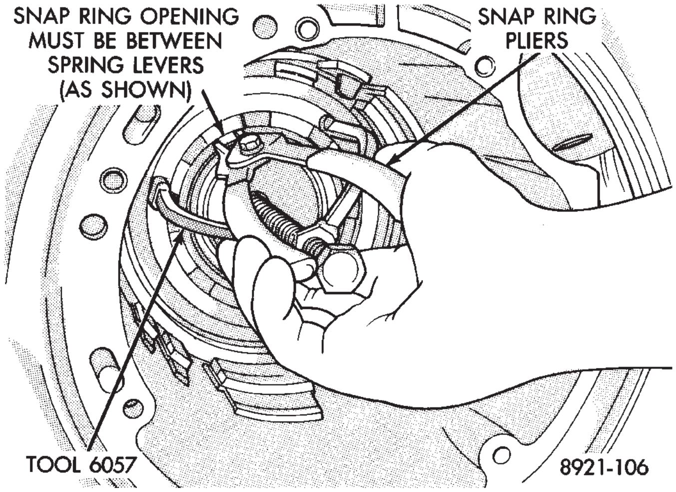


Fig. 70 Remove or Install Snap Ring

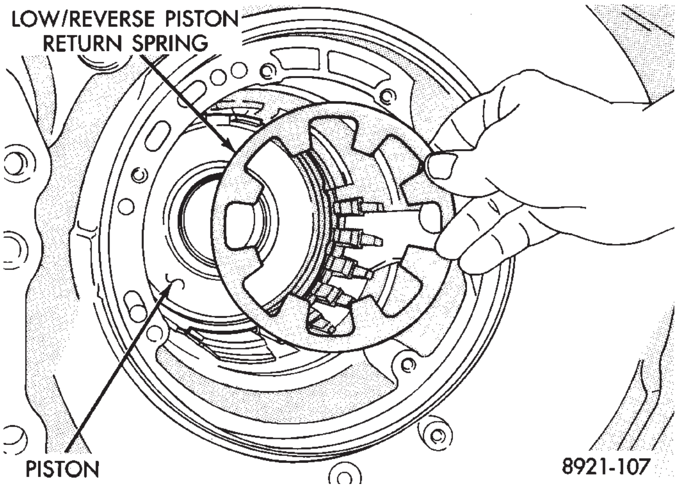


Fig. 71 Low/Reverse Piston Return Spring

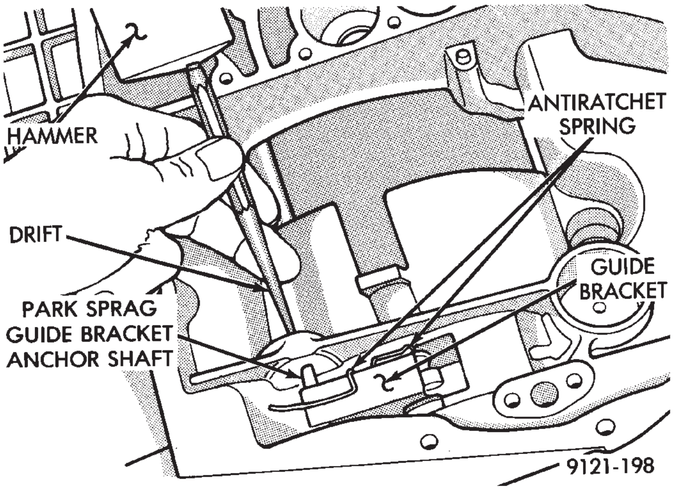


Fig. 72 Drive Out Anchor Shaft

CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.

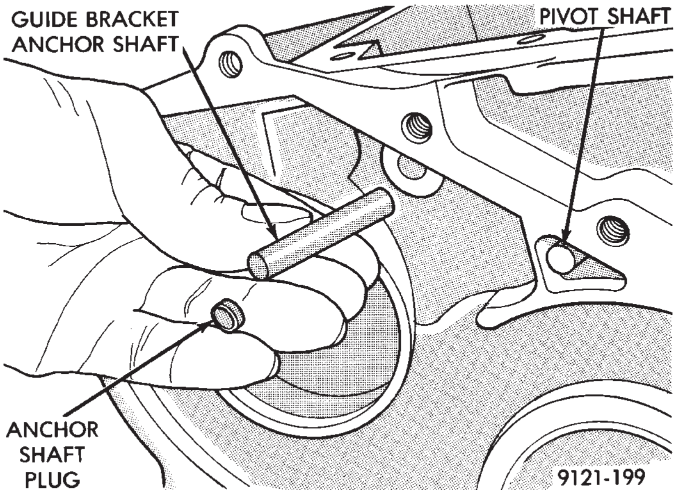


Fig. 73 Anchor Shaft and Plug

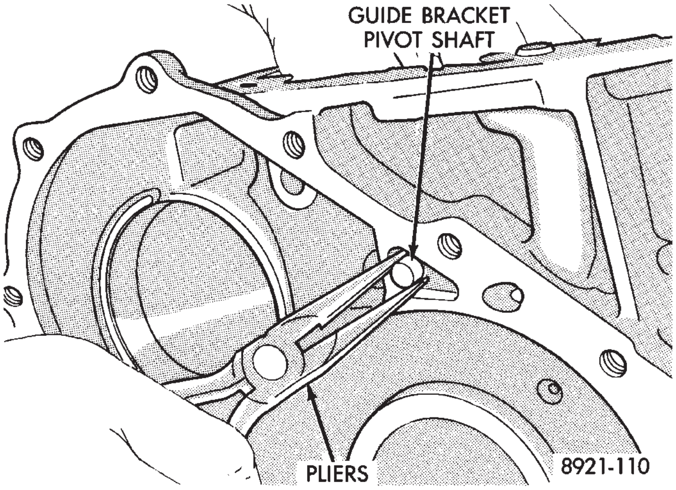


Fig. 74 Guide Bracket Pivot Shaft

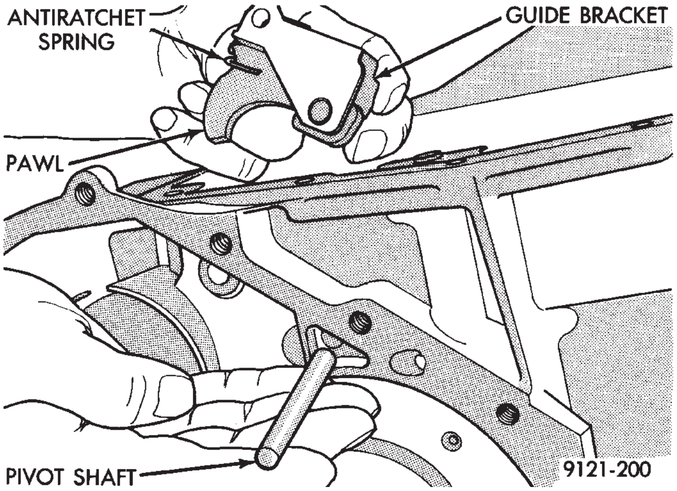


Fig. 75 Pivot Shaft and Guide Bracket

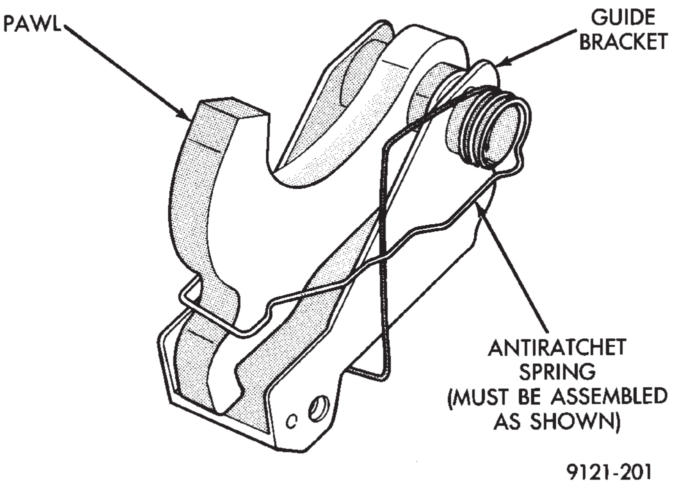


Fig. 76 Guide Bracket Assembled

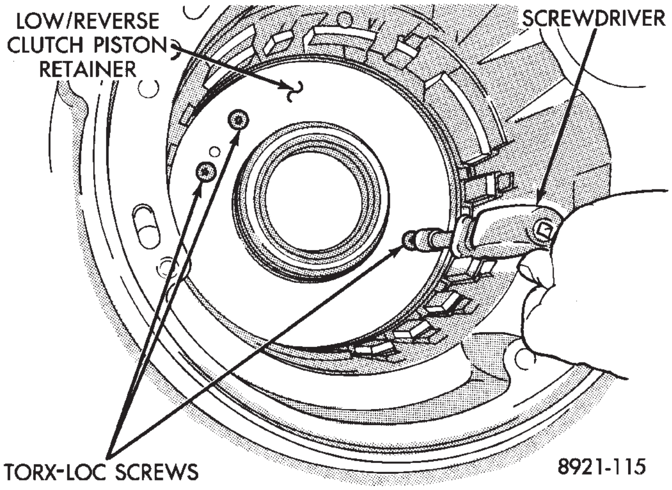


Fig. 79 Piston Retainer Attaching Screws

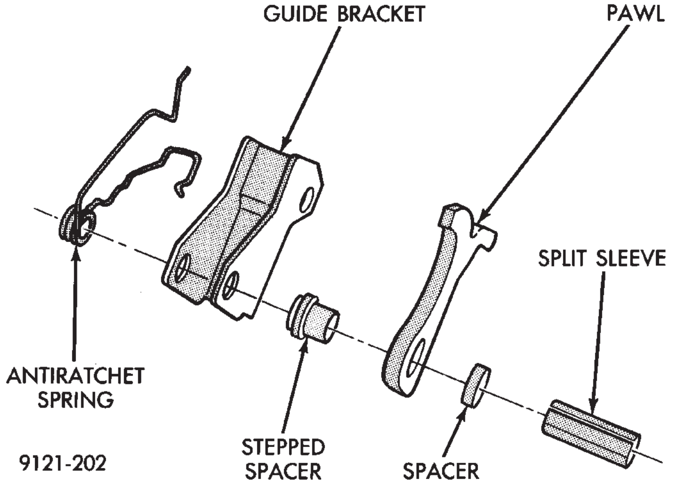


Fig. 77 Guide Bracket Disassembled

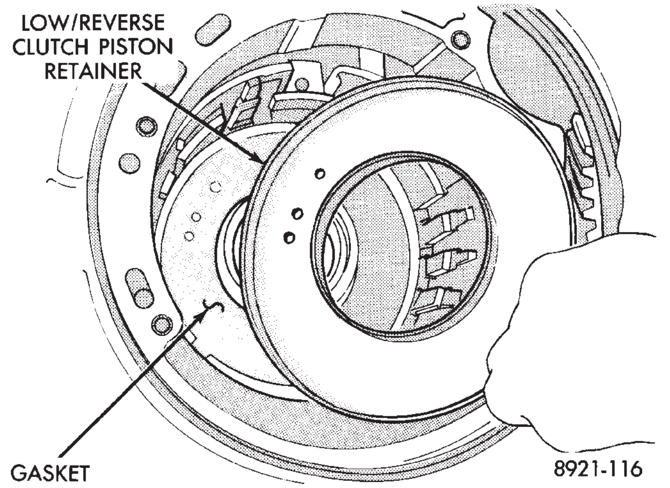


Fig. 80 Piston Retainer

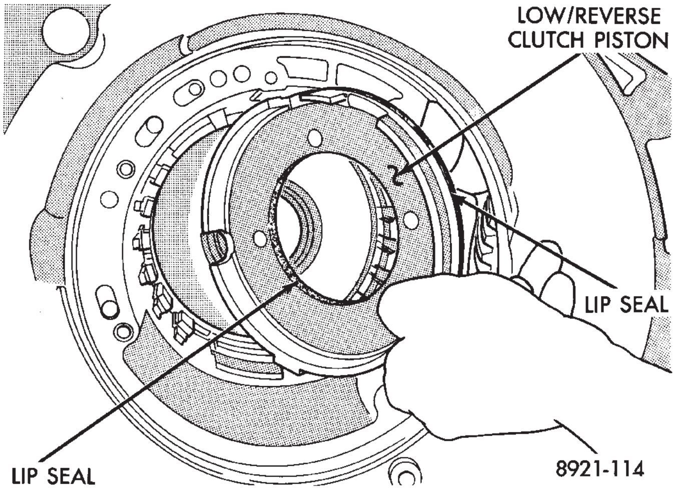


Fig. 78 Low/Reverse Clutch Piston

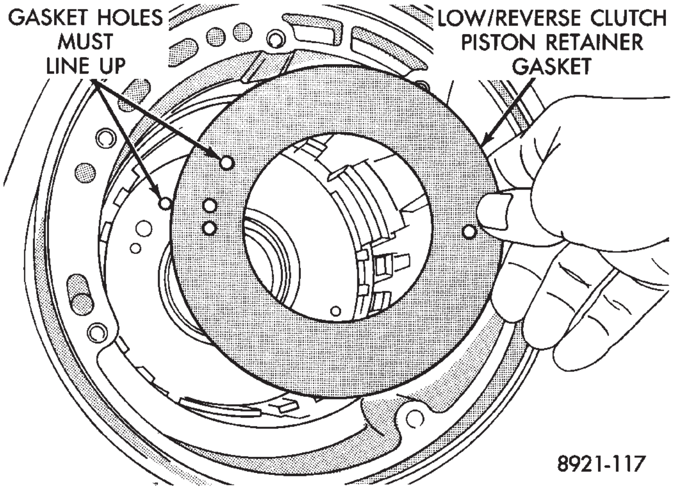


Fig. 81 Piston Retainer Gasket

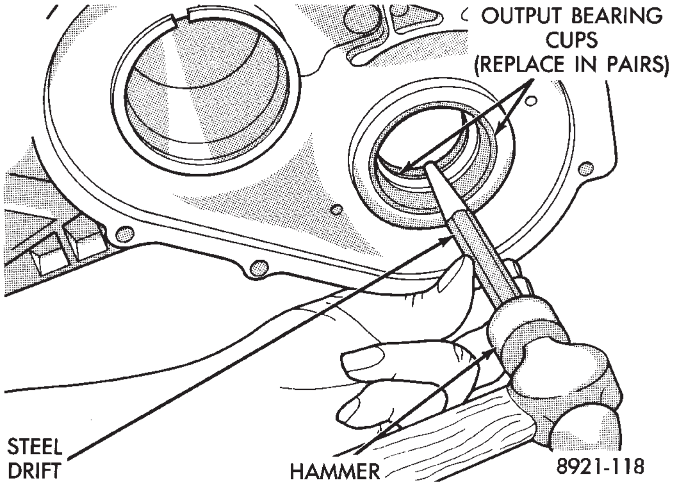


Fig. 82 Remove Output Bearing Inner Cup

CAUTION: Drift bearing cup all the way around.

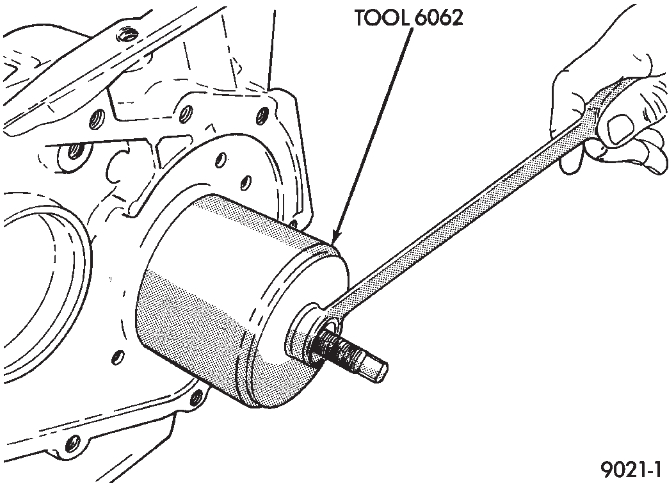


Fig. 83 Remove Output Bearing Outer Cup

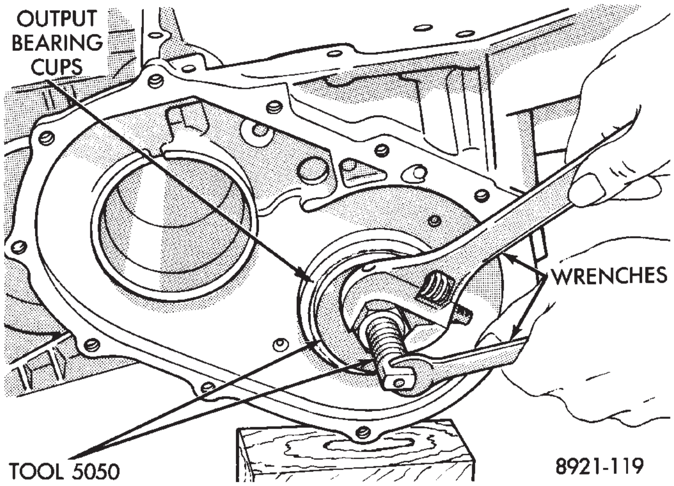


Fig. 84 Install Both Output Bearing Cups

To assemble, reverse the above procedure. Be sure to check both grounded clutch clearances. Before installing the input clutches retainer, follow the instructions in **Determining No. 4 Thrust Plate Thickness**.

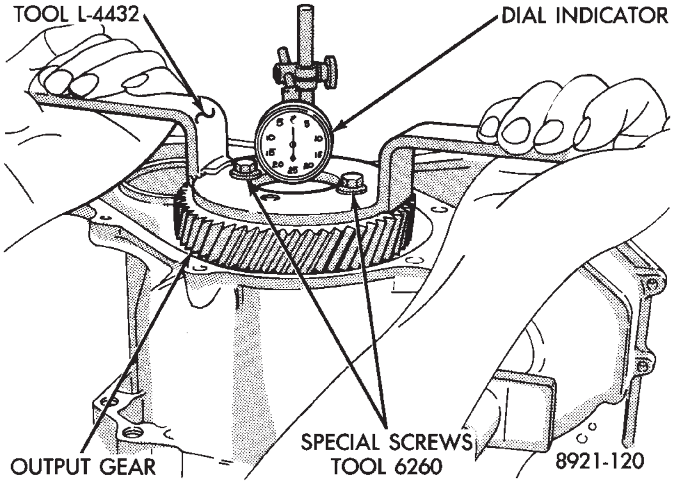


Fig. 85 Checking Output Gear Bearings End Play

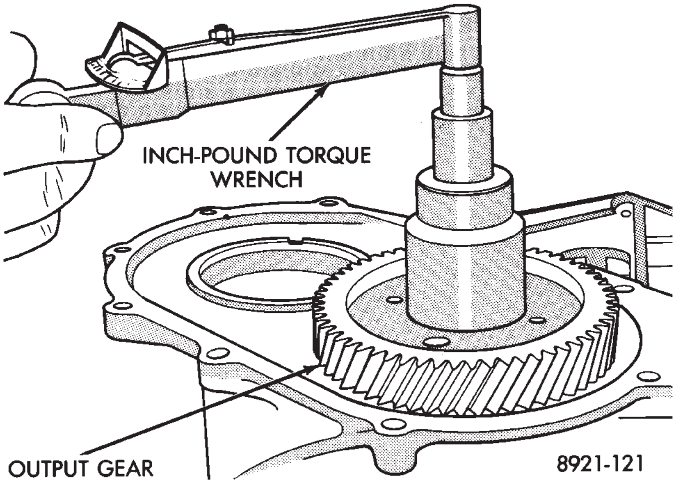


Fig. 86 Checking Output Gear Bearings Turning Torque

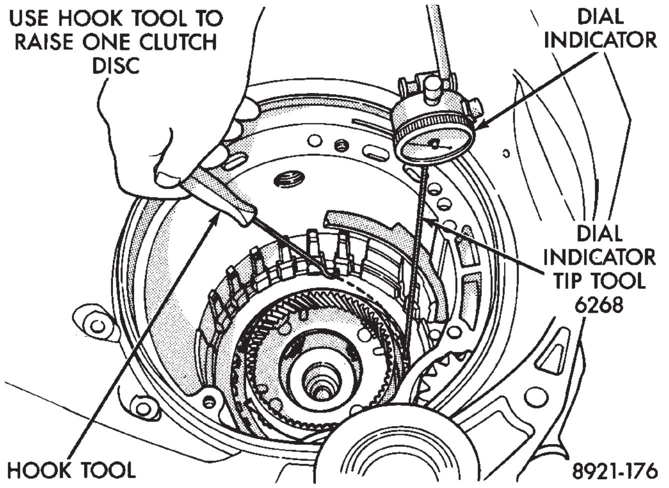
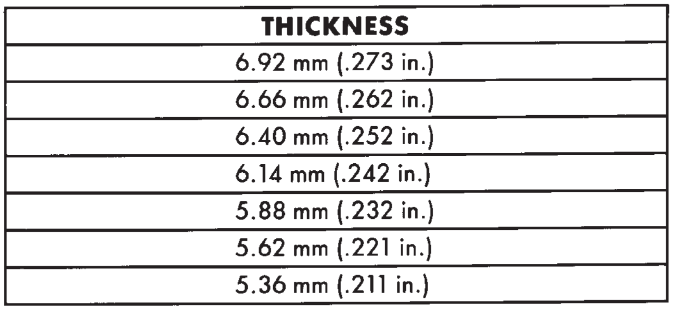


Fig. 87 Check Low/Reverse Clutch Clearance

Press down clutch pack with finger and zero dial indicator. **Low/Reverse clutch pack clearance is 1.04 to 1.65mm (.042 to .065 inch).**

Select the proper low/reverse reaction plate to achieve specifications:

LOW/REVERSE REACTION PLATE CHART



THICKNESS
6.92 mm (.273 in.)
6.66 mm (.262 in.)
6.40 mm (.252 in.)
6.14 mm (.242 in.)
5.88 mm (.232 in.)
5.62 mm (.221 in.)
5.36 mm (.211 in.)

9121-4

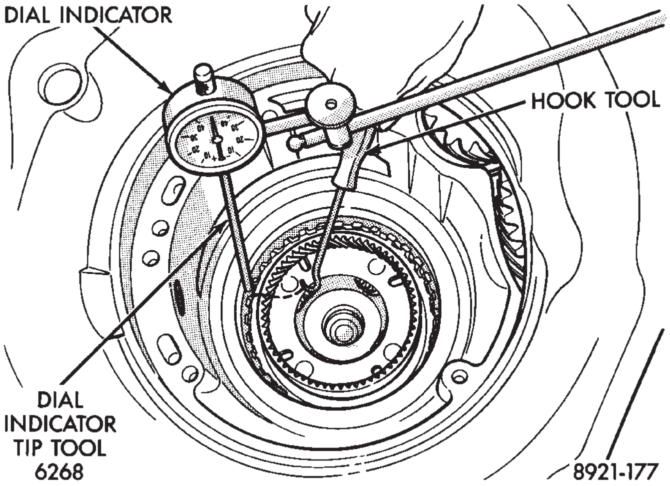


Fig. 88 Check 2/4 Clutch Clearance

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.**

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. 87) to hold thrust plate in position, install input clutches assembly. Be sure the input clutches assembly is completely seated (Fig. 88).

CAUTION: If view through input speed sensor hole is not as shown above, the input clutches assembly is not seated properly.

By removing the oil pump O-ring, you will be able to install and remove the oil pump and gasket very easily to select the proper No. 4 thrust plate.

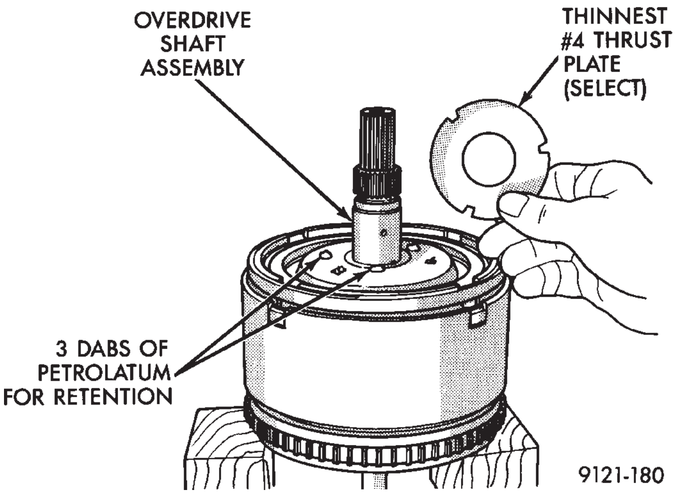


Fig. 89 Select Thinnest No. 4 Thrust Plate

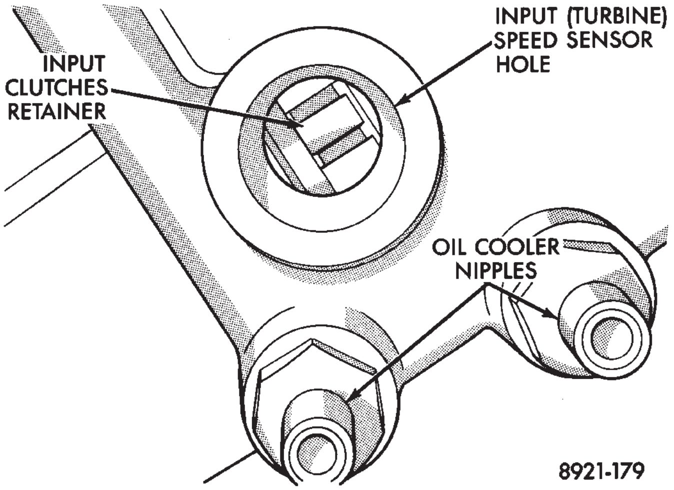


Fig. 90 View Through Input Speed Sensor Hole

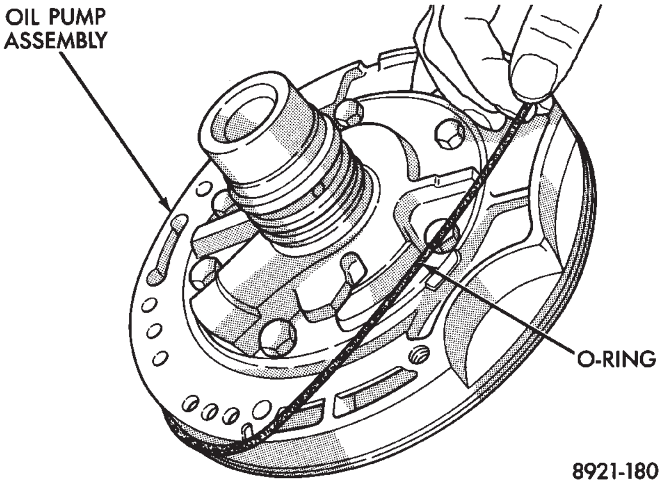


Fig. 91 Remove Oil Pump O-Ring

CAUTION: Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.

Input shaft end play must be .005 to .025 inch.

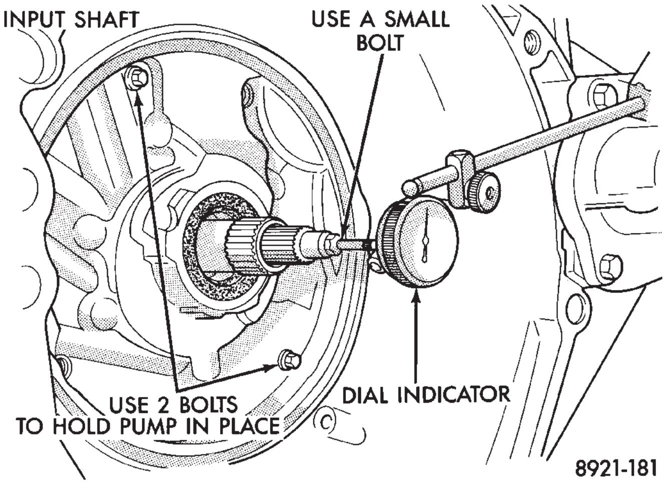
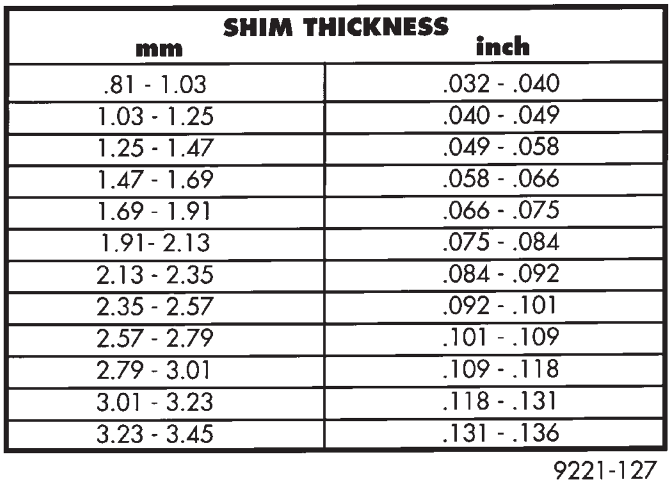


Fig. 92 Measure Input Shaft End Play

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.

See chart below to select the proper No. 4 thrust plate.

NO. 4 THRUST PLATE CHART



SHIM THICKNESS mm	SHIM THICKNESS inch
.81 - 1.03	.032 - .040
1.03 - 1.25	.040 - .049
1.25 - 1.47	.049 - .058
1.47 - 1.69	.058 - .066
1.69 - 1.91	.066 - .075
1.91- 2.13	.075 - .084
2.13 - 2.35	.084 - .092
2.35 - 2.57	.092 - .101
2.57 - 2.79	.101 - .109
2.79 - 3.01	.109 - .118
3.01 - 3.23	.118 - .131
3.23 - 3.45	.131 - .136

9221-127

INPUT CLUTCHES-RECONDITION

DISASSEMBLY

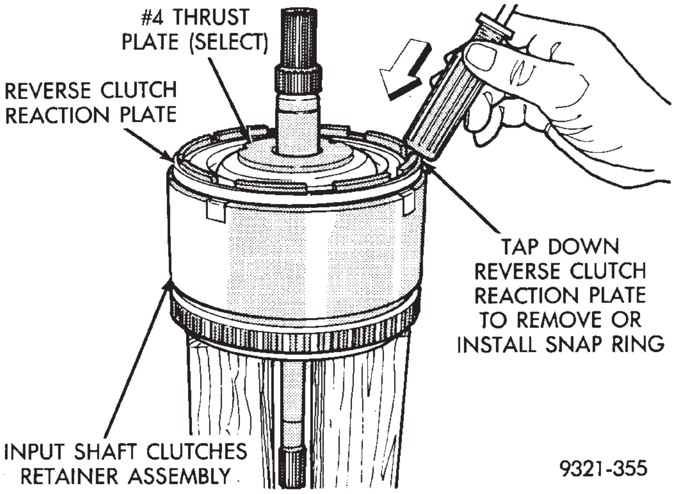


Fig. 1 Tapping Reaction Plate

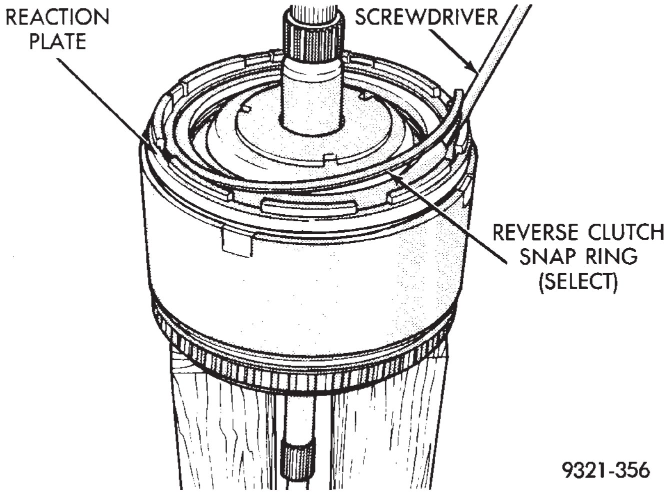


Fig. 2 Reverse Clutch Snap Ring

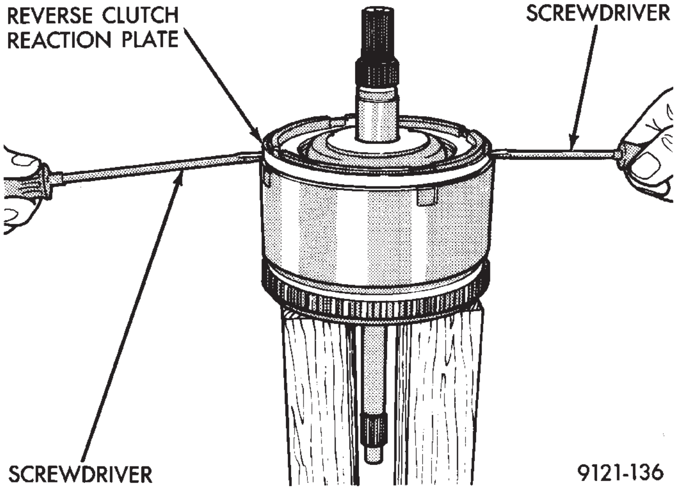


Fig. 3 Pry Reverse Clutch Reaction Plate

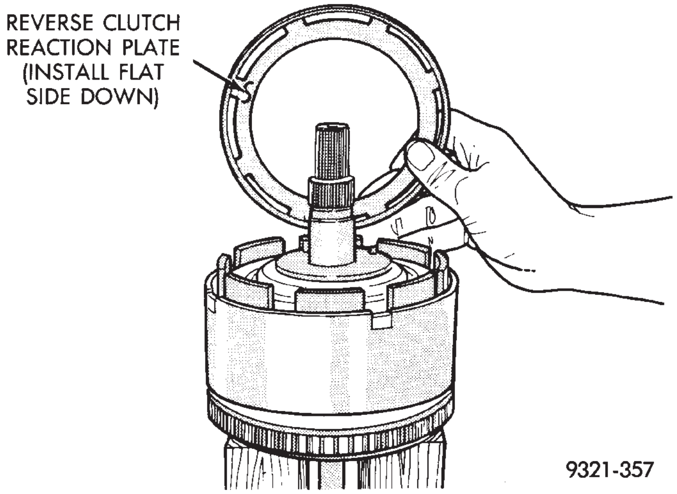


Fig. 4 Reverse Clutch Reaction Plate

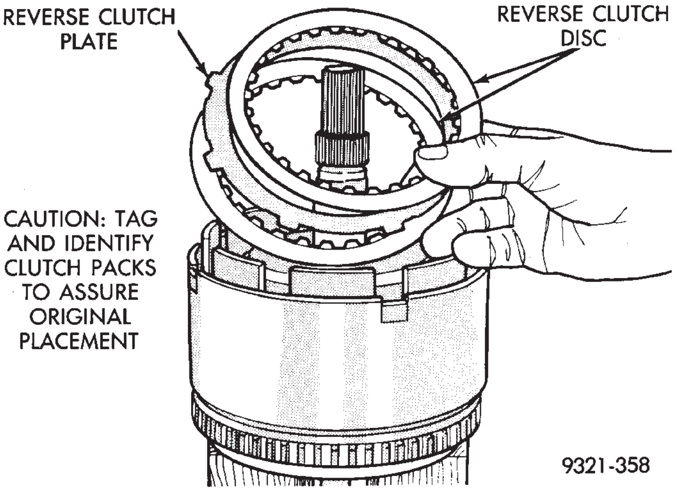


Fig. 5 Reverse Clutch Pack

Tag reverse clutch pack for reassembly identification.

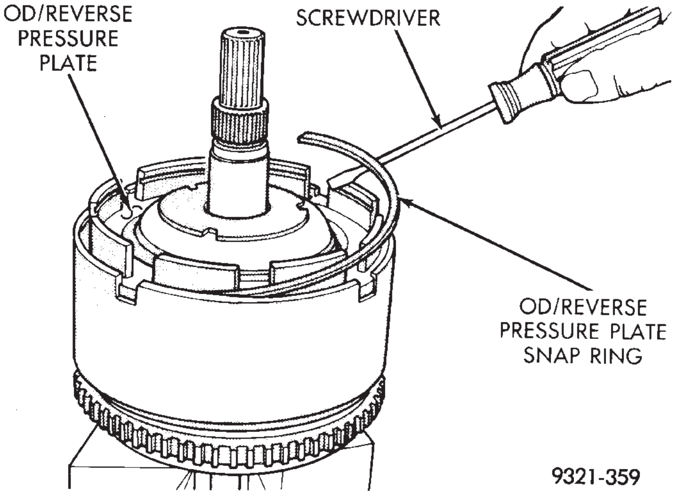


Fig. 6 OD/Reverse Pressure Plate Snap Ring

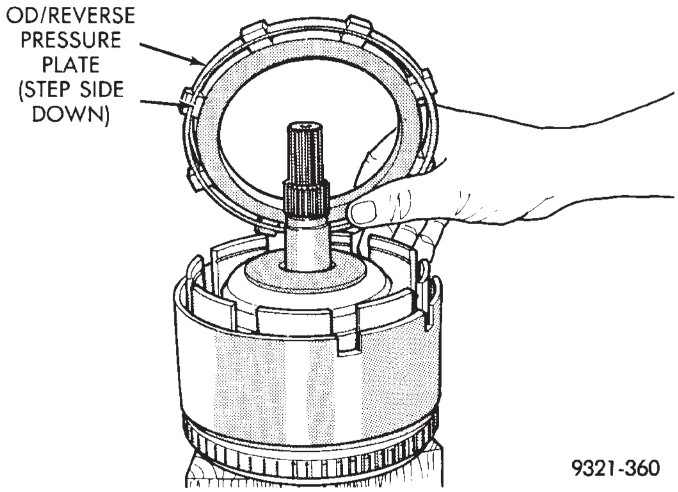


Fig. 7 OD/Reverse Pressure Plate

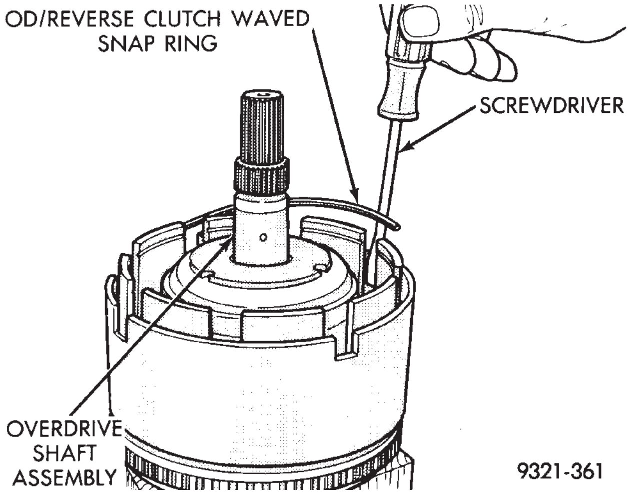


Fig. 8 Waved Snap Ring

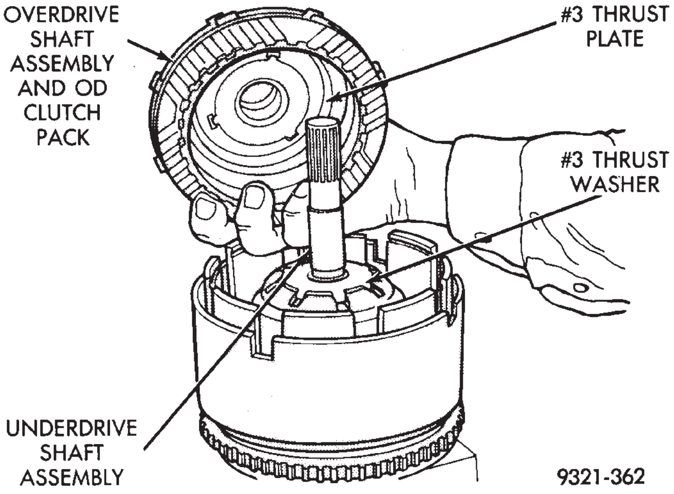


Fig. 9 Remove OD Clutch Pack

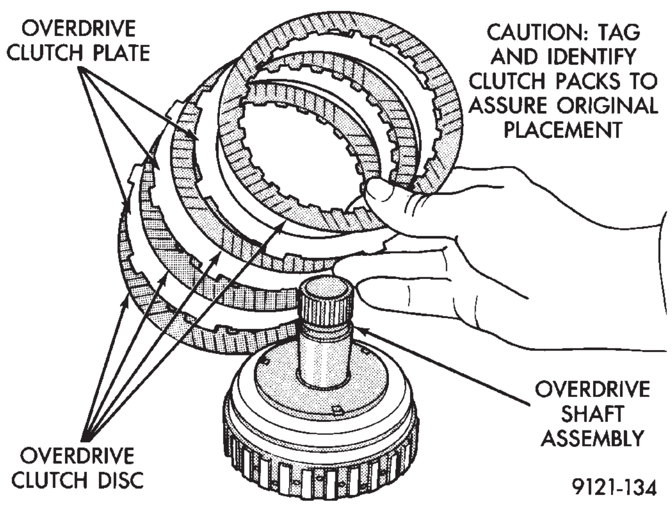


Fig. 10 Overdrive Clutch Pack

Tag overdrive clutch pack for reassembly identification.

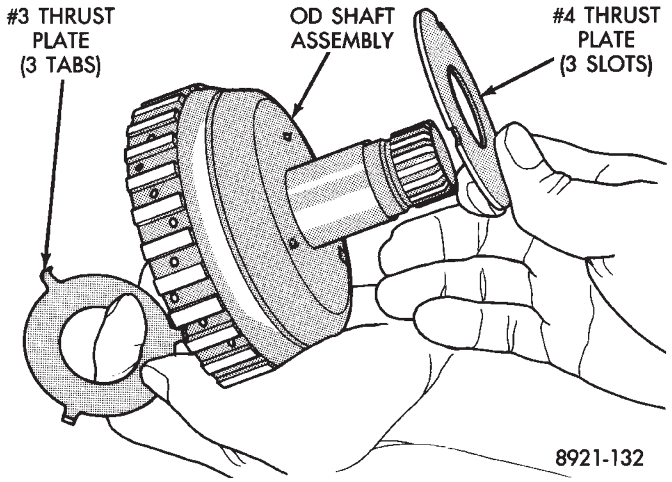


Fig. 11 Overdrive Shaft Assembly

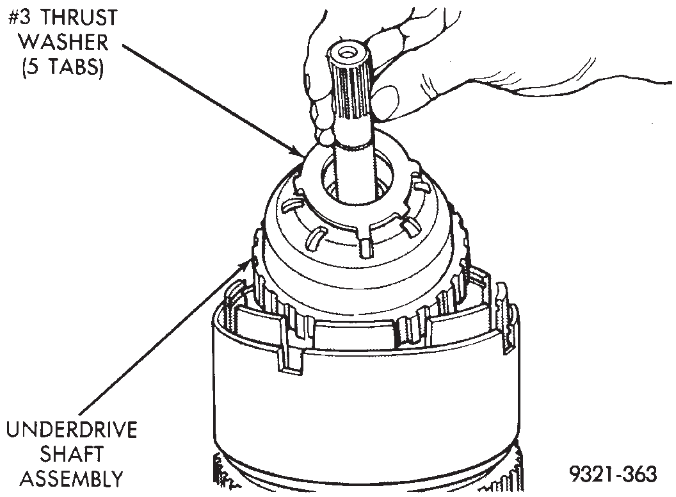


Fig. 12 Underdrive Shaft Assembly

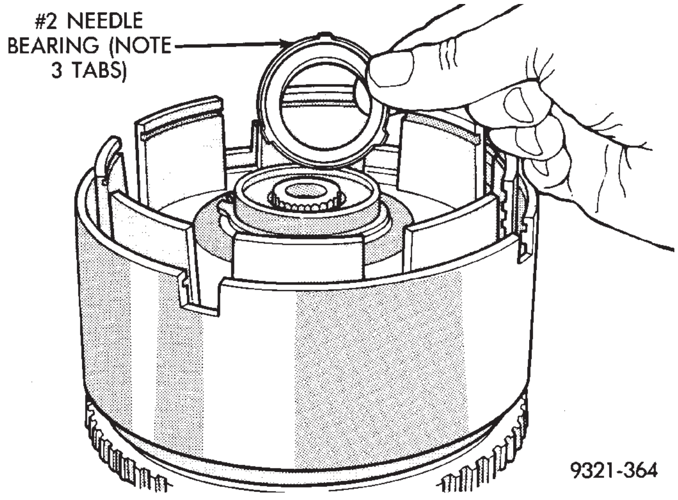


Fig. 13 No. 2 Needle Bearing

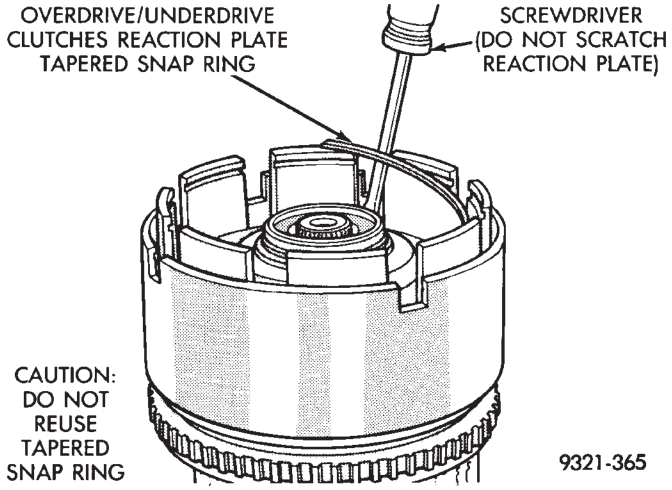


Fig. 14 OD/UD Reaction Plate Tapered Snap Ring

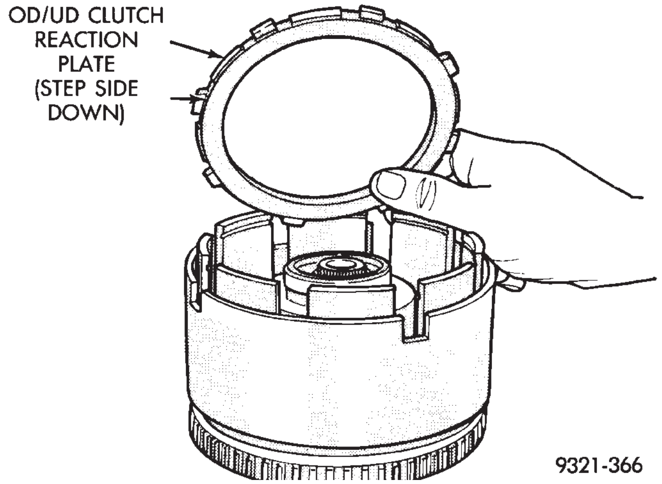


Fig. 15 OD/UD Reaction Plate

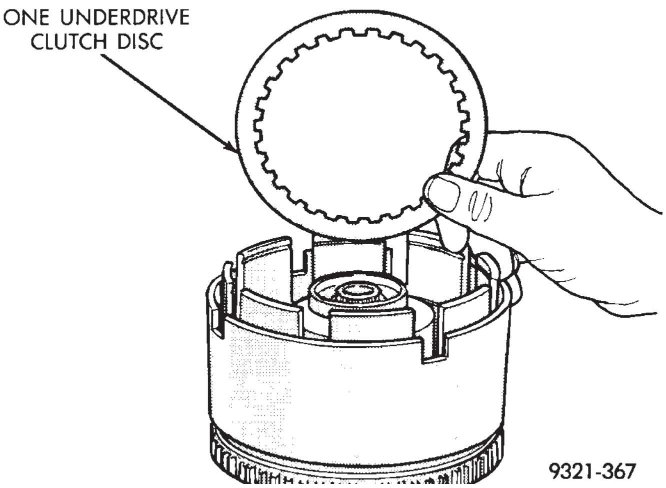


Fig. 16 Remove One UD Clutch Disc

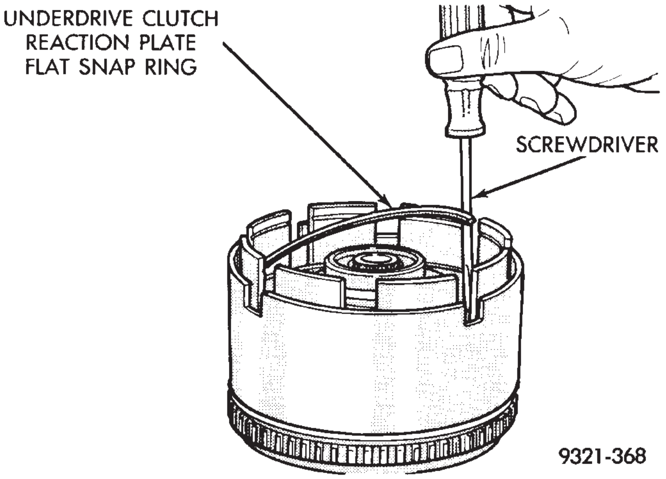


Fig. 17 UD Clutch Flat Snap Ring

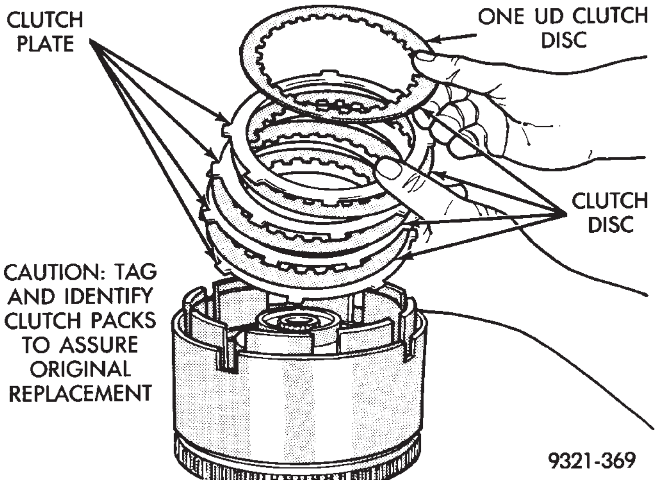


Fig. 18 Underdrive Clutch Pack

Tag underdrive clutch pack for reassembly identification.

CAUTION: Compress return spring just enough to remove or install snap ring.

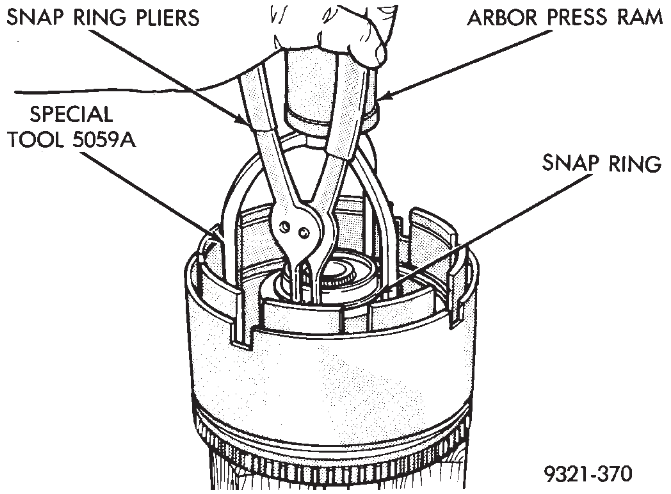


Fig. 19 UD Spring Retainer Snap Ring

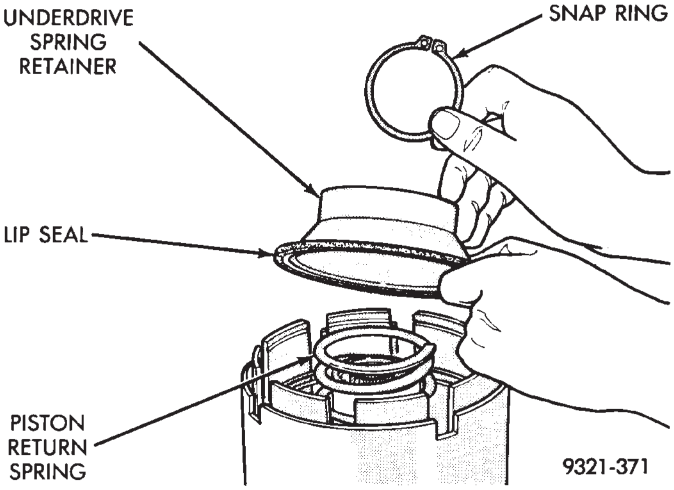


Fig. 20 UD Return Spring and Retainer

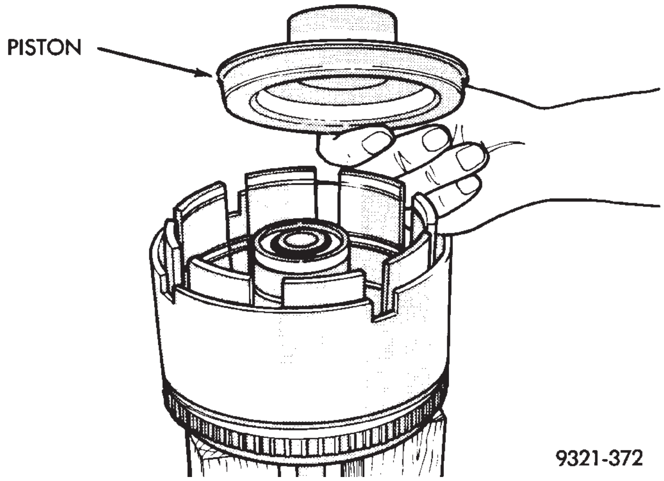


Fig. 21 Underdrive Clutch Piston

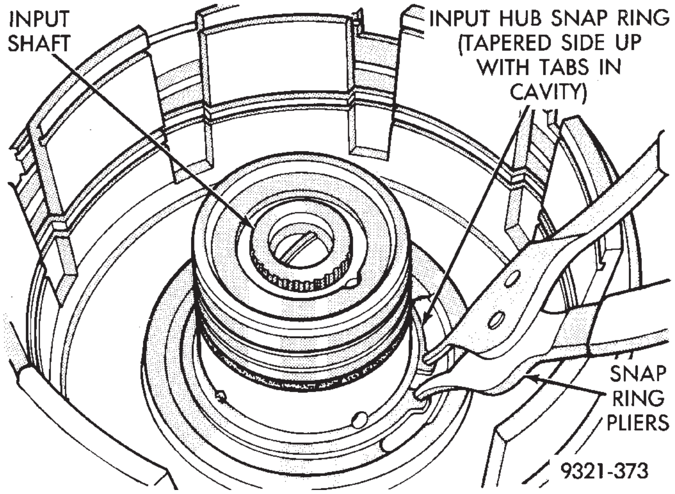


Fig. 22 Input Hub Tapered Snap Ring

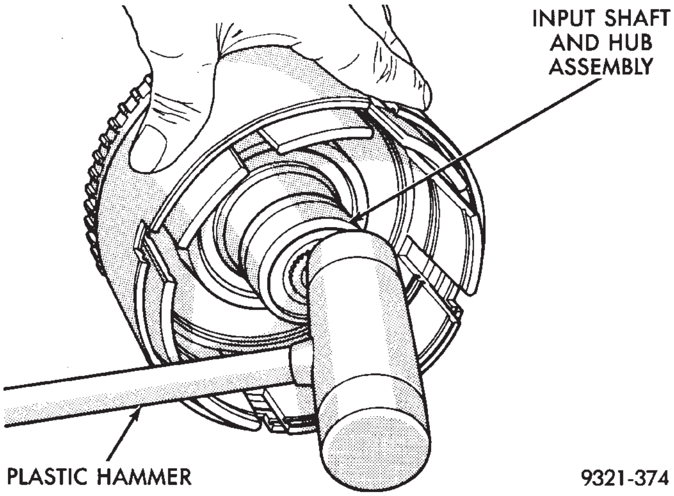


Fig. 23 Tap on Input Hub

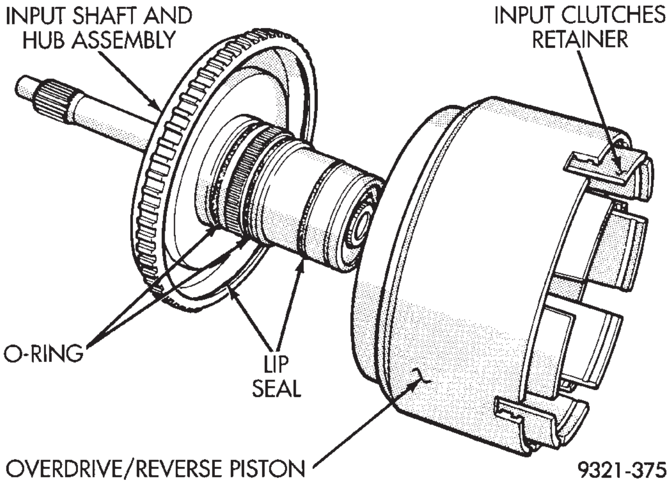


Fig. 24 Input Hub Removed

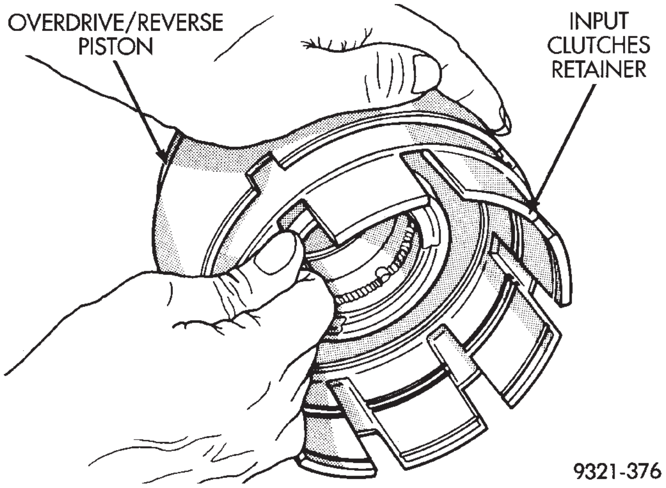


Fig. 25 Pull Retainer from Piston

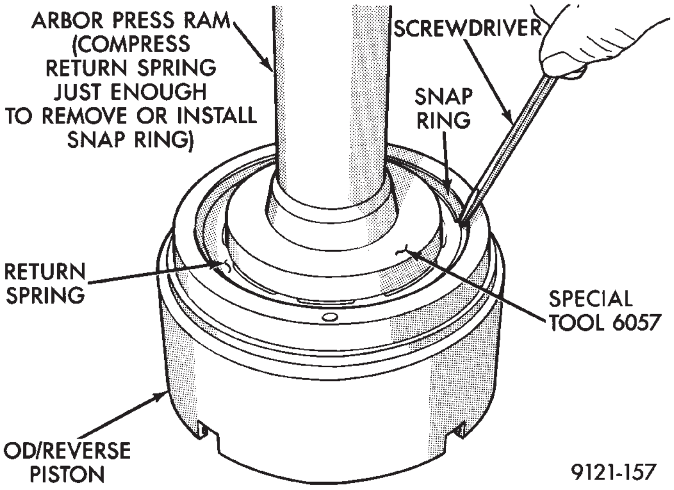


Fig. 26 Install Snap Ring

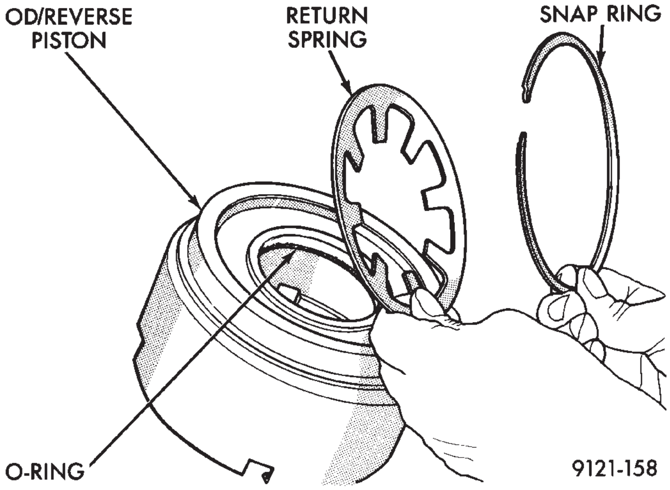


Fig. 27 Snap Ring and Return Spring

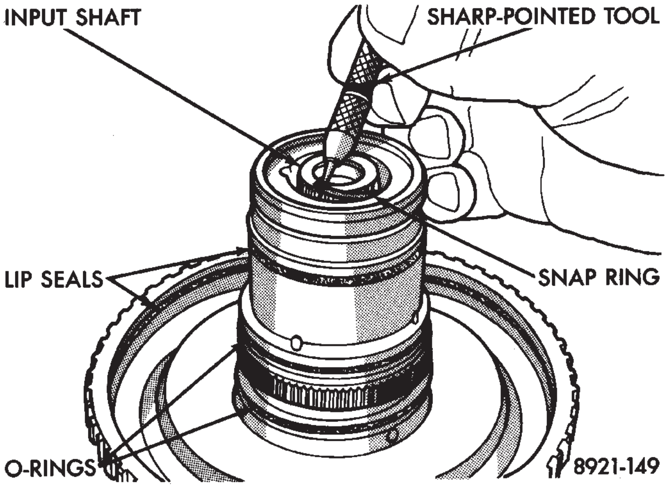


Fig. 28 Remove Input Shaft Snap Ring

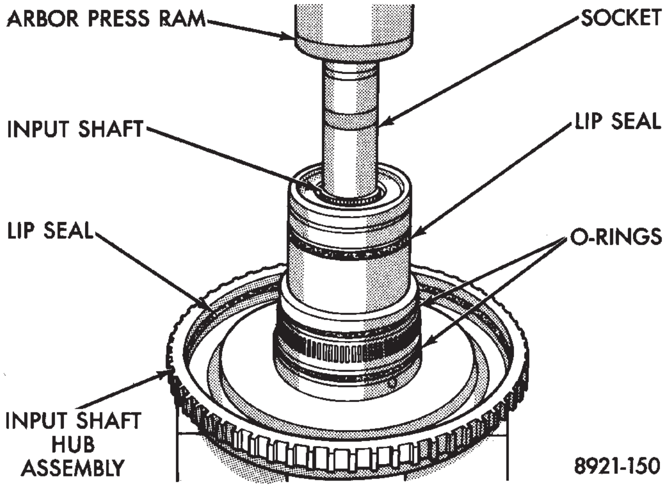


Fig. 29 Remove Input Shaft

ASSEMBLY

Use petrolatum on all seals to ease assembly of components.

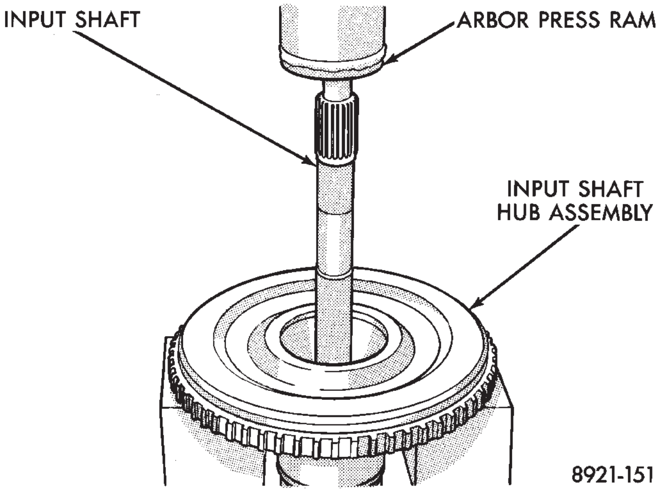


Fig. 1 Install Input Shaft

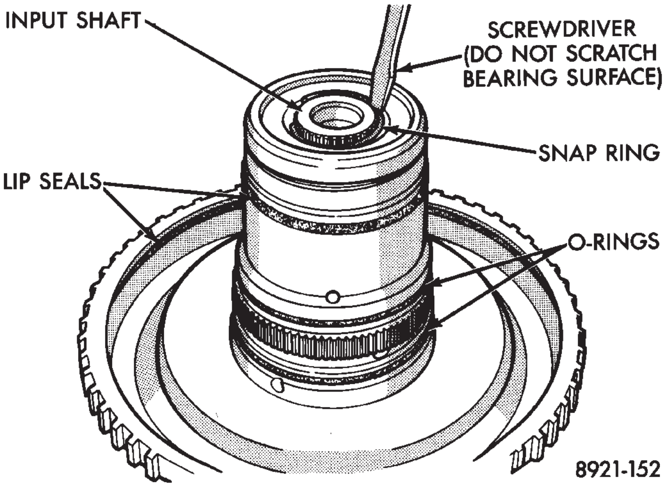


Fig. 2 Install Input Shaft Snap Ring

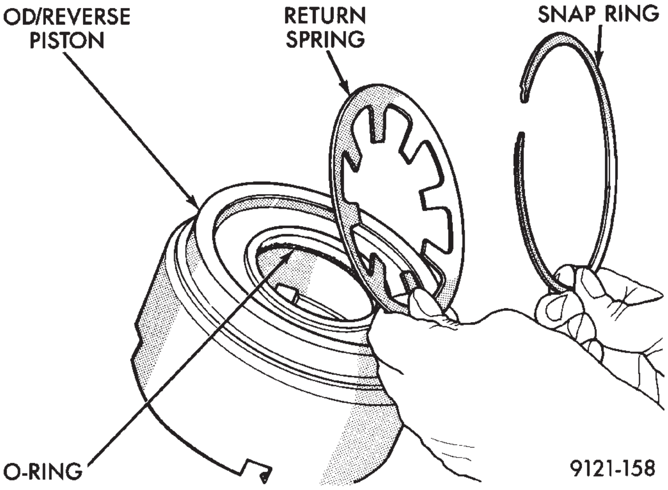


Fig. 3 Return Spring and Snap Ring

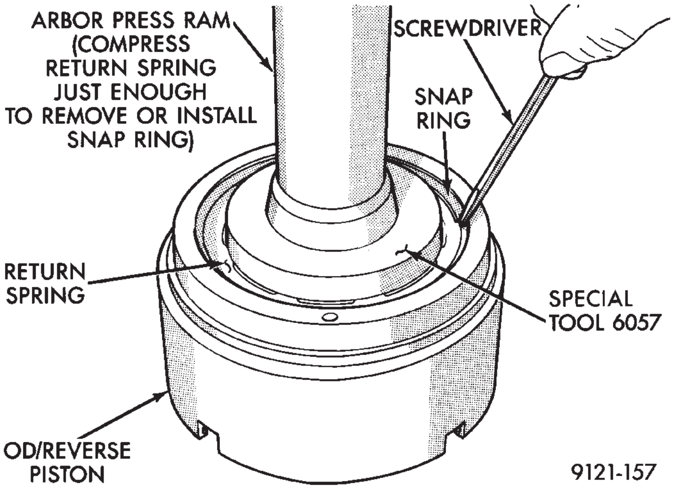


Fig. 4 Install Snap Ring

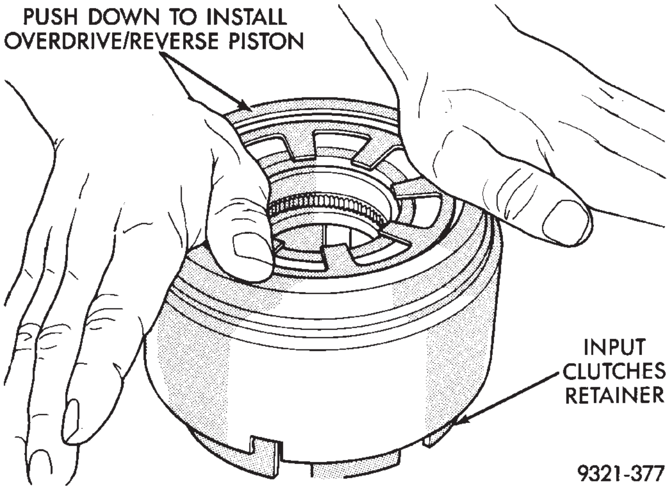


Fig. 5 Install OD/Reverse Piston

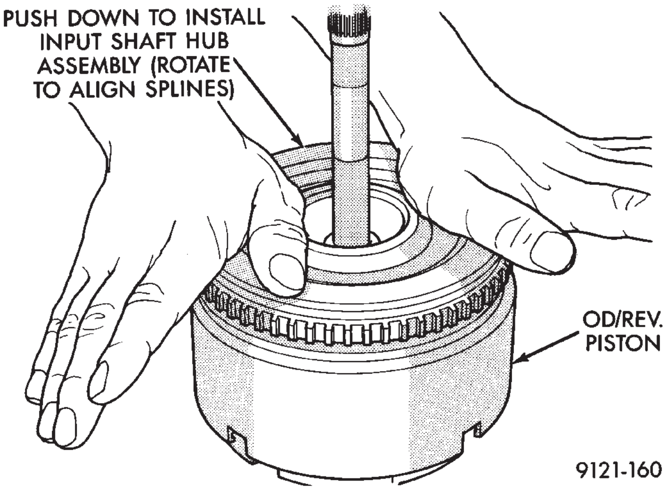


Fig. 6 Install Input Shaft Hub Assembly

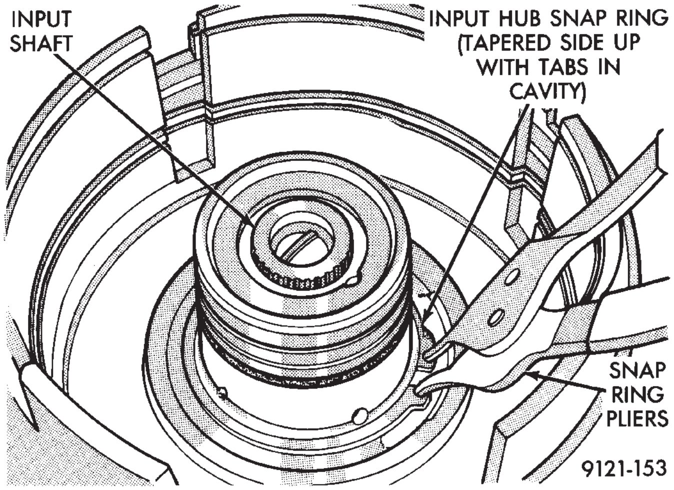


Fig. 7 Input Hub Tapered Snap Ring

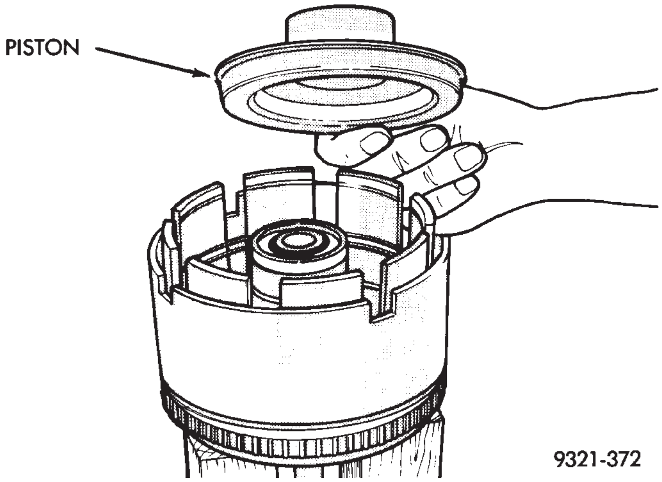


Fig. 8 Underdrive Clutch Piston

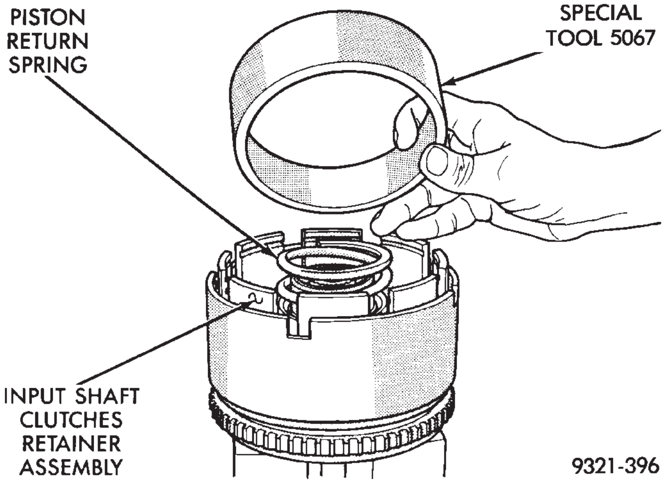


Fig. 9 Seal Compressor Special Tool 5067

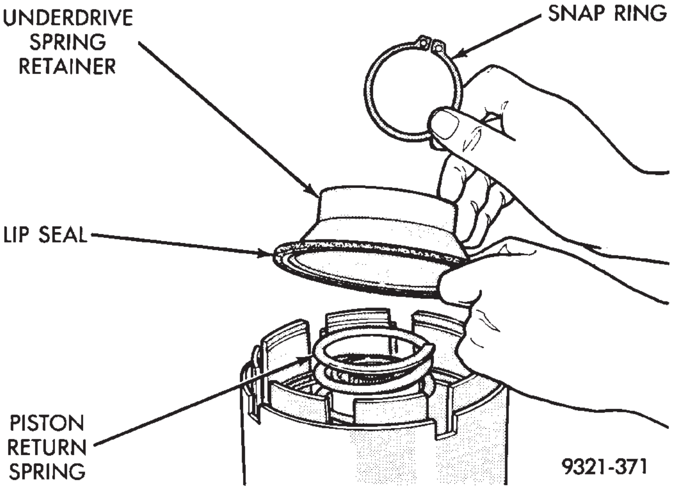


Fig. 10 UD Return Spring and Retainer

CAUTION: Compress return spring just enough to remove or install snap ring.

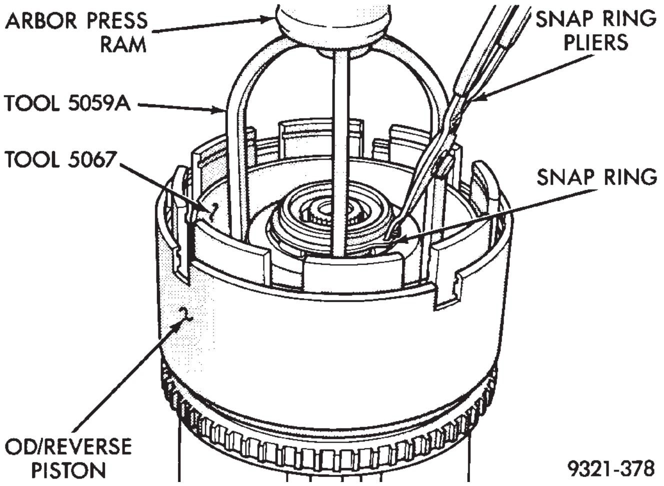


Fig. 11 Install UD Spring Retainer and Snap Ring

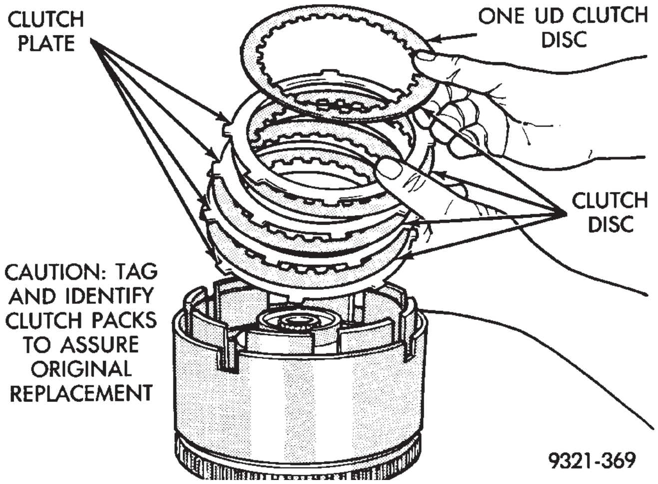


Fig. 12 Underdrive Clutch Pack

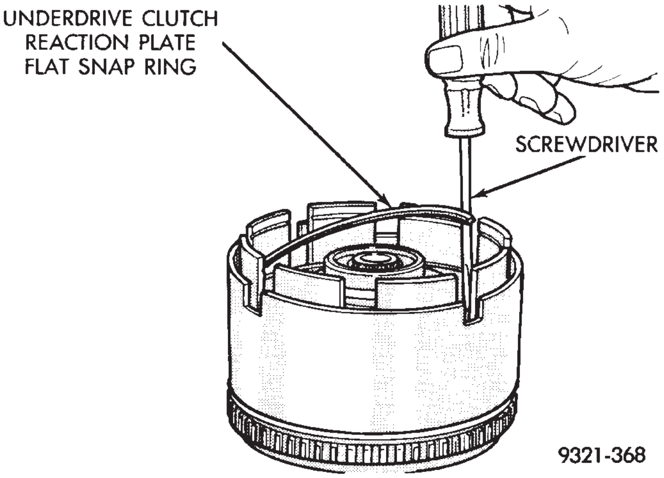


Fig. 13 UD Clutch Flat Snap Ring

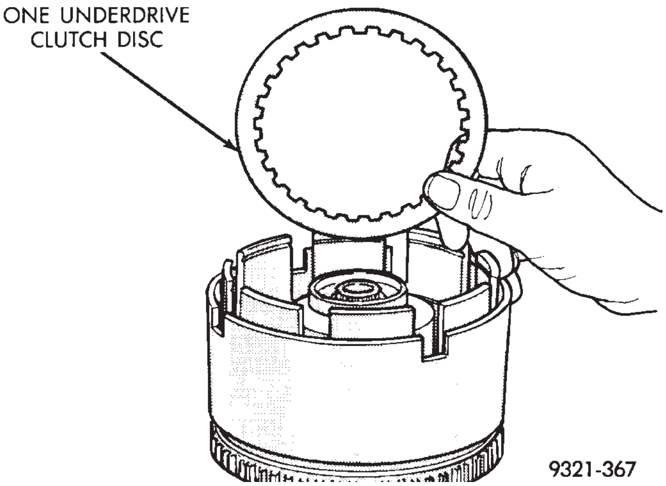


Fig. 14 Install Last UD Clutch Disc

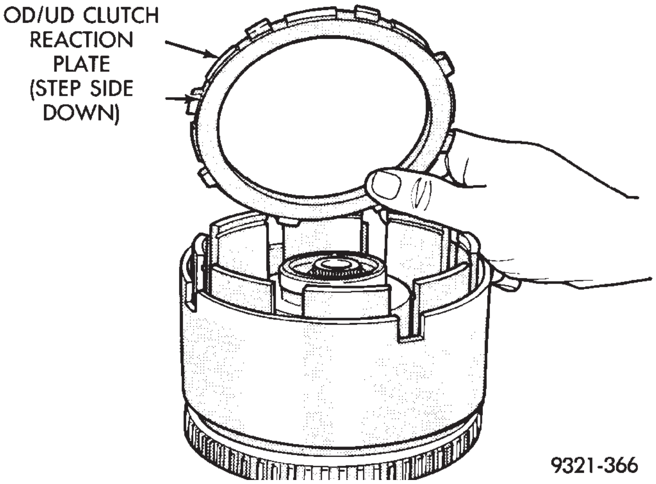


Fig. 15 OD/UD Reaction Plate

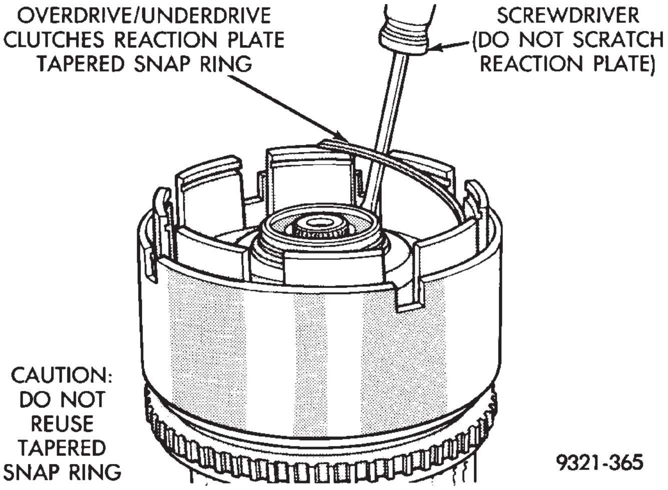


Fig. 16 Tapered Snap Ring

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.

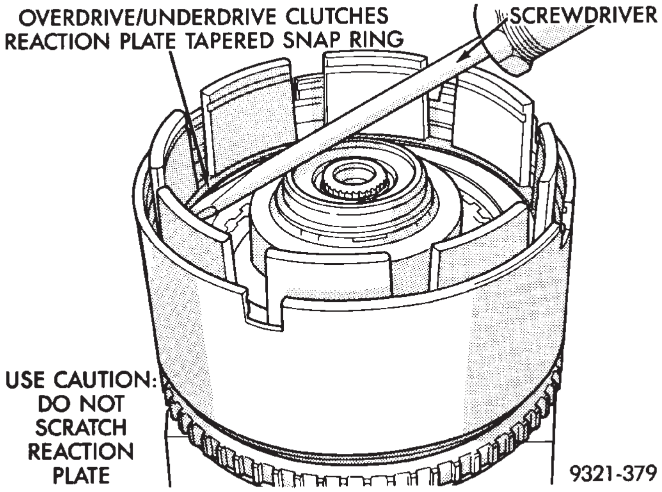


Fig. 17 Seating Tapered Snap Ring

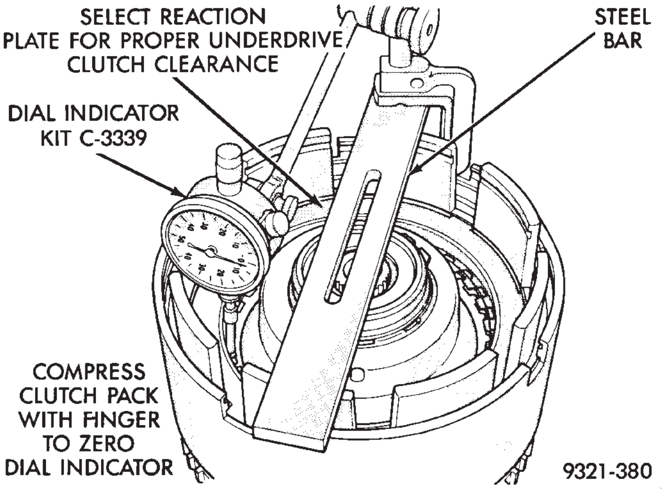


Fig. 18 Set Up Dial Indicator for Clutch Clearance

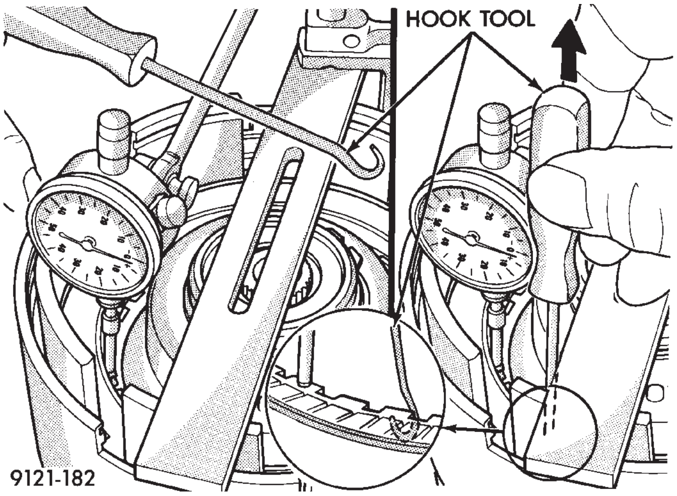


Fig. 19 Use Hook Tool to Raise One Clutch Disc

Underdrive clutch pack clearance must be 0.91 to 1.47 mm (.036 to .058 inch). Select the proper reaction plate to achieve specifications:

UNDERDRIVE REACTION PLATE CHART

THICKNESS
6.99 mm (.275 in.)
6.50 mm (.256 in.)
6.01 mm (.237 in.)
5.52 mm (.217 in.)

9121-5

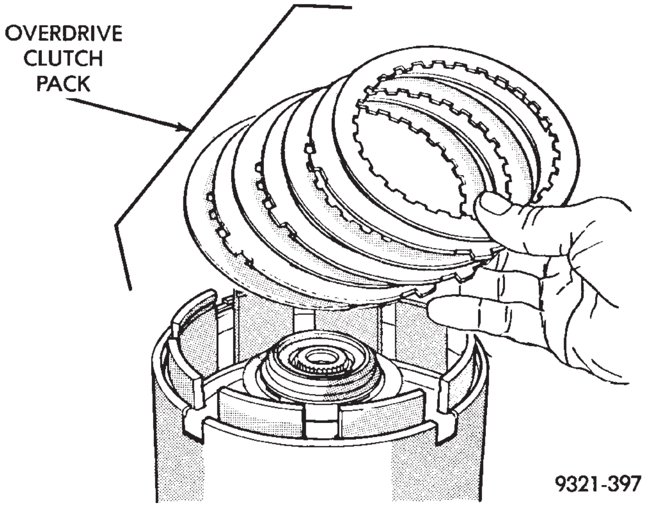


Fig. 20 Install OD Clutch Pack

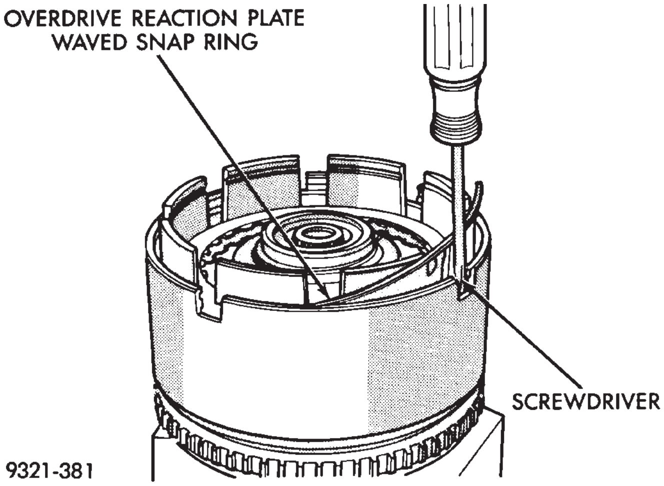


Fig. 21 Install Waved Snap Ring

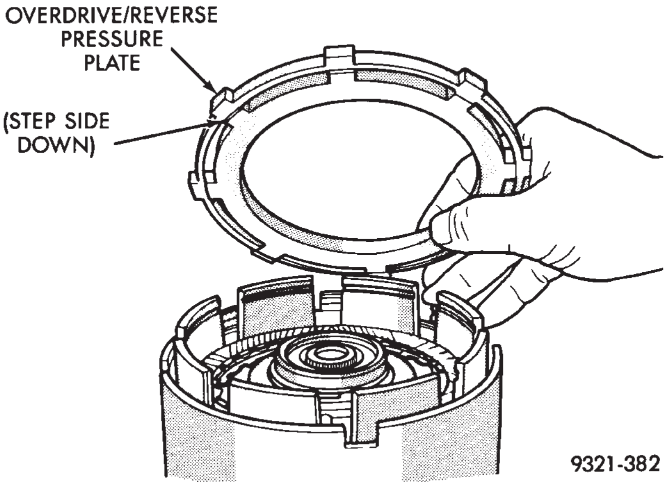


Fig. 22 OD/Reverse Pressure Plate

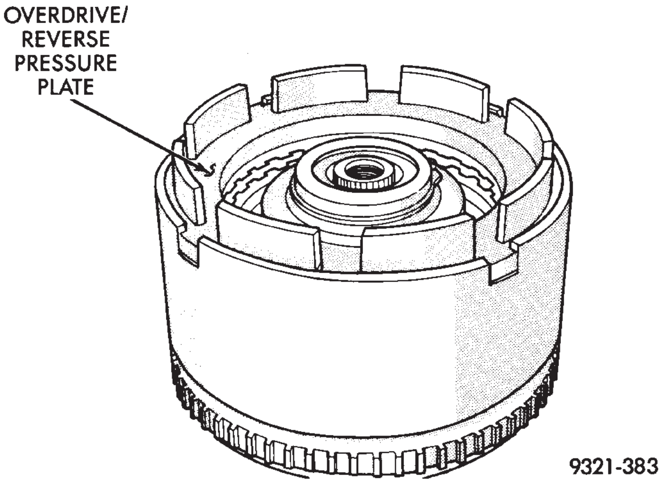


Fig. 23 Pressure Plate Installed

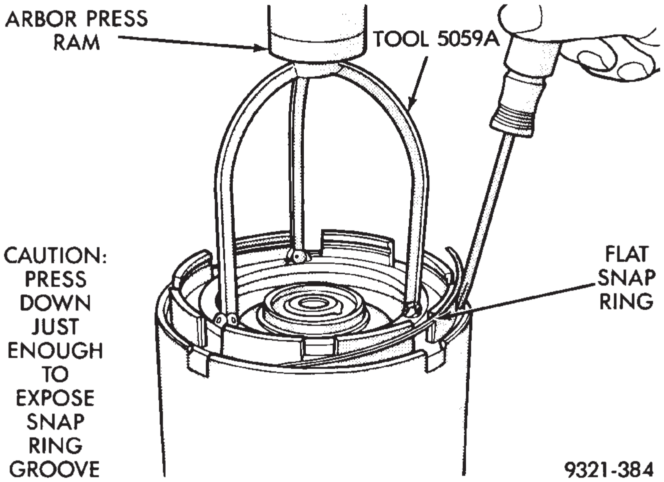


Fig. 24 Install Flat Snap Ring

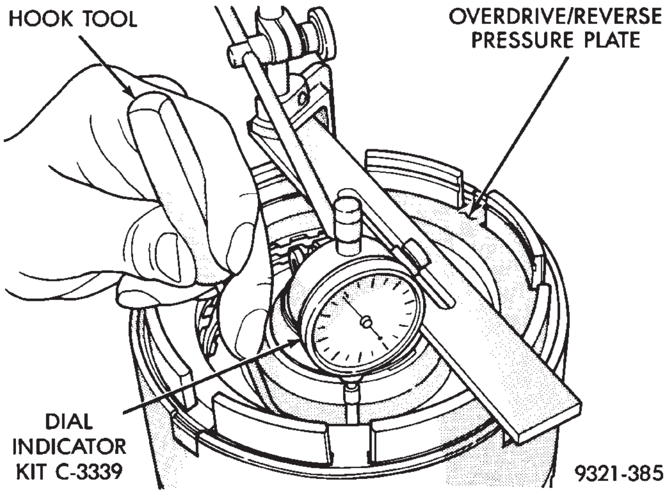


Fig. 25 Check OD Clutch Pack Clearance

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.

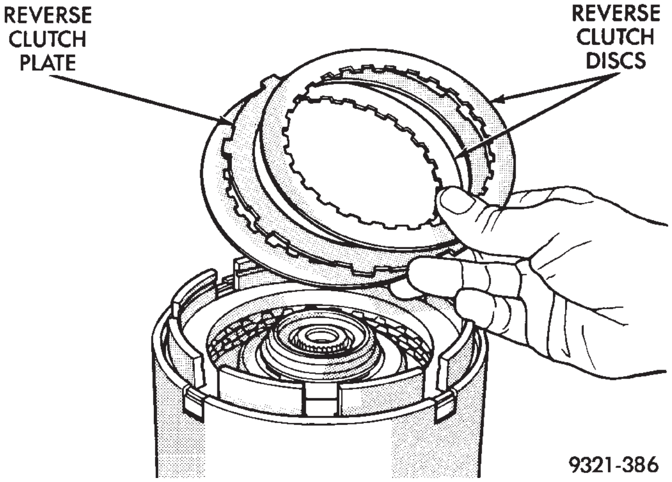


Fig. 26 Install Reverse Clutch Pack

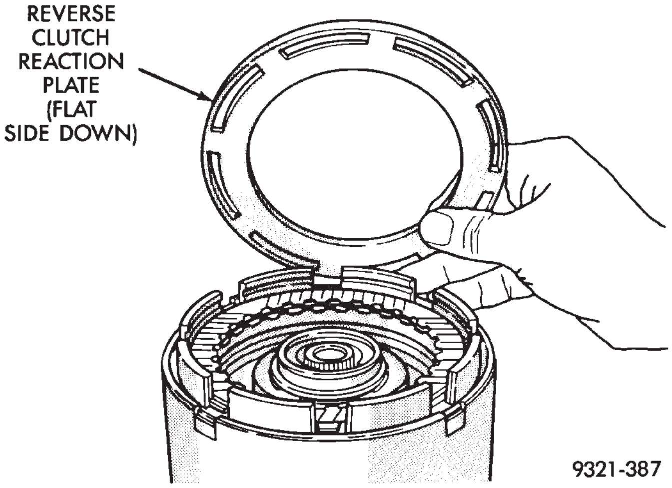


Fig. 27 Install Reaction Plate

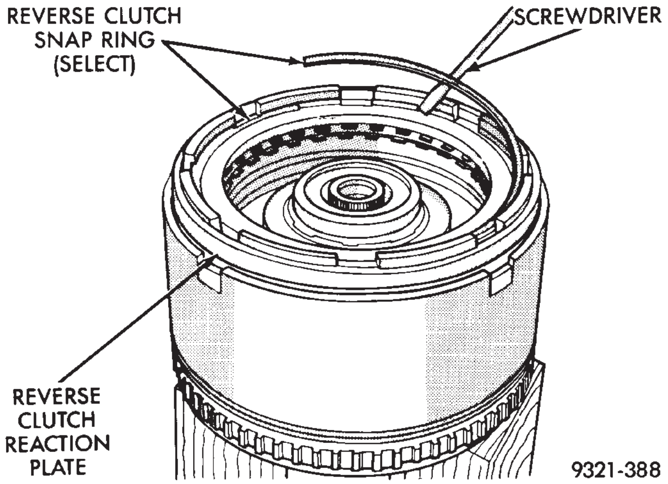


Fig. 28 Install Reverse Clutch Snap Ring

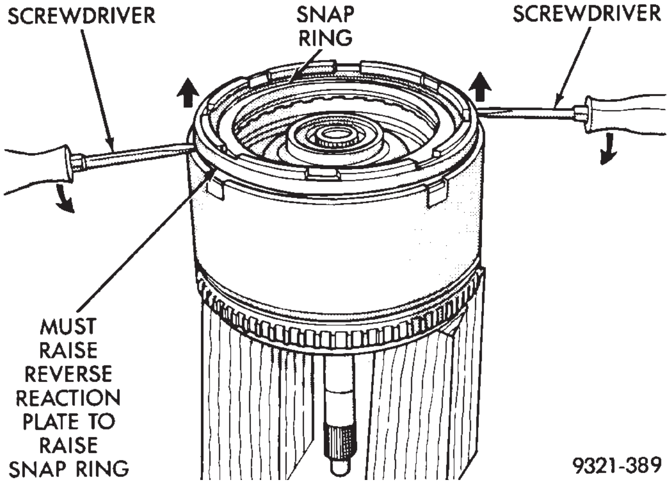


Fig. 29 Seating Snap Ring to Determine Reverse Clutch Clearance

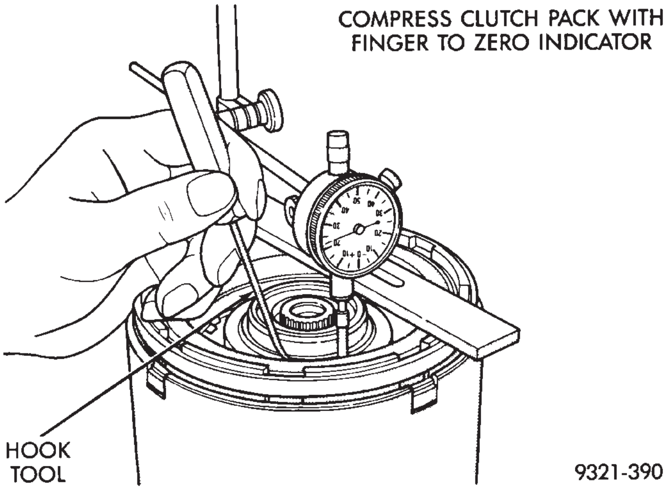


Fig. 30 Check Reverse Clutch Pack Clearance

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:

REVERSE CLUTCH SNAP RING CHART

THICKNESS
1.56 mm (.061 in.)
1.80 mm (.071 in.)
2.05 mm (.081 in.)
2.30 mm (.090 in.)

9121-6

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:

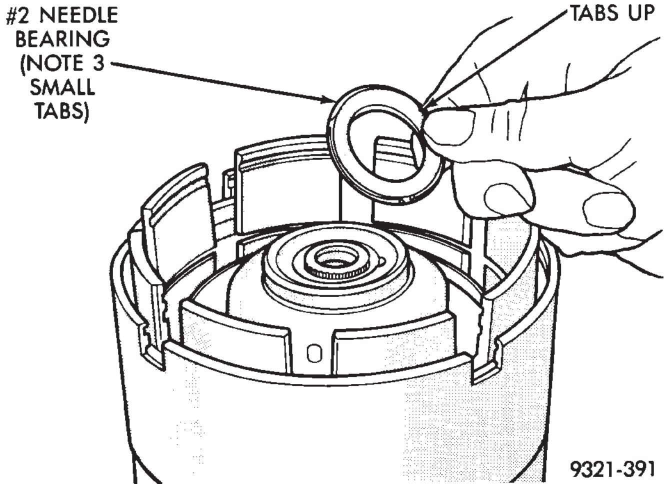


Fig. 31 Install No. 2 Needle Bearing

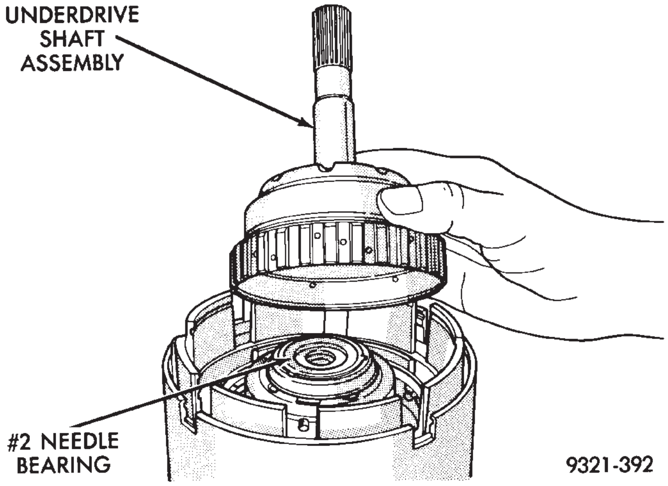


Fig. 32 Install Underdrive Shaft Assembly

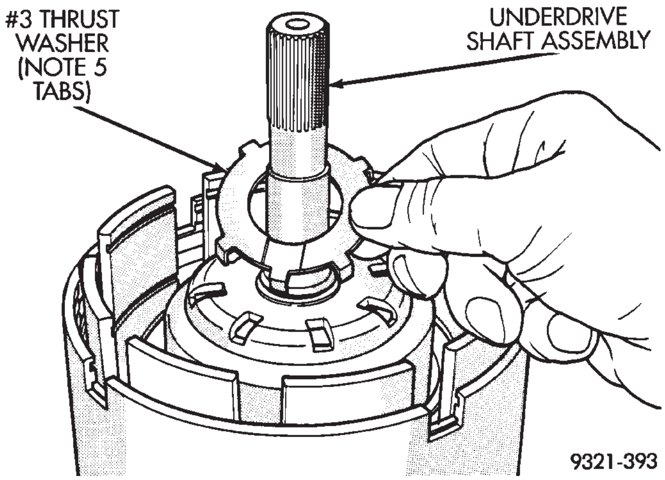


Fig. 33 Install No. 3 Thrust Washer

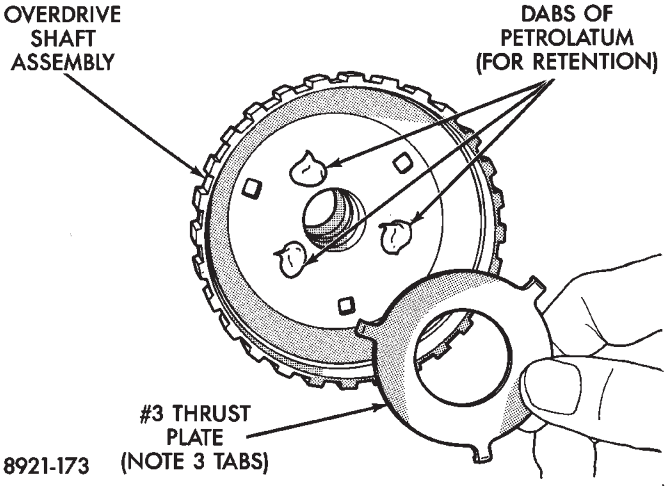


Fig. 34 Install No. 3 Thrust Plate

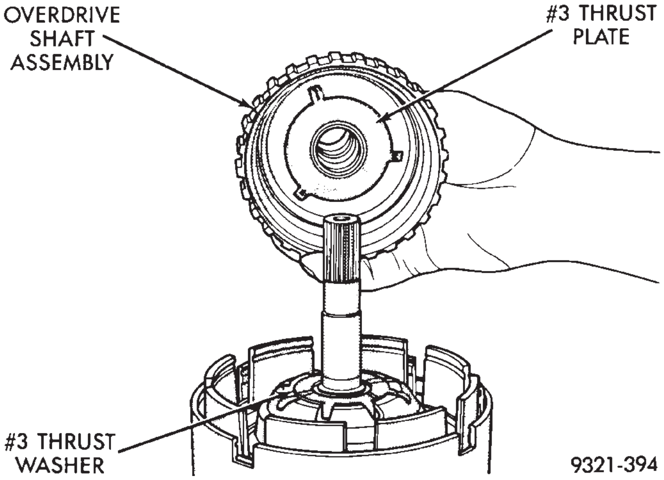


Fig. 35 Install Overdrive Shaft Assembly

Now that both shaft assemblies and thrust washers are properly installed, reinstall overdrive clutch and reverse clutch as shown in Figures 20 through 28. **Rechecking these clutch clearances is not necessary, as they were set and approved previously.**

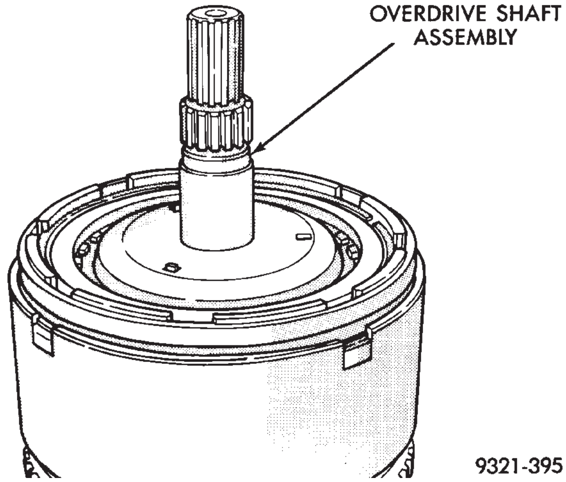


Fig. 36 Input Clutch Assembly

VALVE BODY-RECONDITION

Prior to removing any transaxle subassemblies, plug all openings and thoroughly clean exterior of the 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.

Tag all springs, as they are removed, for reassembly identification.

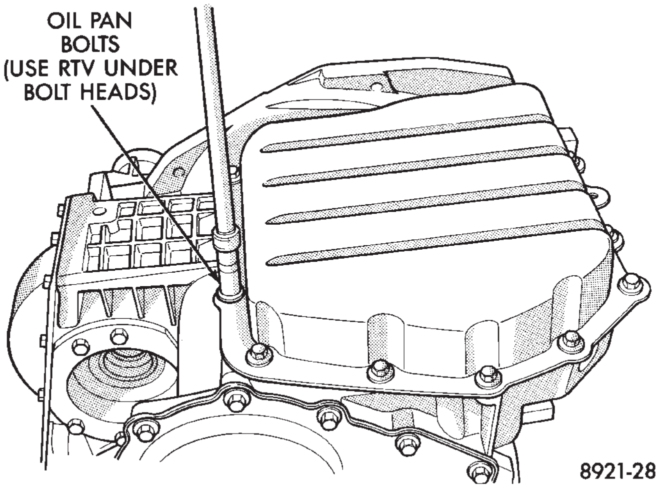


Fig. 1 Oil Pan Bolts

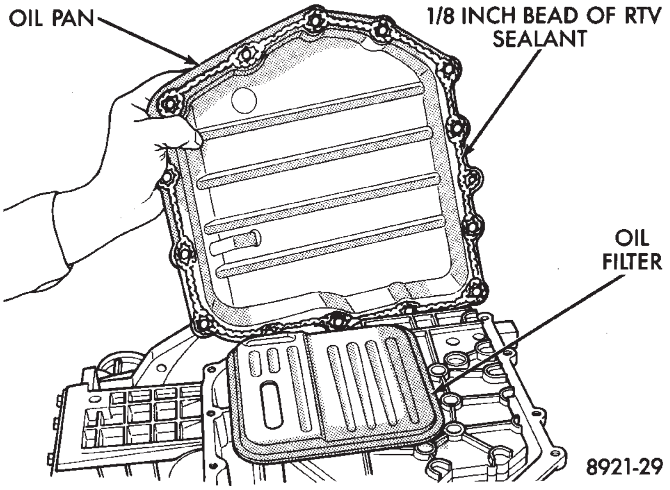


Fig. 2 Oil Pan

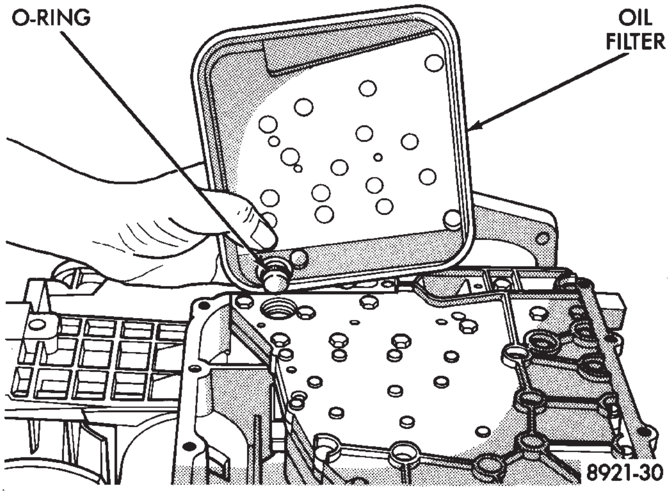


Fig. 3 Oil Filter

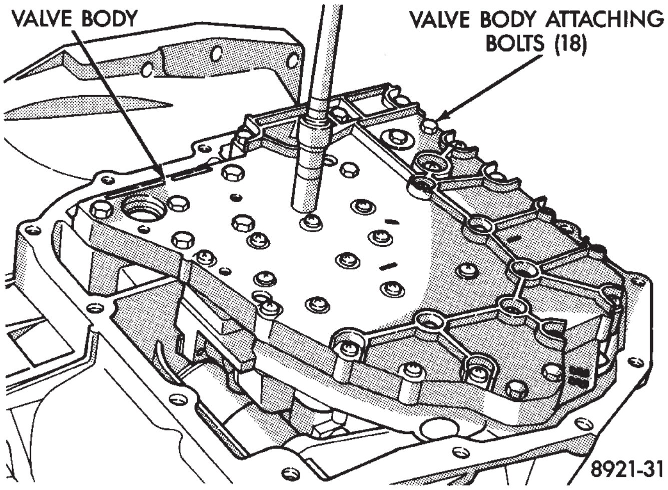


Fig. 4 Valve Body Attaching Bolts

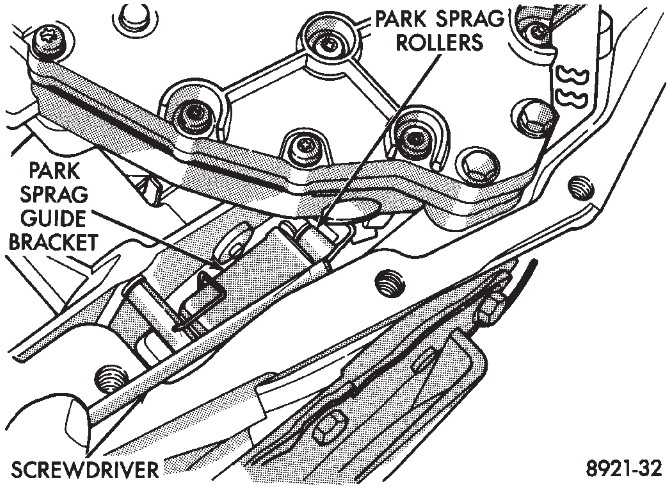


Fig. 5 Push Park Rod Rollers from Guide Bracket

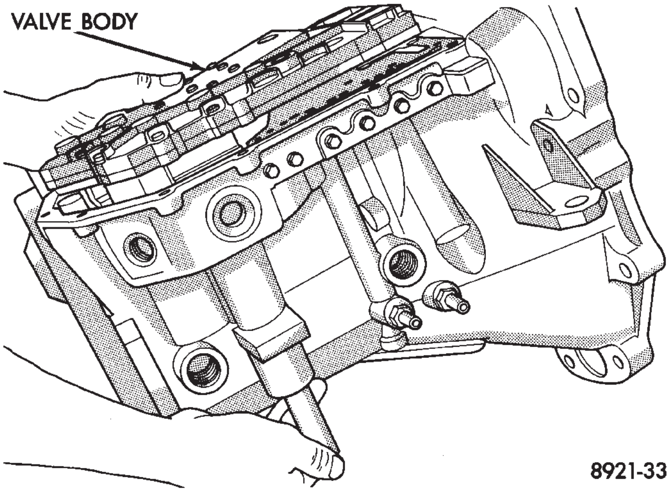


Fig. 6 Remove or Install Valve Body

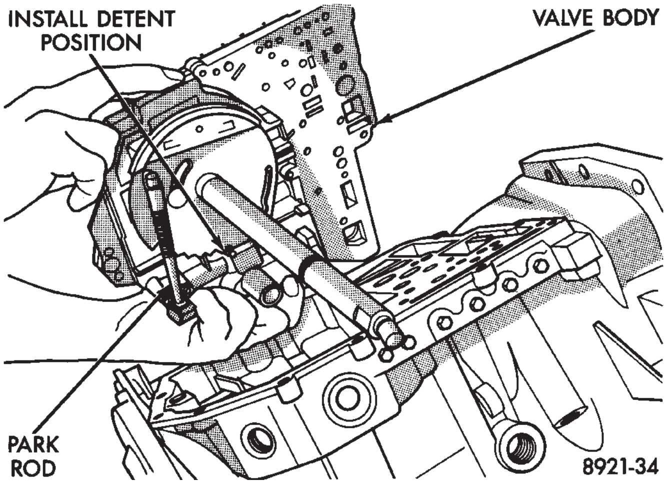


Fig. 7 Valve Body Removed

CAUTION: The valve body manual shaft pilot may distort and bind the manual valve if the valve body is mishandled or dropped.

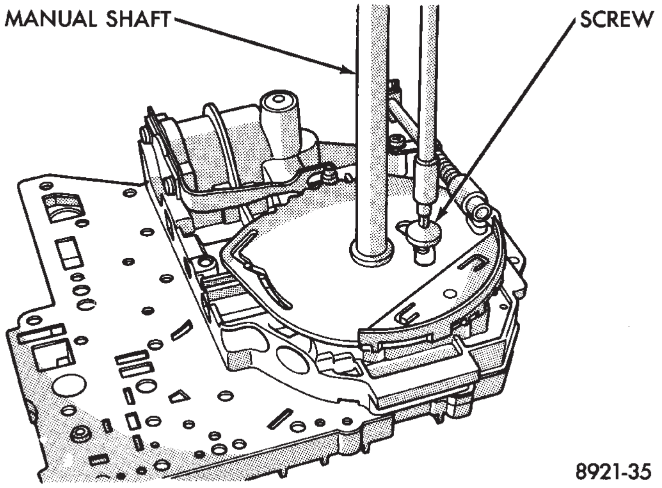


Fig. 8 Manual Shaft Screw

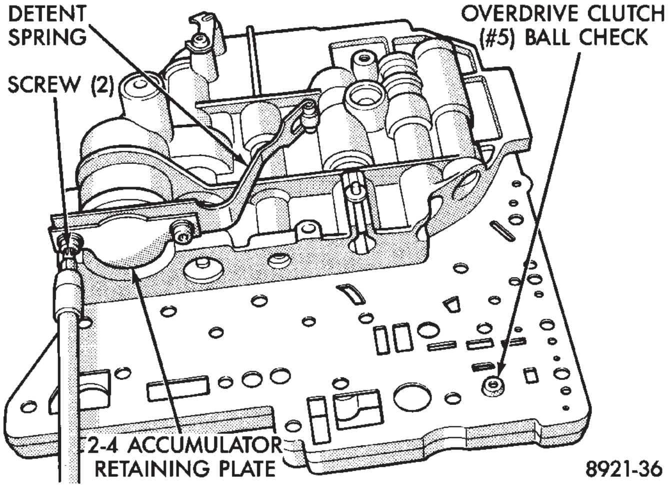


Fig. 9 Retaining Plate Screw

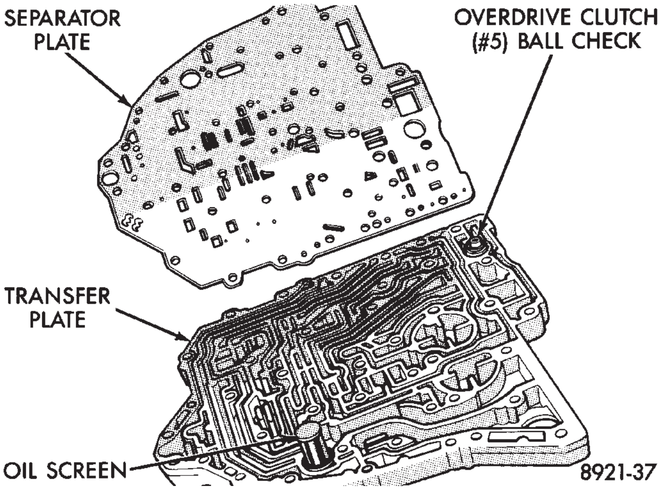


Fig. 10 Transfer Plate and Separator Plate

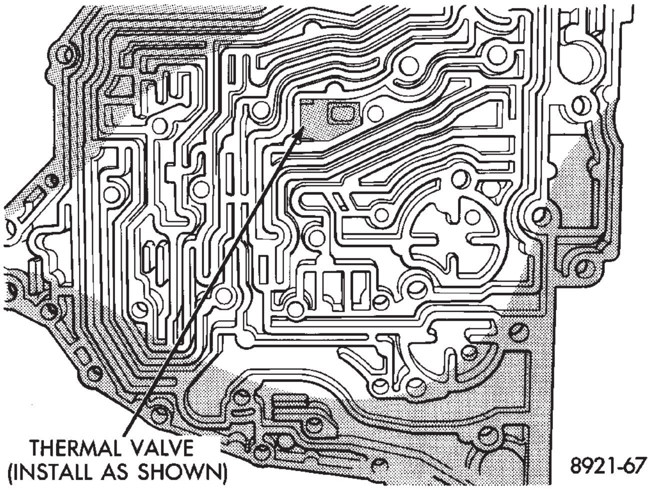


Fig. 11 Transfer Plate

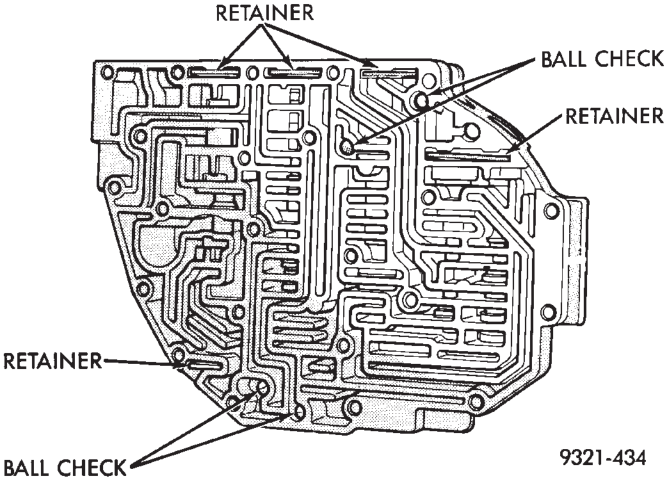


Fig. 12 Ball Check and Retainer Locations

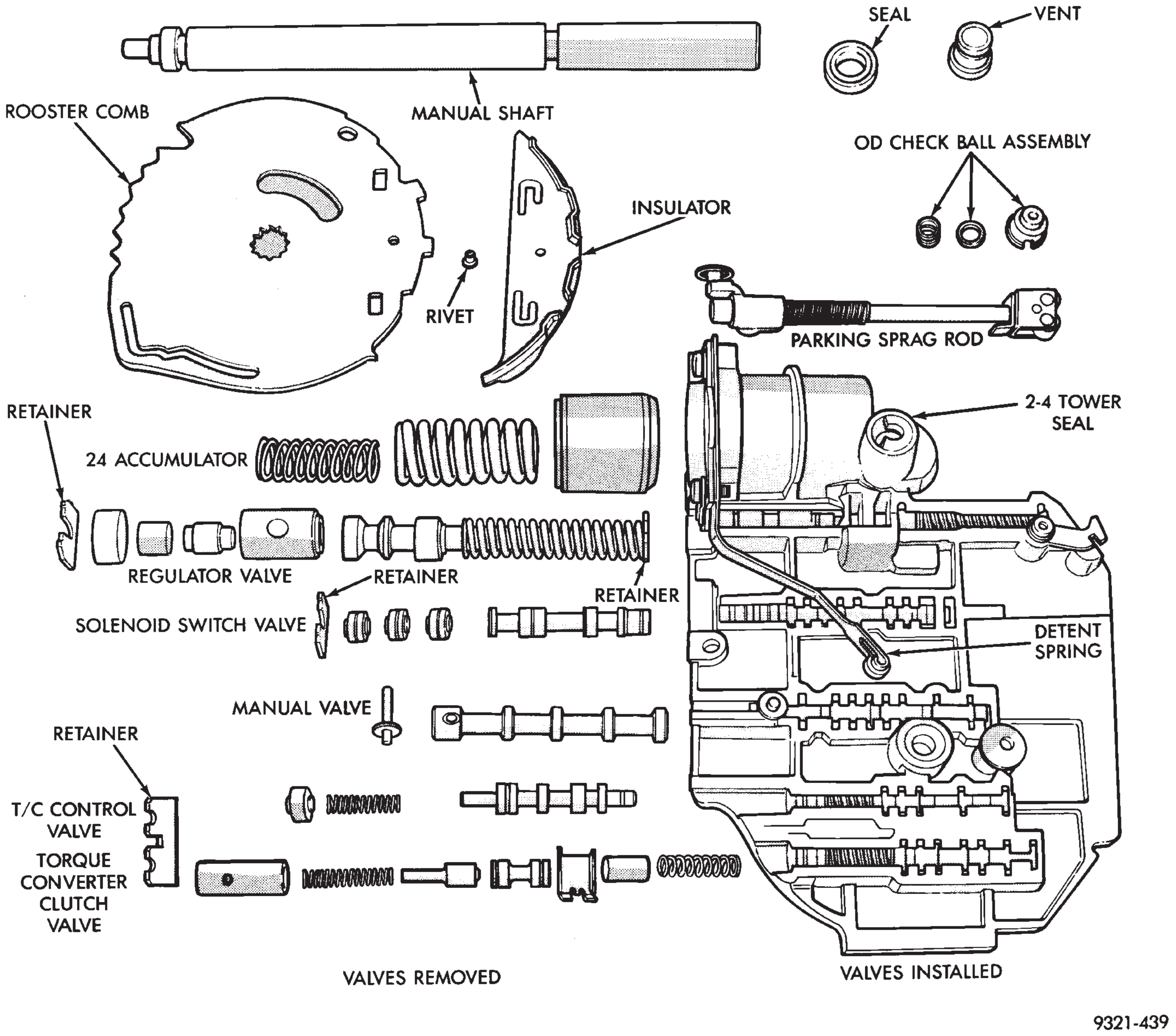


Fig. 13 Springs and Valves Identification

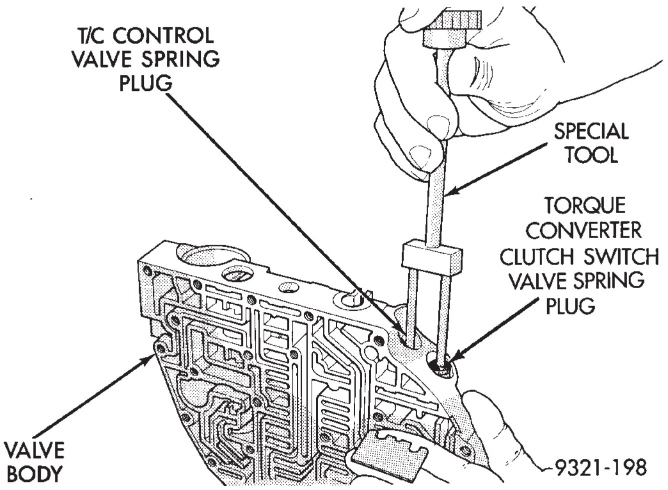


Fig. 14 Remove or Install Dual Retainer Plate

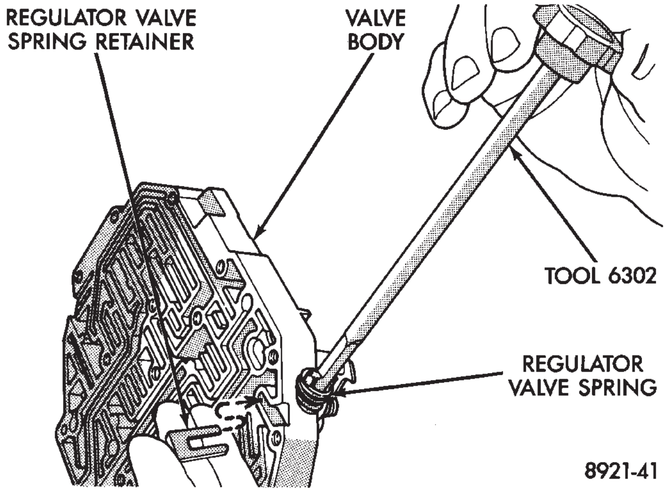


Fig. 15 Remove or Install Retainer Plate

When installing valve body assembly onto transaxle, observe Figure 5. Guide park rod rollers into guide bracket, while shifting manual lever assembly out of the installation position.

OIL PUMP SEAL REPLACE

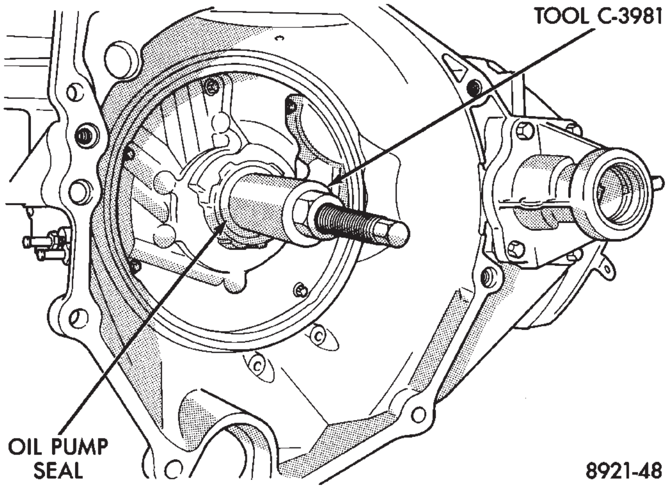


Fig. 16 Remove Oil Pump Seal

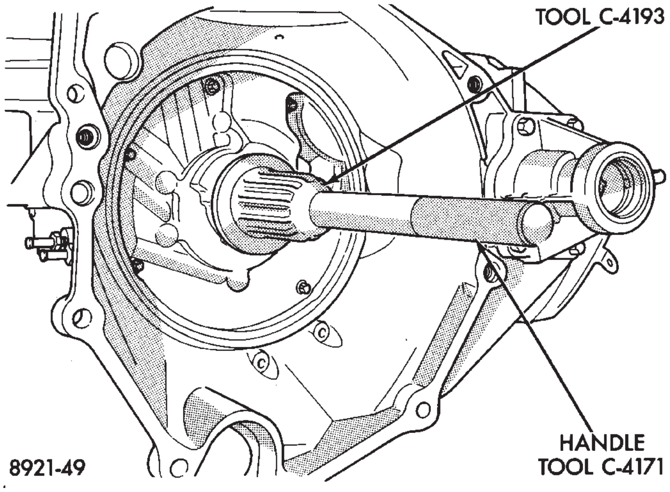


Fig. 17 Install Oil Pump Seal

DIFFERENTIAL REPAIR

The transfer shaft should be removed for differential repair and bearing turning torque checking.

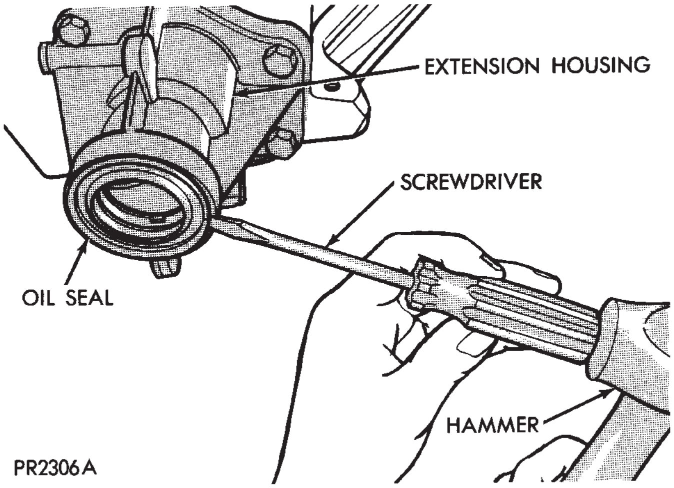


Fig. 1 Remove Extension Seal

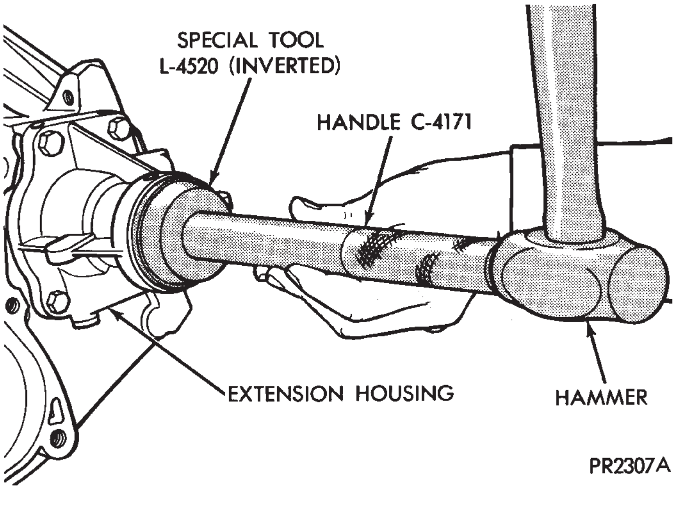


Fig. 2 Install New Seal Into Extension

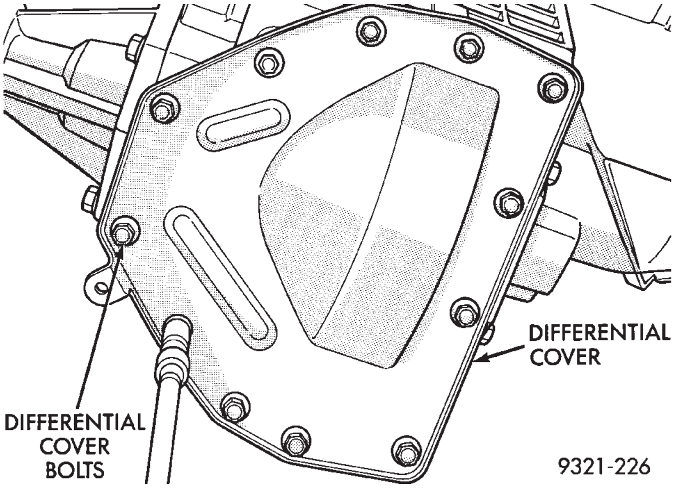


Fig. 3 Differential Cover Bolts

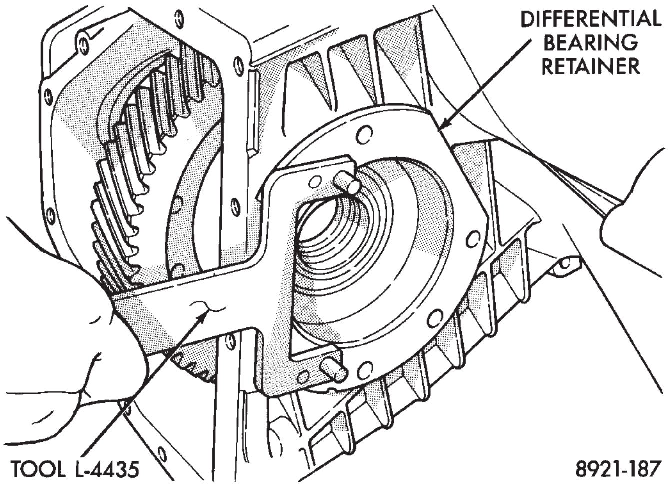


Fig. 6 Remove or Install Bearing Retainer

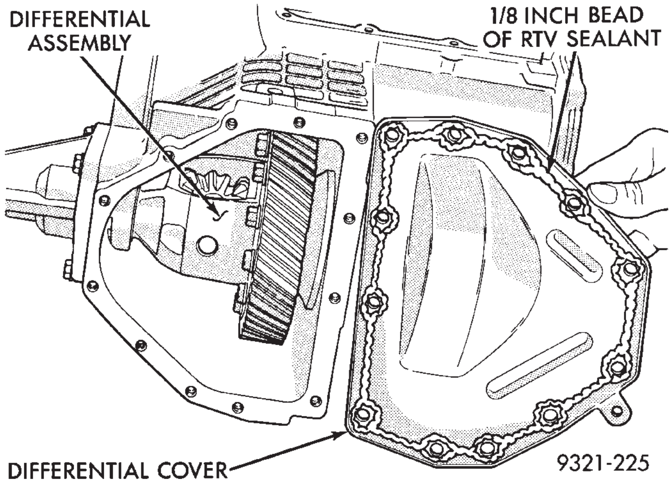


Fig. 4 Remove or Install Differential Cover

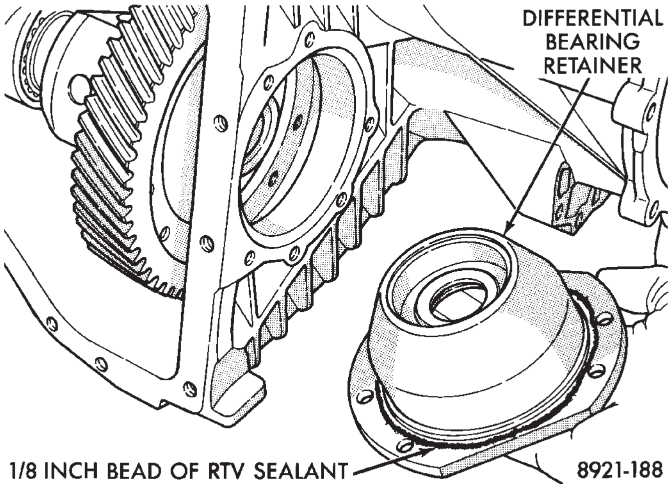


Fig. 7 Differential Bearing Retainer

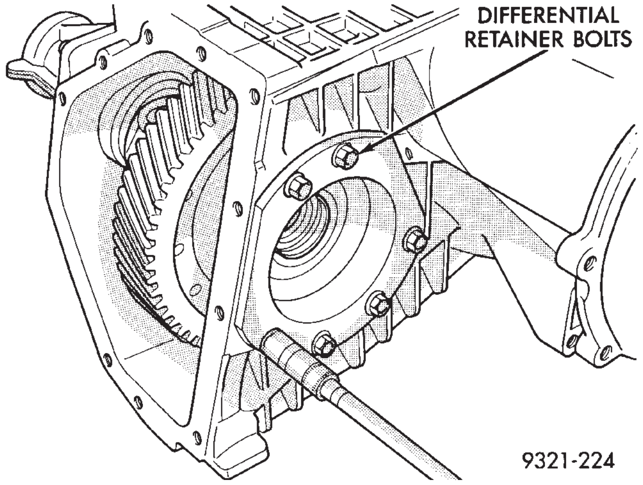


Fig. 5 Differential Retainer Bolts

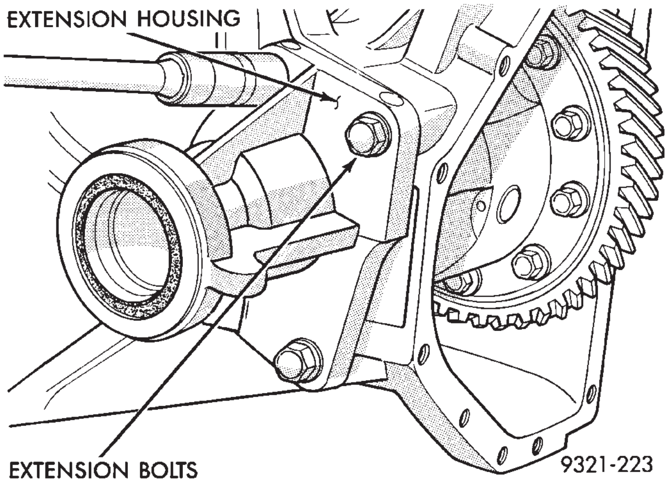


Fig. 8 Extension Bolts

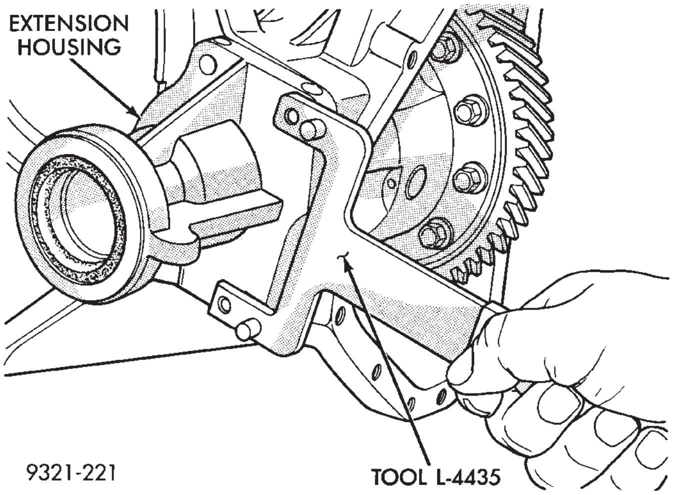


Fig. 9 Remove or Install Extension

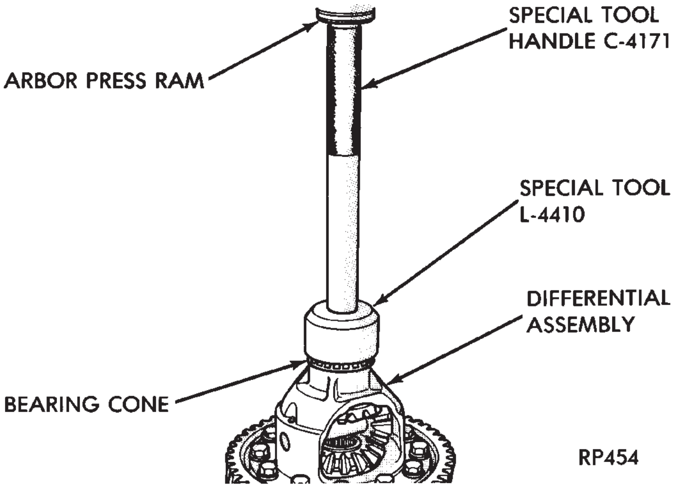


Fig. 12 Install Differential Bearing Cone

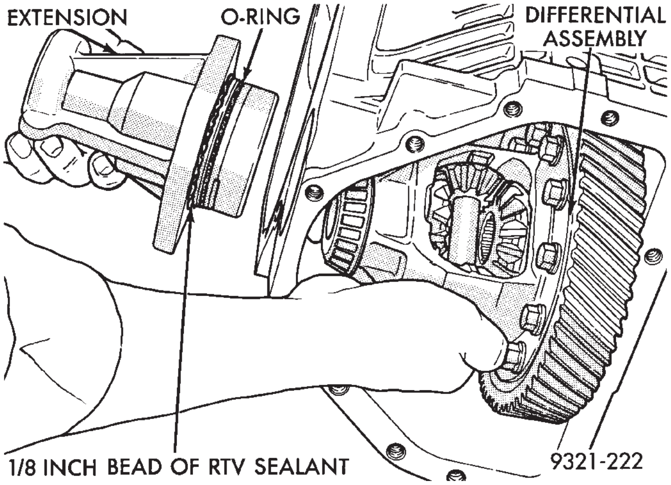


Fig. 10 Differential and Extension

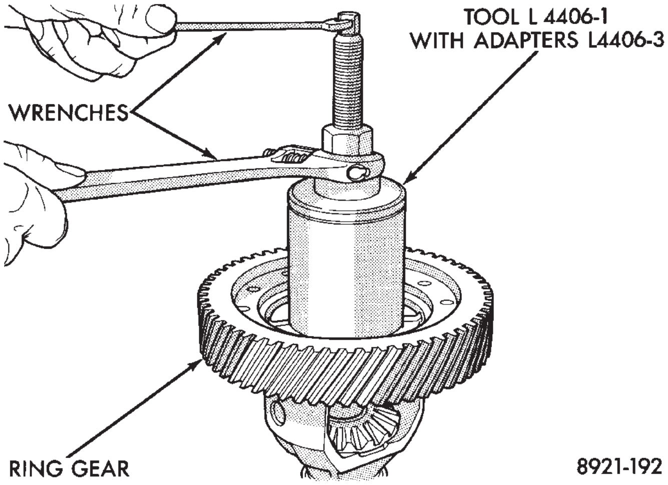


Fig. 13 Remove Differential Bearing Cone

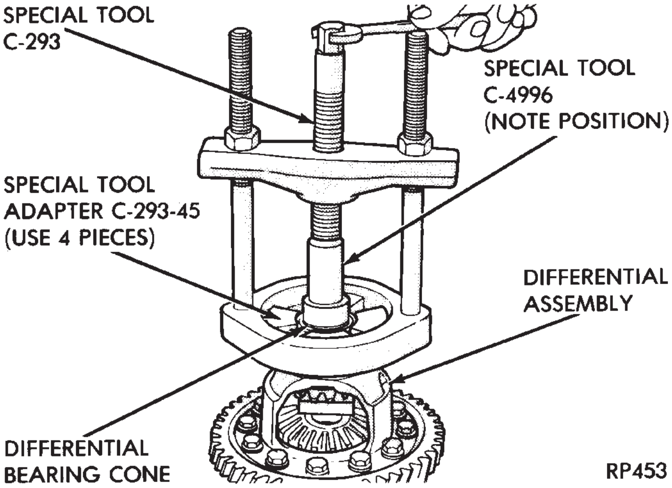


Fig. 11 Remove Differential Bearing Cone

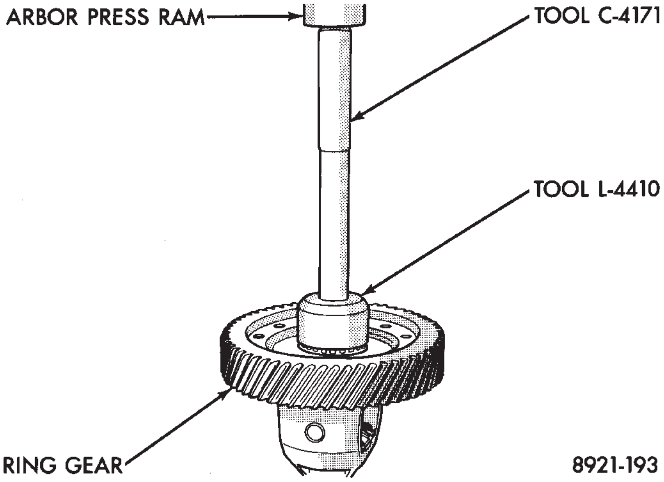


Fig. 14 Install Differential Bearing Cone

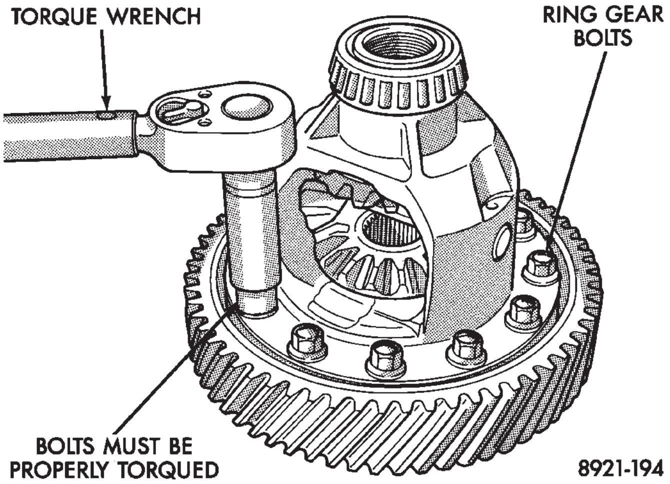


Fig. 15 Torque New Ring Gear Bolts to 95 N•m (70 ft. lbs.)

CAUTION: Always install NEW ring gear bolts. Bolts must be properly torqued.

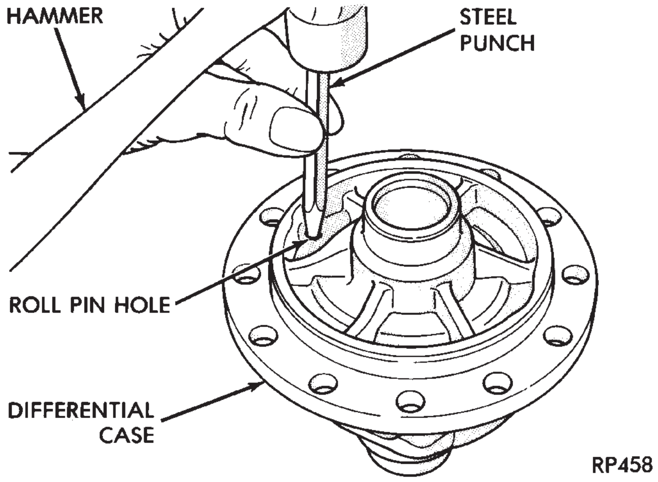


Fig. 16 Remove Pinion Shaft Roll Pin

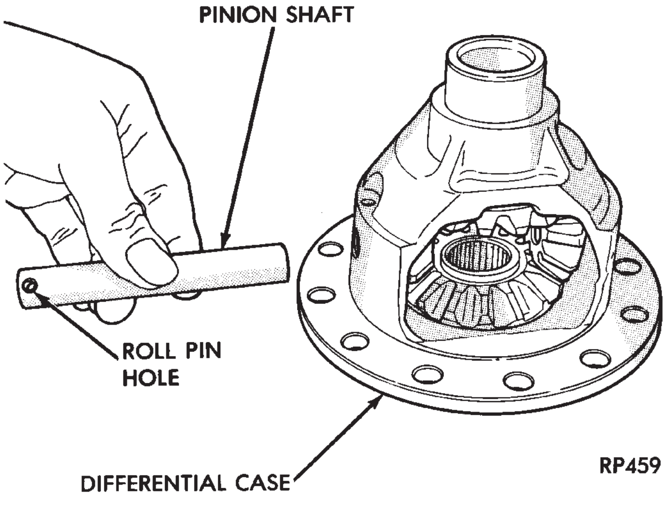


Fig. 17 Remove or Install Pinion Shaft

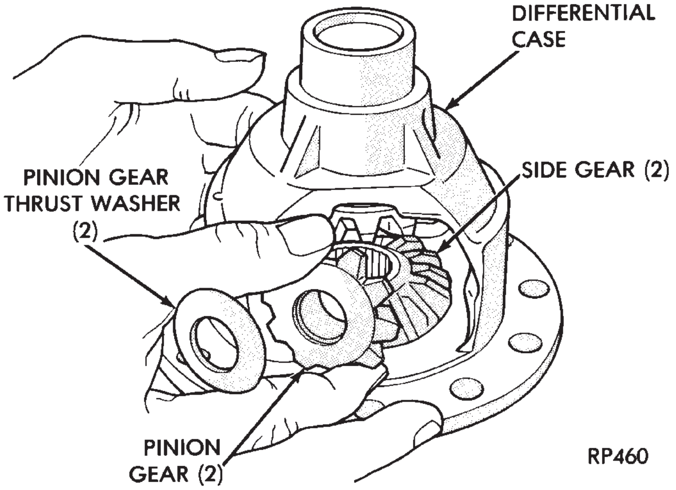


Fig. 18 Remove or Install Pinion Gears, Side Gears, and Tabbed Thrust Washers, by Rotating Pinion Gears to Opening in Differential Case

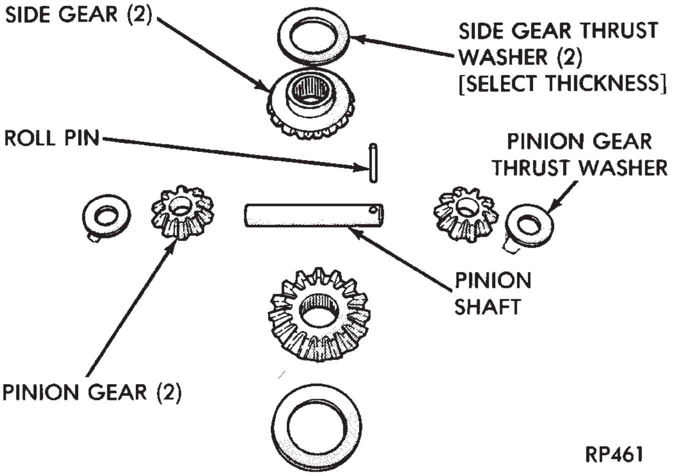


Fig. 19 Differential Gears

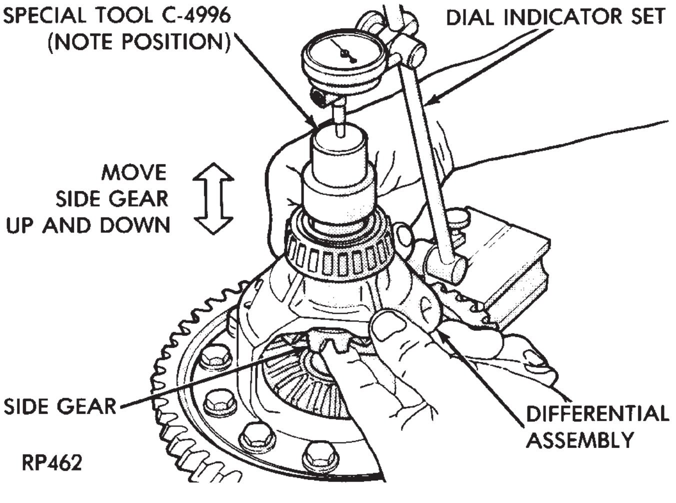


Fig. 20 Checking Side Gear End Play

CAUTION: Side gear end play must be within .001 to .013 inch.

Four select thrust washers are available: .032, .037, .042, and .047 inch.

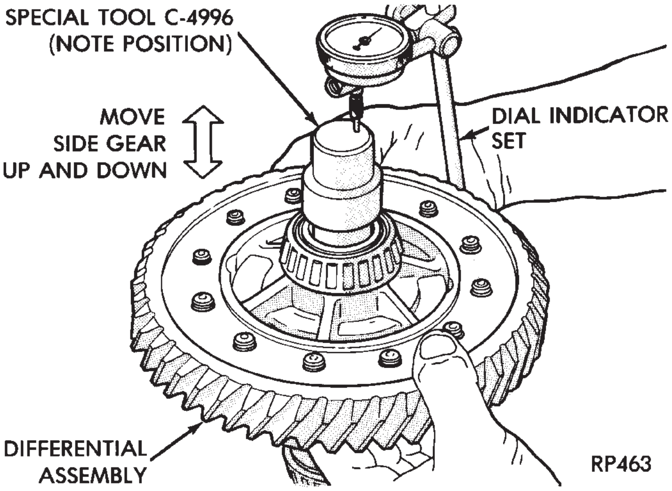


Fig. 21 Checking Side Gear End Play

CAUTION: Side gear end play must be within .001 to .013 inch.

Four select thrust washers are available: .032, .037, .042, and .047 inch.

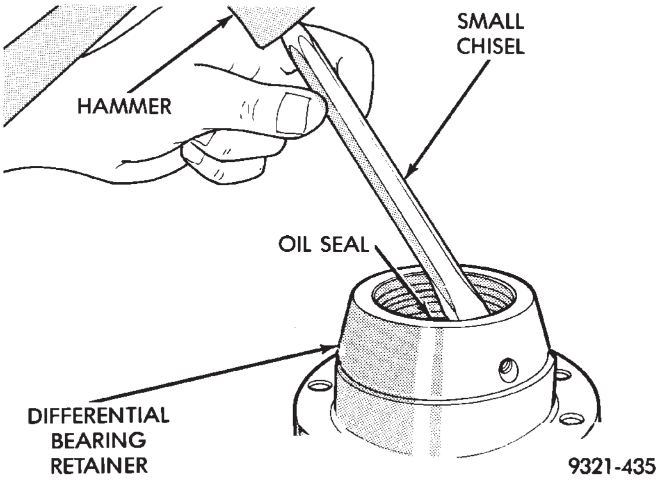


Fig. 22 Remove Oil Seal

DETERMINING SHIM THICKNESS

Shim thickness need only be determined 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 for correct bearing preload and proper bearing turning torque.

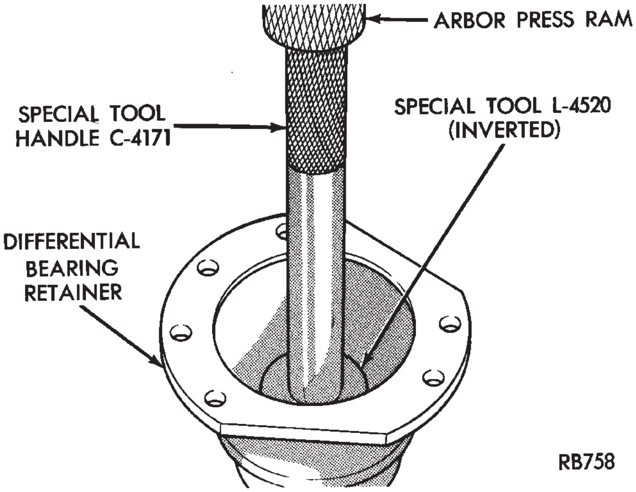


Fig. 23 Install New Oil Seal

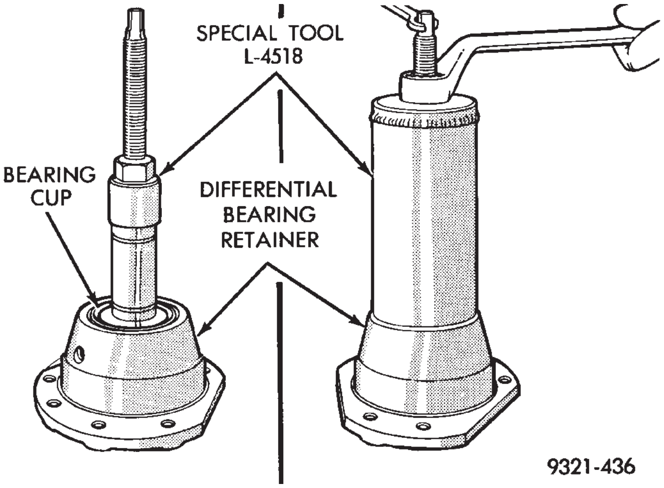


Fig. 24 Remove Bearing Cup

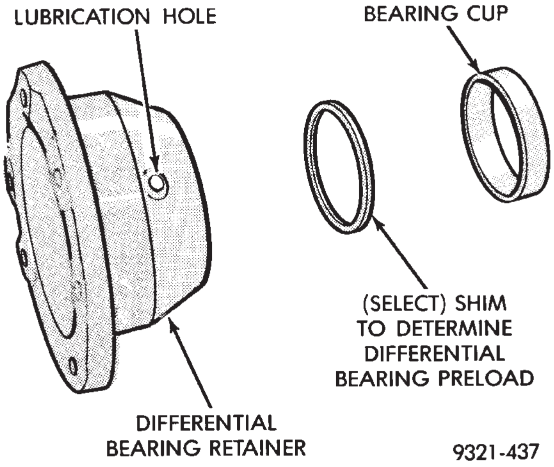


Fig. 25 Differential Bearing Retainer

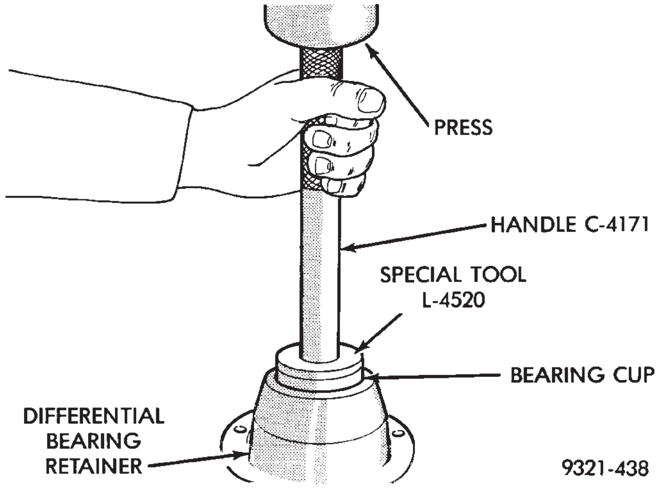


Fig. 26 Install Bearing Cup

When rebuilding, reverse the above procedure.

Remove old sealant before applying new sealant. Use MOPAR® Adhesive Sealant on retainer to seal retainer to case.

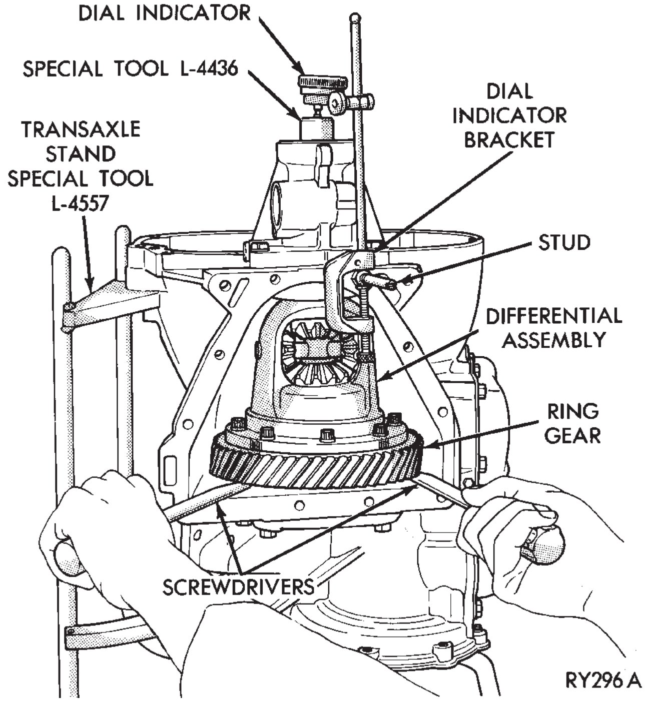


Fig. 27 Checking Differential End Play

BEARING ADJUSTMENT PROCEDURE

GENERAL RULES ON SERVICING BEARINGS

(1) Take extreme care when removing and in stalling 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.

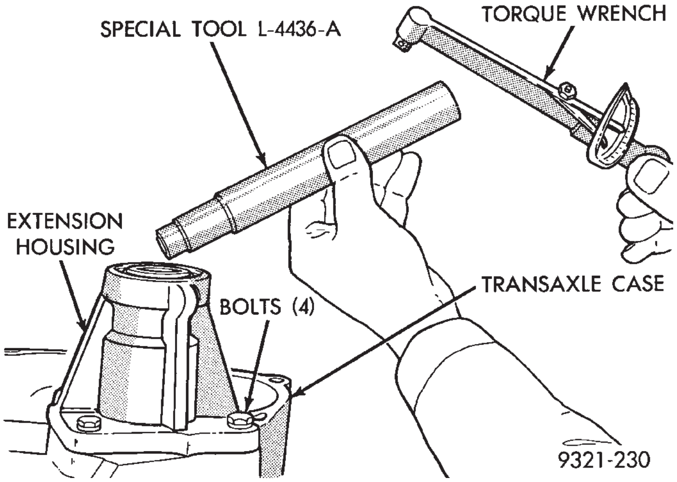


Fig. 28 Tool L-4436 and Torque Wrench

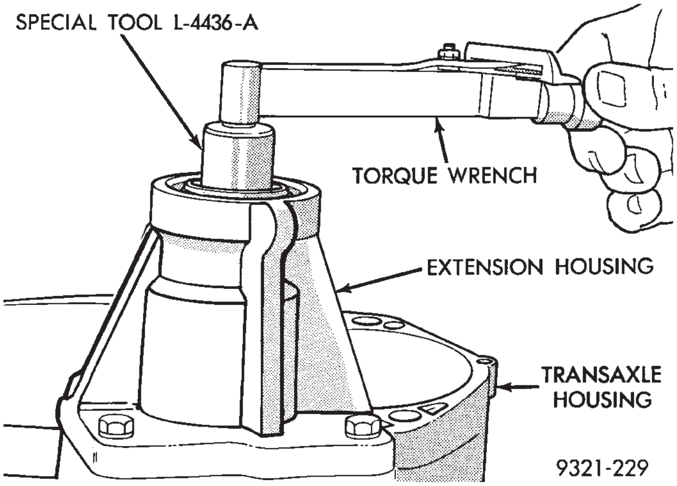


Fig. 29 Checking Differential Bearings Turning Torque

(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.

Bearing end play and drag torque specifications must be maintained to avoid premature bearing failures.

Used (original) bearing may lose up to 50 of the original drag torque after break-in.

All bearing adjustments must be made with no other component interference or gear intermesh, except the transfer gear bearing.

Oil all bearings before checking turning torque.

OUTPUT GEAR BEARING

With output gear removed:

(1) 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) Install output gear and bearing assembly. Torque to 271 N●m (200 ft. lbs.).

(3) To measure bearing end play:

(a) Attach Tool L-4432 to the gear.

(b) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(c) Using a dial indicator, mounted to the transaxle case, measure output gear end play.

(4) Once bearing end play has been determined, refer to the output gear bearing shim chart for the required shim to obtain proper bearing setting.

(5) Use Tool 6259 to remove the retaining bolt and washer. To remove the output gear, use Tool L-4407.

(6) Remove the gauging shim and install the proper shim. Use grease to hold the shim in place. Install the output gear and bearing assembly.

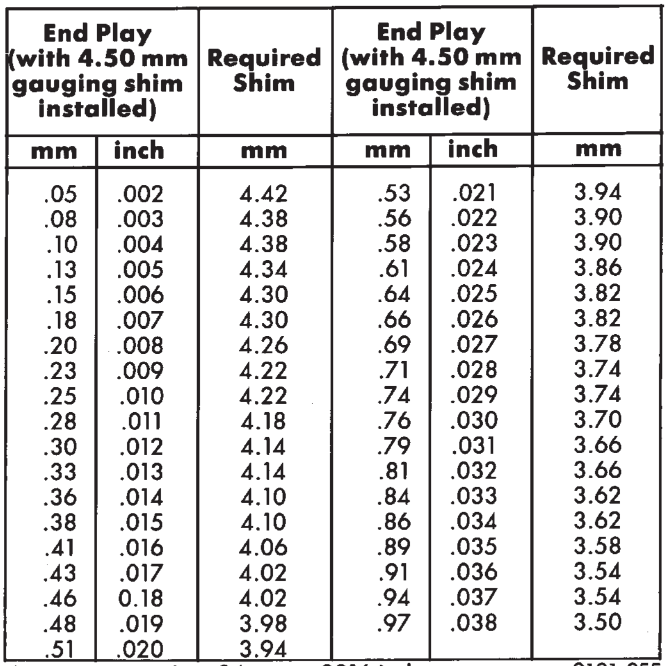
CAUTION: Always use new retaining bolt, old retaining bolt may not be reused.

(7) Install the new retaining bolt and washer. Tighten to 271 N•m (200 ft. lbs.).

(8) Using an inch-pound torque wrench, check the turning torque. **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.

OUTPUT GEAR BEARING SHIM CHART



End Play (with 4.50 mm gauging shim installed)		Required Shim	End Play (with 4.50 mm gauging shim installed)		Required Shim
mm	inch	mm	mm	inch	mm
.05	.002	4.42	.53	.021	3.94
.08	.003	4.38	.56	.022	3.90
.10	.004	4.38	.58	.023	3.90
.13	.005	4.34	.61	.024	3.86
.15	.006	4.30	.64	.025	3.82
.18	.007	4.30	.66	.026	3.82
.20	.008	4.26	.69	.027	3.78
.23	.009	4.22	.71	.028	3.74
.25	.010	4.22	.74	.029	3.74
.28	.011	4.18	.76	.030	3.70
.30	.012	4.14	.79	.031	3.66
.33	.013	4.14	.81	.032	3.66
.36	.014	4.10	.84	.033	3.62
.38	.015	4.10	.86	.034	3.62
.41	.016	4.06	.89	.035	3.58
.43	.017	4.02	.91	.036	3.54
.46	0.18	4.02	.94	.037	3.54
.48	.019	3.98	.97	.038	3.50
.51	.020	3.94			

Average conversion .04 mm =.0016 inch

9121-255

DIFFERENTIAL BEARING

(1) Remove the bearing cup from the differential bearing retainer using Tool L-4518, and remove the existing shim from under the cup.

(2) Install a .50 mm (.020 inch) gauging shim and reinstall the bearing cup into the retainer. Use an arbor press to install the cup.

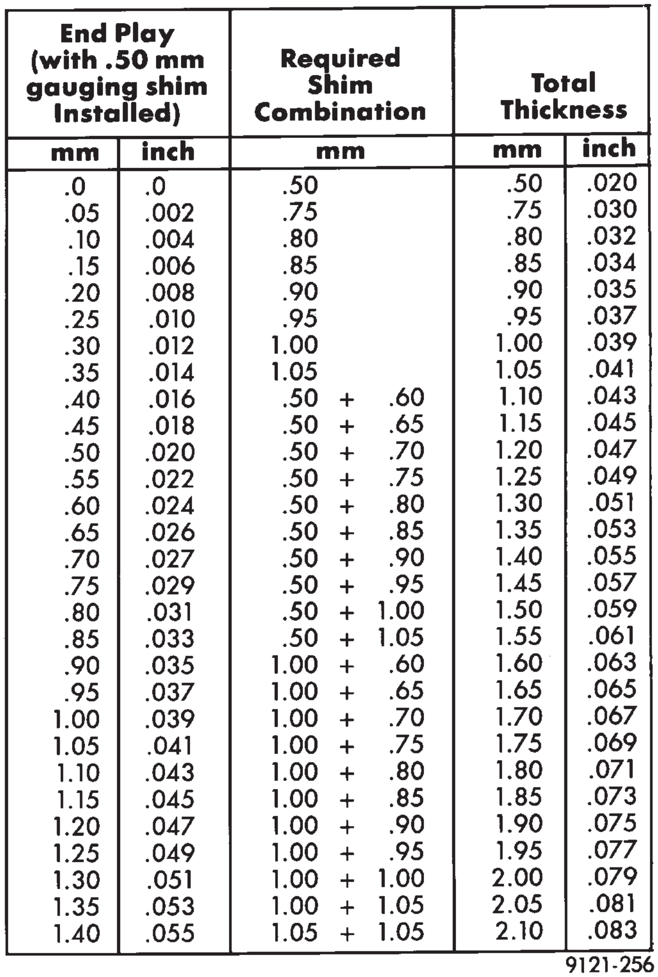
Oil Baffle is not required when making shim selection.

(3) Install the bearing retainer into the case and torque bolts to 28 N•m (250 in. lbs.).

(4) Position the transaxle assembly vertically on the support stand and install Tool C-4995 into side gear.

(5) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

DIFFERENTIAL BEARING SHIM CHART



End Play (with .50 mm gauging shim Installed)		Required Shim Combination	Total Thickness	
mm	inch	mm	mm	inch
.0	.0	.50	.50	.020
.05	.002	.75	.75	.030
.10	.004	.80	.80	.032
.15	.006	.85	.85	.034
.20	.008	.90	.90	.035
.25	.010	.95	.95	.037
.30	.012	1.00	1.00	.039
.35	.014	1.05	1.05	.041
.40	.016	.50 + .60	1.10	.043
.45	.018	.50 + .65	1.15	.045
.50	.020	.50 + .70	1.20	.047
.55	.022	.50 + .75	1.25	.049
.60	.024	.50 + .80	1.30	.051
.65	.026	.50 + .85	1.35	.053
.70	.027	.50 + .90	1.40	.055
.75	.029	.50 + .95	1.45	.057
.80	.031	.50 + 1.00	1.50	.059
.85	.033	.50 + 1.05	1.55	.061
.90	.035	1.00 + .60	1.60	.063
.95	.037	1.00 + .65	1.65	.065
1.00	.039	1.00 + .70	1.70	.067
1.05	.041	1.00 + .75	1.75	.069
1.10	.043	1.00 + .80	1.80	.071
1.15	.045	1.00 + .85	1.85	.073
1.20	.047	1.00 + .90	1.90	.075
1.25	.049	1.00 + .95	1.95	.077
1.30	.051	1.00 + 1.00	2.00	.079
1.35	.053	1.00 + 1.05	2.05	.081
1.40	.055	1.05 + 1.05	2.10	.083

9121-256

(6) Attach a dial indicator to the case and zero the dial indicator. Place the indicator tip on the end of Tool L-4436.

(7) Place a large screwdriver to each side of the ring gear and lift. Check the dial indicator for the amount of end play.

CAUTION: Do not damage the transaxle case and/or differential cover sealing surface.

(8) When the end play has been determined, refer to the Differential Bearing Shim Chart for the correct shim combination to obtain the proper bearing setting.

(9) Remove the differential bearing retainer. Remove the bearing cup and the .50 mm (.020 inch) gauging shim.

(10) Install the proper shim combination under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(11) Install the differential bearing retainer. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N●m (250 in. lbs.).

(12) Using Tool C-4995 and an inch-pound torque wrench, check the turning torque of the differential. **The turning torque should be between 5 and 18 inch-pounds.**

If the turning torque is too high, install a .05 mm (.002 inch) thinner shim. If the turning torque is too low, install a .05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained.

TRANSFER SHAFT BEARING

(1) Use Tool 6259 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

(2) Install a 4.66 mm (.184 inch) gauging shim on the transfer shaft.

(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:

(a) Attach Tool L-4432 to the transfer gear.

(b) Mount a steel ball with grease into the end of the transfer shaft.

(c) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

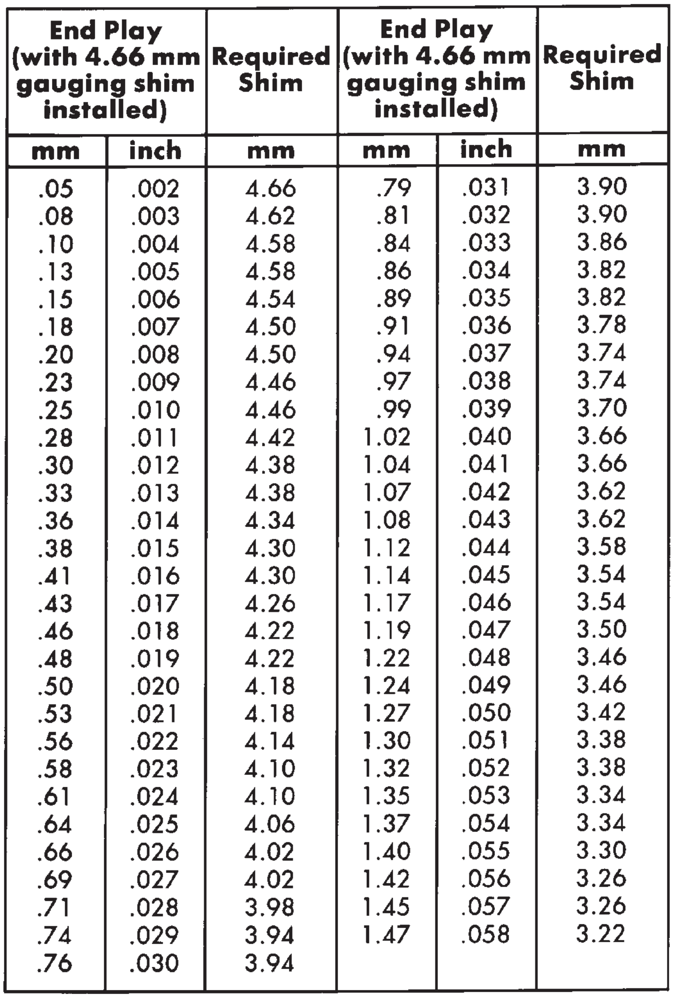
(d) Using a dial indicator, measure transfer shaft end play.

(5) Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

(6) Use Tool 6259 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

(7) Remove the gauging shim and install the correct shim. Install the transfer gear and bearing assembly.

TRANSFER BEARING SHIM CHART



End Play (with 4.66 mm gauging shim installed)		Required Shim	End Play (with 4.66 mm gauging shim installed)		Required Shim
mm	inch	mm	mm	inch	mm
.05	.002	4.66	.79	.031	3.90
.08	.003	4.62	.81	.032	3.90
.10	.004	4.58	.84	.033	3.86
.13	.005	4.58	.86	.034	3.82
.15	.006	4.54	.89	.035	3.82
.18	.007	4.50	.91	.036	3.78
.20	.008	4.50	.94	.037	3.74
.23	.009	4.46	.97	.038	3.74
.25	.010	4.46	.99	.039	3.70
.28	.011	4.42	1.02	.040	3.66
.30	.012	4.38	1.04	.041	3.66
.33	.013	4.38	1.07	.042	3.62
.36	.014	4.34	1.08	.043	3.62
.38	.015	4.30	1.12	.044	3.58
.41	.016	4.30	1.14	.045	3.54
.43	.017	4.26	1.17	.046	3.54
.46	.018	4.22	1.19	.047	3.50
.48	.019	4.22	1.22	.048	3.46
.50	.020	4.18	1.24	.049	3.46
.53	.021	4.18	1.27	.050	3.42
.56	.022	4.14	1.30	.051	3.38
.58	.023	4.10	1.32	.052	3.38
.61	.024	4.10	1.35	.053	3.34
.64	.025	4.06	1.37	.054	3.34
.66	.026	4.02	1.40	.055	3.30
.69	.027	4.02	1.42	.056	3.26
.71	.028	3.98	1.45	.057	3.26
.74	.029	3.94	1.47	.058	3.22
.76	.030	3.94			

9121-2

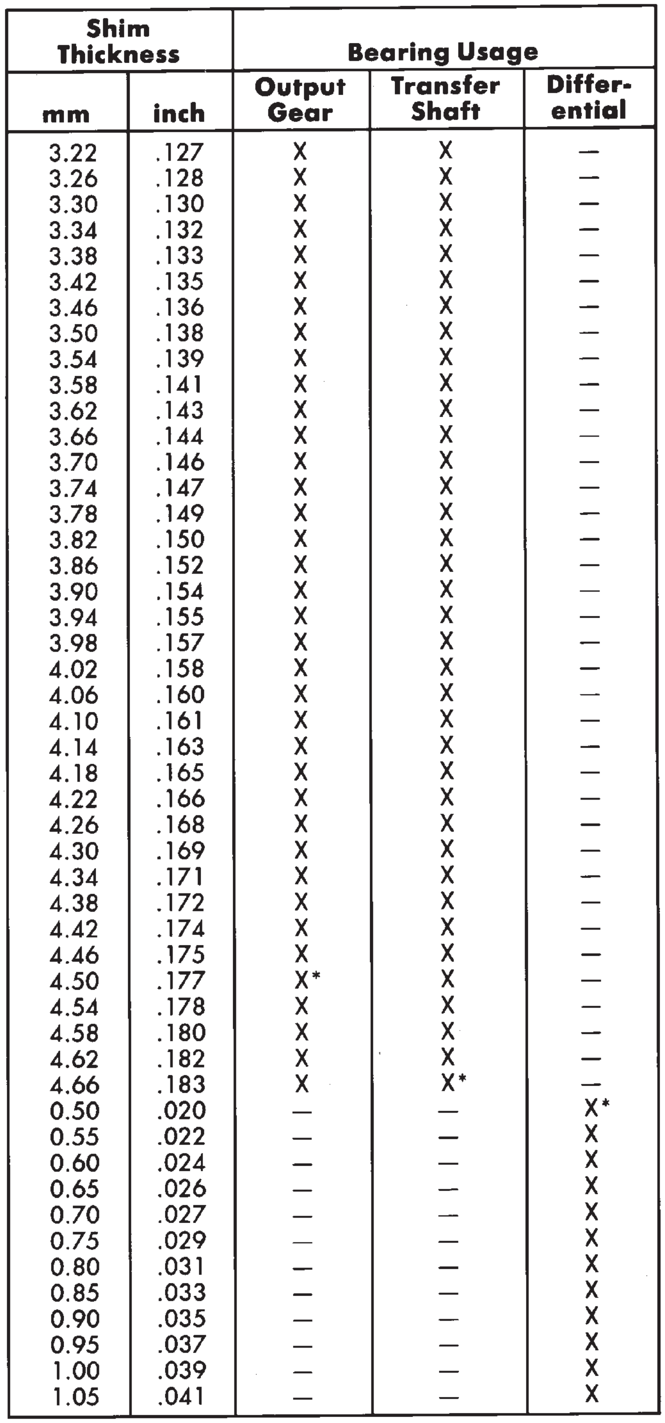
CAUTION: Original retaining nut may not be reused. Always use a new retaining nut when reassembling.

(8) Install the new retaining nut and washer and torque to 271 N●m (200 ft. lbs.). **Measure transfer shaft end play, end play should be .05 to .10 mm (.002 to .004 inch).**

(9) Measure bearing end play as outlined in Step (4). End play should be between .05 mm and .10 mm (.002 to .004 inch).

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.

BEARING SHIM CHART



Shim Thickness		Bearing Usage		
mm	inch	Output Gear	Transfer Shaft	Differ-ential
3.22	.127	X	X	—
3.26	.128	X	X	—
3.30	.130	X	X	—
3.34	.132	X	X	—
3.38	.133	X	X	—
3.42	.135	X	X	—
3.46	.136	X	X	—
3.50	.138	X	X	—
3.54	.139	X	X	—
3.58	.141	X	X	—
3.62	.143	X	X	—
3.66	.144	X	X	—
3.70	.146	X	X	—
3.74	.147	X	X	—
3.78	.149	X	X	—
3.82	.150	X	X	—
3.86	.152	X	X	—
3.90	.154	X	X	—
3.94	.155	X	X	—
3.98	.157	X	X	—
4.02	.158	X	X	—
4.06	.160	X	X	—
4.10	.161	X	X	—
4.14	.163	X	X	—
4.18	.165	X	X	—
4.22	.166	X	X	—
4.26	.168	X	X	—
4.30	.169	X	X	—
4.34	.171	X	X	—
4.38	.172	X	X	—
4.42	.174	X	X	—
4.46	.175	X	X	—
4.50	.177	X*	X	—
4.54	.178	X	X	—
4.58	.180	X	X	—
4.62	.182	X	X	—
4.66	.183	X	X*	—
0.50	.020	—	—	X*
0.55	.022	—	—	X
0.60	.024	—	—	X
0.65	.026	—	—	X
0.70	.027	—	—	X
0.75	.029	—	—	X
0.80	.031	—	—	X
0.85	.033	—	—	X
0.90	.035	—	—	X
0.95	.037	—	—	X
1.00	.039	—	—	X
1.05	.041	—	—	X

* Also used as gauging shims

9121-1

41TE ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

The information in this manual is designed to help the technician understand and repair the transaxle with the aid of the built in on-board diagnostics.

Chrysler Corporation has developed a complete set of diagnostic manuals which cover the diagnosis of the 41TE transaxle. They have been designed to make transaxle diagnosis accurate and simple. Use these manuals with the DRB II scan tool and the latest cartridge, when diagnosing transaxle problems.

ON-BOARD DIAGNOSTICS INFORMATION

The 41TE transaxle is controlled and monitored by the transmission control module. The transmission control module monitors critical input and output circuits within the transaxle.

Some circuits are tested continuously; others are checked only under certain conditions. Each circuit monitored by the transmission control module has a corresponding fault message assigned to it that can be read with the DRB II scan tool.

If the on-board diagnostic system senses that one of the circuits is malfunctioning, the corresponding code is stored in memory. If the malfunction goes away after the code is stored, the transmission control module will erase the code after 75 key cycles.

CCD BUS

In order to diagnose the 41TE transaxle, diagnostic trouble codes in the transmission control module's memory should be read. Use the Diagnostic Readout Box (DRB II) scan tool to read codes. If more than one diagnostic trouble code exists, diagnostic priority should be given to the most recent code. With CCD bus bias and communication problems, the DRB II scan tool displays an appropriate message. Diagnostic trouble codes might not be accessible until the bus problem is fixed. The following is a list of probable causes for a bus problem:

- Open or short to ground/battery in either or both CCD bus wires (pins 4 and 43).
- Open or short to ground/battery in either or both 41TE transaxle's bias wires (pin 5 and 44) on vehicles requiring the transaxle to bias the bus.
- Open or short to ground/battery in the diagnostic connector bus wire.
- Internal failure of any module connected to the bus.

The CCD bus should have 2.5 volts (+2.5 volts on CCD+ and -2.5 volts on CCD-).

The bus error message displayed by the DRB II scan tool should be helpful in diagnosing the CCD bus.

For more information on diagnosing CCD bus problems, refer to the 1993 Diagnostic Procedures Manual (non-communication with the CCD bus). All other problems refer to the 1993 Body Vehicle Communications Diagnostic Procedures Manual.

DIAGNOSTIC TROUBLE CODES

Diagnostic Trouble Codes are two-digit numbers that identify which circuit is malfunctioning. A code can be set for hydraulic and mechanical reasons as well as for electrical problems. In most cases, codes do not pinpoint which specific component is defective.

Diagnostic trouble codes can only be read with the use of the DRB II scan tool or equivalent.

HARD FAULTS

Any Diagnostic trouble code that comes back within 3 engine starts (reset count 3 or less) is a "Hard Fault". This means that the defect is there every time the transmission control module checks that circuit.

SOFT FAULTS

A "Soft Fault" is one that occurs intermittently. It is not there every time the transmission control module checks the circuit. Most soft faults are caused by wiring or connector problems. Intermittent defects must be looked for under the specific conditions that caused them.

LIMP-IN MODE

The transmission control module continuously checks for electrical and internal transaxle problems. When a problem is sensed, the transmission control module stores a diagnostic trouble code. All but twelve of these codes cause the transaxle to go into the "Limp-in mode". While in this mode, electrical power is taken away from the transaxle. When this happens, the only transaxle ranges that will function are:

- Park
- Neutral
- Reverse
- Second Gear

No upshifts or downshifts are allowed while in the Limp-in mode. The position of the manual valve alone allows the three ranges that are available.

Although engine performance will be reduced while in this mode, the vehicle can be driven in for service.

DRB II SCAN TOOL

The DRB II scan tool is a diagnostic read-out box designed by Chrysler to gain access to the on-board diagnostics. These on-board diagnostics are found on all Chrysler-built cars and trucks.

The DRB II scan tool has a few diagnostic capabilities by itself. To perform most diagnostic tests, a program cartridge must be inserted. It contains the diagnostic test programs.

There are scan tools available from other manufactures that can be used on Chrysler vehicles. However, the diagnostic test procedures in this manual have been designed for use with the Chrysler's DRB II scan tool.

The DRB II scan tool operates by communicating with the module of the vehicle system being tested. To communicate with the transmission control module, the DRB II scan tool must be connected to the blue CCD bus connector located under the instrument panel. Refer to the "Using the DRB II Scan Tool" manual or the Diagnostic Procedures Manual for information on how to use the DRB II scan tool.

DIAGNOSTIC TROUBLE CODE CHARTS

Below is a brief description of what each section of the diagnostic trouble code charts are addressing.

- **DIAGNOSTIC TROUBLE CODE-**Tells the code number and name (as shown on the DRB II scan tool).
- **BACKGROUND-**A brief description of the circuit that the transmission control module is monitoring.
- **WHEN CHECKED-**The point of time or condition when the transmission control module makes it's system check.
- **ARMING CONDITIONS-**The parameters that must be met before a code can be set.
- **FAULT CONDITION-**What the transmission control module saw that is determined to be a problem. (ie. voltage to high or low, switch/solenoid problems)
- **FAULT SET TIME-**Refers to the amount of time (in seconds) a failure must occur before a diagnostic trouble code is set in memory.
- **EFFECT-**Refers to how the fault effects transaxle operations.
- **POSSIBLE CAUSE-**Refers to the systems or circuits which could cause the fault to be recorded.

DIAGNOSTIC TROUBLE CODE 11

DIAGNOSTIC TROUBLE CODE:	11 Internal Transmission Control Module (Watchdog Circuit Test)
BACKGROUND:	The internal watchdog (WD) circuit continuously monitors the microprocessor. It provides a transmission limp-in when it detects a problem in the microprocessor. On the other hand, the microprocessor periodically TESTs the WD's ability to provide this shutdown function.
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine), and periodically thereafter.
ARMING CONDITIONS:	(1) Solenoid test must not be in progress. (2) Watchdog test must be in progress. (3) A specific type of watchdog test must be scheduled.
CONDITIONS:	The Delay/Monitor line remains high after period has elapsed for corresponding Watchdog Test.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Internal Transmission Control Module failure.

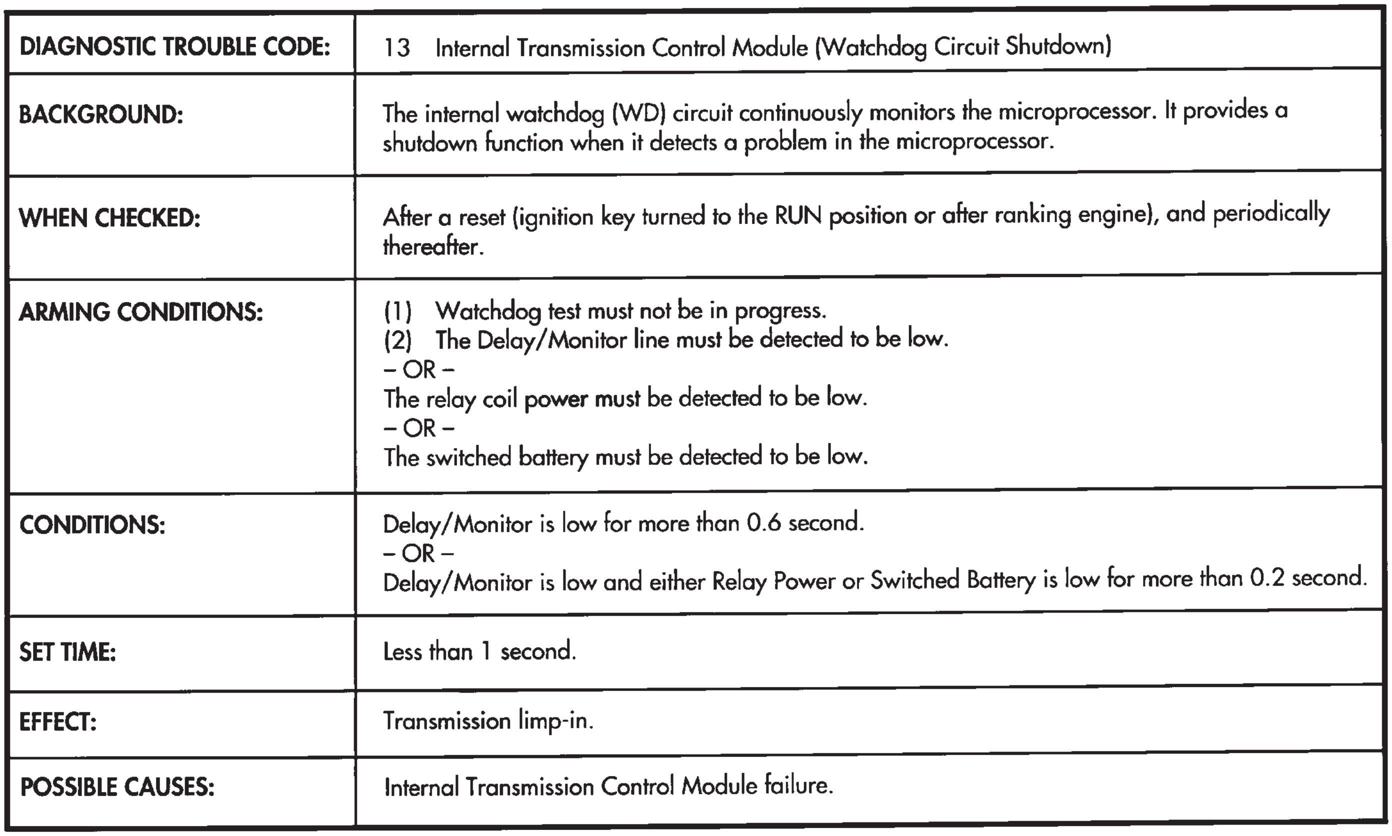
9321-300

DIAGNOSTIC TROUBLE CODE 12

DIAGNOSTIC TROUBLE CODE:	12 Battery Was Disconnected. Note: This is not a code. It exists to provide reference information only.
BACKGROUND:	A battery-backed RAM is used to maintain some learned values. When the battery is disconnected, this memory is lost and, when the battery is connected, it will be detected by the Transmission Control Module. The code will be set and the learned values will be initialized to known constants.
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine).
ARMING CONDITIONS:	None.
CONDITIONS:	Battery disconnected or first installation. – OR – Software interrupt. – OR – Watchdog re-initialization.
RESET CONDITIONS:	75 or more restarts without setting a new fault.
SET TIME:	Less than 1 second.
EFFECT:	Setting the code has no effect except for re-initialization of some learned values. However, disconnecting the battery will result in transmission limp-in.
POSSIBLE CAUSES:	Battery disconnected.

9321-301

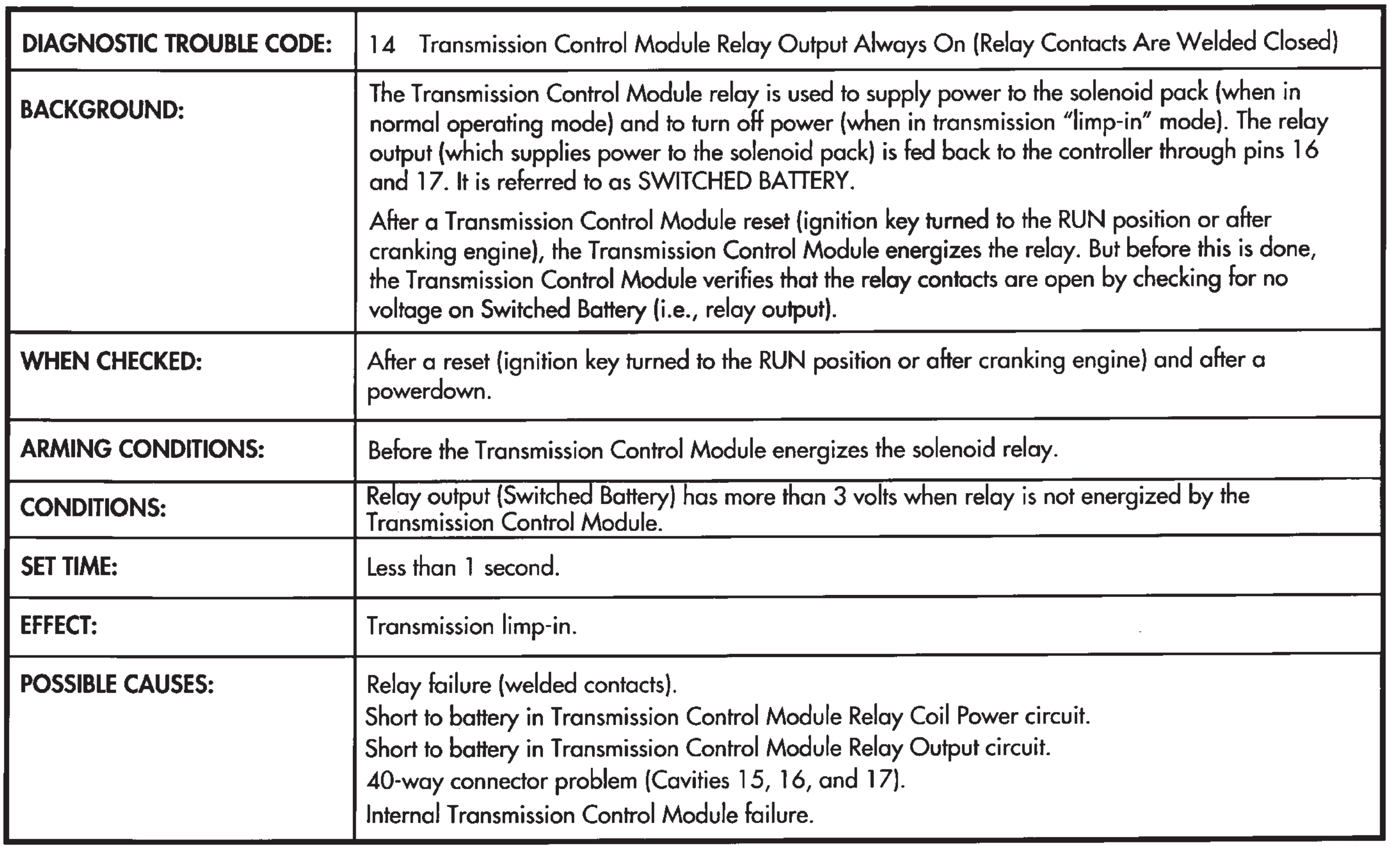
DIAGNOSTIC TROUBLE CODE 13



DIAGNOSTIC TROUBLE CODE:	13 Internal Transmission Control Module (Watchdog Circuit Shutdown)
BACKGROUND:	The internal watchdog (WD) circuit continuously monitors the microprocessor. It provides a shutdown function when it detects a problem in the microprocessor.
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after ranking engine), and periodically thereafter.
ARMING CONDITIONS:	(1) Watchdog test must not be in progress. (2) The Delay/Monitor line must be detected to be low. – OR – The relay coil power must be detected to be low. – OR – The switched battery must be detected to be low.
CONDITIONS:	Delay/Monitor is low for more than 0.6 second. – OR – Delay/Monitor is low and either Relay Power or Switched Battery is low for more than 0.2 second.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Internal Transmission Control Module failure.

9321-302

DIAGNOSTIC TROUBLE CODE 14



DIAGNOSTIC TROUBLE CODE:	14 Transmission Control Module Relay Output Always On (Relay Contacts Are Welded Closed)
BACKGROUND:	The Transmission Control Module relay is used to supply power to the solenoid pack (when in normal operating mode) and to turn off power (when in transmission "limp-in" mode). The relay output (which supplies power to the solenoid pack) is fed back to the controller through pins 16 and 17. It is referred to as SWITCHED BATTERY. After a Transmission Control Module reset (ignition key turned to the RUN position or after cranking engine), the Transmission Control Module energizes the relay. But before this is done, the Transmission Control Module verifies that the relay contacts are open by checking for no voltage on Switched Battery (i.e., relay output).
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine) and after a powerdown.
ARMING CONDITIONS:	Before the Transmission Control Module energizes the solenoid relay.
CONDITIONS:	Relay output (Switched Battery) has more than 3 volts when relay is not energized by the Transmission Control Module.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Relay failure (welded contacts). Short to battery in Transmission Control Module Relay Coil Power circuit. Short to battery in Transmission Control Module Relay Output circuit. 40-way connector problem (Cavities 15, 16, and 17). Internal Transmission Control Module failure.

9321-303

DIAGNOSTIC TROUBLE CODE 15

DIAGNOSTIC TROUBLE CODE:	15 Transmission Control Module Relay Output Always Off (Relay Contacts Are Stuck Open)
BACKGROUND:	The Transmission Control Module relay is used to supply power to the solenoid pack (when in normal operating mode) and to turn off power (when in transmission "limp-in" mode). The relay output (which supplies power to the solenoid pack) is fed back to the Transmission Control Module through pins 16 and 17. It is referred to as SWITCHED BATTERY. After a Transmission Control Module reset (ignition key turned to the RUN position or when cranking engine), the Transmission Control Module energizes the relay. Then the Transmission Control Module makes sure that the relay contacts closed by checking for voltage on Switched Battery (i.e., relay output).
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine).
ARMING CONDITIONS:	After the Transmission Control Module energizes the solenoid relay.
CONDITIONS:	Relay output (Switched Battery) has less than 3 volts when relay is energized by the Transmission Control Module.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Relay failure (open contacts). Short to ground in Transmission Control Module Relay Coil Power circuit. Open Transmission Control Module Relay Coil Power circuit between relay and Transmission Control Module. Open Transmission Control Module Relay Output circuit between relay and Transmission Control Module. Open Transmission Control Module Power Ground (B-) circuit from relay to ground. Open Battery Feed circuit from relay to splice. 40-way connector problem (cavities 15, 16, and 17). Internal Transmission Control Module failure.

9321-304

DIAGNOSTIC TROUBLE CODE 16

DIAGNOSTIC TROUBLE CODE:	16 Internal Transmission Control Module (ROM Check Failure)
BACKGROUND:	When the Transmission Control Module is reset, the microprocessor checks the integrity of the program memory (ROM). It adds all used bytes in the program memory. The amount should be the same as a known constant (stored in program memory).
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine).
ARMING CONDITIONS:	None.
CONDITIONS:	ROM check sum does not match a known constant.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Internal Transmission Control Module failure.

9321-305

DIAGNOSTIC TROUBLE CODE 17

DIAGNOSTIC TROUBLE CODE:	17 Internal Transmission Control Module (RAM Check Failure)
BACKGROUND:	When the Transmission Control Module is reset, the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be the same as the value written.
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine).
ARMING CONDITIONS:	Data read from at least one RAM location does not match data written to it.
CONDITIONS:	RAM check sum does not match a known constant.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Internal Transmission Control Module failure.

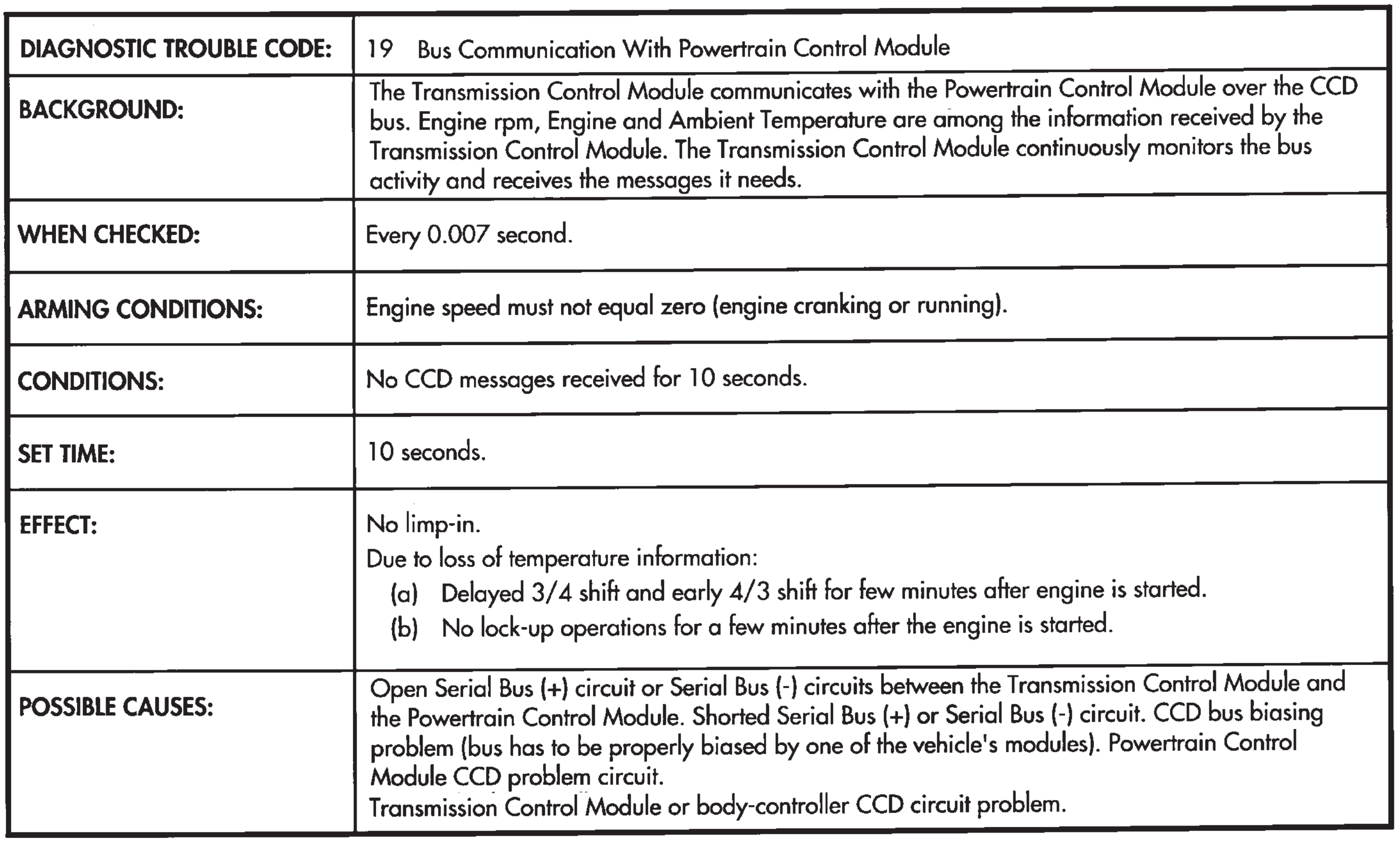
9321-306

DIAGNOSTIC TROUBLE CODE 18

DIAGNOSTIC TROUBLE CODE:	18 Engine Speed Sensor Circuit (Loss of Engine Speed Signal)
BACKGROUND:	The Transmission Control Module uses a distributor signal to calculate the engine rpm (which could be zero when the ignition key is in the RUN position and the engine is not running). When the calculated engine rpm is almost zero, it is compared to the engine speed received from the Powertrain Control Module over the CCD bus to confirm that the engine is actually not running. Otherwise this means a problem with the engine speed signal circuit.
WHEN CHECKED:	Every 0.007 second.
ARMING CONDITIONS:	(1) Calculated engine speed is less than or equal to the start-run threshold of 390 rpm. (2) CCD bus must be operational during the last 1.0 second.
CONDITIONS:	Engine speed received from the Powertrain Control Module over the CCD bus is greater than 384 rpm.
SET TIME:	2 seconds.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Open/short in Engine Speed Signal circuit (distributor pickup or crank sensor signal). Defective distributor reference pickup or crank sensor. 40-way connector problem (cavity 45). Internal Transmission Control Module failure.

9321-307

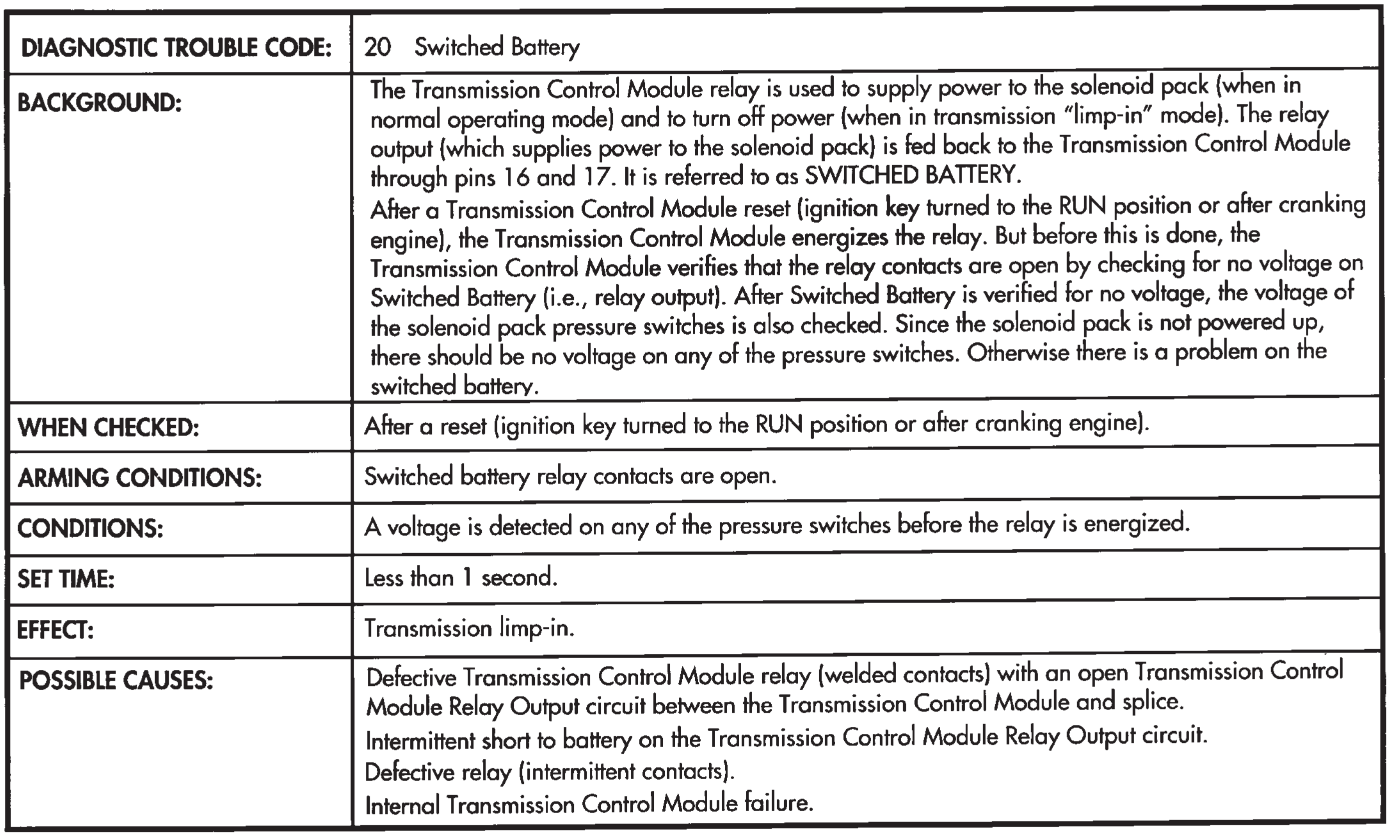
DIAGNOSTIC TROUBLE CODE 19



DIAGNOSTIC TROUBLE CODE:	19 Bus Communication With Powertrain Control Module
BACKGROUND:	The Transmission Control Module communicates with the Powertrain Control Module over the CCD bus. Engine rpm, Engine and Ambient Temperature are among the information received by the Transmission Control Module. The Transmission Control Module continuously monitors the bus activity and receives the messages it needs.
WHEN CHECKED:	Every 0.007 second.
ARMING CONDITIONS:	Engine speed must not equal zero (engine cranking or running).
CONDITIONS:	No CCD messages received for 10 seconds.
SET TIME:	10 seconds.
EFFECT:	No limp-in. Due to loss of temperature information: (a) Delayed 3/4 shift and early 4/3 shift for few minutes after engine is started. (b) No lock-up operations for a few minutes after the engine is started.
POSSIBLE CAUSES:	Open Serial Bus (+) circuit or Serial Bus (-) circuits between the Transmission Control Module and the Powertrain Control Module. Shorted Serial Bus (+) or Serial Bus (-) circuit. CCD bus biasing problem (bus has to be properly biased by one of the vehicle's modules). Powertrain Control Module CCD problem circuit. Transmission Control Module or body-controller CCD circuit problem.

9321-308

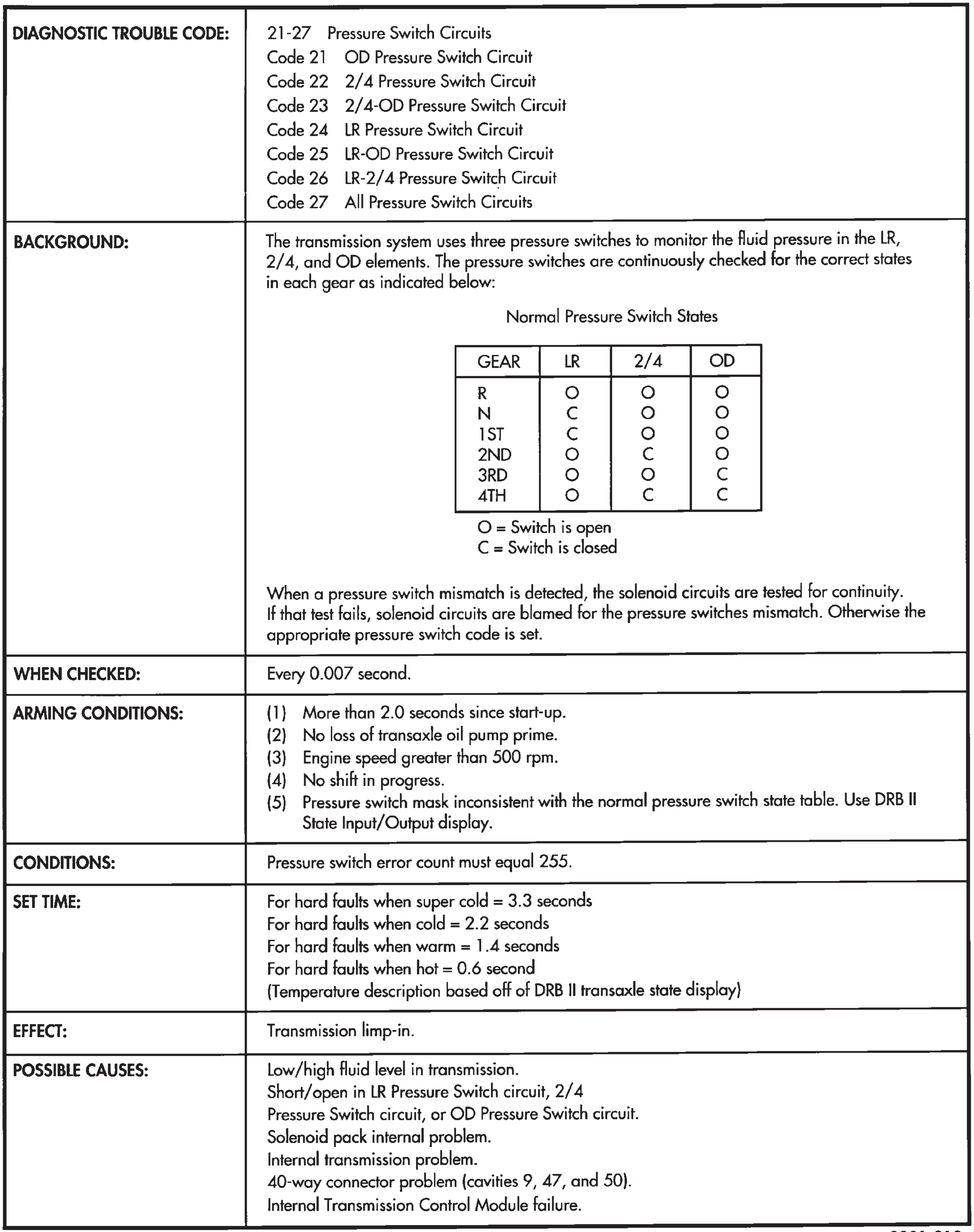
DIAGNOSTIC TROUBLE CODE 20



DIAGNOSTIC TROUBLE CODE:	20 Switched Battery
BACKGROUND:	The Transmission Control Module relay is used to supply power to the solenoid pack (when in normal operating mode) and to turn off power (when in transmission "limp-in" mode). The relay output (which supplies power to the solenoid pack) is fed back to the Transmission Control Module through pins 16 and 17. It is referred to as SWITCHED BATTERY. After a Transmission Control Module reset (ignition key turned to the RUN position or after cranking engine), the Transmission Control Module energizes the relay. But before this is done, the Transmission Control Module verifies that the relay contacts are open by checking for no voltage on Switched Battery (i.e., relay output). After Switched Battery is verified for no voltage, the voltage of the solenoid pack pressure switches is also checked. Since the solenoid pack is not powered up, there should be no voltage on any of the pressure switches. Otherwise there is a problem on the switched battery.
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine).
ARMING CONDITIONS:	Switched battery relay contacts are open.
CONDITIONS:	A voltage is detected on any of the pressure switches before the relay is energized.
SET TIME:	Less than 1 second.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Defective Transmission Control Module relay (welded contacts) with an open Transmission Control Module Relay Output circuit between the Transmission Control Module and splice. Intermittent short to battery on the Transmission Control Module Relay Output circuit. Defective relay (intermittent contacts). Internal Transmission Control Module failure.

9321-309

DIAGNOSTIC TROUBLE CODE 21-27



DIAGNOSTIC TROUBLE CODE:

21-27 Pressure Switch Circuits
Code 21 OD Pressure Switch Circuit
Code 22 2/4 Pressure Switch Circuit
Code 23 2/4-OD Pressure Switch Circuit
Code 24 LR Pressure Switch Circuit
Code 25 LR-OD Pressure Switch Circuit
Code 26 LR-2/4 Pressure Switch Circuit
Code 27 All Pressure Switch Circuits

BACKGROUND:

The transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously checked for the correct states in each gear as indicated below:

Normal Pressure Switch States

GEAR	LR	2/4	OD
R	O	O	O
N	C	O	O
1ST	C	O	O
2ND	O	C	O
3RD	O	O	C
4TH	O	C	C

O = Switch is open
C = Switch is closed

When a pressure switch mismatch is detected, the solenoid circuits are tested for continuity. If that test fails, solenoid circuits are blamed for the pressure switches mismatch. Otherwise the appropriate pressure switch code is set.

WHEN CHECKED:

Every 0.007 second.

ARMING CONDITIONS:

(1) More than 2.0 seconds since start-up.
(2) No loss of transaxle oil pump prime.
(3) Engine speed greater than 500 rpm.
(4) No shift in progress.
(5) Pressure switch mask inconsistent with the normal pressure switch state table. Use DRB II State Input/Output display.

CONDITIONS:

Pressure switch error count must equal 255.

SET TIME:

For hard faults when super cold = 3.3 seconds
For hard faults when cold = 2.2 seconds
For hard faults when warm = 1.4 seconds
For hard faults when hot = 0.6 second
(Temperature description based off of DRB II transaxle state display)

EFFECT:

Transmission limp-in.

POSSIBLE CAUSES:

Low/high fluid level in transmission.
Short/open in LR Pressure Switch circuit, 2/4 Pressure Switch circuit, or OD Pressure Switch circuit.
Solenoid pack internal problem.
Internal transmission problem.
40-way connector problem (cavities 9, 47, and 50).
Internal Transmission Control Module failure.

9321-310

DIAGNOSTIC TROUBLE CODE 28

<table>
<tr><td>DIAGNOSTIC TROUBLE CODE:</td><td>28 Check Shifter Signal (Bad PRNO3L Data)</td></tr>
<tr><td>BACKGROUND:</td><td>PRNO3L and Neutral/Start switches are used to:
(1) Determine the Shift Lever Position.
(2) Supply a ground to the Starter Relay in Park and Neutral only.
(3) Supply a ground to the Backup Lamp Relay in Reverse only.

The Transmission Control Module reads the switch signals (from Neutral/Start switch, and from PRNO3L switch) according to the table below, which includes two recognized temporary codes that occur while moving Shift Lever Position (SLP).

Normal PRNO3L & Neutral/Start Switch States
<table>
<tr><th>SLP</th><th>T42</th><th>T41</th><th>T01</th><th>T03</th></tr>
<tr><td>P</td><td>C</td><td>C</td><td>O</td><td>O</td></tr>
<tr><td>R</td><td>O</td><td>O</td><td>C</td><td>C</td></tr>
<tr><td>N</td><td>O</td><td>C</td><td>C</td><td>O</td></tr>
<tr><td>OD</td><td>O</td><td>O</td><td>O</td><td>C</td></tr>
<tr><td>3</td><td>O</td><td>O</td><td>C</td><td>O</td></tr>
<tr><td>L</td><td>C</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>T1</td><td>O</td><td>C</td><td>O</td><td>O</td></tr>
<tr><td>T2</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
</table>
O = Switch is open
C = Switch is closed

When an invalid code is seen, the Transmission Control Module tries to determine Shift Lever Position through hydraulic interpretation (by energizing some solenoids and monitoring the pressure switch responses).</td></tr>
<tr><td>WHEN CHECKED:</td><td>Every 0.007 second.</td></tr>
<tr><td>ARMING CONDITIONS:</td><td>(1) Ignition key turned to the run position.
(2) Loss of prime test must not be in progress.
(3) CASE 1:
PRNO3L switch mask inconsistent with normal PRNO3L switch state table. (Invalid PRNO3L code.)
Use DRB II State Monitor for Shift Lever display.
CASE 2:
PRNO3L data error flag is set due to invalid sequence of old PRNO3L data versus new PRNO3L data (i.e., Instantaneous PRNO3L data change from reverse to overdrive or overdrive to reverse.)</td></tr>
<tr><td>CONDITIONS:</td><td>CASE 1:
Invalid code timer has expired (0.1 second).
CASE 2:
Third occurrence of setting PRNO3L data error flag since start-up.</td></tr>
<tr><td>SET TIME:</td><td>CASE 1:
0.1 second.
CASE 2:
Third occurrence of setting PRNO3L data error flag since start-up. This fault case is not time specific.</td></tr>
<tr><td>EFFECT:</td><td>No limp-in. However, valid but incorrect PRNO3L and Neutral/Start signals (e.g., shift lever is in OD position where R code is being received) might result in other fault codes and possibly a limp-in. This is why it is very important to verify the correctness of the Shift Lever Position signals before diagnosing any problems.</td></tr>
<tr><td>POSSIBLE CAUSES:</td><td>Open/short Starter Relay Ground, PRNDL (T42) circuit, Neutral Start Switch circuit, PRNDL (T01) circuit, or Back up Lamp Relay Coil Driver.
Open Ignition (+) circuit between Neutral Safety switch and splice.
Open ETAX power Ground (B-) circuit between PRNO3L switch and splice.
Defective or disconnected Neutral Safety or PRNO3L switch.
Defective or disconnected Backup Lamp Relay.
40-way connector problem (cavities 1, 2, 3, 41, and 42).
Internal Transmission Control Module failure.</td></tr>
</table>

9321-311

DIAGNOSTIC TROUBLE CODE 29

DIAGNOSTIC TROUBLE CODE:	29 Throttle Position Signal
BACKGROUND:	The Transmission Control Module receives the Throttle Position Signal circuit and its ground (Signal Reference circuit) from the Throttle Position Sensor (TPS). The TPS has a 5-volt pull-up supplied by the Powertrain Control Module. The throttle signal is checked for out-of-range as well as intermittency (excessive signal changes).
WHEN CHECKED:	Every 0.007 second.
ARMING CONDITIONS:	Engine must be running.
CONDITIONS:	Throttle angle less than 6 degrees. -OR- Throttle angle greater than 120 degrees.
SET TIME:	0.6 second.
EFFECT:	No limp-in. A default throttle value is used. No Torque Converter Clutch. No 4th gear. Limited shift schedule.
POSSIBLE CAUSES:	Open/shorted Throttle Position Signal circuit. Open Signal Reference circuit. Open 5-volt output (for TPS) circuit between TPS and Powertrain Control Module. 40-way connector problem. Defective TPS. Defective Powertrain Control Module. Internal Transmission Control Module.

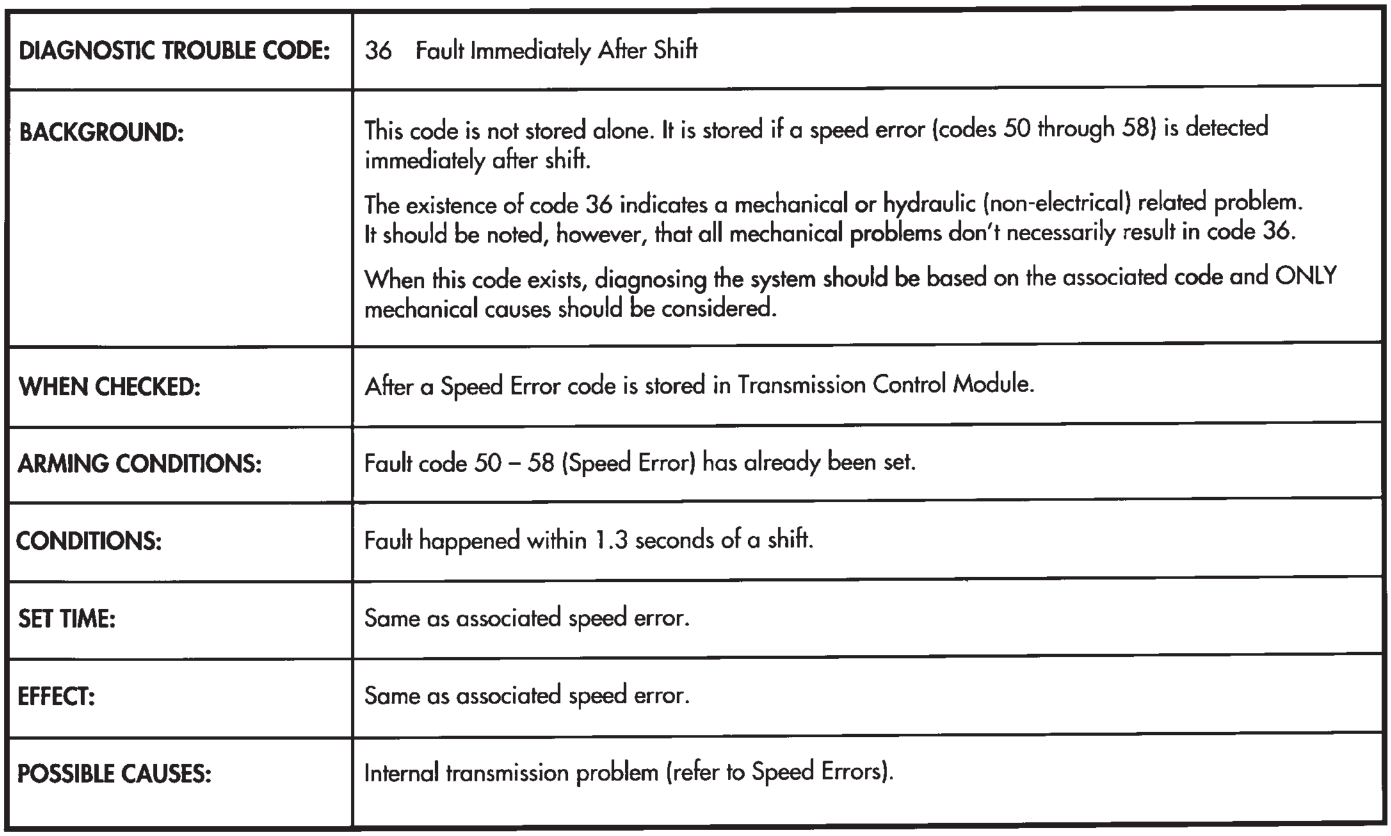
9321-312

DIAGNOSTIC TROUBLE CODE 31-32

DIAGNOSTIC TROUBLE CODE:	31-32 Hydraulic Pressure Switch Failure Code 31 OD Hydraulic Pressure Switch Code 32 2/4 Hydraulic Pressure Switch
BACKGROUND:	The Transmission Control Module tests the OD and 2/4 pressure switches when they are off (i.e., when the corresponding friction element [clutch] is not applied). The test makes sure the switches are operational. The Transmission Control Module verifies that the switch closes when the corresponding element is applied. If a switch fails to respond, it is retested.
WHEN CHECKED:	After a shift is made, periodically thereafter.
ARMING CONDITIONS:	(1) Transmission is at normal operating temperature. (2) Must be in 1st, 2nd or 3rd Gear. (3) Engine rpm fast enough to provide pump pressure (1000 rpm). (4) Acceptable pressure switch fault count (60). (5) Acceptable speed check fault count (80).
CONDITIONS:	Pressure switch does not respond within specified time for given temperature range.
SET TIME:	5 seconds.
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Low/high transmission fluid level. Solenoid pack problem. Internal transmission problem.

9321-313

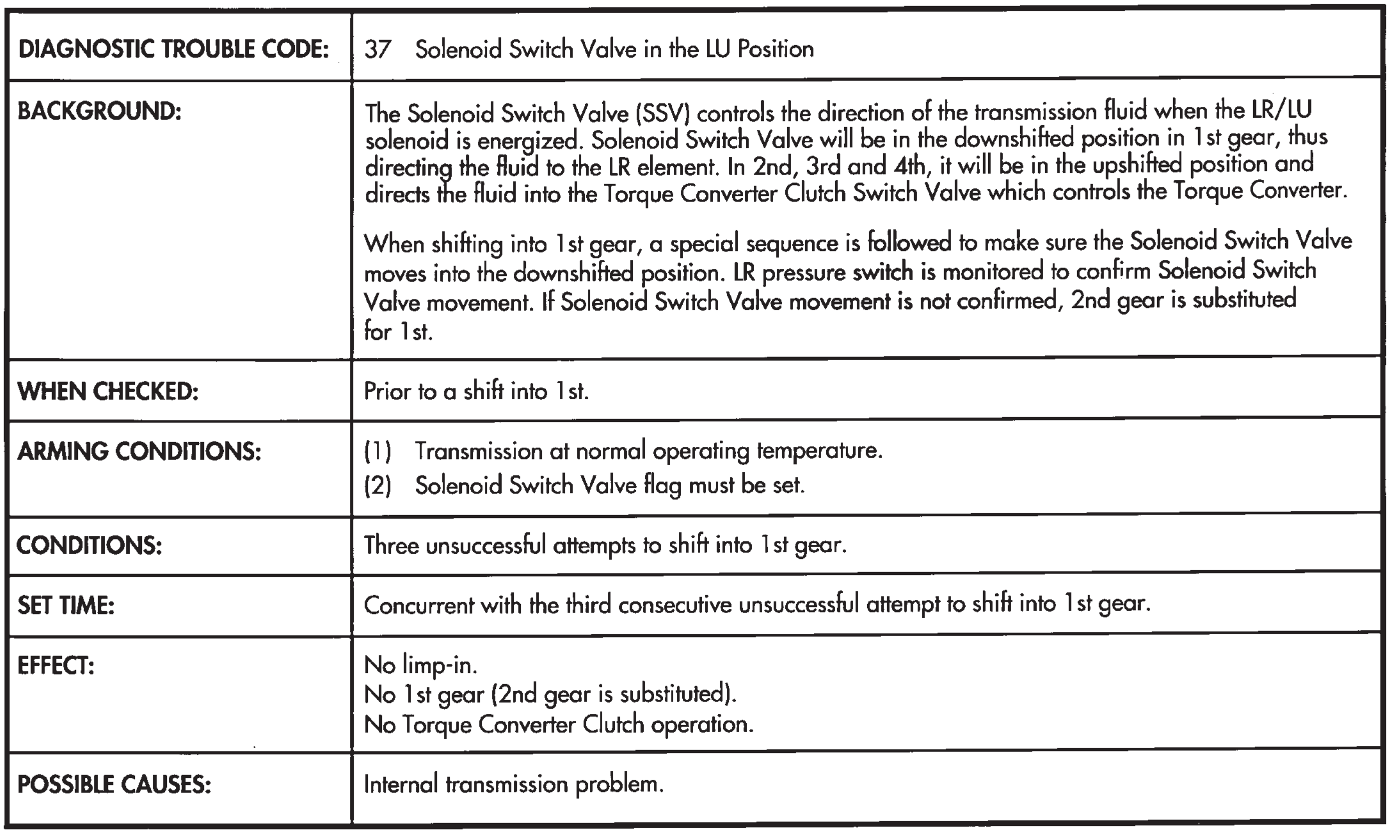
DIAGNOSTIC TROUBLE CODE 36



DIAGNOSTIC TROUBLE CODE:	36 Fault Immediately After Shift
BACKGROUND:	This code is not stored alone. It is stored if a speed error (codes 50 through 58) is detected immediately after shift. The existence of code 36 indicates a mechanical or hydraulic (non-electrical) related problem. It should be noted, however, that all mechanical problems don't necessarily result in code 36. When this code exists, diagnosing the system should be based on the associated code and ONLY mechanical causes should be considered.
WHEN CHECKED:	After a Speed Error code is stored in Transmission Control Module.
ARMING CONDITIONS:	Fault code 50 – 58 (Speed Error) has already been set.
CONDITIONS:	Fault happened within 1.3 seconds of a shift.
SET TIME:	Same as associated speed error.
EFFECT:	Same as associated speed error.
POSSIBLE CAUSES:	Internal transmission problem (refer to Speed Errors).

9321-314

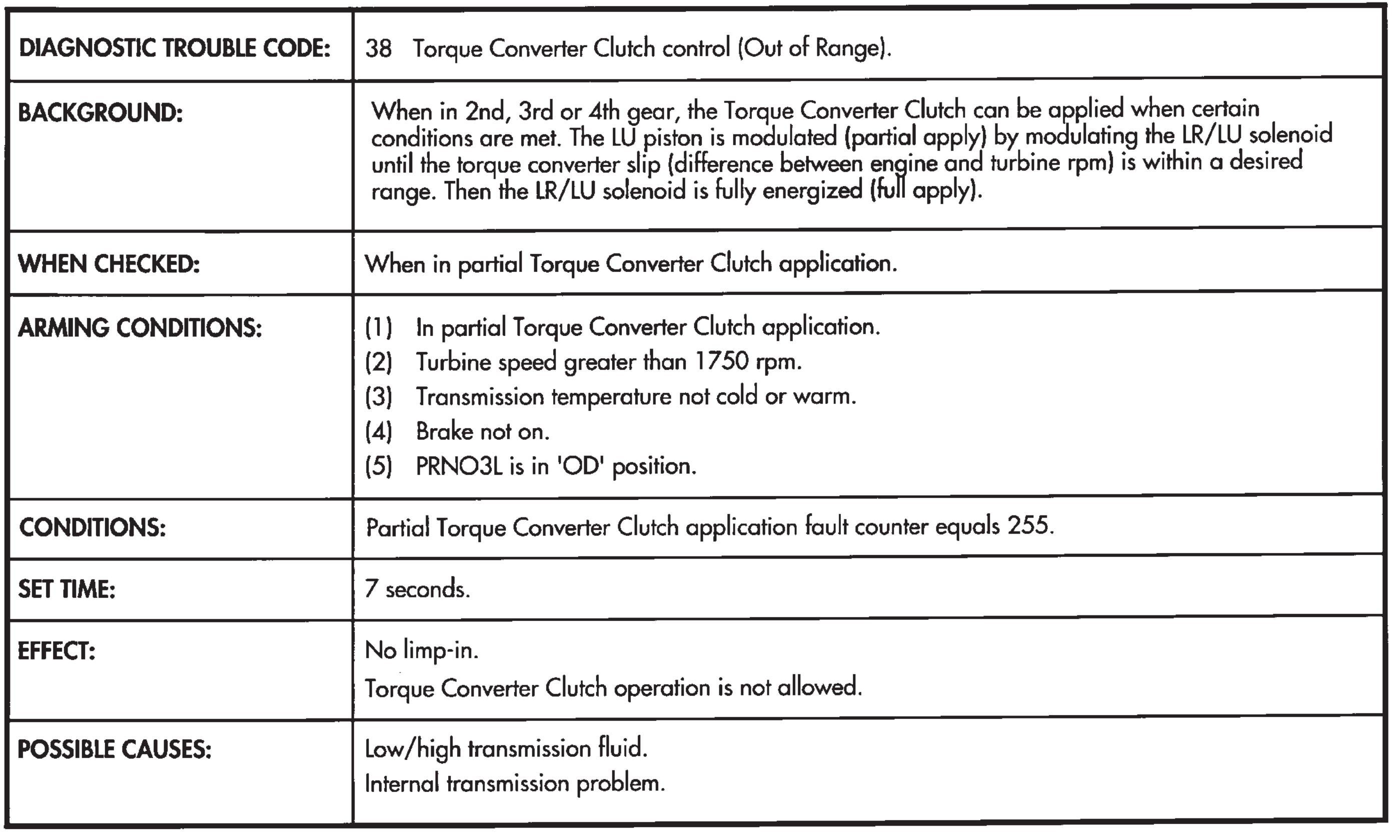
DIAGNOSTIC TROUBLE CODE 37



DIAGNOSTIC TROUBLE CODE:	37 Solenoid Switch Valve in the LU Position
BACKGROUND:	The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the LR/LU solenoid is energized. Solenoid Switch Valve will be in the downshifted position in 1st gear, thus directing the fluid to the LR element. In 2nd, 3rd and 4th, it will be in the upshifted position and directs the fluid into the Torque Converter Clutch Switch Valve which controls the Torque Converter. When shifting into 1st gear, a special sequence is followed to make sure the Solenoid Switch Valve moves into the downshifted position. LR pressure switch is monitored to confirm Solenoid Switch Valve movement. If Solenoid Switch Valve movement is not confirmed, 2nd gear is substituted for 1st.
WHEN CHECKED:	Prior to a shift into 1st.
ARMING CONDITIONS:	(1) Transmission at normal operating temperature. (2) Solenoid Switch Valve flag must be set.
CONDITIONS:	Three unsuccessful attempts to shift into 1st gear.
SET TIME:	Concurrent with the third consecutive unsuccessful attempt to shift into 1st gear.
EFFECT:	No limp-in. No 1st gear (2nd gear is substituted). No Torque Converter Clutch operation.
POSSIBLE CAUSES:	Internal transmission problem.

9321-315

DIAGNOSTIC TROUBLE CODE 38



DIAGNOSTIC TROUBLE CODE:	38 Torque Converter Clutch control (Out of Range).
BACKGROUND:	When in 2nd, 3rd or 4th gear, the Torque Converter Clutch can be applied when certain conditions are met. The LU piston is modulated (partial apply) by modulating the LR/LU solenoid until the torque converter slip (difference between engine and turbine rpm) is within a desired range. Then the LR/LU solenoid is fully energized (full apply).
WHEN CHECKED:	When in partial Torque Converter Clutch application.
ARMING CONDITIONS:	(1) In partial Torque Converter Clutch application. (2) Turbine speed greater than 1750 rpm. (3) Transmission temperature not cold or warm. (4) Brake not on. (5) PRNO3L is in 'OD' position.
CONDITIONS:	Partial Torque Converter Clutch application fault counter equals 255.
SET TIME:	7 seconds.
EFFECT:	No limp-in. Torque Converter Clutch operation is not allowed.
POSSIBLE CAUSES:	Low/high transmission fluid. Internal transmission problem.

9321-316

DIAGNOSTIC TROUBLE CODE 41-44

DIAGNOSTIC TROUBLE CODE:	41-44 Solenoid Continuity Test Failure Code 41 LR Solenoid Circuit Code 42 2/4 Solenoid Circuit Code 43 OD Solenoid Circuit Code 44 UD Solenoid Circuit
BACKGROUND:	Four Solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is tested periodically. Each solenoid is turned off and an inductive voltage spike should be detected. When no spike is detected, the solenoid circuits are tested a second time to verify the failure. In addition to the periodic testing, solenoid circuits are tested when a speed or pressure switch circuit error occurs. In this case, one failure will result in setting the appropriate code.
WHEN CHECKED:	After a reset, then every 10 seconds thereafter. When a speed error or pressure switch mismatch is detected.
ARMING CONDITIONS:	(1) Shift not in progress. (2) Shift Lever Position Test not in progress. (3) Pressure Switch Test not in progress. (4) Watchdog Test not in progress. (5) No voltage spike detected from solenoid during first test.
CONDITIONS:	Solenoid Continuity Test failed for the second time. – OR – Either a pressure switch or speed data problem and Solenoid Continuity Test failed for the first time.
SET TIME:	Without Speed or Pressure Switch error 12.0 seconds. – OR – With Speed error 0.2 second. – OR – With Pressure Switch error Super Cold: 3.0 seconds Cold: 2.0 seconds Warm: 1.2 seconds Hot: 0.5 second (Temperature description based off of DRB II transaxle state display.)
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Open/shorted LR Solenoid Driver circuit, 2/4 Solenoid Driver circuit, UD Solenoid Driver circuit and OD Solenoid Driver circuit. Open Power Ground circuit. 60-way connector problem (cavities 16, 17, 19, 20, 57, 58, 59, and 60). 8-way connector problem (cavities 4, 5, 6, 7, and 8). Solenoid Pack internal problem. Internal Transmission Control Module failure.

9321-317

DIAGNOSTIC TROUBLE CODE 45

DIAGNOSTIC TROUBLE CODE:	45 Internal Transmission Control Module (EEPROM Byte Failure)
BACKGROUND:	The transmission system supports several engine models, each requiring different shift schedules and calibration constants. The Transmission Control Module receives the engine model code from the Powertrain Control Module and stores it in the microprocessor's EEPROM memory. Once the engine model code is established in the EEPROM memory, it is used to select the appropriate shift schedule and other calibrations. The EEPROM memory location used for the engine model code is checked to make sure it can hold data. If the EEPROM memory location fails the checks, the code is set.
WHEN CHECKED:	After a reset (ignition key turned to the RUN position or after cranking engine).
ARMING CONDITIONS:	(1) No write request to EEPROM. (2) Engine model not erased from Transmission Control Module memory.
CONDITIONS:	Engine model stored in EEPROM is different from data stored in RAM.
SET TIME:	14 seconds.
EFFECT:	No limp-in.
POSSIBLE CAUSES:	Internal Transmission Control Module failure.

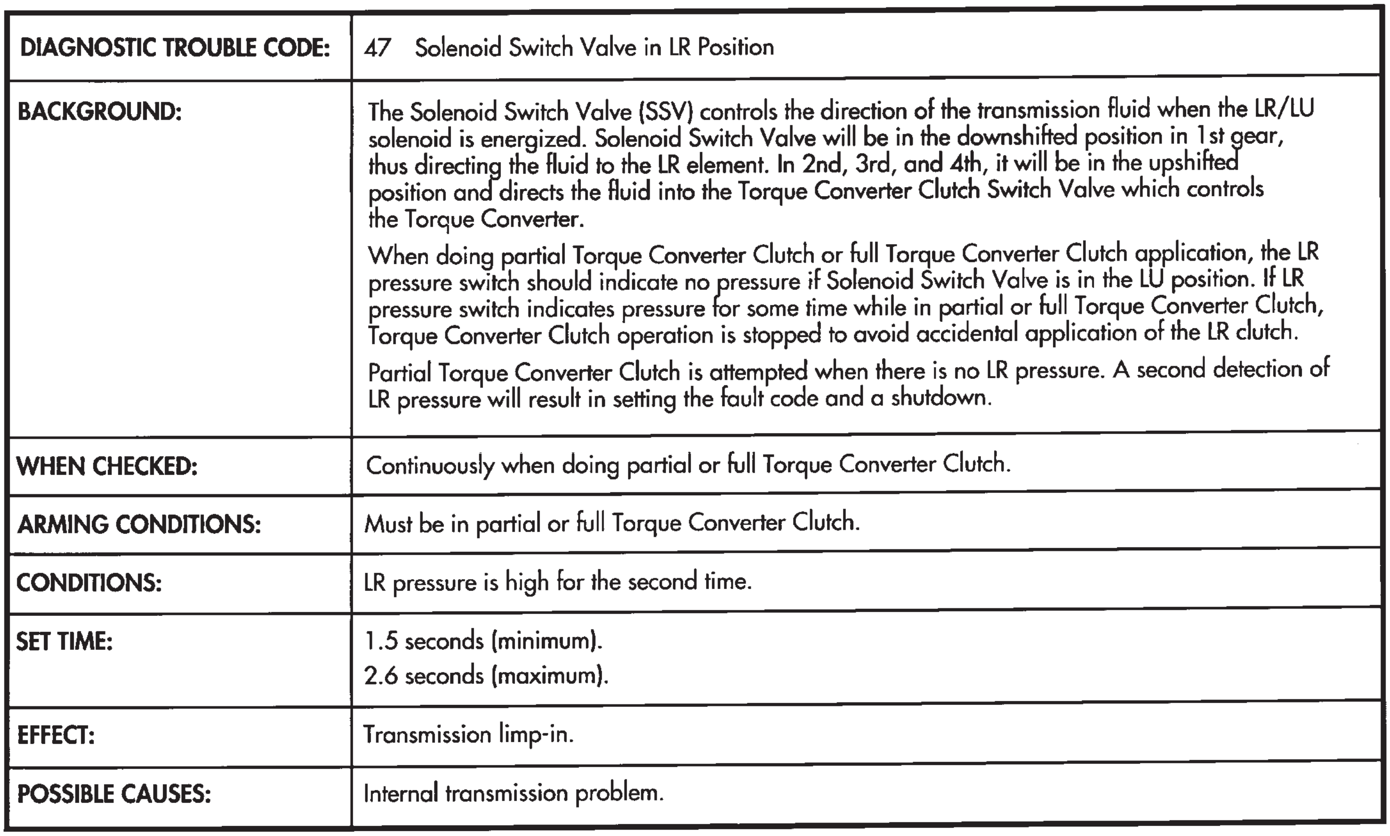
9321-318

DIAGNOSTIC TROUBLE CODE 46

<table>
<tr><td>DIAGNOSTIC TROUBLE CODE:</td><td>46 3/4 Shift Abort (UD Hydraulic Circuit Failure)</td></tr>
<tr><td>BACKGROUND:</td><td>The following table shows the clutches applied in each gear:
<table>
<tr><th>Gear</th><th>UD</th><th>OD</th><th>REV.</th><th>2/4</th><th>LR</th></tr>
<tr><td>Park</td><td></td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>Reverse</td><td></td><td></td><td>X</td><td></td><td>X</td></tr>
<tr><td>Neutral</td><td></td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>1st</td><td>X</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>2nd</td><td>X</td><td></td><td></td><td>X</td><td></td></tr>
<tr><td>3rd</td><td>X</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>4th</td><td></td><td>X</td><td></td><td>X</td><td></td></tr>
</table>
When shifting from 3rd to 4th gear, a delayed speed change will indicate a problem in the UD hydraulic circuit. When this is detected, the 3/4 shift is aborted temporarily. The Transmission Control Module will attempt the 3/4 shift again. After three unsuccessful shift attempts, the code is set.</td></tr>
<tr><td>WHEN CHECKED:</td><td>Prior to the 3/4 shift.</td></tr>
<tr><td>ARMING CONDITIONS:</td><td>(1) Must be doing a 3/4 shift.
(2) Under Drive Failure flag must be set.
(Temperature must not be cold.)</td></tr>
<tr><td>CONDITIONS:</td><td>Under Drive Fault Counter is greater than three.</td></tr>
<tr><td>SET TIME:</td><td>Concurrent with the third consecutive 3/4 shift abort.</td></tr>
<tr><td>EFFECT:</td><td>No limp-in.</td></tr>
<tr><td>POSSIBLE CAUSES:</td><td>Internal transmission failure.</td></tr>
</table>

9321-319

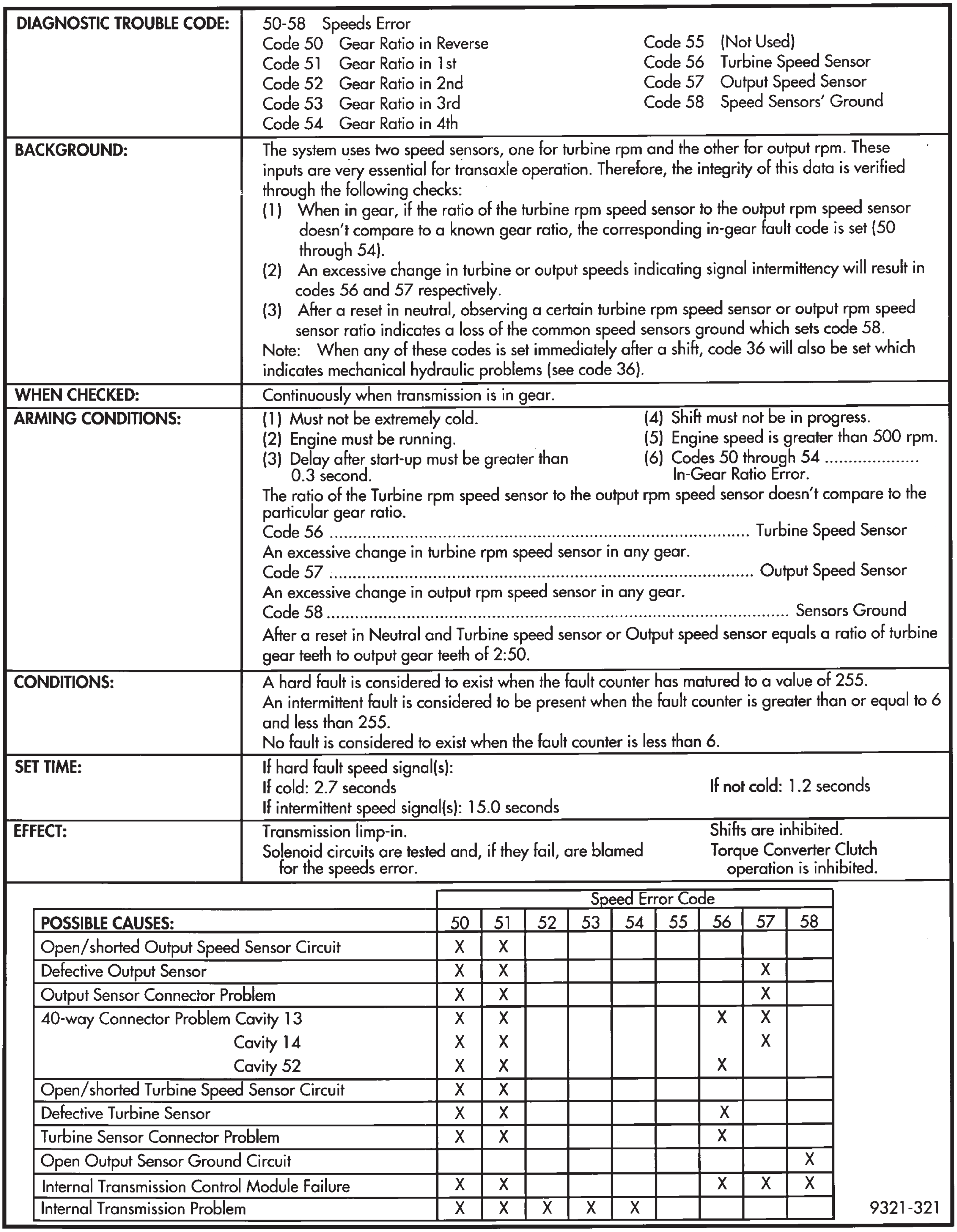
DIAGNOSTIC TROUBLE CODE 47



DIAGNOSTIC TROUBLE CODE:	47 Solenoid Switch Valve in LR Position
BACKGROUND:	The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the LR/LU solenoid is energized. Solenoid Switch Valve will be in the downshifted position in 1st gear, thus directing the fluid to the LR element. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the Torque Converter Clutch Switch Valve which controls the Torque Converter. When doing partial Torque Converter Clutch or full Torque Converter Clutch application, the LR pressure switch should indicate no pressure if Solenoid Switch Valve is in the LU position. If LR pressure switch indicates pressure for some time while in partial or full Torque Converter Clutch, Torque Converter Clutch operation is stopped to avoid accidental application of the LR clutch. Partial Torque Converter Clutch is attempted when there is no LR pressure. A second detection of LR pressure will result in setting the fault code and a shutdown.
WHEN CHECKED:	Continuously when doing partial or full Torque Converter Clutch.
ARMING CONDITIONS:	Must be in partial or full Torque Converter Clutch.
CONDITIONS:	LR pressure is high for the second time.
SET TIME:	1.5 seconds (minimum). 2.6 seconds (maximum).
EFFECT:	Transmission limp-in.
POSSIBLE CAUSES:	Internal transmission problem.

9321-320

DIAGNOSTIC TROUBLE CODE 50-58

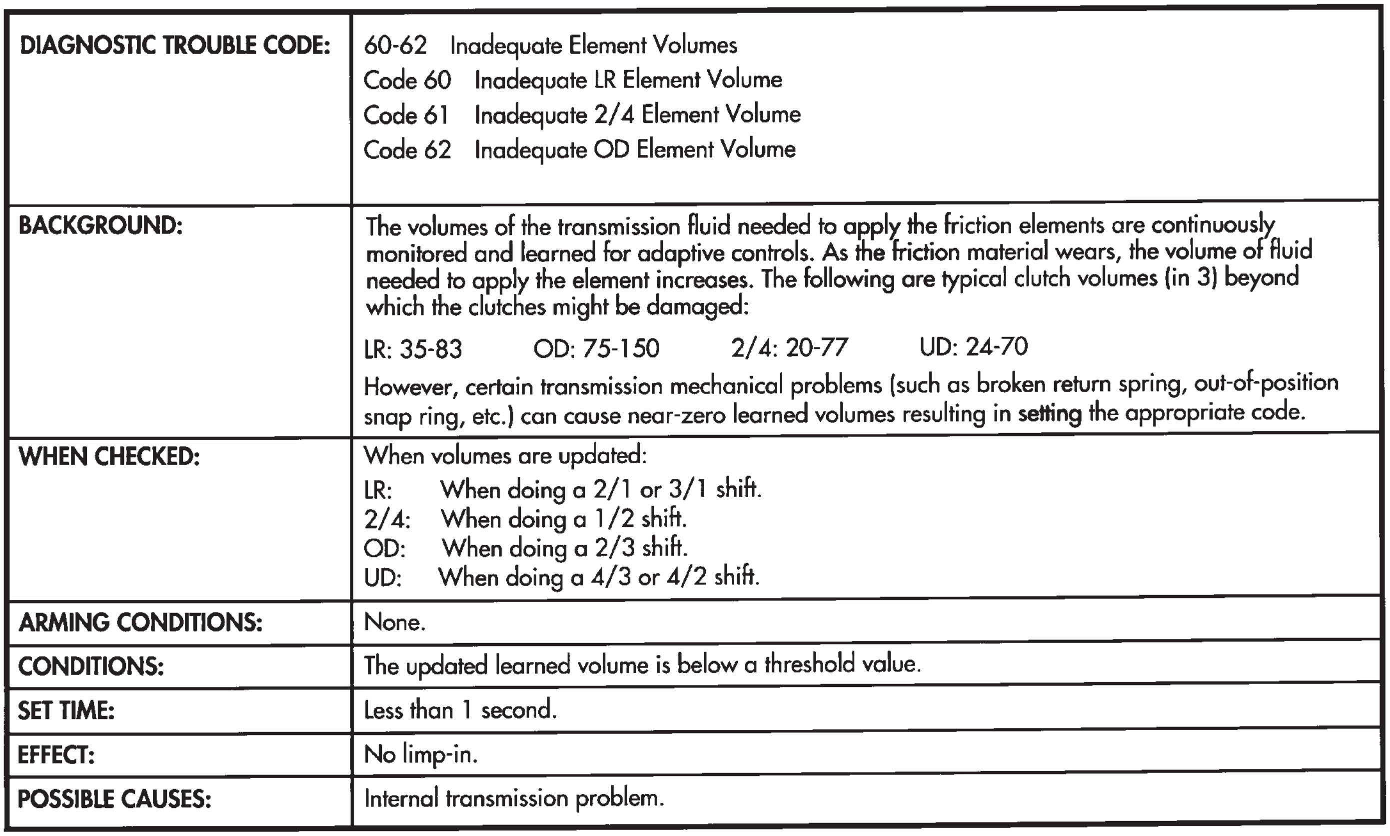


DIAGNOSTIC TROUBLE CODE:	50-58 Speeds Error Code 50 Gear Ratio in Reverse Code 51 Gear Ratio in 1st Code 52 Gear Ratio in 2nd Code 53 Gear Ratio in 3rd Code 54 Gear Ratio in 4th Code 55 (Not Used) Code 56 Turbine Speed Sensor Code 57 Output Speed Sensor Code 58 Speed Sensors' Ground
BACKGROUND:	The system uses two speed sensors, one for turbine rpm and the other for output rpm. These inputs are very essential for transaxle operation. Therefore, the integrity of this data is verified through the following checks: (1) When in gear, if the ratio of the turbine rpm speed sensor to the output rpm speed sensor doesn't compare to a known gear ratio, the corresponding in-gear fault code is set (50 through 54). (2) An excessive change in turbine or output speeds indicating signal intermittency will result in codes 56 and 57 respectively. (3) After a reset in neutral, observing a certain turbine rpm speed sensor or output rpm speed sensor ratio indicates a loss of the common speed sensors ground which sets code 58. Note: When any of these codes is set immediately after a shift, code 36 will also be set which indicates mechanical hydraulic problems (see code 36).
WHEN CHECKED:	Continuously when transmission is in gear.
ARMING CONDITIONS:	(1) Must not be extremely cold. (2) Engine must be running. (3) Delay after start-up must be greater than 0.3 second. (4) Shift must not be in progress. (5) Engine speed is greater than 500 rpm. (6) Codes 50 through 54 .... In-Gear Ratio Error. The ratio of the Turbine rpm speed sensor to the output rpm speed sensor doesn't compare to the particular gear ratio. Code 56 .... Turbine Speed Sensor An excessive change in turbine rpm speed sensor in any gear. Code 57 .... Output Speed Sensor An excessive change in output rpm speed sensor in any gear. Code 58 .... Sensors Ground After a reset in Neutral and Turbine speed sensor or Output speed sensor equals a ratio of turbine gear teeth to output gear teeth of 2:50.
CONDITIONS:	A hard fault is considered to exist when the fault counter has matured to a value of 255. An intermittent fault is considered to be present when the fault counter is greater than or equal to 6 and less than 255. No fault is considered to exist when the fault counter is less than 6.
SET TIME:	If hard fault speed signal(s): If cold: 2.7 seconds If not cold: 1.2 seconds If intermittent speed signal(s): 15.0 seconds
EFFECT:	Transmission limp-in. Solenoid circuits are tested and, if they fail, are blamed for the speeds error. Shifts are inhibited. Torque Converter Clutch operation is inhibited.

	Speed Error Code								
POSSIBLE CAUSES:	50	51	52	53	54	55	56	57	58
Open/shorted Output Speed Sensor Circuit	X	X							
Defective Output Sensor	X	X						X	
Output Sensor Connector Problem	X	X						X	
40-way Connector Problem Cavity 13	X	X					X	X	
Cavity 14	X	X						X	
Cavity 52	X	X					X		
Open/shorted Turbine Speed Sensor Circuit	X	X							
Defective Turbine Sensor	X	X					X		
Turbine Sensor Connector Problem	X	X					X		
Open Output Sensor Ground Circuit									X
Internal Transmission Control Module Failure	X	X					X	X	X
Internal Transmission Problem	X	X	X	X	X				

9321-321

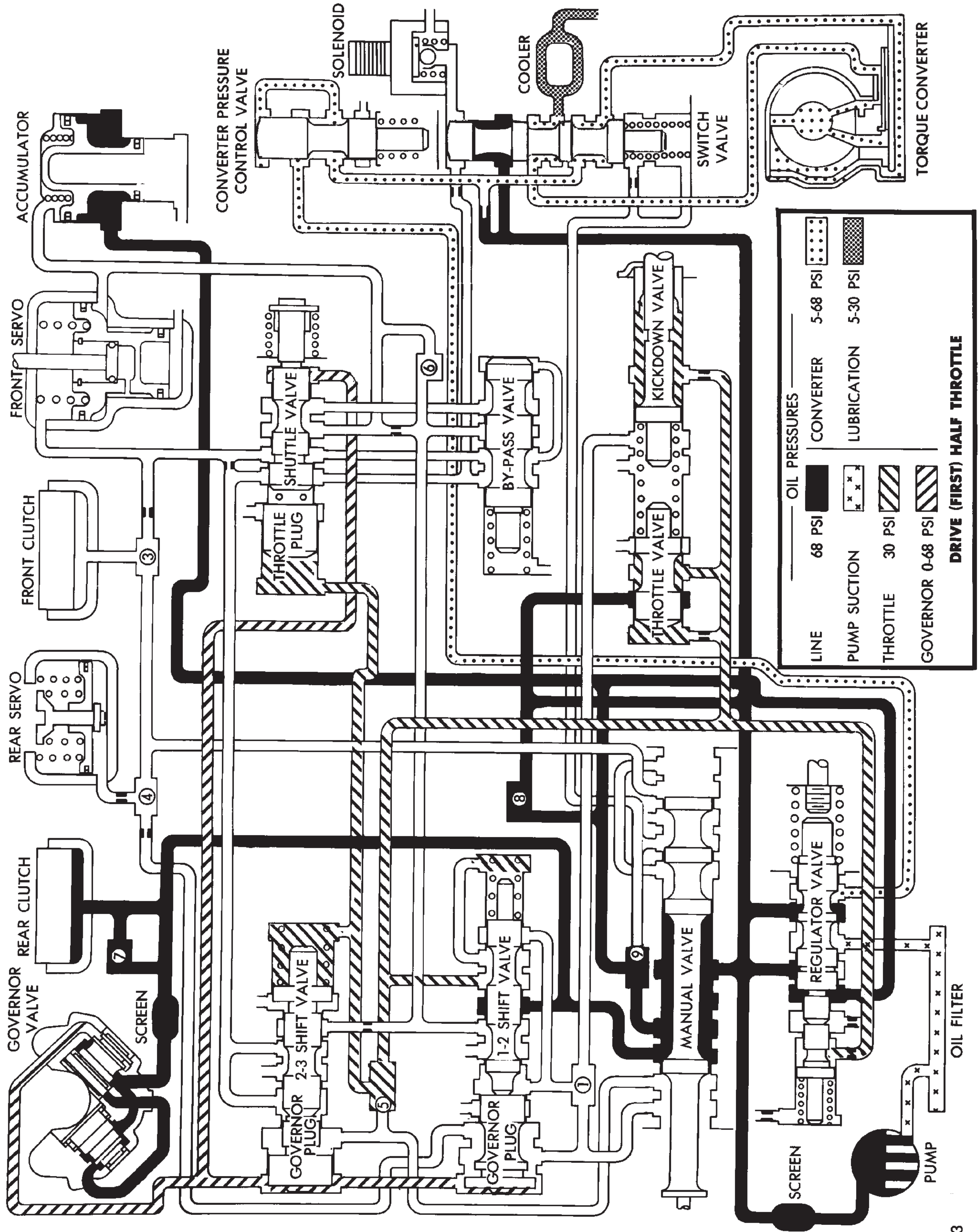
DIAGNOSTIC TROUBLE CODE 60-62



DIAGNOSTIC TROUBLE CODE:	60-62 Inadequate Element Volumes Code 60 Inadequate LR Element Volume Code 61 Inadequate 2/4 Element Volume Code 62 Inadequate OD Element Volume
BACKGROUND:	The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the friction material wears, the volume of fluid needed to apply the element increases. The following are typical clutch volumes (in 3) beyond which the clutches might be damaged: LR: 35-83 OD: 75-150 2/4: 20-77 UD: 24-70 However, certain transmission mechanical problems (such as broken return spring, out-of-position snap ring, etc.) can cause near-zero learned volumes resulting in setting the appropriate code.
WHEN CHECKED:	When volumes are updated: LR: When doing a 2/1 or 3/1 shift. 2/4: When doing a 1/2 shift. OD: When doing a 2/3 shift. UD: When doing a 4/3 or 4/2 shift.
ARMING CONDITIONS:	None.
CONDITIONS:	The updated learned volume is below a threshold value.
SET TIME:	Less than 1 second.
EFFECT:	No limp-in.
POSSIBLE CAUSES:	Internal transmission problem.

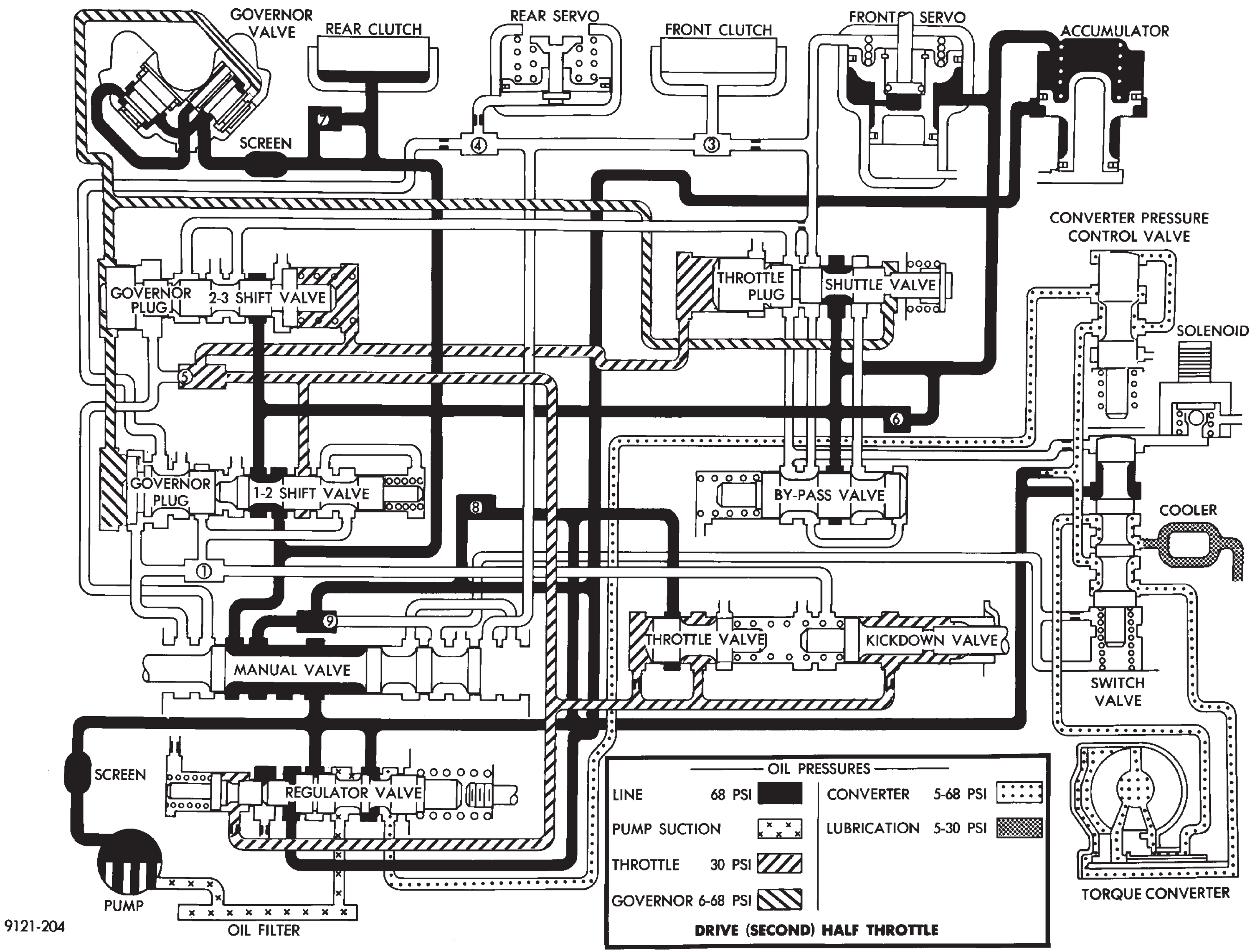
9321-322

THREE SPEED TRANSAXLE HYDRAULIC SCHEMATICS

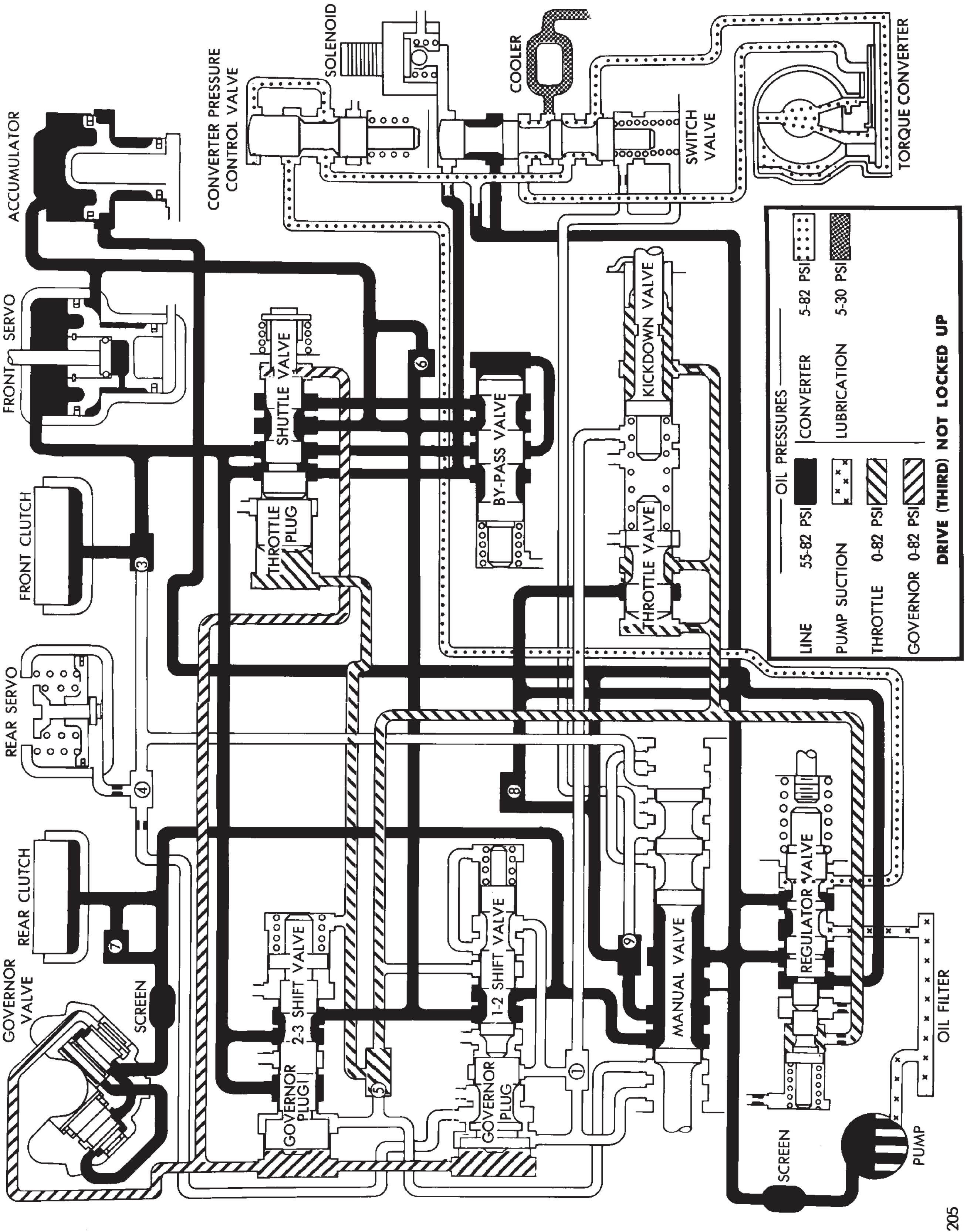


9121-203

THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC

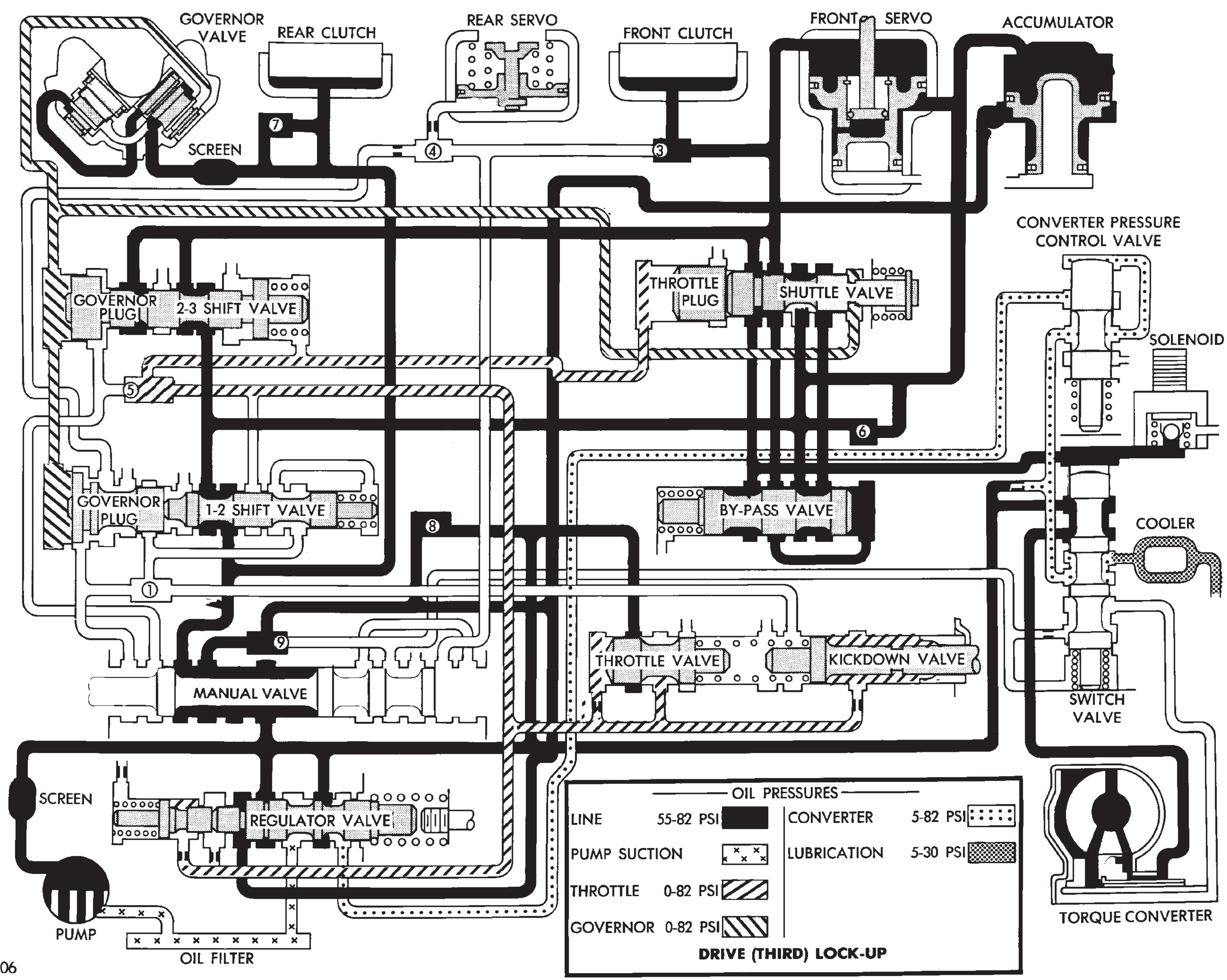


THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC



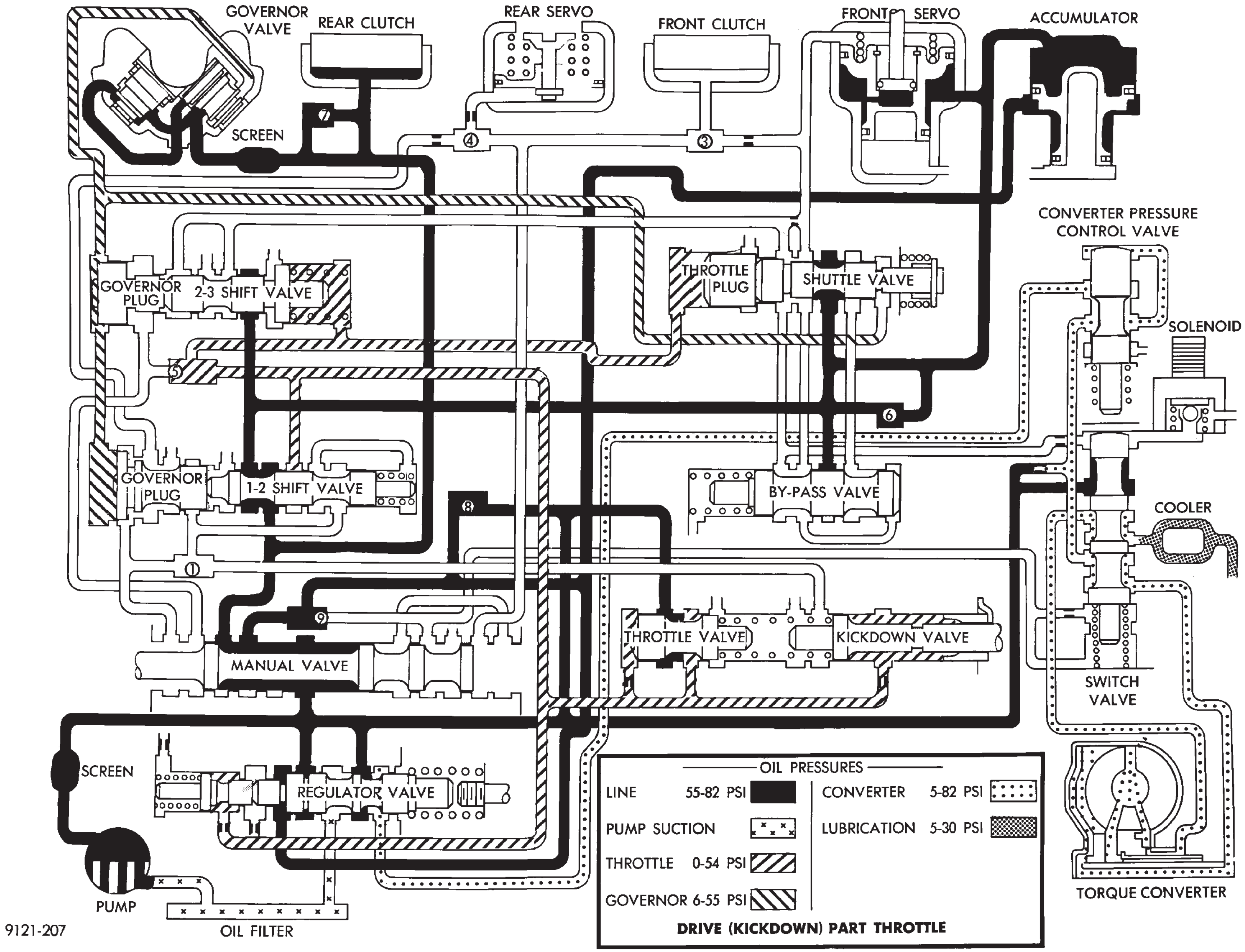
THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC

9121-205

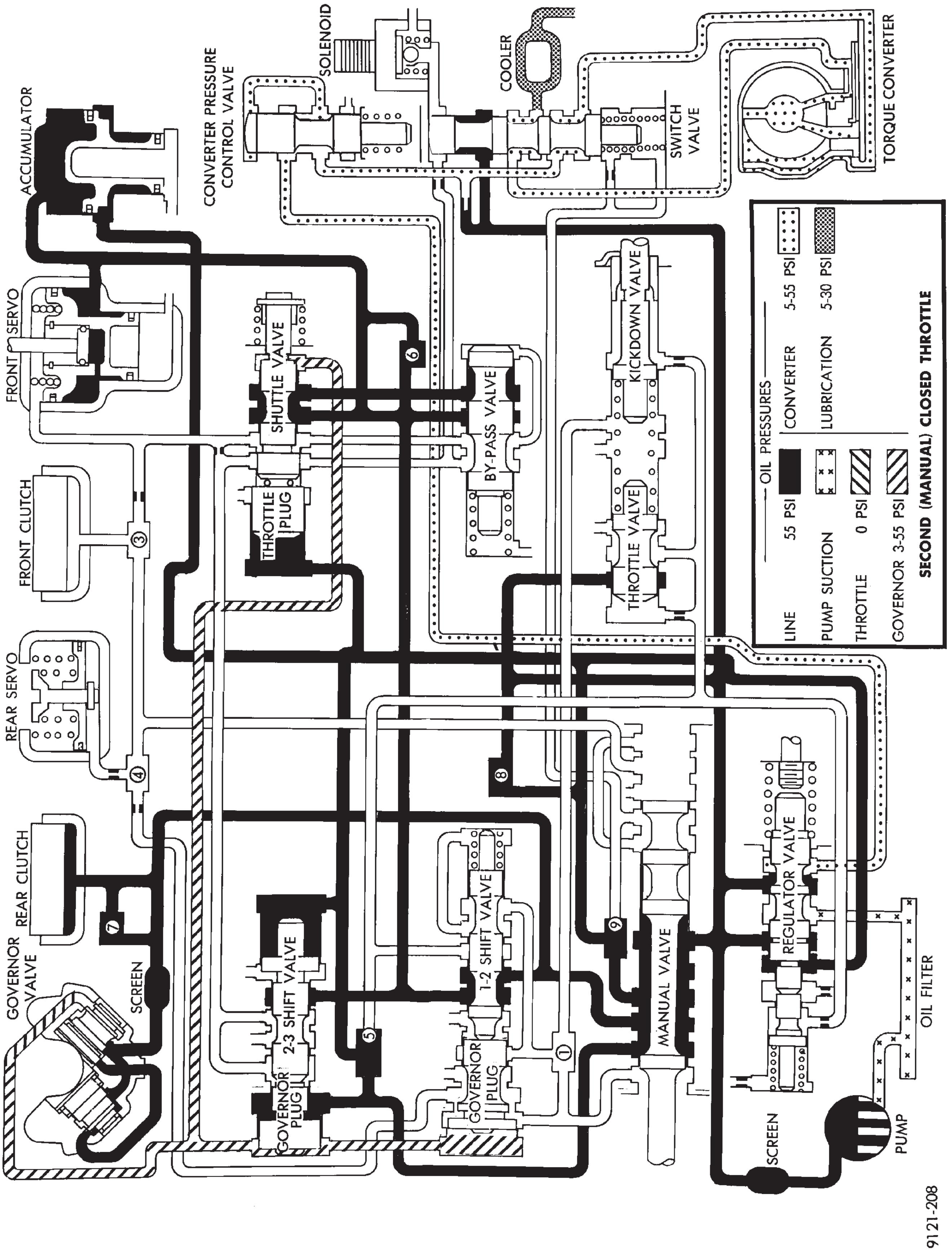


9121-206

THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC

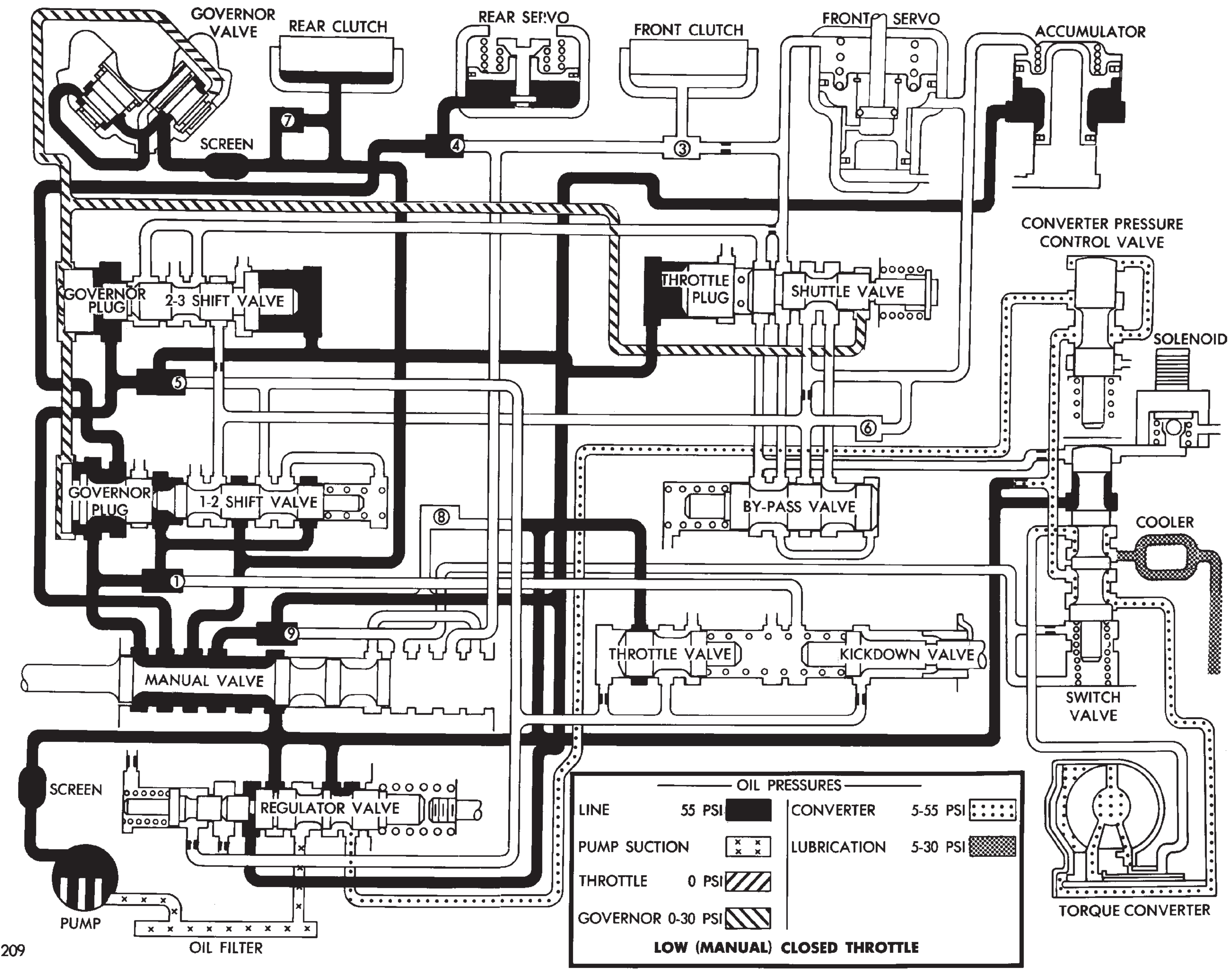


THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC



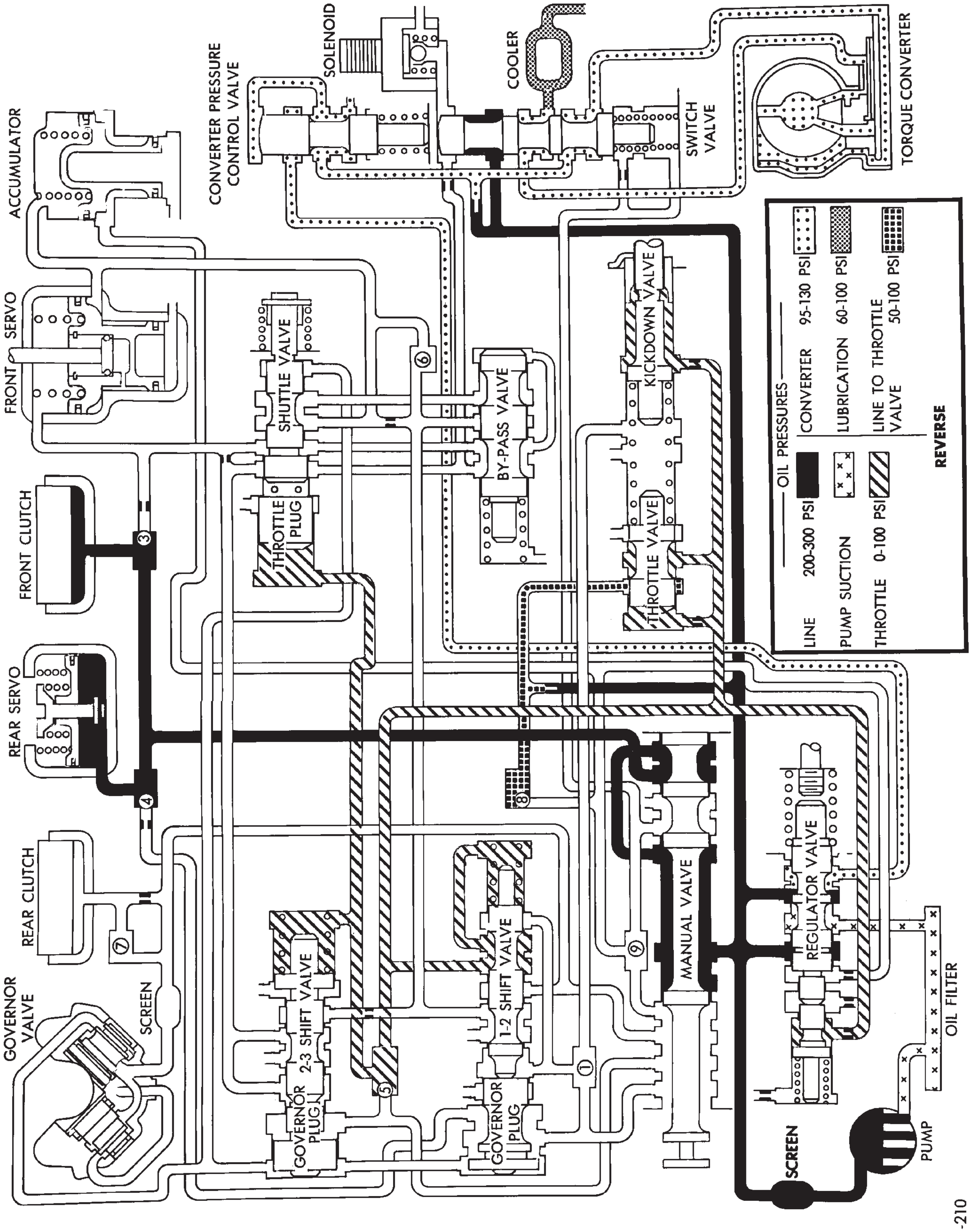
9121-208

THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC



9121-209

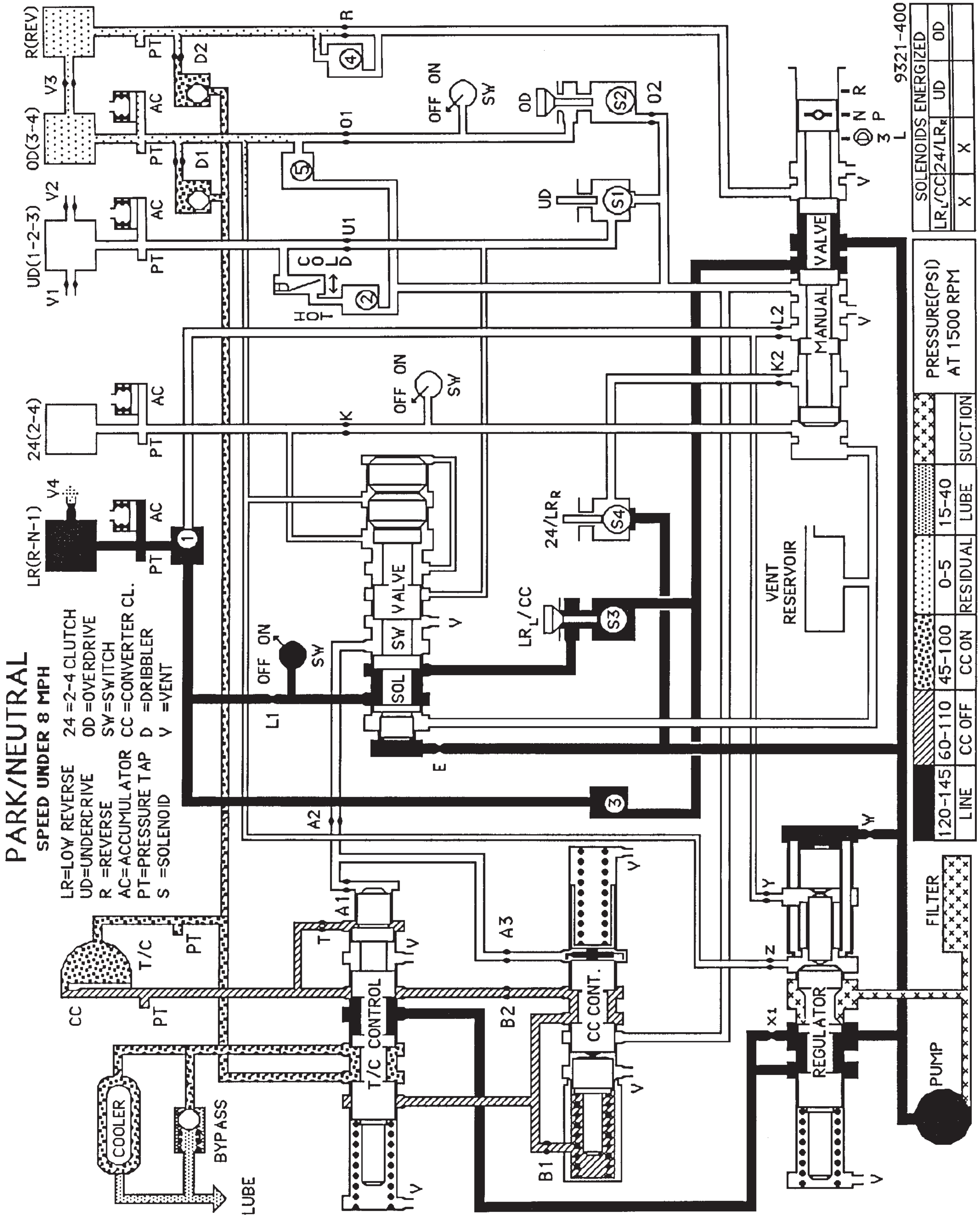
THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC



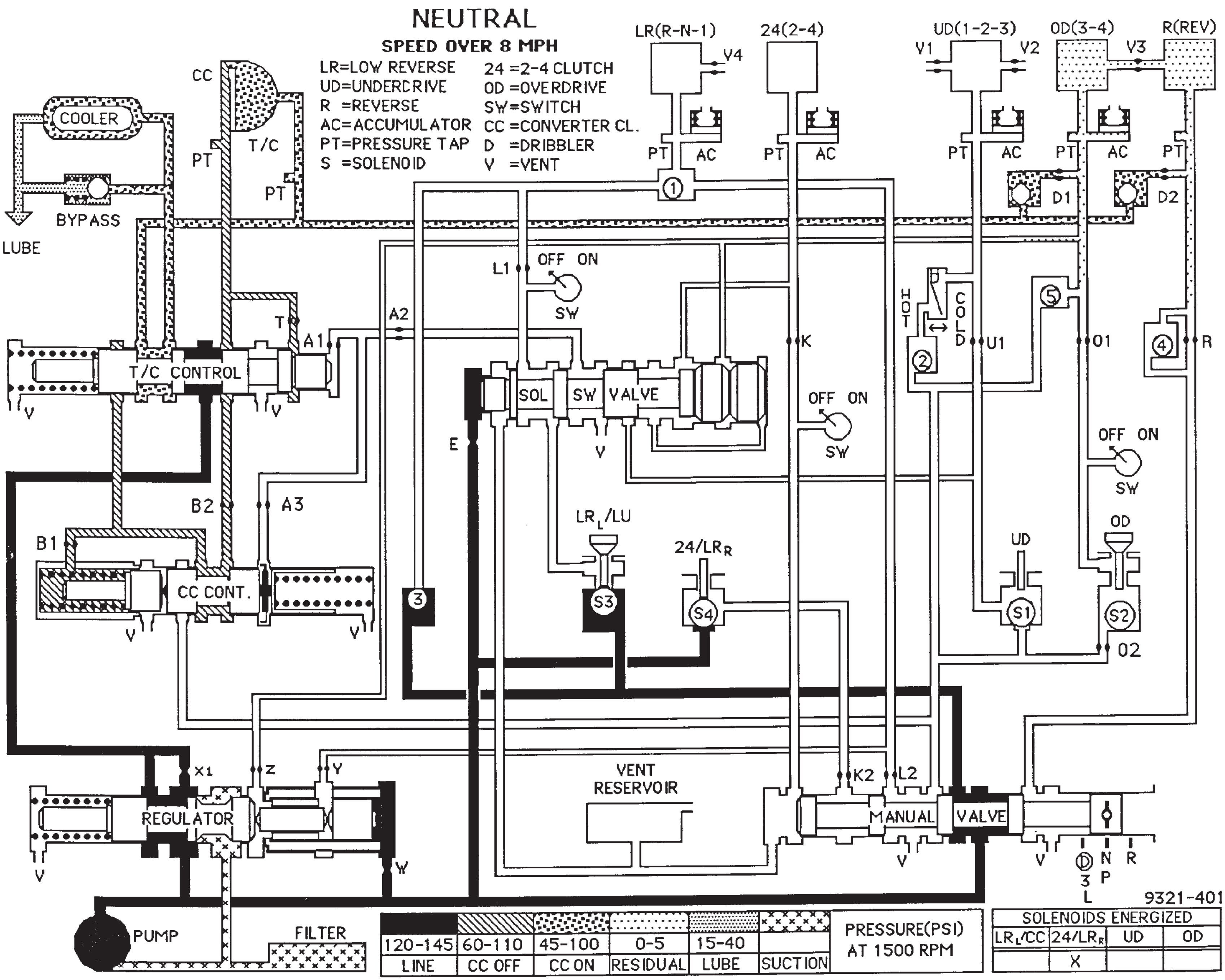
THREE SPEED TRANSAXLE HYDRAULIC SCHEMATIC

9121-210

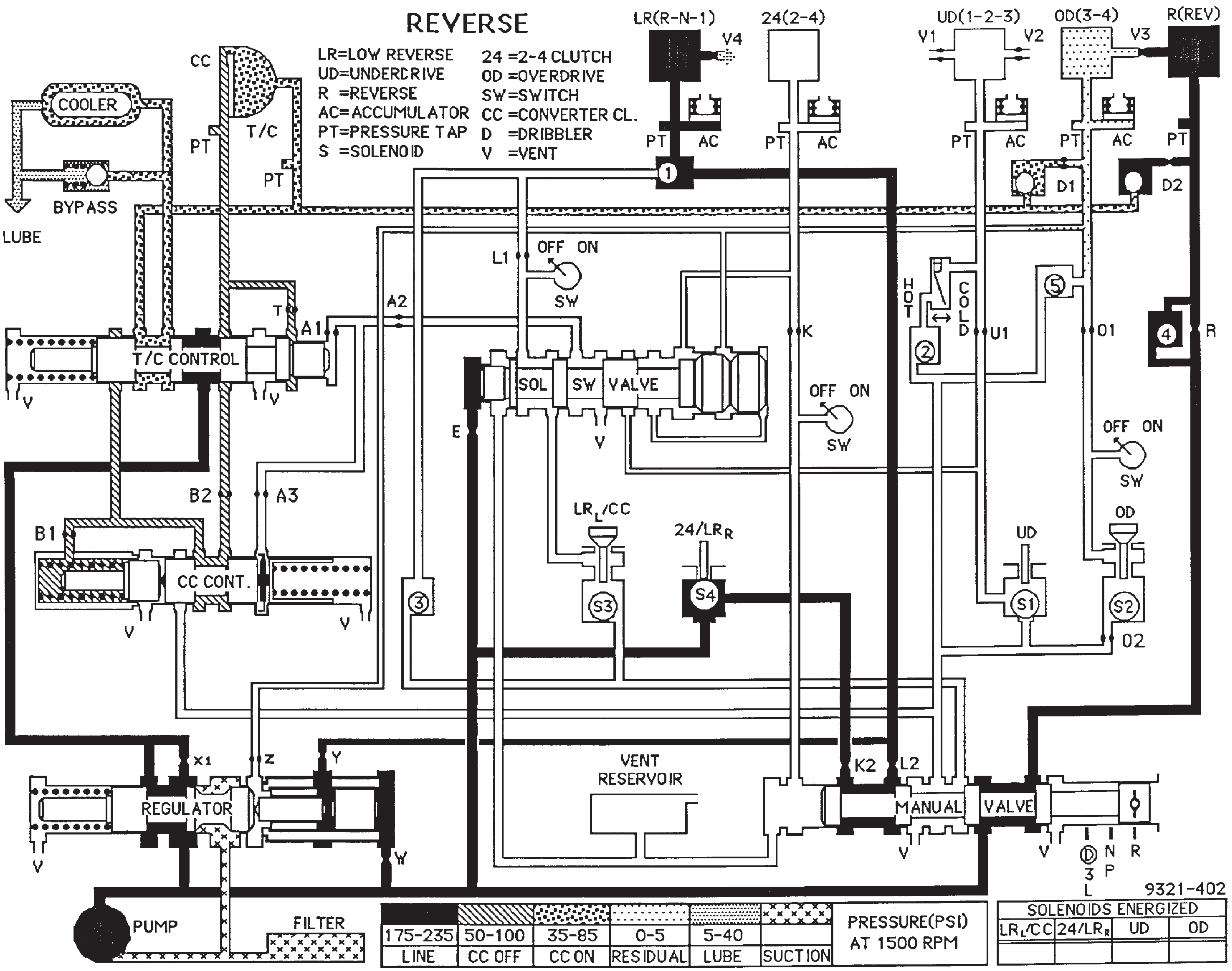
41TE FOUR SPEED TRANSAXLE HYDRAULIC SCHEMATICS



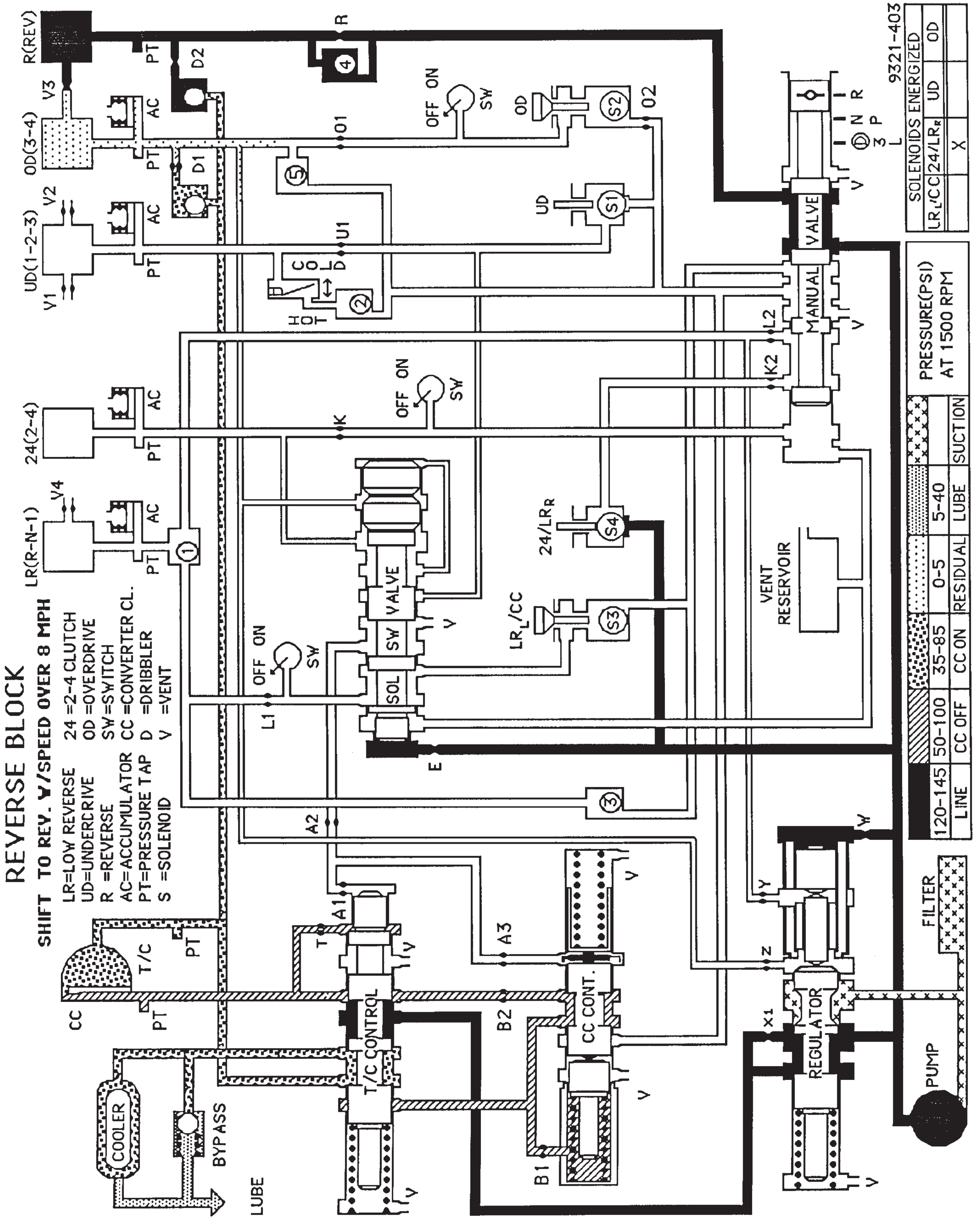
41TE TRANSAXLE HYDRAULIC SCHEMATIC



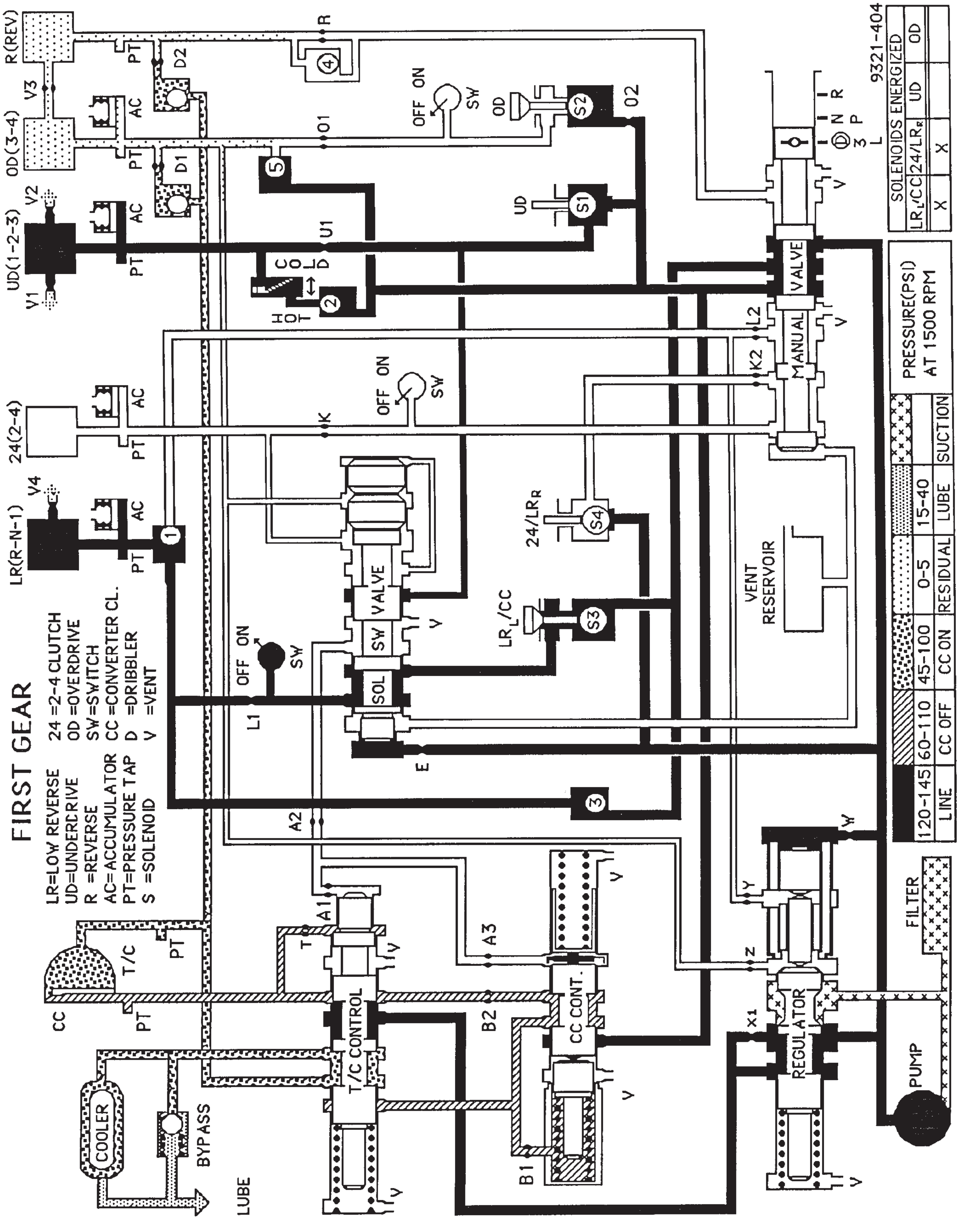
41TE TRANSAXLE HYDRAULIC SCHEMATIC



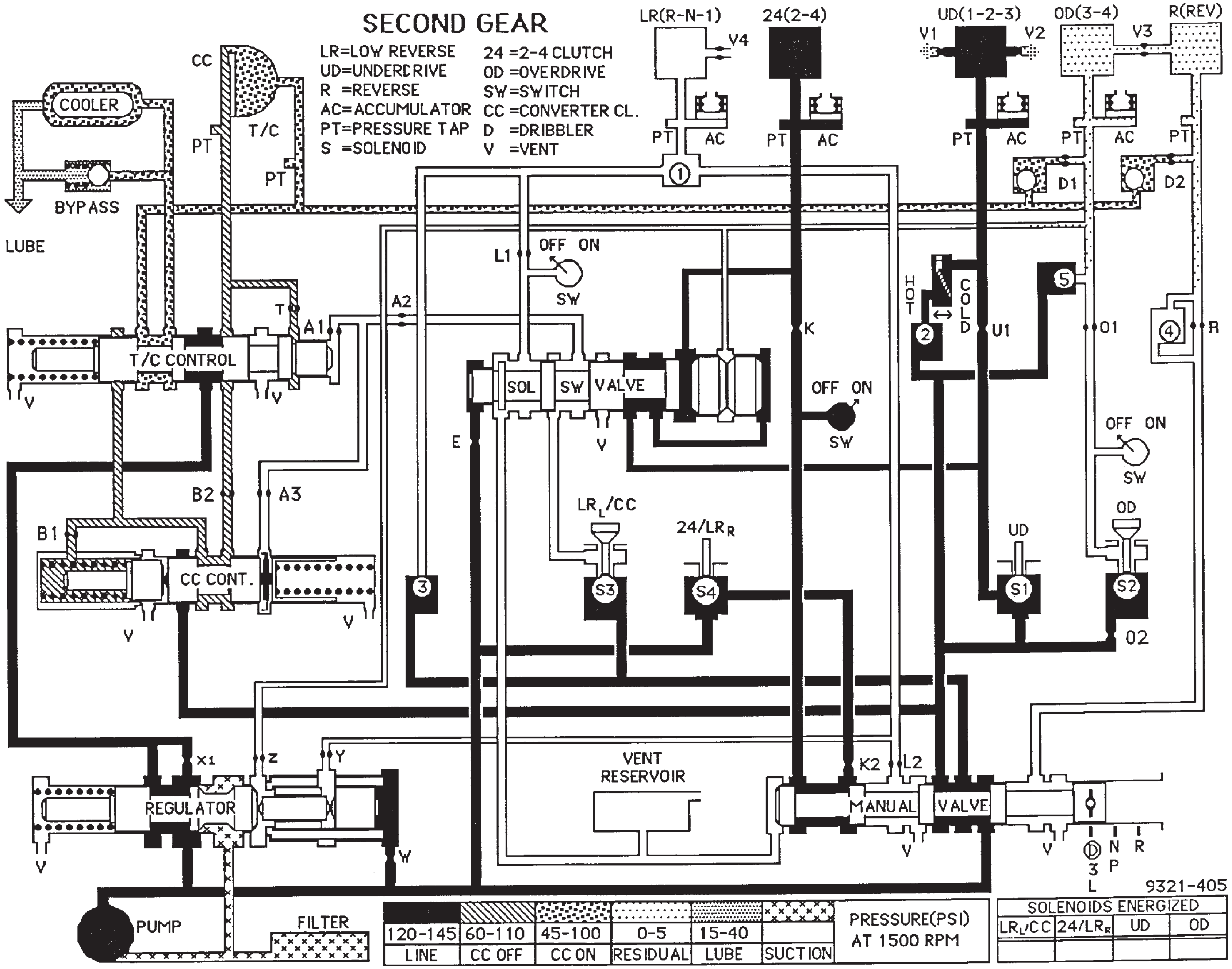
41TE TRANSAXLE HYDRAULIC SCHEMATIC



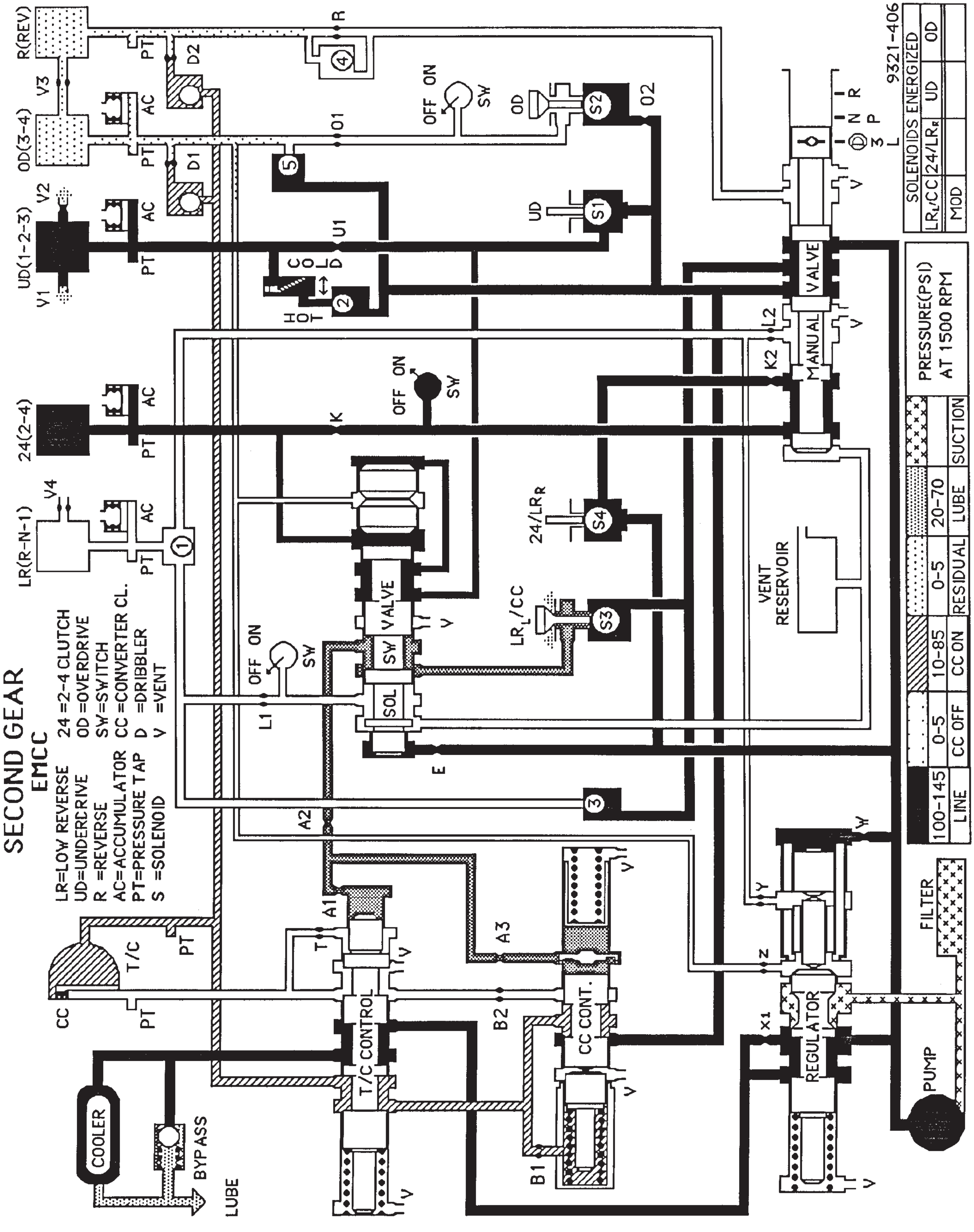
41TE TRANSAXLE HYDRAULIC SCHEMATIC



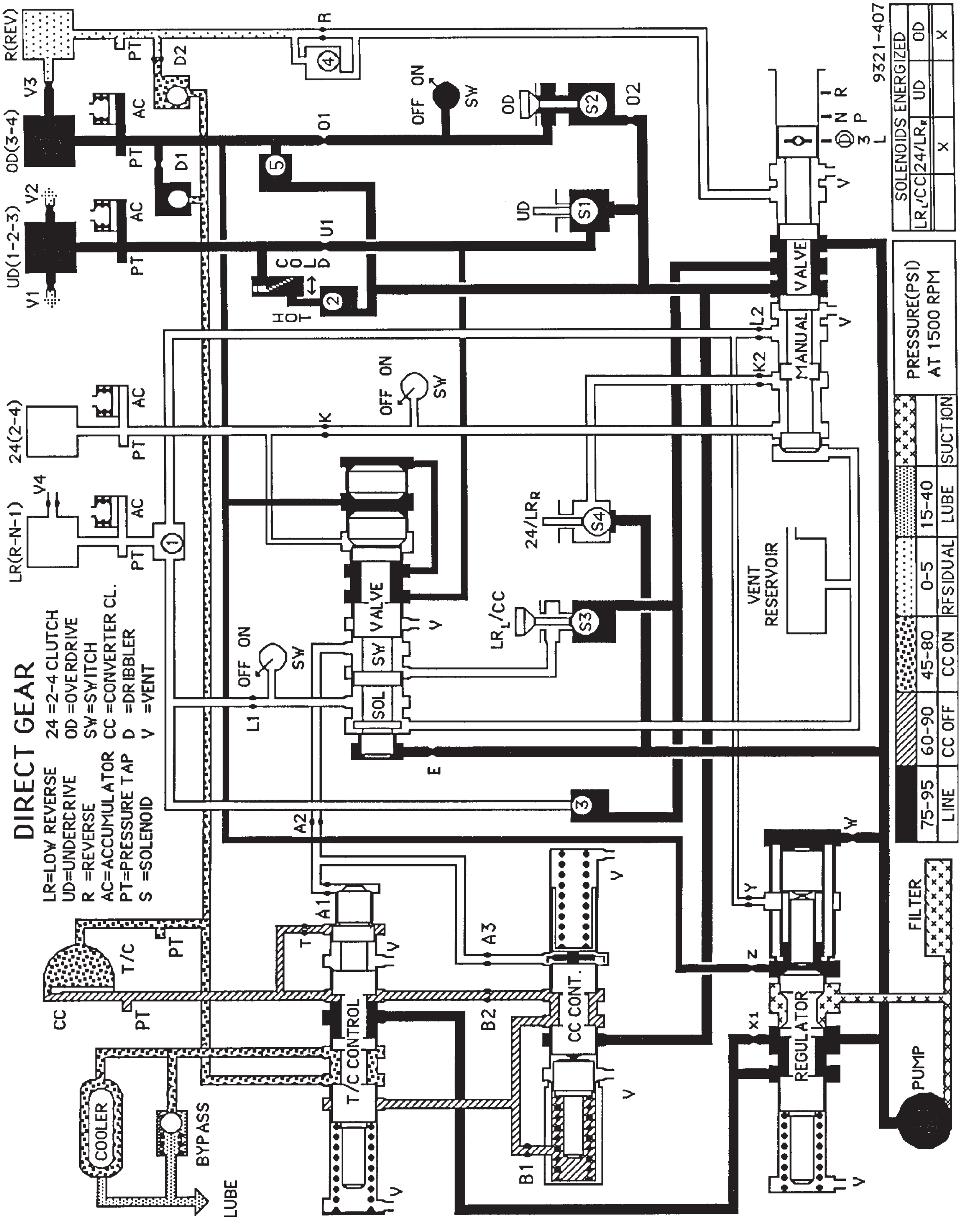
41TE TRANSAXLE HYDRAULIC SCHEMATIC



41TE TRANSAXLE HYDRAULIC SCHEMATIC



41TE TRANSAXLE HYDRAULIC SCHEMATIC



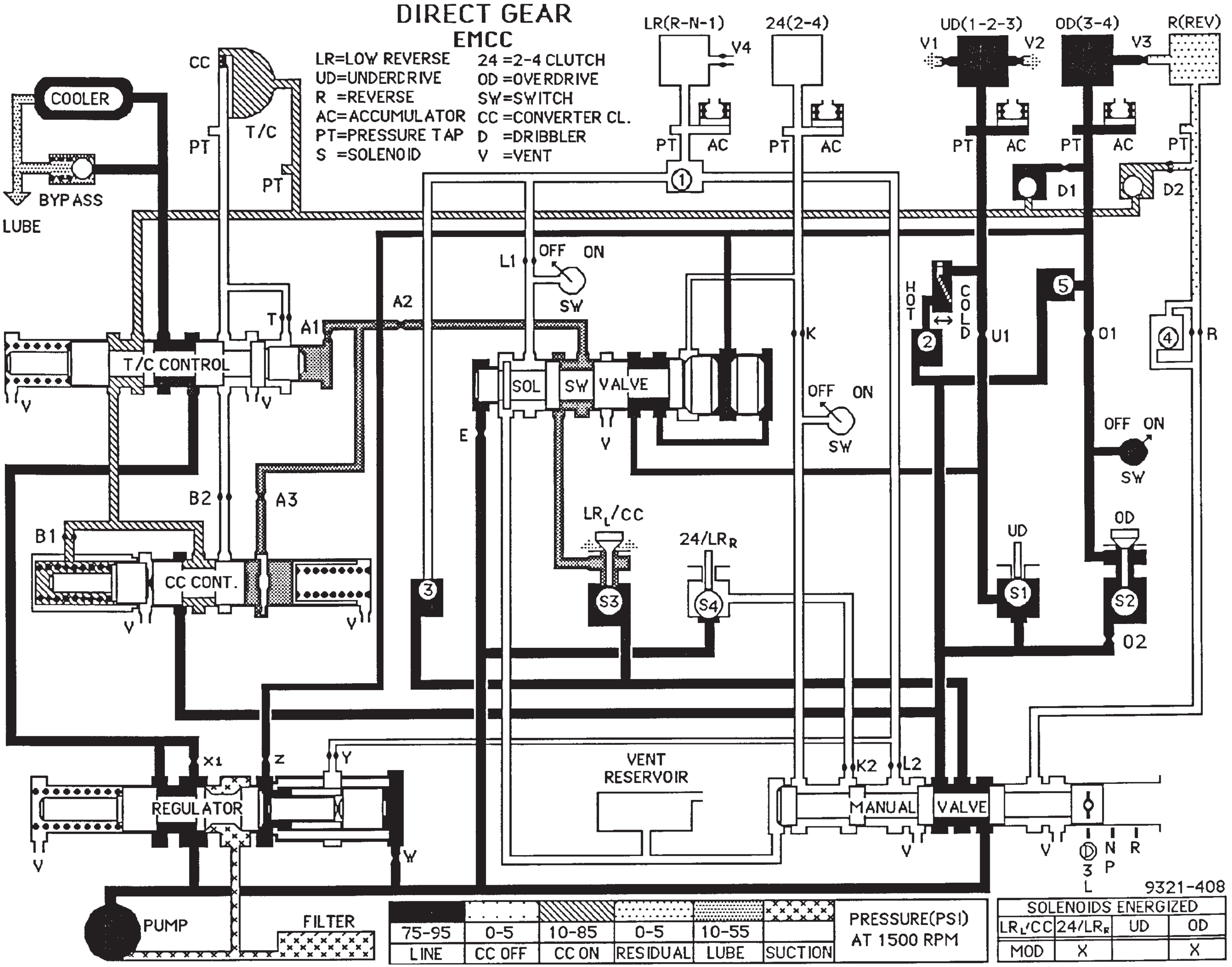
■	▨	▦	░	▒	☒
75-95	60-90	45-80	0-5	15-40	
LINE	CC OFF	CC ON	RESIDUAL	LUBE	SUCTION

PRESSURE(PSI) AT 1500 RPM

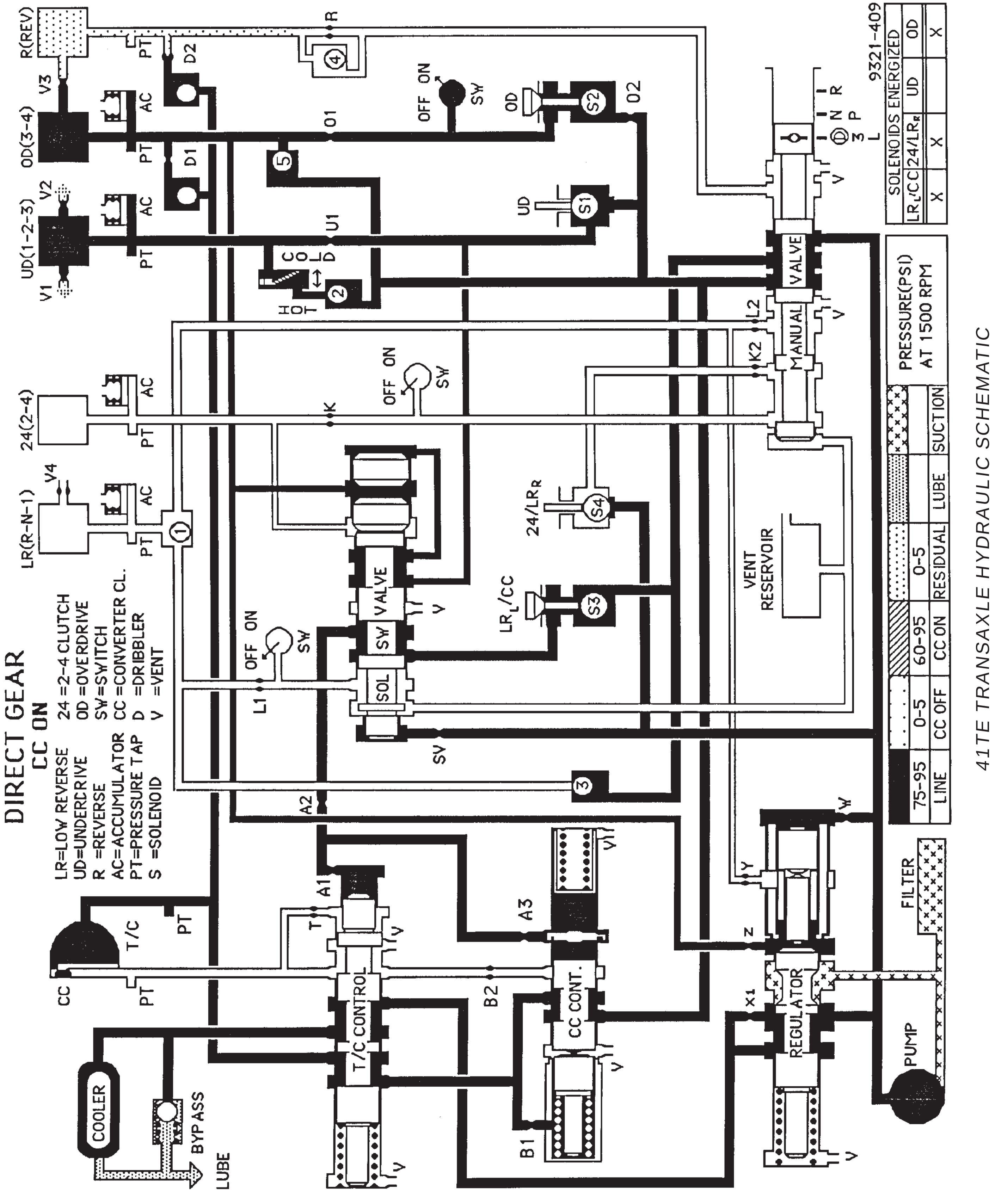
SOLENOIDS ENERGIZED

LR_L/CC	$24/LR_R$	UD	OD
	X		X

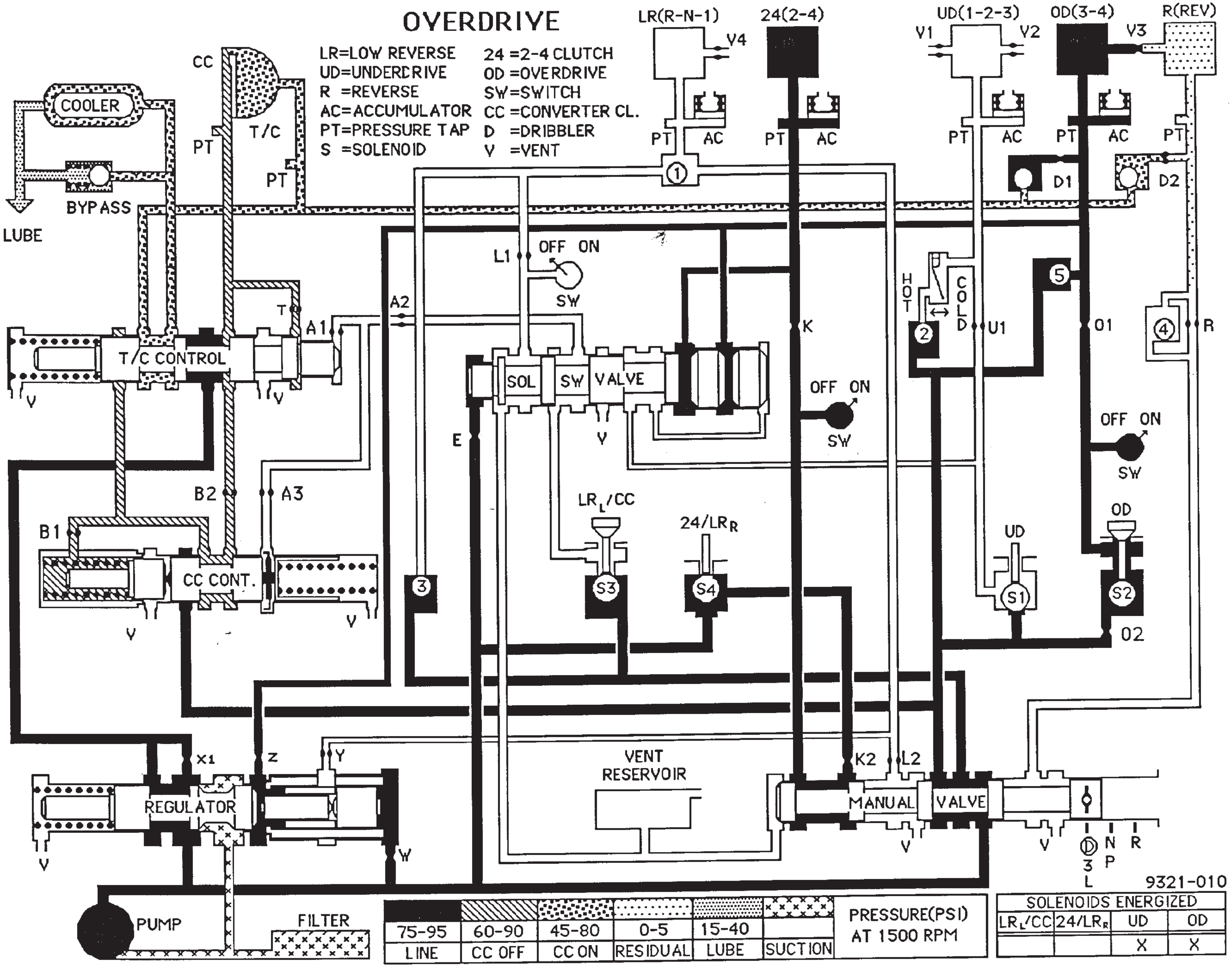
41TE TRANSAXLE HYDRAULIC SCHEMATIC



41TE TRANSAXLE HYDRAULIC SCHEMATIC



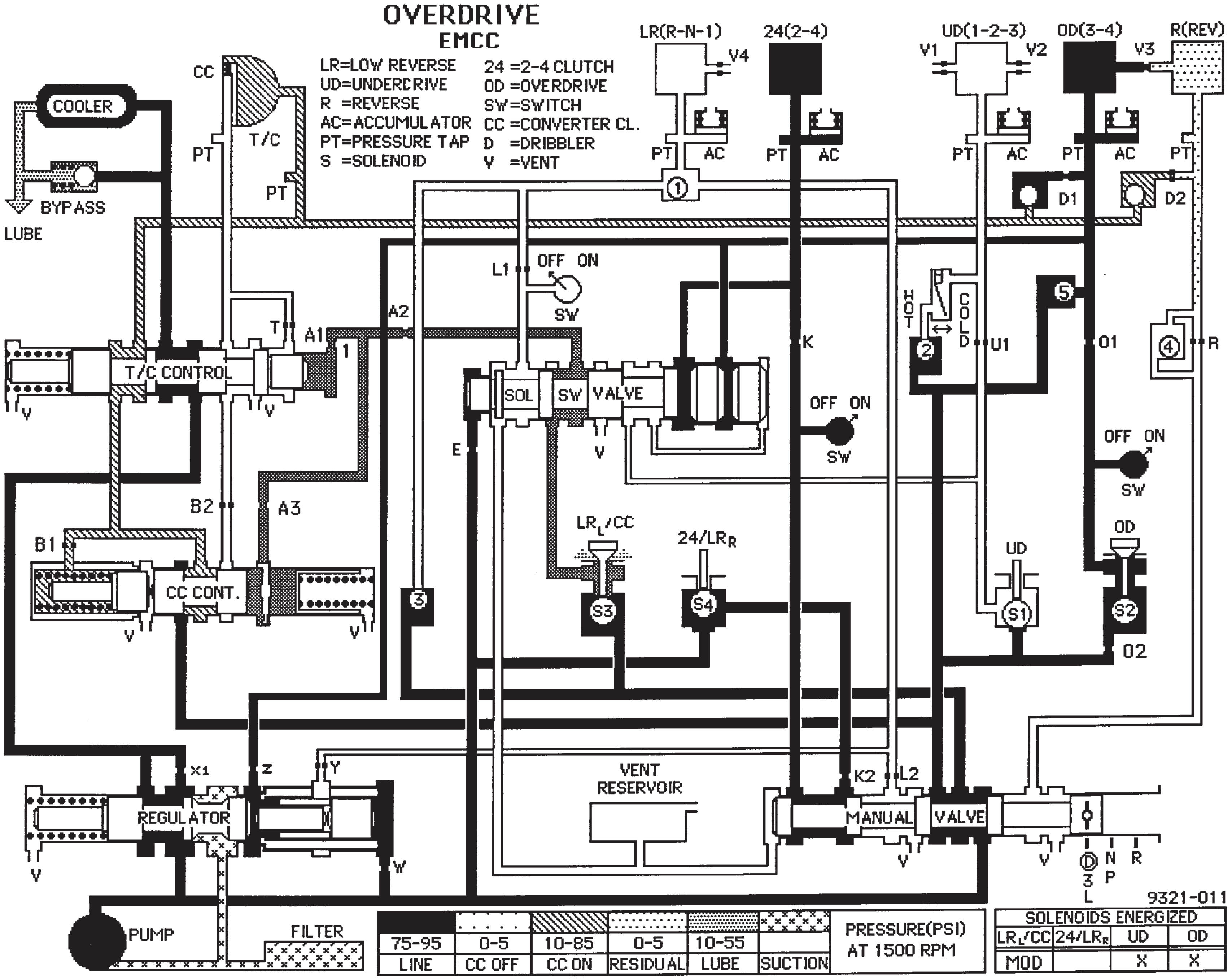
41TE TRANSAXLE HYDRAULIC SCHEMATIC



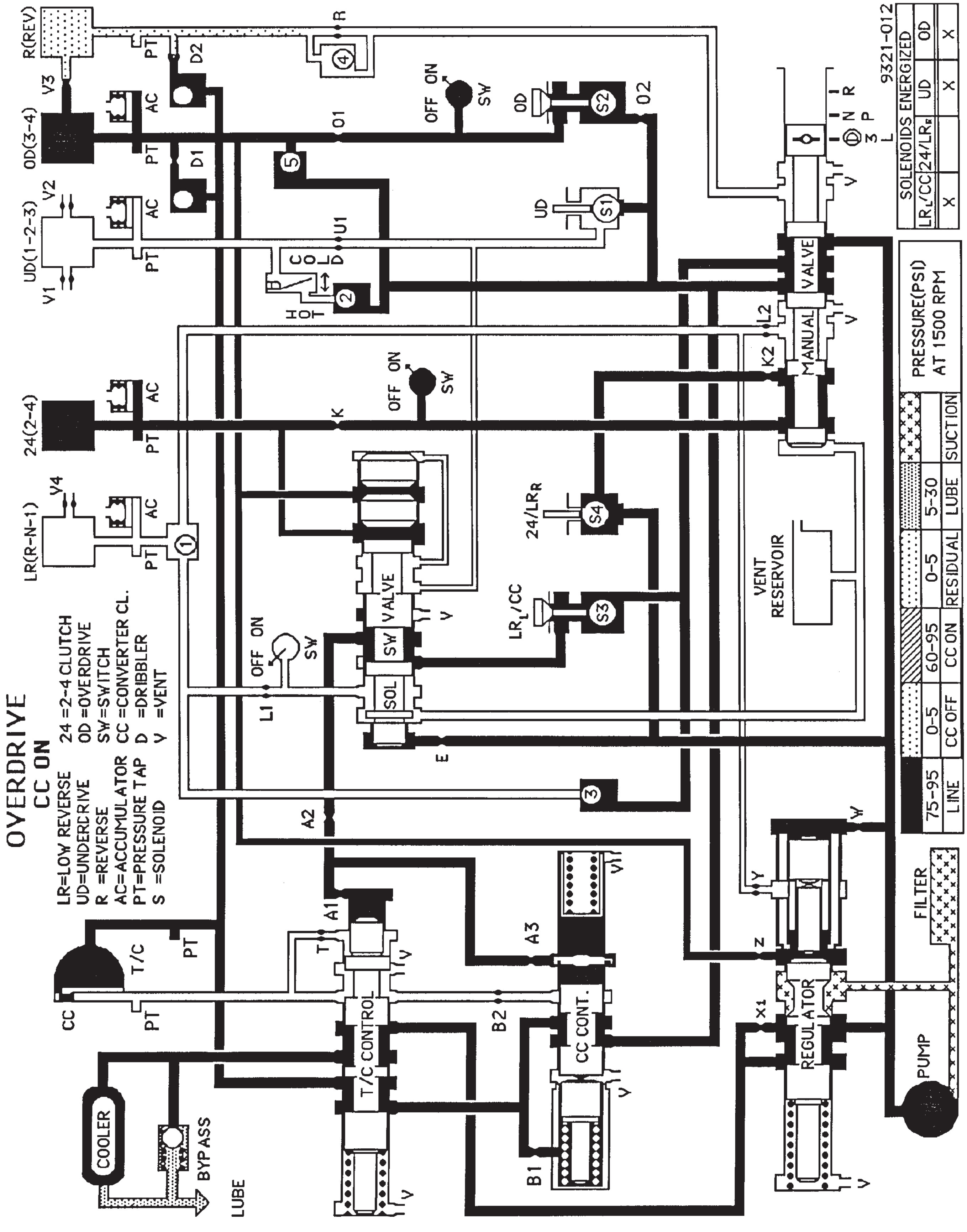
75-95	60-90	45-80	0-5	15-40		PRESSURE(PSI) AT 1500 RPM
LINE	CC OFF	CC ON	RESIDUAL	LUBE	SUCTION	

SOLENOIDS ENERGIZED			
LR_L/CC	24/LR_R	UD	OD
		X	X

41TE TRANSAXLE HYDRAULIC SCHEMATIC



41TE TRANSAXLE HYDRAULIC SCHEMATIC



41TE TRANSAXLE HYDRAULIC SCHEMATIC

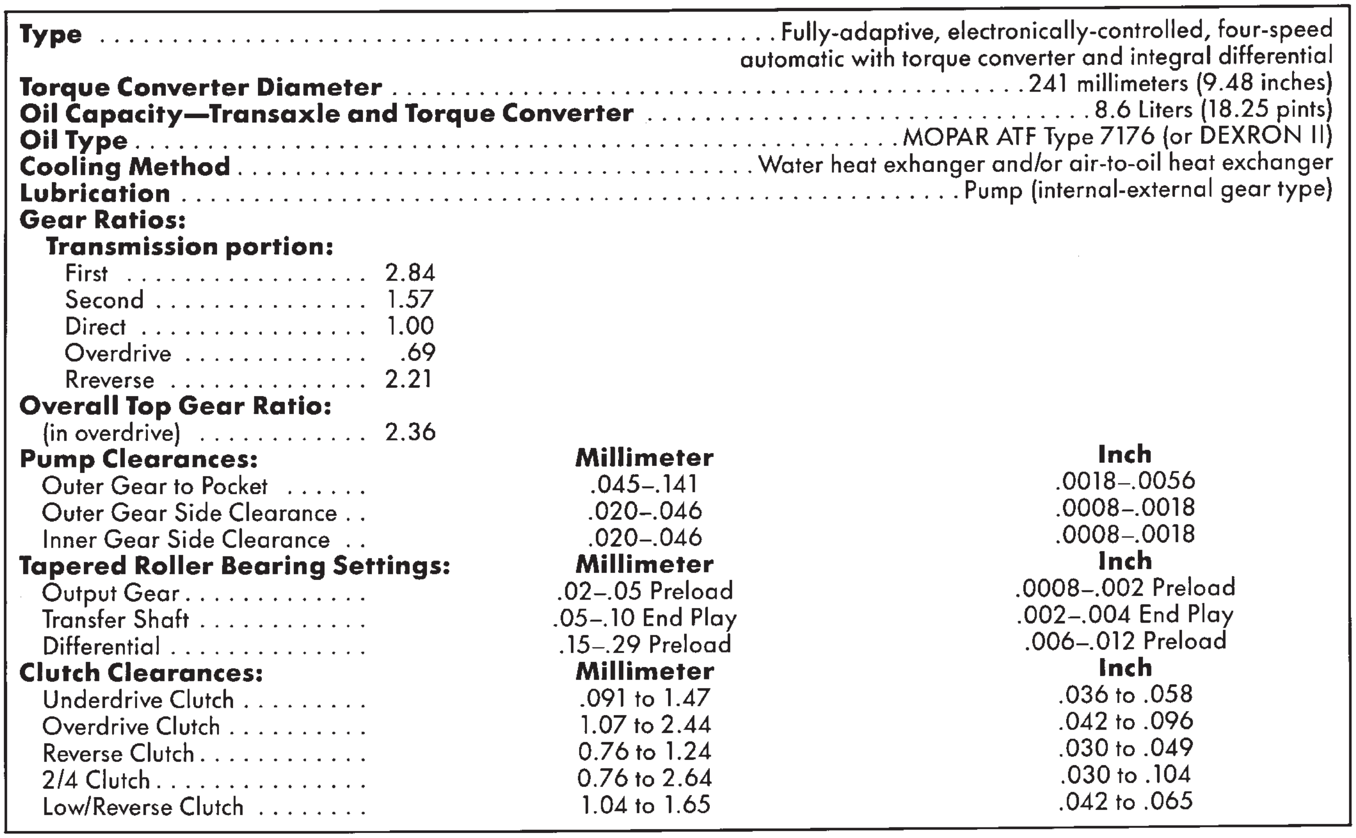
SPECIFICATIONS

THREE SPEED TRANSAXLE

		Metric Measure	U.S. Measure
Type		Automatic Three Speed With Torque Converter and Integral Differential	
Torque Converter Diameter		241 millimeters	9.48 inches
Oil Capacity—Transaxle and Torque Converter:			
except fleet		8.4 Liters	8.9 qts.
fleet only		8.7 Liters	9.2 qts.
Use MOPAR ATF Automatic Transmission Fluid Type 7176 (or DEXRON II)			
Cooling Method		Water-Heat Exhanger and/or oil-to-air heat exchanger	
Lubrication		Pump (Internal-External Gear Type)	
Gear Ratios:			
Transmission Portion:	First	2.69	
	Second	1.55	
	Third	1.00	
	Reverse	2.10	
Pump Clearances:		**Millimeter**	**Inch**
Outer Gear to Pocket		.045–.141	.0018–.0056
Outer Gear Side Clearance		.020–.046	.0008–.0018
Inner Gear Side Clearance		.020–.046	.0008–.0018
End Play:		**Millimeter**	**Inch**
Inut Shaft		.19–1.50	.008–.060
Front Clutch Retainer		.76–2.69	.030–.106
Front Carrier		.89–1.45	.007–.057
Front Annulus Gear		.09–0.50	.0035–.020
Planet Pinion		.15–0.59	.006–.023
Reverse Drum		.76–3.36	.030–.132
Clutch Clearance and Selective Snap Rings:		**Millimeter**	**Inch**
Front Clutch (Non-Adjustable) Measured from Reaction Plate to "Farthest" Wave	3 Disc	2.22–3.37	.087–.133
	4 Disc	2.29–3.71	.090–.146
Rear Clutch (3 and 4 Disc) Adjustable	3 Disc	.67–1.10	.026–.043
	4 Disc	.67–1.10	.026–.043
Selective Snap Rings (5)		1.22–1.27	.048–.050
		1.52–1.57	.060–.062
		1.73–1.78	.068–.070
		1.88–1.93	.074–.076
		2.21–2.26	.087–.089
Band Adjustment:			
Kickdown, Backed off from 8 N·m (72 in. lbs.)		2-1/2 Turns	
Low-Reverse, Backed off from 5 N·m (41 in. lbs.)		3-1/2 Turns	
Thrust Washers:		**Millimeter**	**Inch**
Reaction Shaft Support (Phenolic)	No. 1	1.55–1.60	.061–.063
Rear Clutch Retainer (Phenolic)	No. 2	1.55–1.60	.061–.063
Output Shaft, Steel Backed Bronze . . (Select)	No. 3	1.98–2.03	.077–.080
		2.15–2.22	.085–.087
		2.34–2.41	.092–.095
Front Annulus, Steel Backed Bronze	No. 4	2.95–3.05	.116–.120
Front Carrier, Steel Backed Bronze	Nos. 5, 6	1.22–1.28	.048–.050
Sun Gear (Front)	No. 7	.85–0.91	.033–.036
Sun Gear (Rear)	No. 8	.85–0.91	.033–.036
Rear Carrier, Steel Backed Bronze	Nos. 9, 10	1.22–1.28	.0948–.050
Rev. Drum, Phenolic	No. 11	1.55–1.60	.061–.063
Tapered Roller Bearing Settings:		**Millimeter**	**Inch**
Output Shaft		.0–.07 Preload	.0–.0028 Preload
Transfer Shaft		.05–.25 End Play	.002–.010 End Play
Differential		.15–.29 Preload	.006–.012 Preload

9121-7

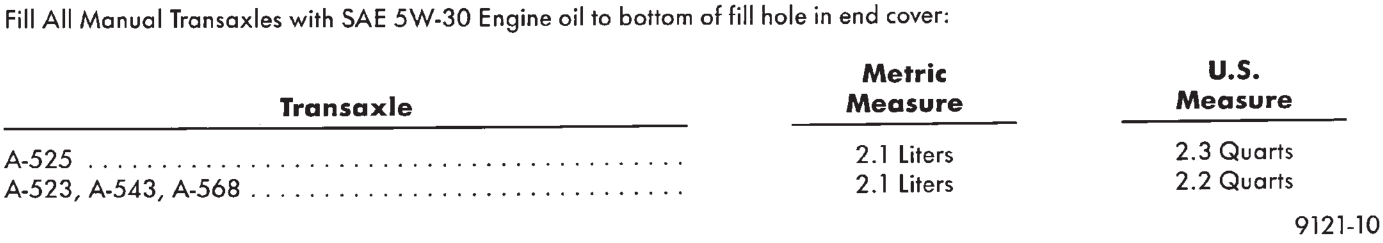
41TE FOUR SPEED TRANSAXLE



Type	Fully-adaptive, electronically-controlled, four-speed automatic with torque converter and integral differential	
Torque Converter Diameter	241 millimeters (9.48 inches)	
Oil Capacity—Transaxle and Torque Converter	8.6 Liters (18.25 pints)	
Oil Type	MOPAR ATF Type 7176 (or DEXRON II)	
Cooling Method	Water heat exhanger and/or air-to-oil heat exchanger	
Lubrication	Pump (internal-external gear type)	
Gear Ratios:		
Transmission portion:		
First	2.84	
Second	1.57	
Direct	1.00	
Overdrive	.69	
Rreverse	2.21	
Overall Top Gear Ratio:		
(in overdrive)	2.36	
Pump Clearances:	**Millimeter**	**Inch**
Outer Gear to Pocket	.045–.141	.0018–.0056
Outer Gear Side Clearance	.020–.046	.0008–.0018
Inner Gear Side Clearance	.020–.046	.0008–.0018
Tapered Roller Bearing Settings:	**Millimeter**	**Inch**
Output Gear	.02–.05 Preload	.0008–.002 Preload
Transfer Shaft	.05–.10 End Play	.002–.004 End Play
Differential	.15–.29 Preload	.006–.012 Preload
Clutch Clearances:	**Millimeter**	**Inch**
Underdrive Clutch	.091 to 1.47	.036 to .058
Overdrive Clutch	1.07 to 2.44	.042 to .096
Reverse Clutch	0.76 to 1.24	.030 to .049
2/4 Clutch	0.76 to 2.64	.030 to .104
Low/Reverse Clutch	1.04 to 1.65	.042 to .065

9121-8

MANUAL TRANSAXLE FLUID FILL

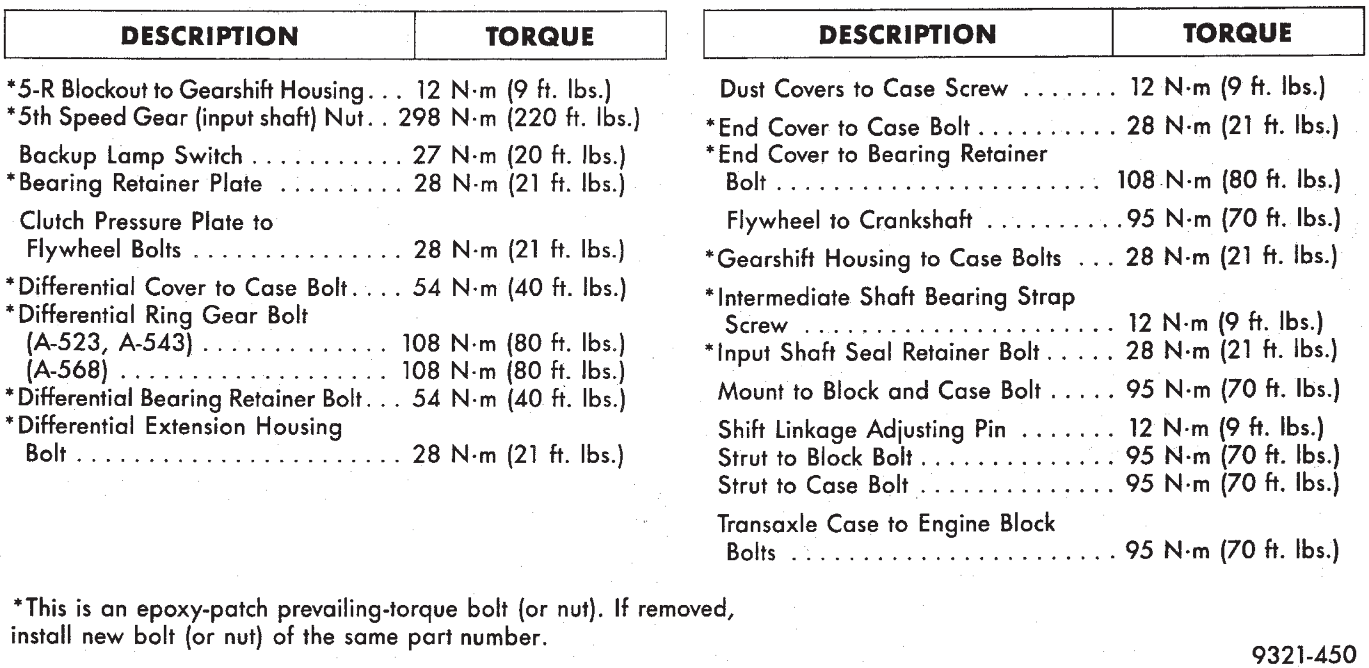


Fill All Manual Transaxles with SAE 5W-30 Engine oil to bottom of fill hole in end cover:

Transaxle	**Metric Measure**	**U.S. Measure**
A-525	2.1 Liters	2.3 Quarts
A-523, A-543, A-568	2.1 Liters	2.2 Quarts

9121-10

MANUAL TRANSAXLE TIGHTENING REFERENCE

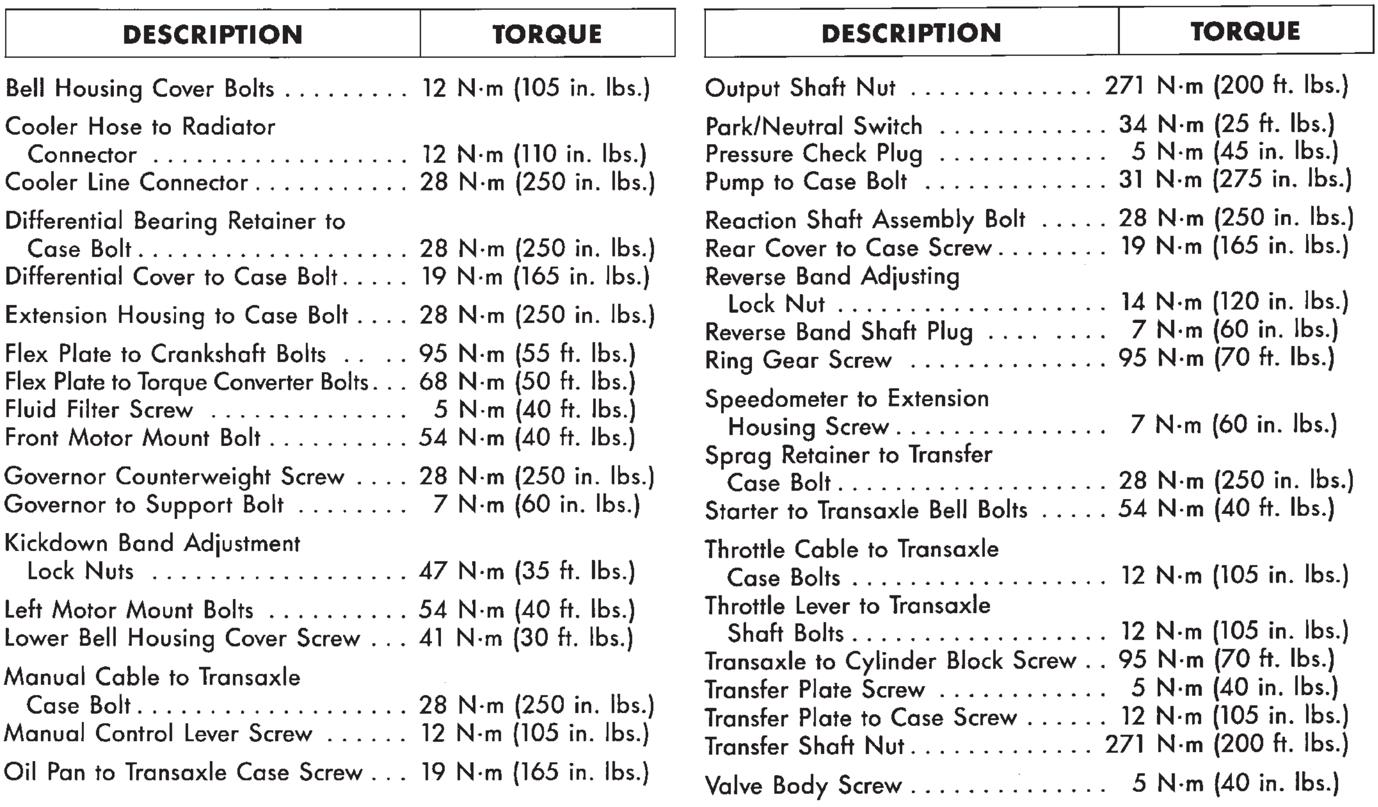


DESCRIPTION	TORQUE
*5-R Blockout to Gearshift Housing	12 N·m (9 ft. lbs.)
*5th Speed Gear (input shaft) Nut	298 N·m (220 ft. lbs.)
Backup Lamp Switch	27 N·m (20 ft. lbs.)
*Bearing Retainer Plate	28 N·m (21 ft. lbs.)
Clutch Pressure Plate to Flywheel Bolts	28 N·m (21 ft. lbs.)
*Differential Cover to Case Bolt	54 N·m (40 ft. lbs.)
*Differential Ring Gear Bolt (A-523, A-543)	108 N·m (80 ft. lbs.)
(A-568)	108 N·m (80 ft. lbs.)
*Differential Bearing Retainer Bolt	54 N·m (40 ft. lbs.)
*Differential Extension Housing Bolt	28 N·m (21 ft. lbs.)
Dust Covers to Case Screw	12 N·m (9 ft. lbs.)
*End Cover to Case Bolt	28 N·m (21 ft. lbs.)
*End Cover to Bearing Retainer Bolt	108 N·m (80 ft. lbs.)
Flywheel to Crankshaft	95 N·m (70 ft. lbs.)
*Gearshift Housing to Case Bolts	28 N·m (21 ft. lbs.)
*Intermediate Shaft Bearing Strap Screw	12 N·m (9 ft. lbs.)
*Input Shaft Seal Retainer Bolt	28 N·m (21 ft. lbs.)
Mount to Block and Case Bolt	95 N·m (70 ft. lbs.)
Shift Linkage Adjusting Pin	12 N·m (9 ft. lbs.)
Strut to Block Bolt	95 N·m (70 ft. lbs.)
Strut to Case Bolt	95 N·m (70 ft. lbs.)
Transaxle Case to Engine Block Bolts	95 N·m (70 ft. lbs.)

*This is an epoxy-patch prevailing-torque bolt (or nut). If removed, install new bolt (or nut) of the same part number.

9321-450

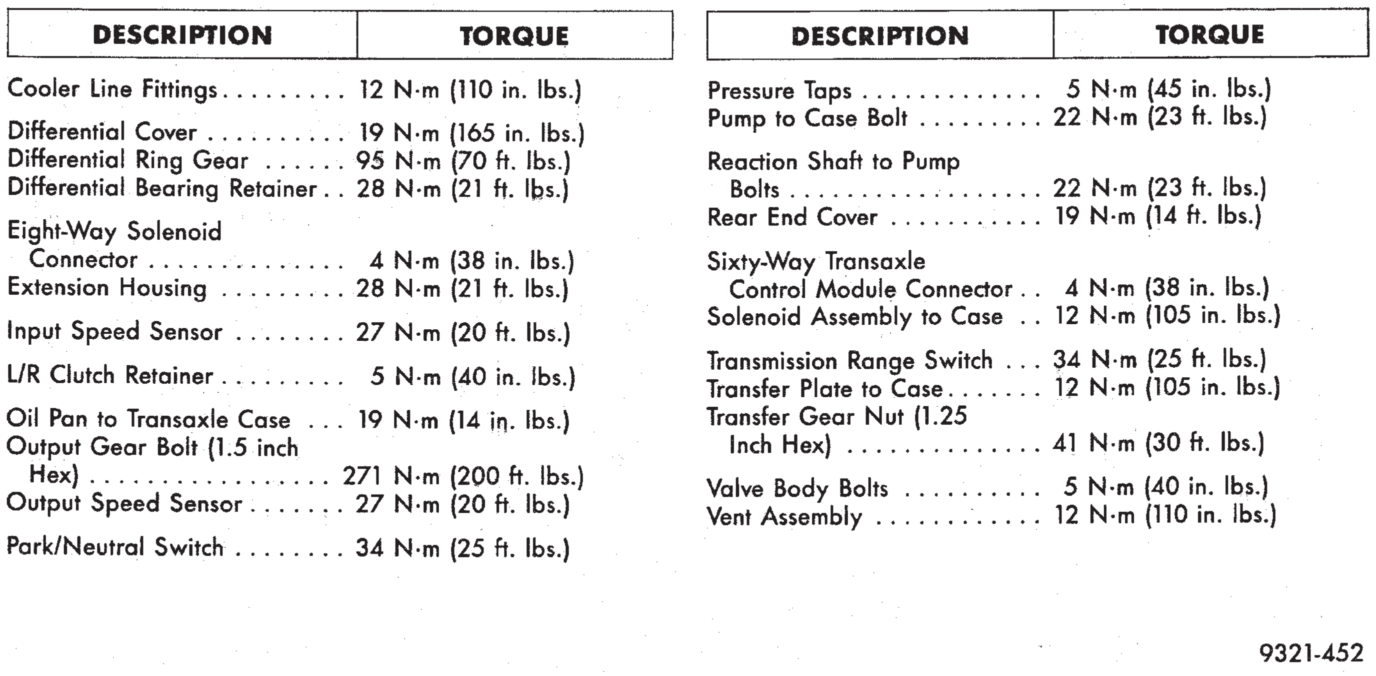
THREE SPEED TRANSAXLE TIGHTENING REFERENCE



DESCRIPTION	TORQUE
Bell Housing Cover Bolts	12 N·m (105 in. lbs.)
Cooler Hose to Radiator Connector	12 N·m (110 in. lbs.)
Cooler Line Connector	28 N·m (250 in. lbs.)
Differential Bearing Retainer to Case Bolt	28 N·m (250 in. lbs.)
Differential Cover to Case Bolt	19 N·m (165 in. lbs.)
Extension Housing to Case Bolt	28 N·m (250 in. lbs.)
Flex Plate to Crankshaft Bolts	95 N·m (55 ft. lbs.)
Flex Plate to Torque Converter Bolts	68 N·m (50 ft. lbs.)
Fluid Filter Screw	5 N·m (40 ft. lbs.)
Front Motor Mount Bolt	54 N·m (40 ft. lbs.)
Governor Counterweight Screw	28 N·m (250 in. lbs.)
Governor to Support Bolt	7 N·m (60 in. lbs.)
Kickdown Band Adjustment Lock Nuts	47 N·m (35 ft. lbs.)
Left Motor Mount Bolts	54 N·m (40 ft. lbs.)
Lower Bell Housing Cover Screw	41 N·m (30 ft. lbs.)
Manual Cable to Transaxle Case Bolt	28 N·m (250 in. lbs.)
Manual Control Lever Screw	12 N·m (105 in. lbs.)
Oil Pan to Transaxle Case Screw	19 N·m (165 in. lbs.)
Output Shaft Nut	271 N·m (200 ft. lbs.)
Park/Neutral Switch	34 N·m (25 ft. lbs.)
Pressure Check Plug	5 N·m (45 in. lbs.)
Pump to Case Bolt	31 N·m (275 in. lbs.)
Reaction Shaft Assembly Bolt	28 N·m (250 in. lbs.)
Rear Cover to Case Screw	19 N·m (165 in. lbs.)
Reverse Band Adjusting Lock Nut	14 N·m (120 in. lbs.)
Reverse Band Shaft Plug	7 N·m (60 in. lbs.)
Ring Gear Screw	95 N·m (70 ft. lbs.)
Speedometer to Extension Housing Screw	7 N·m (60 in. lbs.)
Sprag Retainer to Transfer Case Bolt	28 N·m (250 in. lbs.)
Starter to Transaxle Bell Bolts	54 N·m (40 ft. lbs.)
Throttle Cable to Transaxle Case Bolts	12 N·m (105 in. lbs.)
Throttle Lever to Transaxle Shaft Bolts	12 N·m (105 in. lbs.)
Transaxle to Cylinder Block Screw	95 N·m (70 ft. lbs.)
Transfer Plate Screw	5 N·m (40 in. lbs.)
Transfer Plate to Case Screw	12 N·m (105 in. lbs.)
Transfer Shaft Nut	271 N·m (200 ft. lbs.)
Valve Body Screw	5 N·m (40 in. lbs.)

9321-451

41TE FOUR SPEED TRANSAXLE TIGHTENING REFERENCE



DESCRIPTION	TORQUE
Cooler Line Fittings	12 N·m (110 in. lbs.)
Differential Cover	19 N·m (165 in. lbs.)
Differential Ring Gear	95 N·m (70 ft. lbs.)
Differential Bearing Retainer	28 N·m (21 ft. lbs.)
Eight-Way Solenoid Connector	4 N·m (38 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 (40 in. lbs.)
Oil Pan to Transaxle Case	19 N·m (14 in. lbs.)
Output Gear Bolt (1.5 inch Hex)	271 N·m (200 ft. lbs.)
Output Speed Sensor	27 N·m (20 ft. lbs.)
Park/Neutral Switch	34 N·m (25 ft. lbs.)

DESCRIPTION	TORQUE
Pressure Taps	5 N·m (45 in. lbs.)
Pump to Case Bolt	22 N·m (23 ft. lbs.)
Reaction Shaft to Pump Bolts	22 N·m (23 ft. lbs.)
Rear End Cover	19 N·m (14 ft. lbs.)
Sixty-Way Transaxle Control Module Connector	4 N·m (38 in. lbs.)
Solenoid Assembly to Case	12 N·m (105 in. lbs.)
Transmission Range Switch	34 N·m (25 ft. lbs.)
Transfer Plate to Case	12 N·m (105 in. lbs.)
Transfer Gear Nut (1.25 Inch Hex)	41 N·m (30 ft. lbs.)
Valve Body Bolts	5 N·m (40 in. lbs.)
Vent Assembly	12 N·m (110 in. lbs.)

9321-452

CONVERSION CHART

INCHES TO MILLIMETERS

All values in this table are exact

inches	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
	millimeters									
0.000	—	0.0254	0.0508	0.0762	0.1016	0.1270	0.1524	0.1778	0.2032	0.2286
0.010	0.2540	0.2794	0.3048	0.3302	0.3556	0.3810	0.4064	0.4318	0.4572	0.4826
0.020	0.5080	0.5334	0.5588	0.5842	0.6096	0.6350	0.6604	0.6858	0.7112	0.7366
0.030	0.7620	0.7874	0.8128	0.8382	0.8636	0.8890	0.9144	0.9398	0.9652	0.9906
0.040	1.0160	1.0414	1.0668	1.0922	1.1176	1.1430	1.1684	1.1938	1.2192	1.2446
0.050	1.2700	1.2954	1.3208	1.3462	1.3716	1.3970	1.4224	1.4478	1.4732	1.4986
0.060	1.5240	1.5494	1.5748	1.6002	1.6256	1.6510	1.6764	1.7018	1.7272	1.7526
0.070	1.7780	1.8034	1.8288	1.8542	1.8796	1.9050	1.9304	1.9558	1.9812	2.0066
0.080	2.0320	2.0574	2.0828	2.1082	2.1336	2.1590	2.1844	2.2098	2.2352	2.2606
0.090	2.2860	2.3114	2.3368	2.3622	2.3876	2.4130	2.4384	2.4638	2.4892	2.5146
0.100	2.5400	2.5654	2.5908	2.6162	2.6416	2.6670	2.6924	2.7178	2.7432	2.7686
0.110	2.7940	2.8194	2.8448	2.8702	2.8956	2.9210	2.9464	2.9718	2.9972	3.0226
0.120	3.0480	3.0734	3.0988	3.1242	3.1496	3.1750	3.2004	3.2258	3.2512	3.2766
0.130	3.3020	3.3274	3.3528	3.3782	3.4036	3.4290	3.4544	3.4798	3.5052	3.5306
0.140	3.5560	3.5814	3.6068	3.6322	3.6576	3.6830	3.7084	3.7338	3.7592	3.7846
0.150	3.8100	3.8354	3.8608	3.8862	3.9116	3.9370	3.9624	3.9878	4.0132	4.0386
0.160	4.0640	4.0894	4.1148	4.1402	4.1656	4.1910	4.2164	4.2418	4.2672	4.2926
0.170	4.3180	4.3434	4.3688	4.3942	4.4196	4.4450	4.4704	4.4958	4.5212	4.5466
0.180	4.5720	4.5974	4.6228	4.6482	4.6736	4.6990	4.7244	4.7498	4.7752	4.8006
0.190	4.8260	4.8514	4.8768	4.9022	4.9276	4.9530	4.9784	5.0038	5.0292	5.0546
0.200	5.0800	5.1054	5.1308	5.1562	5.1816	5.2070	5.2324	5.2578	5.2832	5.3086
0.210	5.3340	5.3594	5.3848	5.4102	5.4356	5.4610	5.4864	5.5118	5.5372	5.5626
0.220	5.5880	5.6134	5.6388	5.6642	5.6896	5.7150	5.7404	5.7658	5.7912	5.8166
0.230	5.8420	5.8674	5.8928	5.9182	5.9436	5.9690	5.9944	6.0198	6.0452	6.0706
0.240	6.0960	6.1214	6.1468	6.1722	6.1976	6.2230	6.2484	6.2738	6.2992	6.3246
0.250	6.3500	6.3754	6.4008	6.4262	6.4516	6.4770	6.5024	6.5278	6.5532	6.5786
0.260	6.6040	6.6294	6.6548	6.6802	6.7056	6.7310	6.7564	6.7818	6.8072	6.8326
0.270	6.8580	6.8834	6.9088	6.9342	6.9596	6.9850	7.0104	7.0358	7.0612	7.0866
0.280	7.1120	7.1374	7.1628	7.1882	7.2136	7.2390	7.2644	7.2989	7.3152	7.3406
0.290	7.3660	7.3914	7.4168	7.4422	7.4676	7.4930	7.5184	7.5438	7.5692	7.5946
0.300	7.6200	7.6454	7.6708	7.6962	7.7216	7.7470	7.7724	7.7978	7.8232	7.8486
0.310	7.8740	7.8994	7.9248	7.9502	7.9756	8.0010	8.0264	8.0518	8.0772	8.1026
0.320	8.1280	8.1534	8.1788	8.2042	8.2296	8.2550	8.2804	8.3058	8.3312	8.3566
0.330	8.3820	8.4074	8.4328	8.4582	8.4836	8.5090	8.5344	8.5598	8.5852	8.6106
0.340	8.6360	8.6614	8.6868	8.7122	8.7376	8.7630	8.7884	8.8138	8.8392	8.8646
0.350	8.8900	8.9154	8.9408	8.9662	8.9916	9.0170	9.0424	9.0678	9.0932	9.1186
0.360	9.1440	9.1694	9.1948	9.2202	9.2456	9.2710	9.2964	9.3218	9.3472	9.3726
0.370	9.3980	9.4234	9.4488	9.4742	9.4996	9.5250	9.5504	9.5758	9.6012	9.6266
0.380	9.6520	9.6774	9.7028	9.7282	9.7586	9.7790	9.8044	9.8298	9.8552	9.8806
0.390	9.9060	9.9314	9.9568	9.9822	10.0076	10.0330	10.0584	10.0838	10.1092	10.1346
0.400	10.1600	10.1854	10.2108	10.2362	10.2616	10.2870	10.3124	10.3378	10.3632	10.3886
0.410	10.4140	10.4394	10.4648	10.4902	10.5156	10.5410	10.5664	10.5918	10.6172	10.6426
0.420	10.6680	10.6934	10.7188	10.7442	10.7696	10.7950	10.8204	10.8458	10.8712	10.8966
0.430	10.9220	10.9474	10.9728	10.9982	11.0236	11.0490	11.0744	11.0998	11.1252	11.1506
0.440	11.1760	11.2014	11.2268	11.2522	11.2776	11.3030	11.3284	11.3538	11.3792	11.4046
0.450	11.4300	11.4554	11.4808	11.5062	11.5316	11.5570	11.5824	11.6078	11.6332	11.6586
0.460	11.6840	11.7094	11.7348	11.7602	11.7856	11.8110	11.8364	11.8618	11.8872	11.9126
0.470	11.9380	11.9634	11.9888	12.0142	12.0396	12.0650	12.0904	12.1158	12.1412	12.1666
0.480	12.1920	12.2174	12.2428	12.2682	12.2936	12.3190	12.3444	12.3698	12.3952	12.4206
0.490	12.4460	12.4714	12.4968	12.5222	12.5476	12.5730	12.5984	12.6238	12.6492	12.6746
inches	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009

9021-74

WHEELS—TIRES

CONTENTS

TIRE SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

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.

Tires are designed for the vehicle and 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. They have load carrying capacity, when properly inflated, to operate at loads up to the specified Maximum Vehicle Capacity.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration and deceleration
- Severe application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles

Radial ply tires can be more susceptible to irregular tread wear. **It is very important to follow the tire rotation interval shown in the section on Tire Rotation to achieve a greater tread life potential.**

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life, and ride quality and decrease rolling resistance.

Radial-ply tires must always be used in sets of four and under no circumstances should they be used on the front only. However, they may be mixed with temporary spare tires when necessary, but reduced speeds are recommended.

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.

SPARE TIRE—COMPACT

The compact spare tire is designed for emergency use only. The original tire should be repaired and reinstalled at the first opportunity. Refer to Owner's Manual for complete details.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to Owner's Manual for more information.

CLEANING OF TIRES

Remove protective coating on tires before delivery of vehicle, otherwise it could cause deterioration of tires.

Remove protective coating by applying warm water, letting it soak one minute, and then scrubbing the coating away with a soft bristle brush.

Steam cleaning may also be used for cleaning.

DO NOT use gasoline or wire brush for cleaning.

DO NOT use mineral oil or an oil-based solvent.

PRESSURE GAUGES

High quality dial type air pressure gauges are recommended. After checking pressure with the gauge, replace valve caps and tighten finger tight.

TIRE INFLATION PRESSURES

Under inflation (Fig. 1) causes rapid shoulder wear and tire flexing and can result in tire failure.

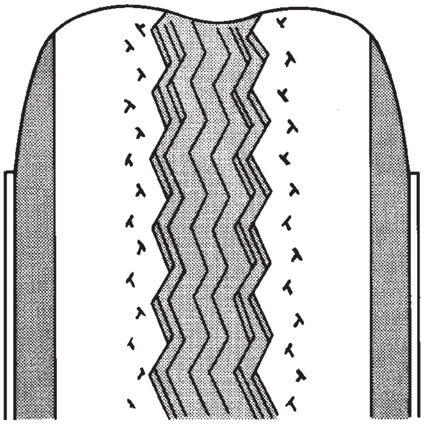


Fig. 1 Under inflation Wear

Over inflation (Fig. 2) cause rapid center wear and loss of the tire's ability to cushion shocks.

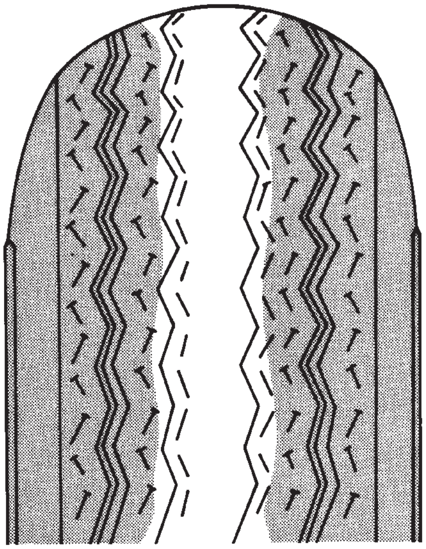


Fig. 2 Over inflation Wear

Improper inflation can cause:
- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- The vehicle to drift.

Proper tire pressure can be found on the placard attached to the vehicle, See Owner's Manual.

This pressure has been selected to provide safe vehicle operation, proper vehicle stability, and a smooth ride. Tire pressure should be checked cold once per month and more frequently when the weather temperature varies widely. Tire pressure will decreases when the outdoor temperature drops.

Inflation pressures specified on the placards are always cold inflation pressure. **Cold inflation pressure is obtained after the vehicle has not been operated for at least 3 hours or 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.

Cold inflation pressures must not exceed 240 kPa (35 psi) for P-Series standard load tires.

TIRE PRESSURES FOR HIGH-SPEED OPERATION

Chrysler Corporation advocates driving at safe speeds within posted speed limits. Where speed limits or conditions are such that the vehicle can be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressure shown on the tire placard. For speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 120 km/h (75 mph).

WARNING: OVERINFLATED OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING. SUDDEN TIRE FAILURE CAN RESULT, CAUSING LOSS OF VEHICLE CONTROL.

For police or emergency vehicles that must be driven at continuous speeds over 144 km/h (90 mph), special high-speed tires must be used. Consult tire manufacturer for tire and inflation pressure recommendations.

REPLACEMENT TIRES

The original equipment tires on the vehicle have been engineered to provide a proper balance of many characteristics such as:
- ride
- noise
- handling
- durability
- tread life
- traction
- rolling resistance
- speed capability

Failure to use equipment 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 tire damage may occur.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED RATING CAN CAUSE SUDDEN TIRE FAILURE.

ROTATION

DIRECTIONAL TREAD PATTERN TIRES

Some vehicles are fitted with special high-performance tires having a directional tread pattern designed to improve traction on wet pavement.

To obtain the full benefits of this design, the tires must be installed so that they rotate in the correct direction. This is indicated by arrows on the tire sidewalls.

When wheels and tires are being installed, extra care is needed to ensure that this direction of rotation is maintained.

Refer to Owner's Manual for rotation schedule.

NONDIRECTIONAL TIRES

Tires on the front and rear axles of vehicles operate at different loads and perform different steering, driving, and braking functions. For these reasons, they wear at unequal rates, and tend to develop irregular wear patterns. These effects can be reduced by timely rotation of tires. 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. This method takes advantage of current tire industry practice which now allows cross rotation of radial-ply tires. Refer to the owner's manual (usually found in the glove box) for additional information. Other rotation methods may be used, but may not have all the benefits of the recommended method.

Always check air pressure and wheel nut tightness after rotation. **Do NOT use oil or grease on studs or nuts.**

Refer to Owner's Manual for rotation schedule.

TREAD WEAR INDICATORS

Tread wear indicators (Fig. 3) are molded into the bottom of the tread grooves. When tread is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band.

Tire replacement is necessary when indicators appear in two or more grooves, or if localized balding occurs.

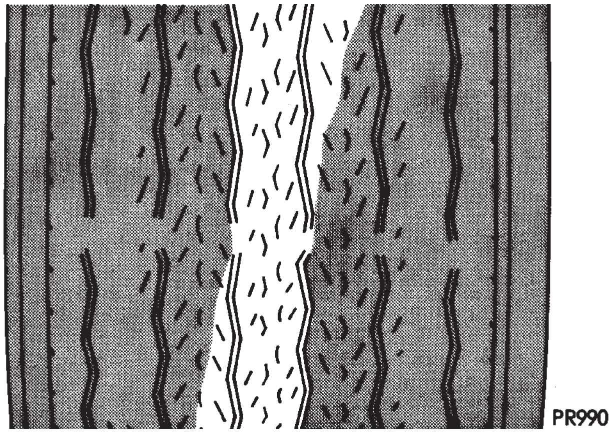


Fig. 3 Tread Wear Indicators

REPAIRING LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect or puncture is in the tread area otherwise the tire should be replaced.

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 scale is removed from the rim and repaint if necessary.

Install wheels on vehicle, progressively tightening wheel nuts to 129 N●m (95 ft. lbs.) torque (See Wheels).

TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, wheel irregularities, or imbalance.

To determine if the tires are causing the noise or vibration, drive the vehicle over a smooth portion of highway at different speeds and note the effect of acceleration and deceleration on noise level. Differential and exhaust noise will change in intensity as speed varies, while tire noise will usually remain constant.

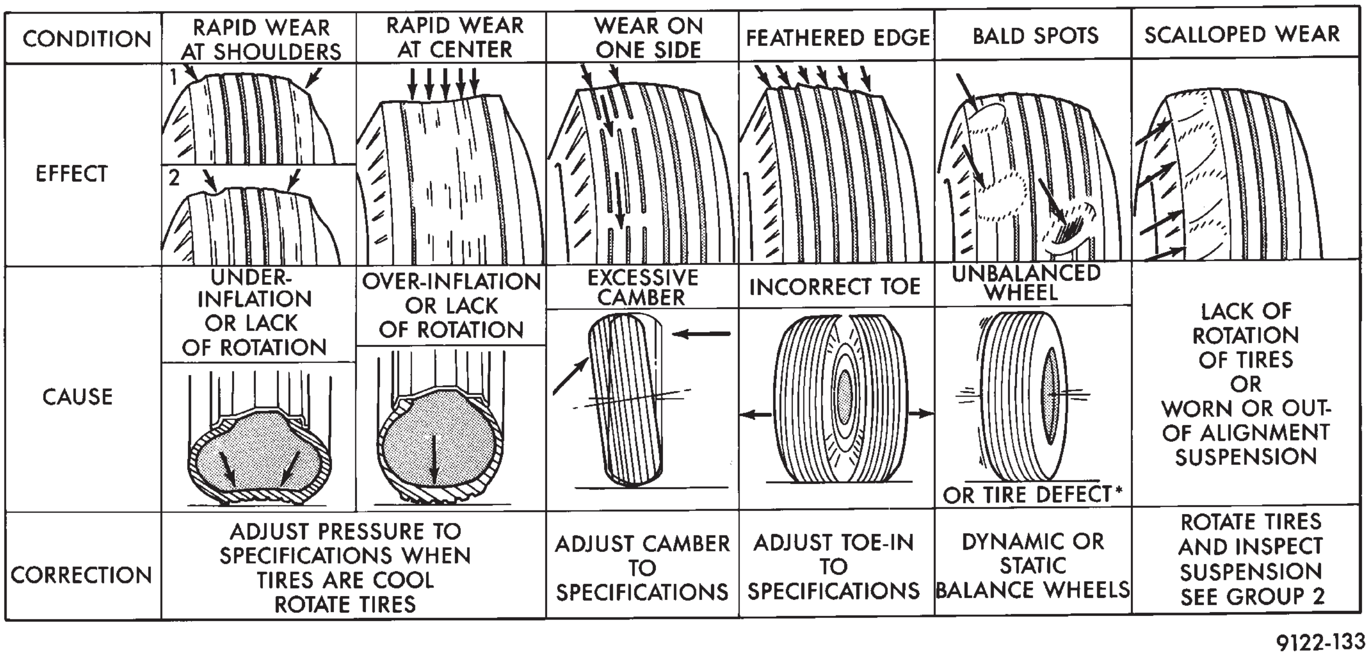
TIRE WEAR PATTERNS

Under inflation results in faster wear on shoulders of tire.

Over inflation causes faster wear at center of tread.

Excessive camber causes the tire to run at an angle to the road. One side of tread is worn more than the other.

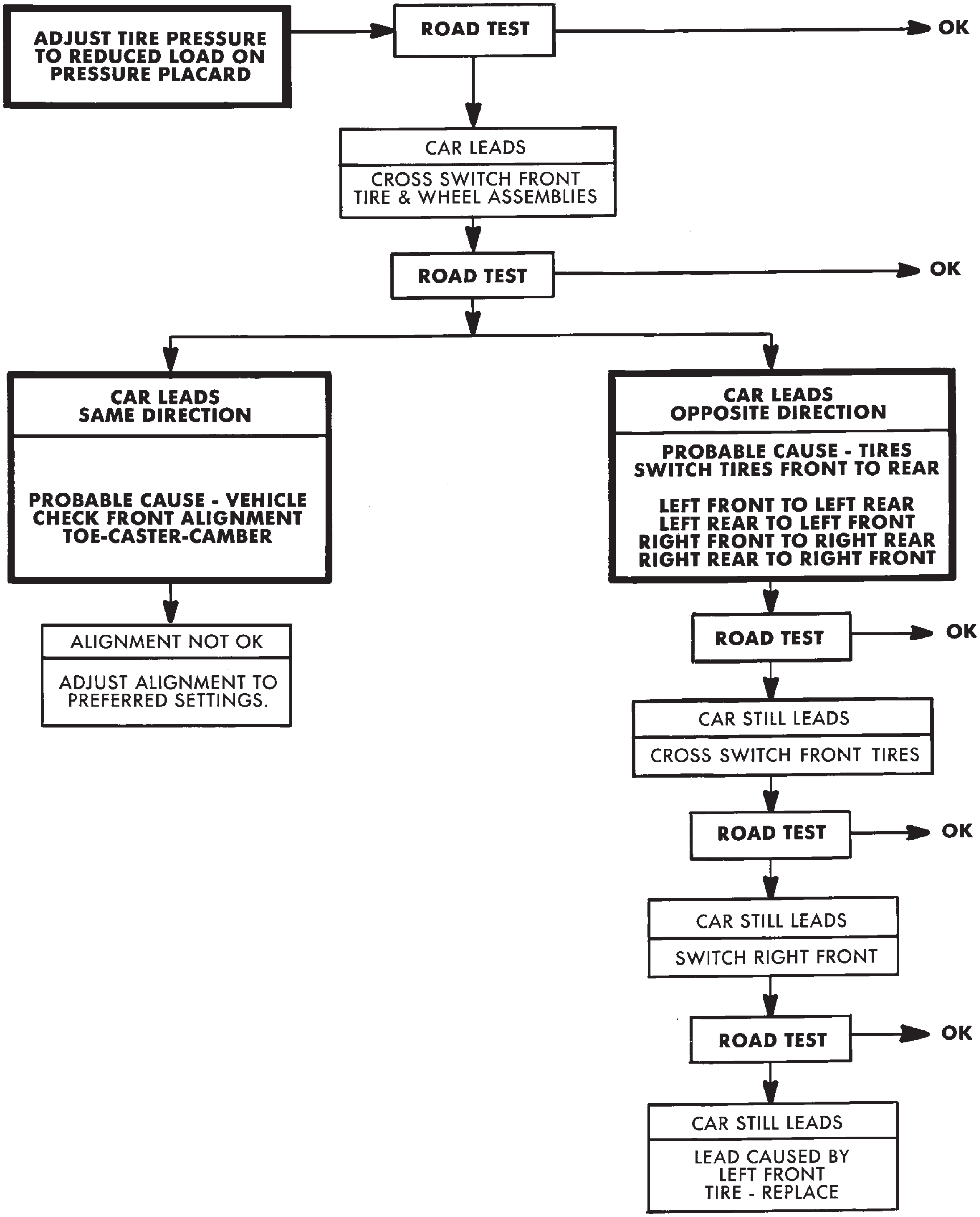
Excessive toe-in or toe-out causes wear on the tread edges of the tire, from dragging of tire. There is a feathered effect across the tread (Fig. 4).



CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT						
CAUSE	UNDER-INFLATION OR LACK OF ROTATION	OVER-INFLATION OR LACK OF ROTATION	EXCESSIVE CAMBER	INCORRECT TOE	UNBALANCED WHEEL OR TIRE DEFECT*	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF ALIGNMENT SUSPENSION
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES		ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

Fig. 4 Tire Wear Patterns

LEAD CORRECTION CHART



9122-77

WHEELS SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

Original equipment wheels are designed for proper operation at all loads up to the maximum vehicle capacity.

All models use steel or cast aluminum drop center wheels. The safety rim wheel (Fig. 1) has raised sections between the rim flanges and the rim well A.

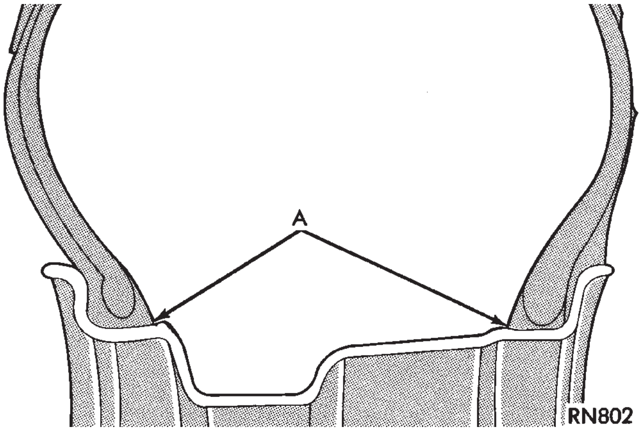


Fig. 1 Safety Rim

Initial inflation of the tires forces the bead over these raised sections. In case of tire failure the raised sections help 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 and alignment equipment.

WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications and must be replaced with equivalent parts. Do not use replacement parts of lessor quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces with scraping and wire brushing. Installing wheels without good metal-to-metal contact could cause later loosening of wheel nuts. This could adversely affect the safety and handling of your vehicle.

To install the wheel, position it properly on the mounting surface using the hub pilot as a guide. All wheel nuts should be lightly tightened before progressively tightening them in sequence (Fig. 2). Tighten wheel nuts to 129 N•m (95 ft. lbs.). **Never use oil or grease on studs or nuts.**

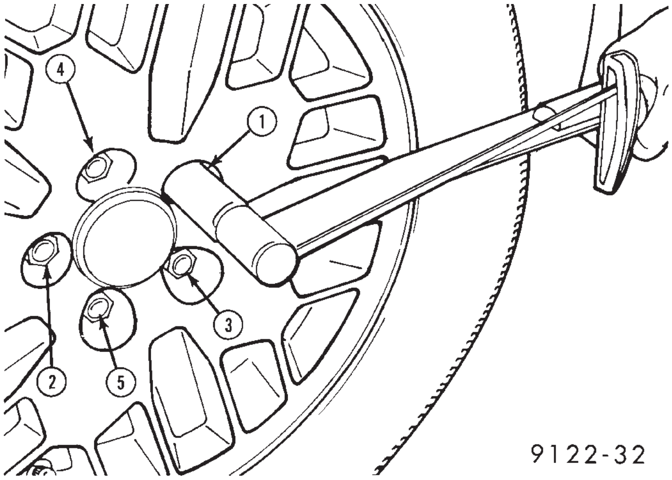


Fig. 2 Tightening Wheel Nuts (5-Stud)

WHEEL REPLACEMENT

Wheels must be replaced if they:

- have excessive run out
- are bent or dented
- leak air through welds
- have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment replacement wheels are available through your dealer. When obtaining wheels from any other source, the replacement wheels should be equivalent in load carrying capacity. The wheel dimensions (diameter, width, offset, and mounting configuration) must match original equipment wheels. Failure to use equivalent replacement wheels may adversely affect the safety and handling of your vehicle. **Replacement with used wheels is not recommended as their service history may have included severe treatment or very high mileage and they could fail without warning.**

TIRE AND WHEEL BALANCE

Balancing need is indicated by vibration of seats, floor pan, or steering wheel when driving over 90 km/h (55 mph) on a smooth road.

It is recommended that a two plane dynamic balancing machine be used when a wheel and tire assembly require balancing. Static balancing should be used only when a two plane dynamic balancing is not available.

For static imbalance, find location of heavy spot causing imbalance and counterbalance 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. Then place the other half on the outer rim flange (Fig. 3). Off-vehicle balancing is preferred.

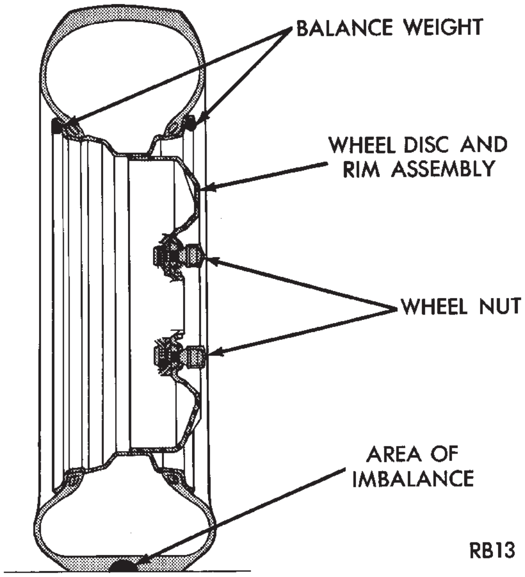


Fig. 3 Counterbalancing

TIRE AND WHEEL RUN OUT

Radial run out is the difference between the high and low points on the tire or wheel periphery.

Lateral run out is the wobble of the tire or wheel.

Radial run out of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral run out of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial run out can be reduced by relocating the wheel and tire assembly on the mounting 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.

Make sure all wheel nuts are properly torqued (Fig. 2).

Use run out gauge D-128-TR to determine run out (Fig. 4).

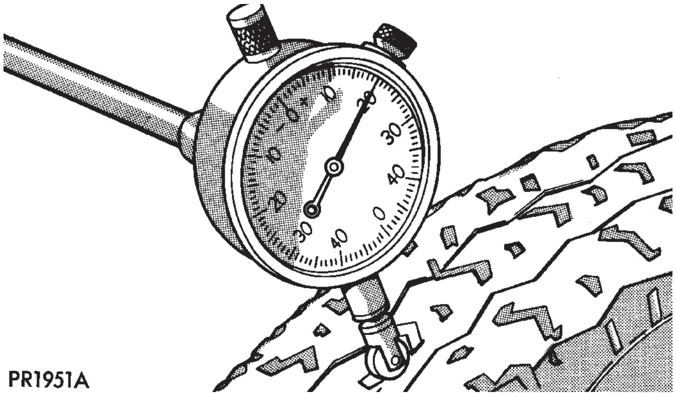


Fig. 4 Run out Gauge D-128-TR

Relocate wheel on the mounting, two studs over from the original position.

Retighten wheel nuts (Fig. 2) until all are properly torqued, to eliminate brake distortion.

Check radial run out. If still excessive, mark tire sidewall, wheel, and stud at point of maximum run out (Fig. 5), and proceed to Method #2.

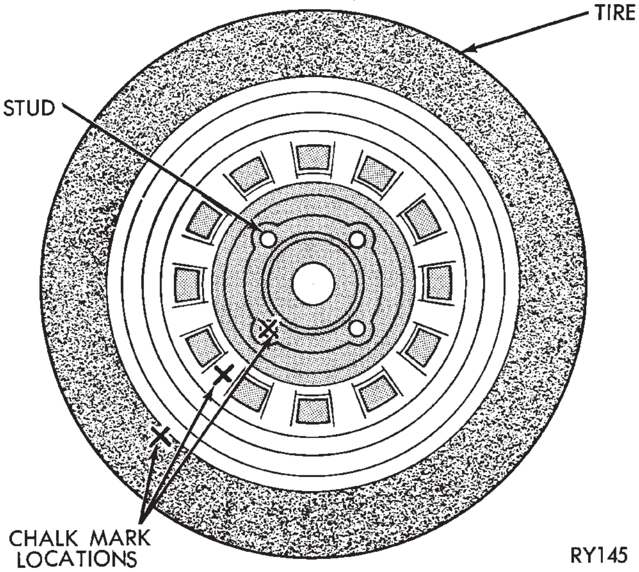


Fig. 5 Chalk Marking on Wheel, Tire, and Stud

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 wheel radial run out (Fig. 6). It should be no more than 0.9 mm (.035 inch).

Lateral run out (Fig. 6) should be no more than 1.1 mm (.045 inch).

If point of greatest wheel radial run out is near original chalk mark, remount tire 180 degrees from its original position. Recheck run out.

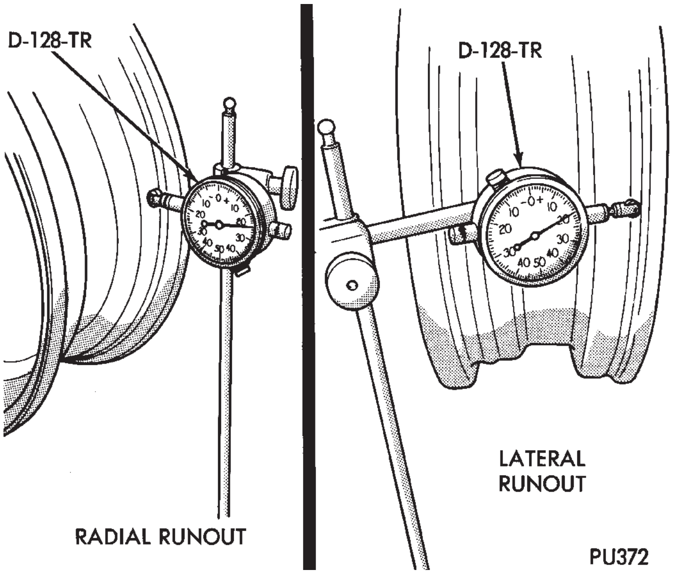


Fig. 6 Checking Wheel Run out

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.

9122-75

TORQUE SPECIFICATIONS

Stud Size	M12 × 1.5mm
Nut Size	19mm
Torque Wheel Nuts (4 or 5 Stud)	129 N·m (95 ft. lbs)

9122-76

BODY

CONTENTS

GENERAL SERVICE INFORMATION

VEHICLE IDENTIFICATION

Throughout this group, references to the Chrysler Corporation vehicle family identification code is used when describing a procedure that is unique to that vehicle. Refer to Introduction Group of this manual for detailed information on vehicle identification. If a procedure is common to all vehicles covered in this manual, no reference will be made to a vehicle family code.

SAFETY PRECAUTIONS AND WARNINGS

WARNING: WHEN SERVICING A VEHICLE EQUIPPED WITH AIRBAG RESTRAINT SYSTEM, REVIEW ALL PRECAUTIONS IN GROUP 8M, RESTRAINT SYSTEMS. PERSONAL INJURY CAN RESULT.

EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

USE A 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 VENTURE 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 a inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle 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 attaching fasteners when servicing interior trim. Plastic panel 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 brake the fastener and use a new one when installing the component. Never pry or pound on a plastic or press-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 that fastener is aligned 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 component to be reused, verify there is no hidden fasteners or captured edges holding the component in. Often a fastener is hidden by carpeting nap or trim plugs.

BODY DIAGNOSTIC PROCEDURES

INDEX

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 an area somewhat distant 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, door, or convertible top seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Over compensating on door, glass, or top adjustments to stop a water leak that occurs under severe conditions, can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, 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 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 a determination has been made on the conditions that a water leak occurs, simulate the conditions as closely as possible.

- If a leak occurs when the car is parked in a steady light rain, flood the leak area with a open ended garden hose.
- If a leak occurs at highway speeds in a steady rain, test the leak area with a stream or fan spray of water from a garden hose with an adjustable nozzle. Direct the spray in the direction comparable to actual conditions.
- If a leak seems to occur only when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition before water testing. This method can also 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, perform a water test and watch for water tracks or droplets forming on the inside if the vehicle. If necessary remove interior trim covers or panels to gain visual access to the leak area. If the hose can not be positioned without being held, have someone help perform the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, determine the highest point of the water track or drop. The highest point usually will indicate the point of entry. After leak point has been determined, repair the leak and water test to verify that leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water splashes or runs from the cavity it is dammed up in, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on a 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 light 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 can not 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 assure 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 air tight in normal driving conditions. Moving sealing surfaces will not always seal air tight under all conditions. At times, side glass, door, or convertible top seals will allow wind noise to be noticed in the passenger compartment during high cross-winds. Over compensating on door, glass, or top 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 leak has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior mouldings or body ornamentation. Loose mouldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create 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, body drains are clear 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 mouldings. After each length is applied drive vehicle. If noise goes away after a piece of tape is applied, remove tape, locate and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Mouldings 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.

PAINT

INTRODUCTION

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 color names provided in the Paint and Trim Code Description chart are the color names used on most repair product containers. The color names in the new vehicle ordering guides vary depending on car line but use the same color code.

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 ultra violet light and provides a durable high gloss finish.

WET SANDING,BUFFING AND POLISHING

Minor acid etching, orange peel or smudging in clear coat can be reduced with light wet sanding, hand buffing and polishing. If the finish has been wet sanded in the past, it can not be repeated. Wet sanding operation should be performed by a trained automotive painter.

CAUTION: Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat to shine.

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 (600 grit) wet sanded 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.

PAINT AND TRIM CODE DESCRIPTIONS

PAINT CODE	COLOR NAME	SATIN GLOW	PEARL COAT	CLEAR COAT
BD	Light Blue	X		
BF	Medium Water Blue	X		
B8	Midnight Blue, Metallic			X
C1	Diamond Blue, Metallic			X
C3	Banzai Blue, Metallic			X
DA	Bright Silver Quartz, Metallic			X
D8	Dark Quartz Gray, Metallic			X
FA	Light Driftwood	X		
GF	Emerald Green		X	
G6	Beryl Green		X	
H6	Light Mahogany, Metallic			X
MB	Wildberry		X	
M3	Raspberry		X	
M4	Claret Red		X	
M9	Black Cherry		X	
QE	Aqua		X	
RB	Radiant Fire			X
RF	Radiant Red, Metallic			X
V4	Light Champagne, Metallic			X
W7	Bright White			X
X8	Black			X

TRIM CODE	COLOR NAME
B7	Slate Blue
B9	Midnight Blue
AR	Agate/Radiant Red
AZ	Agate
DW	Medium Light Quartz
D5	Medium Quartz
H7	Mahogany
MW	Crimson Red/Frost White
M6	Crimson Red
VV	Champagne/Medium Champagne
V4	Champagne
WA	Agate/Frost White
XW	Black/Light Quartz
X7	Black

9323-151

POWER SUNROOF

INDEX

GENERAL INFORMATION

All sunroofs are equipped with drain tubes that are located in the A, B or C-pillars. The drain tubes must be kept open to prevent water from entering the passenger compartment.

LUBRICATION

(1) Lubricate cables with Lubriplate or equivalent when cables are replaced.

(2) Periodically clean dirt from guide rail covers.

DRAIN TUBES

- Inspect the drain holes, located in the trough around the sunroof opening to verify they are clear. Inspection should be performed at least once a year or when problems are suspected. If drain hose or tubes are plugged, use compressed air or blunt flexible wire to clear them. If tubes cannot be cleared, they must be repaired.
- The lower ends of the rear drain tubes are located in the rear quarter panel drop wells. To clear rear drain tubes, use compressed air or blunt flexible wire from the lower ends of the tubes.

GLASS VERTICAL HEIGHT ADJUSTMENT

GLASS VERTICAL ADJUSTMENT (FIG. 1)

(1) Open glass to vent position.

(2) Slide upper half of mechanism covers rearward until clips disengage and separate covers from vehicle.

(3) Close glass panel, separately loosen adjusting bolts and individually adjust the corners of glass.

(4) Adjust front of glass panel to 1.0 mm (0.040 in.) below top surface of roof panel.

(5) Adjust rear of glass to 1.0 mm (0.040 in.) above top surface of roof panel.

(6) Secure adjustment bolts and install cover.

WIND DEFLECTOR

WIND DEFLECTOR REMOVAL (FIG. 2)

(1) Open sun roof glass panel.

(2) Remove screws holding wind deflector to sun roof unit side rail.

(3) Separate wind deflector from vehicle.

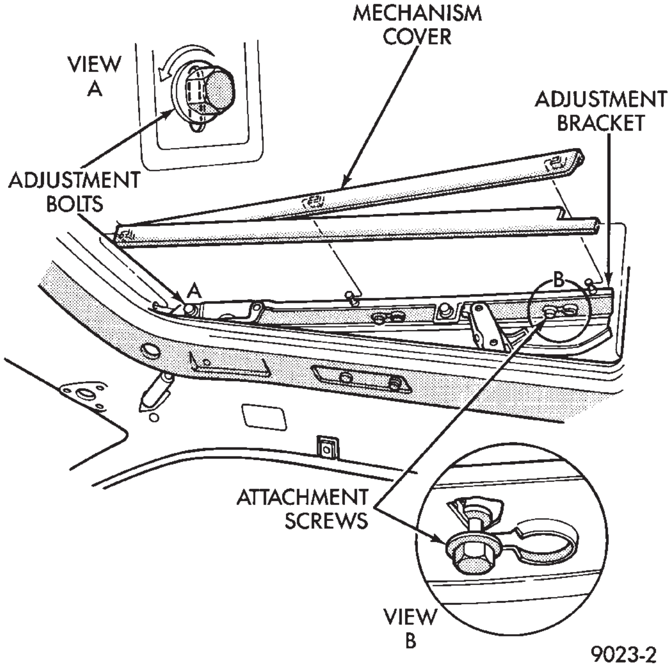


Fig. 1 Glass Adjustment

WIND DEFLECTOR INSTALLATION

Reverse the preceding operation.

WIND DEFLECTOR ADJUSTMENT (FIG. 2)

(1) Open sunroof.

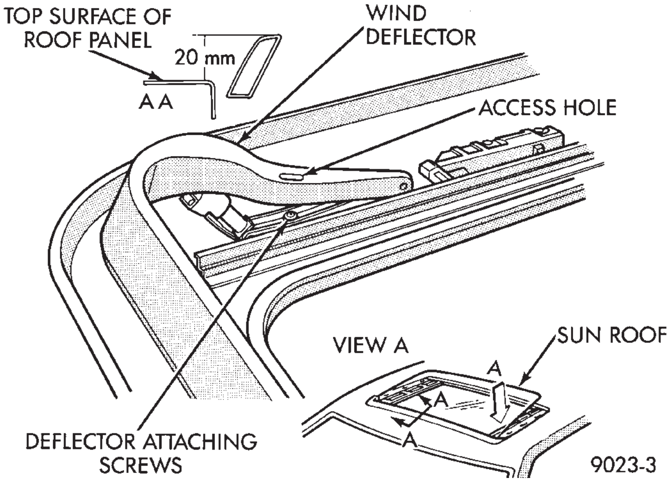


Fig. 2 Deflector Assembly

(2) position wind deflector so 19 mm (0.75 in.) above top surface of roof panel and 1 mm (0.040 in.) rearward of roof panel forward edge.

(3) Secure wind deflector to sunroof unit.

GLASS PANEL

GLASS PANEL REMOVAL

(1) Remove wind deflector mechanism covers (Fig. 1).

(2) Position glass to vent position.

(3) Position sunshade full rearward.

(4) Loosen nuts holding glass panel to side adjustment brackets.

(5) Slide glass panel rearward 12 mm (0.5 in.) and separate glass from sunroof unit.

GLASS PANEL INSTALLATION

(1) Position glass panel in opening with logo rearward and slide panel forward 12 mm (0.5 in.).

(2) Verify that attaching nuts are below top surface of glass adjustment brackets.

(3) Close sunroof to center glass panel in roof opening.

(4) Tighten center screws to hold adjustment.

(5) Open glass to vent position and tighten nuts to 8 N●m (70.8 in-lbs.).

(6) Close glass and check alignment.

(7) Install the mechanism covers.

(8) Adjust wind deflector, if necessary.

ADJUSTMENT BRACKET

ADJUSTMENT BRACKET REMOVAL (FIG. 3)

(1) Remove wind deflector, mechanism covers and glass panel.

(2) Move glass carriage to vent position and remove rearward adjustment bolt from adjustment bracket.

(3) Lift rear of adjustment bracket to highest vertical position and disengage front of bracket from unit.

ADJUSTMENT BRACKET INSTALLATION

Reverse the preceding operation. Adjust glass, and wind deflector as necessary.

DRAIN CHANNEL

DRAIN CHANNEL REMOVAL

(1) Remove wind deflector mechanism covers and glass panel.

(2) Locate glass carriage to vent position and drain channel in full forward position.

(3) Remove screws holding drain channel to support frame.

DRAIN CHANNEL INSTALLATION

Reverse the preceding operation.

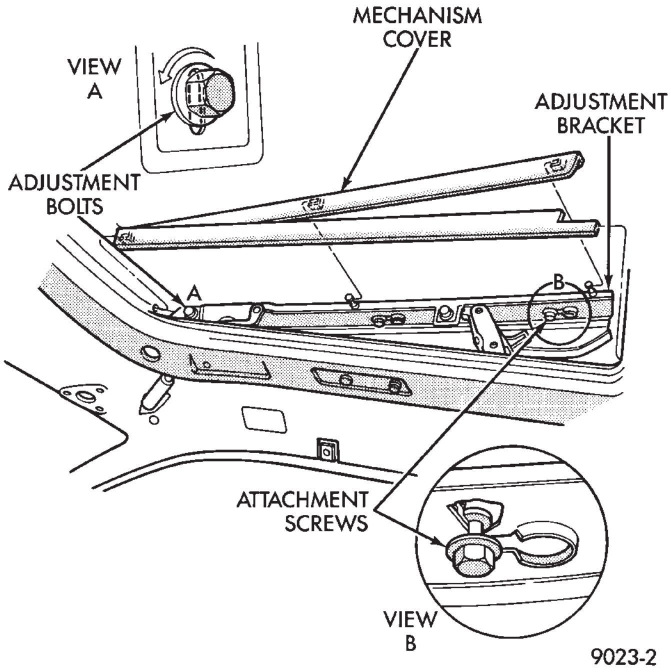


Fig. 3 Glass Height Vertical Adjustment

DRIVE CABLE LOCATORS

DRIVE CABLE LOCATORS REMOVAL (FIG. 4)

(1) Position glass 19 mm (0.75 in.) until rearward until cable locator is visible.

(2) Remove screws holding drive cable locator to unit.

(3) Remove travel limiting micro switch grommet and disconnect wire connector.

(4) Insert a small screwdriver under rear edge of locator and pry locator from track.

DRIVE CABLE LOCATORS INSTALLATION

Reverse the preceding operation. The small outboard lip underneath cable locator slips under bottom slot on guide track. After locator is seated install screws.

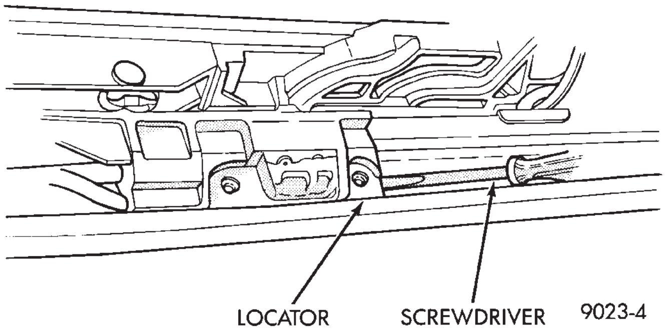


Fig. 4 Removing Cable Drive Locator

MOTOR AND DRIVE GEARS

MOTOR AND DRIVE GEAR REMOVAL (FIG. 5)

(1) Open sunroof to vent position.

(2) Remove head lining.

(3) Remove bolts holding sunroof motor to motor bracket.

(4) Disconnect wire connector.

(5) Separate motor and drive gear from drive cables.

MOTOR AND DRIVE GEAR INSTALLATION

(1) Verify that sunroof is in vent position. Push mechanism forward on both sides to align drive cables.

(2) Engage drive gears onto drive cables.

(3) Install motor and drive gear screws and tighten to 5 N●m (44 in-lbs.).

(4) Install head lining.

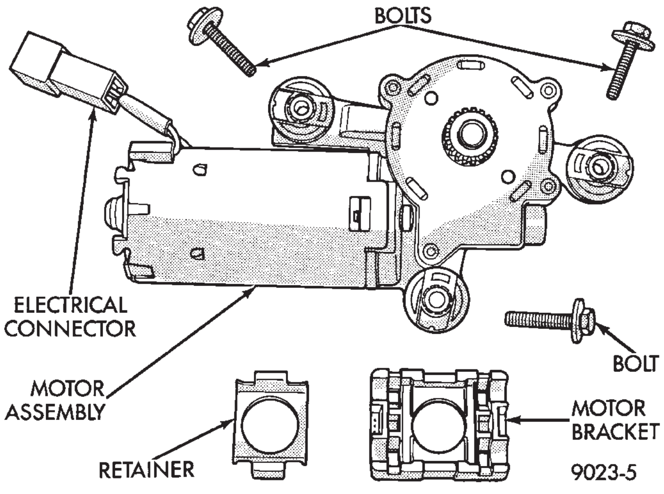


Fig. 5 Sunroof Motor and Drive Gear

DRIVE CABLES

DRIVE CABLES REMOVAL (FIG. 6)

(1) Open sunroof to vent position.

(2) Remove head lining, wind deflector, mechanism covers, glass panel, side glass adjustment brackets, motor and drive cable locators.

(3) Lift cable out of cable retainer and pull forward. Separate cable from assembly.

DRIVE CABLES INSTALLATION

Verify sunroof is in vent position. Push mechanism forward on both sides to align drive cables. Reverse the preceding operation.

SUNSHADE

SUNSHADE REMOVAL (FIG. 7)

(1) Remove wind deflector, mechanism covers and glass panel.

(2) Position system to full rearward position.

(3) Slide sunshade panel full forward and release the front tabs from track assembly.

(4) Pull rear retaining clip inboard and lift sun shade out.

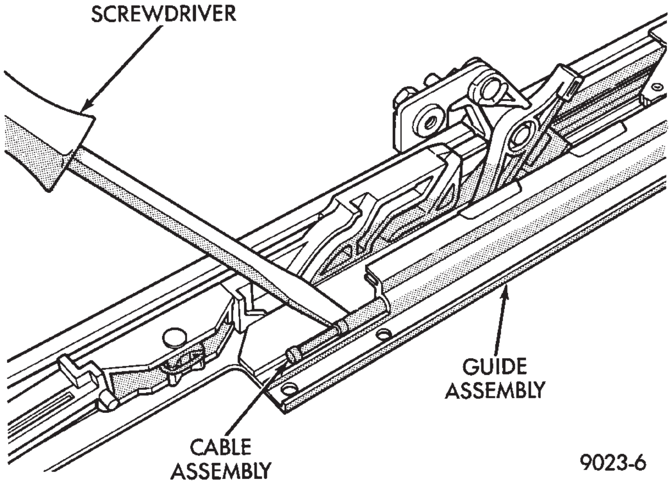


Fig. 6 Drive Cables

SUNSHADE INSTALLATION

Reverse the preceding operation.

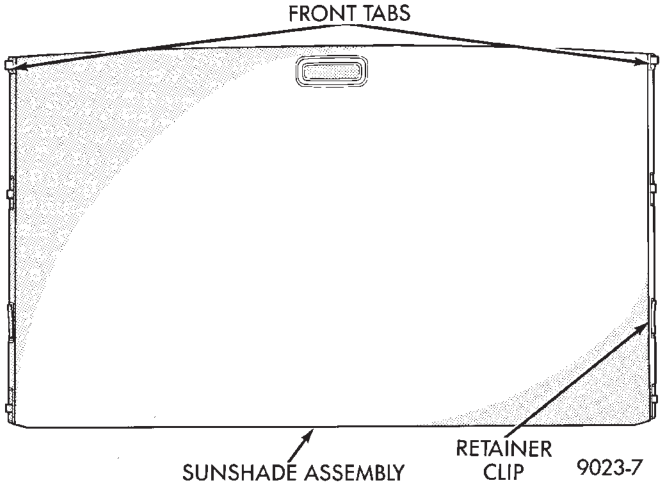


Fig. 7 Sunshade Assembly

GUIDE ASSEMBLY

GUIDE ASSEMBLY REMOVAL (FIG. 8)

(1) Remove wind deflector, mechanism covers, glass panel, drain channel, sunshade and drive cable locator as necessary.

(2) Move glass carriage to vent position.

(3) Remove front slide from guide assembly.

(4) Remove screws holding front and center guide track to unit.

(5) Pull cable out of groove for cable end.

(6) Pull guide outward to release from housing. Separate rear end of guide from clips. Slide guide out of unit.

GUIDE ASSEMBLY INSTALLATION

(1) Install guide cable into rear of guide assembly.

(2) Install guide assembly at an angle so the rear portion slips under finger clips at rear of module housing.

(3) Place cable in groove of cable holder.

(4) Install screws in track assembly.

(5) Install locators.

(6) Reverse removal operation.

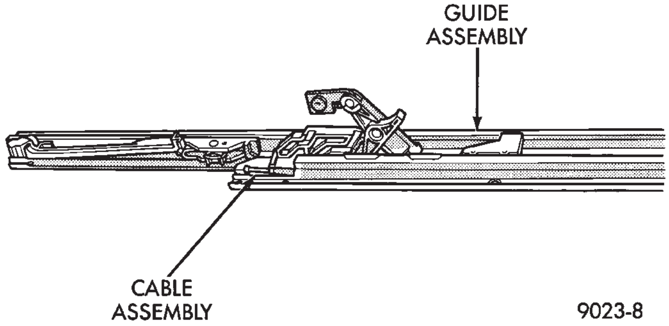


Fig. 8 Guide Assembly

WINDSHIELD

SAFETY PRECAUTIONS AND WARNINGS

WARNING: DO NOT OPERATE VEHICLE FOR AT LEAST 24 HOURS AFTER WINDSHIELD INSTALLATION. WINDSHIELD MAY NOT PERFORM PROPERLY IN THE EVENT OF A COLLISION IF URETHANE ADHESIVE IS NOT SUFFICIENTLY CURED. REFER TO MANUFACTURER OF URETHANE BEING USED FOR CURING TIME SPECIFICATIONS.

WHEN INSTALLING GLASS, DO NOT USE URETHANE ADHESIVE AFTER DATE ON PRODUCT HAS EXPIRED. SAFETY AND QUALITY OF REPAIR WOULD BE QUESTIONABLE.

DO NOT USE URETHANE ADHESIVE OR PRIMER IN CLOSED WORK AREA, PERSONAL INJURY CAN RESULT.

PROTECT SKIN FROM COMING IN CONTACT WITH URETHANE, PERSONAL INJURY CAN RESULT.

WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS, PERSONAL INJURY CAN RESULT.

CAUTION: Protect all painted or trimmed surfaces from coming in contact with urethane or primers, damage will result.

Do not damage painted surfaces when removing mouldings 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 mouldings are set in urethane, it would also be unlikely they could be salvaged. Before removing the windshield, check the availability of the windshield and mouldings from the parts supplier.

WINDSHIELD REMOVAL

(1) Remove inside rear view mirror.

(2) Remove cowl cover.

(3) Remove windshield mouldings using a suitable hook tool and trim stick (Fig. 1).

(4) Cut urethane bonding from around windshield using a suitable sharp cold knife. A pneumatic cutting device can be used if available (Fig. 2).

(5) Separate windshield from vehicle.

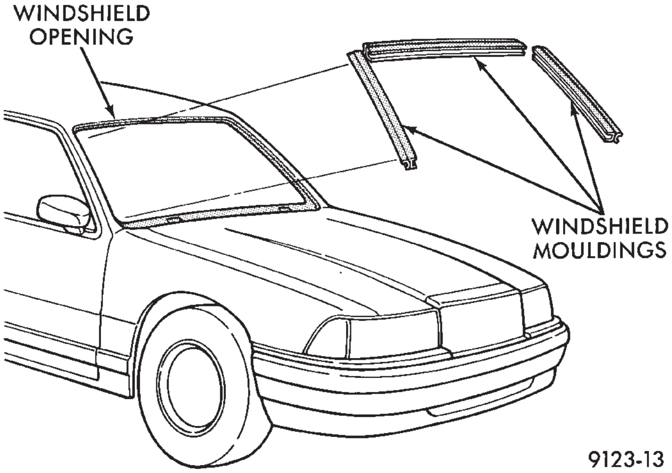


Fig. 1 Windshield Mouldings

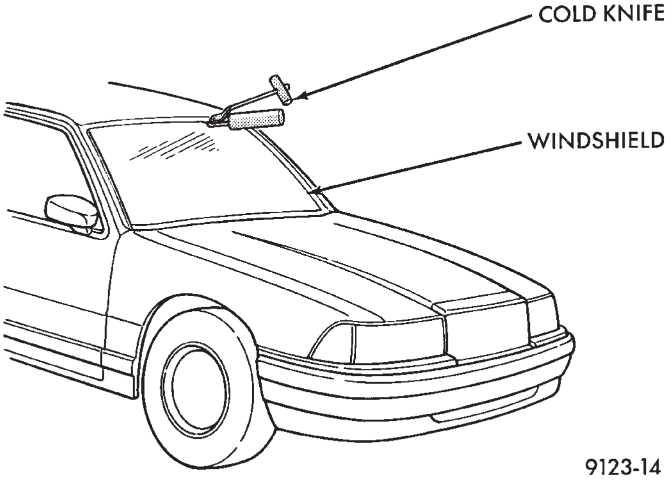


Fig. 2 Cut Urethane Around Windshield

WINDSHIELD INSTALLATION

CAUTION: Open the left front door glass before installing windshield to avoid pressurizing the passenger compartment if a door or the trunk lid 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.

The windshield fence should be cleaned of old urethane bonding material. 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. 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. Remove replacement windshield from windshield opening (Fig. 3).

(2) 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).

(3) Clean inside of windshield with Mopar Glass Cleaner and lint-free cloth.

(4) Apply clear glass primer 25 mm (1 in.) wide around perimeter of windshield and wipe with clean/dry lint-free cloth.

(5) Install mouldings on windshield (Fig. 4).

(6) Apply black-out primer 15 mm (.75 in.) wide on top and sides of windshield and 25 mm (1 in.) on bottom of windshield. Allow at least three minutes drying time.

(7) Position windshield bonding compression spacers on lower fence above the support spacers at the edge of the windshield opening (Fig. 5).

(8) Apply a 10 mm (0.4 in.) bead of urethane around perimeter of windshield along the inside of the mouldings.

(9) 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.

(10) Slowly lower windshield glass to windshield opening fence. Guide the top moulding into proper position if necessary. Push windshield inward to fence spacers at bottom and until top moulding is flush to roof line (Fig. 6).

(11) Clean excess urethane from exterior with Mopar, Super Clean or equivalent.

(12) Install cowl cover and wipers.

(13) Install inside rear view mirror.

(14) After urethane has cured, water test windshield to verify repair.

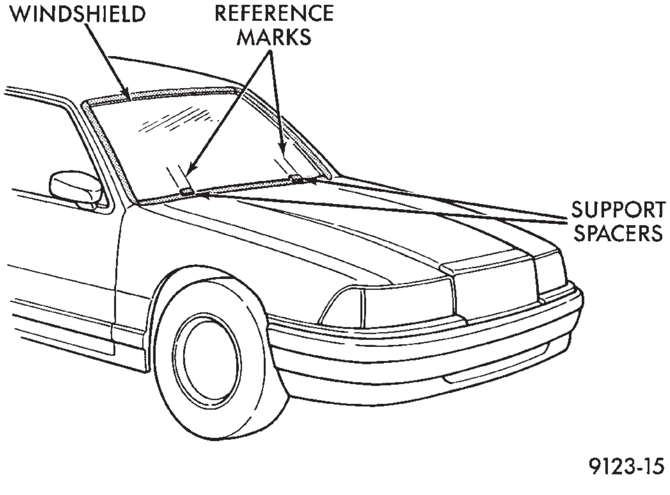


Fig. 3 Center Windshield and Mark at Support Spacers

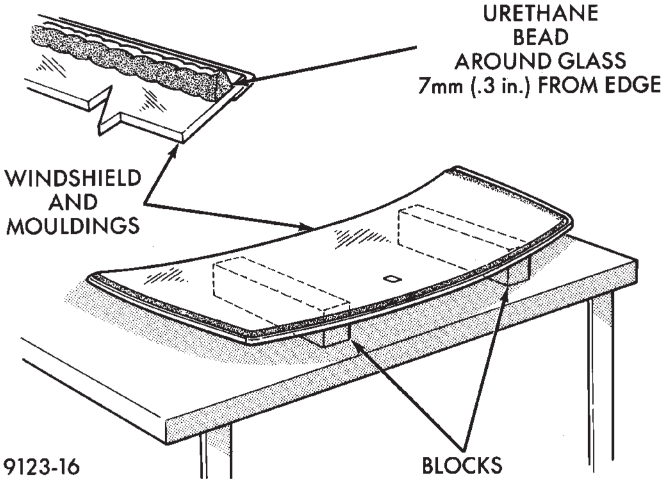


Fig. 4 Work Surface Set-up and Mouldings Installation

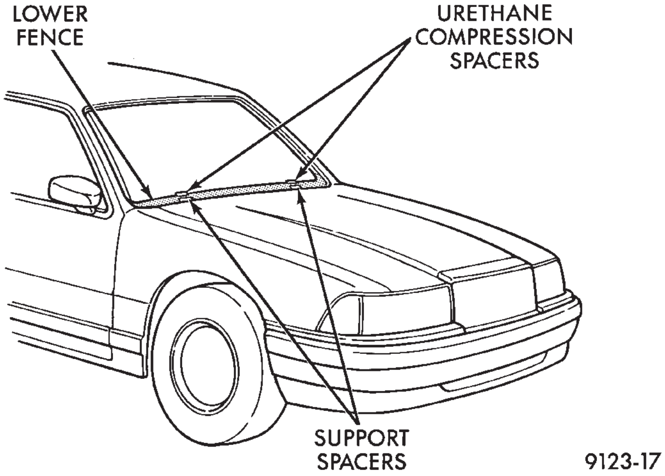


Fig. 5 Position Urethane Compression Spacers

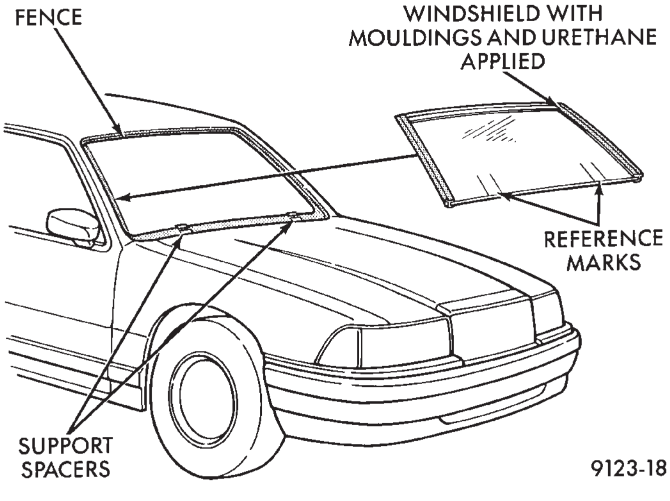


Fig. 6 Lower Windshield Into Position

AA-VEHICLE BODY COMPONENT SERVICE

INDEX

GRILLE

REMOVAL (FIG. 1)

(1) Raise hood to full up position.

(2) Remove hood safety catch release rod retainer and separate rod from grille.

(3) Remove grille end reinforcement attaching bolts.

(4) Remove nuts holding grille to hood.

(5) Separate grille from hood.

INSTALLATION

Reverse the preceding operation.

HOOD AND HINGES

HOOD REMOVAL (FIG. 2)

(1) Raise hood to full up position.

(2) Lift front edge of cowl cover on the right side of the windshield washer bottle and disconnect the under hood lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood, 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.

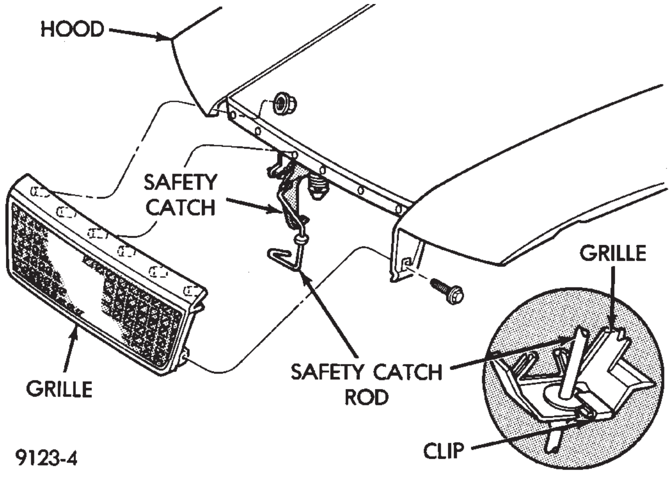


Fig. 1 Grille Assembly

(4) Remove the top hood to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the hood, remove the bottom hood to hinge attaching bolts. Separate the hood from the vehicle.

HOOD INSTALLATION

Reverse the preceding operation.

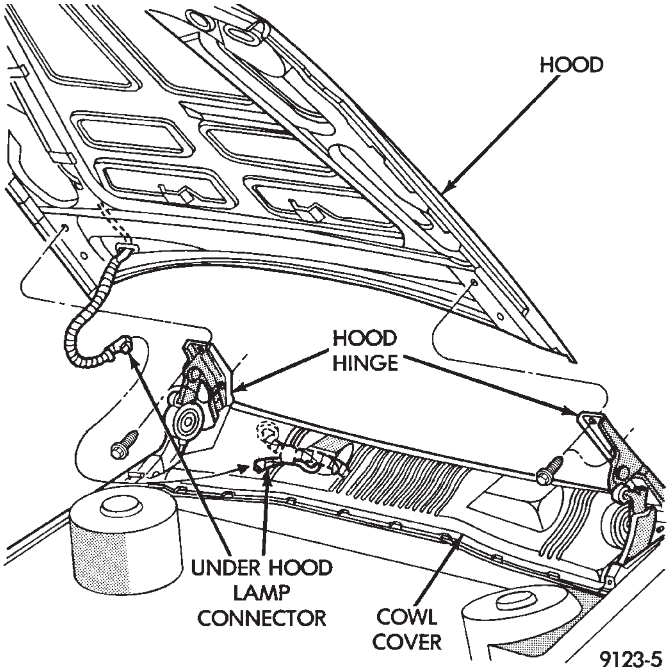


Fig. 2 Hood Assembly

HOOD HINGE REMOVAL (FIG. 3)

(1) Support hood on the side that requires hinge replacement.

(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood hinge, 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.

(3) Remove hood to hinge attaching bolts.

(4) Remove hood hinge to front fender attaching bolts and separate hinge from vehicle.

HOOD HINGE INSTALLATION

Reverse the preceding operation. If necessary, paint new hinge before installation.

HOOD LATCH AND RELEASE CABLE

HOOD LATCH REMOVAL (FIG. 4)

(1) Raise hood top the full up position.

(2) Remove hood latch attaching bolts holding latch to radiator closure panel and separate from vehicle.

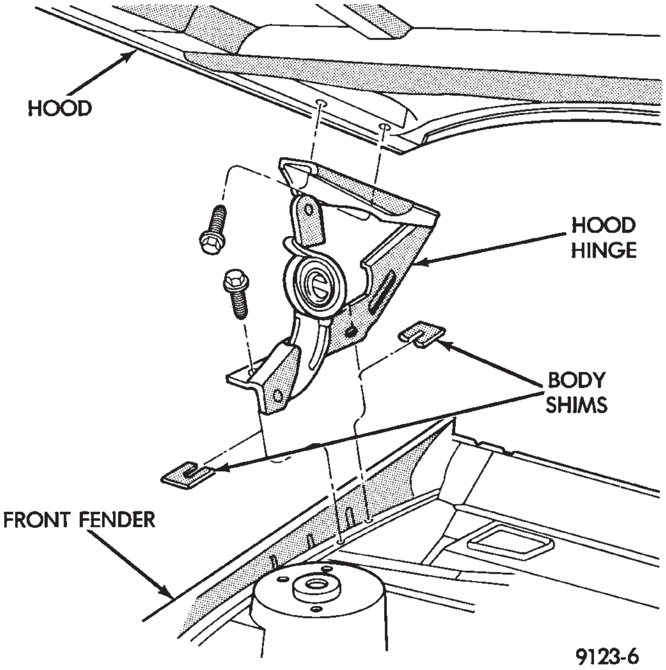


Fig. 3 Hood Hinge Assembly

(3) Pry release cable casing attachment from slot receiver on latch, disengage cable end from latch arm hook.

HOOD LATCH INSTALLATION

Reverse the preceding operation.

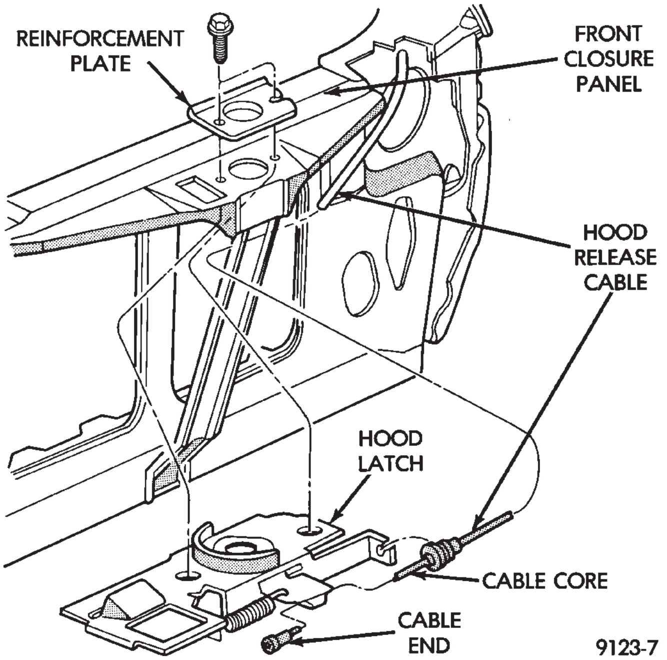


Fig. 4 Hood Latch Assembly

HOOD LATCH RELEASE CABLE REMOVAL (FIG. 5)

(1) Raise hood to the full up position.

(2) Remove push-in fasteners holding hood latch cover to radiator closure panel and separate cover from vehicle.

(3) Disconnect hood release cable casing and cable end from hood latch assembly. Refer to Hood Latch Removal procedure in this section.

(4) Remove hood latch release cable handle attaching bolts from under left lower edge of instrument panel.

(5) Disengage release cable rubber grommet from engine compartment dash panel behind instrument panel.

(6) Rout cable assembly through engine compartment around battery, under fender lip, under relay bank, and under wiring harnesses, toward dash panel. Push cable through access hole in dash panel under the brake master cylinder, into passenger compartment.

HOOD LATCH RELEASE CABLE INSTALLATION

Reverse the preceding operation.

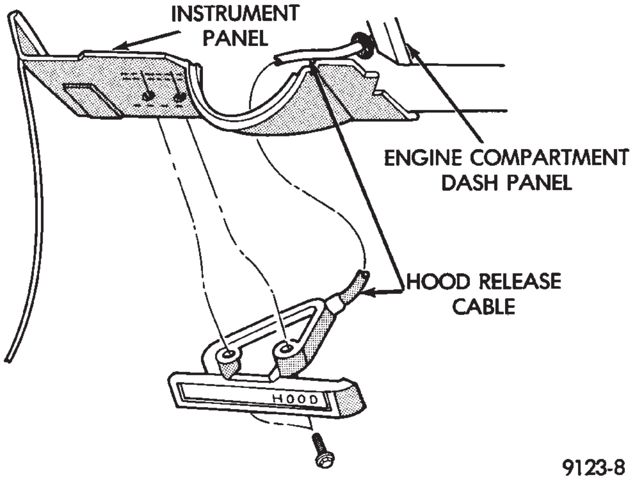


Fig. 5 Hood Latch Release Cable Assembly

COWL COVER

REMOVAL (FIG. 6)

(1) Raise hood to full up position.

(2) Disconnect windshield washer hoses from wiper arms.

(3) Remove windshield wiper arm assemblies. Refer to Group 8K, Windshield Wiper and Washer Systems.

(4) Remove plastic expanding type fasteners holding cowl cover to cowl, below windshield.

(5) Lift back of cowl cover and slide cover rearward from under dash panel to hood seal and separate cover from vehicle.

INSTALLATION

Reverse the preceding operation.

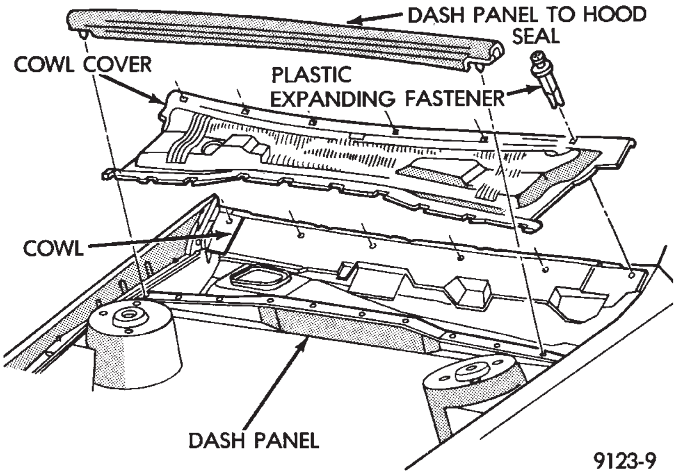


Fig. 6 Cowl Cover Assembly

FRONT END SPLASH SHIELDS

FRONT WHEELHOUSE SPLASH SHIELD REMOVAL (FIG. 7)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove front wheel assembly.

(3) Remove push-in fasteners holding front wheelhouse splash shield to fender opening lip and inner wheelhouse area.

(4) Separate wheelhouse splash shield from vehicle.

FRONT WHEELHOUSE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

TRANSAXLE SPLASH SHIELD REMOVAL (FIG. 7)

(1) Remove one front wheelhouse splash shield push-in fastener and separate wheelhouse splash shield from transaxle splash shield.

(2) Remove transaxle splash shield attaching bolts and separate transaxle splash shield from vehicle.

TRANSAXLE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

ENGINE DRIVE BELT SPLASH SHIELD REMOVAL (FIG. 8)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove bolts holding engine drive belt splash shield to right frame rail.

(3) Separate drive belt splash shield from vehicle.

ENGINE DRIVE BELT SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

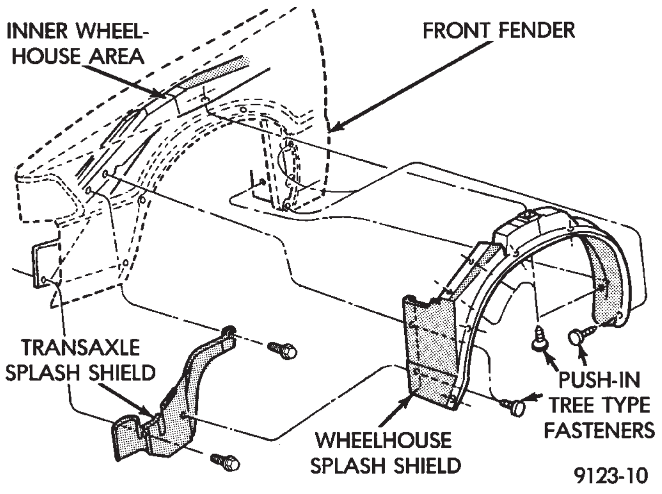


Fig. 7 Front Wheelhouse and Transaxle Splash Shields

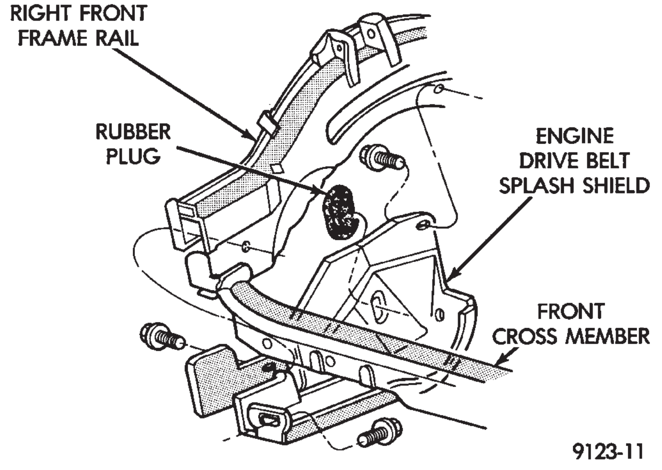


Fig. 8 Engine Drive Belt Splash Shield

FRONT FENDER

REMOVAL (FIG. 9)

(1) Remove front side marker lamp assembly. Refer to Group 8L, Lamps for instructions.

(2) Remove front bumper as necessary to gain clearance to remove front fender. Refer to Front Bumper Removal paragraph in this section.

(3) Remove front wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph of this section.

(4) Remove rocker panel moulding as necessary to clear front fender. Refer to Body Side Moulding and Applique Removal paragraph in this section.

(5) Remove bolts holding bottom front fender at rear of wheel opening.

(6) Remove bolt holding front fender at rear of wheelhouse.

(7) Remove bolt holding front fender at top of front door opening.

(8) Remove bolts holding front fender to front lower brace and under radiator closure panel.

(9) Remove bolts holding front fender to front of radiator closure panel.

(10) Raise hood and support hood on a suitable holding device. Mark hinge for installation indexing. Remove lower hood hinge attaching bolts and separate hinge from front fender. Refer to Hood Hinge Removal paragraph in this section.

(11) Remove bolts holding front fender to inner wheelhouse along hood opening.

(12) Separate front fender from vehicle.

INSTALLATION

Reverse the preceding operation. Align front fender to achieve a 4 mm (0.160 in) gap to hood edge and 6 mm (0.240 in) gap to front door edge. All surfaces across gaps should be flush.

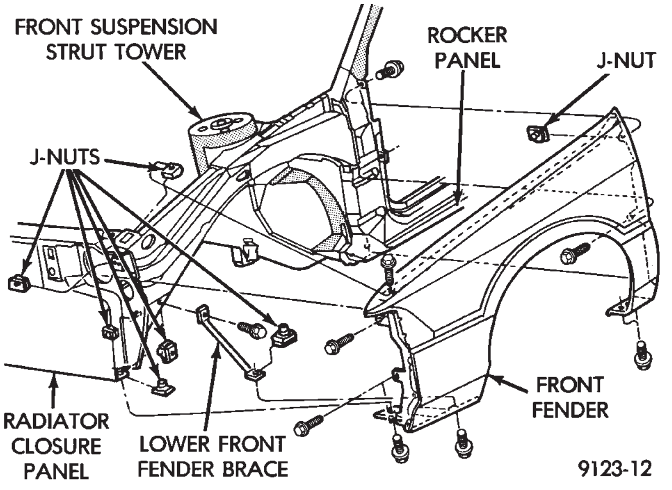


Fig. 9 Front Fender Assembly

FRONT DOOR TRIM PANEL

DOOR TRIM PANEL WITH POWER WINDOWS REMOVAL (FIG. 10)

(1) Move glass to down position.

(2) Disconnect battery negative cable.

(3) Using a suitable prying tool, lift upward at front of power window switch bezel and disengage bezel from clip in door panel. Disconnect wire connector from back of switch.

(4) Remove door latch handle bezel insert. Disconnect power door lock switch wire connector, if equipped. Remove screws holding handle bezel to trim panel and separate bezel from door.

(5) Remove screw holding armrest pull handle to door through door latch handle bezel opening.

(6) Remove hidden screw from in carpet at rear lower corner of trim panel.

(7) Using a suitable trim clip tool, disengage frog leg clips at the ends and bottom of trim panel. After all trim clips are loose, push inward at the top of the trim panel and lift upward to disengage barb fasteners at top of panel. Separate trim from door.

DOOR TRIM PANEL WITH POWER WINDOWS INSTALLATION

Reverse the preceding operation.

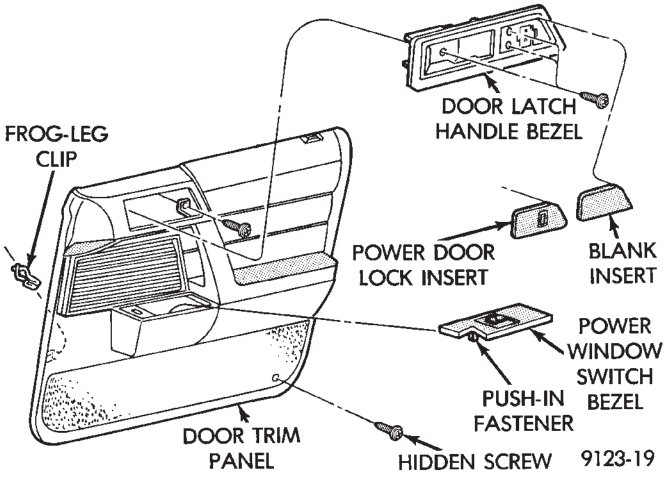


Fig. 10 Front Door Trim Panel with Power Windows

DOOR TRIM PANEL WITH MANUAL WINDOWS REMOVAL (FIG. 11)

(1) Open door glass to full down position.

(2) Disconnect battery negative cable.

(3) Remove window crank cap, attaching screw, and handle.

(4) Remove door latch handle bezel insert. Disconnect power door lock switch wire connector, if equipped. Remove screws holding handle bezel to trim panel and separate bezel from door.

(5) Remove screw holding armrest pull handle to door through door latch handle bezel opening.

(6) Remove hidden screw from in carpet at rear lower corner of trim panel.

(7) Using a suitable trim clip tool, disengage frog leg clips at the ends and bottom of trim panel. After all trim clips are loose, push inward at the top of the trim panel and lift upward to disengage barb retainers at top of panel. Separate trim from door.

DOOR TRIM PANEL WITH MANUAL WINDOWS INSTALLATION

Reverse the preceding operation.

FRONT DOOR SILENCER AND WATER SHIELD

REMOVAL (FIG. 12)

(1) Remove front door trim panel.

(2) Remove push-in fasteners holding silencer pad to door inner panel and separate silencer from door.

(3) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

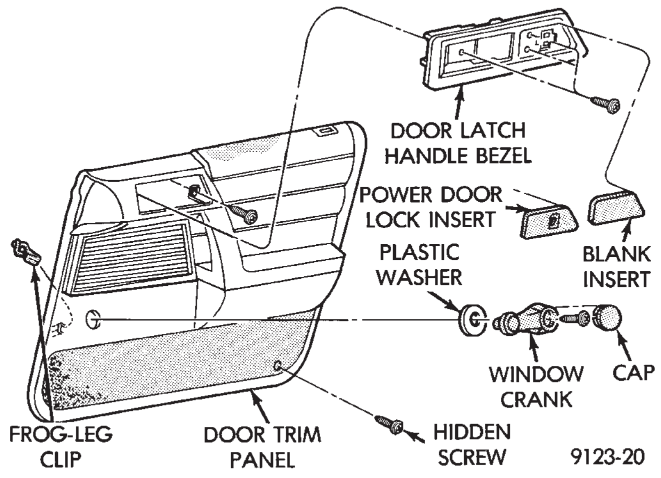


Fig. 11 Front Door Trim Panel with Manual Windows

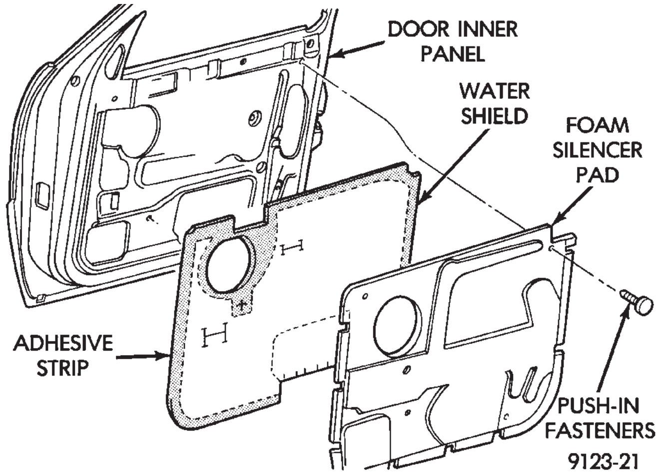


Fig. 12 Front Door Silencer and Water Shield

FRONT DOOR AND HINGE

The front door hinge is welded to the door and bolted to the hinge pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

FRONT DOOR REMOVAL (FIG. 13)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Disconnect all wire connectors and wire harness hold downs inside door and push wire harness through access hole in front of door into hinge pillar opening.

(3) Open door and support door on a suitable lifting device.

(4) Drive bottom hinge pin upward and remove pin from hinge.

(5) Drive top hinge pin downward and remove pin from hinge.

(6) Separate door from vehicle.

FRONT DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Front Door Hinge Installation paragraph in this section.

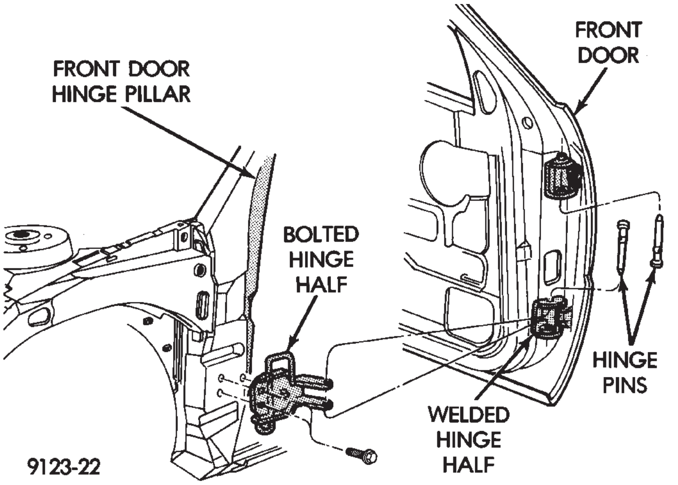


Fig. 13 Front Door Assembly

FRONT DOOR HINGE REMOVAL (FIG. 14)

(1) Remove front fender wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph in this section.

(2) Support door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to hinge pillar and separate hinge form vehicle.

FRONT DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

OUTSIDE FRONT DOOR LATCH RELEASE HANDLE

OUTSIDE FRONT DOOR LATCH RELEASE HANDLE REMOVAL (FIG. 14)

(1) Remove front door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Disconnect security alarm switch and illuminated entry switch from back of outside front door latch release handle, if equipped. For additional information refer to Group 8Q, Vehicle Theft Security System

(4) Disconnect lock rod and latch release rod from door latch assembly.

(5) Remove nuts holding outside door latch handle to retainer bracket and separate bracket from door.

(6) Swing lock rod upward, parallel to back of latch handle, and separate latch handle from door panel.

OUTSIDE FRONT DOOR LATCH RELEASE HANDLE INSTALLATION

Reverse the preceding operation.

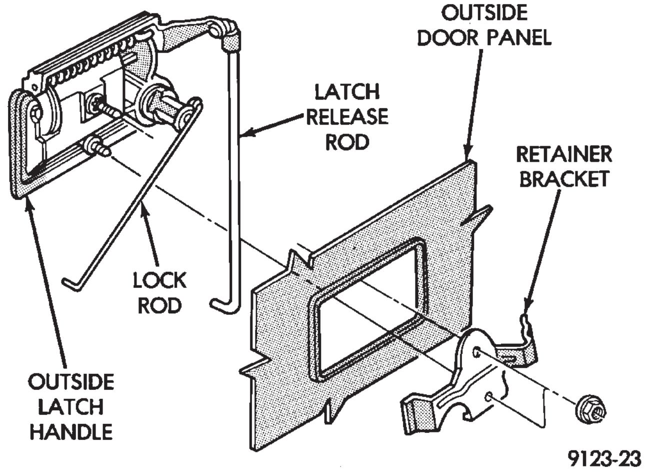


Fig. 14 Outside Front Door Latch Release Handle

FRONT DOOR LATCH

REMOVAL (FIG. 15)

(1) Remove front door trim panel, silencer pad and water shield.

(2) Raise door glass to full up position.

(3) Disconnect all actuator rods from door latch assembly.

(4) Remove screws holding door latch assembly to inner door rear panel and separate latch from door.

INSTALLATION

Reverse the preceding operation.

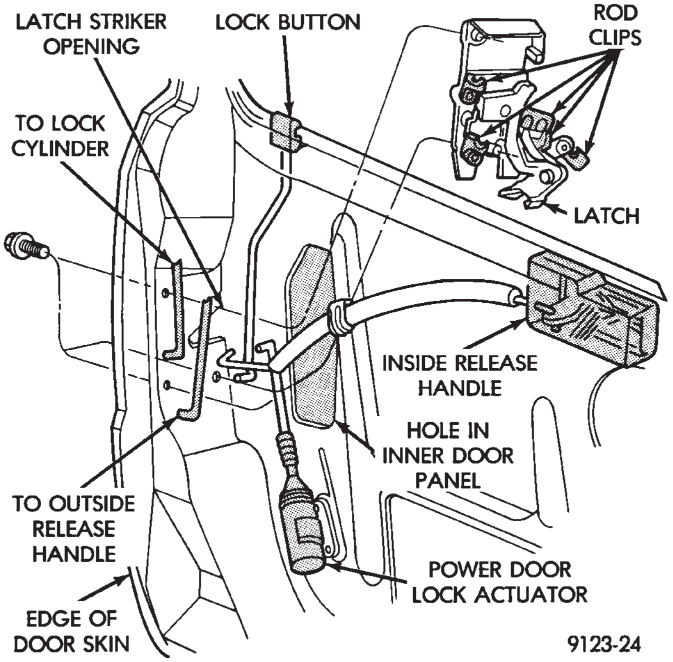


Fig. 15 Front Door Latch Assembly

FRONT DOOR SIDE VIEW MIRROR

REMOVAL (FIG. 16)

(1) Remove front door trim panel.

(2) Remove side view mirror remote adjusting knob cover, if equipped.

(3) Remove screws holding mirror bezel to door frame and separate bezel from door. Loosen set-screw holding bezel to mirror adjuster cable, if equipped.

(4) Remove silencer seal from door frame behind mirror bezel.

(5) Disconnect power mirror wire connector, if equipped.

(6) Remove access hole cover.

(7) Remove nuts holding mirror to door frame and separate mirror from door.

INSTALLATION

Reverse the preceding operation.

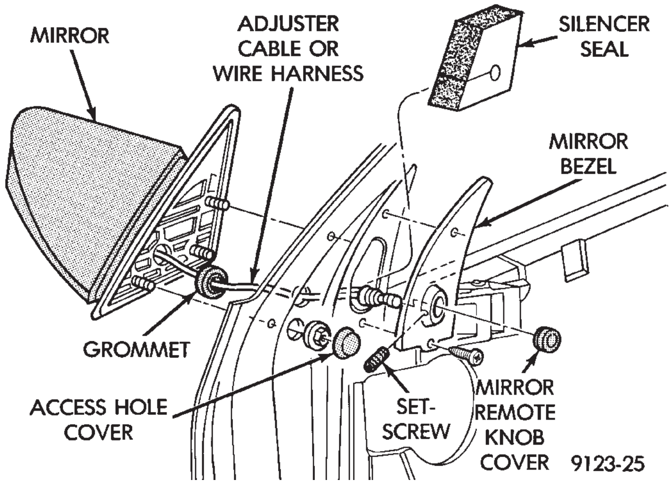


Fig. 16 Front Door Side View Mirror

FRONT DOOR GLASS

REMOVAL (FIG. 17)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Position door glass half way up in door glass opening.

(3) Insert door glass removal tool C-4867 between the glass slide and channel retaining lip at approximately 50 mm (2 in.) down from top rearward corner of glass. Push handle of tool toward glass to open channel. Push downward at the front of the glass to separate the slide from the channel.

(4) Insert door glass removal tool C-4867 between the glass slide and channel retaining lip at approximately 50 mm (2 in.) up from bottom rearward corner of glass through opening in inner door panel. Push handle of tool toward glass to open channel. Pull upward at front of glass to separate the slide from the channel. Do not allow upper slide to snap bank into channel.

(5) Rotate front of glass downward and slide glass forward to separate glass lift channel from regulator lift arm roller.

(6) Remove door glass through opening at top of door.

INSTALLATION

(1) Lower door glass into opening at top of door.

(2) Tip rear of glass downward and insert window regulator lift arm roller into glass lift channel.

(3) Guide door glass into glass run weatherstrip at front of door.

(4) Push top of glass rearward to snap top slide into glass run channel.

(5) Push downward at front of glass to snap bottom slide into glass run channel.

(6) Install water shield, silencer pad and trim panel.

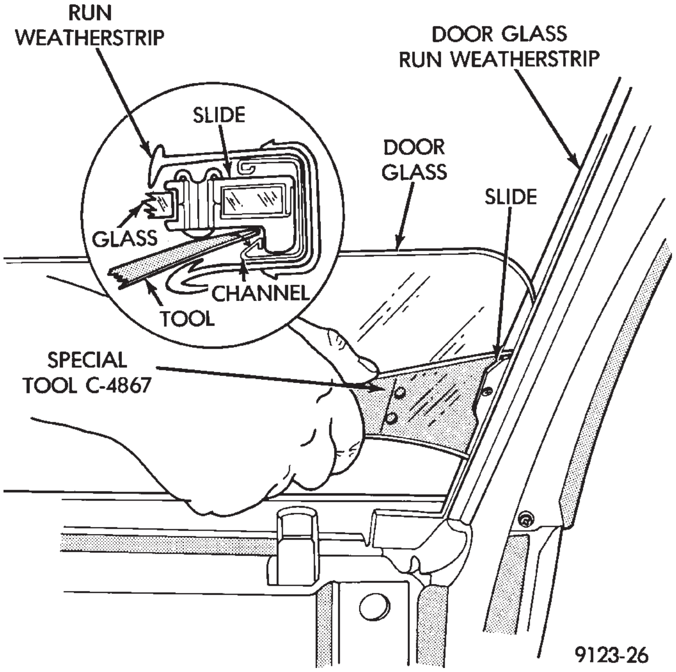


Fig. 17 Front Door Glass

FRONT DOOR BELT MOULDING AND WEATHERSTRIP

BELT MOULDING AND WEATHERSTRIP REMOVAL (FIG. 18)

(1) Remove trim panel, silencer pad, and water shield as necessary to gain access to belt moulding attaching screws.

(2) Remove door glass.

(3) Remove screws holding belt moulding and weatherstrip to outer door panel and separate moulding from door.

BELT MOULDING AND WEATHERSTRIP INSTALLATION

Reverse the preceding operation.

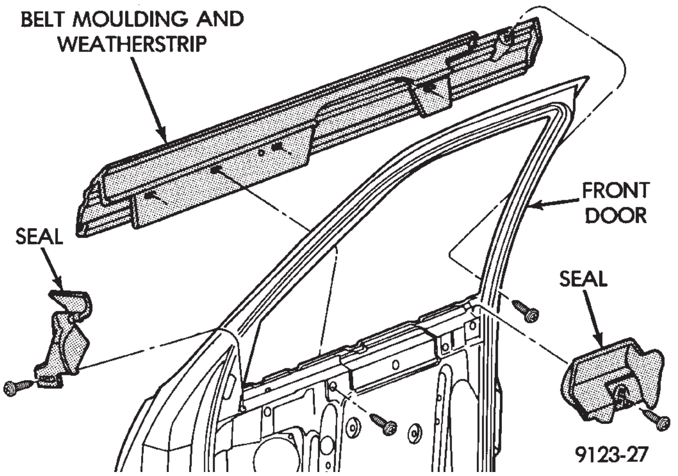


Fig. 18 Front Door Belt Moulding and Weatherstrip

FRONT DOOR GLASS CHANNEL AND RUN WEATHERSTRIP

GLASS CHANNEL AND RUN WEATHERSTRIP REMOVAL (FIG. 19)

(1) Remove door belt moulding and weatherstrip assembly.

(2) Remove front and rear door glass opening corner seals (Fig. 18)

(3) Pull door glass run weatherstrip from forward lower channel and upper door frame back to rear upper corner of door frame.

(4) Separate weatherstrip from top of rear door frame down to first clip. Using a suitable hook tool, disengage clip barb from door frame channel. Pull weatherstrip outward to disengage clip. Repeat this procedure at each clip down the rear channel.

(5) Separate glass channel and run weatherstrip from door.

GLASS CHANNEL AND RUN WEATHERSTRIP INSTALLATION

(1) Insert glass run weatherstrip into top of glass opening upper channel. Align molded corners of weatherstrip to corners of glass opening.

(2) Push weatherstrip and glass run channel into upper rear glass opening channel. Seat the top retaining clip by placing a fiber trim stick (C-4755) over the clip attaching rivet inside the glass run channel and push or tap firmly inward until clip seats. Verify the alignment of the weatherstrip in the top rear corner. Repeat this procedure on each clip going down the run.

(3) Install glass opening corner seals.

(4) Install door belt moulding and weatherstrip assembly.

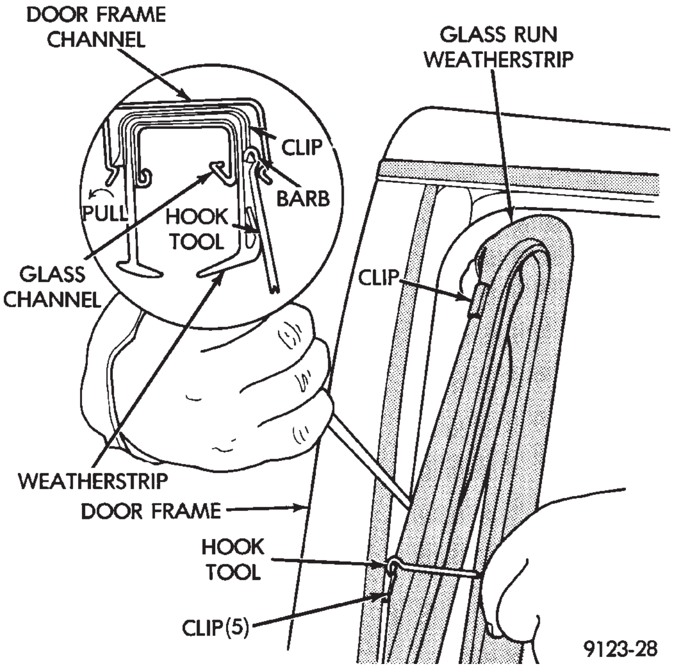


Fig. 19 Front Door Glass Channel and Run Weatherstrip

FRONT DOOR GLASS RUN LOWER CHANNEL

FRONT OR REAR LOWER CHANNEL REMOVAL (FIG. 20)

(1) Remove door glass channel and run weatherstrip as necessary to gain access to lower channels and attaching rivets.

(2) Drift punch rivet center expansion pins from each pop-rivet fastener holding channel to door panel or mirror support frame.

(3) Drill pop-rivet fasteners out of door panel or mirror support frame and separate front or rear channel from door.

FRONT OR REAR LOWER CHANNEL INSTALLATION

(1) Install lower channel into at design location.

(2) Install pop-rivets using a suitable pop-rivet gun.

(3) Install Glass channel and run weatherstrip.

(4) Install belt moulding and weatherstrip assembly.

(5) Install door glass.

(6) Install window opening lower corner seals.

(7) Install door water shield silencer pad and trim panel.

FRONT DOOR WINDOW REGULATOR/MANUAL

MANUAL WINDOW REGULATOR REMOVAL (FIG. 21)

(1) Remove trim panel, silencer pad, and water shield.

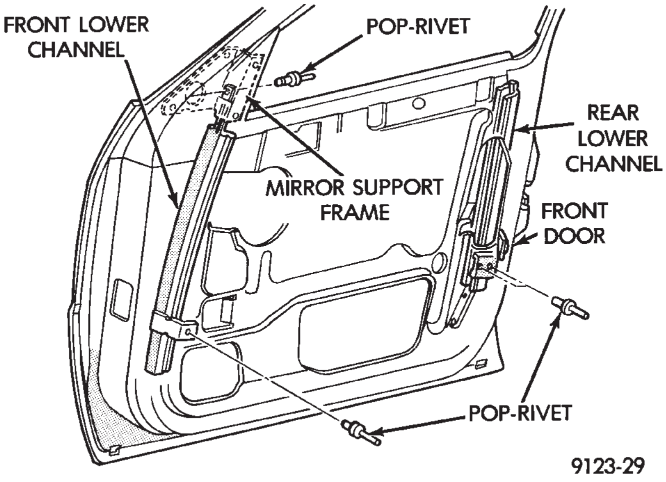


Fig. 20 Front Door Lower Channels

(2) Raise glass to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(3) Remove bolts holding window regulator to inner door panel.

(4) Slide roller from window lift channel. Rotate regulator

to bring lift arm through access hole first.

(5) Remove regulator assembly from door.

MANUAL WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

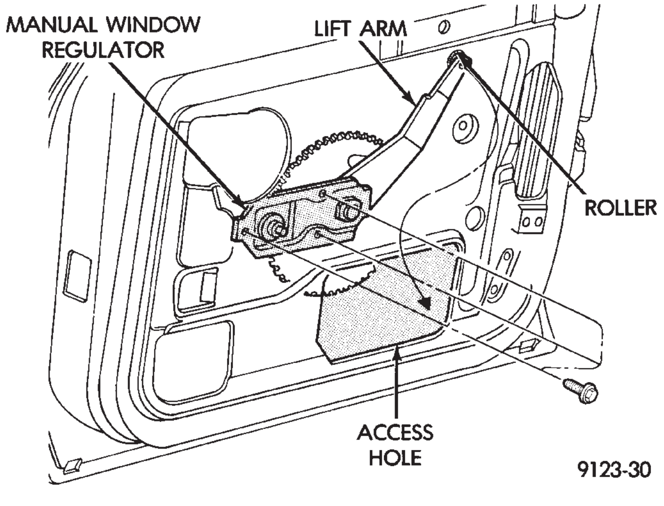


Fig. 21 Front Door Window Regulator—Manual

FRONT DOOR WINDOW REGULATOR/POWER

POWER WINDOW REGULATOR REMOVAL (FIG. 22)

(1) Remove trim panel and water shield and connect window switch to wire connector.

(2) Raise glass to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(3) Disconnect battery negative cable.

(4) Remove bolts holding window regulator to inner door panel.

(5) Slide roller from window lift channel. Rotate regulator

to bring lift arm through access hole first.

(6) Remove regulator assembly from door.

POWER WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

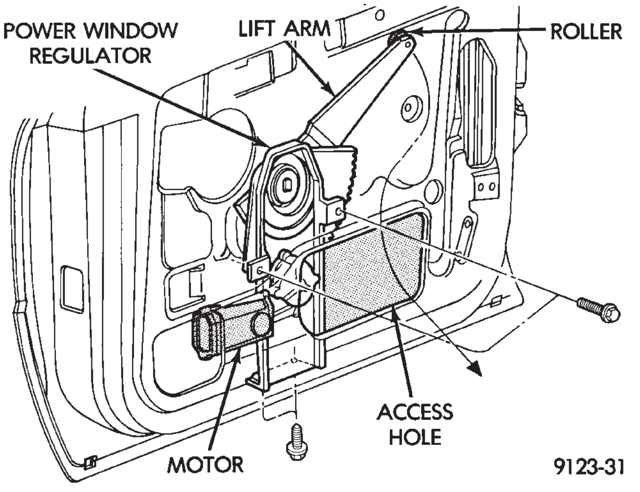


Fig. 22 Front Door Window Regulator—Power

FRONT POWER DOOR LOCK ACTUATOR

REMOVAL (FIG. 23)

(1) Remove trim panel, silencer pad, and water shield.

(2) Disconnect link rod from door latch.

(3) Remove bolts holding power door lock actuator to inner door panel and separate actuator from door.

INSTALLATION

Reverse the preceding operation.

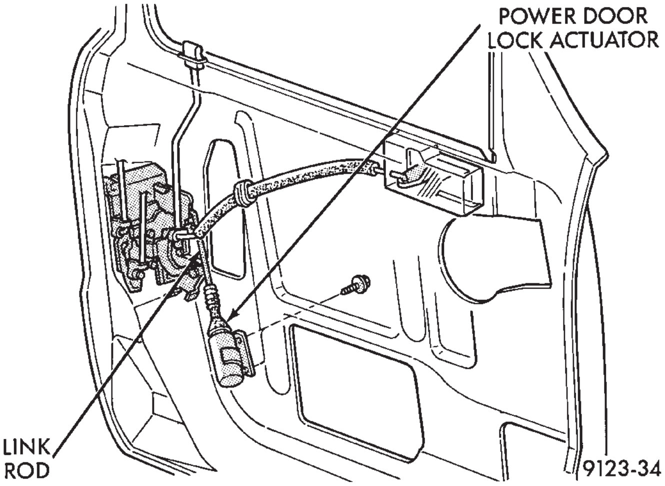


Fig. 23 Front Power Door Lock Actuator

REAR DOOR TRIM PANEL

DOOR TRIM PANEL WITH POWER WINDOWS REMOVAL (FIG. 24)

(1) Move glass to down position.

(2) Disconnect battery negative cable.

(3) Remove screw holding latch release handle bezel to door. Slide bezel forward and separate from door trim.

(4) Remove ash tray. Remove screw holding trim panel to door from ash tray opening.

(5) Pry power window switch from retainer in door trim and disconnect wire connector.

(6) Using a suitable trim clip tool, disengage frog leg clips at the ends and bottom of trim panel. After all trim clips are loose, push inward at the top of the trim panel and lift upward to disengage barb fasteners at top of panel. Separate trim from door.

DOOR TRIM PANEL WITH POWER WINDOWS INSTALLATION

Reverse the preceding operation.

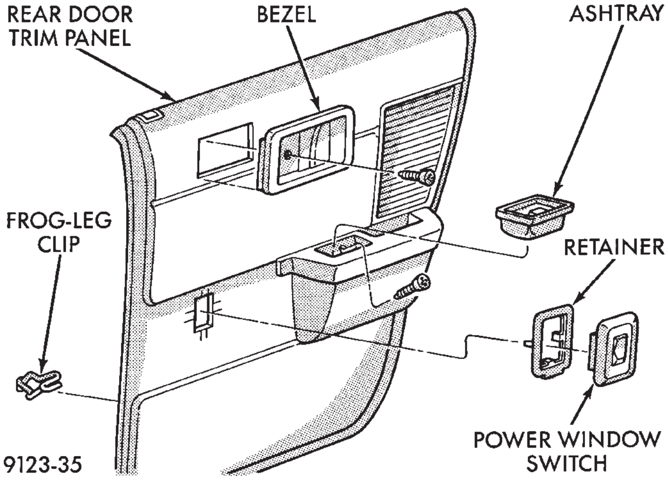


Fig. 24 Rear Door Trim Panel with Power Windows

DOOR TRIM PANEL WITH MANUAL WINDOWS REMOVAL (FIG. 25)

(1) Move glass to down position.

(2) Remove screw holding latch release handle bezel to door. Slide bezel forward and separate from door trim.

(3) Remove ash tray. Remove screw holding trim panel to door from ash tray opening.

(4) Pry window crank cap from crank. Remove screw holding crane to regulator and separate from door

(6) Using a suitable trim clip tool, disengage frog leg clips at the ends and bottom of trim panel. After all trim clips are loose, push inward at the top of the trim panel and lift upward to disengage barb fasteners at top of panel. Separate trim from door.

DOOR TRIM PANEL WITH MANUAL WINDOWS INSTALLATION

Reverse the preceding operation.

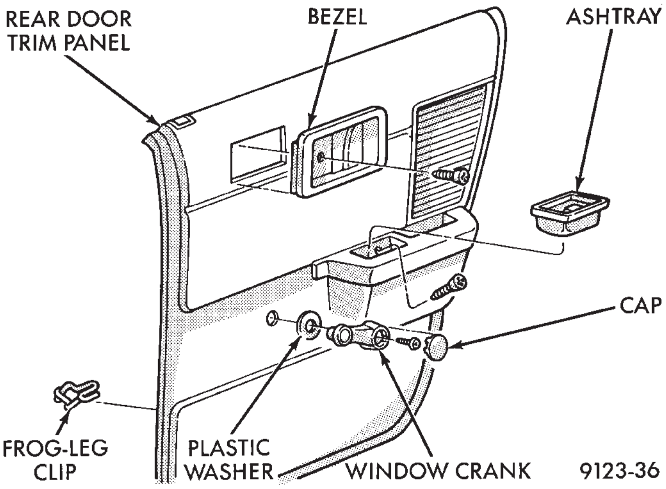


Fig. 25 Rear Door Trim Panel with Manual Window

REAR DOOR SILENCER AND WATER SHIELD

REMOVAL (FIG. 26)

(1) Remove door trim panel.

(2) Remove push-in fasteners holding silencer pad to door inner panel and separate silencer from door.

(3) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

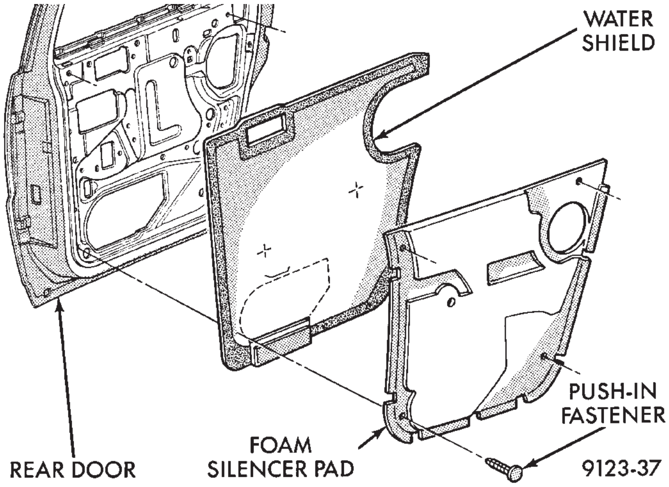


Fig. 26 Rear Door Silencer and Water Shield

REAR DOOR AND HINGE

The rear door hinge is welded to the door and bolted to the B-pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

REAR DOOR REMOVAL (FIG. 27)

(1) Remove B-pillar trim panel and disconnect all wire connectors leading to door. Push wire harness through access hole in B-pillar into hinge opening.

(2) Support door on a suitable lifting device.

(3) Drive bottom hinge pin upward and remove pin from hinge.

(4) Drive top hinge pin downward and remove pin from hinge.

(5) Separate door from vehicle.

REAR DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Rear Door Hinge Installation paragraph in this section.

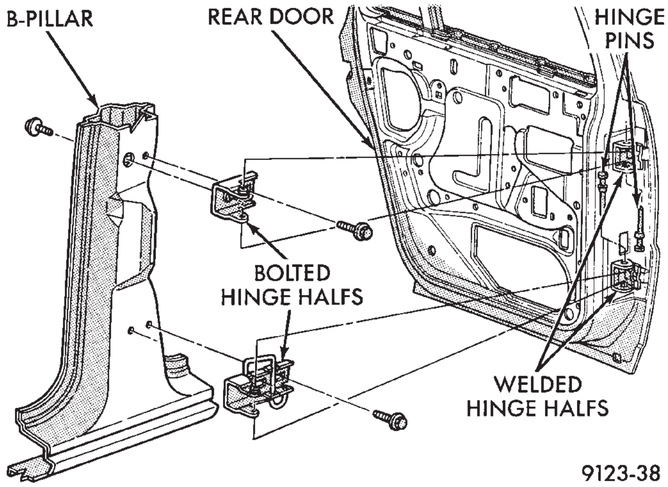


Fig. 27 Rear Door Assembly

REAR DOOR HINGE REMOVAL (FIG. 27)

(1) To remove upper hinge bolted half, remove B-pillar trim panel. To remove lower hinge bolted half it is not necessary to remove B-pillar trim.

(2) Support rear door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to B-pillar and separate hinge form vehicle.

REAR DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

OUTSIDE REAR DOOR LATCH RELEASE HANDLE

REMOVAL (FIG. 28)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Remove rear door speaker, if equipped.

(4) Disconnect latch release rod from door latch assembly.

(5) Remove nuts holding outside door latch handle to retainer bracket and separate bracket from door.

(6) Separate latch handle from door panel.

INSTALLATION

Reverse the preceding operation.

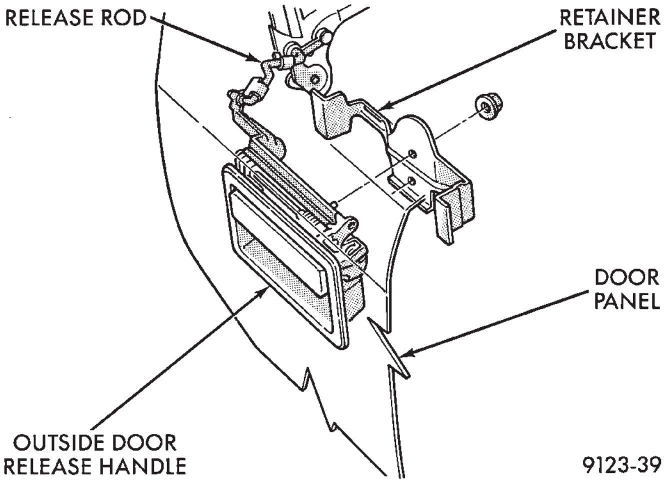


Fig. 28 Outside Rear Door Latch Release Handle

REAR DOOR LATCH

REMOVAL (FIG. 29)

(1) Remove door trim panel, silencer pad and water shield.

(2) Raise door glass to full up position.

(3) Remove door speaker, if equipped.

(4) Disconnect all actuator rods from door latch assembly.

(5) Remove screws holding door latch assembly to inner door rear panel and separate from door.

INSTALLATION

Reverse the preceding operation.

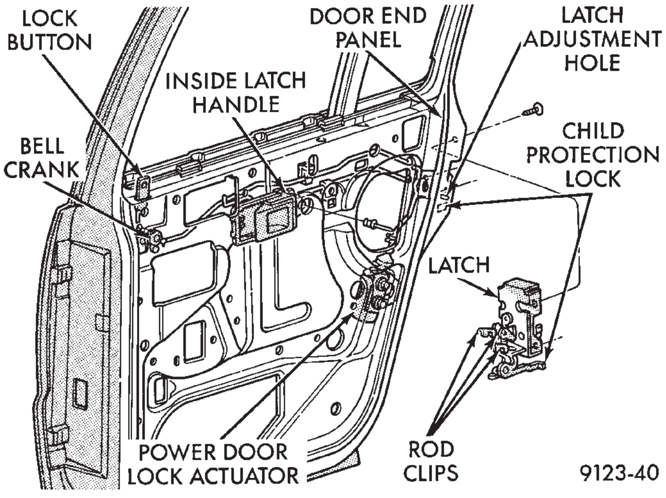


Fig. 29 Rear Door Latch Assembly

REAR POWER DOOR LOCK ACTUATOR

REMOVAL (FIG. 30)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Remove door speaker, if equipped.

(4) Disconnect actuator rod from door latch assembly.

(5) Remove screws holding power lock actuator to inner door panel and separate from door.

INSTALLATION

Reverse the preceding operation.

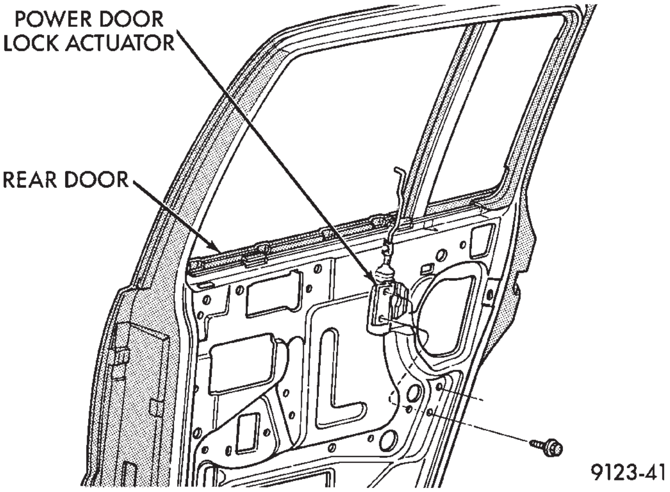


Fig. 30 Rear Power Lock Actuator

REAR DOOR GLASS

REMOVAL (FIG. 31)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Position door glass half way up in door glass opening.

(3) Pull upward firmly at the front upper corner of glass to disengage lower glass guide from run channel.

(4) Insert door glass removal tool C-4867 between the glass slide and division run channel retaining lip at approximately 50 mm (2 in.) down from top rearward corner of glass. Push handle of tool toward glass to open channel. Pull forward on the glass to separate the slide from the channel.

(5) Position glass inboard of the division channel. Pivot top of glass rearward between division channel and inner door panel.

(6) Separate regulator lift arm roller from glass lift channel. Hold regulator lift arm outward and lift glass upward.

(7) Remove door glass through opening at top of door.

INSTALLATION

(1) Lower door glass into opening at top of door.

(2) Insert window regulator lift arm roller into glass lift channel.

(3) Push top of glass rearward to snap top slide into division run channel.

(4) Push downward at front of glass to snap bottom slide into channel.

(5) Install water shield, silencer pad and trim panel.

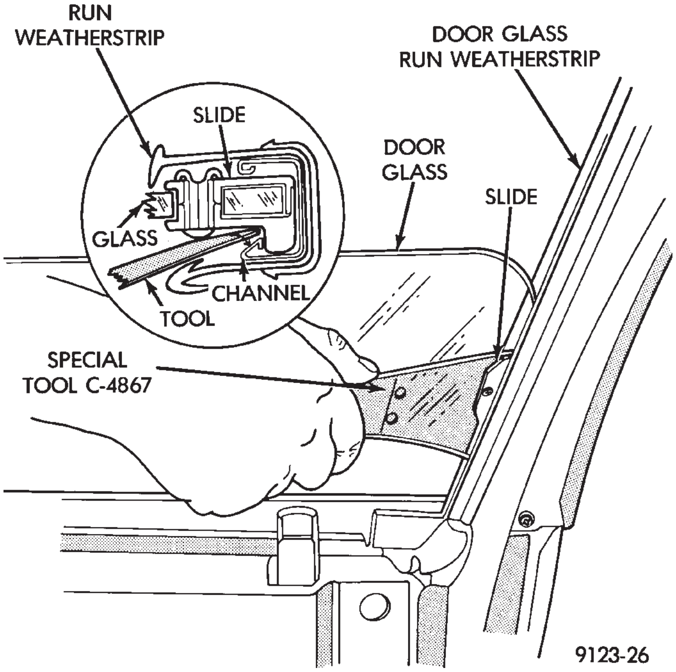


Fig. 31 Rear Door Glass

REAR DOOR BELT MOULDING AND WEATHERSTRIP

BELT MOULDING AND WEATHERSTRIP REMOVAL (FIG. 32)

(1) Remove trim panel, silencer pad, and water shield.

(2) Remove door glass.

(3) Remove screws holding belt moulding and weatherstrip to outer door panel and separate moulding from door.

BELT MOULDING AND WEATHERSTRIP INSTALLATION

Reverse the preceding operation.

REAR DOOR GLASS RUN WEATHERSTRIP

REMOVAL (FIG. 33)

(1) Remove door belt moulding and weatherstrip assembly.

(2) Pull door glass run weatherstrip from forward lower channel and upper door frame back to division channel.

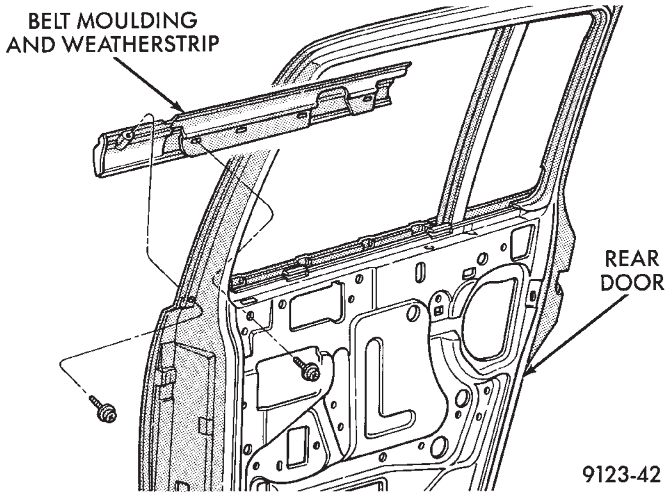


Fig. 32 Rear Door Belt Moulding and Weatherstrip

(3) Separate glass run weatherstrip from door.

INSTALLATION

(1) Insert glass run weatherstrip into top of glass opening upper channel. Align molded corner of weatherstrip to upper front corner of glass opening.

(2) Push weatherstrip into upper rear corner of door frame above division channel.

(3) Install door belt moulding and weatherstrip assembly.

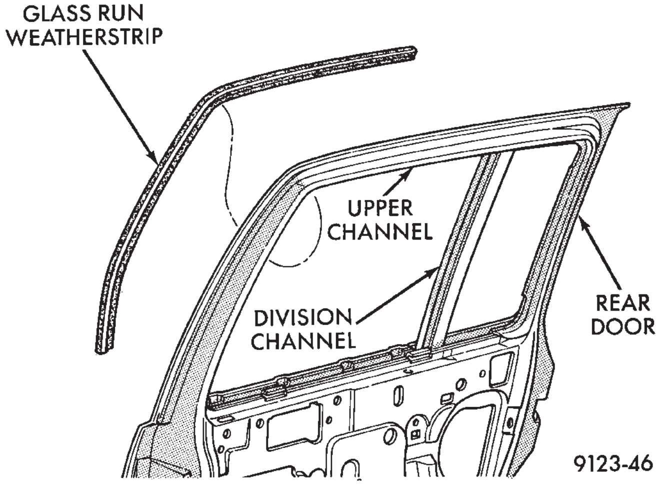


Fig. 33 Rear Door Glass Run Weatherstrip

REAR DOOR GLASS STATIONARY GLASS MODULE

STATIONARY GLASS MODULE REMOVAL (FIG. 34)

(1) Remove belt moulding and weatherstrip assembly.

(2) Remove upper window opening moulding.

(3) Remove bolts and screws holding division channel and glass module to door assembly and separate module from door frame.

(4) Remove module through opening at top of door.

STATIONARY GLASS MODULE INSTALLATION

Reverse the preceding operation. Use two sided adhesive tape to secure module weatherstrip to inside of door frame.

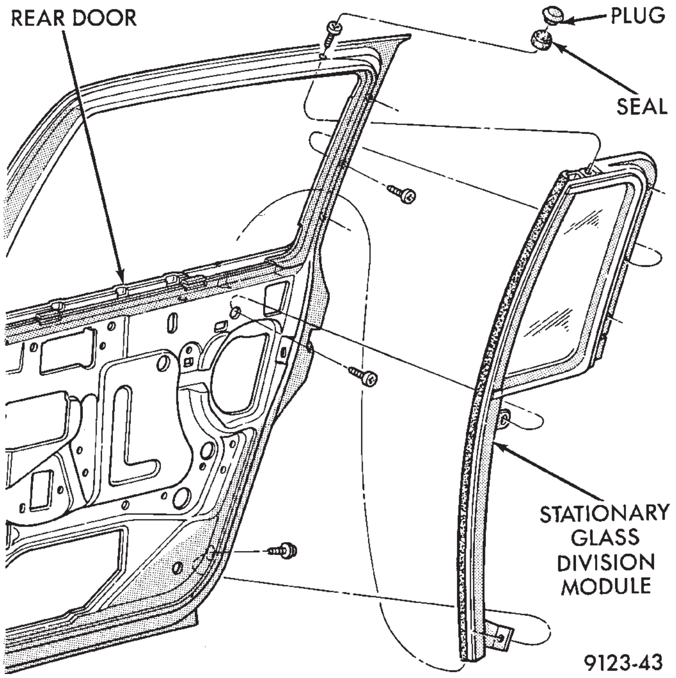


Fig. 34 Rear Door Stationary Glass Module

REAR DOOR WINDOW REGULATOR/MANUAL

MANUAL WINDOW REGULATOR REMOVAL (FIG. 35)

(1) Remove trim panel, silencer pad, and water shield.

(2) Position door glass 150 mm (6 in.) up into glass opening. Pull upward firmly at front edge of glass to disengage lower glass run guide from division channel.

(3) Remove bolts holding window regulator to inner door panel.

(4) Slide roller from window lift channel.

(5) By hand, pull glass upward to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(6) Remove regulator assembly from door.

MANUAL WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

REAR DOOR WINDOW REGULATOR/POWER

POWER WINDOW REGULATOR REMOVAL (FIG. 36)

(1) Remove trim panel, silencer pad, and water shield.

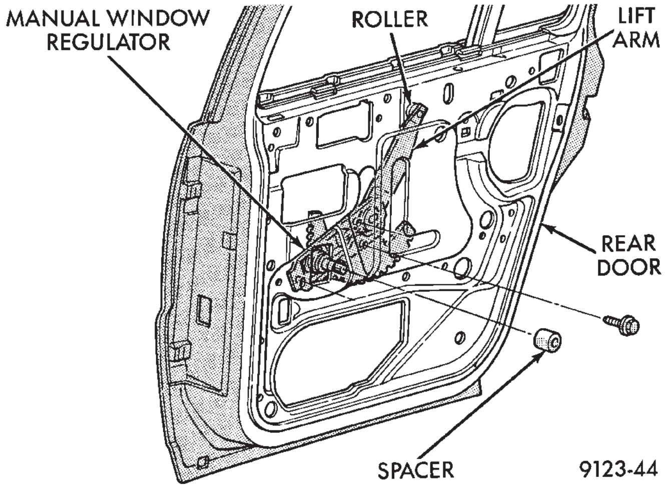


Fig. 35 Rear Door Window Regulator—Manual

(2) Position door glass 150 mm (6 in.) up into glass opening. Firmly pull upward at front edge of glass to disengage lower glass run guide from division channel.

(3) Remove bolts holding window regulator to inner door panel.

(4) Slide roller from window lift channel.

(5) By hand, pull glass upward to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(6) Remove regulator assembly from door.

POWER WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

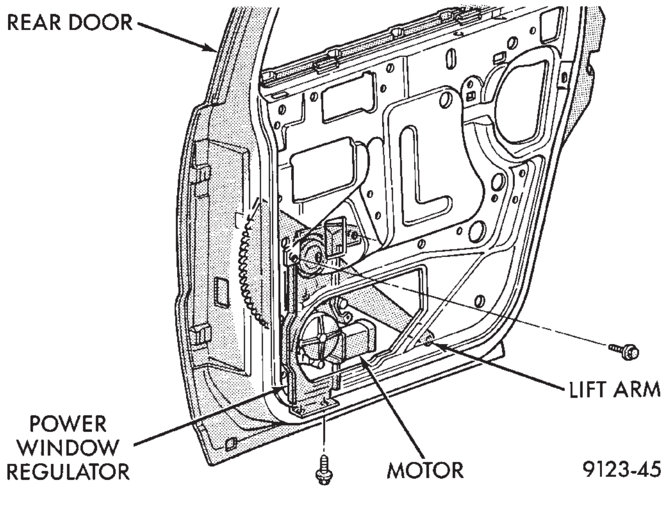


Fig. 36 Rear Door Window Regulator—Power

DOOR OPENING WEATHERSTRIPS

FRONT OR REAR DOOR OPENING WEATHERSTRIP REMOVAL (FIG. 37)

(1) Remove interior trim as necessary to gain access to door opening weatherstrip.

(2) Pull weatherstrip from pinch flange around door opening.

FRONT OR REAR DOOR OPENING WEATHERSTRIP INSTALLATION

(1) Locate the middle to the weatherstrip at the center of the upper pinch flange. Push weatherstrip onto pinch flange at the top corner near the B-pillar.

(2) When the weatherstrip has been installed down the door opening to the sill pinch flange, mate the ends of the weatherstrip together and finish installing.

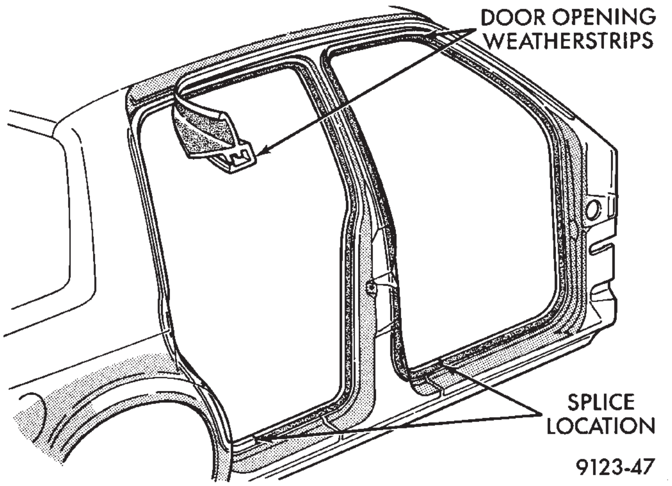


Fig. 37 Door Opening Weatherstrips

BODY SIDE MOULDING AND APPLIQUE

STICK-ON BODY SIDE MOULDING REMOVAL AND INSTALLATION (FIG. 38)

(1) Warm the effected stick-on moulding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(2) Pull stick-on moulding from painted surface.

(3) Remove adhesive tape residue from painted surface of vehicle.

(4) If moulding is to be reused, Remove tape residue from moulding. Clean back of moulding with Mopar, Super Kleen solvent or equivalent. Wipe moulding dry with lint free cloth. Apply new body side moulding (two sided adhesive) tape to back of moulding.

(5) Clean body surface with Mopar, Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(6) Apply a length of masking tape on the body, parallel to the top edge of the moulding to use as a guide, if necessary.

(7) Remove protective cover from tape on back of moulding. Apply moulding to body below the masking tape guide.

(8) Remove masking tape guide and heat body and moulding, see step one. Firmly press moulding to body surface to assure adhesion.

WHEEL OPENING AND BODY SIDE MOULDING REMOVAL AND INSTALLATION (FIG. 38)

FRONT FENDER

(1) Remove screws holding wheel opening moulding to front fender.

(2) Pry bottom of body side moulding from clip on front fender using a suitable trim stick. Lift moulding from clip and separate from fender.

(3) Replace damaged moulding clip weld studs with repair screws. Paint bare metal surfaces behind moulding to avoid rust.

(4) Position moulding in wheel opening and start top center screw of wheel opening moulding.

(5) Hook top of body side moulding over clip and snap bottom of moulding onto clip.

(6) Install screws around wheel opening.

DOORS

(1) Pry bottom of body side moulding from clips on door using a suitable trim stick. Lift moulding from clip and separate from door.

(2) Replace damaged moulding clip weld studs with repair screws. Paint or undercoat bare metal surfaces behind moulding to avoid rust.

(3) Position moulding on door in design location.

(4) Hook top of moulding over clips and snap bottom of moulding onto clips.

QUARTER PANEL

(1) Remove screws holding wheel opening moulding to quarter panel.

(2) Pry bottom of body side moulding from clip on quarter panel using a suitable trim stick. Lift moulding from clip and separate from fender.

(3) Replace damaged moulding clip weld studs with repair screws. Paint or undercoat bare metal surfaces behind moulding to avoid rust.

(4) Position moulding in wheel opening and start top center screw of wheel opening moulding.

(5) Hook top of body side moulding over clip and snap bottom of moulding onto clip.

(6) Install screws around wheel opening.

APPLIQUE MOULDING AND RETAINER REMOVAL (FIG. 38)

(1) Remove screws holding applique to rocker panel from under vehicle.

(2) Lift applique upward to separate from retaining channel.

(3) Remove pop-rivets holding retainer to rocker panel using a suitable drill.

APPLIQUE MOULDING AND RETAINER INSTALLATION

(1) Install applique retainer on rocker panel with pop-rivets. Paint or undercoat bare metal surfaces to avoid rust.

(2) Hook top of applique over retainer channel and install screws under rocker panel.

COWL PANEL TRIM AND SCUFF PLATES

COWL PANEL AND DOOR OPENING SCUFF PLATE REMOVAL (FIG. 39)

(1) Open front door.

(2) Remove screw holding trim panel to cowl forward of the front door opening.

(3) Remove screws holding scuff plate to door sill.

(4) Separate cowl panel trim and scuff plate from vehicle.

COWL PANEL AND DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

REAR DOOR OPENING SCUFF PLATE REMOVAL (FIG. 39)

(1) Open rear door.

(2) Remove screws holding scuff plate to door sill.

(3) Separate scuff plate from vehicle.

REAR DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

A-PILLAR AND ROOF RAIL MOULDINGS

A-PILLAR MOULDING REMOVAL (FIG. 39)

(1) Open front door.

(2) Disengage clips holding A-pillar moulding to roof rail above door opening.

(3) Slide A-pillar moulding upward and pull rearward to separate moulding from A-pillar.

A-PILLAR MOULDING INSTALLATION

Reverse the preceding operation.

REAR DOOR ROOF RAIL MOULDING REMOVAL (FIG. 39)

(1) Open rear door.

(2) Disengage clips holding roof rail moulding to roof rail above rear door opening.

(3) Separate moulding from vehicle.

REAR DOOR ROOF RAIL MOULDING INSTALLATION

Reverse the preceding operation.

B-PILLAR TRIM PANEL

B-PILLAR TRIM PANEL REMOVAL (FIG. 39)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to B-pillar.

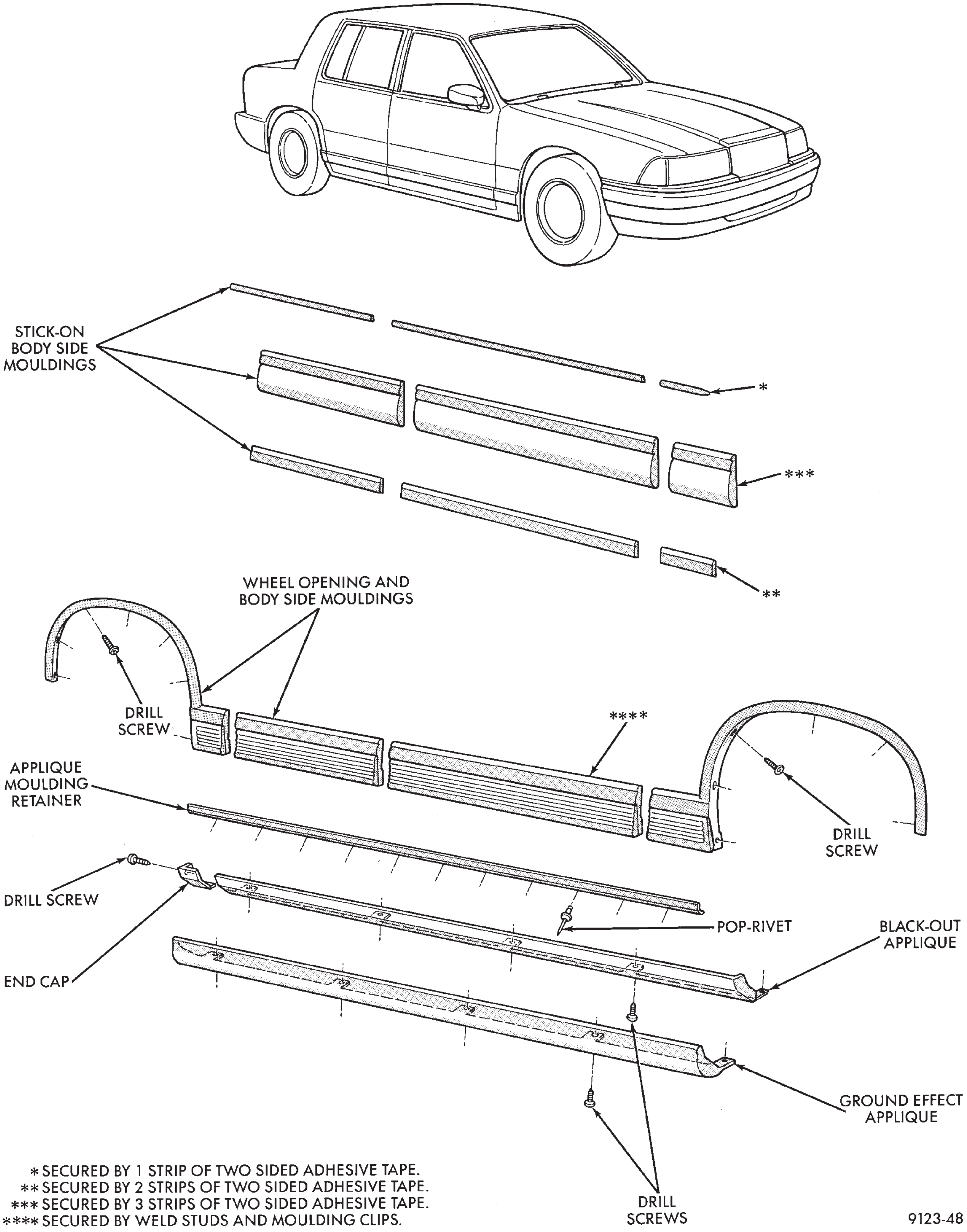


Fig. 38 Body Side Mouldings

(3) Remove bolt holding seat belt to floor below B-pillar.

(4) Lift B-pillar trim off door opening sill weatherstrips and push inward.

(5) Slide B-pillar trim downward as far as possible and separate trim from B-pillar.

B-PILLAR TRIM PANEL INSTALLATION

Reverse the preceding operation.

QUARTER TRIM PANEL

REMOVAL (FIG. 39)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to quarter panel.

(3) Remove rear seat cushion, back, and rear bolster.

(4) Remove push-in fastener holding quarter trim to roof rail.

(5) Remove screws holding quarter trim panel to wheelhouse kickup.

(6) Pull trim panel forward and separate from vehicle.

INSTALLATION

Reverse the preceding operation.

QUARTER EXTENSION TRIM PANEL

REMOVAL (FIG. 39)

(1) Remove rear seat cushion, back, and rear bolster.

(2) Disengage clips holding expansion trim panel to shelf panel.

(3) Separate trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR SHELF TRIM PANEL

REMOVAL (FIG. 39)

(1) Remove one quarter trim panel.

(2) Remove center high mounted stop lamp cover. Refer to Group 8L, Lamps for instructions.

(3) Disengage frog leg fasteners holding trim to shelf panel and separate trim from vehicle.

INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 40)

(1) Remove B-pillar trim panel.

(2) Remove bolt holding seat belt retractor to B-pillar.

(3) Separate retractor from vehicle.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

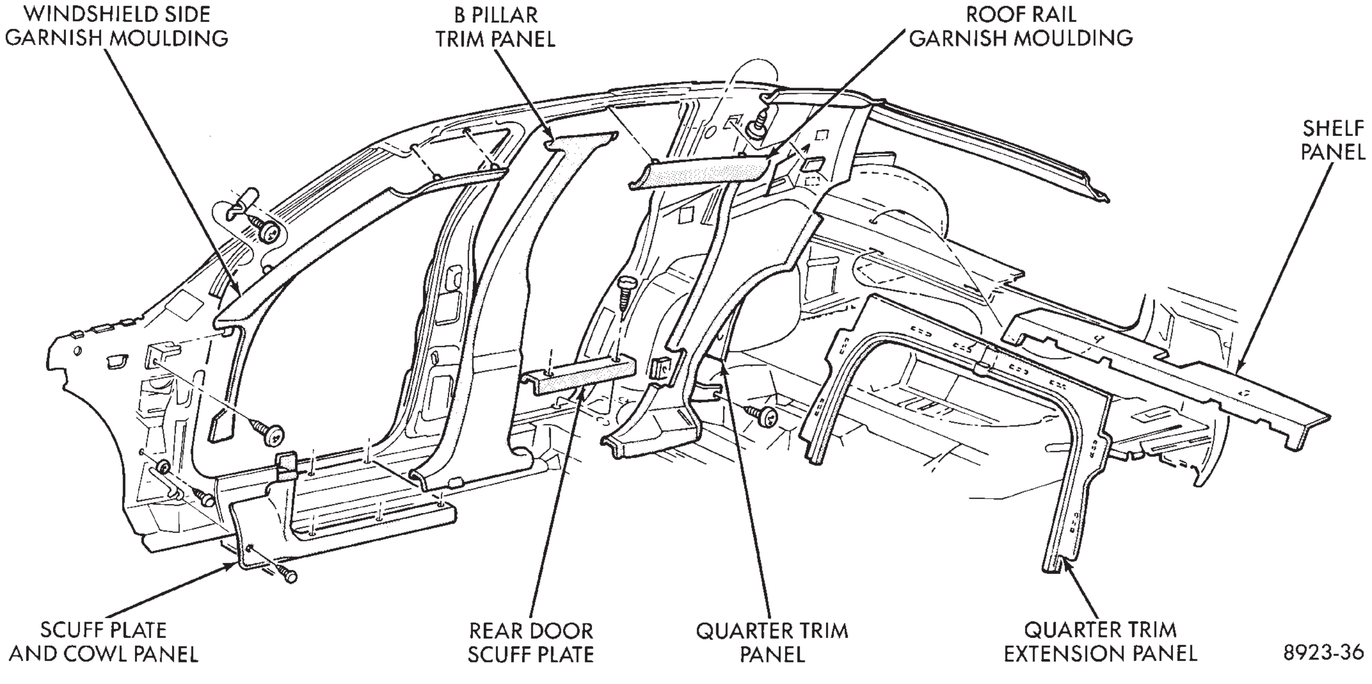


Fig. 39 Interior Mouldings, Panels, and Trim Covers

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 40)

Vehicles equipped with front bucket seats with center console do not have center occupant belts.

(1) Remove bolt holding inboard buckle/center occupant belt to floor.

(2) Disconnect seat belt sensor wire connector.

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

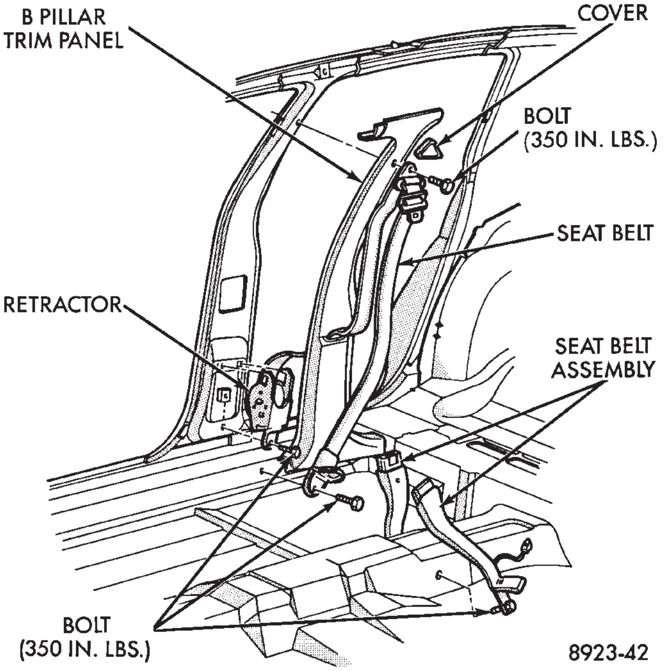


Fig. 40 Front Seat Belts

REAR SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 41)

(1) Remove quarter trim panel.

(2) Remove bolt holding lap belt to floor at wheelhouse kickup.

(3) Remove bolt holding seat belt retractor to quarter panel.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 41)

(1) Remove rear seat cushion.

(2) Remove bolt holding inboard buckle/center occupant belt to floor.

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

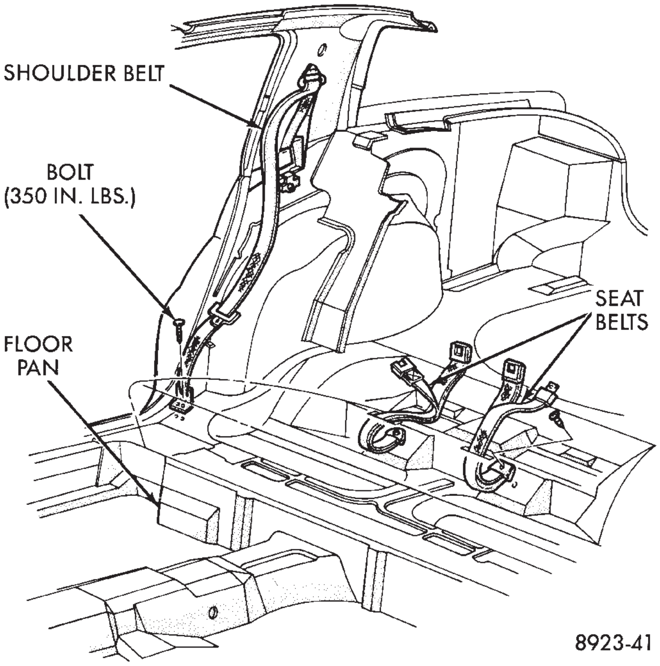


Fig. 41 Rear Seat Belts

FRONT SEATS

REMOVAL (FIG. 42 OR 43)

(1) Position seat full forward.

(2) Remove screws holding rear track riser covers and separate covers from tracks.

(3) On power seat track, remove outboard track cover.

(4) On 50/50 seats, remove inboard seat belt attaching bolt from floor.

(5) Remove nuts holding seat track to floor.

(6) Position seat full rearward.

(7) On power seat track, remove door sill scuff plate and disconnect wire connector.

(8) Remove bolts holding seat track to cross member.

(9) Remove seat from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR SEATS

REAR SEAT CUSHION REMOVAL

(1) Remove bolts holding cushion to floor.

(2) Push center occupant seat belts through openings in cushion.

(3) Remove cushion from vehicle.

REAR SEAT CUSHION INSTALLATION

Reverse the preceding operation.

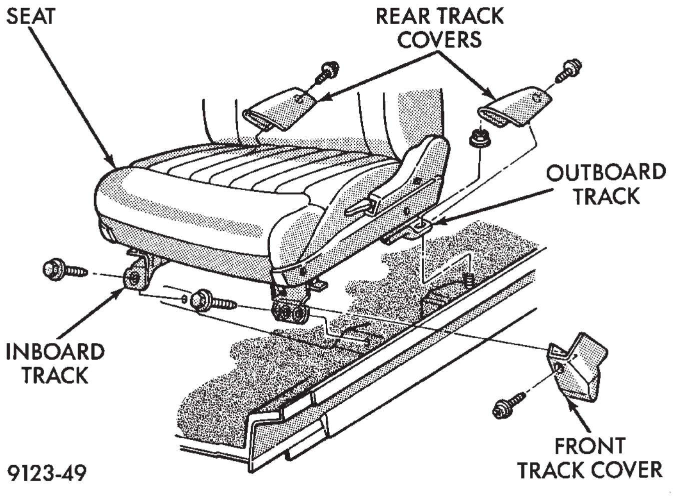


Fig. 42 Manual Front Seat

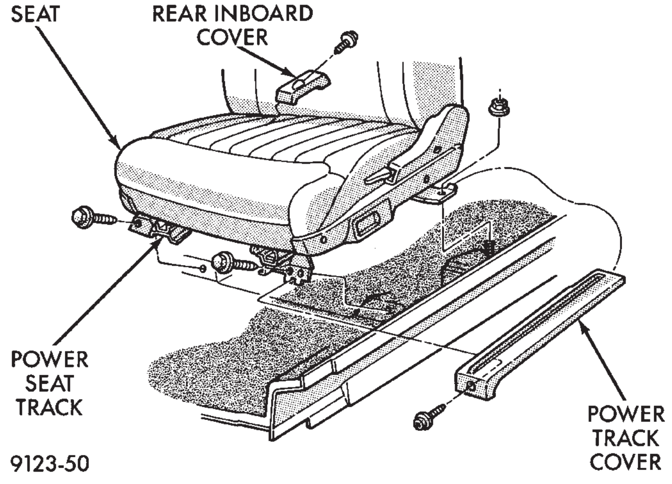


Fig. 43 Power Front Seat

REAR SEAT BACK REMOVAL (FIG. 44)

(1) Hinge seat back forward and disengage push-in fasteners holding carpet backing to trunk floor.

(2) Remove bolts holding outboard hinge pivot bracket to seat back.

(3) Pull seat back outward to disengage inboard pivot and separate from vehicle.

REAR SEAT BACK INSTALLATION

Reverse the preceding operation.

SEAT BACK BOLSTER CUSHION REMOVAL (FIG. 44)

(1) Remove rear seat cushion and back as necessary.

(2) Remove bolts holding outboard back bolster to quarter panel.

(3) Lift bolster upward to disengage hook retainer on back of bolster and separate from vehicle.

SEAT BACK BOLSTER CUSHION INSTALLATION

Reverse the preceding operation

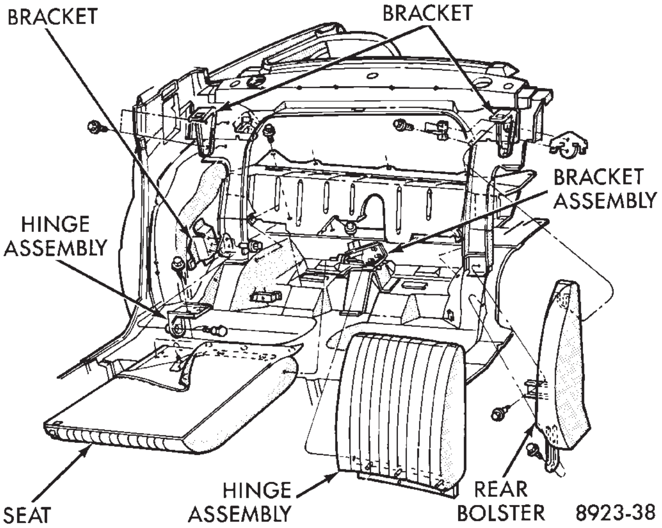


Fig. 44 Rear Seat Cushion and Back

FRONT CENTER CONSOLE

REMOVAL (FIG. 45)

(1) Position front seats full forward.

(2) Remove access hole plugs on sides of center arm rest riser and remove bolts holding riser to floor bracket.

(3) Remove coin holder and remove screws holding arm rest riser to front console.

(4) Position front seats full rearward.

(5) Remove radio bezel from instrument panel. Refer to Group 8E, Instrument Panel. Remove screws holding console to instrument panel.

(6) Remove screws holding console to lower instrument panel rail.

(7) Remove screws and disengage hook and loop fastener holding carpet panels to sides of console and separate panels from console.

(8) Remove screws holding console to forward floor mounting bracket.

(9) Remove set screw holding gear selector knob to shift lever and pull knob from shifter on vehicles with automatic transaxle.

(10) Lift forward edge of PRNDL cover and separate cover from console on vehicles with automatic transaxle.

(11) Lift gear shift boot adapter from console and push adapter through opening in console on vehicles with manual transaxle.

(12) Separate console from floor and remove from vehicle.

INSTALLATION

Reverse the preceding operation. On vehicles with automatic transaxle, verify gear selector indicator adjustment before returning vehicle to use.

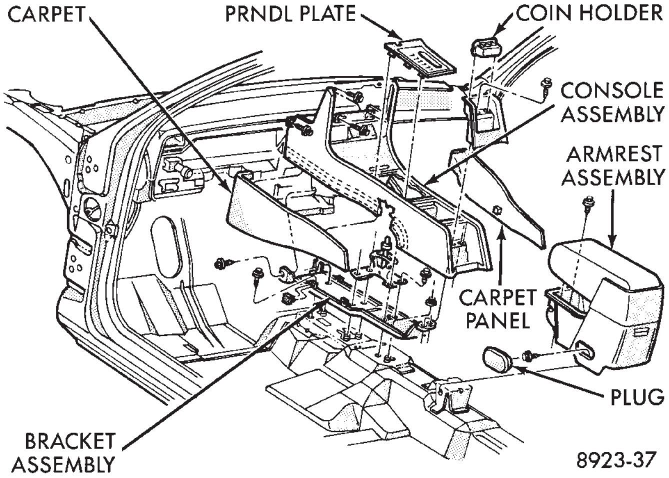


Fig. 45 Front Center Console

FLOOR CARPET

REMOVAL (FIG. 46)

(1) Remove cowl trim panels and scuff plates.

(2) Remove front seats and inboard seat belts.

(3) Remove center arm rest and front console.

(4) Remove outboard seat belt lower attaching bolts.

(5) Remove rear seat cushion.

(6) Pull carpet from under B-pillar trim covers.

(7) Fold carpet and remove through front door opening.

INSTALLATION

Reverse the preceding operation.

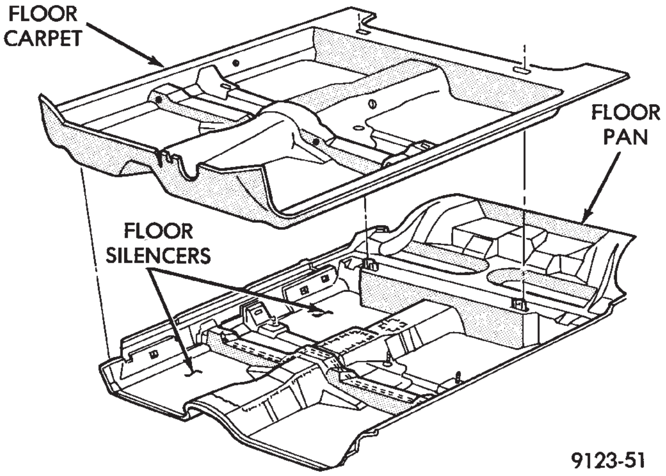


Fig. 46 Floor Carpet and Silencers

OVERHEAD CONSOLE

REMOVAL (FIG. 47)

(1) Remove screws holding overhead console to reinforcement bracket.

(2) Slide overhead console rearward to separate reinforcement bracket retainer tab from console.

(3) Lower console from roof and disconnect wire connectors.

INSTALLATION

Reverse The preceding operation.

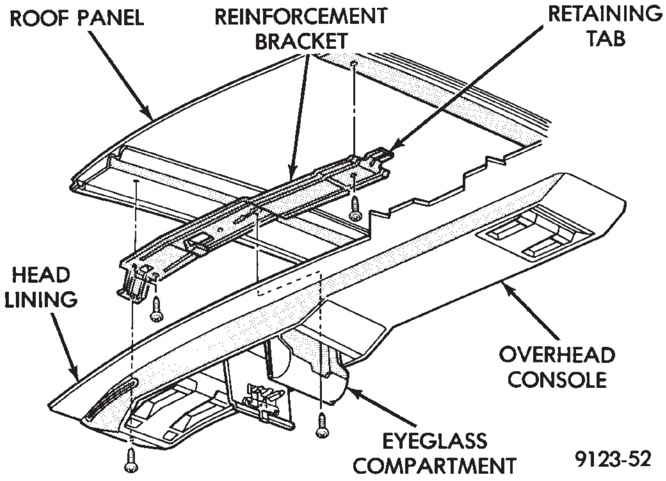


Fig. 47 Overhead Console

HEAD LINING

REMOVAL (FIG. 48)

(1) Disconnect battery negative cable.

(2) Pull dome lamp downward to disengage from retaining ring in head lining. Separate lens from lamp body and remove bulb. Separate bulb holder from lamp body. Remove attaching screw holding retaining ring to roof bow.

(3) Remove screws holding coat hooks to roof above rear doors.

(4) Remove roof rail and A-pillar mouldings.

(5) Remove screws holding sun visors to roof header and disconnect wire connector, if equipped. Remove inboard sun visor hangers.

(6) Remove overhead console, if equipped.

(7) Pull front reading lamp downward to disengage from retaining ring in head lining and disconnect wire connector. Remove screws holding retaining ring to roof header.

(8) Remove pinch welt holding headlining to sun roof opening, if equipped.

(9) Remove inside rear view mirror from windshield bracket if necessary.

(10) Disengage hook and loop fasteners holding head lining to roof above rear window and slide head lining forward about 25 mm (1 in.).

(11) Shift the front of head lining to one side to pull head lining from behind B-pillar trim. Pull head lining from behind other B-pillar trim.

(12) Allow front of head lining to drop downward. Slide head lining forward from behind quarter panel trim.

(13) Remove head lining from vehicle.

INSTALLATION

Reverse the preceding operation.

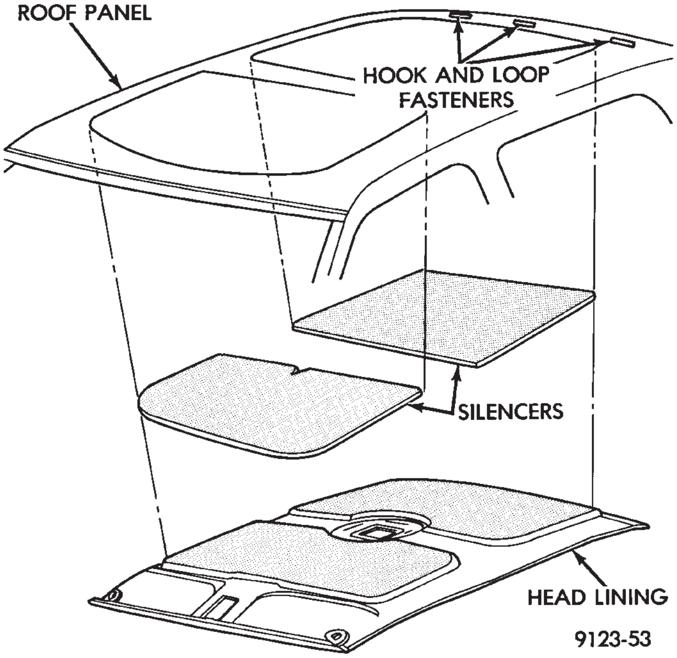


Fig. 48 Head Lining

SUN ROOF WEATHERSTRIP

REMOVAL (FIG. 49)

(1) Remove sun roof sunshade and glass. Refer to Owner's Manual for instructions.

(2) Pull weatherstrip from pinch flange around sun roof opening.

INSTALLATION

Reverse the preceding operation.

SUN ROOF AIR DEFLECTOR

REMOVAL (FIG. 49)

(1) Remove sun roof sunshade and glass. Refer to Owner's Manual for instructions.

(2) Disengage snap-on linkage at rear of air deflector in sun roof opening.

(3) Remove screws holding air deflector to front of sun roof opening.

INSTALLATION

Reverse the preceding operation.

SUN ROOF DRAIN TUBES

REMOVAL (FIG. 49)

(1) Remove head lining as necessary.

(2) Remove A-pillar or B-pillar trim covers as necessary.

(3) Remove cowl panel and sill plate trim as necessary.

(4) Disconnect effected drain tube from nipple at sun roof opening.

(5) Pull drain tube upward to remove from pillar involved.

INSTALLATION

Reverse the preceding operation. Route the tube to avoid kinks or puncture from sharp edges.

VINYL ROOF BONNET

REMOVAL (FIG. 50)

(1) Remove quarter panel trim covers.

(2) Remove head lining.

(3) Remove nuts holding transverse roof moulding to roof panel and separate moulding from vehicle.

(4) Remove nuts holding vinyl top bonnet to roof.

(5) Remove rear deck filler panel.

(6) Remove screws holding rear window opening lower valance to body.

(7) Disengage hook and loop fasteners holding vinyl top bonnet to quarter panels.

(8) Pull vinyl top bonnet away from top panel to separate bonnet from anti-flutter sealer holding bonnet to roof.

INSTALLATION

(1) Clean anti-flutter sealer from roof surface and inside of vinyl roof bonnet.

(2) Apply a 20 mm (0.75 in.) bead of anti-flutter sealer across the roof panel at the mid point between the front of the bonnet and rear of roof.

(3) Apply a 20 mm (0.75 in.) by 150 mm (6 in.) bead of anti-flutter sealer down each roof side panel at mid point between the door opening and rear of roof.

(4) Place the bonnet into position on the roof panel and align to proper fit.

(5) Reverse the removal operation.

REAR DECK FILLER PANEL

REMOVAL (FIG. 51)

(1) Raise truck lid to full up position.

(2) Remove screws holding rear deck filler panel to body in the front trunk opening gutter.

(3) Close trunk lid, do not latch.

(4) Lift filler panel upward and separate from vehicle.

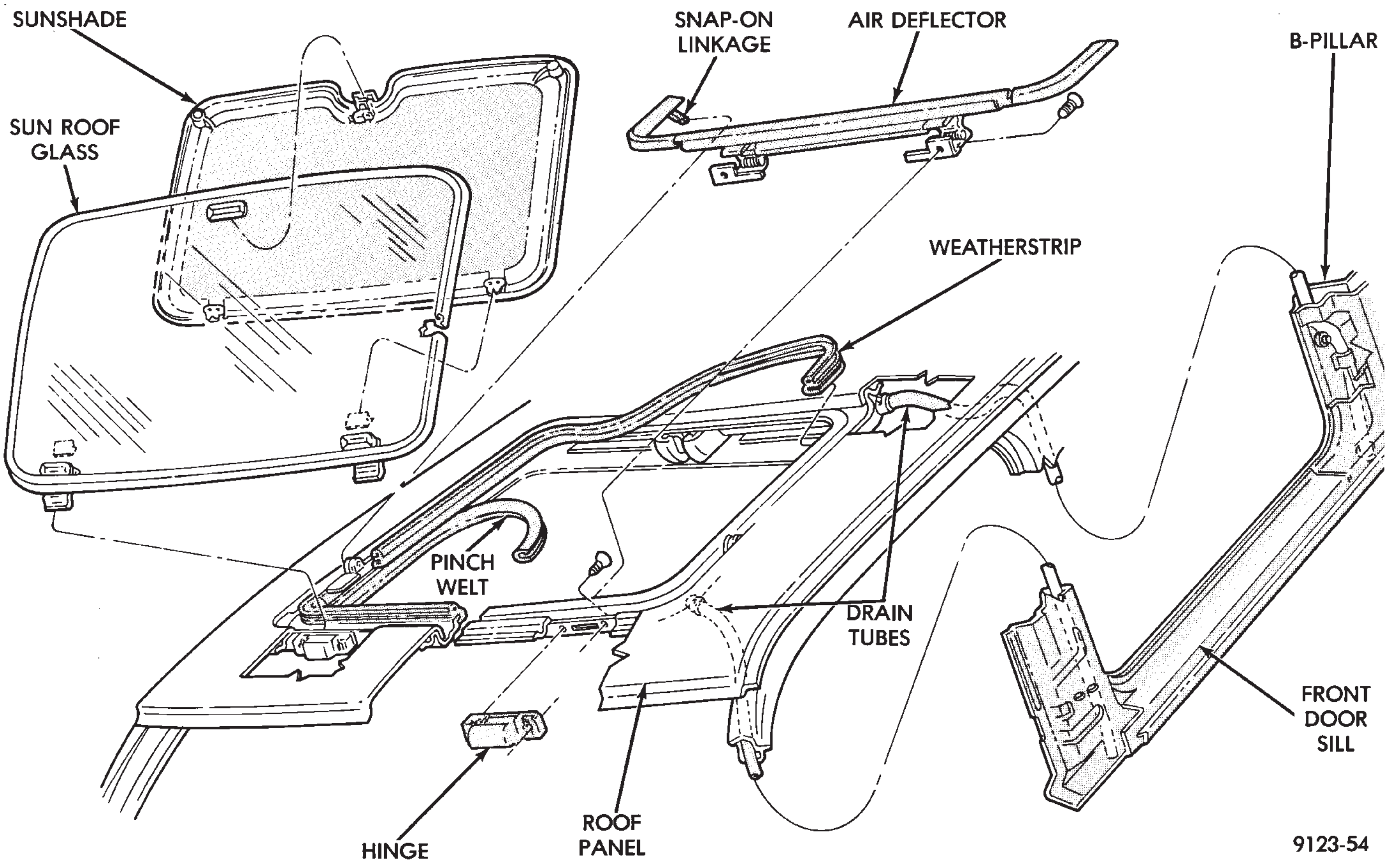


Fig. 49 Sun Roof

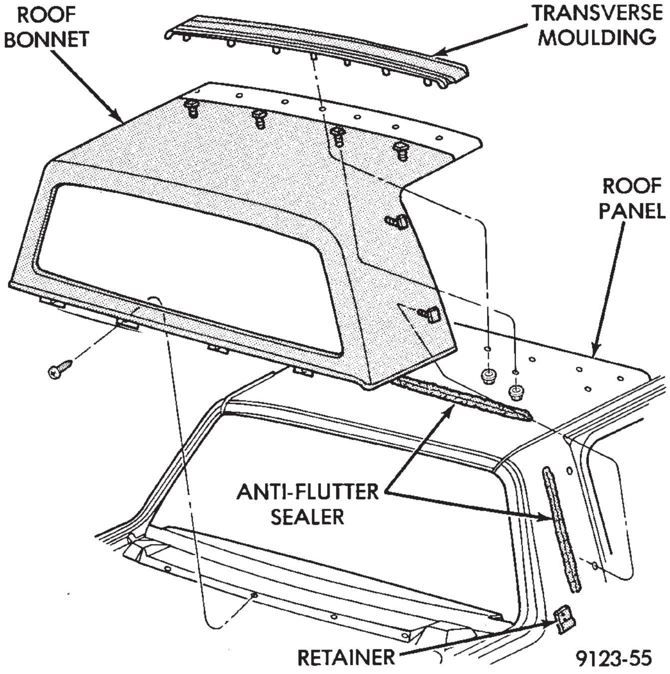


Fig. 50 Vinyl Roof Bonnet

INSTALLATION

Reverse the preceding operation.

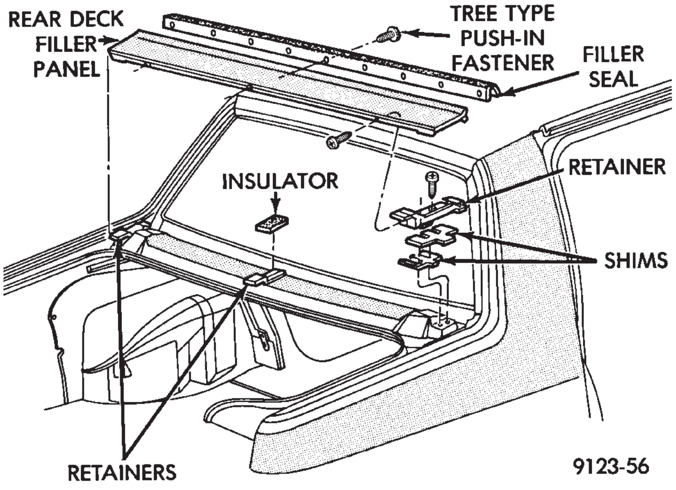


Fig. 51 Rear Deck Filler Panel

REAR WINDOW GLASS

REMOVAL (FIG. 52)

The rear window moulding often cannot be salvaged after removal operation is completed. Verify moulding availability from the parts supplier before removing moulding.

(1) Remove rear deck filler panel.

(2) Pull rear window moulding from between glass and roof panel.

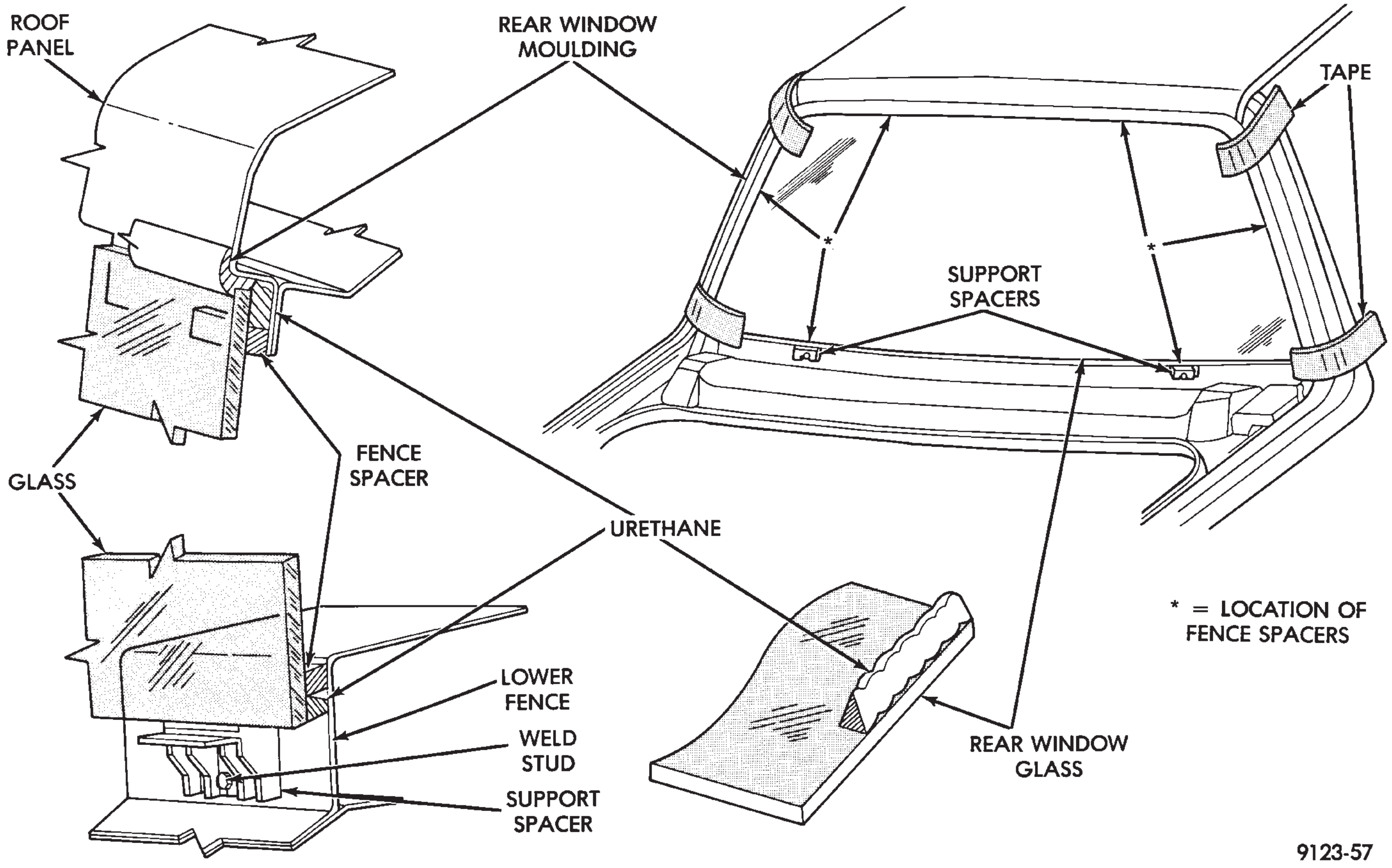


Fig. 52 Rear Window Glass

(3) Remove interior trim as necessary to gain access to rear window defogger wire connector and ground screw, if equipped.

(4) Remove vinyl roof bonnet, if equipped.

WARNING: WEAR EYE AND HAND PROTECTION WHEN HANDLING SAFETY GLASS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not damage body or trim finish when cutting out glass or applying fence primer.

(5) Cut the urethane around the perimeter of the rear window glass. Refer to Windshield section of this group for proper procedures.

(6) Separate the rear window from the vehicle.

INSTALLATION

(1) Prepare the work area, window fence, and glass the same way as described in the Windshield section of this group.

(2) Place the fence spacers at the locations shown (Fig. 52).

(3) Apply a 10 mm (0.4 in.) bead of urethane around the perimeter of the glass.

(4) Install the glass in the same manner described in the Windshield section of this group.

(5) Install the rear window moulding in the gap between the glass and the roof panel.

(6) Secure moulding and glass in position with suitable tape. Remove tape after urethane has cured.

(7) Connect rear window defogger wiring. Install interior trim and rear deck filler panel.

(8) After urethane has cured, water test rear window to verify repair. Verify rear window defogger operation, see Group 8N, Rear Window Defogger.

TRUNK LID

REMOVAL (FIG. 53)

(1) Raise trunk lid to full up position.

(2) Disconnect the trunk lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing trunk lid, align all marks and secure bolts. The trunk lid should be aligned to 4 mm (0.160 in.) gap to the quarter panels and flush across the top surfaces along quarter panels.

(4) Remove the top trunk lid to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the trunk lid, remove the

bottom trunk lid to hinge attaching bolts. Separate the trunk lid from the vehicle.

INSTALLATION

Reverse the preceding operation.

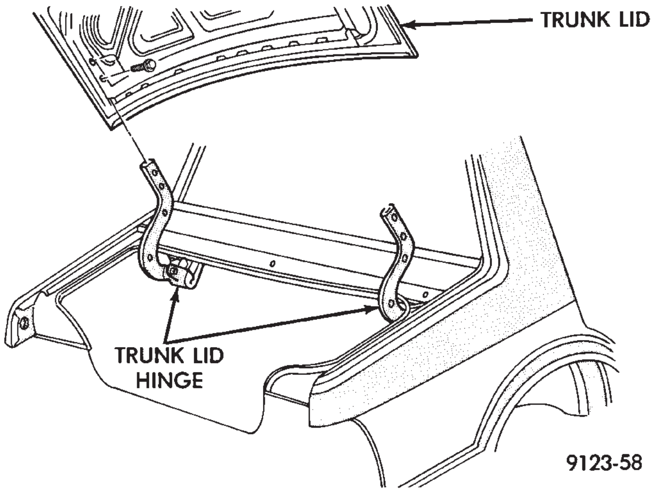


Fig. 53 Trunk Lid

TRUNK LID HINGE

REMOVAL (FIG. 54)

(1) Remove rear deck filler panel.

(2) Disconnect trunk lid lift torsion bars from hinges.

(3) Mark all attaching bolt, nut, and component locations with a suitable marking device. Use marks as a reference when installing hinge.

(4) Remove bolts holding trunk lid to hinge.

(5) Remove nuts and bolts holding hinge to closure panel below rear window glass.

(6) Separate hinge from vehicle.

INSTALLATION

Reverse the preceding operation.

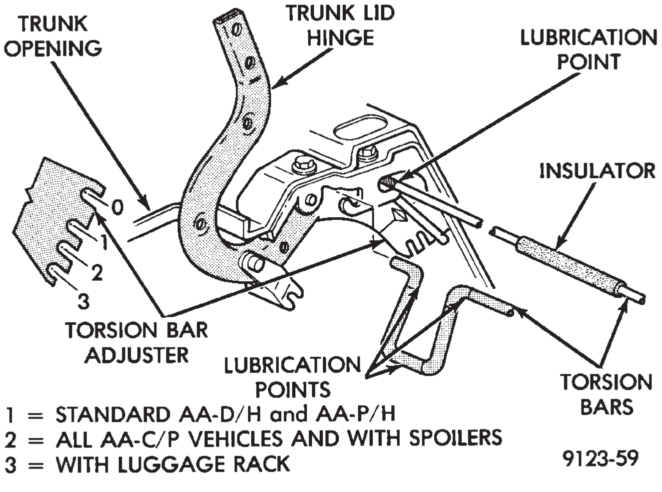


Fig. 54 Trunk Lid Hinge

TRUNK LID TORSION BAR

REMOVAL (FIG. 54)

(1) Raise and support trunk lid in the full up position.

(2) Remove trunk lining as necessary to gain access to torsion bars.

(3) Disengage adjusting end of torsion bar from the slot in the tension adjustment bracket.

(4) Pivot torsion bar out of lift arm swivel.

(5) Disconnect torsion bar from hinge.

INSTALLATION

Reverse the preceding operation.

TRUNK LID LATCH

REMOVAL (FIG. 55)

(1) Raise trunk lid to the full up position.

(2) Remove screws holding trim cover to latch and separate cover from vehicle.

(3) Disconnect remote release cable from latch.

(4) Disconnect trunk lock linkage rod from trunk latch, on AA-P and D models.

(5) Remove bolts holding latch to trunk lid and separate latch from vehicle.

INSTALLATION

Insert trunk lock chill into latch release driver, on AA-C models and reverse the preceding operation.

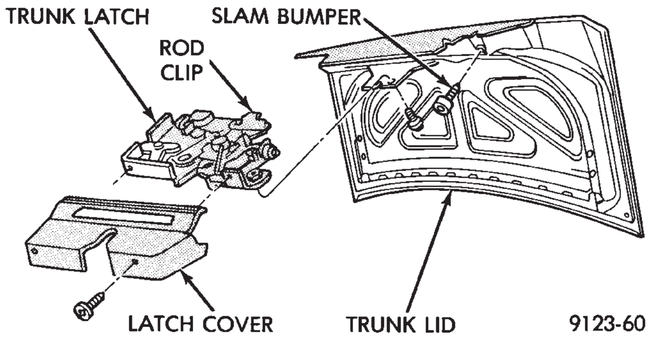


Fig. 55 Trunk Lid Latch

TRUNK LID LOCK

REMOVAL (FIG. 56)

AA-P/D MODELS

(1) Remove trunk lid tail light assembly. Refer to Group 8L, Lamps for proper procedures.

(2) Remove screws holding latch release linkage cover to trunk lid and separate cover from vehicle.

(3) Disconnect linkage rod from lock cylinder lever.

(4) Remove nut holding lock cylinder to trunk lid and separate lock from vehicle.

INSTALLATION

Reverse the preceding operation.

REMOVAL (FIG. 56)

AA-C MODELS

(1) Remove trunk lid tail light assembly. Refer to Group 8L, Lamps for proper procedures.

(2) Remove trunk latch.

(3) Remove bolts holding lock cylinder and chill to trunk lid and separate the lock from the vehicle.

INSTALLATION

Reverse the preceding operation.

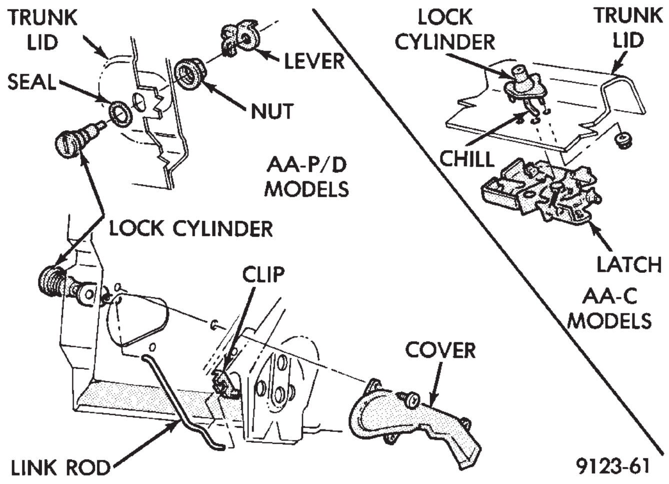


Fig. 56 Trunk Lid Lock

TRUNK OPENING WEATHERSTRIP

REMOVAL(FIG. 57)

(1) Raise trunk lid to the full up position.

(2) Pull the weatherstrip from the pinch flange around the trunk opening.

INSTALLATION

A new trunk lid opening weatherstrip should be heated to approximately 38° C (100° F) before installing. The weatherstrip butt splice should be located at the center rear of trunk opening. Reverse the removal operation. After weatherstrip has been installed, close trunk lid and allow weatherstrip to cool. The weatherstrip will form to the trunk lid contour as it cools.

TRUNK LINING

REMOVAL (FIG. 58)

(1) Remove spare tire and emergency jack from the spare tire well.

(2) Remove screws holding trunk lining to tail closure panel.

(3) Remove screws holding trunk lining to inner quarter panels.

(4) Remove push-in fasteners holding lining to rear seat bulkhead. Remove seat back silencer, if equipped.

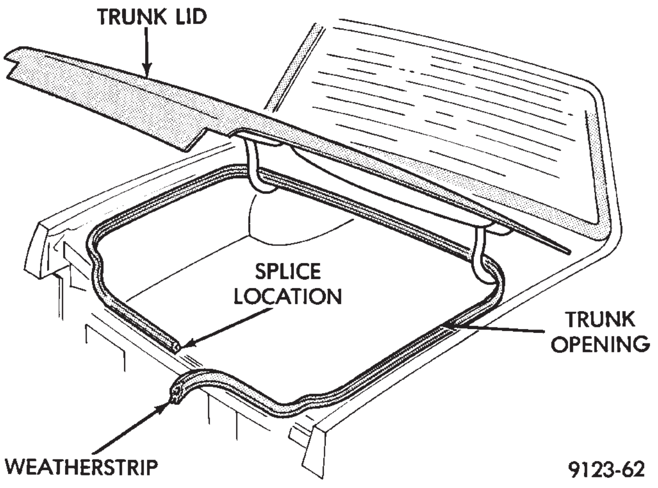


Fig. 57 Trunk Opening Weatherstrip

(5) Remove push-in fasteners holding rear seat back carpet covers to floor pan, if equipped with 60/40 rear seat back.

(6) Fold trunk lining inward, away from quarter panels and remove lining from vehicle.

INSTALLATION

Route the fuel fill door emergency release cable around rear edge of trunk lining side panel and reverse the removal operation.

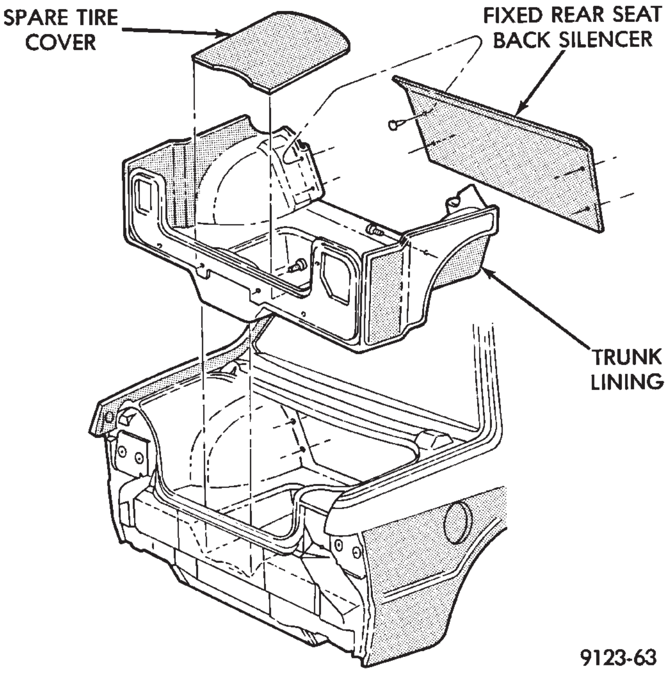


Fig. 58 Trunk Lining

TRUNK LID LUGGAGE RACK

REMOVAL (FIG. 59)

(1) Remove screws holding cross bar to outboard skid strips.

(2) Pry rubber inserts from skid strips.

(3) Remove screws holding skid strips to trunk lid.

INSTALLATION

Reverse the preceding operation

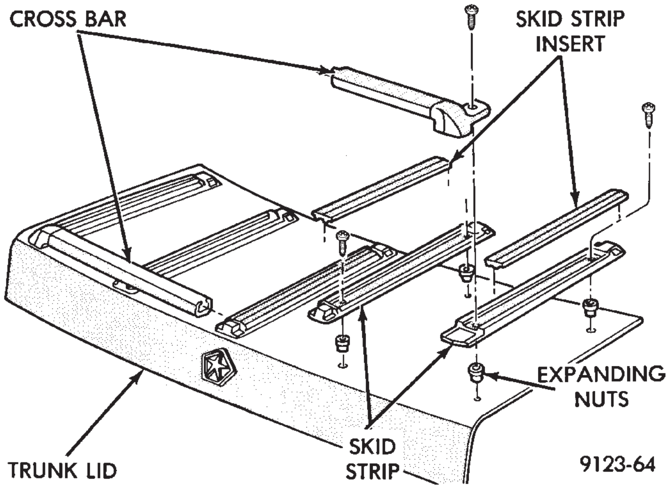


Fig. 59 Trunk Lid Luggage Rack

FUEL FILL DOOR

REMOVAL (FIG. 60)

(1) Open fuel fill door.

(2) Separate trunk lining from right quarter panel.

(3) Remove nuts holding fuel fill door to quarter panel.

(4) Separate fuel fill door from quarter panel opening.

INSTALLATION

Reverse the preceding operation. Align to achieve equal spacing around fuel fill door and flush to the quarter panel.

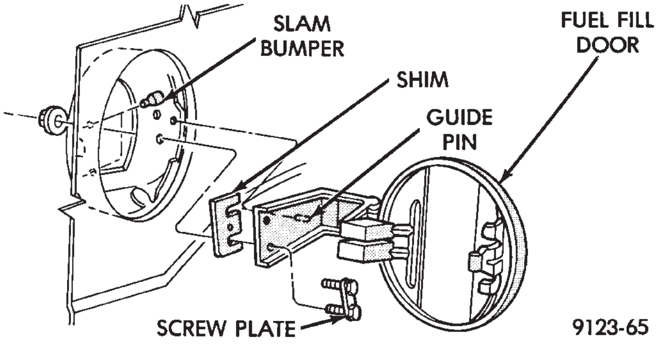


Fig. 60 Fuel Fill Door

AC-VEHICLE BODY COMPONENT SERVICE

INDEX

GRILLE AC/D or AC/C-H BODY

GRILLE REMOVAL (FIG. 1)

(1) Remove screws holding grille to grille opening panel.

(2) Separate grille from vehicle.

GRILLE INSTALLATION

Reverse the preceding operation.

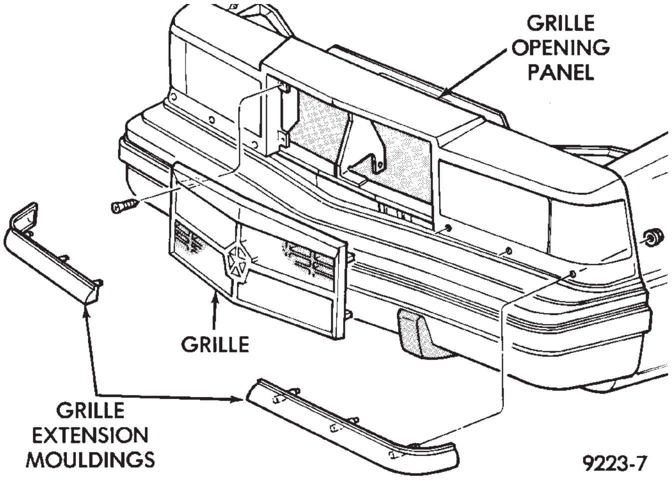


Fig. 1 Grille—AC/D Body

GRILLE EXTENSION MOULDING

REMOVAL (FIG. 1)

(1) Raise vehicle and support on safety stands if necessary.

(2) Remove nuts holding moulding to grille opening panel from behind fascia below headlamps.

(3) Separate moulding from vehicle.

INSTALLATION

Reverse the preceding operation.

GRILLE OPENING PANEL AC/D and AC/C-H BODY

GRILLE OPENING PANEL REMOVAL (FIG. 2)

(1) Remove grille.

(2) Disconnect wire connectors from all front end lighting.

(3) Remove front end splash shields as necessary to gain access to grille opening panel attaching nuts behind front fenders.

(4) Remove nuts holding grille opening panel to front fenders.

(5) Remove bolts holding grille opening panel to center support brace behind grille.

(6) Separate grille opening panel from vehicle.

GRILLE OPENING PANEL INSTALLATION

Reverse the preceding operation.

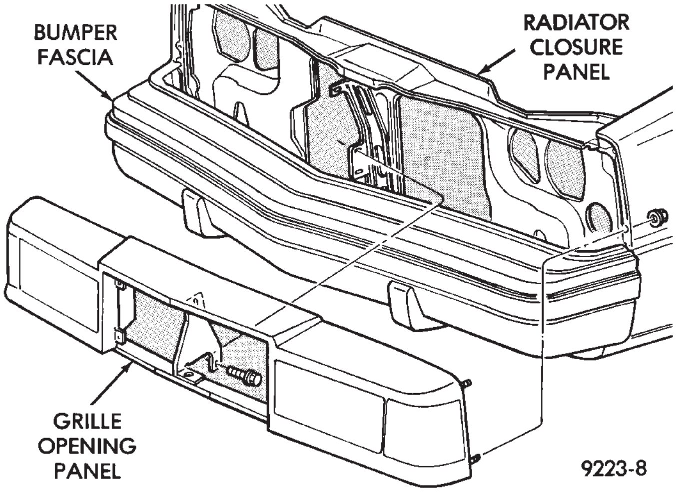


Fig. 2 Grille Opening Panel—AC/D Body

GRILLE AC/C BODY

GRILLE REMOVAL (FIG. 3)

(1) Loosen hidden screws holding grille to grille opening panel at corners of grille. The screws are captured in a clearance hole covered by a bracket behind the grille.

(2) Pull grille forward from grille opening panel.

GRILLE INSTALLATION

Reverse the preceding operation.

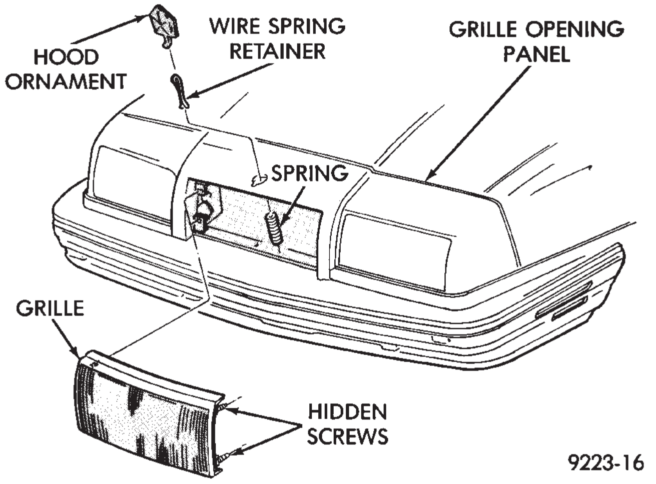


Fig. 3 Grille—AC/C Body

HOOD ORNAMENT AC/C

HOOD ORNAMENT REMOVAL (FIG. 3)

(1) Remove grille.

(2) Locate hood ornament spring under grille opening panel header.

(3) Compress hood ornament spring enough to clear hooks on end of retaining wire.

(4) Squeeze retainer wire hooks together and push hooks inside spring.

(5) Rotate spring counterclockwise to separate spring from retainer.

(6) Separate hood ornament from grille opening panel.

HOOD ORNAMENT INSTALLATION

Reverse the preceding operation.

GRILLE OPENING PANEL AC/C-BODY

For service procedures for headlamp related components refer to Group 8L, Lamps.

REMOVAL (FIG. 4)

(1) Remove front bumper.

(2) Remove front end splash shields as necessary to gain access to behind fenders.

(3) Remove nuts holding mouldings to front fenders.

(4) Remove bolts holding mouldings to bottom of grille opening panel and separate mouldings from vehicle.

(5) Remove nuts holding grille opening panel to front fenders.

(6) Disconnect concealed headlamp motor wire connector.

(7) Disconnect headlamp wire connectors.

(8) Remove bolts holding grille opening panel to radiator closure panel.

(9) Separate grille opening panel from vehicle.

INSTALLATION

Reverse the preceding operation.

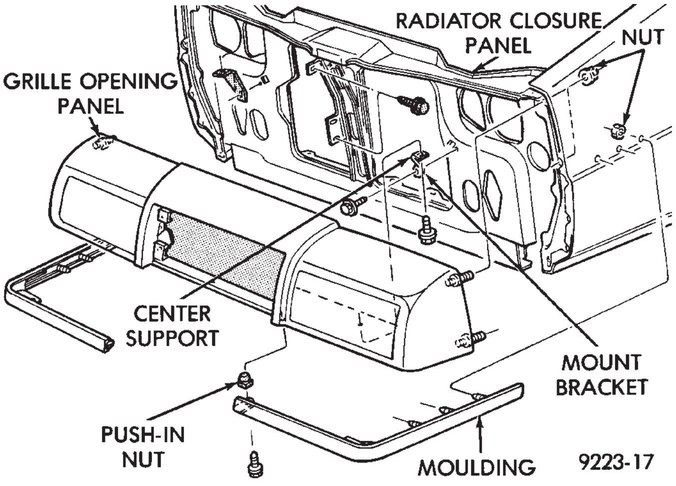


Fig. 4 Grille Opening Panel—AC/C Body

HOOD AND HINGES

HOOD REMOVAL (FIG. 5)

(1) Raise hood to full up position.

(2) Disconnect the under hood lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When install-

ing hood, 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.

(4) Remove the top hood to hinge bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the hood, remove the bottom hood to hinge bolts. Separate the hood from the vehicle.

HOOD INSTALLATION

Reverse the preceding operation.

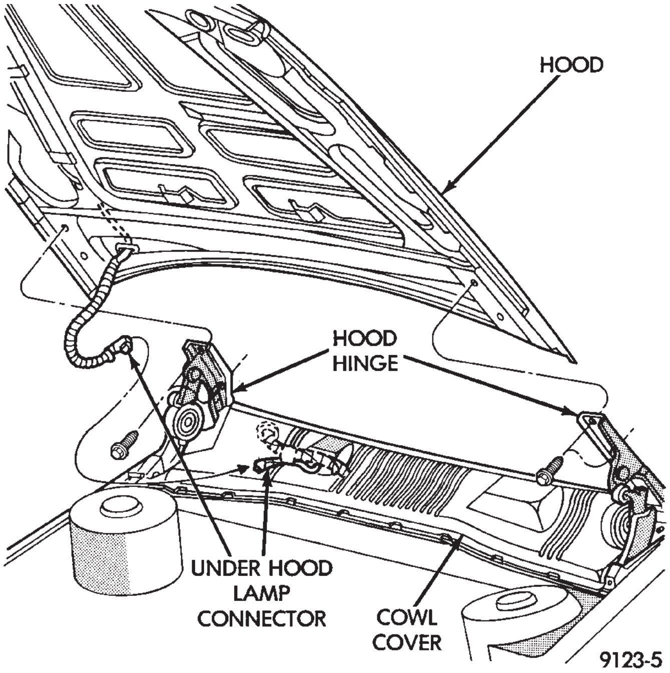


Fig. 5 Hood Remove or Install—Typical

HOOD HINGE REMOVAL (FIG. 6)

(1) Support hood on the side that requires hinge replacement.

(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood hinge, 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.

(3) Remove hood to hinge attaching bolts.

(4) Remove hood hinge to front fender attaching bolts and separate hinge from vehicle.

HOOD HINGE INSTALLATION

Reverse the preceding operation. If necessary, paint new hinge before installation.

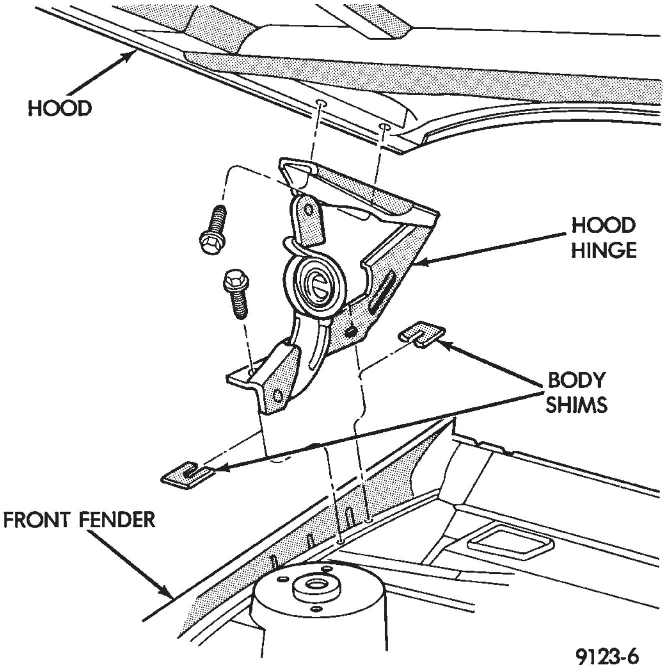


Fig. 6 Hood Hinge Assembly—Typical

HOOD LATCH AND RELEASE CABLE

HOOD LATCH REMOVAL (FIG. 7)

(1) Raise hood top the full up position.

(2) Remove hood latch attaching bolts holding latch to radiator closure panel and separate from vehicle.

(3) Pry release cable casing attachment from slot receiver on latch, disengage cable end from latch arm hook.

HOOD LATCH INSTALLATION

Reverse the preceding operation.

HOOD LATCH RELEASE CABLE

REMOVAL (FIG. 8)

(1) Raise hood to the full up position.

(2) Remove push-in fasteners holding hood latch cover to radiator closure panel and separate cover from vehicle, if equipped.

(3) Disconnect hood release cable casing and cable end from hood latch assembly. Refer to Hood Latch Removal procedure in this section.

(4) Remove hood latch release cable handle attaching bolts from under left lower edge of instrument panel.

(5) Disengage release cable rubber grommet from engine compartment dash panel behind instrument panel.

(6) Rout cable assembly through engine compartment around battery, under fender lip, under relay bank, and under wiring harnesses, toward dash

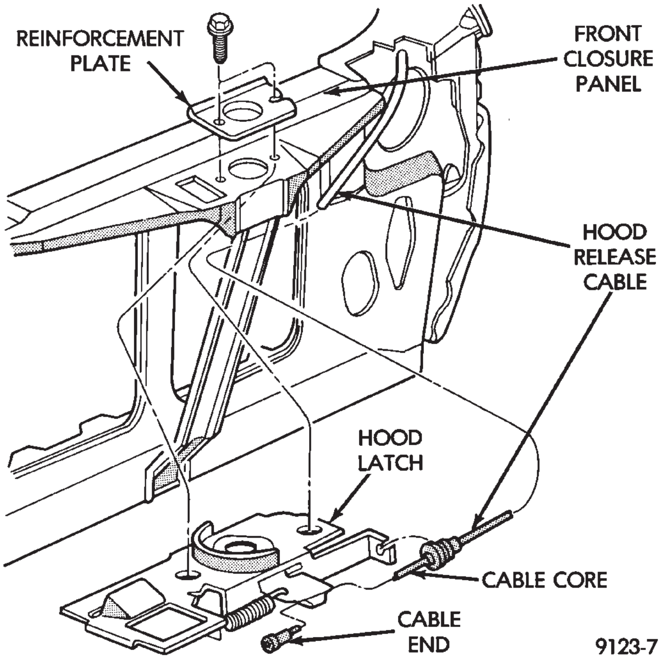


Fig. 7 Hood Latch Assembly

panel. Push cable through access hole in dash panel under the brake master cylinder, into passenger compartment.

INSTALLATION

Reverse the preceding operation.

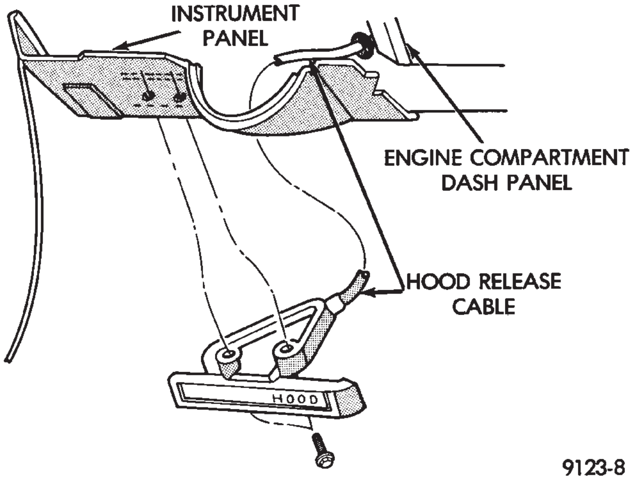


Fig. 8 Hood Latch Release Cable Assembly

FRONT END SPLASH SHIELDS

FRONT WHEELHOUSE SPLASH SHIELD REMOVAL (FIG. 9)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove front wheel assembly.

(3) Remove push-in fasteners holding front wheelhouse splash shield to fender opening lip and inner wheelhouse area.

(4) Separate wheelhouse splash shield from vehicle.

FRONT WHEELHOUSE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

TRANSAXLE SPLASH SHIELD REMOVAL (FIG. 9)

(1) Remove one front wheelhouse splash shield push-in fastener and separate wheelhouse splash shield from transaxle splash shield.

(2) Remove transaxle splash shield attaching bolts and separate transaxle splash shield from vehicle.

TRANSAXLE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

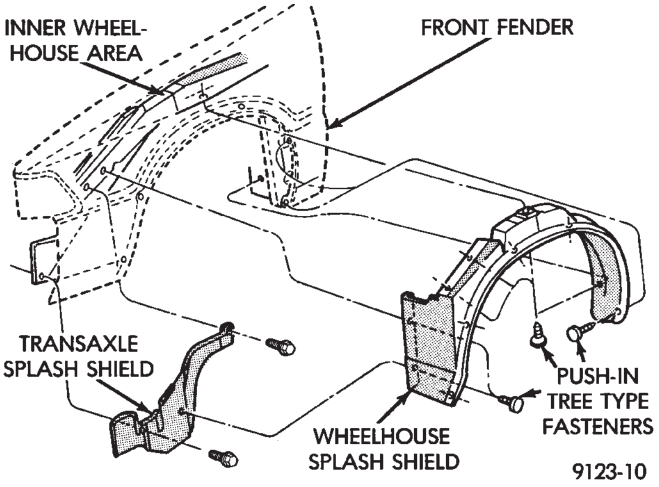


Fig. 9 Front Wheelhouse and Transaxle Splash Shields

ENGINE DRIVE BELT SPLASH SHIELD REMOVAL (FIG. 10)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove bolts holding engine drive belt splash shield to right frame rail.

(3) Separate drive belt splash shield from vehicle.

ENGINE DRIVE BELT SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

FRONT DOOR TRIM PANEL

TRIM PANEL REMOVAL (FIG. 11)

(1) Remove speaker grille. Disconnect power seat switch wire connector, if equipped.

(2) Remove courtesy lamp lens.

(3) Remove screws holding arm rest to inner door panel.

(4) Remove hidden screws from carpet holding trim panel to inner door panel.

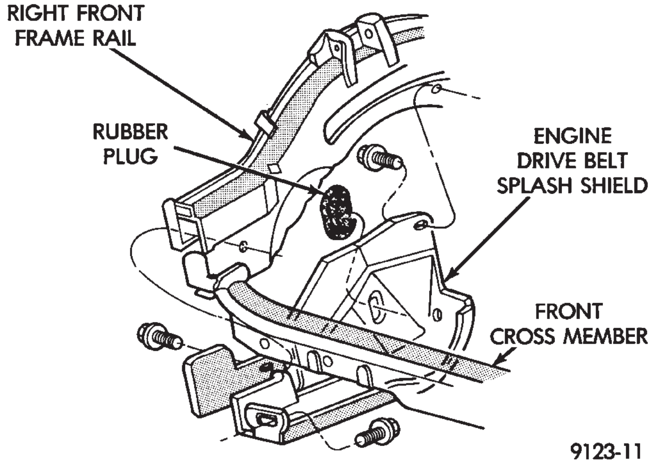


Fig. 10 Engine Drive Belt Splash Shield—Typical

(5) Disengage trim clips holding switch bezel to trim panel and disconnect switch wire connectors.

(6) Disengage frog-leg fasteners from around trim panel and lift trim panel from door. Disconnect courtesy lamp wire connector.

TRIM PANEL INSTALLATION

Reverse the preceding operation.

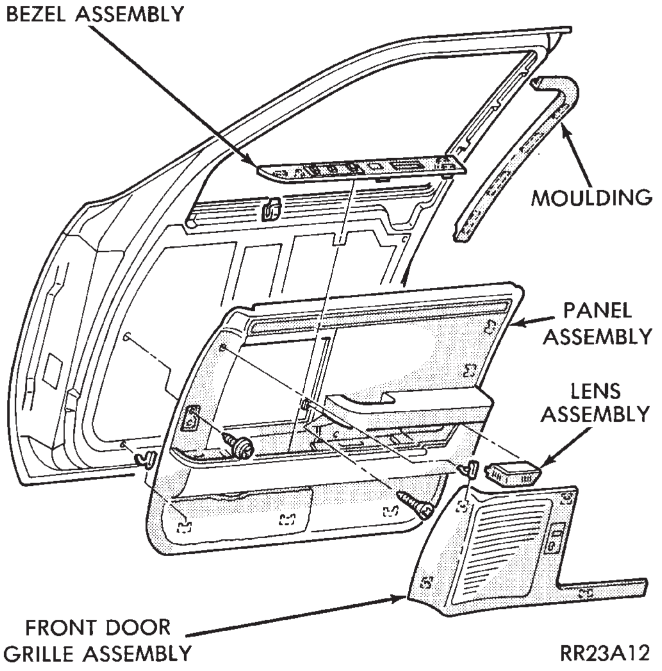


Fig. 11 Front Door Trim Panel

SIDE VIEW MIRROR TRIM COVER

REMOVAL

(1) Remove front door trim panel.

(2) Disconnect power mirror wire connector.

(3) Remove screws holding mirror trim cover to door frame.

INSTALLATION

Reverse the preceding operation.

DOOR FRAME TRIM MOULDING

REMOVAL (FIG. 11)

(1) Remove front door trim panel.

(2) Disengage trim clips holding moulding to window opening frame and separate moulding from door.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR WATER SHIELD

REMOVAL

(1) Remove front door trim panel.

(2) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR AND HINGE

The front door hinge is welded to the door and bolted to the hinge pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

FRONT DOOR REMOVAL (FIG. 12)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Disconnect all wire connectors and wire harness hold downs inside door and push wire harness through access hole in front of door into hinge pillar opening.

(3) Open door and support door on a suitable lifting device.

(4) Drive bottom hinge pin upward and remove pin from hinge.

(5) Drive top hinge pin downward and remove pin from hinge.

FRONT DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Front Door Hinge Installation paragraph in this section.

FRONT DOOR HINGE REMOVAL (FIG. 12)

(1) Remove front fender wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph in this section.

(2) Support door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

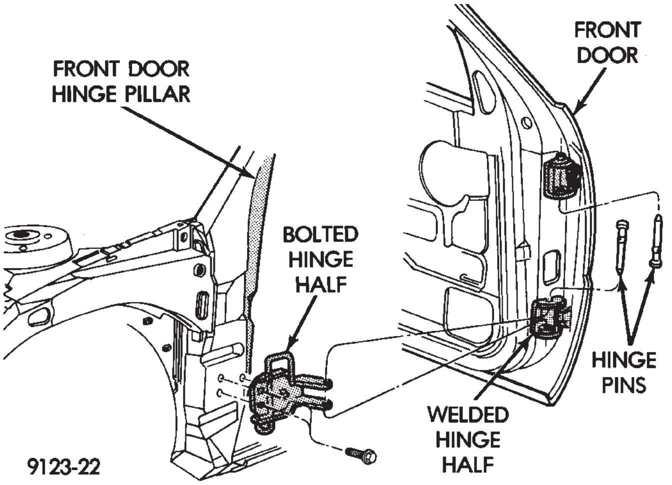


Fig. 12 Front Door Assembly

(4) Remove bolts holding hinge to hinge pillar and separate hinge form vehicle.

FRONT DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

OUTSIDE DOOR HANDLE

REMOVAL (FIG. 13)

(1) Remove door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Raise door glass to up position.

(4) Disconnect illuminated entry wire connector from outside door handle assembly, if equipped.

(5) Disconnect latch release linkage from latch assembly.

(6) Disconnect lock cylinder linkage from latch assembly.

(7) Remove nuts holding outside handle bracket to door panel and separate bracket from panel.

(8) Position linkage rods parallel to the back of handle and remove handle assembly from door.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR LATCH

REMOVAL (FIG. 14)

(1) Remove door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Disconnect linkage rods from door latch assembly.

(4) Remove screws holding latch door end frame.

(5) Separate latch from door.

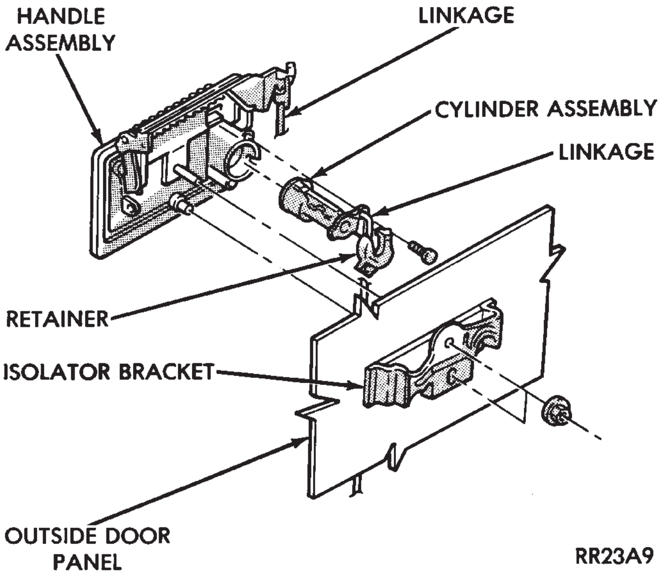


Fig. 13 Front Door Handle Assembly

INSTALLATION

Reverse the preceding operation.

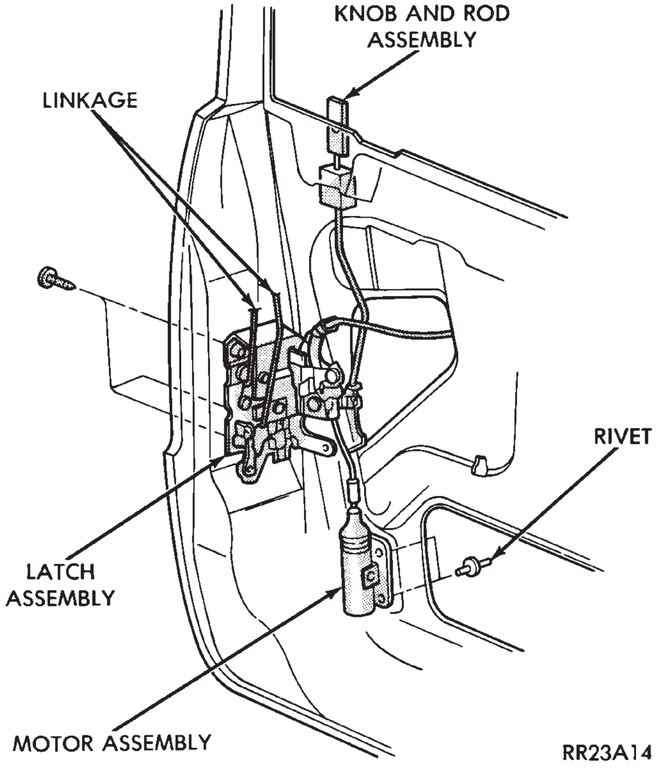


Fig. 14 Front Door Latch Assembly

FRONT DOOR WINDOW REGULATOR

REMOVAL (FIG. 15 OR 16)

MANUAL OR ELECTRIC

(1) Remove front door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove side view mirror trim cover and door frame trim moulding.

(4) Remove door glass.

(5) Remove nut holding cable retainer to inner door panel and slip cables from behind retainer.

(6) Disengage push in retainer holding cables to inner door panel above speaker on vehicles with power windows.

(7) Remove bolts holding top of glass lift bar to inner door panel.

(8) Remove nut holding bottom of lift bar to bottom panel of door.

(9) Remove bolts holding window crank regulator to inner door panel on vehicles with manual windows. Remove nuts holding motor and regulator to inner door panel on vehicles with power windows.

(10) Separate window regulator from vehicle.

INSTALLATION

Reverse the preceding operation.

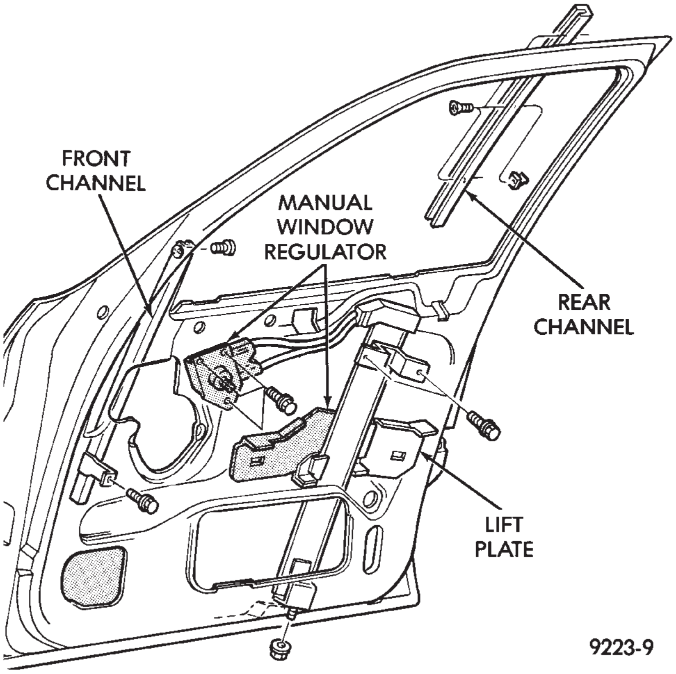


Fig. 15 Front Door Manual Window Regulator

FRONT DOOR GLASS

REMOVAL

(1) Remove front door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove side view mirror trim cover and door frame trim moulding.

(4) Remove front door speaker.

(5) Move glass to the down position and remove glass to lift plate fasteners.

(6) Loosen door glass slam bumpers.

(7) Lift glass upward through opening at top of door.

INSTALLATION

Reverse the preceding operation.

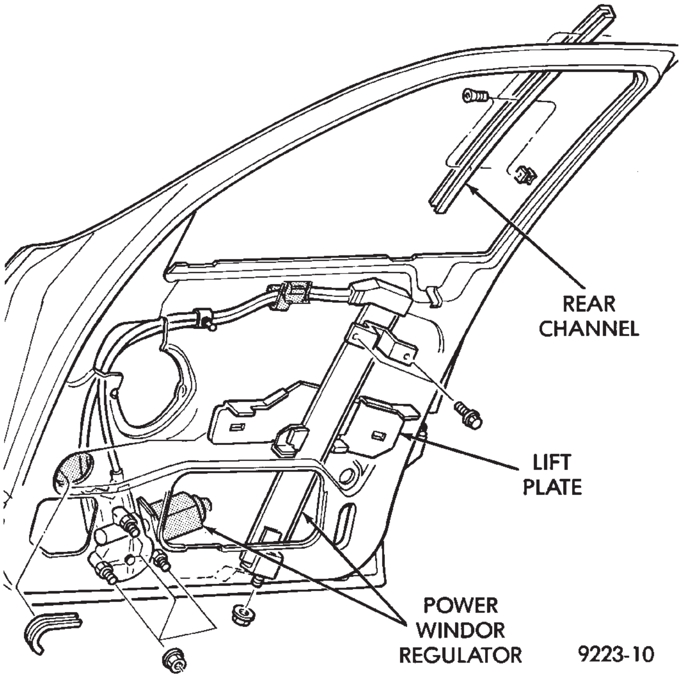


Fig. 16 Front Door Power Window Regulator

REAR DOOR TRIM PANEL

REMOVAL (FIG. 17)

(1) Disengage retaining clips holding padded insert assembly to door panel.

(2) Remove courtesy lamp lens.

(3) Remove screws holding arm rest to door panel.

(4) Remove screws at forward edge of trim panel.

(5) Remove hidden screws from carpet insert on lower trim panel.

(6) Remove screw and disengage clips holding switch bezel to door trim panel.

(7) Disengage frog-leg fasteners holding trim panel to door and disconnect courtesy lamp wire connector.

INSTALLATION

Reverse the preceding operation.

REAR DOOR FRAME TRIM MOULDING

TRIM MOULDING REMOVAL (FIG. 17)

(1) Remove rear door trim panel.

(2) Disengage trim clips holding trim moulding to door frame.

(3) Separate trim moulding from door frame.

TRIM MOULDING INSTALLATION

Reverse the preceding operation.

REAR DOOR SILENCER AND WATER SHIELD

REAR DOOR WATER SHIELD REMOVAL

(1) Remove door trim panel.

(2) Pull water shield from adhesive around perimeter of door inner panel.

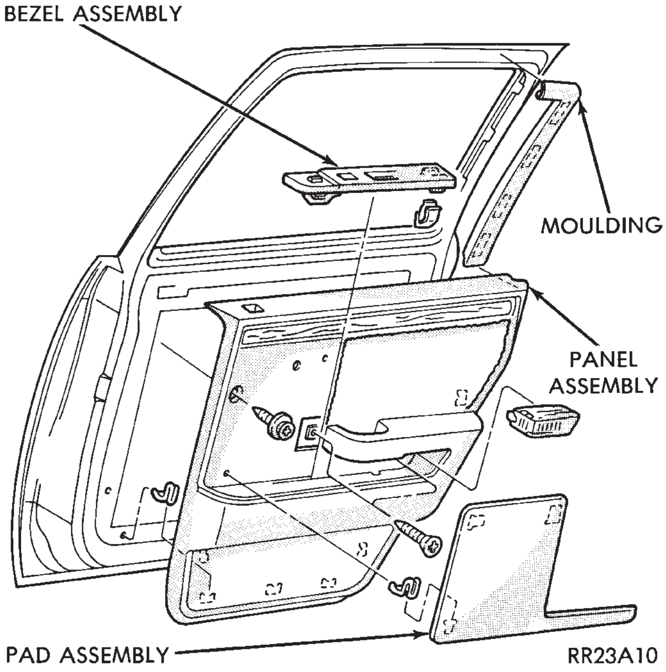


Fig. 17 Rear Door Trim Panel

REAR DOOR SILENCER AND WATER SHIELD INSTALLATION

Reverse the preceding operation.

REAR DOOR AND HINGE

The rear door hinge is welded to the door and bolted to the B-pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

REAR DOOR REMOVAL (FIG. 18)

(1) Remove B-pillar trim panel and disconnect all wire connectors leading to door. Push wire harness through access hole in B-pillar into hinge opening.

(2) Support door on a suitable lifting device.

(3) Drive bottom hinge pin upward and remove pin from hinge.

(4) Drive top hinge pin downward and remove pin from hinge.

(5) Separate door from vehicle.

REAR DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Rear Door Hinge Installation paragraph in this section.

REAR DOOR HINGE REMOVAL (FIG. 18)

(1) To remove upper hinge bolted half, remove B-pillar trim panel. To remove lower hinge bolted half it is not necessary to remove B-pillar trim.

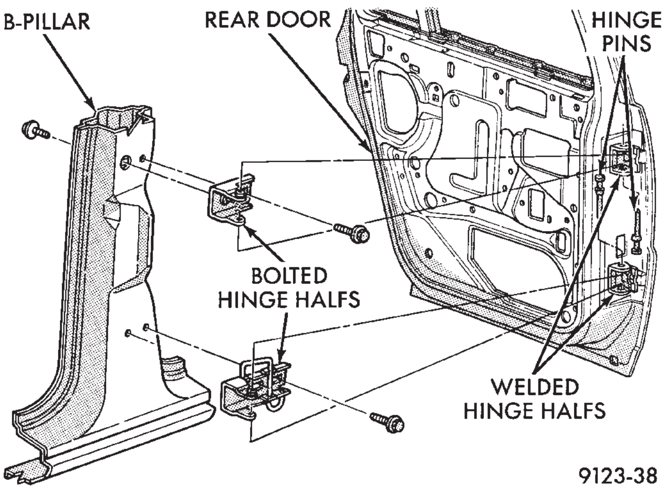


Fig. 18 Rear Door Assembly—Typical

(2) Support rear door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to B-pillar and separate hinge form vehicle.

REAR DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

REAR DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Disconnect latch release linkage rod from door latch.

(4) Remove nuts holding handle bracket to inner door panel.

(5) Separate outside door handle from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR LATCH

REMOVAL

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Disconnect linkage rods from door latch.

(4) Remove screws holding latch to door end frame.

(5) Separate latch from rear door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR GLASS

REMOVAL (FIG. 19)

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove door frame trim moulding.

(4) Remove screws holding lift plate to door glass.

(5) Loosen glass slam bumpers.

(6) Lift glass upward through opening at top of door.

INSTALLATION

Reverse the preceding operation.

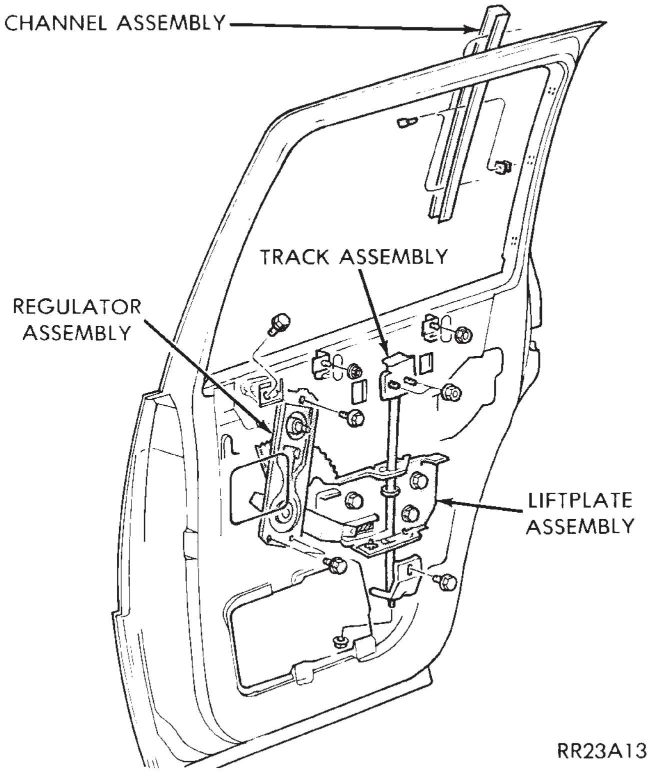


Fig. 19 Rear Door

REAR DOOR WINDOW REGULATOR

REMOVAL

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove bolts holding regulator to inner door panel.

(4) Slide regulator lift arm roller from lift plate channel.

(5) Separate regulator from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR GLASS LIFT PLATE AND GUIDE BAR

REMOVAL

(1) Remove rear door glass.

(2) Remove bolts holding upper guide bar mount bracket to inner door panel.

(3) Remove nut holding guide bar to lower door bottom frame.

(4) Slide lift plate channel from regulator roller.

(5) Separate guide bar from door.

INSTALLATION

Reverse the preceding operation.

OVERHEAD CONSOLE

REMOVAL (FIG. 20)

(1) Remove screws holding overhead console to reinforcement bracket.

(2) Slide overhead console rearward to separate reinforcement bracket retainer tab from console.

(3) Lower console from roof and disconnect wire connectors.

INSTALLATION

Reverse The preceding operation.

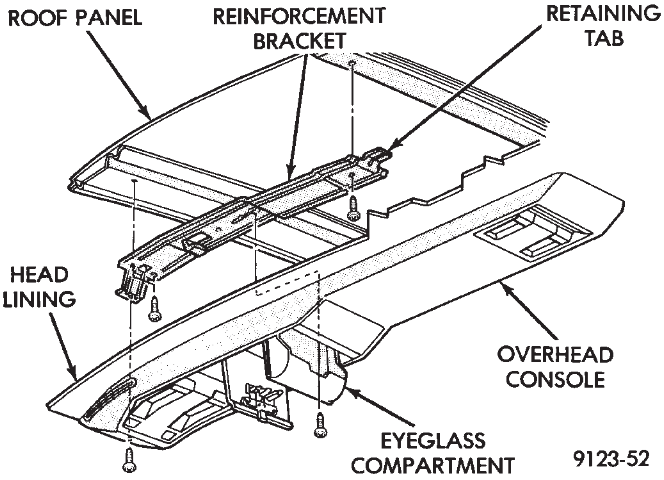


Fig. 20 Overhead Console

HEAD LINING

REMOVAL (FIG. 21)

(1) Disconnect battery negative cable.

(2) Pull dome lamp downward to disengage from retaining ring in head lining. Separate lens from lamp body and remove bulb. Separate bulb holder from lamp body. Remove attaching screw holding retaining ring to roof bow.

(3) Remove screws holding coat hooks to roof above rear doors.

(4) Remove roof rail and A-pillar mouldings.

(5) Remove screws holding sun visors to roof header and disconnect wire connector, if equipped. Remove inboard sun visor hangers.

(6) Remove overhead console, if equipped.

(7) Pull front reading lamp downward to disengage from retaining ring in head lining and disconnect wire connector. Remove screws holding retaining ring to roof header.

(8) Remove pinch welt holding headlining to sun roof opening, if equipped.

(9) Remove inside rear view mirror from windshield bracket, if necessary.

(10) Disengage hook and loop fasteners holding head lining to roof above rear window and slide head lining forward about 25 mm (1 in.).

(11) Shift the front of head lining to one side to pull head lining from behind B-pillar trim. Pull head lining from behind other B-pillar trim.

(12) Allow front of head lining to drop downward. Slide head lining forward from behind quarter panel trim.

(13) Remove head lining from vehicle.

INSTALLATION

Reverse the preceding operation.

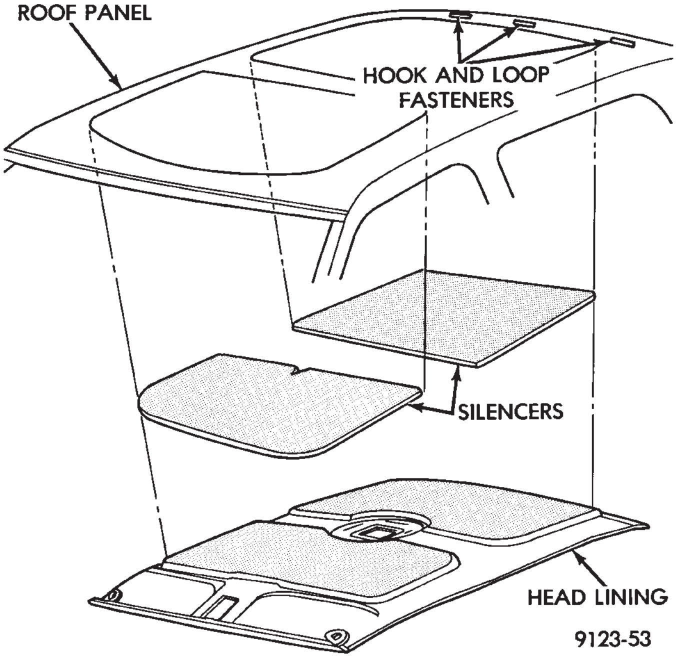


Fig. 21 Head Lining—Typical

COWL PANEL TRIM AND SCUFF PLATES

COWL PANEL AND DOOR OPENING SCUFF PLATE REMOVAL (FIG. 22)

(1) Open front door.

(2) Remove screw holding trim panel to cowl forward of the front door opening.

(3) Remove screws holding scuff plate to door sill.

(4) Separate cowl panel trim and scuff plate from vehicle.

COWL PANEL AND DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

REAR DOOR OPENING SCUFF PLATE REMOVAL (FIG. 22)

(1) Open rear door.

(2) Remove screws holding scuff plate to door sill.

(3) Separate scuff plate from vehicle.

REAR DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

A-PILLAR AND ROOF RAIL MOULDINGS

A-PILLAR MOULDING REMOVAL (FIG. 22)

(1) Open front door.

(2) Disengage clips holding A-pillar moulding to roof rail above door opening.

(3) Slide A-pillar moulding upward and pull rearward to separate moulding from A-pillar.

A-PILLAR MOULDING INSTALLATION

Reverse the preceding operation.

REAR DOOR ROOF RAIL MOULDING REMOVAL (FIG. 22)

(1) Open rear door.

(2) Disengage clips holding roof rail moulding to roof rail above rear door opening.

(3) Separate moulding from vehicle.

REAR DOOR ROOF RAIL MOULDING INSTALLATION

Reverse the preceding operation.

B-PILLAR TRIM PANEL

REMOVAL (FIG. 22)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to B-pillar.

(3) Remove bolt holding seat belt to floor below B-pillar.

(4) Remove upper B-pillar trim.

(5) Remove lower B-pillar trim.

INSTALLATION

Reverse the preceding operation.

QUARTER TRIM PANEL

REMOVAL (FIG. 22)

(1) Remove rear roof rail mouldings and scuff plates as necessary.

(2) Remove rear shoulder harness turning loop cover. Remove bolt holding turning loop to quarter panel.

(3) Remove rear seat cushion and back.

(4) Remove push-in fastener holding quarter trim to roof rail.

(5) Remove screws holding quarter trim panel to wheelhouse kickup.

(6) Pull trim panel away from C-pillar and separate from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR SHELF TRIM PANEL

REMOVAL (FIG. 22)

(1) Remove one quarter trim panel.

(2) Remove center high mounted stop lamp cover. Refer to Group 8L, Lamps for instructions.

(3) Disengage fasteners holding trim to shelf panel and separate trim from vehicle.

INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 23)

(1) Remove B-pillar trim panel.

(2) Remove bolt holding seat belt retractor to B-pillar.

(3) Separate retractor from vehicle.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 23)

Vehicles equipped with front bucket seats with center console do not have center occupant belts.

(1) Remove bolt holding inboard buckle/center occupant belt to floor.

(2) Disconnect seat belt sensor wire connector.

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

REAR SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 24)

(1) Remove quarter trim panel.

(2) Remove bolt holding lap belt to floor at wheelhouse kickup.

(3) Remove bolt holding turning loop to inner quarter panel.

(4) Remove bolt holding seat belt retractor to quarter panel.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

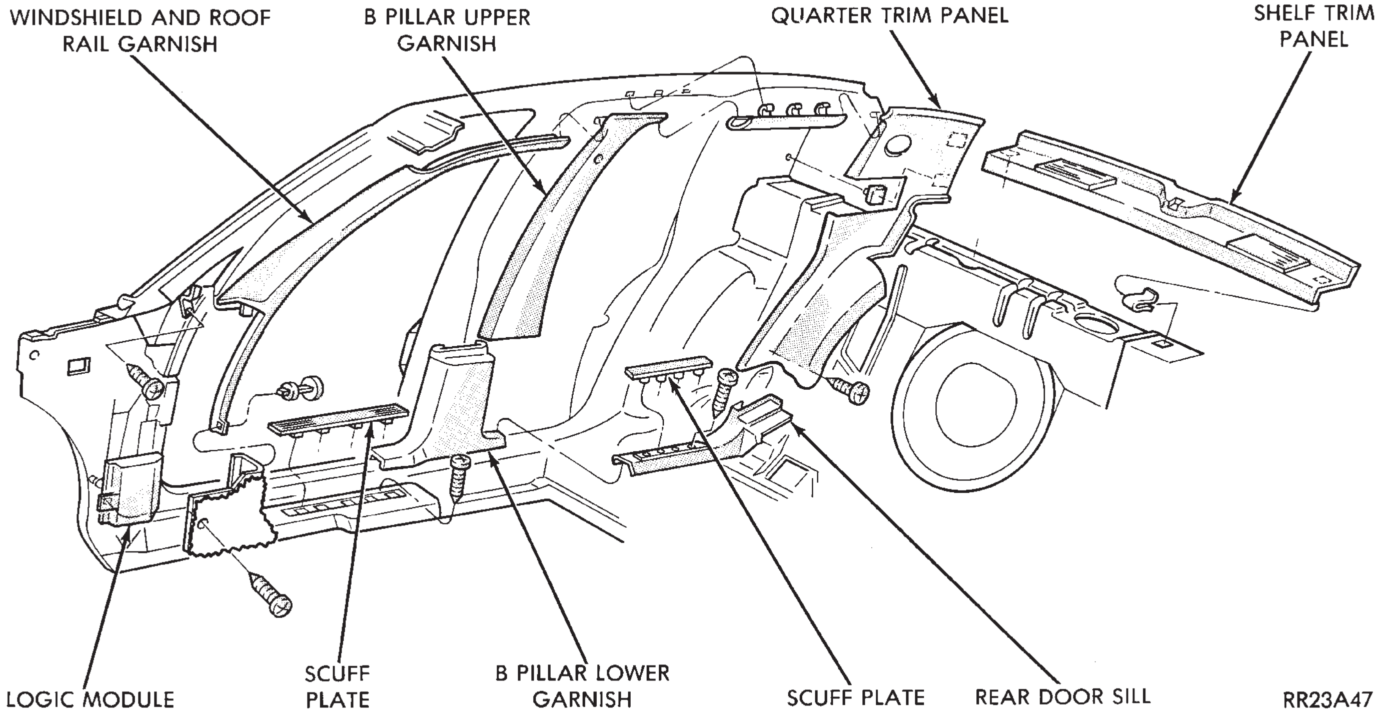


Fig. 22 Interior Mouldings, Panels, and Trim Covers

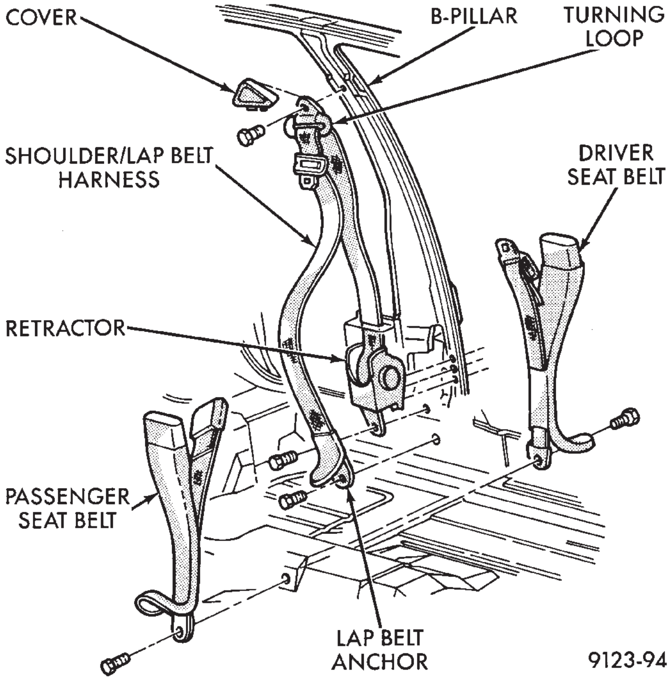


Fig. 23 Front Seat Belts

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 24)

(1) Remove rear seat cushion.

(2) Remove bolt holding inboard buckle/center occupant belt to floor.

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

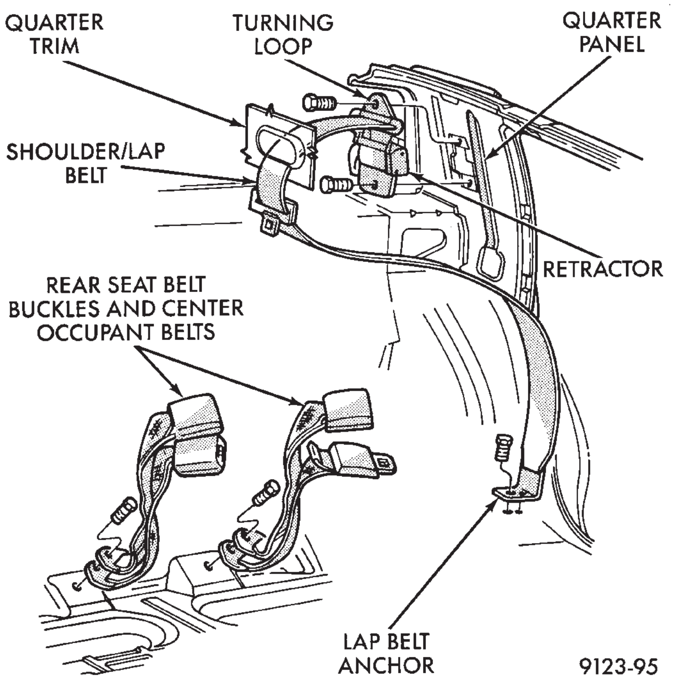


Fig. 24 Rear Seat Belts

FRONT SEATS

REMOVAL (FIG. 25 OR 26)

(1) Position seat full forward.

(2) Remove screws holding rear track riser covers and separate covers from tracks.

(3) On power seat track, remove outboard track cover.

(4) Remove inboard seat belt attaching bolt from floor.

(5) Remove nuts holding seat track to floor.

(6) Position seat full rearward.

(7) Remove door sill scuff plate and disconnect power seat track wire connector.

(8) Remove bolts holding seat track to cross member.

(9) Remove seat from vehicle.

INSTALLATION

Reverse the preceding operation.

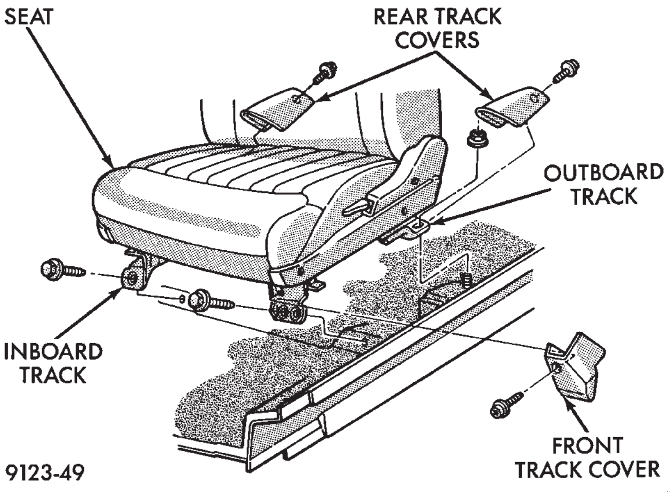


Fig. 25 Manual Front Seat—Typical

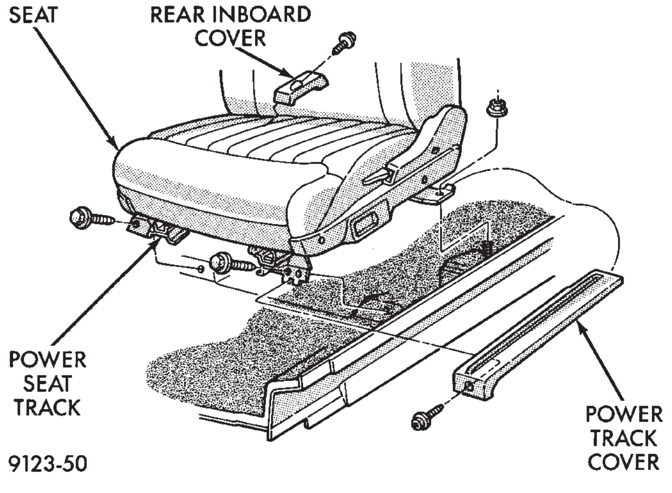


Fig. 26 Power Front Seat—Typical

REAR SEATS

REAR SEAT CUSHION REMOVAL

(1) Remove bolts holding cushion to floor.

(2) Disconnect center occupant seat belts from cushion.

(3) Remove cushion from vehicle.

REAR SEAT CUSHION INSTALLATION

Reverse the preceding operation.

REAR SEAT BACK REMOVAL

(1) Remove rear seat cushion assembly.

(2) Remove bolts holding seat back to rear floor kick-up.

(3) Lift seat back upward to disengage upper hooks from shelf support panel.

(4) Separate seat back from vehicle.

REAR SEAT BACK INSTALLATION

Reverse the preceding operation.

BODY MOULDINGS

STICK-ON BODY SIDE MOULDING REMOVAL AND INSTALLATION

(1) Warm the effected stick-on moulding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(2) Pull stick-on moulding from painted surface.

(3) Remove adhesive tape residue from painted surface of vehicle.

(4) If moulding is to be reused, Remove tape residue from moulding. Clean back of moulding with Mopar®, Super Kleen solvent or equivalent. Wipe moulding dry with lint free cloth. Apply new body side moulding (two sided adhesive) tape to back of moulding.

(5) Clean body surface with Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(6) Apply a length of masking tape on the body, parallel to the top edge of the moulding to use as a guide, if necessary.

(7) Remove protective cover from tape on back of moulding. Apply moulding to body below the masking tape guide.

(8) Remove masking tape guide and heat body and moulding, see step one. Firmly press moulding to body surface to assure adhesion.

FRONT WHEEL OPENING MOULDING REMOVAL

(1) Remove screws holding wheel opening moulding to front fender.

(2) Separate moulding from fender.

FRONT WHEEL OPENING MOULDING INSTALLATION

(1) Position moulding in wheel opening and start top center screw of wheel opening moulding.

(2) Install screws around wheel opening.

REAR WHEEL OPENING MOULDING REMOVAL

(1) Remove screws holding wheel opening moulding to quarter panel.

(2) Separate wheel opening moulding from quarter panel.

REAR WHEEL OPENING MOULDING INSTALLATION

(1) Position moulding in wheel opening and start top center screw of wheel opening moulding.

(2) Install screws around wheel opening.

VINYL ROOF BONNET

REMOVAL (FIG. 27)

(1) Remove quarter panel trim covers.

(2) Remove head lining.

(3) Remove nuts holding transverse roof moulding to roof panel and separate moulding from vehicle.

(4) Remove nuts holding vinyl top bonnet to roof.

(5) Remove rear deck filler panel.

(6) Remove screws holding rear window opening lower valance to body.

(7) Disengage hook and loop fasteners holding vinyl top bonnet to quarter panel.

(8) Pull vinyl top bonnet away from top panel to separate bonnet from anti-flutter sealer holding bonnet to roof.

INSTALLATION

(1) Clean anti-flutter sealer from roof surface and inside of vinyl roof bonnet.

(2) Apply a 20 mm (0.75 in.) bead of anti-flutter sealer across the roof panel at the mid point between the front of the bonnet and rear of roof.

(3) Apply a 20 mm (0.75 in.) by 150 mm (6 in.) bead of anti-flutter sealer down each roof side panel at mid point between the door opening and rear of roof.

(4) Place the bonnet into position on the roof panel and align to proper fit.

(5) Reverse the removal operation.

REAR DECK FILLER PANEL

REMOVAL (FIG. 28)

(1) Raise truck lid to full up position.

(2) Remove screws holding rear deck filler panel to body in the front trunk opening gutter.

(3) Close trunk lid, do not latch.

(4) Lift filler panel upward and separate from vehicle.

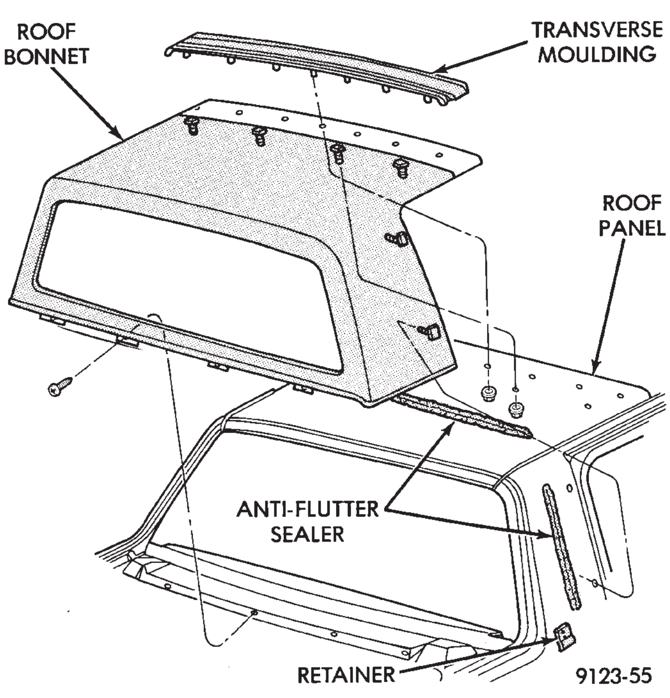


Fig. 27 Vinyl Roof Bonnet—Typical

INSTALLATION

Reverse the preceding operation.

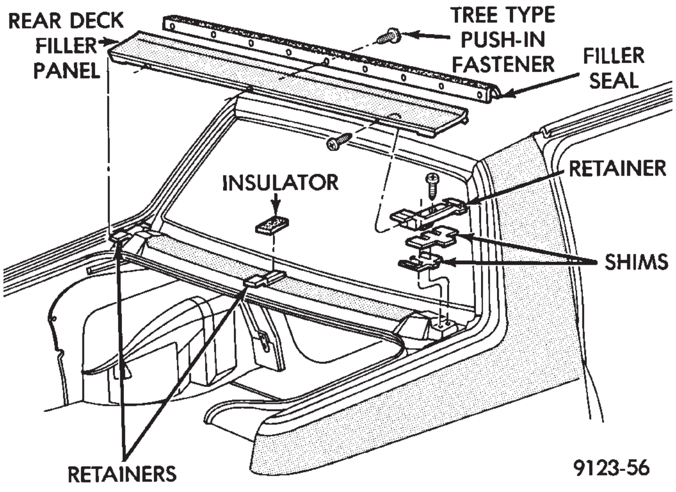


Fig. 28 Rear Deck Filler Panel—Typical

REAR WINDOW GLASS

REMOVAL (FIG. 29)

The rear window moulding often cannot be salvaged after removal operation is completed. Verify moulding availability from the parts supplier before removing moulding.

(1) Remove rear deck filler panel.

(2) Pull rear window moulding from between glass and roof panel.

(3) Remove interior trim as necessary to gain access to rear window defogger wire connector and ground screw, if equipped.

(4) Remove vinyl roof bonnet, if equipped.

WARNING: WEAR EYE AND HAND PROTECTION WHEN HANDLING SAFETY GLASS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not damage body or trim finish when cutting out glass or applying fence primer.

(5) Cut the urethane around the perimeter of the back window glass. Refer to Windshield section of this group for proper procedures.

(6) Separate the rear window from the vehicle.

INSTALLATION

(1) Prepare the work area, window fence, and glass the same way as described in the Windshield section of this group.

(2) Place fence spacers at the locations shown (Fig. 29).

(3) Apply a 10 mm (0.4 in.) bead of urethane around the perimeter of the glass.

(4) Install the glass in the same manner described in the Windshield section of this group.

(5) Install the rear window moulding in the gap between the glass and the roof panel.

(6) Secure moulding and glass in position with suitable tape. Remove tape after urethane has cured.

(7) Connect rear window defogger wiring. Install interior trim and rear deck filler panel.

(8) After urethane has cured, water test rear window to verify repair. Verify rear window defogger operation, see Group 8N, Rear Window Defogger.

TRUNK LID

REMOVAL (FIG. 30)

(1) Raise trunk lid to full up position.

(2) Disconnect the trunk lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing trunk lid, align all marks and secure bolts. The trunk lid should be aligned to 4 mm (0.160 in.) gap to the quarter panels and flush across the top surfaces along quarter panels.

(4) Remove the top trunk lid to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the trunk lid, remove the bottom trunk lid to hinge attaching bolts. Separate the trunk lid from the vehicle.

INSTALLATION

Reverse the preceding operation.

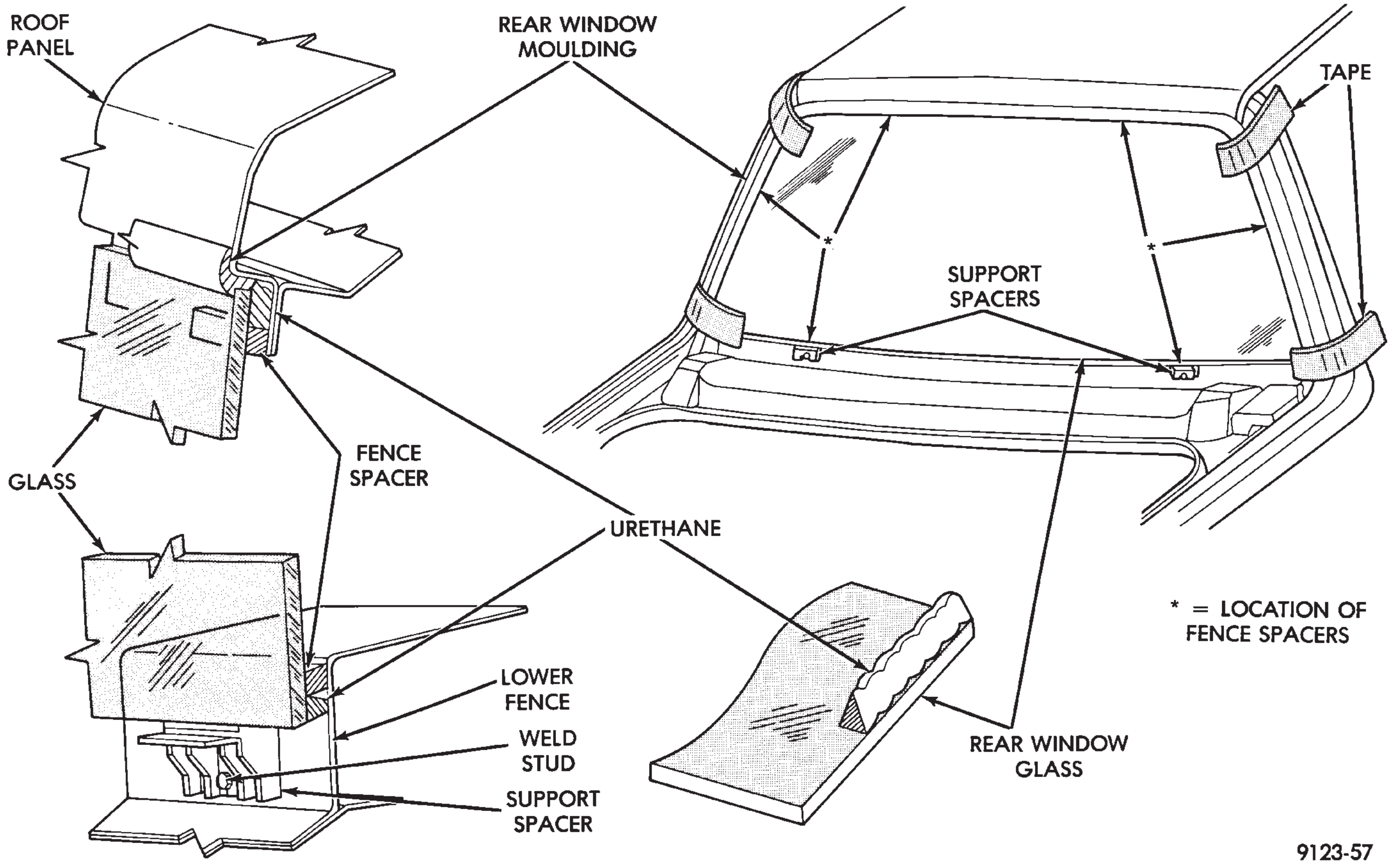


Fig. 29 Rear Window Glass—Typical

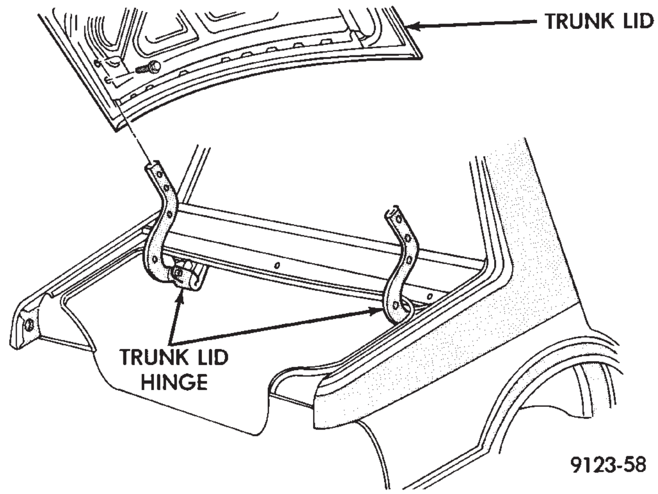


Fig. 30 Trunk Lid

TRUNK LID HINGE

REMOVAL

(1) Remove rear deck filler panel.

(2) Disconnect trunk lid lift torsion bars from hinges.

(3) Mark all attaching bolt, nut, and component locations with a suitable marking device. Use marks as a reference when installing hinge.

(4) Remove bolts holding trunk lid to hinge.

(5) Remove nuts and bolts holding hinge to closure panel below rear window glass.

(6) Separate hinge from vehicle.

INSTALLATION

Reverse the preceding operation.

TRUNK LID TORSION BAR

REMOVAL

(1) Raise and support trunk lid in the full up position.

(2) Remove trunk lining as necessary to gain access to torsion bars.

(3) Disengage adjusting end torsion bar from the slot in the tension adjustment bracket.

(4) Pivot torsion bar out of lift arm swivel.

(5) Disconnect torsion bar from hinge.

INSTALLATION

Reverse the preceding operation.

AG-VEHICLE BODY COMPONENT SERVICE

INDEX

CLOSURE PANEL SIGHT SHIELD

REMOVAL (FIG. 1)

(1) Raise hood to open position.

(2) Loosen twist fasteners holding headlamp covers to fascia.

(3) Disengage hook and loop fasteners holding sight shield to radiator closure panel.

(4) Remove push-in fasteners holding sight shield to bumper fascia.

(5) Separate sight shield from vehicle.

INSTALLATION

Reverse the preceding operation.

HOOD AND HINGES

HOOD REMOVAL (FIG. 2)

(1) Raise hood to full up position.

(2) Lift front edge of cowl cover on the right side of the windshield washer bottle and disconnect the under hood lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood, 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.

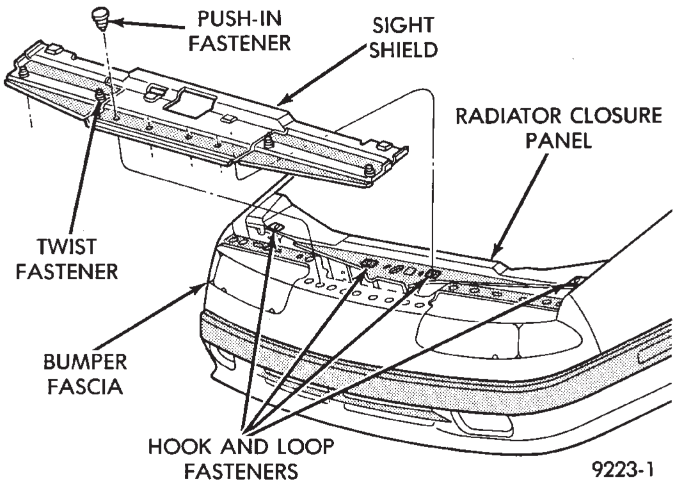


Fig. 1 Closure Panel Sight Shield

(4) Remove the top hood to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the hood, remove the bottom hood to hinge attaching bolts. Separate the hood from the vehicle.

HOOD INSTALLATION

Reverse the preceding operation.

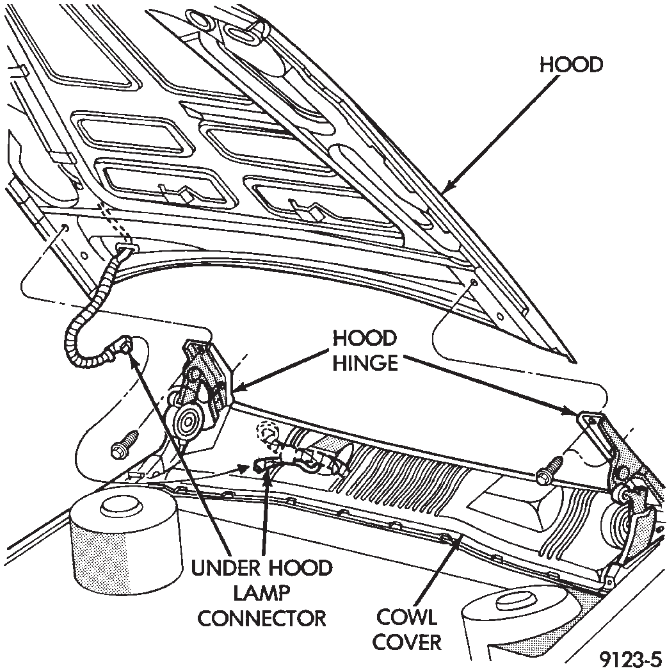


Fig. 2 Hood Assembly Remove or Install—Typical

HOOD HINGE REMOVAL (FIG. 3)

(1) Support hood on the side that requires hinge replacement.

(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood hinge, 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.

(3) Remove hood to hinge attaching bolts.

(4) Remove hood hinge to front fender attaching bolts and separate hinge from vehicle.

HOOD HINGE INSTALLATION

Reverse the preceding operation. If necessary, paint new hinge before installation.

HOOD LATCH AND RELEASE CABLE

HOOD LATCH REMOVAL (FIG. 4)

(1) Raise hood to the full up position.

(2) Remove radiator closure panel sight shield.

(3) Remove hood latch attaching bolts holding latch to radiator closure panel and separate from vehicle.

(4) Pry release cable casing attachment from slot receiver on latch, disengage cable end from latch arm hook.

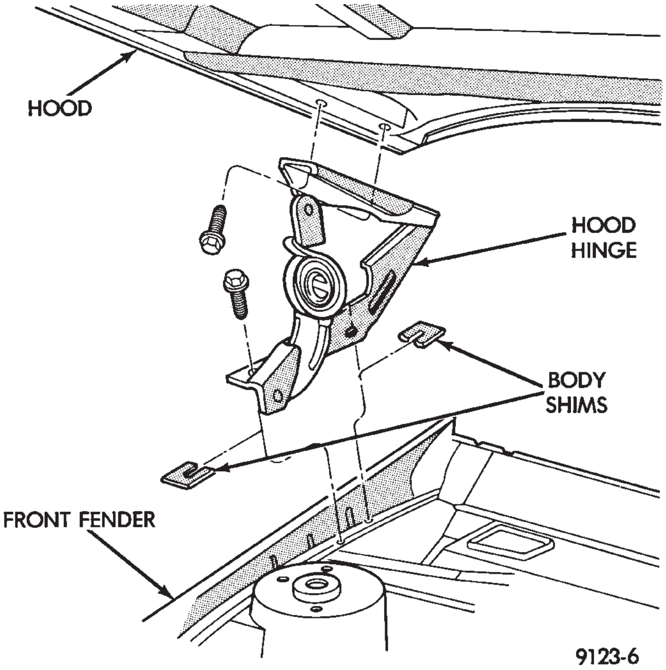


Fig. 3 Hood Hinge Assembly—Typical

HOOD LATCH INSTALLATION

Reverse the preceding operation.

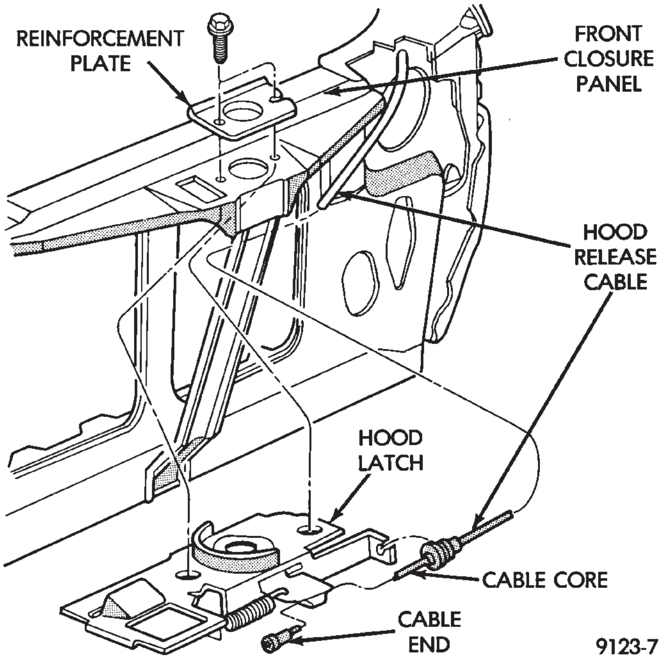


Fig. 4 Hood Latch Assembly—Typical

HOOD LATCH RELEASE CABLE REMOVAL (FIG. 5)

(1) Raise hood to the full up position.

(2) Remove push-in fasteners holding sight shield to radiator closure panel and separate cover from vehicle.

(3) Disconnect hood release cable casing and cable end from hood latch assembly. Refer to Hood Latch Removal procedure in this section.

(4) Remove hood latch release cable handle attaching bolts from under left lower edge of instrument panel.

(5) Disengage release cable rubber grommet from engine compartment dash panel behind instrument panel.

(6) Rout cable assembly through engine compartment around battery, under fender lip, under power distribution center, and under wiring harnesses, toward dash panel. Push cable through access hole in dash panel under the brake master cylinder, into passenger compartment.

HOOD LATCH RELEASE CABLE INSTALLATION

Reverse the preceding operation.

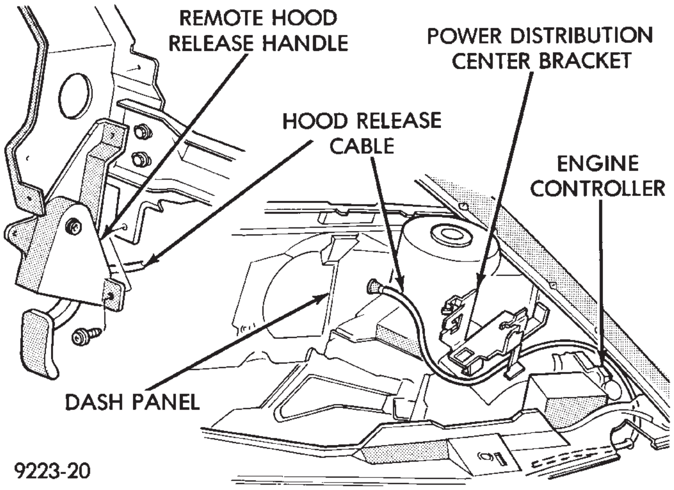


Fig. 5 Hood Latch Release Cable

HOOD LATCH SAFETY CATCH

REMOVAL (FIG. 6)

(1) Raise hood to full up position.

(2) Remove screw holding safety latch handle bracket to hood.

(3) Mark location of safety catch on hood to assist installation alignment.

(4) Remove bolts holding safety catch to hood.

(5) Separate safety catch from hood.

INSTALLATION

Reverse the preceding operation.

HOOD APPLIQUE

REMOVAL (FIG. 7)

(1) Raise hood to full up position.

(2) Remove plugs from access holes at rear of hood.

(3) Remove nuts holding applique to hood.

(4) Separate applique from hood.

INSTALLATION

Reverse the preceding operation.

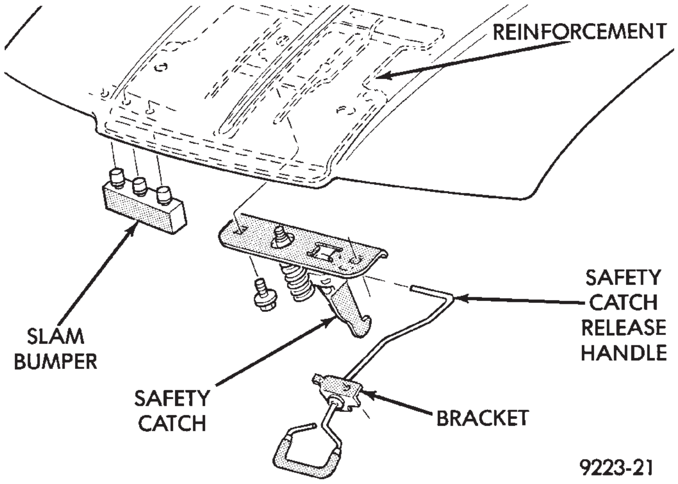


Fig. 6 Hood Latch Safety Catch

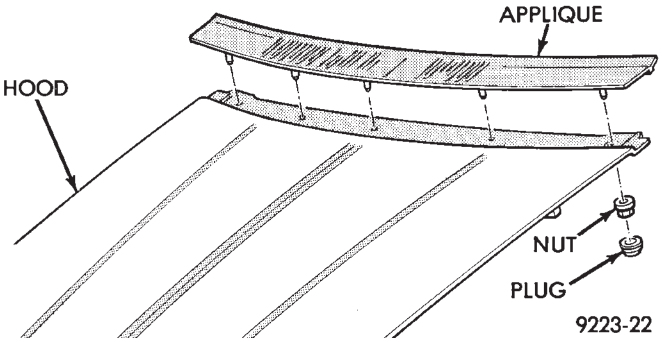


Fig. 7 Hood Applique

COWL COVER

REMOVAL (FIG. 8)

(1) Raise hood to full up position.

(2) Disconnect windshield washer hoses from wiper arms.

(3) Remove windshield wiper arm assemblies. Refer to Group 8K, Windshield Wiper and Washer Systems.

(4) Remove plastic expanding type fasteners holding cowl cover to cowl, below windshield.

(5) Lift back of cowl cover and slide cover rearward from under dash panel to hood seal and separate cover from vehicle.

INSTALLATION

Reverse the preceding operation.

FRONT END SPLASH SHIELDS

REMOVAL (FIG. 9)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove front wheel assembly.

(3) Remove push-in fasteners holding front wheelhouse splash shield to fender opening lip and inner wheelhouse area.

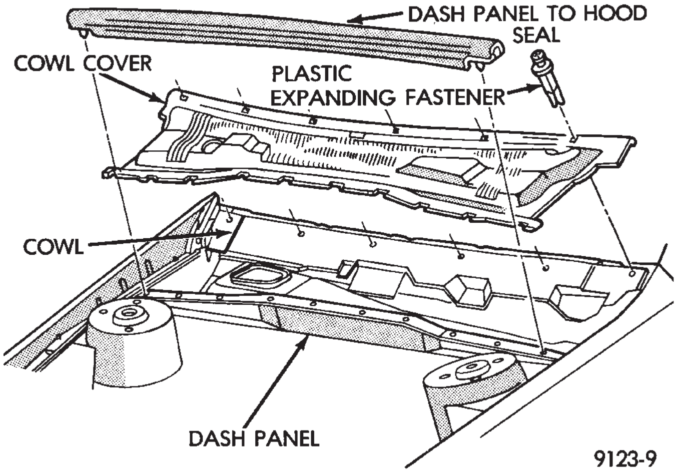


Fig. 8 Cowl Cover Assembly

(4) Separate wheelhouse splash shield from vehicle.

INSTALLATION

Reverse the preceding operation.

TRANSAXLE SPLASH SHIELD REMOVAL (FIG. 9)

(1) Remove one front wheelhouse splash shield push-in fastener and separate wheelhouse splash shield from transaxle splash shield.

(2) Remove transaxle splash shield attaching bolts and separate transaxle splash shield from vehicle.

TRANSAXLE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

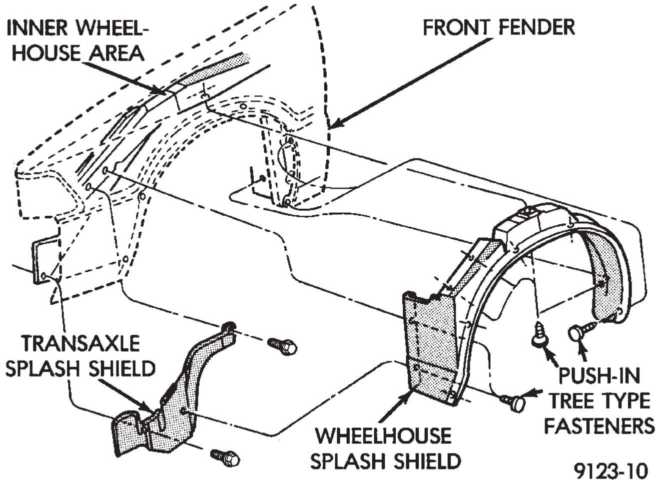


Fig. 9 Front Wheelhouse and Transaxle Splash Shields—Typical

ENGINE DRIVE BELT SPLASH SHIELD REMOVAL (FIG. 10)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove bolts holding engine drive belt splash shield to right frame rail.

(3) Separate drive belt splash shield from vehicle.

ENGINE DRIVE BELT SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

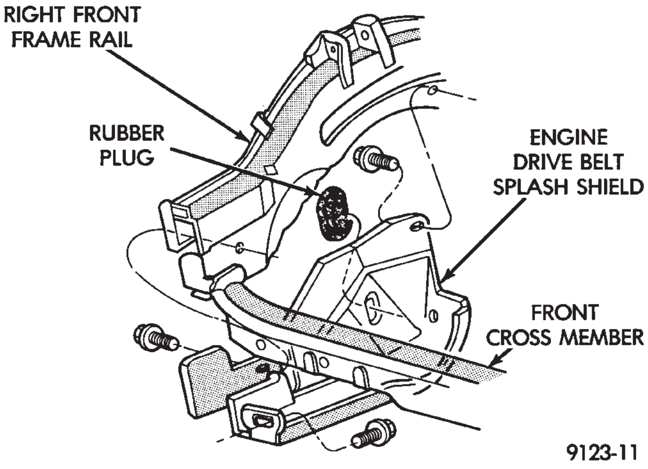


Fig. 10 Engine Drive Belt Splash Shield—Typical

FRONT FENDER

REMOVAL (FIG. 11)

(1) Remove front side marker lamp assembly. Refer to Group 8L, Lamps for instructions.

(2) Remove front bumper as necessary to gain clearance to remove front fender. Refer to Front Bumper Removal paragraph in this section.

(3) Remove front wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph of this section.

(4) Remove side applique as necessary to clear front fender. Refer to Body Side Applique Removal paragraph in this section.

(5) Remove bolts holding bottom of front fender at rear of wheel opening.

(6) Remove bolt holding front fender to hinge pillar at rear of wheelhouse.

(7) Remove bolt holding front fender to cowl at top of front door opening.

(8) Remove bolts holding front fender to underside of radiator closure panel.

(9) Remove bolts holding front fender to front of radiator closure panel.

(10) Raise hood and support hood on a suitable holding device. Mark hinge for installation indexing. Remove lower hood hinge attaching bolts and separate hinge from front fender. Refer to Hood Hinge Removal paragraph in this section.

(11) Remove bolts holding front fender to inner wheelhouse along hood opening.

(12) Separate front fender from vehicle.

INSTALLATION

Reverse the preceding operation. Align front fender to achieve a 4 mm (0.160 in) gap to hood edge and 6 mm (0.240 in) gap to front door edge. All surfaces across gaps should be flush.

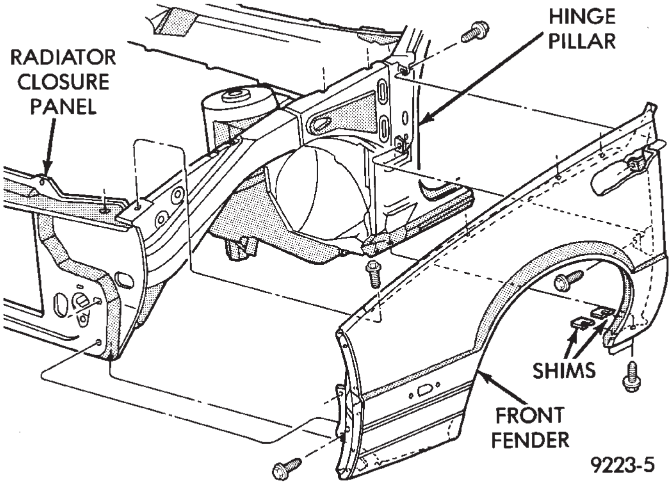


Fig. 11 Front Fender

DOOR TRIM PANEL

REMOVAL (FIG. 12)

(1) Lower door glass to down position. Disconnect battery negative cable, if equipped with power windows.

(2) Remove window crank screw cover. Remove screw holding window crank to regulator and separate crank from door, if equipped with manual windows.

(3) Remove screw holding inside latch release handle bezel to door. Slide bezel forward and remove from door panel. Disconnect power door lock switch wire connector, if equipped.

(4) Pull power mirror switch outward to disengage clips holding switch to door panel. Disconnect mirror switch wire connector, if equipped.

(5) Lift upward at rear edge of power window/seat switch bezel to disengage clips holding bezel to door panel. Disconnect wire connectors from power window and power seat switches, if equipped.

(6) Remove screw holding trim panel to door from inside power window switch bezel opening.

(7) Pry outward on reflector lens to disengage clips. Remove screw holding trim panel to door from behind reflector.

(8) Remove hidden screws holding trim panel to door from carpet area on trim panel.

(9) Disengage push-in fasteners holding trim panel to door at ends and bottom center of trim panel.

(10) Lift trim panel from door.

INSTALLATION

Reverse the preceding operation.

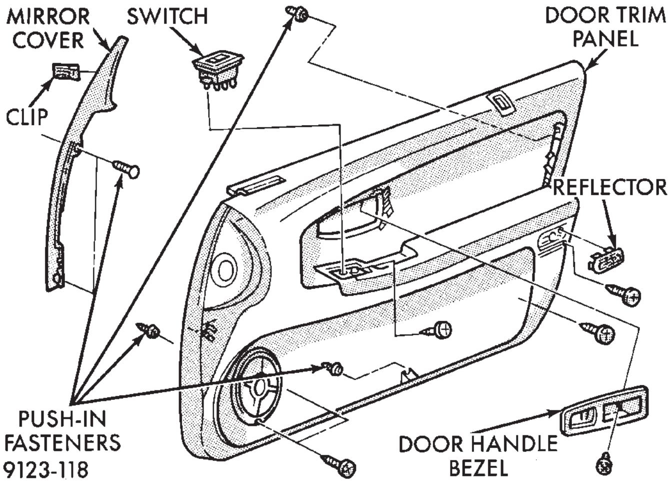


Fig. 12 Door Trim Panel

FRONT DOOR SILENCER AND WATER SHIELD

REMOVAL (FIG. 13)

(1) Remove front door trim panel.

(2) Remove push-in fasteners holding silencer pad to door inner panel and separate silencer from door.

(3) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

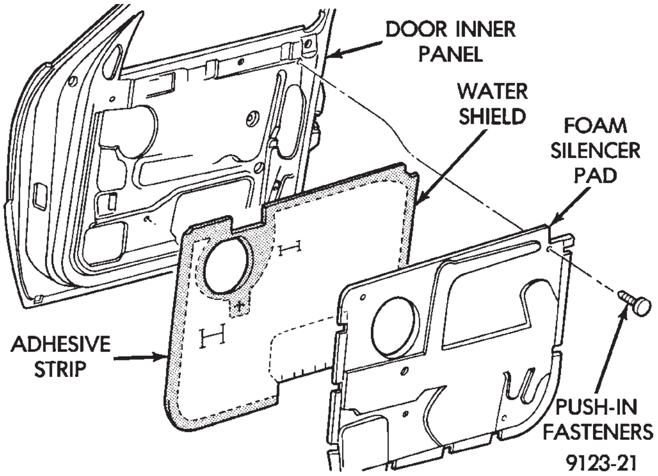


Fig. 13 Front Door Silencer and Water Shield—Typical

FRONT DOOR AND HINGE

The front door hinge is welded to the door and bolted to the hinge pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

FRONT DOOR REMOVAL (FIG. 14)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Disconnect all wire connectors and wire harness hold downs inside door and push wire harness through access hole in front of door into hinge pillar opening.

(3) Open door and support door on a suitable lifting device.

(4) Drive bottom hinge pin upward and remove pin from hinge.

(5) Drive top hinge pin downward and remove pin from hinge.

FRONT DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Front Door Hinge Installation paragraph in this section.

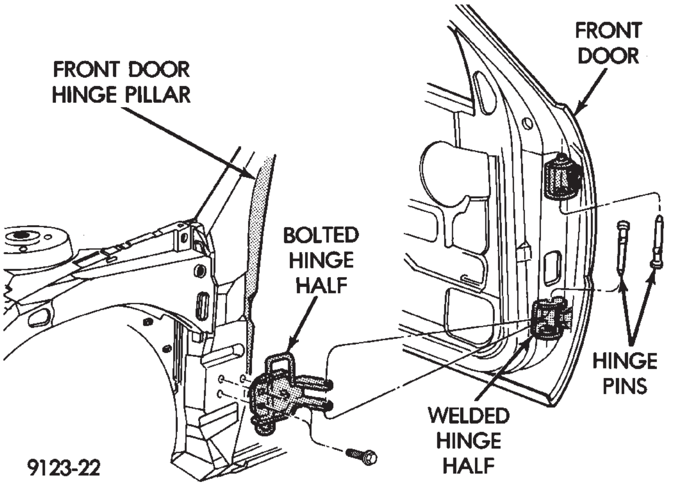


Fig. 14 Front Door Assembly

FRONT DOOR HINGE REMOVAL (FIG. 14)

(1) Remove front fender wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph in this section.

(2) Support door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to hinge pillar and separate hinge form vehicle.

FRONT DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

DOOR LATCH

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield, as necessary.

(3) Raise door glass to up position.

(4) Disconnect linkage rods from door latch assembly.

(5) Remove screws holding latch top door end frame.

(6) Separate latch from door.

INSTALLATION

Reverse the preceding operation.

MANUAL WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield as necessary.

(3) Raise glass to 25 mm (1 in.) below full up position and support glass lift plate to keep the glass from falling.

(4) Remove bolts holding regulator to inner door panel.

(5) Slide regulator lift arm roller from lift plate channel.

(6) Remove regulator assembly through access hole in door.

INSTALLATION

Reverse the preceding operation.

POWER WINDOW REGULATOR

REMOVAL (FIG. 15)

(1) Remove door trim panel.

(2) Remove silencer and water shield as necessary.

(3) Raise glass to 25 mm (1 in.) below full up position and support glass to keep the glass from falling. Disconnect battery negative cable.

(4) Remove bolts holding regulator to inner door panel.

(5) Remove nuts holding lift plate to glass.

(6) Remove regulator assembly through access hole in door.

INSTALLATION

Reverse the preceding operation.

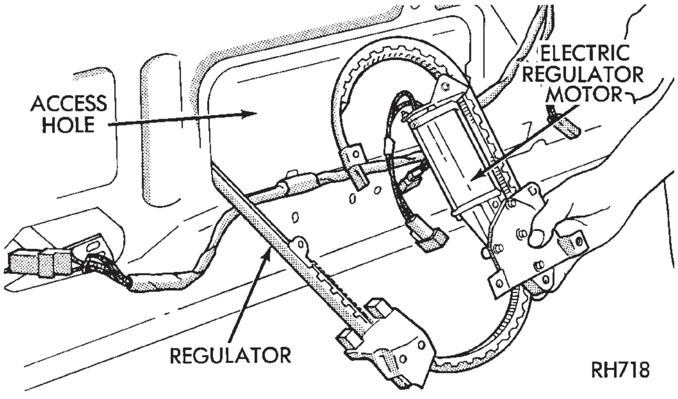


Fig. 15 Power Window Regulator

MANUAL WINDOW REGULATOR

REMOVAL (FIG. 16)

(1) Remove door trim panel.

(2) Remove silencer and water shield as necessary.

(3) Raise glass to 25 mm (1 in.) below full up position and support glass to keep the glass from falling.

(4) Remove bolts holding regulator to inner door panel.

(5) Remove nuts holding lift plate to glass.

(6) Remove regulator assembly through access hole in door.

INSTALLATION

Reverse the preceding operation.

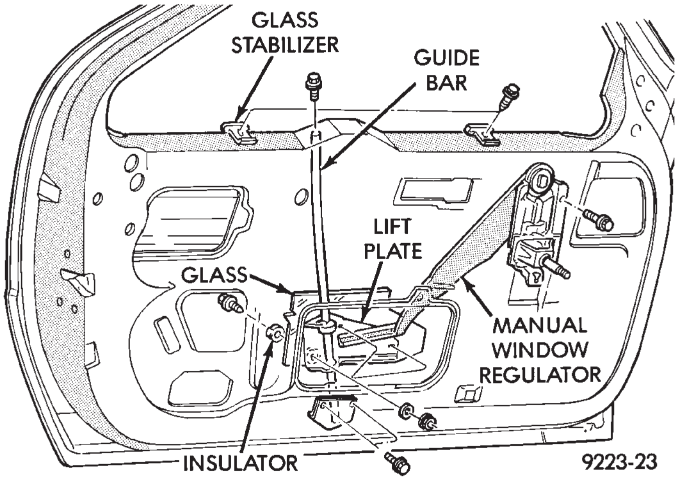


Fig. 16 Manual Window Regulator

MANUAL WINDOW LIFT PLATE AND GUIDE

REMOVAL (FIG. 16)

(1) Remove door trim panel, silencer and water shield.

(2) Raise glass enough to align lift plate to large access hole in inner door panel.

(3) Remove nuts holding glass to lift plate.

(4) Separate glass from lift plate and allow glass to rest on bottom of door.

(5) Remove bolt holding guide bar to upper door frame.

(6) Remove bolts holding guide bar top inner door panel.

(7) Slide regulator lift arm roller from lift plate channel.

(8) Remove lift plate and guide bar through large access hole in inner door panel.

INSTALLATION

Reverse the preceding operation.

DOOR GLASS

REMOVAL (FIG. 17)

(1) Remove door trim panel.

(2) Remove silencer and water shield.

(3) Raise door glass 100 mm (4 in.) from down position.

(4) Disconnect battery negative cable if equipped with power windows.

(5) Loosen bolts holding glass stabilizers and guide hook receiver to top of inner door frame.

(6) Remove nuts holding door glass to lift plate.

(7) Separate glass from lift plate and lift glass upward from opening at top of door.

INSTALLATION

Reverse the preceding operation.

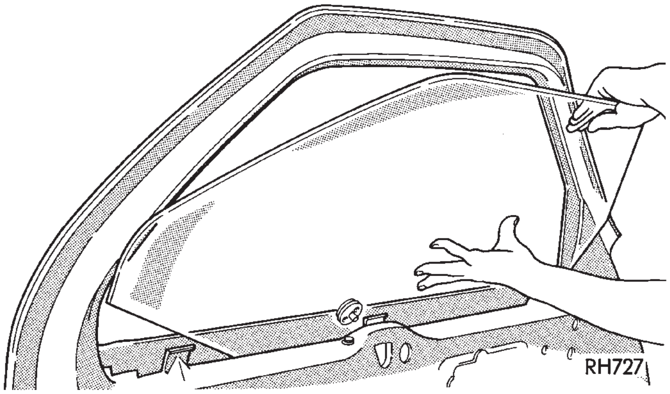


Fig. 17 Door Glass

GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield as necessary.

(3) Remove side view mirror cover.

(4) Pull glass run weatherstrip from door frame channel.

INSTALLATION

Reverse the preceding operation.

OUTSIDE DOOR LATCH RELEASE HANDLE

REMOVAL (FIG. 18)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Disconnect security alarm switch and illuminated entry switch from back of outside front door latch release handle, if equipped. For additional information refer to Group 8Q, Vehicle Theft Security System

(4) Disconnect lock rod and latch release rod from door latch assembly.

(5) Remove nuts holding outside door latch handle to retainer bracket and separate bracket from door.

(6) Swing lock rod upward, parallel to back of latch handle, and separate latch handle from door panel.

INSTALLATION

Reverse the preceding operation.

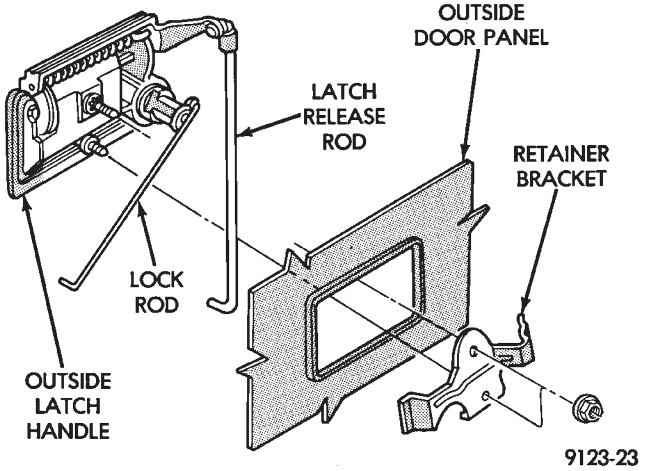


Fig. 18 Outside Door Latch Release Handle—Typical

INSIDE LATCH RELEASE HANDLE

REMOVAL

(1) Remove door trim panel.

(2) Remove screw holding handle to inner door panel.

(3) Disconnect linkage rod from back of handle.

(4) Separate handle from door.

INSTALLATION

Reverse the preceding operation.

POWER DOOR LOCK ACTUATOR

REMOVAL (FIG. 19)

(1) Remove door trim panel. Remove silencer and water shield as necessary.

(2) Raise door glass to the up position.

(3) Disconnect battery negative cable.

(4) Disconnect lock actuator linkage rod from door latch.

(5) Remove bolts holding actuator to inner door panel.

(6) Separate power door lock actuator from door.

INSTALLATION

Reverse the preceding operation.

SIDE VIEW MIRROR

REMOVAL (FIG. 20)

(1) Remove door trim panel.

(2) Disconnect power mirror wire connector.

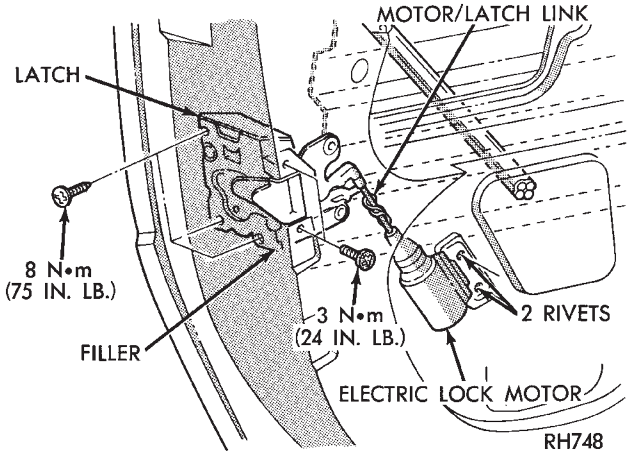


Fig. 19 Power Door Lock Actuator

(3) Remove covers to gain access to mirror attaching nuts.

(4) Remove nuts holding mirror to door frame.

(5) Separate mirror from door frame.

INSTALLATION

Reverse the preceding operation.

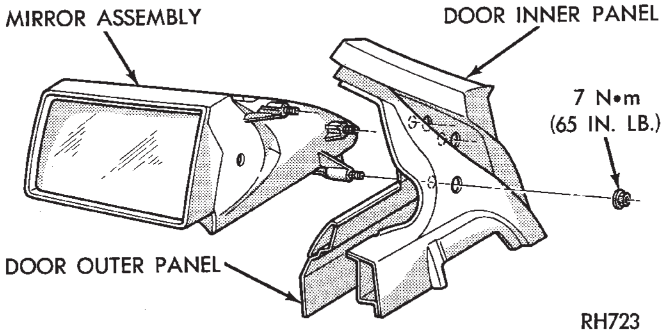


Fig. 20 Side View Mirror

DOOR GLASS OPENING MOULDING

REMOVAL

(1) Remove door trim panel.

(2) Remove door glass.

(3) Remove side view mirror.

(4) Disengage clips holding door glass opening moulding to the door frame (Fig. 21).

(5) Remove screws holding door glass opening moulding and belt weatherstrip to door belt flange (Fig. 22).

(6) Remove the belt weatherstrip.

(7) Remove window opening moulding.

INSTALLATION

Reverse the preceding operation.

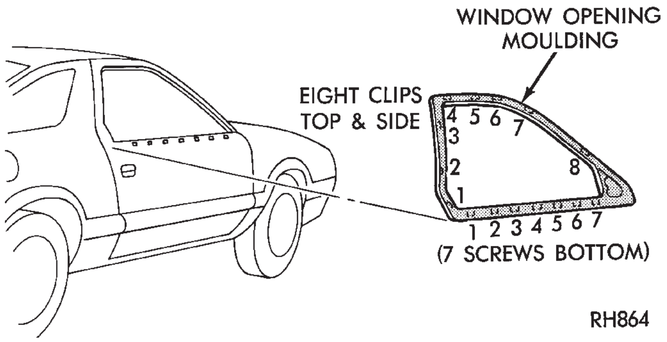


Fig. 21 Window Opening Moulding

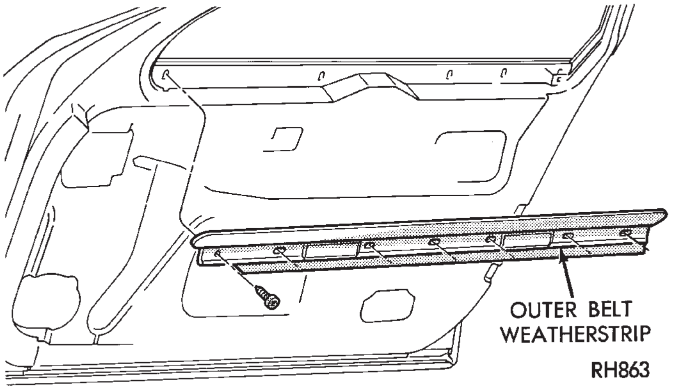


Fig. 22 Outer Belt Weatherstrip

DOOR OPENING WEATHERSTRIPS

REMOVAL

(1) Remove interior trim as necessary to gain access to door opening weatherstrip.

(2) Pull weatherstrip from pinch flange around door opening.

INSTALLATION

(1) Locate the middle to the weatherstrip at the center of the upper pinch flange. Push weatherstrip onto pinch flange at the top corner near the B-pillar.

(2) When the weatherstrip has been installed down the door opening to the sill pinch flange, mate the ends of the weatherstrip together and finish installing.

BODY SIDE MOULDINGS

STICK-ON BODY SIDE MOULDING REMOVAL AND INSTALLATION

(1) Warm the effected stick-on moulding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(2) Pull stick-on moulding from painted surface.

(3) Remove adhesive tape residue from painted surface of vehicle.

(4) If moulding is to be reused, Remove tape residue from moulding. Clean back of moulding with Mopar, Super Kleen solvent or equivalent. Wipe moulding dry with lint free cloth. Apply new body side moulding (two sided adhesive) tape to back of moulding.

(5) Clean body surface with Mopar, Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(6) Apply a length of masking tape on the body, parallel to the top edge of the moulding to use as a guide, if necessary.

(7) Remove protective cover from tape on back of moulding. Apply moulding to body below the masking tape guide.

(8) Remove masking tape guide and heat body and moulding, refer to step one. Firmly press moulding to body surface to assure adhesion.

BODY SIDE APPLIQUE

REMOVAL (FIG. 23)

DOOR APPLIQUE

(1) Remove rivets holding bottom or door applique to door pinch flange using a 3 mm (0.125 in.) drill.

(2) Lift door applique upward to disengage applique from retainer channel.

(3) Separate applique from door.

SILL APPLIQUE

(1) Remove push-in fasteners holding sill applique to bottom of rocker panel.

(2) Remove push-in fasteners holding sill applique to front and rear wheel lip openings.

(3) Lift sill applique upward to disengage applique from retainer channels.

(4) Separate sill applique from vehicle.

INSTALLATION

Prime and touch-up bare metal surfaces before installing applique to avoid corrosion. Reverse the removal operation.

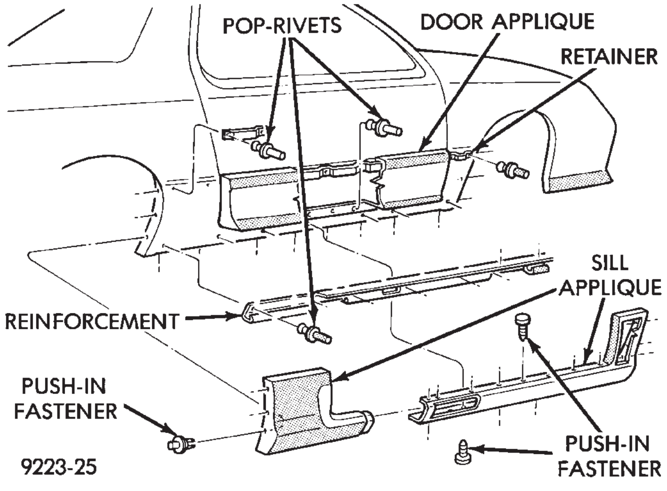


Fig. 23 Body Side Applique

DOOR OPENING SCUFF PLATES

REMOVAL (FIG. 24)

(1) Open front door.

(2) Remove screws holding scuff plate to door sill.

(3) Separate scuff plate from vehicle.

INSTALLATION

Reverse the preceding operation.

A-PILLAR AND ROOF RAIL MOULDINGS

A-PILLAR MOULDING REMOVAL (FIG. 24)

(1) Open front door.

(2) Remove push-in fasteners holding A-pillar moulding to roof rail above door opening.

(3) Remove trim plug and screw holding A-pillar molding to A-pillar

(4) Slide A-pillar moulding upward and pull rearward to separate moulding from A-pillar.

A-PILLAR MOULDING INSTALLATION

Reverse the preceding operation.

LOWER QUARTER TRIM PANEL

REMOVAL (FIG. 24)

(1) Remove tail panel trim cover and security shade, if equipped

(2) Remove rear seat cushion and backs.

(3) Remove seat back latch striker bezel.

(4) Remove screw covers. Remove screws holding lower quarter trim panel to quarter.

(5) Pull rearward end of trim panel away from quarter panel and push trim forward to clear door opening flange.

(6) Separate lower quarter trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

UPPER QUARTER TRIM PANEL

REMOVAL (FIG. 24)

(1) Remove lower quarter trim panel.

(2) Remove rear seat shoulder harness turning loop cover.

(3) Remove bolt holding belt turning loop to C-pillar.

(4) Remove bolt holding front seat belt to floor at door sill.

(5) Remove screw holding coat hook to roof rail.

(6) Remove roof rail moulding as necessary to clear quarter panel removal path.

(7) Remove push-in fastener holding upper quarter trim to roof rail.

(8) Remove screw covers from trim panel to gain access to screws.

(9) Remove screws holding upper quarter trim to quarter panel.

(10) Raise and support lift gate in the up position. Disconnect bottom of lift cylinder.

(11) Swing rear of trim panel away from quarter panel and pull trim forward to clear door opening flange.

(12) Separate upper quarter trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

LOWER TAIL PANEL TRIM COVER

REMOVAL (FIG. 24)

(1) Raise lift gate to the up position.

(2) Remove hidden screws holding tail panel trim cover to tail panel from carpeted area.

(3) Remove push-in fasteners holding top tail panel trim to opening sill.

(4) Lift up floor cover and position cover out of the way.

(5) Separate cover from vehicle.

INSTALLATION

Reverse the preceding operation.

LIFT GATE TRIM

REMOVAL (FIG. 25)

(1) Raise the lift to the up position.

(2) Disengage clips holding side moldings to lift gate. Separate moldings from lift gate.

(3) Remove expanding push-in fasteners holding upper trim panel to lift gate.

(4) Remove screw plugs and screws holding upper trim panel to lift gate. Separate upper trim panel from lift gate.

(5) Remove screw plug and screw holding lower trim panel to rear window wiper motor, if equipped.

(6) Remove screws holding lower trim panel to lift gate. Separate lower trim panel from lift gate.

INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 26)

(1) Adjust front seat to the forward position.

(2) Remove bolt holding outboard lap belt anchor to floor below door sill.

(3) Remove lower and upper quarter trim panels as necessary to gain access to shoulder harness turning loop and retractor.

(4) Remove bolt holding shoulder turning loop to B-pillar.

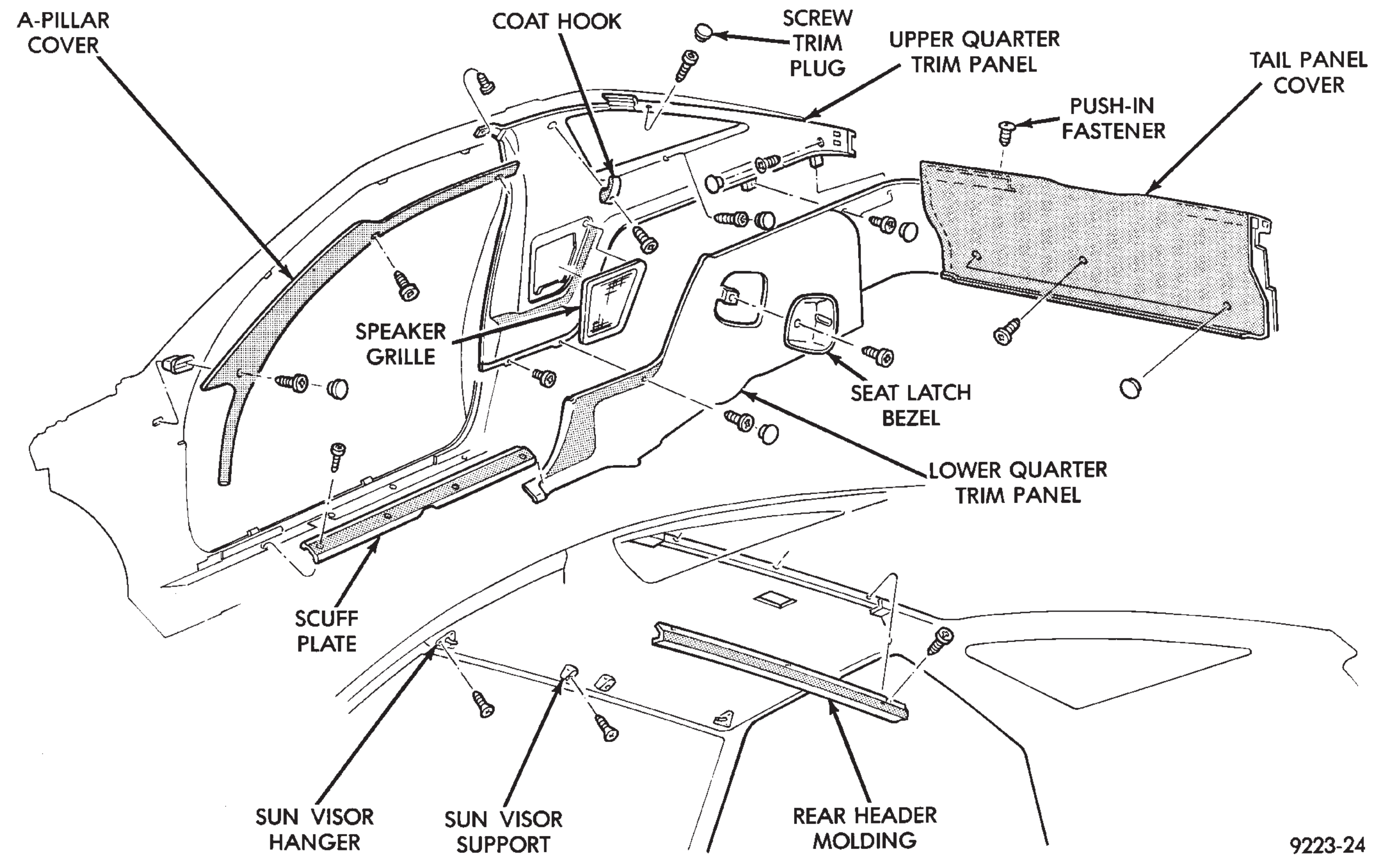


Fig. 24 Interior Mouldings, Panels, and Trim Covers

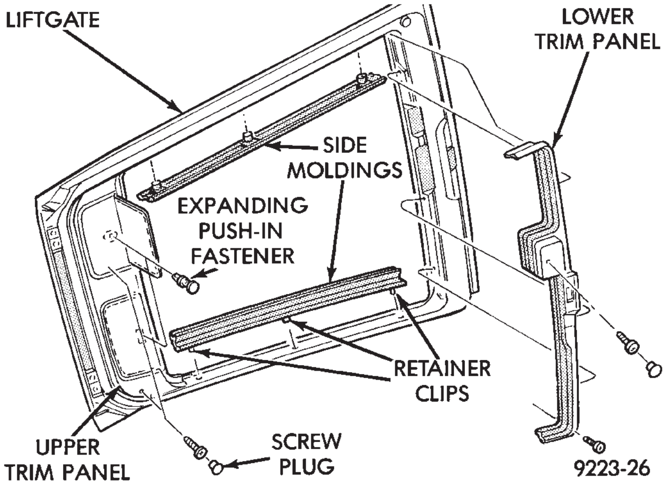


Fig. 25 Lift Gate Trim

(5) Remove bolt holding belt retractor to quarter panel.

(6) Separate belt from vehicle.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD BUCKLE REMOVAL (FIG. 26)

(1) Remove bolt holding inboard buckle to floor.

(2) Disconnect seat belt sensor wire connector, if equipped.

(3) Separate buckle assembly from vehicle.

INBOARD BUCKLE INSTALLATION

Reverse the preceding operation.

REAR SEAT BELTS

REAR OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 27)

(1) Remove lower and upper quarter trim panel.

(2) Remove bolt holding lap belt anchor to floor at wheelhouse kickup.

(3) Remove bolt holding seat belt retractor to quarter panel.

REAR OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

REAR INBOARD BUCKLE REMOVAL (FIG. 27)

(1) Lift seat belt buckle anchor cover to expose bolt.

(2) Remove bolt holding inboard buckle/center occupant belt to seat frame.

(3) Separate buckle from vehicle.

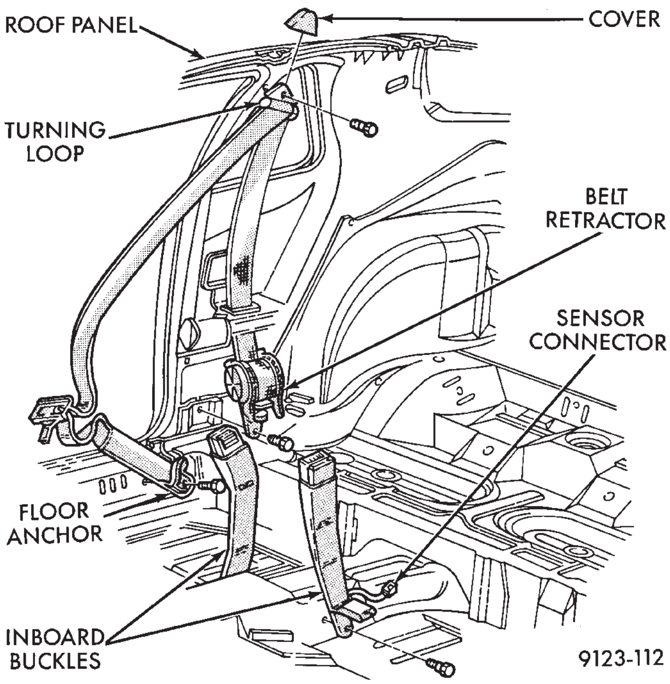


Fig. 26 Front Seat Belts—Typical

REAR INBOARD BUCKLE INSTALLATION

Reverse the preceding operation.

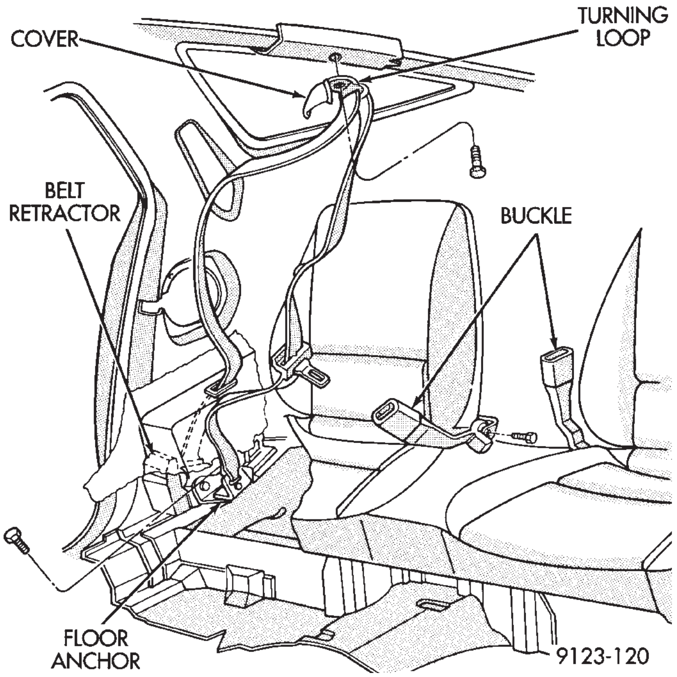


Fig. 27 Rear Seat Belts

FRONT SEATS

REMOVAL (FIG. 28 OR 29)

(1) Position seat full forward.

(2) Remove screws holding rear track riser covers and separate covers from tracks.

(3) On power seat track, remove outboard track cover.

(4) Remove nuts holding seat track to floor.

(5) Position seat full rearward.

(6) On power seat track, remove door sill scuff plate and disconnect wire connector.

(7) Remove bolts holding seat track to cross member.

(8) Remove seat from vehicle.

INSTALLATION

Reverse the preceding operation.

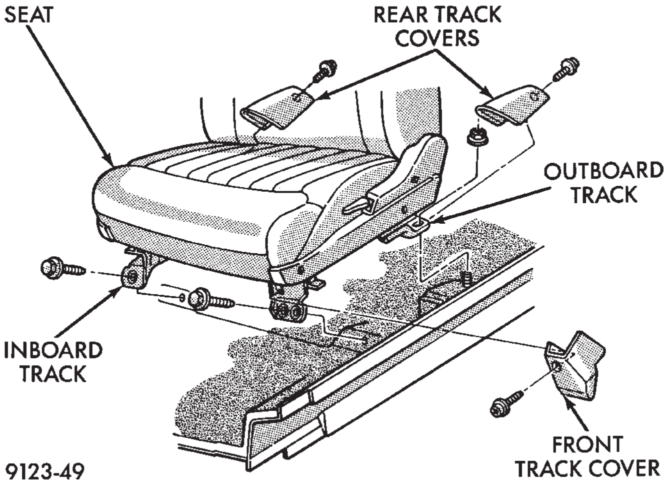


Fig. 28 Manual Front Seat

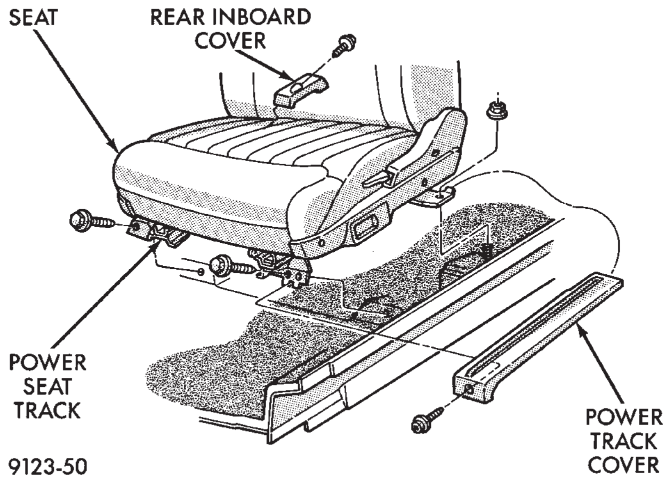


Fig. 29 Power Front Seat

REAR SEATS

REMOVAL (FIG. 30)

(1) Hinge seat backs forward.

(2) Remove bolts holding rear seat frame to floor on sides of center floor hump near luggage compartment kick-up.

(3) Pull seat forward to disengage retaining hooks from floor.

(4) Separate seat from vehicle.

INSTALLATION

Reverse the preceding operation.

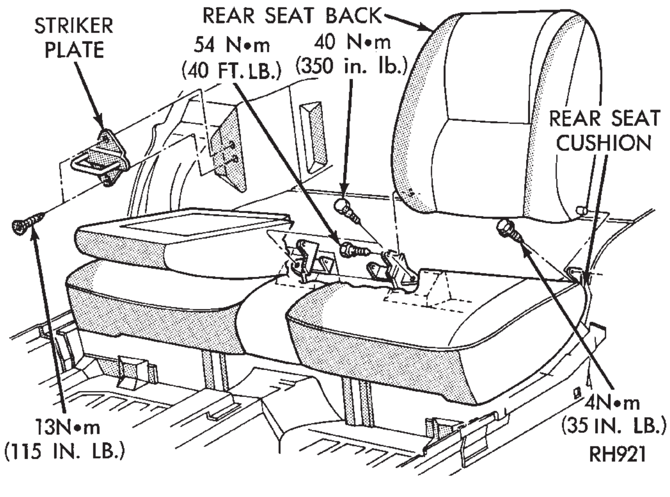


Fig. 30 Rear Seat Cushion and Back

FRONT CENTER CONSOLE

REMOVAL (FIG. 31)

(1) Position front seats full forward.

(2) Remove rear ash tray.

(3) Remove rear lower carpeted end cover.

(4) Remove nuts holding console to floor bracket.

(5) Position front seats full rearward.

(6) Raise console storage bin cover and remove bottom mat.

(7) Remove screws holding bottom of storage bin to floor bracket.

(8) Remove screws holding console side panels to instrument panel. Disengage hook and loop fasteners and separate side panels from console.

(9) Disconnect shift indicator cable and clips from shift mechanism through right side panel opening, if equipped with automatic transaxle. Refer to Group 8E, Instrument Panel and Gauges for proper procedures.

(10) Disengage clips holding parking brake lever cover to console and separate cover from vehicle.

(11) Remove center instrument panel bezel. Refer to Group 8E, Instrument Panel. Remove screws holding console to instrument panel.

(12) Remove screws holding console to lower instrument panel.

(13) Remove bolts holding console to forward floor mounting bracket.

(14) Remove gear selector knob.

(15) Separate console from floor and remove from vehicle.

INSTALLATION

Reverse the preceding operation.

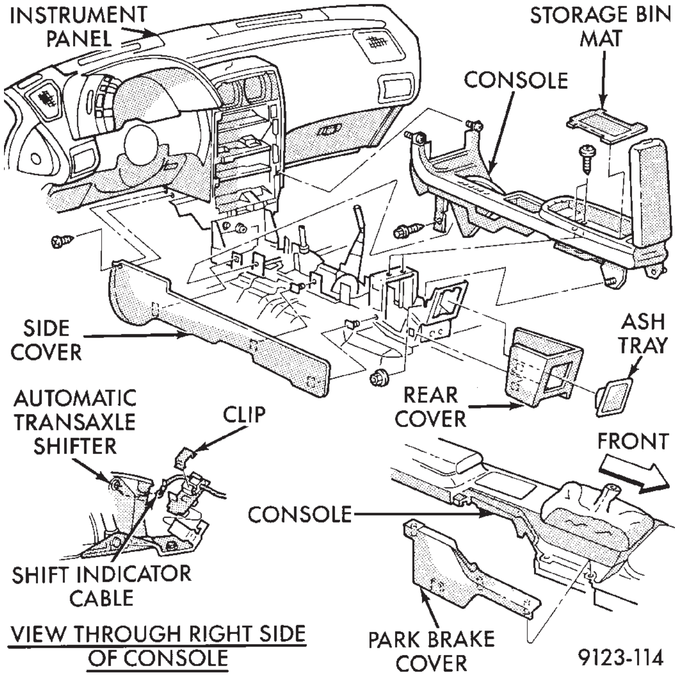


Fig. 31 Center Console

FLOOR CARPET

REMOVAL (FIG. 32)

(1) Remove cowl trim panels and scuff plates.

(2) Remove front seats and inboard seat belts.

(3) Remove center arm rest and front console.

(4) Remove inboard and outboard seat belt lower attaching bolts.

(5) Remove left dash panel foot rest.

(6) Remove rear seat.

(7) Pull carpet from under quarter trim covers.

(8) Fold carpet and remove through door opening.

INSTALLATION

Reverse the preceding operation.

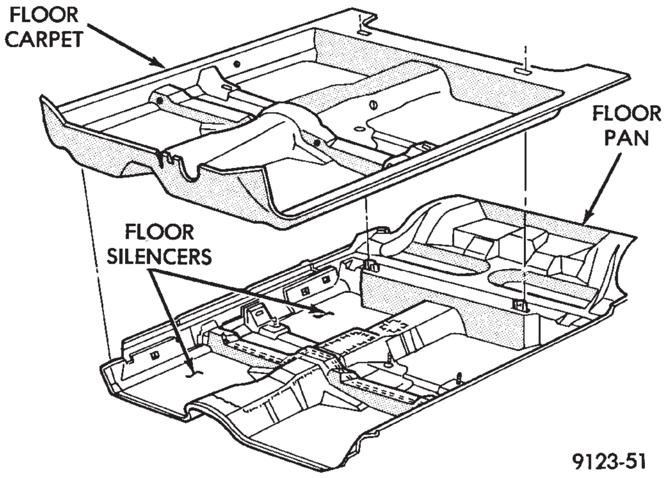


Fig. 32 Floor Carpet and Silencers—Typical

OVERHEAD CONSOLE

REMOVAL (FIG. 33)

(1) Remove screws holding overhead console to reinforcement bracket.

(2) Slide overhead console rearward to separate reinforcement bracket retainer tab from console.

(3) Lower console from roof and disconnect wire connectors.

INSTALLATION

Reverse The preceding operation.

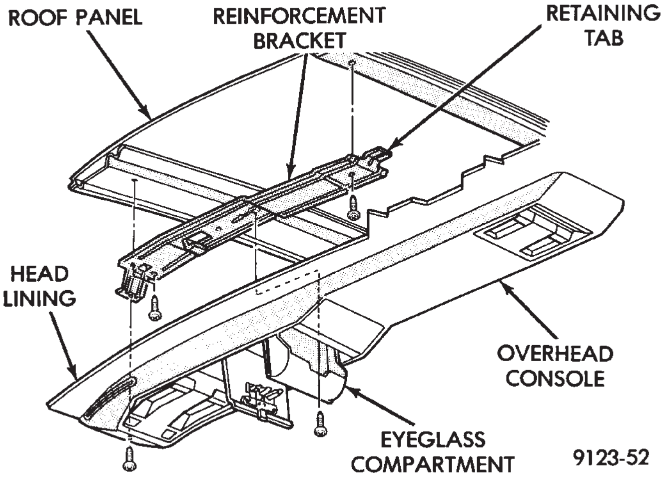


Fig. 33 Overhead Console—Typical

HEAD LINING

REMOVAL

(1) Disconnect battery negative cable.

(2) Pull dome lamp downward to disengage from retaining ring in head lining. Separate lens from lamp body and remove bulb. Separate bulb holder from lamp body. Remove attaching screw holding retaining ring to roof bow, if equipped.

(3) Remove screws holding coat hooks to roof above quarter panels.

(4) Remove roof rail and A-pillar mouldings.

(5) Remove screws holding sun visors to roof header and disconnect wire connector, if equipped. Remove inboard sun visor hangers.

(6) Remove overhead console, if equipped.

(7) Pull front reading lamp downward to disengage from retaining ring in head lining and disconnect wire connector. Remove screws holding retaining ring to roof header, if equipped.

(8) Remove pinch welt holding headlining to sun roof opening, if equipped.

(9) Remove screws holding lift gate opening header moulding to rear roof header. Separate moulding from header.

(10) Remove one quarter trim panel as necessary to clear head lining removal path.

(11) Remove head lining from vehicle.

INSTALLATION

Reverse the preceding operation.

SUNROOF LIFT CONTROL

REMOVAL (FIG. 34)

(1) Remove sunroof glass panel. Refer to Owners manual for proper procedures.

(2) Remove pinch welt holding head lining to edge of sunroof opening.

(3) Remove trim ring from tilt control handle.

(4) Remove screws holding tilt control handle to tilt control. Separate handle from control.

(5) Remove nuts holding lift control to roof panel. Separate lift control from roof.

INSTALLATION

Reverse the preceding operation.

REAR WINDOW GLASS

The rear window moulding often cannot be salvaged after removal operation is completed. Verify moulding availability from the parts supplier before removing moulding.

REMOVAL (FIG. 35)

(1) Remove rear window moulding.

(2) Remove lift gate trim as necessary to gain access to rear window defogger wire connector and ground screw, if equipped.

WARNING: WEAR EYE AND HAND PROTECTION WHEN HANDLING SAFETY GLASS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not damage body or trim finish when cutting out glass or applying fence primer.

(3) Cut the urethane around the perimeter of the back window glass. Refer to Windshield section of this group for proper procedures.

(4) Separate the rear window from the vehicle.

INSTALLATION

(1) Prepare the work area, window fence, and glass the same way as described in the Windshield section of this group.

(2) Place the fence spacers at the locations shown (Fig. 35).

(3) Apply a 10 mm (0.4 in.) bead of urethane around the perimeter of the glass.

(4) Install the glass in the same manner described in the Windshield section of this group.

(5) Install the rear window moulding. Apply 50 mm (2 in.) masking tape over moulding to assure alignment.

(6) Connect rear window defogger wiring and install lift gate trim.

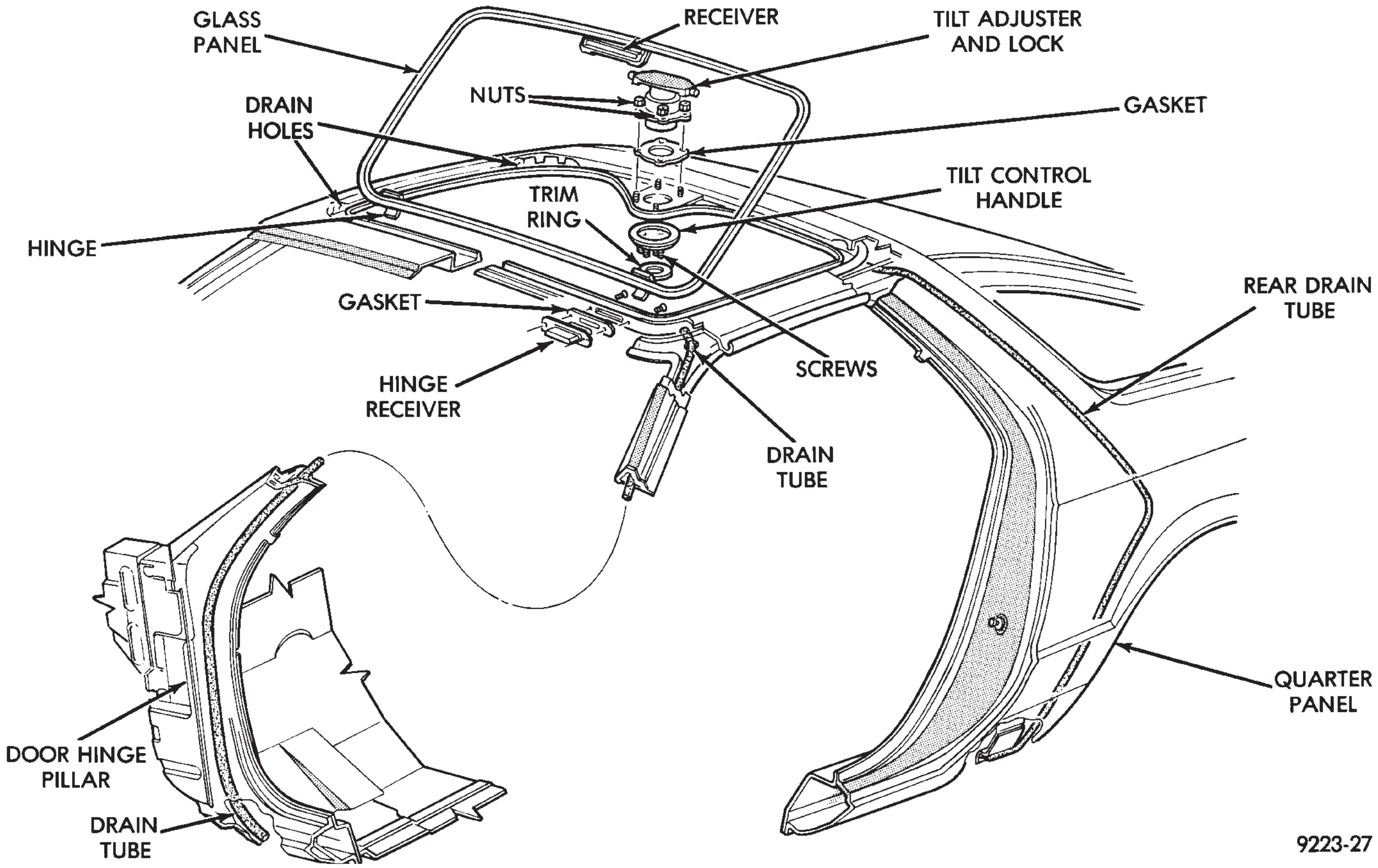


Fig. 34 Sunroof

(7) After urethane has cured remove masking tape and water test to verify repair. Verify rear window defogger operation, refer to Group 8N, Rear Window Defogger.

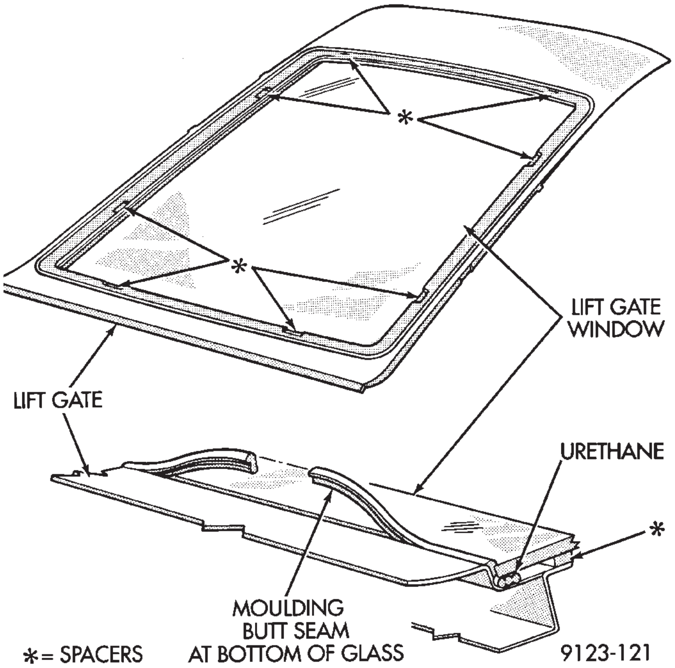


Fig. 35 Lift Gate Window Glass

QUARTER GLASS MODULE

REMOVAL (FIG. 36)

(1) Remove quarter trim panel as necessary to gain access to quarter glass module.

(2) Remove nuts holding quarter glass module to quarter glass opening.

(3) Cut urethane bonding around perimeter of quarter glass opening fence.

(4) Push quarter glass module from quarter glass opening.

(5) Separate module from vehicle.

INSTALLATION

(1) Clean hardened urethane from quarter glass opening fence and glass module, if module replacement is not required.

(2) Prepare fence and module using method described in the Windshield section of this group.

(3) Reverse the removal operation.

ROOF SEAM MOLDING

REMOVAL (FIG. 37)

(1) Remove upper quarter trim panel.

(2) Remove head lining as necessary to gain access to inside roof panel.

(3) Remove seal nut holding seam molding to roof panel.

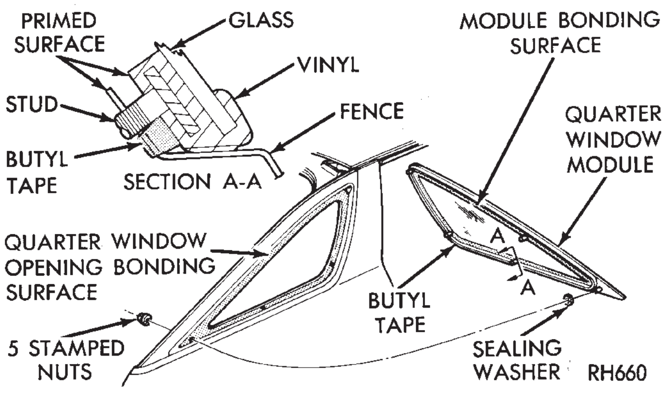


Fig. 36 Quarter Glass Module

(4) Separate molding from roof panel.

INSTALLATION

Reverse the preceding operation.

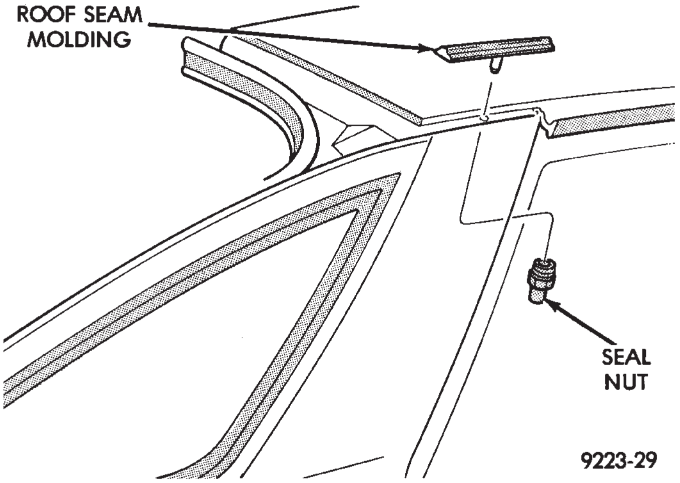


Fig. 37 Roof Seam Molding

QUARTER PANEL SPOILER

REMOVAL (FIG. 38)

(1) Remove access cover from lift gate opening end of quarter panel spoiler.

(2) Remove bolt holding spoiler to tail lamp closure panel.

(3) Remove quarter trim panel.

(4) Remove nuts holding spoiler to quarter panel from behind quarter panel above rear wheelhouse (Fig. 38).

(5) Separate spoiler from vehicle.

INSTALLATION

Reverse the preceding operation.

LIFT GATE SPOILER

REMOVAL (FIG. 39)

(1) Raise lift gate to the up position.

(2) Remove nuts holding spoiler to outboard pinch flanges of lift gate.

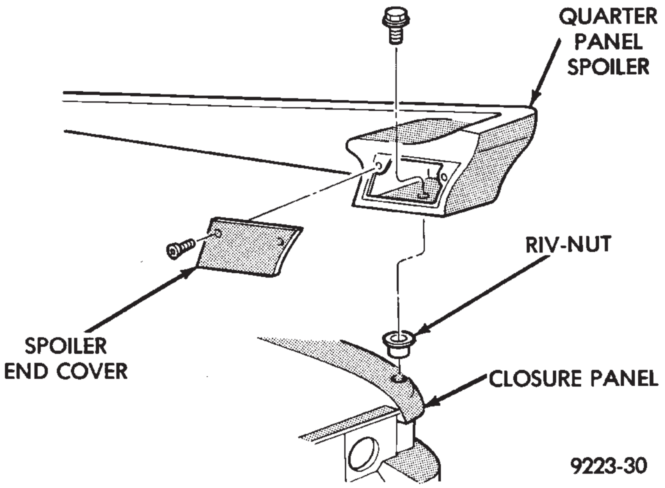


Fig. 38 Quarter Panel Spoiler

(3) Separate spoiler from lift gate.

INSTALLATION

Reverse the preceding operation.

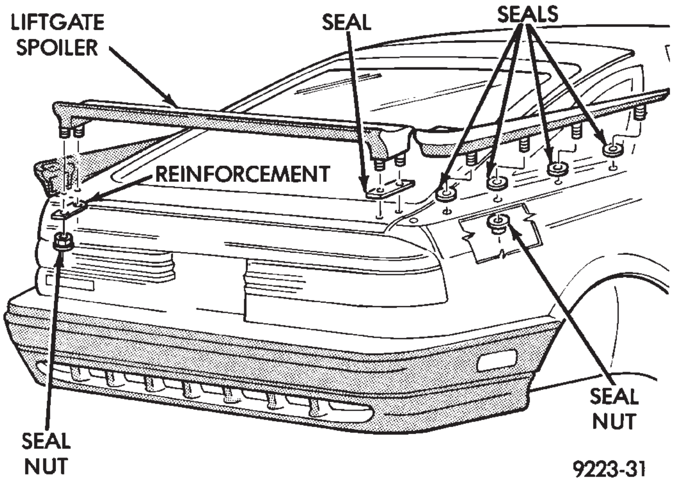


Fig. 39 Lift Gate Spoiler

LIFT GATE PROP CYLINDER

REMOVAL (FIG. 40)

(1) raise lift gate to the full open position.

(2) Support lift gate on a suitable lifting device.

(3) Remove bolt holding bottom of lift gate prop cylinder to c-pillar.

(4) Remove bolt holding top of lift gate prop cylinder to lift gate.

(5) Separate prop cylinder from vehicle.

INSTALLATION

Reverse the preceding operation.

LIFT GATE

REMOVAL (FIG. 41)

(1) Raise lift gate to the full open position.

(2) Remove rear roof header molding.

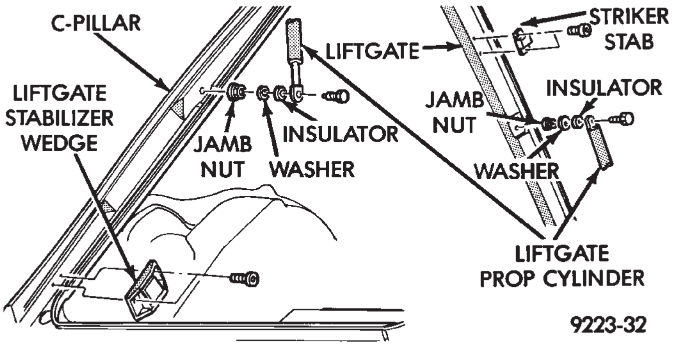


Fig. 40 Lift Gate Prop Cylinder

(3) Disconnect lift gate wire connectors and rear window washer hose, if equipped.

(4) Remove upper lift gate trim molding.

(5) Support lift gate on a suitable lifting device.

(6) Disconnect top of prop cylinders from lift gate.

(7) Mark lift gate hinge locations to assist installation an alignment of lift gate.

(8) With assistance of a helper, remove bolts holding lift gate to hinge.

(9) Separate lift gate from vehicle.

INSTALLATION

Reverse the preceding operation.

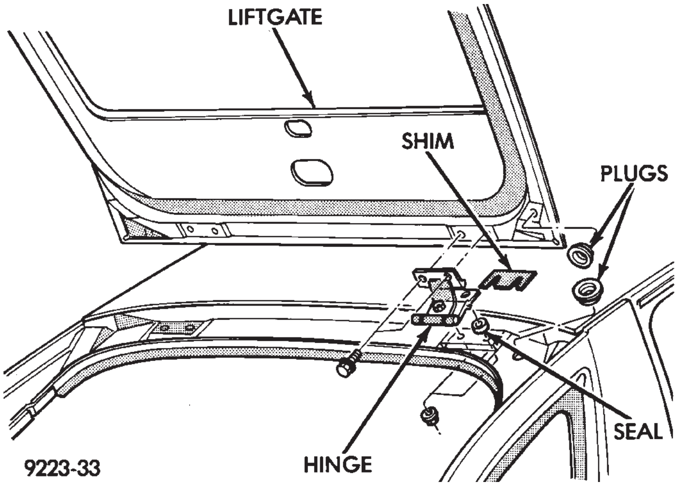


Fig. 41 Lift Gate

LIFT GATE LATCH AND STRIKER

LIFT GATE LATCH REMOVAL (FIG. 42)

(1) Raise lift gate to the full open position.

(2) Remove luggage compartment tail trim panel.

(3) Disconnect lock linkage rod from lift gate latch arm.

(4) Remove nuts holding lift gate latch to tail panel.

(5) Separate latch from tail panel and disconnect lift gate remote release cable.

LIFT GATE LATCH INSTALLATION

LIFT GATE STRIKER REMOVAL (FIG. 42)

(1) Raise lift gate to the full open position.

(2) Remove lower lift gate trim panel.

(3) Mark lift gate striker location to assist installation.

(4) Remove bolts holding lift gate striker to lift gate.

(5) Separate striker from lift gate.

LIFT GATE STRIKER INSTALLATION

Reverse the preceding operation.

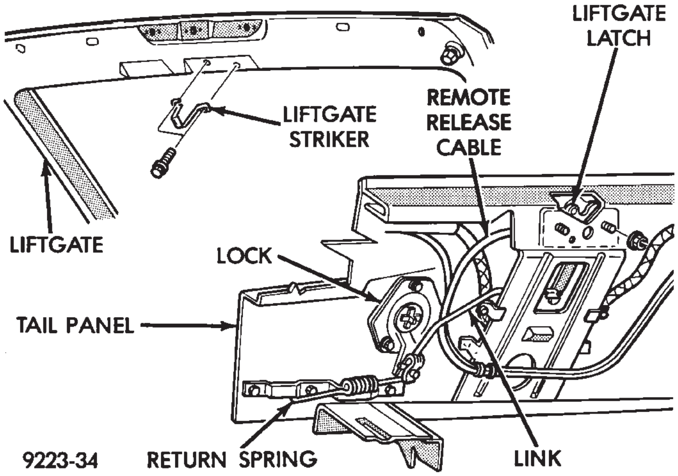


Fig. 42 Lift Gate Latch and Striker

LIFT GATE LOCK CYLINDER

REMOVAL (FIG. 43)

(1) Raise lift gate to the full open position.

(2) Remove luggage compartment tail trim panel.

(3) Disconnect linkage return spring (Fig. 42).

(4) Disconnect linkage rod from lift gate lock arm.

(5) Remove bolts holding lift gate lock to tail panel.

(6) Separate lock from tail panel.

INSTALLATION

Reverse the preceding operation.

FUEL FILL DOOR

REMOVAL (FIG. 44)

(1) Remove right lower quarter trim panel.

(2) Open fuel fill door.

(3) Remove nuts holding fuel fill door to quarter panel from in luggage compartment.

(4) Separate fuel fill door from vehicle.

INSTALLATION

Reverse the preceding operation

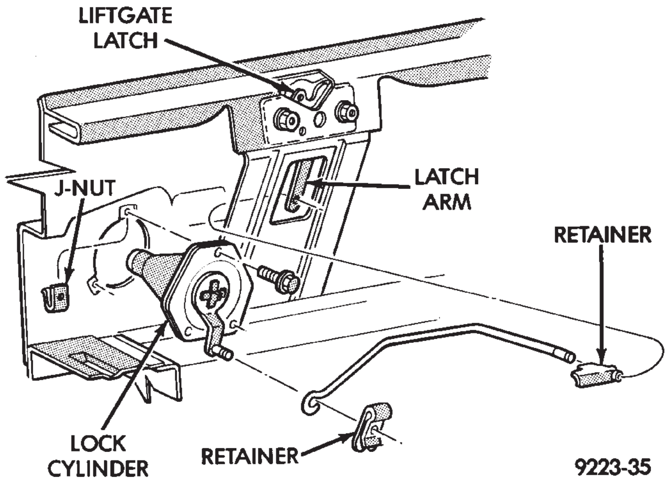


Fig. 43 Lift Gate Lock Cylinder

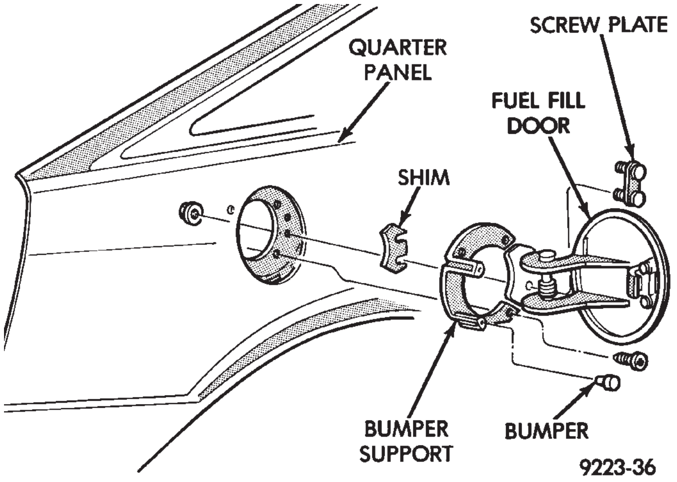


Fig. 44 Fuel Fill Door

LIFT GATE AND FUEL FILL DOOR RELEASE CABLES

LIFT GATE AND FUEL FILL DOOR CABLES REMOVAL (FIG. 45)

(1) Remove interior trim as necessary to gain access to release cables.

(2) Remove left front door opening scuff plate.

(3) Remove screw holding trim cover to release cable handle and separate cover from handle.

(4) Remove screw holding release handle to door sill.

(5) Pry open retainer tab holding cable core end in handle pivot. Pry cable case end from handle.

(6) On fuel fill door cable, remove nut holding cable latch to fuel fill opening.

(7) On lift gate latch, remove lift gate latch cover and disconnect cable end from latch. Route cable back through trunk lid.

LIFT GATE AND FUEL FILL DOOR CABLES INSTALLATION

Reverse the preceding operation.

TAIL LAMP CLOSURE PANEL

REMOVAL

(1) Remove lift gate opening scuff plate.

(2) Remove lift gate opening sill cover.

(3) Remove luggage compartment tail panel trim.

(4) Remove lower quarter trim panels.

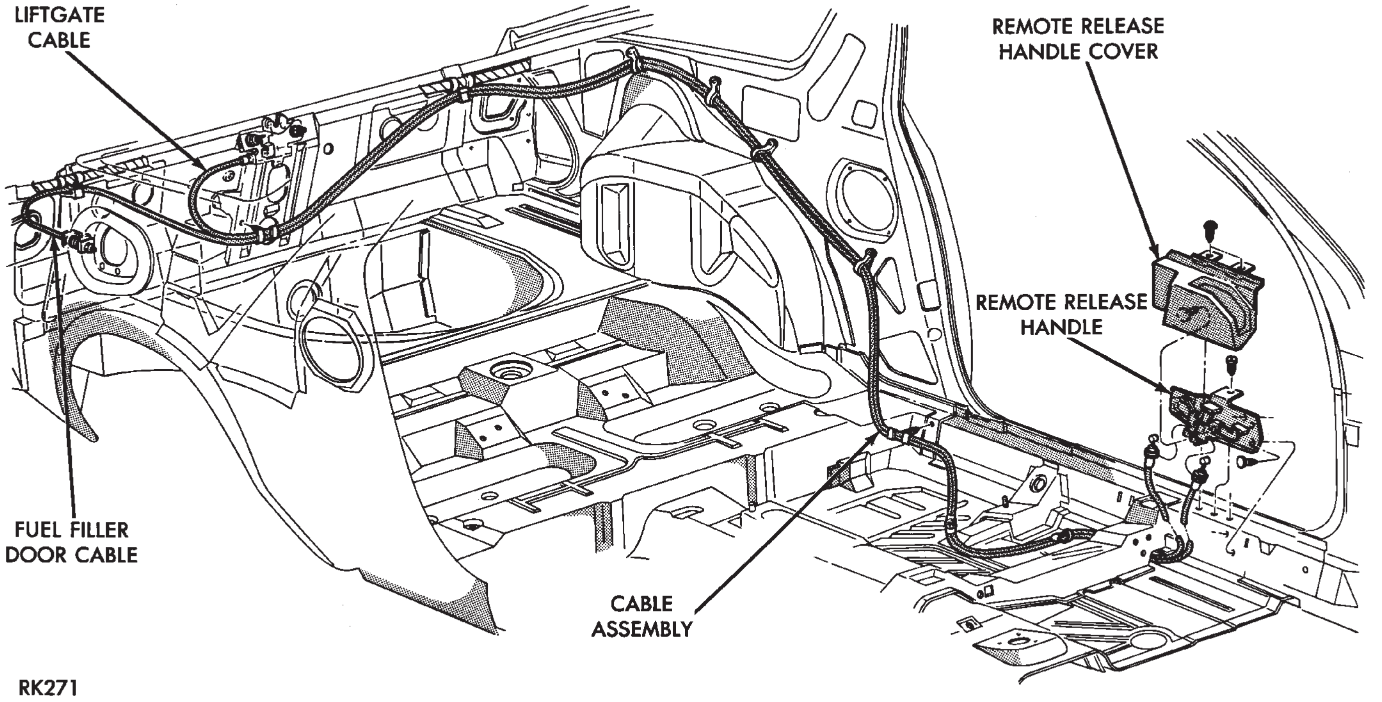


Fig. 45 Lift Gate and Fuel Fill Door Release Cables

(5) Remove bolt holding quarter panel spoiler to tail lamp closure panel, if equipped.

(6) Remove tail lamps and license plate lamps, refer to Group 8L, Lamps for proper procedures.

(7) Remove nuts holding tail lamp closure panel to tail panel.

(8) Remove nuts holding tail lamp closure panel to quarter panel ends.

(9) Separate tail lamp closure panel from vehicle.

INSTALLATION

Reverse the preceding operation.

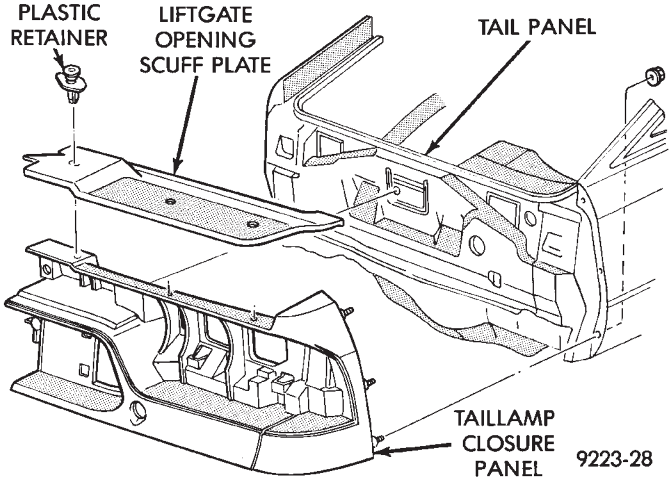


Fig. 46 Tail Lamp Closure Panel

AJ-VEHICLE BODY COMPONENT SERVICE

INDEX

GRILLE

REMOVAL (FIG. 1)

(1) Remove screws holding grille to header molding at top of grille.

(2) Push downward on top of bumper fascia to gain clearance for grille removal.

(3) Push grille downward and pull outward.

(4) Separate grille from vehicle.

INSTALLATION

Reverse the preceding operation.

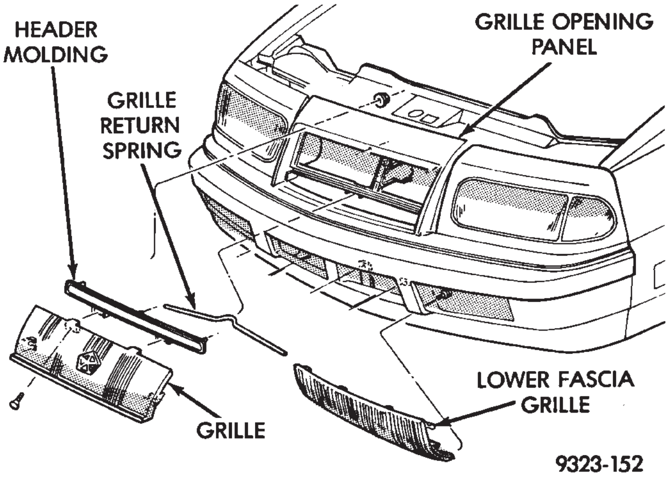


Fig. 1 Grille Assembly

GRILLE HEADER MOLDING

REMOVAL (FIG. 1)

(1) Remove grille.

(2) Remove nuts holding header molding to grille opening panel.

(3) Separate header molding from vehicle.

INSTALLATION

Reverse the preceding operation.

LOWER GRILLE

REMOVAL (FIG. 1)

(1) Remove screws holding lower grille to fascia.

(2) Separate lower grille from vehicle.

INSTALLATION

Reverse the preceding operation.

GRILLE OPENING PANEL

REMOVAL (FIG. 2)

(1) Remove front bumper and fascia.

(2) Remove grille.

(3) Remove headlamp modules.

(4) Remove bolt holding grille opening panel to bracket forward of radiator.

(5) Raise hood and remove push-in fasteners holding sight shields to closure panel. Separate sight shields from vehicle.

(6) Remove nuts holding grille opening panel to front fenders.

(7) Remove bolts holding grille opening panel to front fenders.

(8) Separate grille opening panel form vehicle.

INSTALLATION

Reverse the preceding operation. Align grille opening panel to fit flush across fender joining locations.

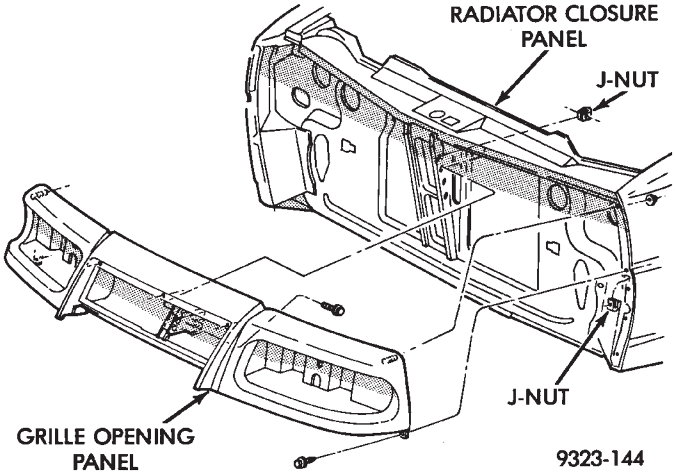


Fig. 2 Grille Opening Panel

HOOD AND HINGES

HOOD REMOVAL (FIG. 2)

(1) Raise hood to full up position.

(2) Lift front edge of cowl cover on the right side of the windshield washer bottle and disconnect the under hood lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood, 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.

(4) Remove the top hood to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the hood, remove the bottom hood to hinge attaching bolts. Separate the hood from the vehicle.

HOOD INSTALLATION

Reverse the preceding operation.

HOOD HINGE REMOVAL (FIG. 3)

(1) Support hood on the side that requires hinge replacement.

(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood hinge, 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.

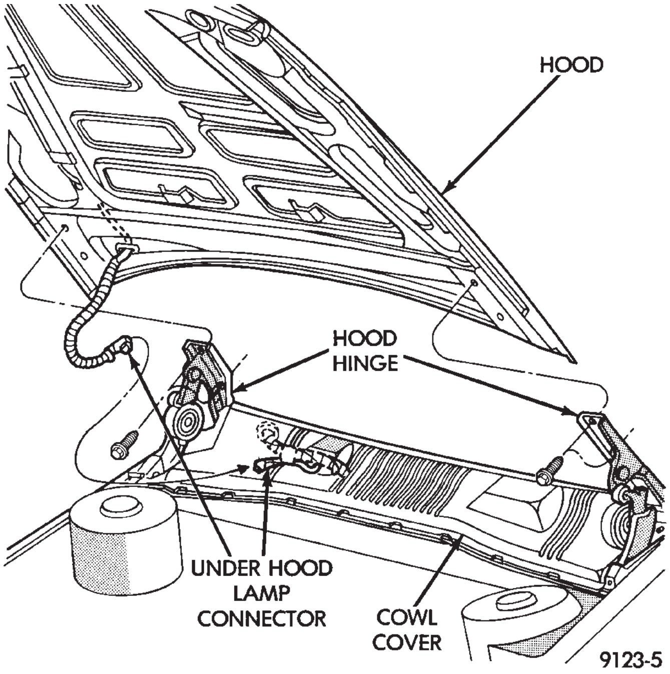


Fig. 2 Hood Assembly Remove or Install—Typical

(3) Remove hood to hinge attaching bolts.

(4) Remove hood hinge to front fender attaching bolts and separate hinge from vehicle.

HOOD HINGE INSTALLATION

Reverse the preceding operation. If necessary, paint new hinge before installation.

HOOD LATCH AND RELEASE CABLE

HOOD LATCH REMOVAL (FIG. 4)

(1) Raise hood to the full up position.

(2) Remove hood latch attaching bolts holding latch to radiator closure panel and separate from vehicle.

(3) Pry release cable casing attachment from slot receiver on latch, disengage cable end from latch arm hook.

HOOD LATCH INSTALLATION

Reverse the preceding operation.

HOOD LATCH RELEASE CABLE REMOVAL

(1) Raise hood to the full up position.

(2) Remove push-in fasteners holding hood latch cover to radiator closure panel and separate cover from vehicle.

(3) Disconnect hood release cable casing and cable end from hood latch assembly. Refer to Hood Latch Removal procedure in this section.

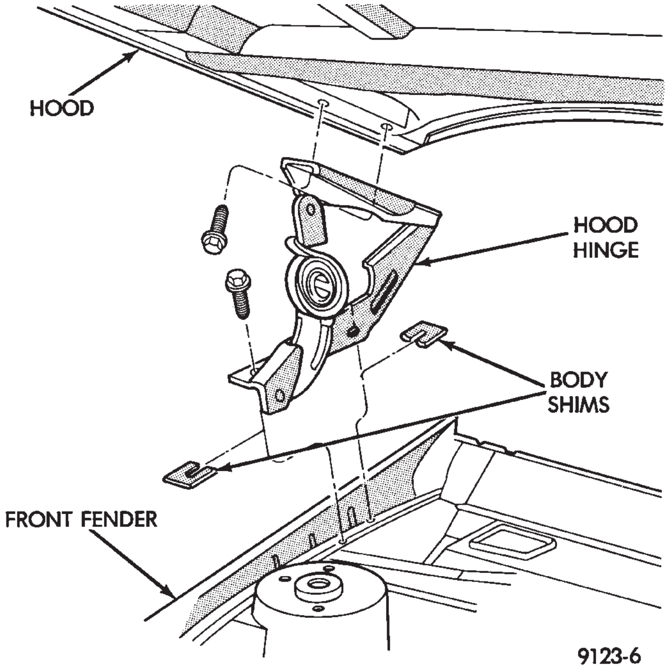


Fig. 3 Hood Hinge Assembly—Typical

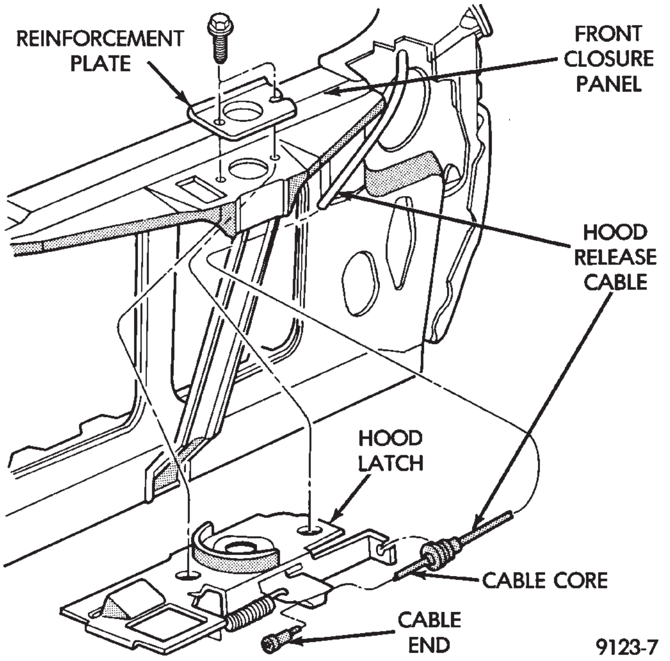


Fig. 4 Hood Latch Assembly—Typical

(4) Remove hood latch release cable handle attaching bolts from under left lower edge of instrument panel.

(5) Disengage release cable rubber grommet from engine compartment dash panel behind instrument panel.

(6) Rout cable assembly through engine compartment around battery, under fender lip, under relay bank, and under wiring harnesses, toward dash panel. Push cable through access hole in dash panel under the brake master cylinder, into passenger compartment.

HOOD LATCH RELEASE CABLE INSTALLATION

Reverse the preceding operation.

COWL COVER

REMOVAL (FIG. 5)

(1) Raise hood to full up position.

(2) Disconnect windshield washer hoses from wiper arms.

(3) Remove windshield wiper arm assemblies. Refer to Group 8K, Windshield Wiper and Washer Systems.

(4) Remove plastic expanding type fasteners holding cowl cover to cowl, below windshield.

(5) Lift back of cowl cover and slide cover rearward from under dash panel to hood seal and separate cover from vehicle.

INSTALLATION

Reverse the preceding operation.

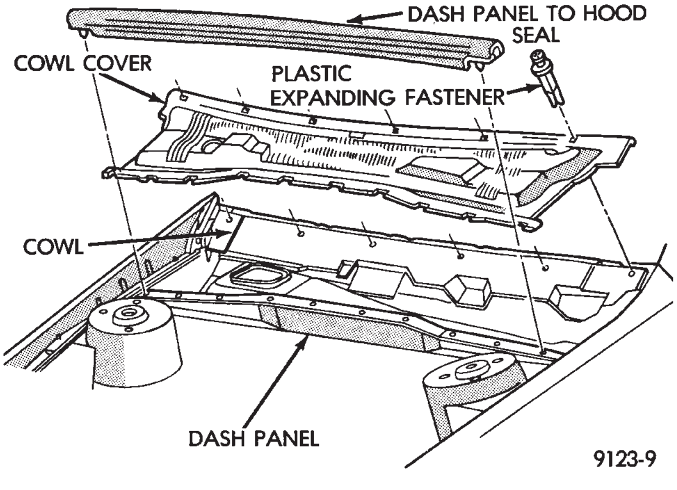


Fig. 5 Cowl Cover Assembly

FRONT END SPLASH SHIELDS

FRONT WHEELHOUSE SPLASH SHIELD REMOVAL (FIG. 6)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove front wheel assembly.

(3) Remove push-in fasteners holding front wheelhouse splash shield to fender opening lip and inner wheelhouse area.

(4) Separate wheelhouse splash shield from vehicle.

FRONT WHEELHOUSE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

TRANSAXLE SPLASH SHIELD REMOVAL (FIG. 6)

(1) Remove one front wheelhouse splash shield push-in fastener and separate wheelhouse splash shield from transaxle splash shield.

(2) Remove transaxle splash shield attaching bolts and separate transaxle splash shield from vehicle.

TRANSAXLE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

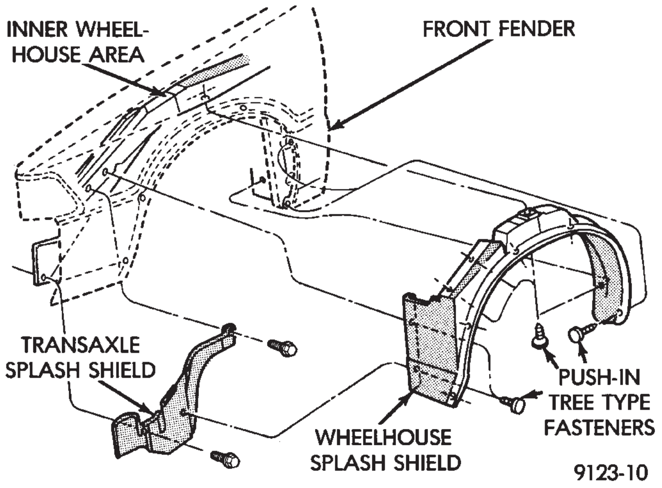


Fig. 6 Front Wheelhouse and Transaxle Splash Shields—Typical

ENGINE DRIVE BELT SPLASH SHIELD REMOVAL (FIG. 7)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove bolts holding engine drive belt splash shield to right frame rail.

(3) Separate drive belt splash shield from vehicle.

ENGINE DRIVE BELT SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

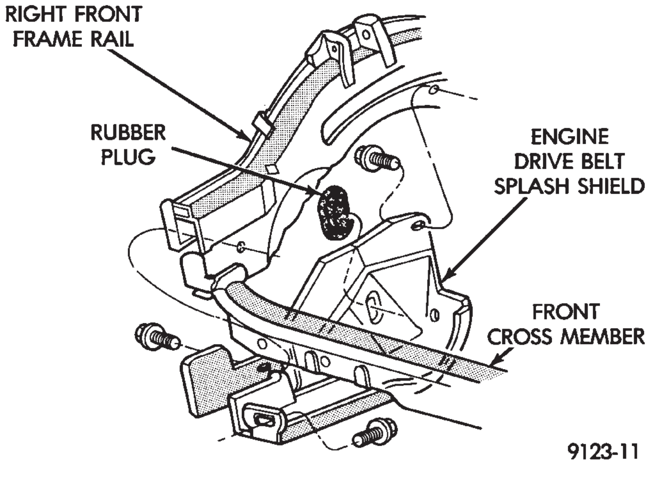


Fig. 7 Engine Drive Belt Splash Shield—Typical

DOOR TRIM PANEL

REMOVAL (FIG. 8)

(1) Lower door glass and disconnect battery negative cable.

(2) Remove courtesy lamp and remove socket.

(3) Remove screw holding trim panel to door from courtesy lamp opening.

(4) Disengage clips holding speaker grille to trim panel and separate grille from door.

(5) Remove screw holding trim panel to door from speaker grille opening.

(6) Remove screw holding inside latch handle bezel to trim panel and separate bezel from door. Disconnect power door lock switch wire connector, if equipped.

(7) Remove window crank, if equipped.

(8) Remove screw holding trim panel to door from arm rest pull cup opening.

(9) Remove hidden screws holding trim panel to door from carpet area at bottom of trim.

(10) Lift trim panel upward and separate panel from door.

(11) Disconnect radio speaker, power window and power mirror wire connectors, if equipped.

INSTALLATION

Reverse the preceding operation.

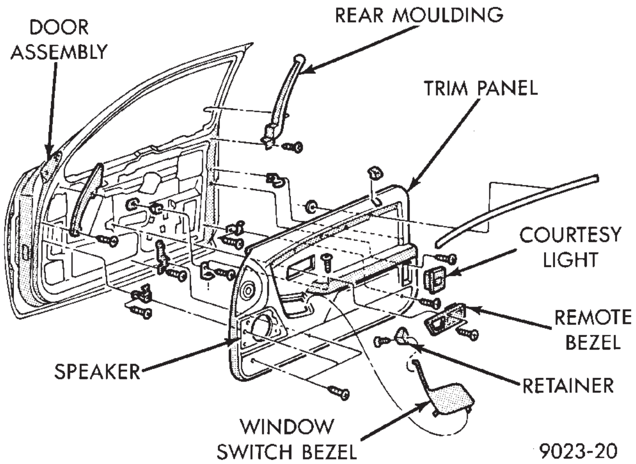


Fig. 8 Door Trim Panel

FRONT DOOR SILENCER AND WATER SHIELD

REMOVAL (FIG. 9)

(1) Remove front door trim panel.

(2) Remove push-in fasteners holding silencer pad to door inner panel and separate silencer from door.

(3) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

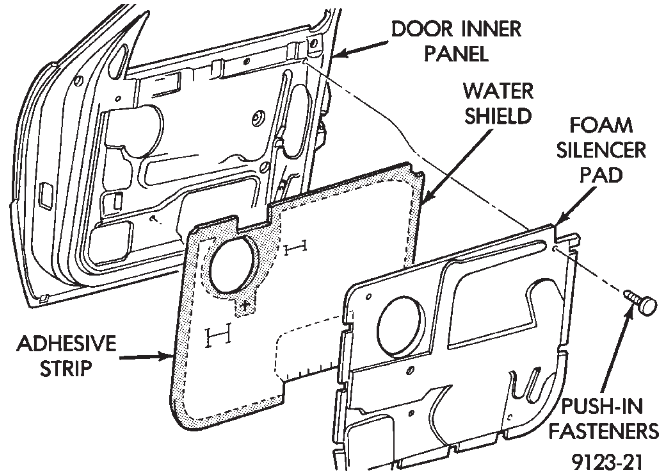


Fig. 9 Front Door Silencer and Water Shield—Typical

FRONT DOOR AND HINGE

The front door hinge is welded to the door and bolted to the hinge pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

FRONT DOOR REMOVAL (FIG. 10)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Disconnect all wire connectors and wire harness hold downs inside door and push wire harness through access hole in front of door into hinge pillar opening.

(3) Open door and support door on a suitable lifting device.

(4) Drive bottom hinge pin upward and remove pin from hinge.

(5) Drive top hinge pin downward and remove pin from hinge.

FRONT DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Front Door Hinge Installation paragraph in this section.

FRONT DOOR HINGE REMOVAL (FIG. 10)

(1) Remove front fender wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph in this section.

(2) Support door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to hinge pillar and separate hinge form vehicle.

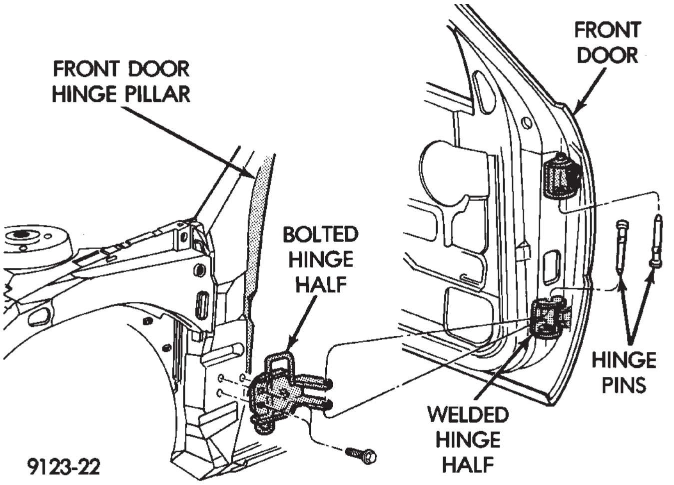


Fig. 10 Front Door Assembly

FRONT DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

DOOR LATCH

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield, as necessary.

(3) Raise door glass to up position.

(4) Disconnect linkage rods from door latch assembly.

(5) Remove screws holding latch top door end frame.

(6) Separate latch from door.

INSTALLATION

Reverse the preceding operation.

WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield as necessary.

(3) Raise glass to 25 mm (1 in.) below full up position and support glass lift plate to keep the glass from falling.

(4) Disconnect power window motor wire connector, if equipped.

(5) Remove rivets holding regulator to inner door panel using a 6 mm (0.250 in) drill.

(6) Slide regulator lift arm roller from lift plate channel.

(7) Remove regulator assembly through access hole in door.

INSTALLATION

Reverse the preceding operation.

DOOR GLASS

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield.

(3) Raise door glass 100 mm (4 in.) from down position.

(4) Disconnect battery negative cable if equipped with power windows.

(5) Loosen bolts holding glass stabilizers and guide hook receiver to top of inner door frame.

(6) Remove nuts holding door glass to lift plate.

(7) Separate glass from lift plate and lift glass upward from opening at top of door.

INSTALLATION

Reverse the preceding operation.

DOOR GLASS LIFT PLATE AND GUIDE POST

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield.

(3) Raise door glass 100 mm (4 in.) from down position.

(4) Disconnect battery negative cable if equipped with power windows.

(5) Remove nuts holding door glass to lift plate and separate glass from lift plate. Allow glass to slide downward to the bottom of door.

(6) Remove bolts (nuts on AJ-27 body) holding guide post to inner door panel.

(7) Separate lift plate channel from regulator lift roller.

(8) Remove lift plate and guide assemble from door through access hole in inner door panel.

INSTALLATION

Reverse the preceding operation.

GLASS RUN WEATHERSTRIP—AJ-21 BODY

REMOVAL

(1) Remove door trim panel.

(2) Remove silencer and water shield as necessary.

(3) Remove side view mirror cover.

(4) Pull glass run weatherstrip from door frame channel.

INSTALLATION

Reverse the preceding operation.

OUTSIDE DOOR LATCH RELEASE HANDLE

REMOVAL (FIG. 11)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Disconnect security alarm switch and illuminated entry switch from back of outside front door latch release handle, if equipped. For additional information refer to Group 8Q, Vehicle Theft Security System

(4) Disconnect lock rod and latch release rod from door latch assembly.

(5) Remove nuts holding outside door latch handle to retainer bracket and separate bracket from door.

(6) Swing lock rod upward, parallel to back of latch handle, and separate latch handle from door panel.

INSTALLATION

Reverse the preceding operation.

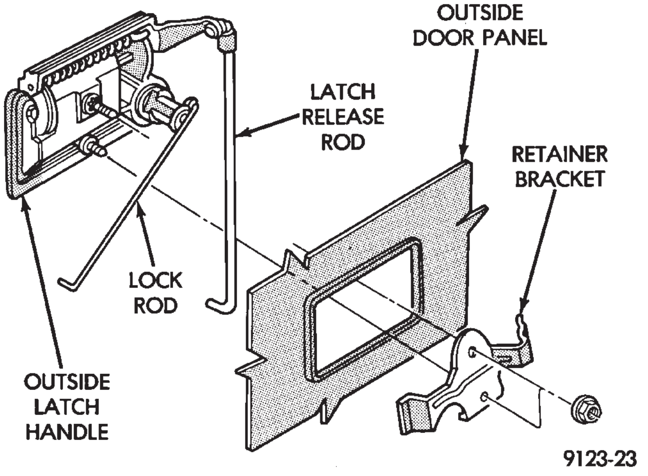


Fig. 11 Outside Door Latch Release Handle—Typical

INSIDE LATCH RELEASE HANDLE

REMOVAL

(1) Remove door trim panel.

(2) Remove screw holding handle to inner door panel.

(3) Disconnect linkage rod from back of handle.

(4) Separate handle from door.

INSTALLATION

Reverse the preceding operation.

POWER DOOR LOCK ACTUATOR

REMOVAL

(1) Remove door trim panel. Remove silencer and water shield as necessary.

(2) Raise door glass to the up position.

(3) Disconnect battery negative cable.

(4) Disconnect lock actuator linkage rod from door latch.

(5) Remove bolts holding actuator to inner door panel.

(6) Separate power door lock actuator from door.

INSTALLATION

Reverse the preceding operation.

COWL PANEL TRIM AND SCUFF PLATES

COWL PANEL AND DOOR OPENING SCUFF PLATE REMOVAL (FIG. 12)

(1) Open front door.

(2) Remove screw holding trim panel to cowl forward of the front door opening.

(3) Remove screws holding scuff plate to door sill.

(4) Separate cowl panel trim and scuff plate from vehicle.

COWL PANEL AND DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

A-PILLAR AND ROOF RAIL MOULDINGS

A-PILLAR MOULDING REMOVAL (FIG. 12)

(1) Open front door.

(2) Disengage clips holding A-pillar moulding to roof rail above door opening.

(3) Slide A-pillar moulding upward and pull rearward to separate moulding from A-pillar.

A-PILLAR MOULDING INSTALLATION

Reverse the preceding operation.

QUARTER TRIM PANEL

QUARTER TRIM PANEL REMOVAL (FIG. 12)

(1) Remove A-pillar moulding and scuff plate as necessary.

(2) Remove front shoulder harness turning loop cover. Remove bolt holding turning loop to quarter panel.

(3) Remove bolt holding rear shoulder harness anchor to floor.

(4) Remove rear seat cushion and back.

(5) Remove screw holding quarter trim to roof rail.

(6) Remove quarter trim extension panel. Remove screws holding quarter trim panel to wheelhouse kickup.

(7) Remove rear reading lamp. Remove screw holding quarter trim to roof from lamp opening.

(8) Pull trim panel forward and separate from vehicle.

QUARTER TRIM PANEL INSTALLATION

Reverse the preceding operation.

QUARTER EXTENSION TRIM PANEL

REMOVAL (FIG. 13)

(1) Remove quarter trim panel.

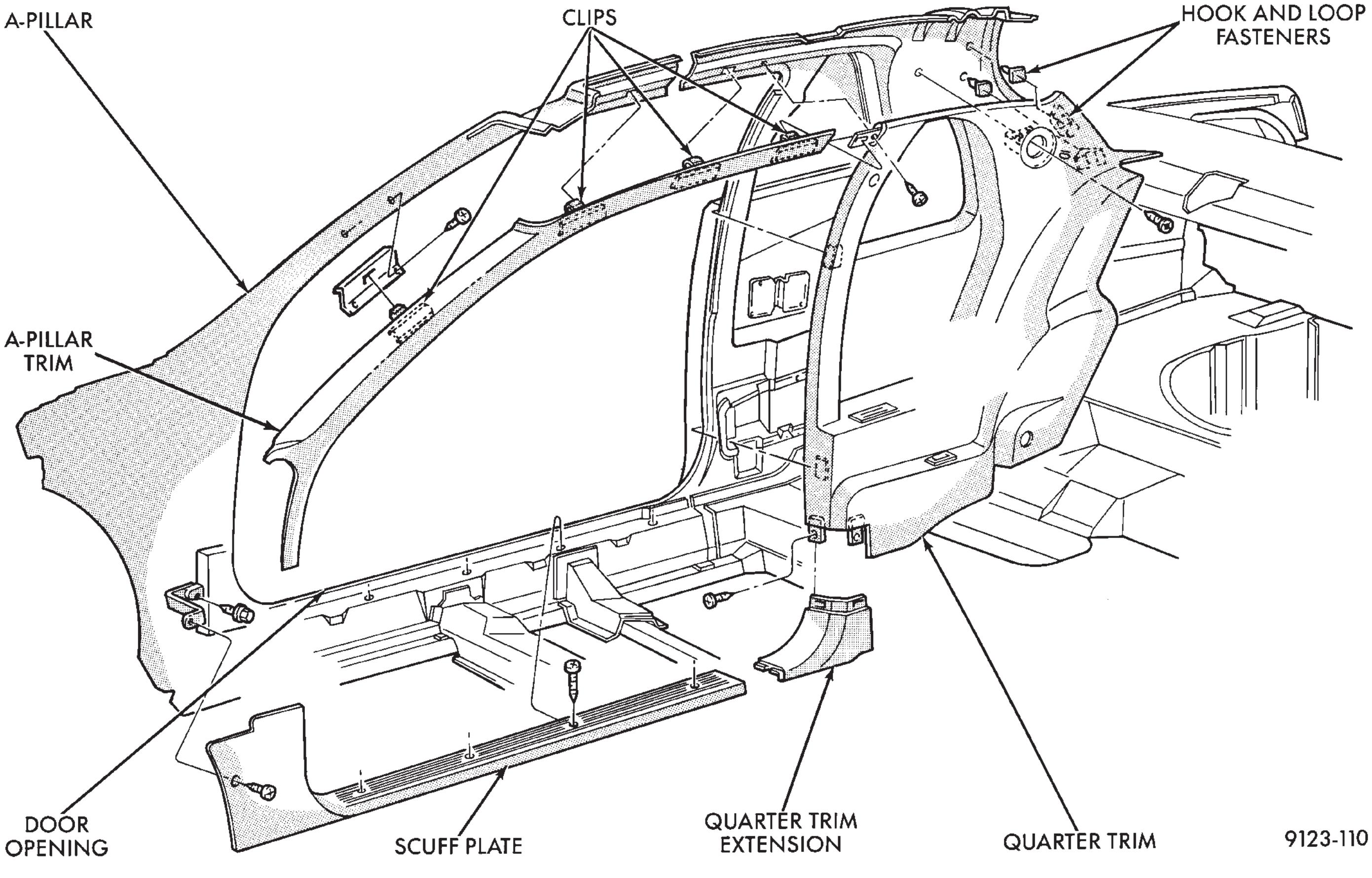


Fig. 12 Interior Mouldings, Panels, and Trim Covers

(2) Disengage clips holding expansion trim panel to shelf panel.

(3) Separate trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR SHELF TRIM PANEL

REMOVAL (FIG. 13)

(1) Remove one quarter trim panel.

(2) Remove center high mounted stop lamp cover. Refer to Group 8L, Lamps for instructions.

(3) Disengage screws holding trim to shelf panel and separate trim from vehicle.

INSTALLATION

Reverse the preceding operation.

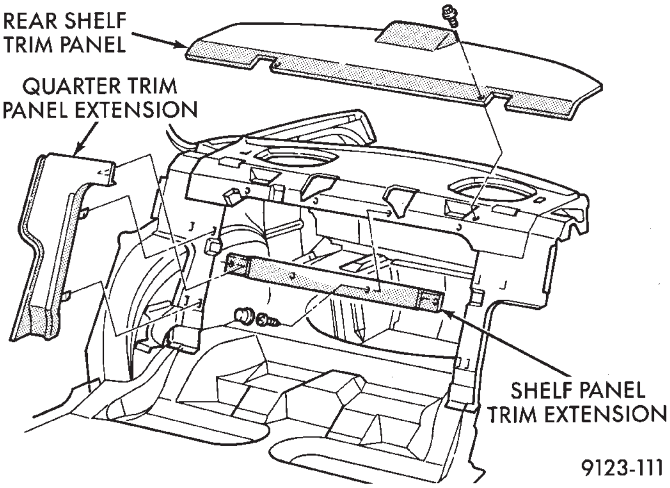


Fig. 13 Quarter Trim Extension and Shelf Trim Panels

FRONT SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 14)

(1) Remove quarter trim panel.

(2) Remove bolt holding seat belt retractor to quarter panel.

(3) Separate retractor from vehicle.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD SEAT BELT BUCKLE REMOVAL (FIG. 14)

(1) Remove bolt holding inboard buckle to floor.

(2) Disconnect seat belt sensor wire connector.

(3) Separate buckle assembly from vehicle.

INBOARD SEAT BELT BUCKLE INSTALLATION

Reverse the preceding operation.

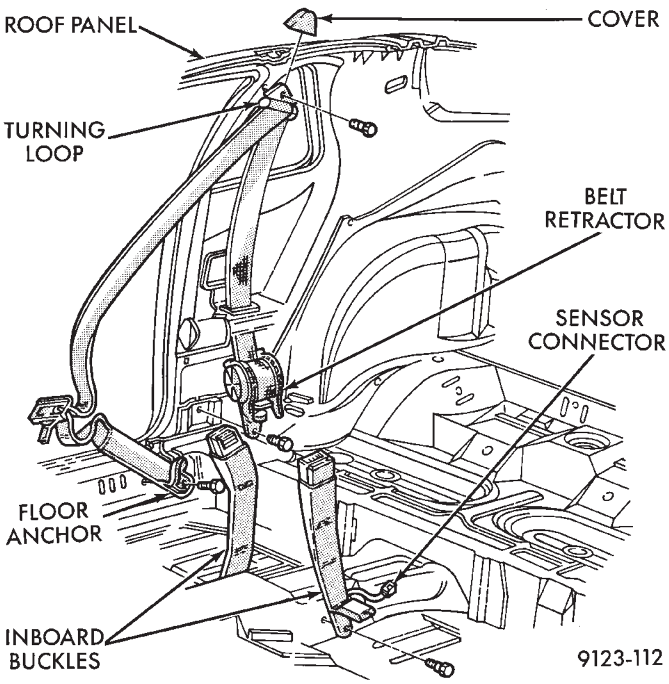


Fig. 14 Front Seat Belts

REAR SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 15)

(1) Remove quarter trim panel.

(2) Remove bolt holding lap belt to floor at wheelhouse kickup.

(3) Remove bolt holding seat belt retractor to quarter panel.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 15)

(1) Remove rear seat cushion.

(2) Remove bolt holding inboard buckle/center occupant belt to floor.

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

FRONT SEATS

FRONT SEAT REMOVAL (FIG. 16 OR 17)

(1) Position seat full forward.

(2) Remove screws holding rear track riser covers and separate covers from tracks.

(3) On power seat track, remove outboard track cover.

(4) Remove nuts holding seat track to floor.

(5) Position seat full rearward.

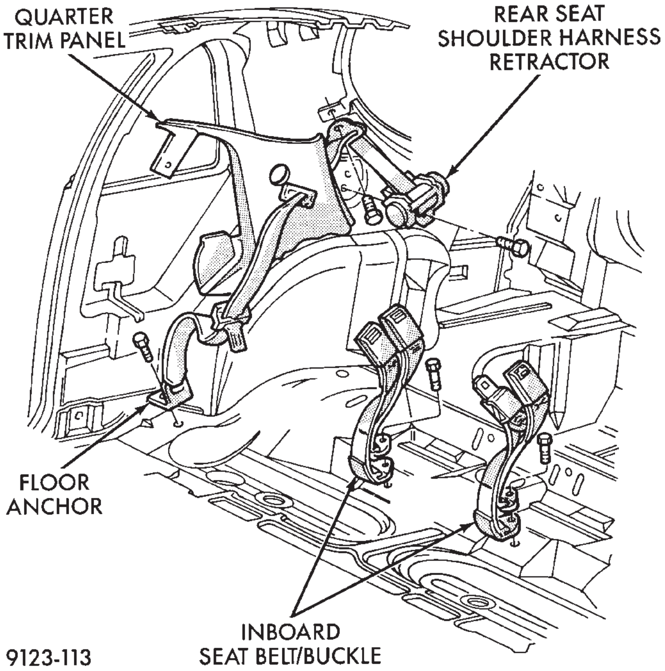


Fig. 15 Rear Seat Belts

(6) On power seat track, remove door sill scuff plate and disconnect wire connector.

(7) Remove bolts holding seat track to cross member.

(8) Remove seat from vehicle.

FRONT SEAT INSTALLATION

Reverse the preceding operation.

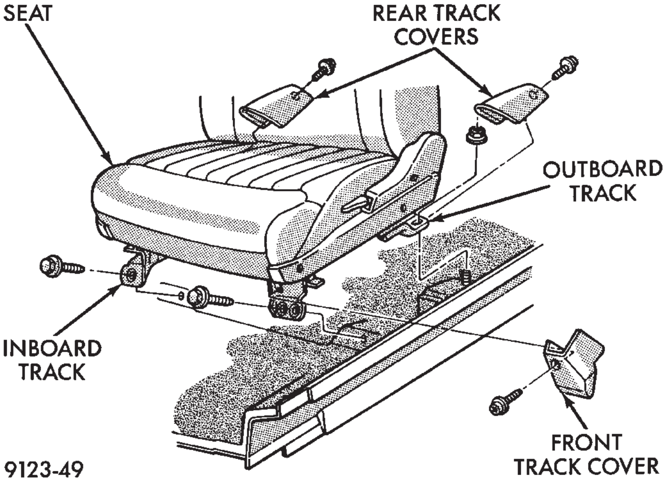


Fig. 16 Manual Front Seat

REAR SEATS

REAR SEAT CUSHION REMOVAL

(1) Remove bolts holding cushion to floor.

(2) Push center occupant seat belts through openings in cushion.

(3) Remove cushion from vehicle.

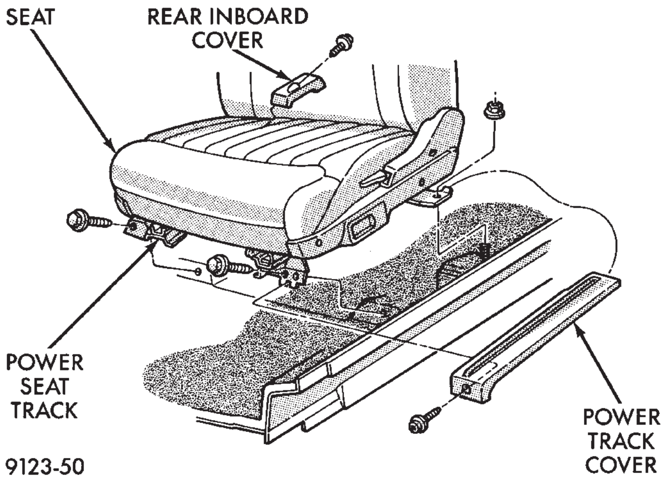


Fig. 17 Power Front Seat

REAR SEAT CUSHION INSTALLATION

Reverse the preceding operation.

REAR SEAT BACK REMOVAL (FIG. 18)

(1) Hinge seat back forward and disengage push-in fasteners holding carpet backing to trunk floor.

(2) Remove bolts holding outboard hinge pivot bracket to seat back.

(3) Pull seat back outward to disengage inboard pivot and separate from vehicle.

REAR SEAT BACK INSTALLATION

Reverse the preceding operation.

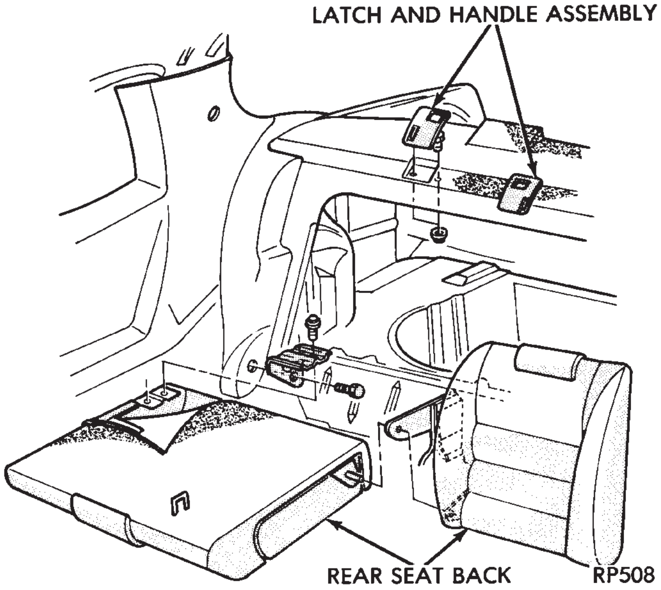


Fig. 18 Rear Seat Cushion and Back

FRONT CENTER CONSOLE

REMOVAL (FIG. 19)

(1) Position front seats full forward.

(2) Remove rear ash tray.

(3) Remove rear lower carpeted end cover.

(4) Remove nuts holding console to floor bracket.

(5) Position front seats full rearward.

(6) Raise console storage bin cover and remove bottom mat.

(7) Remove screws holding bottom of storage bin to floor bracket.

(8) Remove screws holding console side panels to instrument panel. Disengage hook and loop fasteners and separate side panels from console.

(9) Disconnect shift indicator cable and clip from shift mechanism through right side panel opening, if equipped with automatic transaxle. Refer to Group 8E, Instrument Panel and Gauges for proper service procedures.

(10) Disengage clips holding parking brake lever cover to console and separate cover from vehicle.

(11) Remove center instrument panel bezel. Refer to Group 8E, Instrument Panel. Remove screws holding console to instrument panel.

(12) Remove screws holding console to lower instrument panel.

(13) Remove bolts holding console to forward floor mounting bracket.

(14) Remove gear selector knob.

(15) Separate console from floor and remove from vehicle.

INSTALLATION

Reverse the preceding operation.

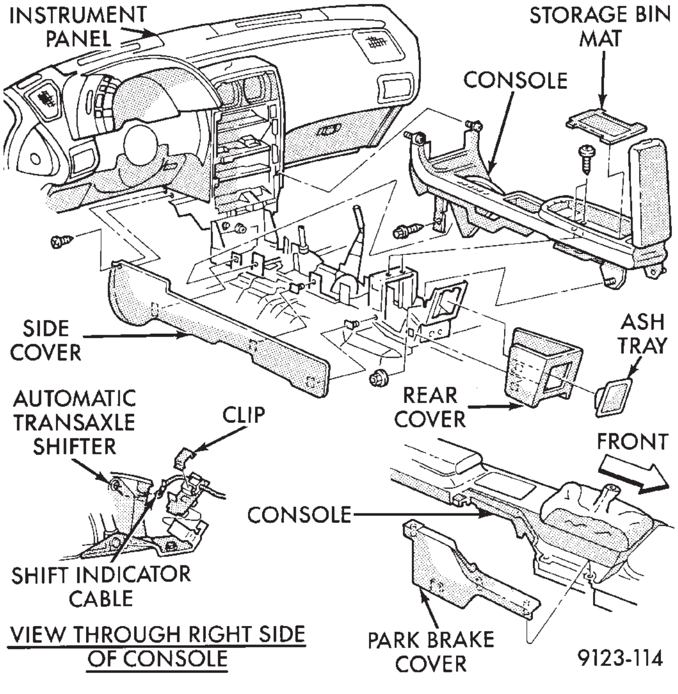


Fig. 19 Center Console

FLOOR CARPET

REMOVAL (FIG. 20)

(1) Remove cowl trim panels and scuff plates.

(2) Remove front seats and inboard seat belts.

(3) Remove center arm rest and front console.

(4) Remove outboard seat belt lower attaching bolts.

(5) Remove left dash panel foot rest.

(6) Remove rear seat cushion.

(7) Pull carpet from under quarter trim covers.

(8) Fold carpet and remove through door opening.

INSTALLATION

Reverse the preceding operation.

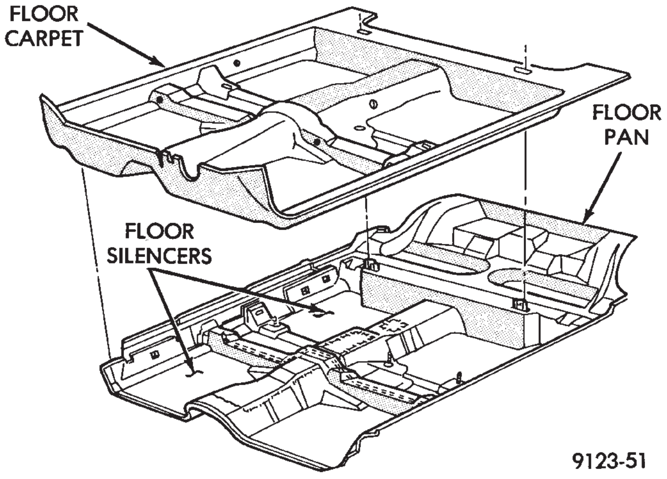


Fig. 20 Floor Carpet and Silencers—Typical

OVERHEAD CONSOLE

REMOVAL (FIG. 21)

(1) Remove screws holding overhead console to reinforcement bracket.

(2) Slide overhead console rearward to separate reinforcement bracket retainer tab from console.

(3) Lower console from roof and disconnect wire connectors.

INSTALLATION

Reverse The preceding operation.

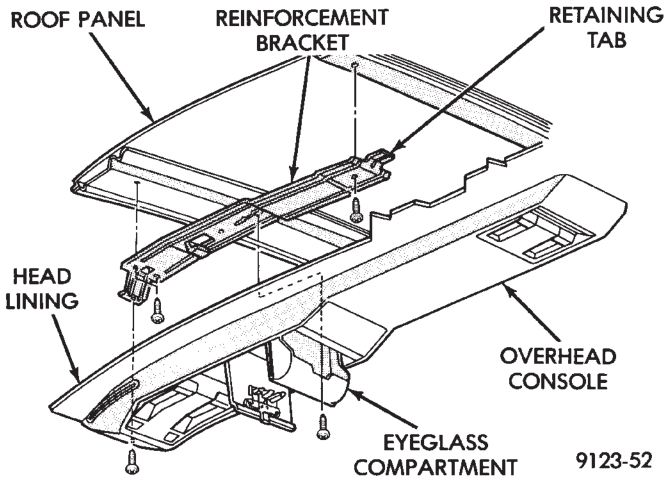


Fig. 21 Overhead Console—Typical

HEAD LINING

REMOVAL

(1) Disconnect battery negative cable.

(2) Pull dome lamp downward to disengage from retaining ring in head lining. Separate lens from lamp body and remove bulb. Separate bulb holder from lamp body. Remove attaching screw holding retaining ring to roof bow, if equipped.

(3) Remove screws holding coat hooks to roof above quarter panels.

(4) Remove roof rail and A-pillar mouldings.

(5) Remove screws holding sun visors to roof header and disconnect wire connector, if equipped. Remove inboard sun visor hangers.

(6) Remove overhead console, if equipped.

(7) Pull front reading lamp downward to disengage from retaining ring in head lining and disconnect wire connector. Remove screws holding retaining ring to roof header, if equipped.

(8) Remove pinch welt holding headlining to sun roof opening, if equipped.

(9) Remove one quarter trim panel as necessary to clear head lining removal path.

(10) Disengage hook and loop fasteners holding head lining to roof above rear window and slide head lining from behind quarter panel.

(11) Remove head lining from vehicle.

INSTALLATION

Reverse the preceding operation.

SUN ROOF WEATHERSTRIP

REMOVAL (FIG. 22)

(1) Remove sun roof sunshade and glass. Refer to Owner's Manual for instructions.

(2) Pull weatherstrip from pinch flange around sun roof opening.

INSTALLATION

Reverse the preceding operation.

SUN ROOF AIR DEFLECTOR

REMOVAL (FIG. 22)

(1) Remove sun roof sunshade and glass. Refer to Owner's Manual for instructions.

(2) Disengage snap-on linkage at rear of air deflector in sun roof opening.

(3) Remove screws holding air deflector to front of sun roof opening.

INSTALLATION

Reverse the preceding operation.

SUN ROOF DRAIN TUBES

REMOVAL (FIG. 22)

(1) Remove head lining as necessary.

(2) Remove A-pillar or quarter trim covers as necessary.

(3) Remove cowl panel and sill plate trim as necessary.

(4) Disconnect effected drain tube from nipple at sun roof opening.

(5) Pull drain tube upward to remove from pillar involved.

INSTALLATION

Reverse the preceding operation. Route the tube to avoid kinks or puncture from sharp edges.

REAR WINDOW GLASS

REMOVAL (FIG. 23)

(1) Remove rear window mouldings.

(2) Remove interior trim as necessary to gain access to rear window defogger wire connector and ground screw, if equipped.

WARNING: WEAR EYE AND HAND PROTECTION WHEN HANDLING SAFETY GLASS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not damage body or trim finish when cutting out glass or applying fence primer.

(3) Cut the urethane around the perimeter of the back window glass. Refer to Windshield section of this group for proper procedures.

(4) Separate the rear window from the vehicle.

INSTALLATION

(1) Prepare the work area, window fence, and glass the same way as described in the Windshield section of this group.

(2) Place fence spacers at the locations shown (Fig. 23).

(3) Apply a 10 mm (0.4 in.) bead of urethane around the perimeter of the glass.

(4) Install the glass in the same manner described in the Windshield section of this group.

(5) Install the rear window moulding.

(6) Connect rear window defogger wiring and install interior trim.

(7) After urethane has cured, water test rear window to verify repair. Verify rear window defogger operation, see Group 8N, Rear Window Defogger.

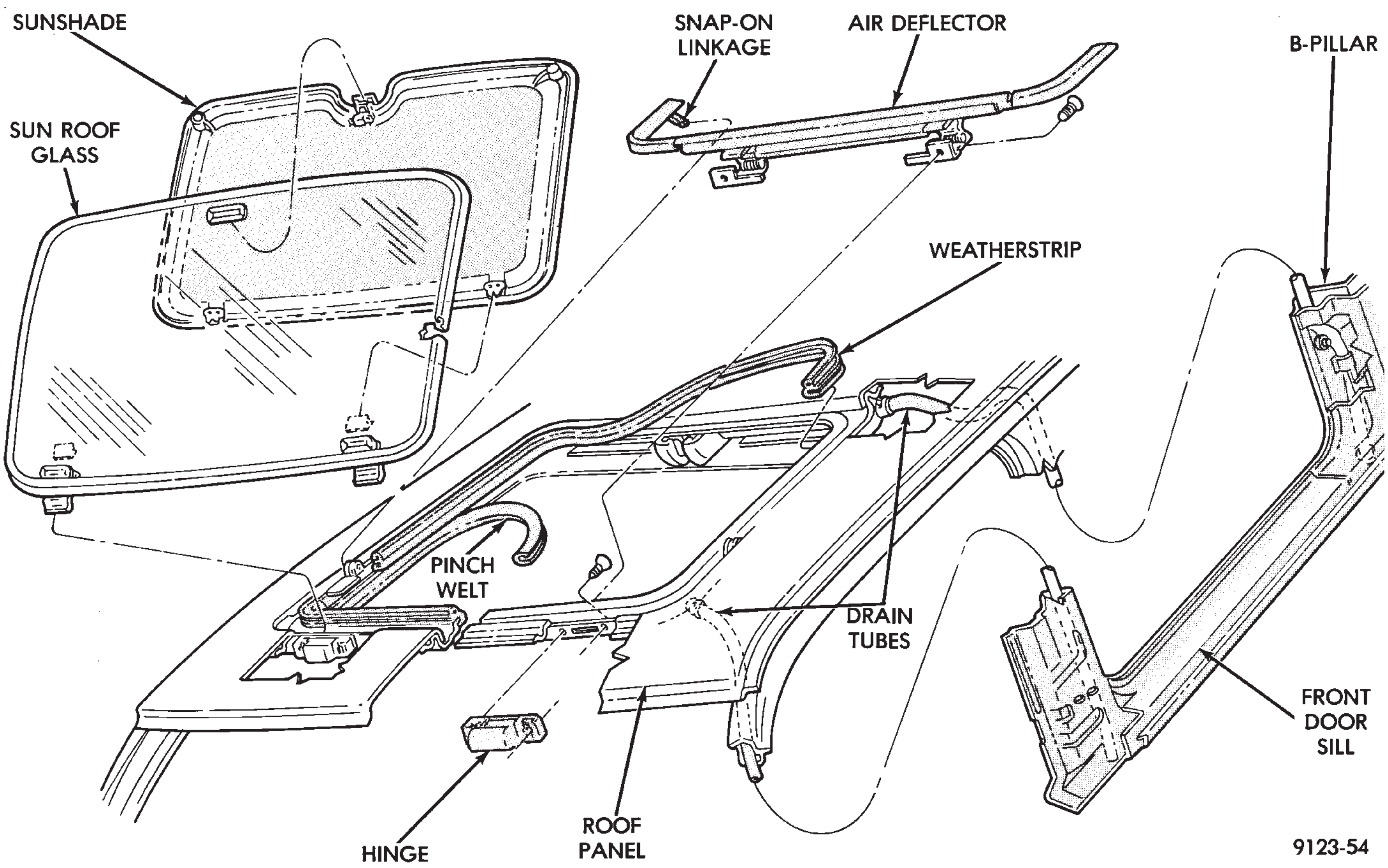


Fig. 22 Sun Roof

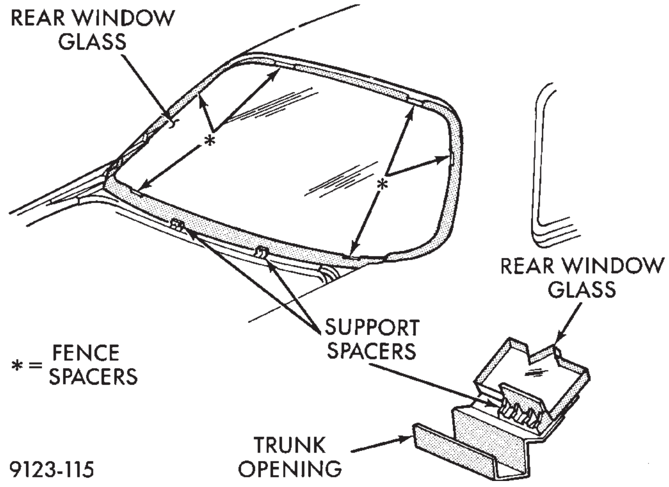


Fig. 23 Rear Window Glass

TRUNK LID

REMOVAL (FIG. 24)

(1) Raise trunk lid to full up position.

(2) Disconnect the trunk lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing trunk lid, align all marks and secure bolts. The trunk lid should be aligned to 4 mm (0.160 in.) gap to the quarter panels and flush across the top surfaces along quarter panels.

(4) Remove the top trunk lid to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the trunk lid, remove the bottom trunk lid to hinge attaching bolts. Separate the trunk lid from the vehicle.

INSTALLATION

Reverse the preceding operation.

TRUNK LID HINGE

REMOVAL

(1) Remove rear parcel shelf trim cover.

(2) Disconnect trunk lid lift torsion bars from hinges.

(3) Mark all attaching bolt, nut, and component locations with a suitable marking device. Use marks as a reference when installing hinge.

(4) Remove bolts holding trunk lid to hinge.

(5) Remove nuts and bolts holding hinge to closure panel below rear window glass.

(6) Separate hinge from vehicle.

INSTALLATION

Reverse the preceding operation.

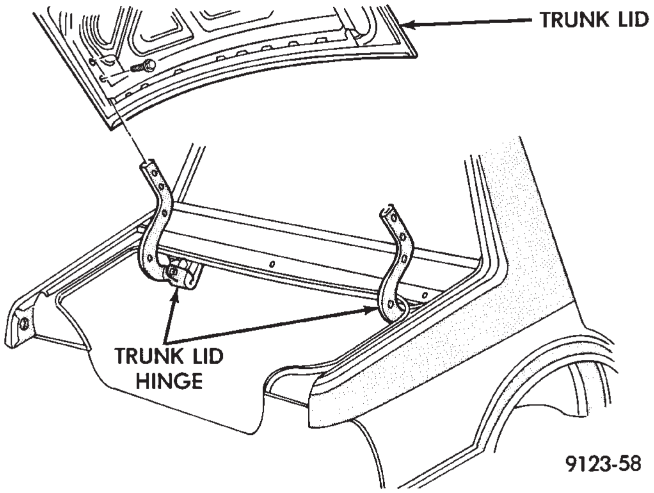


Fig. 24 Trunk Lid—Typical

TRUNK LID TORSION BAR

REMOVAL

(1) Raise and support trunk lid in the full up position.

(2) Remove trunk lining as necessary to gain access to torsion bars.

(3) Disengage adjusting end of torsion bar from the slot in the tension adjustment bracket.

(4) Pivot torsion bar out of lift arm swivel.

(5) Disconnect torsion bar from hinge.

INSTALLATION

Reverse the preceding operation.

TRUNK LID LATCH

REMOVAL

(1) Raise trunk lid to the full up position.

(2) Remove push-in fasteners holding lining to trunk lid as necessary.

(3) Disconnect remote release cable from latch.

(4) Remove bolts holding latch to trunk lid and separate latch from vehicle.

INSTALLATION

Insert trunk lock chill into latch release driver and reverse the preceding operation.

TRUNK LID LOCK

REMOVAL

(1) Remove trunk lid tail light assembly. Refer to Group 8L, Lamps for proper procedures.

(2) Remove trunk latch.

(3) Remove nuts holding lock cylinder and chill to trunk lid and separate the lock from the vehicle.

INSTALLATION

Reverse the preceding operation.

TRUNK OPENING WEATHERSTRIP

REMOVAL (FIG. 25)

(1) Raise trunk lid to the full up position.

(2) Pull the weatherstrip from the pinch flange around the trunk opening.

INSTALLATION

A new trunk lid opening weatherstrip should be heated to approximately 38° C (100° F) before installation. The weatherstrip butt splice should be located at the center rear of trunk opening. Reverse the removal operation. After weatherstrip has been installed, close trunk lid and allow weatherstrip to cool. The weatherstrip will form to the trunk lid contour as it cools.

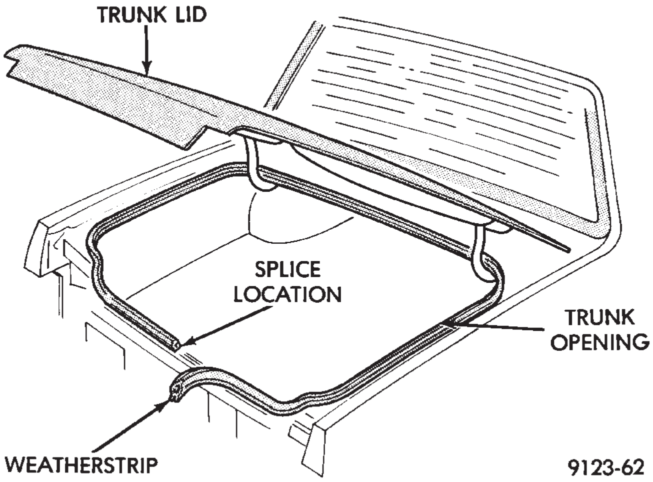


Fig. 25 Trunk Opening Weatherstrip—Typical

TRUNK LID LUGGAGE RACK

REMOVAL (FIG. 26)

(1) Remove screws holding spoiler to trunk lid.

(2) Pry rub strip inserts from skid strips.

(3) Remove screws holding skid strips to trunk lid.

INSTALLATION

Reverse the preceding operation

TRUNK LID AND FUEL FILL DOOR RELEASE CABLES

REMOVAL (FIG. 27)

(1) Remove interior trim as necessary to gain access to release cables.

(2) Remove left front door scuff plate.

(3) Remove screw holding trim cover to release cable handle and separate cover from handle.

(4) Remove screw holding release handle to door sill.

(5) Pry open retainer tab holding cable core end in handle pivot. Pry cable case end from handle.

(6) Remove trunk lining as necessary to gain access to the release cables.

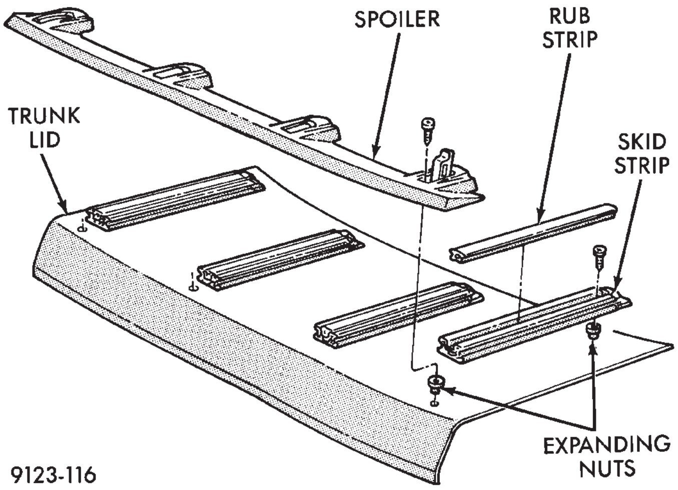


Fig. 26 Trunk Lid Luggage Rack

(7) On fuel fill door cable, remove nut holding cable latch to fuel fill opening.

(8) On trunk lid latch, remove trunk latch cover and disconnect cable end from latch. Route cable back through trunk lid.

INSTALLATION

Reverse the preceding operation.

FUEL FILL DOOR

REMOVAL (FIG. 28)

(1) Open fuel fill door.

(2) Separate trunk lining from right quarter panel.

(3) Remove nuts holding fuel fill door to quarter panel.

(4) Separate fuel fill door from quarter panel opening.

INSTALLATION

Reverse the preceding operation. Align to achieve equal spacing around fuel fill door and flush to the quarter panel.

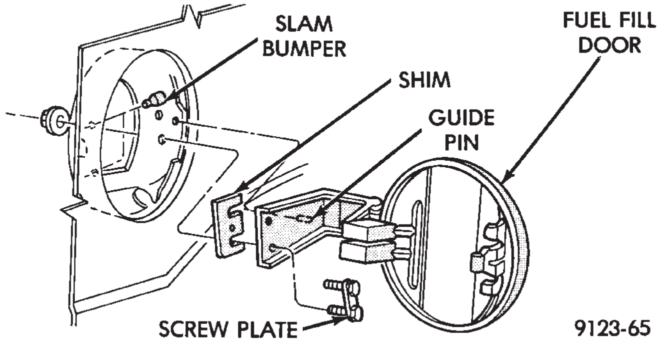


Fig. 28 Fuel Fill Door—Typical

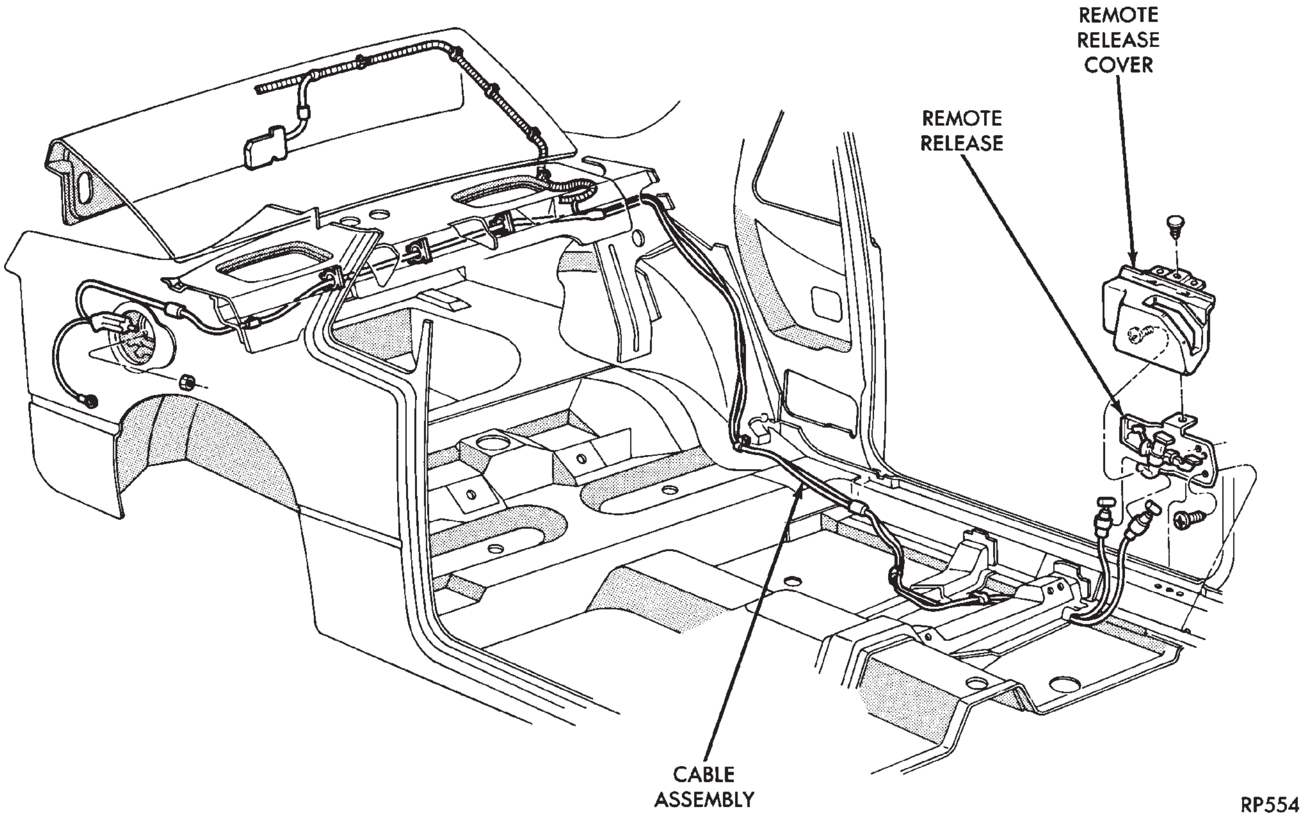


Fig. 27 Trunk Lid and Fuel Fill Door Release Cables

QUARTER GLASS MODULE

REMOVAL (FIG. 29)

(1) Remove quarter trim panel as necessary.

(2) Remove screws holding quarter glass module to quarter glass opening.

(3) Cut urethane from around perimeter of quarter glass opening with a suitable cold knife.

(4) Push quarter glass module out of quarter glass opening.

INSTALLATION

(1) Clean cured urethane from quarter glass opening fence.

(2) Prepare quarter glass opening fence and glass module using the same procedure described in the Windshield section of this group.

(3) Insert quarter glass module into quarter glass opening and push inward.

(4) Install screws holding module to quarter panel.

(5) Install quarter trim panel.

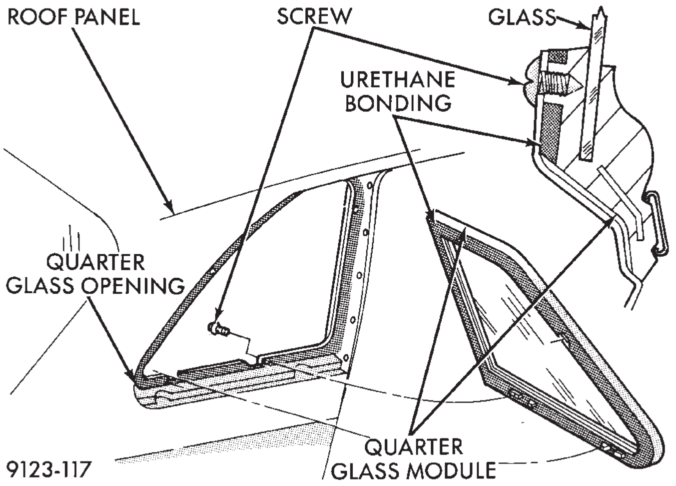


Fig. 29 Quarter Glass Module

AJ/27-VEHICLE CONVERTIBLE BODY COMPONENT SERVICE

INDEX

REAR SEAT CUSHION

REMOVAL (FIG. 1)

(1) Using a large flat blade screw driver, pry upward at the retainer loop at each end of the seat cushion.

(2) Disengage retainer loops from retainer cups in floor pan.

(3) Separate seat cushion from vehicle.

INSTALLATION

Reverse the preceding operation.

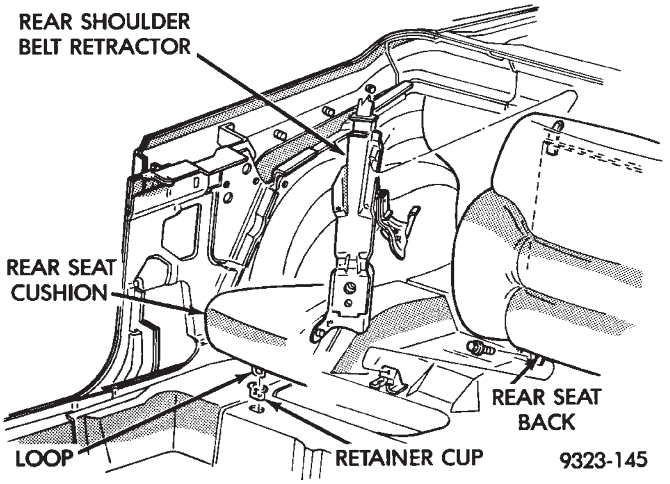


Fig. 1 Rear Seat Cushion

REAR SEAT BACK

REMOVAL (FIG. 1)

(1) Remove rear seat cushion.

(2) Remove bolts holding rear seat back to floor pan kick-up.

(3) Push seat back downward and disengage hook retainers at top of back frame.

(4) Separate seat back from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR SEAT BELT RETRACTORS

REMOVAL (FIG. 2)

(1) Remove rear seat cushion and back.

(2) Remove bolt holding shoulder belt turning loop to seat back reinforcement panel.

(3) Remove bolts holding rear seat belt retractor to floor kick-up.

(4) Remove bolts holding retractor to quarter panel reinforcement.

(5) Remove bolts holding lap belt to lower quarter panel reinforcement.

(6) Separate seat belt retractor from vehicle.

INSTALLATION

Reverse the preceding operation.

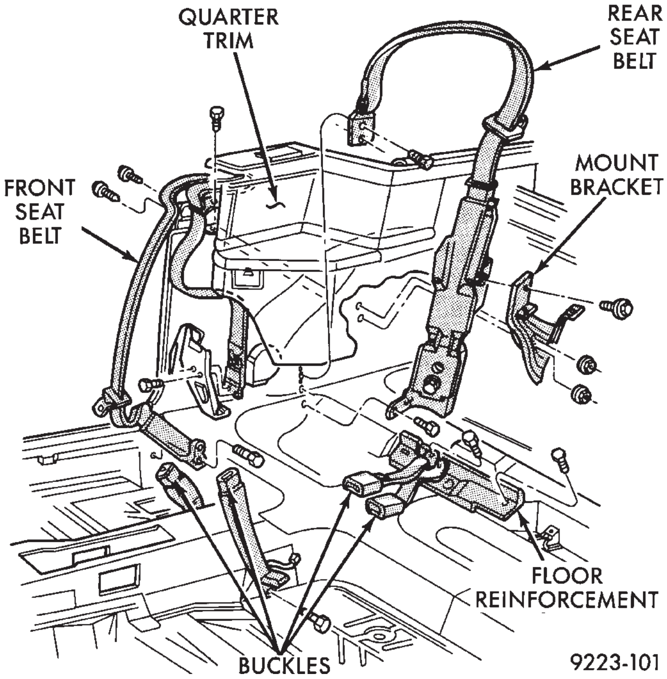


Fig. 2 Rear Seat Belts

QUARTER WINDOW

REMOVAL

(1) Disengage snaps holding sling well to rear deck panel.

(2) From each side of vehicle, Disengage clips holding sling well to belt reinforcement brace. Drape sling well over rear seat back into passenger compartment.

(3) Remove screw holding quarter trim panel and door weatherstrip to door opening.

(4) Remove the cowl trim and scuff plate covers.

(5) Remove the rear seat cushion.

(6) Disconnect rear speaker wire connectors.

(7) Remove screws holding seat back to floor brackets and rear shoulder belt retractors (Fig. 1). Separate rear seat back from vehicle.

(8) Remove screws holding quarter trim to quarter panel at the boot latches.

(9) Remove screws holding quarter trim to floor pan kick up.

(10) Separate quarter trim from rear reinforcement. Position trim panel out of quarter window removal path (Fig. 3).

(11) Raise quarter window approximately 100 mm (4 in.) from the down position.

(12) Remove bolt holding glass stabilizer bumper to top of quarter panel opening.

(13) Disconnect power window motor wire connector.

(14) Remove bolts holding quarter window assembly to quarter panel and lift the assembly through the opening at the top of the quarter panel.

INSTALLATION

Reverse the preceding operation. Align the quarter glass to have adequate pressure on the weatherstrips for proper sealing. Insert sling well drain tubes into the holes in the floor pan.

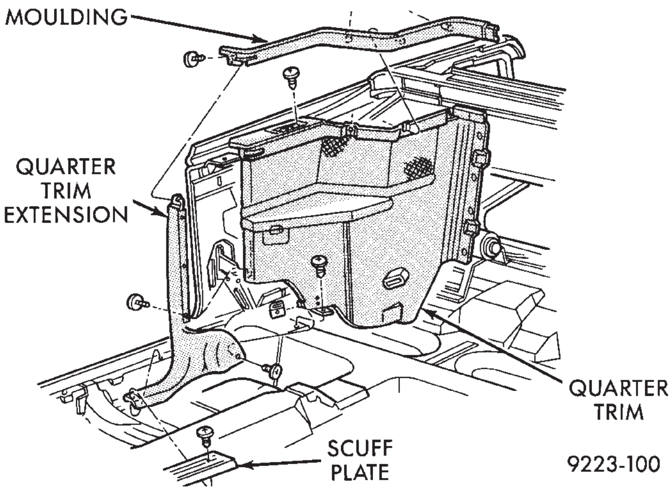


Fig. 3 Quarter Trim Panel

FOLDING TOP STORAGE SLING WELL

REMOVAL (FIG. 4)

(1) Disengage snaps holding sling well to rear deck inner panel.

(2) Disengage snaps holding sling well to quarter inner panels.

(3) Disengage snaps holding sling well to back of quarter trim panels.

(4) Remove bolts upper seat back support bar to quarter trim panels.

(5) Separate support bar from vehicle.

(6) Disconnect drain tubes from bottom of sling well.

(7) Pull sling well from the end of the support bar retainer channel.

INSTALLATION

Reverse the preceding operation.

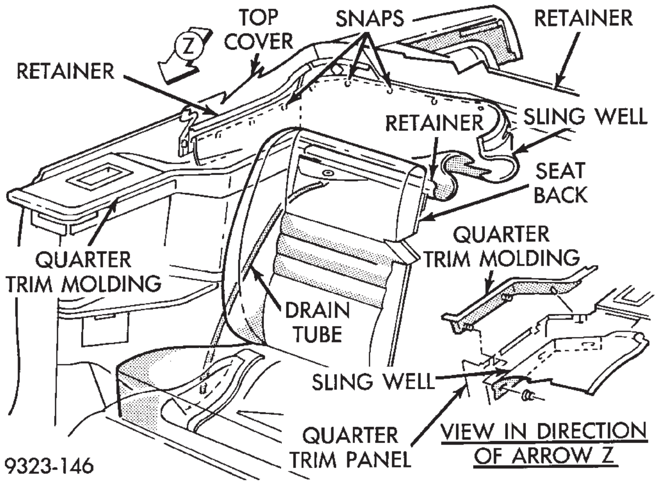


Fig. 4 Folding Top Storage Sling Well

FOLDING TOP HEADLINING

REMOVAL (FIG. 5)

(1) Disengage snaps and hook and loop fasteners holding headlining to quarter inner panels.

(2) Disengage hook and loop fasteners holding headlining to roof rails and top header.

(3) Disengage clips holding headlining to roof rail rearward of quarter glass opening.

(4) Remove screws holding headlining to third roof bow.

(5) Remove screws holding headlining to second roof bow.

(6) Remove screws holding headlining to first roof bow.

(7) Remove screws holding headlining to top header.

(8) Separate headlining from vehicle.

INSTALLATION

Reverse the preceding operation.

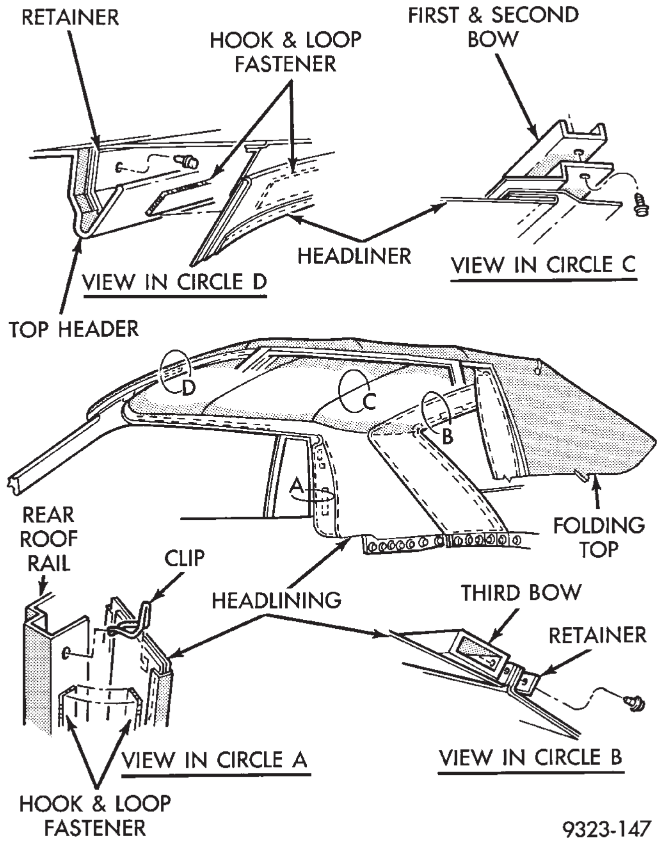


Fig. 5 Folding Top Headlining

REAR WINDOW—WITHOUT ZIPPER

If the rear window zipper is damaged, perform Rear Window and Zipper replacement procedures.

REMOVAL

(1) Release folding top latches and allow top cover to relax.

(2) Disengage hook and loop fasteners holding headlining to quarter panel areas.

(3) Pull headlining forward from behind quarter trim panels and tape headlining around roof rails, out of the way.

(4) Disengage snaps holding folding top storage sling well to inner quarter and deck panels.

(5) Position sling well out of the way.

(6) Disengage wire connectors from terminals on heated rear window.

(7) Pull wire harnesses from pockets at each side of rear window.

(8) Remove bolts holding rear tack strip to inner deck panel (Fig. 6).

(9) Separate rear tack strip from deck panel.

(10) Position rear tack strip to gain access to staples holding material to tack strip.

(11) Using a grease pencil, mark location of outer top cover on rear tack strip to aid installation.

(12) Remove staples holding top cover to rear tack strip (Fig. 7).

(13) Unzip rear window from upper zipper listing.

(14) Separate window and rear tack strip from vehicle.

(15) Place rear window on a suitable work surface.

(16) Using a grease pencil, mark location of rear window apron on rear tack strip to aid installation.

(17) Remove staples holding rear window lower apron to tack strip.

(18) Separate rear window from tack strip.

INSTALLATION

(1) Using old rear window as a pattern, mark new window to the same size and shape as the old window.

(2) Trim excess material from new window.

(3) Position window at index marks on rear tack strip.

(4) Install staples to hold window apron to tack strip (Fig. 7).

(5) Trim excess material from around bolt holes in tack strip.

(6) Position rear window and tack strip in opening behind rear seat.

(7) Position top cover at index marks on rear tack strip.

(8) Install staples to hold top cover to rear tack strip.

(9) Zip rear window to upper zipper listing.

(10) Place rear tack strip in proper position under deck panel (Fig. 6).

(11) Install bolts to hold rear tack strip to deck panel.

(12) Latch top header to windshield header and inspect top cover for excess wrinkling. If wrinkling is apparent, the top cover and rear window apron must be repositioned on the tack strips.

(13) Route wire harnesses through pockets at each side of window and connect ends to terminals on glass.

(14) Install sling well and rear section of headlining.

REAR WINDOW AND ZIPPER

If the window zipper is not damaged and an original equipment rear window is being installed, use Rear Window Glass—Without Zipper replacement procedures.

REMOVAL

(1) Release folding top latches and allow top cover to relax.

(2) Disengage hook and loop fasteners holding headlining to quarter panel areas.

(3) Pull headlining forward from behind quarter trim panels and tape headlining around roof rails, out of the way.

(4) Disengage snaps holding folding top storage sling well to inner quarter and deck panels.

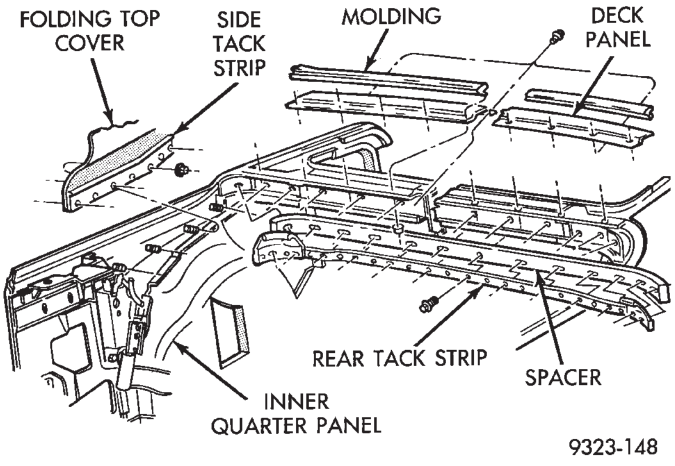


Fig. 6 Tack Strips

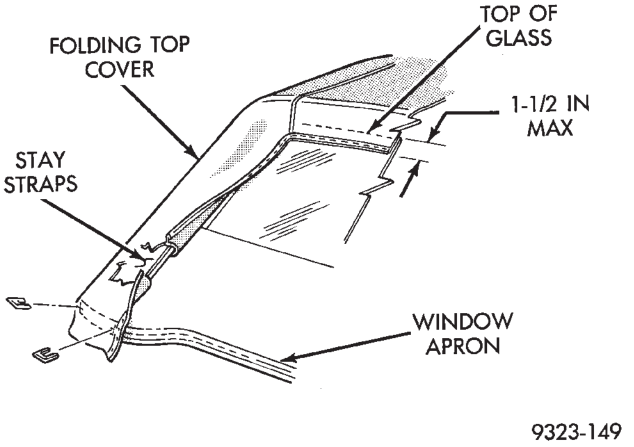


Fig. 7 Rear Window Glass

(5) Position sling well out of the way.

(6) Disengage wire connectors from terminals on heated rear window.

(7) Pull wire harnesses from pockets at each side of rear window.

(8) Remove bolts holding rear tack strip to inner deck panel (Fig. 6).

(9) Separate rear tack strip from deck panel.

(10) Remove bolts holding side tack strips to inside of quarter panels (Fig. 6).

(11) Separate tack strips from quarter panels.

CAUTION: Cover all painted and upholstered surfaces to avoid damage while performing the following operations.

(12) Reposition tack strips above rear deck and quarter panels.

(13) Using a grease pencil, mark location of outer top cover on rear tack strip to aid installation.

(14) Remove staples holding top cover to rear tack strip (Fig. 7).

(15) Fold rear of top cover, tack strips and rear window up and over the third (rear) roof bow (Fig. 8).

(16) Unzip and separate rear window from vehicle.

(17) Mark location of rear stay straps on third roof bow.

(18) Remove staples holding rear stay straps to third roof bow (Fig. 8).

(19) Mark location of top cover hold down listing on third roof bow.

(20) Remove staples holding top cover listing to third roof bow (Fig. 8).

(21) Mark location of rear window zipper upper half listing on third roof bow.

(22) Remove staples holding zipper listing to third roof bow (Fig. 8).

(23) Separate rear window zipper from third roof bow.

The following is a work bench operation

(24) Place rear window on a suitable work surface.

(25) Using a grease pencil, mark location of rear window apron on rear tack strip to aid installation.

(26) Remove staples holding rear window lower apron to tack strip.

(27) Separate rear window from tack strip.

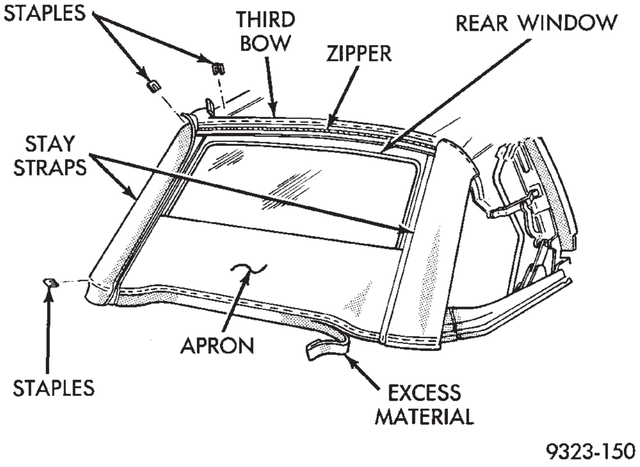


Fig. 8 Third Roof Bow

INSTALLATION

(1) Using old rear window as a pattern, mark new window to the same size and shape as the old window.

(2) Trim excess material from new window.

(3) Position window at index marks on rear tack strip.

(4) Install staples to hold window apron to tack strip (Fig. 7).

(5) Trim excess material from around bolt holes in tack strip.

(6) Using old zipper upper half listing as a pattern, mark new listing to the same size and shape as the old listing.

(7) Trim excess material from new listing.

(8) Position zipper upper half listing at index marks on the third roof bow. Verify that start end of zipper upper half is at the same end as the rear window half.

(9) Install staples to hold zipper listing to third roof bow (Fig. 8).

(10) Position top cover hold down listing at index marks on third roof bow.

(11) Install staples to hold top cover listing to third roof bow (Fig. 8).

(12) Position stay straps at index marks on the third roof bow.

(13) Install staples to hold stay straps to third roof bow.

(14) Zip rear window into position.

(15) Fold rear of top cover, tack strips and rear window up and over the third roof bow to the rear of the top opening (Fig. 8).

(16) Position top cover at index marks at each end of rear tack strip.

(17) Install staples to hold top cover to rear tack strip (Fig. 6).

(18) Position side and rear tack strips behind quarter and deck panels.

(19) Install bolts to hold side tack strips to inside of quarter panels (Fig. 6).

(20) Install bolts to hold rear tack strip to deck panel.

(21) Latch top header to windshield header and inspect top cover for excess wrinkling. If wrinkling is apparent, the top cover and rear window apron must be repositioned on the tack strips.

(22) Route wire harnesses through pockets at each side of window and connect ends to terminals on glass.

(23) Install sling well and rear section of headlining.

FOLDING TOP COVER

REMOVAL

(1) Release folding top latches and allow top cover to relax.

(2) Remove headlining.

(3) Disengage snaps holding top storage sling well to rear deck and quarter panels.

(4) Position sling well out of the way.

(5) Remove bolts holding rear tack strip to inner deck panel.

(6) Separate rear tack strip from deck panel.

(7) Remove bolts holding side tack strips to inside of quarter panels.

(8) Separate tack strips from quarter panels.

CAUTION: Cover all painted and upholstered surfaces to avoid damage while performing the following operations.

(9) Reposition tack strips above rear deck and quarter panels.

(10) Using a grease pencil, mark location of outer top cover on rear tack strip to aid installation.

(11) Remove staples holding top cover to rear tack strip.

(12) Fold rear of top cover, tack strips and rear window up and over the third (rear) roof bow.

(13) Unzip and separate rear window from vehicle.

(14) Mark location of top cover hold down listing on third roof bow.

(15) Remove staples holding top cover listing to third roof bow.

(16) Remove screws holding roof rail tension cable springs to roof rear roof rail behind quarter glass opening.

(17) Pull quarter glass weatherstrips from roof rail channels.

(18) Remove screws holding roof rail channels to roof rails.

(19) Separate roof rail channels from vehicle.

(20) Separate top cover listing from adhesive on roof rail.

(21) Lower folding top to the mid point.

(22) Pull top header weatherstrip from retaining channel. Separate first 50 mm (2 in.) of weather strip from roof rail channels.

(23) Remove screws holding weatherstrip channel to top header.

(24) Separate channel from top header.

(25) Remove staples holding top header feature strip to top header.

(26) Separate feature strip from header.

(27) Mark location or top cover on top header.

(28) Remove staples holding top cover to header.

(29) Close folding top, do not latch.

(30) Remove rubber plugs holding roof rail tension cable ends into key-hole slots in roof rails

(31) Disengage roof rail tension cables from roof rails.

(32) Pull tension cables from rear of pockets on back of top cover.

(33) Remove screws holding top cover retainer rod to second roof bow.

(34) Separate retainer rod from second roof bow.

(35) Remove screws holding top cover retainer rod to first roof bow.

(36) Separate retainer rod from first roof bow.

(37) Separate top cover from vehicle.

(38) Pull retainer rod from listing pockets on back of top cover.

INSTALLATION

The new top cover must be trimmed to the same size and shape as the old top cover to minimize wrinkling after installation. Use the rear sections of the old top as a pattern.

(1) On old top cover mark a line from the top of the quarter glass opening to the center of rear glass opening on each side of the top.

(2) Using a suitable cutting tool, cut the rear quarter sections off of old top.

(3) Mark locations of old top cover on side tack strips.

(4) Remove staples holding old top cover to side tack strips.

(5) Using quarter sections cut from old top cover as a pattern, mark lower tack strip edge of new top to same size and shape as old top.

(6) Trim excess material from new top cover.

(7) Position side tack strips under edge of new top and align index marks.

(8) Install staples 100 mm (4 in.) apart to hold top cover to side tack strips.

(9) Install retainer rod in listing pockets on back of top cover.

(10) Position top cover over top bows on vehicle and center top cover side to side.

(11) Mate retainer rod to first roof bow.

(12) Install screws to hold top cover retainer rod to first roof bow.

(13) Mate retainer rod to second roof bow.

(14) Install screws to hold top cover retainer rod to second roof bow.

(15) Route roof rail tension cables through rear of pockets on back of top cover.

(16) Connect roof rail tension cables to key-hole slots in roof rails.

(17) Install rubber plugs to hold roof rail tension cable ends into key-hold slots in roof rails.

(18) Apply suitable contact adhesive to roof rail rear of quarter glass opening and back of top cover hold down listing.

(19) Stick top cover listing to roof rail.

(20) Place roof rail weatherstrip channel in proper position.

(21) Install screws to hold channel to roof rail.

(22) Position top cover listing at index marks on third roof bow.

(23) Install staples 10 mm (0.3 in.) apart to hold top cover listing to third roof bow.

(24) Zip rear window into position.

(25) Fold rear of top cover, tack strips and rear window down and over the third roof bow.

(26) Position top cover at index marks on rear tack strip.

(27) Install staples 100 mm (4 in.) apart to hold top cover to rear tack strip.

CAUTION: Cover all painted and upholstered surfaces to avoid damage while performing the following operations.

(28) Reposition tack strips under rear deck and quarter panels.

(29) Place side tack strips in position behind quarter panels.

(30) Install enough bolts to temporarily hold side tack strips to inside of quarter panels.

(31) Place rear tack strip in position behind deck panel.

(32) Install enough bolts to temporarily hold rear tack strip to inner deck panel.

(33) Close and latch folding top.

(34) Pull top cover forward over top of windshield and hold cover material taut.

(35) Mark location of froward lower edge of top header on top cover material.

(36) Release top latches and lower top to midpoint.

(37) Align marks on top material to front lower edge of top header.

(38) Verify that top cover will be wrinkle free and aligned side to side.

(39) Install staples 10 mm (0.3 in.) apart to hold top cover to header.

(40) Place top header feature strip in position under top header.

(41) Install staples 10 mm (0.3 in.) apart to hold feature strip to top header.

(42) Place weatherstrip channel in position under top header.

(43) Install screws to hold channel to top header.

(44) Insert top header weatherstrip into header and roof rail channels.

(45) Install screws to hold roof rail tension cable springs to roof rear roof rail behind quarter glass opening.

(46) Close and latch top windshield header.

(47) Inspect top cover for excess wrinkling. If excess wrinkles are apparent, the top cover must be repositioned on the tack strips.

(48) If top cover is smooth, release top header latches to allow top cover to relax.

(49) Remove bolts holding tack strips to deck and quarter panels.

(50) Install staples 10 mm (0.3 in.) apart to hold top cover to rear and side tack strips.

(51) Place side and rear tack strips in position.

(52) Install bolts to hold tack strips to deck and quarter panels.

(53) Insert quarter glass weatherstrips into roof rail channels.

(54) Place sling well into position.

(55) Engage snaps to hold sling well to rear deck and quarter panels. Verify that drain tube is connected to bottom of sling well.

(56) Install headlining.

(57) Close top and latch header to windshield header.

ADJUSTMENT PROCEDURES

DOWEL PIN ADJUSTMENTS (FIG. 9)

(1) Loosen dowel pins.

(2) Position dowel pins to the center of the receiver holes in the windshield header.

(3) Tighten dowel pins and verify adjustment.

Refer to Cam Adjustment or Control Link Adjustment paragraphs of this section to adjust forward or rearward position of the top header.

LATCH HOOK ADJUSTMENT (FIG. 9)

If the convertible top latching effort is excessive, it can be reduced by lengthening the latch hook. The top header weatherstrip requires enough compression to prevent air and water leaks. Adjust latch hook to achieve reasonable latching effort and proper sealing.

FRONT TO CENTER RAIL ADJUSTMENT (FIG. 10)

To align the roof rail weatherstrips to the door and quarter glass contact, adjust the front to center rail adjusting screw. To decrease pressure on door glass turn adjuster inward. To increase pressure on door glass turn adjuster outward.

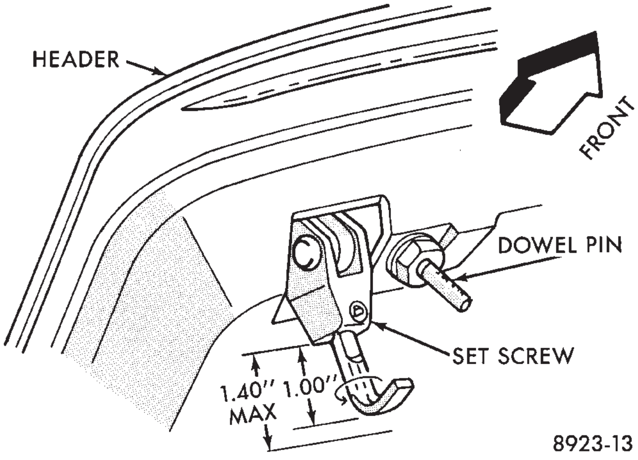


Fig. 9 Roof Latch and Guide Dowel Pin

TOP FRAME CAM ADJUSTMENT (FIG. 11)

The top frame cam changes forward or rearward position of the top header in relation to the windshield header. The cam turns inside the rear side rail and thrust link. It may be necessary to lengthen the control links 1 or 2 serration after a cam adjustment. The position of the cam high side determines the angle between the center and rear side rails. When the high side is fully forward, the angle is at a minimum, and when turned rearward, the angle is increased. An increased angle increases the forward movement of the top. The cam high side is indicated by a arrow on the cam threaded end.

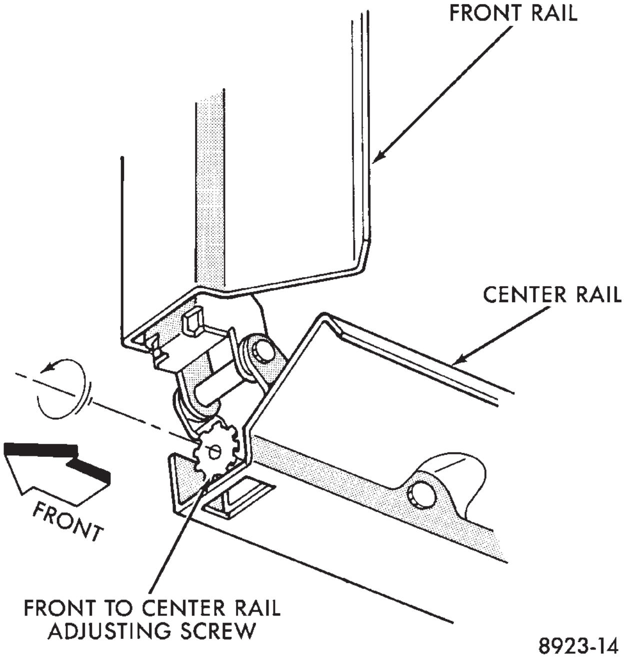


Fig. 10 Roof Rail Adjustment

TO ADJUST CAM SETTING

(1) Lower top to half down position to remove all possible strain from the cam.

(2) Loosen set screw and tap cam threaded end with a soft faced hammer to loosen any paint bond between cam and linkage.

(3) Using a 3/16 Allen wrench, rotate cam as necessary and secure set screw.

CONTROL LINK ADJUSTMENT (FIG. 12)

WARNING: DO NOT PLACE HANDS OVER GAPS IN MOVABLE CONVERTIBLE TOP COMPONENTS DURING SERVICING. PERSONAL INJURY CAN RESULT.

(1) Remove convertible top head lining as necessary to gain access to adjusters.

(2) With the top latched in up position, loosen both bolts just enough to permit moving link up or down.

(3) Push upward in the area of the front to center rail joint. Push rails up by hand as far as possible.

(4) With the control link adjusting bolts loosened, allow the control link to seek proper position.

(5) Tighten bolts while rail is held in position.

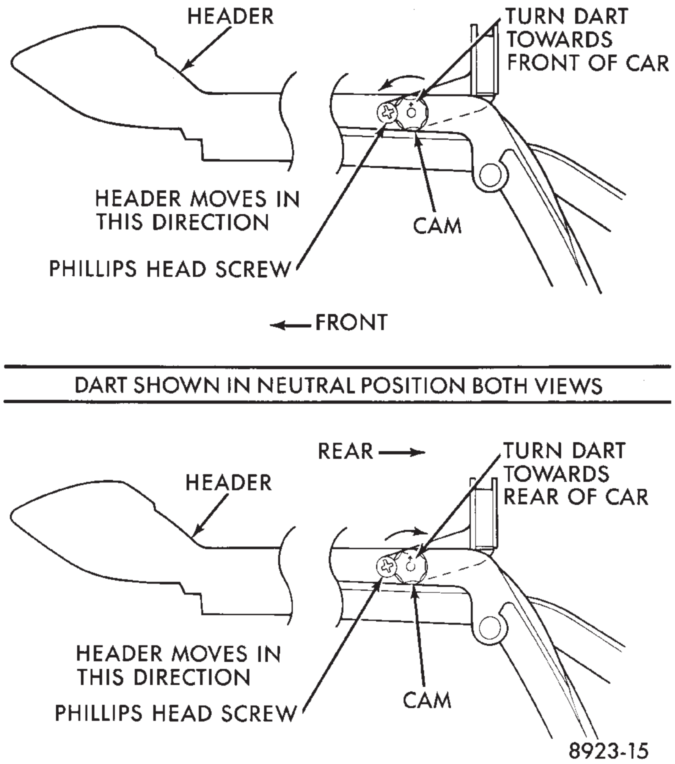


Fig. 11 Cam Assembly

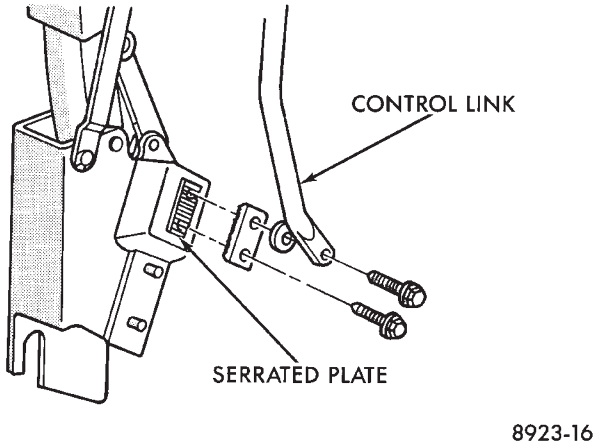
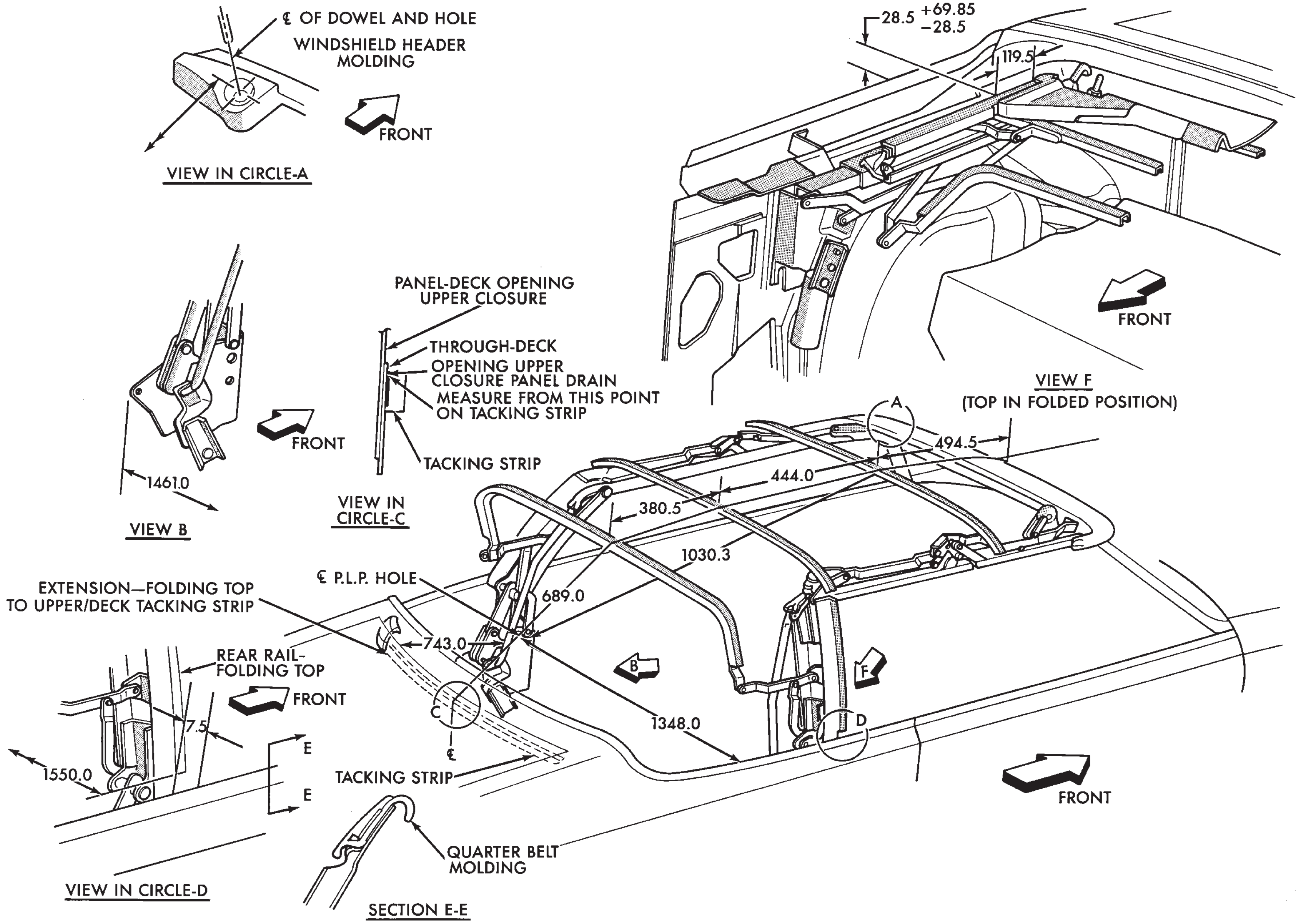


Fig. 12 Control Link Adjustment



CONVERTIBLE TOP DIMENSIONS

HYDRAULIC SYSTEMS

The power convertible top hydraulic system consists of;

- Two hydraulic cylinders
- Hydraulic lines
- Electric hydraulic pump and reservoir
- Dual relays

HYDRAULIC SYSTEM TESTS

The convertible top will raise slowly or make abnormal noise if the hydraulic fluid level is low.

(1) Remove sling well and floor cover.

(2) With the top up and latched, remove the reservoir fill plug.

(3) Visually inspect fluid level. If low, inspect for leak in hydraulic system.

(4) Repair or replace components, as necessary.

(5) Fill reservoir with Dexron® II, Type A, automatic transmission fluid to the bottom of the fill hole.

(6) Replace fill plug and lower top.

(7) Raise top and verify fluid level.

(8) Install sling well and floor cover.

HYDRAULIC PUMP ASSEMBLY

HYDRAULIC PUMP REMOVAL (FIG. 13)

(1) Disconnect battery negative cable.

(2) Remove sling well and floor cover from behind rear seat.

(3) Disconnect pump wire connector and ground connection.

(4) Disconnect hydraulic lines from pump.

(5) Remove motor pump assembly from vehicle. The rubber mounts are pressed and locked into the mounting bracket. Pull up motor assembly to remove.

HYDRAULIC PUMP INSTALLATION

Reverse the preceding operation

HYDRAULIC CYLINDER

HYDRAULIC CYLINDER REMOVAL

(1) Disconnect battery negative cable.

(2) Remove interior trim as necessary to gain access to hydraulic cylinders.

(3) Remove cylinder mounting bracket and nut.

(4) Remove pivot bolt holding cylinder shaft to top linkage.

(5) Disconnect hydraulic lines from the cylinder.

(6) Remove cylinder from vehicle.

HYDRAULIC CYLINDER INSTALLATION

Reverse the preceding operation, and verify each hydraulic seal is in place when connecting the line to the cylinder. Replace seal if damaged.

HYDRAULIC PUMP LINE SEALS

HYDRAULIC PUMP LINE SEALS REMOVAL

(1) Disconnect battery negative cable.

(2) Disconnect hydraulic lines from pump and remove seals.

HYDRAULIC PUMP LINE SEALS INSTALLATION

Reverse the preceding operation.

HYDRAULIC CYLINDER LINE SEALS

REMOVAL

(1) Remove hydraulic cylinder to gain access to hydraulic line connections.

(2) Disconnect hydraulic lines from cylinder and remove seals.

INSTALLATION

Reverse the preceding operation.

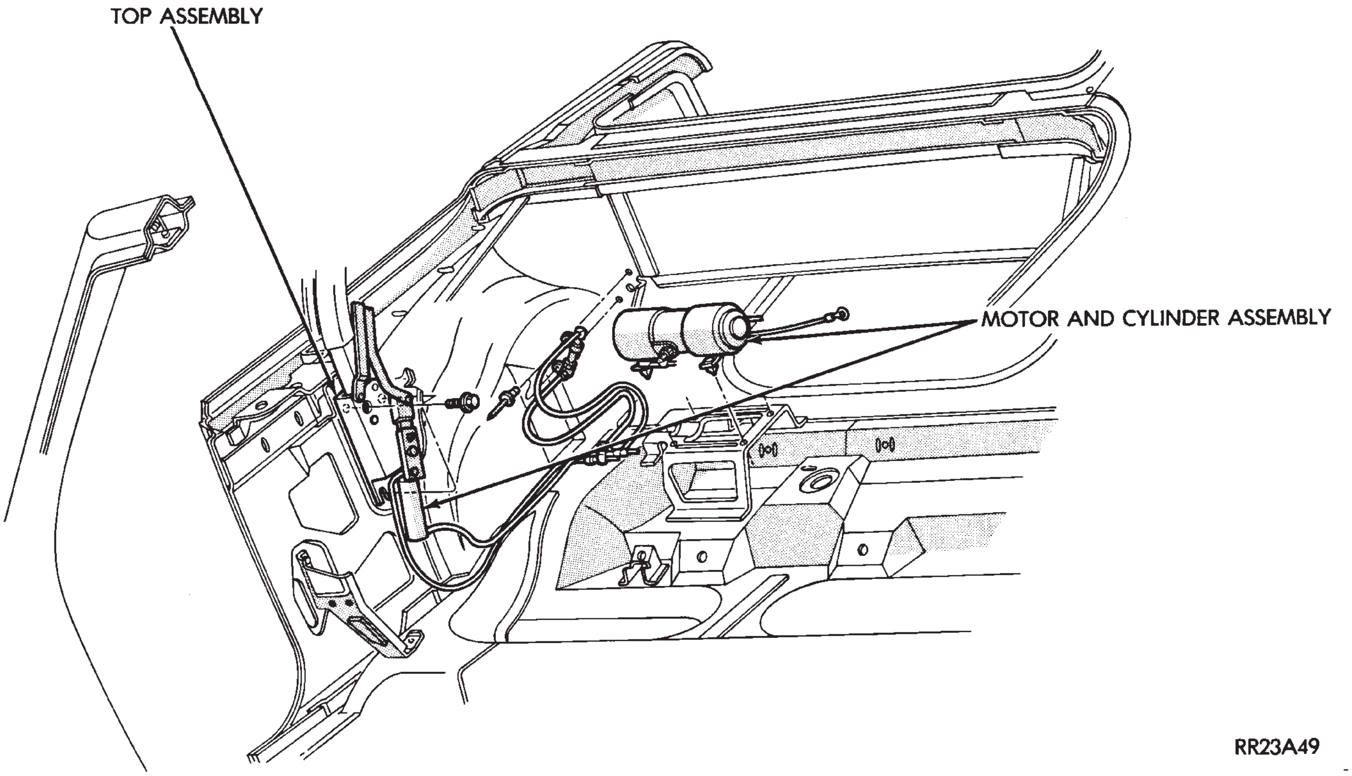


Fig. 13 Hydraulic System

AP-VEHICLE BODY COMPONENT SERVICE

INDEX

GRILLE

REMOVAL (FIG. 1)

(1) Raise hood to the up position.

(2) Remove screws holding grille to grille opening panel.

(3) Separate grille from vehicle.

INSTALLATION

Reverse the preceding operation.

GRILLE OPENING PANEL

REMOVAL (FIG. 1)

(1) Remove grille from grille opening panel.

(2) Remove headlamp assemblies. Refer to Group 8L. Lamps for proper procedures.

(3) Remove bolts holding grille opening panel to closure panel brackets.

(4) Remove bolt holding grille opening panel to brace in front of radiator.

(5) Separate grille opening panel from vehicle.

INSTALLATION

Reverse the preceding operation.

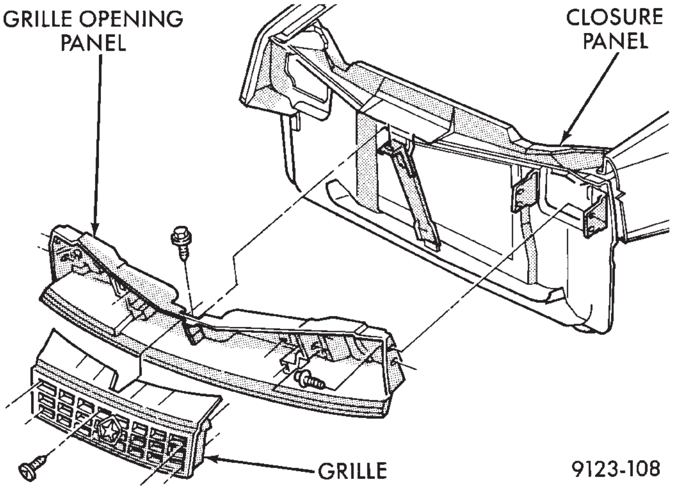


Fig. 1 Grille and Grille Opening Panel

HOOD AND HINGES

HOOD REMOVAL (FIG. 2)

(1) Raise hood to full up position.

(2) Disconnect the under hood lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When install-

ing hood, 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.

(4) Remove the top hood to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the hood, remove the bottom hood to hinge attaching bolts. Separate the hood from the vehicle.

HOOD INSTALLATION

Reverse the preceding operation.

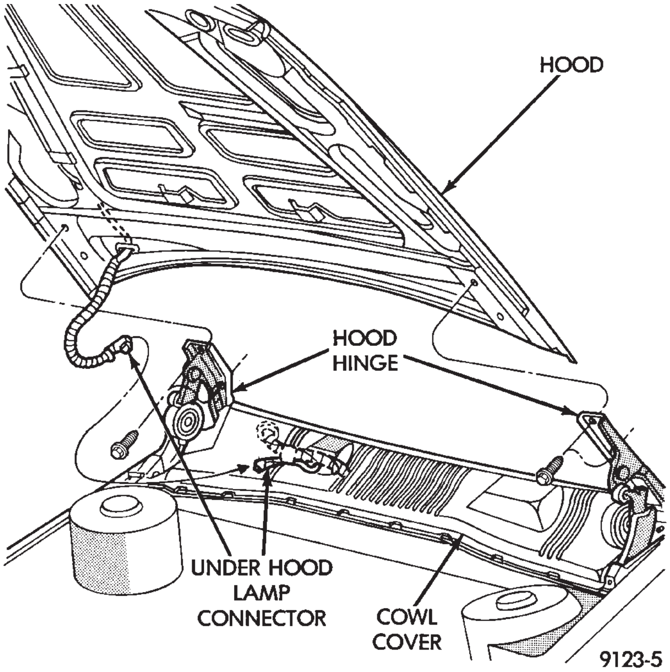


Fig. 2 Hood Assembly—Typical

HOOD HINGE REMOVAL (FIG. 3)

(1) Support hood on the side that requires hinge replacement.

(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood hinge, 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.

(3) Remove hood to hinge attaching bolts.

(4) Remove hood hinge to front fender attaching bolts and separate hinge from vehicle.

HOOD HINGE INSTALLATION

Reverse the preceding operation. If necessary, paint new hinge before installation.

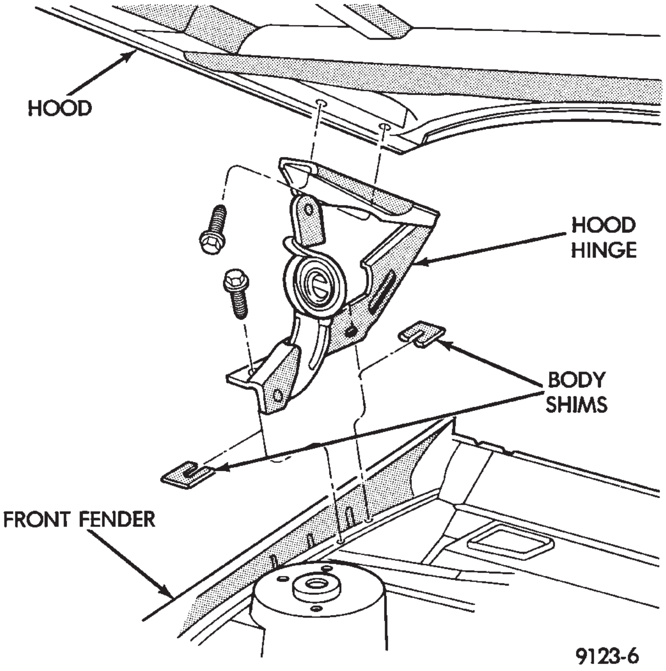


Fig. 3 Hood Hinge Assembly

HOOD LATCH AND RELEASE CABLE

HOOD LATCH REMOVAL (FIG. 4)

(1) Raise hood top the full up position.

(2) Remove hood latch attaching bolts holding latch to radiator closure panel and separate from vehicle.

(3) Pry release cable casing attachment from slot receiver on latch, disengage cable end from latch arm hook.

HOOD LATCH INSTALLATION

Reverse the preceding operation.

HOOD LATCH RELEASE CABLE REMOVAL (FIG. 5)

(1) Raise hood to the full up position.

(2) Remove push-in fasteners holding hood latch cover to radiator closure panel and separate cover from vehicle.

(3) Disconnect hood release cable casing and cable end from hood latch assembly. Refer to Hood Latch Removal procedure in this section.

(4) Remove hood latch release cable handle attaching bolts from under left lower edge of instrument panel.

(5) Disengage release cable rubber grommet from engine compartment dash panel behind instrument panel.

(6) Rout cable assembly through engine compartment around battery, under fender lip, under relay bank, and under wiring harnesses, toward dash panel. Push cable through access hole in dash panel under the brake master cylinder, into passenger compartment.

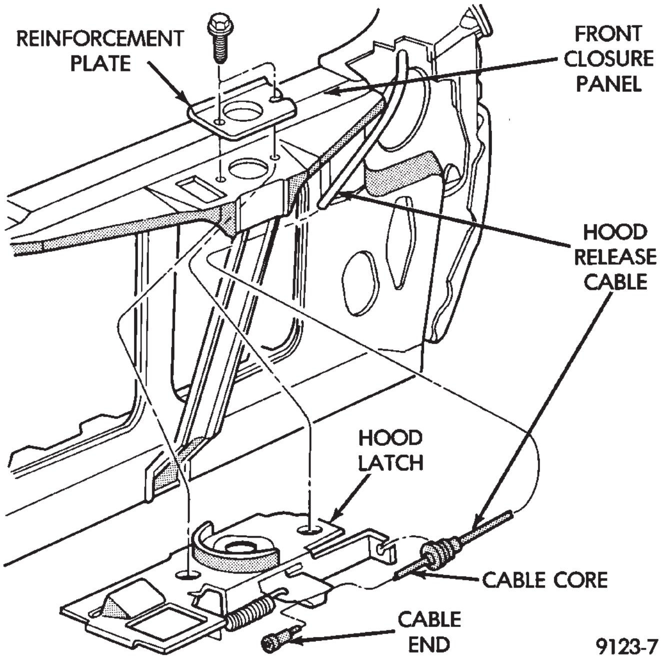


Fig. 4 Hood Latch—Typical

HOOD LATCH RELEASE CABLE INSTALLATION

Reverse the preceding operation.

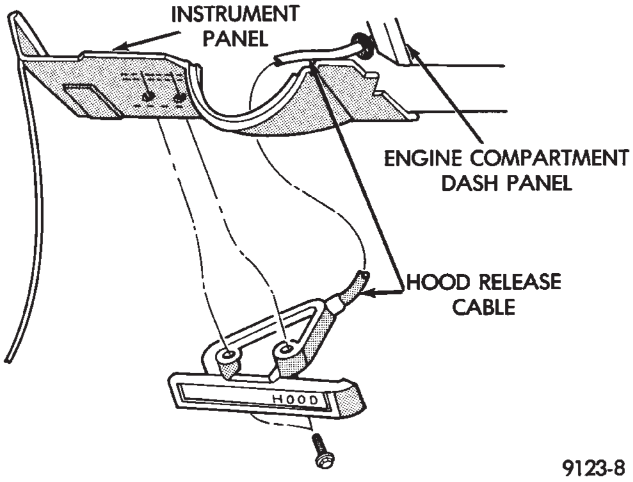


Fig. 5 Hood Latch Release Cable—Typical

FRONT END SPLASH SHIELDS

FRONT WHEELHOUSE SPLASH SHIELD REMOVAL (FIG. 6)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove front wheel assembly.

(3) Remove push-in fasteners holding front wheelhouse splash shield to fender opening lip and inner wheelhouse area.

(4) Separate wheelhouse splash shield from vehicle.

FRONT WHEELHOUSE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

TRANSAXLE SPLASH SHIELD REMOVAL (FIG. 6)

(1) Remove one front wheelhouse splash shield push-in fastener and separate wheelhouse splash shield from transaxle splash shield.

(2) Remove transaxle splash shield attaching bolts and separate transaxle splash shield from vehicle.

TRANSAXLE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

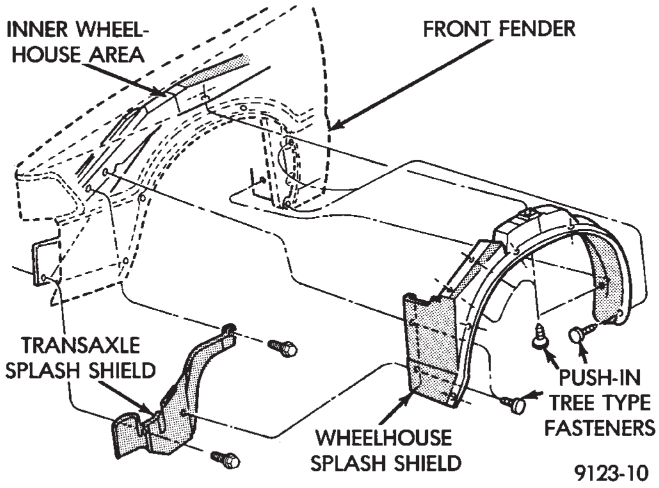


Fig. 6 Front Wheelhouse and Transaxle Splash Shields

ENGINE DRIVE BELT SPLASH SHIELD REMOVAL (FIG. 7)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove bolts holding engine drive belt splash shield to right frame rail.

(3) Separate drive belt splash shield from vehicle.

ENGINE DRIVE BELT SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

FRONT DOOR TRIM PANEL—AP-24/44 Body

DOOR TRIM PANEL REMOVAL (FIG. 8)

(1) Move glass to down position.

(2) Disconnect battery negative cable.

(3) Remove inside latch release handle bezel. Pull outward at forward edge and push bezel rearward.

(4) Remove screw cover from window crank. Remove screw holding crank to regulator and separate crank from door, if equipped.

(5) Remove remote control mirror bezel.

(6) Remove screw covers from arm rest.

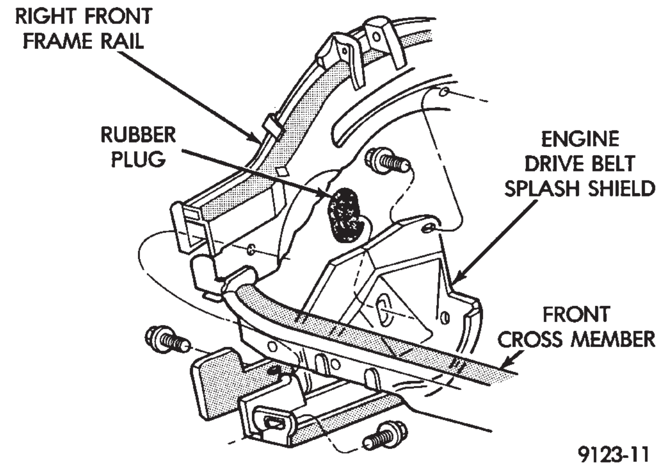


Fig. 7 Engine Drive Belt Splash Shield

(7) Remove screws holding arm rest to door trim. Disconnect power door lock switch wire connector.

(8) Disengage frog-leg clips from around bottom and side edges of trim panel. Lift trim panel upward and separate trim from door.

(9) Disconnect courtesy lamp wire connector.

DOOR TRIM PANEL INSTALLATION

Reverse the preceding operation.

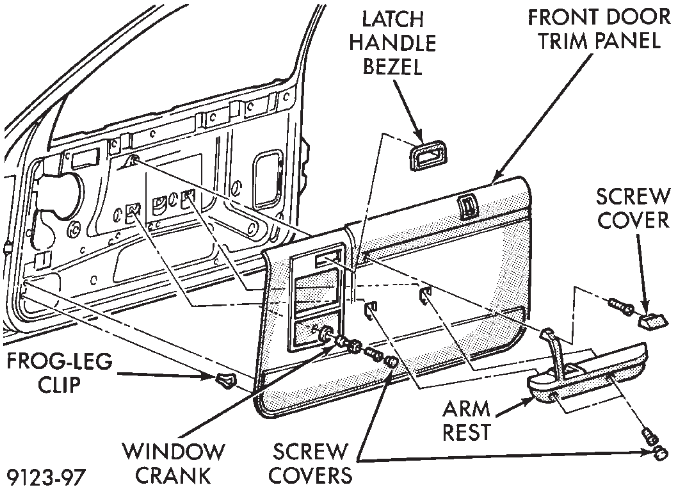


Fig. 8 Front Door Trim Panel

FRONT DOOR WATER SHIELD

REMOVAL

(1) Remove front door trim panel.

(2) Remove push-in fasteners holding silencer pad to door inner panel and separate silencer from door.

(3) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR AND HINGE

The front door hinge is welded to the door and bolted to the hinge pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

FRONT DOOR REMOVAL (FIG. 9)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Disconnect all wire connectors and wire harness hold downs inside door and push wire harness through access hole in front of door into hinge pillar opening.

(3) Open door and support door on a suitable lifting device.

(4) Drive bottom hinge pin upward and remove pin from hinge.

(5) Drive top hinge pin downward and remove pin from hinge.

FRONT DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Front Door Hinge Installation paragraph in this section.

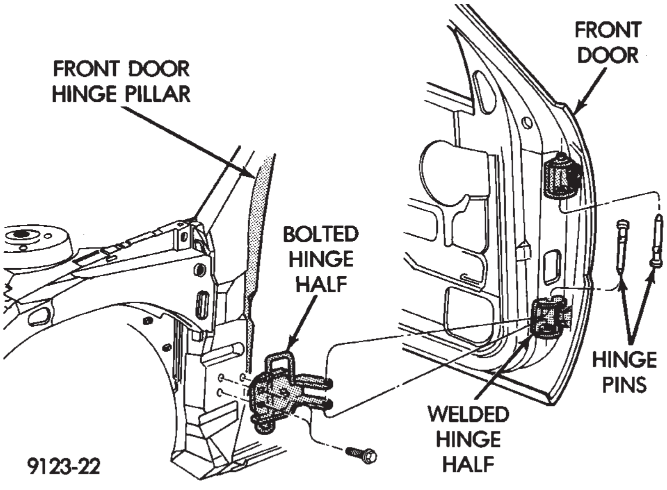


Fig. 9 Front Door Hinges—Typical

FRONT DOOR HINGE REMOVAL (FIG. 9)

(1) Remove front fender wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph in this section.

(2) Support door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to hinge pillar and separate hinge form vehicle.

FRONT DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

OUTSIDE FRONT DOOR LATCH RELEASE HANDLE

REMOVAL (FIG. 10)

(1) Remove front door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Disconnect security alarm switch and illuminated entry switch from back of outside front door latch release handle, if equipped. For additional information refer to Group 8Q, Vehicle Theft Security System

(4) Disconnect lock rod and latch release rod from door latch assembly.

(5) Remove nuts holding outside door latch handle to retainer bracket and separate bracket from door.

(6) Swing lock rod upward, parallel to back of latch handle, and separate latch handle from door panel.

INSTALLATION

Reverse the preceding operation.

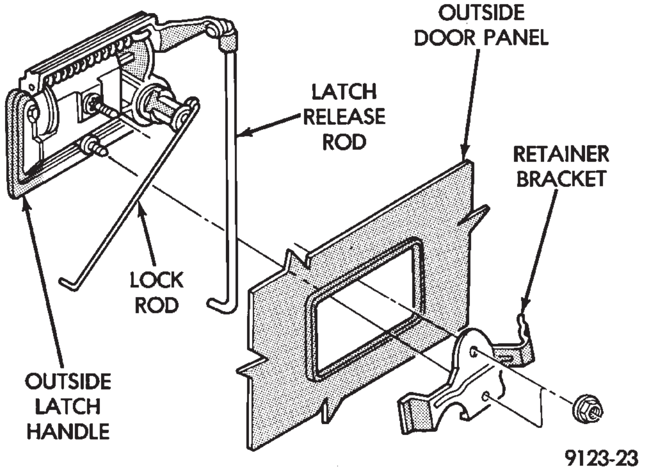


Fig. 10 Outside Front Door Latch Release Handle—Typical

FRONT DOOR LATCH

REMOVAL (FIG. 11)

(1) Remove front door trim panel, silencer pad and water shield.

(2) Raise door glass to full up position.

(3) Disconnect all actuator rods from door latch assembly.

(4) Remove screws holding door latch assembly to inner door rear panel and separate latch from door.

INSTALLATION

Reverse the preceding operation.

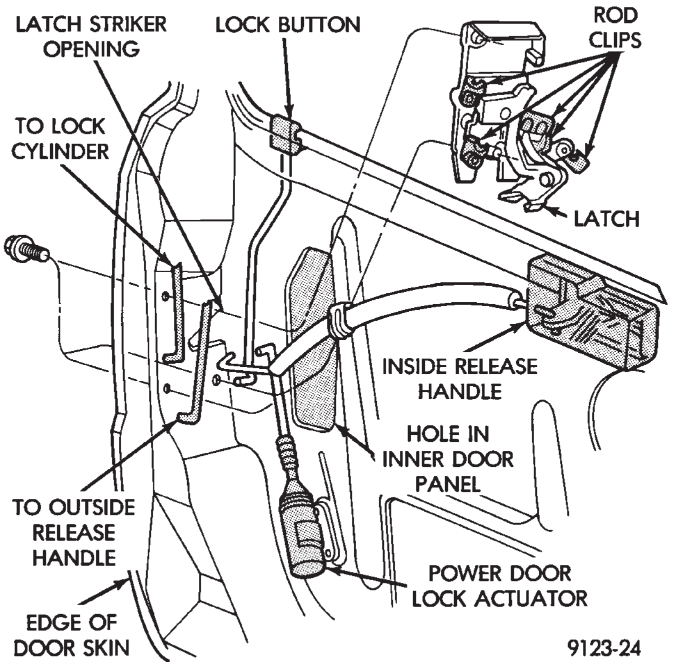


Fig. 11 Front Door Latch—Typical

FRONT DOOR SIDE VIEW MIRROR

REMOVAL (FIG. 12)

(1) Remove front door trim panel.

(2) Remove side view mirror remote adjusting knob cover, if equipped.

(3) Remove screws holding mirror bezel to door frame and separate bezel from door. Loosen set-screw holding bezel to mirror adjuster cable, if equipped.

(4) Remove silencer seal from door frame behind mirror bezel.

(5) Disconnect power mirror wire connector, if equipped.

(6) Remove access hole cover.

(7) Remove nuts holding mirror to door frame and separate mirror from door.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR GLASS

REMOVAL (FIG. 13)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Position door glass half way up in door glass opening.

(3) Insert door glass removal tool C-4867 between the glass slide and channel retaining lip at approximately 50 mm (2 in.) down from top rearward corner of glass. Push handle of tool toward glass to open channel. Push downward at the front of the glass to separate the slide from the channel.

(4) Insert door glass removal tool C-4867 between the glass slide and channel retaining lip at approxi-

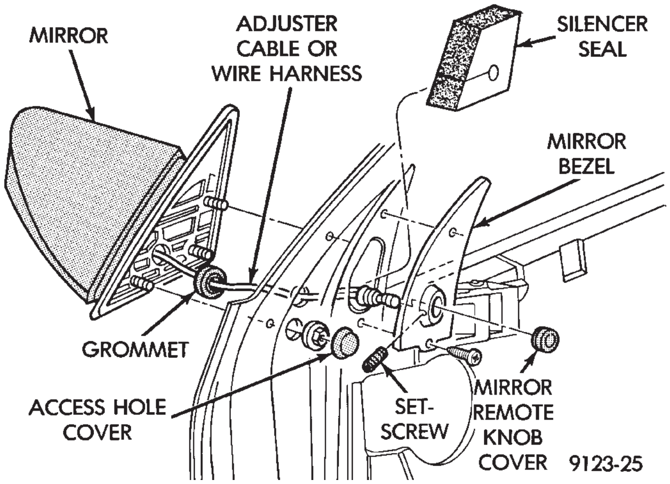


Fig. 12 Front Door Side View Mirror—Typical

mately 50 mm (2 in.) up from bottom rearward corner of glass through opening in inner door panel. Push handle of tool toward glass to open channel. Pull upward at front of glass to separate the slide from the channel. Do not allow upper slide to snap bank into channel.

(5) Rotate front of glass downward and slide glass forward to separate glass lift channel from regulator lift arm roller.

(6) Remove door glass through opening at top of door.

INSTALLATION

(1) Lower door glass into opening at top of door.

(2) Tip rear of glass downward and insert window regulator lift arm roller into glass lift channel.

(3) Guide door glass into glass run weatherstrip at front of door.

(4) Push top of glass rearward to snap top slide into glass run channel.

(5) Push downward at front of glass to snap bottom slide into glass run channel.

(6) Install water shield, silencer pad and trim panel.

FRONT POWER DOOR LOCK ACTUATOR

REMOVAL (FIG. 14)

(1) Disconnect battery negative cable.

(2) Remove front door trim panel.

(3) Remove water shield as necessary.

(4) Remove rivets holding lock motor to inner door panel with a 6 mm (1/4 in.) drill.

(5) Disconnect lock motor linkage rod from door latch.

(6) Disconnect lock motor wire connector.

(7) Separate lock motor from door.

INSTALLATION

Reverse the preceding operation.

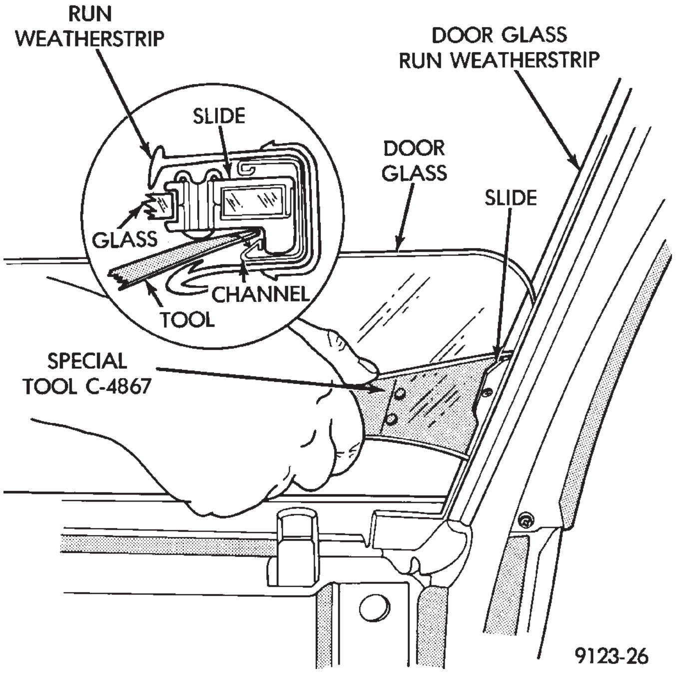


Fig. 13 Front Door Glass

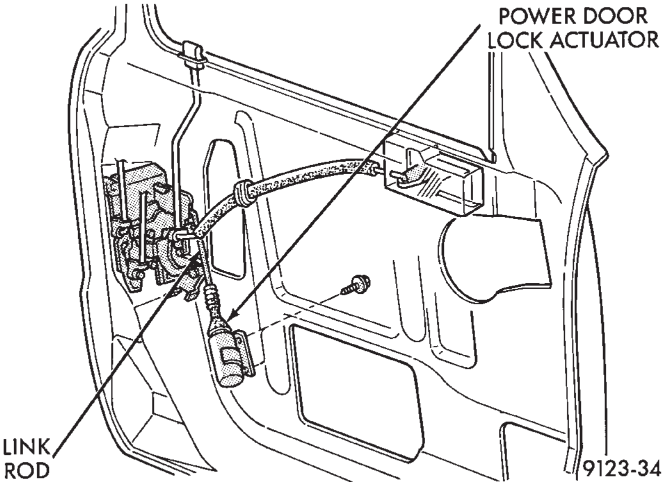


Fig. 14 Front Power Door Lock Actuator—Typical

FRONT DOOR BELT MOULDING AND WEATHERSTRIP

BELT MOULDING AND WEATHERSTRIP REMOVAL

(1) Remove trim panel, silencer pad, and water shield as necessary to gain access to belt moulding attaching screws.

(2) Remove door glass.

(3) Remove screws holding belt moulding and weatherstrip to outer door panel and separate moulding from door.

BELT MOULDING AND WEATHERSTRIP INSTALLATION

Reverse the preceding operation.

FRONT DOOR GLASS CHANNEL AND RUN WEATHERSTRIP

GLASS CHANNEL AND RUN WEATHERSTRIP REMOVAL (FIG. 15)

(1) Remove door belt moulding and weatherstrip assembly.

(2) Pull door glass run weatherstrip from forward lower channel and upper door frame back to rear upper corner of door frame.

(3) Separate weatherstrip from top of rear door frame down to first clip. Using a suitable hook tool, disengage clip barb from door frame channel. Pull weatherstrip outward to disengage clip. Repeat this procedure at each clip down the rear channel.

(4) Separate glass channel and run weatherstrip from door.

GLASS CHANNEL AND RUN WEATHERSTRIP INSTALLATION

(1) Insert glass run weatherstrip into top of glass opening upper channel. Align molded corners of weatherstrip to corners of glass opening.

(2) Push weatherstrip and glass run channel into upper rear glass opening channel. Seat the top retaining clip by placing a fiber trim stick (C-4755) over the clip attaching rivet inside the glass run channel and push or tap firmly inward until clip seats. Verify the alignment of the weatherstrip in the top rear corner. Repeat this procedure on each clip going down the run.

(3) Install door belt moulding and weatherstrip assembly.

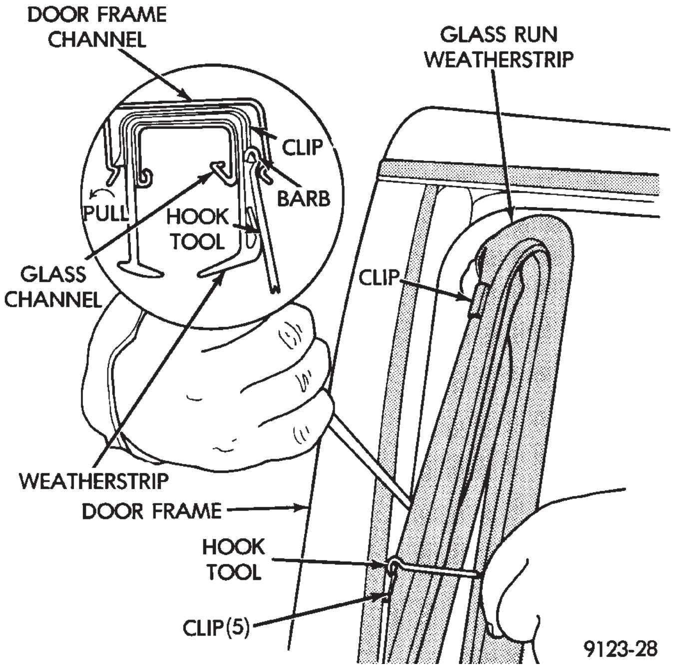


Fig. 15 Front Door Glass Channel and Run Weatherstrip—Typical

FRONT DOOR GLASS RUN LOWER CHANNELS

FRONT OR REAR LOWER CHANNEL REMOVAL (FIG. 16)

(1) Remove door glass channel and run weatherstrip as necessary to gain access to lower channels and attaching rivets.

(2) Drift punch rivet center expansion pins from each pop-rivet fastener holding channel to door panel or mirror support frame.

(3) Drill pop-rivet fasteners out of door panel or mirror support frame and separate front or rear channel from door.

FRONT OR REAR LOWER CHANNEL INSTALLATION

(1) Install lower channel into at design location.

(2) Install pop-rivets using a suitable pop-rivet gun.

(3) Install Glass channel and run weatherstrip.

(4) Install belt moulding and weatherstrip assembly.

(5) Install door glass.

(6) Install door water shield silencer pad and trim panel.

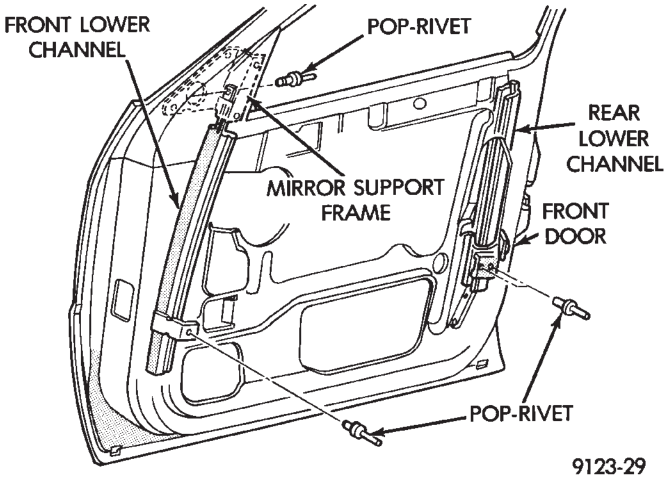


Fig. 16 Front Door Lower Channels—Typical

FRONT DOOR WINDOW REGULATOR/MANUAL

MANUAL WINDOW REGULATOR REMOVAL (FIG. 17)

(1) Remove trim panel, silencer pad, and water shield.

(2) Raise glass to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(3) Remove bolts holding window regulator to inner door panel.

(4) Slide roller from window lift channel. Rotate regulator

to bring lift arm through access hole first.

(5) Remove regulator assembly from door.

MANUAL WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

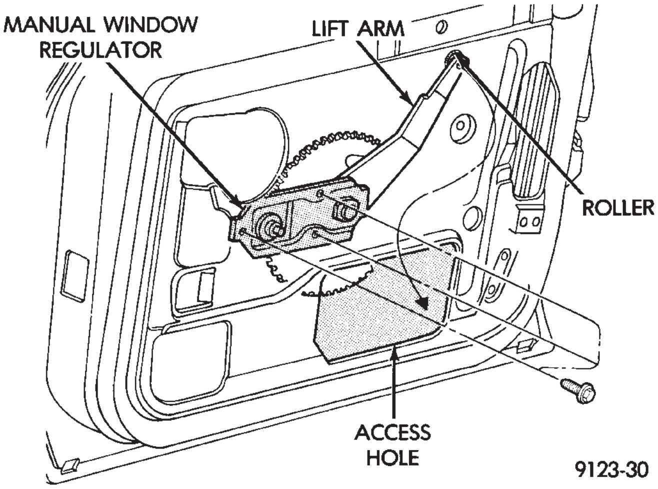


Fig. 17 Front Door Manual Window Regulator—Typical

FRONT DOOR WINDOW REGULATOR/POWER

POWER WINDOW REGULATOR REMOVAL (FIG. 18)

(1) Remove trim panel and water shield and connect window switch to wire connector.

(2) Raise glass to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(3) Disconnect battery negative cable.

(4) Remove bolts holding window regulator to inner door panel.

(5) Slide roller from window lift channel. Rotate regulator

to bring lift arm through access hole first.

(6) Remove regulator assembly from door.

POWER WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

REAR DOOR TRIM PANEL

REMOVAL (FIG. 19)

(1) Move glass to down position.

(2) Disconnect battery negative cable.

(3) Remove inside latch release handle bezel. Pull outward at forward edge and push bezel rearward.

(4) Remove screw cover from window crane. Remove screw holding crank to window regulator, if equipped.

(5) Remove screw covers from armrest. Remove screws holding armrest to door.

(6) Disengage frog-leg clips holding trim panel to door. Separate trim panel from door.

(7) Disconnect courtesy lamp wire connector.

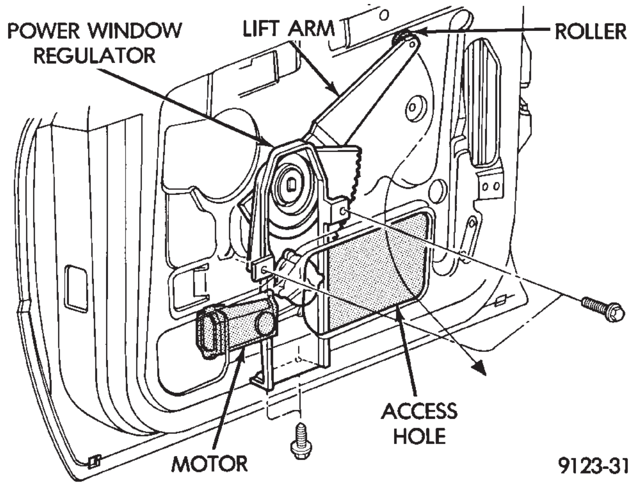


Fig. 18 Front Door Power Window Regulator—Typical

INSTALLATION

Reverse the preceding operation.

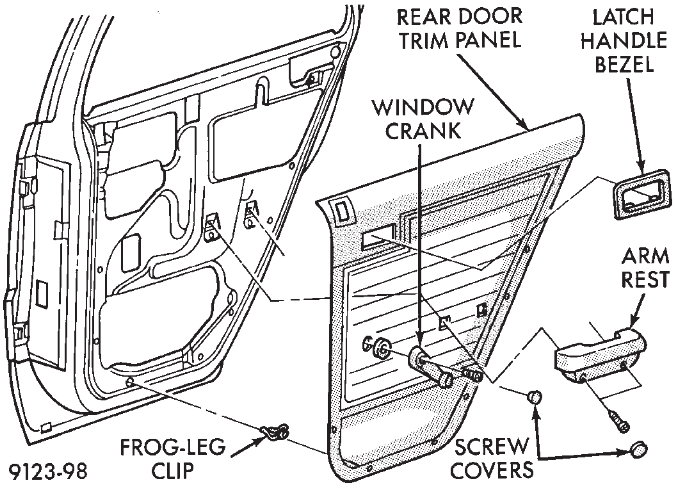


Fig. 19 Rear Door Trim Panel

REAR DOOR SILENCER AND WATER SHIELD

REMOVAL (FIG. 20)

(1) Remove door trim panel.

(2) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

REAR DOOR AND HINGE

The rear door hinge is welded to the door and bolted to the B-pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

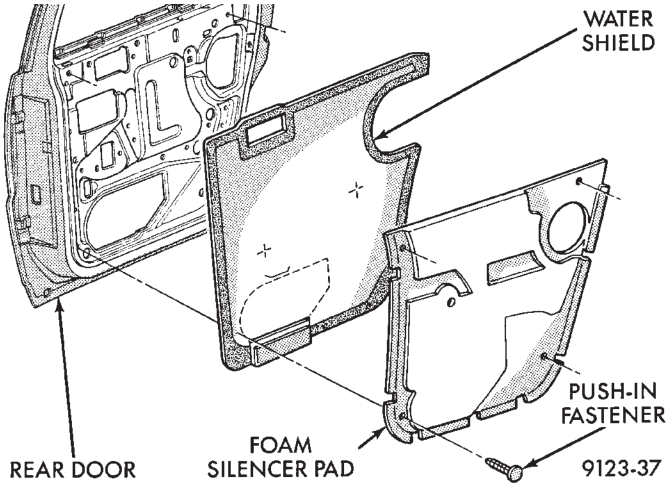


Fig. 20 Rear Door Silencer and Water Shield—Typical

REAR DOOR REMOVAL (FIG. 21)

(1) Remove B-pillar trim panel and disconnect all wire connectors leading to door. Push wire harness through access hole in B-pillar into hinge opening.

(2) Support door on a suitable lifting device.

(3) Drive bottom hinge pin upward and remove pin from hinge.

(4) Drive top hinge pin downward and remove pin from hinge.

(5) Separate door from vehicle.

REAR DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Rear Door Hinge Installation paragraph in this section.

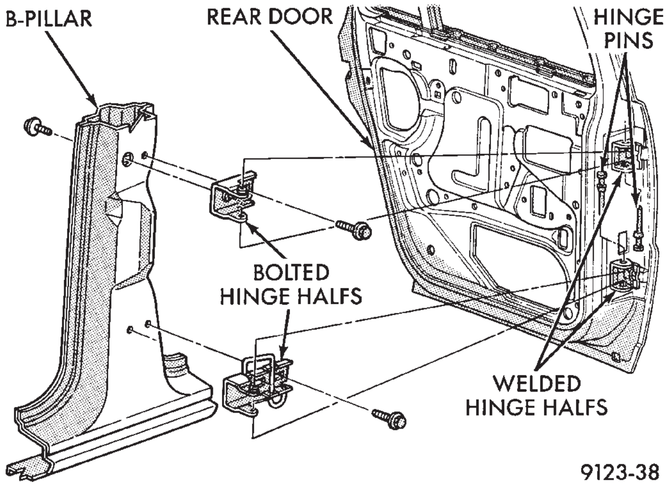


Fig. 21 Rear Door Hinges—Typical

REAR DOOR HINGE REMOVAL (FIG. 21)

(1) To remove upper hinge bolted half, remove B-pillar trim panel. To remove lower hinge bolted half it is not necessary to remove B-pillar trim.

(2) Support rear door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to B-pillar and separate hinge form vehicle.

REAR DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

OUTSIDE REAR DOOR LATCH RELEASE HANDLE

REMOVAL (FIG. 22)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Remove rear door speaker, if equipped.

(4) Disconnect latch release rod from door latch assembly.

(5) Remove nuts holding outside door latch handle to retainer bracket and separate bracket from door.

(6) Separate latch handle from door panel.

INSTALLATION

Reverse the preceding operation.

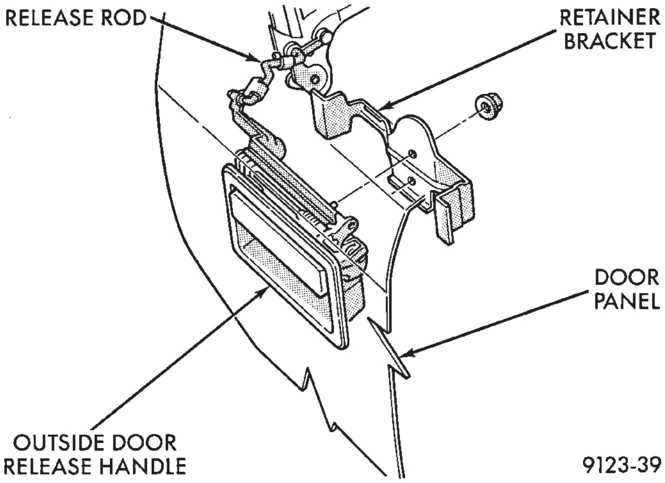


Fig. 22 Outside Rear Door Latch Release Handle—Typical

REAR DOOR LATCH

REMOVAL (FIG. 23)

(1) Remove door trim panel, silencer pad and water shield.

(2) Raise door glass to full up position.

(3) Remove door speaker, if equipped.

(4) Disconnect all actuator rods from door latch assembly.

(5) Remove screws holding door latch assembly to inner door rear panel and separate from door.

INSTALLATION

Reverse the preceding operation.

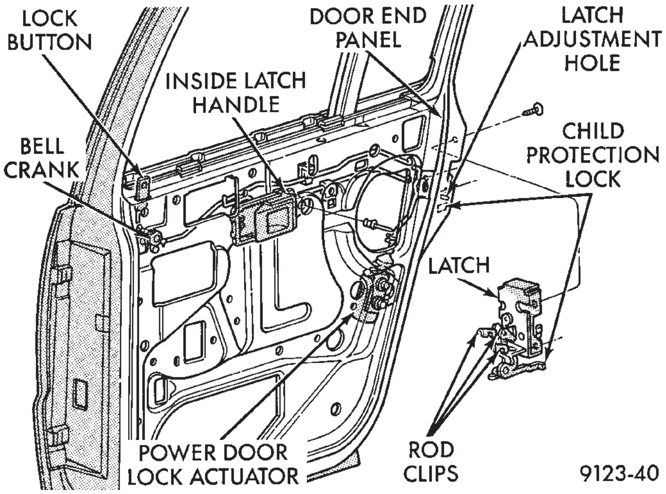


Fig. 23 Rear Door Latch Assembly—Typical

REAR POWER DOOR LOCK ACTUATOR

REMOVAL (FIG. 24)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Raise door glass to full up position.

(3) Remove door speaker, if equipped.

(4) Disconnect actuator rod from door latch assembly.

(5) Remove screws holding power lock actuator to inner door panel and separate from door.

INSTALLATION

Reverse the preceding operation.

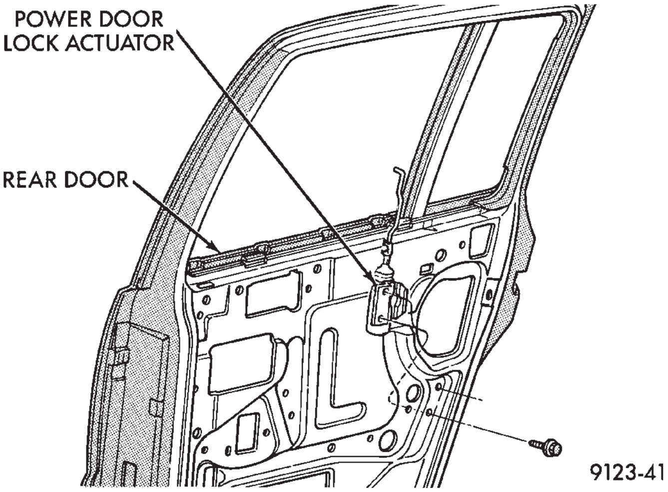


Fig. 24-Rear Power Lock Actuator—Typical

REAR DOOR GLASS

REMOVAL (FIG. 25)

(1) Remove door trim panel and water shield.

(2) Position door glass half way up in door glass opening.

(3) Pull upward firmly at the front upper corner of glass to disengage lower glass guide from run channel.

(4) Insert door glass removal tool C-4867 between the glass slide and division run channel retaining lip at approximately 50 mm (2 in.) down from top rearward corner of glass. Push handle of tool toward glass to open channel. Pull forward on the glass to separate the slide from the channel.

(5) Position glass inboard of the division channel. Pivot top of glass rearward between division channel and inner door panel.

(6) Separate regulator lift arm roller from glass lift channel or remove bolt from regulator track, with power windows.

(7) Remove door glass through opening at top of door.

INSTALLATION

(1) Lower door glass into opening at top of door.

(2) Insert window regulator lift arm roller into glass lift channel or install bolt to regulator track, with power windows.

(3) Push top of glass rearward to snap top slide into division run channel.

(4) Push downward at front of glass to snap bottom slide into channel.

(5) Install water shield and trim panel.

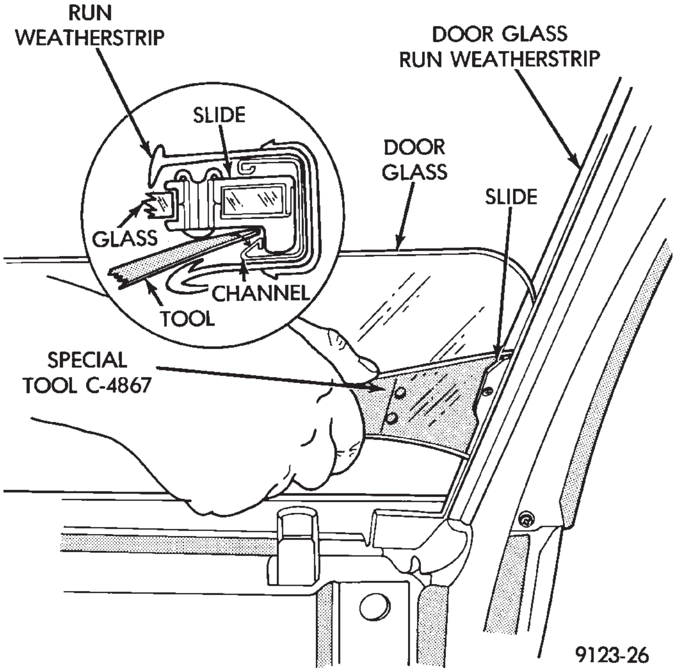


Fig. 25 Rear Door Glass

REAR DOOR BELT MOULDING AND WEATHERSTRIP

REMOVAL

(1) Remove trim panel, silencer pad, and water shield.

(2) Remove door glass.

(3) Remove screws holding belt moulding and weatherstrip to outer door panel and separate moulding from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove door belt moulding and weatherstrip assembly.

(2) Pull door glass run weatherstrip from forward lower channel and upper door frame.

(3) Separate glass run weatherstrip from door.

INSTALLATION

(1) Insert glass run weatherstrip into top of glass opening upper channel. Align molded corner of weatherstrip to upper front corner of glass opening.

(2) Push weatherstrip into door frame window opening.

(3) Install door belt moulding and weatherstrip assembly.

REAR DOOR STATIONARY GLASS

STATIONARY GLASS REMOVAL

(1) Remove belt moulding and weatherstrip assembly.

(2) Remove upper window opening moulding.

(3) Remove bolts and screws holding division channel and glass module to door assembly and separate division channel from door frame.

(4) Separate stationary glass from division channel.

(5) Remove division channel through opening at top of door.

STATIONARY GLASS INSTALLATION

Reverse the preceding operation.

REAR DOOR WINDOW REGULATOR/MANUAL

MANUAL WINDOW REGULATOR REMOVAL (FIG. 26)

(1) Remove trim panel, silencer pad, and water shield.

(2) Position door glass 150 mm (6 in.) up into glass opening.

(3) Remove bolts holding window regulator to inner door panel.

(4) Slide roller from window lift channel.

(5) Remove bolts holding reinforcement brace to inner door panel.

(6) By hand, pull glass upward to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(7) Remove regulator assembly from door.

MANUAL WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

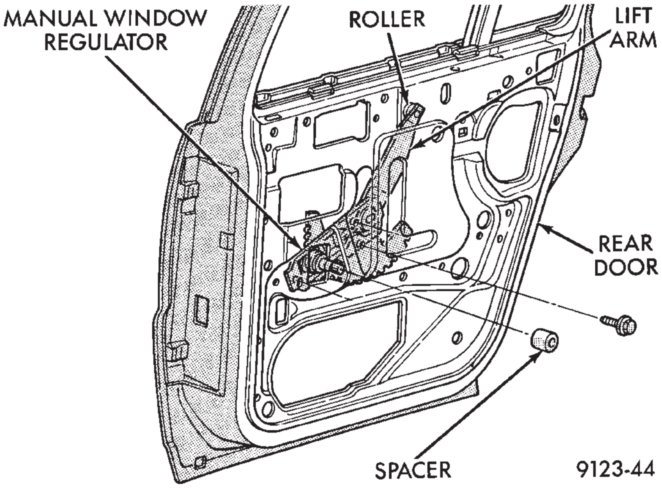


Fig. 26 Rear Door Manual Window Regulator—Typical

REAR DOOR WINDOW REGULATOR/POWER

POWER WINDOW REGULATOR REMOVAL

(1) Remove trim panel and water shield.

(2) Position door glass 150 mm (6 in.) up into glass opening.

(3) Remove bolts holding window regulator lift bracket to door glass.

(4) Remove fasteners holding power window regulator to inner door panel.

(5) By hand, pull glass upward to 25 mm (1 in.) from full up position. Using suitable tape, secure door glass to upper window frame.

(6) Remove regulator assembly from door.

POWER WINDOW REGULATOR INSTALLATION

Reverse the preceding operation.

DOOR OPENING WEATHERSTRIPS

FRONT OR REAR DOOR OPENING WEATHERSTRIP REMOVAL (FIG. 27)

(1) Remove interior trim as necessary to gain access to door opening weatherstrip.

(2) Pull weatherstrip from pinch flange around door opening.

FRONT OR REAR DOOR OPENING WEATHERSTRIP INSTALLATION

(1) Locate the middle to the weatherstrip at the center of the upper pinch flange. Push weatherstrip onto pinch flange at the top corner near the B-pillar.

(2) When the weatherstrip has been installed down the door opening to the sill pinch flange, mate the ends of the weatherstrip together and finish installing.

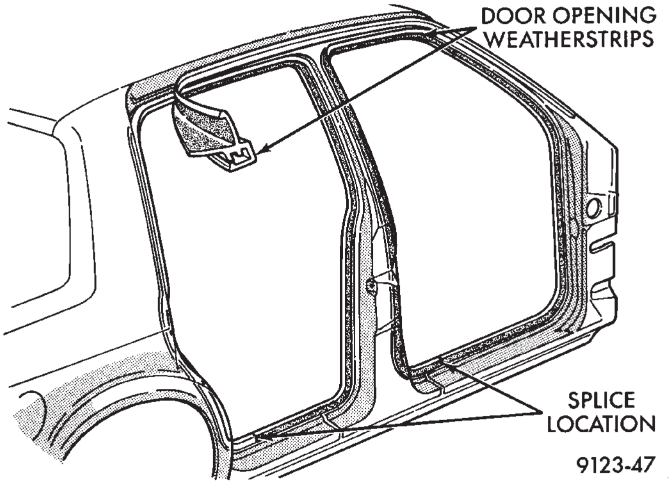


Fig. 27 Door Opening Weatherstrips—Typical

QUARTER GLASS WINDOW

REMOVAL (FIG. 28)

(1) Remove quarter trim panel as necessary to gain access to quarter glass fasteners.

(2) Remove quarter window opening moulding.

(3) Remove screw holding quarter glass to retaining bracket.

(4) Remove rivets holding quarter glass to B-pillar with a 6 mm (0.250 in.) drill.

INSTALLATION

Reverse the preceding operation.

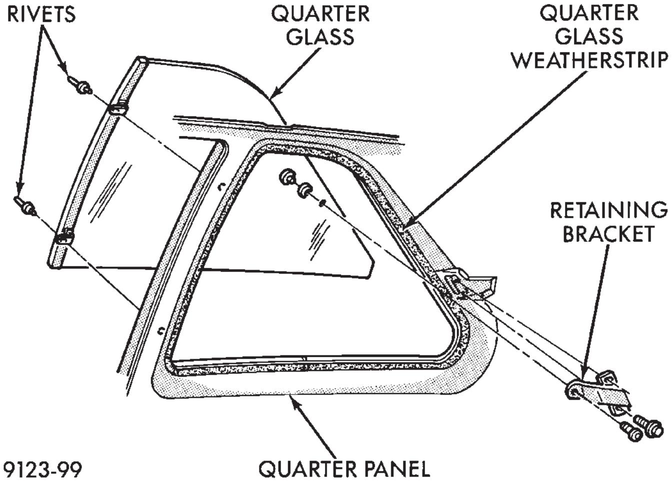


Fig. 28 Quarter Glass—AP-24 Body

QUARTER GLASS WEATHERSTRIP

REMOVAL (FIG. 29)

(1) Remove quarter trim panel as necessary to gain access to quarter glass fasteners.

(2) Remove screw holding quarter glass to retaining bracket.

(3) Hinge quarter glass away from weatherstrip.

(4) Remove quarter glass weatherstrip from pinch flange.

INSTALLATION

Reverse the preceding operation.

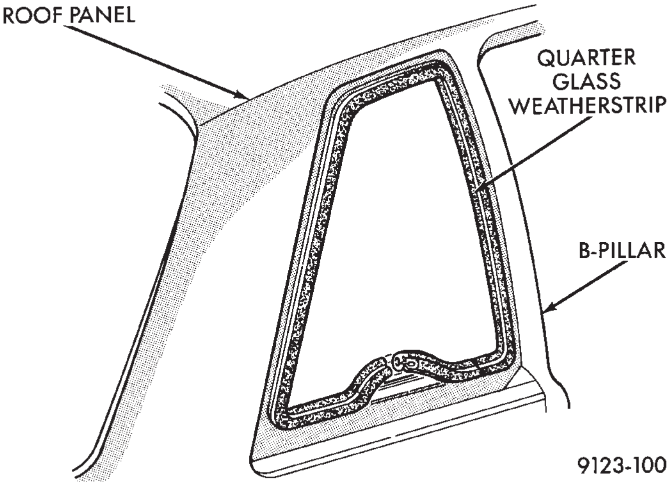


Fig. 29 Quarter Glass Weatherstrip—AP-24 Body

BODY SIDE MOULDING AND APPLIQUE

STICK-ON BODY SIDE MOULDING REMOVAL AND INSTALLATION

(1) Warm the effected stick-on moulding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(2) Pull stick-on moulding from painted surface.

(3) Remove adhesive tape residue from painted surface of vehicle.

(4) If moulding is to be reused, Remove tape residue from moulding. Clean back of moulding with Mopar, Super Kleen solvent or equivalent. Wipe moulding dry with lint free cloth. Apply new body side moulding (two sided adhesive) tape to back of moulding.

(5) Clean body surface with Mopar, Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(6) Apply a length of masking tape on the body, parallel to the top edge of the moulding to use as a guide, if necessary.

(7) Remove protective cover from tape on back of moulding. Apply moulding to body below the masking tape guide.

(8) Remove masking tape guide and heat body and moulding, see step one. Firmly press moulding to body surface to assure adhesion.

APPLIQUE MOULDING AND RETAINER REMOVAL

(1) Remove screws holding applique to rocker panel from under vehicle.

(2) Lift applique upward to separate from retaining channel.

(3) Remove pop-rivets holding retainer to rocker panel using a suitable drill.

APPLIQUE MOULDING AND RETAINER INSTALLATION

(1) Install applique retainer on rocker panel with pop-rivets. Paint or undercoat bare metal surfaces to avoid rust.

(2) Hook top of applique over retainer channel and install screws under rocker panel.

COWL PANEL TRIM AND SCUFF PLATES

COWL PANEL AND DOOR OPENING SCUFF PLATE REMOVAL (FIG. 30 OR 31)

(1) Open front door.

(2) Remove screw holding trim panel to cowl forward of the front door opening.

(3) Remove screws holding scuff plate to door sill.

(4) Separate cowl panel trim and scuff plate from vehicle.

COWL PANEL AND DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

A-PILLAR AND ROOF RAIL MOULDINGS

A-PILLAR MOULDING REMOVAL (FIG. 30 OR 31)

(1) Open front door.

(2) Disengage clips holding A-pillar moulding to roof rail above door opening.

(3) Slide A-pillar moulding upward and pull rearward to separate moulding from A-pillar.

A-PILLAR MOULDING INSTALLATION

Reverse the preceding operation.

REAR DOOR ROOF RAIL MOULDING REMOVAL—AP-44 BODY (FIG. 30)

(1) Open rear door.

(2) Disengage clips holding roof rail moulding to roof rail above rear door opening.

(3) Separate moulding from vehicle.

REAR DOOR ROOF RAIL MOULDING INSTALLATION—AP-44 BODY

Reverse the preceding operation.

B-PILLAR TRIM PANEL—AP-44 Body

REMOVAL (FIG. 30)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to B-pillar.

(3) Remove bolt holding seat belt to floor below B-pillar.

(4) Lift B-pillar trim off door opening sill weatherstrips and push inward.

(5) Slide B-pillar trim downward as far as possible and separate trim from B-pillar.

INSTALLATION

Reverse the preceding operation.

UPPER QUARTER TRIM PANEL—AP-44 BODY

REMOVAL (FIG. 30)

(1) Remove roof rail mouldings as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to quarter panel.

(3) Remove rear seat as necessary to gain access to quarter trim fasteners.

(4) Remove screws holding rear header moulding to roof as necessary to clear quarter removal path.

(5) Remove screws holding upper quarter trim panel to quarter panel.

(6) Disengage hook and loop fastener holding trim to quarter panel.

(7) Pull trim panel forward and separate from vehicle.

INSTALLATION

Reverse the preceding operation.

LOWER QUARTER TRIM PANEL—AP-44 BODY

REMOVAL (FIG. 30)

(1) Open rear door.

(2) Remove rear seat as necessary to gain access to quarter trim fasteners.

(3) Remove screw holding lower quarter trim panel to quarter panel.

(4) Separate lower quarter trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

QUARTER TRIM PANEL—AP-44 BODY

REMOVAL (FIG. 31)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to quarter panel.

(3) Remove rear seat cushion, back, and rear bolster.

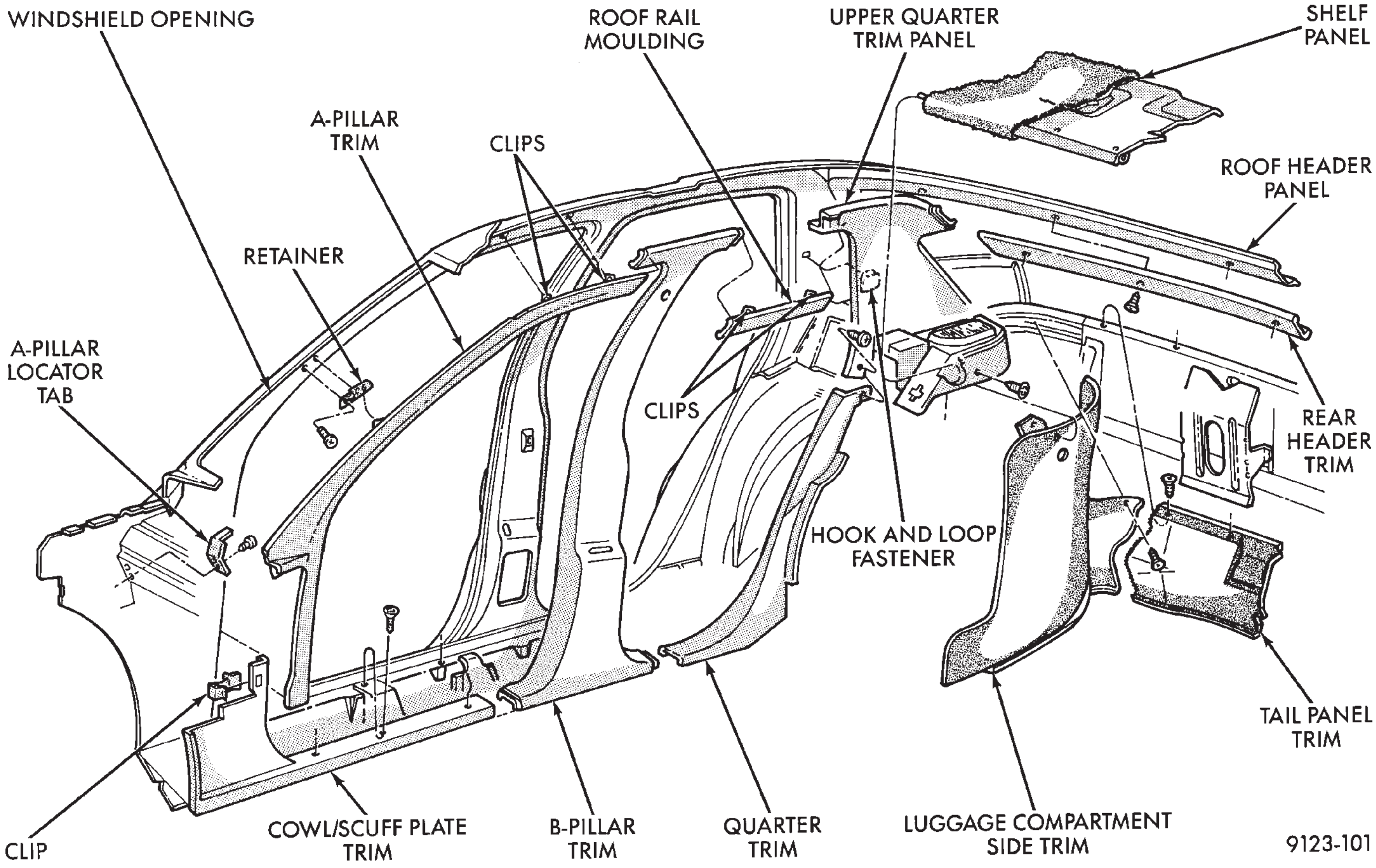


Fig. 30 Interior Mouldings, Panels, and Trim Covers—AP-44 Body

(4) Remove screws holding rear header moulding to roof as necessary to clear quarter removal path.

(5) Remove screws holding upper quarter trim panel to quarter panel.

(6) Disengage hook and loop fastener holding trim to quarter panel.

(7) Pull trim panel forward and separate from vehicle.

INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELTS—AP-44 BODY

FRONT SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 32)

(1) Remove B-pillar trim panel.

(2) Remove bolt holding seat belt retractor to B-pillar.

(3) Separate retractor from vehicle.

FRONT SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

FRONT INBOARD BUCKLE REMOVAL (FIG. 32)

(1) Remove bolt holding inboard buckle to floor.

(2) Disconnect seat belt sensor wire connector.

(3) Separate buckle assembly from vehicle.

FRONT INBOARD BUCKLE INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELTS—AP-24 BODY

FRONT SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 33)

(1) Remove quarter trim panel as necessary.

(2) Remove bolt holding seat belt retractor quarter panel.

(3) Remove bolt holding front lap belt anchor to floor.

(4) Separate retractor from vehicle.

FRONT SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

FRONT INBOARD BUCKLE REMOVAL (FIG. 33)

(1) Remove bolt holding inboard buckle to floor.

(2) Disconnect seat belt sensor wire connector.

(3) Separate buckle assembly from vehicle.

FRONT INBOARD BUCKLE INSTALLATION

Reverse the preceding operation.

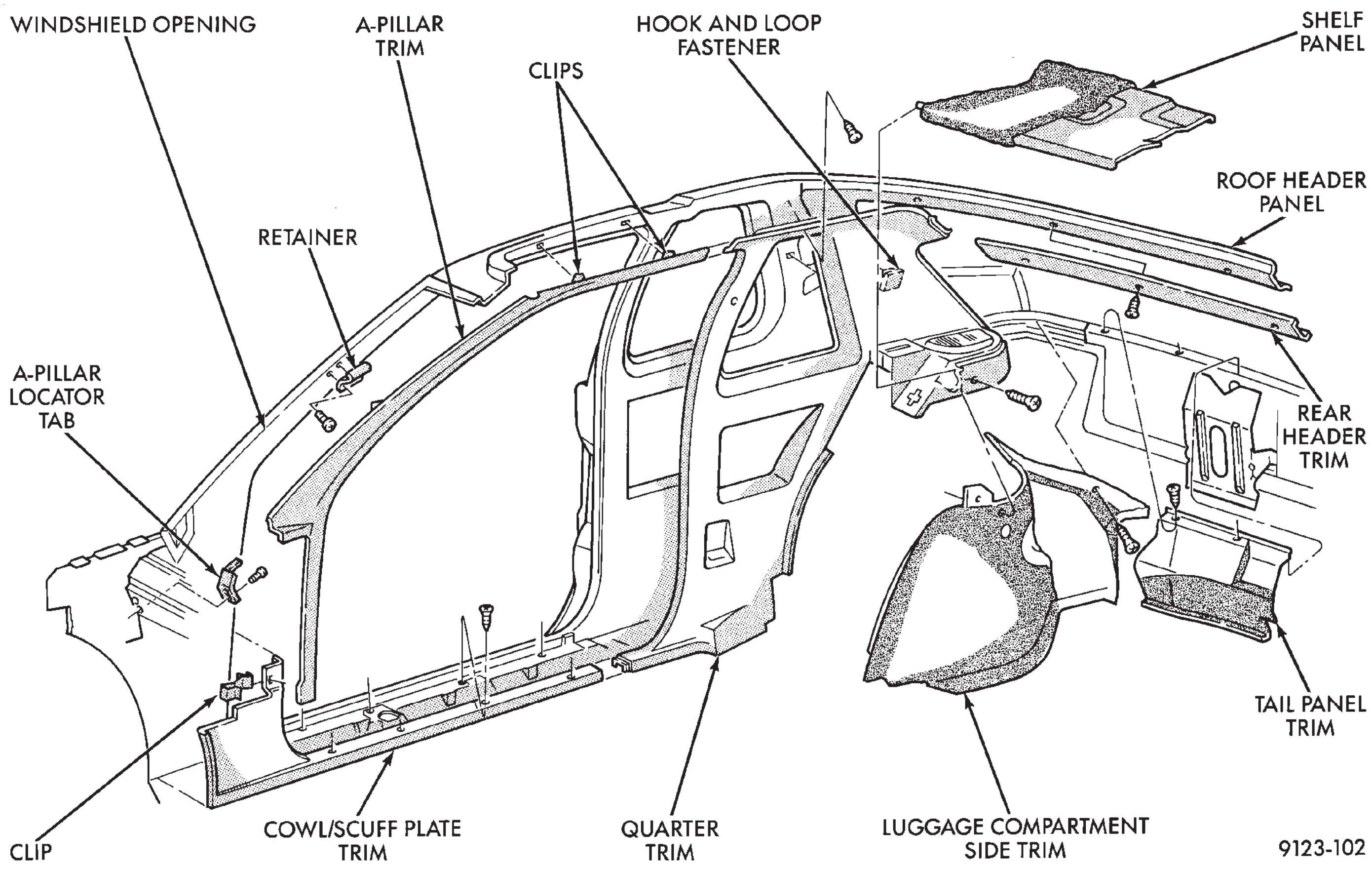


Fig. 31 Interior Mouldings, Panels, and Trim Covers—AP-24 Body

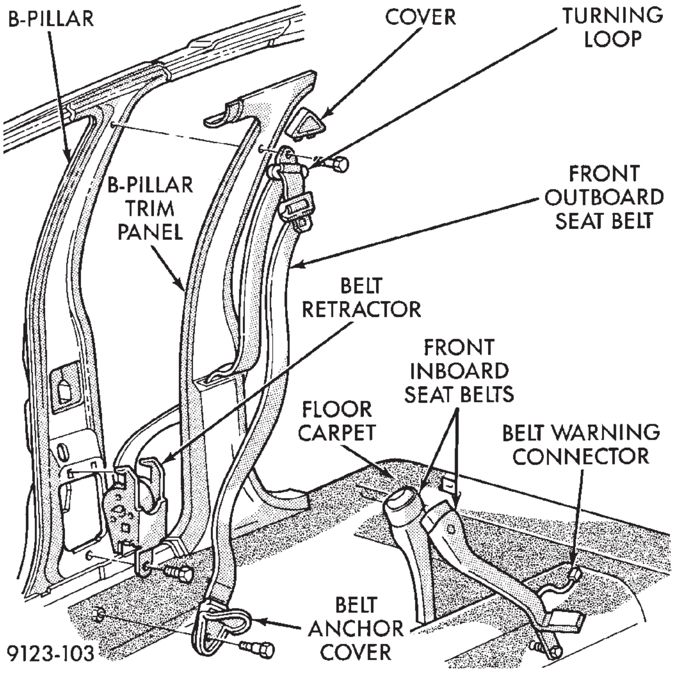


Fig. 32 Front Seat Belts—AP-44 Body

REAR SEAT BELTS

REAR SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 34)

(1) Remove rear shoulder harness turning loop cover. Remove bolt holding turning loop to roof panel.

(2) Remove quarter trim panel, lower panel on AP-44.

(3) Remove bolt holding lap belt to floor at wheelhouse kickup.

(4) Remove bolt holding seat belt retractor to quarter panel.

REAR SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

REAR INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 34)

(1) Remove rear seat cushion.

(2) Remove bolt holding inboard buckle/center occupant belt to floor.

(3) Separate buckle/belt assembly from vehicle.

REAR INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

FRONT SEATS

REMOVAL (FIG. 35 OR 36)

(1) Position seat full forward.

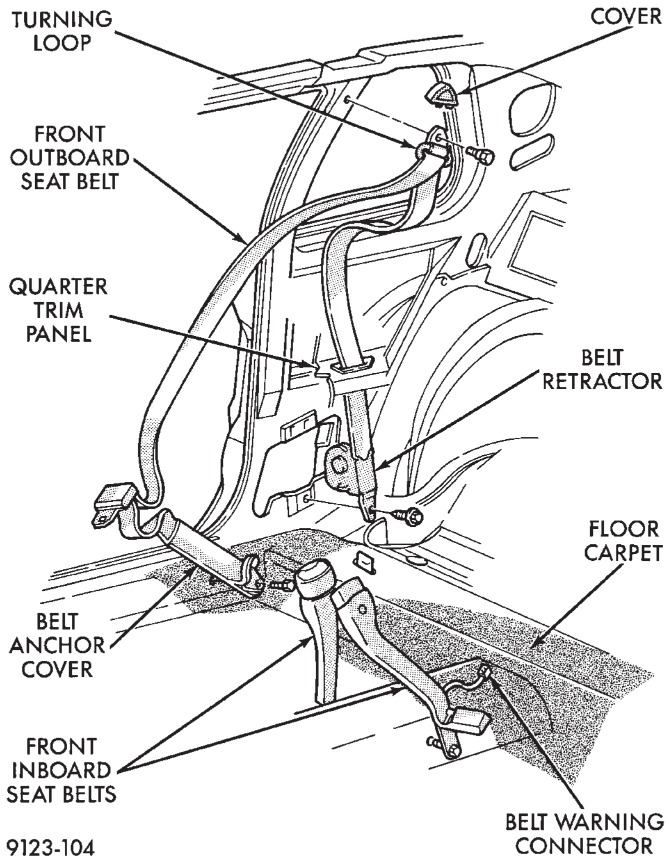


Fig. 33 Front Seat Belts—AP-24 Body

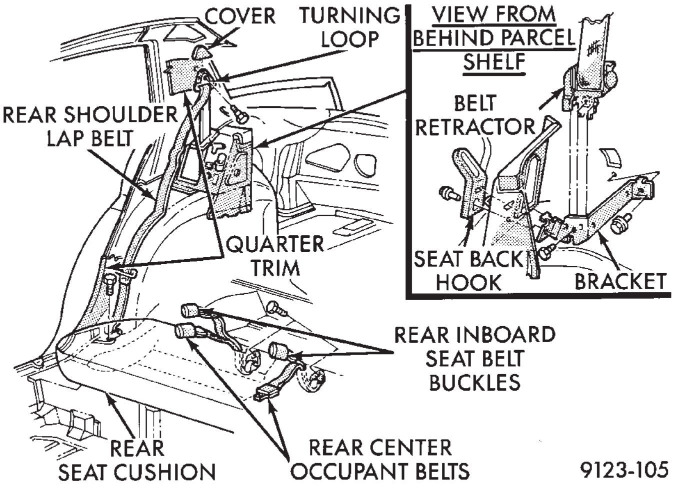


Fig. 34 Rear Seat Belts—Typical

(2) Remove screws holding rear track riser covers and separate covers from tracks.

(3) On power seat track, remove outboard track cover.

(4) Remove nuts holding seat track to floor.

(5) Position seat full rearward.

(6) On power seat track, remove door sill scuff plate and disconnect wire connector.

(7) Remove bolts holding seat track to cross member.

(8) Remove seat from vehicle.

INSTALLATION

Reverse the preceding operation.

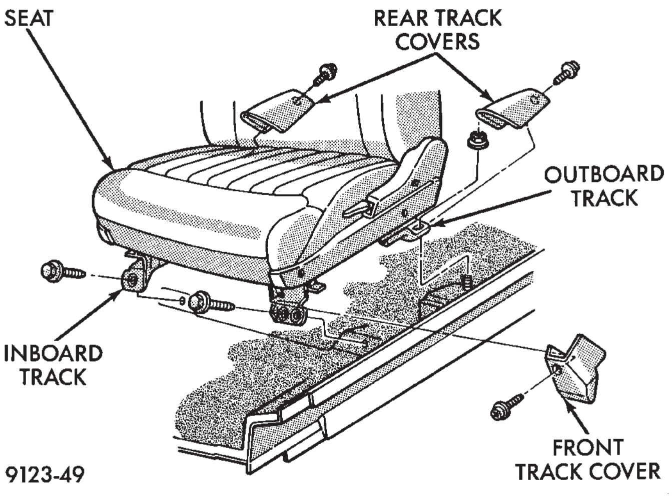


Fig. 35 Manual Front Seat

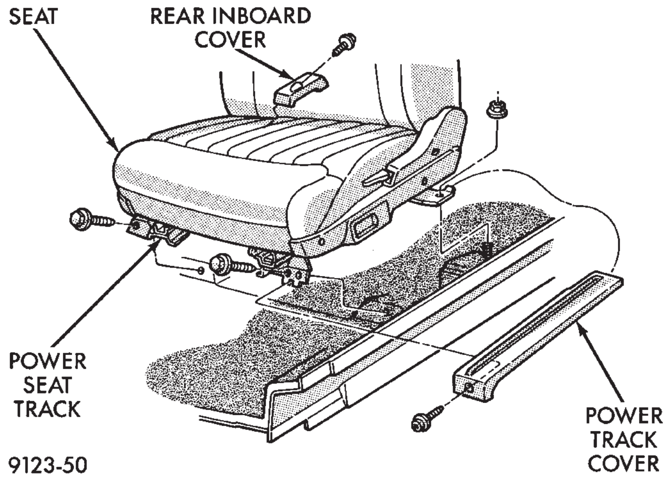


Fig. 36 Power Front Seat

REAR SEATS

REAR SEAT CUSHION REMOVAL

(1) Remove bolts holding cushion to floor.

(2) Push center occupant seat belts through openings in cushion.

(3) Remove cushion from vehicle.

REAR SEAT CUSHION INSTALLATION

Reverse the preceding operation.

REAR SEAT BACK REMOVAL (FIG. 37)

(1) Hinge seat back forward and disengage push-in fasteners holding carpet backing to trunk floor.

(2) Remove bolts holding outboard hinge pivot bracket to seat back.

(3) Pull seat back outward to disengage inboard pivot and separate from vehicle.

REAR SEAT BACK INSTALLATION

Reverse the preceding operation.

SEAT BACK BOLSTER CUSHION REMOVAL (FIG. 37)

(1) Remove rear seat cushion and back as necessary.

(2) Remove bolts holding outboard seat back bolster to quarter panel.

(3) Lift bolster upward to disengage hook retainer on back of bolster and separate from vehicle.

SEAT BACK BOLSTER CUSHION INSTALLATION

Reverse the preceding operation

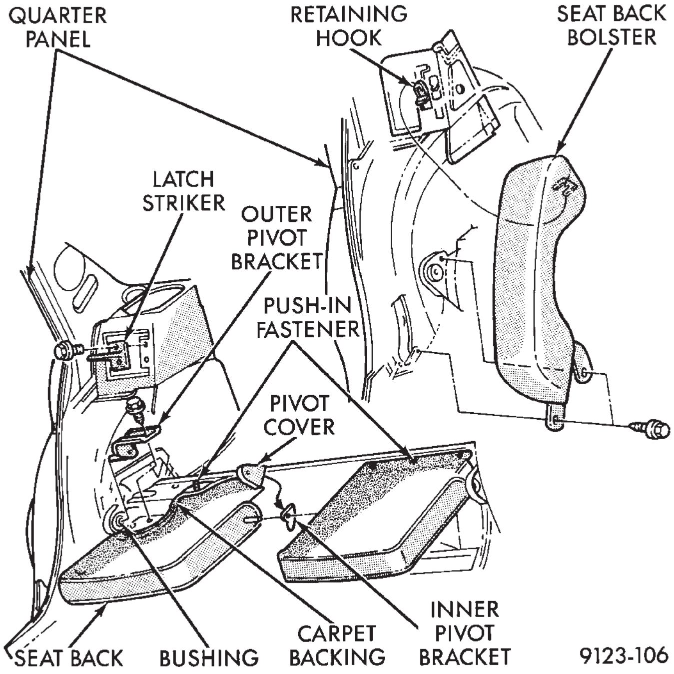


Fig. 37 Rear Seat Back and Bolster

FRONT CENTER CONSOLE

REMOVAL (FIG. 38)

(1) Position front seats full forward.

(2) Remove gear selector knob and PRNDL on vehicles with automatic transaxle. Remove illumination lamp socket and position socket out of the way.

(3) Lift gear shift boot adapter from console and push adapter through opening in console on vehicles with manual transaxle.

(4) Remove bolts holding arm rest riser to floor bracket.

(5) Separate rear console from floor and remove from vehicle.

(6) Position front seats full rearward.

(7) Remove radio bezel from instrument panel. Refer to Group 8E, Instrument Panel. Remove screws holding console to instrument panel.

(8) Remove screws holding forward console to lower instrument panel rail.

(9) Remove screws holding forward console to forward brace.

(10) Separate forward console from vehicle.

INSTALLATION

Reverse the preceding operation. Verify PRNDL adjustment before returning vehicle to use.

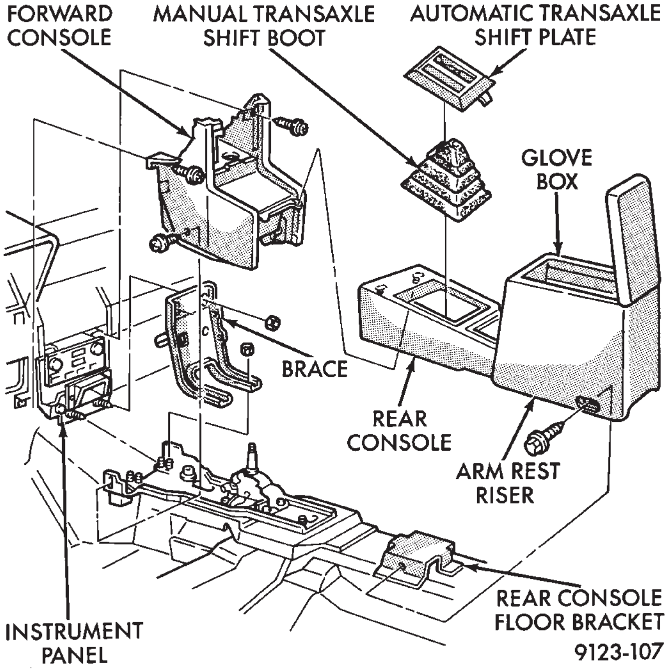


Fig. 38 Front Center Console

FLOOR CARPET

REMOVAL (FIG. 39)

(1) Remove cowl trim panels and scuff plates.

(2) Remove front seats and inboard seat belts.

(3) Remove center arm rest and front console.

(4) Remove outboard seat belt lower attaching bolts.

(5) Remove rear seat cushion.

(6) Pull carpet from under B-pillar trim covers.

(7) Fold carpet and remove through front door opening.

INSTALLATION

Reverse the preceding operation.

OVERHEAD CONSOLE

REMOVAL (FIG. 40)

(1) Remove screws holding overhead console to reinforcement bracket.

(2) Slide overhead console rearward to separate reinforcement bracket retainer tab from console.

(3) Lower console from roof and disconnect wire connectors.

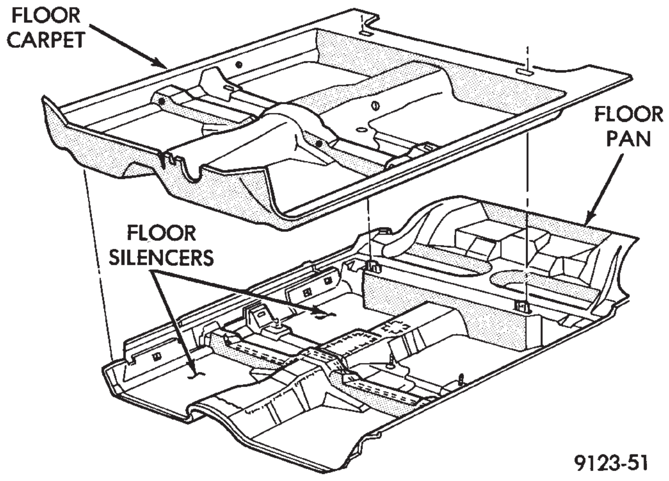


Fig. 39 Floor Carpet and Silencers—Typical

INSTALLATION

Reverse The preceding operation.

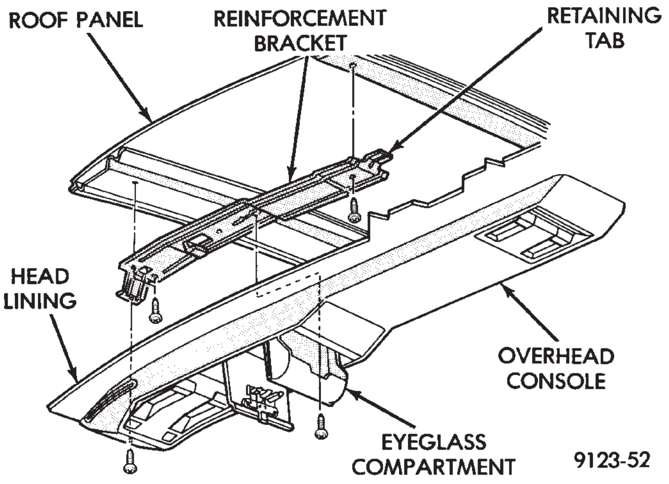


Fig. 40 Overhead Console—Typical

HEAD LINING

REMOVAL (FIG. 41)

(1) Disconnect battery negative cable.

(2) Pull dome lamp downward to disengage from retaining ring in head lining. Separate lens from lamp body and remove bulb. Separate bulb holder from lamp body. Remove attaching screw holding retaining ring to roof bow.

(3) Remove screws holding coat hooks to roof above rear doors.

(4) Remove roof rail and A-pillar mouldings.

(5) Remove screws holding sun visors to roof header and disconnect wire connector, if equipped. Remove inboard sun visor hangers.

(6) Remove overhead console, if equipped.

(7) Pull front reading lamp downward to disengage from retaining ring in head lining and disconnect wire connector. Remove screws holding retaining ring to roof header.

(8) Remove pinch welt holding headlining to sun roof opening, if equipped.

(9) Remove inside rear view mirror from windshield bracket if necessary.

(10) Disengage hook and loop fasteners holding head lining to roof above rear window and slide head lining forward about 25 mm (1 in.).

(11) Shift the front of head lining to one side to pull head lining from behind B-pillar trim. Pull head lining from behind other B-pillar trim.

(12) Allow front of head lining to drop downward. Slide head lining forward from behind quarter panel trim.

(13) Remove head lining from vehicle.

INSTALLATION

Reverse the preceding operation.

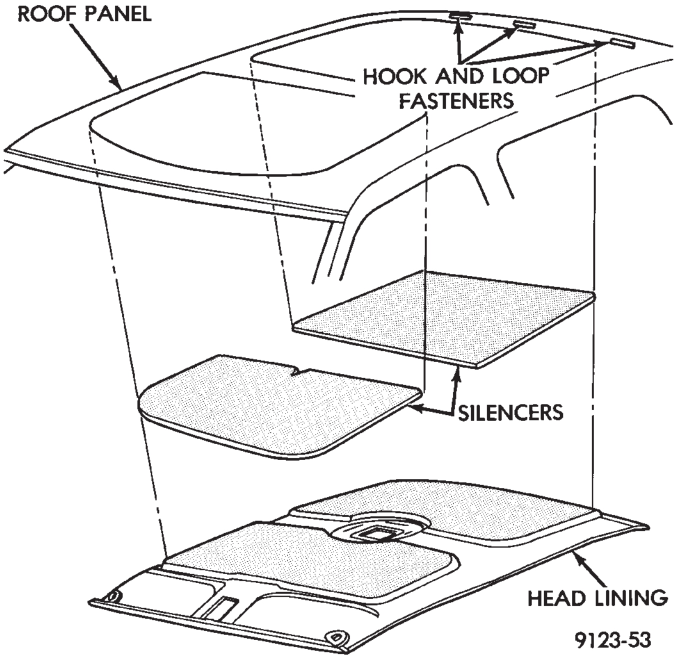


Fig. 41 Head Lining—Typical

SUN ROOF WEATHERSTRIP

REMOVAL (FIG. 42)

(1) Remove sun roof sunshade and glass. Refer to Owner's Manual for instructions.

(2) Pull weatherstrip from pinch flange around sun roof opening.

INSTALLATION

Reverse the preceding operation.

SUN ROOF AIR DEFLECTOR

REMOVAL (FIG. 42)

(1) Remove sun roof sunshade and glass. Refer to Owner's Manual for instructions.

(2) Disengage snap-on linkage at rear of air deflector in sun roof opening.

(3) Remove screws holding air deflector to front of sun roof opening.

INSTALLATION

Reverse the preceding operation.

SUN ROOF DRAIN TUBES

REMOVAL (FIG. 42)

(1) Remove head lining as necessary.

(2) Remove A-pillar or B-pillar trim covers as necessary.

(3) Remove cowl panel and sill plate trim as necessary.

(4) Disconnect effected drain tube from nipple at sun roof opening.

(5) Pull drain tube upward to remove from pillar involved.

INSTALLATION

Reverse the preceding operation. Route the tube to avoid kinks or puncture from sharp edges.

LIFT GATE REMOTE RELEASE CABLE

REMOVAL

(1) Remove interior trim as necessary to gain access to release cables.

(2) Remove left front door scuff plate.

(3) Remove screw holding trim cover to release cable handle and separate cover from handle.

(4) Remove screw holding release handle to door sill.

(5) Pry open retainer tab holding cable core end in handle pivot. Pry cable case end from handle.

(6) Remove trunk lining as necessary to gain access to the release cable.

(7) Disconnect cable end from latch.

(8) Separate cable from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR WINDOW GLASS

REMOVAL (FIG. 43)

(1) Raise lift gate to up position.

(2) Remove screws holding outward edges to rear window moulding to lift gate frame.

(3) Position protective card board covers along the top of the quarter panels to protect painted surfaces.

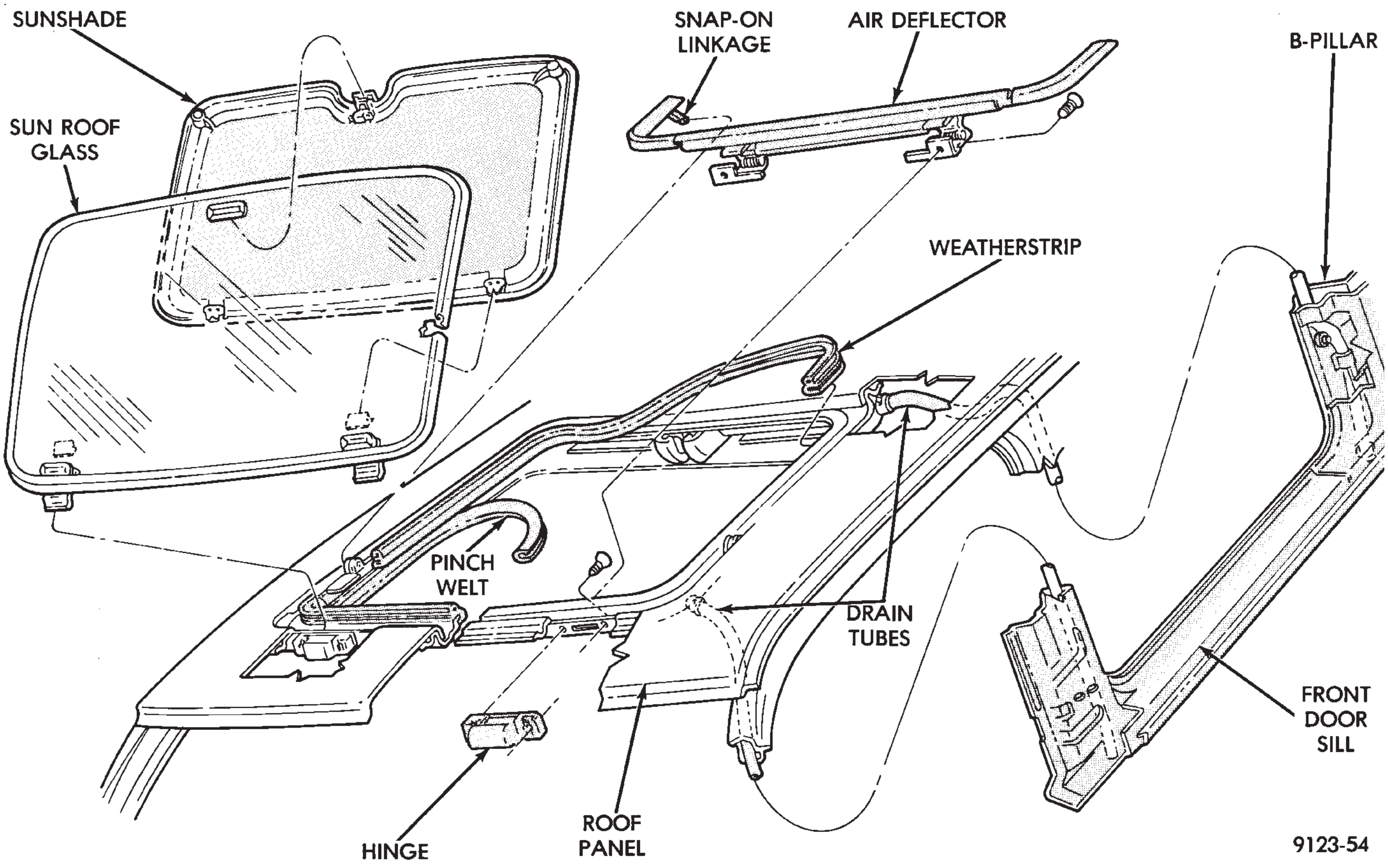


Fig. 42 Sun Roof

(4) Support lift gate in the up position and remove bolts holding lift gate hinge closed. Lower lift gate to opening weatherstrip.

(5) Remove screws holding top of rear window moulding to lift gate frame. Separate moulding from lift gate.

(6) Pull lower rear window moulding from under glass.

(7) Cut urethane bonding from around rear window. Refer to Windshield section of this group.

INSTALLATION

Prepare the lift gate fence and rear window as described in the Windshield Installation section of this group. Reverse the removal operation.

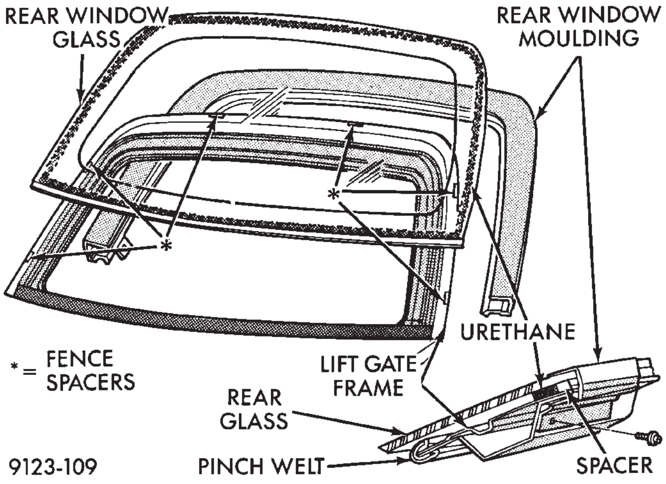


Fig. 43 Rear Window Glass

LIFT GATE LUGGAGE RACK

REMOVAL (FIG. 44)

(1) Remove screws holding cross bar to outboard skid strips.

(2) Pry rubber inserts from skid strips.

(3) Remove screws holding skid strips to lift gate.

INSTALLATION

Reverse the preceding operation

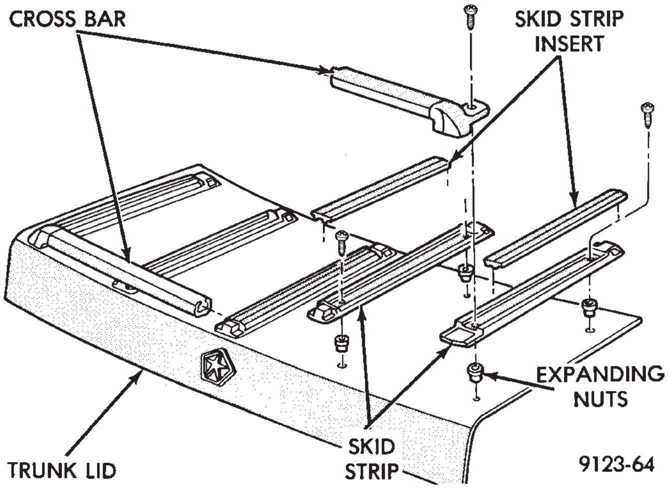


Fig. 44 Lift Gate Luggage Rack

AP/27-VEHICLE CONVERTIBLE BODY COMPONENT SERVICE

INDEX

GENERAL INFORMATION

This section will cover components that are unique to the AP-vehicle convertible. All components that are common to the AP-vehicle two door hardtop are covered in the AP-Vehicle Body Components section.

WINDSHIELD HEADER MOULDING

REMOVAL (FIG. 1)

(1) Remove windshield header lining.

(2) Remove nuts holding moulding to windshield header.

(3) Separate windshield header moulding from vehicle.

INSTALLATION

Apply sealing putty around mounting studs on back of moulding and reverse the removal operation.

WINDSHIELD HEADER LINING

REMOVAL (FIG. 1)

(1) Remove sun visors and inner sun visor hanger clips.

(2) Remove upper A-pillar trim covers.

(3) Remove dome lamp.

(4) Separate header lining from vehicle.

INSTALLATION

Reverse the preceding operation.

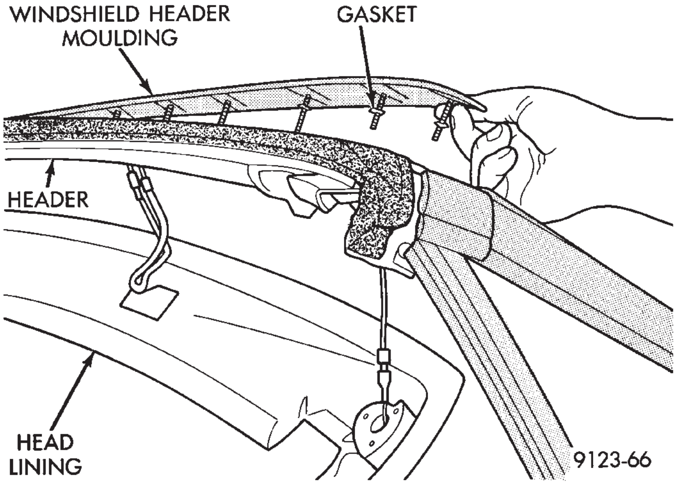


Fig. 1 Windshield Header Moulding

A-PILLAR AND WINDSHIELD HEADER WEATHERSTRIP

REMOVAL (FIG. 2)

(1) Remove upper and lower A-pillar trim covers.

(2) Remove header lining and moulding.

(3) Pull A-pillar door opening weatherstrip from pinch flange.

(4) Pull drip rail weatherstrip from drip rail next to windshield.

(5) Pull windshield header weatherstrip from retaining channel and separate weatherstrip from vehicle.

INSTALLATION

(1) Apply a bead of Mopar, Glass Adhesive and Sealer to back of windshield header weatherstrip.

(2) Apply a strip of double sided adhesive tape to windshield header rearward of the header moulding stud holes.

(3) Reverse the removal operation.

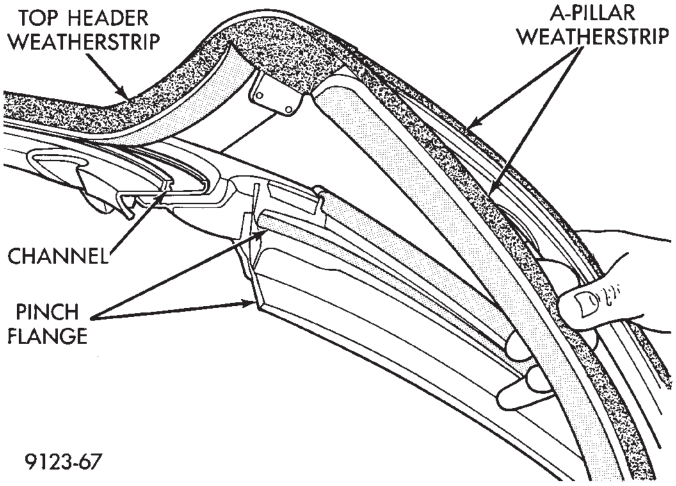


Fig. 2 A-pillar and Windshield Header Weatherstrip

ROOF RAIL WEATHERSTRIP

REMOVAL (FIG. 3)

(1) Remove screw holding front of roof rail weatherstrip to convertible top header.

(2) Pull weatherstrip from retaining channel above door opening.

INSTALLATION

Reverse the preceding operation.

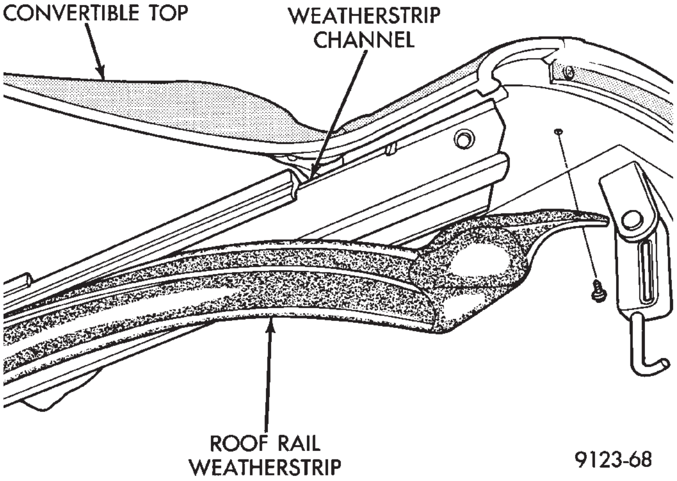


Fig. 3 Roof Rail Weatherstrip

TOP HEADER TRIM COVER

REMOVAL (FIG. 4)

(1) Lower top.

(2) Remove screws holding header trim to top header.

CAUTION: The screws on the rearward edge have caps over the pointed ends to protect top operator from injury.

(3) Separate trim from header.

INSTALLATION

Reverse the preceding operation.

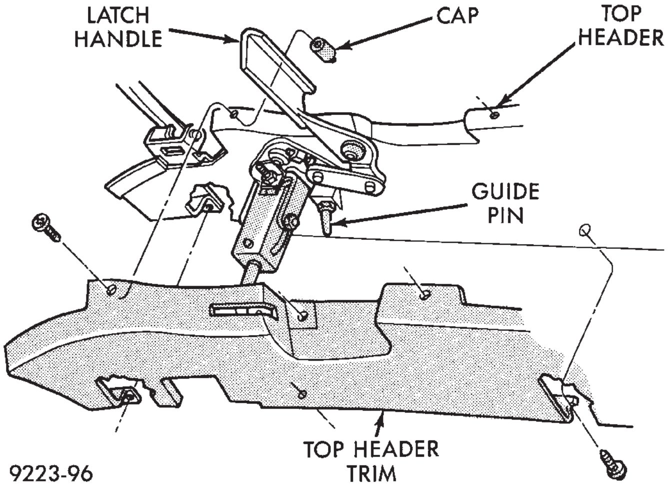


Fig. 4 Top Header Trim

TOP LATCH

REMOVAL (FIG. 5)

(1) Lower top.

(2) Remove E-ring and clevis pin and separate latch hook from top header.

(3) Remove latch pivot bolts and separate latch from top header.

INSTALLATION

Reverse the preceding operation.

CONVERTIBLE TOP HEADER

REMOVAL

(1) Lower convertible top and remove top header trim cover.

(2) Remove screws holding forward top cover retaining strip to top header and separate strip from top.

(3) Using a heat gun to soften the adhesive, separate the top cover from the top header (Fig. 6).

(4) Peel top cover back over forward edge of header to gain access to stay pad and retention cable attachment.

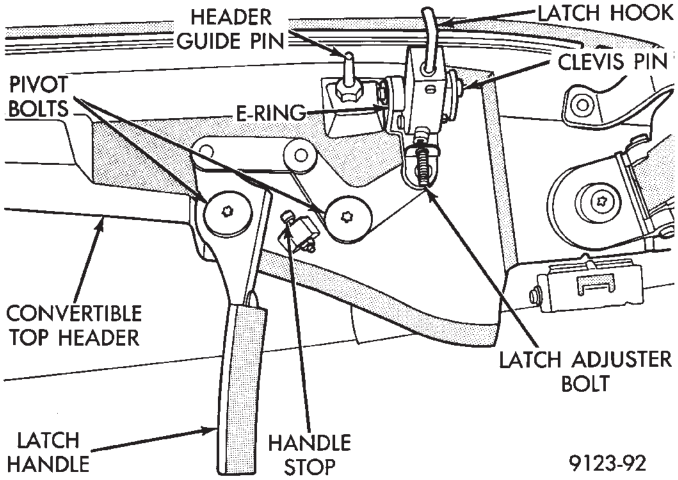


Fig. 5 Top Latch

(5) Raise convertible top, do not latch top to windshield header.

(6) Remove pop-rivets holding stay pads and retention cables to top header.

(7) Lower convertible top.

(8) Remove E-clips and clevis pins holding second bow pivot link to top header (Fig. 7).

(9) Remove bolts holding roof rail pivot bracket to top header (Fig. 7).

(10) Separate top header from convertible top frame.

If top header replacement is required, transfer latching components to replacement header.

INSTALLATION

(1) Place replacement top header in position in front of roof rail ends on top of cover material.

(2) Install bolts to hold top header to roof rail pivot brackets.

(3) Install clevis pins and E-clips holding top header to second bow pivot link.

(4) Raise convertible top. Do not latch.

(5) Rivet retention cables to top header.

CAUTION: Do not stretch top material, top latching effort increases if top cover or stay pads are to tight.

(6) Rivet forward ends of stay pads to top header. A foam tape over rivet heads.

(7) Apply contact adhesive to forward rolled flange of top header and inside forward two inches of top cover material. Allow adhesive to cure until slight tackiness is evident.

(8) Pull top cover material forward until wrinkles are gone.

(9) Press adhesive coated surfaces together over front edge of top header.

(10) Verify opening and closing effort of the convertible top and latches.

(11) Verify that wrinkles in top cover, with headers latched, are minimal. Slight wrinkles in top cover will decrease when top is heated by the sun or artificial heat source. If necessary, adjust top latch hooks.

(12) Lower convertible top.

(13) Place retaining strip at front edge of top header over edge turned material. Using a scratch awl, align screws holes in retaining strip to holes in top header.

(14) Install screws to hold retaining strip to top header.

(15) Install top header trim panel.

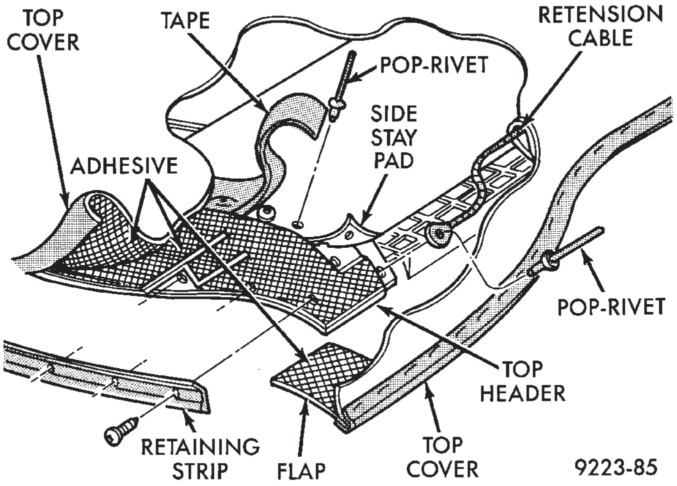


Fig. 6 Stay Pads and Retention Cables

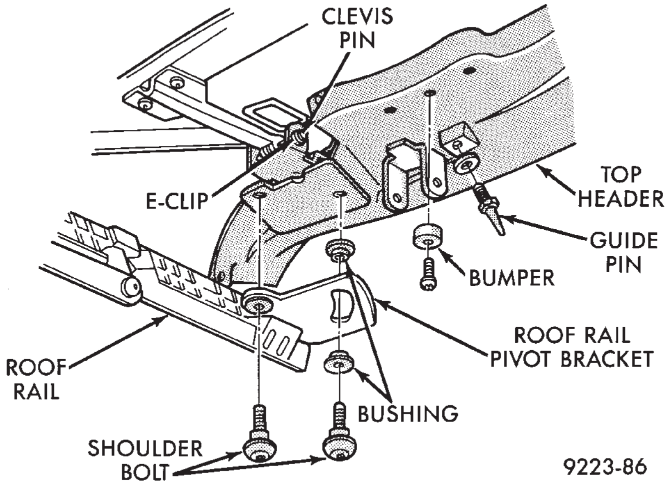


Fig. 7 Pivot Link and Roof Rail Pivot Bracket.

SECOND ROOF BOW AND LINKAGE

REMOVAL

(1) Lower convertible top.

(2) Remove E-clip and clevis pin holding second roof bow pivot link to top header (Fig. 8).

(3) Remove screws holding second roof bow actuating link to pivot link (Fig. 8).

(4) Remove screws holding second roof bow to top cover listing retainer (Fig. 9).

(5) Remove staples holding stay pads to second roof bow.

(6) Separate second roof bow from top frame.

INSTALLATION

(1) Position second roof bow on convertible top.

(2) Staple stay pads to second roof bow tack strip in same locations as the original assembly.

(3) Install screws to hold top cover listing retainer to second roof bow.

(3) Install screws, washers and spacers to hold roof bow actuating link to pivot link.

(4) Install clevis pins and E-clips to hold second roof bow pivot link to top header.

(5) Verify convertible top operation.

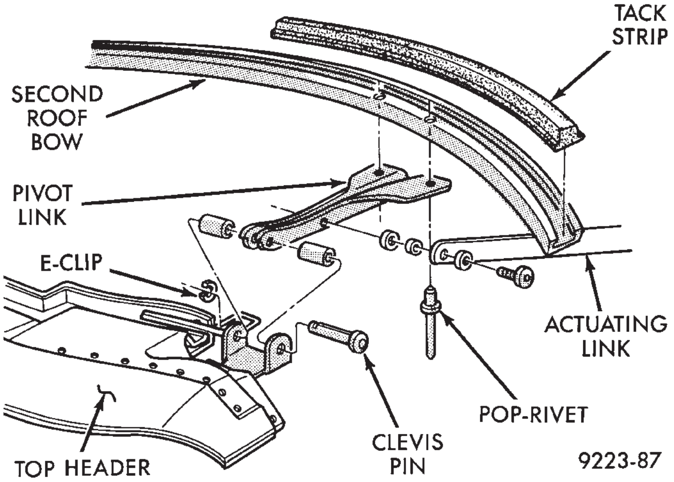


Fig. 8 Second Roof Bow

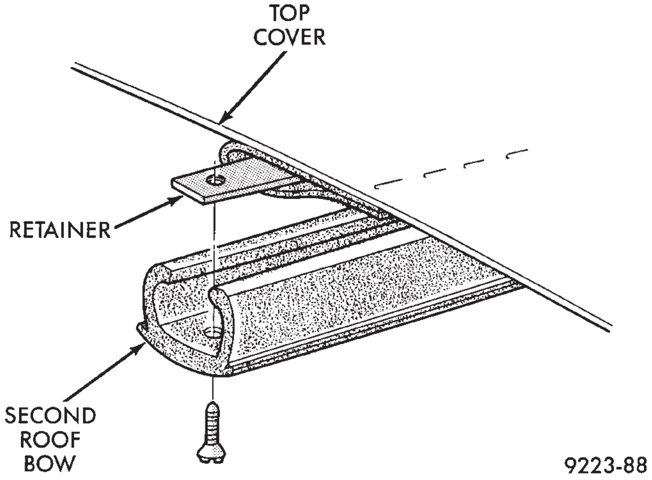


Fig. 9 Second Roof Bow Retainer

THIRD ROOF BOW

REMOVAL

(1) Disengage top header latches.

(2) Lower convertible top halfway down.

(3) Remove bolts holding third roof bow to rear roof rails.

(4) Separate third roof bow from rear roof rails.

(5) Rotate third roof bow to gain access to staples holding stay pads to tack strip.

(6) Remove staples holding stay pads to third roof bow.

(7) Remove screws holding top cover listing retainer to third roof bow (Fig. 10).

(8) Separate third roof bow from top frame.

INSTALLATION

(1) Position third roof bow on convertible top.

(2) Staple stay pads to third roof bow tack strip in same locations as the original assembly.

(3) Install screws to hold top cover listing retainer to third roof bow.

(3) Install bolts to hold third roof bow rear roof rails.

(4) Align third roof bow to be centered over the rear roof rails.

(5) Verify convertible top operation.

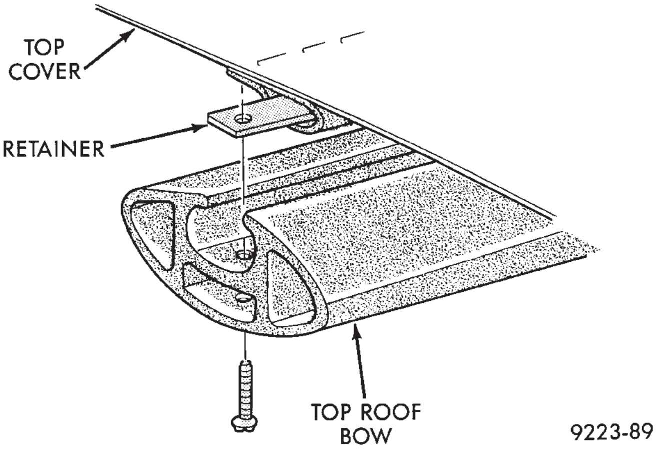


Fig. 10 Third Roof Bow Retainer

FOURTH ROOF BOW AND SLAT

The fourth roof bow and slat is adjustable to decrease wrinkles in the convertible top cover sail panel and rear window areas.

REMOVAL (FIG. 11)

(1) Lower rear window glass. position glass flat on the bottom of the sling well.

(2) Lower convertible top halfway down.

(3) Remove pivot bolts and bushings holding fourth roof bow slat to rear roof rail (Fig. 12).

(4) Remove tension spring from between rear roof rail and fourth roof bow slat (Fig. 13).

(5) Remove shoulder bolts holding fourth roof bow to slat.

(6) Separate bow from slats (Fig. 12).

(7) Allow roof bow to drop downward.

(8) Tip bow toward interior of vehicle and away from top cover.

(9) Lower convertible top enough to allow to loosen around fourth roof bow.

(10) Locate feature strip insert at end of bow. Slide feature strip to the side and separate strip from bow. Do not damage foam filler strips attached to fourth bow.

(11) Separate top cover from fourth roof bow.

(12) Remove rivets holding rear window retainer to fourth roof bow.

(13) Separate retainer from bow.

(14) Mark location of stay pads and rear window zipper apron to aid installation.

(15) Remove staples holding stay pads to fourth roof bow.

(16) Remove staples holding rear window zipper apron to fourth roof bow.

(17) Remove staples holding side stay pads to fourth roof bow.

(18) Separate fourth roof bow from vehicle.

INSTALLATION

Reverse the preceding operation.

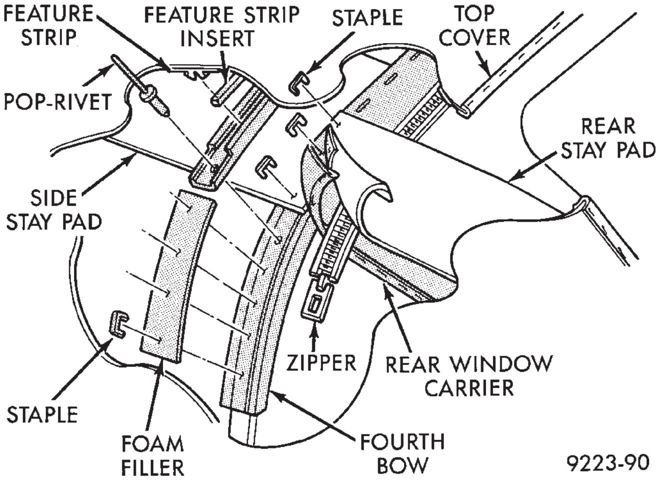


Fig. 11 Fourth Roof Bow

FORWARD ROOF RAIL

REMOVAL

(1) Lower convertible top and remove top header trim cover.

(2) Remove screws holding pivot bracket to forward roof rail.

(3) Remove bolt, washer and bushing holding center link arm to forward roof rail.

(4) Remove bolt, washer and bushing holding control link arm to forward roof rail.

(5) Separate forward roof rail from frame.

INSTALLATION

Reverse the preceding operation.

ROOF LINKAGE

REMOVAL (FIG. 12)

(1) Disengage top header latches.

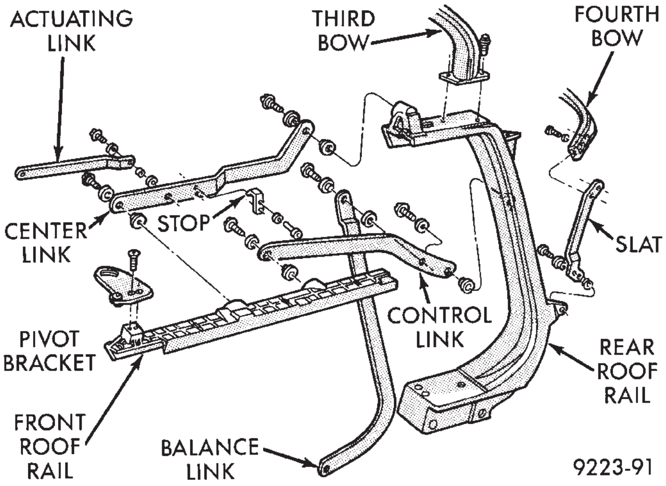


Fig. 12 Roof Rails and Linkage

(2) Remove bolt, washer and bushing holding balance link arm to control link.

(3) Remove bolt, washer and bushing holding balance link arm to rear roof rail behind quarter trim link.

(4) Separate balance link arm from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR ROOF RAIL

REMOVAL (FIG. 13)

(1) Remove quarter trim panel.

(2) Disengage top latches, do not lower top.

(3) Remove quarter glass and weatherstrip.

(4) Loosen bolts holding rear roof rail main pivot plate to quarter panel.

(5) Remove clip and clevis pin holding gas assist cylinder to rear roof rail.

(6) Remove fourth roof bow slat spring.

(7) Remove pivot bolt holding slat to rear roof rail.

(8) Remove pivot bolt holding center link to rear roof rail.

(9) Remove bolts holding third roof bow to rear roof rail.

(10) Remove pivot bolt holding rear roof rail to main pivot bracket.

(11) Separate rear roof rail from roof frame.

INSTALLATION

Reverse the preceding operation.

STATIONARY QUARTER GLASS AND WEATHERSTRIP

REMOVAL (FIG. 14)

(1) Lower convertible top.

(2) Remove quarter trim panel.

(3) Remove nut holding quarter glass to rear roof rail.

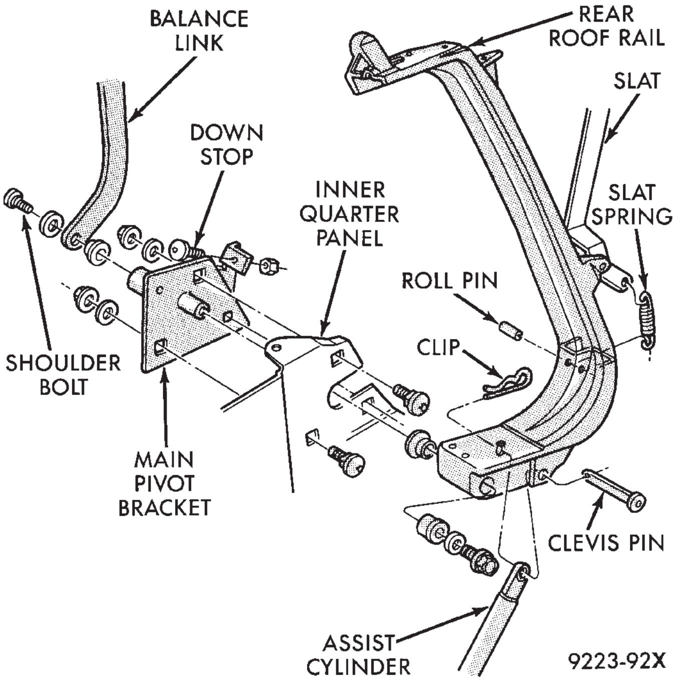


Fig. 13 Rear Roof Rail

(4) Remove nuts and plastic insulators holding quarter glass to lower mounting bracket. Separate mounting stud plate and plastic insulators from glass.

(5) Slide glass downward to clear upper stud from top rail.

(6) Separate glass and weatherstrip from convertible top frame.

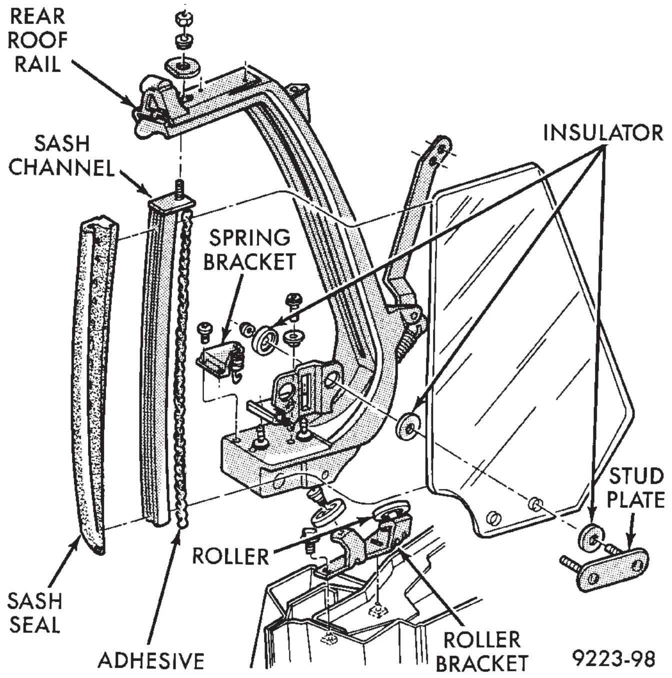


Fig. 14 Stationary Quarter Glass and Weatherstrip

INSTALLATION

(1) Install roof rail weatherstrip on glass (Fig. 15).

(2) Position glass assembly in convertible top frame opening.

(3) Install nut and washer to hold upper glass stud to top rail.

(4) Install lower glass stud plate and plastic insulators through holes at bottom of glass.

(5) Install plastic insulators and nuts to hold glass and stud plate to spring bracket.

(6) Before tightening nuts at top and bottom of glass, verify alignment to door glass and top rail weatherstrip.

(7) Secure all nuts holding glass to vehicle and install quarter trim panel.

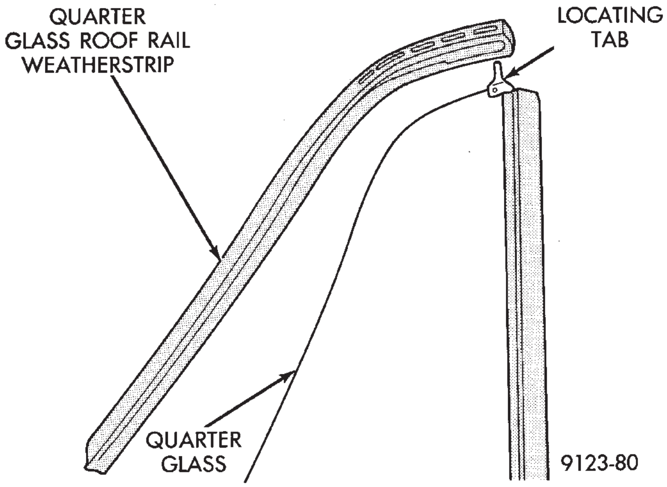


Fig. 15 Quarter Glass Roof Rail Weatherstrip

TOP LIFT ASSIST CYLINDER

REMOVAL (FIG. 16)

(1) Remove interior trim as necessary to gain access to quarter panel to top frame attachment bolts and gas cylinder.

(2) With top in up position (not latched). Loosen top frame to quarter panel reinforcement bolts to allow top frame to shift rearward.

(3) Remove clevis pin holding gas cylinder to top frame.

(4) Remove door ajar switch from B-pillar below door striker.

(5) Through door ajar switch mounting hole, remove bolt holding bottom of gas cylinder to quarter panel reinforcement.

(6) Separate top lift assist cylinder from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR WINDOW

REMOVAL (FIG. 17)

There are foam strips attached to the outboard corners of the No. 4 bow on short tacking strips. These are used to prevent any read-through of the bow. The

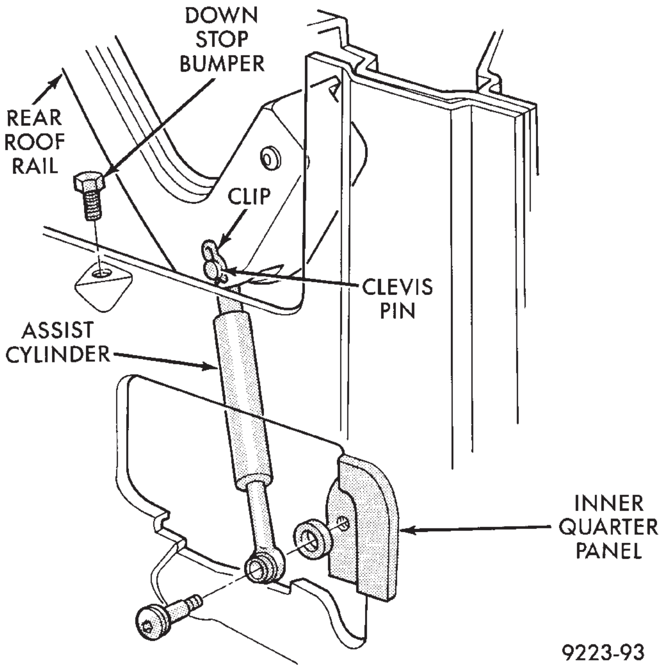


Fig. 16 Gas Assist Cylinder

foam is easily damaged and may need replacement. Inspect them, if they are either loose or missing replace them as necessary.

(1) Unlock and raise the trunk lid.

(2) Remove rear seat back.

(3) Apply masking tape to the painted surfaces around the top of the quarter panels to avoid damage during tack strip removal.

(4) Remove the nuts and bolts holding top cover rear tack strip to deck filler panel and quarter panels.

(5) Separate the tack strip from the quarter panel flanges.

(6) Using a suitable white marking pencil, mark the edges of top cover on the tack strip to aid installation.

(7) Remove staples holding top cover to the tack strip.

(8) Separate top cover from the tack strip.

(9) Using a suitable white marking pencil, mark the locations of the rear stay pads tack strip to aid installation.

(10) Remove staples holding lower end of rear stay pads to tack strip.

(11) Mark location of suspender strap on the tack strip to aid installation.

(12) Remove staples holding lower end of suspender straps to tack strip.

(13) Slide feature strip from retainer channel on the fourth roof bow.

(14) Separate top cover from the fourth roof bow retainer.

(15) Remove rivets holding retainer channel to fourth roof bow.

(16) Separate retainer channel from fourth roof bow.

(17) Remove staples holding rear stay pads and suspender straps to fourth roof bow.

(18) Separate rear stay pads and suspender straps from the vehicle.

(19) Using a suitable white marking pencil, mark the edge of the upper rear window on the fourth roof bow to aid installation.

If the foam filler strips must be replaced, mark the locations of the filler strips on the fourth roof bow to aid installation.

(20) Remove staples holding rear window to fourth roof bow.

(21) Remove staples holding outboard corners of rear window valance and carrier from rear tack strip.

(22) Separate bottom of rear window from rear tack strip.

(23) Separate top of rear window from fourth roof bow.

(24) Separate rear window from vehicle.

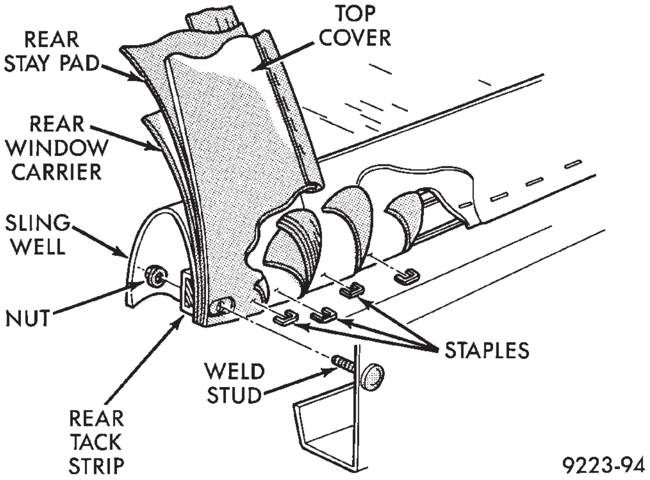


Fig. 17 Rear Window

INSTALLATION

Cut square holes in lower edge of rear window fabric for mounting studs of rear tack strip. Holes should be no higher or wider than fastener holes. Holes should be open ended on the bottom edge. Use original rear window as a template for marks and hole locations.

(1) Tape paper to front and back sides of new rear window without attaching tape to rear window.

(2) Position centerline of upper rear window valance to the centerline of the fourth roof bow.

(3) Staple the rear window to the fourth roof bow tack strip from center, outward. Install staples at one inch spacing across the roof bow to allow for staples to hold on the suspender straps and stay pads.

(4) Install foam filler strip at the ends of the fourth roof, if replacement is required.

(5) Install side stay pads on fourth roof bow.

(6) staple side stay pads to fourth roof bow.

(7) Install lower portion of rear window in position on rear tack strip, align to the bottom center mark.

(8) Staple the corners of the rear window valance and carrier to the rear tack strip. Verify the edges are even.

(9) Position rear stay pads and suspender straps over fourth roof bow and over the outboard ends of the rear window fabric.

(10) Stretch lower end of suspender straps to edge of rear tack strip.

(11) Staple lower end of suspender straps to rear tack strip.

(12) Staple lower end of rear stay pad to rear tack strip.

(13) Position top cover retainer channel on fourth roof bow.

(14) Rivet top cover retainer channel to fourth roof bow with aluminum pop-rivets.

(15) Position top cover over the fourth roof bow retainer locating the centerline reference marks.

(16) Slide feature strip insert into the fourth roof bow retainer channel.

(17) Position top cover on rear tack strip.

(18) Staple top cover to rear tack strip starting from the outboard corner and stapling inward.

(19) Position rear tack strip over the mounting studs on inside of quarter panels.

(20) Install nuts and bolts to hold rear tack strip to the quarter panels an deck panel.

(21) Install rear seat back.

(22) Remove protective materials that was applied to the body during to removal operation.

TOP COVER

REMOVAL (FIG. 18)

(1) Open rear window and position glass, as flat as possible, in the drop well.

(2) Lower convertible top.

(3) Remove rear seat cushion and back.

(4) Remove quarter trim panels.

(5) Remove quarter glass assemblies.

(6) Raise top to mid-point.

(7) Remove screws holding cover retainer to top header. Separate retainer from header.

(8) Separate top cover from adhesive on top header.

(9) Open trunk lid. Remove screws holding rear deck filler panel to rear deck below rear window. Mark screw locations before removal to aid installation. The rear deck filler panel applies pressure to top cover to eliminate wrinkles.

(10) From in luggage compartment, remove nuts and bolts holding lower top tack strip to deck and quarter panels. Lift sling well upward to gain access to fasteners.

CAUTION: Do not damage painted surfaces when separating tack strip from mounting locations.

(11) Separate tack strip from deck and quarter panels and remove staples holding top cover. Leave rear window skirt, pads and drop well attached to tack strip.

(12) Pull top cover from adhesive in quarter glass weatherstrip channel.

(13) Remove rivets holding top cover roof rail tension cables to top header. Pull tension cables from rear of listing pockets on top cover.

(14) Remove screws holding top cover fastener strip to center roof bows. Separate top cover from roof bows and pull retainers from listing pockets on top cover.

(15) Fold top cover so that all material is above rear roof bow. Slide rear top cover retainer to one side from rear roof bow channel.

(16) Separate top cover from vehicle.

INSTALLATION

Reverse the preceding operation. Use contact adhesive to secure top cover to header and quarter glass weatherstrip channels. Fold replacement convertible top along center line and mark with tailors chalk. Measure and mark the center line of header, center bow and tack strip. Install top cover from the center line out. Do not over stretch top cover when removing wrinkles. Allow for some shrinkage. Water leak and wind noise tests should be performed before returning vehicle to use.

SLING-WELL

REMOVAL

(1) Remove rear seat cushion and back.

(2) Remove quarter trim panels.

(3) Remove rear shoulder harness turning loop covers.

(4) Remove bolts holding shoulder harness turning loops to seat back support.

(5) Remove seat back support trim cover.

(6) Disengage wire hanger from hole in quarter panel near front seat belt retractor.

(7) Disengage convertible top header latches.

(8) From in luggage compartment, remove nuts and bolts holding lower top tack strip to deck and quarter panels. Lift sling well upward to gain access to fasteners.

CAUTION: Do not damage painted surfaces when separating tack strip from mounting locations.

(9) Separate tack strip from deck and quarter panels and remove staples holding sling well and top cover to tack strip.

(10) Separate sling well from vehicle.

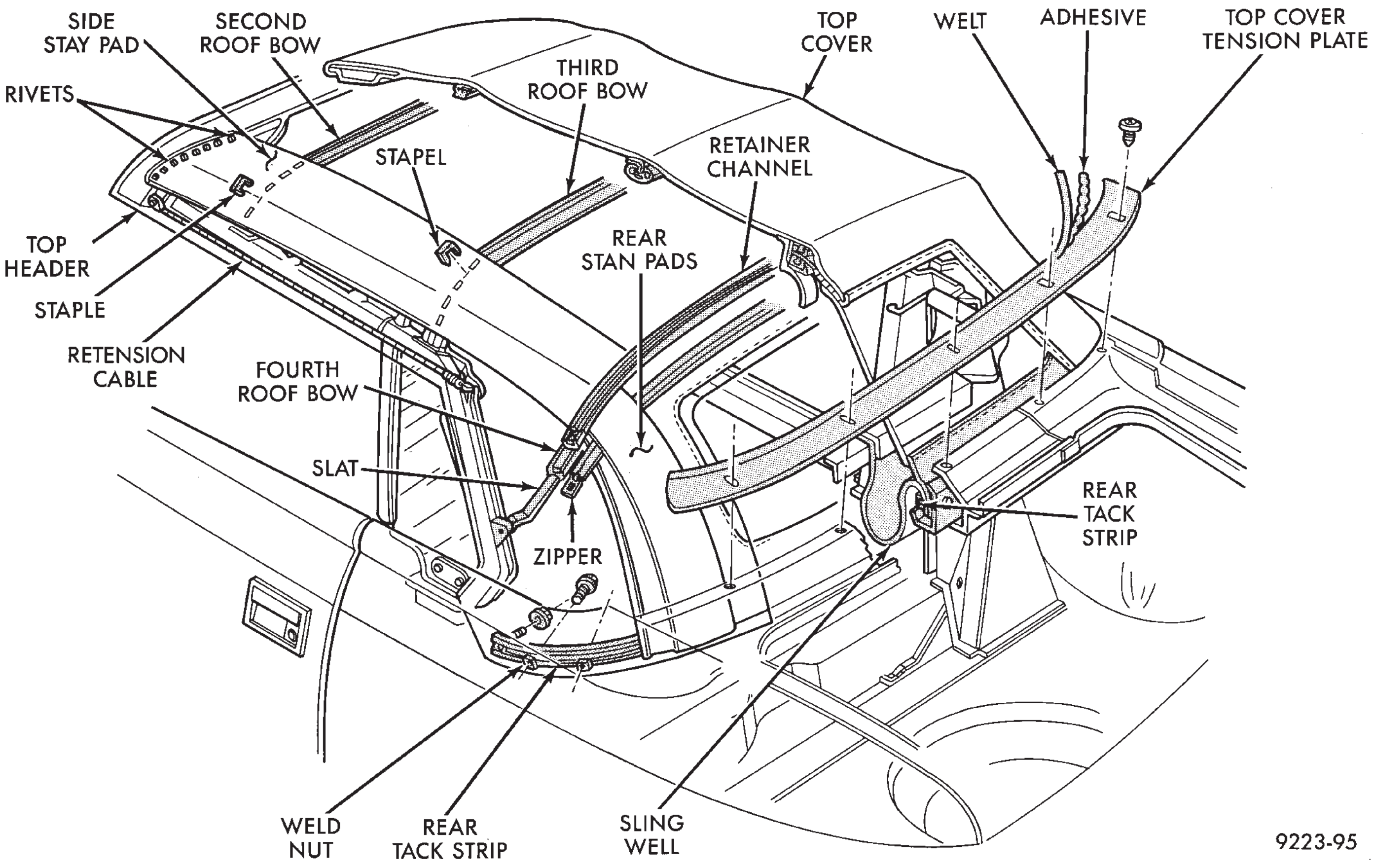


Fig. 18 Top Cover and Stay Pads

INSTALLATION

Reverse the preceding operation. Use a suitable contact adhesive to secure sling well to seat back support and wherever necessary

TOP FRAME

REMOVAL

(1) Remove rear seat cushion and back.

(2) Remove quarter trim panels.

(3) Disengage convertible top header latches.

(4) From in luggage compartment, remove nuts and bolts holding tack strip to deck and quarter panels. Lift sling well upward to gain access to fasteners.

(5) Separate sling well from seat back reinforcement and wire hangers.

(6) Lower convertible top.

(7) Remove bolts holding top frame to quarter panel mounting supports.

(8) Disconnect upper top lift assist cylinder mounting.

(9) Separate top frame from vehicle.

INSTALLATION

Reverse the preceding operation. Align top to achieve proper sealing at roof rail and header weatherstrips.

FRONT DOOR GLASS

REMOVAL

(1) Remove door trim panel.

(2) Remove window frame cap from above stationary glass wing (Fig. 19).

(3) Remove bolts holding division channel to inner door panel (Fig. 20).

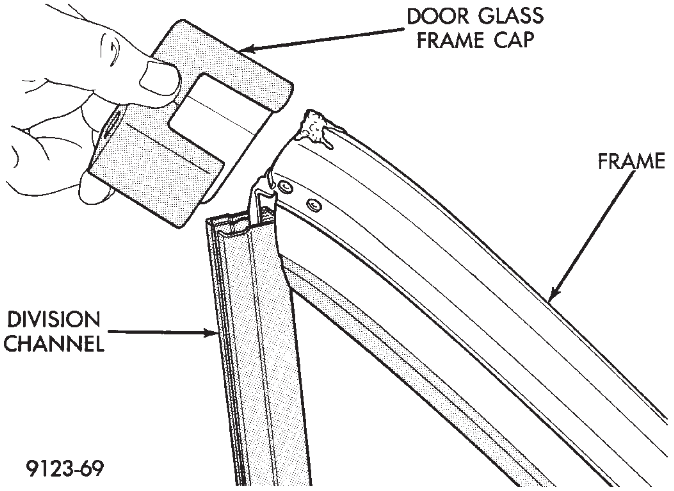


Fig. 19 Door Glass Frame Cap

(4) Push door glass forward to disengage window regulator roller from lift channel on glass.

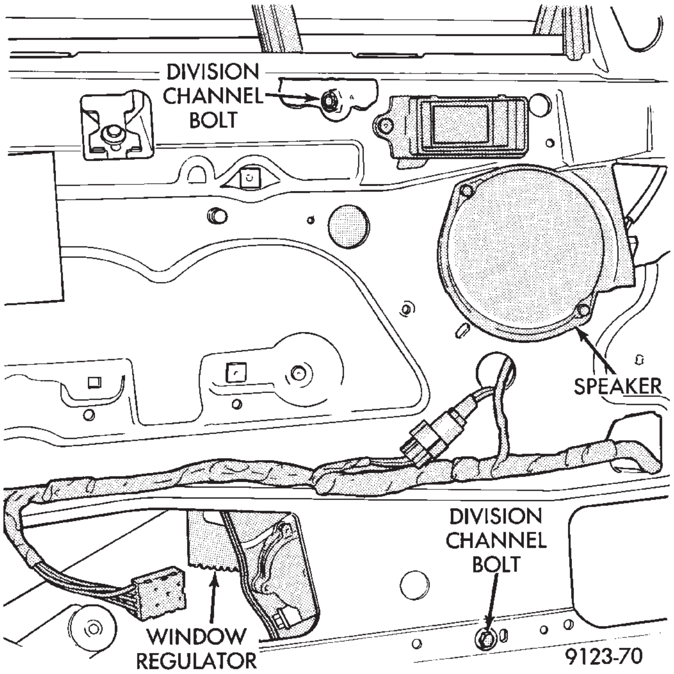


Fig. 20 Division Channel Bolts

(5) Lift glass upward from opening at top of door.

(6) Separate glass from division channel (Fig. 21).

INSTALLATION

Reverse the preceding operation.

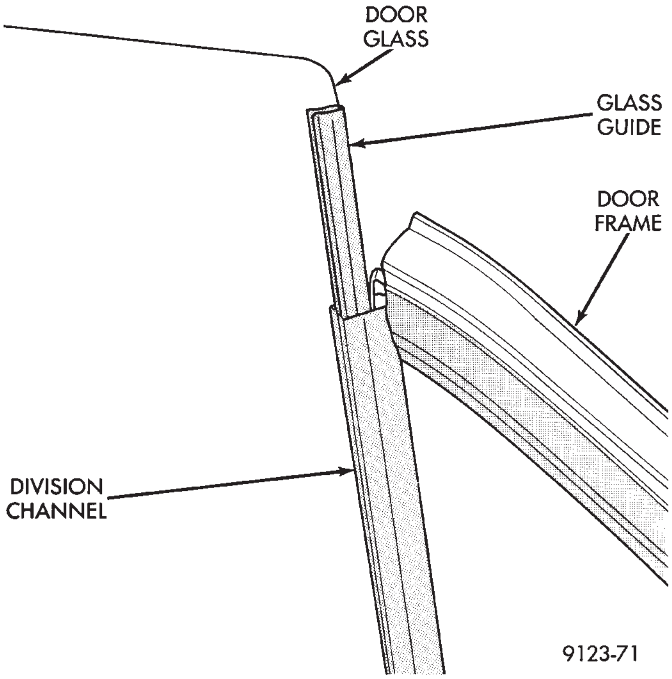


Fig. 21 Front Door Glass

FRONT DOOR STATIONARY GLASS AND DIVISION CHANNEL

REMOVAL

(1) Remove front door glass.

(2) Drill out rivets holding division channel to door frame (Fig. 22).

(3) Separate division channel from stationary glass and remove glass from door (Fig. 23).

(4) Lift division channel upward, out of the door.

(5) Pull the stationary glass weatherstrip from the division channel.

INSTALLATION

Install the division channel weatherstrip on the stationary glass. Position the glass in the door frame and reverse the removal operation.

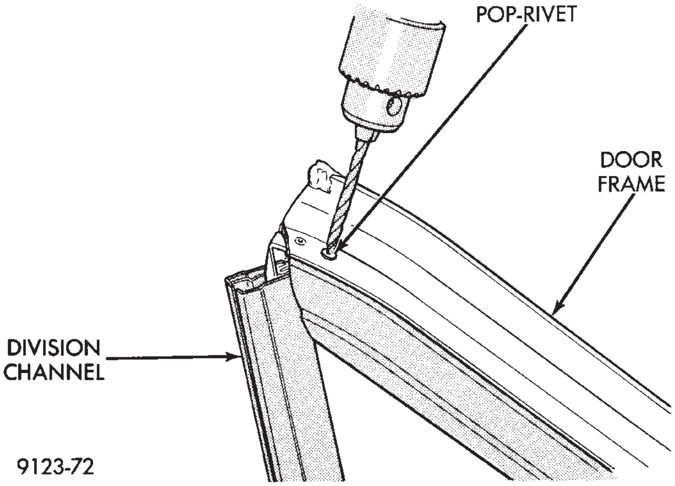


Fig. 22 Pop-rivet Removal

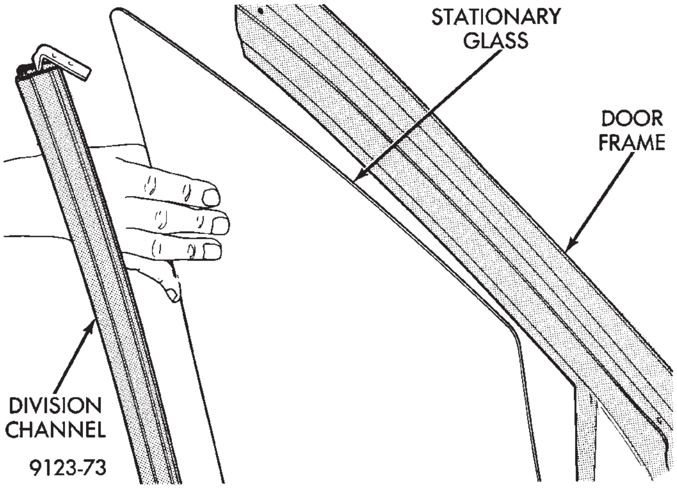


Fig. 23 Front Door Stationary Glass

FRONT DOOR STATIONARY GLASS CHANNEL WEATHERSTRIP

REMOVAL

(1) Remove stationary glass.

(2) Pull weatherstrip from door frame channel (Fig. 24).

INSTALLATION

Loosen outside rear view mirror if necessary, and reverse the removal operation.

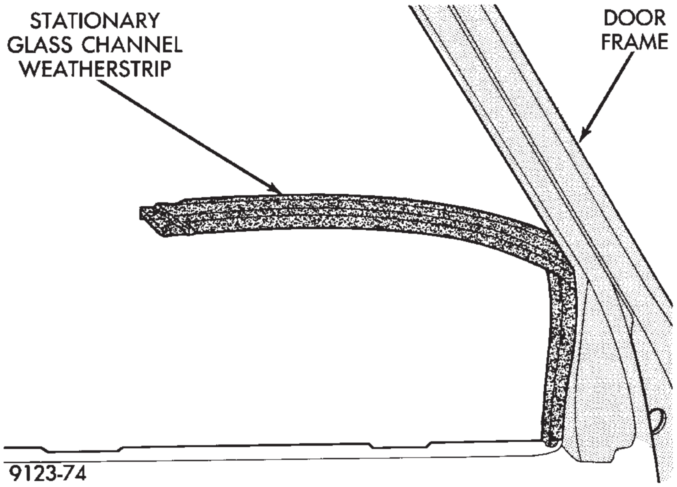


Fig. 24 Front Door Stationary Glass Channel Weatherstrip

DOOR GLASS REAR CHANNEL

REMOVAL (FIG. 25)

(1) Remove door trim panel.

(2) Raise door glass to full up position.

(3) Remove bolts holding rear channel to inner door panel and door end frame.

(4) Separate channel from door.

INSTALLATION

Reverse the preceding operation.

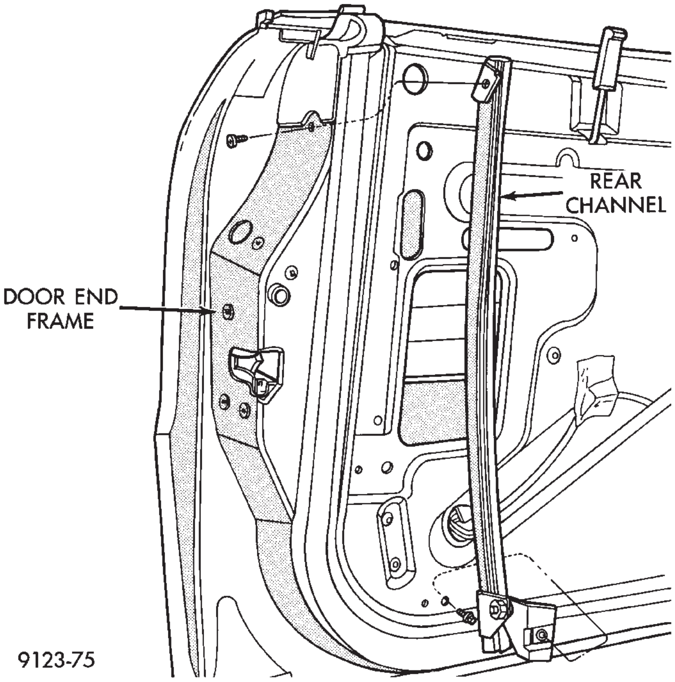


Fig. 25 Front Door Glass Rear Channel

FRONT DOOR BELT MOULDING AND WEATHERSTRIP

REMOVAL (FIG. 26)

(1) Remove door glass.

(2) Remove side view mirror.

(3) Remove screws holding belt moulding to outer door panel upper flange.

(4) Separate belt moulding and weatherstrip from door.

INSTALLATION

Reverse the preceding operation.

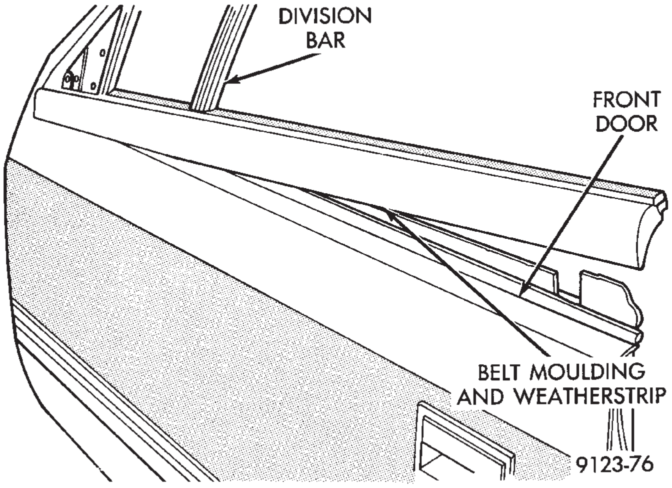


Fig. 26 Front Door Belt Moulding and Weatherstrip

FRONT DOOR STRIKER GUIDE SOCKET

REMOVAL (FIG. 27)

(1) Remove door trim panel.

(2) Remove screws holding guide socket to door end frame.

(3) Separate guide socket from door.

INSTALLATION

Reverse the preceding operation

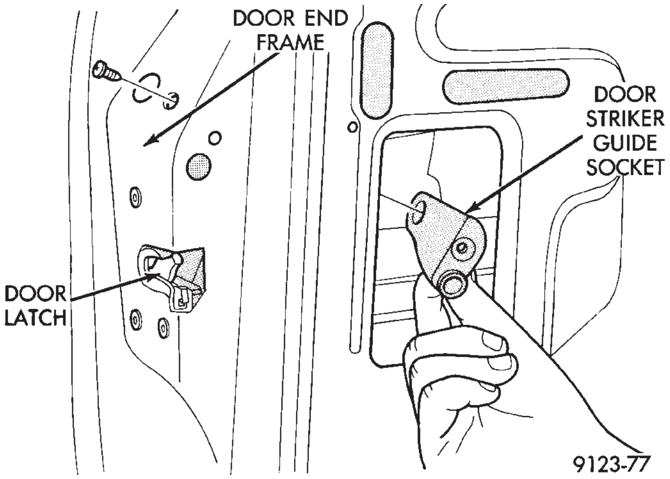


Fig. 27 Front Door Striker Guide Socket

REAR SEAT BACK

REMOVAL (FIG. 28)

(1) Remove seat cushion.

(2) Raise sling well behind quarter trim panels to gain access to seat back nuts.

(3) Reach beneath sling well and remove nuts holding seat back to support reinforcement.

(4) Separate seat back from vehicle.

INSTALLATION

Reverse the preceding operation.

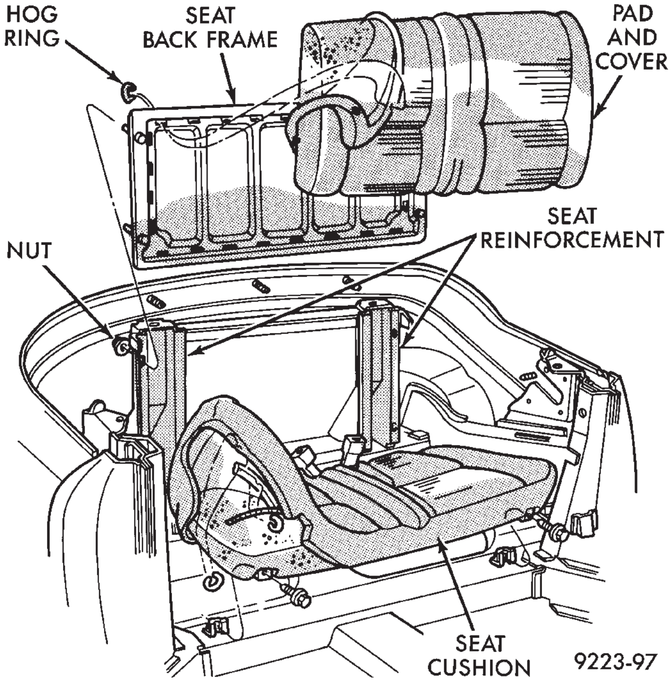


Fig. 28 Rear Seat Attaching Nuts

QUARTER TRIM PANEL

REMOVAL (FIG. 29)

(1) Remove bolts holding front outboard seat belt to floor. Remove cover from belt end.

(2) Remove screws holding quarter trim to inner quarter panel.

(3) Remove push-in fastener holding top of door opening weatherstrip to quarter trim panel.

(4) Remove door opening sill plate as necessary to clear quarter trim.

(5) Remove courtesy lamp and disconnect wire connector.

(6) Separate trim panel from inner quarter panel and disconnect speaker wire.

(7) Remove bolts holding rear outboard seat belt to inner quarter panel.

(8) Push seat belt end through openings in trim panel and remove trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

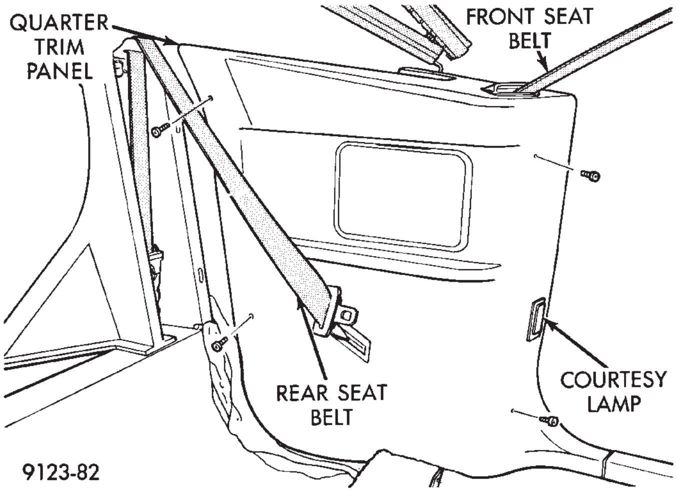


Fig. 29 Quarter Trim Panel

DOOR STRIKER GUIDE

REMOVAL (FIG. 30)

(1) Remove quarter trim panel as necessary to gain access to striker guide attachments.

(2) Remove nuts holding striker guide to inner quarter panel.

(3) Separate striker guide from lock pillar.

INSTALLATION

Reverse the preceding operation.

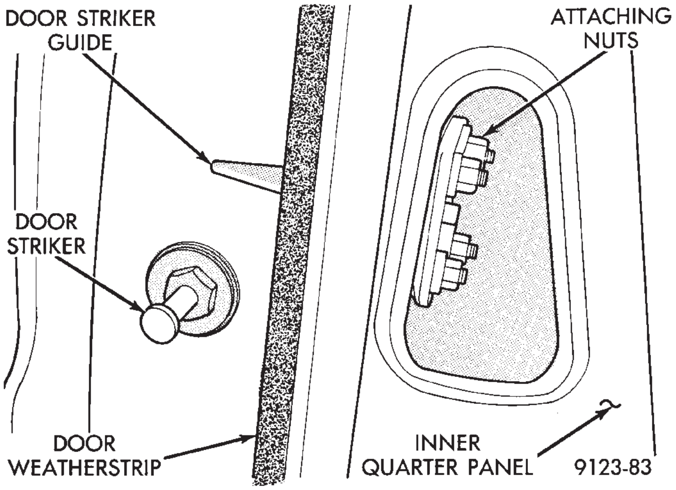


Fig. 30 Door Striker Guide

FRONT SEAT BELT RETRACTOR

REMOVAL (FIG. 31)

(1) Remove quarter trim panel as necessary to gain access to seat belt retractor.

(2) Remove bolt holding shoulder harness turning loop to inner quarter panel.

(3) Remove bolt holding seat belt retractor to inner quarter panel.

(4) Separate seat belt from vehicle.

INSTALLATION

Reverse the preceding operation.

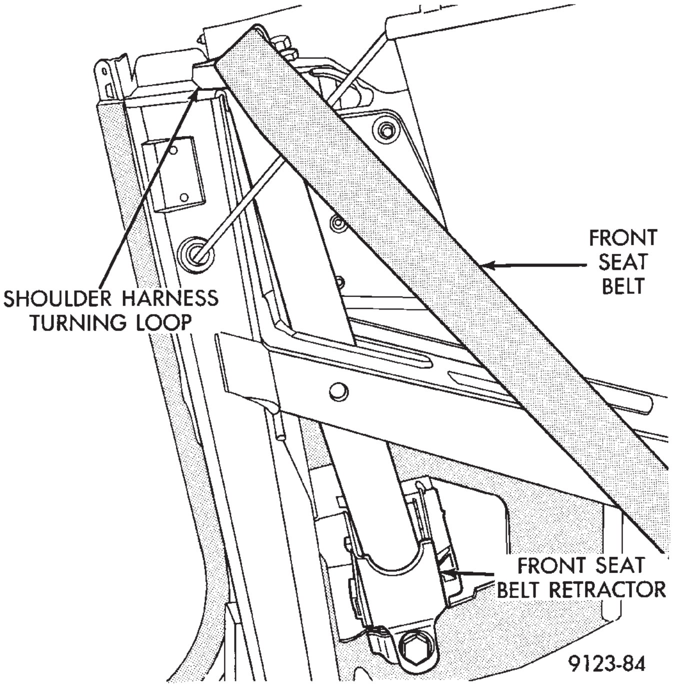


Fig. 31 Front Seat Belt Retractor

REAR SEAT BELT RETRACTOR

REMOVAL (FIG. 32)

(1) Remove quarter trim panel as necessary to gain access to the rear seat belt retractor.

(2) Remove snap-on cover from shoulder harness turning loop.

(3) Remove bolt holding turning loop to rear seat back support reinforcement.

(4) Remove bolt holding retractor to rear seat back support reinforcement.

(5) Separate retractor from vehicle.

INSTALLATION

Reverse the preceding operation.

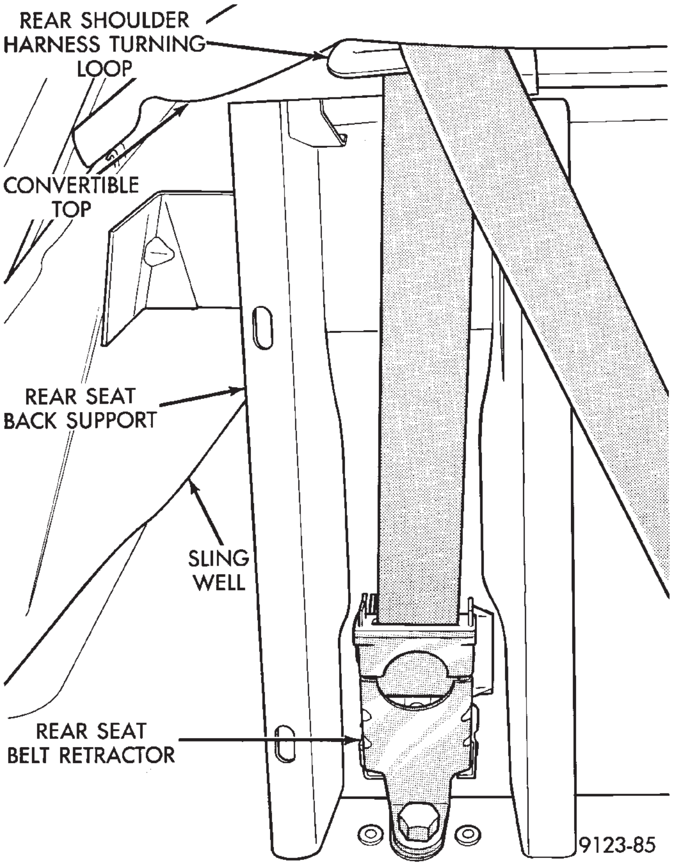


Fig. 32 Rear Seat Belt Retractor

QUARTER PANEL BELT MOULDING

REMOVAL (FIG. 33)

(1) Lower convertible top.

(2) Remove quarter trim panel as necessary to gain access to the belt moulding and weatherstrip attaching screws through the opening at the top of the quarter panel.

(3) Remove screws holding moulding to inner quarter panel in quarter glass opening.

(4) Remove nuts holding moulding to quarter panel along top opening.

(5) Raise trunk lid. Remove nut holding moulding to quarter panel from behind quarter panel reinforcement.

(6) Separate quarter panel belt moulding from vehicle.

INSTALLATION

Apply sealing putty around mounting studs on back of moulding and reverse the removal operation.

TRUNK LID LINING

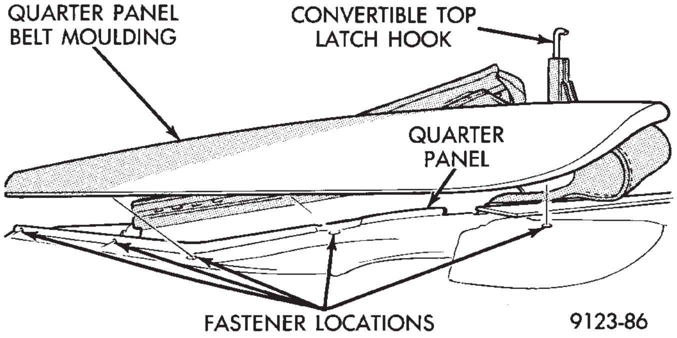


Fig. 33 Quarter Panel Belt Moulding

REMOVAL (FIG. 34)

(1) Raise trunk lid.

(2) Remove screws holding trunk lid lining to inside of trunk lid.

(3) Support trunk lid in the full up position.

(4) Disconnect trunk lid prop cylinders.

(5) Separate trunk lid lining from vehicle.

INSTALLATION

Reverse the preceding operation.

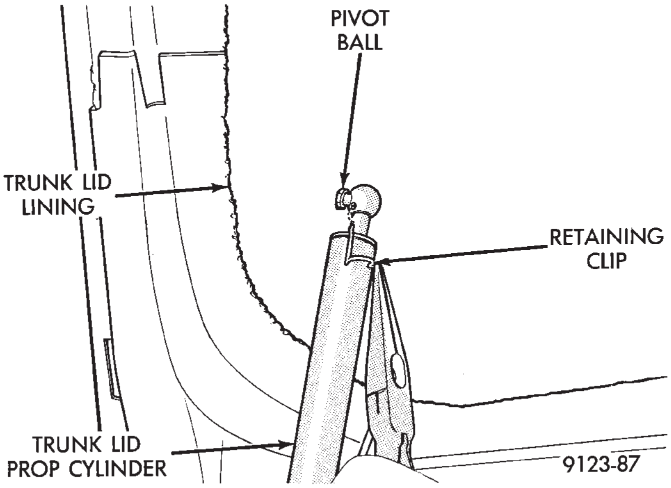


Fig. 34 Trunk Lid Lining and Prop Cylinder

TRUNK LID APPLIQUE

REMOVAL (FIG. 35)

(1) Remove trunk lid lining as necessary to gain access to applique attaching nuts.

(2) Remove nuts holding applique to trunk lid.

(3) Separate applique from trunk lid.

(4) Disconnect center high mounted stop lamp wire connector.

(5) Remove applique from vehicle.

INSTALLATION

Apply sealing putty around mounting studs on back of applique and reverse the removal operation.

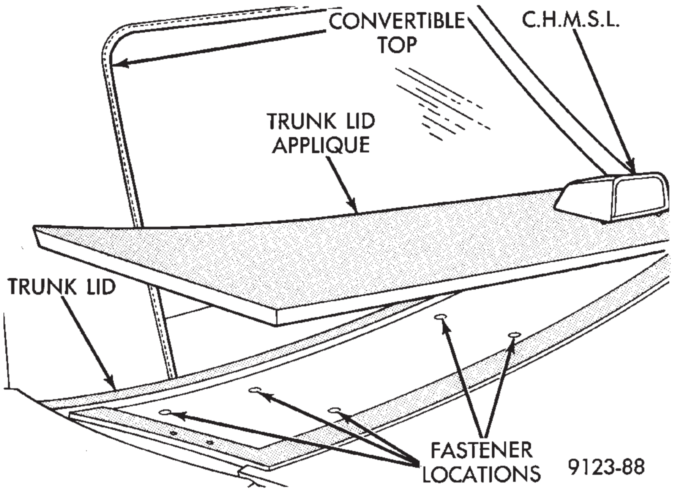


Fig. 35 Trunk Lid Applique

TRUNK OPENING WEATHERSTRIP

REMOVAL (FIG. 36)

(1) Raise trunk lid.

(2) Pull trunk lid opening weatherstrip from pinch flange around opening.

(3) Separate weatherstrip from vehicle.

INSTALLATION

Position weatherstrip at center of rearward pinch flange. Push weatherstrip onto pinch flange around trunk opening and join the ends of the weatherstrip when they meet.

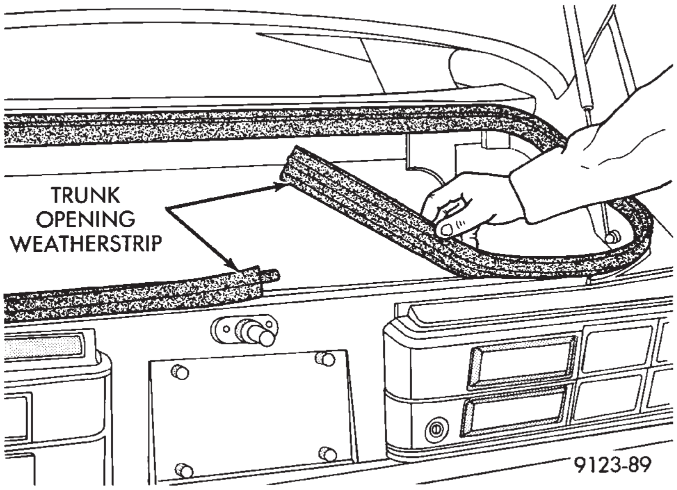


Fig. 36 Trunk Opening Weatherstrip

TRUNK LID

REMOVAL (FIG. 37)

(1) Raise trunk lid to full up position.

(2) Disconnect the trunk lamp wire connector, if equipped.

(3) Mark all bolt and hinge attachment locations with a grease pencil to provide reference marks for installation. When installing trunk lid, align all marks and secure bolts. The trunk lid should be aligned to 4 mm (0.160 in.) gap to the quarter panels and flush across the top surfaces along quarter panels.

(4) Support trunk lid and remove prop-rod cylinders.

(5) Remove the top trunk lid to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(6) With assistance of a helper at the opposite side of the vehicle, remove the remaining bolts. Separate the trunk lid from the vehicle.

INSTALLATION

Reverse the preceding operation.

TRUNK HINGE LID

REMOVAL (FIG. 38)

(1) Raise and support trunk lid in the full up position.

(2) Remove pivot bolts holding trunk lid hinge to trunk opening side panel.

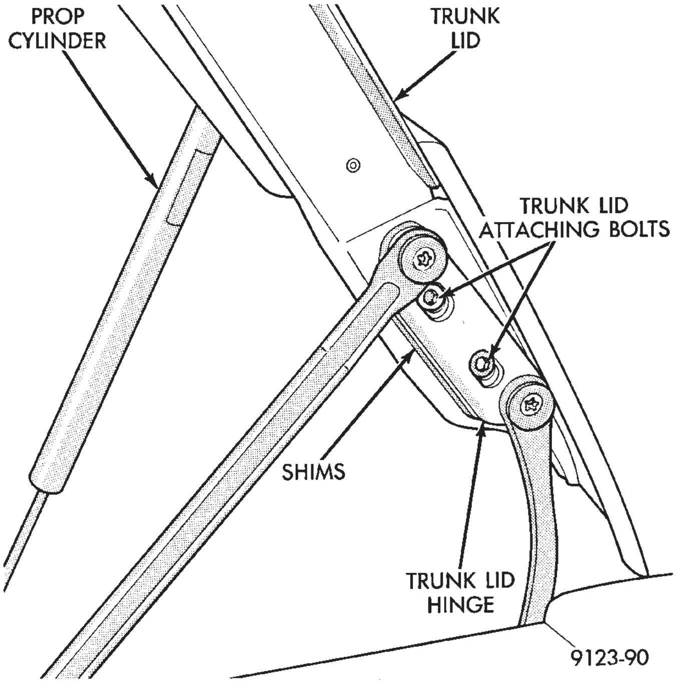


Fig. 37 Trunk Lid

(3) Mark all bolt and hinge attachment locations with a grease pencil to provide reference marks for installation. When installing hinge, align all marks and secure bolts. The trunk lid should be aligned to 4 mm (.160 in.) gap to the quarter panels and flush across the top surfaces along quarters.

(4) Remove bolts holding hinge to trunk lid and separate hinge from vehicle.

INSTALLATION

Reverse the preceding operation.

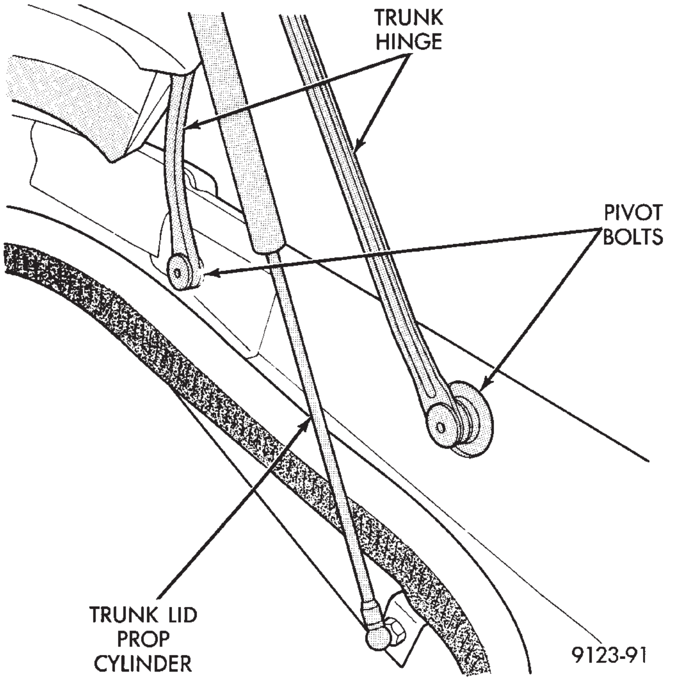


Fig. 38 Trunk Lid Hinge

CONVERTIBLE TOP ADJUSTMENTS

When a convertible top component is aligned to proper fit and finish specifications, weatherstrips and seals will not always make proper contact. In these cases, the use of shims, spacers, caulking putty and foam adhesive backed tape will be required to gain proper seal compression. Align weatherstrip and seal channels or retainers so the contact surfaces are smooth and make full contact with mating surfaces. A paper strip, equal in size to a dollar bill, should be able to be drawn through the contact surfaces without tearing the paper. A reasonable amount of effort should be required to pull the paper through.

Bolt on body panels should be aligned to the weld on body components. The door should be aligned to the quarter panel, rocker panel and A-pillar. The gaps between panels should be as equal as possible. When the door is fitted properly, the door glass can be aligned to roof rail and A-pillar weatherstrips. After verifying the door and door glass alignment, the quarter glass can be aligned to the door glass and rear roof rail.

DOOR GLASS ALIGNMENT

GLASS UP-STOP

The door glass up-stop bumper can be adjusted to raise or lower the glass in the full up position.

(1) Remove door trim panel and water shield.

(2) Loosen up-stop bolt.

(3) Adjust bracket.

(4) Tighten up-stop bolt.

DIVISION BAR ALIGNMENT

The rear of the glass can be aligned up or down by shifting the bottom attachment of the division bar. Division bar adjustments are small and may not be possible on some vehicles.

(1) Remove door trim panel and water shield.

(2) Loosen blot holding bottom of division bar to inner door panel.

(3) Loosen bolt holding division bar to door inner panel below stationary glass.

(4) Shift division bar forward or rearward to achieve proper adjustment.

(5) Tighten bolts.

CONVERTIBLE TOP LATCH HOOKS

(1) Disengage top latches and raise top halfway.

(2) Loosen set screw locking latch hook in position.

(2) Rotate latch hook in or out to adjust latching effort and roof header weatherstrip compression.

(3) Verify latching effort and tighten set screws.

ROOF RAIL WEATHERSTRIP RETAINER

(1) Disengage top latches and raise top halfway.

(2) Verify that door glass is all the way up and properly aligned.

(3) Loosen nuts holding roof rail weatherstrip retainer to roof rail. Shift retainer inboard or outboard to achieve proper alignment.

(4) Tighten nuts to hold retainer to roof rail and latch top header.

(5) Verify weatherstrip sealing and door closing effort.

QUARTER GLASS AND ROLLER BRACKET

QUARTER GLASS

(1) Verify that door glass is properly aligned.

(2) Loosen nut holding top of quarter glass to rear roof rail.

(3) Shift quarter glass inboard or outboard, forward or rearward to achieve proper alignment.

(4) Tighten nut to hold top of quarter glass to rear roof rail.

(5) Verify door glass operation and weatherstrip sealing.

ROLLER BRACKET

The roller bracket controls the in and out movement at the bottom for the quarter glass.

(1) Remove quarter trim panel as necessary to gain access to the bottom of the quarter glass.

(2) Lower convertible top.

(3) Loosen bolts holding roller bracket to quarter panel reinforcement.

(4) Align roller bracket to reduce quarter belt weatherstrip contact when top is raised and proper sash weatherstrip compression against the door glass.

(5) Tighten bolts to hold roller to quarter panel and verify top operation and weatherstrip sealing.

TOP STACK DOWN-STOP

Adjust down-stop in or out to set top stack down position height.

CAUTION: Avoid setting top stack position too low, top cover can be pinched and cut between wheelhouse and fourth bow.

Seal base of down-stop with silicone after adjusting to prevent water leaks.

TOP STACK UP-STOP

Adjust up-stop in or out to change the contact with the rear rail. This will effect the fore/aft position of the No. 1 bow.

FOURTH ROOF BOW SLAT

Adjust the fourth roof bow slat to reduce wrinkles and bagging around rear window and sail panels.

(1) Verify convertible top is up and latched.

(2) Loosen bolts holding the slat to the fourth roof bow.

(3) Slide the bow up or down as necessary and tighten bolts.

REAR TENSIONER PLATE

Adjust rear tensioner plate by loosening screws, positioning plate forward or backward, and tightening screws. Tension can be adjusted on the back of the top cover by varying contact.

AY-VEHICLE BODY COMPONENT SERVICE

INDEX

GRILLE AY/P BODY

REMOVAL (FIG. 1)

(1) Remove screws holding grille to opening panel.

(2) Push top of grille downward and pull forward.

(3) Separate grille from vehicle.

INSTALLATION

Reverse the preceding operation.

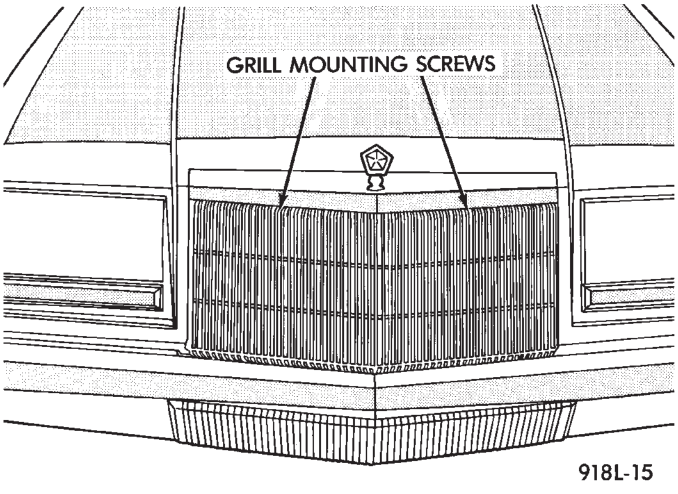


Fig. 1 Grille—AY/P Body

GRILLE AY/S BODY

REMOVAL (FIG. 2)

(1) Loosen hidden screws holding grille to grille opening panel at corners of grille. The screws are captured in a clearance hole covered by a bracket behind the grille.

(2) Pull grille forward from grille opening panel.

INSTALLATION

Reverse the preceding operation.

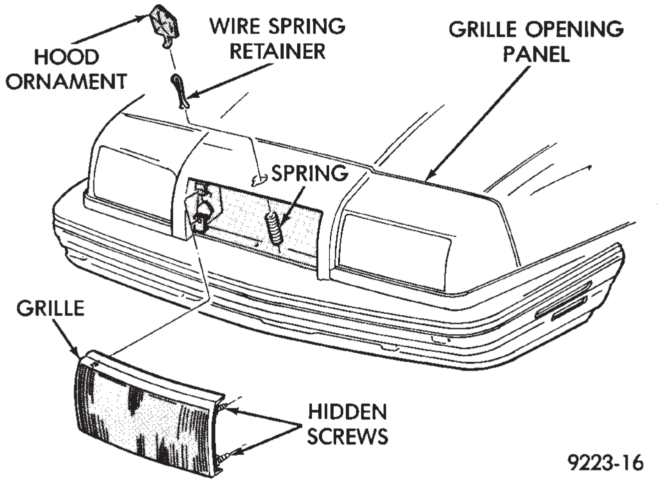


Fig. 2 Grille—AY/S Body

HOOD ORNAMENT AY/P-S

REMOVAL (FIG. 2)

(1) Remove grille.

(2) Locate hood ornament spring under grille opening panel header.

(3) Compress hood ornament spring enough to clear hooks on end of retaining wire.

(4) Squeeze retainer wire hooks together and push hooks inside spring.

(5) Rotate spring counterclockwise to separate spring from retainer.

(6) Separate hood ornament from grille opening panel.

INSTALLATION

Reverse the preceding operation.

GRILLE OPENING PANEL AY/P BODY

For service procedures for headlamp related components refer to Group 8L, Lamps.

REMOVAL (FIG. 3)

(1) Remove front bumper and grille.

(2) Remove front end splash shields as necessary to gain access to behind fenders.

(3) Remove nuts holding GOP mouldings to front fenders.

(4) Remove nuts holding grille opening panel to front fenders.

(6) Disconnect concealed headlamp motor wire connector.

(7) Disconnect all lamp wire connectors.

(8) Remove bolts holding grille opening panel to radiator closure panel and center brace.

(9) Separate grille opening panel from vehicle.

INSTALLATION

Reverse the preceding operation.

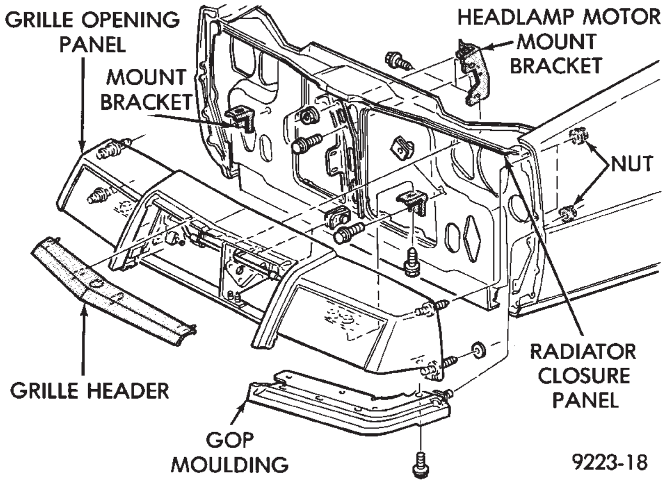


Fig. 3 Grille Opening Panel—AY/P Body

GRILLE OPENING PANEL AY/S BODY

For service procedures for headlamp related components refer to Group 8L, Lamps.

REMOVAL (FIG. 4)

(1) Remove front bumper and grille.

(2) Remove front end splash shields as necessary to gain access to behind fenders.

(3) Remove nuts holding mouldings to front fenders.

(4) Remove bolts holding mouldings to bottom of grille opening panel and separate mouldings from vehicle.

(5) Remove nuts holding grille opening panel to front fenders.

(6) Disconnect concealed headlamp motor wire connector.

(7) Disconnect headlamp wire connectors.

(8) Remove bolts holding grille opening panel to radiator closure panel mount brackets and center brace.

(9) Separate grille opening panel from vehicle.

INSTALLATION

Reverse the preceding operation.

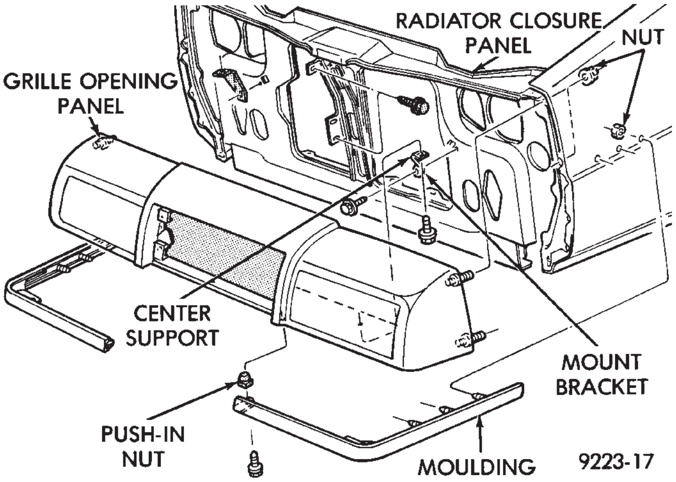


Fig. 4 Grille Opening Panel—AY/S Body

HOOD AND HINGES

HOOD REMOVAL (FIG. 5)

(1) Raise hood to full up position.

(2) Lift front edge of cowl cover on the right side of the windshield washer bottle and disconnect the under hood lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood, 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.

(4) Remove the top hood to hinge bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the hood, remove the bottom hood to hinge bolts. Separate the hood from the vehicle.

HOOD INSTALLATION

Reverse the preceding operation.

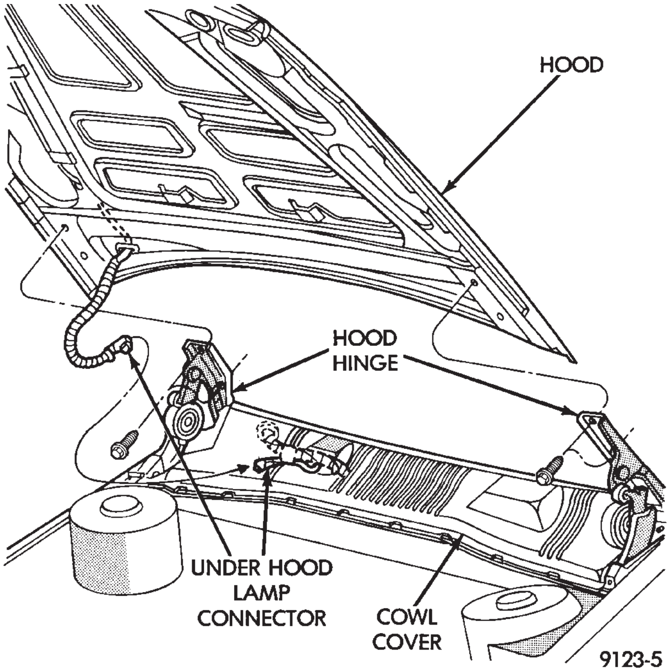


Fig. 5 Hood

HOOD HINGE REMOVAL (FIG. 6)

(1) Support hood on the side that requires hinge replacement.

(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing hood hinge, 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.

(3) Remove hood to hinge attaching bolts.

(4) Remove hood hinge to front fender attaching bolts and separate hinge from vehicle.

HOOD HINGE INSTALLATION

Reverse the preceding operation. If necessary, paint new hinge before installation.

HOOD LATCH AND RELEASE CABLE

HOOD LATCH REMOVAL (FIG. 7)

(1) Raise hood top the full up position.

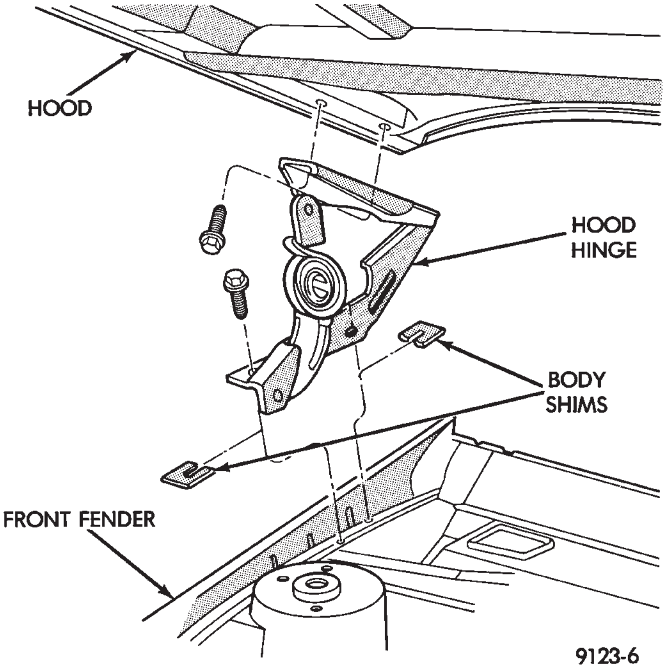


Fig. 6 Hood Hinge—Typical

(2) Remove hood latch attaching bolts holding latch to radiator closure panel and separate from vehicle.

(3) Pry release cable casing attachment from slot receiver on latch, disengage cable end from latch arm hook.

HOOD LATCH INSTALLATION

Reverse the preceding operation.

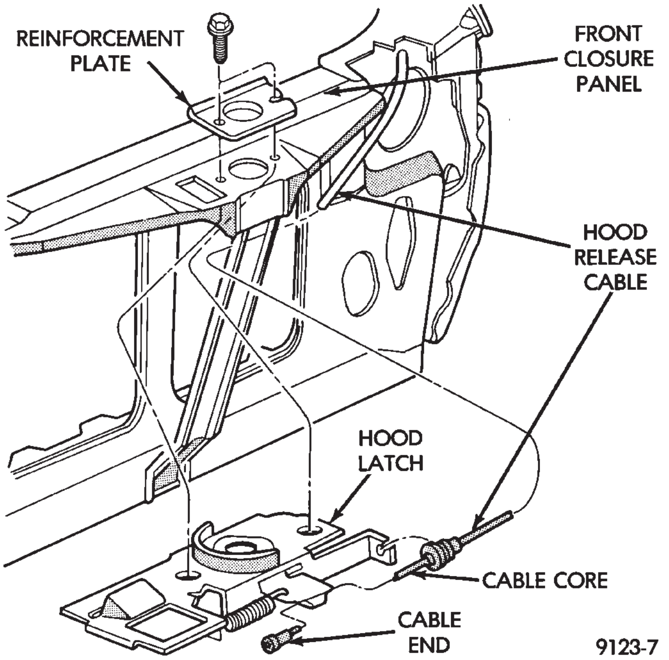


Fig. 7 Hood Latch Assembly—Typical

HOOD LATCH RELEASE CABLE REMOVAL (FIG. 8)

(1) Raise hood to the full up position.

(2) Remove push-in fasteners holding hood latch cover to radiator closure panel and separate cover from vehicle.

(3) Disconnect hood release cable casing and cable end from hood latch assembly. Refer to Hood Latch Removal procedure in this section.

(4) Remove hood latch release cable handle attaching bolts from under left lower edge of instrument panel.

(5) Disengage release cable rubber grommet from engine compartment dash panel behind instrument panel.

(6) Rout cable assembly through engine compartment around battery, under fender lip, under relay bank, and under wiring harnesses, toward dash panel. Push cable through access hole in dash panel under the brake master cylinder, into passenger compartment.

HOOD LATCH RELEASE CABLE INSTALLATION

Reverse the preceding operation.

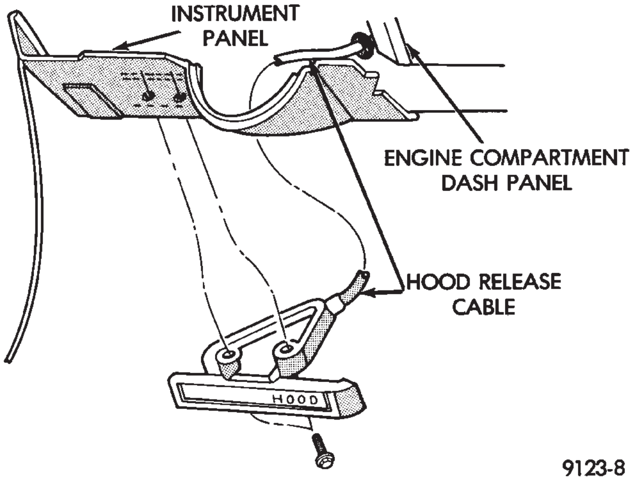


Fig. 8 Hood Latch Release Cable—Typical

FRONT END SPLASH SHIELDS

FRONT WHEELHOUSE SPLASH SHIELD REMOVAL (FIG. 9)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove front wheel assembly.

(3) Remove push-in fasteners holding front wheelhouse splash shield to fender opening lip and inner wheelhouse area.

(4) Separate wheelhouse splash shield from vehicle.

FRONT WHEELHOUSE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

TRANSAXLE SPLASH SHIELD REMOVAL (FIG. 9)

(1) Remove one front wheelhouse splash shield push-in fastener and separate wheelhouse splash shield from transaxle splash shield.

(2) Remove transaxle splash shield attaching bolts and separate transaxle splash shield from vehicle.

TRANSAXLE SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

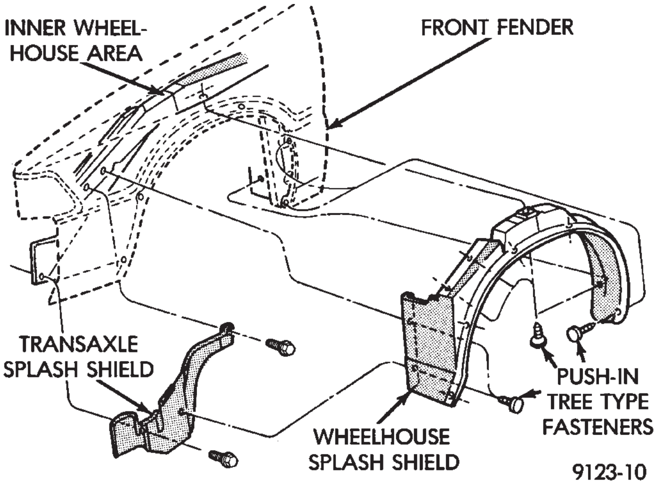


Fig. 9 Front Wheelhouse and Transaxle Splash Shields

ENGINE DRIVE BELT SPLASH SHIELD REMOVAL (FIG. 10)

(1) Hoist vehicle and support on suitable safety stands.

(2) Remove bolts holding engine drive belt splash shield to right frame rail.

(3) Separate drive belt splash shield from vehicle.

ENGINE DRIVE BELT SPLASH SHIELD INSTALLATION

Reverse the preceding operation.

FRONT DOOR TRIM PANEL

TRIM PANEL REMOVAL (FIG. 11)

(1) Disengage frog-leg fasteners holding power seat switch/speaker bezel to door trim. Separate bezel from trim panel.

(2) Disconnect power seat switch wire connector.

(3) Remove screws holding trim panel to door from around speaker and power seat switch.

(4) Remove screws holding pull handle to door trim and separate pull handle from door.

(5) Remove hidden screws holding trim panel to inner door panel from behind carpet insert.

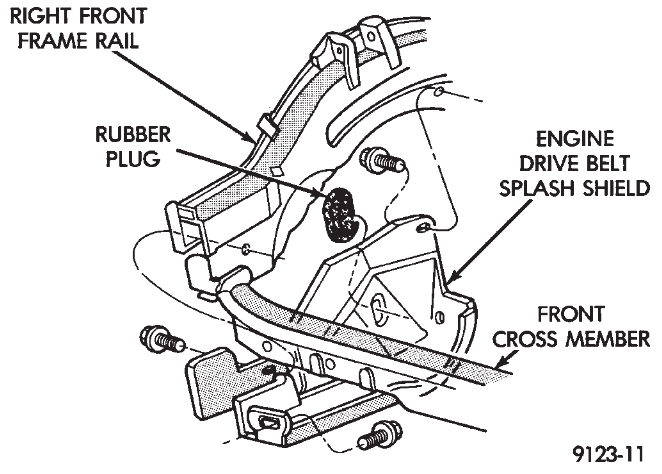


Fig. 10 Engine Drive Belt Splash Shield—Typical

(6) Disengage frog-leg fasteners holding trim panel to inner door panel.

(7) Lift trim panel upward and separate trim from door.

(8) Disconnect courtesy lamp, power door lock switch and power window switch wire connectors.

TRIM PANEL INSTALLATION

Reverse the preceding operation.

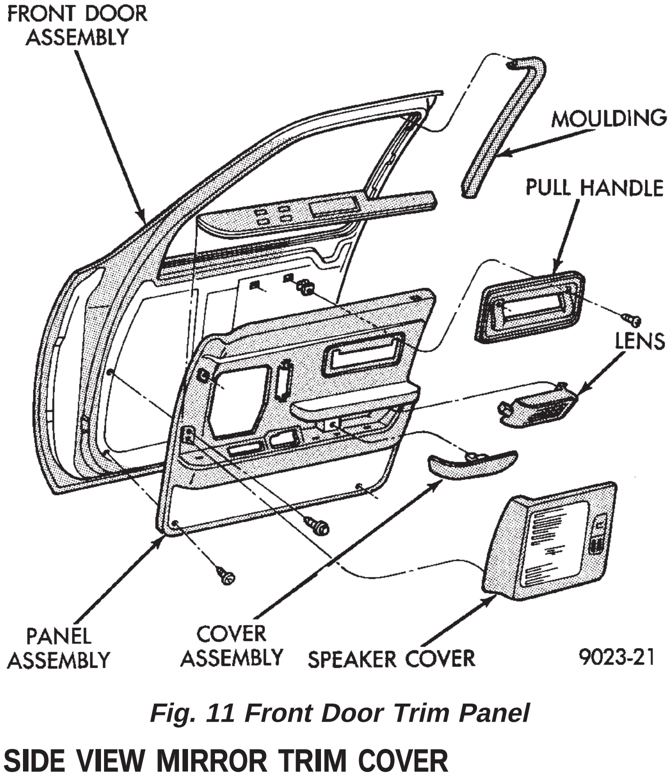


Fig. 11 Front Door Trim Panel

SIDE VIEW MIRROR TRIM COVER

REMOVAL

(1) Remove Front door trim panel.

(2) Disconnect power mirror wire connector.

(3) Remove screws holding mirror trim cover to door frame.

INSTALLATION

Reverse the preceding operation.

DOOR FRAME TRIM MOULDING

REMOVAL (FIG. 11)

(1) Remove front door trim panel.

(2) Disengage trim clips holding moulding to window opening frame and separate moulding from door.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR SILENCER AND WATER SHIELD

REMOVAL

(1) Remove front door trim panel.

(2) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR AND HINGE

The front door hinge is welded to the door and bolted to the hinge pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

FRONT DOOR REMOVAL (FIG. 12)

(1) Remove door trim panel, silencer pad, and water shield.

(2) Disconnect all wire connectors and wire harness hold downs inside door and push wire harness through access hole in front of door into hinge pillar opening.

(3) Open door and support door on a suitable lifting device.

(4) Drive bottom hinge pin upward and remove pin from hinge.

(5) Drive top hinge pin downward and remove pin from hinge.

FRONT DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Front Door Hinge Installation paragraph in this section.

FRONT DOOR HINGE REMOVAL (FIG. 12)

(1) Remove front fender wheelhouse splash shield. Refer to Front Wheelhouse Splash Shield Removal paragraph in this section.

(2) Support door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

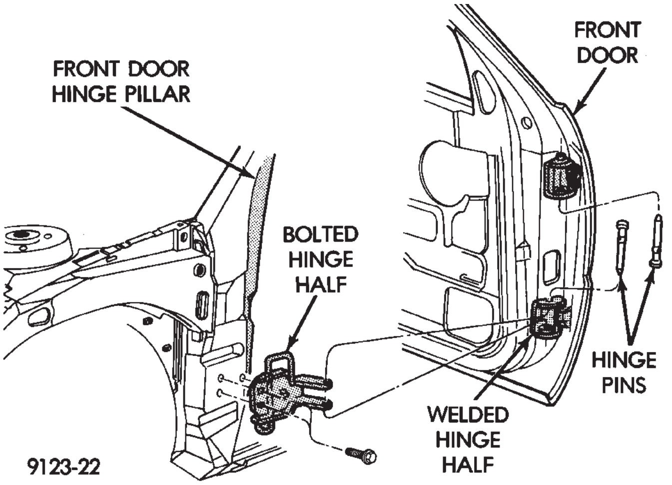


Fig. 12 Front Door Assembly

(4) Remove bolts holding hinge to hinge pillar and separate hinge form vehicle.

FRONT DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

OUTSIDE DOOR HANDLE

REMOVAL (FIG. 13)

(1) Remove door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Raise door glass to up position.

(4) Disconnect illuminated entry wire connector from outside door handle assembly, if equipped.

(5) Disconnect latch release linkage from latch assembly.

(6) Disconnect lock cylinder linkage from latch assembly.

(7) Remove nuts holding outside handle bracket to door panel and separate bracket from panel.

(8) Position linkage rods parallel to the back of handle and remove handle assembly from door.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR LATCH

REMOVAL (FIG. 14)

(1) Remove door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Disconnect linkage rods from door latch assembly.

(4) Remove screws holding latch door end frame.

(5) Separate latch from door.

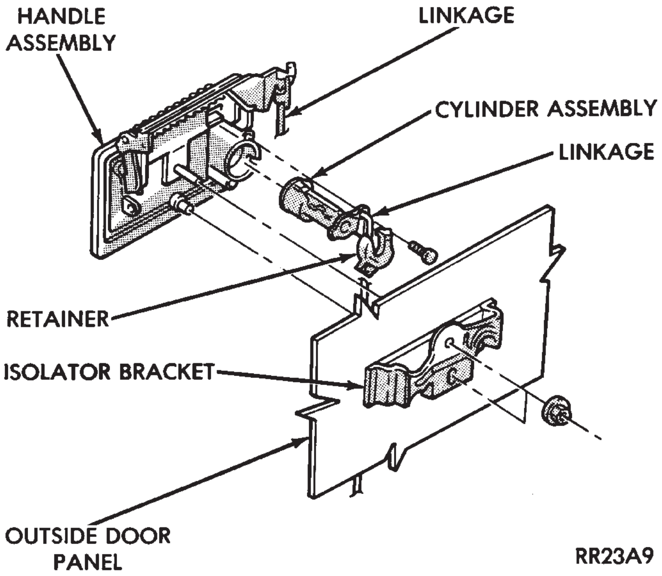


Fig. 13 Front Door Handle Assembly

INSTALLATION

Reverse the preceding operation.

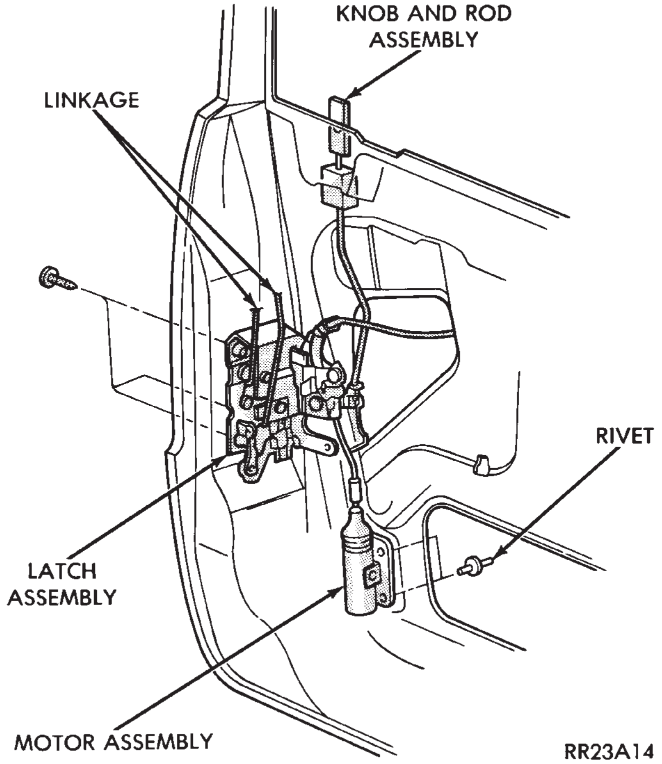


Fig. 14 Front Door Latch Assembly

FRONT DOOR WINDOW REGULATOR

REMOVAL (FIG. 15 OR 16)

MANUAL OR ELECTRIC

(1) Remove front door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove side view mirror trim cover and door frame trim moulding.

(4) Remove door glass.

(5) Remove nut holding cable retainer to inner door panel and slip cables from behind retainer.

(6) Disengage push in retainer holding cables to inner door panel above speaker on vehicles with power windows.

(7) Remove bolts holding top of glass lift bar to inner door panel.

(8) Remove nut holding bottom of lift bar to bottom panel of door.

(9) Remove bolts holding window crank regulator to inner door panel on vehicles with manual windows. Remove nuts holding motor and regulator to inner door panel on vehicles with power windows.

(10) Separate window regulator from vehicle.

INSTALLATION

Reverse the preceding operation.

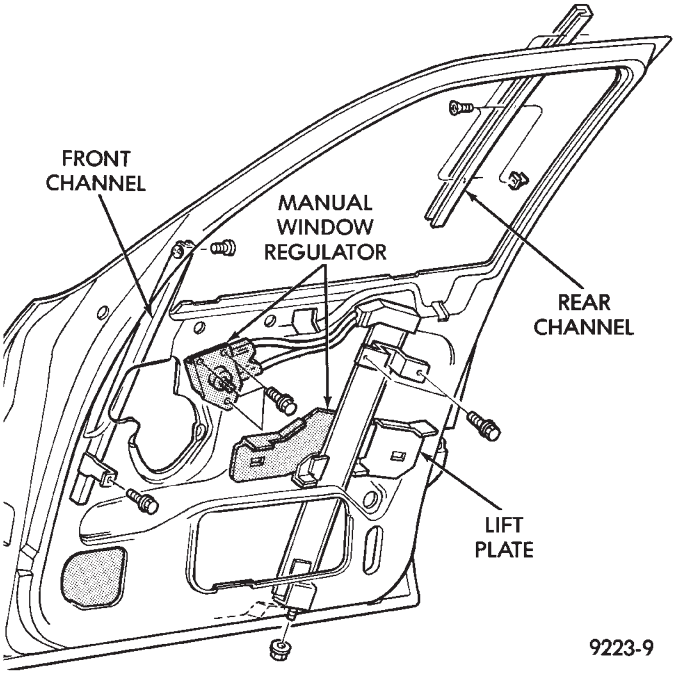


Fig. 15 Front Door Manual Window Regulator

FRONT DOOR GLASS

REMOVAL

(1) Remove front door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove side view mirror trim cover and door frame trim moulding.

(4) Remove front door speaker.

(5) Move glass to the down position and remove glass to lift plate fasteners.

(6) Loosen door glass slam bumpers.

(7) Lift glass upward through opening at top of door.

INSTALLATION

Reverse the preceding operation.

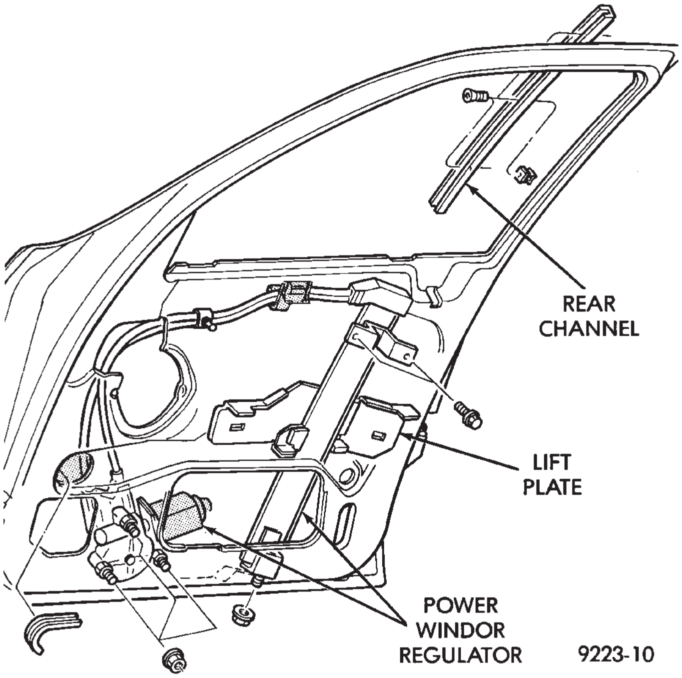


Fig. 16 Front Door Power Window Regulator

REAR DOOR TRIM PANEL

REMOVAL (FIG. 17)

(1) Remove screw plugs from fixed glass trim bezel. Remove screws holding bezel to door frame and separate trim from door.

(2) Remove screws holding pull handle and padded insert to door trim and separate handle and insert from door.

(3) Disengage frog-leg fasteners holding forward padded insert assembly to door panel.

(4) Remove hidden screws from behind carpeting on lower trim panel.

(5) Remove screws and disengage frog-leg fasteners holding trim panel to door. Lift trim panel upward and separate trim from door.

(6) Disconnect courtesy lamp wire connector. Disconnect cigar lighter wire connectors. Disconnect power window switch wire connector.

INSTALLATION

Reverse the preceding operation.

REAR DOOR FRAME TRIM MOULDING

TRIM MOULDING REMOVAL

(1) Remove rear door trim panel.

(2) Disengage trim clips holding trim moulding to door frame.

(3) Separate trim moulding from door frame.

TRIM MOULDING INSTALLATION

Reverse the preceding operation.

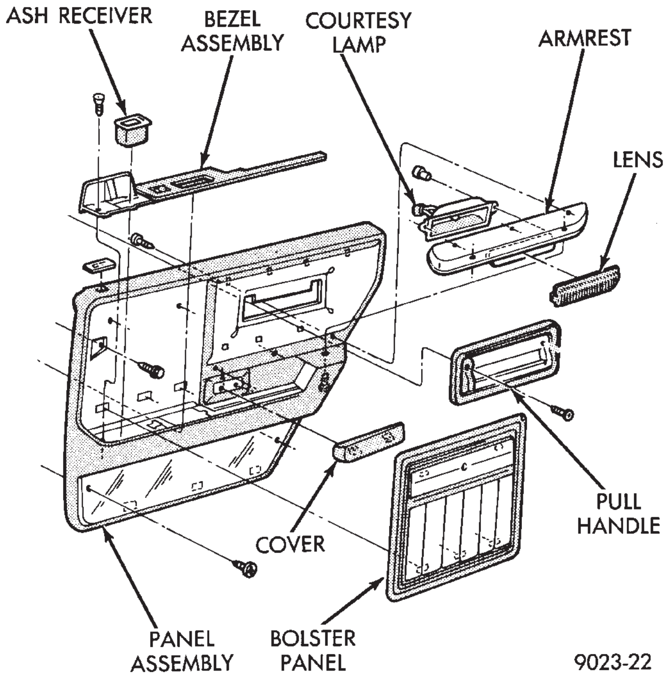


Fig. 17 Rear Door Trim Panel

REAR DOOR SILENCER AND WATER SHIELD

REMOVAL

(1) Remove door trim panel.

(2) Pull water shield from adhesive around perimeter of door inner panel.

INSTALLATION

Reverse the preceding operation.

REAR DOOR AND HINGE

The rear door hinge is welded to the door and bolted to the B-pillar. The door half of the hinge pivots on a removable hinge pin. The hinge pin is driven in from the bottom on the top hinge and from the top on the bottom hinge. All adjustments to the hinge are performed on the hinge pillar half of the hinge. If the welded half of the hinge must be bent to align door, consult an authorized body repair facility.

REAR DOOR REMOVAL (FIG. 18)

(1) Remove B-pillar trim panel and disconnect all wire connectors leading to door. Push wire harness through access hole in B-pillar into hinge opening.

(2) Support door on a suitable lifting device.

(3) Drive bottom hinge pin upward and remove pin from hinge.

(4) Drive top hinge pin downward and remove pin from hinge.

(5) Separate door from vehicle.

REAR DOOR INSTALLATION

Reverse the preceding operation. The door should not require re-alignment. If door does need alignment, refer to Rear Door Hinge Installation paragraph in this section.

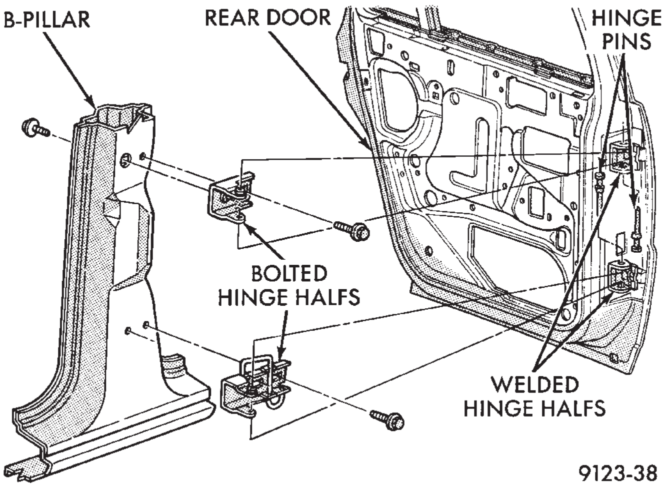


Fig. 18 Rear Door Assembly—Typical

REAR DOOR HINGE REMOVAL (FIG. 18)

(1) To remove upper hinge bolted half, remove B-pillar trim panel. To remove lower hinge bolted half it is not necessary to remove B-pillar trim.

(2) Support rear door on a suitable lifting device.

(3) Drive out hinge pin on the effected hinge.

(4) Remove bolts holding hinge to B-pillar and separate hinge form vehicle.

REAR DOOR HINGE INSTALLATION

Reverse the preceding operation. Align door to achieve 6 mm (0.240 in.) gap to all surrounding panels and flush across gaps.

REAR DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Disconnect latch release linkage rod from door latch.

(4) Remove nuts holding handle bracket to inner door panel.

(5) Separate outside door handle from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR LATCH

REMOVAL

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield as necessary.

(3) Disconnect linkage rods from door latch.

(4) Remove screws holding latch to door end frame.

(5) Separate latch from rear door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR GLASS

REMOVAL (FIG. 19)

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove door frame trim moulding.

(4) Remove screws holding lift plate to door glass.

(5) Loosen glass slam bumpers.

(6) Lift glass upward through opening at top of door.

INSTALLATION

Reverse the preceding operation.

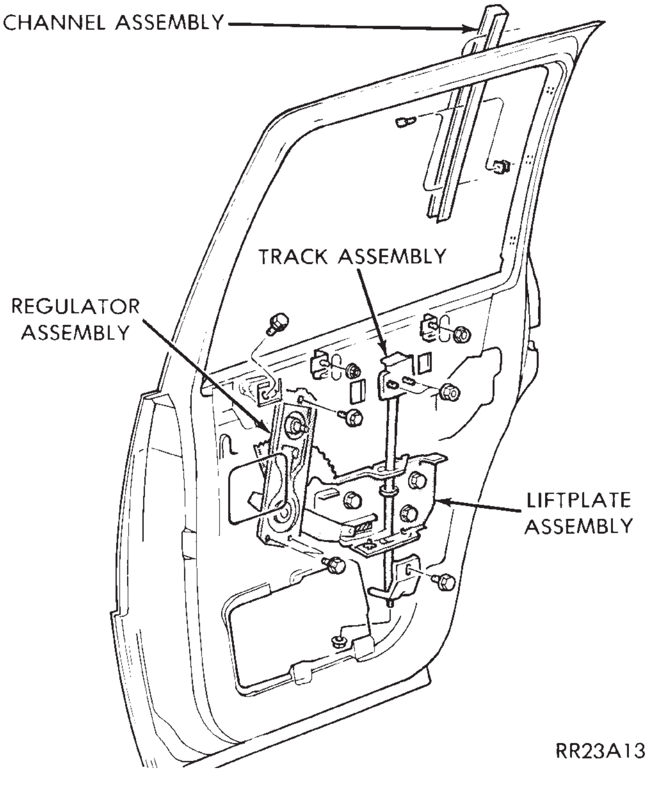


Fig. 19 Rear Door

REAR DOOR WINDOW REGULATOR

REMOVAL

(1) Remove rear door trim panel.

(2) Remove silencer pad and water shield.

(3) Remove bolts holding regulator to inner door panel.

(4) Slide regulator lift arm roller from lift plate channel.

(5) Separate regulator from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR GLASS LIFT PLATE AND GUIDE BAR

REMOVAL (FIG. 19)

(1) Remove rear door glass.

(2) Remove bolts holding upper guide bar mount bracket to inner door panel.

(3) Remove nut holding guide bar to lower door bottom frame.

(4) Slide lift plate channel from regulator roller.

(5) Separate guide bar from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR FIXED GLASS OUTER COVER—AY-S BODY

REMOVAL (FIG. 20)

(1) Remove inner rear door fixed trim bezel.

(2) Remove screws holding fixed glass outer cover to door frame.

(3) Separate cover from door.

INSTALLATION

Reverse the preceding operation.

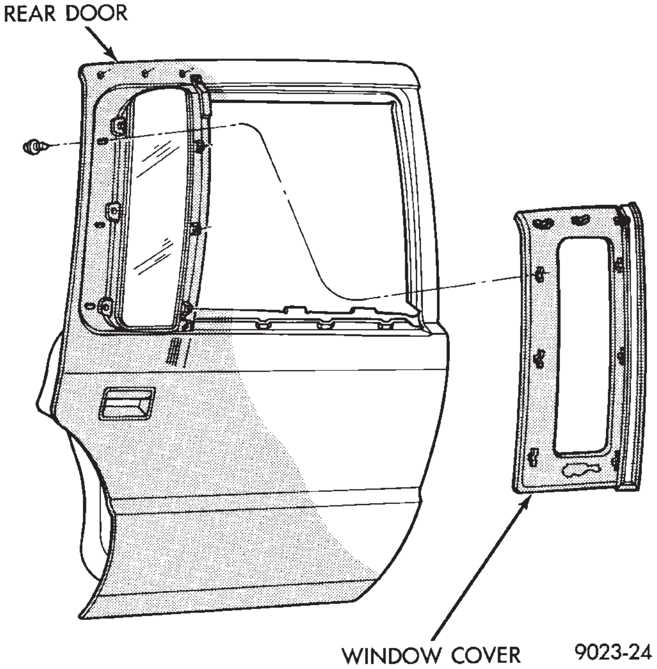


Fig. 20 Rear Door Fixed Glass Outer Cover—AY-S Body

REAR DOOR OUTER COVER—AY-P BODY

REMOVAL (FIG. 21)

(1) Remove rear door trim panel and upper frame trim covers.

(2) Remove screws holding rear door outer cover to door upper frame.

(3) Separate outer cover from door.

INSTALLATION

Reverse the preceding operation.

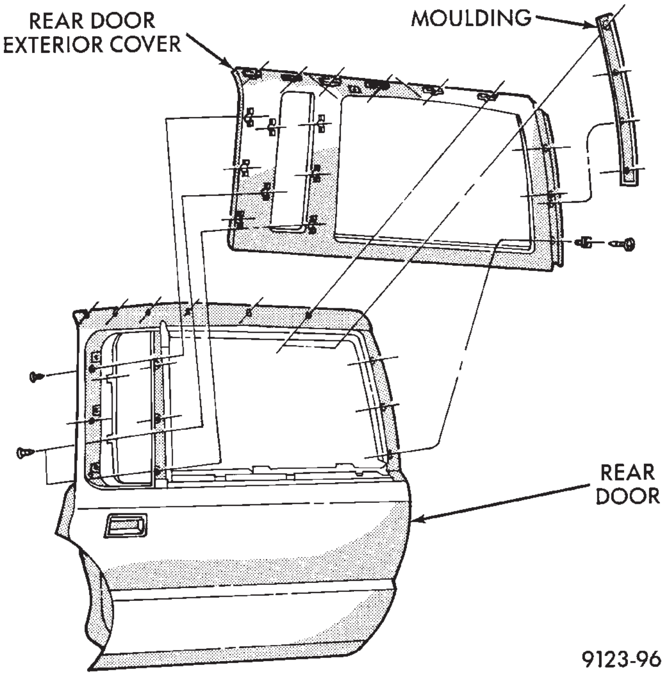


Fig. 21 Rear Door Outer Cover—AY-P Body

REAR DOOR FIXED WINDOW MODULE

REMOVAL (FIG. 22)

(1) Remove rear door trim panel.

(2) Remove rear door glass.

(3) Remove screws and bolts holding rear door fixed glass module to door.

(4) Separate fixed glass module from door.

INSTALLATION

Reverse the preceding operation.

OVERHEAD CONSOLE

REMOVAL (FIG. 23)

(1) Remove screws holding overhead console to reinforcement bracket.

(2) Slide overhead console rearward to separate reinforcement bracket retainer tab from console.

(3) Lower console from roof and disconnect wire connectors.

INSTALLATION

Reverse The preceding operation.

HEAD LINING

REMOVAL (FIG. 24)

(1) Disconnect battery negative cable.

(2) Pull dome lamp downward to disengage from retaining ring in head lining. Separate lens from lamp body and remove bulb. Separate bulb holder from lamp body. Remove attaching screw holding retaining ring to roof bow, if equipped.

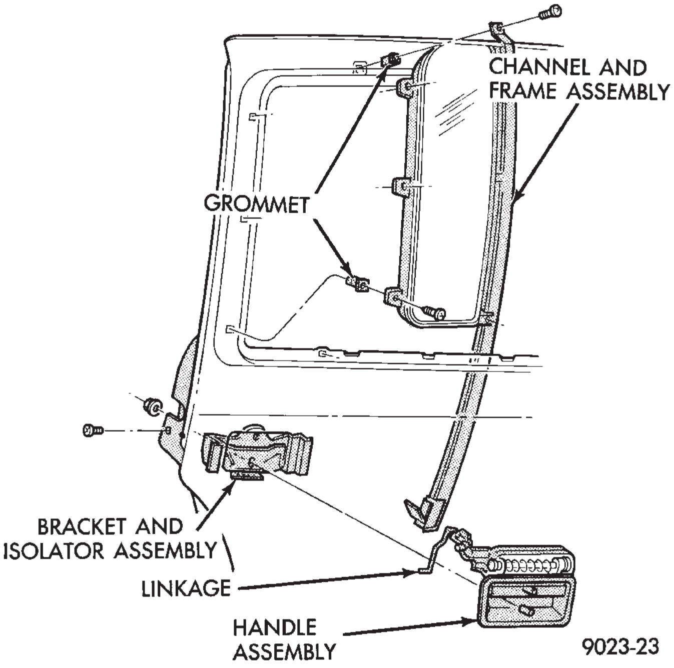


Fig. 22 Rear Door Fixed Window

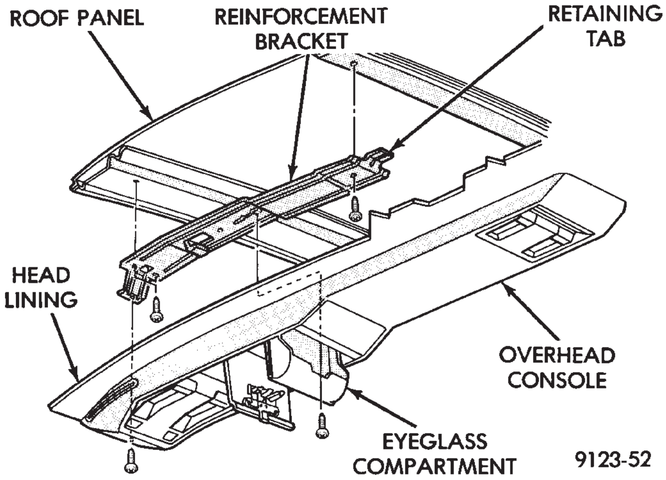


Fig. 23 Overhead Console

(3) Remove screws holding coat hooks to roof above rear doors.

(4) Remove roof rail and A-pillar mouldings.

(5) Remove screws holding sun visors to roof header and disconnect wire connector, if equipped. Remove inboard sun visor hangers.

(6) Remove overhead console, if equipped.

(7) Pull front reading lamp downward to disengage from retaining ring in head lining and disconnect wire connector. Remove screws holding retaining ring to roof header, if equipped.

(8) Remove pinch welt holding headlining to sun roof opening, if equipped.

(9) Remove inside rear view mirror from windshield bracket if necessary.

(10) Disengage hook and loop fasteners holding head lining to roof above rear window and slide head lining forward about 25 mm (1 in.).

(11) Shift the front of head lining to one side to pull head lining from behind B-pillar trim. Pull head lining from behind other B-pillar trim.

(12) Allow front of head lining to drop downward. Slide head lining forward from behind quarter panel trim.

(13) Remove head lining from vehicle.

INSTALLATION

Reverse the preceding operation.

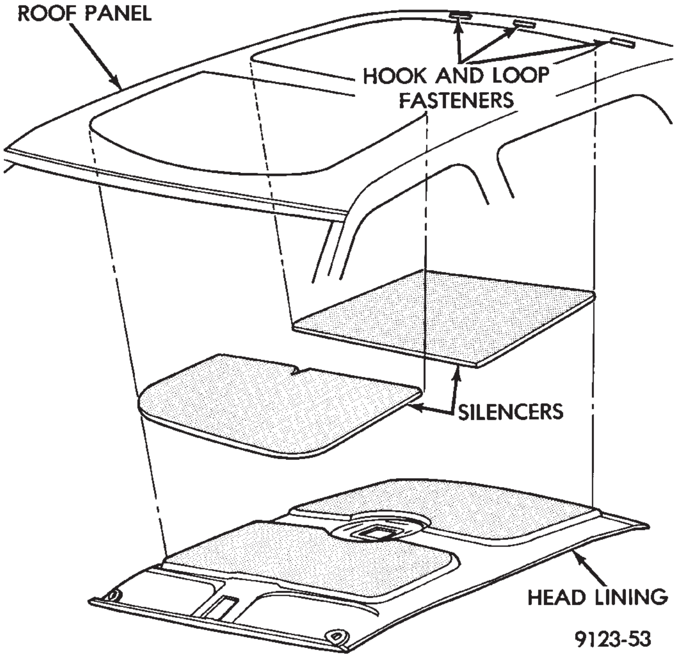


Fig. 24 Head Lining—Typical

COWL PANEL TRIM AND SCUFF PLATES

COWL PANEL AND DOOR OPENING SCUFF PLATE REMOVAL (FIG. 25)

(1) Open front door.

(2) Remove screw holding trim panel to cowl, forward of the front door opening.

(3) Remove screws holding scuff plate to door sill.

(4) Separate cowl panel trim and scuff plate from vehicle.

COWL PANEL AND DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

REAR DOOR OPENING SCUFF PLATE REMOVAL (FIG. 25)

(1) Open rear door.

(2) Remove screws holding scuff plate to door sill.

(3) Separate scuff plate from vehicle.

REAR DOOR OPENING SCUFF PLATE INSTALLATION

Reverse the preceding operation.

A-PILLAR AND ROOF RAIL MOULDINGS

A-PILLAR MOULDING REMOVAL (FIG. 25)

(1) Open front door.

(2) Disengage clips holding A-pillar moulding to roof rail above door opening.

(3) Remove push-in fastener holding lower A-pillar trim to pillar.

(4) Slide A-pillar moulding upward and pull rearward to separate moulding from A-pillar.

A-PILLAR MOULDING INSTALLATION

Reverse the preceding operation.

REAR DOOR ROOF RAIL MOULDING REMOVAL (FIG. 25)

(1) Open rear door.

(2) Disengage clips holding roof rail moulding to roof rail above rear door opening.

(3) Separate moulding from vehicle.

REAR DOOR ROOF RAIL MOULDING INSTALLATION

Reverse the preceding operation.

B-PILLAR TRIM PANEL

REMOVAL (FIG. 25)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to B-pillar.

(3) Remove bolt holding seat belt to floor below B-pillar.

(4) Remove screws holding upper B-pillar trim to pillar and separate trim from pillar.

(5) Remove screws holding lower b-pillar trim to pillar and separate trim from pillar.

INSTALLATION

Reverse the preceding operation.

QUARTER TRIM PANEL

REMOVAL (FIG. 25)

(1) Remove roof rail mouldings and scuff plates as necessary.

(2) Remove shoulder harness turning loop cover. Remove bolt holding turning loop to quarter panel.

(3) Remove rear seat cushion and back.

(4) Remove fastener holding quarter trim to roof rail.

(5) Remove screws holding quarter trim panel to wheelhouse kickup.

(6) Pull trim panel forward and separate from vehicle.

(7) Remove bolt holding lap belt anchor to floor and push end of belt through access hole in trim panel.

INSTALLATION

Reverse the preceding operation.

REAR SHELF TRIM PANEL

REMOVAL (FIG. 25)

(1) Remove one quarter trim panel.

(2) Remove center high mounted stop lamp cover. Refer to Group 8L, Lamps for instructions.

(3) Disengage clips holding trim to shelf panel and separate trim from vehicle.

INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 26)

(1) Remove B-pillar trim panel.

(2) Remove bolt holding seat belt retractor to B-pillar.

(3) Separate retractor from vehicle.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 26)

Vehicles equipped with front bucket seats with center console do not have center occupant belts.

(1) Remove bolt holding inboard buckle/center occupant belt to floor.

(2) Disconnect seat belt sensor wire connector.

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

REAR SEAT BELTS

OUTBOARD SHOULDER HARNESS/LAP BELT REMOVAL (FIG. 27)

(1) Remove quarter trim panel.

(2) Remove bolt holding lap belt to floor at wheelhouse kickup.

(3) Remove bolt holding turning loop to inner quarter panel.

(4) Remove bolt holding seat belt retractor to quarter panel.

OUTBOARD SHOULDER HARNESS/LAP BELT INSTALLATION

Reverse the preceding operation.

INBOARD BUCKLE/CENTER OCCUPANT BELTS REMOVAL (FIG. 27)

(1) Remove rear seat cushion.

(2) Remove bolt holding inboard buckle/center occupant belt to floor.

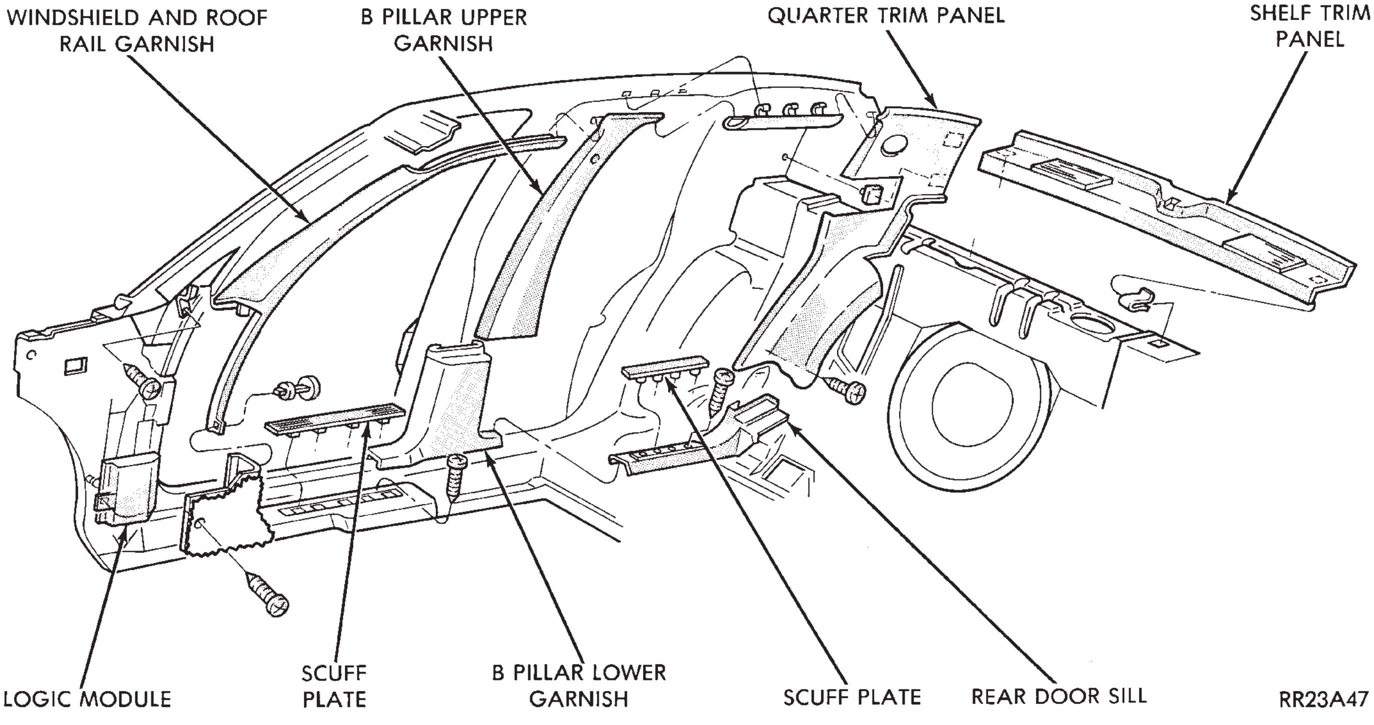


Fig. 25 Interior Mouldings, Panels, and Trim Covers

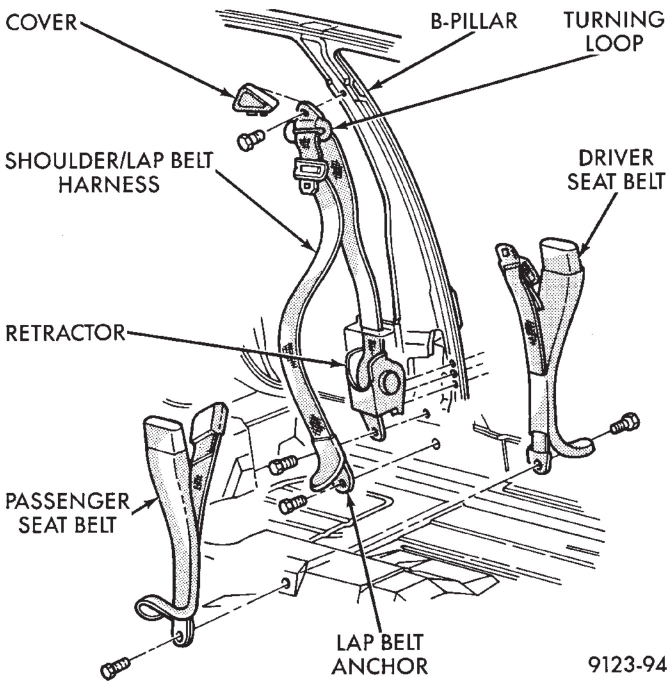


Fig. 26 Front Seat Belts

(3) Separate buckle/belt assembly from vehicle.

INBOARD BUCKLE/CENTER OCCUPANT BELT INSTALLATION

Reverse the preceding operation.

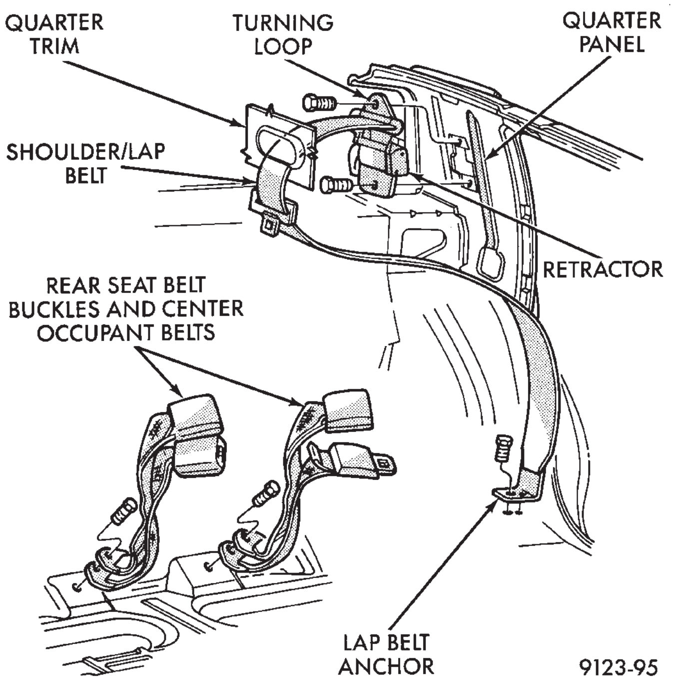


Fig. 27 Rear Seat Belts

FRONT SEATS

REMOVAL (FIG. 28 OR 29)

(1) Position seat full forward.

(2) Remove screws holding rear track riser covers and separate covers from tracks.

(3) On power seat track, remove outboard track cover.

(4) Remove inboard seat belt attaching bolt from floor.

(5) Remove nuts holding seat track to floor.

(6) Position seat full rearward.

(7) Remove door sill scuff plate and disconnect power seat track wire connector.

(8) Remove bolts holding seat track to cross member.

(9) Remove seat from vehicle.

INSTALLATION

Reverse the preceding operation.

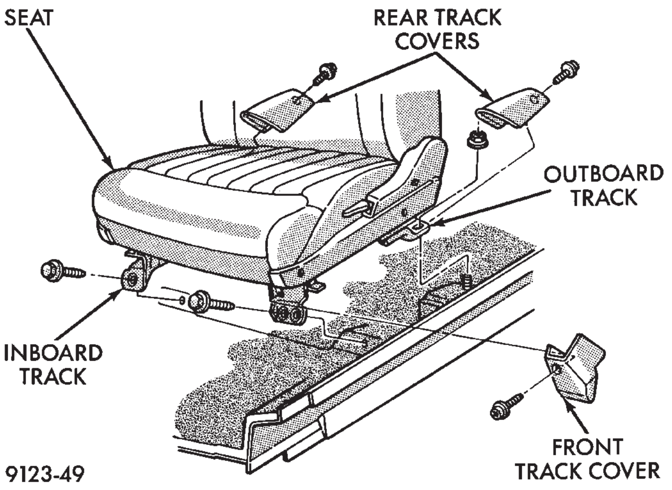


Fig. 28 Manual Front Seat—Typical

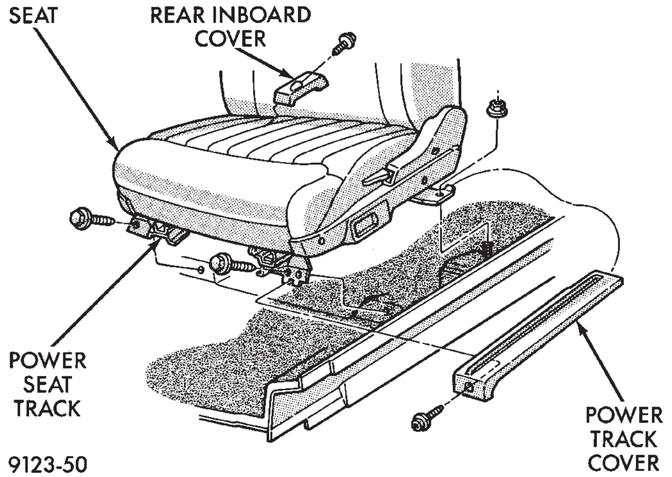


Fig. 29 Power Front Seat—Typical

REAR SEATS

REAR SEAT CUSHION REMOVAL

(1) Remove bolts holding cushion to floor.

(2) Disconnect center occupant seat belts from cushion.

(3) Remove cushion from vehicle.

REAR SEAT CUSHION INSTALLATION

Reverse the preceding operation.

REAR SEAT BACK REMOVAL

(1) Remove rear seat cushion assembly.

(2) Remove bolts holding seat back to rear floor kick-up.

(3) Lift seat back upward to disengage upper hooks from shelf support panel.

(4) Separate seat back from vehicle.

REAR SEAT BACK INSTALLATION

Reverse the preceding operation.

BODY MOULDINGS

STICK-ON BODY SIDE MOULDING REMOVAL AND INSTALLATION

(1) Warm the effected stick-on moulding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(2) Pull stick-on moulding from painted surface.

(3) Remove adhesive tape residue from painted surface of vehicle.

(4) If moulding is to be reused, Remove tape residue from moulding. Clean back of moulding with Mopar, Super Kleen solvent or equivalent. Wipe moulding dry with lint free cloth. Apply new body side moulding (two sided adhesive) tape to back of moulding.

(5) Clean body surface with Mopar, Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(6) Apply a length of masking tape on the body, parallel to the top edge of the moulding to use as a guide, if necessary.

(7) Remove protective cover from tape on back of moulding. Apply moulding to body below the masking tape guide.

(8) Remove masking tape guide and heat body and moulding, see step one. Firmly press moulding to body surface to assure adhesion.

FRONT WHEEL OPENING MOULDING REMOVAL

(1) Remove screws holding wheel opening moulding to front fender.

(2) Separate moulding from fender.

FRONT WHEEL OPENING MOULDING INSTALLATION

(1) Position moulding in wheel opening and start top center screw of wheel opening moulding.

(2) Install screws around wheel opening.

REAR WHEEL OPENING MOULDING REMOVAL

(1) Remove screws holding wheel opening moulding to quarter panel.

(2) Separate wheel opening moulding from quarter panel.

REAR WHEEL OPENING MOULDING INSTALLATION

(1) Position moulding in wheel opening and start top center screw of wheel opening moulding.

(2) Install screws around wheel opening.

VINYL ROOF BONNET

REMOVAL (FIG. 30)

(1) Remove quarter panel trim covers.

(2) Remove head lining.

(3) Remove nuts holding transverse roof moulding to roof panel and separate moulding from vehicle.

(4) Remove nuts holding vinyl top bonnet to roof.

(5) Remove rear deck filler panel.

(6) Remove screws holding rear window opening lower valance to body.

(7) Disengage clips holding vinyl top bonnet to quarter panel.

(8) Pull vinyl top bonnet away from top panel to separate bonnet from anti-flutter sealer holding bonnet to roof.

INSTALLATION

(1) Clean anti-flutter sealer from roof surface and inside of vinyl roof bonnet.

(2) Apply a 20 mm (0.75 in.) bead of anti-flutter sealer across the roof panel at the mid point between the front of the bonnet and rear of roof.

(3) Apply a 20 mm (0.75 in.) by 150 mm (6 in.) bead of anti-flutter sealer down each roof side panel at mid point between the door opening and rear of roof.

(4) Place the bonnet into position on the roof panel and align to proper fit.

(5) Reverse the removal operation.

REAR DECK FILLER PANEL

REMOVAL (FIG. 31)

(1) Raise truck lid to full up position.

(2) Remove screws holding rear deck filler panel to body in the front trunk opening gutter.

(3) Close trunk lid, do not latch.

(4) Lift filler panel upward and separate from vehicle.

INSTALLATION

Reverse the preceding operation.

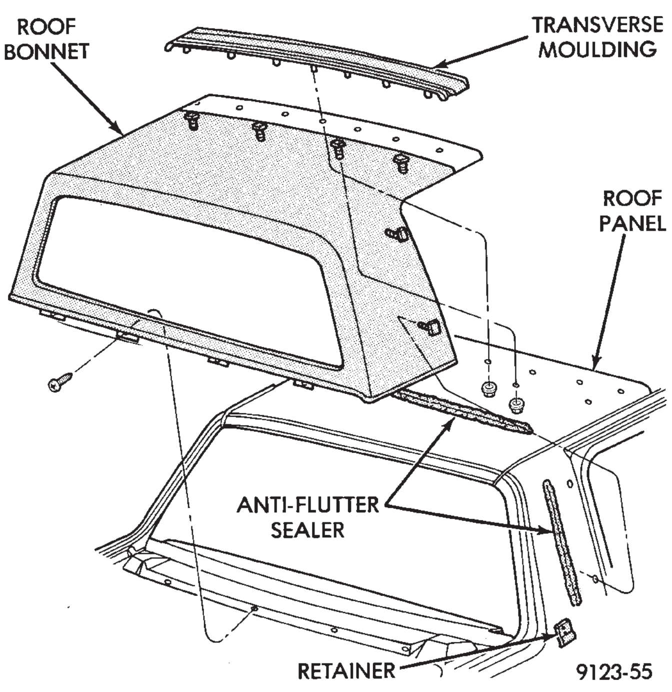


Fig. 30 Vinyl Roof Bonnet—Typical

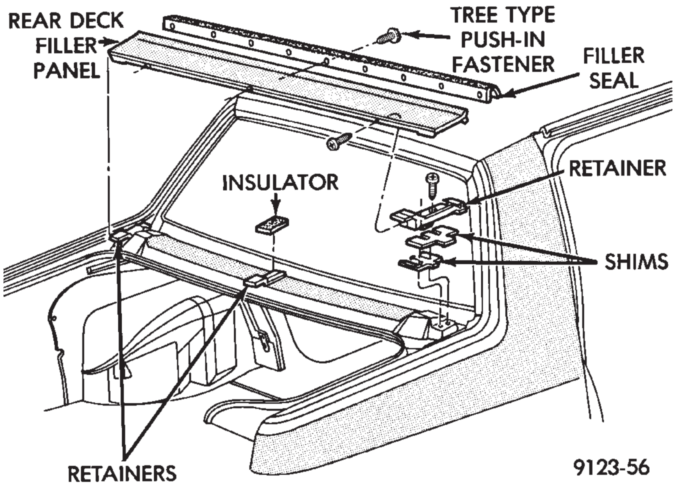


Fig. 31 Rear Deck Filler Panel—Typical

REAR WINDOW GLASS

REMOVAL (FIG. 32)

(1) Remove rear deck filler panel.

(2) Remove interior trim as necessary to gain access to rear window defogger wire connector and ground screw, if equipped.

(3) Remove vinyl roof bonnet, if equipped.

WARNING: WEAR EYE AND HAND PROTECTION WHEN HANDLING SAFETY GLASS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not damage body or trim finish when cutting out glass or applying fence primer.

(4) Cut the urethane around the perimeter of the back window glass. Refer to Windshield section of this group for proper procedures.

(5) Separate the rear window from the vehicle.

INSTALLATION

(1) Prepare the work area, window fence, and glass the same way as described in the Windshield section of this group.

(2) Place fence spacers at the locations shown (Fig. 32).

(3) Apply a 10 mm (0.4 in.) bead of urethane around the perimeter of the glass.

(4) Install the glass in the same manner described in the Windshield section of this group.

(5) Install roof bonnet.

(6) Connect rear window defogger wiring. Install interior trim and rear deck filler panel.

(7) After urethane has cured, water test rear window to verify repair. Verify rear window defogger operation, see Group 8N, Rear Window Defogger.

TRUNK LID

REMOVAL (FIG. 33)

(1) Raise trunk lid to full up position.

(2) Disconnect the trunk lamp wire connector.

(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation. When installing trunk lid, align all marks and secure bolts. The trunk lid should be aligned to 4 mm (0.160 in.) gap to the quarter panels and flush across the top surfaces along quarter panels.

(4) Remove the top trunk lid to hinge attaching bolts and loosen the bottom bolts until they can be removed by hand.

(5) With assistance of a helper at the opposite side of the vehicle to support the trunk lid, remove the bottom trunk lid to hinge attaching bolts. Separate the trunk lid from the vehicle.

INSTALLATION

Reverse the preceding operation.

TRUNK LID HINGE

REMOVAL

(1) Remove rear deck filler panel.

(2) Disconnect trunk lid lift torsion bars from hinges.

(3) Mark all attaching bolt, nut, and component locations with a suitable marking device. Use marks as a reference when installing hinge.

(4) Remove bolts holding trunk lid to hinge.

(5) Remove nuts and bolts holding hinge to closure panel below rear window glass.

(6) Separate hinge from vehicle.

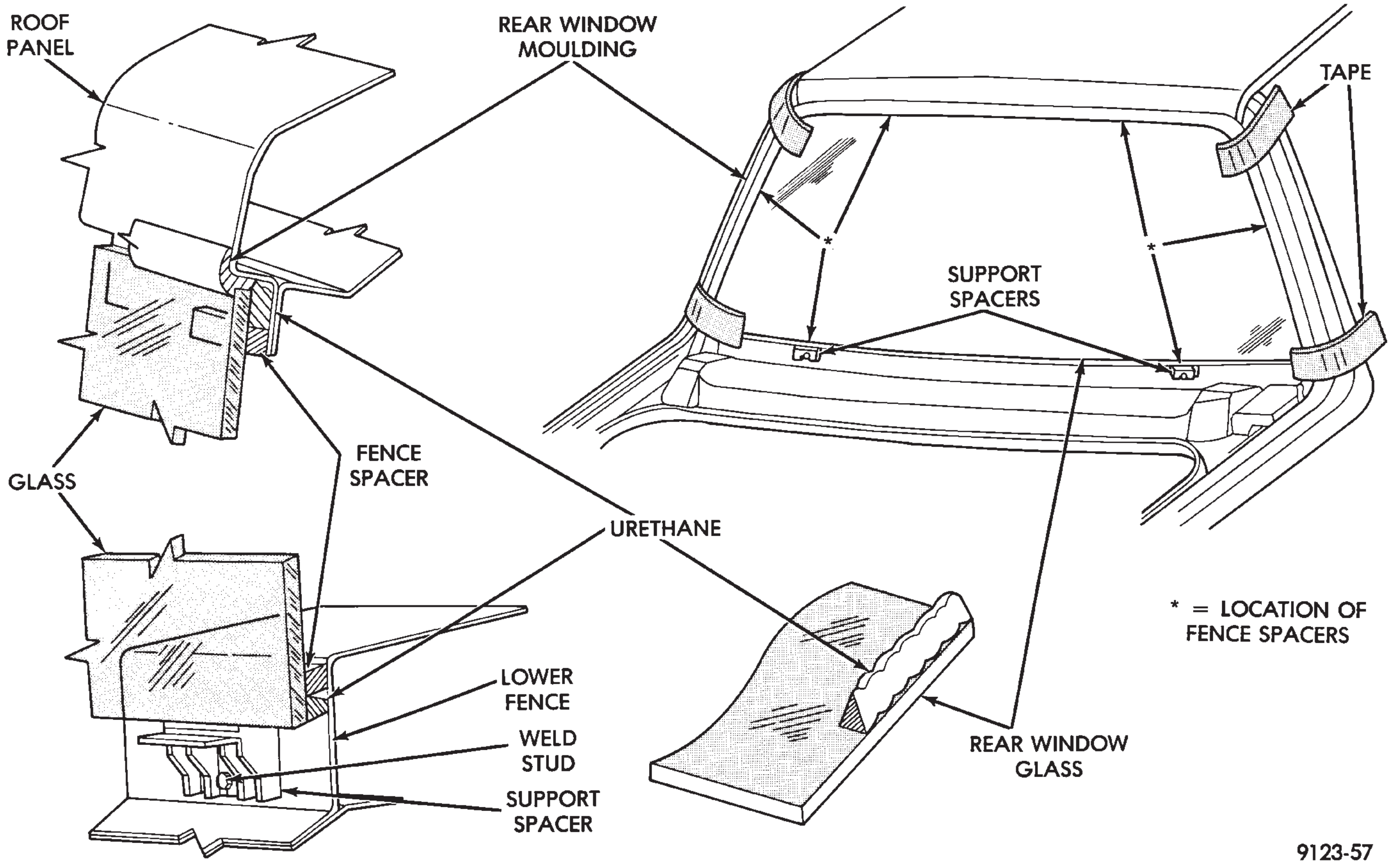


Fig. 32 Rear Window Glass—Typical

INSTALLATION

Reverse the preceding operation.

TRUNK LID TORSION BAR

REMOVAL

(1) Raise and support trunk lid in the full up position.

(2) Remove trunk lining as necessary to gain access to torsion bars.

(3) Disengage adjusting end torsion bar from the slot in the tension adjustment bracket.

(4) Pivot torsion bar out of lift arm swivel.

(5) Disconnect torsion bar from hinge.

INSTALLATION

Reverse the preceding operation.

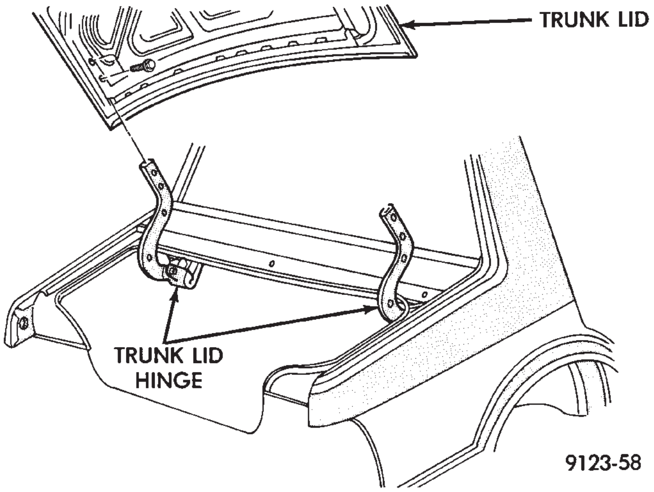


Fig. 33 Trunk Lid

HEATING AND AIR CONDITIONING

CONTENTS

GENERAL INFORMATION

INDEX

A/C SYSTEM IDENTIFICATION

The terms Fixed Displacement Compressor and Variable Displacement Compressor will be used to describe the two types of A/C systems used throughout this Group. Refer to (Figs. 1, 2, 3 and 4).

The Variable Displacement Compressor can be identified by the location of the high pressure line. It is mounted to the end of the compressor case (Fig. 4).

DESCRIPTION AND OPERATION

Both the heater and the heater/air conditioning systems share many of the same functioning 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. On heater only systems, the evaporator and recirculating air door are omitted (Fig. 5).

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 A/C-heater unit housing. On air conditioned vehicles, the air passes through the evaporator. Air flow can be directed either through or around the heater core. This

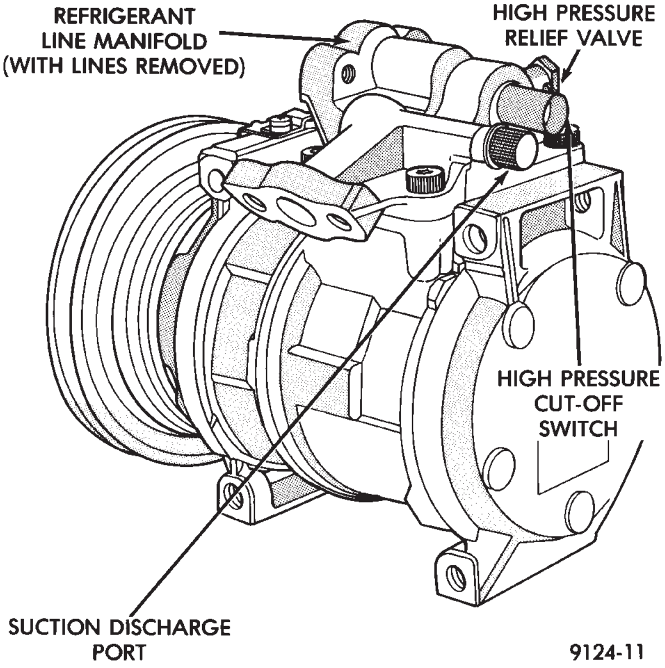


Fig. 1 Fixed Displacement Compressor—Model 10PA17

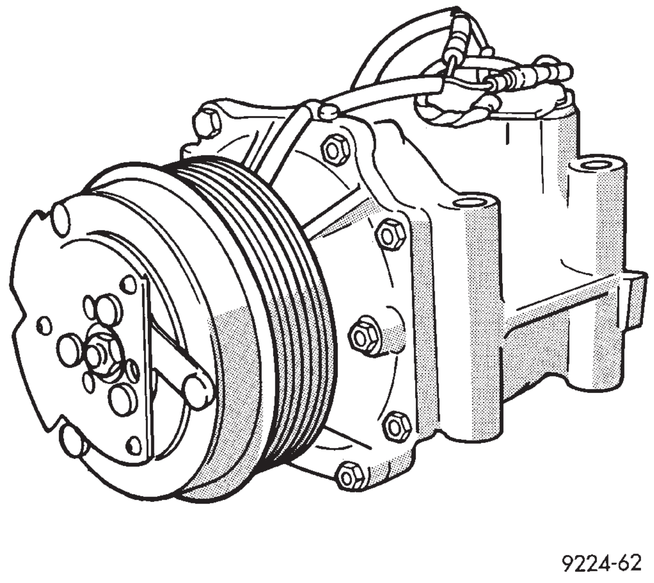


Fig. 2 Fixed Displacement Compressor—Model TR105

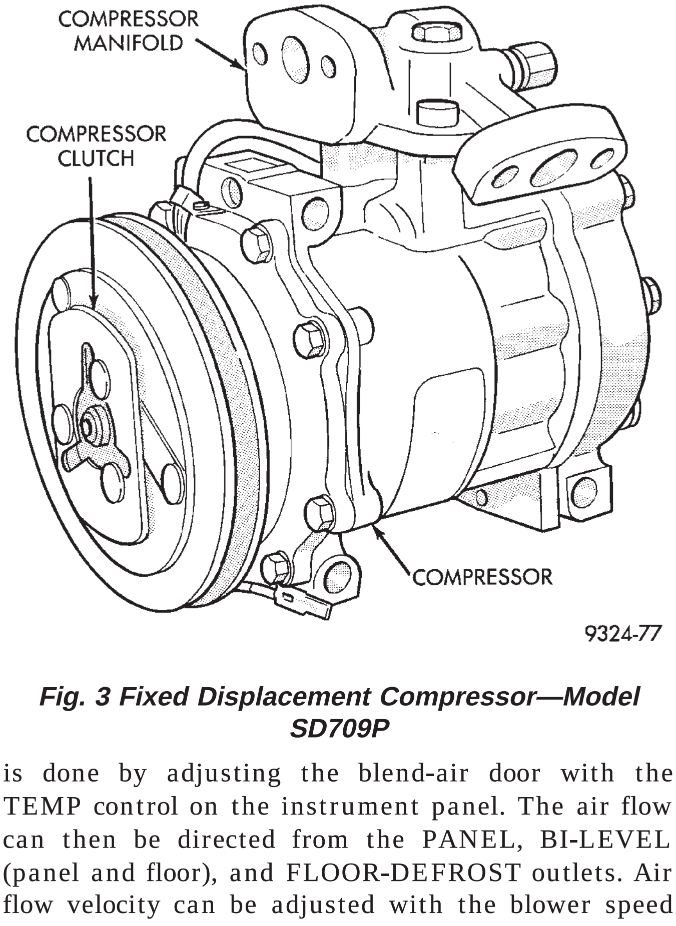


Fig. 3 Fixed Displacement Compressor—Model SD709P

is done by adjusting the blend-air door with the TEMP control on the instrument panel. The air flow can then be directed from the PANEL, BI-LEVEL (panel and floor), and FLOOR-DEFROST outlets. Air flow velocity can be adjusted with the blower speed selector switch on the instrument panel (Fig. 6).

On air conditioned vehicles, 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 moving the TEMP control into the RECIRC position. Depressing the DEFROST or A/C button will engage the compressor. This will send refrigerant through the evaporator, and will remove heat and humidity from the air before it is directed through or around the heater core.

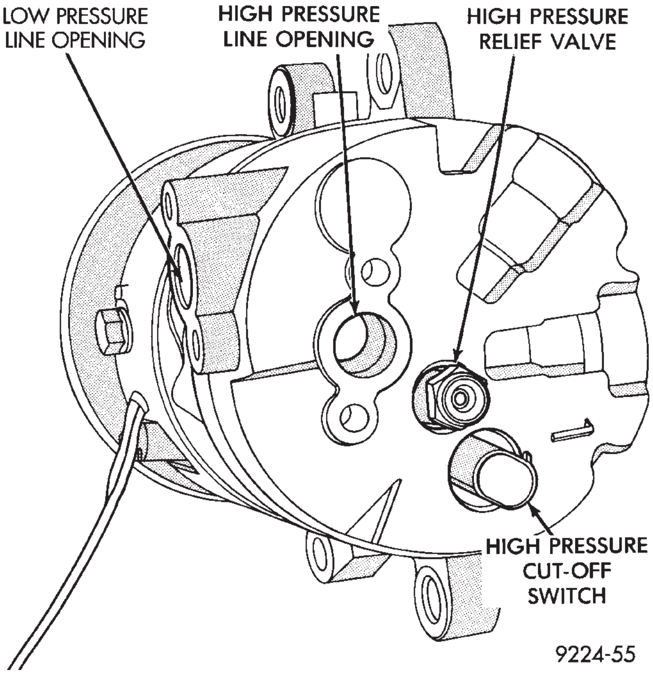


Fig. 4 Variable Displacement Compressor—Model 6C17

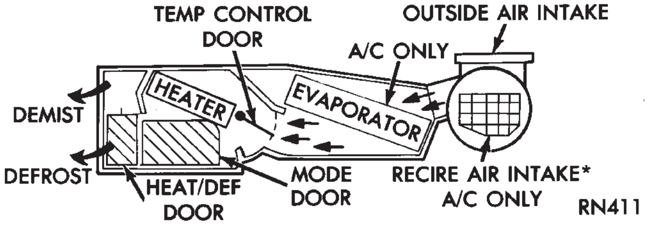


Fig. 5 Common Blend-Air Heater A/C System

SIDE WINDOW DEMISTERS

The side window demisters direct air from the heater assembly. The outlets are located on the top outboard corners of the instrument panel. The Demisters operate when the A/C control mode selector is on FLOOR or DEFROST setting.

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain the performance level of the heating/air conditioning system, the engine cooling system must be prepared as shown in this manual.

The use of a bug screen is not recommended. Any obstructions in front of the radiator or condenser can reduce the performance of the A/C or engine cooling system.

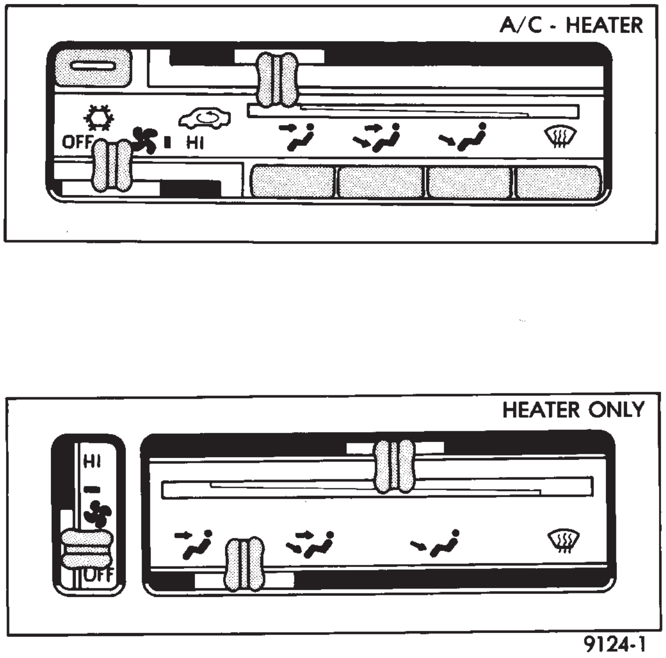


Fig. 6 Heater only or Heater—A/C Controls

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 (R-12) 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.

CAUTION: Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with equipment being used.

COOLING SYSTEM PRECAUTIONS

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT STORE IN OPEN OR UNMARKED CONTAINERS.

WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL.

KEEP OUT OF REACH OF CHILDREN AND PETS.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY CAN RESULT.

The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi). Allow the vehicle 15 minutes (or until a safe temperature and pressure are attained) before opening the cooling system. Refer to Group 7, Cooling System.

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.

The following precautions must be observed:

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, allow trapped pressure to bleed off very slowly.

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.

Unified plumbing connections with aluminum gaskets cannot be serviced with O-rings. These gaskets are not reusable and do not require lubrication before installing.

The use of correct wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings.

The A/C system will remain chemical stabile as long as pure-moisture-free R-12 and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This condition could cause operational troubles or even serious damage if present in more than very small quantities.

When it is necessary to open the refrigeration system, have everything needed to service the system ready. The system should not be left open any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance or dirt and moisture. All lines and components in parts stock 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.

VACUUM CONTROL SYSTEM DIAGNOSIS

GENERAL INFORMATION

Use an adjustable Vacuum Test Gauge (C-3707) and a suitable vacuum pump to test heater A/C control vacuum. With a finger placed over the end of test hose (Fig. 1), calibrate vacuum control valve on the test gauge to obtain -27 kPa (8 in. Hg.). Release and block the end of the test hose several times to verify vacuum setting.

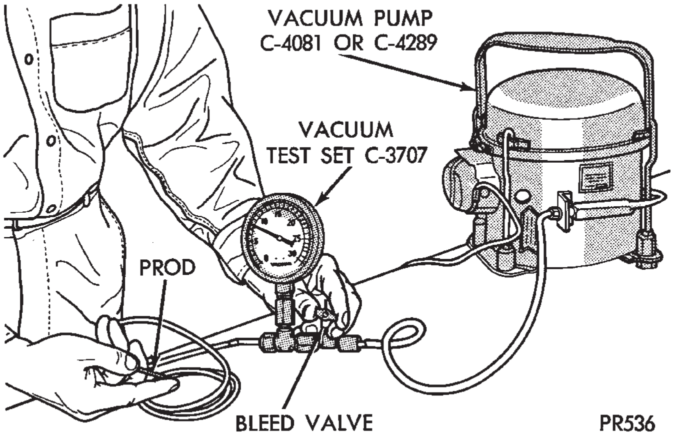


Fig. 1 Adjust Vacuum Test Bleed Valve

VACUUM TESTING THE ONE-WAY CHECK VALVE

(1) In the engine compartment, disconnect the Heater-A/C vacuum supply (black) hose. This hose passes through an opening in the dash panel used for the air conditioning expansion valve.

(2) Remove the vacuum check valve. This valve is located on the (black) vacuum supply hose at the brake power booster.

(3) Connect test vacuum supply hose to the **heater side** of the valve. In this direction the gauge should return to calibrated setting. If valve leaks vacuum in this direction, valve replacement is necessary.

(4) Connect test vacuum supply hose to the **engine vacuum side** of the valve. Vacuum should flow through valve.

VACUUM TESTING THE HEATER-A/C CONTROLS

(1) Connect the test vacuum prod to the vehicles (black) vacuum supply hose. Position vacuum test gauge so it can be viewed from the passenger compartment.

(2) Position the heater A/C control mode selector to DEFROST, FLOOR, BI-LEVEL, PANEL, and RECIRC (with A/C). Pause after each selection. The test gauge should return to the calibrated setting of -27 kPa (8 in. Hg.) after each selection is made. If the gauge cannot achieve the calibrated setting, a vacuum circuit or component has a leak.

LOCATING VACUUM LEAKS

To locate a vacuum leak, disconnect 7-way vacuum connector behind the instrument panel at the heater A/C control. For removal and installation of heater A/C control panel, refer to the Switch and Panel Component Service section of Group 8E, Instrument Panel. Connect the calibrated vacuum hose prod (Fig. 4) to each port in the vacuum harness connector (Fig. 2). The brown, bi-level, vacuum circuit has a metal fiber restrictive device located in the line. More reaction time is required for the test gauge to return to calibrated setting. After each connection is made, the test gauge should return to calibrated setting. If all circuits function properly, replace control mode vacuum switch. If not, determine the color of the vacuum circuit that is leaking. To determine vacuum line colors, refer to the Vacuum Circuits-Heater or Heater A/C Control chart in this section. Disconnect the vacuum actuator at the other end of the circuit. (Instrument panel removal may be necessary to gain access to some components). Block the end of the disconnected vacuum line. The test gauge should return to calibrated setting. If not, that circuit has a leak and must be repaired or replaced. If test gauge returns to calibrated setting, the vacuum actuator must be replaced.

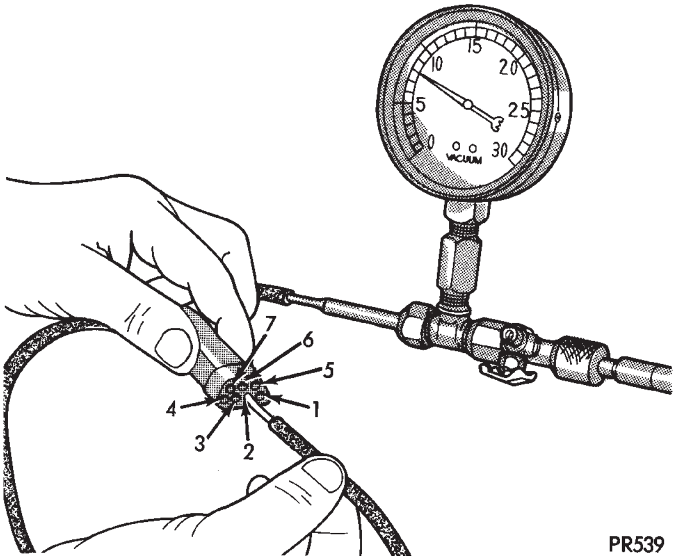
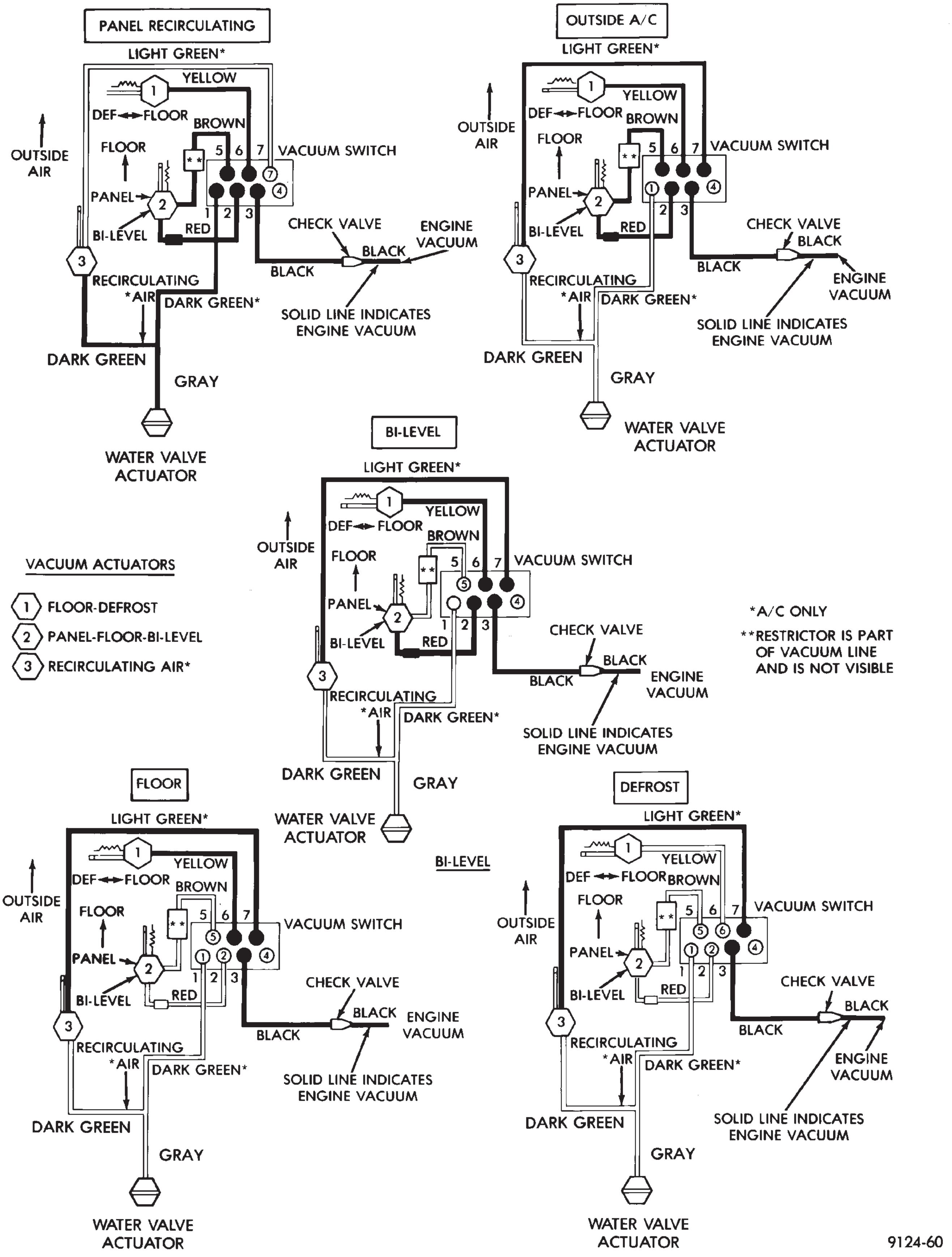


Fig. 2 Vacuum Circuit Test

VACUUM CIRCUITS—HEATER OR HEATER A/C CONTROL



HEATER AND A/C PERFORMANCE TESTS

HEATER OUTPUT TEST

PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings before performing the following procedures.

Check the radiator coolant level, drive belt tension, and engine vacuum line connections. Also check radiator air flow and radiator fan operation. Start engine and allow to warm up to normal operating temperature.

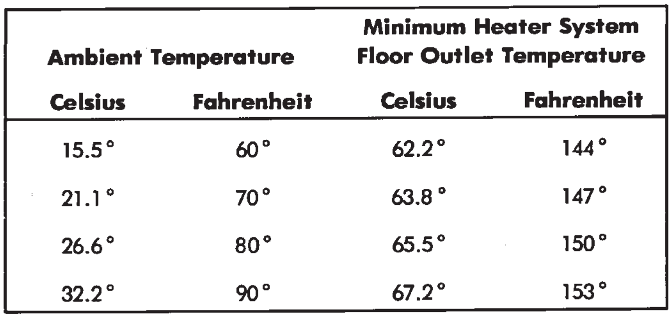
WARNING: DO NOT REMOVE RADIATOR CAP WHEN ENGINE IS HOT, PERSONAL INJURY CAN RESULT.

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 Temperature		Minimum Heater System 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°

9124-4

If the floor outlet air temperature is low, refer to Group 7, Cooling System for coolant temperature specifications. Both heater hoses should be HOT to the touch. The 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

(a) Pinched or kinked heater hoses.
(b) Improper heater hose routing.
(c) Plugged heater hoses or supply and return ports at cooling system connections, refer to Group 7, Cooling System.
(d) Plugged heater core.

If proper coolant flow through heater system is verified and outlet air temperature is still low, a mechanical problem may exist.

POSSIBLE LOCATION OR CAUSE OF INSUFFICIENT HEAT

(a) Obstructed cowl air intake.
(b) Obstructed heater system outlets.
(c) Blend-air door not functioning properly.

TEMPERATURE CONTROL

If temperature cannot be adjusted with the TEMP lever on the control panel, or TEMP lever is difficult to move, the following could require service:

(a) Blend-air door binding.
(b) Control cables miss-routed, pinched, kinked, or disconnected.
(c) Improper engine coolant temperature.

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 behind the instrument panel, 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 A/C system will be less effective than during periods of high heat and low humidity. 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 before proceeding with this procedure. Air temperature in test room and on vehicle must be 70°F (21°C) minimum for this test.

(1) Connect a tachometer and manifold gauge set.

(2) Set control to A/C, RECIRC, PANEL, or MAX A/C, temperature lever on full cool and blower on high.

(3) Start engine and hold at 1000 rpm with A/C clutch engaged.

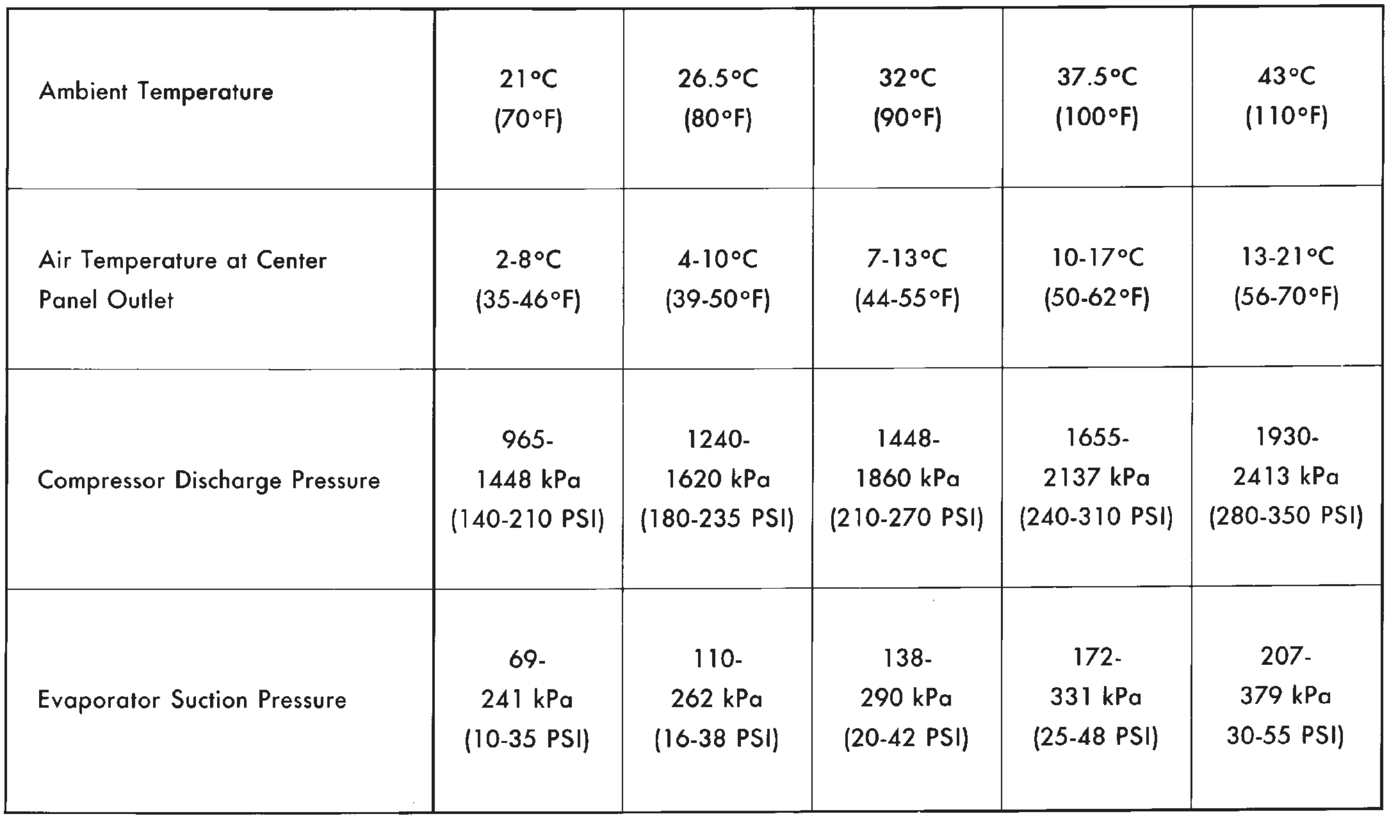
(4) Engine should be warmed up with doors and windows closed.

(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.

(7) If the discharge air temperature is low, refer to the Diagnostic Analysis Charts in this Group.

A/C PERFORMANCE TEMPERATURES



Ambient Temperature	21°C (70°F)	26.5°C (80°F)	32°C (90°F)	37.5°C (100°F)	43°C (110°F)
Air Temperature at Center Panel Outlet	2-8°C (35-46°F)	4-10°C (39-50°F)	7-13°C (44-55°F)	10-17°C (50-62°F)	13-21°C (56-70°F)
Compressor Discharge Pressure	965- 1448 kPa (140-210 PSI)	1240- 1620 kPa (180-235 PSI)	1448- 1860 kPa (210-270 PSI)	1655- 2137 kPa (240-310 PSI)	1930- 2413 kPa (280-350 PSI)
Evaporator Suction Pressure	69- 241 kPa (10-35 PSI)	110- 262 kPa (16-38 PSI)	138- 290 kPa (20-42 PSI)	172- 331 kPa (25-48 PSI)	207- 379 kPa 30-55 PSI)

9124-26

REFRIGERANT SERVICE PROCEDURES

INDEX

SIGHT GLASS REFRIGERANT LEVEL INSPECTION

The filter-drier is equipped with a sight glass (Fig. 1) that is used as a refrigerant level indicator only. **This sight glass is not to be used for A/C performance testing.** To check the refrigerant level remove the vehicle jack. Then clean the sight glass, start and warm up engine, and hold rpm slightly above idle (1100 rpm). Place the air conditioning control on A/C, RECIRC and high blower. The work area should be at least 21°C (70°F). If a Fixed Displacement type compressor does not engage, the refrigerant level is probably too low for the Low Pressure Cut-Off switch to detect. Or, with a Variable Displacement compressor, for the Differential Pressure Cut-off to detect. If compressor clutch does not engage, test the refrigerant system for leaks. If compressor clutch engages, allow approximately one minute for refrigerant to stabilize. View refrigerant through sight glass. The suction line should be cold to the touch and the sight glass should be clear.

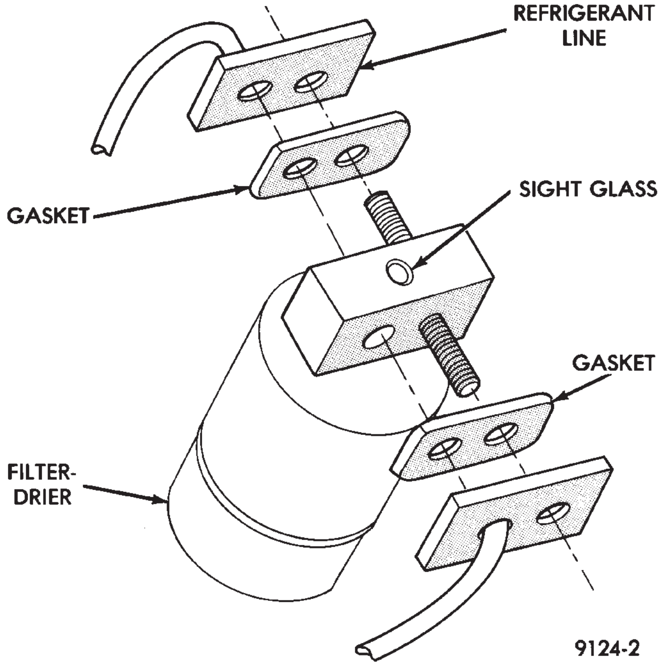


Fig. 1 Filter Drier and Sight Glass

If foam or bubbles are visible in sight glass, the refrigerant level is probably low. Occasional foam or bubbles are normal when the work area temperature is above 43°C (110°F) or below 21°C (70°F). If suction line is cold and occasional bubbles are visible in the sight glass, block the condenser air flow. This will increase the compressor discharge pressure. **Do not allow engine to over heat.** Bubbles should dissipate. If not, the refrigerant level is low.

CAUTION: Do not allow engine to over heat while blocking the condenser air flow.

WARNING: R-12 REFRIGERANT IS DETRIMENTAL TO THE ENVIRONMENT WHEN RELEASED TO THE ATMOSPHERE. DO NOT ADD R-12 REFRIGERANT TO A SYSTEM THAT HAS A KNOWN LEAK.

The refrigerant system will not be low on (R-12) unless there is a leak. Find and repair the leak before charging.

R-12 REFRIGERANT EQUIPMENT

WARNING: EYE PROTECTION MUST BE USED WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED BEFORE PROCEEDING WITH THIS OPERATION. PERSONNEL INJURY CAN RESULT.

When servicing an air conditioning system, an A/C charging station is recommended (Fig. 2). An (R-12) refrigerant recovery/recycling device (Fig. 3) should also be used. This device should meet SAE standards. Contact an automotive service equipment supplier for refrigerant recycling/recovering equipment. Refer to the operating instructions provided with the equipment for proper operation.

A manifold gauge set (Fig. 4) must also be used in conjunction with the charging and/or recovery/recycling device. The service hoses on the gauge set being used should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant from being release into the atmosphere.

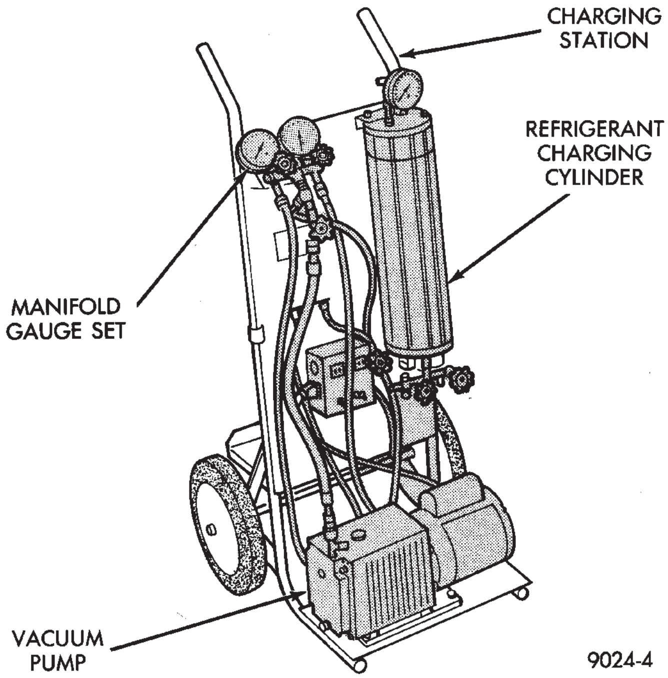


Fig. 2 Refrigerant Charging Station—Typical

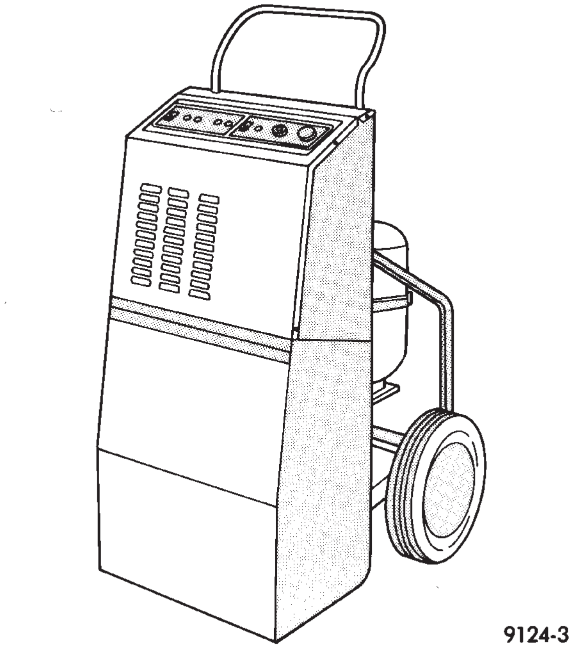


Fig. 3 Refrigerant Recovery/Recycling Station—Typical

REFRIGERANT RECYCLING

(R-12) refrigerant is a chlorofluorocarbon (CFC) that can contribute to the depletion of the ozone layer in the upper atmosphere. To help protect the ozone layer, an R-12 recycling device must be used. Contact an automotive service equipment supplier for refrigerant recycling equipment. Refer to the operating instructions provided with the recycling equipment for proper operation.

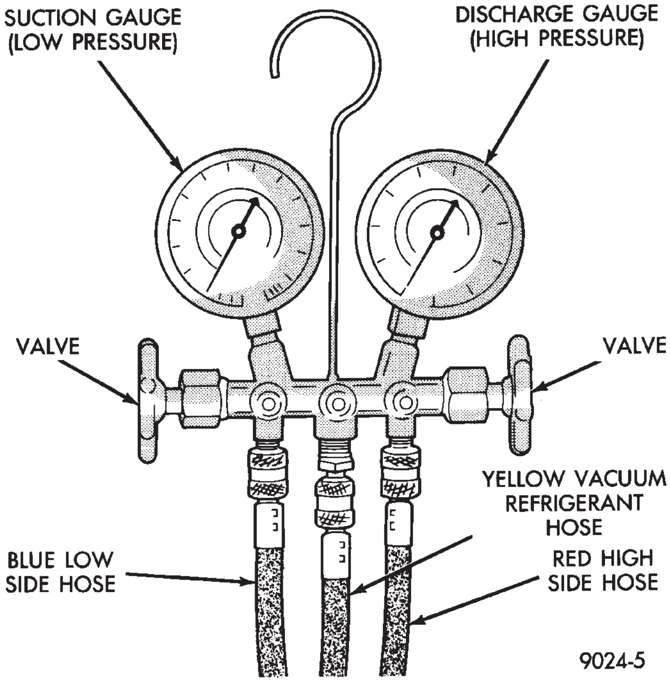


Fig. 4 Manifold Gauge Set—Typical

MANIFOLD GAUGE SET CONNECTIONS

GENERAL INFORMATION

The high pressure (discharge) (RED) hose should be attached to the 1/4 in. discharge service port. This port is located on the discharge line between the A/C compressor and the condenser, or on the high pressure (liquid) line.

The low pressure (suction) (BLUE) hose should be attached to the 3/8 in. suction service port. This port is located on the air conditioning compressor, or the suction line between the expansion valve and the compressor.

SUCTION (LOW PRESSURE) GAUGE CONNECTION

(1) Remove the service port cap from 3/8 in. suction service port.

(2) Check all valves on the equipment being used to verify they are closed.

(3) Inspect the hose gasket in the service port connector at the end of the (BLUE) hose. If the gasket is flawed, replace it.

(4) Thread the hose connector onto the service port. Quickly secure hose connector to the service port to avoid loosing refrigerant.

To disconnect suction gauge (BLUE) hose:

(a) Wrap the end of hose with a shop towel.

(b) Loosen the hose connector.

(c) Push and hold the end of hose toward the service port to keep the gasket in contact with service port.

(d) Quickly rotate the connector counterclockwise. When the hose connector is completely backed off, immediately point the end of hose toward floor, as possibly trapped refrigerant in the hose will be released.

(e) Install service port cap.

DISCHARGE (HIGH PRESSURE) GAUGE CONNECTION

(1) Remove the service port cap from the 1/4 in. service port.

(2) Check all valves on the equipment being used to verify they are closed.

(3) Inspect the hose gasket in the service port connector at the end of the (RED) hose. If the gasket is flawed, replace it.

(4) Use a suitable (3/8 in. male to 1/4 in. female) adapter (Fig. 5), threaded securely into the end of the (RED) hose connector.

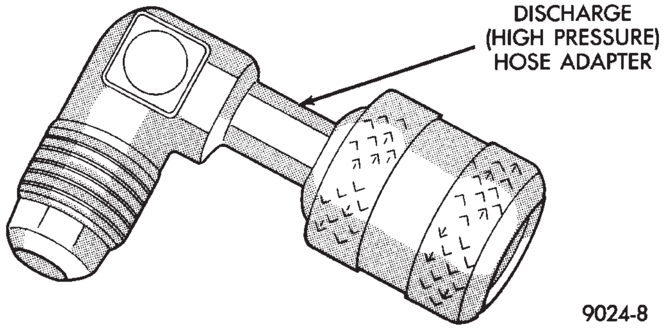


Fig. 5 Discharge Hose Adapter

(5) Thread the 1/4 in. hose adapter connector onto the service port. Quickly secure adapter connector to service port to avoid loosing refrigerant.

To disconnect the discharge gauge (RED) hose:

(a) Wrap the end of hose with a shop towel.

(b) Loosen the hose connector.

(c) Push and hold the end of hose toward the service port to keep the gasket in contact with service port.

(d) Quickly rotate the connector counterclockwise. When the hose connector is completely backed off, immediately point the end of hose toward floor, as possibly trapped refrigerant in the hose will be released.

(e) Install service port cap.

EVACUATION/RECOVERY/RECYCLING/CHARGING LINE CONNECTION

The center manifold (YELLOW) or (WHITE) hose is used to recycle, recover, evacuate, and charge the refrigerant system. When the discharge or suction valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose. **This hose should be attached to a R-12 Recovery/Recycling device. Refer to the Recovery/Recycling devices operators manual for procedures.**

For disconnection of this hose, refer to Disconnecting the Discharge Gauge (RED) hose in the preceding paragraphs.

TESTING FOR REFRIGERANT LEAKS

If the A/C system is not cooling properly, determine if the refrigerant system is fully charged with R-12. Follow the procedures in the Performance Test Procedures section of this Group. If the refrigerant system is empty or low in refrigerant charge, a leak at any line fitting or component seal is likely. To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

EMPTY REFRIGERANT SYSTEM LEAK TEST

CAUTION: Review Safety Precautions and Warnings in General Information section of this Group.

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible.

(2) Prepare a 10 oz. refrigerant (R-12) charge to be injected into the system. Refer to Charging Refrigerant System for instructions.

(3) Connect and dispense 10 ozs. of refrigerant into the evacuated refrigerant system.

(4) Proceed to step two of Low Refrigerant Level Leak Test.

LOW REFRIGERANT LEVEL LEAK TEST

Caution: Review Safety Precautions and Warnings in the General Information section of this group.

(1) Using the refrigerant level sight glass, determine if there is any (R-12) refrigerant in the system.

(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.

(4) With the engine not running, use an Electronic Leak Detector (or equivalent) and search for leaks. Fittings, lines, or components that appear to be oily usually will indicate a refrigerant leak. To inspect the evaporator core for leaks, it is possible to insert the leak detector probe into the recirculating air door opening (Fig. 6).

ADDING PARTIAL REFRIGERANT CHARGE

After all leaks have been corrected and it was not necessary to empty the refrigerant system, a partial refrigerant charge can be added.

CAUTION:Review all Safety Precautions and Warnings before attempting to add refrigerant to the system. Do not add refrigerant to a system that is known to have a leak.

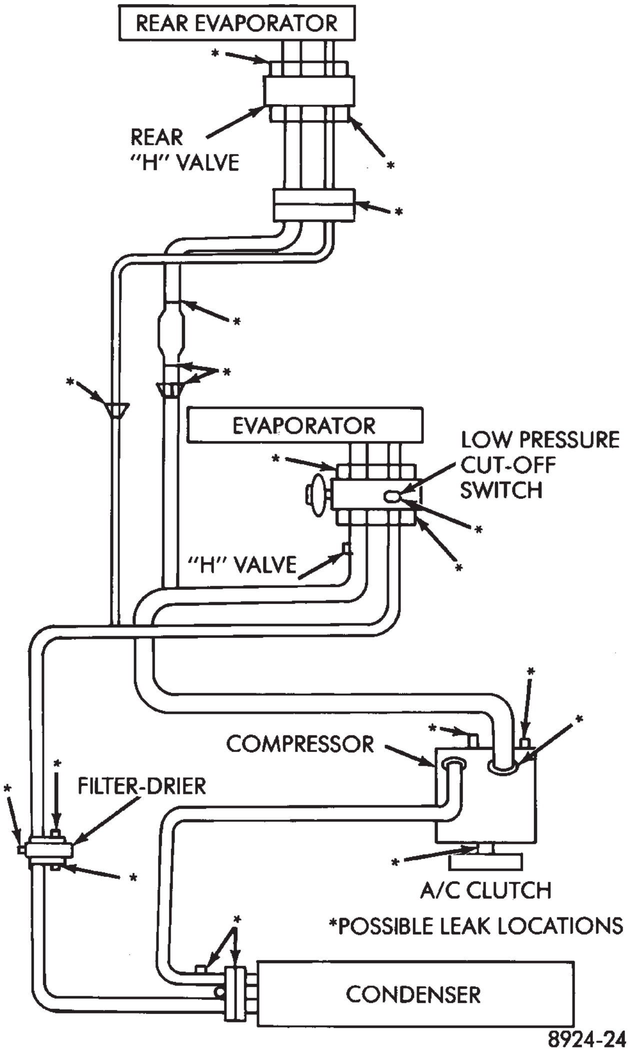


Fig. 6 Testing for A/C Leaks—Typical Front/Rear A/C System

(1) Attach manifold gauge set.

(2) Open the windows of the passenger compartment and set the air conditioning controls to A/C, RECIRC, and Low blower speed.

(3) Start the engine and allow it to warm up to normal running temperature.

(4) If the air conditioning compressor does not engage, disconnect the low pressure cut-off switch. Place a jumper wire across the terminals in the connector boot. If the compressor still does not engage, a problem exists in the compressor clutch feed circuit.

(6) Hold the engine speed at 1400 rpm.

(7) Following the instructions provided with the charging equipment being used. Charge through the suction side of the system. Use enough refrigerant to clear the sight glass in the filter drier.

(8) At the point when the sight glass clears, note the weight of the refrigerant supply drum or the level in the charging cylinder. Then add an additional 340 g (12 oz) of refrigerant to the system. Remove the jumper wire from the low pressure cut-off switch connector and connect the cut-off switch.

(9) Test the over all performance of the air conditioner as described in A/C Overall Performance Test in this Group. Close all valves on the charging equipment and disconnect the hoses from the service ports as described in the Manifold Gauge Set Connections section of this Group. Install the service port caps.

DISCHARGING REFRIGERANT SYSTEM

(R-12) refrigerant is a chlorofluorocarbon (CFC) that can contribute to the depletion of the ozone layer in the upper atmosphere. To help protect the ozone layer, an R-12 refrigerant recycling device must be used. Use this device when it is necessary to empty the refrigerant system. Contact an automotive service equipment supplier for refrigerant recycling equipment. Refer to the operating instructions provided with the recycling equipment for proper operation.

EVACUATING REFRIGERANT SYSTEM

If the A/C system has been open to the atmosphere, it must be evacuated before the system can be charged. 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:

(1) Connect a suitable charging station, refrigerant recovery machine, and a manifold gauge set with vacuum pump.

(2) Open the suction and discharge valves and start the vacuum pump. When the suction gauge reads -88 kPa (-26 in. Hg) vacuum or greater, 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. Then open the suction and discharge valves, and allow the system to evacuate an additional 10 minutes.

(3) Close all valves. Turn off and disconnect the vacuum pump.

The refrigerant system is prepared to be charged with refrigerant.

CHARGING REFRIGERANT SYSTEM—EMPTY SYSTEM

CAUTION: Do not over charge refrigerant system, as excessive compressor head pressure can cause noise and system failure.

WARNING: REVIEW SAFETY PRECAUTIONS AND WARNINGS BEFORE CHARGING THE REFRIGERANT SYSTEM.

After the system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system.

(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 = 907 g (32 oz.)
- With Rear A/C = 1219 g (43 oz.)

(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 refrigerant charge did not transfer from the dispensing device, start engine and hold at 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. Refer to Heater and A/C Performance Tests in this Group.

(7) Disconnect the charging station or manifold gauge set. Install the service port caps.

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.

The oil used in the compressor is a 500 SUS viscosity, wax-free 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, and then tightly capped after use to prevent contamination from dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with.

It will not be necessary to check oil level in the compressor or to add oil unless there has been an oil loss. This may be due to a ruptured line, shaft seal leakage, leakage from the evaporator, condenser leak, filter drier or loss of refrigerant due to a collision. Oil loss at a the leak point will be evident by the presence of a wet, shiny surface around the leak.

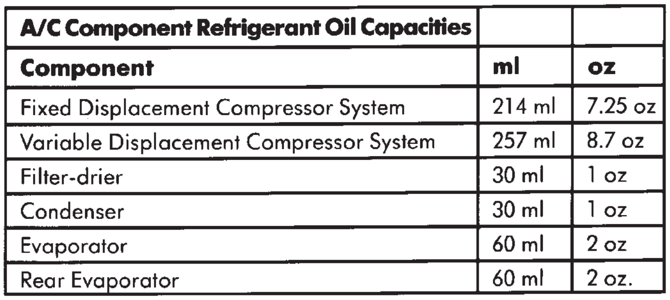
REFRIGERANT OIL LEVEL CHECK

When an A/C system is assembled at the factory, all components (except the compressor) are refrigerant oil free. After the system has been charged with R-12 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 refrigerant line or component has ruptured and it has released an unknown amount of oil. The A/C compressor should be removed and drained through the suction port. The filter-drier must be replaced along with the ruptured part. Then the oil capacity of the system (minus the amount of oil still in the remaining components) can be poured into the suction port of the compressor.

Example: The evaporator retains 60 ml (2 oz). The condenser retains 30 ml (1 oz) of oil, and system capacity may be 214 ml (7.25 oz) of oil.

214 ml minus 90 ml = 124 ml (4.25 oz).

REFRIGERANT OIL CAPACITIES



A/C Component Refrigerant Oil Capacities		
Component	**ml**	**oz**
Fixed Displacement Compressor System	214 ml	7.25 oz
Variable Displacement Compressor System	257 ml	8.7 oz
Filter-drier	30 ml	1 oz
Condenser	30 ml	1 oz
Evaporator	60 ml	2 oz
Rear Evaporator	60 ml	2 oz.

9124-61

VERIFY 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 oil capacity minus the capacity of components that have not been replaced. Refer to the Refrigerant Oil Capacity chart. Add oil through suction port on compressor.

(6) Install compressor, connect refrigerant lines, evacuate, and charge refrigerant system.

VARIABLE DISPLACEMENT COMPRESSOR—MODEL 6C17

INDEX

GENERAL INFORMATION

The Variable Displacement Compressor (VDC) provides maximum A/C performance under most conditions. It is designed to operate continuously without any cycling of the compressor clutch. The compressor has a variable angle wobble plate with six axially oriented cylinders.

During vehicle A/C system operation, the compressor will change its displacement to match the vehicles A/C cooling demands. When the A/C system needs more cooling capacity, the compressor will increase its pumping capacity. This is done by increasing the wobble plate angle to increase the piston stroke. When the A/C system cooling demand is low, the compressor will decrease its pumping capacity by reducing the piston pumping stroke. The low cooling capacity will prevent evaporator from freezing.

COMPRESSOR IDENTIFICATION

The Variable Displacement Compressor can be identified by the location of the high pressure line. It is mounted to the end of the compressor case (Fig. 1).

COMPRESSOR DIAGNOSIS

(1) Verify that refrigerant system is at full charge. Refer to the Refrigerant Service Procedures section in this Group.

(2) Perform A/C Performance Test. Refer to Heater and A/C Performance Test section in this Group.

(3) If performance is not acceptable, perform expansion valve tests. Refer to Expansion Valve Tests in this section.

(4) If expansion valve test is correct, refer to the Variable Displacement Compressor Diagnosis charts.

COMPRESSOR NOISE

Excessive noise that occurs when the air conditioning is being used, can be caused by:

- Loose bolts
- Mounting brackets
- Loose clutch
- Excessive high refrigerant system operating pressure

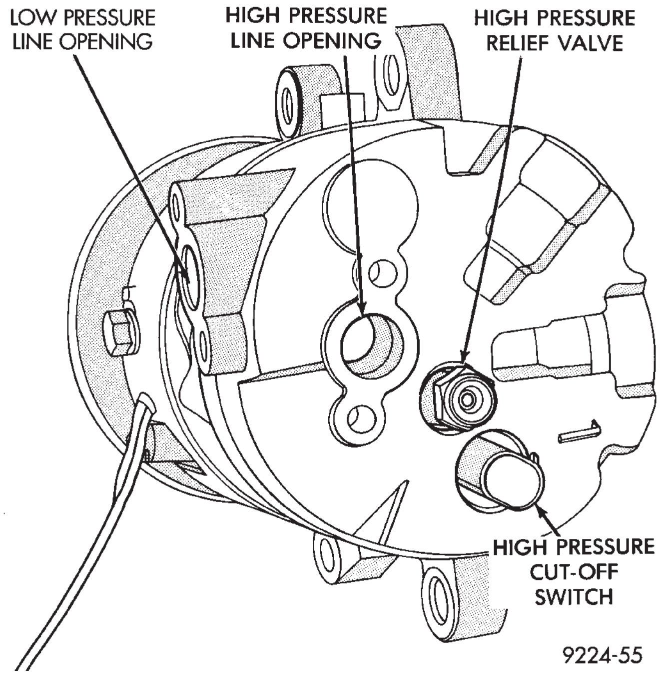


Fig. 1 Variable Displacement Compressor—Model 6C17

Verify compressor drive belt condition, proper refrigerant charge and head pressure before compressor repair is performed.

For noise diagnostic procedures, refer to the Compressor Noise and Compressor Clutch Diagnosis chart in this section.

COMPRESSOR CLUTCH INOPERATIVE

The air conditioning compressor clutch electrical circuit is controlled by the engine controller. The controller is located in the engine compartment outboard of the battery.

If the compressor clutch does not engage:

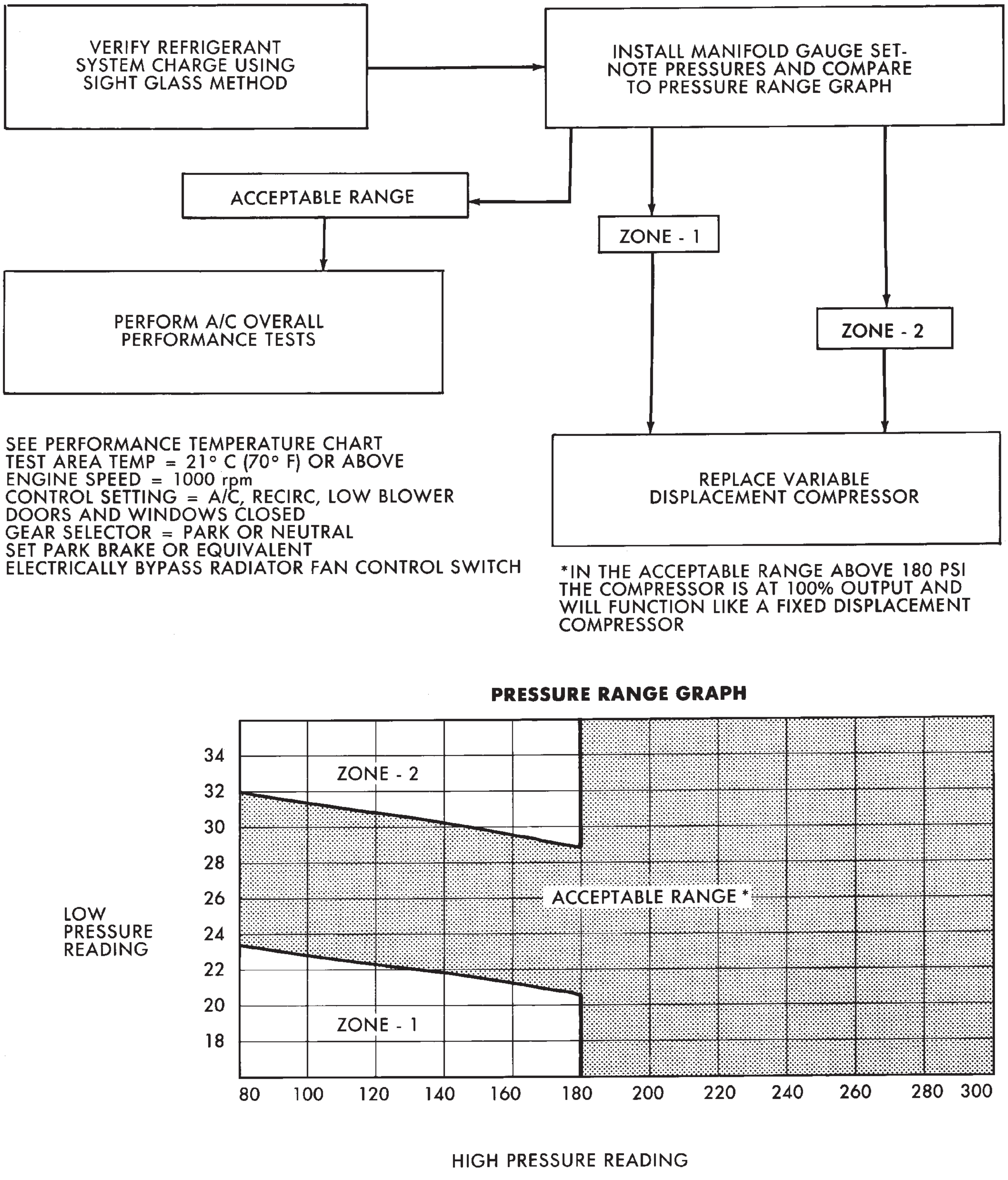
Verify refrigerant charge. Refer to Refrigerant Service Procedures in this section.

If the compressor clutch still does not engage:

Check for battery voltage at the differential pressure cut-off switch located on the expansion valve. If voltage is not detected, refer to:

(1) Group 8W, Wiring Diagrams.

VARIABLE DISPLACEMENT COMPRESSOR DIAGNOSIS

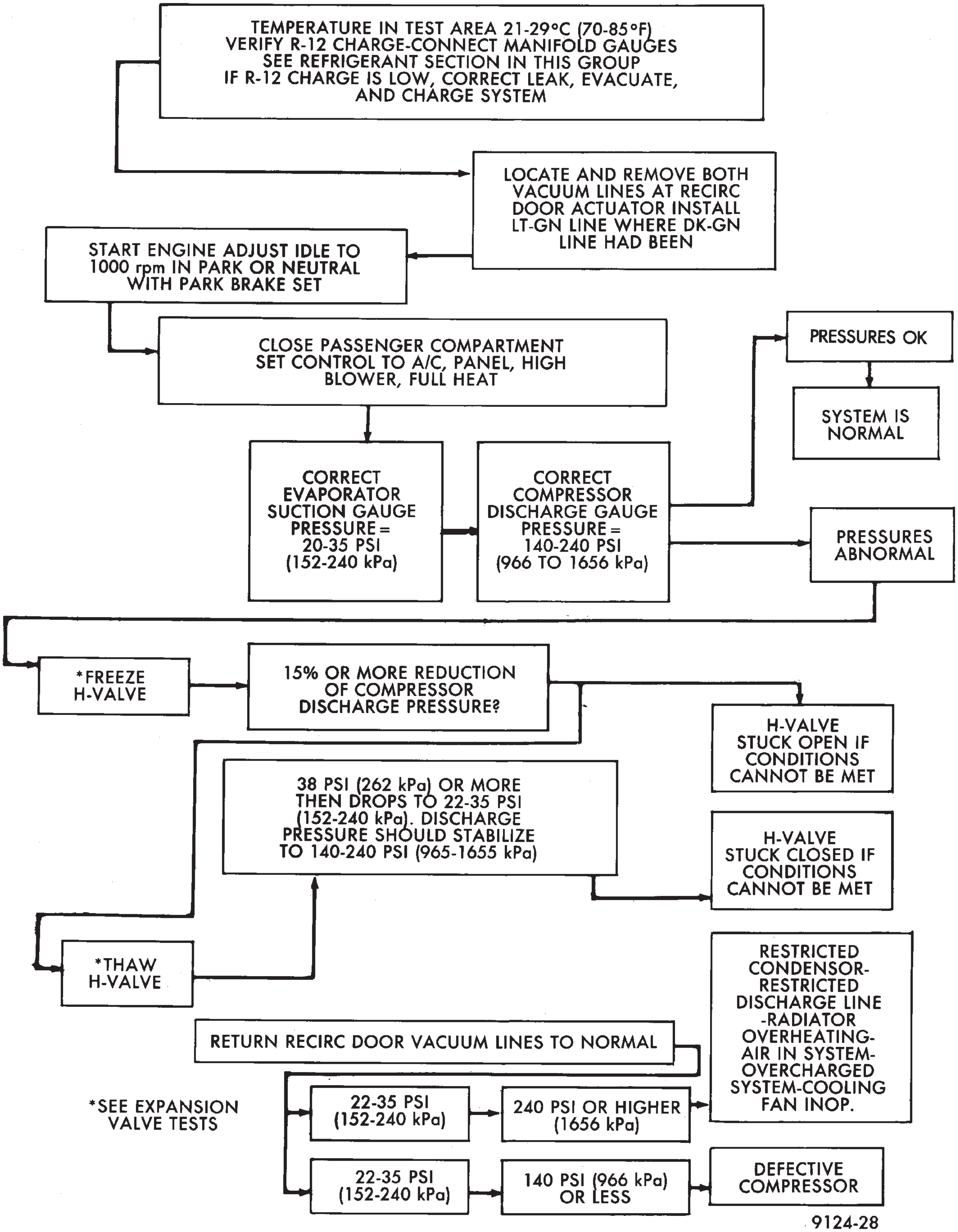


SEE PERFORMANCE TEMPERATURE CHART
TEST AREA TEMP = 21° C (70° F) OR ABOVE
ENGINE SPEED = 1000 rpm
CONTROL SETTING = A/C, RECIRC, LOW BLOWER
DOORS AND WINDOWS CLOSED
GEAR SELECTOR = PARK OR NEUTRAL
SET PARK BRAKE OR EQUIVALENT
ELECTRICALLY BYPASS RADIATOR FAN CONTROL SWITCH

*IN THE ACCEPTABLE RANGE ABOVE 180 PSI THE COMPRESSOR IS AT 100% OUTPUT AND WILL FUNCTION LIKE A FIXED DISPLACEMENT COMPRESSOR

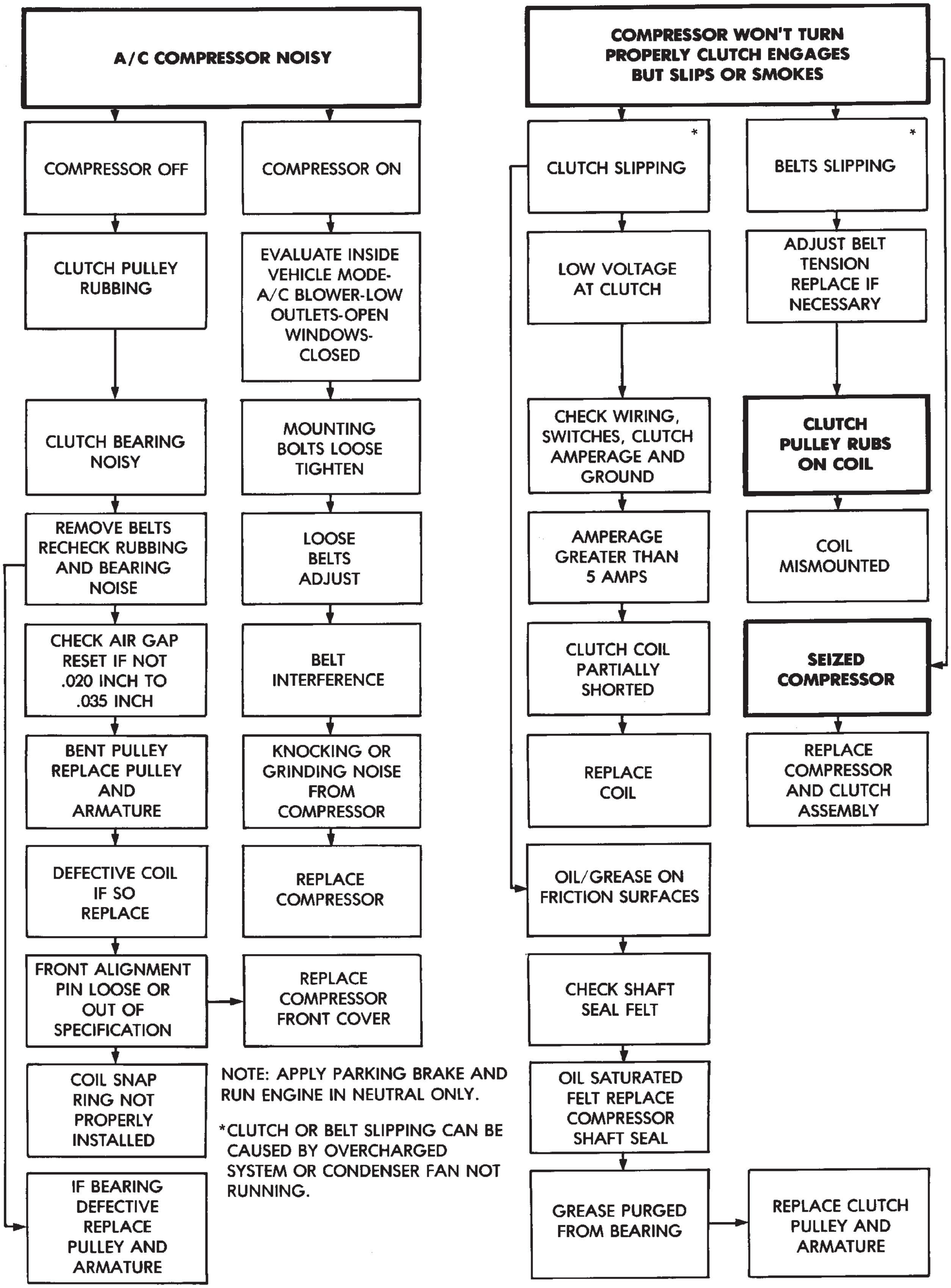
9124-27

REFRIGERANT SYSTEM DIAGNOSIS—VARIABLE DISPLACEMENT COMPRESSOR



9124-28

COMPRESSOR NOISE AND COMPRESSOR CLUTCH DIAGNOSIS



NOTE: APPLY PARKING BRAKE AND RUN ENGINE IN NEUTRAL ONLY.

*CLUTCH OR BELT SLIPPING CAN BE CAUSED BY OVERCHARGED SYSTEM OR CONDENSER FAN NOT RUNNING.

9124-8

(2) The appropriate Powertrain Diagnostic Procedures Manual for diagnostic information.

(3) The Compressor Clutch Diagnosis—Variable Displacement Compressor chart in this section.

(4) On 2.2 L Turbo III engines, check for battery voltage at the Thermal Limiter Switch located on the compressor.

If voltage is found at the cut-off and/or thermal limiter switch, reconnect switch. Then check for battery voltage between the compressor clutch connector terminals.

If voltage is detected, perform A/C Clutch Coil Tests. Refer to Clutch Coil Tests in this section.

CLUTCH COIL TESTS

(1) Verify battery state of charge. (Test indicator in battery should be green).

(2) Connect an ammeter (0-10 ampere scale) in series with the clutch coil terminal. Use a volt meter (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 fusible link.

(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.

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.

COMPRESSOR

The A/C compressor may be removed and positioned without discharging the refrigerant system. Discharging is not necessary if removing the A/C compressor clutch/coil assembly, engine, cylinder head, or generator.

WARNING: REFRIGERANT PRESSURES REMAIN HIGH EVEN THOUGH THE ENGINE MAY BE TURNED OFF. BEFORE REMOVING A FULLY CHARGED COMPRESSOR, REVIEW THE SAFETY PRECAUTIONS AND WARNINGS SECTION IN THIS GROUP. DO NOT TWIST OR KINK THE REFRIGERANT LINES WHEN REMOVING A FULLY CHARGED COMPRESSOR. SAFETY GLASSES MUST BE WORN.

REMOVAL AND INSTALLATION

(1) Disconnect NEGATIVE battery cable.

(2) Loosen and remove drive belts (Refer to Group 7, Cooling System) and disconnect compressor clutch wire lead.

(3) Remove refrigerant lines from compressor (if necessary).

(4) Remove compressor attaching nuts and bolts (Fig. 2 or 3).

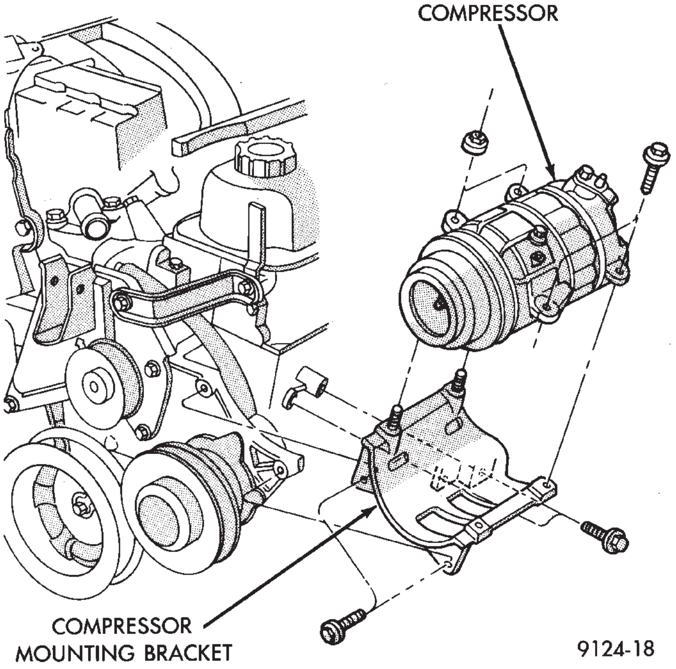


Fig. 2 A/C Compressor Removal and Installation—3.3L Engines

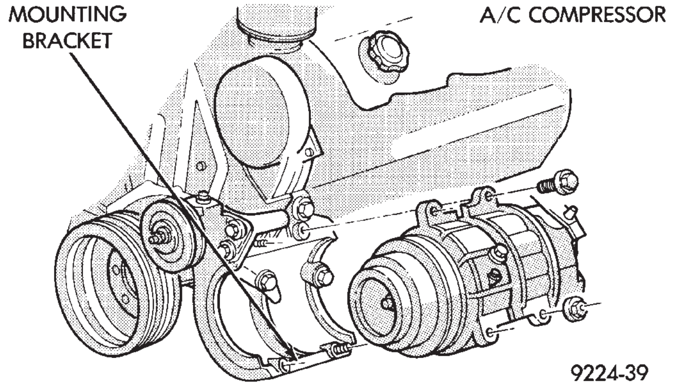
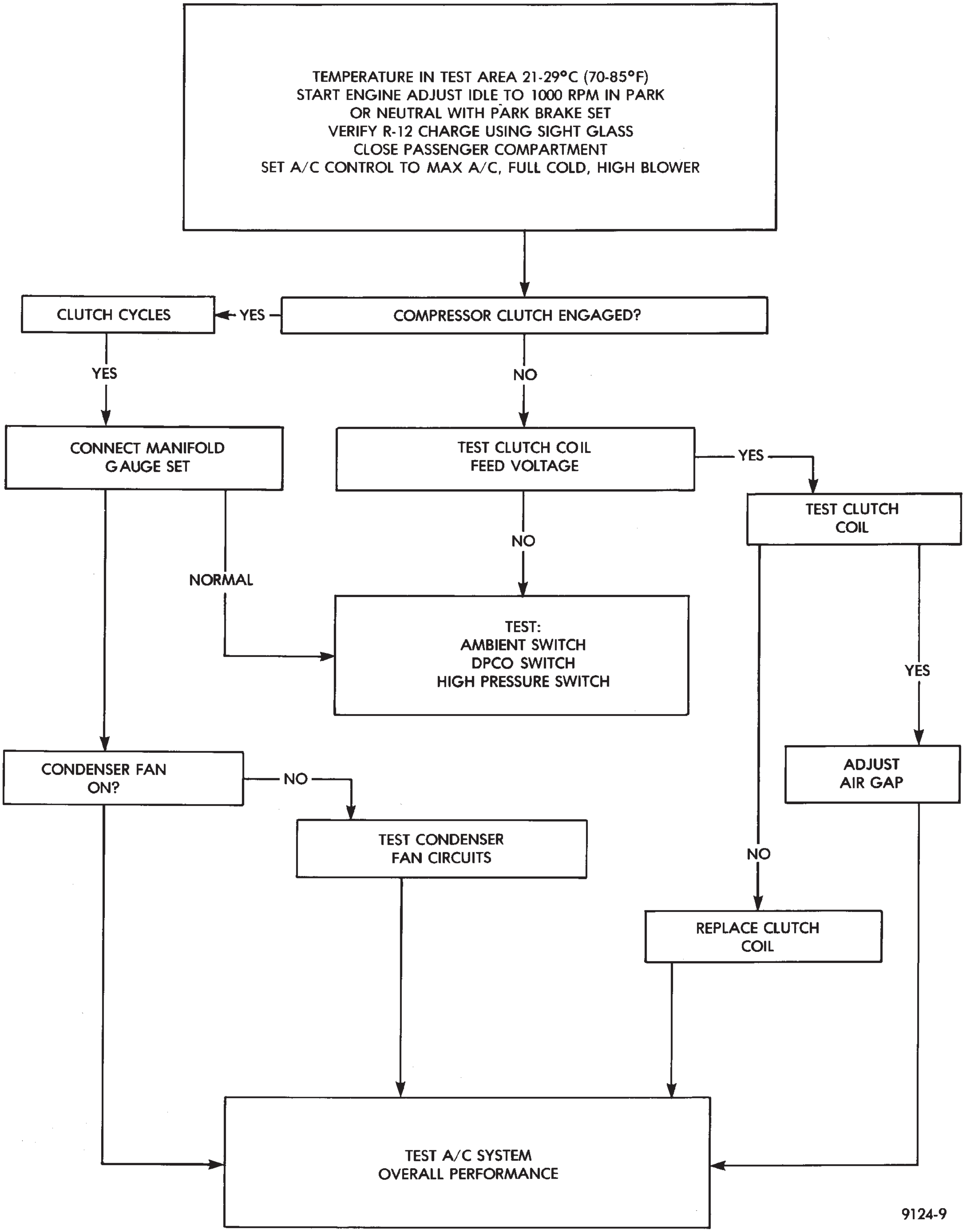


Fig. 3 A/C Compressor Removal and Installation—3.0 L Engine

(5) Remove compressor. If refrigerant lines were not removed, lift compressor/clutch assembly and tie it to a suitable component.

To install, reverse the preceding operation.

COMPRESSOR CLUTCH DIAGNOSIS—VARIABLE DISPLACEMENT COMPRESSOR—MODEL 6C17



COMPRESSOR CLUTCH/COIL ASSEMBLY

Compressor assembly must be removed from mounting. Refrigerant removal is not necessary to replace the clutch/coil assembly. Refer to Compressor Removal and Installation.

On 3.0 liter engine, remove the front lower splash shield and front engine mount through-bolt. Allow the engine to swing down to provide access to the front of the compressor.

On 3.3 liter engine, remove the coolant recovery bottle to provide access the front of the compressor.

REMOVAL AND INSTALLATION

(1) Remove clutch retaining center nut by using Clutch Plate Holder (6355) (Fig. 4).

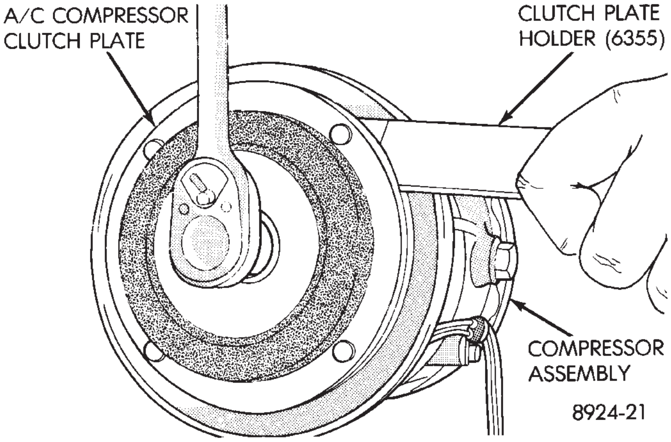


Fig. 4 Remove or Install Front Plate Retaining Nut

(2) Using a Clutch Plate Remover (6354), remove the clutch front plate from the compressor (Fig. 5). When installing the front plate, select the proper shims to achieve .5 to .9 mm (.020 to .035 inch) air gap to the pulley surface (Fig. 6). To install front plate, align shaft key to groove in front plate hub. Push on until it seats, and measure the air gap (Fig. 7).

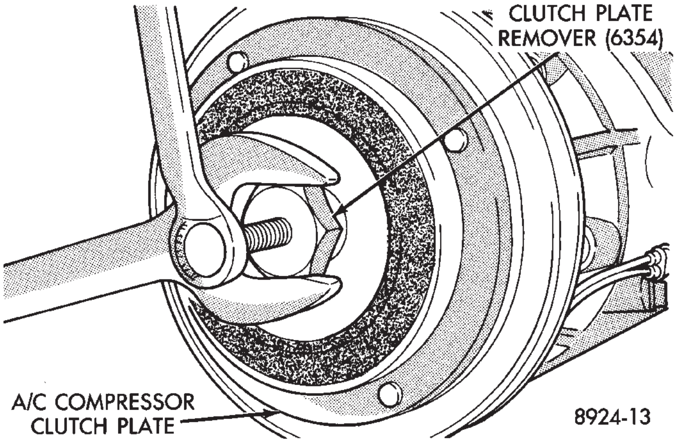


Fig. 5 Remove Front Plate

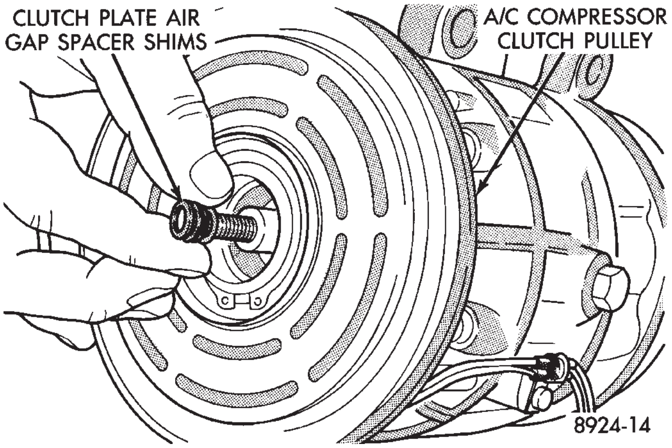


Fig. 6 Install Front Plate and Shims

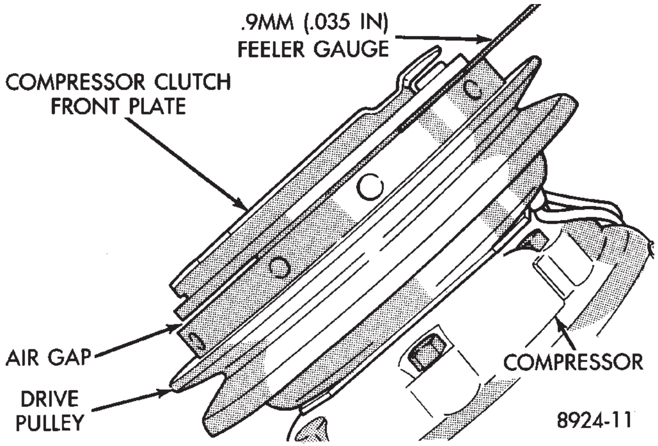


Fig. 7 Measure Front Plate Air Gap

(3) Remove clutch pulley retaining snap ring (Fig. 7) and pull the pulley from the assembly (Fig. 8).

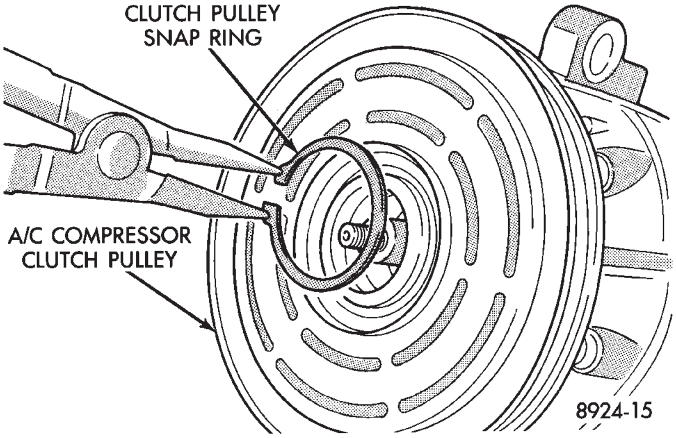


Fig. 8 Remove or Install Pulley Snap Ring

(4) Remove the clutch coil wire lead strap screw.

(5) Remove clutch coil retaining snap ring (Fig. 10) and pull the coil from the assembly (Fig. 11). When installing the clutch coil, align the pin on the front of

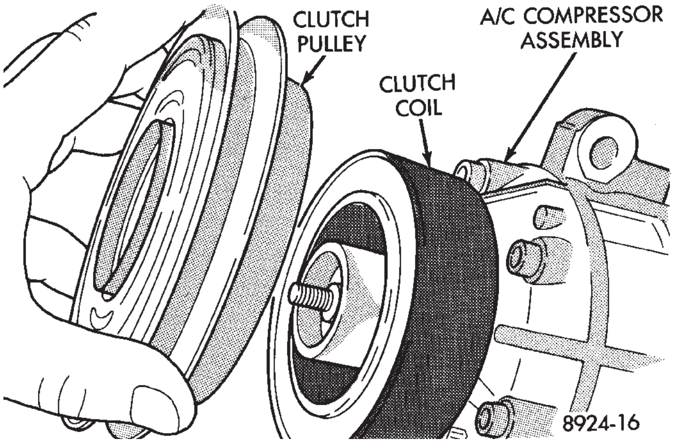


Fig. 9 Remove or Install Pulley

the compressor to the middle hole in the hub of the coil. Position the pin in the snap ring gap.

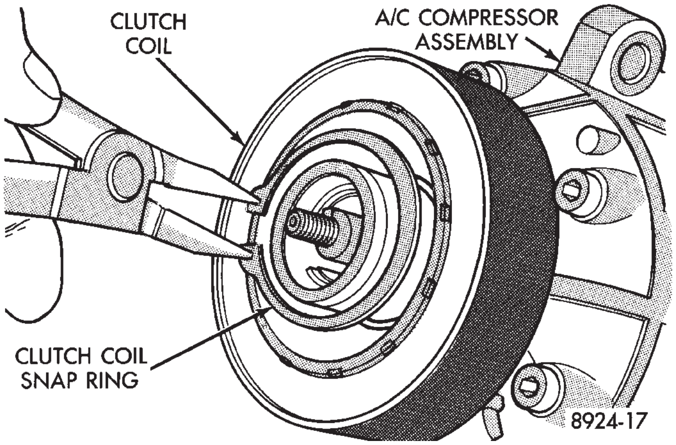


Fig. 10 Remove or Install Clutch Coil Snap Ring

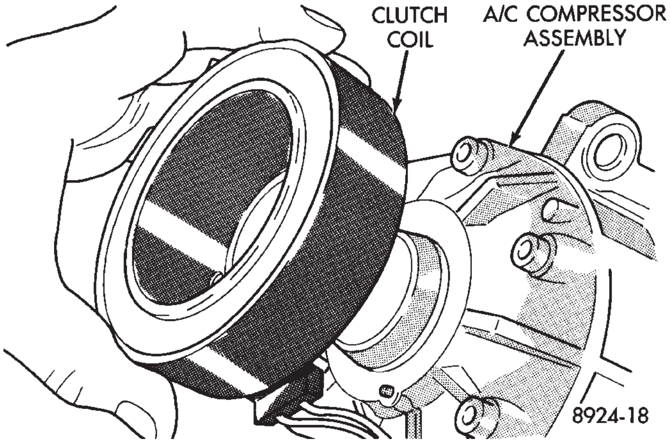


Fig. 11 Remove or Install Clutch Coil

To install, reverse the preceding operation.

COMPRESSOR FRONT SHAFT SEAL

REMOVAL

(1) Using a refrigerant recovery machine, remove the refrigerant from the A/C system.

(2) Remove A/C compressor.

(3) Remove the compressor clutch assembly and shaft key.

(4) Remove the felt contaminant absorber and retainer (Fig. 1).

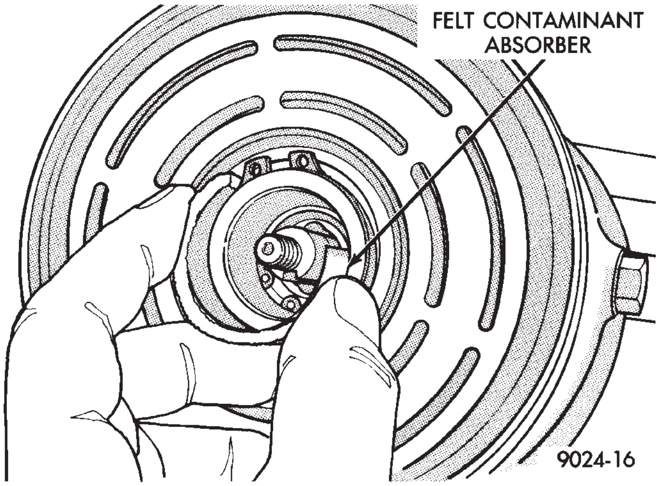


Fig. 1 Felt Contaminant Absorber

(5) Using a mineral spirits based solvent, thoroughly clean and dry the seal end of the compressor.

(6) Remove the snap ring shaft seal retainer (Fig. 2). Do not use the old snap ring to assemble.

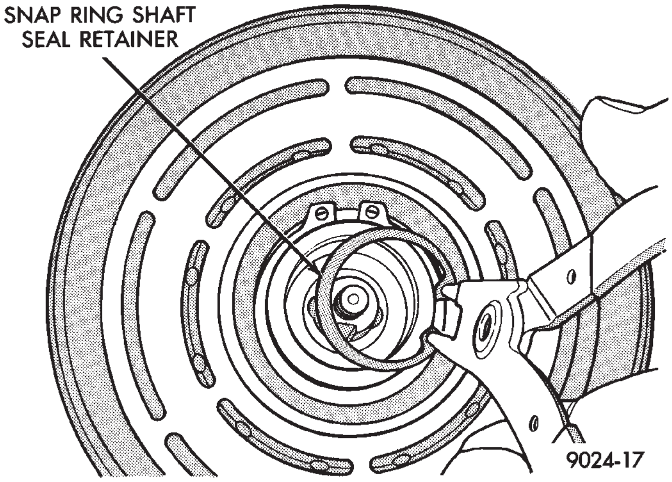


Fig. 2 Shaft Seal Snap Ring

(7) Using Seal Remover/Installer (6429), remove the shaft seal (Fig. 3).

INSTALLATION

(1) Lubricate the new shaft seal with refrigerant oil.

(2) Place Seal Protector (6231) over the end of compressor shaft (Fig. 4). Use the larger flat end of the remover/installer to push the seal in until it seats. The snap ring groove should be visible above the seal (Fig. 5).

(3) Install clutch/coil assembly.

(4) Install compressor.

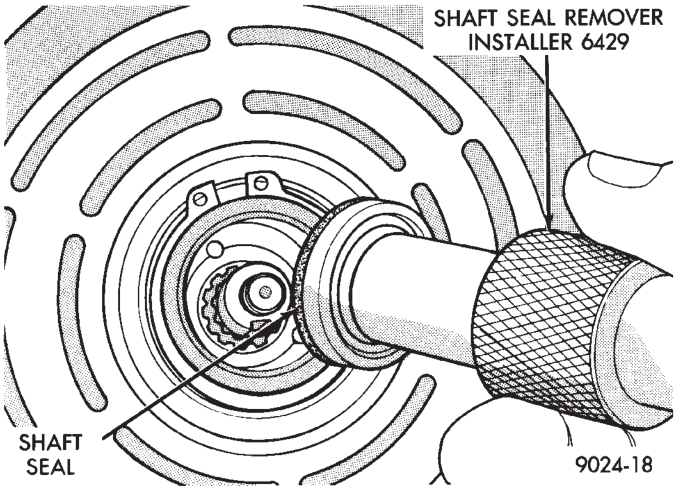


Fig. 3 Remove Shaft Seal

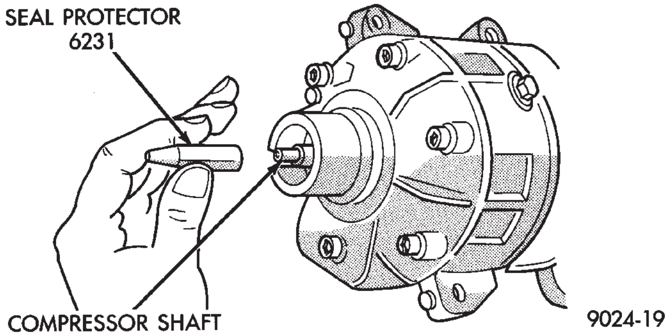


Fig. 4 Shaft Seal Protector

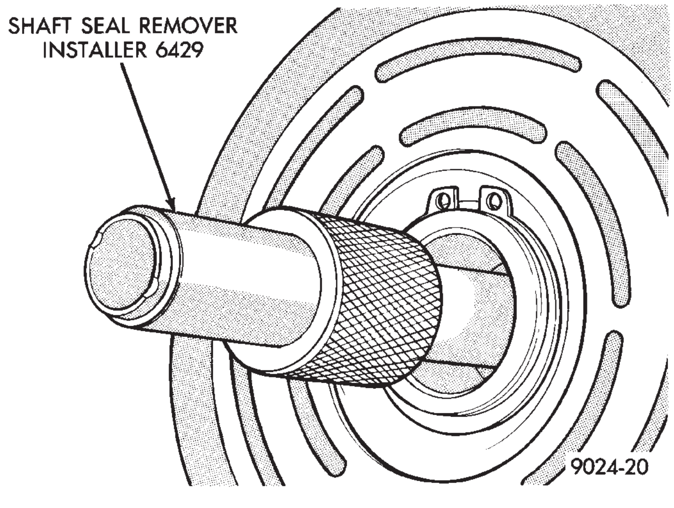


Fig. 5 Install Shaft Seal

(5) Evacuate and charge the refrigerant system. If oil loss of 3 ml (1 oz) or greater is suspected, refer to Oil Level in the Refrigerant Service Procedures section.

COMPRESSOR HIGH PRESSURE CUT-OUT SWITCH

The High Pressure Cut Out (HPCO) switch is located on the rear cover of the Variable Displacement Compressor (Fig. 6). The function of the switch is to disengage the compressor clutch by monitoring the compressor discharge (high) pressure. The HPCO Switch is in the same circuit as the Differential Pressure Cut Out (DPCO) switch and Ambient Switch.

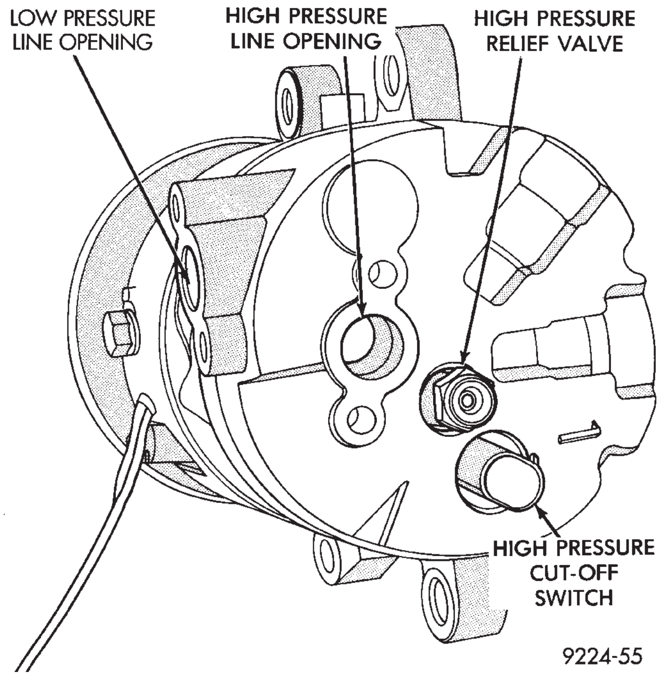


Fig. 6 Variable Displacement Compressor—Model 6C17

DIAGNOSIS

Review Safety Precautions and Warnings before proceeding with this operation.

Connect a suitable manifold gauge set to the refrigerant system service ports. Work area temperature can not be below 21°C (70°F).

(1) Raise hood of vehicle.

(2) With gear selector in park or neutral, and park brake set, start engine and allow to idle at 1300 rpm.

(3) Set the A/C controls to A/C and High blower.

(6) If the high pressure gauge reads below 2963 kPa (430 psi) ±138 kPa (20 psi) the compressor clutch should be engaged.

CAUTION: Do not allow engine to overheat when radiator air flow is blocked.

(7) Block radiator air flow with a suitable cover to increase the high side pressure to at least 3100 kPa (450 psi). Compressor clutch should disengage.

(8) Remove cover from front of vehicle to allow high side pressure to decrease. When pressure drops below 1826 kPa (265 psi), compressor clutch should engage.

REMOVAL AND INSTALLATION

(1) Using a refrigerant recovery machine, remove the refrigerant from the A/C system.

(2) Disconnect wire connector from the high pressure cut-out switch (Fig. 7).

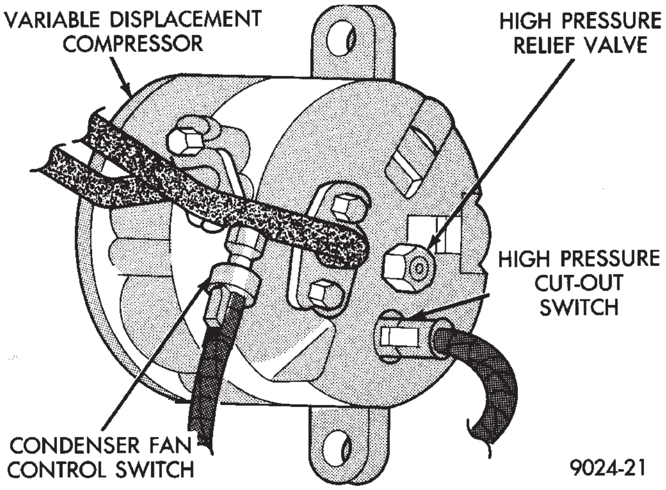


Fig. 7 High Pressure Cut-out Switch

(3) Remove snap ring securing the switch in the compressor end cover (Fig. 8).

CAUTION: The high pressure cut-out switch service kit has two snap rings. One is black and the other is silver. Use the one which has the same color as the original one in the compressor.

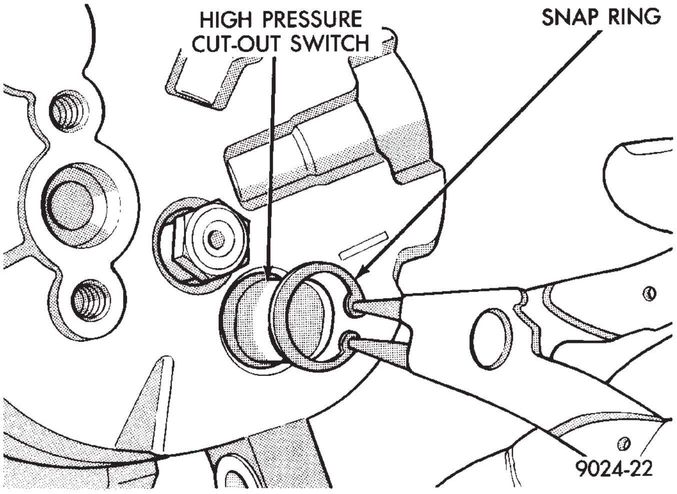


Fig. 8 Remove or Install Snap Ring

(4) Pull switch straight out from end cover. Remove and discard used O-ring seal (Fig. 9).

To install, reverse the preceding operation using a new O-ring seal. Evacuate and charge the refrigerant system.

COMPRESSOR HIGH PRESSURE RELIEF VALVE (HPR)

DIAGNOSIS

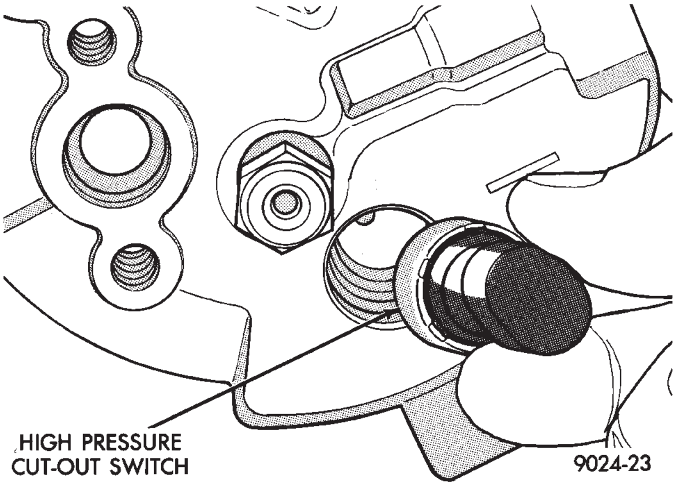


Fig. 9 Remove or Install High Pressure Cut-out Switch

The High Pressure Relief valve prevents damage to the air conditioning system if excessive pressure develops. Excessive pressure may 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 3100 to 4140 Kpa (450 to 600 psi). If a valve has vented a small amount of refrigerant, it does not necessarily mean the valve is defective.

VALVE LOCATION

The High Pressure Relief Valve is located on the compressor end plate.

REMOVAL AND INSTALLATION

(1) Using a refrigerant recovery machine, remove the refrigerant from the A/C system.

(2) Rotate the high pressure relief valve counterclockwise and separate relief valve from the vehicle (Fig. 10).

To install, reverse the preceding operation using a new O-ring seal. Evacuate and charge the refrigerant system.

COMPRESSOR MAIN OR SUB CONTROL VALVES

If the main or sub control valve is leaking refrigerant to the atmosphere, replace the main or sub control valve. If a functional problem is suspected with the main or sub control valve, the compressor should be replaced.

REMOVAL AND INSTALLATION

(1) Using a refrigerant recovery machine, remove the refrigerant from the A/C system.

(2) Remove the compressor assembly. Position it to gain access to the control valves. It is not necessary to disconnect the suction or discharge lines from the compressor.

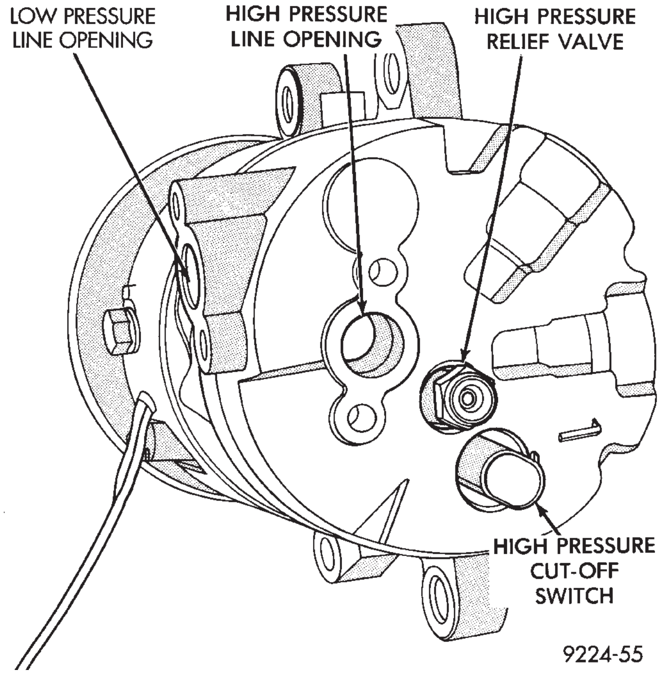


Fig. 10 High Pressure Relief Valve Removal

(3) Remove the snap ring retaining either the main or sub control valve to the compressor (Fig. 11).

(4) Pull the main or sub control valve from the compressor end cover (Fig. 12).

To install, reverse the preceding operation using new O-ring seals. Evacuate and charge the refrigerant system.

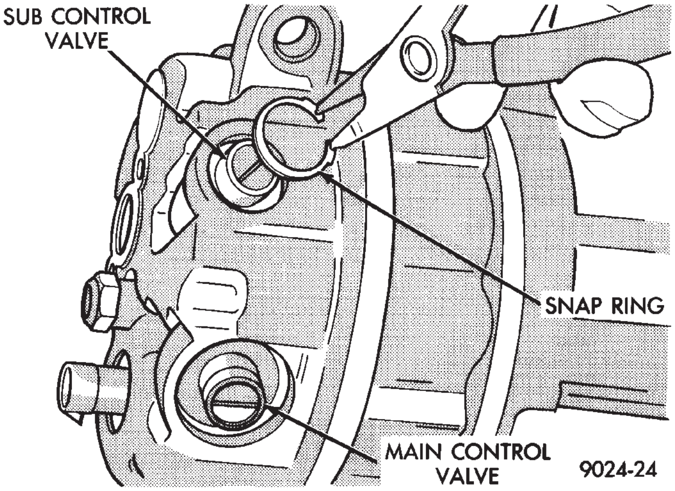


Fig. 11 Main or Sub Control Valve Snap Ring

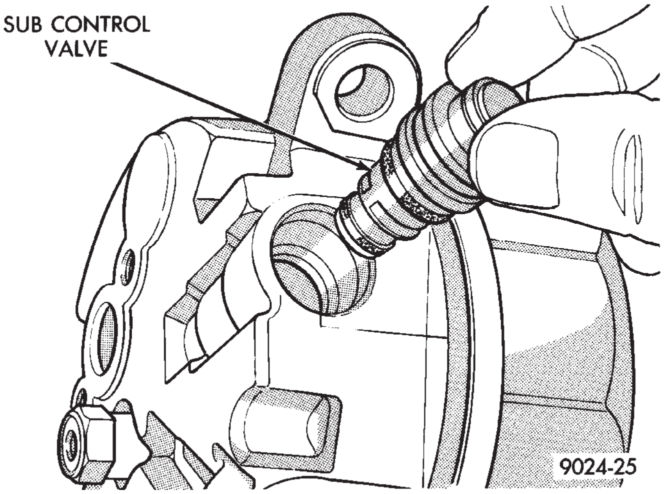


Fig. 12 Remove or Install Main or Sub Control Valve

FIXED DISPLACEMENT COMPRESSOR—MODEL 10PA17

INDEX

COMPRESSOR

COMPRESSOR NOISE

Excessive noise that occurs when the air conditioning is being used, can be caused by:

- Loose bolts
- Mounting brackets
- Loose clutch
- Excessive high refrigerant system operating pressure

Verify compressor drive belt condition, proper refrigerant charge and head pressure before compressor repair is performed.

For noise diagnostic procedures, refer to the Compressor Noise and Compressor Clutch Diagnosis chart in this section.

REMOVAL AND INSTALLATION

The A/C compressor may be removed and positioned without discharging the refrigerant system. Discharging is not necessary if removing the A/C compressor clutch/coil assembly, engine, cylinder head, or generator.

WARNING: REFRIGERANT PRESSURES REMAIN HIGH EVEN THOUGH THE ENGINE MAY BE TURNED OFF. BEFORE REMOVING A FULLY CHARGED COMPRESSOR, REVIEW THE SAFETY PRECAUTIONS AND WARNINGS SECTION IN THIS GROUP. DO NOT TWIST OR KINK THE REFRIGERANT LINES WHEN REMOVING A FULLY CHARGED COMPRESSOR. SAFETY GLASSES MUST BE WORN.

(1) Disconnect Negative battery cable.

(2) Loosen and remove drive belts (refer to Group 7, Cooling System) and disconnect compressor clutch wire lead.

(3) Remove refrigerant lines from compressor (if necessary).

(4) Remove compressor attaching nuts and bolts.

(5) Remove compressor. If refrigerant lines were not removed, lift compressor/clutch assembly and tie it to a suitable component.

To install, reverse the preceding operation. If necessary, refer to Charging Refrigerant System in the Refrigerant Service Procedures section.

COMPRESSOR CLUTCH/COIL ASSEMBLY

CLUTCH INOPERATIVE

The air conditioning compressor clutch electrical circuit is controlled by the engine controller. The controller 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 low pressure or differential pressure cut-off switch located on the expansion valve. If voltage is not detected, refer to:

- Group 8W, Wiring Diagrams.
- The appropriate Powertrain Diagnostic Procedures Manual for diagnostic information.

If voltage is detected at the cut-off switch, reconnect switch. Then check for battery voltage between the compressor clutch connector terminals.

If voltage is detected, perform A/C Clutch Coil Tests.

CLUTCH COIL TESTS

(1) Verify battery state of charge. (Test indicator in battery should be green).

(2) Connect an ammeter (0-10 ampere scale) in series with the clutch coil terminal. Use a volt meter (0-20 volt scale) with clip leads measuring voltage across the battery and A/C clutch.

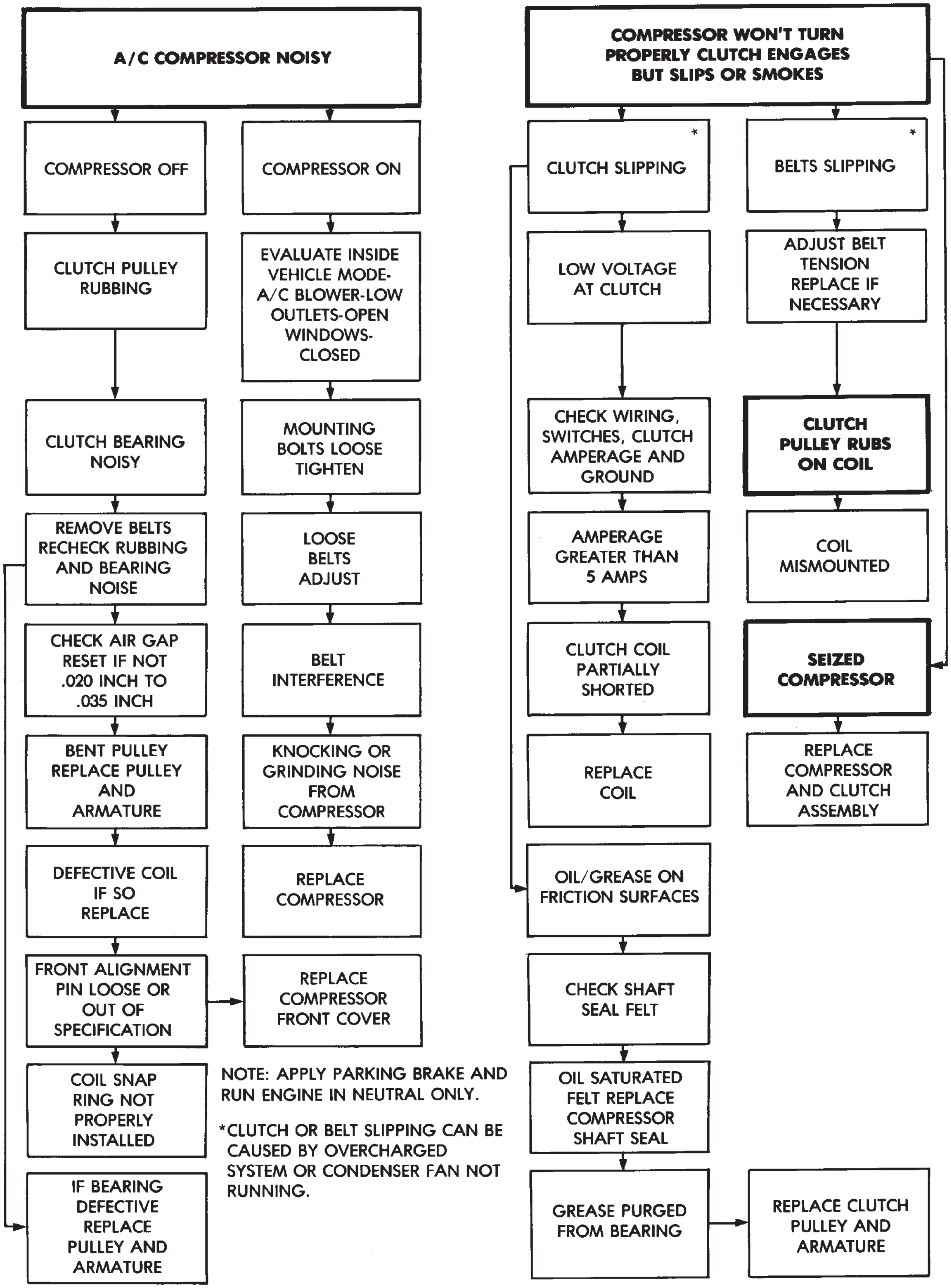
(3) With A/C control in A/C mode and blower at low speed, start the engine and run at normal idle.

(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 fusible link.

(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.

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.

COMPRESSOR NOISE AND COMPRESSOR CLUTCH DIAGNOSIS



NOTE: APPLY PARKING BRAKE AND RUN ENGINE IN NEUTRAL ONLY.

*CLUTCH OR BELT SLIPPING CAN BE CAUSED BY OVERCHARGED SYSTEM OR CONDENSER FAN NOT RUNNING.

9124-8

REMOVAL

Compressor assembly must be removed from mounting. Although, refrigerant removal is not necessary.

(1) Remove the compressor shaft bolt (Fig. 1). A band type oil filter removal tool can be placed around the clutch plate to aid in bolt removal.

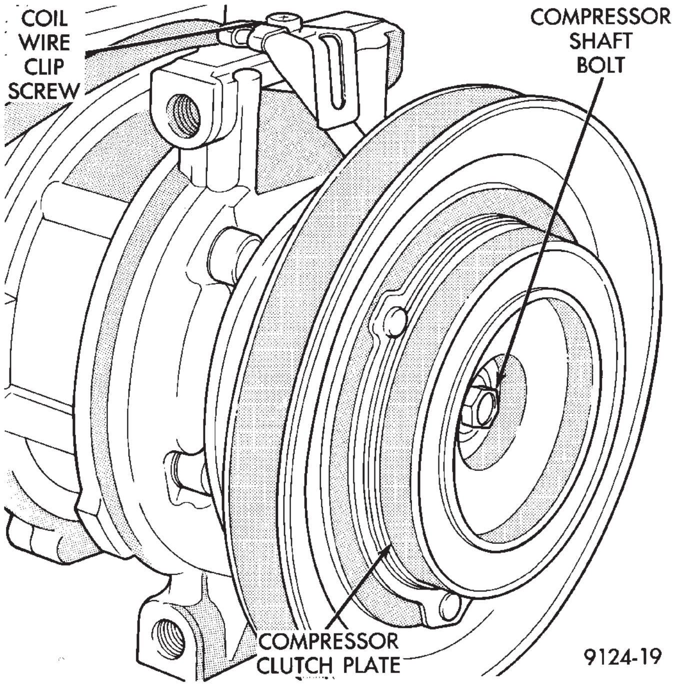


Fig. 1 Compressor Shaft Bolt and Clutch Plate

(2) Tap the clutch plate with a plastic hammer and remove clutch plate and shim (Fig. 2).

CAUTION: Do not use screwdrivers between the clutch plate assembly and pulley to remove front plate as this may damage the front plate assembly.

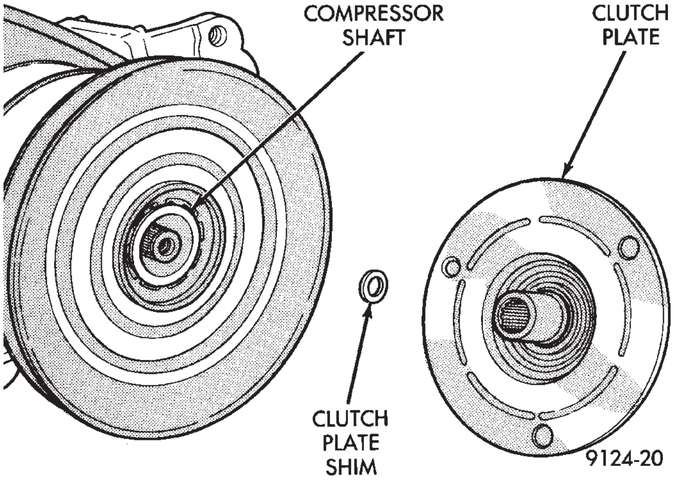


Fig. 2 Clutch Plate and Shim(s)

(3) Remove pulley retaining snap ring with Snap Ring Pliers (C-4574), and slide pulley assembly off of compressor (Fig. 3).

(4) Remove coil wire clip screw and wire harness.

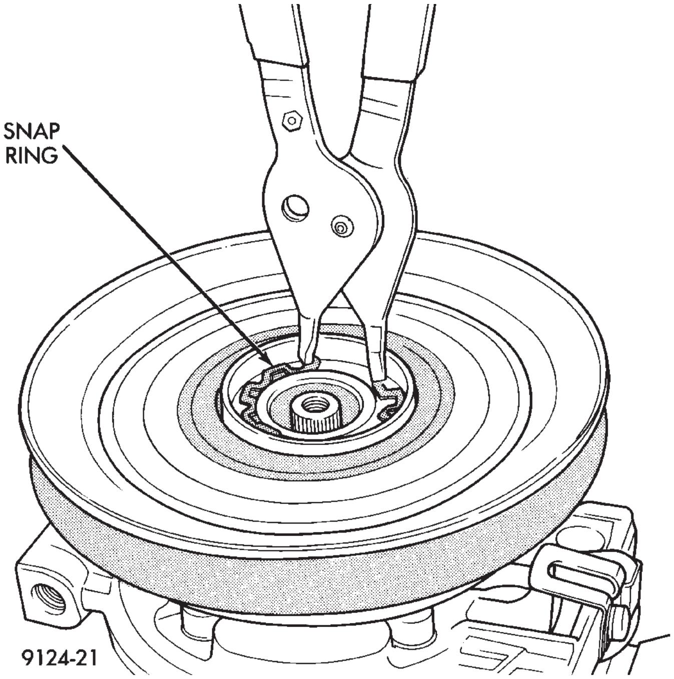


Fig. 3 Removing Pulley Snap Ring

(5) Remove snap ring retaining field coil onto compressor housing (Fig. 4). Slide field coil off of compressor housing.

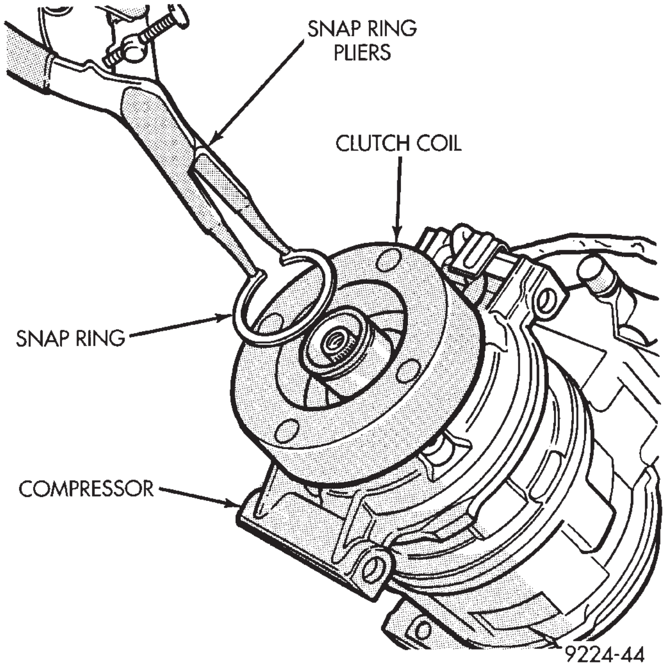


Fig. 4 Clutch Coil Snap Ring

(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.

(7) Check bearing for roughness or excessive leakage of grease. Replace bearing as required.

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 retaining screw.

(2) Install field coil retaining snap ring with Snap Ring Pliers (C-4574). The bevel side of the snap ring must be outward. Also both eyelets must be to the right or left of the pin on the 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. 5).

CAUTION: Do not mar the pulley frictional surface.

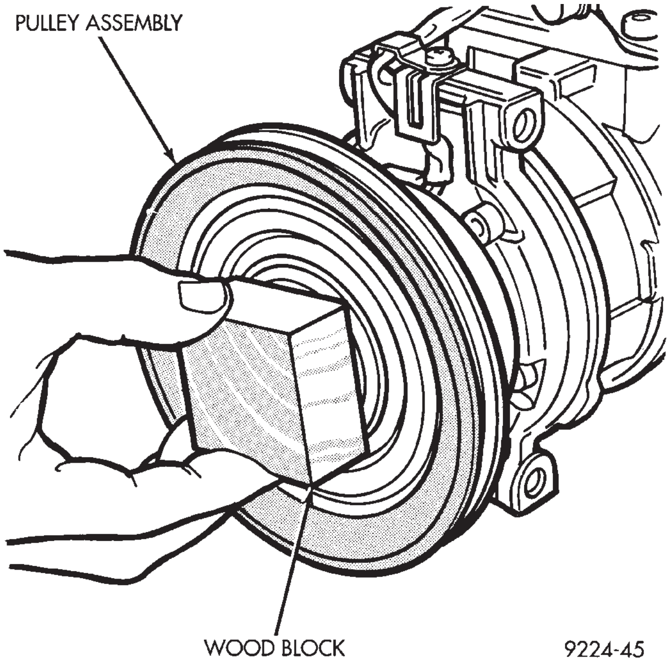


Fig. 5 Installing Pulley Assembly

(4) Install pulley assembly retaining snap ring (bevel side outward) with Snap Ring Pliers (C-4574). 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, 2.54 mm (0.10 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.).

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 cycle the A/C clutch 20 times (5 sec. on and 5 sec. off). During this procedure, set the system to the A/C mode, engine rpm at 1500-2000, and high blower speed. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher clutch torque capability.

COMPRESSOR FRONT SHAFT SEAL

REMOVAL

(1) Using a refrigerant recovery machine, remove the refrigerant from the system.

(2) Remove A/C compressor.

(3) Remove compressor clutch/coil assembly.

(4) Remove compressor through-bolts (Fig. 1).

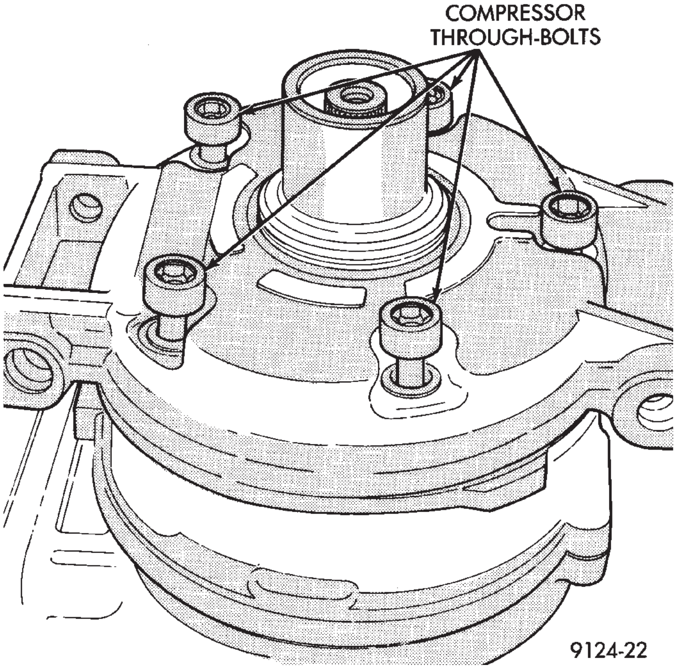


Fig. 1 Compressor Through-Bolts

(5) Remove front cover by tapping on the outside diameter of the cover with a plastic hammer (Fig. 2).

(6) Remove steel valve plate gasket and O-ring seal and discard (Fig. 3 and 4).

CAUTION:Never reuse cover O-rings or the steel valve plate gaskets.

(7) Pry out the felt retainer and remove felt from front cover (Fig. 5).

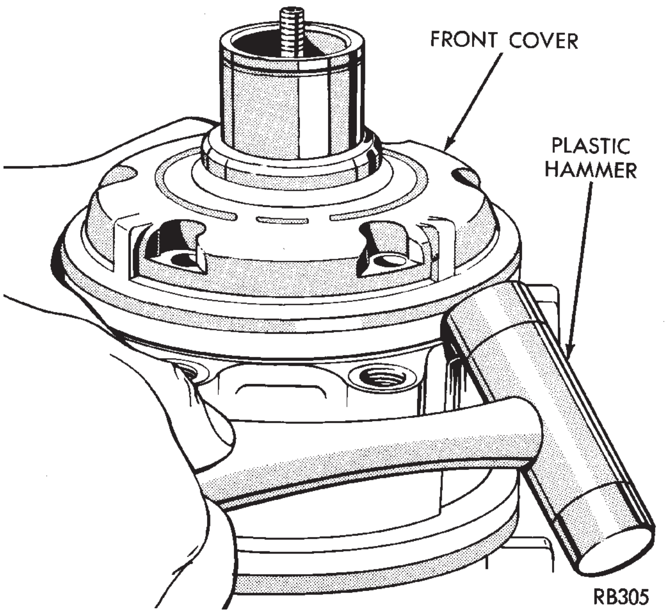


Fig. 2 Removing Front Cover

Fig. 3 Removing Steel Valve Plate Gasket

(8) Remove seal snap ring (Fig. 6).

(9) Place compressor front cover on a flat surface with neck of cover facing up. Using a brass drift, press out seal assembly (Fig. 7).

(10) Remove dowel pins, valve plates, and steel valve plate gasket. Discard steel gasket (Fig. 8).

INSTALLATION

(1) Install dowel pins in front compressor body.

(2) Install cleaned valve plates.

(3) Install steel gasket.

(4) Clean crankshaft and coat lightly with refrigerant oil.

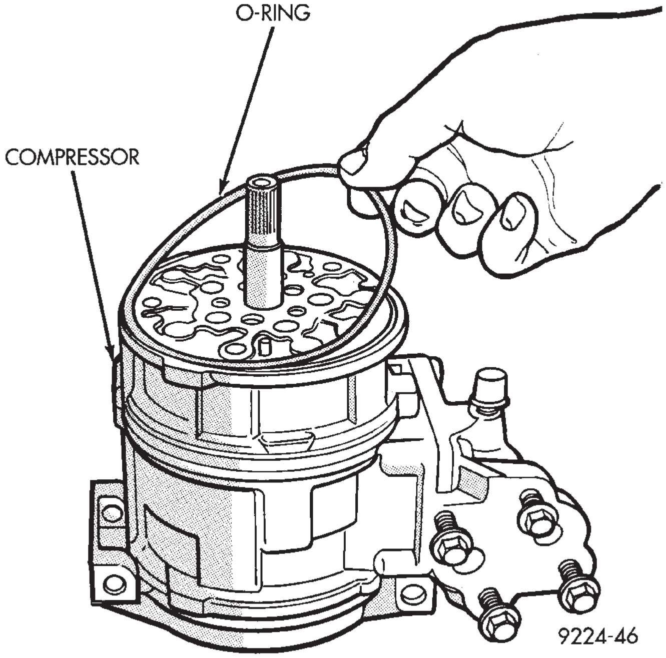


Fig. 4 Removing O-Ring

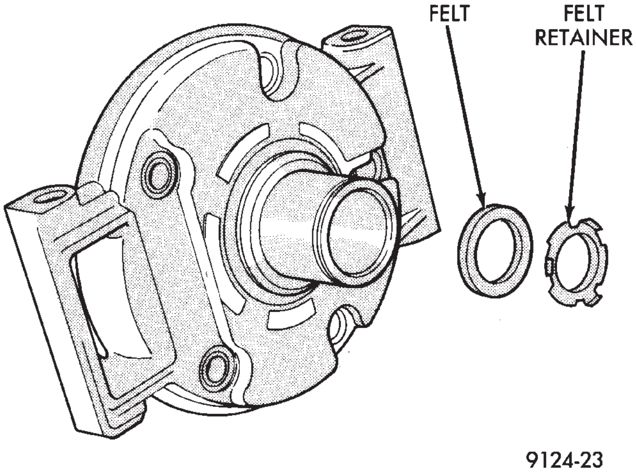


Fig. 5 Removing Felt Retainer and Felt

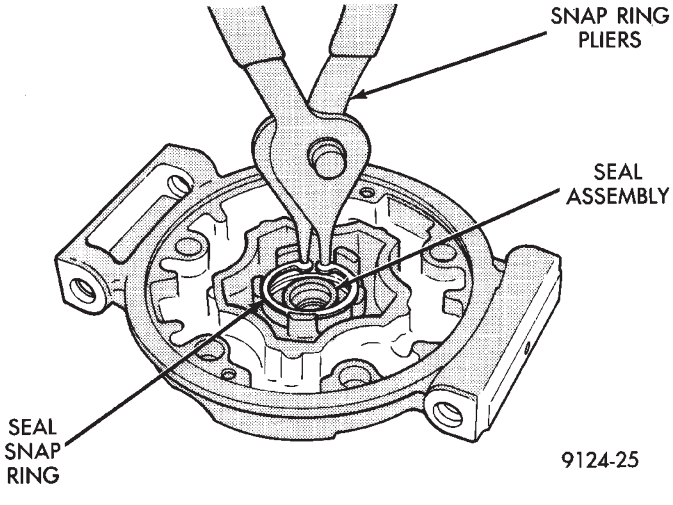


Fig. 6 Seal Snap Ring

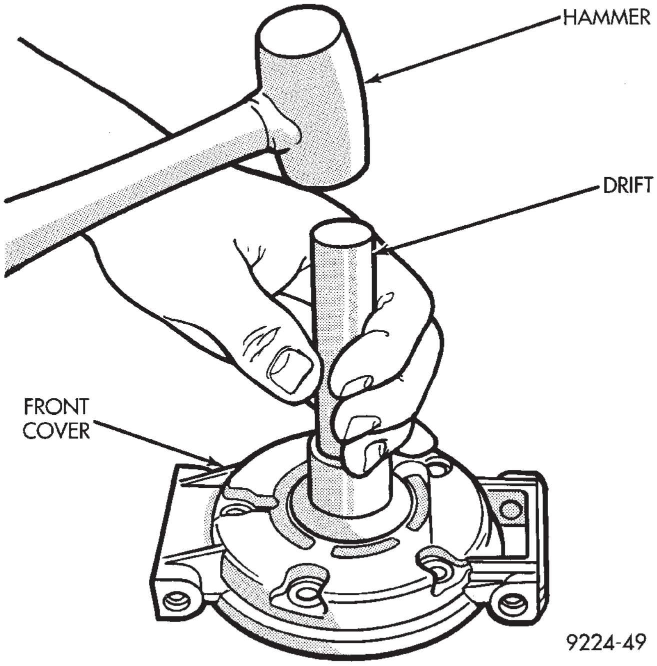


Fig. 7 Removing Seal

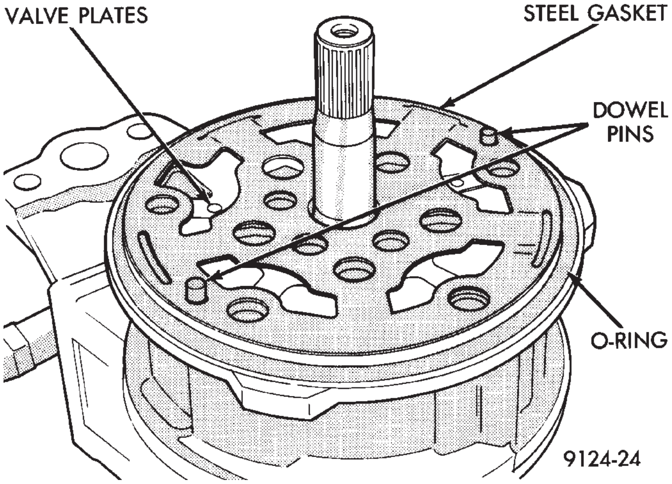


Fig. 8 Disassembling Compressor Front End

(5) Lubricate crankshaft seal seat cavity of front housing with refrigeration oil.

(6) Lubricate crankshaft lip seal and seal O-ring with refrigeration oil. Then install lip seal in front cover using a socket that contacts the outer diameter of the lip seal (Figs. 9 and 10).

(7) Install seal snap ring (Fig. 11).

(8) Lubricate front cover O-ring with refrigeration oil and carefully place it in seal groove.

(9) Install lip seal protector on shaft (Fig. 12).

(10) Install front cover to front compressor body.

(11) Install compressor through-bolts and finger tighten only. After bolts have been finger tightened, torque to 29 N●m (260 in. lbs.).

(12) Install felt shaft seal and retainer (Fig. 13) into front housing.

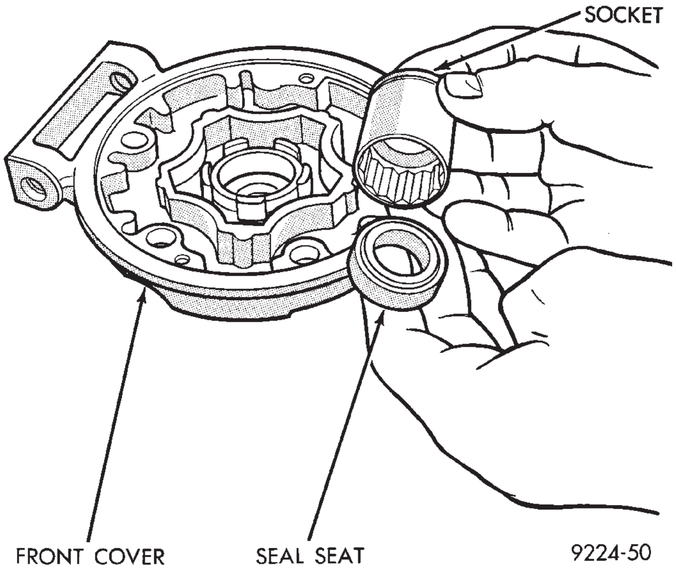


Fig. 9 Match Socket to Outer Seal Diameter

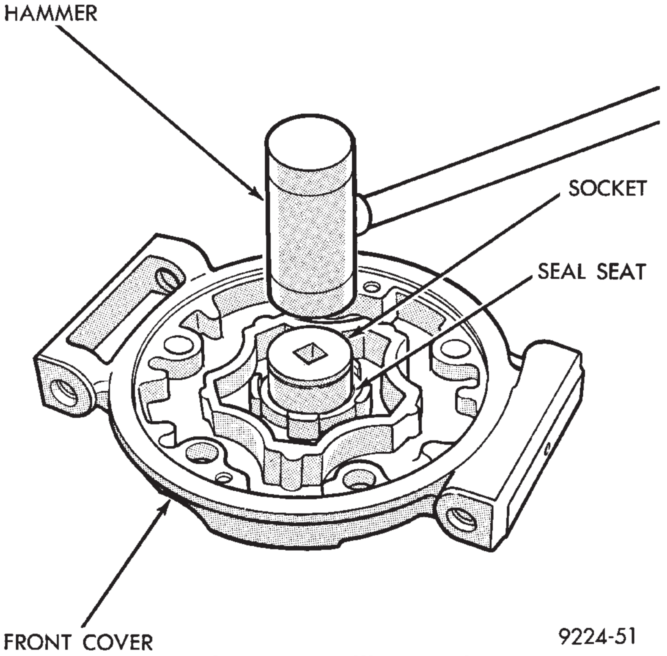


Fig. 10 Installing Seal

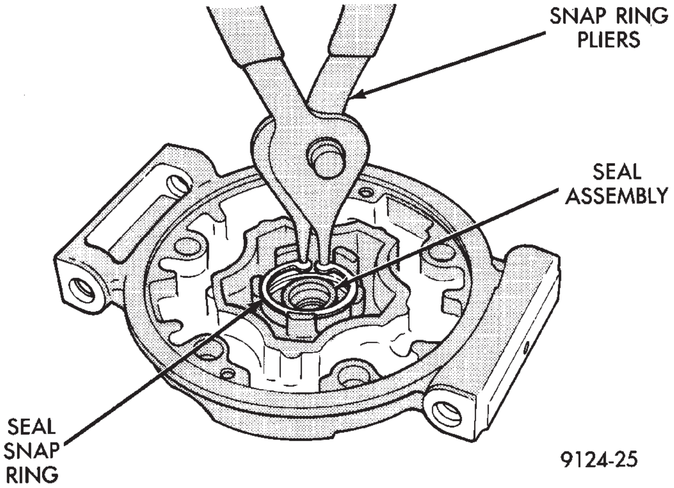


Fig. 11 Seal Snap Ring

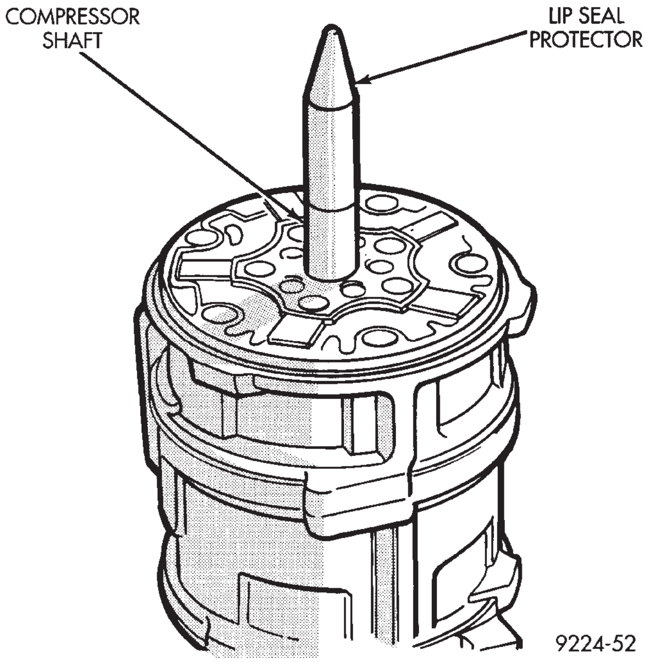


Fig. 12 Installing Lip Seal Protector

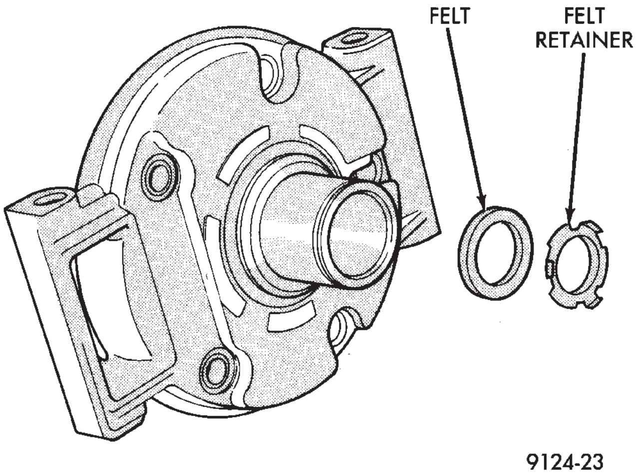


Fig. 13 Felt Retainer and Felt

CAUTION: Refer to Oil Level in the Refrigerant Service Procedures section for further details.

(13) Install refrigeration oil (500 SUS) into the compressor through the suction port.

(14) Check compressor operation for smoothness by rotating crankshaft at least five full revolutions.

(15) Check front housing clutch coil alignment pin for proper installation.

(16) Install clutch assembly.

(17) Install compressor.

(18) Evacuate and charge refrigerant system.

COMPRESSOR HIGH-PRESSURE RELIEF VALVE

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 3100 to 4140 Kpa (450 to 600 psi). If a valve has vented a small amount of refrigerant, it does not necessarily mean the valve is defective.

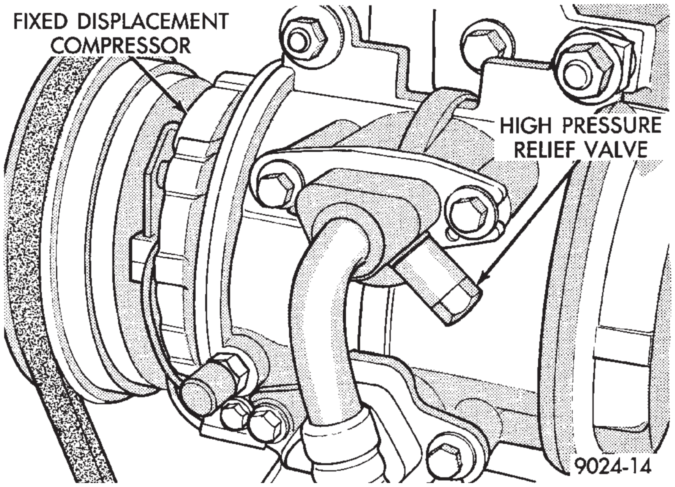


Fig. 14 High Pressure Relief Valve— Typical

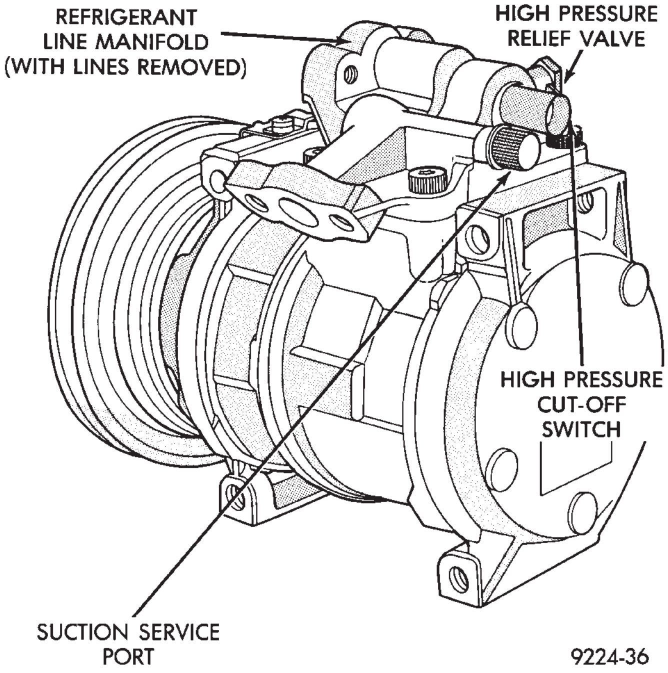


Fig. 15 High Pressure Relief Valve—Typical

(HPR) VALVE LOCATION

The HPR Valve is located on the discharge line at the A/C compressor (Fig. 14).

REMOVAL AND INSTALLATION

(1) Using a refrigerant recovery machine, remove the refrigerant from the A/C system.

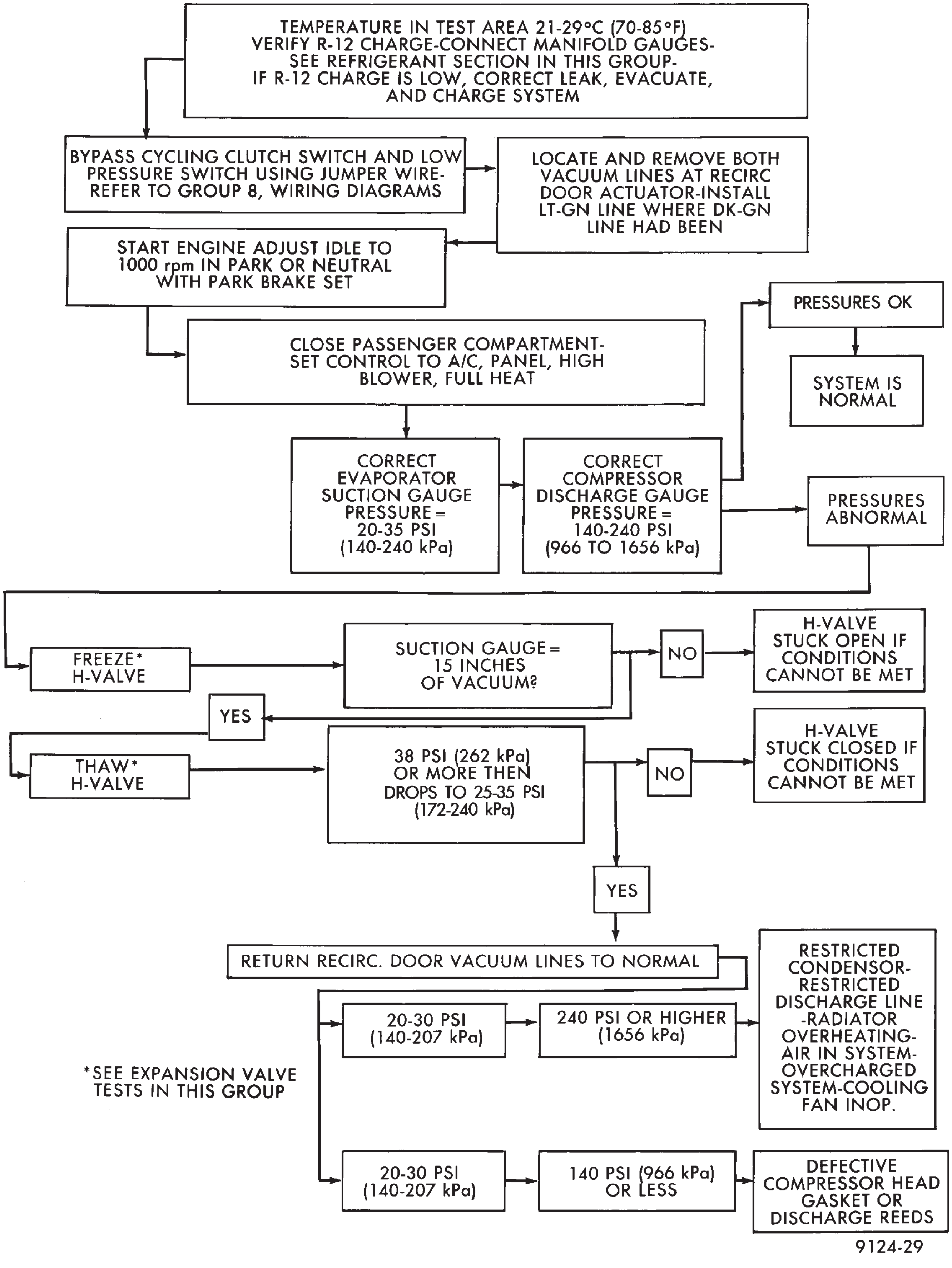
(2) Rotate the high pressure relief valve counterclockwise and separate relief valve from the vehicle (Fig. 15).

To install, Reverse the preceding operation using a new O-ring seal. Evacuate and charge the refrigerant system.

REFRIGERANT SYSTEM DIAGNOSIS

Refer to the Refrigerant System Diagnosis chart in this section.

REFRIGERANT SYSTEM DIAGNOSIS



FIXED DISPLACEMENT COMPRESSOR—MODEL TR105

INDEX

COMPRESSOR

Cleanliness is extremely important when disassembly of the compressor is necessary. The surfaces around the suction and discharge ports of the compressor should be cleaned thoroughly before opening the system at these points. If compressor is removed from vehicle, apply tape to the opened ports to prevent any contamination.

REMOVAL

(1) Disconnect battery negative cable.
(2) Loosen and remove drive belts (refer to Group 7, Cooling System).
(3) Disconnect compressor clutch wire lead.
(4) Using a refrigerant recovery machine, remove refrigerant from the A/C system.
(5) Remove refrigerant lines from compressor.
(6) Remove compressor attaching bolts.
(7) Remove compressor.

INSTALLATION

(1) Position the compressor on the mount and fit drive belt.
(2) Tighten the compressor attaching bolts to 41 N●m (30 ft. lbs.) torque.
(3) Adjust drive belt (see Group 7, Cooling System).
(4) Install refrigerant hoses.
(5) Connect the clutch wire.
(6) Evacuate and charge the system.
(7) Connect the battery negative cable.

COMPRESSOR CLUTCH/COIL ASSEMBLY

CLUTCH INOPERATIVE

The air conditioning compressor clutch electrical circuit is controlled by the engine controller. The controller 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 low pressure or differential pressure cut-off switch located on the expansion valve. If voltage is not detected, refer to:

- Group 8W, Wiring Diagrams.
- The appropriate Powertrain Diagnostic Procedures Manual for diagnostic information.

If voltage is detected at the cut-off switch, reconnect switch. Then check for battery voltage between the compressor clutch connector terminals.

If voltage is detected, perform A/C Clutch Coil Tests.

CLUTCH COIL TESTS

(1) Verify battery state of charge. (Test indicator in battery should be green).
(2) Connect an ammeter (0-10 ampere scale) in series with the clutch coil terminal. Use a volt meter (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 fusible link.
(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.

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.

REMOVAL

(1) Remove the compressor from the mount.
(2) To prevent compressor shaft rotation, install 2 (6 mm) bolts, along with 2 wrenches, to the threaded holes in the armature plate (Fig. 1). Remove compressor shaft nut.
(3) Tap the armature plate with a plastic and remove plate and shim(s).

CAUTION: Do not use screwdrivers between the armature plate assembly and rotor-pulley to remove the armature plate. This may damage the armature plate assembly.

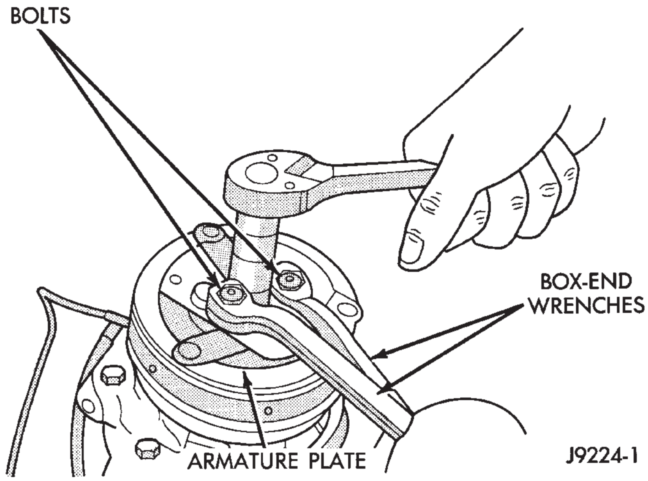


Fig. 1 Compressor Shaft Nut Removal/Installation

(4) Remove rotor-pulley retaining snap ring with Snap Ring Pliers C-4574. Slide rotor-pulley assembly from compressor. Use a plastic hammer, if necessary.

(5) Loosen the lead wire retaining clamps and remove lead wire from the compressor front end plate. Disconnect the lead wire from the thermal limiter switch.

(6) Remove the snap ring which secures the field coil-core assembly to the front boss (Fig. 2). Note the alignment of field coil-core assembly when removing.

WARNING: TAKE CARE THAT THE SNAP RING DOES NOT FLY OUT FROM THE GROOVE.

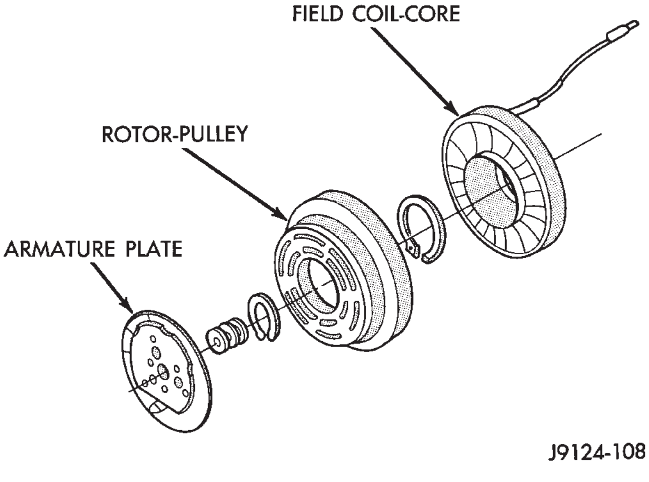


Fig. 2 Armature Plate/Rotor-Pulley/Field Coil-Core

INSPECTION

Examine frictional faces of the rotor-pulley and armature plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring. If the friction surfaces are oily, inspect the shaft nose area of the compressor for excess oil. If excess oil is present, the shaft seal is leaking and will have to be replaced.

Check rotor-pulley bearing for roughness or excessive grease leakage. Check for bearing grease contamination on armature plate faces.

The rotor-pulley and armature plate should be replaced as a matched set.

INSTALLATION

(1) Position the back of the field coil-core over the compressor front boss. This will allow the locating nipple on the back of the coil to line up with the locating indentation on the front boss. This ensures correct angular position of the clutch coil and lead wire.

(2) Fasten lead wire to the compressor front plate with the retaining clip. Connect the lead wire to the thermal limiter switch.

(3) Install field coil-core retaining snap ring (bevel side outward) with Snap Ring Pliers C-4574. Press snap ring to make sure it is properly seated in the groove.

CAUTION: If snap rings on field coil-core and rotor-pulley are not fully seated, they will vibrate out. A clutch failure and possible severe damage to the compressor could result.

(4) Slide pulley assembly onto compressor.

CAUTION: Do not mar the pulley frictional surface.

(5) Install rotor-pulley assembly retaining snap ring (bevel side outward) with Snap Ring Pliers C-4574. Press the snap ring to make sure it is properly seated in the groove.

(6) If the original armature plate assembly and rotor-pulley assembly are to be reused, the old shim(s) can be used. If not, place a trial stack of shims, 2.54 mm (0.10 in.) thick, on the compressor shaft against the shoulder of the armature plate.

(7) Install armature plate to the compressor shaft. Note the machined mating splines (Fig. 3).

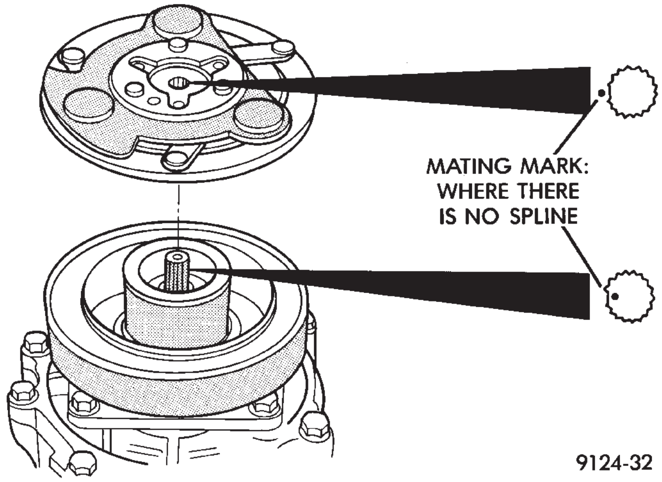


Fig. 3 Aligning Clutch Plate Splines

(8) With the front clutch plate assembly tight against the shims, measure the air gap between armature plate and rotor-pulley face with feeler gauges (Fig. 4). The air gap should be between 0.35 and 0.65 mm (0.013 and 0.025 inch). If proper air gap is not obtained, add or subtract shims until desired air gap is obtained.

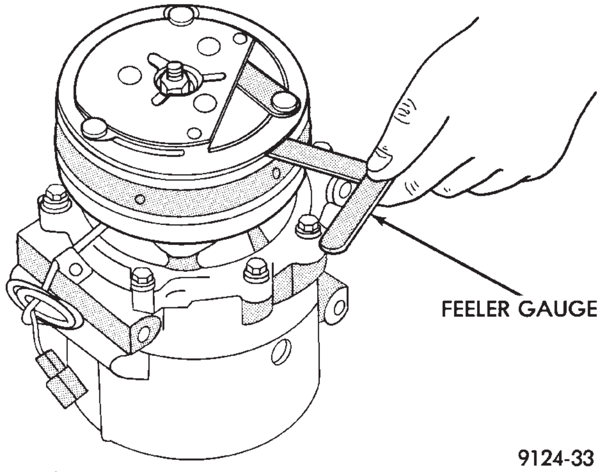


Fig. 4 Measuring Air Gap

(9) Install compressor shaft nut. Tighten nut to 17.5 N•m (155 in. lbs.) torque.

Shims may compress after tightening shaft bolt. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

(10) Install the compressor onto the mount.

CLUTCH/COIL BREAK-IN

After a new clutch/coil has been installed, cycle the A/C clutch 20 times (5 sec. on and 5 sec. off). During this procedure, run engine at 1500-2000 rpm and set the A/C on the HIGH mode. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher clutch torque capability.

THERMAL LIMITER SWITCH

The Thermal Limiter Switch (Fig. 5) is bolted to the side of the compressor case. It measures compressor surface temperature and is used as a safety device to cut battery voltage to the compressor clutch coil. This is performed if compressor case temperature is excessive.

This switch is **NOT USED** to cycle the clutch coil. After the compressor has cooled to normal operating temperature, the switch will reset.

DIAGNOSIS

The switch can remain bolted to the compressor for testing.

(1) Disconnect the wiring connectors from the thermal limiter switch.

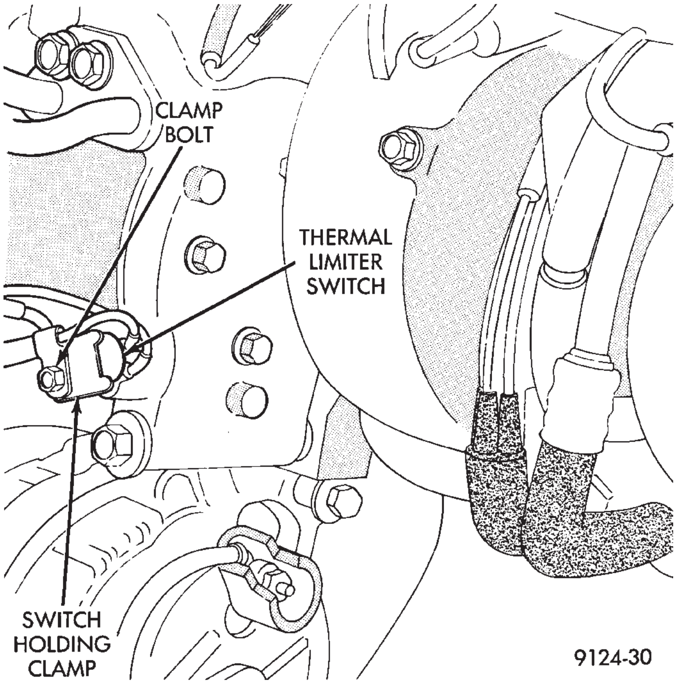


Fig. 5 Thermal Limiter Switch

(2) Using an ohmmeter, check for continuity between the two wiring leads. If continuity is not detected, replace switch. Also check for possible compressor overheating.

- Switch cut-out (no continuity) occurs at 125°C ±3°C (255°F ±37°F).
- Switch cuts back in (continuity) at 110°C ±6°C (230°F ±42°F).

REMOVAL

The refrigerant system can remained fully charged for thermal limiter switch replacement.

After removing the thermal limiter switch, always replace with a new unit.

(1) Disconnect wiring connectors from switch.

(2) Remove the bolt retaining the switch holding clamp and the switch to the side of the compressor (Fig. 6).

(3) Pry the switch from compressor case with a screwdriver.

CLEANING

Remove silicone filler from the socket and thoroughly clean the socket with thinners.

INSTALLATION

(1) Place the new thermal limiter switch so that the flat copper surface faces upward.

(2) Apply the specified silicone filler (KE 347 RTV) to the flat copper surface until the surface is evenly covered. When silicone is applied, apply only from tube and not by hand.

(3) Install the thermal limiter switch into the socket and secure it with the thermal protector (limiting switch) fixing plate and bolt. Tighten the bolt

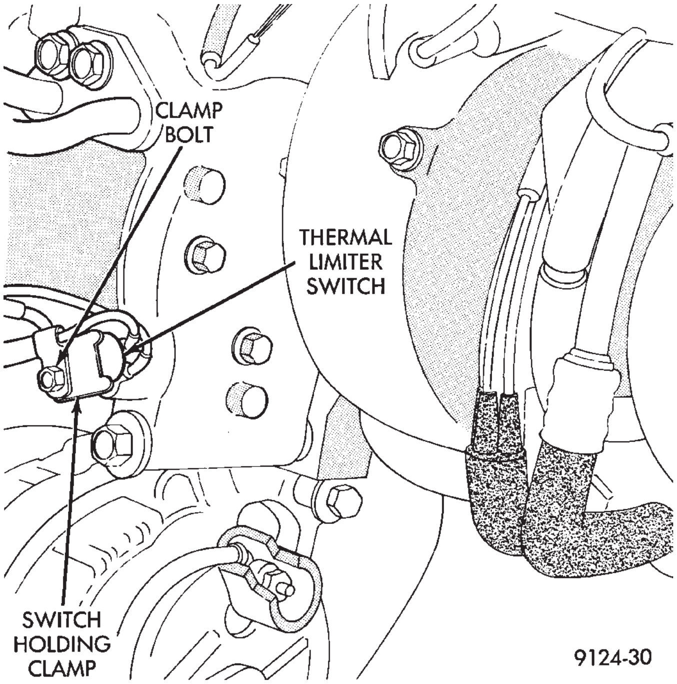


Fig. 6 Thermal Limiter Switch

to 1.8 N●m (17 in. lbs.) torque.

(4) Connect wiring connectors to switch.

COMPRESSOR SHAFT BEARING/SEAL

CAUTION: Cleanliness is extremely important when disassembly of the compressor is necessary. The surfaces around the suction and discharge ports of the compressor should be cleaned thoroughly before opening the system at these points. If compressor is removed from vehicle, apply tape to the opened ports to prevent any contamination.

REMOVAL

(1) Remove the compressor from the mounting.

(2) Remove the compressor nut and armature plate.

(3) Remove the shaft bearing by using Shaft Bearing Removal/Installation Tool 6533 as follows:

(a) With the collet on top of the bearing, insert the 2 jaws into the bearing groove (Fig. 7). Position the jaw retainer over the 2 jaws.

(b) Thread in the screw (Fig. 7). Turn the screw until the bearing is moved up and loosened.

(4) Remove felt washer (Fig. 8).

(5) Remove snap ring using snap ring pliers (Fig. 9).

CAUTION: Be careful not to scratch the inside bore of front boss.

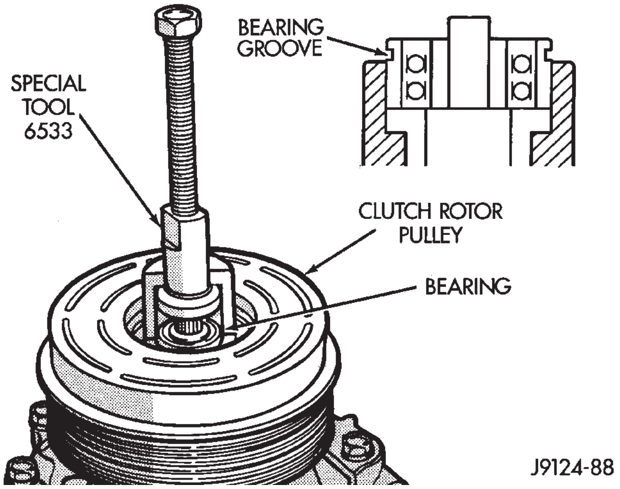


Fig. 7 Bearing Removal using Tool 6533

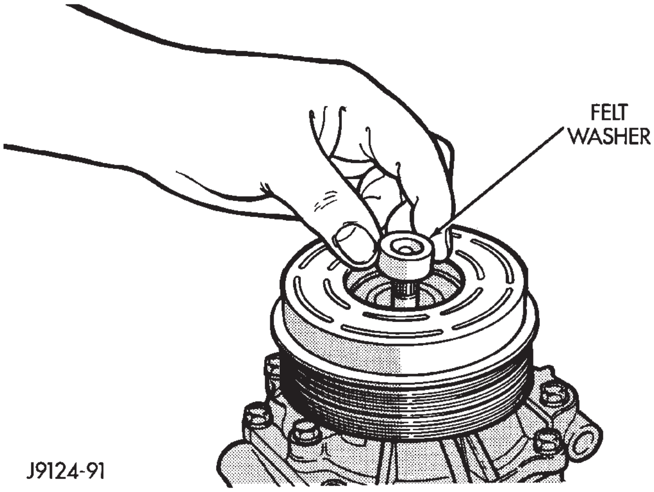


Fig. 8 Felt Washer

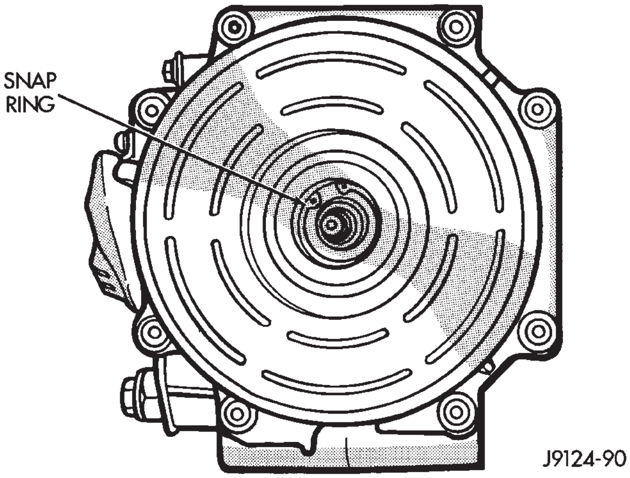


Fig. 9 Compressor Shaft Seal Snap Ring

(6) Insert Lip Seal Removal/Installation Tool 6551 and twist the tool until it is engaged into the slots of the seal case (Fig. 10). Carefully lift out seal assembly.

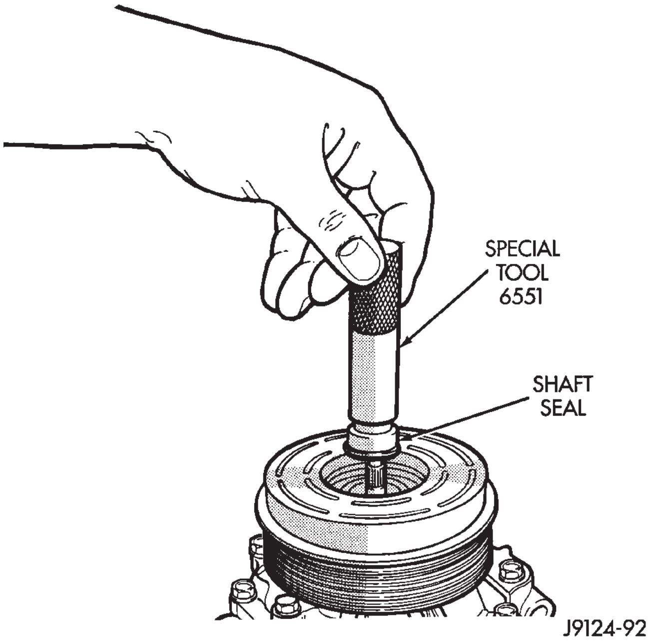


Fig. 10 Compressor Shaft Seal

INSTALLATION

CAUTION: Do not touch seal contact surfaces.

(1) Insert Seal Sleeve Protector Tool 6552 over compressor shaft (Fig. 11).

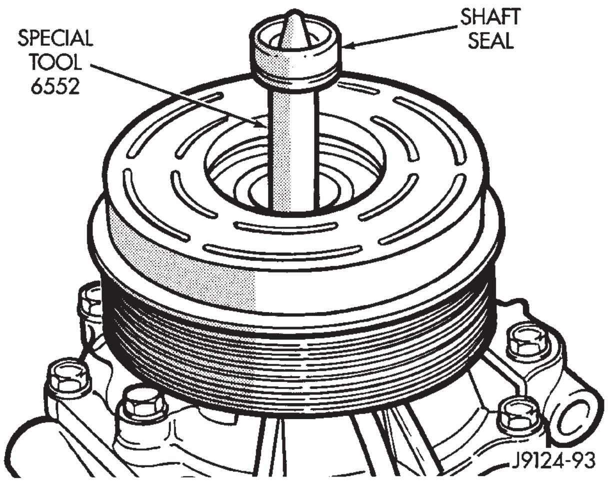


Fig. 11 Compressor Shaft Seal Sleeve Proctor

(2) Apply a little oil on seal sleeve protector.

(3) Apply oil on O-ring portion of the lip seal.

(4) Engage the slots of the Lip Seal Removal/Installation Tool 6551 to the lip seal cage. Install the lip seal into place by pushing gently over the seal protector.

(5) Twist tool and remove from the seal. Remove seal sleeve protector.

(6) Install snap ring into the snap ring groove. Push snap ring down to ensure correct positioning by using opposite end of Lip Seal Removal/Installation Tool 6551.

(7) Replace felt washer.

(8) Position the shaft bearing into front boss.

(9) Install bearing with Shaft Bearing Removal/Installation Tool 6533. Use the 2 jaws, the jaw retainer and the collet and gently hammer with a plastic hammer to seat the bearing (Fig. 12). The use of this tool will properly position the bearing.

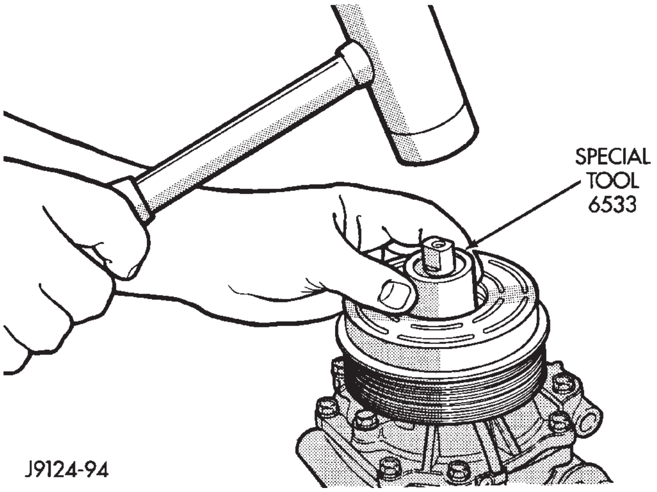


Fig. 12 Shaft Bearing Installation

(10) Install armature plate to the compressor shaft. Note the machined mating splines (Fig. 13).

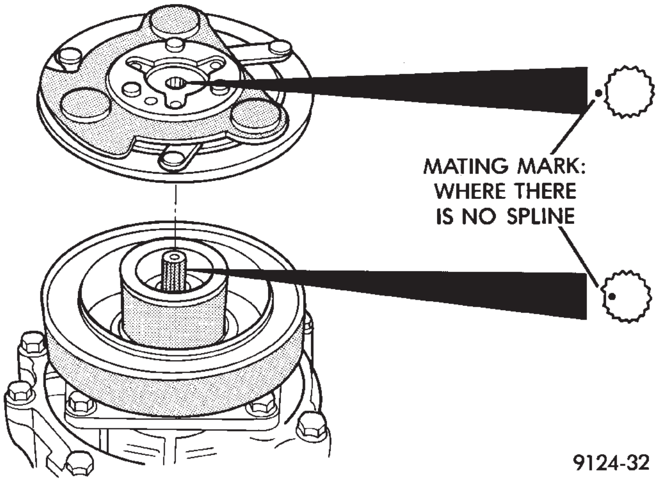


Fig. 13 Aligning Clutch Plate Splines

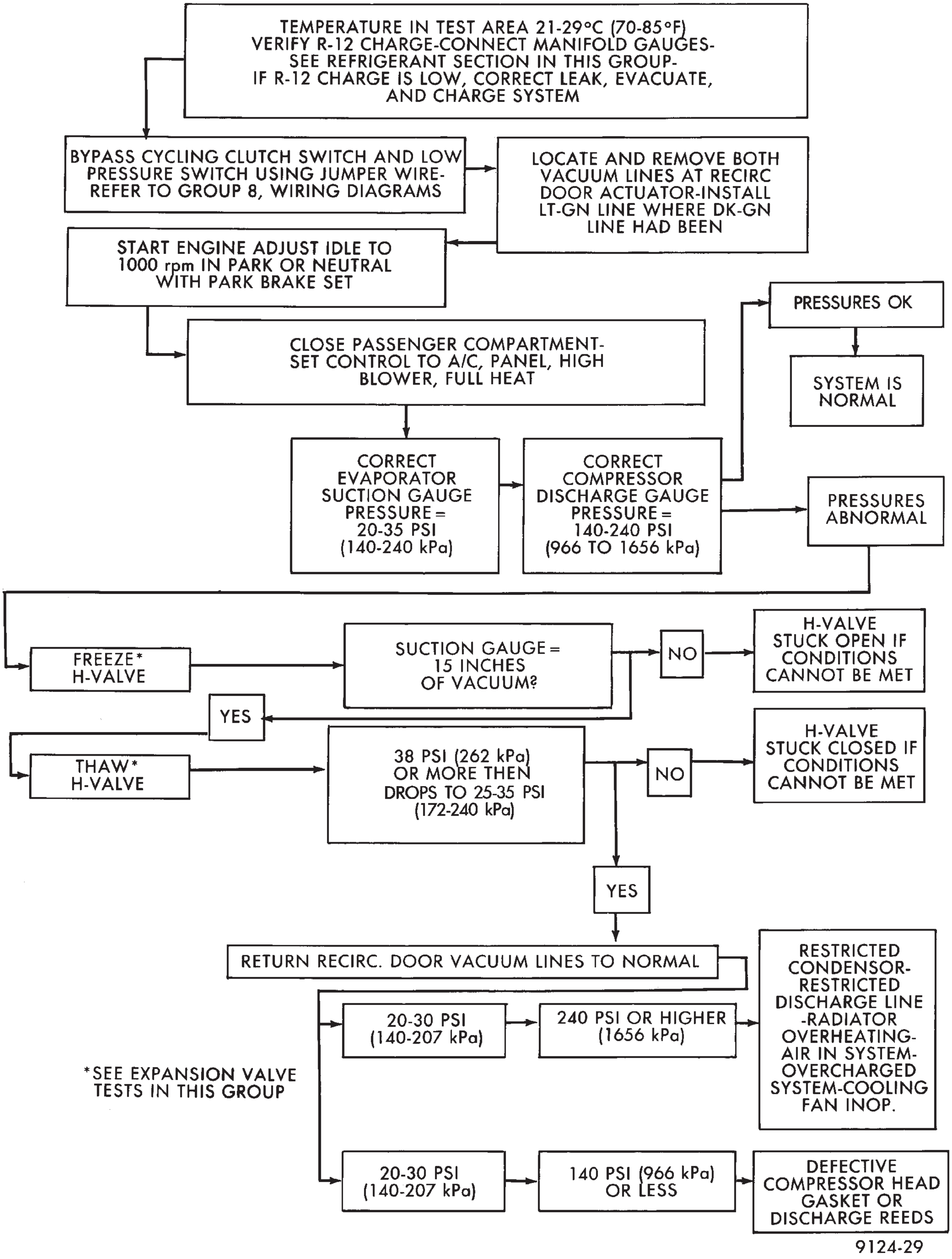
(11) Install compressor shaft nut. Tighten nut to 17.5 N•m (155 in. lbs.) torque.

(12) Install the compressor onto the mount.

REFRIGERANT SYSTEM DIAGNOSIS

Refer to the Refrigerant System Diagnosis chart in this section.

REFRIGERANT SYSTEM DIAGNOSIS



FIXED DISPLACEMENT COMPRESSOR—MODEL SD709P

INDEX

DESCRIPTION

The Sanden compressor is a 7 piston design. System lubrication is provided by 135 ml ±15 ml (4.6 oz. ±0.5 oz.) of 500 viscosity refrigerant oil.

The clutch used on the compressor consists of 3 basic components:

- The pulley
- Front plate
- Field coil

The pulley and field coil are attached to the front head of the compressor with tapered snap rings. The hub is keyed to the compressor shaft and is retained on the shaft with a self-locking nut. Special service tools are required to remove and install the clutch plate on the compressor shaft.

COMPRESSOR

The A/C compressor may be removed and positioned without discharging the refrigerant system. Discharging is not necessary if removing the A/C compressor clutch/coil assembly, engine, cylinder head, or generator.

WARNING: REFRIGERANT PRESSURES REMAIN HIGH EVEN THOUGH THE ENGINE MAY BE TURNED OFF. BEFORE REMOVING A FULLY CHARGED COMPRESSOR, REVIEW THE SAFETY PRECAUTIONS AND WARNINGS SECTION IN THIS GROUP. DO NOT TWIST OR KINK THE REFRIGERANT LINES WHEN REMOVING A FULLY CHARGED COMPRESSOR. SAFETY GLASSES MUST BE WORN.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Loosen and remove drive belts (refer to group 7, Cooling System) and disconnect compressor clutch wire lead.

(3) Remove refrigerant lines from compressor (if necessary).

(4) Remove compressor attaching nuts and bolts.

(5) Remove compressor. If refrigerant lines were not removed, lift compressor/clutch assembly and tie it to a suitable component.

To install, reverse the removal procedure.

COMPRESSOR CLUTCH/COIL ASSEMBLY

The magnetic clutch consists of a stationary electro-magnetic coil and a rotating pulley and plate assembly.

The electromagnetic coil is retained on the compressor with a snap ring and is dimpled to maintain its position.

The pulley and plate assembly are mounted on the compressor shaft.

When the compressor is not in operation, the pulley free wheels on the clutch hub bearing. When the coil is energized the plate is magnetically engaged with the pulley and turns the compressor shaft.

REMOVAL

(1) Insert the 2 pins of the front plate spanner into any 2 threaded holes of the clutch front plate (Fig. 1). Hold clutch plate stationary. Remove hex nut with 19 mm (3/4 inch) socket.

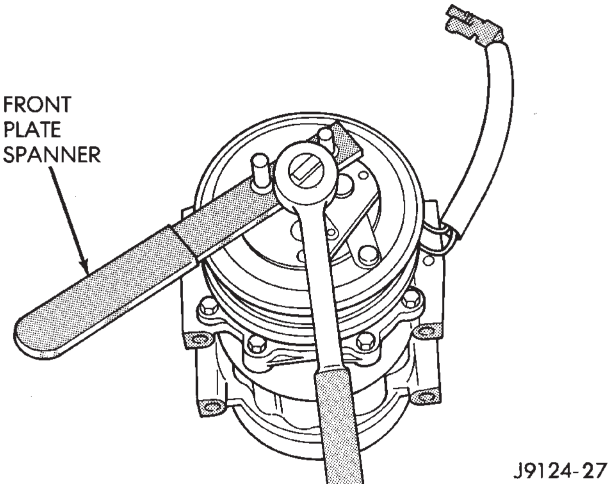


Fig. 1 Hex Nut Removal

(2) Remove clutch front plate using puller. Align puller center bolt to compressor shaft (Fig. 2). Thumb tighten the puller bolts into the threaded holes.

(3) Turn center bolt clockwise with 19 mm (3/4 inch) socket until front plate is loosened.

(4) Remove shaft key by lightly tapping it loose with a slot screwdriver and hammer (Fig. 3).

(5) Remove the external front housing snap ring by using spread type snap ring pliers (Fig. 4).

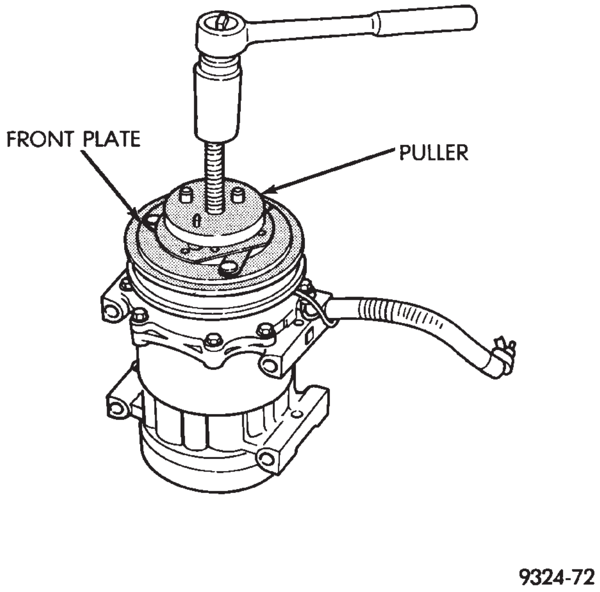


Fig. 2 Clutch Front Plate Removal

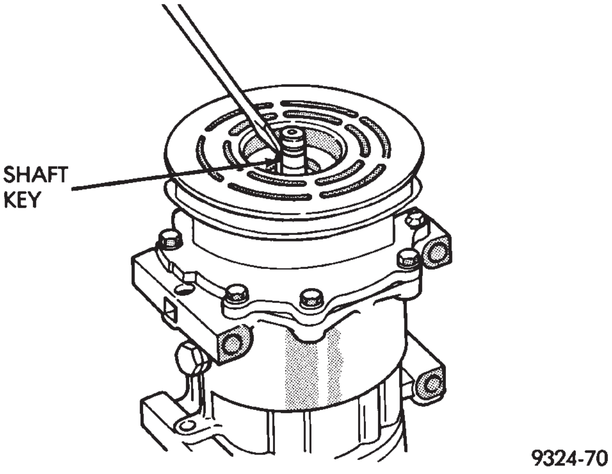


Fig. 3 Shaft Key Removal

(6) Insert the lip of the jaws of the rotor puller into the snap ring groove exposed in the previous step (Fig. 5).

(7) Place rotor puller shaft protector over the exposed shaft.

(8) Install the puller plate and bolt (Fig. 6). 2 bolts go through the plate and into the jaws. Finger tighten bolts.

(9) Turn puller center bolt clockwise using 3/4 inch socket until rotor pulley is free.

(10) Loosen coil lead wire from clip on top of compressor front housing (Fig. 7).

(11) Using spread type snap ring pliers, remove snap ring and field coil (Fig. 8).

INSTALLATION

(1) Install the field coil with the snap ring.

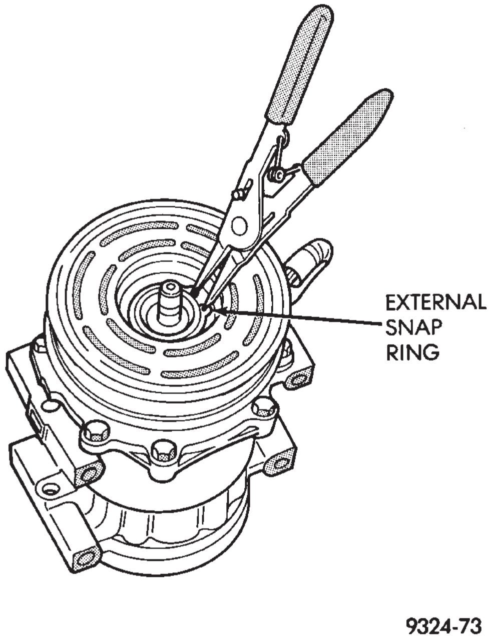


Fig. 4 External Snap Ring Removal

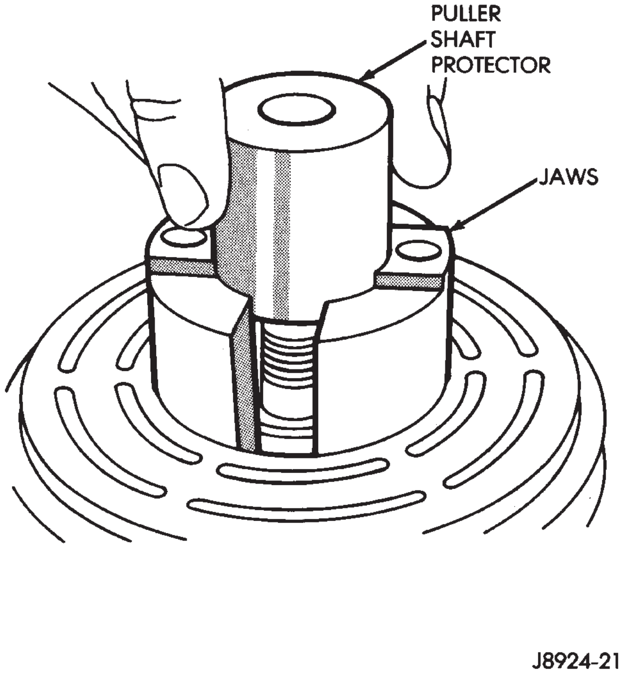


Fig. 5 Install Shaft Protector

(2) Place coil lead wire under clip on top of compressor front housing and tighten the retaining screw.

(3) Support the compressor on the 4 mounting ears at the compressor rear. If a vise is being used, clamp only on the mounting ears. Never clamp on the compressor body.

(4) Align rotor assembly squarely on the front housing hub.

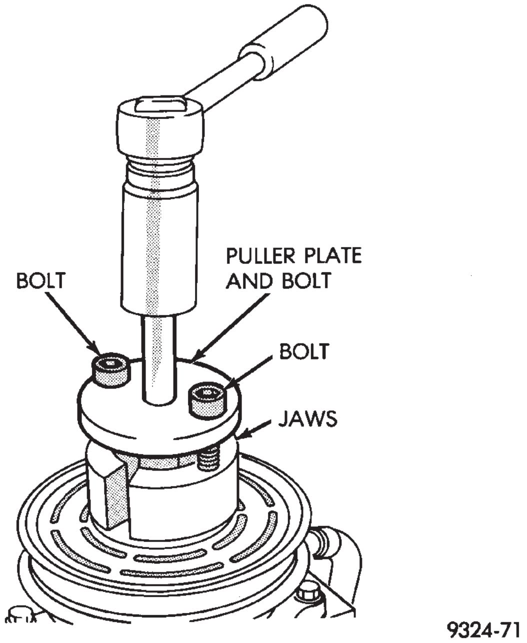


Fig. 6 Install Puller Plate

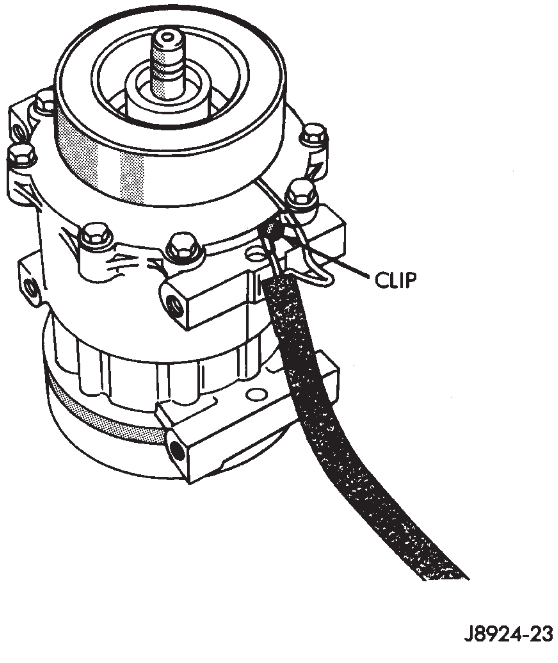


Fig. 7 Loosen Coil Lead Wire

(5) Using Rotor Installer Set, place the ring part of the set into the bearing cavity (Fig. 9). Make certain the outer edge rests firmly on the rotor bearing inner race.

(6) Place the tool set driver into the ring (Fig. 10).

(7) With a hammer, tap the end of the driver while guiding the rotor to prevent binding. Tap until the rotor bottoms against the compressor front housing hub. Listen for a distinct change of sound during the tapping process.

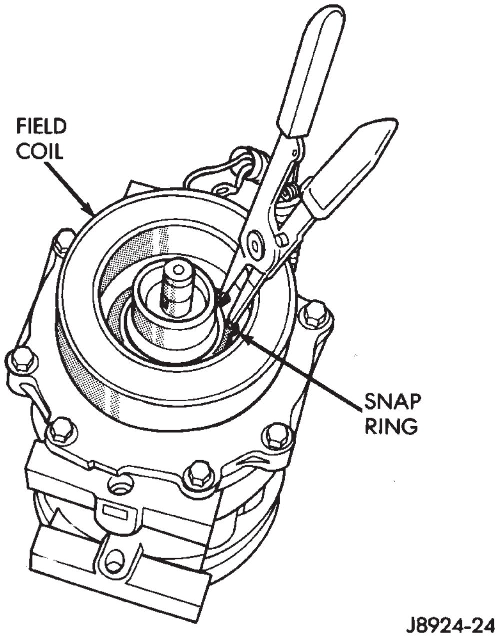


Fig. 8 Snap Ring and Field Coil Removal

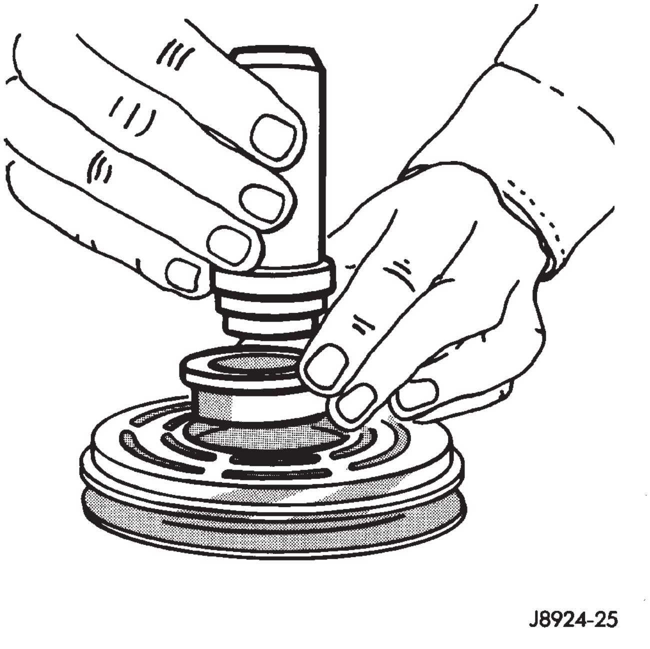


Fig. 9 Rotor Installer Set

(8) Install external front housing snap ring with spread type snap ring pliers.

(9) Install front plate assembly.

- Check that original clutch shims are in place on compressor shaft.
- Replace compressor shaft key.
- Align front plate key-way to compressor shaft key.

(10) Using shaft protector, tap front plate to shaft until it has bottomed to the clutch shims (Fig. 11). Listen for a distinct change of sound during the tapping process.

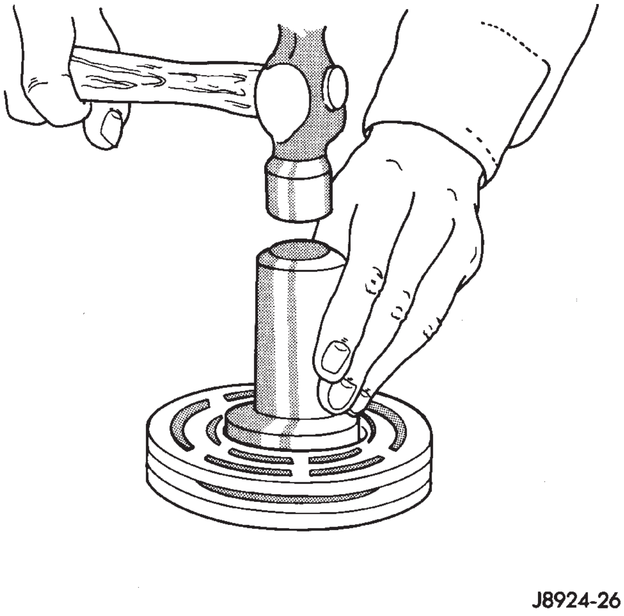


Fig. 10 Tool Set Driver

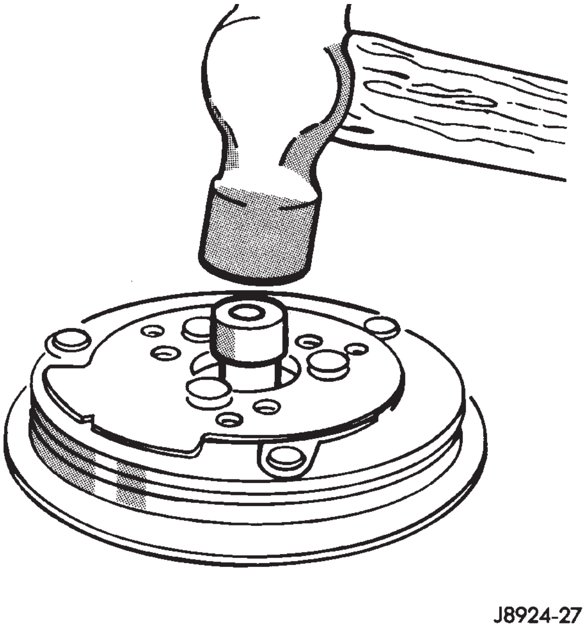


Fig. 11 Front Plate Installation

(11) Replace shaft hex nut. Tighten the hex nut to 37 N●m (27 ft. lbs.) torque.

(12) Check air gap with feeler gauge (Fig. 12). The specification is 0.406-0.787 mm (0.016-0.031 inch). If air gap is not consistent around the circumference, lightly pry up at the minimum variations. Lightly tap down at points of maximum variation.

The air gap is determined by the spacer shims. When installing the original or a new clutch assembly, try the original shims first. When installing a new clutch onto a compressor that previously did not have a clutch, use 0.040, 0.020, and 0.005 shims from the clutch accessory sack.

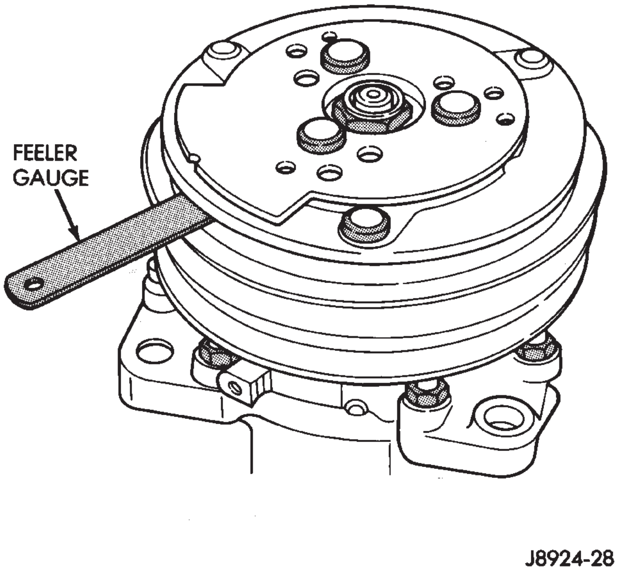


Fig. 12 Check Air Gap

(13) If the air gap does not meet the specification given, add or subtract shims as required.

COMPRESSOR SHAFT SEAL

Using a refrigerant recovery machine, remove the refrigerant from the A/C system before replacing shaft seal.

REMOVAL

(1) Insert the 2 pins of the front plate spanner into any 2 threaded holes of the clutch front plate (Fig. 1). Hold clutch plate stationary. Remove hex nut with 19 mm (3/4 inch) socket.

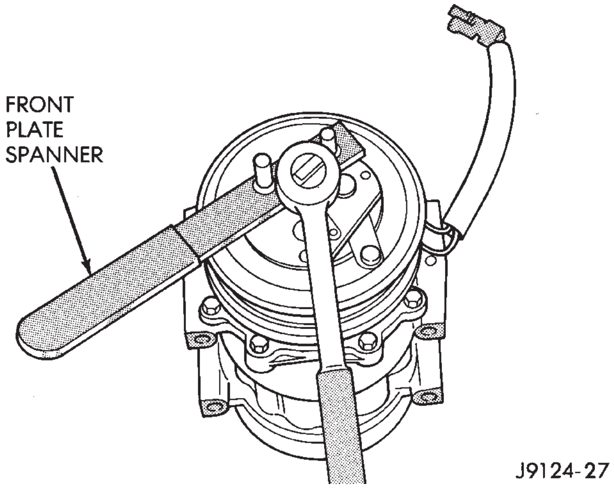


Fig. 1 Hex Nut Removal

(2) Remove clutch front plate using puller (Fig. 2). Align puller center bolt to compressor shaft. Thumb tighten the 3 puller bolts into the threaded holes.

(3) Turn center bolt clockwise with 19 mm (3/4 inch) socket until front plate is loosened.

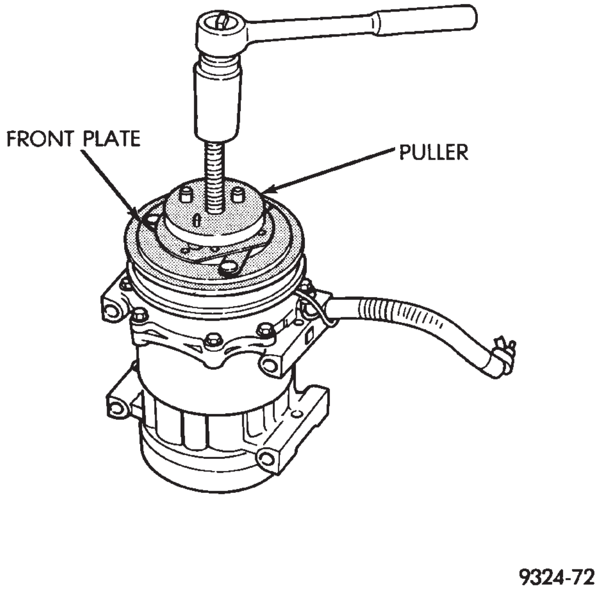


Fig. 2 Remove Clutch Front Plate

Shaft seal replacement should be done on the bench. Never use any old parts of the shaft seal assembly. Rebuild the complete assembly.

(4) Using either of the snap ring tools, insert the tool points into the 2 holes of the felt ring metal retainer. Lift the felt ring out (Fig. 3).

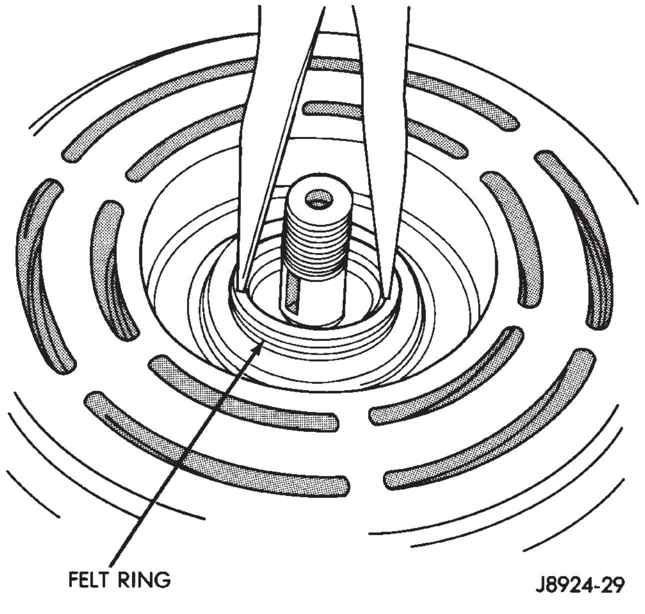


Fig. 3 Felt Ring Removal

(5) Remove the clutch shim. Use O-ring hook and a small screwdriver to prevent shim from binding on shaft (Fig. 4).

(6) Remove shaft seal seat retaining snap ring with pinch type snap ring pliers (Fig. 5).

(7) Remove the shaft seal seat, using seal seat tool (Fig. 6).

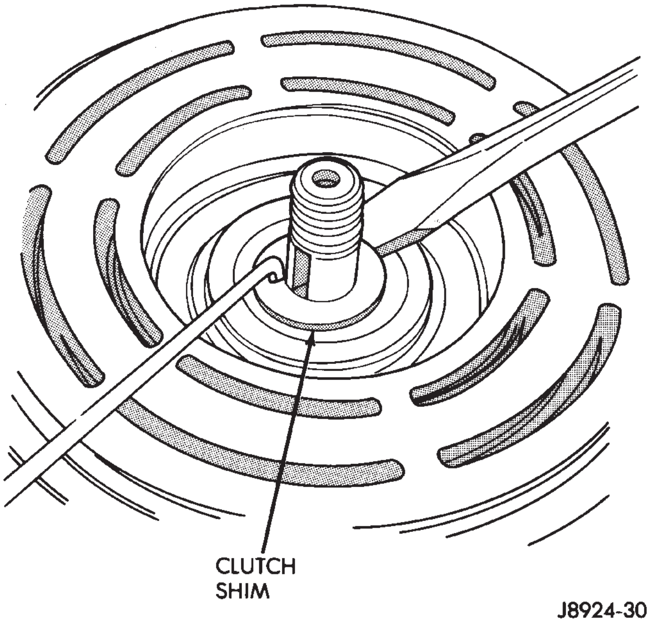


Fig. 4 Clutch Shim Removal

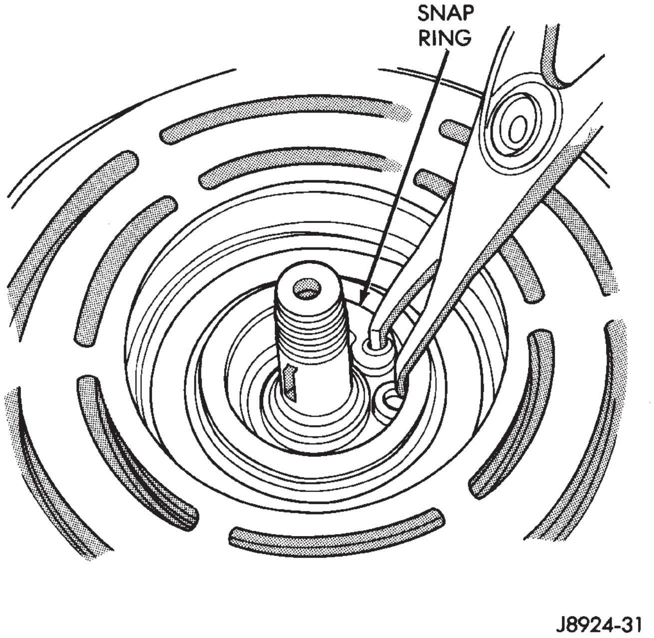


Fig. 5 Snap Ring Removal

(8) Insert the Seal Remover and Installer Tool against the seal assembly. Press down against the seal spring and twist the tool until it engages the slots of the seal cage (Fig. 7). Lift out seal assembly.

INSTALLATION

(1) Clean seal cavity thoroughly with a lint-free or synthetic cloth and clean refrigerant oil. Then blow out with dry pressurized vapor.

(2) Make sure all foreign substances are thoroughly removed.

(3) Insert Seal Sleeve Protector over compressor shaft (Fig. 8).

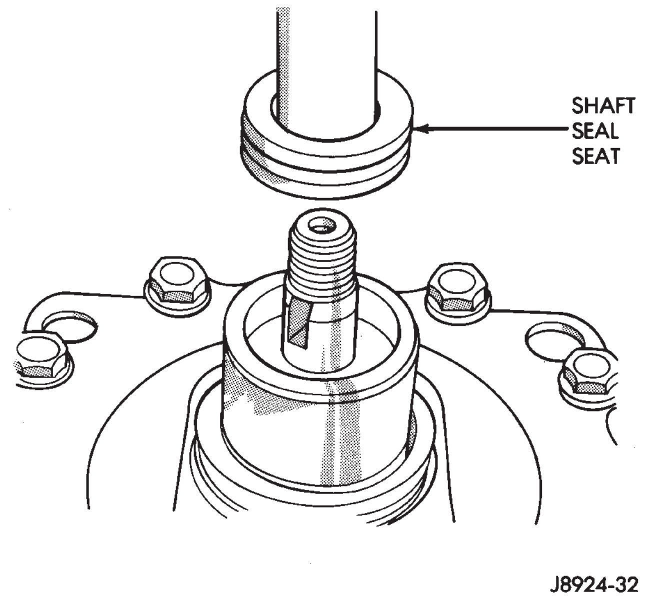


Fig. 6 Shaft Seal Seat Removal

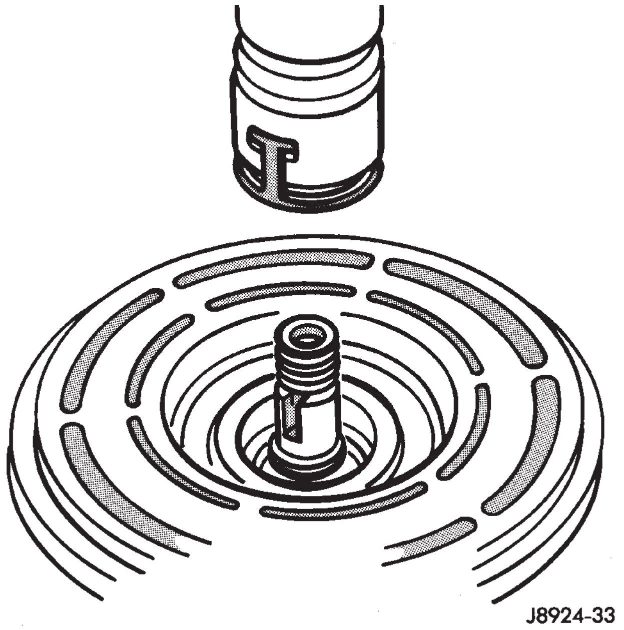


Fig. 7 Seal Assembly Removal

(4) Do not touch the new seal lapping surfaces. Dip the mating surfaces in clean refrigerant oil before proceeding.

(5) Engage slots of Seal Remover and Installer to new seal cage and insert seal assembly firmly into place in the compressor seal cavity (Fig. 9). Twist tool in opposite direction to disengage tool from seal cage. Remove tool.

(6) Coat seal retainer with clean refrigerant oil. Use seal seat tool to install (Fig. 10). Press lightly against seal.

(7) Install snap ring. Beveled edge lies outward from compressor. Flat side lies toward compressor. It may be necessary to lightly tap the snap ring to securely position it in its groove.

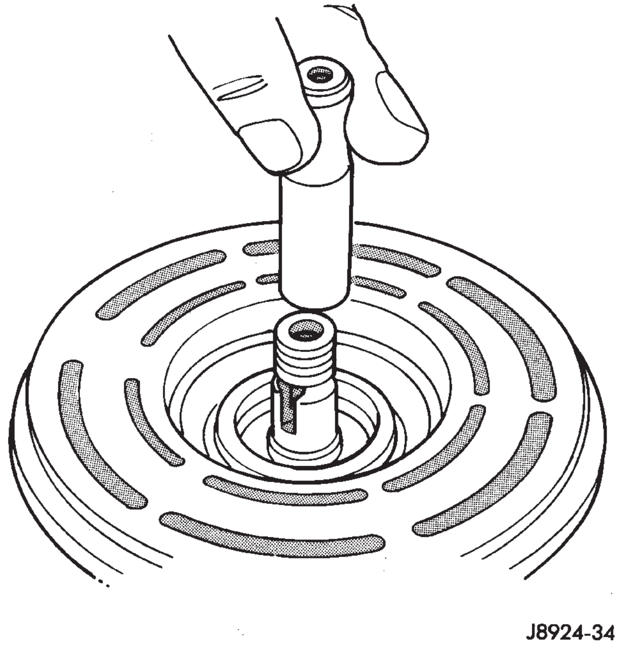


Fig. 8 Insert Seal Sleeve Protector

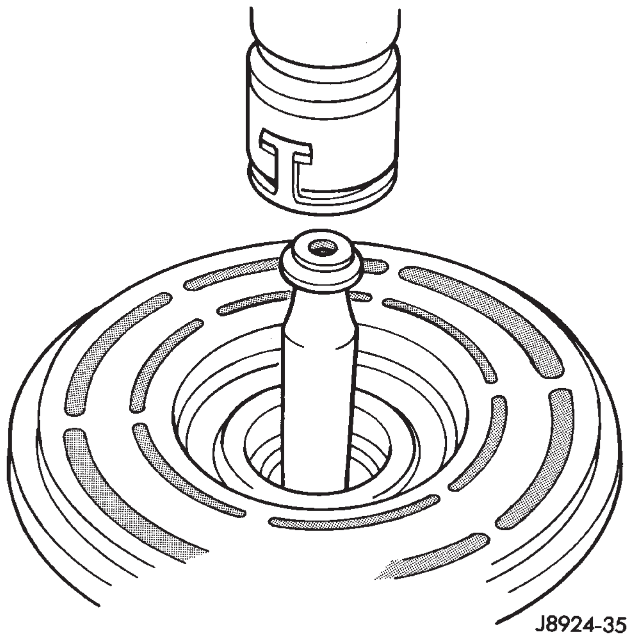


Fig. 9 Compressor Shaft Seal Installation

(8) Replace clutch spacer shims.

(9) Tap new felt ring into place (Fig. 11).

(10) Align front plate key-way to compressor shaft key.

(11) Using shaft protector, tap front plate to shaft until it has bottomed to the clutch shims. Listen for a distinct change of sound during the tapping process.

(12) Replace shaft hex nut. Tighten the hex nut to 37 N•m (27 ft. lbs.) torque.

(13) Check air gap with feeler gauge (Fig. 12). The specification is 0.406-0.787 mm (0.016-0.031 inch). If

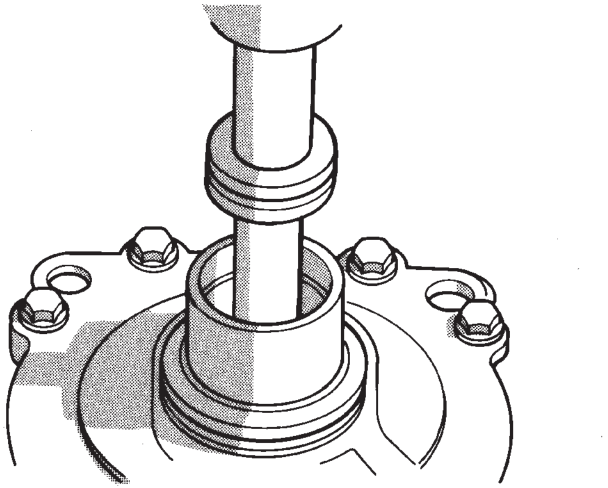


Fig. 10 Install Seal Retainer

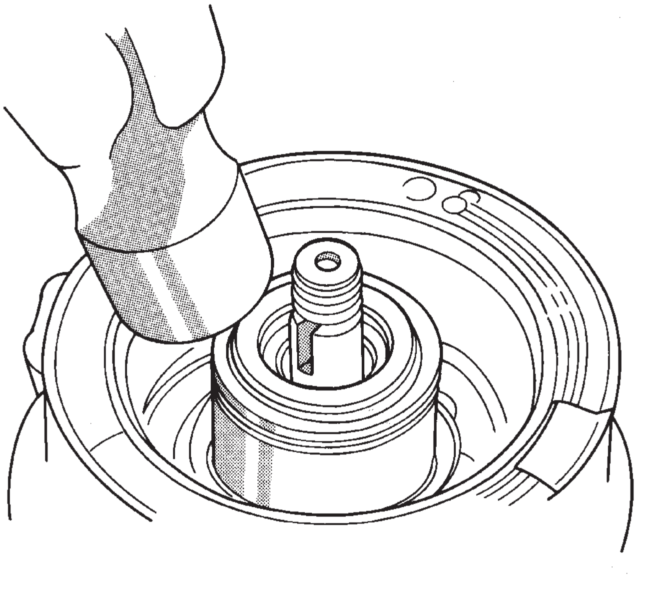


Fig. 11 Install New Felt Ring

air gap is not consistent around the circumference, lightly pry up at the minimum variations. Lightly tap down at points of maximum variation.

The air gap is determined by the spacer shims. When installing the original or a new clutch assembly, try the original shims first. When installing a new clutch onto a compressor that previously did not have a clutch, use 0.040, 0.020, and 0.005 shims from the clutch accessory sack.

(14) If the air gap does not meet the specification given, add or subtract shims as required.

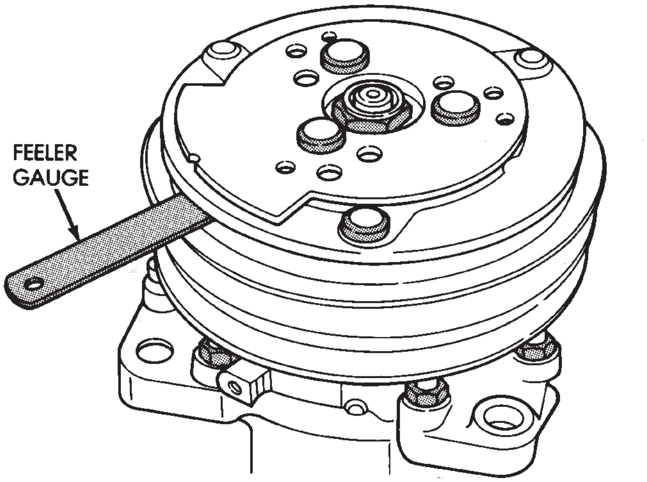


Fig. 12 Check Air Gap

CYLINDER HEAD/VALVE PLATE

REMOVAL

(1) Remove cylinder head bolts.

(2) Using a small hammer and a gasket scraper separate the cylinder head from the valve plate (Fig. 1).

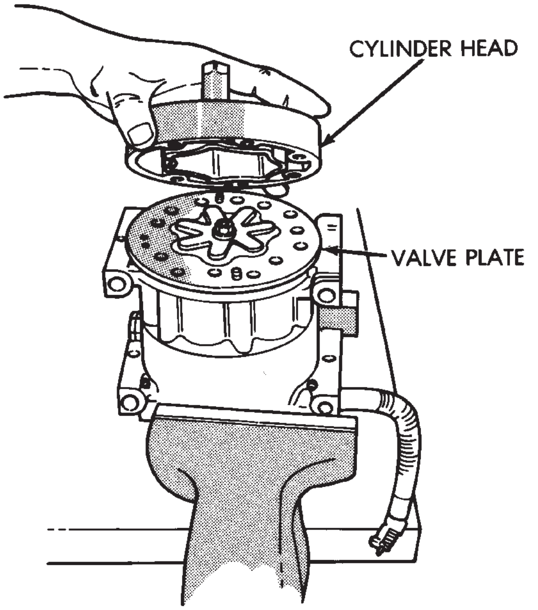


Fig. 1 Cylinder Head and Valve Plate

(3) Visually inspect all parts for damage.

(4) Separate the valve plate from the cylinder block (Fig. 2).

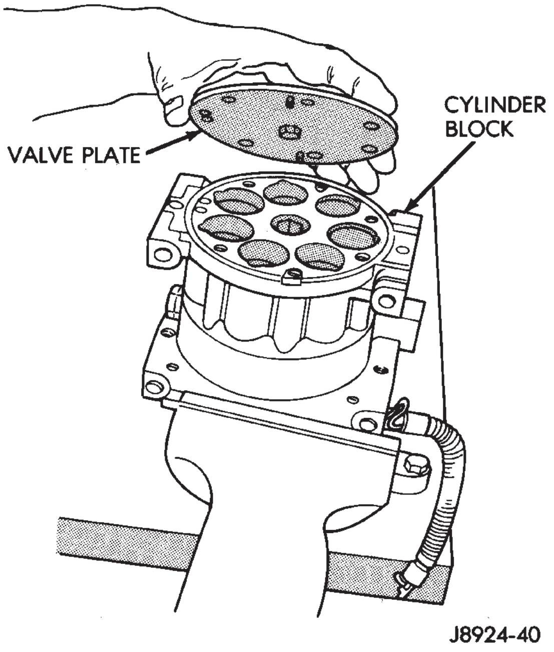


Fig. 2 Valve Plate Removal

INSPECTION

Visually inspect the rear valves and discharge retainer for damage. Discard any component if any portion is damaged.

CLEANING

If valve plate and/or cylinder head are to be reused, carefully remove gasket materials using the gasket scraper. Do not damage cylinder block or valve plate surfaces.

INSTALLATION

When installing the cylinder head valve plate, use the new gaskets in the parts kit.

(1) Coat new valve plate gasket with clean refrigerant oil.

(2) Install valve plate gasket by aligning valve plate gasket to locating pin holes and oil orifice in cylinder block. (For easy reference, the gaskets have a notch at the bottom outside edge).

(3) Install valve plate by aligning valve plate locating pins to the pin holes in the block and position valve plate.

(4) Install cylinder head and tighten bolts in order to 32 N●m (24 ft. lbs.) torque (Fig. 3).

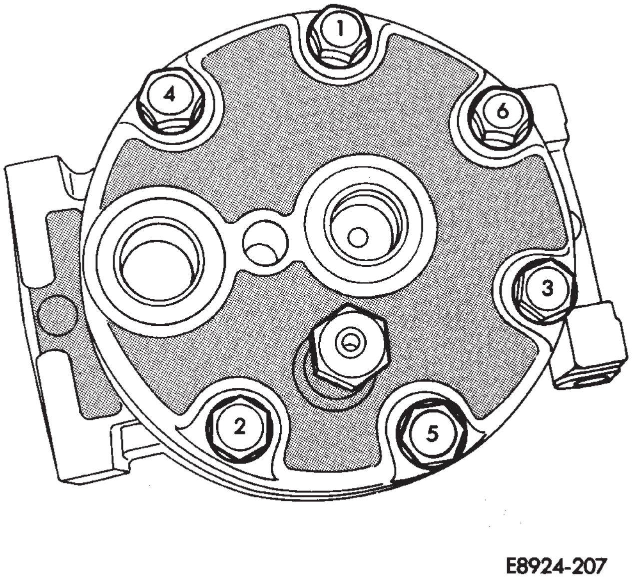
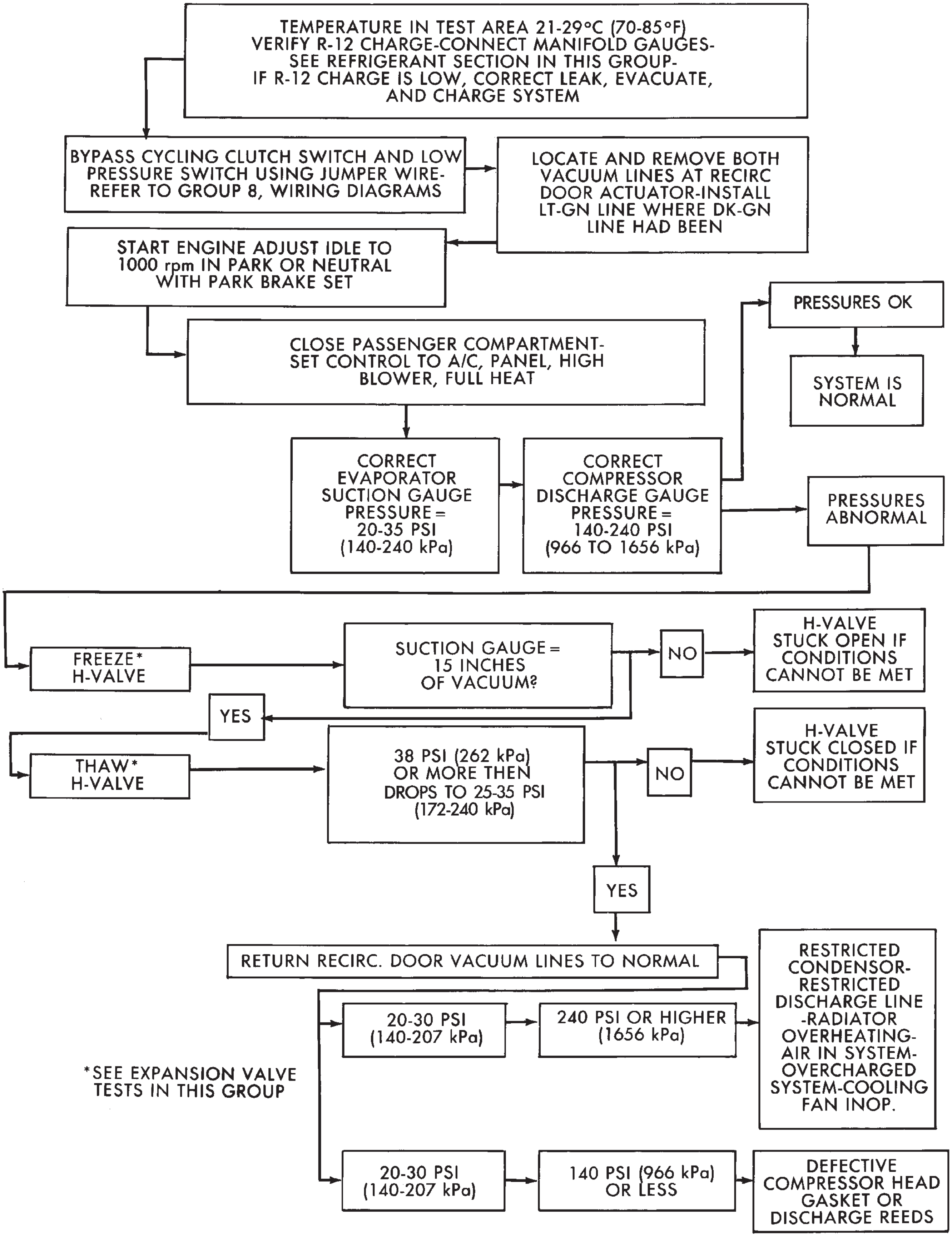


Fig. 3 Cylinder Head Bolt Torque Sequence

REFRIGERANT SYSTEM DIAGNOSIS

Refer to the Refrigerant System Diagnosis chart in this section.

REFRIGERANT SYSTEM DIAGNOSIS



COMPONENT SERVICE PROCEDURES

INDEX

AMBIENT SWITCH

The ambient switch is a temperature sensor located in front of the condenser behind the grille (Fig. 1). The ambient switch prevents the compressor from engaging in cold temperatures. The ambient switch is a sealed factory calibrated unit. It must be replaced if defective.

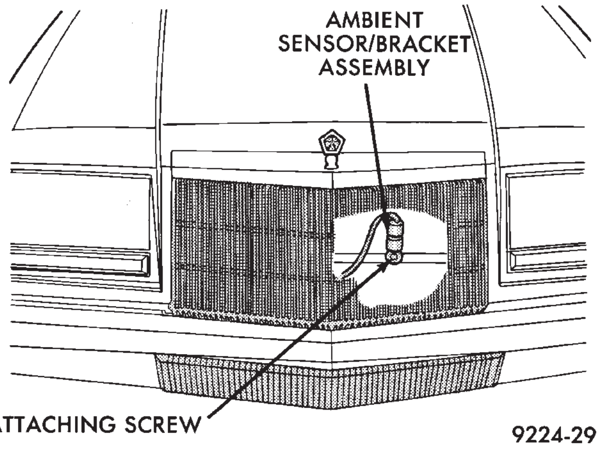


Fig. 1 Ambient Temperature Sensor Switch—Typical Mounting

AMBIENT SWITCH TEST

(1) Disconnect ambient switch wire connector.

(2) Using a suitable ohm meter or continuity tester, test for continuity across the ambient switch terminals.

(a) At temperature above 10°C (50°F), the switch circuit should be complete.

(b) Chill the switch with ice to below 10°C (50°F) and test for continuity. The switch circuit should be open, with continuity not detected.

Replace ambient switch if defective.

REMOVAL AND INSTALLATION

(1) Remove the one attaching screw.

(2) Remove the sensor/bracket assembly from the vehicle.

To install, reverse the preceding operation.

CONDENSER FAN CONTROL SWITCH

The Fan Control Switch is located on the plumbing discharge line at the A/C compressor (Fig. 2). The fan control switch cycles the radiator/condenser fan on and off by monitoring the compressor discharge pressure. The radiator top tank temperature sensor can over ride the function of the fan control switch. It can cycle the radiator/condenser fan on and off depending on the engine temperature.

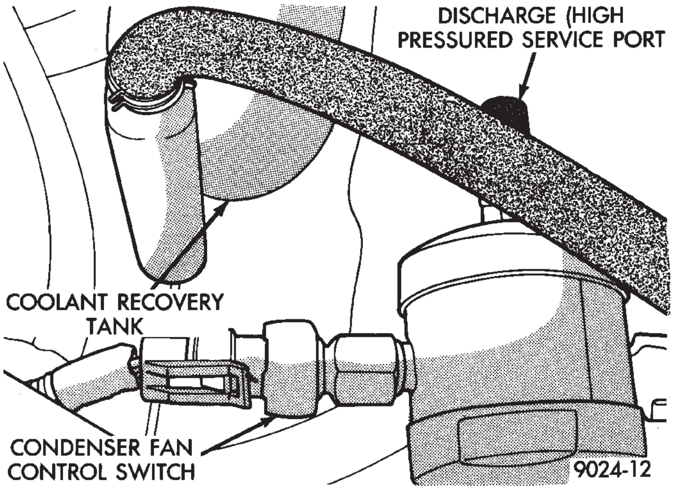


Fig. 2 Condenser Fan Control Switch

FAN CONTROL SWITCH DIAGNOSIS

Review Safety Precautions and Warnings before proceeding. Connect a manifold gauge set to the refrigerant system service ports. Work area temperature can not be below 21°C (70°F).

WARNING: AVOID RADIATOR/CONDENSER FAN BLADES WHEN WORKING IN THE RADIATOR AREA. FAN IS CONTROLLED BY TEMPERATURE AND CAN START ANY TIME IGNITION IS ON. PERSONAL INJURY CAN RESULT.

(1) Disconnect fan control switch wire connector.

(2) Using a suitable jumper wire, jump across terminals in wire connector.

(3) Connect a suitable continuity tester across fan control switch terminals.

(4) Start engine and set idle at 1300 rpm. The radiator fan should run constantly.

(5) Set the A/C controls to A/C and high blower.

(6) If the high pressure gauge reads below 1102 kPa (160 psi) there should be no continuity across the switch terminals.

CAUTION: Do not allow engine to overheat when radiator air flow is blocked.

(7) Block radiator air flow with a suitable cover to increase the high side pressure to at least 1585 kPa (230 psi). Electrical continuity should be detected across the fan control switch terminals.

(8) Remove cover from front of vehicle to allow high side pressure to decrease. When pressure drops below 1102 kPa (160 psi), continuity should cease.

If fan control switch is defective, replace it.

REMOVAL AND INSTALLATION

CAUTION: Refrigerant removal is not necessary when removing the Condenser Fan Control Switch. However, a small amount of refrigerant will vent from the switch port. Review the refrigerant handling section of Safety Precautions and Warnings in the General Information section of this Group.

(1) Disconnect wire connector from condenser fan control switch.

(2) Loosen and quickly rotate the switch counterclockwise and separate from the high pressure line switch port.

To install, reverse the preceding operation.

DIFFERENTIAL PRESSURE CUT-OUT SWITCH DIAGNOSIS

The Differential Pressure Cut-Out (DPCO) Switch (Fig. 3) monitors the liquid refrigerant pressure on the liquid side of the system. The DPCO is located on the expansion valve. The expansion valve is black in color when a variable displacement compressor is used. The DPCO turns off voltage to the compressor clutch coil when liquid refrigerant pressure drops to levels that could damage the compressor. The DPCO is a sealed factory calibrated unit. It must be replaced if defective.

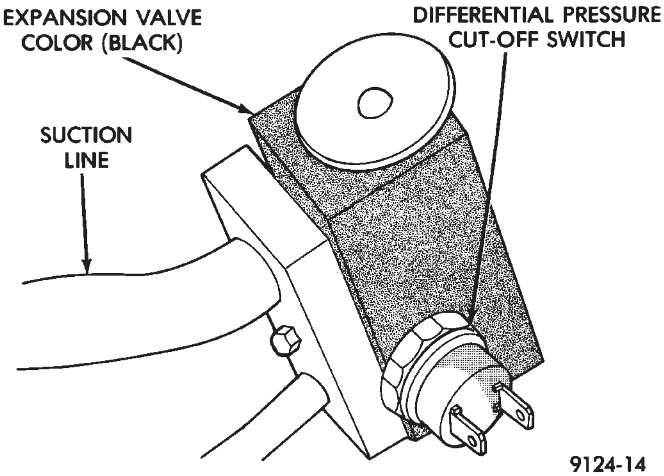


Fig. 3 Differential Pressure Cut-Out Switch

DPCO SWITCH DIAGNOSIS

The work area must not be below 10°C (50°F) to test the compressor clutch circuit.

(1) With gear selector in park or neutral, and park brake set, start engine and allow to idle.

(2) Raise hood and disconnect DPCO switch connector boot.

(3) Using a suitable jumper wire, jump across the terminals inside wire connector boot.

(4) If clutch does not engage, the wiring, fuse, relay, ambient switch, or high pressure cut-off switch can be defective. Refer to Group 8W, Wiring Diagrams.

(5) If clutch engages, connect a suitable manifold gauge set. Read low pressure gauge. At pressure 283 kPa (41 psi) and above, DPCO switch will complete the clutch circuit. If the low pressure gauge reads below 317 kPa (46 psi), the system is low on refrigerant charge or empty due to a leak. Refer to Testing For Refrigerant Leaks in the Refrigerant Service Procedures section.

(6) Install connector boot on switch and repeat step number 3. If the clutch does not engage, replace the DPCO switch.

TEMPERATURE CONTROL CABLE—AC/AY MODELS

REMOVAL AND INSTALLATION

A Temperature Control Cable is used on non-ATC heat or heater-A/C systems only. ATC (Automatic Temperature Control) systems use an electrically operated temperature control. Refer to the ATC section of this Group.

(1) Remove the A/C-Heater control panel assembly. Refer to A/C-Heater Control Replacement in Group 8E Instrument Panel. Disconnect the cable attaching flag from the A/C-heater control and remove the cable from control panel.

(2) Locate and disconnect the cable attaching flag on the bottom of the A/C-heater housing behind the floor air duct (Fig. 4).

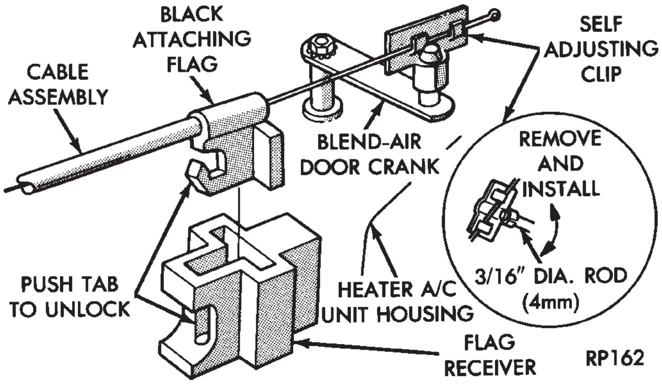


Fig. 4 Temperature Control Cable—Typical

(3) Slip cable self-adjusting clip downward from the blend-air door crank.

(4) Insert a 3/16 diameter tool (drill bit or phillips screwdriver shank) into the crank pin access hole and rotate the clip from the cable.

To install, reverse the preceding operation.

To adjust temperature cable, position the TEMP lever on the control to the cool side of its travel. Allowing the self-adjusting clip to slide on the cable, rotate the blend-air door crank counterclockwise by hand until it stops.

TEMPERATURE CONTROL CABLE—AA,AP,AG AND AJ MODELS

REMOVAL AND INSTALLATION

(1) Remove heater-A/C control panel. Refer to Switch and Panel Component Service in Group 8E, Instrument Panel. Disconnect the attaching flag on the control cable from the heater-A/C control panel.

(2) Remove console assembly. Refer to Group 8E, Instrument Panel.

(3) Remove instrument panel lower steering column cover. Refer to Group 8E, Instrument Panel.

(4) Remove the right lower instrument panel/glove box door assembly. This assembly is clipped to the upper instrument panel at the right upper side.

(5) A/C equipped vehicles: From under the hood, disconnect the A/C suction line mounting bracket from the dash panel (above the expansion valve).

(6) From under the hood, loosen (do not remove) the four heater-A/C assembly to dash panel mounting nuts.

(7) From inside the vehicle: Remove the vertical (heater-A/C housing) support bracket (below the glove box).

(8) Tilt the entire heater-A/C housing assembly downward to gain access to the temperature cable.

(9) Locate and disconnect the attaching flag on the control cable at the heater-A/C housing (Fig. 5).

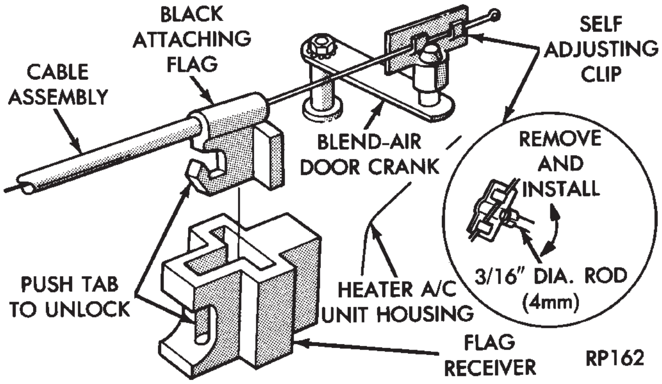


Fig. 5 Temperature Control Cable—Typical

(10) Slip the cable self-adjusting clip from the blend-air door crank (Fig. 5).

(11) Remove the cable from the vehicle.

(12) To remove the self-adjusting clip from cable (Fig. 5):

(a) Insert a 4mm (3/16 inch) diameter drill bit (Fig. 1-Inset) into the door crank access hole. Then rotate the clip from the cable.

To install, reverse the preceding operation.

To adjust temperature cable: Position the TEMP lever on the control to the cool side of its travel. Allowing the self-adjusting clip to slide on the cable, rotate the blend-air door crank counterclockwise by hand until it stops.

BLOWER RESISTOR BLOCK

WARNING: STAY CLEAR OF THE BLOWER MOTOR AND RESISTOR BLOCK (HOT) DURING THE FOLLOWING PROCEDURES.

CAUTION: Do not operate the blower motor with the resistor block removed from the heater-A/C housing. Air must move over the hot coils.

CAUTION: Disconnect battery before performing this operation.

REMOVE AND INSTALL

AJ AND AG BODY

(1) Remove the instrument panel glove box and door assembly. Refer to Group 8E Instrument Panel.

(2) Remove security and lamp outage modules.

(3) Locate the blower resistor block (Fig. 6). It is above and to the front of the glove box opening on the dash panel. Remove the wire connector.

(4) Remove the two attaching screws at the resistor block.

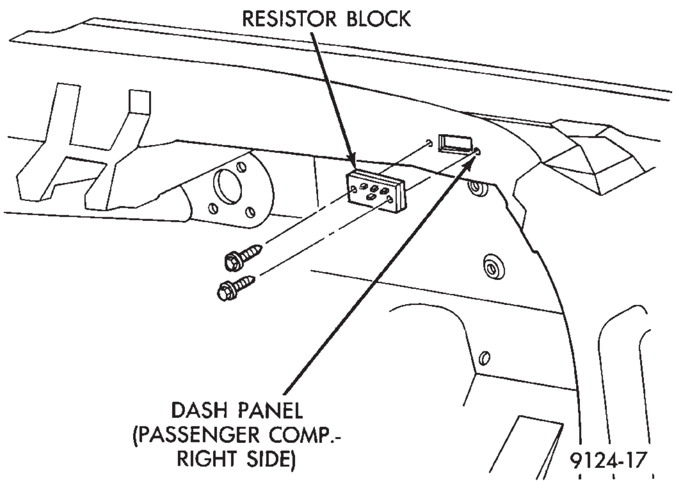


Fig. 6 Blower Resistor Block Location—AJ and AG Body

(5) Carefully pull the resistor block straight out from the cowl plenum opening and remove the resistor block from the vehicle.

To install, reverse the preceding operation. 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.

AA, AP, AY, AND AC BODY

(1) Raise the hood and remove the windshield wiper arm assemblies.

(2) Remove five cowl-plenum grille attaching screws and carefully lift the grille from the vehicle.

(3) (AA and AP): Locate and remove four air intake shield attaching screws and lift the shield from the vehicle.

(4) (AC and AY): Remove two resistor block terminal cover screws and remove cover.

(5) Disconnect the wire connector from the resistor block located behind the windshield washer reservoir (Fig. 7).

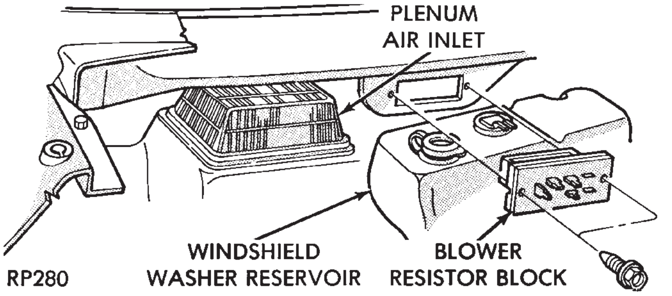


Fig. 7 Blower Resistor Block Location—AA, AP, AY and AC Body

(6) Remove two blower resistor block attaching screws. Then carefully pull the resistor block forward until the coils clear the plenum and lift it from the vehicle.

To install, reverse the preceding operation. 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.

VACUUM ACTUATOR—FRESH/RECIRC DOOR

This actuator is located on the passenger side of the heater-A/C housing.

REMOVAL AND INSTALLATION

(1) AA, AC or AY Body: Remove silencer cover under the instrument panel (below glove box).

(2) Remove glove box assembly. Refer to Group 8E, Instrument Panel.

(3) Disconnect vacuum lines.

(4) Locate and remove the two vacuum actuator attaching screws.

(5) Disengage the actuator arm linkage from the door pivot and remove the vacuum actuator (Fig. 8) from vehicle.

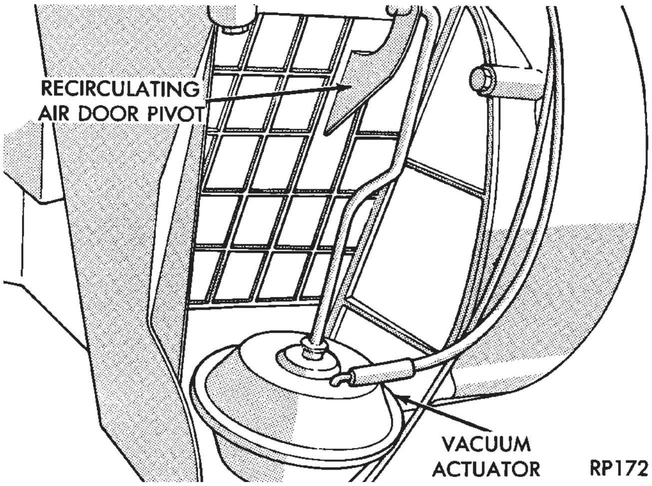


Fig. 8 Recirculating Air Door Vacuum Actuator—Typical

To install, reverse the preceding operation.

AIR DISTRIBUTION DUCT

REMOVAL AND INSTALLATION

AA BODY

On AA Body the instrument panel must be rolled down to service duct. Refer to Group 8E, Instrument Panel.

AC, AP, AY BODY

(1) Remove lower instrument panel module. Refer to Group 8E, Instrument Panel.

(2) Remove distribution duct attaching screws from under the front edge of the instrument panel (Fig. 9).

(3) Slide duct downward and remove from vehicle.

To install, reverse the preceding operation.

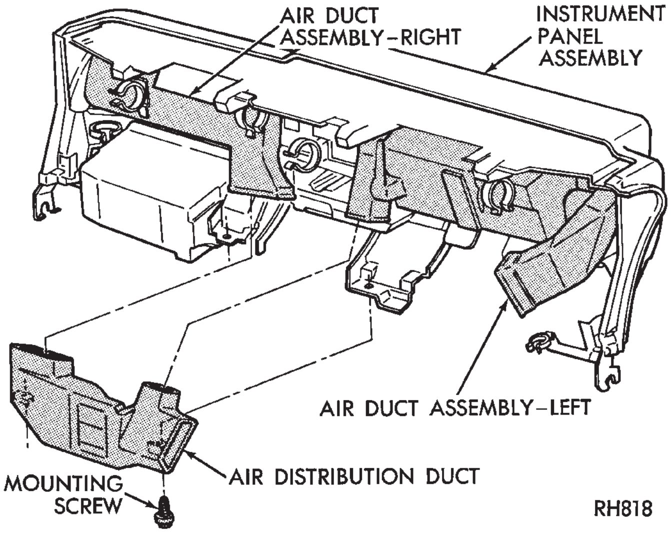


Fig. 9 Air Distribution Ducts—Typical

DEFROSTER DUCT ADAPTER

REMOVAL AND INSTALLATION

AA BODY

On AA body, the instrument panel must be rolled down to service duct. Refer to Group 8E, Instrument Panel.

AC, AP, AY BODY

(1) Remove air distribution duct.

(2) Separate the defroster adapter from the heater-A/C unit and pull the adapter downward and out from under the instrument panel.

To install, reverse the preceding operation.

DEFROSTER DUCT

REMOVAL AND INSTALLATION

AA, AG, AND AJ BODY

On AA, AG, and AJ Body, the instrument panel must be rolled down to service duct. Refer to Group 8E, Instrument Panel.

AC, AP, AY BODY

(1) Remove the air distribution duct.

(2) Remove the defroster duct adapter.

(3) Remove the instrument panel top cover. Refer to Group 8E, Instrument Panel.

(4) Locate and remove defroster duct attaching screws at the ends of each outlet (Fig. 10).

(5) Allow the defroster duct to drop downward and remove it from the vehicle.

To install, reverse the preceding operation.

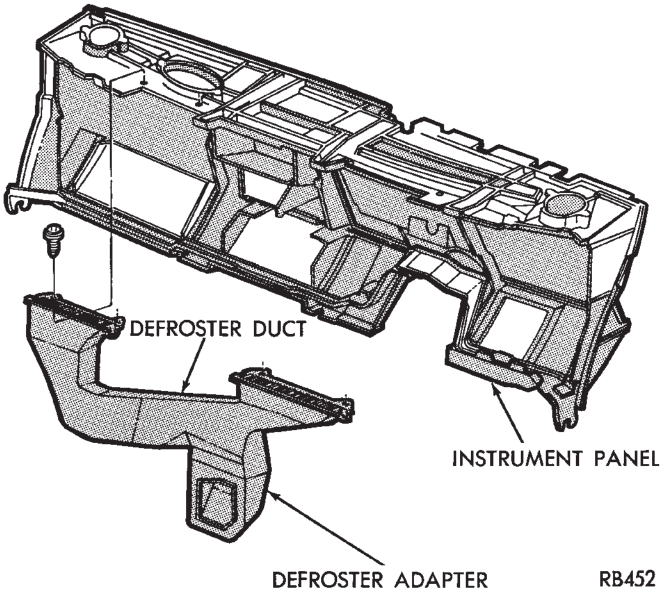


Fig. 10 Removing or Installing Defroster Duct—Typical

HEATER HOSES

REMOVAL AND INSTALLATION

Review Cooling System Precautions before proceeding with this operation.

(1) Drain engine cooling system. Refer to Group 7, Cooling System.

(2) Loosen clamps at each end of hose to be removed (Figs. 11 or 12).

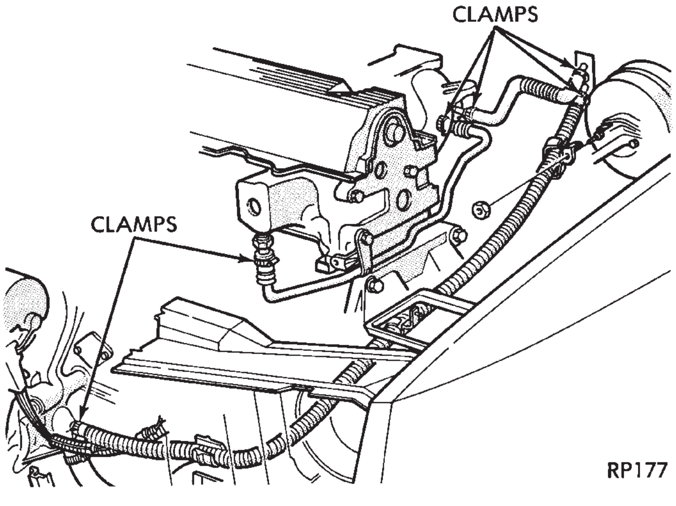


Fig. 11 Heater Hose Routing—2.2 L, 2.5 L Engines—Typical

(3) Carefully rotate hose back and forth while tugging slightly away from connector nipple.

CAUTION: When removing hoses from heater core inlet or outlet nipples DO NOT exert excess pressure. The heater core may become damaged and leak engine coolant into heater-A/C unit.

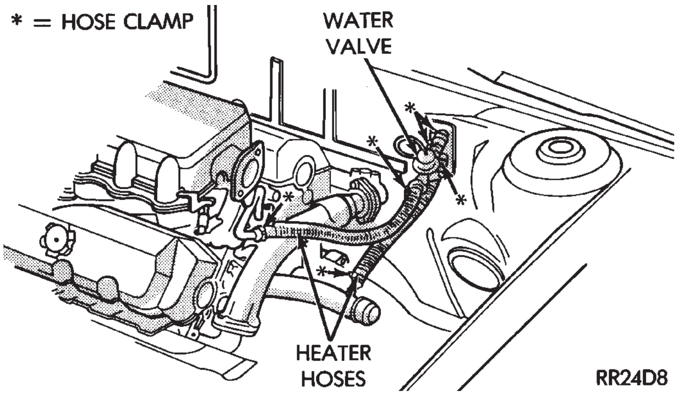


Fig. 12 Heater Hose Routing—3.0 L Engine—Typical

To install, reverse the preceding operation.

VACUUM ACTUATORS—MODE DOORS

The Vacuum Actuators for the Mode Doors are located on the drivers side of heater/AC housing above the accelerator pedal.

REMOVAL

(1) Remove the instrument panel cover under the steering column. Refer to Group 8E, Instrument Panel.

Heat/Defrost Actuator:

Remove two screws from bracket. Lift actuator upward and pull out (Fig. 13).

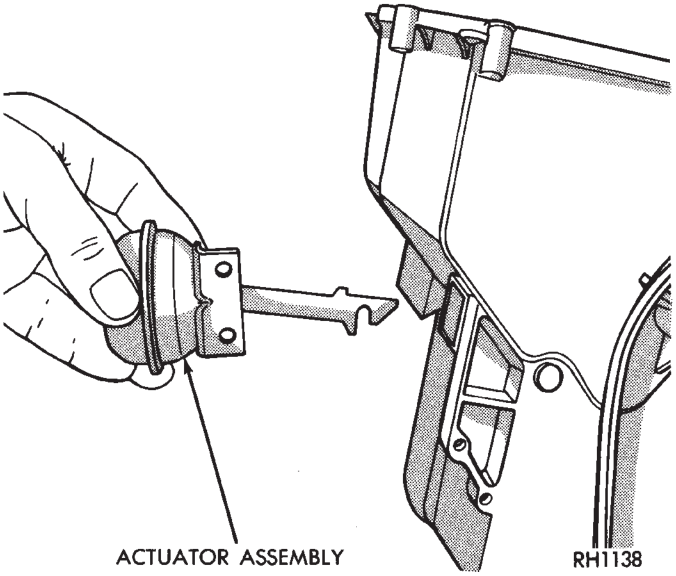


Fig. 13 Removing or Installing Heat/Defrost Vacuum Actuator Assembly

Mode Door Actuator:

Remove two screws from bracket (Fig. 14). Rotate actuator counter-clockwise to unhook from door and pull to remove.

INSTALLATION

Heat/Defrost Actuator:

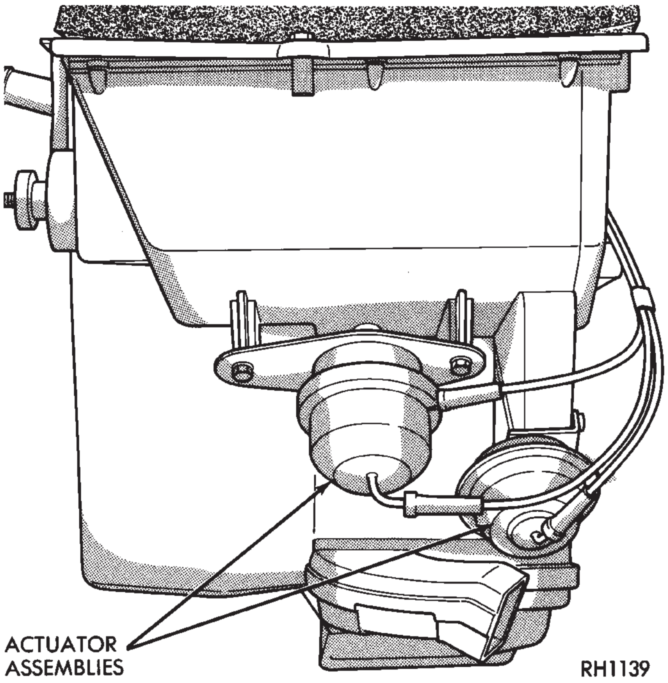


Fig. 14 Mode Door Vacuum Actuators

Install actuator link through housing and insert in heat defrost door slot. Push down to hook link to door. Locate the bracket to the housing and install two screws.

Mode Door Actuator:

Insert the actuator shaft through the hole in the housing and heat/defrost door. Attach through mounting hole in the mode door. Install two screws in bracket.

Install the instrument panel cover under the steering column.

AIR DISTRIBUTION DUCT

REMOVAL AND INSTALLATION

(1) Instrument panel assembly must be removed. Refer to Group 8E, Instrument Panel.

(2) After instrument panel has been removed, separate the defroster/demister ducts from the air distribution duct.

(3) Remove the air distribution duct-to-instrument panel mounting screws (Fig. 15).

To install, reverse removal procedure.

DEFROSTER DUCTS/DEMISTER DUCTS AND HOSES

REMOVAL AND INSTALLATION

(1) Instrument panel assembly must be removed. Refer to Group 8E, Instrument Panel.

(2) After instrument panel has been removed, separate the defroster/demister ducts from the air distribution duct.

(3) Remove the demister tubes and hoses (Fig. 16).

To install, reverse removal procedure.

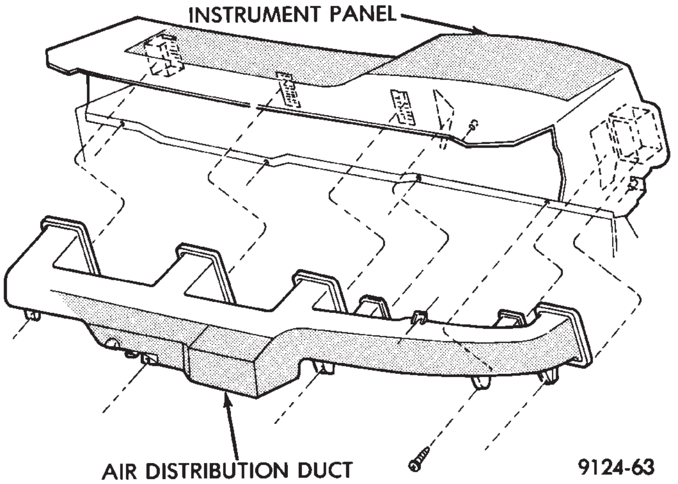


Fig. 15 Air Distribution Duct

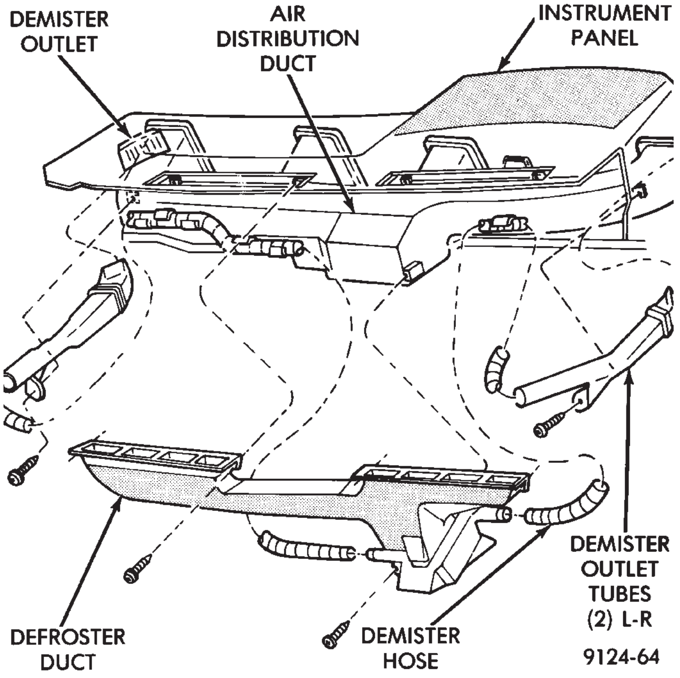


Fig. 16 Defroster Ducts/Demister Ducts and Hoses

FIN-SENSING CYCLING CLUTCH SWITCH

The Fin-Sensing Cycling Clutch Switch (FCCS) (Fig. 17) is located in the heater-A/C unit housing near the blower motor and placed in the evaporator fins. The FCCS prevents evaporator condensate freeze-up. This is done by cycling the compressor clutch OFF when evaporator temperature drops below freeze point. It cycles ON when the evaporator temperature rises above freeze point. The FCCS uses a thermistor probe in a capillary tube inserted between the evaporator fins in the heater-A/C unit housing. If the compressor clutch does not cycle, and all other clutch circuit components test correct, test the switch.

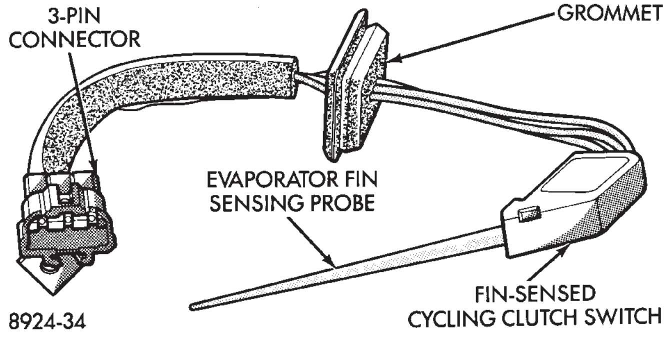


Fig. 17 Fin-sensing Cycling Clutch Switch

At temperatures above 32°C (90°F) the compressor clutch may engage continuously and not cycle. This is due to evaporator temperature above the freezing point.

DIAGNOSIS

The work area and vehicle must be between 21°C (70°F) and 32°C (90°F) when testing the Fin-sensing Cycling Switch.

(1) Disconnect the 3-wire connector from switch lead located behind the glove box.

(2) Test for voltage between pin #1 to pin #3 on the wire harness connector (Fig. 18). If voltage is not detected, refer to the Front Wheel Drive Car-Wiring Diagrams Service Manual. If voltage is detected, jump pin #1 to pin #3 using a jumper wire. Compressor clutch should engage.

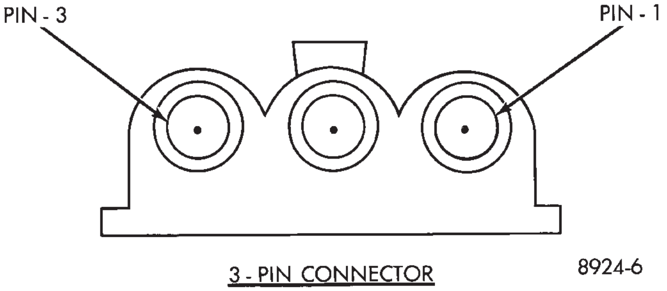


Fig. 18 Fin-sensing Cycling Clutch Switch Harness Connector

(3) If compressor clutch engages, test for continuity from terminal pin #1 to pin #3 of the switch lead connector. Continuity should be detected. If not, replace the Fin-sensing Cycling Clutch Switch.

REMOVAL AND INSTALLATION

(1) Remove the cover/housing from the heater-A/C blower motor. Refer to Blower Motor removal and installation. Remove the cover only. Blower motor or blower motor wheel removal is not necessary.

(2) Disconnect the (three pin) wiring pigtail connector from the clutch switch sensor harness (located on the outside of the A/C-heater housing). Push the wire harness grommet (attached to the A/C-heater

housing) through the hole in the housing. Feed the wire harness and connector through the opening and into the housing (Fig. 19).

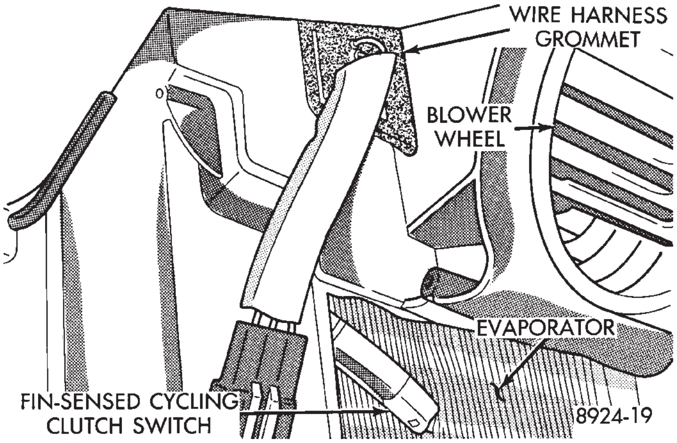


Fig. 19 Remove or Install Wire Harness Grommet

(3) Work through the air inlet opening (to the left of the blower motor wheel). Pull the fin-sensing cycling switch from the A/C evaporator (Fig. 20). **The metal probe on the switch is pushed into the evaporator approximately three inches.**

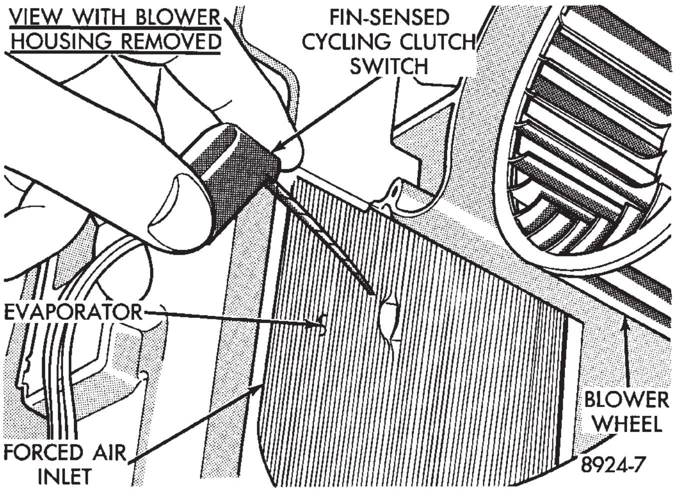


Fig. 20 Remove or Install Fin-sensing Cycling Clutch Switch

To install, reverse the preceding operation. The switch probe should not be installed in the original location (hole). Insert the probe in the evaporator coil approximately 5 mm (3 to 4 fins) to the right or left of the position it was removed. This will insure correct temperature sensing and system performance. Excessive force should not be required for probe insertion. Care should be taken not to damage the A/C evaporator coil or the switch probe.

LOW OR DIFFERENTIAL PRESSURE CUT-OFF SWITCH

The Low Pressure Cut-Off (LPCO) Switch (Fig. 21) monitors the refrigerant gas pressure on the suction side of the system. The LPCO is located on the expansion valve, and the expansion valve is silver in color when a fixed displacement compressor is used. The LPCO turns off voltage to the compressor clutch coil when refrigerant gas pressure drops to levels that could damage the compressor. The LPCO is a sealed factory calibrated unit. It must be replaced if defective.

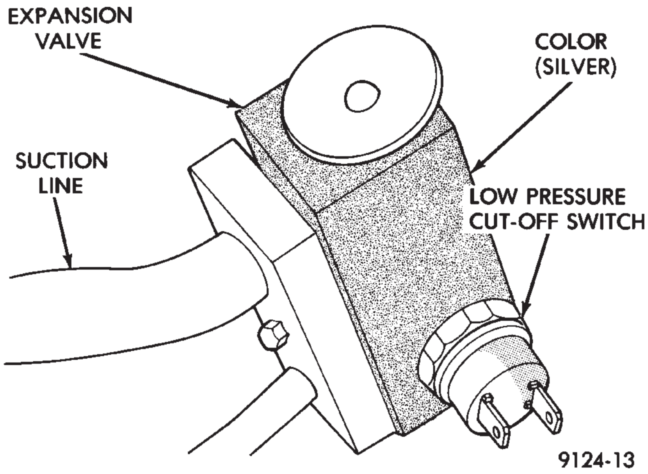


Fig. 21 Low Pressure Cut-Off Switch

LPCO SWITCH DIAGNOSIS

The work area must not be below 10°C (50°F) to test the compressor clutch circuit.

(1) With gear selector in park or neutral and park brake set, start engine and allow to idle.

(2) Raise hood and disconnect LPCO switch connector boot.

(3) Using a suitable jumper wire, jump across the terminals inside wire connector boot.

(4) If the compressor clutch does not engage, the cycling clutch switch, wiring, relay, or fuse can be defective. Refer to Group 8W, Wiring Diagrams.

(5) If clutch engages, connect manifold gauge set. Read low pressure gauge. At pressure above 97 kPa (14 psi) and above, LPCO switch will complete the clutch circuit. If the low pressure gauge reads below 172 kPa (25 psi), the system is low on refrigerant charge or empty due to a leak. Refer to Testing For Refrigerant Leaks in the Refrigerant Service Procedures section.

(6) Install connector boot on switch and repeat step number 3. If the clutch does not engage, replace the LPCO switch.

REMOVAL AND INSTALLATION

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION. REFER TO REFRIGERANT RECOVERY SECTION.

(1) Disconnect the boot like wire connector at the cut-off switch.

(2) Using a sender unit type socket, remove the switch from the expansion valve (Fig. 22 or 23).

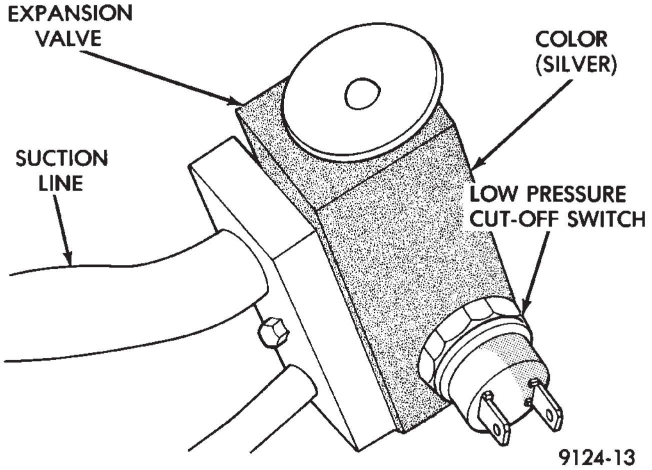


Fig. 22 Low Pressure Cut-Off Switch and Expansion Valve—Typical

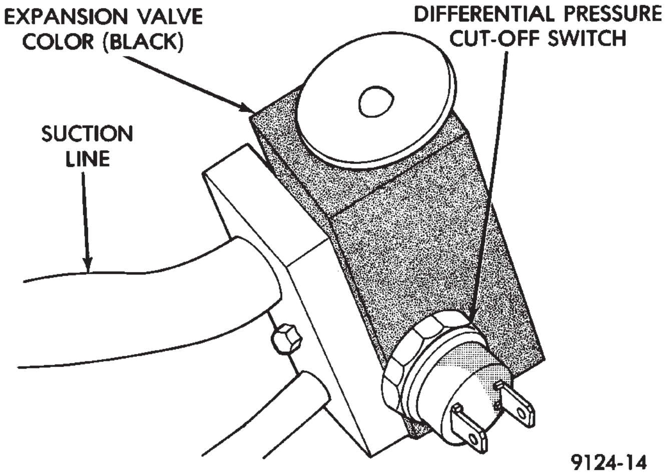


Fig. 23 Differential Pressure Cut-Off Switch and Expansion Valve—Typical

To install, assure an adequate seal by using a small amount of thread sealing tape on the replacement switch and reverse the preceding steps.

Evacuate and charge the system.

EXPANSION VALVE

DIAGNOSIS

BLACK EXPANSION VALVE TEST

Liquid CO_2 is required to test the expansion valve. It is available from most welding supply facilities. CO_2 is also available from companies which service and sell fire extinguishers.

Review Safety Precautions and Warnings before proceeding with this operation. The work area must be 21°C to 27°C (70°F to 85°F) when testing expansion valve. To test the expansion valve:

(1) Connect a charging station or manifold gauge set to the refrigerant system service ports.

(2) Verify the refrigerant charge level using the sight glass method.

(3) Disconnect the wire connector at the differential pressure cut-off switch. Using a jumper wire, jump across the terminals inside the connector boot (Fig. 24).

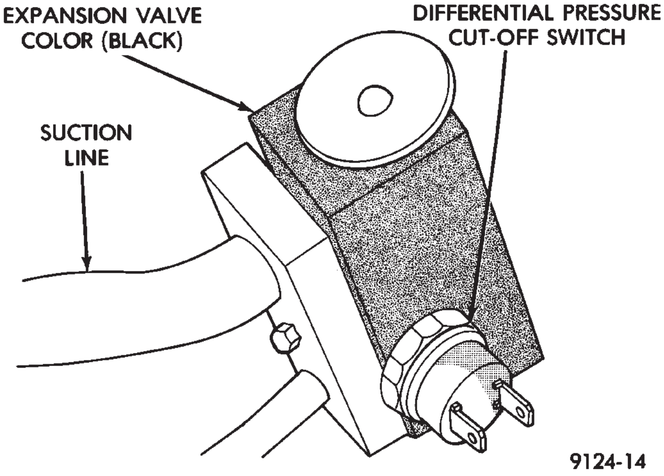


Fig. 24 Differential Pressure Cut-Out Switch

(4) Close all doors, windows and vents to the passenger compartment.

(5) Set heater-A/C control to A/C, full heat, FLOOR, and high blower.

(6) Start the engine and hold the idle speed (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.

(7) Discharge (high pressure) gauge should read 965 to 1655 kPa (140 to 240 psi) when the refrigerant charge is sufficient. If system cannot achieve proper pressure, replace the expansion valve. If pressure is correct, record reading and proceed with test.

WARNING: PROTECT SKIN AND EYES FROM CONTACTING CO_2 PERSONAL INJURY CAN RESULT.

(8) If discharge pressure is within specified range, freeze the expansion valve control head (Fig. 8) for 30 seconds. Use a super cold substance (liquid CO_2).**Do not spray R-12 Refrigerant on the expansion valve for this test. Refer to Refrigerant Recycling in the Refrigerant Service Procedures section.** If compressor discharge (high) pressure does not drop by 15% or more than the pressure recorded in step 7, replace the expansion valve. Allow the expansion valve to thaw. The discharge pressure should

stabilize to the pressure recorded in step 7. If the pressure does not stabilize, replace the expansion valve.

When expansion valve tests are complete, refer to Heater and A/C Performance Tests and remove all test equipment before returning vehicle to use.

SILVER EXPANSION VALVE TEST

Expansion valve tests should be performed after compressor tests.

Liquid CO_2 is required to test the expansion valve. It is available from most welding supply facilities. CO_2 is also available from companies which service and sell fire extinguishers.

Review Safety Precautions and Warnings in the General Information section of this Group. The work area and vehicle must be 21°C to 27°C (70°F to 85°F) when testing expansion valve. To test the expansion valve:

(1) Connect a charging station or manifold gauge set to the refrigerant system service ports.

(2) Verify the refrigerant charge level using the sight glass method.

(3) Disconnect wire connector at low pressure cut-off switch (Fig. 25). Using a jumper wire, jump terminals inside wire connector boot.

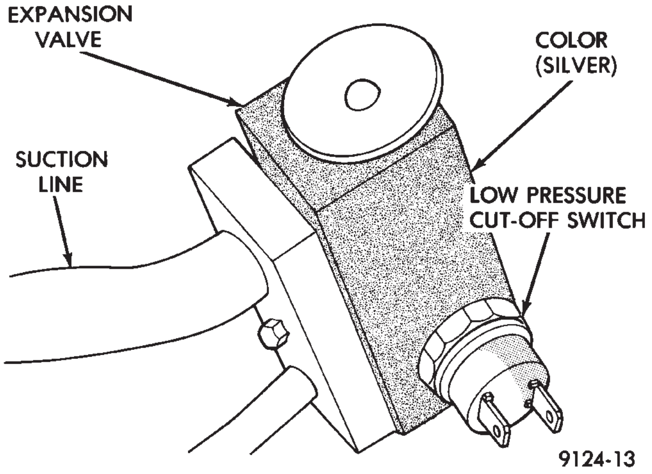


Fig. 25 Low Pressure Cut-Off Switch

(4) Close all doors, windows and vents to the passenger compartment.

(5) Set heater-A/C control to A/C, full heat, FLOOR, and high blower.

(6) Start the engine and hold the idle speed (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.

(7) 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 psi). 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 CO_2 PERSONAL INJURY CAN RESULT.

(8) If suction side low pressure is within specified range, freeze the expansion valve control head (Fig. 26) for 30 seconds. Use a super cold substance (liquid CO_2). **Do not spray R-12 Refrigerant on the expansion valve for this test.** Suction side low pressure should drop to -50 kPa (-15 in. Hg) If not, replace expansion valve.

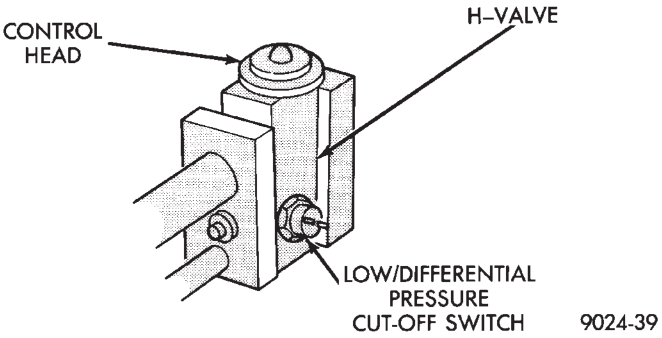


Fig. 26 Expansion Valve

(9) Allow expansion valve to thaw. The low pressure gauge reading should stabilize at 140 kPa to 240 kPa (20 psi to 30 psi). If not, replace expansion valve.

When expansion valve test is complete, test A/C overall performance. Refer to the Heater and A/C Performance Test in this section. Remove all test equipment before returning vehicle to use.

REMOVAL

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

(1) Remove the boot-type wire connector from the pressure cut-off switch.

(2) Remove the attaching bolt in center of refrigerant line-plumbing sealing plate (Fig. 27).

(3) Carefully pull the refrigerant line-sealing plate assembly from the expansion valve towards front of vehicle. Do Not scratch the expansion valve sealing surfaces with pilot tubes.

(4) Cover the openings on A/C line-sealing plate assembly to prevent contamination.

(5) Remove two screws securing the expansion valve to the evaporator sealing plate.

(6) Carefully remove valve.

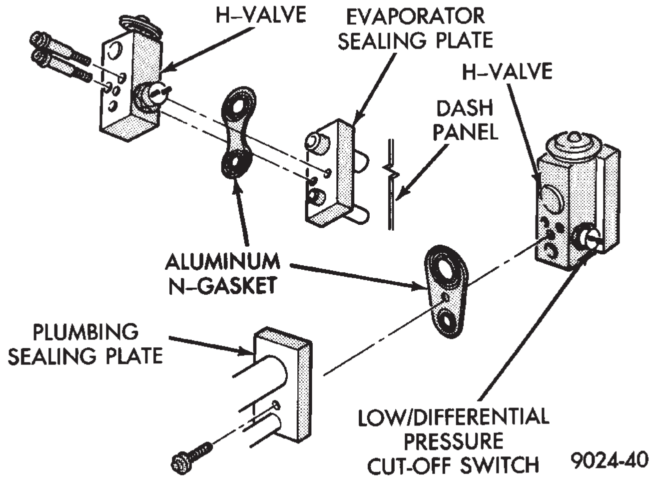


Fig. 27 Expansion Valve

INSTALLATION

(1) Remove and replace the aluminum gasket on the evaporator sealing plate.

(2) Carefully hold the expansion valve to the evaporator sealing plate (do not scratch sealing surface). Install two attaching screws and tighten to 11 ± 3 N●m (100 ± 30 inch lbs.).

(3) Remove and replace the aluminum gasket (Fig. 15) on the refrigerant line-sealing plate assembly.

(4) Carefully hold the refrigerant line-sealing plate assembly to the expansion valve, install bolt and tighten to 23 ± 3 N●m (200 ± 30 inch lbs.).

(5) Connect wires to low pressure cut-off switch.

(6) Evacuate and recharge system.

(7) After expansion valve is installed, system is charged, and leaks have been checked, repeat A/C performance check.

FILTER-DRIER ASSEMBLY

REMOVAL AND INSTALLATION

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

(1) Remove the two high pressure lines from the sides of the filter-drier assembly (Fig. 1). Then carefully separate the lines from filter-drier. Discard old gaskets.

(2) Cover the open ends of the A/C lines to minimize system contamination.

(3) Remove two mounting strap bolts and lift the filter-drier from vehicle. If replacing the filter-drier assembly, transfer the mounting strap to replacement part.

To install, replace both refrigerant line to filter-drier gaskets, and reverse the preceding operation.

Evacuate and recharge system.

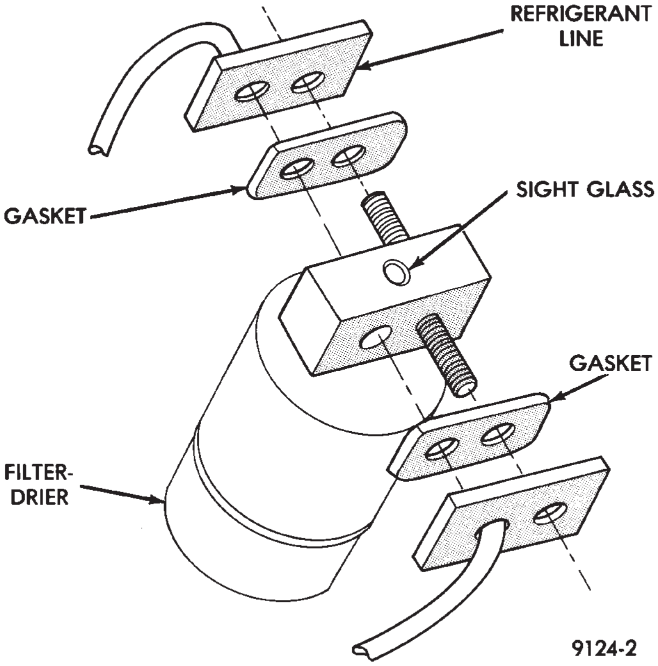


Fig. 1 Filter-Drier—Typical

CONDENSER ASSEMBLY

The A/C condenser is mounted to the radiator with bolts (upper) and mounting pads (lower).

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY REMOVED BEFORE PROCEEDING WITH THIS OPERATION. REFER TO DISCHARGING REFRIGERATION SYSTEM IN THIS GROUP.

REMOVAL AND INSTALLATION

(1) Using a refrigerant recovery machine, remove the refrigerant from the A/C system.

(2) Remove the refrigerant line mounting nut (Fig. 2) and separate the refrigerant lines from condenser sealing plate.

(3) Cover the open ends of the A/C lines and condenser to minimize system contamination.

(4) Remove the coolant overflow bottle, electric cooling fans and radiator assembly. Also remove the turbocharger inter-cooler if equipped. Refer to Group 7, Cooling System.

On some models, complete removal of the radiator, or coolant drainage is not necessary. The radiator may be moved slightly rearward to remove the condenser.

(5) Remove the two bolts securing the condenser assembly to the radiator.

(6) Slip the condenser from the lower radiator mounting brackets.

(7) Remove condenser.

To install, replace all O-rings and gaskets and coat sealing surfaces with approved refrigerant oil. Then reverse the preceding operation. When installing a

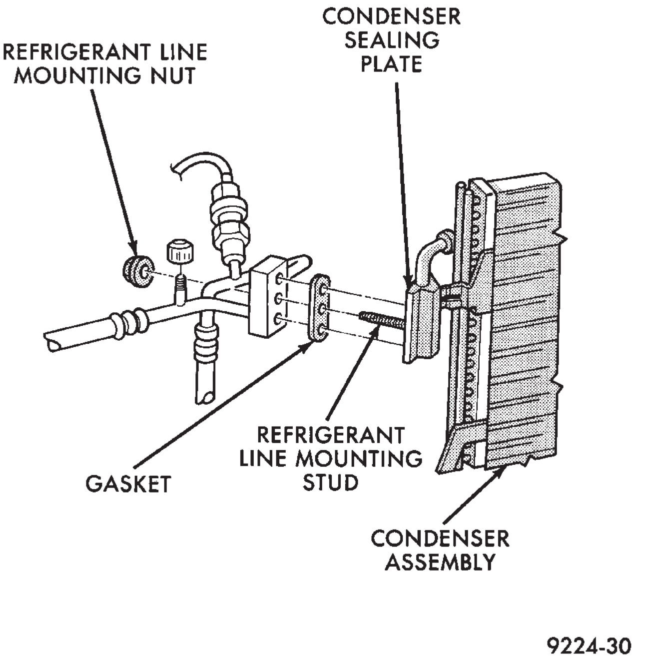


Fig. 2 A/C Condenser Refrigerant Lines—Typical

new condenser, refer to Oil Level in the Refrigerant section. Tighten the refrigerant line mounting nut to 23 N●m (200 inch pounds).

Evacuate and recharge system.

BLOWER MOTOR

BLOWER MOTOR VIBRATION AND/OR NOISE DIAGNOSIS

The resistor block (Fig. 3), supplies the blower motor with varied voltage (low and middle speeds) or battery voltage (high speed).

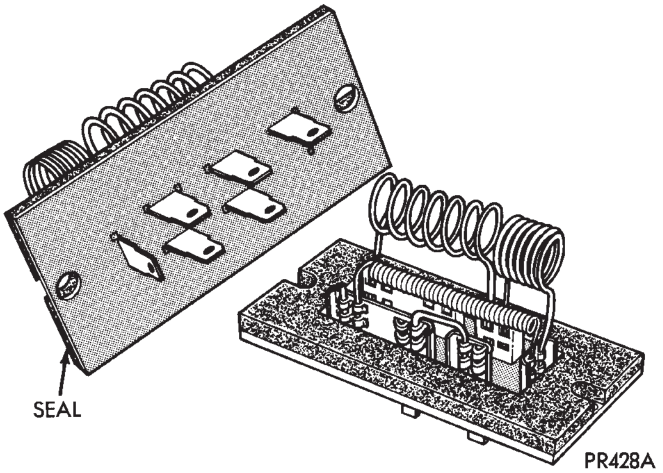


Fig. 3 Blower Motor Resistor Block—Typical

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.

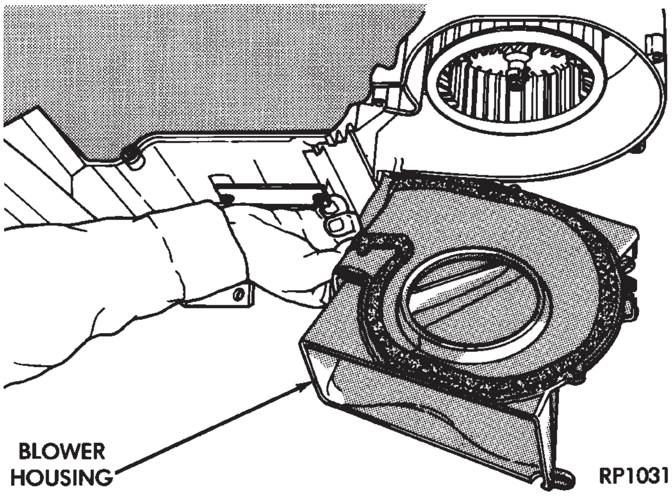


Fig. 4 Blower Housing—Typical

Refer to the Blower Motor Vibration/Noise chart in this section for diagnosis.

BLOWER MOTOR ELECTRICAL DIAGNOSIS

Refer to the Blower Motor Electrical System Diagnosis chart in this section. Also refer to Group 8W, Wiring Diagrams for more information.

REMOVAL AND INSTALLATION

(1) Disconnect the negative battery cable.

(2) Remove the glove box. Refer to Group 8E, Instrument Panel.

(3) On vehicles equipped with A/C, disconnect the two vacuum

lines from the recirculating air door actuator. Disconnect blower lead wire connector.

(4) Remove two screws at the top of the blower housing, securing it to the unit cover.

(5) Remove five screws from around the blower housing and separate the blower housing from the unit (Fig. 4).

(6) Remove three screws securing the blower and wheel assembly to the heater or A/C unit housing. Then separate the assembly from the unit (Fig. 5).

To install, reverse the preceding operation.

BLOWER MOTOR WHEEL ASSEMBLY

REMOVAL AND INSTALLATION

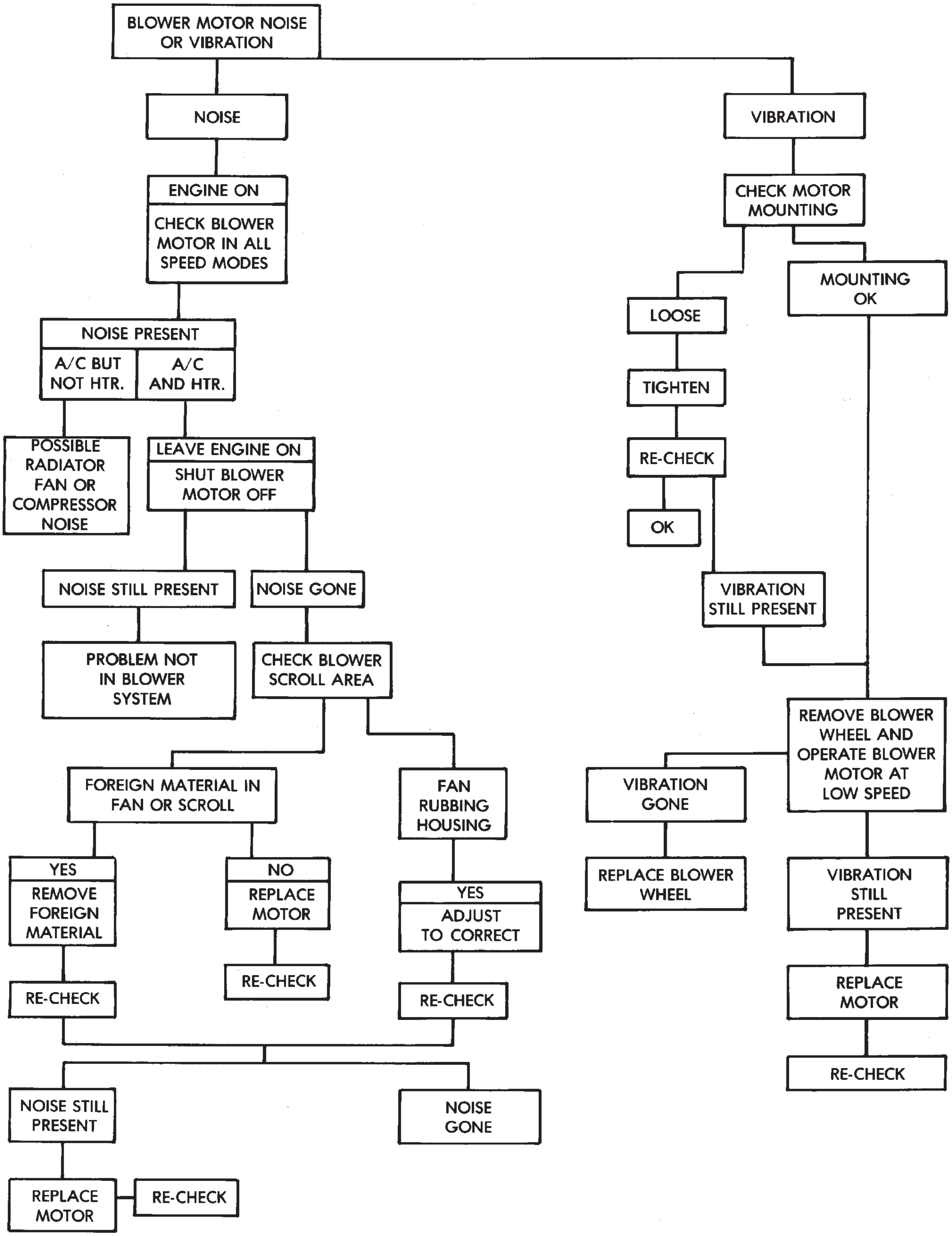
Blower motor must be removed from vehicle before performing this operation. Refer to Blower Motor Removal and Installation.

(1) Remove the spring type retaining ring from the center of the blower wheel (Fig. 6). Note the location of the blower wheel on the blower motor shaft.

(2) Remove blower wheel from blower motor shaft.

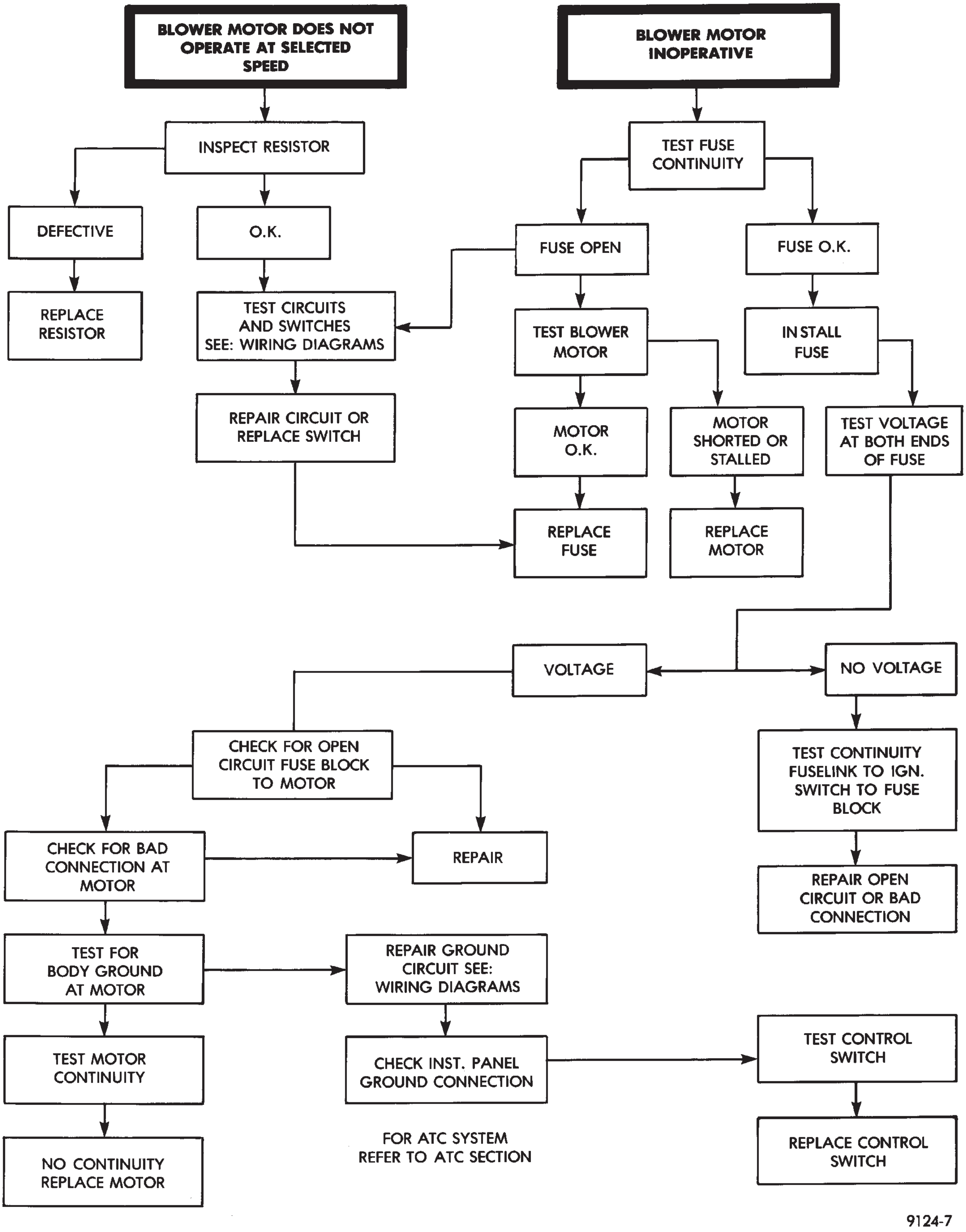
To install, reverse the preceding operation. To prevent noise or vibration, rotate the blower wheel by hand to check for rubbing.

BLOWER MOTOR NOISE/VIBRATION DIAGNOSIS



9124-6

BLOWER MOTOR ELECTRICAL SYSTEM DIAGNOSIS



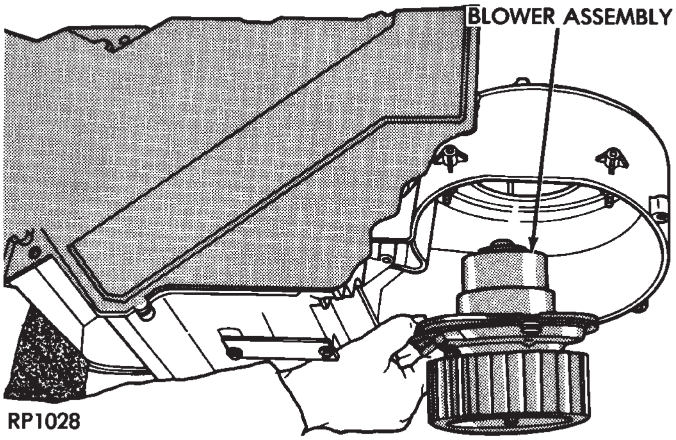


Fig. 5 Blower Motor and Wheel Assembly

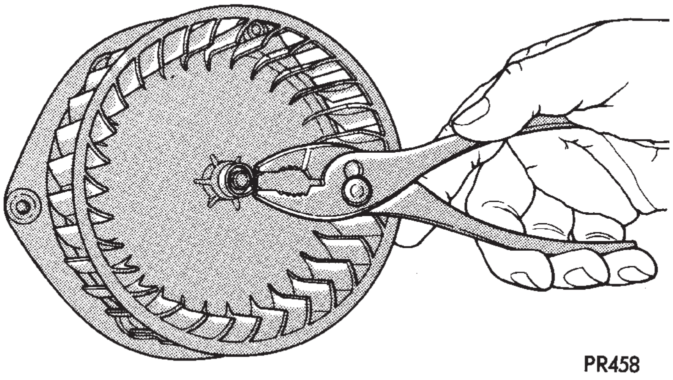


Fig. 6 Blower Wheel Retaining Ring Removal and Installation

HEATER-A/C UNIT ASSEMBLY—REMOVAL AND INSTALLATION

AP, AC, AY BODY PROCEDURE

WARNING: IF EQUIPPED WITH A/C, THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

(1) Disconnect battery NEGATIVE cable.

(2) Drain radiator and disconnect heater hoses at unit. Tape heater tubes to keep from leaking during removal. Refer to Group 7, Cooling System.

(3) Remove A/C condensate drain and disconnect vacuum lines.

(4) Inside passenger compartment, perform as follows, according to body designation.

(a) AC-body, remove right upper and lower under-panel silencers.

(b) AP & AC-bodies, remove steering column cover.

(c) AC-body, remove left under-panel silencer.

(5) Position front seat or right front seat full rear.

(a) AP-body, remove right A-pillar trim.

(b) Remove right cowl side trim.

(6) Remove glove box.

(a) AC-body, remove right instrument panel reinforcement.

(7) AP-body only:

(a) Remove right instrument panel lower mounting screw.

(b) Remove center bezel.

(c) Remove lower center module cover.

(d) Remove floor console.

(e) Remove instrument panel support brace (from steering column opening to right cowl side at bottom of instrument panel).

(f) Remove instrument panel to support bracket (below glove box opening).

(g) Remove ash receiver.

(h) Remove radio.

(i) Remove panel top cover.

(j) Remove three right side panel to fence (below windshield) attaching screws.

(8) AC-body, remove ash receiver.

(9) AP body, pull right lower side of instrument panel rearward.

(10) Remove center distribution and defroster adapter ducts.

(11) AP and AC-bodies, disconnect relay module.

(12) AP-body, remove instrument panel to unit bracket.

(13) AP-body, remove lower air distribution duct.

(14) Disconnect blower motor wire connector.

(15) Disconnect demister hoses from top of unit.

(16) For Non-ATC equipped vehicles, disconnect the temperature control cable flag from the bottom of the heater-A/C unit. Then un-clip the cable from the left side of the heat distribution duct. Swing the cable out of the way to the left. Disconnect the vacuum lines at the unit.

(17) For ATC equipped vehicles, disconnect the instrument panel wiring from the rear face of the ATC control unit.

(18) AC body, disconnect right 25-way connector bracket and fuse block from panel.

(19) Fold floor right side carpet back (except AC body).

(20) From engine compartment, remove four unit attaching nuts.

(21) Remove unit hanger strap lower screw, and rotate strap.

(22) Move heater-A/C unit rearward to clear mounting studs, and lower unit.

(23) AP-body, remove demister adapter from top of unit.

(24) While pulling the lower right of instrument panel rearward:

(a) Slide unit upright from under instrument panel for AP-body.

(b) Except for AP-body, rotate unit while pulling from under instrument panel.

To install, reverse the preceding operation.

AA BODY PROCEDURE

WARNING: IF EQUIPPED WITH A/C, THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

Refer to Group 8E and Group 23 for component removal and installation when performing this operation.

(1) Perform steps 1 through 7 of Blower Motor removal and installation.

(2) Remove relay panel above glove compartment opening.

(3) Disconnect the A/C vacuum line connector and radio noise capacitor connectors.

(4) Remove left windshield pillar trim cover.

(5) Remove left lower side cowl trim cover.

(6) Remove hood release handle mechanism attaching screws.

(7) Remove steering column trim covers.

(8) Disconnect parking brake release mechanism connecting rod. Gain access through fuse panel opening.

(9) Remove lower left instrument panel silencer.

(10) Remove lower left instrument panel reinforcement.

(11) Remove instrument panel center (radio) bezel.

(12) Remove forward floor console.

(13) Remove the radio.

(14) Remove the heater-A/C control.

(15) Remove cigar lighter.

(16) Remove message center/trip computer, if equipped.

(17) Disconnect side window demister tubes from top of heat A/C unit.

(18) Remove steering column upper attaching bolts and allow the steering wheel to rest on the driver seat cushion.

(19) Remove upper instrument panel (defroster outlet) cover.

(20) Remove upper instrument panel attaching screws from below the windshield opening.

(21) Loosen (do not remove) the left lower cowl instrument panel attaching screw.

(22) Remove the right lower cowl instrument panel attaching screw.

CAUTION: Protect the passenger seat cover from soiling or damage using a suitable cover.

(23) Carefully pull the right side of the instrument panel away from the vehicle. Allow the instrument panel to rest on the passenger seat cushion.

CAUTION: Before proceeding with the next operation, review the Safety Precautions and Warnings at the front of this Group.

(24) From the engine compartment, drain the cooling system and disconnect the heater hoses from the heater core nipples. Plug the nipples to avoid spilling coolant inside the vehicle.

(25) Disconnect the refrigerant lines from the expansion-valve at the dash panel on the right side of the vehicle. Seal the refrigerant lines to prevent contamination.

(26) Remove the expansion valve from the evaporator plate. Seal the valve to avoid contamination.

(27) Remove the condensate drain tube.

(28) Remove heater-A/C unit to dash panel attaching nuts.

(29) From inside the vehicle, pull rearward on the heater-A/C unit to clear the dash panel silencer and remove the unit from the vehicle.

To install, reverse the preceding operation. Refill cooling system and test for leaks. Evacuate and charge the refrigerant system and test overall performance.

AG, AJ BODY PROCEDURE

WARNING: IF EQUIPPED WITH A/C, THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

(1) Disconnect the battery negative cable.

(2) Drain the coolant from cooling system. Refer to Group 7, Cooling System.

(3) Remove the air conditioner expansion valve (if equipped).

(4) Disconnect the heater hoses from heater core. Then plug or cap the tubes on heater core. This will prevent spilling coolant into the interior of vehicle during unit removal.

(5) Remove the condensate drain tube.

(6) Disconnect the A/C-heater vacuum supply line from vacuum supply nipple (in the engine compartment).

(7) Remove the four A/C-heater assembly-to-dash panel attaching nuts.

(8) Remove the passenger side front seat. Refer to Group 23, Body.

(9) Remove the kick panel/sill cover at right door opening.

(10) Remove the body computer (Fig. 6) located at the lower right section of the right front door pillar.

(11) Remove the glove box assembly. Refer to Group 8E, Instrument Panel.

(12) Remove the carpeted panels from both sides of the console.

(13) Un-clip the radio antenna cable from the metal support (Fig. 6) located behind and below the glove box opening.

(14) Instrument panel removal is not necessary to remove the A/C-heater assembly from the vehicle.

Although, part of the lower instrument panel must be cut. The cut line is marked: **CUT HERE FOR A/C HTR REMOVAL.**

This cut line is stamped (indented) into the right-outer side of the instrument panel padding (outboard of the glove box opening). Using a hacksaw blade, cut the instrument panel padding along the indented line from point A to point B (Fig. 7). **CUT THE PLASTIC ONLY**. Do not cut the metal support behind the instrument panel padding.

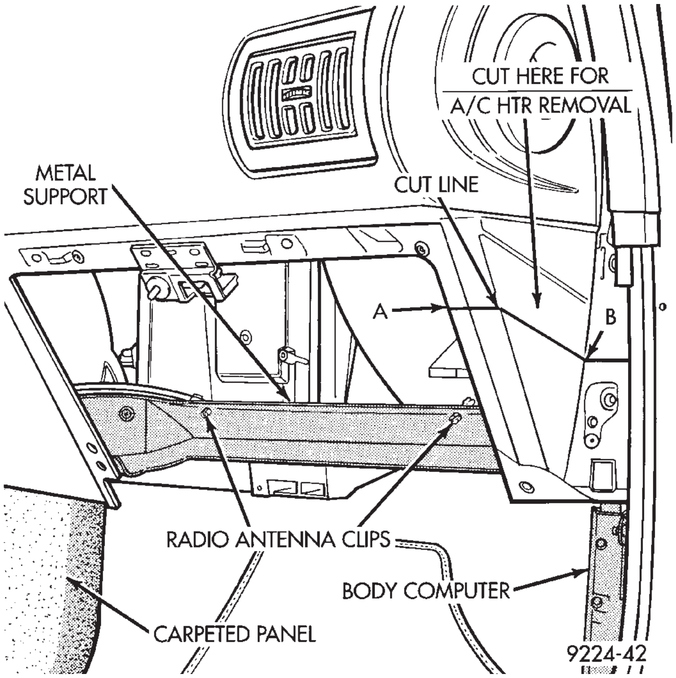


Fig. 7 Cut Line For A/C-heater Removal—AG/AJ Body

(15) Remove the metal support behind and below the glove box opening, and the previously cut piece of the instrument panel that is riveted to it.

(16) Remove the radio choke, security alarm module and the lamp outage module from above the glove box opening (if equipped).

(17) Remove the plastic cover under the steering column.

(18) Remove the metal support under the steering column.

(19) AJ Body only: Remove the under-panel silencer pad from under the glove box opening.

(20) Remove the lower heat distribution duct (3 screws).

(21) Remove the air distribution duct through the opening at the left side of instrument panel.

(22) Reach through glove box opening and disconnect the demister hoses from the top of the A/C-heater assembly.

(23) Disconnect the temperature control cable from the bottom of the A/C-heater assembly and position out of the way.

(24) Disconnect wiring at the blower motor and fin-sensing cycling clutch switch electrical connectors.

(25) Un-plug the antenna cable from the radio.

(26) Remove the metal (A/C-heater-to-instrument panel) hanger strap from the upper part of the A/C-heater assembly.

(27) Roll back the floor carpeting from under the A/C-heater assembly far enough to avoid restricting unit removal.

(28) Remove the A/C-heater assembly through the opening on the right side of the console, and remove unit from vehicle.

The instrument panel (to the left side of the glove box opening) must be slightly folded back to remove the unit from the vehicle. If wrinkles appear in the instrument panel after the unit has been installed, they may be removed using a heat gun. Refer to Installation AG, AJ Body for instructions.

To install, reverse steps (28) through (13). If wrinkles have appeared in the instrument panel, apply low heat from a heat gun over the wrinkled area. **Do not overheat the instrument panel padding or the surrounding area.**

Reverse steps (12) through (1). If equipped with A/C, evacuate and charge the refrigerant system.

HEATER-A/C UNIT RECONDITION

The following operation requires the removal of the heater-A/C unit assembly from the vehicle. Refer to Heater-A/C Unit Assembly removal and installation in this Group.

DISASSEMBLE

(1) Place the heater-A/C unit on a suitable work surface. (Fig. 1).

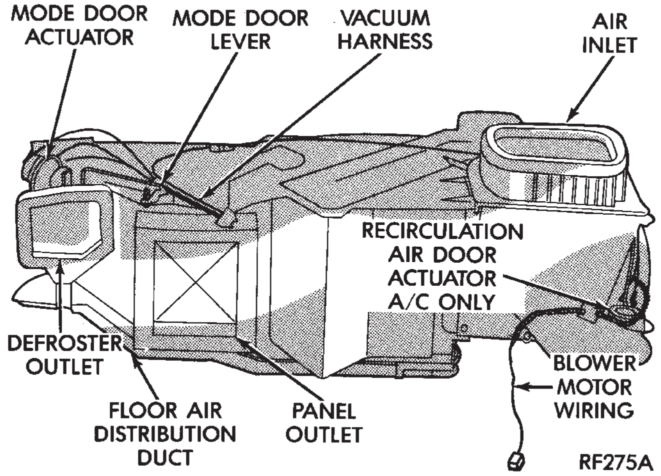


Fig. 1 Position Heater-A/C Unit for Disassembly and Reassembly

(2) Locate and remove one retaining nut from the blend-air door pivot shaft.

(3) To remove the top cover from the A/C-heater case, the crank arm must be removed (Fig. 2).

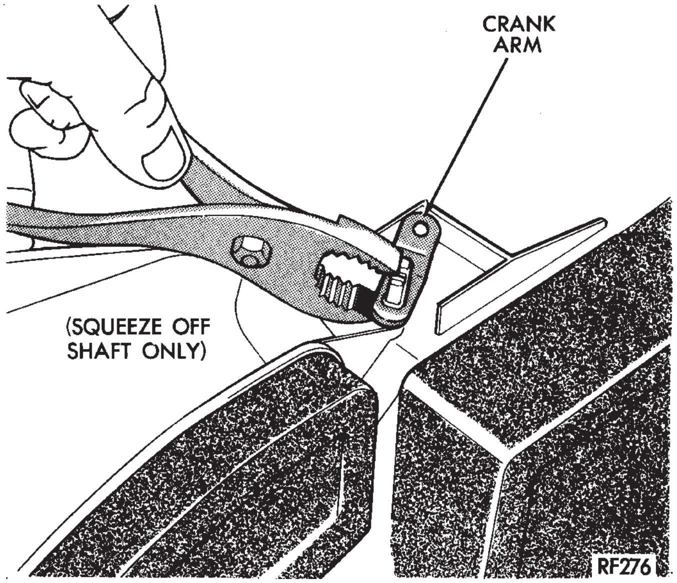


Fig. 2 Blend-Air Door Crank Linkage Removal

(4) Disconnect the vacuum lines from the defroster and panel mode vacuum actuators and position them out of the way.

(5) Remove three heater-A/C unit cover attaching screws going upward at the defroster outlet chamber.

(6) Remove two heater-A/C unit cover attaching screws going upward at the air inlet plenum.

(7) Remove eleven heater-A/C unit cover attaching screws going downward into the housing. Then lift the cover from the heater-A/C unit. (Fig. 3).

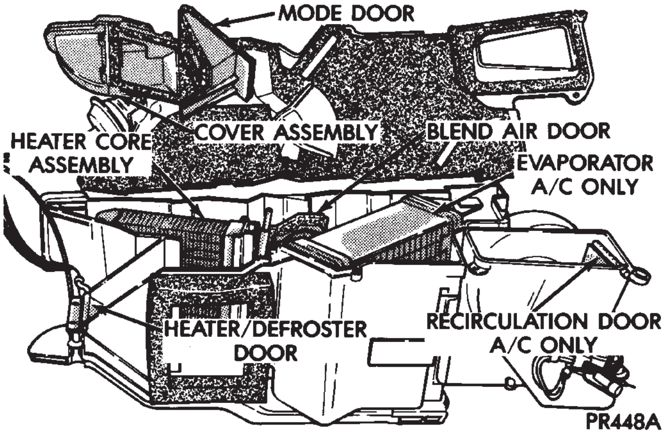


Fig. 3 Heater-A/C Unit Cover Removal and Installation

To reassemble, lower the heater-A/C unit cover into place. Then guide the panel air mode door pivot shaft into its socket and reverse the preceding operation.

BLEND-AIR DOOR

REMOVAL AND INSTALLATION

The following operation requires the removal of the heater-A/C unit assembly from the vehicle. Refer to Heater-A/C Unit Assembly removal and installation in this Group.

(1) Remove Heater-A/C unit top cover.

(2) Remove the nut from bottom of the blend-air door pivot shaft and lift the blend-air door from the heater-A/C unit housing. (Fig. 4).

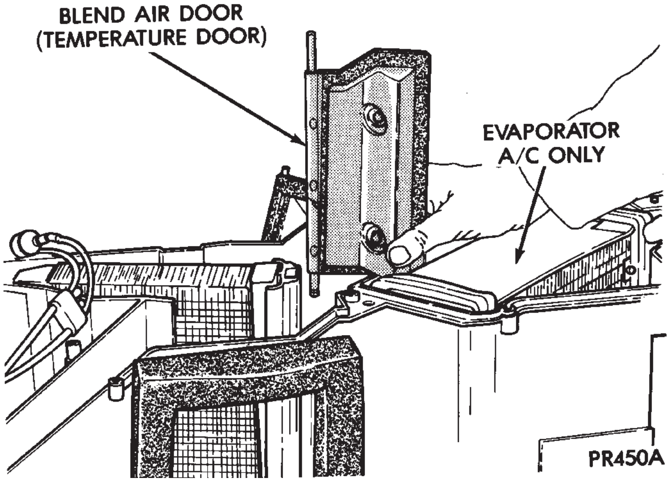


Fig. 4 Blend-Air Door Removal and Installation

To install, reverse the preceding operation.

HEATER CORE

REMOVAL AND INSTALLATION

Refer to Heater A/C Unit Recondition in this Group.

EVAPORATOR COIL

REMOVAL AND INSTALLATION

Refer to Heater A/C Unit Recondition in this Group.

CONDENSATE DRAIN TUBE

Condensation that accumulates on the bottom of the evaporator housing is drained from a rubber tube through the dash panel and on to the ground. This tube must be kept open to prevent condensate water from collecting in the bottom of the heater A/C unit housing.

The tapered end of the drain tube is designed to keep contaminants from entering the heater A/C unit housing. If the tube is pinched or 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. If the tube is damaged, it should be replaced.

REMOVAL AND INSTALLATION

(1) Raise vehicle.

(2) Locate rubber Drain Tube on right side of dash panel (Fig. 5).

(3) Squeeze clamp and remove drain tube.

To install, reverse the preceding operation. Check the drain tube nipple on the heater-A/C housing for any obstructions.

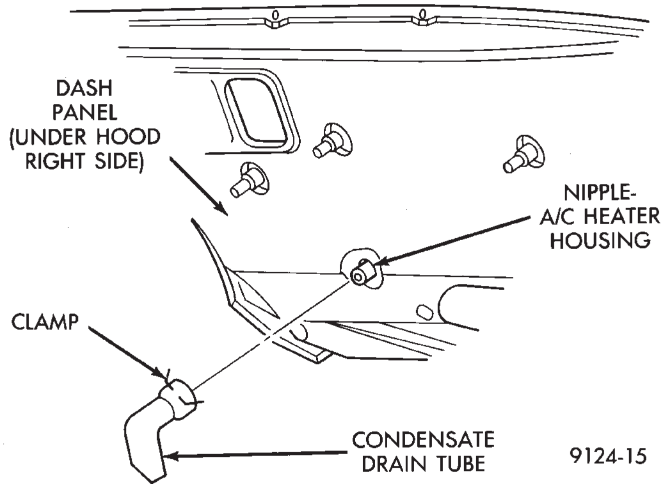


Fig. 5 Condensate Water Drain Tube—Typical

AUTOMATIC TEMPERATURE CONTROL (ATC)

INDEX

GENERAL INFORMATION—COMPONENT OPERATION

The Automatic Temperature Control (ATC) system lets the operator change the passenger compartment environment. A computer, built into the control panel (Fig. 1), regulates the desired temperature, air flow direction and blower speed. The operator may select an AUTO or MANUAL by using the mode button. Refer to the Owner's Manual for proper operation.

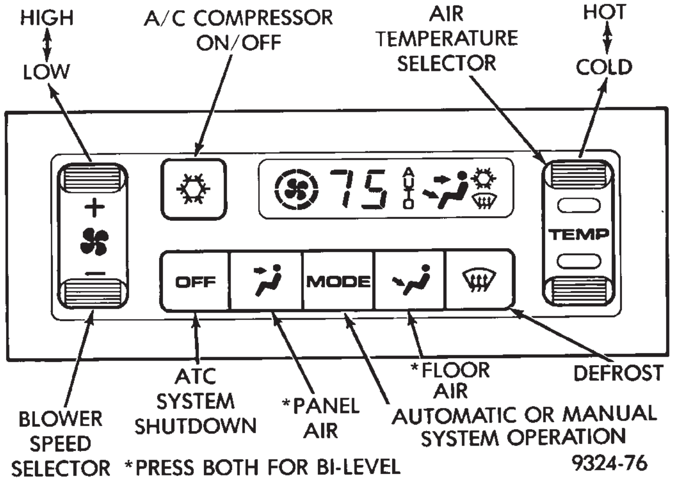


Fig. 1 Automatic Temperature Control Computer Panel

The system goes into a maximum cool recirculated air lock-in mode:

- After selecting a comfort temperature setting of 18°C or 65°F.
- With the A/C compressor turned "ON". The snowflake will only illuminate when the system is in the manual mode.
- With the system not in the defrost mode.
- When the temperature button is held in for ten seconds.

This will not regulate the temperature until the system is turned off or the comfort setting is raised (Fig. 2).

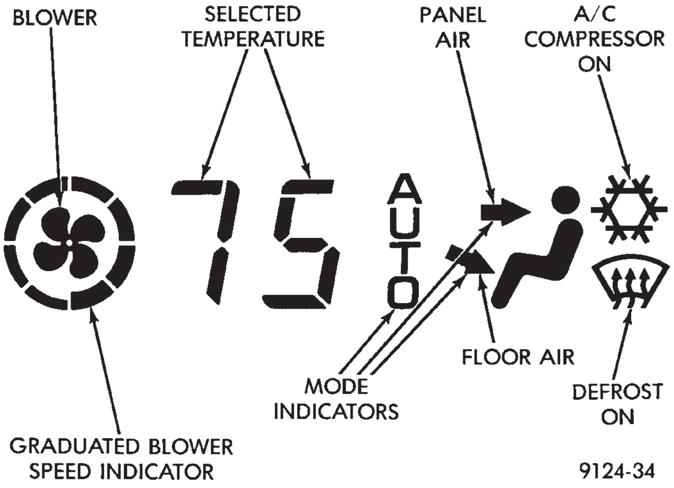


Fig. 2 Automatic Temperature Control Panel Display Symbols

Vacuum is not used to control any of the ATC system or components. It is a totally electronic unit.

The A/C compressor can not be turned off in the AUTO mode.

MANUAL A/C MODE

The manual mode can be activated by pressing the mode button. The compressor can only be turned OFF when the climate control system is in the manual mode. The snowflake will be illuminated when the compressor is ON.

The display panel will show LO, 1-10, and HI symbols when in the manual mode.

ATC COMPUTER/CONTROL PANEL

The ATC computer controller (Fig. 3) manages all of the systems electronic functions. It provides logic and/or power to operate the power module, blend-air door actuator, the mode door and fresh/recirc actuators. It remembers the operators control panel selected settings when the vehicle is not running. Then it measures return inputs from the sun sensor and various temperature sensors. After measuring all input information, the computer will ground the output circuits. This provides logic signals for automatic system control. The computer control panel is not serviceable except for the illumination bulbs.

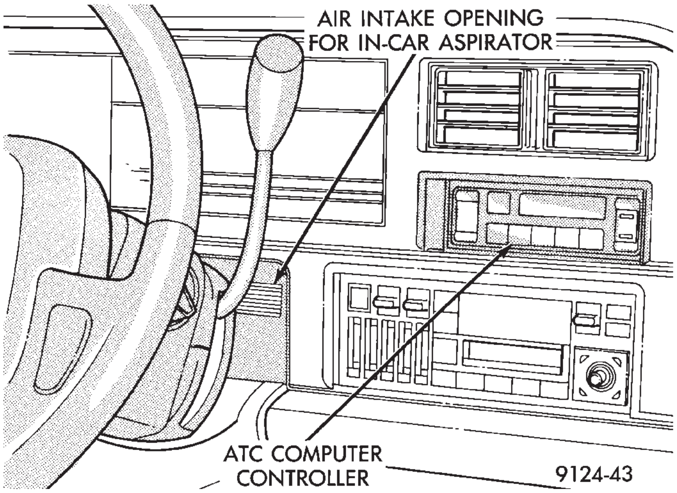


Fig. 3 ATC Computer Controller—Aspirator Air Intake

For bulb replacement, refer to A/C-Heater Control Lamp Replacement in Group 8E Instrument Panel.

The ATC Computer/Control Panel is located in the center of the instrument panel above the radio.

REMOVAL AND INSTALLATION

Refer to A/C-Heater control replacement in the Switch and Panel Component section of Group 8E, Instrument Panel and Gauges.

POWER MODULE

The power module (PM) (Fig. 4) receives pulse width modulated logic signals from the computer control. The PM then supplies varied voltage to the blower motor ground circuit for different blower speeds based on the logic signal. The power module is not serviceable and must be replaced if found to be defective.

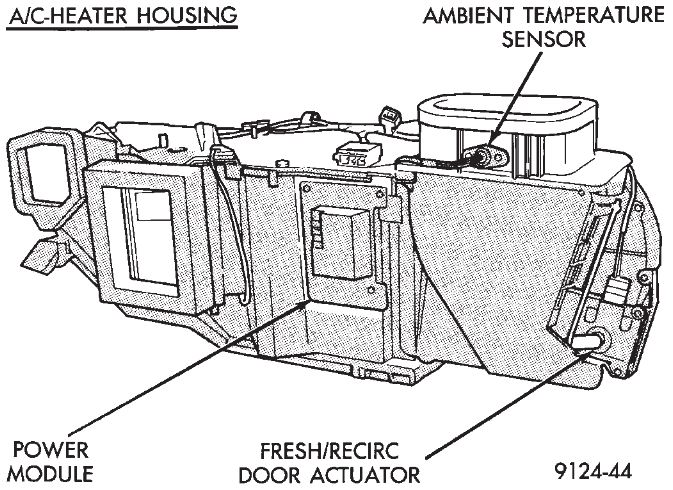


Fig. 4 Power Module—Ambient Temperature Sensor—Fresh/Recirc Door Actuator

REMOVAL AND INSTALLATION

(1) Disconnect the negative battery cable.

(2) Remove glove box/ash tray assembly. Refer to Switch and Panel Component Service section of Group 8E.

(3) Remove the four PM attaching screws (Fig. 5).

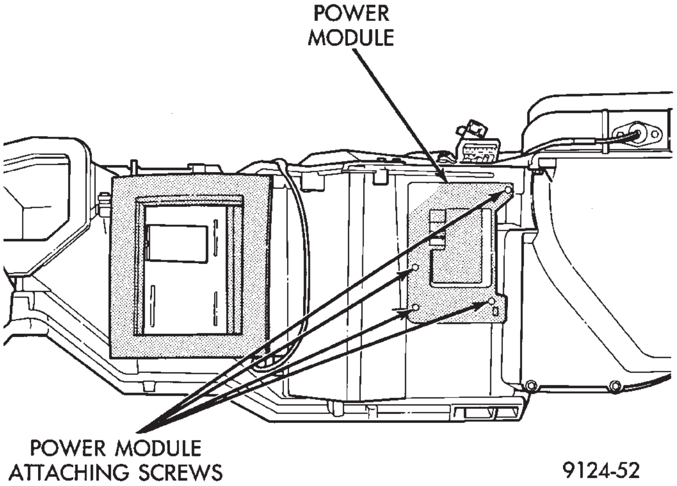


Fig. 5 Power Module Removal and Installation

(4) Disconnect electrical connector.

(4) Gently extract PM (to prevent damage to A/C evaporator) from A/C-heater housing and remove from under instrument panel.

To install, reverse the preceding operation. Perform systems check.

AMBIENT TEMPERATURE SENSOR

The ambient air temperature sensor is located in the A/C housing above the glove box. This is also a thermistor and will pick up on the environmental ambient temperature. The computer control uses the information provided by the ambient sensor to:

- Regulate the low blower speed
- Temperature offsets
- Mode control

The ambient sensor is not serviceable and must be replaced if found to be defective.

The ambient temperature sensor is plugged into a two wire receptacle in the A/C-heater housing behind and above the glove box.

REMOVAL AND INSTALLATION

(1) Remove glove box/ash tray assembly.

(2) Locate and remove two attaching screws on sensor receptacle (Fig. 6).

(3) Carefully pull receptacle and sensor from housing.

CAUTION: It is possible for the sensor to hang up on the edge of the hole in the A/C-heater housing assembly during removal. This may cause the sensor to disengage from the receptacle and fall into the housing.

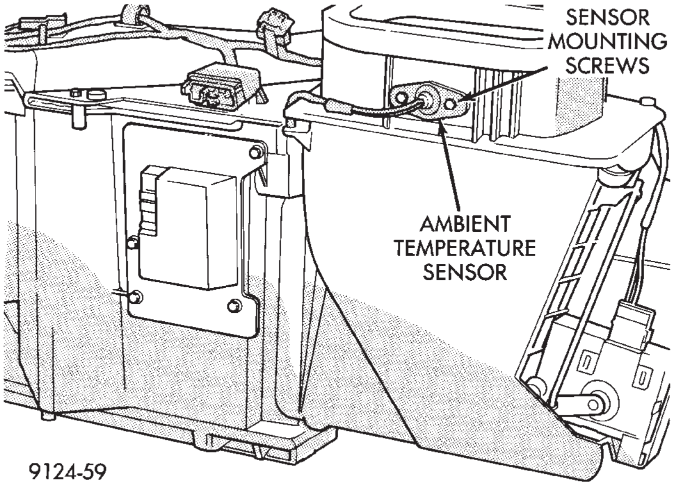


Fig. 6 Ambient Sensor Removal and Installation

(4) Unplug sensor from receptacle.

To install, reverse the preceding operation and retest system.

FRESH/RECIRC DOOR ACTUATOR

The fresh/recirc door actuator is an electric servo motor. It (with the use of linkage) mechanically positions the A/C unit door in the open or closed position. Actuation of the servo motor will occur when drive signals are supplied to the actuator from the computer control. This actuator does not contain a feedback strip therefore can not communicate the fresh/recirc door position back to the computer control. The fresh/recirc door actuator is not serviceable and must be replaced if found to be defective.

The Fresh/Recirc Door Actuator is located on the passenger side of the A/C-heater case.

CAUTION: Do not remove any of the motor actuators from the heater-A/C unit assembly with any electrical power applied. Removal should only be done with the Ignition OFF. The actuators have no mechanical stops to limit their travel. If the actuator rotates and is not connected to the unit assembly, it will become un-calibrated.

REMOVAL AND INSTALLATION

(1) Remove the glove box/ash tray assembly. Refer to the Switch and Panel Component Service section of Group 8E.

(2) Remove under panel silencer pad.

(3) Remove the carpeted cover over the air bag module.

(4) Remove the right front kick panel.

(5) Remove metal instrument panel brace (Fig. 7).

(6) Remove two screws mounting the actuator mounting bracket to the A/C-heater case (Fig. 8).

(7) Remove three screws holding the actuator to the mounting bracket (Fig. 9).

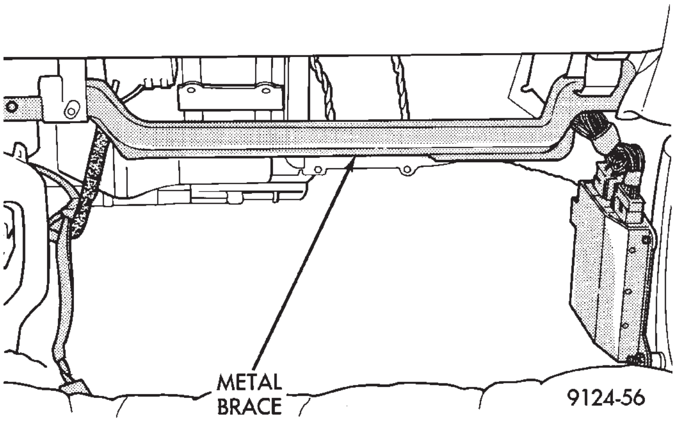


Fig. 7 Brace Removal and Installation

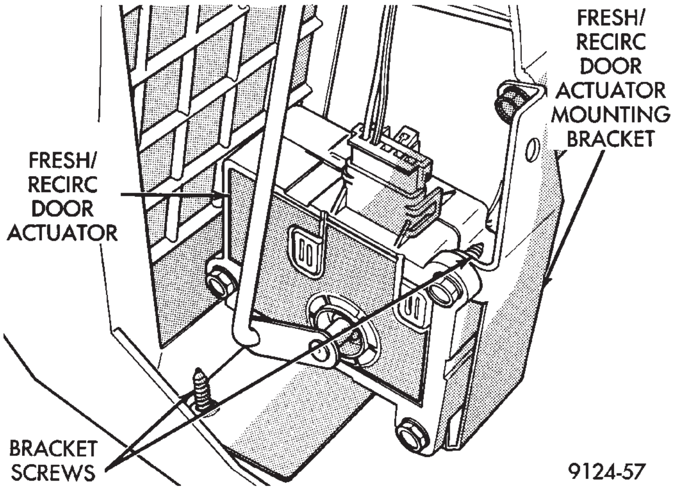


Fig. 8 Actuator Mounting Bracket Removal and Installation

CAUTION: Do not allow screw A (Fig. 8) to drop into A/C-heater housing assembly.

(8) Tilt actuator to release from actuator link. Remove actuator from vehicle.

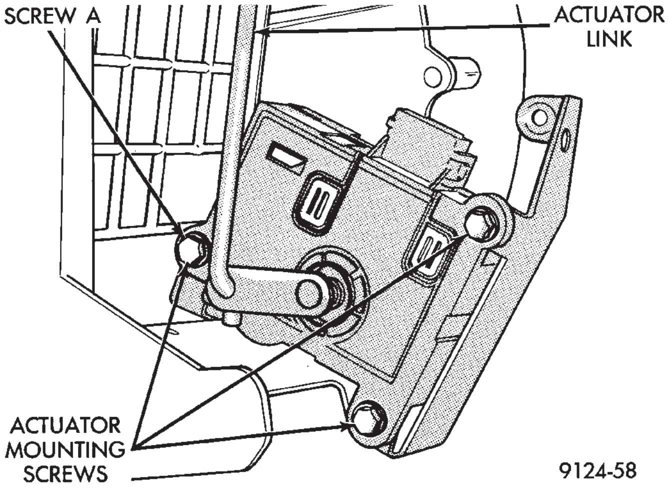


Fig. 9 Actuator Removal and Installation

To install, reverse the preceding operation.

BLEND-AIR DOOR ACTUATOR

The blend-air door actuator (Fig. 10) is an electric servo motor which mechanically positions the A/C unit temperature door. Actuation of the servo motor will occur when drive signals are supplied to the actuator from the computer control. A feedback strip in the actuator allows the computer control to know the exact position of the temperature door at all times. The blend-air door actuator is not serviceable and must be replaced if found to be defective.

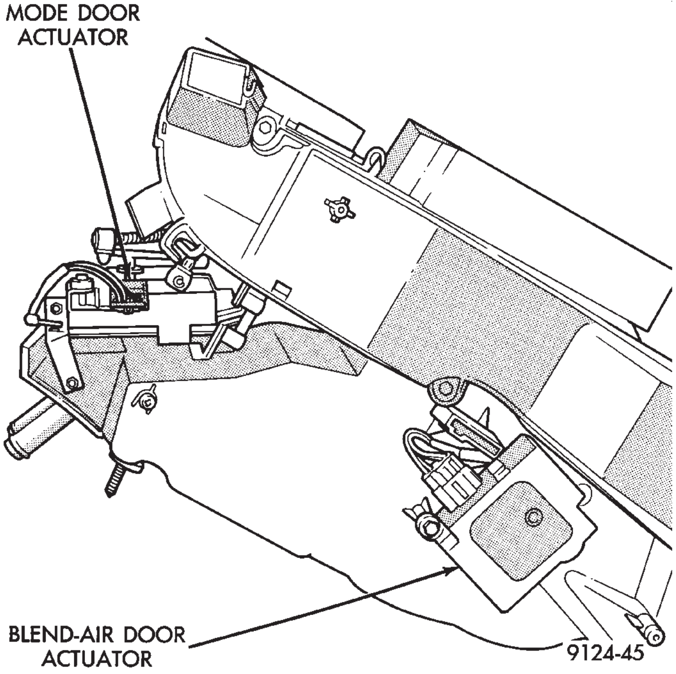


Fig. 10 Blend-Air Door Actuator—Mode Door Actuator—View from bottom of A/C Housing

CAUTION: Do not remove any of the motor actuators from the heater-A/C unit assembly with any electrical power applied. Removal should only be done with the Ignition OFF. The actuators have no mechanical stops to limit their travel. If the actuator rotates and is not connected to the unit assembly, it will become un-calibrated.

REMOVAL AND INSTALLATION

The blend-air door actuator is located on the A/C-heater housing above the floor hump.

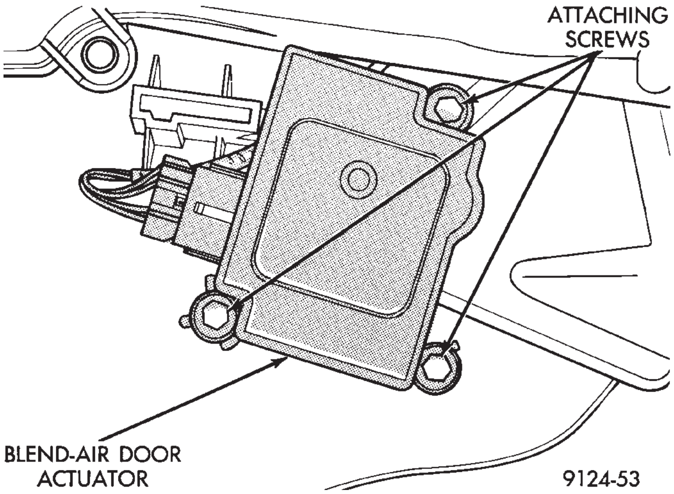
(1) Remove under panel silencers.

(2) Remove the carpeted cover over the air bag control module.

(3) Remove floor air distribution duct.

(4) Locate and remove three actuator attaching screws.

(5) Lower the blend-air door actuator from A/C-heater housing while removing actuator from blend-air door shaft (Fig. 11).



Figs. 11 Blend-Air Door Actuator Removal and Installation—View from bottom of A/C Housing

(6) Disengage wire connector lock and unplug connector.

To install, reverse the preceding operation.

CAUTION: Align the blend-air door shaft to the slot in the actuator. Be sure the shaft on blend-air door actuator is properly engaged (when installing) to prevent damage.

Perform system check.

MODE DOOR ACTUATOR

The mode door actuator is an electric servo motor. It (with the use of linkages) mechanically positions the A/C unit panel/bi-level door and the floor/defrost door. Actuation of the servo motor will occur when drive signals are supplied to the actuator from the computer control. This actuator also contains a feedback strip which allows the computer control to know the exact position of the mode door at all times. The mode door actuator is not serviceable and must be replaced if found to be defective.

The Mode Door Actuator is located on the side of the A/C-heater case near the accelerator pedal.

CAUTION: Do not remove any of the motor actuators from the heater-A/C unit assembly with any electrical power applied. Removal should only be done with the Ignition OFF. The actuators have no mechanical stops to limit their travel. If the actuator rotates and is not connected to the unit assembly, it will become un-calibrated.

REMOVAL AND INSTALLATION

(1) Remove under panel silencer.

(2) Disconnect electrical connector from actuator.

(3) Pinch and remove the lower plastic clip from the actuator arm (Fig. 12).

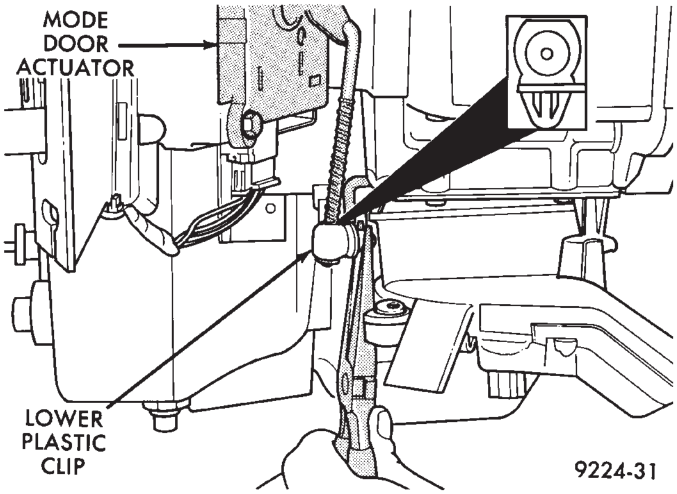


Fig. 12 Plastic Clip on Mode Door Actuator

(4) Remove the three actuator bracket mounting screws (Fig. 13).

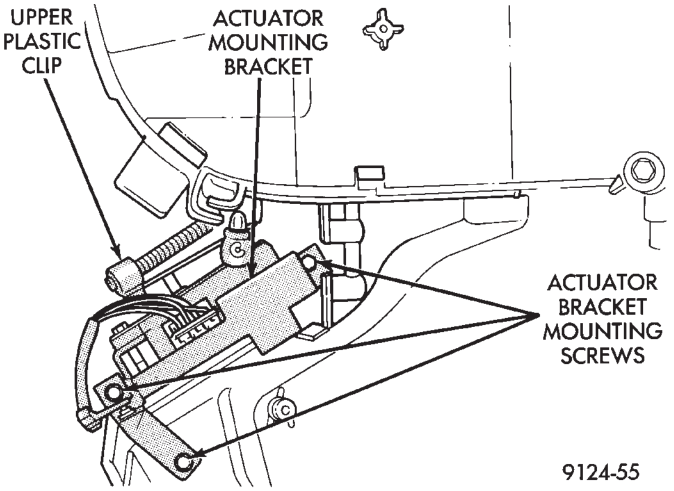


Fig. 13 Actuator Bracket Mounting Screws

(5) Rotate actuator to gain access to upper plastic clip. Pinch and remove the upper plastic clip from the actuator arm.

(6) Remove actuator-to-actuator mounting bracket screws.

(7) Remove actuator from mounting bracket. Remove from vehicle.

To install, reverse the preceding operation.

IN-CAR TEMPERATURE SENSOR/ASPIRATOR ASSEMBLY

The ATC system uses various sensors which return electrical signals to the computer control. The in-car temperature sensor is part of a motorized aspirator assembly (Fig. 14) that is mounted in the instrument panel. A small fan (in the aspirator) draws air through an intake on the instrument panel. This air flows over a thermistor which picks up temperature variations. The computer control then makes system adjustments to maintain a constant passenger compartment temperature. The in-car temperature sensor/aspirator assembly is not serviceable and must be replaced if found to be defective.

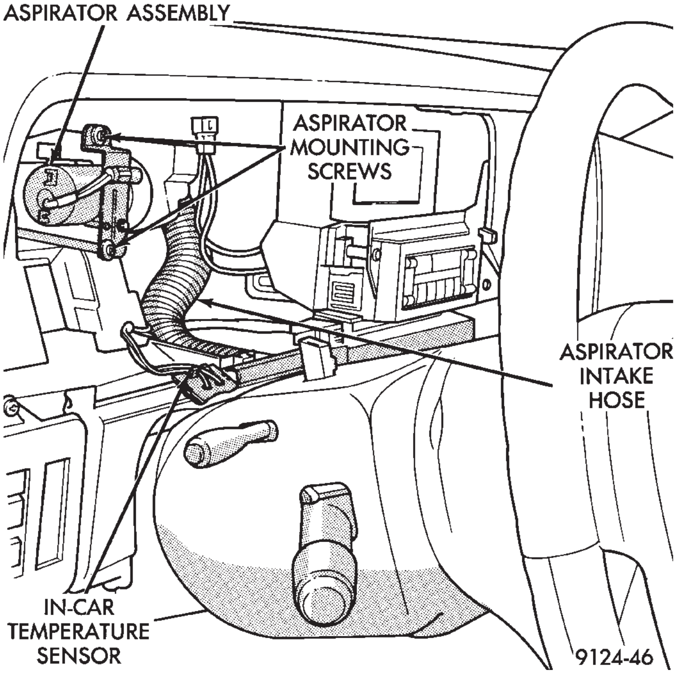


Fig. 14 In-car Temperature Sensor/Aspirator Assembly

The In-Car Temperature Sensor/Aspirator Assembly is located behind the instrument panel and to the right of the steering column. The air intake opening for the aspirator is located to the right of the steering column (Fig. 15). The Sensor and Aspirator are wired together and must be replaced as an assembly.

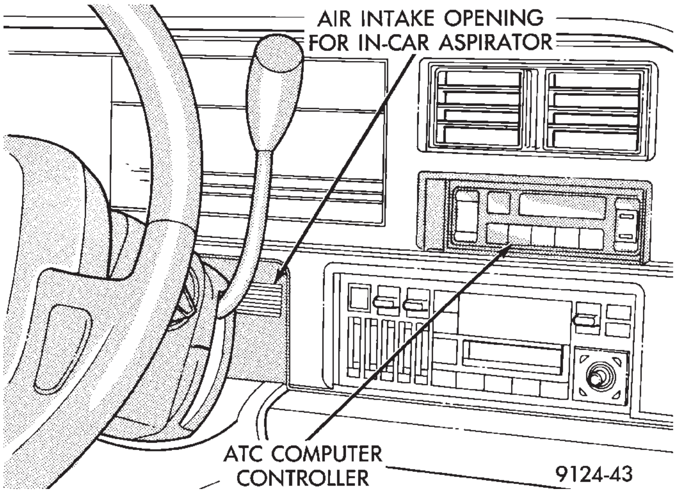


Fig. 15 Aspirator Air Intake

REMOVAL AND INSTALLATION

(1) Remove the instrument cluster assembly. Refer to Cluster and Gauge Service section in Group 8E.

(2) Un-snap the sensor from the instrument panel (Fig. 16).

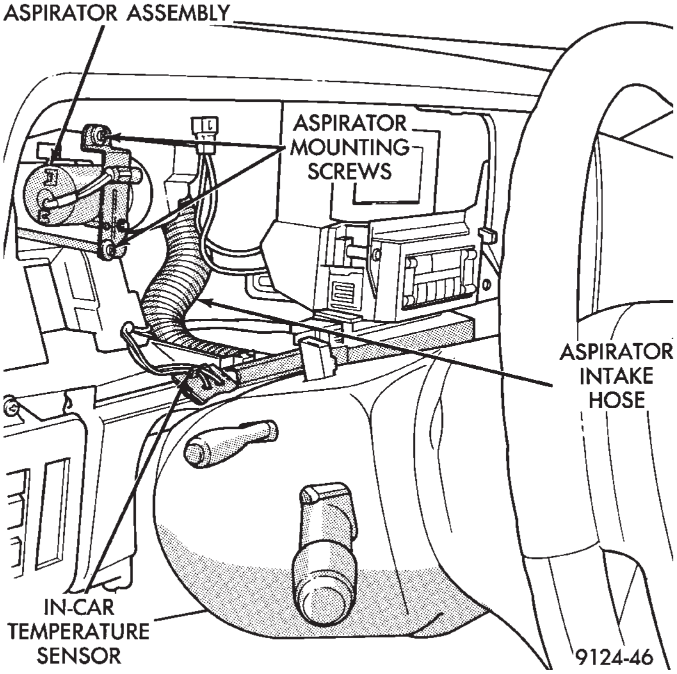


Fig. 16 In-Car Temperature Sensor/Aspirator Assembly Removal and Installation

(3) Remove the two aspirator mounting screws.

(4) Disconnect the aspirator intake hose from the instrument panel.

(5) Remove sensor/aspirator and it's wiring harness from vehicle.

To install, reverse the preceding operation.

WATER TEMPERATURE SENSOR

The water temperature sensor is located on the heater core mounting plate (Fig. 17). This is a thermistor which will pick up on the engines coolant temperature. The computer control uses this information to control the cold engine lockout time. The water temperature sensor is not serviceable and must be replaced if found to be defective.

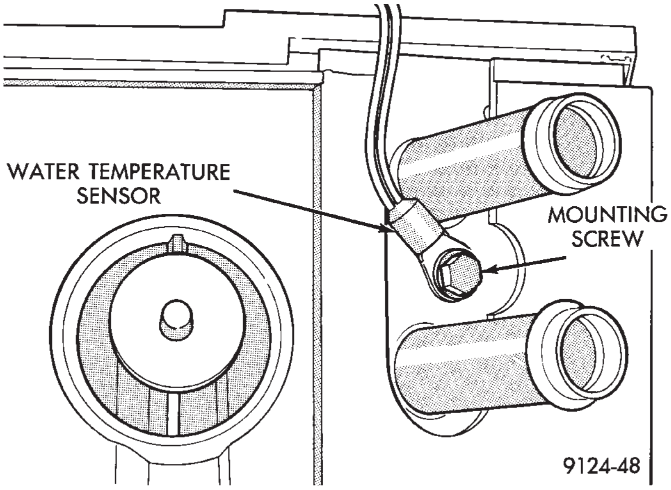


Fig. 17 Water Temperature Sensor

The Water Temperature Sensor is located on the heater hose mounting plate between the heater hose nipples.

REMOVAL AND INSTALLATION

(1) The A/C-heater housing assembly must be removed for Water Temperature Sensor replacement. Refer to Heater-A/C Unit Housing Removal and Installation—AC/AY Body for procedures.

(2) Remove sensor mounting screw (Fig. 18).

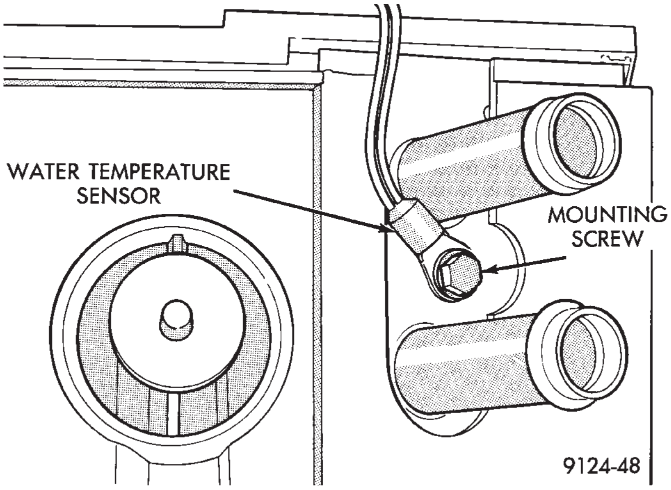


Fig. 18 Water Temperature Sensor Removal and Installation

(3) Disconnect the sensor pigtail wiring harness from the main wiring harness and remove sensor from vehicle.

To install, reverse the preceding operation. When tightening the sensor mounting screw, allow the sensor to rotate and contact the upper heater hose nipple. This will aid in sensor efficiency.

SUN SENSOR

The sun sensor (Fig. 19) is mounted on the driver side of the vehicle on top of the instrument panel. This is not a thermistor type sensor but rather a photo diode. For this reason the sun sensor responds to sun light intensity rather than temperature. It is used to aid in determining proper mode door position. The sun sensor is not serviceable and must be replaced if found to be defective.

REMOVAL AND INSTALLATION

(1) Carefully pry up the sensor from the instrument panel with a screwdriver (Fig. 20). Place a rag under the screwdriver to prevent scratching of the instrument panel.

(2) Disconnect the sensor at the wiring harness.

To install, reverse the preceding operation. Snap the sensor securely to the instrument panel.

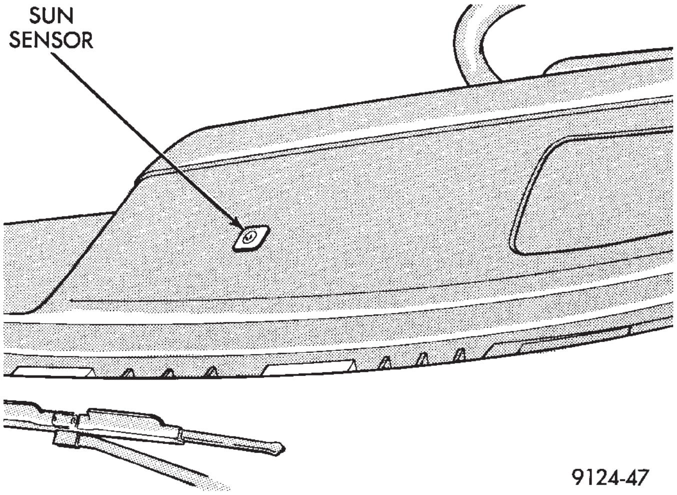


Fig. 19 Sun Sensor

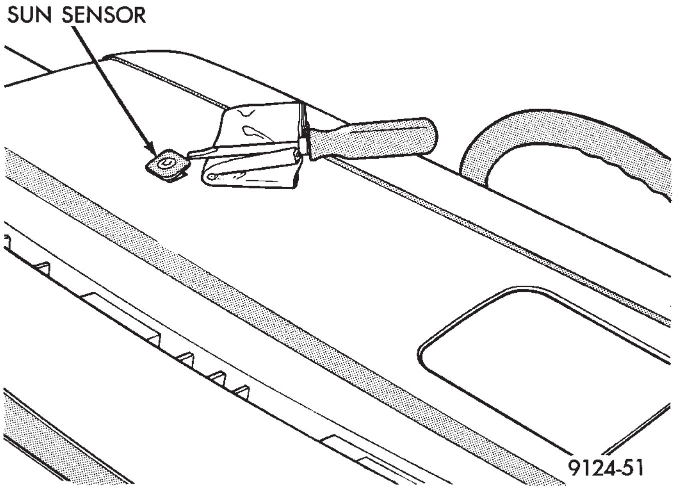


Fig. 20 Sun Sensor Removal

NON—COMPUTER AIDED DIAGNOSTIC TESTS

Determine whether the operator complaint is due to a system failure or improper operation of the ATC system. The system will to go into a maximum heat or cooling mode if the operator changes the temperature setting four or more degrees.

Check the following:

- Coolant level
- Refrigerant charge
- Drive belt tension
- Radiator air flow
- Radiator fan operation
- Air suction of In-car Temperature Sensor/Aspirator

To check air suction of the Aspirator, place a small piece of tissue paper over the Aspirator opening on the instrument panel. This opening is located to the right of the steering column. The tissue paper should cling to the opening if system is functioning properly.

Bring the engine to normal operating temperature and proceed with Computer Aided Diagnostic Procedures. Always test the entire system after each repair has been performed.

COMPUTER AIDED DIAGNOSTIC TESTS

The ATC control has a computer capable of troubleshooting the entire ATC system in approximately 60 seconds. The engine must be running and at normal operating temperature during the test to provide hot coolant for the heater.

During the ATC Diagnostic Test, the computer will calibrate the Mode and Blend Door actuators.

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 un-calibrated.

The Diagnostic Test is capable of checking all electrical signals between the ATC Control Module, actuators, sensors and blower control.

The Diagnostic Test will display two types of Diagnostic trouble Codes (Fig. 21). The Diagnostic Trouble Codes numbered 01 through 22, have been detected during the Diagnostic Test. Diagnostic Trouble Codes numbered 23 through 28, have been detected during normal ATC operation. Diagnostic Trouble Codes 23 through 28 would then be stored in the ATC control computer and are only being retrieved during the Diagnostic Test.

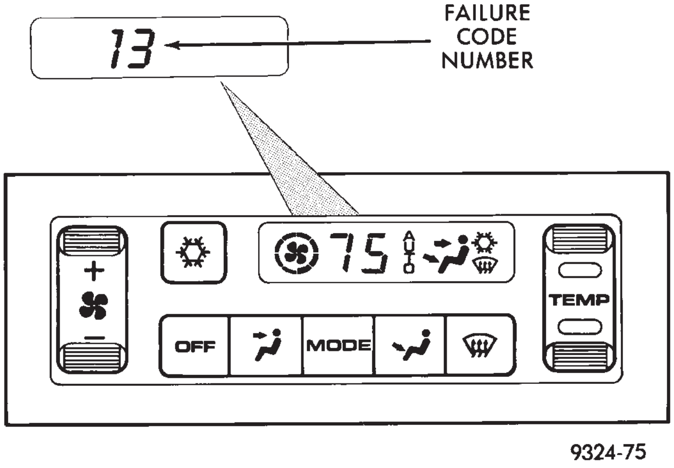


Fig. 21 Automatic Temperature Control Diagnostic Trouble Codes

For electrical pin numbers, refer to the wiring Pin out charts on the following pages in this section.

(1) Start vehicle and allow engine to warm up.

(2) For two seconds, depress the DEFROST, FLOOR and MODE buttons at the same time. The ATC control should begin to flash on and off.

(3) During the Diagnostic Test perform the following symptom tests:

(a) Do all display symbols and indicators illuminate ?

(b) Does the blower motor operate at its highest speed ?

(c) Feel the outlet temperature. Does it get hot and then cycle cold ?

(d) Does the air flow switch from DEFROST outlets and then cycle to PANEL outlets?

If you can answer NO to any of these questions, proceed to step 4, otherwise proceed to step 5.

(4) If you answered NO to:

SYMPTOM A

The display symbols and indicators do not illuminate. Diagnostic Trouble Codes are not displayed.

TEST

After self-diagnostic test is complete, select a mode that will display the malfunction.

ACTION

If the ATC system operates properly, and the display does not, replace ATC control panel computer.

SYMPTOM B

The blower motor does not operate.

CAUTION: Stay clear of blower motor and power module (PM) heat sink. Do not run system for more than 10 minutes with PM removed from A/C unit.

TEST

Check all power module and blower motor connections. Use a voltmeter to test for 12 volts (ignition) at both ends of the fuse with ignition ON. If fuse is good, test the green wire at the blower motor connector for 12 volts (ignition) to body ground.

Turn ignition to the ON position.

With the blower motor still connected, check for 12 volts to body ground on the black/tan wire of the blower motor two way connector.

Check for 12 volts at the Power Module pin #4 (BK/TN).

Check for continuity from the Power Module pin #3 (BK) to chassis ground.

Replace the Power Module.

ACTION

If 12 volts is not detected, repair feed circuit. Refer to the Front Wheel Drive Car-Wiring Diagrams Service Manual.

If 12 volts is not detected, repair wires of the blower motor or replace the blower motor.

If 12 volts is not present, repair wire from the blower motor connector to the Power Module.

If circuit is open, repair ground circuit of the Power Module.

Replace the Power Module (power transistor open).

SYMPTOM C

The outlet air temperature does not become hot and then cycle to cold during self-test operation. Diagnostic Trouble Codes are not displayed.

TEST/ACTION

Make sure the blend-air door is properly attached to the actuator.

If cold air is not discharged from the outlets, check the base A/C refrigerant system.

Make sure heating operation works correctly, (water level, thermostat, heater hoses, heater core, etc.).

SYMPTOM D

Air does not flow from DEFROST outlets and then cycle to PANEL outlets during self-test operation.

TEST/ACTION

Check linkages from the mode door actuator for binding.

Check for proper door travel in the unit.

(5) The computer will do one of two things:

- Will return to the control settings that were selected before the Diagnostic Test was started. This means the test is over. If Diagnostic Trouble Codes did not occur, and answers to questions (a), (b), (c), and (d) were YES, the entire system is operating correctly.
- The blower motor will stop and the computer will flash a Diagnostic Trouble Code number from 01 through 28. Record the number and then depress the PANEL button to advance to the next test. If the ATC control flashes one or more codes 23 to 28, the digits on the display will flash alternating Zeros. If you do nothing, these codes will remain stored within the ATC control computer. After all repairs have been made erase fault codes. Refer to Erasing Diagnostic Trouble Codes 23 through 28 from ATC Control in this section.

Repair all Diagnostic Trouble Codes in the order that they have been indicated, and then retest the system. If any blend door test fails, all remaining blend door tests will be skipped. IF any mode door tests fail, all remaining mode door tests will be skipped.

Diagnostic Test can be stopped at any time by depressing any button other than PANEL.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

Non-computer aided diagnostics should be performed first. Hood of vehicle should be closed during the diagnostic test to keep engine heat from effecting the ambient temperature sensor.

Also refer to the wiring Pin out charts.

- DIAGNOSTIC TROUBLE CODE 1

Involves the wiring or the ATC control head.

- DIAGNOSTIC TROUBLE CODES 2, 13, 14, 15, 20, and 23

Involves the wiring, blend-air door actuator, or the ATC control head.

- DIAGNOSTIC TROUBLE CODES 3, 16, 17, 18, 19, and 24

Involves the wiring, mode door actuator, or the ATC control head.

- DIAGNOSTIC TROUBLE CODE 4

Involves the wiring, blend-air door actuator, mode door actuator, fresh/recirc. door actuator, or the ATC control head.

- DIAGNOSTIC TROUBLE CODE 5

Involves the wiring, fresh/recirc. door actuator, or the ATC control head.

- DIAGNOSTIC TROUBLE CODE 6

Involves the compressor circuit signal wiring, or the ATC control head.

- DIAGNOSTIC TROUBLE CODE 7

Involves the blower wiring, power module, or the ATC control head.

- DIAGNOSTIC TROUBLE CODES 8, 21, 22

Requires replacing the ATC control head.

- DIAGNOSTIC TROUBLE CODES 9, and 27

Involves the wiring, sun sensor, or the ATC control head.

- DIAGNOSTIC TROUBLE CODES 10, and 28

Involves the wiring, water temperature sensor, or the ATC control head.

- DIAGNOSTIC TROUBLE CODES 11, and 25

Involves the wiring, ambient temperature sensor, or the ATC control head.

- DIAGNOSTIC TROUBLE CODES 12, and 26

Involves the wiring, in-car temperature sensor/aspirator, or the ATC control head.

DIAGNOSTIC TROUBLE CODE SERVICE PROCEDURES

The control keyboard will not function if pins 7, 9, 17, 19, or 20 of the 21-way wiring connector are shorted to battery voltage.

For electrical pin numbers, refer to the wiring Pin out charts (Figs. 1, 2, 3, 4, 5, or 6).

DIAGNOSTIC TROUBLE CODE 1—OUTPUT FAILURE WITH ALL OUTPUTS LOW

(1) Remove pin #2 from 21-way connector on control and retest system. If code 01 does not appear, the control is good.

Disconnect 21-way connector from control. With an ohmmeter, measure the resistance between pin #2 and pin #12 of 21-way. This should be between 2,600 and 2,800 ohms. If yes, the power module is good.

Source of voltage on pin #2 is in the wiring. Repair and retest system.

(2) Remove pin #13 from 21-way connector on control and retest system. If code 01 does not appear, the control is good. Locate source of voltage on pin #13. Repair and retest system.

(3) Remove pin #5 from 21-way connector on control and retest system. If code 01 does not appear, the control is good. Locate source of voltage on pin #5. Repair and retest system.

(4) Remove pin #6 from 21-way connector on control and retest system. If code 01 does not appear, the control is good. Locate source of voltage on pin #6. Repair and retest system.

(5) Remove pin #15 from 21-way connector on control and retest system. If code 01 does not appear, the control is good. Locate source of voltage on pin #15. Repair and retest system.

DIAGNOSTIC TROUBLE CODE 2—BLEND ACTUATOR DRIVE SIGNAL NOT HIGH

If both Diagnostic Trouble Codes 2 and 3 occur simultaneously, do both procedures. There is typically only 1 failure.

(1) Disconnect terminal #6 on the ATC control 21-way connector and retest the system. Note that removing this terminal may generate additional Diagnostic Trouble Codes. Disregard these at this time.

(2) If Diagnostic Trouble Code 2 reappears, replace control.

(3) If code 2 does not reappear, the problem is a shorted blend door actuator motor or a short to ground in circuit 33 (pin #6).

(4) Remove 21-way connector and check for continuity from pin #6 to chassis ground. There should not be any continuity. If continuity is there, repair wiring and retest.

(5) Check resistance across pins #6 and #4 of the 21-way for a shorted actuator motor. Resistance should be between 20 and 50 ohms. If not correct, replace actuator.

DIAGNOSTIC TROUBLE CODE 3—MODE ACTUATOR DRIVE SIGNAL NOT HIGH

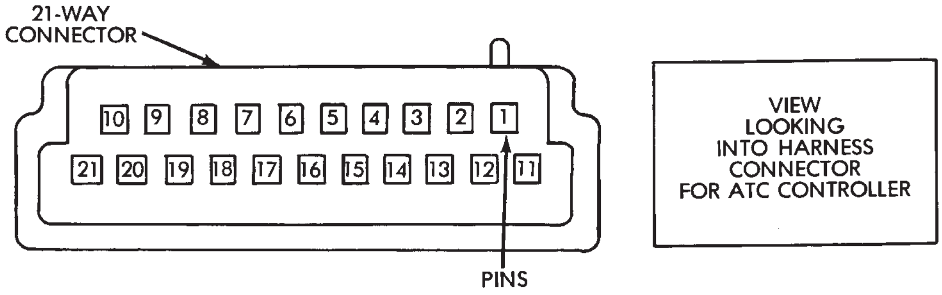
If both Diagnostic Trouble Codes 2 and 3 occur simultaneously, do both procedures. There is typically only 1 failure.

(1) Disconnect terminal #5 on the ATC control 21-way connector and retest the system. Removing this terminal may generate additional Diagnostic Trouble Codes. Disregard these at this time.

(2) If Diagnostic Trouble Code 3 reappears, replace control.

(3) If code 3 does not reappear, the problem is a shorted mode door actuator motor, or a short to ground in circuit #35 (pin #5).

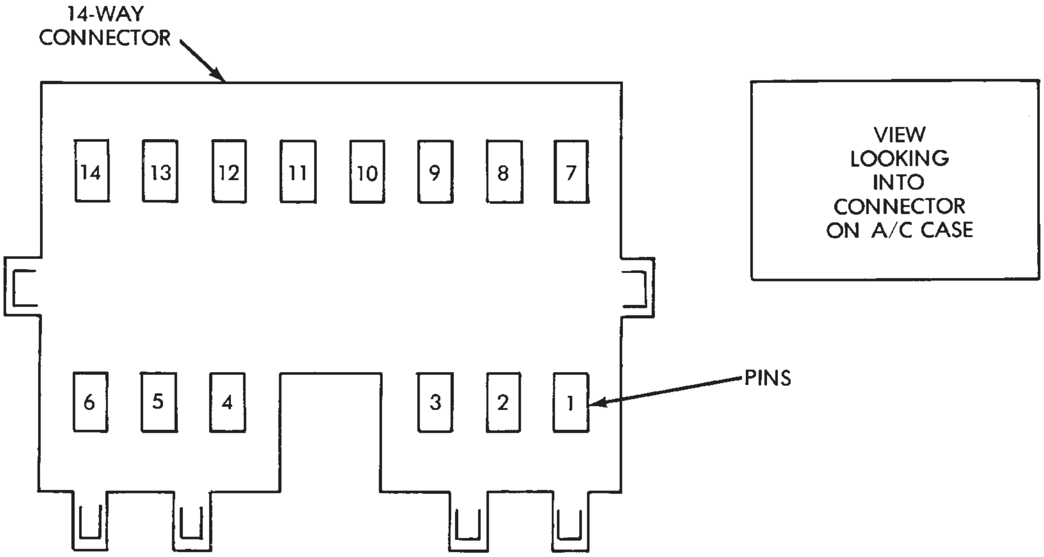
(4) Remove 21-way and check for continuity from pin #5 to chassis ground. There should not be any continuity. If continuity is there, repair wiring and retest.



PIN/ CAVITY NUMBER	CIRCUIT DESIGNATION/ WIRE COLOR		DESCRIPTION
1	F20	18WT	IGNITION FEED
2	C31	20LB	BLOWER SIGNAL FROM CONTROLLER
3	OPEN		OPEN
4	C34	20RD/LG	+/− TO BLEND, MODE, RECIRC
5	C35	20OR/DG	+/− TO MODE
6	C33	20LB/RD	+/− TO BLEND AIR
7	C57	20DB/GY	SENSOR/ACT GRND. TO CONTROLLER
8	C36	20GY/OR	BLEND AIR FEEDBACK
9	C08	20DG/RD	AMBIENT SENSOR SIGNAL TO CONTROLLER
10	E17	18BK/YL	DIMMER SIGNAL
11	Z02	18BK/LG	ELEC. GROUND
12	C30	18VT	BLOWER-IGNITION FROM CONTROLLER
13	C02	18DB/YL	CLUTCH CYCLE SIGNAL
14	Z03	20BK/OR	PANEL LAMP GROUND
15	C32	20YL/PK	+/− TO RECIRC
16	C37	20DG/WT	MODE FEEDBACK SIGNAL
17	C39	20LB/VT	WATER TEMP SIGNAL
18	OPEN		OPEN
19	C38	20BK/DG	SUN SENSOR SIGNAL
20	C10	20RD/TN	IN-CAR SENSOR SIGNAL
21	E02	18OR	PANEL LAMPS

9124-37

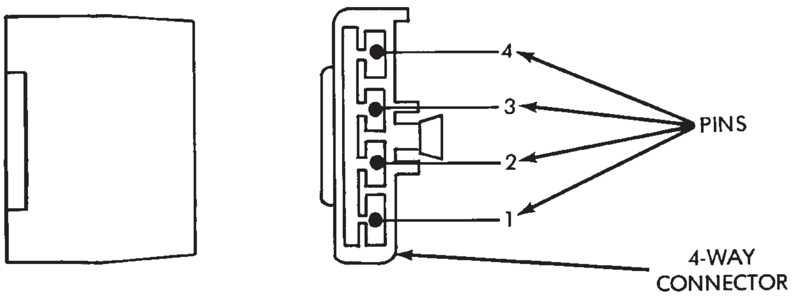
Fig. 1 Pin outs for 21-way Connector at ATC Computer Connector



PIN/ CAVITY NUMBER	CIRCUIT DESIGNATION/ WIRE COLOR	DESCRIPTION
1	OPEN	OPEN
2	C34 20RD/LG	+/– TO BLEND AIR, MODE RECIRC ACT.
3	C35 20OR/DG	+/– MODE ACT.
4	C33 20LB/RD	+/– BLEND AIR ACT.
5	C37 20DG/WT	MODE ACT. FEEDBACK TO CONTROL
6	C32 20YL/PK	+/– RECIRC ACT.
7	OPEN	OPEN
8	OPEN	OPEN
9	C08 20DG/RD	AMBIENT SENSOR, I/P TO CONTROLLER
10	C39 20LB/VT	WATER SENSOR CONTROL
11	C57 20DG/GY	SENSOR/ACT COMM. GROUND TO CONTROLLER
12	C36 20GY/OR	BLEND AIR ACT. FEEDBACK TO CONTROLLER
13	OPEN	OPEN
14	OPEN	OPEN

9124-38

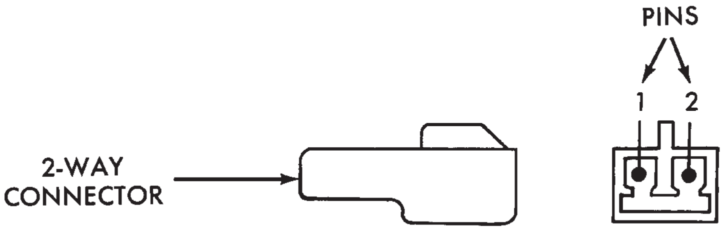
Fig. 2 Pin outs for 14-way Connector at ATC Harness on A/C Housing



PIN/ CAVITY NUMBER	CIRCUIT DESIGNATION/ WIRE COLOR	DESCRIPTION
1	C30 18VT	IGNITION FROM CONTROLLER
2	C31 20LB	BLOWER SIGNAL FROM CONTROLLER
3	Z01 10BK	GROUND
4	C07 12BK/TN	BLOWER MOTOR GROUND SIGNAL

9124-39

Fig. 3 Pin outs for 4-Way Connector



PIN/ CAVITY NUMBER	CIRCUIT DESIGNATION/ WIRE COLOR	DESCRIPTION
1	C57 20DB/GY	SENSOR ACT. GND. TO CONT.
2	C38 20 TAN	SUN SENSOR SIGNAL

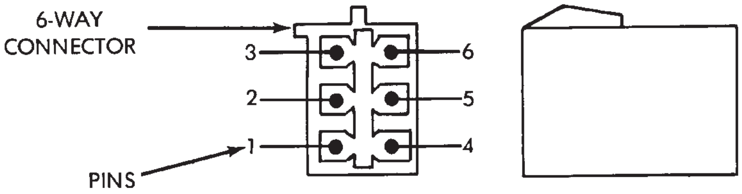
9224-33

Fig. 4 Pin outs for Sun Sensor 2-Way Connector

(5) Check resistance across pins #4 and #5 of the 21-way connector for a shorted actuator motor. Resistance should be between 20 and 50 ohms. If not correct, replace actuator.

DIAGNOSTIC TROUBLE CODE 4—ACTUATOR DRIVE COMMON SIGNAL NOT HIGH

If both Diagnostic Trouble Codes 4 and 5 occur simultaneously, do both procedures. There is typically only 1 failure.



PIN/ CAVITY NUMBER	CIRCUIT DESIGNATION/ WIRE COLOR		DESCRIPTION
1	C10	22RD/TN	IN CAR SENSOR TO CONTROLLER
2	F20	18WT	IGNITION
3	Z01	20BK	GROUND
4	C57	20DB/GY	SENSOR/ACT COMMON GROUND TO CONTROLLER
5	OPEN		OPEN
6	C38	20TN	SUN SENSOR SIGNAL +

9124-41

Fig. 5 Pin outs for 6-Way Connector In-Car Sensor and Sun Sensor

(1) Disconnect terminal #4 on the ATC control 21-way connector and retest the system. Removing this terminal may generate additional Diagnostic Trouble Codes. Disregard these at this time.

(2) If Diagnostic Trouble Code 4 reappears, replace control.

(3) If code 4 does not reappear, the problem is a shorted actuator motor or a short to ground in circuit #34 (pin #4).

(4) Remove 21-way connector and check for continuity from pin #4 to chassis ground. There should not be any continuity. If continuity is there, repair wiring and retest.

(5) Check resistance across pins #4 and #5, #4 and #6, and #4 and #15 of the 21-way connector for a shorted actuator motor. Resistance should be between 20 and 50 ohms. If not correct, replace actuator involved.

DIAGNOSTIC TROUBLE CODE 5—FRESH/ RECIRC ACTUATOR DRIVE SIGNAL NOT HIGH

If both Diagnostic Trouble Codes 4 and 5 occur simultaneously, do both procedures. There is typically only 1 failure.

(1) Disconnect terminal #15 on the ATC control 21-way connector and retest the system. Removing this terminal may generate additional Diagnostic Trouble Codes. Disregard these at this time.

(2) If Diagnostic Trouble Code 5 reappears, replace control.

(3) If code 5 does not reappear, the problem is a shorted fresh/recirc door actuator motor. It could also be a short to ground in circuit #32 (pin #15).

(4) Remove 21-way connector and check for continuity from pin #15 to chassis ground. There should not be any continuity. If continuity is there, repair wiring and retest.

(5) Check resistance across pins #15 and #4 of the 21-way connector for a shorted actuator motor. Resistance should be between 20 and 50 ohms. If not correct, replace actuator.

DIAGNOSTIC TROUBLE CODE 6—COMPRESSOR DRIVE SIGNAL NOT HIGH

(1) Disconnect the low pressure cut out switch and retest diagnostics.

(2) If code 6 does not reappear, then the problem is in the A/C signal circuit C02. Check for wiring problem between the low pressure cut out switch and the engine controller, or a bad engine controller.

(3) If code 6 does reappear, remove the 21-way connector from the control and check for a short between pin #13 and chassis ground. This test will check the wire from the control to the low pressure cut out switch for a short to ground.

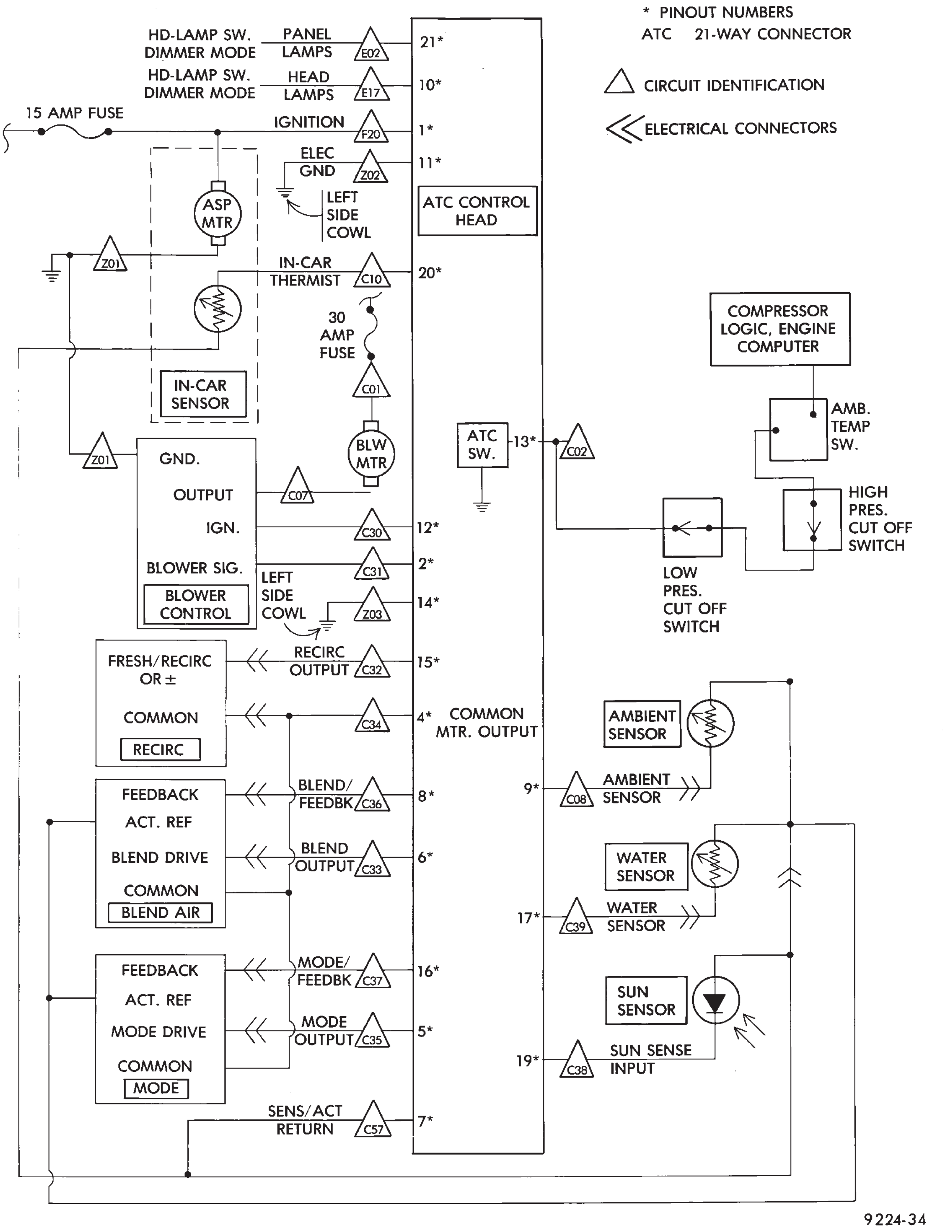


Fig. 6 ATC Circuits

(4) If pin #13 shows continuity, repair circuit C02 and retest.

(5) If no continuity is shown, replace the ATC control and retest.

DIAGNOSTIC TROUBLE CODE 7—BLOWER DRIVE SIGNAL NOT HIGH

First check the 4-way connector to the power module for correct installation

(1) With the ignition ON, check for ignition voltage to the power module pin #1 from the ATC control. If ignition is present at the power module, proceed to step 3. If not proceed to step 2.

(2) With the 21-way connector still connected and the ignition ON, check for power module ignition feed at the control pin #12. If ignition is not present, replace the control. If ignition voltage is present, repair the open in the wire between the control pin #12 and power module pin #1. Retest system.

(3) Turn ignition OFF and disconnect the 21-way connector. Measure the resistance between pins #2 and #12. The resistance should read between 2,600 and 2,800 ohms. If correct, replace the ATC control. If not correct, proceed to step 4.

(4) Remove the 4-way connector from the power module. Check for continuity between the ATC control pin #2 and power module pin #2. If no continuity is shown, repair the wire for an open. If continuity is shown, replace the power module and retest.

DIAGNOSTIC TROUBLE CODE 8—A/D CONVERTOR INTERNAL FAILURE

Diagnostics will indicate a Diagnostic Trouble Code 8 if the internal reference voltage of the A/D Convertor is not correct. This Diagnostic Trouble Code is not serviceable. If a Diagnostic Trouble Code 8 occurs, the computer control head must be replaced.

DIAGNOSTIC TROUBLE CODE 9—SUN LOAD SENSOR FAILURE

(1) Unplug the 21-way connector from the control and check pin #19 for continuity to chassis ground. If continuity is present, repair the wire shorted to ground. If no continuity is present, proceed to step 2.

(2) Plug the 21-way connector back in. Remove pin #19 from the 21 way connector and run diagnostics again. If Diagnostic Trouble Code 9 is still present, replace the control. If code 9 is not present, replace the sun sensor.

DIAGNOSTIC TROUBLE CODE 10—WATER TEMPERATURE SENSOR FAILURE

(1) Disconnect 21-way connector at control. Measure resistance between pin #17 and pin #7. This value will change with temperature. Refer to Temperature Reference—Diagnostic Trouble Code 10 chart.

TEMPERATURE REFERENCE—DIAGNOSTIC TROUBLE CODE 10

WATER TEMPERATURE (DEGREES FAHRENHEIT)	RESISTANCE (OHMS)
–20°	479358
0°	249910
20°	136049
40°	77260
50°	59173
60°	45703
70°	35583
80°	27915
90°	22057
100°	17548
110°	14052
120°	11322
130°	9178
140°	7487
150°	6145
160°	5073
170°	4211
180°	3514
190°	2947
200°	2483

9124-49

(2) Check for continuity between pin #17 and chassis ground. If continuity is present, repair and retest.

DIAGNOSTIC TROUBLE CODE 11—AMBIENT TEMPERATURE SENSOR FAILURE

(1) Disconnect 21-way connector at control. With an ohmmeter, measure the resistance between pin #9 and pin #7. Refer to the Temperature Reference—Diagnostic Trouble Code 11 chart.

TEMPERATURE REFERENCE—DIAGNOSTIC TROUBLE CODE 11

WATER TEMPERATURE (DEGREES FAHRENHEIT)	RESISTANCE (OHMS)
–20°	195000
–10°	142000
0°	99200
20°	52500
40°	38000
60°	12670
80°	9310
90°	7310
100°	5730
110°	4520
120°	3550

9124-50

(2) Check for continuity between pin #9 and chassis ground. If continuity is present, repair and retest.

DIAGNOSTIC TROUBLE CODE 12—IN-CAR TEMPERATURE SENSOR/ASPIRATOR FAILURE

(1) Disconnect 21-way connector at control. With an ohmmeter, measure the resistance between pin #20 and pin #7. Refer to Temperature Reference—Diagnostic Trouble Code 11 chart for electrical values.

(2) Check for continuity between pin #20 and chassis ground. If continuity is present, repair and retest.

DIAGNOSTIC TROUBLE CODE 13—BLEND DOOR FAILED TO DRIVE TO HEAT POSITION

(1) Check door and linkage for binding.

(2) Disconnect 21-way connector from control head and the 5-way connector from the blend air door actuator. Check continuity between pin #6 of the 21-way connector and pin #5 of the 5-way connector. If continuity is shown, go to step 3. If continuity is not shown, repair circuit for an open circuit and retest system.

(3) Plug in the 5-way connector and check for resistance between pins #4 and #6 of the 21-way connector. A resistance of 20-50 ohms should be present. If not, replace actuator. If correct, proceed to step 4.

(4) If steps 1 and 2 indicate no failures, replace the ATC control head.

DIAGNOSTIC TROUBLE CODE 14—BLEND DOOR FAILED TO DRIVE TO COLD POSITION

First check the 5-way connector to the blend air door actuator for proper connection

(1) Check door and linkage for binding.

(2) Remove the 21-way connector from the control. With ignition ON, check for ignition voltage between pin #8 of the 21-way connector and chassis ground. If voltage is present, repair circuit for short to ignition voltage. If voltage is not present, proceed to step 3.

(3) Turn ignition OFF. With the 21-way still removed, disconnect the 5-way connector from the blend air door actuator. Check for continuity between pin #8 of the 21-way connector and pin #1 of the 5-way connector. If continuity is not present, repair open circuit. If present, continue to step 4.

(4) Install the 5-way connector back into the blend air door actuator and check for continuity between the pins #7 and #8 of the 21-way connector. If continuity is present, replace the ATC control. If continuity is not present, replace the blend air door actuator.

DIAGNOSTIC TROUBLE CODE 15—BLEND DOOR FEEDBACK SHORTED TO GROUND

(1) Remove the 21-way connector from the control and the 5-way connector from the blend air door actuator.

(2) Check for continuity between pin #8 of the 21-way connector and chassis ground. If present, repair circuit for short to ground. If not present, continue to step 3.

(3) Plug in the 5-way connector and measure resistance between pins #7 and #8 of the 21-way connector. If the resistance is less than 10 ohms, replace the actuator. If not, replace the control head.

DIAGNOSTIC TROUBLE CODE 16—MODE DOOR MOVED DURING BLEND DOOR TEST

(1) Remove the 21-way connector from the control and the 5-way connector from the three actuators.

(2) Check for continuity between pin #4 of the 21-way connector and pin #4 of each actuator. If continuity is not present for a particular actuator circuit, repair that circuit and retest system. If continuity is present for all circuits, continue to step 3.

(3) Plug in the 5-way connectors and check for resistance between pins #4 and #6 of the 21-way connector for the blend air actuator. Then check pins #4 and #5 of the 21-way for the mode actuator. The resistance should be between 20-50 ohms. If either of the actuators do not pass the resistance tests, replace that particular actuator and retest the system. If both pass the resistance test, replace the ATC control.

DIAGNOSTIC TROUBLE CODE 17—MODE DOOR FAILED TO DRIVE TO DEFROST

(1) Disconnect 21-way connector from control head and the 5-way connector from the blend air door actuator. Check continuity between pin #5 of the 21-way connector and pin #5 of the 5-way connector. If continuity is present, proceed to step 2. If continuity is not present, repair open circuit and retest system.

(2) Plug in the 5-way connector and check for resistance between pins #4 and #5 of the 21-way connector. A resistance of 20-50 ohms should be present. If not, replace actuator. If correct, proceed to step 3.

(3) If steps 1 and 2 do not indicate any failures, replace the ATC control head.

DIAGNOSTIC TROUBLE CODE 18—MODE DOOR FAILED TO DRIVE TO PANEL

Check the 5-way connector to the mode door actuator for proper installation.

(1) Check the door and linkage for binding.

(2) Remove the 21-way connector from the control. With ignition ON, check for ignition voltage between pin #16 of the 21-way connector and chassis ground. If voltage is present, repair circuit for short to ignition voltage. If voltage is not present, proceed to step 3.

(3) Turn ignition OFF. With the 21-way connector still removed, disconnect the 5-way connector from the mode door actuator. Check for continuity between pin #16 of the 21-way connector, and pin #1

of the 5-way connector. If continuity is not present, repair circuit for an open. If present, continue to step 4.

(4) Install 5-way connector back into the mode door actuator. Then check for continuity between pins #7 and #16 of the 21-way connector. If continuity is present, replace the ATC control. If continuity is not present, replace the mode door actuator.

DIAGNOSTIC TROUBLE CODE 19—MODE DOOR FEEDBACK SHORTED TO GROUND

(1) Remove the 21-way connector from the control, and the 5 way connector from the mode door actuator.

(2) Check for continuity between pin #16 of the 21-way connector and chassis ground. If present, repair circuit for short to ground. If not present, continue to step 3.

(3) Plug in the 5-way connector and measure resistance between pins #7 and #16 of the 21-way connector. If the resistance is less than 10 ohms, replace the actuator. If not, replace the control head.

DIAGNOSTIC TROUBLE CODE 20—BLEND DOOR MOVED DURING MODE DOOR TEST

(1) Remove the 21-way connector from the control and the 5-way connector from the three actuators.

(2) Check for continuity between pin #4 of the 21-way connector and pin #4 of each actuator. If continuity is not present for a particular actuator circuit, repair that circuit and retest system. If continuity is present for all circuits, continue to step 3.

(3) Plug in the 5-way connectors and check for resistance between pins #4 and #6 of the 21-way connector for the blend air actuator. Then check pins #4 and #5 of the 21-way connector for the mode actuator. The resistance should be between 20-50 ohms. If either of the actuators do not pass the resistance tests, replace that particular actuator and retest the system. If both pass the resistance test, replace the ATC control.

DIAGNOSTIC TROUBLE CODE 21—ROM CHECK SUM ERROR

During the Diagnostics test, the computer will verify it's own internal program. If it finds any part to be bad, a Diagnostic Trouble Code 21 will be set. This Diagnostic Trouble Code is not serviceable. If a Fail Code 21 occurs, the ATC Control Module must be replaced.

DIAGNOSTIC TROUBLE CODE 22—COMPUTER ERROR

If incorrect data is found in the ATC Control computer module, a Diagnostic Trouble Code 22 will be set. This Fail Code is not serviceable. If a Diagnostic Trouble Code 22 occurs, the ATC Control Module must be replaced.

DIAGNOSTIC TROUBLE CODE 23—BLEND DOOR FEEDBACK FAILED

This Diagnostic Trouble Code is set during normal ATC operation. The Diagnostic Trouble Code will be set only after the ATC control has been operating for 15 minutes. The control will compensate for the feedback failure immediately upon power up, but the Diagnostic Trouble Code will not be set until the time limit has been met.

Diagnostic Trouble Code 23 will be stored within the ATC Control, and must be cleared after the failure has been repaired. To clear this Diagnostic Trouble Code, refer to Erasing Diagnostic Trouble Codes 23 through 28 from ATC Control.

Follow service procedures for Diagnostic Trouble Codes 14 and 15 when repairing.

DIAGNOSTIC TROUBLE CODE 24—MODE DOOR FEEDBACK FAILED

This Diagnostic Trouble Code is set during normal ATC operation. The Diagnostic Trouble Code will be set only after the ATC control has been operating for 15 minutes. The control will compensate for the feedback failure immediately upon power up, but the Diagnostic Trouble Code will not be set until the time limit has been met.

Diagnostic Trouble Code 24 will be stored within the ATC Control, and must be cleared after the failure has been repaired. To clear this Diagnostic Trouble Code, refer to Erasing Diagnostic Trouble Codes 23 through 28 From ATC Control.

Follow service procedures for Diagnostic Trouble Codes 18 and 19 when repairing.

DIAGNOSTIC TROUBLE CODE 25—AMBIENT TEMPERATURE SENSOR FAILURE

This Diagnostic Trouble Code is set during normal ATC operation. The Diagnostic Trouble Code will be set only after the ATC control has been operating for 15 minutes. The control will compensate for the feedback failure immediately upon power up, but the Diagnostic Trouble Code will not be set until the time limit has been met.

Diagnostic Trouble Code 25 will be stored within the ATC Control, and must be cleared after the failure has been repaired. To clear this Diagnostic Trouble Code, refer to Erasing Diagnostic Trouble Codes 23 through 28 from ATC Control.

Follow service procedures for Diagnostic Trouble Code 11 when repairing.

DIAGNOSTIC TROUBLE CODE 26—IN-CAR TEMPERATURE SENSOR/ASPIRATOR FAILED

This Diagnostic Trouble Code is set during normal ATC operation. The Diagnostic Trouble Code will be set only after the ATC control has been operating for 15 minutes. The control will compensate for the feedback failure immediately upon power up, but the Diagnostic Trouble Code will not be set until the time limit has been met.

Diagnostic Trouble Code 26 will be stored within the ATC Control, and must be cleared after the failure has been repaired. To clear this Diagnostic Trouble Code, refer to Erasing Diagnostic Trouble Codes 23 through 28 from ATC Control.

Follow service procedures for Diagnostic Trouble Code 12 when repairing.

DIAGNOSTIC TROUBLE CODE 27—SUN LOAD SENSOR FAILED

This Diagnostic Trouble Code is set during normal ATC operation. The Diagnostic Trouble Code will be set only after the ATC control has been operating for 15 minutes. The control will compensate for the feedback failure immediately upon power up, but the Diagnostic Trouble Code will not be set until the time limit has been met.

Diagnostic Trouble Code 27 will be stored within the ATC Control, and must be cleared after the failure has been repaired. To clear this Diagnostic Trouble Code, refer to Erasing Diagnostic Trouble Codes 23 through 28 from ATC Control.

Follow service procedures for Diagnostic Trouble Code 12 when repairing.

DIAGNOSTIC TROUBLE CODE 28—WATER TEMPERATURE SENSOR FAILED

This Diagnostic Trouble Code is set during normal ATC operation. The Diagnostic Trouble Code will be set only after the ATC control has been operating for 15 minutes. The control will compensate for the feedback failure immediately upon power up, but the Diagnostic Trouble Code will not be set until the time limit has been met.

Diagnostic Trouble Code 28 will be stored within the ATC Control and must be cleared after the failure has been repaired. To clear this Diagnostic Trouble Code, refer to Erasing Diagnostic Trouble Codes 23 through 28 from ATC Control.

Follow service procedures for Diagnostic Trouble Code 10 when repairing.

ERASING DIAGNOSTIC TROUBLE CODES

Diagnostic Trouble Codes 23 through 28 are stored within the ATC in the computer memory. These codes may be erased from the memory after the correct repairs have been made. Intermittent Diagnostic Trouble Codes 23 through 28 will be stored until they are erased.

(1) Run the DIAGNOSTIC TEST.

(2) Depress the PANEL button to access all Diagnostic Trouble Codes. When the Display begins flashing alternating zeros, you can do three things:

- Do nothing, and in five seconds control will return to normal ATC operation. All codes will remain stored in the control.
- Depress any button within five seconds, other than A/C, and stop the test immediately. Control will return to normal ATC operation.
- Depress the A/C button within five seconds, and proceed to the erasing procedure. By depressing the A/C button, you will not erase any Diagnostic Trouble Codes. You will only access the next part of the procedure. Proceed to step 3.

(3) After you depress the A/C button the display will alternate E's. This is for ERASE. You can now do two things:

- Do nothing, and in five seconds, all Diagnostic Trouble Codes from 23 through 28 will be erased from the ATC control.
- Depress any button within five seconds, and Diagnostic Trouble Codes will not be erased.

Control will return to normal ATC operation.

COMPONENT AND SYSTEM INDEX

Name — Group-page

CHRYSLER CORPORATION

ELECTRICAL—FUEL—EMISSION SYSTEMS SERVICE MANUAL

1993 FRONT WHEEL DRIVE PASSENGER VEHICLES

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

CHRYSLER
CORPORATION
SERVICE & PARTS DIVISION

NEXT PAGE ▶

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 components.

The Component and System Index of this manual identifies the correct group for the component or system to be serviced. 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.

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

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

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

NOTE: The acronyms, terminology and nomenclature used to identify emissions related components in this manual may have changed from prior publications. These new terms are in compliance with S.A.E. recommended practice J1930. This terminology standard (J1930) is required to comply with the 1993 California Air Research Board (CARB) requirements.

FOR INFORMATION NOT CONTAINED IN THIS MANUAL, REFER TO FRONT WHEEL DRIVE PASSENGER VEHICLES ENGINE—CHASSIS—BODY OR WIRING DIAGRAMS SERVICE MANUALS.

NEXT PAGE ▶

GROUP TAB LOCATOR

BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS

CONTENTS

GENERAL INFORMATION

- For Battery, Starter or Generator replacement refer to Group 8B, Battery/Starter/Generator Service. This Group 8A will cover diagnostics only.

The Battery, Starting, and Charging Systems operate with one another, and must be thoroughly tested as a complete system. To enable the vehicle to start and charge properly, it must have a battery that will perform to specifications. The starter motor, generator, wiring, and electronics also must perform within specifications. Group 8A will cover Starting (Fig. 1) and Charging System (Fig. 2) diagnostic procedures. These will be covered from the most basic conventional methods to On Board Diagnostics (OBD) built into the vehicle's electronics. The need for conventional testing equipment has not been eliminated by the introduction of OBD. Frequent use of an ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12 volt (low wattage) test light will be required.

All front wheel drive vehicles are equipped with OBD and all OBD sensing systems are monitored by the Powertrain Control Module. The Powertrain Control module will store in electronic memory, any detectable failure within the monitored circuits. It will retain this information for a period of 50 engine starts, then erase the memory if the failure does not reoccur during that period. This also will translate a monitored failure as a FAULT CODE when a readout command is given. A readout command can be made by turning the ignition switch to ON-OFF-ON-OFF-ON without starting the engine. The Malfunction Indicator (CHECK ENGINE) Lamp on the instrument cluster will flash in preset sequences to show Fault Codes. However, the Malfunction Indicator (Check Engine) Lamp cannot express fault codes for all failures. Fault codes are easier to obtain and more complete with the use of Diagnostic Tool (DRB II). This tool is plugged into the diagnostic connector located in the engine compartment (Fig. 2). Refer to the instructions provided with the (DRB II) tool being used.

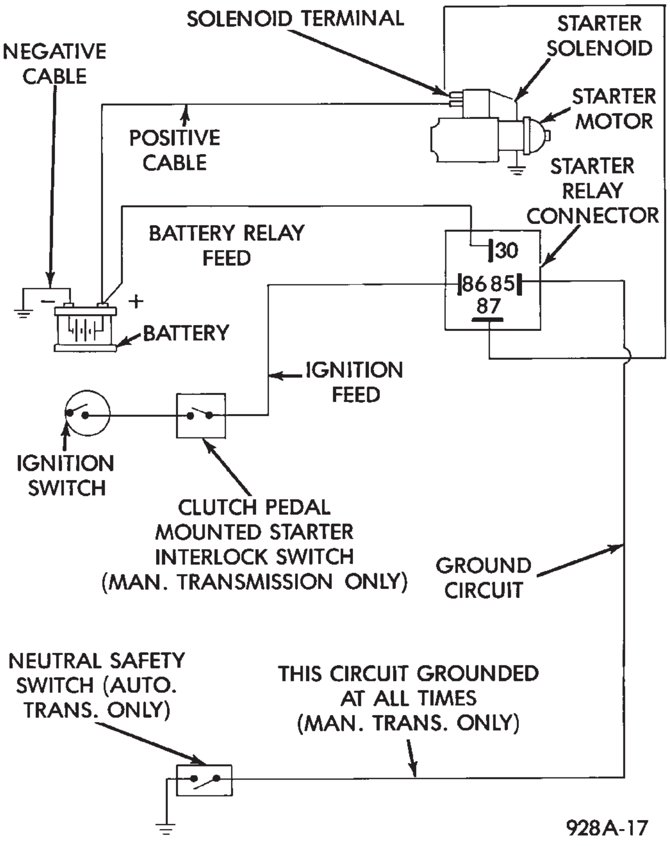


Fig. 1 Starting System Components

For numbered Fault Codes pertaining to components within this Group, refer to Failure Codes—On Board Diagnostics in Group 8A. For other Fault Codes which, do not pertaining to this Group 8A, refer to Group 14, Fuel System, On Board Diagnostics.

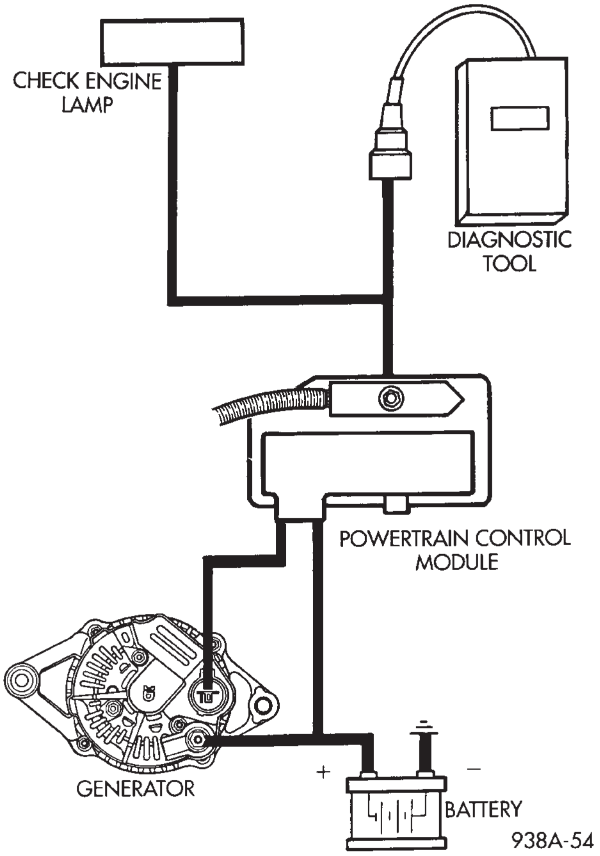


Fig. 2 Charging System Components

BATTERY TEST PROCEDURES ON-VEHICLE

INDEX

GENERAL INFORMATION

The battery stores, stabilizes, and produces electrical current to operate various electrical systems in the vehicle. The determination of whether a battery is good or bad is made by the battery's ability to accept a charge. It also must produce high amperage current output over an extended 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 amount of acid, specific gravity in the electrolyte can be measured with a hydrometer. The factory installed battery is equipped with a built in hydrometer as a test indicator (Figs. 3, 4 and 5) to help in determining the battery's state of charge. The factory installed battery also is sealed. Water cannot and should not be added.

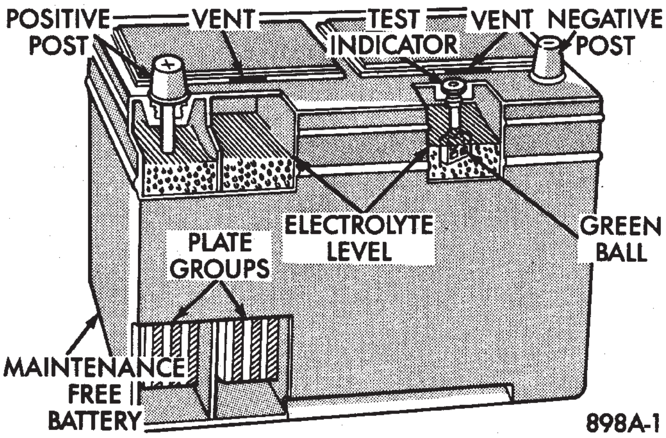


Fig. 3 Battery Construction and Test Indicator

The battery is vented to release gases that is 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 (Fig. 3).

WARNING: DO NOT ASSIST BOOST, CHARGE, ADD WATER, OR LOAD TEST BATTERY WHEN ELECTROLYTE LEVEL IS BELOW THE TOP OF THE PLATES. PERSONAL INJURY MAY OCCUR.

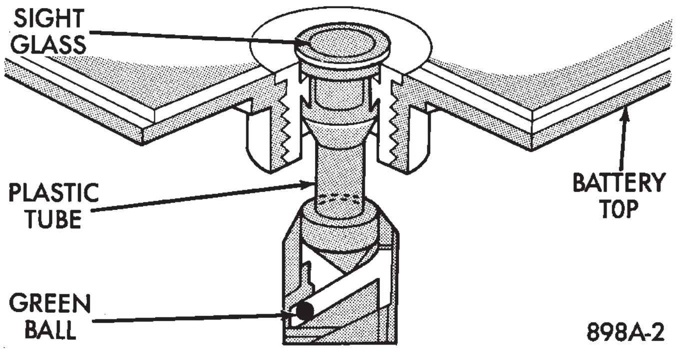


Fig. 4 Built in Test Indicator

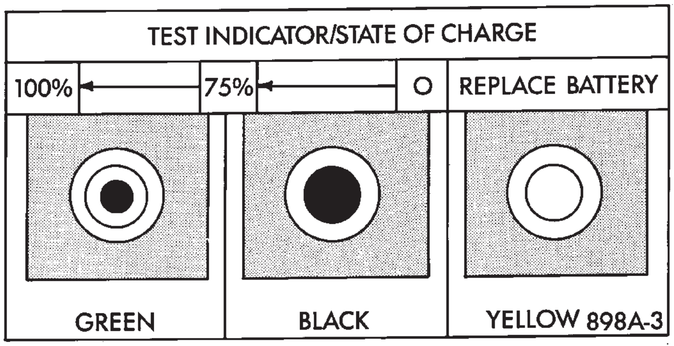


Fig. 5 Test Indicator Sight Glass

When the electrolyte level is below the top of the plates a yellow or bright color indicator in sight glass (Figs. 4 and 5), the battery must be replaced. Refer to Test Indicator. The battery must be completely charged with a green color in sight glass. The top, posts, and terminals should be properly cleaned before diagnostic procedures are performed. Also refer to Group 8B, Battery/Starter/Generator Service.

TEST INDICATOR

The test indicator a hydrometer is viewed through a sight glass, it is built into the top of battery case (Figs. 3, 4 and 5). This provides visual information for battery testing. The test indicator sight glass is to be used with diagnostic procedures described in this Group.

It is important when using the Test Indicator that the battery be level and have a clean top to see the correct indications. A light may be required to view the Indicator.

WARNING: DO NOT USE OPEN FLAME NEAR BATTERY BECAUSE OF EXPLOSIVE GASES AT FORM ABOVE BATTERY.

STATE OF CHARGE TESTS

USING TEST INDICATOR

The built in test hydrometer (Figs. 3, 4 and 5) 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. Look into the sight glass (Figs. 4 and 5) and note the color of the indicator (Fig. 5). Refer to the following description of colors:

- GREEN = 75 to 100 degree state of charge

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.

- BLACK OR DARK = 0 to 75 degree 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 use. Refer to Causes of Battery Discharging.

- YELLOW OR BRIGHT COLOR = Battery must be replace

WARNING: DO NOT CHARGE, ASSIST BOOST, LOAD TEST, OR ADD WATER TO THE BATTERY WHEN YELLOW OR BRIGHT COLOR DOT IS VISIBLE. PERSONAL INJURY MAY OCCUR.

A yellow or bright color dot shows electrolyte level in battery is below the test indicator (Fig. 5). 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 30 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 approximately 20 days the Main Fusible Link Connector (Fig. 6) should be disconnected. This is located near the battery on the engine wiring harness. Disconnection of this connector will help prevent battery discharging. Refer to Fig. 7 for Battery Diagnostics.

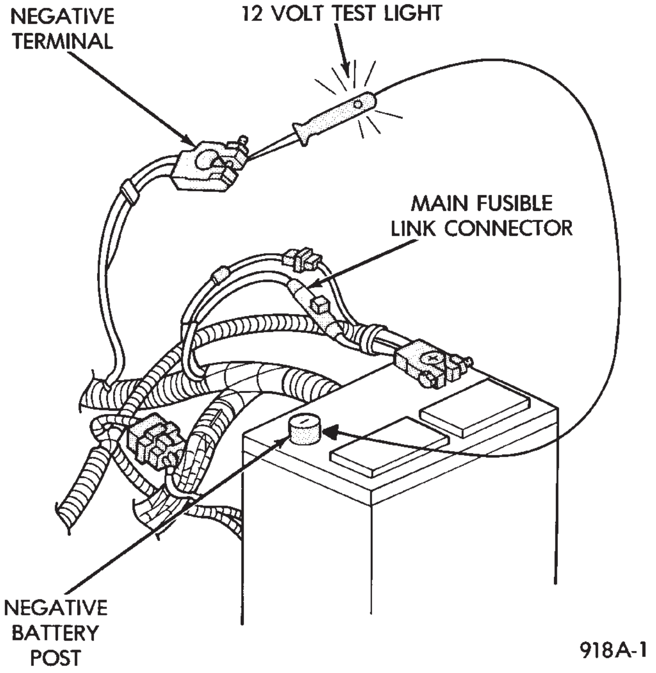


Fig. 6 Main Fusible Link Connector

ABNORMAL BATTERY DISCHARGING

(1) Corroded battery posts, cables or terminals.

(2) Loose or worn generator drive belt.

(3) Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.

(4) Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.

(5) Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Ignition OFF Draw (IOD).

(6) Defective charging system.

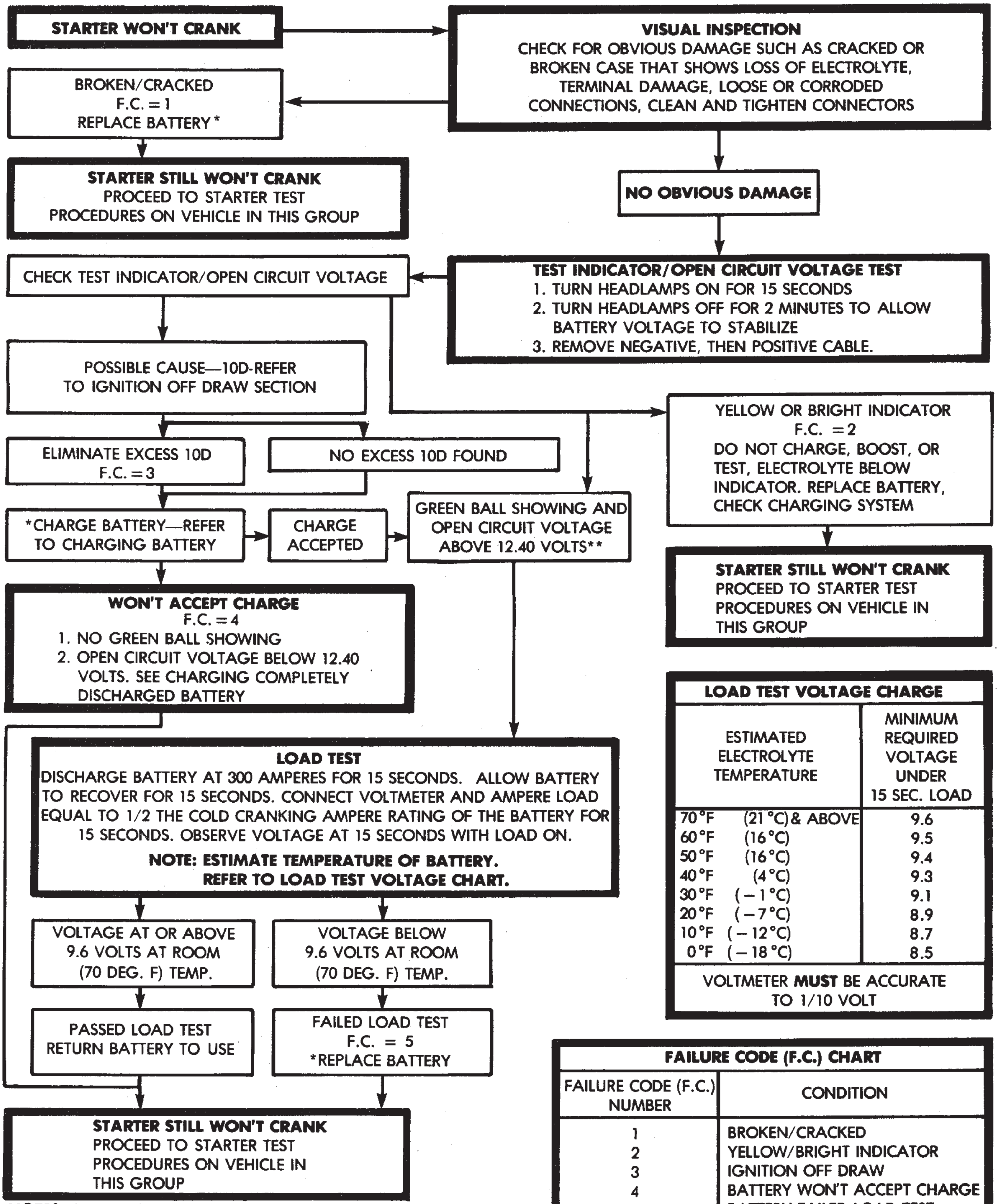
(7) Defective battery.

BATTERY OPEN CIRCUIT VOLTAGE TEST

An open circuit voltage, no load test will show the state of charge in a battery. Also, if it will pass a load test of 50 percent of the battery cold crank rating. Refer to Battery Load Test. If a battery has an open circuit voltage reading of 12.4 volts or greater, and will not pass a load test, it is defective and replacement would be required. To test open circuit voltage, perform the following operation:

(1) Remove both battery cables, negative first. If the battery has been boosted, charged, or loaded just prior to this operation, allow the battery a few minutes to stabilize.

(2) Using a voltmeter connected to the battery posts and measure the open circuit voltage (Fig. 8).



LOAD TEST VOLTAGE CHARGE

ESTIMATED ELECTROLYTE TEMPERATURE		MINIMUM REQUIRED VOLTAGE UNDER 15 SEC. LOAD
70°F	(21°C)& ABOVE	9.6
60°F	(16°C)	9.5
50°F	(16°C)	9.4
40°F	(4°C)	9.3
30°F	(−1°C)	9.1
20°F	(−7°C)	8.9
10°F	(−12°C)	8.7
0°F	(−18°C)	8.5

VOLTMETER **MUST** BE ACCURATE TO 1/10 VOLT

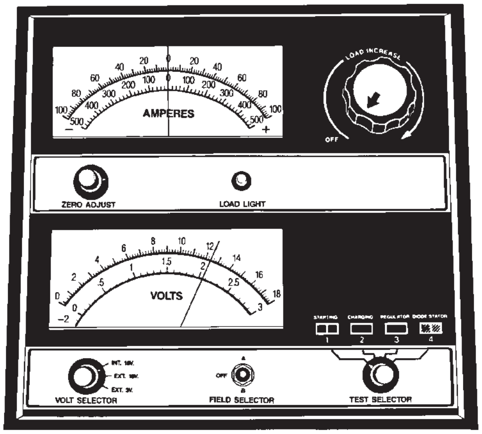
FAILURE CODE (F.C.) CHART

FAILURE CODE (F.C.) NUMBER	CONDITION
1	BROKEN/CRACKED
2	YELLOW/BRIGHT INDICATOR
3	IGNITION OFF DRAW
4	BATTERY WON'T ACCEPT CHARGE
5	BATTERY FAILED LOAD TEST

NOTES: *AFTER CHARGING OR REPLACING A BATTERY, CHECK THE VEHICLE'S CHARGING SYSTEM, AND CLEAN AND TIGHTEN BATTERY CONNECTORS (REFER TO APPLICABLE SECTIONS OF THIS SERVICE MANUAL).

****CHECKING OPEN CIRCUIT VOLTAGE WILL MONITOR "GREEN BALL" INDICATION FOR ALL 6 CELLS**

Fig. 7 Battery Diagnostics



898A-7

Fig. 8 Testing Open Circuit Voltage

This voltage reading will show the battery state of charge. It will not reveal battery cranking capacity (Fig. 8).

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. 9 Battery Open Circuit Voltage

BATTERY LOAD TEST

A fully charged battery must have reserve cranking capacity. This will enable 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 performance based on the cold crank rating of the battery.

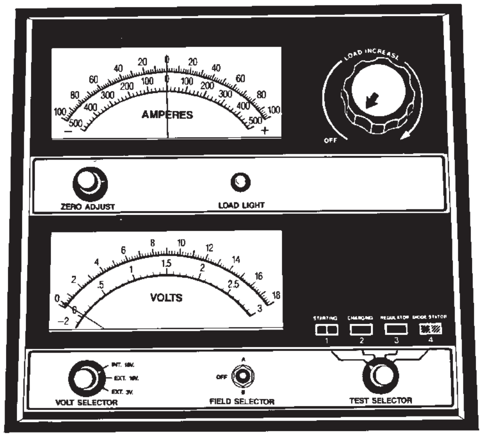
WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.

(1) Remove both battery cables, negative 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) Use a suitable Volt Ammeter Load tester (Fig. 10) connected to the battery posts (Fig. 11). Check the open circuit voltage of the battery.

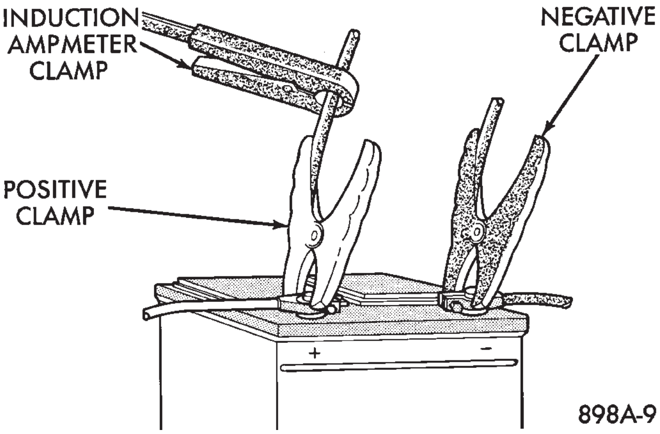
Voltage should be equal to or greater than 12.4 volts with the green dot visible in test indicator.

(3) Rotate the load control knob 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. 12).



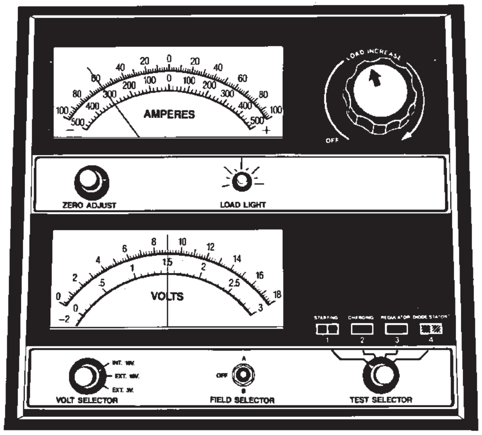
898A-8

Fig. 10 Volt-Ammeter-Load Tester



898A-9

Fig. 11 Volt-Ammeter-Load Tester Connections



898A-10

Fig. 12 Remove Surface Charge from Battery

(4) Allow the battery to stabilize for 15 seconds, and then verify open circuit voltage.

(5) Rotate the load control knob on the tester to maintain 50 percent of the battery cold crank rating for a minimum 15 seconds (Fig. 13).

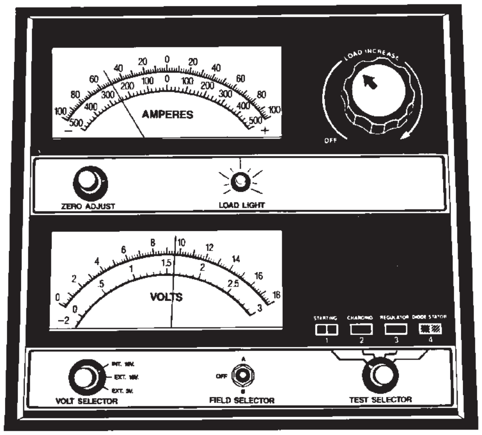


Fig. 13 Load 50 Percent Cold Crank Rating

After 15 seconds, record the loaded voltage reading and return the load control to the off position.

(6) 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, boosted, or loaded a few minutes prior to the test, the battery would be slightly warmer. Refer to Fig. 14 for proper loaded voltage reading.

Minimum Voltage	Temperature
	C°
9.6	21 and above
9.5	16
9.4	10
9.3	4
9.1	−1
8.9	−7
8.7	−12
8.5	−18

918A-4

Fig. 14 Load Test Temperature

(7) 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 CHARGING

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. 9)
- It passes the 15 second load test (Fig. 14)
- The built in test indicator dot is GREEN (Fig. 5)
- The battery cannot be refilled with water. It must be replaced

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 AND THE BATTERY 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. 15) 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

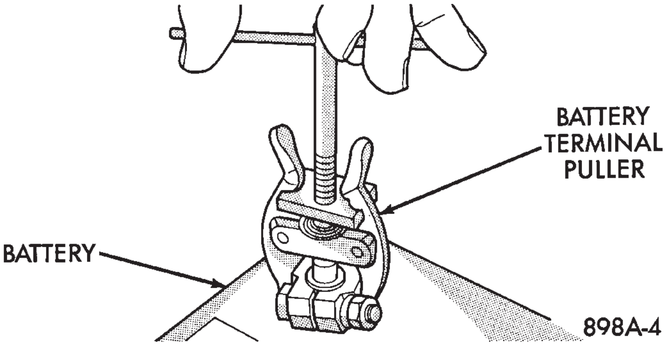


Fig. 15 Disconnect Negative Battery Cable

Battery electrolyte will bubble inside the 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.

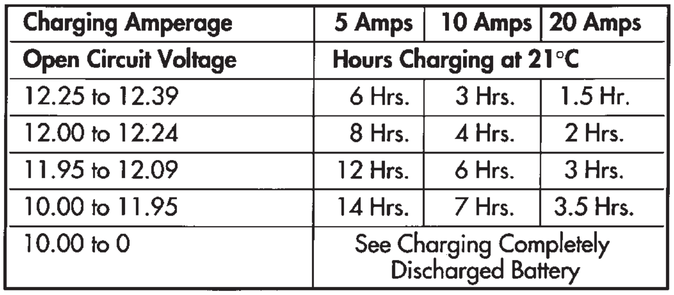
After the battery has been charged to 12.4 volts or greater, perform a load test to decide cranking capacity. Refer to Battery Load Test. If the battery will endure a load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service. Also refer to Group 8B, Battery/Starter/Generator Service.

CHARGING TIME REQUIRED

The time required to charge a battery will vary depending upon the following factors:

- SIZE OF BATTERY

A completely discharged large heavy-duty battery requires more than twice the recharging time as a completely discharged small capacity battery (Fig. 16).



Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging at 21°C		
12.25 to 12.39	6 Hrs.	3 Hrs.	1.5 Hr.
12.00 to 12.24	8 Hrs.	4 Hrs.	2 Hrs.
11.95 to 12.09	12 Hrs.	6 Hrs.	3 Hrs.
10.00 to 11.95	14 Hrs.	7 Hrs.	3.5 Hrs.
10.00 to 0	See Charging Completely Discharged Battery		

928A-19

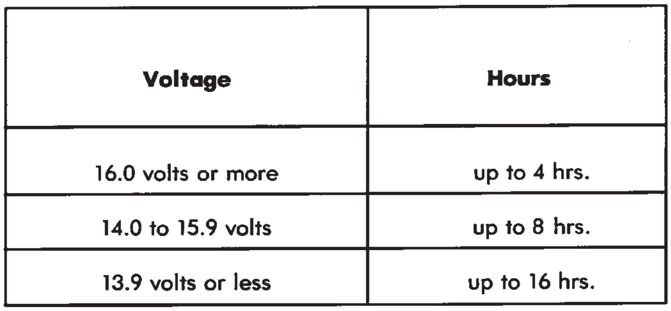
Fig. 16 Battery Charging Time

- 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 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 30 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 to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise, bringing the green dot (Fig. 5) into view.

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD -1°C (30°F) BATTERY. PERSONAL INJURY MAY RESULT.

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. 17).

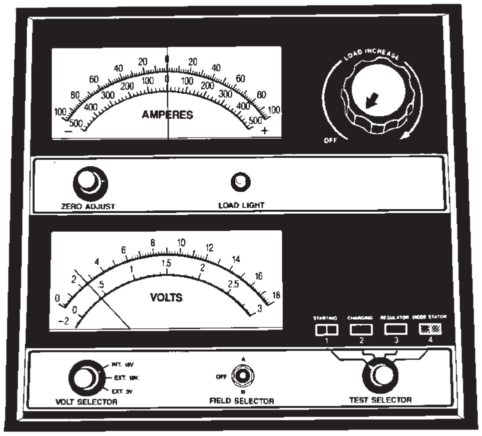


Voltage	Hours
16.0 volts or more	up to 4 hrs.
14.0 to 15.9 volts	up to 8 hrs.
13.9 volts or less	up to 16 hrs.

918A-6

Fig. 17 Charge Rate

(1) Measure the voltage at battery posts with a voltmeter accurate to 1/10 volt (Fig. 18). 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.



898A-12

Fig. 18 Voltmeter Accurate to 1/10 Volt (Connected)

(2) Connect charger leads. Some chargers feature polarity protection circuitry which, 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 if 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. 17. If charge current is still not measurable after charging period 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.

IGNITION OFF DRAW (IOD)

GENERAL INFORMATION

A normal electrical system will draw from 5 to 30 milliamperes from the battery. This is with the ignition in the OFF position, and all non-ignition controlled circuits in proper working order. The amount of IOD will depend on body model and electrical components. A vehicle that has not been operated for an extended period of approximately 20 days may discharge the battery to an inadequate level. In this case, the Main Fusible Link Connector should be disconnected. The Main Fusible Link connector is located rearward of the battery on the engine wiring harness (Fig. 19).

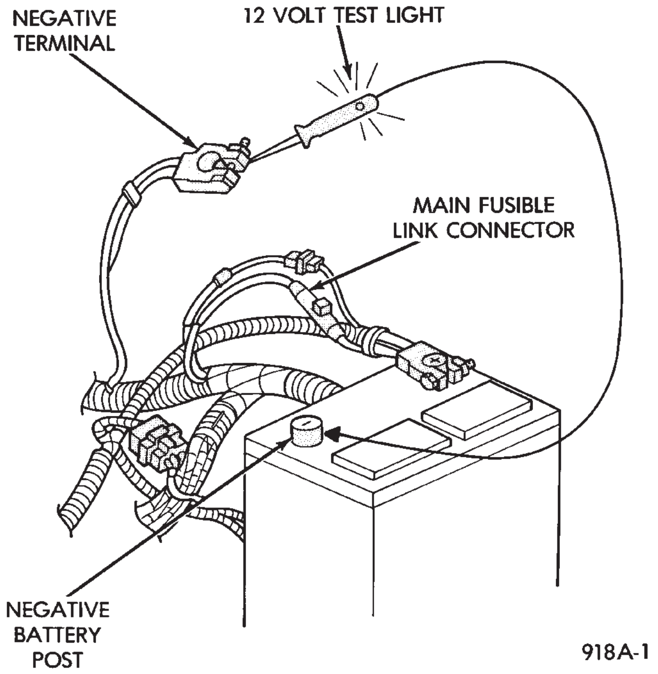


Fig. 19 IOD Test

If the IOD is over 30 milliamperes, the defect must be found and corrected before condemning the battery. Usually, the battery can be charged and returned to service (Fig. 16).

IGNITION OFF DRAW (IOD) TESTS

VEHICLES WITHOUT ELECTRONIC AUTOMATIC TRANSMISSION/LOAD LEVELING SUSPENSION OR ALARM SYSTEMS

Testing for HIGHER AMPERAGE IOD must be performed first to prevent damage to most milliamp meters.

A standard 12 volt test light and a milliamp meter that is equipped with two leads will be used for the following tests. The milliamp meter should be able to handle up to two amps.

(1) Verify that all electrical accessories are OFF. Turn off all lights, close trunk lid, close glove box door, turn off sun visor vanity lights, close all doors and remove ignition key. Allow the Illuminated Entry System if equipped to time out in approximately 30 seconds.

(2) Verify the engine compartment lamp bulb is working by opening/closing hood. Remove the lamp.

(3) Disconnect negative battery cable (Fig. 15).

(4) Connect a typical 12 volt test light between the negative cable clamp and the negative battery post (Fig. 19). The test light may be brightly lit for up to three minutes or may not be lit at all. This depending on the body model or electronic components on the vehicle.

(a) The term brightly used throughout the following tests. This implies the brightness of the test light will be the same as if it were connected across the battery posts. This would be with a fully charged battery.

(b) The test light or the milliamp meter MUST be positively connected to the battery post and the battery cable during all IOD testing.

(c) Do not allow the test light or the milliamp meter to become disconnected during any of the IOD tests. If this happens, the electronic timer functions will be started and all IOD tests must be repeated from the beginning. Clamp the test light at both ends to prevent accidental disconnection.

(d) After three minutes time has elapsed, the test light should turn OFF or be dimly lit depending on the electronic components on the vehicle. If the test light remains BRIGHTLY lit, do not disconnect test light. Disconnect each fuse or circuit breaker until test light is either OFF or DIMLY lit. Refer to the Front Wheel Drive Car Wiring Diagrams Service Manual. This will eliminate higher amperage IOD. It is now safe to install the milliamp meter without damage to the meter to check for low amperage IOD.

(e) Possible sources of high IOD are usually vehicle lamps trunk lamp, glove compartment, luggage compartment, etc..

(f) If test light is still brightly lit after disconnecting each fuse and circuit breaker, disconnect the wiring harness from the generator. Refer to Generator Testing. Do not disconnect test light.

CAUTION: This last test has higher amperage IOD and must be performed before going on with low amperage IOD tests. The higher amperage IOD must be eliminated before hooking up milliamp meter to check for low amperage IOD. If higher amperage IOD has not been eliminated, milliamp meter may be damaged. Most milliamp meters will not handle over one or two amps. Do not hook up meter if test light is glowing brightly. Refer to maximum amperage specifications and instructions supplied with milliamp meter.

After higher amperage IOD has been corrected, low amperage IOD may be checked. The MAXIMUM IOD= 30 MILLIAMPERES.

(5) With test light still connected, connect milliamp meter between battery negative post and negative battery cable (Fig. 20). Do not open any doors or turn on any electrical accessories with the test light disconnected and the milliamp meter connected. Meter may be damaged.

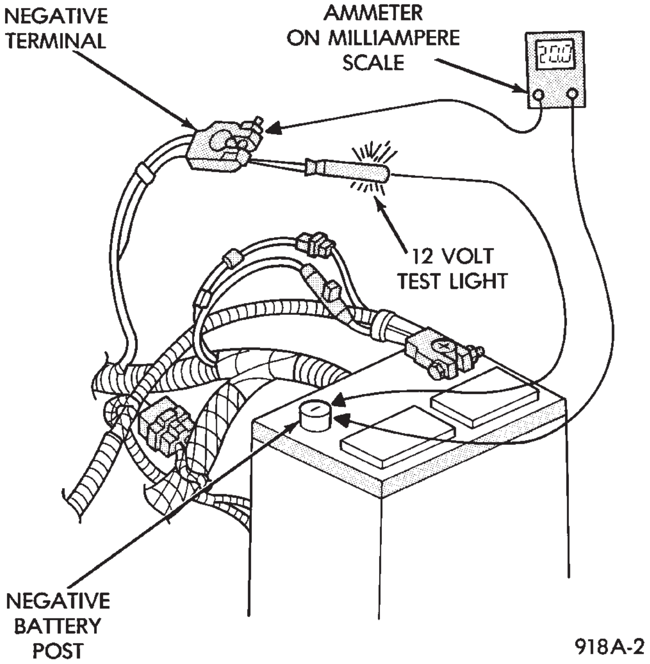


Fig. 20 Low Amperage IOD Test

(6) Disconnect test light. Milliamp meter reading should be less than 30 milliamperes. If low amperage IOD is not within specifications, disconnect:

(a) The 60 way connector at the Powertrain Control Module located outboard of the battery. Refer to Group 8D, Ignition for more information.

(b) The 25 way connectors on the Body Controller if equipped.

(c) The circuits to the clock and radio.

(d) The wiring harness from the generator. Refer to Generator Testing.

Check each component until excessive IOD is found.

Each time the test light or milliamp meter is disconnected and connected, all electronic timer functions will be activated. Tests must be repeated from the beginning.

Test light or meter MUST remain connected for all tests.

VEHICLES EQUIPPED WITH ELECTRONIC AUTOMATIC TRANSMISSION, LOAD LEVELING SUSPENSION, OR ALARM SYSTEM

This vehicles will have temporary high IOD of 15 amps or more for up to 65 minutes. This higher IOD can often mask another problem and should be considered when performing IOD testing.

Testing for higher IOD will be the same as in the previous IOD tests. However, certain additional procedures should be followed.

- WITH ALARM SYSTEM: After disconnecting battery and hooking up test light, cycle the key lock on the driver's door to disarm the alarm. The parking lamps should stop flashing.

Also locate the Power Distribution Center. This Center is located in front of the left front strut tower (Fig. 21). Remove the cover from the Center and remove the 50 amp fuse.

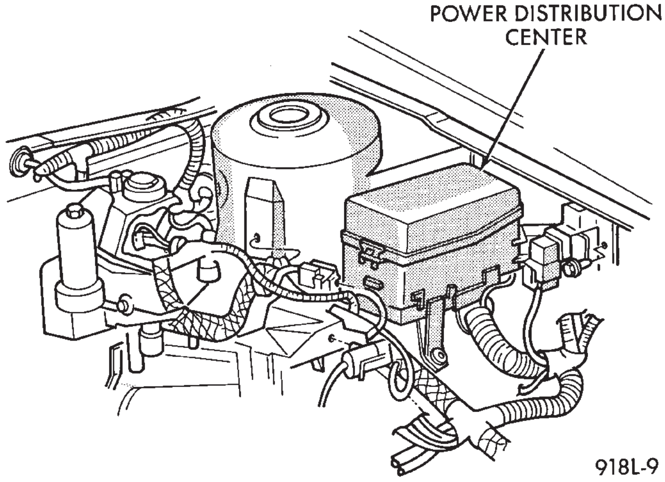


Fig. 21 Power Distribution Center

- WITH ELECTRONIC AUTOMATIC TRANSMISSION: If equipped with this option, and high or low IOD is suspected, allow an additional 25 minutes minimum of electronic shut off time.

To defeat the timer, disconnect the 60-way connector on the Transmission Controller. This controller is located on the right inner fender.

- WITH AUTOMATIC LOAD LEVELING SYSTEM: If equipped with this option, and high or low IOD is suspected, allow an additional 65 minutes minimum of electronic shut off time.

To defeat the timer, open the trunk lid, locate the Automatic Load Leveling computer, located inside right rear wheel house, and disconnect the 11-way connector. Close the trunk lid.

If equipped with an electrical trunk closing feature, temporarily install a heavy gauge jumper wire between the disconnected negative cable and the negative battery post. When this jumper is installed the trunk lid should automatically close. Do not disconnect the test light as all electronic timing features will be activated and all IOD tests must be repeated from the beginning.

Remove the temporarily installed jumper wire.

STARTER TEST PROCEDURES ON VEHICLE

INDEX

GENERAL INFORMATION

The starting system (Fig. 1) has:

- Ignition switch
- Starter relay (Fig. 2)
- Neutral starting and back-up switch with automatic transmissions
- Clutch pedal mounted starter interlock switch with manual transmissions
- Wiring harness
- Battery
- Starter motor with an integral solenoid

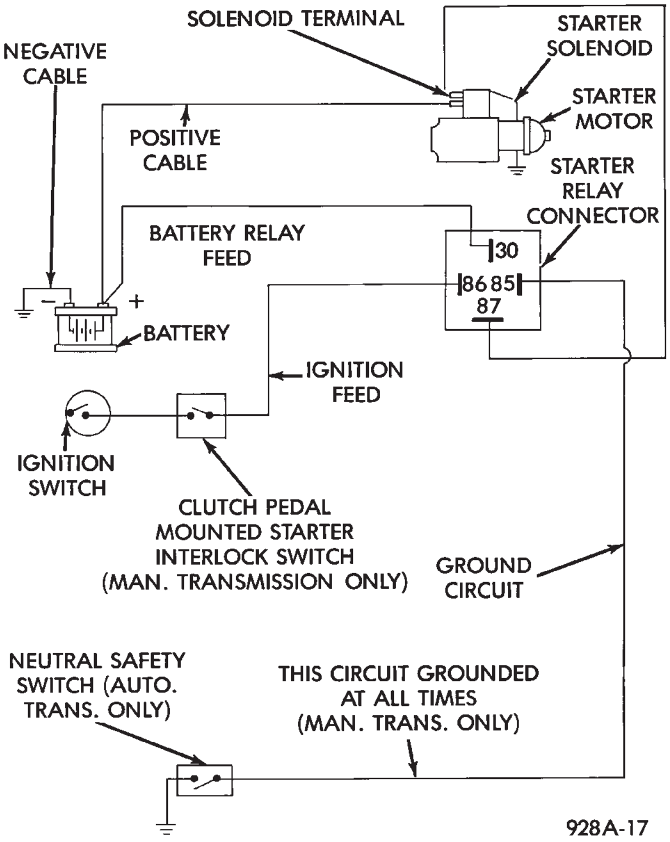


Fig. 1 Starting Components/Wiring

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.

DIAGNOSTIC PREPARATION

Before going on with starting system diagnostics, verify:

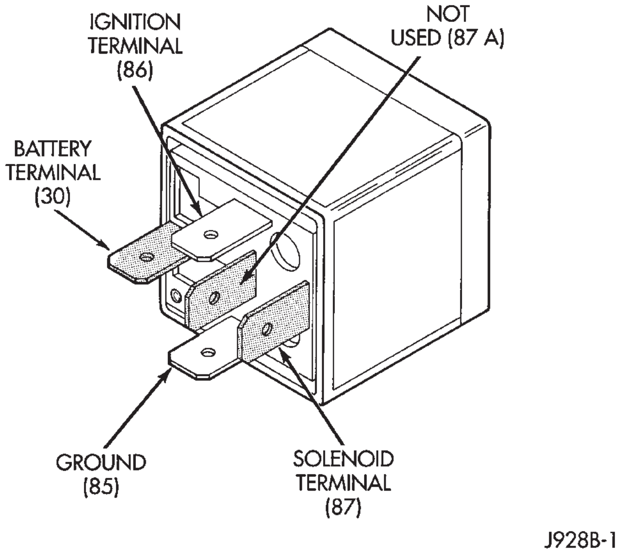


Fig. 2 Starter Relay

(1) The battery top, posts, and terminals are clean.

(2) The generator drive belt tension and condition is correct.

(3) The battery state-of-charge is correct.

(4) The battery will pass load test.

(5) The battery cable connections at the starter and engine block are clean and free from corrosion.

(6) The wiring harness connectors and terminals are clean and free from corrosion.

(7) Proper circuit grounding.

(8) Refer to Starter System Diagnostics (Fig. 3).

STARTER FEED CIRCUIT TESTS

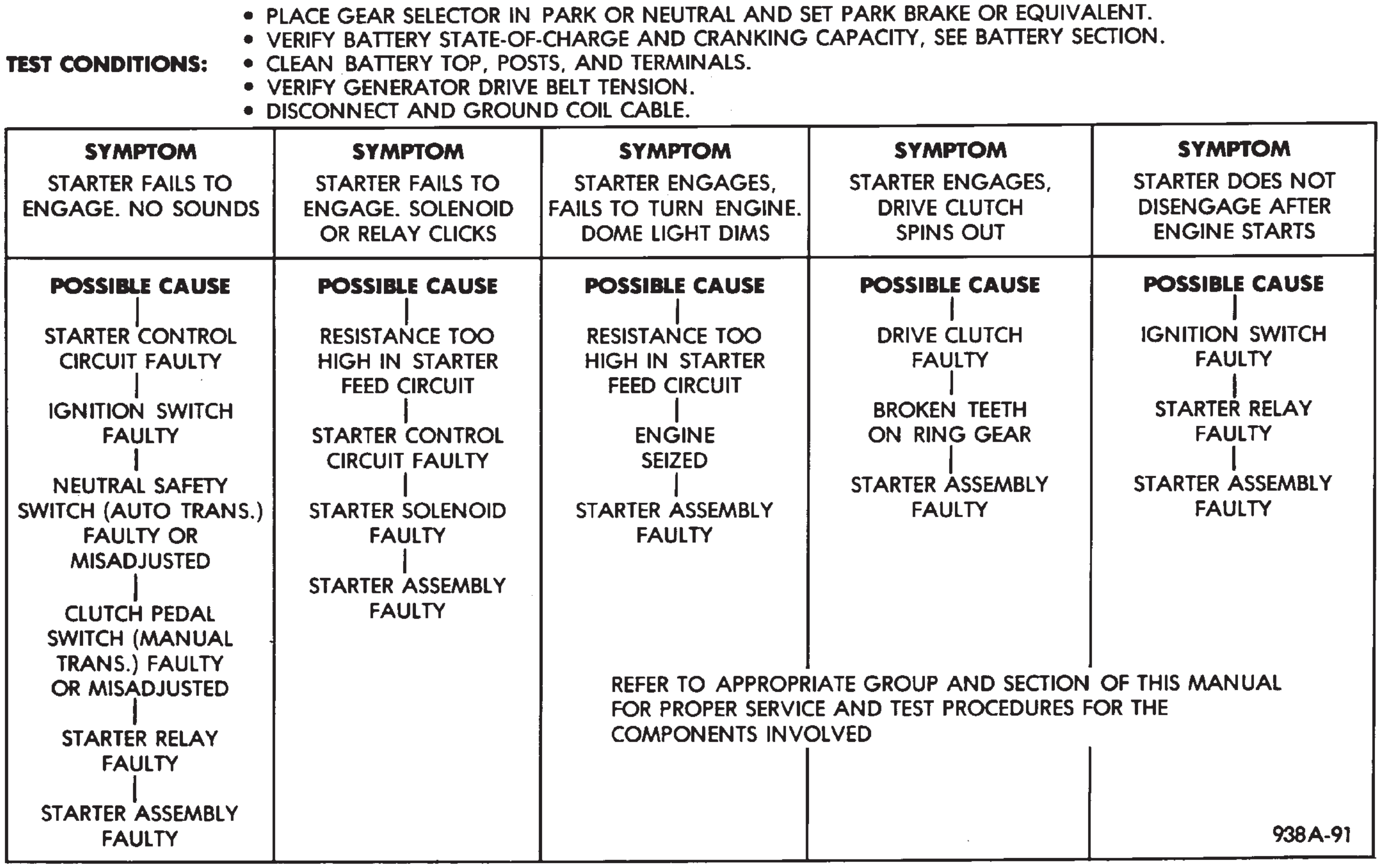
The following procedure will require a suitable volt/ampere tester (Fig. 4).

CAUTION: Ignition system also must be disabled to prevent engine start while performing the following tests.

(1) Connect a volt-ampere tester (Fig. 4) to the battery terminals (Fig. 5). Refer to the operating instructions provided with the tester being used.

(2) Disable ignition system as follows:

- VEHICLES WITH CONVENTIONAL DISTRIBUTORS: Disconnect the ignition coil cable from the distributor cap. Connect a suitable jumper wire between the coil cable end-terminal and a good body ground (Fig. 6).



TEST CONDITIONS:

- PLACE GEAR SELECTOR IN PARK OR NEUTRAL AND SET PARK BRAKE OR EQUIVALENT.
- VERIFY BATTERY STATE-OF-CHARGE AND CRANKING CAPACITY, SEE BATTERY SECTION.
- CLEAN BATTERY TOP, POSTS, AND TERMINALS.
- VERIFY GENERATOR DRIVE BELT TENSION.
- DISCONNECT AND GROUND COIL CABLE.

SYMPTOM STARTER FAILS TO ENGAGE. NO SOUNDS	**SYMPTOM** STARTER FAILS TO ENGAGE. SOLENOID OR RELAY CLICKS	**SYMPTOM** STARTER ENGAGES, FAILS TO TURN ENGINE. DOME LIGHT DIMS	**SYMPTOM** STARTER ENGAGES, DRIVE CLUTCH SPINS OUT	**SYMPTOM** STARTER DOES NOT DISENGAGE AFTER ENGINE STARTS
POSSIBLE CAUSE	**POSSIBLE CAUSE**	**POSSIBLE CAUSE**	**POSSIBLE CAUSE**	**POSSIBLE CAUSE**
STARTER CONTROL CIRCUIT FAULTY IGNITION SWITCH FAULTY NEUTRAL SAFETY SWITCH (AUTO TRANS.) FAULTY OR MISADJUSTED CLUTCH PEDAL SWITCH (MANUAL TRANS.) FAULTY OR MISADJUSTED STARTER RELAY FAULTY STARTER ASSEMBLY FAULTY	RESISTANCE TOO HIGH IN STARTER FEED CIRCUIT STARTER CONTROL CIRCUIT FAULTY STARTER SOLENOID FAULTY STARTER ASSEMBLY FAULTY	RESISTANCE TOO HIGH IN STARTER FEED CIRCUIT ENGINE SEIZED STARTER ASSEMBLY FAULTY	DRIVE CLUTCH FAULTY BROKEN TEETH ON RING GEAR STARTER ASSEMBLY FAULTY	IGNITION SWITCH FAULTY STARTER RELAY FAULTY STARTER ASSEMBLY FAULTY

REFER TO APPROPRIATE GROUP AND SECTION OF THIS MANUAL FOR PROPER SERVICE AND TEST PROCEDURES FOR THE COMPONENTS INVOLVED

938A-91

Fig. 3 Starter System Diagnostics

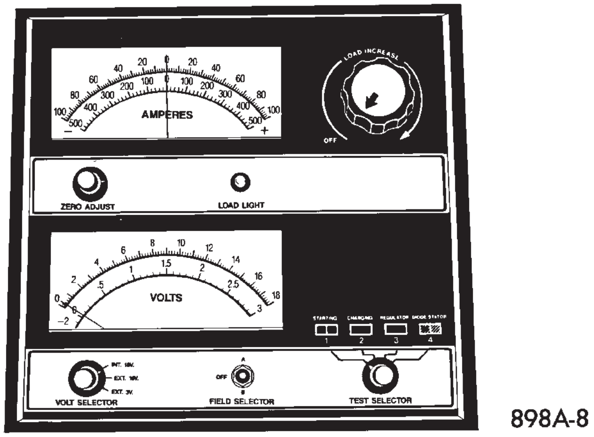


Fig. 4 Volt Ampere Tester

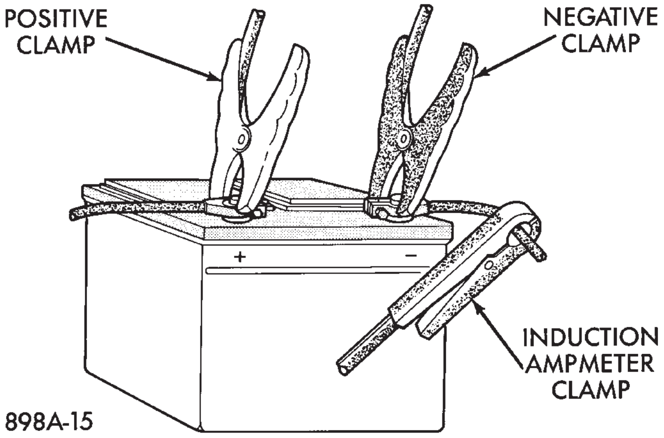


Fig. 5 Volt-Ampere Tester Connections

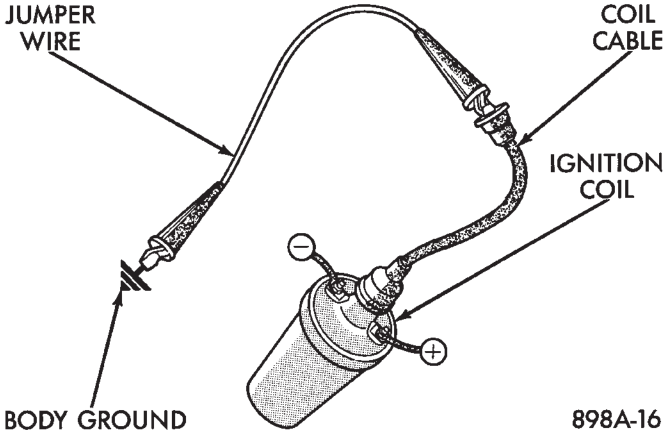


Fig. 6 Ground Ignition Coil Cable

- VEHICLES WITH DIRECT IGNITION SYSTEM: Disconnect the ignition coils electrical connector (Fig. 7).

(3) Verify that all lights and accessories are OFF, and the transmission shift selector is in PARK or manual in NEUTRAL. Set parking brake.

(4) Rotate and hold the ignition switch in the START position. Observe the volt-ampere tester (Fig. 8).

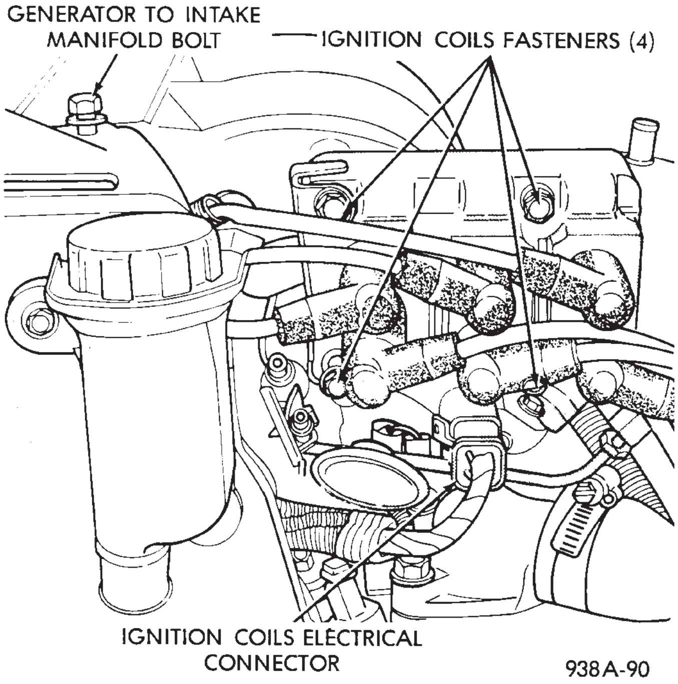


Fig. 7 Ignition Coils Electrical Connection

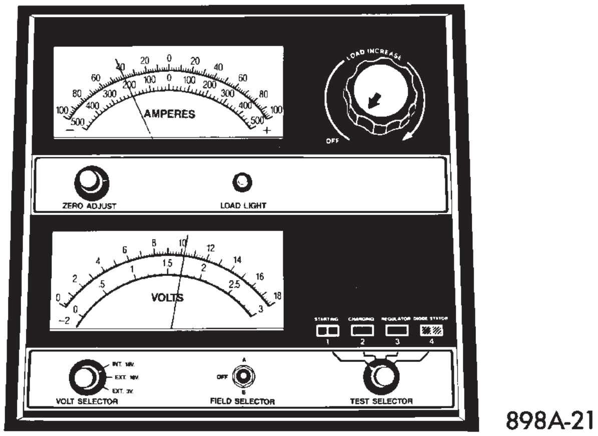


Fig. 8 Starter Draw Tests

- If voltage reads above 9.6 volts, and amperage draw reads above 250 amps, go to the starter feed circuit resistance test.
- If voltage reads 12.4 volts or greater and amperage reads 0 to 10 amps, go to starter control circuit test.

CAUTION: Do not overheat the starter motor or draw the battery voltage below 9.6 volts during cranking operations.

(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 ignition coil cable or ignition coil connector. Start the vehicle several times to assure the problem was corrected.

STARTER FEED CIRCUIT RESISTANCE TEST

Before going on 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: Ignition system also must be disabled to prevent engine start while performing the following tests.

(1) Disable ignition system as follows:

- VEHICLES WITH CONVENTIONAL DISTRIBUTORS: Disconnect the ignition coil cable from the distributor cap. Connect a suitable jumper wire between the coil cable end-terminal and a good body ground (Fig. 6).
- VEHICLES WITH DIRECT IGNITION SYSTEM: Disconnect the ignition coils electrical connector (Fig. 7).

(2) With all wiring harnesses and components properly connected, perform the following:

(a) Connect the negative lead of the voltmeter to the negative battery post, and positive lead to the negative battery cable clamp (Fig. 9). 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 positive battery post, and negative lead to the positive battery 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.

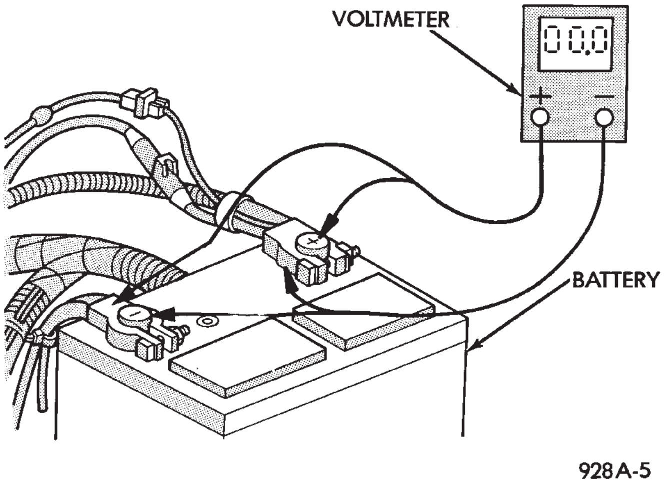


Fig. 9 Test Battery Connection Resistance

(c) Connect negative lead of voltmeter to negative battery terminal, and positive lead to engine block near the battery cable attaching point (Fig. 10). 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.

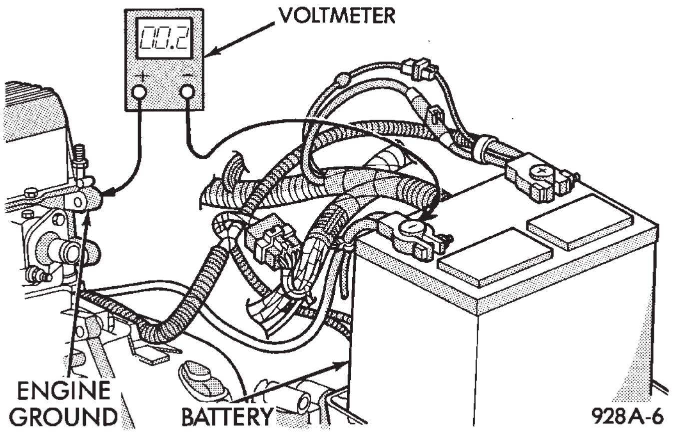


Fig. 10 Test Ground Circuit Resistance

(3) Remove starter heat shield. Refer to Starter replacement to gain access to the starter motor and solenoid connections. Perform the following steps:

(a) Connect positive voltmeter lead to the starter motor housing and the negative lead to the negative battery terminal (Fig. 11). Hold the ignition switch key in the START position. If voltage reads above 0.2 volt, correct poor starter to engine ground.

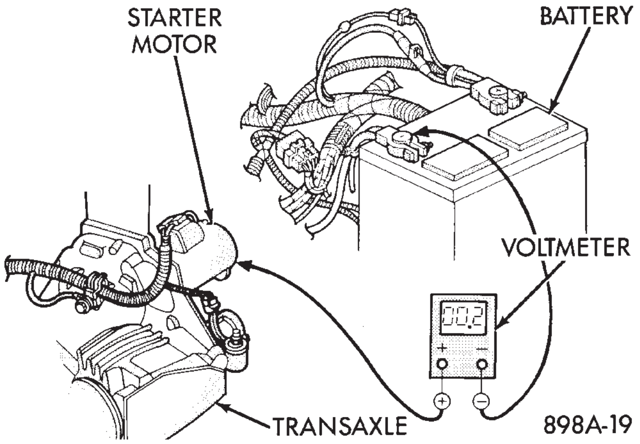


Fig. 11 Test Starter Motor Ground

(b) Connect the positive voltmeter lead to the positive battery terminal, and negative lead to battery cable terminal on starter solenoid (Fig. 12). Rotate and hold the ignition switch key 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 positive battery cable.

(c) If resistance tests do not detect feed circuit failures, remove the starter motor and go to Bench Testing Starter Solenoid.

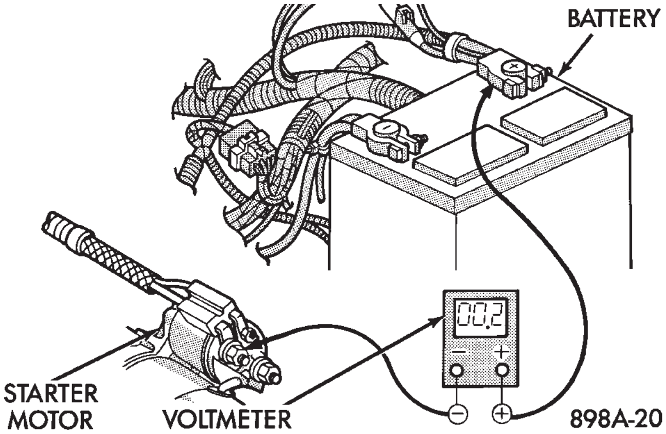


Fig. 12 Test Positive Battery Cable Resistance

STARTER CONTROL CIRCUIT TESTS

The starter control circuit has:

- Starter solenoid
- Starter relay (Fig. 2)
- Neutral starting and back-up switch with automatic transmissions
- Clutch pedal mounted starter interlock switch with manual transmissions
- Ignition switch
- Battery
- All related wiring and connections

CAUTION: Before performing any starter tests, the ignition system must be disabled.

- VEHICLES EQUIPPED WITH A CONVENTIONAL DISTRIBUTOR: Disconnect coil wire from distributor cap center tower. Secure wire to a good ground to prevent engine from starting (Fig. 6).
- VEHICLES EQUIPPED WITH DIRECT IGNITION SYSTEM: Unplug the coils electrical connector (Fig. 7).

STARTER SOLENOID TEST

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN PARK OR NEUTRAL 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 this 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 the starter relay as follows:

- On AC, AG, AJ and AY Bodies the relay is located in the Power Distribution Center. This Center is mounted near the front of the left front strut tower (Fig. 13). The position of the starter relay within this Center will be shown on the Center cover.

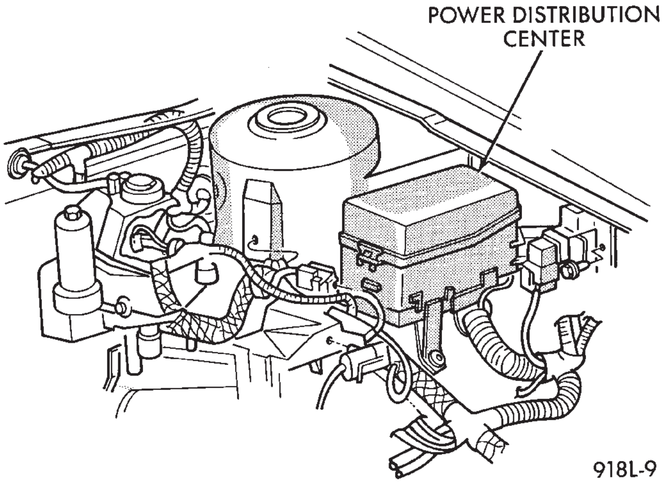


Fig. 13 Starter Relay Location—AC, AG, AJ, and AY Bodies

- On AA/AP Bodies the relay is located on the front of the left front strut tower (Fig. 14).

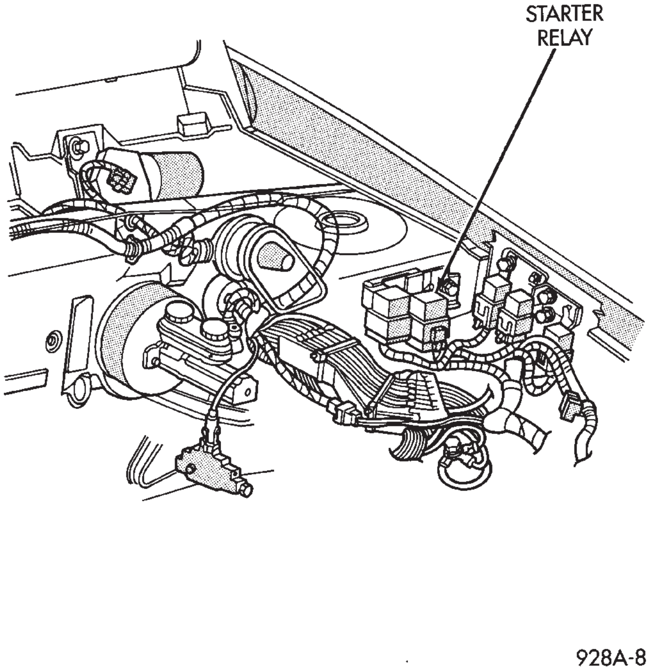


Fig. 14 Starter Relay Location—AA/AP Body

(7) Remove the starter relay from the connector.

(8) Connect a remote starter switch or a jumper wire between the battery positive post and terminal 87 on the starter relay connector. To decide the starter relay terminal numbers, refer to the Starter Relay Tests.

- If engine now cranks, starter/starter solenoid is good. Go to the starter relay test.
- If engine does not crank with this test, or solenoid chatters, check wiring and connectors from starter

relay to starter solenoid for loose or corroded connections. Particularly at starter terminals.

- Repeat test. If engine still fails to crank properly, trouble is within starter or starter mounted solenoid, and it must be removed for repairs. Refer to Group 8B, Battery/Starter/Generator Service, Starter replacement.

STARTER RELAY TEST

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN PARK OR NEUTRAL 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 the preceding starter solenoid tests BEFORE performing starter relay tests. Refer to Starter Solenoid Test.

(3) Locate and remove the starter relay. For starter relay locations, refer to Starter Solenoid Test (Fig. 13 or 14).

(4) After the starter relay has been located and removed, refer to Starter Relay Tests (Fig. 15).

NEUTRAL STARTING AND BACK-UP SWITCH

AUTOMATIC TRANSMISSION ONLY

For electrical diagnostics, when checking starter circuits, refer to Starter Relay Tests (Fig. 15).

For replacement of switch, refer to Group 21, Transaxle, Neutral Starting and Switch Replacement.

STARTER INTERLOCK SWITCH—CLUTCH PEDAL MOUNTED

MANUAL TRANSMISSION ONLY

For electrical diagnostics, refer to the Starter Relay Tests.

For replacement and/or adjustment of the switch, refer to Group 6, Manual Transaxle Clutch, Manual Transaxle Starter Interlock Switch.

IGNITION SWITCH TEST

After testing the starter solenoid and relay, test ignition switch and wiring. Refer to Group 8D, Ignition Systems, or the Front Wheel Drive Car Wiring Diagrams Service Manual. Check all wiring for opens or shorts, and all connectors for being loose or corroded.

BENCH TESTING STARTER SOLENOID

(1) Disconnect field coil wire from field coil terminal (Fig. 16 or 17).

(2) Check for continuity between solenoid terminal and field coil terminal with a continuity tester. Continuity should be detected (Fig. 18 or 19).

(3) Check for continuity between solenoid terminal and solenoid housing (Fig. 20 or 21). Continuity should be detected. If continuity is detected, solenoid is good.

(4) If continuity is not detected in either test, solenoid has an open circuit and is defective. If equipped with:

- BOSCH STARTER: Replace the solenoid.
- NIPPONDENSO STARTER: Replace the starter assembly.

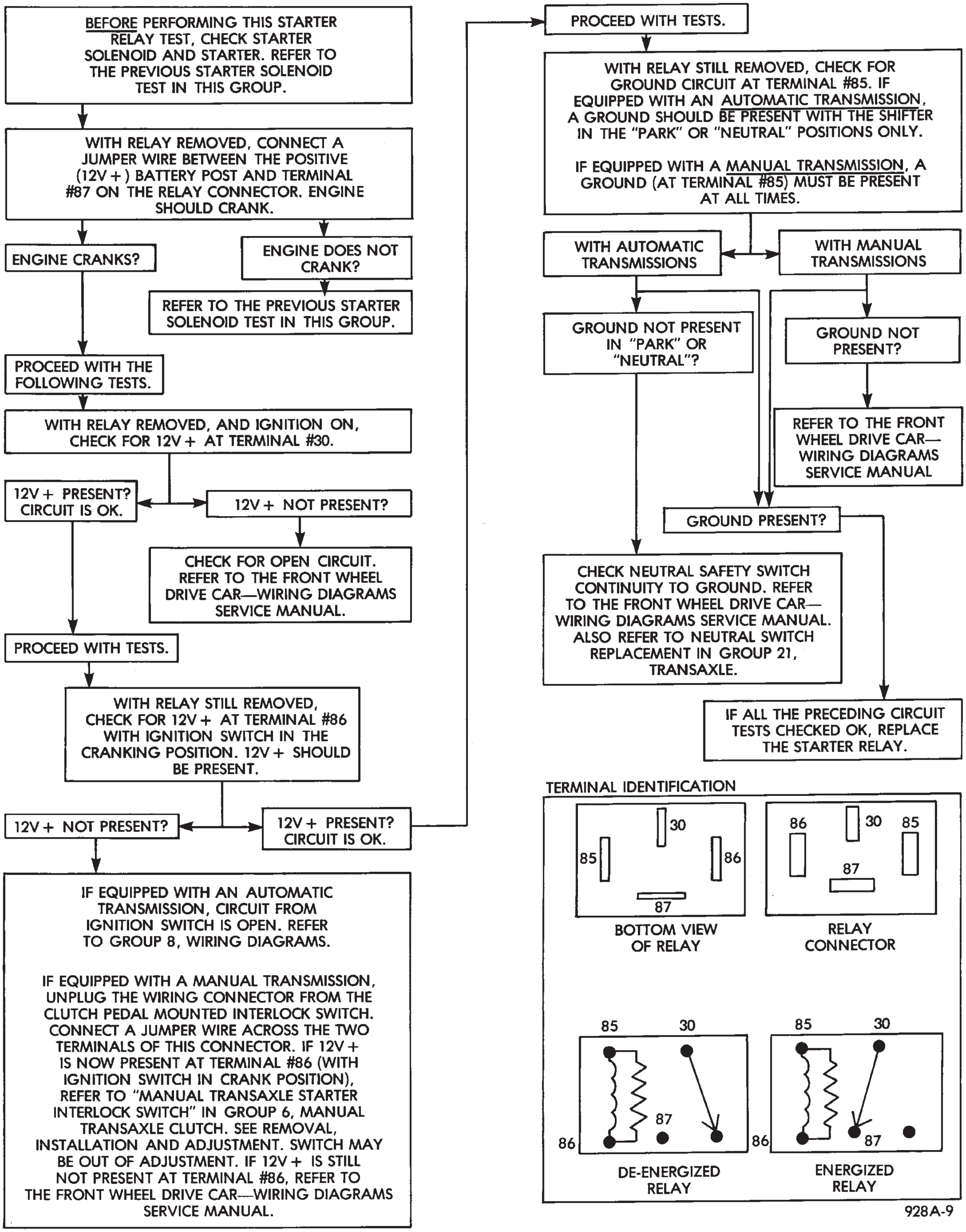


Fig. 15 Starter Relay Tests

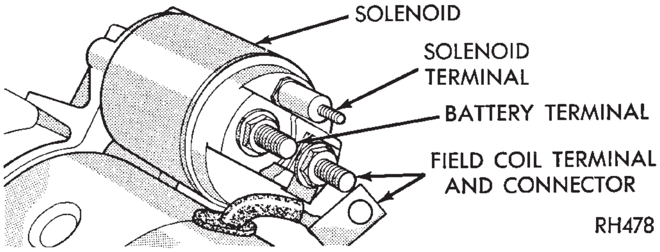


Fig. 16 Field Coil Wire Terminal—Bosch

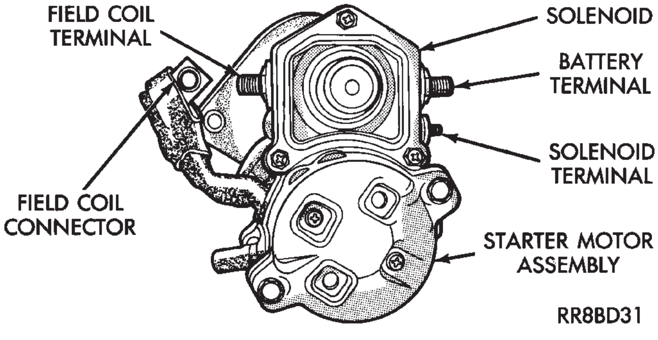


Fig. 17 Field Coil Wire Terminal—Nippondenso

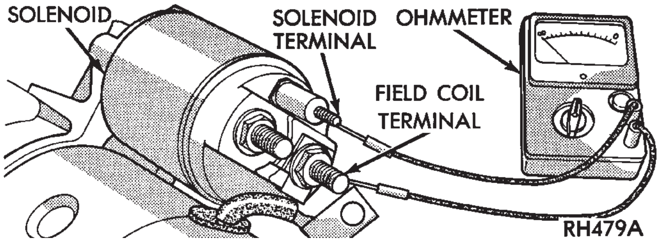


Fig. 18 Continuity Test Between Solenoid Terminal and Field Coil Terminal—Bosch

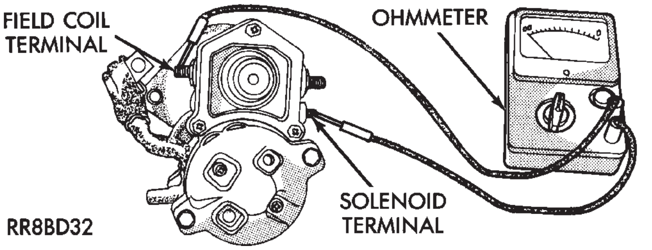


Fig. 19 Continuity Test Between Solenoid Terminal and Field Coil Terminal—Nippondenso

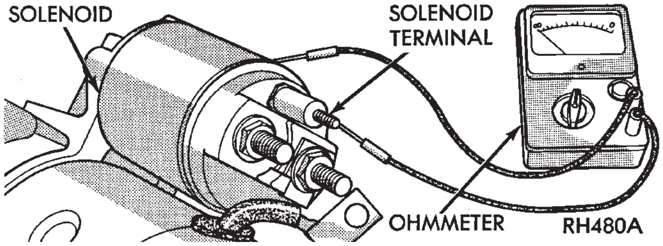


Fig. 20 Continuity Test Between Solenoid Terminal and Solenoid Case —Bosch

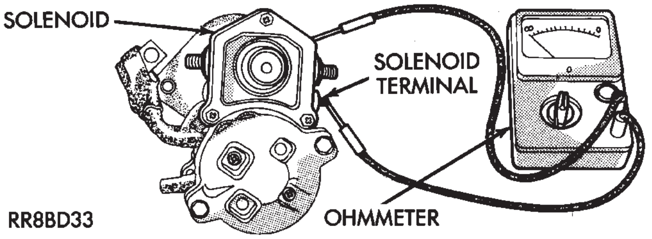


Fig. 21 Continuity Test Between Solenoid Terminal and Solenoid Case —Nippondenso

GENERATOR TEST PROCEDURES ON VEHICLE

INDEX

CHARGING SYSTEM DIAGNOSTICS (Fig. 1)

OUTPUT WIRE RESISTANCE TEST

The generator output wire resistance test shows the amount of voltage drop across the generator output wire between the generator B+ terminal and the positive battery post.

PREPARATION

Before starting test, make sure the vehicle has a fully charged battery. Tests and procedures to check for a fully charged battery is shown in the Battery section.

(1) Turn the ignition switch OFF.

(2) Disconnect battery NEGATIVE cable.

(3) Disconnect the generator B+ output wire from the generator output battery terminal (Fig. 2).

(4) Connect a 0-150 ampere scale (DC) ammeter in series between B+ terminal and output wire (Fig. 2 and 3). Connect positive lead to B+ terminal, and negative lead to output wire.

(5) Using o-18 volt scale voltmeter, connect the positive lead to the disconnected (B+) output wire (Fig. 2). Connect the negative lead to positive battery post.

(6) Remove fresh air hose between Powertrain Control Module and air cleaner if necessary.

(7) Connect jumper wire between a good ground and K20 circuit terminal at the back of the generator.

CAUTION: Do not connect the A142 circuit terminal (Fig. 2) to ground the Fusible link will burn.

(8) Connect an engine tachometer and connect battery negative cable.

(10) Connect a volt/amp tester equipped with a variable carbon pile rheostat between battery terminals (Fig. 4).

Caution: Be sure the carbon pile is in OFF position before connecting leads.

TEST

(1) Start engine. Immediately after starting, reduce engine speed to idle.

(2) Adjust engine speed and carbon pile to maintain 20 amperes flowing in the circuit. Observe voltmeter reading. Voltmeter reading should not exceed 0.5 volts.

RESULTS

If a higher voltage drop is shown, inspect, clean and tighten all connections between generator B+ terminal and battery positive post. A voltage drop test may be performed at each connection to locate a connection with excessive resistance. If resistance tests are satisfactory, reduce engine speed, turn off carbon pile, and turn off ignition switch.

(1) Disconnect battery negative cable.

(2) Remove test ammeter, voltmeter, carbon pile, and tachometer.

(3) Remove jumper wire.

(4) Connect generator output wire to generator B+ terminal.

(5) Connect battery negative cable.

(6) Connect fresh air hose between Powertrain Control Module and air cleaner if removed.

CURRENT OUTPUT TEST

The current output test decides whether the generator can deliver its rated current output. For generator identification and output amperage specifications, refer to Generator Specifications.

For generator maximum voltage at individual temperatures, refer to Generator Output Voltage Specifications.

PREPARATION

Before starting any tests, make sure the vehicle has a fully charged battery. Tests and procedures to check for a fully charged battery is shown in Battery section.

(1) Disconnect battery negative cable.

(2) Disconnect output wire at the B+ terminal (Figs. 2 and 5).

(3) Connect a 0-150 ampere scale (DC) ammeter in series between the B+ terminal and output wire. Connect Positive lead to B+ terminal and negative lead to output wire.

(4) Using 0-18 voltmeter, connect positive lead to B+ terminal (Figs. 2 and 5). Connect negative lead to a good ground.

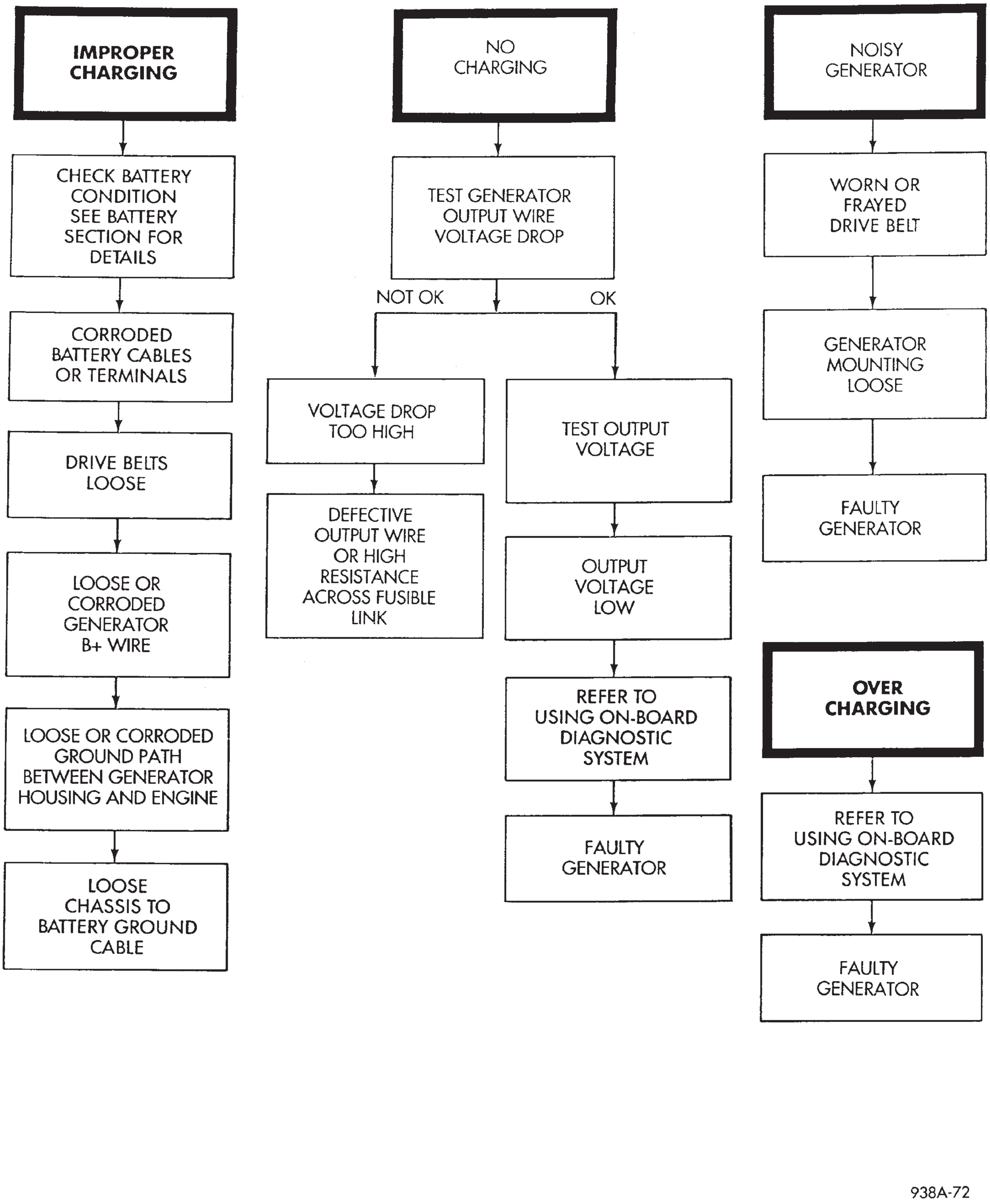


Fig. 1 Charging Diagnostics

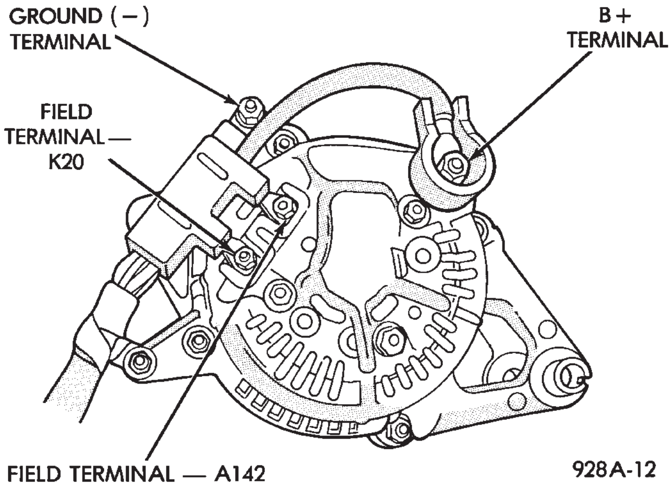


Fig. 2 Generator Wiring Connections

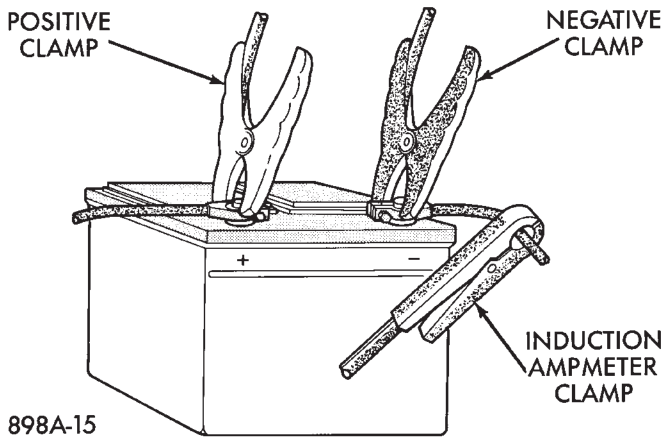


Fig. 4 Volt/Amp Tester Connections

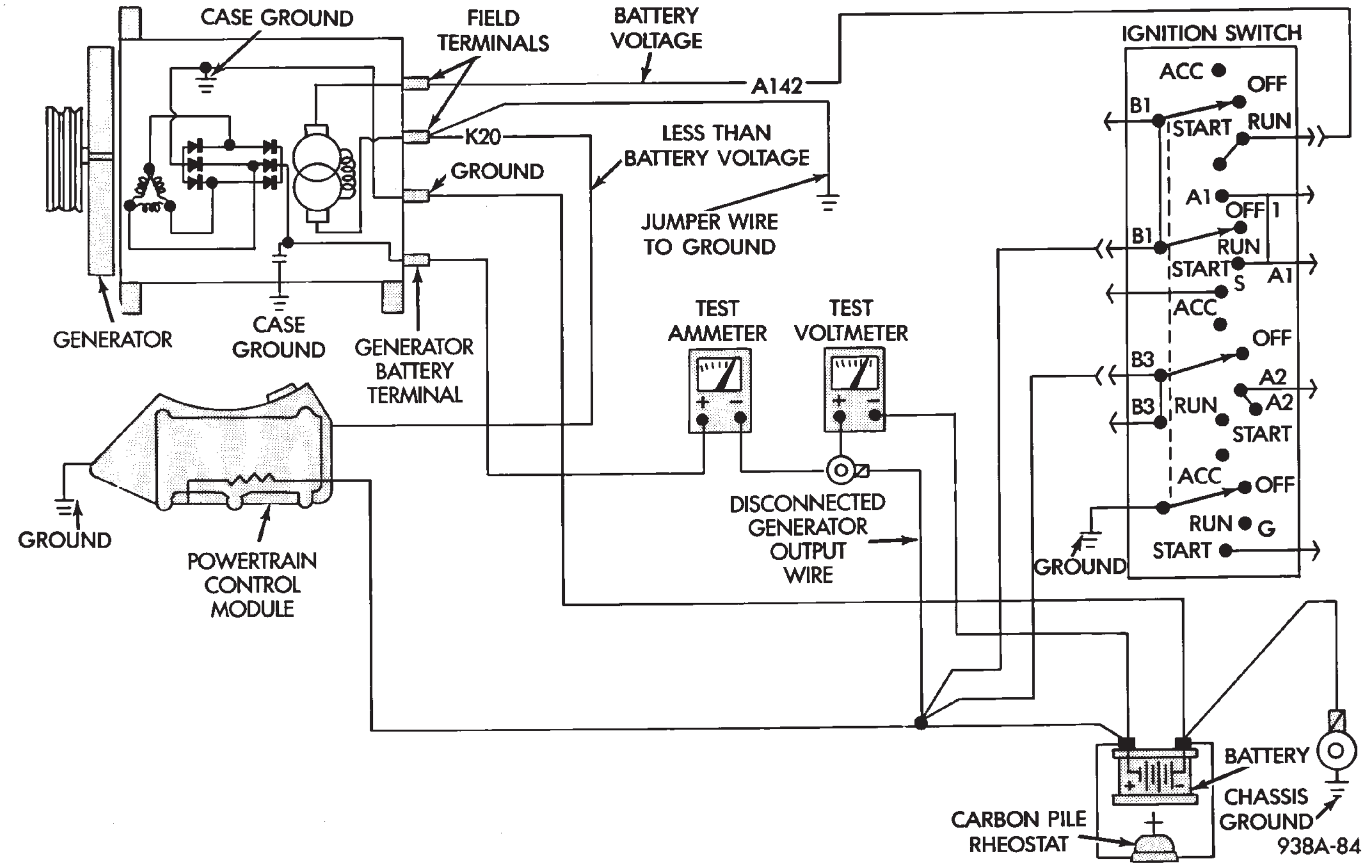


Fig. 3 Generator Output Wire Resistance Test

(5) Connect an engine tachometer and connect battery negative cable.

(6) Connect a volt/amp tester equipped with a variable carbon pile rheostat between battery terminals (Fig. 6). Be sure carbon pile is in OFF position before connecting leads.

(7) Remove fresh air hose between Powertrain Control Module computer and air cleaner if necessary.

(8) Full field the generator. Connect a jumper wire between a good ground and K20 circuit terminal at the back of the generator (Figs. 2 and 5).

CAUTION: Do not connect the A142 circuit terminal (Fig. 2) to ground. Fusible link will burn.

TEST

(1) Start the engine. Immediately after starting, reduce engine speed to idle.

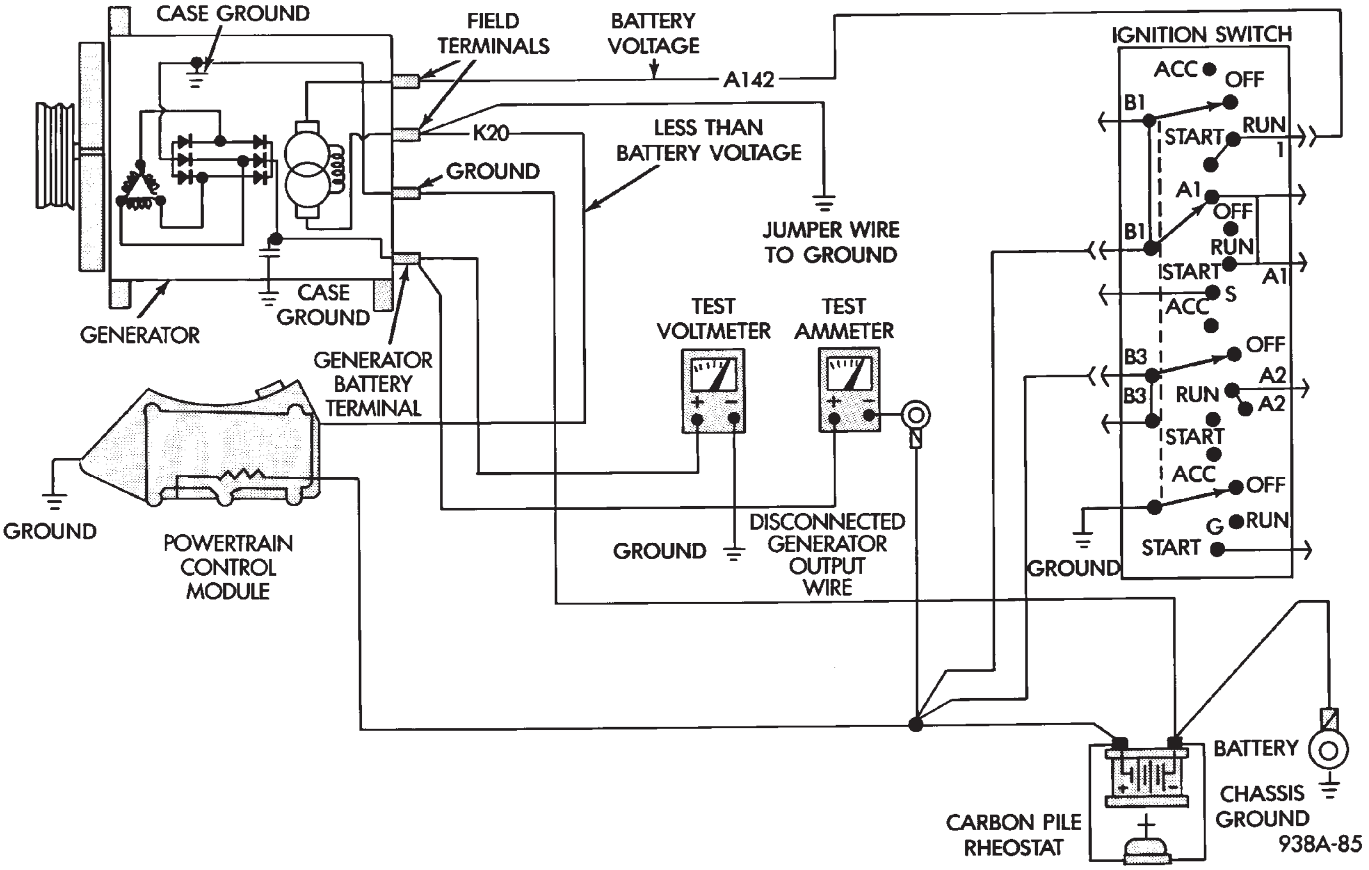


Fig. 5 Generator Current Output Test

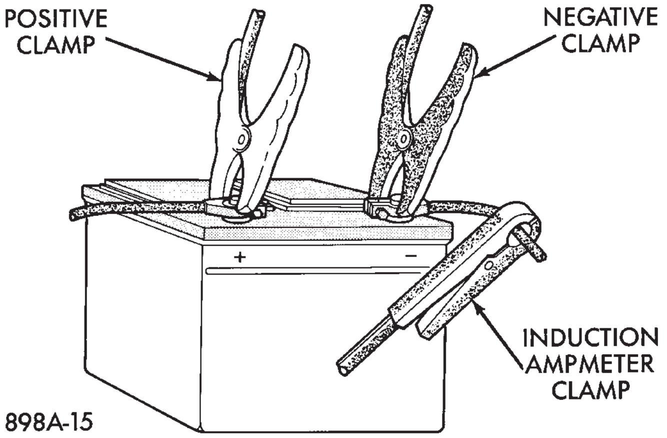


Fig. 6 Volt/Amp Tester Connections

(2) Adjust the carbon pile and engine speed in steps until an engine speed of 1250 rpm, and a voltmeter reading of 15 volts is obtained.

CAUTION: Do not allow the battery voltage to exceed 16 volts.

(3) The generator amperage must meet the output requirements for the particular generator being tested. Refer to Generator Specifications for generator identification and amperage outputs.

RESULTS

(1) If amperage reading is less than specified, and generator output wire resistance is not found excessive from the previous tests, generator should be replaced. Refer to Group 8B, Battery/Starter/Generator Service, Generator Replacement. These generators are not intended to be disassembled for service. It must be replaced as an assembly.

(2) After current output test is completed, reduce engine speed, turn off carbon pile, and turn off ignition switch.

(3) Disconnect battery negative cable.

(4) Remove test ammeter, voltmeter, tachometer and carbon pile.

(5) Remove jumper wire between K20 circuit terminal and ground.

(6) Connect output wire to B+ terminal.

(7) Connect negative battery cable.

(8) Connect fresh air hose between powertrain control module and air cleaner if removed.

FAULT CODES—ON BOARD DIAGNOSTICS

INDEX

GENERAL DESCRIPTION/INFORMATION

Another way of diagnosing charging system problems can be accomplished using the On Board Diagnostic System Fault Codes.

A Fault Code shows a potential problem in a monitored circuit,

or a condition caused by a faulty component. A Fault Code can be retrieved by turning the ignition switch ON-OFF-ON-OFF-ON without starting the engine, and counting the number of flashes of the Malfunction Indicator (CHECK ENGINE) Lamp in the instrument cluster.

EXAMPLES:

- If the Malfunction Indicator (Check Engine) Lamp flashes four times, pauses, and flashes one more time, a Code 41 is shown. The first set of four flashes indicates number four. The second set of one flash indicates one.
- If the Malfunction Indicator (Check Engine) Lamp flashes four times, pauses, and flashes six more times, a Code 46 is shown. The first set of four flashes indicates number four. The second set of six flashes indicates six.
- If the Malfunction Indication (Check Engine) Lamp flashes four times, pauses, and flashes seven more times, a Code 47 is shown. The first set of four flashes indicates number four. The second set of seven flashes indicates seven.

POWERTRAIN CONTROL MODULE

The Powertrain Control Module is equipped with On Board Diagnostic features and monitors all engine control circuits during a run/drive period. If a circuit or system does not perform properly, the powertrain control module will file in memory a preset Fault Code. This can be used to help in diagnosing a problem. After 50 to 100 ignition switch ON/RUN cycles, the memory will be erased if the fault does not reoccur.

The Powertrain Control Module is located in the engine compartment outboard of the battery (Fig. 7).

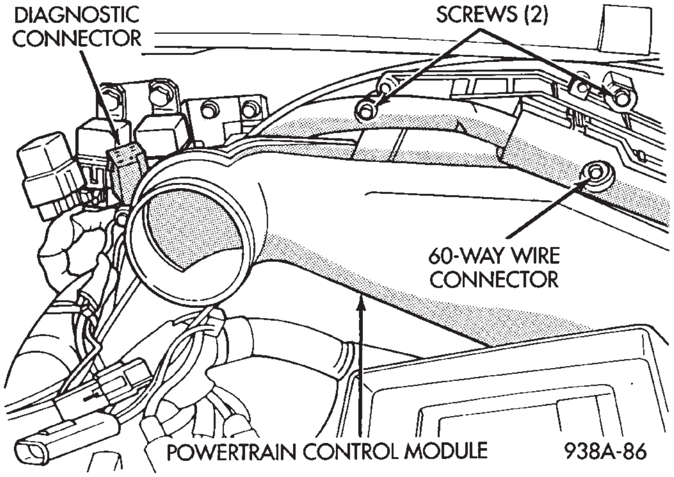
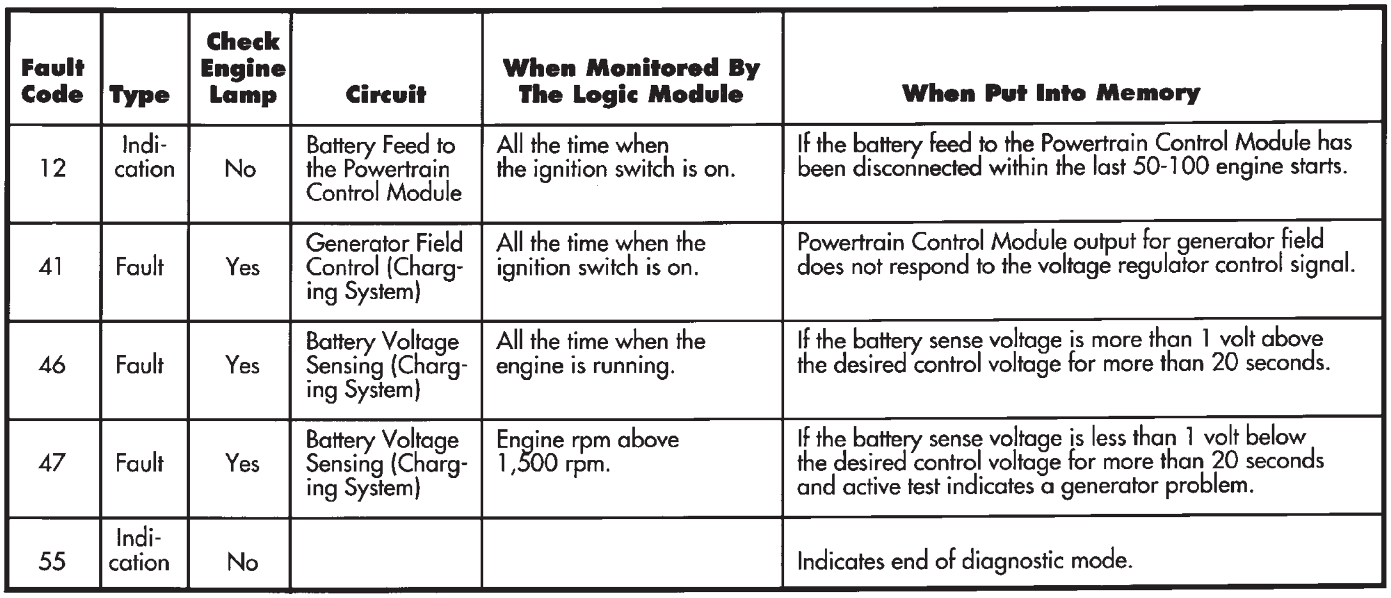


Fig. 7 Powertrain Control Module

Refer to Fig. 8 Generator Fault Codes Chart for relationships of generator/charging system Fault Code numbers.



Fault Code	Type	Check Engine Lamp	Circuit	When Monitored By The Logic Module	When Put Into Memory
12	Indication	No	Battery Feed to the Powertrain Control Module	All the time when the ignition switch is on.	If the battery feed to the Powertrain Control Module has been disconnected within the last 50-100 engine starts.
41	Fault	Yes	Generator Field Control (Charging System)	All the time when the ignition switch is on.	Powertrain Control Module output for generator field does not respond to the voltage regulator control signal.
46	Fault	Yes	Battery Voltage Sensing (Charging System)	All the time when the engine is running.	If the battery sense voltage is more than 1 volt above the desired control voltage for more than 20 seconds.
47	Fault	Yes	Battery Voltage Sensing (Charging System)	Engine rpm above 1,500 rpm.	If the battery sense voltage is less than 1 volt below the desired control voltage for more than 20 seconds and active test indicates a generator problem.
55	Indication	No			Indicates end of diagnostic mode.

938A-76

Fig. 8 Generator Fault Codes

DIAGNOSTIC TESTING USING FAULT CODES

For diagnostic testing when using the fault codes, refer to Fig.9 through 13.

DRB II DIAGNOSTIC TESTER

TESTING FAULT CODES

A more accurate device to retrieve fault codes is Diagnostic Tool (DRB II). This diagnostic tool, plugged into the diagnostic connector (Fig. 7) located near the battery, will display fault descriptions. The DRB II also can test various circuits and component functions. Refer to the instructions provided with the (DRB II) tool being used. Descriptions of Fault Codes for other vehicle systems can be found in the General Diagnosis sections of Group 14, Fuel System.

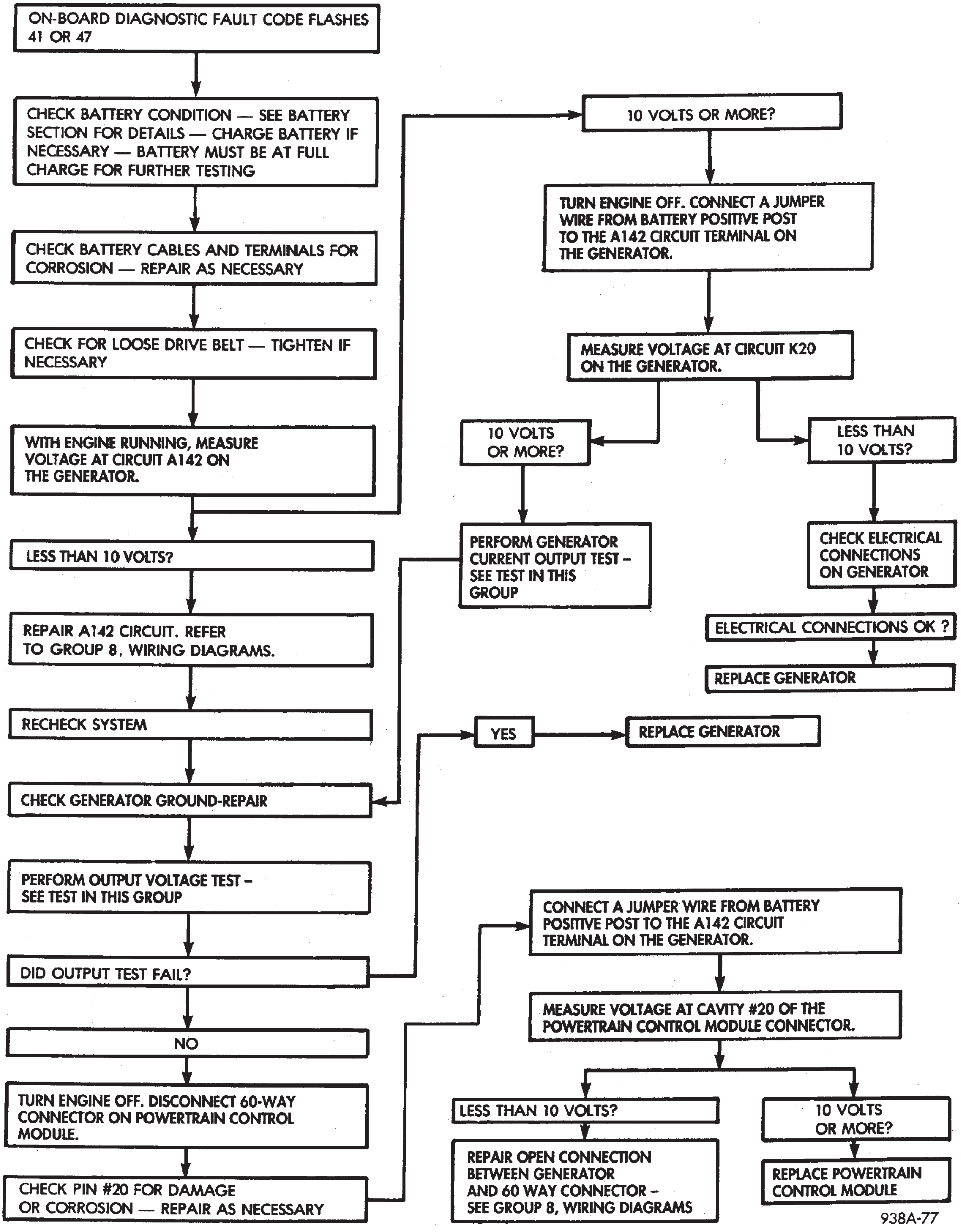
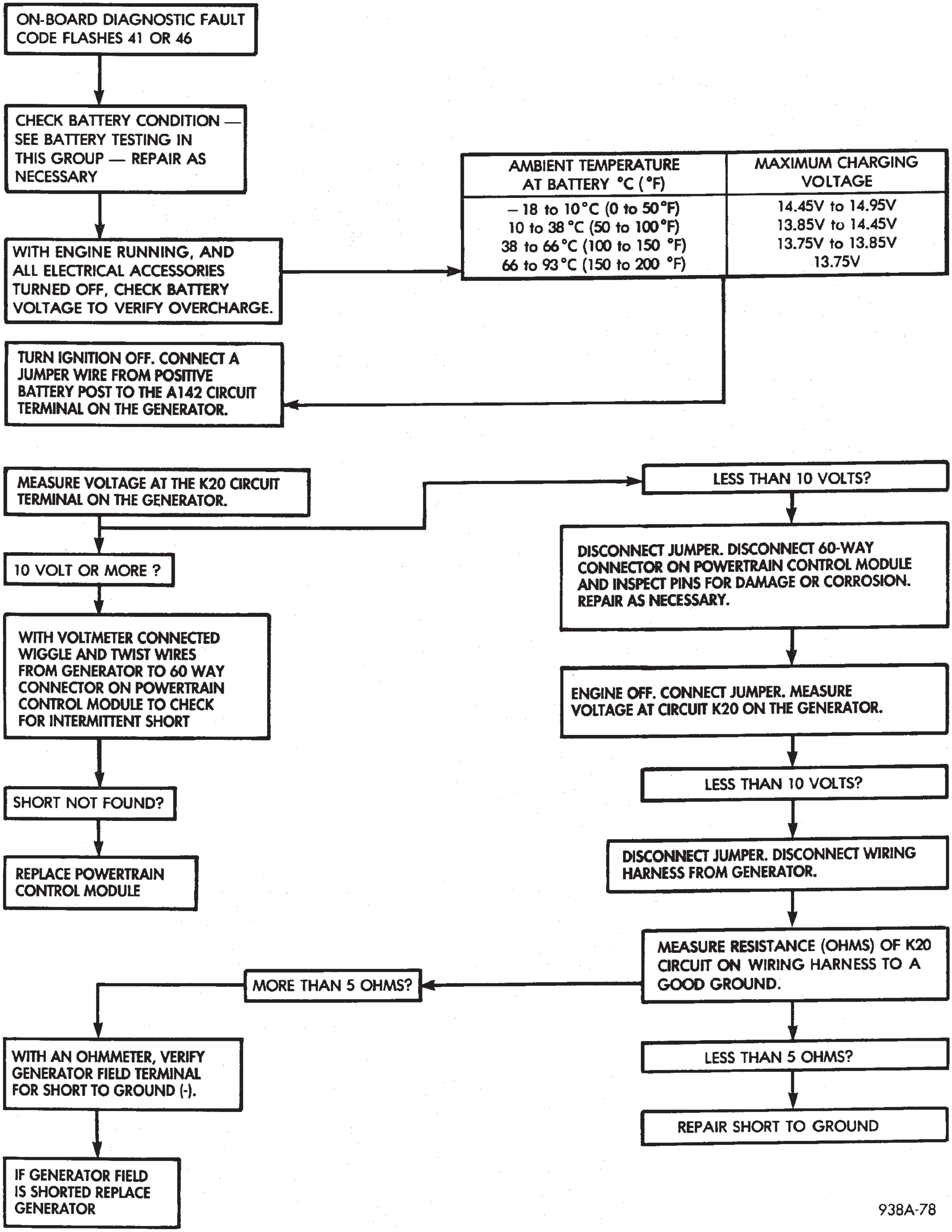


Fig. 9 Check For Inadequate/Low Charging



AMBIENT TEMPERATURE AT BATTERY °C (°F)	MAXIMUM CHARGING VOLTAGE
– 18 to 10 °C (0 to 50 °F)	14.45V to 14.95V
10 to 38 °C (50 to 100 °F)	13.85V to 14.45V
38 to 66 °C (100 to 150 °F)	13.75V to 13.85V
66 to 93 °C (150 to 200 °F)	13.75V

Fig. 10 Check For Overcharging

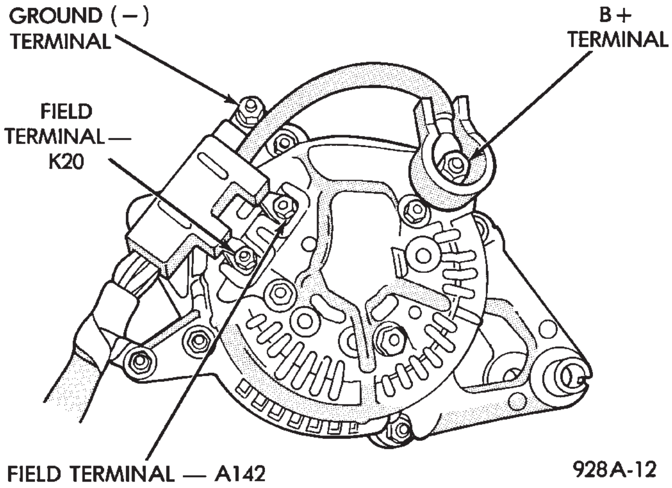


Fig. 11 Generator Wiring Connections

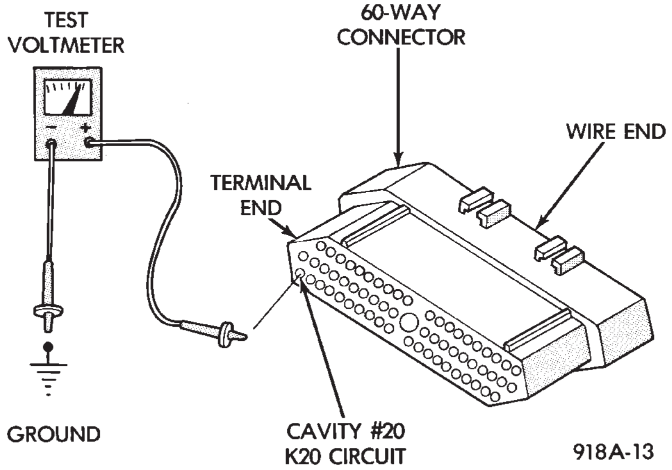


Fig. 12 Powertrain Control Module Connector

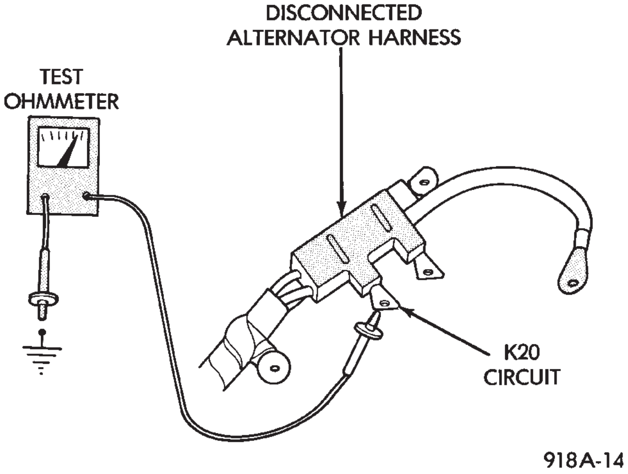


Fig. 13 Electrical Resistance Test

SPECIFICATIONS

STARTER/BATTERY

STARTER

Manufacturer	Nippondenso		Bosch	
Engine Application	3.0L/3.8L	3.3L	3.0L	2.2-2.5L
Part Number and Power Rating	1.4 Kw	1.2 Kw	1.1 Kw	1.1 Kw
Voltage	12	12	12	12
No. of Fields	4	4	Permanent Magnet	
No. of Poles	4	4	6	6
Brushes	4	4	4	4
Drive	Conventional Gear Train	Conventional Gear Train	Planetary Gear Train	Planetary Gear Train
Free Running Test Voltage Amperage Draw Minimum Speed RPM	 11 73 Amps 3601 RPM	 11 73 Amps 3401 RPM	 11 73 Amps 3473 RPM	 11 69 Amps 3447 RPM
Solenoid Closing Voltage	7.5 Volts	7.5 Volts	7.5 Volts	7.5 Volts
Cranking Amperage Draw Test	150-220 Amps*	150-200 Amps*	150-220 Amps*	

*Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

BATTERY

Load Test (Amps)	**Cold Cranking Rating @ 0°F**	**Reserve Capacity**
200 Amp	500 Amp	110 Minutes
250 Amp	600 Amp	120 Minutes
315 Amp	685 Amp	125 Minutes

CRANKING RATING is the current a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

RESERVE CAPACITY RATING is 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).

928A-10

GENERATOR AMPERAGE/IDENTIFICATION NUMBERS

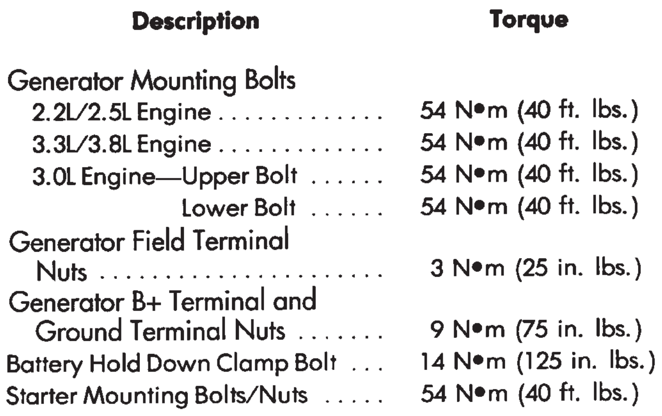
Type	****Case I.D. Tag Number**	**Pulley Grooves**	**Engine Usage**	***Amperage Output**
Bosch 90 HS	4557431	4	2.2L-2.5L	84 AMP
Bosch 90 HS	4557432	6	3.0L	86 AMP
Denso 75 HS	4557301	4	2.2L	68 AMP
Denso 90 HS	5234031	4	2.2L-2.5L	86 AMP
Denso 90 HS	5234032	6	3.0L-3.3L-3.8L	90 AMP
Denso 120 HS	5234033	6	3.0L-3.3L-3.8L	102 AMP

*With Generator Full Fielded at 1250 RPM

**Case I.D. Tag Number is Located on Bottom of Generator Case

938A-87

TORQUE SPECIFICATIONS



Description	Torque
Generator Mounting Bolts	
2.2L/2.5L Engine	54 N•m (40 ft. lbs.)
3.3L/3.8L Engine	54 N•m (40 ft. lbs.)
3.0L Engine—Upper Bolt	54 N•m (40 ft. lbs.)
Lower Bolt	54 N•m (40 ft. lbs.)
Generator Field Terminal Nuts	3 N•m (25 in. lbs.)
Generator B+ Terminal and Ground Terminal Nuts	9 N•m (75 in. lbs.)
Battery Hold Down Clamp Bolt	14 N•m (125 in. lbs.)
Starter Mounting Bolts/Nuts	54 N•m (40 ft. lbs.)

938A-88

BATTERY/STARTER/GENERATOR SERVICE

CONTENTS

BATTERY REMOVAL, INSTALLATION AND SERVICE

GENERAL INFORMATION

This first section will cover Battery replacement and service procedures only. For Battery diagnostic procedures, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.

Factory installed batteries (Fig. 1) do not have removable battery cell caps. Water cannot be added to factory installed battery. Battery is sealed, except for small vent holes in the top. Chemical composition inside the battery produces an extremely small amount of gases at normal charging voltages. The factory installed battery is equipped with a test indicator that displays a colored ball to show the battery's state of charge.

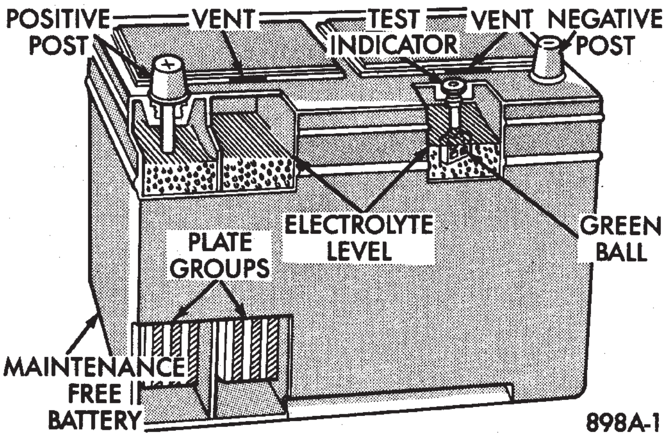


Fig. 1 Maintenance Free Battery

- Green Indicator = Full charge
- Black Indicator = Discharged
- Yellow Indicator = Battery replacement required.

BATTERY VISUAL INSPECTION AND SERVICE

(1) Make sure ignition switch is in OFF position and all accessories are OFF.

(2) Disconnect and remove the battery cable terminals from the battery posts. Remove negative cable first (Fig. 2).

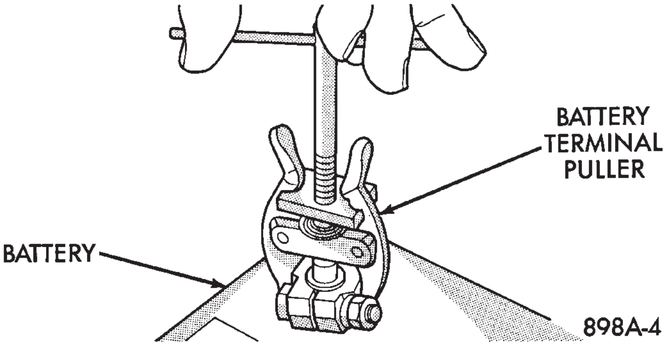


Fig. 2 Remove Battery Cables

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.

(3) Lift battery heat shield off battery, if equipped (Fig. 3).

(4) Remove battery hold down nut and clamp.

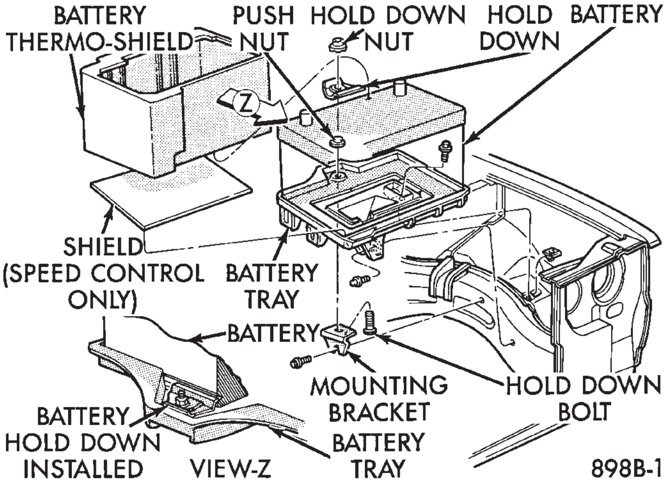


Fig. 3 Battery Hold-Down

(5) Remove the battery from vehicle.

(6) Clean top of battery with a solution of warm water and baking soda. Apply solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 4). Rinse with clear water and blot dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on the top of battery.

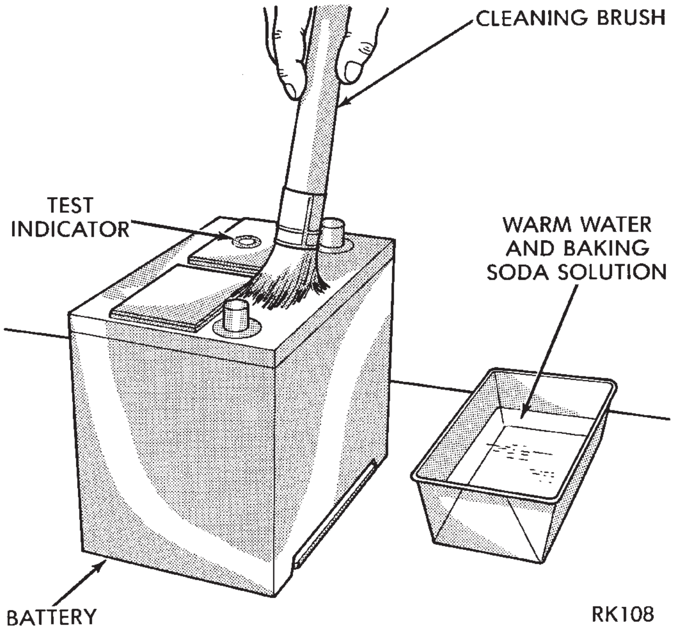


Fig. 4 Cleaning Battery

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(7) Inspect battery case and cover for cracks or leakage. If leakage is present, battery must be replaced.

(8) Inspect battery tray (Fig. 5) for damage caused by acid from battery. If acid damage is present, it will be necessary to clean area with same solution described in Step (6).

(9) Clean battery posts with a suitable battery post cleaning tool (Fig. 6).

(10) Clean inside surfaces of battery cable terminal clamps with a suitable battery terminal cleaning tool (Fig. 7). Replace damaged or frayed cables and broken terminal clamps.

(11) Inspect battery for proper or damaged hold down ledge.

(12) Install battery in vehicle making sure that battery is positioned properly on battery tray (Fig. 3).

(13) Install battery hold down clamp and nut. Be sure that clamp is positioned properly and aligned on battery.

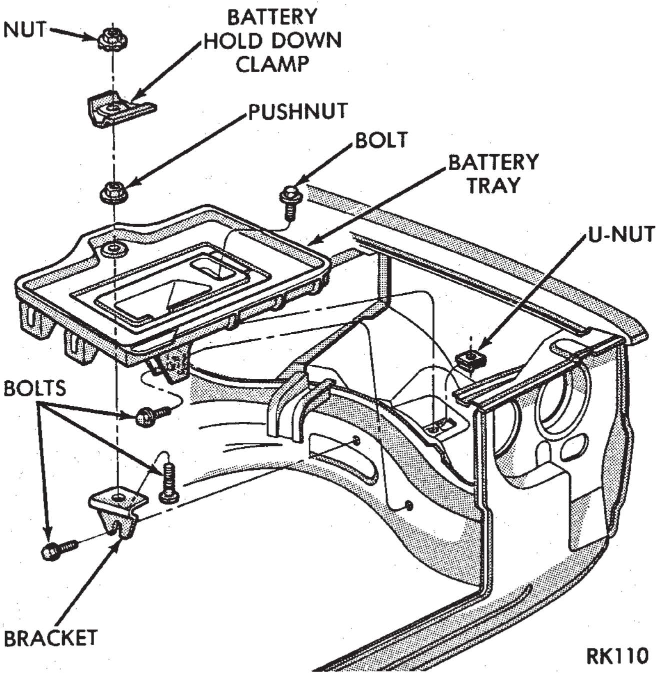


Fig. 5 Battery Tray

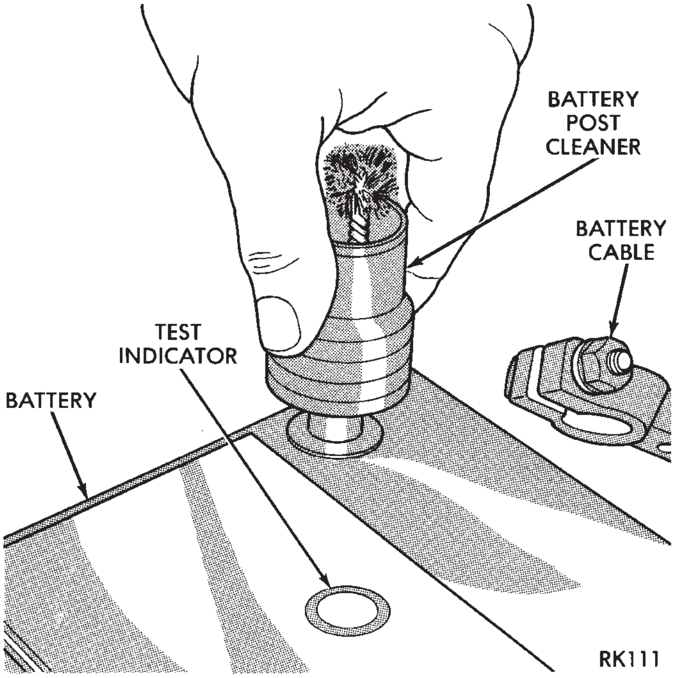


Fig. 6 Cleaning Battery Posts

(14) Install battery heat shield.

(15) Place felt grease washer onto Positive (+) battery post.

(16) Connect battery cable clamps to battery posts making sure top of clamp is flush with top of post (Fig. 8). Install POSITIVE cable first.

(17) Tighten clamp nuts securely.

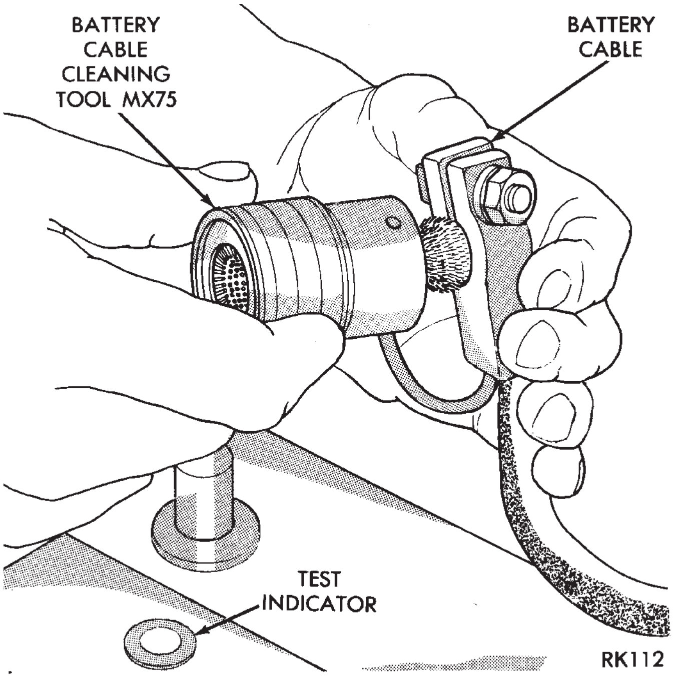


Fig. 7 Cleaning Battery Cable Terminal

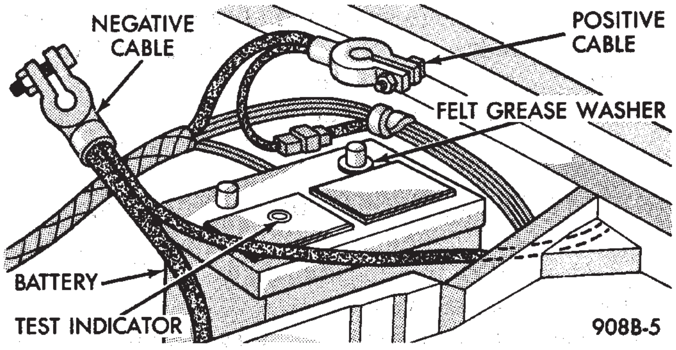


Fig. 8 Battery Cables Disconnected

STARTER

INDEX

GENERAL INFORMATION

This section will cover Starter replacement and service procedures only. For starter diagnostic procedures, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.

STARTING SYSTEM

The starting system has:

- Ignition switch
- Starter relay
- Neutral starting and back-up switch with automatic transmissions
- Clutch pedal mounted starter interlock switch with manual transmissions
- Wiring harness
- Battery
- Starter motor with an integral solenoid

BOSCH STARTERS

- A Bosch permanent magnet starter motor is available on 2.2L, 2.5L and 3.0L engines on all vehicles. A planetary gear train transmits power between starter motor and pinion shaft. The fields consist of six permanent magnets.

NIPPONDENSO STARTERS

- A Nippondenso reduction gear-field coil starter motor is available on 3.0L, 3.3L and 3.8L engines.

SUPPLY CIRCUIT AND CONTROL CIRCUIT

Both starter systems consist of two separate circuits:

- A high amperage supply to feed the starter motor.
- A low amperage circuit to control the starter solenoid.

For additional information on starter motor supply and control circuits, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.

STARTER MOTOR REPLACEMENT

BOSCH STARTER—2.2L/2.5L ENGINE

(1) Disconnect battery negative cable (Fig. 1).

(2) Raise vehicle.

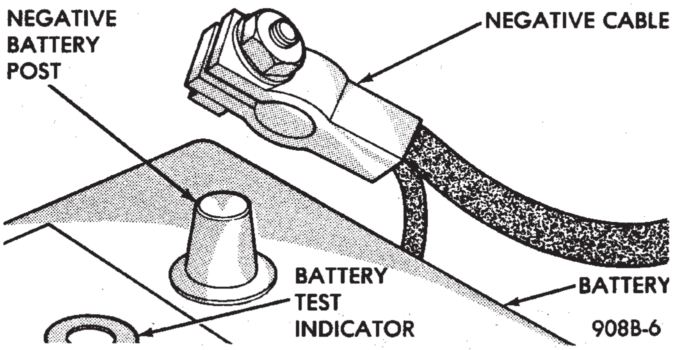


Fig. 1 Remove or Install Battery Cable

(3) Remove heat shield clip from the starter and heat shield is clipped to starter (Fig. 2). For easier servicing, do not remove the wiring from starter at this time.

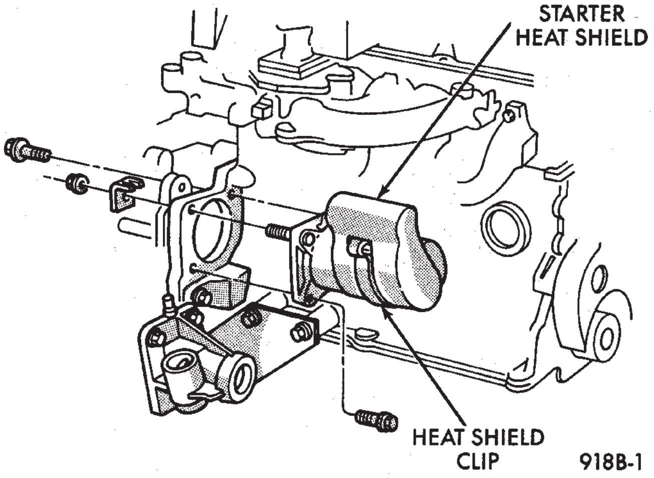


Fig. 2 Starter Heat Shield—4 Cylinder Engines

(4) Remove two bolts and one nut attaching starter to engine (Fig. 3).

(5) Remove starter/starter solenoid assembly from engine. Position the starter to gain access to the wiring connectors.

(6) Disconnect the positive battery cable and wiring at the starter.

(7) Remove the starter from vehicle.

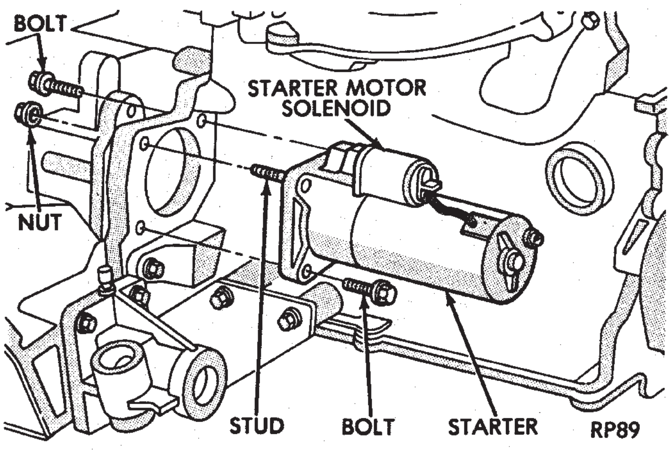


Fig. 3 Bosch Starter—2.2L/2.5L Engine

(8) For installation, reverse above procedures. Clean corrosion/dirt from the cable and wire terminals before installing wiring to the solenoid.

BOSCH OR NIPPONDENSO STARTER—3.0L/3.3L/3.8L ENGINE

(1) Disconnect NEGATIVE battery cable (Fig. 1).

(2) Raise vehicle.

(3) Remove three starter attaching bolts at engine/transaxle (Fig. 4).

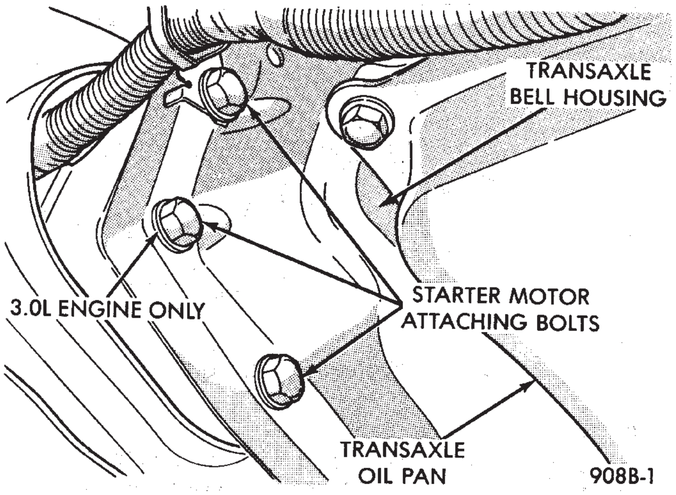


Fig. 4 Remove or Install Attaching Bolts—Typical

(4) Remove the two wire connector terminal nuts and remove wiring connector (Bosch, Fig. 5) (Nippondenso, Fig. 6 or 7).

(5) Remove starter from vehicle (Bosch, Fig. 8) (Nippondenso, Fig. 9).

(6) For installation, reverse above procedures. Clean corrosion/dirt from the cable and wire terminals before installing wiring to the solenoid.

STARTER COMPONENT REPLACEMENT

Caution: When servicing the starter assembly off the vehicle, do not clamp the starter to a vice. Internal damage may result.

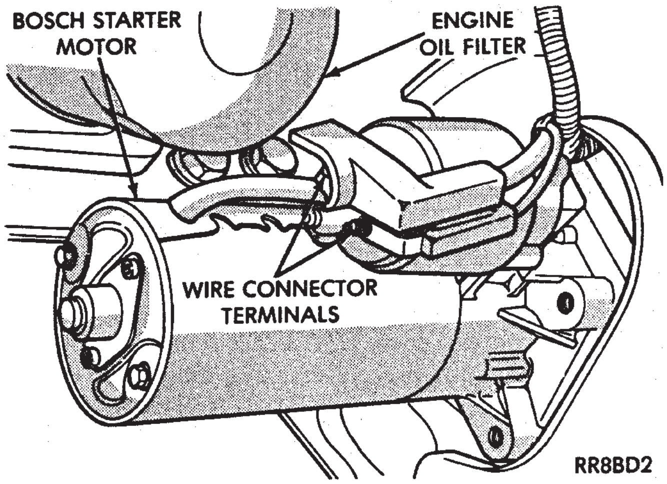


Fig. 5 Wire Terminal Connections—Bosch Starter

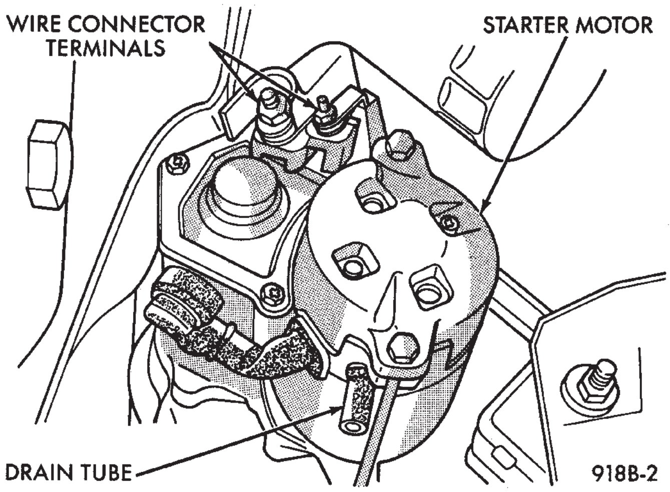


Fig. 6 Wire Terminal Connections—3.0L Engine—Nippondenso Starter

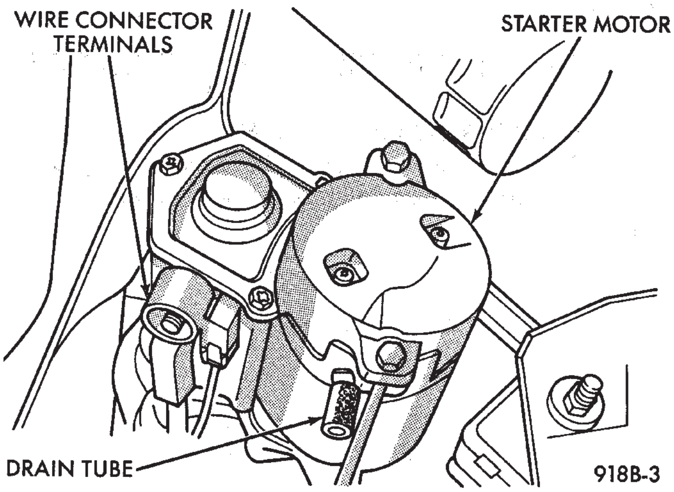


Fig. 7 Wire Terminal Connections—3.3L/3.8L Engine—Nippondenso Starter

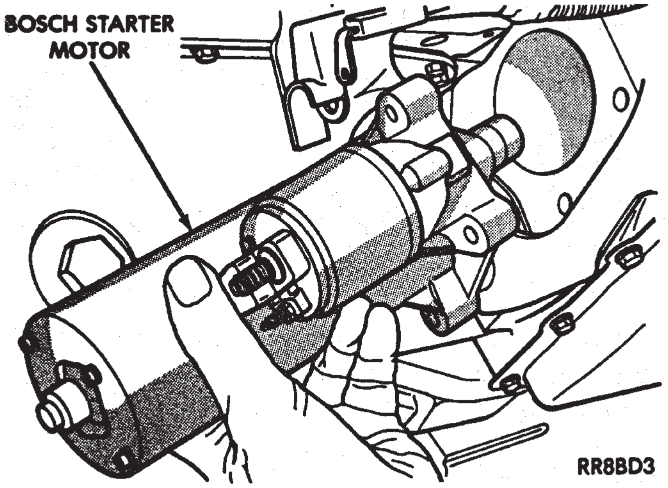


Fig. 8 Remove/Install Starter—Bosch—Typical

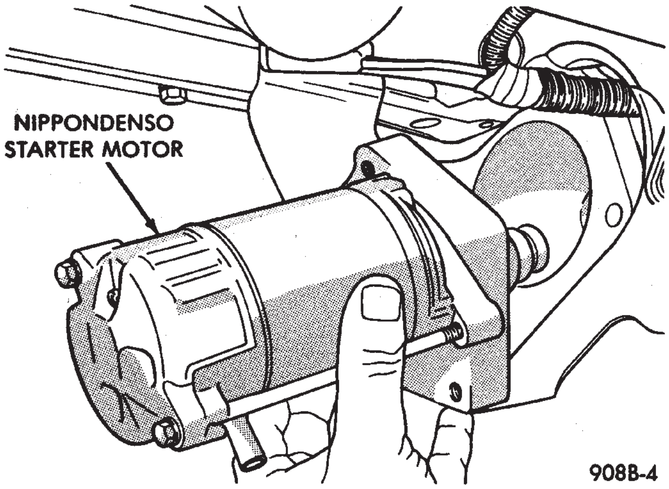


Fig. 9 Remove/Install Starter—Nippondenso—Typical

NIPPONDENSO STARTER GEAR AND CLUTCH

REMOVAL AND INSTALLATION

(1) Remove the two gear housing attaching screws and separate the gear housing from the solenoid housing (Fig. 10). The pinion gear, pinion gear bearing, and drive gear will be loose between the solenoid housing and gear housing (Fig. 11). When reinstalling pinion gear and bearing, wipe with a clean rag and coat with lightweight high temperature wheel bearing grease. Place the lubricated bearing and gear over the bearing shaft in the gear housing (Fig. 12).

(2) Remove the starter gear and clutch assembly from the solenoid housing (Fig. 13).

(3) For assemble, reverse above procedures.

BOSCH STARTER SOLENOID REPLACEMENT

(1) Remove field terminal nut (Fig. 14).

(2) Remove field terminal (Fig. 15).

(3) Remove field washer (Fig. 16).

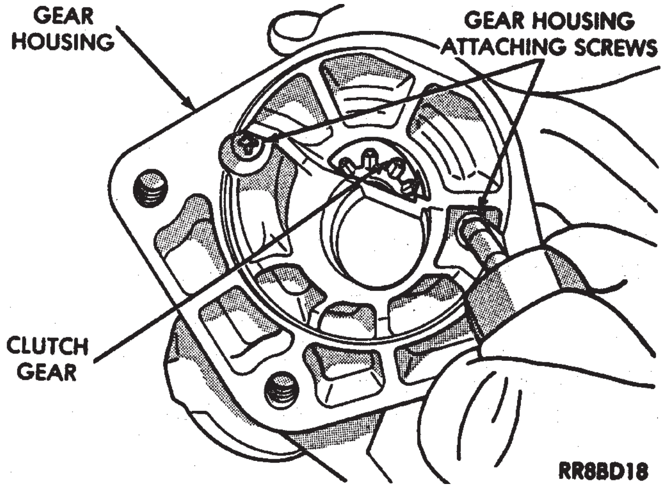


Fig. 10 Remove or Install Gear Housing

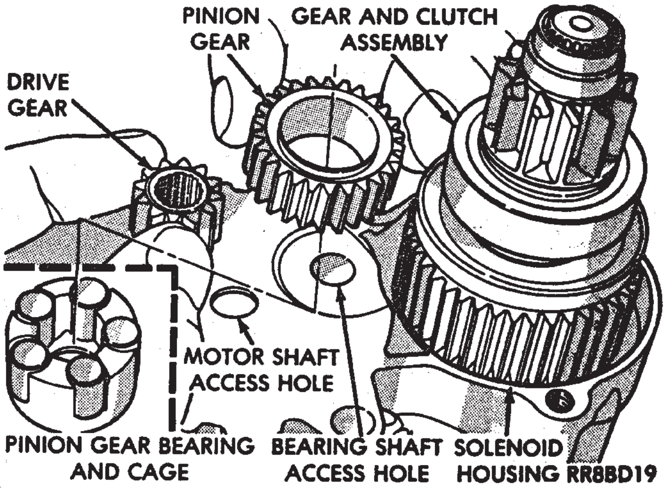


Fig. 11 Remove or Install Drive and Pinion Gears

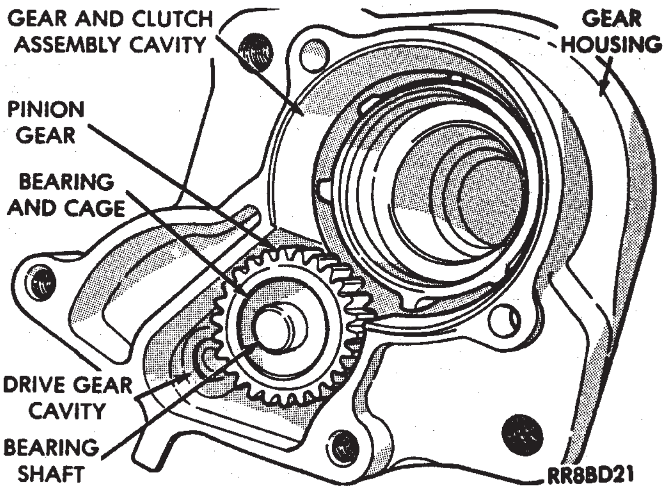


Fig. 12 Lubricate and Install Pinion Gear Bearing

(4) Remove three solenoid mounting screws (Fig. 17).

(5) Remove the solenoid from the starter assembly.

(6) For installation, reverse above procedures.

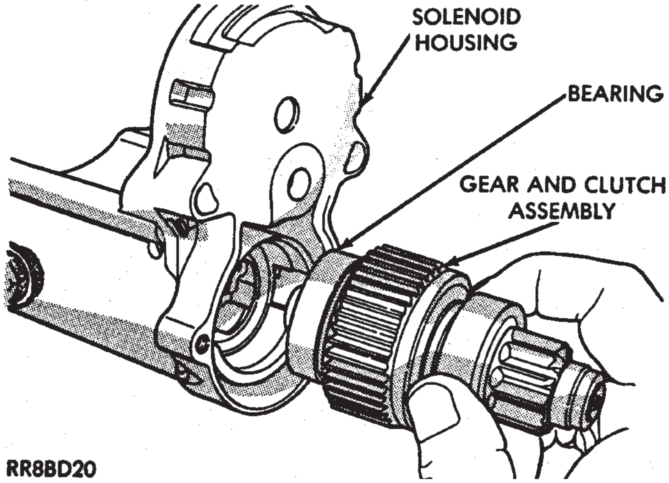


Fig. 13 Gear and Clutch Assembly

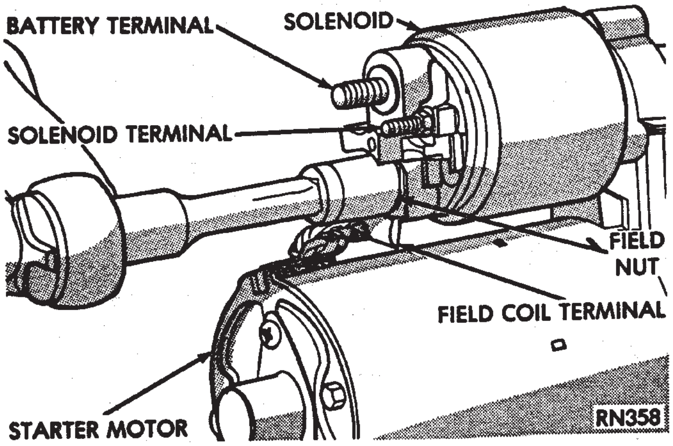


Fig. 14 Field Terminal Nut

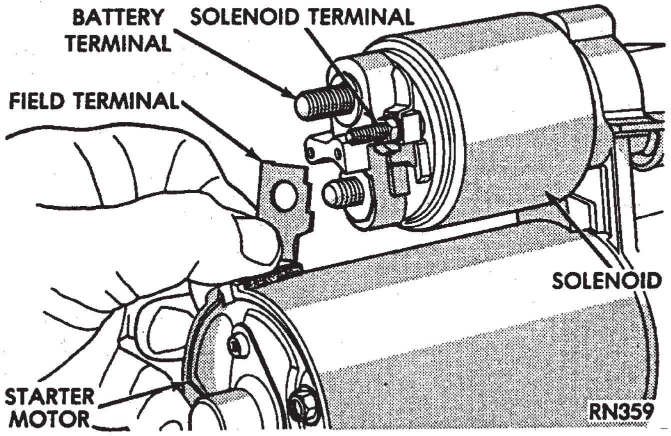


Fig. 15 Field Coil Terminal

BOSCH STARTER GEAR AND CLUTCH REPLACEMENT

(1) Remove solenoid assembly (Fig. 18).

(2) Remove the two through-bolts securing the starter drive end housing to the motor housing (Fig. 19) and separate housings.

(3) Remove rubber seal (Fig. 20).

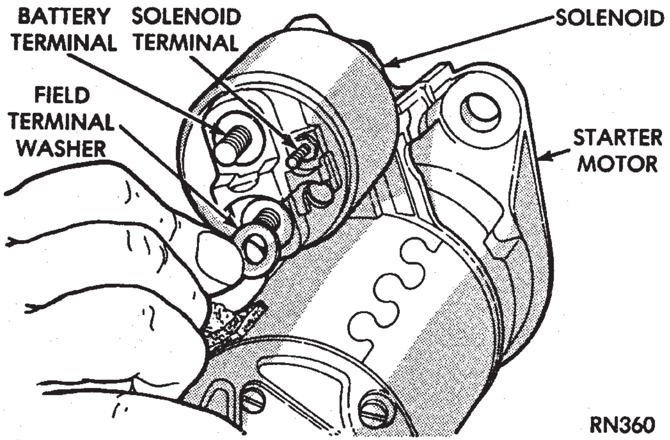


Fig. 16 Field Terminal Washer

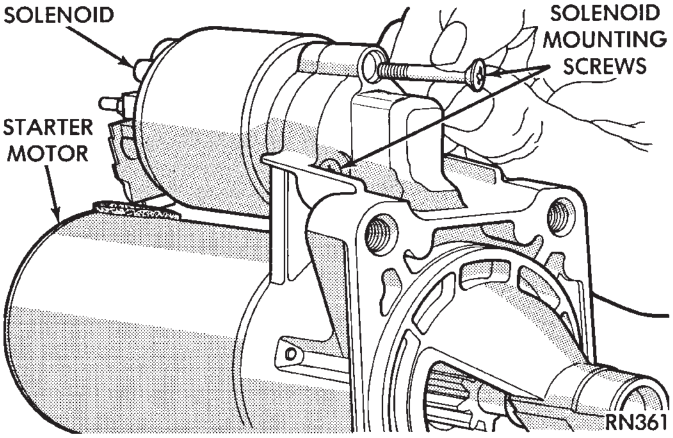


Fig. 17 Solenoid Mounting Screws

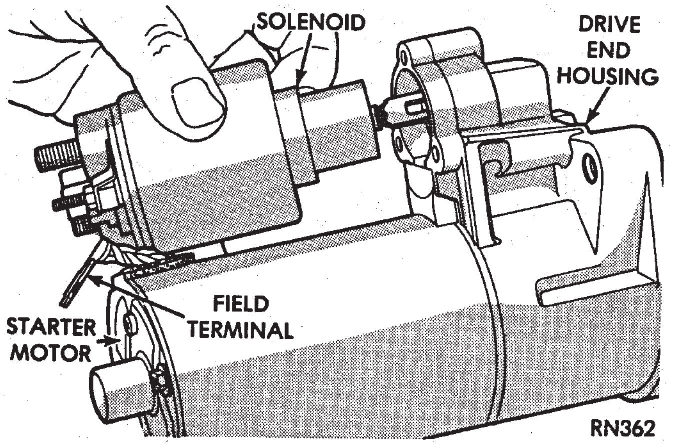


Fig. 18 Solenoid

(4) Pull the gear and clutch assembly from the drive end housing (Fig. 21).

(5) For installation, reverse above procedures.

STARTER INTERLOCK SWITCH: CLUTCH PEDAL MOUNTED/MANUAL TRANSMISSION ONLY

For electrical diagnostics, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics, Starter relays.

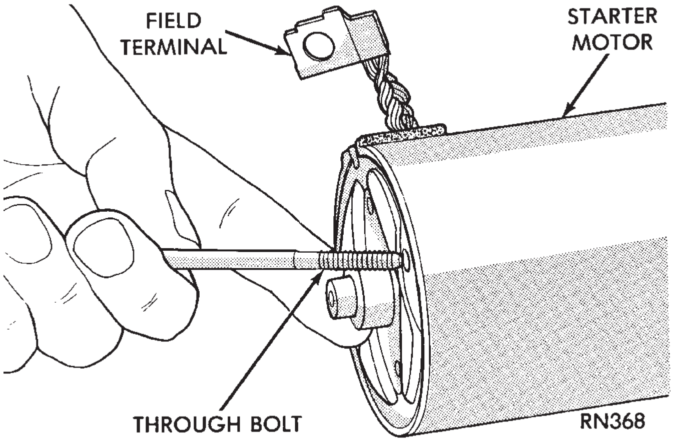


Fig. 19 Through-Bolt

For replacement and adjustment of this switch, refer to Group 6, Manual Transaxle Clutch, Manual Transaxle Starter Interlock Switch.

NEUTRAL STARTER AND BACK-UP SWITCH

For electrical diagnostics when checking the starter circuits, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics, Starter Relays.

For removal and installation of neutral switch, refer to Group 21, Transaxle Neutral Starter and Back-up Switch Replacement.

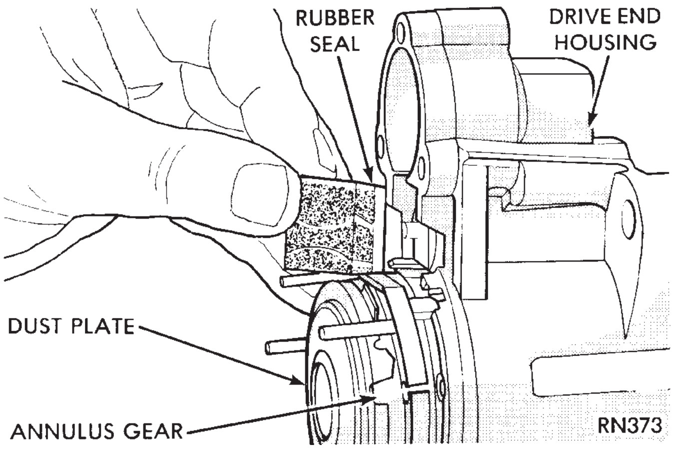


Fig. 20 Rubber Seal

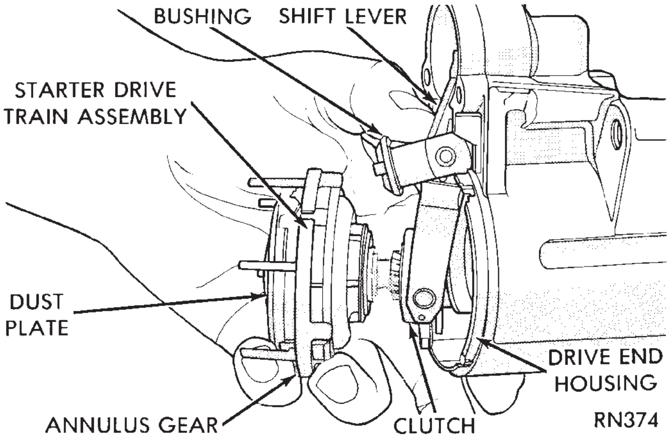


Fig. 21 Starter Drive Gear Train

GENERATOR

INDEX

GENERAL INFORMATION

This section will cover generator removal and installation only. Information covering generator on-vehicle testing and diagnosis can be found in Group 8A, Battery/Starting/Charging Systems Diagnostics. To identify the generator, refer to the Generator Specification chart at the rear of this section.

These generators are not intended to be disassembled for service. It must be replaced as an assembly.

GENERATOR REPLACEMENT—2.2L/2.5L ENGINE

Removal and repositioning of A/C compressor (without disconnecting refrigerant lines) is necessary on some models to gain access to generator.

(1) Disconnect battery negative cable (Fig. 1).

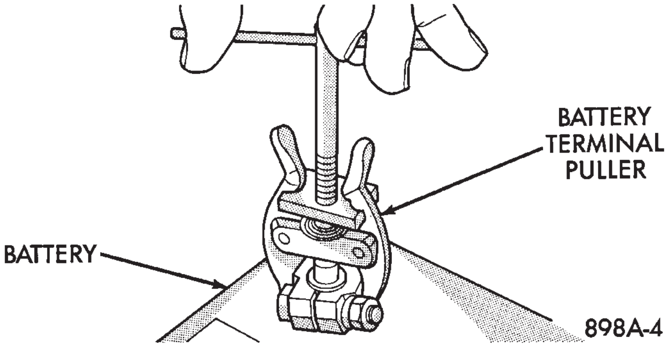


Fig. 1 Remove Battery Negative (-) Cable

(2) If Equipped With Air Conditioning:

(a) Remove the A/C drive belt. Refer to Group 7, Cooling System.

(b) Remove the four bolts retaining the A/C compressor to the mounting bracket (Fig. 2).

(c) Without disconnecting the A/C refrigerant lines, position the A/C compressor to allow generator removal.

WARNING: THE A/C REFRIGERANT SYSTEM IS UNDER PRESSURE EVEN WHEN THE ENGINE IS OFF. REFER TO THE SAFETY PRECAUTIONS AND WARNINGS SECTION IN HEATING AND A/C, GROUP 24, BEFORE PERFORMING ANY SERVICE OPERATION.

(3) Remove the generator drive belt. Refer to Group 7, Cooling System.

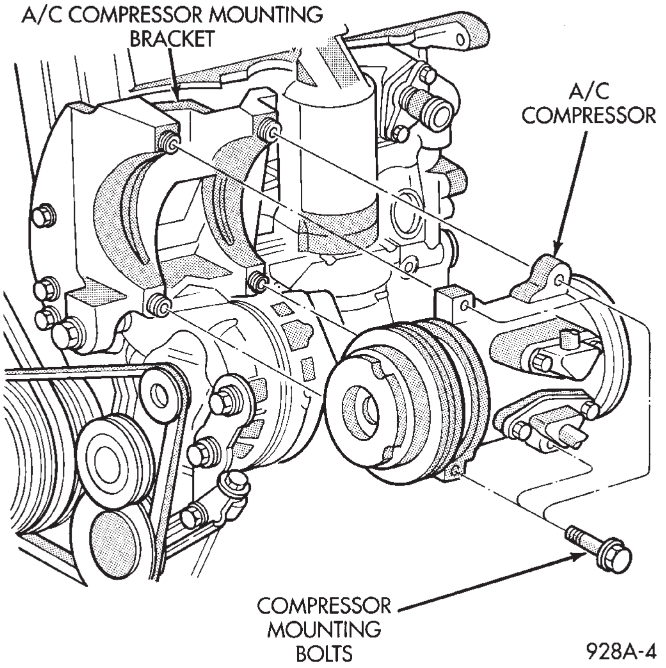


Fig. 2 A/C Compressor Replacement—2.2 L/2.5 L Engine

(4) Remove the two generator mounting bolts (Fig. 3) and position the generator to gain access to all the wire connectors. If equipped with:

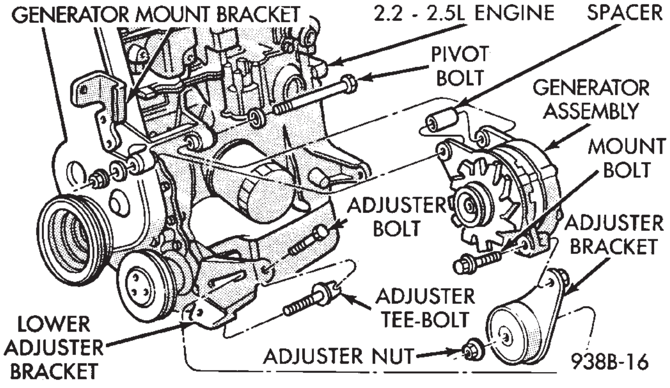


Fig. 3 Remove/Install Generator

- BOSCH GENERATOR: Remove B+ terminal nut, field terminal nuts, and ground harness hold down nuts (Fig. 4). Remove wire connector assembly.
- NIPPONDENSO GENERATOR: Remove nuts from field terminals, ground terminal, wire harness

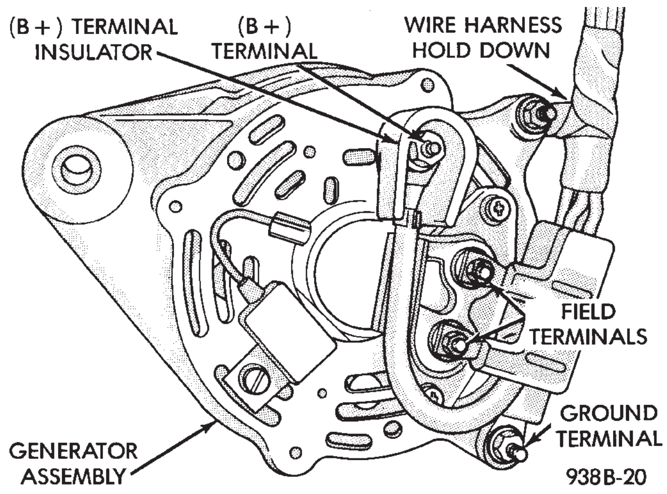


Fig. 4 Remove or Install Wire Connector Assembly—Bosch Generator

and B+ terminal (Fig. 5). B+ terminal nut must be removed last to prevent damage to terminal insulator.

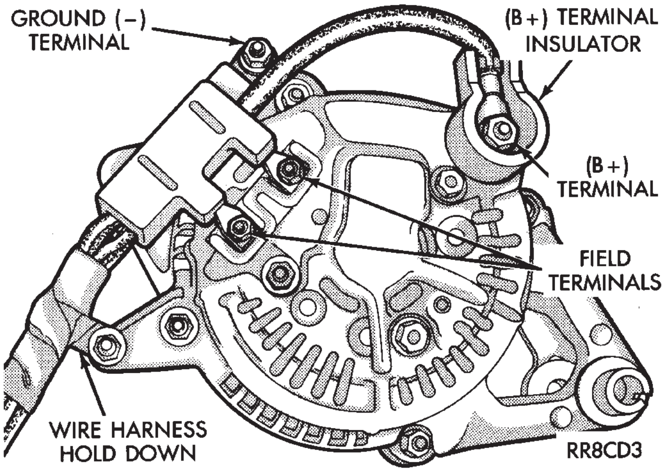


Fig. 5 Remove or Install Wire Connector Assembly—Nippondenso Generator

(5) Remove the generator from the vehicle.

(6) For installation, reverse above procedures. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart at the rear of this group.

GENERATOR REPLACEMENT—2.2L TURBO ENGINE (WITH 16 VALVE CYLINDER HEAD)

(1) Disconnect battery NEGATIVE cable (Fig. 1).

(2) Remove generator/air conditioning drive belt. Refer to Group 7, Cooling System.

(3) Remove the bolts retaining the A/C compressor to the mounting bracket.

(4) Without disconnecting the A/C refrigerant lines, position the A/C compressor to allow generator removal.

WARNING: THE A/C REFRIGERANT SYSTEM IS UNDER PRESSURE EVEN WHEN THE ENGINE IS OFF. REFER TO THE SAFETY PRECAUTIONS AND WARNINGS SECTION IN HEATING AND A/C, GROUP 24, BEFORE PERFORMING ANY SERVICE OPERATION.

(5) Remove the generator mounting bracket bolts and separate generator from mounting bracket (Fig. 6).

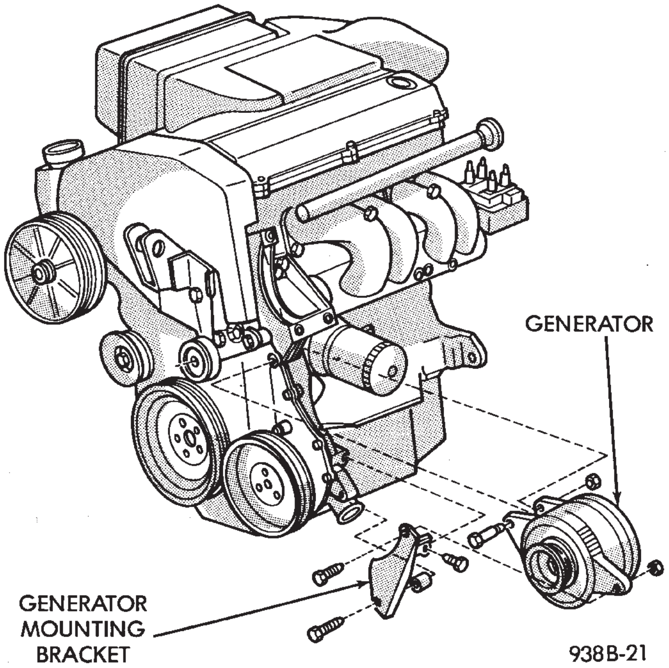


Fig. 6 Generator Mounting—2.2 L Turbo Engine With 16 Valve Cylinder Head

(6) Remove the B+ terminal nut, field terminal nuts, and ground/wire harness hold-down nuts. Remove wire connectors.

(7) Remove the generator from the vehicle.

(8) For installation, reverse above procedures. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart at the rear of this group.

GENERATOR REPLACEMENT—3.0L ENGINE

(1) Disconnect battery negative cable (Fig. 1).

(2) Remove generator drive belt. Refer to Group 7, Cooling System.

(3) Remove the generator mounting bolts and separate the generator from the mounting bracket (Fig. 7).

(4) Remove the B+ terminal nut, field terminal nuts, and ground/wire harness hold-down nuts. Remove wire connectors.

(5) Remove the generator from the vehicle.

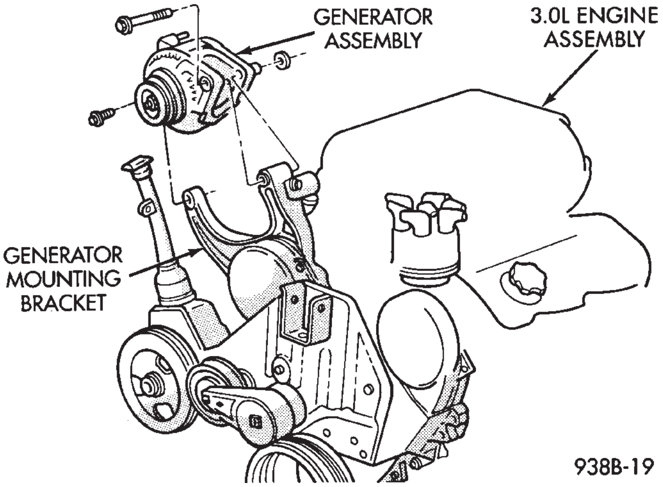


Fig. 7 Remove or Install Generator Mounting Bolts—3.0L Engine

(6) For installation, reverse above procedure. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart at the rear of this group.

GENERATOR REPLACEMENT—3.3L/3.8L ENGINE

(1) Disconnect battery negative cable (Fig. 1).

(2) Remove generator drive belt. Refer to Group 7, Cooling System.

(3) Loosen, but do not remove the nut on the support bracket at exhaust manifold (Fig. 8).

(4) Remove the generator tensioner power steering bracket bolt.

(5) Remove the tensioner stud nut and the tensioner (Fig. 9).

(6) Remove the generator mounting bolts (Fig. 9).

(7) Remove the power steering reservoir from the generator mounting bracket.

(8) Remove the three generator support bracket bolts (Fig. 8).

(9) Remove intake plenum to generator mounting bracket bolt.

(10) Remove generator support bracket (Fig. 9).

(11) Position the generator to gain access to wiring and remove wiring from generator.

(12) Remove generator.

(13) For installation, reverse above procedures. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart at the rear of this group.

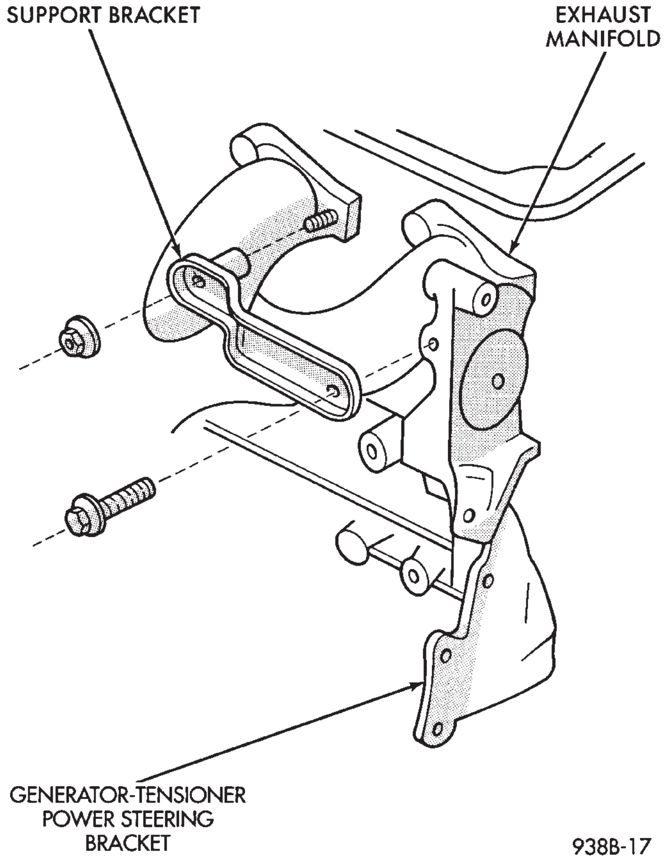


Fig. 8 Support Bracket

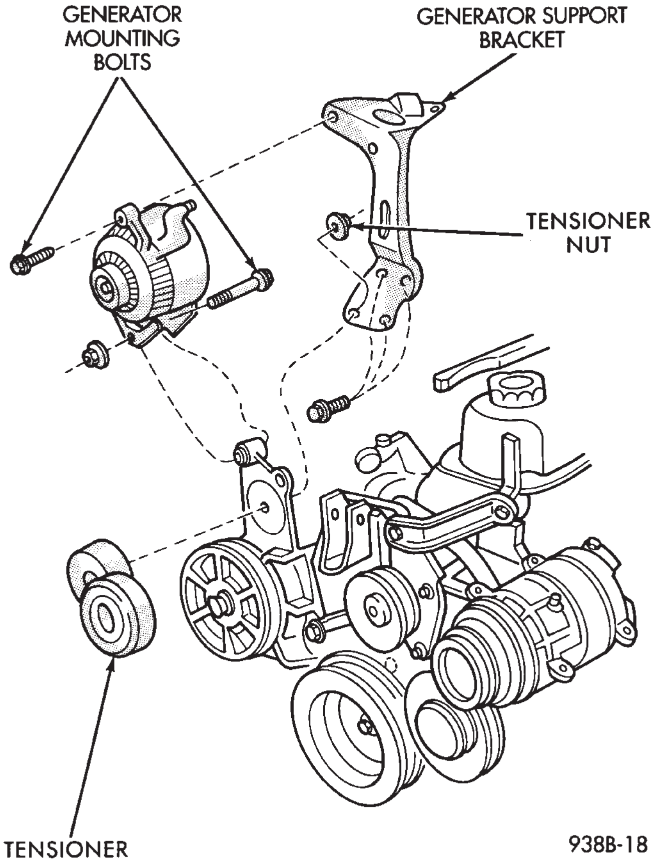


Fig. 9 Generator/Generator Support Bracket—3.3L/ 3.8L Engine

SPECIFICATIONS

STARTER/BATTERY

STARTER

Manufacturer	Nippondenso		Bosch	
Engine Application	3.0L/3.8L	3.3L	3.0L	2.2-2.5L
Part Number and Power Rating	1.4 Kw	1.2 Kw	1.1 Kw	1.1 Kw
Voltage	12	12	12	12
No. of Fields	4	4	Permanent Magnet	
No. of Poles	4	4	6	6
Brushes	4	4	4	4
Drive	Conventional Gear Train	Conventional Gear Train	Planetary Gear Train	Planetary Gear Train
Free Running Test Voltage Amperage Draw Minimum Speed RPM	 11 73 Amps 3601 RPM	 11 73 Amps 3401 RPM	 11 73 Amps 3473 RPM	 11 69 Amps 3447 RPM
Solenoid Closing Voltage	7.5 Volts	7.5 Volts	7.5 Volts	7.5 Volts
Cranking Amperage Draw Test	150-220 Amps*	150-200 Amps*	150-220 Amps*	

*Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

BATTERY

Load Test (Amps)	Cold Cranking Rating @ 0°F	Reserve Capacity
200 Amp	500 Amp	110 Minutes
250 Amp	600 Amp	120 Minutes
315 Amp	685 Amp	125 Minutes

CRANKING RATING is the current a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

RESERVE CAPACITY RATING is 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).

928A-10

GENERATOR AMPERAGE/IDENTIFICATION NUMBERS

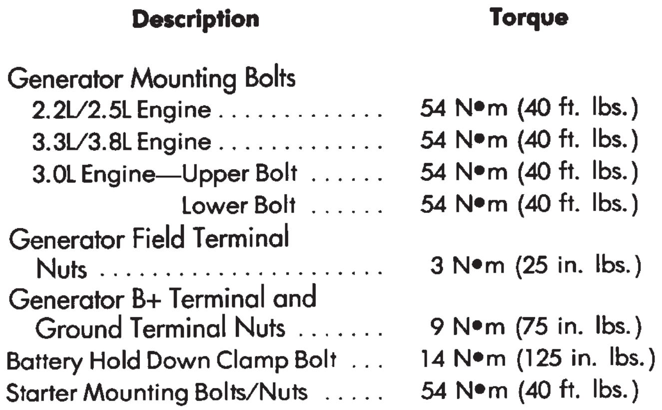
Type	**Case I.D. Tag Number	Pulley Grooves	Engine Usage	*Amperage Output
Bosch 90 HS	4557431	4	2.2L-2.5L	84 AMP
Bosch 90 HS	4557432	6	3.0L	86 AMP
Denso 75 HS	4557301	4	2.2L	68 AMP
Denso 90 HS	5234031	4	2.2L-2.5L	86 AMP
Denso 90 HS	5234032	6	3.0L-3.3L-3.8L	90 AMP
Denso 120 HS	5234033	6	3.0L-3.3L-3.8L	102 AMP

*With Generator Full Fielded at 1250 RPM

**Case I.D. Tag Number is Located on Bottom of Generator Case

938A-87

TORQUE SPECIFICATIONS



Description	Torque
Generator Mounting Bolts	
2.2L/2.5L Engine	54 N•m (40 ft. lbs.)
3.3L/3.8L Engine	54 N•m (40 ft. lbs.)
3.0L Engine—Upper Bolt	54 N•m (40 ft. lbs.)
Lower Bolt	54 N•m (40 ft. lbs.)
Generator Field Terminal Nuts	3 N•m (25 in. lbs.)
Generator B+ Terminal and Ground Terminal Nuts	9 N•m (75 in. lbs.)
Battery Hold Down Clamp Bolt	14 N•m (125 in. lbs.)
Starter Mounting Bolts/Nuts	54 N•m (40 ft. lbs.)

938A-88

OVERHEAD CONSOLE

CONTENTS

GENERAL INFORMATION

AA BODY

INDEX

MAP READING LAMPS

The map reading and rear passenger lamps are turned on and off by pressing their individual switch marked LAMP. These same lamps also serve as courtesy lamps whenever a door is opened, the illuminated entry system is activated, or the headlamp switch is turned fully clockwise.

LAMP REPLACEMENT

(1) Remove lens by inserting a large paper clip or wire, with a hook on the end, into the hole in the lens and pull downward (Fig. 1).

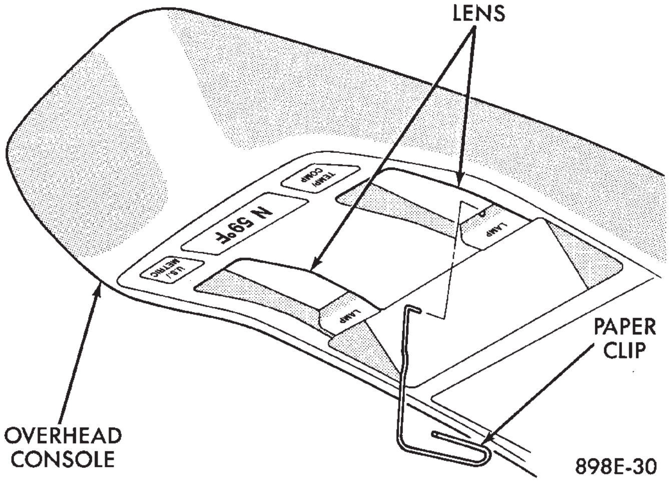


Fig. 1 Overhead Console Lens Removal

(2) Remove lamp by pulling firmly toward front of vehicle.

(3) Install new lamp by pushing firmly into receptacle.

(4) Snap lens into position taking care to orient the tabs on the lens with the slots in the housing and snap into position.

LAMP TEST

(1) Close vehicle doors.

(2) Press each lamp switch button (Fig.2). Right hand button should light passenger side lamp and left hand button should light drivers side lamp front or rear.

(3) If any of the lamps fail to illuminate, open vehicle doors:

(a) If lamp does not illuminate check for a burned out lamp. If lamp is OK, check fuse and wire connectors.

(b) If lamp illuminates when doors are open check switch.

THERMOMETER AND COMPASS OPERATION

The ignition switch must be in the ON or ACCESSORY position before the temperature and compass reading can be displayed. The Comp/Temp switch, located left of the display module, turns the display on and off. The US/Metric switch, located right of the display, changes the temperature reading from Fahrenheit to Celsius. Should the compass blank out and the CAL symbol only light, demagnetizing may be necessary.

The compass is a flux-gate system which, is integral to the console. The temperature readout is connected to a thermistor sensor which, located on the front lower radiator closure panel.

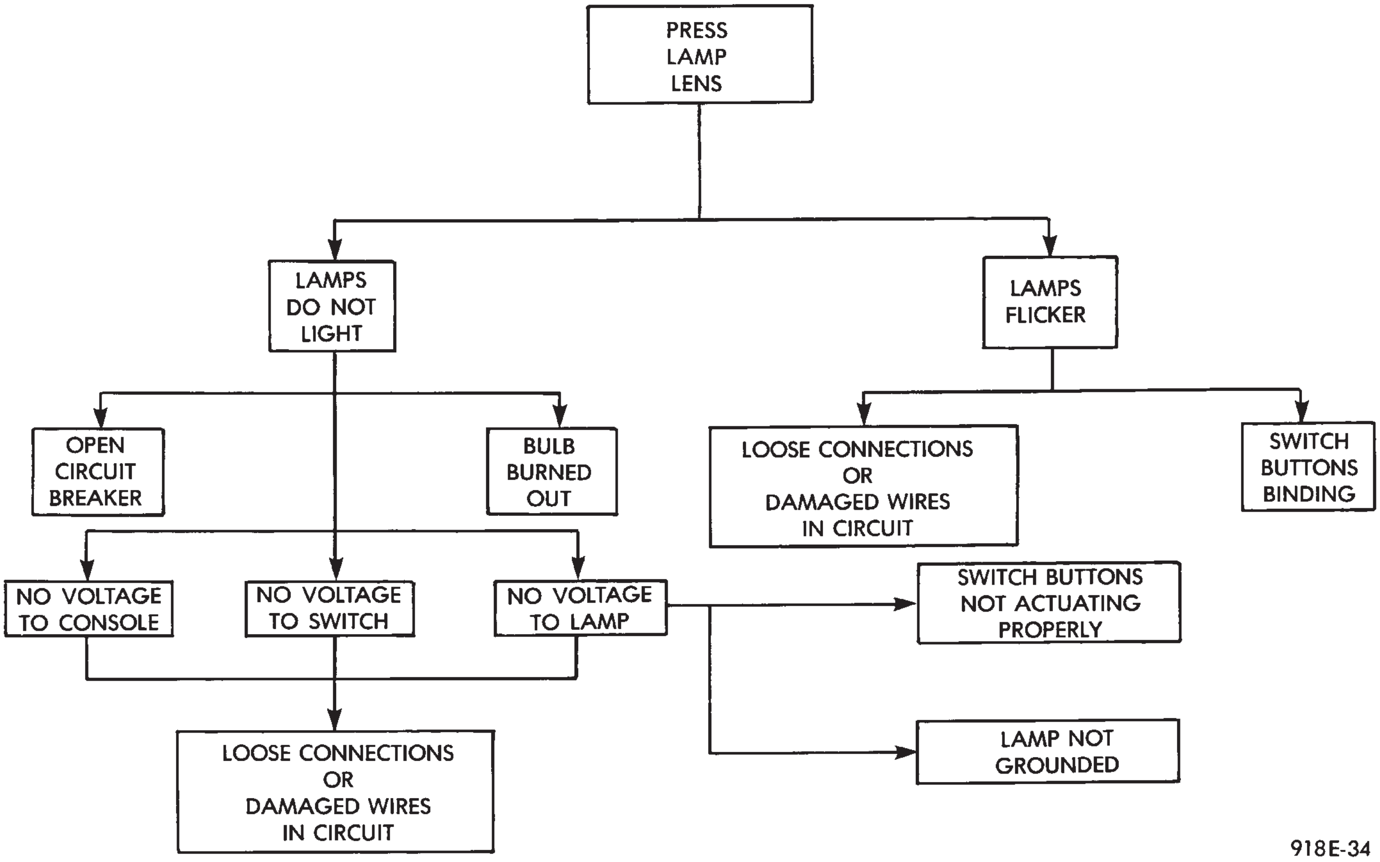


Fig. 2 Map Lamp Diagnosis

When the vehicle is standing still, engine compartment temperature may be radiated to the temperature sensor. Therefore the most accurate ambient temperature readings are displayed when the vehicle is moving in a forward motion.

When the ignition switch is turned off the last displayed temperature reading stays in memory. When the ignition switch is turned on again the thermometer will display the memory temperature for 1 minute; then update the display to the actual temperature within 5 minutes. Refer to Compass and Thermometer Diagnosis (Fig. 3).

COMPASS CALIBRATION

The compass unit automatically calibrates itself as the vehicle is driven; therefore, no calibration should be required. When the compass is first powered up, the CAL light on the display should be on. The CAL light will go off and the compass will be accurate after the vehicle completes one to three complete circles.

Do not attempt to set the compass near large metal objects, such as, other vehicles, large buildings, or bridges.

If the vehicle's compass headings are inaccurate, the compass also can be manually calibrated using the following procedures:

(1) Depress and hold down both the Comp/Temp button and the U.S./Metric button.

(2) The display will go off and after 5 seconds the VAR light will come on. Continue to hold both buttons down.

(3) In approximately 10 seconds, the CAL light will come on. Release both buttons and the display will show the heading and outside temperature.

(4) Release buttons the CAL light will then go off, showing the compass is calibrated.

(5) The variation may need to be adjusted. The variation is the difference between magnetic north and true north. To set variation refer the to Variation Setting Procedure.

If the compass portion of the display is not lit or compass readings are not accurate after calibration. The vehicle may have too much magnetism for the compass to be accurate or the compass circuitry is not working properly. Refer to Variance Procedure, Demagnetizing Procedure and/or Compass Diagnostics.

VARIANCE

Variance is the difference between magnetic North and geographic North. In some areas the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this occurs, the variance must be set.

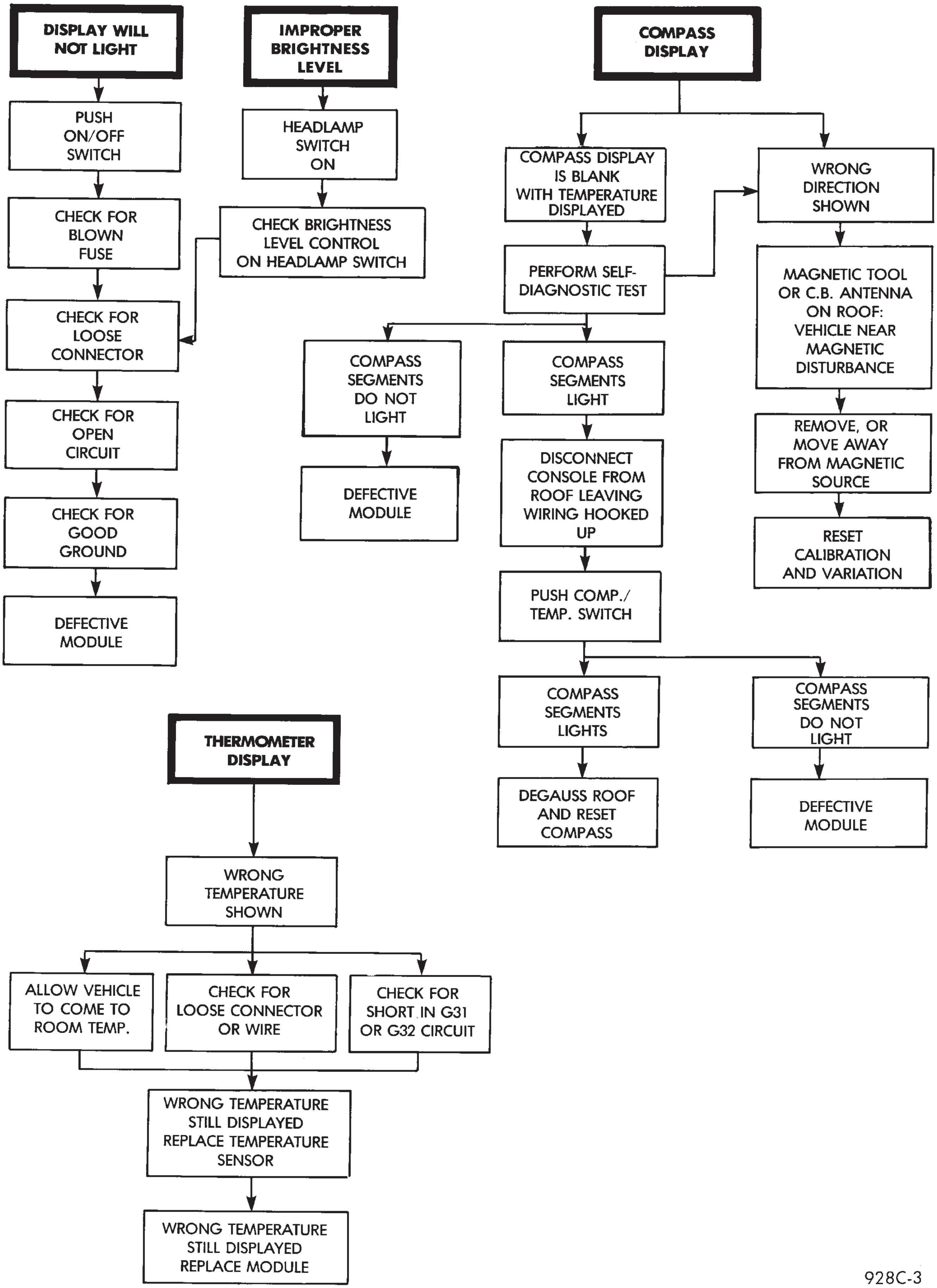


Fig. 3 Compass and Thermometer Diagnosis

VARIANCE SETTING PROCEDURE

There are two methods for setting variance while in variance set mode. If the CAL symbol is on procedure 2 must be used.

PROCEDURE 1

(1) Turn ignition switch to the on position.

(2) Press and hold the Comp/Temp button till the display is turned OFF.

(3) While continuing to hold Comp/Temp button depress and hold US/Metric button until the VAR symbol lights in approximately 5 seconds.

(4) Release buttons.

(5) To determine the zone number which, corresponds with your geographic area refer to Fig. 4.

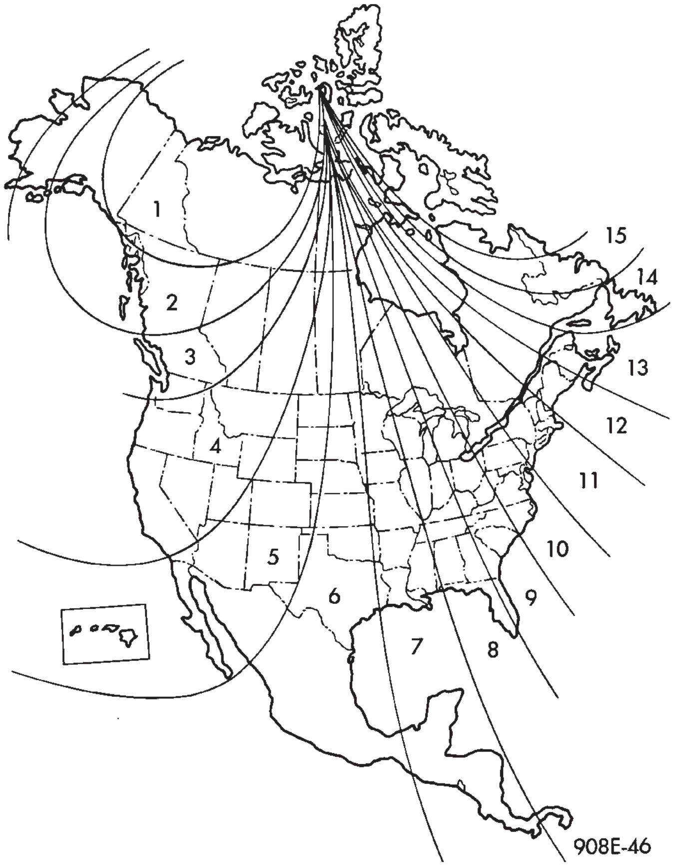


Fig. 4 Variance Settings

(6) Press the US/Metric button until the zone number matches the display.

(7) Press the Comp/Temp button to finish setting of variation.

(8) Variation is complete.

PROCEDURE 2

(1) Move away from any large metal objects like buildings, or bridges. With the engine running and the doors closed point vehicle true north.

(2) Press and hold Comp/Temp button. The display will go blank.

(3) While continuing to hold Comp/Temp button depress and hold the US/Metric button until the VAR symbol lights in approximately 5 seconds.

(4) Release buttons.

(5) Press the Comp/Temp button to finish setting of variation.

(6) Variation is complete.

DEMAGNETIZING PROCEDURE

Do not attach magnetic devices, such as magnetic CB antennas to the vehicle roof, as they can cause the compass to give false readings.

Every vehicle has its own magnetic field. This magnetic field is created by the various processes a steel roof goes through when the vehicle is built. A magnetic field also can be created if the roof is subjected to A magnet, example:

- Magnetic c.b. antenna
- Magnetic tipped screwdriver and etc.

If the roof becomes magnetized use a demagnetizing Tool 6029 to demagnetize the roof.

In this demagnetizing procedure you will use the demagnetizing tool to 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 degaussing of the roof panel.

(1) Be sure the ignition switch is in the OFF position before you begin the demagnetizing procedure.

(2) Open the sun glass compartment to gain access to the overhead console mounting screws.

(3) 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.

(4) Slowly approach the console mounting screw with the plastic coated tip of the tool for at least 2 seconds.

(5) 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.

(6) After you have pulled at least 12 inches from the last screw, remove the demagnetizing tool from inside of the vehicle and disconnect it from the electrical outlet.

(7) Place an 8 1/2 in. X 11 in. 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 2 feet away from the compass unit.

(9) Slowly approach the center of the roof panel at the windshield with the demagnetizing tool plugged in.

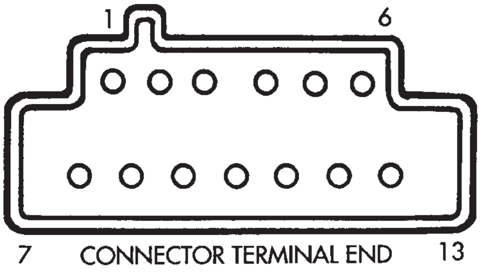
- Contact the roof panel with the tip of the tool.
- Using slow sweeping motions of 1/2 inch between sweeps
- Move the tool approximately 4 inches either side of the centerline, and at least 11 inches back from the windshield.

(10) 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.

(11) Recalibrate compass.

COMPASS DIAGNOSTICS

To place the unit into the diagnostics mode, turn the vehicle ignition off. Depress the Comp/Temp button while turning on the ignition/run switch. The display will then show DO. There are three tests that can be performed when in the diagnostics mode. Press the U.S./Metric button to choose test desired (Fig. 5).



1	BLANK	8	DIM ON/OFF
2	COMPASS GROUND	9	BLANK
3	BLANK	10	TEMPERATURE RETURN
4	MAP LAMP GROUND	11	TEMPERATURE SENSOR
5	PANEL SWITCH	12	COURTESY
6	BATTERY	13	IGNITION
7	DIM PANEL		

938C-11

Fig. 5 Terminal Identification

Test 1 (d1) determines the magnetic field strength at the compass. The compass displays compensation numbers which, correspond to the current magnetic field strength at the compass. The letter N is displayed in the compass portion of the display. While a number which, corresponds to the magnetic field strength in the North/South direction is displayed. The temperature portion of the display or the letter W is displayed in the compass portion of the display. A number which, corresponds to the magnetic field strength in the East/West direction is displayed in the temperature portion of the display. For proper compass operation the numbers should be between 1 and 14. A number of 7 or 8 is ideal (no vehicle magnetism) while numbers approaching 1 or 14 show that the vehicle is highly magnetic. If the numbers show that the vehicle is highly magnetic, perform the demagnetized procedure in this Group and retest for magnetism at compass.

Test 2 (d2) checks the electronic circuits of the compass, temperature. If the test passes d2 will be displayed, and if the test fails F2 will be displayed. Refer to Body Diagnostic Procedure Manual for further testing procedures.

Test 3 (d3) performs a walking segment test which, sequentially puts different directions and numbers on the display. If any segment fails, replace the compass module.

SELF-DIAGNOSTIC TEST

(1) With the ignition switch in the OFF position simultaneously press the Comp/Temp button and the US/Metric button.

(2) Turn ignition switch ON.

(3) Continue to hold both buttons until the display performs a walking segment test. This checks for open or shorted segments. To repeat the test press the Comp/Temp button.

(4) Press the US/Metric button, all segments will light for about 2 seconds. To repeat the test press the Comp/Temp button.

(5) Press the US/Metric button to return to normal operation.

OVERHEAD CONSOLE REPLACEMENT

(1) Unscrew the mounting screw in sun glass bin compartment (Fig. 6).

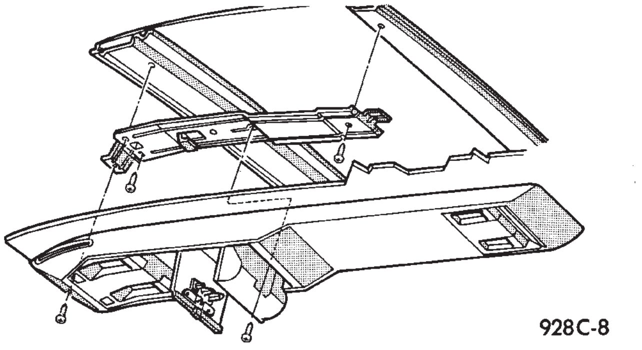


Fig. 6 Overhead Console Mounting

(2) Slide console forward toward windshield until the console unhooks from roof bracket.

(3) Disconnect wire harness from console.

(4) For installation reverse above procedures.

COMPASS MODULE REPLACEMENT

(1) Remove overhead console.

(2) Using a small screwdriver, release the 2 snaps at rear of compass module.

(3) After releasing the 2 snaps, slide compass module rearward until free of mounting bar.

(4) For installation reverse above procedures.

AMBIENT TEMPERATURE SENSOR

(1) Raise and support vehicle on safety stands.

(2) From behind front bumper fascia, remove screw attaching sensor to front lower crossmember (Fig. 7).

(3) For installation, reverse above procedures.

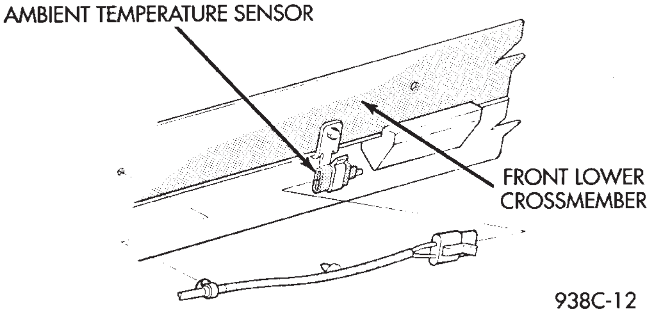


Fig. 7 Ambient Temperature Sensor

AC AND AY BODY

INDEX

ELECTRONIC VEHICLE INFORMATION CENTER (EVIC) OVERHEAD CONSOLE

The Electronic Vehicle Information Center is a computer controlled warning system which, monitors various sensors used on the vehicle. The system supplements the warning indicators in ′the instrument cluster. Visual warning messages are displayed by a digital display in the overhead console (Fig. 1).

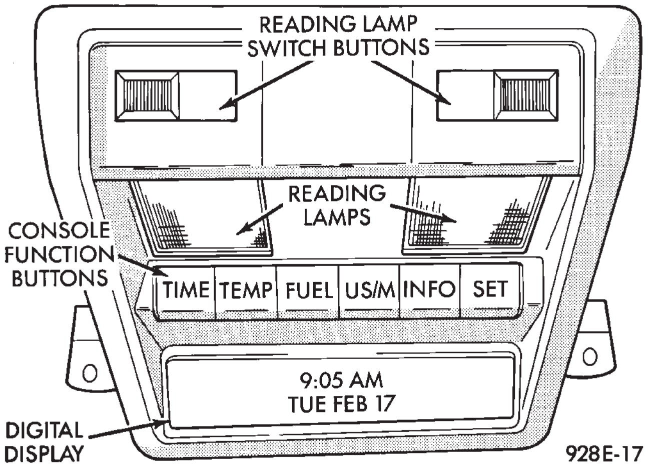


Fig. 1 EVIC Overhead Console

When a warning message has been activated, a tone will sound to attract the driver's attention. The warning message will then be displayed on the overhead console until the condition is corrected or a new display function is called up. A tone will announce each new warning condition.

For complete diagnostic procedures for the EVIC systems, refer to the Body-Chassis Diagnostic Test Procedures Manual.

The EVIC has a 24 function system that provides the driver with visual messages when a warning condition exists. These messages are displayed on the overhead console.

For complete EVIC overhead console operating instructions, refer to the Owners Manual provided with the vehicle.

EVIC BUTTON FUNCTIONS

TIME button will display:

- Time of day
- Day of week
- Day of month
- Month of year

The body controller is the source of this information. The EVIC function buttons are used to reset and display this data.

- To set HOURS, press TIME button and within four seconds press the SET button. An arrow will appear on the display and point to the hours. Press and hold the SET button to advance the hours or INFO button to set back the hours.
- To set MINUTES, press TIME button. The arrow will point to the minutes. Press and hold the SET button to advance the minutes or INFO button to set back the minutes.

- To set DAY of WEEK, press TIME button. An arrow will appear on the display and point to the Day. Press and hold the SET button to move the day forward or INFO button to move it backward.
- To set DAY of MONTH, press TIME button. The arrow will point to Date. Press and hold the SET button to advance the date or INFO button to move it backwards.
- To set MONTH of YEAR, press TIME button. The arrow will point to the Month. Press and hold the SET button to advance the Month forward or INFO button to move backward.

TEMP button, pressing the Temp button will display:

- The temperature outside the vehicle
- Vehicle direction define by an eight point compass

If Compass has lost calibration or not receiving good information from the engine compartment node, an asterisk (*) will flash on the display and the word calibrate will appear. Refer to Compass Calibration.

FUEL BUTTON, WILL DISPLAY:

- Pressing FUEL button the first time will show, the estimated number of miles that can be driven with the remaining fuel. The destination to empty indication will vary every few seconds as the amount of fuel and fuel efficiency is calculated. This function can not be reset.
- Pressing the FUEL button second time; will display the fuel consumed.
- Pressing the FUEL button third time; will display the average fuel economy in miles per gallon since last reset. The display will be updated every 16 seconds.
- Pressing the FUEL button forth time, the current fuel economy will be displayed. The current fuel economy will be up updated every two seconds.
- To reset Fuel consumed, press SET button until the fuel consumed message is displayed and then within five seconds press SET button.
- To reset AVERAGE FUEL ECONOMY, press the FUEL button until average fuel economy is displayed and within five seconds press SET button.

TRIP RESET, press FUEL button and wait four seconds press the SET button twice. This clears all trip information and the message Trip Reset will be displayed. This will occur only if a reset function is currently being displayed. The reset functions:

- Fuel consumed
- Average fuel economy message

INFO button, will active a MONITORED SYSTEMS OK message on display if all monitored systems are operating properly. If a problem is detected, the appropriate message will be displayed.

SET button, will clear the various functions after they have been displayed. It is used to enter the clock set or compass variance modes. This button is also used to reset certain trip computer functions and the maintenance reminder message.

The EVIC display may be turned off by pressing the TIME and SET buttons at the same time. Pressing the buttons a second time will restore the display.

EVIC INFORMATION SOURCES

The EVIC monitors information provided by the body controller, engine compartment node and powertrain control module. Refer to Body Diagnostic Test Procedure Manual for test procedures.

The Body Controller is a micro-controller unit which, informs the EVIC overhead console via the CCD bus of:

- Time of day
- Day of week
- Day of month
- Month of year
- Fuel range
- Fuel consumed
- Fuel efficiency
- Warning messages as noted in Fig. 2

Warning Message	Sensor	Received From
Keys in Ignition	Key-In Switch	Body Controller
Exterior Lamps On	Headlamp Switch	Body Controller
Passenger Door Ajar	Right Front Door Ajar Switch	Body Controller
Driver Door Ajar	Left Front Door Ajar Switch	Body Controller
Trunk Ajar	Trunk Ajar Switch	Body Controller
Park Brake Engaged	Park Brake Switch	Body Controller
Right Rear Door Ajar	Right Rear Door Ajar Switch	Body Controller
Left Rear Door Ajar	Left Rear Door Ajar Switch	Body Controller
Low Oil Pressure	Oil Pressure Switch	Body Controller
Engine Temp High	Engine Temperature Sensor	Powertrain Control Module
Coolant Level Low	Coolant Level Switch	Engine Node
Low Fuel Level	Fuel Tank Sender	Body Controller
Low Brake Fluid	Brake Fluid Level Sensor	Engine Node
Washer Fluid Low	Washer Fluid Level Switch	Body Controller
Voltage Improper		Powertrain Control Module
Fasten Seat Belts	Seat Belt Switch	Body Controller
Check Engine Oil Level	Oil Level Switch	Engine Node
Headlamp Out	Lamp Outage Module	
Brake Lamp Out	Lamp Outage Module	
Tail Lamp Out	Lamp Outage Module	
Service Reminder		Body Controller
Turn Signal On	Flasher	Body Controller

938C-16

Fig. 2 EVIC Messages and Sensors

The Engine Compartment Node is a microcomputer controlled unit which, informs the EVIC overhead console via the CCD bus of:

- Outside temperature
- Compass direction

THE FOLLOWING ARE WARNING MESSAGES:

- Low brake fluid
- Low coolant level
- Low engine oil level

The powertrain control module is a microcomputer controlled unit which, informs the EVIC overhead console via the CCD bus of the following warning messages:

- Engine temperature high
- Voltage improper

VISUAL MESSAGES

Following are the visual messages and the conditions under which, the messages will be given:

- Keys in ignition
- Exterior lamps on

These messages will appear if the conditions are present and the driver's door is open while the ignition switch is in the OFF, LOCK, or ACC positions. A tone will sound until the condition is corrected or the door is closed.

- Passenger door ajar
- Driver door ajar
- Trunk ajar
- Park brake engaged
- Right rear door ajar
- Left rear door ajar

These messages will appear if a condition is detected after the vehicle is in motion. When the condition is corrected, a short tone will sound to acknowledge the action.

LOW OIL PRESSURE

If this message is displayed while the vehicle is at cruising speeds, immediate attention is required. If this message appears at idle speed, increase the idle speed and the message should go off. If the message remains on, immediate attention is required.

ENGINE TEMP CRITICAL

This message appears when a sensor has determined that the engine coolant is overheating. If this message comes on and stays on, immediate action is required.

COOLANT LEVEL LOW

LOW FUEL LEVEL

LOW BRAKE FLUID

WASHER FLUID LOW

These messages will appear if a continuous warning condition is detected while the engine is running. Inspection is required. To clear this message from the display, after the condition is corrected, the ignition switch must be turned OFF.

CHECK TRANS

This message will appear if a continuous warning condition is detected while the engine is running. Immediate attention is recommended. To clear this message from the display, after the condition has been corrected, the ignition switch must be turned OFF.

VOLTAGE IMPROPER

This message will appear if a continuous warning condition is detected. Immediate attention is required. To clear this message from the display, after the condition has been corrected, the ignition switch must be turned OFF.

TURN SIGNAL ON

This message will appear if the turn signal is left on while vehicle speed is over 15 mph and the vehicle has traveled over one-half mile.

FASTEN SEAT BELTS

An intermittent chime tone will sound for several seconds if the seat belt is not fastened.

CHK ENGINE OIL LEVEL

If this message is delivered, a check of the engine oil dipstick is suggested. To clear this message, after the condition is corrected, the ignition switch must be turned OFF.

HEADLAMP OUT

BRAKE LAMP OUT

TAIL LAMP OUT

These conditions are monitored only when the lamps are on. The message will remain, even after the lamp is replaced, until the lamp is turned on and operates.

SERVICE REMINDER

The maintenance reminder statement is programmed to provide general information only. Refer to Group 0, Lubrication & Maintenance for specific vehicle requirements.

The service reminder message is displayed at 7,500 miles or 12 months intervals, which ever comes first.

MONITORED SYSTEMS OK

If there is no warning condition to report, the message Monitored Systems OK is displayed (Fig. 2).

AUTOMATIC CALIBRATION SET PROCEDURE

The engine compartment node will continuously and automatically recalibrate the compass under normal driving conditions. As long as the vehicle is turning, the engine compartment node will record new compass data. This new data will be used to recalibrate the compass at a rate of at least once per full (360 degree) turn of the vehicle. Automatic calibration does not require operator interface.

MANUAL CALIBRATION SET PROCEDURE

Manual compass calibration has been replaced by automatic calibration set procedure. The manual calibration set procedure is available, but no longer serves any useful purpose.

EVIC SELF CHECK DIAGNOSTICS

Ignition switch ON, the EVIC not displaying any message, may imply a system failure and not an EVIC failure. Turn the ignition OFF, close all vehicle doors and wait at least 60 seconds before beginning test. Turn ignition switch to the ON position. Pressing the TEMP, FUEL and INFO buttons at the same time shall provide the visual message MODULE SELF CHECK for two seconds. Following at two second interval there will be messages:

- E2-0 SELF CHECK
- E3-0 SELF CHECK
- END OF SELF CHECK

Showing the microcomputer is working properly. When the self check mode and message shows:

- E2-1
- E3-2

This would show a fault exists in the EVIC's microcomputer and the EVIC should be replaced (Fig. 3).

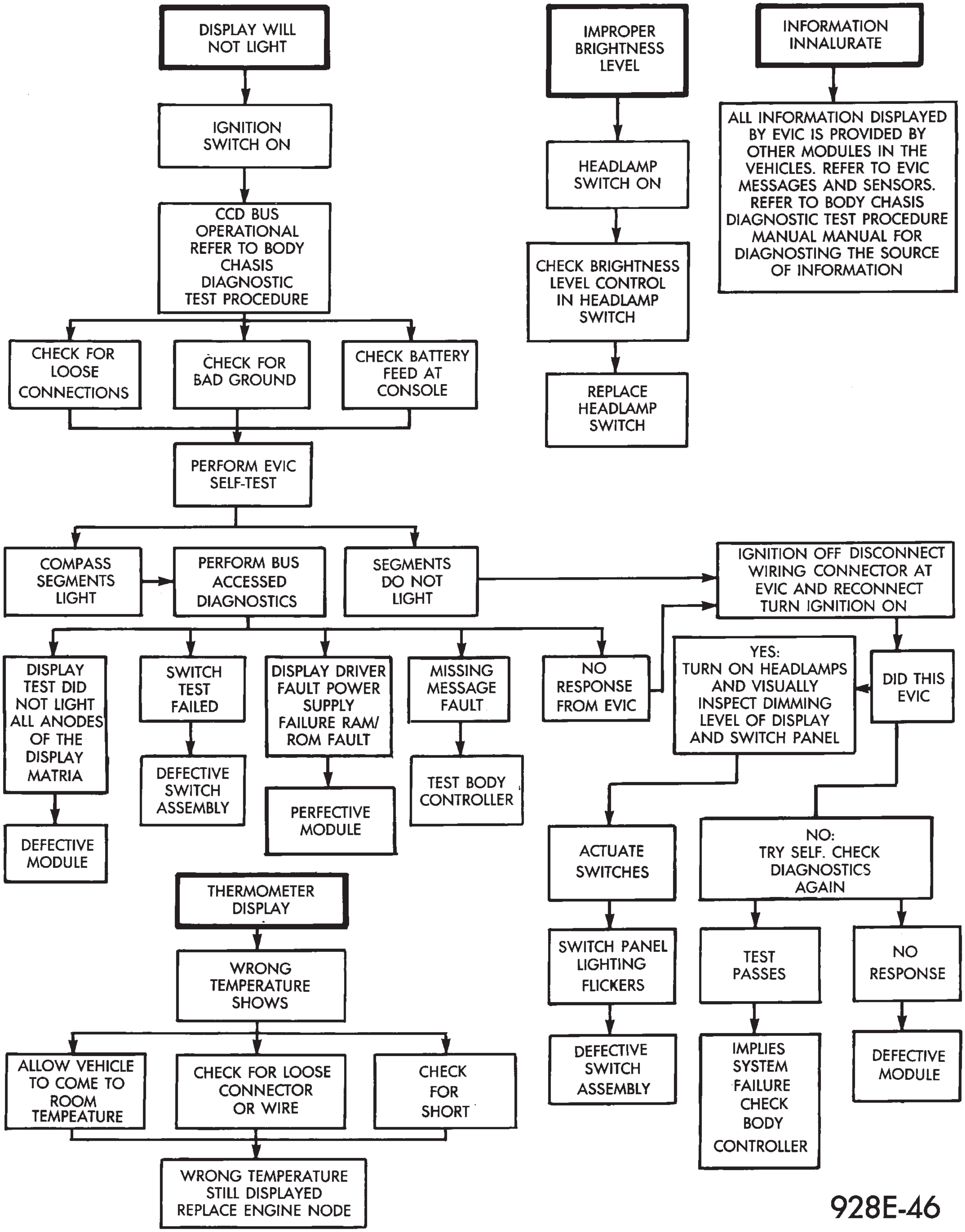


Fig. 3 Compass and Thermometer Diagnosis

BUS ACCESSED DIAGNOSTICS

The following diagnostic test may be used to check the integrity of the EVIC's internal connections and operations. Refer to the Body Chassis Diagnostic Test Procedure Manual for test procedures.

MODULE RESET TEST, when the EVIC receives this request from the DRB II, the EVIC will immediately enter into reset.

DISPLAY TEST: The EVIC receives a request from the DBR II, the EVIC will enter into a visual display mode. Also checks the integrity of the display driver to anode connections. The test shall consist of walking through the vertical and horizontal rows of anodes in the dot matrix display.

SWITCH STATUS TEST, when the EVIC receives this request from the DRB II, the EVIC will report the open/closed status of each individual switch.

FAULT BYTE TEST, when the EVIC receives this request from the DRB II, the EVIC will report fault status. Messages reported are:

- NO FAULT
- DISPLAY DRIVER FAULT
- EVIC MISSING MESSAGES
- POWER SUPPLY FAILURE
- FAULT IN RAM
- FAULT IN ROM

EVIC missing message implies that there may be a system failure and/or the body controller is not providing EVIC with sufficient information.

DISPLAY DRIVER FAULT, power supply failure and fault in RAM/ROM implies that the EVIC is defective.

CONSOLE REMOVAL

(1) Remove lenses (Fig. 4).

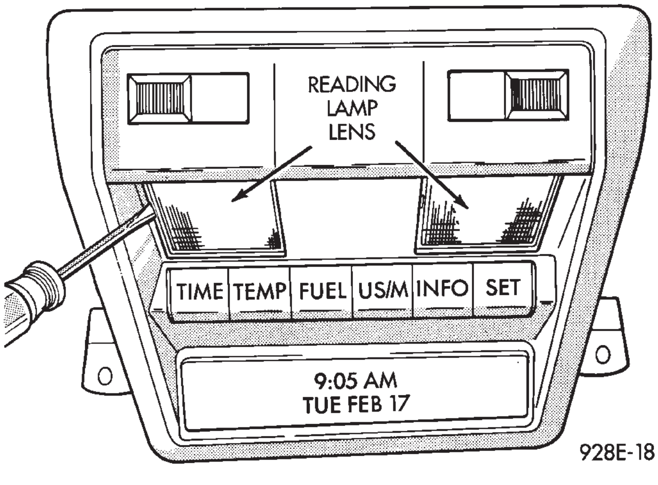


Fig. 4 EVIC Overhead Console Lens Removal

(2) Remove screws from visor tip-pin retainers.

(3) Remove screws in lens openings, after removing lamps.

(4) Remove console and disconnect wires.

(5) For installation reverse above procedures.

ELECTRONIC BOARD ASSEMBLY REPLACEMENT

(1) Remove console, refer to Console Replacement (Fig. 5).

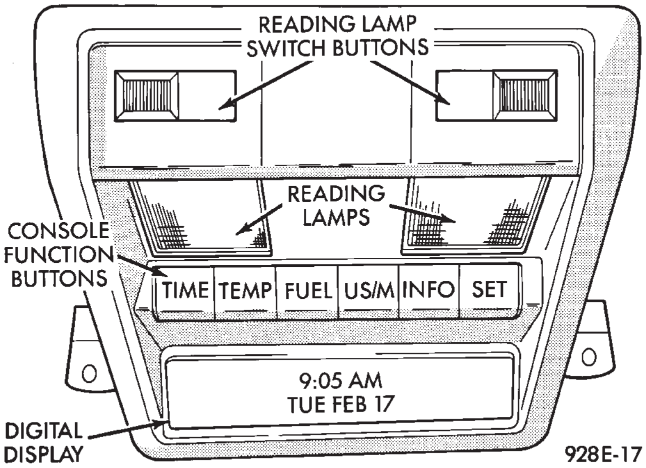


Fig. 5 EVIC Overhead Console

(2) Remove six mounting screws holding bezel to housing.

(3) Remove switch assembly by pulling down mounting tabs and swing assembly out of position.

(4) Disconnect switch wiring connector and replace electronic board assembly.

(5) For installation reverse above procedures.

BEZEL/BUTTON SWITCH REMOVAL

(1) Remove console, refer to Console Replacement.

(2) Remove six mounting screws holding bezel to housing.

(3) Remove switch assembly by pulling down mounting tabs and swing assembly out of position.

(4) Disconnect switch wiring connector and remove electronic board and switch assembly. Replace function button switch assembly. The buttons are not serviceable.

(5) For installation reverse above procedures.

WIRING HARNESS REMOVAL

(1) Remove console, refer to Console Replacement (Fig. 6).

(2) Disconnect wiring connector from retaining bracket.

(3) Remove screws, securing wiring to console housing.

(4) Remove push/slide switches. The reading lamp switch buttons are not serviceable.

(5) Remove lamp sockets from reflector bracket.

(6) Remove wiring.

(7) For installation reverse above procedures.

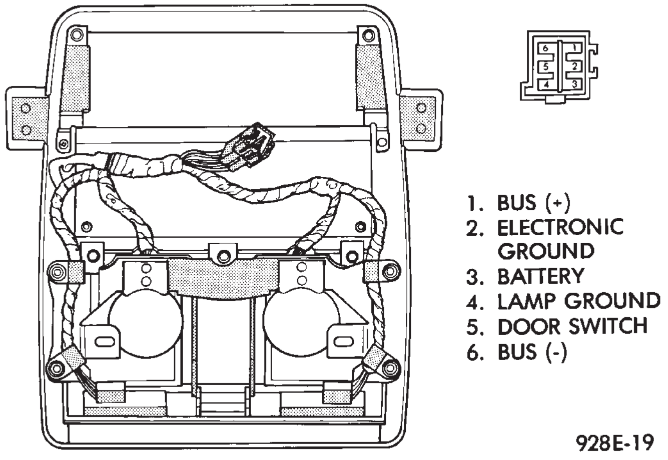


Fig. 6 EVIC Overhead Console Connector

MAP READING LAMPS/POWER SUNROOF SWITCH REMOVAL

SWITCH REPLACEMENT

(1) Remove console, refer to Console Replacement.

(2) Disconnect switch wiring connector from retaining bracket.

(3) Pry switch out of bezel snap tabs.

(4) Replace switch.

(5) For installation reverse above procedures.

LAMP/LENS REMOVAL

(1) Remove lens by inserting a flat blade tool into slot located on the left side of lens. Pry lens to the side and swing down as it unhooks from housing (Fig. 4).

(2) Replace lamp as necessary.

(3) Position lens with the center tabs on the left side of lens snap into place. The lens are identified with L and R on the reverse side. Do not reverse the lens or it may damage the lens tabs.

POWER SUNROOF SWITCH/BEZEL REMOVAL

(1) Remove console, refer to Overhead Reading/ Courtesy Lamp Console Replacement.

(2) Disconnect switch wiring connector from retaining bracket.

(3) Pry switch out of bezel. Replace switch. If necessary, push carefully at top closest to roof of bezel to disengage trim bezel and pivot bezel out of housing.

(4) Replace switch.

(5) For installation reverse above procedures.

OVERHEAD READING/COURTESY LAMP CONSOLE

The two reading/courtesy lamps are actuated by pressing on the switch (Fig. 7):

- Courtesy lamps for when a door is opened
- Illuminated entry system is activated
- Headlamp switch is turned fully clockwise

The map lamp console also includes:

- A cubby storage bin.

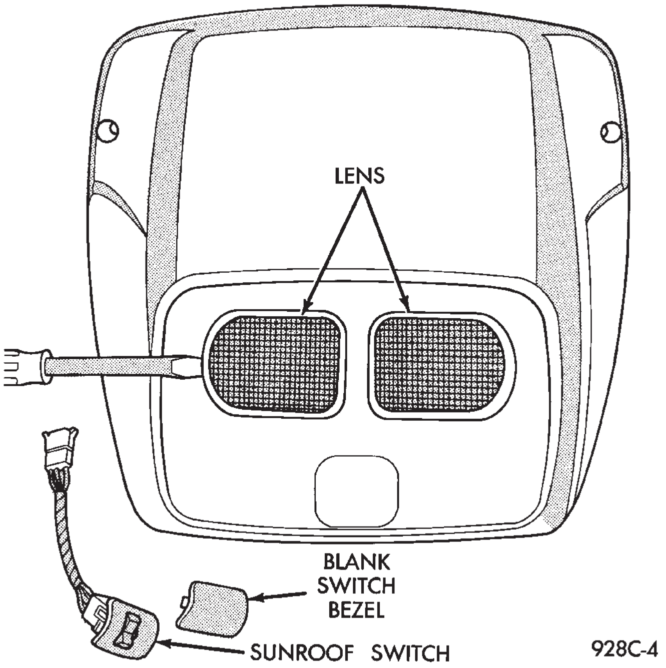


Fig. 7 Reading/Courtesy Lamp Console

- Power sunroof switch, if equipped.

READING/COURTESY LAMP CONSOLE REMOVAL

(1) Remove screws from visor tip-pin retainers.

(2) Slide console forward until free from retainer bracket.

(3) Disconnect wiring.

(4) For installation reverse above procedures. For vehicles equipped with sunroof, avoid sliding console to install. Install screws for console attachment and push at rear of unit to snap over mounting bracket for engagement.

LAMP/LENS REMOVAL

(1) Remove lens by inserting a flat blade tool between the round end of lamp lens and housing. Pry lens from the housing. Pivot the lens and remove (Fig. 7).

(2) Replace lamp as necessary.

(3) Position lens into housing by locating lens pivot and snap into place.

OVERHEAD CONSOLE WIRING HARNESS REMOVAL

(1) Remove console, refer to Overhead Reading/ Courtesy Lamp Console Removal.

(2) Disconnect wiring connector from retaining bracket.

(3) Remove four screws attaching lamp housing to console bezel.

(4) Remove wiring and lamp housing.

(5) Remove lamp and replace assembly.

(6) For installation, reverse above procedures.

AMBIENT TEMPERATURE SENSOR

(1) Remove screws attaching grille and remove grille.

(2) Remove screw attaching sensor to radiator closure panel (Fig. 8).

(3) For installation, reverse above procedures.

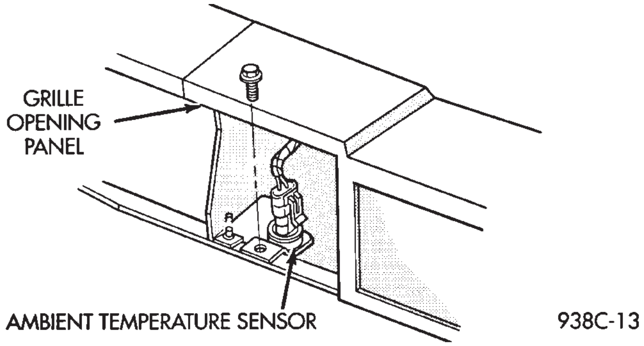


Fig. 8 Ambient Temperature Sensor

ENGINE COMPARTMENT NODE REMOVAL

(1) Remove screws attaching grille and remove grille.

(2) Disconnect wire harness connector.

(3) Remove screw attaching engine compartment node to the closure panel (Fig. 9).

(4) For installation, reverse above procedures.

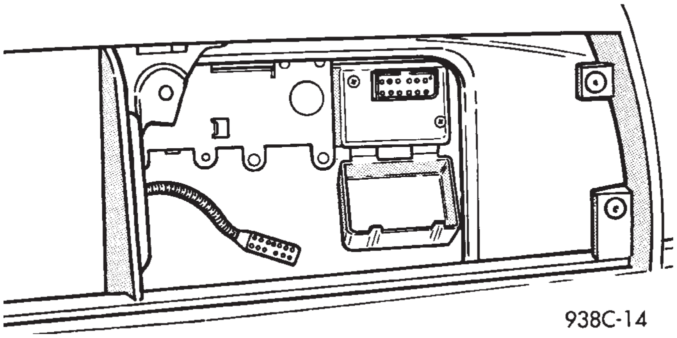


Fig. 9 Engine Compartment Node

AG AND AJ BODIES

INDEX

MAP READING LAMPS

The map lamps are actuated by pressing on the lens. These same lamps also serve as courtesy lamps whenever a door is opened. The illuminated entry system is activated, or the headlamp switch is turned fully clockwise (Fig. 1).

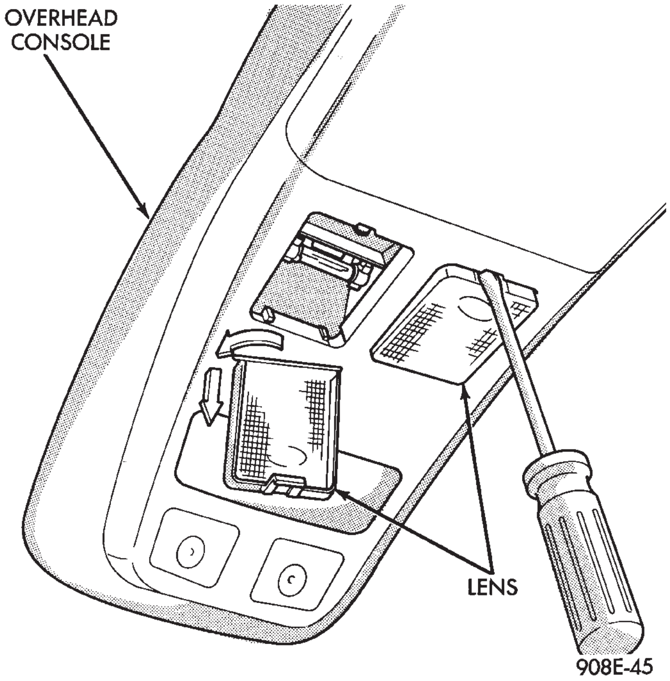


Fig. 1 Overhead Console Lamp Replacement

LAMP REPLACEMENT

(1) Remove lens by inserting a screw driver or knife blade into slot located along-side of lens. Once screwdriver is inserted pry lens to the side and swing down as it unhooks from housing edge.

(2) Remove lamp by pulling straight down.

(3) Install new lamp by pushing firmly into receptacle.

(4) Snap lens into position taking care to orient the tabs on the lens with the slots in the housing.

LAMP TEST

(1) Close vehicle doors.

(2) Press each lamp switch. Right hand switch should light passenger lamp and left hand switch should light drivers lamp.

(3) If either of the lamps fail to illuminate, open vehicle doors.

(a) If lamp does not illuminate check for a burned out lamp.

(b) If lamp illuminates when doors are open check switch and wiring.

ELECTRONIC VEHICLE INFORMATION CENTER (EVIC)

The Electronic Vehicle Information Center is a computer controlled warning system which, monitors various sensors used on the vehicle. The system supplements the warning indicators in the instrument cluster. Visual warning messages are displayed by a digital display (Fig. 2).

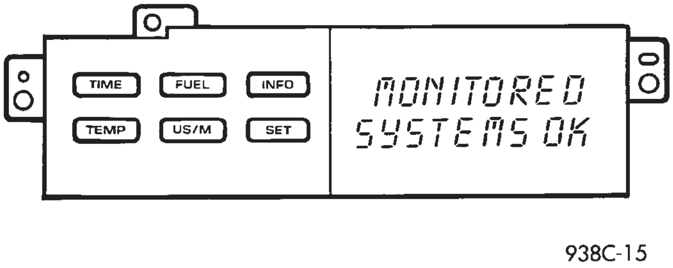


Fig. 2 EVIC

When a warning message has been activated, a tone will sound to attract the driver's attention. The warning message will then be displayed on the EVIC center until the condition is corrected or a new display function is called up. A tone will announce each new warning condition.

For complete diagnostic procedures for the EVIC systems, refer to the Body-Chassis Diagnostic Test Procedures Manual.

The EVIC has a 24 function system that provides the driver with visual messages when a warning condition exists. These messages are displayed on the center of the instrument panel.

For complete EVIC operating instructions, refer to the Owners Manual provided with the vehicle.

EVIC BUTTON FUNCTIONS

TIME button will display:

- Time of day
- Day of week
- Day of month
- Month of year
- To set HOURS, press TIME button and within four seconds press the SET button. An arrow will appear on the display and point to the hours. Press and hold the SET button to advance the hours or INFO button to set back the hours.
- To set MINUTES, press TIME button. The arrow will point to the minutes. Press and hold the SET button to advance the minutes or INFO button to set back the minutes.
- To set DAY of WEEK, press TIME button. An arrow will appear on the display and point to the Day. Press and hold the SET button to move the day forward or INFO button to move it backward.
- To set DAY of MONTH, press TIME button. The arrow will point to Date. Press and hold the SET button to advance the date or INFO button to move it backwards.
- To set MONTH of YEAR, press TIME button. The arrow will point to the Month. Press and hold the SET button to advance the Month forward or INFO button to move backward.

TEMP button, pressing the Temp button will display:

- The temperature outside the vehicle
- Vehicle direction define by an eight point compass

If Compass has lost calibration or not receiving good information from the engine compartment node, an asterisk (*) will flash on the display and the word calibrate will appear. Refer to Compass Calibration.

FUEL BUTTON, WILL DISPLAY:

- Pressing FUEL button the first time will show, the estimated number of miles that can be driven with the remaining fuel. The destination to empty indication will vary every few seconds as the amount of fuel and fuel efficiency is calculated. This function can not be reset.
- Pressing the FUEL button second time; will display the fuel consumed.
- Pressing the FUEL button third time; will display the average fuel economy in miles per gallon since last reset. The display will be updated every 16 seconds.
- Pressing the FUEL button forth time, the current fuel economy will be displayed. The current fuel economy will be up updated every two seconds.
- To reset Fuel consumed, press SET button until the fuel consumed message is displayed and then within five seconds press SET button.
- To reset AVERAGE FUEL ECONOMY, press the FUEL button until average fuel economy is displayed and within five seconds press SET button.

TRIP RESET, press FUEL button and wait four seconds press the SET button twice. This clears all trip information and the message Trip Reset will be displayed. This will occur only if a reset function is currently being displayed. The reset functions:

- Fuel consumed
- Average fuel economy message

INFO button, will active a MONITORED SYSTEMS OK message on display if all monitored systems are operating properly. If a problem is detected, the appropriate message will be displayed.

SET button, will clear the various functions after they have been displayed. It is used to enter the clock set or compass variance modes. This button is also used to reset certain trip computer functions and the maintenance reminder message.

The EVIC display may be turned off by pressing the TIME and SET buttons at the same time. Pressing the buttons a second time will restore the display.

EVIC INFORMATION SOURCES

The EVIC monitors information provided by the body controller, engine compartment node and powertrain control module. Refer to Body Diagnostic Test Procedure Manual for test procedures.

The Body Controller is a micro-controller unit which, informs the EVIC via the CCD bus of:

- Time of day
- Day of week
- Day of month
- Month of year
- Fuel range
- Fuel consumed
- Fuel efficiency
- Warning messages as noted in Fig. 3.

The Engine Compartment Node is a microcomputer controlled unit which, informs the EVIC via the CCD bus of:

- Outside temperature
- Compass direction

THE FOLLOWING ARE WARNING MESSAGES:

- Low brake fluid
- Low coolant level
- Low engine oil level

The powertrain control module is a microcomputer controlled unit which, informs the EVIC via the CCD bus of the following warning messages:

- Engine temperature high
- Voltage improper

Warning Message	Sensor	Received From
Keys in Ignition	Key-In Switch	Body Controller
Exterior Lamps On	Headlamp Switch	Body Controller
Passenger Door Ajar	Right Front Door Ajar Switch	Body Controller
Driver Door Ajar	Left Front Door Ajar Switch	Body Controller
Trunk Ajar	Trunk Ajar Switch	Body Controller
Park Brake Engaged	Park Brake Switch	Body Controller
Right Rear Door Ajar	Right Rear Door Ajar Switch	Body Controller
Left Rear Door Ajar	Left Rear Door Ajar Switch	Body Controller
Low Oil Pressure	Oil Pressure Switch	Body Controller
Engine Temp High	Engine Temperature Sensor	Powertrain Control Module
Coolant Level Low	Coolant Level Switch	Engine Node
Low Fuel Level	Fuel Tank Sender	Body Controller
Low Brake Fluid	Brake Fluid Level Sensor	Engine Node
Washer Fluid Low	Washer Fluid Level Switch	Body Controller
Voltage Improper		Powertrain Control Module
Fasten Seat Belts	Seat Belt Switch	Body Controller
Check Engine Oil Level	Oil Level Switch	Engine Node
Headlamp Out	Lamp Outage Module	
Brake Lamp Out	Lamp Outage Module	
Tail Lamp Out	Lamp Outage Module	
Service Reminder		Body Controller
Turn Signal On	Flasher	Body Controller

938C-16

Fig. 3 EVIC Messages and Sensors

VISUAL MESSAGES

Following are the visual messages and the conditions under which, the messages will be given:

- Keys in ignition
- Exterior lamps on

These messages will appear if the conditions are present and the driver's door is open while the ignition switch is in the OFF, LOCK, or ACC positions. A tone will sound until the condition is corrected or the door is closed.

- Passenger door ajar
- Driver door ajar
- Trunk ajar
- Park brake engaged
- Right rear door ajar
- Left rear door ajar

These messages will appear if a condition is detected after the vehicle is in motion. When the condition is corrected, a short tone will sound to acknowledge the action.

LOW OIL PRESSURE

If this message is displayed while the vehicle is at cruising speeds, immediate attention is required. If this message appears at idle speed, increase the idle speed and the message should go off. If the message remains on, immediate attention is required.

ENGINE TEMP CRITICAL

This message appears when a sensor has determined that the engine coolant is overheating. If this message comes on and stays on, immediate action is required.

COOLANT LEVEL LOW
LOW FUEL LEVEL
LOW BRAKE FLUID
WASHER FLUID LOW

These messages will appear if a continuous warning condition is detected while the engine is running. Inspection is required. To clear this message from the display, after the condition is corrected, the ignition switch must be turned OFF.

CHECK TRANS

This message will appear if a continuous warning condition is detected while the engine is running. Immediate attention is recommended. To clear this message from the display, after the condition has been corrected, the ignition switch must be turned OFF.

VOLTAGE IMPROPER

This message will appear if a continuous warning condition is detected. Immediate attention is required. To clear this message from the display, after the condition has been corrected, the ignition switch must be turned OFF.

TURN SIGNAL ON

This message will appear if the turn signal is left on while vehicle speed is over 15 mph and the vehicle has traveled over one-half mile.

FASTEN SEAT BELTS

An intermittent chime tone will sound for several seconds if the seat belt is not fastened.

CHK ENGINE OIL LEVEL

If this message is delivered, a check of the engine oil dipstick is suggested. To clear this message, after the condition is corrected, the ignition switch must be turned OFF.

HEADLAMP OUT
BRAKE LAMP OUT
TAIL LAMP OUT

These conditions are monitored only when the lamps are on. The message will remain, even after the lamp is replaced, until the lamp is turned on and operates.

SERVICE REMINDER

The maintenance reminder statement is programmed to provide general information only. Refer to Group 0, Lubrication & Maintenance for specific vehicle requirements.

The service reminder message is displayed at 7,500 miles or 12 months intervals, which ever comes first.

MONITORED SYSTEMS OK

If there is no warning condition to report, the message Monitored Systems OK is displayed (Fig. 3).

ENGINE COMPARTMENT NODE (ECN)

The Engine Compartment Node is a microcomputer controlled unit which, informs the Electronic Vehicle Information Center (EVIC) via the CCD bus of:

- Outside temperature
- Compass direction

and the following warning messages:

- Low Brake Fluid
- Low Coolant Level
- Low Engine Oil Level

The Engine Compartment Node is located behind the grille.

For complete diagnostic procedures for the Engine Compartment Node, refer to the Body Diagnostic Test Procedure Manual.

ENGINE COMPARTMENT NODE COMPASS CALIBRATION

Automatic or Manual Calibration, refer to AY Body Compass Calibration.

THERMOMETER AND COMPASS

OPERATION

The ignition switch must be in the ON or ACCESSORY position before the temperature and compass reading can be displayed. The Comp/Temp switch turns the compass display on and off. The US/Metric switch changes the temperature reading from Fahrenheit to Celsius (Fig. 4).

When the vehicle is standing still, engine compartment temperatures may be radiated to the temperature sensor. Therefore the most accurate ambient temperature readings are displayed when the vehicle is moving in a forward motion.

When the ignition switch is in the ON position the temperature display is updated every 5 minutes. When the ignition switch is turned off the last displayed temperature reading stays in memory. When the ignition switch is turned on again the thermometer will display the memory temperature for 1 minute; then update the display to the actual temperature within 5 minutes.

COMPASS CALIBRATION

Do not attempt to set the compass near large metal objects, such as, other vehicles, large buildings, or bridges.

The compass unit automatically calibrates itself as the vehicle is driven; therefore, no calibration should be required. When the compass is first powered up, the CAL light on the display should be on. The CAL light will go off and the compass will be accurate after the vehicle completes 1 to 3 complete circles.

If the vehicle's compass headings are inaccurate, the compass also can be manually calibrated using the following procedures:

(1) Depress and hold down both the Comp/Temp button and the U.S./Metric button.

(2) The display will go off and after 5 seconds the VAR light will come on. Continue to hold both buttons down.

(3) In approximately 10 seconds, the CAL light will come on. Release both buttons and the display will show the heading and outside temperature.

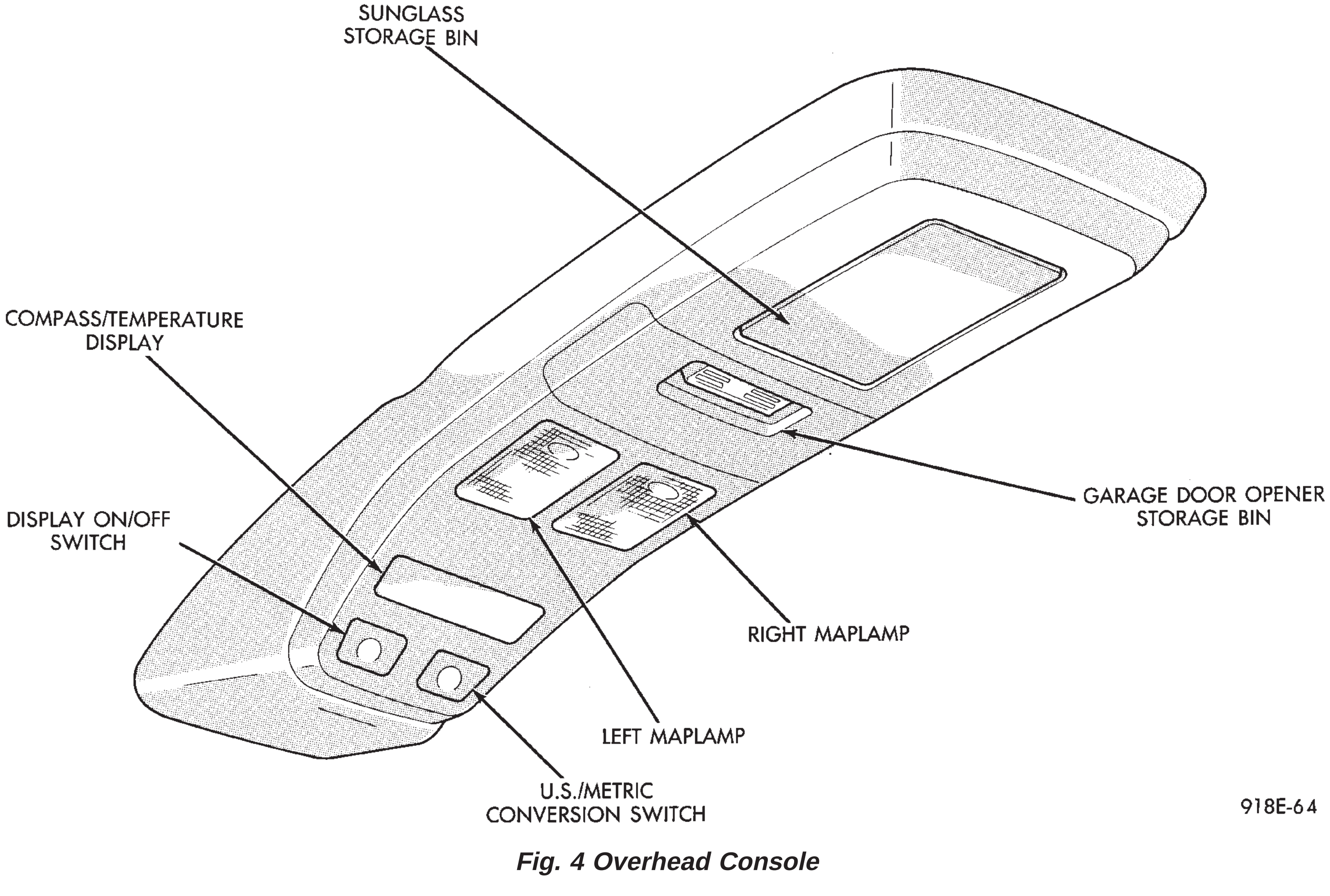


Fig. 4 Overhead Console

(4) Drive the vehicle 1 to 3 complete circles. The CAL light will then go off, showing the compass is calibrated.

If the compass portion of the display:

- It does not display.
- Readings are not accurate after calibration.
- The vehicle may have too much magnetism for the compass to be accurate.
- The compass circuitry is not working properly.
- Refer to Variance Procedure, Demagnetizing Procedure and/or Compass Diagnostics.

VARIANCE PROCEDURE

Variance is the difference between magnetic North and geographic North. In some areas the difference between magnetic and geographic North is great enough to cause the compass to give false readings. If this occurs, the variance must be set.

To set the variance, depress and hold down both the Comp/Temp button and the U.S./Metric button. The display will go off and after 5 seconds the VAR light will come on. Release both buttons. Using the zone map (Fig. 5) to find your geographic location, note the zone which, you are in. Press the U.S./Metric button until the zone number appears on the display. Press the Comp/Temp button to enter your zone number.

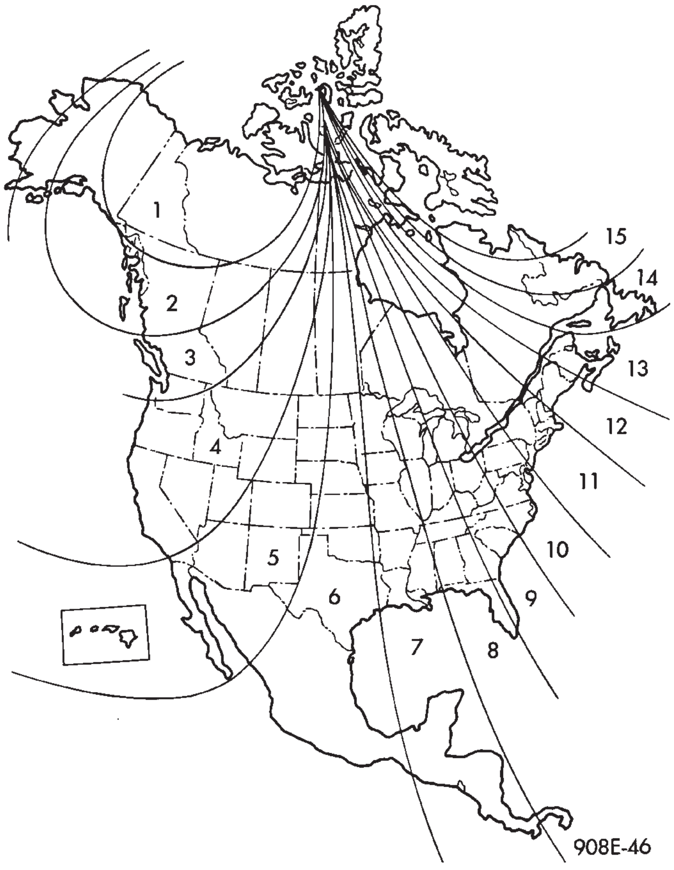


Fig. 5 Variance Zone Map

Do not attach magnetic devices, such as magnetic CB antennas to the vehicle roof, as they can cause the compass to give false readings.

DEMAGNETIZING PROCEDURE

Every vehicle has its own magnetic field. This magnetic field is created by the various processes a steel roof goes through when the vehicle is built. A magnetic field also can be created if the roof is subjected to a magnet, example:

- Magnetic c.b. antenna
- Magnetic tipped screwdriver and etc.

If the roof becomes magnetized use a demagnetizer tool 6029 to demagnetize the roof.

In this demagnetizing procedure you will use the demagnetizing tool to 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) Open the sun glass compartment to gain access to the overhead console mounting screws.

(3) 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.

(4) Slowly approach the console mounting screw with the plastic coated tip of the tool for at least 2 seconds.

(5) 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.

(6) After you have pulled at least 12 inches from the last screw, remove the demagnetizing tool from inside of the 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 2 feet away from the compass unit.

(9) Slowly approach the center of the roof panel at the windshield with the demagnetizing tool plugged in.

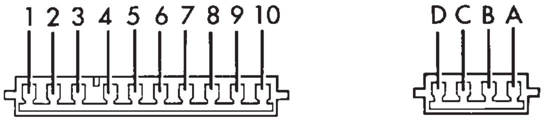
(10) Contact the roof panel with the tip of the tool. Using slow sweeping motions of 1/2 inch between sweeps. Move the tool approximately 4 inches either side of the centerline and at least 11 inch back from the windshield.

(11) With the demagnetizing tool still energized, slowly back away from the roof panel until the tip is at least 2 feet from the roof before unplugging the tool.

(12) Recalibrate compass.

COMPASS DIAGNOSTICS

To place the unit into the diagnostics mode, turn the vehicle ignition off. Depress the Comp/Temp button while turning on the ignition/run switch. The display will then show DO. There are 3 tests that can be performed when in the diagnostics mode. Press the U.S./Metric button to choose test desired (Fig. 6 and 7).



1	BODY GROUND	6	AMBIENT TEMP INPUT
2	COURTESY INPUT	7	BLANK
3	BATTERY FEED	8	AMBIENT TEMP RETURN
4	IGNITION FEED	9	BUSS +
5	BODY GROUND	10	BUSS -
A	CHASSIS GROUND	C	BATTERY FEED
B	COURTESY OUTPUT	D	

938C-21

Fig. 6 Terminal Identification

Test 1 (d1) determines the magnetic field strength at the compass. The compass displays compensation numbers which, correspond to the current magnetic field strength at the compass. The letter N is displayed in the compass portion of the display. While a number which, corresponds to the magnetic field strength in the North/South direction is displayed. The temperature portion of the display or the letter W is displayed in the compass portion of the display. A number which, corresponds to the magnetic field strength in the East/West direction is displayed in the temperature portion of the display. For proper compass operation the numbers should be between 1 and 14. A number of 7 or 8 is ideal (no vehicle magnetism) while numbers approaching 1 or 14 show that the vehicle is highly magnetic. If the numbers show that the vehicle is highly magnetic, perform the demagnetized procedure in this Group and retest for magnetism at compass. If the compass is not receiving information from the CCD bus, F1 will be displayed 15 seconds after this test is requested. Refer to AG and AJ Body Diagnostic Procedure Manual for further testing procedures.

Test 2 (d2) checks the electronic circuits of the compass, temperature, and CCD bus. If the test passes d2 will be displayed, and if the test fails F2 will be displayed. Refer to AG and AJ Body Diagnostic Procedure Manual for further testing procedures.

Test 3 (d3) performs a walking segment test which, sequentially puts different directions and numbers on the display. If any segment fails, replace the compass module.

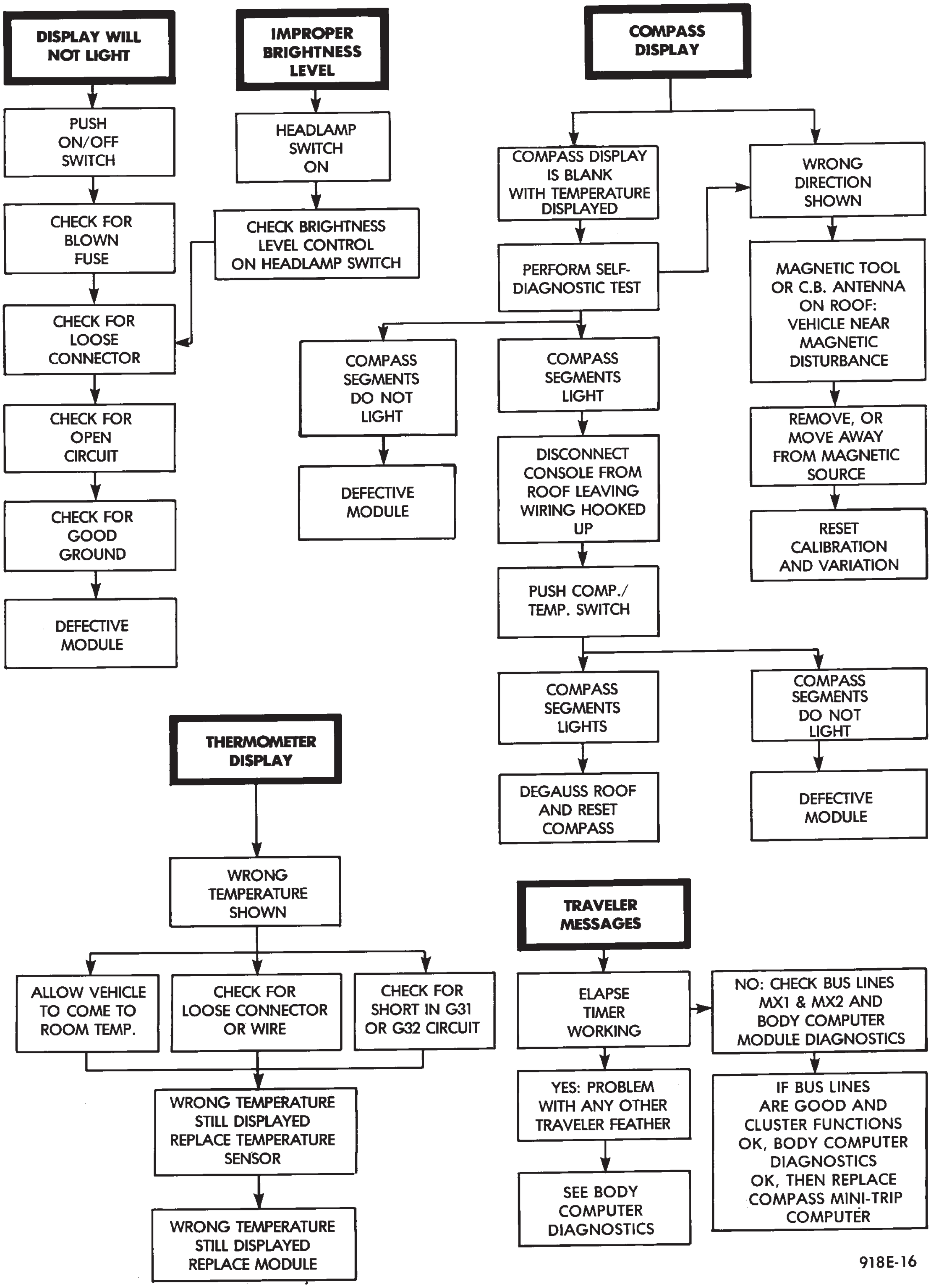


Fig. 7 Compass and Thermometer Diagnosis

OVERHEAD CONSOLE REPLACEMENT

(1) Unscrew the mounting screw in sun glass bin compartment (Fig. 8).

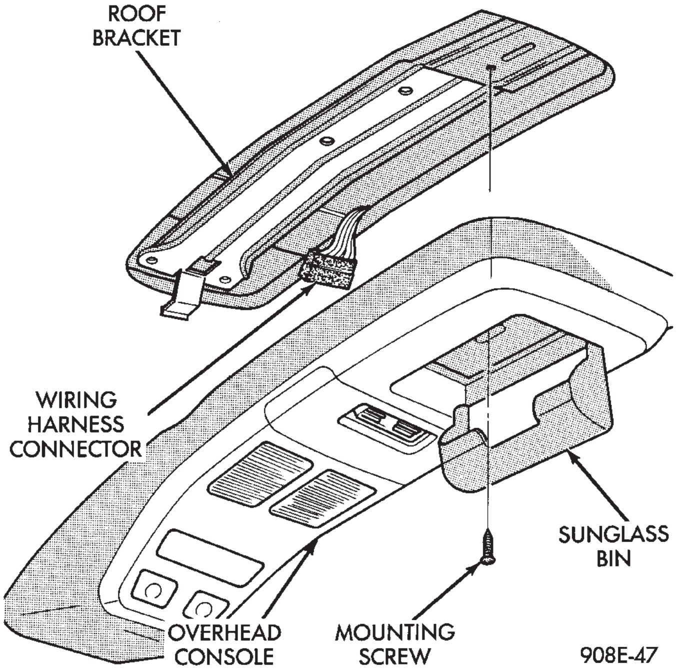


Fig. 8 Overhead Console Mounting

(2) Slide console forward toward windshield until the console unhooks from roof bracket.

(3) Disconnect wire harness from console.

(4) For installation reverse above procedures.

COMPASS MODULE REPLACEMENT

(1) Remove overhead console.

(2) Using a small screwdriver, release the 2 snaps at rear of compass module (Fig. 9).

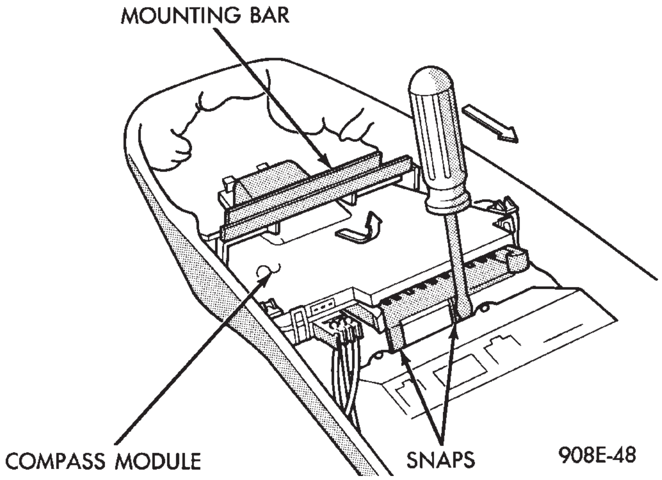


Fig. 9 Compass Module Removal

(3) After releasing the 2 snaps, slide compass module rearward until free of mounting bar.

(4) For installation reverse above procedures.

ELECTRONIC VEHICLE INFORMATION CENTER (EVIC) REMOVAL

(1) Use a straight edge tool to pry out one end of the EVIC center and continue to disengage six clips along the length of the message center.

(2) Remove the EVIC center and disconnect the wiring.

(3) For installation reverse the above procedures.

AMBIENT TEMPERATURE SENSOR REMOVAL

(1) Raise and support vehicle on safety stands.

(2) From behind front bumper fascia, remove screw attaching sensor to radiator closure panel (Fig. 10).

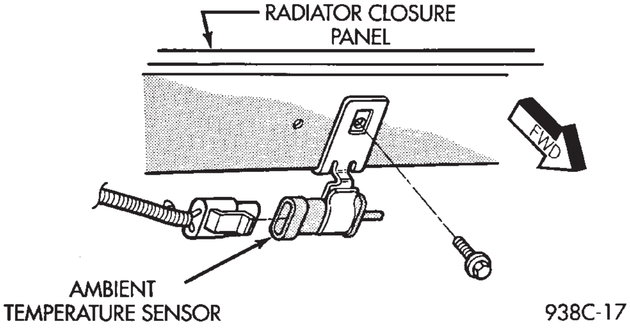


Fig. 10 Ambient Temperature Sensor

(3) For installation, reverse above procedures.

ENGINE NODE SENSOR REMOVAL

(1) Raise and support vehicle on safety stands.

(2) From behind front bumper fascia, remove screws attaching engine node to bumper fascia (Fig. 11).

(3) For installation, reverse above procedures.

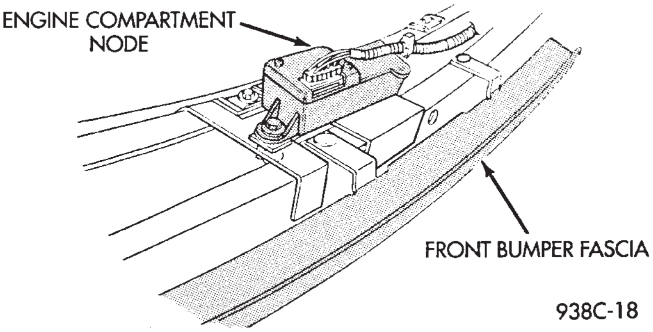


Fig. 11 Engine Node

AP BODY

INDEX

MAP READING LAMPS OPERATION

The map lamps are actuated by pressing on the lens (Fig. 1).

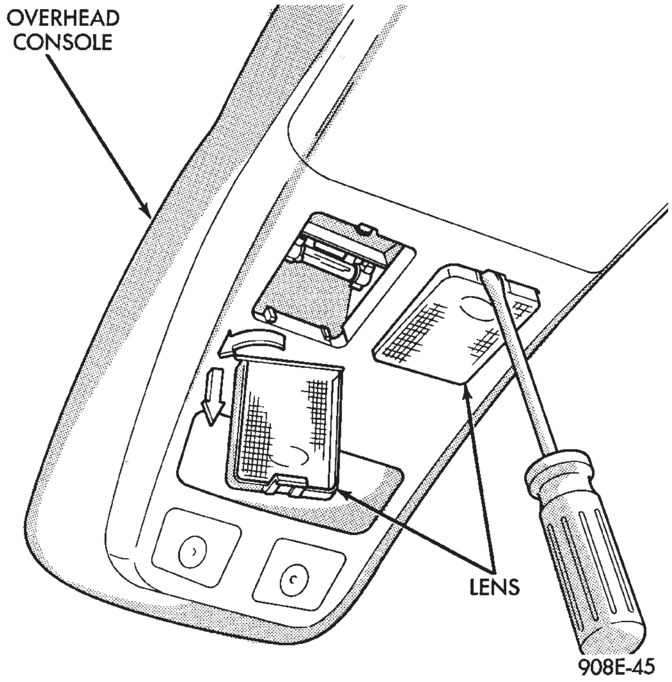


Fig. 1 Overhead Console Lamp Replacement

LAMP REPLACEMENT

(1) Remove lens by inserting a screw driver or knife blade into slot located along-side of lens. Once screwdriver is inserted pry lens to the side and swing down as it unhooks from housing edge.

(2) Remove lamp by pulling straight down.

(3) Install new lamp by pushing firmly into receptacle.

(4) Snap lens into position taking care to orient the tabs on the lens with the slots in the housing.

MAP LAMP TEST

(1) Press each lamp switch. Right hand switch should light passenger lamp and left hand switch should light drivers lamp.

(2) If lamp does not illuminate check for a burned out lamp, voltage, defective switch or faulty wiring.

THERMOMETER AND COMPASS

The ignition switch must be in the ON or ACCESSORY position before the temperature and compass reading can be displayed. The Comp/Temp switch turns the compass display on and off. The US/Metric switch changes the temperature reading from Fahrenheit to Celsius (Fig. 2).

When the vehicle is standing still, engine compartment temperatures may be radiated to the temperature sensor. Therefore the most accurate ambient temperature readings are displayed when the vehicle is moving in a forward motion.

When the ignition switch is in the ON position the temperature display is updated every 5 minutes. When the ignition switch is turned off the last displayed temperature reading stays in memory. When the ignition switch is turned on again the thermometer will display the memory temperature for 1 minute; then update the display to the actual temperature within 5 minutes.

COMPASS CALIBRATION

Do not attempt to set the compass near large metal objects, such as, other vehicles, large buildings, or bridges.

The compass unit automatically calibrates itself as the vehicle is driven; therefore, no calibration should be required. When the compass is first powered up, the CAL light on the display should be on. The CAL light will go off and the compass will be accurate after the vehicle completes one to three complete circles.

If the vehicle's compass headings are inaccurate, the compass also can be manually calibrated using the following procedures:

(1) Depress and hold down both the Comp/Temp button and the U.S./Metric button.

(2) The display will go off and after 5 seconds the VAR light will come on. Continue to hold both buttons down.

(3) In approximately 10 seconds, the CAL light will come on. Release both buttons and the display will show the heading and outside temperature.

(4) Drive the vehicle 1 to 3 complete circles, without turning ignition OFF. The CAL light will then go off, showing the compass is calibrated.

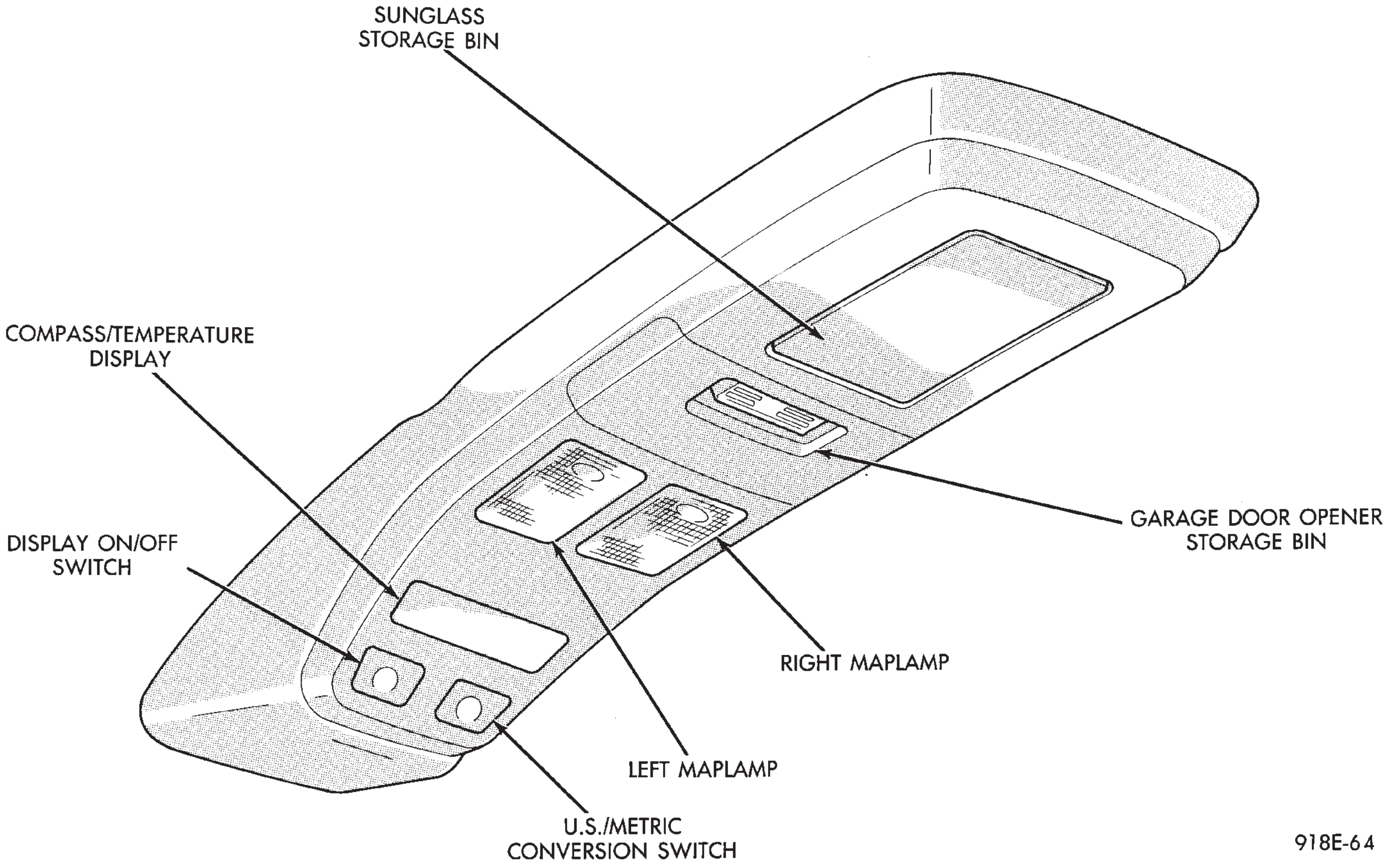


Fig. 2 Overhead Console

(5) The variation may need to be adjusted. The variation is the difference between magnetic north and true north. To set variation refer the to Variation Setting Procedure.

If the compass portion of the display is not lit or compass readings are not accurate after calibration. The vehicle may have too much magnetism for the compass to be accurate or the compass circuitry is not working properly. Refer to Variance Procedure, Demagnetizing Procedure and/or Compass Diagnostics.

VARIANCE PROCEDURE

Variance is the difference between magnetic North and geographic North. In some areas the difference between magnetic and geographic North is great enough to cause the compass to give false readings. If this occurs, the variance must be set.

VARIANCE SETTING PROCEDURE

To set the variance, depress and hold down both the Comp/Temp button and the U.S./Metric button. The display will go off and after 5 seconds the VAR light will come on. Release both buttons. Using the zone map (Fig. 3) to find your geographic location, note the zone which you are in. Press the U.S./Metric button until the zone number appears on the display. Press the Comp/Temp button to enter your zone number.

Do not attach magnetic devices, such as magnetic CB antennas to the vehicle roof, as they can cause the compass to give false readings.

DEMAGNETIZING PROCEDURE

Every vehicle has its own magnetic field. This magnetic field is created by the various processes a steel roof goes through when the vehicle is built. A magnetic field also can be created if the roof is subjected to a magnet, example:

- Magnetic c.b. antenna
- Magnetic tipped screwdriver, etc.

If the roof becomes magnetized use a demagnetizing tool 6029 to demagnetize the roof.

In this demagnetizing procedure you will use the demagnetizing tool to 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) Open the sun glass compartment to gain access to the overhead console mounting screws.

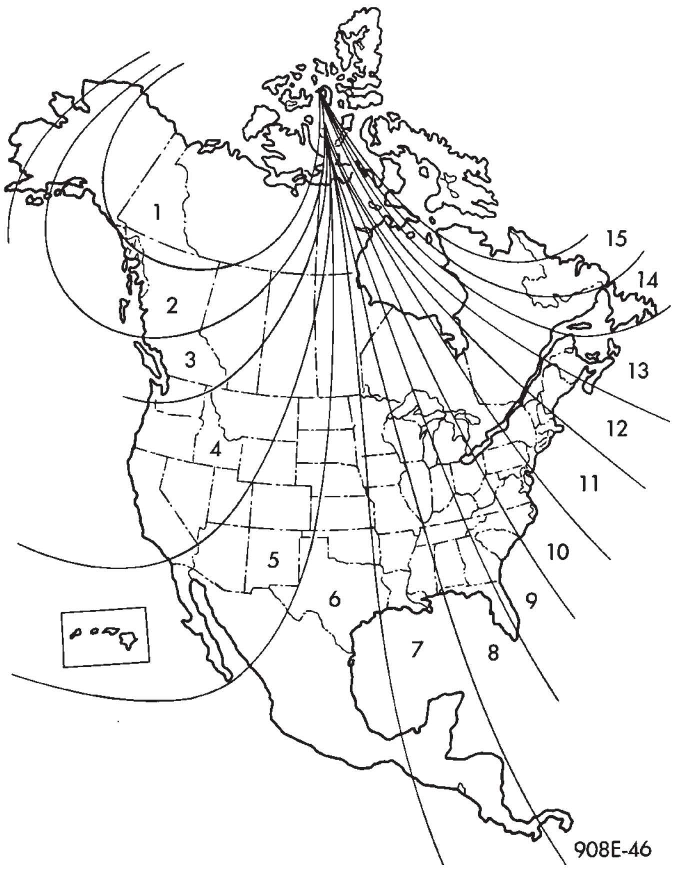


Fig. 3 Variance Zone Map

(3) 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.

(4) Slowly approach the console mounting screw with the plastic coated tip of the tool for at least 2 seconds.

(5) 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.

(6) After you have pulled at least 12 inches from the last screw, remove the demagnetizer tool from inside of the 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 2 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 and using slow sweeping motions of 1/2 inch between sweeps. Move the tool approximately 4 inches either side of the centerline 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 2 feet from the roof before unplugging the tool.

(12) Recalibrate compass.

COMPASS DIAGNOSTICS

To place the unit into the diagnostics mode, turn the vehicle ignition off. Depress the Comp/Temp button while turning on the ignition/run switch. The display will then show DO. There are 3 tests that can be performed when in the diagnostics mode. Press the U.S./Metric button to choose test desired. Refer to Fig. 4 and 5.

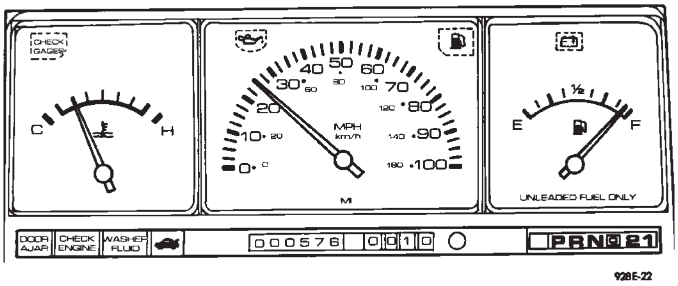


Fig. 4 Overhead Console Connector

Test 1 (d1) determines the magnetic field strength at the compass. The compass displays compensation numbers which, correspond to the current magnetic field strength at the compass. The letter N is displayed in the compass portion of the display. While a number which, corresponds to the magnetic field strength in the North/South direction is displayed. The temperature portion of the display or the letter W is displayed in the compass portion of the display. A number which, corresponds to the magnetic field strength in the East/West direction is displayed in the temperature portion of the display. For proper compass operation the numbers should be between 1 and 14. A number of 7 or 8 is ideal (no vehicle magnetism) while numbers approaching 1 or 14 show that the vehicle is highly magnetic. If the numbers show that the vehicle is highly magnetic, perform the demagnetized procedure in this Group and retest for magnetism at compass. If the numbers show that the vehicle is highly magnetic, perform the demagnetizing procedure in this section and retest for magnetism at compass. The compass is not on the CCD bus, if not functioning properly, refer to the Overhead Console and Thermometer diagnosis.

Test 2 (d2) checks the electronic circuits of the compass, temperature, and CCD bus. If the test passes d2 will be displayed, and if the test fails F2 will be displayed. Refer to AG and AJ Body Diagnostic Procedure Manual for further testing procedures.

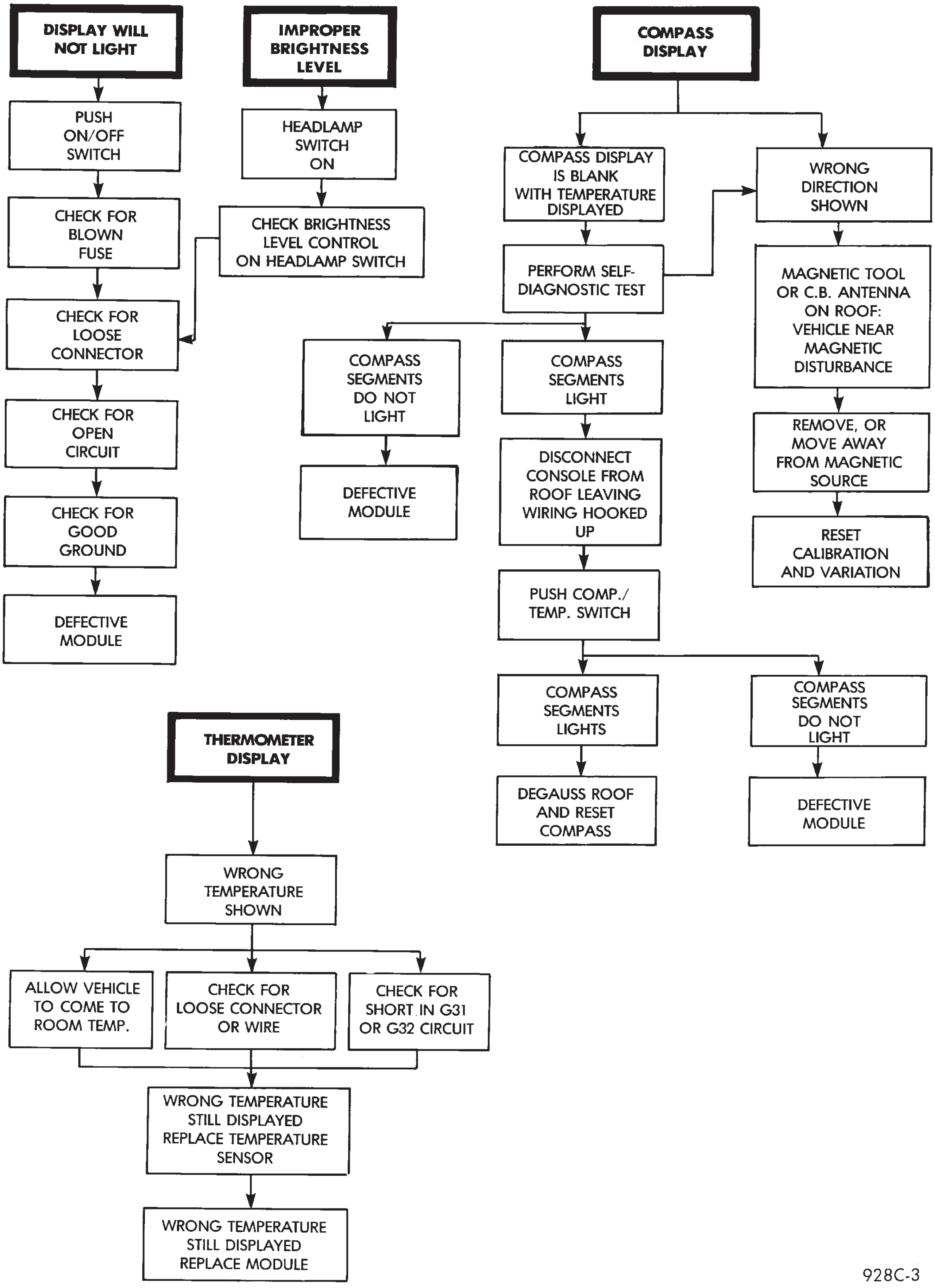


Fig. 5 Compass and Thermometer Diagnosis

Test 3 (d3) performs a walking segment test which, sequentially puts different directions and numbers on the display. If any segment fails, replace the compass module.

OVERHEAD CONSOLE REPLACEMENT

(1) Unscrew the mounting screw in sun glass bin compartment (Fig. 6).

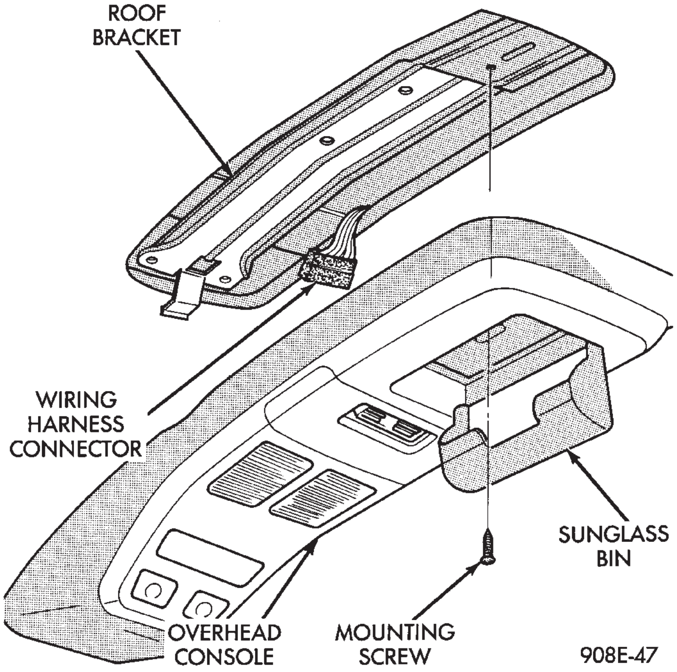


Fig. 6 Overhead Console Mounting

(2) Slide console forward toward windshield until the console unhooks from roof bracket.

(3) Disconnect wire harness from console.

(4) For installation reverse above procedures.

COMPASS MODULE REPLACEMENT

(1) Remove overhead console (Fig 6).

(2) Using a small screwdriver, release the 2 snaps at rear of compass module (Fig. 7).

(3) After releasing the 2 snaps, slide compass module rearward until free of mounting bar.

(4) For installation reverse above procedures.

AMBIENT TEMPERATURE SENSOR REMOVAL

(1) Raise and support vehicle on safety stands.

(2) Behind front bumper fascia, remove screw attaching sensor to radiator closure panel (Fig. 8).

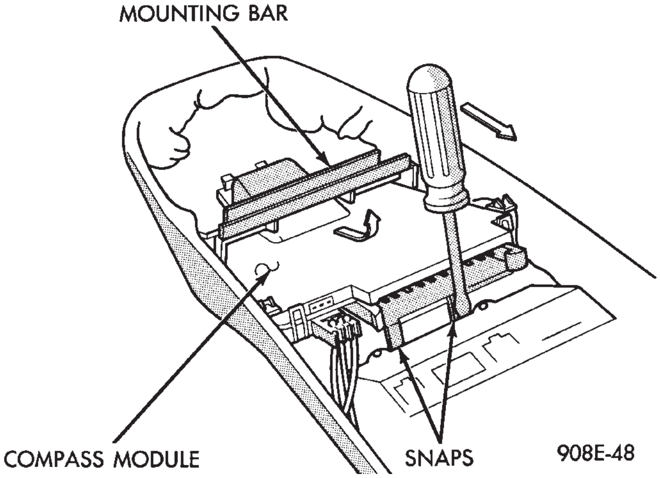


Fig. 7 Compass Module Removal

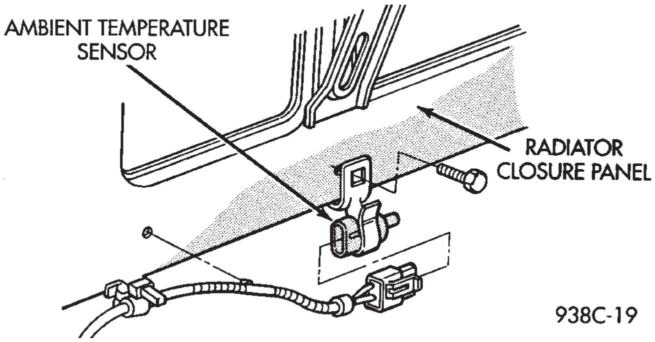


Fig. 8 Ambient Temperature Sensor

(3) For installation, reverse above procedures.

IGNITION SYSTEMS

CONTENTS

GENERAL INFORMATION

Throughout this group, references are made to particular vehicles by letter designation. A chart explaining the designations appears in the Introduction Section of this manual.

2.2L TBI, 2.5L TBI, 2.5L MPI AND 3.0L IGNITION SYSTEMS—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

This section describes the ignition systems of the 2.2L TBI, 2.5L TBI, 2.5L MPI (flexible fuel AA-body) and 3.0L engines.

The Fuel Injection sections of Group 14 explain On Board Diagnostics.

Group 0, Lubrication and Maintenance, contains general maintenance information for ignition related items. The Owner's Manual also contains maintenance information.

DISTRIBUTOR CAP

Remove the distributor cap and inspect the inside for flash over, cracking of carbon button, lack of spring tension on carbon button, cracking of cap, and burned, worn terminals (Fig. 1). Also check for broken distributor cap towers. If any of these conditions are present the distributor cap and/or cables should be replaced.

When replacing the distributor cap, transfer cables from the original cap to the new cap one at a time. Ensure each cable is installed into the corresponding tower of the new cap. Fully seat the wires into the towers. If necessary, refer to the appropriate engine firing order diagram (Fig. 2 or Fig. 3).

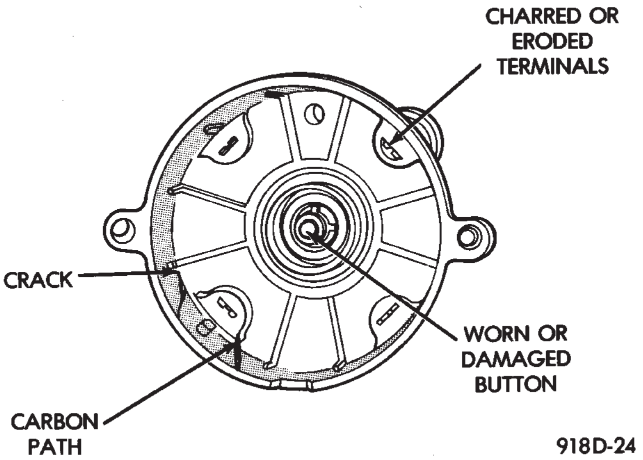


Fig. 1 Distributor Cap Inspection

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.

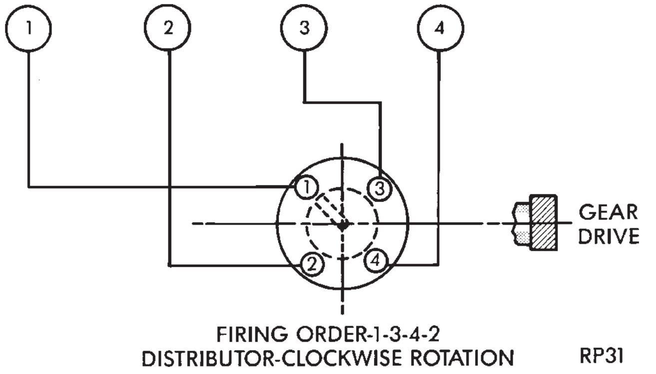


Fig. 2 Engine Firing Order—2.2L TBI, 2.5L TBI, 2.5L MPI and Turbo III Engines

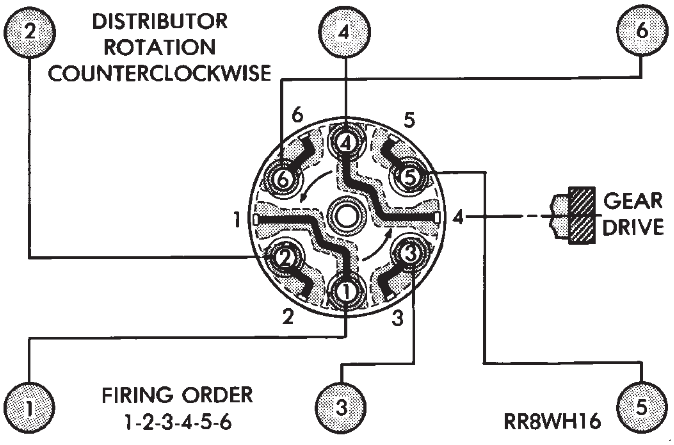


Fig. 3 Engine Firing Order—3.0L Engine

ROTOR

Replace the rotor if it is cracked, the tip is excessively burned or heavily scaled (Fig. 4). If the spring terminal does not have adequate tension, replace the rotor.

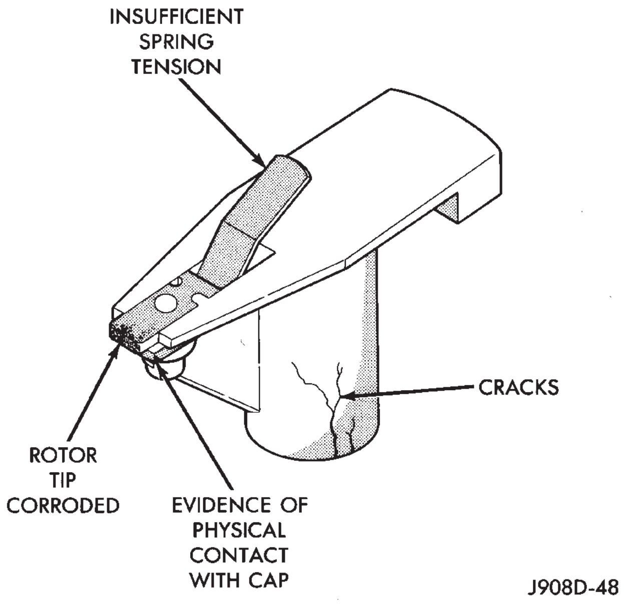


Fig. 4 Rotor Inspection—Typical

SPARK PLUG CABLES

Spark Plug cables are sometimes referred to as secondary ignition wires. They transfer electrical current from the distributor to individual spark plugs at each cylinder. 2.2L TBI, 2.5L TBI, 2.5L MPI, Turbo III and 3.0L engines use resistance type cables. The cables suppress radio frequency emissions from the ignition system.

Check the spark plug cable connections for good contact at the coil and distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil and distributor cap towers and spark plug cover should fit tight around spark plug insulators. Loose cable connections can cause ignition malfunctions by permitting water to enter the towers, corroding, and increasing resistance. **To maintain proper sealing at the terminal connections, the connections should not be broken unless testing indicates high resistance, an open circuit or other damage.**

CAUTION: Do not pull spark plug cables from distributor cap of four cylinder engines. The cables must be released from inside the distributor cap (Fig. 5).

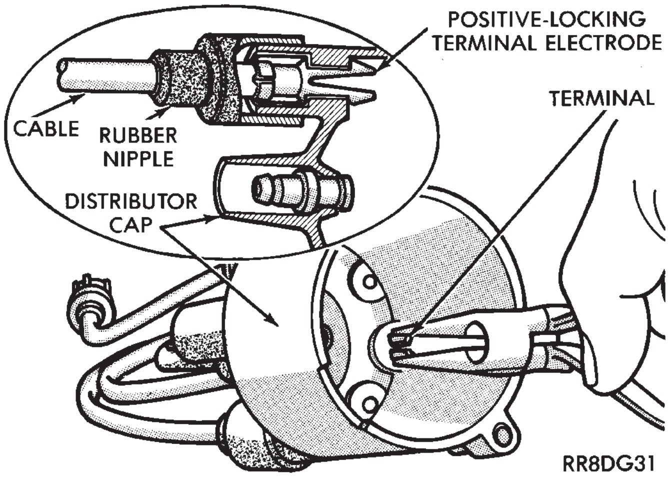


Fig. 5 Spark Plug Cable Removal/Installation—2.2L and 2.5L TBI Engines

Clean high tension cables with a cloth moistened with a non-flammable solvent and wipe dry. Check for brittle or cracked insulation.

When testing secondary cables for punctures and cracks with an oscilloscope follow the equipment manufacturers instructions.

If an oscilloscope is not available, secondary cables can be tested as follows:

CAUTION: Do not leave any one spark plug cable disconnected any longer than necessary during testing. Excessive heat could damage the catalytic converter. Total test time must not exceed ten minutes.

(a) With the engine not running, connect one end of a test probe to a good ground. Use a probe made of insulated wire with insulated alligator clips on each end.

(b) With engine running, move test probe along entire length of all cables (approximately 0 to 1/8 inch gap). If punctures or cracks are present there will be a noticeable spark jump from the faulty area to the probe. Check the coil cable the same way. Replace cracked, leaking or faulty cables.

When replacing cables, install the new high tension cable and nipple assembly over cap or coil tower. When entering the terminal into the tower, push lightly, then pinch the large diameter of nipple to release air trapped between the nipple and tower. Continue pushing on the cable and nipple until cables are properly seated in the cap towers. A snap should be heard as terminal goes into place.

Use the same procedure to install cable in coil tower. Wipe the spark plug insulator clean before reinstalling cable and cover.

Use the following procedure when removing the high tension cable from the spark plug. First, remove the cable from the retaining bracket. Then grasp the terminal as close as possible to the spark plug. Rotate the cover and pull the cable straight back. **Pulling on the cable itself will damage the conductor and terminal connection. Do not use pliers and do not pull the cable at an angle. Doing so will damage the insulation, cable terminal or the spark plug insulator. Wipe spark plug insulator clean before reinstalling cable and cover.**

Resistance type cable is identified by the words **Electronic Suppression** printed on the cable jacket.

Use an ohmmeter to check resistance type cable for open circuits, loose terminals or high resistance as follows:

(a) Remove cable from spark plug.

(b) Lift distributor cap from distributor with cables intact. **Do not remove cables from cap.** The cables must be removed from the spark plugs.

(c) Connect the ohmmeter between spark plug end terminal and the corresponding electrode inside the cap, make sure ohmmeter probes are in good contact. Resistance should be within tolerance shown in the cable resistance chart. If resistance is not within tolerance, remove cable at cap tower and check the cable. If resistance is still not within tolerance, replace cable assembly. Test all spark plug cables in same manner.

CABLE RESISTANCE CHART

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

J908D-43

To test coil to distributor cap high tension cable, remove distributor cap with the cable intact. **Do not remove cable from the cap.** Connect the ohmmeter between center contact in the cap and remove the cable at coil tower and check cable resistance. If resistance is not within tolerance, replace the cable.

SPARK PLUGS

Resistor spark plugs are used in all engines and have resistance values of 6,000 to 20,000 ohms when checked with at least a 1000 volt tester.

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.

Undamaged low milage spark plugs can be cleaned and reused. Refer to the Spark Plug Condition section of this group. After cleaning, file the center electrode flat with a small point file or jewelers file. Adjust the gap between the electrodes (Fig. 6) to the dimensions specified in the chart at the end of this section.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion and change spark plug gap. Tighten spark plugs to 28 N•m (20 ft. lbs.) torque.

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. 7). 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. Spark plugs that have normal wear can usually be cleaned, have the electrodes filed and regapped, and then reinstalled.

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT)

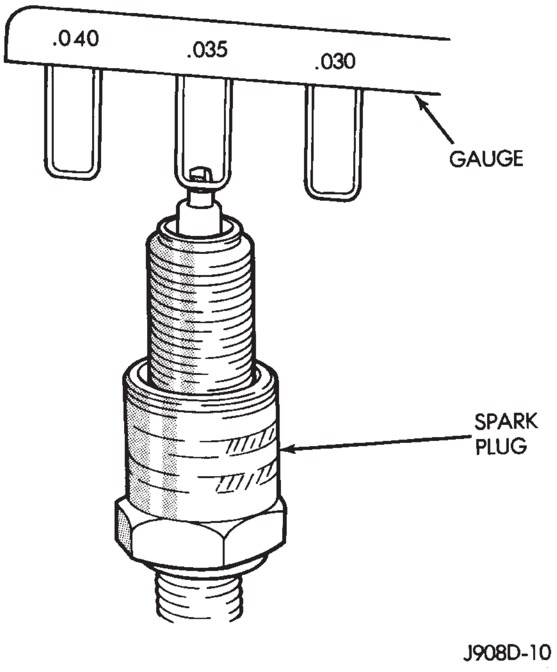


Fig. 6 Setting Spark Plug Electrode Gap—Typical

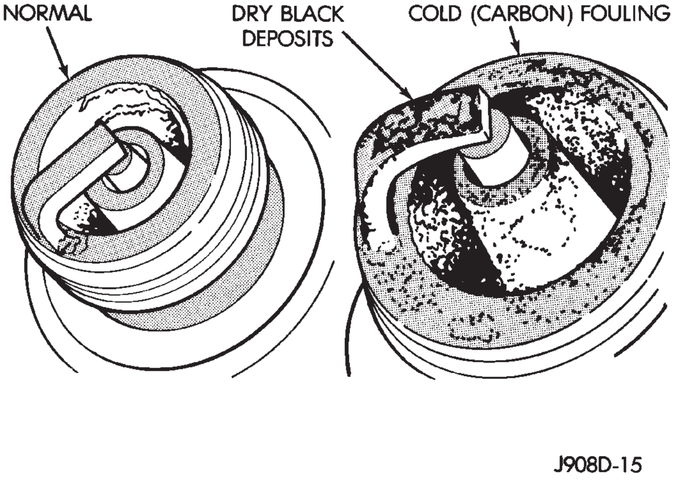


Fig. 7 Normal Operation and Cold (Carbon) Fouling

for unleaded fuel. During combustion, fuel with MMT coats the entire tip of the spark plug with a rust color deposit. The rust color deposits could be misdiagnosed as being caused by coolant in the combustion chamber. MMT deposits do not affect spark plug performance.

COLD FOULING (CARBON FOULING)

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 7). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set 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.

WET FOULING

A spark plug that is coated with excessive wet fuel or oil is wet 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. In new or recently overhauled engines, wet fouled spark plugs can be usually be cleaned and reinstalled.**

OIL OR ASH ENCRUSTED

If one or more plugs are oil or oil ash encrusted, engine oil is entering the combustion chambers (Fig. 8). Evaluate the engine to determine the cause.

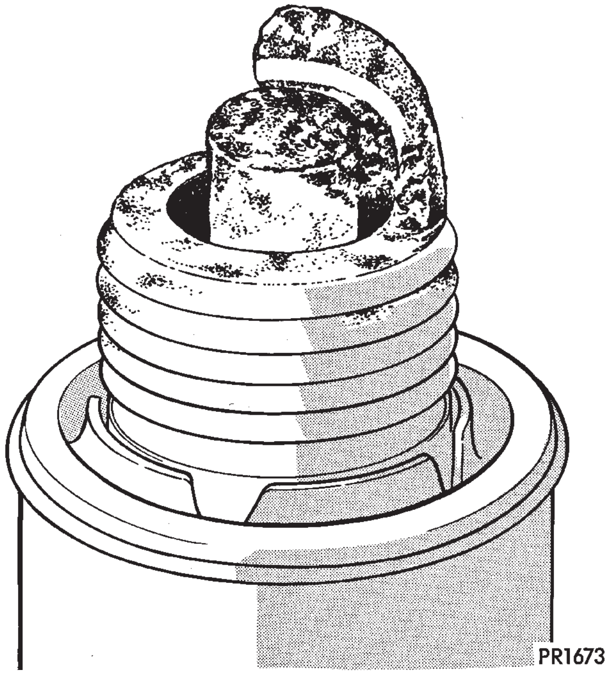


Fig. 8 Oil or Ash Encrusted

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. 9). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

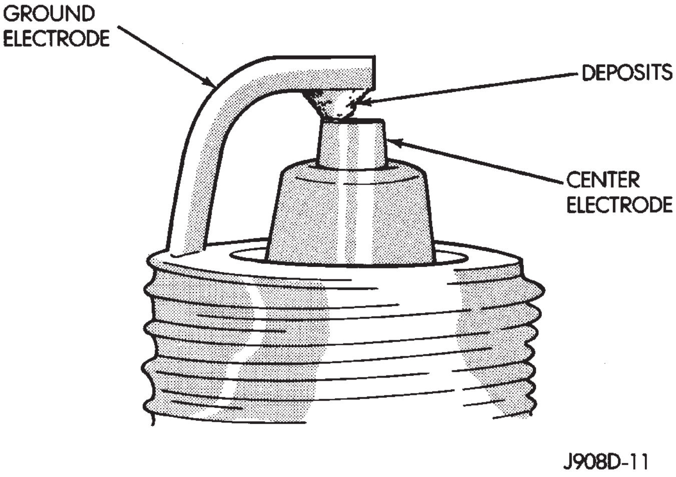


Fig. 9 Electrode Gap Bridging

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 10). 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. Accumulation on the ground electrode and shell area may be heavy but the deposits are easily removed. Spark plugs with scavenger deposits can be considered normal in condition and be cleaned using standard procedures.

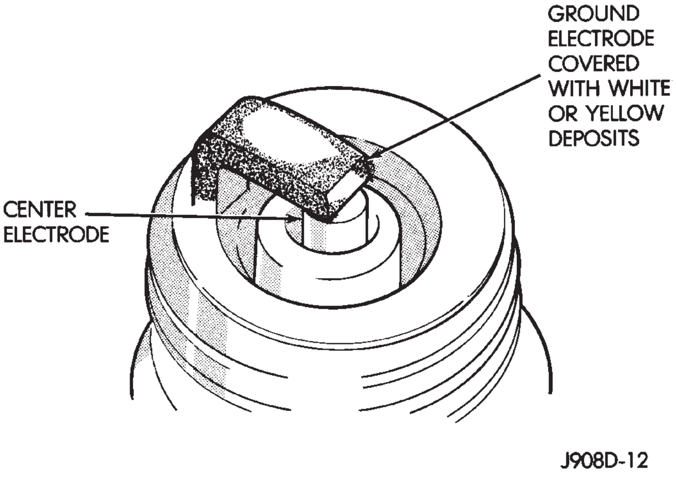


Fig. 10 Scavenger Deposits

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. 11). Replace spark plugs with chipped electrode insulators.

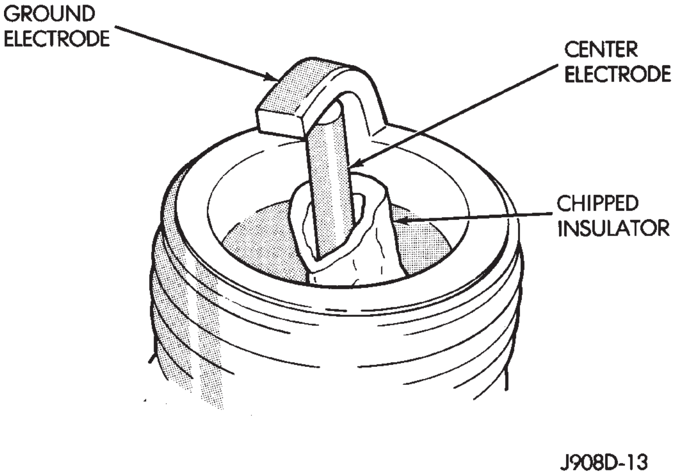


Fig. 11 Chipped Electrode Insulator

PREIGNITION DAMAGE

Excessive combustion chamber temperature can cause preignition damage. The center electrode dissolves first and the ground electrode dissolves somewhat later (Fig. 12). Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating for the engine, if ignition timing is over advanced or if other operating conditions are causing engine overheating. The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges depending upon the thickness and length of the center electrode and porcelain insulator.

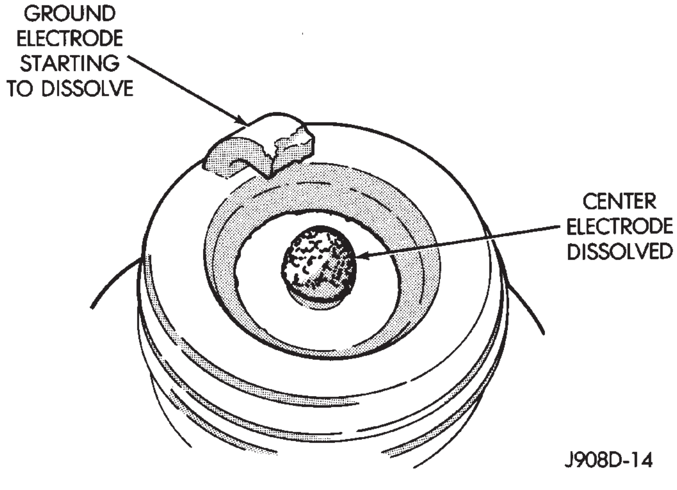


Fig. 12 Preignition Damage

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 13). 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.

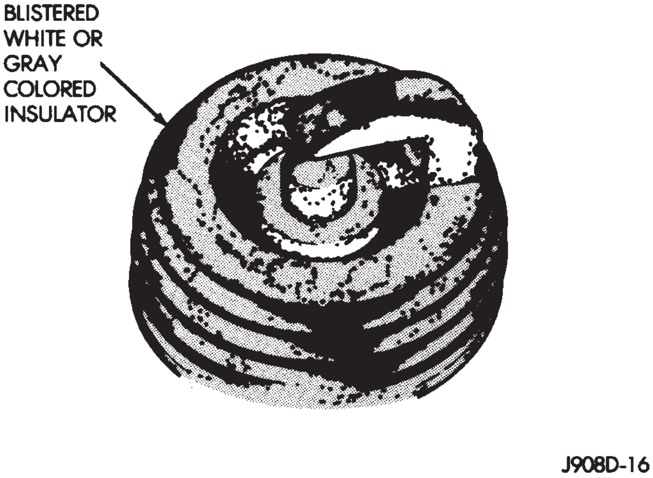


Fig. 13 Spark Plug Overheating

SPARK PLUG SERVICE

When replacing the spark plug and coil cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise, cross ignition of the spark plugs or short circuit the cables to ground.

SPARK PLUG REMOVAL

Always remove the spark plug cable by grasping at the spark plug boot turning, 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 rubber or foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

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. 6).

SPARK PLUG 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.

POWERTRAIN CONTROL MODULE (PCM)

The ignition system is regulated by the powertrain control module (PCM) (Fig. 14). The PCM supplies battery voltage to the ignition coil through the Auto Shutdown (ASD) Relay. The PCM also controls the 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 these input factors:

- coolant temperature
- engine RPM
- available manifold vacuum

The PCM also regulates the fuel injection system. Refer to the Fuel Injection sections of Group 14.

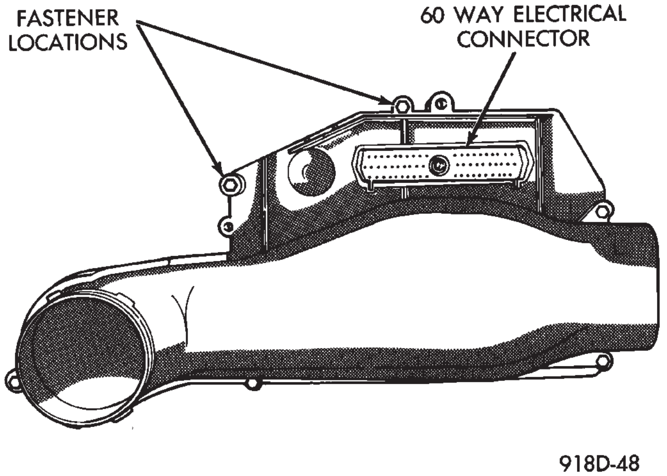


Fig. 14 Powertrain control module (PCM)

DISTRIBUTOR PICK-UP—PCM INPUT

The engine speed input is supplied to the powertrain control module (PCM) by the distributor pick-up. The distributor pick-up is a Hall Effect device (Fig. 15 or Fig. 16).

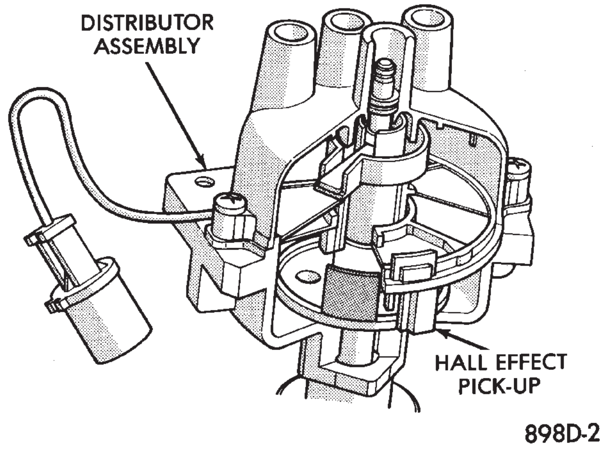


Fig. 15 Distributor—2.2L and 2.5L TBI Engines

A shutter (sometimes referred to as an interrupter) is attached to the distributor shaft. The shutter contains four blades, one per engine cylinder. A switch plate is mounted to the distributor housing above the shutter. The switch plate contains the distributor

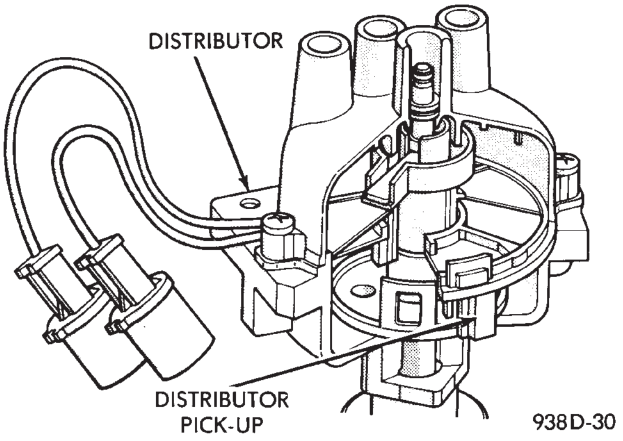


Fig. 16 Distributor—2.5L MPI (Flexible Fuel AA-Body)

pick-up (a Hall Effect device and magnet) through which the shutter blades rotate. As the shutter blades pass through the pick-up, they interrupt the magnetic field. The Hall effect device in the pick-up senses the change in the magnetic field and switches on and off (which creates pulses), generating the input signal to the PCM. The PCM calculates engine speed through the number of pulses generated.

On 2.5L MPI (flexible fuel AA-Body) engines, one of the shutter blades has a window cut into it. The PCM determines injector synchronization from the window. Also, the PCM uses the input for detonation control.

DISTRIBUTOR PICK-UP—3.0L ENGINE

The distributor pick-up provides two inputs to the powertrain control module (PCM). From one input the PCM determines RPM (engine speed). From the other input it derives crankshaft position. The PCM regulates injector synchronization and adjusts ignition timing and engine speed based on these inputs.

The distributor pick-up contains two signal generators. The pick-up unit consists of 2 light emitting diodes (LED), 2 photo diodes, and a separate timing disk. The timing disk contains two sets of slots. Each set of slots rotates between a light emitting diode and a photo diode (Fig. 17). The inner set contains 6 large slots, one for each cylinder. The outer set contains several smaller slots.

The outer set of slots on the rotating disk represents 2 degrees of crankshaft rotation. Up to 1200 engine RPM, the PCM uses the input from the outer set of slots to increase ignition timing accuracy.

The outer set of slots contains a 10 degree flat spot. This area is not slotted (Fig. 17). The flat spot tells the PCM that the next piston at TDC will be number 6. Each piston's position is referenced by one of the six inner slots (Fig. 18).

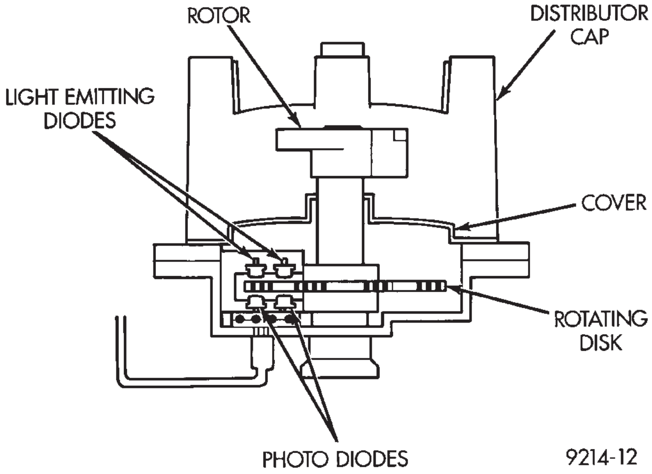


Fig. 17 Distributor Pick-up—3.0L Engine

As each slot on the timing disk passes between the diodes, they interrupt the beam from the light emitting diode. This creates an alternating voltage in each photo diode which is converted into on-off pulses. The pulses are the input to the PCM.

During cranking, the PCM cannot determine which cylinder will be at TDC until the 10 degree flat spot on the outer set of slots rotates through the optical unit. Once the flat spot is detected, the PCM knows piston number 6 will be the next piston at TDC.

Since the disk rotates at half crankshaft speed, it may take up to 2 engine revolutions during cranking before the PCM determines the position of piston number 6. For this reason the PCM energizes all six injectors at the same time until it senses the position of piston number 6.

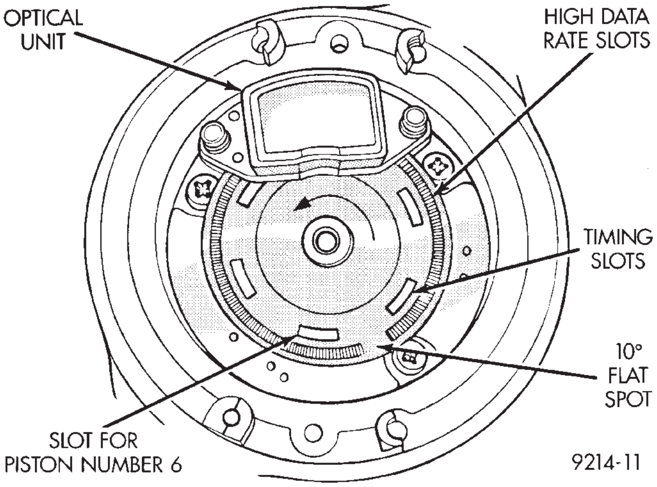


Fig. 18 Inner and Outer Slots of Rotating Disk—3.0L Engine

COOLANT TEMPERATURE SENSOR

On 2.2L TBI, 2.5L TBI and 2.5L MPI engines, the coolant temperature sensor is installed behind the thermostat housing and ignition coil in the hot box (Fig. 19). On 3.0L engines the sensor is located next to the thermostat housing (Fig. 20). The sensor provides an input voltage to the powertrain control module (PCM). The 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 emissions and improve driveability. Because spark advance changes at different engine operating temperatures during warm-up, all spark advance testing should be done with the engine fully warmed.

The PCM demands slightly richer air-fuel mixtures and higher idle speeds until the engine reaches normal operating temperature.

The coolant sensor input is also used for radiator fan control.

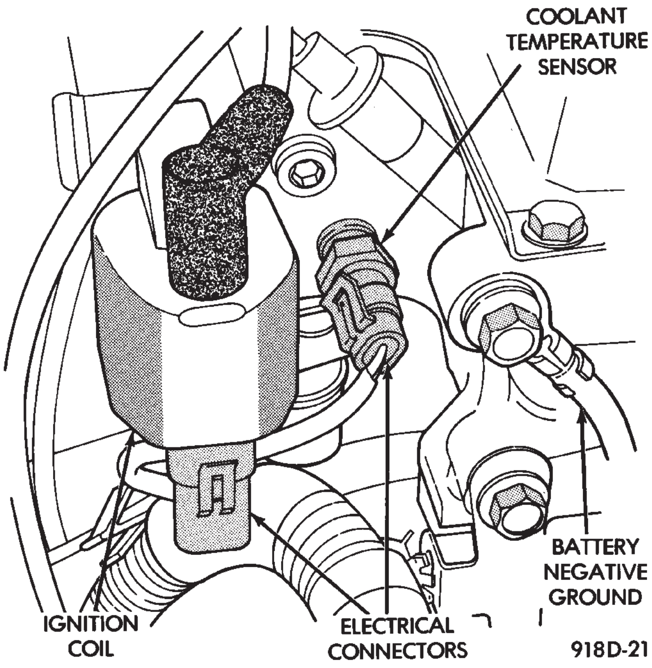


Fig. 19 Coolant Temperature Sensor—2.2L TBI, 2.5L TBI and 2.5L MPI Engines

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 causes the MAP sensors output voltage to change. The change in MAP sensor output voltage 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. The PCM uses this input along with inputs from other sensors to adjust air-fuel mixture.

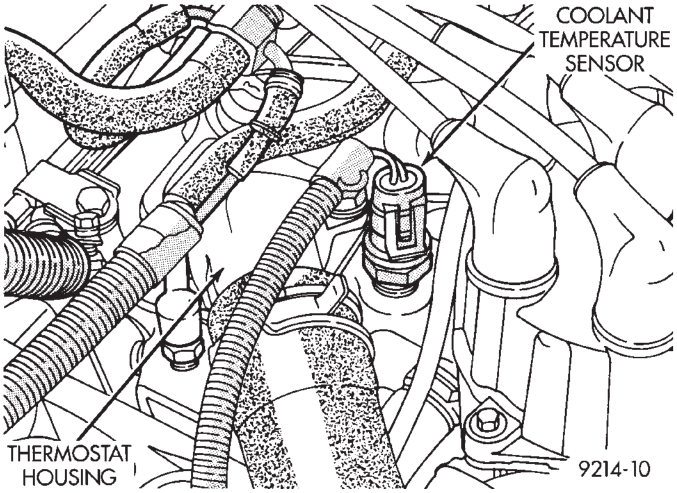


Fig. 20 Coolant Temperature Sensor—3.0L Engines

On 2.2L TBI, 2.5L TBI and 2.5L MPI (flexible fuel AA-body) engines, the MAP sensor is mounted to the dash panel (Fig. 21 or Fig. 22). On 3.0L engines, the sensor is mounted to a bracket across from the distributor (Fig. 23). The sensor is connected to the throttle body or intake manifold with a vacuum hose and to the PCM electrically.

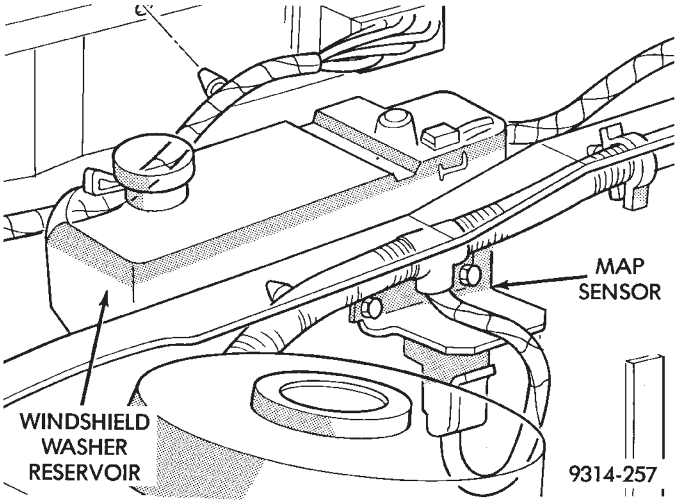


Fig. 21 MAP Sensor—2.2L and 2.5L TBI Engines

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY

The powertrain control module (PCM) operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the distributor pick-up sig-

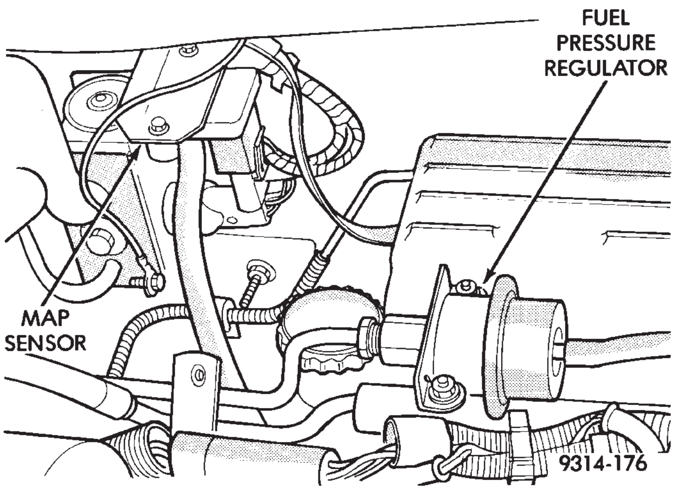


Fig. 22 MAP Sensor—2.5L MPI (Flexible Fuel AA-Body) Engines

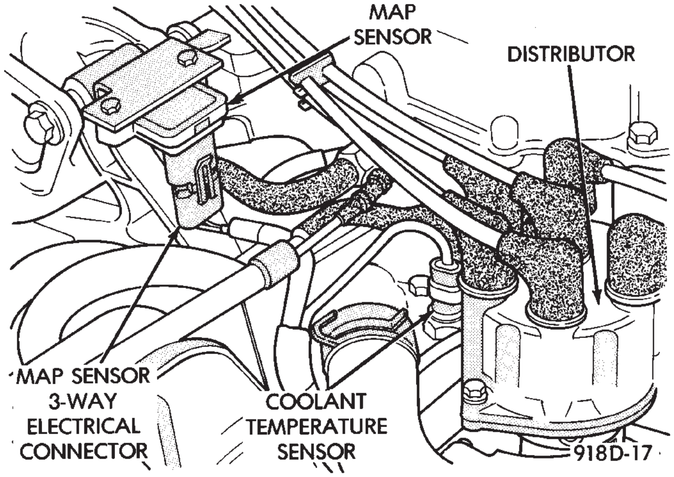


Fig. 23 MAP Sensor—3.0L Engine

nal. From the pick-up signal, the PCM determines engine speed and ignition timing (coil dwell). If the PCM does not receive a distributor signal when the ignition switch is in the Run position, it will de-energize both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

On AC, AG, AJ and AY models, the ASD relay and fuel pump relay are located in the power distribution center (Fig. 24, 25, 26, or 27).

On AA and AP models, the ASD relay and fuel pump relay are mounted on the drivers side fender well, next to the strut tower (Fig. 28).

IGNITION COIL

The 2.2L TBI, 2.5L TBI, 2.5L MPI and 3.0L engines use an epoxy type coil. The coils are not oil filled. The windings are embedded in a heat and vibration resistant epoxy compound.

The powertrain control module (PCM) operates the ignition coil through the auto shutdown (ASD) relay.

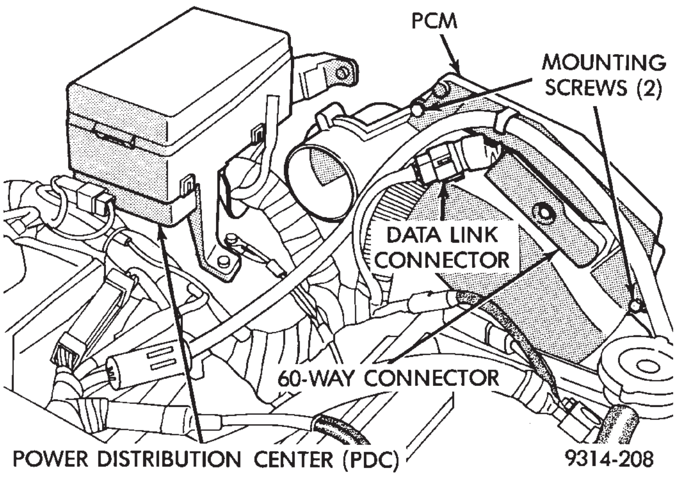


Fig. 24 Power Distribution Center (PDC) (AC Body)

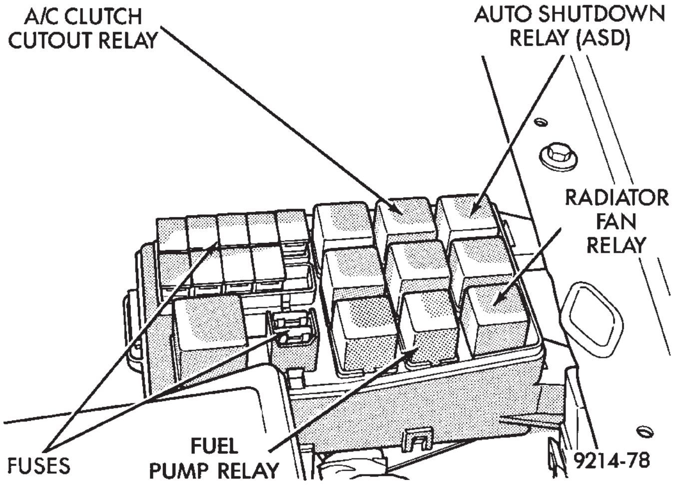


Fig. 25 Relay Identification (AC Body)

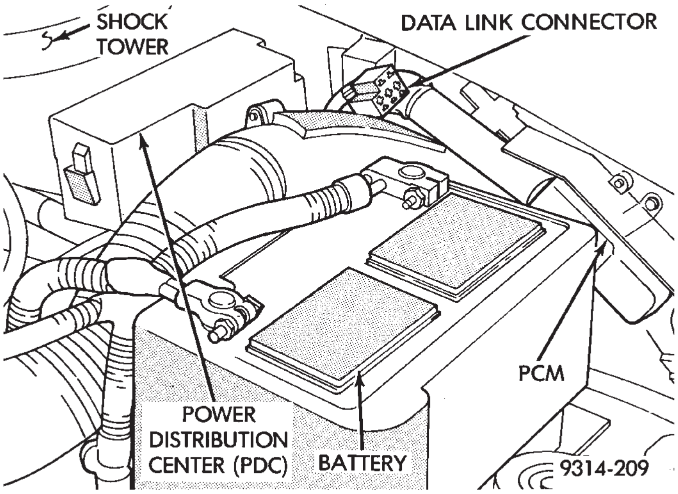


Fig. 26 Power Distribution Center (PDC) (AG and AJ Body)

When the relay is energized by the PCM, battery voltage is connected to the ignition coil positive terminal. The PCM will de-energize the ASD relay if it does not receive an input from the distributor pick-

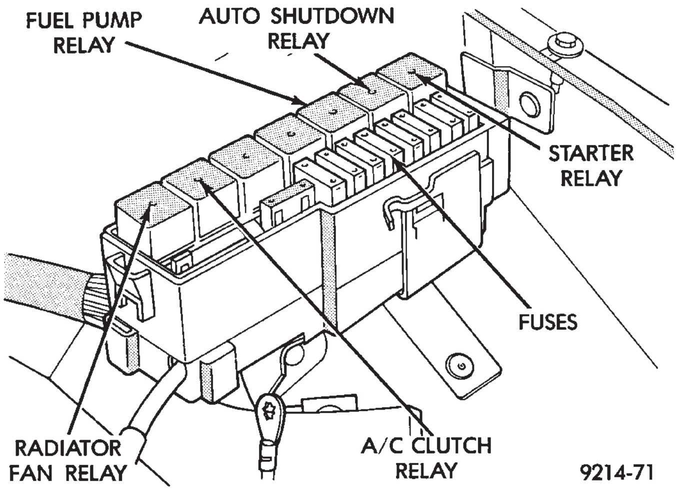


Fig. 27 Relay Identification (AG and AJ Body)

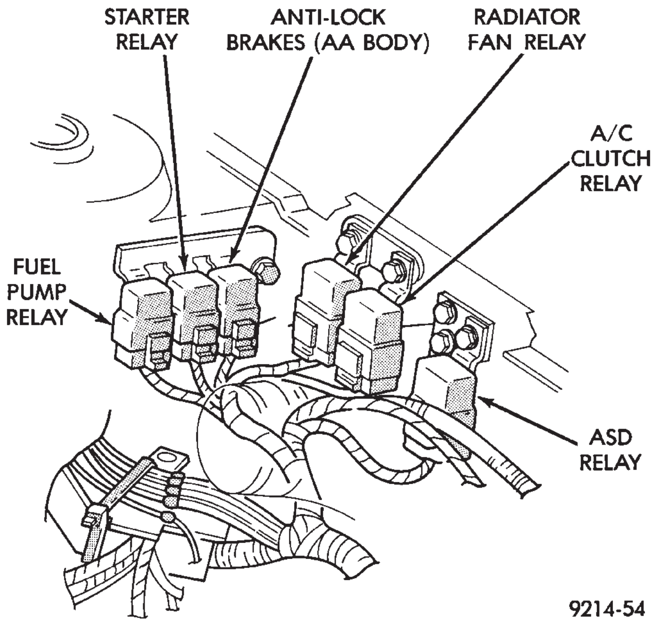


Fig. 28 Relay Identification (AA and AP Bodies)

up. Refer to Auto Shutdown (ASD) Relay and Fuel Pump Relay in this section.

On 2.2L TBI, 2.5L TBI and 2.5L MPI engines, the ignition coil is mounted to the thermostat housing (Fig. 29). On 3.0L engines the coil is mounted on the rear of the intake manifold next to the air cleaner (Fig. 30).

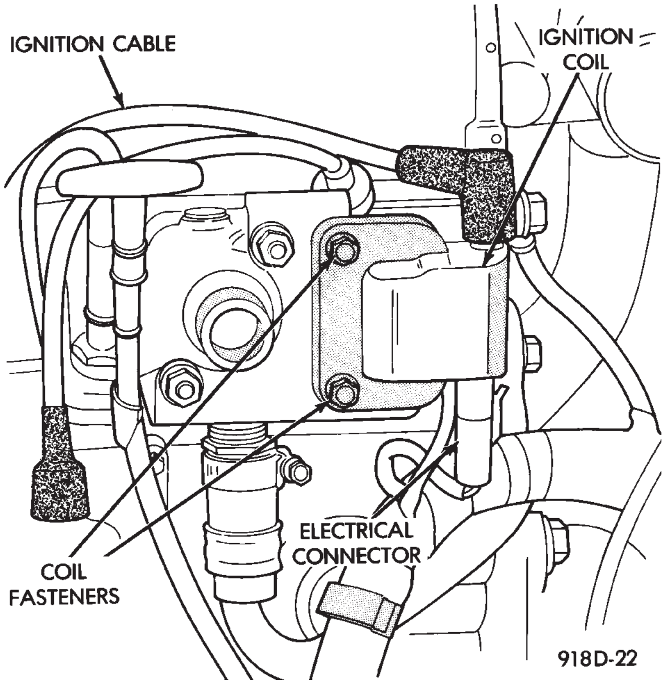


Fig. 29 Ignition Coil—2.2L TBI, 2.5L TBI and 2.5L MPI Engines

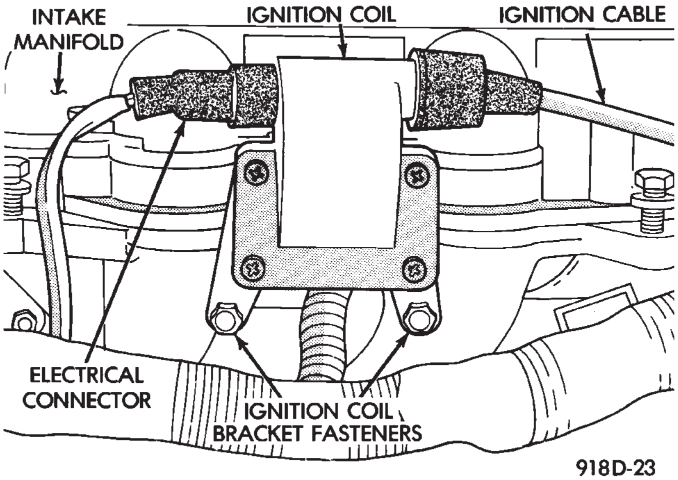


Fig. 30 Ignition Coil—3.0L Engine

2.2L TBI, 2.5L TBI, 2.5L MPI AND 3.0L IGNITION SYSTEMS—DIAGNOSTIC PROCEDURES

INDEX

GENERAL INFORMATION

For additional information, refer to On Board Diagnostics in the Fuel Injection General Diagnosis sections of Group 14. Also, refer to the DRBII scan tool and appropriate Powertrain Diagnostic Procedures Manual.

SPARK PLUGS

Faulty or fouled spark plugs may perform well at idle speed, but frequently fail at higher engine speeds. Faulty plugs can be identified in a number of ways: poor fuel economy, power loss, decrease in engine speed, hard starting and, in general, poor engine performance.

Spark plugs also malfunction because of carbon fouling, excessive electrode air gap, or a broken insulator. Refer to the General Information Section of this group for spark plug diagnosis.

IGNITION COIL

The ignition coil is designed to operate without an external ballast resistor.

Inspect the coil for arcing. Test the coil according to coil tester manufacturer's instructions. Test coil primary and secondary resistance. Replace any coil that does not meet specifications. Refer to the Coil Resistance chart.

If the ignition coil is replaced due to a burned tower, carbon tracking, arcing at the tower, or damage to the terminal or boot on the coil end of the secondary cable, the cable must be replaced. Arcing at the tower will carbonize the nipple which, if it is connected to a new coil, will cause the coil to fail.

If a secondary cable shows any signs of damage, the cable should be replaced with a new cable and new terminal. Carbon tracking on the old cable can cause arcing and the failure of a new coil.

TESTING FOR SPARK AT COIL

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 (Fig. 1). Crank the engine and inspect for spark at the coil secondary cable.

There must be a constant spark at the coil secondary cable. If the spark is constant, have a helper 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 spark is not constant or there is no spark, proceed to the failure to start test.

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,

COIL RESISTANCE

COIL (MANUFACTURER)	PRIMARY RESISTANCE 21–27°C (70–80°F)	SECONDARY RESISTANCE 21–27°C (70–80°F)
Diamond	0.97 - 1.18 Ohms	11,300 - 15,300 Ohms
Toyodenso	0.95 - 1.20 Ohms	11,300 - 13,300 Ohms

J918D-2

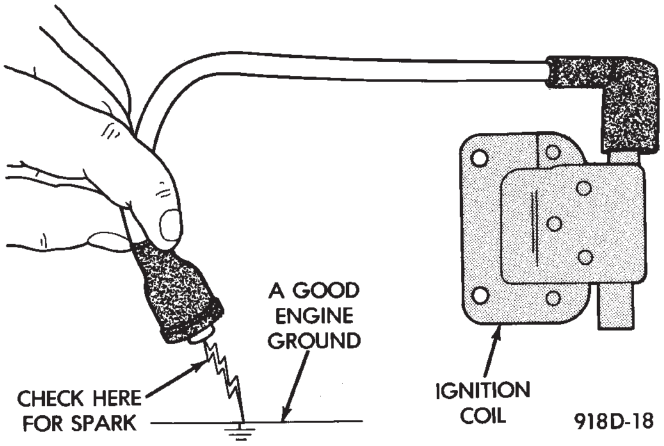


Fig. 1 Checking for Spark

make 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.

FAILURE TO START TEST—2.5L TBI AND 3.0L ENGINES

Before proceeding with this test make sure Testing For Spark At Coil has been performed. Failure to do this may lead to unnecessary diagnostic time and wrong test results.

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST WITH THE ENGINE RUNNING.

(1) Battery voltage must be at least 12.4 volts to perform test.

(2) Crank the engine for 5 seconds while monitoring the voltage at the coil positive (+) terminal (Fig. 2 or Fig. 3). If the voltage remains near zero during the entire period of cranking, refer to Group 14 for On-Board Diagnostic checks. Also, refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Procedures manual. These checks will help diagnose problems with the PCM and auto shutdown relay.

(3) If voltage is at near-battery voltage and drops to zero after 1-2 seconds of cranking, refer to On-Board Diagnostic in Group 14. Also, refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Procedures manual. These tests will help check the distributor reference pickup circuit to the PCM.

(4) If voltage remains at near battery voltage during the entire 5 seconds, **with the key off,** remove the PCM 60-way connector. Check the 60-way connector for any terminals that are pushed out or loose.

(5) Remove the connector to coil (+) and connect a jumper wire between battery (+) and coil (+).

(6) Using the special jumper (Fig. 4), momentarily ground terminal #19 of the 60-way connector (Fig. 5). A spark should be generated when the ground is removed.

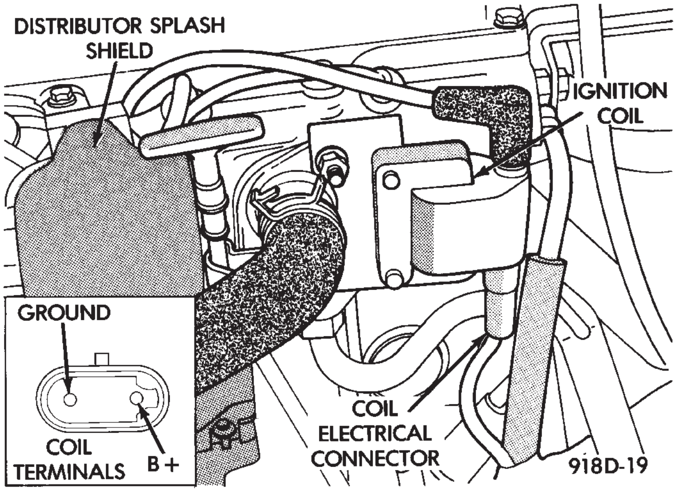


Fig. 2 Coil Terminals—2.2L TBI, 2.5L TBI and 2.5L MPI Engines

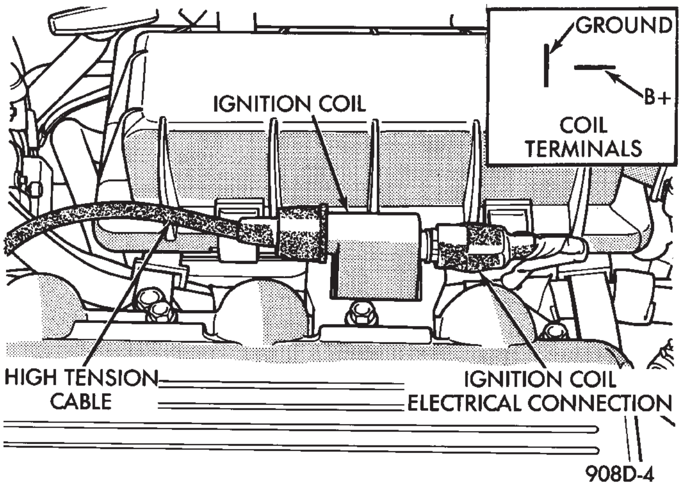


Fig. 3 Coil Terminals—3.0L Engine

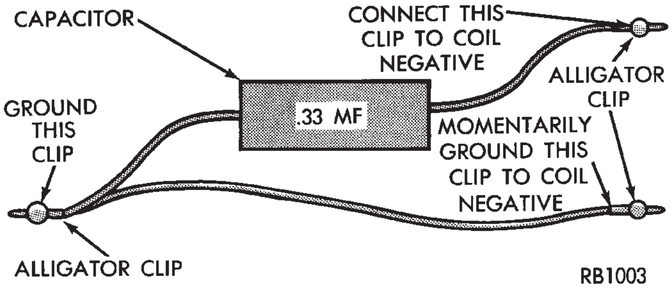


Fig. 4 Special Jumper to Ground Coil Negative

(7) If spark is generated, replace the PCM.

(8) If no spark is seen, use the special jumper to ground the coil (-) terminal directly.

(9) If spark is produced, inspect wiring harness for an open condition.

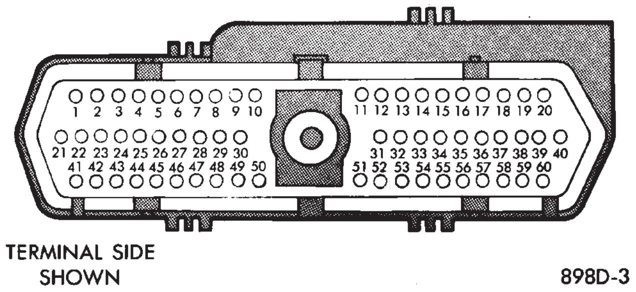


Fig. 5 60-Way Electrical Connector, Powertrain control module

(10) If no spark is produced, replace the ignition coil.

POOR PERFORMANCE TEST

To prevent unnecessary diagnostic time and possible incorrect results, the Testing For Spark At Coil procedure should be performed before this test.

WARNING: APPLY PARKING BRAKE AND/OR BLOCK THE WHEELS BEFORE PERFORMING ANY ENGINE RUNNING TESTS.

Check and adjust basic timing (refer to the specification section of this group and see service procedures).

COOLANT TEMPERATURE SENSOR TEST

(1) With key off, disconnect wire connector from coolant temperature sensor (Fig. 6).

(2) Connect one lead of ohmmeter to one terminal of coolant temperature sensor.

(3) Connect the other lead of ohmmeter to remaining terminal of coolant temperature sensor. The ohmmeter should read as follows;

- Engine/Sensor at normal operating temperature around 200°F should read approximately 700 to 1,000 ohms.
- Engine/Sensor at room temperature around 70°F, ohmmeter should read approximately 7,000 to 13,000 ohms.

Refer to On Board Diagnostics in the General Diagnosis section of Group 14. Also, refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Procedures manual for additional test procedures.

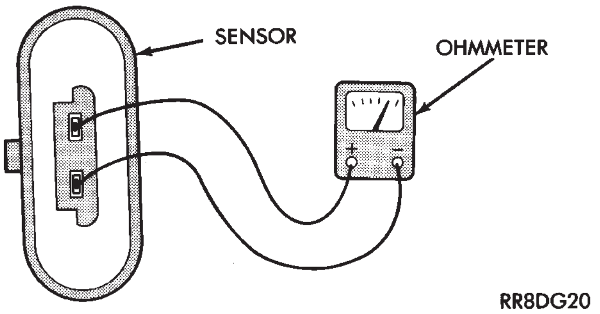


Fig. 6 Coolant Temperature Sensor Test

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

Refer to the DRB II scan tool and appropriate Powertrain Diagnostic Procedures manual for further test procedures.

2.2L TBI, 2.5L TBI, 2.5L MPI AND 3.0L IGNITION SYSTEMS—SERVICE PROCEDURES

INDEX

POWERTRAIN CONTROL MODULE (PCM)

The powertrain control module (PCM) is located next to the battery (Fig. 1).

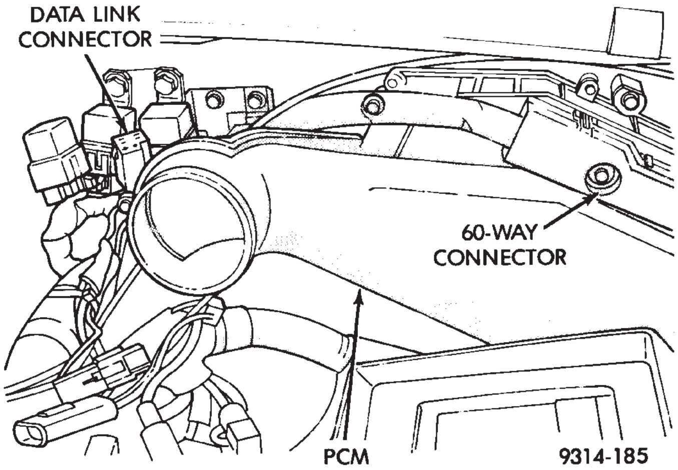


Fig. 1 Powertrain control module (PCM)

REMOVAL

(1) Remove air cleaner duct or air cleaner assembly.

(2) Remove battery.

(3) Remove PCM mounting screws.

(4) Remove 60-way wiring connector from the PCM.

(5) Remove PCM.

INSTALLATION

(1) Connect 60-Way electrical connector to PCM (Fig. 1).

(2) Install PCM. Tighten mounting screws.

(3) Install battery.

(4) Install air cleaner duct or air cleaner assembly.

COOLANT TEMPERATURE SENSOR

On 2.2L TBI, 2.5L TBI and 2.5L MPI (flexible fuel AA-Body) engines, the coolant temperature sensor is located behind the ignition coil (Fig. 2). On 3.0L engines the sensor is located next to the thermostat housing (Fig. 3).

REMOVAL

(1) Drain cooling system until coolant level is below coolant sensor. Refer to Group 7, Cooling System.

(2) Disconnect electrical connector from sensor.

(3) Remove sensor from engine.

INSTALLATION

(1) Install coolant sensor. Tighten 2.2L TBI, 2.5L TBI or 2.5L MPI engine coolant sensor to 28 N●m (20 ft. lbs.) torque. Tighten the 3.0L engine coolant 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.

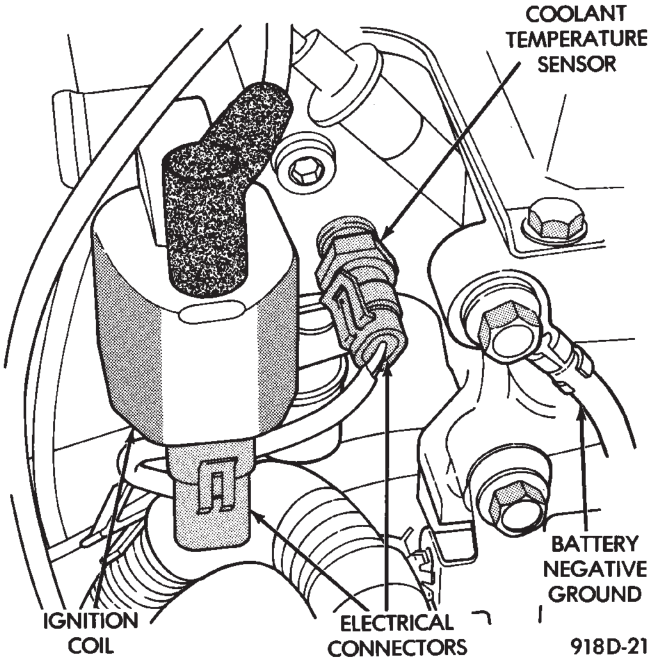


Fig. 2 Coolant Temperature Sensor—2.2 TBI, 2.5L TBI and 2.5L MPI Engines

IGNITION COIL—2.2L TBI, 2.5L TBI AND 2.5L MPI ENGINES

The ignition coil mounts to the thermostat housing (Fig. 4).

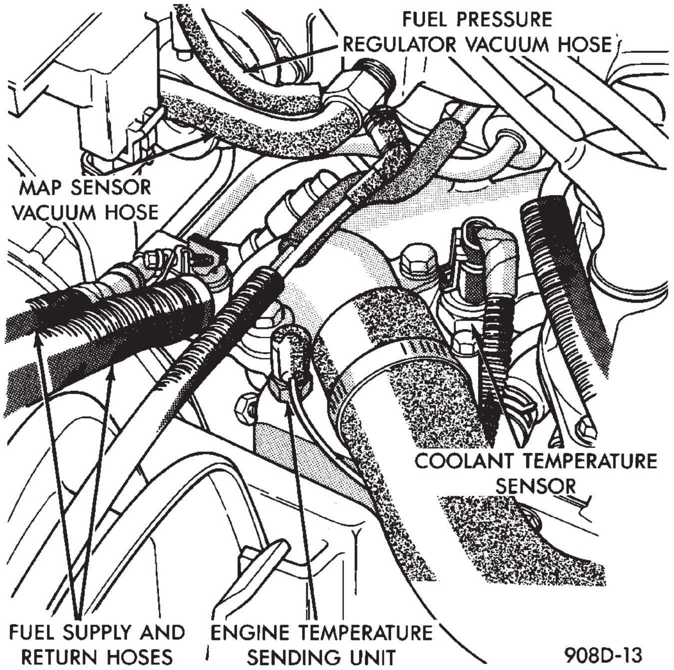


Fig. 3 Coolant Temperature Sensor—3.0L Engine

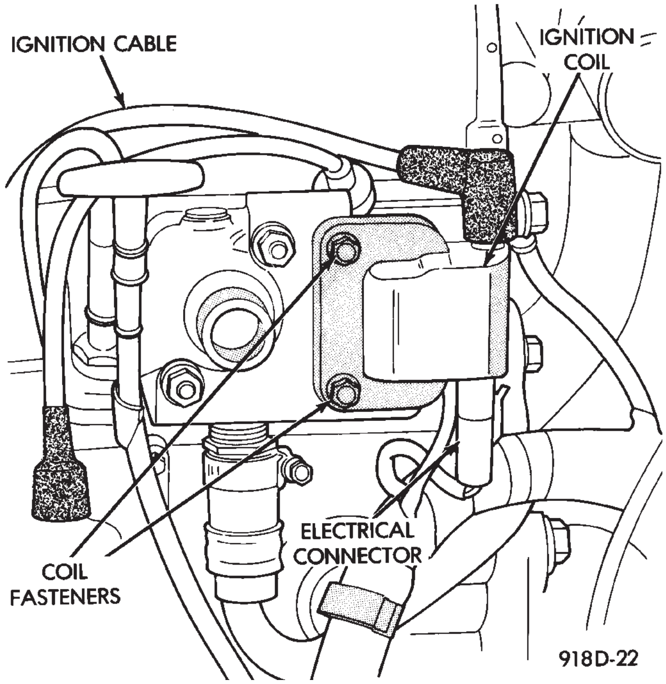


Fig. 4 Ignition Coil—2.2L TBI, 2.5L TBI and 2.5L MPI Engines

REMOVAL

(1) Disconnect the coil to distributor ignition cable (Fig. 4).

(2) Disconnect the wiring harness connector from the coil.

(3) Remove ignition coil mounting screws.

INSTALLATION

(1) Install ignition coil onto the bracket. Tighten the screws to 9.5 N●m (85 in. lbs.) torque.

(2) Connect the wiring harness connector.

(3) Connect the coil to distributor ignition cable.

IGNITION COIL—3.0L ENGINES

The ignition coil is located at the back of the intake manifold (Fig. 5).

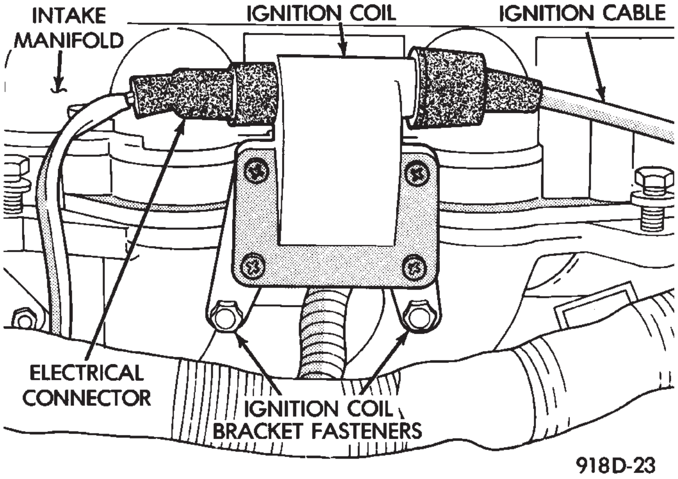


Fig. 5 Ignition Coil—3.0L Engine

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.

SPARK PLUG SERVICE

When replacing the spark plug and coil cables, route the cables correctly and secure them in the appropriate retainers. Incorrectly routed cables can cause the radio to reproduce ignition noise. It can also cause cross ignition of the spark plugs or short circuit the cables to ground.

SPARK PLUG REMOVAL

Always remove cables by grasping at 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 rubber or foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

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. 6).

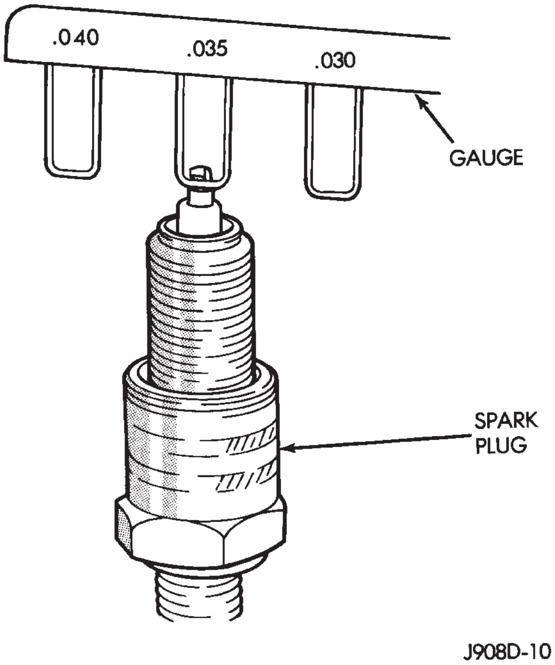


Fig. 6 Setting Spark Plug Gap—Typical

SPARK PLUG INSTALLATION

(1) Start the spark plug into the cylinder head by hand to avoid cross threading.

(2) Tighten spark plugs to 28 N●m (20 ft. lbs.) torque.

(3) Install spark plug cables over spark plugs.

IDLE RPM TEST—2.5L AND 3.0L ENGINES

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY TESTS WITH A RUNNING ENGINE.

Engine idle set **rpm** should be **recorded when the vehicle is first brought into shop for testing.** This will assist in diagnosing complaints of engine stalling, creeping and hard shifting on vehicles equipped with automatic transaxles.

Proceed to the Throttle Body Minimum Airflow procedures in Group 14.

IGNITION TIMING PROCEDURE—2.2L TBI, 2.5L TBI, 2.5L MPI, AND 3.0L ENGINES

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING SETTING IGNITION TIMING OR PERFORMING ANY TEST ON AN OPERATING ENGINE.

Proper ignition timing is required to obtain optimum engine performance. The distributor must be correctly indexed to provide correct initial ignition timing.

(1) Set the gearshift selector in park or neutral and apply the parking brake. All lights and accessories must be off.

(2) If using a magnetic timing light, insert the pickup probe into the open receptacle next to the timing scale window. If a magnetic timing unit is not available, use a conventional timing light connected to the number one cylinder spark plug cable.

Do not puncture cables, boots or nipples with test probes. Always use proper adapters. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition breaking the rubber insulation may permit secondary current to arc to ground.

(3) Turn selector switch to the appropriate cylinder position.

(4) Start engine and run until operating temperature is obtained.

(5) With the engine at normal operating temperature, connect the DRBII scan tool to the data link connector (diagnostic connector). Access the State Display screen. Refer to the appropriate Powertrain Diagnostics Procedures Manual. **If not using the DRBII scan tool, disconnect the coolant temperature sensor electrical connector.** The electric radiator fan will operate and the malfunction indicator lamp (instrument panel Check Engine light) will turn on after disconnecting the coolant sensor or starting the DRBII scan tool procedure.

(6) Aim Timing Light at timing scale (Fig. 7 or Fig. 8) or read magnetic timing unit. If flash occurs when timing mark is before specified degree mark, timing is advanced. To adjust, turn distributor housing in direction of rotor rotation.

If flash occurs when timing mark is after specified degree mark, timing is retarded. To adjust, turn distributor housing against direction of rotor rotation. Refer to Vehicle Emission Control Information label for correct timing specification. If timing is within ± 2° of value specified on the label, proceed to step (8). If outside specified tolerance, proceed to next step.

(7) Loosen distributor hold-down arm screw enough to rotate the distributor housing (Fig. 9 or

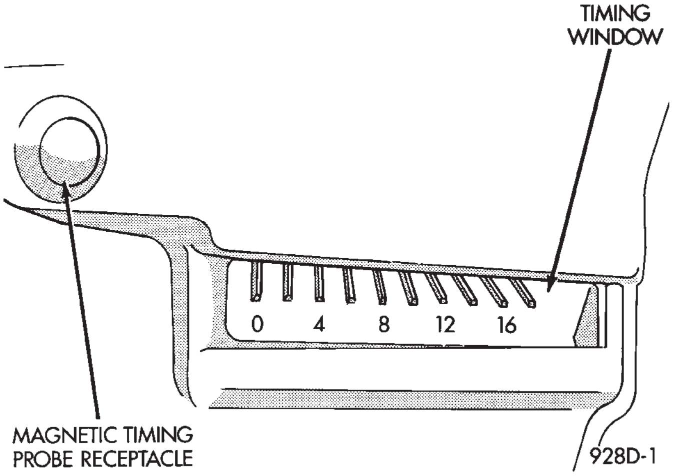


Fig. 7 Timing Scale—2.2L TBI, 2.5L TBI and 2.5L MPI Engines

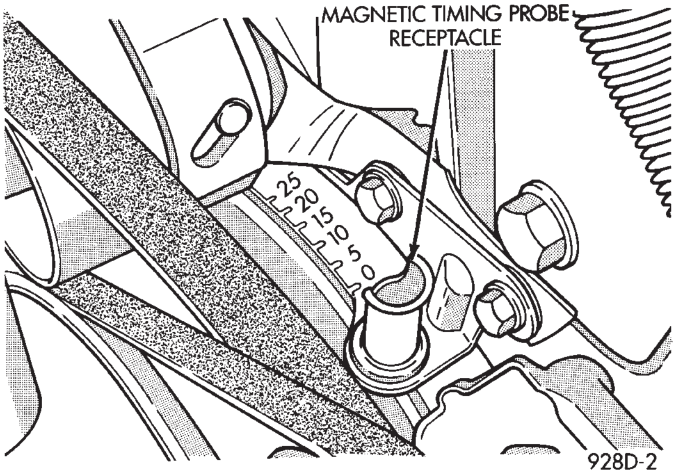


Fig. 8 Timing Scale—3.0L Engine

Fig. 10). Turn distributor housing to adjust timing. Tighten the hold-down arm screw and recheck timing.

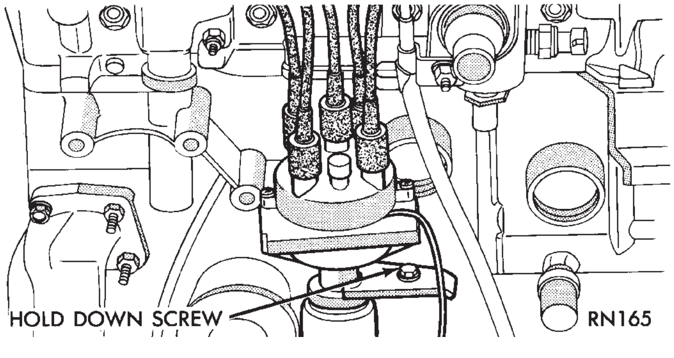


Fig. 9 Distributor Holddown—2.5L Engine

(8) Turn the engine off. Remove timing light or magnetic timing unit and tachometer. If the coolant temperature sensor was disconnected, connect the sensor and **erase fault codes using the Erase Fault Code Mode on the DRBII scan tool.**

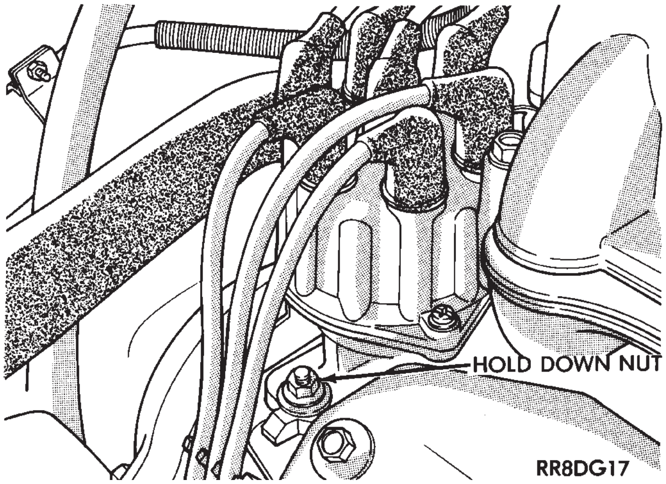


Fig. 10 Distributor Holddown—3.0L Engine

DISTRIBUTOR—2.2L TBI, 2.5L TBI AND 2.5L MPI ENGINES

REMOVAL

(1) Disconnect distributor pick-up connector from wiring harness connector (Fig. 11).

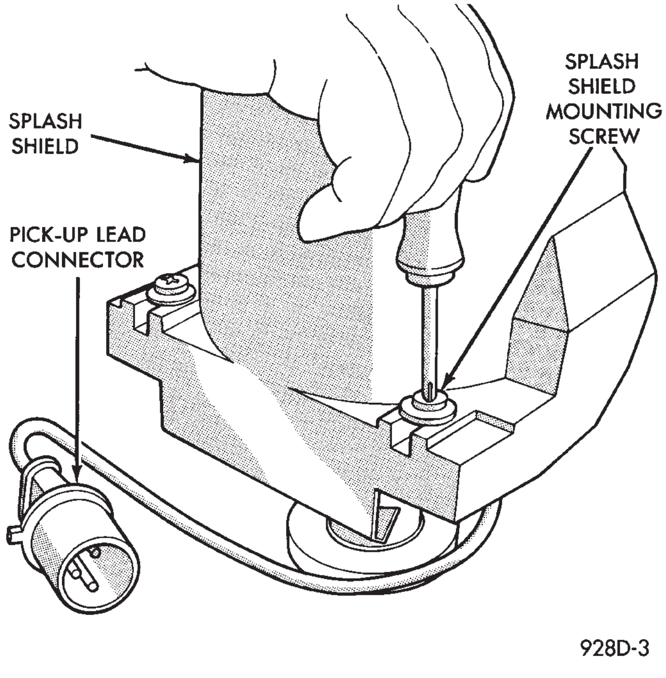


Fig. 11 Distributor Pickup Connector—2.5L Engine

(2) Remove splash shield retaining screws (Fig. 12).

(3) Remove splash shield (Fig. 12).

(4) Loosen distributor cap retaining screws (Fig. 13).

(5) Lift cap off of distributor (Fig. 14).

(6) Rotate engine crankshaft until the distributor rotor is pointing toward the cylinder block. Use this as reference when reinstalling distributor.

(7) Remove distributor hold-down screw.

(8) Carefully lift the distributor from the engine.

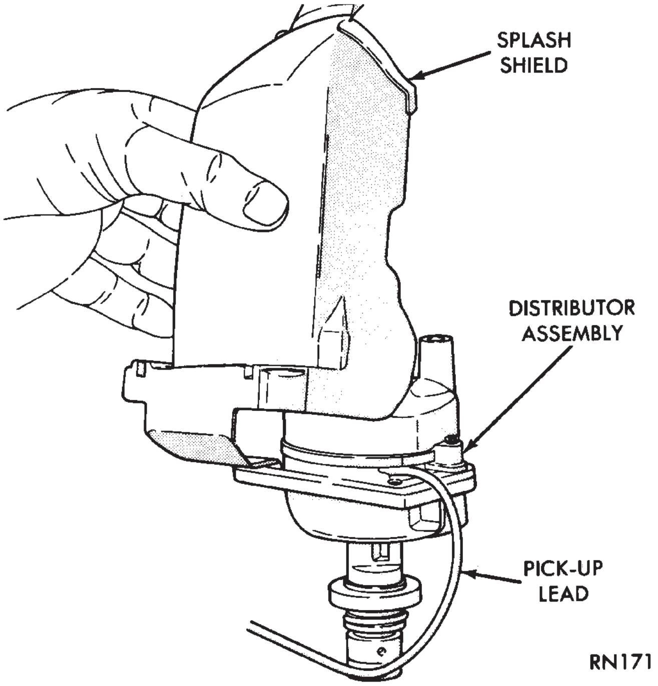


Fig. 12 Splash Shield—2.5L Engine

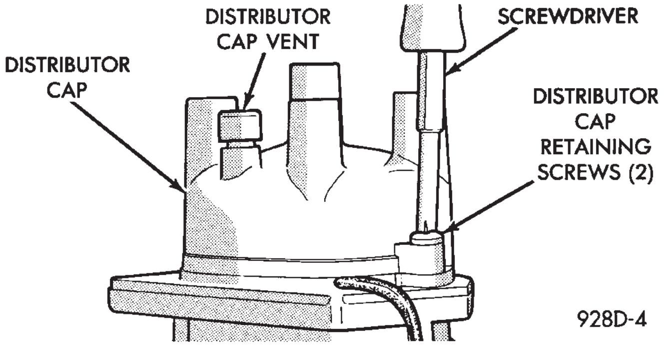


Fig. 13 Distributor Cap Retaining Screws—2.5L Engine

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 it with new one.

(2) Carefully engage distributor drive with auxiliary shaft drive. When distributor is installed properly, rotor will be pointing toward cylinder block. **If engine has been cranked while distributor is removed, 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. Pointer on clutch housing should be in line with the **O(TDC)** mark on flywheel.

(b) Rotate rotor to a position just ahead of the number one distributor cap terminal.

(c) Lower the distributor into the opening, engaging distributor drive with drive on auxiliary shaft. With distributor fully seated on engine, rotor should be under the cap number 1 tower.

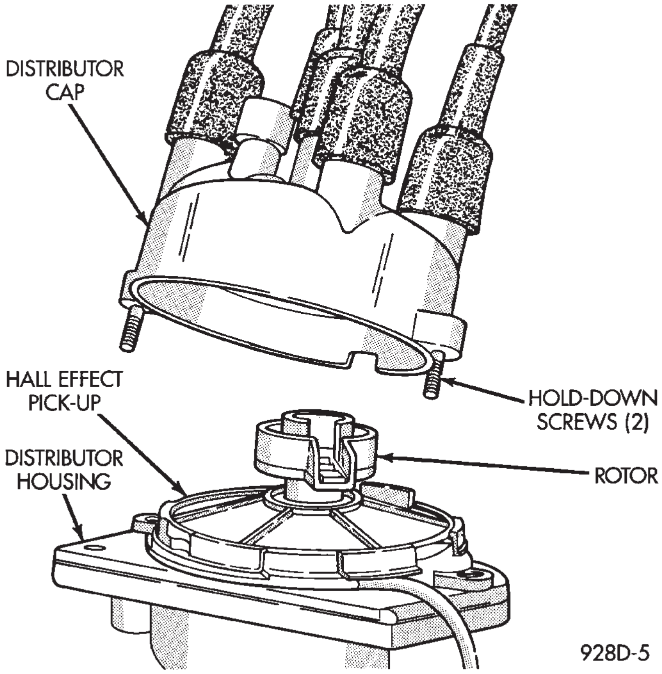


Fig. 14 Distributor Cap—2.5L Engine

(3) Install the distributor cap. Ensure all high tension wires snap firmly in the cap towers.

(4) Install hold-down arm screw and finger tighten.

(5) Install splash shield.

(6) Connect distributor pick-up connector lead wire at wiring harness connector.

(7) Set ignition timing to specification. Refer to Ignition Timing.

DISTRIBUTOR PICK-UP—2.2L TBI, 2.5L TBI AND 2.5L MPI ENGINES

REMOVAL

(1) Remove splash shield and cap. Refer to Distributor Removal.

(2) Remove rotor from shaft (Fig. 15).

(3) Remove **Hall effect pick-up assembly** (Fig. 16).

INSTALLATION

(1) Place pick-up assembly into distributor housing (Fig. 16).

The distributor pick-up wires may be damaged if not properly reinstalled.

(2) Install rotor (Fig. 15).

(3) Install cap and splash shield. Refer to Distributor Installation.

DISTRIBUTOR SERVICE—3.0L ENGINE

REMOVAL

(1) Disconnect distributor connector from wiring harness connector (Fig. 17).

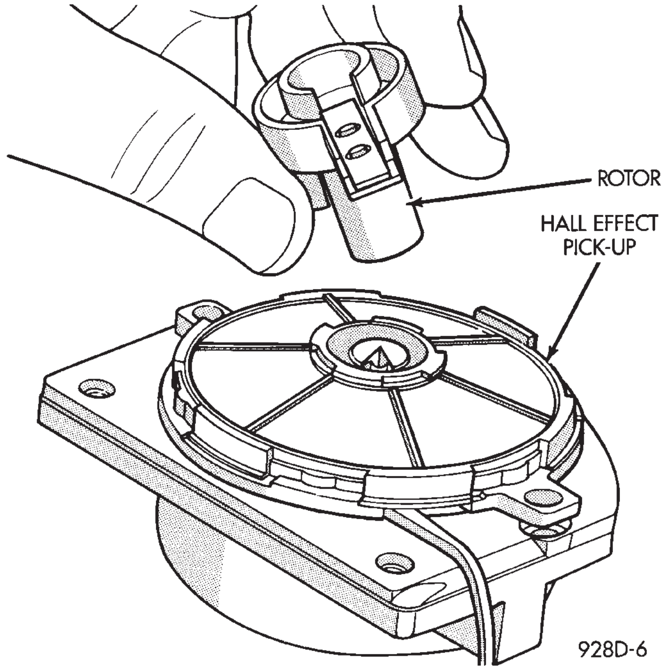


Fig. 15 Ignition Rotor—2.2L TBI, 2.5L TBI and 2.5L MPI Engines

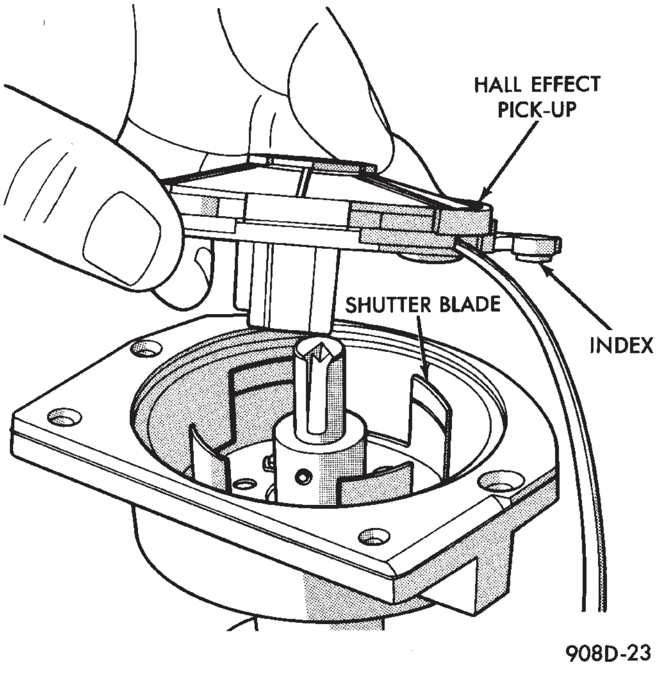


Fig. 16 Hall Effect Pickup Assembly—2.2L TBI, 2.5L TBI and 2.5l MPI Engines

(2) Loosen distributor cap retaining screws.

(3) Lift cap of off distributor (Fig. 18).

(4) Rotate engine crankshaft until the distributor rotor points 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. 19).

(6) Carefully lift the distributor from the engine.

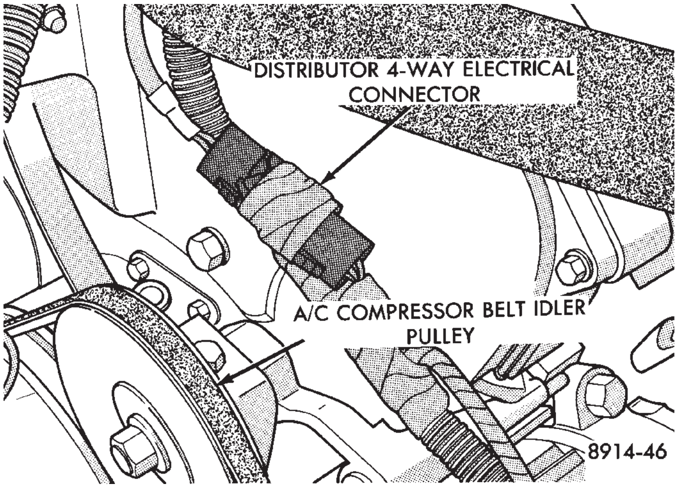


Fig. 17 Distributor Electrical Connector—3.0L Engine

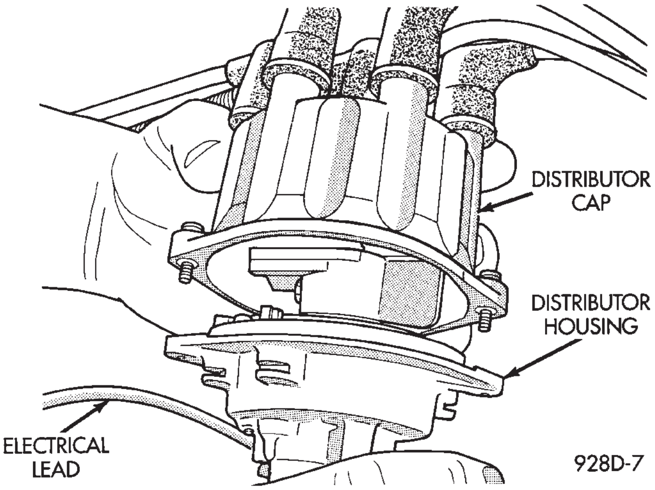


Fig. 18 Distributor Cap—3.0L Engine

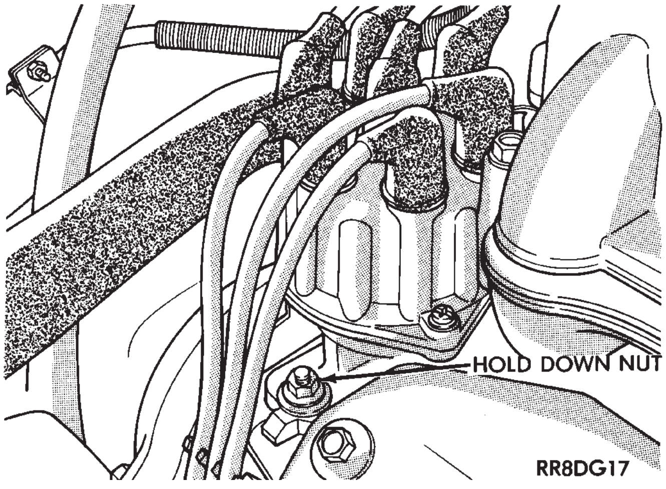


Fig. 19 Distributor Hold-Down—3.0L Engine

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, 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. 20).

(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. 20).

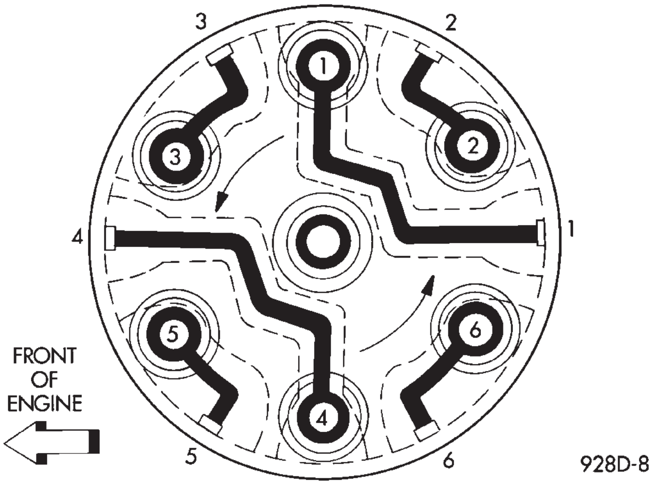


Fig. 20 Distributor Cap Terminal Routing, View from Top of Cap—3.0L Engine

(3) Install distributor cap. Ensure sure all high tension wires are firmly in the cap towers.

(4) Install hold-down nut and finger tighten.

(5) Connect distributor electrical connector to wiring harness connector (Fig. 17).

(6) Set ignition timing to specification. Refer to Ignition Timing in this section.

DISASSEMBLY

(1) Remove distributor cap mounting screws (Fig. 18).

(2) Remove distributor cap and inspect for flashover, cracked carbon button, cracked cap, or burned terminals. If any of these conditions exist, replace cap.

(3) Remove rotor screw (Fig. 21). Inspect rotor for cracks or burned electrode. If any of these conditions exist, replace rotor.

(4) Remove protective cover from distributor housing (Fig. 22).

(5) Remove lead wire clamp screw and remove lead wire (Fig. 23).

(6) Remove disk assembly screw (Fig. 24).

(7) Remove disk spacers and disk (Fig. 25). Disk

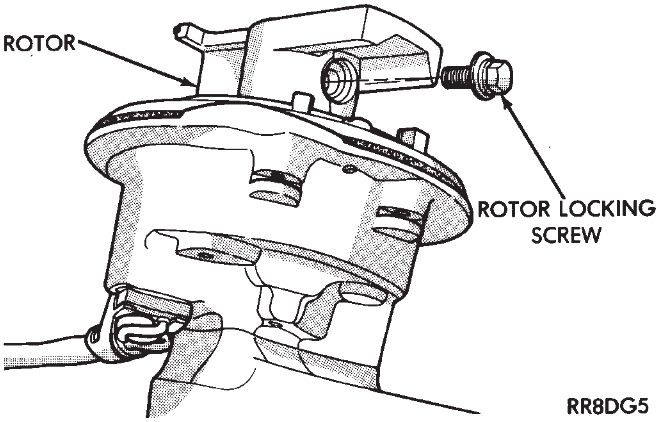


Fig. 21 Rotor Screw

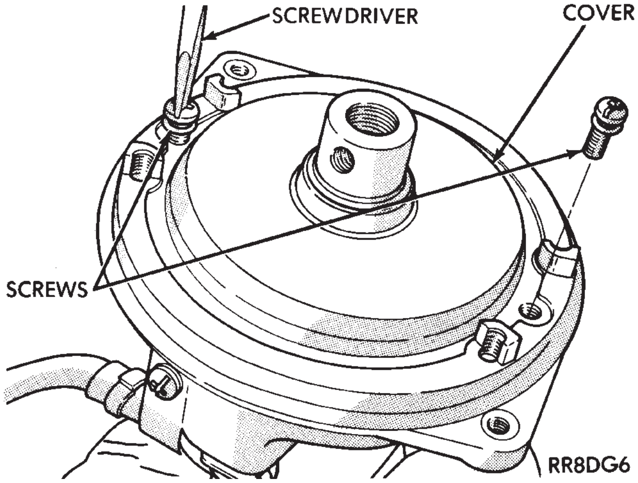


Fig. 22 Protective Cover

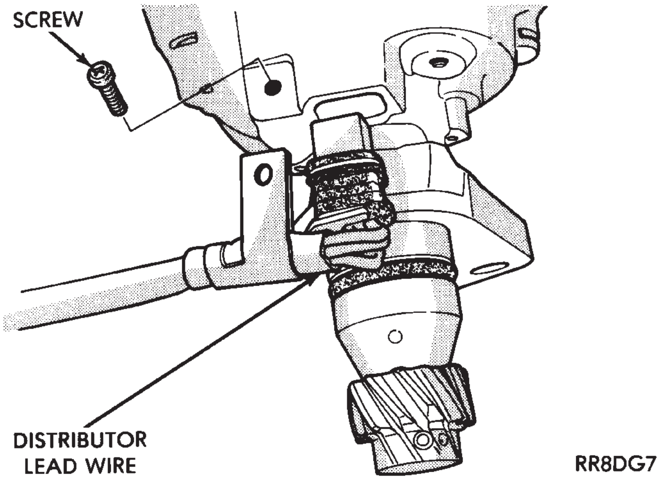


Fig. 23 Lead Wire Clamp

and spacers are keyed. Check disk for warpage, cracks or damaged slots (Fig. 26).

(8) Remove bushing and photo optic sensing unit fasteners. Remove unit from distributor housing (Fig. 27).

(9) Remove bearing retainer screws (Fig. 28).

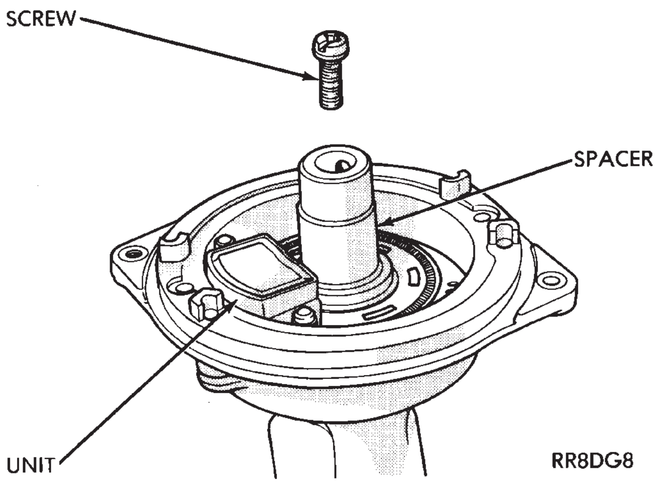


Fig. 24 Disk Assembly Screw

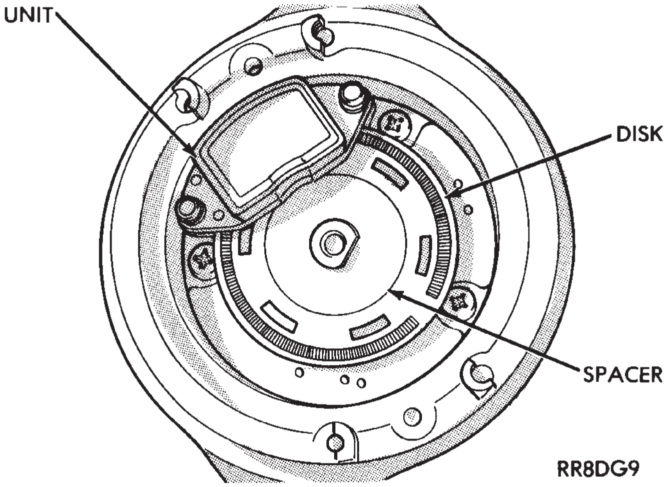


Fig. 25 Disk and Spacers Installed

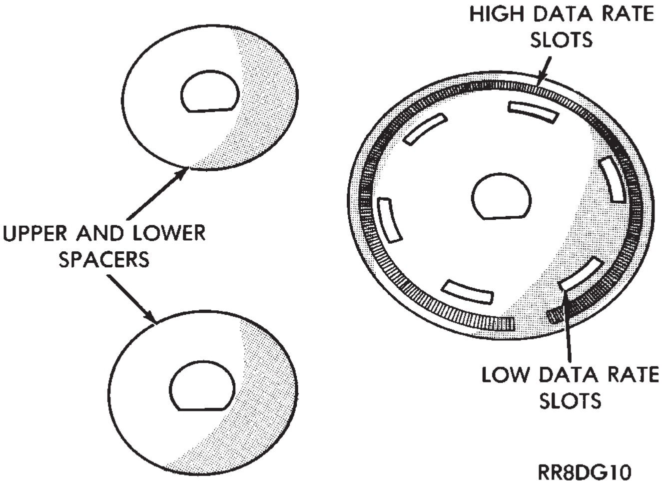


Fig. 26 Disk and Spacers

(10) Make reassembly alignment marks on gear and shaft (Figs. 29 and 30).

(11) With a pin punch drive out distributor drive gear roll pin (Fig. 31).

(12) Remove distributor drive gear (Fig. 32).

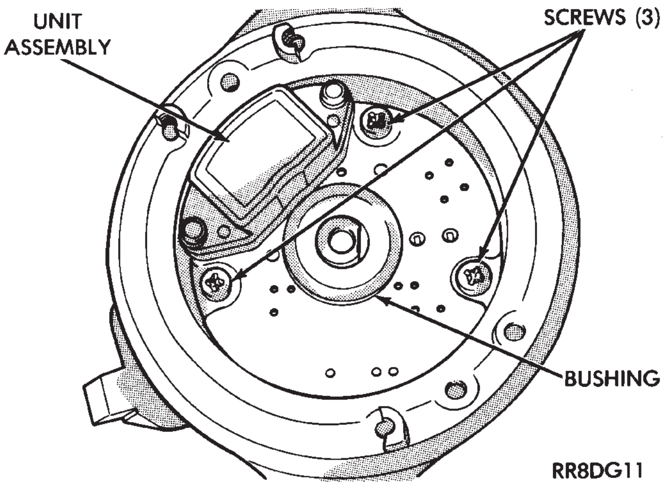


Fig. 27 Photo Optic Sensing Unit Assembly and Bushing

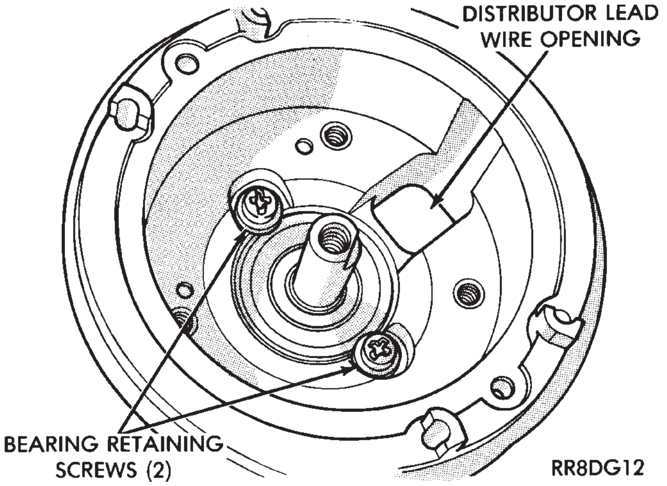


Fig. 28 Bearing Retainer Screws

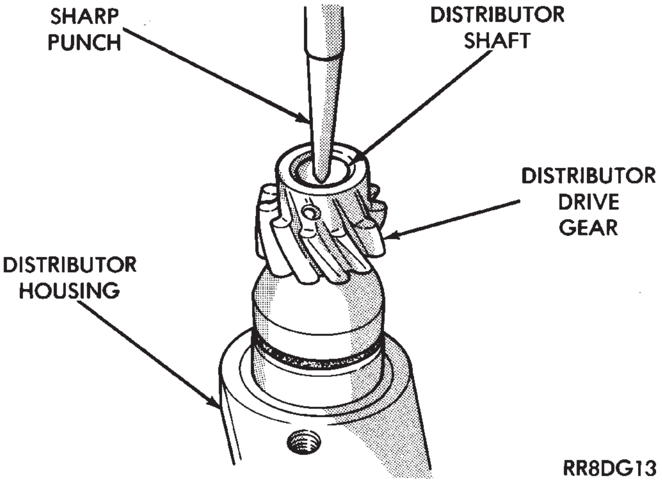


Fig. 29 Marking Drive Gear and Shaft

(13) Remove distributor shaft and bearing assembly (Fig. 33).

(14) To reassemble, reverse preceding procedure. Refer to Fig. 34.

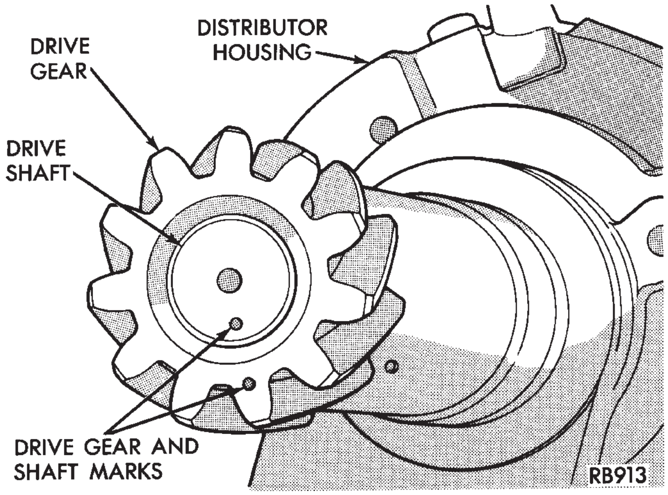


Fig. 30 Marks on Drive Gear and Shaft

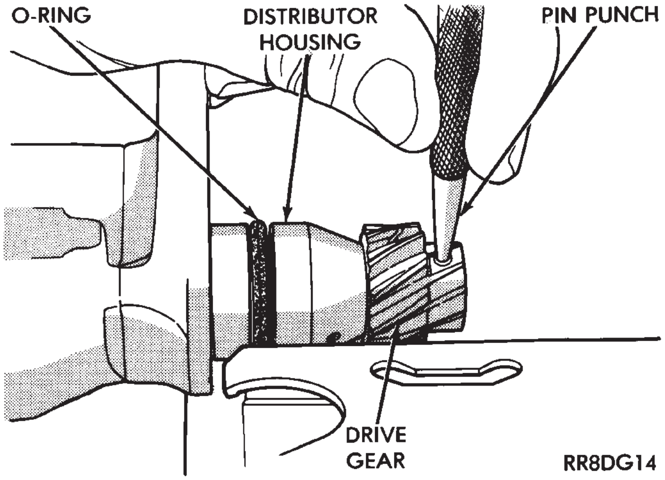


Fig. 31 Drive Gear Roll Pin

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SERVICE—2.5L TBI AND 3.0L ENGINES

(1) Remove vacuum hose and remove mounting screws from sensor (Fig. 35, 36 and 37).

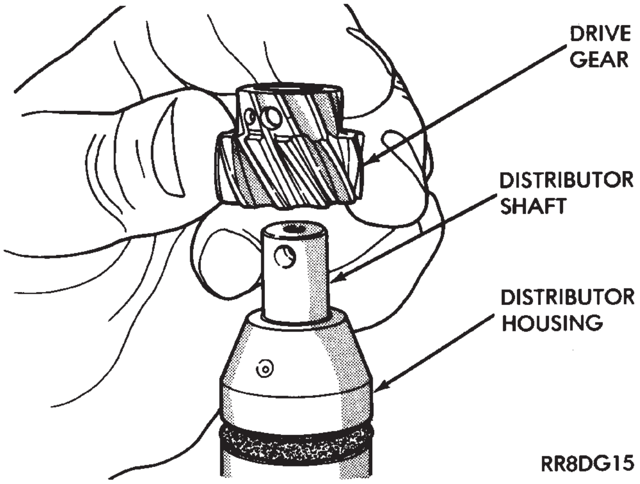


Fig. 32 Drive Gear

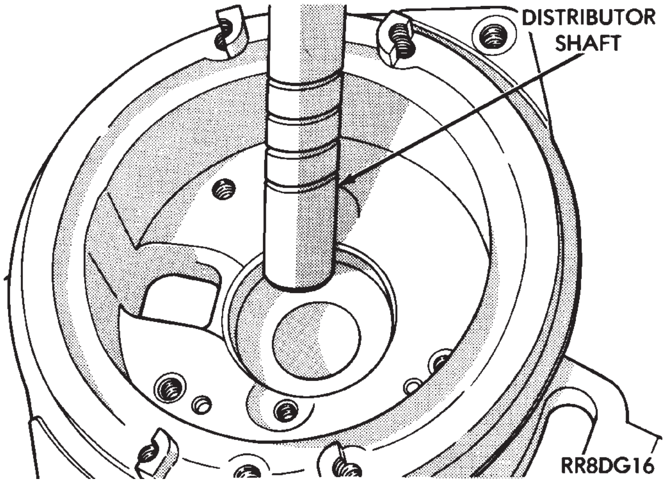


Fig. 33 Distributor Shaft

(2) Remove wiring harness and remove sensor.

(3) Reverse the above procedure for installation. Check that vacuum hose is attached to vacuum source.

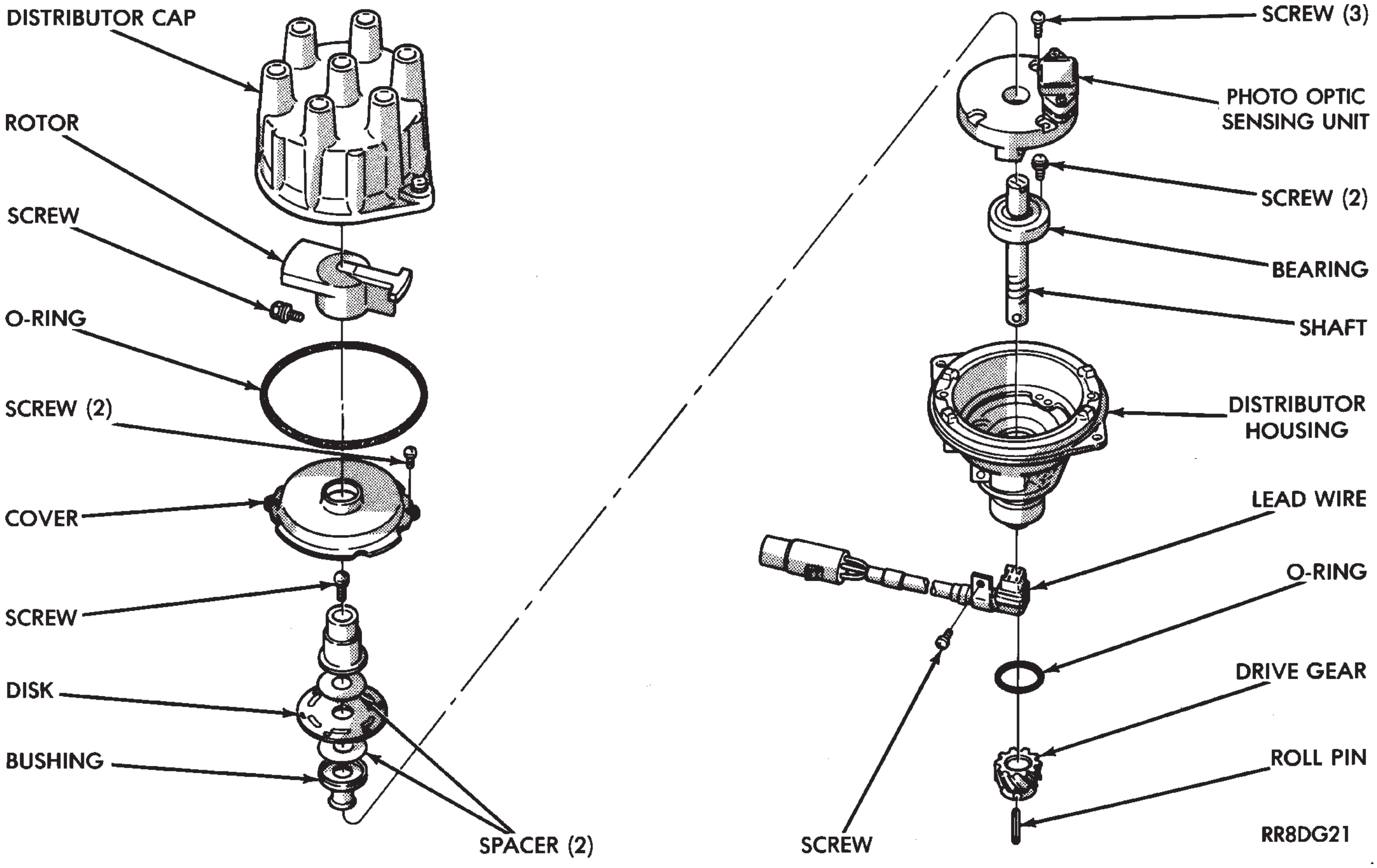


Fig. 34 Distributor—3.0L Engine

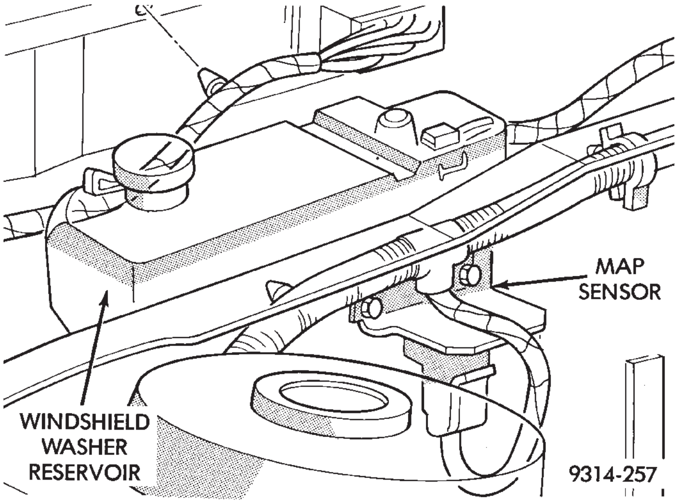


Fig. 35 Manifold Absolute Pressure (MAP) Sensor—2.2L and 2.5L TBI Engines

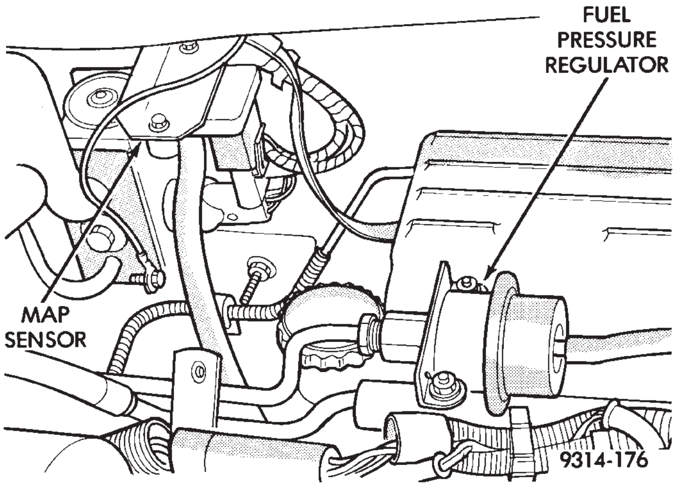


Fig. 36 Manifold Absolute Pressure (MAP) Sensor—2.5L MPI (Flexible Fuel AA-Body) Engines

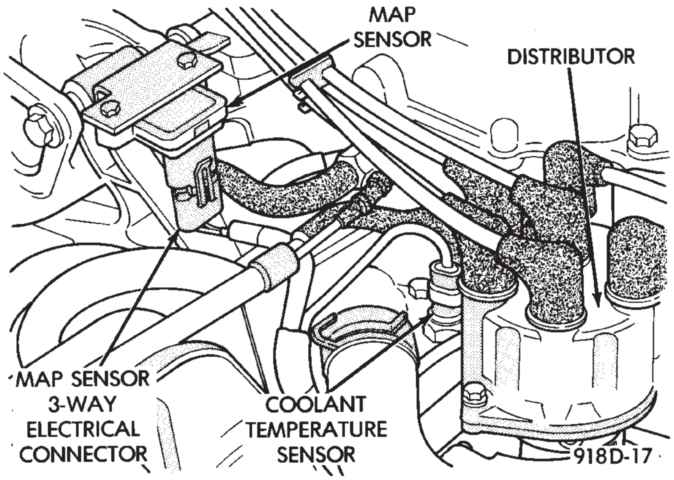


Fig. 37 Manifold Absolute Pressure (MAP) Sensor—3.0L Engine

2.2L TURBO III, 3.3L AND 3.8L IGNITION SYSTEM—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

This section describes the ignition systems for 2.2L Turbo III, 3.3L and 3.8L engines.

The Fuel Injection sections of Group 14 describe On Board Diagnostics.

Group 0, Lubrication and Maintenance, contains general maintenance information for ignition related items. The Owner's Manual also contains maintenance information.

2.2L Turbo III, 3.3L and 3.8L engines uses a fixed ignition timing system. Basic ignition timing is not adjustable. All spark advance is determined by the powertrain control module (PCM).

The ignition system does not use a distributor. The system is referred to as the Direct Ignition System. The system's three main components are the coil pack, crankshaft position sensor, and camshaft position sensor. The crankshaft and camshaft sensors are hall effect devices.

The camshaft position and crankshaft position sensors generate pulses that are the inputs sent to the PCM. The PCM interprets crankshaft and camshaft position from these sensors. The PCM uses crankshaft position sensor input to determine ignition timing. The PCM determines injector sequence from the camshaft position sensor.

The camshaft position sensor determines when a slot in the camshaft gear passes beneath it (Fig. 1 or Fig. 2). The crankshaft position sensor determines when a window in the drive plate passes under it (Fig. 3 or Fig. 4). 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.

FIRING ORDER

The firing order of the 2.2L Turbo III engine direct ignition system is 1-3-4-2 (Fig. 5). The firing order of the 3.3L and 3.8L engines direct ignition system is 1-2-3-4-5-6 (Fig. 6).

POWERTRAIN CONTROL MODULE (PCM)

The ignition system is regulated by the powertrain control module (PCM) (Fig. 7). 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.

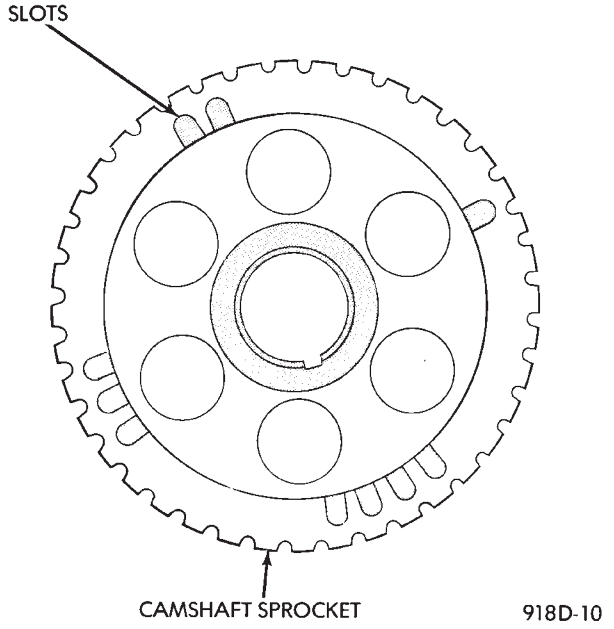


Fig. 1 Camshaft Sprocket—2.2L Turbo III Engine

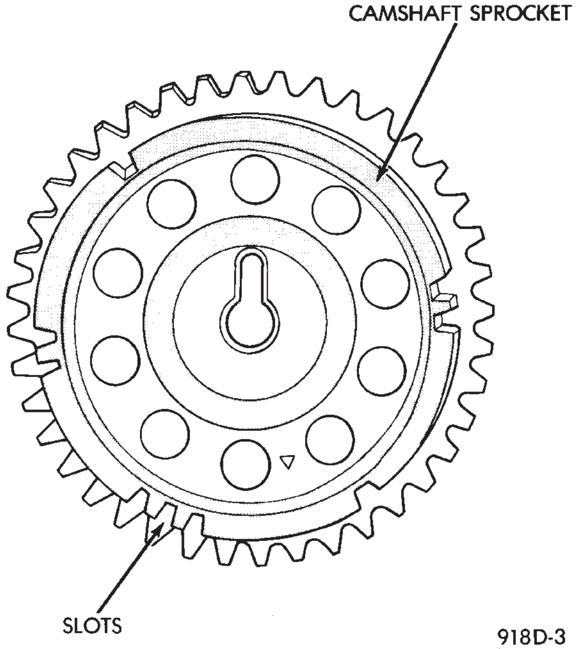


Fig. 2 Camshaft Sprocket—3.3L and 3.8L Engines

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 these input factors:

- coolant temperature
- knock sensor (Turbo III)
- engine RPM
- available manifold vacuum

The PCM also regulates the fuel injection system. Refer to the Fuel Injection sections of Group 14.

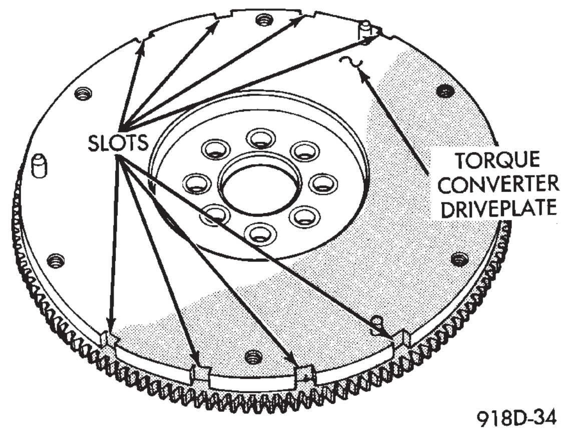


Fig. 3 Driveplate—2.2L Turbo III Engine

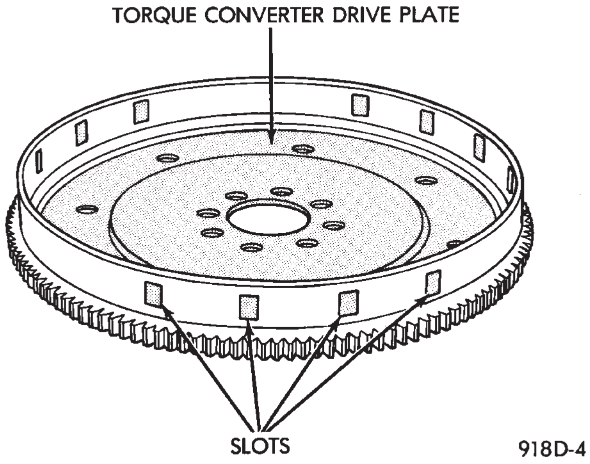


Fig. 4 Driveplate—3.3L and 3.8L Engines

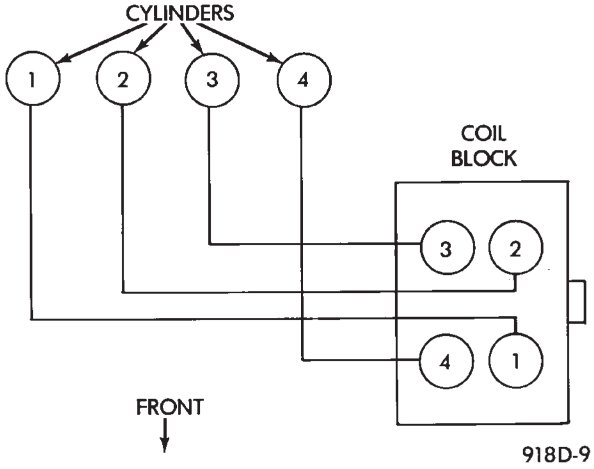


Fig. 5 Spark Plug Wire Routing—Turbo III Engine

SPARK PLUG CABLES

Spark Plug cables are sometimes referred to as secondary ignition wires. The wires transfer electrical current from the distributor to individual spark plugs at each cylinder. The spark plug cables are of nonmetallic construction and have a built in resis-

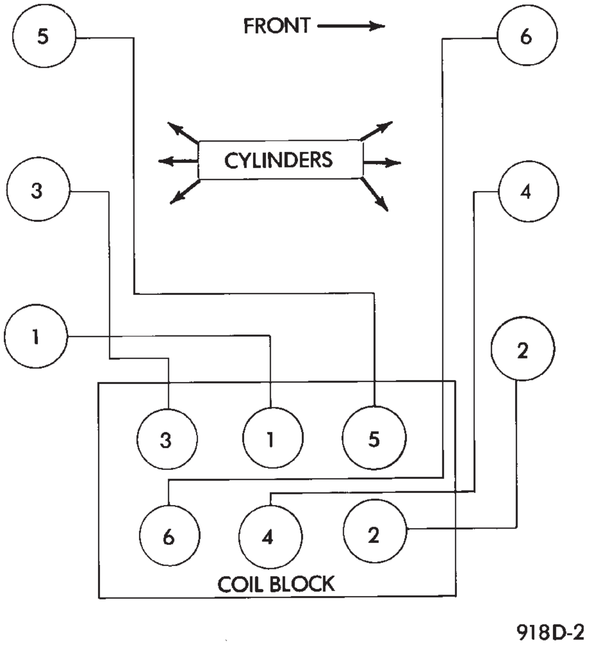


Fig. 6 Spark Plug Wire Routing—3.3L and 3.8L Engines

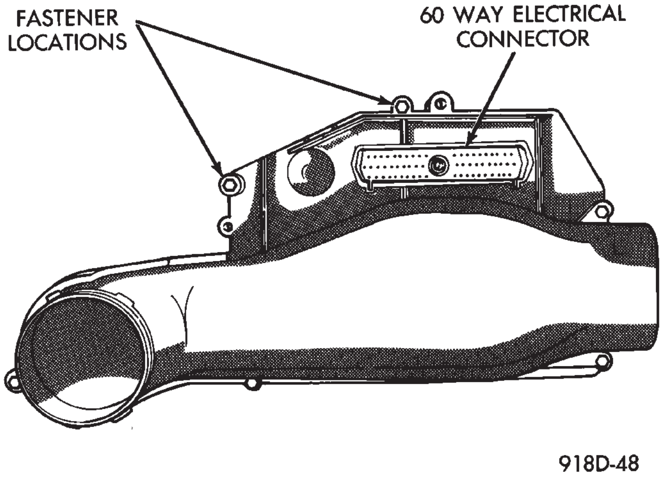


Fig. 7 Powertrain Control Module (PCM)

tance. The cables provide suppression of radio frequency emissions from the ignition system.

Check the spark plug cable connections for good contact at the coil and distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil and distributor cap towers and spark plug cover should fit tight around spark plug insulators. Loose cable connections can cause ignition malfunctions by permitting water to enter the towers, corroding, and increasing resistance.

SPARK PLUGS

The 2.2L Turbo III, 3.3L and 3.8L engines use resistor spark plugs. They have resistance values of 6,000 to 20,000 ohms when checked with at least a 1000 volt tester.

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.

Spark plugs that have low milage may be cleaned and reused if not otherwise defective. Refer to the Spark Plug Condition section of this group. After cleaning, file the center electrode flat with a small point file or jewelers file. Adjust the gap between the electrodes (Fig. 8) to the dimensions specified in the chart at the end of this section.

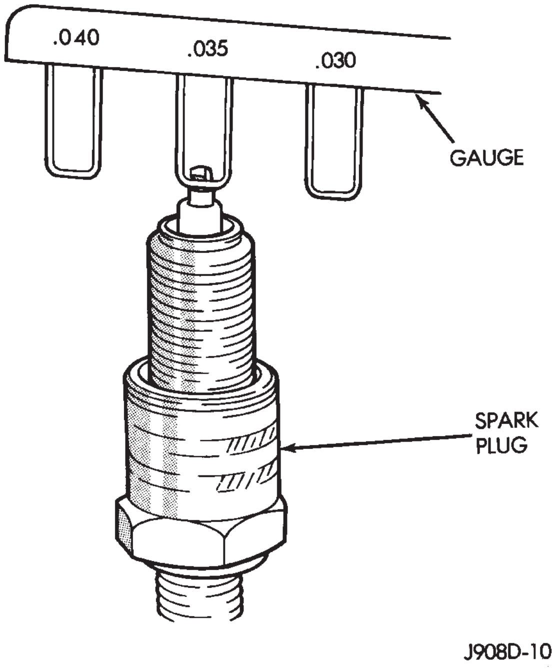


Fig. 8 Setting Spark Plug Electrode Gap—Typical

Always tighten spark plugs to the specified torque. Over tightening can cause distortion and change spark plug gap. Tighten 2.2L Turbo III, 3.3L and 3.8L spark plugs to 28 N•m (20 ft. lbs.) torque.

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. 9). 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. Spark plugs that have nor-

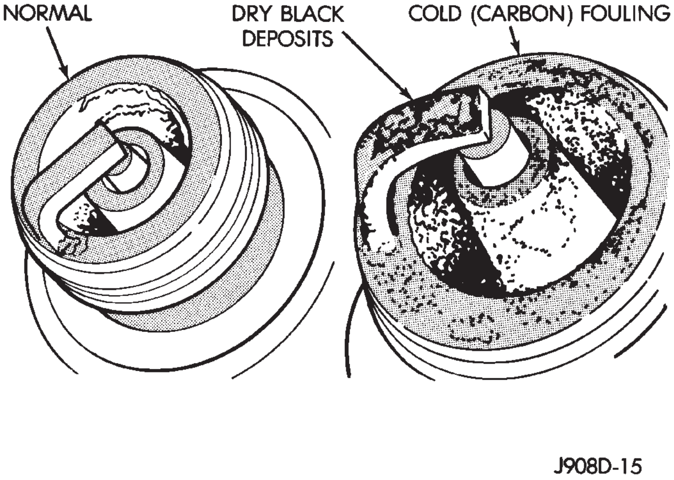


Fig. 9 Normal Operation and Cold (Carbon) Fouling

mal wear can usually be cleaned, have the electrodes filed and regapped, and then reinstalled.

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.

COLD FOULING (CARBON FOULING)

Cold fouling is sometimes referred to as carbon fouling because the deposits that cause cold fouling are basically carbon (Fig. 9). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set 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.

WET FOULING

A spark plug that is coated with excessive wet fuel or oil is wet 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. In new or recently overhauled engines, wet fouled spark plugs can be usually be cleaned and reinstalled.**

OIL OR ASH ENCRUSTED

If one or more plugs are oil or oil ash encrusted, engine oil is entering the combustion chambers (Fig. 10). Evaluate the engine to determine the cause.

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.

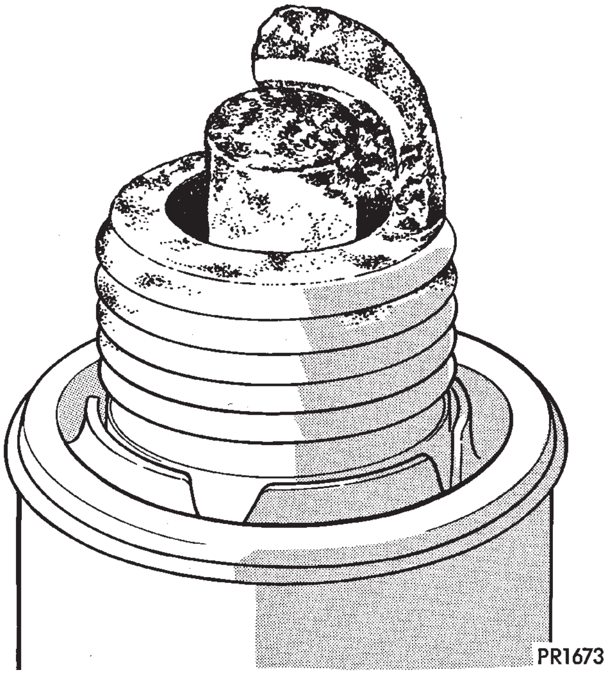


Fig. 10 Oil or Ash Encrusted

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. 11). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

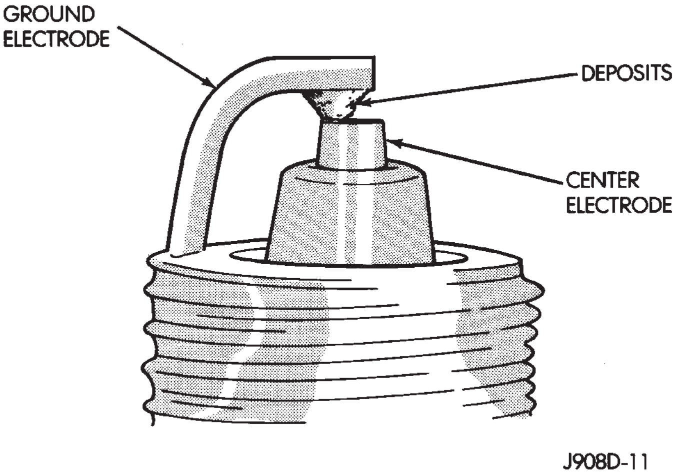


Fig. 11 Electrode Gap Bridging

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 12). 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. Accumulation on the ground electrode and shell area may be heavy but the deposits are easily removed. Spark plugs with scavenger deposits can be considered normal in condition and be cleaned using standard procedures.

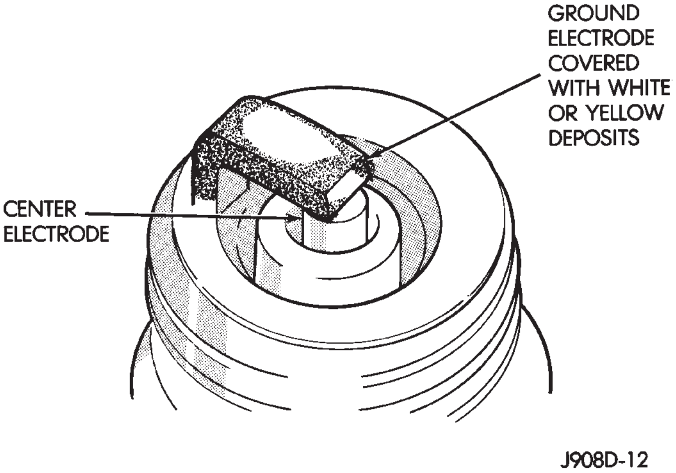


Fig. 12 Scavenger Deposits

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. 13). Spark plugs with chipped electrode insulators must be replaced.

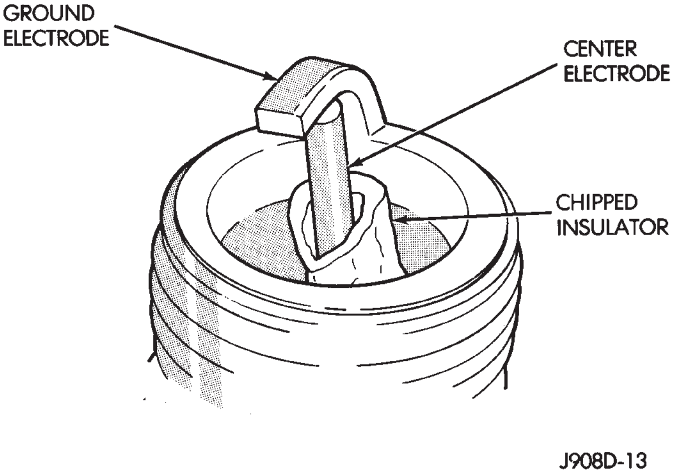


Fig. 13 Chipped Electrode Insulator

PREIGNITION DAMAGE

Excessive combustion chamber temperature can cause preignition damage. First, the center electrode dissolves and the ground electrode dissolves somewhat later (Fig. 14). Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating for the engine, if ignition timing is over advanced or if other operating conditions are causing engine overheating. The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges depending upon the thickness and length of the center electrode and porcelain insulator.

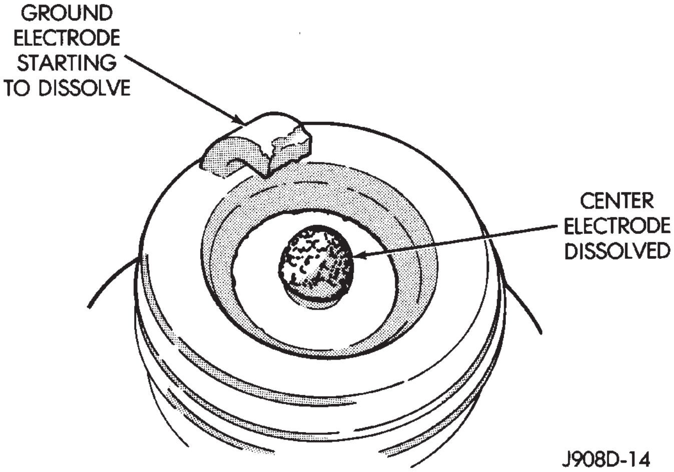


Fig. 14 Preignition Damage

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 15). 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.

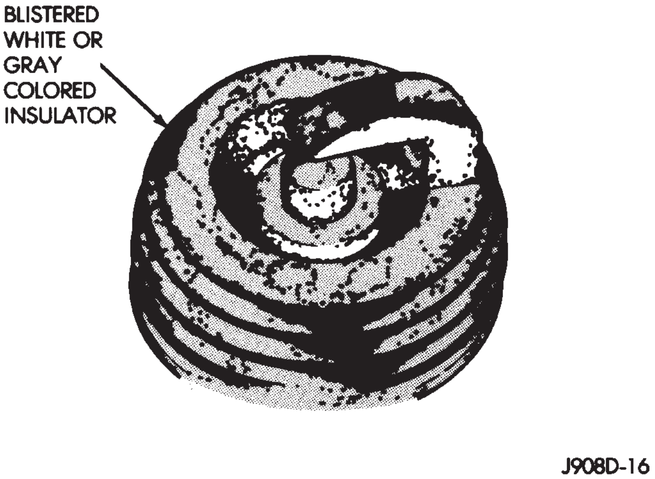


Fig. 15 Spark Plug Overheating

CAMSHAFT POSITION SENSOR

The camshaft position sensor provides fuel injection synchronization and cylinder identification information (Fig. 16 or Fig. 17). The sensor generates pulses that are the input sent to the PCM. The PCM interprets the camshaft position sensor input (along with the crankshaft position sensor input) to determine crankshaft position. The PCM uses the crankshaft position sensor input to determine injector sequence and ignition timing.

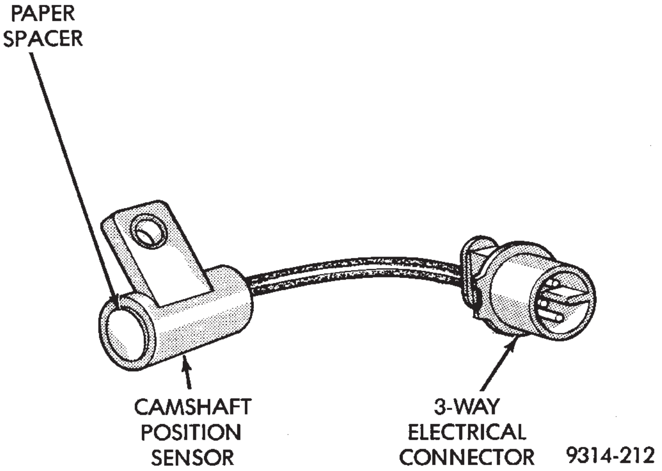


Fig. 16 Camshaft Position Sensor—Turbo III Engine

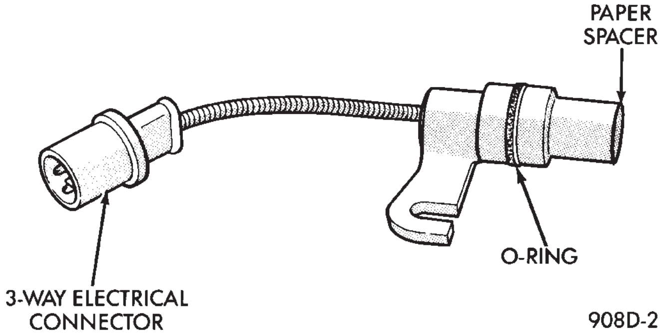


Fig. 17 Camshaft Position Sensor—3.3L and 3.8L Engines

The camshaft position sensor determines when a slot in the camshaft gear passes beneath it (Fig. 18 or Fig. 19). 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.

The camshaft position sensor is mounted to the top of the timing case cover (Fig. 20 or Fig. 21). 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 Turbo III, 3.3L and 3.8L Ignition System—Service Procedures section in this Group.**

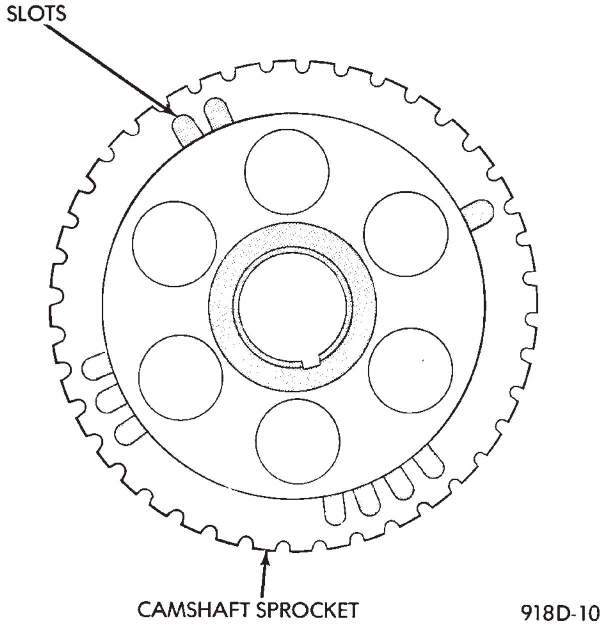


Fig. 18 Camshaft Gear—Turbo III Engine

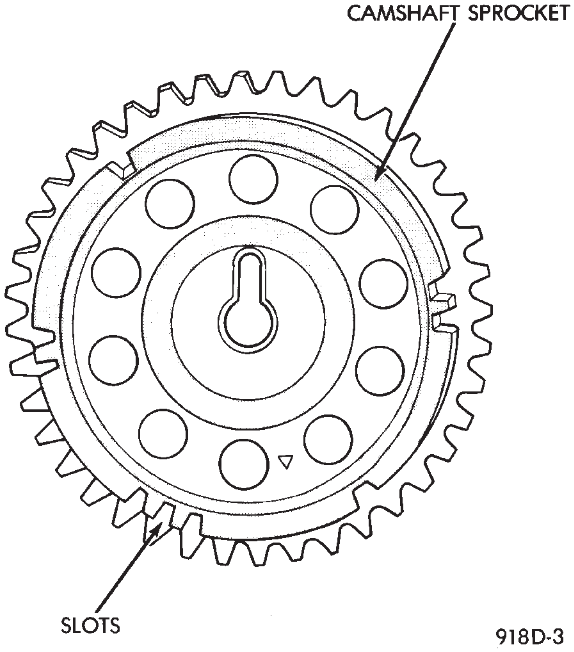


Fig. 19 Camshaft Gear—3.3L and 3.8L Engines

CRANKSHAFT POSITION SENSOR

The crankshaft position sensor senses slots cut into the transaxle driveplate extension (Fig. 22 or Fig. 23). On Turbo III, there are a 2 sets of slots. Each set contains 4 slots, for a total of 8 slots (Fig. 24). On 3.3L and 3.8L engines, there are a 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 25).

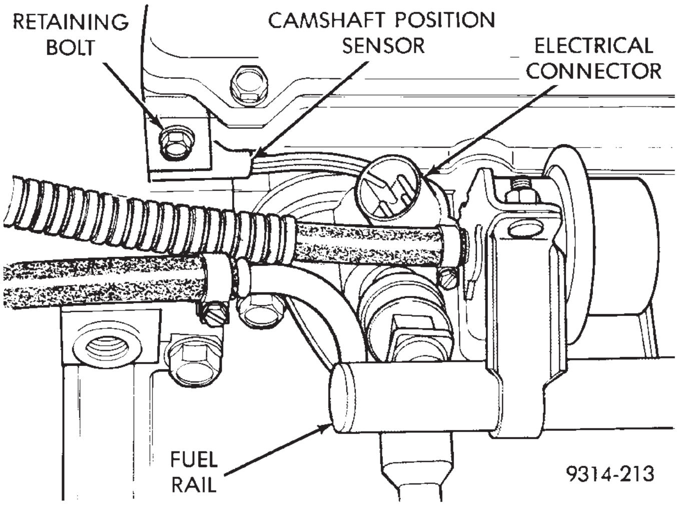


Fig. 20 Camshaft Position Sensor Location—Turbo III Engines

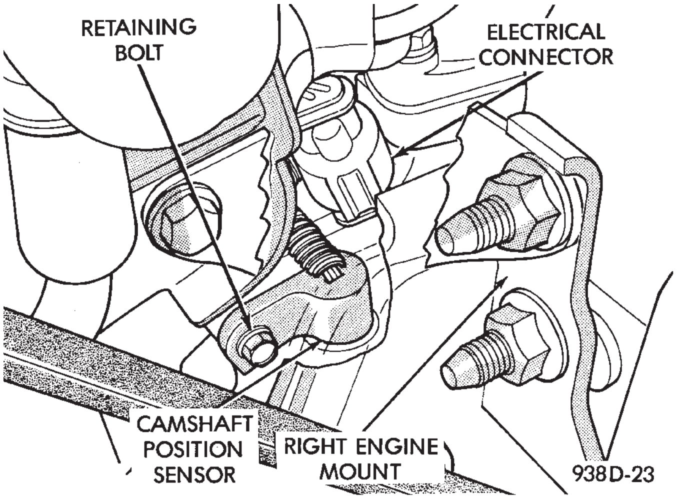


Fig. 21 Camshaft Position Sensor Location—3.3L and 3.8L Engines

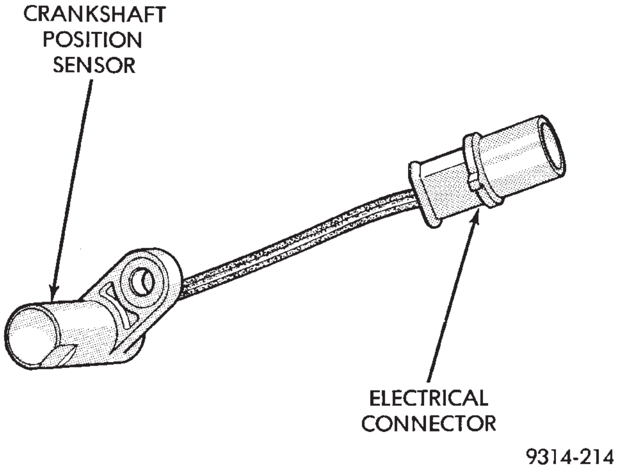


Fig. 22 Crankshaft Position Sensor—Turbo III Engine

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 during cranking.

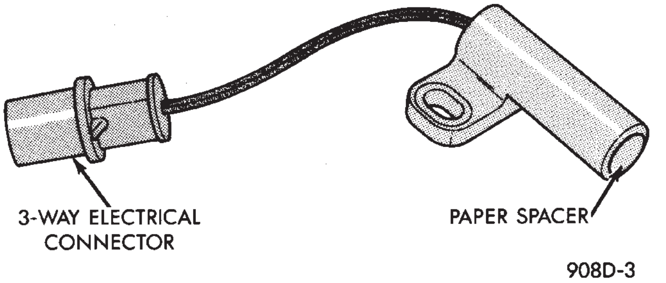


Fig. 23 Crankshaft Position Sensor—3.3L and 3.8L Engines

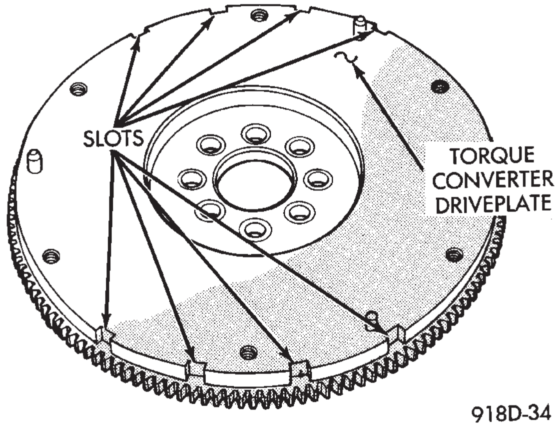


Fig. 24 Timing Slots in Transaxle Driveplate—Turbo III Engine

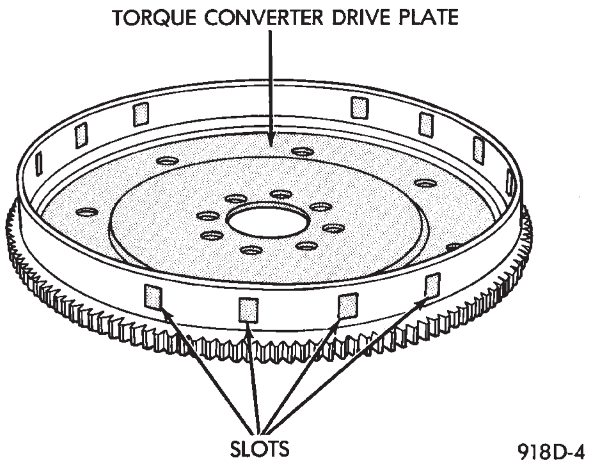


Fig. 25 Timing Slots in Transaxle Driveplate—3.3L and 3.8L Engines

The PCM uses the camshaft position sensor to determine injector sequence. The PCM determines ignition timing from the crankshaft position sensor. Once crankshaft position has been determined, the PCM begins energizing the injectors in sequence.

On Turbo III engines, the crankshaft position sensor is located in the transaxle housing, below the throttle body (Fig. 26). On 3.3L and 3.8L engines, the crankshaft position sensor is located in the transaxle housing (Fig. 27).

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 sensor, refer to the 3.3L Ignition System—Service Procedures section in this Group.**

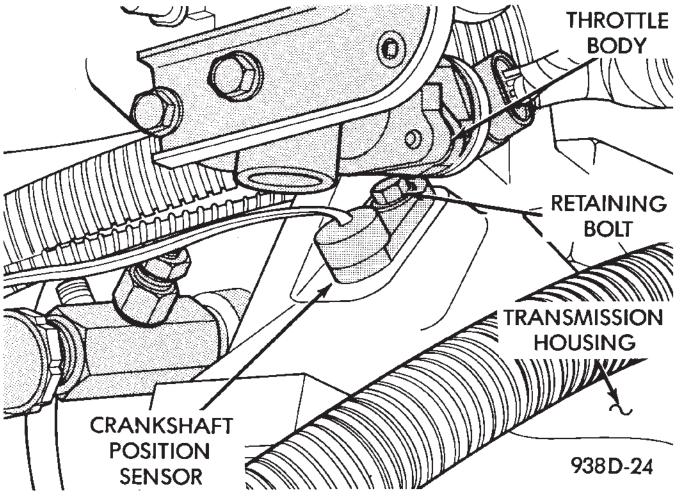


Fig. 26 Crankshaft Position Sensor Location—Turbo III Engines

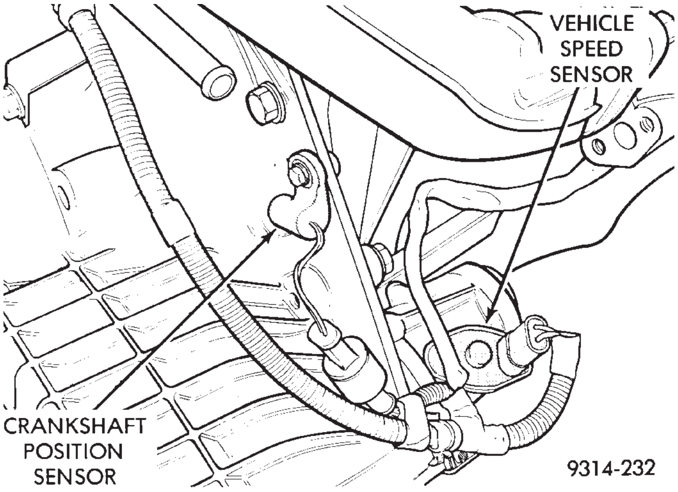


Fig. 27 Crankshaft Position Sensor Location—3.3L and 3.8L Engines

IGNITION COIL

WARNING: THE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The 3.3L and 3.8L coil assembly consists of 3 coils molded together (Fig. 28). The assembly is mounted on the intake manifold. The 2.2L Turbo III coil assembly consists of 2 coils molded together (Fig. 29). The assembly is mounted at the front of the engine. For all engines, the number of each coil appears on the front of the coil pack.

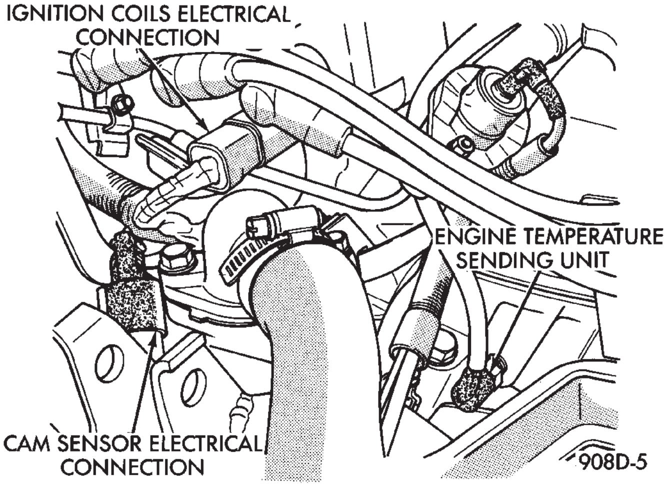


Fig. 28 Coil Pack—2.2L Turbo III Engine

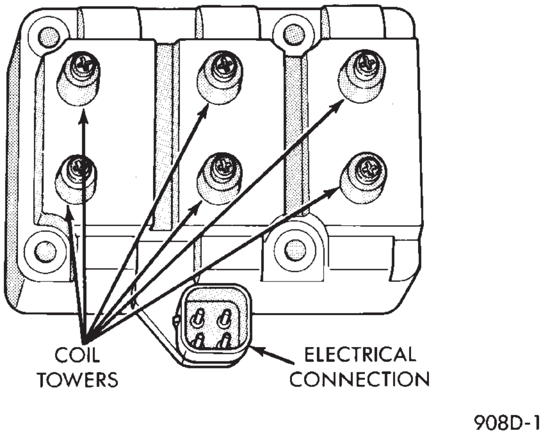


Fig. 29 Coil Pack—3.3L and 3.8L Engines

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.

On 3.3L and 3.8L engines, coil one fires cylinders 1 and 4, coil two fires cylinders 2 and 5, coil three fires cylinders three and six.

The coil's low primary resistance allows the PCM to fully charge the coil for each firing.

COOLANT TEMPERATURE SENSOR

On 2.2L Turbo III engines, the coolant temperature sensor is installed into the thermostat housing (Fig. 30). On 3.3L and 3.8L engines, the coolant temperature sensor is located next to the thermostat housing (Fig. 31).

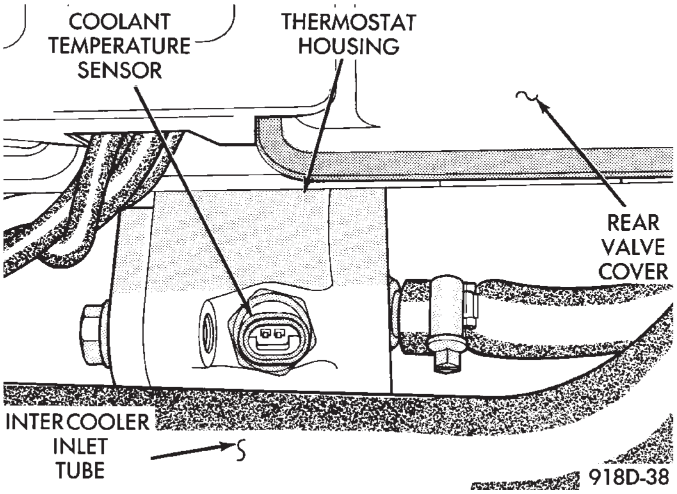


Fig. 30 Coolant Temperature Sensor—Turbo III Engines

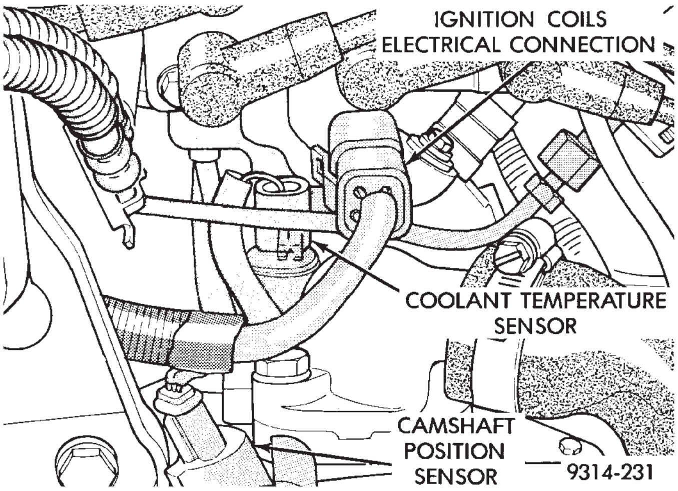


Fig. 31 Coolant Temperature Sensor—3.3L and 3.8L Engines

The coolant temperature sensor provides an input voltage to the powertrain control module (PCM). The sensor is a variable resistance (thermistor) with a range of -40°C to 130°C (-40°F to 265°F). As coolant temperature varies, the sensor 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.

The PCM demands slightly richer air-fuel mixtures and higher idle speeds until the engine reaches normal operating temperature.

The coolant sensor input is also used for cooling fan control.

KNOCK SENSOR—TURBO III ENGINE

Turbo III engines use a knock sensor. The sensor generates a signal when spark detonation occurs in the combustion chambers. The sensor is mounted on the intake manifold behind the PCV breather (Fig. 32). The sensor provides input voltage used by the powertrain control module (PCM) to modify spark advance and boost schedules in order to eliminate detonation.

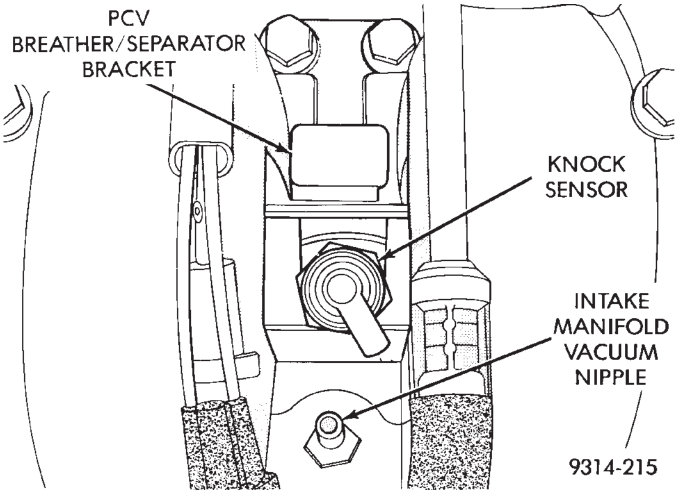


Fig. 32 Knock Sensor—Turbo III Engine

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 output voltage to change. The change in MAP sensor output voltage 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. The PCM uses this input along with inputs from other sensors to adjust air-fuel mixture.

On Turbo III engines, the MAP sensor is mounted to the front right fender (Fig. 33) On 3.3L and 3.8L engines, the MAP sensor (Fig. 34) is mounted to the side of the intake manifold, below the positive crankcase ventilation (PCV) valve. The sensor is connected to the PCM electrically.

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY

The powertrain control module (PCM) operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

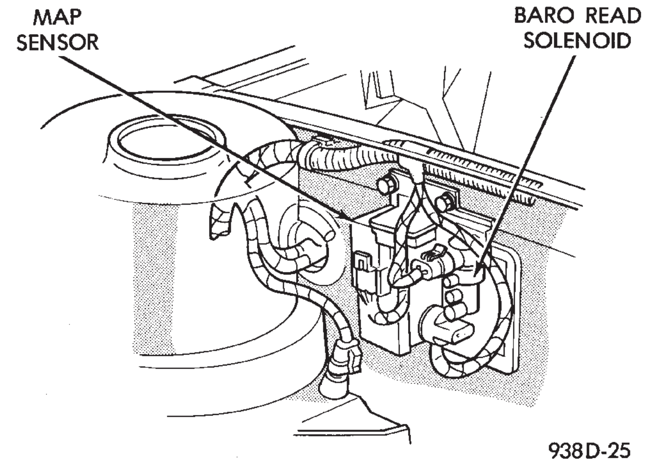


Fig. 33 MAP Sensor—Turbo III Engine

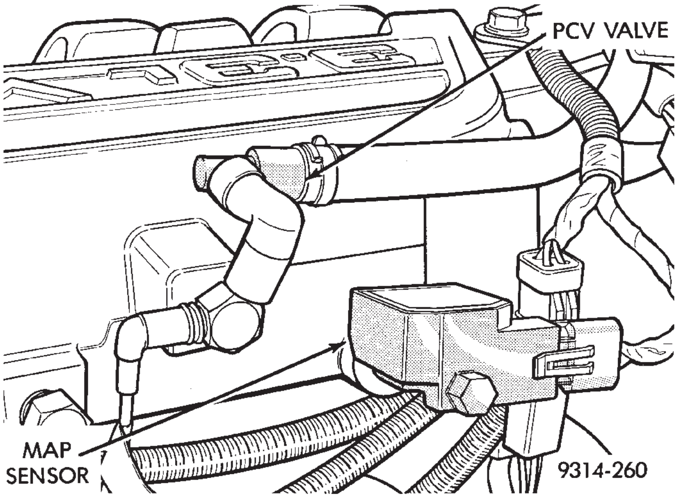


Fig. 34 Map Sensor—3.3L and 3.8L Engines

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the camshaft position sensor and crankshaft position sensor signals. From these inputs, the PCM determines engine speed and ignition timing (coil dwell). If the PCM does not receive a camshaft position sensor signal when the ignition switch is in the Run position, it will de-energize both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

On AC, AG, AJ and AY models, the ASD relay and fuel pump relay are located in the power distribution center (Fig. 35, 36, 37, or 38).

On AA and AP models, the ASD relay and fuel pump relay are mounted on the drivers side fender well, next to the strut tower (Fig. 39).

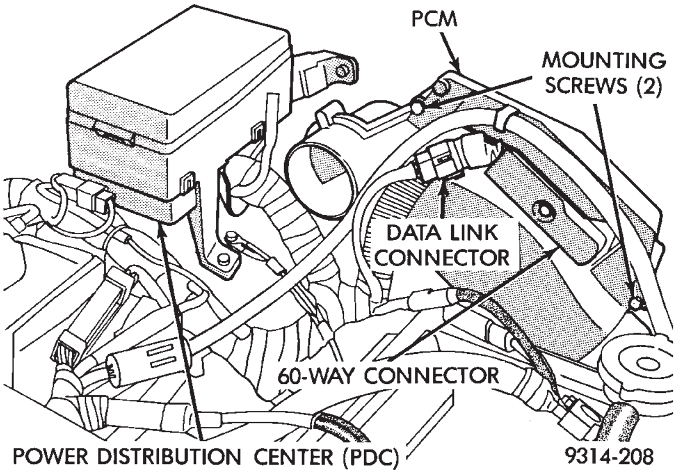


Fig. 35 Power Distribution Center (PDC) (AC Body)

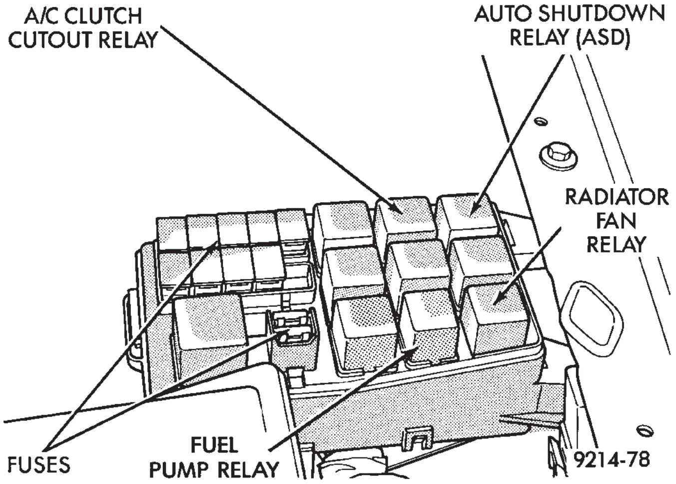


Fig. 36 Relay Identification (AC Body)

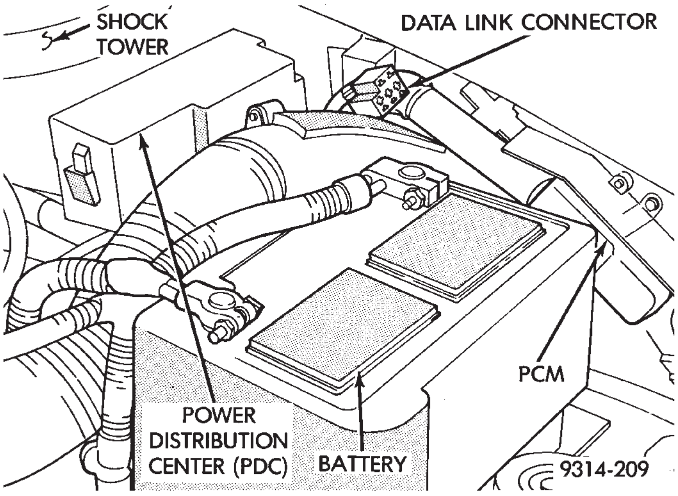


Fig. 37 Power Distribution Center (PDC) (AG and AJ Body)

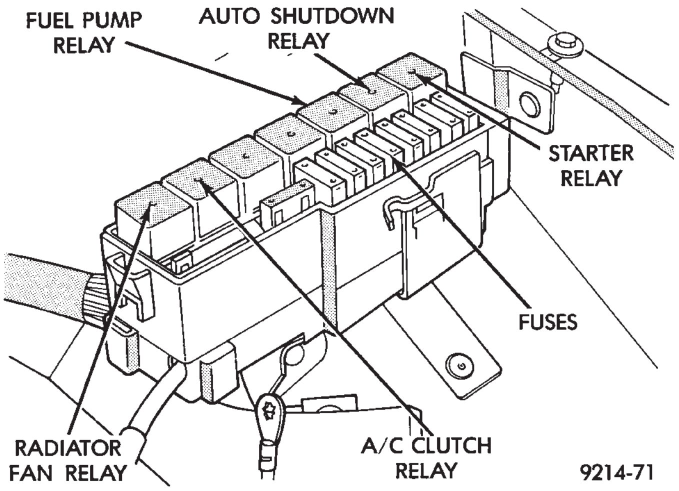


Fig. 38 Relay Identification (AG and AJ Body)

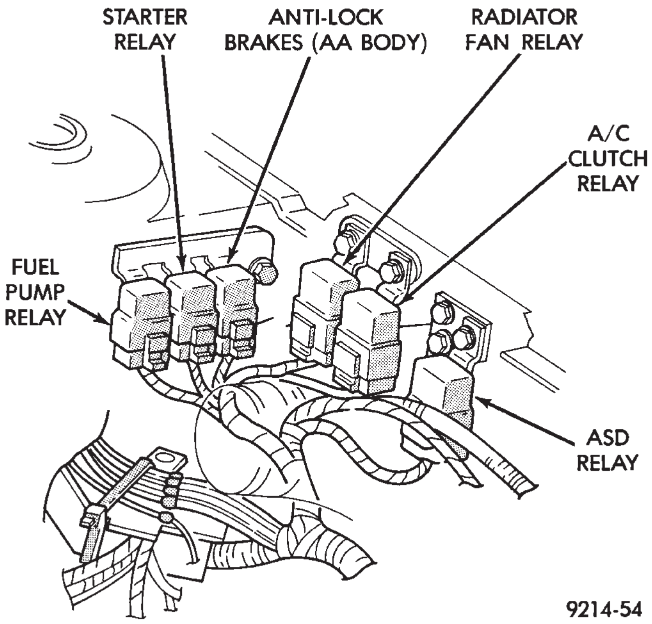


Fig. 39 Relay Identification (AA and AP Bodies)

2.2L TURBO III, 3.3L AND 3.8L IGNITION SYSTEM—DIAGNOSTIC PROCEDURES

INDEX

TESTING FOR SPARK AT COIL—TURBO III ENGINE

WARNING: THE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The coil pack contains 2 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.

Remove the cable from number 1 spark plug. Insert a clean spark plug into the spark plug boot, and ground plug to the engine (Fig. 1).

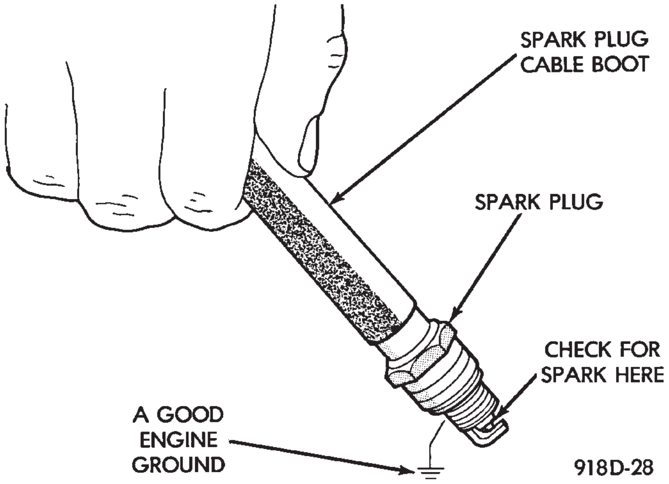


Fig. 1 Testing For Spark

CAUTION: Spark plug wire damage may occur if the spark plug is moved more than 1/4 inch away from the engine ground.

Crank the engine and look for spark across the electrodes of the spark plug. Repeat the above test for the remaining cylinders. If there is no spark during the cylinder tests, proceed to the failure to start test.

If one or more cylinders have irregular, weak, or no spark, proceed to Check Coil Test.

CHECK COIL TEST—TURBO III ENGINE

Cylinders 1 & 4, and 2 & 3 are grouped together.

(1) Remove the ignition cables and measure the resistance of the cables. Resistance must be between 3,000 to 12,000 ohms per foot of cable. Replace any cable not within tolerance.

(2) Disconnect the electrical connector from the coil pack (Fig. 2).

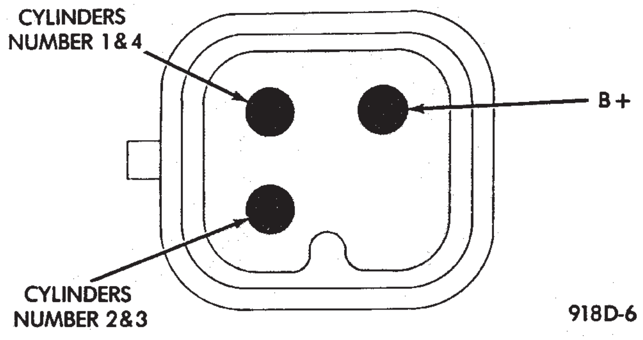


Fig. 2 Ignition Coil Electrical Connection—Turbo III Engine

(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. 3). Resistance on the primary side of each coil should be 0.5-0.7 ohm. Replace the coil if resistance is not within tolerance.

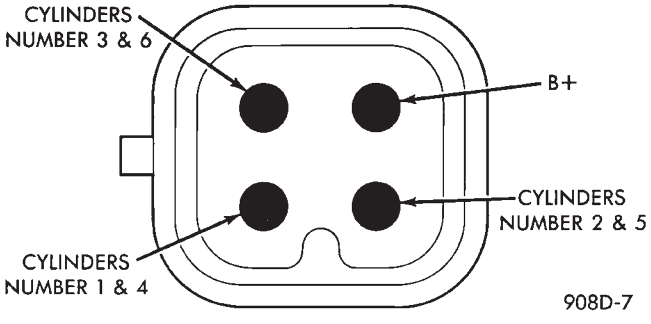


Fig. 3 Ignition Coil Terminal Identification

(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. 4). Secondary resistance should be 11,600 to 15,800 ohms. Replace the coil if resistance is not within tolerance.

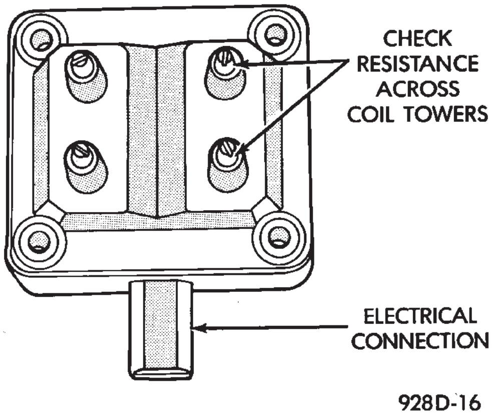


Fig. 4 Checking Ignition Coil Secondary Resistance—Turbo III Engines

FAILURE TO START TEST—TURBO III ENGINE

(1) Determine that sufficient battery voltage (12.4 volts nominal) is present for the cranking and ignition systems.

(2) Connect a voltmeter to the wiring harness coil connector at the B+ pin (Fig. 5).

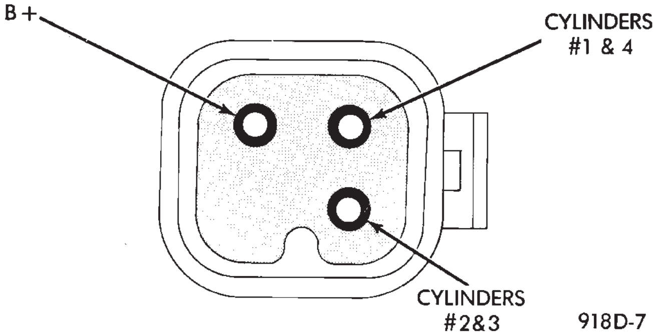


Fig. 5 Wiring Harness Coil Connector—Turbo III Engine

(3) Crank the engine for 5 seconds while monitoring the voltage at the B+ connector terminal. If the voltage remains near zero during the entire period of cranking, check the auto shutdown relay and PCM. Refer to DRBII scan tool and the appropriate Powertrain Diagnostic Procedures manual. Refer to Group 14 for description of On Board Diagnostics.

(4) If voltage is at near-battery voltage, and drops to zero after 1-2 seconds of cranking, check the camshaft position sensor and crankshaft position sensor and their circuits. Refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Procedure manual. Refer to Group 14 for a description of On-Board Diagnostics.

(5) If voltage remains at near-battery voltage during the entire 5 seconds, turn the key off, remove the PCM 60-way connector. Check the 60-way for any terminals loose from the connector (push-out).

TESTING FOR SPARK AT COIL—3.3L AND 3.8L ENGINES

WARNING: THE ENGINE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The coil pack contains 3 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.

Remove the cable from number 2 spark plug. Insert a clean spark plug into the spark plug boot, and ground plug to the engine (Fig. 1).

Crank the engine and look for spark across the electrodes of the spark plug. Repeat the above test for the five remaining cylinders. If there is no spark during all cylinder tests, proceed to the failure to start test.

If one or more tests indicate irregular, weak, or no spark, proceed to Check Coil Test.

WARNING: THE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

CHECK COIL TEST—3.3L AND 3.8L ENGINES

Coil one fires cylinders 1 and 4, coil two fires cylinders 2 and 5, coil three fires cylinders three and six.

Each coil tower is labeled with the number of the corresponding cylinder.

(1) Remove the ignition cables and measure the resistance of the cables. Resistance must be between 3,000 to 12,000 ohms per foot of cable. Replace any cable not within tolerance.

(2) Disconnect the electrical connector from the coil pack (Fig. 6).

(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. 7). Resistance on the primary side of each coil should be 0.5 - 0.7 ohm. Replace the coil if resistance is not within tolerance.

(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. 8). Refer to the Coil Specifications Chart in the Specifications section of this group. Replace the coil if resistance is not within tolerance.

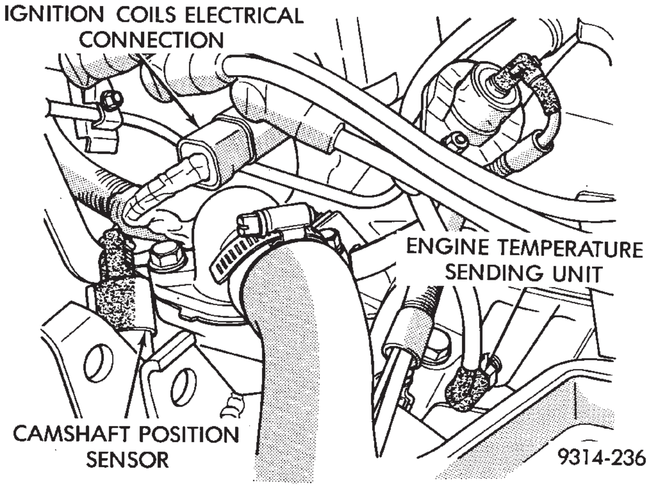


Fig. 6 Ignition Coil Electrical Connection

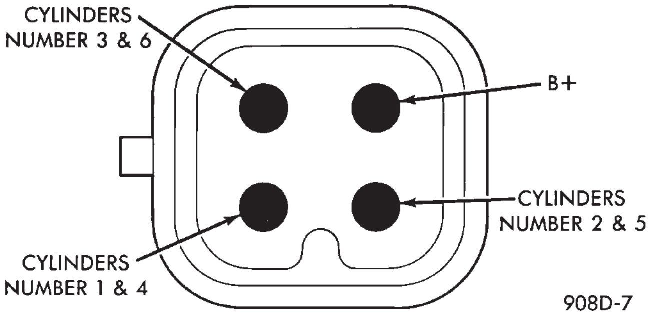


Fig. 7 Ignition Coil Terminal Identification

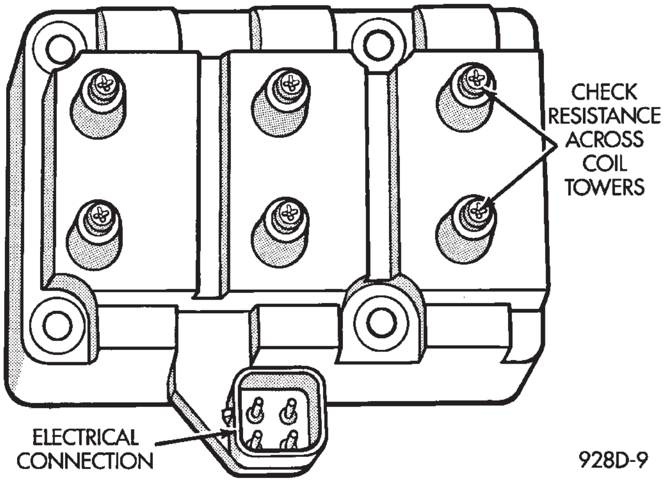


Fig. 8 Checking Ignition Coil Secondary Resistance

FAILURE TO START TEST

This no-start test checks the camshaft position sensor and crankshaft position sensor.

The powertrain control module (PCM) supplies 8.0 volts to the camshaft position sensor and crankshaft position sensor through one circuit. If the 8.0-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 PCM de-energizes the relay within one second because it has not received a crankshaft position sensor signal indicating engine rotation.

During cranking, the ASD relay will not energize until the PCM receives a crankshaft signal. Secondly, the ASD relay remains energized only if the PCM senses a camshaft position sensor signal immediately after detecting the crankshaft position sensor signal.

(1) Check battery voltage. Voltage should approximately 12.66 volts or higher to perform failure to start test.

(2) Disconnect the harness connector from the coil pack (Fig. 2).

(3) Connect a test light to the B+ (battery voltage) terminal of the coil electrical connector and ground. The wire for the B+ terminal is dark green with a black tracer.

(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 DRBII 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.

(a) If the test light momentarily flashes during cranking, the PCM is not receiving a camshaft position sensor signal. Use the DRBII scan tool to test the camshaft position sensor and sensor circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

(b) If the test light did not flash during cranking, unplug the camshaft 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 camshaft position sensor is shorted and must be replaced. If the light did not flash, the cause of the no-start is in either the crankshaft position sensor/camshaft position sensor 8.0-volt supply circuit, or the crankshaft position sensor 5-volt output or ground circuits. Use the DRBII scan tool to test the crankshaft position sensor and the sensor circuits.

Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

COOLANT TEMPERATURE SENSOR TEST

(1) With key off, disconnect wire connector from coolant temperature sensor (Fig. 9).

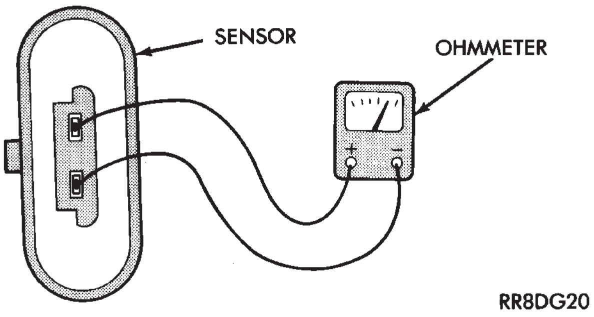


Fig. 9 Coolant Temperature Sensor Test

(2) Connect one lead of ohmmeter to one terminal of coolant temperature sensor.

(3) Connect the other lead of ohmmeter to remaining terminal of coolant temperature sensor. The ohmmeter should read as follows;

- Engine/Sensor hot at normal operating temperature around 200°F should read approximately 700 to 1,000 ohms.
- Engine/Sensor at room temperature around 70°F, ohmmeter should read approximately 7,000 to 13,000 ohms.

To test the coolant temperature sensor circuits, refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Service manual.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

Refer to the appropriate Powertrain Diagnostic Procedure manual.

CRANKSHAFT POSITION SENSOR AND CAMSHAFT POSITION SENSOR TESTS

Refer to the appropriate Powertrain Diagnostic Procedure manual.

2.2L TURBO III, 3.3L AND 3.8L IGNITION SYSTEMS—SERVICE PROCEDURES

INDEX

POWERTRAIN CONTROL MODULE (PCM)

REMOVAL

(1) Remove air cleaner duct or air cleaner assembly.

(2) Remove battery.

(3) Remove powertrain control module (PCM) mounting screws (Fig. 1).

(4) Remove 60-way connector from PCM. Remove PCM.

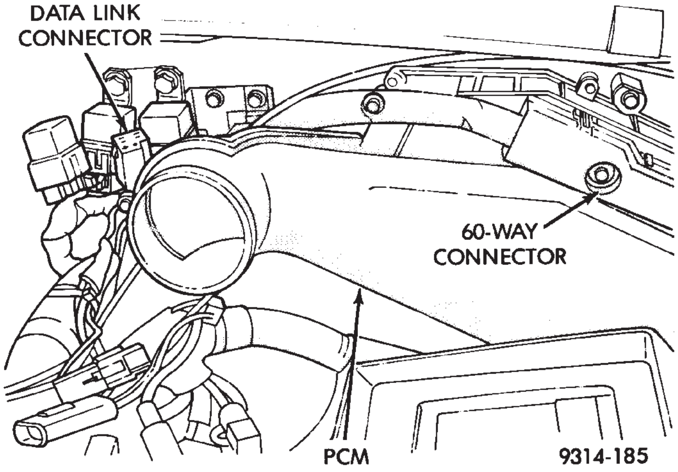


Fig. 1 Powertrain Control Module (PCM)

INSTALLATION

(1) Connect 60-Way connector to PCM (Fig. 1).

(2) Install PCM on inside left front fender. Install and tighten mounting screws.

(3) Install the battery.

(4) Install air cleaner duct or air cleaner assembly.

COOLANT TEMPERATURE SENSOR—TURBO III

The coolant sensor threads into the thermostat housing (Fig. 2).

REMOVAL

(1) Drain cooling system until coolant level is below thermostat housing. Refer to Group 7, Cooling System.

(2) Remove air cleaner fresh air duct.

(3) Disconnect electrical connector from coolant sensor.

(4) Remove sensor from thermostat housing (Fig. 2).

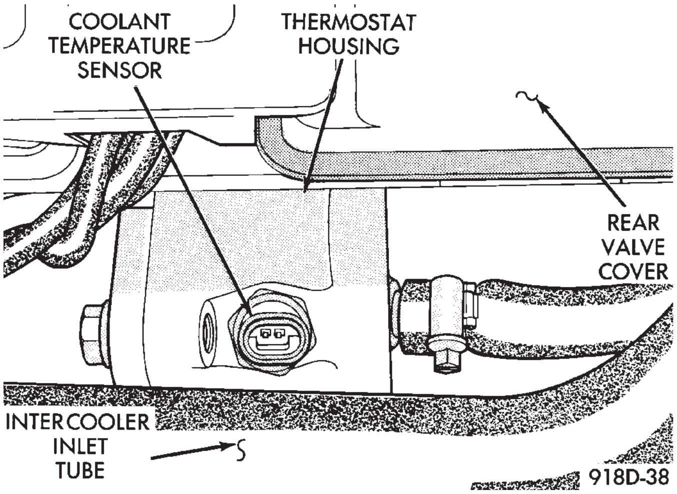


Fig. 2 Coolant Temperature Sensor—Turbo III

INSTALLATION

(1) Install sensor. Tighten to 7 N●m (60 in. lbs.) torque.

(2) Connect electrical connector to coolant sensor

(3) Fill cooling system. Refer to Group 7, Cooling System.

(4) Install fresh air duct.

COOLANT TEMPERATURE SENSOR—3.3L AND 3.8L ENGINES

The coolant temperature sensor is located below the ignition coil (Fig. 3).

REMOVAL

(1) Drain cooling system until coolant level is below coolant sensor. Refer to Group 7, Cooling System.

(2) Remove electrical connector from coil (Fig. 4).

(3) Remove coil mounting screws.

(4) Rotate coil away from coolant temperature sensor.

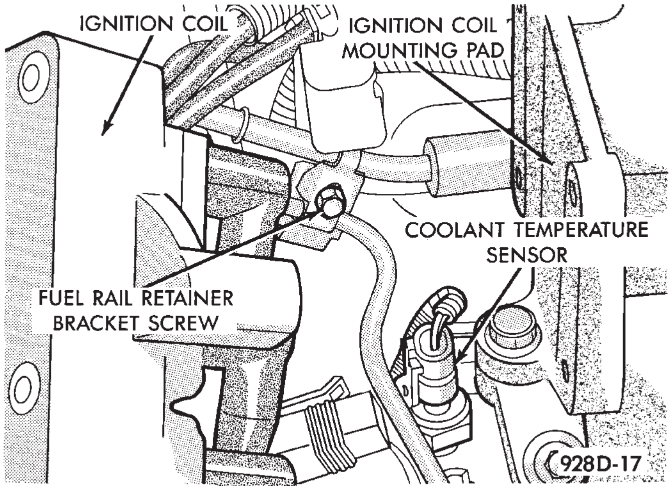


Fig. 3 Coolant Temperature Sensor—3.3L and 3.3L Engine

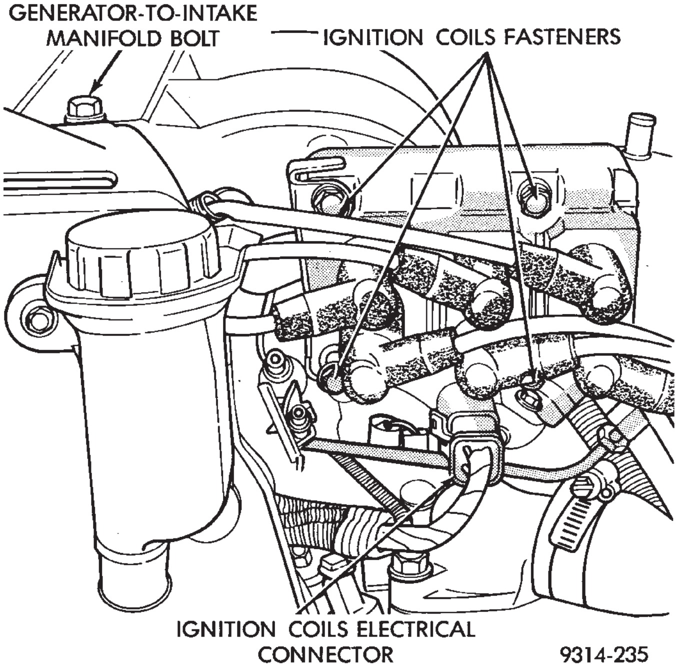


Fig. 4 Ignition Coil Removal

(5) Disconnect electrical connector from coolant temperature sensor.

(6) Remove sensor from engine.

INSTALLATION

(1) Tighten the coolant 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.

KNOCK SENSOR—TURBO III ENGINES

The knock sensor is located on the intake manifold, behind the PCV breather (Fig. 5).

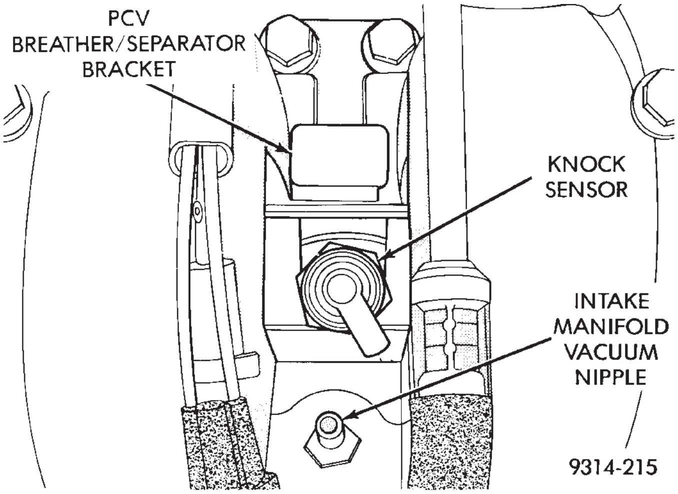


Fig. 5 Knock Sensor—Turbo III Engine

REMOVAL

(1) Remove PCV breather.

(2) Remove harness connector from the knock sensor.

(3) Remove knock sensor.

INSTALLATION

(1) Install knock sensor. Tighten sensor to 9 N●m (7 ft. lbs) torque.

(2) Connect harness connector to sensor.

(3) Install PCV breather.

SPARK PLUG CABLE SERVICE

Clean high tension cables with a cloth moistened with a non-flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

When testing cables for punctures and cracks with an oscilloscope, follow the instructions of the equipment manufacturers.

CAUTION: Do not leave any one spark plug cable disconnected any longer than necessary during test or possible heat damage to catalytic converter will occur. Total test time must not exceed ten minutes.

If an oscilloscope is not available, cables can be tested as follows:

(1) With the engine not running, connect one end of a test probe to a good ground. Use a probe made of insulated wire and insulated alligator clips on each end.

WARNING: THE ENGINE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

(2) With engine running, move test probe along entire length of all cables (approximately 0 to 1/8 inch gap). If punctures or cracks are present there will be a noticeable spark jump from the faulty area to the probe. Cracked, leaking or faulty cables should be replaced.

Use the following procedure when removing the high tension cable from the spark plug. First, remove the cable from the retaining bracket. Then grasp the terminal as close as possible to the spark plug. Rotate the cover (boot) slightly and pull straight back. **Do not use pliers and do not pull the cable at an angle.** Doing so will damage the insulation, cable terminal or the spark plug insulator. **Wipe spark plug insulator clean before reinstalling cable and cover.**

Resistance cables are identified by the words **Electronic Suppression**.

Use an ohmmeter to check cables for opens, loose terminals or high resistance.

(a) Remove cable from spark plug.

(b) Remove cable from the coil tower.

(c) Connect the ohmmeter between spark plug end terminal and the coil end terminal. Resistance should be within tolerance shown in the cable resistance chart. If resistance is not within tolerance, replace cable assembly. Test all spark plug cables in same manner.

CABLE RESISTANCE CHART

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

J908D-43

SPARK PLUG SERVICE

When replacing the spark plug cables, route the cables correctly and secure them in the appropriate retainers. Incorrectly routed cables can cause the radio to reproduce ignition noise. It can also cause cross ignition of the spark plugs or short circuit the cables to ground.

SPARK PLUG REMOVAL

Always remove cables by grasping at 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 rubber or foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

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. 6).

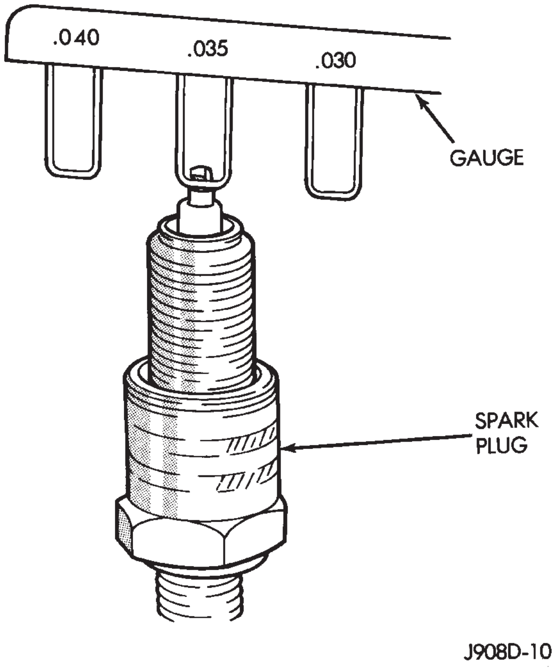


Fig. 6 Setting Spark Plug Gap—Typical

SPARK PLUG 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.

IDLE RPM TEST

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY ENGINE RUNNING TESTS.

Engine idle set **rpm** should be **tested and recorded as it is when the vehicle is first brought into shop for testing.** This will assist in diagnosing complaints of engine stalling, creeping and hard shifting on vehicles equipped with automatic transaxle. Refer to the Throttle Body Minimum Airflow procedures in Group 14.

IGNITION TIMING PROCEDURE

Ignition timing cannot be changed or set on Turbo III, 3.3L or 3.8L engines. For diagnostic information, refer to the DRBII scan tool and the appropriate Powertrain Diagnostics Procedures manual.

CRANKSHAFT POSITION SENSOR—TURBO III ENGINE

REMOVAL

(1) Remove throttle body.

(2) Remove inter-cooler to turbo-charger air hose.

(3) Disconnect crank timing sensor pick-up lead at wiring harness connector (Fig. 7).

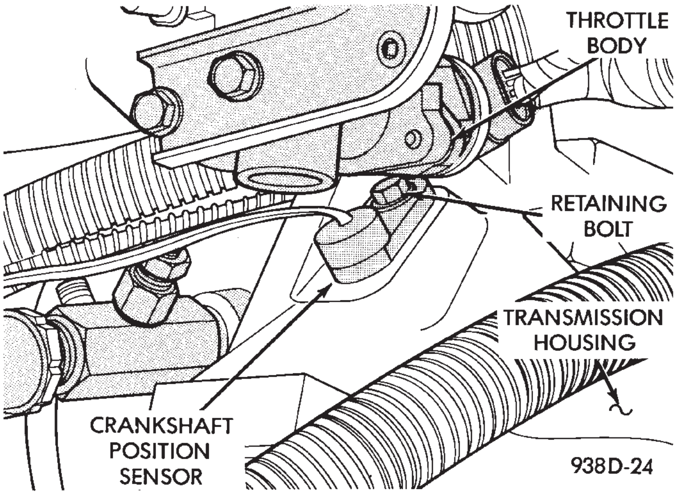


Fig. 7 Crankshaft Position Sensor Service—Turbo III Engine

(4) Remove crank timing sensor retaining bolt.

(5) Pull crank timing sensor straight up out of the transaxle housing.

INSTALLATION

(1) Install sensor in transaxle. Push sensor down until contact is made with the transaxle housing. Hold the sensor in this position. Install and tighten retaining bolt to 16 N●m (145 in. lbs.) torque.

(2) Connect electrical connector to sensor.

CRANKSHAFT POSITION SENSOR—3.3L AND 3.8L ENGINES

REMOVAL

(1) Disconnect crankshaft position sensor electrical connector from the wiring harness connector (Fig. 8).

(2) Remove sensor retaining bolt.

(3) Pull crankshaft position sensor straight up out of the transaxle housing.

INSTALLATION

If installing the original sensor, 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. 9).

(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 12 N●m (105 in. lbs.) torque.

(2) Connect crankshaft position sensor electrical connector to the wiring harness connector.

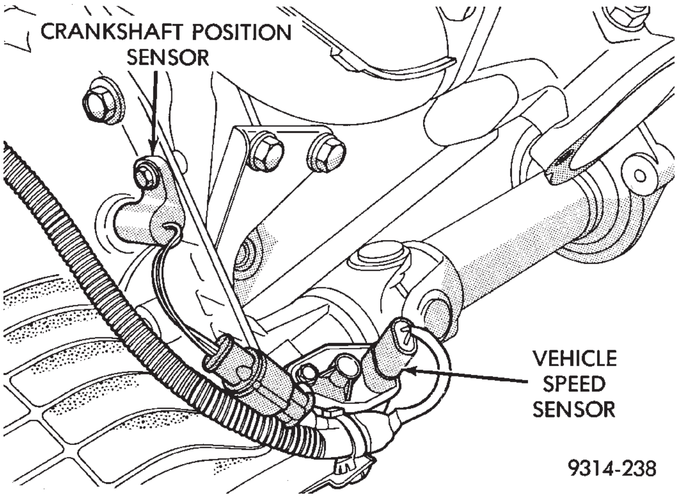


Fig. 8 Crankshaft Position Sensor—3.3L and 3.8L Engines

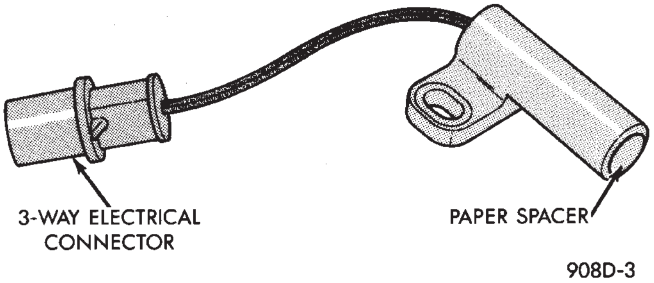


Fig. 9 Crankshaft Position Sensor and Spacer

CAMSHAFT POSITION SENSOR SERVICE—TURBO III ENGINE

REMOVAL

(1) Disconnect camshaft position sensor connector from wiring harness (Fig. 10).

(2) Remove camshaft position sensor retaining bolt and remove sensor.

INSTALLATION

If installing the original sensor, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face (Fig. 11).

(1) Install sensor in the cylinder head and push sensor down until contact is made with the camshaft gear. While holding the sensor in this position, install and tighten the retaining bolt 16 N●m (145 in. lbs.) torque.

(2) Connect electrical connector to the sensor.

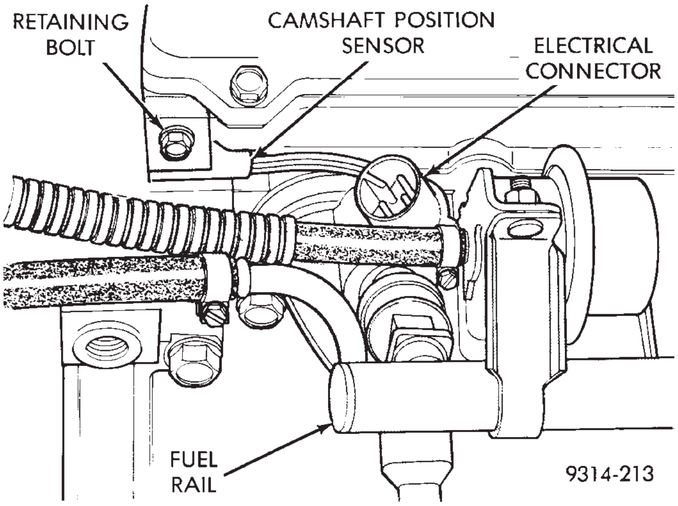


Fig. 10 Camshaft Position Sensor Location—Turbo III Engines

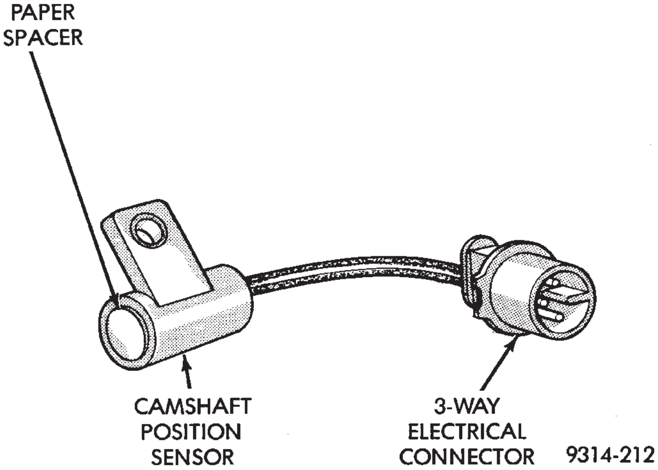


Fig. 11 Camshaft Position Sensor—Turbo III Engine

CAMSHAFT POSITION SENSOR—3.3L AND 3.8L ENGINES

REMOVAL

(1) Disconnect camshaft position sensor electrical connector from the wiring harness (Fig. 12).

(2) Remove engine mount support bracket.

(3) Loosen camshaft position sensor retaining bolt enough to allow slot in sensor to slide past the bolt.

(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 installing the original sensor, 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. 13).

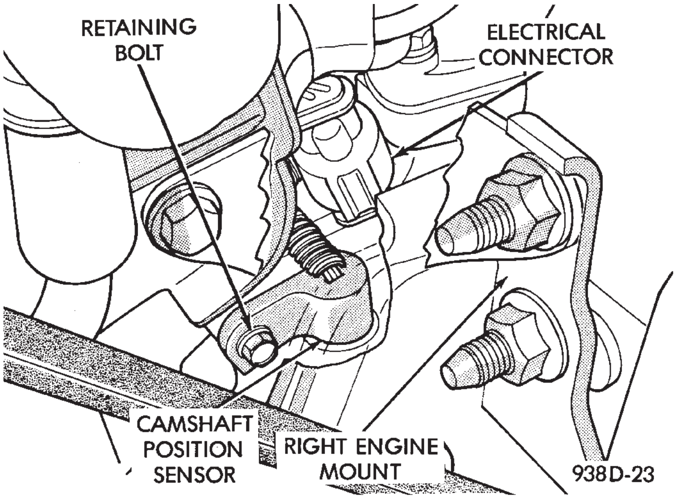


Fig. 12 Camshaft Position Sensor Location—3.3L and 3.8L Engine

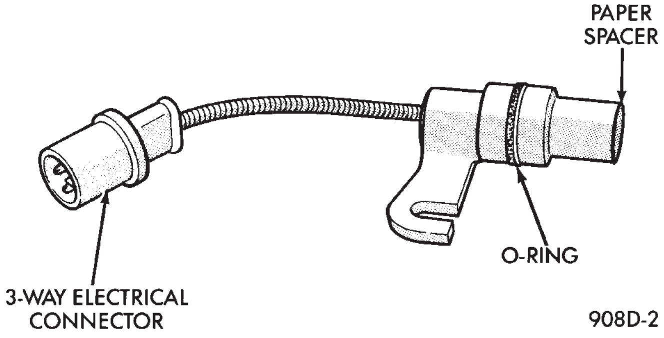


Fig. 13 Camshaft Position Sensor—3.3L and 3.8L Engines

(1) Apply a couple drops of clean engine oil to the O-ring prior to installation. Install sensor in the chain case cover and push sensor down until contact is made with the camshaft timing gear. While holding the sensor in this position, install and tighten the retaining bolt 14 N●m (125 in. lbs.) torque.

(2) Connect camshaft position sensor electrical connector to harness connector. Position connector away from the accessory belt.

(3) Install engine mount support bracket.

IGNITION COIL SERVICE—TURBO III ENGINE

(1) Remove spark plug cables from coil (Fig. 14).

(2) Remove electrical connector from coil pack.

(3) Remove ignition coil fasteners.

(4) Reverse the above procedure for installation. Tighten fasteners to 12 N●m (105 in. lbs.) torque.

IGNITION COIL—3.3L AND 3.8L ENGINE

(1) Remove spark plug cables from coil (Fig. 15).

(2) Remove ignition coil electrical connector.

(3) Remove ignition coil mounting screws.

(4) Remove ignition coil.

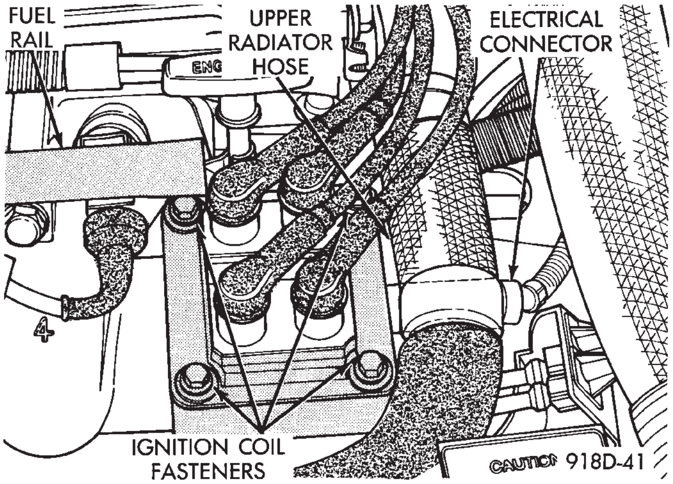


Fig. 14 Ignition Coil Service—2.2L Turbo III

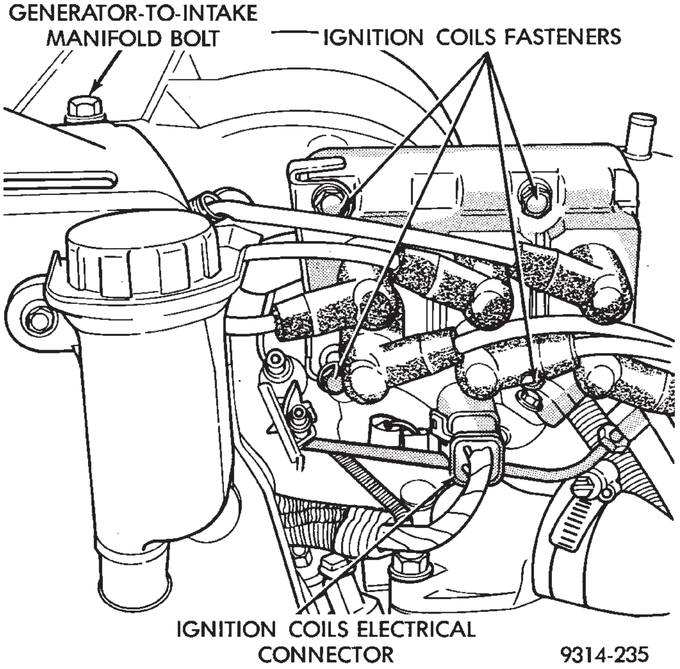


Fig. 15 Ignition Coil Removal and Installation

Reverse the above procedure for installation. Tighten mounting screws to 12 N•m (105 in. lbs.) torque.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—TURBO III ENGINE

The map sensor mounts to the right front fender (Fig. 16).

(1) Remove vacuum hose from MAP sensor.
(2) Remove MAP sensor mounting screws.
(3) Remove electrical connector from sensor.
(4) Reverse procedure for installation.

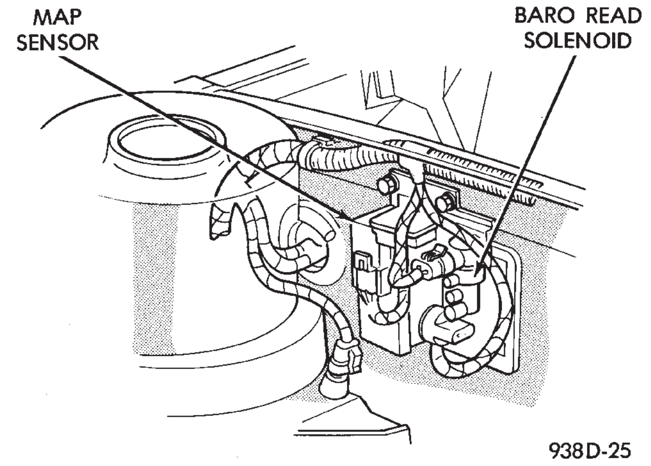


Fig. 16 MAP Sensor—Turbo III Engine

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.3L AND 3.8L ENGINES

The alignment of the MAP sensor is critical to the sensors performance. The top of the sensor is marked This Side Up (Fig. 17).

(1) Disconnect electrical connector from MAP sensor.

(2) Remove sensor by unscrewing from the intake manifold (Fig. 17).

(3) Reverse the above procedure for installation.

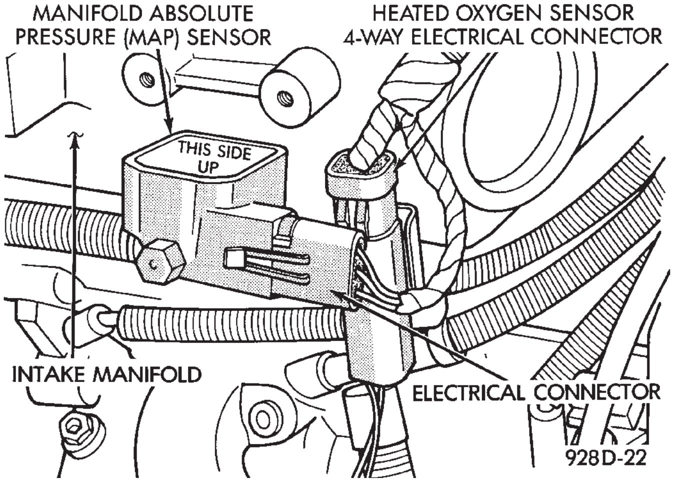


Fig. 17 Manifold Absolute Pressure Sensor

IGNITION SWITCH

IGNITION SWITCH AND KEY CYLINDER SERVICE

The ignition switch is located on the steering column. The Key In Switch is located in the ignition switch module. For diagnosis of the Key In Switch, refer to Section 8M.

IGNITION SWITCH DESIGNATIONS

IGNITION SWITCH CONNECTOR LOOKING INTO SWITCH

WIRE CAVITY	WIRE COLOR	APPLICATION
1	YELLOW	STARTER RELAY
2	DARK BLUE	IGNITION RUN/START
3	GRAY/BLACK	BRAKE WARNING LAMP
4	PINK/BLACK	IGNITION SWITCH BATTERY FEED
5	BLACK/ORANGE	RUN ACCESSORY
6	BLACK/WHITE	ACCESSORY
7	RED	IGNITION SWITCH BATTERY FEED

928D-10

REMOVAL

If the vehicle has a floor mounted gear shifter, place the selector in the Park position.

(1) Disconnect negative cable from battery.

(2) If the vehicle has a tilt column, remove the tilt lever by turning it counterclockwise.

(3) Remove upper and lower covers from steering column.

(4) Remove ignition switch mounting screws. Use tamper proof torx bit Snap-on TTXR15A2, TTXR20A2 or equivalent to remove the screws (Fig. 1).

(5) Gently pull switch away from the column. Release connector locks on the 7 terminal wiring connector, then remove the connector from the ignition switch.

(6) Release connector lock on the 4 terminal connector, then remove the connector from the ignition switch.

(7) To remove the key cylinder from the ignition switch:

(a) Insert key in the ignition switch. Turn the key to the LOCK position. Using a small screwdriver, depress the key cylinder retaining pin until it is flush with the key cylinder surface (Fig. 2).

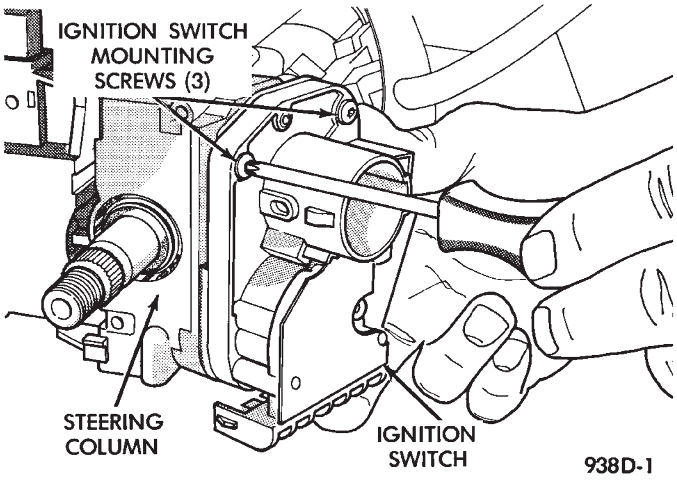


Fig. 1 Ignition Switch Screw Removal

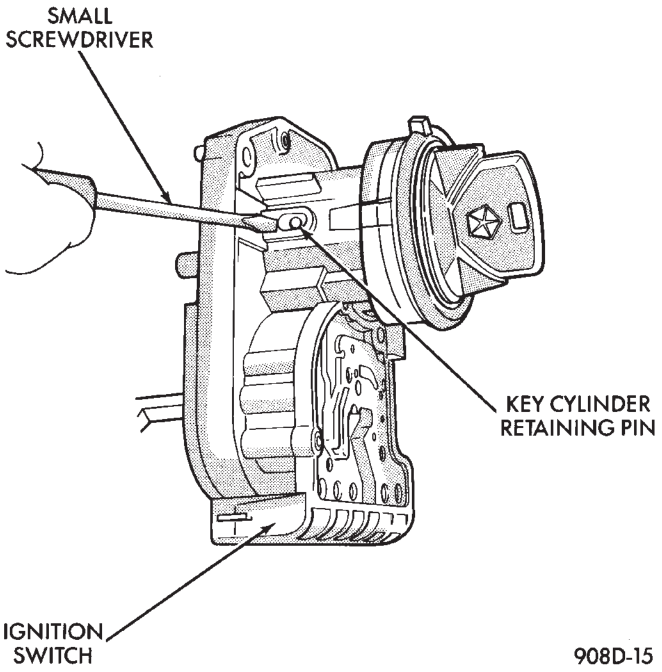


Fig. 2 Key Cylinder Retaining Pin

(b) Rotate the key clockwise to the OFF position. The key cylinder will unseat from the ignition switch (Fig. 3). When the key cylinder is unseated, it will be approximately 1/8 inch away from the ignition switch halo light ring. **Do not attempt to remove the key cylinder at this time.**

(c) With the key cylinder in the unseated position, rotate the key counterclockwise to the lock position and remove the key.

(d) Remove key cylinder from ignition switch (Fig. 4).

INSTALLATION

If the vehicle has a floor mounted gear shifter, place the selector in the Park position.

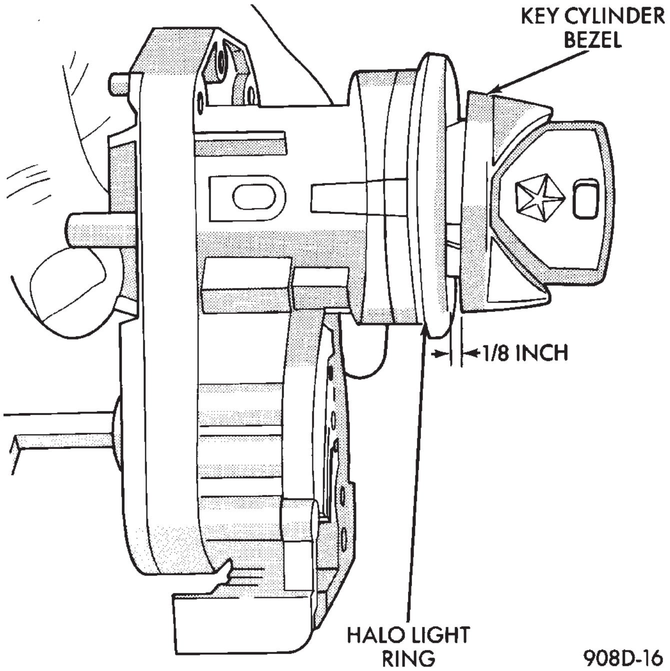


Fig. 3 Unseated Key Cylinder

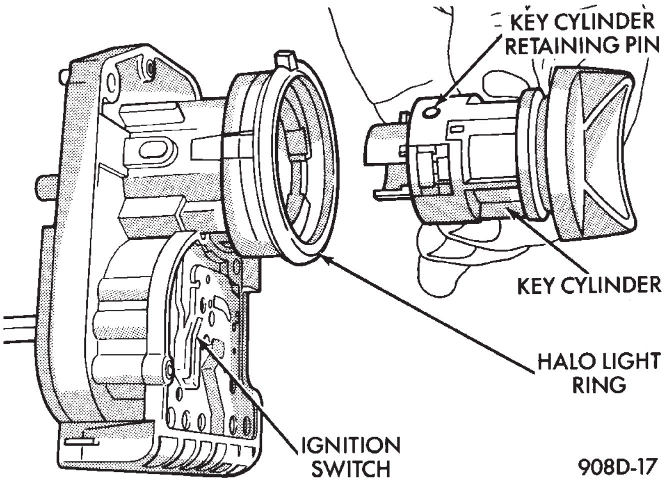


Fig. 4 Key Cylinder Removal

(1) Connect electrical connectors to the ignition switch. Make sure that the switch locking tabs are fully seated in the wiring connectors.

(2) Before attaching the ignition switch to a tilt steering column, the transaxle shifter must be in the Park position. Also the park lock dowel pin and the column lock flag must be properly indexed before installing the switch (Fig. 5).

(a) Place the transaxle shifter in the PARK position.

(b) Place the ignition switch in the lock position. The switch is in the lock position when the column lock flag is parallel to the ignition switch terminals (Fig. 5).

(c) Position ignition switch park lock dowel pin so it will engage the steering column park lock slider linkage (Fig. 6).

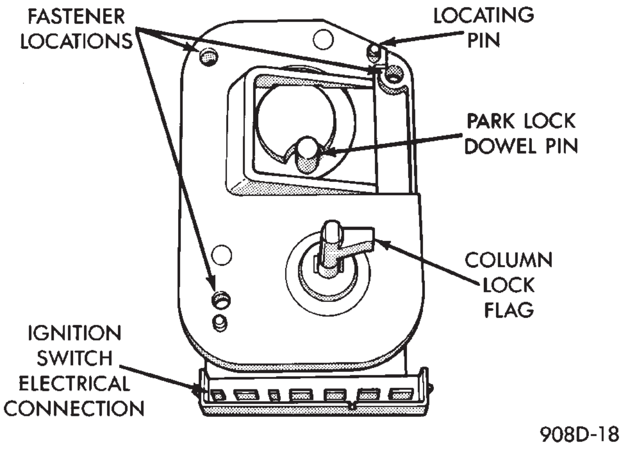


Fig. 5 Ignition Switch View From Column

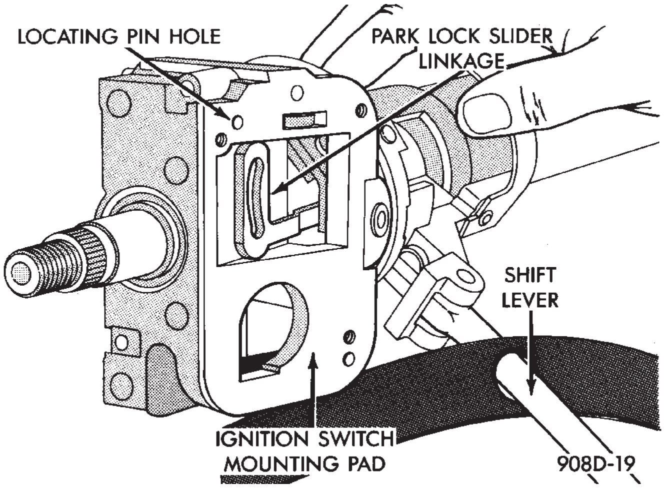


Fig. 6 Ignition Switch Mounting Pad

(d) Apply a light coating of grease to the column lock flag and the park lock dowel pin.

(3) Place the ignition switch against the lock housing opening on the steering column. Ensure ignition switch park lock dowel pin enters the slot in the park lock slider linkage in the steering column.

(4) Install ignition switch mounting screws. Tighten screws to 2 N●m (17 in. lbs.) torque.

(5) Install steering column covers. Tighten screws to 2 N●m (17 in. lbs.) torque.

(6) If the vehicle is equipped with a tilt steering column, install the tilt lever.

(7) To install the ignition key in the lock cylinder:

(a) With the key cylinder and the ignition switch in the Lock position, insert the key cylinder into the ignition switch until it bottoms.

(b) Insert ignition key into lock cylinder. While gently pushing the key cylinder in toward the ignition switch, rotate the ignition key until to the end of travel.

(c) Connect negative cable to battery.

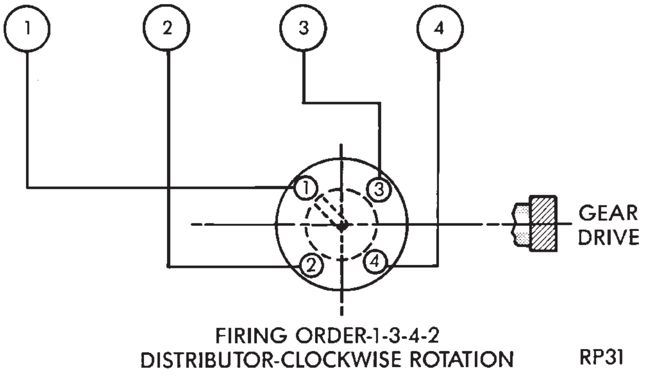
(8) Check for proper operation of the halo light, shift lock (if applicable), and column lock. Also check for proper operation of the ignition switch accessory, lock, off, run, and start positions.

SPECIFICATIONS

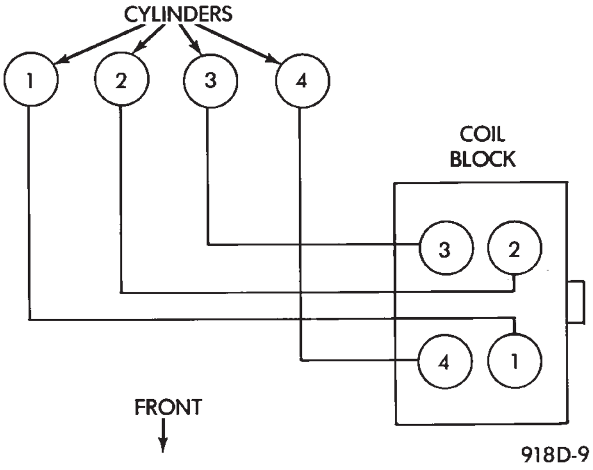
GENERAL INFORMATION

The following specifications are published from the latest information available at the time of publication. If anything differs from the specifications on the Vehicle Emission Control Information Label, use the specifications on the label.

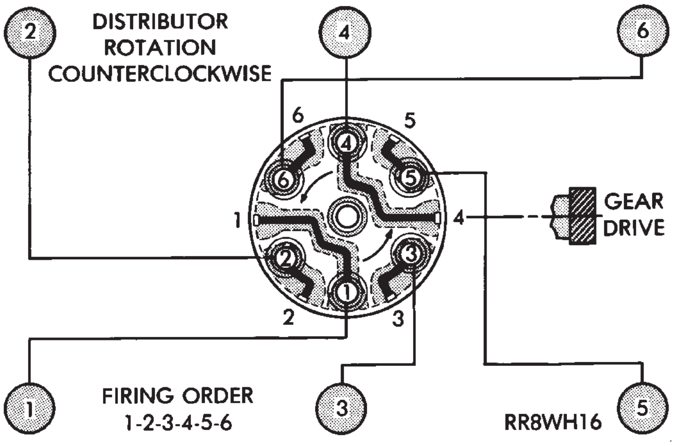
SPARK PLUG WIRE ROUTING—2.2L TBI, 2.5L TBI AND 2.5L MPI ENGINES



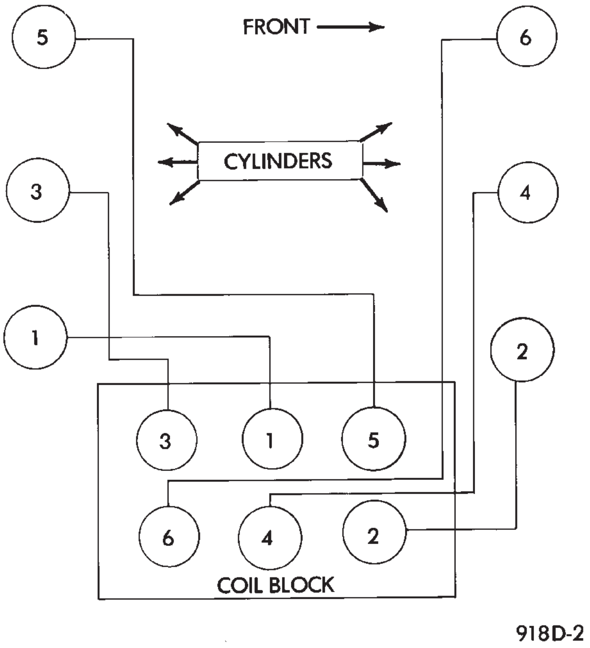
SPARK PLUG WIRE ROUTING—TURBO III ENGINE



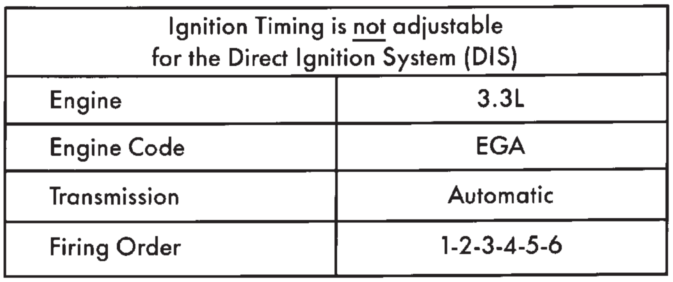
SPARK PLUG WIRE ROUTING—3.0L ENGINE



SPARK PLUG WIRE ROUTING—3.3L AND 3.8L ENGINES



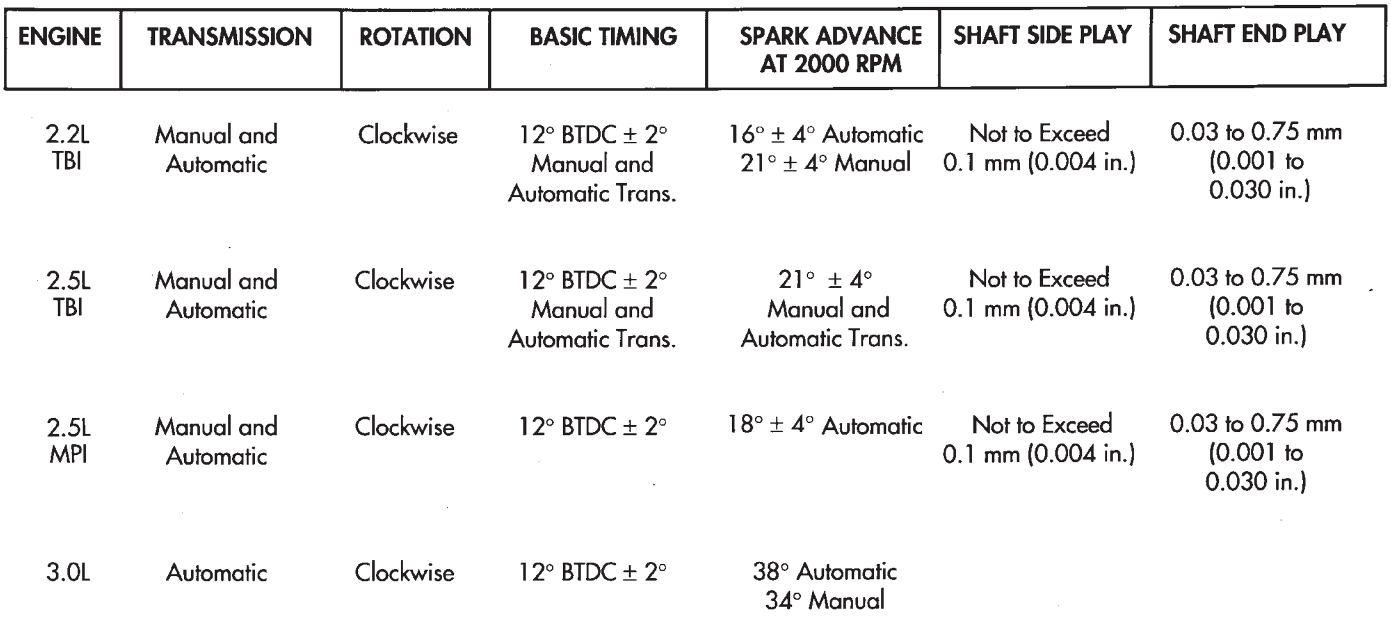
3.3L/3.8L ENGINE DIRECT IGNITION SYSTEM



Ignition Timing is not adjustable for the Direct Ignition System (DIS)	
Engine	3.3L
Engine Code	EGA
Transmission	Automatic
Firing Order	1-2-3-4-5-6

918D-50

DISTRIBUTORS



ENGINE	TRANSMISSION	ROTATION	BASIC TIMING	SPARK ADVANCE AT 2000 RPM	SHAFT SIDE PLAY	SHAFT END PLAY
2.2L TBI	Manual and Automatic	Clockwise	12° BTDC ± 2° Manual and Automatic Trans.	16° ± 4° Automatic 21° ± 4° Manual	Not to Exceed 0.1 mm (0.004 in.)	0.03 to 0.75 mm (0.001 to 0.030 in.)
2.5L TBI	Manual and Automatic	Clockwise	12° BTDC ± 2° Manual and Automatic Trans.	21° ± 4° Manual and Automatic Trans.	Not to Exceed 0.1 mm (0.004 in.)	0.03 to 0.75 mm (0.001 to 0.030 in.)
2.5L MPI	Manual and Automatic	Clockwise	12° BTDC ± 2°	18° ± 4° Automatic	Not to Exceed 0.1 mm (0.004 in.)	0.03 to 0.75 mm (0.001 to 0.030 in.)
3.0L	Automatic	Clockwise	12° BTDC ± 2°	38° Automatic 34° Manual		

938D-28

IGNITION COILS

ENGINE	COIL MANUFACTURER	PRIMARY RESISTANCE AT 21°C - 27°C (70°F - 80°F)	SECONDARY RESISTANCE AT 21°C - 27°C (70°F - 80°F)
2.2L/2.5L	Diamond	0.97 to 1.18 Ohms	11,300 to 15,300 Ohms
2.2L/2.5L	Toyodenso	0.95 to 1.20 Ohms	11,300 to 13,300 Ohms
2.2L Turbo III	Diamond	0.52 to 0.63 Ohms	11,600 to 15,800 Ohms
3.0L	Diamond	0.97 to 1.18 Ohms	11,000 to 15,300 Ohms
3.3L/3.8L	Diamond	0.52 to 0.63 Ohms	11,600 to 15,800 Ohms
3.3L/3.8L	Toyodenso	0.51 to 0.61 Ohms	11,500 to 13,500 Ohms

938D-27

SPARK PLUGS

ENGINE	SPARK PLUG	GAP	THREAD SIZE
2.2L TBI	RN12YC	0.033 to 0.038 in.	14 mm (3/4 in.) reach
2.5L TBI	RN12YC	0.033 to 0.038 in.	14 mm (3/4 in.) reach
2.5L MPI	RN12YC	0.035 to 0.038 in.	14 mm (3/4 in.) reach
2.2L Turbo III	RN9YC	0.033 to 0.038 in.	14 mm (3/4 in.) reach
3.0L	RN11YC4	0.039 to 0.044 in.	14 mm (3/4 in.) reach
3.0L	BPR5ES-11	0.039 to 0.044 in.	14 mm (3/4 in.) reach
3.3L	RN16YC5	0.048 to 0.053 in.	14 mm (3/4 in.) reach
3.8L	RN16YC5	0.048 to 0.053 in.	14 mm (3/4 in.) reach

938D-29

TORQUE

DESCRIPTION	TORQUE
Camshaft sensor bolt - Turbo III	16 N•m (145 in. lbs.)
Camshaft sensor bolt - 3.3L and 3.8L	14 N•m (125 in. lbs.)
Crankshaft sensor bolt - Turbo III	16 N•m (145 in. lbs.)
Cranshaft sensor bolt - 3.3L and 3.8L.	12 N•m (105 in. lbs.)
Coolant sensor - 2.2L TBI, 2.5L TBI and 2.5L MPI	28 N•m (20 ft. lbs.)
Coolant sensor - 3.0L.	7 N•m (60 in. lbs.)

DESCRIPTION	TORQUE
Coolant Sensor - Turbo III	7 N•m (60 in. lbs.)
Coolant Sensor - 3.3L and 3.8L	7 N•m (60 in. lbs.)
Detonation sensor - Turbo III	9 N•m (7 ft. lbs.)
Ignition coil mounting screws - 2.2L TBI, 2.5L TBI and 2.5L MPI	10 N•m (85 in. lbs.)
Ignition coil mounting screws - 3.3L and 3.8L	12 N•m (105 in. lbs.)
Ignition coil bracket - 3.0L	10 N•m (96 in. lbs.)
Spark Plugs - All Engines	28 N•m (20 ft. lbs.)

938D-26

INSTRUMENT PANEL AND GAUGES

CONTENTS

AA BODY

INDEX

GENERAL INFORMATION

INSTRUMENT CLUSTERS

There are three instrument cluster assemblies. The mechanical clusters incorporate magnetic type gauges. The electronic instrument cluster incorporates, a digital speedometer/odometer and electronic analog gauges.

The mechanical Lo-Line instrument cluster has magnetic type gauges for coolant temperature, fuel level and charging system voltage (Fig. 1).

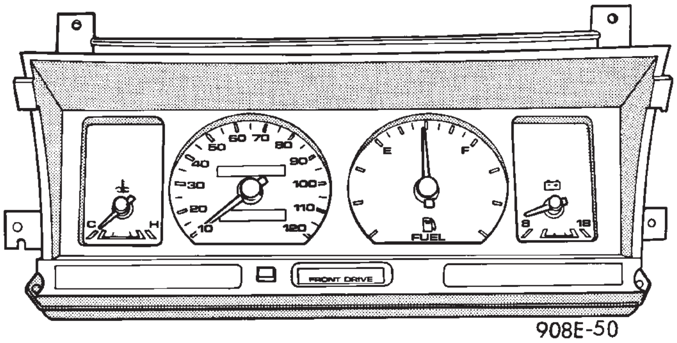


Fig. 1 Instrument Cluster

The mechanical Hi-Line instrument cluster has magnetic type gauges for oil pressure, coolant temperature, charging system voltage and fuel level. The premium instrument cluster also has a tachometer (Fig. 2).

If the ignition switch is in the OFF position each gauge will show a reading, except for the volt gauge.

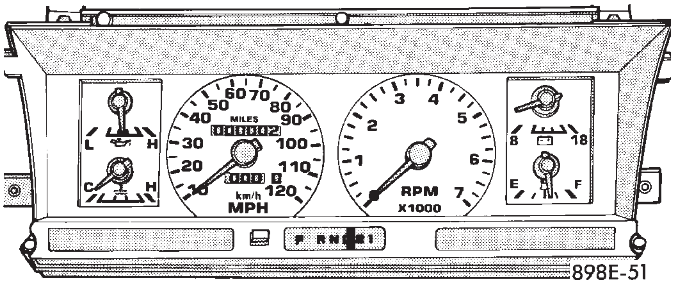


Fig. 2 Instrument Cluster With Tachometer

However the readings are only accurate when the ignition switch is in the ON position.

TACHOMETER DRIVE MODULE

The tachometer drive module is an electronic module used to drive a magnetic tachometer in a conventional instrument cluster.

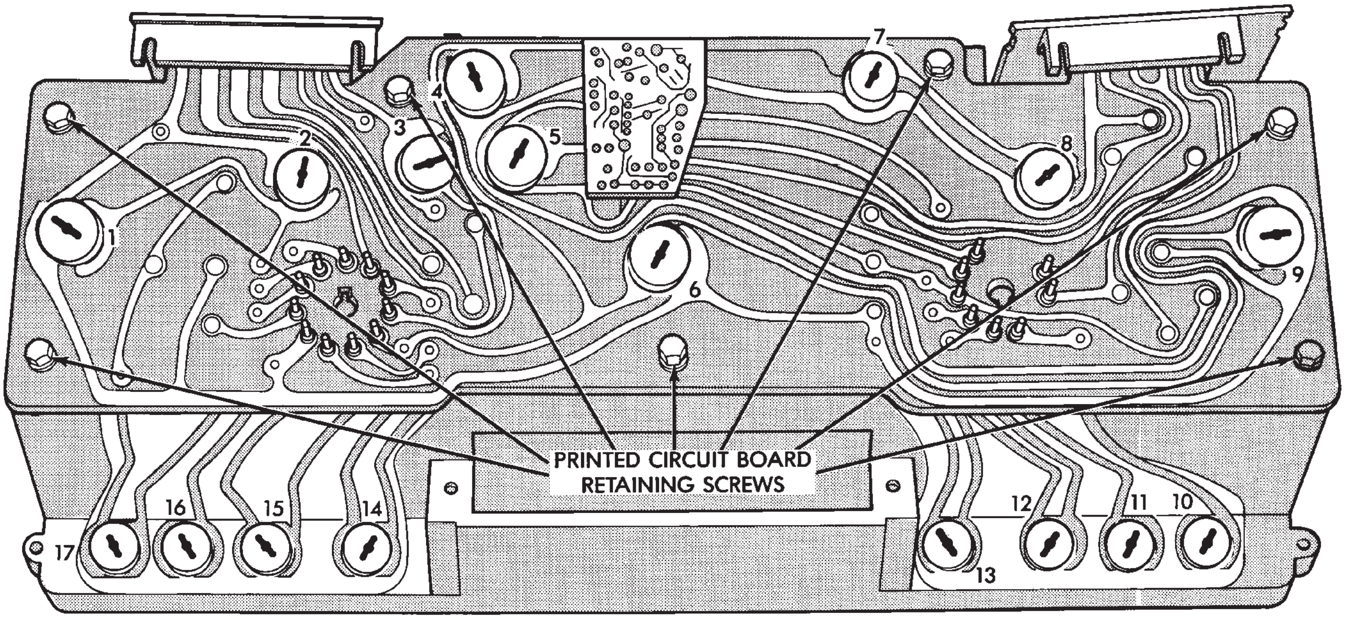
ELECTRONIC DIGITAL CLOCK

The electronic digital clock is in the radio. The clock and radio each use the display panel built into the radio. A digital readout indicates the time in hours and minutes whenever the ignition switch is in the ON or ACC position.

When the ignition switch is in the OFF position, or when the radio frequency is being displayed, time keeping is accurately maintained.

MESSAGE CENTER

The message center includes the graphic display of the car with illuminating graphics for: low wind-



1. Fuel and Voltmeter Illumination
2. Tachometer-Voltmeter Illumination
3. Airbag Warning
4. Tachometer Illumination
5. Check Gauges
6. Speedometer-Tachometer Illumination
7. Speedometer Illumination
8. Speedometer-Oil Gauge Illumination
9. Oil Pressure-Temperature Gauge Illumination
10. Fasten Seat Belt
11. Left Turn Signal
12. Brake System Warning
13. Low Fuel Warning
14. Anti-lock Brake Warning
15. High-beam Indicator
16. Right Turn Signal
17. Check Engine

Fig. 3 Message Center

shield washer fluid, door ajar for each door, and trunk ajar. It also includes headlamp out, tail lamp out, and brake lamp out warning lights (Fig. 3), these lights are operated by a lamp outage module. When there is no message center there is no door ajar function.

TRAVELER

The traveler is a five function trip computer. It uses vacuum fluorescent displays to display: trip miles, instantaneous fuel economy, trip elapsed time, trip average fuel economy and, estimate distance to empty. It is located in the message center (Fig. 4).

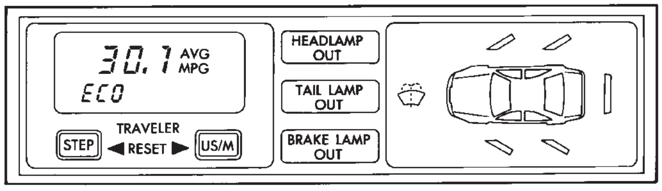


Fig. 4 Traveler and Message Center

WARNING LAMPS AND INDICATOR LIGHTS

The mechanical instrument cluster assemblies have warning lamps and indicator lights for ten different systems. These include left and right turn signals, low fuel level, low oil pressure, high beam indicator, seat belt reminder, brake system, malfunction indicator (check engine) lamp, check gauges, anti-lock system and air bag system indicator.

The low oil pressure indicator replaces the Check Gauges indicator in the cluster assembly without a tachometer.

In the cluster assembly with tachometer, Check Gauges indictor illuminates in a warning situation. This will notify driver to check for a problem in coolant temperature, oil pressure or electrical systems.

CLUSTER AND GAUGE SERVICE AND TESTING

CAUTION: Disconnect battery cable. Before servicing the instrument panel. Reconnect battery cable when power is required for test purposes.

FUEL GAUGE—FLEXIBLE FUEL

The flexible fuel vehicle uses a dampened fuel gauge. Methanol fuel causes erratic gauge movement if the proper gauge is not used.

The unique fuel gauge may be identified by either a green logo on the face of the gauge or by checking the part number. Remove cluster from the instrument panel and check the part number on top of the cluster. Refer to Mechanical/Electronic Cluster Removal for proper procedures. Refer to parts catalog for proper part number.

SENDING UNIT TEST

When a problem occurs with a cluster gauge, before disassembling the cluster to check the gauge, check for a defective sending unit or wiring.

(1) Sending units and wiring can be checked by grounding the connector leads, at the sending unit, in the vehicle.

(2) With the ignition in the ON position; a grounded input will cause the oil, fuel or temperature gauge to read at or above maximum.

LOW OIL PRESSURE/CHECK GAUGES WARNING LAMP TEST

The low oil pressure/check gauges warning lamp will illuminate when the ignition key is turned to the ON position without starting the vehicle.

In the cluster assembly without tachometer, the low oil pressure lamp will illuminate if the engine oil pressure drops below a safe oil pressure level.

In the cluster assembly with tachometer, the Check Gauges warning lamp illuminates when there is a problem in oil pressure level, high engine temperature or low voltage.

To test the system turn ignition key to the ON position. If the lamp fails to light, inspect for a broken or disconnected wire at the oil pressure combination unit, which is located at the front of the engine (Figs. 5 and 6). If the wire at the connector checks good, pull connector loose from the switch terminal and with a jumper wire ground connector to the engine (Fig. 7). With the ignition key turned to the ON position check the warning lamp. If lamp still fails to light, inspect for a burned out lamp or disconnected socket in the cluster.

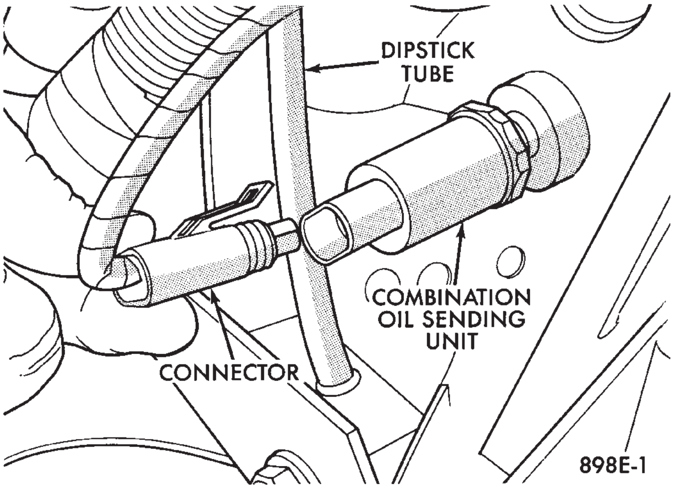


Fig. 5 Combination Oil Unit (2.5L)

COMBINATION OIL UNIT TEST

The combination oil unit has two functions:

(1) The normal closed circuit keeps the oil pressure warning/check gauges lamp on until there is oil pressure (Fig. 7).

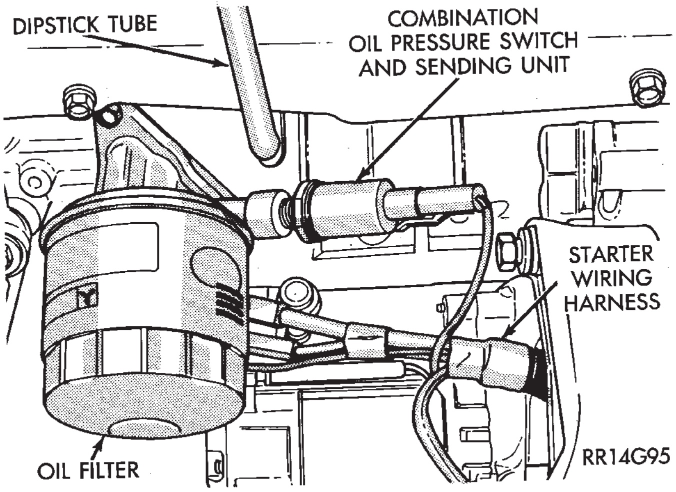


Fig. 6 Combination Oil Unit (3.0L)

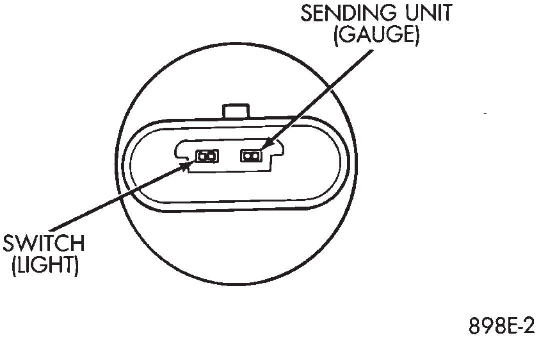


Fig. 7 Combination Oil Unit Test

(2) The sending unit provides a resistance that varies with oil pressure.

(3) To test the normally closed oil lamp circuit, disconnect the locking connector and measure the resistance between the switch terminal and the metal housing. The ohmmeter should read 0 ohms. Start the engine.

(4) If there is oil pressure, the ohmmeter should read an open circuit.

(5) To test the sending unit, measure the resistance between the sending unit terminal and the metal housing. The ohmmeter should read open. Start the engine.

(6) The ohmmeter should read between 30 to 55 ohms, depending on engine speed, oil temperature, and oil viscosity.

(7) If the above results are not obtained, replace the switch.

BRAKE SYSTEM WARNING LAMP TEST

The brake warning lamp illuminates when parking brake is applied with ignition key turned ON. The same lamp will also illuminate should one of the two service brake systems fail when brake pedal is applied. To test system turn ignition key ON, and apply parking brake. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or

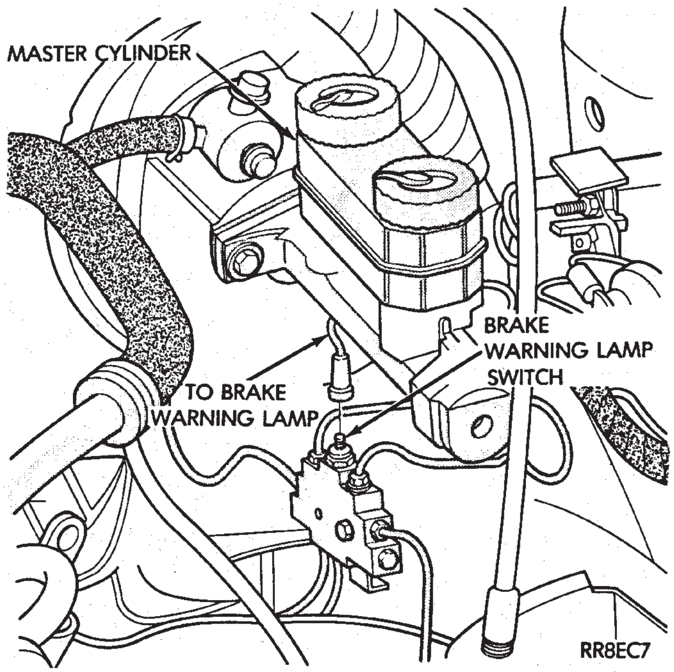


Fig. 8 Brake Warning Lamp Switch

disconnected wire at switch. The lamp also lights when the ignition switch is turned to START.

To test service brake warning system, raise vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses brake pedal and observes warning lamp. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch.

If lamp is not burned out and wire continuity is proven, replace brake warning switch in brake line Tee fitting mounted on frame rail in engine compartment below master cylinder (Fig. 8 and 9).

CAUTION: If wheel cylinder bleeder was opened check master cylinder fluid level.

SEAT BELT WARNING SYSTEM

For testing of this system refer to Group 8M, Restraint Systems.

MALFUNCTION INDICATOR (CHECK ENGINE) SYSTEM

For testing this system refer to the Powertrain Diagnostic Test Procedures booklet.

AIR BAG WARNING SYSTEM

For testing this system refer to Group 8M, Restraint Systems.

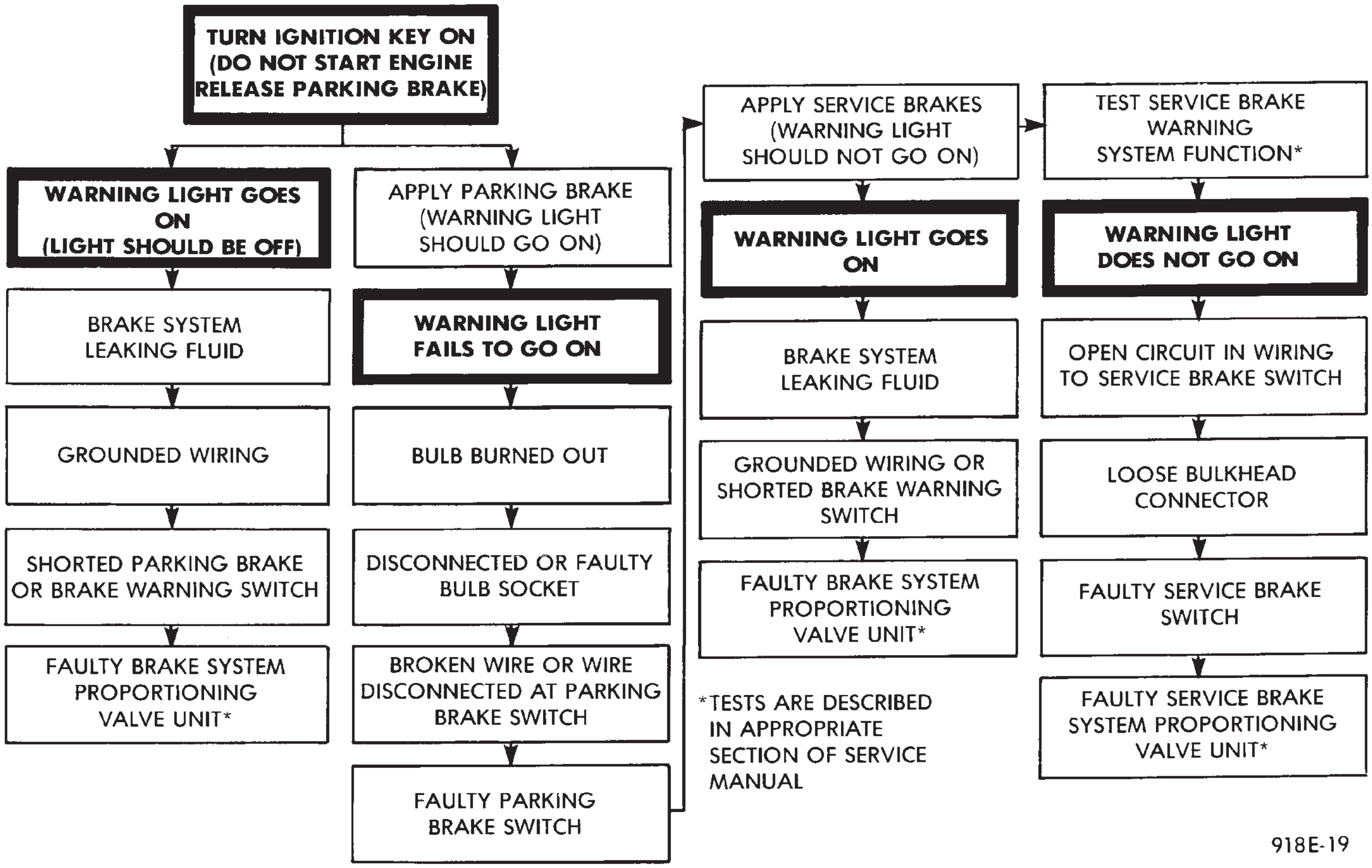


Fig. 9 Brake System Warning Lamp Diagnosis

MECHANICAL/ELECTRONIC CLUSTER REMOVAL

CLUSTER BEZEL REMOVAL

(1) On column shift vehicles, place column shifter to neutral position.

(2) On tilt steering column vehicles, adjust tilt range to lowest position.

(3) Pull cluster bezel rearward to disengage 11 clips (Fig. 10).

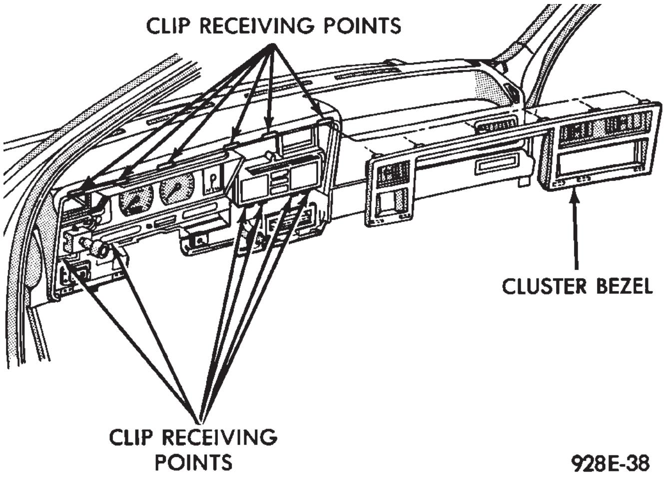


Fig. 10 Cluster Bezel

(4) Remove cluster bezel.

(5) For installation reverse above procedures.

CLUSTER MASK AND LENS REMOVAL

(1) Remove cluster, radio and rear window defogger bezels (Fig. 10).

(2) Remove four cluster to panel screws.

(3) Pull cluster assembly rearward. Vehicles with column shift use care to not damage transmission range indicator guide tube.

(4) Remove four screws holding the cluster mask to cluster housing (Fig. 11).

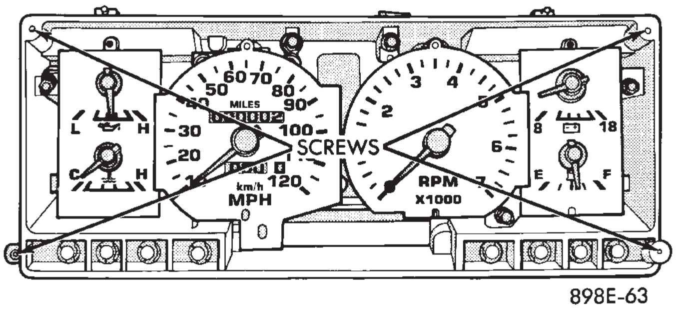


Fig. 11 Cluster Mask and Lens

(5) Pull cluster mask and lens rearward to remove.

(6) For installation reverse above procedures.

CLUSTER ASSEMBLY

REMOVAL—CLUSTER WITH TRANSMISSION RANGE INDICATOR FROM STEERING COLUMN

(1) Disconnect battery to assure no air bag system fault codes are stored.

(2) Remove cluster bezel (Fig. 10).

(3) On column shift vehicle: (Fig. 12 through 15).

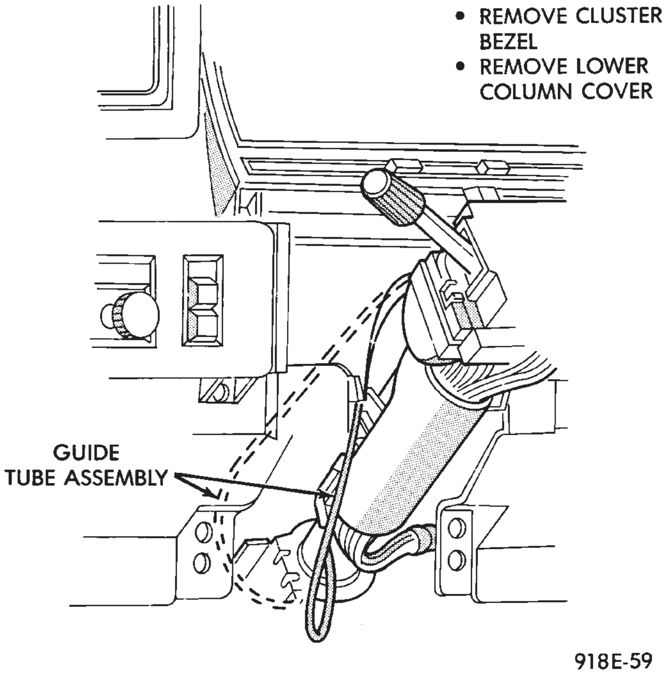


Fig. 12 Transmission Range Indicator Step 1

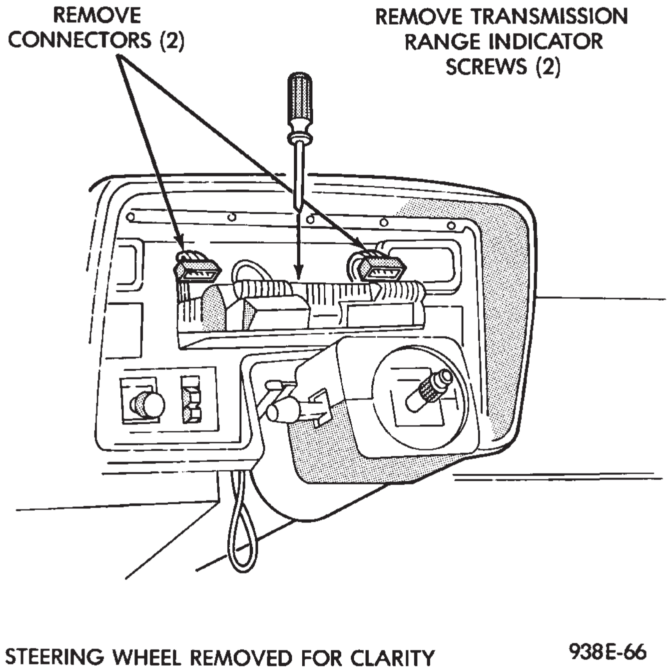


Fig. 13 Transmission Range Indicator Step 2

(a) Remove lower steering column cover (Fig. 16). Release guide tube from behind fuse block.

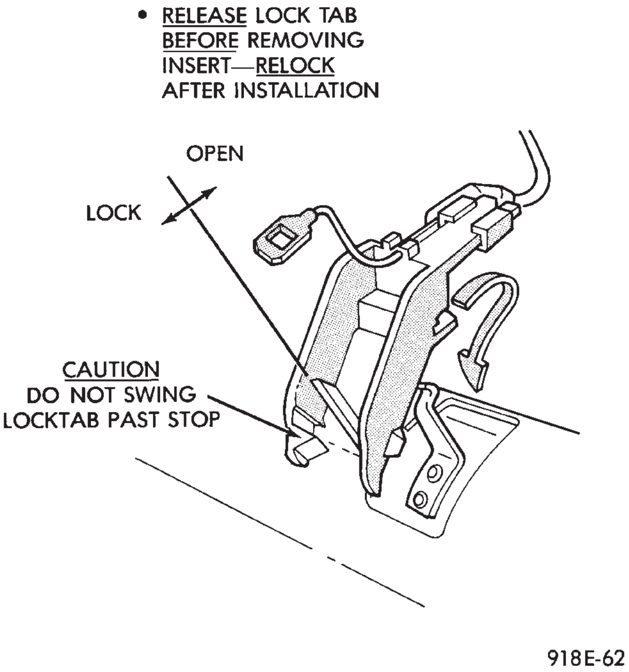


Fig. 14 Transmission Range Indicator Step 3

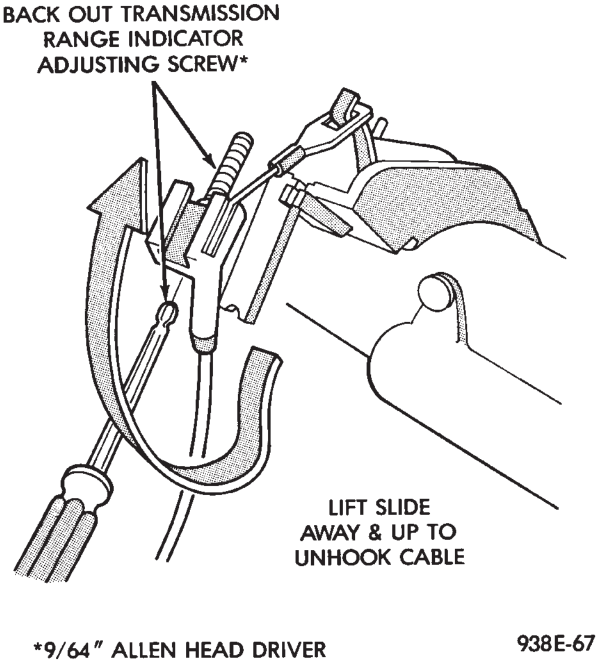


Fig. 15 Transmission Range Indicator Step 4

(b) Place gear shift lever in neutral or park.

(c) Remove guide tube from behind fuse block and disconnect cable eyelet from column actuating arm.

(d) Release lock bar on column insert, squeeze legs together and remove from column (Fig. 14).

(e) Secure insert and cable guide out of the way.

(4) Remove the rear window defogger bezel and radio bezel.

(5) Remove the upper steering column cover.

(6) Remove the four screws attaching cluster housing to the base panel.

(7) Pull cluster rearward, reach behind cluster and disconnect the two wiring harnesses.

(8) Remove cluster assembly.

INSTALLATION

(1) Connect wiring harnesses.

(2) Position cluster and secure to base panel with four screws.

(3) On column shift vehicles (Fig. 12 through 15):

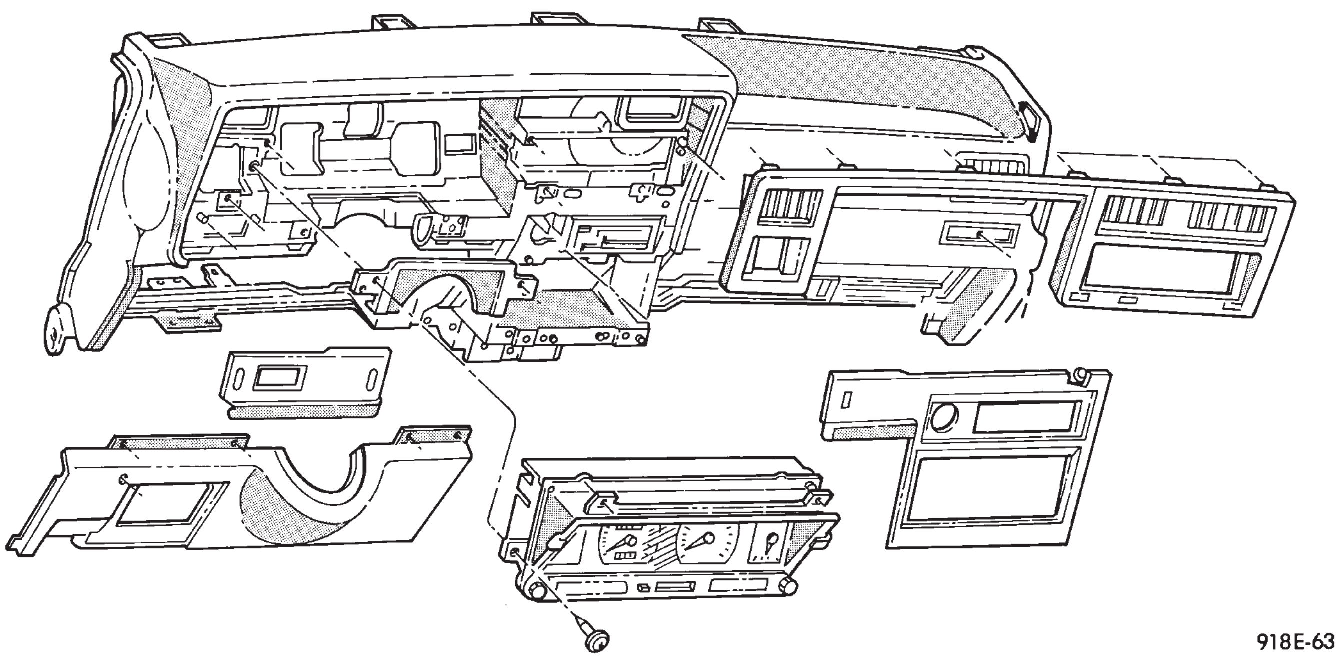


Fig. 16 Instrument Panel Bezels

(a) Route transmission range indicator guide assembly under left steering column wing and down left side of column (Fig. 12).

(b) Insert flange of column insert into column, squeeze legs together with tabs under column jacket and engage lock bar to secure insert (Fig. 14).

(c) Hook cable eyelet to steering column actuator check pointer, should indicate neutral. Do not kink or bind transmission range indicator guide tube and position guide tube in original location.

(d) Adjust with tool if necessary to center pointer on N (Neutral) and check in other gears (Fig. 15).

(4) Install upper and lower steering column cover.

(5) Install the rear window defogger bezel and radio bezel.

(6) Install cluster bezel.

(7) Reconnect battery.

REMOVAL—CLUSTER WITHOUT TRANSMISSION RANGE INDICATOR FROM STEERING COLUMN

(1) Remove cluster bezel (Fig. 10).

(2) Remove four screws attaching cluster to base panel.

(3) Pull cluster rearward carefully, reach behind and disconnect the two harness connectors.

(4) Carefully rotate cluster and remove the two transmission range indicator screws.

(5) Remove cluster assembly.

(6) For installation reverse above procedures.

(a) Do not kink guide tube when installing cluster.

(b) Replace guide tube behind fuse block.

GAUGES

It is not necessary to remove instrument cluster assembly from vehicle for gauge replacement.

When removing gauge assemblies from cluster, gauge must be pulled straight out, not twisted, or damage to gauge pin may result.

MULTIPLE GAUGE MALFUNCTION

If the fuel, voltage and tachometer gauges appear to be malfunctioning, remove the cluster assembly. Check for good pin contact between the wire harness and printed circuit board. If there is good contact, check for ignition voltage at ignition cavity C of the black connector. If there is ignition voltage, check for continuity between the wire harness ground cavity H of the black connector and ground. If there is continuity, replace printed circuit board.

If the temperature, oil pressure and speedometer gauges appear to be malfunctioning remove the cluster assembly. Check for a good contact between the wire harness and the printed circuit board. If there is good contact, check for ignition voltage at cavity J of the red connector. If there is voltage, check for continuity at cavity H of the black connector. If there is continuity, replace the printed circuit board.

If the temperature, fuel, voltage and speedometer gauges appear to be malfunctioning, remove the cluster assembly. Check for good pin contact between the wire harness and the printed circuit board. If there is good contact, check ignition voltage at cavity J of the red connector. If there is voltage, check for continuity at cavity H of the black connector. If there is continuity, replace the printed circuit board.

GAUGE INOPERATIVE (FIG. 17 THROUGH 23)

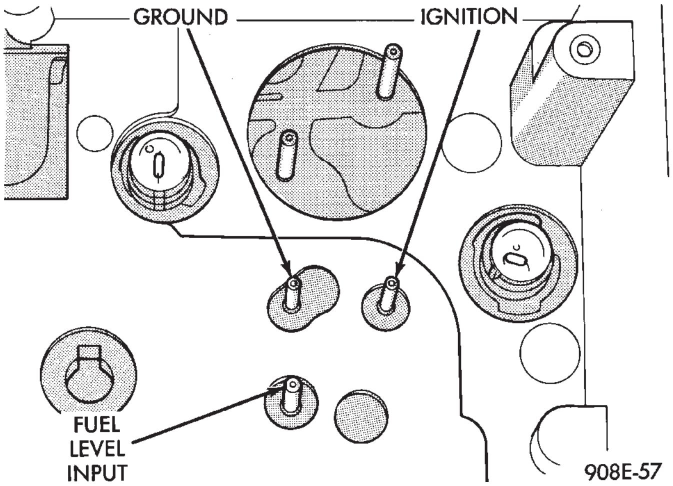


Fig. 17 Fuel Gauge Pins—With Tachometer

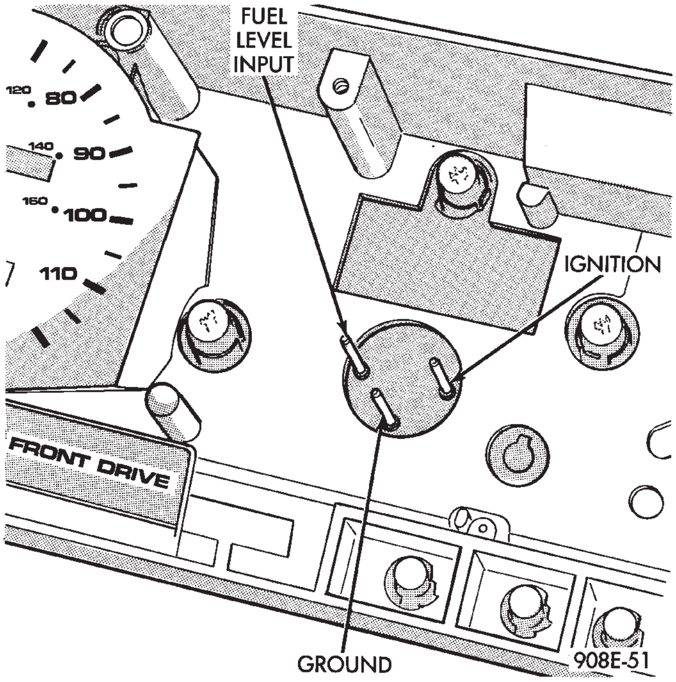


Fig. 18 Fuel Gauge Pins—Without Tachometer

(1) Remove gauge in question.

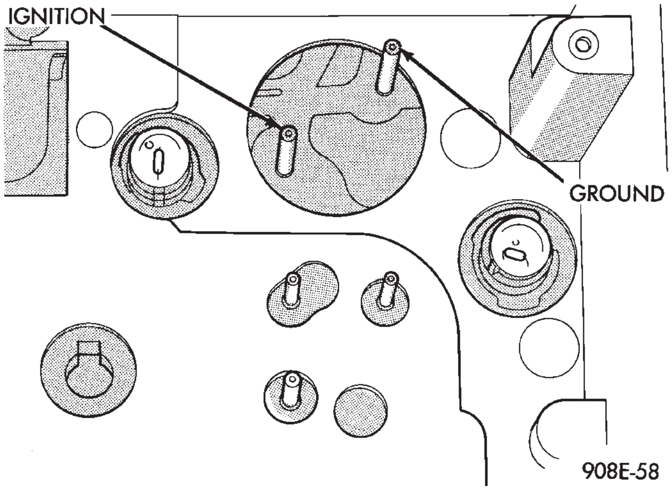


Fig. 19 Voltmeter Pins—With Tachometer

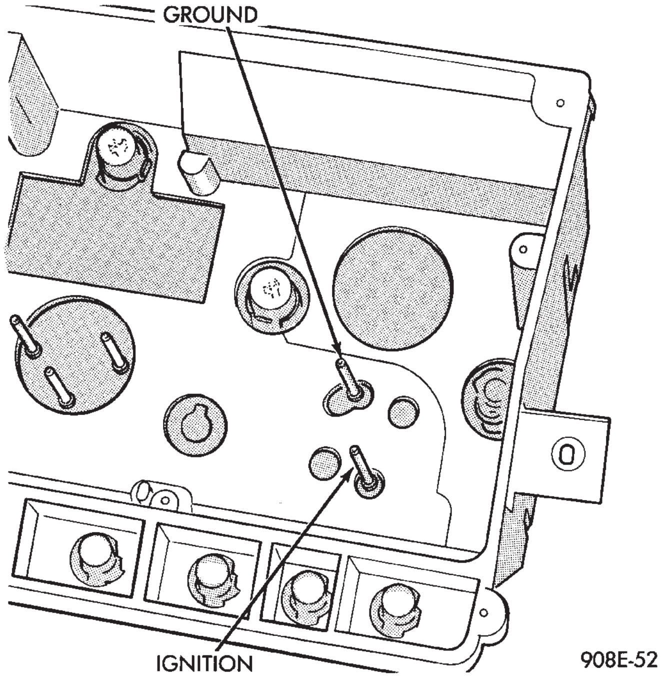


Fig. 20 Voltmeter Pins—Without Tachometer

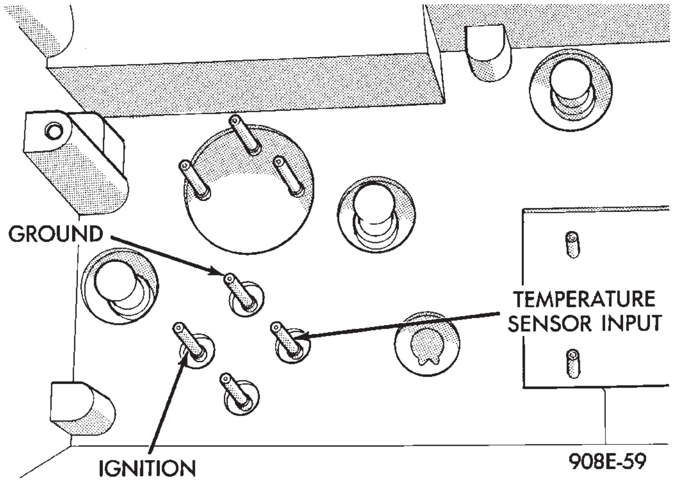


Fig. 21 Temperature Gauge Pins—With Tachometer

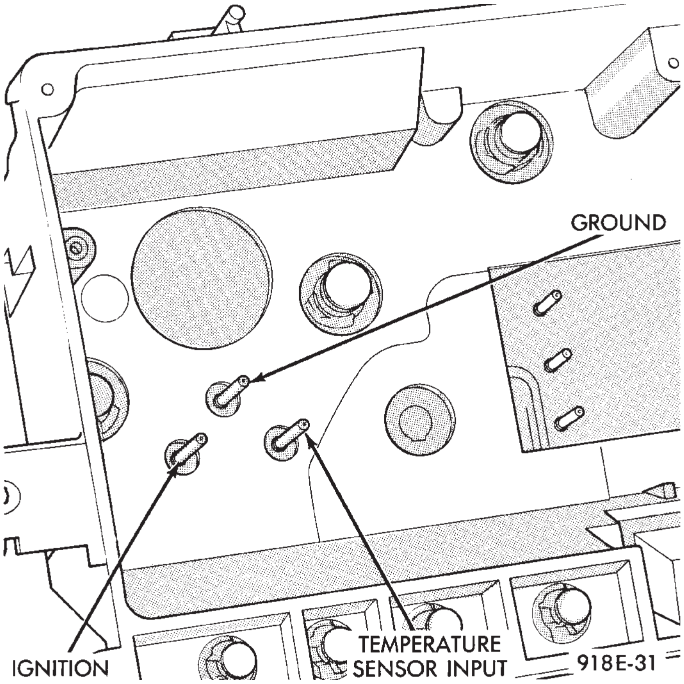


Fig. 22 Temperature Gauge Pins—Without Tachometer

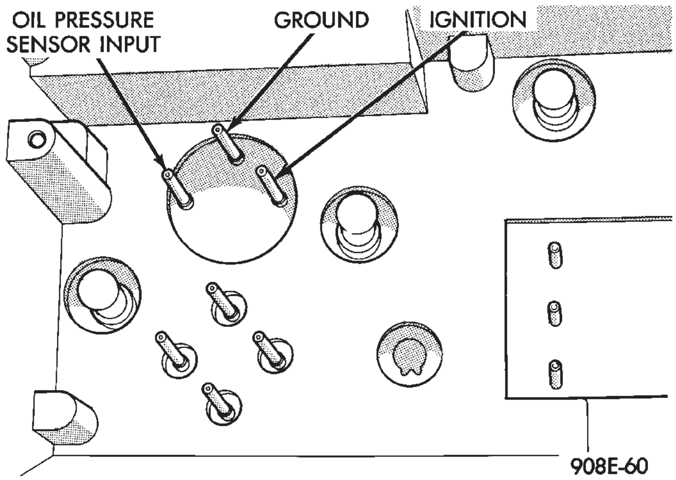


Fig. 23 Oil Pressure Gauge Pins—With Tachometer

(2) With the ignition key ON, check for ignition voltage at ignition pin of gauge. Check for ground at ground pin of gauge. Refer to the individual gauge circuit test for proper pin.

(a) If voltage at pin, replace gauge.

(b) If no voltage or ground at gauge pins, check for ignition voltage and ground at cluster harness connectors.

(c) If no voltage or ground, repair as necessary. Refer to 8W, Wiring Diagrams.

(d) If there is voltage or ground, check cluster for distorted terminals. If terminals are OK, replace printed circuit board.

(3) When testing temperature, allow the engine to run until the vehicle reaches a normal operating temperature. Turn ignition OFF, and remove gauge from cluster.

(a) Testing oil pressure gauge, engine needs to be running.

(b) Measure and record the resistance between sending unit pin and ground pin of the gauge in question. Refer to Gauge Calibration.

(c) It is important to have the same engine temperature and engine speed when checking temperature and oil pressure gauges position. The time between gauge position reading and sending unit measuring should be kept to a minimum.

(d) If resistance and gauge position are not similar, replace gauge.

(e) If OK, test resistance from the sending unit to the cluster connector.

(f) If resistance reading is different, check printed circuit board for contact to cluster connector.

(g) If OK and contacts are not distorted, replace printed circuit board.

(h) If everything checks out OK, refer to sending unit test.

(4) If fuel gauge does not meet specifications, refer to Group 14, Fuel for the test procedure.

GAUGE CALIBRATION

(1) Remove the gauge.

(2) Check for ignition voltage and ground to the gauge.

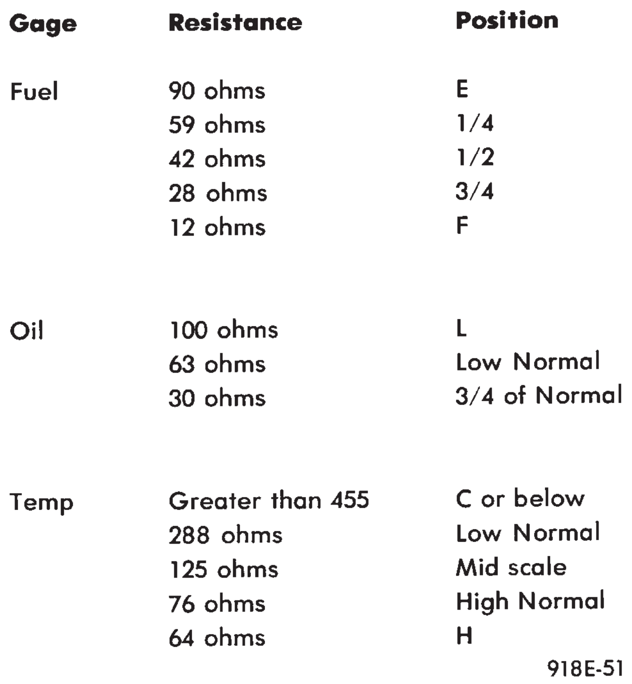
(3) With the ignition key in the OFF position, replace gauge. Turn the ignition key to the ON position. To test oil pressure gauge engine must be running. When testing oil or temperature gauge the engine should be at normal operating temperature. Record the gauge position.

(4) Remove gauge and record the resistance between the sending unit pin and the gauge ground pin. When checking gauges, it is important to have the same engine temperature and speed when noting gauge position. The time between gauge reading and measuring should be kept to a minimum.

(5) The Gauge Resistance Chart (Fig. 24), is general guidelines for checking the gauge position against the sending unit resistance.

Because of only a few specific points of gauge position versus sending unit resistance, a good estimate is need when the resistance falls between graduations. Even when the resistance corresponds to graduations, the gauge has a tolerance of ± 4 ohms.

Volt gauge: The calibration dot on the volt gauge corresponds to 13 volts between the gauge ignition and ground pins. If voltage varies from this, estimate proper gauge position with input voltage.



Gage	Resistance	Position
Fuel	90 ohms	E
	59 ohms	1/4
	42 ohms	1/2
	28 ohms	3/4
	12 ohms	F
Oil	100 ohms	L
	63 ohms	Low Normal
	30 ohms	3/4 of Normal
Temp	Greater than 455	C or below
	288 ohms	Low Normal
	125 ohms	Mid scale
	76 ohms	High Normal
	64 ohms	H

918E-51

Fig. 24 Gauge Resistance

TACHOMETER REPLACEMENT

(1) Remove cluster, radio and rear window defogger bezels and mask/lens assembly.

(2) Remove screws attaching tachometer to cluster housing.

(3) Pull tachometer rearward to remove.

(4) For installation reverse above procedures.

TACHOMETER CIRCUIT TESTING

(1) Remove cluster, radio and rear window defogger bezels and mask/lens assembly.

(2) Check for battery voltage at cavity A of the instrument cluster black connector.

(3) With the ignition in the ON position, check for battery voltage at cavity C of the black connector (Fig. 25).

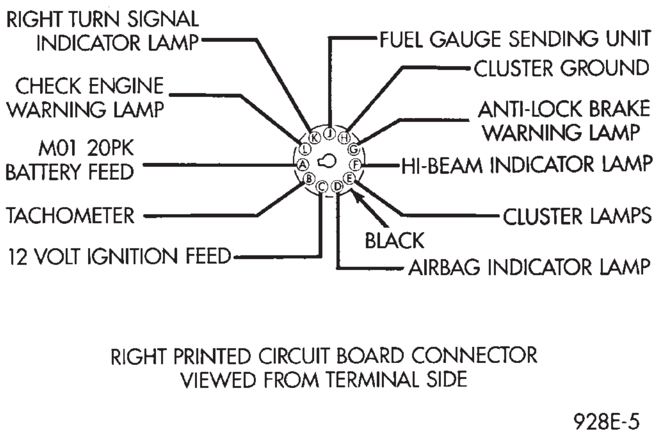


Fig. 25 Printed Circuit Board 11-Way Connector

(4) Check cavity H of the black connector for continuity to ground.

(5) Check for tachometer signal from the powertrain control module by connecting an AC DIGITAL VOLTMETER to cavity B of the instrument cluster black connector and ground. A reading of at least 1.0 volt should be present with the engine running (Fig. 26).

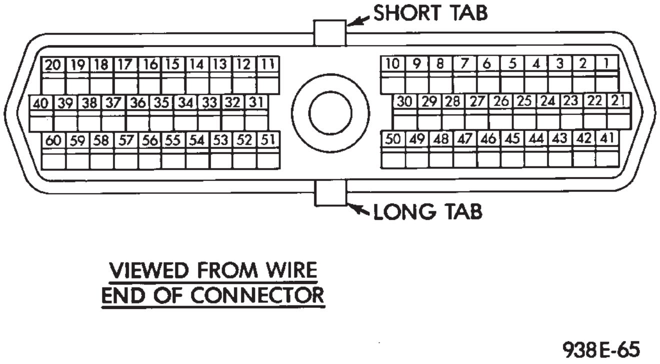


Fig. 26 Powertrain Control Module Pin Location

(a) If voltage is within specification, go to step 7.

(b) If voltage is NOT within specification, perform steps 6.

(6) If there is less than 1.0 volt at cavity B, check for continuity between cavity B and pin 43 of the powertrain control module connector.

(a) If continuity is OK, between cavity B and pin 43 of the powertrain control module connector, replace the powertrain control module.

(b) No continuity, check the connectors for damaged pins or terminal push outs or defective wire.

(7) If all tests performed test good replace the tachometer drive module.

(8) If the tachometer continues to be inoperative, replace the tachometer assembly.

VOLTMETER AND FUEL GAUGE ASSEMBLY REPLACEMENT

(1) Remove cluster, radio and rear window defogger bezels and mask/lens assembly.

(2) Remove tachometer.

(3) Remove screw attaching gauge assembly to cluster.

(4) Pull rearward to remove gauge assembly.

(5) For installation reverse above procedures.

OIL PRESSURE AND TEMPERATURE GAUGE ASSEMBLY REPLACEMENT

(1) Remove cluster, radio and rear window defogger bezels and mask/lens.

(2) Remove speedometer.

(3) Remove screw attaching gauge assembly to cluster.

(4) Pull rearward to remove gauge assembly.

(5) For installation reverse above procedures.

FUEL GAUGE REPLACEMENT

(1) Remove cluster, radio and rear window defogger bezels and mask/lens.

(2) Remove screws attaching fuel gauge to cluster housing.

(3) Pull fuel gauge rearward to remove.

(4) For installation reverse above procedures.

VOLTMETER GAUGE REPLACEMENT

(1) Remove cluster bezel and mask.

(2) Remove fuel gauge.

(3) Remove screws attaching voltmeter assembly to cluster.

(4) Pull rearward to remove gauge assembly.

(5) For installation reverse above procedures.

TEMPERATURE GAUGE ASSEMBLY REPLACEMENT

(1) Remove cluster bezel and mask.

(2) Remove speedometer.

(3) Remove screws attaching gauge assembly to cluster.

(4) Pull rearward to remove gauge assembly.

(5) For installation reverse above procedures.

SPEEDOMETER SYSTEM

AA body vehicles are equipped with electronically driven speedometer and odometer assemblies. The unit has the same appearance as a conventional speedometer but it eliminates the cable-driven mechanical system. A signal is sent from a transmission-mounted vehicle speed sensor to the speedometer circuitry through the wiring harness. By eliminating the speedometer cable, instrument cluster service and removal is improved. Refer to Fig. 27 Speedometer Diagnosis Chart.

When the speedometer is out of calibration. The electronic automatic transaxle vehicle speed sensor output must be calibrated to reflect the different combinations of equipment. The procedure is called Pinion Factor, refer to Group 21, Transaxle for the procedure.

SPEEDOMETER-ODOMETER ASSEMBLY REPLACEMENT

(1) Remove cluster bezel and mask.

(2) Remove two screws attaching the speedometer and odometer assembly to the cluster housing.

(3) Pull speedometer rearward to disengage from gauge pins.

(4) For installation reverse above procedures.

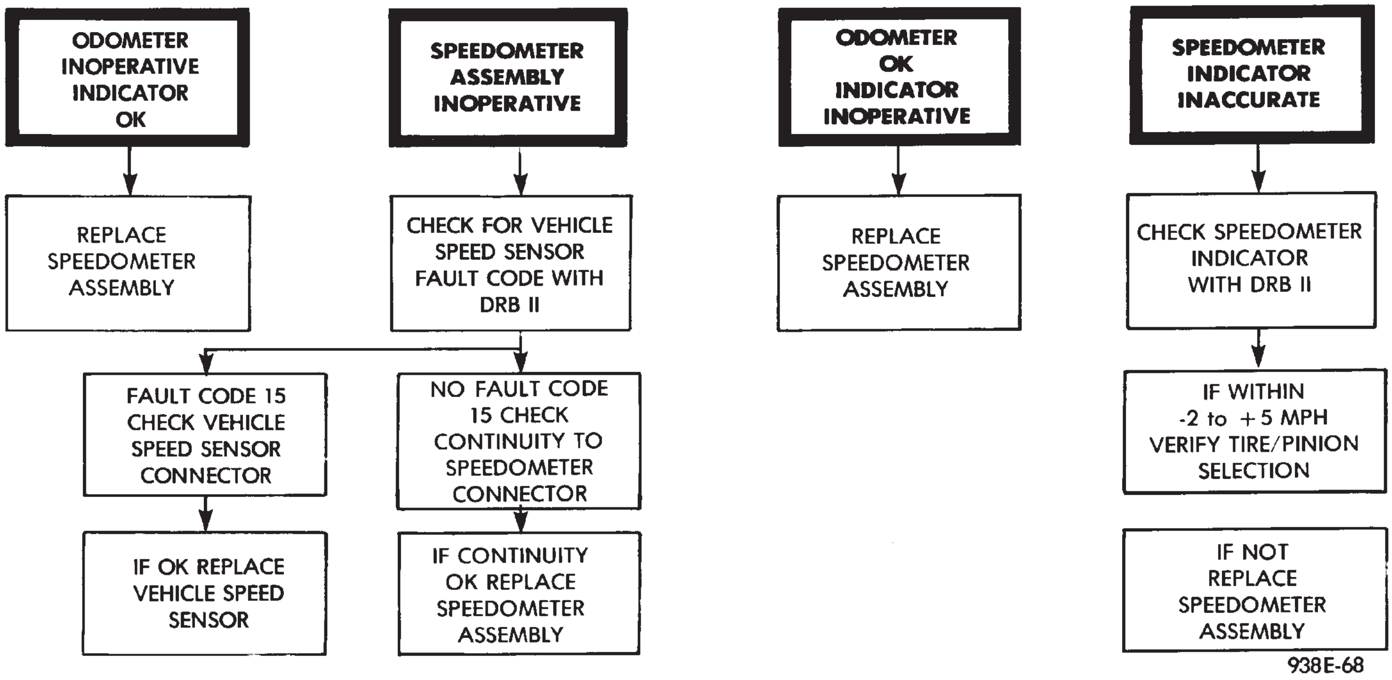


Fig. 27 Speedometer Diagnosis

SPEEDOMETER CIRCUIT TESTING

(1) Remove speedometer from cluster.

(2) With ignition switch in the ON position, check for battery voltage across ignition and ground pins (Fig. 28).

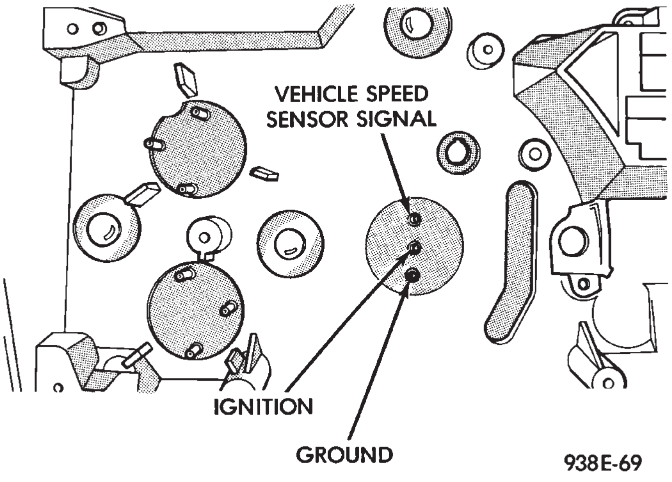


Fig. 28 Speedometer Pins

(3) Check continuity from vehicle speed sensor signal pin to connector at vehicle speed sensor.

(4) Test for faulty vehicle speed sensor.

(5) If all of these tests prove good, replace speedometer.

VEHICLE SPEED SENSOR REPLACEMENT

(1) Remove harness connector from sensor and make sure weather seal is on harness connector (Fig. 29).

(2) Remove sensor retaining bolt.

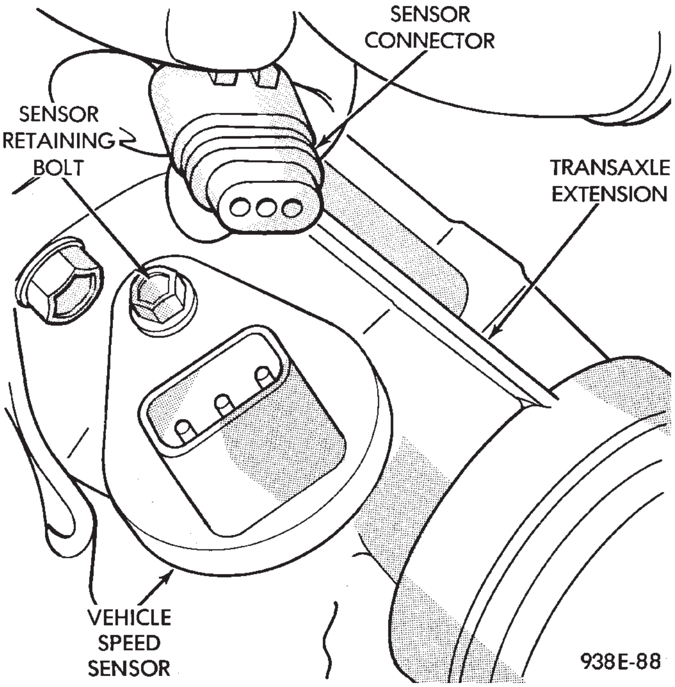


Fig. 29 Vehicle Speed Sensor and Connector

(3) Pull sensor and pinion gear assembly out of transaxle. If necessary, carefully pry loose with a flat blade screwdriver (Fig. 30).

(4) Remove pinion gear from sensor.

(5) For installation reverse above procedures and seat sensor assembly by hand to insure proper gear engagement. Tighten retaining bolt to 7 N●m (60 in. lbs.) torque.

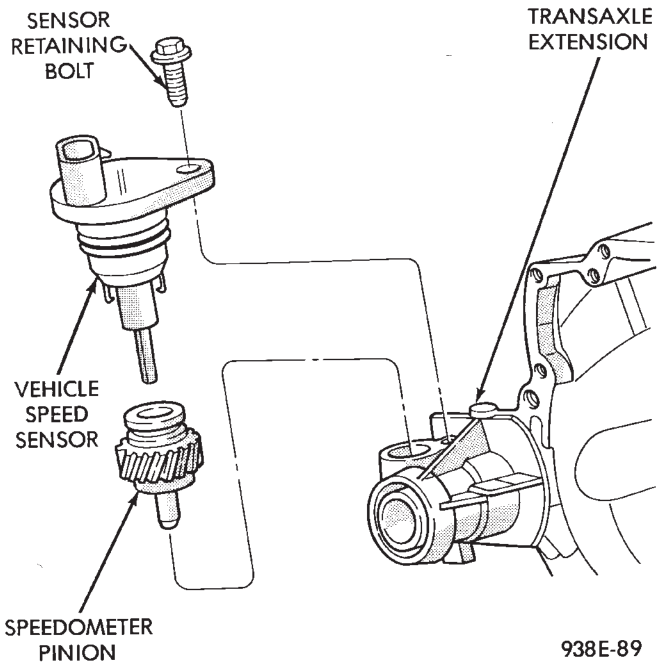


Fig. 30 Vehicle Speed Sensor and Speedometer Pinion

ELECTRONIC AUTOMATIC TRANSAXLE VEHICLE SPEED SENSOR REPLACEMENT

The output vehicle speed sensor is located to the left of the manual shift lever.

(1) Raise and support vehicle on safety stands.

(2) Remove vehicle speed sensor (Fig. 31).

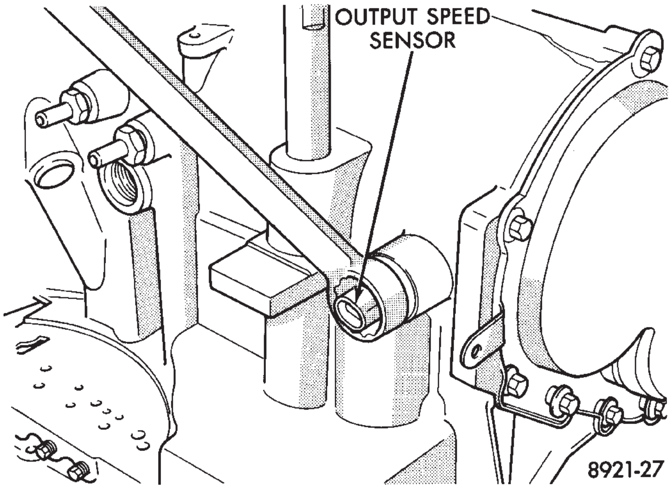


Fig. 31 Vehicle Speed Sensor Removal

(3) For installation, reverse above procedures.

VEHICLE SPEED SENSOR TEST

For testing of the vehicle speed sensor and related components refer to the Powertrain Diagnostics Test Procedure Manual.

TACHOMETER DRIVE MODULE REPLACEMENT

(1) Remove cluster assembly. Refer to Cluster Assembly Replacement.

(2) Pull tachometer drive module from printed circuit board (Fig. 32).

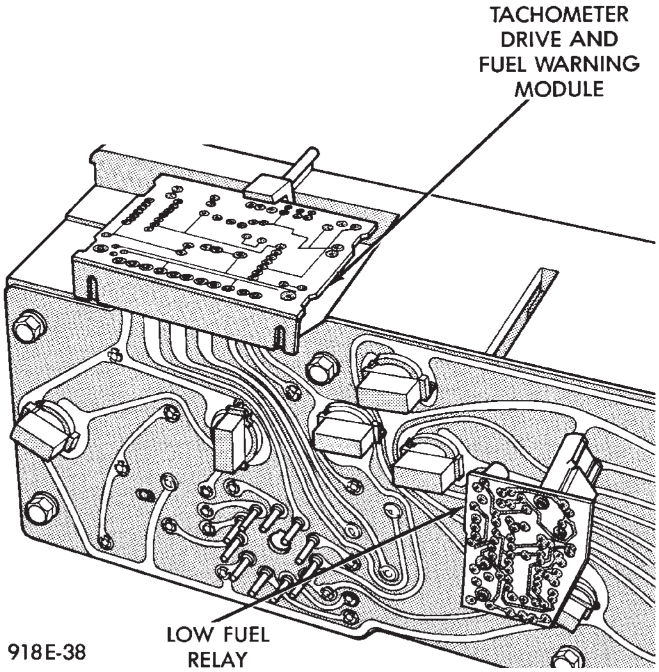


Fig. 32 Tachometer Drive and Low Fuel Warning Module

(3) For installation reverse above procedures and use care when aligning module to printed circuit board.

LOW FUEL WARNING MODULE REPLACEMENT

(1) Remove cluster assembly. Refer to Cluster Assembly Replacement.

(2) Pull low fuel relay from printed circuit board (Fig. 32).

(3) For installation reverse above procedure. Use care when aligning module to printed circuit board.

GAUGE ALERT MODULE REPLACEMENT

(1) Remove cluster assembly. Refer to Cluster Assembly Replacement.

(2) Pull gauge alert module from printed circuit board (Fig. 33).

(3) For installation reverse above procedures. Use care when aligning module to printed circuit board.

CLUSTER LAMP REPLACEMENT

(1) Remove cluster, radio and rear window defogger bezels.

(2) Remove cluster. Refer to Cluster Assembly Replacement.

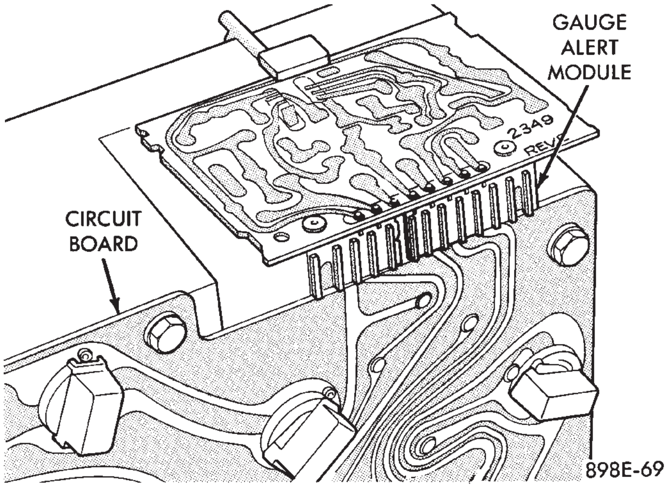


Fig. 33 Gauge Alert Module

(3) Remove lamp sockets as necessary by turning them counterclockwise (Fig. 34 and 35).

PRINTED CIRCUIT BOARD REPLACEMENT

(1) Remove cluster assembly.

(2) Remove tachometer drive module, low fuel relay and gauge alert module (Fig. 32).

(3) Remove all cluster lamps.

(4) Remove mounting screws securing printed circuit board to cluster housing (Fig. 34).

(5) For installation reverse above procedures.

ELECTRONIC CLUSTER

SELF DIAGNOSTIC SYSTEM

The electronic clusters (Fig. 36) have an internal diagnostics routing to isolate problems within the cluster or sending units.

Using the cluster Self-Diagnostic Test will determine whether problem is within cluster or outside of cluster (Fig. 37 and 38).

Successful completion of the SELF DIAGNOSTIC TEST indicates that the problem is in the connectors or sensors outside of the module. Refer to Fig. 39 for terminal listing.

CONDITION: CLUSTER DISPLAYS DO NOT ILLUMINATE AFTER VEHICLE IS STARTED

PROCEDURE

(1) Check fuses and verify battery and ignition voltage at cluster connector.

(2) Check ground from cluster connector to instrument panel ground stud.

(3) Check lamps, replace if necessary.

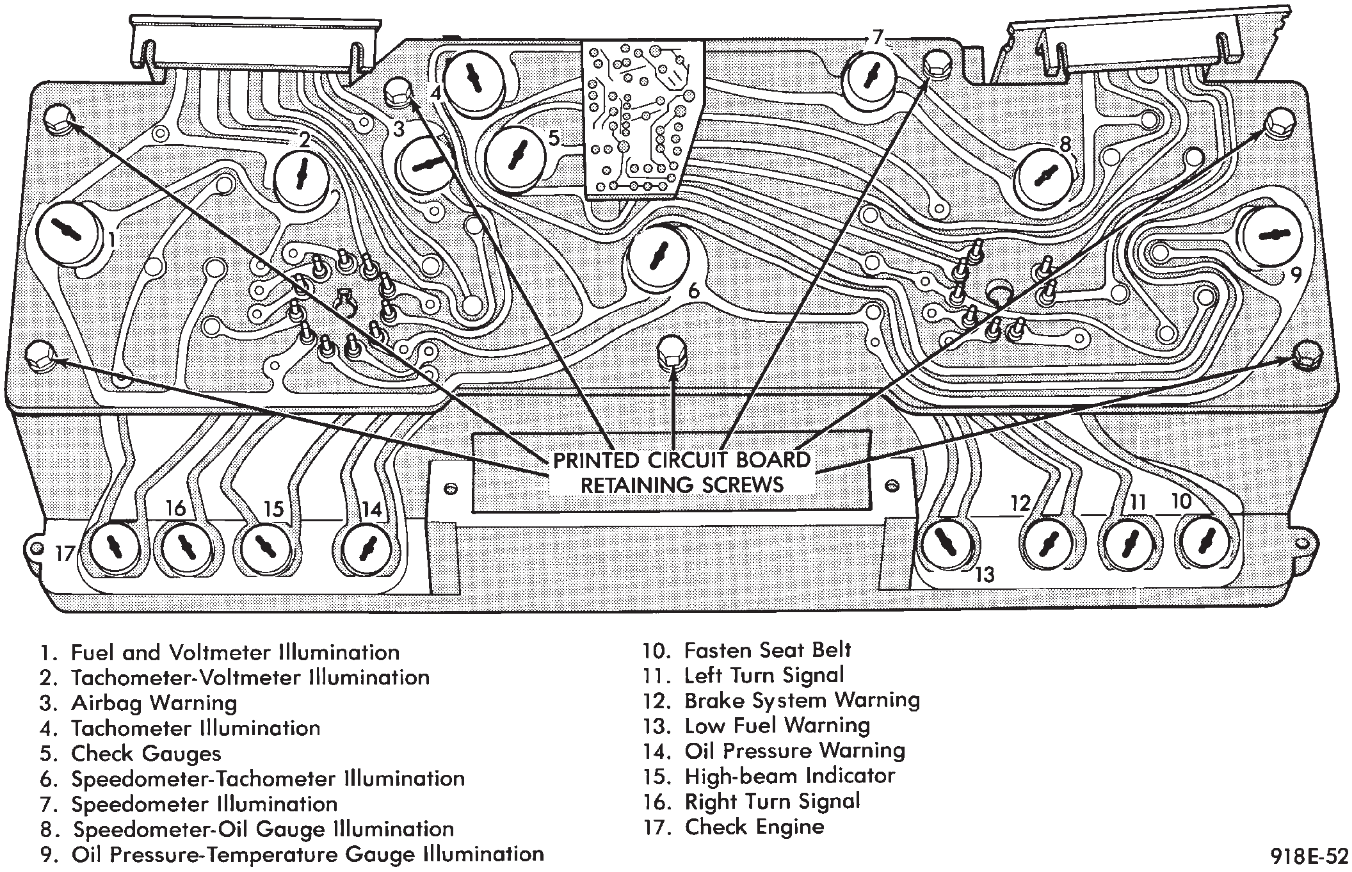
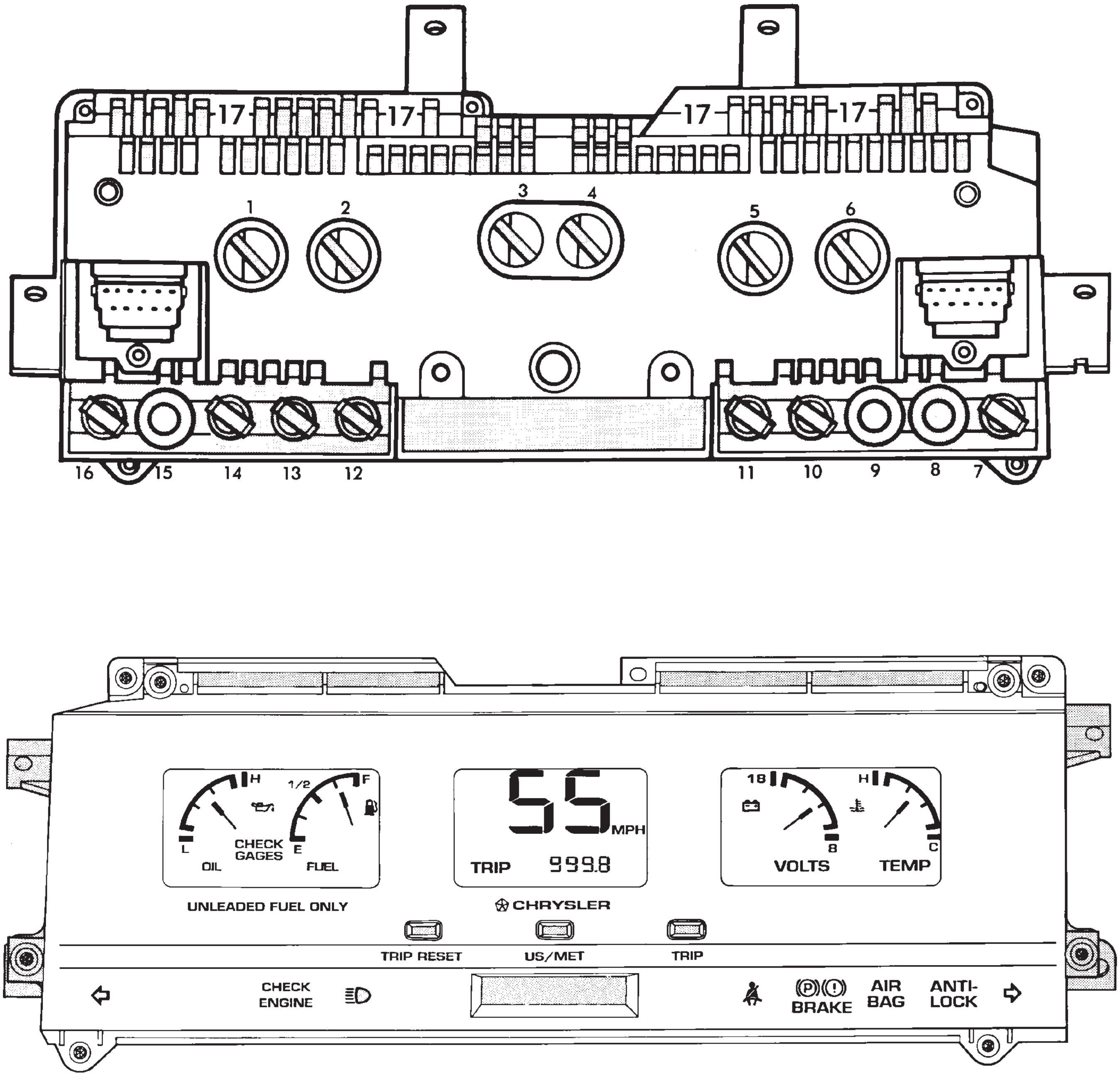


Fig. 34 Mechanical Cluster Lamp Location



1. VOLT & TEMPERATURE ILLUMINATION
2. VOLT & TEMPERATURE ILLUMINATION
3. ODOMETER & SPEEDOMETER ILLUMINATION
4. ODOMETER & SPEEDOMETER ILLUMINATION
5. FUEL & OIL ILLUMINATION
6. FUEL & OIL ILLUMINATION
7. LEFT TURN SIGNAL
8. BLANK
9. BLANK
10. CHECK ENGINE
11. HIGH BEAM
12. SEAT BELT
13. BRAKE
14. AIR BAG
15. ANTI-LOCK/ABS
16. RIGHT TURN SIGNAL
17. ILLUMINATION (BEHIND MASK)

938E-70

Fig. 35 Electronic Cluster Lamp Location

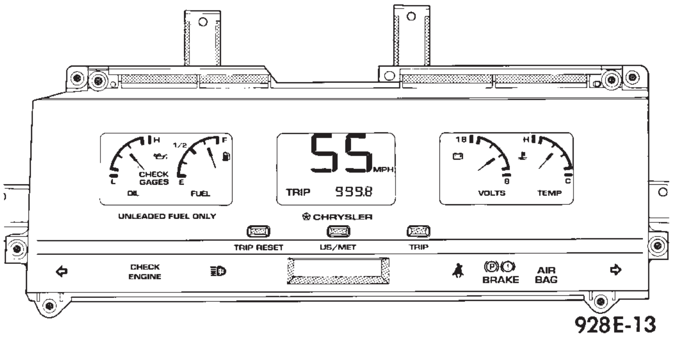


Fig. 36 Electronic Cluster

CONDITION: SPEEDOMETER AND ODOMETER ARE INOPERATIVE OR OPERATES INTERMITTENTLY

PROCEDURE

Check for defective vehicle speed sensor wiring.

CONDITION: OIL GAUGE, FUEL GAUGE, TEMPERATURE GAUGE, OR VOLTAGE GAUGE INOPERATIVE

PROCEDURE

Check for defective sending unit or wiring:

(a) Sending units and wiring can be checked by grounding the connector leads, at the sending unit, in the vehicle.

(b) With the ignition in the ON position, a grounded input will cause the oil, fuel, or temperature gauge to read maximum.

CONDITION: CLUSTER DISPLAY DOES NOT DIM WHEN HEADLAMP SWITCH IS ACTIVATED AND RHEOSTAT ROTATED

PROCEDURE

(1) Check fuses in headlamp circuit.

(2) Check for loose connections or defective wiring from headlamp switch to the cluster.

(3) Check for defective headlamp switch.

(4) The electronic instrument cluster requires both a marker feed and illumination feed to operate correctly.

SWITCH AND PANEL COMPONENT SERVICE

HEADLAMP/FOG LAMP SWITCH REPLACEMENT

(1) Remove cluster bezel (Fig. 40).

(2) Remove three screws securing headlamp switch mounting plate to base panel (Fig. 41).

(3) Pull headlamp/fog lamp switch mounting plate rearward. Disconnect wiring connectors from headlamp switch and fog lamp switch pigtail (Fig. 42).

(4) Remove knob and stem by depressing button on bottom of the switch (Fig. 43).

(5) Snap-out escutcheon.

(6) Remove fog lamp switch from escutcheon.

(7) Remove nut that attaches headlamp switch to mounting plate (Fig. 44).

(8) For installation reverse above procedures.

FOG LAMP SWITCH TEST

(1) Remove the fog lamp switch from mounting location.

(2) Disconnect the wiring harness from the switch pigtail.

(3) Using a Ohmmeter, test for continuity between the terminals of the switch pigtail (Fig. 45).

(4) If not OK, replace switch.

LOWER STEERING COLUMN COVER REPLACEMENT

(1) Disconnect park brake release rod from park brake.

(2) Remove fuse box access door and remove screw from lower column cover (Fig. 46).

(3) Remove screws from lower cover, four across the top and two on bottom.

(4) Remove lower steering column cover.

(5) For installation reverse above procedures.

LEFT LOWER INSTRUMENT PANEL SILENCER REPLACEMENT

(1) Remove screws from front of silencer (Fig. 47).

(2) Remove push nut.

(3) Remove silencer.

(4) For installation reverse above procedures.

RIGHT LOWER INSTRUMENT PANEL SILENCER REPLACEMENT

(1) On floor shift vehicles, remove console assembly and center brace bracket.

(2) On column shift vehicles, remove center brace bracket.

(3) Remove screws from front of silencer (Fig. 47).

(4) Remove three push nuts from rear of silencer.

(5) Remove lower right silencer.

(6) For installation reverse above procedures.

GLOVE BOX ASSEMBLY REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #2 prior to removing switch or wires may short to ground.

(2) Open glove box door and disconnect check strap.

(3) Remove glove box light and switch by squeezing retaining tabs from behind switch mount and slide rearward. Disconnect wiring connectors.

(4) Remove 11 screws from glove box assembly (Fig. 48).

(5) Remove glove box assembly.

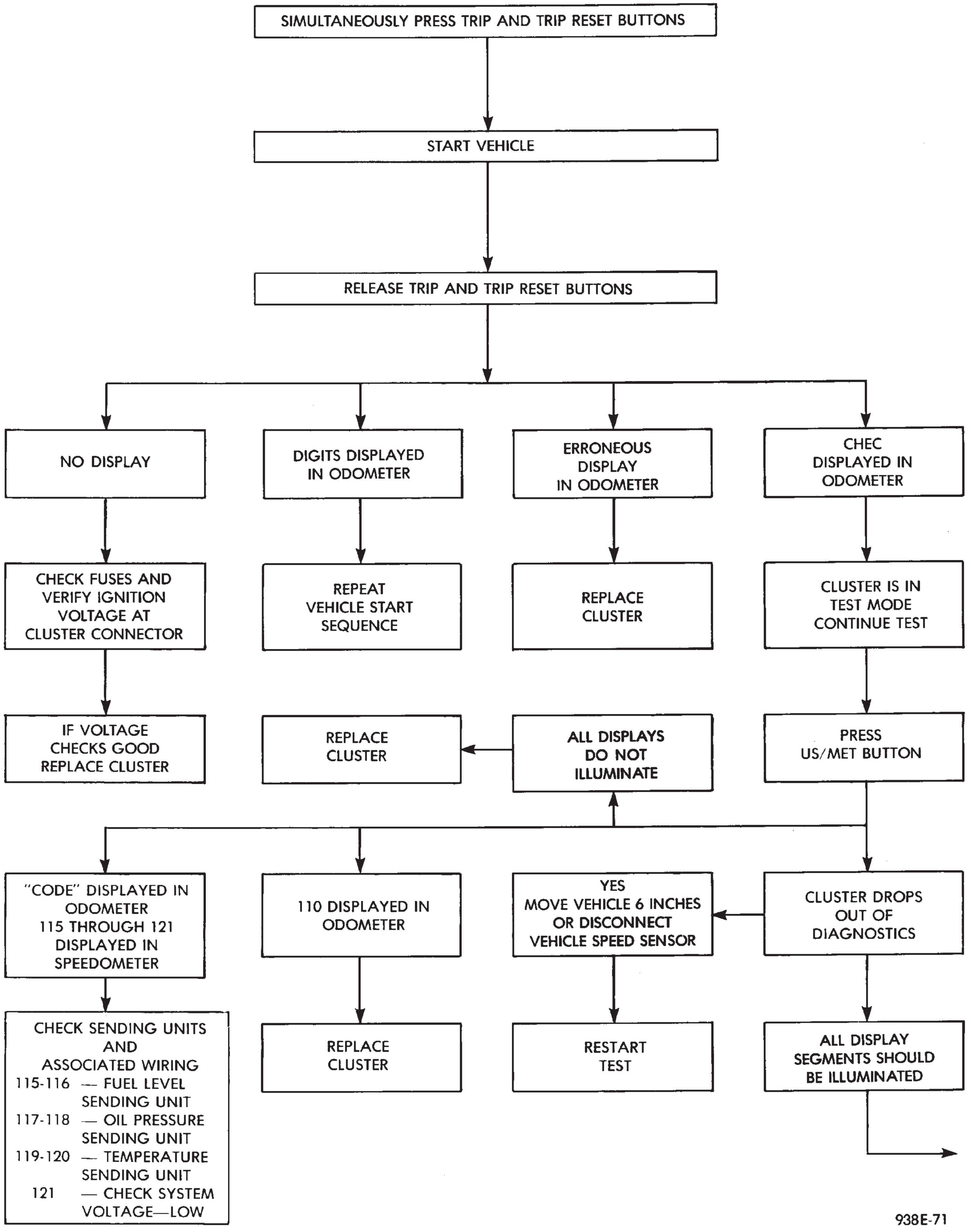
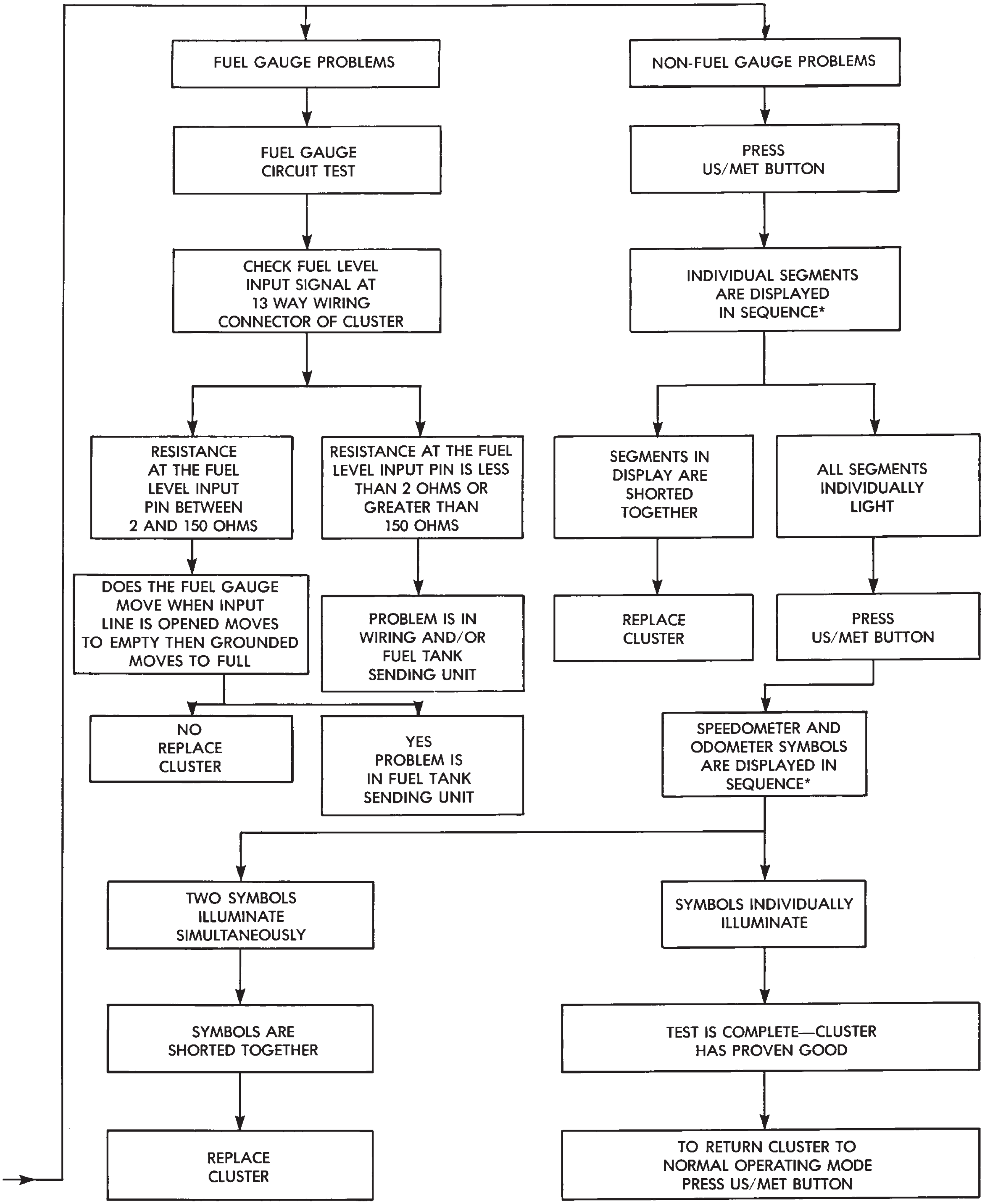


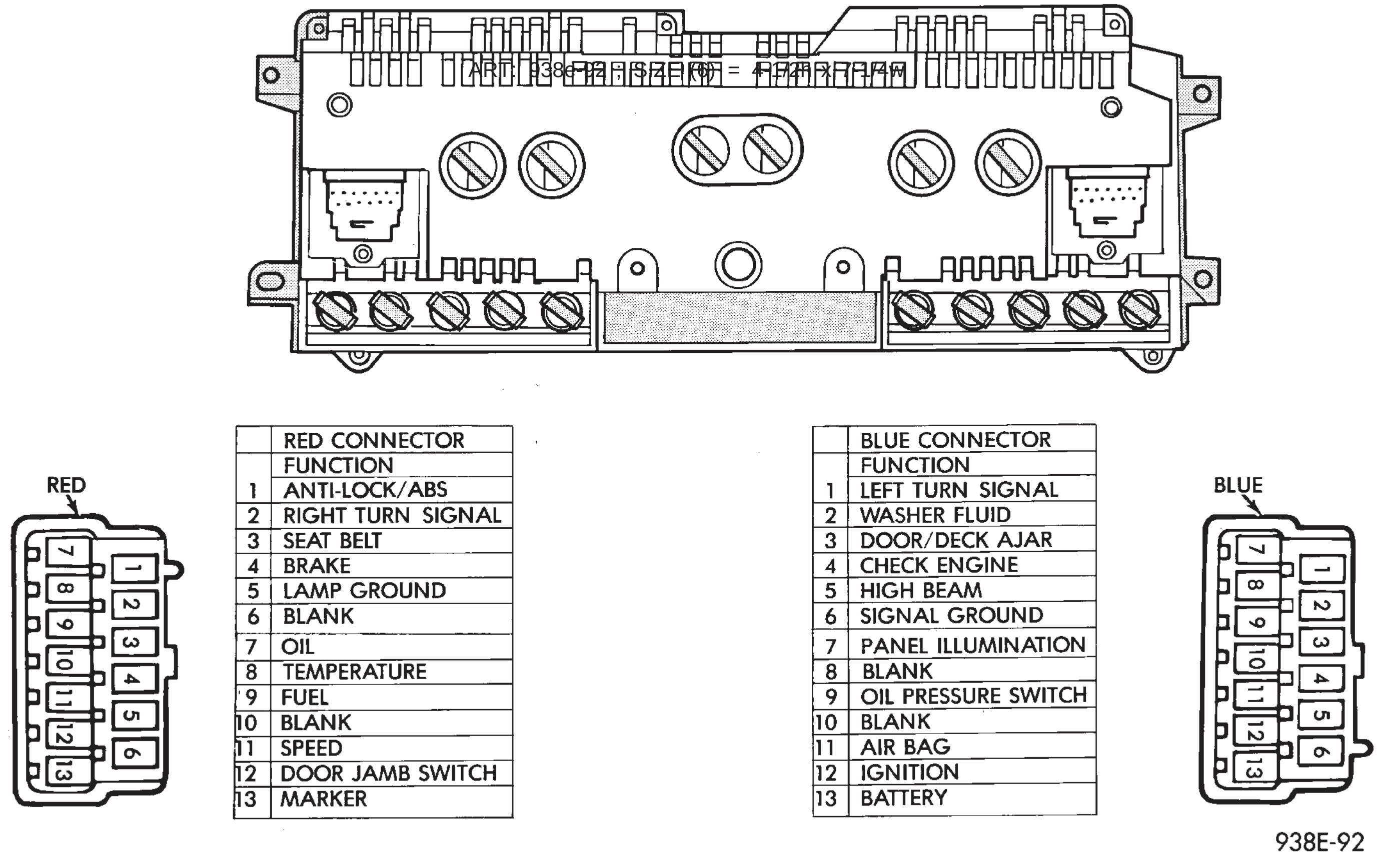
Fig. 37 Self-Diagnostic Test



*VISUAL TEST CAN BE REPEATED BY PRESSING TRIP RESET BUTTON

918E-56

Fig. 38 Self-Diagnostic Test Continued



	RED CONNECTOR FUNCTION
1	ANTI-LOCK/ABS
2	RIGHT TURN SIGNAL
3	SEAT BELT
4	BRAKE
5	LAMP GROUND
6	BLANK
7	OIL
8	TEMPERATURE
9	FUEL
10	BLANK
11	SPEED
12	DOOR JAMB SWITCH
13	MARKER

	BLUE CONNECTOR FUNCTION
1	LEFT TURN SIGNAL
2	WASHER FLUID
3	DOOR/DECK AJAR
4	CHECK ENGINE
5	HIGH BEAM
6	SIGNAL GROUND
7	PANEL ILLUMINATION
8	BLANK
9	OIL PRESSURE SWITCH
10	BLANK
11	AIR BAG
12	IGNITION
13	BATTERY

Fig. 39 Cluster Connectors

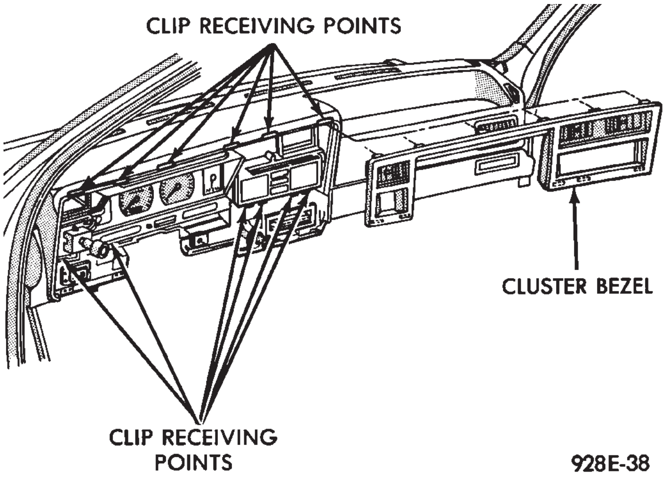


Fig. 40 Cluster Bezel

(6) For installation reverse above procedures and check operation of glove box door and adjust latch as necessary.

GLOVE BOX LAMP AND SWITCH REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #2 prior to removing switch or wires may short to ground.

(2) Open glove box door. The lamp can be removed without removing switch

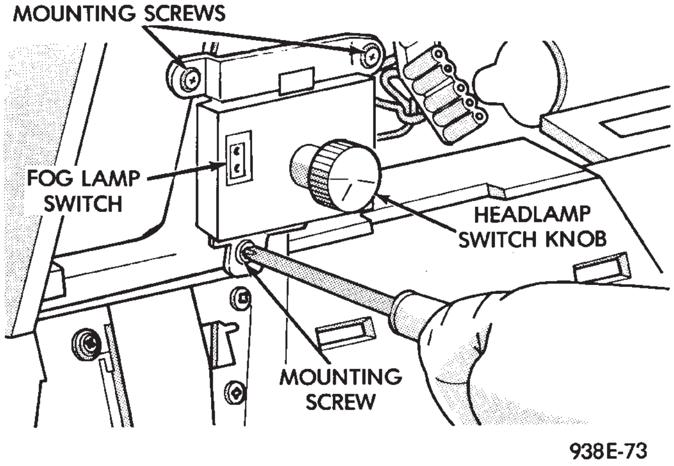


Fig. 41 Headlamp Switch Mounting Screws

(3) Remove switch by squeezing retaining tabs from behind switch mount and slide rearward. Disconnect wiring connectors.

(4) Remove lamp and switch.

(5) For installation reverse above procedures.

FOG LAMP RELAY REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #2 prior to removing switch or wires may short to ground.

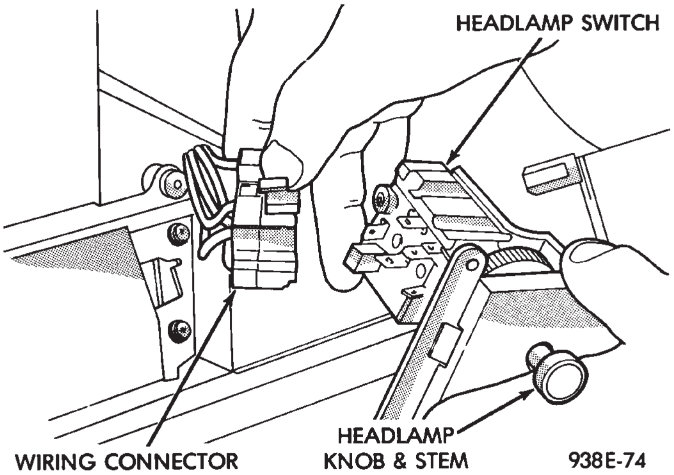


Fig. 42 Headlamp Switch Wiring Connectors

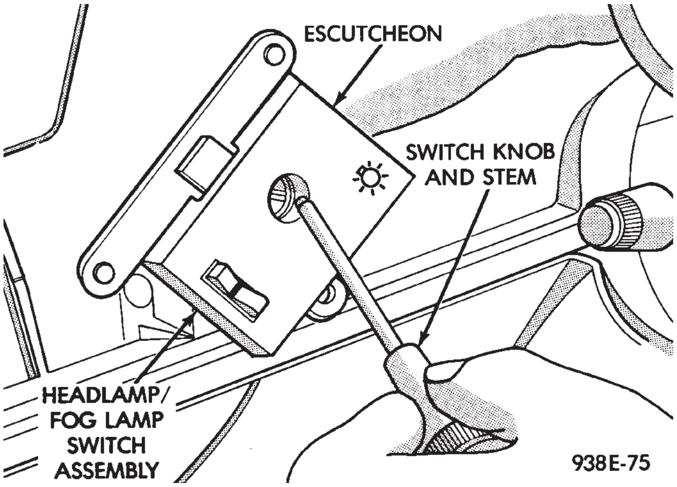


Fig. 43 Headlamp Switch Knob and Stem

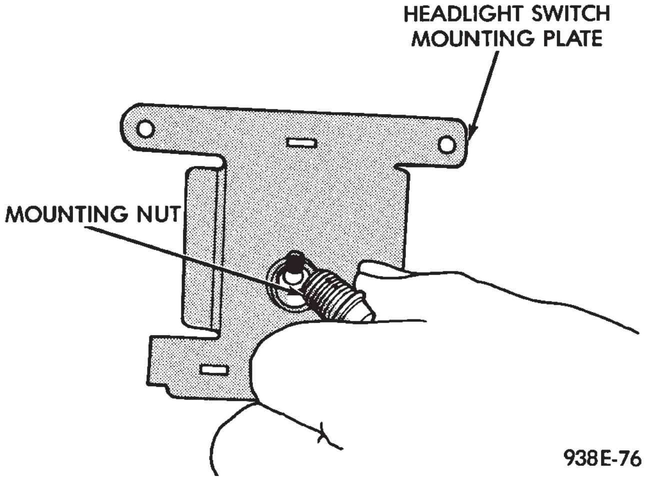


Fig. 44 Headlamp Switch Mounting Nut

(2) Remove glove box assembly (Fig. 49). Refer to Glove Box Assembly Replacement.

(3) Remove screw from relay.

(4) Disconnect wiring.

(5) Remove relay.

POSITION	CONDITION	PINS
ON	CONTINUITY	1 and 2
ON	CONTINUITY	1 and 3
OFF	NO CONTINUITY	1 and 2
OFF	NO CONTINUITY	1 and 3
OFF / ON	CONTINUITY	2 and 3

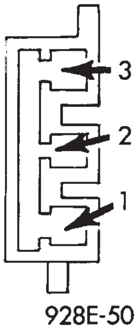


Fig. 45 Fog Lamp Switch Test

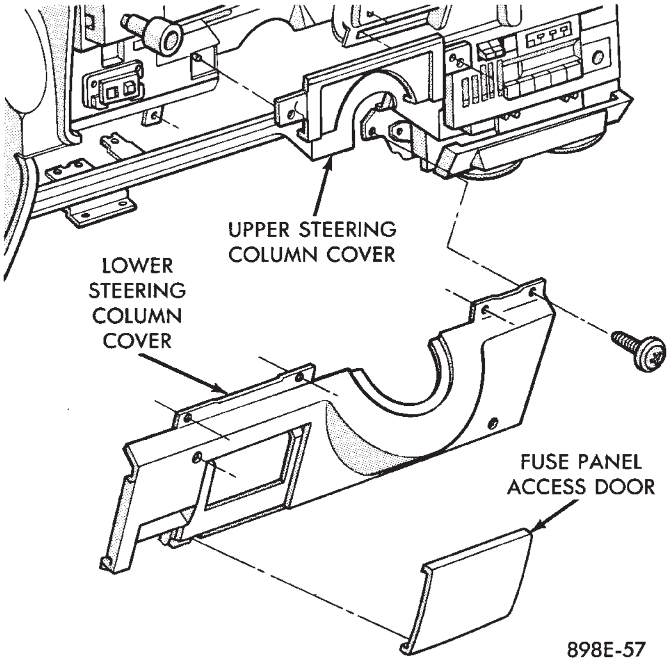


Fig. 46 Lower Steering Column Cover

(6) For installation reverse above procedures.

REAR WINDOW DEFOGGER SWITCH REPLACEMENT

(1) Remove left bezel by pulling straight back.

(2) Press tabs and pull switch rearward.

(3) Disconnect wiring and remove switch.

(4) For installation reverse above procedures.

INSTRUMENT PANEL CENTER BEZEL REPLACEMENT

(1) Pull bezel straight back disengaging five clips.

(2) Disconnect ash receiver lamp and wiring from bezel.

(3) For installation reverse above procedures.

ASH RECEIVER/CUP HOLDER REPLACEMENT

(1) Remove center bezel. Disconnect ash receiver lamp socket.

(2) Remove four screws from center module and remove module.

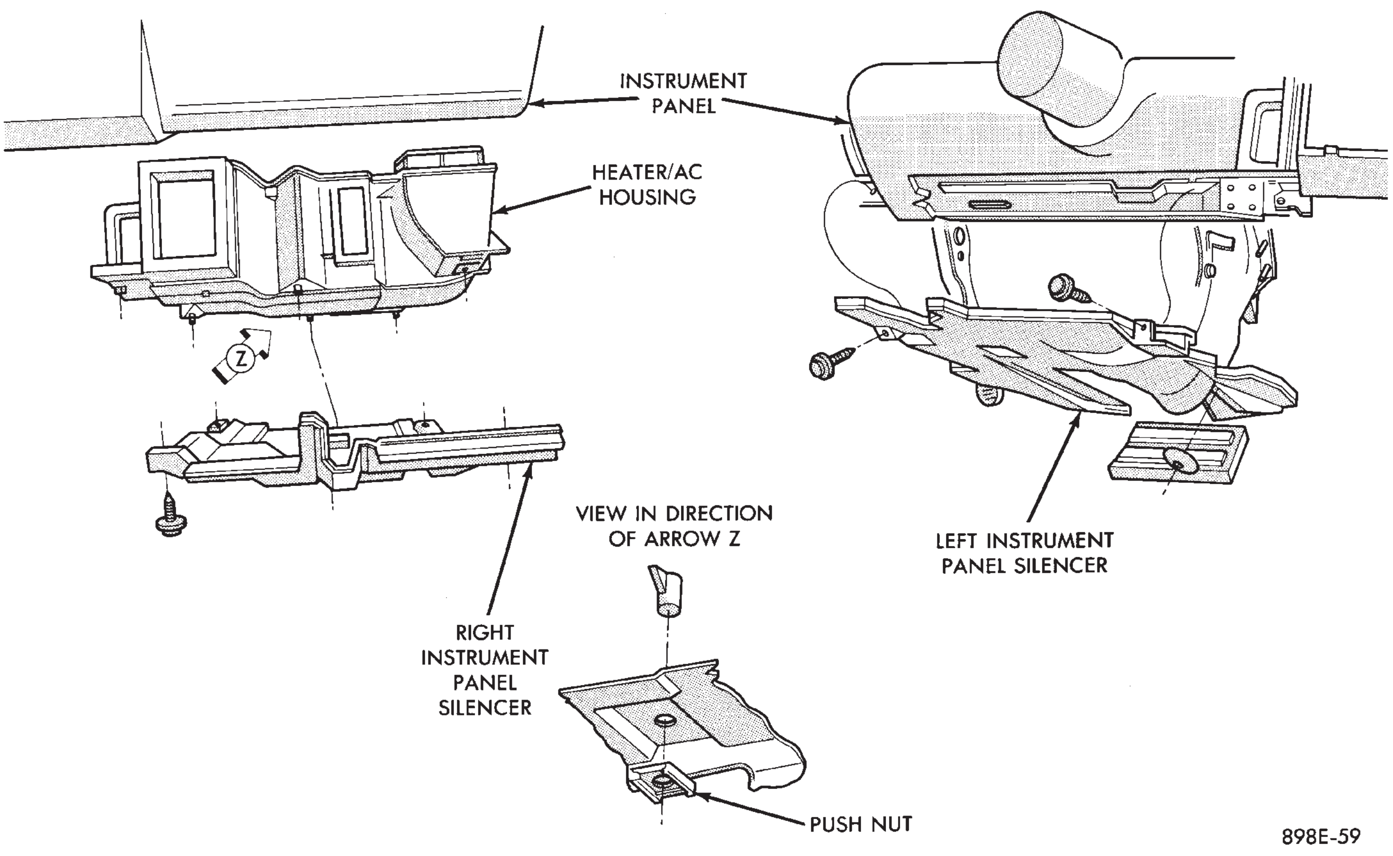


Fig. 47 Instrument Panel Silencers

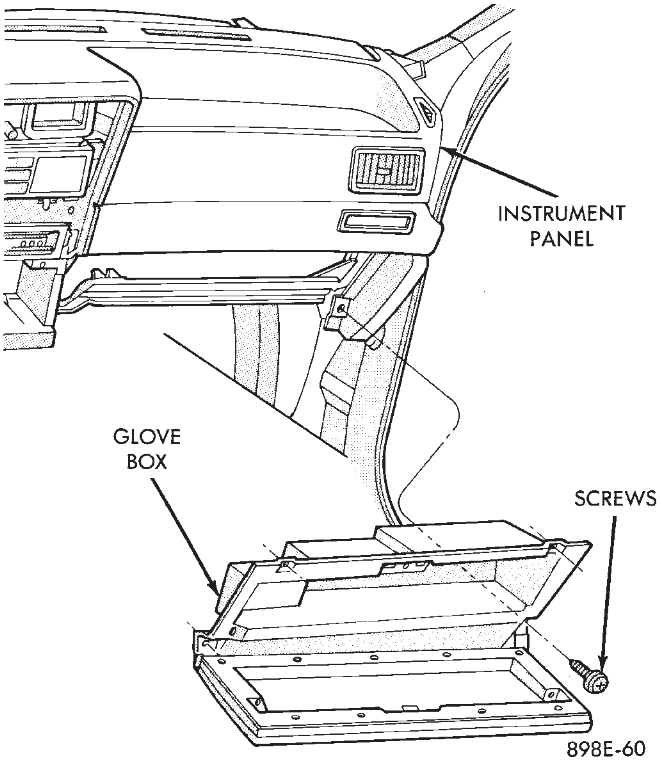


Fig. 48 Glove Box Assembly

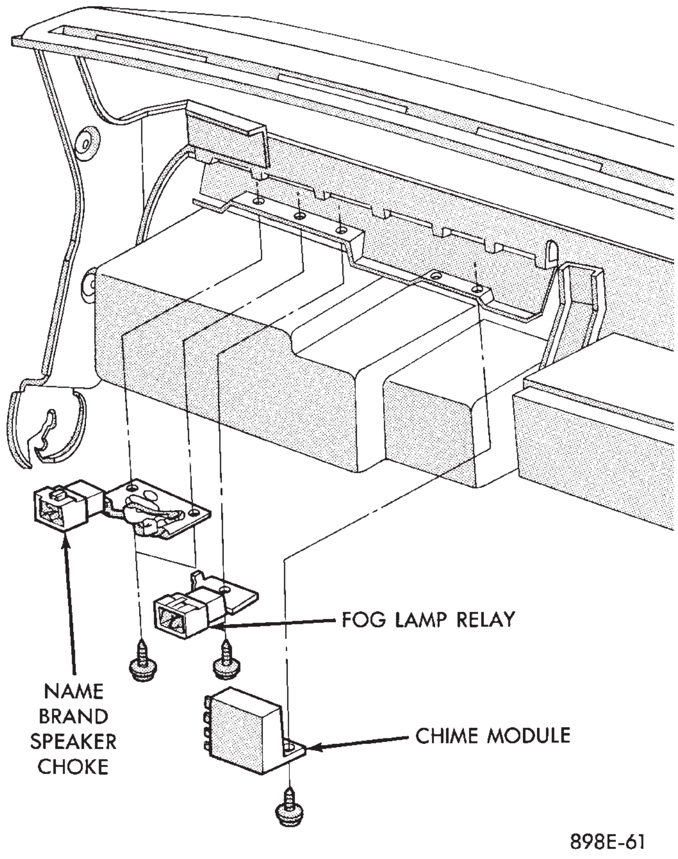


Fig. 49 Fog Lamp Relay

(3) Remove four screws from ash receiver/cup holder housing.

(4) For installation reverse above procedures.

AIR CONDITIONING CONTROL REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #2 prior to removing switch or wires may short to ground.

(2) Remove center bezel. Disconnect ash receiver lamp socket.

(3) Remove glove box assembly. Refer to Glove Box Assembly Replacement.

(4) Reach through glove box opening and disconnect vacuum lines.

(5) Remove two control mounting screws (Fig. 50).

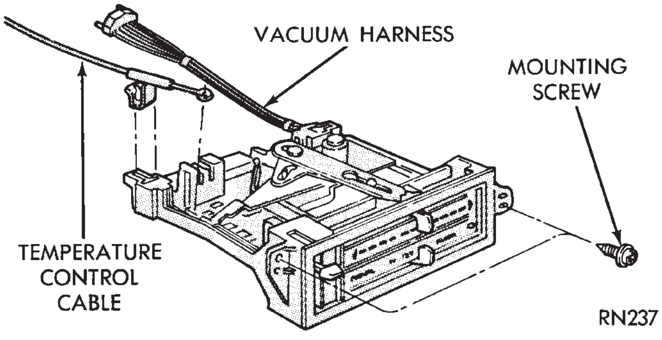


Fig. 50 A/C Control

(6) Slide control rearward, disconnect cable, and electrical wiring.

(7) Remove unit.

(8) For installation reverse above procedures.

CIGAR LIGHTER ASSEMBLY REPLACEMENT

(1) Remove center bezel. Disconnect ash receiver lamp socket.

(2) Remove two screws from bezel of the lighter assembly.

(3) Pull assembly rearward and disconnect wiring.

(4) For installation reverse above procedures.

TRAVELER/MESSAGE CENTER REPLACEMENT

(1) Remove cluster bezel.

(2) Remove four mounting screws.

(3) Pull unit rearward and disconnect wiring.

(4) For installation reverse above procedures.

INSTRUMENT PANEL

INSTRUMENT PANEL TOP COVER REPLACEMENT

(1) Lift up rearward edge of instrument panel top cover.

(2) Pull panel rearward to remove.

(3) To install: position top cover and snap into place, pull rearward for proper fit.

INSTRUMENT PANEL REPLACEMENT

CAUTION: Disconnect negative battery cable, in engine compartment, before servicing instrument panel.

(1) Disconnect battery negative cable and isolate or remove fuse #2 prior to removing switch or wires may short to ground.

(2) Remove left and right A-pillar trim.

(3) Remove left and right cowl side trim.

(4) Remove glove box assembly. Refer to Glove Box Assembly Replacement.

(5) Remove four relays above glove box assembly.

(6) Reach through glove box opening and disconnect A/C control vacuum lines, radio noise suppressor wires, and blower motor/cycling switch wires.

(7) Remove hood release handle.

(8) Remove lower steering column cover.

(9) Remove lower left instrument panel silencer and reinforcement.

(10) Remove instrument panel center bezel.

(11) Remove floor console. Refer to Group 23, Body.

(12) Remove radio, A/C control, cigar lighter, and message center/traveler.

(13) Disconnect demister hoses.

(14) Remove instrument panel top cover (Fig. 51).

(15) Disconnect battery to assure no air bag system fault codes are stored.

(16) Remove cluster refer to Cluster Assembly.

(17) Remove radio and rear window defogger bezels.

(18) Lower steering column.

(19) Loosen instrument panel pivot bolts.

(20) Remove screws which attach instrument panel to windshield fence line.

(21) Allow panel to roll down slightly and disconnect remaining electrical connections.

(22) With the aid of a helper remove panel pivot bolts and remove panel from vehicle.

(23) For installation reverse above procedures.

INTERIOR LAMP REPLACEMENT

The dome, overhead console and door lamps, if equipped operate when the doors are open or headlamp switch is placed in courtesy position. The front header reading lamp operates only when the lamp push buttons are ON.

DOME LAMP

Pry either the forward or rearward edge of the lens away from the bezel and replace lamp.

FRONT HEADER READING LAMP

Pull lamp from headliner. Disconnect wiring and replace lamp.

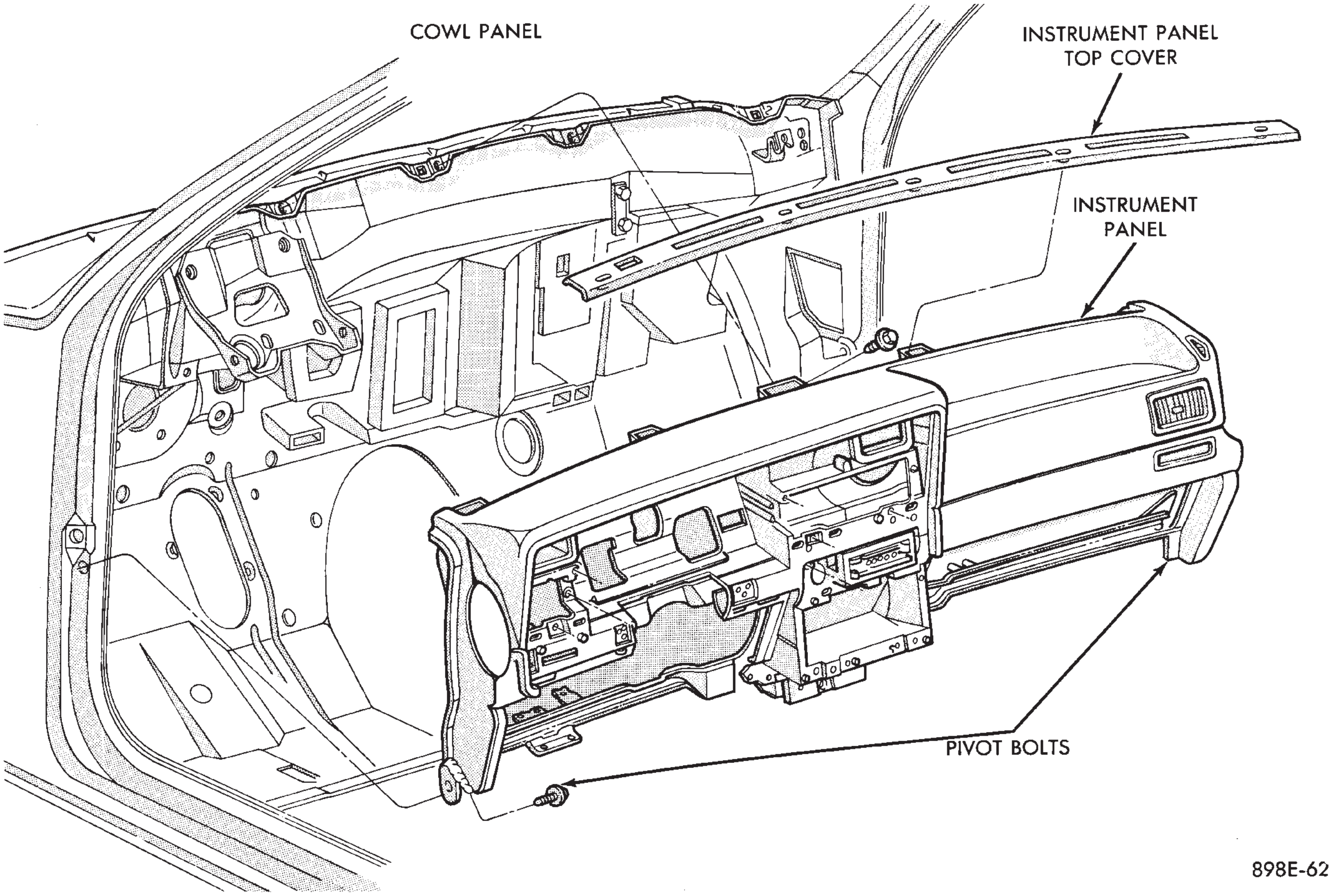


Fig. 51 Instrument Panel

DOOR LAMPS

Pry along top edge of lens and pivot lens out of lamp. Replace lamp. To remove lamp remove door trim panel and disconnect all wiring. Flex the tabs of the lamp retaining bracket and remove lamp.

DOOR KEY CYLINDER LED LAMP

(1) Remove door trim panel. Refer to Group 23, Body.

(2) Assure window is in full up position.

(3) Disconnect LED lamp wiring pig tail and note wire routing for installation. Use care when removing lamp so not to disengage lamp retaining clip from key cylinder (Fig. 52).

(4) For installation reverse above procedures.

TRUNK LAMP

The lamp is easily accessible without removing any components.

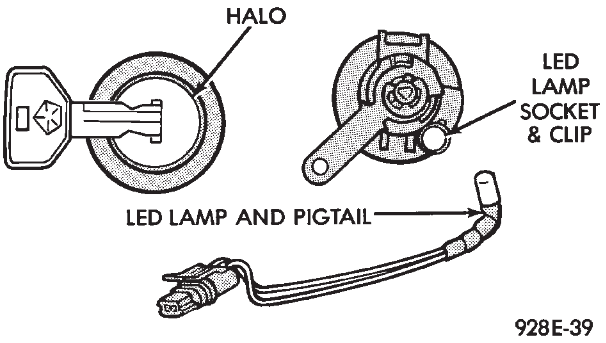


Fig. 52 Door Key Cylinder LED Lamp

AC AND AY BODIES

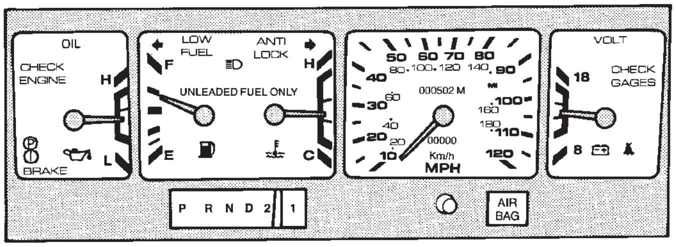
INDEX

GENERAL INFORMATION

MECHANICAL CLUSTER

The mechanical cluster includes a fuel, oil pressure, coolant temperature, and voltmeter gauges. All incorporate magnetic type gauges. When the ignition switch is in the OFF position, the gauges will show a reading; however, the readings are only accurate when the ignition switch is in the ON position.

The mechanical cluster also includes an electric speedometer, driven by pulses from the vehicle speed sensor (Fig. 1).



918E-50

Fig. 1 Mechanical Cluster

ELECTRONIC CLUSTER

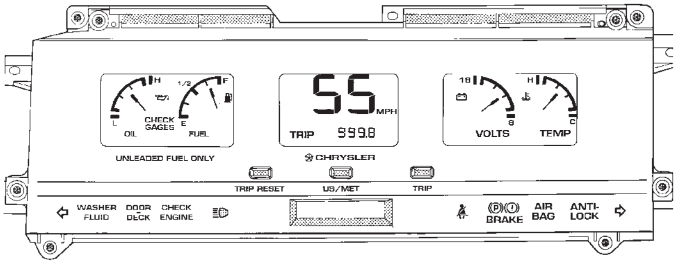
The electronic cluster is easily distinguished from the mechanical cluster by its digital and linear display. The electronic cluster includes:

- Oil pressure gauge
- Coolant temperature gauge
- Voltmeter
- Fuel gauge

The electronic cluster receives virtually all of its information to display from the body controller and powertrain control module via the Chrysler Collision Detection (CCD) Serial Data Bus. The odometer memory is no longer retained in the cluster. This is now retained in the body controller (Fig. 2).

ELECTRONIC CLUSTER DIMMING

The electronic cluster display is dimmed from daytime to night time intensity when the headlamp switch is turned on. This intensity can be controlled using the headlamp switch rheostat.



928E-14

Fig. 2 Electronic Cluster

An additional detent on the headlamp switch rheostat will allow daytime intensity while driving with headlamps on during the daytime.

WARNING LAMPS

The mechanical instrument cluster will have warning lamps for six systems. These include brake system, air bag, seat belt, low fuel, anti-lock for optional anti-lock brake system, and malfunction indicator (check engine) lamp. The cluster also includes check gages indicator which will illuminate in a warning situation. This will notify driver to check for a problem in coolant temperature, oil pressure, or electrical systems.

The electronic cluster will have warning indicator lamps for eight different systems. These include:

- Air Bag
- Low washer fluid
- Door/deck lid ajar
- Malfunction Indicator (Check engine) Lamp
- Brake system
- Seat belt
- Anti-lock (ABS) for optional anti-lock brake system
- Check gages, monitors engine coolant, oil pressure and electrical charging system failures.

In addition, ISO symbol will flash to notify the driver in event of:

- Low fuel
- High temperature
- Low oil pressure
- Charging system failure

MESSAGE CENTER

The message center is a car graphic warning lamp module. This conventional warning system and located above the headlamp switch.

ELECTRONIC DIGITAL CLOCK

The electronic digital clock is in the radio. The clock and radio each use the display panel built into the radio. A digital readout indicates the time in hours and minutes whenever the ignition switch is in the ON or ACC position.

When the ignition switch is in the OFF position, or when the radio frequency is being displayed, time keeping is accurately maintained.

The procedure for setting the clock varies slightly with each radio. The correct procedure is described under the individual radio operating instructions referred to in the Owner's Manual supplied with the vehicle.

AIR BAG WARNING SYSTEM

For testing of this system refer to Group 8M, Restraint Systems.

MECHANICAL CLUSTER AND GAUGE SERVICE

CAUTION: Disconnect negative battery cable, in engine compartment, before servicing instrument panel. When power is required for test purposes, reconnect battery cable for the test only.

Disconnect negative battery cable after test and before continuing service procedures.

SENDING UNIT TEST

When a problem occurs with a cluster gauge, before disassembling the cluster to check the gauge, check for a defective sending unit or wiring.

(1) Sending units and wiring can be checked by grounding the connector leads, at the sending unit, in the vehicle.

(2) With the ignition in the ON position; a grounded input will cause the oil, fuel or temperature gauge to read at or above maximum.

CHECK GAUGES WARNING LAMP TESTS

The check gauges warning lamp is illuminated by the low oil pressure sending unit switch or the body controller when there is high temperature or charging system failure.

To test the lamp, turn ignition key to the ON position without starting the vehicle. The low oil pressure switch is grounded and the light will be on indefinitely.

If the lamp fails to light, pull the cluster and check the following:

(a) Continuity between ground and check gauge pin J (Fig. 3).

(b) Proper contact between the gauge pins and wiring harness and printed circuit board pins.

(c) If there is ground and proper pin contact, replace lamp.

(d) If there is no continuity, check the low oil pressure sending unit switch (Fig. 4 and 5).

To test the switch disconnect the switch electrical connector. Attach positive lead of an ohmmeter to the switch terminal for the gray (GY) wire and the negative lead to an engine ground. With the engine

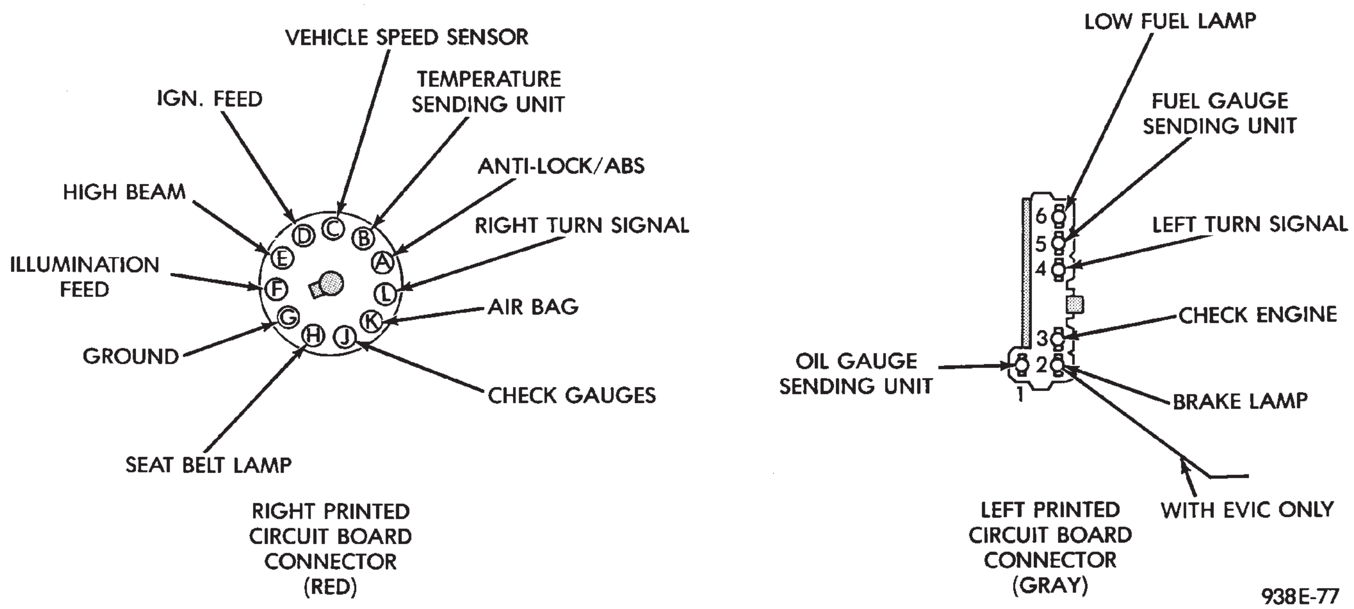


Fig. 3 Mechanical Cluster Connectors

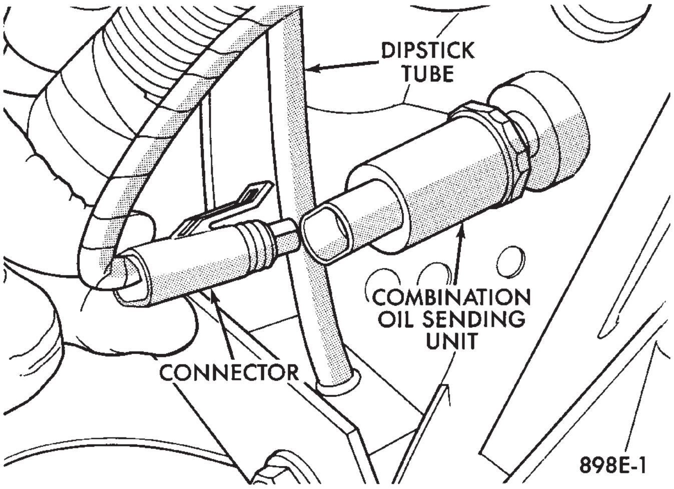


Fig. 4 Combination Oil Sending Unit

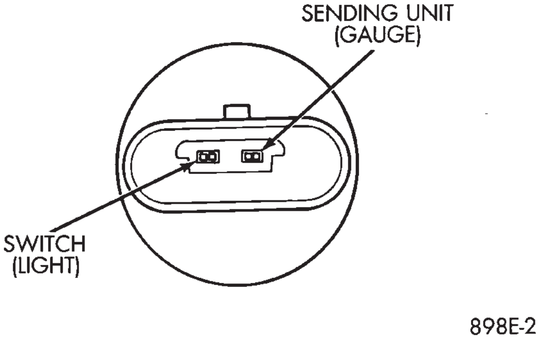


Fig. 5 Combination Oil Sending Unit Test

off, there should be continuity in the system. Start the engine. With the engine running, the ohmmeter should show no continuity. If the above results are not obtained, replace the switch.

BRAKE SYSTEM WARNING LAMP

The brake warning lamp illuminates when parking brake is applied with ignition key turned ON. The same lamp will also illuminate should one of the two service brake systems fail when brake pedal is applied. To test system turn ignition key ON, and apply parking brake. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch. The lamp also lights when the ignition switch is turned to START.

To test service brake warning system, raise vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses brake pedal and observes warning light. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch.

If lamp is not burned out and wire continuity is proven, replace brake warning switch in brake line Tee fitting mounted on frame rail in engine compartment below master cylinder (Fig.6 and 7).

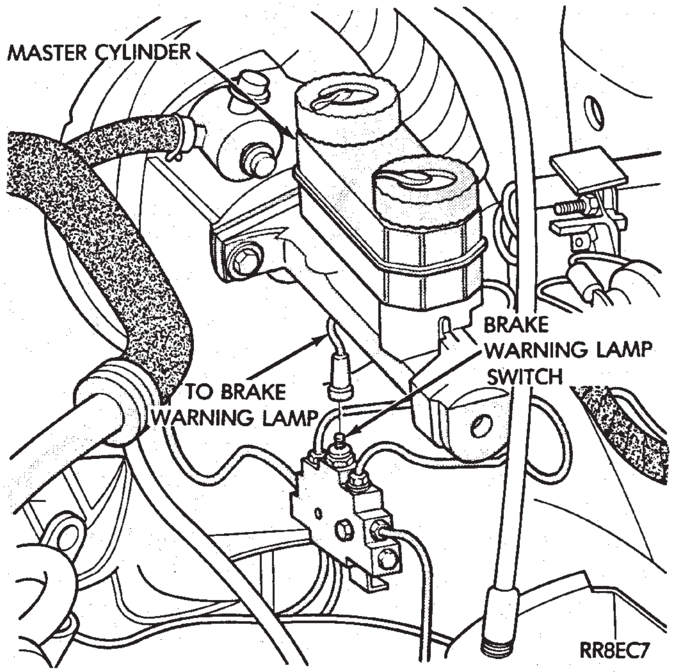


Fig. 6 Brake Warning Lamp Switch

CAUTION: If wheel cylinder bleeder was opened check master cylinder fluid level.

SEAT BELT WARNING LAMP

For testing of this system, refer to Group 8M, Restraint System.

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP

For testing of this system, refer to the Powertrain Diagnostic Test Procedure Manual.

MECHANICAL/ELECTRONIC CLUSTER REMOVAL

CLUSTER BEZELS REMOVAL

(1) Move gear selector to the low position.

(2) Remove five screws attaching upper bezel to instrument panel (Fig. 8).

(3) Lift cluster bezel over steering wheel.

(4) Remove four screws attaching lower bezel to instrument panel.

(5) Lift lower cluster bezel from instrument panel.

(6) For installation reverse above procedures.

CLUSTER MASK AND LENS REMOVAL

(1) Remove cluster bezel.

(2) Remove trip reset knob by pulling straight back.

(3) Remove five screws attaching mask and lens to cluster.

(4) For installation reverse above procedures.

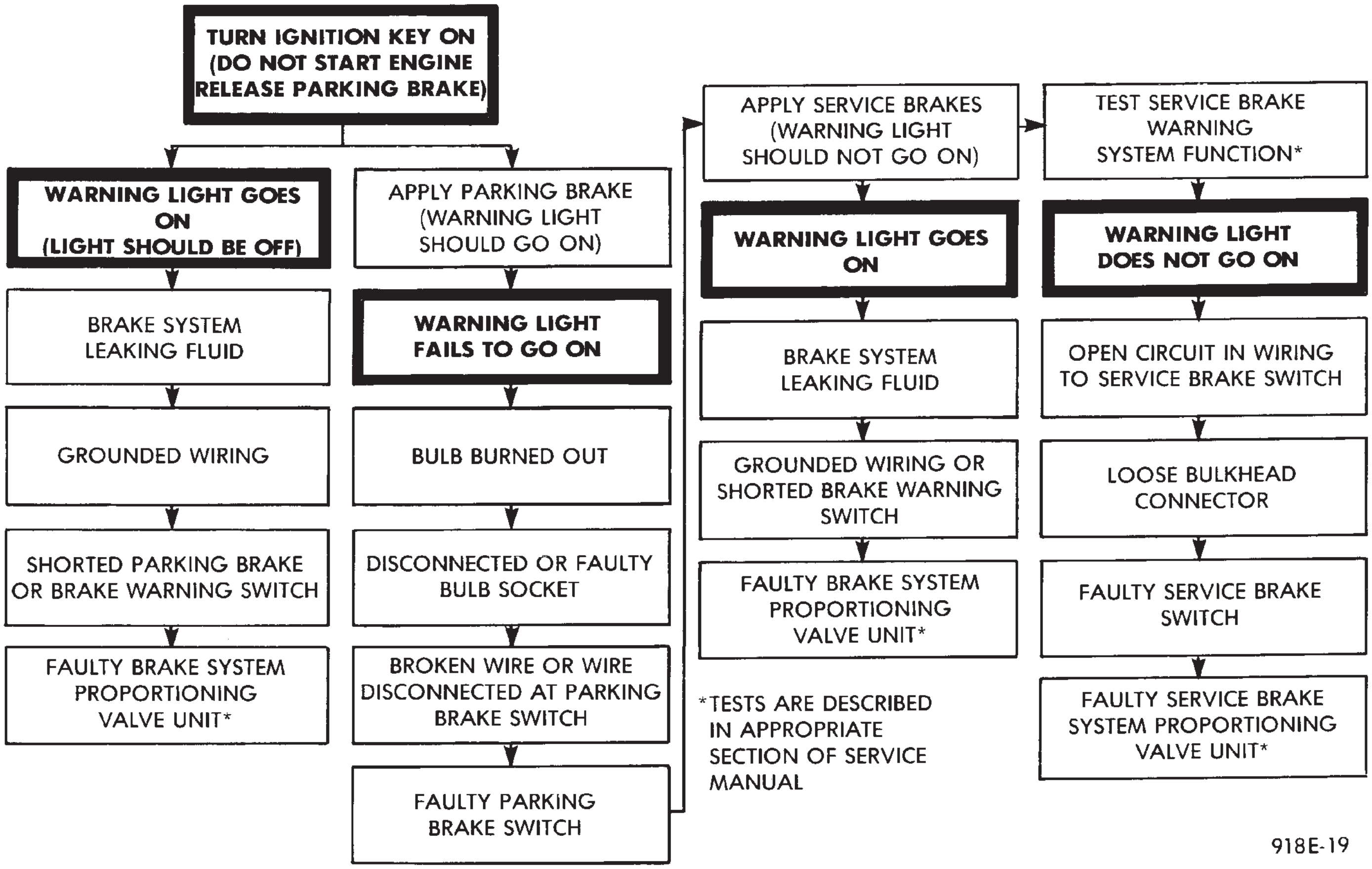


Fig. 7 Brake System Warning Lamp Diagnosis

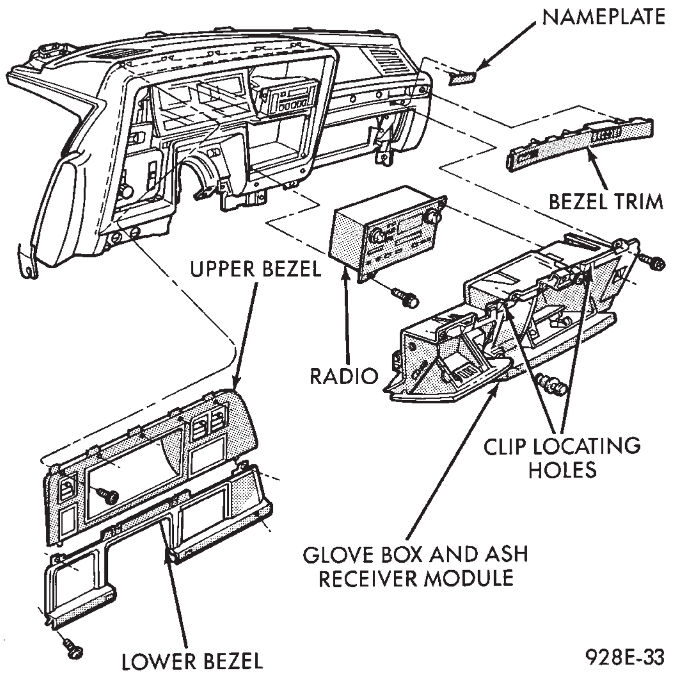


Fig. 8 Cluster Bezel

CLUSTER ASSEMBLY

REMOVAL—CLUSTER WITH TRANSMISSION RANGE INDICATOR FROM STEERING COLUMN

(1) Disconnect battery to assure no air bag system fault codes are stored.

(2) Remove cluster bezel (Fig. 9).

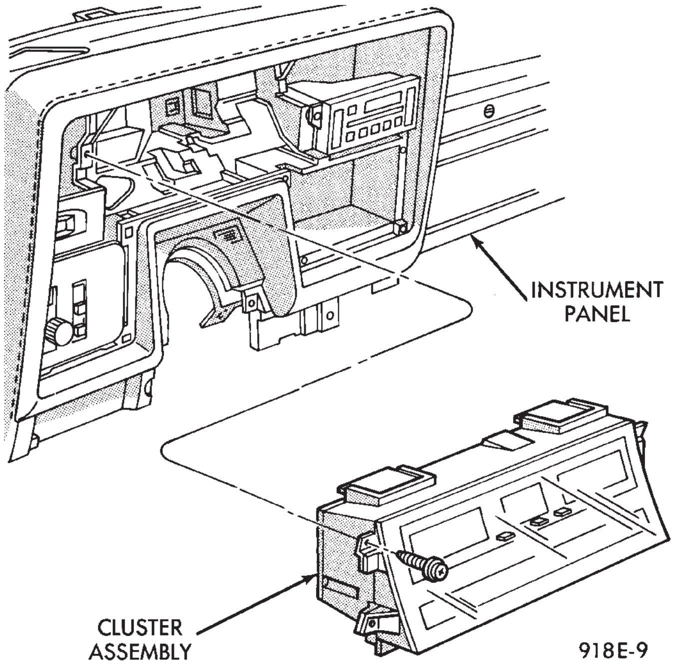


Fig. 9 Instrument panel Bezels

(3) Remove lower steering column cover (Fig. 10 through 14).

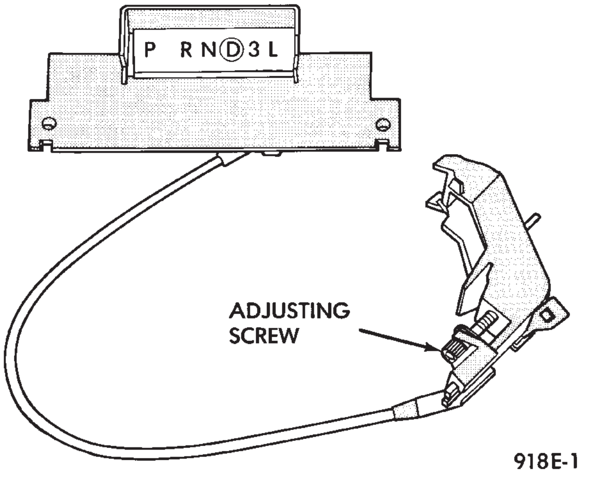


Fig. 10 Transmission Range Indicator

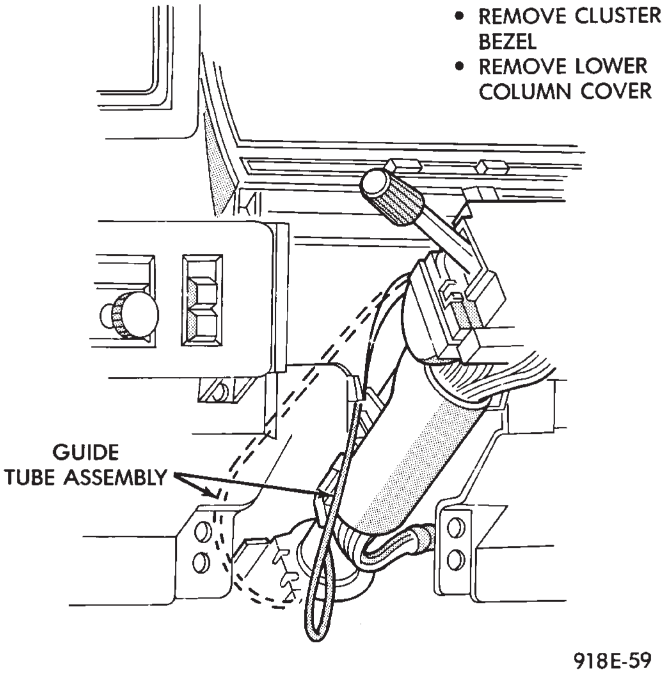


Fig. 11 Transmission Range Indicator Step 1

(4) Place gear shift lever in neutral or park.

(5) Remove guide tube from behind fuse block and disconnect cable eyelet from column actuating arm.

(6) Release lock bar on column insert, squeeze legs together and remove from column (Fig. 13).

(7) Secure insert and cable guide out of the way.

(8) Remove the rear window defogger bezel and radio bezel.

(9) Remove the upper steering column cover.

(10) Remove the four screws attaching cluster housing to the base panel (Fig. 15).

(11) Pull cluster rearward, reach behind cluster and disconnect the two wiring harnesses.

(12) Remove cluster assembly.

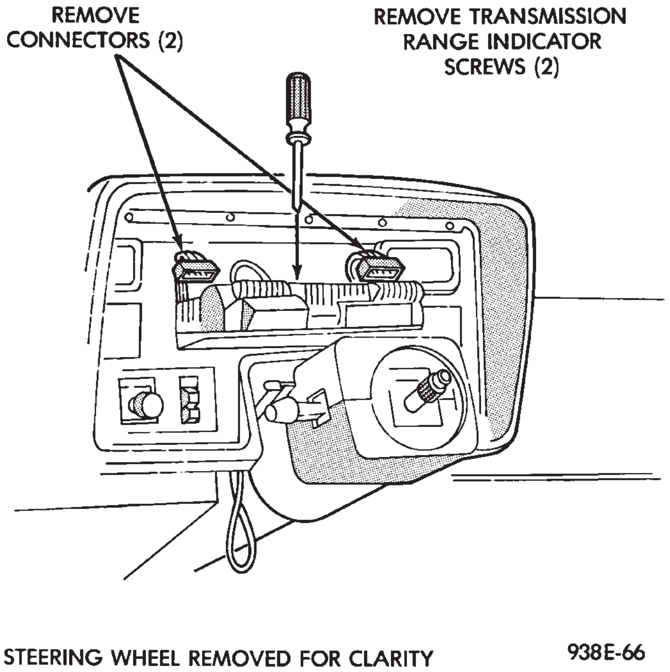


Fig. 12 Transmission Range Indicator Step 2

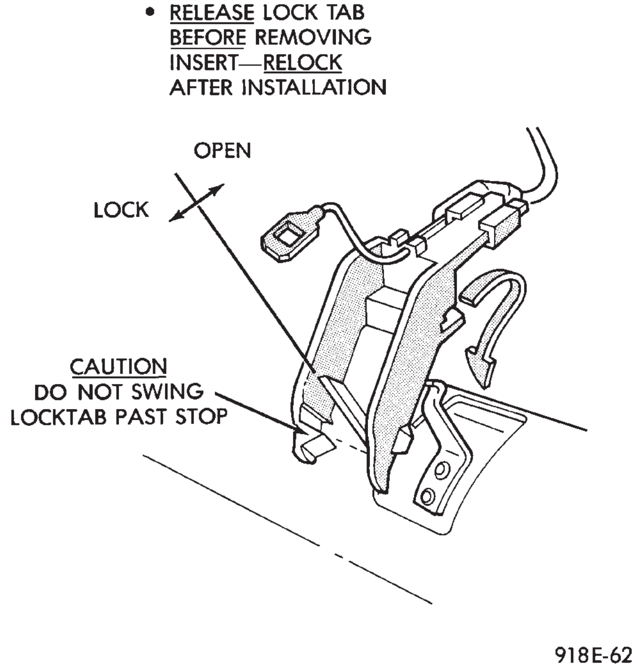


Fig. 13 Transmission Range Indicator Step 3

INSTALLATION

(1) Connect wiring harnesses.

(2) Install cluster assembly while routing transmission range indicator guide tube through access hole in base panel (Fig. 10 through 14). Release guide tube from behind fuse block.

(3) Insert flange of column insert into column, squeeze legs together with tabs under column jacket and engage lock bar to secure insert (Fig. 13).

(4) Hook cable eyelet to steering column actuator check pointer, should indicate neutral. Do not kink

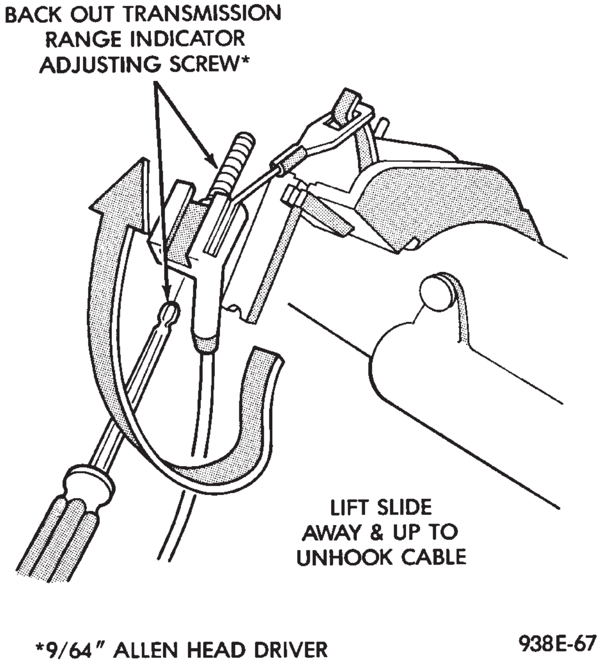


Fig. 14 Transmission Range Indicator Step 4

or bind the transmission range indicator guide tube and position guide tube in original location.

(5) Adjust with tool if necessary to center pointer on N (Neutral) and check in other gears (Fig. 14).

(6) Install upper and lower steering column cover.

(7) Install the rear window defogger bezel and radio bezel.

(8) Install cluster bezel.

(9) Reconnect battery.

REMOVAL—CLUSTER WITHOUT TRANSMISSION RANGE INDICATOR FROM STEERING COLUMN

(1) Remove cluster bezel (Fig. 10).

(2) Remove four screws attaching cluster to base panel.

(3) Pull cluster rearward carefully, reach behind and disconnect the two harness connectors.

(4) Carefully rotate cluster and remove the two transmission range indicator screws.

(5) Remove cluster assembly.

(6) For installation reverse above procedures.

(a) Do not kink guide tube when installing cluster.

(b) Replace guide tube behind fuse block.

GAUGES

It is not necessary to remove instrument cluster from vehicle for gauge replacement. When removing gauge assemblies from cluster, gauge must be pulled straight out, not twisted, or damage to gauge pins may result.

MULTIPLE GAUGE MALFUNCTION

If all the instrument cluster gauges appear to be malfunctioning, remove the cluster assembly.

- Check for good pin contact
- Check for ignition voltage between the IGN cavity D and ground.
- If there is ignition voltage
- Check for continuity between the wire harness ground cavity G and ground.
- If there is continuity, replace the print circuit board (Fig. 16).

GAUGE INOPERATIVE (FIG. 17 THROUGH 20)

(1) Remove gauge in question.

(2) With the ignition key ON, check for ignition voltage at ignition pin of gauge. Check for ground at ground pin of gauge. Refer to the individual gauge circuit test for proper pin.

(a) If no voltage or ground at gauge pins. Check cavity D red cluster connector for ignition voltage or cavity G for ground.

(b) If no voltage or ground, repair as necessary. Refer to 8W, Wiring Diagrams.

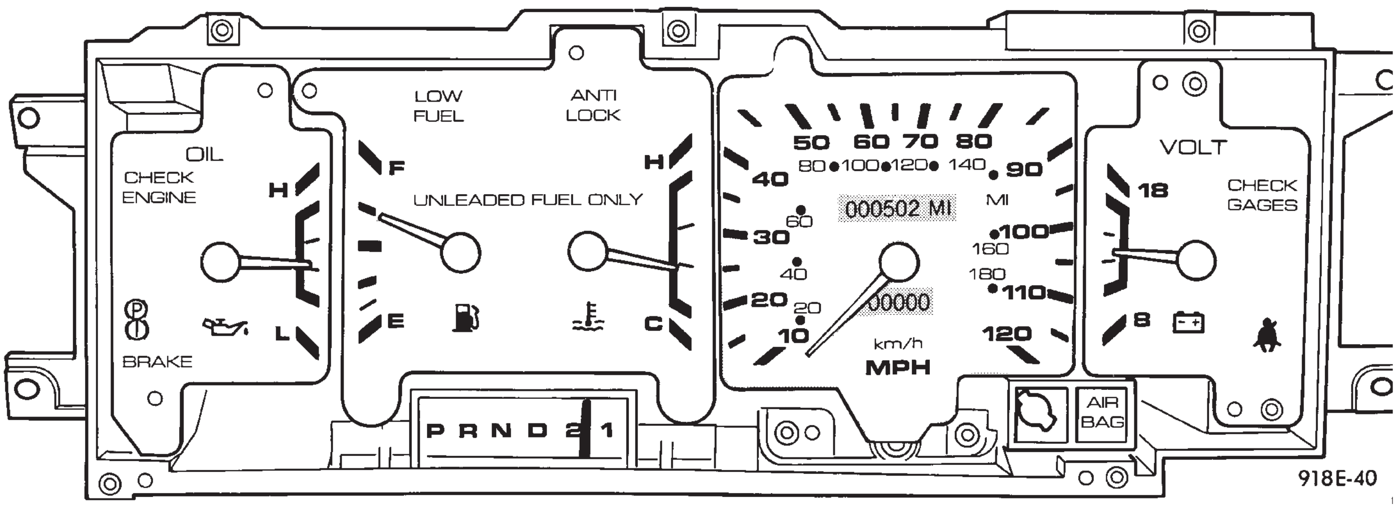


Fig. 15 Cluster With Mask and Lens Removed

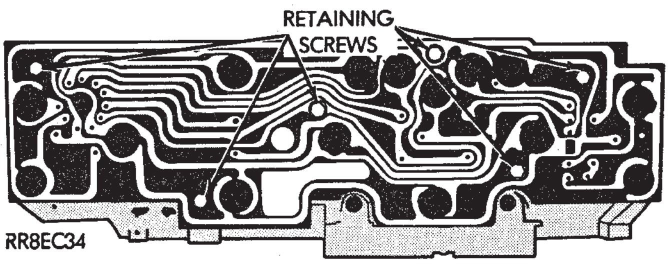


Fig. 16 Printed Circuit Board

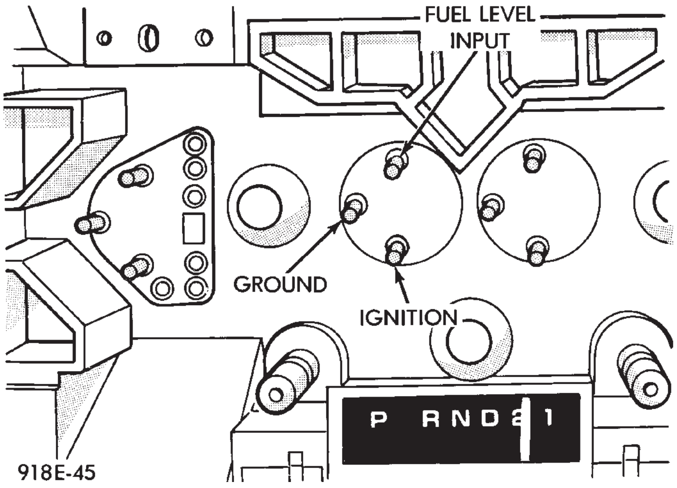


Fig. 17 Fuel Gauge Pins

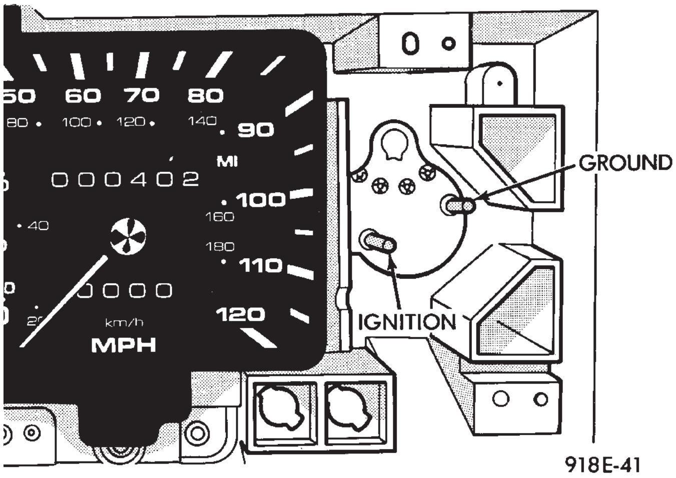


Fig. 18 Voltmeter Pins

(c) If there is voltage or ground, check cluster for distorted terminals. If terminals are OK, replace printed circuit board.

(3) When testing temperature and oil pressure gauges allow the engine to run until the vehicle reaches a normal operating temperature. Turn ignition OFF, and remove gauge from cluster.

(a) Testing oil pressure gauge, engine needs to be running.

(b) Measure and record the resistance between sending unit pin and ground pin of the gauge in question. Refer to Gauge Calibration.

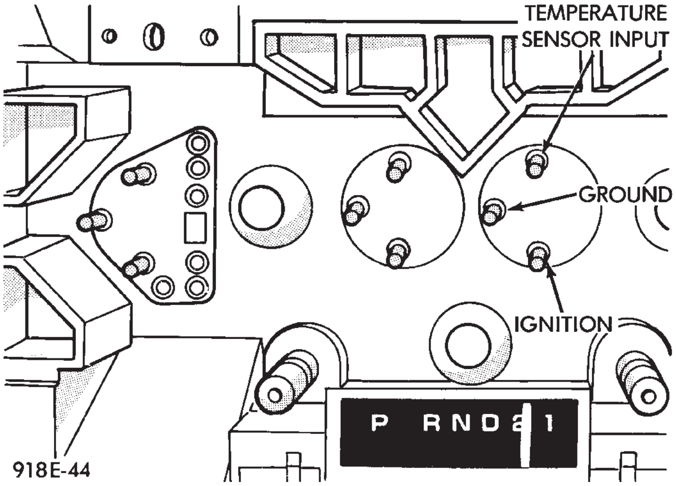


Fig. 19 Temperature Gauge Pins

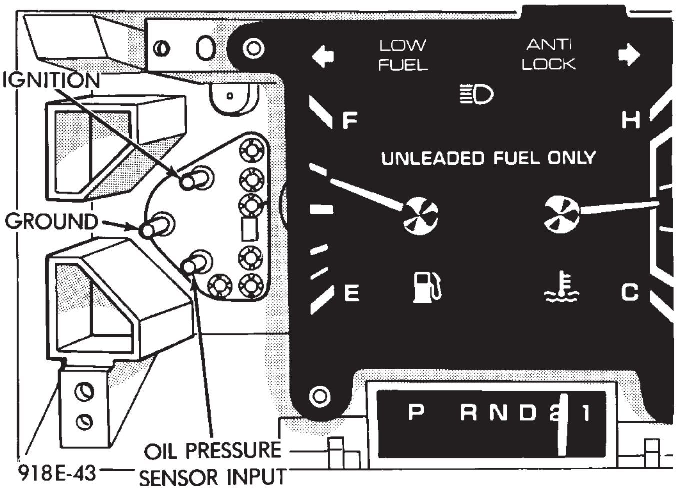


Fig. 20 Oil Pressure Gauge Pins

(c) When checking temperature and oil pressure gauges, it is important to have the same engine temperature and speed when noting gauge position. The time between gauge reading and measuring should be kept to a minimum.

(d) If resistance and gauge position are not similar, replace gauge.

(e) If OK, test resistance from the sending unit to the cluster connector.

(f) If resistance reading is different, check printed circuit board for contact to cluster.

(g) If OK and contacts are not distorted, replace printed circuit board.

(h) If everything checks out OK, refer to Sending Unit Test.

(4) If fuel gauge meets specifications check fuel tank and original fuel tank sending unit as follow:

(a) Carefully remove fuel tank sending unit from tank.

(b) Refer to sending unit removal Group 14, Fuel.

(c) Connect sending unit wire and jumper wire as described in the test procedure.

(5) If fuel gauge now checks within specifications, original sending unit is electrically okay, check following as a possible cause:

(a) Ground wire from sending unit to left side cowl for continuity.

(b) Sending unit deformed. Make sure sending unit float arm moves freely and pick up tube is not bent upwards creating an interference with bottom of tank and inspect float.

(c) Sending unit improperly installed. Install properly.

(d) Mounting flange on fuel tank for sending unit deformed. Feel for interference fit of sending unit to bottom of tank. It is permissible to bend pick up tube down a little near mounting flange to gain interference fit.

(e) Fuel tank bottom deformed, causing improper positioning of sending unit pick up tube. Replace or repair tank and recheck sending unit.

GAUGE CALIBRATION

(1) Remove the gauge.

(2) Check for ignition voltage and ground to the gauge.

(3) With the ignition key in the OFF position, replace gauge. Turn the ignition key to the ON position. To test oil pressure gauge engine must be running. When testing oil or temperature gauge the engine should be at normal operating temperature. Record the gauge position.

(4) Remove gauge and record the resistance between the sending unit pin and the gauge ground pin. When checking gauges, it is important to have the same engine temperature and speed when noting gauge position. The time between gauge reading and measuring should be kept to a minimum.

(5) The resistance Chart (Fig. 21), is general guidelines for checking the gauge position against the sending unit resistance.

Because of only a few specific points of gauge position versus sending unit resistance, a good estimate is need when the resistance falls between graduations. Even when the resistance corresponds to graduations, the gauge has a tolerance of ± 4 ohms.

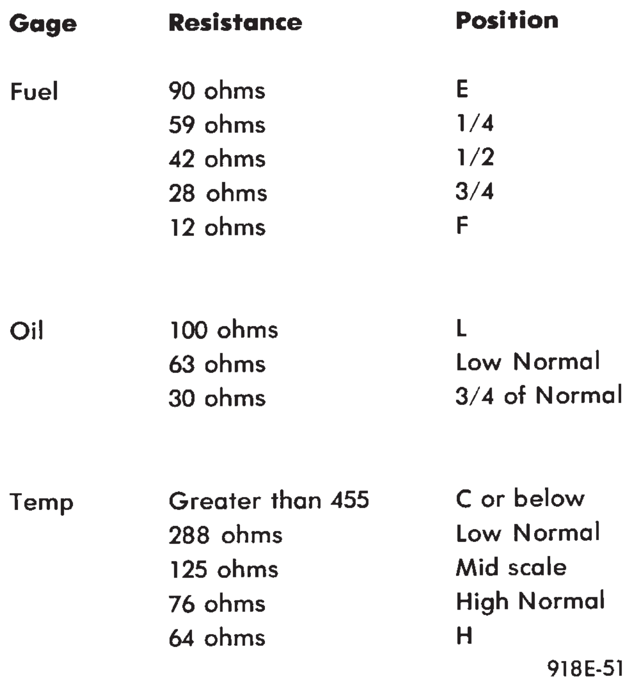
Volt gauge: The calibration dot on the volt gauge corresponds to 13 volts between the gauge ignition and ground pins. If voltage varies from this, estimate proper gauge position with input voltage.

VOLTMETER REPLACEMENT

(1) Remove cluster bezels and mask (Fig. 22).

(2) Remove screws attaching gauge assembly to cluster.

(3) Pull rearward to disengage gauge from gauge pins.



Gage	Resistance	Position
Fuel	90 ohms	E
	59 ohms	1/4
	42 ohms	1/2
	28 ohms	3/4
	12 ohms	F
Oil	100 ohms	L
	63 ohms	Low Normal
	30 ohms	3/4 of Normal
Temp	Greater than 455	C or below
	288 ohms	Low Normal
	125 ohms	Mid scale
	76 ohms	High Normal
	64 ohms	H

918E-51

Fig. 21 Gauge Resistance

(4) For installation reverse above procedures.

OIL PRESSURE GAUGE REPLACEMENT

(1) Remove cluster bezels and mask/lens (Fig. 22).

(2) Remove screws attaching gauge assembly to cluster.

(3) Pull rearward to disengaged gauge from gauge pins.

(4) For installation reverse above procedures.

FUEL AND TEMPERATURE GAUGE ASSEMBLY REPLACEMENT

(1) Remove cluster bezel and mask/lens (Fig. 22).

(2) Remove oil pressure gauge.

(3) Remove screws attaching gauge assembly to cluster.

(4) Pull rearward to disengage gauge from gauge pins.

(5) For installation reverse above procedures.

SPEEDOMETER SYSTEM

AC body vehicles are equipped with electronically driven speedometer and odometer assemblies. The unit has the same appearance as a conventional speedometer but it eliminates the cable-driven mechanical system. A signal is sent from a transmission-mounted vehicle speed sensor to the speedometer circuitry through the wiring harness. By eliminating the speedometer cable, instrument cluster service and removal is improved. Refer to Fig. 23 Speedometer Diagnosis Chart.

When the speedometer is out of calibration. The electronic automatic transaxle vehicle speed sensor output must be calibrated to reflect the different combinations of equipment. The procedure is called Pinion Factor, refer to Group 21, Transaxle for the procedure.

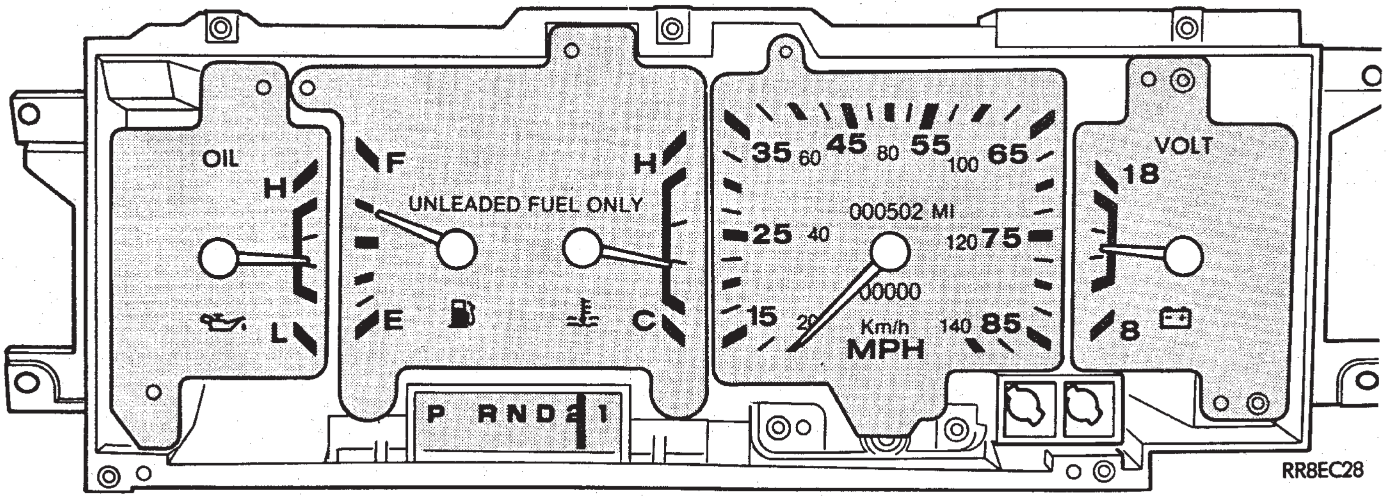


Fig. 22 Cluster with Mask and Lens Removed

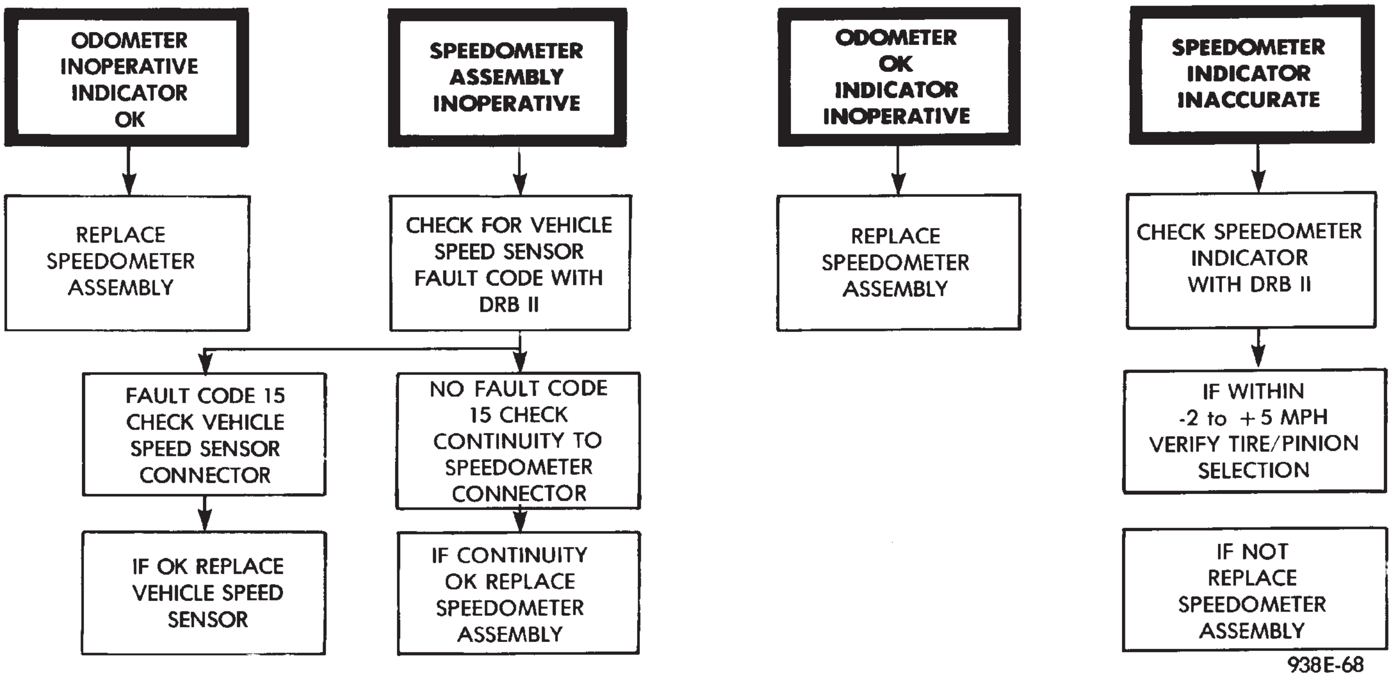


Fig. 23 Speedometer Diagnosis

SPEEDOMETER ODOMETER ASSEMBLY REPLACEMENT

(1) Remove cluster bezel and mask/lens.

(2) Remove volt gauge.

(3) Remove screws attaching gauge assembly to cluster.

(4) Pull speedometer rearward to disengage from gauge pins.

(5) For installation: Position speedometer on gauge pins and push firmly until seated and reverse above procedures.

SPEEDOMETER CIRCUIT TESTING

(1) Using the DRB II, check vehicle speed sensor for fault code and for proper speed indication. Refer to Powertrain Diagnostics Procedure Manual, Speed Control System Test.

(2) Remove speedometer from cluster.

(3) With ignition on check for battery voltage across ignition and ground pins (Fig. 24).

(4) Check for continuity from vehicle speed sensor signal pin to connector at speed sensor.

VEHICLE SPEED SENSOR REPLACEMENT

(1) Remove harness connector from sensor and make sure the weather seal is on harness connector (Figs. 25 and 26).

(2) Remove sensor retaining bolt.

(3) Pull sensor and pinion gear assembly out of transaxle. If necessary, carefully pry loose with a flat blade screwdriver.

(4) Remove pinion gear from sensor.

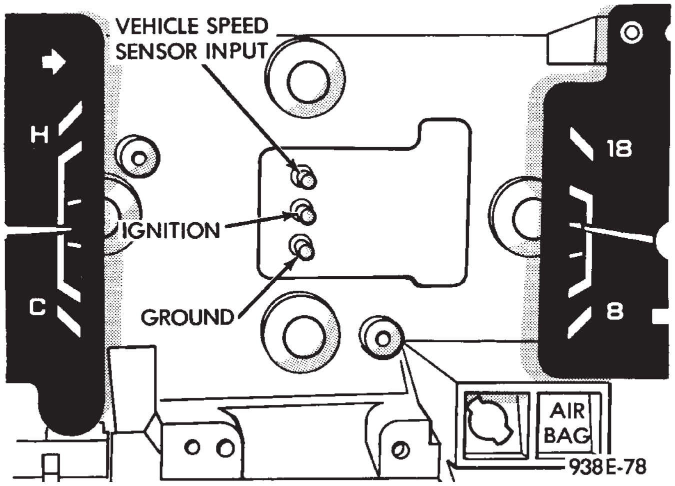


Fig. 24 Speedometer Pins

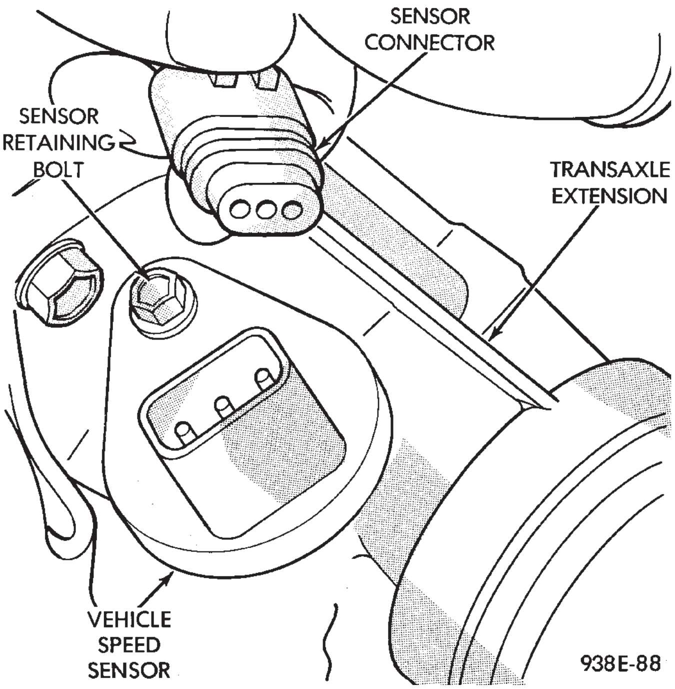


Fig. 25 Vehicle Speed Sensor and Connector

(5) For installation reverse above procedures. Seat sensor assembly by hand to insure proper gear engagement. Tighten retaining bolt to 7 N•m (60 in. lbs.) torque.

ELECTRONIC AUTOMATIC TRANSAXLE VEHICLE SPEED SENSOR REPLACEMENT

The output vehicle speed sensor is located to the left of the manual shift lever.

(1) Raise and support vehicle on safety stands.

(2) Remove vehicle speed sensor (Fig. 27).

(3) For installation, reverse above procedures.

VEHICLE SPEED SENSOR TEST

For testing of the vehicle speed and related components, refer to the Powertrain Diagnostics Test Procedure Manual.

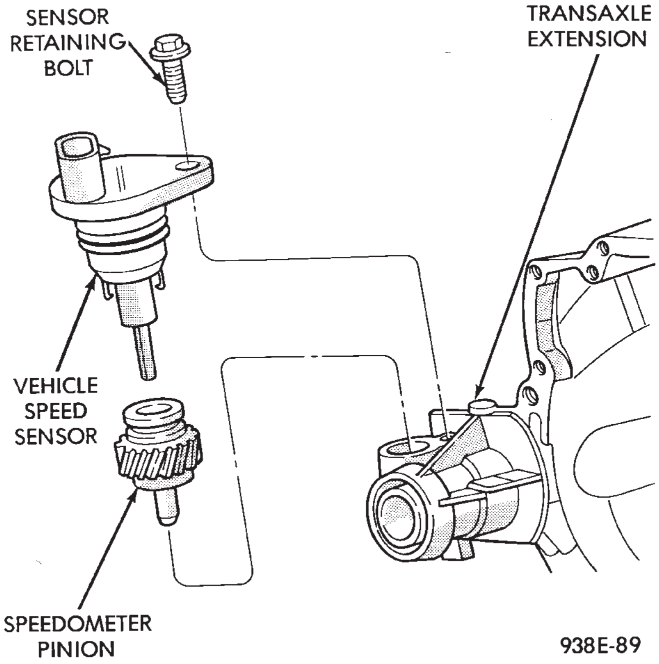


Fig. 26 Vehicle Speed Sensor and Speedometer Pinion

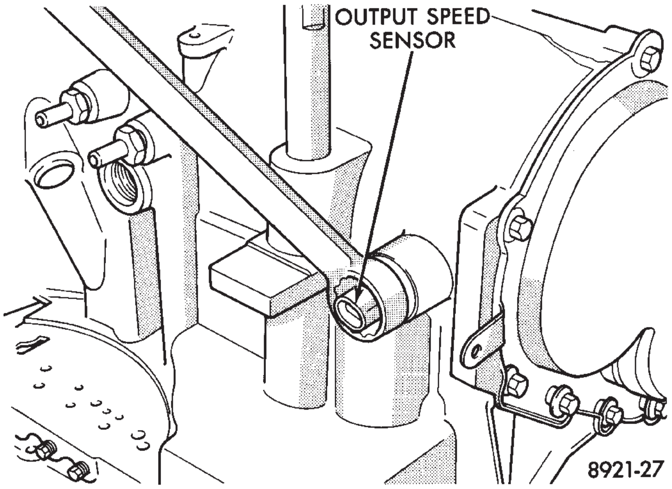


Fig. 27 Vehicle Speed Sensor Removal

PRINTED CIRCUIT BOARD REPLACEMENT

(1) Remove cluster assembly, refer to Cluster Assembly Replacement.

(2) Twist out all lamp sockets.

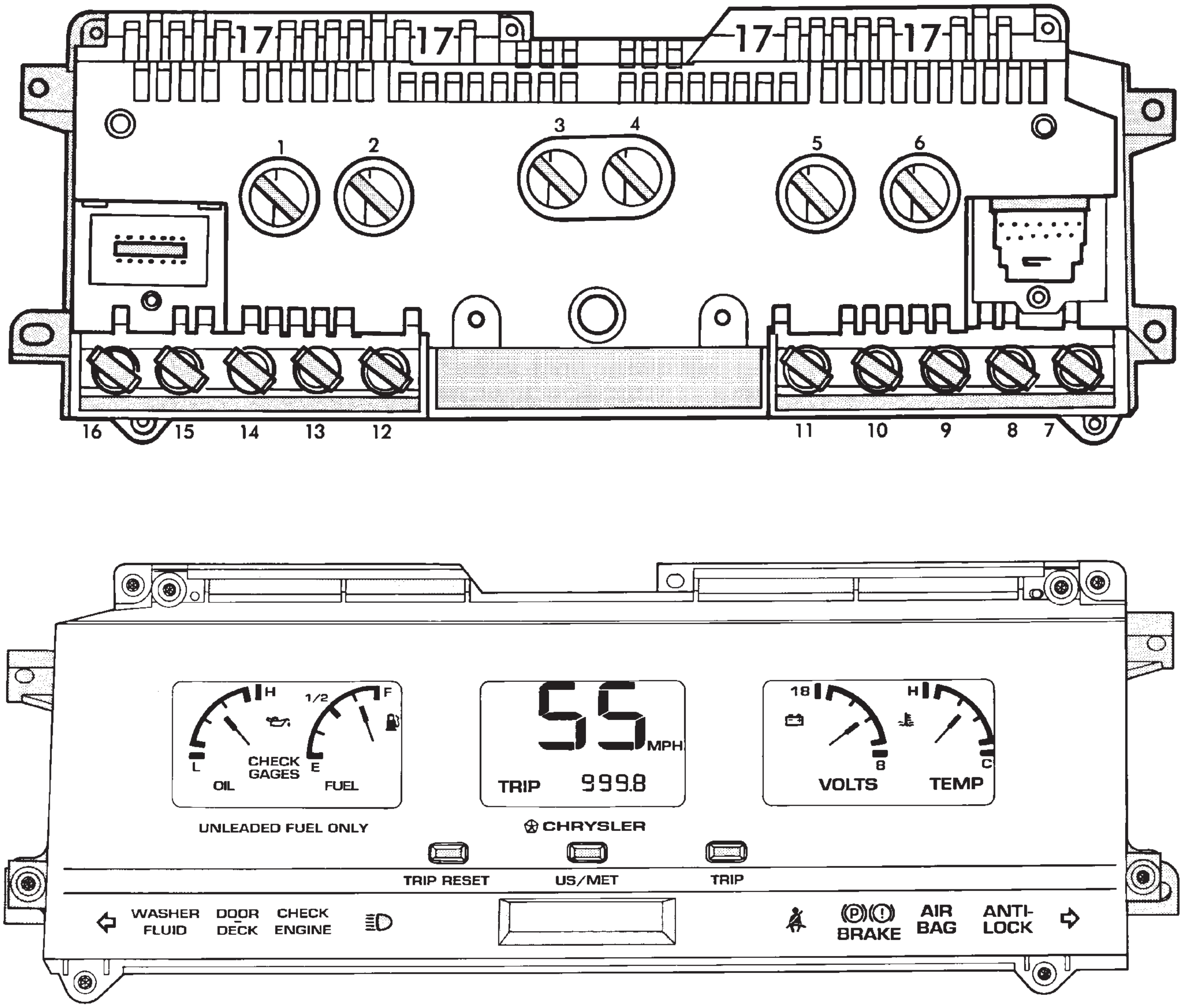
(3) Remove screws securing printed circuit board to cluster housing (Fig. 11).

(4) Pull printed circuit board straight out and avoid bending the board.

(5) For installation reverse above procedures. Be sure that all gauge pins are carefully aligned.

CLUSTER LAMPS REPLACEMENT

All cluster lamps are one-piece lamp and socket assemblies. Can be replaced by removing cluster assembly from instrument panel. Replace appropriate lamp shown in rear view of cluster (Fig. 28).



1. VOLT & TEMPERATURE ILLUMINATION
2. VOLT & TEMPERATURE ILLUMINATION
3. ODOMETER & SPEEDOMETER ILLUMINATION
4. ODOMETER & SPEEDOMETER ILLUMINATION
5. FUEL & OIL ILLUMINATION
6. FUEL & OIL ILLUMINATION
7. LEFT TURN SIGNAL
8. LOW WASH
9. DOOR-DECK
10. CHECK ENGINE
11. HIGH BEAM
12. SEAT BELT
13. BRAKE
14. AIR BAG
15. ANTI-LOCK/ABS
16. RIGHT TURN SIGNAL
17. ILLUMINATION (BEHIND MASK)

938E-79

Fig. 28 Instrument Cluster Illumination Lamp

ELECTRONIC CLUSTER

SELF DIAGNOSTIC SYSTEM

The electronic clusters have an internal diagnostics routing to isolate problems within the cluster or CCD Bus.

Using the cluster Self-Diagnostic Test will determine whether the problem is within the cluster or outside of cluster (Fig. 29 and 30).

Successful completion of the Self Diagnostic Test indicates that the problem is in the CCD Bus, interfacing modules, connectors, or sensors outside of the cluster. Refer to Fig. 31 for terminal listing.

CONDITION: CLUSTER DISPLAYS DO NOT ILLUMINATE AFTER VEHICLE IS STARTED

PROCEDURE

(1) Check fuses and verify battery and ignition voltage at cluster connector.

(2) Check ground from cluster connector to instrument panel ground stud.

CONDITION: CLUSTER ASTERISK (*) FLASHES, CLUSTER DISPLAYS NOT INDICATING CORRECT DATA.

PROCEDURE

CCD bus problem. Use the Body Chassis Diagnostic Manual to diagnose CCD Bus.

CONDITION: SPEEDOMETER AND ODOMETER ARE INOPERATIVE OR OPERATES INTERMITTENTLY

PROCEDURE

(1) If speedometer reads 0, or odometer is blank, and cluster asterisk is flashing, use the Body Chassis Diagnostic Manual to diagnose CCD Bus problem.

(2) If cluster asterisk is not flashing, check for defective vehicle speed sensor or speed sensor wiring.

CONDITION: OIL GAUGE, FUEL GAUGE, TEMPERATURE GAUGE, OR VOLTAGE GAUGE INOPERATIVE

PROCEDURE

If any gauge gives no indication and cluster asterisk is flashing, use the Body Chassis Manual to diagnose CCD Bus problem.

If cluster asterisk is not flashing:

(1) Check for defective sending unit or wiring.

(a) Sending units and wiring can be checked by grounding the connector leads, at the sending unit, in the vehicle.

(b) With the ignition in the ON position, a grounded input will cause the oil, fuel, or temperature gauge to read maximum.

(2) If the problem is with the oil, temperature, or fuel gauge, check the body controller. If the problem is with the voltage gauge, check the powertrain control module operation.

CONDITION: CLUSTER DISPLAY DOES NOT DIM WHEN HEADLAMP SWITCH IS ACTIVATED AND RHEOSTAT ROTATED

PROCEDURE

If the cluster asterisk is flashing, Refer to the Body Chassis Diagnostic Manual to diagnose the CCD Bus.

If the cluster asterisk is not flashing:

(1) Check fuses in headlamp circuit.

(2) Check for loose connections or defective wiring for headlamp switch to body controller.

(3) Check for defective headlamp switch. The electronic instrument cluster receives the display intensity status from the body controller via the CCD Bus.

CONDITION: SEAT BELT WARNING LAMP DOES NOT ILLUMINATE

PROCEDURE

Turn on ignition. Lamp should illuminate for six seconds. If not:

(1) Check for burned out lamp and retest.

(2) Replace cluster.

CONDITION: LOW WASHER, DOOR/DECK, OR MALFUNCTION INDICATOR (CHECK ENGINE) LAMP, DO NOT ILLUMINATE

PROCEDURE

(1) Perform cluster self-diagnostics to determine if lamp will illuminate. If lamp does not, check for burned out lamp, replace and retest.

(2) If cluster asterisk is flashing, Refer to the Body Chassis Diagnostic Manual to diagnose CCD Bus.

(3) If cluster asterisk is not flashing:

(a) For low washer fluid or door/deck, check inputs to body controller.

(b) For malfunction indicator (check engine), check powertrain control module operation.

CONDITION: ODOMETER DISPLAY IS BLANK. THE ODOMETER VALUE IS NO LONGER RETAINED IN THIS ELECTRONIC CLUSTER. THIS TAKES PLACE IN THE BODY CONTROLLER

PROCEDURE

(1) If cluster asterisk is flashing, Refer to the Body Chassis Diagnostic Manual to diagnose CCD Bus.

(2) If cluster asterisk is not flashing, perform cluster self-diagnostics. If code 921 appears in the odometer display, replace body controller for odometer failure.

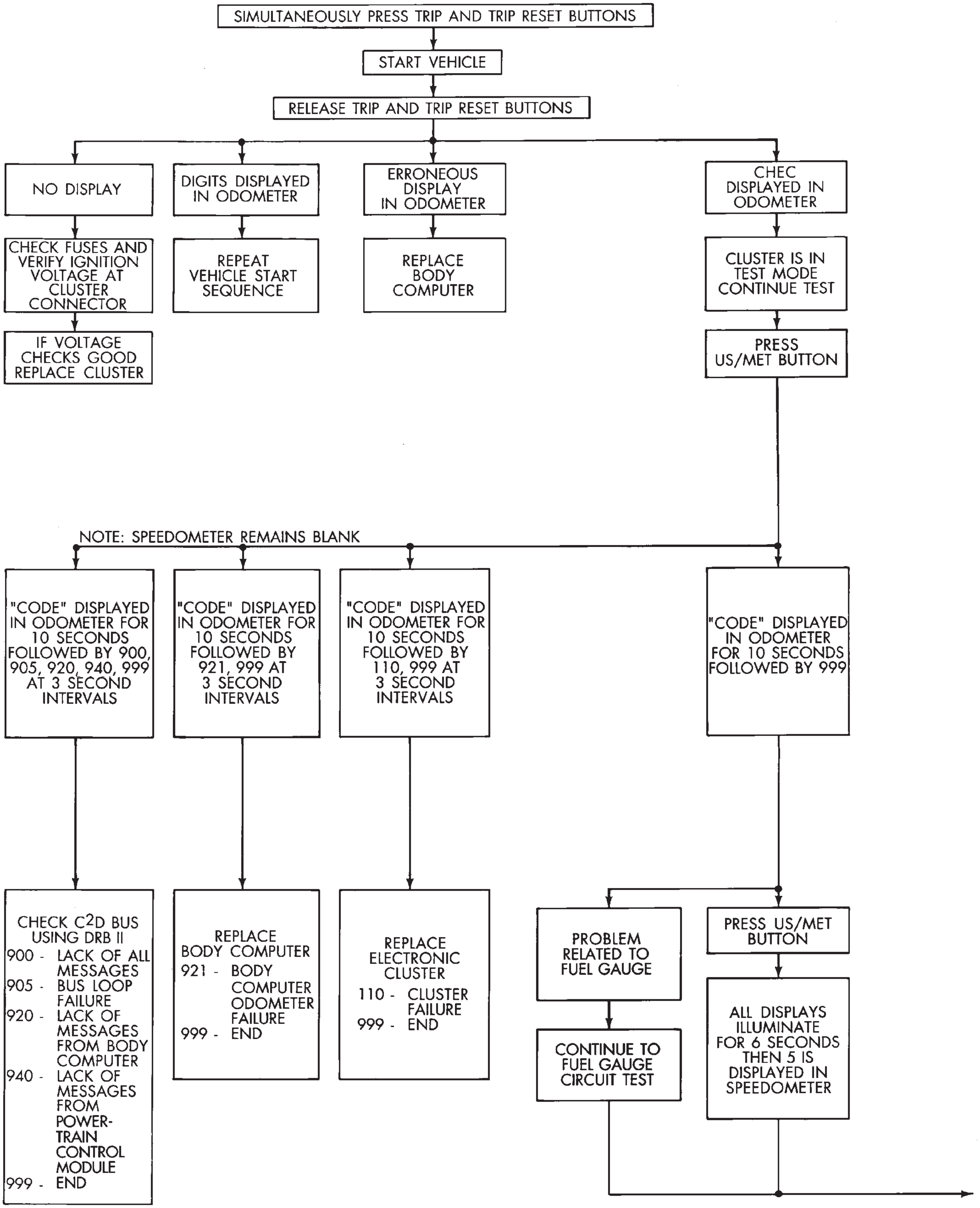


Fig. 29 Electronic Cluster Self-Diagnostic Test

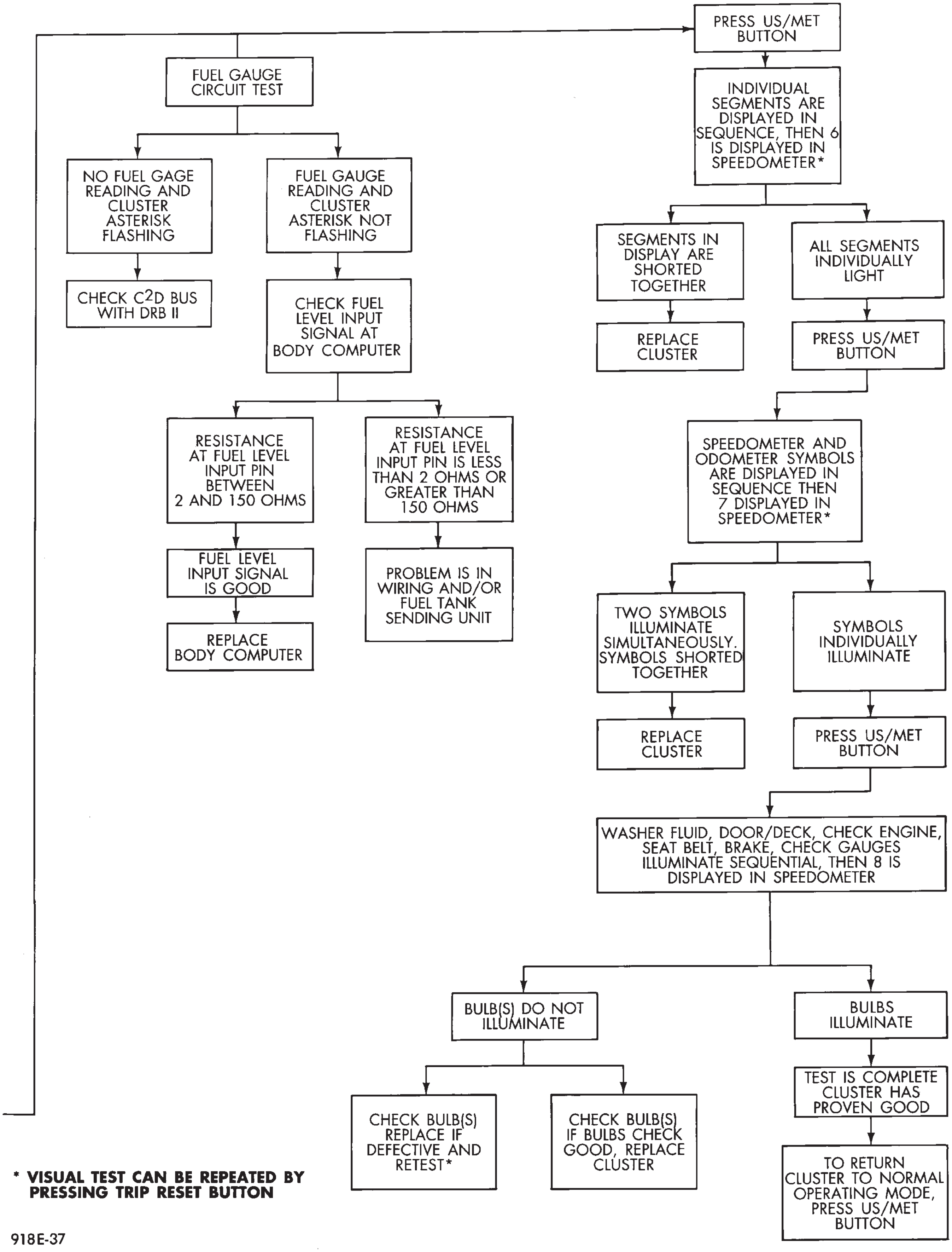
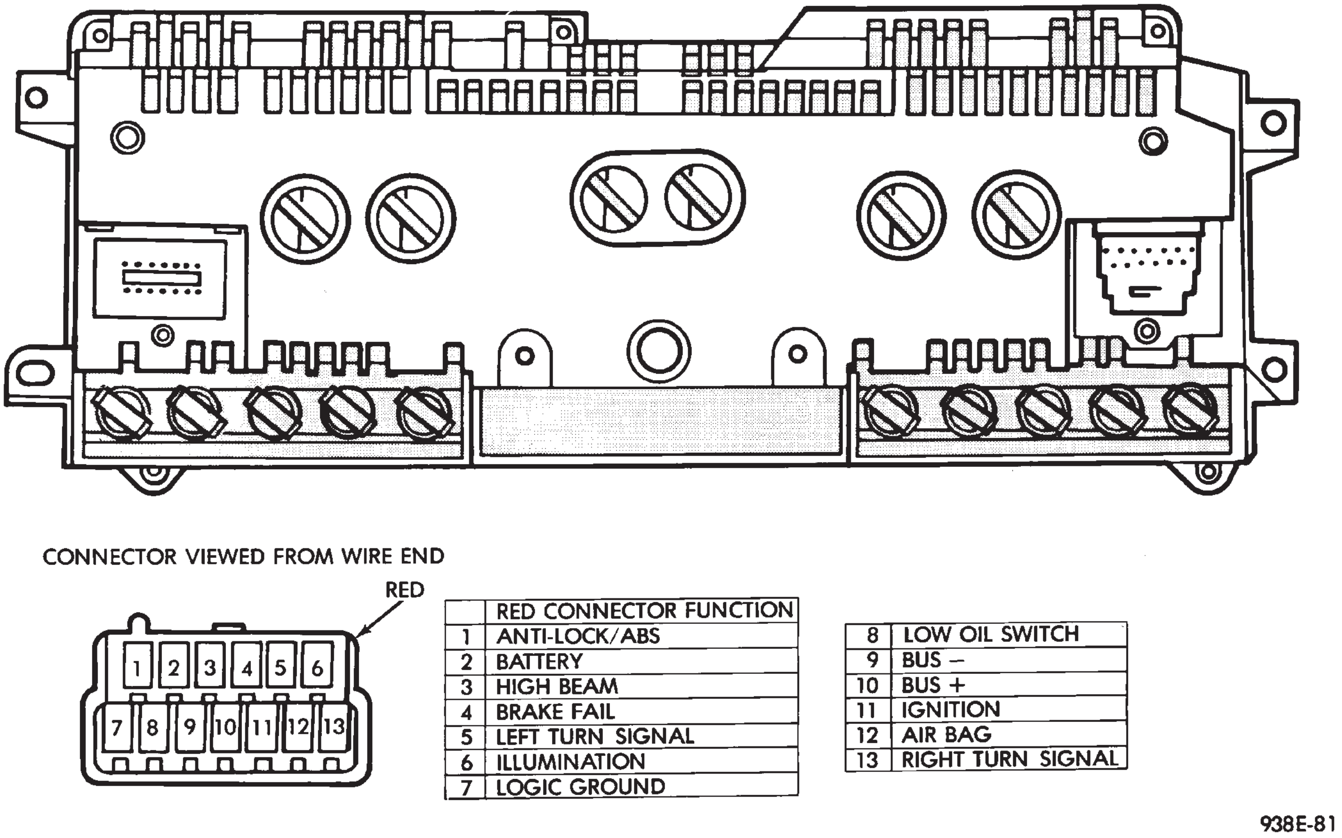


Fig. 30 Electronic Cluster Self-Diagnostic Test Continued



	RED CONNECTOR FUNCTION
1	ANTI-LOCK/ABS
2	BATTERY
3	HIGH BEAM
4	BRAKE FAIL
5	LEFT TURN SIGNAL
6	ILLUMINATION
7	LOGIC GROUND

8	LOW OIL SWITCH
9	BUS –
10	BUS +
11	IGNITION
12	AIR BAG
13	RIGHT TURN SIGNAL

Fig. 31 Cluster Connector

CONDITION: US/METRIC MODES WILL NOT TOGGLE OR TRIP ODOMETER WILL NOT RESET

PROCEDURE

(1) Perform cluster self-diagnostics to determine if push buttons are operational.

(2) Refer to the Body Chassis Diagnostic Manual to diagnose CCD Bus. The US/Metric toggle and trip odometer reset are activated over the CCD Bus.

ODOMETER ADJUSTMENT

The odometer memory is no longer retained in the cluster. This information is stored in the body controller. Therefore, there is no adjustment procedure. If the cluster is replaced odometer value will not change. If the body controller is replaced the mileage may be transferred using the DRB II. Refer to the Body Chassis Diagnostic Manual for the procedure.

SWITCH AND PANEL COMPONENT SERVICE

MESSAGE CENTER REPLACEMENT

(1) Remove upper cluster bezel (Fig. 32).

(2) Remove two attaching screws (Fig. 33).

(3) Disconnect wiring connector and remove message center.

(4) For installation reverse above procedures.

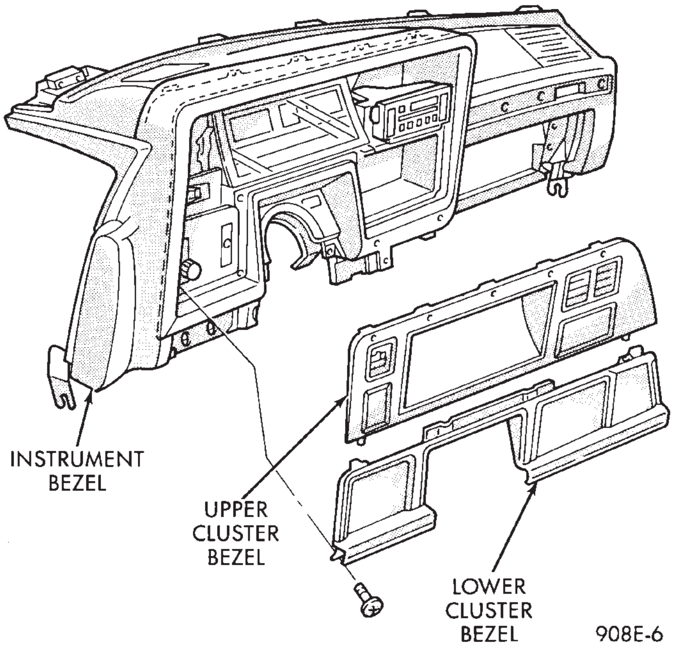


Fig. 32 Cluster Bezel

AIR CONDITIONING CONTROL REPLACEMENT

(1) Remove upper cluster bezel (Fig. 32).

(2) Remove two control mounting screws.

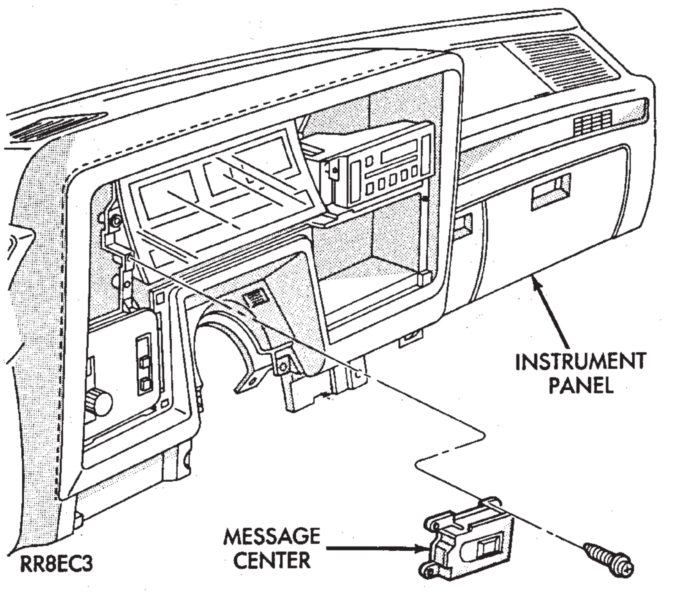


Fig. 33 Message Center

(3) Slide control rearward, disconnect cable, vacuum harness and electrical wiring (Fig. 34).

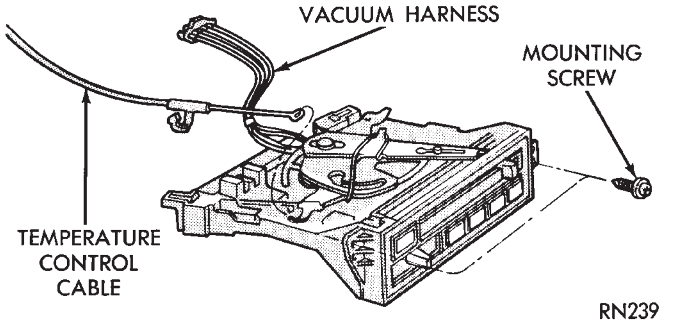


Fig. 34 A/C Control

(4) Remove control.

(5) For installation reverse above procedures.

AUTOMATIC TEMPERATURE CONTROL LAMP REPLACEMENT

(1) Remove automatic temperature control from instrument panel.

(2) Remove top cover screw and unsnap cover from control (Fig. 35).

(3) Remove four screws that connect computer housing to the button housing.

(4) Unsnap the button housing from the computer housing.

(5) Remove lamps by turning in a counter clockwise direction and install lamps by turning in a clockwise direction.

(6) For installation reverse above procedures. When finish perform ATC system function test.

HEADLAMP AND ACCESSORY SWITCH MODULE REPLACEMENT

(1) Remove cluster bezel (Fig. 32).

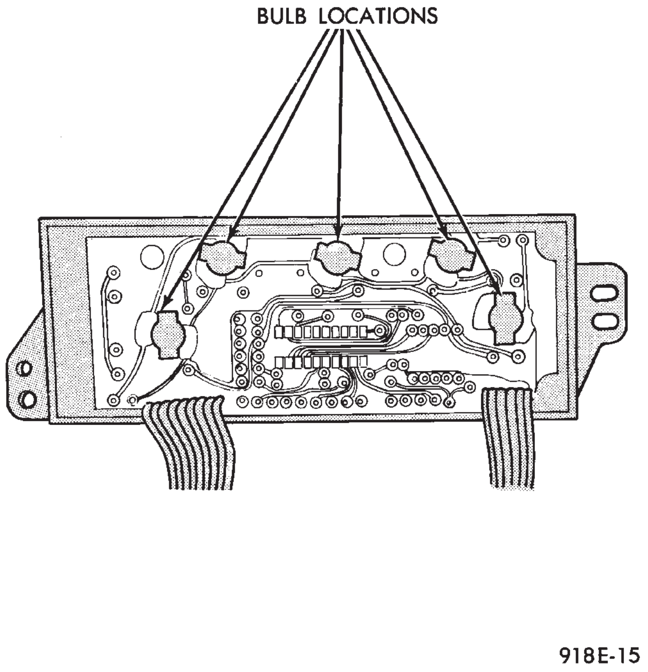


Fig. 35 Automatic Temperature Control Lamp

(2) Remove four screws attaching module to instrument panel (Fig. 36).

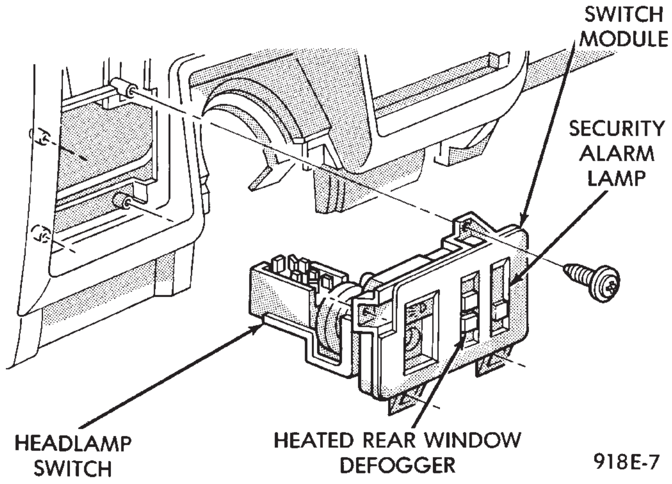


Fig. 36 Headlamp and Accessory Switch Module

(3) Disconnect all wiring connectors to remove module.

(4) For installation reverse above procedures.

HEADLAMP SWITCH REPLACEMENT

(1) Remove headlamp and accessory switch module from instrument panel (Fig. 36).

(2) Press button on underside of headlamp switch and pull knob and shaft to remove.

(3) Remove switch assembly and escutcheon from switch module by removing four attaching screws (Fig. 37).

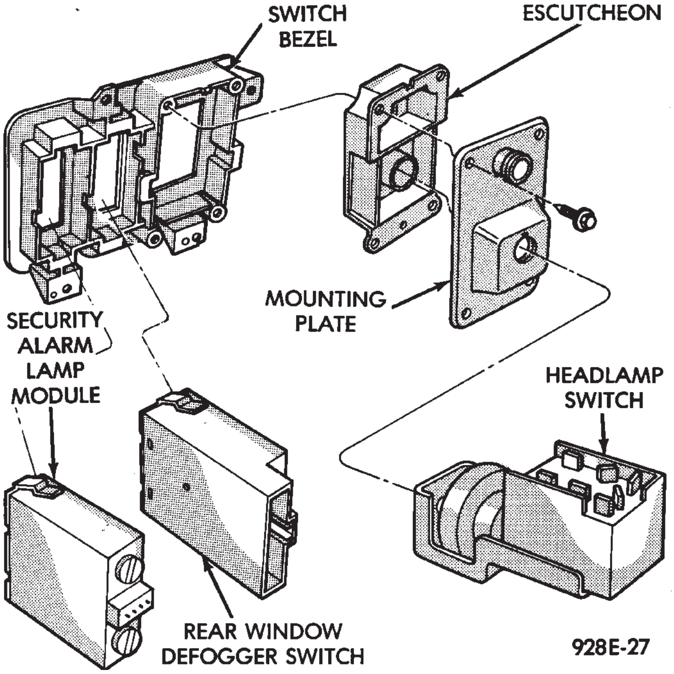


Fig. 37 Headlamp and Accessory Switch

(4) Remove headlamp switch mounting plate from switch by removing retaining nut.

(5) For installation reverse above procedures.

REAR WINDOW DEFOGGER SWITCH REPLACEMENT

(1) Remove headlamp and accessory switch module from instrument panel (Fig. 36).

(2) Remove rear window defogger switch by depressing snap-in clips on top and bottom of switch.

(3) For installation reverse above procedures.

HOOD RELEASE HANDLE AND CABLE REPLACEMENT

(1) Disconnect hood release cable at hood latch.

(2) Remove two screws from underside of hood release handle.

(3) Pull mechanism assembly rearward to remove.

(4) For installation reverse above procedures.

PARK BRAKE RELEASE HANDLE AND LINK REPLACEMENT

(1) Remove left side under panel silencer.

(2) Remove park brake link from lever on park brake mechanism.

(3) Remove upper and lower cluster bezels.

(4) Pull park brake release handle and remove screw.

(5) Remove column cover/park brake release handle assembly by removing four remaining screws.

(6) For installation reverse above procedures.

LAMP OUTAGE MODULE REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #13 prior to removing switch or wires may short to ground.

(2) Remove lower right instrument panel silencer.

(3) Remove glove box and ash receiver module.

(4) Remove three screws attaching the mounting bracket to instrument panel.

(5) Lower bracket and module assembly, to disconnect wire connectors.

(6) Remove two screws attaching the Lamp Outage Module to bracket.

(7) Remove two screws attaching the security module to bracket.

(8) To installation reverse above procedures.

BODY CONTROLLER REPLACEMENT

(1) Remove right side door sill and kick panel trim five screws (Fig. 38).

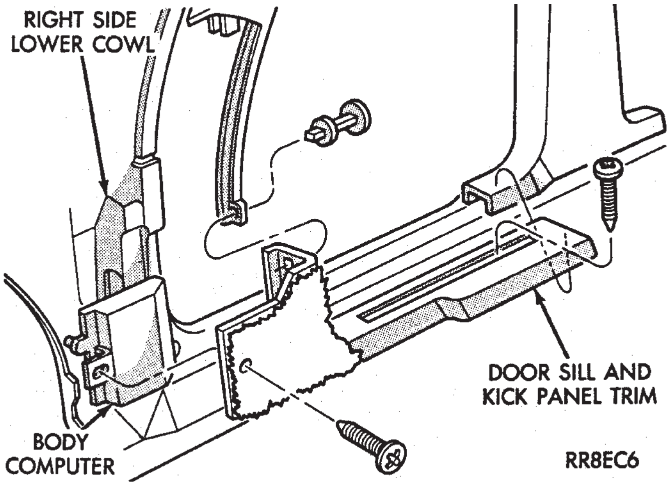


Fig. 38 Body Controller Location

(2) Disconnect body controller wiring.

(3) Remove controller retaining nuts.

(4) For installation reverse above procedures.

GLOVE BOX/ASH RECEIVER ASSEMBLY REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #13 prior to removing switch or wires may short to ground.

(2) Remove center support cover/floor console as necessary.

(3) Disconnect glovebox/Ash receiver wiring connectors (Fig. 39).

(4) Remove ten screws around edge of glovebox/ash receiver assembly.

(5) Remove glovebox/ash receiver module from instrument panel.

(6) For installation reverse above procedures.

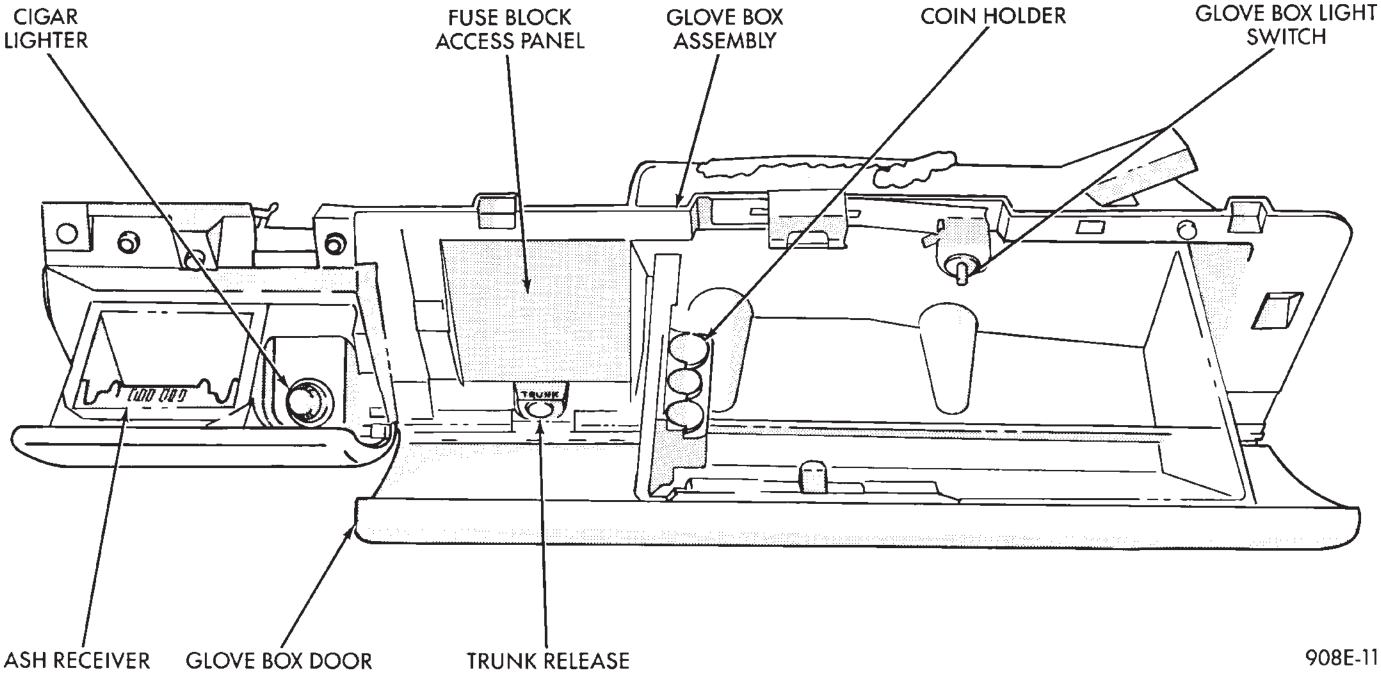


Fig. 39 Glovebox/Ash Receiver Assembly

GLOVE BOX LAMP/SWITCH REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #13 prior to removing switch or wires may short to ground.

(2) Open glove box door. The lamp can be removed without removing switch.

(3) Remove switch by squeezing retaining tabs from behind switch and slide rearward. Disconnect wiring connectors.

(4) Remove lamp/switch.

(5) For installation reverse above procedures.

CIGAR LIGHTER ASSEMBLY REPLACEMENT

(1) Remove four screws from ash receiver.

(2) Pull assembly rearward and disconnect wiring.

(3) Remove ash receiver and cigar lighter.

(4) For installation reverse above procedures.

FLOOR CONSOLE REPLACEMENT

(1) Open upper storage bin door (Fig. 40).

(2) Remove two screws attaching front wall of storage bin to mounting bracket.

(3) Remove console and drawer.

(4) Remove two screws attaching mounting bracket to lower instrument panel.

(5) Remove mounting bracket.

(6) For installation reverse above procedures.

INSTRUMENT PANEL TOP COVER REPLACEMENT

(1) Remove panel top cover by, pushing forward and prying up, using a straight edge to assist in the removal.

(2) For installation: align top cover clips and push cover into position.

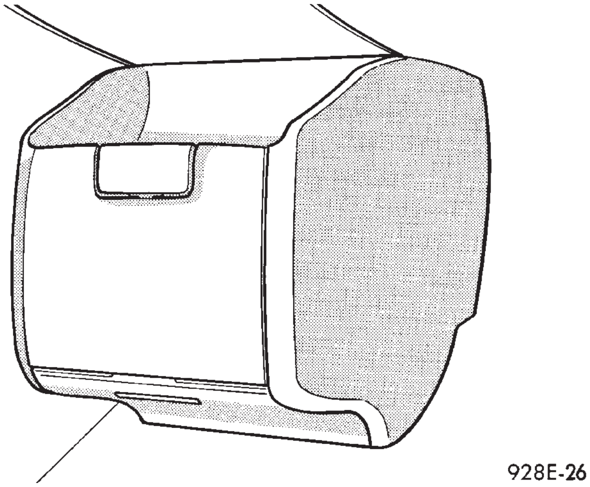


Fig. 40 Floor Console

(3) Pull cover rearward for good fit.

INSTRUMENT PANEL ASSEMBLY REPLACEMENT

CAUTION: Disconnect negative battery cable, in engine compartment, before servicing instrument panel.

(1) Remove left instrument panel silencer.

(2) Remove right and left cowl side and scuff plate trim molding by removing five screws per side.

(3) Remove right and left A-pillar trim moldings by removing two push-pin fasteners per side and disengaging from clip at B-pillar trim.

(4) Remove panel top cover by pushing forward and prying up, using a straight edge to assist in the removal.

(5) Disconnect bulkhead connector at brace under instrument panel at left side.

(6) Remove glovebox/ash receiver module and right instrument panel silencer.

(7) Remove center panel support brace and air bag diagnostic module assembly.

(8) Disconnect wiring to airbag module.

(9) Remove upper and lower cluster bezels.

(10) Remove steering column cover.

(11) Remove steering column mounting nuts and lower steering column.

(12) Unhook shift indicator cable eyelet from steering column actuator.

(13) Unlatch lock tab in shift indicator column insert and squeeze legs together to remove from steering column.

(14) Remove cluster assembly while guiding transmission range indicator guide tube through access hole in the base panel.

(15) Remove instrument panel steering column opening support/hood release handle assembly.

(16) Remove two steering column upper studs and loosen side cowl tie-down bolts.

(17) Remove steering column tilt lever.

(18) Remove upper and lower lock housing shroud.

(19) Remove lower fixed shroud.

(20) Remove upper fixed shroud (snaps in place).

(21) Disconnect airbag pigtail, ignition switch and halo light/key buzzer switch wiring.

(22) Disconnect Multi-function switch by loosening connector jack screw and pulling connector from switch.

(23) Disconnect airbag pigtail from wiring trough housing by pulling two push fasteners.

(24) Remove wiring trough from steering column.

(25) Remove defroster ducts.

(26) Remove five screws along fence line and roll panel down, attach a hook to hold in position.

(27) Open hood and remove plenum grill.

(28) Disconnect washer bottle, resistor block and under hood lamp wiring. Washer bottle must be removed to gain access.

(29) Remove grommet and pull plenum wiring into vehicle through plenum panel.

(30) Disconnect right demister hose from instrument panel.

(31) Disconnect antenna cable.

(32) Disconnect right and left 25 way body wiring connectors.

(33) Disconnect A/C heater control cables, wiring connectors and vacuum harness.

(34) Remove right side panel ground wire.

(35) Disconnect body controller wiring.

(36) Remove instrument panel assembly from vehicle.

(37) For installation reverse above procedures.

INTERIOR LAMP REPLACEMENT

The reading, overhead console and door lamps operate when the doors are open or headlamp switch is placed in courtesy position. Front overhead lamps refer to Group 8C, Overhead Console.

TRUNK LAMP

The lamp has easily accessible without removing components.

DOOR LAMP

Pry along the forward edge of the lens and pivot lens out of the door trim panel. Remove lamp. To remove lamp housing, remove door trim panel. Refer to Group 23, Body. Disconnect all wiring. Remove screws, if so equipped securing lamp housing to trim panel, and replace housing.

C—PILLAR READING/COURTESY LAMP

Pry along the rearward edge of the lamp and pivot lamp out from quarter trim panel. Disconnect wiring and remove lamp cover. Replace lamp.

The lamp operates when the doors are open or the headlamp switch is turned to the courtesy mode. The lamp will function as a reading lamp when the doors are closed and the button switch on the lamp is depressed.

ROOF RAIL READING

Pry along the bottom edge of the lens and pivot lens out. Replace lamp. To remove the lamp, remove the screw which retains the coat hook. Remove the garnish molding. Disconnect the wiring harness. Remove the two clips which retain the lamp to the molding. Replace lamp. The lamp operates like the C-pillar reading/courtesy lamp.

AG AND AJ BODIES

INDEX

GENERAL INFORMATION

CONVENTIONAL INSTRUMENT CLUSTER

The conventional instrument cluster incorporates magnetic type gauges (Fig. 1).

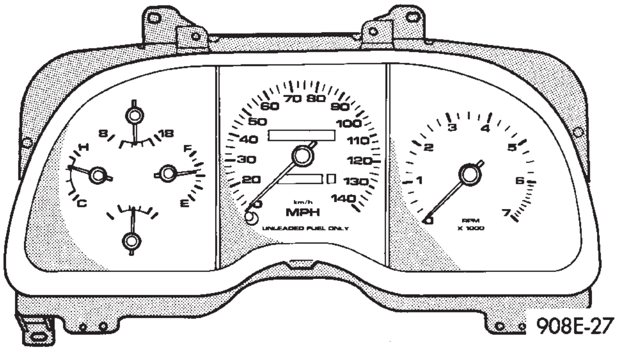


Fig. 1 Conventional Instrument Cluster

The readings are only accurate when the ignition switch is in the ON position.

TACHOMETER DRIVE MODULE

The tachometer drive module is an electronic module used to drive a magnetic tachometer in a conventional instrument cluster.

MESSAGE CENTER

The message center provides the driver with information in addition to the standard vehicle instrumentation. A bezel will light up with door ajar, washer fluid, deck ajar and alarm set information. For vehicles without message center a plain bezel is used.

ELECTRONIC VEHICLE INFORMATION CENTER (EVIC)

The Electronic Vehicle Information Center is a computer controlled warning system which, monitors various sensors used on the vehicle. The system supplements the warning indicators in the instrument cluster. Visual warning messages are displayed by a digital display (Fig. 2). Refer to Group 8C, Overhead Console.

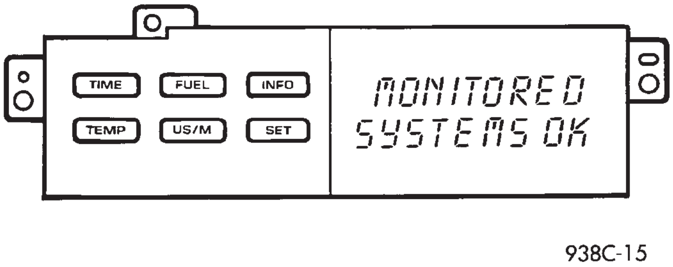


Fig. 2 EVIC

ELECTRONIC INSTRUMENT CLUSTER

The electronic instrument cluster uses vacuum fluorescent displays to display:

- Oil pressure
- System voltage
- Engine temperature
- Fuel level
- Speedometer and tachometer readings as well as all warning indicators. The electronic cluster is easily distinguished from the conventional cluster by its digital and linear display (Fig. 3.

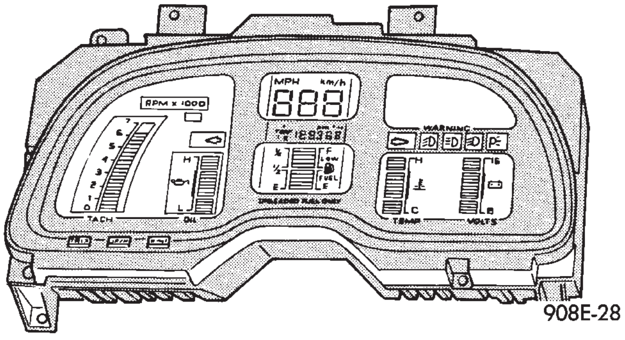


Fig. 3 Electronic Instrument Cluster

ELECTRONIC CLUSTER DIMMING

The electronic cluster display is dimmed from daytime to nighttime intensity when the head]lamp switch is turned on. This intensity can be controlled using the headlamp switch sliding rheostat.

An additional detent on the headlamp switch rheostat will allow daytime intensity while driving with headlamps ON in daytime.

ELECTRONIC DIGITAL CLOCK

The electronic digital clock is in the radio. The clock and radio each use the display panel built into the radio. A digital readout indicates the time in hours and minutes whenever the ignition switch is in the ON or ACC position.

When the ignition switch is in the ON or OFF position, or when the radio frequency is being displayed, time keeping is accurately maintained.

The procedure for setting the clock varies slightly with each radio. The correct procedure is described under the individual radio operating instructions referred to in the Owner's manual supplied with the vehicle.

WARNING LAMPS

The AG & AJ Body instrument clusters have warning lamps or indicators with the electronic cluster for six different systems. These include low oil pressure, check gauges, brake system, air bag, seat belt, malfunction indicator (check engine) lamp.

CLUSTER AND GAUGE SERVICE AND TESTING

CAUTION: Disconnect negative battery cable, in engine compartment, before servicing instrument panel. When power is required for test purposes, reconnect battery cable for test only.

Disconnect negative battery cable after test and before continuing service procedures.

It is not necessary to remove instrument cluster from vehicle for gauge replacement.

Gauges must be pulled straight out, when removing or pins may be damaged.

SWITCH POD ASSEMBLY REMOVAL

(1) Disconnect negative battery cable.

(2) Pry up edge of panel vent grille, using a straight flat edge tool to disengage clips, then remove grille (Fig. 4).

(3) Remove two screws located under panel vent grille.

(4) Remove two screws underneath switch POD assembly.

(5) With tilt steering adjust steering wheel to the lowest setting.

(6) Pull switch module rearward to remove module and disconnect all wire connections.

(7) For Installation reverse above procedures. Tighten all screws to 2 N•m (20 in. lbs.) torque.

MECHANICAL/ELECTRONIC CLUSTER REMOVAL

CLUSTER MASK AND LENS REMOVAL

(1) Remove switch pod assembly (Fig. 4).

(2) Remove tilt column lever if equipped.

(3) Remove steering column trim cover.

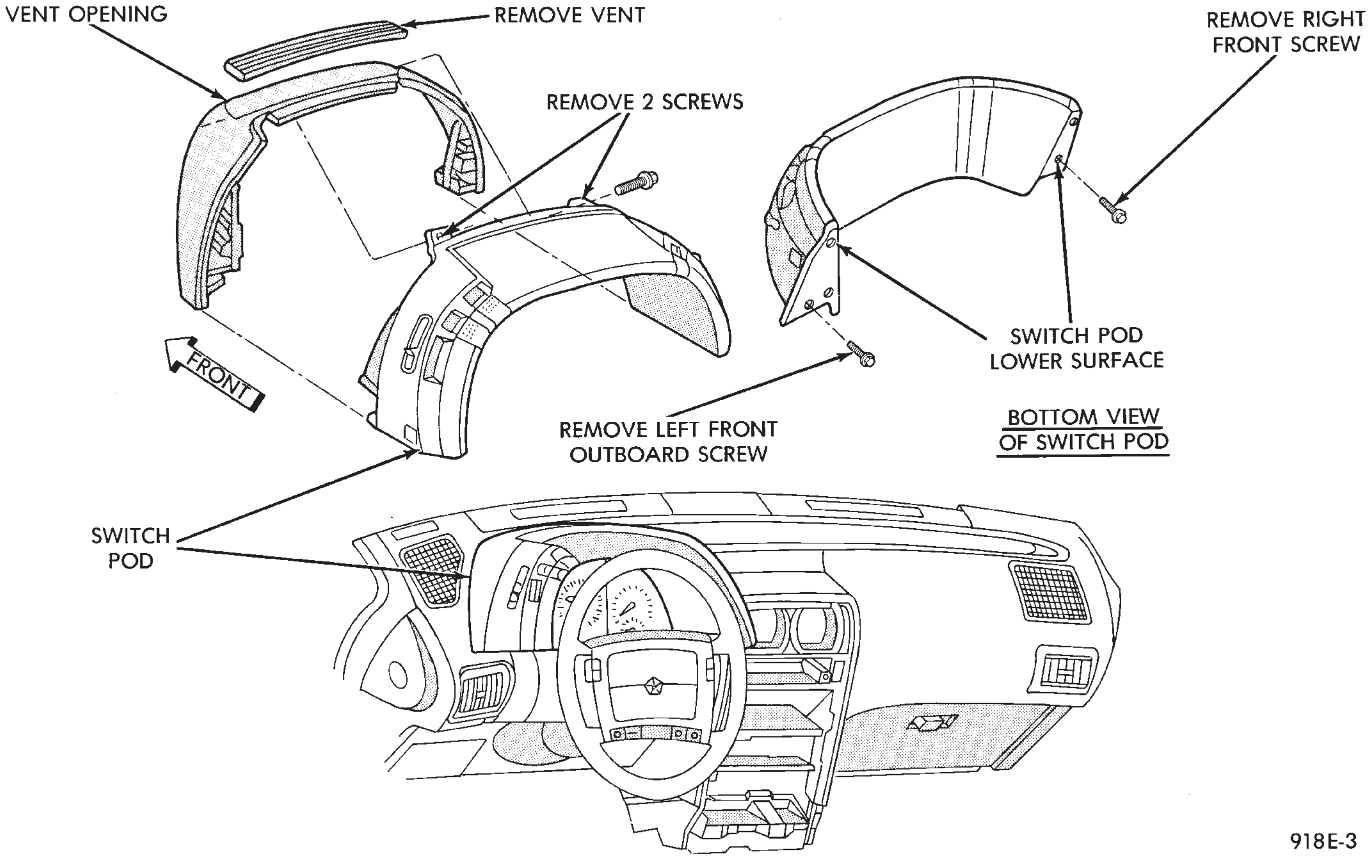


Fig. 4 Switch POD Assembly

(4) Remove six screws holding the cluster mask and lens assembly.

(5) Pull cluster mask and lens rearward to remove (Fig. 5 and 6).

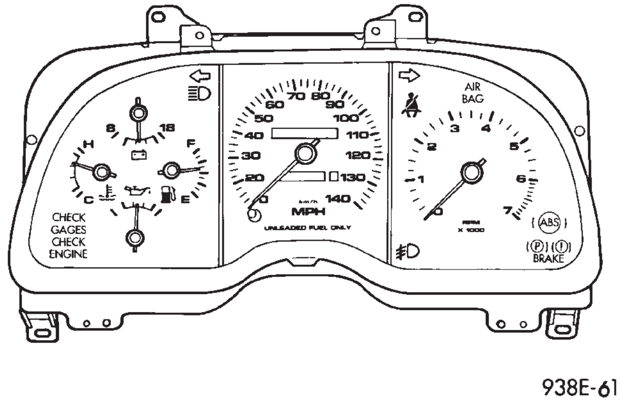


Fig. 5 Cluster Mask and Lens

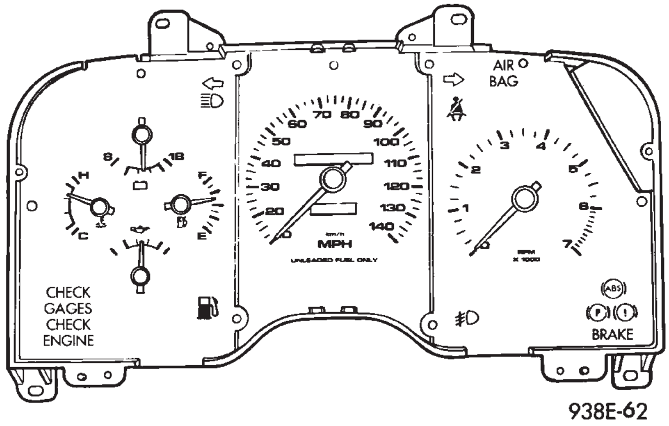


Fig. 6 Cluster with Mask Removed

(6) For installation reverse above procedures.

CLUSTER ASSEMBLY REMOVAL

(1) Disconnect battery to assure no Air Bag System fault codes are stored.

(2) Remove switch pod assembly.

(3) Unscrew tilt column lever if equipped.

(4) Remove steering column trim cover.

(5) Remove attaching screws on cluster and pull cluster rearward.

(6) Tilt cluster to disconnect wiring connections and turbo gauge hose if equipped, then remove cluster.

(7) For installation reverse above procedures.

GAUGES

MULTIPLE GAUGE INOPERATIVE

Volt, speedometer, tachometer and other gauges appear to malfunction:

(1) Remove cluster

(2) Check for ignition voltage at cavity 9 of the red cluster connector and ground. If no voltage, repair as necessary (Fig. 7).

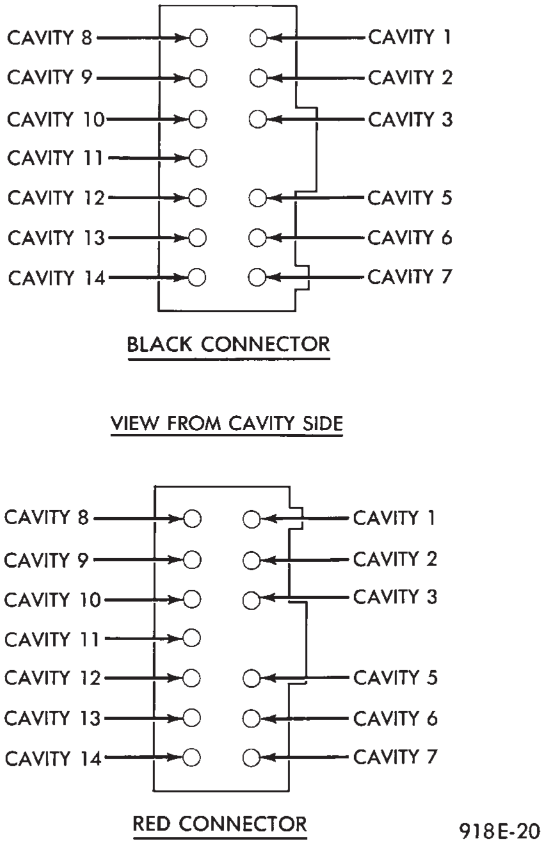


Fig. 7 Conventional Cluster Connectors

(3) Check for ground continuity between cavity 14 of the red cluster connector and ground. If no ground, repair as necessary.

(4) If OK and pins or connectors are not distorted, replace printed circuit board.

(5) Install cluster.

GAUGE CALIBRATION/INOPERATIVE

(1) Remove gauge in question (Fig. 8 through 11).

(2) With the ignition key ON, check for ignition voltage at ignition pin of gauge and ground. Check ground pin of gauge for continuity to ground.

(a) If no voltage or ground, check at cluster red connector pin 9 for ignition voltage and pin 14 for ground.

(b) If no voltage or ground, repair as necessary. Refer to 8W, Wiring Diagrams.

(c) If there is voltage or ground, check cluster for distorted terminals. If terminals are OK, replace printed circuit board.

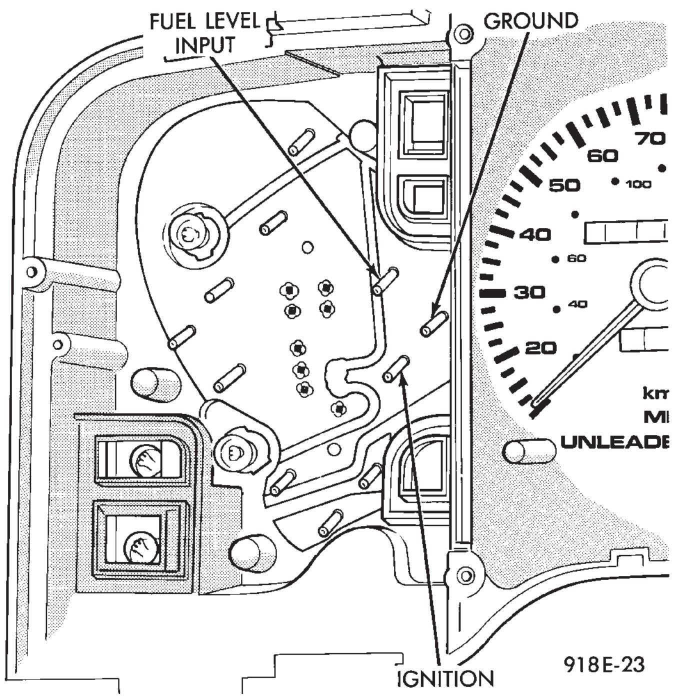


Fig. 8 Fuel Gauge Pins

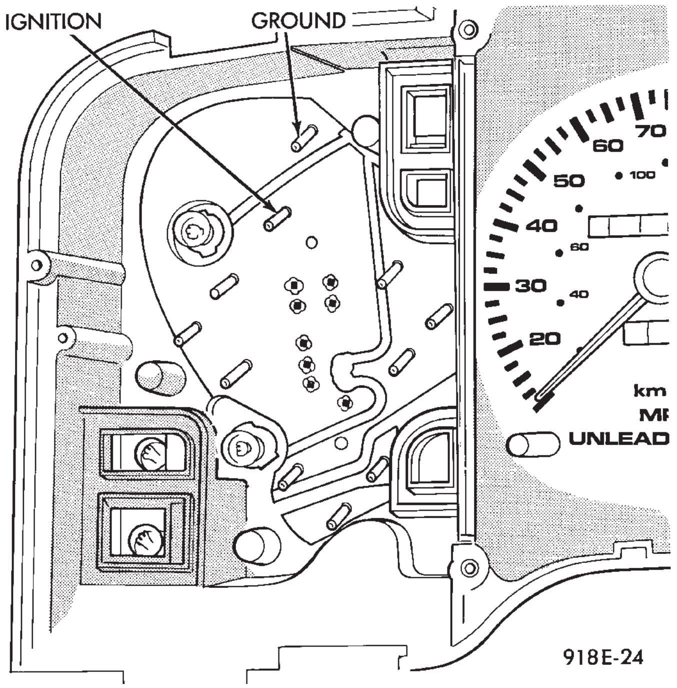


Fig. 9 Voltmeter Pins

(3) When testing temperature and oil pressure gauge, allow the engine to run until the vehicle reaches a normal operating temperature. Turn ignition OFF, and remove gauge from cluster.

(a) Testing oil pressure gauge, engine needs to be running.

(b) Measure and record the resistance between sending unit pin and ground pin of the gauge in question. Refer to Gauge Resistance (Fig. 12).

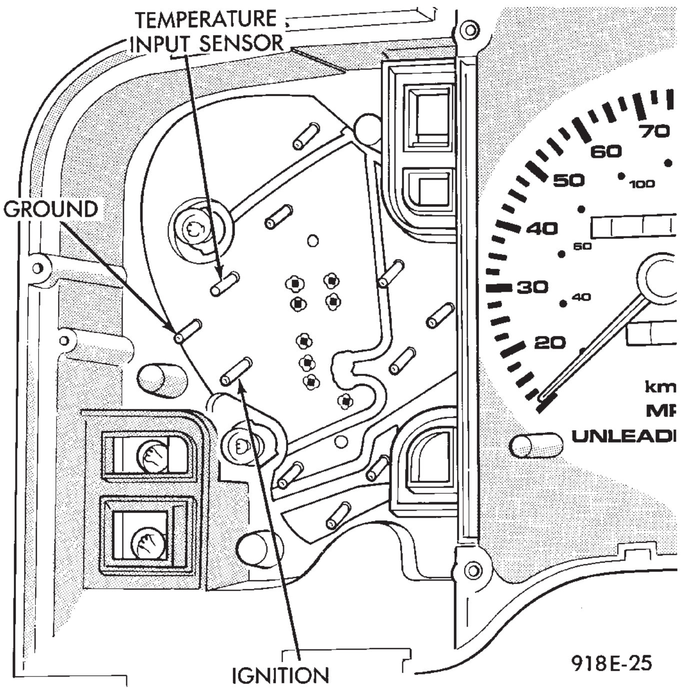


Fig. 10 Temperature Gauge Pins

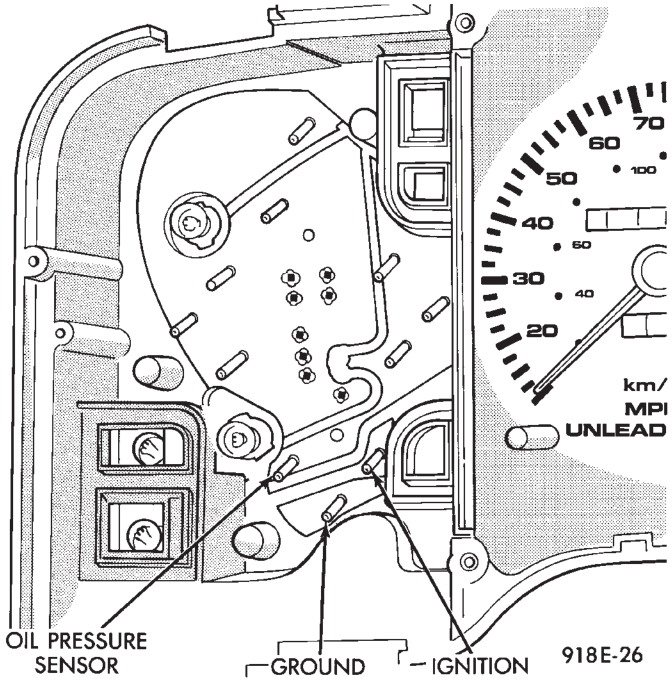


Fig. 11 Oil Pressure Gauge Pins

(c) When checking temperature and oil pressure gauges, it is important to have the same engine temperature and engine speed when noting gauge position. Therefore, time between noting gauge position and sending unit measuring should be kept to a minimum.

(d) If resistance and gauge position are not similar, replace gauge.

(e) If OK, measure the resistance between the sending unit pin in question and the ground pin at the cluster wire harness connectors.

Gage	Resistance	Position
Fuel	90 ohms	E
	59 ohms	1/4
	42 ohms	1/2
	28 ohms	3/4
	12 ohms	F
Oil	100 ohms	L
	63 ohms	Low Normal
	30 ohms	3/4 of Normal
Temp	Greater than 455	C or below
	288 ohms	Low Normal
	125 ohms	Mid scale
	76 ohms	High Normal
	64 ohms	H

918E-51

Fig. 12 Gauge Resistance

(f) If there is a difference in readings, check printed circuit board for contact to cluster connectors.

(g) If OK and contacts are not distorted, replace printed circuit board.

(h) If everything checks out OK, refer to Sending Unit Test.

(4) The Gauge Resistance Chart (Fig. 12), is general guidelines for checking the gauge position against the sending unit resistance. Because of only a few specific points of gauge position versus sending unit resistance, a good estimate is needed when the resistance falls between graduations. Even when the resistance corresponds to graduations, the gauge has a tolerance of ± 4 ohms.

Volt gauge: The calibration dot on the volt gauge corresponds to 13 volts between the gauge ignition and ground pins. If voltage varies from this, estimate proper gauge position with input voltage.

TACHOMETER AND TURBO GAUGE REMOVAL

(1) Remove switch pod assembly.

(2) Remove steering column trim cover.

(3) Remove cluster mask and lens assembly.

(4) Remove screws attaching tachometer to cluster housing.

(5) Pull tachometer rearward to remove.

(6) Disconnect turbo gauge hose. If turbo hose cannot be disconnected, remove cluster.

(7) For installation reverse above procedures.

TACHOMETER CIRCUIT TESTING

(1) Remove cluster.

(2) Check for battery voltage at cavity 8 of the instrument cluster red connector (Fig.6).

(3) With the ignition in the ON position, check for battery voltage at cavity 9 of the instrument cluster red connector.

(4) Check cavity 14 of the instrument cluster red connector for continuity to ground.

(5) Check for tachometer signal from the powertrain control module by connecting an AC DIGITAL VOLTMETER to cavity 6 of the instrument cluster black connector and ground. A reading of at least 1.0 volt should be present with the engine running (Fig. 7).

(a) If voltage is within specification, go to step 7.

(b) If voltage is NOT within specification, perform steps 6.

(6) If there is less than 1.0 volt at cavity 6, check for continuity between cavity 6 and pin 43 of the powertrain control module connector.

(a) If continuity is OK, between cavity 6 and pin 43 of the powertrain control module connector, replace the powertrain control module.

(b) No continuity check the connectors for damaged pins or terminal push outs or defective wire.

(7) If all tests performed test good replace the tachometer drive module.

(8) If the tachometer continues to be inoperative, replace the tachometer assembly.

VOLTMETER, TEMPERATURE GAUGE, OIL PRESSURE GAUGE AND FUEL GAUGE ASSEMBLY—REMOVAL

(1) Remove pod switch assembly.

(2) Remove steering column trim cover.

(3) Remove cluster mask and lens assembly.

(4) Remove screws attaching gauge assembly to cluster.

(5) Pull rearward to remove gauge assembly.

(6) For installation reverse above procedures.

SENDING UNIT TEST

It is not necessary to remove instrument cluster from vehicle for gauge replacement.

When removing gauge assemblies from cluster, gauge must be pulled straight out, not twisted, or damage to gauge pin may result.

When a problem occurs with a cluster gauge, before disassembling the cluster to check the gauge, check for a defective sending unit or wiring.

(1) Sending units and wiring can be checked by grounding the connector leads, at the sending unit, in the vehicle.

(2) With the ignition in the ON position; a grounded input will cause the oil, fuel or temperature gauge to read at or above maximum.

(3) With the ignition switch ON, an open (disconnected sending unit wire) causes the oil, fuel or temperature gauge to read below low, empty or cold indicators.

(4) If steps 2 and 3 check OK, refer to the individual sending unit test procedures.

FUEL TANK SENDING UNIT TEST

Refer to Group 14, Fuel for test procedure.

CHECK GAUGES WARNING LAMP TESTS

The check gauges warning lamp will illuminated when the ignition key is turned to the ON position. The lamp will illuminate if the engine oil pressure drops below a safe level. The check gauge lamp will light for high engine temperature or for low voltage.

To test the system turn ignition key to the ON position. If the lamp fails to light, inspect for a broken or disconnected wire at the oil pressure combination sending unit, which is located at the front of the engine (Fig. 13). If the wire at the connector checks good pull connector loose from the switch terminal and with a jumper wire ground connector to the engine. With the ignition key turned to the ON position check the warning lamp. If lamp still fails to light, inspect for a burned lamp. If lamp still fails to light, inspect for a burned out lamp or disconnected socket in the cluster.

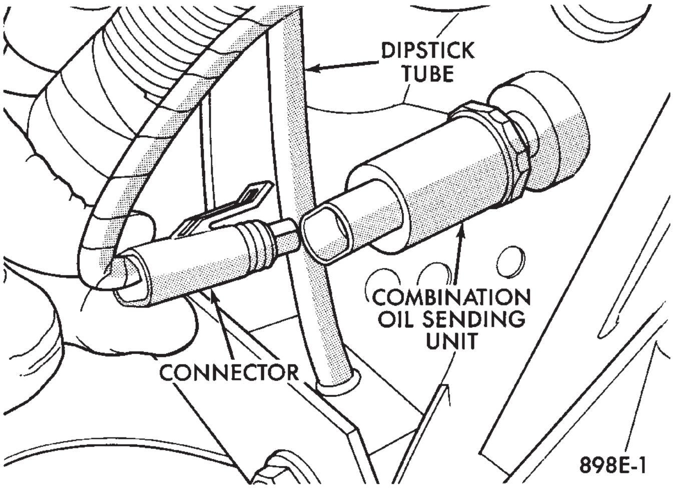


Fig. 13 Combination Oil Sending Unit

To test the switch disconnect the switch electrical connector. Attach positive lead of an ohmmeter to the switch terminal for the gray (GY) wire and the negative lead to an engine ground. With the engine off, there should be continuity in the system. Start the engine. With the engine running, the ohmmeter should show no continuity. If the above results are not obtained, replace the switch.

COMBINATION OIL SENDING UNIT TEST

The combination oil sending unit has two functions:

(1) The normal closed circuit keeps the oil pressure warning lamp on until there is oil pressure.

(2) The sending unit provides a resistance that varies with oil pressure.

To test the normally closed oil lamp circuit, disconnect the locking connector and measure the resistance between the switch terminal and the metal housing. The ohmmeter should read 0 ohms. Start the engine (Fig. 14).

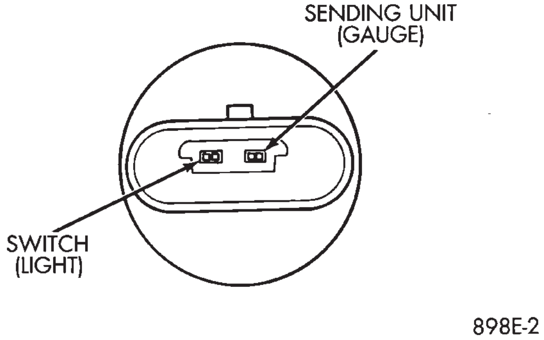


Fig. 14 Combination Oil Sending Unit Test

If there is oil pressure, the ohmmeter should read an open circuit.

To test the sending unit, measure the resistance between the sending unit terminal and the metal housing. The ohmmeter should read open. Start the engine.

The ohmmeter should read between 30 to 55 ohms, depending on engine speed, oil temperature, and oil viscosity.

If the above results are not obtained, replace the sending unit.

SEAT BELT WARNING SYSTEM

For testing of this system refer to Group 8U, Chime Warning/Reminder System.

MALFUNCTION INDICATOR (CHECK ENGINE) SYSTEM

For testing this system refer to the Body Diagnostic Procedures booklet.

BRAKE SYSTEM WARNING LAMP TEST

The brake warning lamp illuminates when parking brake is applied with ignition key turned ON. The same lamp will also illuminate should one of the two service brake systems fail when brake pedal is applied. To test system turn ignition key ON, and apply parking brake. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch. The lamp also lights when the ignition switch is turned to START. Refer to Brake System Warning Lamp Diagnosis Chart (Fig. 15).

To test service brake warning system, raise vehicle on a hoist and open a wheel cylinder bleeder while a

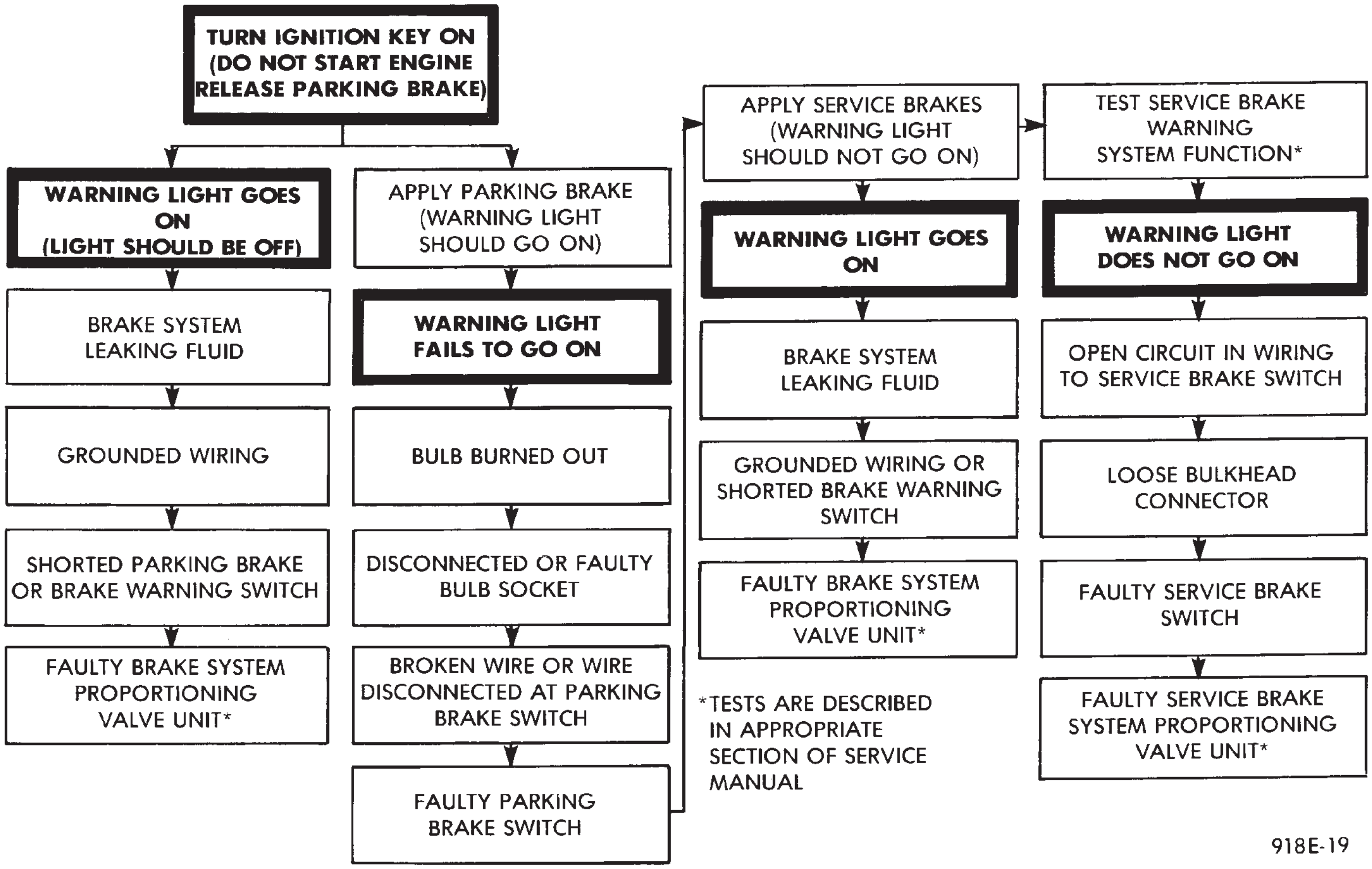


Fig. 15 Brake System Warning Lamp Diagnosis

helper depresses brake pedal and observes warning lamp. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch.

If lamp is not burned out and wire continuity is proven, replace brake warning switch in brake line TEE fitting mounted on frame rail in engine compartment below master cylinder (Fig.16).

CAUTION: If wheel cylinder bleeder was opened check master cylinder fluid level.

SPEEDOMETER SYSTEM

The vehicles are equipped with electronically driven speedometer and odometer assemblies. The unit has the same appearance as a conventional speedometer but it eliminates the cable-driven mechanical system. A signal is sent from a transmission-mounted vehicle speed sensor to the speedometer circuitry through the wiring harness. By eliminating the speedometer cable, instrument cluster service and removal is improved. Refer to Fig. 17 Speedometer Diagnosis Chart.

When the speedometer is out of calibration. The electronic automatic transaxle vehicle speed sensor output must be calibrated to reflect the different combinations of equipment. The procedure is called Pinion Factor, refer to Group 21, Transaxle for the procedure.

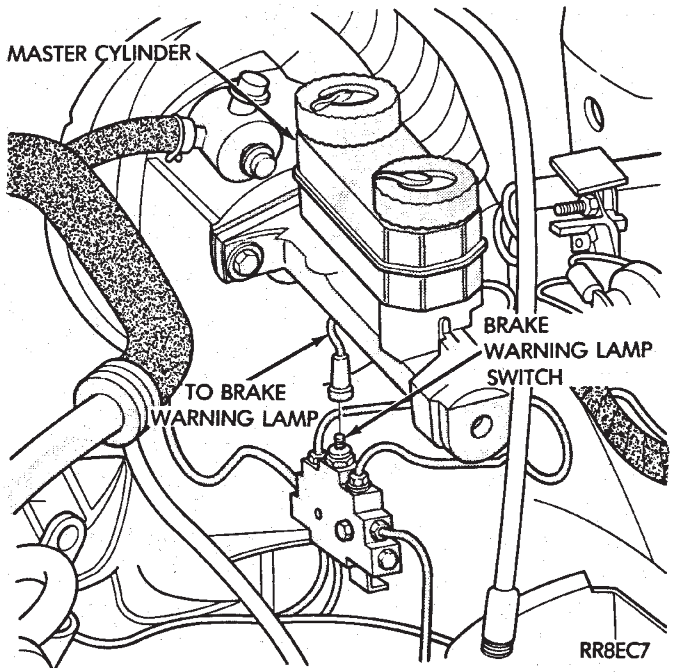


Fig. 16 Brake Warning Lamp Switch

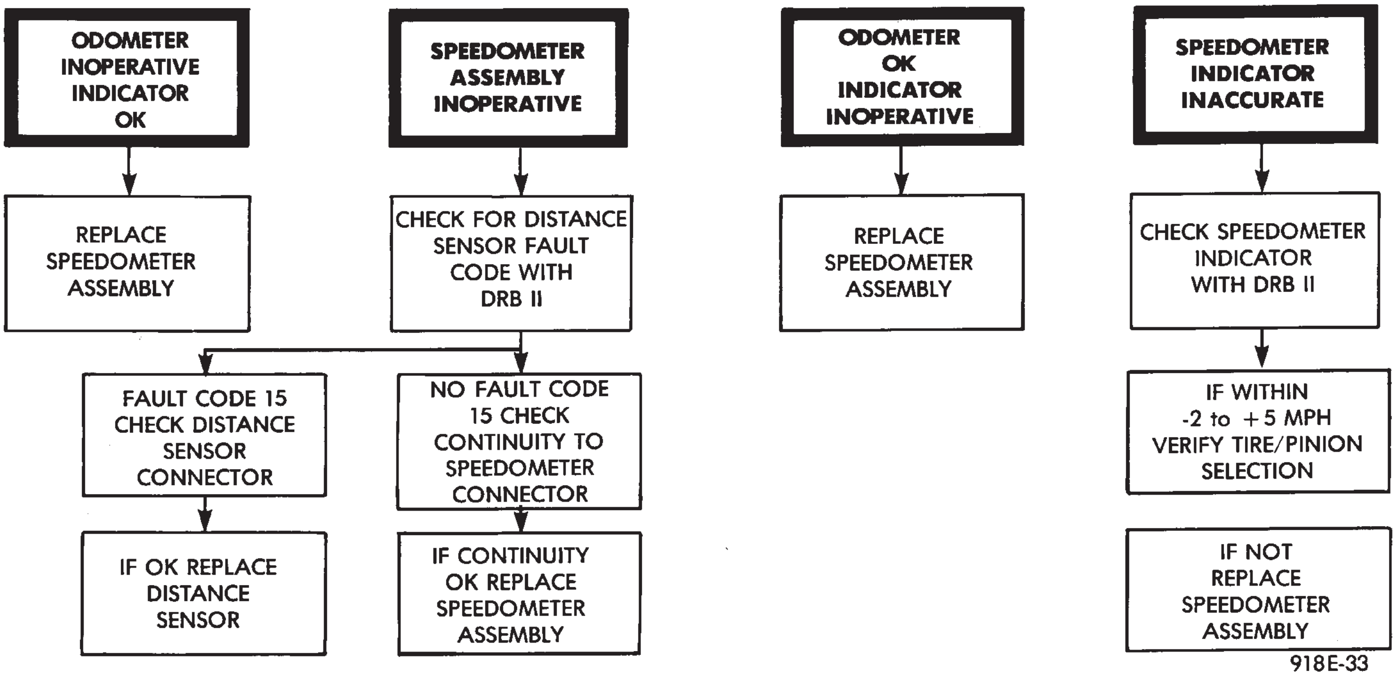


Fig. 17 Speedometer Diagnosis

SPEEDOMETER/ODOMETER ASSEMBLY REMOVAL

(1) Remove switch pod assembly.

(2) Remove cluster, refer to Cluster Removal.

(3) Remove mask and lens assembly.

(4) Remove tachometer, turbo gauge.

(5) Remove volt, temperature, oil and fuel gauge assemblies.

(6) Remove the speedometer/odometer assembly from the cluster housing.

(7) Disconnect pigtail connector from the cluster printed circuit board.

(8) For installation reverse above procedures. Listen for the pigtail connector to snap in place.

SPEEDOMETER CIRCUIT TESTING

(1) Using DRB II, check vehicle speed sensor for speed sensor fault code and for proper speed indication. Refer to Powertrain Diagnostics Procedure Manual; Speed Control Test (Fig. 18).

(2) Remove cluster, but do not disconnect cluster wiring.

(3) With ignition ON check for battery voltage across the ignition pin and ground pin of speedometer connector.

(4) Check for continuity from vehicle speed sensor signal pin to connector at speed sensor.

(5) Check cluster to body for continuity to ground.

(6) If all these tests prove good, replace speedometer.

VEHICLE SPEED SENSOR REPLACEMENT

(1) Remove harness connector from sensor and make sure weather seal is on harness connector.

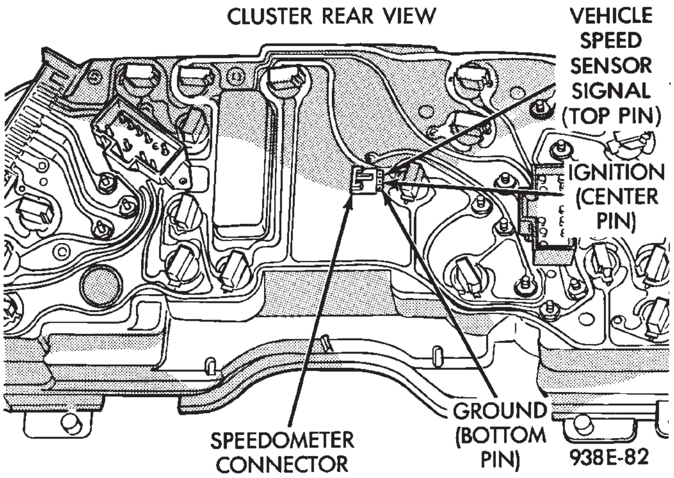


Fig. 18 Speedometer

(2) Remove sensor retaining bolt (Fig. 19).

(3) Pull sensor and pinion gear assembly out of transaxle. If necessary carefully pry loose with a flat blade screwdriver (Fig. 20).

(4) Remove pinion gear from sensor.

(5) For installation reverse above procedures. Seat the sensor assembly by hand to ensure proper gear engagement. Tighten retaining bolt to 7 N•m (60 in. lbs.) torque.

ELECTRONIC AUTOMATIC TRANSAXLE VEHICLE SPEED SENSOR REPLACEMENT

The output vehicle speed sensor is located to the left of the manual shift lever.

(1) Raise and support vehicle on safety stands.

(2) Remove vehicle speed sensor (Fig. 21).

(3) For installation, reverse above procedures.

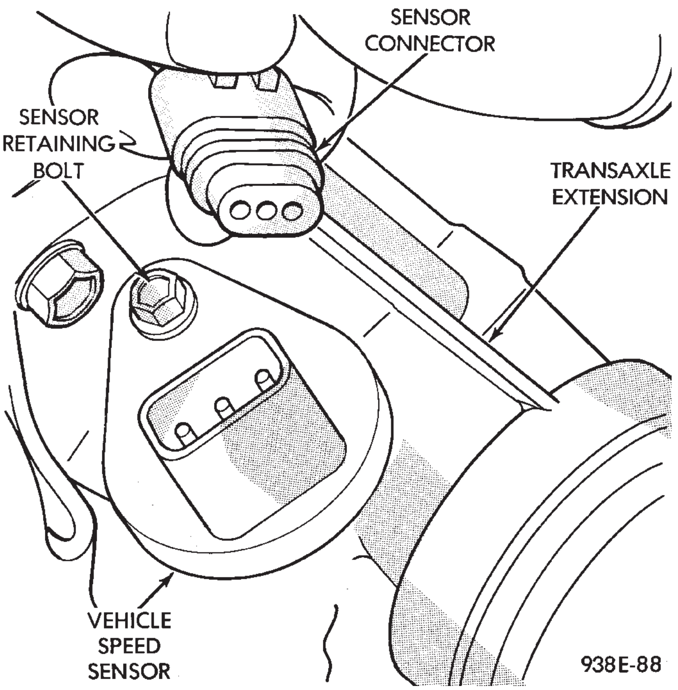


Fig. 19 Vehicle Speed Sensor and Connector

VEHICLE SPEED SENSOR TEST

For testing of the vehicle speed sensor and related components using DRB II, refer to the appropriate Powertrain Diagnostics Test Procedure Manual.

TACHOMETER DRIVE MODULE REMOVAL

(1) Remove cluster assembly.

(2) Pull tachometer drive module from printed circuit board (Fig. 22).

(3) For installation reverse above procedures. Use care when aligning module to printed circuit board.

PRINTED CIRCUIT BOARD REMOVAL

(1) Remove cluster assembly.

(2) Remove mounting screws securing printed circuit board to cluster housing.

(3) Remove tachometer drive module (Fig. 22).

(4) Twist out all lamp sockets.

(5) For installation reverse above procedures.

CLUSTER LAMPS REMOVAL—MECHANIAL CLUSTER ONLY

(1) Remove cluster assembly (Fig. 23).

(2) Remove one piece integral lamp and socket from rear of cluster.

ELECTRONIC CLUSTER

Refer to Body Diagnostic Procedures Manual when using DRB II.

SELF DIAGNOSTIC SYSTEM

The electronic clusters have an internal diagnostic routing to isolate problems within the cluster.

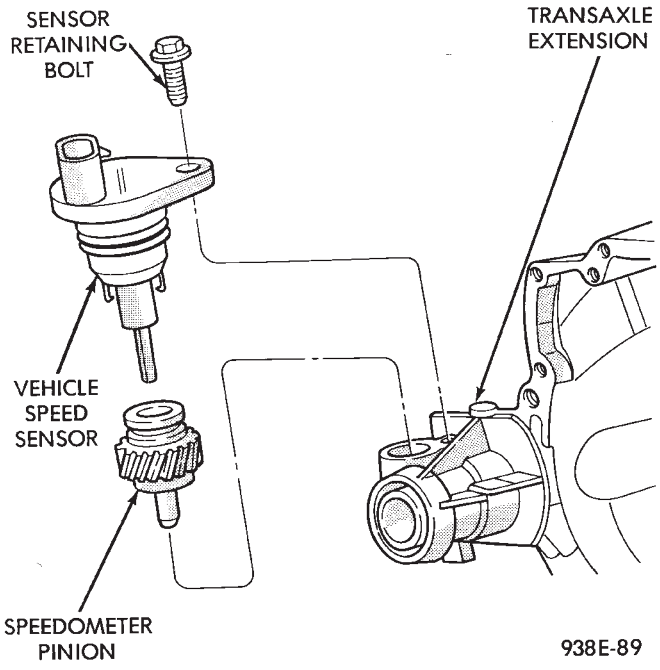


Fig. 20 Vehicle Speed Sensor and Speedometer Pinion

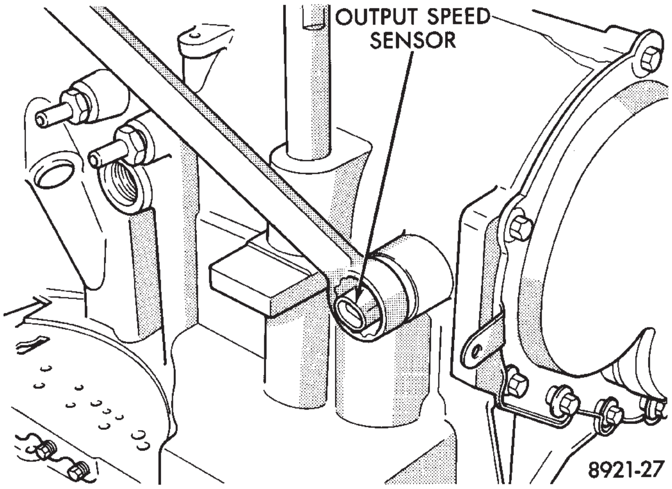


Fig. 21 Vehicle Speed Sensor Removal

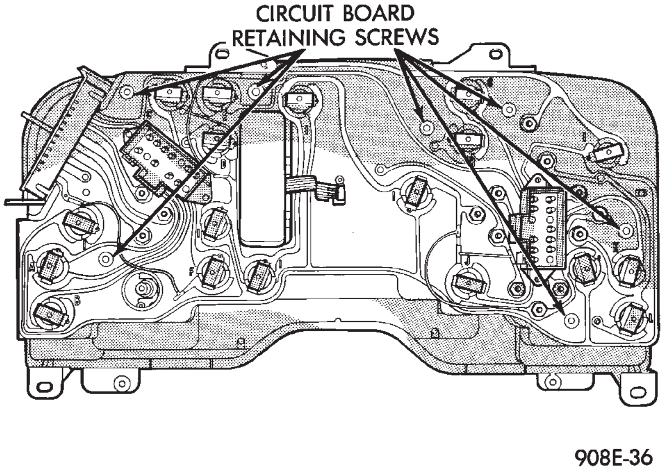


Fig. 22 Cluster Printed Circuit Board

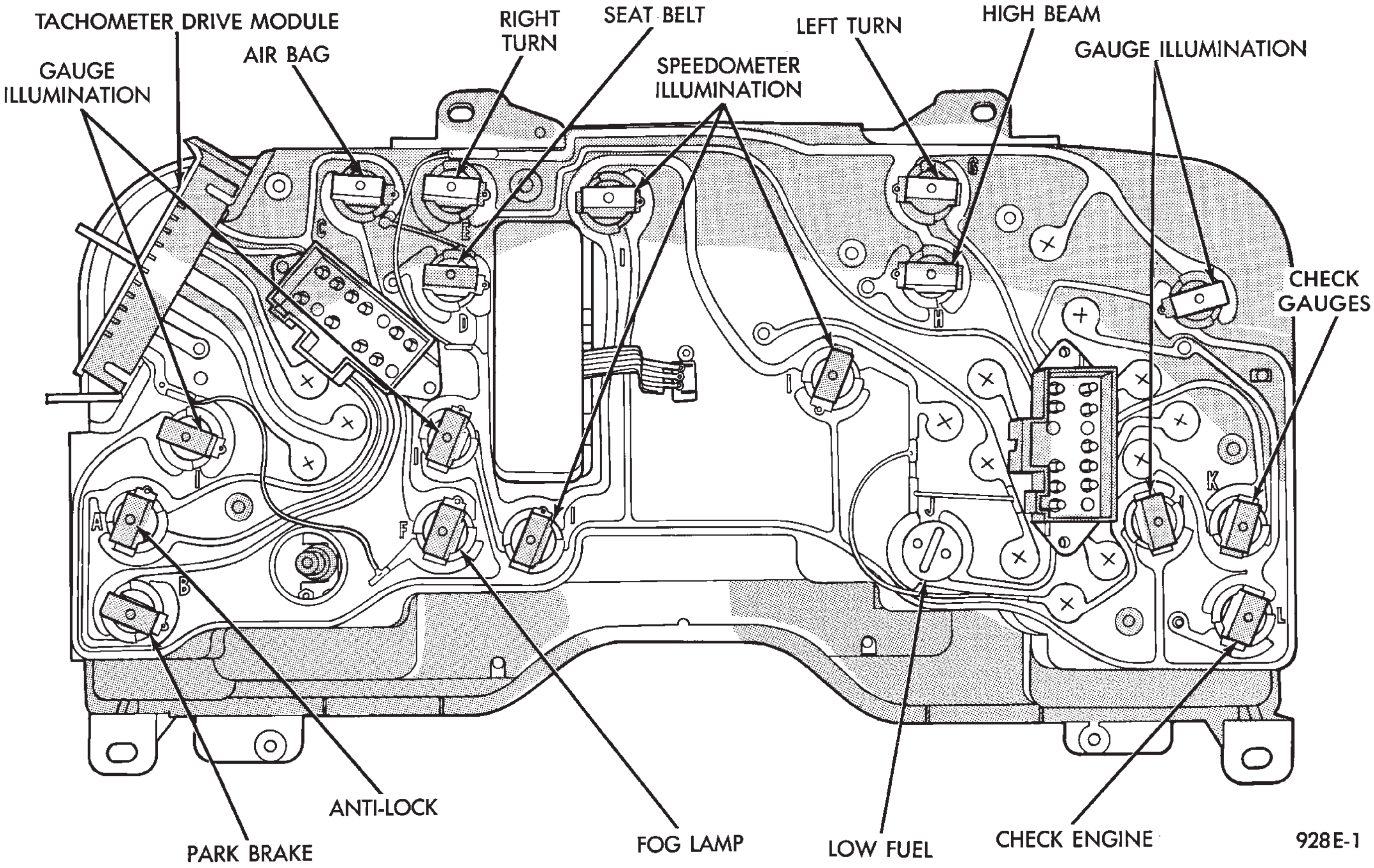


Fig. 23 Mechanical Cluster Lamp Location

Perform cluster Self Diagnostic Test to determine whether problem is within cluster or outside of cluster.

Refer to Fig. 24 and 25.

Successful completion of the SELF DIAGNOSTIC TEST indicates that the problem is in the wiring, connectors or sensors out side of the cluster.

CLUSTER ASSEMBLY REMOVAL

The electronic cluster which is serviced as an assembly is removed with the same procedure as the conventional cluster.

CONDITION: CLUSTER DISPLAYS DO NOT ILLUMINATE AFTER VEHICLE IS STARTED

(1) Check fuses and verify battery and ignition voltage at cluster connector.

(2) Check ground from cluster connector to instrument panel ground stud.

SWITCH AND PANEL COMPONENT SERVICE

HEADLAMP SWITCH

The headlamp switch is located on the left side of the switch pod. The switch controls the headlamps, parking lamps, fog lamps and instrument light dimming. If any of the switches require replacement the entire headlamp switch assembly must be replaced (Fig. 26 and 27).

REMOVAL

(1) Remove switch pod assembly from the instrument panel. DO NOT attempt to remove instrument cluster dimmer switch or wiper delay switch knob, they are not removable.

(2) Remove turn signal switch lever by pulling straight out of switch pod.

(3) Remove screws from bottom of switch pod.

(4) Separate inner and outer switch pod halves and remove turn signal switch to gain access to screw.

(5) Remove five inner switch pod panel screws and 3 screws from underneath the switch pod. Separate the inner bezel from the outer bezel.

(6) Remove switch mounting screws before disconnecting linkage.

(7) Disconnect switch linkage from buttons. Pull the linkage straight up from the switch/button to disengage it and remove switch.

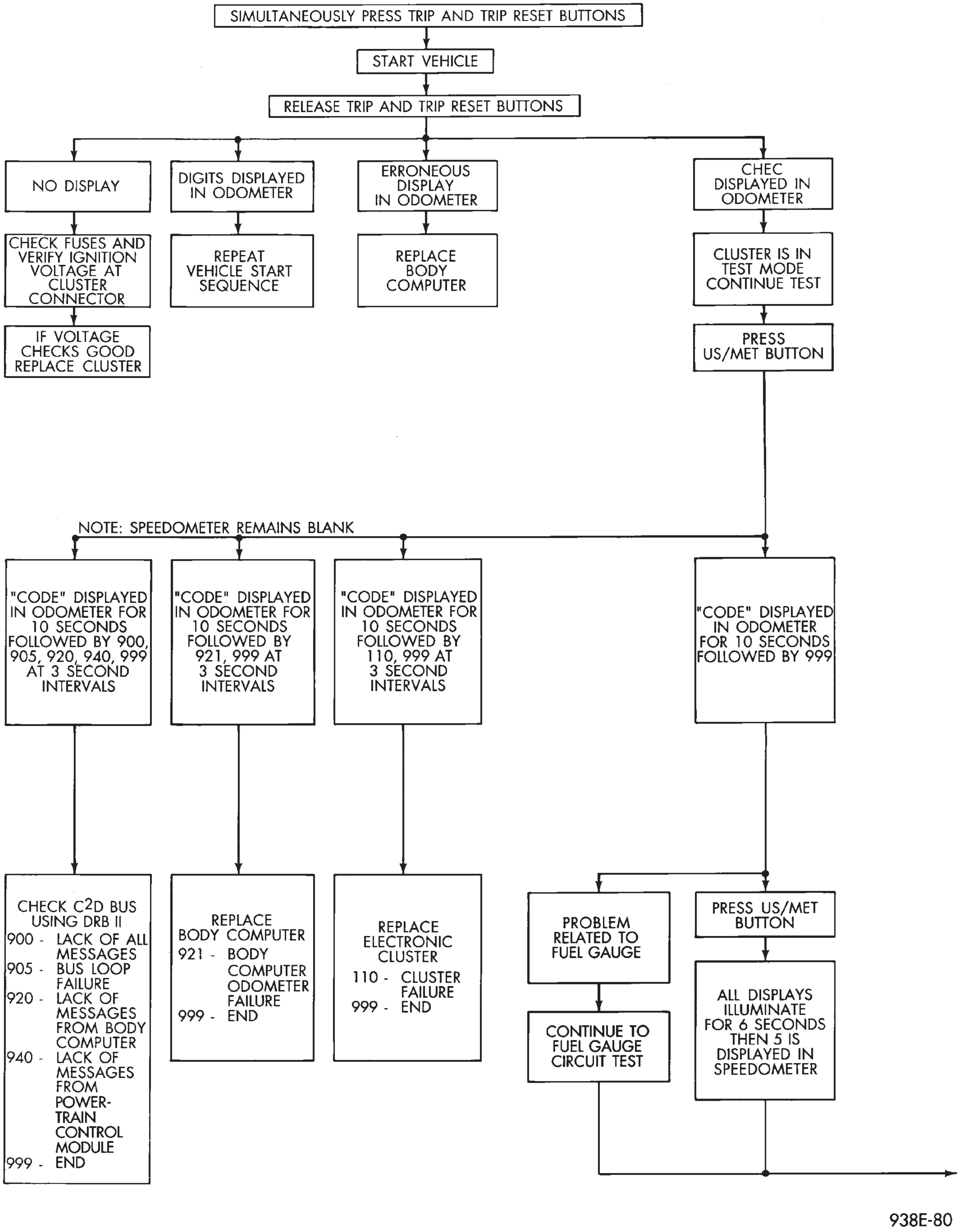
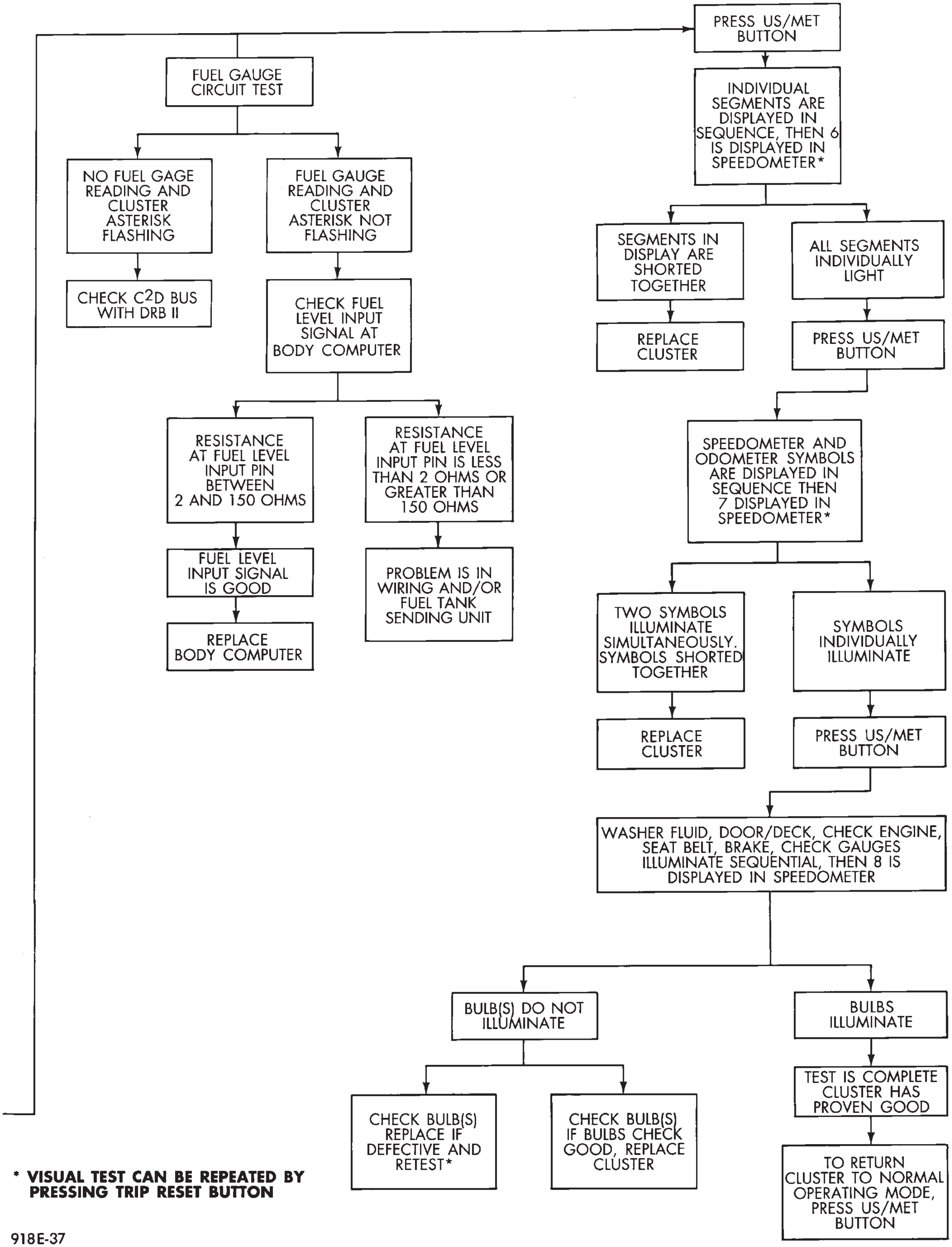


Fig. 24 Electronic Cluster Self-Diagnostic Test



*** VISUAL TEST CAN BE REPEATED BY PRESSING TRIP RESET BUTTON**

918E-37

Fig. 25 Electronic Cluster Self-Diagnostic Test—Continued

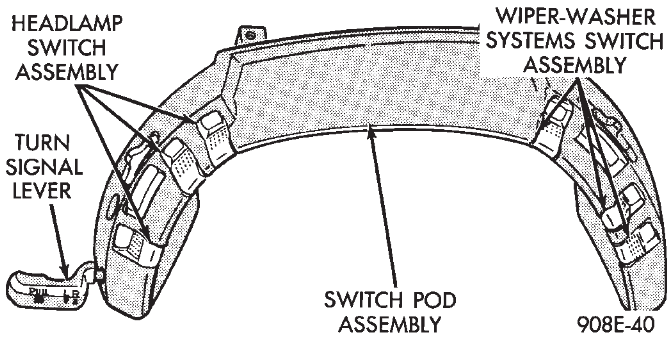


Fig. 26 Switch Pod Assembly

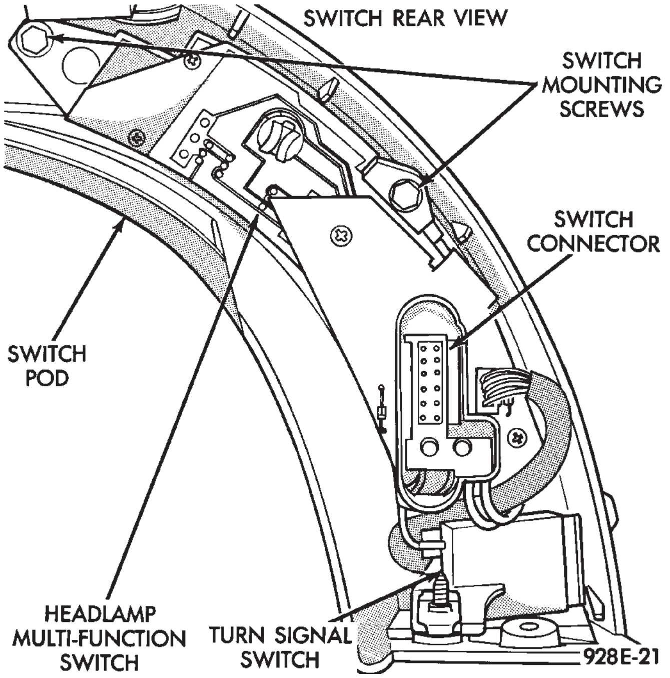


Fig. 27 Headlamp Multi-Function Switch

INSTALLATION

(1) Latch switch linkage in the up position.

(2) Insert dimmer shaft into dimmer knob while aligning switch in to switch pod assembly.

(3) Install switch attaching screws.

(4) Unlatch linkage and install onto push buttons.

(5) Operate all switch modes for correct operation.

(6) Install turn signal switch.

(7) Reconnect wiring for turn signal switch, making sure wire is properly clipped into position.

(8) Place together the inner and outer bezels. Install five inner switch pod panel screws and three screws from underneath the switch pod.

(9) Install turn signal lever by pushing straight into switch assembly.

(10) Install switch pod assembly.

LOWER STEERING COLUMN COVER REMOVAL

(1) Remove screws along top edge of cover.

(2) Remove screw at each lower corner of cover.

(3) Remove cover from underneath over column cover.

(4) For installation reverse above procedures.

GLOVEBOX MODULE REMOVAL

(1) Disconnect battery negative cable and isolate or remove fuse #26 prior to removing switch or wires may short to ground.

(2) Remove cowl side trim panel.

(3) Remove screws at right end of glovebox and lower corners.

(4) Open glovebox, remove light and disconnect wiring.

(5) Remove five screws along top of glovebox frame and screw at each lower corner.

(6) Remove glovebox assembly.

(7) For installation reverse above procedures.

CONCEALED HEADLAMP MODULE REMOVAL

(1) Remove left under panel silencer.

(2) Slide module off bayonet bracket while disengaging spring retainer.

(3) Disconnect wiring terminal.

(4) For installation reverse above procedures.

HOOD RELEASE REMOVE

(1) Remove lower column cover.

(2) Remove screws on fuse block and move aside.

(3) Remove screws on hood release assembly to remove.

(4) For installation reverse above procedures.

AIR CONDITIONING CONTROL REMOVE

(1) Remove center stack bezel.

(2) Remove two control mounting screws (Fig. 28 and 29).

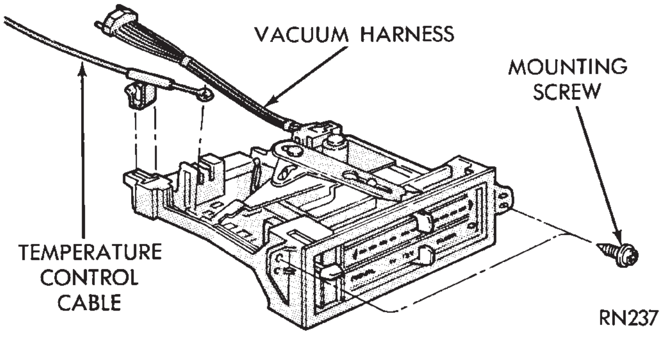


Fig. 28 A/C Control

(3) Slide control rearward, disconnect cable, vacuum harness, and electrical wiring. With automatic temperature control, disconnect wiring connector; being careful not to break off locking tab.

(4) For installation reverse above procedures.

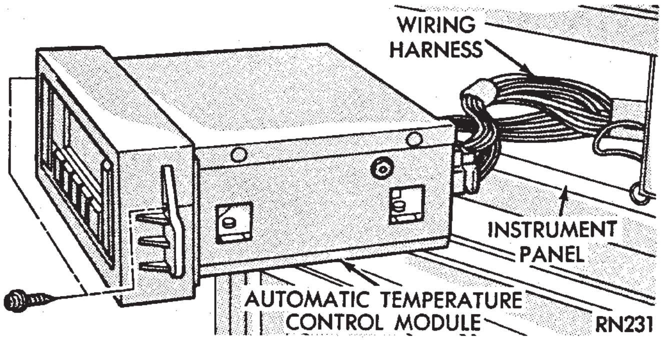


Fig. 29 Automatic Temperature Control

AUTOMATIC TEMPERATURE CONTROL LAMP REMOVAL

(1) Remove automatic temperature control from instrument panel.

(2) Remove top cover screw and unsnap cover from control (Fig. 30).

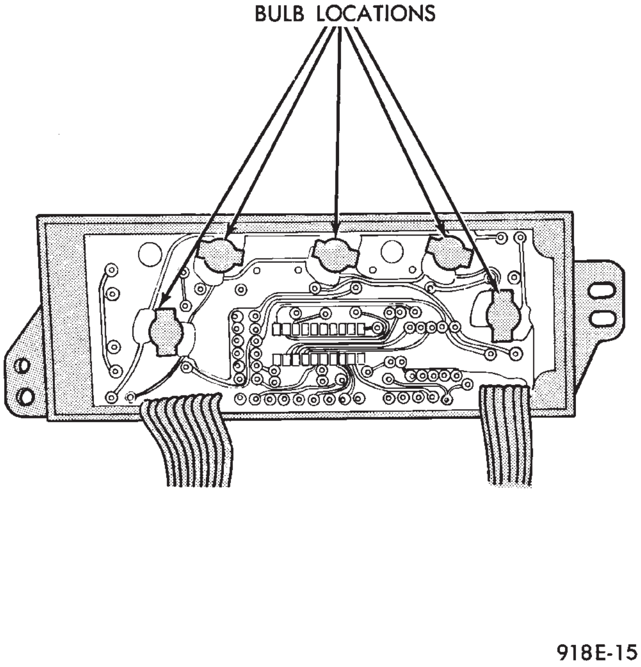


Fig. 30 Automatic Temperature Control Lamp

(3) Remove four screws that connect computer housing to the button housing.

(4) Unsnap the button housing from the computer housing.

(5) Remove lamps by turning in a counter clockwise direction and install lamps by turning in a clockwise direction.

(6) For installation reverse above procedures. When finish perform ATC system function test.

GLOVE BOX LAMP AND SWITCH REMOVAL

(1) Disconnect battery negative cable and isolate or remove fuse #26 prior to removing switch or wires may short to ground.

(2) Open glove box door.

(3) Remove lamp and test. If bad replace lamp. If OK proceed to step 3.

(4) Carefully pry switch from its mounting surface with tip of a small pry bar.

(5) Remove switch from glove box and disconnect electrical leads and test for battery voltage and ground.

(6) If OK test switch for continuity. If bad replace switch.

(7) For installation reverse above procedures.

ENGINE COMPARTMENT NODE

The Engine Compartment Node is a microcomputer controlled unit which informs the EVIC overhead console via the CCD bus of outside temperature, compass direction and the following warning messages:

- Brake Fluid
- Low Coolant Level
- Low Engine Oil Level

The Engine Compartment Node is located behind the front bumper reinforcement.

For complete diagnostic procedures for the Engine Compartment Node, refer to the AG and AJ Body Diagnostic Procedures Manual.

TRAVELER/EVIC REMOVAL

To test Traveler/EVIC, refer to AG, AJ Body Diagnostic Procedure.

(1) Remove cluster stack bezel.

(2) Remove three screws and disconnect wiring connector.

(3) For installation reverse above procedures.

BEZEL WITH/WITHOUT MESSAGE CENTER REMOVAL

(1) Use a straight edge tool to pry out one end of the message center and continue to disengage six clips along the length of the message center.

(2) Remove the message center and disconnect the wiring.

(3) For installation reverse the above procedures.

CONSOLE SWITCH PLATE/CUBBY BOX REMOVAL

(1) Pry up edge of switch plate or cubby box.

(2) Disconnect wiring terminal to switch plate if so equipped.

(3) For installation reverse above procedures.

CIGAR LIGHTER REMOVAL

(1) Remove center bezel.

(2) Remove two center console attaching screws.

(3) Remove ash receptacle/cup holder.

(4) Remove two screws underneath ash receptacle/cup holder.

(5) Remove ash receiver/bezel.

(6) Disconnect wiring connectors from lighter receptacle.

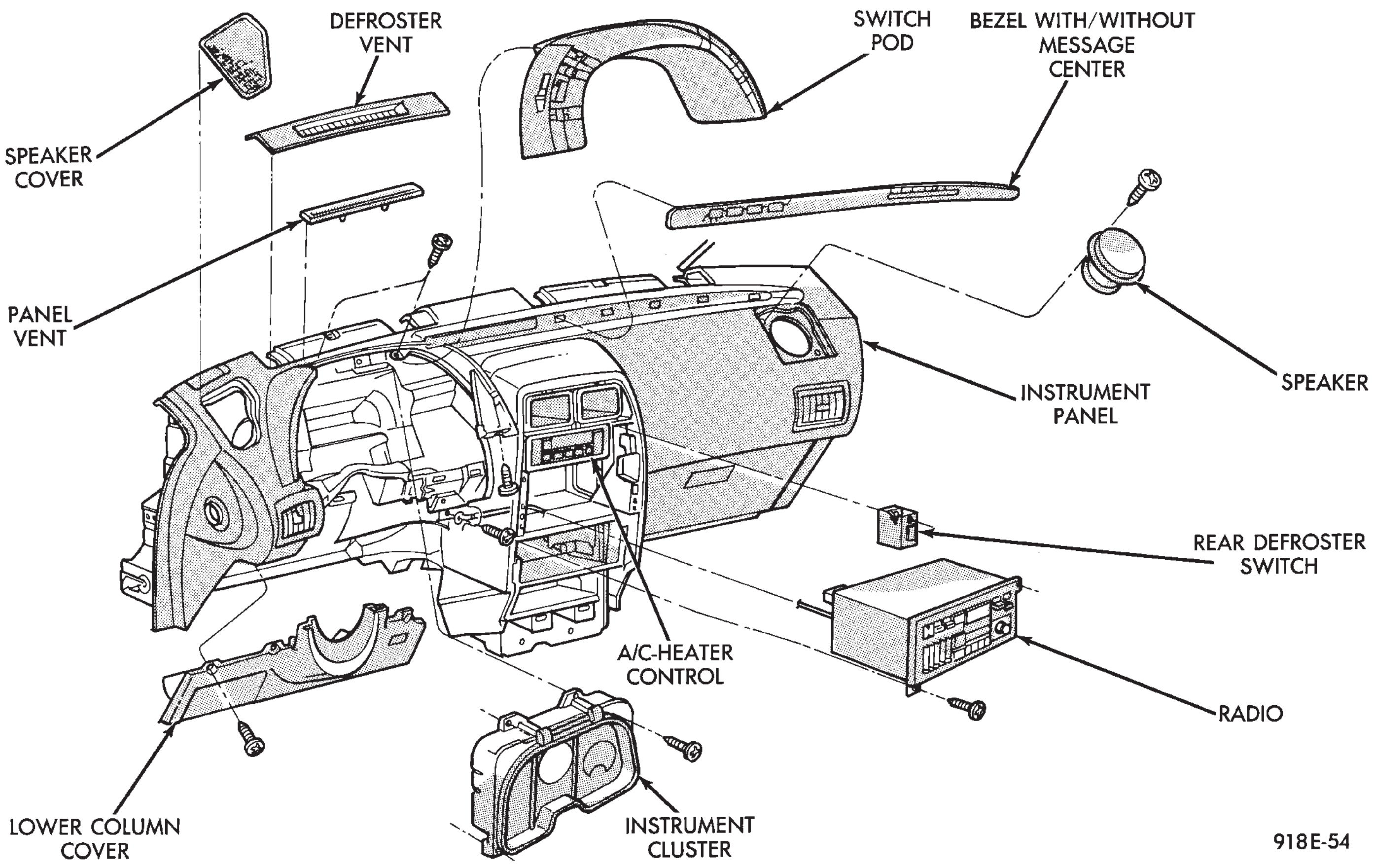


Fig. 31 Instrument Panel Components

(7) Unscrew lighter receptacle shell from element and remove.

(8) For installation reverse above procedures.

INSTRUMENT PANEL ROLL DOWN PROCEDURE

CAUTION: Disconnect negative battery cable, in engine compartment, before servicing instrument panel.

(1) Remove instrument panel center bezel (Fig. 31).

(2) Remove upper and lower steering column covers.

(3) Remove the left under panel silencer.

(4) Set parking brake.

(5) Remove console side carpet panels (Fig. 32).

(6) Remove console, refer to Group 23, Body.

(7) Remove transmission range clip and cable loop end from post on gear shifter (Fig. 33 and 34).

(8) Remove adjuster from tab on gear shifter bracket. By pushing in locking knob on adjuster, and sliding the adjuster off the tab on the gear shifter bracket.

(a) For installation: insert transmission range cable into adjuster and line up with the end of the adjuster.

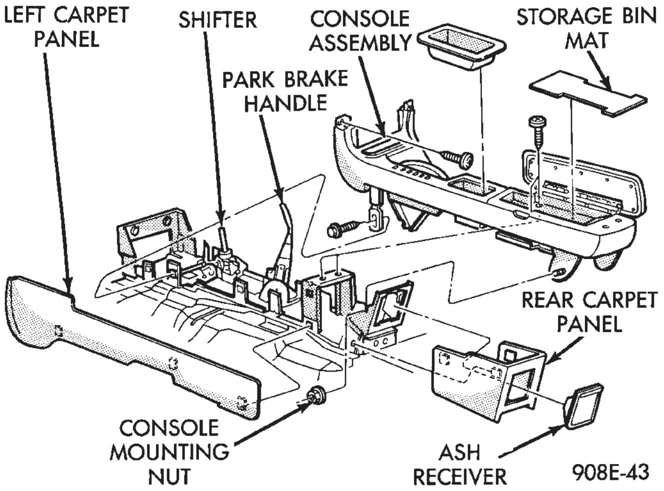


Fig. 32 Center Console

(b) The transmission range indicator must be adjusted with the gear shifter in low position.

(c) Check the gear selector indicator for proper alignment.

(d) Attach transmission range clip to the adjuster to secure cable.

(9) Remove two screws and slide Air Bag Diagnostic Module out of right side of instrument panel center stack area, then disconnect wiring.

(10) Remove screw from instrument panel dimmer module at left of steering column and lower module.

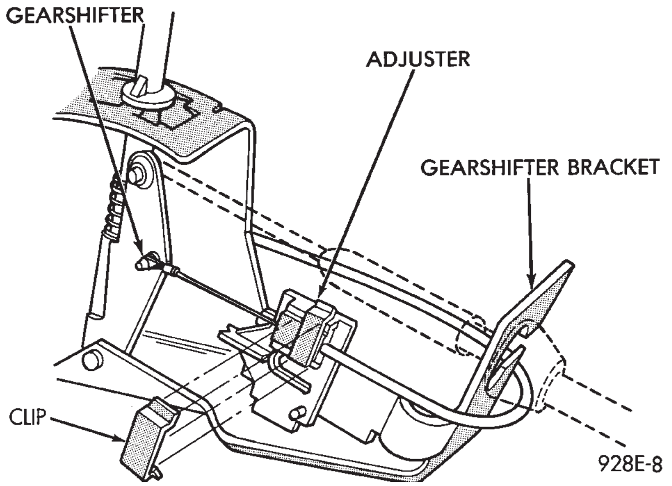


Fig. 33 Transmission Range Cable

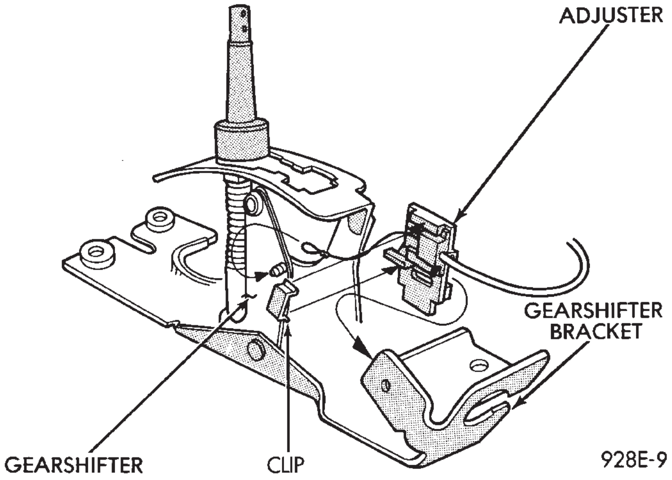


Fig. 34 Cable Adjustment

(11) Remove two screws from fuse block and lower fuse block.

(12) Remove three screws from hood release and lower hood release handle.

(13) Remove flasher relay from bracket on center distribution duct.

(14) Remove screw from ATC sensor motor assembly and unhook from bracket if equipped.

(15) Remove the radio ground screw above flasher relay mount.

(16) Remove center distribution duct screw from left instrument panel lower brace, then remove four screws to remove left lower brace.

(17) Remove five nuts on steering column and drop column, then remove two upper column attaching studs.

(18) Remove two screws and pull out compact disc player or cubby box, disconnect Co-Axial cable from compact disc player.

(19) Remove Electronic Vehicle Information Center (E.V.I.C.) or Traveler from vehicle.

(20) Remove radio.

(21) Remove A.T.C., A/C or heater controls.

(22) Squeeze latches on side of Rear Window defogger switch and remove.

(23) Snap off cluster lower trim bezel, switch pod vent grille, speaker grilles and defroster grilles.

(24) Remove switch pod assembly.

(25) Remove cluster assembly.

(26) Remove dash speakers.

(27) Snap out bezel with or without message center and disconnect wiring.

(28) Open glovebox door, squeeze sides and roll glovebox completely open. Remove glovebox light switch, and disconnect wires.

(29) Loosen right cowl side pivot bolt through glovebox opening then close glovebox.

(30) Loosen left cowl side pivot.

(31) Remove four screw attachments at top of instrument panel and roll panel out.

(32) Pull wiring, antenna cable, A/C cable and vacuum lines out of instrument panel. Disconnect demister hose and remove instrument panel with ducts attached.

(33) Transfer ducts and brackets onto new panel.

(34) For instrument panel roll up, reverse above procedures.

INTERIOR LAMP REMOVAL

The Dome, Floor Console and Door Lamps operate when the doors are open or headlamp switch is placed in courtesy position.

DOME LAMP

(1) Pry either the forward or rearward edge of the dome lamp to free it from retaining bracket.

(2) Pry either the forward or rearward edge of the lens away from the bezel and replace lamp.

(3) For installation reverse above procedures.

FRONT HEADER READING LAMP

Pull lamp from headliner. Disconnect wiring and replace lamp.

FLOOR CONSOLE LAMP

Pry along top edge of lamp and pivot lamp out of floor console, the lens does not remove. Remove lamp and twist out lamp socket. Replace lamp.

DOOR LAMPS

Pry along bottom edge of lamp and pivot lamp out of door trim panel, the lens does not remove. Remove lamp and twist out lamp socket. Replace lamp.

DOOR REFLECTORS

Pry reflector away from the door trim panel, and replace.

TRUNK LAMP

Remove lens by prying lens out of trunk trim panel and replace bulb.

AP BODY

INDEX

GENERAL INFORMATION

INSTRUMENT CLUSTER

There are two conventional instrument cluster assemblies available. The clusters incorporates magnetic type gauges and an electronically driven speedometer and odometer assembly (Fig. 1 and 2).

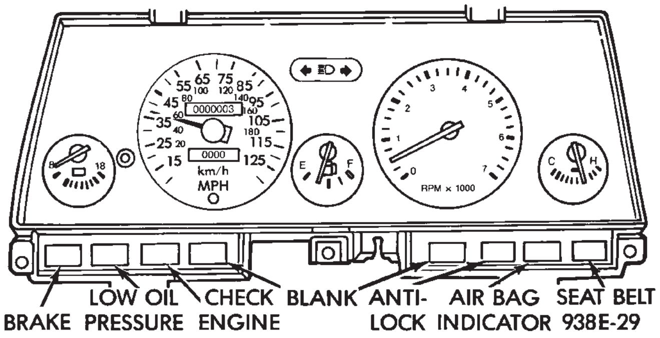


Fig. 1 Instrument Cluster With Tachometer

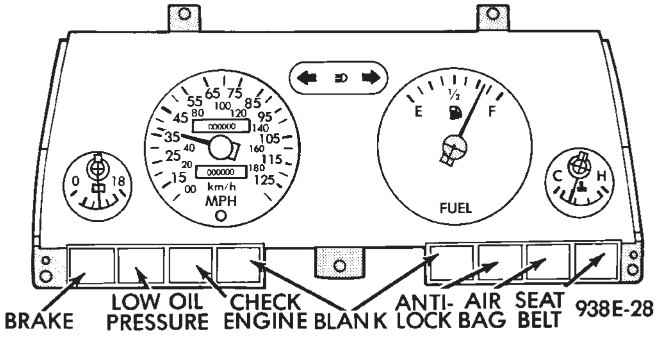


Fig. 2 Instrument Cluster Without Tachometer

MAGNETIC GAUGES

All gauges on the AP Body clusters are the magnetic type gauges. When the ignition switch is in the OFF position each gauge, except for the voltmeter and tachometer will show a reading. However, the readings are only accurate when the ignition switch is in the ON position.

TACHOMETER DRIVE MODULE

The tachometer drive module is an electronic module used to drive the magnetic tachometer in the high line cluster.

This module is located on top of the instrument cluster.

ELECTRONIC DIGITAL CLOCK

The electronic digital clock is in the radio. The clock and radio each use the display panel built into the radio. A digital readout indicates the time in hours and minutes whenever the ignition switch is in the ON or ACC position.

When the ignition switch is in the OFF position, or when the radio frequency is being displayed, time keeping is accurately maintained.

The procedure for setting the clock varies slightly with each radio. The correct procedure is described under the individual radio operating instructions refer to the Sound Systems Manual supplied with the vehicle.

WARNING LAMPS AND INDICATOR LIGHTS

The instrument cluster has warning and indicators lamps for eight different systems:

- Low oil pressure
- Brake warning
- Seat belt warning
- Malfunction indicator (check engine) lamp
- Air Bag
- High beam indicator
- Right and left turn signals.
- Anti-lock (ABS)

CLUSTER AND GAUGE SERVICE AND TESTING

CAUTION: Disconnect the negative battery cable before servicing the instrument panel. When power is required for test purposes, reconnect battery cable for test only. Disconnect the negative battery cable after test and before continuing service procedures.

SENDING UNIT TEST

Check for a defective sending unit or wiring, when a problem occurs with a cluster gauge. Do this before disassembling the cluster.

(1) Sending units and wiring can be checked by grounding the connector leads, at the sending unit, in the vehicle.

(2) With the ignition in the ON position, a grounded input will cause the fuel or temperature gauge to read at or above maximum.

FUEL TANK SENDING UNIT TEST

Refer to Group 14, Fuel for test procedures.

LOW OIL PRESSURE WARNING LAMP TEST

The low oil pressure warning lamp will illuminate when the ignition key is turned to the ON position without engine running. The lamp also illuminates should the engine oil pressure drop below a safe oil pressure level.

To test the system turn ignition key to the ON position. If the lamp fails to light, inspect for a broken or disconnected wire at the oil pressure combination unit, located at the front of the engine (Fig. 3). If the wire at the connector checks good, pull connector loose from the switch and with a jumper wire ground connector to the engine. With the ignition key turned to the ON position check the warning lamp. If lamp still fails to light, inspect for a burned out lamp or disconnected socket in the cluster.

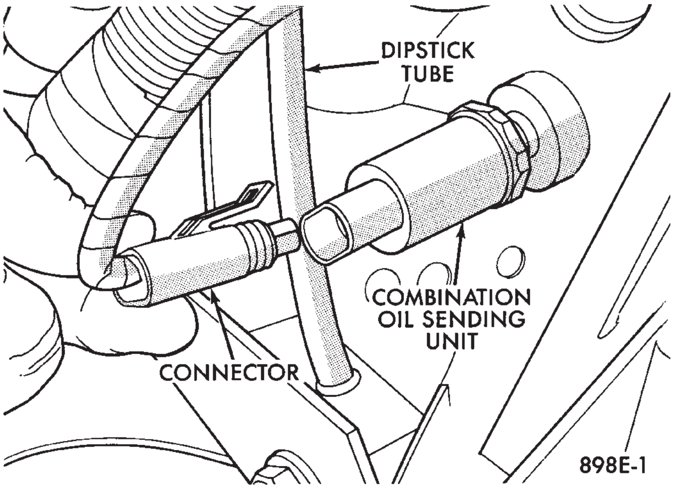


Fig. 3 Combination Oil Sending Unit

COMBINATION OIL SENDING UNIT TEST

The combination oil sending unit has two functions:

(1) The normal closed circuit keeps the oil pressure warning lamp on until there is oil pressure (Fig. 4).

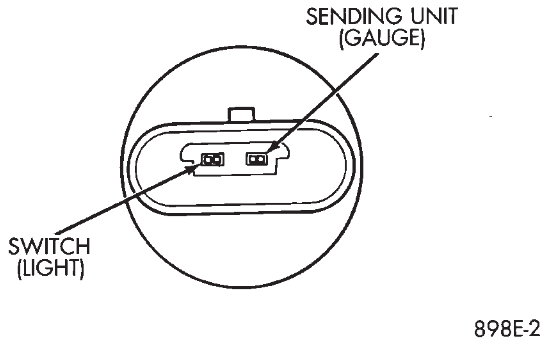


Fig. 4 Combination Oil Sending Unit Test

(2) The sending unit provides a resistance that varies with oil pressure.

To test the normally closed oil lamp circuit, disconnect the locking connector and measure the resistance between the switch terminal and the metal housing. The ohmmeter should read continuity. Start the engine.

If there is oil pressure, the ohmmeter should read an open circuit.

To test the sending unit, measure the resistance between the sending unit terminal and the metal housing. The ohmmeter should no continuity. Start the engine.

The ohmmeter should read between 30 to 55 ohms, depending on engine speed, oil temperature and oil viscosity.

If the above results are not obtained, replace the sending unit.

SEAT BELT WARNING SYSTEM

For testing of this system refer to Group 8M, Restraint Systems.

AIR BAG WARNING SYSTEM

For testing of this system refer to Group 8M, Restraint Systems.

MALFUNCTION INDICATOR (CHECK ENGINE) SYSTEM

For testing of this system using DRB II, refer to the Body Powertrain Diagnostic Procedures.

BRAKE SYSTEM WARNING LAMP TEST

The brake warning lamp illuminates when parking brake is applied with ignition key turned ON. The same lamp will also illuminate should one of the two service brake systems fail when brake pedal is applied. Refer to Brake system warning Lamp Diagnosis (Fig. 5).

To test system turn ignition key ON and apply parking brake. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch. The lamp also lights when the ignition switch is turned to start.

To test service brake warning system, raise vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses brake pedal and observes warning lamp. If lamp fails to light, inspect for a burned out lamp, disconnected socket, a broken or disconnected wire at switch.

If lamp is not burned out and wire continuity is proven, replace brake warning switch in brake line Tee fitting mounted on frame rail in engine compartment below master cylinder (Fig. 6).

CAUTION: If wheel cylinder bleeder was opened check master cylinder fluid level.

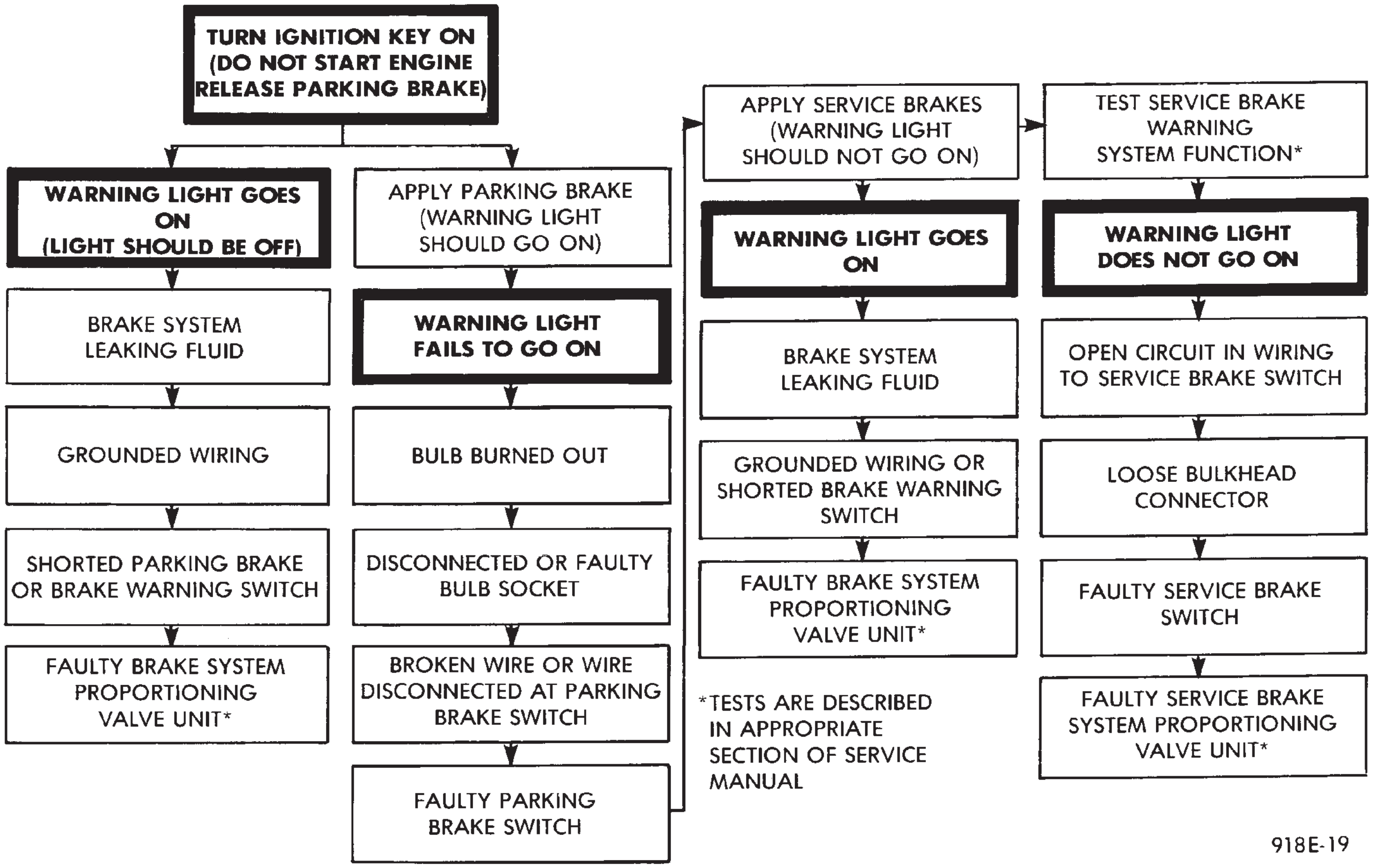


Fig. 5 Brake System Warning Lamp Diagnosis

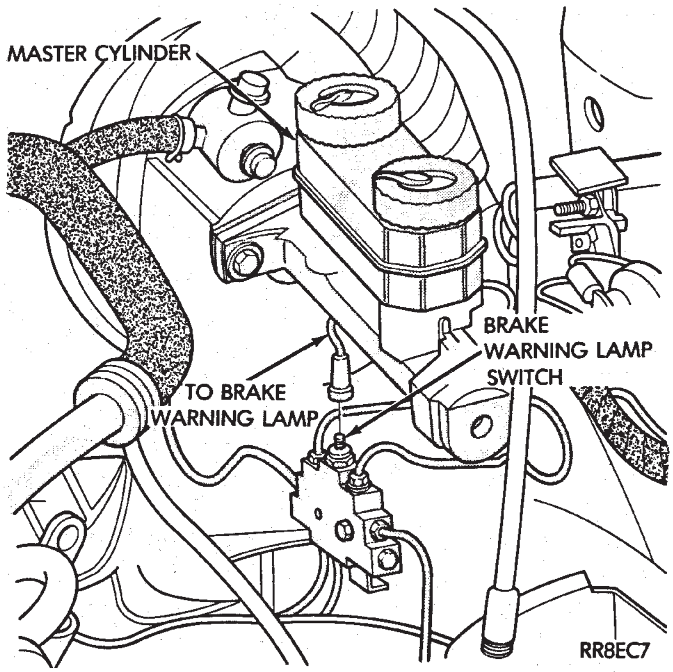


Fig. 6 Brake Warning Lamp Switch

CLUSTER BEZEL REPLACEMENT

(1) Remove four screws holding bezel to instrument panel (Fig. 7).

(2) Remove bezel over steering wheel.

(3) For installation reverse above procedures.

CLUSTER MASK AND LENS

REMOVAL

(1) Remove instrument cluster bezel.

(2) Remove five screws holding mask and lens to cluster.

(3) Remove mask and lens.

(4) For installation reverse above procedures.

CLUSTER ASSEMBLY REPLACEMENT

(1) Disconnect battery to assure no Air Bag System fault codes are stored.

(2) Remove cluster bezel (Fig. 7).

(3) Remove the upper steering column cover.

(4) Remove the four screws attaching cluster housing to the base panel.

(5) Pull cluster rearward, reach behind cluster and disconnect the two wiring harnesses.

(6) Remove cluster assembly.

INSTALLATION

(1) Connect wiring harnesses.

(2) Position cluster and secure to base panel with four screws.

(3) Install upper and lower steering column cover.

(4) Install cluster bezel.

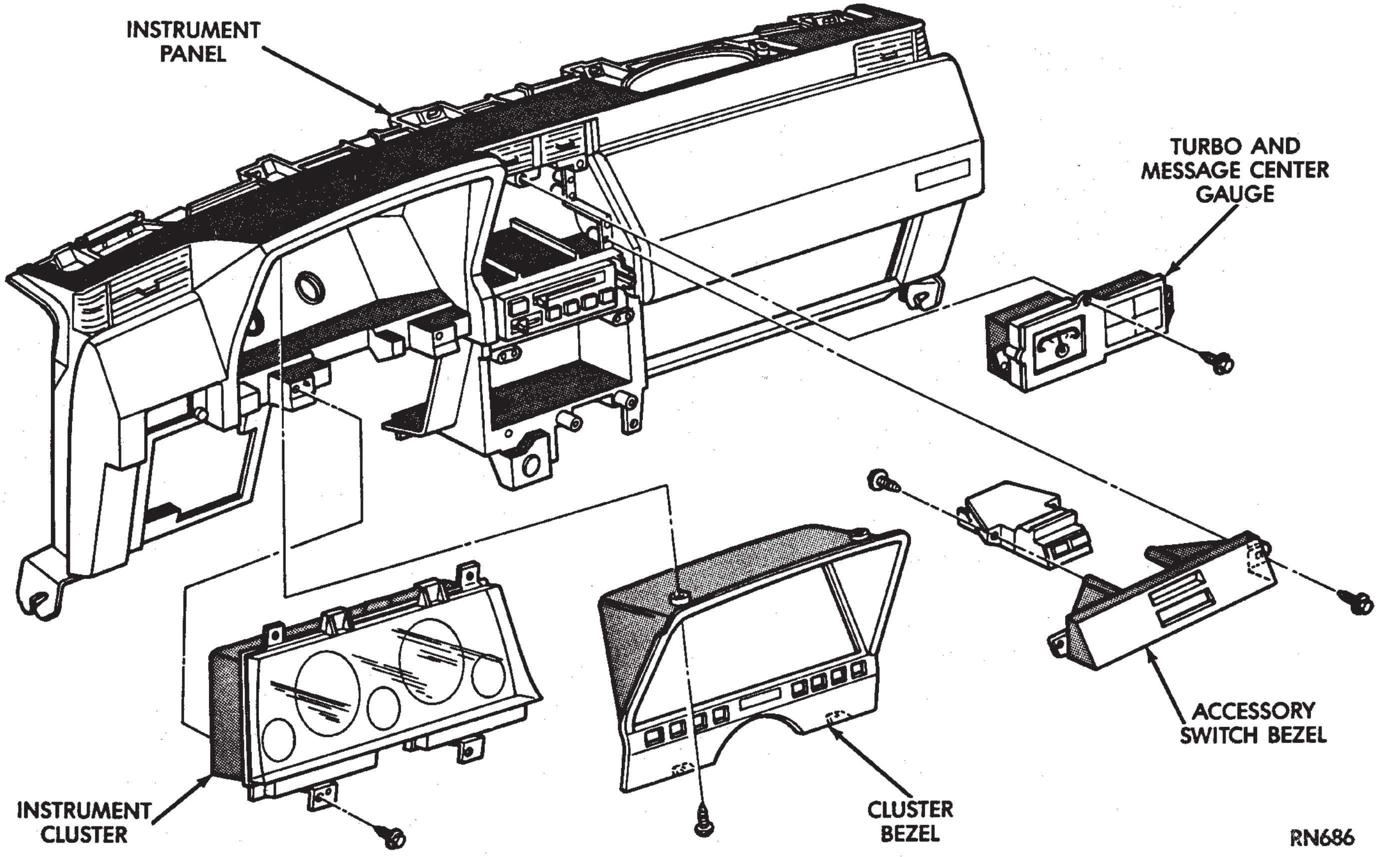


Fig. 7 Upper Instrument Panel Components

(5) Reconnect battery.

GAUGES

CAUTION: During the removal and installation watch overlays are not damage.

It is not necessary to remove instrument cluster from vehicle for gauge replacement.

When removing gauge assemblies from cluster, gauge must be pulled straight out, not twisted, or damage to gauge pins may result.

MULTIPLE GAUGE INOPERATIVE

Volt, speedometer, tachometer and other gauges appear to malfunction. Also check warning indicator lamps:

(1) Remove cluster

(2) Check for ignition voltage at pin E of the red connector. If no voltage, repair as necessary (Fig. 8).

(3) Check for ground continuity between pin C of the gray connector. If no ground, repair as necessary.

(4) If voltage and ground OK and pins or connectors are not distorted, replace printed circuit board.

(5) Install cluster.

SINGLE GAUGE INOPERATIVE (FIG. 9 AND 10)

(1) Remove gauge in question.

(2) With the ignition key ON, check for ignition voltage at ignition pin of gauge. Check for ground at ground pin of gauge.

(a) If no voltage or ground, remove cluster and check pin E red connector for ignition voltage or pin C gray connector for ground (Fig. 8).

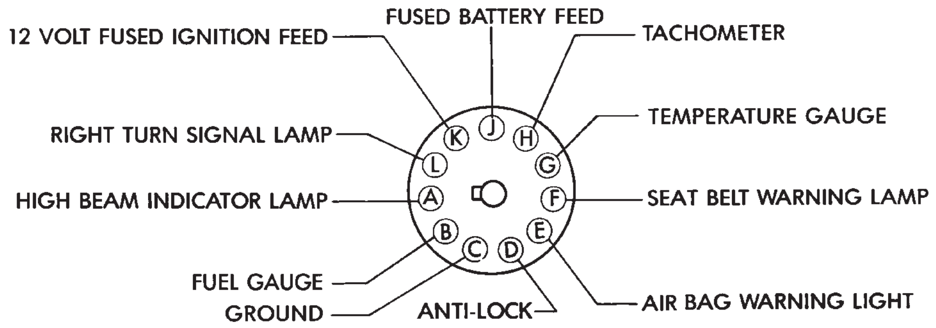
(b) If no voltage or ground, repair as necessary. Refer to 8W, Wiring Diagrams.

(c) If there is voltage or ground, check cluster for distorted terminals. If terminals are OK, replace printed circuit board.

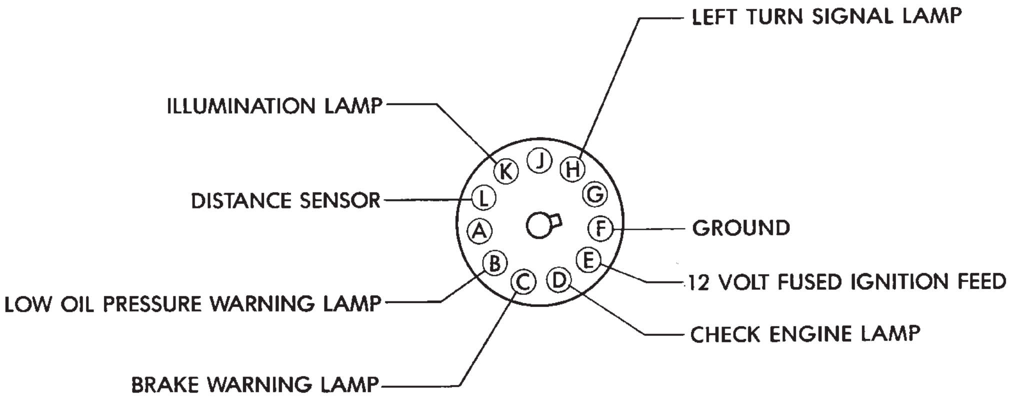
(3) When testing the temperature gauge, allow the engine to run until the vehicle reaches a normal operating temperature. Turn ignition OFF and remove gauge from cluster.

- When checking the temperature and oil pressure gauges, it is important to have the same engine temperature and engine speed when noting gauge position.
- The time between gauge position reading and sending unit measuring should be kept to a minimum.
- When testing oil pressure gauge, engine needs to be running.

(a) Measure and record the resistance between sending unit pin and ground pin of the gauge in question. Refer to Gauge Calibration.



RIGHT PRINTED CIRCUIT BOARD CONNECTOR (GRAY) TERMINAL VIEW



LEFT PRINTED CIRCUIT BOARD CONNECTOR (RED) TERMINAL VIEW

938E-27

Fig. 8 Printed Circuit Board Connector

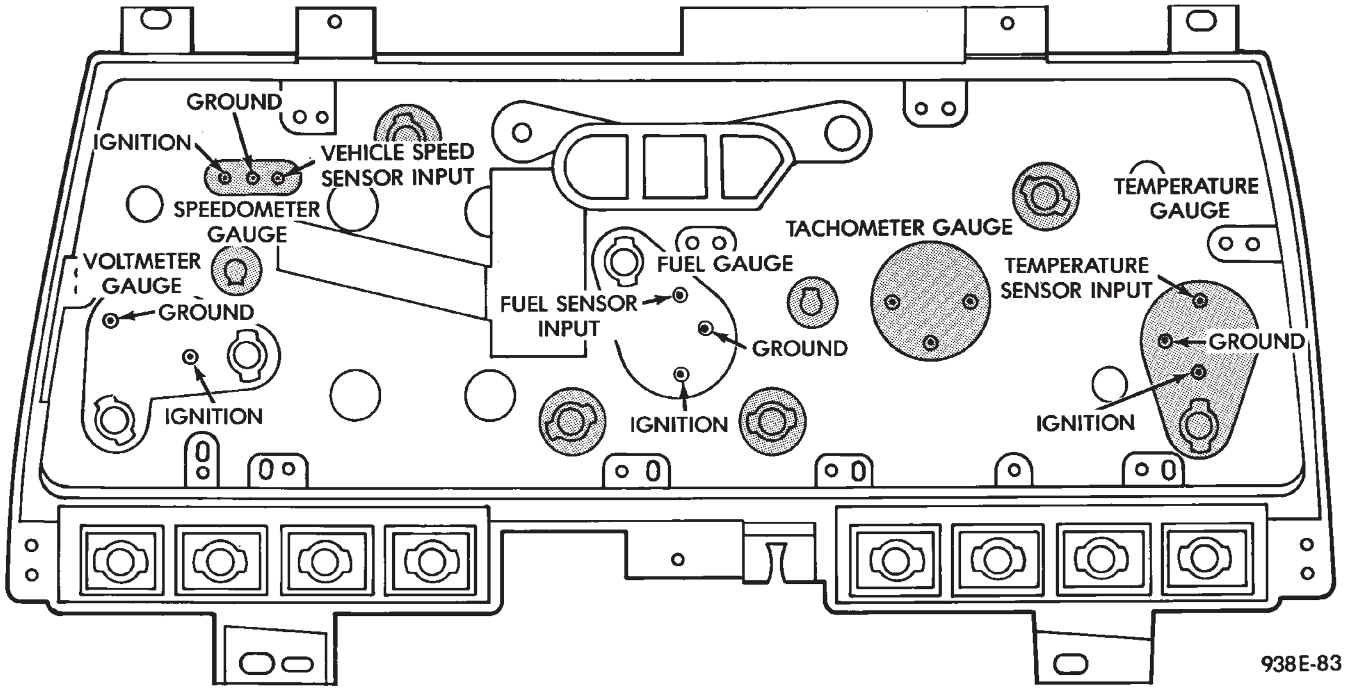


Fig. 9 Instrument Cluster With Tachometer

(b) If resistance and gauge position are not similar, replace gauge.

(c) If OK, test resistance from the sending unit to the cluster connector.

(d) If reading is different from the first resistance measured, check printed circuit board for contact to cluster connector.

(e) If OK and contacts are not distorted, replace printed circuit board.

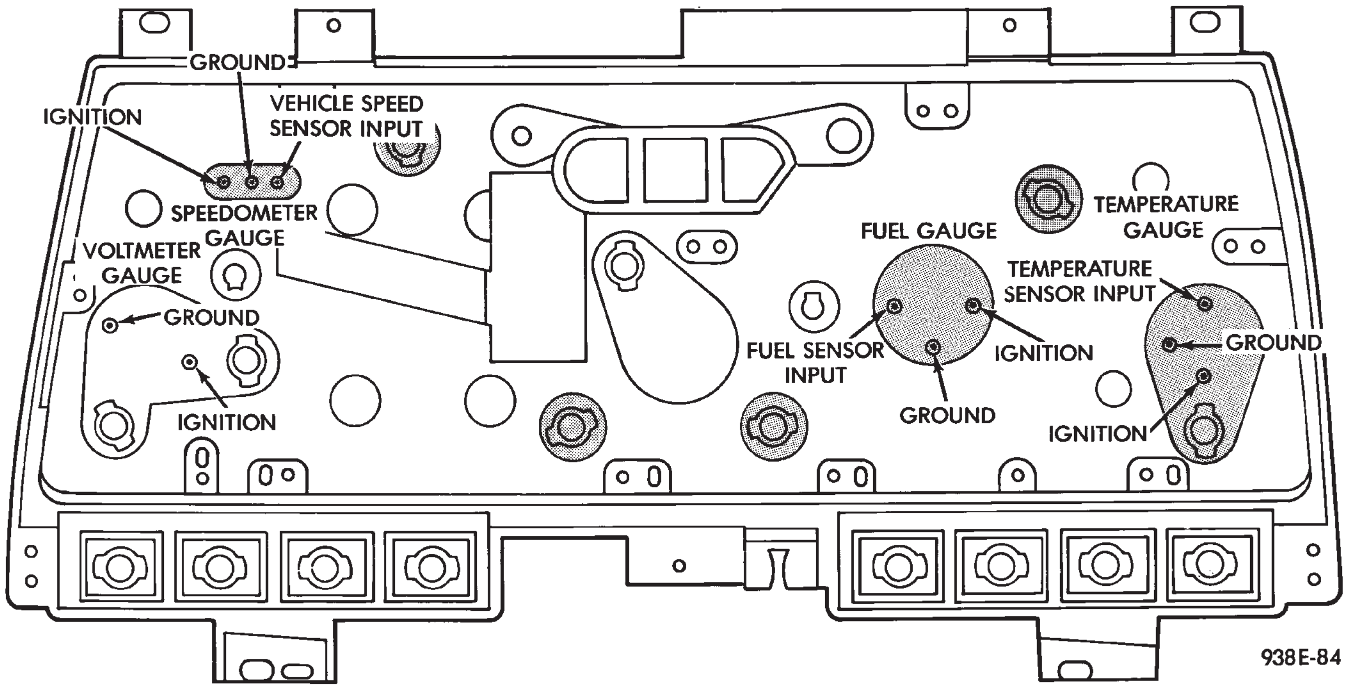


Fig. 10 Instrument Cluster Without Tachometer

(f) If everything checks out OK, refer to Sending Unit Test.

(4) With the ignition switch in the ON position, check for battery voltage across the ignition pin and the ground pin.

(5) If fuel gauge meets specifications check fuel tank and original fuel tank sending unit as follows:

(a) Carefully remove fuel tank sending unit from tank.

(b) Refer to sending unit removal Group 14, Fuel.

(c) Connect sending unit wire and jumper wire as described in the test procedure.

(6) If fuel gauge now checks within specifications, original sending unit is electrically okay, check following as a possible cause:

(a) Ground wire from sending unit to left side cowl for continuity.

(b) Sending unit deformed. Make sure sending unit float arm moves freely and pick up tube is not bent upwards creating an interference with bottom of tank and inspect float.

(c) Sending unit improperly installed. Install properly.

(d) Mounting flange on fuel tank for sending unit deformed. Feel for interference fit of sending unit to bottom of tank. It is permissible to bend pick up tube down a little near mounting flange to gain interference fit.

(e) Fuel tank bottom deformed, causing improper positioning of sending unit pick up tube. Replace or repair tank and recheck sending unit.

GAUGE CALIBRATION

(1) Remove the gauge.

(2) Check for ignition voltage and ground to the gauge.

(3) With the ignition key in the OFF position, replace gauge. Turn the ignition key to the ON position. To test oil pressure gauge engine must be running. When testing oil or temperature gauge the engine should be at normal operating temperature. Record the gauge position.

(4) Remove gauge and record the resistance between the sending unit pin and the gauge ground pin. When checking gauges, it is important to have the same engine temperature and speed when noting gauge position. The time between gauge reading and measuring should be kept to a minimum.

(5) Resistance Chart (Fig. 11), is general guidelines for checking the gauge position against the sending unit resistance.

Because of only a few specific points of gauge position versus sending unit resistance, a good estimate is needed when the resistance falls between graduations. Even when the resistance corresponds to graduations, the gauge has a tolerance of ± 4 ohms.

Volt gauge: The calibration dot on the volt gauge corresponds to 13 volts between the gauge ignition and ground pins. If voltage varies from this, estimate proper gauge position with input voltage.

FUEL GAUGE REPLACEMENT

(1) Remove instrument cluster bezel.

(2) Remove mask and lens.

(3) If equipped with tachometer, remove three retaining screws and pull the tach straight back.

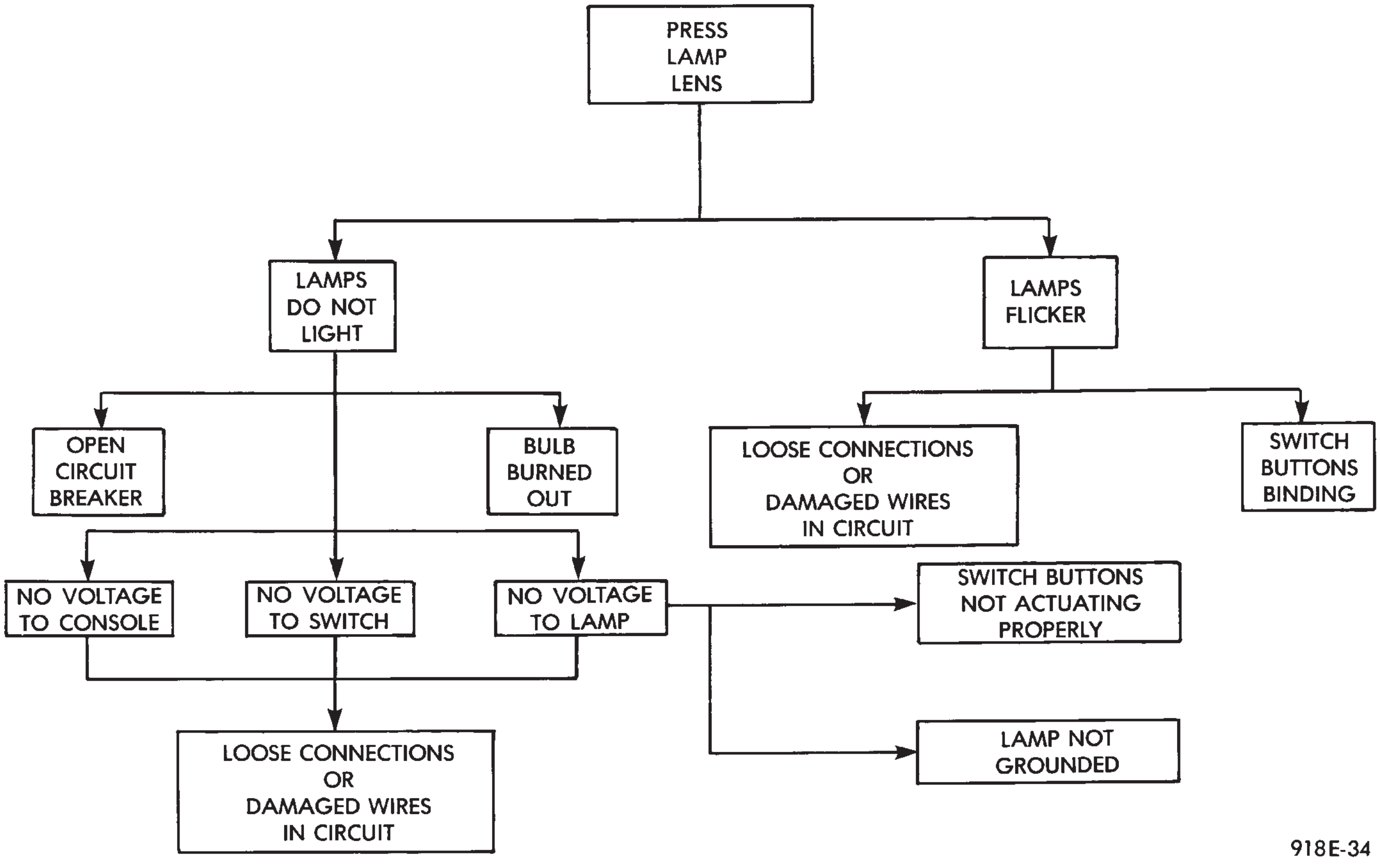


Fig. 11 Gauge Resistance

(4) Remove two retaining screws and pull fuel gauge straight back.

(5) For installation reverse above procedures.

TEMPERATURE GAUGE REPLACEMENT

(1) Remove instrument cluster bezel (Fig. 7).

(2) Remove mask and lens.

(3) Remove two retaining screws and pull temperature gauge straight back.

(4) For installation reverse above procedures.

VOLTMETER REPLACEMENT

(1) Remove instrument cluster bezel (Fig. 7).

(2) Remove mask and lens.

(3) Remove three speedometer retaining screws and pull the speedometer straight back and set aside.

(4) Remove two voltmeter retaining screws and pull voltmeter straight back.

(5) For installation, place voltmeter on gauge pins and push until gauge is securely seated in cluster and reverse above procedures.

TACHOMETER REPLACEMENT

(1) Remove instrument cluster bezel.

(2) Remove mask and lens.

(3) Remove three retaining screws and pull tachometer straight back.

(4) For installation, place tachometer on gauge pins and push until gauge is securely seated in cluster and reverse above procedures.

TACHOMETER CIRCUIT TESTING

(1) Remove cluster.

(2) Check for battery voltage at cavity J if instrument cluster gray connector.

(3) With the ignition in the ON position, check for battery voltage at cavity K of the instrument cluster gray connector (Fig. 8).

(4) Check cavity F of the instrument cluster red connector for continuity to ground (Fig. 8).

(5) Check for tachometer signal from the powertrain control module by connecting an AC DIGITAL VOLTMETER to cavity H of the instrument cluster gray connector and ground. A reading of at least 1.0 volts should be present with the engine running.

(a) If voltage is within specification, go to step 7.

(b) If voltage is NOT within specification, perform steps 5 and 6.

(6) If there is less than 1.0 volts at cavity H check for continuity between cavity H of the instrument cluster and pin 43 of the powertrain control module connector (Fig. 12). Also, check the connector at the powertrain control module for damaged pins or terminal push outs.

(7) If voltage is less than 1.0 volts at cavity H and there is continuity between cavity H of the instru-

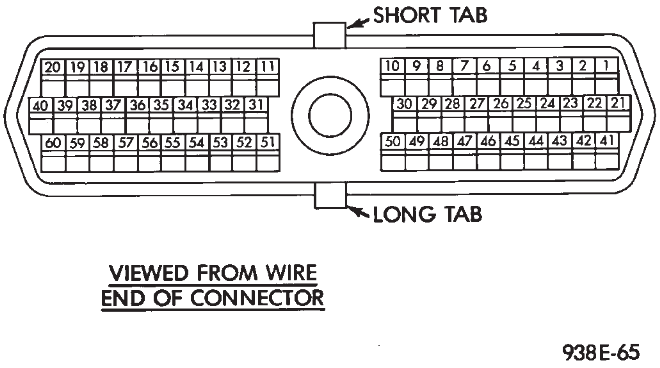


Fig. 12 Powertrain Control Module Pin Location

ment cluster and pin 43 of the powertrain control module connector, replace the powertrain control module.

(8) If all tests performed test good replace the tachometer drive module.

(9) If the tachometer continues to be inoperative, replace the tachometer assembly.

TACHOMETER DRIVE MODULE REPLACEMENT

(1) Remove instrument cluster (Fig. 13).

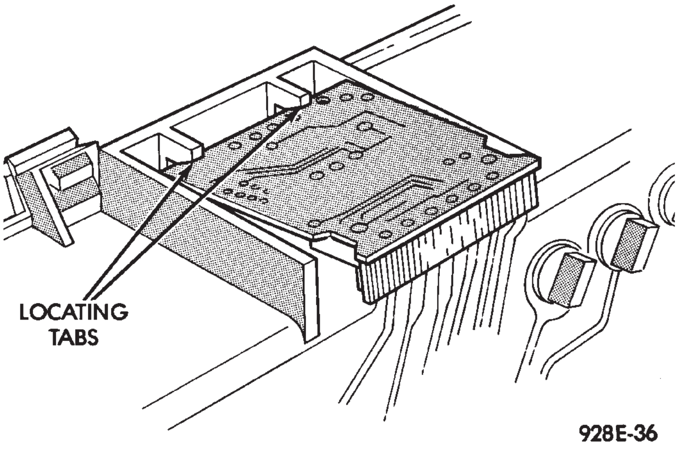


Fig. 13 Tachometer Drive Module

(2) Remove drive module by pivoting upward from printed circuit board and pulling away from locating notches.

(3) For installation, position module on locating notches and push down securely over printed circuit board and reverse above procedures.

SPEEDOMETER SYSTEM

AP-body vehicles are equipped with electronically driven speedometer and odometer assemblies. The unit has the same appearance as a conventional speedometer but it eliminates the cable-driven mechanical system. A signal is sent from a transmission-mounted speed sensor to the speedometer circuitry through the wiring harness. By eliminating the speedometer cable, instrument cluster service and removal is improved. Refer to Fig. 14 Speedometer Diagnosis.

When the speedometer is out of calibration. The electronic automatic transaxle vehicle speed sensor output must be calibrated to reflect the different combinations of equipment. The procedure is called Pinion Factor, refer to Group 21, Transaxle for the procedure.

SPEEDOMETER/ODOMETER ASSEMBLY REPLACEMENT

(1) Remove cluster bezel.

(2) Remove cluster mask and lens.

(3) Remove tachometer. If equipped.

(4) Remove fuel gauge.

(5) Remove three screws attaching speedometer/odometer assembly to the cluster housing.

(6) Pull speedometer rearward to remove from cluster housing.

(7) For installation reverse above procedures.

VEHICLE SPEED SENSOR REPLACEMENT

(1) Remove harness connector from sensor and make sure weather seal is on harness connector.

(2) Remove sensor retaining bolt.

(3) Pull sensor and pinion gear assembly out of transaxle. If necessary, carefully pry loose with a flat blade screwdriver (Fig. 15 and 16).

(4) For installation reverse above procedures and seat sensor assembly by hand to insure proper gear engagement. Tighten retaining bolt to 7 N●m (60 in. lbs.) torque.

ELECTRONIC AUTOMATIC TRANSAXLE VEHICLE SPEED SENSOR REPLACEMENT

The output vehicle speed sensor is located to the left of the manual shift lever.

(1) Raise and support vehicle on safety stands.

(2) Remove vehicle speed sensor (Fig. 17).

(3) For installation, reverse above procedures.

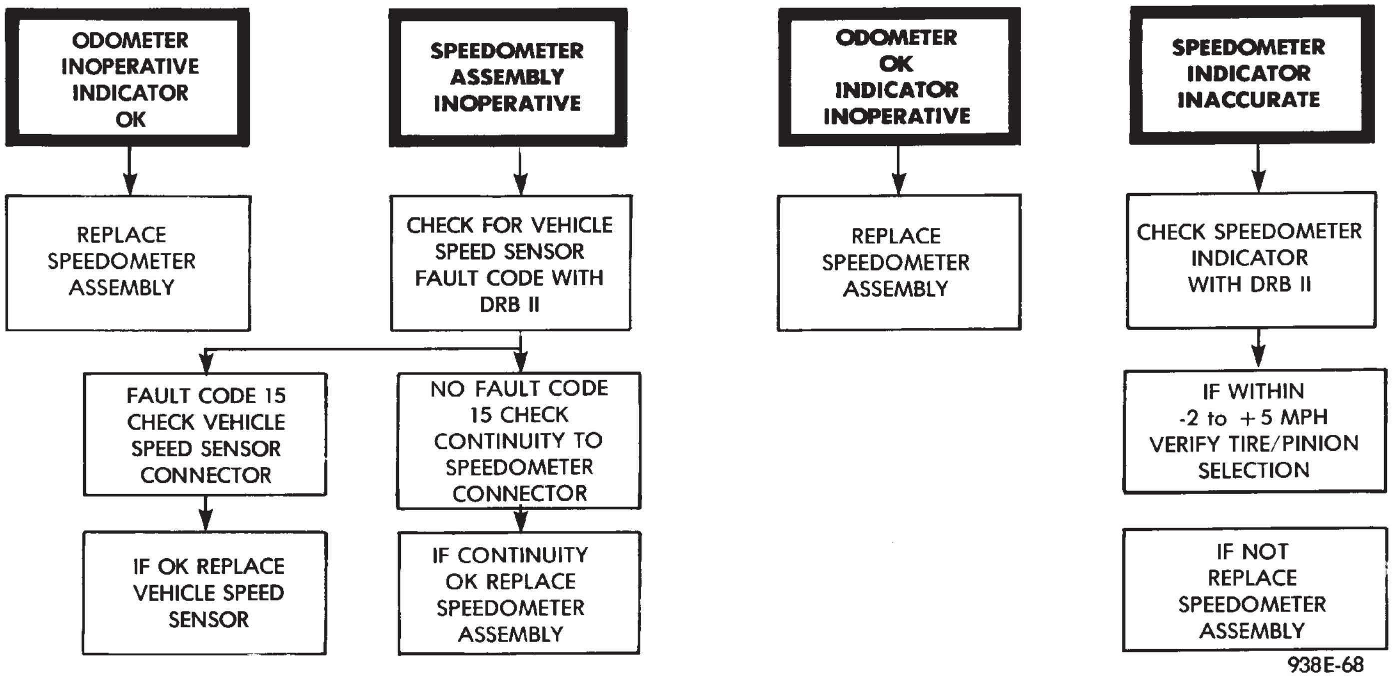


Fig. 14 Speedometer System Diagnosis

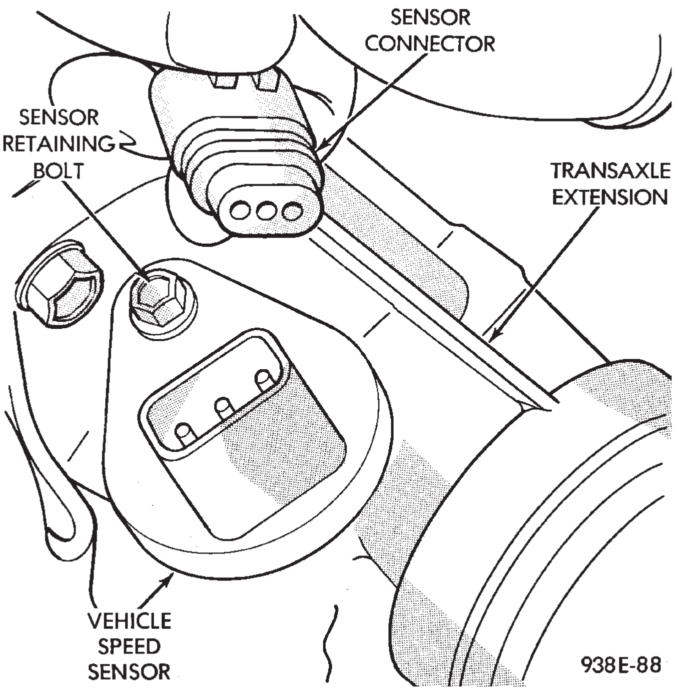


Fig. 15 Vehicle Speed Sensor and Connector

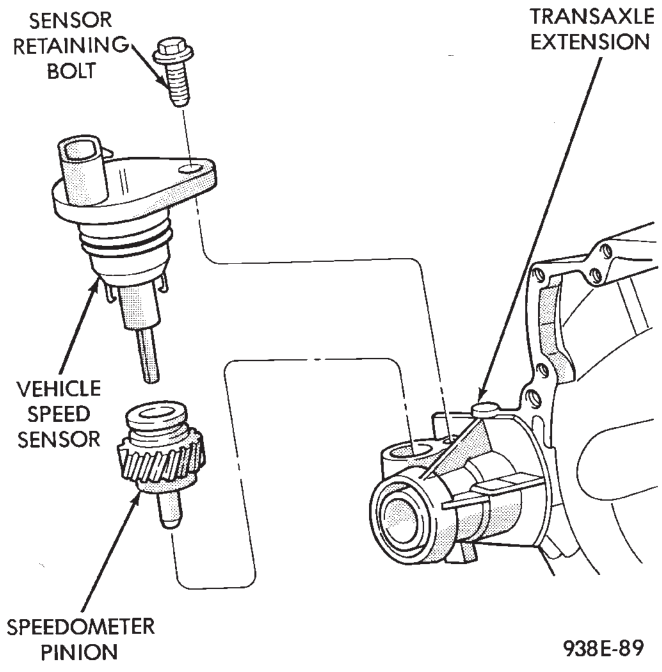


Fig. 16 Vehicle Speed Sensor and Speedometer Pinion

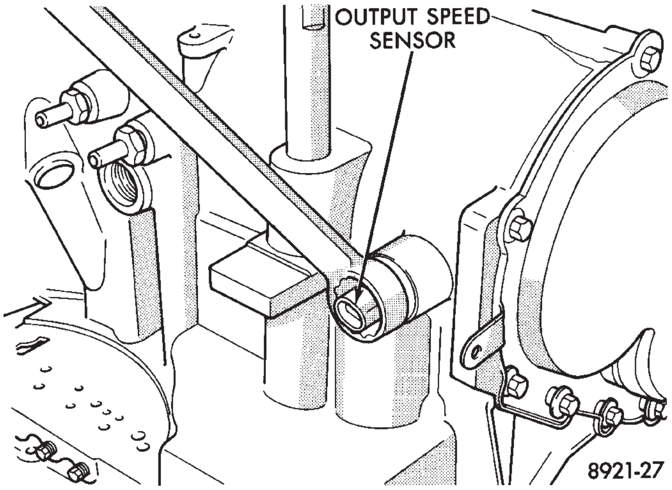


Fig. 17 Vehicle Speed Sensor Removal

VEHICLE SPEED SENSOR TEST

For testing of the vehicle speed sensor and related components using DRB II, refer to the appropriate Powertrain Diagnostics Test Procedure Manual.

PRINTED CIRCUIT BOARD REPLACEMENT

(1) Remove cluster bezel.

(2) Remove instrument cluster.

(3) Remove tachometer drive module, if equipped.

(4) Remove six retaining screws (Fig. 18).

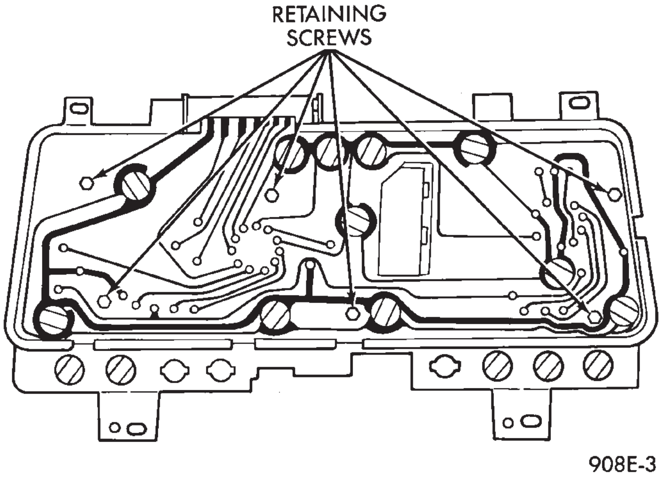


Fig. 18 Printed Circuit Board

(5) Twist out all illumination and warning lamp sockets.

(6) Pull printed circuit board from cluster housing.

(7) For installation reverse above procedures. Position printed circuit board on cluster housing, being certain that all gauge pins are inserted correctly.

CLUSTER LAMP REPLACEMENT

Illumination Lamp Chart shows cluster as viewed from rear. However, all lamps must be replaced by removing cluster from instrument panel (Fig. 19).

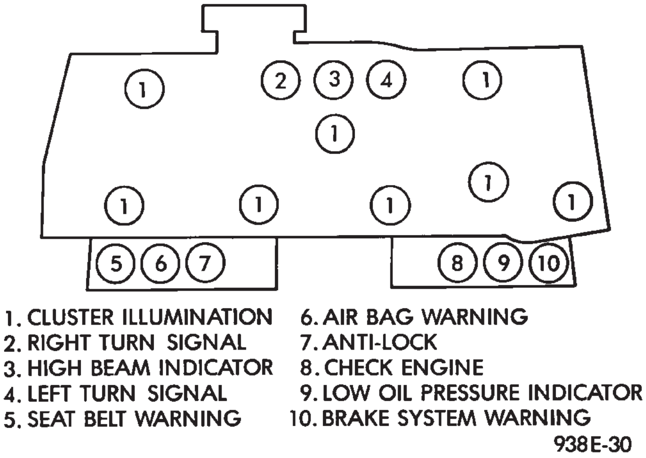


Fig. 19 Instrument Cluster Illumination Lamps

SWITCH AND PANEL COMPONENT SERVICE

LOWER STEERING COLUMN COVER REPLACEMENT

(1) Disconnect park brake release rod from the park brake handle.

(2) Remove two screws attaching hood release (Fig. 20).

(3) Remove fuse access door and remove steering column cover attaching screw located directly above the fuse block.

(4) Remove six screws around outside of steering column cover.

(5) Remove steering column cover.

(6) For installation reverse above procedures.

CENTER MODULE LOWER COVER REPLACEMENT

(1) Open ash receiver and remove center module bezel.

(2) Remove module cover to instrument panel retaining screws (Fig. 20).

(3) Remove module cover from vehicle.

(4) For installation reverse above procedures.

CENTER MODULE BEZEL REPLACEMENT

(1) Open ash receiver.

(2) Grip module bezel around outer edges and pull rearward to release six spring-type retaining clips (Fig. 20).

(3) For installation position spring clips to instrument panel and push firmly until seated.

(4) Close ash receiver.

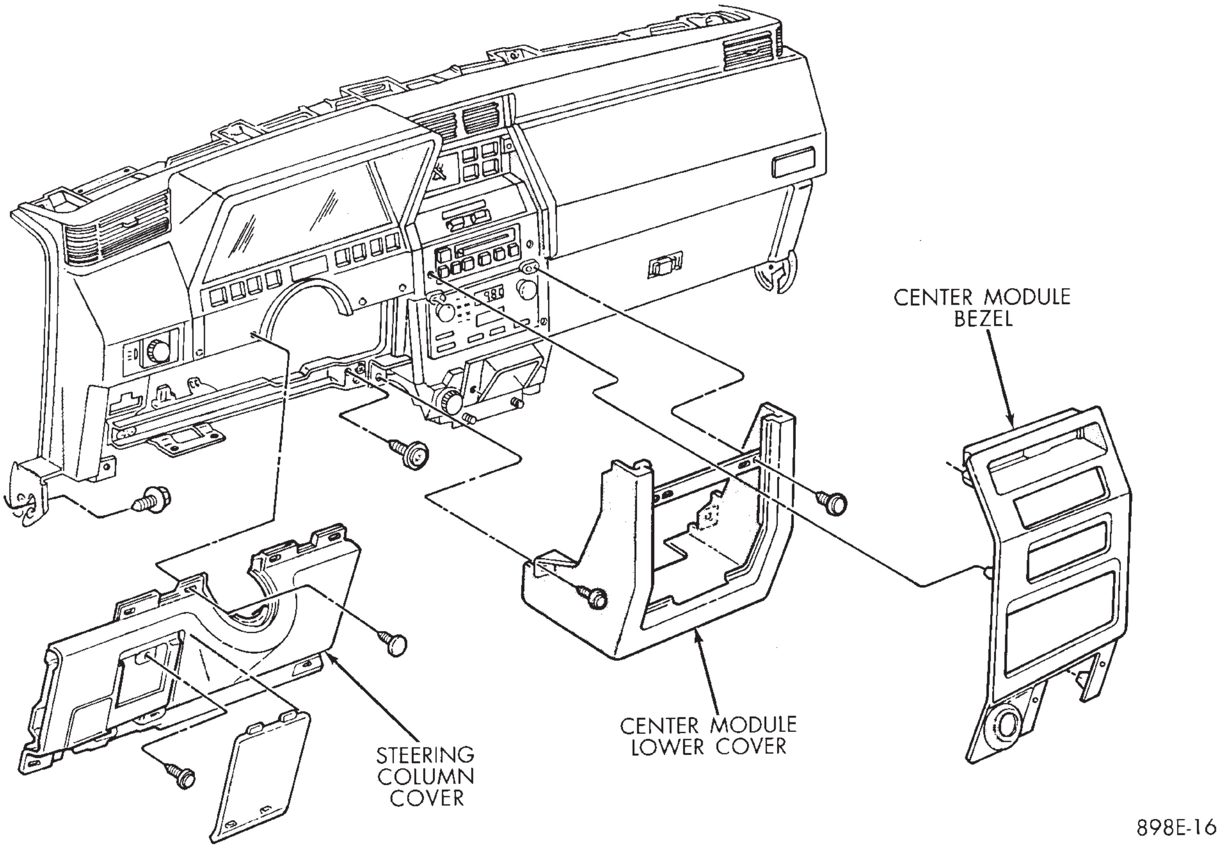


Fig. 20 Lower Instrument Panel

HEADLAMP SWITCH REPLACEMENT

(1) Snap headlamp switch bezel out of instrument panel pad (Fig. 21).

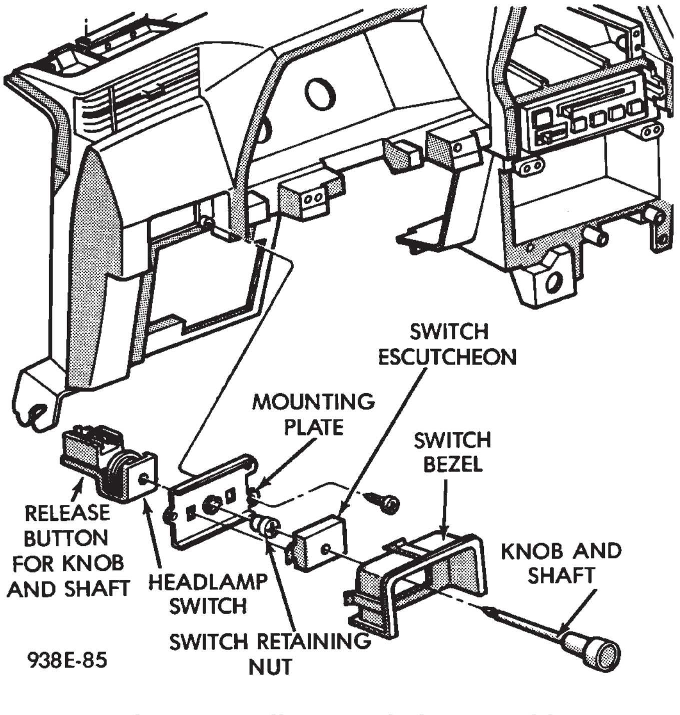


Fig. 21 Headlamp Switch Assembly

(2) Remove three screws securing headlamp switch mounting plate to instrument panel.

(3) Pull headlamp switch and mounting plate rearward from instrument panel opening.

(4) Disconnect wiring connector from switch.

(5) Remove switch knob by depressing release button on the bottom on the switch and pulling knob out from switch.

(6) Snap headlamp switch escutcheon out of mounting plate to gain access to mounting plate retaining nut.

(7) Remove headlamp switch to mounting plate retaining nut and separate switch from mounting plate.

(8) For installation reverse above procedures.

A/C HEATER CONTROL REPLACEMENT

(1) Remove center bezel assembly.

(2) Remove A/C control to instrument panel retaining screws (Fig. 22).

(3) Pull control rearward and disconnect temperature control cable and electrical and vacuum connectors.

(4) Remove control from vehicle.

(5) For installation reverse above procedures.

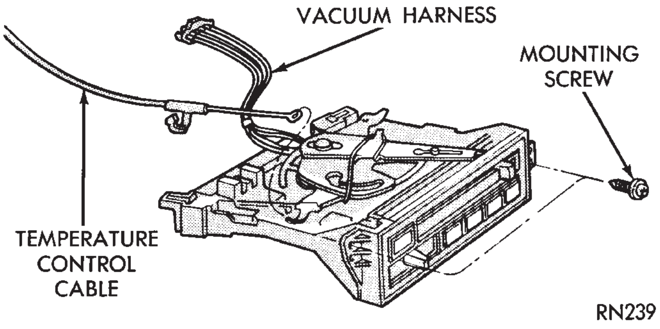


Fig. 22 A/C Heater Control

HEATER CONTROL LAMP REPLACEMENT

(1) Remove heater control. Refer to A/C Heater Control for removal.

(2) Pull control far enough to gain access to the lamp socket.

(3) Replace lamp. To remove lamp rotate socket counter clockwise. To install rotate clockwise.

(4) For installation reverse above procedures.

A/C CONTROL LAMP REPLACEMENT

(1) Remove heater control. Refer to A/C Heater Control for removal.

(2) Pry temperature and blower switch knobs off with flat blade tool. To protect cosmetic face place cardboard or similar material on the face plate while prying.

(3) Remove face plate by lifting on the six tabs. Three on top and three on bottom of the face plate.

(4) Replace lamp.

(5) For installation reverse above procedures.

HEATER CONTROL BLOWER SWITCH REPLACEMENT

(1) Remove heater control. Refer to A/C Heater Control for removal.

(2) Pry temperature and blower switch knobs off with flat blade tool. To protect cosmetic face place cardboard or similar material on the face plate while prying.

(3) Remove face plate by lifting on the six tabs. Three on top and three on bottom of the face plate.

(4) Pry blower switch off with flat blade tool. To protect cosmetic face, place cardboard or similar material on the face plate while prying.

(5) To replace, line up blower switch terminals and press firmly until the it bottoms out on the housing.

(6) For installation reverse above procedures.

A/C CONTROL BLOWER SWITCH REPLACEMENT

(1) Remove heater control. Refer to A/C Heater Control for removal.

(2) Position the temperature knob at the maximum heat position to gain screw access.

(3) Remove two screws holding the blower switch located on top of the control.

(4) Pry the blower switch off with a flat blade tool.

(5) To replace, line up blower switch terminals and press firmly until the it bottoms out on the housing.

(6) For installation reverse above procedures.

GLOVE BOX MODULE REPLACEMENT

(1) Disconnect battery negative cable and isolate or remove fuse #13 prior to removing switch or wires may short to ground.

(2) Open glove box door (Fig. 23).

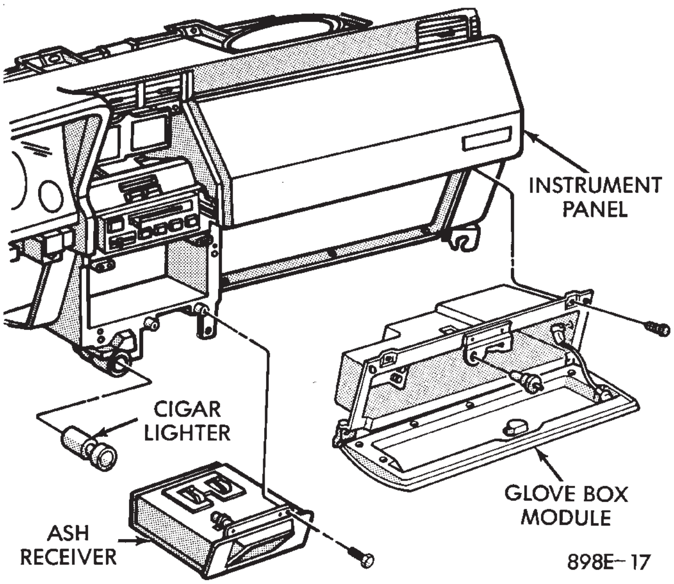


Fig. 23 Glove Box, Ash Receiver and Cigar Lighter

(3) Remove check strap screws to allow full downward movement of the glove box door.

(4) Remove six screws attaching glove box module to instrument panel.

(5) Pull glove box module rearward and disconnect wiring from lamp and switch.

(6) Remove glove box from vehicle.

(7) For installation reverse above procedures. When installing glove box module, be sure that left edge of module is pressed against foam bead on trim pad. This will assure that there will be an adequate gap between right edge of glove box door and trim pad.

ASH RECEIVER ASSEMBLY REPLACEMENT

(1) Open ash receiver and remove center module bezel.

(2) Remove ash receiver bracket to instrument panel retaining screws (Fig. 23).

(3) Pull assembly rearward off of locating pins and disconnect wiring for lamp.

(4) Remove ash receiver from vehicle.

(5) For installation reverse above procedures.

CIGAR LIGHTER REPLACEMENT

(1) Remove center bezel assembly (Fig. 23).

(2) Remove center module lower cover or open forward console lid.

(3) Unscrew lighter receptacle shell from receptacle and remove from base instrument panel.

(4) Disconnect wiring connectors from lighter receptacle and remove from vehicle.

(5) For installation reverse above procedures.

REAR WINDOW DEFOGGER AND/OR FOG LAMP SWITCH REPLACEMENT

(1) Remove center module bezel assembly (Fig. 20).

(2) Remove two switch bezel screws (Fig. 24).

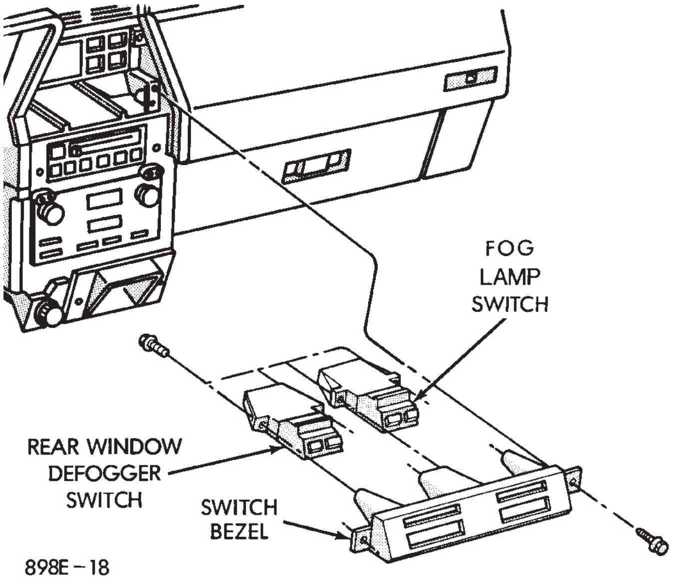


Fig. 24 Rear Window Defogger and Fog Lamp Switch

(3) Pull switches and bezel rearward and disconnect wiring connector.

(4) Remove two switch retaining screws.

(5) Remove switch from bezel.

(6) For installation reverse above procedures.

INTERMITTENT WIPE MODULE REPLACEMENT

(1) Remove lower steering column cover.

(2) Slide intermittent wipe module off of bracket located on steering column reinforcement (Fig. 25).

(3) Disconnect wiring connector from module and remove module from vehicle.

(4) For installation reverse above procedures.

GLOVE BOX LAMP AND SWITCH REPLACEMENT

(1) Disconnect battery and/or pull fuse # 13 before starting removal procedure.

(2) Open glove box door (Fig. 26).

(3) Carefully pry lamp from its mounting surface with tip of a small screwdriver.

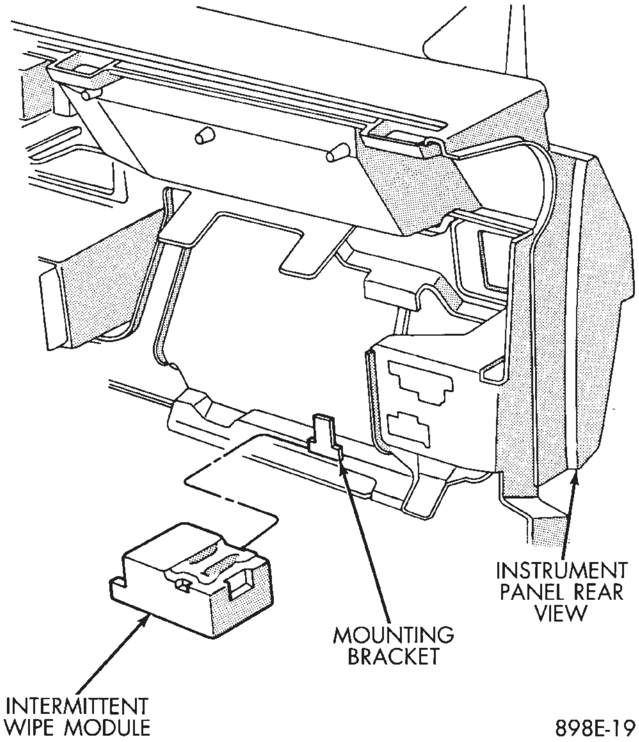


Fig. 25 Intermittent Wipe Module

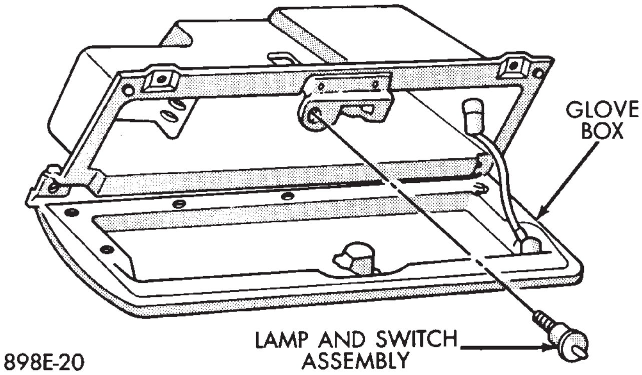


Fig. 26 Glove Box Lamp and Switch

(4) Pull lamp from box and disconnect electrical leads.

(5) Remove lamp.

(6) For installation reverse above procedures.

CONSOLETTE ASSEMBLY REPLACEMENT

(1) Remove shifter handle.

(2) Unsnap transmission range indicator bezel or shift boot bezel from consolette, disconnect wiring and remove bezel assembly (Fig. 27).

(3) Remove two screws from side of armrest.

(4) Remove four caps which cover attaching screws.

(5) Remove four attaching screws.

(6) Lift consolette up and over shift mechanism to remove.

(7) For installation reverse above procedures.

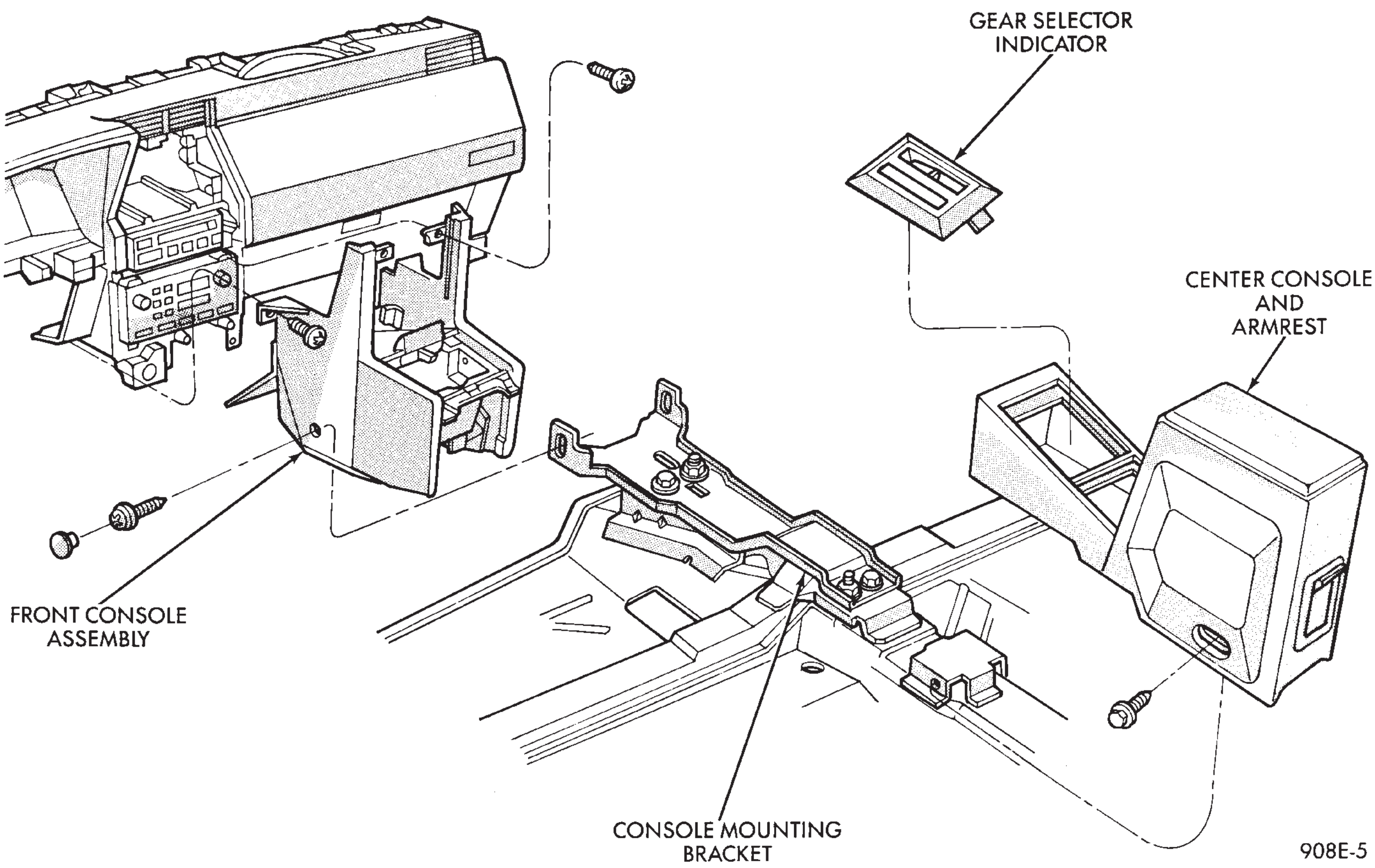


Fig. 27 Front and Center Console with Transmission Range Indicator

CENTER CONSOLE ASSEMBLY REPLACEMENT

(1) Place transmission in neutral and remove shifter handle.

(2) Unsnap transmission range indication bezel or shift boot bezel from console, disconnect wiring and remove bezel assembly (Fig. 27).

(3) Unsnap power window/mirror switch bezel, when so equipped and disconnect switch wiring.

(4) Remove two screws from side of armrest.

(5) Remove arm rest and center console section as a unit by lifting from the front and unsnapping from front console section.

(6) For installation reverse above procedures. Adjust transmission range indicator in the PARK position.

CONSOLE GEAR SELECTOR INDICATOR LAMP REPLACEMENT

(1) Place shifter handle in Neutral position.

(2) Remove handle from shifter.

(3) Unsnap gear selector bezel and pull upward (Fig. 27).

(4) Remove indicator lamp socket from bezel to replace lamp.

(5) For installation reverse above procedures. Adjust transmission range indicator in the PARK position.

FRONT CONSOLE ASSEMBLY REPLACEMENT

(1) Remove shifter handle.

(2) Unsnap transmission range indicator bezel or shift boot bezel from console assembly, disconnect wiring and remove bezel assembly (Fig. 27).

(3) Unsnap power mirror/window switch bezel, when so equipped and disconnect switch wiring.

(4) Open arm rest and remove three screws holding arm rest to center console retractor bracket.

(5) Remove armrest and center console section as a unit by lifting and unsnapping from forward console section.

(6) Remove center module bezel.

(7) Remove forward console and side walls as complete unit by removing six sidewall attaching screws to instrument panel and console bracket. Slide unit rearward and lift to remove.

(8) For installation reverse above procedures.

(a) For adjustment move gearshift lever with force into park position.

(b) Check gear selector indicator for proper alignment.

INSTRUMENT PANEL TOP COVER REPLACEMENT

(1) Place trim-stick tool in groove between the panel top cover and pad surface (FIG. 28).

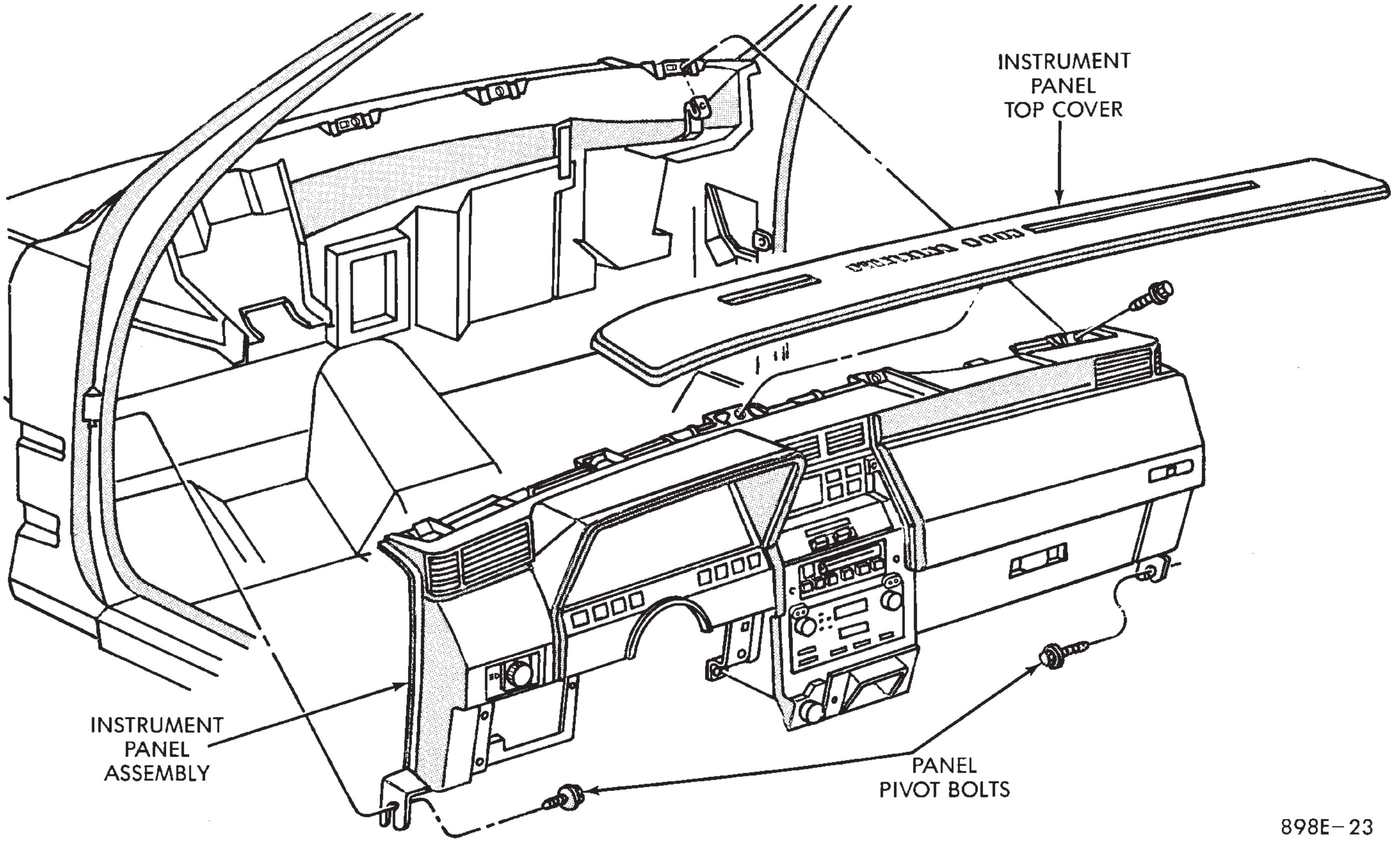


Fig. 28 Instrument Panel and Top Cover

(2) Pry cover up and forward until released from instrument panel pad.

(3) Lift top cover upward and rearward to remove from vehicle.

(4) For installation place top cover on panel opening. Be certain that blades of top cover are located in the retaining spring clips.

(5) Push forward and down to engage in pad.

INSTRUMENT PANEL REPLACEMENT

CAUTION: Disconnect negative battery cable, in engine compartment, before servicing instrument panel.

(1) Remove windshield wiper arms.

(2) Open hood and remove cowl top plastic cover.

(3) Remove windshield washer reservoir.

(4) Pull connector loose from the A/C resistor block and push wiring and grommet through bulkhead into passenger compartment.

(5) Remove the console/consolette assembly.

(6) Remove the passive restraint seat belt logic control module wiring.

(7) Remove six attaching nuts securing the instrument panel to console support brace.

(8) Remove the instrument panel to console support brace with the Air Bag System Diagnostic Module attached.

(9) Remove right and left cowl side and scuff plate trim moldings.

(10) Remove left and right A-pillar trim moldings.

(11) Remove instrument panel top cover (Fig. 28).

(12) Remove lower steering column cover.

(13) Disconnect the steering column wiring at the 25-way connector.

(14) Disconnect park brake, stop lamp and speed control wiring.

(15) Remove five steering column support nuts and lower steering column. Then remove two steering column attaching studs.

(16) Disconnect engine harness wiring at 18-way and 16-way connectors located on the left side panel support bracket.

(17) Remove glove box assembly.

(18) Remove the panel top cover assembly.

(19) Loosen the panel roll-down pivot bolts.

(20) Remove the defroster duct adapter from defroster duct.

(21) Remove screws which attach instrument panel to windshield fence line. Roll panel down, attach heavy wire to hold in position and remove defroster duct retaining screws.

(22) Disconnect body wiring at the right side 18-way connector and left side 25-way connector.

(23) Disconnect temperature mode cable at in-line connector. Disconnect resistor block and blower motor wiring connectors.

(24) Disconnect antenna cable.

(25) Disconnect left and right demister hoses from demister outlets on the panel.

(26) Remove instrument panel from vehicle.

(27) For installation reverse above procedures.

INTERIOR LAMP REPLACEMENT

The Dome Lamp operates when the doors are open or headlamp switch is placed in courtesy position.

DOME LAMP

(1) Pry the forward or rearward edge of the dome lamp to free it from the retaining bracket.

(2) Pry either the forward or rearward edge of the lens away from the bezel and replace lamp.

(3) For installation, snap lens into bezel and then bezel into bracket.

TRUNK LAMP

Pry along rearward portion of lens and pivot out of trunk trim panel. Remove lens and replace lamp.

For installation, snap lens into trunk trim panel.

AUDIO SYSTEM

CONTENTS

RADIOS

INDEX

DESCRIPTION

For operation of the factory installed standard and optional radios and the optional compact disc player, refer to the Sound Systems Operating Instructions Manual supplied with the vehicle.

All vehicles are equipped with an Ignition-Off Draw Connector which, is used when the vehicles are originally shipped from the factory. This connector which, is located near the battery, helps to prevent battery discharge during storage. For specific connector type and location, refer to Group 8W, Wiring Diagrams.

This connector is included in the radio memory circuitry and should be checked if the memory of time or radio station programming is inoperative.

INTERFERENCE ELIMINATION

Some components are used on vehicles equipped with a radio capacitor, to suppress radio frequency interference/static.

Capacitors are mounted in various locations, on the generator either internal or external, internal to the instrument cluster, and internal to the windshield wiper motor.

Ground straps are mounted from radio chassis to instrument panel support structure, engine to cowl, across engine mount on right hand side. On vehicles with air conditioning there is a strap from evaporator valve to cowl. These ground straps should be securely tightened to assure good metal to metal contact. Ground straps conduct very small high frequency electrical signals to ground and require clean large surface area contact.

Radio resistance type spark plug cables in the high tension circuit of the ignition system complete the interference suppression (Fig. 1).

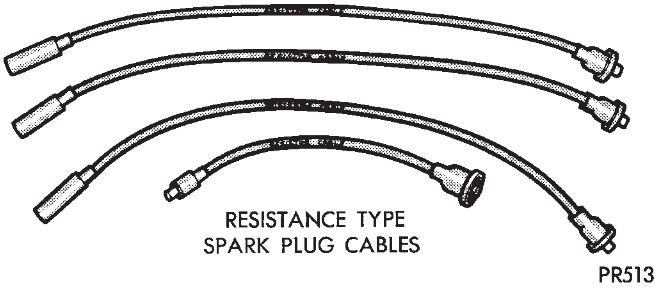


Fig. 1 Resistance Type Spark Plug Cables

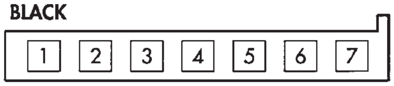
If radio noises are evident, be sure the capacitor lead wires are making good contact on their respective terminals and are securely mounted. Faulty or deteriorated spark plug wires should be replaced.

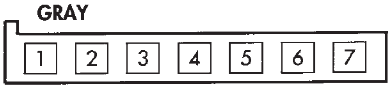
AUDIO DIAGNOSTIC TEST PROCEDURES

Whenever a audio malfunction occurs, first verify that the radio wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Audio Diagnostic Charts and/or Radio Connector Circuit Chart (Fig. 2).

AM/FM STEREO—CASSETTE TAPE

RADIO CONNECTORS

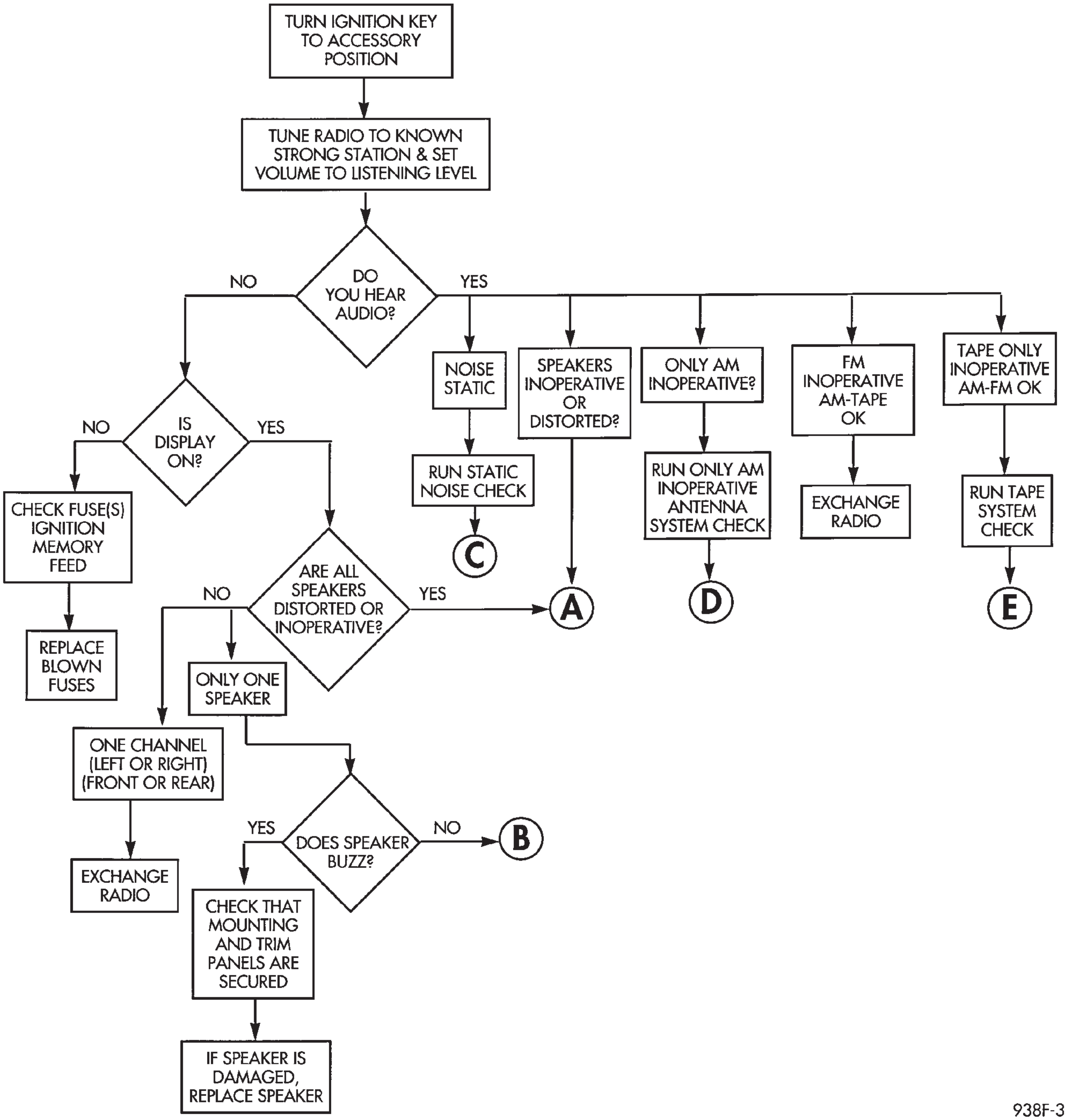




LEGEND:

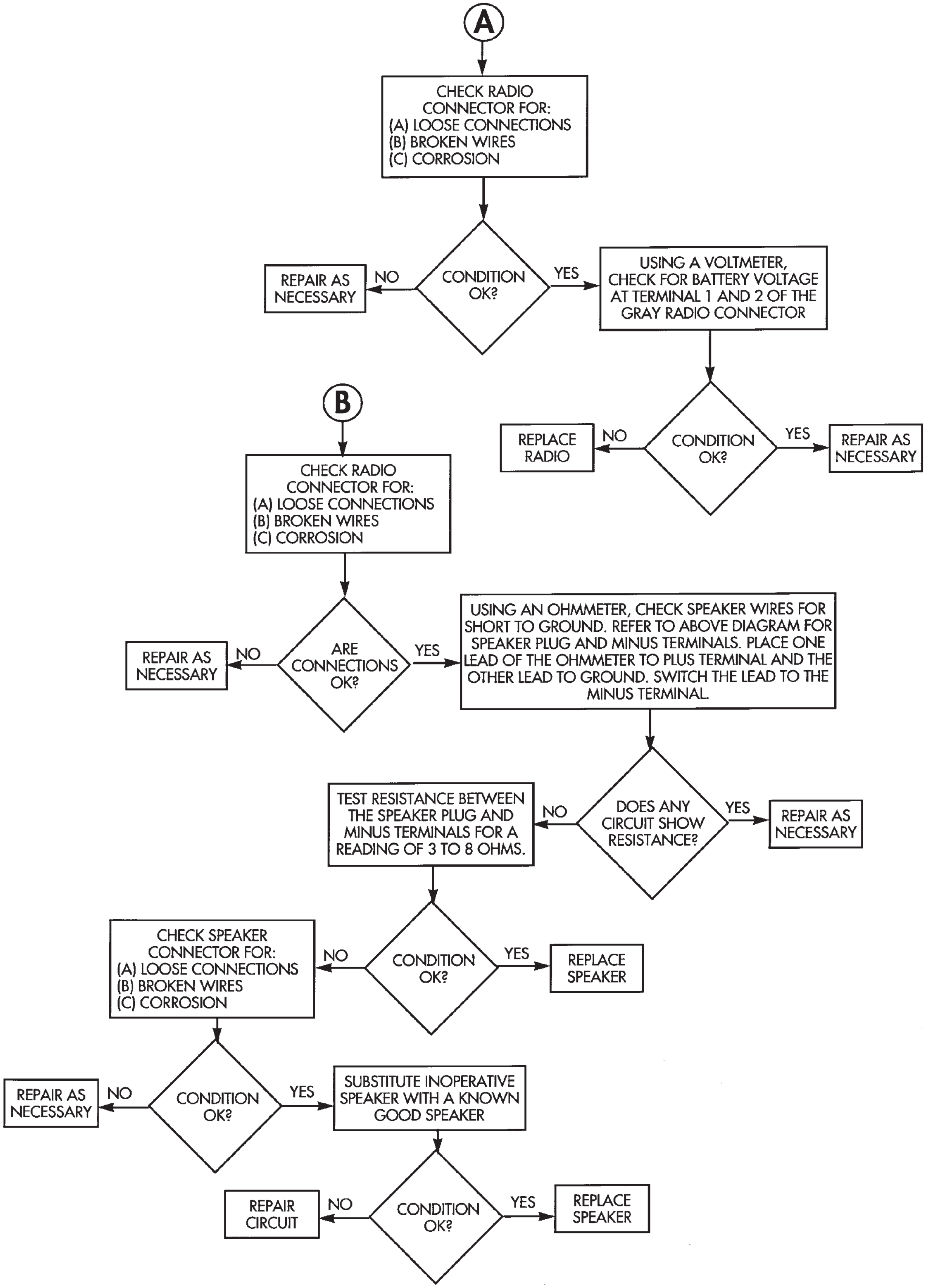
1 - RIGHT REAR SPEAKER RETURN (-)
2 - LEFT REAR SPEAKER RETURN (-)
3 - RIGHT FRONT SPEAKER FEED (+)
4 - LEFT FRONT SPEAKER FEED (+)
5 - RIGHT REAR SPEAKER FEED (+)
6 - LEFT REAR SPEAKER FEED (+)
7 - AMP ON-OFF SIGNAL/ANT UP SIGNAL

1 - BATTERY — (MEMORY)
2 - ACCESSORY — (SWITCHED B+)
3 - DIMMER — (PANEL, LAMPS, VARIABLE)
4 - MARKER — (HEAD/PARK LAMPS)
5 - RIGHT FRONT SPEAKER RETURN (-)
6 - LEFT FRONT SPEAKER RETURN (-)
7 - RADIO MUTE



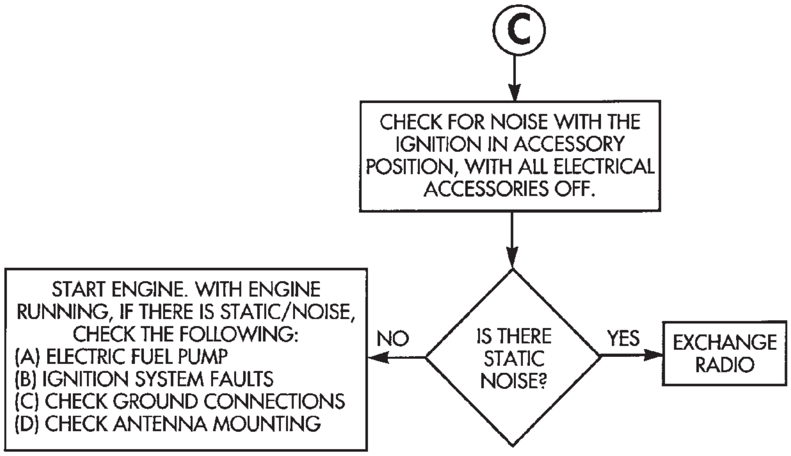
938F-30

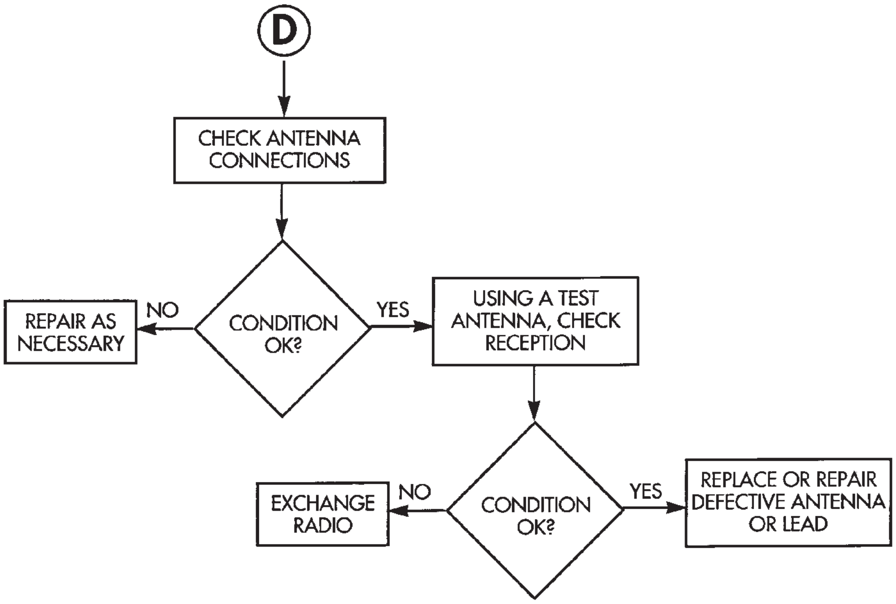
AM/FM STEREO—CASSETTE TAPE CONTINUED



938F-31

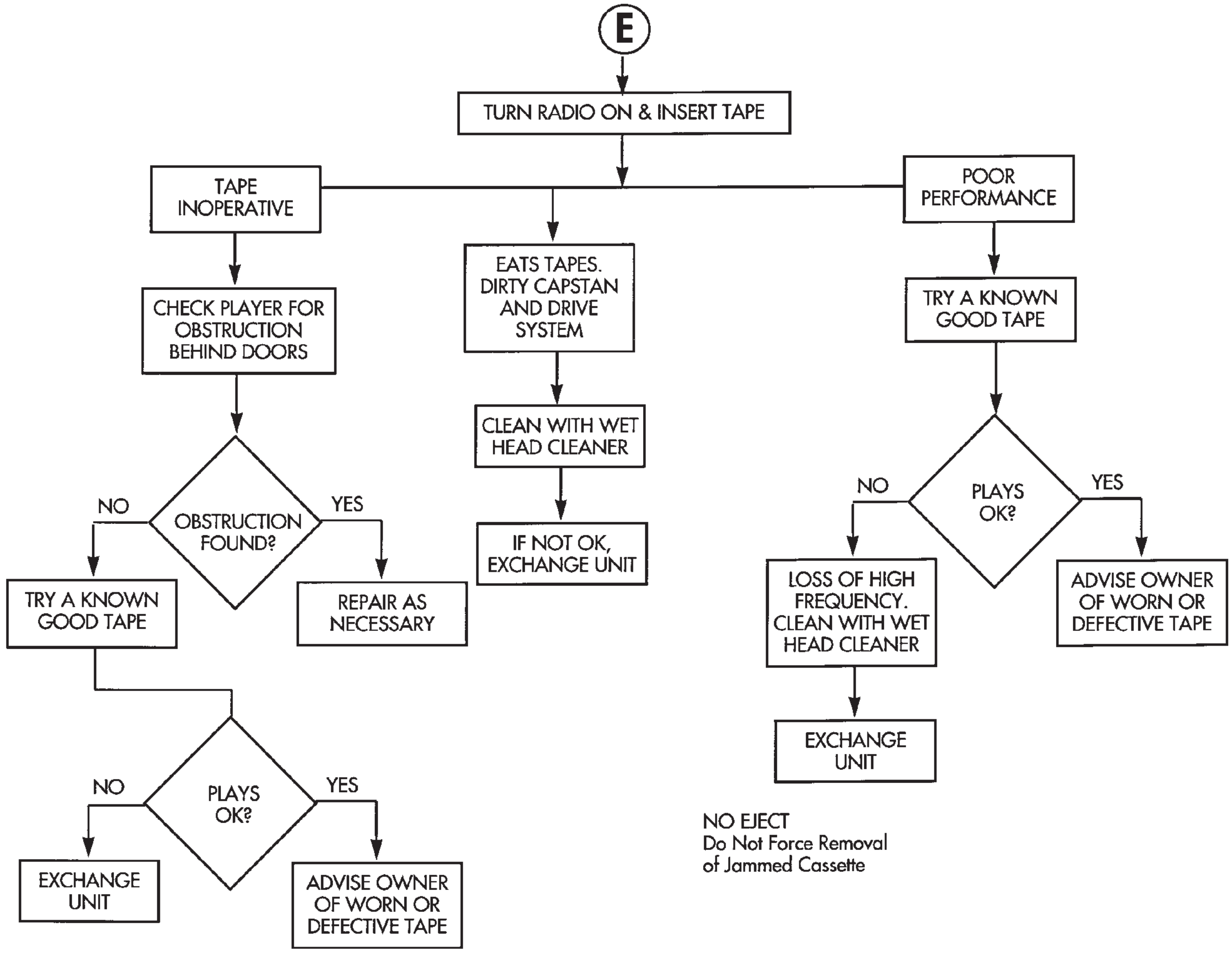
AM/FM STEREO—CASSETTE TAPE CONTINUED





938F-32

AM/FM STEREO—CASSETTE TAPE CONTINUED



NO EJECT
Do Not Force Removal
of Jammed Cassette

938F-33

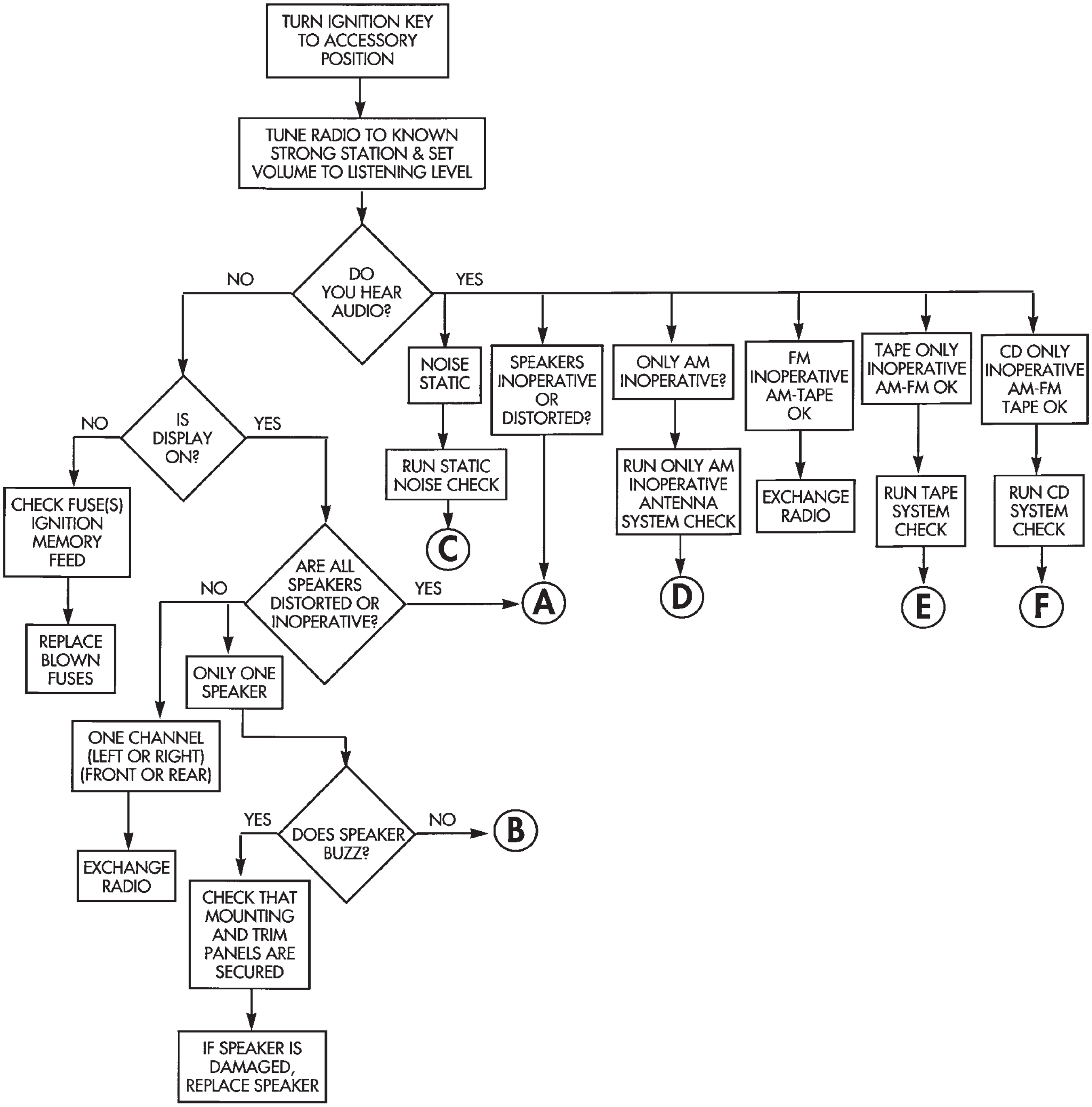
INFINITY—AA-AG-AP BODIES

RADIO CONNECTORS

LEGEND:

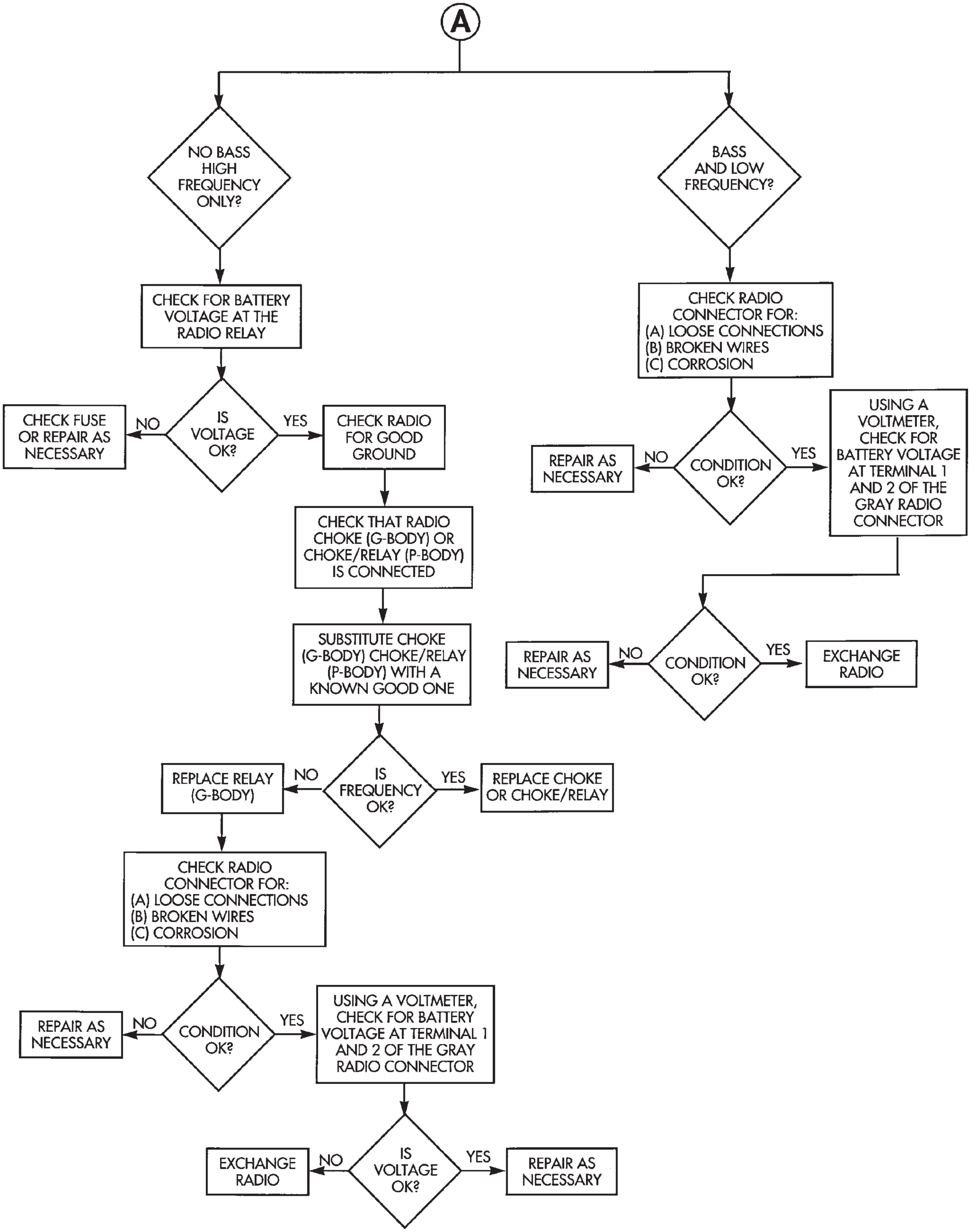
1 - RIGHT REAR SPEAKER RETURN (-)
2 - LEFT REAR SPEAKER RETURN (-)
3 - RIGHT FRONT SPEAKER FEED (+)
4 - LEFT FRONT SPEAKER FEED (+)
5 - RIGHT REAR SPEAKER FEED (+)
6 - LEFT REAR SPEAKER FEED (+)
7 - AMP ON-OFF SIGNAL/ANT UP SIGNAL

1 - BATTERY — (MEMORY)
2 - ACCESSORY — (SWITCHED B+)
3 - DIMMER — (PANEL, LAMPS, VARIABLE)
4 - MARKER — (HEAD/PARK LAMPS)
5 - RIGHT FRONT SPEAKER RETURN (-)
6 - LEFT FRONT SPEAKER RETURN (-)
7 - RADIO MUTE



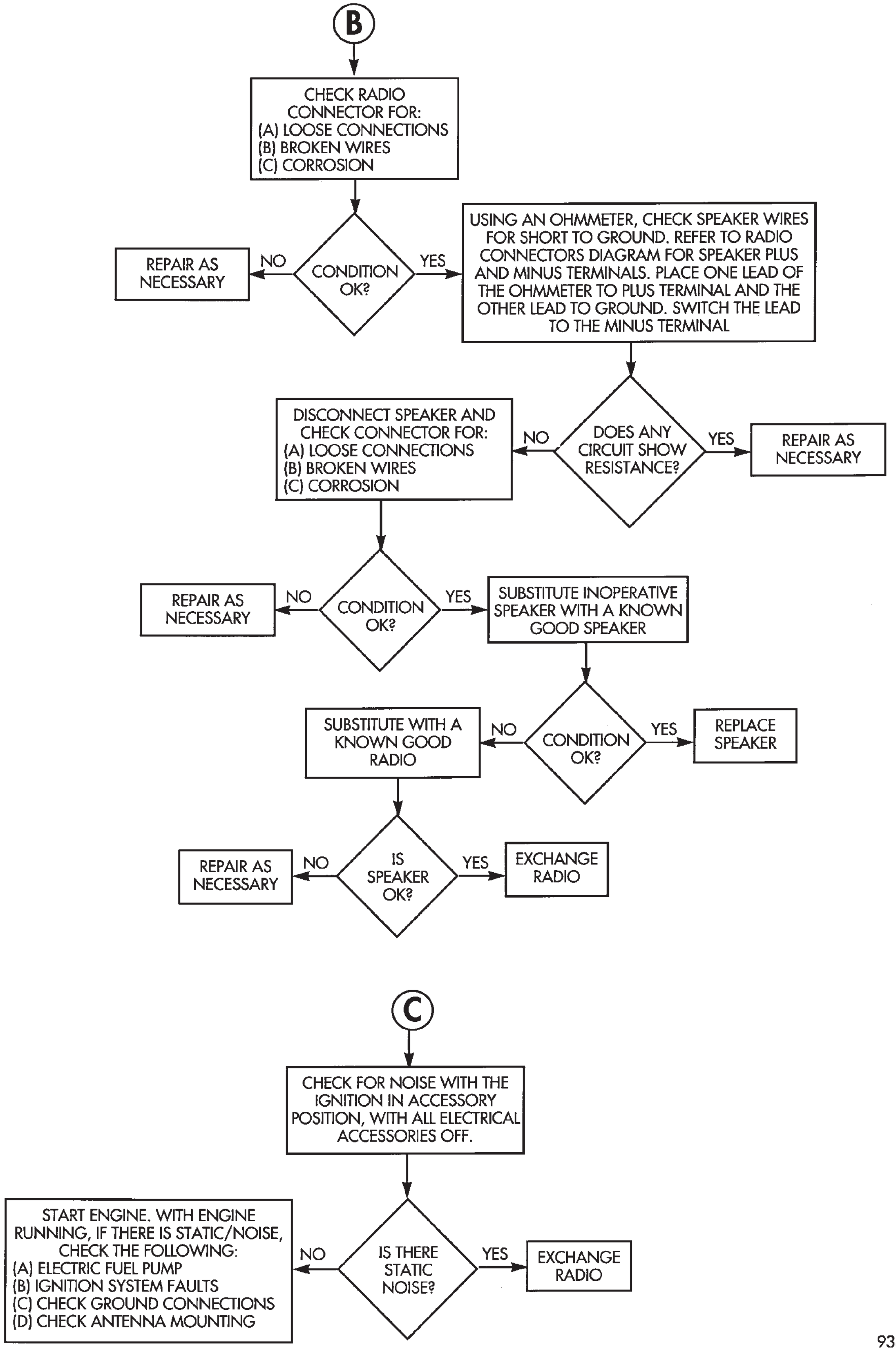
938F-34

INFINITY—AA-AG-AP BODIES CONTINUED



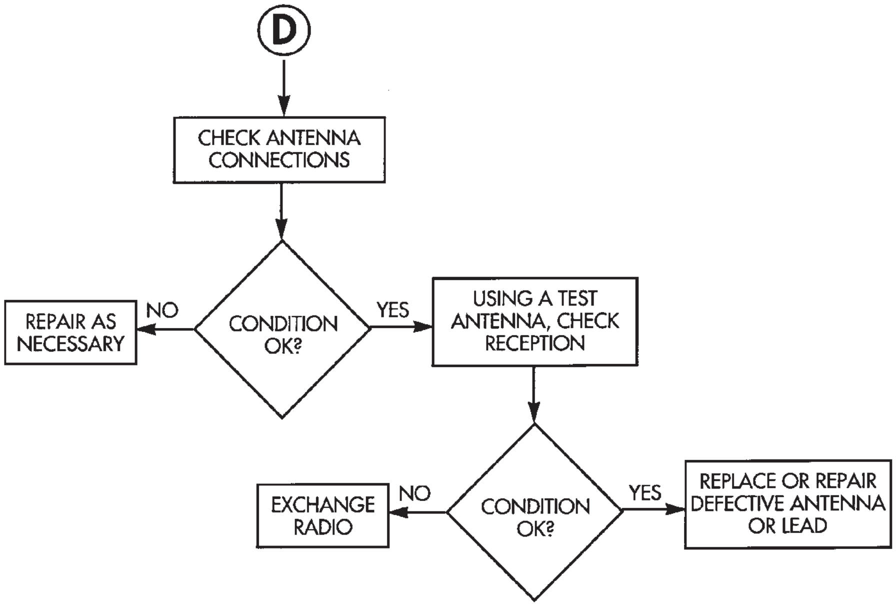
938F-35

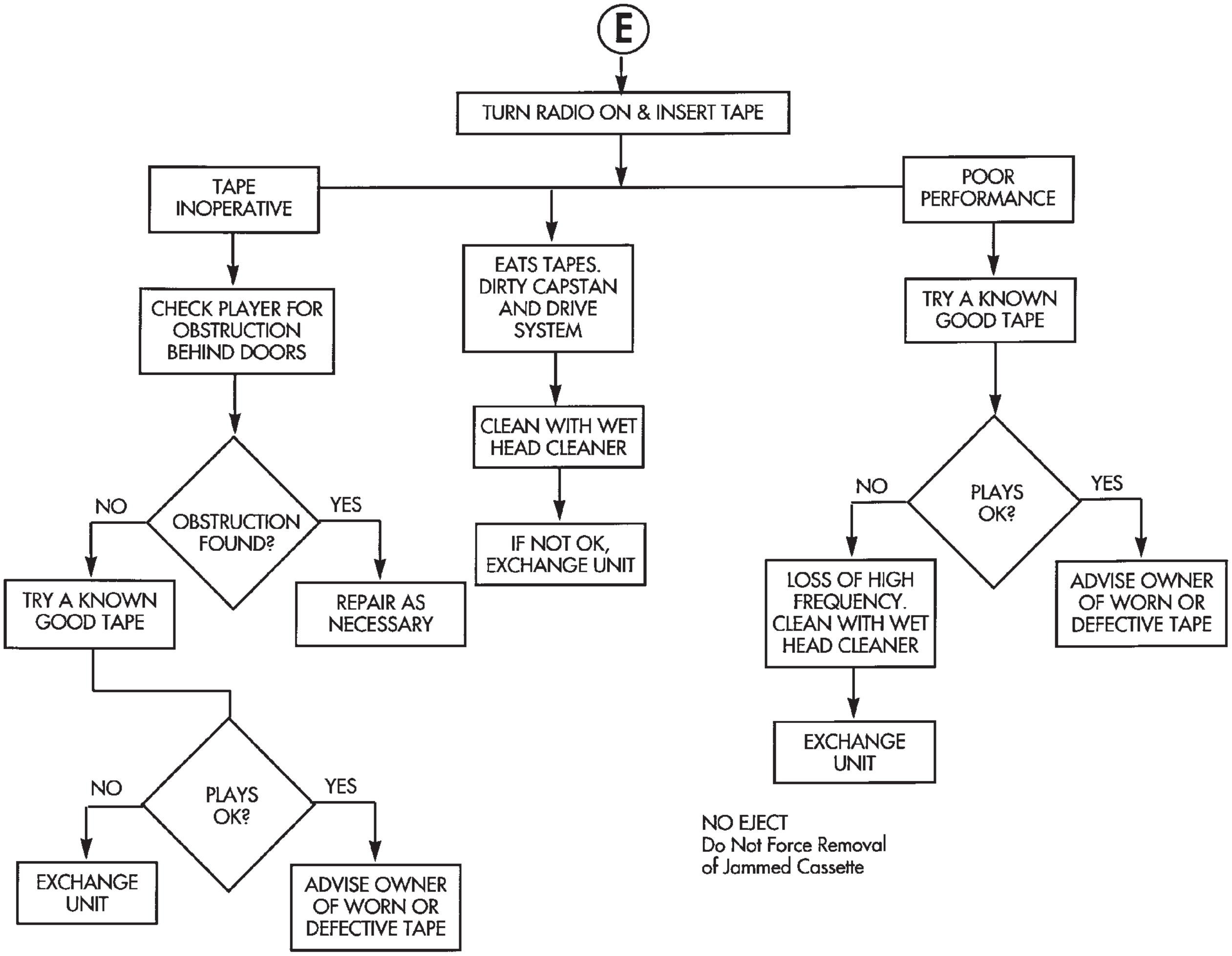
INFINITY—AA-AG-AP BODIES CONTINUED



938F-36

INFINITY—AA-AG-AP BODIES CONTINUED

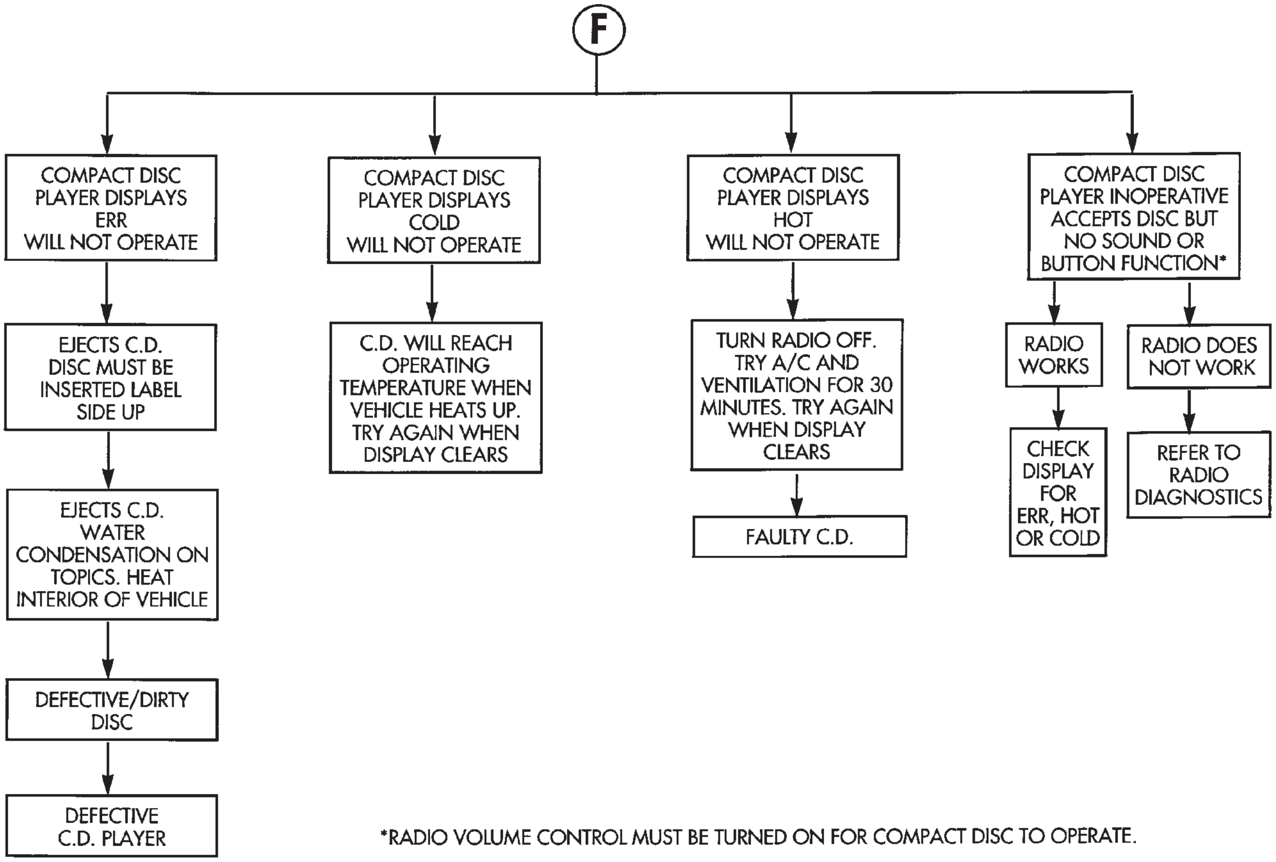




NO EJECT
Do Not Force Removal
of Jammed Cassette

938F-37

INFINITY—AA-AG-AP BODIES CONTINUED



938F-38

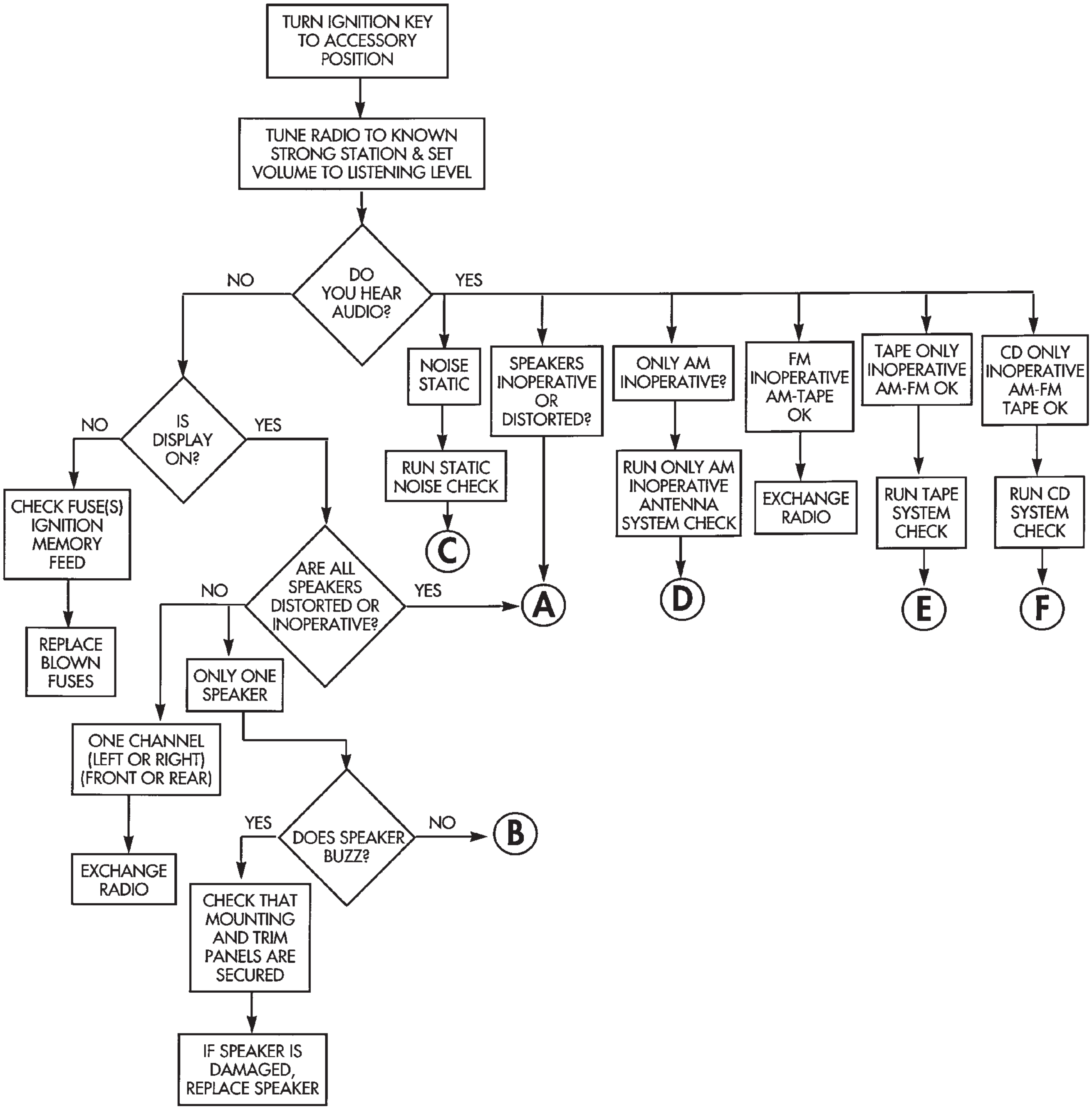
INFINITY—AC-AJ-AY BODIES

RADIO CONNECTORS

LEGEND:

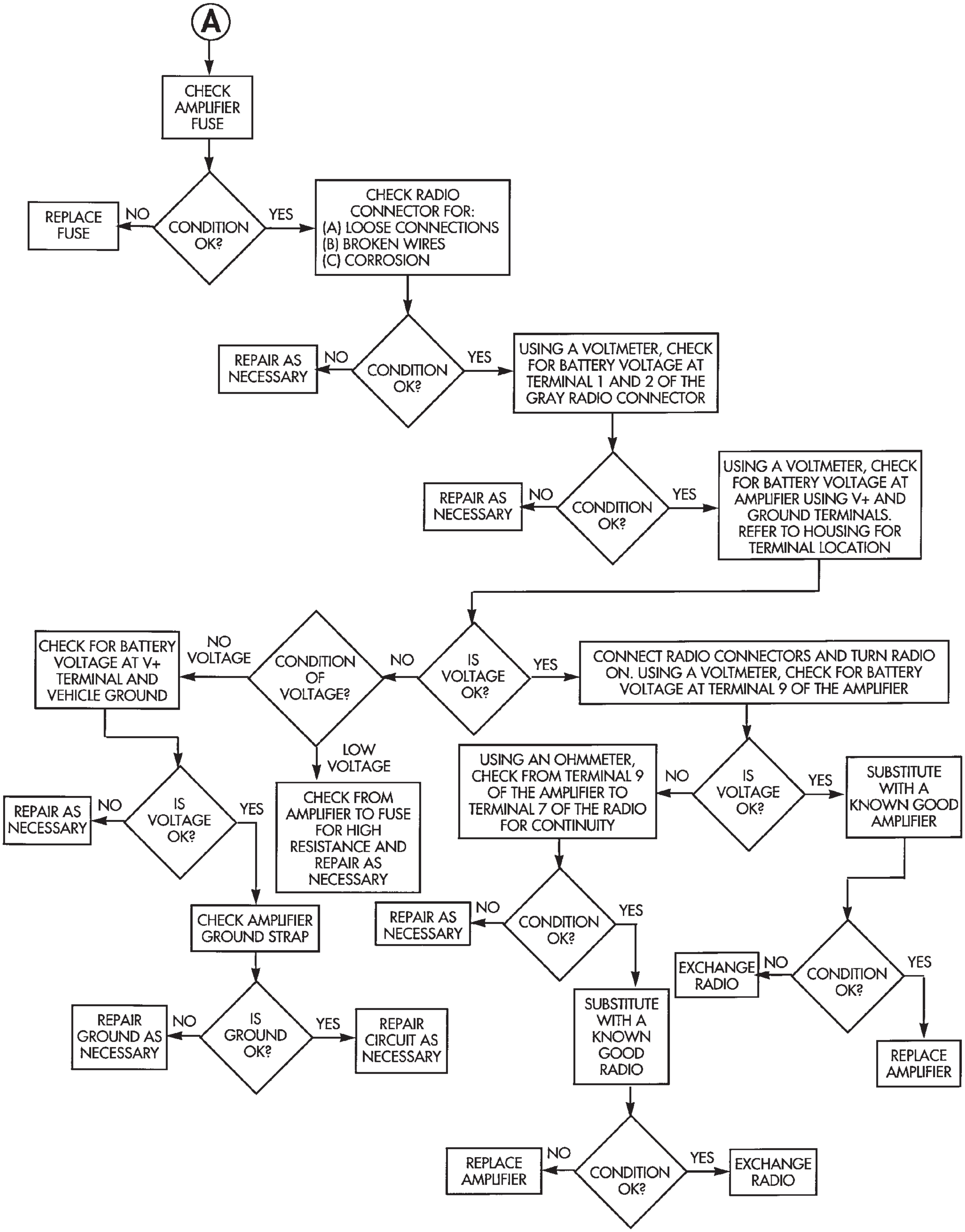
1 - RIGHT REAR SPEAKER RETURN (-)
2 - LEFT REAR SPEAKER RETURN (-)
3 - RIGHT FRONT SPEAKER FEED (+)
4 - LEFT FRONT SPEAKER FEED (+)
5 - RIGHT REAR SPEAKER FEED (+)
6 - LEFT REAR SPEAKER FEED (+)
7 - AMP ON-OFF SIGNAL/ANT UP SIGNAL

1 - BATTERY — (MEMORY)
2 - ACCESSORY — (SWITCHED B+)
3 - DIMMER — (PANEL, LAMPS, VARIABLE)
4 - MARKER — (HEAD/PARK LAMPS)
5 - RIGHT FRONT SPEAKER RETURN (-)
6 - LEFT FRONT SPEAKER RETURN (-)
7 - RADIO MUTE



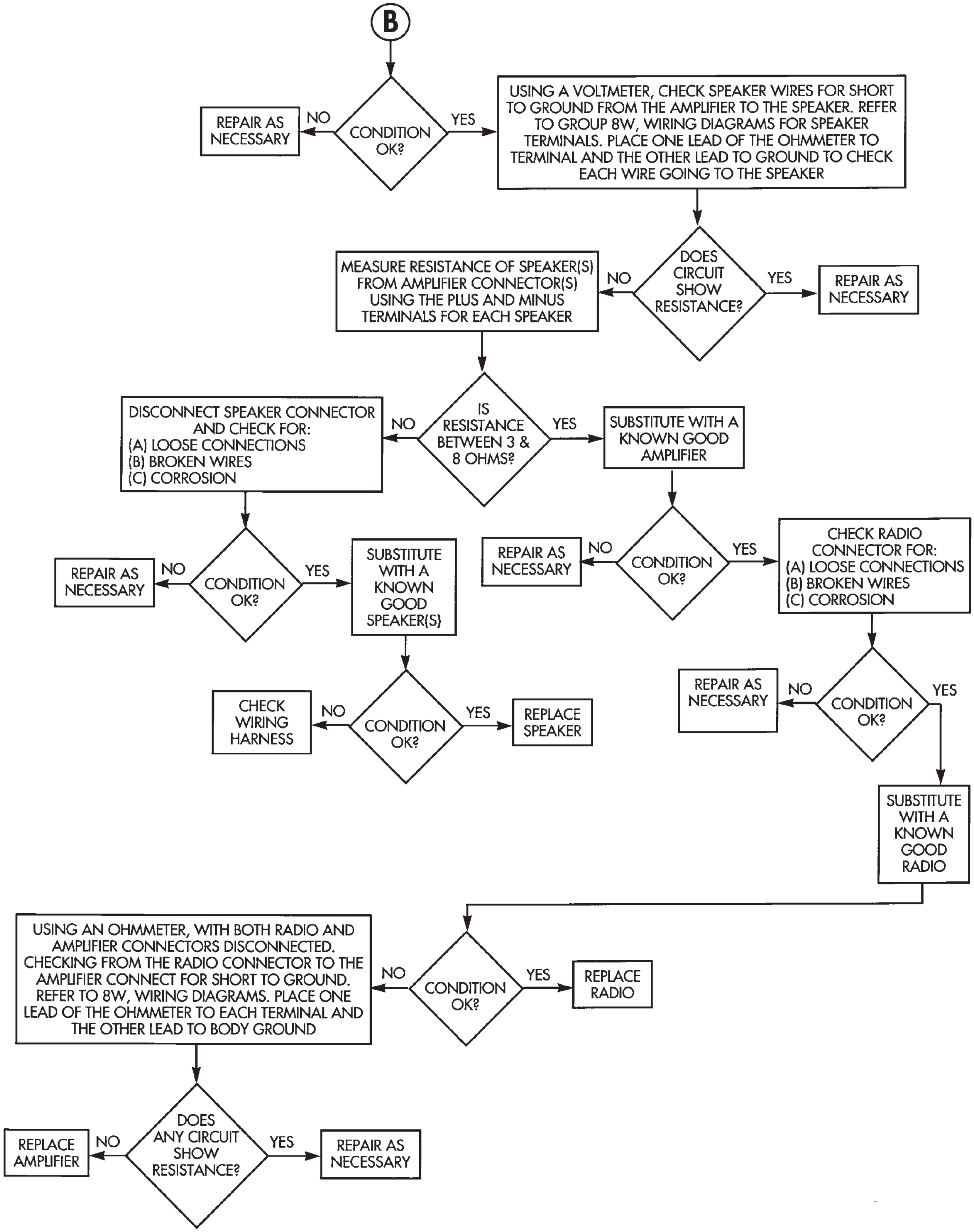
938F-39

INFINITY—AC-AJ-AY BODIES CONTINUED



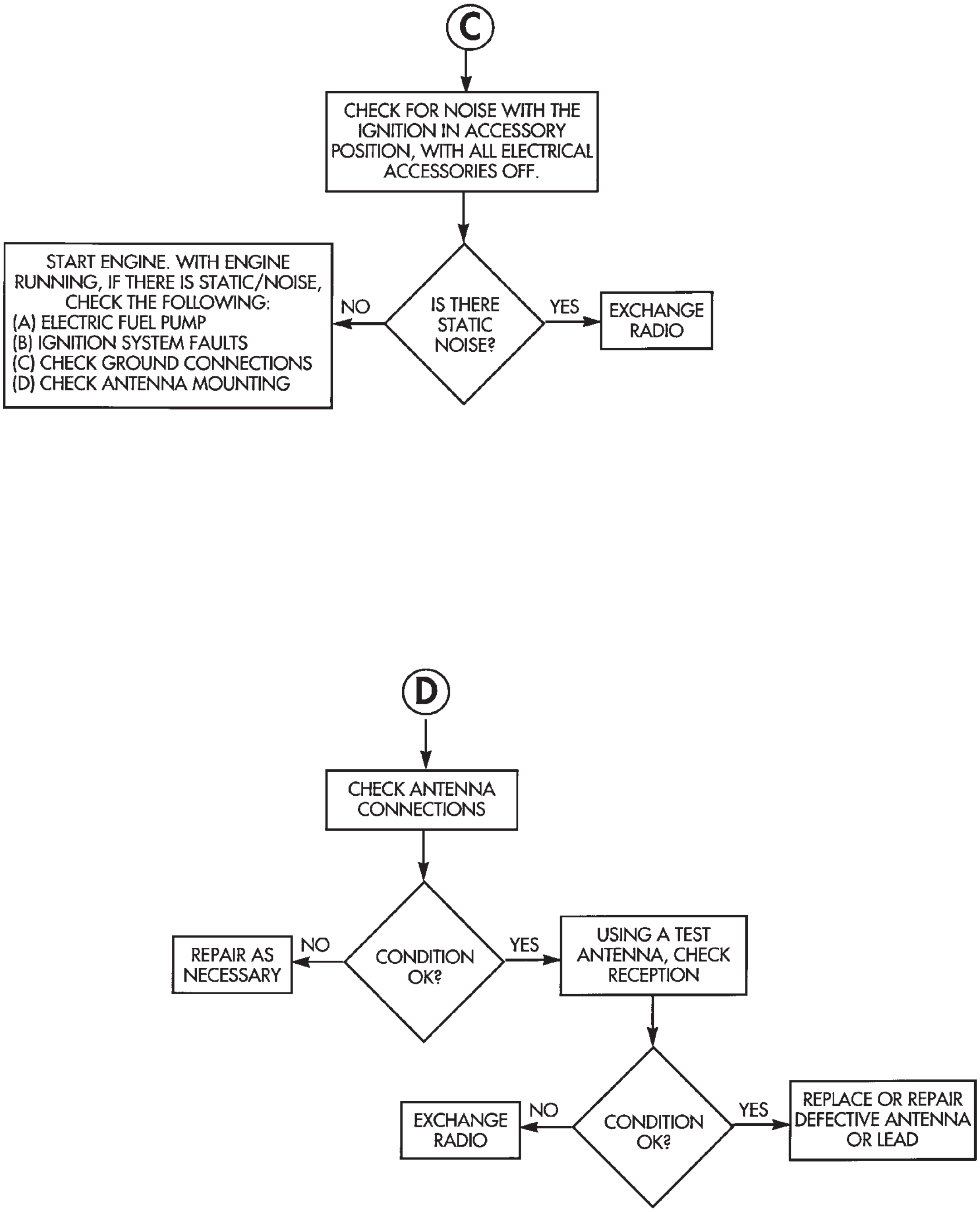
938F-40

INFINITY—AC-AJ-AY BODIES CONTINUED



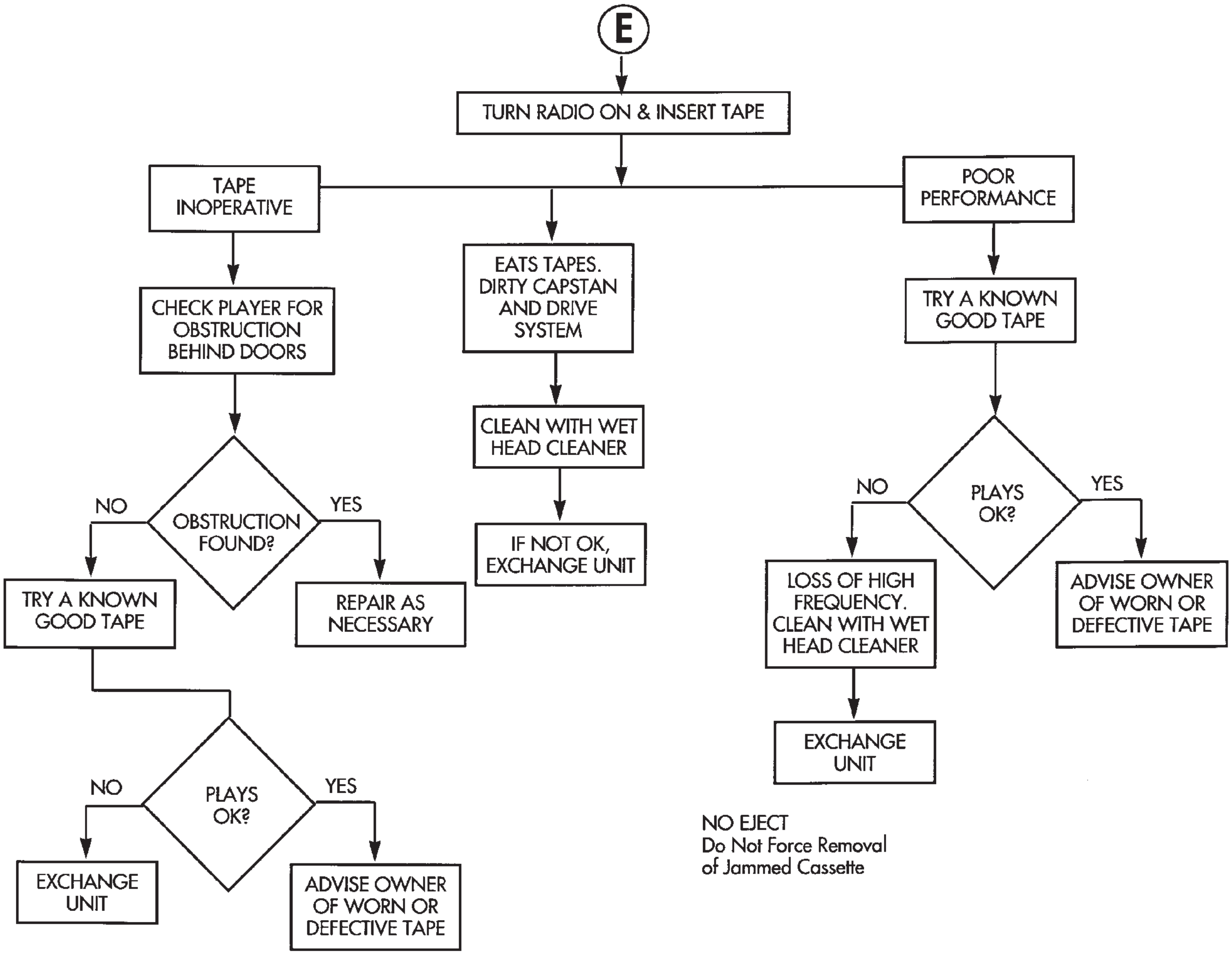
938F-41

INFINITY—AC-AJ-AY BODIES CONTINUED



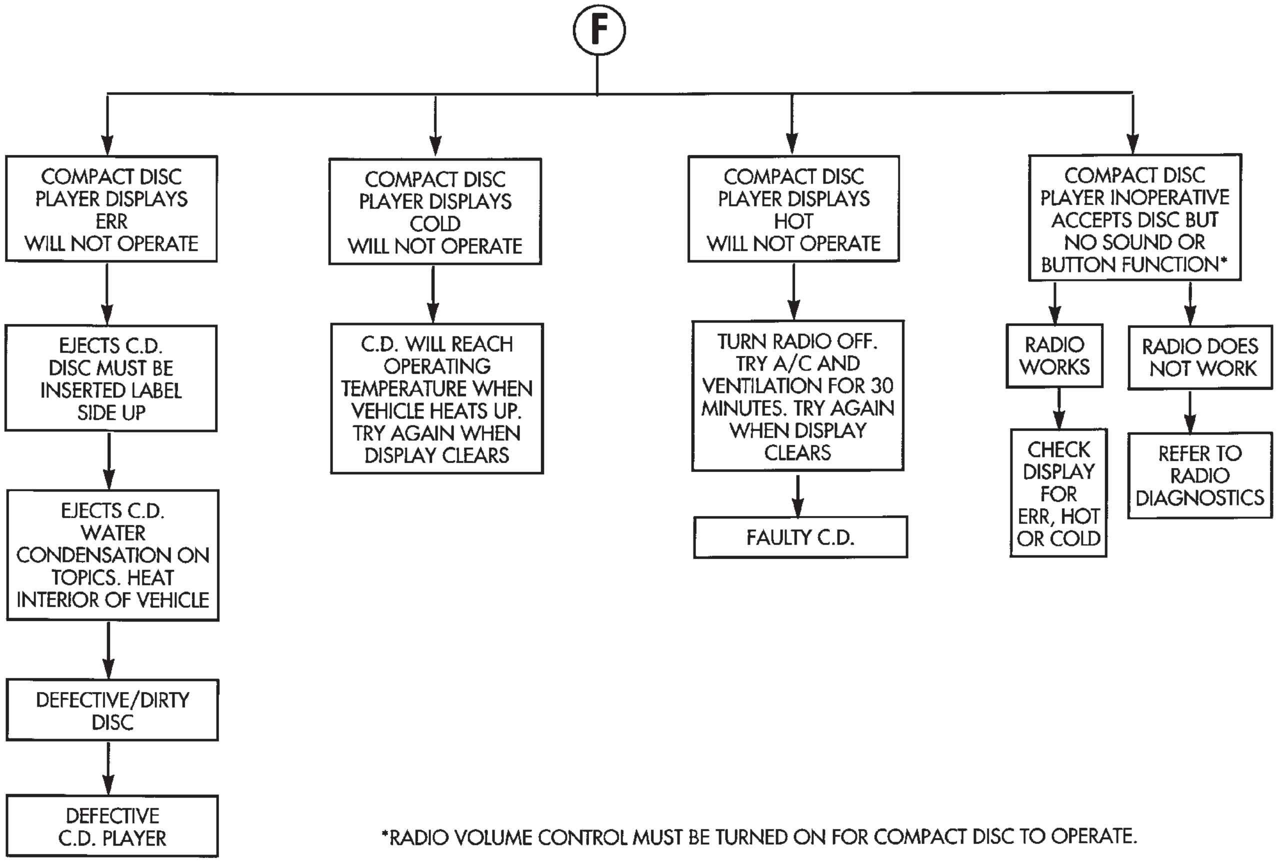
938F-42

INFINITY—AC-AJ-AY BODIES CONTINUED



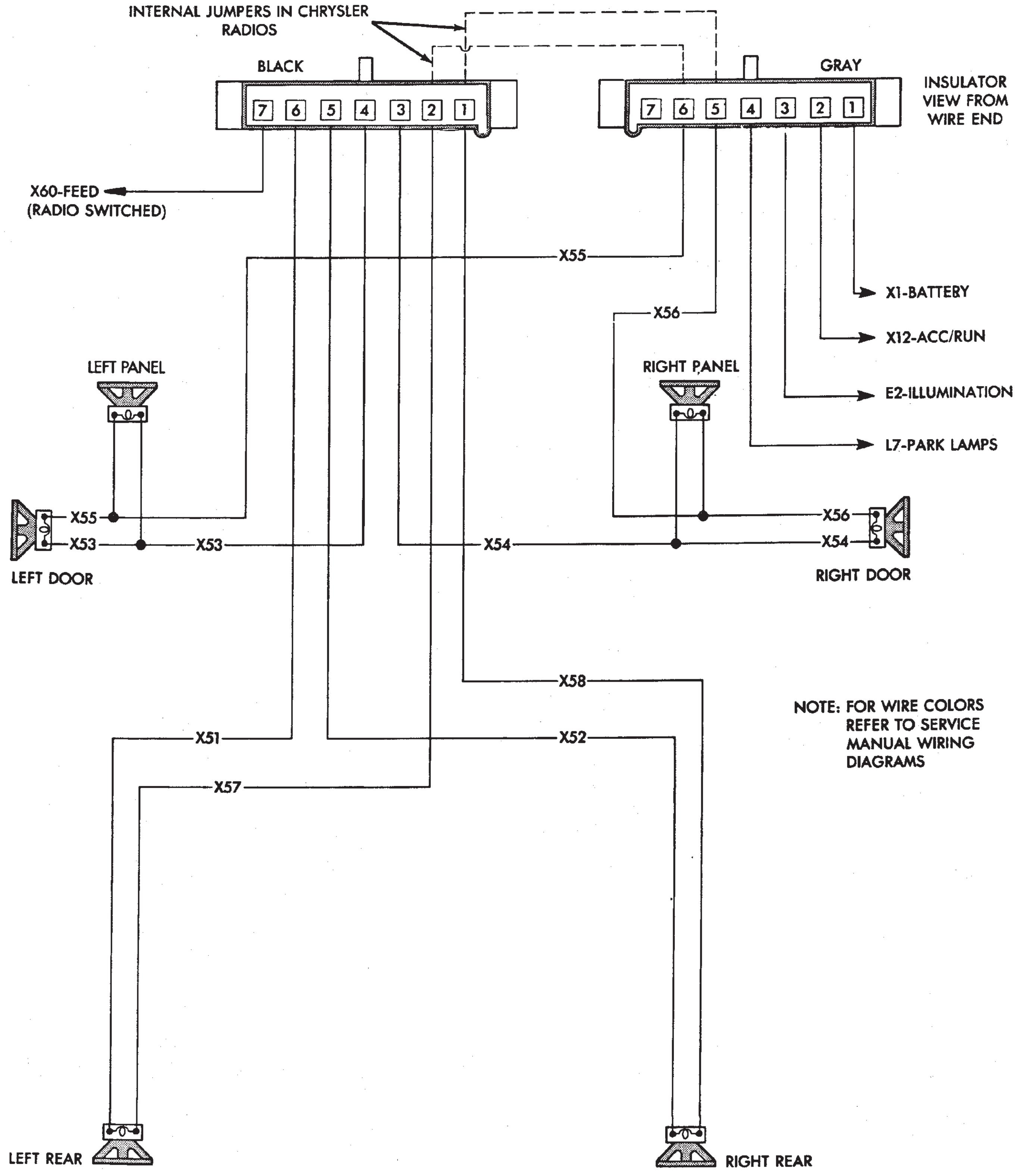
938F-43

INFINITY—AC-AJ-AY BODIES CONTINUED



*RADIO VOLUME CONTROL MUST BE TURNED ON FOR COMPACT DISC TO OPERATE.

938F-44



NOTE: FOR WIRE COLORS REFER TO SERVICE MANUAL WIRING DIAGRAMS

LEGEND:
E2-ILLUMINATION
L7-PARK LAMPS
X1-BATTERY
X12-ACC/RUN
X50-MONO COMMON
X51-LEFT REAR FEED
X52-RIGHT REAR FEED
X53-LEFT PNL/DR FEED
X54-RIGHT PNL/DR FEED
X55-LEFT PNL/DR RETURN
X56-RIGHT PNL/DR RETURN
X57-LEFT REAR RETURN
X58-RIGHT REAR RETURN
X59-MONO FEED
X60-FEED (RADIO SWITCHED)
X61-MUTE

938F-11

Fig. 2 Radio Connector Circuits

RADIO REMOVAL—AA BODY

(1) Remove center bezel by pulling straight back disengaging the five clips.

(2) Remove radio mounting screws (Fig. 3).

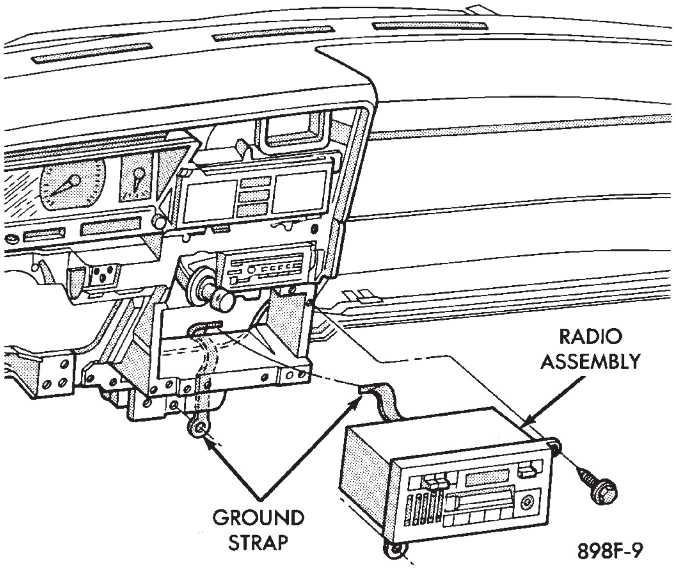


Fig. 3 Radio Assembly—AA BODY

(3) Pull radio from panel and disconnect wiring, ground strap and antenna lead from radio.

(4) Remove radio.

INSTALLATION

(1) Connect wiring, ground strap and antenna lead to radio.

(2) Position radio into panel, install mounting screws and tighten securely.

(3) Install center bezel.

RADIO REMOVAL—AG AND AJ BODIES

(1) Remove center instrument panel bezel by pulling toward the rear of the car (Fig. 4).

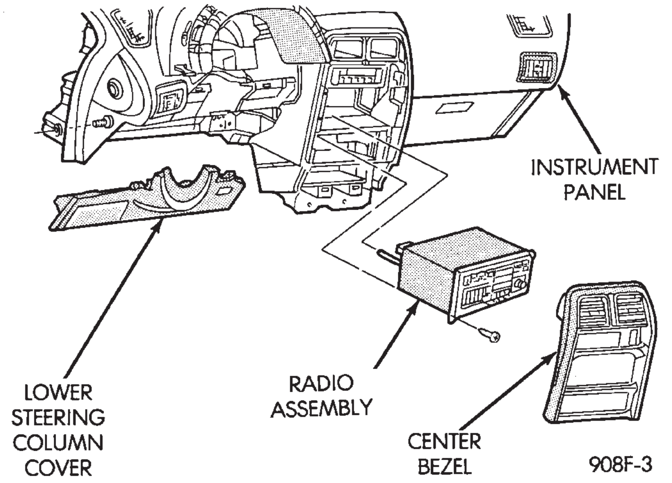


Fig. 4 Radio Assembly—AG and AJ Bodies

(2) Remove two screws attaching radio to console.

(3) Pull radio through front face of console, disconnect wiring harness, antenna lead, and ground strap.

INSTALLATION

(1) Position radio so that the wiring harness, antenna lead, and ground strap can be connected.

(2) Install two screws attaching radio to console.

(3) Install center bezel by pushing in until clips engage.

RADIO REMOVAL—AC AND AY BODIES

(1) Remove upper and lower bezel screws (Fig. 5) and bezels.

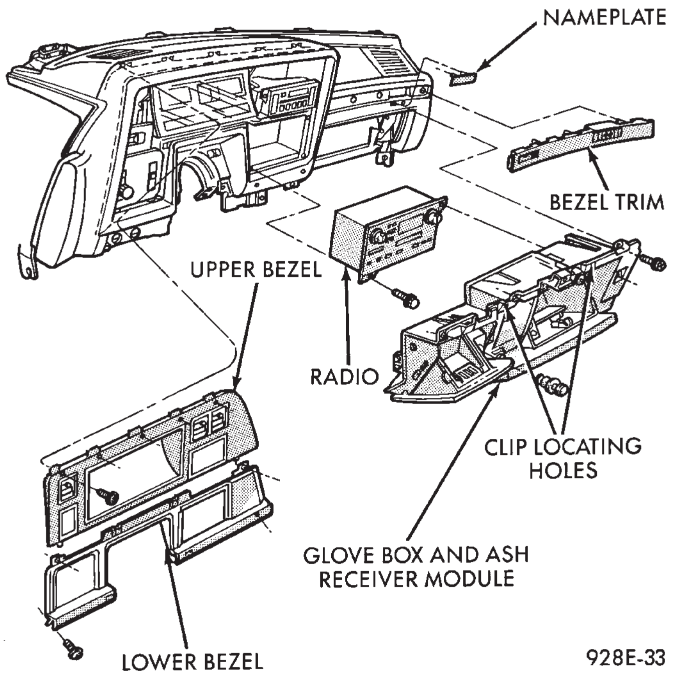


Fig. 5 Radio Assembly—AC and AY Bodies

(2) Remove two radio attaching screws.

(3) Disconnect wiring connectors and antenna cable.

(4) Remove screw attaching ground strap.

(5) For installation reverse above procedures.

RADIO REMOVAL AP BODY REPLACEMENT

(1) Remove center module bezel (Fig. 6).

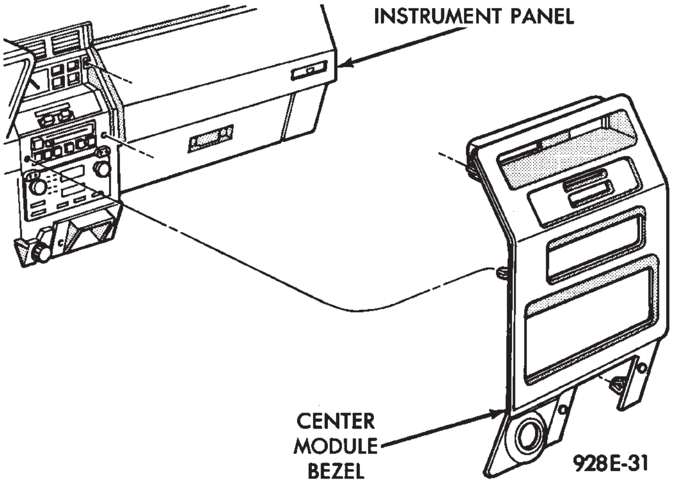


Fig. 6 Center Module Bezel

(2) Remove lower center module cover if equipped with base console.

(3) Remove right console side wall if equipped with full console assembly.

(4) Remove two mounting screws on the radio and pull out of instrument panel (Fig. 7).

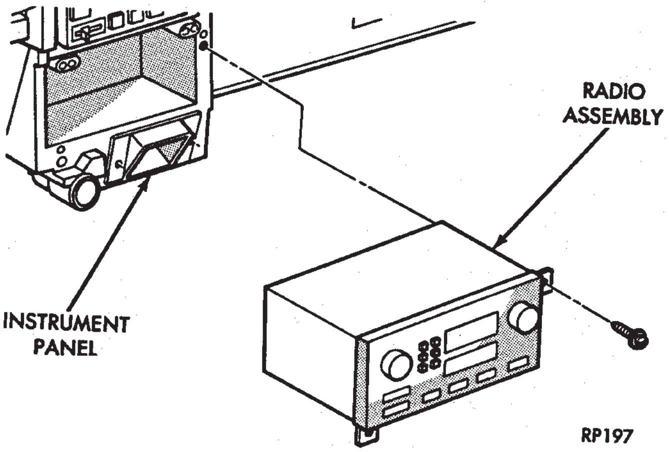


Fig. 7 Radio Assembly—AP Body

(5) Disconnect wiring and antenna cable.

(6) Remove ground strap from radio.

(7) For installation reverse above procedures.

ANTENNAS

INDEX

MANUAL ANTENNAS

TESTING

Antenna performance may be tested by substituting a known good antenna. It is also possible to check short or open circuits with an ohmmeter or continuity light once the antenna cable is disconnected from the radio as follows:

(1) Continuity should be present between the antenna mast and radio end pin of antenna cable plug (Fig. 8 and 9).

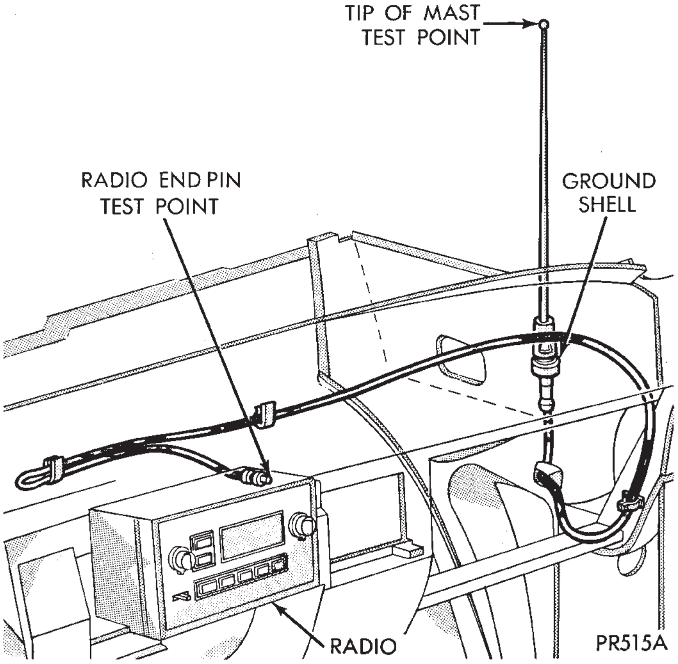


Fig. 8 Antenna Test Points

(2) No continuity should be observed or a very high resistance of several megohms between the ground shell of the connector and radio end pin.

(3) Continuity should be observed between the ground shell of the connector and the mounting hardware on the vehicle fender.

REMOVAL

AA, AC and AY bodies have a short cable that plugs into the panel harness cable.

To remove antenna, the radio must be removed first. See radio removal. Except AA and AC bodies.

(1) Unplug antenna lead from radio receiver.

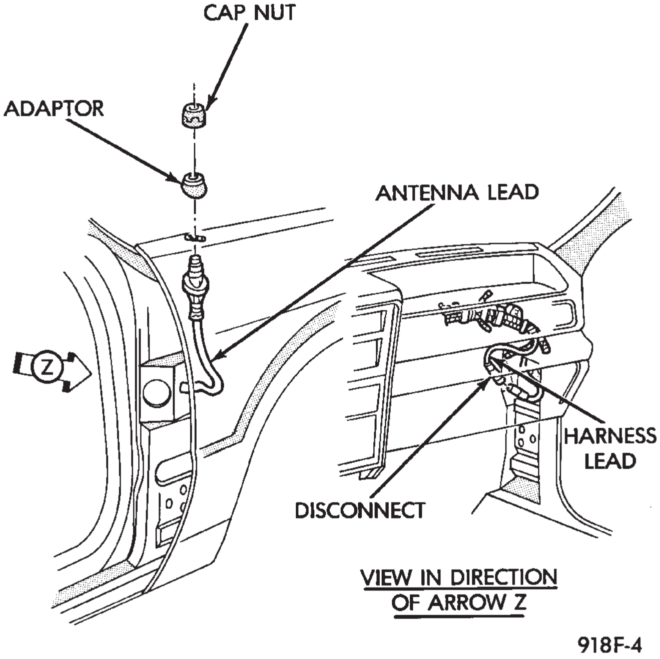


Fig. 9 Antenna Test Points—Two Piece Cable

(2) Remove antenna mast by unscrewing mast from antenna body (Fig. 10).

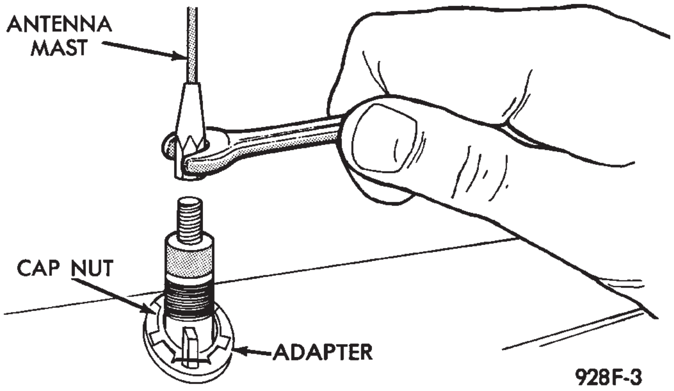


Fig. 10 Antenna Mast Removal and Installation

(3) Remove cap nut with Antenna Nut Wrench C-4816 (Fig. 11).

(4) Remove antenna adapter and gasket (Fig. 12).

(5) Unfasten three push pins from the rear of the plastic inner fender shield and bend the shield away to gain access to the antenna body.

(6) From under fender remove antenna lead and body assembly (Fig. 12).

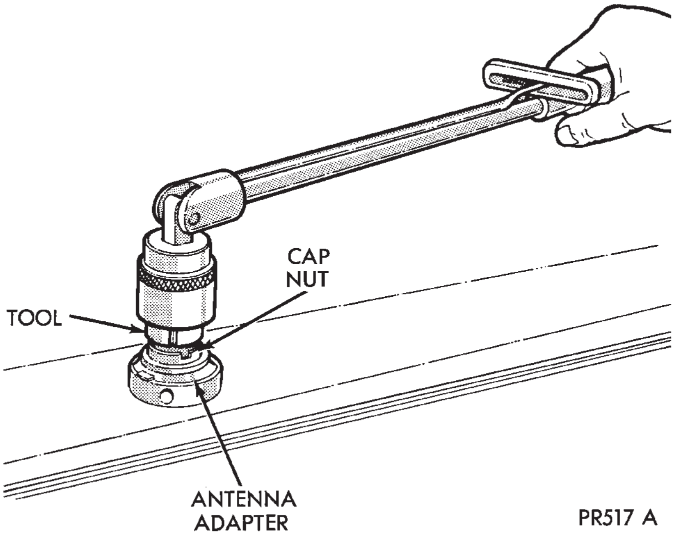


Fig. 11 Removing or Tightening Antenna Cap Nut

INSTALLATION

(1) Install antenna body and cable from underneath fender (Fig. 12).

(2) Install gasket, adapter, and cap nut. Tighten cap nut to 14 N•m (125 in. lbs.) with Antenna Nut Wrench C-4816.

(3) Install antenna mast into antenna body until sleeve bottoms on antenna body (Fig. 11).

(4) Route cable to radio if necessary.

BENCH TEST FOR ANTENNA MALFUNCTION

It is also possible to check short or open circuits with an ohmmeter or continuity light once the antenna has been removed from the vehicle.

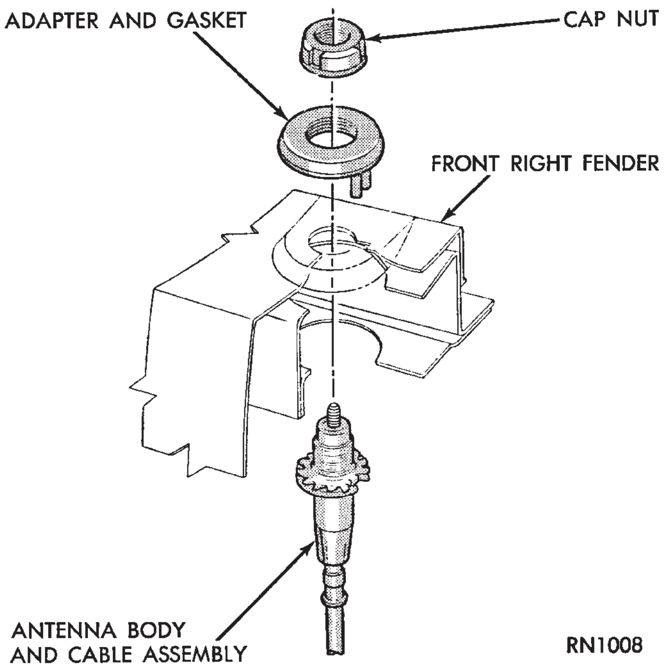


Fig. 12 Antenna Mounting

(1) Continuity should be present between the tip of the mast and radio end pin (Fig. 13 and 14).

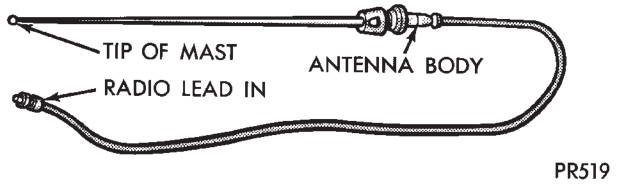


Fig. 13 Antenna Bench Test Points

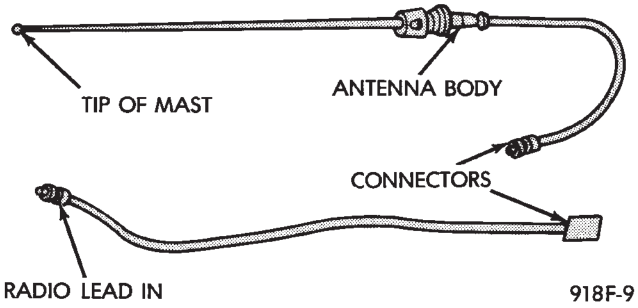


Fig. 14 Antenna Bench Test Points—Two Part

(2) No continuity should be observed or a very high resistance of several megohms between the ground shell of the connector and radio end pin.

(3) Continuity should be observed between the ground shell of the connector and the mounting hardware.

Wiggle cable over its entire length to reveal intermittent short or open circuits during step 1, 2 and 3.

POWER ANTENNA

OPERATION

The power operated radio antenna (Fig. 15) is a telescoping type antenna, extended and retracted by a reversible electric motor.

The Automatic Power Antenna is controlled by a combination of an external relay and limit switches built into the antenna motor housing. The antenna is actuated when radio is switched ON and the ignition switch in ON or ACCESSORY position. The antenna mast should extend. When the ignition switch or radio is turned OFF the antenna mast should fully retract and declutch.

Many antenna problems may be avoided by frequent cleaning of the antenna mast telescoping sections. Clean the antenna mast sections with a clean soft cloth.

Before an antenna is removed, the antenna performance should be tested to decide if it is a reception problem or an operational problem.

Whenever an operational malfunction occurs, first verify that the radio antenna wire harness is properly connected. Check all connectors before starting normal diagnosis and repair procedures. Refer to Power Antenna Electrical Diagnosis Chart (Fig. 16).

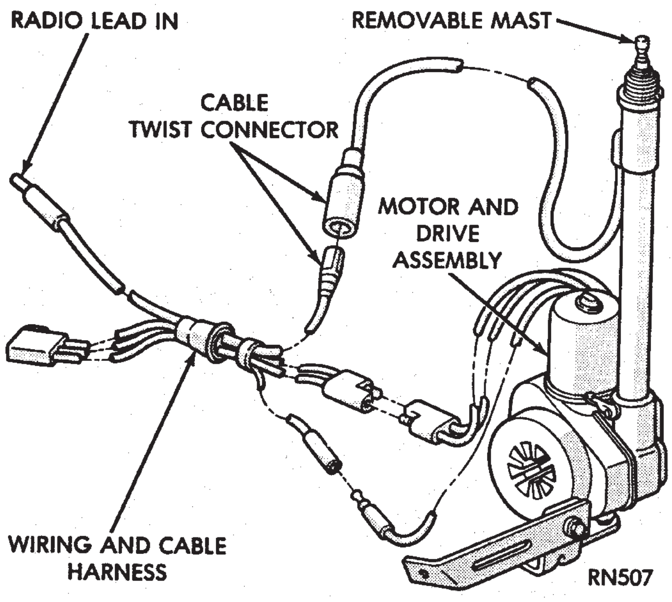


Fig. 15 Power Antenna Assembly

TEST

EXTEND OR RETRACT ANTENNA

(1) To extend antenna, attach the positive (+) lead of a 12 volt power source to the green antenna lead and the negative (-) lead to the gray antenna lead.

(2) To retract antenna attach the positive (+) lead of a 12 volt power source to the white antenna lead and the negative (-) lead to the green antenna lead.

(3) If the motor will not operate, replace the antenna assembly.

(4) If the motor runs freely and the antenna does not extend or retract, the mast or drive assembly is at fault.

(a) Remove the mast and verify that all the drive teeth are intact. If not replace mast.

(b) Check for a defective drive mechanism, if defective replace antenna assembly.

(5) If the mast jumps or travel rate is slow during operation or the motor labors.

(a) Check for bent mast. If bent replace mast.

(b) Check for dirty or corroded mast. If necessary clean and lubricate.

(c) If cleaning the antenna sections does not solve the problem, the antenna mast should be replaced.

(6) If mast fails to extend or retract completely, or motor continued to operate after full extension or retraction of mast.

(a) Check for broken teeth on the mast drive rod or bent mast.

(b) Check limit switches, replace if necessary.

(7) If the mast checks good, the antenna assembly should be replaced.

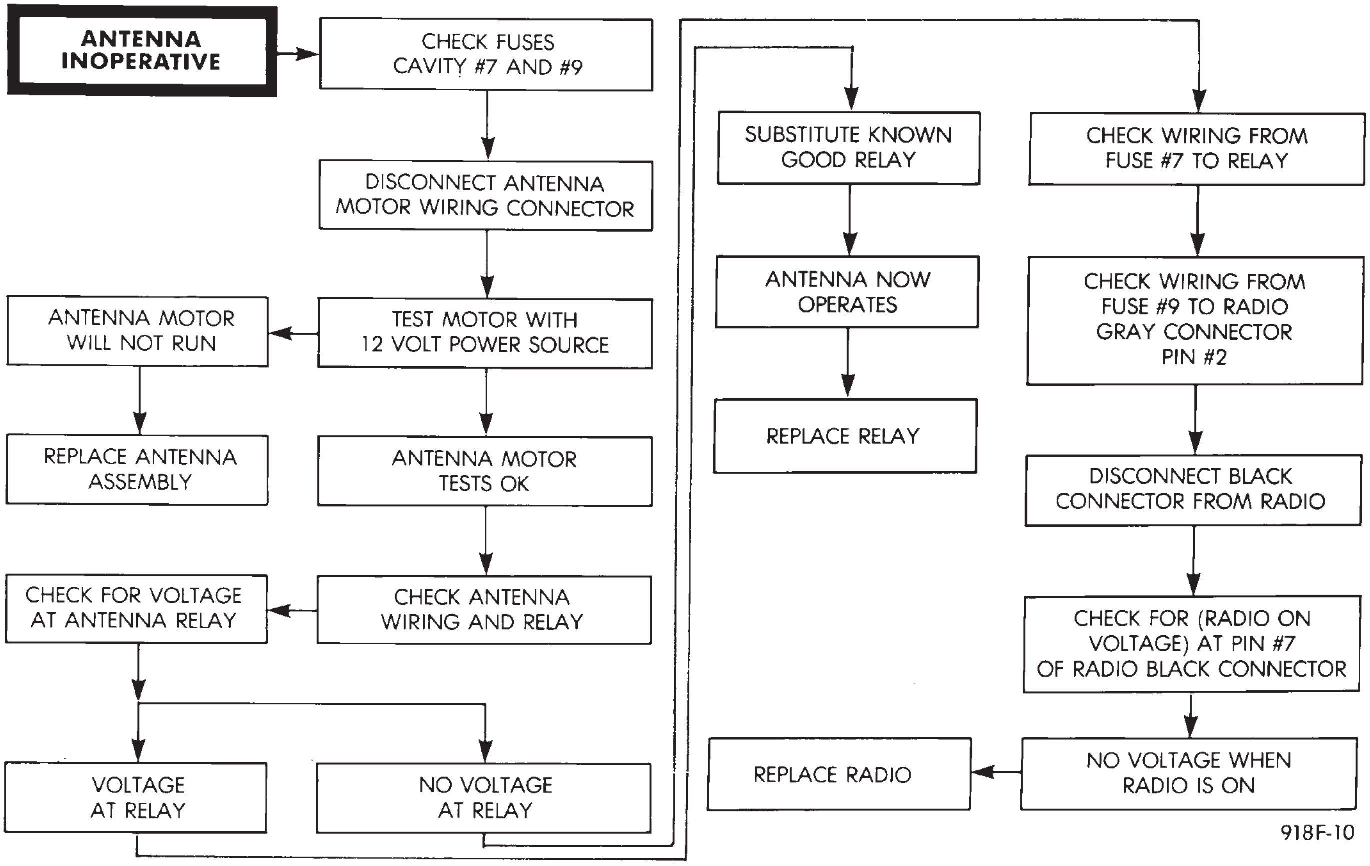


Fig. 16 Power Antenna Electrical Diagnosis

(8) Upon establishing that the fault is in the antenna assembly, it may be traced to one or more of the following conditions:

(a) Broken lead-in wire or shielding.

(b) Grounded lead-in wire or mast assembly.

(c) Moisture in support tube or lead-in assembly.

(d) Poor connection at antenna lead-in assembly or shielding ground.

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove the right front fender splash shield fasteners and pull shield away from the wheel housing.

(3) Disconnect motor leads at the connector (Fig. 15).

(4) Disconnect lead-in cable by twisting at connector (Fig. 17).

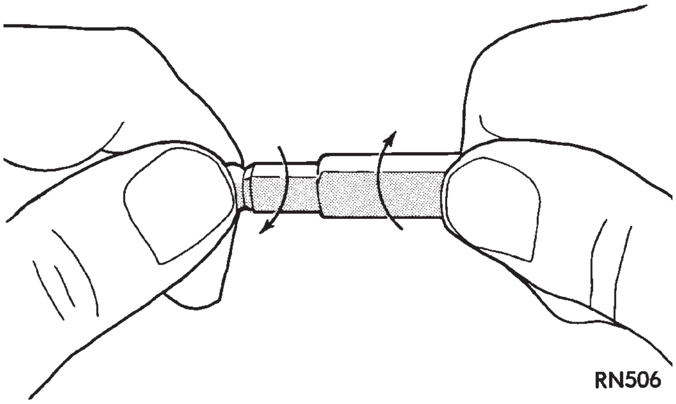


Fig. 17 Power Antenna Twist Connector

(5) Remove one screw attaching antenna to antenna brace (Fig. 18).

(6) Remove cap nut on fender surface with Antenna Nut Wench C-4816 (Fig. 11).

(7) Remove antenna from under fender.

INSTALLATION

(1) Position antenna under fender and through fender adapter.

(2) Replace and tighten cap nut to 14 N●m (125 in. lbs.) torque with Antenna Nut Wench C-4816.

(3) Position antenna on antenna brace and install attaching screw. Tighten to 4 N●m (40 in. lbs.) torque.

(4) Connect antenna lead at twist connector.

(5) Connect motor leads at connector.

(6) Position right front fender splash shield and install attaching fasteners.

(7) Connect negative battery cable and test operation of antenna.

POWER ANTENNA MAST

REMOVAL

(1) Remove cap nut using Antenna Nut Wrench C-4816.

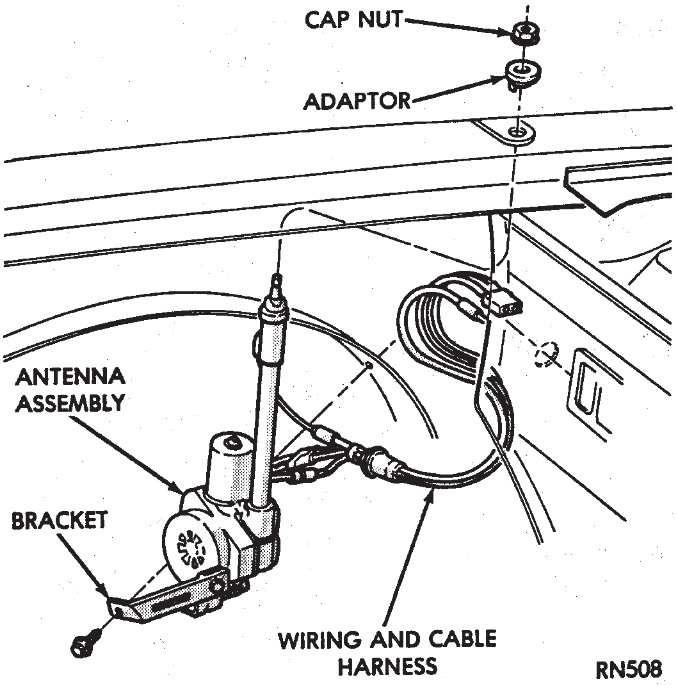


Fig. 18 Power Antenna Mounting

(2) Install temporary nut provided with the replacement mast.

(3) Turn ignition key to ACCESSORY position and turn on radio.

(4) While the mast is moving up pull upward to remove mast and drive rod from the mast tube.

INSTALLATION

(1) Insert new drive rod into mast tube with drive teeth toward antenna motor (Fig. 19).

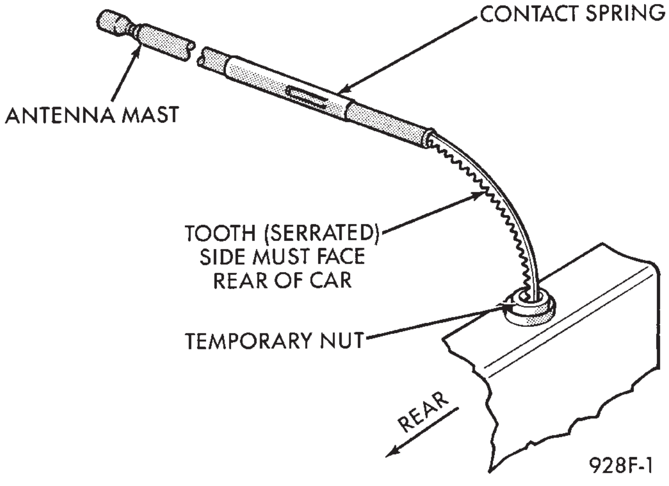


Fig. 19 Power Antenna Mast

(2) Turn off radio and guide mast into tube. The mast may not be fully lowered when first installed.

(3) Replace the temporary nut with the original cap nut and tighten to 14 N●m (125 in. lbs.) torque using Antenna Nut Wench C-4816.

(4) Turn radio on and off to extend and retract antenna. Mast should be fully lowered after recycling.

SPEAKERS

INDEX

AA BODY

FRONT DOOR MOUNTED SPEAKER REPLACEMENT

(1) Remove power window switch.

(2) Pry out on speaker grille at two locations on forward edge of grille to disengage clips (Fig. 20).

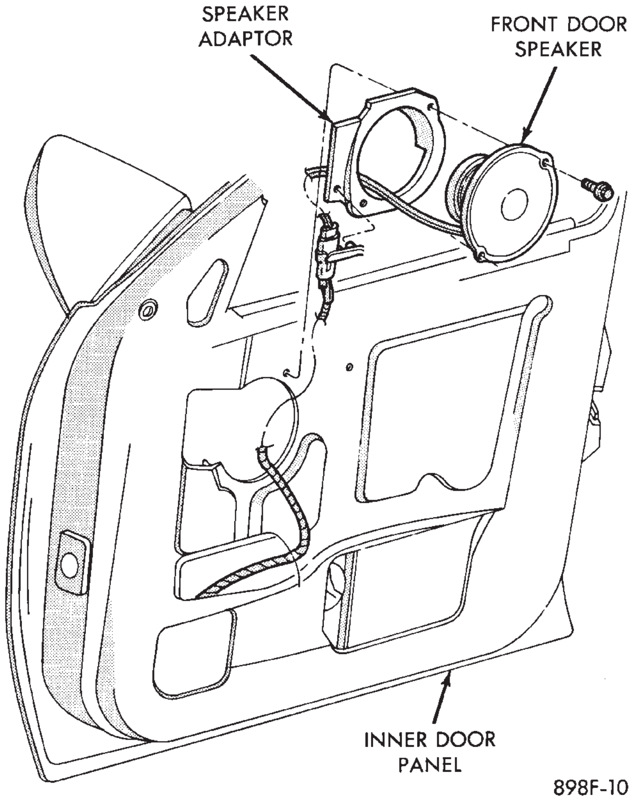


Fig. 20 Front Door Mounted Speaker—AA Body

(3) Remove two speaker mounting screws.

(4) Pull speaker away from door and disconnect wiring connector.

(5) For installation reverse the above procedures.

REAR DOOR MOUNTED SPEAKER REPLACEMENT

(1) Carefully pry with a blunt edge tool at the two slotted openings on top edge of grille to disengage clips.

(2) Tilt top edge of grille away from door and lift up to disengage plastic hooks on grille from trim panel.

(3) To aid in removing speaker it may be necessary to disengage door trim panel near speaker opening.

(4) Remove speaker-adaptor retaining screws (Fig. 21).

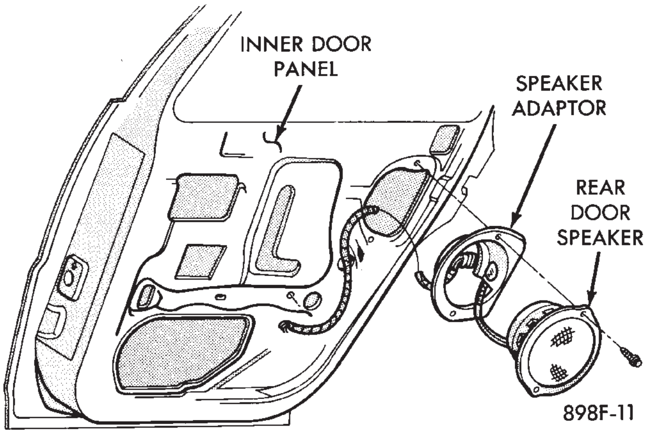


Fig. 21 Rear Door Mounted Speaker—AA Body

(5) Pull speaker away from door and disconnect wiring connector.

(6) For installation reverse above procedures.

AC and AY BODIES

INSTRUMENT PANEL SPEAKERS REPLACEMENT

(1) Carefully pry up at rearward corners of grille with a blunt edge tool to disengage two plastic posts from receptacle cavities in the instrument panel pad.

(2) As rearward edge of grille comes free of pad insert your fingers under exposed grille surface and push up to disengage two more posts at forward corners of grille.

(3) Remove two speaker attaching screws.

(4) Lift up speaker and disconnect wire connector. Remove speaker.

(5) For installation reverse above procedures.

FRONT DOOR SPEAKER REMOVAL

(1) Remove door trim panel, refer to Group 23, Body.

(2) Remove two speaker attaching screws and disconnect wire connector.

(3) Remove speaker.

(4) For installation reverse above procedures.

REAR SHELF SPEAKERS REMOVAL

(1) Remove rear shelf, refer to Group 23, Body.

(2) Remove two speaker attaching screws and disconnect wire connector.

(3) Remove speaker.

(4) For installation reverse above procedures.

AG and AJ BODIES

INSTRUMENT PANEL SPEAKERS REPLACEMENT

(1) Remove instrument panel top cover (Fig. 22).

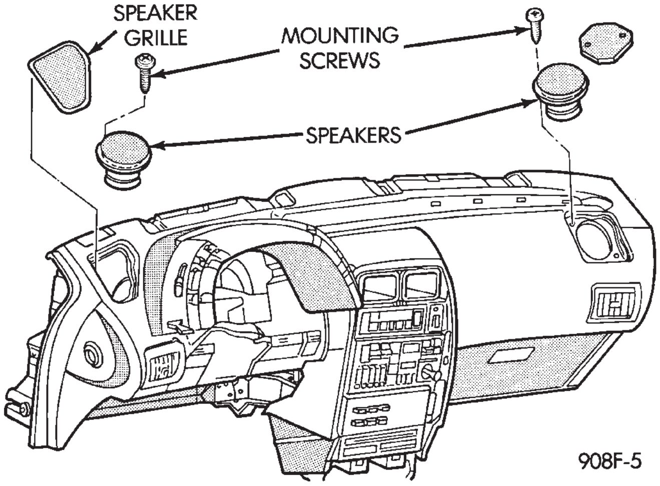


Fig. 22 Instrument Panel Speakers—AG and AJ Bodies

(2) Remove two speaker retaining screws.

(3) Lift speaker away from panel and disconnect wiring.

(4) For installation reverse above procedures.

FRONT DOOR MOUNTED SPEAKER REPLACEMENT—AG BODY

(1) Remove door trim panel.

(2) Remove two speaker-adaptor retaining screws (Fig. 23).

(3) Pull speaker away from door and disconnect wiring.

(4) For installation reverse above procedures.

REAR SPEAKER REPLACEMENT—AG BODY

(1) Remove speaker grille by pulling away from quarter trim panel to disengage retaining clips (Fig. 24).

(2) Remove four speaker retaining screws.

(3) Pull speaker away from body and disconnect wiring.

(4) For installation reverse above procedures.

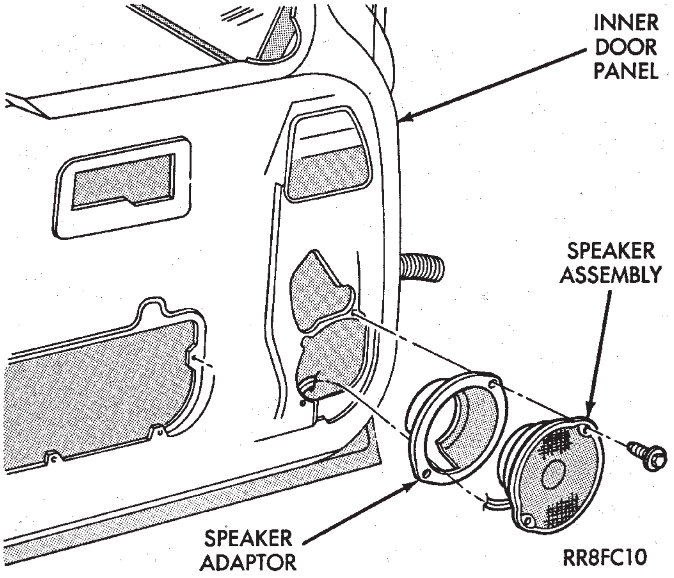


Fig. 23 Front Door Mounted Speaker—AG Body

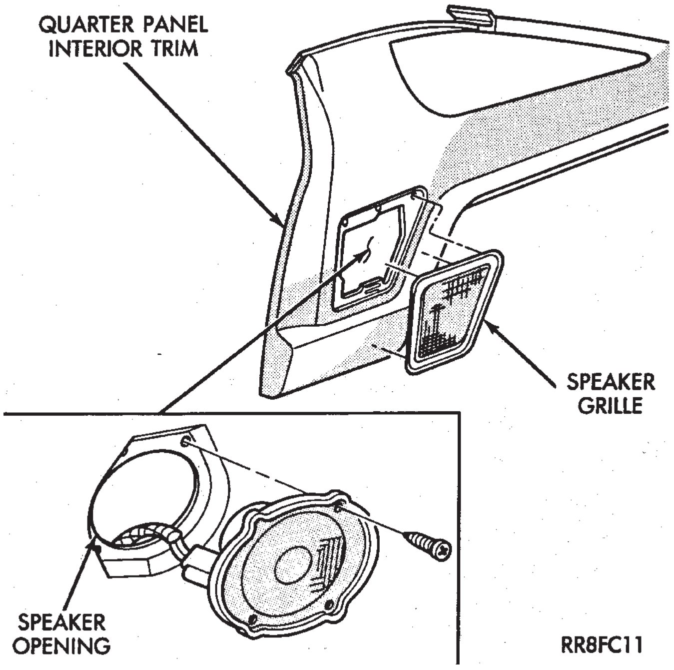


Fig. 24 Rear Speaker—AG Body

DOOR MOUNTED SPEAKER REPLACEMENT—AJ BODY

(1) Pull speaker grille away from door trim panel to disengage retaining clips (Fig. 25).

(2) Remove two speaker retaining screws.

(3) Pull speaker away from door and disconnect wiring.

(4) For installation reverse above procedures.

REAR SPEAKER REPLACEMENT—AJ BODY WITH 60/40 FOLDING REAR SEAT

(1) Remove 40-side seat back.

(2) Remove 60-side seat back.

(3) Remove outboard pivot brackets.

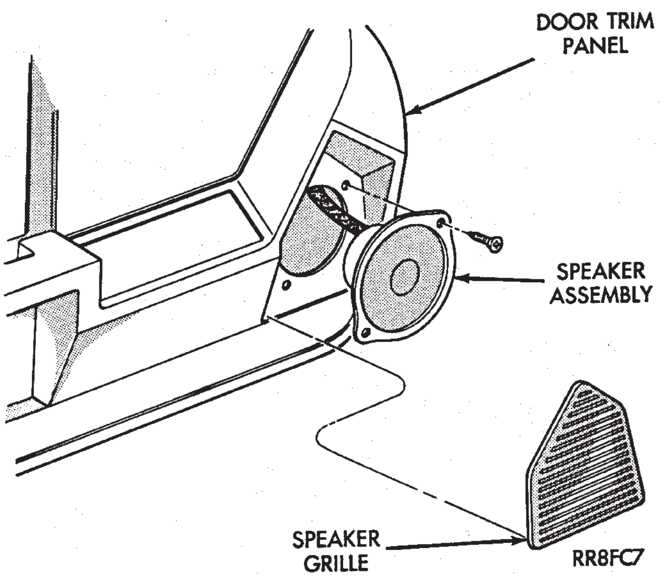


Fig. 25 Door Mounted Speaker—AJ Body

(4) Remove seat cushion.

(5) Remove quarter trim lower extension panel.

(6) Remove front seat belt turning loop and cover.

(7) Remove rear reading lamp.

(8) Remove quarter trim panel.

(9) Remove two seat back latches.

(10) Pull out shelf trim side extension molding.

(11) Remove shelf trim center extension molding.

(12) Remove shelf trim panel (Fig. 26).

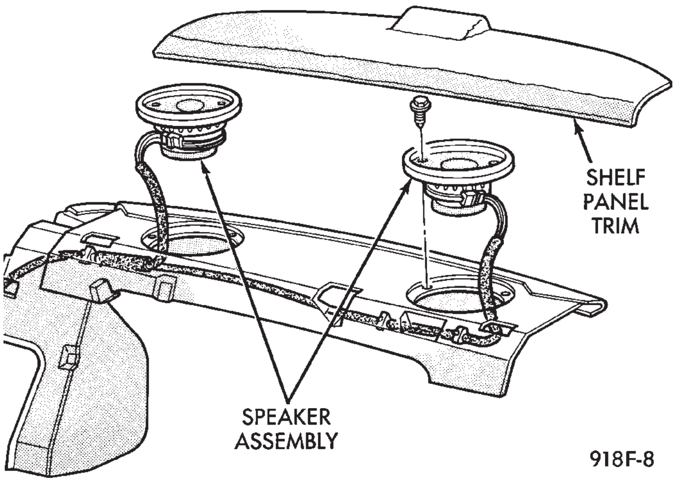


Fig. 26 Rear Speaker—AJ Body

(13) Remove four speaker retaining screws.

(14) Lift speaker away from shelf panel and disconnect wiring.

(15) For installation reverse above procedures. Be sure to position speakers so that terminals are pointing outward.

REAR SPEAKER REPLACEMENT—AJ BODY WITH FIXED SEAT BACK

(1) Remove seat cushion.

(2) Remove seat back.

(3) Remove quarter trim panels.

(4) Remove shelf trim panel.

(5) Remove four speaker retaining screws (Fig. 26).

(6) Lift speaker away from shelf panel and disconnect wiring.

(7) For installation reverse above procedures. Be sure to position speakers so that terminals are pointing outward.

REAR SPEAKER REPLACEMENT—AJ BODY CONVERTIBLE

(1) Move folding top to UP position.

(2) Unsnap sling well from tacking strip and fold-out of the way to gain access to speaker.

(3) Lower folding top to improve speaker accessibility.

(4) Remove two speaker retaining screws (Fig. 27).

(5) Disconnect wiring and pull out speaker.

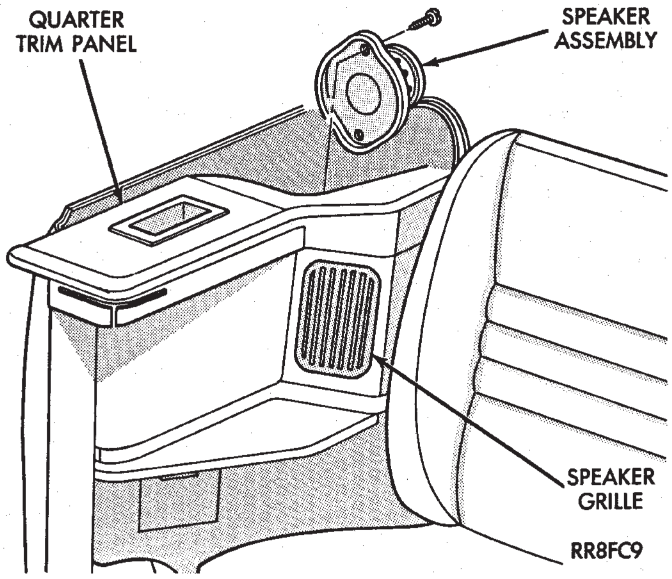


Fig. 27 Rear Speaker—AJ Body

(6) For installation reverse above procedures.

AP Body

DOOR MOUNTED SPEAKER REPLACEMENT—AP BODY

(1) Remove door trim panel.

(2) Remove two screws holding speaker to inner door panel (Fig. 28).

(3) Pull speaker out and disconnect wiring.

(4) For installation reverse above procedures.

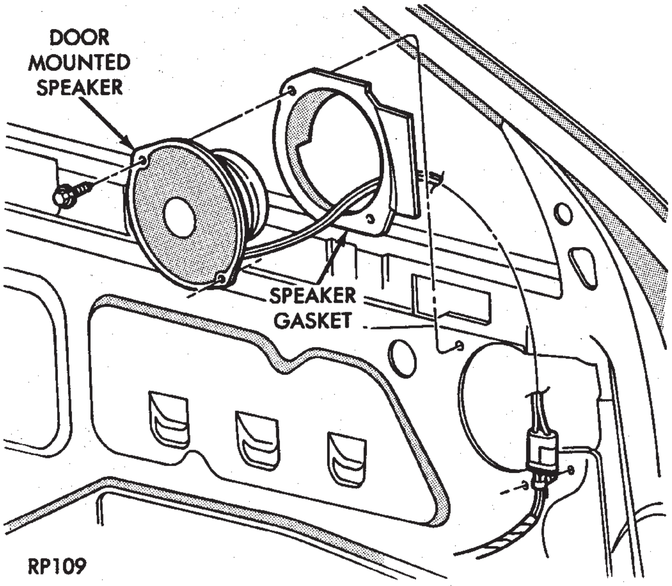


Fig. 28 Door Mounted Speaker—AP Body

REAR MOUNTED SPEAKER REPLACEMENT—AP BODY

(1) Remove cargo side trim panel (Fig. 29).

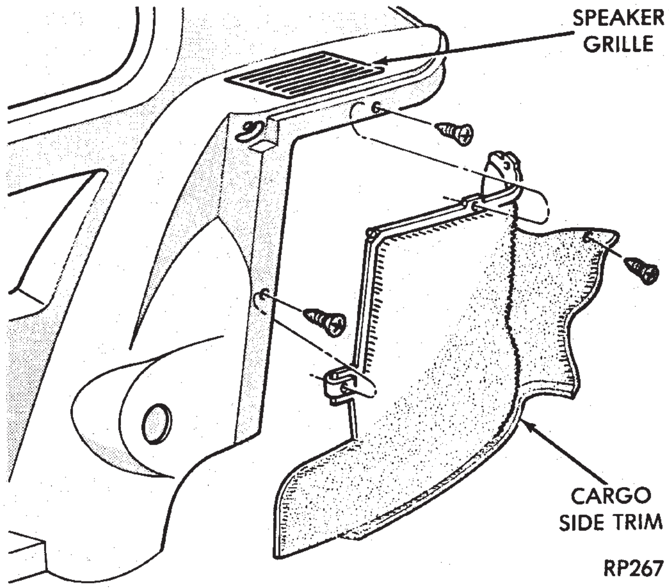


Fig. 29 Cargo Side Trim Panel—AP Body

(2) Reaching up underneath quarter panel extension, remove four speaker retaining nuts (Fig. 30).

(3) Move speaker away from mounting bracket and disconnect wiring.

(4) For installation reverse above procedures.

AC AND AY BODIES

INSTRUMENT PANEL SPEAKER REPLACEMENT

(1) Carefully, pry speaker grille away from instrument panel (Fig. 31).

(2) Remove two speaker retaining screws.

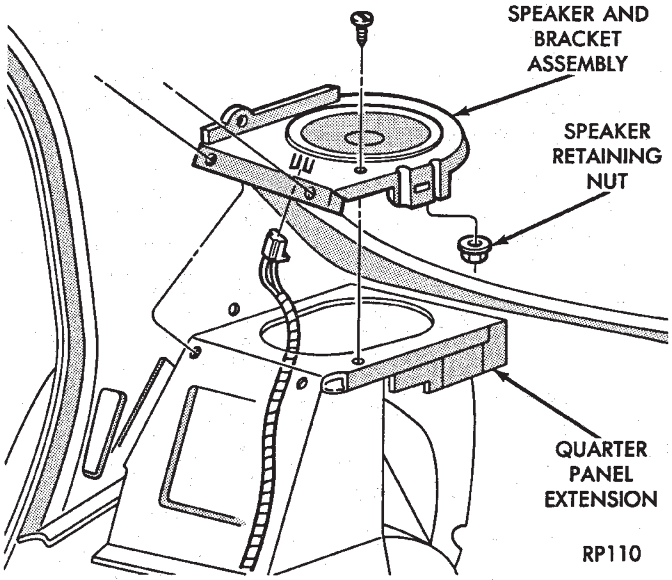


Fig. 30 Rear Mounted Speaker—AP Body

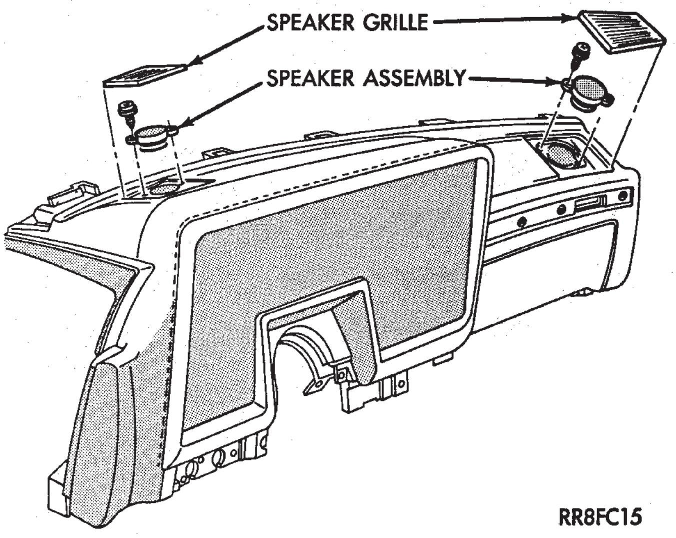


Fig. 31 Instrument Panel Speakers—AC and AY Bodies

(3) Lift speaker away from panel and disconnect wiring.

(4) For installation reverse above procedures.

DOOR MOUNTED SPEAKER REPLACEMENT—AC AND AY BODIES

(1) Carefully, pry speaker grille away from door trim panel (Fig. 32).

(2) Remove two speaker retaining screws.

(3) Pull speaker away from door and disconnect wiring.

(4) For installation reverse above procedures.

REAR SPEAKER REPLACEMENT—AC AND AY BODIES

(1) Remove seat cushion.

(2) Remove seat back.

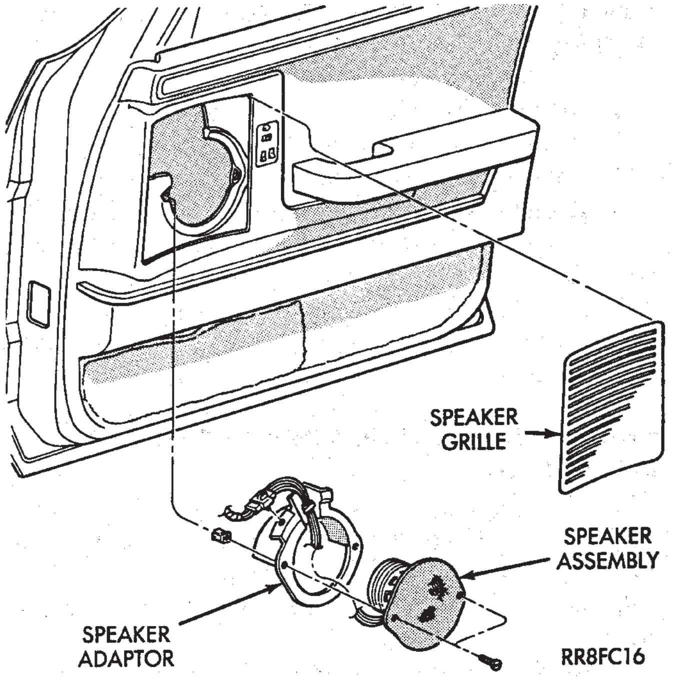


Fig. 32 Door Mounted Speaker—AC and AY Bodies

(3) Remove shelf trim panel (Fig. 33).

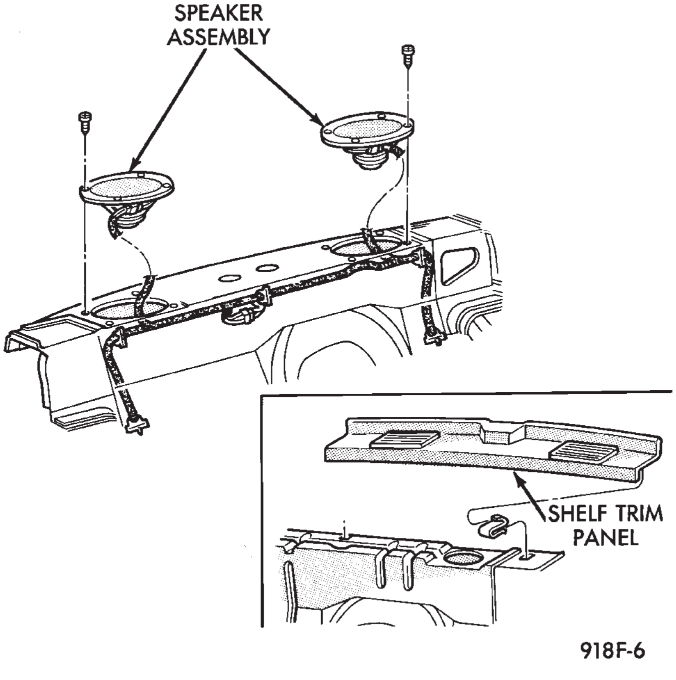


Fig. 33 Rear Speakers—AC and AY Bodies

(4) Remove four speaker retaining screws.

(5) Pull speaker away from shelf panel and disconnect wiring.

(6) For installation reverse above procedures.

INFINITY REMOTE AMPLIFIER

The AC and AY amplifier is located in the trunk on the rear seat bulkhead and the behind rear trim panel.

The AJ amplifier is located in the trunk on the left wheel housing extension behind the side trim panel.

When the radio system is ON, and all or some speakers are not operating or have a noise distortion refer to the diagnostic tests. The amplifier has the terminal connections list on the case (Fig. 34).

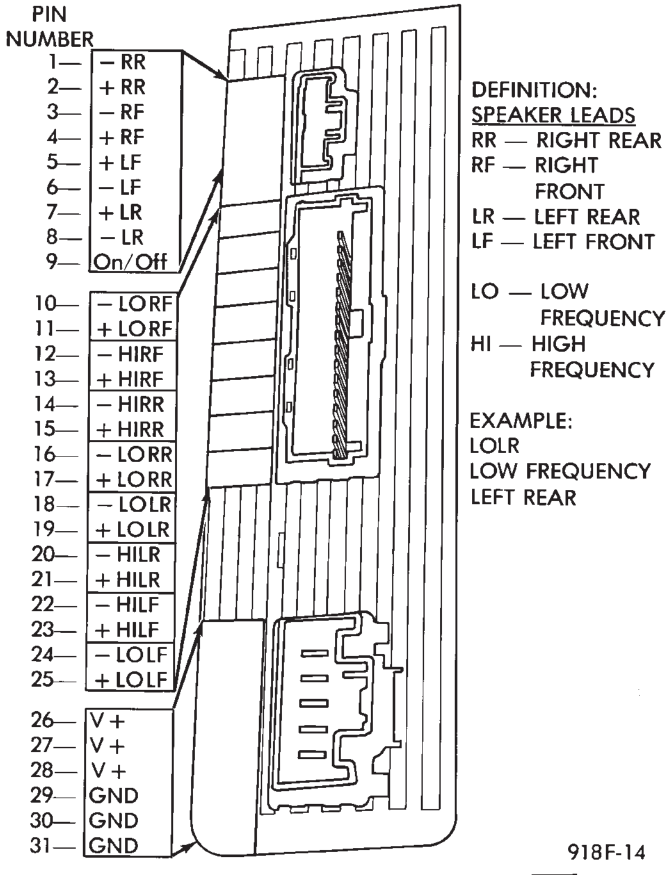


Fig. 34 Amplifier Terminals

CONDITION: NOISE DISTORTION IN ALL SPEAKERS

- Check battery voltage for 11 Volts or more
- Check amplifier connectors and wires for proper connection and continuity
- If OK, check radio, refer to Audio Diagnostic Charts.
- If OK, replace amplifier

CONDITION: ELECTRICAL NOISE DISTORTION ONE SPEAKER

Remove output signal connector from amplifier and check for short to ground on the speaker with the distortion. Refer to Fig. 34 for the appropriate pin numbers.

- If shorted to ground disconnect speaker connector and recheck the amplifier connector for short to ground.
- If still shorted to ground repair wires. If not shorted to ground, replace speaker.

- If no short to ground at connector, check speaker resistance at amplifier connector for an reading of three to five ohms.
- If resistance is OK, refer to Radio Diagnosis. If radio checks OK, replace amplifier.
- If resistance is less than three ohms check speaker. Check across the speaker connector if less than three ohms replace speaker. If resistance is OK repair wires

CONDITION: MECHANICAL NOISE DISTORTION

- Check trim for loose parts and speaker attachments for buzzes
- Remove speaker still connected and listen for distortion. Distortion replace speaker.

CONDITION: ONE SPEAKER NON-OPERATIVE

- Remove output signal connector from amplifier and check for three to five ohms resistance to the non-operative speaker. Refer to Fig. 34 for the appropriate pin numbers.
- If resistance is less than three ohms, test speaker for resistance.
- If OK repair wire. If not replace speaker.

CONDITION: ALL SPEAKERS NON-OPERATIVE

- Check radio for being ON, are the display lights on
- Radio not ON, refer to Radio Diagnosis
- Check Amplifier Connectors and wires for proper connection
- Check pin 9 and pin 27 for battery voltage
- If voltage OK replace amplifier
- If pin 27 has battery voltage and pin 9 has 0 voltage. Refer to Power Antenna Diagnosis and test voltage at antenna relay.
- If pin 9 has battery voltage and pin 27 has 0 voltage. Check pin 27 for short to ground.
- If shorted to ground repair wire
- If no short to ground check fuse cavity number 16 for blown fuse.
- If fuse blows again replace amplifier

RELAY/CHOKE—INFINITY SPEAKER

If the audio system is lacking bass, check for continuity across the relay and choke connectors. If no continuity, replace relay/choke assembly (Fig. 35).

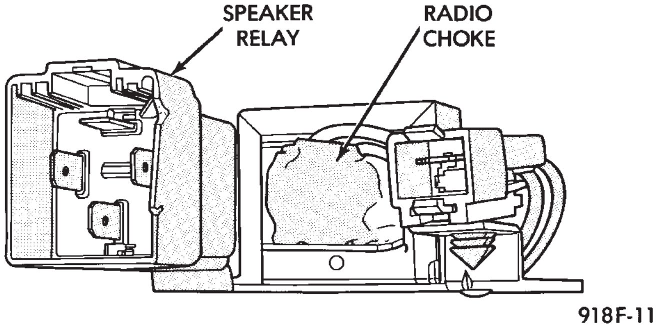


Fig. 35 Relay/Choke Assembly

LOCATION

(1) AA and AP Bodies, attached to the reinforcement above glove box.

(2) AG Body, attached to the dimmer module bayonet bracket on the bulkhead behind the glove box.

COMPACT DISC PLAYER

WARNING: USE OF THE CONTROLS, ADJUSTMENTS, OR SERVICE PROCEDURES NOT SPECIFIED HERE OR IN THE OWNER MANUAL MAY RESULT IN HAZARDOUS RADIATION EXPOSURE. REPAIR PROCEDURES SHOULD ONLY BE PERFORMED BY A TRAINED TECHNICIAN.

DIAGNOSIS TEST

Power to the compact disc player is supplied by the radio through the CD interface cable. The compact disc player will only work with the radio system turned ON. When a compact disc is inserted with the label side facing up, the disc is automatically loaded and will begin to play.

The CD player may eject the disc with a display of E under the following conditions:

- The surface of the disc is dirty or wet
- The disc was inserted with the label side facing down
- The disc is defective
- The CD player may skip or mute while playing a disc under severe vibration conditions example pot holes, railroad tracks, etc.
- If the CD player becomes too hot at temperatures above 60°C (140 °F) the CD player will shut down with a display of HOT until it cools down. Refer to the Audio Diagnostic Charts.

COMPACT DISC PLAYER REPLACEMENT

With intergral compact disc player refer to Radio Removal.

AJ BODY

(1) Remove center instrument panel bezel by pulling toward the rear of the car.

(2) Remove two screws attaching disc player to console (Fig. 36).

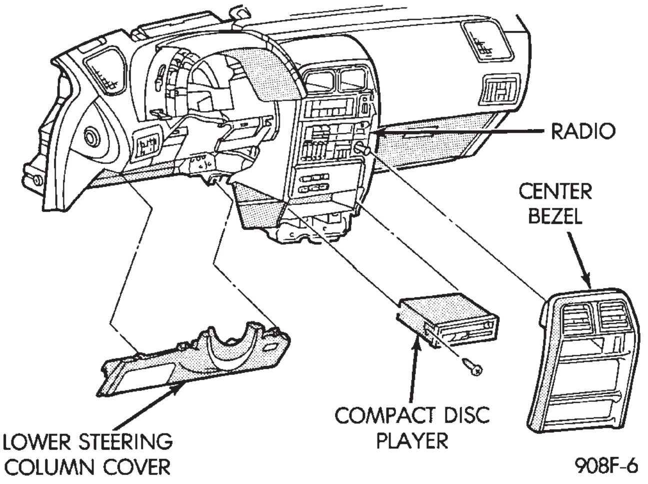


Fig. 36 Compact Disc Player

(3) Pull disc player out of console and disconnect interface cable.

(4) To install compact disc player, above the removal procedures.

HORNS

CONTENTS

GENERAL INFORMATION

WARNING: ON VEHICLES EQUIPPED WITH AIR BAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

The horn circuit consists of a horn switch, horn relay, and horns. The horn circuit feed is from the fuse box to the number 1 terminal on the horn relay. When the horn switch is depressed, this completes the circuit to ground. This activates the horn relay and an set of contacts in the relay to close, which allows current to flow to the horn(s). The horn ground wire is attached to the headlamp ground screw (Fig. 1).

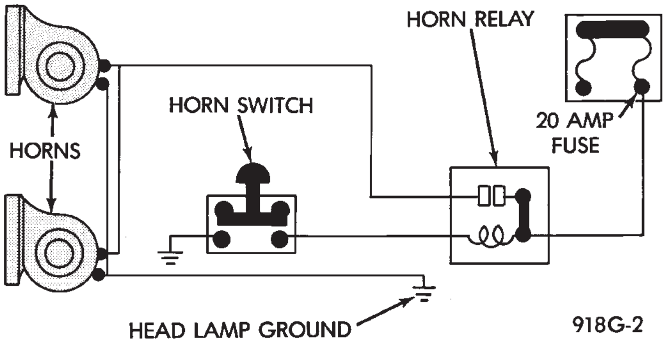


Fig. 1 Conventional Horn System

TESTING HORN SYSTEM

HORNS WILL NOT SOUND

If the horns do not sound, check for a blown horn fuse in the fuse block. If the fuse is blown, replace it with the same fuse type. If the horns 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.

If the fuse is good, disconnect wire connector at horn. Using an test lamp, connect one lead to the negative terminal and the other to the positive terminal (Fig. 2). Depress the horn switch, the test lamp should illuminate. If not connect the test lamp wire to a good ground and depress the horn switch. If test lamp lights inspect ground wire circuit and repair as needed.

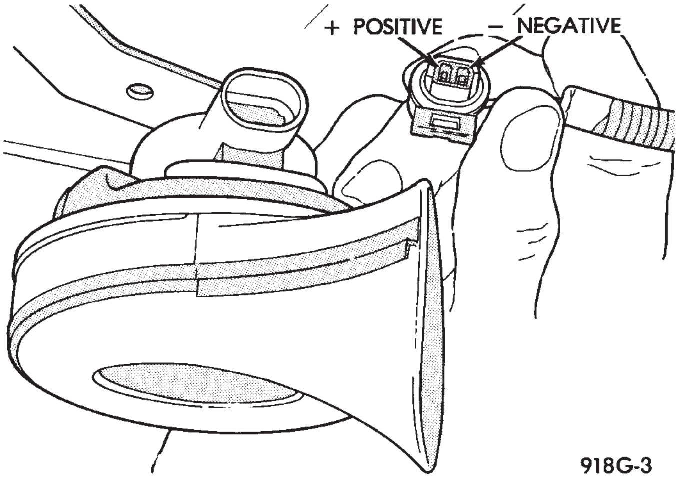


Fig. 2 Horn and Connector

If the test lamp fails to illuminate, check for a defective horn relay. Substituting a known good horn relay in the circuit. If the test lamp illuminates when depressing the horn switch, the original relay is defective. If the test lamp fails to illuminate with a known good relay, unplug that relay. Connect a jumper wire from the battery terminal to the horn terminal on the relay terminal board (Fig. 3, 4, or 5). If the test lamp connected in place of the horns, fails to illuminate an open circuit in the wiring between the relay terminal and the horn switch is at fault repair as necessary.

HORNS SOUND CONTINUOUSLY

CAUTION: Continuous sounding of horns may cause relay to fail.

Should the horns sound continuously, unplug the horn relay from the terminal board inside the passenger compartment. Plug in a known good relay. If the horns stop blowing, relay is defective and must be replaced. Should the horns still sound, proceed as follows: Connect one voltmeter lead to battery terminal on relay board and the other lead to switch terminal. Refer to Figs. 6, 7, or 8. Voltmeter will

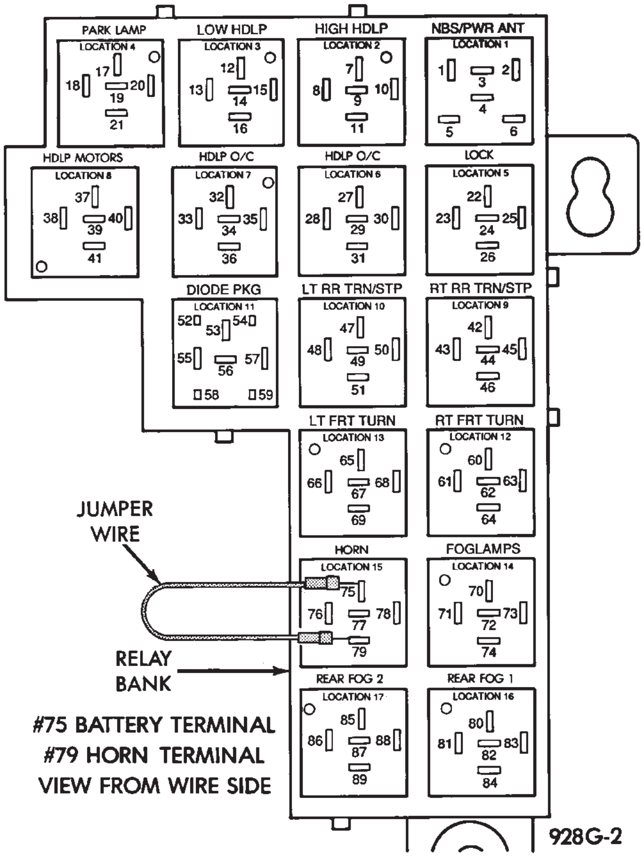


Fig. 3 Testing for an Open Circuit—AG and AJ Bodies

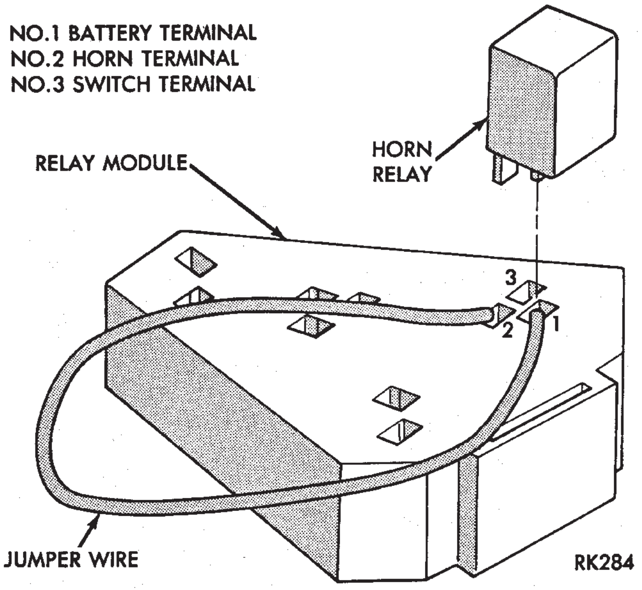


Fig. 4 Testing for an Open Circuit—AP and AA Bodies

register battery voltage when the wire to the horn switch is shorted to ground or the horn switch is defective.

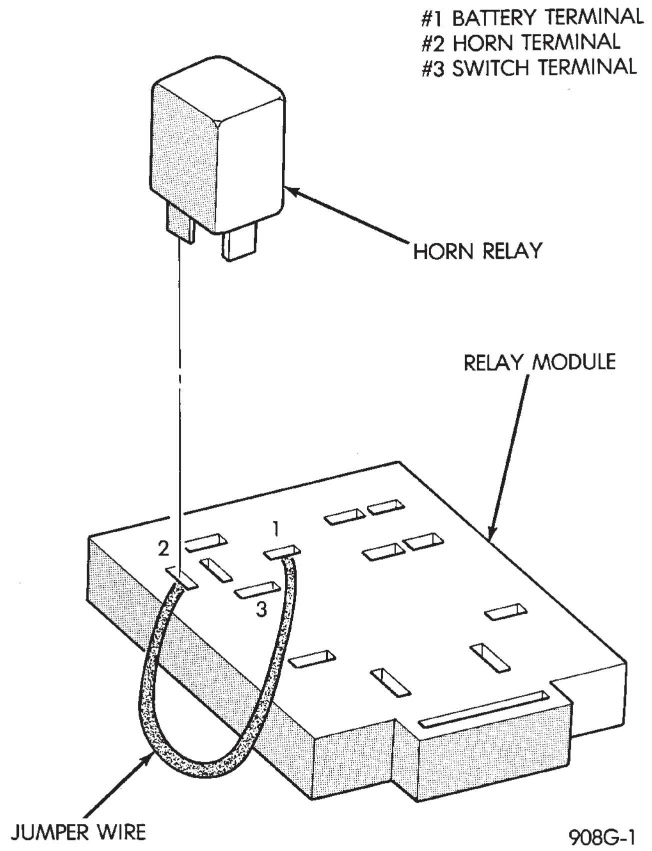


Fig. 5 Testing for an Open Circuit—AC and AY Bodies

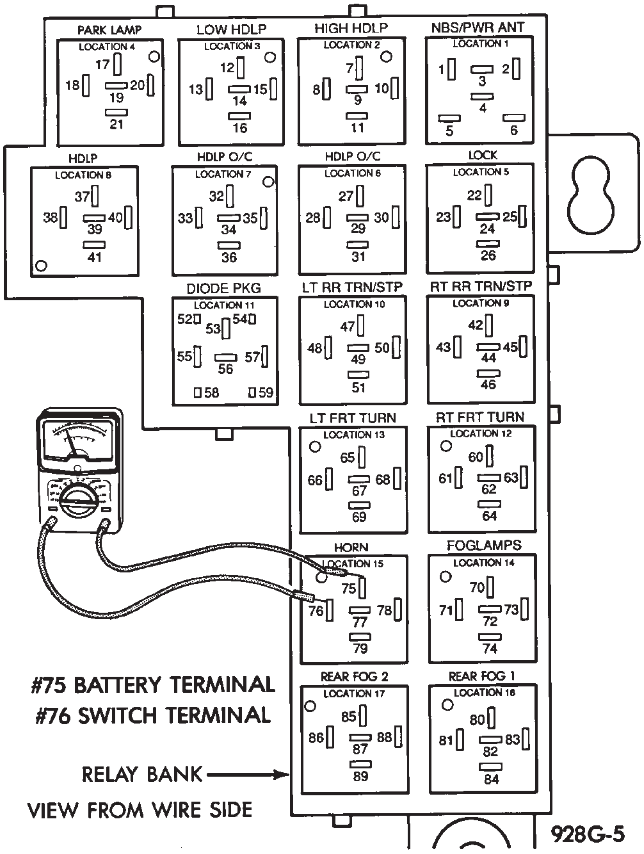


Fig. 6 Testing for Short to Ground—AG and AJ Bodies

Remove steering wheel horn pad and disconnect wire from horn switch. Repeat the above test and if the test lamp still illuminates, wire is shorted and should be repaired. If test lamp does not illuminate, horn switch is defective and must be replaced.

DIAGNOSIS TESTING

Horn does not sound, horn sounds intermittently, or horn sounds continuously go to Horn Diagnosis Chart (Fig. 9).

HORN SWITCH REPLACEMENT

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, 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.

(1) Disconnect and isolate negative battery cable in engine compartment.

(2) Remove four retaining nuts from back of steering wheel. Remove air bag module (Fig. 10 and 11).

(a) Disconnect wire from rear of air bag module.

(b) Place air bag module on a clean level surface with pad facing upward.

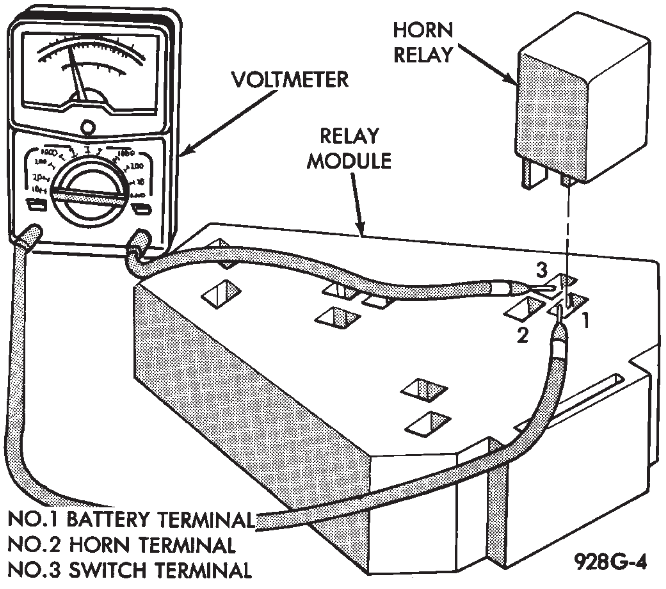


Fig. 8 Testing Horn for Continuous Sound— AP and AA Bodies

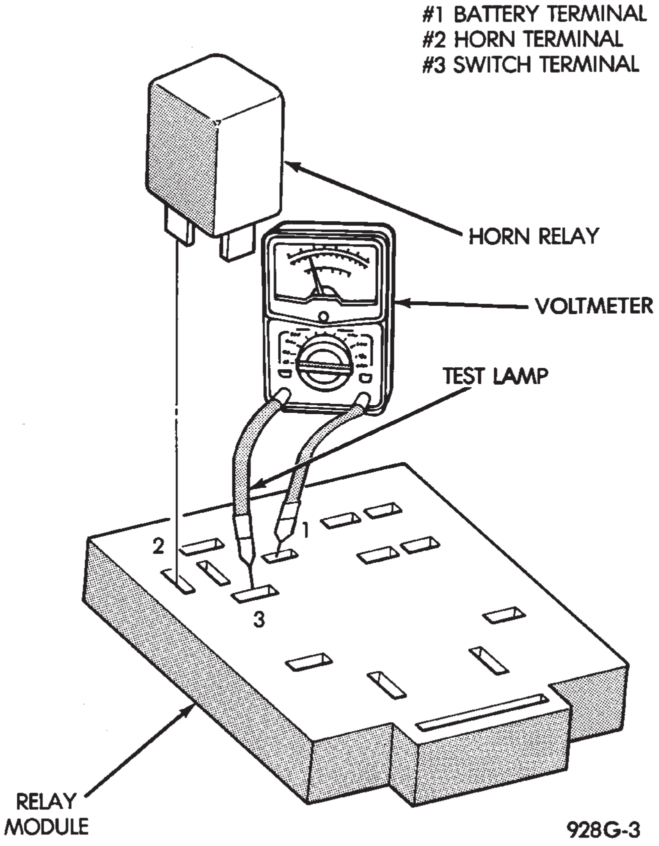


Fig. 7 Testing for Short to Ground—AC and AY Bodies

(3) Remove horn switch assembly from steering wheel.

(a) On luxury steering wheel (Fig. 10), pry out two trim cover buttons on back of steering wheel to access retaining screws for the horn switch. The sport steering wheel (Fig. 11) the horn screws are accessible after the Air Bag is removed.

(b) Remove two screws and disconnect horn wires located in the lower portion of steering wheel. Feed wires through the access ports and remove horn switch.

(4) For installation reverse the above procedures. Use caution not to pinch wires.

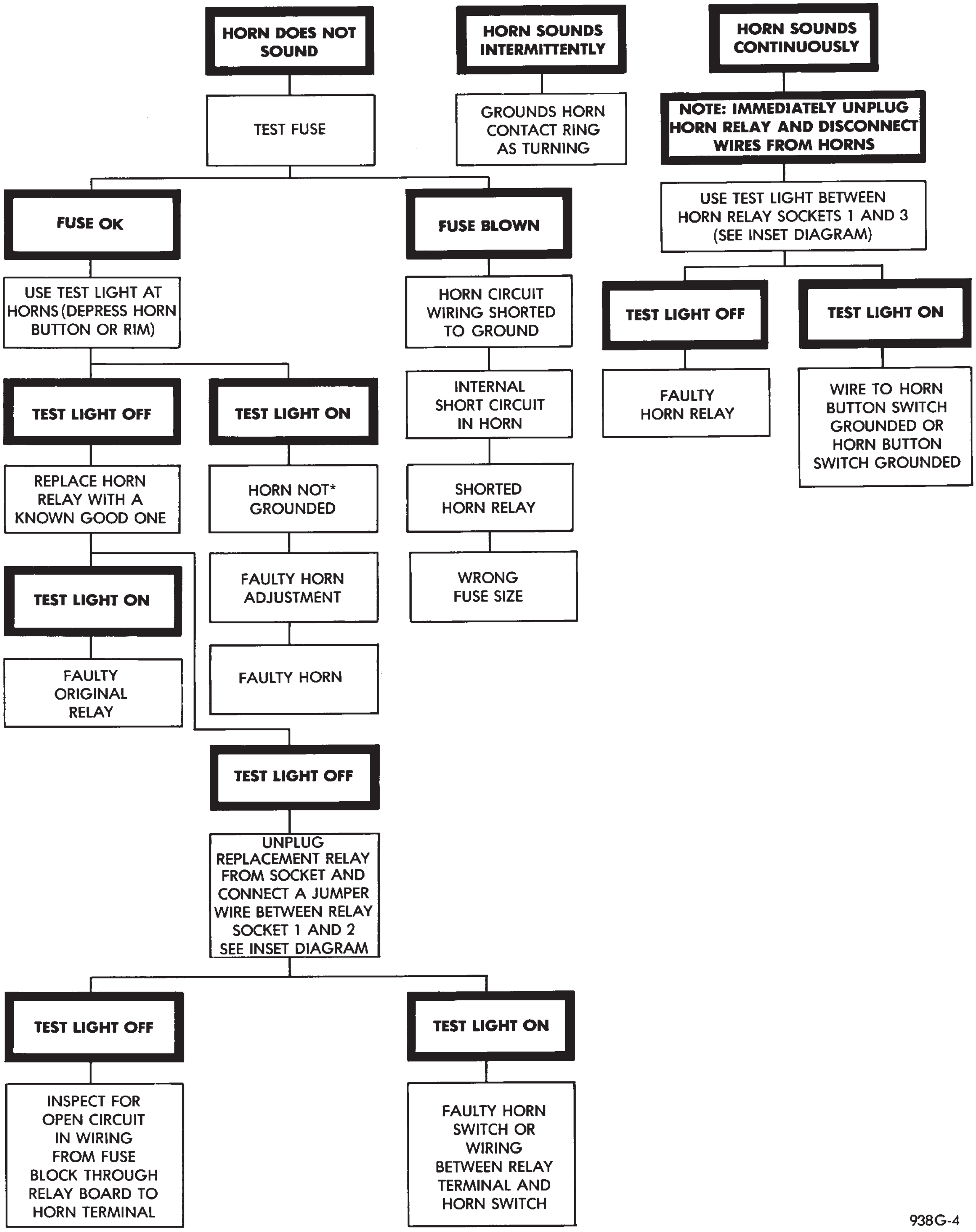


Fig. 9 Horn Diagnosis

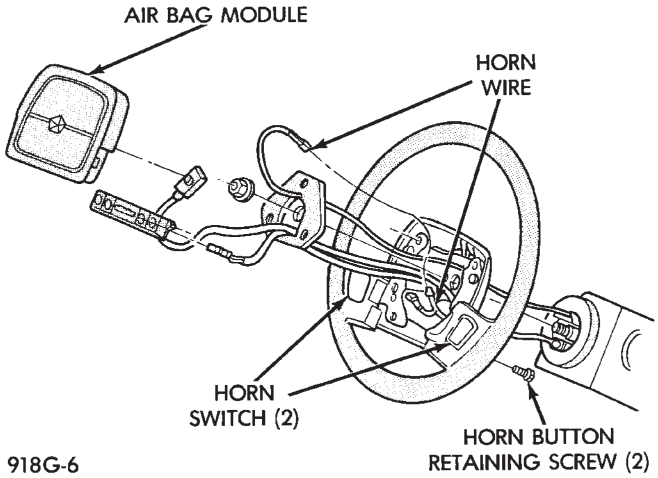


Fig. 10 High Line Steering Wheel

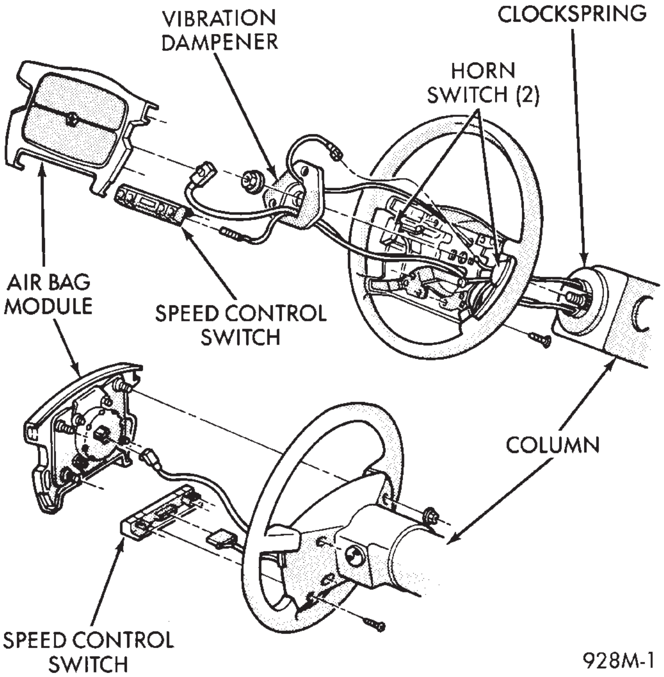


Fig. 11 Low Line Steering

VEHICLE SPEED CONTROL

CONTENTS

GENERAL INFORMATION

The vehicle speed control 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, RESUME/ACCEL and SET/DECEL buttons (Fig. 1). For identification and location of the major components (Fig. 2 through 8).

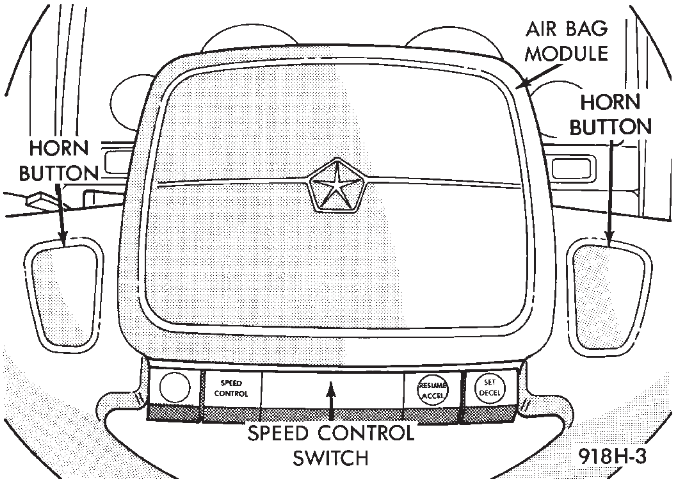


Fig. 1 Vehicle Speed Control Switch

The system is designed to operate at speeds above 35 mph (50 km/h).

WARNING: THE USE OF VEHICLE SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

TO ACTIVATE: The ON/OFF button to the depressed latched position, ON, the vehicle speed control function is now ready for use.

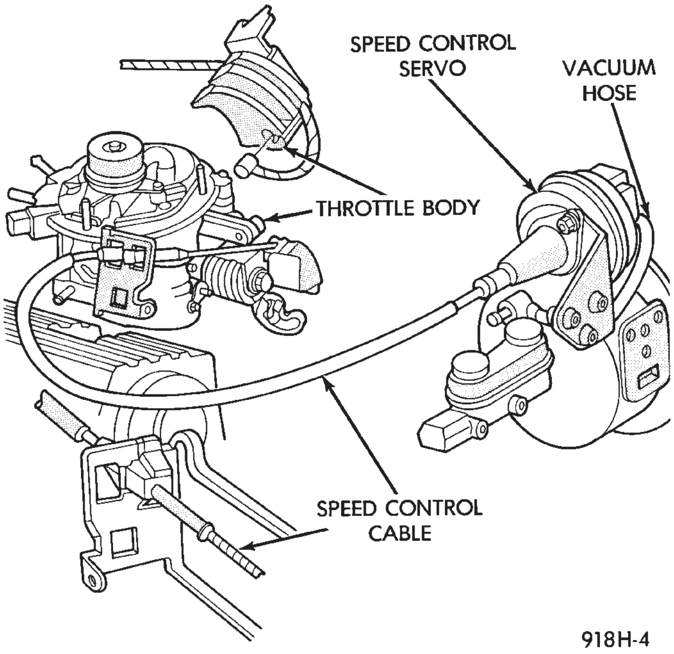


Fig. 2 Vehicle Speed Control—2.2L and 2.5L

TO DEACTIVATE: A soft tap of the brake pedal, normal brake application or depressing the clutch pedal while the system is engaged will disengage vehicle speed control without erasing memory. A sudden increase in engine rpm may be experienced if the clutch pedal is depressed while the vehicle speed control is engaged. Pushing the ON/OFF button to the unlatched position or turning off the ignition erases the memory.

TO SET SPEED: When the vehicle has reached the desired speed push the SET/DECEL button to engage system which will then automatically maintain the desired speed.

TO DECELERATE: When vehicle speed control is engaged, holding the SET/DECEL button depressed allows the vehicle to coast to a lower speed setting.

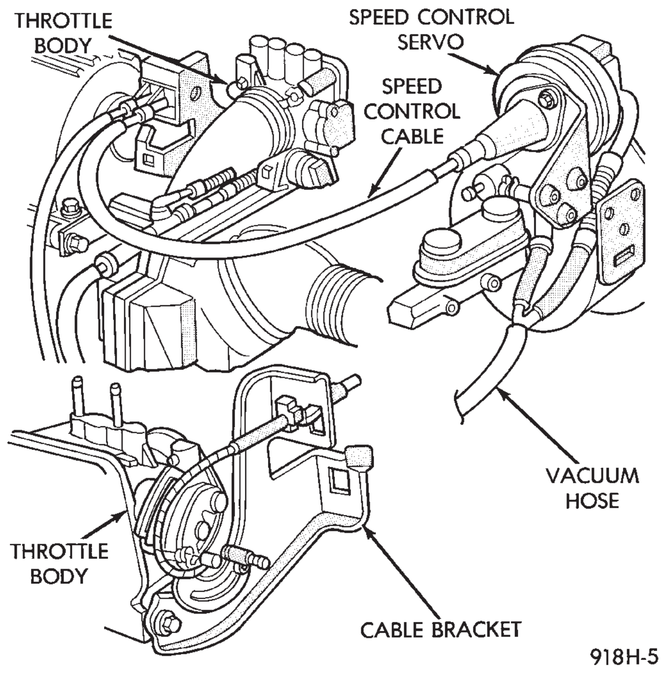


Fig. 3 Vehicle Speed Control—Turbo

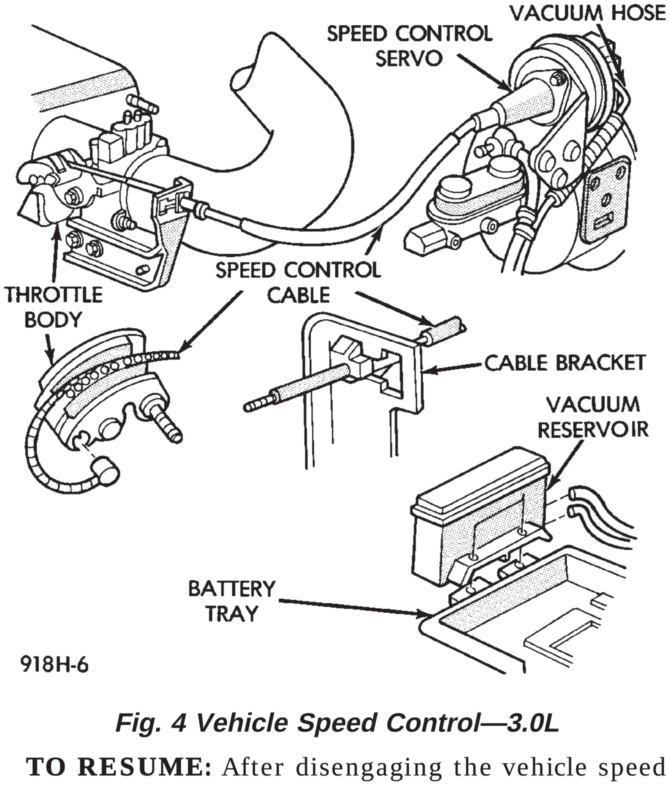


Fig. 4 Vehicle Speed Control—3.0L

TO RESUME: After disengaging the vehicle speed control by tapping the brake pedal or clutch pedal, push the RESUME/ACCEL button to return vehicle to the previously set speed.

TO ACCELERATE: While vehicle speed control is engaged, hold the RESUME/ACCEL button depressed and release at a new desired speed. This will allow the vehicle to continuously accelerate and set at a higher speed setting.

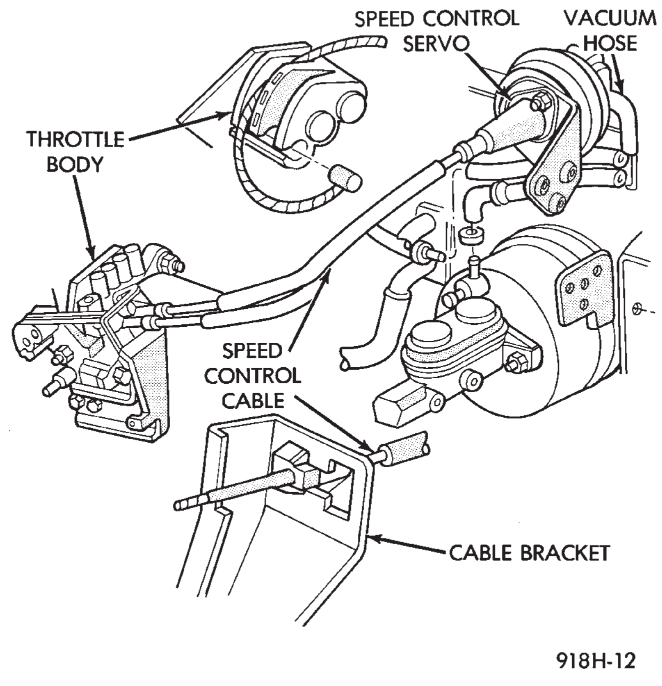


Fig. 5 Vehicle Speed Control—2.2L Turbo III

TAP-UP: When the vehicle speed control is engaged, tapping the RESUME/ACCEL button will increase the speed setting by 2 mph (3 km/h). The system will respond to multiple tap-ups.

TO ACCELERATE for PASSING: Depress the accelerator as you would normally. When the pedal is released the vehicle will return to the speed setting in memory.

DIAGNOSIS PROCEDURES

Whenever a vehicle speed control malfunction occurs, first verify that the vehicle speed control wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Electronic Vehicle Speed Control Diagnosis Chart or Vehicle Speed Control Circuit (Fig. 9, 10 and 11).

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.

Also, check all vacuum connections for tightness and cracked hoses.

ROAD TEST

Road test vehicle to verify reports of vehicle speed control 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 vehicle speed control. The cause of any speedometer deficiencies should be corrected before proceeding.

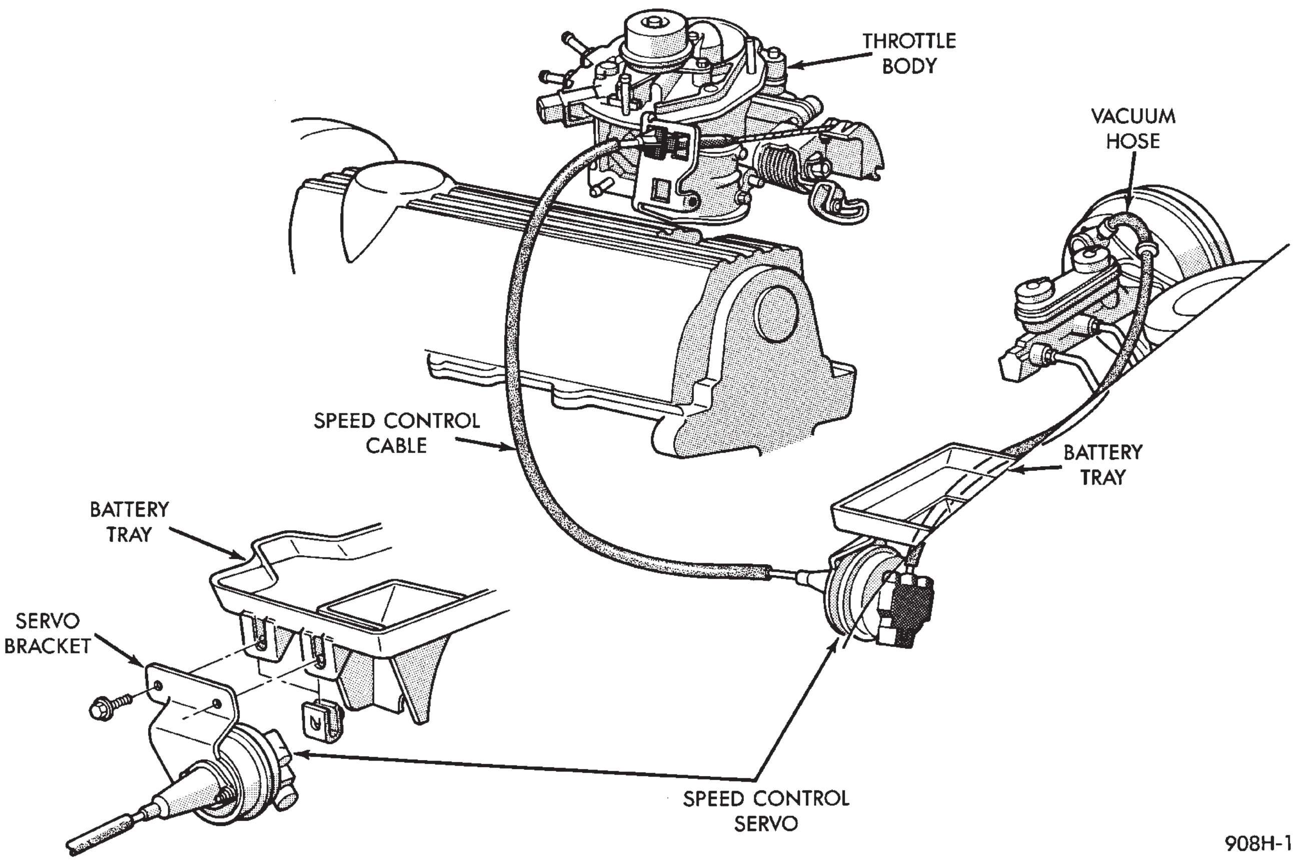


Fig. 6 Vehicle Speed Control—AC & AY Bodies with 2.5L

INOPERATIVE SYSTEM

If road test verifies an inoperative system with a correct speedometer operation:

- Inspect fuse
- Check for loose electrical and vacuum connections at the servo
- Check for correct position of the vacuum check valve in the hose from servo to vacuum source. The word VAC on the valve must point toward the vacuum source.
- Inspection should also be made to verify that both ends of the vehicle speed control cable are securely attached. If either end is loose, the vehicle speed control will be inoperative.

CHECKING FOR FAULT CODE

(1) When trying to verify a vehicle speed control electronic malfunction:

(a) Connect a DRB II if available.

(b) Plug DRB II into the diagnostic connector in the engine compartment.

(c) Check that either a Fault Code 34 or Fault Code 15 is indicated.

(d) An inoperative vehicle speed control may still occur without either fault code being indicated.

(e) With key inserted in ignition switch, cycle switch to ON position three times. On third cycle, leave switch in ON position.

(f) After switch has been cycled three times, observe CHECK ENGINE indicator on instrument cluster. If a Fault Code is present, indicator will flash (blink) in a series which will show which Fault Code is the problem. EXAMPLE: A series of three flashes in rapid succession, a slight pause, then four flashes in rapid succession would indicate Fault Code 34.

(2) If no Fault Code appears, or Fault Code 34 is observed, refer to:

- The Servo Electrical Test.
- The Powertrain Control Module Electrical Test.

(3) If a fault code 15 is observed, test vehicle speed sensor.

For testing vehicle speed sensor and related components refer to the Powertrain Diagnostics Test Procedure Manual.

(4) Correct any problems found when performing these tests and recheck for Fault Code if changes were made.

(5) If no problems were found above, replace powertrain control module.

VEHICLE SPEED CONTROL ELECTRICAL TESTS

WARNING: IF REMOVAL OF AIR BAG MODULE IS NECESSARY, REFER TO GROUP 8M, RESTRAINT SYSTEMS.

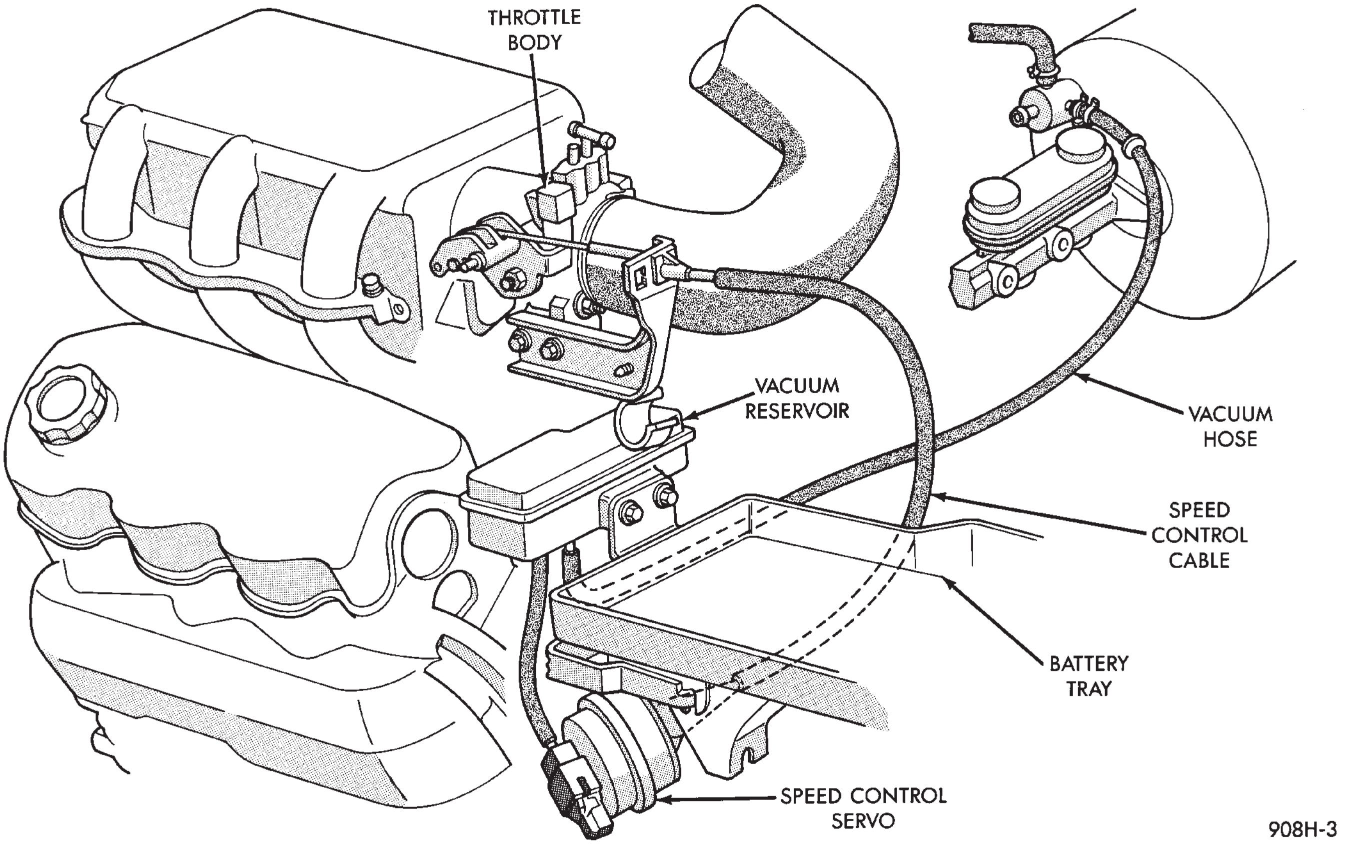


Fig. 7 Vehicle Speed Control—AC & AY Bodies with 3.0L

Electronic vehicle speed control may be tested using two different methods. One involves use of a DRB II. If this test method is desired, refer to the Powertrain Diagnostic Test Procedures for charging and vehicle speed control manual.

The other test method uses a volt/ohm meter and is described in the following tests.

If any information is needed concerning wiring, refer to Group 8W, Wiring Diagrams.

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.

SERVO ELECTRICAL TESTS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR AIRBAG, STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

(1) Turn ignition switch to the ON position. With the vehicle speed control switch in the ON position, set up a voltmeter to read battery voltage and connect the negative lead to a good chassis ground.

(2) Disconnect the four-way connector going to the servo (Fig. 12). Test pin 2 of the main harness four-way connector for battery voltage. If not OK go to step 3. If voltage is OK go to step 4.

(3) Perform the following tests.

(a) Disconnect the six-way connector at the stop lamp switch and test pin 1 of the main harness for battery voltage. If voltage is OK perform the stop lamp switch test.

(b) If the stop lamp switch tests OK; repair wire between the servo and the stop lamp switch.

(c) If no voltage at pin 1 at the 6-way stop lamp connector, remove the vehicle speed control switch and disconnect the four-way connector. Test pin 1 of main harness for battery voltage.

(d) If voltage is OK perform the vehicle speed control switch test.

(e) If vehicle speed control switch is OK, test continuity across the clockspring.

(f) If clockspring OK, repair as required, wire between stop lamp switch and clockspring.

(g) If no voltage at pin 1 of the 4-way vehicle speed control switch connector.

- Test for battery voltage between the ignition and the fuse
- If voltage OK, check fuse
- If fuse OK, repair wire between fuse and clockspring

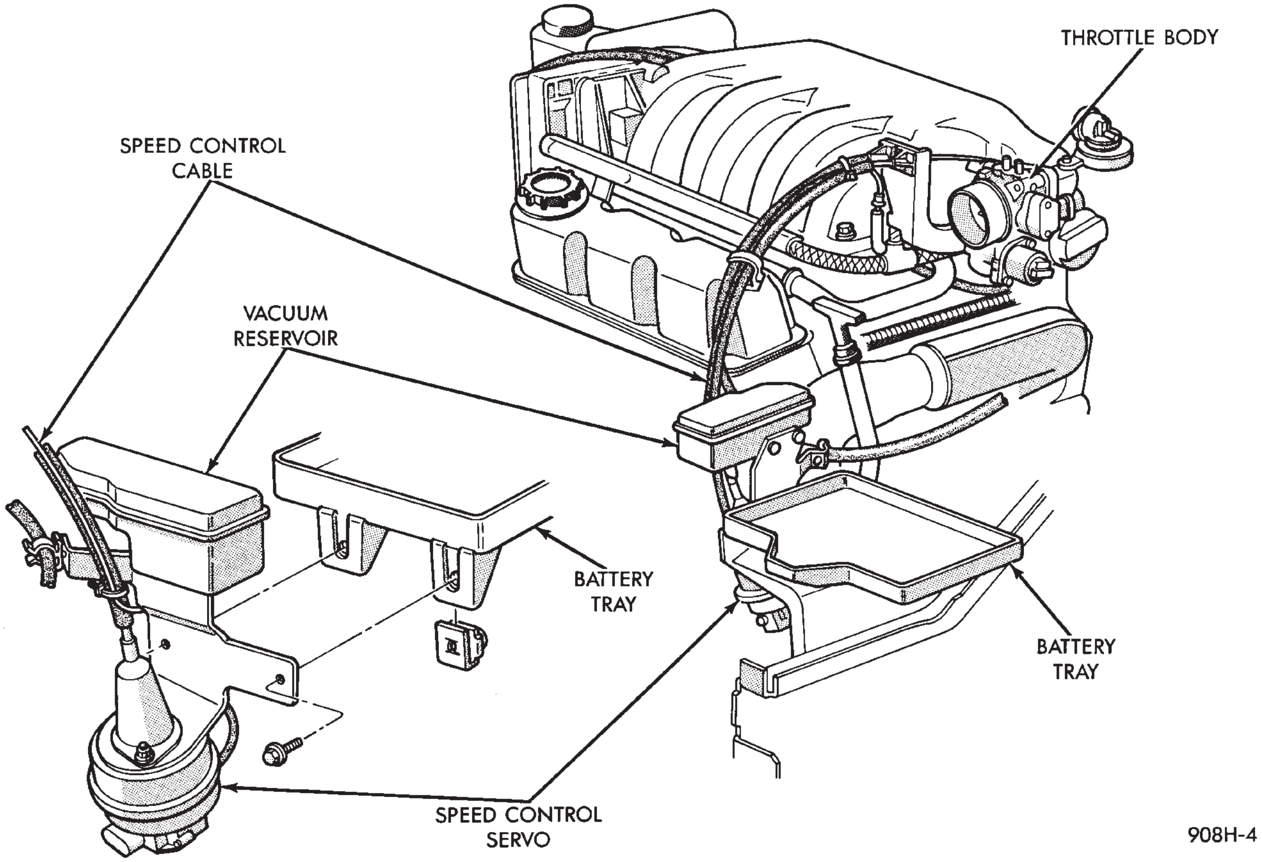


Fig. 8 Vehicle Speed Control—AC & AY Bodies with 3.3/3.8L

(4) Connect a jumper wire between pin 2 of the four-way servo connector of the main harness and pin 2 of the vehicle speed control servo (Fig. 12). The other three pins from the servo should show battery voltage. If not, replace the servo.

(5) Using an ohmmeter, connect one lead to a good body ground and the other lead touch pin 1 in the four-way servo connector of the main harness. The meter should show continuity. If not, repair the ground circuit as necessary.

POWERTRAIN CONTROL MODULE ELECTRICAL TEST

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR AIRBAG, STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

(1) Unplug 60-way connector from the powertrain control module, located next to the battery (Fig. 13).

(2) Remove vehicle speed control switch. Refer to Vehicle Speed Control Switch Removal. Disconnect the 4-way connector.

(3) Using an ohmmeter test continuity between pin 23 of powertrain control module and pin 4 of the vehicle speed control switch harness. Refer to Fig. 14 for controller terminal locations.

(a) If no continuity, repair wire circuit as necessary.

(b) Continuity OK, refer to Vehicle Speed Control Switch Test.

(4) Connect the 4-way connector to vehicle speed control switch.

(5) Connect negative lead of voltmeter to a good body ground near the powertrain control module.

(6) Turn ignition switch ON.

(7) Place vehicle speed control switch in the OFF position. Touch the positive lead of the voltmeter to pin 53, the voltmeter should read 0 volts.

(8) Place vehicle speed control switch in the ON position. Touch the positive lead of the voltmeter to pin 53, the voltmeter should read battery voltage.

(9) If no voltage, repair the wire between pin 53 and pin 3 of the vehicle speed control servo (Fig. 6). If voltage is OK go to step 8.

(10) Place vehicle speed control switch in the OFF position. Touch the positive lead of the voltmeter to pin 33, voltmeter should read 0 volts.

(11) Place vehicle speed control switch in the ON position. Touch the positive lead of the voltmeter to pin 33, the voltmeter should read battery voltage.

(12) If no voltage, repair the wire between pin 33 and pin 4 of the vehicle speed control servo (Fig. 6). If voltage is OK go to step 11.

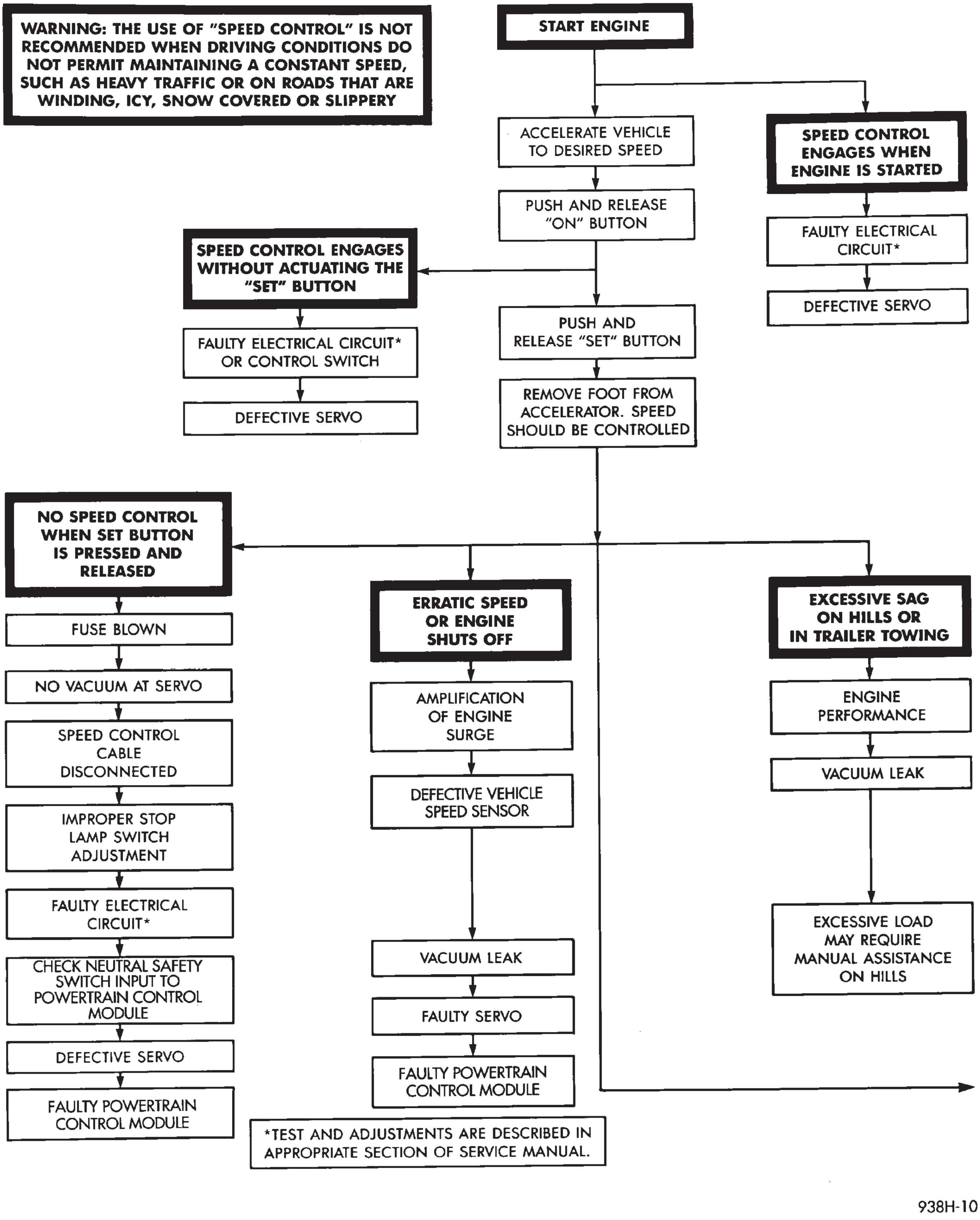


Fig. 9 System Diagnosis

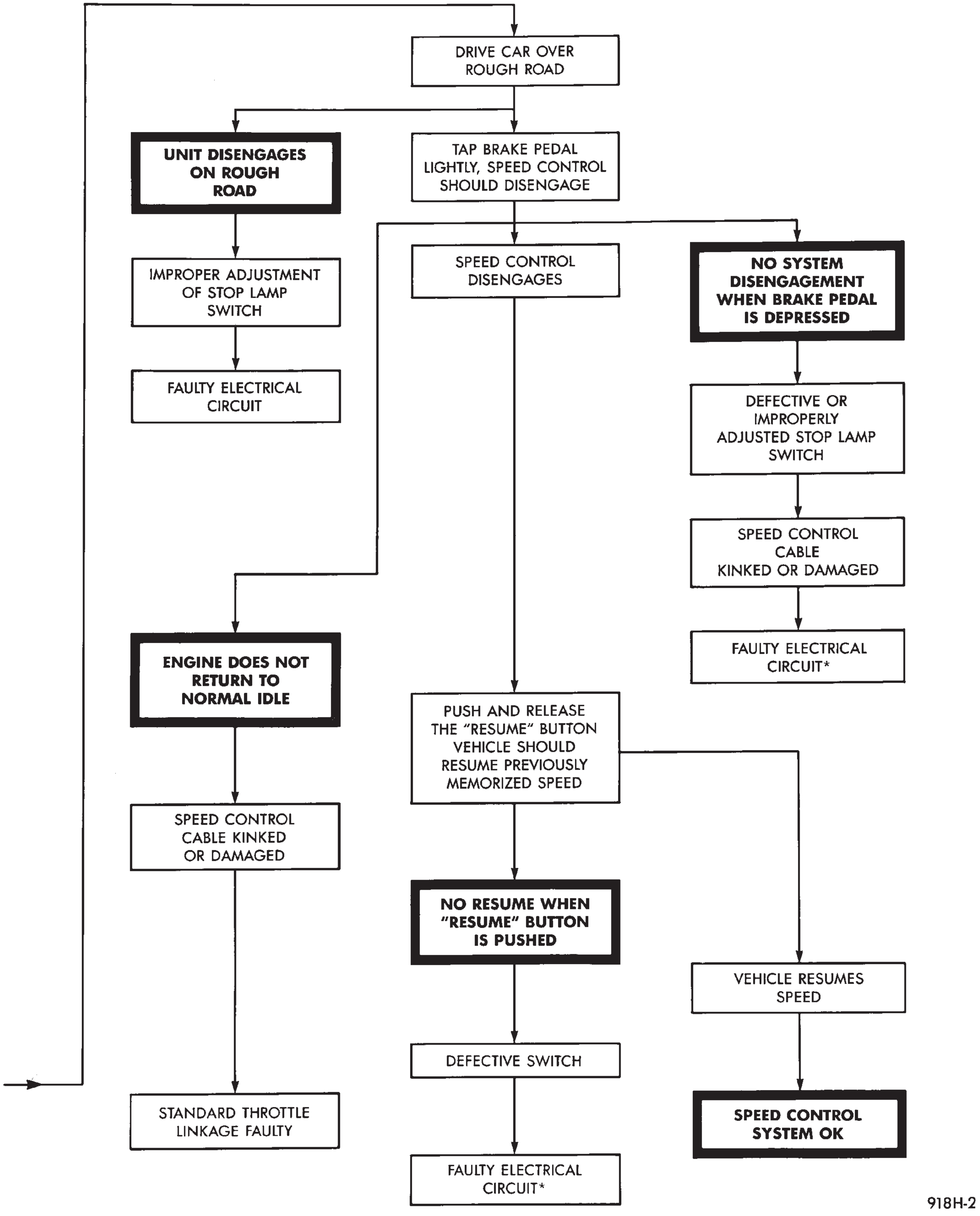


Fig. 10 System Diagnosis—Continued

(13) Using an ohmmeter, connect one lead to a good body ground and touch the other lead to pin 29. When the pedal is depressed, the meter should show no continuity. With the brake pedal released, the

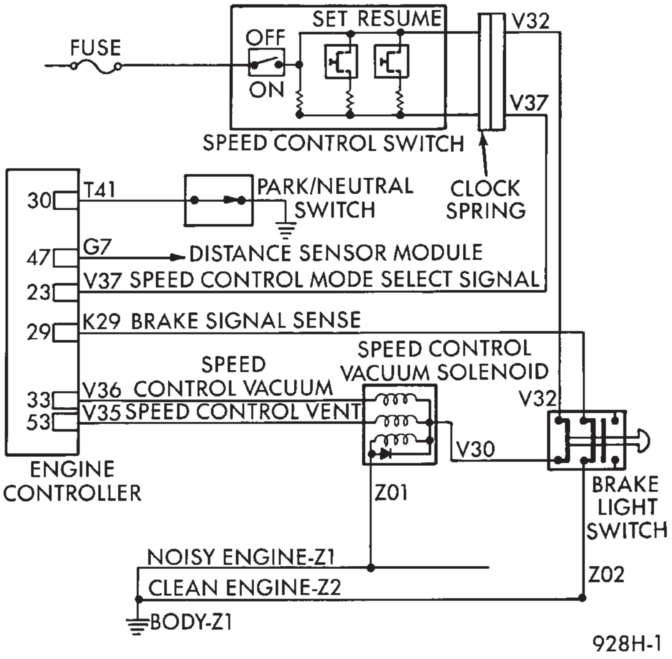


Fig. 11 Vehicle Speed Control Circuit

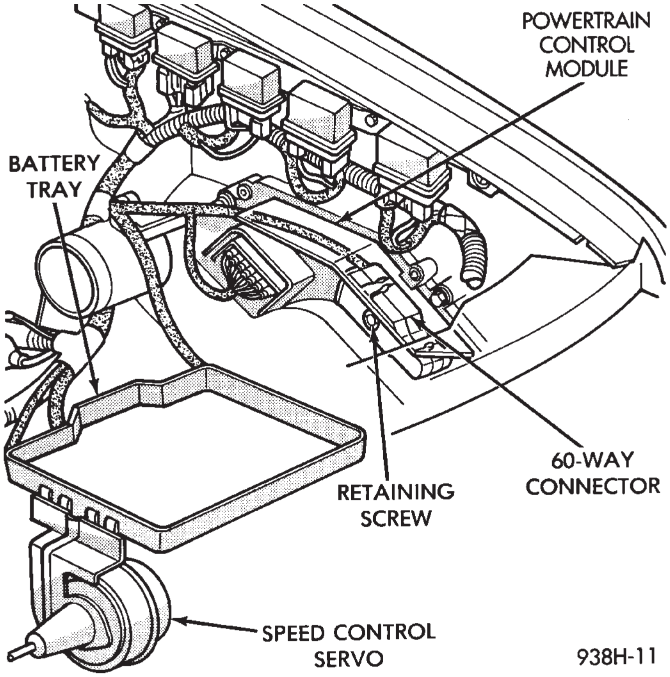


Fig. 13 Powertrain Control Module and Connector Location

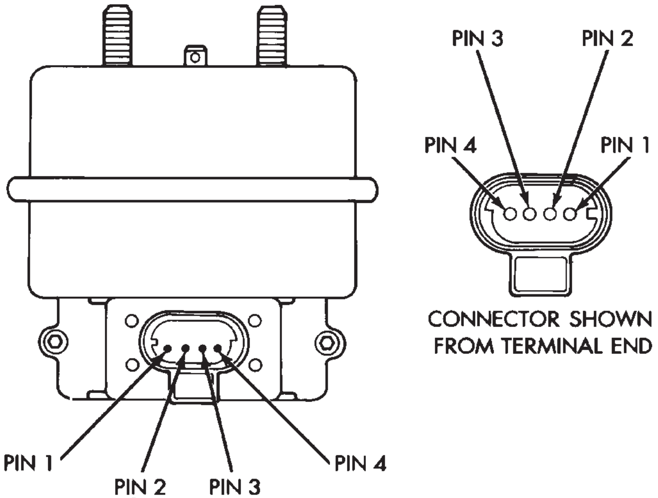


Fig. 12 Servo Harness Connector

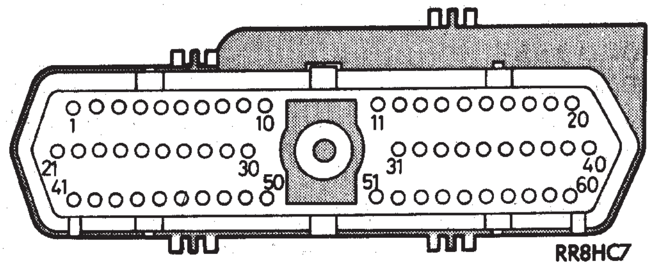


Fig. 14 Powertrain Control Module 60-Way Connector Shown from Terminal End

meter should show continuity. If no continuity perform the following test. Continuity OK, go to step 12.

(a) Using an ohmmeter test continuity between pin 29 of powertrain control module and pin 3 of the stop lamp switch connector.

(b) If no continuity, repair as necessary.

(c) If continuity, refer to Stop Lamp Switch Test.

(d) If stop lamp switch test OK, Test continuity between pin 6 of stop lamp switch and ground.

(14) Using an ohmmeter, touch one lead to a good body ground and touch the other lead to pin 30. The meter should show no continuity when transmission is in DRIVE and continuity when in PARK or NEUTRAL. If not test Neutral Start and Back-Up switch using DRB II.

VEHICLE SPEED CONTROL SWITCH TEST

WARNING: IF REMOVAL OF AIR BAG MODULE IS NECESSARY, REFER TO GROUP 8M, RESTRAINT SYSTEMS.

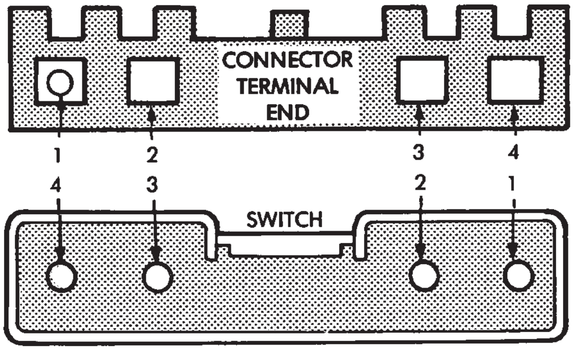
(1) Remove the switch and disconnect 4-way connector.

(2) Using an ohmmeter, test continuity at the four pins of the vehicle speed control switch. Refer to Vehicle Speed Control Switch Continuity (Fig. 15).

(3) If there is no continuity or incorrect continuity at any one of the switch positions, replace the switch.

STOP LAMP VEHICLE SPEED CONTROL SWITCH TEST

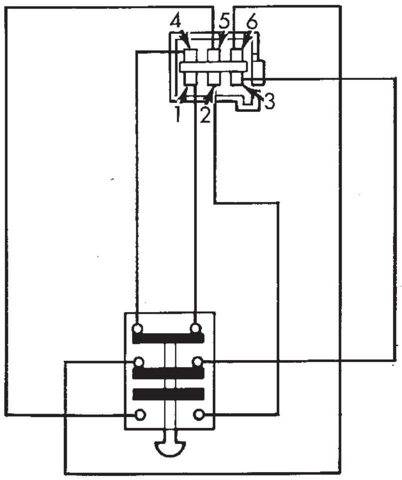
(1) Disconnect the six way connector at the stop lamp switch (Fig.16). Using an ohmmeter, continuity may be checked at the switch side of the connector as follows:



SWITCH POSITION	CONTINUITY BETWEEN	RANGE
OFF	PIN 3 AND PIN 4	5890-6510 Ω
	PIN 1 AND PIN 3	NO CONTINUITY
ON	PIN 1 AND PIN 4	5890-6510 Ω
	PIN 1 AND PIN 3	CONTINUITY
ON/SET	PIN 3 AND PIN 4	1020-1130 Ω
ON/RESUME	PIN 3 AND PIN 4	2040-2260 Ω

938H-9

Fig. 15 Vehicle Speed Control Switch Continuity



STOP LAMP AND SPEED CONTROL SWITCH

SWITCH SHOWN WITH BRAKE PEDAL RELEASED

938H-1

Fig. 16 Stop Lamp and Vehicle Speed Control Switch Wiring

(a) With brake pedal released, there should be continuity:

- Between pin 1 and pin 4
- Between pin 3 and pin 6
- No continuity between pin 2 and pin 5

(b) With brake pedal depressed, there should be no continuity:

- Between pin 1 and pin 4
- Between pin 3 and pin 6
- Continuity between pin 2 and pin 5

(2) If the above results are not obtained, the stop lamp switch is defective or out of adjustment.

(3) Stop lamp switch adjustment is detailed in Group 5, Brakes.

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at the servo and install a vacuum gauge in the hose (Fig. 17).

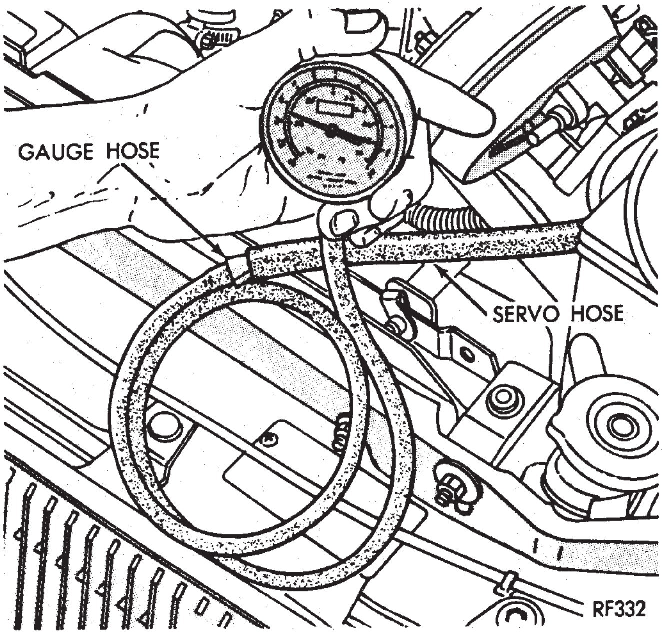


Fig. 17 Vacuum Gauge Test

(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:

- Vacuum lines
- Check valve
- Vacuum reservoir
- Servo, refer to Servo Vacuum Test
- Poor engine performance

SERVO VACUUM TEST

(1) Remove the vehicle speed control cable at the throttle body end.

(2) Disconnect the 4-way electrical connector and the vacuum harness at the servo (Refer to Fig. 12).

(3) Connect battery voltage to pin 2 of the servo.

(4) Ground the remaining three servo pins 1, 3 and 4.

(5) Connect a hand held vacuum pump to the servo vacuum nipple and apply 10 to 15 inches of vacuum.

(6) The cable should pull in and hold for as long as vacuum is applied.

SERVO UNIT

REMOVAL

(1) Remove two nuts attaching vehicle speed control cable and mounting bracket to servo.

(2) Remove screws attaching servo mounting bracket.

(3) Remove servo mounting bracket.

(4) Disconnect electrical connector and vacuum hose.

(5) Pull cable away from servo to expose retaining clip and remove clip attaching cable to servo.

INSTALLATION

(1) With throttle in full open position align hole in vehicle speed control cable sleeve with hole in servo pin and install retaining clip.

(2) Connect vacuum hose to servo.

(3) Connect electrical connector.

(4) Position mounting bracket and install screws attaching bracket and tighten to 12 N●m (105 in. lbs.) torque.

(5) Insert servo studs through holes in vehicle speed control cable and mounting bracket.

(6) Install nuts, tighten to 7 N●m (60 in. lbs.) torque.

VEHICLE SPEED CONTROL SWITCH REMOVAL

The vehicle speed control switch is mounted in the steering wheel and wired through the clock spring device under the steering wheel hub (Fig.1).

WARNING: IF REMOVAL OF AIR BAG MODULE IS NECESSARY, REFER TO GROUP 8M, RESTRAINT SYSTEMS.

REMOVAL

(1) Turn off ignition.

(2) Remove two screws from back side of steering wheel.

(3) Rock switch away from air bag or horn pad while lifting switch out of steering wheel.

(4) Disconnect 4-way electrical connector.

INSTALLATION

(1) Turn off ignition.

(2) Connect 4-way electrical connector from clock spring to switch.

(3) Place switch in steering wheel, sliding the forward edge of switch under air bag or horn pad. Line up locating pins on switch with holes in steering wheel frame.

(4) Attach switch to wheel with two screws starting with the screw at the left end of the switch.

TURN SIGNALS AND HAZARD WARNING FLASHER

CONTENTS

GENERAL INFORMATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR AIRBAG REMOVAL PROCEDURES.

TURN SIGNALS—AC, AY, AA AND AP BODIES

The turn signals are part of the multi-function switch. Which contains electrical circuitry for turn signal, cornering lamps, hazard warning, headlamp beam select, headlamp optical horn, windshield wiper, pulse wipe and windshield washer switching. The integrated switch assembly is mounted to the left hand side of the steering column. When the driver wishes to signal his intentions to change direction of travel, he moves the lever upward to cause the right signals to flash and downward to cause the left signals to flash. After completion of a turn the system is deactivated automatically. As the steering wheel returns to the straight ahead position, a canceling cam of two lobes molded to the clockspring mechanism 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.

If only momentary signaling such as indication of a lane change is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the OFF position as soon as the lever is released.

When the system is activated, 1 of 2 indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating.

AG AND AJ BODIES

The turn signals are actuated with lever on the left side of the instrument panel switch pod. When the driver wishes to signal his intentions to change direction of travel, he moves the lever upward to cause the right signals to flash and downward to cause the left signals to flash.

After completion of a turn the system is deactivated automatically. The cancellation switch in the steering column sends a signal to a remote turn signal switch in the switch pod to cancel the turn signal function. As the steering wheel returns to the straight ahead position from a turn, a cancel cam which is located on the steering wheel contacts a cancel flipper located on the cancellation switch. When the flipper is contacted by the cancel cam in the proper rotational direction, the cancel switch sends a signal to the remote turn signal switch.

If only momentary signaling such as indication of a lane change is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the OFF position as soon as the lever is released.

When the system is activated, 1 of 2 indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating.

HAZARD WARNING SYSTEM

The hazard warning system is actuated by a push button located on the top of the steering column between the steering wheel and the instrument panel. The hazard switch is identified with a double triangle on top of the button. Push and release the button to turn the hazard function ON or OFF. The button will move out from the steering column in the ON position and will remain in toward the column in the OFF position.

CHIME FUNCTION—AC, AG, AJ AND AY

The chime will sound after the vehicle has traveled a distance of 0.6 miles at a speed above 15 miles per hour.

TESTING PROCEDURES

MULTI-FUNCTION SWITCH TESTS AA, AC, AP, AND AY BODIES

The multi-function switch contains electrical circuitry for turn signal, cornering lamps (optional), hazard warning, headlamp beam select, headlamp optical horn, windshield wiper, pulse wipe, and windshield washer switching. This integrated switch assembly is mounted to the left hand side of the steering column. Should any function of the switch fail, the entire switch assembly must be replaced. Refer to Fig. 1 for diagnosis.

To test the switch, first disconnect the negative battery cable, then remove the upper and lower column covers to gain access to the switch connector. Remove switch connector. Using an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the following continuity charts (Fig 2 or 3).

DUAL-FUNCTION SWITCH TESTS—AG AND AJ BODIES

The dual-function switch contains electrical circuitry for hazard warning switching, and circuitry and electronics for turn signal cancellation. The switch assembly is mounted to the left hand side of the steering column.

To test the hazard warning portion of the switch, first disconnect the negative battery cable, then remove the upper and lower steering column covers to gain access to the switch connector. Remove switch connector (Fig. 4). Using an ohmmeter, test for continuity between the terminals of the switch as shown in the following continuity chart (Fig. 5).

To test the cancellation portion of the switch:

(1) Reconnect battery and switch connector (Fig. 5).

(2) Connect voltmeter positive lead (+) to pin 8 and negative lead (-) to ground.

(3) Place ignition switch to the ON position. Voltmeter should read battery voltage. If no voltage is present, check feed wire to pin 8. If battery voltage is present continue with switch test.

RIGHT CANCELLATION TEST

(1) Connect one side of a jumper wire to pin 3 and the other end of jumper wire to ground.

(2) Connect the positive lead (+) of a voltmeter to pin 5 and the negative lead (-) to ground.

CAUTION: Do not allow pin 5 to become grounded during test, switch failure will result.

(3) With the ignition switch in the ON position, push the cancellation pawl down and read the voltmeter.

(4) The voltmeter should show at least 9 volts.

(5) If voltage is 0 to 8 volts the cancellation switch is defective. If voltage is 9 volts or more the cancellation switch is working correctly.

LEFT CANCELLATION TEST

(1) Connect one side of a jumper wire to pin 4 and the other end of jumper wire to ground.

(2) Connect the positive lead (+) of a voltmeter to pin 5 and the negative lead (-) to ground.

CAUTION: Do not allow pin 5 to become grounded during test, switch failure will result.

(3) With the ignition switch in the ON position, push the cancellation pawl up and read the voltmeter.

(4) The voltmeter should show at least 9 volts.

(5) If voltage is 0 to 8 volts the cancellation switch is defective. If voltage is 9 volts or more the cancellation switch is working correctly.

REMOTE TURN SIGNAL SWITCH TEST—AA AND AJ BODIES

The remote turn signal switch is located on the left side of the instrument panel switch pod. To test, remove switch pod assembly from instrument panel. Using an ohmmeter, test for continuity between the terminals of the switch as shown in the following continuity chart (Fig. 6). The white 7 way connector next to the 14 way connector must be connected when performing continuity checks.

CANCELLATION SOLENOID TEST—AG AND AJ BODIES

To test the turn signal cancellation solenoid:

(1) Remove switch pod from instrument panel.

(2) Connect one end of a jumper wire to the positive terminal of the battery, the other end to pin 6 of the turn signal switch 14 way connector.

(3) Place turn signal switch in the left turn mode.

(4) Take a second jumper wire and connect one end to a good ground. Momentarily touch the other end of the jumper wire to pin 11 or 14. The solenoid should energize, and return the switch to its center OFF position.

(5) Place turn signal switch in the right turn mode.

(6) Repeat step 4. The solenoid should energize, and return the switch to its center OFF position.

(7) If switch does not return to center in either direction, the switch is defective.

MULTI-FUNCTION SWITCH—AA, AC, AP AND AY BODIES

REMOVAL

(1) Disconnect negative battery cable.

(2) Tilt column only remove tilt lever.

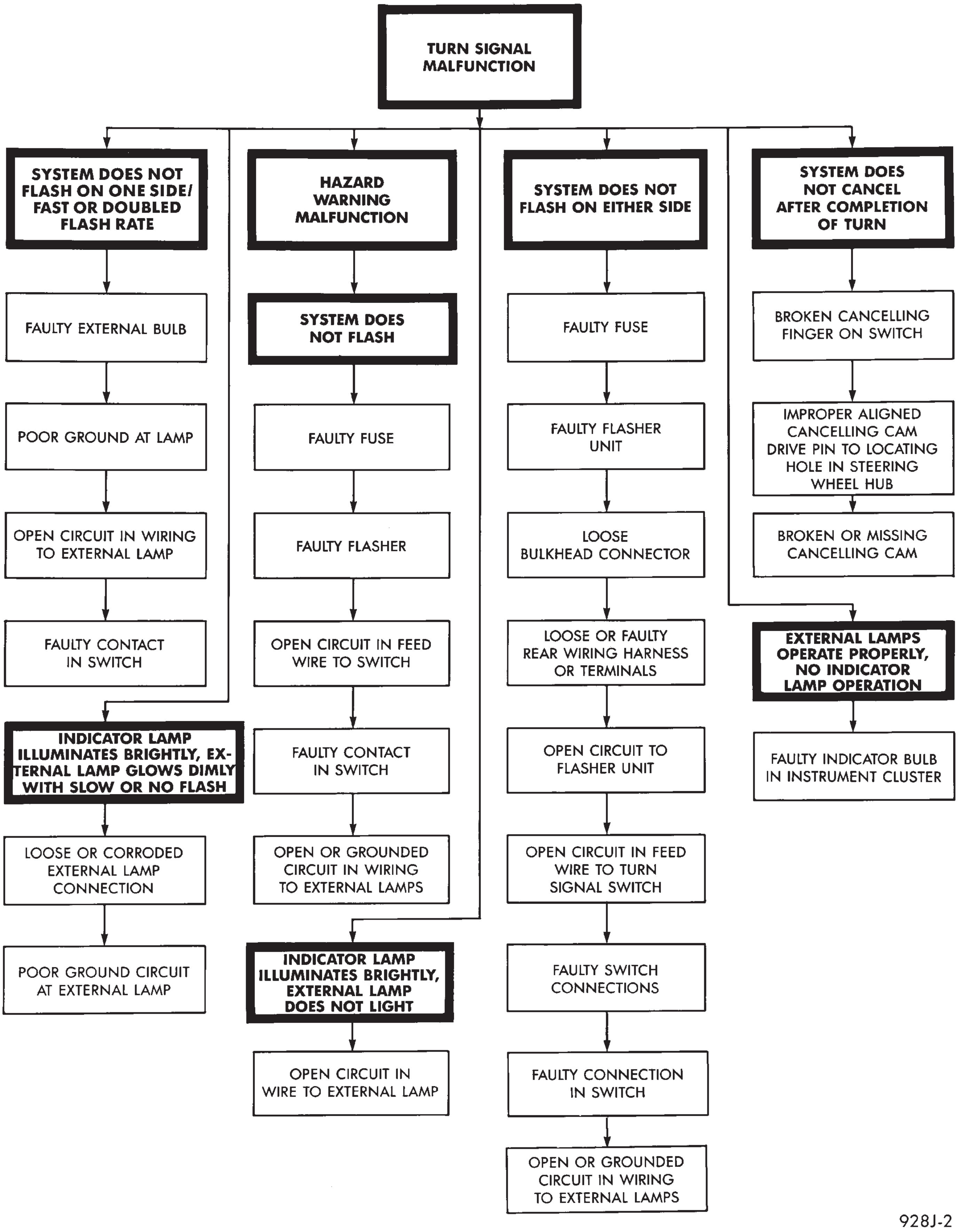
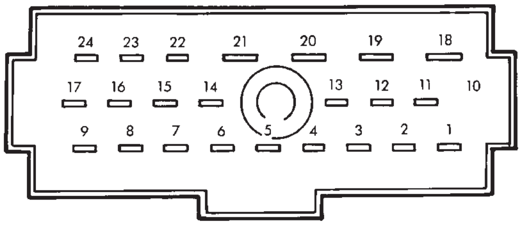


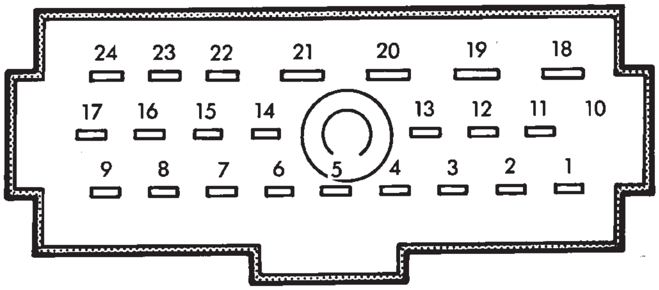
Fig. 1 Turn Signal and Hazard Warning Flasher Diagnosis



SWITCH POSITIONS		CONTINUITY BETWEEN
TURN SIGNAL	HAZARD WARNING	
NEUTRAL	OFF	12 AND 14 AND 15
LEFT	OFF	15 AND 16 AND 17
LEFT	OFF	12 AND 14
LEFT	OFF	22 AND 23 WITH OPTIONAL CORNER LAMPS
RIGHT	OFF	11 AND 12 AND 17
RIGHT	OFF	14 AND 15
RIGHT	OFF	23 AND 24 WITH OPTIONAL CORNER LAMPS
NEUTRAL	ON	11 AND 12 AND 13 AND 15 AND 16

918J-6

Fig. 2 Turn Signal and Hazard Switch Continuity



SWITCH POSITION	CONTINUITY BETWEEN
LOW BEAM	18 AND 19
HIGH BEAM	19 AND 20
OPTICAL HORN	20 AND 21

908J-5

Fig. 3 Beam Select Switch Continuity

(3) Remove both upper and lower steering column shrouds.

(4) Remove multi-function switch tamper proof mounting screws (Fig.7).

(5) Gently pull switch away from column. Loosen connector screw. The screw will remain in the connector.

(6) Remove wiring connector from multi-function switch.

INSTALLATION

(1) Install wiring connector to switch and tighten connector retaining screw to 2 N•m (17 in. lbs.) torque.

(2) Mount multi-function switch to column and tighten retaining screws to 2 N•m (17 in. lbs.) torque.

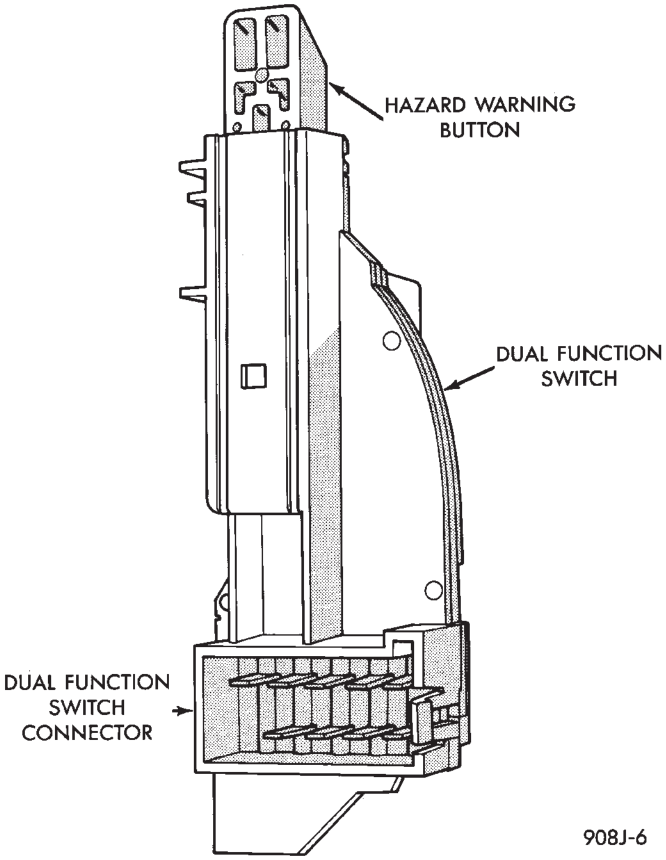
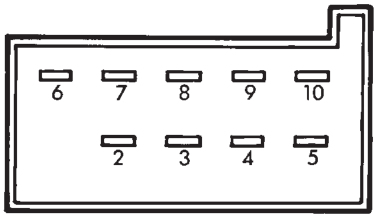


Fig. 4 Dual-Function Switch Connector



SWITCH POSITION	CONTINUITY BETWEEN
OFF	6 AND 8
ON	6 AND 9 7 AND 10

908J-7

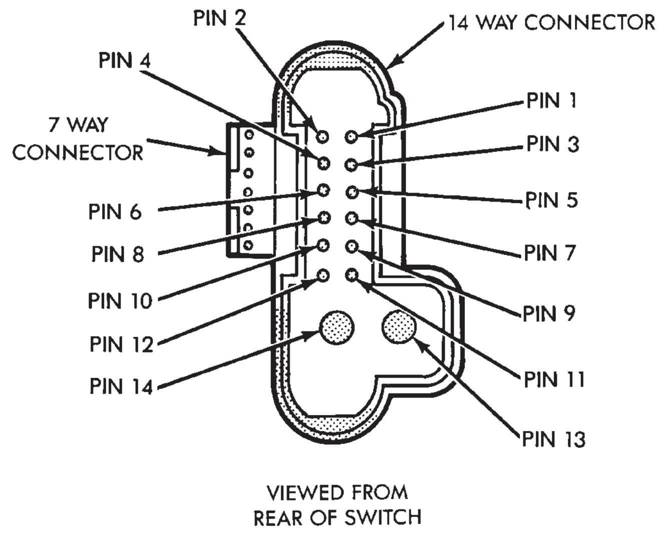
Fig. 5 Hazard Warning Switch Continuity—AJ Body

(3) Install steering column covers. Tighten retaining screws to 2 N• (17 in. lbs.) torque.

(4) Tilt column only install tilt lever.

(5) Install negative battery cable.

(6) Check all functions of switch for proper operation.



SWITCH POSITION	CONTINUITY BETWEEN
LEFT	PIN 2 AND PIN 7 PIN 2 AND PIN 13
RIGHT	PIN 1 AND PIN 7 PIN 1 AND PIN 13

Fig. 6 Remote Turn Signal Switch Continuity—AG and AJ Bodies

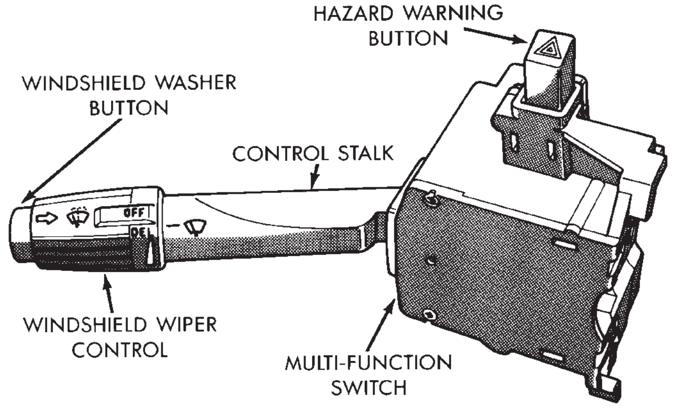


Fig. 7 Multi-Function Switch—AA, AC, AP and AY Bodies

DUAL-FUNCTION SWITCH—AG AND AJ BODIES

REMOVAL

(1) Disconnect negative battery cable.

(2) Tilt column only remove tilt lever.

(3) Remove three attaching screws, in the upper and lower steering column covers and remove covers.

(4) Remove two tamper proof mounting screws.

(5) Gently pull switch away from column. Release connector lock on the wiring connector, then remove the connector from the switch (Fig. 8).

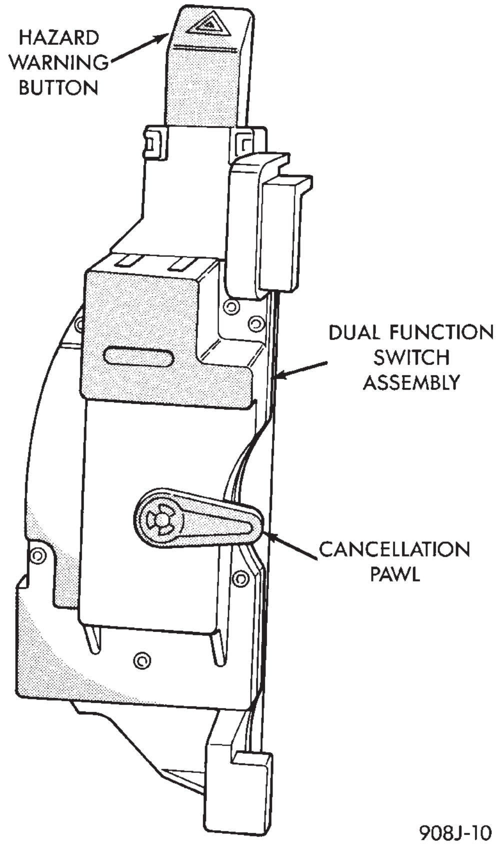


Fig. 8 Dual-Function Switch—AG and AJ Bodies

INSTALLATION

(1) Install wiring connector to switch. Make sure that switch locking tab is fully seated in the wiring connector.

(2) Mount switch to column and tighten screws to 2 N• (17 in. lbs.) torque.

(3) Install steering column covers and tighten screws to 2 N• (17 in. lbs.) torque.

(4) Tilt column only install tilt lever.

(5) Re-install negative battery cable.

(6) Check all functions of switch for proper operation of the hazard warning and turn signal cancellation.

REMOTE TURN SIGNAL SWITCH REMOVAL—AG AND AJ BODIES

(1) Disconnect battery ground cable..

(2) Remove turn signal lever by pulling it straight out of the switch (Fig. 9).

(3) Remove two screws from the bottom of the switch pod that hold turn signal switch.

(4) Disconnect turn signal pigtail wire from headlamp switch at the 8-way connector.

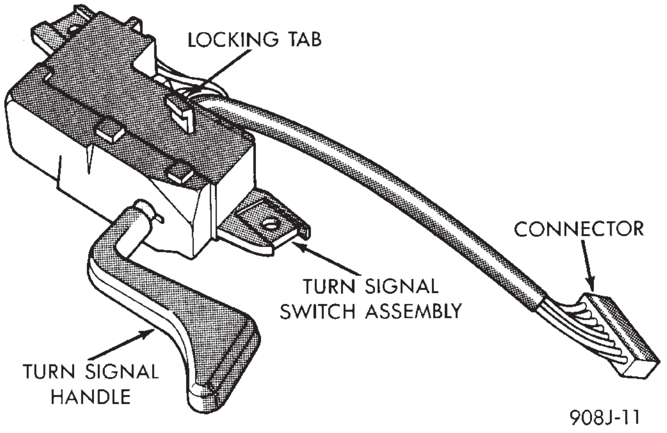


Fig. 9 Remote Turn Signal Switch—AG and AJ Bodies

(5) For installation reverse above procedure.

(6) Check for proper operation of all components which are controlled by the pod mounted switch.

TURN SIGNAL AND HAZARD WARNING FLASHER LOCATION

AA, AC, AP AND AY BODIES

The turn signal flasher and the hazard warning flasher are two separate plug-in type units.

On AC and AY both flashers are on the relay module (Fig. 10).

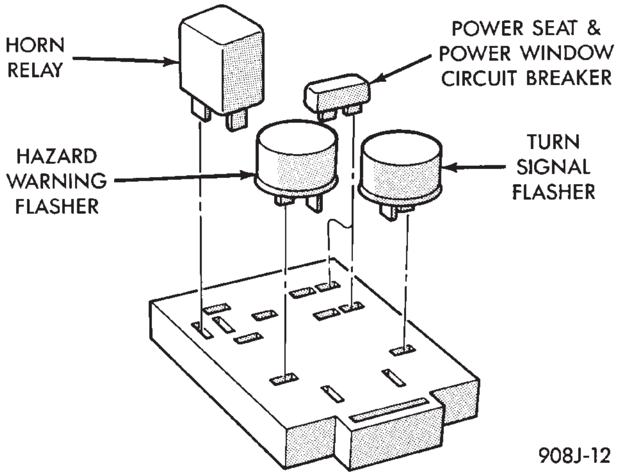


Fig. 10 Turn Signal and Hazard Warning Flasher—AC and AY Bodies

On AA and AP Bodies the hazard flasher is located on the relay module (Fig. 11). The turn signal flasher is on the driver's side of A/C duct for AA Body (Fig. 12) and center A/C duct for AP Body.

AG AND AJ BODIES

The turn signal flasher and the hazard warning flasher are combined into one unit called a combination flasher (combo-flasher). The combo-flasher controls the flashing of the hazard warning system and the turn signal system. An inoperative bulb or incomplete turn signal circuit will result in an increase in flasher speed.

The combo-flasher is located under the instrument panel, right of the steering column and is clipped on the A/C distribution duct. The combo-flasher is yellow in color for ease of identification.

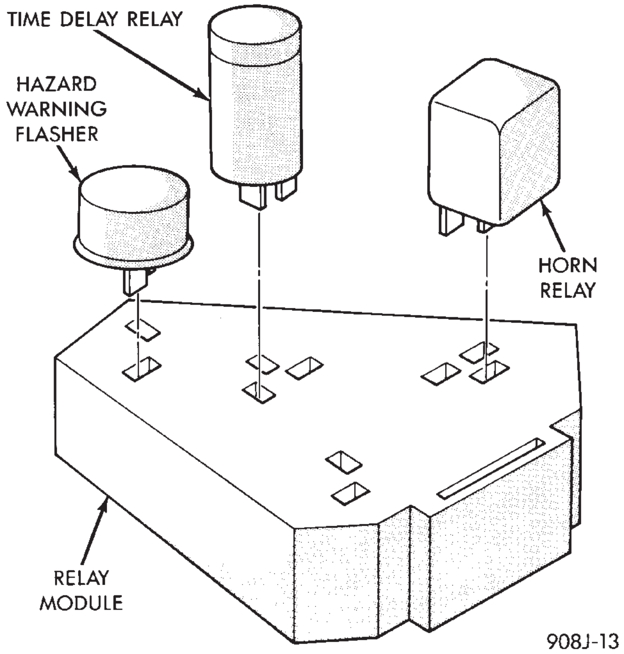


Fig. 11 Hazard Warning Flasher—AA and AP Bodies

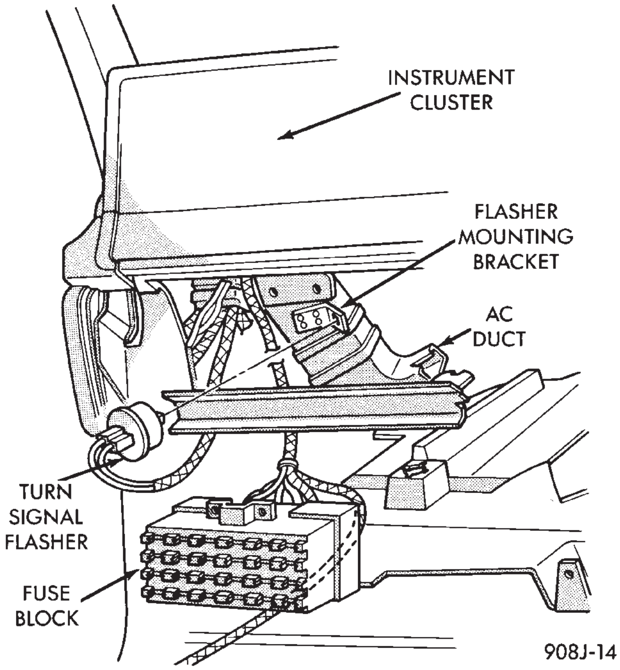


Fig. 12 Turn Signal Flasher—AA Body

TURN SIGNAL RELAYS—AG AND AJ BODIES

The AG and AJ models are equipped with four turn signal relays.

One relay controls the right rear turn signal and stop lamp. The second relay controls the left rear turn signal and stop lamp. The third relay controls the right front turn signal. The fourth relay controls the left front turn signal.

The turn signal relays are located in the relay bank, underneath the driver's side of the instrument panel. The four turn signal relays are identical and can be interchanged.

The turn signal relays do not cycle on and off with the turn signal lamp. Their function is to complete the turn signal circuit when the turn signal is switched on. Turn signal cycling is done by the combination flasher.

To test the relay, remove the suspect relay and switch it with 1 of the other 3 turn signal relays. If the problem follows the relay, replace that relay. If the problem remains in the same circuit, the relay is not the problem. Refer to Group 8W, Wiring Diagrams.

WINDSHIELD WIPER AND WASHER SYSTEMS

CONTENTS

GENERAL WIPER INFORMATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

The windshield wipers can be operated with the windshield wiper switch only when the ignition switch is in the ACCESSORY or IGNITION position. A fuse, located in the fuse block, protects the circuitry of the wiper system and the vehicle.

The wiper motor has permanent magnet fields. The speeds are determined by current flow to the appropriate set of brushes.

The intermittent wipe system, in addition to low and high speed, has a delay mode. The delay mode has a range of 2 to 15 seconds. This is accomplished by a variable resistor in the wiper switch and is controlled electrically by a relay.

The wiper system completes the wipe cycle when the switch is turned OFF. The blades park in the lowest portion of the wipe pattern.

WINDSHIELD WIPER BLADE AND ARM SERVICE PROCEDURES

WIPER BLADES

Wiper blades, exposed to the weather for a long period of time, tend to lose their wiping effectiveness. Periodic cleaning of the wiper blade is suggested to remove the accumulation of salt and road film. The wiper blades, arms, and windshield should be cleaned with a sponge or cloth and a mild detergent or nonabrasive cleaner. If the blades continue to streak or smear, they should be replaced.

WIPER BLADE ELEMENT CHANGE

(1) Turn wiper switch ON, position blades to a convenient place by turning the ignition switch ON and OFF.

(2) Lift wiper arm to raise blade off glass.

(3) Remove blade assembly from arm by inserting a small screwdriver blade into release slot of wiper blade and push downward (Fig. 1 and 2), or push release button (2).

(4) To remove wiping element from blade assembly:

- Place blade assembly on a working surface
- Apply pressure backwards to open up the blade assembly (Fig. 3)
- By pushing downward and pulling away remove the wiping element, or lift tab on one end links and squeeze link to remove from center bridge.

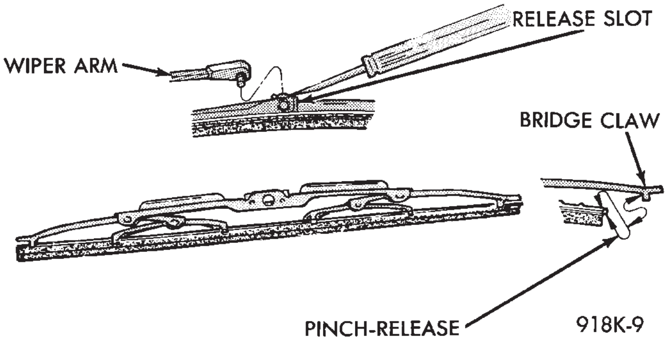


Fig. 1 Wiper Blade and Element

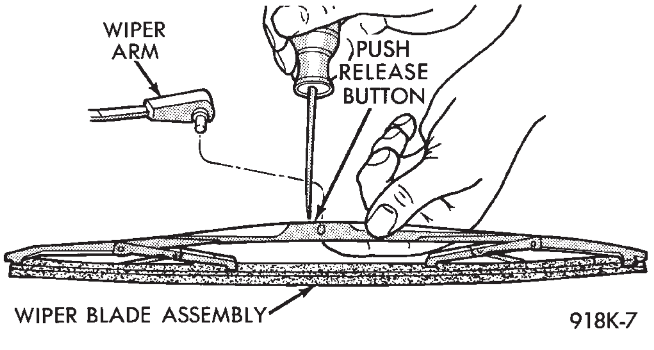


Fig. 2 Blade Assembly from Arm

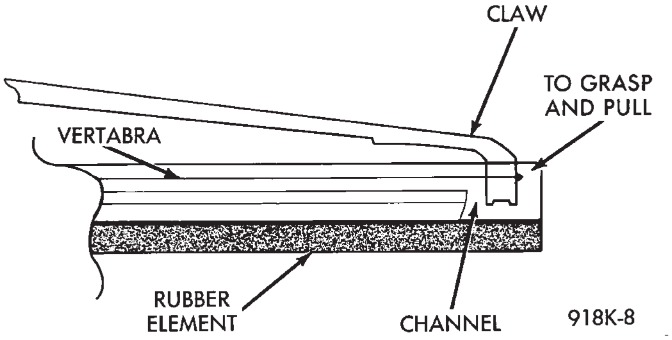


Fig. 3 Wiper Element

- Slide end link off element from claws of other link (Fig. 4), or by grasping the rubber element where the channel is and pull the element out for replacement.

(5) To install reverse above procedures.

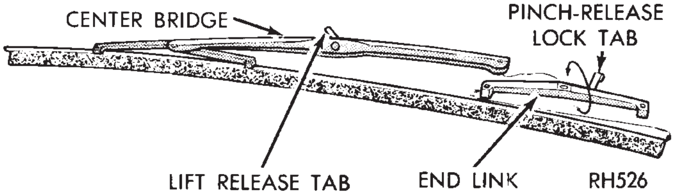


Fig. 4 Wiping Element from Blade Assembly

(6) Check each bridge claw for positive locking when installing blade element, and blade assembly for positive locking.

WIPER ARM REPLACEMENT

AG AND AJ BODIES

REMOVAL

Lift the arm to permit the latch (Fig. 5) to be pulled out to the holding position then release the arm. Arm front will remain off windshield in this position. Remove the arm from the pivot using a rocking motion.

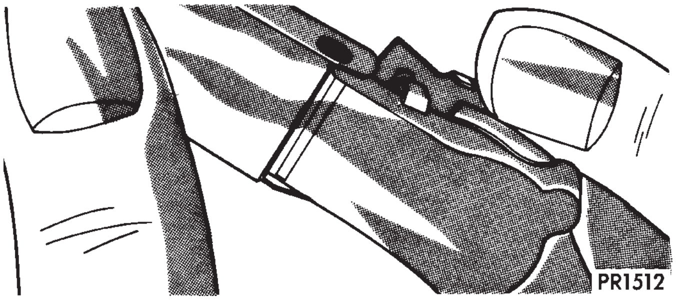


Fig. 5 Removing Wiper Arm—AG and AJ Bodies

INSTALLATION

For proper installation of wiper arm, refer to Wiper Arm Adjustment.

AA, AC, AP AND AY BODIES

REMOVAL

(1) Lift the wiper arm and place a 3.17mm (1/8 inch) pin into the arm pin hole (Fig. 6).

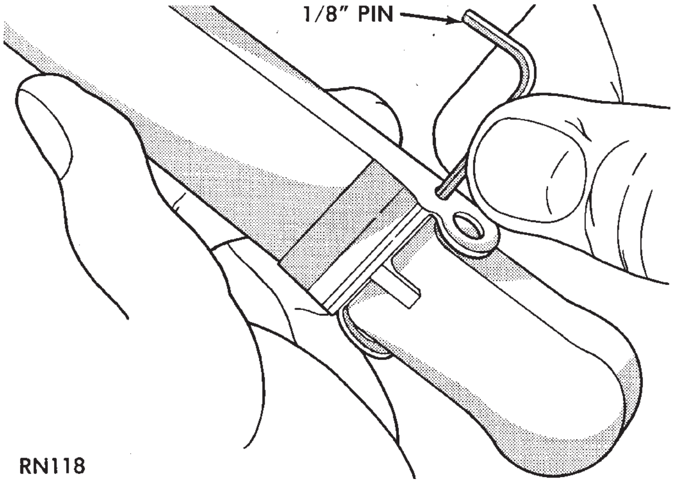


Fig. 6 Removing Wiper Arm—AA, AC, AP and AY Bodies 16

(2) Lift the head cover (Fig. 7) and remove the wiper arm attaching nut.

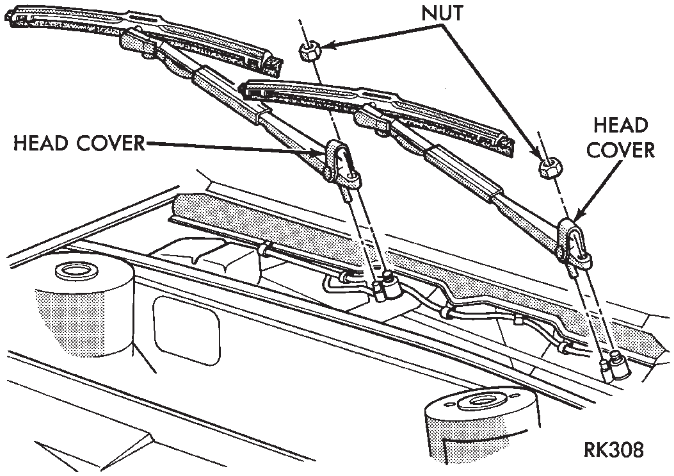


Fig. 7 Wiper Arm Head Cover and Nut—AA, AC, AP and AY Bodies

(3) Remove the wiper arm from the pivot using a rocking motion.

INSTALLATION

(1) Clean the wiper pivot shaft of any metal filings using a wire brush.

(2) Position wiper arm so that the blade tip is 19.05 mm (3/4 inch) from the top of the cowl screen.

(3) Secure arm to pivot with attaching nut and tighten 17 to 22 N●m (155 to 195 in. lbs.) torque.

(4) Close head cover and remove pin from arm pin hole.

WIPER ARM ADJUSTMENT

FRONT ARM ADJUSTMENT

(1) Cycle the wiper motor into the PARK position.

(2) Check the tips of the blades in blackout area. From the bottom edge of the windshield to the blade should be no closer than 25 mm (1 inch) (Fig. 8).

(3) Operate the wipers if the requirements are not met, check linkage and pivot assembly for worn parts.

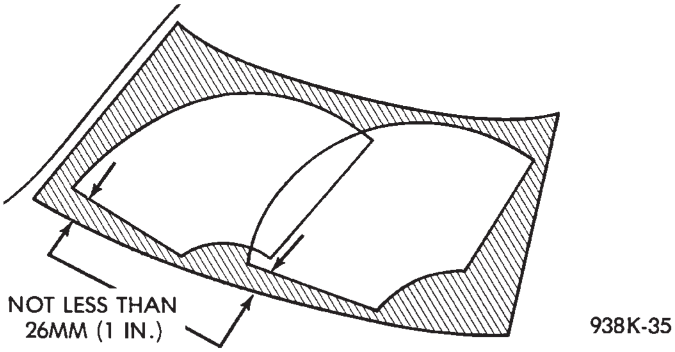


Fig. 8 Windshield Wiper Arm Adjustment

REAR ARM ADJUSTMENT

With the motor in the park position, mount the arm on the motor shaft. Choose a serration engagement that positions the blade, parallel with the bottom edge of the liftgate glass.

WINDSHIELD WIPER MOTOR AND LINKAGE ASSEMBLY SERVICE PROCEDURES

INDEX

WIPER MOTOR SYSTEM TEST PROCEDURES

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

Whenever a wiper motor malfunction occurs, first verify that the wiper motor wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Wiper Motor Diagnosis Chart (Fig. 9).

The following is a list of general wiper motor system problems, the tests that are to be performed to locate the faulty part, and the corrective action to be taken. These tests will cover both two speed and intermittent wipe functions.

TWO SPEED MOTOR FUNCTION TESTS

CONDITION: MOTOR WILL NOT RUN IN ANY SWITCH POSITION

PROCEDURE

(1) Check for a blown fuse in the fuse block.

(a) If fuse is good, proceed to step 2.

(b) If fuse is defective, replace and check motor operation in all switch positions.

(c) If motor is still inoperative and the fuse does not blow, proceed to step 2.

(d) If replacement fuse blows, proceed to step 5.

(2) Place switch in LOW speed position.

(3) Listen to motor. If you cannot hear it running, proceed to Step 4. If you hear it running, check motor output shaft. If output shaft is not turning, replace motor assembly. If it is turning, drive link to output shaft or linkage is not properly connected. Replace worn parts and/or properly connect drive link to the motor output shaft.

(4) Connect a voltmeter between motor terminal 3 and ground strap (Fig. 10). If there is no voltage or very little voltage (less than one volt) present, move negative test lead from the ground strap to negative battery terminal.

(a) If an increase in voltage is noticed, the problem is a bad ground circuit. Make sure the motor mounting is free of paint and that nuts or bolts are tight.

(b) If there is still no indication of voltage, the problem is an open circuit in the wiring harness or wiper switch.

(c) If no more than 3 volts increase in voltage is observed, the problem is a faulty motor assembly.

(5) Disconnect motor wiring connector and replace fuse.

(a) If fuse does not blow, motor is defective.

(b) If fuse blows, switch or wiring is at fault.

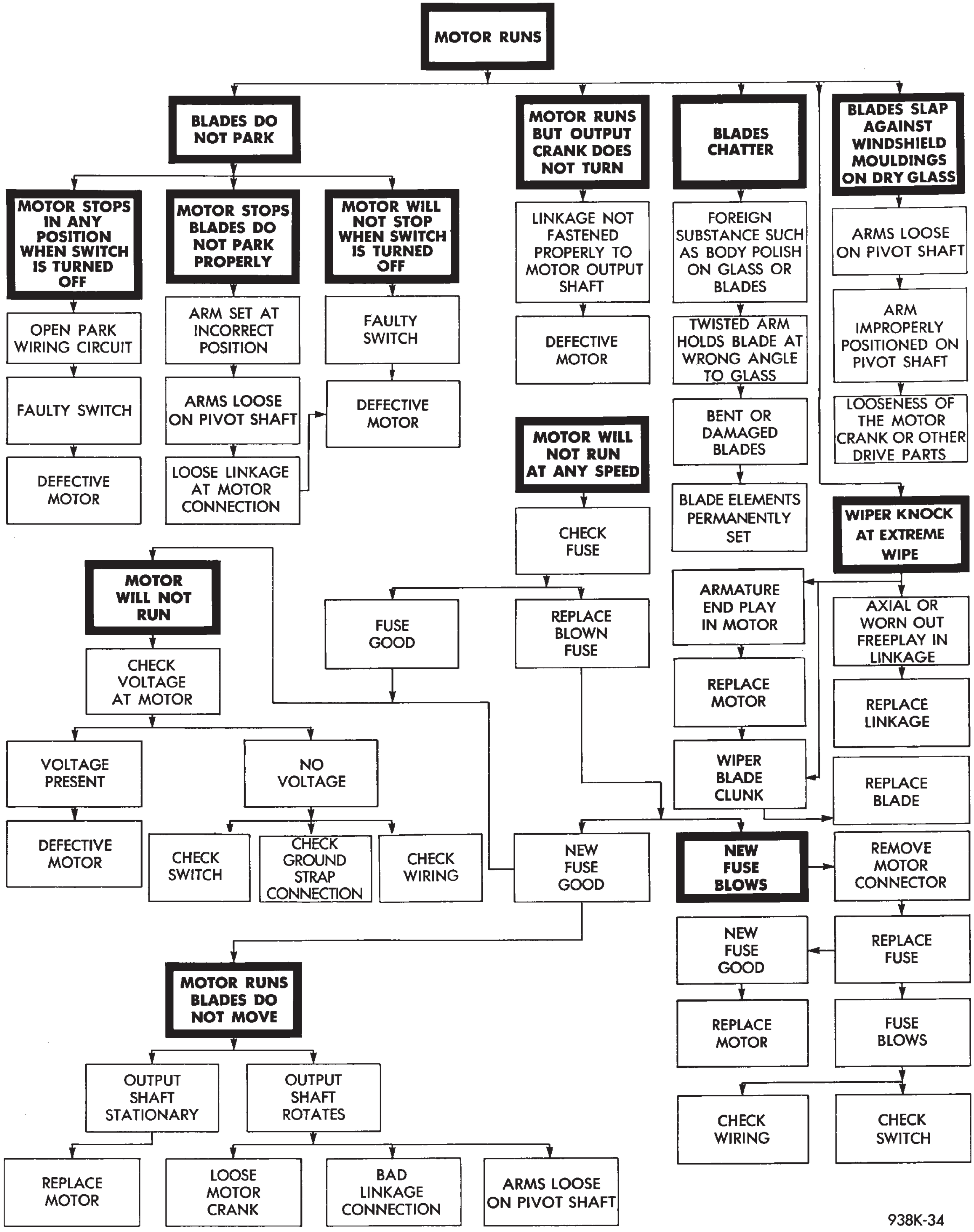


Fig. 9 Windshield Wiper Motor Diagnosis

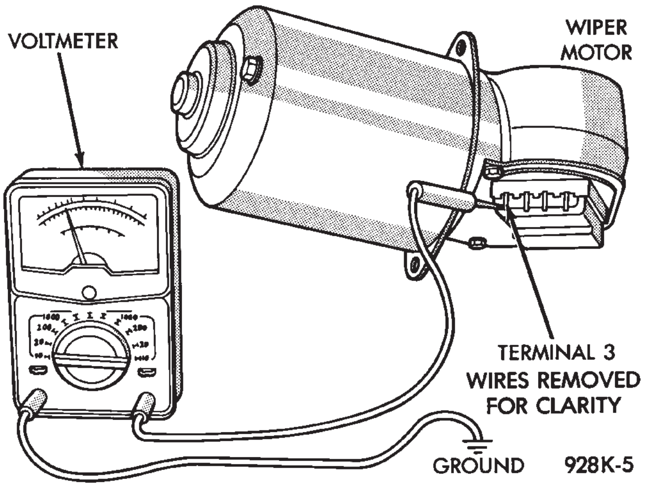


Fig. 10 Voltmeter Between Terminal 3 and Ground

CONDITION: MOTOR RUNS SLOWLY AT ALL SPEEDS

PROCEDURE

(1) Disconnect wiring harness connector at motor. Remove wiper arms and blades. Connect an ammeter between battery (B+) and terminal 3 on motor (Fig. 11).

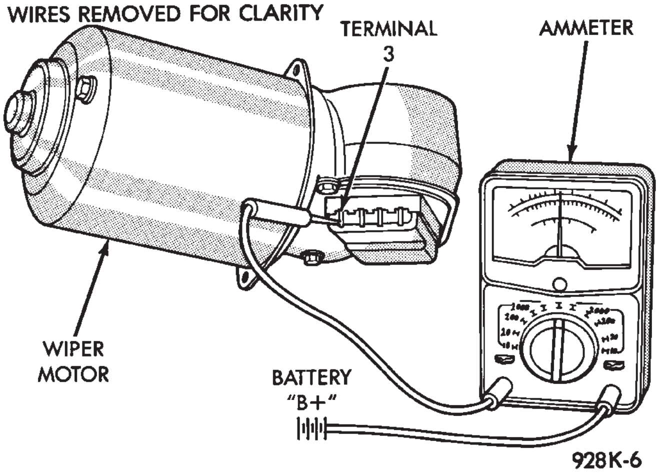


Fig. 11 Ammeter Between Terminal 3 and Battery

(a) If motor runs and average ammeter reading is more than 6 amps, proceed to step 2.

(b) If motor runs and average ammeter reading is less than 6 amps, proceed to step 3.

(2) Check to see if wiper linkage or pivots are binding or caught. Disconnect drive link from motor.

(a) If motor now runs and draws less than 3 amps, repair linkage system.

(b) If motor continues to draw more than 3 amps, replace motor assembly.

(3) Check motor wiring harness for shorting between high and low speed wires as follows:

(a) Connect a voltmeter or test lamp to motor ground strap.

(b) Set wiper switch to LOW position.

(c) Connect other lead of voltmeter to terminal 4 of the wiring harness.

(d) If voltage is present, there is a short in the wiring or wiper switch. If no voltage is present proceed to step e.

(e) Set wiper switch to HIGH position.

(f) Move voltmeter lead from terminal 4 to terminal 3 of the wiring harness.

(g) If voltage is present, there is a short in the wiring or wiper switch.

CONDITION: MOTOR WILL RUN AT HIGH SPEED, BUT NOT AT LOW SPEED. MOTOR WILL RUN AT LOW SPEED, BUT NOT AT HIGH SPEED

PROCEDURE

(1) If motor will not run on high speed, put switch in HIGH position and connect a test lamp between motor Terminal 4 and ground (Fig. 12).

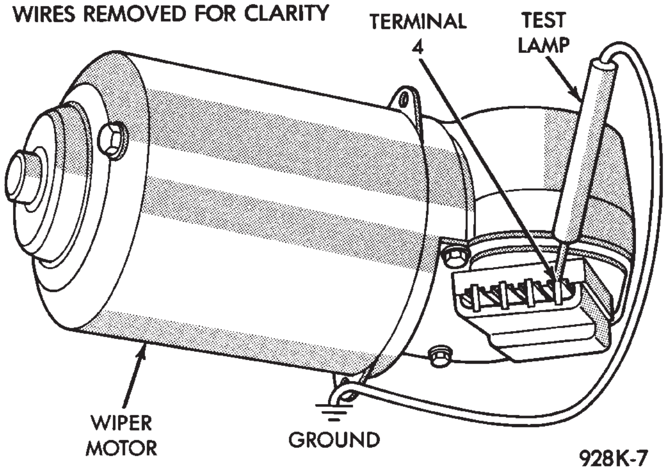


Fig. 12 Test Lamp Between Terminal 4 and Ground

(2) If motor will not run on low speed, put switch in LOW position and connect a test lamp between motor Terminal 3 and ground.

(3) If test lamp does not light at motor terminal, there is an open in wiring or switch. If test lamp lights at motor terminal, replace motor assembly.

CONDITION: MOTOR WILL KEEP RUNNING WITH SWITCH IN OFF POSITION

PROCEDURE

Remove wiring harness. Connect jumper from Terminal 1 to Terminal 3 of wiper motor (Fig. 13). Connect second jumper from Terminal 2 to battery (B+). If motor runs to PARK position and stops, wiper switch is faulty. If motor keeps running and does not park, replace motor assembly.

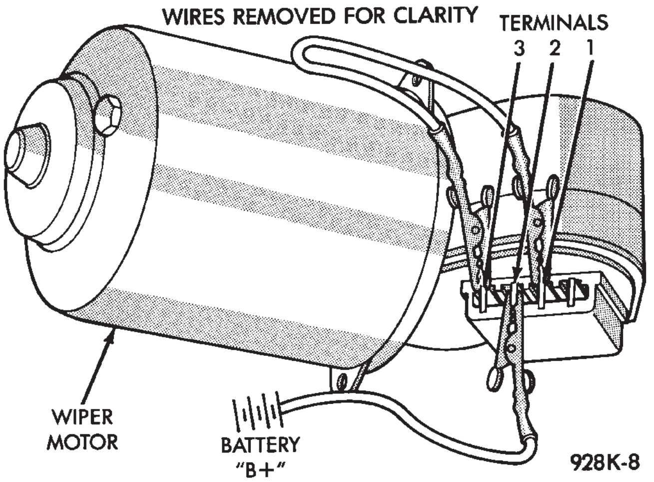


Fig. 13 One Jumper Wire Between Terminal 1 and 3. One Jumper Wire Between Terminal 2 and Battery positive

CONDITION: MOTOR WILL STOP WHEREVER IT IS, WHEN COLUMN SWITCH IS PUT IN OFF POSITION. THE WIPERS DO NOT CONTINUE RUNNING TO PARK POSITION

PROCEDURE

(1) Remove motor wiring connector and clean terminals. Reconnect connector and test motor.If problem persists, proceed to Step 2.

(2) Set wiper switch to OFF position. Disconnect motor wiring connector. Connect a voltmeter or test lamp to the motor ground strap. Connect the other lead to terminal 2 of wiring connector.

(a) If voltage is not present, check for an open circuit in the wiring harness or wiper control switch.

(b) If voltage is present, proceed to step 3.

(3) Connect an ohmmeter or continuity tester between terminals 3 and 1 (Fig. 14).

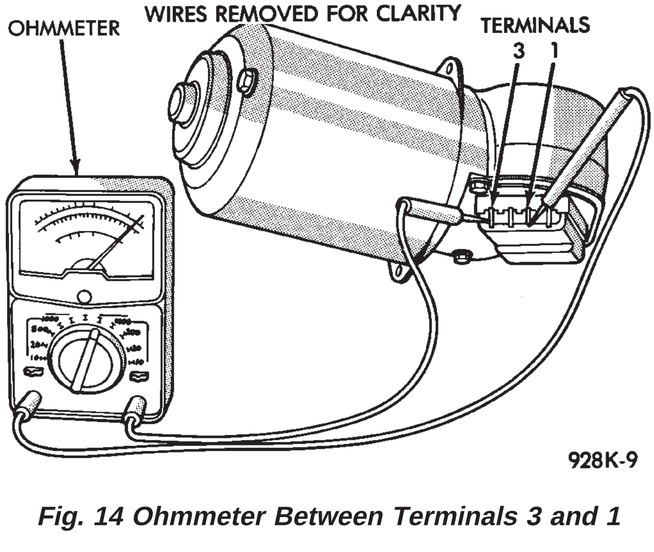


Fig. 14 Ohmmeter Between Terminals 3 and 1

(a) If there is continuity between these terminals, the problem is a defective motor.

(b) If there is no continuity, the problem is an open circuit in the wiper control switch or wiring harness.

REAR WIPER MOTOR—AG BODY TEST

The following test is used in order to locate and then repair liftgate wiper motor defects. Refer to Group 8W, Wiring Diagrams for liftgate wiper motor wiring schematic.

(1) Remove lower cover on liftgate (Fig. 15).

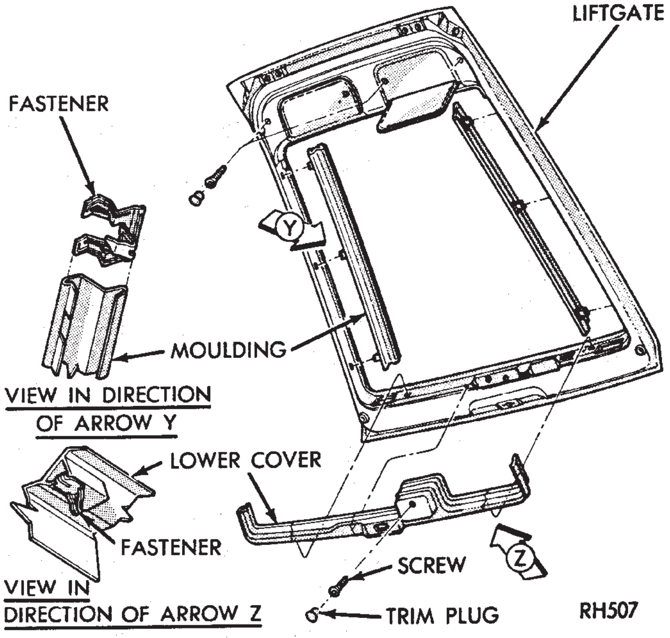


Fig. 15 Liftgate Lower Cover

(2) Disconnect feed connector from wiper motor.

(3) With ignition switch in ON position, check for battery voltage at blue wire.

(4) With ignition switch in ON position and wiper switch ON, check for battery voltage at blue and brown wire. If battery voltage is not present in steps 3 and 4, check fuse, liftgate wiper switch and wiring.

(5) With ignition switch in ON position, and wiper switch in OFF position, check for battery voltage between blue and brown wires. If battery voltage is not present, check ground wire to liftgate switch.

(6) If battery voltage is present in steps 3 and 4, replace motor.

FRONT WIPER MOTOR ASSEMBLY—AG and AJ BODIES

REMOVAL

(1) Park system.

(2) Open the hood assembly.

(3) Remove wiper arms and blades, disconnect hoses from tee connector (Fig. 16).

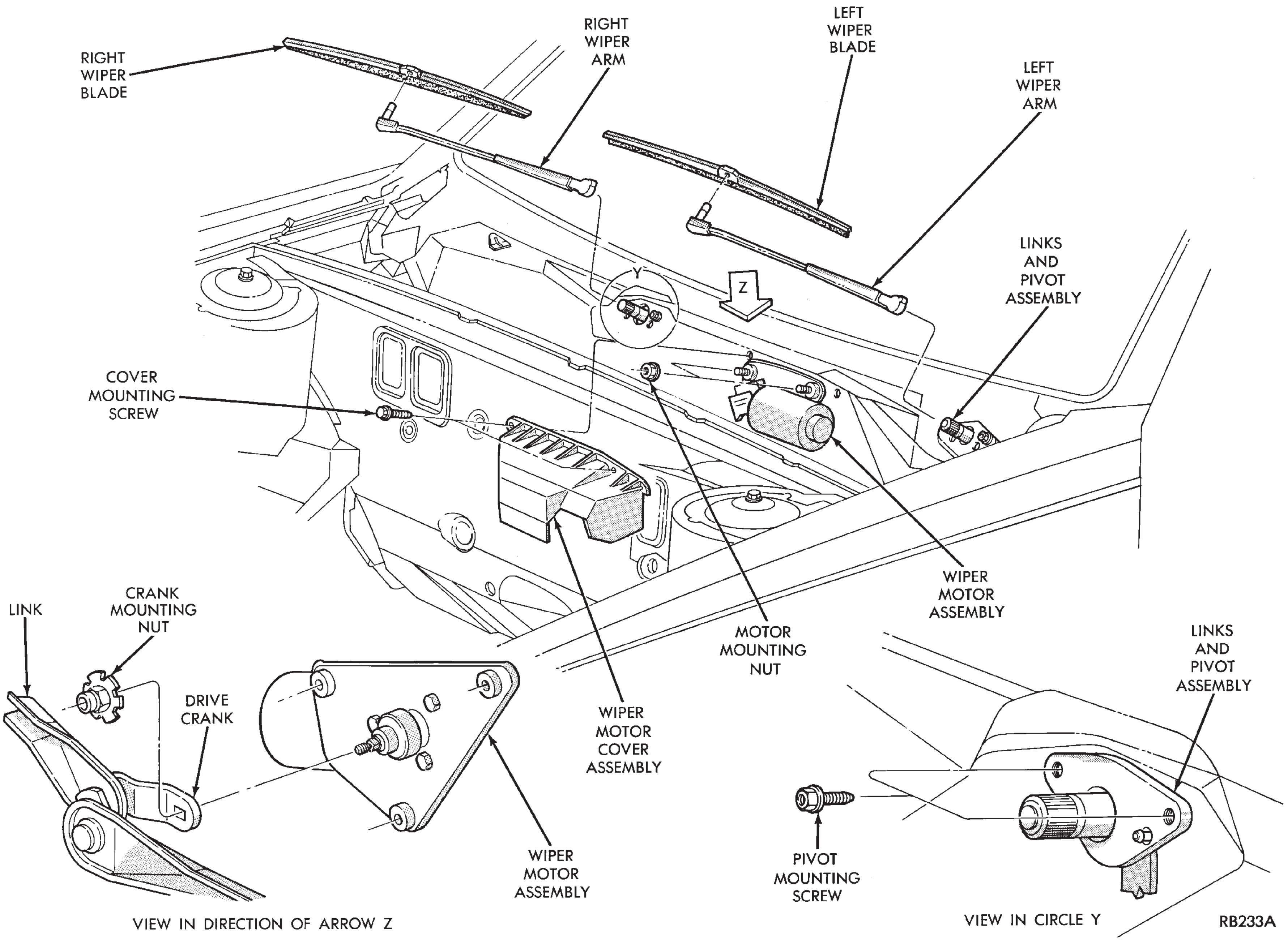


Fig. 16 Windshield Wiper Motor and Linkage—AG and AJ Bodies

(4) Remove the cowl top plastic screen.

(5) Remove pivot screws.

(6) Remove wiper motor cover and disconnect wiring harness.

(7) Remove three motor mounting nuts.

(8) Push pivots down into plenum chamber and pull motor out until it clears the mounting studs. Then move it as far to the drivers side or outboard as it will go. Pull right pivot and link out through opening. Shift motor to opposite side or inboard of opening and remove motor, left link and pivot.

(9) Clamp motor crank in a vise and remove nut from end of motor shaft. **Do not rotate motor output shaft from PARK position.**

INSTALLATION

(1) Assemble linkage to motor. Make sure crank fits over D slot on motor shaft. Tighten mounting nut to 10 to 11 N●m (90 to 100 in. lbs.) torque. Be sure motor is still in park position before assembling to linkage, if not temporarily connect motor to wiring and operate switch to position motor in park before assembling linkage.

(2) Place left pivot and link into plenum chamber.

- (a) Slide it all the way to the left or outboard side until motor clears studs and crank is behind sheet metal.
- (b) Push right pivot and link through opening.
- (c) Move assembly right and position motor on studs.

(3) Install three motor mounting nuts and tighten 7 to 8 N●m (60 70 in. lbs.) torque.

(4) Position pivots and install pivot screws and tighten 7 to 8 N●m (60 to 70 in. lbs.) torque.

(5) Connect wiring to motor.

(6) Install motor cover. Tighten screws to 4 N●m (35 in. lbs.) torque.

(7) Attach reservoir hose to T-connector through hole provided in cowl screen.

(8) Use plastic fasteners to install cowl screen.

(9) Install arm and blade assemblies. Refer to Wiper Arm Adjustment. Connect arm washer hoses to T-connector.

REAR WIPER MOTOR ASSEMBLY—AG BODY

REMOVAL

(1) Remove arm and blade assembly, refer to Arm and Blade Removal.

(2) Unlock and open liftgate.

(3) Remove trim panel refer to Group 23, Body.

(4) Disconnect feed wire connector from motor.

(5) Remove grommet from liftgate glass (Fig. 17).

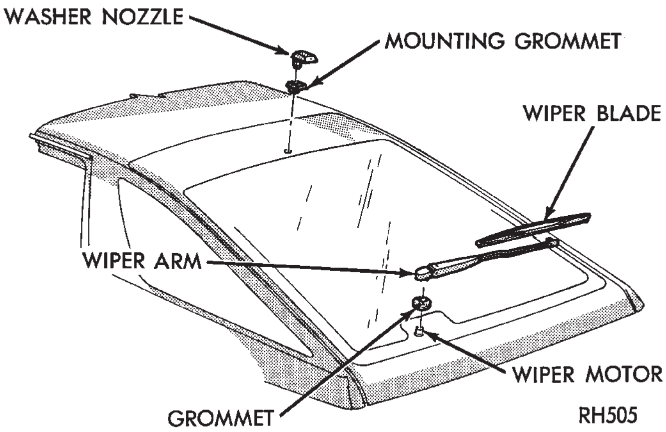


Fig. 17 Liftgate Wiper Grommet

(6) Remove two screws fastening bracket to liftgate (Fig. 18).

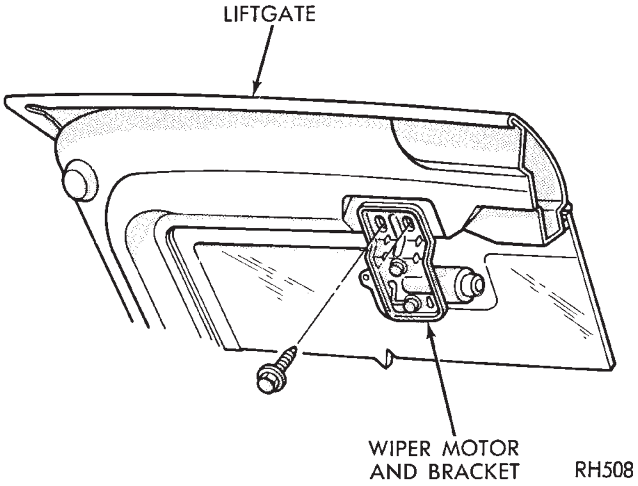


Fig. 18 Liftgate Wiper Motor—AG Body

(7) Remove motor from liftgate.

INSTALLATION

(1) Install new grommet in liftgate glass.

(2) Position motor to liftgate and secure with two screws. Tighten screws 7 to 8 N●m (60 to 70 in. lbs.) torque.

(3) Connect feed wires to motor.

(4) Install trim panel.

(5) Install and adjust arm and blade assembly refer to Arm Assembly. Tighten nut 17 to 19 N●m (150 to 170 in. lbs.) torque.

WIPER MOTOR AND LINKAGE ASSEMBLY—AA, AC, AY BODIES

REMOVAL

(1) Open hood assembly.

(2) Remove wiper arms (Fig. 19 and 20).

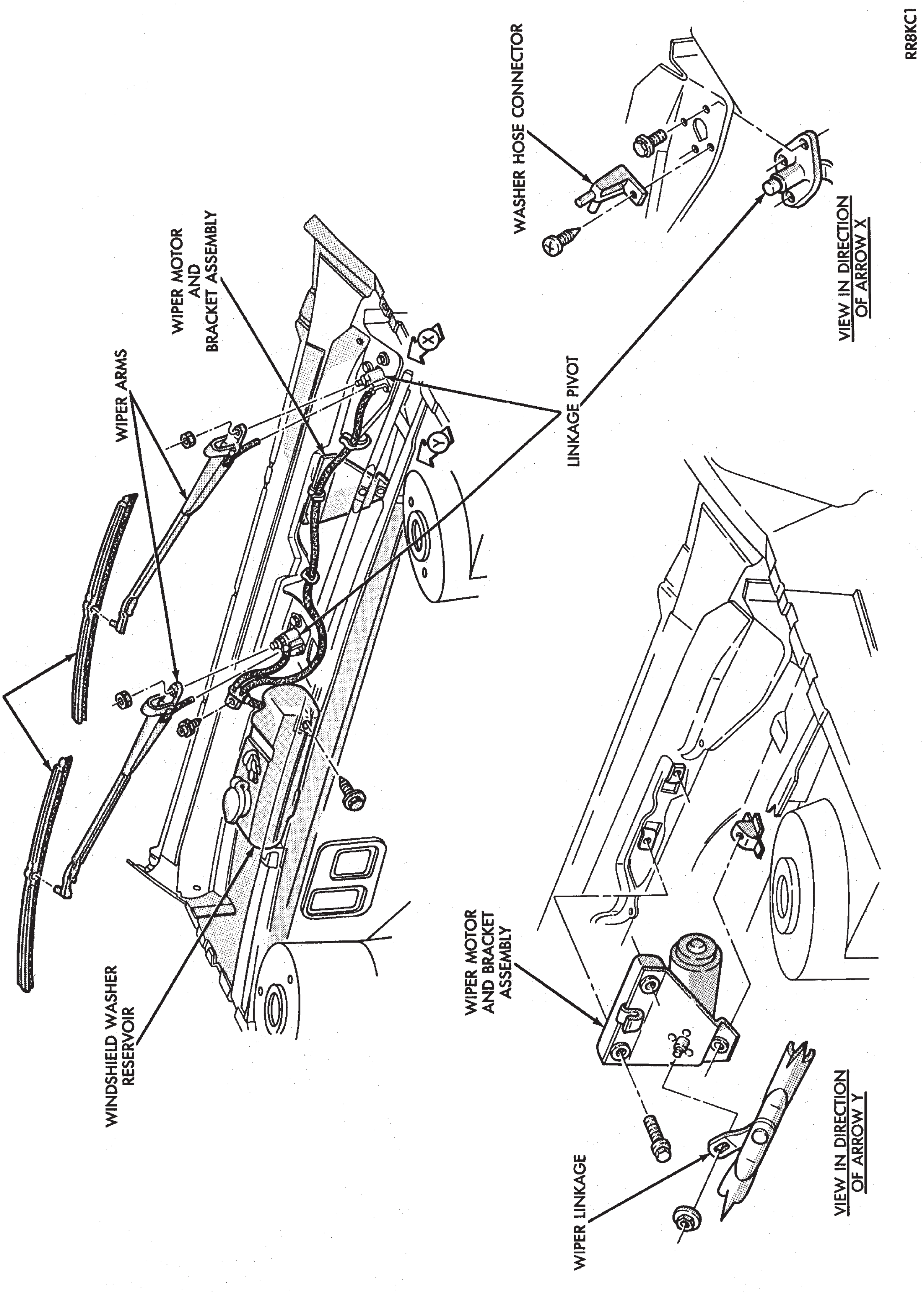


Fig. 19 Windshield Wiper Motor and Linkage—AC and AY Bodies

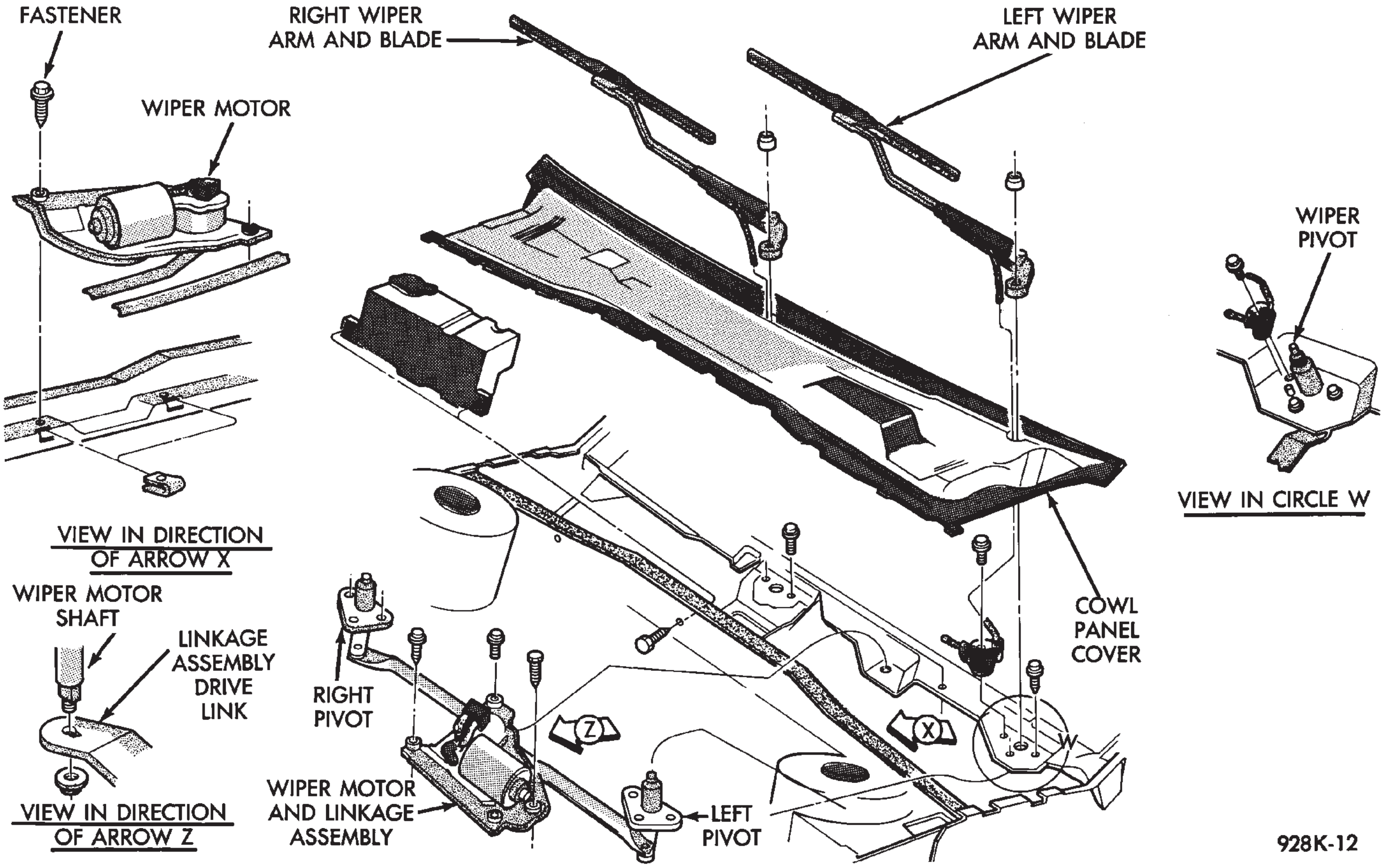


Fig. 20 Windshield Wiper Motor and Linkage—AA Body

(3) Remove cowl top plastic cover.

(4) Remove three attaching screws from each pivot.

(5) Disconnect the wiper motor wiring harness.

(6) Remove three bolts that attach motor mounting bracket to body.

(7) Remove wiper motor, bracket, and linkage assembly from cowl plenum.

(8) Clamp motor crank in a vise and remove nut from end of motor shaft. **Do not rotate motor output shaft from PARK position.**

INSTALLATION

(1) Assemble linkage to motor. Make sure crank fits over D slot on motor shaft. Tighten mounting nut 10 to 11 N●m (90 to 100 in. lbs.) torque. Be sure motor is still in park position before assembling to linkage, if not temporarily connect motor to wiring and operate switch to position motor in park before assembling linkage.

(2) Install wiper motor, bracket, crank and linkage assembly into cowl plenum.

(3) Loosely install pivots and hose connector with three attaching screws.

(4) Secure motor mounting bracket screws to body and tighten to 7 to 8 N●m (60 to 70 in. lbs.) torque.

(5) Tighten pivot attaching screws to 7 to 8 N●m (60 to 70 in. lbs.) torque.

(6) Attach wiper motor wiring harness.

(7) Cycle wiper motor and turn OFF. To ensure wiper motor is in the park position.

(8) Install cowl top plastic cover.

(9) Install and adjust wiper arm assembly tighten to 17 to 19 N●m (150 to 170 in. lbs.) torque.

WIPER MOTOR AND LINKAGE ASSEMBLY—AP BODY

REMOVAL

(1) Open hood assembly.

(2) Remove wiper arms (Fig. 21).

(3) Remove cowl top plastic cover.

(4) Disconnect the wiper motor wiring harness.

(5) Remove retaining nuts from the pivot mounting studs.

(6) Remove the three bolts that attach motor mounting bracket to body.

(7) Remove wiper motor, bracket, and linkage assembly from cowl plenum.

(8) Clamp motor crank in a vise and remove nut from end of motor shaft. **Do not rotate motor output shaft from PARK position.**

INSTALLATION

(1) Assemble linkage to motor. Make sure crank fits over D slot on motor shaft. Tighten mounting nut 10 to 11 N●m (90 to 100 in. lbs.) torque. Be sure mo-

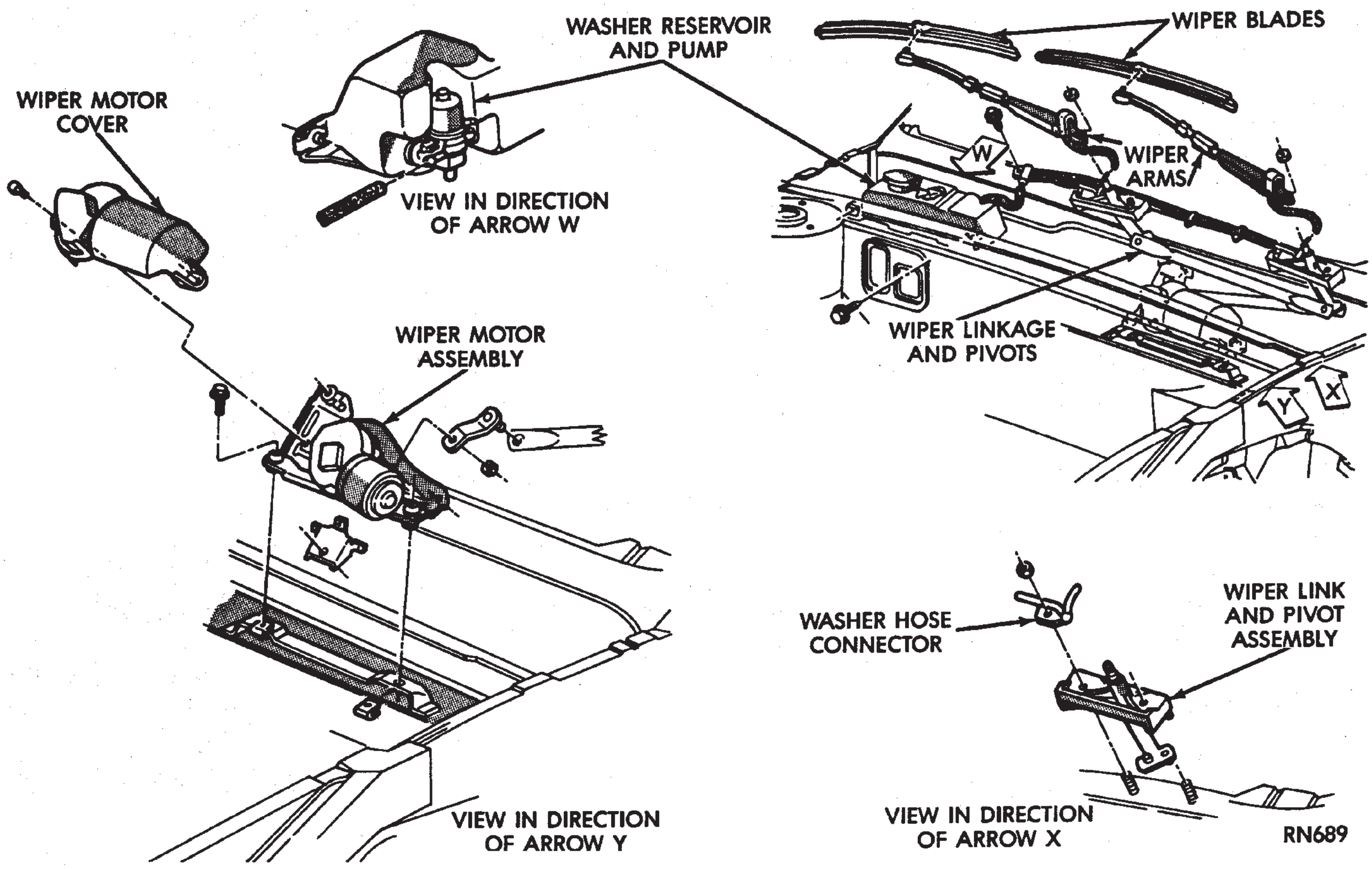


Fig. 21 Windshield Wiper Motor and Linkage—AP BODY

tor is still in park position before assembling to linkage, if not temporarily connect motor to wiring and operate switch to position motor in park before assembling linkage.

(2) Install wiper motor, bracket crank and linkage assembly into cowl plenum.

(3) Loosely install pivots and hose connector with retaining nuts to mounting studs.

(4) Secure motor mounting bracket screws to body and tighten to 7 to 8 N●m (60 to 70 in. lbs.) torque.

(5) Attach wiper motor wiring harness.

(6) Tighten pivot attaching screws to 7 to 8 N●m (60 to 70 in. lbs.) torque.

(7) Cycle wiper motor and turn OFF. To ensure wiper motor is in the park position.

(8) Install cowl top plastic cover.

(9) Install and adjust wiper arm assembly. Tighten to 17 to 19 N●m (150 to 170 in. lbs.) torque.

INTERMITTENT WINDSHIELD WIPER MOTOR AND SWITCH SERVICE PROCEDURES

INDEX

INTERMITTENT WIPER MOTOR SYSTEM TEST

Intermittent Wiper Motor Service Procedures for diagnosis of problems which do not involve the delay function, refer to the Two-Speed Motor Function Tests. The two-speed functions of all wiper motors are identical.

If a problem occurs, only in the DELAY mode, the following tests are to be performed.

INTERMITTENT WINDSHIELD WIPER SWITCH TESTS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

The intermittent wipe function on AC, AG, AJ and AY vehicles is controlled by the body controller, located in the passenger compartment behind the right side kick panel (Fig. 22). If the body controller is determined to be the problem, refer to Group 8E, Instrument Panels and Gauges, for replacement procedures.

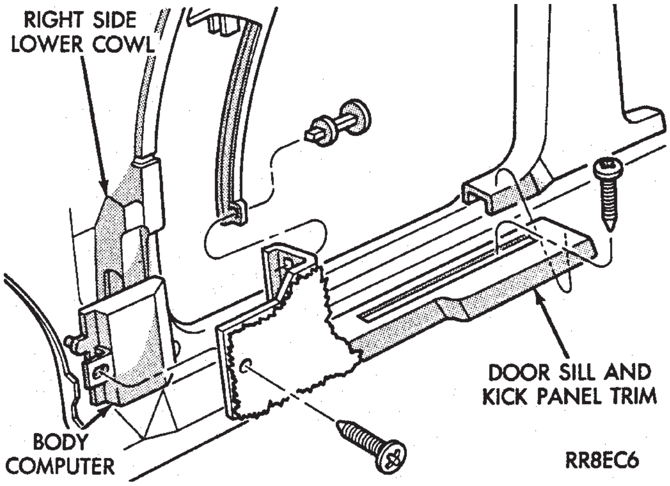


Fig. 22 Body Controller Location

CONDITION: WIPERS DO NOT COME ON WHEN THE SWITCH IS IN DELAY POSITION

PROCEDURE

(1) Disconnect 25-way connector (blue) from the body controller.

(2) Place wiper control switch in maximum DELAY position.

(3) Connect positive lead of voltmeter to pin 9 of connector (blue) and negative lead to the good ground.

(a) If voltmeter reads 0, check control switch and wiring for an open circuit.

(b) If voltmeter reads 10 to 15 volts, proceed to step 4.

(4) Connect positive lead of voltmeter to pin 22 of blue connector and negative lead to a good ground.

(a) If voltmeter reads 0, check fuses and wiring for an open circuit.

(b) If voltmeter reads 10 to 15 volts, reconnect body controller and proceed to step 5.

(5) Connect positive lead of voltmeter to pin 24 of blue connector and negative lead to the metal case of the body controller. Disconnect wiring harness from wiper motor. Set control switch to the minimum delay mode.

(a) If voltmeter reads 0, check wiring from the intermittent wipe switch to body controller for an open circuit.

(b) If voltmeter reads 10 to 15 volts, proceed to step 6.

(6) Connect voltmeter to pin L of the Intermittent wiper switch. Place intermittent wiper switch in the Max. Delay position.

(a) If voltmeter reads zero volts, change the intermittent wiper switch.

(b) If voltmeter reads 10-15 volts, check the wiring harness from the intermittent wiper switch to the wiper motor for an open circuit.

(7) If all tests above have been performed and the problem was not found, replace the body controller.

CONDITION: WIPERS START TO WIPE, BUT STOP BEFORE ONE COMPLETE CYCLE AND DO NOT RETURN TO PARK POSITION

PROCEDURE

(1) Verify that motor will park when the column switch is put in the OFF position.

(2) Set wiper control switch to maximum DELAY and allow motor to run until it stops during the wipe cycle. When motor stops, disconnect 25-way blue connector from the body controller.

(3) Connect positive lead of voltmeter to pin 20 of blue connector and negative lead to the metal case of the body controller.

(a) If voltmeter reads 0, check wiring for an open circuit.

(b) If voltmeter reads 10 to 15 volts, proceed to step 4.

(4) Using an ohmmeter or continuity tester;

(a) Check for continuity between pins 20 and 24 of blue connector of the body controller.

(b) Reverse ohmmeter leads on pins 20 and 24, again checking for continuity.

(c) If continuity between pins 20 and 24 is not observed in both steps a and b, replace the body controller.

CONDITION: EXCESSIVE DELAY OF MORE THAN 30 SECONDS OR INADEQUATE VARIATION IN DELAY

PROCEDURE

(1) Variations in delay should be as follows:

(a) Minimum delay control to extreme counterclockwise position before first detent of 1/2 to 2 seconds.

(b) Maximum delay control to extreme clockwise position before OFF detent of 15 to 25 seconds.

(2) If there is excessive delay or no variations in delay, remove the wiper motor wiring harness while the motor is parked in the OFF position.

(3) Remove 25-way blue connector from the body controller.

(4) Set wiper control switch to maximum DELAY position.

(5) With ignition switch in ON position, measure voltage between pin 9 of black connector and a good ground.

(a) If voltmeter reads 0, proceed to step 6.

(b) If voltmeter reads 10 to 15 volts, proceed to step 7.

(6) Set wiper control switch to minimum DELAY position and measure voltage between pin 9 of blue connector and a good ground. If voltmeter reads 0, check for an open circuit in the intermittent wipe wiring harness.

(7) Remove wiper motor circuit fuse.

(8) Using an ohmmeter, measure the resistance between pins 9 and 22 of the body controller 25-way black connector. Set the wiper control switch first to minimum DELAY and then maximum DELAY.

(a) If resistance reading at minimum DELAY setting is between 0 and 15 ohms, and at maximum DELAY setting the resistance is between 240,000 and 400,000 ohms, replace the body controller.

(b) If the resistance values above are not obtained, replace the wiper control switch.

CONDITION: WIPERS DO NOT RUN CONTINUALLY WHEN WASH CONTROL IS OPERATED DURING DELAY MODE

PROCEDURE

(1) Disconnect 25-way blue connector from the body controller

(2) Using a voltmeter, connect the positive lead to pin 10 of the (Black) connector. Connect negative lead to the body computer metal case.

(3) Set wiper control switch to DELAY position.

(4) Depress wash switch.

(5) If voltage reads 0, check switch relay and wiring.

(6) If voltage is between 10 and 15 volts, the problem is in the body controller.

CONDITION: IN DELAY MODE, WIPERS RUN CONTINUALLY WHEN WASH IS OPERATED BUT DO NOT PROVIDE FOUR EXTRA WIPES WHEN WASH CONTROL IS RELEASED

PROCEDURE

Replace body controller.

CONDITION: WIPERS START ERRATICALLY DURING DELAY MODE

PROCEDURE

(1) Verify that the ground connection at the instrument panel is making a good connection, free from paint and is tight.

(2) Verify that the motor ground strap is making good contact and that the motor mounting bolts are tight.

(3) Verify that the wiring connections to the body controller, wiper motor, and wiper motor switch are tight and free of corrosion.

(4) If condition is not corrected, problem is with the body controller

INTERMITTENT WIPER FUNCTION TESTS

CONDITION: EXCESSIVE DELAY OF MORE THAN 30 SECONDS OR INADEQUATE VARIATION IN DELAY

PROCEDURE

Variations in delay should be as follows:

(1) Minimum delay control to extreme counterclockwise position before first detent of one half to two seconds.

(2) Maximum delay control to extreme clockwise position before off detent of ten to thirty seconds.

(3) If there is excessive delay or no variations in delay proceed to intermittent wipe switch test.

CONDITION: IN DELAY MODE WIPERS RUN CONTINUALLY WHEN WASH IS OPERATED BUT DO NOT PROVIDE AN EXTRA WIPE WHEN THE WASH CONTROL IS RELEASED

PROCEDURE

Replace the control unit.

CONDITION: WIPERS START ERRATICALLY DURING DELAY MODE

PROCEDURE

(1) Verify that the ground connection at the instrument panel is making good connection, free from paint and is tight.

(2) Verify that the motor ground strap is making good contact and that the motor mounting bolts are tight.

(3) Verify that the wiring ground connections for the intermittent wipe control unit and the wiper switch are tight.

(4) If condition is not corrected, replace control unit.

STANDARD WIPER SWITCH TEST

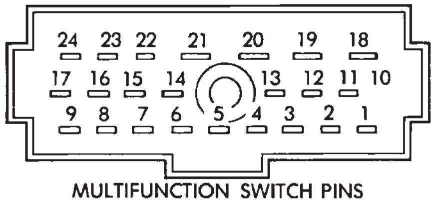
AP BODY

To test the switch, first disconnect the switch wires from the body wiring in the steering column. Using an ohmmeter, test for continuity between the terminals of the switch, as indicated in the following continuity chart. The identity of each terminal is shown in Fig. 23.

INTERMITTENT WIPE SWITCH TEST

AC AND AY BODIES

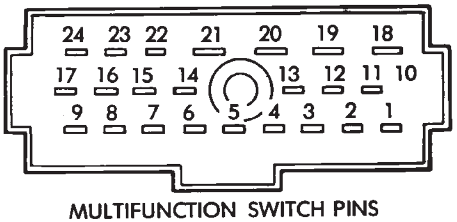
To test the switch, first disconnect the switch wires from the body wiring in the steering column. Using an ohmmeter, test for continuity between the terminals of the switch, as indicated in the following continuity chart. The identity of each terminal is shown in Fig. 24.



SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN 1 AND PIN 2
LOW	PIN 1 AND PIN 4
HIGH	PIN 4 AND PIN 5
WASH	PIN 3 AND PIN 4
* RESISTANCE AT MAXIMUM DELAY POSITION SHOULD BE BETWEEN 210,000 OHMS AND 390,000 OHMS. * RESISTANCE AT MINIMUM DELAY POSITION SHOULD BE ZERO WITH OHMMETER SET ON HIGH OHM SCALE.	

928J-4

Fig. 23 Standard 2-Speed Wiper Switch Test



SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN 6 AND PIN 7
DELAY	PIN 8 AND PIN 9 PIN 2 AND PIN 4 PIN 1 AND PIN 2 PIN 1 AND PIN 4
LOW	PIN 4 AND PIN 6
HIGH	PIN 4 AND PIN 5
WASH	PIN 3 AND PIN 4
* RESISTANCE AT MAXIMUM DELAY POSITION SHOULD BE BETWEEN 210,000 OHMS AND 390,000 OHMS. * RESISTANCE AT MINIMUM DELAY POSITION SHOULD BE ZERO WITH OHMMETER SET ON HIGH OHM SCALE.	

928J-3

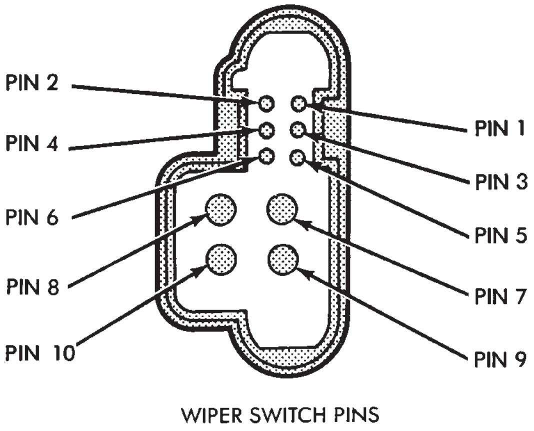
Fig. 24 Multi-Function Switch Connector and Intermittent Wipe Continuity

For test purposes, the first position is the OFF position, next is the slide for the DELAY wipe. LOW is the next detent position and HIGH is the full counterclockwise detent position.

In any wiper mode, if the knob is pushed all the way in, the washer circuit will be completed.

AG AND AJ BODIES

To test the switch, remove switch pod from instrument panel. Using an ohmmeter, test for continuity between the terminals of the switch, as indicated in the following continuity chart (Fig. 25).



SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN 8 AND PIN 10
DELAY	PIN 1 AND PIN 9
LOW	PIN 9 AND PIN 10
HIGH	PIN 9 AND PIN 7

918K-11

Fig. 25 Front Wiper Continuity—AG and AJ Bodies

WIPER SWITCH SERVICE PROCEDURE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

AC AND AY BODIES

The wiper switch is part of the multi-function switch assembly. If the wiper switch fails, the multi-function switch must be replaced. Refer to Group 8J, Turn Signals and Hazard Warning Flasher for multi-function switch service procedure.

AG AND AJ BODIES

REMOVAL

(1) Remove switch pod assembly from instrument panel.

(2) Remove five inner switch pod panel.

(3) Unhook switch linkage from buttons.

(4) Remove switch mounting screws.

(5) Remove switch.

INSTALLATION

(1) Latch switch linkage in the up position.

(2) Insert switch into switch pod and install mounting screws.

(3) Unlatch linkage and install onto push buttons.

(4) Operate all switch modes for correct operation.

(5) Reinstall five inner switch pod panel screws.

(6) Reinstall switch pod assembly.

PULSE INTERMITTENT WINDSHIELD WIPER CONTROLLER (PIWWC)

The controller is a part of the washing and wiper system which includes:

- Pulse intermittent windshield wiper controller
- Wiper blades and arms
- Wiper motor
- Windshield washer reservoir
- Wiring harness
- Windshield washer pump
- Windshield washer hoses

Any part not working properly could cause, the whole system not to work properly or at all. If the system is not working proper, check all parts before taking any action of part replacements.

The controller controls the pulse/wipe and the intermittent modes only. The time delay in the intermittent wipe mode is a minimum of 45 to a maximum of 25 seconds depending on the switch setting.

The wash function can be turn ON with the wiper control switch in the OFF position. Pressing the wash button on the end of the level will operate the washer pump until released. The wipers will operate while the pump is operating and continue for about three addition wipes (±1) after before parking.

AA BODY

The PIWWC (Fig. 26) is attached to a bracket located to the right of the steering column behind the steering column cover (Fig. 27).

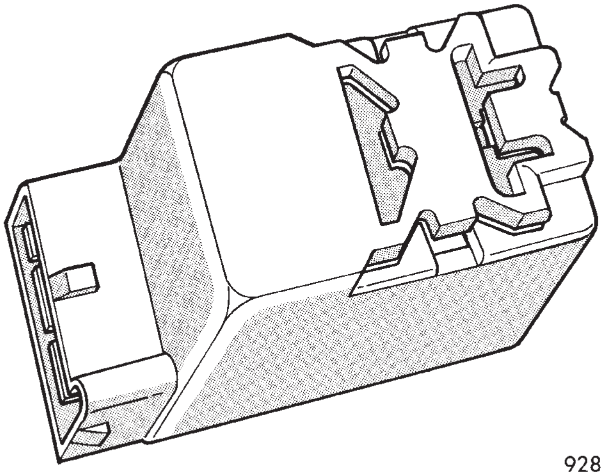


Fig. 26 Pulse Intermittent Windshield Wiper Controller (PIWWC)

AP BODY

The PIWWC is attached to a bracket located to the right of the steering column behind the steering column cover (Fig. 28).

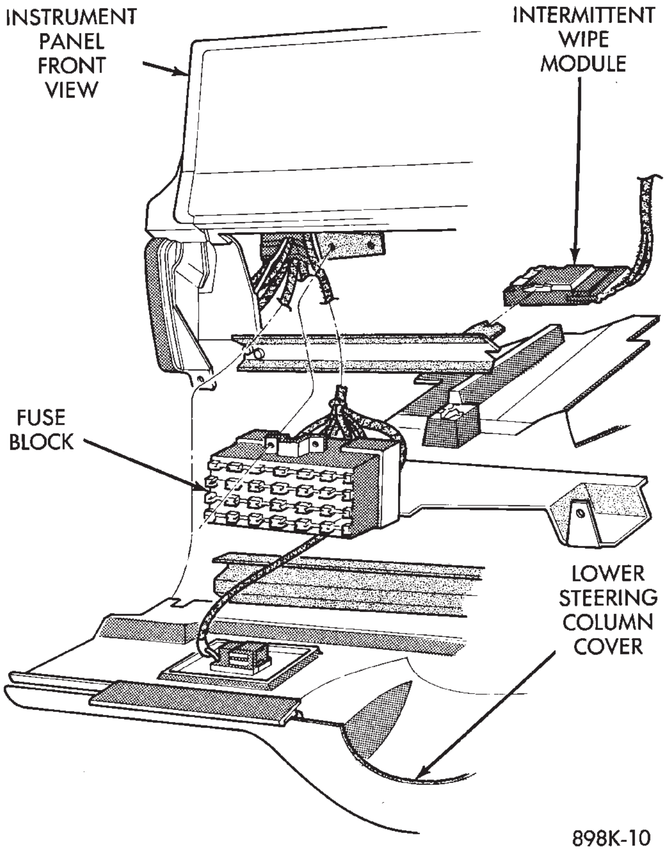


Fig. 27 PIWWC Location AA-Body

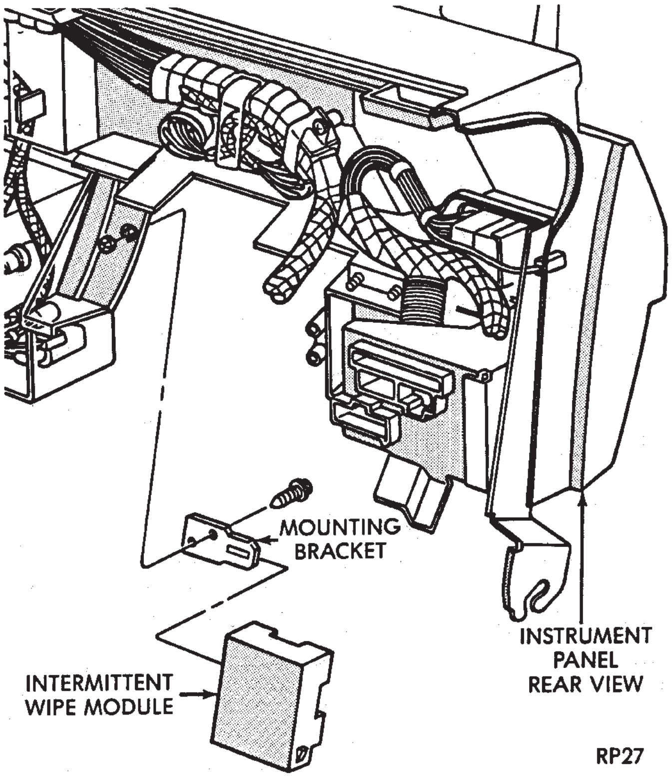


Fig. 28 PIWWC Location AP-Body

WINDSHIELD WASHERS

INDEX

GENERAL INFORMATION

All models are equipped with electric operated windshield washer pumps.

The wash function can be accessed in the OFF position of the wiper control switch. Holding the wash button depressed when the switch is in the OFF position will operate the wipers and washer motor pump continuously until the washer button is released. Releasing the button will stop the washer pump but the wipers will complete the current wipe cycle. Then followed by an average of two more wipe cycles (±1) before the wipers park and the module turns off.

Whenever a windshield washer malfunction occurs, first verify that the windshield washer wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Windshield Washer Diagnosis Chart (Fig. 29).

The electric pump assembly is mounted directly to the reservoir. A permanently lubricated sealed motor is coupled to a rotor type pump. Fluid, gravity fed from the reservoir, is forced by the pump through rubber hoses to the nozzles which direct the streams to the windshield.

The pump and reservoir are serviced as separate assemblies on all vehicles.

WASHER RESERVOIRS

FRONT WASHER RESERVOIR

REMOVAL

(1) Remove cowl top screen on applicable models (Fig. 30 through 33)

(2) Remove sheet metal screws attaching the reservoir in plenum.

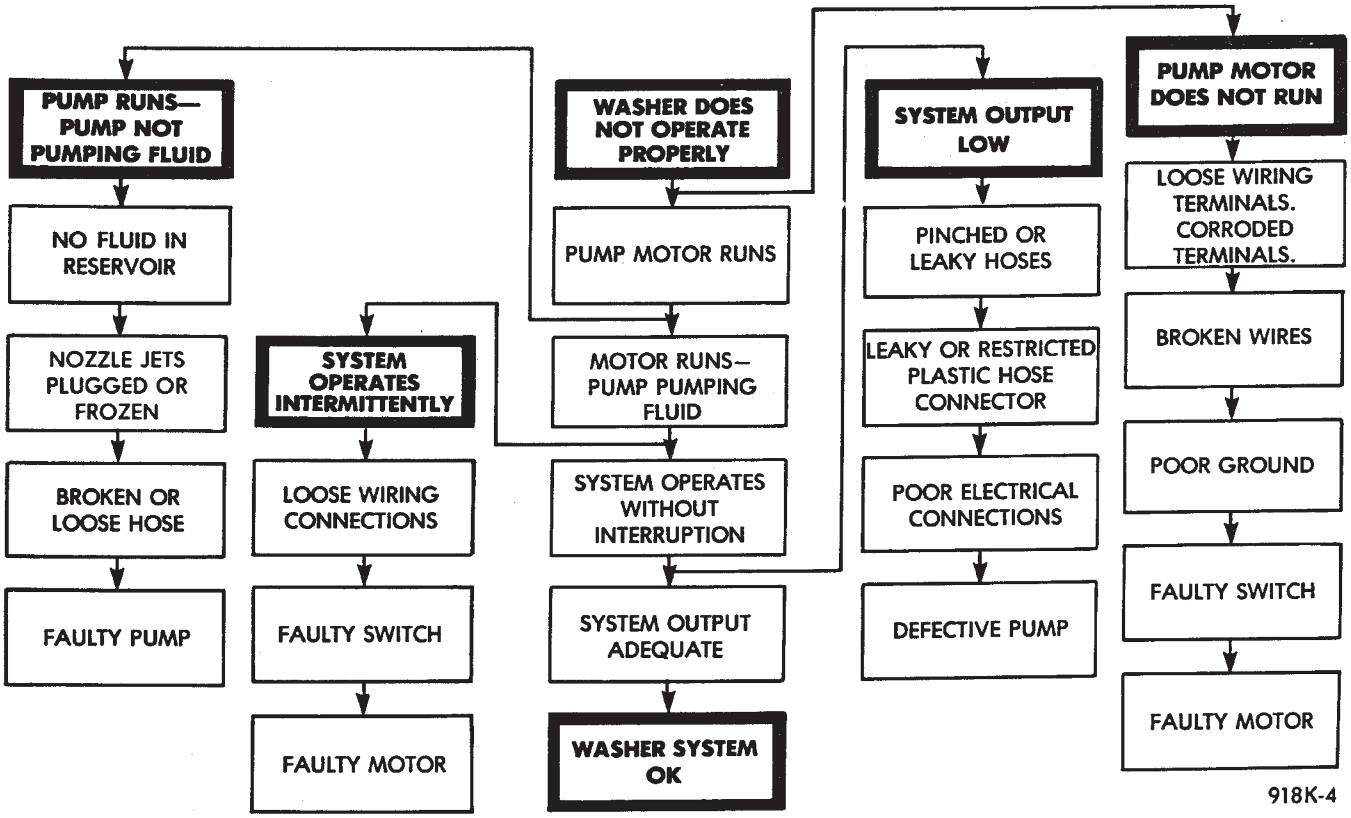


Fig. 29 Windshield Washer Diagnosis

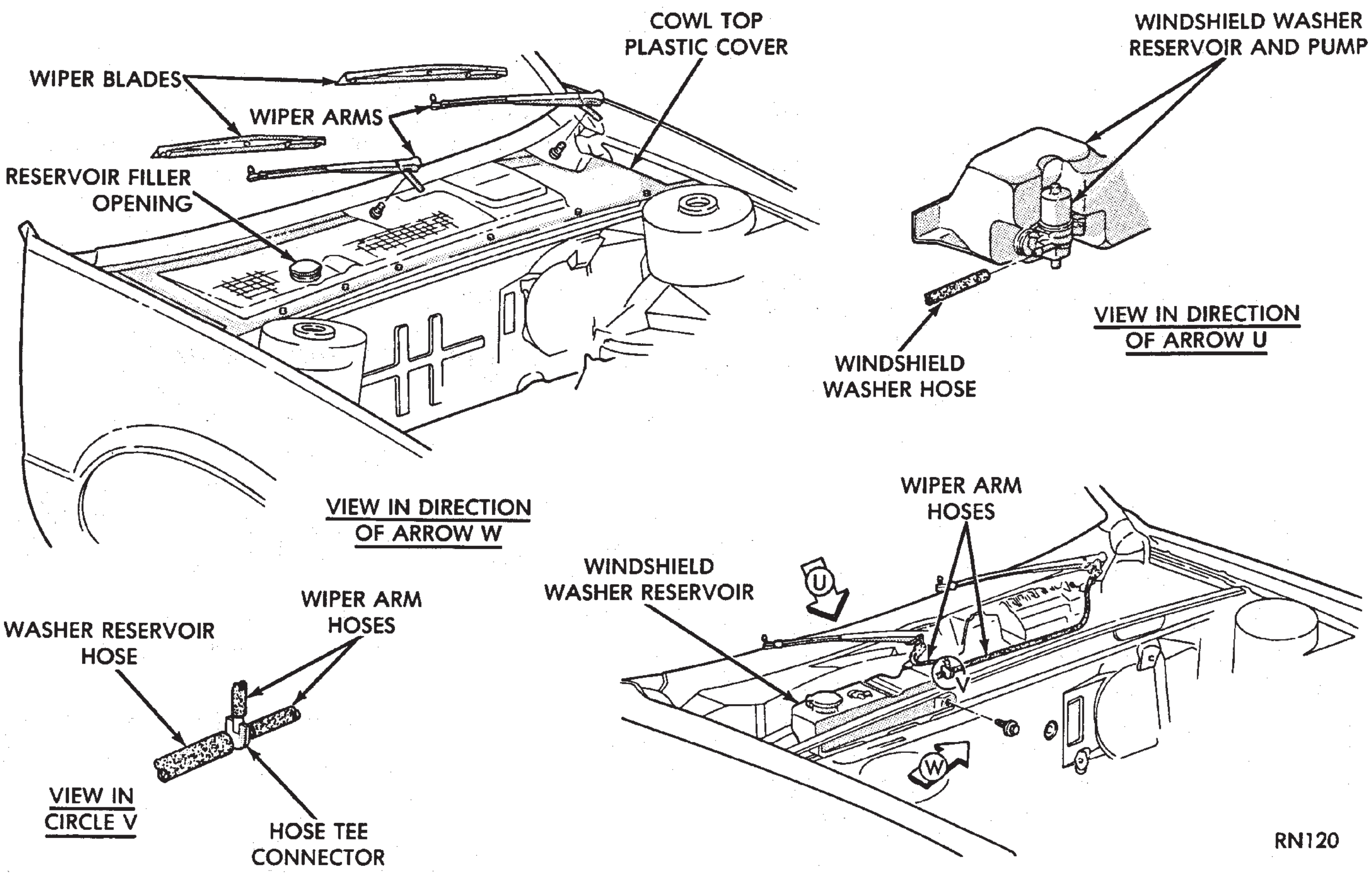


Fig. 30 Windshield Washer System—AG and AJ Bodies

(3) Disconnect the wiring harness from the reservoir pump.

(4) Disconnect the washer hose and block the liquid outlet to prevent the liquid from running out while removing the reservoir from engine compartment.

INSTALLATION

(1) Connect washer hose, wiring harness and install the reservoir in the plenum chamber.

(2) Install sheet metal attaching screws. Tighten to 3 N•m (24 in. lbs.) torque.

REAR WASHER RESERVOIR

REMOVAL

(1) Unlock and open liftgate.

(2) Remove right rear quarter panel inside trim as necessary to gain access to reservoir (Fig. 34).

(3) Remove two reservoir mounting screws.

(4) Disconnect wiring harness and filler tube from reservoir and pump assembly.

(5) Disconnect the washer hose and block the pump outlet to prevent liquid from running out.

(6) Remove reservoir and pump assembly from rear quarter panel.

INSTALLATION

(1) Position reservoir and pump assembly into the right rear quarter panel.

(2) Connect washer hose, wire harness and filler tube to the reservoir and pump assembly.

(3) Install two reservoir mounting screws.

(4) Install right rear quarter panel inside trim.

WASHER RESERVOIR PUMP

FRONT WASHER RESERVOIR PUMP

REMOVAL

(1) Remove liquid from reservoir.

(2) Remove reservoir mounting screws and remove reservoir and pump assembly (Fig. 30 through 33).

(3) Disconnect electrical lead and rubber hose from bottom of pump.

(4) Gently pry pump away from reservoir and out of grommet. Care must be taken not to puncture reservoir.

(5) Remover rubber grommet from reservoir and throw away.

INSTALLATION

(1) Install new rubber grommet on reservoir.

(2) Position pump into place, and push in firmly until it locks into grommet.

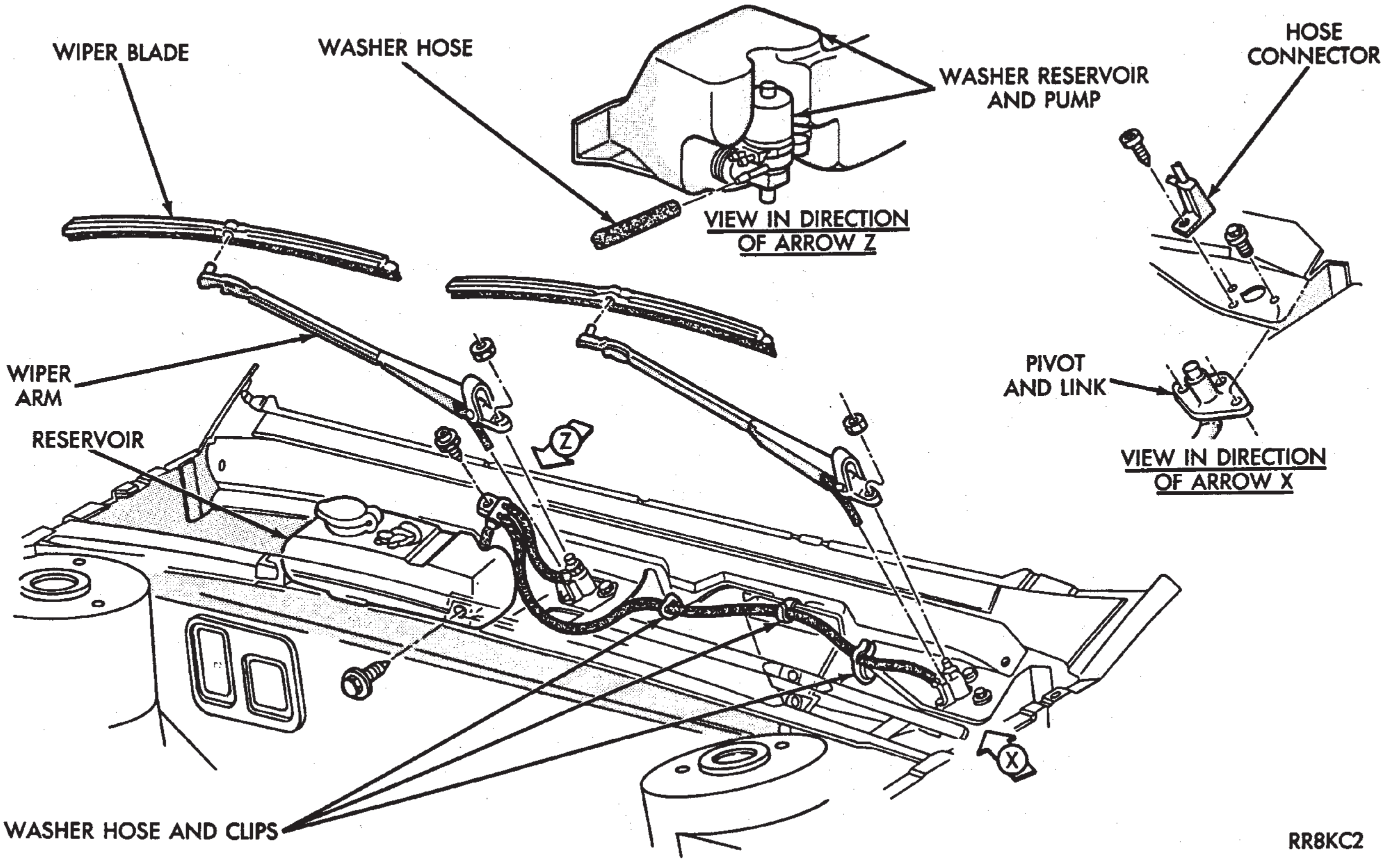


Fig. 31 Windshield Washer System—AC and AY Bodies

(3) Connect electrical lead and rubber hose to pump.

(4) Position reservoir into place and install mounting screws.

(5) Fill reservoir.

REAR WASHER RESERVOIR PUMP

REMOVAL

(1) Remove washer reservoir and pump assembly, refer to Washer Reservoir Removal.

(2) With mechanical fingers, loosen pump filter and nut through liquid filler opening.

(3) Disconnect the outside portion of the pump.

(4) Remove inner and outer portions of the pump, and remove pump.

INSTALLATION

(1) Install rubber grommet into place in bottom of reservoir.

(2) Position pump into place, install nut through filler opening and tighten with mechanical fingers.

(3) Install reservoir and pump assembly, refer to Reservoir Installation.

WASHER NOZZLE

FRONT WASHER NOZZLE

These models are equipped with the washer nozzles attached to the wiper arms. Each arm emit five streams across the wiper pattern. These washer systems requires no adjustment. If nozzle performance is unsatisfactory, they should be replaced. The right and left nozzles are identical.

REMOVAL

To remove unsnap nozzle from wiper arm and disconnect hose.

INSTALLATION

To install make sure that both the nozzle and the hose guard are securely snapped into position.

REAR WASHER NOZZLE

REMOVAL

(1) Pull washer nozzle out of mounting grommet (Fig. 35).

(2) Disconnect hose from nozzle.

INSTALLATION

(1) Connect the hose to the nozzle.

(2) Moisten the nozzle and hose.

(3) Insert nozzle into mounting grommet.

(4) Align nozzle.

(5) Open liftgate.

(6) Verify engagement of hose grommets to vehicle body and liftgate.

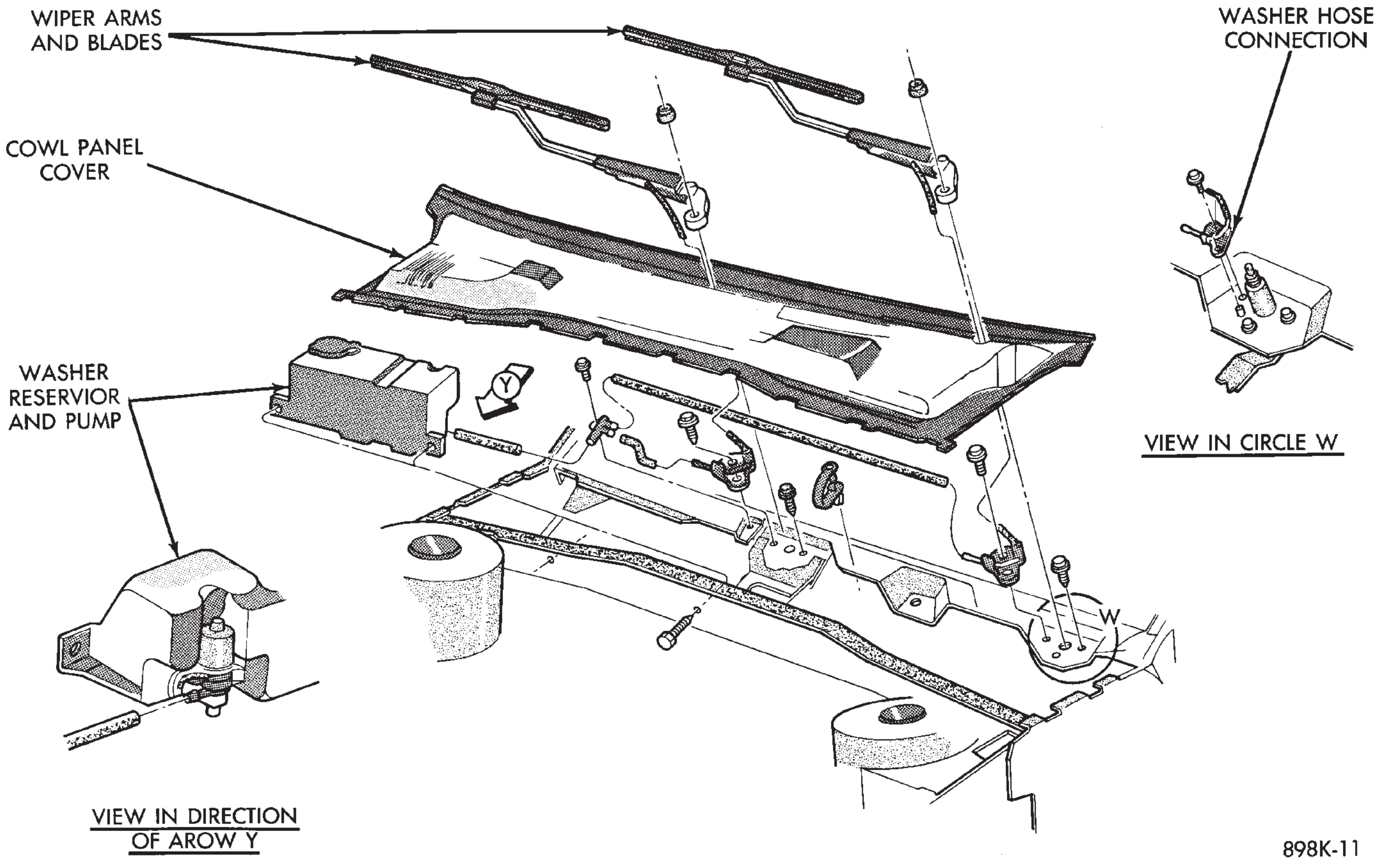


Fig. 32 Windshield Washer System—AA Body

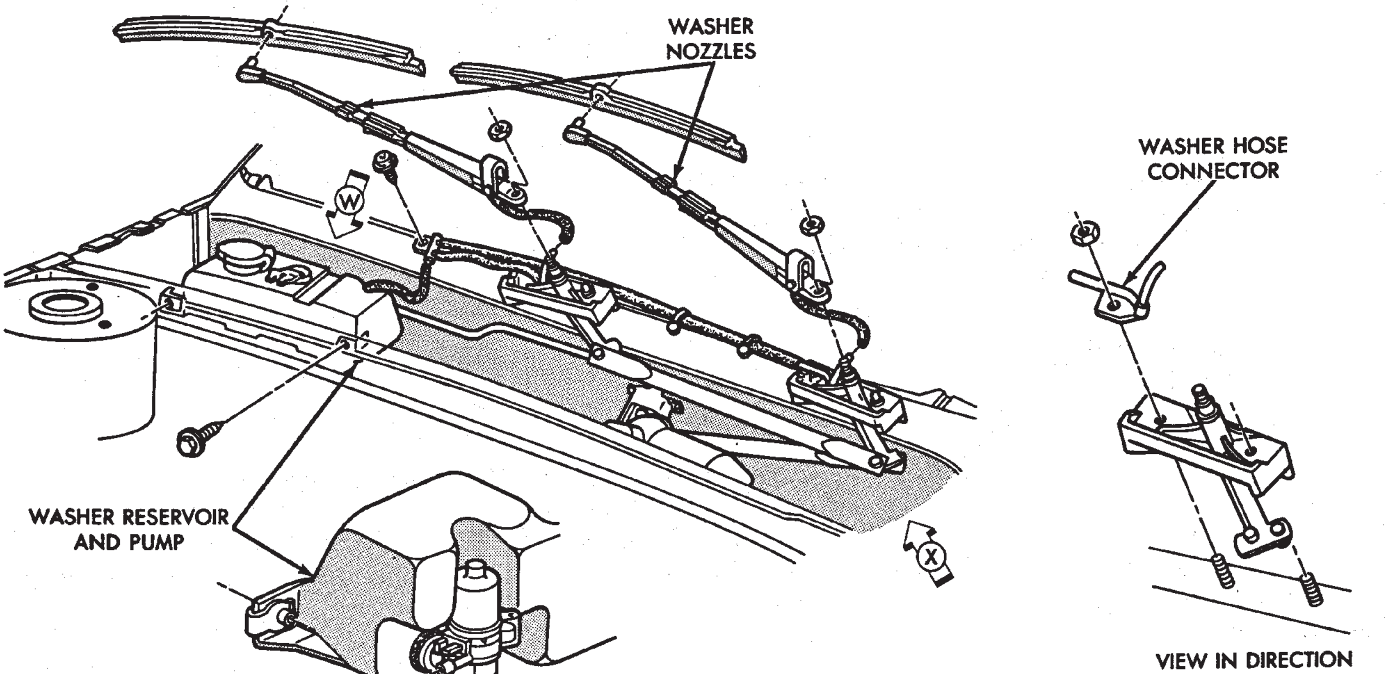


Fig. 33 Windshield Washer System—AP Body

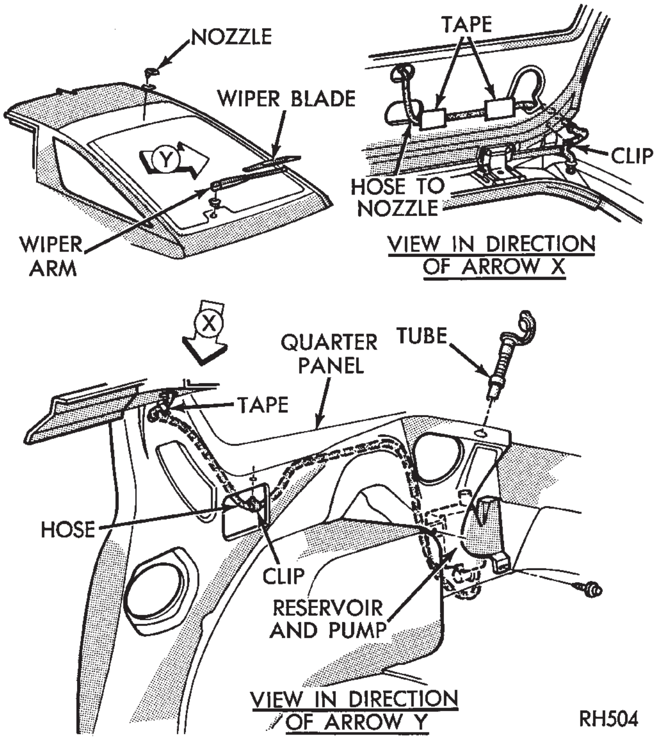


Fig. 34 Liftgate Washer System

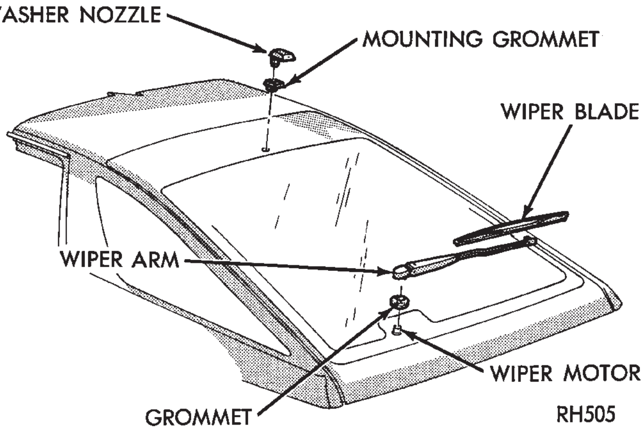


Fig. 35 Washer Nozzle

LAMPS

CONTENTS

GENERAL INFORMATION

Each vehicle is equipped with lamps used for illuminating and indicating purposes. A circuit must have a good ground to be complete. Circuit ground occurs when the lamp socket makes contact with the metal body. On vehicles with plastic lamps, a wire between the socket and the body makes the grounds.

When changing lamp bulbs, check the socket for corrosion. If corrosion is present, clean contacts with a wire brush and coat the inside of the socket with Mopar® Multi-purpose Grease or equivalent.

CAUTION: Do not touch the glass of halogen bulbs with fingers or any possibly oily surface, reduced bulb life will result.

BODY IDENTIFICATION

Throughout this Group, references are made to the vehicle family or body code. To decode the vehicle identification plates, refer to the Introduction Section at the front of this manual.

DIAGNOSTIC PROCEDURES

Begin electrical system failure diagnosis by testing all related fuses and circuit breakers in the fuse block and engine compartment.

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 Wiring Diagrams manual for component locations and circuit information.

SYMPTOM

Headlamps are dim when engine is idling of with ignition turned OFF. Canada cars must have lamps ON.

ACTION

- Clean battery terminal clamps and posts. Refer to Group 8B, Battery/Starter/Generator Service for proper procedures.
- Test charging system output. Refer to Group 8A, Battery/Starting/Charging Systems Diagnostics for proper testing procedures.
- Test for high resistance in headlamp circuits.
- Defective headlamp bulb.

SYMPTOM

Bulbs burn out frequently.

ACTION

- Test charging system output. Refer to Group 8A, Battery/Starting/Charging Systems Diagnostics for proper testing procedures.
- Check for loose or corroded connector terminals or splices in headlamp circuits. Refer to Wiring Diagrams manual for component and splice locations.

SYMPTOM

Headlamps are dim with engine running above idle. Canada cars must have lamps ON.

ACTION

- Test charging system output. Refer to Group 8A, Battery/Starting/Charging Systems Diagnostics for proper testing procedures.
- Test for high resistance in headlamp circuits.
- Defective headlamp bulb.

SYMPTOM

Headlamps flash randomly.

ACTION

- Test for poor circuit ground.
- Test for high resistance in headlamp circuits.

- Test condition of headlamp relay.
- Check for loose or corroded connector terminals or splices in headlamp circuits. Refer to Wiring Diagrams manual for component and splice locations.

SYMPTOM

Headlamps do not illuminate.

ACTION

- Test for voltage at headlamp bulbs connectors.
- Test headlamp relay.
- Test headlamp switch.
- Test high-beam headlamp dimmer switch.
- Check for loose or corroded connector terminals or splices in headlamp circuits. Refer to Wiring Diagrams manual for component and splice locations.

FOG LAMP DIAGNOSIS

The fog lamp system receives voltage from the headlamp relay when the low-beam headlamps are turned ON. The high-beam headlamp dimmer switch when actuated cancels out voltage feed to the fog lamp circuit. The fog lamp circuit is protected by a 20 amp fuse located in the fuse panel. Refer to Wiring Diagrams manual for component location and circuit information.

SYMPTOM

Fog lamps do not illuminate.

ACTION

- Test fog lamp bulb.
- Test for voltage at fog lamp connector.
- Test for proper fog lamp ground.
- Test circuit fuse.
- Test fog lamp switch.
- Test high-beam headlamp dimmer switch.
- Test headlamp relay.
- Test for open circuit in wire harness.

EXTERIOR LAMP SWITCHES AND HEADLAMP ALIGNMENT

INDEX

HEADLAMP SWITCH

Service procedures for the headlamp switch can be found in Group 8E, Instrument Panel and Gauges. More information can be found in Wiring Diagrams manual.

HEADLAMP DIMMER SWITCH

The headlamp dimmer switch is incorporated into the 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.

HEADLAMP ALIGNMENT

Headlamps can be aligned using the screen method provided in this section. Alignment Tool C4466-A or equivalent can also be used. Refer to instructions provided with the tool for proper procedures. **The preferred headlamp alignment setting is 0 for the left/right adjustment and 0 for the up/down adjustment.**

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 not heavily loaded.

(6) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

HEADLAMP ADJUSTMENT USING ALIGNMENT SCREEN

ALIGNMENT SCREEN PREPARATION (FIG. 1 AND 2)

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft) away from front of headlamp lens.

(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 centerline of the vehicle. Sight along the centerline of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.

(4) Rock vehicle side-to-side three times to allow suspension to stabilize.

(5) Jounce front suspension three times by pushing downward on front bumper and releasing.

(6) Measure the distance from the center of headlamp lens to the floor. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(7) 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 (FIG. 3, 4, 5, 6 OR 7)

A properly aimed low beam headlamp will project the top edge of low beam hot spot on the alignment screen from 50 mm (2 in.) above to 50 mm (2 in.) below the headlamp centerline. The side-to-side left edge of low beam hot spot should be from 50 mm (2 in.) left to 50mm (2 in.) right of headlamp centerline (Fig. 1). **The preferred headlamp alignment is 0 for the up/down adjustment and 0 for the left/right adjustment.** 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 alignment screws to achieve the specified low beam hot spot pattern.

CAUTION: Do not cover an illuminated headlamp for more then 15 seconds. Lamp will overheat and burn or melt cover.

To adjust headlamps, rotate alignment screws to achieve the specified high intensity pattern (Fig. 1 or 2).

FOG LAMP ALIGNMENT (FIG. 8)

Prepare an alignment screen. Refer to 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 centerline and straight ahead.

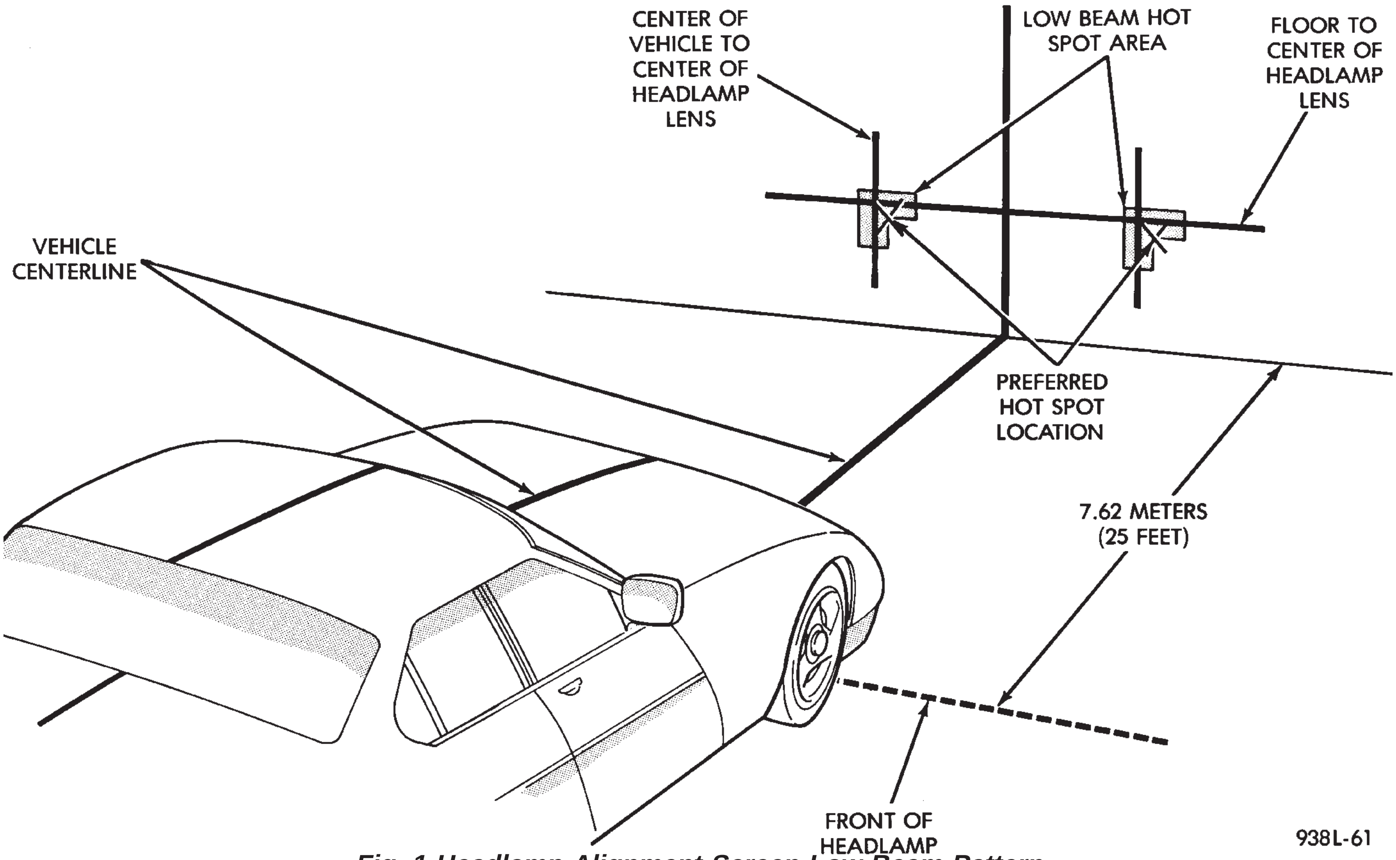


Fig. 1 Headlamp Alignment Screen Low Beam Pattern

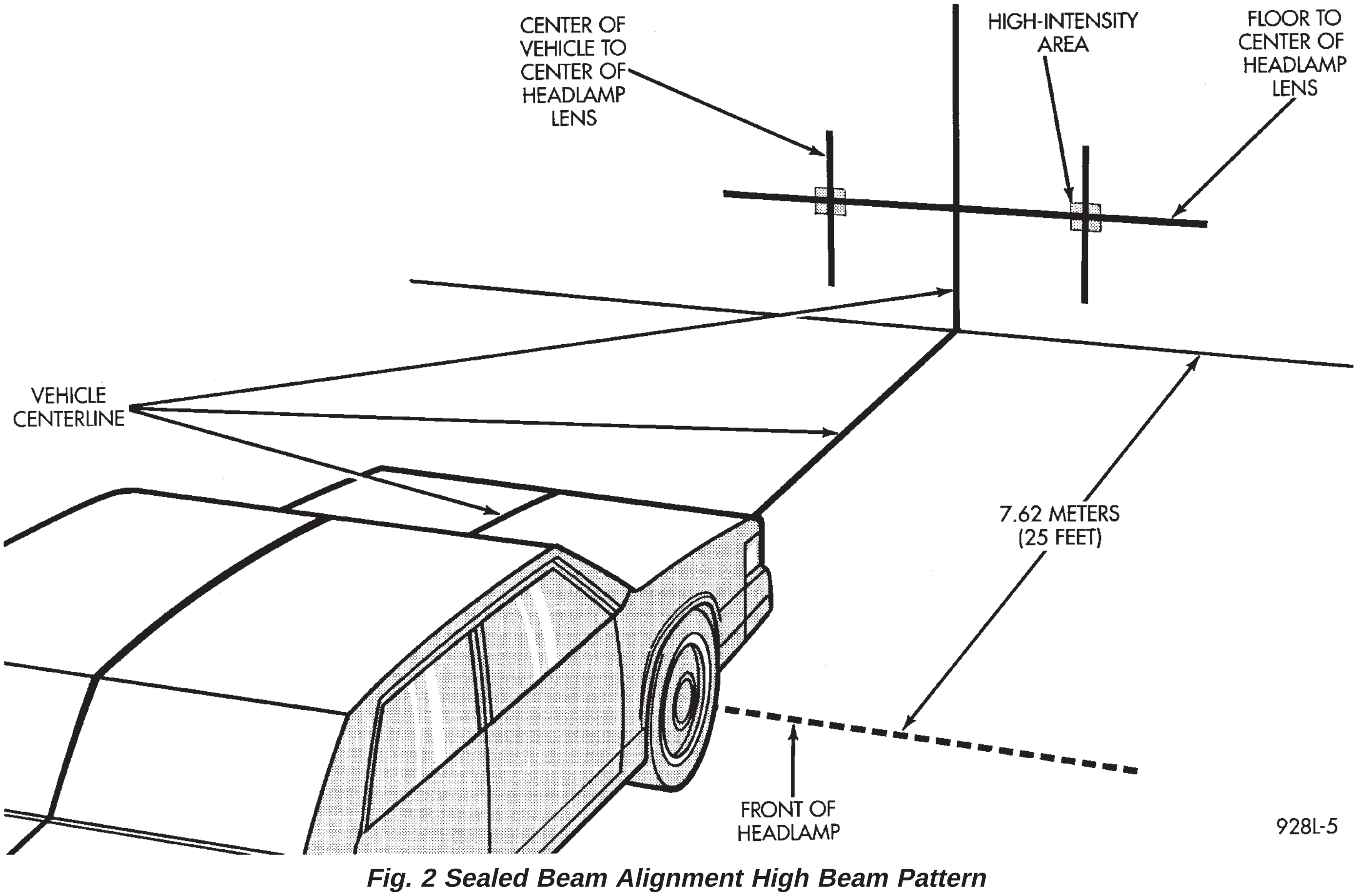


Fig. 2 Sealed Beam Alignment High Beam Pattern

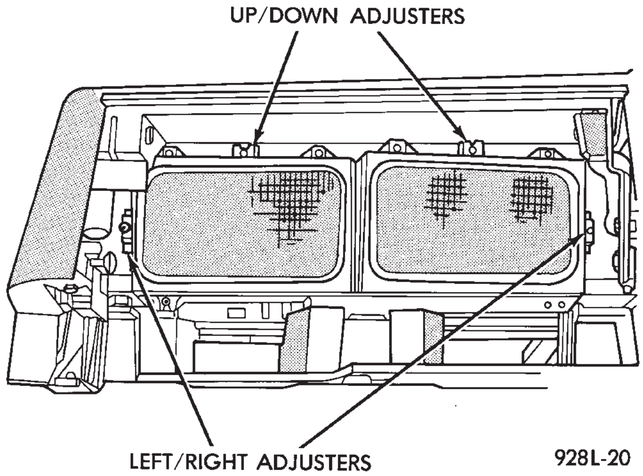


Fig. 3 Alignment Screws—AC and AY-Vehicles

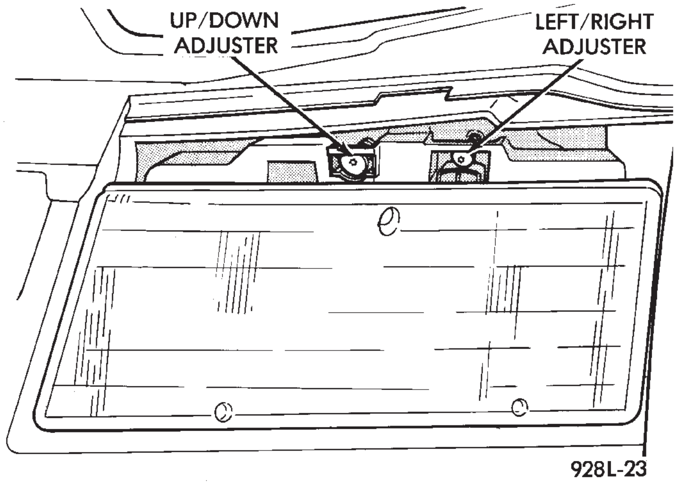


Fig. 6 Alignment Screws— AP-Vehicle

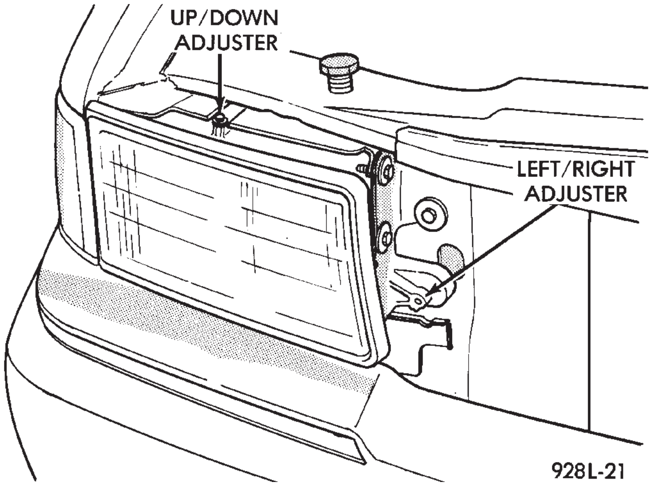


Fig. 4 Alignment Screws— AA-Vehicle

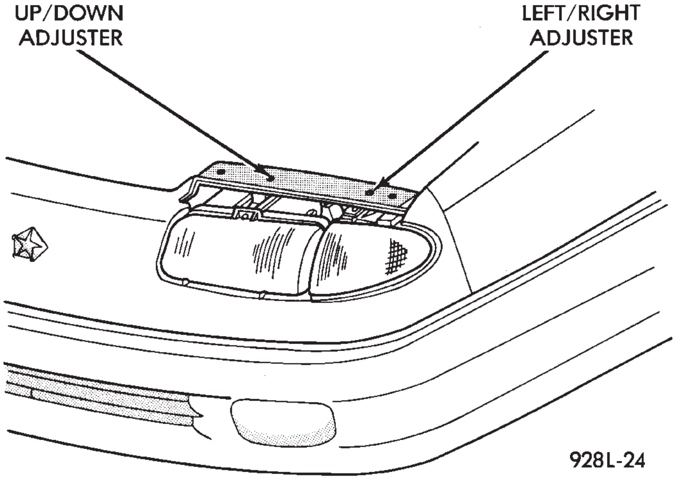


Fig. 7 Alignment Screws— AG and AJ-Vehicle—Typical

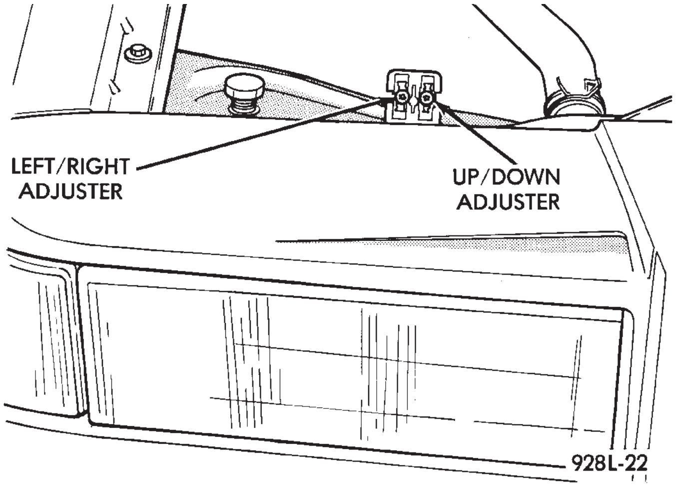


Fig. 5 Alignment Screws— ACl-Vehicle

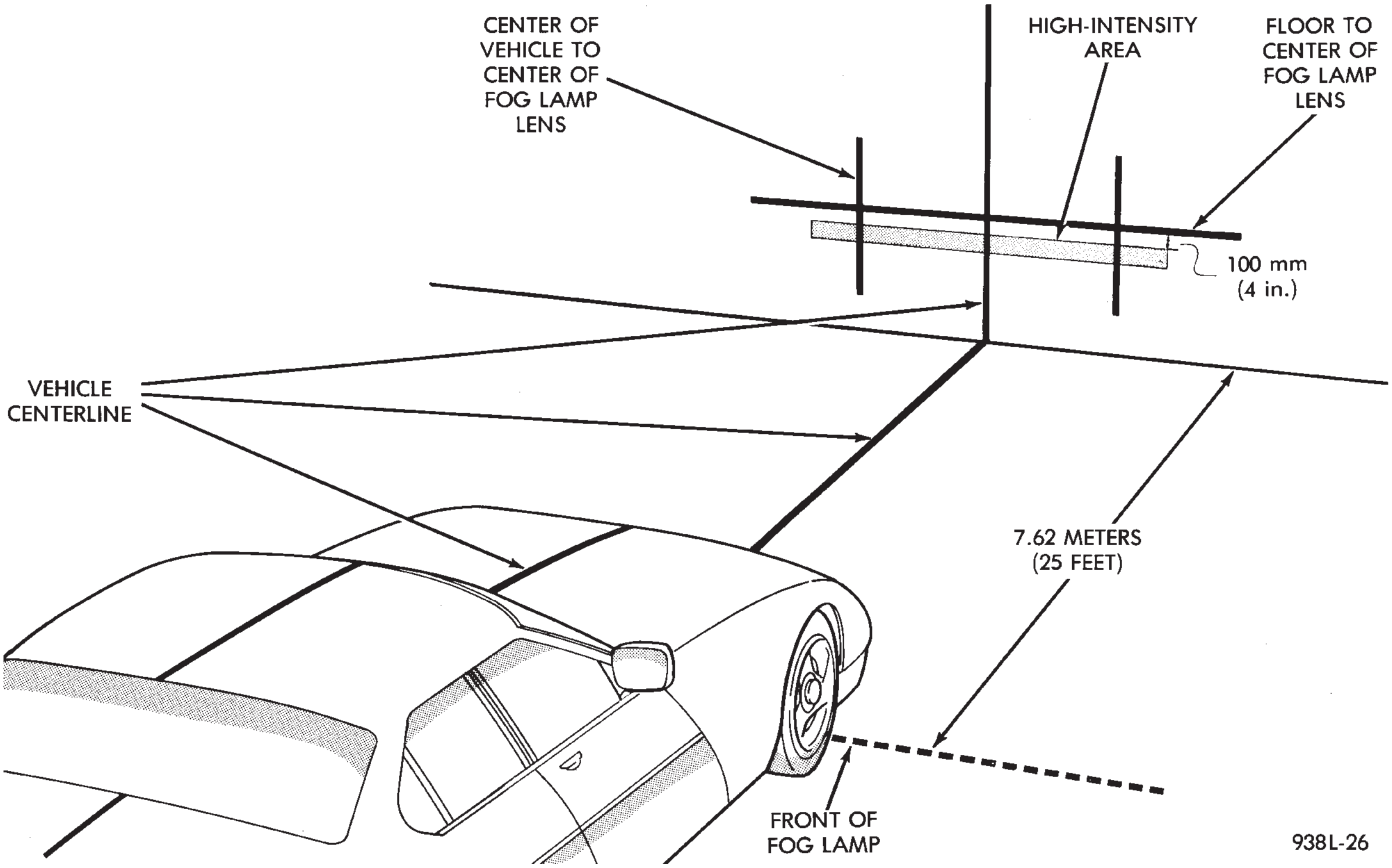


Fig. 8 Fog Lamp Alignment

EXTERIOR LAMPS—AA BODY

INDEX

HEADLAMP BULB

REMOVAL (FIG. 1)

(1) Raise hood to the open position.

(2) Disconnect wire connector from lamp socket behind the headlamp in the engine compartment.

(3) Rotate bulb retaining ring counterclockwise one quarter turn and remove the ring from the lamp.

(4) Pull bulb from the lens assembly. When installing bulb, align notches on bulb base to grooves in lamp opening.

CAUTION: Do not touch the bulb with fingers or any possibly oily surface, reduced bulb life will result.

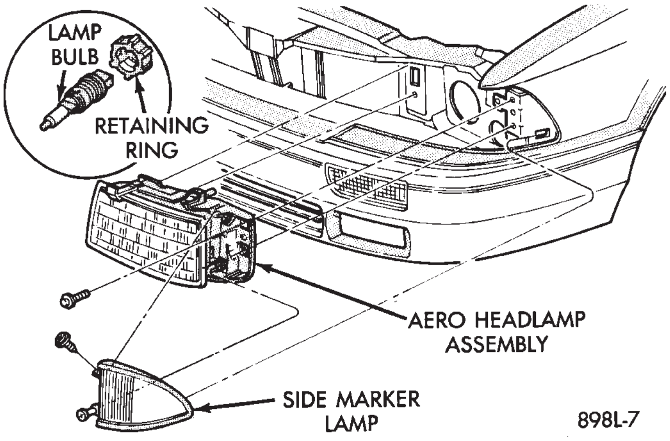


Fig. 1 Aero Headlamp

INSTALLATION

Reverse the preceding operation.

HEADLAMP LENS

REMOVAL

(1) Raise hood to the open position.

(2) Disconnect wire connector from back of headlamp bulb.

(3) Remove screws holding side marker lamp to front fender.

(4) Separate side marker lamp from fender and remove bulb socket from lamp.

(5) Remove screws holding headlamp to radiator closure panel.

(6) Separate headlamp from radiator closure panel.

INSTALLATION

Reverse the preceding operation.

PARK AND TURN SIGNAL LAMP OR BULB

REMOVAL (FIG. 2)

(1) Remove screws holding park and turn signal lamp to bumper fascia.

(2) Separate lamp from bumper fascia.

(3) Remove socket from lamp.

(4) Pull bulb from socket.

INSTALLATION

Reverse the preceding operation.

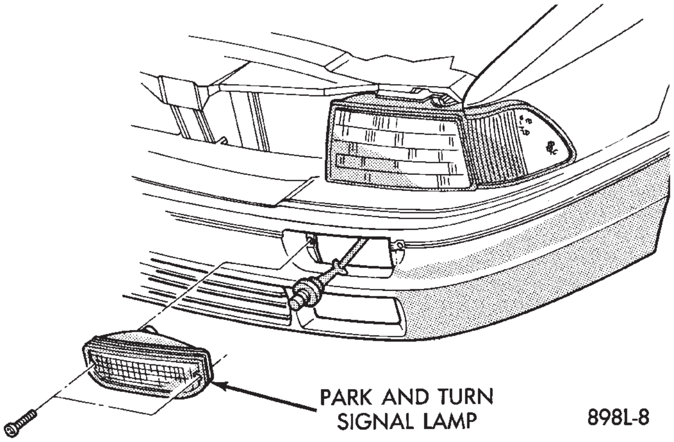


Fig. 2 Park and Turn Signal Lamp

FRONT SIDE MARKER LAMP OR BULB

REMOVAL (FIG. 3)

(1) Remove lamp assembly attaching screws and separate the lamp from the front fender opening.

(2) Rotate the side marker lamp socket counterclockwise one quarter turn and pull the socket and bulb from the lamp.

(3) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

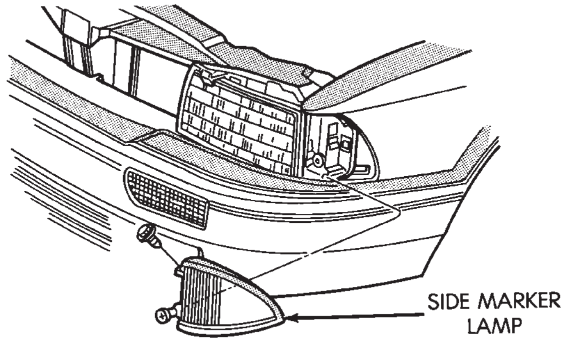


Fig. 3 Front Side Marker Lamps

TAIL, STOP AND TURN SIGNAL AND BACK-UP LAMP

REMOVAL (FIG. 4)

(1) Open deck lid and remove the plastic wing nut securing the rear trim cover in place.

(2) Pivot the end of the trim panel out of the way to gain access, and remove wing-nuts holding the lamp to the vehicle.

(3) Separate the tail lamp from the body far enough to rotate the socket and bulb assemblies. Rotate sockets one-half turn and pull the sockets out of the lamp body.

(4) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

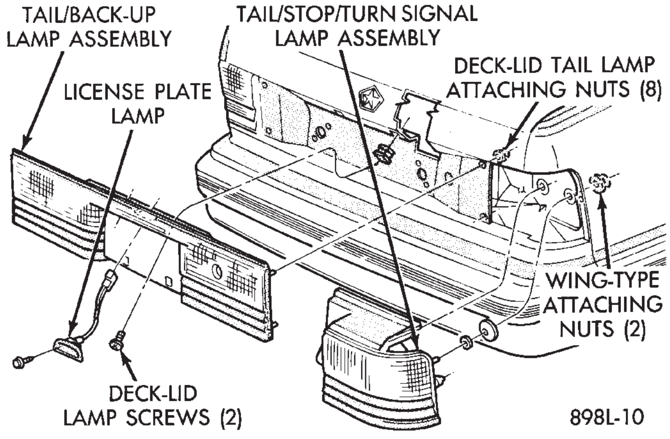


Fig. 4 Rear Lighting—AA/P or AA/D Body

LICENSE PLATE LAMPS—AA/C Body

REMOVAL (FIG. 5)

(1) Remove screws holding license plate lamp to rear bumper fascia.

(2) Separate license plate lamp from fascia.

(3) Remove socket from license plate lamp.

(4) Pull bulb from socket if bulb replacement is required.

INSTALLATION

Reverse the preceding operation.

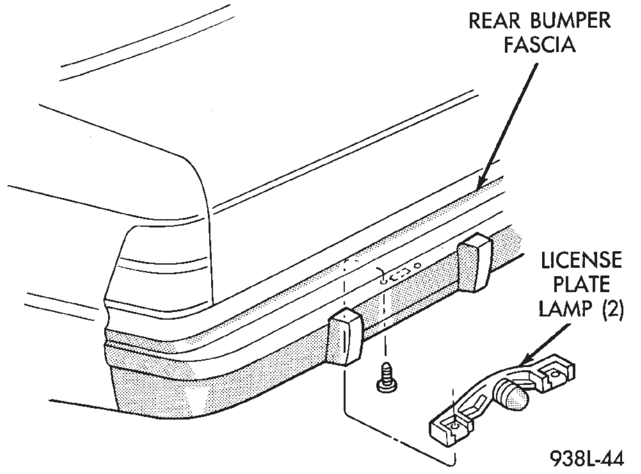


Fig. 5 License Plate Lamps—AA/C Body

LICENSE PLATE LAMP OR BULB—AA/P Body

REMOVAL (FIG. 6)

(1) Remove two lamp assembly attaching screws above the rear license plate opening.

(2) Remove the lens from the deck-lid.

(3) Pull the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

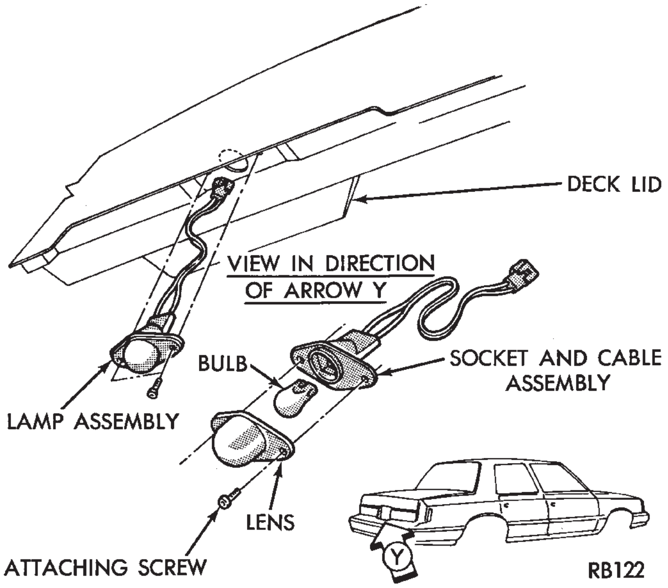


Fig. 6 License Plate Lamp—AA/P Body

CENTER HIGH-MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL (FIG. 7)

(1) Pull cover from lamp assembly.

(2) Rotate socket counterclockwise to remove socket and bulb.

(3) Remove bulb from socket.

INSTALLATION

Reverse the preceding operation.

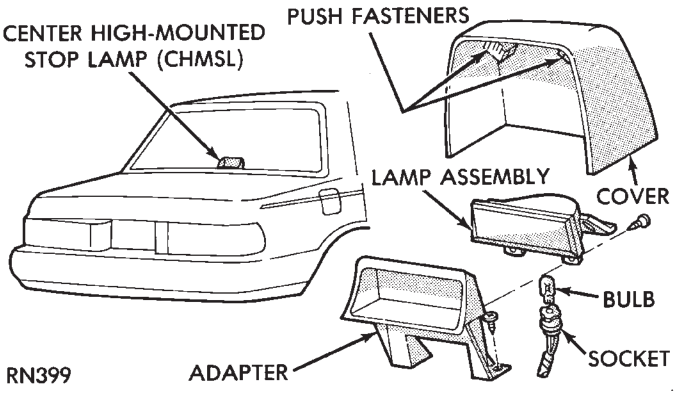


Fig. 7 Center High-Mounted Stop Lamp

FOG LAMP BULB

REMOVAL (FIG. 8)

(1) From behind front bumper fascia disengage fog lamp wire connector from bulb base.

(2) Rotate bulb base counterclockwise one half turn and pull bulb from lamp.

CAUTION: Do not touch bulb glass with fingers or other possibly oily surface, reduced bulb life will result.

INSTALLATION

Reverse the preceding operation.

FOG LAMP

REMOVAL (FIG. 8)

(1) Disengage wire connector.

(2) Remove nut holding lamp mounting bracket.

(3) Pull the lamp assembly from opening in bumper fascia.

INSTALLATION

Reverse the preceding operation. Refer to Fog Lamp Adjustment Procedures in this group for alignment instructions.

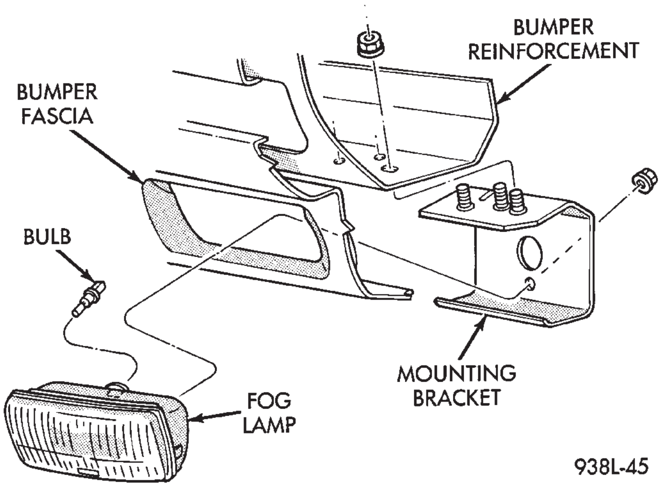


Fig. 8 Fog Lamp

EXTERIOR LAMPS—AC BODY

INDEX

HEADLAMP DIAGNOSIS

Refer to the Headlamp Diagnosis at the beginning of this Group. Refer to Wiring Diagrams Manual for circuit and component locations.

HEADLAMP SEALED BEAM—AC/C BODY

REMOVAL

(1) Turn the headlight switch ON.

(2) Open the hood and locate the Power Distribution Center forward of the left front suspension tower (Fig. 1). Remove the cover.

(3) Remove the Headlamp Close Relay (Fig. 2) to prevent the headlamp doors from closing.

(4) Turn the headlight switch OFF.

(5) Remove screws from headlamp bezel and remove bezel, if equipped.

(6) Remove screws from interior retaining ring (Fig. 3), and remove ring.

Do not disturb the headlamp adjusting screws.

(7) Pull out sealed beam unit and unplug connector.

INSTALLATION

Reverse the preceding operation.

AERO HEADLAMPS—AC/D-BODY

Lens fogging is a normal condition and does not require service, as moisture will vent from tubes behind the lens.

AERO HEADLAMP BULB

REMOVAL (FIG. 4)

(1) Locate and remove the wire connector behind the headlamp assembly in the engine compartment.

CAUTION: Do not touch the bulb with fingers or any possibly oily surface, reduced bulb life will result.

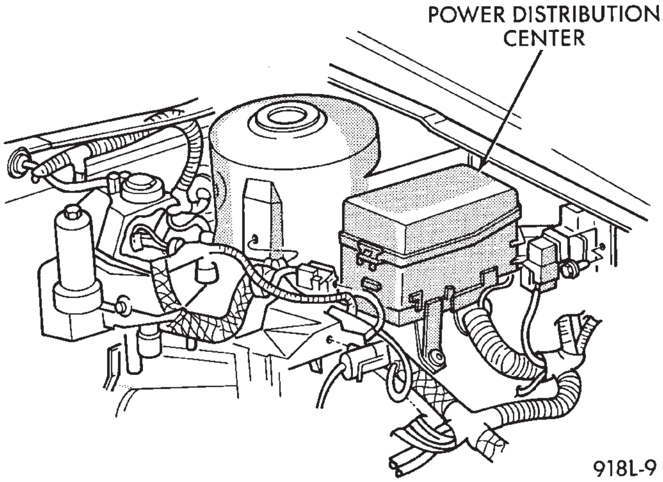


Fig. 1 Power Distribution Center

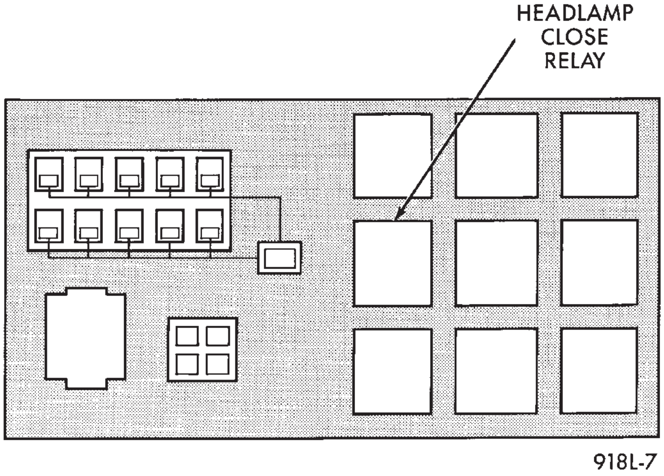


Fig. 2 Headlamp Close Relay

(2) Rotate the bulb retaining ring counterclockwise one quarter turn and remove the ring, bulb and bulb holder from the lens assembly. The bulb holder has alignment notches.

INSTALLATION

Reverse the preceding operation.

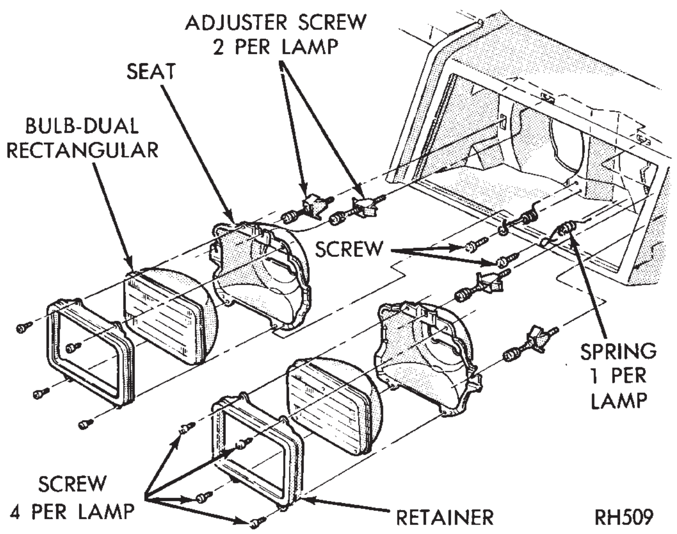


Fig. 3 Sealed Beam Replacement—Typical

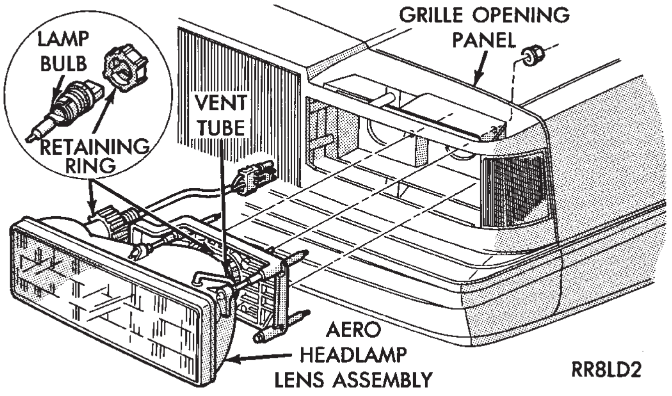


Fig. 4 Aero Headlamp—AC/D-Body

AERO HEADLAMP HOUSING

REMOVAL (FIG. 4 AND 5)

To remove the aero headlamp housing, perform steps (1) and (2) of bulb removal operation and proceed with the following procedures.

(1) The battery may have to be removed to replace the left front headlamp bulb or lens.

(2) From inside the engine compartment, unsnap the headlamp adjuster cables from the headlamp adjuster screws.

(3) Remove the four headlamp lens attaching nuts from behind the grille opening panel, and remove the lamp housing from the vehicle.

INSTALLATION

Reverse the preceding operation.

PARK/TURN SIGNAL LAMP OR BULB—AC/D-BODY

REMOVAL (FIG. 6)

(1) Remove nut holding park turn signal lamp to the GOP through an access hole in the radiator closure panel from behind the lamp.

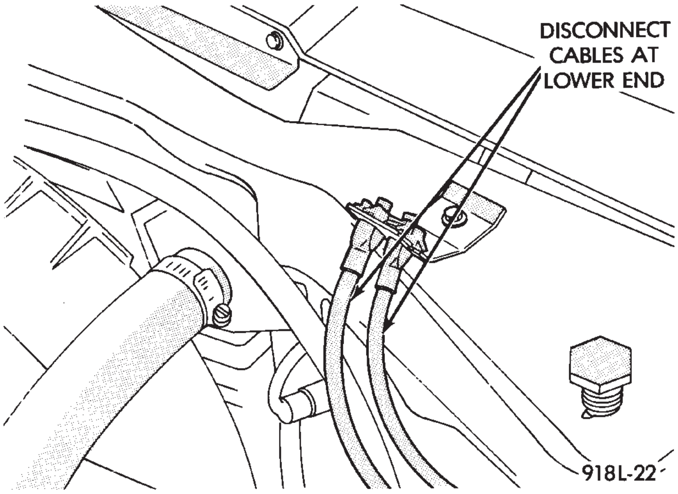


Fig. 5 Headlamp Adjuster Cables—AC/D-Body

(2) Separate the park and turn signal lamp from the GOP.

(3) Remove the socket from the lamp

(4) Pull the bulb from the socket if bulb replacement is required.

INSTALLATION

Reverse the preceding operation.

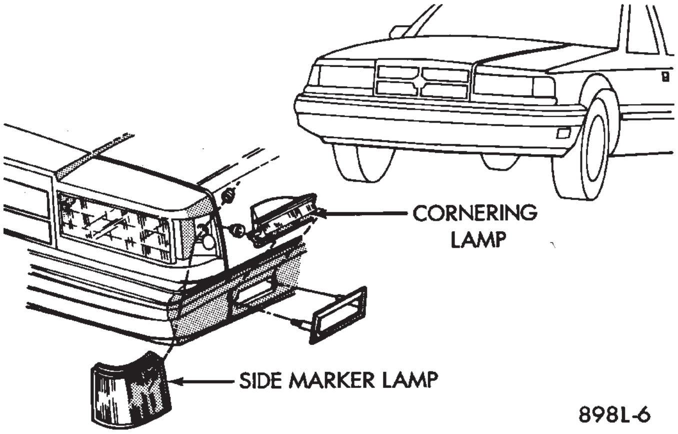


Fig. 6 Park, Turn Signal, Cornering and Side Marker Lamps—AC/D-Body

PARK/TURN SIGNAL LAMP OR BULB—AC/C-BODY

REMOVAL (FIG. 7)

(1) Remove the two park and turn signal lamp attaching screws.

(2) Separate the lamp from the front bumper fascia and remove the bulb and socket assembly.

INSTALLATION

Reverse the preceding operation.

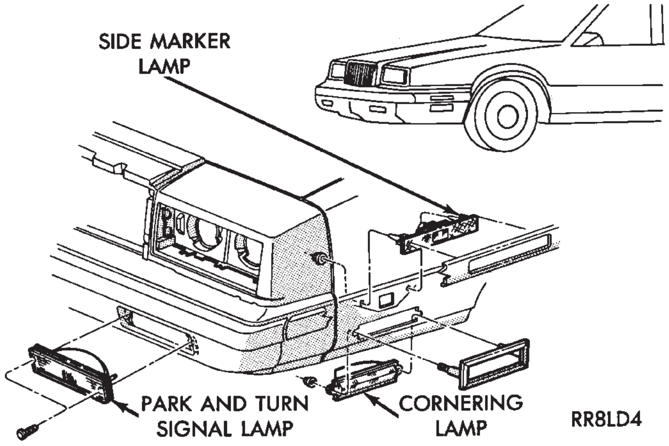


Fig. 7 Park, Turn Signal, Cornering, and Side Marker Lamps—AC/C or AY/C-S-Body

FRONT SIDE MARKER BULB—AC/C-BODY

REMOVAL (FIG. 7)

(1) Reach behind the front fender and rotate the socket counterclockwise. Pull the socket from the lamp body.

(2) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

FRONT SIDE MARKER LAMP—AC/C-BODY

REMOVAL (FIG. 7)

(1) Remove the cornering lamp retaining nuts, and remove cornering lamp.

(2) Remove the four nuts retaining the bumper trim moulding to the body.

(3) Remove bumper trim moulding.

(4) Remove side marker lamp.

INSTALLATION

Reverse the preceding operation.

CORNERING LAMP BULB

REMOVAL (FIG. 6 OR 7)

(1) Reach behind the front fender and rotate the socket assembly counterclockwise.

(2) Pull the socket out of the lamp body.

(3) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

CORNERING LAMP ASSEMBLY

REMOVAL (FIG. 6 OR 7)

(1) Remove the bulb and socket assembly from the lamp body.

(2) Remove nuts securing the lamp assembly to the cornering lamp bezel.

(3) Pull the lamp from the bezel.

INSTALLATION

Reverse the preceding operation.

TAIL, STOP, TURN SIGNAL, BACK-UP LAMP—AC/C OR AY/S-BODY

REMOVAL (FIG. 8)

(1) Open trunk lid.

(2) Remove screws holding tail lamp to quarter panel extension.

(3) Separate lamp from vehicle.

(4) Rotate the bulb sockets counterclockwise and pull the sockets from the lamp.

(5) Pull bulb from socket if bulb replacement is required.

INSTALLATION

Reverse the preceding operation.

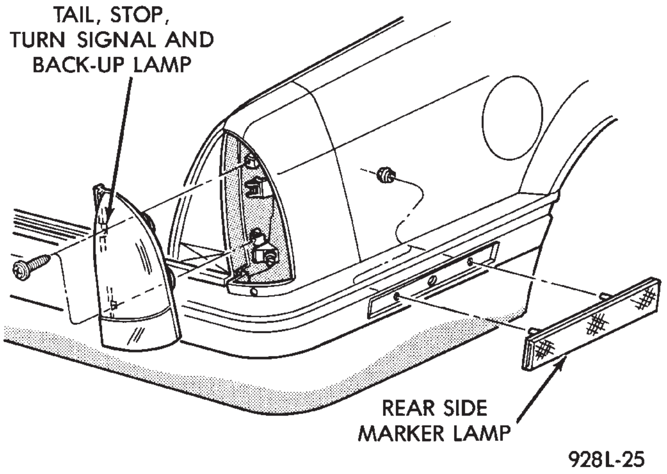


Fig. 8 Tail, Stop, Turn Signal, Back-Up, and Side Marker Lamps—AC/C or AY/C-S Body

TAIL, STOP, TURN SIGNAL, BACK-UP AND SIDE MARKER LAMP—AC/D-BODY

REMOVAL (FIG. 9)

(1) Raise deck lid and remove closure panel lower trim cover.

(2) Remove tail lamp attaching wing nuts from behind the rear closure panel.

(3) Separate the lamp assembly from the rear closure panel.

(4) Rotate the socket and bulb assemblies counterclockwise and pull the sockets from the lamp.

(5) Remove the bulbs from the sockets.

INSTALLATION

Reverse the preceding operation.

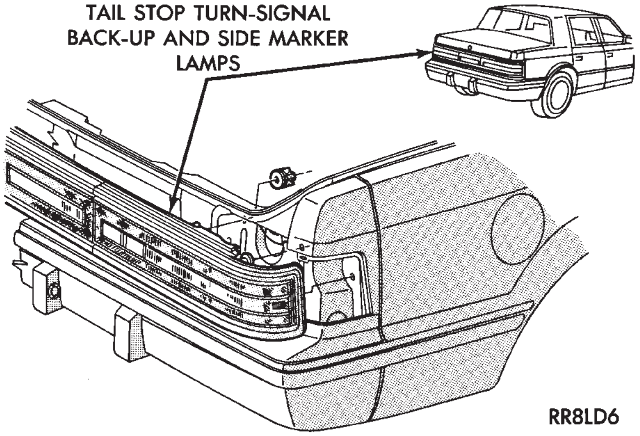


Fig. 9 Rear Lighting—AC/D-Body

REAR SIDE MARKER LAMP BULB—AC/C-BODY

REMOVAL (FIG. 8)

(1) Raise the deck lid and roll the trunk liner away from the inner quarter panel.

(2) Rotate the socket and bulb assembly counterclockwise and pull the socket from the lamp.

(3) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

REAR SIDE MARKER LAMP—AC/C-BODY

REMOVAL (FIG. 8)

(1) Remove the body side molding. Refer to Group 23, Body.

(2) Remove socket assembly and attaching nuts and separate lamp from the body.

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP/BULB

REMOVAL

(1) Remove the two screws retaining the lamp to the bumper guard.

(2) Remove the bulb from the socket assembly.

INSTALLATION

Reverse the preceding operation.

CENTER HIGH-MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Open trunk lid.

(2) From under the parcel shelf, rotate socket counterclockwise, and pull the CHMSL socket and bulb from the lamp.

(3) Pull bulb from the socket.

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL (FIG. 10)

(1) Remove parcel shelf trim cover. Refer to Group 23, Body.

(2) Remove two CHMSL attaching screws and separate the lamp from the parcel shelf.

INSTALLATION

Reverse the preceding operation.

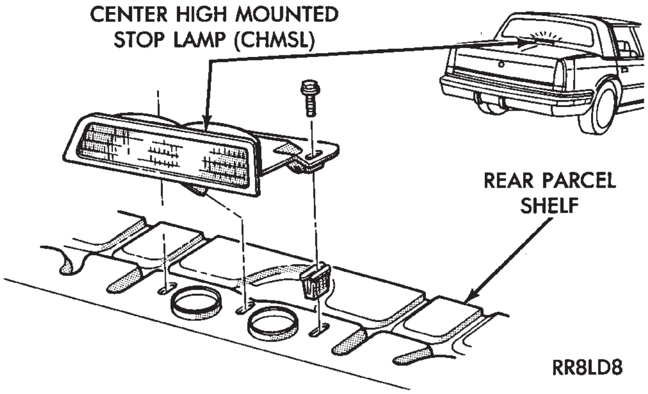


Fig. 10 CHMSL

EXTERIOR LAMPS—AG BODY

INDEX

HEADLAMP DIAGNOSIS

For headlamp diagnosis, refer to the Headlamp Diagnosis at the beginning of this Group. Refer to Wiring Diagrams manual for circuit and component locations.

HEADLAMP HOUSING AND BULB

REMOVAL (FIG. 1)

(1) Raise hood.

(2) Disengage fasteners holding sight shield flaps to headlamp mounting panel. Refer to Group 23, Body for instructions.

(3) Remove nuts holding lamp housing to headlamp mounting panel.

(4) Separate lamp from mounting panel.

(5) Disconnect wire connectors from lamp sockets behind lamp.

(6) Separate lamp housing from vehicle.

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces, reduced bulb life will result.

(7) Rotate sockets counterclockwise and pull bulb unit from lamp.

INSTALLATION

Reverse the preceding operation.

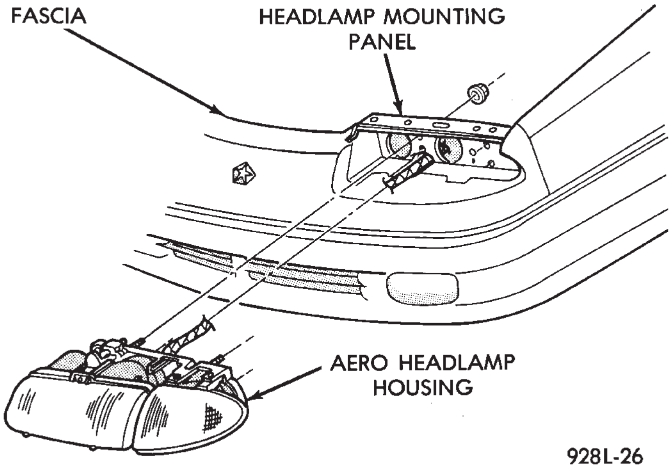


Fig. 1 Aero Headlamp

PARK AND TURN SIGNAL LAMP OR BULB

REMOVAL (FIG. 1)

(1) Remove headlamp housing.

(2) Remove the bulb and socket assembly from the lamp. Pull bulb from socket if bulb replacement is required.

(3) Remove screws holding park and turn signal lamp to headlamp housing.

INSTALLATION

Reverse the preceding operation.

FOG LAMP OR BULB

REMOVAL (FIG. 2 AND 3)

(1) Remove screws holding fog lamp to front fascia.

(2) Disengage tabs holding cover to back of fog lamp.

(3) Separate cover from lamp.

(4) Disengage bulb retainer clip from tabs on back of lamp. Separate clip from lamp.

(5) Pull bulb from lamp.

CAUTION: Do not touch the bulb glass with fingers or other oily surface, as reduced bulb life will result.

INSTALLATION

Reverse the preceding operation. Refer to Fog Lamp Alignment procedures in this group.

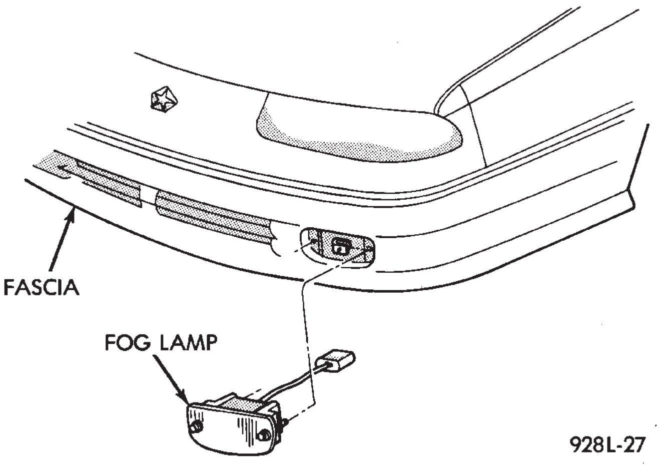


Fig. 2 Fog Lamp

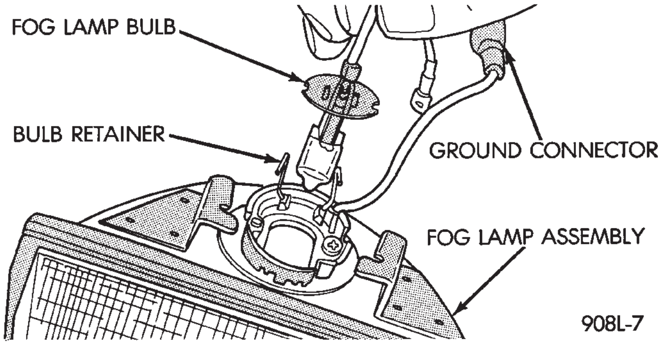


Fig. 3 Fog Lamp Bulb

TAIL, STOP, TURN SIGNAL, SIDE MARKER, BACK-UP LAMP

The lamp must be separated from the rear closure panel to replace the bulbs.

REMOVAL (FIG. 4)

(1) Remove rear lift gate scuff plate.

(2) Remove screws holding tail lamp to rear closure panel.

(3) Separate the lamp from rear closure panel.

(4) Rotate sockets counterclockwise and separate sockets from tail lamp.

(5) Pull bulb from socket if bulb replacement is required.

INSTALLATION

Reverse the preceding operation.

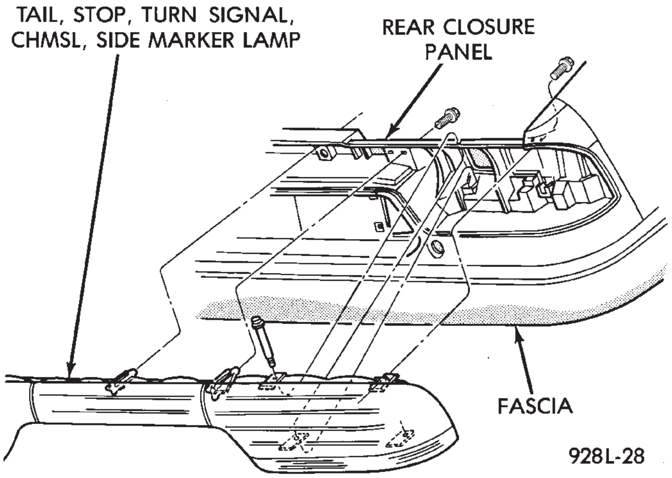


Fig. 4 Tail Lamps

CENTER HIGH MOUNTED STOP LAMP BULB

REMOVAL

(1) Open the lift gate.

(2) Remove the lower scuff plate, reach behind the closure panel, and rotate the bulb and socket counterclockwise and separate socket from the lamp.

(3) Remove bulb from socket.

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP OR BULB

REMOVAL (FIG. 5)

(1) Remove screws holding license plate lamp to the rear closure above the license plate.

(2) Separate the lamp from the rear closure panel.

(3) Remove socket from the lamp and pull bulb from socket if bulb replacement is required.

INSTALLATION

Reverse the preceding operation.

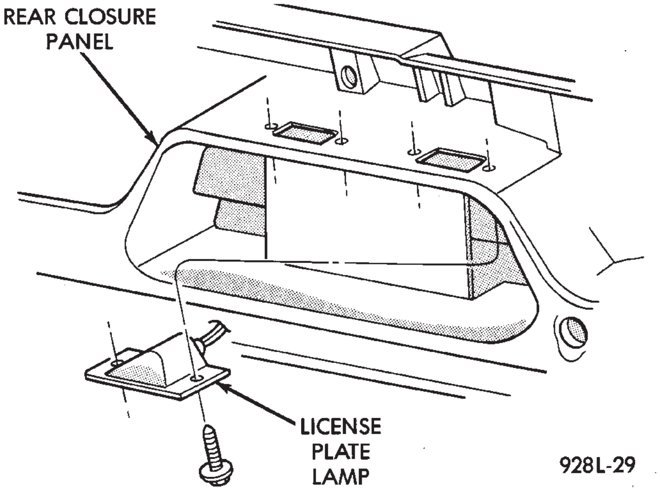


Fig. 5 License Plate Lamp

BACK-UP LAMPS

REMOVAL (FIG. 6)

(1) Remove license plate, if equipped.

(2) Remove screws holding back-up lamp to rear closure panel.

(3) Separate back-up lamp from closure panel.

(4) Remove sockets from back of lamp.

(5) Pull bulbs from sockets if bulb replacement is required.

INSTALLATION

Reverse the preceding operation.

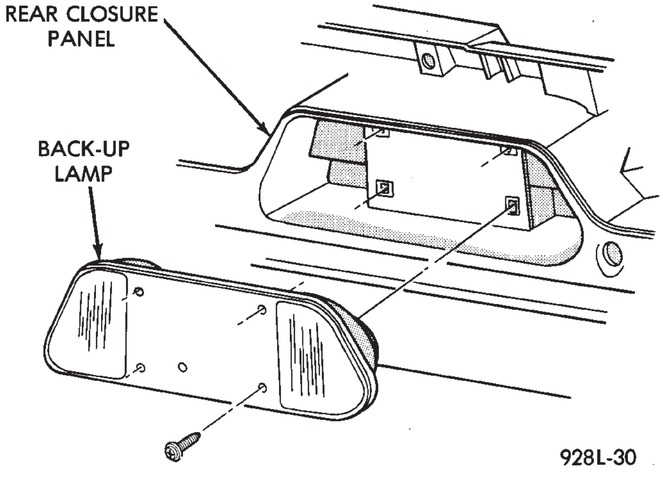


Fig. 6 Back-up Lamps

EXTERIOR LAMPS—AJ BODY

INDEX

HEADLAMPS

HEADLAMP MODULE AND BULB

REMOVAL (FIG. 1)

(1) Release hood latch and open hood.

(2) Remove bolts holding headlamp module to grille opening panel.

(3) Separate lamp module from grille opening panel.

(4) Disengage wire connectors from lamp sockets behind lamp.

(5) Separate lamp module from vehicle.

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces, reduced bulb life will result.

(7) Remove bulb socket retaining ring and pull bulb unit from lamp.

INSTALLATION

Reverse the preceding operation.

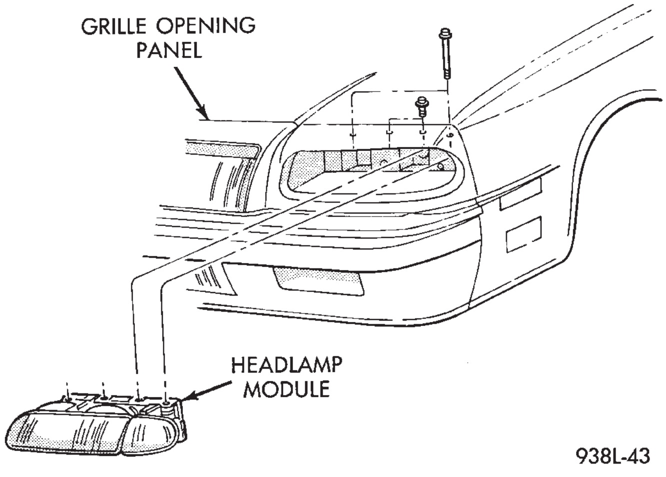


Fig. 1 Aero Headlamp

PARK AND TURN SIGNAL LAMP OR BULB

REMOVAL (FIG. 2)

(1) Remove two screws from the lamp and pull the lamp from the bumper fascia.

(2) Remove the socket and bulb assembly from the lamp body.

INSTALLATION

Reverse the preceding operation.

FRONT SIDE MARKER LAMP BULB

REMOVAL

(1) Reach under and behind the front fender to rotate the socket counterclockwise one half turn.

(2) Pull the socket from the lamp body.

(3) Pull bulb from the socket.

INSTALLATION

Reverse the preceding operation.

FRONT SIDE MARKER LAMP

REMOVAL (FIG. 2)

(1) Remove the socket and bulb from the lamp body.

(2) From behind front fender, remove nuts holding side marker lamp to fender.

(3) Separate side marker lamp from vehicle.

INSTALLATION

Reverse the preceding operation.

CORNERING LAMP OR BULB

REMOVAL (FIG. 2)

(1) From behind front fender, remove nuts holding cornering lamp to fender.

(2) Remove socket from lamp.

(3) Separate cornering lamp from the vehicle.

INSTALLATION

Reverse the preceding operation.

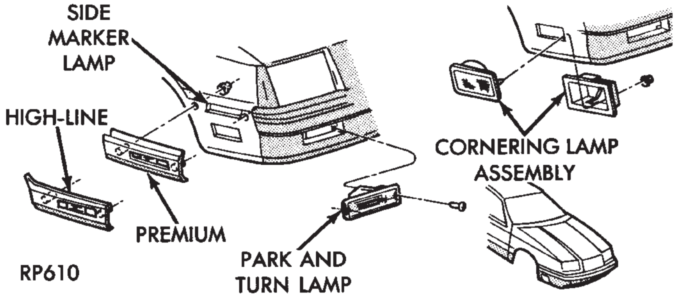


Fig. 2 Park, Turn Signal, Cornering and Side Marker Lamp—Typical

TAIL, STOP, TURN SIGNAL BULB OR LAMP

REMOVAL (FIG. 3)

(1) Open deck lid and remove the plastic wing nut securing the rear trim cover in place.

(2) Pivot the end of the trim panel out of the way to gain access, and remove three plastic wing-nuts securing the lamp to the vehicle.

(3) Separate the tail lamp from the body far enough to rotate the socket and bulb assemblies counterclockwise one-half turn and pull the sockets out of the lamp body.

(4) Remove the bulb from socket.

INSTALLATION

Reverse the preceding operation.

TRUNK LID TAIL LAMP BULB

REMOVAL (FIG. 3)

(1) Remove deck lid liner as necessary. Through access hole in the inner deck lid, rotate socket counterclockwise one-half turn, and pull the socket and bulb assembly from the lamp body.

(2) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

TRUNK LID TAIL LAMP

REMOVAL (FIG. 3)

(1) Remove bulb and sockets from trunk lid tail lamp.

(2) Remove six nuts and four screws securing the tail lamp to the deck lid and remove the lamp assembly from the vehicle.

INSTALLATION

Reverse the preceding operation.

BACK-UP LAMP BULB

REMOVAL (FIG. 3)

(1) From behind the rear bumper fascia, rotate the bulb and socket assembly counterclockwise one-half turn and pull the bulb and socket out of the lamp body.

(2) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

BACK-UP LAMP

REMOVAL (FIG. 3)

(1) Remove the socket and bulb assembly from the lamp body.

(2) Remove two screws from the lamp and pull the lamp from the rear bumper fascia.

INSTALLATION

Reverse the preceding operation.

REAR SIDE MARKER LAMP BULB

REMOVAL (FIG. 3)

(1) Open the deck lid and remove the fastener (wing nut) from the lower rear trim panel. Rotate the inner quarter trim panel forward to gain access to the lamp assembly. Rotate counterclockwise one-half turn, and pull the socket and bulb from the lamp body.

(2) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

REAR SIDE MARKER LAMP

REMOVAL (FIG. 3)

(1) Remove the socket and bulb assembly.

(2) Remove two attaching nuts from the lamp behind the quarter panel and remove the lamp from the vehicle.

INSTALLATION

Reverse the preceding operation.

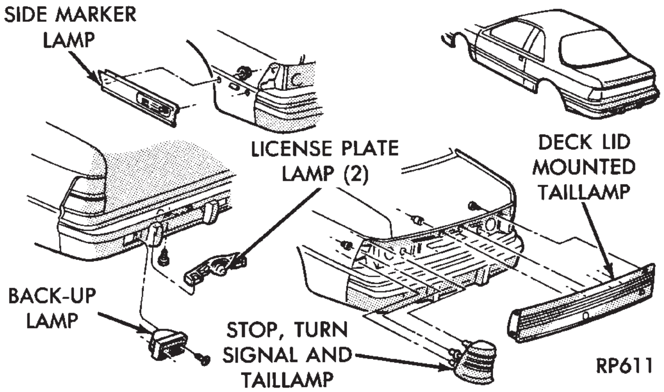


Fig. 3 Tail, Stop, Turn Signal, Back-Up, License Plate and Side Marker Lamps

LICENSE PLATE LAMP OR BULB

REMOVAL (FIG. 3)

(1) Remove screws holding license plate lamp to rear bumper fascia.

(2) Remove socket from back of lamp.

(3) Pull bulb from socket if bulb replacement is required.

(4) Separate lamp from vehicle.

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL—AJ-BODY (FIG. 4)

(1) Open deck lid.

(2) From under the parcel shelf, rotate socket counterclockwise, and pull the CHMSL socket and bulb from the lamp. Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

REMOVAL—AJ/27-BODY (FIG. 5)

(1) Remove CHMSL lens attaching screws and separate lens from the lamp body.

(2) Remove socket from lamp.

(3) Remove bulb.

INSTALLATION

Reverse the preceding operation.

CENTER HIGH-MOUNTED STOP LAMP ASSEMBLY (CHMSL)

REMOVAL—AJ-BODY (FIG. 4)

(1) Remove parcel shelf trim cover. Refer to Group 23, Body.

(2) Remove two CHMSL attaching screws and separate the lamp from the parcel shelf.

INSTALLATION

Reverse the preceding operation.

REMOVAL—AJ/27-BODY (FIG. 5)

(1) From inside the luggage compartment, locate and remove the two plastic plugs from under the filler panel behind the compartment opening.

(2) Remove the two CHMSL attaching nuts through the clearance holes under the filler panel.

(3) Disconnect the wire connector and separate the lamp assembly from the filler panel.

INSTALLATION

Reverse the preceding operation.

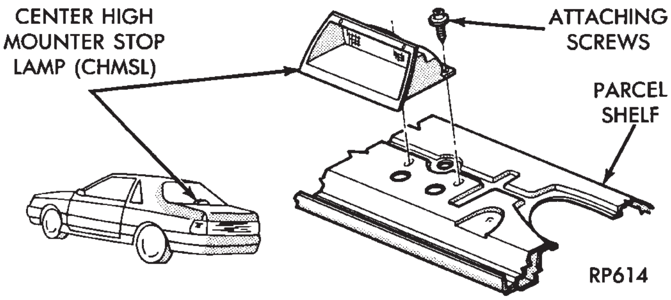


Fig. 4 Center High Mounted Stop Lamp—AJ-Body

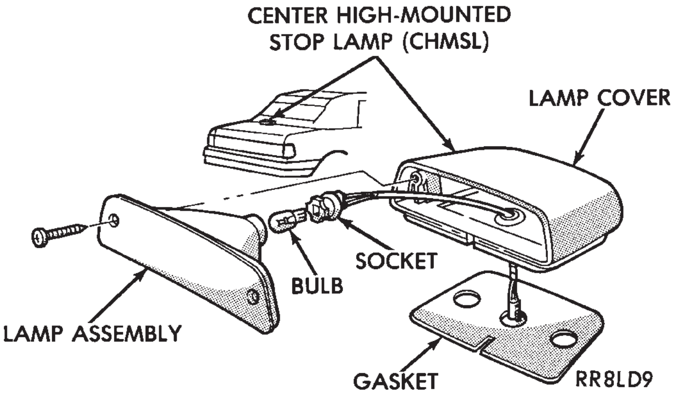


Fig. 5 Center High Mounted Stop Lamp—AJ/27-Body

EXTERIOR LAMPS—AP BODY

INDEX

HEADLAMP DIAGNOSIS

For headlamp diagnosis, refer to the headlamp diagnosis chart at the beginning of this group. Refer to Wiring Diagrams manual for circuit and component locations.

HEADLAMP BULB

REMOVAL (FIG. 1)

(1) Left front bulb removal: Remove the windshield washer reservoir upper mounting screw and position reservoir rearward.

(2) Disconnect wire connector from back of headlamp behind radiator closure panel.

CAUTION: Do not touch the bulb glass with fingers or other oily surface, reduced bulb life will result.

(3) Rotate the bulb retaining ring counterclockwise one quarter turn and remove the ring, bulb holder and bulb from the lens assembly. The bulb holder has alignment notches.

INSTALLATION

Reverse the preceding operation.

HEADLAMP HOUSING

RIGHT HEADLAMP REMOVAL (FIG. 1)

To remove the aero headlamp housing, perform steps 1, 2 and 3 of bulb removal operation and proceed with the following steps.

(1) From in the engine compartment, remove the three headlamp assembly to body attaching nuts and separate the lamp from the body.

(2) Pull headlamp/lens assembly forward.

(3) Pull the lower section of the headlamp adjuster cable from the lamp adjuster screw.

(4) Remove headlamp/lens assembly.

(5) Remove the four lamp/lens to headlamp bucket screws.

(6) Remove headlamp/lens.

INSTALLATION

Reverse the preceding operation.

LEFT HEADLAMP REMOVAL (FIG. 1)

(1) Disconnect battery cables, negative first, and remove battery.

(2) Remove the windshield washer reservoir upper mounting screw and position reservoir rearward.

(3) Remove the air cleaner intake tube.

(4) Remove screws holding Engine Controller to inner fender flange.

(5) Move Engine Controller rearward, leave wires connected.

(6) Remove air duct from front of Engine Controller.

(7) Disconnect wire connector from back of headlamp.

(8) From in the engine compartment, remove nuts holding headlamp housing to radiator closure panel.

(9) Separate headlamp housing from radiator closure panel.

(10) Pull headlamp housing forward.

(11) Pull the lower section of the headlamp adjuster cable from the lamp adjuster screw.

(12) Separate headlamp from vehicle.

INSTALLATION

Reverse the preceding operation.

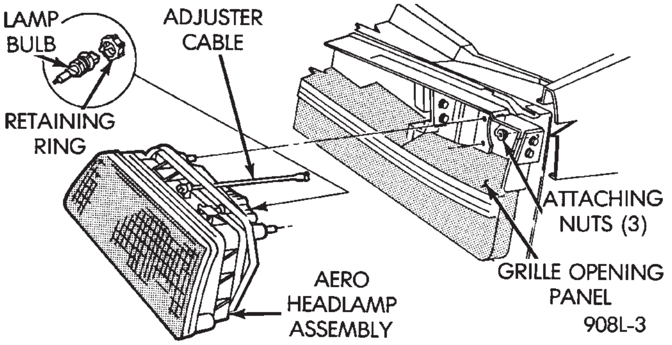


Fig. 1 Aero Headlamp

PARK AND TURN SIGNAL LAMP OR BULB

REMOVAL (FIG. 2)

(1) Remove screws holding the park and turn signal lamp to the bumper facia.

(2) Separate lamp from bumper fascia.

(3) Rotate the socket counterclockwise and remove the socket from the lamp assembly.

(4) Pull the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

FRONT SIDE MARKER LAMP OR BULB

REMOVAL (FIG. 2)

(1) Locate back of side marker lamp behind bumper fascia.

(2) Rotate socket counterclockwise and remove the socket and bulb from the lamp.

(3) Pull bulb from socket if replacement is required.

(4) Remove nuts holding side marker lamp to the fascia and separate lamp from vehicle.

INSTALLATION

Reverse the preceding operation.

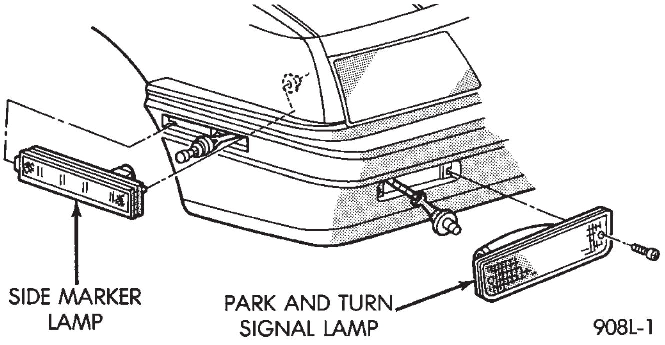


Fig. 2 Park, Turn Signal, and Side Marker Lamps

TAIL, STOP, TURN SIGNAL, BACK-UP AND SIDE MARKER LAMP BULBS

REMOVAL (FIG. 3)

(1) Remove luggage compartment rear trim cover.

(2) Loosen and shift the quarter panel silencer out of the way.

(3) Rotate socket counterclockwise and separate socket and bulb from lamp assembly.

(4) Remove the bulb from the socket.

INSTALLATION

Reverse the preceding operation.

TAIL, STOP, TURN SIGNAL, BACK-UP AND SIDE MARKER LAMP

REMOVAL (FIG. 3)

(1) Remove luggage compartment rear trim cover.

(2) Loosen and shift the quarter panel silencer out of the way.

(3) Rotate sockets counterclockwise and separate sockets from lamp assembly.

(4) Remove the lamp assembly to body retaining nuts.

(5) Remove the lamp assembly.

INSTALLATION

Reverse the preceding operation.

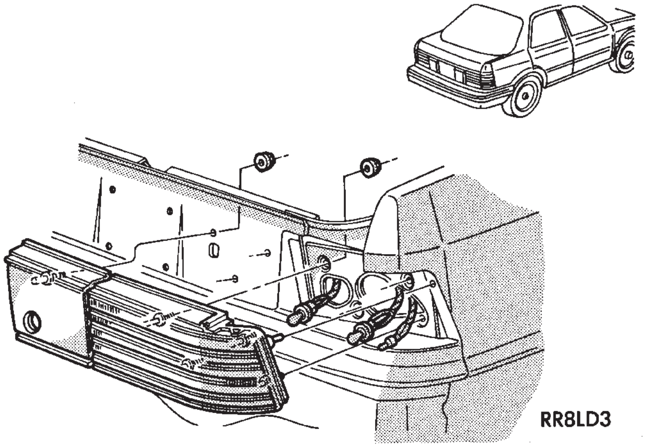


Fig. 3 Tail, Stop, Turn Signal, Side Marker and Back-Up Lamps

LICENSE PLATE LAMP OR BULB

REMOVAL (FIG. 4)

(1) Locate and remove two attaching screws holding the assembly to the tail panel.

(2) Separate the lens from the lamp assembly.

(3) Remove bulb from socket assembly.

INSTALLATION

Reverse the preceding operation.

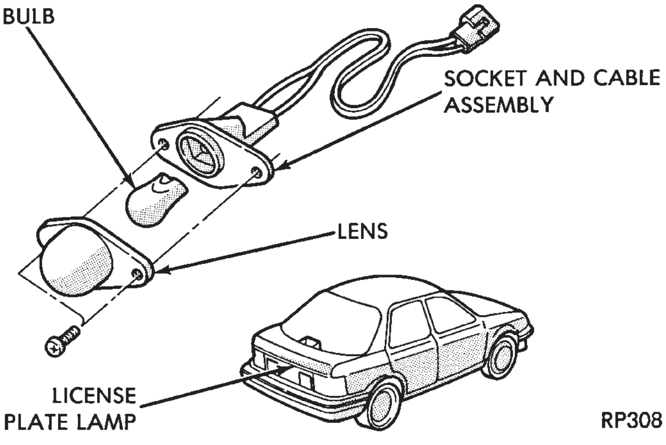


Fig. 4 License Plate Lamp—Typical

CENTER HIGH MOUNTED STOP LAMP BULB—AP/24-44-BODY

REMOVAL (FIG. 5)

(1) Remove the lower rear glass trim cover. Refer to Group 23, Body.

(2) Rotate lamp sockets counterclockwise and remove them from the lamp assembly.

(3) Remove bulb from the socket.

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)—AP/24-44-BODY

REMOVAL (FIG. 5)

(1) Remove the lower rear glass trim cover. Refer to Group 23, Body.

(2) Remove two attaching nuts from the assembly mounting and lift the lamp from the bracket.

(3) Remove bulbs from lamp.

(4) Remove lamp attaching nuts.

(5) Remove lamp assembly.

INSTALLATION

Reverse the preceding operation.

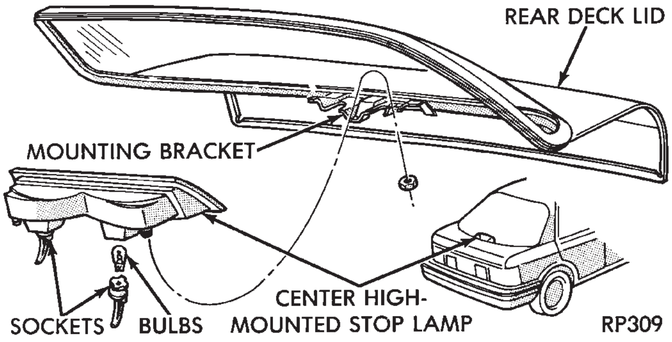


Fig. 5 Center High Mounted Stop Lamp—AP/24-44-Body

FOG LAMP BULB

REMOVAL

(1) From behind the front bumper support, rotate the socket

counterclockwise one quarter turn, and remove the socket from lamp assembly.

(2) Disconnect wire connector and remove bulb.

INSTALLATION

Reverse the preceding operation.

FOG LAMPS

REMOVAL (FIG. 6)

(1) Disconnect wire connector from back of lamp.

(2) Remove nut holding fog lamp to mounting bracket.

(3) Separate fog lamp from bumper fascia.

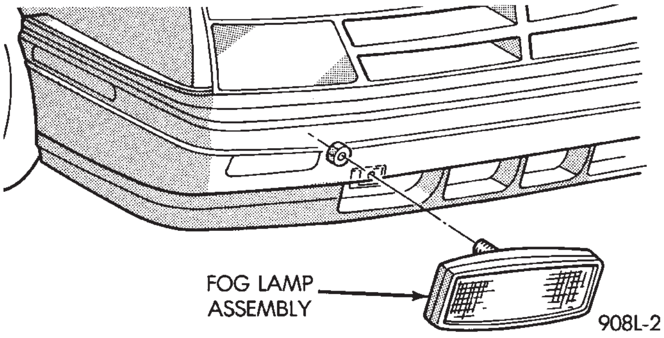


Fig. 6 Fog Lamps

EXTERIOR LAMPS—AY-BODY

INDEX

GENERAL INFORMATION

To service exterior lamps on AY/C-S-Body, refer to procedures covered in Exterior Lamps—AC-Body section. AC/C-S-Body uses the same lamps as AY/C-S-Body.

HEADLAMPS

Conventional and halogen sealed beams are interchangeable, It is not recommended that they be mixed. The lens, filament and reflector of sealed beams are molded into one unit.

HEADLAMP DIAGNOSIS

For headlamp diagnosis, refer to the headlamp diagnosis chart at the beginning of this Group. Refer to Wiring Diagrams manual for circuit and component locations.

SEALED BEAM

REMOVAL

(1) Turn the headlight switch ON.

(2) Open the hood and locate the power distribution center forward of the left front suspension tower (Fig. 1). Remove the cover.

(3) Remove the headlamp close relay (Fig. 2) to prevent the headlamp doors from closing.

(4) Turn the headlight switch OFF.

(5) Remove screws from headlamp bezel and remove bezel, if equipped.

Do not disturb the headlamp adjusting screws.

(6) Remove screws from interior retaining ring (Fig. 3), and remove ring.

(7) Separate sealed beam from seat and disconnect wire connector.

INSTALLATION

Reverse the preceding operation.

PARK, TURN SIGNAL LAMP OR BULB—AY/C-P-BODY

REMOVAL

(1) Open the headlamp doors.

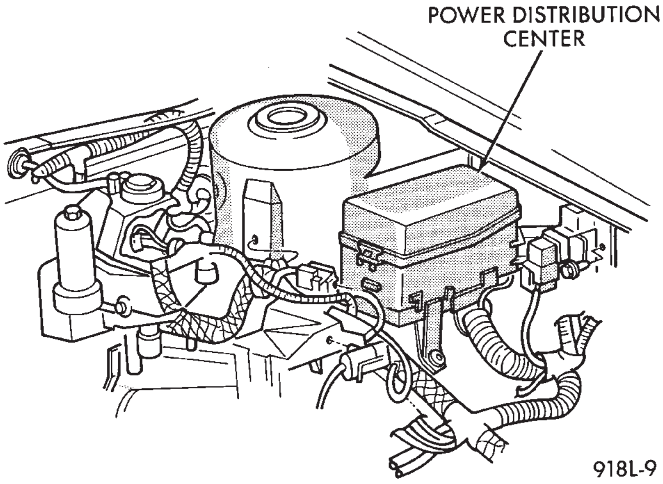


Fig. 1 Power Distribution Center

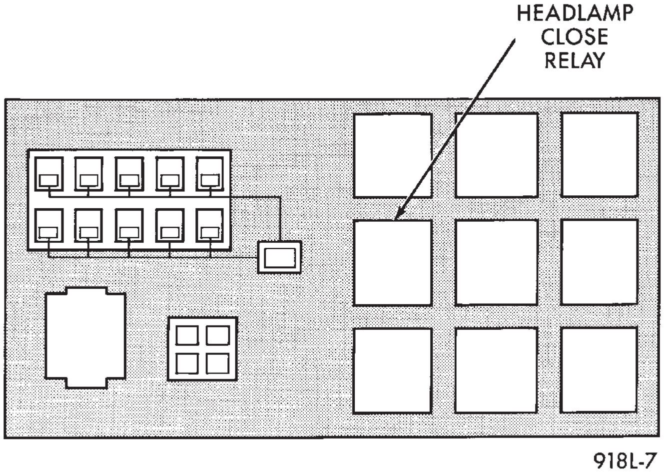


Fig. 2 Headlamp Close Relay

(2) Remove push-in fasteners holding lower park and turn signal lamp shield to grille opening panel (Fig. 4).

(3) Remove screws holding park and turn signal lamp grille opening panel (Fig. 5).

(4) Remove sockets from lamp and pull bulbs from sockets if bulbs replacement is required (Fig. 6).

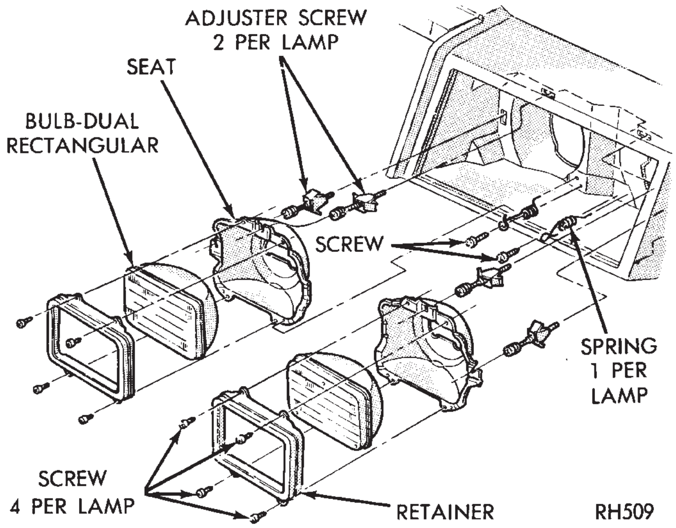


Fig. 3 Sealed Beam Replacement—Typical

INSTALLATION

Reverse the preceding operation.

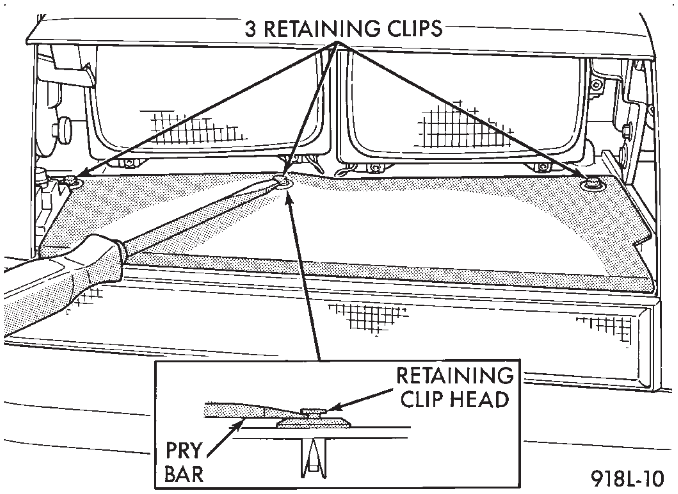


Fig. 4 Turn Signal Lamp Shield

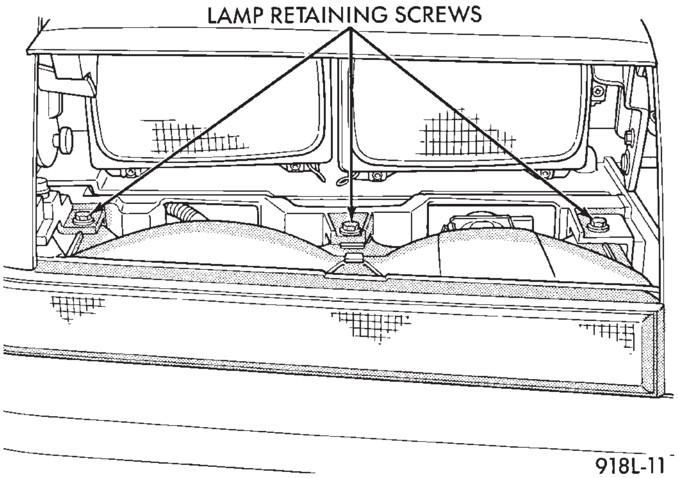


Fig. 5 Turn Signal Lamp Mounting Screws

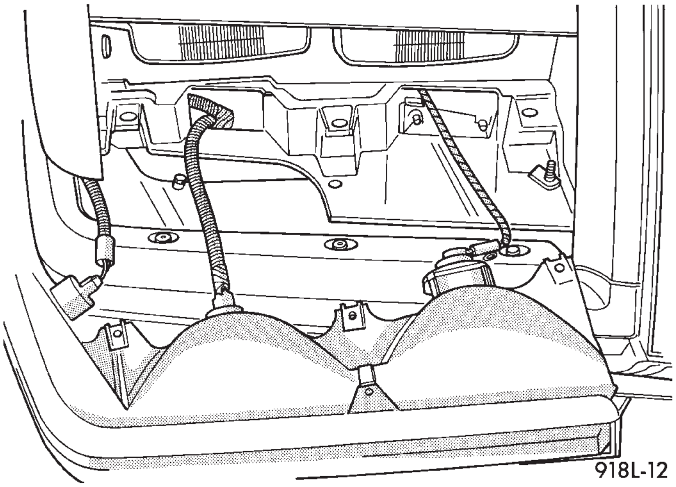


Fig. 6 Turn Signal Lamp

FRONT SIDE MARKER BULB—AY/C-P-BODY

REMOVAL

(1) Raise vehicle.

(2) Reach over the top of cornering lamp (Fig. 7) and remove bulb/socket (Fig. 8).

INSTALLATION

Reverse the preceding operation.

FRONT SIDE MARKER LAMP—AY/C-P-BODY

REMOVAL (FIG. 7)

(1) Remove the cornering lamp retaining nuts, and remove cornering lamp.

(2) Remove the four nuts retaining the bumper trim moulding to the body.

(3) Remove bumper trim moulding.

(4) Remove side marker lamp.

INSTALLATION

Reverse the preceding operation.

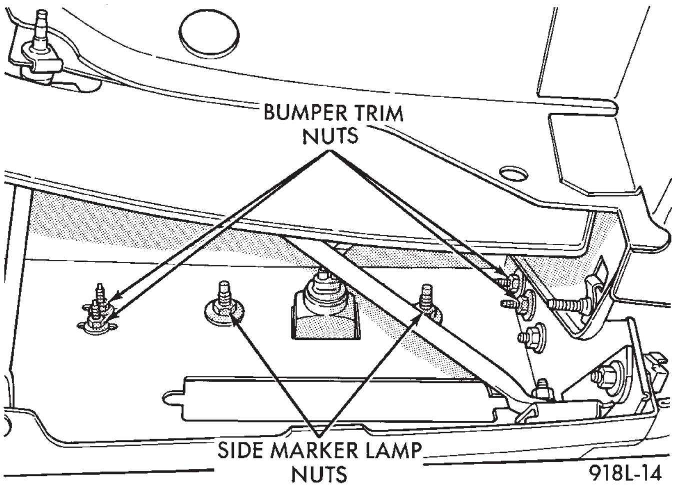


Fig. 7 Bumper Trim Moulding Nuts—AY/C-P-Body

CORNERING LAMP OR BULB—AY/C-P-BODY

REMOVAL (FIG. 8)

(1) Raise vehicle.

(2) Remove bulb.

(3) To remove lamp assembly, remove the two retaining nuts.

INSTALLATION

Reverse the preceding operation.

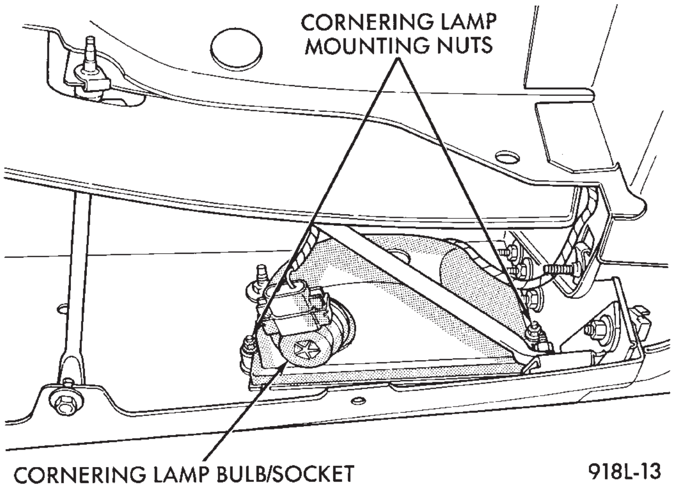


Fig. 8 Cornering Lamp—AY/C-P-Body

TAIL, STOP, TURN SIGNAL, SIDE MARKER AND BACK-UP LAMP OR BULB—AY/C-P-BODY

REMOVAL (FIG. 9)

(1) Open the trunk lid and remove the tail panel trim cover attaching screws and position the trim cover away from the tail panel.

(2) Disconnect rear end lamp wire connector and push the harness grommet outward through the tail panel.

(3) Remove rear lamp assembly attaching screws and separate the lamp assembly from the body.

(4) Remove bulbs from lamp assembly.

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP OR BULB—AY/C-P-BODY

REMOVAL

(1) Remove the two screws retaining the lamp to the bumper guard.

(2) Remove the bulb from the socket assembly.

INSTALLATION

Reverse the preceding operation.

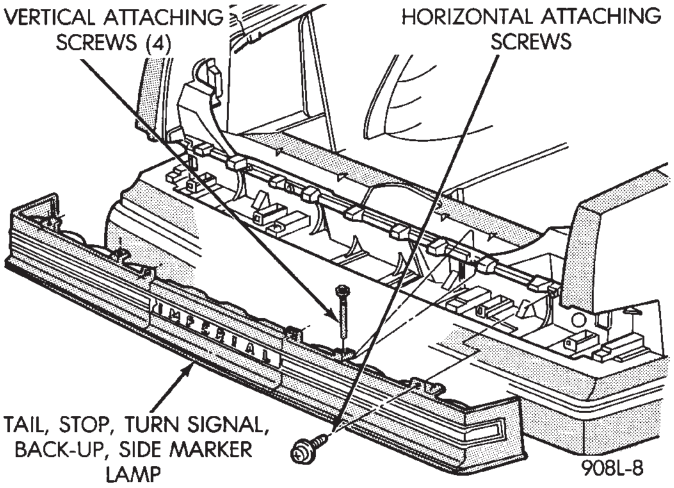


Fig. 9 Rear End Lighting—AY/C-P-Body

CENTER HIGH MOUNTED STOP LAMP BULB (CHMSL)

REMOVAL AND INSTALLATION

(1) Open deck lid.

(2) From under the parcel shelf, rotate socket counterclockwise, and pull the CHMSL socket and bulb from the lamp.

(3) Pull bulb from the socket.

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP

REMOVAL (FIG. 10)

(1) Remove parcel shelf trim cover. Refer to Group 23, Body.

(2) Remove two CHMSL attaching screws and separate the lamp from the parcel shelf.

INSTALLATION

Reverse the preceding operation.

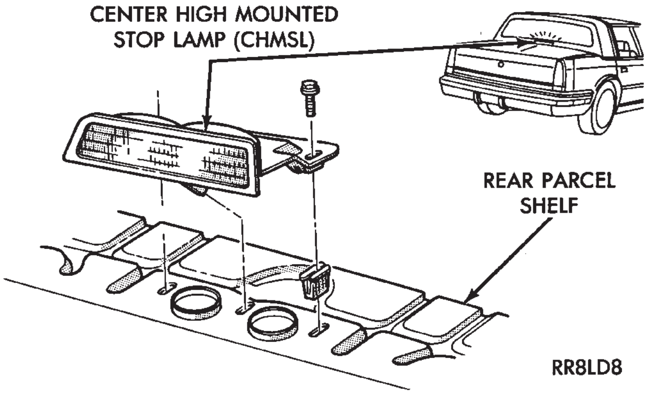


Fig. 10 Center High Mounted Stop Lamp—Typical

EXTERIOR LAMP SYSTEMS

INDEX

LAMP OUTAGE SYSTEM

Diagnostics and component relationships for AC, AG, AJ or AY-Bodies can be found in the Body Diagnostic Procedures Manual, Electronic Vehicle Information Center (EVIC) section.

For circuit and component locations on AA-body, refer to the Wiring Diagrams Manual.

LAMP OUTAGE MODULE—ALL EXCEPT AA-BODY

REMOVAL

(1) Remove battery negative cable.

(2) Remove the glove box assembly. Refer to Group 8E, Instrument Panel.

(3) Disconnect the wire connector from the lamp outage module.

(4) Remove lamp outage module attaching screw and remove the module from the vehicle (Figs. 1, 2 or 3).

INSTALLATION

Reverse the preceding operation.

LAMP OUTAGE MODULE—AA-BODY

REMOVAL (FIG. 1)

(1) Remove battery negative cable

(2) Disconnect the wire connectors from the lamp outage module.

(3) Remove screws or clip holding lamp outage module to instrument panel above glove compartment (Fig. 1, 2 or 3).

(4) Separate lamp outage module from vehicle.

INSTALLATION

Reverse the preceding operation.

DAYTIME RUNNING LAMP—CANADA ONLY

DIAGNOSIS

For circuit and component locations refer to the Wiring Diagrams manual.

REMOVAL (FIG. 4)

(1) Remove the left front inner fender shield, if equipped, and disconnect the wire connector from the day time running lamp module.

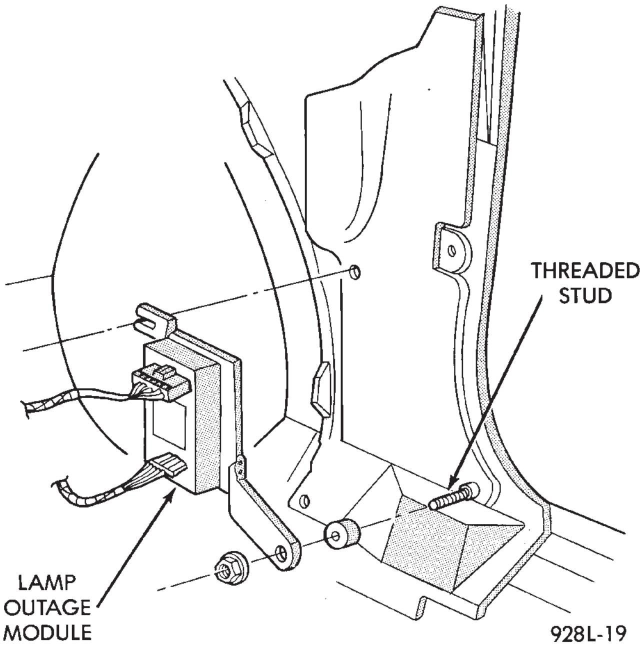


Fig. 1 Lamp Outage Module—AA-Body

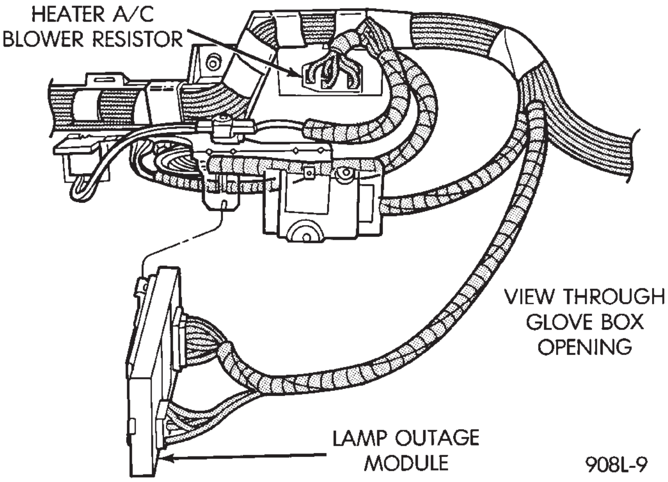


Fig. 2 Lamp Outage Module—AG and AJ-Body

(2) Remove daytime running lamp module attaching screws and separate the module from the inner fender support.

INSTALLATION

Reverse the preceding operation.

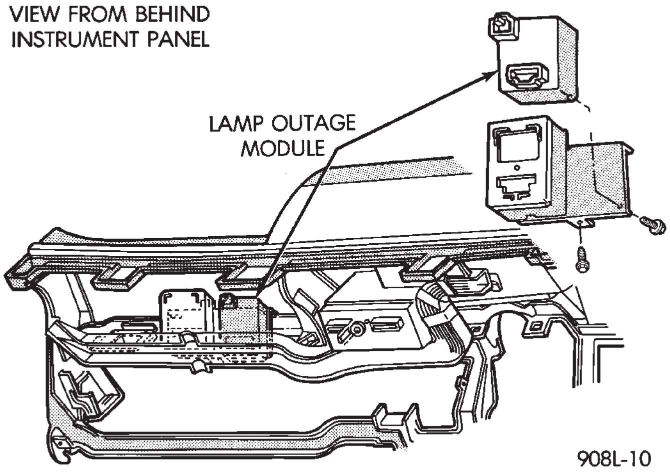


Fig. 3 Lamp Outage Module—AC and AY-Body

HEADLAMP TIME DELAY SYSTEM

SYSTEM OPERATION

The Body Controller controls the Headlamp Time Delay system, if equipped.

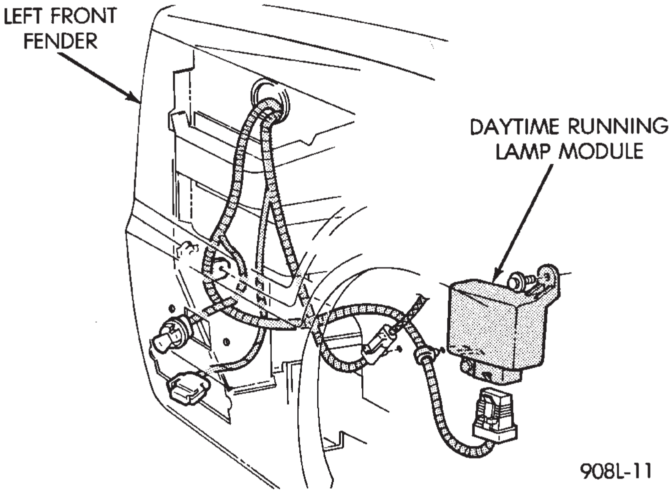


Fig. 4 Daytime Running Lamp Module—Canada Only

OPERATION:

By turning off the ignition switch first then off the headlamp switch, the Body Controller will allow the headlamps to remain ON for 60 seconds before they automatically turn off and the headlamp doors close.

DIAGNOSIS

Refer to the Pre-diagnostic Test section of the appropriate Body Diagnostic Procedures service manual.

CONCEALED HEADLAMPS

INDEX

GENERAL INFORMATION

For proper operation of the Concealed Headlamp System, refer to the Owner's Manual provided with the vehicle.

The Concealed Headlamps are controlled by the Body Controller (Fig. 1). Refer to Group 8E, Instrument Panel for service procedures. The Body Controller receives input information from the ignition switch, headlamp switch, and the headlamp dimmer switch.

The Body Controller also controls the headlamp doors when the Passing Lights (manually flashing bright lights) are used. With the headlamp switch turned off, actuating the headlamp dimmer switch will signal the Body Controller to open the headlamp doors. The operator then has two seconds to flash the bright lights before the Body Controller closes the headlamp doors. Holding the headlamp dimmer switch in the engaged position will signal the Body Controller to keep the headlamp doors open until the dimmer switch is released. Actuating the headlamp dimmer switch with the parking lamps ON signals the Body Controller to open the headlamp doors and keep them open until the headlamp switch is turned off.

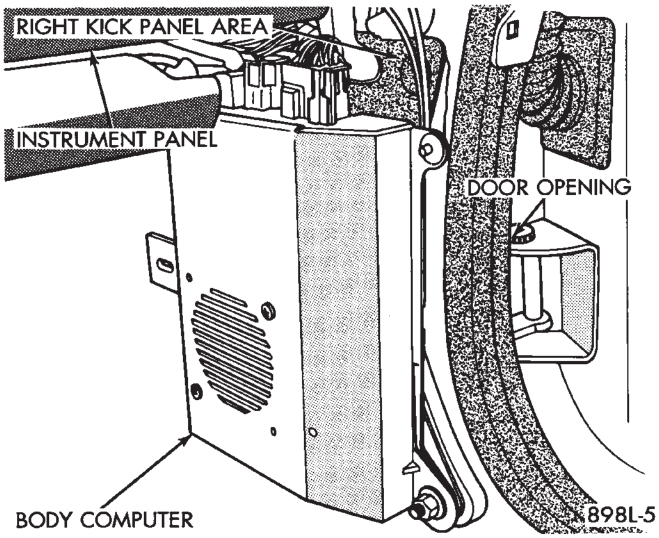


Fig. 1 Body Controller

AY and AC vehicles use a single motor, centrally located behind the radiator grille, and linked to the headlamp doors by a torsion bar. Refer to Service Procedures for more information.

The headlamp door drive motors are equipped with a manual override hand wheel to open or close the headlamp doors if a failure should occur or servicing is required. Access to the handwheel can be gained through a flap covered hole in the sight shield behind the bumper fascia, and under the hood. Several revolutions of the handwheel may be required to move the headlamp doors.

DIAGNOSTIC PROCEDURES

Before diagnosing a problem with the headlamp doors, check for possible collision damage, binding, improperly installed assemblies, or freezing weather conditions.

When diagnosing an electrical problem, refer to:

- The Concealed Headlamps Electrical Diagnosis chart in this section.
- The Wiring Diagrams Manual.
- The Headlamp Doors System section of the appropriate Body Diagnostic Procedures Manual.

PROBLEM

One headlamp door is inoperative when the headlamp switch is ON and the ignition switch is in the RUN position. The other headlamp door operates normally.

AC OR AY-VEHICLE BODY CHECK:

- Headlamp door pivot and crank for seizure.
- Headlamp torsion bar sleeve or clip for excessive wear or breakage.
- Headlamp door crank for missing or broken screw.
- Headlamp torsion bar for disengagement or breakage.

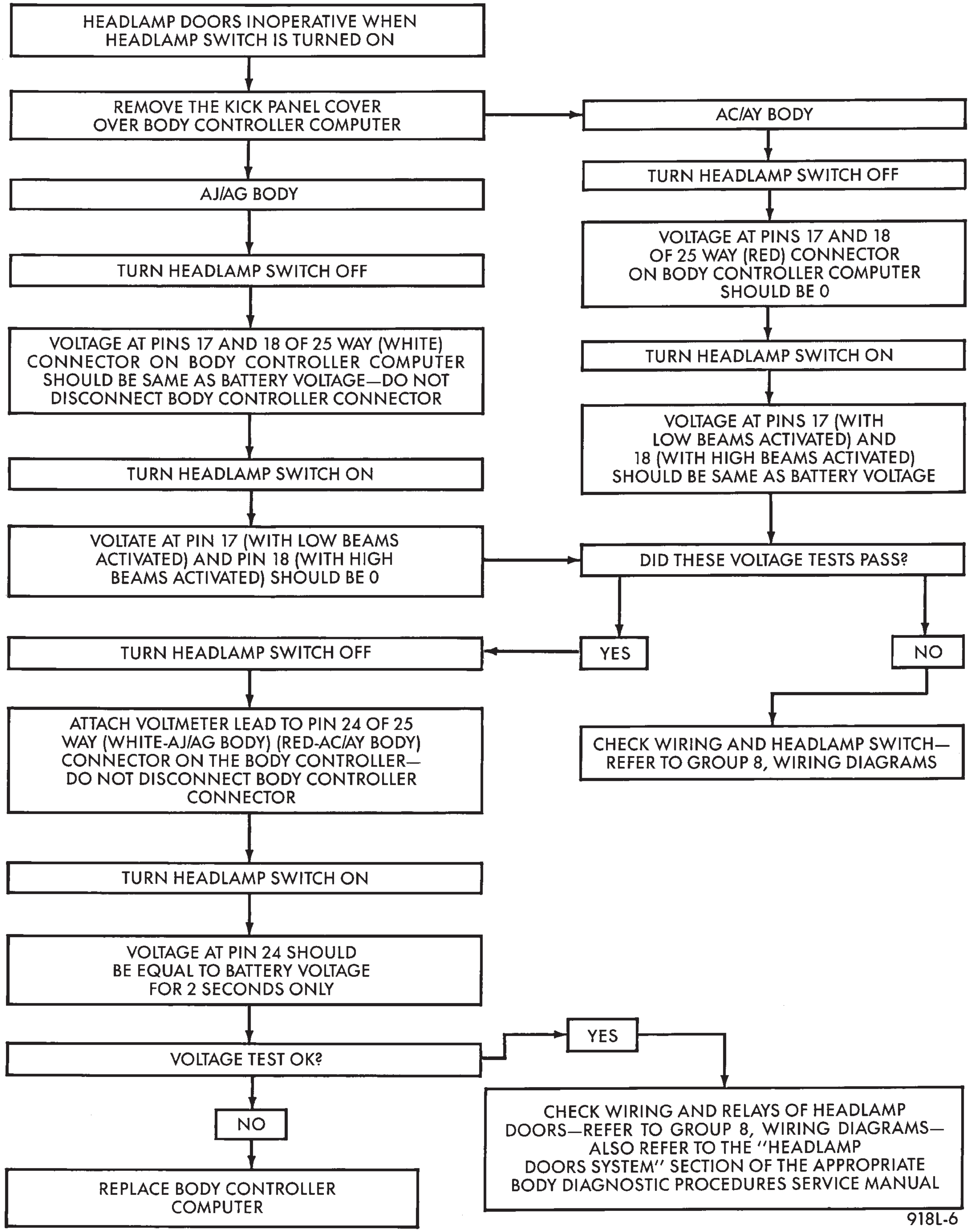
PROBLEM

Headlamp door operates erratically.

CHECK:

- For freezing weather conditions.
- For excessive effort to move headlamp door pivots.
- For corrosion or improperly aligned components.
- For stripped motor reduction gears.
- For defective body controller. Refer to the Concealed Headlamp Electrical Diagnosis chart in this section. Also refer to the Wiring Diagrams Manual and Body Diagnostic Procedures Manual.

CONCEALED HEADLAMPS—ELECTRICAL DIAGNOSIS



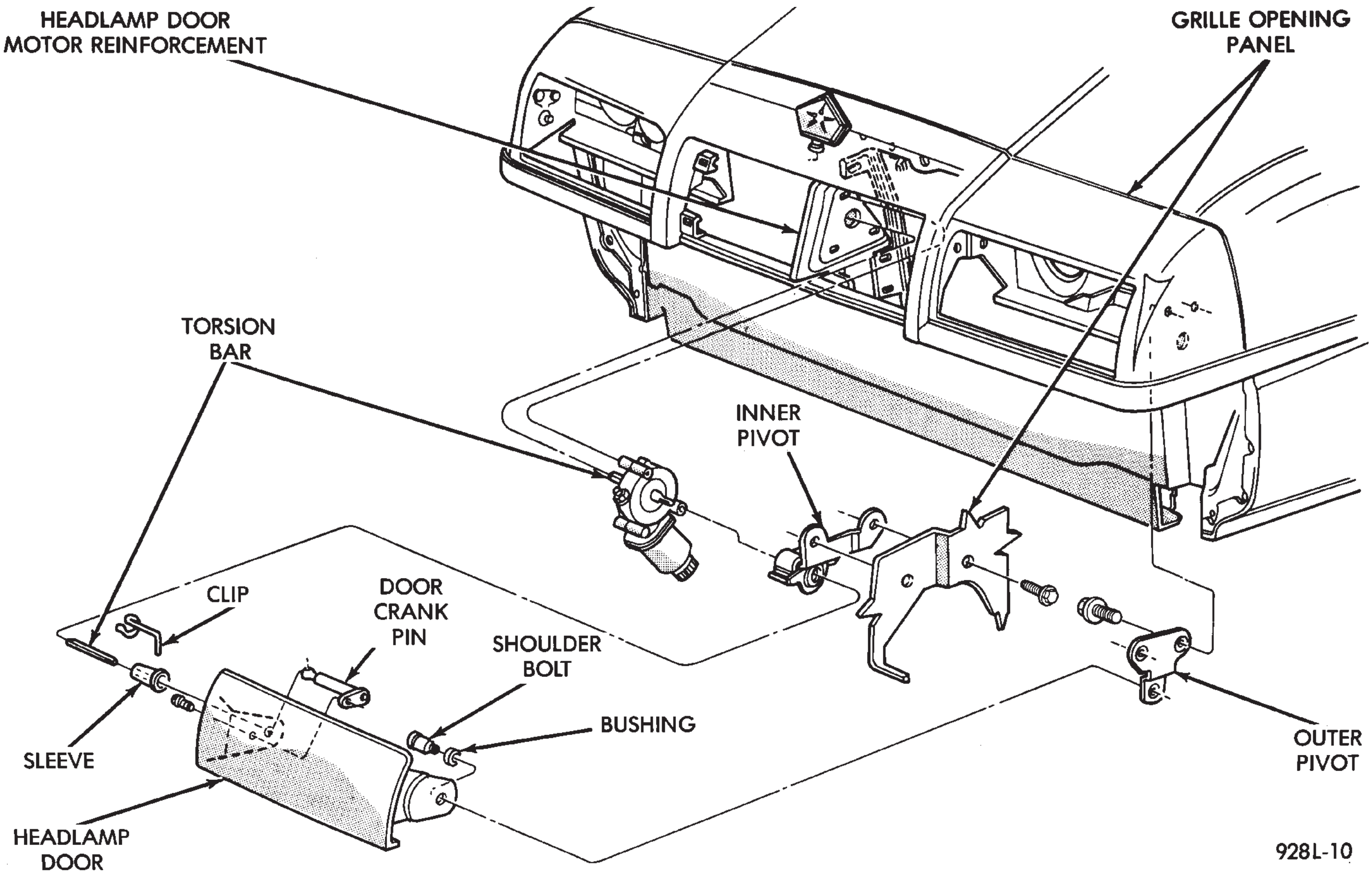


Fig. 2 Concealed headlamps—AC-body

PROBLEM

Headlamp door or doors fit poorly, rattle, or bang when coming open or closed.

CHECK:

- Headlamp door fascia mounting bracket or adjustable stops for improper alignment.
- Headlamp door pivot brackets or door/crank lateral adjustment for improperly aligned collar.
- For missing or worn pivot bushings.
- For defective motor.

HEADLAMP DOOR—AC-BODY

REMOVAL (FIG. 2)

(1) Remove the grill. Refer to Group 23, Body.

(2) Remove the front bumper assembly. Refer to Group 23, Body.

(3) Loosen and separate the grille opening panel from the front fender on the side of the vehicle affected. Refer to Group 23, Body.

(4) Compress torsion bar retainer clip tabs together and slide the retainer toward the center of the vehicle. Separate the torsion bar from the door crank on the side of the vehicle affected.

(5) Remove headlamp door side trim covers and lower trim covers.

(6) Remove outer pivot screw, door crank screw, and loosen the door (lateral) adjustment collar.

(7) Remove the door crank from the door and adjustment collar.

(8) Lower the door from under the grille opening panel and remove the door from the vehicle.

INSTALLATION

Reverse the preceding operation.

CONCEALED HEADLAMP MOTOR—AC-BODY

REMOVAL (FIG. 2)

(l) Remove the grille. Refer to Group 23, Body.

(2) Compress torsion bar retainers and slide them toward the center of the vehicle. Separate the torsion bar from the door cranks.

(3) Disconnect the headlamp door drive motor wire connector. Remove three motor attaching bolts and separate the drive motor and torsion bar from the vehicle.

INSTALLATION

Reverse the preceding operation.

HEADLAMP DOOR—AY BODY

REMOVAL

(1) Turn headlight switch ON.

(2) Open hood and locate Power Distribution Center forward of the left suspension tower (Fig. 3).

(3) Remove cover from the center and pull the Headlamp Close Relay (Fig. 4) to keep the headlamp doors from closing.

(4) Turn headlight switch OFF.

(5) Remove two grill mounting screws and remove grill assembly (Fig. 5).

(6) Spring tension must be relieved from the headlamp doors before removing headlamp motor torsion bar clips. Locate the thumb wheel on bottom of headlamp motor (Fig. 6). Rotate thumb wheel approximately six to seven turns clockwise to relieve all tension.

(7) Remove torsion bar anchor clip (Fig. 7).

(8) Slide torsion bar sleeve over the torsion bar (Fig. 8).

(9) Remove three clips retaining turn signal lamp shield to body (Fig. 9), and remove shield.

(10) Remove two screws retaining headlamp cover to headlamp cover bracket (Fig. 10).

(11) Remove outer headlamp.

(12) Remove outer pivot screw (Fig. 11).

(13) Remove E-clip and door crank screw (Fig. 12).

(14) Remove three bolts retaining cam pivot to body and remove cam pivot (Fig. 11).

(15) Remove Headlamp door assembly.

INSTALLATION

Reverse the preceding operation. Before installing torsion bar clips, the holes in the torsion bars, torsion bar sleeves and headlamp door cam pivots must be in alignment. Refer to Aligning Headlamp Doors.

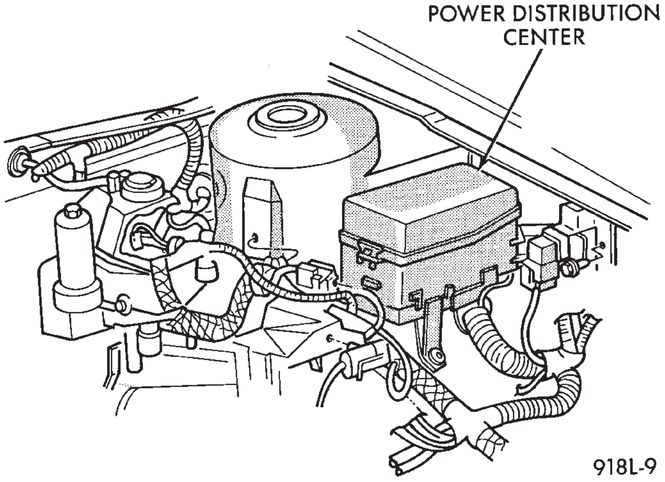


Fig. 3 Power Distribution Center

HEADLAMP DRIVE MOTOR—AY BODY

REMOVAL

(1) Open headlamp doors. Refer to Headlamp Door paragraph for instructions.

(2) Remove grill mounting screws and remove grill assembly (Fig. 5).

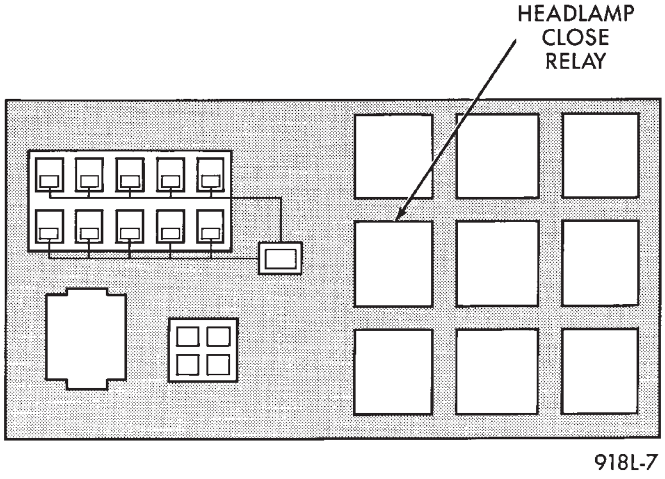


Fig. 4 Headlamp Close Relay

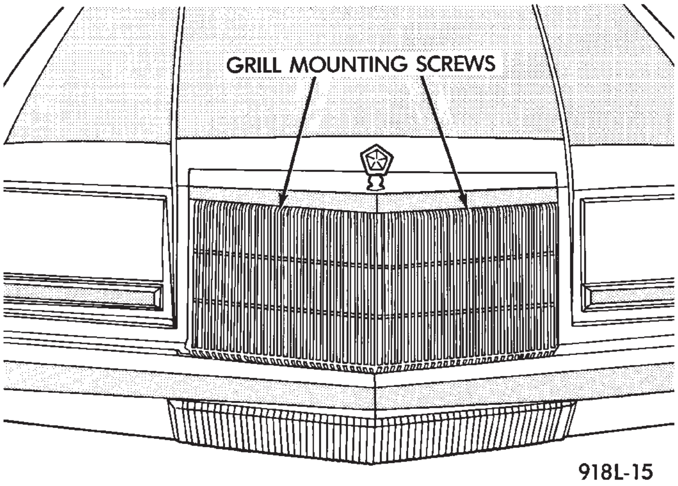


Fig. 5 Grill

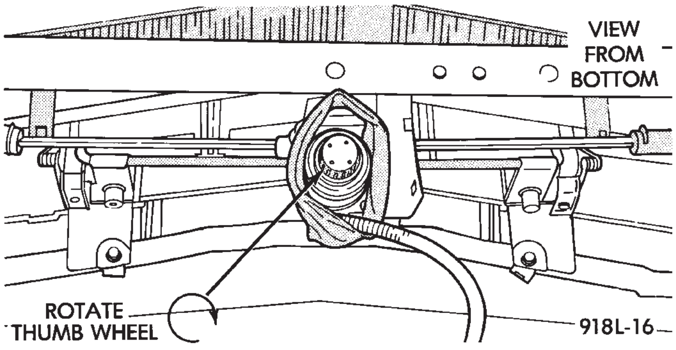


Fig. 6 Headlamp Motor—Bottom View

(3) Spring tension must be relieved from headlamp doors before removing the headlamp motor torsion bar clips. Locate the thumb wheel on bottom of the headlamp motor (Fig. 6). Rotate thumb wheel approximately six to seven turns (clockwise) to relieve all tension.

(4) Remove both torsion bar anchor clips (Fig. 7).

(5) Slide torsion bar sleeves over the torsion bar (Fig. 8).

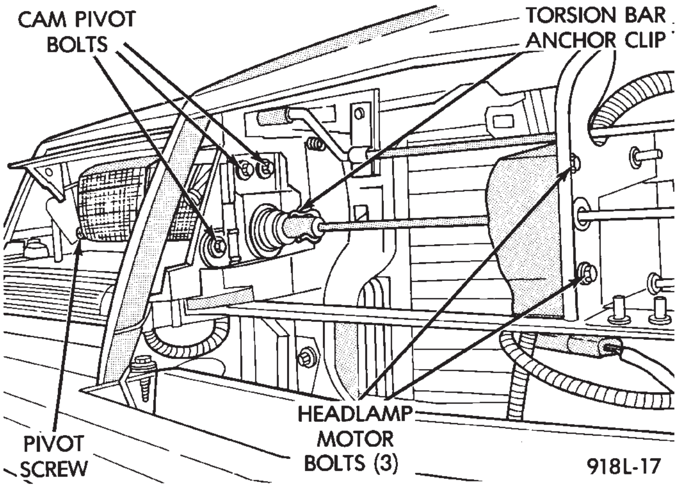


Fig. 7 Torsion Bar Anchor Clips

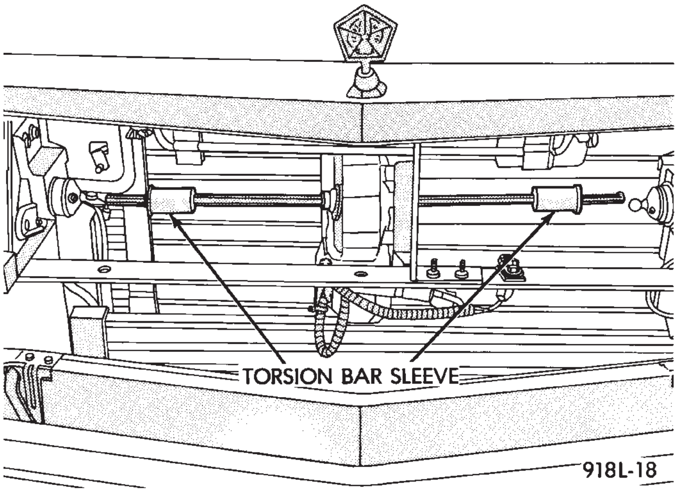


Fig. 8 Torsion Bar Sleeves

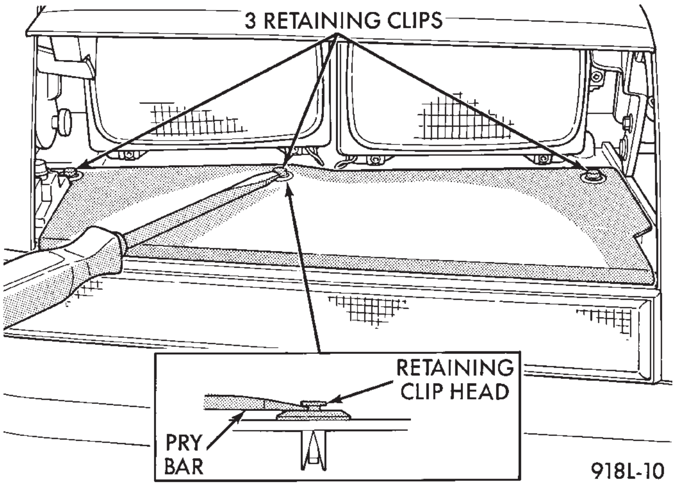


Fig. 9 Front Turn Signal Lamp Shield

(6) Disconnect wire connector from motor.
(7) Remove motor mounting bolts (Fig. 11).

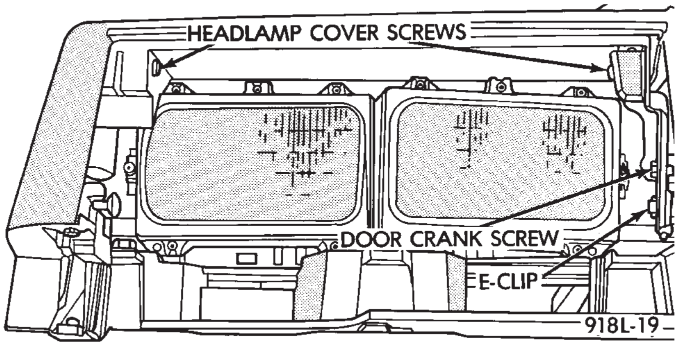


Fig. 10 Headlamp Cover/Cover Pivot Bracket

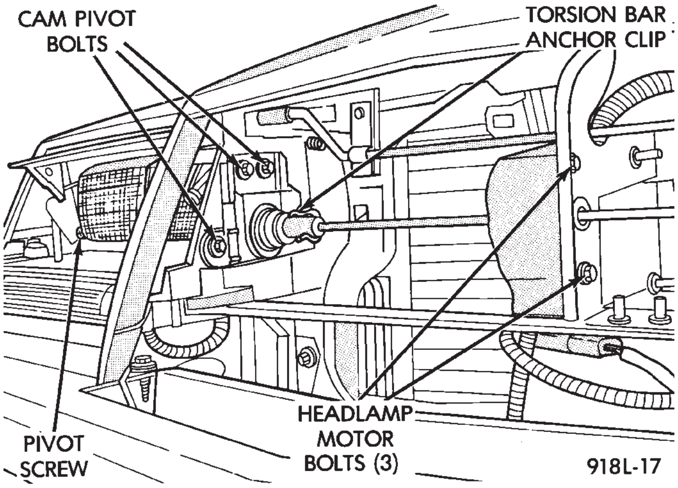


Fig. 11 Outer Pivot Screw

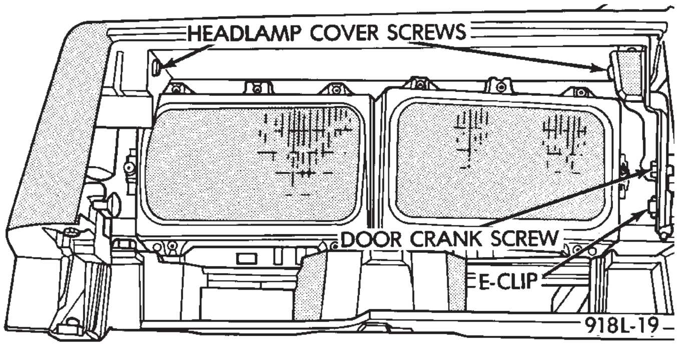


Fig. 12 Headlamp Pivot E-Clip and Crank Screw

(8) Slide torsion bar through the headlamp motor (Fig. 13) and remove headlamp motor.

INSTALLATION

Reverse the preceding operation. Before installing torsion bar clips, the holes in the torsion bars, torsion bar sleeves and headlamp door cam pivots must be in alignment.

HEADLAMP DOOR ALIGNMENT

Door stop adjustment screws, and a movable cam pivot are used to adjust and align the headlamp doors.

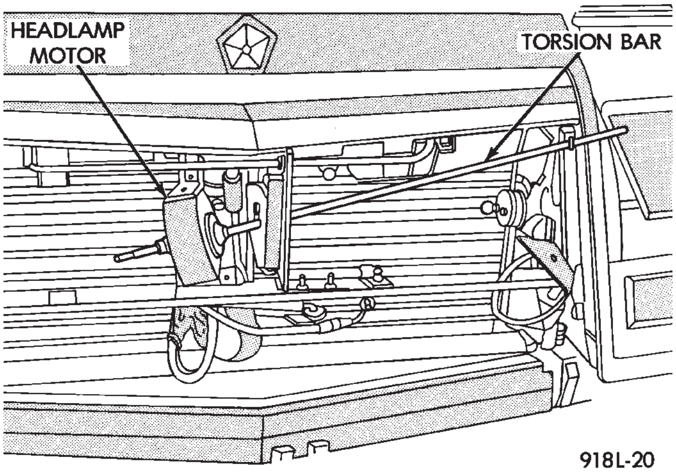


Fig. 13 Headlamp Motor

Loosening the cam pivot bolts (Fig. 14) will allow an up/down or in/out adjustment of the headlamp doors.

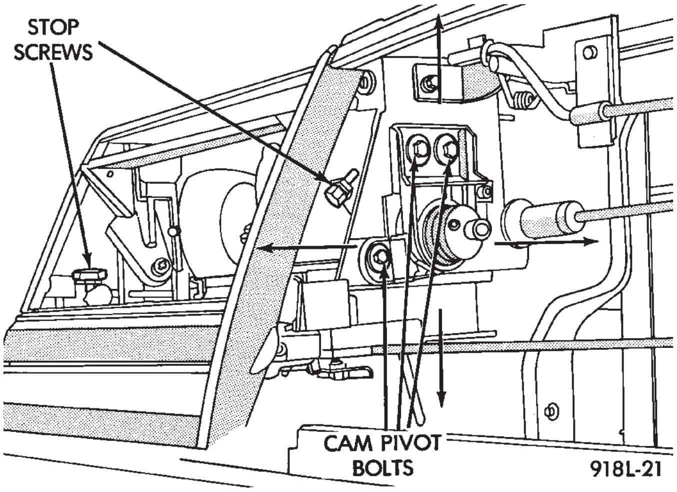


Fig. 14 Cam Pivot Adjustment

The stop screws (Fig. 14) are also used to achieve proper tolerances.

ILLUMINATED ENTRY SYSTEM

INDEX

GENERAL INFORMATION

AA-BODY

The Illuminated Entry System (on AA Body) actuates the interior courtesy and/or dome lamps (except for the illuminated ignition switch) by lifting either front door exterior handle.

Lamp illumination is terminated 35 seconds (± 8 seconds later when battery voltage is normal), or by turning the ignition switch to the run position, whichever occurs first. When testing the system, all vehicle doors must be closed to prevent the door jam switches from activating the courtesy/dome lamps.

Front door handle switches (Fig. 1), and the Illuminated Entry Module (located behind and above the glove box (Fig. 2) are used to control the system.

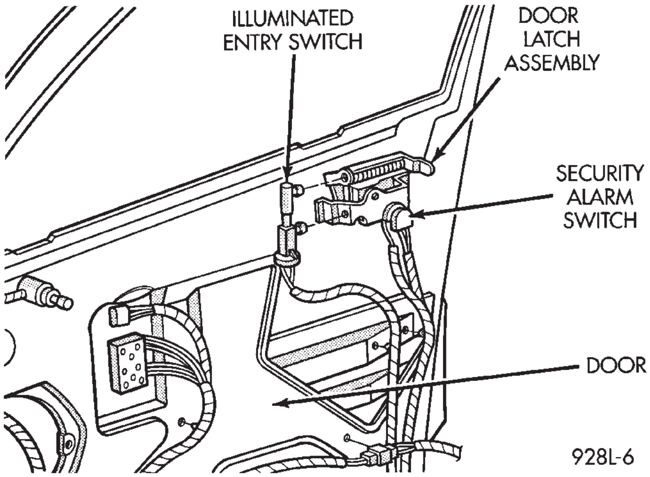


Fig. 1 Illuminated Entry Door Switches—Typical

Depending on vehicle options, as many as six different electrical components/relays are located above the glove box. The Illuminated Entry Module will be the one mounted the closest to the outside of the instrument panel. The Module bracket is also used to commonly mount the Power Door Lock Inhibitor Relay, if equipped.

Service procedures for door related components can be found in Group 23, Body.

AC, AG, AJ OR AY BODY

The Illuminated Entry System (AC, AG, AJ or AY Body) actuates the interior courtesy and/or dome lamps (except illuminated ignition switch) by lifting either front door exterior handle. Activation can also be accomplished with the remote keyless entry systems hand held module, if equipped.

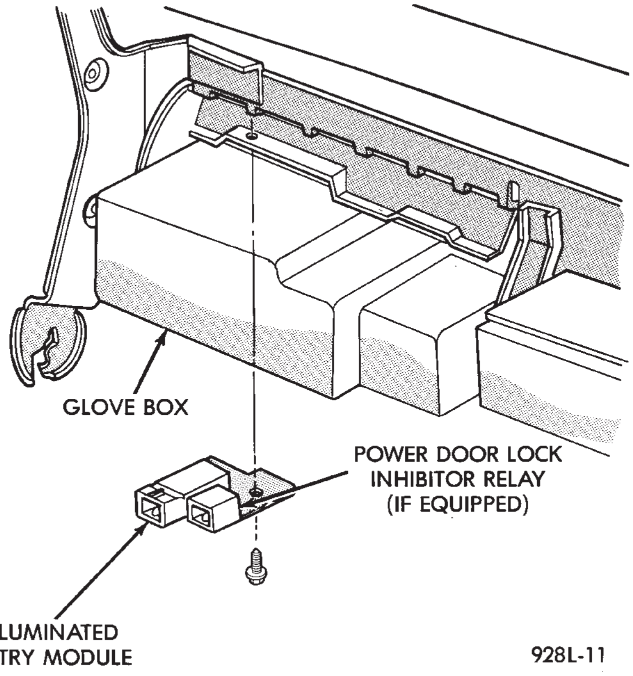


Fig. 2 Illuminated Entry Module—AA Body

Lamp illumination is terminated 30 seconds (± 2 seconds) later, or by turning the ignition switch to the run position, whichever occurs first. When testing this system, all vehicle doors must be closed to prevent the operation of the courtesy/dome lamps.

Front door handle switches (Fig. 1), and the Body Controller (Fig. 3) are used to control the system.

Service procedures for door related components can be found in Group 23, Body.

DIAGNOSTIC PROCEDURES—AA-BODY

For diagnostics and wiring schematics, refer to:

- The Illuminated Entry Diagnosis—AA-Body chart in this section.
- The Wiring Diagrams Manual.
- Fig. 4 and 5.

DIAGNOSTIC PROCEDURES—AC, AG, AJ AND AY-BODY

For diagnostics and wiring schematics, refer to:

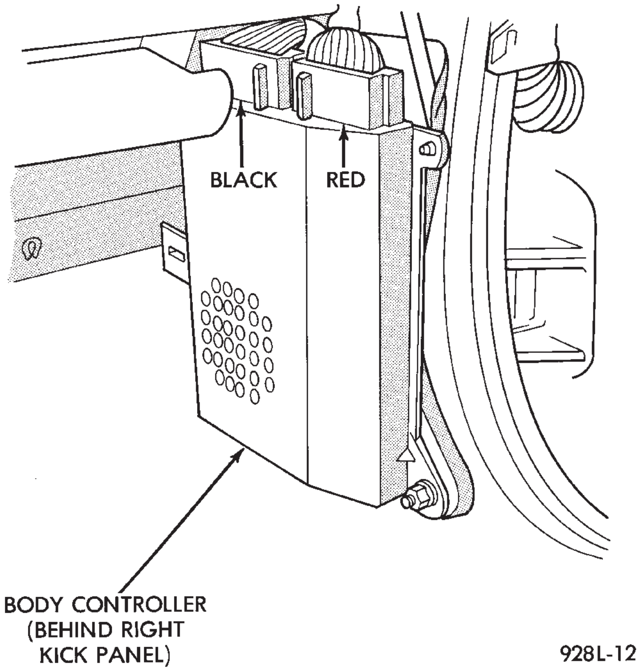


Fig. 3 Body Controller

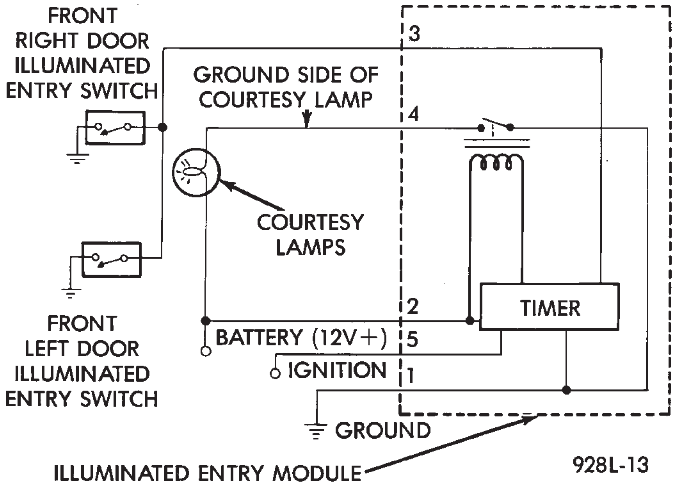


Fig. 4 Illuminated Entry Circuit Wiring—AA-Body

- The Illuminated Entry Diagnosis—AC, AG, AJ and AY-BODY chart in this section.
- The Illuminated Entry System section of the appropriate Body Diagnostic Procedures Manual.
- The Wiring Diagrams Manual.

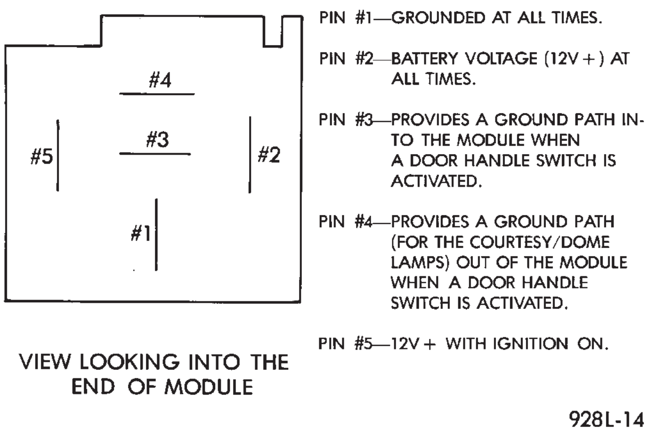


Fig. 5 Module Pin Outs—AA-Body

ILLUMINATED ENTRY MODULE—AA-BODY

REMOVAL

(1) Disconnect the battery negative cable.

(2) Remove the glove box to gain access to the module (Fig. 2). Refer to Group 8E, Instrument Panel and Gauges.

(3) Working through the glove box opening, disconnect the wiring connector at the module.

(4) Remove the module bracket mounting screw.

(5) Remove the module bracket from the vehicle.

INSTALLATION

Reverse the preceding operation.

BODY CONTROLLER COMPUTER—AC, AG, AJ and AY-BODY

REMOVAL

The Body Controller Computer is located at the right front door opening behind the cowl trim panel (Fig. 3).

(1) Remove the battery negative cable before removing the Body Controller.

(2) Remove screws holding cowl trim and door opening scuff plate to cowl panel.

(3) Disconnect wire connectors from body controller.

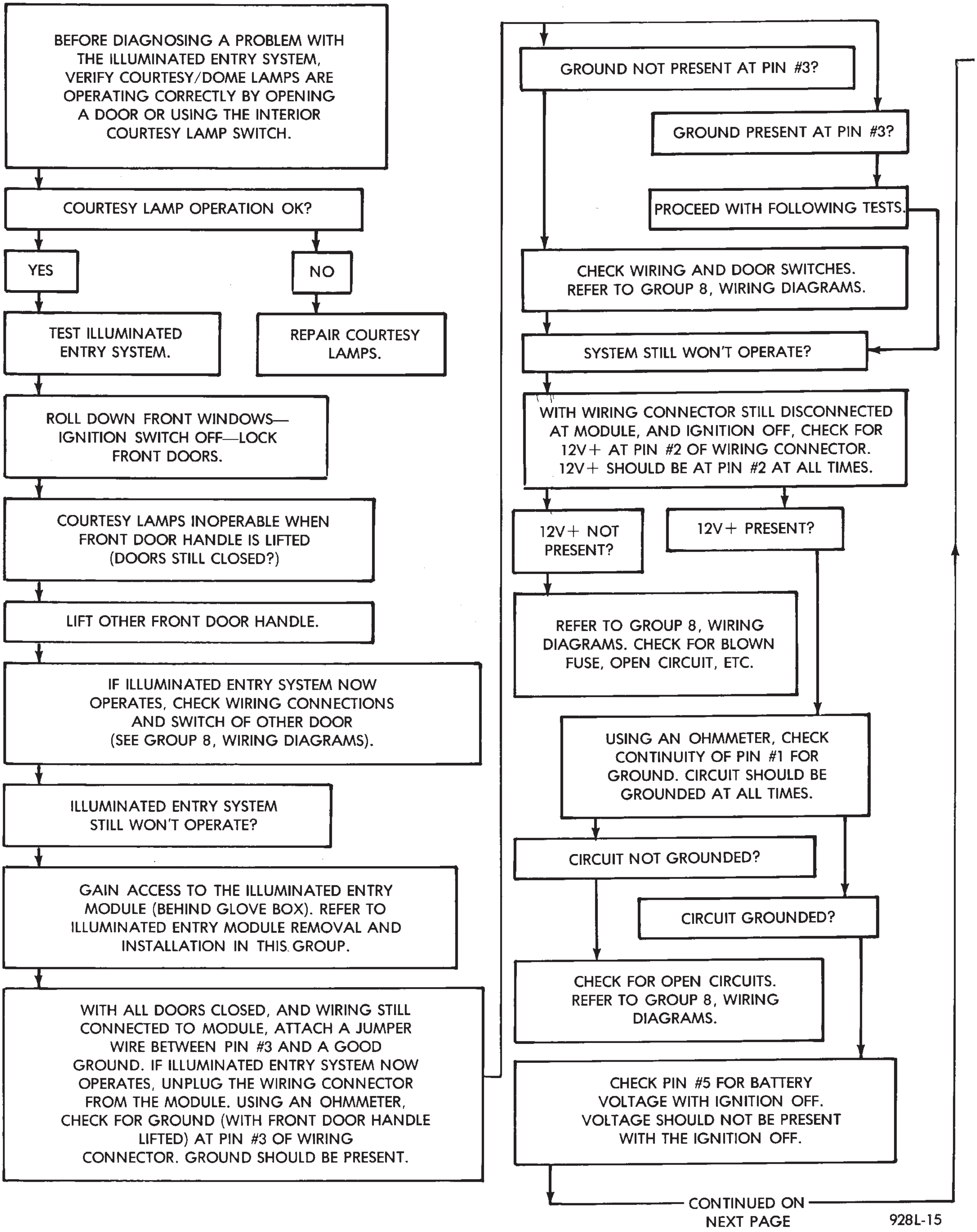
(4) Remove nuts holding body controller to cowl panel.

(5) Separate body controller from vehicle.

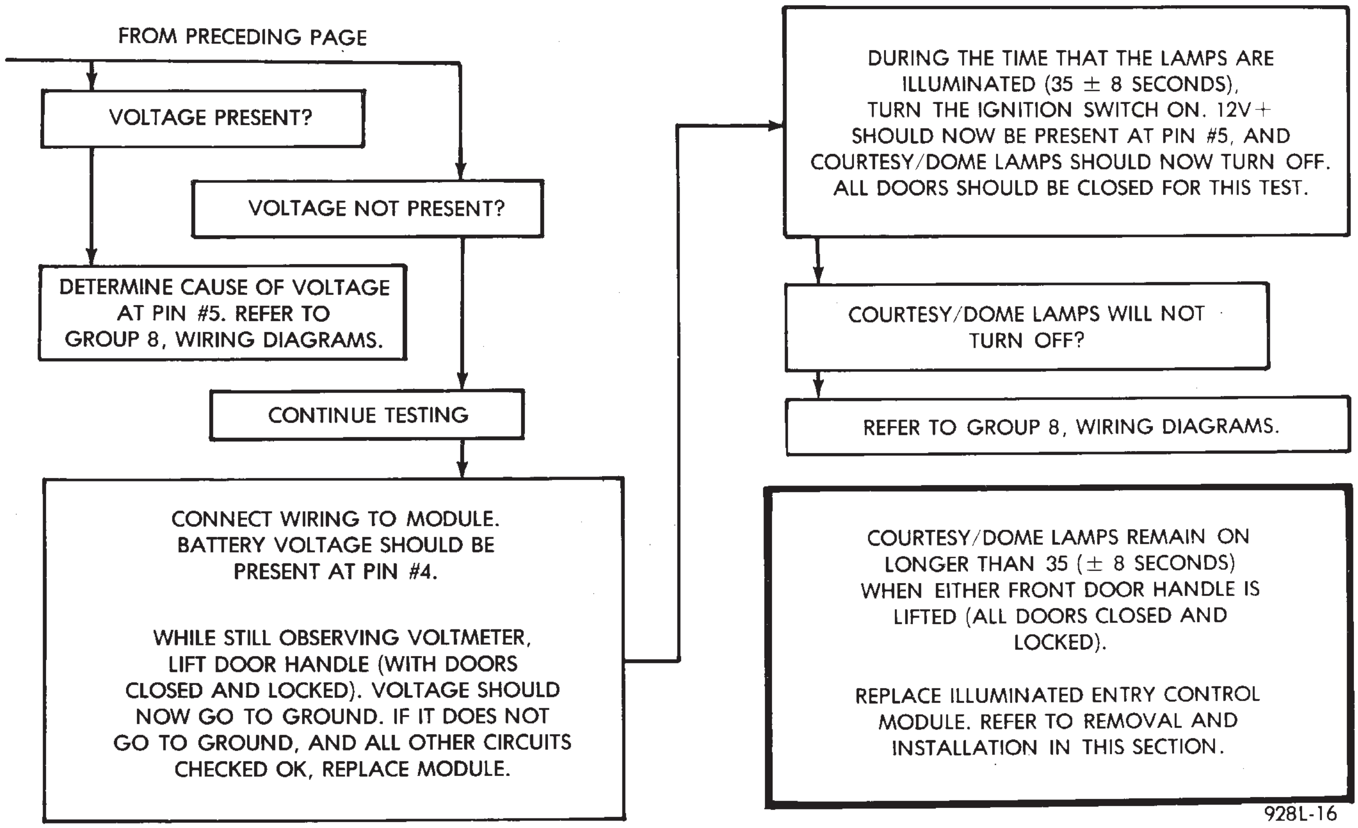
INSTALLATION

Reverse the preceding operation.

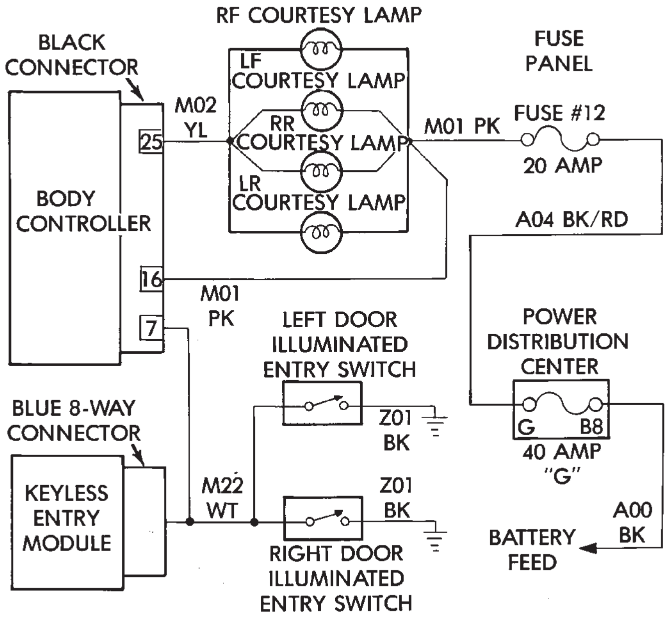
ILLUMINATED ENTRY DIAGNOSIS—AA-BODY



ILLUMINATED ENTRY DIAGNOSIS (CONT.)—AA-BODY



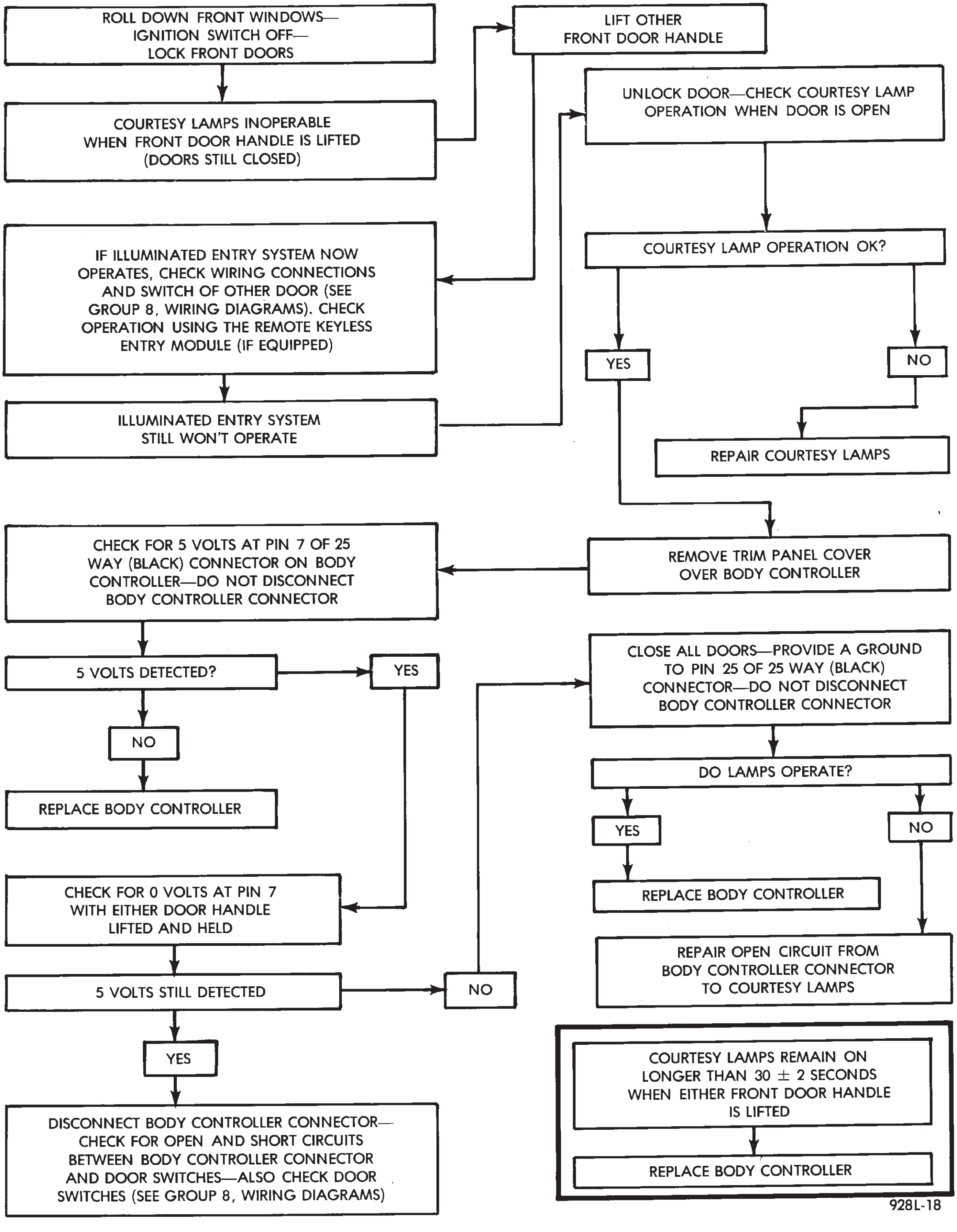
928L-16



928L-17

Fig. 6 Illuminated Entry Circuit Wiring—AC, AG, AJ and AY- Body—Typical

ILLUMINATED ENTRY DIAGNOSIS—AC, AG, AJ AND AY-BODY



ROLL DOWN FRONT WINDOWS—IGNITION SWITCH OFF—LOCK FRONT DOORS

COURTESY LAMPS INOPERABLE WHEN FRONT DOOR HANDLE IS LIFTED (DOORS STILL CLOSED)

LIFT OTHER FRONT DOOR HANDLE

IF ILLUMINATED ENTRY SYSTEM NOW OPERATES, CHECK WIRING CONNECTIONS AND SWITCH OF OTHER DOOR (SEE GROUP 8, WIRING DIAGRAMS). CHECK OPERATION USING THE REMOTE KEYLESS ENTRY MODULE (IF EQUIPPED)

ILLUMINATED ENTRY SYSTEM STILL WON'T OPERATE

UNLOCK DOOR—CHECK COURTESY LAMP OPERATION WHEN DOOR IS OPEN

COURTESY LAMP OPERATION OK?

YES

NO

REPAIR COURTESY LAMPS

REMOVE TRIM PANEL COVER OVER BODY CONTROLLER

CHECK FOR 5 VOLTS AT PIN 7 OF 25 WAY (BLACK) CONNECTOR ON BODY CONTROLLER—DO NOT DISCONNECT BODY CONTROLLER CONNECTOR

5 VOLTS DETECTED?

YES

NO

REPLACE BODY CONTROLLER

CHECK FOR 0 VOLTS AT PIN 7 WITH EITHER DOOR HANDLE LIFTED AND HELD

5 VOLTS STILL DETECTED

NO

YES

DISCONNECT BODY CONTROLLER CONNECTOR—CHECK FOR OPEN AND SHORT CIRCUITS BETWEEN BODY CONTROLLER CONNECTOR AND DOOR SWITCHES—ALSO CHECK DOOR SWITCHES (SEE GROUP 8, WIRING DIAGRAMS)

CLOSE ALL DOORS—PROVIDE A GROUND TO PIN 25 OF 25 WAY (BLACK) CONNECTOR—DO NOT DISCONNECT BODY CONTROLLER CONNECTOR

DO LAMPS OPERATE?

YES

NO

REPLACE BODY CONTROLLER

REPAIR OPEN CIRCUIT FROM BODY CONTROLLER CONNECTOR TO COURTESY LAMPS

COURTESY LAMPS REMAIN ON LONGER THAN 30 ± 2 SECONDS WHEN EITHER FRONT DOOR HANDLE IS LIFTED

REPLACE BODY CONTROLLER

928L-18

BULB APPLICATION TABLE

GENERAL INFORMATION

The following Bulb Application Table lists the lamp title in bold print on the left side of the column. The vehicle family and model codes are listed under the lamp title. The trade number or part number is listed on the right side of the column.

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.

EXTERIOR LAMPS

Back-up

AY/C-P	921
AA/D-A, AC/C, AY/C-S	922
AA/P-P-C, AJ/C, AP/D-P	1156
AA/P-H, AC/D, AG/V, AY/C-P	3157

Center High Mounted Stop

AA	921
AC, AG, AJ, AY, AP	922

Cornering

AA, AY	3157

Fog

AA	GE880
AP/D	GE893
AG, AP/P	H3

Front Side Marker

AA/P-H, AA/D, AC, AJ, AP, AY-S	168
AA/P-PX, AA/C, AY-P	194NA

Front Side Marker/Turn Sig.

AG	3157NA

Headlamp/Aero

AG, AJ-High Beam	9005
AG, AJ-Low beam	9006
AA, AC/D, AP	9004

Headlamp/Sealed Low Beam

AC/C, AY	H4703

Headlamp/Sealed High Beam

AC/C, AY	H4701

License Plate

AA, AC/C, AG, AJ, AP, AY/C-S	168
AC/D, AY/C-P	194

Park/Turn Signal

AC/C-D, AY/C-P, AY/C-S	3157NA
AA/P-X-C, AC/C, AG, AY/C-P, AY/C-S	194NA
AA/P-H-D	3157
AJ, AP	2057

Rear Side Marker

AC/C, AG, AJ, AY/C-S-P	168
AA/P-C-D, AC/D, AP, AY/CS (opt.)	916

Tail

AG	168
AJ, AY/C-P	916

Tail Reflector

AY	168

Tail/Stop/Turn Signal

AP	2057
AG, AC	3057
AA, AJ, AY	3157

INTERIOR LAMPS

Some components have lamps that can only be serviced by a Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC. Chrysler vehicles are equipped with a mechanical instrument cluster (MIC) or an optional electronic instrument cluster (EIC). If a bulb is unique to the MIC or EIC the acronym will follow the title.

INDICATOR LAMPS

Service procedures for the indicator lamps in the instrument cluster are located in Group 8E, Instrument Panel and Gauges.

Air Bag (MIC)

AC, AY	103
AA, AG, AJ, AP	PC194

Antilock (MIC)

AA	103
AC, AG, AJ, AP, AY	PC194

Antilock (EIC)

AA, AY	PC194
AJ	103

Brake (MIC)

AA	103
AC, AG, AJ, AP, AY	PC194

Brake (EIC)

AA, AY	PC194
AJ	103

Check Engine (MIC)

AA	103
AC, AG, AJ, AP, AY	PC194

Check Engine (EIC)

AA, AY	PC194
AJ	103

Check Gauges

All	PC194

Door Open

AA, AC, AY	74
AP	161
AG, AJ	4437661

Fog Lamp (MIC)

AG	PC194

High Beam (MIC)

AA	103
AC, AG, AJ, AP, AY	PC194

High Beam (EIC)

AA, AY	PC194

Lamp Outage

AA 74

Low Fuel

AA 103
AP 161
AC, AY........PC194
AG, AJ 5269245

Low Washer Fluid

AA, AC, AY 74
AP 161
AG, AJ 4437661

Oil Pressure

All........PC194

Trunk Open

AA, AC, AY 74
AP 161
AG, AJ 4437661

Theft Alarm Set

AC, AY........168
AG, AJ 4437661

Turn Signal (MIC)

AA 103
AC, AG, AJ, AP, AY PC194

Turn Signal (EIC)

AA, AY PC194

Seat Belt (MIC)

AA 103
AC, AG, AJ, AP, AY PC194

Seat Belt (EIC)

AA, AY PC194
AJ 103

DIMMER CONTROLLED LAMPS

Service procedures for most of the lamps in the instrument panel, Instrument cluster and switches are located in Group 8E, Instrument Panel and Gauges.

A/C Heater Control

All........37

Automatic Temperature Control

All........4437661

Column Gearshift Indicator

AA, AC, AY 161

Console Gearshift Indicator

AP........194
AA, AG, AJ 161

Fog Lamp Switch Symbol

AG PC194

Headlamp Dimmer Switch

AG, AJ 37

Headlamp Switch Symbol

AC, AY........161
AG, AJ 37

Heater Control

All........158

EVIC

AJ........ASC

Instrument Cluster (MIC)

All........PC194

Instrument Cluster (EIC)

AA, AY 74

Message Center

AA, AC, AY 74
AP 161

Navigator/Travel Companion

AA, AJ 74

Radio

All ....ASC

Rear Defogger Switch

Not Serviceable, Replace Switch

Rear Wiper Switch

AG 37

Theft Alarm

AC, AY........161

Top Lift Switch

AJ 5268053

Travel Computer

All ....ASC

Turbo Gauge

AP 161

Windshield Wiper Switch

AG, AJ 37

NON-DIMMING LAMPS

Service procedures for most of the lamps in the following list can be found in Group 23, Body. Some components have lamps that can only be serviced by a Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC.

Ash Receiver

AA 74
AC, AP, AY........161
AG, AJ 37

Center Console Rear

AJ 906

Cigar Lighter

AA, AP........161

Courtesy

AA, AC, AY-S........214-2
AJ 906
AY-P........212-2

Dome

ALL 211-2

Engine Compartment

All........105

Glove Compartment

All........1891

Ignition Lock

All........37

Inside Rear View Mirror

AJ 168

Overhead Console

AA 912
AC, AY........906
AG, AJ, AP 212-2

Reading Lamp Front

All........906

Reading Lamp Rear	
AC, AJ	168
AP-27	561
AY	214-2
Rear Cargo	
AG, AJ	212-2
AP	912
Luggage Compartment	
AA	1004
AC, AY	105
Visor Vanity	
All	6501966

RESTRAINT SYSTEMS

CONTENTS

AIR BAG SERVICE AND TEST PROCEDURES

WARNING: THIS 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 NEGATIVE (GROUND) BATTERY CABLE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES THEN BEGIN AIR BAG SYSTEM COMPONENT REMOVAL.

Vehicles equipped with a Air Bag System must be inspected every three years or 30,000 miles / 48,000 Km. To inspect system use Passive Restraint System Diagnostic Procedures Manual.

If the Air Bag Module Assembly is defective and non-deployed, refer to Chrysler Motors current return list for proper handling procedures.

WARNING: REPLACE AIR BAG SYSTEM COMPONENTS WITH CHRYSLER MOPAR® SPECIFIED REPLACEMENT PARTS. SUBSTITUTE PARTS MAY VISUALLY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

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.

GENERAL INFORMATION

AIR BAG MODULE

The air bag module is the most visible part of the system (Fig 1). It contains the air bag cushion and its supporting components. The air bag module contains a housing to which the cushion and inflator are attached and sealed.

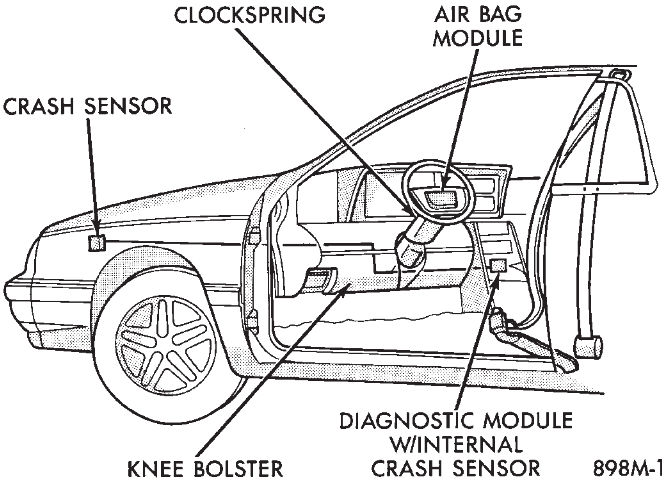


Fig. 1 Air Bag Passive Restraint System

The inflator assembly is mounted to the back of the module housing. When supplied with the proper electrical signal the inflator assembly will produce a gas and discharges it directly into the cushion. A protective cover is fitted to the front of the air bag module and forms a decorative cover in the center of the steering wheel. The air bag module is mounted directly to the steering wheel.

FRONT IMPACT SENSORS

The driver air bag 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 sensors provide verification of the direction and severity of the impact. Three impact sensors are used. One is called a safing sensor. It is located inside the diagnostic module which is mounted on the floor pan, just forward of the center console. The other two sensors are mounted on the upper crossmember of the radiator closure panel on the left and right side of the vehicle under the hood.

The impact sensors are threshold sensitive switches that complete an electrical circuit when an impact provides a sufficient G force to close the switch. The sensors are calibrated for the specific vehicle and react to the severity and direction of the impact.

CLOCKSPRING

The clockspring is mounted on the steering column behind the steering wheel, and is used to maintain a continuous electrical circuit between the wiring harness and the driver's air bag module. This assembly consists of a flat ribbon-like electrically conductive tape which winds and unwinds with the steering wheel rotation.

DIAGNOSTIC MODULE

The Air Bag System Diagnostic Module (ASDM) contains the safing sensor and energy reserve capacitor. The ASDM monitors the system to determine the system readiness. The ASDM will store sufficient energy to deploy the air bag for only two minutes after the battery is disconnected. If both front impact sensors are open the air bag could be deployed up to 9.5 minutes after the battery is disconnected. The ASDM contains on-board diagnostics, and will illuminate the AIR BAG warning lamp in the cluster when a fault occurs.

STORAGE

The air bag module must be stored in its original special container until used for service. Additionally, it must be stored in a clean, dry environment, away from sources of extreme heat, sparks, and sources of high electrical energy. Always place or store the module on a surface with the trim cover facing up to minimize movement in case of accidental deployment.

HANDLING LIVE MODULE

At no time should any source of electricity be permitted near the inflator on the back of the module. When carrying a live module, the trim cover should be pointed away from the body to minimize injury in the event of accidental deployment. In addition, if the module is placed on a bench or other surface, the plastic trim cover should be face up to minimize movement in case of accidental deployment.

When handling a steering column with an air bag module attached, never place the column on the floor or other surface with the steering wheel or module face down.

DEPLOYED MODULE

The vehicle interior may contain a very small amount of sodium hydroxide powder, a byproduct of air bag deployment. Since this powder can irritate the skin, eyes, nose or throat, be sure to wear safety glasses, rubber gloves and long sleeves during cleanup (Fig. 2).

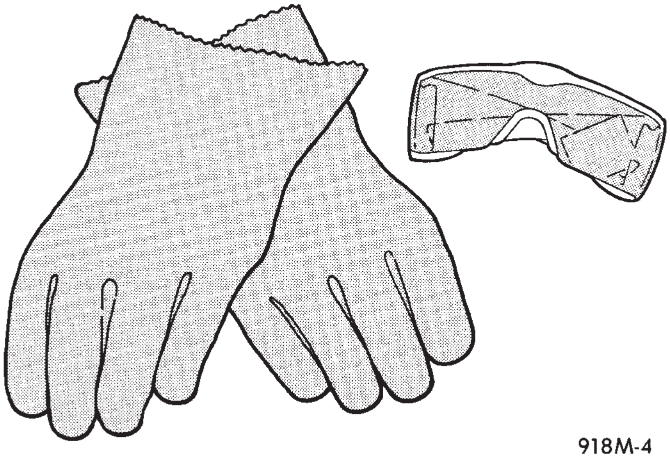


Fig. 2 Wear Safety Glasses and Rubber Gloves

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.

CLEANUP PROCEDURE

Begin the cleanup by putting tape over the two air bag exhaust vents (Fig. 3) so that no additional powder will find its way into the vehicle interior. Then remove the air bag and air bag module from the vehicle.

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Work from the outside in so that you avoid kneeling or sitting in a uncleaned area.

Be sure to vacuum the heater and A/C outlets as well (Fig. 4). In fact it's a good idea to run the blower on low and to vacuum up any powder expelled from the plenum. You may need to vacuum the interior of the car a second time to recover all of the powder.

Place the deployed bag and module in your automotive scrap.

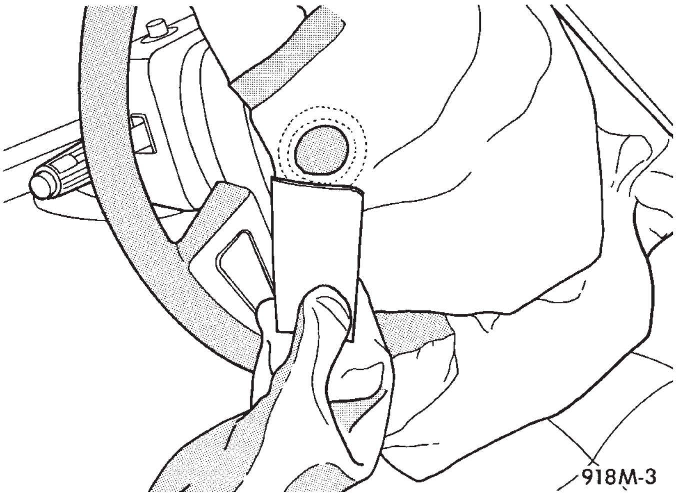


Fig. 3 Seal the Air Bag Exhaust Vents

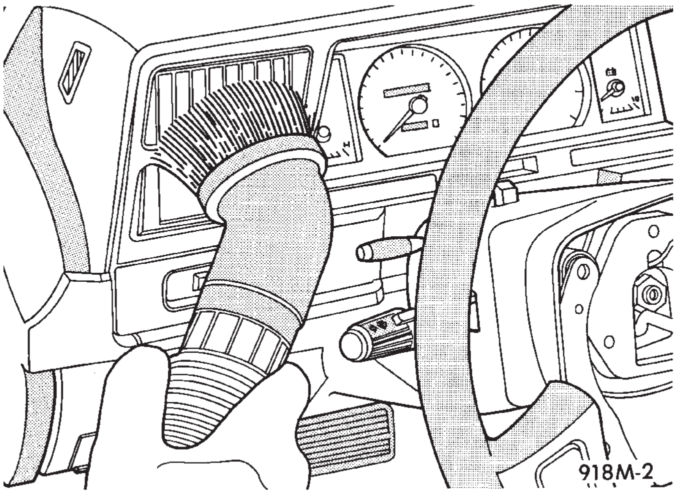


Fig. 4 Vacuum Heater and A/C Outlets

SERVICE OF DEPLOYED AIR BAG MODULE

After an air bag has been deployed, the air bag module and clockspring must be replaced because they cannot be reused. Other air bag system components are replaced if damaged.

SCHEDULED MAINTENANCE INSPECTION

Vehicles equipped with a Air Bag System must be inspected every three years or 30,000 miles / 48,000 Km. The following items should be inspected.

(1) Inspect components for damage or deterioration.

(a) If the air bag module housing shows signs of physical damage or abuse, replace the module.

(b) Check that both front impact sensors are properly installed to the upper crossmember of the radiator closure panel. Repair as required.

(2) Check the air bag warning lamp for proper operation as follows:

(a) Turn ignition switch to the ON position, the air bag warning lamp should light. If not, test the system using the DRB II and Passive Restraint System Diagnostic Procedures Manual. Repair as required.

(b) The air bag warning lamp lights, but fails to go out after ten seconds. Test the system using the DRB II and Passive Restraint System Diagnostic Procedures Manual. Repair as required.

(c) Erasing of fault codes is not required.

AIR BAG SYSTEM CHECK

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM CHECK PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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.

WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES, THEN BEGIN AIR BAG REMOVAL.

(1) Disconnect the battery negative cable and isolate.

(2) Remove forward console or cover as necessary.

(3) Connect DRB II to ASDM diagnostic 6-way connector, located at right side of module.

(4) Turn the ignition key to ON position. Exit vehicle with DRB II. Use the latest version of the proper cartridge.

(5) After checking that no one is inside the vehicle, connect the negative battery cable.

(6) Using the DRB II, read and record active fault data.

(7) Read and record any stored faults.

(8) Refer to the Passive Restraint Diagnostic Test Manual if any faults are found in steps 6 and 7.

(9) Erase stored faults if there are no active fault codes. If problems remain, fault codes will not erase.

(10) With the ignition key in the ON position, make sure no one is in the vehicle.

(11) From the passenger side of vehicle, turn the ignition key to OFF then ON and observe the instrument cluster air bag lamp. It should go on for 6 to 8 seconds, then go out; indicating system is functioning normally.

If air bag warning lamp either fails to light, blinks on and off or goes on and stays on, there is a system malfunction. Refer to the Passive Restraint Diagnostic Test Manual to diagnose the problem.

AIR BAG MODULE

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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.

UNDEPLOYED AIR BAG REMOVAL FROM THE STEERING WHEEL: DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES. BEGIN AIR BAG REMOVAL.

REMOVAL

When removing a deployed module, wear rubber gloves, eye protection and a long sleeve shirt as deposits may be on the surface which could irritate the skin and eyes.

(1) Disconnect battery negative cable and isolate.

(2) Wait two minutes for the reserve capacitor to discharge before removing undeployed module.

(3) Remove four nuts attaching air bag module to steering wheel (Fig. 5).

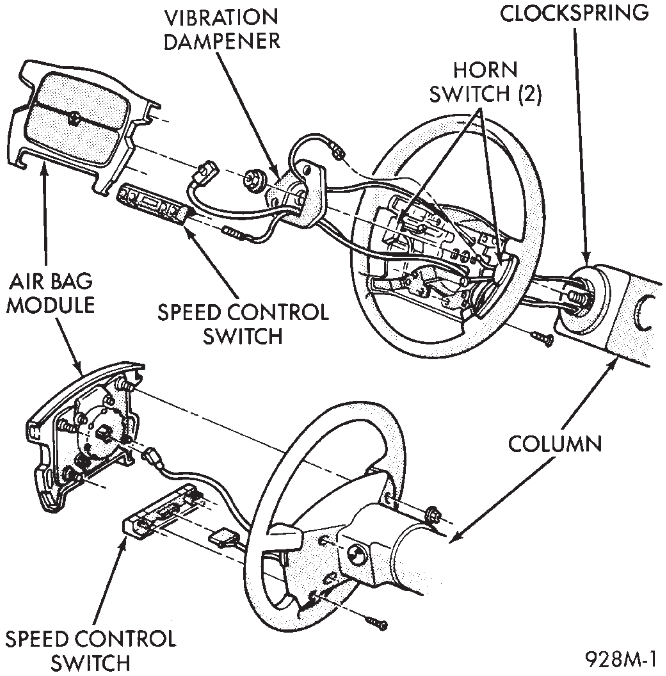


Fig. 5 Air Bag Module

(4) Lift module, and disconnect electrical connector from rear of module.

(5) Remove module.

(6) When replacing a deployed module, the clockspring must also be replaced. Refer to Clockspring Removal and Installation for proper procedure.

INSTALLATION

(1) Connect clockspring wiring connector to the module, by pressing straight in on the connector.

(2) Install four nuts and tighten to 9 to 11 N●m (80 to 100 in. lbs.) torque.

(3) Do not connect battery negative cable. Refer to Air Bag System Check for proper procedure.

LEFT FRONT IMPACT SENSOR

REMOVAL

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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.

(1) Disconnect battery negative cable and isolate.

(2) Disconnect speed control servo from battery tray, if equipped.

(3) Remove battery, battery tray, powertrain control module and coolant bottle.

(4) Disconnect impact sensor electrical connector.

(5) Remove three screws holding sensor to radiator closure panel. Remove left sensor (Fig. 6).

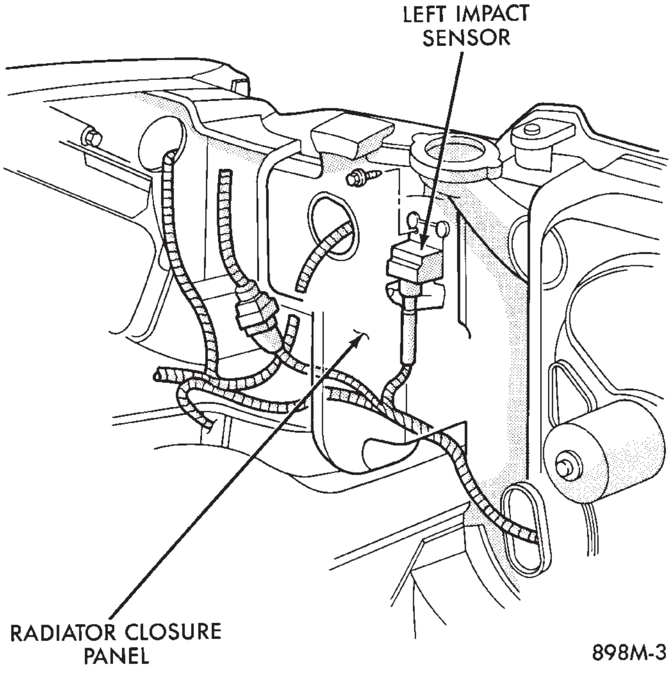


Fig. 6 Left Impact Sensor

INSTALLATION

(1) Mount left sensor (arrow pointed forward) to engine side of closure panel using three screws provided with new sensor. Tighten to 10 to 13 N●m (90 to 120 in. lbs.) torque.

(2) Connect sensor wiring lead from harness to connector on body of sensor.

(3) Install coolant bottle, powertrain control module, battery tray and battery.

(4) Install speed control servo to battery tray, if equipped.

(5) Do not connect negative battery cable. Refer to Air Bag Systems Check for proper procedure.

RIGHT FRONT IMPACT SENSOR

REMOVAL

(1) Disconnect battery ground cable and isolate.

(2) Disconnect impact sensor electrical connector (Fig. 7).

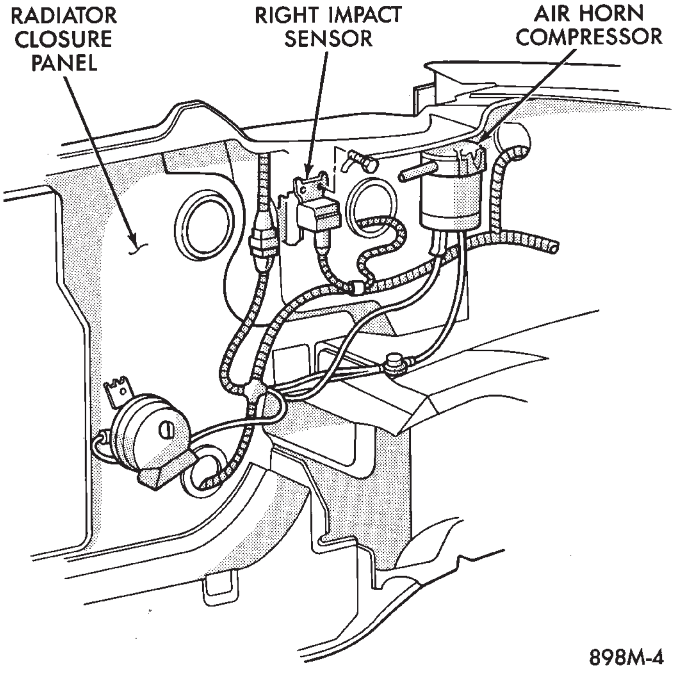


Fig. 7 Right Impact Sensor

(3) Remove three screws holding sensor to radiator closure panel. Remove right sensor.

INSTALLATION

(1) Mount right sensor (arrow pointed forward) to engine side of closure panel using three screws provided with the new sensor. Tighten 10 to 13 N•m (90-120 in. lbs.) torque.

(2) Connect sensor wiring lead from harness to connector on body of sensor.

(3) Do not connect negative battery cable. Refer to Air Bag Systems Check for proper procedure.

AIR BAG SYSTEM DIAGNOSTIC MODULE (ASDM)

WARNING: THE ASDM CONTAINS ONE OF THE IMPACT SENSORS WHICH ENABLE THE SYSTEM TO DEPLOY THE AIR BAG. TO AVOID ACCIDENTAL DEPLOYMENT, NEVER CONNECT ASDM ELECTRICALLY TO THE SYSTEM UNLESS IT IS BOLTED TO VEHICLE. BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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.

REMOVAL

(1) Disconnect battery ground cable, and isolate.

(2) Remove forward console bezel (Fig. 8).

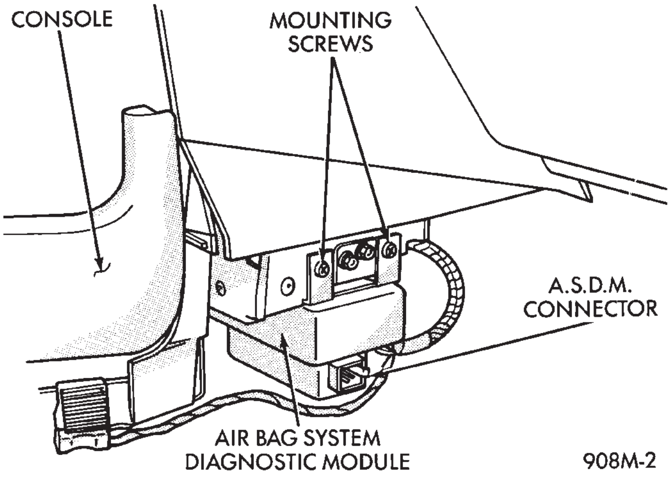


Fig. 8 Air Bag System Diagnostic Module (ASDM)

(3) Remove two screws from right side console bezel and remove bezel.

(4) Disconnect wiring at ASDM.

(5) Remove module mounting screws, and remove module.

INSTALLATION

(1) Position the ASDM with the arrow pointing forward on the console reinforcement. Insert tab on the ASDM in the slot on the reinforcement.

(2) Attach the ASDM to the support bracket with the screws supplied and tighten to 1.7 to 2 N•n (15-20 in. lbs.) torque.

(3) Connect wiring at ASDM, making sure both connectors are seated and locking tabs engaged.

(4) Install right side console bezel.

(5) Install forward console bezel.

(6) Do not connect negative battery cable. Refer to Air Bag System Check for proper procedure.

CLOCKSPRING

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) CABLE (GROUND) FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT, AND POSSIBLE INJURY.

WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES, THEN BEGIN AIR BAG REMOVAL.

REMOVAL

(1) Place the front wheels in the straight ahead position before starting the repair.

(2) Disconnect battery negative cable and isolate.

(3) Wait two minutes for the reserve capacitor to discharge before removing undeployed module.

(4) Remove the air bag module.

(5) Remove Speed Control switch and connector if so equipped or cover.

(6) Disconnect horn terminals.

(7) Remove the steering wheel.

(8) Remove upper and lower steering column shrouds to gain access to clockspring wiring.

(9) Disconnect the 2-way connector between the clockspring and the instrument panel wiring harness on top of the fuse block.

(10) To remove, pull clockspring assembly from the steering column by lifting locating fingers as necessary. The clockspring cannot be repaired, and must be replaced if faulty.

INSTALLATION

(1) Snap clockspring onto the steering column. If the clockspring is not properly positioned, follow the clockspring centering procedure before installing steering wheel.

(2) Connect the clockspring to the instrument panel harness, ensure wiring locator clips are properly seated on wiring trough. Ensure harness locking tabs are properly engaged.

(3) Install steering column shrouds. Be sure air bag wire is inside of shrouds.

(4) Front wheels should still be in the straight-ahead position. Install steering wheel, ensure the flats on hub align with clockspring. Pull the horn lead through the smaller upper hole. Pull the air bag and speed control leads through the larger bottom hole. Ensure leads are not pinched under the steering wheel.

(5) Connect the horn lead wire, then the air bag lead wire to the air bag module.

(6) Install the air bag module and tighten nuts to 9 to 11 N●m (80 to 100 in. lb.) torque.

(7) Install speed control switch and connector or cover.

(8) Do not connect battery negative cable. Refer to Air Bag Systems Check for proper procedure.

CLOCKSPRING CENTERING PROCEDURE

If the rotating tape within the clockspring is not positioned properly with the steering wheel and the front wheels, the clockspring may fail during use. 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: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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 INJURY.

WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES, THEN BEGIN AIR BAG REMOVAL.

(1) Place front wheels in the straight ahead position.

(2) Wait two minutes for the reserve capacitor to discharge before removing undeployed module.

(3) Refer to Steering Wheel procedures for removal of air bag module and steering wheel.

(4) Depress the two plastic locking pins to disengage locking mechanism (Fig. 10).

(5) Keeping locking mechanism disengaged, rotate the clockspring rotor in the CLOCKWISE DIRECTION to the end of travel. Do not apply excessive torque.

(6) From the end of travel, rotate the rotor two full turns and a half in the counterclockwise direction. The horn wire should end up at the top and the squib wire at the bottom. Engage clockspring locking mechanism.

(7) Refer to Steering Wheel procedures for installation of steering wheel and air bag module.

(8) Do not connect battery negative cable. Refer to Air Bag System Check for proper procedure.

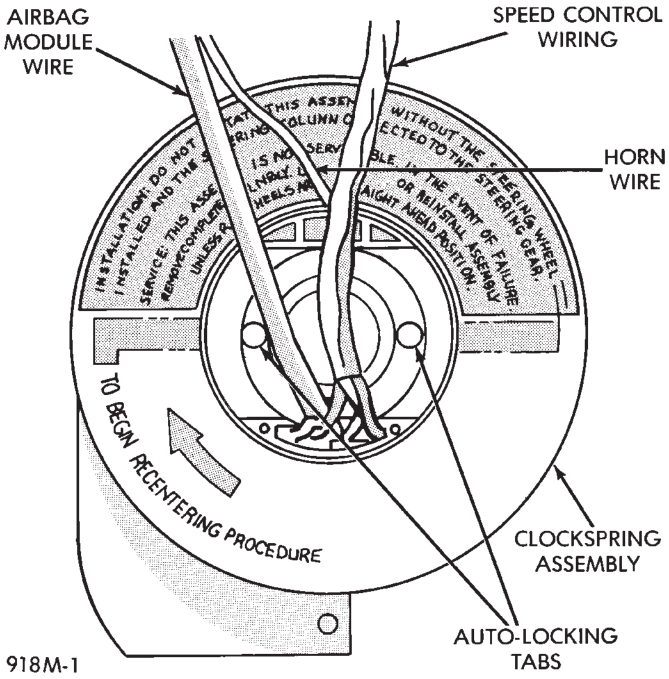


Fig. 10 Clockspring (Auto-Locking)

STEERING WHEEL

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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.

WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES. BEGIN AIR BAG REMOVAL.

REMOVAL

(1) Make sure front wheels are straight, and steering column is locked in place.

(2) Disconnect battery negative cable and isolate.

(3) Wait two minutes for the reserve capacitor to discharge before removing undeployed module.

(4) Remove four nuts attaching air bag module from the back side of steering wheel.

(5) Lift module, and disconnect connector from rear of module.

(6) Remove speed control switch and connector if so equipped or cover.

(7) Remove steering wheel retaining nut.

(8) Remove steering wheel with steering wheel puller Tool C-3428B.

INSTALLATION

(1) If the clockspring is not properly positioned or if front wheels were moved, follow the clockspring centering procedure before installing steering wheel. With the front wheels in the straight ahead position. Position the steering wheel on the steering column. Making sure to fit the flats on the hub of the steering wheel with the formations on the inside of the clockspring. Pull the air bag and speed control wires through the lower, larger hole in the steering wheel and the horn wire through smaller hole at the top. Make sure not to pinch wires (Fig. 11).

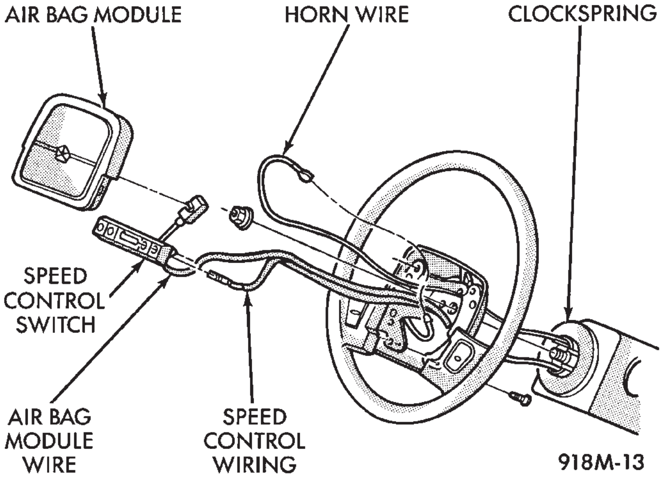


Fig. 11 Steering Wheel Wiring

(2) Install retaining nut, and tighten to 61 N•m (45 ft. lbs.) torque.

(3) Connect horn wiring lead.

(4) Connect 4-way connector to speed control switch and attach switch to steering wheel.

(5) Connect air bag lead wire to air bag module, and secure module to steering wheel.

(6) Do not connect negative battery cable. Refer to Air Bag System Check for proper procedure.

STEERING COLUMN SWITCHES

This procedure covers the removal and installation of the steering wheel and clockspring. Once the steering wheel and clockspring have been removed, refer to the appropriate section of this service manual for switch replacement.

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) 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 INJURY.

WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACI-

TOR TO DISCHARGE FOR TWO MINUTES. BEGIN AIR BAG REMOVAL.

REMOVAL

(1) Disconnect battery negative cable, and isolate.

(2) Wait two minutes for the reserve capacitor to discharge before removing undeployed module.

(3) Remove four nuts attaching air bag module from the back side of steering wheel.

(4) Lift module, and disconnect connector from rear of module.

(5) Remove speed control switch and connector if so equipped or cover.

(6) Remove steering wheel.

(7) Unsnap clockspring, and remove it.

(8) Refer to the appropriate section for switch replacement.

INSTALLATION

(1) Snap clockspring on to steering column. Assure the 4 way connector is still seated.

(2) Install steering wheel.

(3) Install speed control switch and connector or cover.

(4) Connect clockspring wiring connector to the module.

(5) Install four nuts to module, and tighten to 9 to 11 N●m (80 to 100 in. lbs.) torque.

(6) Do not connect negative battery cable. Refer to Air Bag System Check for proper procedure.

REAR WINDOW DEFOGGER

CONTENTS

GENERAL INFORMATION

For proper operation of the Rear Window Defogger system refer to the Owner's Manual.

Vehicles equipped with an electrically heated rear window defogger also have a 40/90 amp generator.

The system consists of a rear glass with two vertical bus bars and a series of electrically connected grid lines fired on the inside surface. A control switch and a timer relay combined into a single assembly is used on all models (Fig.1).

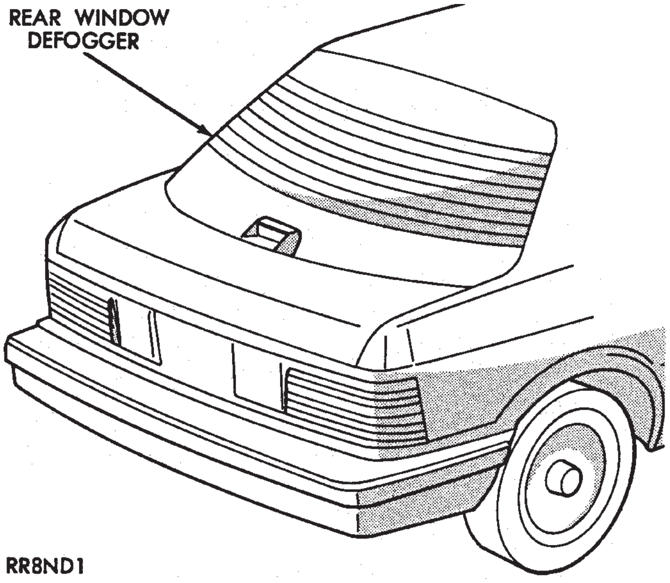


Fig. 1 Rear Window Defogger—Typical

Circuit protection is provided by a fusible link, located in the charging circuit, for the heated grid circuit and by a fuse for the relay control circuit.

When the switch is turned to the ON position, current is directed to the rear defogger grid lines. The heated grid lines heat the rear glass to clear the surface of fog or frost.

CAUTION: Grid lines can be damaged or scraped off with sharp instruments, care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

CONTROL SWITCH/TIMER RELAY MODULE

The control switch and timer relay are integrated into a single panel or console mounted assembly. Actuating the switch energizes the circuit which allows current to flow through the grid lines. Upon initial actuation for approximately ten minutes, or until either the switch or ignition is turned off. An indicating lamp illuminates a lens inlaid in the control switch.

SERVICE PROCEDURES

Electrically heated rear window defogger operation can be checked in vehicle in the following manner:

(1) Turn ignition ON.

(2) Turn rear window defogger control switch ON.

(3) Using a ammeter on the battery. Turn the Defogger control switch ON, a distinct increase in amperage draw should be noted.

(4) The rear window defogger 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 three to four minutes of operation.

(5) Using a DC voltmeter (Fig. 2) contact terminal B with the negative lead, and terminal A with the positive lead. The voltmeter should read 10-14 volts.

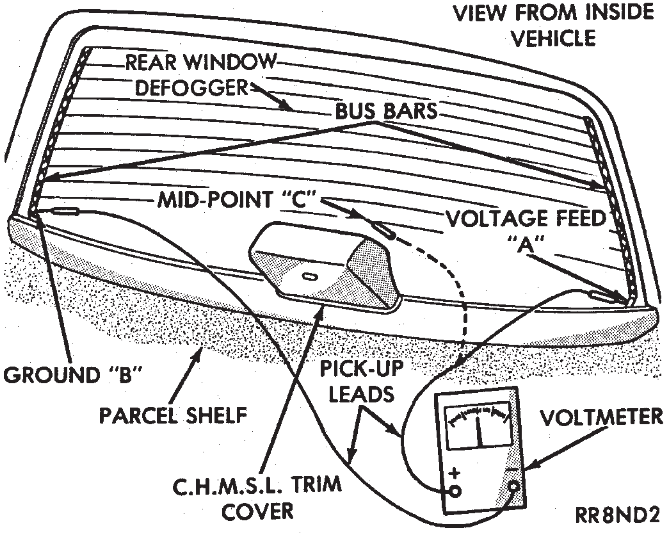


Fig. 2 Rear Glass Grid Line Test—Typical

(6) Steps (3, 4 or 5) above will confirm system operation. Indicator light illumination means that there is power available at the output of the relay only, and does not necessarily verify system operation.

(7) If turning the switch ON produced no distinct current draw on the ammeter the problem should be isolated in the following manner:

(a) Confirm the ignition switch is ON.

(b) Ensure that the heated rear glass feed wire is connected to the terminal or pigtail and that the ground wire is in fact grounded.

(c) Ensure that the fusible link and control circuit fuse is operational and all electrical connections are secure.

(8) When the above steps have been completed and the system is still inoperative, one or more of the following is defective:

(a) Control switch/timer relay module.

(b) All rear window grid lines would have to be broken or one of the feed wires are not connected for the system to be inoperative.

(9) If turning the switch ON produces severe voltmeter deflection, the circuit should be closely checked for a shorting condition.

(10) If the system operation has been verified but indicator lamp does not light, replace the switch.

(11) For detailed wiring information, refer to group 8W, Wiring Diagrams.

GRID TEST

The horizontal grid lines and vertical bus bar lines printed and fired on inside surface of rear window glass (Fig. 2) comprise an electrical parallel circuit. The electrically conductive lines are composed of a silver-ceramic material which when fired on glass becomes bonded to the glass and is highly resistant to abrasion. It is possible, however, that a break may 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 ON and turn control switch to ON. The indicator light should come on.

(2) Using a DC voltmeter with 0-15 volt range, contact terminal B with negative lead of voltmeter. With positive lead of voltmeter, contact terminal A (Fig. 2). The voltmeter should read 10-14 volts. A lower voltage reading indicates a poor ground connection.

(3) With negative lead of voltmeter, contact a good body ground point. The voltage reading should not change.

(4) Connect negative lead of voltmeter to terminal B 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 A. A reading of 10-14 volts indicates a break between Mid-Point C and terminal B. Move toward break and voltage will change as soon as break is crossed (Figs. 2 and 3).

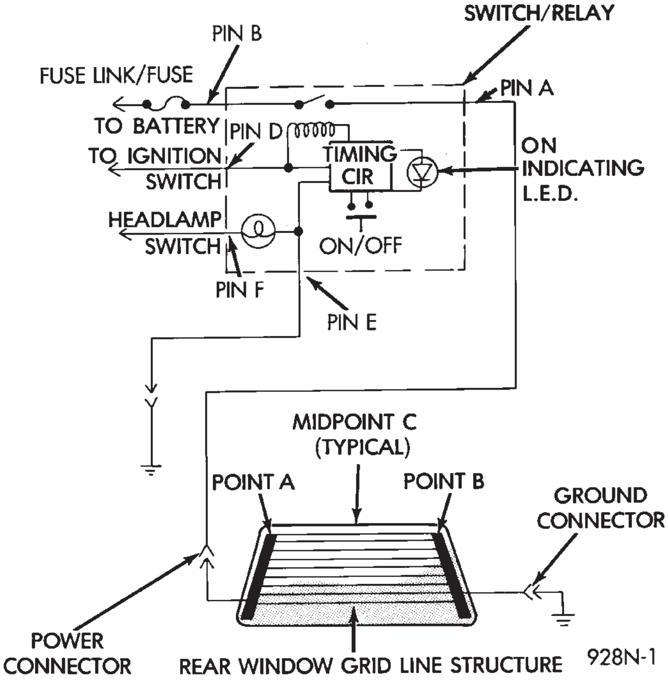


Fig. 3 Systems Electrical Circuit

CONTROL SWITCH/TIMER RELAY MODULE TEST

Control switch/timer relay module may be tested in-vehicle or bench tested. In vehicle testing is accomplished in the following manner:

(1) Remove the switch, relay assembly from the instrument panel or console, see Group 8E, Instrument Panel and leave the switch connector plugged in.

(2) Turn ignition ON.

(3) Using a DC voltmeter, with 0-15 range, check voltage at terminals B, I and L. (Figs. 3 and 4). Terminals B and I should confirm a voltage of 10 to 14 volts to ground when the ON switch is pressed. Terminal L should confirm voltage to ground. When terminals B and I show no voltage, trace circuit upstream of switch/relay module for problem (wiring cut, fusible link or circuit breaker inoperative, bulkhead connector not operative, etc.) If terminal L indicates voltage, place switch in Off position. If voltage at L is still indicated or indicator lamp remains on, the switch/relay module should be replaced.

(4) If the relay checks out to this point, momentarily operate switch to ON position. The indicator lamp should come on and remain on for approximately 10 minutes. Terminal L should confirm voltage. If the indicator lamp fails to light or voltage at terminal L is not confirmed the switch/relay module should be replaced.

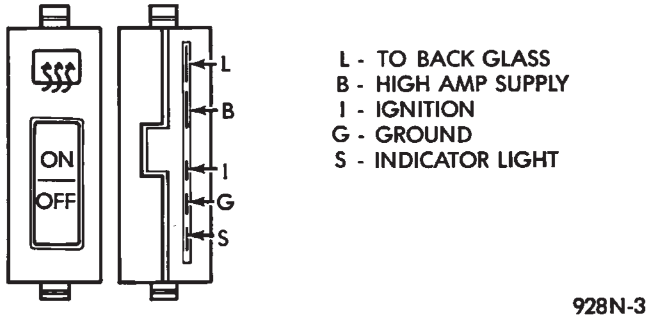


Fig. 4 Rear Window Defogger Switch, Timer, Relay, and Wire Connector

Bench checking of the relay may be accomplished in the following manner. By following the in-vehicle procedure except Step 2: With a DC power supply, apply 12 volts to terminal B and I and ground terminal G.

REPAIR GRID LINES, TERMINALS AND PIGTAILS

The repair of the grid lines or the terminal is possible using the Mopar Repair Package or equivalent.

(1) Mask repair area so conductive epoxy can be extended onto the line or the bus bar (Fig. 5).

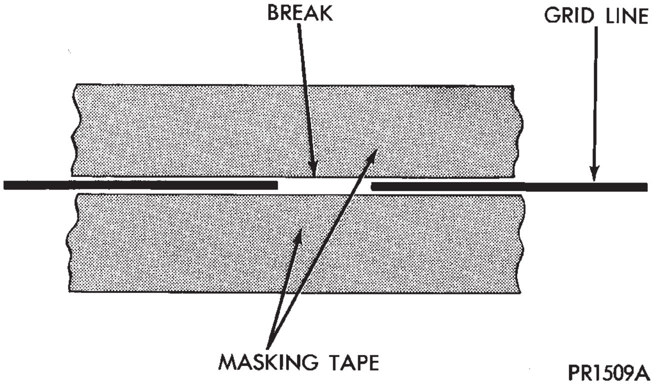


Fig. 5 Grid Line Repair—Typical

(2) Follow instructions in repair kit for preparing damaged area.

(3) Remove package separator clamp and mix plastic conductive epoxy thoroughly. Fold in half and cut center corner to dispense epoxy.

(4) For grid line, mark off area to be repaired with masking tape or a template (Fig. 5).

(5) Apply conductive epoxy through slit in masking tape. Overlap both ends of the break by 19mm (3/4 inch).

(6) For a terminal or pigtail replacement, mask adjacent areas so epoxy can be extended onto line as well as bus bar. Apply a thin layer of epoxy to area where terminal was fastened and to adjacent line.

(7) Apply a thin layer of conductive epoxy on terminal and place terminal on desired location. To prevent terminal from moving while the epoxy is curing, it must be wedged or clamped.

(8) Carefully remove masking tape from grid line.

CAUTION: Do not allow the glass surface to exceed 204°C (400°F), glass may fracture.

(9) Allow epoxy to cure 24 hours at room temperature or use heat gun with a 260°-371°C (500°-700°F) range for 15 minutes. Hold gun approximately 254 mm (10 inches) from repaired area.

(10) After conductive epoxy is properly cured remove wedge from terminal and check out operation of rear window defogger. Do not attach connectors until curing is complete.

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 CONTAIN 3 PERCENT FLAMMABLE SOLVENTS.

WARNING: KEEP OUT OF REACH OF CHILDREN.

POWER LOCKS

CONTENTS

GENERAL INFORMATION

All doors can be locked or unlocked electrically by operating the switch on a front door panel or arm rest.

The rear doors can be locked or unlocked by actuation of the front door switch, or can be locked or unlocked mechanically and independently with their respective locking knobs.

The front doors can be locked or unlocked mechanically with the locking knob regardless of electrical locking and unlocking actuation with the front door knobs.

The right and left front door on all car lines can be locked or unlocked mechanically from the outside with the key or electrically as described above. The left front can also be unlocked by actuation of the inside remote door handle. The right front door on AC, AG, AJ and AY can be unlocked by actuation of the inside remote door handle.

The deck lid lock consists of a latch with internal solenoid and push button switch. The solenoid is energized only when the push button is depressed.

DOOR LOCK INHIBIT

The power door lock inhibit system prevents the doors from being locked using the power door locks when either of two conditions occur:

(1) The key is in the ignition switch and any of the doors are open. The ignition switch does not have to be ON.

(2) The key is in the ignition switch and the headlamp are on.

KEYLESS ENTRY SYSTEM

The system allows locking and unlocking of vehicle door(s) and Trunk lid by remote control using a hand held radio transmitter. The ignition switch must be OFF before the trunk lid can be unlocked with the transmitter.

The receiver may receive signals from two transmitters. Each transmitter has its own code, and the code has been stored in memory. If the transmitter is replaced or a second transmitter is add, the code on both units have to be placed in memory.

CIRCUIT BREAKER TEST

Find correct circuit breaker on fuse block. Pull out slightly but be sure that circuit breaker terminals still contact terminals in fuse block. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive wire, check both terminals of circuit breaker for 12 volts. If only one terminal checks at 12 volts, circuit breaker is defective and must be replaced. If neither terminal shows 12 volts, check for open or shorted circuit to circuit breaker.

WIRING VOLTAGE TEST

The following wiring test sequence determines whether or not voltage is continuous through the body harness to switch.

(1) Remove left side switch from trim panel.

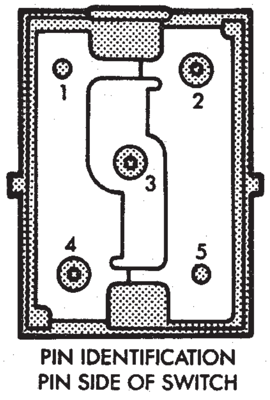
(2) Carefully separate multiple terminal block on wiring harness from switch body.

(3) Connect one lead of test light to a ground terminal:

- Black Wire AA and AC Bodies
- Gray wire AG and AJ Bodies
- Touch other test light lead to Red Wire terminal.
- If test light comes on, the wiring circuit between the battery and switch is functional.
- If test light does not come on, check 30 amp circuit breaker or for a open circuit.

SWITCH TEST

Remove the switch from its mounting location. Using an ohmmeter, refer to (Fig. 1) to determine if continuity is correct in the Lock and Unlock switch positions. If these results are not obtained, replace the switch.



SWITCH POSITION	CONTINUITY BETWEEN
OFF	PINS 1 & 4 PINS 2 & 5
LOCK	PINS 3 & 4 PINS 2 & 5
UNLOCK	PINS 2 & 3 PINS 1 & 4

AG, AJ, AP, AC, AY BODIES

SWITCH POSITION	CONTINUITY BETWEEN
OFF	PINS 1 & 4 PINS 2 & 5
LOCK	PINS 2 & 3 PINS 1 & 4
UNLOCK	PINS 3 & 4 PINS 2 & 5

AA-BODY

908P-3

Fig. 1 Door Lock Switch Continuity

ELECTRIC MOTOR TEST

Make certain battery is in normal charged condition before circuits are tested.

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 maybe caused by a shorted motor, or a bad switch. Disconnecting the defective motor will allow the others to work.

The power lock motors are also equipped with a thermal protection system which prevents the motors from burning out. The motors may chatter if they are continuously activated.

To test an individual door lock motor, disconnect the wire connector at the motor (Fig. 2 and 3). Test at the connector for 12 volts while applying door lock switch. If no voltage repair wire. Apply 12 volts to the motor terminal, and a known good ground to the other terminal to check motor operation.

Should the motor defect be a result of a broken wire, it should have no effect on the operation of the other motors.

POWER DOOR LOCKS

When AC, AG, AJ or AY Body vehicles are equipped with power door locks, the system includes an automatic door locking feature which is actuated through the vehicle's body controller.

When this system is enabled the automatic door locks will work automatically. When the system is disabled the door locks will work by use of the door lock switches only.

The body controller controls the power locks when the door lock switch is activated. If the door lock switch is pressed for longer than eight consecutive seconds, the body controller will de-energize the door lock relay. Also, the body controller will automatically lock all doors when all of the conditions below are met:

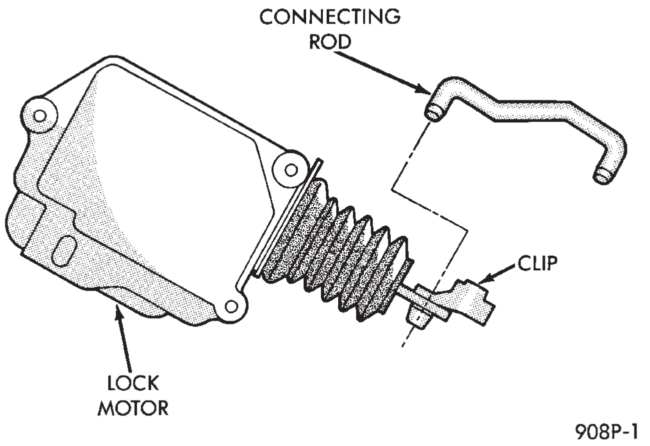


Fig. 2 Door Lock Motor

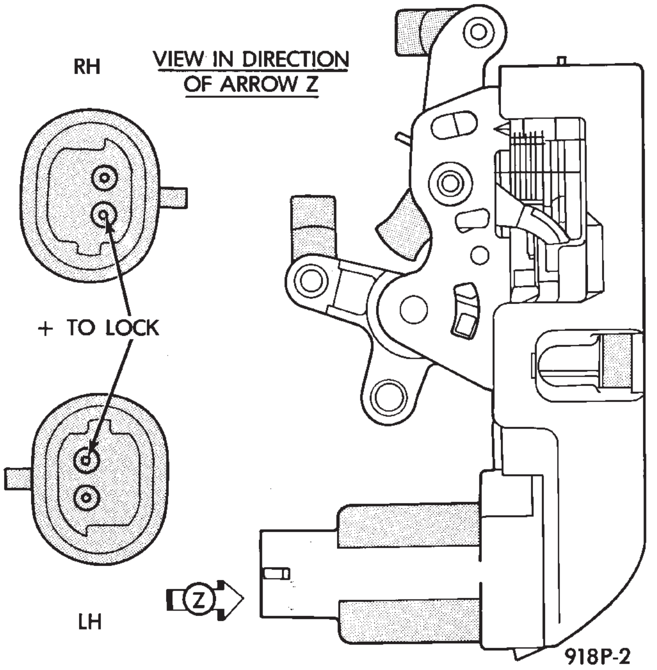


Fig. 3 Door Latch with Lock Motor—AC and AY Bodies

- All doors are closed
- The vehicle speed exceeds 15 ± 1 MPH
- The throttle position sensor tip-in is greater than 10 ± 2 degrees

The DRB II must be used to enable/disable the automatic door lock system. Refer to the Body Diagnostic Procedures Manual for the procedure.

The body controller will automatically re-lock all doors if the above conditions are met and if any of the doors become ajar. The body controller does not control the door unlock function. The switch is wired directly to the lock relay.

DOOR LOCK SYSTEM TEST

For complete testing of the AC, AG, AJ and AY body automatic door lock systems, refer to the Body Diagnostic Procedures Manual.

DOOR LOCK MOTOR REPLACEMENT

(1) Remove inside door release handle, window regulator handle, if equipped and door trim panel.

(2) Roll door watershield away from lower rear corner of door to reveal inside panel access opening.

(3) Disconnect link at the motor as required (Fig. 4 through 7).

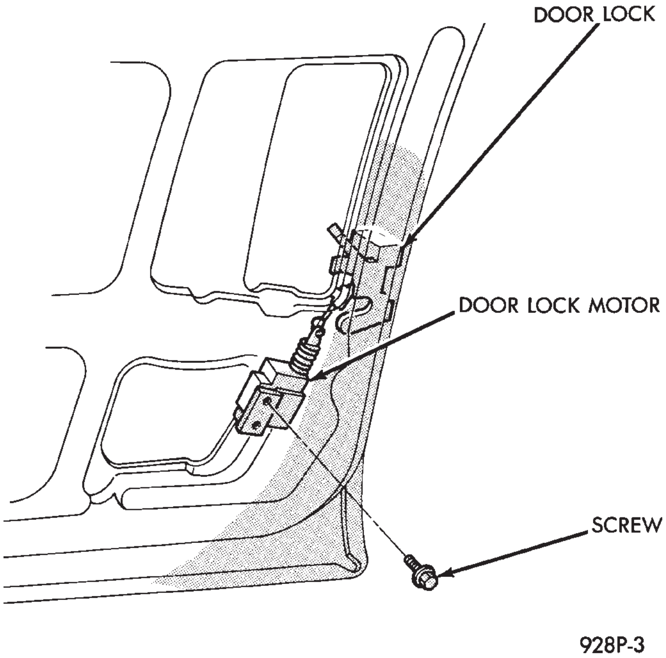


Fig. 4 Front Power Door Lock Motors—AA, AG, AJ and AP Bodies

(4) Disconnect motor lead wires.

(5) Remove motor or latch attaching screws and remove motor assembly.

(6) For installation reverse above procedures.

DECK LID OPERATION

For vehicles equipped with electric deck lid release.

TEST

(1) Confirm solenoid lead wire is connected and 10 volts or more are available at solenoid.

(2) Provide proper ground through latch mounting screws.

(3) Remove latch and examine plunger. Plunger should spring back when pressed.

(4) Insure that solenoid plunger travel is adequate approximately 16 mm (5/8 inch).

ADJUSTMENT

Adjust deck lid latch and striker so that deck lid latches with a moderate slam. With ignition switch in On or Accessory position, push deck lid unlock switch. Should latch fail to lock or unlock replace latch assembly.

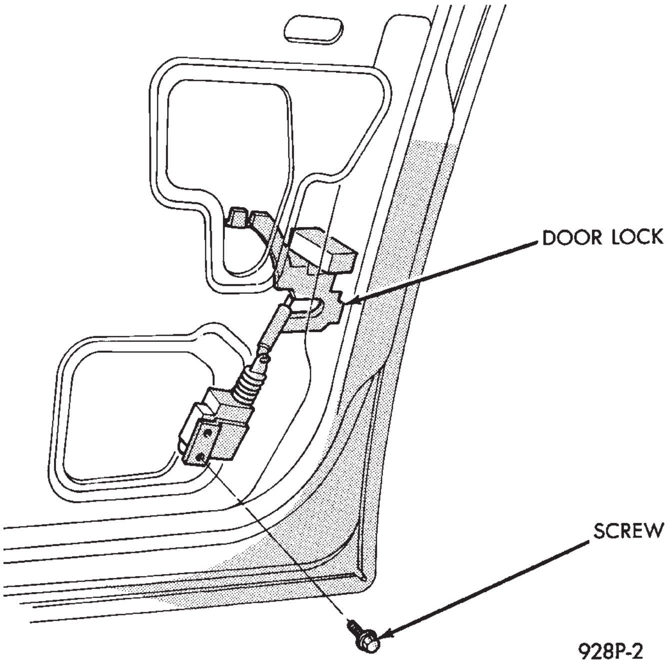


Fig. 5 Rear Power Door Lock Motors—AA and AP Bodies

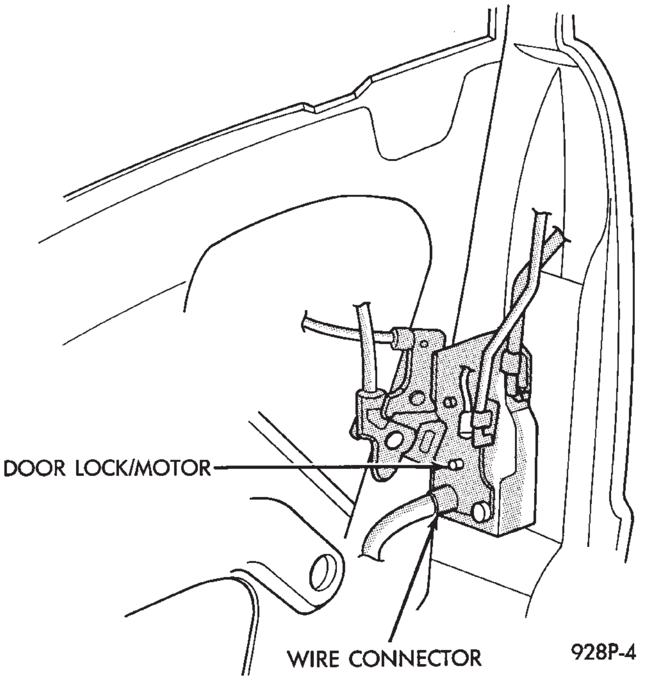


Fig. 6 Front Power Door Lock Motors—AC and AY Bodies

DECK LID PULL-DOWN SYSTEM—AC and AY BODIES

C-body vehicles have, as an option, a deck lid power pull-down mechanism which latches and pulls the deck lid down the last 25 mm (1 in.) of travel. The system incorporates a combination latch/deck lid

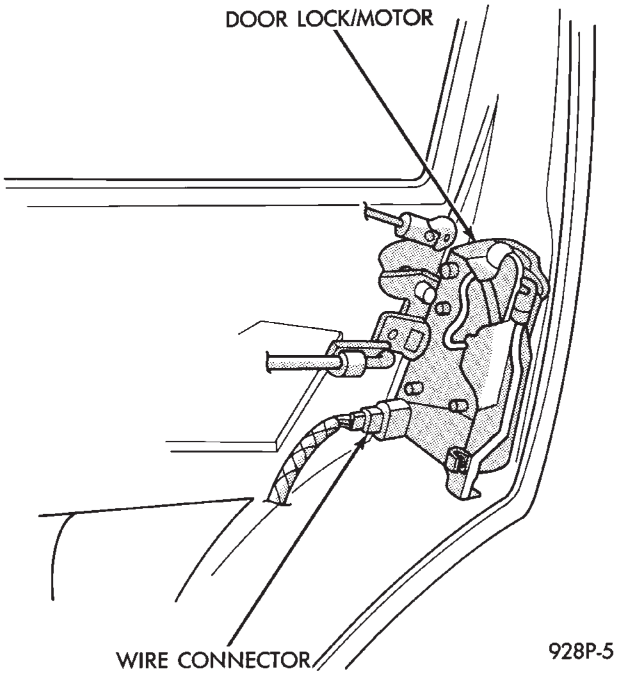


Fig. 7 Rear Power Door Lock Motors—AC and AY Bodies

release mechanism and a power pull-down motor assembly (Fig. 8 through 10).

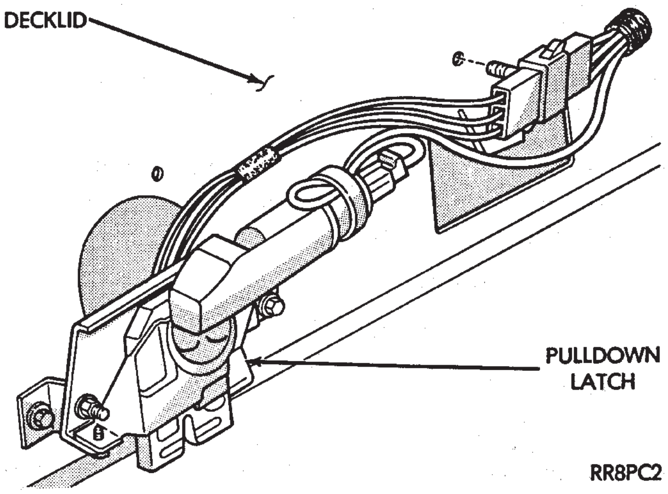


Fig. 8 Deck Lid Pull Down Latch—AC and AY Bodies

When the deck lid is closed, very light pressure is required to cause the latch to grab the pull down bar. The pull down motor will automatically take the deck lid to its completely closed position.

POWER PULL DOWN

(1) Latch testing:

(a) With the deck lid open and the latch switch released. There should be continuity between the black with the red tracer (BK/RD*) and the black (BK) wire (Fig. 10).

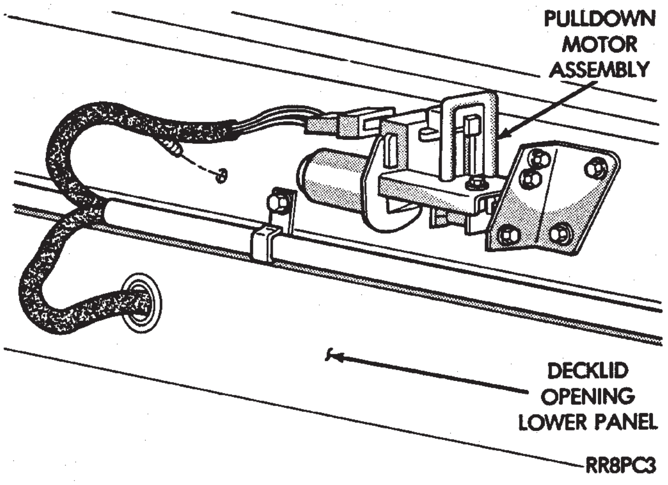


Fig. 9 Deck Lid Power Pull Down Motor—AC and AY Bodies

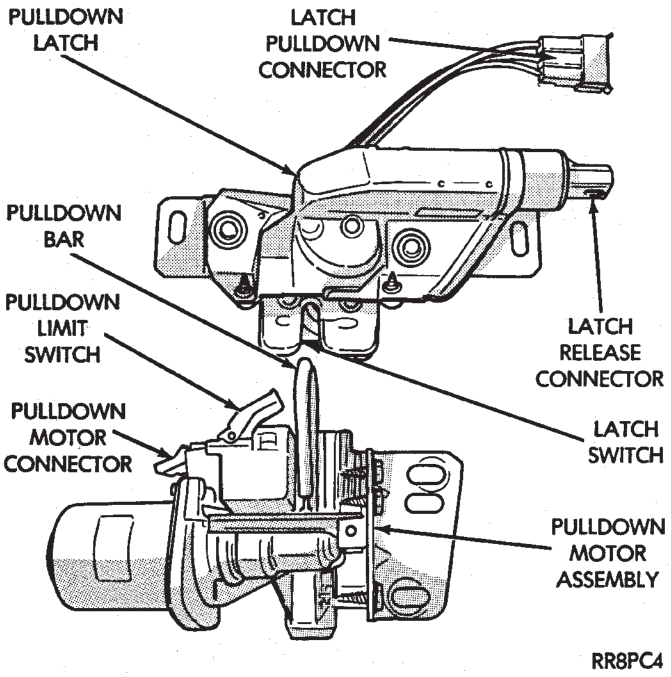


Fig. 10 Deck Lid Power Pull Down Assembly—AC and AY Bodies

(b) With the latch switch depressed (as if the deck lid was closed), there should be continuity between the black (BK) and the black with white tracer (BK/WT*) wire terminals.

(c) If these results are not obtained, replace the pull down latch.

(2) Pull down motor testing:

(a) With the pull down motor connector wiring removed, connect a 12 volt positive source to the red (RD) wire terminal of the motor and ground the tan (TN) wire terminal. This will cause the pull down bar to retract.

(b) With the positive source still connected to the red (RD) wire terminal, ground the grey (GY) wire terminal. This will cause the pull down bar to raise to the deck lid open position. If the pull down limit switch is depressed at this time, the motor should stop.

(c) If these results are not obtained, replace the pull down motor assembly.

REMOTE KEYLESS ENTRY

OPERATION

The transmitter has three buttons for operation (Fig. 11).

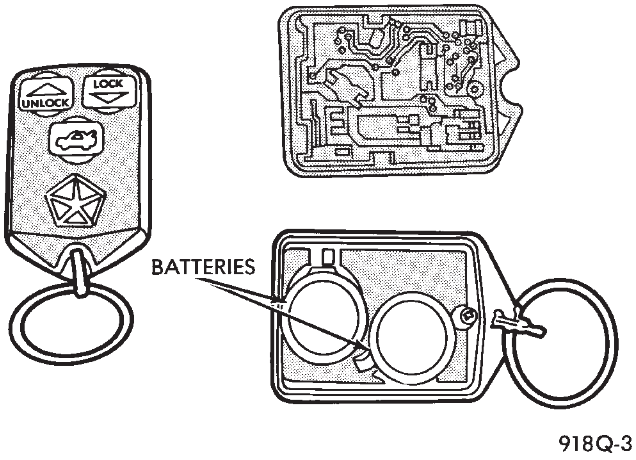


Fig. 11 Transmitter

- UNLOCK driver's door, enable illuminated entry, and disarm the Theft Security System. Pushing and releasing the button once will unlock the driver's door. Two times within five seconds all doors will unlock.
- LOCK all doors, set Theft Security System and chirp horn. Chirp of horn is a short toot to notify that the alarm system is set and the indicator lamp on the instrument panel will flash for about 15 seconds.
- Unlock Trunk Lid
- The receiver is capable of retaining VAC even when power is removed.
- Each receiver must have at least one and no more than two transmitters.

CONTROL RANGE

Operation range is within 7 meters (23 ft.) of the receiver.

TRANSMITTER BATTERY

The battery 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.

PROGRAM REMOTE KEYLESS ENTRY

(1) Remove trim cover or floor console as needed that may be covering the Air Bag System Diagnostic Module (ASDM).

(2) Pull floor carpeting back between the accelerator peddle and ASDM.

(3) Locate program line a dark green wire with a insulator on the end. Located between the accelerator and (ASDM).

(4) Turn ignition switch to the ON position.

(5) Connect the program line from the Remote Keyless Entry Module to ground. The door locks will lock and unlock to indicate the receiver is ready to receive transmitter code. Trunk solenoid will not cycle.

(6) Press any button on the transmitter to set code. If there is a second transmitter it has to be set at this time. The locks will cycle to confirm programming.

(7) Disconnect the program line from ground. This returns the system to its normal operation mode.

(8) Replace trim cover or floor console as necessary.

HORN CHIRP CANCELLATION

During the programming operation the horn chirp can be disabled using the following procedures:

(1) Remove trim cover or floor console as needed that may be covering the Air Bag System Diagnostic Module (ASDM).

(2) Pull floor carpeting back between the accelerator peddle and ASDM.

(3) Locate program line a dark green wire with a insulator on the end. Located between the accelerator and (ASDM).

(4) Turn ignition switch ON.

(5) Connect the program line from the Remote Keyless Entry Module to ground. The door locks will lock and unlock to indicate the receiver is ready to receive transmitter code. Trunk solenoid will not cycle.

(6) Press any button on the transmitter to set code. If there is a second transmitter it has to be set at this time. The locks will cycle to confirm programming.

(7) Press LOCK then UNLOCK transmitter buttons repeat three times.

(8) Door locks and rear release will cycle three times as feedback of Horn Chirp lockout.

(9) Remove ground from program line to restore normal system operation.

(10) To reinstate the Horn Chirp feature refer to Program Remote Keyless Entry.

TESTING

CONDITION: When trying to program the receiver module in the vehicle with a new transmitter and there is no response from the module, Example: the door locks do not cycle through a lock/unlock routine. Refer to Fig. 12 for a block wiring diagram or to Group 8W, Wiring Diagrams.

(1) Be sure that the module has a battery feed from the 20 Amp breaker in cavity 1 of the black connector. Also affected would be the optical horn and the stop lamps.

(2) Be sure that the module has an ignition feed from 5 Amp fuse in cavity 8 of the black connector. Also affected would be the body computer, instrument cluster and message center.

(3) Be sure that the module has a ground from the right side cowl behind the body computer to the cavity 5 of the black connector.

(4) Be sure that you are supplying a good ground to the programming wire.

(5) If the above circuits are good, replace the Receiver Module.

CONDITION: Doors can be locked or unlocked with the Keyless Entry transmitter. But the doors will not lock. The Vehicle Theft Alarm system will not arm, when using only the power door LOCK switch in the driver's door.

(1) Be sure you have not left key in the ignition column lock cylinder.

(2) If step 1 is OK, check the Key in Lock switch circuit in the steering column for a short to ground.

(3) In this problem the body computer controls the LOCK function. Be sure that it is providing a battery voltage output to the door lock relay. The door lock relay controls the door lock motors.

CONDITION: Doors will lock but Vehicle Theft System will not arm when using the transmitter.

(1) The Keyless Entry Receiver Module controls the door lock signal to the door lock relay. The door lock relay controls the door lock motors. Check for battery voltage at cavity 10 of the Theft Alarm module from the Receiver module.

(2) If voltage is OK, replace Receiver module.

CONDITION: All doors except driver's door will lock with the transmitter.

(1) Test the driver's door output of the Receiver Module for a ground.

(2) If there is no ground at the pin, replace the Receiver module.

(3) If there is a ground at the output, replace the door lock motor.

CONDITION: Only driver's door will lock with the transmitter.

- Repair ground circuit to unlock relay
- Replace unlock relay

CONDITION: Doors do not lock with the transmitter, but still get horn CHIRP that indicates that they did lock. Replace Receiver module.

CONDITION: Doors will lock with the transmitter but there is no horn CHIRP.

(1) Press horn button, listen horn sound.

(2) If the horn sounded, change horn relay.

(3) Still no CHIRP, check continuity between the horn relay and the receiver output pin. Repair as necessary.

(4) Still no horn CHIRP, replace the receiver module.

(5) If using a DRB II, refer to Body Diagnostic Procedures.

REMOTE KEYLESS MODULE REPLACEMENT

(1) Remove lower right instrument panel silencer.

(2) Remove glove box assembly.

(3) Remove three screws attaching the mounting bracket to instrument panel.

(4) Lower bracket and module assembly, to disconnect wire connector.

(5) Remove two screws attaching the Remote Keyless entry Module to bracket.

(6) Remove two screws attaching the security module to bracket.

(7) To installation reverse above procedures.

LAMP OUTAGE MODULE REPLACEMENT

(1) Remove lower right instrument panel silencer.

(2) Remove glove box and ash receiver module.

(3) Remove three screws attaching the mounting bracket to instrument panel.

(4) Lower bracket and module assembly, to disconnect wire connectors.

(5) Remove two screws attaching the Lamp Outage Module to bracket.

(6) Remove two screws attaching the security module to bracket.

(7) To installation reverse above procedures.

DOOR LOCK INHIBIT

The power door lock inhibit system prevents the doors from being locked using the power door locks when either of two conditions occur:

(1) The key is in the ignition switch and any of the doors are open. The ignition switch does not have to be ON.

(2) The key is in the ignition switch and the headlamp are on.

AC, AG, AJ AND AY BODIES

With the ignition switch in the ON or OFF position and the driver's door open the Body Controller will ignore the command to lock the power door locks. Once the key is removed, or the driver's door is closed, the Body Controller will allow the power door locks to lock. Refer to Body Diagnostic Procedure Manual for further testing procedures.

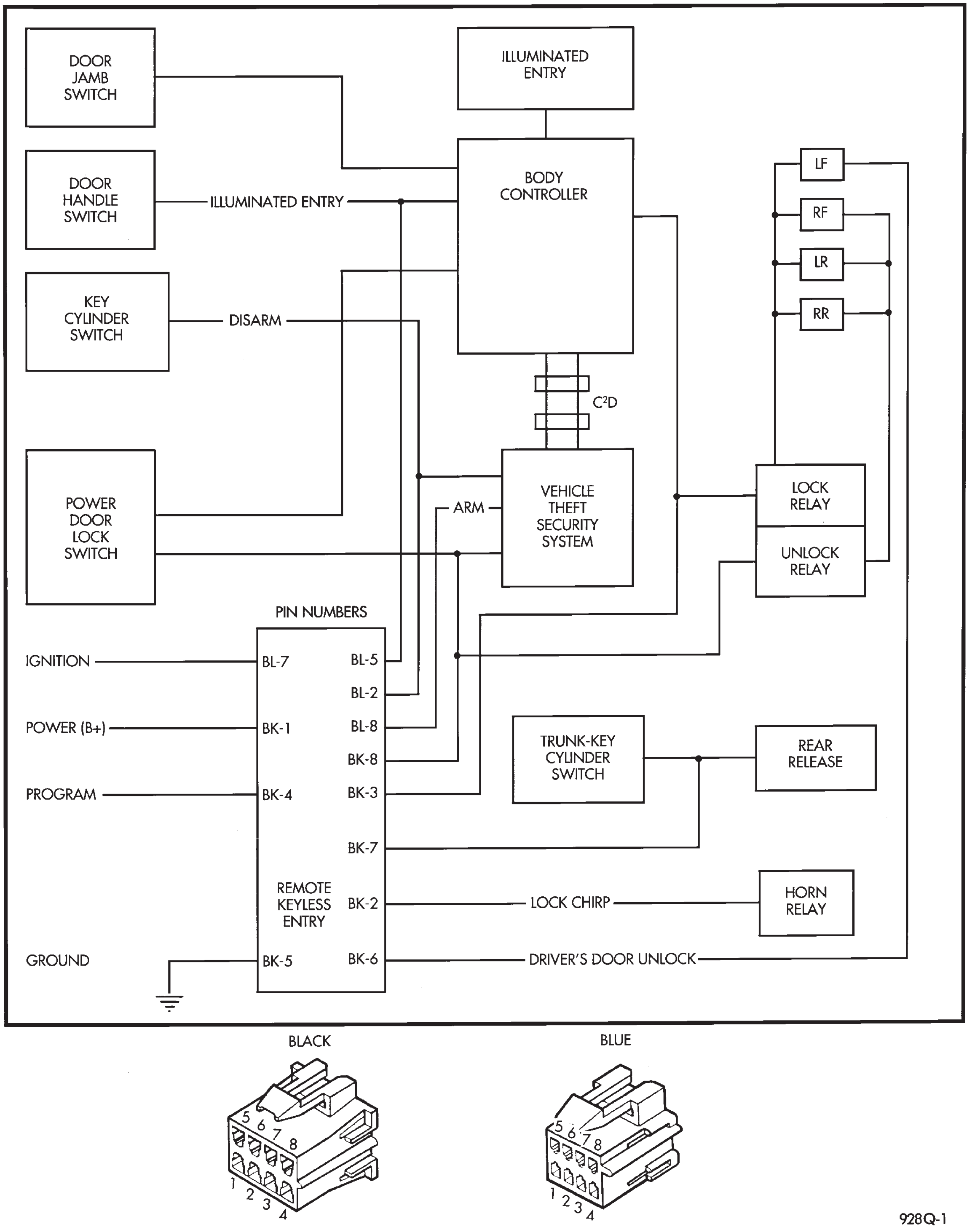


Fig. 12 Block Wiring Diagram

AA BODY

Uses a power door lock inhibit relay. The relay is located above the glove box compartment.

INHIBIT RELAY

(1) Using a voltmeter, test for battery voltage at pin 4. If no voltage check fuse 15 (Fig. 13).

(2) Using a ohmmeter, check for continuity to ground at pin 8. If no continuity to ground, check instrument panel ground.

(3) To check pin 5:

(a) The key is in the ignition switch and a door is open.

(b) The key is in the ignition switch and the headlamps are ON.

(c) Test for continuity to ground.

(d) If not, the relay contact is open or the relay is being energized when it should not be. Pin 5 feeds the ground from the relay to door lock switch.

(4) To check pin 6:

(a) The key is in the ignition switch and a door is open.

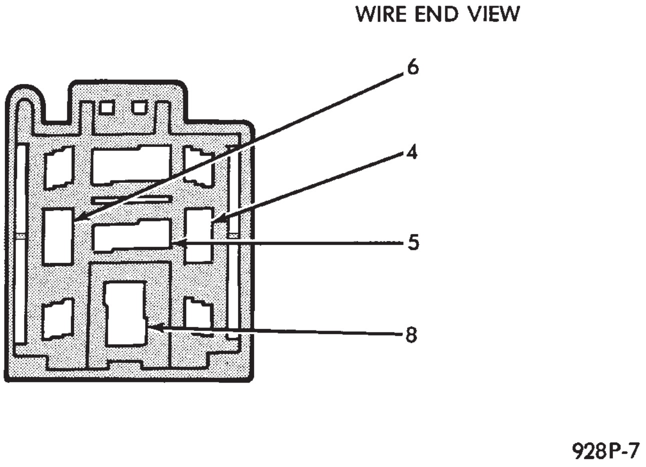


Fig. 13 Inhibit Relay Connector

(b) The key is in the ignition switch and the headlamps are ON.

(c) Test for continuity to ground.

(d) If not, check key in switch, headlamps on switch and/or door jamb switches. Pin 6, feeds ground from key in switch to the relay.

VEHICLE THEFT SECURITY SYSTEM

CONTENTS

GENERAL INFORMATION

JUMP-STARTING, VEHICLE EQUIPPED WITH THEFT SECURITY SYSTEM. After the booster battery has been connected, the Theft System must be turned OFF. Using the key, lock then unlock either front door. This turns the Theft System OFF and the remainder of the Jump-Starting procedure can be followed.

If this procedure is not followed, the Theft System electronics will prevent the engine from starting.

If a new Powertrain Control Module is installed, the engine has to be cranked 20 times before the alarm system activated.

This passive system is designed to protect against whole vehicle theft. The system monitors vehicle doors, hood, trunk key cylinder, and ignition action for unauthorized operation. The alarm activates by sounding the horn, flashing the park and tail lamps, and providing an engine kill feature (Fig. 1).

Passive arming occurs upon normal vehicle exit, open door, lock with power locks, close door. The SET lamp in the panel will flash for 15 seconds, indicating that arming is in progress. If no monitored systems are activated during this period, the system will arm. If the hood or trunk key cylinder switches are not sensed by the system. The SET lamp will remain lit during the arming process, although the system will still arm. The system is to be considered as an active armed system when using the Remote Keyless Entry. If the SET lamp does not illuminate at all upon door closing it indicates that the system is not arming.

Passive disarming occurs upon normal vehicle entry unlocking either door with the key, or unlocking using the Remote Keyless transmitter. This disarming will also halt the alarm once it has been activated.

Whenever the battery is disconnected and reconnected, the Vehicle Theft Security System enters power up alarm mode which flashes the park and tail lamps and prevents the engine from running. To exit this mode, the system must be disarmed as mentioned above.

A tamper alert exists to notify the driver that the alarm had been activated, and the alarm has since timed-out for more than 18 minutes. This alert consists of 3 horn pulses when the vehicle is disarmed.

The alarm system will not arm if the doors are manually locked, providing a manual override of the alarm.

WHAT WILL TRIGGER THE SYSTEM

One of the following actions will trigger the system while it is armed. Without properly disarming system, by using the key or the remote transmitter.

(1) Opening the HOOD.
(2) Opening any DOOR.
(3) Removing the TRUNK KEY CYLINDER.
(4) Turning the IGNITION ON.
(5) The ignition switch can be turned to the accessory position without triggering alarm system.

SYSTEM SELF-TESTS

A diagnostics mode is available in the system to verify operation of all monitored switches or circuits. To enter diagnostics, cycle the ignition key to the accessory position 3 times, leaving the key in this position.

Upon entering diagnostics, the park and tail lamps will begin flashing to verify their operation. In addition, the horn will sound twice to indicate that the trunk key cylinder is in its proper position. Returning the ignition to the OFF position will stop the lamps from flashing while keeping the system in diagnostics.

While in diagnostics mode, a horn pulse should occur at each of the following events indicating proper operation:

(1) Beginning with all doors closed, open then close each door. The horn will sound when the door ajar switch closes, and then again when the switch opens. There must be a 1 second delay between closing and opening the switch.

(2) Open, then close the hood. The horn will sound when the hood is opened, and again when it is closed.

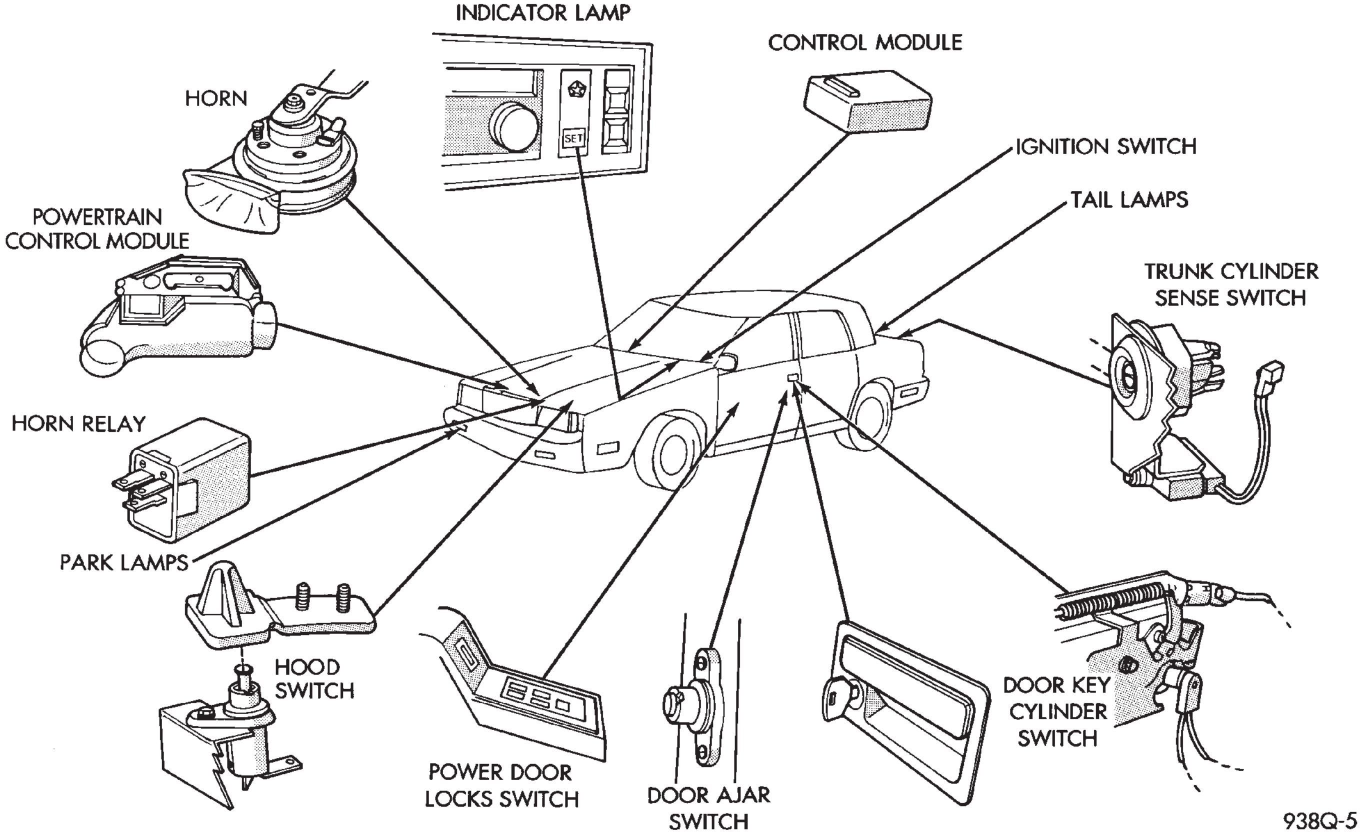


Fig. 1 Vehicle Theft Security System Components

(3) Activate the power door locks in both the LOCK and UNLOCK directions. The horn will sound after each activation.

(4) Rotate the key in each of the door lock cylinders to the unlock position. The horn will sound as the switch closes, and again when it opens. There must be a 1 second delay between changing switch states, or the horn will not sound.

- Press the LOCK button,horn will sound.
- Press the UNLOCK button, horn will sound.

(5) Cycle the key to the ignition RUN position. A single horn pulse will indicate proper operation of the ignition input. This will also take the module out of the diagnostics mode. For any of these tests, if the switch does not remain open or closed for at least 1 second, the horn will only sound once.

The lack of a horn pulse, during any operation, indicates a switch failure. Check for continuity at the switch, if this is good, check for an open or shorted wire between the switch and alarm module. Also, check if a new powertrain control module has been installed recently. Vehicle Theft Security System will not function until 20 engine cranks.

Whenever a Vehicle Theft Security System malfunction occurs, first verify that the wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Vehicle Theft Security System Diagnosis Chart (Fig. 3).

VEHICLE THEFT SECURITY SYSTEM MODULE REPLACEMENT

If the Vehicle Theft Security System module is being removed and no replacement module is being installed, the module wiring must be disconnected while the engine is running. Failure to do so will cause a no-start condition (Fig. 3 and 4).

(1) Remove lower right instrument panel silencer.

(2) Remove glove box assembly.

(3) Remove three attaching screws mounting the bracket to instrument panel.

(4) Lower bracket and module assembly, to disconnect wire connectors.

(5) Remove the Remote keyless module so to have access to the Security Module two screws attaching module to bracket.

(6) For installation reverse above procedures.

SECURITY SYSTEM HOOD SWITCH REPLACEMENT

(1) Remove screw from left inner fender (Fig. 5).

(2) Disconnect wiring.

(3) Remove switch.

(4) For installation reverse above procedures.

SECURITY SYSTEM DOOR SWITCH REPLACEMENT

(1) Remove door trim panel and water shield. Refer to Group 23, Body.

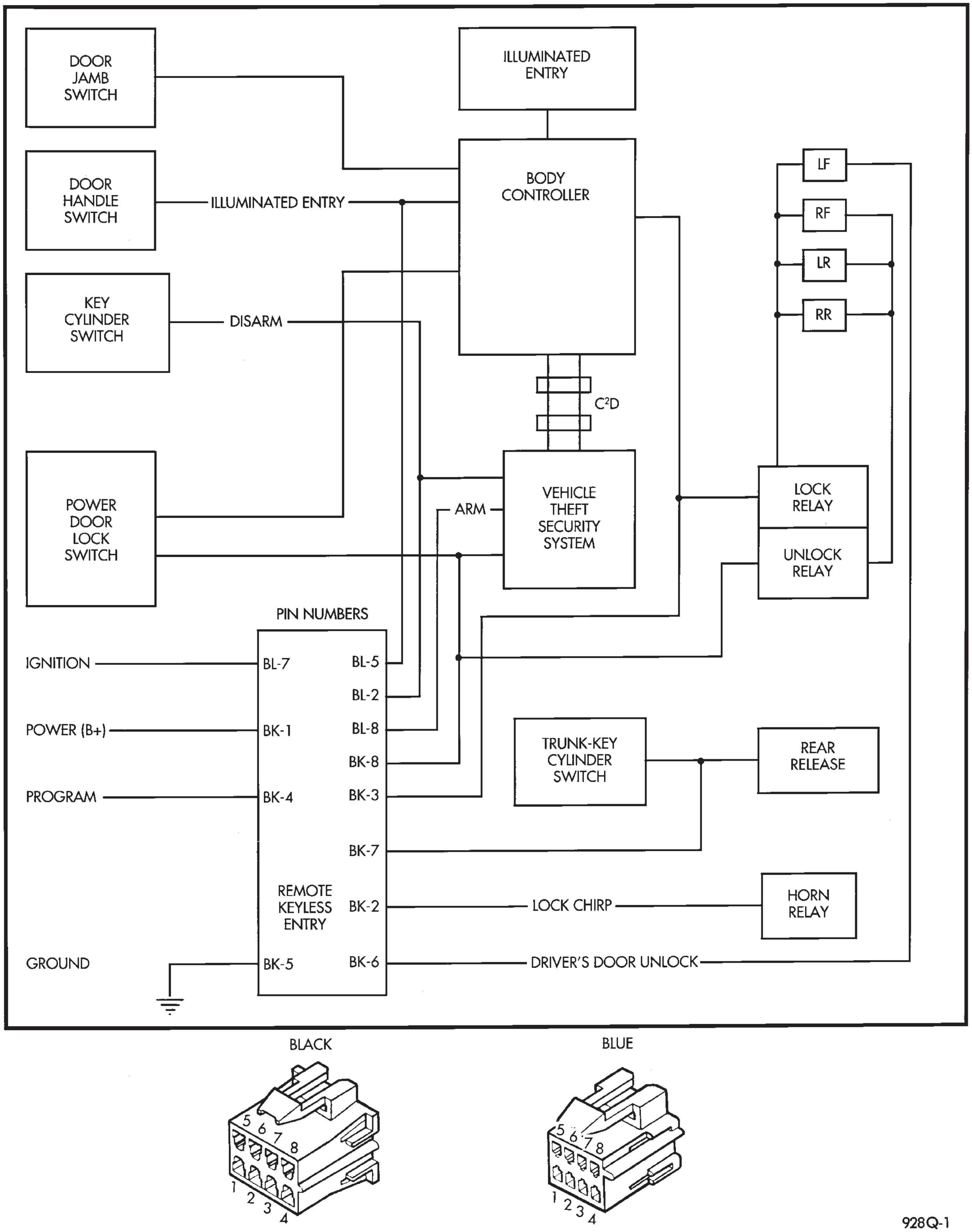


Fig. 2 Vehicle Theft Security System Diagnosis

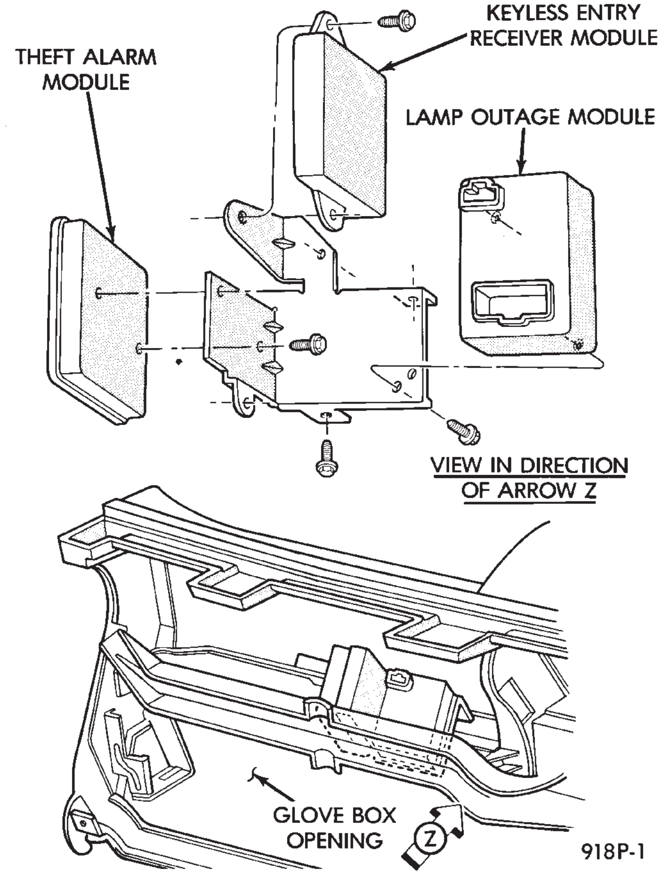


Fig. 3 Vehicle Theft Security System Module—AC and AY Bodies

(2) Remove illuminated entry switch wiring clip (Fig. 6).

(3) Remove disarming switch from door handle.

(4) For installation reverse above procedures.

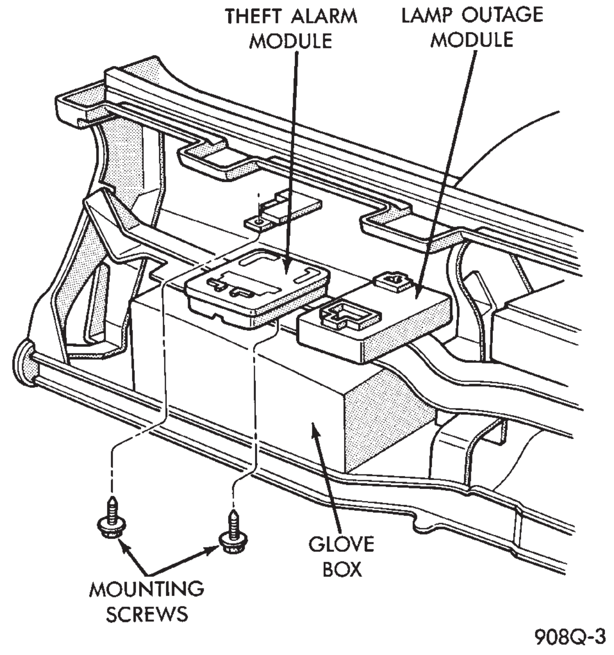


Fig. 4 Vehicle Theft Security System Module—AG and AJ Bodies

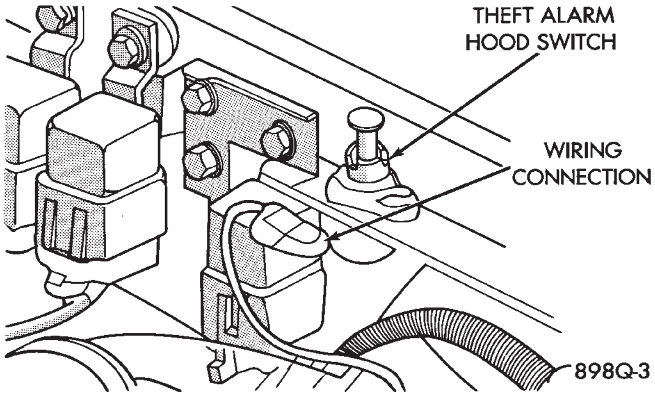


Fig. 5 Hood Switch

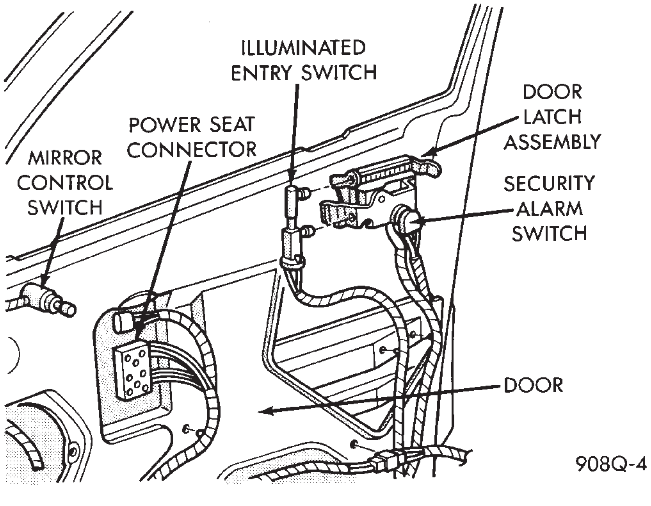


Fig. 6 Door Switch (Typical)

POWER SEATS

CONTENTS

GENERAL INFORMATION

Power seats can be adjusted in six different directions up, down, forward, back, tilt forward, or tilt rearward.

A three armature permanent magnet reversible motor is coupled through cables to worm gear box assemblies located in the seat tracks, providing the various seat movements.

The electrical circuit is protected by a 30 amp circuit breaker located on the fuse block.

TEST PROCEDURES

Before any testing is attempted the battery should be carefully charged and all connections and terminals cleaned and tightened to insure proper continuity and grounds.

With dome lamp on, apply switch in direction of failure. If dome lamp dims the seat motor is trying to work indicating mechanical jamming. If dome lamp does not dim, then proceed with the following electrical tests.

CIRCUIT BREAKER TEST

Find correct circuit breaker on fuse block. Pull out slightly but be sure that circuit breaker terminals still contact terminals in fuse block. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive wire, check both terminals of circuit breaker for battery voltage. If only one terminal checks at battery voltage, circuit breaker is defective and must be replaced. If neither terminal shows battery voltage, check for open or shorted circuit to circuit breaker.

HARNESS VOLTAGE TEST

The following test will determine whether or not voltage is continuous through the body harness to the switch.

(1) Remove power seat switch from mounting position and disconnect switch from wiring harness.

(2) Connect one lead of test light to ground terminal, black wire (BK) of center section, and touch other test light lead to red wire (RD) terminal.

(3) If test light comes on, harness to switch is good. If test light does not come on, perform circuit breaker test.

MOTOR TESTS

AA BODY

(1) Remove switch from mounting position and disconnect from harness.

(2) To check the center motor, connect a jumper wire between pin 5 and pin 3 (Fig. 1). Connect a second jumper wire between pin 7 and pin 4 If motor does not operate, reverse the jumpers, pin 5 to pin 4 and pin 7 to pin 3. If motor still does not operate check wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(3) To check the front motor, connect a jumper wire between pin 5 and pin 1 (Fig. 1). Connect a second jumper wire between pin 7 and pin 8. If motor does not operate, reverse the jumpers, pin 5 to pin 8 and pin 7 to pin 1. If motor still does not operate check wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(4) To check the rear motor, connect a covered jumper wire between pin 5 and pin 6 (Fig. 1). Connect a second

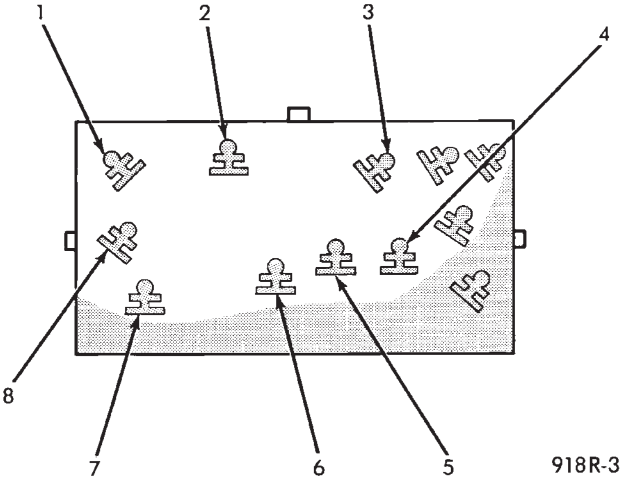


Fig. 1 Power Seat Switch Connector—AA Body

jumper wire between pin 7 and 2.If motor does not operate, reverse the jumpers, pin 5 to pin 2 and pin 7 to 6. If motor still does not operate check wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(5) If all motors and the seat operate properly, perform Switch Test.

AG & AJ BODIES

(1) Remove switch from mounting position and disconnect from harness.

(2) To check the front motor, connect a jumper wire between cavity number 2 and cavity number 9 (Fig. 2). Connect a second jumper wire between cavity number 6 and cavity number 5. If the motor does not operate, reverse the jumpers, 2 to 5 and 6 to 9. If motor still does not operate check wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(3) To check the center motor, connect a jumper wire between cavity number 2 and cavity number 8. Connect a second jumper wire between cavity 6 and cavity number 7. If the motor does not operate, reverse the jumpers, 2 to 7 and 6 to 8. If motor still does not operate check wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(4) To check the rear motor, connect a jumper between cavity number 2 and cavity number 10. Connect a second jumper wire between cavity number 6 and cavity number 3. If the motor does not operate, reverse the jumpers, 2 to 3 and 6 to 10. If motor still does not operate, check wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(5) To check the seat back recliner motor if equipped, connect a jumper wire be tween cavity number 2 and cavity number 1. Connect a second jumper wire between cavity number 6 and cavity number 11. If the motor does not operate, reverse the jumpers (2 to 11 and 6 to 1). If motor still does not operate check wiring be tween switch connector and motor assembly. If wiring checks good replace motor assembly.

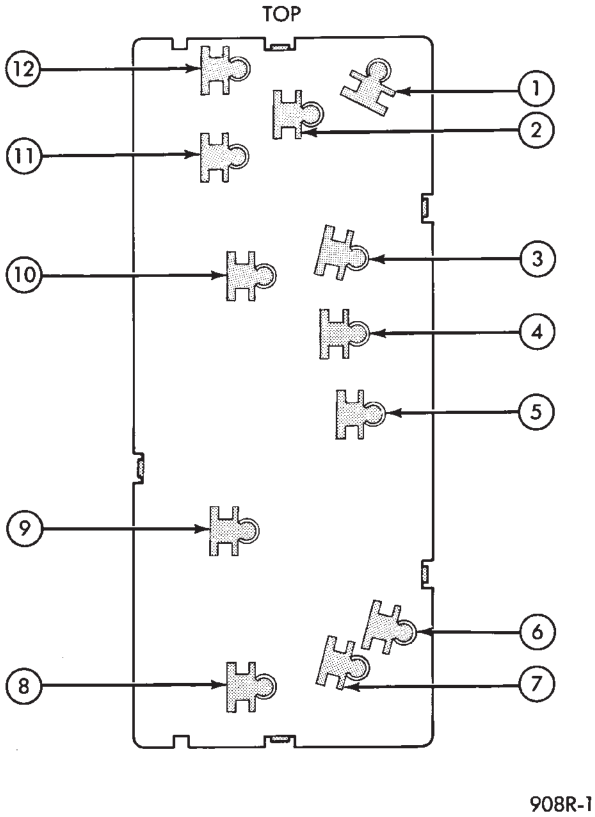


Fig. 2 Power Seat Switch Connector—AG & AJ Bodies

(6) If all motors and the seat operate properly, perform Switch Test.

AC AND AY BODIES

The following tests do not apply to left seat on vehicles equipped with memory mirrors/seats. Refer to test procedures for power memory mirrors/seats in this section.

(1) Remove switch from mounting position and disconnect from harness.

(2) To check the front motor, connect a jumper wire between cavity number 3 and cavity number 8 (Fig. 3 and 4). Connect a second jumper wire between cavity number 6 and cavity number 7. If the motor does not operate, reverse the jumpers, 3 to 7 and 6 to 8. If the motor still does not operate check the wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(3) To check the center motor, connect a jumper wire between cavity number 3 and cavity number 5. Connect a second jumper wire between cavity number 6 and cavity number 2. If the motor does not operate, reverse the jumpers, 3 to 2 and 6 to 5. If the motor still does not operate check the wiring between

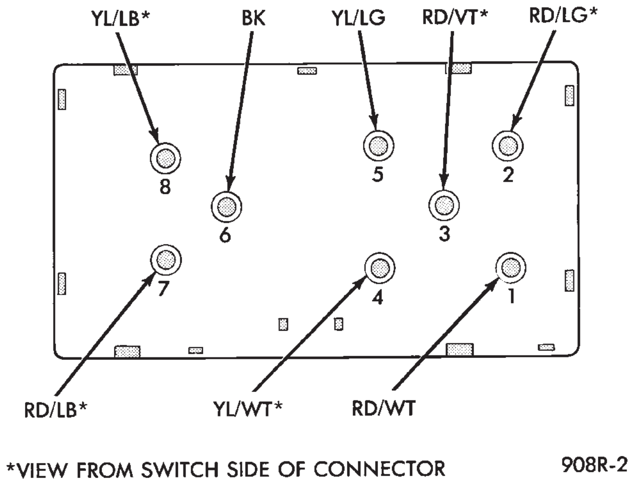


Fig. 3 Left Power Seat Switch—AC & AY Bodies

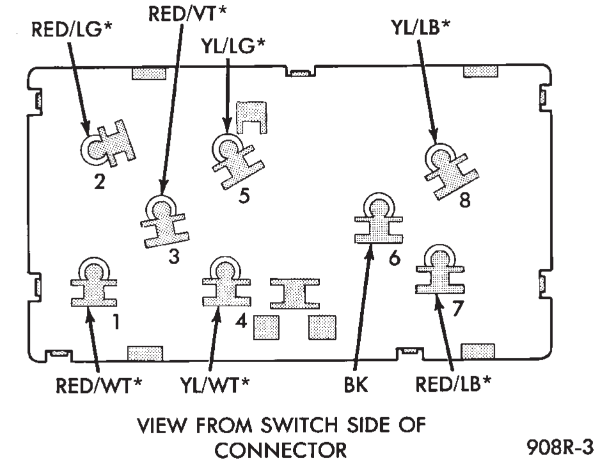


Fig. 4 Right Power Seat Switch—AC & AY Bodies

switch connector and motor assembly. If wiring checks good replace motor assembly.

(4) To check the rear motor, connect a jumper wire between cavity number 3 and cavity number 4. Connect a second jumper wire between cavity number 6 and cavity number 13. If the motor does not operate, reverse the jumpers, 3 to 13 and 6 to 4. If the motor still does not operate check the wiring between switch connector and motor assembly. If wiring checks good replace motor assembly.

(5) If all motors and the seat operate properly, perform Switch Test.

SWITCH TEST

To check the switch, remove the switch from its mounting position. Using an ohmmeter, perform switch continuity test (Fig. 5, 6 and 7). If there is no continuity at any one of the switch positions, replace the switch.

SEAT ASSEMBLY

REMOVAL

(1) Remove plastic covers.

(2) Remove adjuster attaching bolts and nuts from floor pan. Move adjuster as required for access.

(3) Disconnect battery negative cable.

(4) Disconnect wiring harness power lead at carpet.

(5) Remove seat assembly from vehicle.

INSTALLATION

(1) Position seat assembly in vehicle.

(2) Connect wiring harness.

(3) Install and tighten mounting bolts and nuts to 28 N•m (250 in. lbs.) torque.

(4) Connect battery negative cable and check seat operation.

(5) Install plastic covers.

HORIZONTAL AND VERTICAL TRANSMISSIONS

Transmissions are not removable and no maintenance is required. If transmission fails replace entire seat adjuster assembly.

ADJUSTER

REMOVAL

(1) Remove seat assembly from vehicle following procedure outlined under Seat Assembly Removal.

(2) Lay seat on its back on some clean surface.

(3) Remove bolts attaching adjuster to seat assembly (Fig. 8 Through 11).

(4) Disconnect wiring harness at switch if seat mounted switch is used.

(5) Remove tie straps holding cable housing to seat for power bench seat adjuster only.

INSTALLATION

(1) Lay seat on its back on a clean surface.

(2) Position adjuster to seat assembly and install attaching bolts.

(3) Connect wiring harness at switch and replace tie straps where removed.

(4) Install seat following procedure outlined under Seat Assembly Installation.

MOTOR

REMOVAL

Anytime the motor, cable and housing assemblies, or vertical and horizontal transmission assemblies, require maintenance, the assemblies must be synchronized to insure easy and proper operation.

(1) Remove seat assembly from vehicle following procedure outlined under Seat Assembly Removal (Fig. 8 through 11).

(2) Lay seat assembly on its back on a clean surface.

SWITCH POSITION	CONTINUITY BETWEEN
OFF	B-N, B-J, B-M, B-E, B-L, B-K
VERTICAL UP	A-E, A-M, B-N, B-J
VERTICAL DOWN	A-J, A-N, B-M, B-E
HORIZONTAL FORWARD	A-L, B-K
HORIZONTAL AFT	A-K, B-L
FRONT TILT UP	A-M, B-N
FRONT TILT DOWN	A-N, B-M
REAR TILT UP	A-E, B-J
REAR TILT DOWN	A-J, B-E

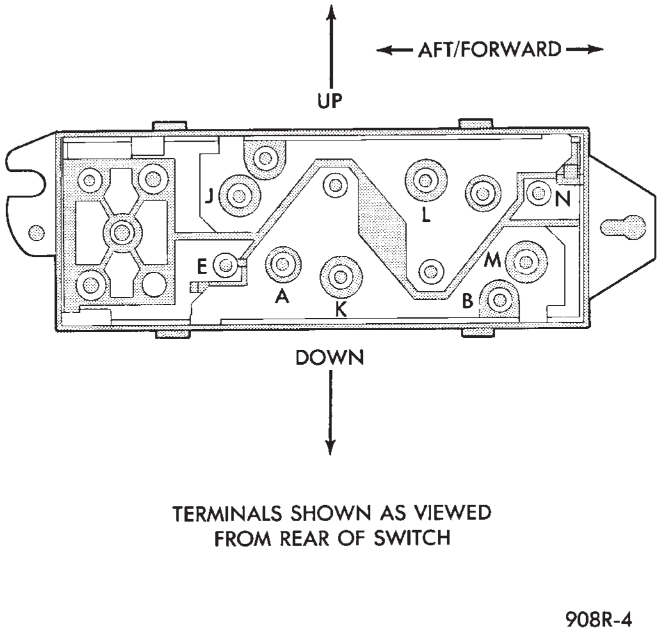


Fig. 5 Switch Continuity—AA Body

SWITCH POSITION	CONTINUITY BETWEEN
OFF	B-N, B-J, B-M, B-E, B-K, B-L
VERTICAL UP	B-M, B-E, A-N, A-J
VERTICAL DOWN	B-N, B-J, A-M, A-E
HORIZONTAL FORWARD	B-K, A-L
HORIZONTAL AFT	B-L, A-K
FRONT TILT UP	B-M, A-N
FRONT TILT DOWN	B-N, A-M
REAR TILT UP	B-E, A-J
REAR TILT DOWN	B-J, A-E

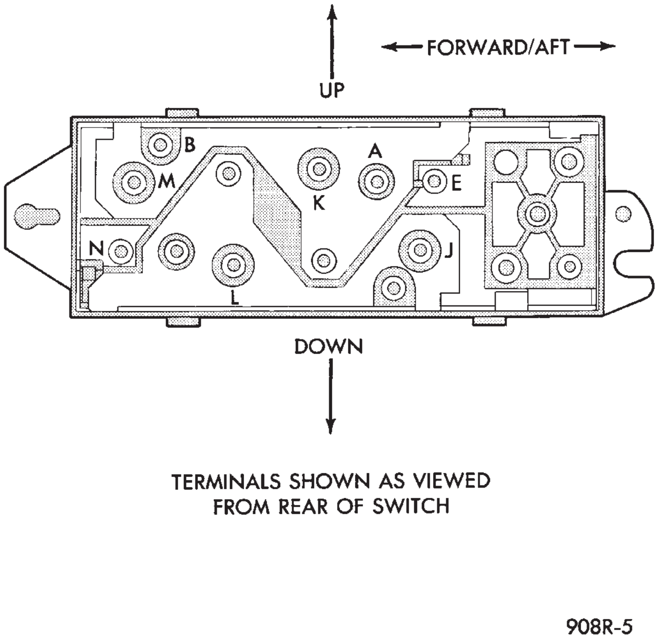


Fig. 6 Switch Continuity—AJ Body

(3) Remove motor mounting screws.

(4) Carefully disconnect housing and cables from motor assembly.

INSTALLATION

(1) Place motor assembly into position.

(2) Carefully connect cables and housings to motor assembly.

(3) Install mounting screws.

(4) Install bolt holding motor assembly to adjuster.

(5) Install seat following procedure outlined under Seat Assembly Installation.

ENTHUSIAST SEAT

AG and AJ body vehicles have, as an option, a special enthusiast seat package. The seat includes not only the normal six-way power seat adjuster, but also special lumbar air filled support bag and adjustable seat back side wings (Fig. 12). These mechanisms are adjusted by a switch located on the right side seat

SWITCH POSITION	CONTINUITY BETWEEN
OFF	B-N, B-J, B-M, B-K, B-E, B-L, G-C
VERTICAL UP	B-M, B-E, A-N, A-J
VERTICAL DOWN	B-N, B-J, A-M, A-E
HORIZONTAL FORWARD	B-K, A-L
HORIZONTAL AFT	B-L, A-K
FRONT TILT UP	B-M, A-N
FRONT TILT DOWN	B-N, A-M
REAR TILT UP	B-E, A-J
REAR TILT DOWN	B-J, A-E
RECLINER FORWARD	G-C, H-F
RECLINER AFT	G-F, H-C

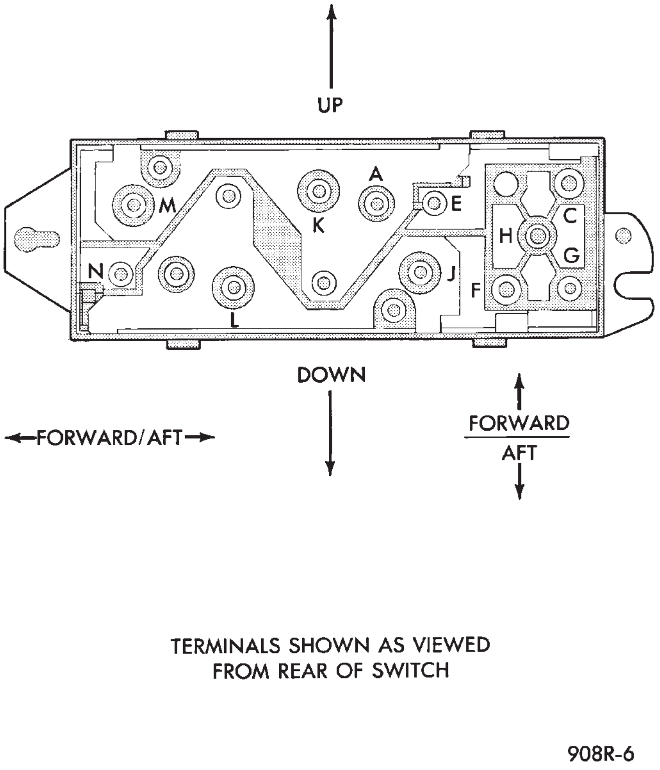


Fig. 7 Switch Continuity—AG & AJ Bodies (8-Way)

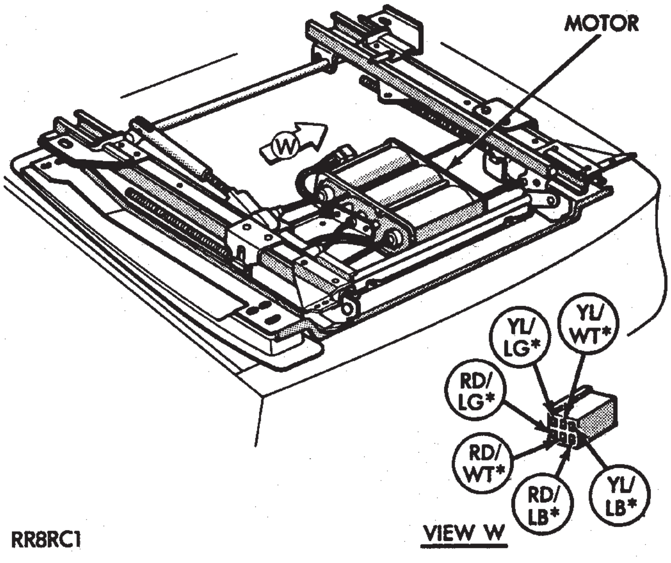


Fig. 8 Seat Adjuster—AC and AJ Bodies

wing. Refer to Owner Manual supplied with vehicle for complete instructions for seat operation.

SWITCH TEST

For switch testing, remove switch from its mounting location. Using an ohmmeter, refer to Figures 13 and 14 to determine if continuity is correct. If these results are not obtained, replace the switch.

SWITCH REPLACEMENT REMOVAL

(1) Remove left cushion side shield.

(2) Disconnect wiring from switch.

(3) Depress bezel retainers and push switch from bezel.

(4) For installation, reverse above procedure.

POWER MEMORY SEAT, RECLINER AND MIRRORS

AC & AY Body vehicles have, as an option, a special 2 position memory power seat, recliner and memory power outside rear view mirror system. Each of the components can be moved to a desired position by operating switches (Fig. 15). The seat and recliner use potentiometers as position sensors and the mirrors use rheostats to send their positioning information back to the control module in the driver's seat. After the desired seat and mirror position is set. The seat, recliner, and mirror position can be memorized at any time by pressing and release the Set button. Followed by pressing the Position 1 or 2 button, for the specific position desired. DO NOT press any other seat related switch for at least 5 seconds. However, for the driver to recall a position, the vehicle must not be moving and the seat belt must NOT be buckled. Refer to the Owners Manual supplied with the vehicle for complete instructions on system operation.

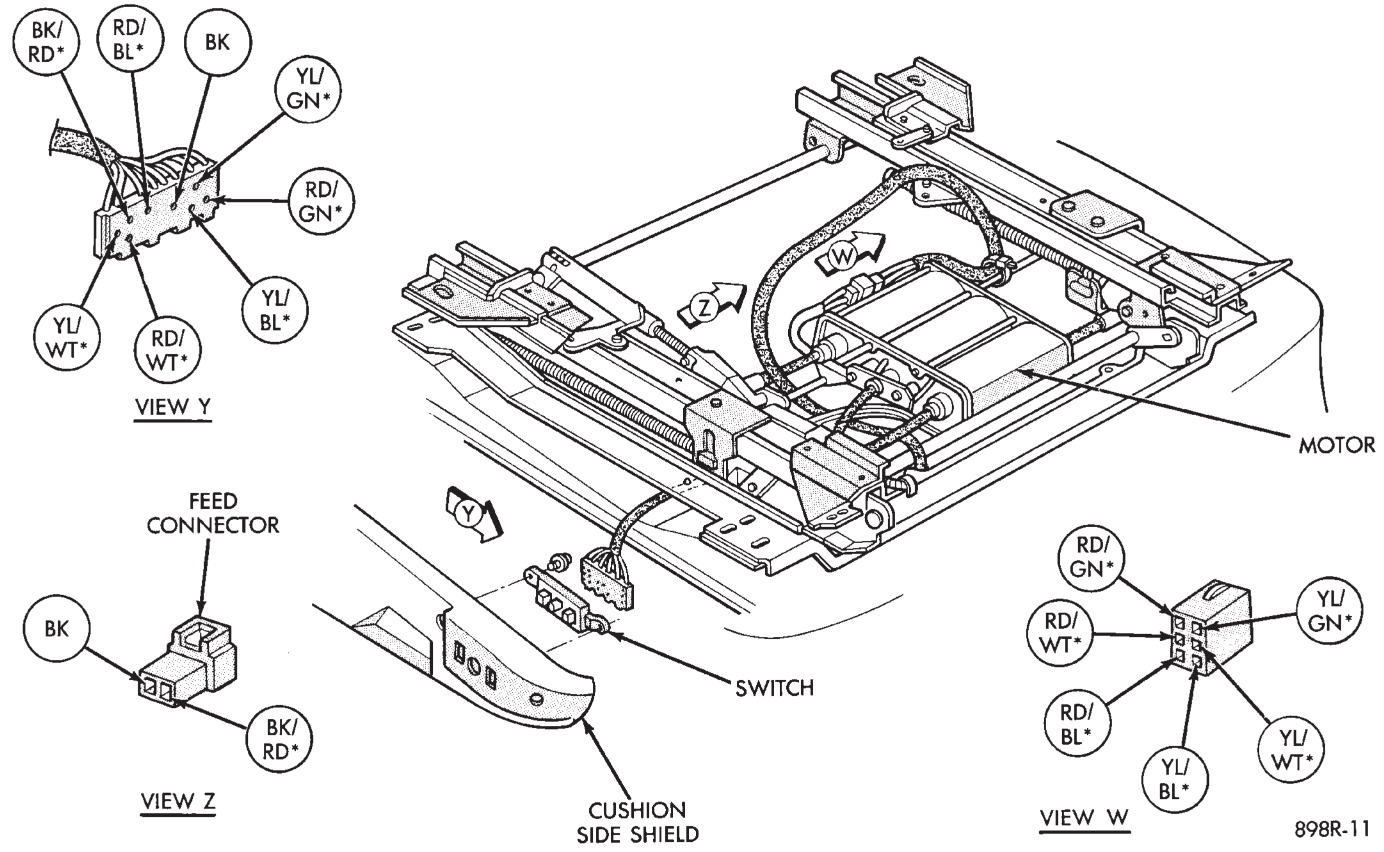


Fig. 9 Seat Adjuster—AA Body

SYSTEM SOFT LIMITS

This portion of the system becomes activated when the control module must shut off a specific seat, recliner or mirror motor because it has reached the end of its travel. When a mechanical stall condition is detected, the control module will set a soft limit in its memory and will not allow the motor to be driven past that point.

To override the soft limits, activate the seat or recliner switch twice in the desired direction holding the switch activated until the end of travel has been reached. Reactivate and hold the switch once more for three seconds. This will cause new soft limits to be set in the control module.

SETTING SYSTEM SOFT LIMITS

If the control module or motor assemblies have been replaced, the control module must learn its new soft limits. To do this, perform the memory seat diagnostic self-test. After the tests are completed, the control module will have learned and memorized its new soft limits.

TEST PROCEDURES

Before any testing is attempted, the battery should be carefully charged and all connections and terminals cleaned and tightened to insure proper continuity and grounds.

MEMORY SEAT AND MIRROR DIAGNOSTIC SELF-TESTS

The system has a built-in set of three self-tests which check all components in the system while giving a visual feedback.

To enter the first self-test mode, switch test, press memory position 1 and 2 buttons, hold for at least five seconds and no longer than ten seconds. Follow this immediately by pressing the Set button and hold for at least five seconds but less than ten seconds. Three seconds after the button is released, the seat, recliner and mirrors will move to a mid-travel position. Within ten seconds, press and release a seat button to activate a seat or recliner motor. All switches except the mirror switches may now be tested one at a time. The memory switches, Position 1 and 2 and Set buttons, may also be tested. A good switch contact actuation will NOD the seat. The seat nod consists of seat front up and seat track forward followed by seat front down and seat track rearward. The nod also includes both outside power rear view mirrors operating in the vertical plane. The system will continue NODDING for good switches until 10 seconds pass without any switch actuation.

Within 10 seconds of the last seat nod, press memory position 1 and 2 buttons for at least 5 seconds

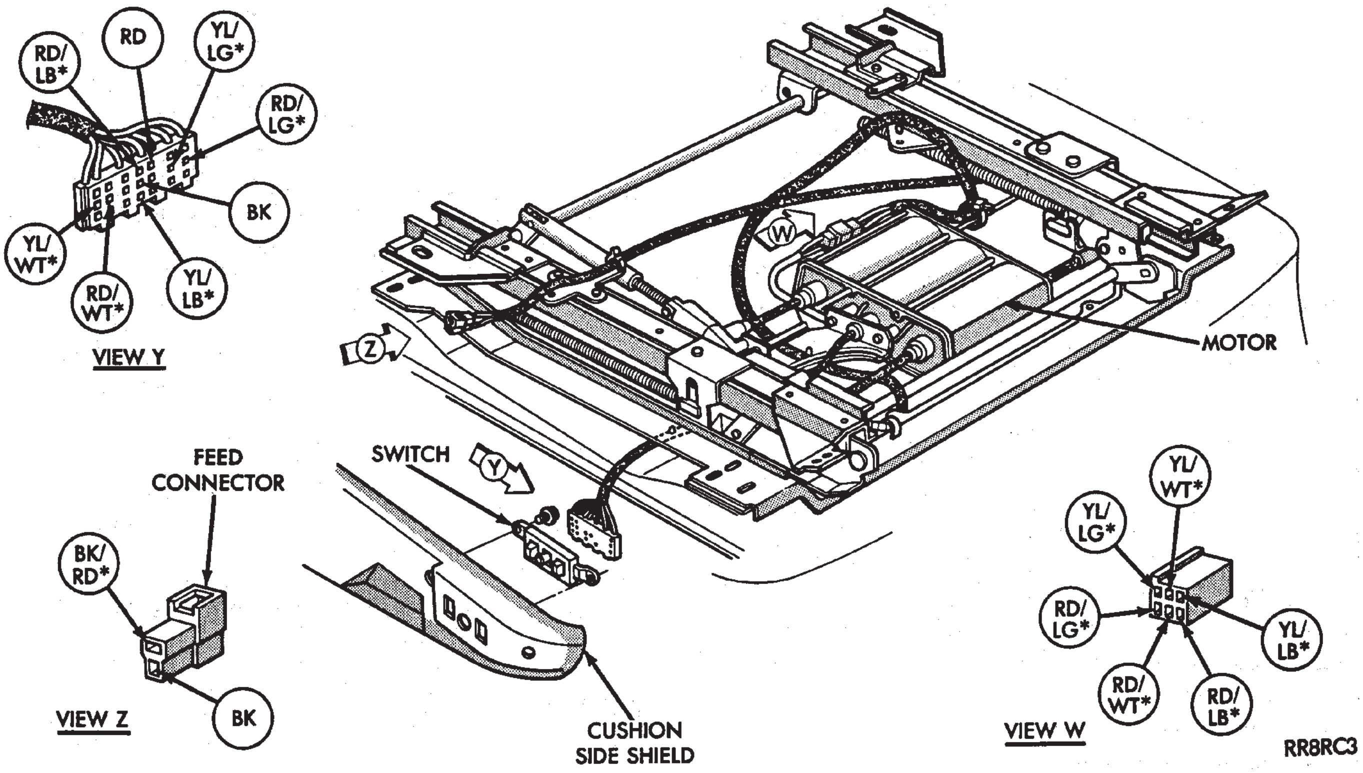


Fig. 10 Seat Adjuster—AP Body

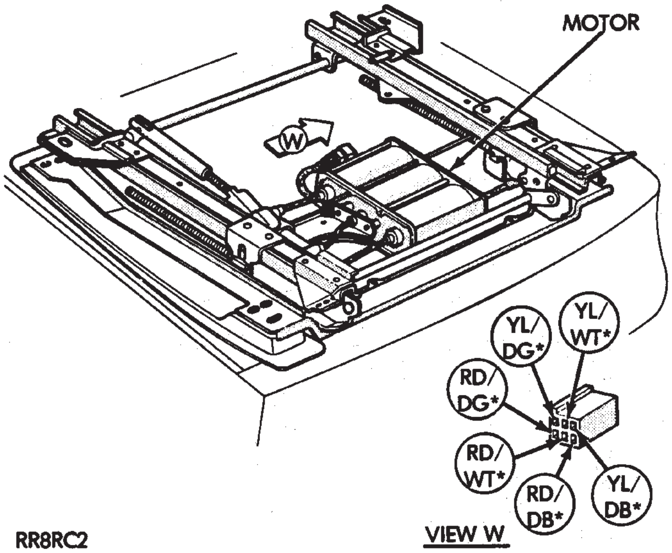


Fig. 11 Seat Adjuster—AG Body

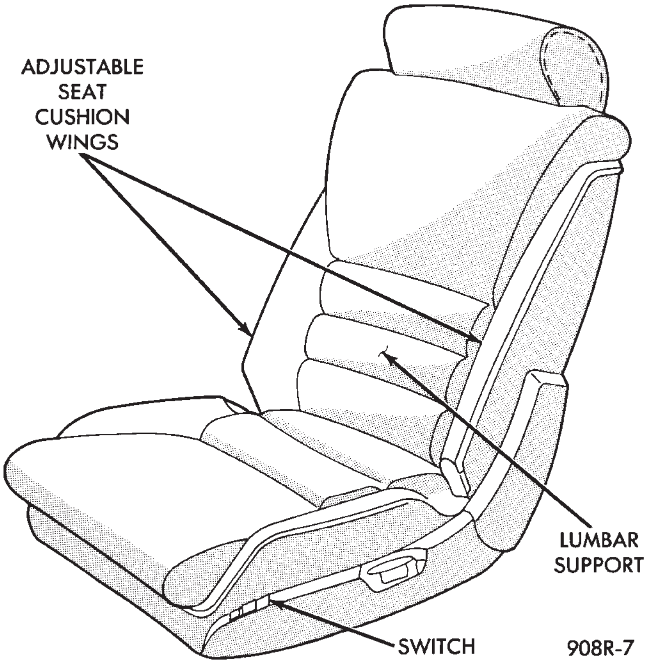
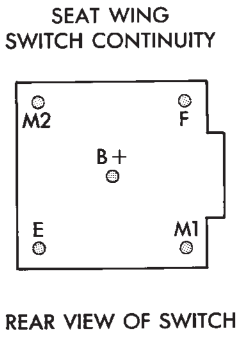


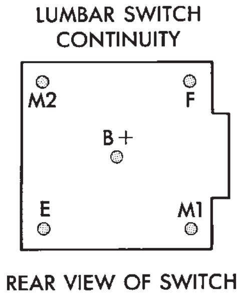
Fig. 12 Enthusiast Seat—AG and AJ Bodies



OFF	E-M1, F-M2
OUT	E-M1, M2-B+
IN	F-M2, M1-B+

908R-8

Fig. 13 Seat Wing Switch Continuity



OFF	E-M1, F-M2
INFLATE	E-M1, M2-B+
DEFLATE	F-M2, M1-B+

908R-9

Fig. 14 Lumbar Switch Continuity

but less than 10 seconds, and then release. The seat will move, after 3 seconds, to a full down and rearward position.

This is the seat check mode. The control module will now move the motors to a stall in forward, rearward, front up, front down, rear up, rear down, recliner forward, and recliner rear ward positions. If a problem exists, the control module will not move that part of the seat. After all motors have been run to stall, the system will pause for 3 seconds, then return to the mid-travel position.

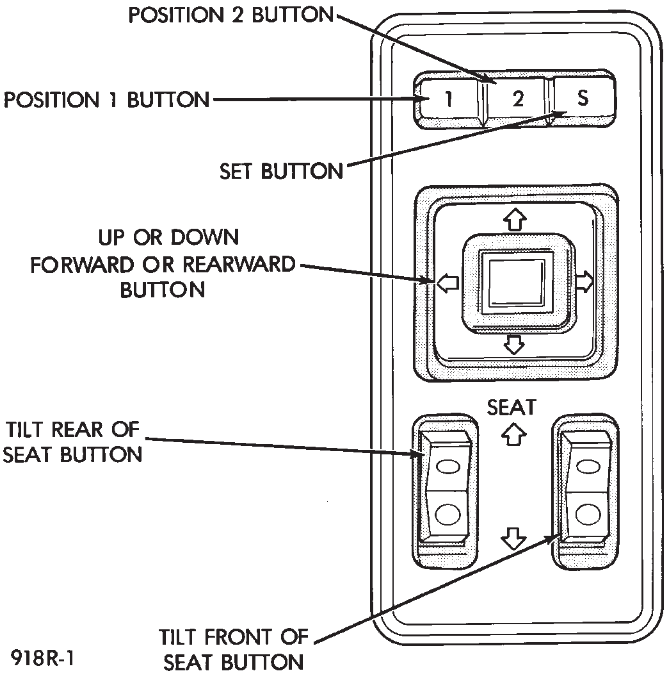


Fig. 15 Memory Seat Switch

The control module will now move the seat through its positions for two seconds run time.

If a problem has been found, the control module will go into a loop and just move the problem part of the system. To exit the loop, press the Set or Position 1 or 2 buttons or repair the fault; i.e.: repair a terminal push out, etc.

When the seat movements are complete, the system will return to its normal operating mode unless memory Position 1 and 2 buttons are held for at least five seconds, but less than ten seconds and then released. The seat will return to its mid-travel position and the mirrors will move full downward and to the left. This is the mirror check mode. The control module will then move the right mirror fully horizontal outboard, and horizontal inboard. This is followed by the left mirror fully horizontal inboard, horizontal out board, vertical up, and vertical down. Each motor will be driven until the associated mirror plane face has been stalled for up to 1-1/2 seconds at each end of travel. If the control module encounters a problem with any position sensing rheostat that is connected to each motor, that particular motor will not be actuated. After an other three second pause, the control module will again try running the mirror motors in the directions given above plus the right mirror vertical up and vertical down. Any motor that has no problem will run for two seconds in each of the given directions.

If a problem is found, the control module will go into a loop and move only the problem part of the system. To exit the loop, repair the fault, or press the Set, Position 1 or 2 buttons. The control module will then finish the motor actuation that are shown above. When the control module has finished, it will return to the normal operating mode after ten seconds if no further switches are activated.

The control module will also return to normal operating mode if any manual seat or recliner movement switch is actuated during the ten second timeout.

If the system has found a problem, refer to the appropriate diagnosis condition.

POWER MEMORY SEAT, RECLINER AND MIRRORS DIAGNOSIS

Before any diagnosis is done on the system, move the seat switches and listen for relays clicking in the control module under the seat. If relays can be heard, the main battery and ground circuits to the control module as well as the battery circuit to the switches in the driver's door are good.

When checking for voltage or continuity, always use a volt/ohm meter to get accurate readings. The seat and recliner switches must be activated to check for voltage at the seat and recliner motors or at the input to the control module from the switches.

The control module creates a special voltage supply for the position sensing functions. It also shuts down after five seconds, in order to check this or any other voltage being fed back to the control module. A switch may have to be activated more than once to verify a voltage reading. The voltage from the control module that feeds the seat and recliner position sensing potentiometer, will be between 4.5 to 5 volts. For simplicity in the diagnosis section, the feed voltage will be called 5 volts. On the position sensing wires, these voltages will always be less than 5 volts but more than 0 volts. Typically the high level is at a maximum of about 4.25 volts and the low level can be as little as 0.1 volts.

If any seat or recliner potentiometer or mirror rheostat position sense wires are crossed, the control module will not move that part of the system. The seat or mirror will be in a fault diagnostic mode.

CONDITION: SYSTEM WILL NOT OPERATE.

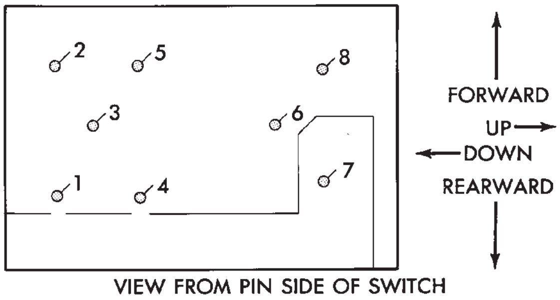
PROCEDURE

(1) Check for forward/rearward operation of recliner. If not operable, check for an open or loose circuit breaker mounted in board on the relay bank in cavity 15.

(2) Check for continuity between 2-way connector under driver's seat and pin 1 at control module 10-way connector (Fig. 16 and 17).

(3) Check for continuity between 2-way connector under driver's seat and pin 6 at control module 10-way connector.

(4) Check for any movement of the seat by operating the seat switch.If movement the circuit is good into the control module.



SWITCH POSITION	CONTINUITY BETWEEN
NO SWITCH OPERATED	PINS 6 AND 8; PINS 6 AND 7 PINS 6 AND 5; PINS 6 AND 4 PINS 6 AND 2; PINS 6 AND 1
FRONT ROCKER UP	PINS 3 AND 5
FRONT ROCKER DOWN	PINS 3 AND 2
REAR ROCKER UP	PINS 3 AND 4
REAR ROCKER DOWN	PINS 3 AND 1
SQUARE KNOB UP	PINS 3 AND 5; PINS 3 AND 4
SQUARE KNOB DOWN	PINS 3 AND 2; PINS 3 AND 1
SQUARE KNOB FORWARD	PINS 3 AND 8
SQUARE KNOB REARWARD	PINS 3 AND 7

908R-10

Fig. 16 Memory Seat Switch Continuity

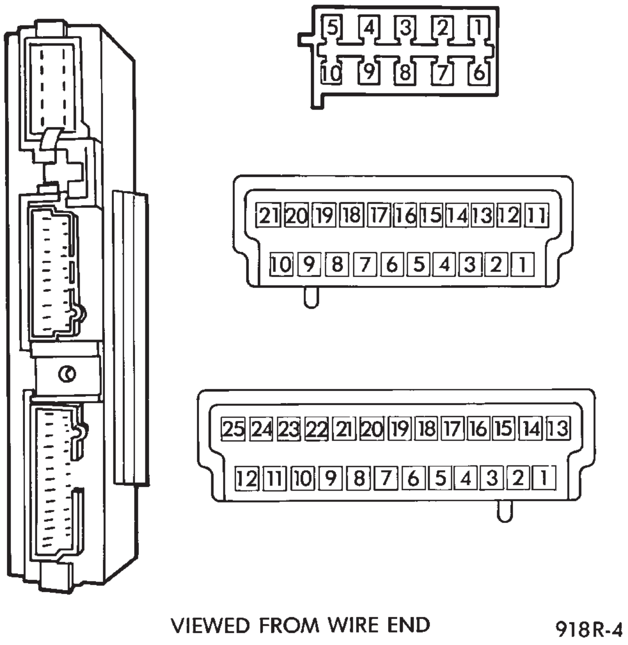


Fig. 17 Memory Seat Module Connectors

(5) No movement check for an open or loose fuse in cavity 15 of the fuse block.

(6) Check for battery voltage to pin 3 of driver's power seat switch.

(7) If battery is good, check for continuity of driver's power seat switch. Refer to Power Memory Seat Switch Continuity (Fig. 16).

(8) Check that all connectors are securely plugged into control module under driver's seat with no terminal push outs.

(9) No correctable faults are found in the above steps. The battery voltage and ground circuits are good into the control module. There is battery voltage through the seat switch to the control module. Then replace the control module.

(10) If the control module must be replaced, open it and observe the non-relay side of the printed circuit board. The module may be damaged by an intermittent short on the inside of the recliner switch. If a trace is burnt open near the 10-way connector, may be caused by the recliner switch (Fig. 18).

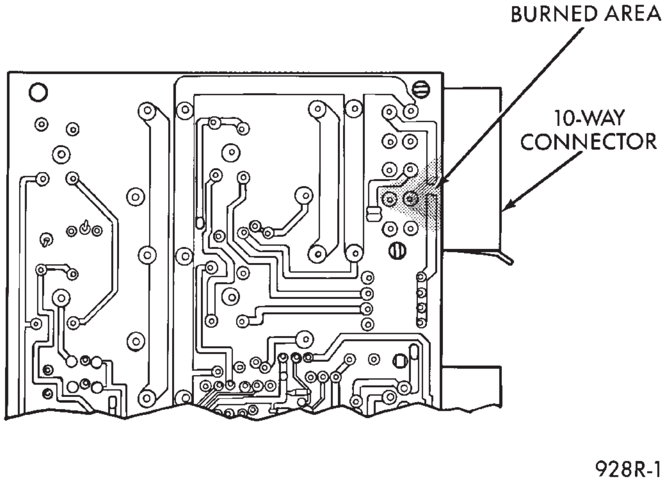


Fig. 18 Memory Module Burnt Area

(11) If module is burnt, remove recliner switch. Open the switch and observe the movable contacts staking at the staked end. If the contact, arm can be rotated, by a sideways motion, the switch must be replaced. This will prevent the new control module from damaged by the switch.

CONDITION: NO RECLINER MOTION FORWARD OR REARWARD AND NO RELAYS CAN BE HEARD CLICKING WHEN THE RECLINER SWITCH IS ACTIVATED.

PROCEDURE

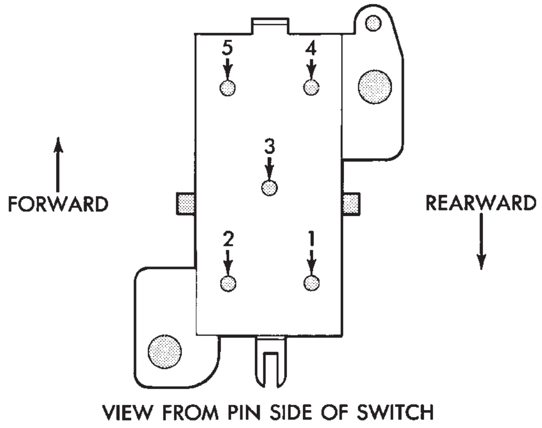
(1) Check for battery voltage at pin 11 of the control module 21-way connector.

(2) Check for battery voltage at pin 3 of the recliner switch connector.

(3) Check for ground at pin 1 of the control module 21-way connector.

(4) Check for ground at both pins 1 and 5 of recliner switch connector. If ground is missing at only one of these pins, repair or replace the seat wiring harness.

(5) If battery voltage and ground are correct to the recliner switch connector, check continuity of the recliner switch. Refer to Left Power Memory Recliner Switch Continuity (Fig. 19).



SWITCH POSITION	CONTINUITY BETWEEN
NO SWITCH OPERATION	PINS 5 AND 2; PINS 1 AND 4
RECLINER FORWARD	PINS 3 AND 2
RECLINER REARWARD	PINS 3 AND 4

908R-11

Fig. 19 Memory Recliner Switch Continuity

CONDITION: NO RECLINER MOTION FORWARD, AND A RELAY CAN BE HEARD CLICKING WHEN THE RECLINER SWITCH IS ACTIVATED.

PROCEDURE

(1) Check for battery voltage at pin 2 of the control module 10-way connector with the recliner switch activated.

(2) Check for ground at pin 4 of the control module 10-way connector with the recliner switch activated.

(3) If battery voltage and ground are NOT present at the above pins of the 10-way connector, replace the control module. If battery and ground are present, then continue procedure.

(4) Check for battery voltage and ground at recliner motor connector in seat.

(5) If recliner motor will not operate, refer to Service Procedure for Recliner Motor and Cable.

CONDITION: NO RECLINER MOTION REARWARD, AND RELAYS CAN BE HEARD CLICKING WHEN THE RECLINER SWITCH IS ACTIVATED.

PROCEDURE

(1) Check for ground at pin 2 of the control module 10-way connector with the recliner switch activated.

(2) Check for battery voltage at pin 4 of the control module 10-way connector with the recliner switch activated.

(3) If battery voltage and ground are NOT present at the above pins of the 10-way connector, replace the control module. If battery and ground are present, then continue procedure.

(4) Check for battery voltage and ground at recliner motor connector in seat.

(5) If recliner motor will not operate, refer to Service Procedure for Recliner Motor and Cable.

CONDITION: NO RECLINER MANUAL MOVEMENT FORWARD OR REARWARD, RECLINER MOVES IN RECALL MODE ONLY.

PROCEDURE

(1) Check wiring harness in seat between control module and recliner switch for shorted wires to ground or crossed wires. If the ground pins 1 and 5 are in the wrong cavities of the recliner switch connector, the control module may be damaged. Determine the cause and replace the control module after repairing the wiring if necessary.

(2) The recliner moves forward in the recall mode only. Press the recliner switch in the forward direction and check for battery voltage at pin 2 of the recliner switch connector and at pin 5 of the 21-way control module connector.

(3) The recliner moves rearward in the recall mode only. Press the recliner switch in the rearward direction and check for battery voltage at pin 4 of the recliner switch connector and at pin 6 of the 21-way control module connector.

CONDITION: NO RECLINER MOVEMENT IN THE RECALL MODE, RECLINER WILL MOVE MANUALLY WITHOUT STALL DETECTION.

PROCEDURE

(1) Check for 5 volts at pin 9 of the control module 21-way connector (This is the 5 volt feed from the control module to the recliner position sensing resistor.

(2) Check for ground at pin 7 of the 21-way control module connector. To test for ground, one lead of the voltmeter must be connected to the 5 volt supply for the control module. If the sense voltage and ground are NOT present, at the above pins of the 21-way control module connector when the recliner switch is pressed. Replace the control module since an in advertent application of battery voltage to the circuit could damaged the control module. If the circuits are present then continue this procedure.

(3) Check for 5 volts at pin 2 of the black 5-way connector plugged into the recliner motor end-bell.

(4) Check for ground at pin 4 of the black 5-way connector plugged into the recliner motor end-bell.

(5) Unplug the black 5-way connector and observe the male pins for deformation. If deformed, carefully straighten to mate properly with the connector. Carefully reconnect 5-way connector.

(6) Check for a voltage at pin 3 of the black 5-way connector plugged into the recliner motor end-bell with the recliner switch activated. Less than 5 volts when fully forward and more than 0 volts when fully reclined that is variable when the recliner is moving. This is the position sense voltage the control module must have or it will not move the recliner in recall since it has no reference for movement. To test for this voltage, one lead of the voltmeter must be connected to either pin 4 of the black 5-way connector or pin 7 of the 21-way connector. If the above steps have been followed and the voltage is 0, check for a seat wiring harness short to ground of this circuit, repair as necessary, before continuing with this procedure.

(7) Check for the position sense voltage at pin 3 of the control module 21-way connector. If the voltage appears correct, and varies as indicated in step (6) above and there is continuity back to the 5-way connector, then replace the control module.

CONDITION: NO SEAT OR RECLINER MOVEMENT FROM THE MANUAL SWITCHES. SEAT AND RECLINER WILL MOVE IN THE RECALL MODE ONLY.

PROCEDURE

(1) Check for a stuck switch contact in the recliner switch mounted in the driver's left seat side shield. Refer to the Memory Recliner Switch Continuity (Fig. 19).

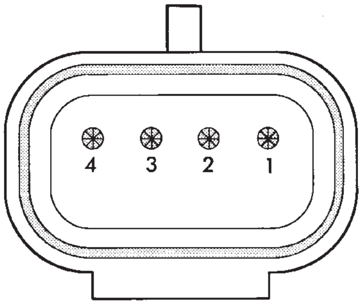
(2) Check for a stuck switch contact in the driver's power seat switch. Refer to Memory Seat Switch Continuity (Fig. 16).

CONDITION: NO MEMORY RECALL OF SEAT, RECLINER, OR MIRRORS. SEAT, RECLINER, AND MIRRORS WILL MOVE BY MANUAL SWITCH ACTUATION ONLY.

PROCEDURE

(1) Check for a stuck switch contact in the memory switch. Refer to the Memory Switch Continuity (Fig. 20).

(2) Check for battery voltage pin 1 of the memory switch (Fig. 20).



SWITCH POSITION		CONTINUITY BETWEEN
NO SWITCH OPERATED		NONE
"1"	ACTUATED	PINS 1 AND 2
"2"	ACTUATED	PINS 1 AND 3
"S" (SET)	ACTUATED	PINS 1 AND 4

908R-12

Fig. 20 Memory Switch Continuity

CONDITION: NO MEMORY RECALL OF SEAT, RECLINER, OR MIRRORS TO POSITION 1 ONLY. UNABLE TO ENTER DIAGNOSTIC SELF TEST MODES. POSITION 2 RECALL WORKS.

PROCEDURE

(1) Check for continuity of actuated memory position 1 switch. Refer to the Memory Switch Continuity (Fig. 19). If there is continuity, continue with procedure. If not replace switch.

(2) Check for a terminal push out at pin 2 of the memory switch connector.

(3) Check for battery voltage at pin 14 of the control module 25-way connector with position 1 switch actuated. If battery voltage is OK. There is no terminal push out, and the connector is properly seated. But no reaction from the control module, manually move the seat to a different position than 2. To insure that the Position 1 is not simply a duplicate of Position 2. If there is still no reaction of the control module to the actuation of the Position 1 button, then replace the control module.

CONDITION: NO MEMORY RECALL OF SEAT, RECLINER, OR MIRRORS TO POSITION 2 ONLY. UNABLE TO ENTER DIAGNOSTIC SELF TEST MODES. POSITION 1 RECALL WORKS.

PROCEDURE

(1) Check for continuity of actuated memory Position 2 button. Refer to the Memory Switch Continuity (Fig. 20). If there is continuity, continue with procedure. If not replace switch.

(2) Check for a terminal push out at pin 3 of the memory switch connector.

(3) Check for battery voltage at pin 1 of the control module 25-way connector with Position 2 button actuated. If battery voltage OK. There is no terminal push out, and the connector is properly seated. But no reaction from the control module, manually move the seat to a different position than 1. To insure that the position 2 is not simply a duplicate of position 1. If there is still no reaction of the control module to the actuation of the 2 switch, then replace the control module.

CONDITION: ACTUATION OF THE SET BUTTON WILL NOT SET ANY NEW POSITIONS IN MEMORY. UNABLE TO ENTER DIAGNOSTIC SELF TEST MODES. ONLY PREVIOUSLY SET MEMORY POSITIONS CAN BE RECALLED.

PROCEDURE

(1) Check for continuity of actuated memory switch Set button. Refer to the Memory Switch Continuity (Fig. 20). If there is continuity, continue with procedure. If not replace switch.

(2) Check for a terminal push out at pin 4 of the memory switch connector.

(3) Check for battery voltage at pin 2 of the control module 25-way connector with the Set button actuated. If battery voltage is OK, there is no terminal push out, and the connector is properly seated then replace the control module.

CONDITION: NO MEMORY POSITIONS CAN BE RECALLED AND THE MEMORY SEAT DIAGNOSTIC SELF SWITCH CHECK IS THE ONLY PART OF SELF TEST THAT WORKS. THE SEAT MOVES OK WITH MANUAL SWITCH.

PROCEDURE

(1) Check for continuity of the seat belt buckle switch in its unbuckled state. Operate the buckle switch to ensure the contact opens when the seat belt is buckled.

(2) Check for continuity between pin 2 of the 2-way seat belt buckle switch connector, harness side, to ground.

(3) Check for continuity between pin 1 of the 2-way seat belt buckle switch connector, harness side, to pin 13 of the control module 25-way connector.

CONDITION: MEMORY RECALLS CAN BE MADE WHILE THE VEHICLE IS IN MOTION WITH THE SEAT BELT UNBUCKLED.

PROCEDURE

Check for continuity of the circuit between the left side instrument panel blue 16-way connector cavity 9 and pin 7 of the control module 25-way connector. The vehicle speed sensor signal can be tested with a volt/ohmmeter at pin 7 of the control module 25-way connector. Turn on the vehicle ignition and check for a 5 volt signal as the vehicle is moved about 3 to 5 feet. If not repair open wiring, terminal push out, bad crimp, drive in vehicle speed sensor, etc., as necessary to correct condition. Ensure that the 25-way connector is plugged into the control module securely. Road test vehicle after repairs have been made to ensure that no recalls can occur while moving.

CONDITION: INSTRUMENT CLUSTER SPEEDOMETER STAYS AT 0 MPH/ (0 KM/H) WHILE VEHICLE IS MOVING, BODY COMPUTER DOES NOT LOCK DOORS AT 15 MPH (24 KM/H), AND THE SPEED CONTROL WILL NOT ACCEPT A SPEED SET.

PROCEDURE

(1) Remove driver's seat anchor bolts and nuts. Adjust the driver's seat to a safe driving position. Disconnect the 25-way connector from the memory seat control module. Replace the driver's seat anchor bolts and nuts. Road test the vehicle to complete this diagnosis. If the doors lock, the cruise control accepts a set, and the speedometer now works, replace the Memory Seat control module.

(2) After replacing the Memory Seat control module, perform the memory seat diagnostic self tests. This teaches the new module it's soft limits and now re-road test the vehicle before returning it to the customer.

CONDITION: NO SEAT MOVEMENT IN THE RECALL MODE, SEAT WILL MOVE BY MANUAL SWITCH ACTUATION IN ALL DIRECTIONS WITHOUT STALL DETECTION.

PROCEDURE

(1) Check for 5 volts at pin 10 of the control module 25-way connector. This is the 5 volt feed from the control module to the seat track position sensing potentiometer.

(2) Check for ground at pin 8 of the control module 25-way connector. To test for ground, one lead of the voltmeter must be connected to either the 5 volt supply for the control module or the battery positive. If the sense voltage and ground are NOT present at the above pins of the 21-way control module connector. When the seat switch is pressed, replace the control module. An inadvertent application of battery voltage to the circuit could damaged the control module. If the voltage and ground circuits are present then continue this procedure.

(3) Check for 5 volts at pin 5 of the natural 5-way connector plugged into the power seat adjuster motors end-bell.

(4) Check for ground at pin 4 of the natural 5-way connector plugged into the power seat adjuster motors end-bell. If the power seat adjuster still has no movement in the recall mode, then continue this procedure.

(5) Disconnect the natural 5-way connector from the power seat adjuster motors end-bell.

(6) Check with an ohmmeter for a resistance reading that may be from 2600 to 4000 ohms between pins 4 and 5 of the motors end-bell connector. If there is an open circuit reading or the reading obtained falls outside this range, then replace the seat motor package assembly. After replacement of the seat motor package, reconnect all wiring connectors and reinstall seat assembly in vehicle. Operate the switches manually to cause maximum seat movement in all directions. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly.

CONDITION: NO SEAT TRACK FORWARD OR REARWARD MOVEMENT IN THE RECALL MODE, SEAT TRACK WILL MOVE FORWARD OR REARWARD BY MANUAL SWITCH ACTUATION WITHOUT STALL DETECTION.

PROCEDURE

(1) Check for a voltage at pin 12 of the control module 21-way connector. Less than 5 volts for the seat track fully forward and more than 0 volts when fully rearward. This voltage should vary corresponding to the position.

(2) Check for a voltage at pin 1 of the natural 5-way connector, Same as in step (1) above. The ground lead connected to pin 4 of the 5-way connector. If the voltage reading is at 0 volts, disconnect the 5-way natural connector and check for a short to ground in the harness. If no short is found, reconnect the connector and continue the procedure.

(3) Check for the voltage to vary as noted above, if it does not vary as the seat track is moved forward and rearward, the sensing potentiometer is defective. Replace the seat motor package assembly. After replacement of the seat motor package, reconnect all wiring connectors and reinstall seat assembly in vehicle. Operate the switches manually to cause maximum seat movement in all directions. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly.

CONDITION: NO SEAT TRACK FRONT UP OR DOWN MOVEMENT IN THE RECALL MODE, SEAT TRACK FRONT WILL MOVE UP OR DOWN BY MANUAL SWITCH ACTUATION WITHOUT STALL DETECTION.

PROCEDURE

(1) Check for a voltage at pin 2 of the control module 21-way connector. Less than 5 volts for the seat track front full up and more than 0 volts when fully down.

(2) Check for a voltage at pin 2 of the natural 5-way connector. Same as in step (1) above. With the ground lead of the meter at pin 4 of this connector. If the voltage reading is at 0 volts, disconnect the 5-way natural connector and check for a short to ground in the harness. If no short is found, reconnect the connector and continue the procedure.

(3) Check for the voltage to vary as noted above, if it does not vary as the seat track front is moved up and down, the sensing potentiometer is defective. Replace the seat motor package assembly. After replacement of the seat motor package, reconnect all wiring connectors and reinstall seat assembly in vehicle. Operate the switches manually to cause maximum seat movement in all directions. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly.

CONDITION: NO SEAT TRACK REAR UP OR DOWN MOVEMENT IN THE RECALL MODE, SEAT TRACK REAR WILL MOVE UP OR DOWN BY MANUAL SWITCH ACTUATION WITHOUT STALL DETECTION.

PROCEDURE

(1) Check for a voltage at pin 13 of the control module 21-way connector. Less than 5 volts for the seat track rear full up and more than 0 volts when fully down.

(2) Check for a voltage at pin 3 of the natural 5-way connector. Same as in step (1) above. The ground lead connected to pin 4 of the 5-way connector. If the voltage reading is at 0 volts, disconnect the 5-way natural connector and check for a short to ground in the harness. If no short is found, reconnect the connector and continue the procedure.

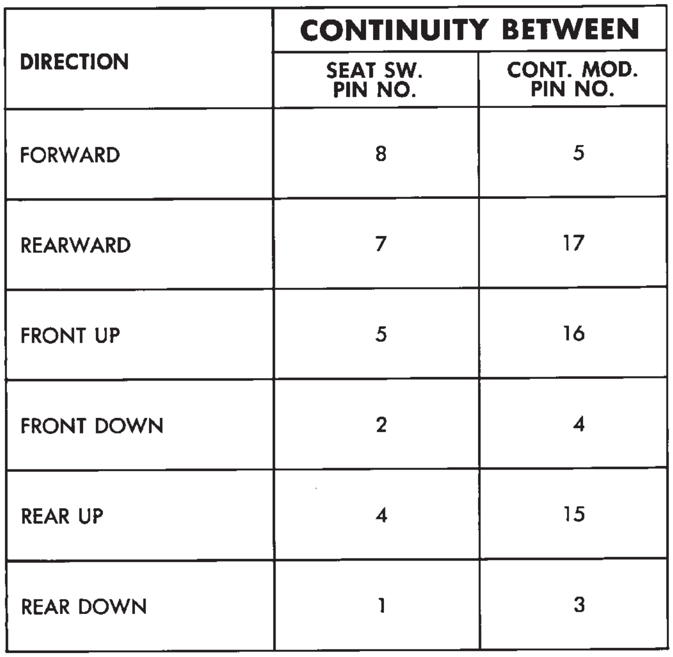
(3) Check for the voltage to vary as noted above, if it does not vary as the seat track rear is moved up and down, the sensing potentiometer is defective. Replace the seat motor package assembly. After replacement of the seat motor package, reconnect all wiring connectors and reinstall seat assembly in vehicle. Operate the switches manually to cause maximum seat movement in all directions. Perform the diagnostic self seat check so the control module will learn the new soft limits of the assembly.

CONDITION: NO MOVEMENT OF THE SEAT, SEAT WILL MOVE IN THE RECALL MODE ONLY.

PROCEDURE

(1) Check for battery voltage to terminal 3 of driver's power seat switch.

(2) Check for continuity of driver's power seat switch. Refer to Memory Seat Switch Continuity (Fig. 19). If switch is good, check for continuity between the driver's door switch and the 25-way connector in the control module in the driver's seat (Figs. 21 and 22).



DIRECTION	CONTINUITY BETWEEN	
	SEAT SW. PIN NO.	CONT. MOD. PIN NO.
FORWARD	8	5
REARWARD	7	17
FRONT UP	5	16
FRONT DOWN	2	4
REAR UP	4	15
REAR DOWN	1	3

908R-13

Fig. 21 Driver's Door Switch to 25-Way Connector at the Seat Control Module Continuity

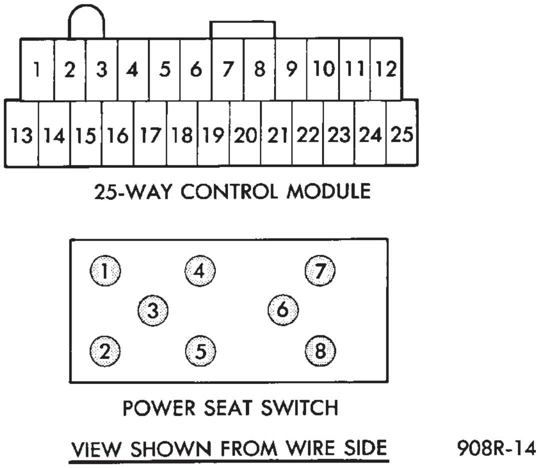


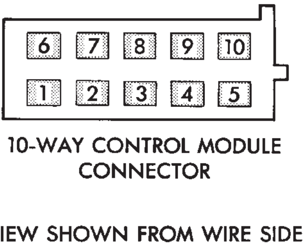
Fig. 22 Control Module and Seat Switch Pin Location

(3) Use an ohmmeter to test the wiring between the door switch and the control module in the driver's seat. The circuits should be disconnected from their components at each end. Repair the wiring as required for open circuits, terminal push outs, or bad crimps. If the circuits are good to the control module but the function is still missing, replace the control module.

CONDITION: NO MOVEMENT OF THE SEAT, RELAYS CAN BE HEARD CLICKING WHEN THE SEAT SWITCH IS ACTIVATED.

PROCEDURE

(1) Check for battery voltage and ground at the appropriate pins of the control module 10-way connector (Fig. 23). If the proper results are not obtained, replace the control module. If the circuits are correct, then continue the procedure.



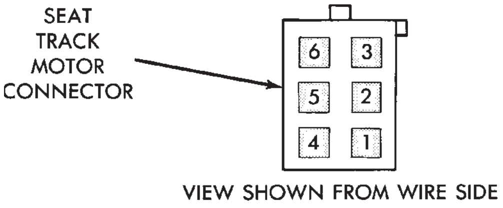
DIRECTION	BATTERY VOLTAGE	GROUND
	CONTROL MODULE 10-WAY PIN NO.	
FORWARD	7	8
REARWARD	8	7
FRONT UP	3	5
FRONT DOWN	5	3
REAR UP	10	9
REAR DOWN	9	10

908R-15

Fig. 23 Control Module 10-Way Connector Voltage and Ground Test

(2) Check for continuity of the motor circuits from the control module 10-way connector to the left power seat motor package (Fig. 24).

(3) Repair the wiring as required for open circuits, terminal push outs, or bad crimps. If the circuits are good but the seat movement direction is still missing, replace the seat motor package assembly. After replacement of the seat motor package, reconnect all wiring connectors and reinstall seat assembly in vehicle. Operate the switches manually to cause maximum seat movement in all directions. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly.



CONTINUITY BETWEEN	
MOTOR CONN. PIN	10-WAY PIN
1	7
2	10
3	3
4	8
5	9
6	5

908R-16

Fig. 24 Control Module 10-Way Connector to Power Seat Motor Connector Continuity

CONDITION: NO MOVEMENT OF THE MEMORY MIRRORS WHEN THE POWER MIRROR SWITCH IS ACTUATED, MEMORY MIRRORS MOVE DURING RECALL ONLY.

PROCEDURE

(1) Check for battery voltage at pin 1 of the memory mirror switch 8-way connector in the driver's door. This battery feed is through a diode package that is located in the left cowl side area. A grounded wire on the switch side of the diode would most likely cause the diode package to open. Solder and tape the connections if replacement is necessary. The fuse is in cavity 13 of the fuse block.

(2) Check for ground at pin 5 of the memory mirror switch 8-way connector. Repair as needed.

(3) Check for continuity of the memory mirror switch. Refer to the Group 8T, Mirror Switch Test Procedure and the Continuity.

CONDITION: NO MOVEMENT OF BOTH MEMORY MIRRORS OR ONLY ONE MEMORY MIRROR DURING THE RECALL MODE, MEMORY MIRRORS WILL MOVE ONLY WHEN THE POWER MIRROR SWITCH IS ACTUATED. MEMORY SEAT AND RECLINER MOVE IN RECALL.

PROCEDURE

(1) Determine the fault precisely. If all memory mirror recall movements appear to be missing, first set the mirrors to two different vertical and horizontal positions for both mirrors. Refer to the General Information paragraph at the beginning of this section for position setting instructions. Try to recall these set positions that were just placed in memory.

(2) Observe for no movement in a specific direction for a specific mirror. If there is still no movement of either mirror in any direction, re place the control module. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly. If the non-movement is in a specific direction or a specific mirror, continue with the procedure.

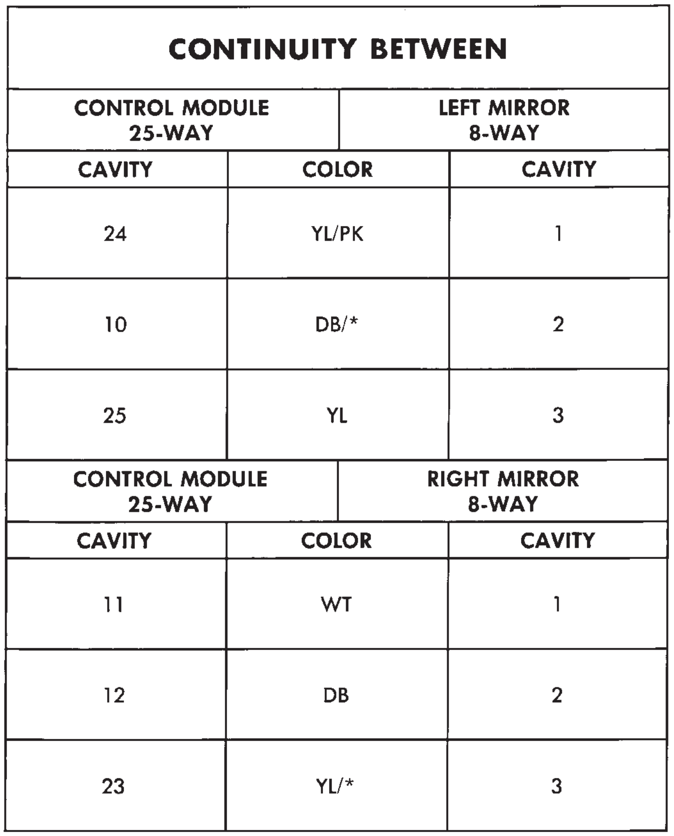
(3) Perform the diagnostic self tests, mirror check mode, to determine if the fault is with a motor or with a position sensing rheostat circuit. Refer to Memory Seat and Mirror Diagnostic Self-Tests explanation for further information and understanding of the diagnostic process and identifying of the fault. If the fault is with a motor, continue this procedure as follows in step (4) below. If the fault is with a rheostat, as indicated by the mirror nod in the vertical or horizontal plane, continue the procedure with step (5) of this procedure that follows.

(4) Check for continuity of the motor drive circuits between the control module 25-way connector and the mirror 8-way connector (Fig. 25 and 26).

Repair open wiring, terminal push outs or bad crimps as necessary to correct the fault. If there is still no recall movement of an individual mirror after ensuring continuity of the motor drive circuits, then replace the control module. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly.

(5) Check for continuity of the position sensing rheostat circuits at the disconnected 25-way connector under the driver's seat. Connect an ohmmeter between the cavities of the 25-way connector as indicated in the charts for the left or right mirrors as required (Fig. 27). If the resistance values cannot be obtained, i.e., an open circuit, continue the procedure.

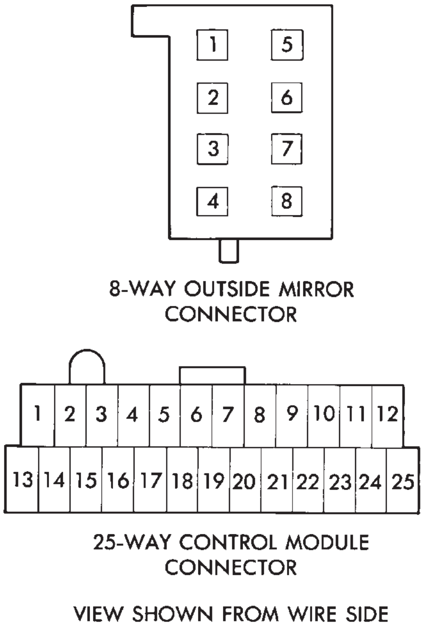
(6) Check for continuity of the position sensing rheostat circuits between the control module 25-way connector and the mirror 8-way connector for the left or right mirrors as required (Fig. 28). Repair the open wiring, terminal push outs or bad crimps as necessary to correct the fault. If continuity exists in these circuits, then continue this procedure.



CONTINUITY BETWEEN		
CONTROL MODULE 25-WAY		LEFT MIRROR 8-WAY
CAVITY	COLOR	CAVITY
24	YL/PK	1
10	DB/*	2
25	YL	3
CONTROL MODULE 25-WAY		RIGHT MIRROR 8-WAY
CAVITY	COLOR	CAVITY
11	WT	1
12	DB	2
23	YL/*	3

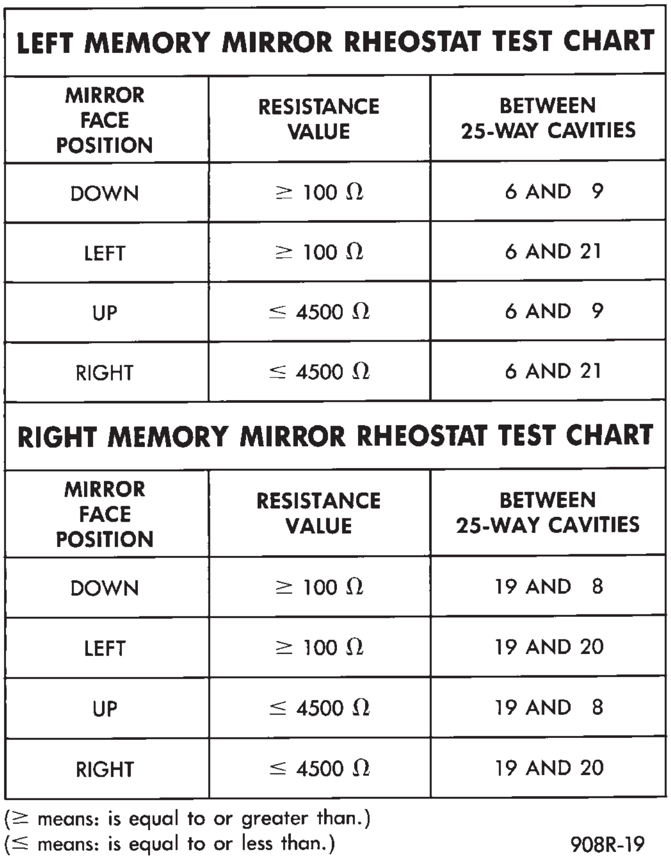
908R-17

Fig. 25 Control Module 25-Way Connector to Mirror 8-Way Connector Continuity



908R-18

Fig. 26 Mirror 8-Way Connector and 25-Way Control Module Connector



LEFT MEMORY MIRROR RHEOSTAT TEST CHART

MIRROR FACE POSITION	RESISTANCE VALUE	BETWEEN 25-WAY CAVITIES
DOWN	≥ 100 Ω	6 AND 9
LEFT	≥ 100 Ω	6 AND 21
UP	≤ 4500 Ω	6 AND 9
RIGHT	≤ 4500 Ω	6 AND 21

RIGHT MEMORY MIRROR RHEOSTAT TEST CHART

MIRROR FACE POSITION	RESISTANCE VALUE	BETWEEN 25-WAY CAVITIES
DOWN	≥ 100 Ω	19 AND 8
LEFT	≥ 100 Ω	19 AND 20
UP	≤ 4500 Ω	19 AND 8
RIGHT	≤ 4500 Ω	19 AND 20

(≥ means: is equal to or greater than.)
(≤ means: is equal to or less than.)

908R-19

Fig. 27 Sensing Rheostat Resistance

(7) Check for resistance values in the left or right mirror assembly as indicated by the diagnostic self test fault locator. Connect an ohmmeter between the mirror 8-way connector cavities as shown in the chart (Fig. 29). Both left and right mirrors use the same cavities. As the mirror face is moved manually the resistance value will change between the values given in the chart. If these results are not obtained, replace the mirror assembly.

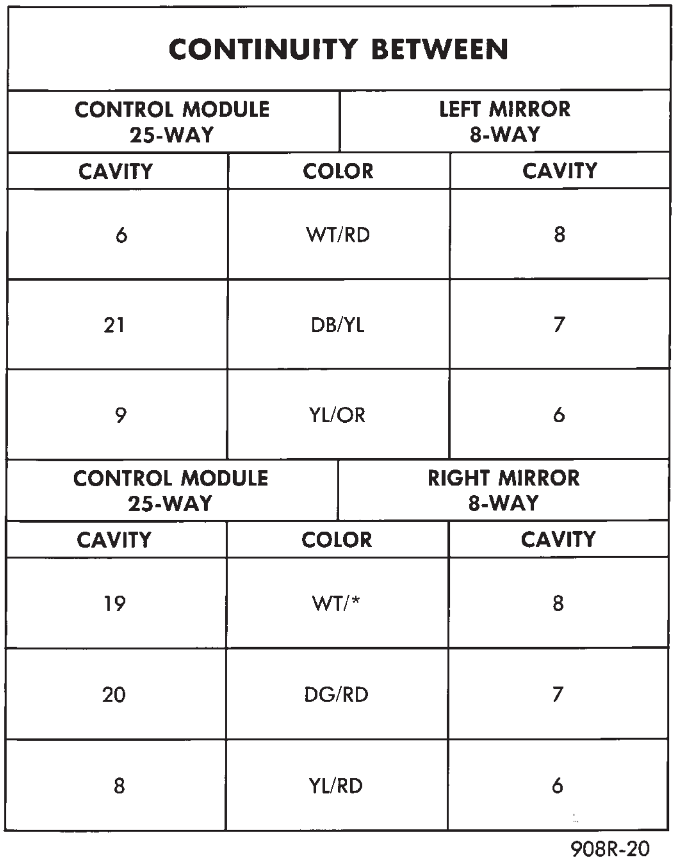
(8) If the resistance values from procedure (5) cannot be obtained and indicate a short to ground or battery, use an ohmmeter to isolate the circuits and components at fault. If the fault is in the wiring harness, repair or replace the wiring harness as necessary. If the fault is in the mirror, replace the mirror assembly.

(9) If after checking the rheostat circuits of an individual mirror and all circuits are correct then replace the control module. Perform the memory seat diagnostic self check so the control module will learn the new soft limits of the assembly.

POWER RECLINER MOTOR AND CABLE

REMOVAL

(1) Remove seat assembly from vehicle, following procedure outlined under Seat Assembly Removal.



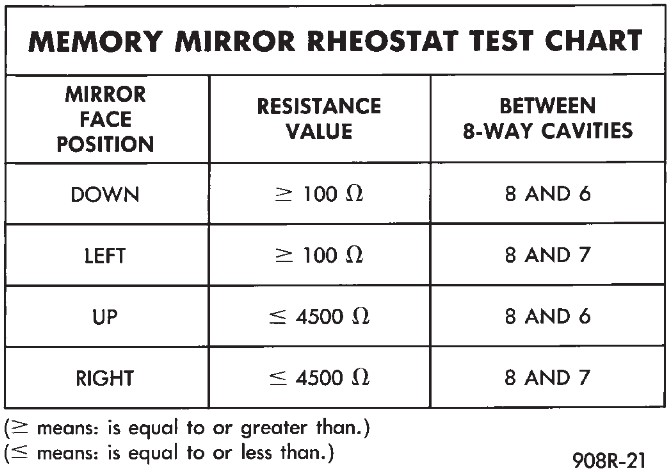
CONTINUITY BETWEEN

CONTROL MODULE 25-WAY		LEFT MIRROR 8-WAY
CAVITY	COLOR	CAVITY
6	WT/RD	8
21	DB/YL	7
9	YL/OR	6

CONTROL MODULE 25-WAY		RIGHT MIRROR 8-WAY
CAVITY	COLOR	CAVITY
19	WT/*	8
20	DG/RD	7
8	YL/RD	6

908R-20

Fig. 28 Sensing Rheostat Continuity



MEMORY MIRROR RHEOSTAT TEST CHART

MIRROR FACE POSITION	RESISTANCE VALUE	BETWEEN 8-WAY CAVITIES
DOWN	≥ 100 Ω	8 AND 6
LEFT	≥ 100 Ω	8 AND 7
UP	≤ 4500 Ω	8 AND 6
RIGHT	≤ 4500 Ω	8 AND 7

(≥ means: is equal to or greater than.)
(≤ means: is equal to or less than.)

908R-21

Fig. 29 Mirror Rheostat Resistance

(2) Remove seat outboard side shields to expose recliner and cable (Fig. 30).

(3) Remove cable housing clip from cushion frame.

(4) Remove cable housing clamp from the recliner transmission housing, and remove drive cable.

(5) Lay seat on its back on some clean surface.

(6) Remove four bolts, attaching the power seat track to cushion frame.

(7) Remove two motor attachment screws from power seat track cross strap.

(8) Disconnect recliner motor connectors.

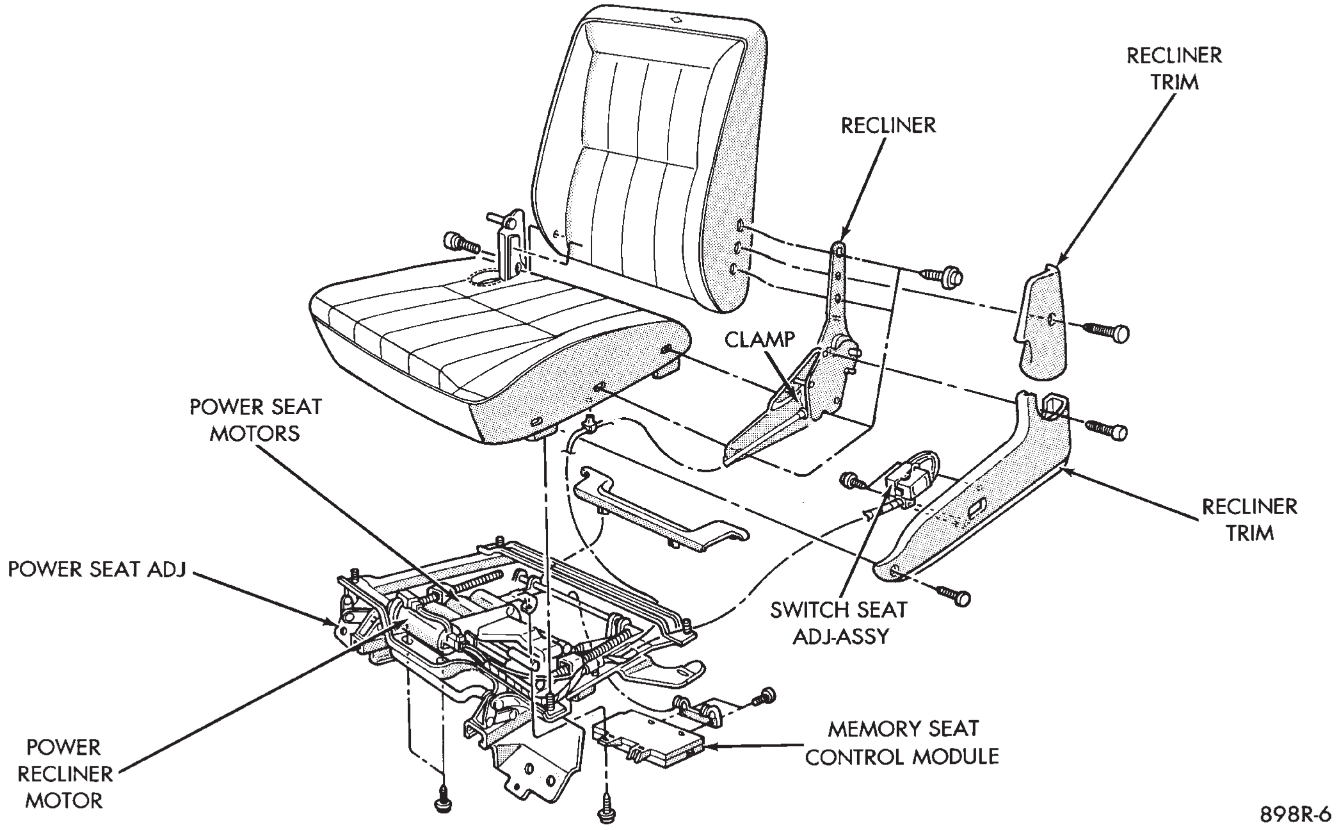


Fig. 30 Power Memory Seat

(9) Remove recliner motor and cable assembly.

INSTALLATION

(1) Position recliner motor and cable assembly to seat track. Check that the cable is equipped with a cable housing clip and clamp.

(2) Connect wiring connectors.

(3) Install power recliner motor to power seat track front cross strap with two attaching screws (Fig. 30).

(4) Align power seat track with the cushion frame. The power recliner cable housing must be routed toward the recliner through the gap between the cushion frame and the power seat track side strap.

(5) Install the power seat track to the cushion frame.

(6) Install the square drive cable end into the square hole in the drive worm gear at transmission. The cable may have to be rotated manually in order to align properly with the square hole in the drive worm gear.

(7) Position cable housing so that it is properly seated into the transmission housing.

(8) Clamp the cable housing to the transmission housing with the clamp. The prongs of the clamp should be pointing towards the floor of the vehicle.

(9) Install cable housing clip into the hole located in the cushion frame.

(10) Install the seat outboard side shield.

(11) Install the seat assembly into the vehicle following the procedure outlined under Seat Assembly Installation.

POWER RECLINER MECHANISM

REMOVAL

(1) Remove seat outboard side shields (Fig. 30).

(2) Remove four recliner attaching screws. Some vehicles require the trim to be lifted in order to expose recliner screws at the seat back attachment.

(3) Disconnect cable housing clamp at transmission.

(4) Remove cable from transmission drive worm gear. Be careful not to allow the cable to be pulled out of the housing. This will prevent possibility of disconnecting the cable from the motor at the other end.

INSTALLATION

(1) Install the square drive cable end into the square hole in the drive worm gear at recliner mechanism. The cable may have to be rotated manually in order to align properly with the square hole in the drive worm gear.

(2) Position the cable housing so that it is securely seated into the transmission housing.

(3) Clamp the cable housing to the transmission housing with clamp. The prongs of the clamp should

be pointing towards the floor of the vehicle.

(4) Install the four recliner to seat frame fasteners (Fig. 30).

(5) Install seat outboard side shields and fix all trim so that no foam is exposed.

(6) Set system soft limits.

MEMORY CONTROL MODULE REPLACEMENT

(1) Remove seat assembly from vehicle and follow the procedure outlined under Seat Assembly Removal.

(2) Lay seat on its back on a clean surface.

(3) Remove screws attaching control module to seat track (Fig. 30).

(4) Disconnect control module wiring.

(5) Remove control module.

(6) For installation reverse above procedures. Set system soft limits by performing the memory seat diagnostic self check. So that the control module will learn the soft limits of the assembly.

RECLINER SWITCH REPLACEMENT

(1) Remove seat side shields (Fig. 30).

(2) Disconnect wiring from switch.

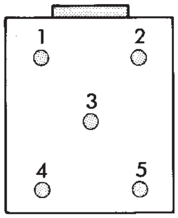
(3) Remove attaching screws from side shields.

(4) Remove switch.

(5) For installation reverse above procedures.

RECLINER SWITCH TEST

For switch testing, remove the switch from its mounting position. Using a ohmmeter, and referring to the Recliner Switch Continuity (Fig. 31), determine if continuity is correct. If there is no continuity at any one of the switch positions, replace the switch.



SWITCH POSITION	CONTINUITY BETWEEN
OFF	PINS 1 AND 4 PINS 2 AND 5
UPRIGHT	PINS 3 AND 4 PINS 2 AND 5
RECLINE	PINS 2 AND 3 PINS 1 AND 4

908R-22

Fig. 31 Recliner Switch Continuity 2

POWER WINDOWS

CONTENTS

GENERAL INFORMATION

Front and rear door window lift motors are of the permanent magnet type. A positive and negative battery 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.

Each individual motor is grounded through the master switch by a black wire attached to the left cowl panel.

It is necessary that the window be free to slide up and down in the glass channels or tubes and tracks. If the window is not free to move up and down, the window lift motor will not be able to move the glass.

To determine if the glass is free is to disconnect the regulator from the glass lift plate, and slide the window up and down by hand. For conventional arm-sector regulators, after the lift plate is detached from the glass, it will slide off the regulator drive arm. Flex-drive regulators may be detached the same way or by removing one screw holding the flex rack to the lift plate drive arm.

WIRING VOLTAGE TEST

The following wiring test determines whether or not voltage is continuous through the body harness to switch.

After removing switch for testing purposes, carefully separate multiple terminal block on wiring harness from switch body. With ignition switch ON connect one lead of test light to black (or gray) wire terminal and touch other test light lead to tan wire terminal. If the test light comes on, the wiring circuit between the battery and switch is functional. If light does not come on, check 30 amp main fuse (circuit breaker) or for a broken wire. For wiring, specific connector type and location, refer to Group 8W, Wiring Diagrams.

WINDOW LIFT SWITCH TEST

For switch testing, remove the switch from its mounting. Using an ohmmeter, refer to Window Switch Continuity Charts to determine if continuity is correct. If the results are not obtained, replace the switch.

AC and AY Bodies are equipped with an Auto-Down feature. This feature allows the operator to lower the driver's window without having to hold the switch in the down position. The Auto-Down feature can be activated by pressing the down switch past the first detent (Stop).

To test the auto-down feature, operate the window in the normal up and down mode. If the window works correctly in the normal mode, but not in the auto-down mode, replace the switch.

To test the window switch (other than Auto-Down mode), install a known good switch.

WINDOW LIFT MOTOR TEST

(1) Connect positive (+) lead from a test battery to either of the two motor terminals.

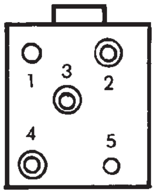
(2) Connect negative (-) lead from test battery to remaining motor terminal.

(3) The motor should now rotate in one direction to either move window up or down.

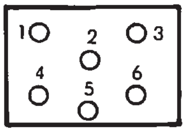
(a) If window happens to already be in full UP position and motor is connected so as to rotate in UP direction no movement will be observed.

(b) Likewise, motor connected to DOWN direction rotation, no movement will be observed if window is already in full DOWN position.

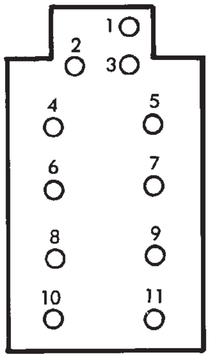
WINDOW SWITCH CONTINUITY



DOOR SWITCH	**BODY**	
PASSENGER DOOR	**AC, AJ, AY**	**AA, AG**
REAR DOORS	**AA, AC, AP, AY**	
SWITCH POSITION	CONTINUITY BETWEEN	CONTINUITY BETWEEN
OFF	PINS 1 & 4 PINS 2 & 5	PINS 1 & 4 PINS 2 & 5
UP	PINS 3 & 4 PINS 2 & 5	PINS 2 & 3 PINS 1 & 4
DOWN	PINS 2 & 3 PINS 1 & 4	PINS 3 & 4 PINS 2 & 5



MASTER SWITCH		**BODY**	
SWITCH POSITION		**AJ** **CONTINUITY BETWEEN**	**AG** **CONTINUITY BETWEEN**
OFF		PINS 1 & 2 PINS 2 & 3 PINS 2 & 4 PINS 2 & 6	PINS 1 & 2 PINS 2 & 3 PINS 2 & 4 PINS 2 & 6
UP	DRIVER'S	PINS 3 & 5 PINS 2 & 6	PINS 1 & 2 PINS 4 & 5
	PASSENGER'S	PINS 1 & 5 PINS 2 & 4	PINS 5 & 6 PINS 2 & 3
DOWN	DRIVER'S	PINS 5 & 6 PINS 2 & 3	PINS 1 & 5 PINS 2 & 4
	PASSENGER'S	PINS 1 & 2 PINS 4 & 5	PINS 3 & 5 PINS 2 & 6



MASTER SWITCH		**BODY**
SWITCH POSITION		**AA, AP, AC, AY** **CONTINUITY BETWEEN**
OFF		PINS 2 & 4 PINS 2 & 5 PINS 2 & 6 PINS 2 & 7 PINS 2 & 8 PINS 2 & 9 PINS 2 & 10 PINS 2 & 11
UP	DRIVER'S	PINS 3 & 5 PINS 2 & 7
	RIGHT FRT	PINS 2 & 7 PINS 2 & 6
	LEFT RR	PINS 3 & 9 PINS 2 & 11
	RIGHT RR	PINS 3 & 8 PINS 2 & 10
DOWN	DRIVER'S	PINS 3 & 7 PINS 2 & 5
	RIGHT FRT	PINS 3 & 6 PINS 2 & 4
	LEFT RR	PINS 3 & 11 PINS 2 & 9
	RIGHT RR	PINS 2 & 8 PINS 3 & 10
WINDOW LOCK		PINS 1 & 3

918S-1

(4) Reverse battery leads (steps 1 and 2 above) and window should now move. If window does not move, remove motor. See below for motor removal from vehicle.

(5) If window moved completely up or down, motor should be reversed one more time (reverse leads from step 4) to complete a full window travel inspection.

GEAR AND PINION REPLACEMENT AND LUBRICATION

The window glass and mechanism have been found to move freely. The window motor works. But the glass does not move up or down. The motor gear and pinion will need to be replaced (Fig. 1).

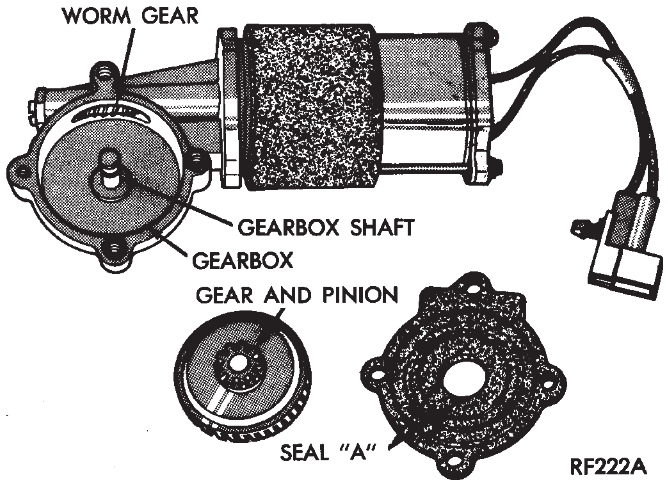


Fig. 1 Motor Lubrication

When gear and pinion assembly is replaced in gear box, lubrication of gear box, gear pinion and seal is necessary.

In the event there is no lubricant in gear box, fill with MOPAR multi-mileage lubricant or equivalent. Apply a liberal amount of lubricant to inside area of seal marked A as illustrated in Fig. 1 and sealing surface at center area of gear and pinion coupling. Also lubricate center gear box shaft and worm gear.

MOTOR REPLACEMENT CONVENTIONAL REGULATORS

The following procedure describes replacement of a defective motor without removing window regulator or detaching any window system components. This method of motor replacement is not acceptable if any of window system parts are loosened or removed from door such as:

- Lift channels
- Up stops
- Tracks and pivot brackets
- Are already loose by deficiency
- Are to be loosened or removed from the door.

Then use method of repair where entire regulator is removed from door (Fig. 2 through 9).

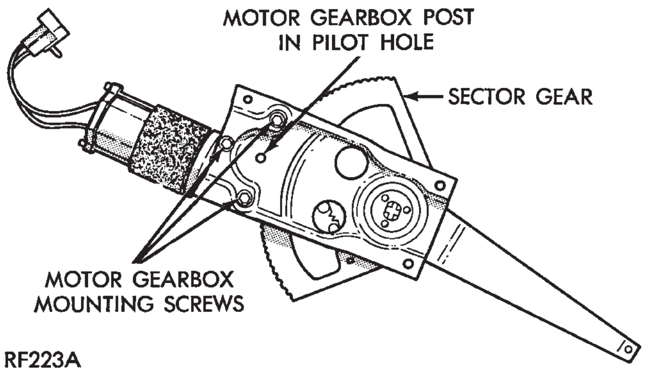


Fig. 2 Electric Motor Mounting—Conventional Regulators

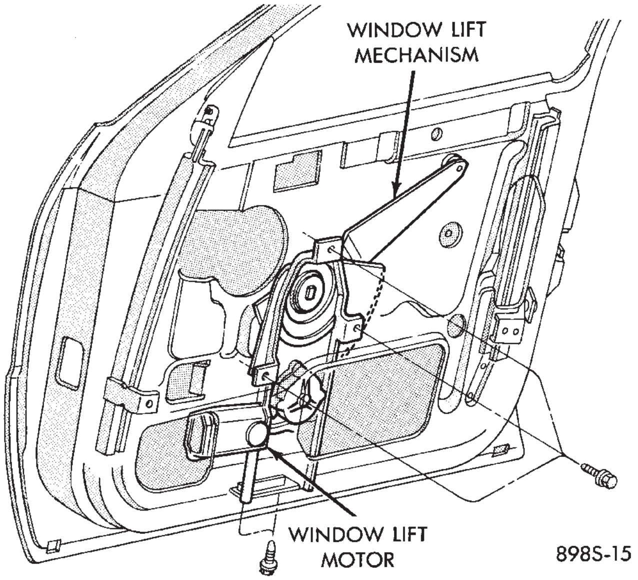


Fig. 3 Front Door Power Window—AA Body

REMOVAL

(1) Raise window to full UP position and keep it there at all times while replacing motor. If window is in any position other than full UP and motor is separated from spring loaded regulator, then regulator counterbalance spring will tend to propel window upwards.

WARNING:PLACE A WINDOW BLOCK IN DOOR THAT WILL POSITIVELY PREVENT WINDOW FROM GOING DOWN. THIS ACTION WILL PREVENT INJURY THAT COULD BE CAUSED BY INCORRECT INSTALLATION OF COUNTERBALANCE SPRING OR UPWARD MOVEMENT OF THE WINDOW.

(2) Disconnect wiring connector from motor which is located about eleven inches from motor.

(3) Remove three mounting screws that hold motor gearbox to regulator. Remove third screw that secures motor tie-down bracket to inner panel if so equipped. There are three holes in inner panel which provide access to three mounting screws that secure gearbox to regulator (Fig. 2).

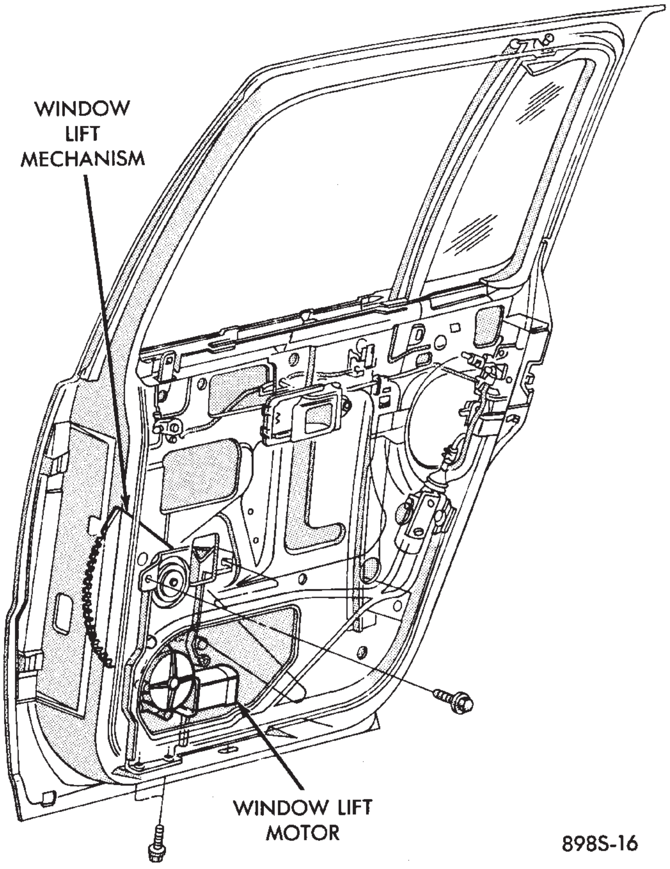


Fig. 4 Rear Door Power Window—AA Body

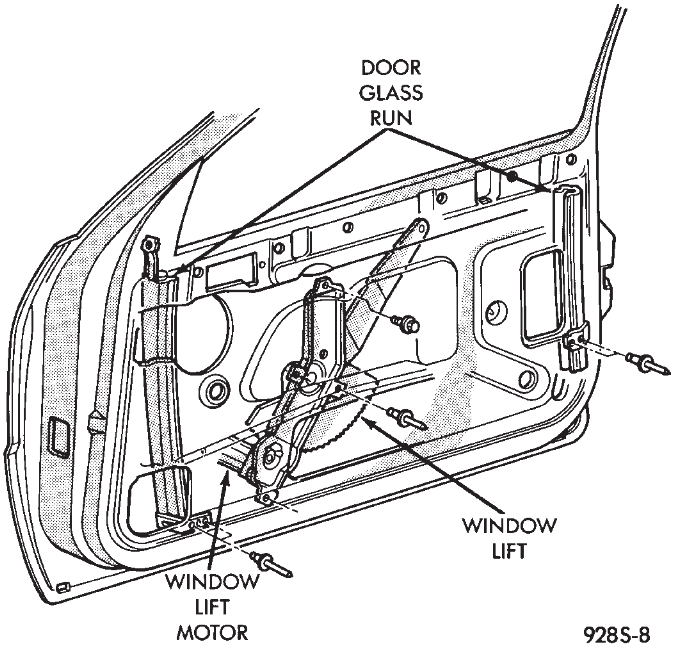


Fig. 5 Power Window Two Door—AP Body

For AJ body vehicles, it will be necessary to reach through opening in inner door panel and around behind regulator to gain access to motor gearbox retaining screws.

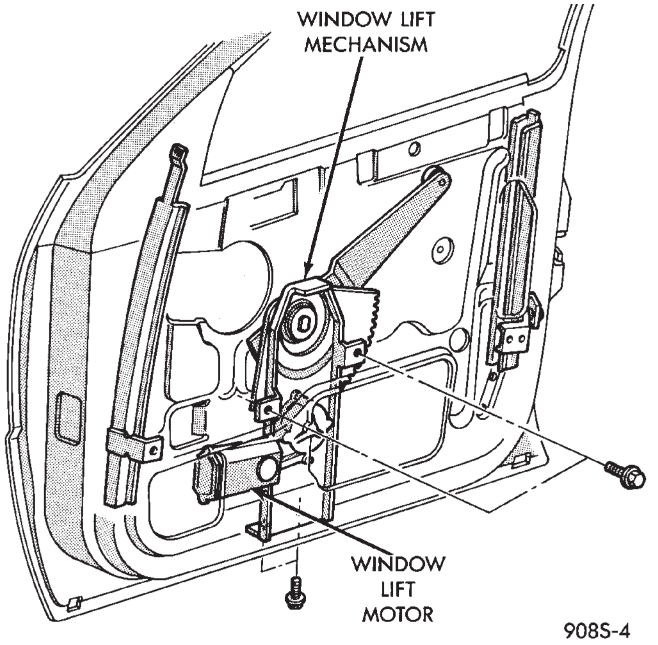


Fig. 6 Power Window Four Door—AP Body

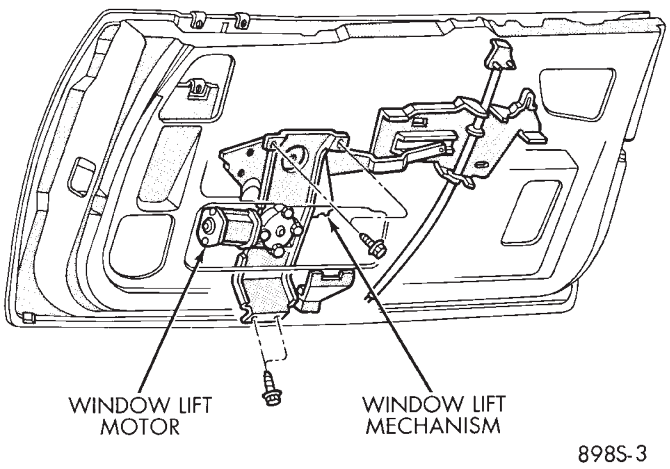


Fig. 7 Power Window Convertible—AJ Body

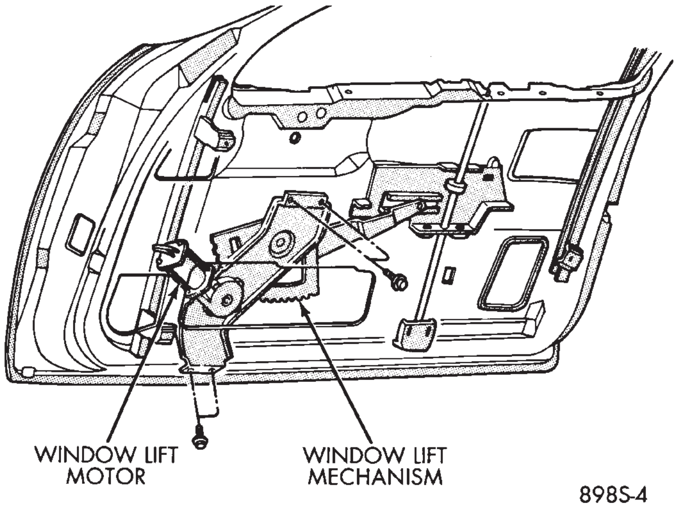


Fig. 8 Power Window—AJ Body

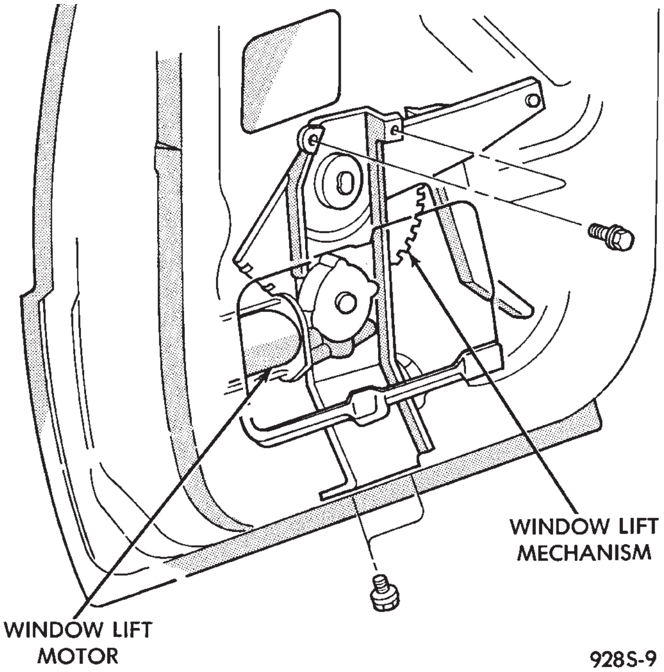


Fig. 9 Rear Door Power Window—AC, and AY Body

(4) To remove motor from regulator, grip motor housing and pull motor towards inner or outer panel, depending on regulator type. Some rocking or twisting action may be necessary to disengage motor from regulator.

WARNING:DO NOT HAVE ANY HANDS OR FINGERS IN SECTOR GEAR AREA WHERE THEY CAN BE PINCHED BY SMALL MOVEMENTS OF REGULATOR LINKAGE.

INSTALLATION

New motor gearbox retaining screw holes are not threaded. It may be desirable to tap holes before attempting assembly.

(1) Install new motor on regulator by positioning motor gearbox so that it engages regulator sector teeth.

(2) Position motor so that center post gearbox fits into its pilot hole in plate. A slight rotational or rocking movement may be necessary to bring three motor gearbox screw holes into proper position.

(3) Install three gearbox screws and one tie down bracket screw, if applicable. Tighten to 5 to 7 N•m (50 to 60 in. lbs.) torque.

(4) Connect pigtail wiring harness connector.

(5) Remove window block.

(6) Actuate regulator with switch to verify satisfactory operation.

BENCH REPAIR OF REGULATOR AND MOTOR CONVENTIONAL REGULATORS

To repair or inspect the entire electric window regulator, remove from the door as follows:

REMOVAL

(1) Disconnect wiring connector from motor.

(2) Hold glass in the up position.

(3) Remove rivets and/or screws that hold regulator and motor to inner door panel.

(4) Maneuver regulator assembly by hand to disengage the drive arm slider from the glass lift channel. Remove from door.

REPAIR

If entire regulator is not being replaced, repair as follows:

WARNING:REMOVE COUNTER BALANCE SPRING BEFORE THE MOTOR IS REMOVED. IF IT IS NOT, THE SPRING TENSION WILL CAUSE THE REGULATOR ARMS TO CLOSE AS SOON AS THE MOTOR IS REMOVED AND COULD SERIOUSLY INJURE YOUR FINGERS .

(1) Remove regulator as described above.

(2) Secure regulator in vise to prevent sector gear from rotating.

(3) Remove counter balance spring.

(4) Remove three motor attaching screws and remove motor.

(5) Inspect regulator for:

(a) Sector gear teeth must not be broken or severely worn.

(b) All rivets and sliders must be securely attached.

(c) Parts must not be bent or cracked.

(d) Sector gear must rotate freely.

(e) Perform window lift motor test as described above.

INSTALLATION

(1) Install motor and attach with three motor attaching screws. If installation of new motor is necessary, it may be desirable to tap motor retaining screw holes.

(2) Install counter balance spring.

(3) Replace regulator in door by reversing Removal steps 1, 2 and 3.

(4) Regulators may be secured to door panel using rivets or 1/4-20 X 1/2 screws and nuts.

MOTOR REPLACEMENT—FLEX DRIVE REGULATORS

REMOVAL

(1) Raise or lower window to the proper access hole position and remove screw that attaches the flex rack to the drive arm (Fig. 10). Hold the glass in that position.

(2) Remove the regulator attaching rivets by knocking out the rivet center mandrel and drilling

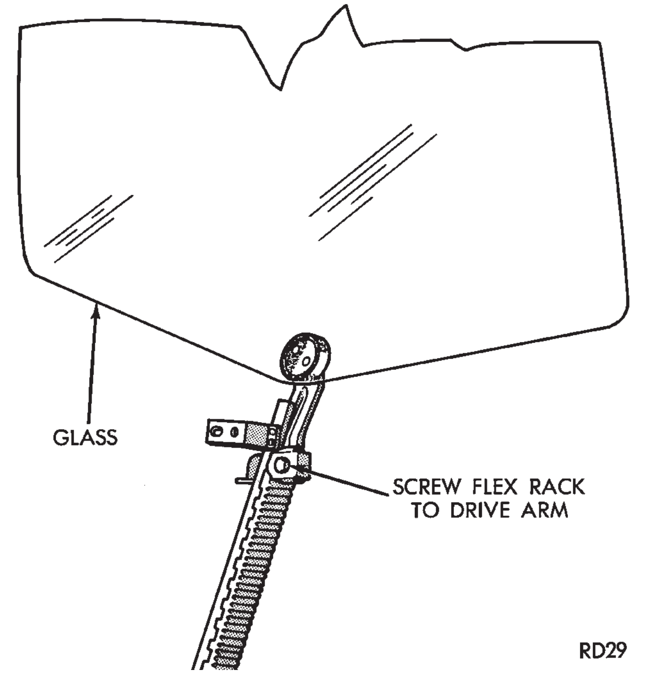


Fig. 10 Window Regulator Flex Rack to Drive Arm

rivet with a 1/4 inch diameter drill. Remove retaining screws if necessary (Fig. 11 through 14).

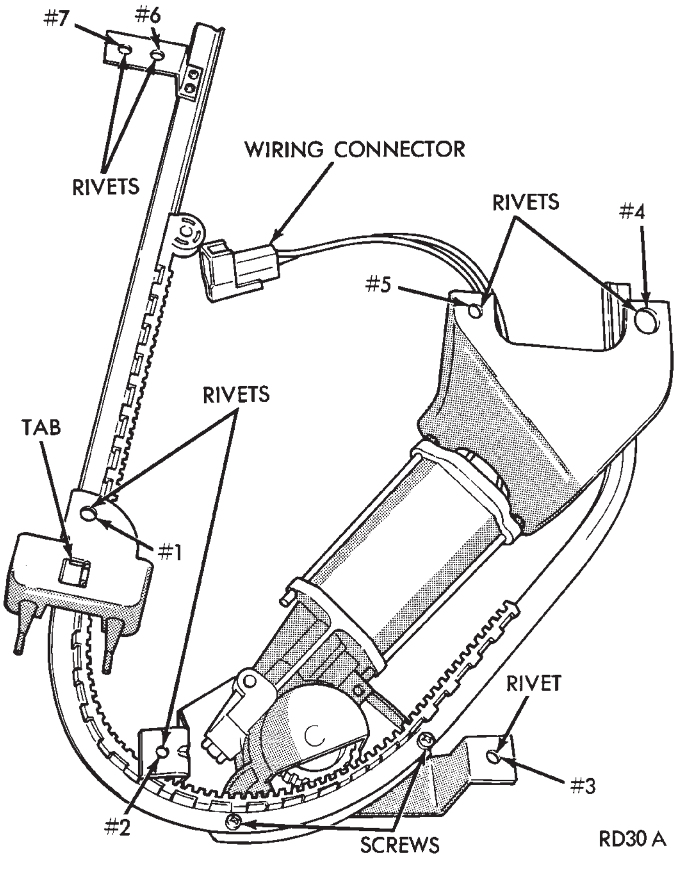


Fig. 11 Flex Drive Window Regulator Rear Door—AP Body

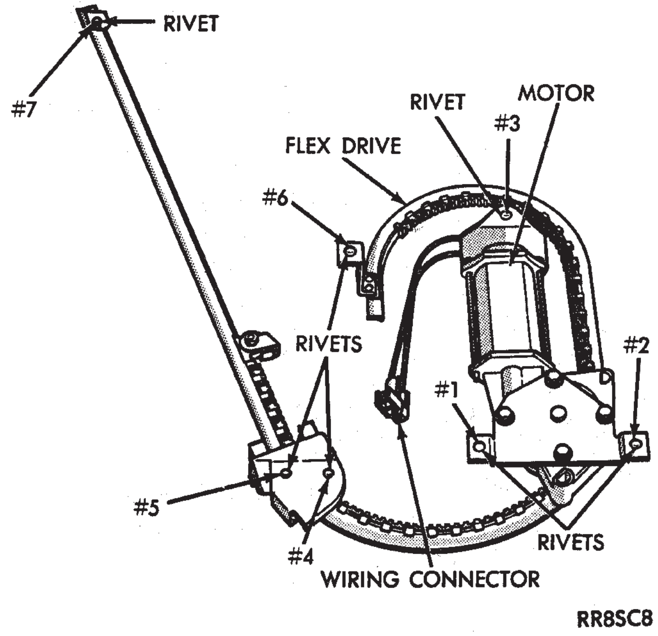


Fig. 12 Flex Drive Window Regulator Front Door—AG Body

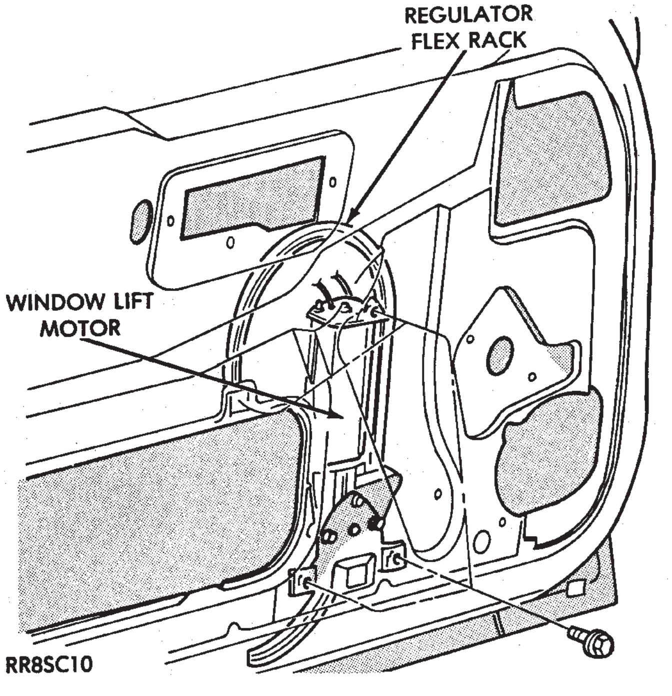


Fig. 13 Door Power Window—AG Body

(3) Maneuver the motor end of the flex drive regulator outside of the large inside panel access hole and rotate regulator out of door.

(4) If the window motor cannot be actuated and is stuck or frozen in any position other than at the access hole, the removal procedure is as follows:

(a) Remove the regulator attaching rivets by knocking out the rivet center mandrel and drilling the rivets with a 1/4 inch diameter drill. Remove retaining screws if necessary.

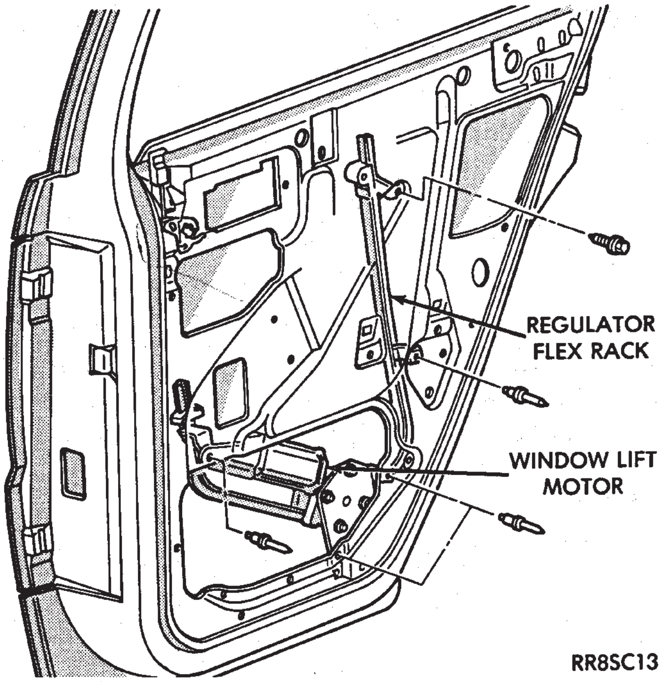


Fig. 14 Rear Door Power Window—AP Body

(b) Manually lift the window upward with the unriveted flex drive electric regulator still attached until the screw can be removed. If more access is needed, remove the two screws that hold the T-track to the motor gearbox. This will allow removal of the motor from the T-track.

(5) Remove two screws that fasten the motor gearbox to the metal T-track.

(6) Perform bench test.

BENCH TEST

(1) Connect positive (+) lead from test battery to either of the two motor terminals.

(2) Connect negative (-) lead from test battery to remaining motor terminal.

(3) The motor will now rotate in one direction.

(4) Reverse the battery leads and the motor should now rotate in the opposite direction.

(5) If the motor does not rotate in both directions, replace the motor.

INSTALLATION

(1) Install new motor on T-track using No. 8-32 X 1/2 screws tighten to 4 N●m (40 in. lbs.) torque.

(2) Feed top of T- track into access hole and point and rotate it towards the hinge pillar until regulator motor is approximately horizontal. Then rotate regulator in the opposite direction about a 1/4 turn and line up bracket tab to inner panel slot.

(3) Fasten regulator with the rivet sequence shown in (Figs. 10 and 11).

(4) Actuate the motor until the flex rack is visible within the access slot. Attach the window and drive arm assembly to the flex rack with the screws. Tighten screws to 4 N●m (40 in. lbs.) torque.

POWER WINDOW CABLE HOUSING/MOTOR REPLACEMENT—AC and AY Bodies

WARNING: REMOVAL OF THE WINDOW LIFT MOTOR FROM THE REGULATOR WILL CAUSE THE ASSIST SPRING TO UNWIND RAPIDLY WITH THE POTENTIAL OF CAUSING PHYSICAL INJURY. IF THE WINDOW LIFT MOTOR REQUIRES REPLACEMENT, SEE REGULATOR REPLACE CABLE AND DRUM IN THIS GROUP OF THIS MANUAL.

(1) Remove front door trim panel. Refer to group 23, Body.

(2) Disconnect window lift plate from glass (Fig. 15).

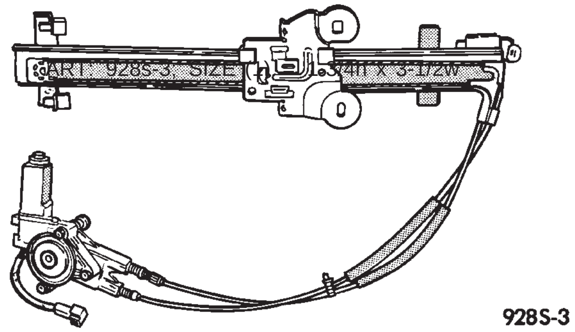


Fig. 15 Cable and Housing/Motor

(3) Disconnect window track from door.

(4) Disconnect window lift motor and drive cables.

(5) Disconnect electrical connections.

(6) Carefully remove window track, cables and lift motor assembly from door.

(7) For installation reverse above procedures.

MOTOR REPLACEMENT

(1) Refer to Front Door Window Regulator for removal.

(2) The door glass must be in the down position.

(3) Tape glass to door frame to hold glass in the up position.

(4) If the window is not in the full up position, remove only the motor from the door.

(5) Remove nuts from motor and cable housing (Fig. 16).

(6) Make sure motor is facing you before separating motor from housing.

(7) Using a flat tool slowly separate motor from housing, making sure the cable drum under the motor stays in cable housing. When motor is fully separated the assist spring will be completely unwound (Fig. 17).

(8) Remove assist spring by releasing the tabs on the opposite sides of the spring, do not remove spring from its case (Fig. 18).

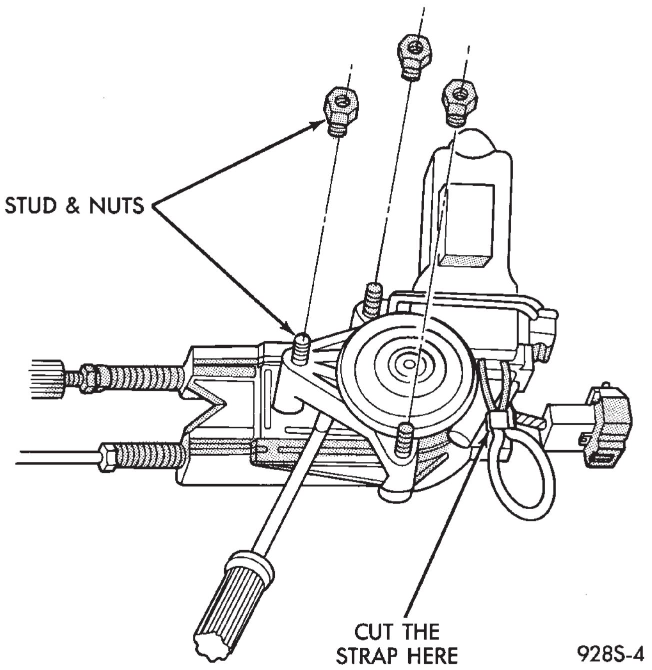


Fig. 16 Separating Motor from Housing

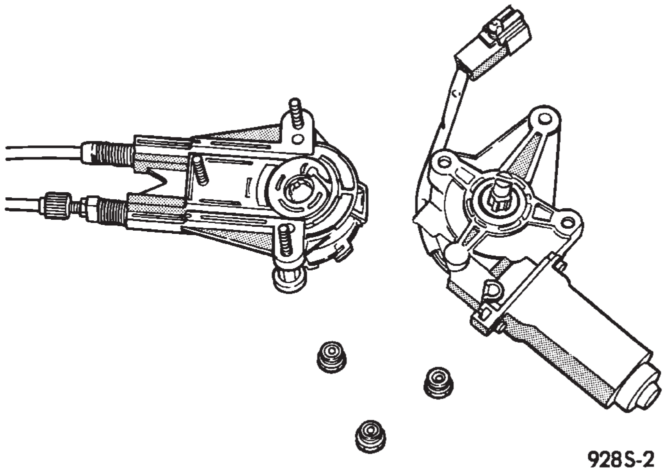


Fig. 17 Cable/Drum and Motor

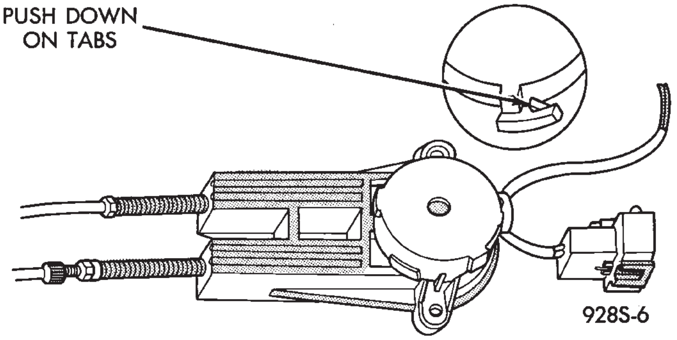


Fig. 18 Assist Spring Cover

INSTALLATION

(1) Install motor into housing with one stud and in center of housing to secure motor to housing.

(2) Before installing new spring, power the motor into the full-up position.

(3) Replace assist spring on cable housing. Wind spring counter clockwise 3 1/2 turns on the left door. The right door, wind spring clockwise 3 1/2 turns (Fig. 19).

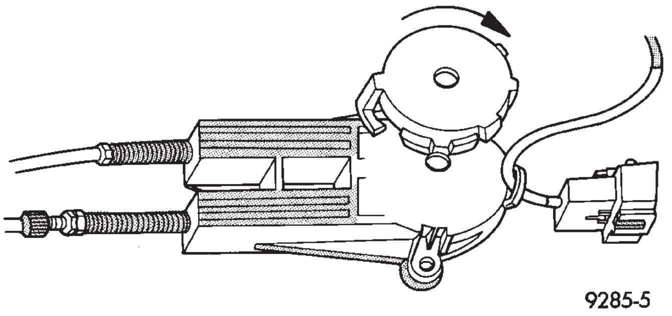


Fig. 19 Wind Assist Spring Cover

(4) Install the other two studs and nuts and tighten to 4 to 5 M●m (35 to 45 in. lbs.) torque.

(5) Inspect that cables are not twisted prior to installing motor and housing into door.

QUARTER WINDOW REPLACEMENT—AJ BODY

For steps (1) through (5) refer to Group 23, Body, for complete procedures.

(1) Remove the folding top sling well assembly.

(2) Remove the quarter trim upper moldings.

(3) Remove the cowl trim and scuff plate panels.

(4) Remove the rear seat cushion.

(5) Remove the quarter trim and rear seat back assembly.

(6) Remove quarter windows assembly (Fig. 20).

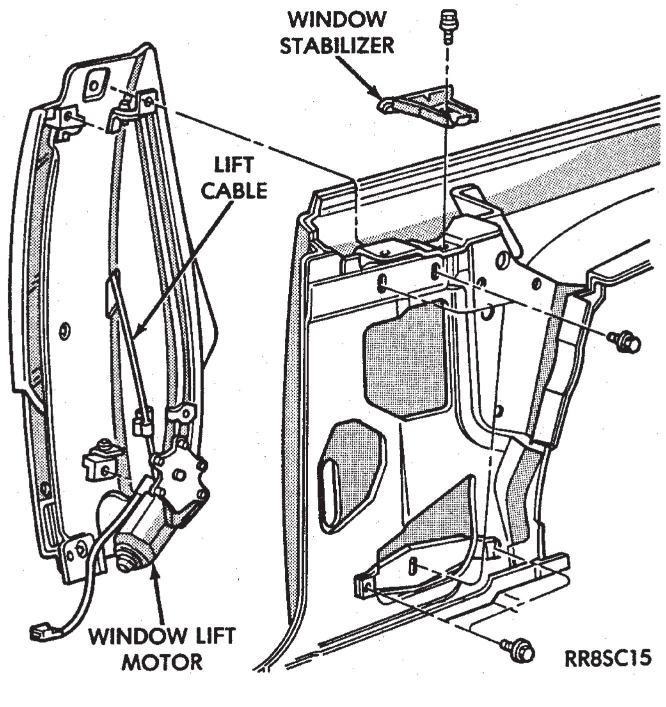


Fig. 20 Power Quarter Window—AJ Body

(a) Position window approximately one-third the way up.

(b) Remove glass stabilizer.

(c) Disconnect window motor wiring.

(d) Remove three quarter window assembly attaching screws and lift window assembly out of vehicle.

(7) For installation reverse above procedure. Refer to Group 23, Body, for window glass adjustment.

QUARTER WINDOW MOTOR REPLACEMENT—AJ BODY

(1) Remove window assembly from car and have window in mid position (halfway up).

(2) Remove No. 1 and No. 2 lower motor mounting screws (Fig. 21) and loosen No. 3 to allow the motor to pivot around the third screw. This will allow easy removal of the glass and lift plate assembly and also allow some tension to be relieved from the cables.

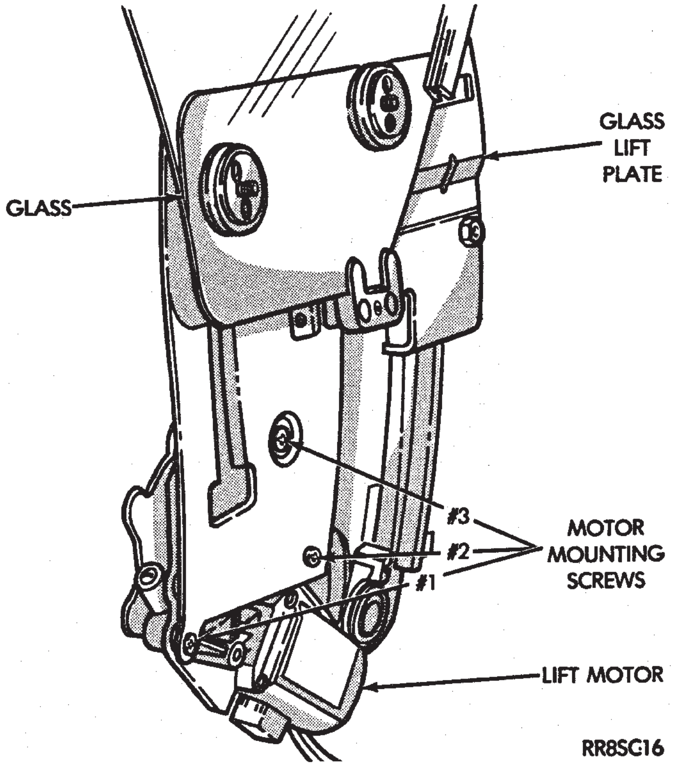


Fig. 21 Quarter Window Lift Mechanism—AJ Body

(3) Remove the mounting nuts on the lift plate and remove the glass and lift plate assembly.

(4) Remove motor from regulator plate.

(5) Remove cover plate on cable drum housing (Fig. 22).

CAUTION: Cable drum may pop up and out of housing due to residual tension remaining on cables.

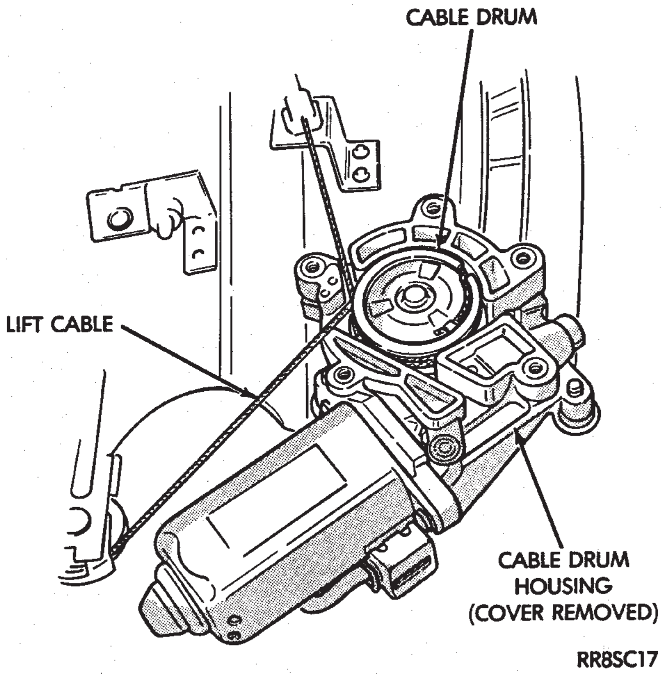


Fig. 22 Cable Drum and Lift Cable—AJ Body

(6) Pull drum out of the motor housing. Remove cables from drum, paying very close attention to the cable routing on the drum.

(7) Inspect the cables for signs of wear. If necessary, replace the cables with Mopar Cable Replacement Package.

(8) Rewind cables on new cable drum.

(9) Dab grease on internal motor shocks. Place in drum and install drum into the new housing.

(10) Install housing cover plate.

(11) Mount motor on regulator plate by inserting a guide pin through No. 3 motor mount screw hole and pivot motor around this point. Install No. 1 mounting screw and bushing. Replace remaining screws and bushings and tighten to 2 N•m (20 in. lbs.) torque.

(12) Lubricate with grease the areas of guide rail where cable and glider assembly travel.

(13) Run assembly up and down to verify correct cable routing.

(14) Loosen motor mounting screws to allow reassembly of lift plate onto regulator. Tighten lift plate nuts to 5 N•m (50 in. lbs.) torque. Tighten motor mounting screws to 2 N•m (20 in. lbs.) torque.

POWER MIRRORS

CONTENTS

GENERAL INFORMATION

Electrically operated power mirrors are available on all car lines. The mirrors are controlled by a single switch assembly located either on the driver's door trim panel or on the center console.

There are three types of switches currently used, each uses a L (left) R (right) for mirror selection (Fig. 1). Type I, which uses a rocker for mirror selection and four buttons for mirror movement direction. Type II, uses a toggle switch which is rotated clockwise for the Right mirror or counterclockwise for the Left mirror selection, and moved UP, DOWN, LEFT, or RIGHT for mirror movement direction. Type III, uses a paddle knob which is moved Left or Right for mirror selection and four buttons for mirror movement direction.

The motors which operate the mirrors are part of the mirror assembly and cannot be replaced separately.

All vehicles are equipped with an Ignition-Off Draw Connector which is used when the vehicles are originally shipped from the factory. This connector, which is located near the battery, helps to prevent battery discharge during storage. For specific connector type and location, refer Group 8W, Wiring Diagrams.

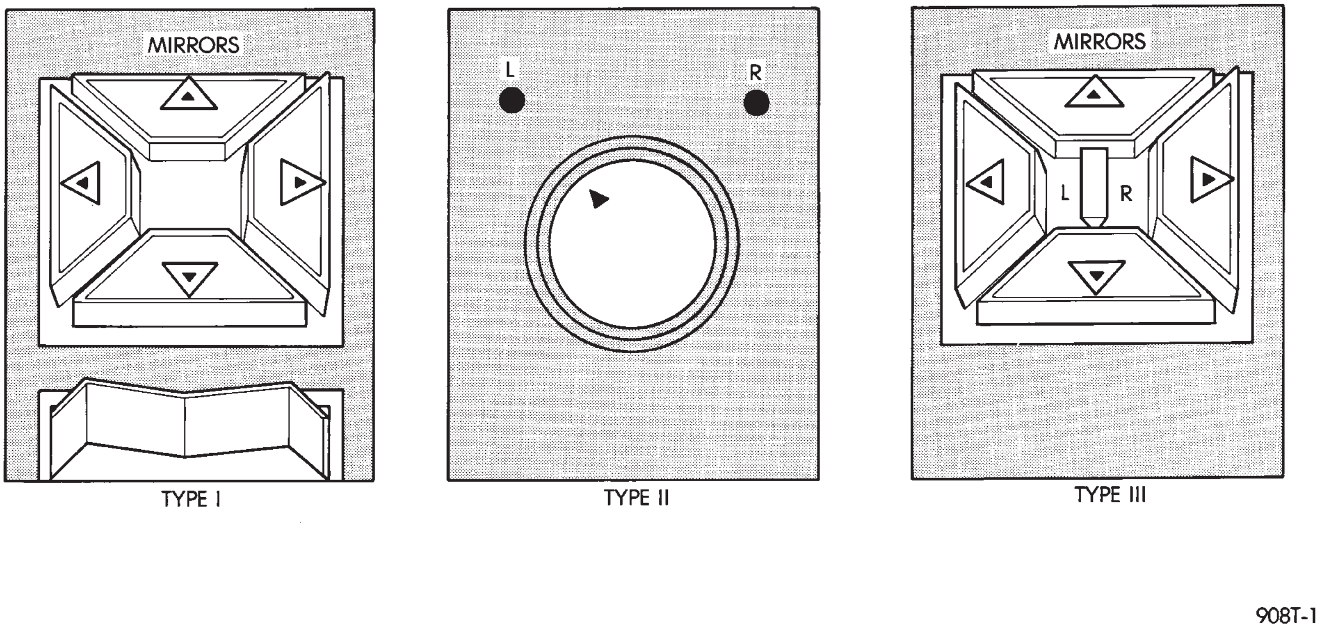


Fig. 1 Power Mirror Switches

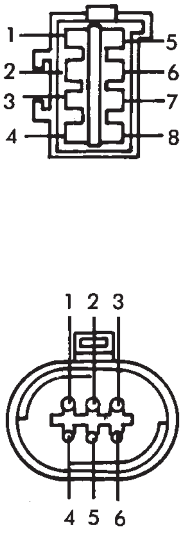
This connector is included in the power mirror circuity except, for AC and AY body and should be checked if the mirrors are inoperative.

MIRROR MOTOR TEST PROCEDURE

(1) Remove power mirror switch from mounting position.

(2) Disconnect switch wiring harness at connector. In the case of memory mirrors, (green 8-way mirror connector and memory switch in drivers door panel), the switch wiring disconnects from the cowl top harness rather than the mirror harness.

(3) Using two jumper wires, one connected to a 12 volt source, and the other connected to a good body ground. Refer to the Mirror Test (Fig. 2 through 5) for appropriate switch style, and for pin numbers.



MIRROR TEST

SWITCH CONNECTOR

12 Volts	Ground	MIRROR REACTION	
		Right	Left
PIN 2	PIN 3	UP	
PIN 6	PIN 3		UP
PIN 3	PIN 2	DOWN	
PIN 3	PIN 6		DOWN
PIN 7	PIN 1	RIGHT	
PIN 7	PIN 5		RIGHT
PIN 1	PIN 7	LEFT	
PIN 5	PIN 7		LEFT

DOOR CONNECTOR

12 Volts	Ground	MIRROR REACTION
PIN 4	PIN 6	UP
PIN 6	PIN 4	DOWN
PIN 5	PIN 3	RIGHT
PIN 3	PIN 5	LEFT
PIN 1	PIN 2	HEATER

918T-4

Fig. 2 MIRROR TEST—AP Body

(4) If results shown in the Fig. 2 through 5 are not obtained, check for broken or shorted circuit, or replace mirror assembly as necessary.

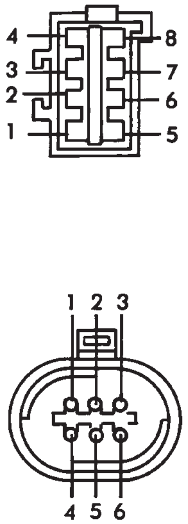
MIRROR SWITCH TEST PROCEDURE

(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 for appropriate switch style (Fig. 6 through 8).

(4) If results shown in the Fig. 5, 6 and 7 are not obtained, replace the switch.



MIRROR TEST

SWITCH CONNECTOR

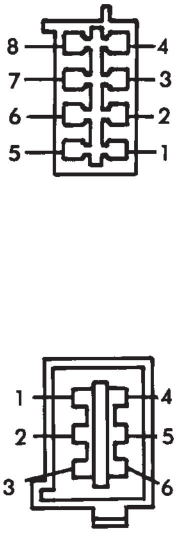
12 Volts	Ground	MIRROR REACTION	
		Right	Left
PIN 6	PIN 7	UP	
PIN 2	PIN 3		UP
PIN 7	PIN 6	DOWN	
PIN 3	PIN 2		DOWN
PIN 7	PIN 5	RIGHT	
PIN 3	PIN 1		RIGHT
PIN 5	PIN 7	LEFT	
PIN 1	PIN 3		LEFT

DOOR CONNECTOR

12 Volts	Ground	MIRROR REACTION
PIN 4	PIN 6	UP
PIN 6	PIN 4	DOWN
PIN 5	PIN 3	RIGHT
PIN 3	PIN 5	LEFT
PIN 1	PIN 2	HEATER

928T-4

Fig. 3 MIRROR TEST—AA Body



MIRROR TEST

SWITCH CONNECTOR

12 Volts	Ground	MIRROR REACTION	
		Right	Left
PIN 6	PIN 7	UP	
PIN 2	PIN 3		UP
PIN 7	PIN 6	DOWN	
PIN 3	PIN 2		DOWN
PIN 7	PIN 5	RIGHT	
PIN 3	PIN 1		RIGHT
PIN 5	PIN 7	LEFT	
PIN 1	PIN 3		LEFT

DOOR CONNECTOR

12 Volts	Ground	MIRROR REACTION
PIN 4	PIN 6	UP
PIN 6	PIN 4	DOWN
PIN 6	PIN 5	RIGHT
PIN 5	PIN 6	LEFT
PIN 1	PIN 3	HEATER

928T-3

Fig. 4 MIRROR TEST—AC and AY Bodies

HEATED MIRROR

Heated mirrors are available on all car lines except AP Body, with Power Mirrors and Rear Window Defogger only. The heated mirror is controlled by the rear window defogger switch. Only time that the heated mirror is on is when the rear window defogger is on.

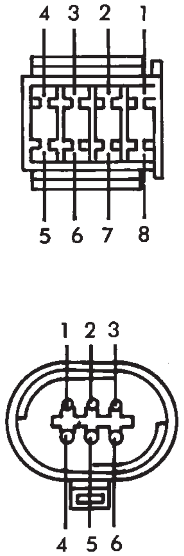
TEST PROCEDURES

The mirror should be warm to the touch.

(a) If not check fuses.

(b) Test voltage at rear window defogger switch.

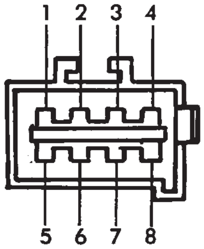
- If no voltage repair wire.
- Apply voltage to one wire and ground the other, refer to Fig. 2 through 5 for pin numbers. Mirror should become warm to the touch.



MIRROR TEST			
SWITCH CONNECTOR			
		MIRROR REACTION	
12 Volts	Ground	Right	Left
PIN 6	PIN 5	UP	
PIN 4	PIN 5		UP
PIN 5	PIN 6	DOWN	
PIN 5	PIN 4		DOWN
PIN 5	PIN 7	RIGHT	
PIN 5	PIN 8		RIGHT
PIN 7	PIN 5	LEFT	
PIN 8	PIN 5		LEFT
DOOR CONNECTOR			
12 Volts	Ground	MIRROR REACTION	
PIN 1	PIN 5	UP	
PIN 5	PIN 1	DOWN	
PIN 4	PIN 6	RIGHT	
PIN 6	PIN 4	LEFT	
PIN 2	PIN 3	HEATER	

918T-5

Fig. 5 MIRROR TEST—AG and AJ Bodies



MIRROR SWITCH CONTINUITY TYPE I	
Mirror Selector Knob in "L" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 1 AND 2 PINS 6 AND 8
▶	PINS 1 AND 3 PINS 5 AND 8
▼	PINS 1 AND 6 PINS 2 AND 8
◀	PINS 1 AND 5 PINS 3 AND 8
Mirror Selector Knob in "R" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 1 AND 4 PINS 6 AND 8
▶	PINS 1 AND 3 PINS 7 AND 8
▼	PINS 1 AND 6 PINS 4 AND 8
◀	PINS 1 AND 7 PINS 3 AND 8

938T-10

Fig. 6 Type I Mirror Switch Test

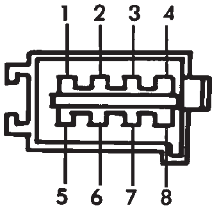
- If not remove mirror glass and test the wires for continuity. If no continuity repair wires.
- If wires are OK, replace mirror glass.
- To test defogger switch refer to Group 8N, Rear Window Defogger, Control Switch/Timer Relay Module Test.

MIRROR SWITCH REPLACEMENT—AA BODY

(1) Remove door trim panel.

(2) Remove set screw from pillar trim bezel.

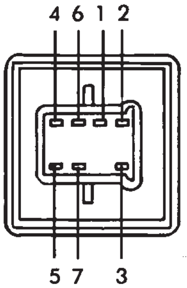
(3) Remove pillar trim bezel retaining screws.



MIRROR SWITCH CONTINUITY TYPE II	
Mirror Selector Knob in "L" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 2 AND 8 PINS 3 AND 4
▶	PINS 3 AND 8 PINS 1 AND 4
▼	PINS 3 AND 8 PINS 2 AND 4
◀	PINS 1 AND 8 PINS 3 AND 4
Mirror Selector Knob in "R" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 6 AND 8 PINS 7 AND 4
▶	PINS 7 AND 8 PINS 5 AND 4
▼	PINS 7 AND 8 PINS 6 AND 4
◀	PINS 5 AND 8 PINS 4 AND 7

938T-11

Fig. 7 Type II Mirror Switch Test



MIRROR SWITCH CONTINUITY TYPE III	
Mirror Switch Knob in "L" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 1 AND 4 PINS 2 AND 5
▶	PINS 1 AND 3 PINS 2 AND 5
▼	PINS 1 AND 3 PINS 2 AND 4
◀	PINS 1 AND 5 PINS 2 AND 4
Mirror Selector Knob in "R" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 1 AND 6 PINS 2 AND 7
▶	PINS 1 AND 3 PINS 2 AND 7
▼	PINS 1 AND 3 PINS 2 AND 6
◀	PINS 1 AND 7 PINS 2 AND 3 PINS 2 AND 6

938T-4

Fig. 8 Type III Mirror Switch Test

(4) Disconnect switch wiring (Fig. 9).

(5) Remove switch from switch bezel.

(6) For installation, reverse above procedure.

MIRROR SWITCH REPLACEMENT—AG AND AJ BODIES

(1) Carefully pry switch from switch bezel (Fig. 10).

(2) Remove switch wiring connector.

(3) For installation, reverse above procedure.

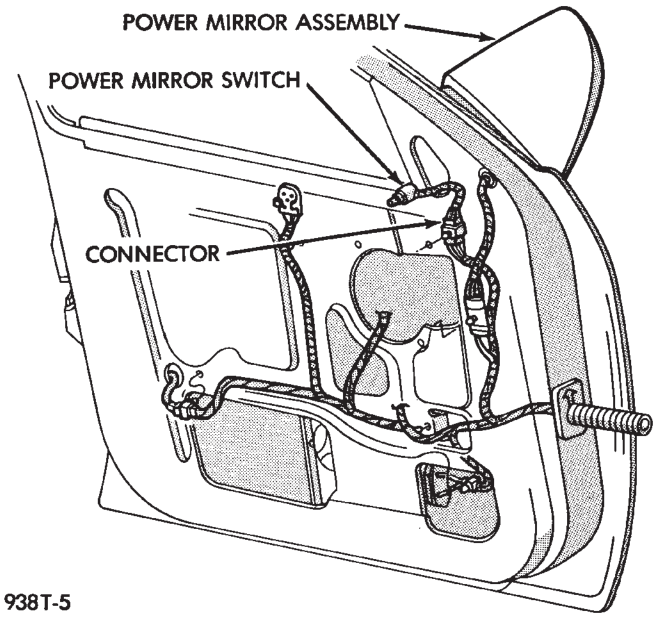


Fig. 9 Power Mirror Switch—AA Body

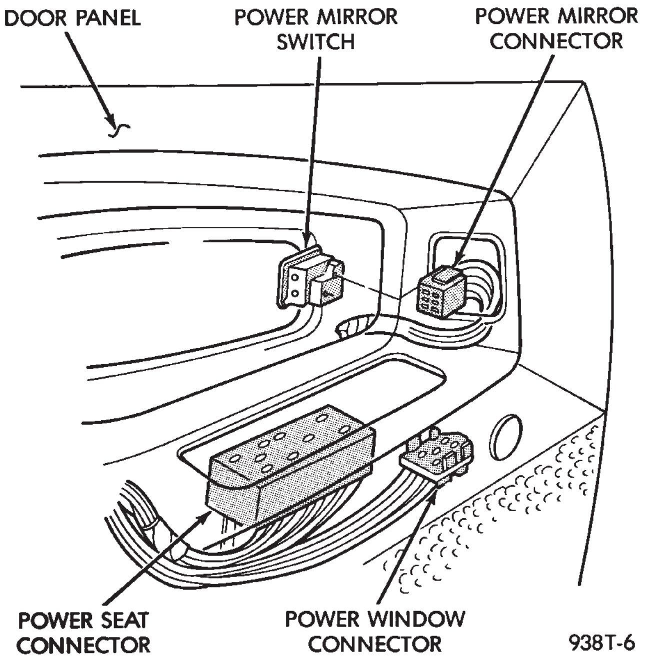


Fig. 10 Power Mirror Switch—AG, and AJ Bodies

MIRROR SWITCH REPLACEMENT—AP BODY

(1) Remove power mirror switch bezel from mounting position (Fig. 11).

(2) Turn bezel over and remove two switch retaining screws.

(3) Disconnect wiring at switch connector.

(4) Remove switch from vehicle.

(5) For installation, reverse above procedure.

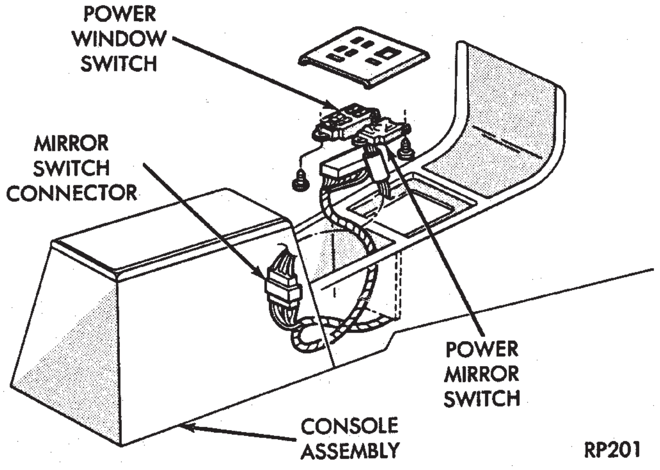


Fig. 11 Power Mirror Switch—AP Body

MIRROR SWITCH REPLACEMENT—AC AND AY BODIES

(1) Remove door trim panel.

(2) Remove three pillar trim bezel retaining screws and pull bezel from door.

(3) Loosen remote control switch retaining screw and pull switch from bezel.

(4) Disconnect switch wiring at connector near bottom of door and pull switch and harness from door (Fig. 12).

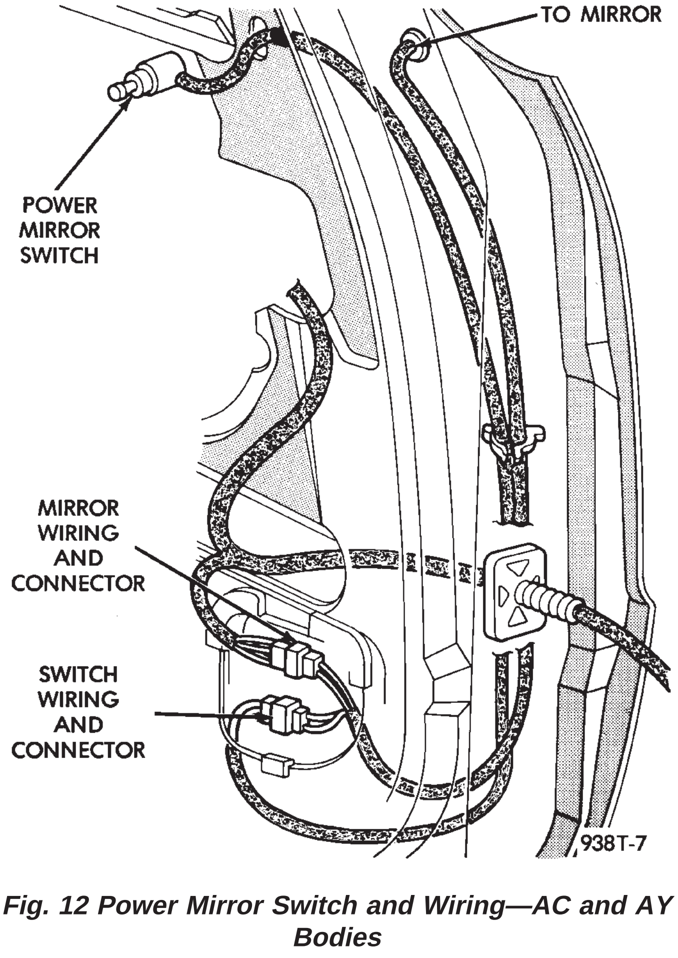


Fig. 12 Power Mirror Switch and Wiring—AC and AY Bodies

(5) For installation, reverse above procedure.

MIRROR ASSEMBLY REPLACEMENT—AA BODY

(1) Remove door trim panel.

(2) Remove switch set screw from door pillar trim.

(3) Remove two pillar trim bezel screws and remove bezel (Fig.13).

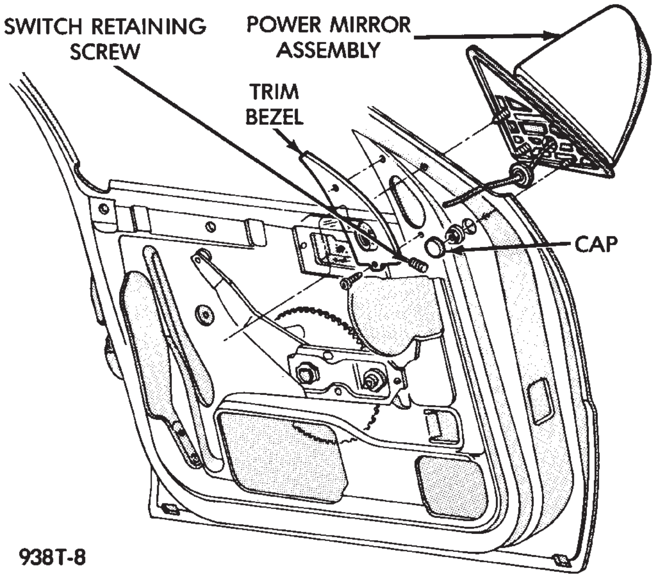


Fig. 13 Power Mirror Assembly—AA Body

(4) Disconnect mirror wiring connector.

(5) Remove three mirror retaining nuts and pull mirror and harness from door.

(6) For installation, reverse above procedure. Test operation of mirror before installing door trim panel.

MIRROR ASSEMBLY REPLACEMENT—AG BODY

(1) Remove door trim panel.

(2) Disconnect mirror wiring at connector (Figs. 14 and 15).

(3) Remove plugs used to conceal mirror mounting nuts.

(4) Remove mirror mounting nuts and release mirror from door.

(5) For installation, reverse above procedure. Test mirror for proper operation before installing door trim panel.

MIRROR ASSEMBLY REPLACEMENT—AJ BODY

(1) Remove door trim panel.

(2) Remove door speaker and disconnect mirror wiring connectors (Fig. 16).

(3) Remove plugs used to conceal mirror mounting nuts.

(4) Remove mirror mounting nuts and release mirror from door.

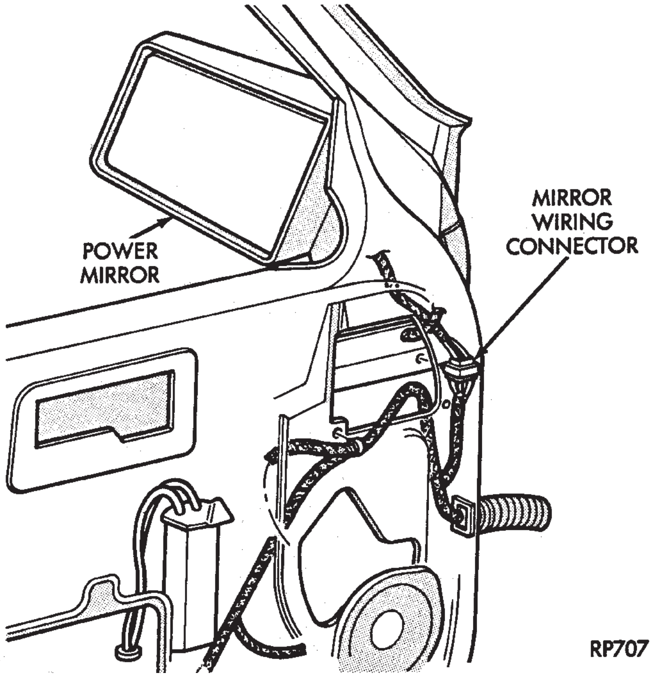


Fig. 14 Power Mirror Wiring—AG Body

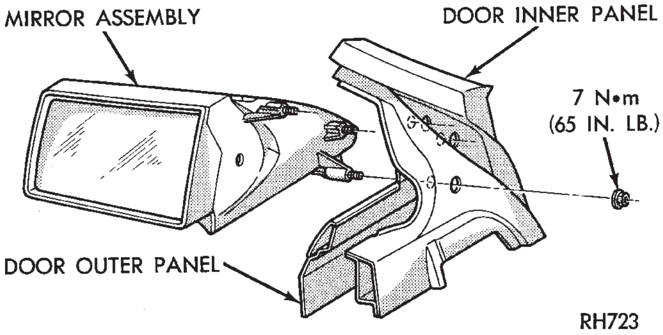


Fig. 15 Power Mirror Assembly—AG Body

(5) For installation, reverse above procedure. Test mirror for proper operation before installing door trim panel.

MIRROR ASSEMBLY REPLACEMENT—AP BODY

(1) Remove door trim panel.

(2) Disconnect wiring at connector (Figs. 17 and 18).

(3) Remove door bezel and small plug to gain access to mirror retaining nuts.

(4) Remove three mirror retaining nuts and remove mirror from vehicle.

(5) For installation, reverse above procedure. Test mirror for proper operation before installing door trim panel.

MIRROR ASSEMBLY REPLACEMENT—AC AND AY BODIES

(1) Remove door trim panel.

(2) Remove three pillar trim bezel retaining screws and pull bezel from door.

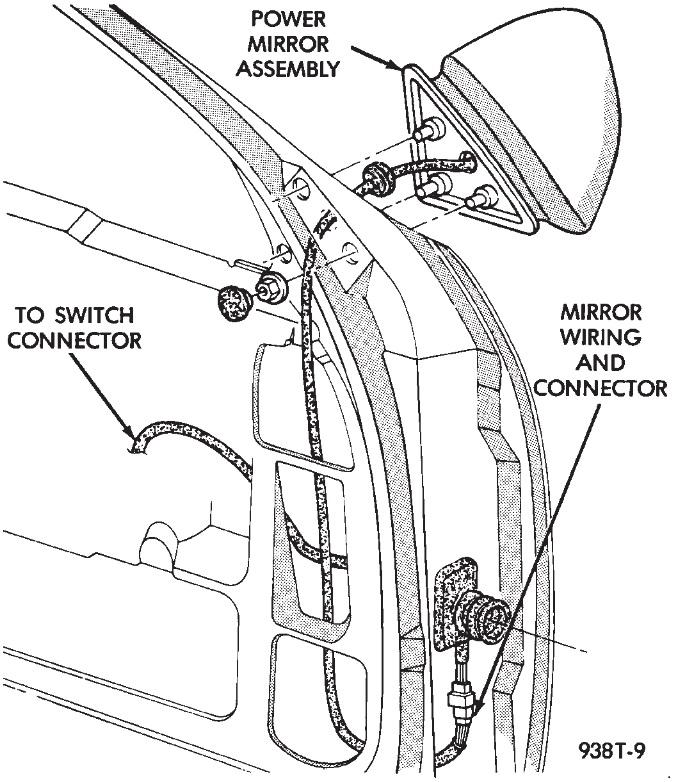


Fig. 16 Power Mirror Assembly—AJ Body

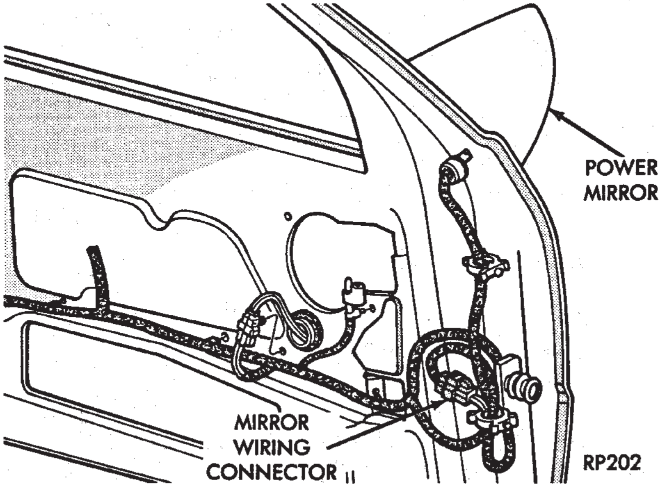


Fig. 17 Power Mirror Wiring—AP Body

(3) Disconnect mirror wiring connector near bottom of door (Fig. 19).

(4) Remove two mirror retaining nuts and screw one, and pull mirror and harness from door.

(5) For installation, reverse above procedure. Test mirror for proper operation before installing door trim panel.

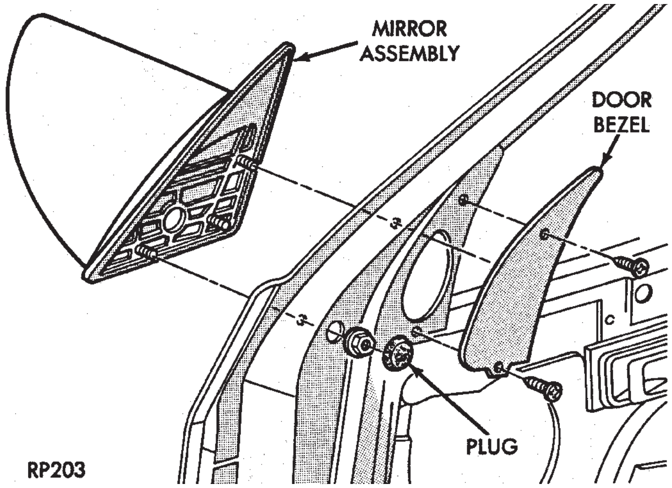


Fig. 18 Power Mirror Assembly—AP Body

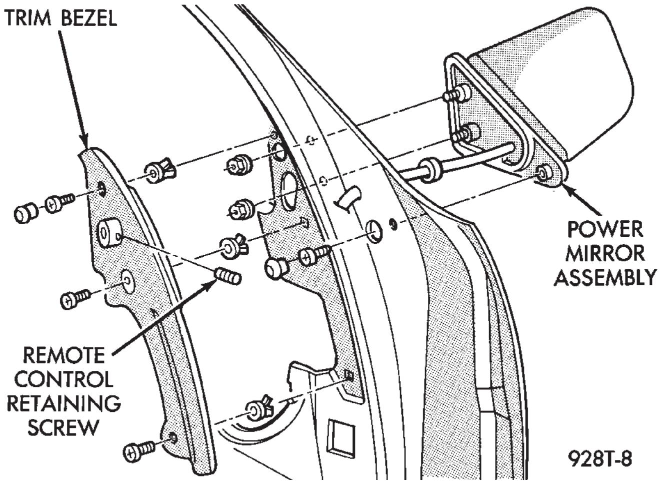


Fig. 19 Power Mirror Assembly—AC and AY Body

INSIDE MIRROR/READING LAMPS REPLACEMENT

(1) Release locking tab on front side of mirror stay by pushing down. While holding tab down, pull mirror rearward to remove (Fig. 20).

(2) Remove visor center attaching clips.

(3) Remove header end caps.

(4) Remove header trim.

(5) Disconnect wiring connector.

(6) For installation, reverse above procedure. Ensure the mirror is fully locked into place.

INSIDE MIRROR/READING LAMPS BULB/LENS REPLACEMENT

(1) Place a small thin blade tool in the notch at the outside end of the lens housing and pry off the lens housing.

(2) Remove lamp socket from lens housing. Remove bulb from socket and replace if necessary.

(3) Remove lens by applying pressure on locking tabs to remove lens.

(4) Replacing lens, set into place apply pressure until it is locked into position.

(5) For installation, reverse above procedure.

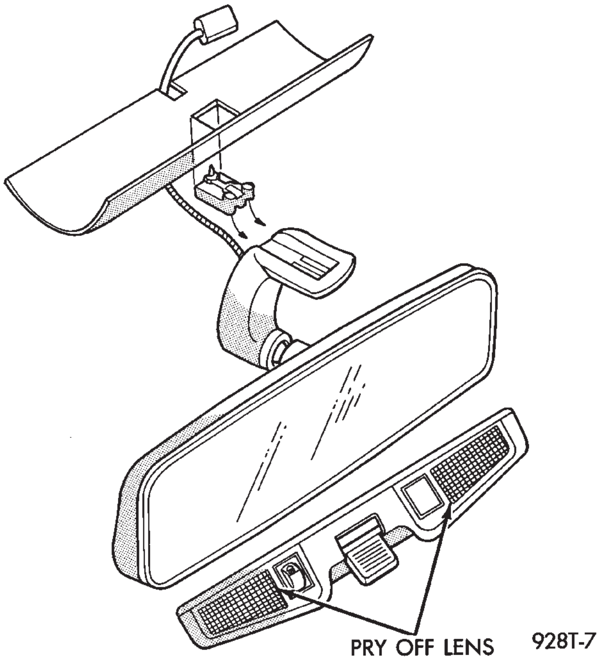


Fig. 20 Header Mirror/Reading Lamps

AUTOMATIC DAY/NIGHT INSIDE MIRROR

Operational test:

- Turn ignition switch to the ON position with the vehicle in park (Fig. 21).

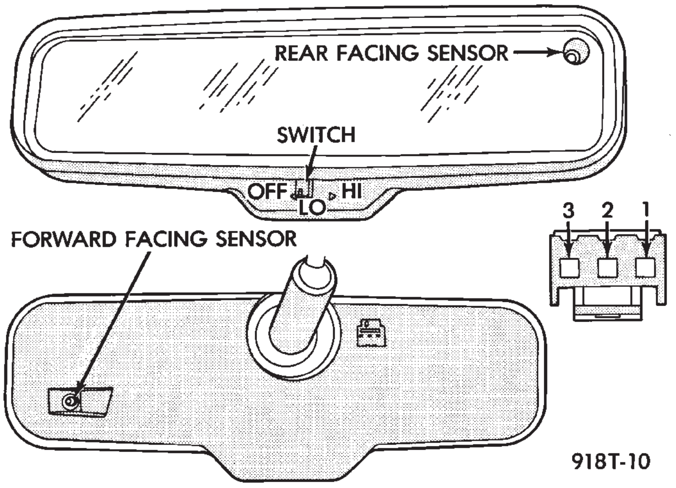


Fig. 21 Automatic Day / Night Mirror

- Place mirror switch in the high position.
- Cover the forward facing sensor with dark cloth to keep out any ambient light.
- Shine a light into the rear facing sensor, watch to see if the mirror darkens.

With the mirror darkened, place the vehicle in reverse, the mirror should return to its normal condition.

If the above conditions are met the mirror is operating properly.

- If not test voltage.

Test three way connector harness. Refer to Fig. 21.

(1) Pin 1 Ignition Switch in run position, should have battery voltage.

(2) Pin 2 Should have continuity to Ground.

(3) Pin 3 When the transmission is in reverse, should have battery voltage.

(4) If test is OK replace Mirror.

(5) If not refer, to Wiring Diagrams manual to test the circuits.

AUTOMATIC DAY/NIGHT INSIDE MIRROR WITH ULTRALIGHT HEADLAMP CONTROL

CAUTION:When JUMP STARTING the vehicle, before cranking engine turn ignition ON and turn OFF the Automatic Headlamp Control.

The mirror automatically reduces the amount of headlamp glare from rear approaching traffic and provides automatic headlamp control (Fig. 22).

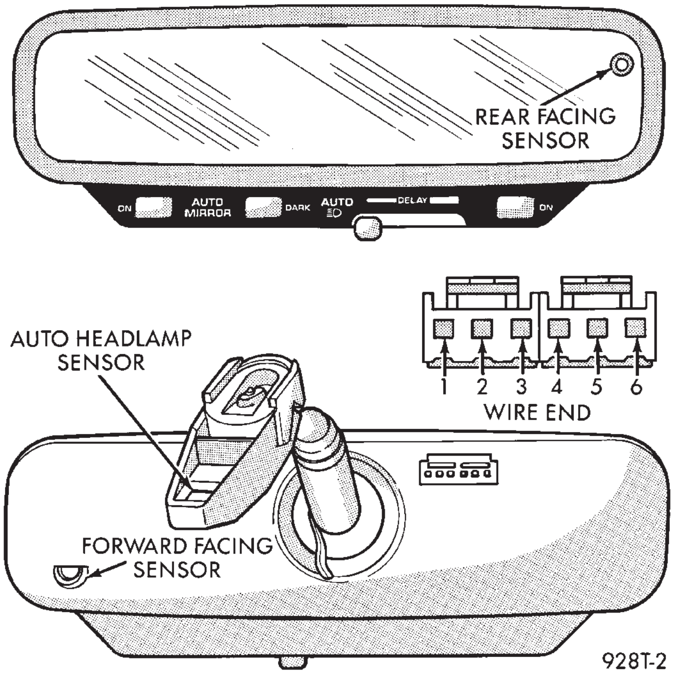


Fig. 22 Automatic Day / Night Mirror with Ultralight Headlamp Control

SELF DIAGNOSTIC MODE—OPERATIONAL TEST:

(1) Place shift selector in park (P) or Neutral (N) position. With ignition OFF, press and hold AUTO MIRROR and AUTO LAMP (headlamp) buttons, turn ignition switch ON. When LED indicators start flashing, release buttons.

(a) The button LED indicators should flash for about five seconds.

- AUTO MIRROR
- DARK
- AUTO LAMP

(b) If they continue to flash much longer than five seconds, the mirror assembly is defective.

(2) The headlamps and parking lamps should turn ON for about five seconds.

- AUTO MIRROR LED
- DARK LED
- AUTO LAMP LED
- The LED indicators blink for about 5 seconds.
- If the three indicators continue to blink considerably longer than 5 seconds, then the mirror assembly is defective.

(3) The mirror should change to dim state.

(a) Place shift selector in reverse (R), with ignition switch ON:

- AUTO MIRROR LED indicator ON
- DARK LED indicator flashing
- Lasting about 15 seconds

(b) The mirror should slowly change to bright state.

(c) If the ignition is not turned OFF within the 15 second time period, the mirror will reset to its previous setting.

The previous conditions are OK, the mirror is operating properly.

If not OK, continue with voltage tests below.

VOLTAGE TEST

To test for voltage insert voltmeter probe into wire end of connector to contact terminal.

Pin 1 ignition voltage

(a) Ignition switch OFF, zero volts.

(b) Ignition switch ON, battery voltage.

Pin 2 battery voltage

(a) Battery voltage at all times.

(b) No voltage, check 15 amp. fuse.

Pin 3 Ground

(a) Continuity to ground.

(b) No voltage

Pin 4 Reverse over-ride

(a) Ignition OFF, zero voltage.

(b) Ignition ON shift selector in Reverse (R), battery voltage.

(c) Ignition ON shift selector in any position other than Reverse (R), zero voltage.

Pin 5 Headlamp relay

(a) Battery voltage at all times from headlamp relay.

(b) No battery voltage, test headlamp relay.

Pin 6 Park lamp relay

(a) Ignition switch ON, battery voltage feed from park lamp relay.

(b) Ignition switch OFF, zero voltage.

(c) Ignition ON, No battery voltage test park lamp relay.

If Voltage Test are OK, replace mirror assembly.

If not OK, refer to Wiring Diagrams manual.

CHIME WARNING/REMINDER SYSTEM

CONTENTS

GENERAL INFORMATION

WARNING: ON VEHICLES EQUIPPED WITH AN AIR BAG REFER TO THE AIR BAG PORTION OF THIS SECTION FOR STEERING WHEEL OR SWITCH REMOVAL AND INSTALLATION PROCEDURES.

BUZZER SYSTEM

The seat belt warning system uses both visual and audible signals. A combined seat belt and key warning buzzer with a red light on the instrument panel.

The system will always illuminate the seat belt warning lamp for four to eight seconds when the ignition switch is turned to the ON position. Also, only if the driver does not fasten his seat belt, the buzzer will sound during the same time interval. Passenger belts are not connected to the system.

A timed buzzer-relay is used to operate the system for the time period. It consists of a time delay mechanism and buzzer assembly. Only the driver's seat belt buckle has a switch that is connected to the system.

CHIME WARNING/REMINDER SYSTEM

The chime warning/reminder system is similar in operation to the buzzer system except for a more pleasant sounding tone. This chime type tone sounds for all three warning/reminder conditions; namely headlamps left on, keys left in ignition and fasten seat belt.

TIMED BUZZER-RELAY TEST—AP BODY

PREPARATION

(1) Remove timed buzzer-relay (Fig. 1).

(2) Connect one end of a jumper wire to a 12 volt supply.

(3) Connect a test lamp equipped with a number 194 lamp or equivalent, between terminal number 3 of relay and ground.

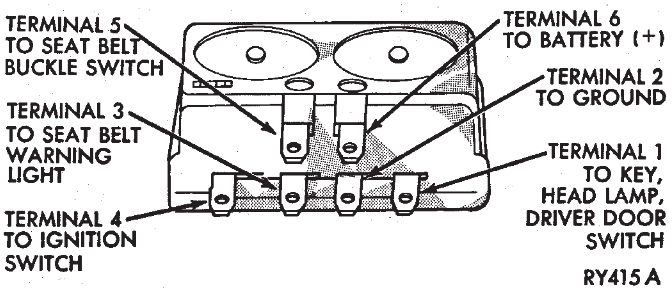


Fig. 1 Timed Buzzer-Relay Terminal Identification

(4) Ground terminals 2 and 5 of relay.

TEST

(1) Connect 12 volt jumper wire to terminal number 4 of timed buzzer-relay, look at test lamp and listen for buzzer.

(2) Test lamp should come on and buzzer should sound for four to eight seconds and then both should go off; if not, replace timed buzzer-relay.

(3) If operation is okay, check all wiring in vehicle for opens, shorts, or poor connections.

SEAT BELT BUCKLE SWITCH TEST BUZZER SYSTEM

Test timed buzzer-relay. If it checks OK, check the wiring between seat belt buckle and ground. The wire that goes to terminal 5 of relay from buckle switch, refer to Fig. 2 and 3. If they check out okay, replace buckle switch.

CHIME WARNING/REMINDER SYSTEM TEST

FASTEN SEAT BELTS

To test the fasten seat belts function, turn the ignition switch to the ON position with the driver's seat belt unbuckled. The seat belt warning lamp should light for four to eight seconds and the tone should sound three to five times.

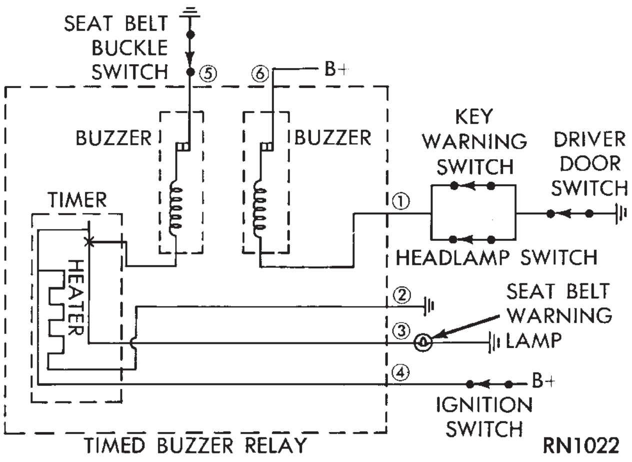


Fig. 2 Buzzer System Wiring Schematic

HEADLAMPS LEFT ON

To test the headlamps left on function, turn headlamps on with drivers door open. Chime should sound until headlamps are turned off or drivers door is closed.

KEY LEFT IN IGNITION

To test the key left in ignition function, insert key into the ignition and open drivers door. Chime should sound until key is removed from ignition or drivers door is closed.

CHIME SYSTEM DIAGNOSIS—AA AND AP BODIES

WARNING: ON VEHICLES EQUIPPED WITH AN AIR BAG REFER TO THE AIR BAG PORTION OF THIS SECTION FOR STEERING WHEEL OR SWITCH REMOVAL AND INSTALLATION PROCEDURES.

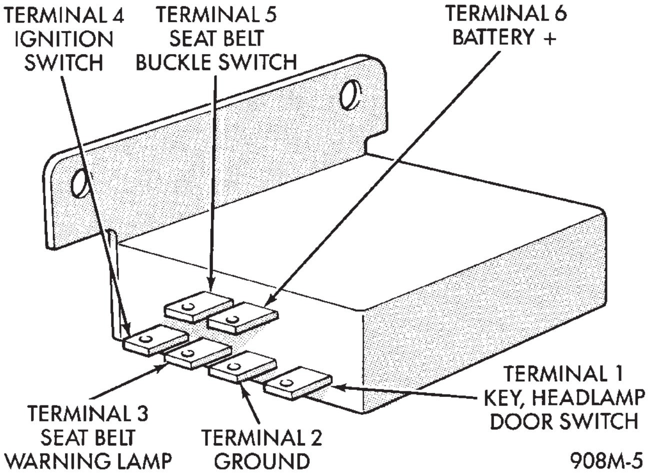


Fig. 4 Chime Module Terminal Identification

CONDITION: NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVERS SEAT BELT OR AUTOMATIC SHOULDER HARNESS IS UNBUCKLED

PROCEDURE

(1) Check seat belt buckle switch (drivers seat) or rotary switch in automatic shoulder harness retractor for a ground when unbuckled.

(2) Check for battery feed at terminal 6 and ignition feed at terminal 4 of chime module (Fig. 4 and 5).

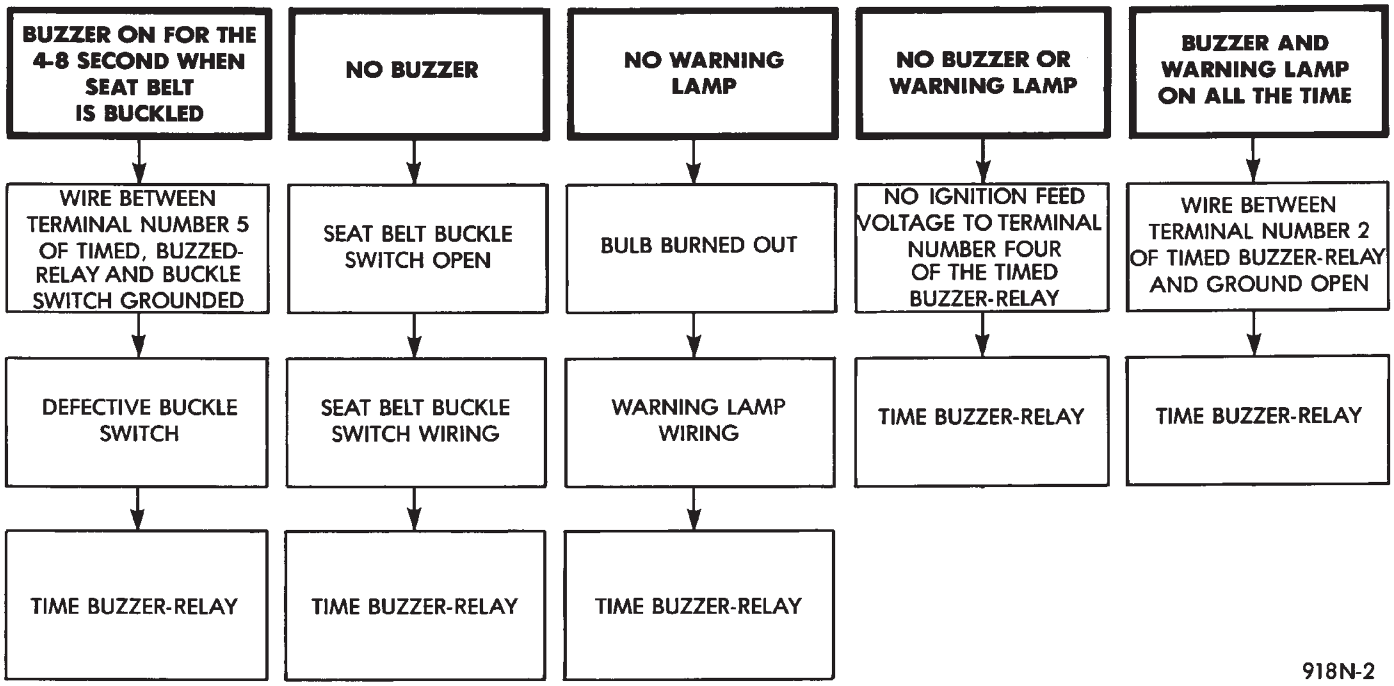


Fig. 3 Seat Belt Warning System Diagnosis

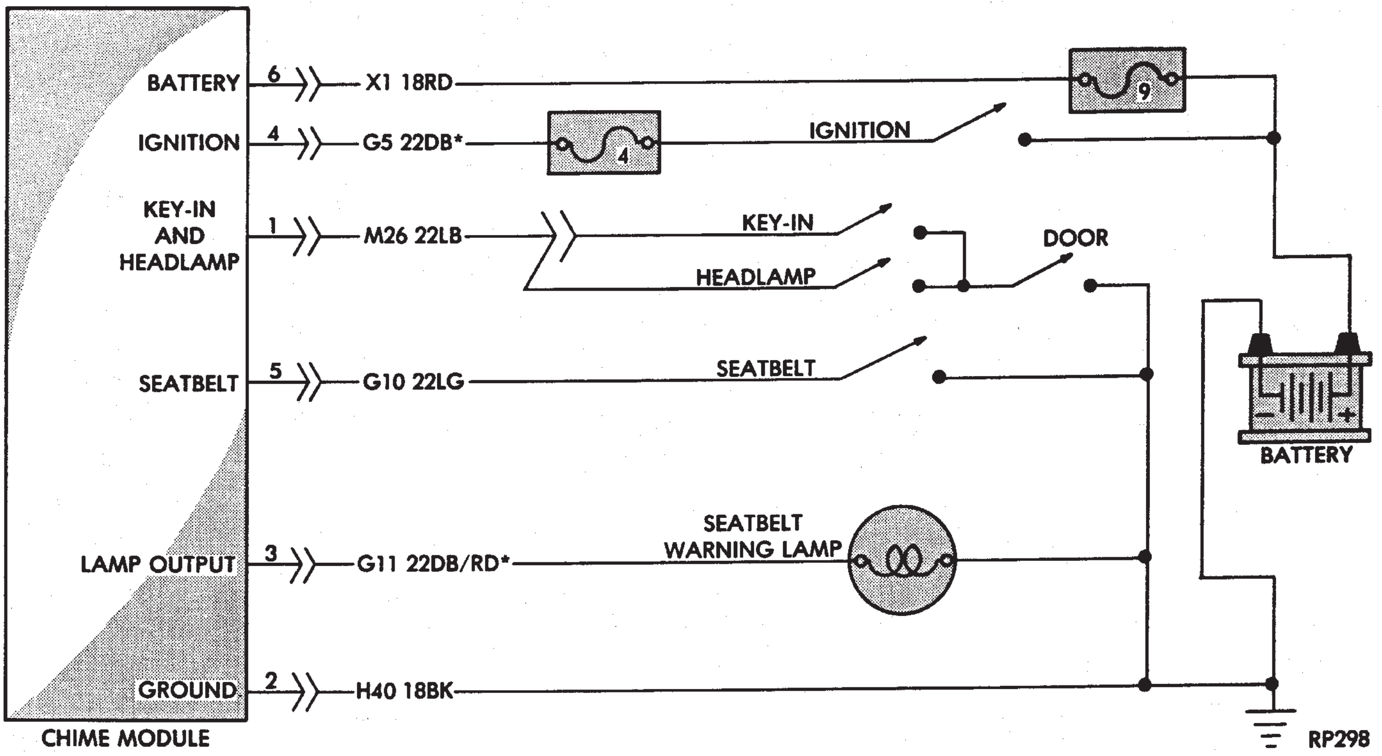


Fig. 5 Chime Module Wiring—AA and AP Bodies

(3) Check for tone in any other function.

CONDITION: NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON.

PROCEDURE

(1) Check for burned out lamp.
(2) Check for battery feed at terminal 6 and lamp output at terminal 3 of chime module.
(3) Check for ignition feed at terminal 4 of chime module.

CONDITION: FASTEN SEAT BELT LAMP OR TONE CONTINUE FOR MORE THAN TEN SECONDS AFTER SEAT BELTS ARE FASTENED AND DRIVERS DOOR IS CLOSED

PROCEDURE

(1) Check left door jamb switch.
(2) Check chime module.

CONDITION: NO TONE WHEN HEADLAMPS ARE ON AND DRIVERS DOOR IS OPEN

PROCEDURE

(1) Check left door jamb switch for good ground when drivers door is open.
(2) Check wiring connector for good contact at chime module.
(3) Check for battery feed at terminal 6 of chime module.
(4) Check headlamp switch.

CONDITION: NO TONE WHEN KEY IS LEFT IN IGNITION AND DRIVERS DOOR IS OPEN

PROCEDURE

(1) Check left door jamb switch for good ground when drivers door is open.
(2) Check wiring connector for good contact at chime module.
(3) Check for battery feed at terminal 6 of chime module.
(4) Check key-in switch.

CONDITION: CHIMES CONTINUE WHEN HEADLAMPS ARE TURNED OFF AND/OR KEY IS REMOVED FROM IGNITION

PROCEDURE

(1) Check wiring for a grounded condition between headlamp switch, key-in switch and chime module.
(2) Check chime module.

CHIME SYSTEM DIAGNOSIS—AC, AG, AJ AND AY BODIES

CONDITION: NO TONE WHEN IGNITION IS TURNED ON AND DRIVER'S SEAT BELT IS UNBUCKLED

PROCEDURE

(1) Check driver's seat belt buckle switch for a ground when unbuckled.

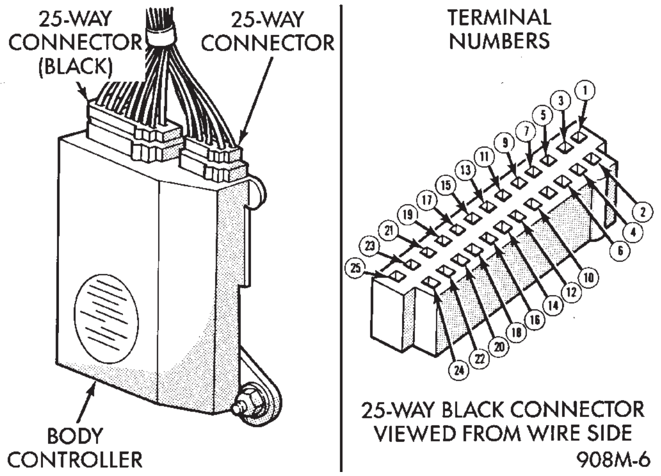


Fig. 6 Body Controller 25-Way Connector

(2) Check for battery feed at terminal 16 and ignition feed at terminal 12 of 25-way body controller connector (Fig. 6, 7 and 8).

(3) Check for tone in any other function.

CONDITION: NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON

PROCEDURE

(1) Check for burned out lamp.

(2) Check for battery feed at terminal 16 and lamp output at terminal 21 of 25-way body controller connector.

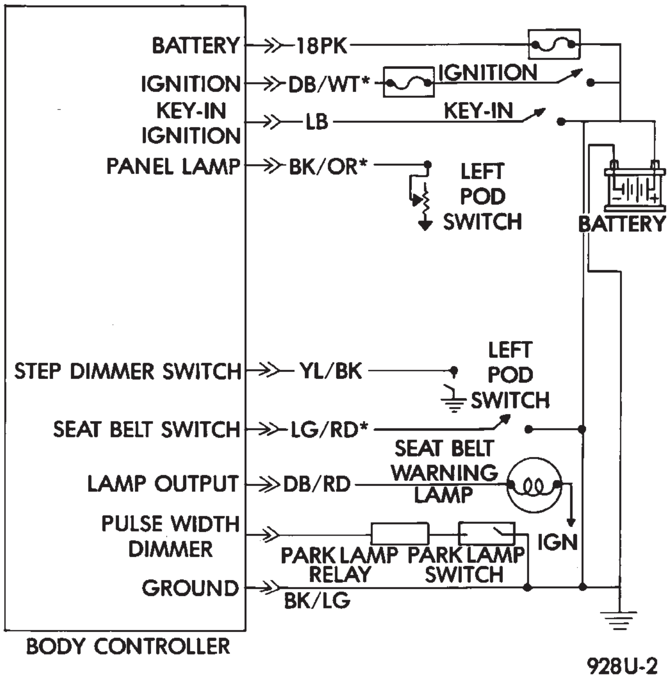


Fig. 7 Chime System Wiring—AG and AJ Bodies

(3) Check for ignition feed at terminal 12 of 25-way body controller connector.

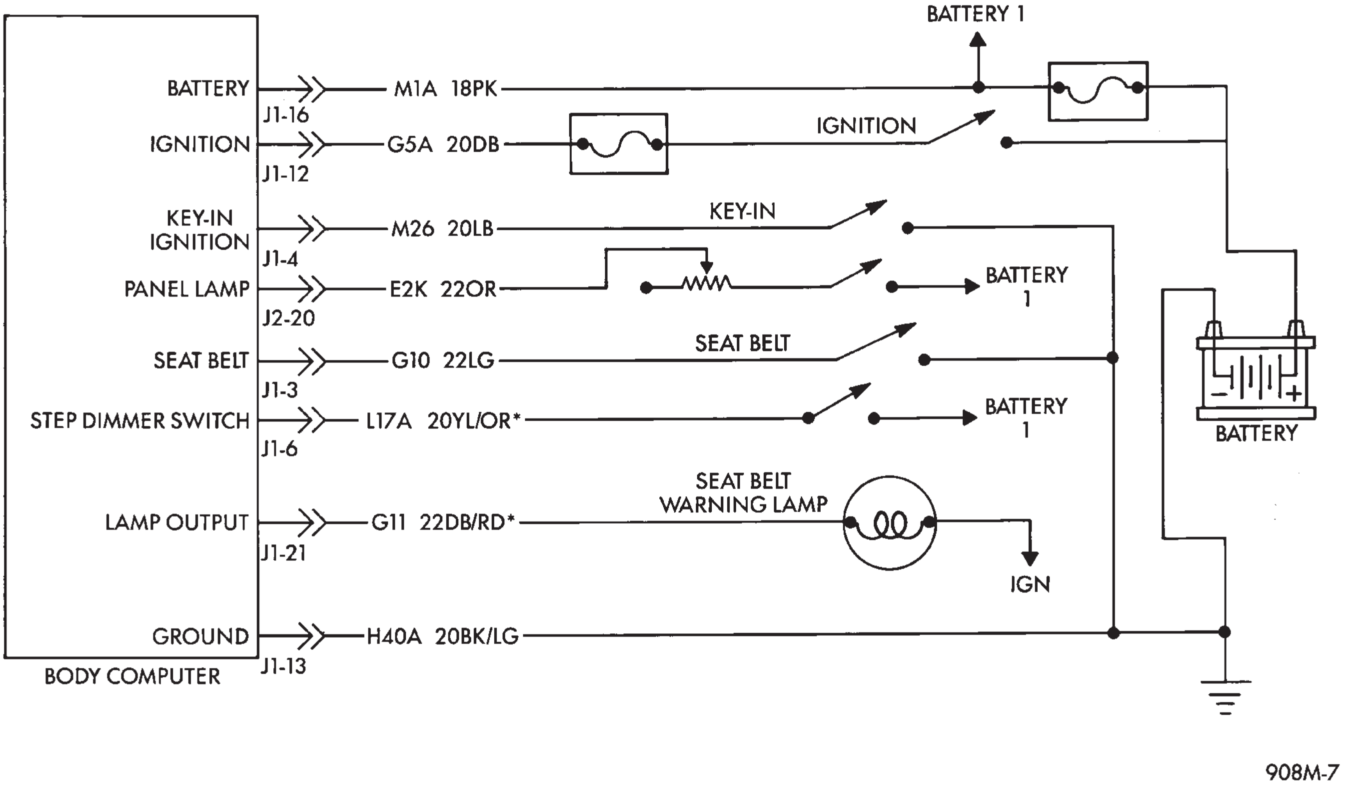


Fig. 8 Chime System Wiring—AC and AY Bodies

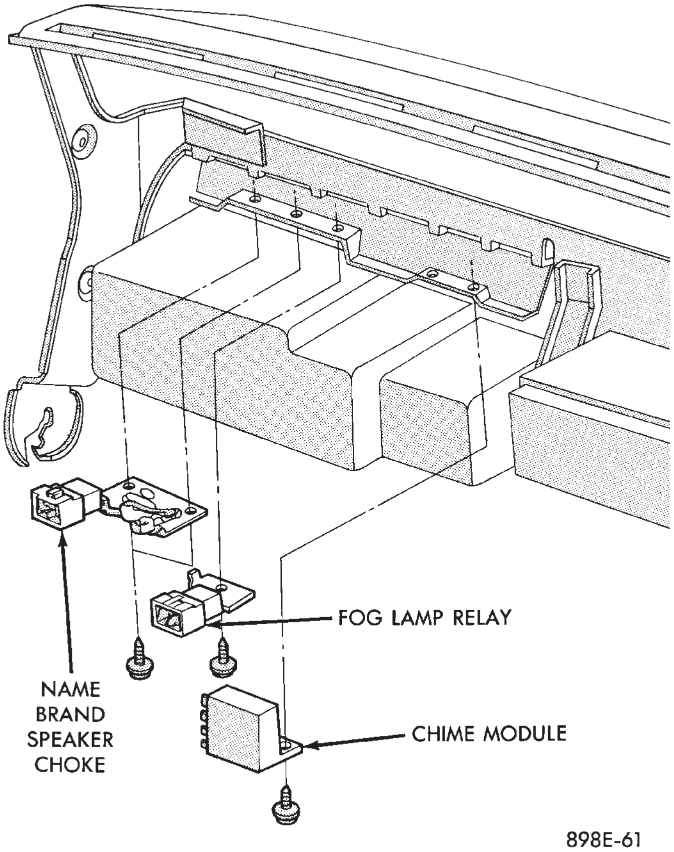


Fig. 9 Chime Module Location—AA Body

CONDITION: NO TONE WHEN HEADLAMPS ARE ON AND DRIVER'S DOOR IS OPEN, AND IGNITION IS OFF

PROCEDURE

(1) Check left door jamb switch for good ground when driver's door is open. This may be checked at terminal 1 of 25-way body controller connector.

(2) Check for battery feed at terminal 16 of 25-way body controller connector.

(3) Check headlamp switch.

CONDITION: NO TONE WHEN KEY IS LEFT IN IGNITION AND DRIVER'S DOOR IS OPEN

PROCEDURE

(1) Check left door jamb switch for good ground when driver's door is open. This may be checked at terminal 1 of 25-way body controller connector.

(2) Check for battery feed at terminal 16 of 25-way body controller connector.

(3) Check key-in switch.

CONDITION: CHIMES CONTINUE WHEN HEADLAMPS ARE TURNED OFF AND/OR KEY IS REMOVED FROM IGNITION

PROCEDURE

Check wiring for a grounded condition between headlamp switch, key-in switch, and body controller.

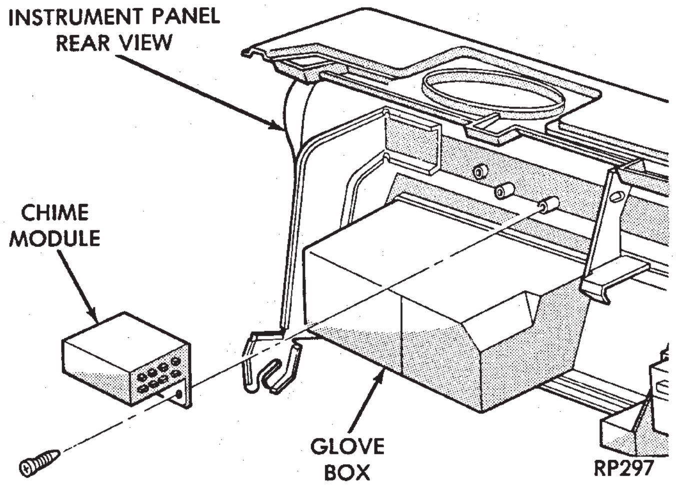


Fig. 10 Chime Module Location

SERVICE PROCEDURES

CHIME MODULE REPLACEMENT AA and AP BODIES

(1) Open glove box door and disconnect check strap.

(2) Disconnect glove box light switch.

(3) Remove screws from glove box assembly and remove.

(4) Remove two screws from chime module mounting bracket (Figs. 9 and 10).

(5) Disconnect chime module wiring and remove module.

(6) For installation reverse above procedures.

BODY CONTROLLER REPLACEMENT

Refer to Group 8E, Instrument Panel and Gauges.

SEAT BELT BUCKLE REPLACEMENT

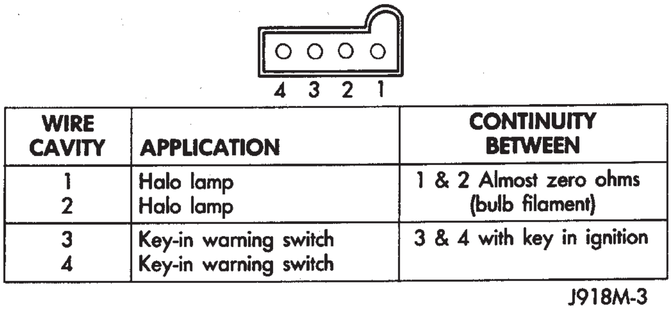
Refer to Group 23, Body of this service manual.

HEADLAMP SWITCH REPLACEMENT

Refer to Group 8E, Instrument Panel and Gauges.

KEY-IN SWITCH REPLACEMENT

The Key-in switch is built into the ignition switch assembly. Should the Key-in switch require service, the ignition switch assembly must be replaced. Refer to Group 8D Ignition System of this service manual (Fig. 11).



WIRE CAVITY	APPLICATION	CONTINUITY BETWEEN
1 2	Halo lamp Halo lamp	1 & 2 Almost zero ohms (bulb filament)
3 4	Key-in warning switch Key-in warning switch	3 & 4 with key in ignition

Fig. 11 Halo Lamp and Key-In Warning Switch Continuity

FUEL SYSTEMS

CONTENTS

GENERAL INFORMATION

Throughout this group, references are made to a particular vehicle by letter designation. A chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

The Fuel System consists of the fuel tank, fuel pump, fuel filter, throttle body, fuel injectors, fuel tubes and vacuum tubes.

The Fuel Delivery System consists of the fuel pump, fuel filter, fuel lines and fuel hoses.

The Fuel Tank Assembly consists of the fuel tank, filler tube, a fuel gauge sending unit assembly and a pressure-vacuum filler cap.

Also, the Evaporation Control System is part of the fuel system. The evaporation control system is designed to reduce 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.

FUEL REQUIREMENTS

Your vehicle was designed to meet all emission regulations and provide excellent fuel economy when using high quality unleaded gasoline.

VEHICLES WITHOUT TURBOCHARGED ENGINES

Use unleaded gasoline having a minimum octane rating of 87.

VEHICLES WITH TURBOCHARGED ENGINES—EXCEPT 16 VALVE 2.2L ENGINES

These vehicles will operate satisfactorily on both regular unleaded gasoline having a minimum octane rating or 87, and premium unleaded gasoline having a minimum octane rating of 91. The use of premium unleaded gasoline will improve performance.

VEHICLES WITH 2.2L 16 VALVE ENGINES

The use of premium unleaded gasoline having a minimum octane of 91 is recommended. If premium unleaded is not available, then unleaded gasoline with a minimum octane of 87 may be used. However, the use of lower octane gasoline will result in reduced performance.

FLEXIBLE FUEL AA-BODY VEHICLES

These vehicles will operate on either unleaded gasoline with a minimum posted octane of 87 or M85 fuel. M85 fuel is a mixture of 85 percent methanol and 15 percent unleaded gasoline. The vehicle also will operate on mixture of M85 and unleaded gasoline with a minimum posted octane of 87. **Do not use 100 percent methanol in these vehicles.**

THE FOLLOWING IS APPLICABLE TO ALL VEHICLES

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and should be reported to your dealer immediately. Engine damage resulting from operating with a heavy spark knock may not be covered by the new vehicle warranty.

In addition to using unleaded gasoline with the proper octane rating, gasolines 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. Generally, premium unleaded gasolines contain more additive than regular unleaded.

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.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend gasoline with materials that contain oxygen such as alcohol, MTBE (Methyl Tertiary Butyl Ether) and ETBE (Ethyl Tertiary Butyl Ether). 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.

Methanol - (Methyl or Wood Alcohol) is used in a variety of concentrations when blended with unleaded gasoline. You may find 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 Motors and may not be covered by the new vehicle warranty.

MTBE/ETBE - Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline blended and up to 15 percent MTBE. Gasoline and ETBE (Ethyl Tertiary Butly Ether) are blends of gasoline and up to 17 percent ETBE. Gasoline blended with MTBE or ETBE may be used in your vehicle.

Clean Air Gasoline

Many gasolines are now being blended that contribute to cleaner air, especially in those areas of the country where pollution levels are high. These new blends provide a cleaner burning fuel and some are referred to as reformulated gasoline.

In areas of the country where carbon monoxide levels are high, gasolines are being treated with oxygenated materials such as ETBE, MTBE and ethanol. The use of gasoline blended with these materials also contributes to cleaner air.

Chrysler Corporation supports these efforts toward cleaner air and recommends that you use these gasolines as they become available.

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.

FUEL DELIVERY SYSTEM

INDEX

GENERAL INFORMATION

Beginning this model year, Chrysler began producing AA-Body vehicles designed to operate on a mixture of gasoline and methanol. These automobiles are referred to as Flexible Fuel vehicles.

Flexible fuel vehicles can operate on a mixture of up to 85 percent methanol, 15 percent unleaded gasoline. These vehicles also operate on mixtures containing a lower percentage of methanol or just pure unleaded gasoline.

In many cases, the procedures for servicing flexible fuel components is identical to gasoline only components. Refer to the particular Service Procedure in this section. If the service procedure for flexible fuel component differs from a gasoline only component, the title of each service procedure identifies the application.

SERVICE PRECAUTIONS FOR FLEXIBLE FUEL VEHICLES

Methanol is more toxic than gasoline. Always release fuel system pressure before servicing fuel system components and wear methanol resistant gloves and eye protection.

Avoid breathing methanol vapors or ingesting methanol. Headaches, dizziness and even unconsciousness could result from breathing these vapors. Serious injury, blindness and even death could result from ingesting methanol.

Methanol vapors are extremely flammable and can travel along the ground. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle.

Do not allow methanol to contact skin. Prolonged contact with methanol can cause dry skin or an allergic skin reaction. Also, prolonged contact could result in absorption through the skin.

IDENTIFYING FLEXIBLE FUEL COMPONENTS

Flexible Fuel vehicles have unique methanol compatible fuel system components. Chrysler identifies methanol compatible components that could be physically interchanged with gasoline only parts by coloring them green or applying a green label or tag to them. Even though they may appear physically identical, components for gasoline only vehicles must not be used on flexible fuel vehicles.

FLEXIBLE FUEL COMPONENTS

Flexible fuel AA-body vehicles uses many unique fuel system components. The unique parts are green in appearance or have a green tag or label attached to them. While components used on gasoline only vehicles may look similar or identical, they cannot be used on flexible fuel vehicles. When servicing a component, always use an original equipment or equivalent flexible fuel replacement.

The fuel system of flexible fuel AA-body vehicles have the following unique components.

- Fuel pump module
- Fuel level sensor
- Fuel gauge (gauge cluster).
- Fuel tank
- Fuel pressure regulator (including O-rings)
- Fuel rail
- Fuel injectors (including O-rings)
- Fuel tubes
- Fuel filter
- EVAP canister
- Fuel filler cap
- Fuel filler tube
- Pressure relief/Rollover valve
- All fuel system and emission system hoses and tubes

INSTRUMENT PANEL CLUSTER IDENTIFICATION—FLEXIBLE FUEL AA-BODY

Flexible fuel A-Body vehicles use a unique gauge cluster. To identify the cluster, remove it from the instrument panel and check the number on the tag on the top. If the part number matches the number in the parts book for flexible fuel A-bodies, the vehicle was built with the correct cluster. Refer to Group 8E, Instrument Panel and Gauges, for cluster removal and installation.

METHANOL CONCENTRATION SENSOR—FLEXIBLE FUEL AA-BODY

The methanol concentration sensor contains a microprocessor that determines the percentage of gasoline and methanol in the fuel system. From the methanol concentration sensor input, the powertrain control module (PCM) determines the amount of methanol in the fuel. The vehicle can operate on a mixtures up to 85 percent methanol, 15 percent gasoline.

The methanol concentration sensor output voltages varies with the percent of methanol in the fuel system. The sensor output voltage (input for PCM) ranges from 0.5 volts for pure gasoline to 4.75 volts for 85 percent methanol. For two seconds at key ON when the operator starts the vehicle, the sensor calibrates the PCM. During the calibration period the sensor sends 4.45 volts to the PCM as a correction factor.

The methanol concentration sensor has a built-in shutdown capability. If the sensor shuts down, it defaults to the previous learned value (output voltage based on methanol percentage of fuel).

The methanol concentration sensor attaches to a bracket at the rear of the fuel tank, next to the fuel filler tube (Fig. 1).

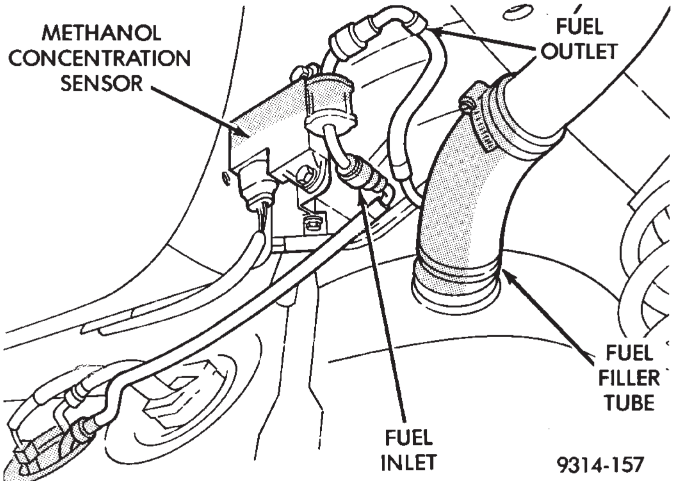


Fig. 1 Methanol Concentration Sensor

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

Quick connect fittings attach the fuel tubes to the methanol concentration sensor (Fig. 1)

(1) Release fuel system pressure. Refer to the Fuel System Pressure Release Procedure.

(2) Disconnect the fuel tubes from sensor. Refer to Quick Connect Fittings in this section.

(3) Disconnect electrical connector from sensor.

(4) Remove mounting nuts.

INSTALLATION

(1) Place sensor on bracket. Tighten mounting nut.

(2) Attach electrical connector to sensor.

(3) Connect fuel tubes to sensor. Refer to Quick Connect Fittings in this section.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—EXCEPT 2.2L/2.5L TBI AND 3.0L

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. 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 the protective cap from the fuel pressure test port on the fuel rail (Fig. 2).

(4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container or a container approved for gasoline/methanol mixtures. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 3). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—2.2L/2.5L TBI

CAUTION: Before servicing the fuel pump, fuel lines, fuel filter, throttle body, or fuel injector, release fuel system pressure.

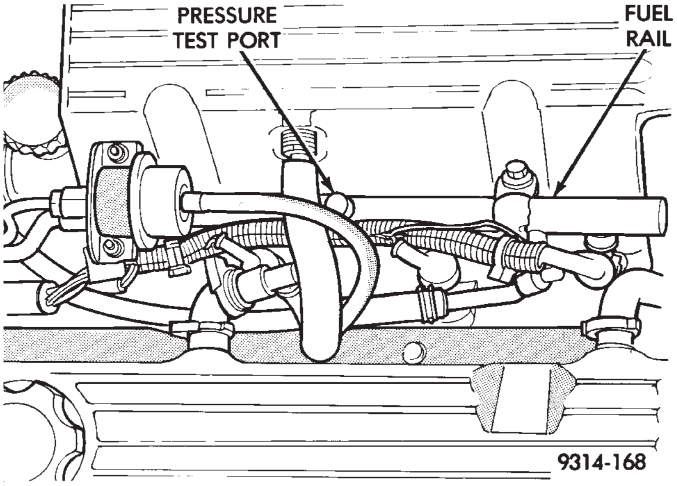


Fig. 2 Fuel Pressure Test Port—Typical

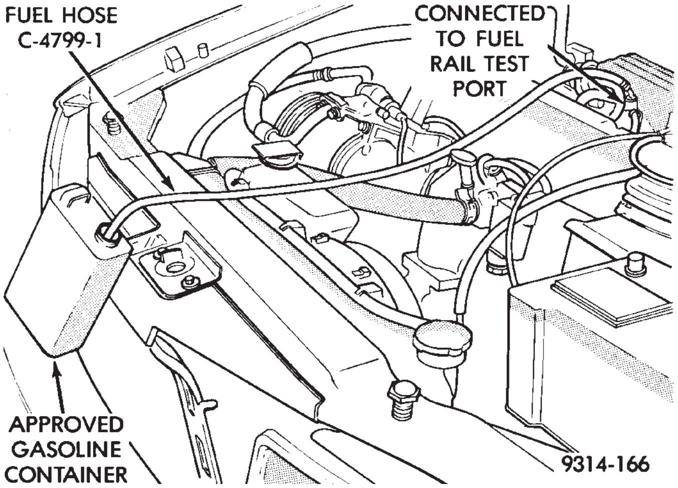


Fig. 3 Releasing Fuel Pressure—Engines With Test Ports On Fuel Rail

(1) Loosen fuel filler cap to release fuel tank pressure.

(2) Disconnect injector wiring harness connector at edge of throttle body (Fig. 4).

(3) Connect a jumper wire between terminal Number 1 of the injector harness and engine ground.

(4) Connect a jumper wire to the positive terminal Number 2 of the injector harness and touch the battery positive post **for no longer than 5 seconds**. This releases system pressure.

(5) Remove jumper wires.

(6) Continue fuel system service.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—3.0L

(1) Disconnect the fuel rail electrical harness from the engine harness. Refer to Group 8W, Wiring Diagrams.

(2) Connect one end of a jumper wire to the A142 circuit terminal of the fuel rail harness connector.

(3) Connect the other end of the jumper wire to a 12 volt power source.

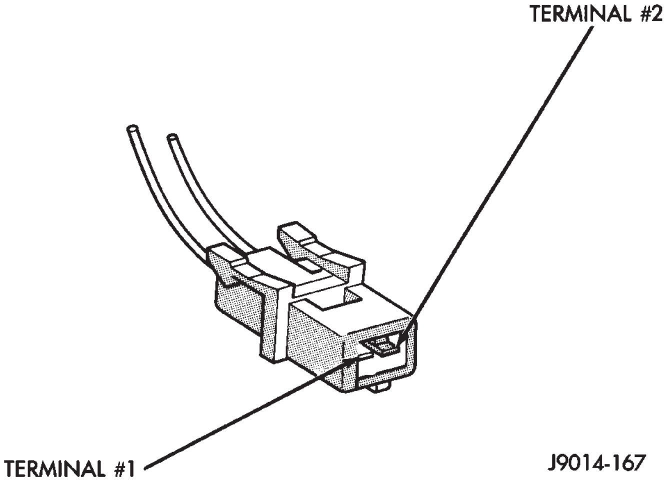


Fig. 4 Injector Harness Connector—2.2L/2.5L TBI

(4) Connect one end of a jumper wire to a good ground source.

(5) Momentarily ground one of the injectors by connecting the other end of the jumper wire to an injector terminal in the harness connector. Repeat procedure for 2 to 3 injectors.

FUEL PUMP ASSEMBLY

The fuel pump assembly consists of the fuel pump and the reservoir body.

The reservoir body takes the place of an internal fuel tank reservoir. The reservoir maintains fuel at the pump inlet during all driving conditions, especially when the fuel level is low.

The system uses a positive displacement, gerotor gear, immersible pump with a permanent magnet electric motor (Fig. 5). The pump draws fuel through a strainer and pushes it through the electric motor to the outlet. The pump contains three check valves. One valve relieves internal fuel pump pressure and regulates maximum pump output. Another valve, inside the pump assembly in the fuel return circuit, prevents fuel tank leakage if the line is damaged during an accident. The third valve, in the pump outlet, maintains pump pressure during engine off conditions. The fuel pump relay provides voltage to the fuel pump. All pumps have a maximum stall pressure output of approximately 930 kPa (135 psi).

All front wheel drive car fuel systems, except Turbo III and flexible fuel AA-body vehicles use the same fuel pump. Turbo III and flexible fuel AA-Body vehicles each use different fuel pumps although they look similar to pumps used in other vehicles.

Release fuel system pressure before servicing the fuel tank, fuel pump, fuel lines, fuel filter, or parts of the fuel rail. Follow the Fuel System Pressure Release procedure to relieve fuel system pressure.

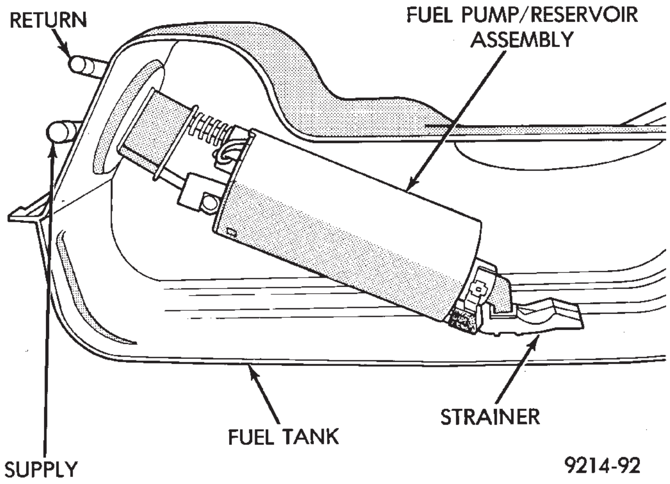


Fig. 5 Fuel Pump—Typical

FUEL SYSTEM PRESSURE

Fuel system pressure is regulated at the fuel rail or throttle body by a fuel pressure regulator. Refer to the Fuel System Pressure Chart for pressure specifications. The chart reflects system pressure when the pump is energized with the engine not running and without vacuum applied to the pressure regulator.

FUEL SYSTEM PRESSURE

System	Pressure
2.2L TBI	265 kPa (39 psi)
2.5L TBI	265 kPa (39 psi)
2.5L MPI (Flexible Fuel AA-Body)	380 kPa (55 psi)
2.2L Turbo III	380 kPa (55 psi)
3.0L MPI	330 kPa (48 psi)
3.3L MPI	330 kPa (48 psi)
3.8L MPI	330 kPa (48 psi)

9314-164

FUEL PUMP PRESSURE TEST—ALL EXCEPT 2.2L/2.5L TBI AND 3.0L MPI

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

The specifications in the Fuel Pressure chart reflect system pressure with the vacuum hose removed from the pressure regulator.

(1) Remove the vacuum hose from the pressure regulator before checking fuel pressure.

(2) Release fuel system pressure. Refer to the Fuel System Pressure Release procedure in this section.

(3) Connect Fuel Pressure Gauge C-4799 to service port on fuel rail (Fig. 6).

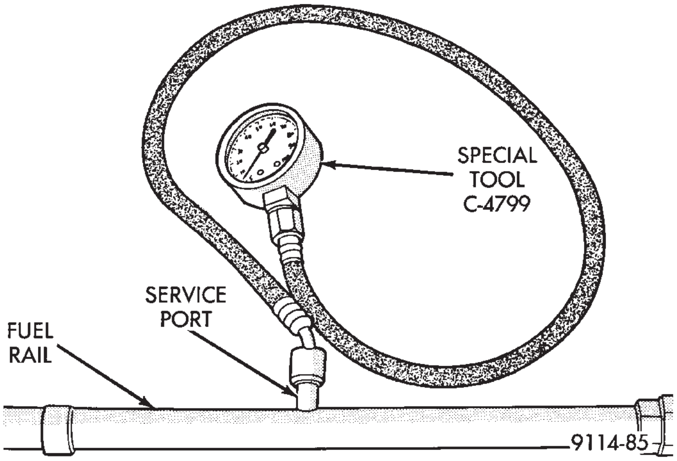


Fig. 6 Fuel Pressure Testing—Engines With Service Ports

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.

(4) Place the ignition key in the ON position. Using the DRBII scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

If the gauge reads the specification listed in the Fuel System Pressure chart, further testing is not required. If pressure is not correct, record the pressure and remove gauge. Use the DRBII scan tool ASD Fuel System Test to pressurize the system. Ensure fuel does not leak from the fuel rail service valve. Install protective cover on fuel rail service valve.

If pressure is below specifications, proceed to **Fuel System Pressure Below Specifications** . If pressure is above specifications, proceed to **Fuel System Pressure Above Specifications**.

Fuel System Pressure Below Specifications

If the fuel pressure reading in step (4) was below specifications, test the system according to the following procedure.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A FUEL SYSTEM HOSE OR COMPONENT.

(a) Perform Fuel Pressure Release procedure.

(b) Install Fuel Pressure Gauge C-4799 and Fuel Pressure Test Adapter 6539 in the fuel supply line between the fuel tank and fuel filter at the rear of vehicle (Fig. 7).

(c) Using the DRBII scan tool, with the ignition key in the ON position, repeat the ASD Fuel System Test.

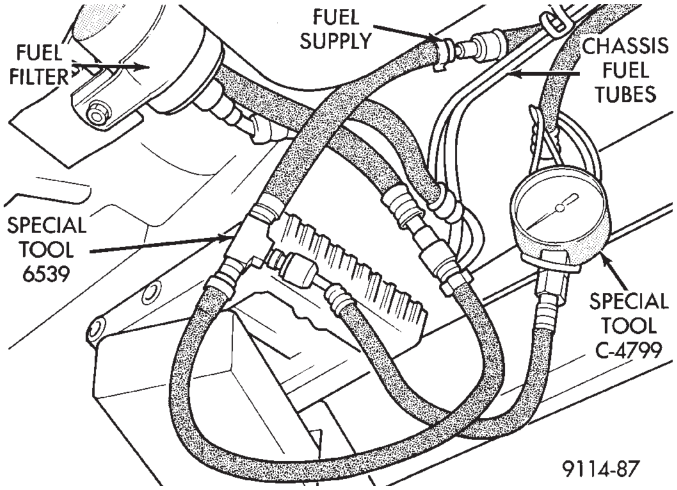


Fig. 7 Fuel Pressure Test

- If pressure is at least 5 psi higher than reading recorded in step (4), replace fuel filter.
- If no change is observed, gently squeeze the return hose. If fuel pressure increases, replace pressure regulator. If gauge reading does not change while squeezing the return hose, the problem is either a plugged inlet strainer or defective fuel pump.

Fuel System Pressure Above Specifications

If the fuel pressure reading in step (4) was above specifications, test the system according to the following procedure.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A FUEL SYSTEM HOSE OR COMPONENT.

(a) Perform Fuel Pressure Release procedure.

(b) Remove the fuel return line hose from the fuel pump at fuel tank.

(c) Connect Fuel Pressure Test Adapter 6541 to the return line (Fig. 8). Place the other end of adapter 6541 into an approved gasoline container or a container approved for methanol/gasoline mixtures (minimum 2 gallon size). All return fuel will flow into container.

(d) Using the DRBII scan tool, with the ignition key in the ON position, repeat the ASD Fuel System Test.

- If pressure is now correct, replace fuel pump assembly.
- If pressure is still above specifications, remove fuel return hose from chassis fuel tubes (at engine). Attach Fuel Pressure Test Connect Adapter 6541 to the fuel return hose and place other end of hose in clean container (Fig. 9). Repeat test. If pressure is now correct, check for restricted fuel return line. If no change is observed, replace fuel pressure regulator.

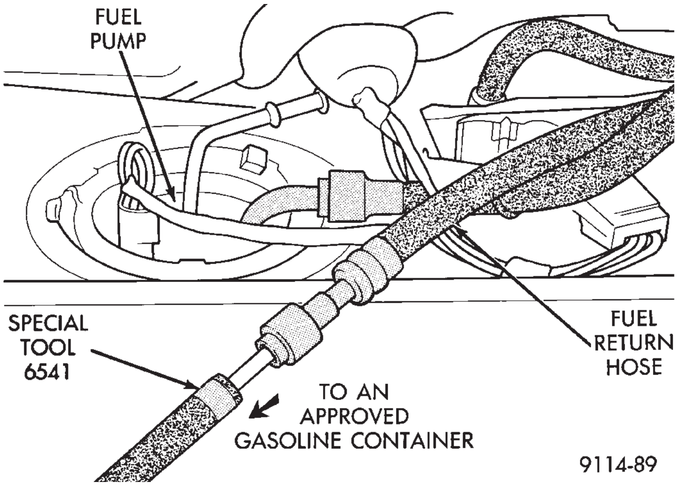


Fig. 8 Fuel Pressure Return Test

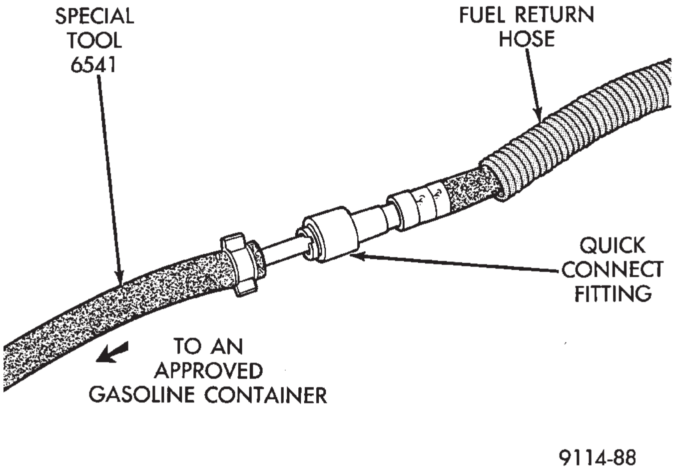


Fig. 9 Fuel Return Connection

FUEL PUMP PRESSURE TEST—2.2L/2.5L TBI and 3.0L MPI ENGINES

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A FUEL SYSTEM HOSE OR COMPONENT.

The specifications in the Fuel Pressure chart reflect system pressure with the vacuum hose removed from the pressure regulator. Remove the vacuum line from the pressure regulator on 3.0L engines before testing fuel system pressure. The pressure regulators on 2.2L/2.5L TBI engines are not vacuum assisted.

(1) Perform fuel system pressure release.

(2) Remove fuel supply hose quick connector from the chassis lines (at the engine).

(3) Connect Fuel Pressure Gauge C-4799 to Fuel Pressure Test Adapter 6539 (Fig. 10). Install the adapter between fuel supply hose and chassis fuel line assembly.

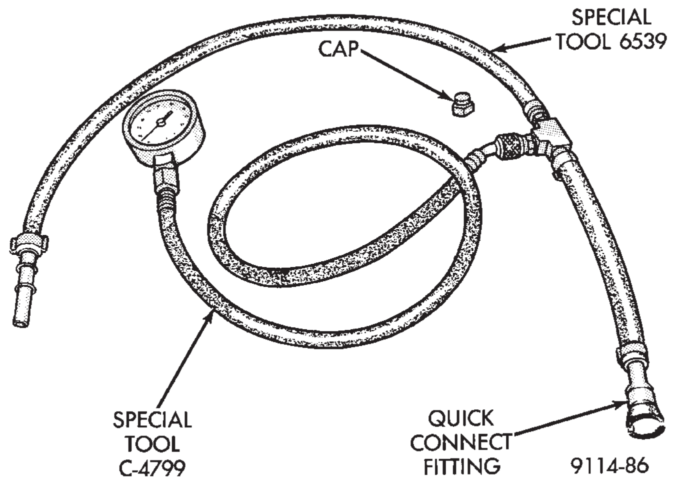


Fig. 10 Fuel Pressure Gauge and Adapter

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.

(4) Place the ignition key in the ON position. Using the DRBII scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

If the gauge reads the pressure shown in the Fuel System Pressure chart, further testing is not required. If pressure is not correct, record the pressure and remove gauge.

If pressure is below specifications, proceed to **Fuel System Pressure Below Specifications**. If pressure is above specifications, proceed to **Fuel System Pressure Above Specifications**.

Fuel System Pressure Below Specifications

If the fuel pressure reading in step (4) was below specifications, test the system according to the following procedure.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A FUEL SYSTEM HOSE OR COMPONENT.

(a) Perform Fuel Pressure Release procedure.

(b) Install Fuel Pressure Gauge C-4799 and Fuel Pressure Adapter 6433 in the fuel supply line (Fig. 7) between the fuel tank and fuel filter.

(c) Using the DRBII scan tool, with the ignition key in the ON position, repeat the ASD Fuel System Test.

- If pressure is at least 5 psi higher than reading recorded in step (4), replace fuel filter.
- If no change is observed, gently the squeeze return hose. If fuel pressure increases, replace pressure regulator. If the gauge reading does not change while squeezing the return hose, the problem is either a plugged inlet strainer or defective fuel pump.

Fuel System Pressure Above Specifications

If the fuel pressure reading in step (4) was above specifications test the system according to the following procedure.

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE A FUEL SYSTEM HOSE OR COMPONENT IS DISCONNECTED.

(a) Perform Fuel Pressure Release procedure.

(b) Install Fuel Pressure Gauge C-4799 and Fuel Pressure Adapter 6433 in the fuel supply line between the fuel tank and fuel filter (Fig. 7).

(c) Remove the fuel return line hose from the fuel pump at fuel tank. Connect Fuel Pressure Test Adapter 6541 to the return line (Fig. 8). Place the other end of adapter 6541 into an approved gasoline container or a container approved for gasoline/methanol mixtures (minimum 2 gallon size). All return fuel will flow into container.

(d) Using the DRBII scan tool, with the ignition key in the ON position, repeat the ASD Fuel System Test.

- If pressure is now correct, replace fuel pump assembly.
- If pressure is still above specifications, remove fuel return hose from chassis fuel tubes (at engine). Attach Fuel Pressure Test Connect Adapter 6541 to the fuel return hose and place other end of hose in clean approved gasoline container or a container approved for methanol/gasoline mixtures (Fig. 9). Repeat test. If pressure is now correct, check for restricted fuel return line. If no change is observed, replace fuel pressure regulator.

MECHANICAL MALFUNCTIONS

Mechanical malfunctions are more difficult to diagnose with this system. The powertrain control module (PCM) compensates for some mechanical malfunctions. If engine performance problems are encountered, and no fault codes are displayed, the problem may be mechanical rather than electronic.

FUEL PUMP MODULE REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

Remove the fuel tank to service the fuel pump. Refer to Fuel Tank Section for fuel tank removal.

(1) Using a hammer and a brass drift punch carefully tap lock ring counter clockwise to release pump (Fig. 11).

(2) Remove fuel pump and O-ring seal from tank. Discard old seal.

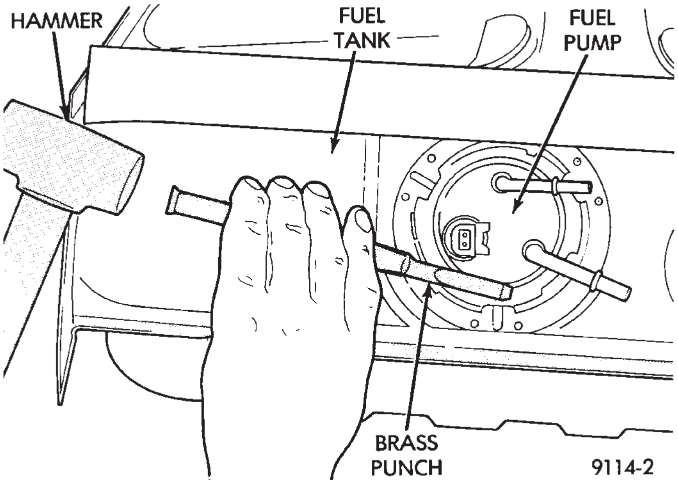


Fig. 11 Fuel Pump Service

FUEL PUMP MODULE INSTALLATION

WARNING: FUEL PUMP MODULES DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(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 locking ring.

(3) Using a hammer and brass drift, drive ring around in clockwise direction to lock pump in place.

CAUTION: Over tightening the pump lock ring may result in a leak.

(4) Install tank. Refer to the Fuel Tank Section in this Group.

FUEL PUMP STRAINER SERVICE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL

(1) Remove fuel pump module. Refer to Fuel Pump Module in this section.

(2) Bend locking tabs on fuel pump reservoir assembly to clear locking tangs on the fuel pump strainer (Fig. 12).

(3) Pull strainer off.

(4) Remove strainer O-ring from the fuel pump reservoir body.

(5) Remove any contaminants by washing the inside of the fuel tank.

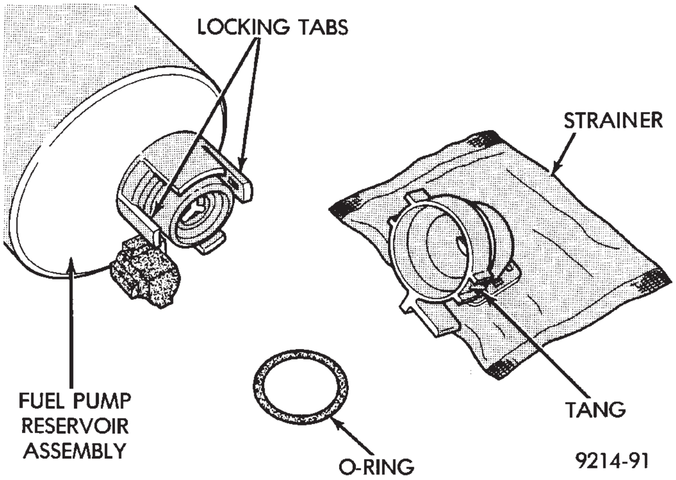


Fig. 12 Fuel Strainer Service

INSTALLATION

WARNING: FUEL STRAINERS (AND O-RINGS) DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Lubricate the strainer O-ring with Mopar Silicone Spray Lube.

(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 in this section.

FUEL FILTER—ALL VEHICLES

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL

(1) Perform the Fuel System Pressure Release procedure.

(2)) Remove the fuel filter retaining screw (Fig. 13). Remove fuel filter from mounting plate.

(3) Wrap a shop towel around hoses to absorb fuel. Remove quick-connect fittings at filter and fuel supply tube. Refer to Quick-Connect Fittings in this section.

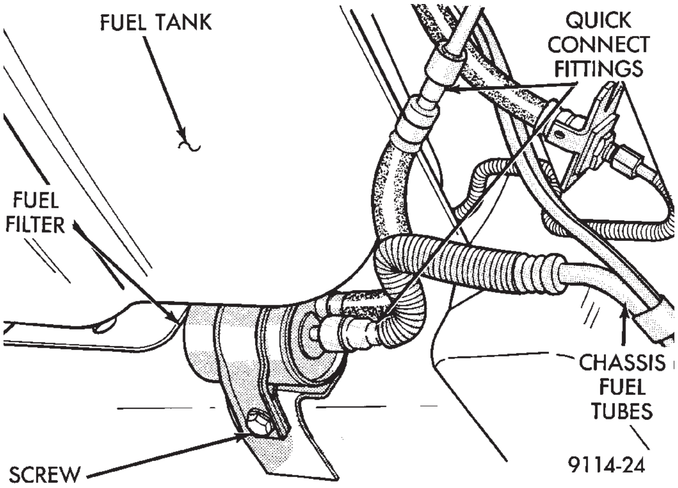


Fig. 13 Fuel Filter

INSTALLATION

WARNING: FUEL FILTERS DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Connect quick-connect fuel fittings to the filter and fuel supply line. Refer to Quick-Connect Fittings in this section.

(2) Position filter assembly on mounting plate and tighten mounting screw to 8 N•m (75 in. lbs.) torque.

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.

(3) Place the ignition key in the ON position. Using the DRBII scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system. Inspect for leaks.

FUEL HOSES, CLAMPS, AND QUICK CONNECT FITTINGS

HOSES AND CLAMPS

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

WARNING: FUEL SYSTEM HOSES AND TUBES DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

Inspect all hose connections (clamps and quick connect fittings) for completeness and make sure they are not leaking. Hoses that are cracked, scuffed, swelled, rub against other vehicle components or show any sign of wear, should be replaced.

When installing hoses, route them away from components they could rub against. Avoid contact with clamps or other components that cause abrasions or scuffing. Ensure rubber hoses are properly routed and avoid heat sources.

The clamps have rolled edge 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

Most fuel lines have quick connect fittings. The fittings speed up the installation and removal of fuel lines (Fig. 14).

Quick connect fittings consist of a metal casing, a black plastic release ring, a metal locking retainer, and internal O-rings.

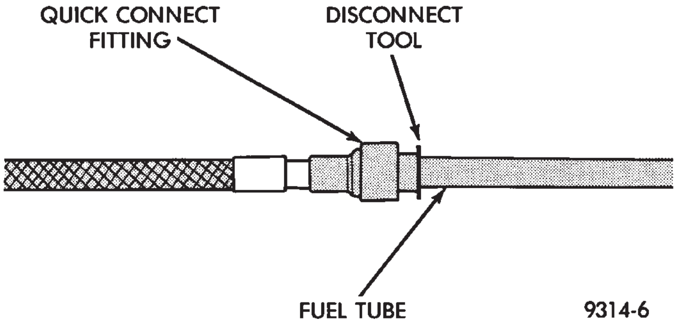


Fig. 14 Metal Quick-Connect Fittings

METAL QUICK CONNECT FITTINGS

The fuel filter and fuel rail use steel quick-connect fittings. The fitting contains non-serviceable sealed O-rings. The fittings contain a plastic disconnect tool.

The quick-connect fitting consists of the O-rings, casing, disconnect tool and a retainer (Fig. 14). When the fuel tube enters the fitting, the retainer locks the shoulder of the nipple in place and the O-rings seal the tube.

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.

When installing fuel tubes, route them in the holders along the frame rail, fuel tank and the rear of the engine.

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect negative cable from the battery.

(2) Perform the Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.

(3) Remove any loose dirt from quick connect fittings.

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY FUEL SPILLAGE.

(4) Push the quick connect fitting toward the fuel tube while depressing the built-in release tool. Then slightly twist the fitting and pull it off the fuel tube (Fig. 14).

(5) Cover the fitting to prevent contamination.

TUBE/FITTING SERVICE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

If a quick connect fitting needs service, the following procedure must be followed:

(1) Disconnect the battery negative battery cable.

(2) Perform the Fuel System Pressure Release Procedure.

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY FUEL SPILLAGE.

(3) Remove the quick connect fitting from the fuel tube by pushing in on the plastic ring located on the end of the fitting. Gently pull the fitting from the fuel tube.

(4) Cut off the crimp ferrules at each end of the hose, taking care not to damage the quick connect fitting or the fuel tube.

(5) Discard the ferrules and hose.

WARNING: FUEL SYSTEM HOSES AND TUBES DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(6) Replace the hose using original equipment or equivalent hose.

(7) Attach the replacement hose to the quick connect fitting and fuel tube using the correct hose clamps (Fig. 15). Original equipment hose clamps have a special rolled edge construction to prevent the edge of the clamp cutting into the hose. Only original equipment clamps or equivalent may be used in this system. Other types of clamps may cut into the hoses and cause high pressure fuel leaks.

(8) Tighten hose clamps to 1 N●m (10 in. lbs.) torque.

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.

(9) Use the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

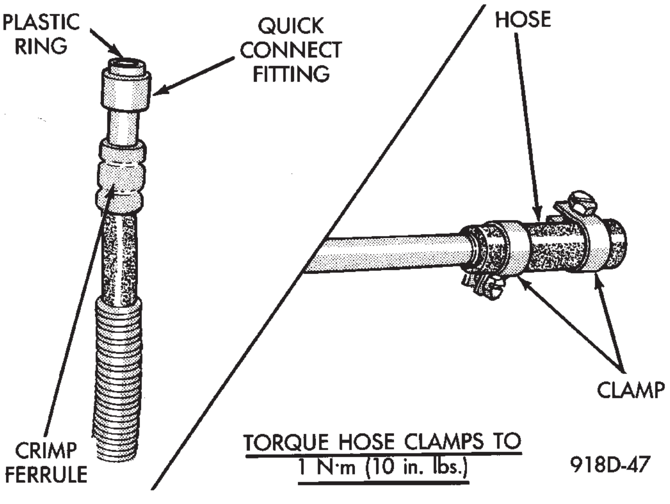


Fig. 15 Quick Connect Fuel Fittings

CHASSIS FUEL TUBES

Figures 16 and 17 show fuel system component locations and chassis fuel tube routings.

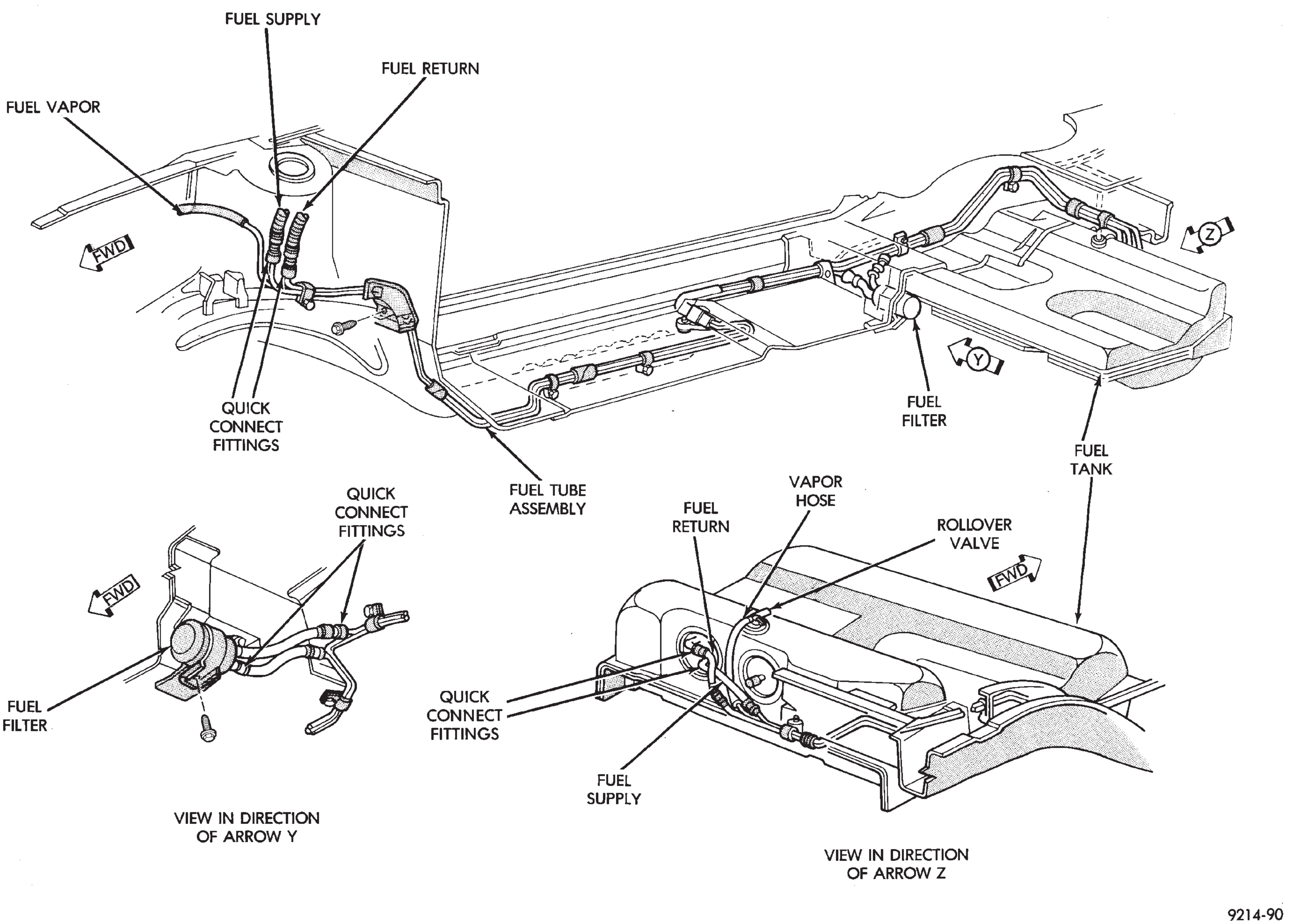


Fig. 16 Fuel Tank, Filter, and Chassis Line Routing—Except Flexible Fuel AA-Body

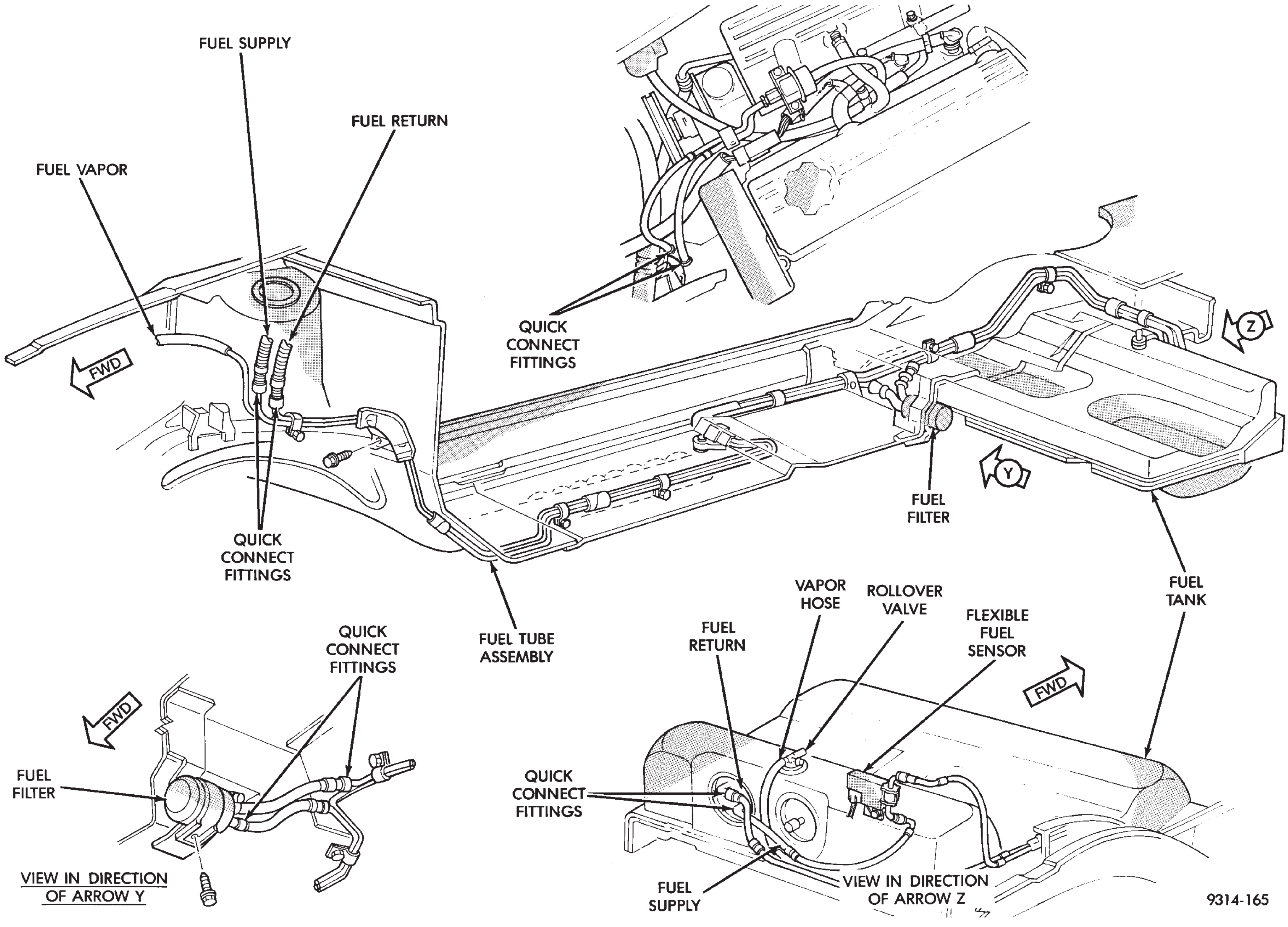


Fig. 17 Fuel Tank, Filter, and Chassis Line Routing—Flexible Fuel AA-Body

FUEL TANKS

INDEX

GENERAL INFORMATION

The fuel tanks of Chrysler Corporation built vehicles are equipped with fuel and vapor controls that allow the vehicle to pass a full 360° rollover.

The fuel delivery system used on front wheel drive vehicles contains a fuel tank pressure relief/rollover valve. The valve mounts on the top of the fuel tank. The valve functions as a pressure relief valve while the vehicle is upright. The valve also contains a check valve that prevents fuel from escaping the fuel tank if the vehicle turns over.

The fuel filler cap also acts as a pressure/vacuum valve. When pressure inside the fuel tank gets too high or too low, the fuel filler cap opens to relieve the difference in air pressure.

An evaporation control system restricts fuel evaporation into the atmosphere and reduces unburned 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 operates, vapors are drawn through the intake manifold into the combustion chambers.

FLEXIBLE FUEL VEHICLES

Beginning this model year, Chrysler began producing AA-Body vehicles designed to operate on a mixture of gasoline and methanol. These automobiles are referred to as Flexible Fuel Vehicles.

Flexible fuel vehicles can operate on a mixture of up to 85 percent methanol, 15 percent unleaded gasoline. These vehicles also operate on mixtures containing a lower percentage of methanol or just pure unleaded gasoline.

In many cases, the procedures for servicing flexible fuel components is identical to gasoline only components. Refer to the particular Service Procedure in this section. If the service procedure for flexible fuel component differs from a gasoline only component, the title of each service procedure identifies the application.

IDENTIFYING FLEXIBLE FUEL COMPONENTS

Flexible Fuel vehicles have unique methanol compatible fuel system components. Chrysler identifies methanol compatible components that could be physically interchanged with gasoline only parts by coloring them green or applying a green label or tag to them. Even though they may appear physically identical, components for gasoline only AA-body vehicles must not be used on flexible fuel vehicles.

SERVICE PRECAUTIONS FOR FLEXIBLE FUEL VEHICLES

Methanol is more toxic than gasoline. Always release fuel system pressure before servicing fuel system components and wear methanol resistant gloves and eye protection.

Avoid breathing methanol vapors or ingesting methanol. Headaches, dizziness and even unconsciousness could result from breathing these vapors. Serious injury, blindness and even death could result from ingesting methanol.

Methanol vapors are extremely flammable and can travel along the ground. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle.

Do not allow methanol to contact skin. Prolonged contact with methanol can cause dry skin or an allergic skin reaction. Also, prolonged contact could result in absorption through the skin.

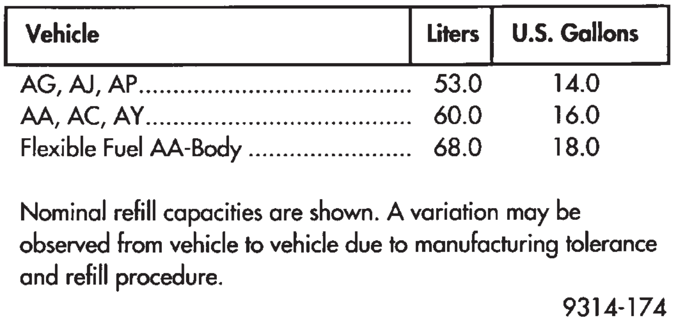
PRESSURE VACUUM FUEL FILLER TUBE CAP

WARNING: REMOVE FUEL FILLER TUBE CAP TO RELIEVE TANK PRESSURE BEFORE REMOVING OR REPAIRING FUEL SYSTEM COMPONENTS.

The loss of any fuel or vapor out of the filler tube neck is prevented by the use of a safety filler cap. The cap releases only under significant pressure 10.9 to 13.45 kPa (1.58 to 1.95 psi). The vacuum release for all gas caps is between .97 and 2.0 kPa (.14 and .29 psi). The cap must be replaced by a similar unit in order for the system to remain effective.

WARNING: FUEL FILLER TUBE CAPS DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

FUEL TANK CAPACITIES



Vehicle	Liters	U.S. Gallons
AG, AJ, AP	53.0	14.0
AA, AC, AY	60.0	16.0
Flexible Fuel AA-Body	68.0	18.0

Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.

9314-174

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—EXCEPT 2.2L/2.5L TBI AND 3.0L

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. 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 the protective cap from the fuel pressure test port on the fuel rail (Fig. 1).

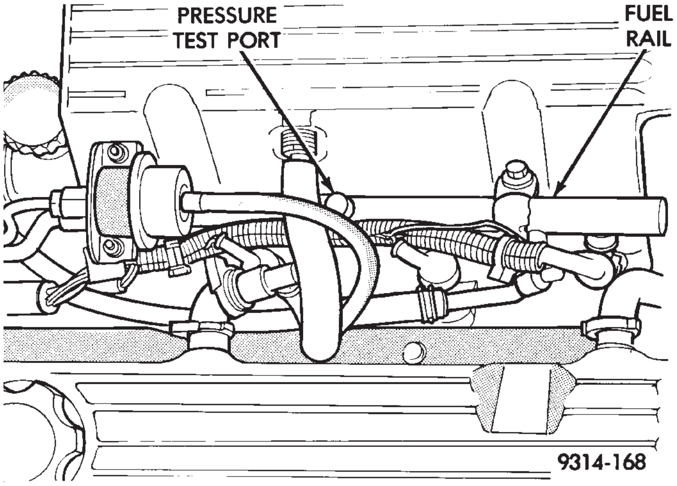


Fig. 1 Fuel Pressure Test Port—Typical

(4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container or a container approved for methanol/gasoline mixtures. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 2). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

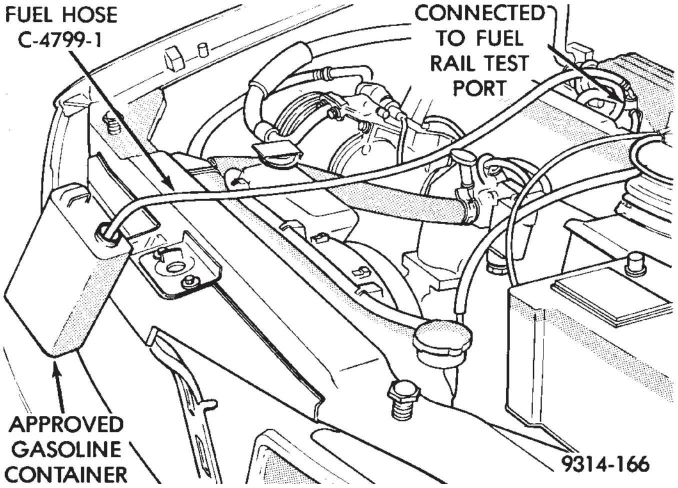


Fig. 2 Releasing Fuel Pressure—Engines With Test Ports On Fuel Rail

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—2.2L/2.5L TBI

CAUTION: Before servicing the fuel pump, fuel lines, fuel filter, throttle body, or fuel injector, release fuel system pressure.

(1) Loosen fuel filler cap to release fuel tank pressure.

(2) Disconnect injector wiring harness connector at edge of throttle body (Fig. 3).

(3) Connect a jumper wire between terminal Number 1 of the injector harness and engine ground.

(4) Connect a jumper wire to the positive terminal Number 2 of the injector harness and touch the battery positive post **for no longer than 5 seconds**. This releases system pressure.

(5) Remove jumper wires.

(6) Continue fuel system service.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE—3.0L

(1) Disconnect the fuel rail electrical harness from the engine harness. Refer to Group 8W, Wiring Diagrams.

(2) Connect one end of a jumper wire to the A142 circuit terminal of the fuel rail harness connector.

(3) Connect the other end of the jumper wire to a 12 volt power source.

(4) Connect one end of a jumper wire to a good ground source.

(5) Momentarily ground one of the injectors by connecting the other end of the jumper wire to an in-

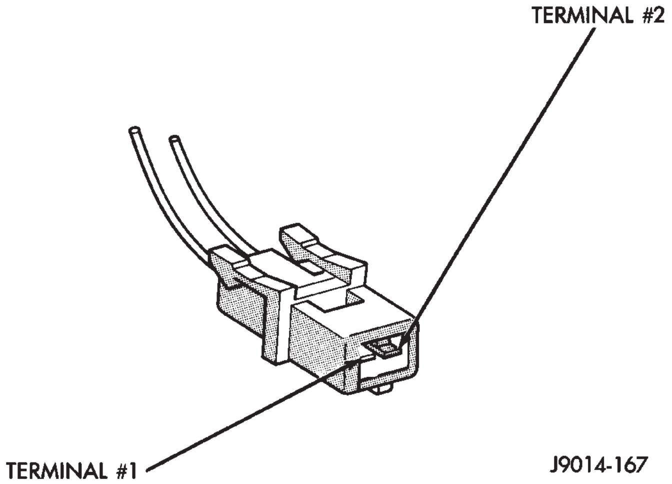


Fig. 3 Injector Harness Connector—2.2L/2.5L TBI

jector terminal in the harness connector. Repeat procedure for 2 to 3 injectors.

FUEL TANK

DRAINING FUEL TANK

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Remove fuel filler cap.

(2) Perform the Fuel System Pressure Release procedure.

(3) Remove ground cable from battery.

(4) Raise vehicle on hoist.

(5) Remove rubber cap from drain tube. The tube is located on rear of fuel tank. Connect either a portable holding tank or a siphon hose to the drain tube (Fig. 4).

(6) Drain fuel tank into holding tank or a properly labeled **Gasoline** safety container.

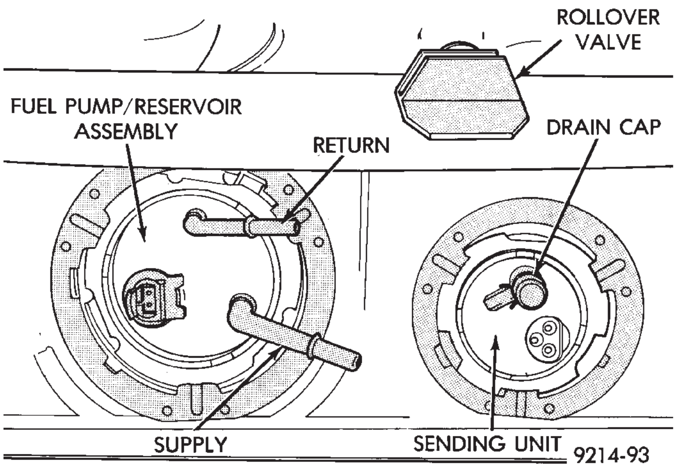


Fig. 4 Drain Tube Connection Location

FUEL TANK REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Perform fuel system pressure release.

(2) Drain fuel tank. Refer to Draining Fuel Tank in this section.

(3) Remove fuel filler tube to quarter panel screws (Fig. 5).

(4) Raise vehicle on hoist. Some models will require removal of the right rear wheel to access the fuel filler tube.

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(5) Disconnect fuel pump and gauge sending unit electrical connectors.

(6) Disconnect the fuel supply and return hoses from fuel pump. Refer to Quick Connect Hoses in the Fuel Delivery section of this group.

(7) Support tank with transmission jack. Loosen tank mounting straps and lower tank slightly. Remove hose from pressure relief/rollover valve.

(8) Carefully work fuel filler tube from tank.

(9) Remove tank mounting straps and lower tank.

(10) If removing tank from an flexible fuel AA-body vehicle, inspect the heat shield. Replace as necessary.

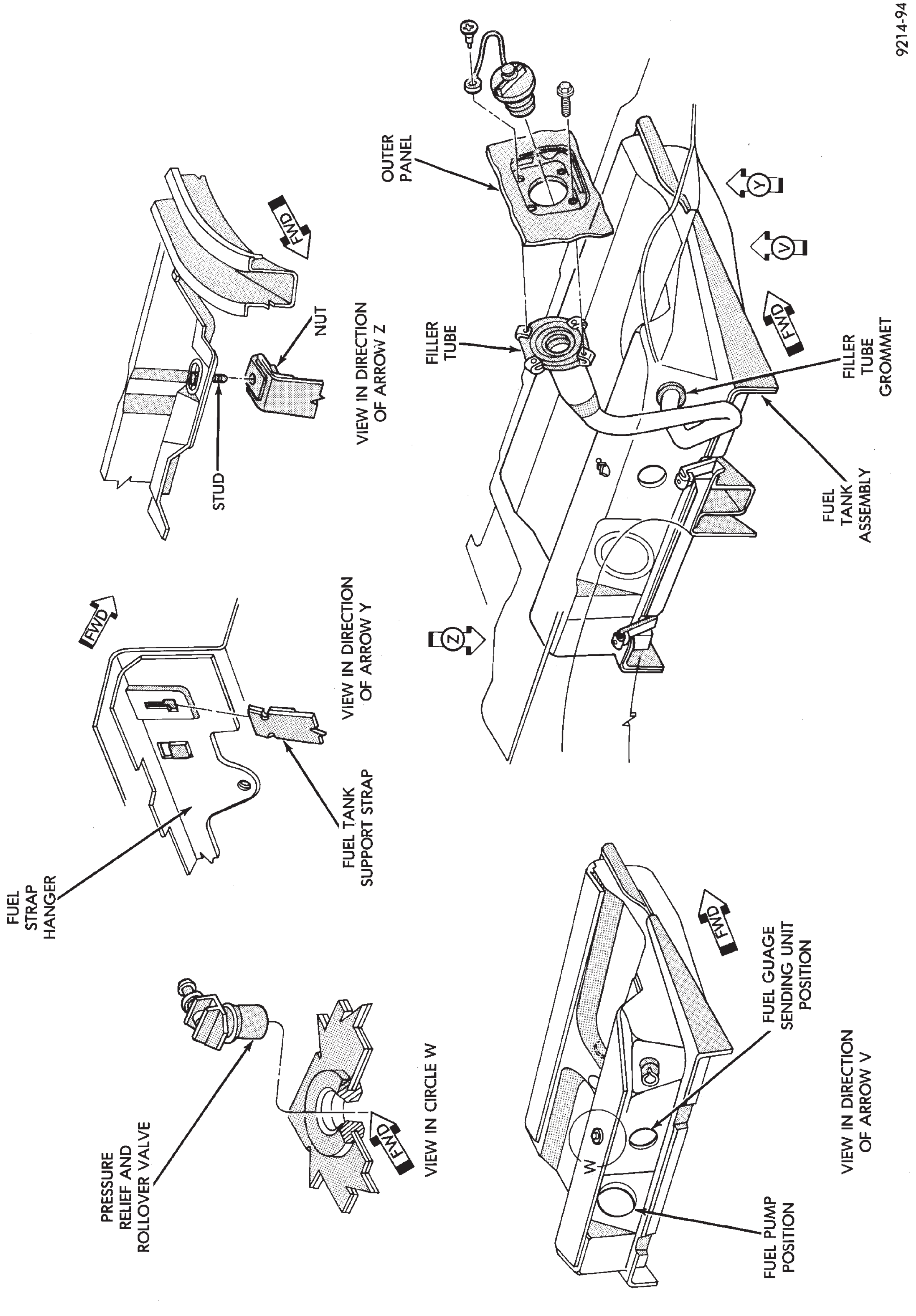


Fig. 5 Fuel Tank Assembly—Typical

INSTALLATION

WARNING: FUEL TANKS DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Position fuel tank on transmission jack. Connect vapor separator/rollover valve hose and position insulator pad on fuel tank. Position vapor vent so that it is not pinched between tank and floor pan during installation.

(2) Raise tank and fuel filler tube carefully into position. Use a light coating of power steering fluid to ease fuel filler tube installation. Ensure filler tube grommet is not damaged. Verify that the tube is installed correctly.

(3) Tighten fuel tank strap nuts to 23 N●m (250 in. lbs.) torque. Remove transmission jack. Ensure straps are not twisted or bent.

(4) Lubricate the metal tubes on the fuel pump with clean 30 weight engine oil. Install the quick connect fuel fittings. Refer to Quick Connect Fittings in the Fuel Delivery section of this Group.

(5) Attach electrical connector to fuel pump module and level sensor unit.

(6) Lower the vehicle.

(7) Attach filler tube to filler neck opening in quarter panel. Tighten quarter panel screws to 2 N●m (17 in. lbs.) torque.

(8) Fill fuel tank, install filler cap, and connect battery cable.

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.

(9) Use the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL PUMP MODULE

Refer to the Fuel Delivery section of this group.

METHANOL CONCENTRATION SENSOR

Refer to the Fuel Delivery section of this group.

FUEL RESERVOIR

The fuel reservoir is internal to the fuel pump assembly (Fig. 6). The purpose is to provide fuel at the fuel pump intake during all driving conditions, especially when low fuel levels are present.

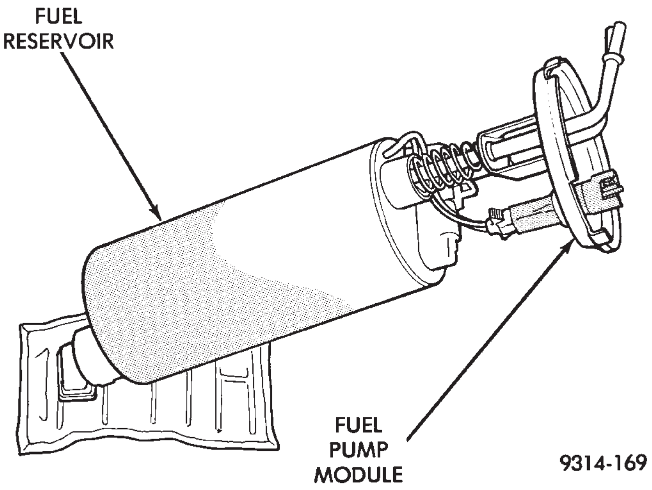


Fig. 6 Fuel Reservoir

FUEL TANK LEVEL SENSOR

DIAGNOSIS

This procedure test the resistance of the level sensor itself. It does not test the level sensor circuit. Refer to Group 8W, Wiring Diagrams for circuit identification and Group 8E, Instrument Panel and Gauges for fuel gauge information.

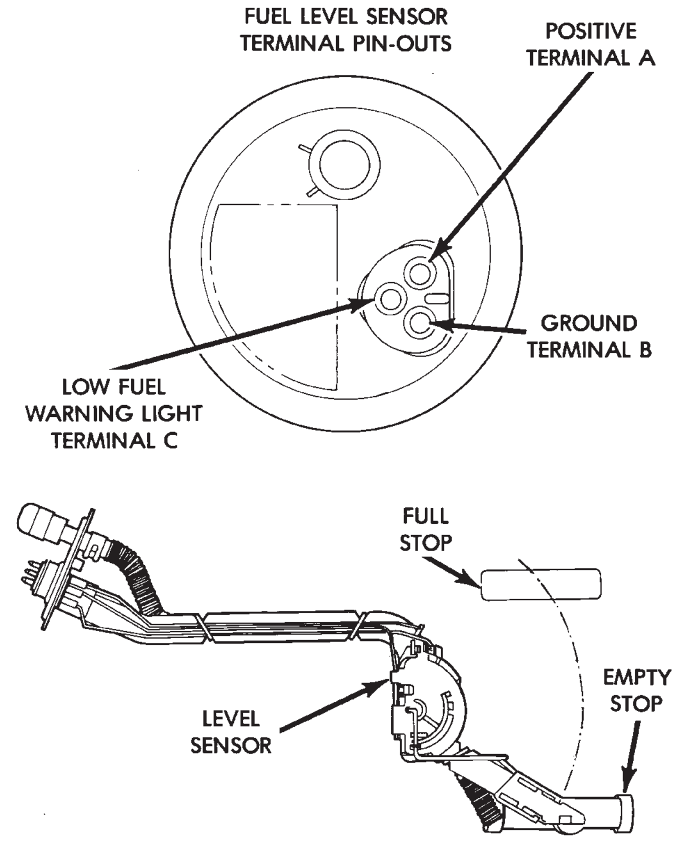
The level sensor is a variable resistor. Its resistance changes with the amount of fuel in the tank. The float arm attached to the sensor moves as the fuel level changes. To test the level sensor, connect an ohmmeter across the sensor signal and sensor ground terminals of the fuel level sensor connector (Fig. 7 or Fig. 8). Move the float lever to the full stop and empty stop positions shown in the resistance chart (Fig. 7 or Fig. 8). Record the resistance at each point. Replace the level sensor if the resistance is not within specifications.

The low fuel warning light specifications determine if the level sensor portion of the warning light circuit functions properly. It does not test the complete warning light circuit.

Refer to Group 8W, Wiring Diagrams for circuit identification and Group 8E, Instrument Panel and Gauges for fuel gauge information.

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.



FUEL GAUGE REFERENCE	(pins A and B)
FLOAT POSITION	**RESISTANCE**
Sensor Full Stop............................	0 to 8 Ohms
Sensor Empty Stop........................	106 ± 20 Ohms

LOW FUEL WARNING LIGHT REFERENCE	(pins B and C)
FLOAT POSITION	**RESISTANCE**
Full Stop	Infinity
Empty Stop	Continuity

9314-170

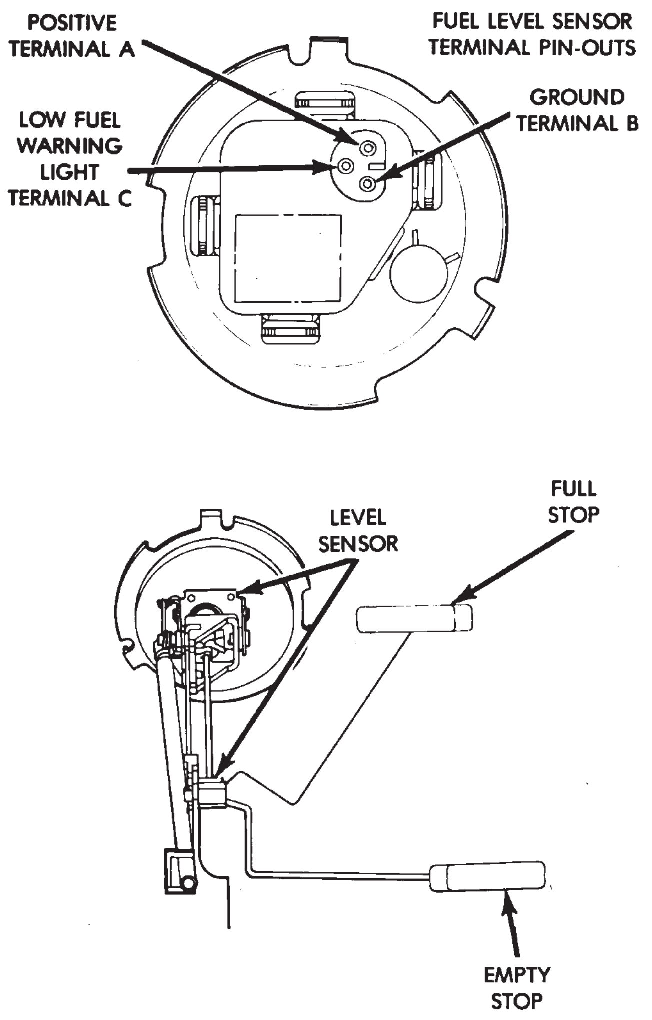
Fig. 7 Level Sensor Diagnosis—Except Flexible Fuel AA-Body

The fuel tank must be removed to service the fuel sending unit. Refer to Fuel Tank Removal in this section.

(1) Using a hammer and brass drift punch, carefully tap lock ring counterclockwise to release sending unit (Fig. 9).

(2) Lift level unit and O-ring away from tank (Fig. 10 or Fig. 11).

INSTALLATION



FUEL GAUGE REFERENCE	(pins A and B)
FLOAT POSITION	**RESISTANCE**
Sensor Full Stop............................	0 to 8 Ohms
Sensor Empty Stop........................	93 to 108 Ohms

LOW FUEL WARNING LIGHT REFERENCE	(pins B and C)
FLOAT POSITION	**RESISTANCE**
Empty Stop	Infinity
Full Stop	Continuity

9314-171

Fig. 8 Level Sensor Diagnosis—Flexible Fuel AA-Body

WARNING: FUEL LEVEL SENSORS DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Wipe seal area of tank clean and place a new O-ring seal in position.

(2) Place sending unit in tank. Position lock ring in place. Using a brass drift and hammer, tap ring in a clockwise direction.

(3) Install tank.

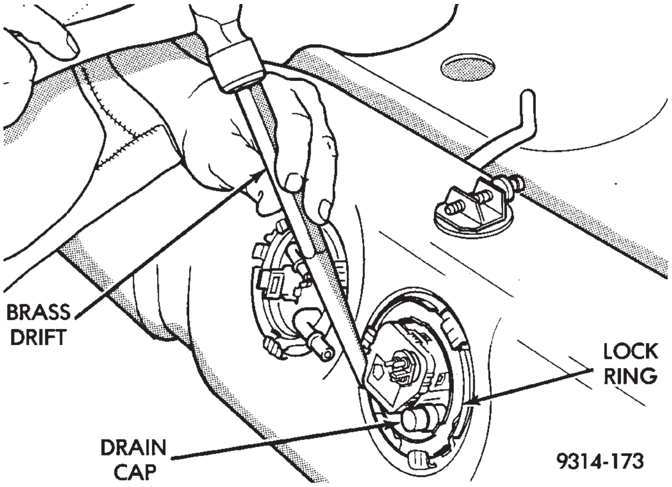


Fig. 9 Level Sensor Removal—Typical

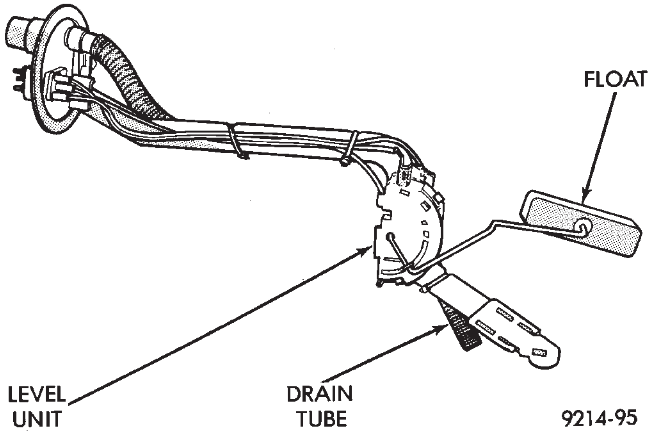


Fig. 10 Fuel Tank Level Sensor—Except Flexible Fuel AA-Body

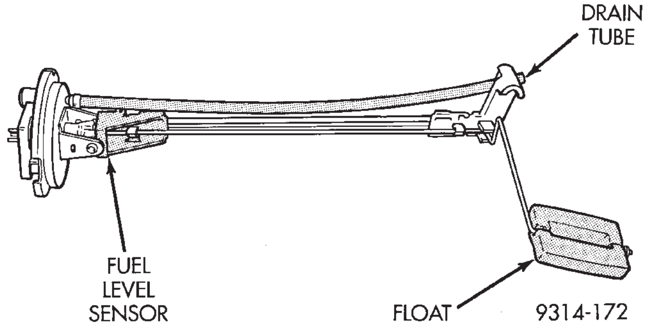


Fig. 11 Fuel Tank Level Sensor—Flexible Fuel AA-Body

FUEL TANK PRESSURE RELIEF AND ROLL-OVER VALVE

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Remove fuel tank. Refer to Fuel Tank Removal in this section.

(2) Wedge the blade of a screwdriver between the rubber grommet and the fuel tank where the support rib is located (Fig. 12). **Do not wedge between the valve and the grommet. This could damage the valve during removal.**

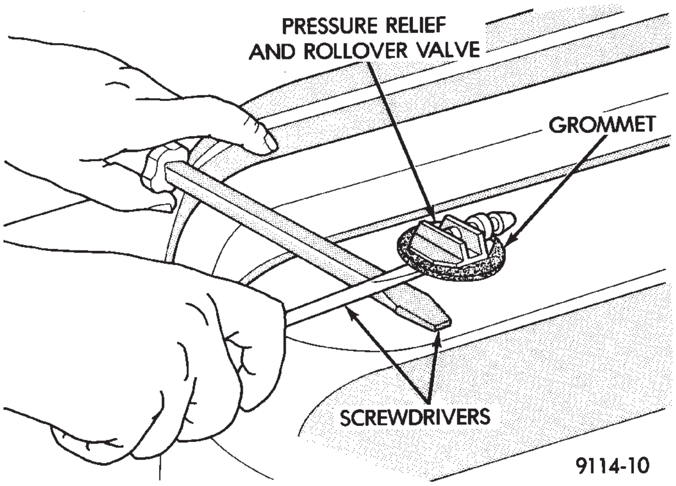


Fig. 12 Removing Pressure Relief/Rollover Valve

(3) Use a second screwdriver as a support to pry the valve and grommet assembly from the tank.

(4) Place the valve upright on a flat surface. Push down on the grommet and peel it off the valve.

INSTALLATION

WARNING: FUEL PRESSURE RELIEF/ROLLOVER VALVES DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Install the rubber grommet in the fuel tank by working it around the curled lip of the tank (Fig. 13).

CAUTION: Only use power steering fluid to lubricate the pressure relief/rollover valve grommet.

(2) Lightly lubricate the grommet with power steering fluid only and push the valve downward into the grommet. Twist valve until properly positioned.

(3) Install fuel tank (refer to fuel tank installation).

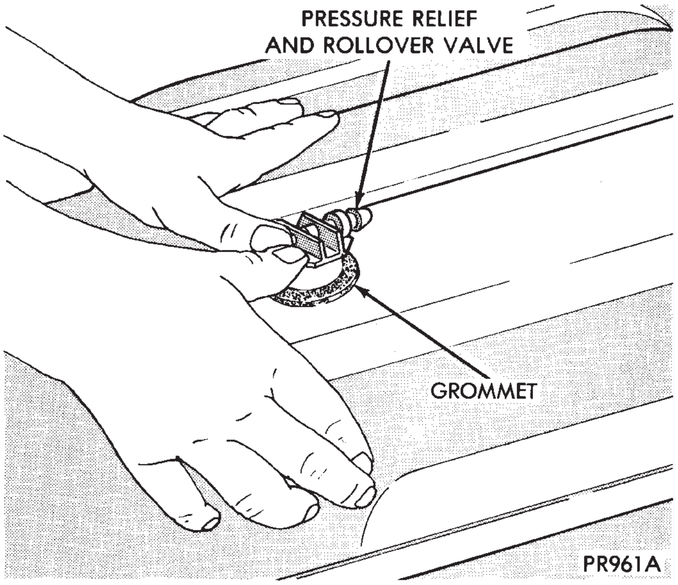


Fig. 13 Installing Pressure Relief/Rollover Valve

ACCELERATOR PEDAL AND THROTTLE CABLE

INDEX

ACCELERATOR PEDAL

CAUTION: When servicing the accelerator pedal, throttle cable or speed control cable, do not damage or kink the control cable core wire.

REMOVAL

(1) Working from the engine compartment, hold the throttle body throttle lever in the wide open position. Remove the throttle cable from the throttle body cam.

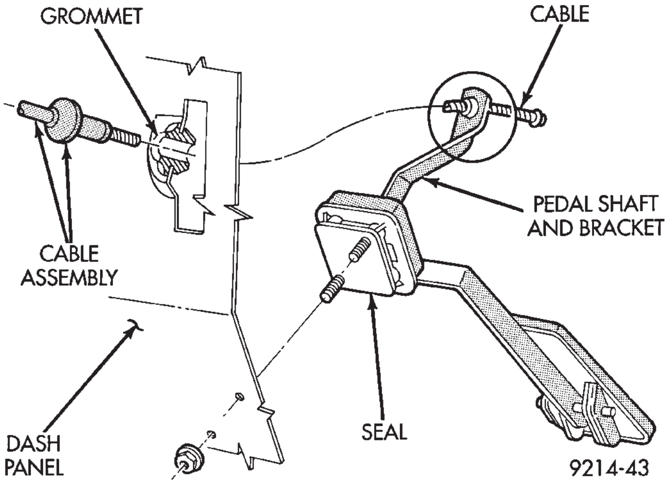


Fig. 1 Accelerator Pedal and Throttle Cable—Front View

(2) 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. 1 and Fig. 2).

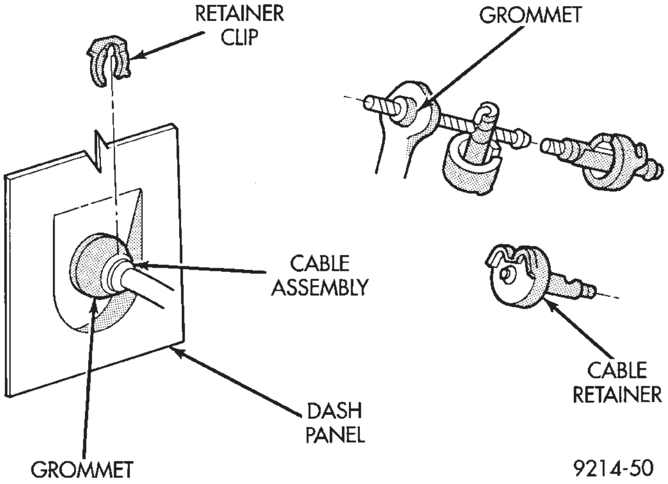


Fig. 2 Accelerator Pedal and Throttle Cable—Rear View

(3) Working from the engine compartment, remove nuts from accelerator pedal assembly studs (Fig. 1). 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.

(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.

THROTTLE CABLE

REMOVAL

(1) Working from the engine compartment, hold throttle lever in the wide open position and remove the throttle cable from the throttle body cam (Fig. 3, 4, 5, 6 and 7).

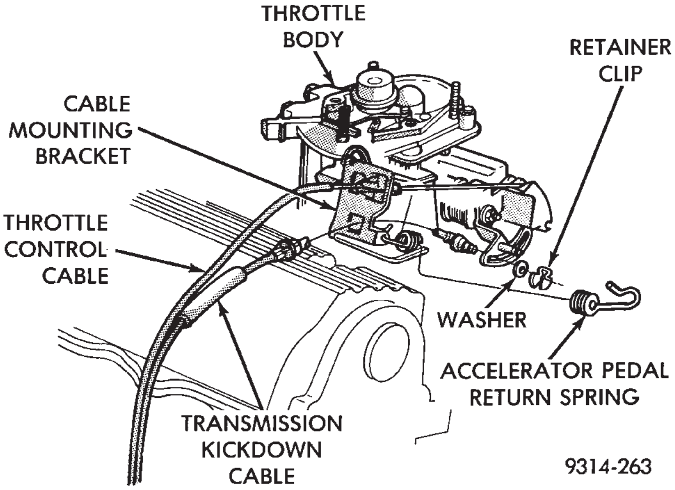


Fig. 3 Throttle Cable Attachment to Throttle Body—2.2L/2.5L TBI Engine

(2) From inside the vehicle, hold the throttle pedal up and remove the cable retainer and cable from upper end of pedal shaft (Fig. 1 and Fig. 2).

(3) Remove retainer clip from throttle cable and grommet at the dash panel (Fig. 2).

(4) From the engine compartment, pull the throttle cable out of the dash panel grommet. The grommet should remain in the dash panel.

(5) Remove the throttle cable from the throttle bracket by carefully compressing both retaining tabs simultaneously. Gently pull throttle cable from throttle bracket.

INSTALLATION

(1) From the engine compartment, push the housing end fitting into the dash panel grommet.

(2) Install cable housing (throttle body end) into the cable mounting bracket on the engine.

(3) From inside the vehicle, hold up pedal and feed throttle cable core wire through hole in upper end of the pedal shaft. Install cable retainer (Fig. 2).

(4) Install cable retainer clip (Fig. 2).

(5) From the engine compartment, rotate the throttle lever to the wide open position and install throttle cable.

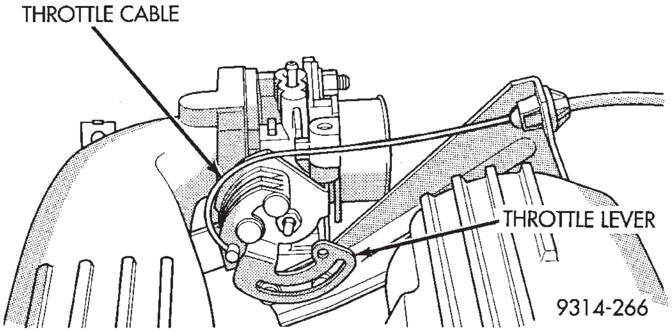


Fig. 4 Throttle Cable Attachment to Throttle Body—2.5L MPI Flexible Fuel Engine

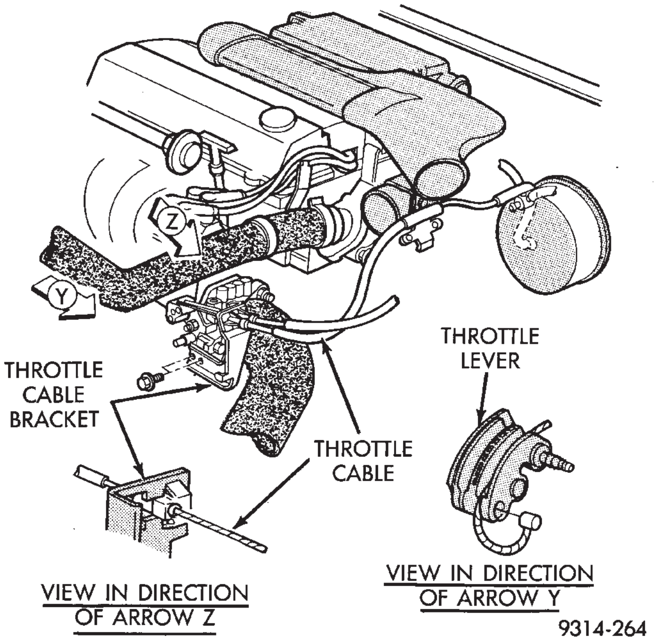


Fig. 5 Throttle Cable Attachment to Throttle Body—Turbo III Engine

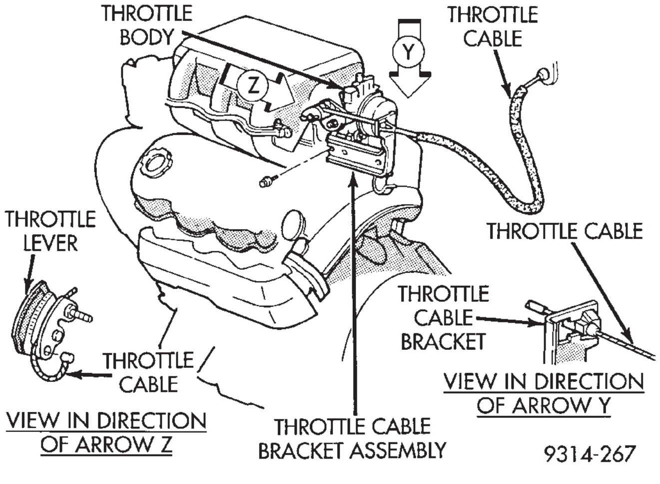


Fig. 6 Throttle Cable Attachment to Throttle Body—3.0L Engine

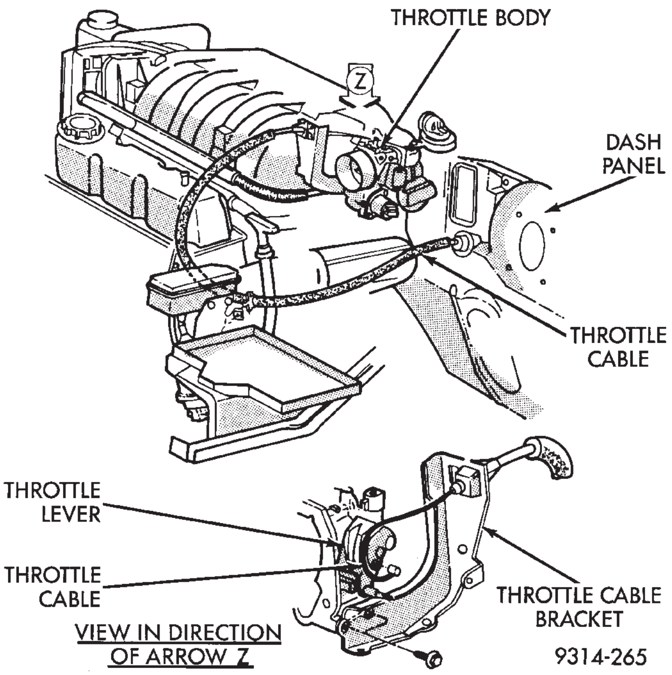


Fig. 7 Throttle Cable Attachment to Throttle Body—3.3L and 3.8L Engines

2.2L/2.5L SINGLE POINT FUEL INJECTION—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

The computer regulated, Electronic Fuel Injection System (Fig. 1) provides a precise air/fuel ratio for all driving conditions. The fuel injection system is controlled by the powertrain control module (PCM).

The PCM is a pre-programmed digital computer. The PCM regulates ignition timing, air-fuel ratio, emission control devices, cooling fan, charging system, speed control, and idle speed. The PCM can adapt its requirement to meet changing operating conditions.

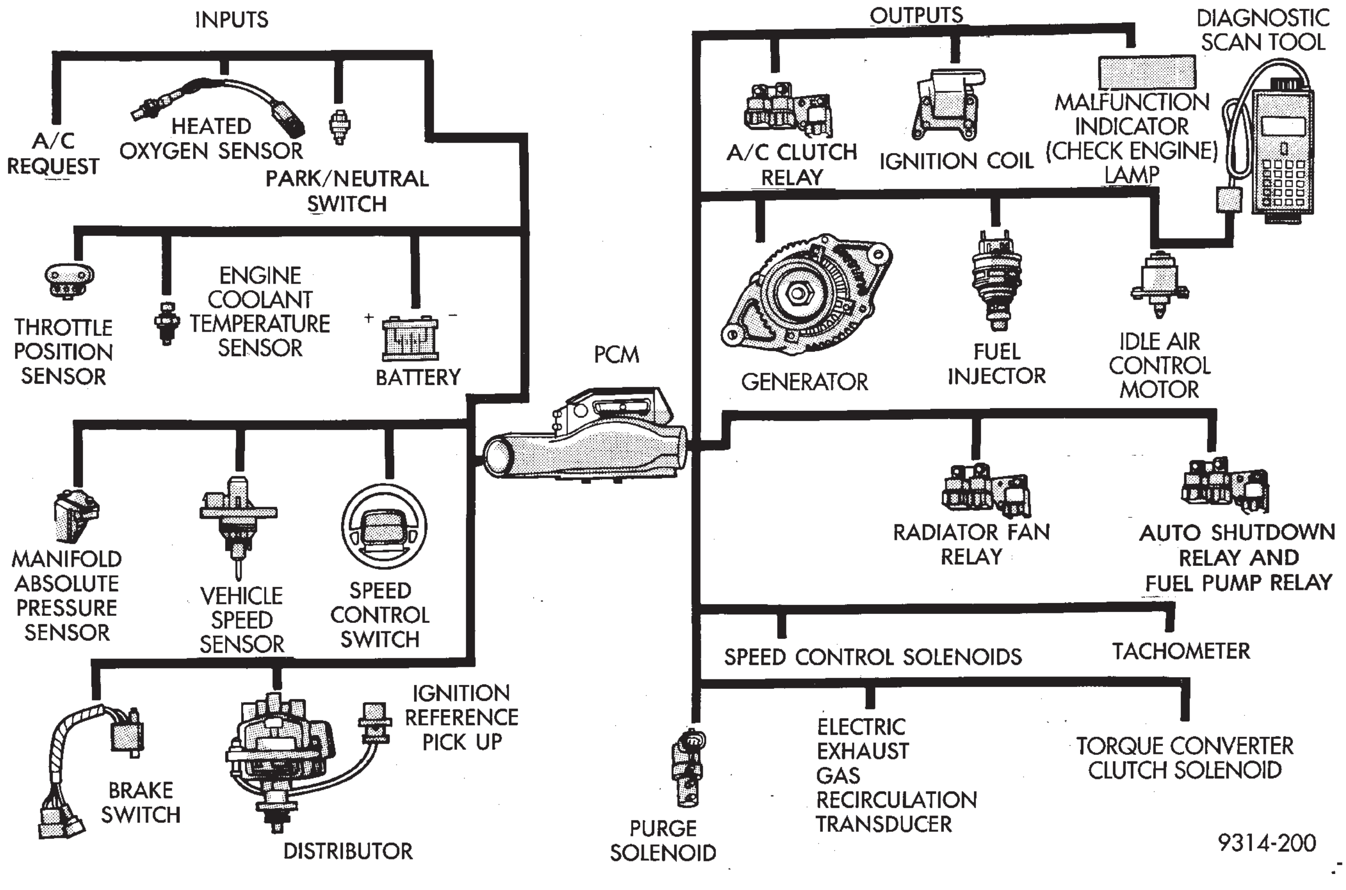


Fig. 1 Electronic Fuel Injection Components

Various sensors provide the inputs necessary for the PCM to correctly regulate fuel flow at the fuel injector. These include the manifold absolute pressure, throttle position, oxygen sensor, coolant temperature, and vehicle speed sensors. In addition to the sensors, various switches and relays provide important information and system control. The inputs include the park/neutral switch and air conditioning clutch switch. The outputs include the auto shutdown relay and fuel pump relay.

All inputs to the PCM are converted into signals. Based on these inputs the PCM adjusts air-fuel ratio, ignition timing and other controlled outputs. The PCM adjusts the air-fuel ratio by changing the injector pulse width. Injector pulse width is the period of time the injector is energized.

SYSTEM DIAGNOSIS

The PCM tests many of its own input and output circuits. If a fault is found in a major system, the information is stored in memory. Technicians can display fault information through the instrument panel Malfunction Indicator lamp (instrument panel Check Engine lamp) or by connecting the DRBII scan tool. For diagnostic trouble code information, refer to On Board Diagnostics in 2.2L/2.5L Single Point Fuel Injection—General Diagnosis section of this group.

CCD BUS

Various modules exchange information through a communications port called the CCD Bus. The powertrain control module (PCM) transmits vehicle load data on the CCD Bus.

POWERTRAIN CONTROL MODULE

The powertrain control module (PCM) is a digital computer containing a microprocessor (Fig. 2). 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.

PCM Inputs:
- Air Conditioning Controls
- Battery Voltage
- Brake Switch
- Coolant Temperature Sensor
- Distributor (Hall Effect) Pick-up
- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensor
- SCI Receive
- Speed Control System Controls
- Throttle Position Sensor
- Park/Neutral Switch (automatic transaxle)
- Vehicle Speed Sensor

PCM Outputs:
- Air Conditioning Clutch Relay
- Generator Field

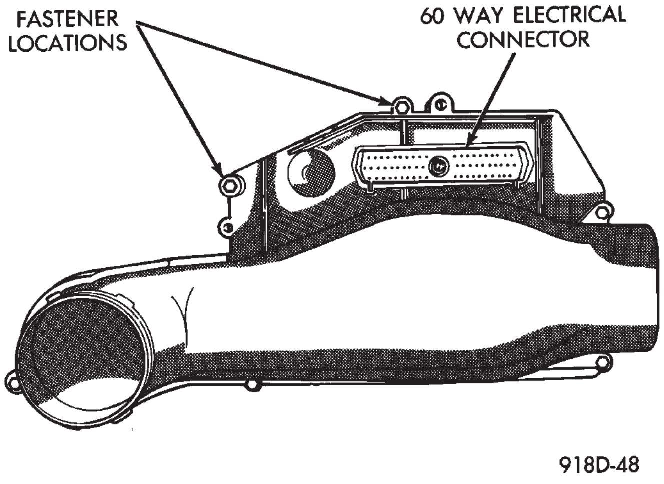


Fig. 2 PCM

- Idle Air Control Motor
- Auto Shutdown (ASD) Relay
- Canister Purge Solenoid
- Malfunction Indicator (Check Engine) Lamp
- Data Link Connector (Diagnostic Connector)
- Electronic EGR Transducer
- Fuel Injector
- Ignition Coil
- Part Throttle Unlock Solenoid (Automatic Transaxle)
- Radiator Fan Relay
- Speed Control Solenoids
- Tachometer Output

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 operation of the EGR, cooling fan, A/C 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
- coolant temperature
- exhaust gas content
- engine speed (distributor pick-up)
- manifold absolute pressure
- throttle position

The PCM adjusts ignition timing based on the following inputs.
- coolant temperature
- engine speed (distributor pick-up)
- manifold absolute pressure
- throttle position

The Auto Shutdown (ASD) and Fuel Pump relays are mounted externally, but turned on and off by the PCM through the same circuit.

The distributor pick-up signal is sent to the PCM. If the PCM does not receive a distributor signal within approximately one second of engine cranking, it de-activates the ASD relay and fuel pump relay. When these relays are deactivated, power is shut off from the fuel injector, fuel pump, ignition coil, and oxygen sensor heater element.

The PCM contains a voltage converter that changes battery voltage to a regulated 8.0 volts to power the distributor pick-up and vehicle speed sensor. The PCM also provides a 5.0 volts supply for the coolant temperature sensor, manifold absolute pressure sensor and throttle position sensor.

AIR CONDITIONING SWITCH SENSE—PCM INPUT

ALL VEHICLES EXCEPT AC-BODY

When the air conditioning or defrost switch is put in the ON position and the low pressure and high pressure switches are closed, the PCM receives an input indicating that the air conditioning has been selected. 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.

AC-BODY VEHICLES

When the air conditioning or defrost switch is put in the ON position and the low pressure switch, high pressure switch and electronic cycling switch close, the PCM receives an air conditioning select input. After receiving this input, the PCM activates the A/C compressor clutch by grounding the A/C compressor clutch relay. The PCM also adjusts idle speed to a scheduled RPM to compensate for increased engine load.

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 increases injector pulse width.

BRAKE SWITCH—PCM INPUT

When the brake switch is activated, the PCM receives an input indicating that the brakes are being applied. After receiving the input, the PCM vents the speed control servo. Venting the servo turns the speed control system off.

COOLANT TEMPERATURE SENSOR—PCM INPUT

The coolant temperature sensor is installed behind the thermostat housing and ignition coil in the hot box. The sensor provides an input voltage to the PCM (Fig. 3). As coolant temperature varies, the sensors resistance changes, resulting in a different input voltage to the PCM.

The PCM demands slightly richer air-fuel mixtures and higher idle speeds until the engine reaches normal operating temperature.

This sensor is also used for cooling fan control.

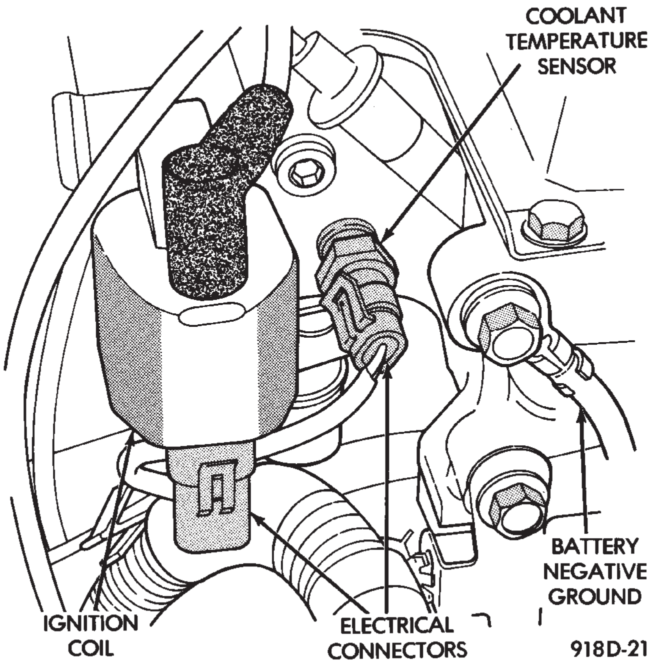


Fig. 3 Coolant Temperature Sensor

DISTRIBUTOR (HALL EFFECT) PICK-UP—PCM INPUT

The distributor pick-up supplies engine speed to the PCM. The distributor pick-up is a Hall Effect device (Fig. 4).

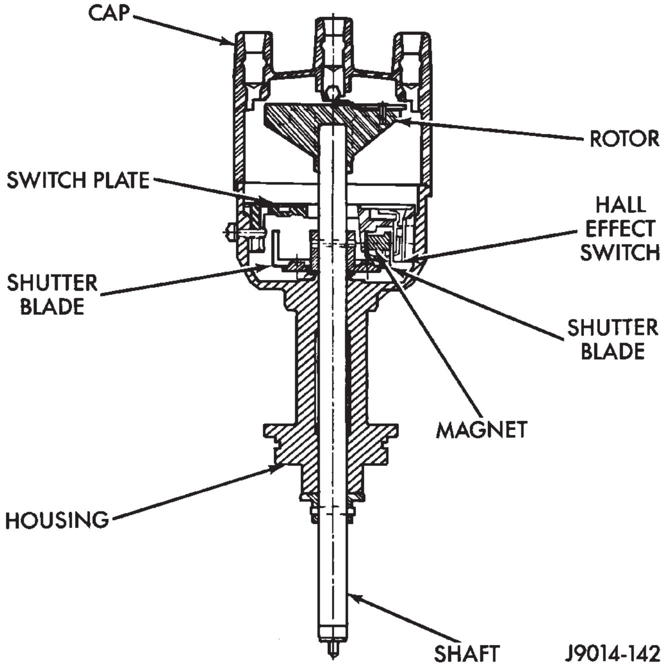


Fig. 4 Distributor Pick-Up—Typical

A shutter (sometimes referred to as an interrupter) is attached to the distributor shaft. The shutter contains four blades, one per engine cylinder. A switch plate is mounted to the distributor housing above the shutter. The switch plate contains the distributor pick-up which is a Hall Effect device and magnet. The shutter blades rotate through the distributor pick-up. As the shutter blades pass through the pick-up, they interrupt the magnetic field. The Hall effect device in the pick-up senses the change in the magnetic field and switches on and off (which creates pulses), generating the input signal to the PCM. The PCM calculates engine speed through the number of pulses generated.

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.

Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

The MAP sensor mounts on the dash panel (Fig. 5). A vacuum hose connects the sensor to the throttle body.

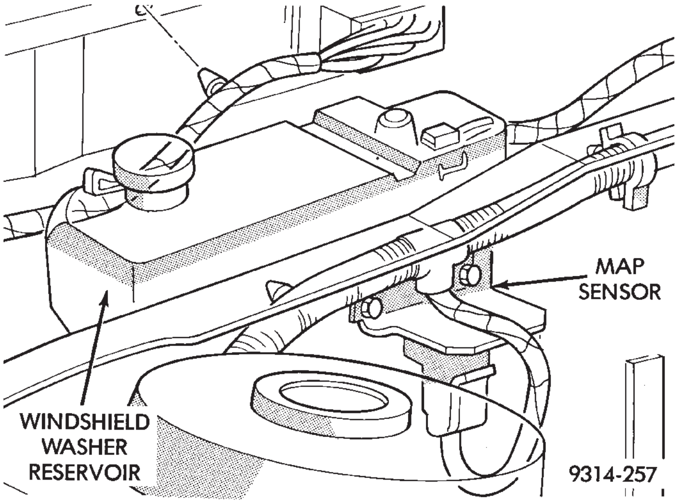


Fig. 5 Manifold Absolute Pressure (MAP) Sensor Location

HEATED OXYGEN SENSOR (O_2 SENSOR)—PCM INPUT

The O_2 sensor 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. 6). The PCM uses the information to fine tune the air-fuel ratio by adjusting injector pulse width.

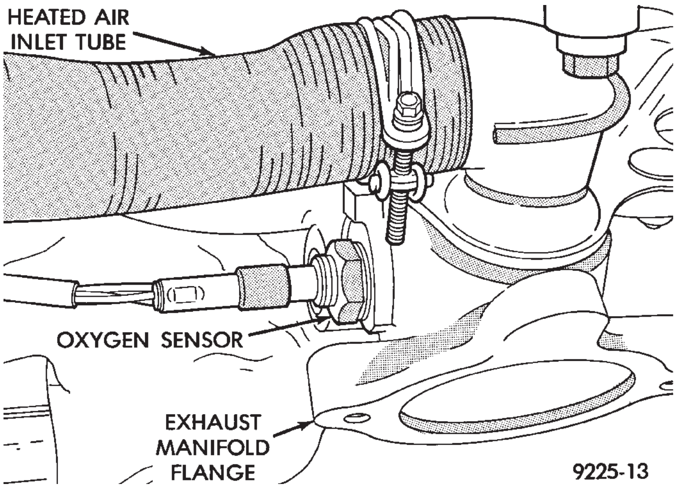


Fig. 6 Heated Oxygen Sensor

The O_2 sensor produces voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas. When a large amount of oxygen is present (caused by a lean air-fuel mixture), the sensor 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 sensor acts as a rich-lean switch.

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors the O_2 sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O_2 sensor input. The PCM adjusts injector pulse width based on a preprogrammed (fixed) oxygen sensor input value and inputs from other sensors.

SPEED CONTROL—PCM INPUT

The speed control system provides four separate voltages (inputs) to the PCM. The voltages correspond to the On/Off, Set, and Resume.

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 a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for further speed control information.

TRANSAXLE PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the automatic transaxle housing (Fig. 7). Manual transaxles do not use park neutral switches. The switch provides an input to the PCM. The input indicates whether the automatic transaxle is in Park, Neutral, or a drive gear selection. This input is used to determine idle speed (varying with gear selection), fuel injector pulse width, and ignition timing advance. The park neutral switch is sometimes referred to as the neutral safety switch.

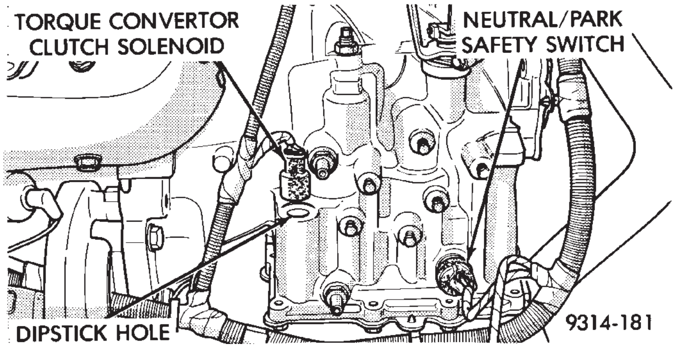


Fig. 7 Park/Neutral Switch

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The Throttle Position Sensor (TPS) is mounted on the throttle body and connected to the throttle blade shaft (Fig. 8). The TPS is a variable resistor. The sensor provides an input signal (voltage) to the PCM representing throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.

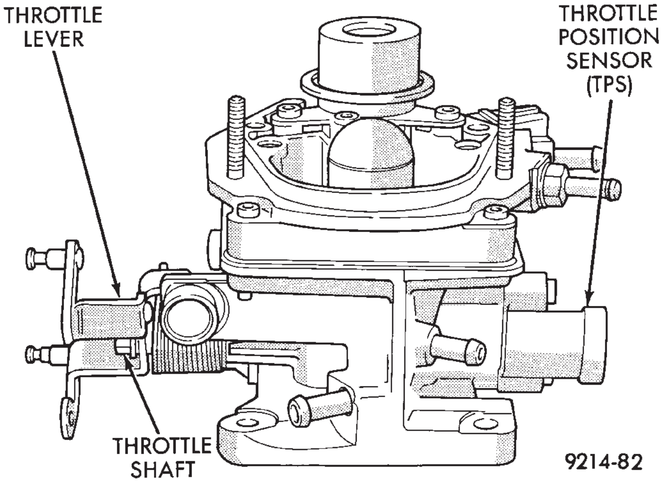


Fig. 8 Throttle Position Sensor

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS varying in an approximate range of from 1 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. The PCM adjusts fuel injector pulse width and ignition timing based on these inputs.

VEHICLE SPEED SENSOR—PCM INPUT

The vehicle speed sensor is located in the transaxle extension housing (Fig. 9). The sensor input is used by the PCM to determine vehicle speed and distance traveled.

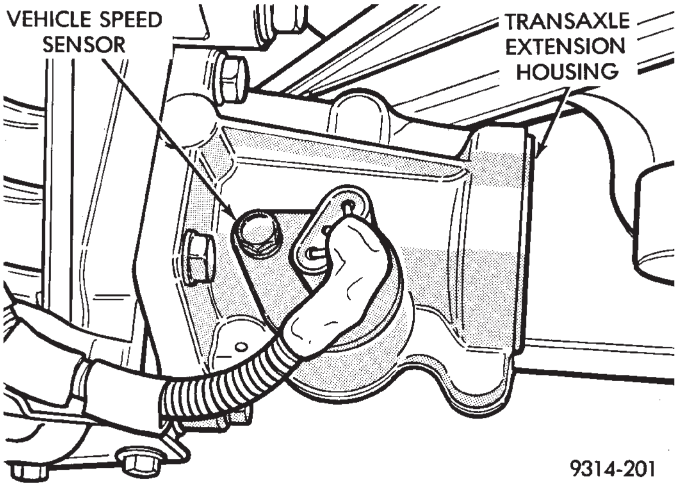


Fig. 9 Vehicle Distance (Speed) Sensor—Typical

The speed sensor generates 8 pulses per sensor revolution. These 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.

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit. The radiator fan relay supplies battery power to the solenoid side of the A/C clutch relay. The air conditioning clutch relay will not energize unless the radiator fan relay energizes. The PCM energizes the radiator fan relay when the air conditioning or defrost switch is put in the ON position and the low pressure and high pressure switches 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.

On AC, AG and AJ models, the A/C clutch is located in the power distribution center. Refer to the Wiring and Component Identification section of Group 8W.

ON AA and AP models, the A/C clutch relay is mounted to the inner fender panel, next to the drivers side strut tower (Fig. 10).

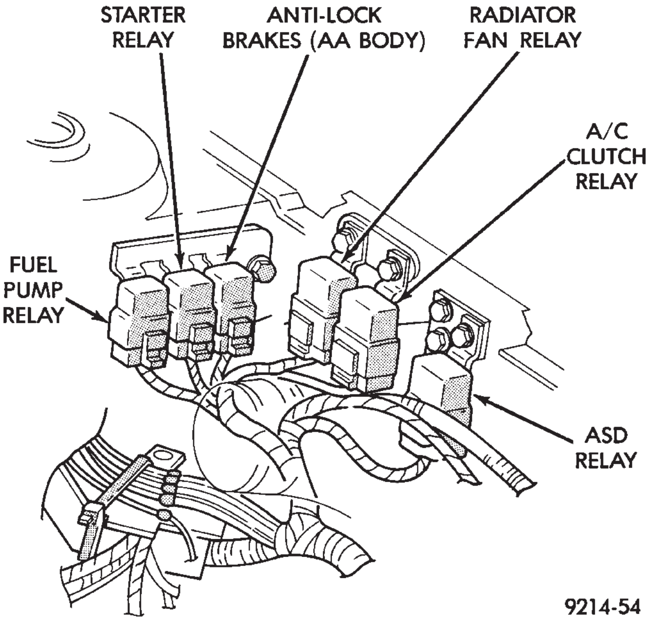


Fig. 10 Relay Identification

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY—PCM OUTPUT

The PCM operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the distributor pick-up signal. From the distributor signal, the PCM determines engine speed and ignition timing (coil dwell). If the PCM does not receive a distributor signal when the ignition switch is in the Run position, it will de-energize both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

On AC, AG and AJ models, the ASD relay and fuel pump relay are located in the power distribution center. Refer to the Wiring and Component Identification section of Group 8W.

On AA and AP models, the ASD relay and fuel pump relay are mounted on the drivers side fender well, next to the strut tower (Fig. 10).

IDLE AIR CONTROL MOTOR—PCM OUTPUT

The idle air control motor is mounted on the throttle body (Fig. 11). The PCM operates the idle air control motor. The PCM adjusts engine idle speed through the idle air control motor to compensate for engine load or ambient conditions.

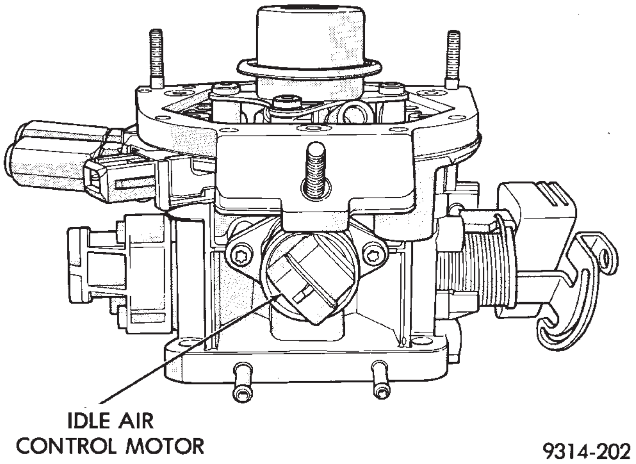


Fig. 11 Idle Air Control Motor

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 from the throttle position sensor, speed sensor (distributor pick-up coil), coolant temperature sensor, and various switch operations (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.

EVAP CANISTER PURGE SOLENOID—PCM OUTPUT

Vacuum for the Evaporative Canister is controlled by the EVAP Canister Purge Solenoid (Fig. 12). The solenoid is controlled by the PCM.

The PCM operates the solenoid by switching the ground circuit on and off based on engine operating conditions. When grounded, the solenoid energizes and prevents vacuum from reaching the evaporative canister. When not energized, the solenoid allows vacuum to flow to the canister.

During warm-up and for a specified time period after hot starts, the PCM grounds the purge solenoid. Vacuum does not operate the evaporative canister valve.

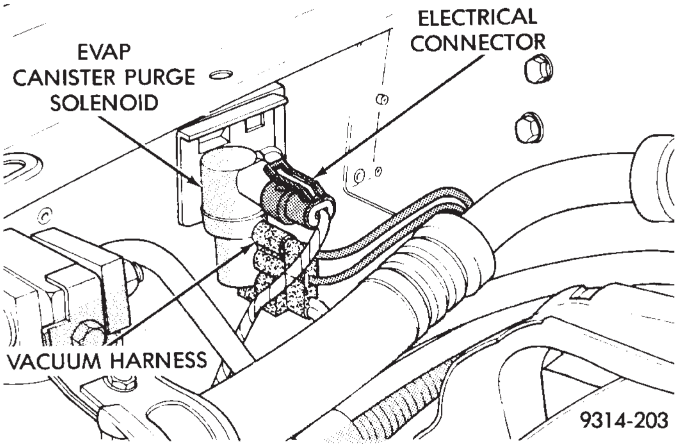


Fig. 12 EVAP Canister Purge Solenoid

The PCM removes the ground to the solenoid when the engine reaches a specified temperature and the time delay interval has occurred. When the solenoid is de-energized, vacuum flows to the canister purge valve. Vapors are purged from the canister and flow to the throttle body.

The purge solenoid is also energized during certain idle conditions to update the fuel delivery calibration.

MALFUNCTION INDICATOR LAMP (CHECK ENGINE)—PCM OUTPUT

The Malfunction Indicator lamp (instrument panel 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 warns the operator that the PCM has entered a Limp-in mode. During Limp-in-Mode, the PCM attempts to keep the system operational. The malfunction indicator lamp 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.

Signals that can trigger the Malfunction Indicator Lamp.

- Coolant Temperature Sensor
- Manifold Absolute Pressure Sensor
- Throttle Position Sensor
- Battery Voltage Input
- An Emissions Related System
- Charging system

The malfunction indicator lamp can also be used to display diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within five seconds and any diagnostic trouble codes stored in the PCM will be displayed. Refer to the 2.2L/2.5L Single Point Fuel Injection—On-Board Diagnostics section in this group.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector provides the technician with the means to connect the DRBII scan tool to diagnosis the vehicle.

ELECTRIC ELECTRONIC GAS RECIRCULATION—PCM OUTPUT

The electronic exhaust gas recirculation transducer (EET) is a back pressure transducer/electric vacuum solenoid assembly (Fig. 13). The EET assembly mounts above the EGR valve (Fig. 14).

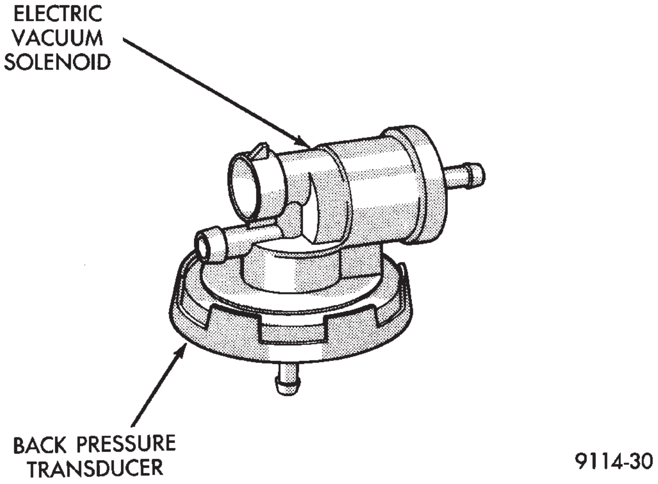


Fig. 13 Electronic EGR Recirculation Transducer

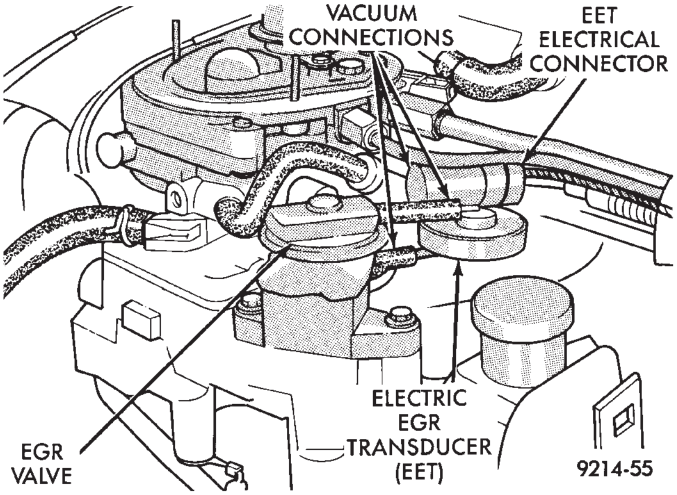


Fig. 14 EGR Valve and Electric EGR Transducer

The solenoid turns the vacuum supply to the transducer on and off. The electric vacuum solenoid portion of the EET energizes when the PCM provides a ground path. When the solenoid energizes, vacuum is prevented from flowing to the transducer. When the solenoid de-energizes, vacuum flows to the transducer. The solenoid energizes during engine warm-up, closed throttle (idle or cruise), wide open throttle, and rapid acceleration/deceleration. **If the solenoid wire connector is disconnected, the EGR valve will operate at all times.**

FUEL INJECTOR—PCM OUTPUT

The Fuel Injector is an electric solenoid operated by the PCM (Fig. 15).

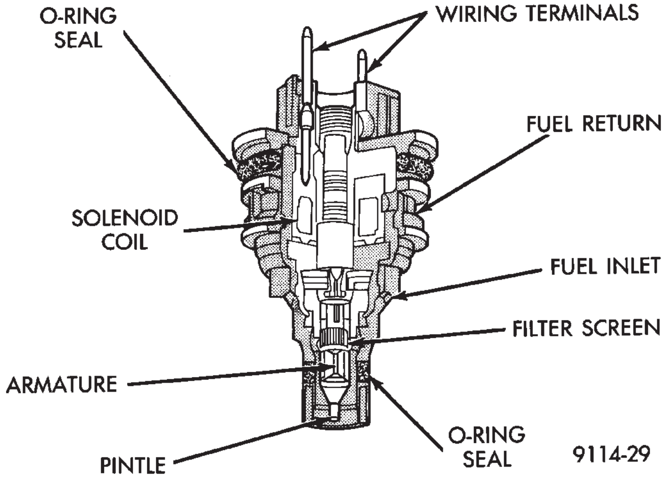


Fig. 15 Fuel Injector

Based on sensor inputs, the PCM determines when and how long the fuel injector should operate. The amount of time the injector fires is referred to as injector pulse width. The auto shutdown (ASD) relay supplies battery voltage to the injector. The PCM supplies the ground path. By switching the ground path on and off, the PCM adjusts injector pulse width. When the PCM supplies a ground path, a spring loaded needle or armature lifts from its seat. Fuel flows through the orifice and deflects off the sharp edge of the injector nozzle. The resulting fuel sprays forms a 45° cone shaped pattern before entering the air stream in the throttle body.

Fuel is supplied to the injector constantly at regulated 270 Kpa (39 psi). Unused fuel returns to the fuel tank.

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 charging system information.

IGNITION COIL—PCM OUTPUT

The PCM provides a ground contact (circuit) for energizing the ignition 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 an input from the distributor pick-up. Refer to Auto Shutdown (ASD) Relay/Fuel Pump Relay—PCM Output in this section for relay operation.

The ignition coil is mounted on the hot box next to the thermostat housing (Fig. 16).

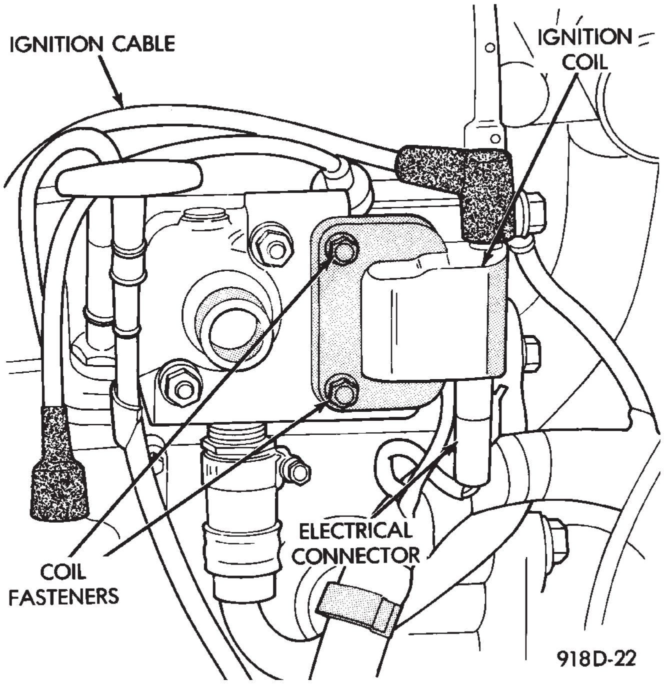


Fig. 16 Ignition Coil

PART THROTTLE UNLOCK SOLENOID—PCM OUTPUT

Three-speed automatic transaxles use a part throttle unlock solenoid. The PCM controls the lock-up of the torque convertor through the part throttle unlock solenoid. The transaxle is locked up only in direct drive mode. Refer to Group 21 for transaxle information.

RADIATOR FAN RELAY—PCM OUTPUT

The radiator fan is energized by the PCM through the radiator fan relay. The PCM grounds the radiator fan relay when engine coolant reaches a predetermined temperature. For more information, refer to Group 7, Cooling Systems.

On AC, AG and AJ models, the radiator fan relay is located in the power distribution center. Refer to the Wiring and Component Identification section of Group 8W.

On AA and AP models, the radiator fan relay is mounted on the drivers side fender well, next to the strut tower (Fig. 10).

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 blade. When the PCM supplies a ground only to the vent solenoid, the throttle blade holds position. When the PCM removes the ground from both the vacuum and vent solenoids, the throttle blade closes. The PCM balances 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. Refer to Group 8 for tachometer information.

MODES OF OPERATION

As input signals to the PCM change, the PCM adjusts its response to the 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 (O_2) sensor is not monitored during OPEN LOOP modes.

During CLOSED LOOP modes, the PCM does monitor the oxygen (O_2) sensor input. This input tells the PCM if the calculated injector pulse width results in an air-fuel ratio of 14.7 to 1. By monitoring the exhaust oxygen content, the can PCM fine tune injector pulse width for optimum fuel economy and low emissions.

The single point 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 (cranking), engine warm-up, and wide open throttle modes are OPEN LOOP modes. The acceleration, deceleration, and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes (under most operating conditions).

IGNITION SWITCH ON (ZERO RPM) MODE

When the single point 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 calculate basic fuel strategy.
- The PCM monitors the coolant temperature sensor and throttle position sensor inputs. The PCM modifies fuel strategy based on these inputs.

When the key is in the ON position and the engine is not running, the (ASD) and fuel pump relays are not energized. Therefore, battery voltage is not supplied to the fuel pump, ignition coil, fuel injector 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 a distributor signal it energizes the auto shutdown (ASD) relay and fuel pump relay to supply battery voltage to the fuel injector, ignition coil and oxygen sensor heating element. If the PCM does not receive a distributor input, it de-energizes the ASD and fuel pump relays after approximately one second.

When the engine idles within ±64 RPM of the target RPM, the PCM compares the current MAP value with the atmospheric pressure value it received during the Ignition Switch On (Zero RPM) Mode. If a minimum difference between the two is not detected, a MAP sensor fault is set into memory.

Once the ASD relay and fuel pump relay have energized, the PCM:

- Supplies a ground path to the injector. The injector is pulsed four times per engine revolution instead of the normal two pulses per revolution.
- Determines injector pulse width based on coolant temperature, MAP sensor input, throttle position, and the number of engine revolutions since cranking was initiated.
- Monitors the coolant temperature sensor, distributor pick-up, 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:

- coolant temperature
- manifold absolute pressure (MAP)
- engine speed (distributor pick-up)
- throttle position
- A/C switch
- battery voltage

The PCM provides a ground path for the injector to precisely control injector pulse width (by switching the ground on and off) and fires the injector twice per engine revolution. The PCM regulates ignition timing. It also adjusts engine idle speed through the idle air control motor.

CRUISE OR IDLE MODE

When the engine is at operating temperature this is a CLOSED LOOP mode. During cruising speed and at idle the following inputs are received by the PCM:

- coolant temperature
- manifold absolute pressure
- engine speed
- throttle position
- exhaust gas oxygen content
- A/C control positions
- battery voltage

The PCM provides a ground path for the injector to precisely control injector pulse width and fires the injector twice per engine revolution. The PCM controls engine idle speed and ignition timing. The PCM controls 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:
- 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) at the same time it senses an abrupt decrease in manifold pressure from the manifold absolute pressure (MAP) sensor. This indicates a hard deceleration. The PCM may reduce injector firing to once per engine revolution. This helps maintain better control of the air-fuel mixture (as sensed through the O_2 sensor).

During a deceleration condition, the PCM grounds the exhaust gas recirculation transducer (EET) solenoid. EGR stops when the PCM grounds the solenoid.

WIDE OPEN THROTTLE MODE

This is an OPEN LOOP mode. During wide open throttle operation, the following inputs are received by the PCM:
- coolant temperature
- manifold absolute pressure
- engine speed
- throttle position

When the PCM senses a wide open throttle condition through the throttle position sensor (TPS) it will:
- De-energize the air conditioning relay. This disables the air conditioning system.
- Provide a ground path for the electric EGR transducer (EET) solenoid, preventing the EGR system from functioning.

The exhaust gas oxygen content input is not accepted by the PCM during wide open throttle operation. The PCM will adjust injector pulse width to supply a predetermined amount of additional fuel.

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.

FUEL PRESSURE REGULATOR

The pressure regulator is a mechanical device located at the top of the throttle body (Fig. 17). Its function is to maintain a constant 270 kPa (39 PSI) across the fuel injector tip.

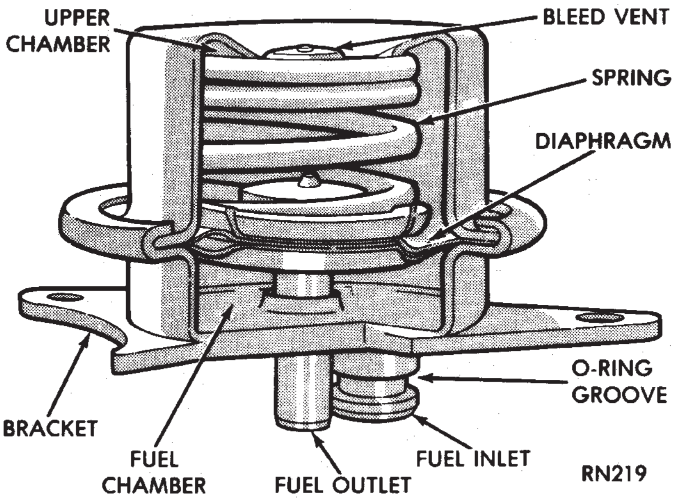


Fig. 17 Fuel Pressure Regulator

The regulator uses a spring loaded rubber diaphragm to uncover a fuel return port. When the fuel pump becomes operational, fuel flows past the injector into the regulator, and is restricted from flowing any further by the blocked return port. When fuel pressure reaches 270 kPa (39 PSI) it pushes on the diaphragm, compresses the spring, and uncovers the fuel return port. The diaphragm and spring constantly move from an open to closed position keeping fuel pressure consistent.

THROTTLE BODY

The throttle body assembly (Fig. 18) is mounted on top of the intake manifold. It contains the fuel injector, pressure regulator, throttle position sensor and 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. The throttle body itself provides the chamber for metering, atomizing, and mixing fuel with the air entering the engine.

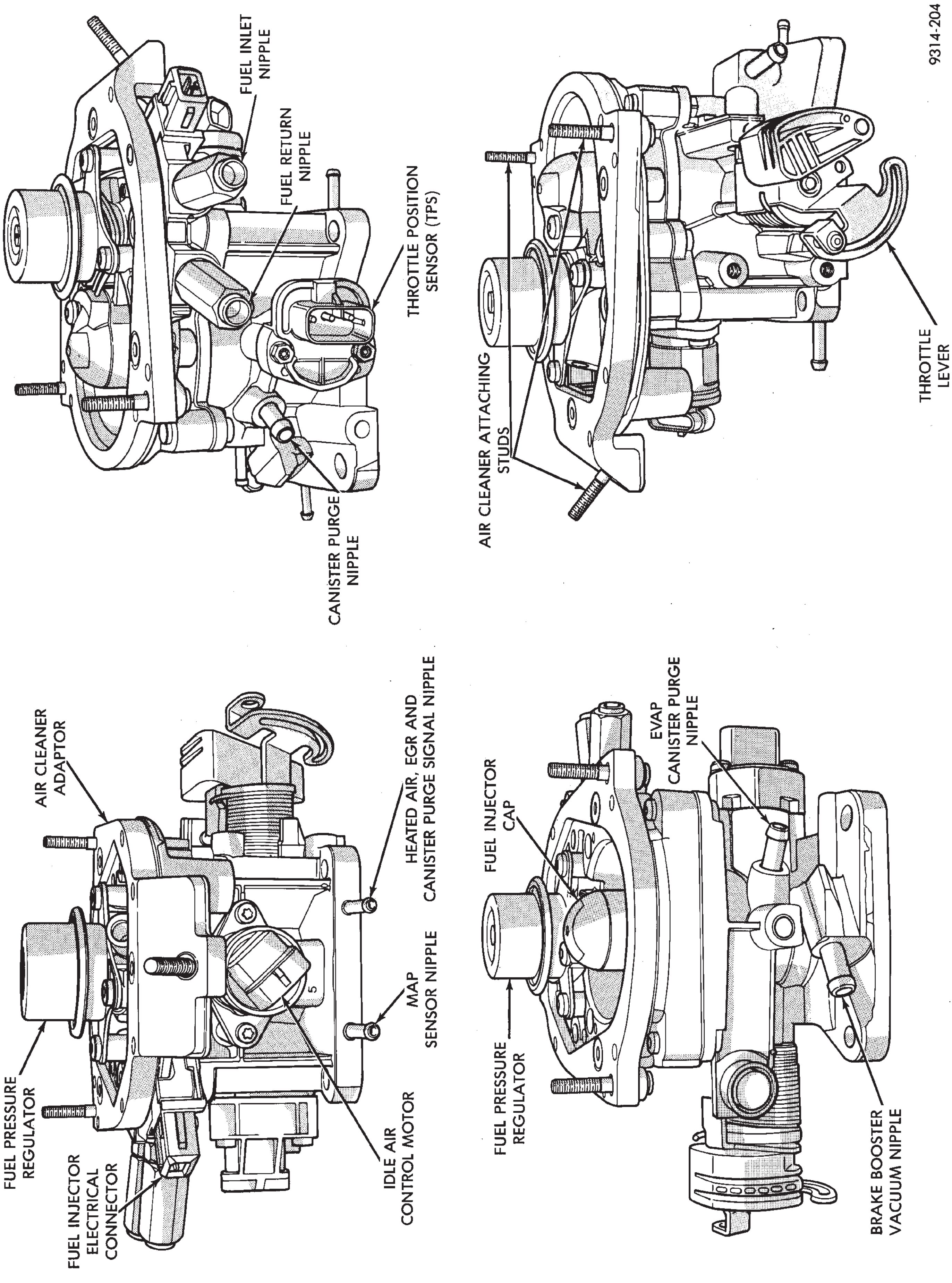


Fig. 18 Throttle Body

2.2L/2.5L SINGLE POINT FUEL INJECTION—GENERAL DIAGNOSIS

INDEX

FUEL SYSTEM DIAGRAM

The fuel injection system is managed by the powertrain control module (PCM). The PCM receives inputs from various switches and sensors (Fig. 1). Based on these inputs the PCM adjusts ignition timing and idle speed through output devices. Refer to the Single Point Fuel Injection System Operation section of this group for system and component descriptions.

VISUAL INSPECTION

Perform a visual inspection for loose, disconnected, or misrouted wires and hoses before diagnosing or servicing the fuel injection system. A visual check helps save unnecessary test and diagnostic time. A thorough visual inspection includes the following checks:

(1) Check Ignition Coil Electrical Connections (Fig. 2).

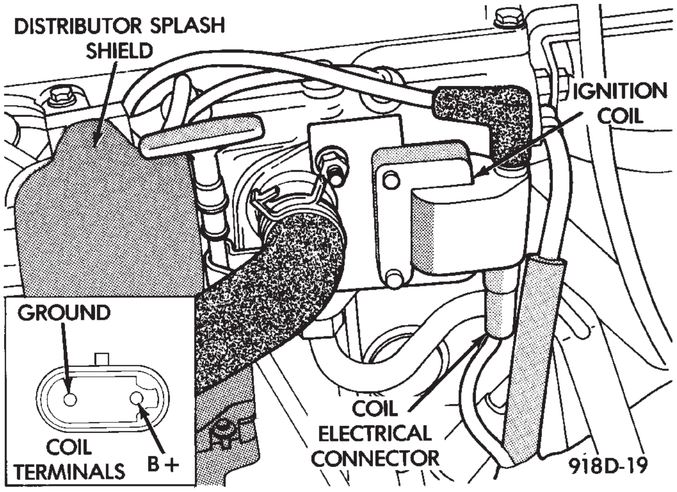


Fig. 2 Ignition Coil

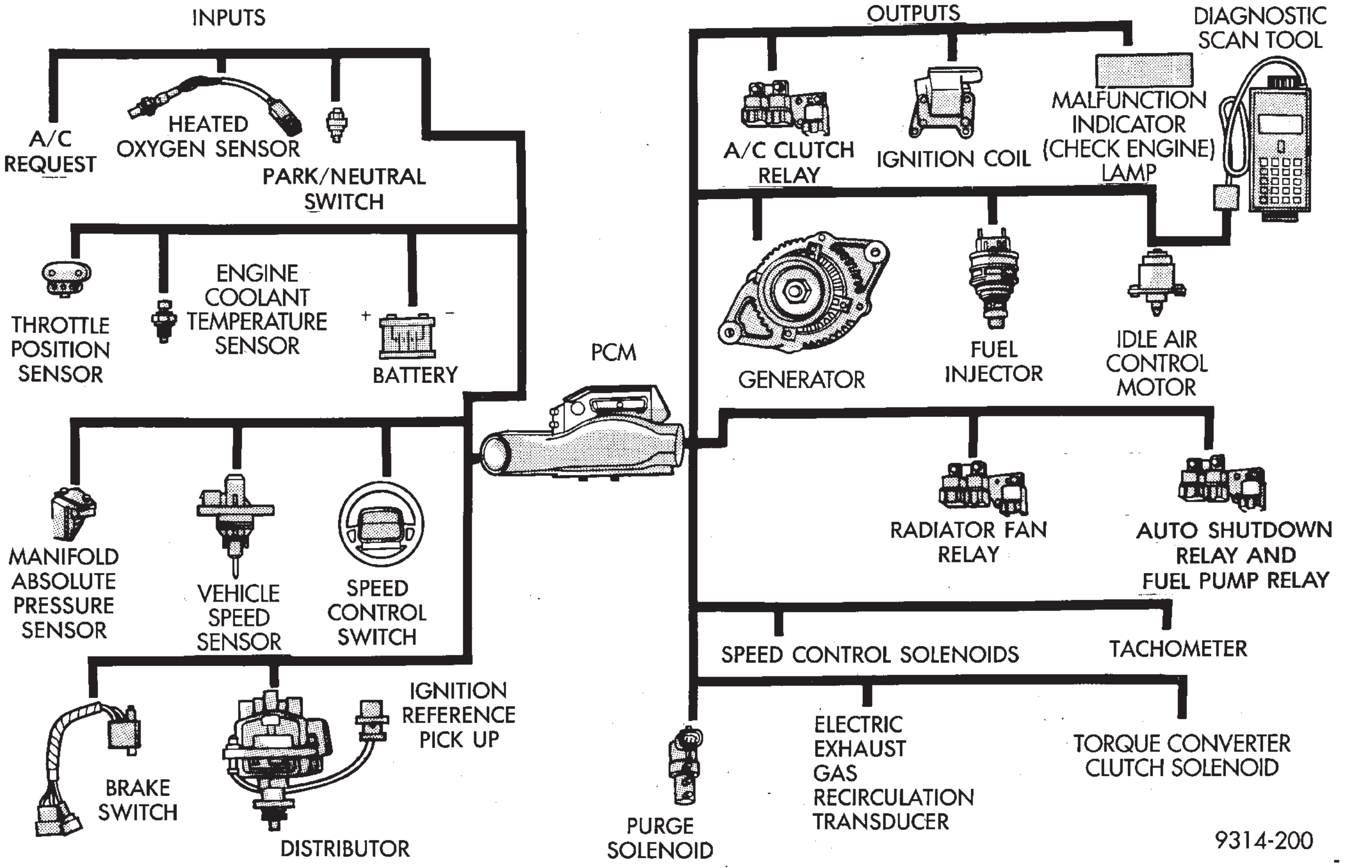


Fig. 1 Single Point Fuel Injection Components

(2) Verify the electrical connector is attached to the Canister Purge Solenoid (Fig. 3).

(3) Verify vacuum connection at Canister Purge Solenoid is secure and not leaking.

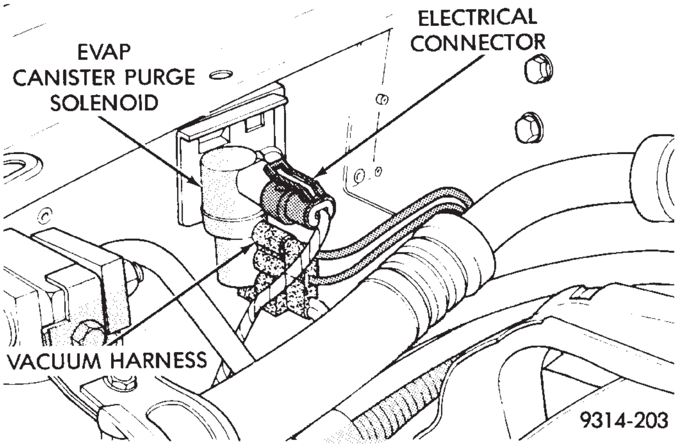


Fig. 3 Canister Purge Solenoid

(4) Verify the wiring connector is attached to the Electric EGR Transducer (EET) solenoid (Fig. 4).

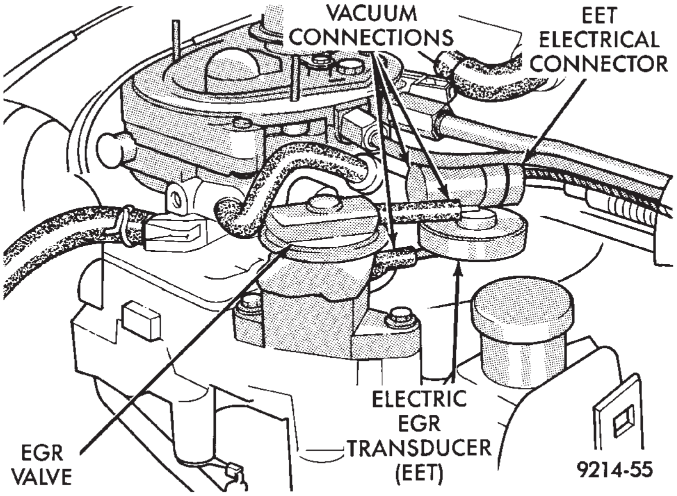


Fig. 4 Electric EGR Transducer (EET) Assembly

(5) Verify vacuum connection at the Electric EGR Transducer is secure and not leaking (Fig. 4).

(6) Verify the connector is attached to the MAP sensor (Fig. 5).

(7) Verify the vacuum hose is attached to the MAP sensor (Fig. 5).

(8) Verify the generator wiring and belt are correctly installed and tightened.

(9) Verify hoses are securely attached to the EVAP canister (Fig. 6).

(10) Verify the throttle body wiring connection to main harness is attached (Fig. 7).

(11) Verify the electrical connector is attached to idle air control motor (Fig. 8).

(12) Verify the electrical connector is attached to the throttle position sensor (Fig. 8).

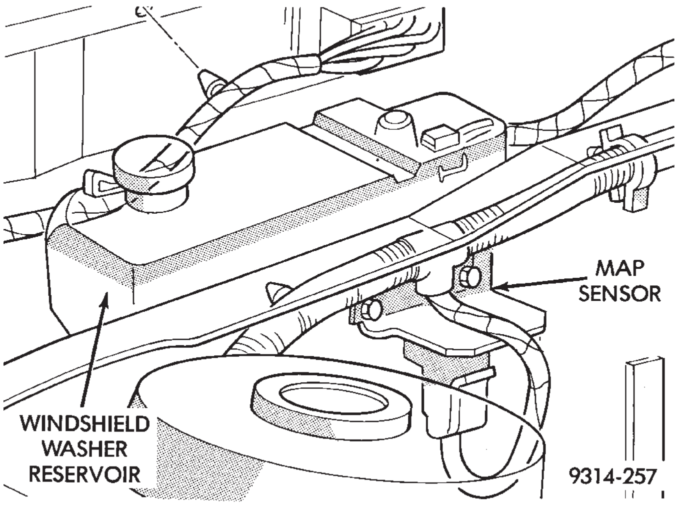


Fig. 5 Manifold Absolute Pressure (MAP) Sensor

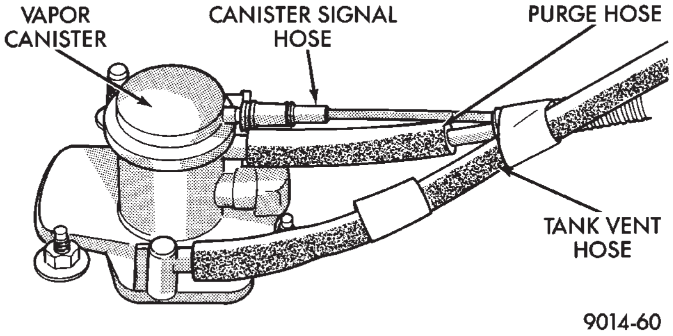


Fig. 6 EVAP Canister

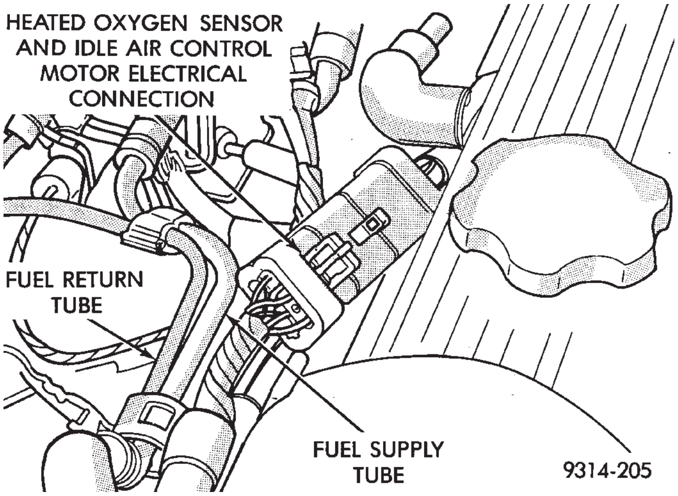


Fig. 7 Throttle Body Wiring Connection to Main Harness

(13) Verify the electrical connector is attached to the fuel injector (Fig. 8).

(14) Verify the hose from PCV valve is securely attached to the intake manifold vacuum port (Fig. 9).

(15) Verify vacuum connections on the front and rear of Throttle Body are secure and not leaking (Figs. 10 and 11).

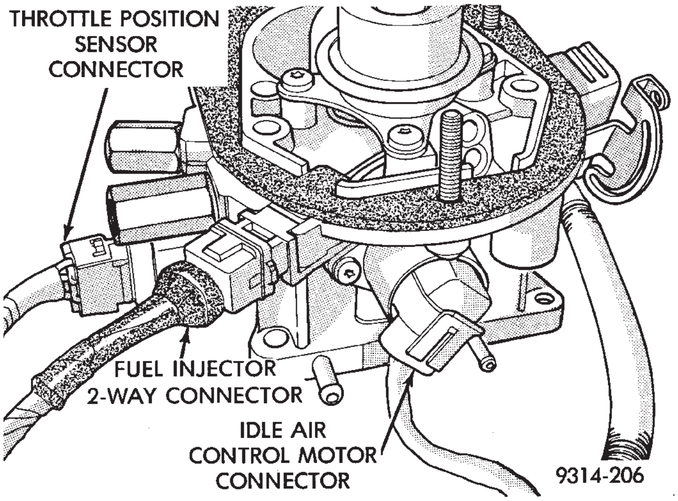


Fig. 8 Throttle Body Wiring Connections

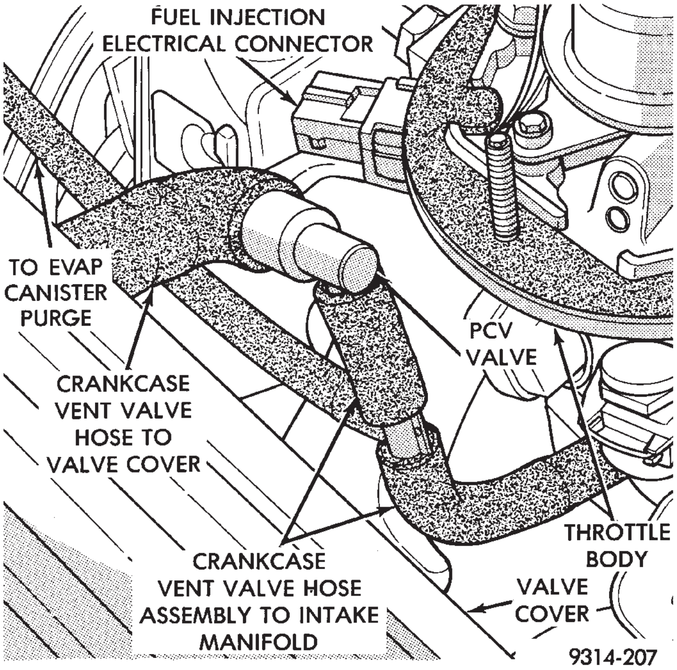


Fig. 9 Vacuum Hose from Intake Manifold to PCV Valve

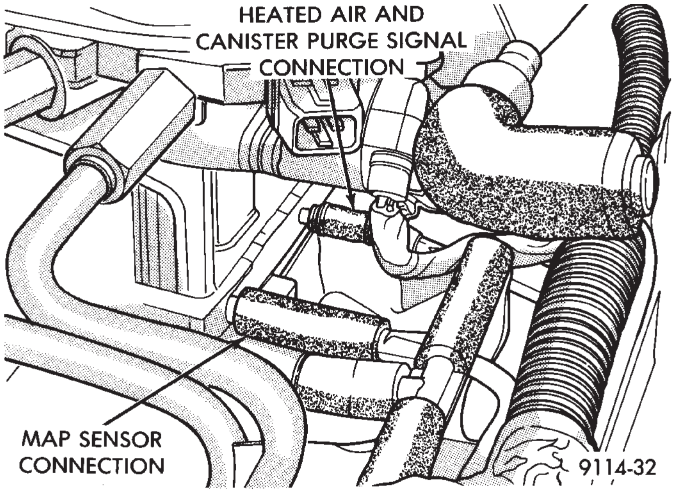


Fig. 10 Throttle Body Vacuum Ports—Front

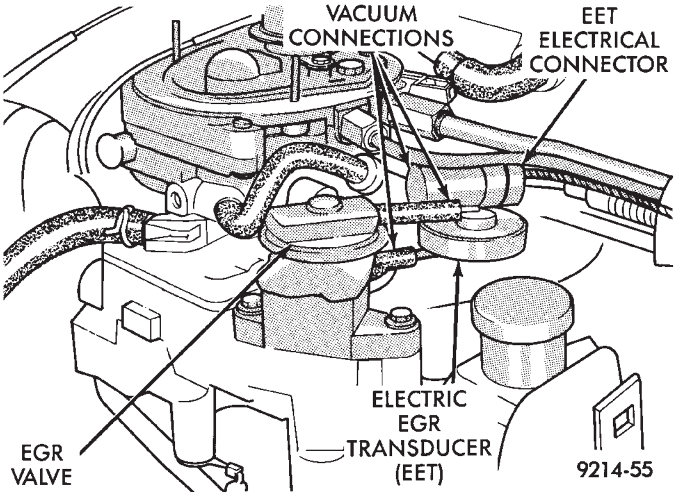


Fig. 11 Throttle Body Vacuum Ports—Rear

(16) Verify hoses are attached to back pressure transducer or electric EGR transducer (EET) (Fig. 11).

(17) Verify heated air door vacuum connection is connected and not leaking.

(18) Verify power brake and speed control vacuum connectors are tight (Fig. 12).

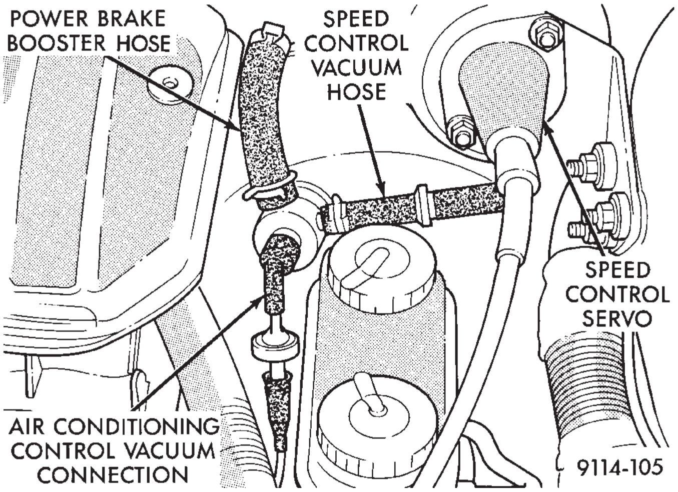


Fig. 12 Power Brake and Speed Control Vacuum Connection

(19) Verify all ignition cables are in correct order and seated into place (Fig. 13).

(20) Verify the electrical connector is attached to coolant temperature sensor (Fig. 14).

(21) Verify battery negative ground eyelet is mounted to the cylinder head (Figs. 14).

(22) Verify electrical connector is attached to distributor (Fig. 15).

(23) Verify radiator fan electrical connector is attached to the harness (Fig. 15).

(24) Verify oil pressure switch electrical connector is attached to the switch (Fig. 15).

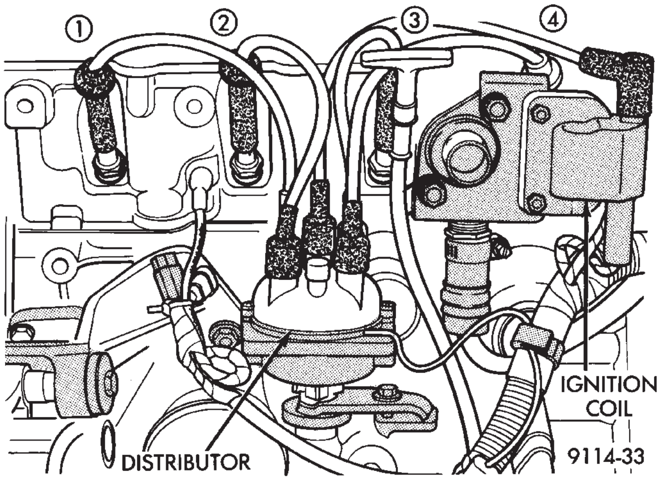


Fig. 13 Ignition Cable Routing and Connection

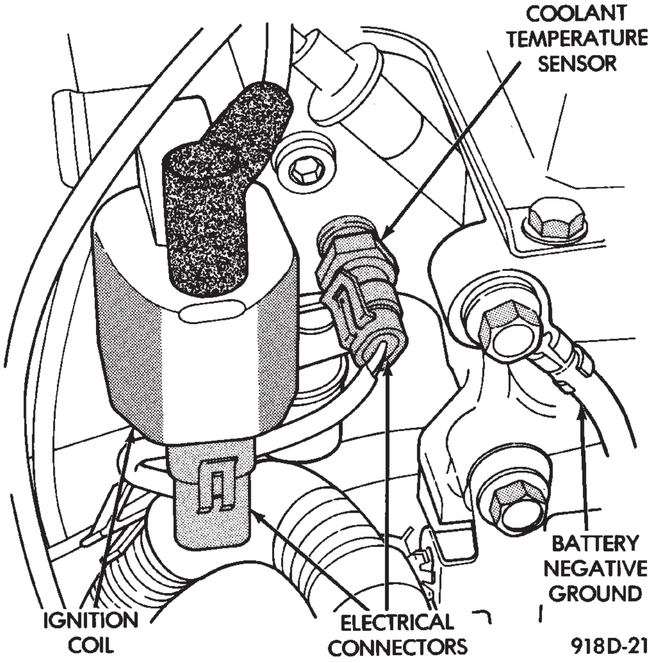


Fig. 14 Coolant Temperature Sensor

(25) On automatic transaxle equipped vehicles, verify the park/neutral position switch electrical connector is attached to the switch (Fig. 16).

(26) On automatic transaxle equipped vehicles, check the torque convertor lockup solenoid electrical connection (Fig. 16).

(27) Verify the 60-way connector is fully inserted into the socket on the PCM (Fig. 17).

(28) Verify all electrical connectors are fully inserted into relays and that battery connections are clean and tight (Figs. 18, 19, 20, 21, and 22).

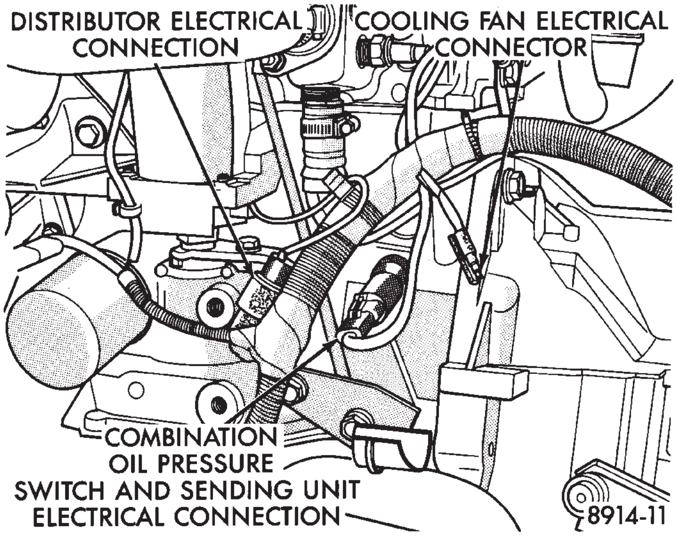


Fig. 15 Distributor, Oil Pressure Switch, and Radiator Fan Electrical Connections

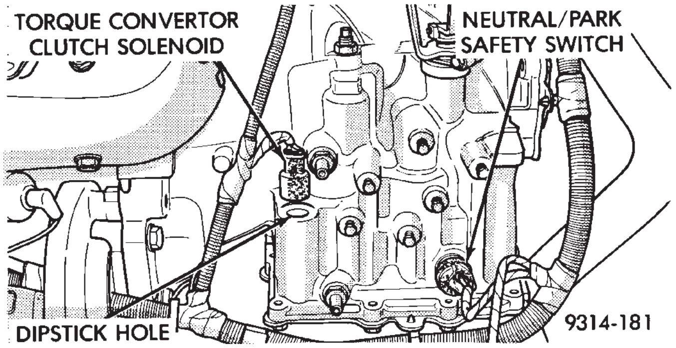


Fig. 16 Automatic Transaxle Electrical Connections

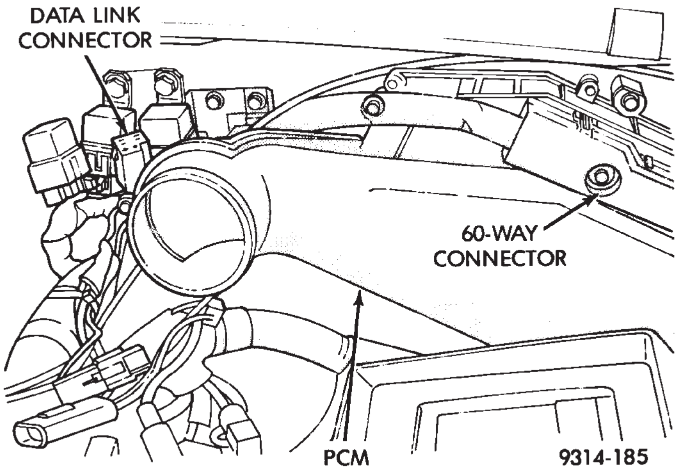


Fig. 17 PCM Electrical Connector

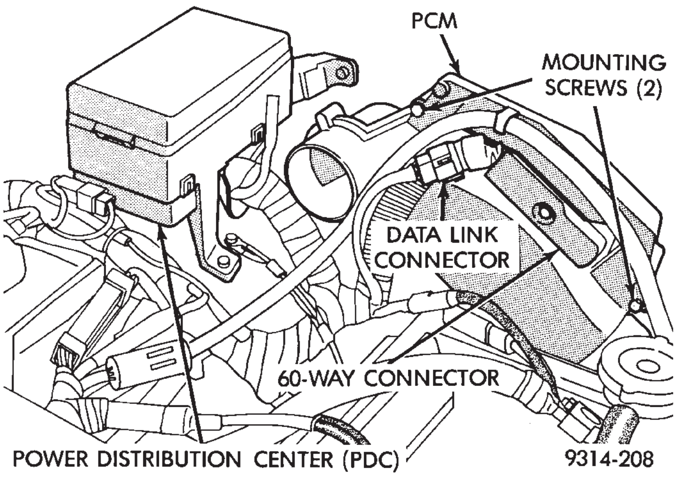


Fig. 18 Power Distribution Center (PDC) (AC Body)

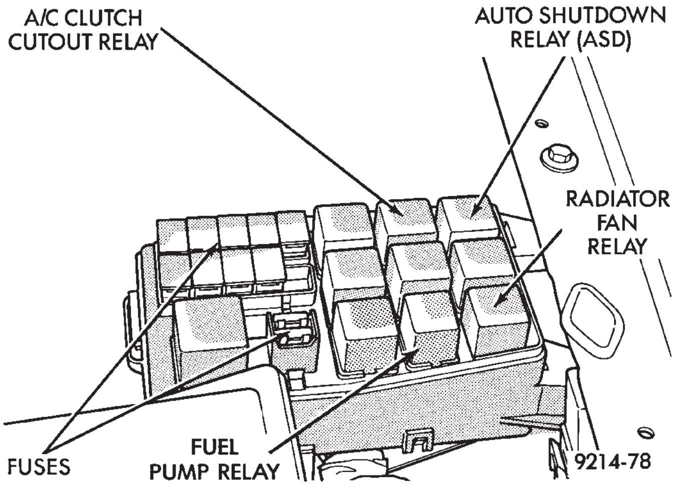


Fig. 19 Relay Identification (AC Body)

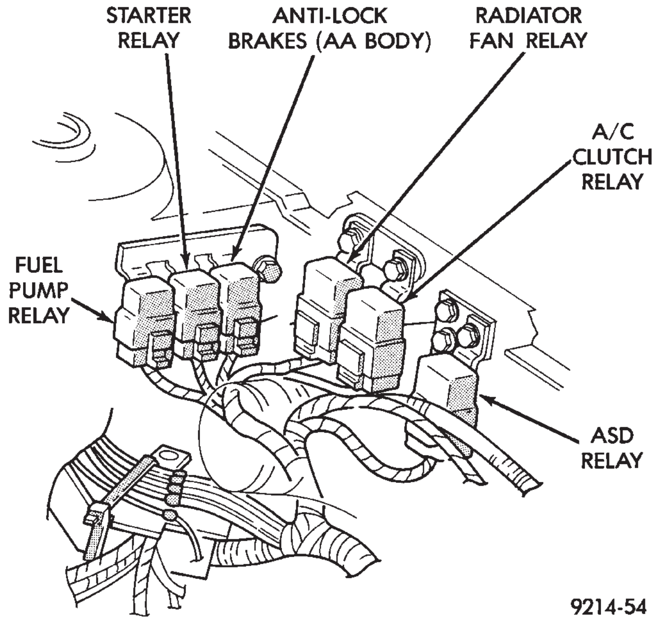


Fig. 20 Relay Identification (AA and AP Bodies)

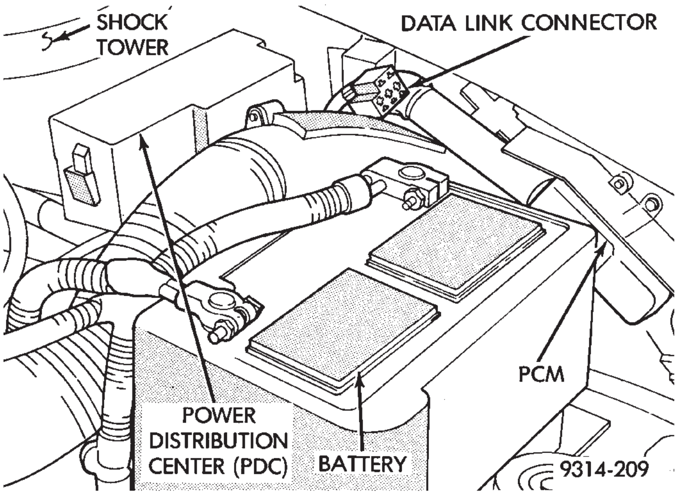


Fig. 21 Power Distribution Center (PDC) (AG and AJ Body)

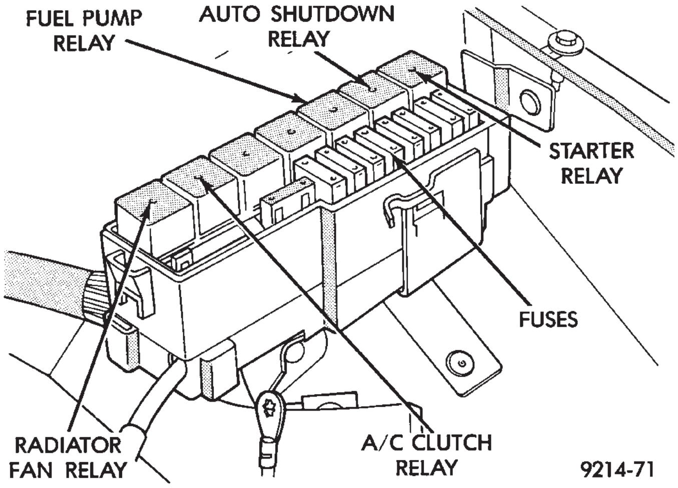


Fig. 22 Relay Identification (AG and AJ Body)

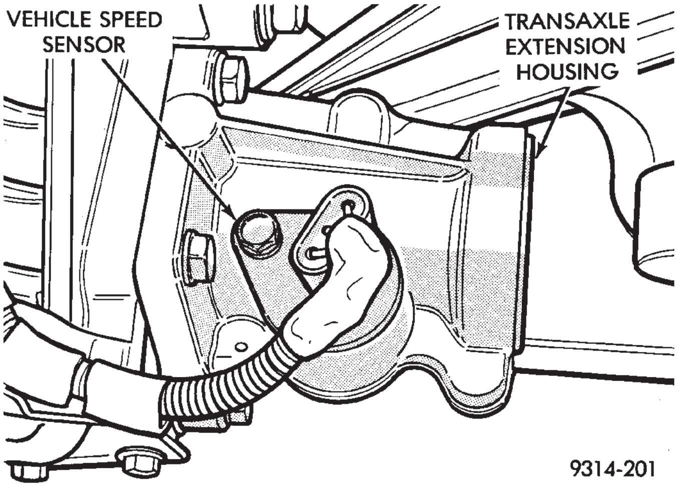


Fig. 23 Vehicle Speed Sensor Wiring Connection

(29) Verify engine harness to main harness connections are fully inserted.

(30) Check the vehicle speed sensor connector (Fig. 23).

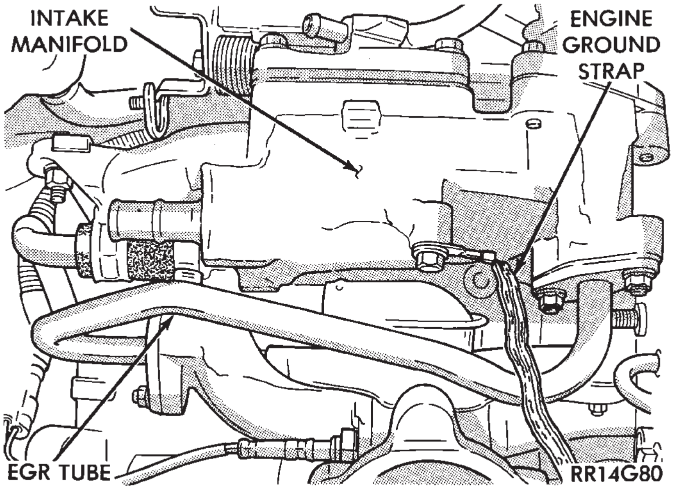


Fig. 24 Engine Ground Strap at Intake Manifold

(31) Verify engine ground strap is attached at the engine and dash panel (Figs. 24 and 25).

(32) Verify oxygen sensor electrical connector is attached to the sensor (Fig. 26).

(33) Check Hose and Wiring Connections at Fuel Pump. Check that wiring connector is making contact with terminals on pump.

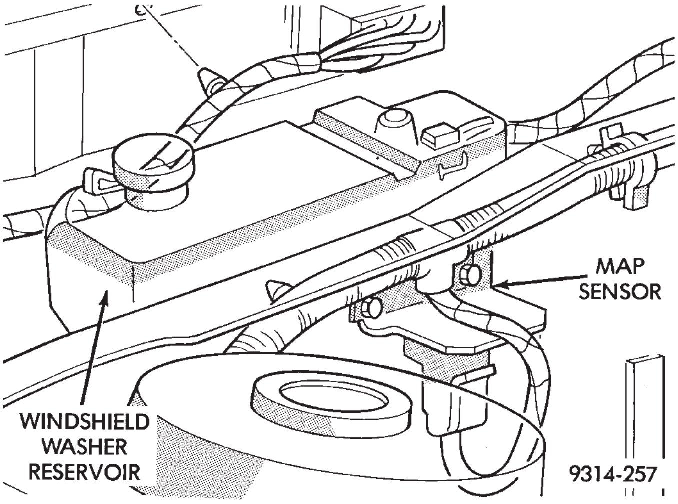


Fig. 25 Engine Ground Strap to Dash Panel

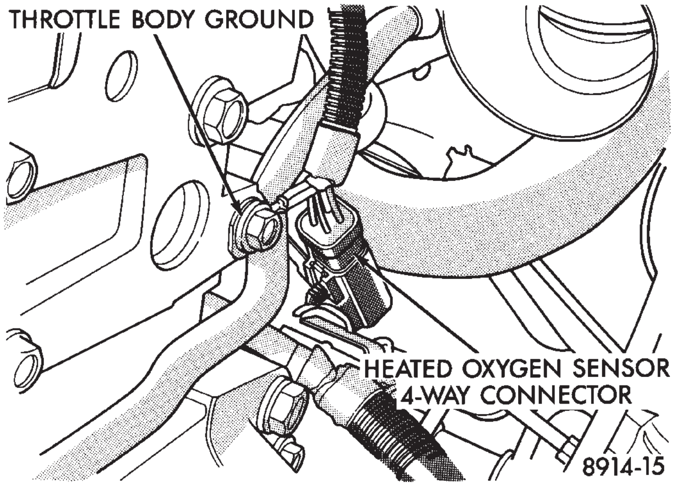


Fig. 26 Heated Oxygen Sensor Electrical Connection

2.2L/2.5L SINGLE POINT FUEL INJECTION—ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

The powertrain control module (PCM) has been programmed to monitor many different circuits of the fuel injection system. If a problem is sensed with a monitored circuit often enough to indicate an actual problem, the PCM stores a fault. If the problem is repaired or ceases to exist, the PCM cancels the Diagnostic Trouble Code after 50 to 100 vehicle key on/off cycles.

Certain criteria must be met for a diagnostic trouble code to be entered into powertrain control module (PCM) memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

It is possible that a diagnostic trouble code for a monitored circuit may not be entered into memory even though a malfunction has occurred. This may happen because one of the diagnostic trouble code criteria for the circuit has not been met. **For example**, assume that one of the diagnostic trouble code criteria for a certain sensor circuit is that the engine must be operating between 750 and 2000 RPM to be monitored for a diagnostic trouble code. If the sensor output circuit shorts to ground when engine RPM is above 2400 RPM (resulting in a 0 volt input to the PCM) a diagnostic trouble code will not be entered into memory. This is because the condition does not occur within the specified RPM range.

There are several operating conditions for which the PCM does not monitor and set diagnostic trouble codes. Refer to Monitored Circuits and Non-Monitored Circuits in this section.

Stored diagnostic trouble codes can be displayed by cycling the ignition key On - Off - On - Off - On. Also, the technician can display fault information using the DRB II scan tool. The DRBII scan tool connects to the data link connector in the vehicle (Fig. 1, 2 or 3).

MONITORED CIRCUITS

The powertrain control module (PCM) can detect certain fault conditions in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if the sensor output (input to PCM) is within proper range, and if the circuit is open or shorted.

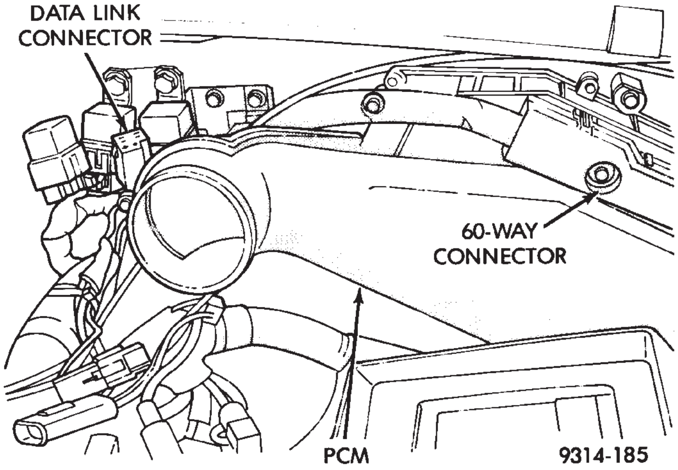


Fig. 1 Data Link Connector Location—AA and AP Vehicles

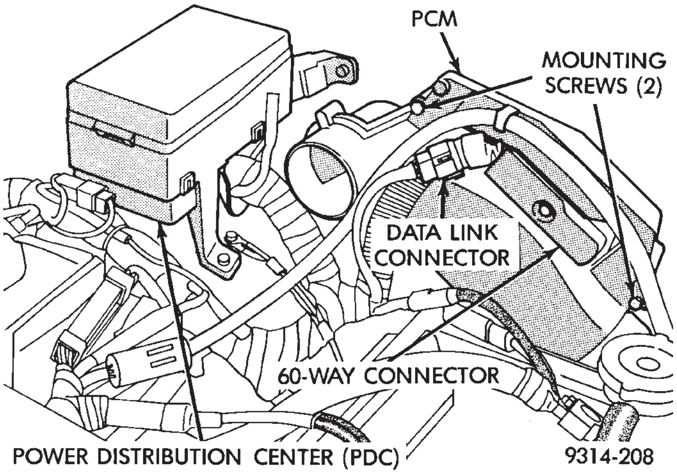


Fig. 2 Data Link Connector Location—AC Vehicles

Output Device Current Flow - The PCM senses whether the output devices are hooked up. If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground, or shorted high.

Oxygen Sensor - The PCM can determine if the oxygen sensor is switching between rich and lean

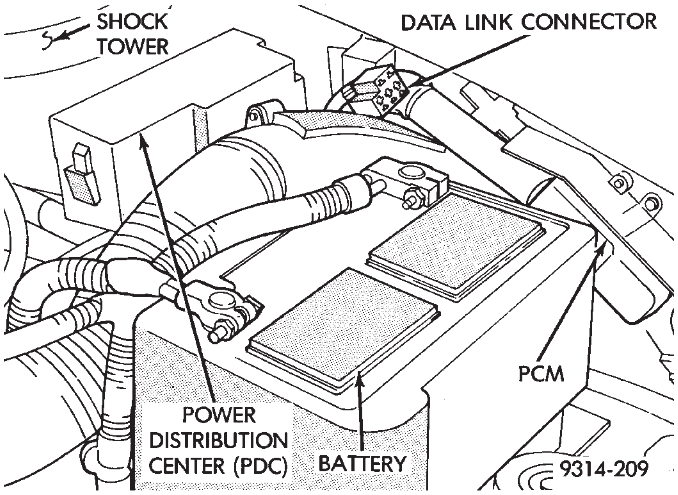


Fig. 3 Data Link Connector Location—AG and AJ Vehicles

once the system has entered closed loop. Refer to Modes of Operation in this section for an explanation of closed loop operation.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions that result in driveability problems. Diagnostic trouble codes may not be displayed for these conditions. However, problems with these systems may cause diagnostic trouble codes to be displayed for other systems. For example, a fuel pressure problem will not register a fault directly, but could cause a rich or lean condition. This could cause an oxygen sensor fault to be stored in the PCM.

Fuel Pressure - Fuel pressure is controlled by the fuel pressure regulator. 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 an oxygen sensor fault.

Secondary Ignition Circuit - The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

Engine Timing - The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket and crankshaft sprocket. The PCM also cannot detect an incorrectly indexed distributor. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

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, the pintle is sticking or the wrong injector is installed. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

Excessive Oil Consumption - Although the PCM monitors the exhaust stream oxygen content through the oxygen sensor 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.

Evaporative System - The PCM will not detect a restricted, plugged or loaded evaporative purge canister.

Vacuum Assist - Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM. However, these could result in a MAP sensor fault being stored in the PCM.

PCM System Ground - The PCM cannot determine a poor system ground. However, a diagnostic trouble code may be generated as a result of this condition.

PCM Connector Engagement - The PCM cannot determine spread or damaged connector pins. However, a diagnostic trouble code may be generated as a result of this condition.

HIGH AND LOW LIMITS

The powertrain control module (PCM) compares input signal voltages from each input device with established high and low limits that are programmed into it for that device. If the input voltage is not within specifications and other diagnostic trouble code criteria are met, a diagnostic trouble code will be stored 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 a fault condition can be verified.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

When a diagnostic trouble code appears, it indicates the powertrain control module (PCM) has recognized an abnormal condition in the system. Diagnostic trouble codes can be obtained from the malfunction indicator lamp (instrument panel Check Engine lamp) on the Instrument Panel or from the DRBII scan tool. Diagnostic trouble codes indicate the results of a failure but do not identify the failed component directly.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
11	No reference SignaL During Cranking	No camshaft position sensor detected during engine cranking.
13+**	Slow change in Idle MAP signal	MAP output change is slower and/or smaller than expected.
	or	
	No change in MAP from start to run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14+**	MAP voltage too low	MAP sensor input below minimum acceptable voltage.
	or	
	MAP voltage too High	MAP sensor input above maximum acceptable voltage.
15**	No vehicle speed signal	No vehicle speed sensor signal detected during road load conditions.
17	Engine is cold too long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O_2 signal stays at center	Neither rich or lean condition detected from the oxygen sensor input.
	or	
	O_2 signal shorted to voltage	Oxygen sensor input voltage maintained above the normal operating range.
22+**	Coolant sensor voltage too high	Coolant temperature sensor input above the maximum acceptable voltage.
	or	
	Coolant sensor voltage too low	Coolant temperature sensor input below the minimum acceptable voltage.
24+**	Throttle position sensor voltage high	Throttle position sensor input above the maximum acceptable voltage.
	or	
	Throttle position sensor voltage low	Throttle position sensor input below the minimum acceptable voltage.
25**	Idle air control motor circuits	An open or shorted condition detected in one or more of the idle air control motor circuits.
27	Injector control circuit	Injector output driver does not respond properly to the control signal.
31**	EVAP purge solenoid circuit	An open or shorted condition detected in the EVAP purge solenoid circuit.
32**	EGR solenoid circuit	An open or shorted condition detected in the EGR transducer solenoid circuit.
	or	
	EGR system failure	Required change in air/fuel ratio not detected during diagnostic test.
33	A/C clutch relay circuit	An open or shorted condition detected in the A/C clutch relay circuit.

\+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-255

DIAGNOSTIC TROUBLE CODE DESCRIPTION

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
34	Speed control solenoid circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
35	Radiator fan relay circuits	An open or shorted condition detected in the radiator fan circuit
37	Torque convertor unlock solenoid CKT	An open or shorted condition detected in the torque convertor part throttle unlock solenoid circuit (3 speed automatic transmission).
41+**	Generator field not switching properly	An open or shorted condition detected in the generator field control circuit.
42	Auto shutdown relay control circuit	An open or shorted condition detected in the auto shutdown relay circuit.
46+**	Charging system voltage too high	Battery voltage sense input above target charging voltage during engine operation.
47+**	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 alternator output.
51**	O_2 signal stays below center (lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**	O_2 signal stays above center (rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53	Internal controller	Engine controller internal fault condition detected.
62	EMR miles	Unsuccessful attempt to update EMR mileage in the PCM.
63	Controller Failure EEPROM write denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
55	N/A	Completion of fault code display on Check Engine lamp.

+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-256

SYSTEMS TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING A TEST WITH THE ENGINE OPERATING.

OBTAINING DIAGNOSTIC TROUBLE CODES

(1) Connect DRBII scan tool to the data link connector located in the engine compartment near the powertrain control module (PCM).

(2) Start the engine if possible, cycle the transaxle selector and the **A/C** switch if applicable. Shut off the engine.

(3) Turn the ignition switch on, access Read Fault Screen. Record all the fault messages shown on the DRBII scan tool. Observe the malfunction indicator lamp (check engine lamp on the instrument panel). The lamp should light for 3 seconds then go out (bulb check).

STATE DISPLAY TEST MODE

The switch inputs used by the powertrain control module (PCM) have only 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 change is displayed, it can be assumed that the entire switch circuit to the PCM is functional. From the state display screen access either State Display Inputs and Outputs or State Display Sensors.

STATE DISPLAY INPUTS AND OUTPUTS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Inputs and Outputs. The following is a list of the engine control system functions accessible through the Inputs and Outputs screen.

Park/Neutral Switch (automatic transaxle only)
Speed Control Resume
Brake Switch
Speed Control On/Off
Speed Control Set
A/C Switch Sense
S/C (Speed Control) Vent Solenoid
S/C (Speed Control) Vacuum Solenoid
Torque Converter Clutch Solenoid (3 speed automatic transaxle)
A/C Clutch Relay
EGR Solenoid
Auto Shutdown Relay
Radiator Fan Relay
Purge Solenoid
Malfunction Indicator (Check Engine) Lamp

STATE DISPLAY SENSORS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following is a list of the engine control system functions accessible through the Sensor Display screen.

Oxygen Sensor Signal
Coolant Temperature
Coolant Temp Sensor
Throttle Position
Minimum Throttle
Battery Voltage
MAP Sensor Reading
Idle Air Control Motor Position
Added Adaptive Fuel
Adaptive Fuel Factor
Barometric Pressure
Min Airflow Idl Spd
Engine Speed
Fault #1 Key-On Info
Module Spark Advance
Speed Control Target
Fault #2 Key-On Info
Fault #3 Key-On Info
Speed Control Status
Charging System Goal
Theft Alarm Status
Speed Control Switch Voltage
Map Sensor Voltage
Vehicle Speed
Oxygen Sensor State
MAP Gauge Reading
Throttle Opening (percentage)
Total Spark Advance

CIRCUIT ACTUATION TEST MODE

The circuit actuation test mode checks for proper operation of output circuits or devices which the powertrain control module (PCM) cannot internally recognize. The PCM can attempt 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, spray fuel, etc.). With the exception of an intermittent condition, if a device functions properly during its test, it can be assumed that the device, its associated wiring, and its driver circuit are in working order.

OBTAINING CIRCUIT ACTUATION TEST

Connect the DRBII scan tool to the vehicle and access the Actuators screen. The following is a list of the engine control system functions accessible through Actuators screens.

Stop All Tests
Ignition Coil #1
Fuel Injector #1
Idle Air Control Motor Open/Close

Radiator Fan Relay
A/C Clutch Relay
Auto Shutdown Relay
Purge Solenoid
S/C Servo Solenoids
Generator Field
Tachometer Output
Torque Converter Clutch Solenoid (3 speed automatic transaxle only)
EGR Solenoid
All Solenoids/Relays
ASD Fuel System Test
Speed Control Vacuum Solenoid
Speed Control Vent Solenoid

THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE

(1) Connect DRBII scan tool.

(2) Remove air cleaner assembly. Plug the heated air door vacuum hose.

(3) Warm engine in Park or Neutral until the cooling fan has cycled on and off at least once.

(4) Hook-up timing check device and tachometer.

(5) Disconnect the coolant temperature sensor and set basic timing to 12°BTDC ± 2°BTDC.

(6) Shut off engine. Reconnect coolant temperature sensor.

(7) Disconnect the PCV valve hose from the intake manifold nipple.

(8) Attach Air Metering Fitting #6457 (Fig. 4) to the intake manifold PCV nipple.

(9) Restart the engine, allow engine to idle for at least one minute.

(10) Using the DRBII scan tool, Access Min Airflow Idle Spd in the sensor read test mode.

(11) The following will then occur:

- Idle air control motor will fully close.
- Idle spark advance will become fixed.
- Idle fuel will be provided at a set value.
- Engine RPM will be displayed on DRBII scan tool.

(12) Check idle RPM with tachometer. If idle RPM is within the specifications listed below, then the throttle body minimum air flow is set correctly.

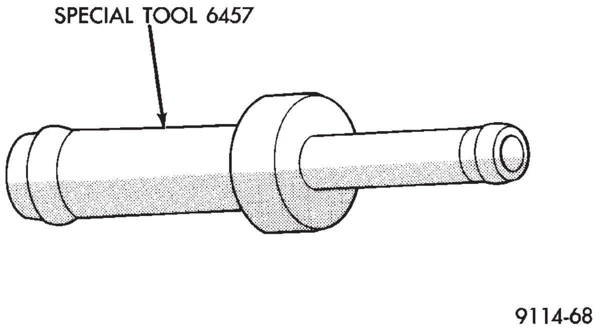


Fig. 4 Air Metering Fitting

IDLE SPECIFICATIONS

ODOMETER READING	IDLE RPM
Below 1000 Miles	600 - 1200 RPM
Above 1000 Miles	800 - 1200 RPM

9314-272X

If idle RPM is not within specification replace throttle body.

(13) Shut off engine.

(14) Remove Special Tool number 6457 from intake manifold PCV nipple. Reinstall the PCV valve hose.

(15) Remove DRBII scan tool.

(16) Reinstall air cleaner assembly. Reinstall heated air door vacuum hose.

(17) Disconnect timing check device and tachometer.

IGNITION TIMING PROCEDURE

Refer to Group 8D Ignition System

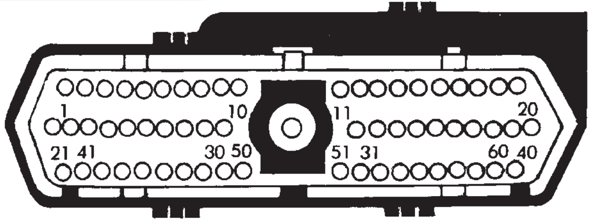
60-WAY PCM WIRING CONNECTOR

Refer to the powertrain control module (PCM) wiring connector descriptions for information regarding wire colors and cavity numbers (Fig. 5).

CAV	WIRE COLOR	DESCRIPTION	CAV	WIRE COLOR	DESCRIPTION
1	DG/RD*	MAP SENSOR SIGNAL	37		
2	TN/BK*	COOLANT SENSOR	38		
3	RD/WT*	DIRECT BATTERY VOLTAGE	39	GY/RD*	IDLE AIR CONTROL MOTOR #3 DRIVER
4	BK/LB*	SENSOR RETURN	40	BR/WT*	IDLE AIR CONTROL MOTOR #1 DRIVER
5	BK/WT*	SIGNAL GROUND	41	BK/DG*	OXYGEN SENSOR SIGNAL
6	VT/WT*	5.0 VOLT OUTPUT (MAP AND TPS)	42		
7	OR	8.0 VOLT OUTPUT	43	GY/LB*	TACHOMETER SIGNAL OUTPUT
8	WT	B1 VOLTAGE SENSE (START SIGNAL)	44		
9	DB	A21 SUPPLY (IGNITION START/RUN)	45	LG	SCI RECEIVE
10			46	WT/BK*	CCD (-) BUS
11	BK/TN*	POWER GROUND	47	WT/OR*	DISTANCE SENSOR SIGNAL
12	BK/TN*	POWER GROUND	48		
13			49		
14			50		
15			51	DB/YL*	AUTO SHUTDOWN RELAY AND FUEL PUMP RELAY
16	WT/DB*	INJECTOR DRIVER	52	PK/BK*	PURGE SOLENOID
17			53	LG/RD*	SPEED CONTROL VENT SOLENOID
18			54	LG/WT*	TORQUE CONVERTER CLUTCH SOLENOID
19	BK/GY*	IGNITION COIL	55		
20	DG	GENERATOR FIELD CONTROL	56		
21			57	DG/OR*	A142 CIRCUIT VOLTAGE SENSE
22	OR/DB*	THROTTLE POSITION SENSOR	58'		
23	RD/LG*	SPEED CONTROL SENSE	59	VT/BK*	IDLE AIR CONTROL MOTOR #4 DRIVER
24	GY/BK*	IGNITION REFERENCE PICK-UP	60	YL/BK*	IDLE AIR CONTROL MOTOR #2 DRIVER
25	PK	SCI TRANSMIT			
26	VT/BR*	CCD (+) BUS			
27	BR	A/C SWITCH SENSE			
28					
29	WT/PK*	BRAKE SWITCH			
30	BR/LB*	PARK/NEUTRAL SWITCH (AUTO TRANS.)			
31	DB/PK*	RADIATOR FAN RELAY			
32	BK/PK*	MALFUNCTION INDICATOR LAMP (CHECK ENGINE)			
33	TN/RD*	SPEED CONTROL VACUUM SOLENOID			
34	DB/OR*	A/C CLUTCH RELAY			
35	GY/YL*	EGR SOLENOID			
36					

WIRE COLOR CODES					
		LB	LIGHT BLUE	VT	VIOLET
BK	BLACK	LG	LIGHT GREEN	WT	WHITE
BR	BROWN	OR	ORANGE	YL	YELLOW
DB	DARK BLUE	PK	PINK	*	WITH TRACER
DG	DARK GREEN	RD	RED		
GY	GRAY	TN	TAN		

CONNECTOR TERMINAL SIDE SHOWN



9314-258

Fig. 5 PCM Wiring Connector Cavity Description

2.2L/2.5L SINGLE POINT FUEL INJECTION—SERVICE PROCEDURES

INDEX

FUEL LINES AND HOSES

Perform the Fuel System Pressure Relief Procedure before servicing the fuel system. The procedure must be done to bleed fuel pressure from the system before removing clamps or hoses.

Use care when removing fuel hoses to prevent damage to hose or hose nipple. Always use new hose clamps, of the correct type, during reassembly. Tighten hose clamps to 1 N●m (10 in. lbs.) torque. **Do not use aviation style clamps on this system or hose damage may result.**

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

CAUTION: Before servicing the fuel pump, fuel lines, fuel filter, throttle body, or fuel injector, release fuel system pressure.

(1) Loosen fuel filler cap to release fuel tank pressure.

(2) Disconnect injector wiring harness connector at edge of throttle body (Fig. 1).

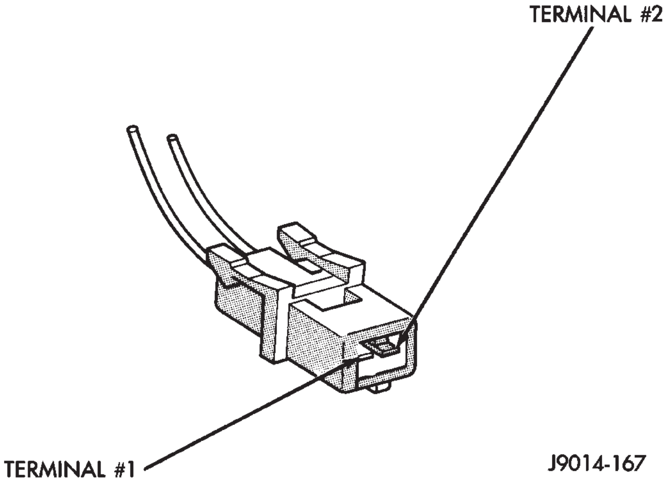


Fig. 1 Injector Harness Connector

(3) Connect a jumper wire between terminal Number 1 of the injector harness and engine ground.

(4) Connect a jumper wire to the positive terminal Number 2 of the injector harness and touch the battery positive post **for no longer than 5 seconds**. This releases system pressure.

(5) Remove jumper wires.

(6) Continue fuel system service.

THROTTLE BODY

CAUTION: The fuel system is under a constant pressure of 270 kPa (39 psi). When servicing the fuel portion of the throttle body, release fuel pressure before disconnecting any tubes. Refer to the fuel pressure release procedure.

Always reassemble throttle body components with new O-rings and seals where applicable. Never use silicone lubricants on O-rings or seals, damage may result. Use care when removing fuel tubes to prevent damage to quick connect fittings or tube ends. Refer to Fuel Hoses, Clamps, and Quick Connect Fittings in the Fuel Delivery Section of this Group.

REMOVAL

(1) Remove air cleaner (Fig. 2).

(2) Perform fuel system pressure release procedure.

(3) Disconnect negative battery cable.

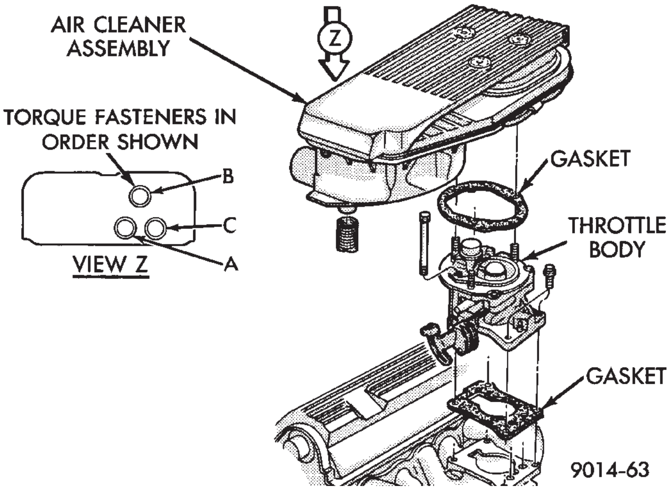


Fig. 2 Throttle Body and Air Cleaner Assembly

(4) Disconnect vacuum hoses and electrical connectors (Fig. 3).

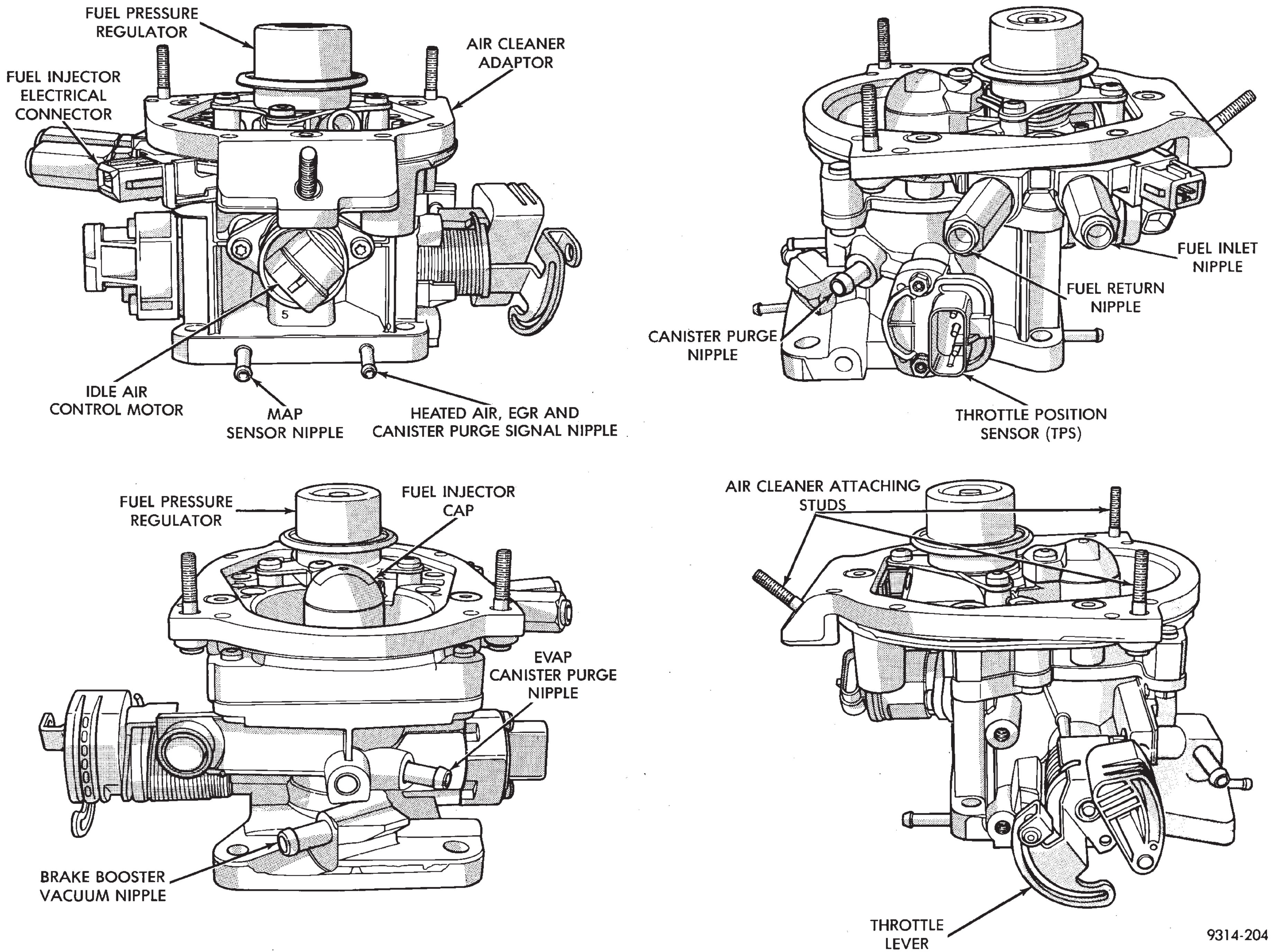


Fig. 3 Throttle Body

(5) Remove throttle cable. If equipped, remove the speed control and transaxle kickdown cables.

(6) Remove return spring.

(7) Loosen fuel tube clamp on valve cover (Fig. 4).

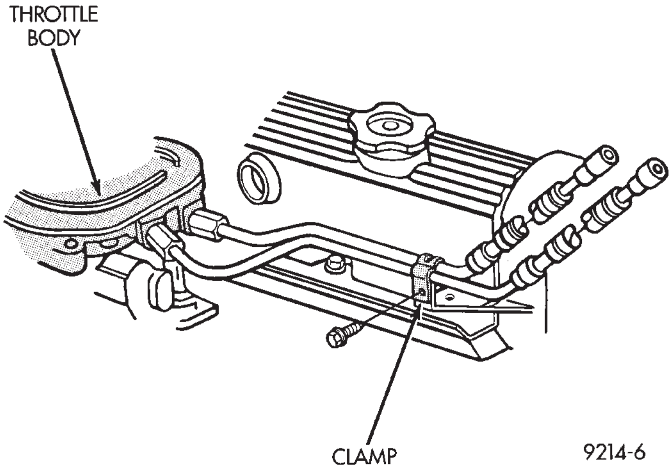


Fig. 4 Fuel Line Clamp

(8) Wipe quick connect fittings to remove any dirt. Remove fuel intake and return tubes. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group.** Place a shop towel under the connections to absorb any fuel spilled.

(9) Remove throttle body mounting screws and lift throttle body from vehicle. Remove throttle body gasket from intake manifold.

INSTALLATION

(1) Using a new gasket, install throttle body and tighten mounting screws to 20 N●m (175 in. lbs.) torque.

(2) Lubricate the ends of the fuel supply and return tubes with clean 30 weight oil. Connect fuel lines to quick connect fittings. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group**. After the fuel tubes are connected to the fittings, pull on the tubes to ensure that they are fully inserted and locked into position.

(3) Tighten the fuel tube clamp on the valve cover.

(4) Install return spring.

(5) Install throttle cable. If equipped, install kickdown and speed control cables.

(6) Install wiring connectors and vacuum hoses.

(7) Install air cleaner.

(8) Reconnect negative battery cable.

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.

(9) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL FITTING

REMOVAL

(1) Remove air cleaner assembly.

(2) Perform Fuel System Pressure Release procedure.

(3) Disconnect negative battery cable.

(4) Loosen fuel tube clamp on valve cover.

(5) Wipe any dirt from around quick connect fittings. (Fig. 5) Place a shop towel under the connections to catch any spilled fuel. Remove fuel tubes from quick connect fittings. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group**.

(6) Remove each fitting from throttle body and note inlet diameter. Remove copper washers.

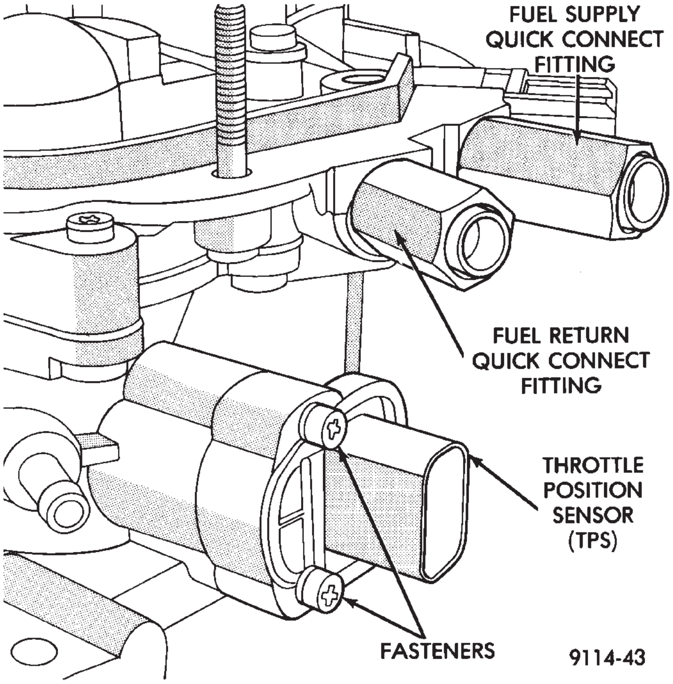


Fig. 5 Servicing Fuel Fitting

INSTALLATION

(1) Replace copper washers with new washers.

(2) Install fuel fittings in proper ports and tighten to 20 N●m (175 in. lbs.) torque.

(3) Lubricate ends of the fuel tubes with 30 weight oil. Insert the tubes into the quick connect fittings. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group**. After the fuel tubes are connected to the fittings, pull on the tubes to ensure that they are fully inserted and locked into position.

(4) Tighten fuel tube clamp on valve cover.

(5) Reconnect negative battery cable.

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.

(6) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

(7) Reinstall air cleaner assembly.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is mounted on top of the throttle body (Fig. 6).

REMOVAL

(1) Remove air cleaner assembly.

(2) Perform Fuel System Pressure Release procedure.

(3) Disconnect battery negative cable.

(4) Remove pressure regulator mounting screws (Fig. 6).

WARNING: PLACE A SHOP TOWEL AROUND FUEL INLET CHAMBER TO CONTAIN ANY FUEL REMAINING IN THE SYSTEM.

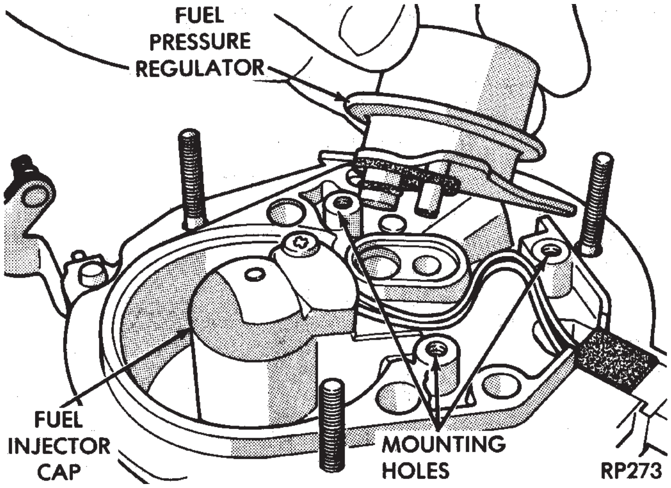


Fig. 6 Servicing Fuel Pressure Regulator

(5) Pull pressure regulator from the throttle body.

(6) Carefully remove O-ring from pressure regulator and remove gasket.

INSTALLATION

(1) Place new gasket on pressure regulator. Carefully install new O-ring.

(2) Position pressure regulator on throttle body. Press regulator into place and install mounting screws. Tighten screws to 5 N•m (40 in. lbs.) torque.

(3) Connect negative cable to battery.

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.

(4) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

(5) Reinstall air cleaner assembly.

FUEL INJECTOR

The fuel injector is installed in the top of the throttle body. The injector is covered by a cap.

REMOVAL

(1) Remove air cleaner assembly.

(2) Perform Fuel System Pressure Release procedure.

(3) Disconnect negative cable from battery.

(4) Remove injector cap holddown screw (Torx-head).

(5) With two small screwdrivers, lift the top off the injector using the slots provided (Fig. 7).

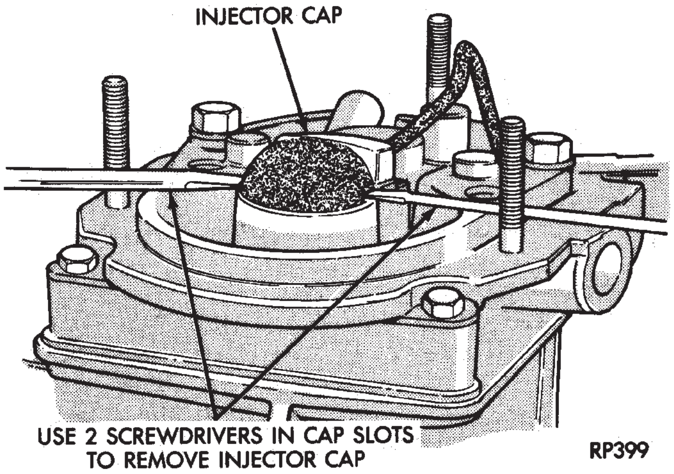


Fig. 7 Removing Injector Cap

(6) Using a small screwdriver placed in the hole in the front of the electrical connector, gently pry the injector from the pod (Fig. 8).

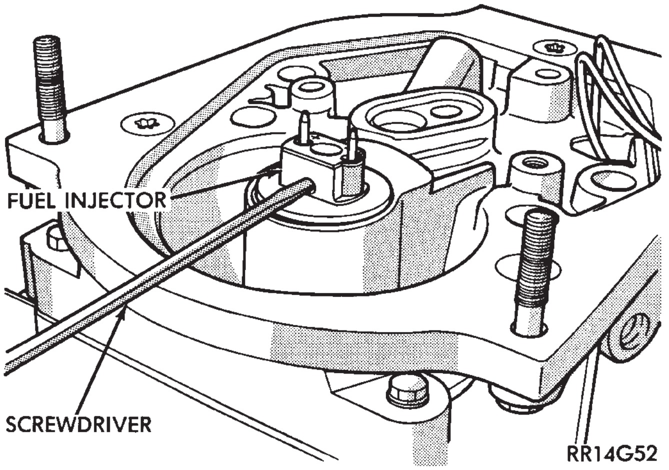


Fig. 8 Removing Fuel Injector

(7) Ensure the injector lower O-ring has been removed from the pod (Fig. 9).

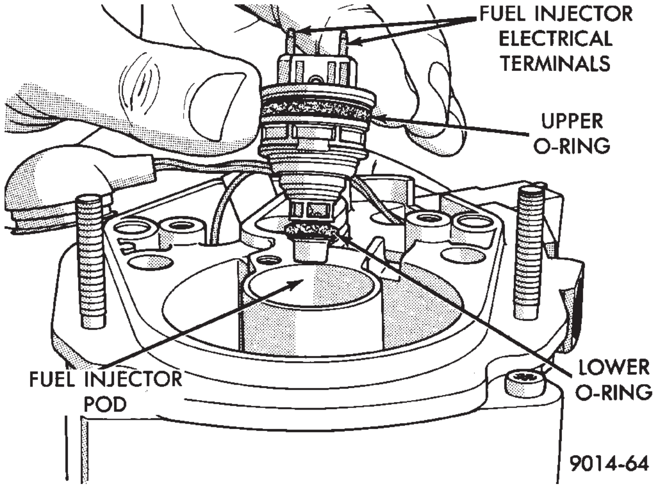


Fig. 9 Servicing Fuel Injector

INSTALLATION

(1) Apply a light coating of clean engine oil on the O-rings.

(2) Place assembly in the pod. Align the injector wiring terminals with the injector cap fastener hole (Fig. 10).

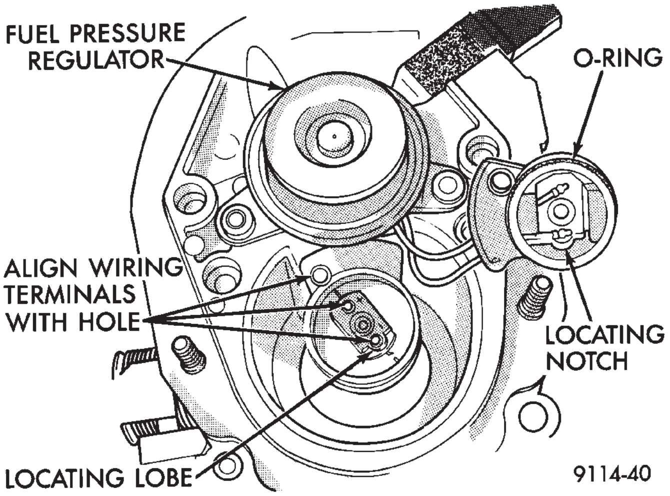


Fig. 10 Fuel Injector Installation

(3) Install injector cap with locating notch aligned with the locating lobe on the injector (Fig. 11).

(4) Push down on the cap to ensure a good seal.

(5) Rotate the cap and injector to line up the attachment hole (Fig. 12).

(6) Install injector cap holddown screw (torx-head screw). Tighten screw to 4-5 N•m (35-45 in. lbs.) torque.

(7) Connect negative cable to battery.

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.

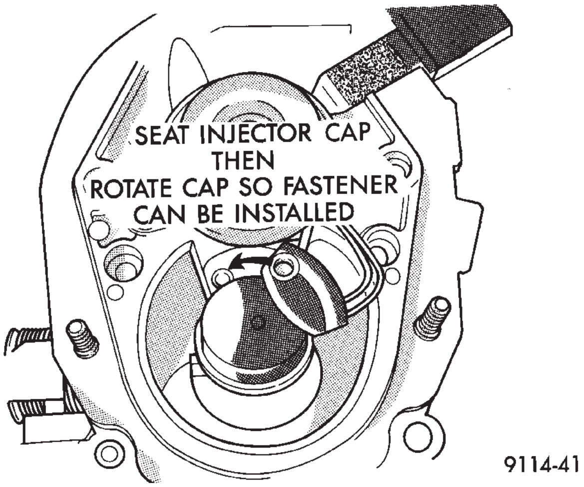


Fig. 11 Installing Fuel Injector Cap

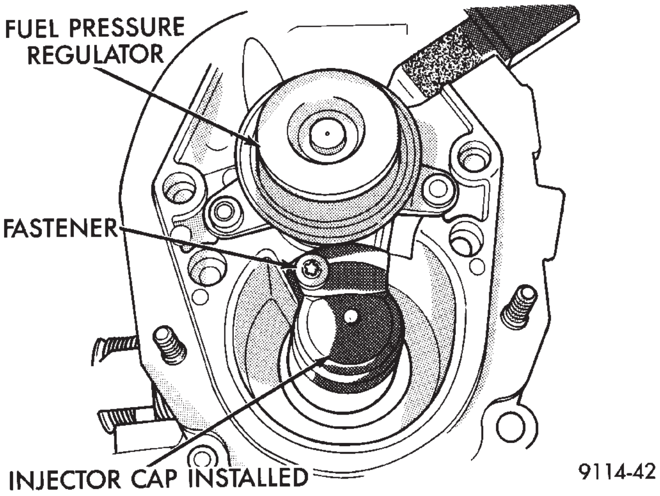


Fig. 12 Fuel Injector Installed

(8) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

(9) Reinstall the air cleaner assembly.

THROTTLE POSITION SENSOR

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove air cleaner.

(3) Disconnect harness connector from throttle position sensor (Fig. 13).

(4) Remove throttle position sensor mounting screws.

(5) Remove throttle position sensor from throttle shaft.

INSTALLATION

(1) Install throttle position sensor to throttle body, position toward the front of the vehicle. Tighten screws to 2 N•m (20 in. lbs.) torque.

(2) Connect 3 way connector at throttle position sensor.

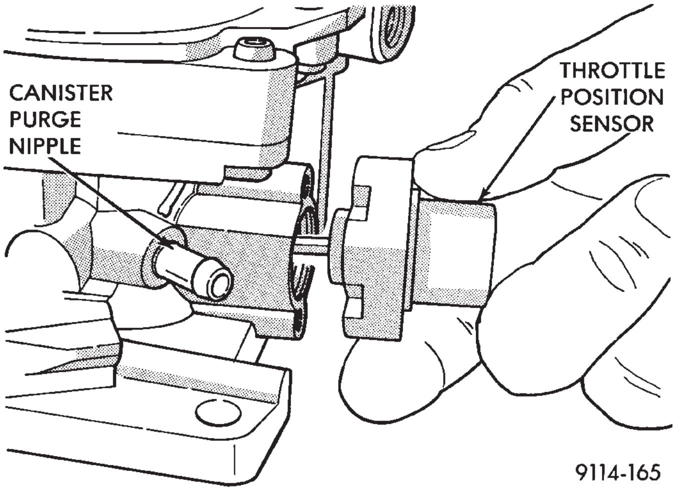


Fig. 13 Servicing Throttle Position Sensor

(3) Install air cleaner.

(4) Connect negative cable to battery.

IDLE AIR CONTROL MOTOR

The idle air control motor is mounted on the throttle body (Fig. 14).

REMOVAL

(1) Remove air cleaner.

(2) Disconnect negative cable from battery.

(3) Disconnect idle air control motor connector.

(4) Remove idle air control motor mounting screws (Torx head screws, 25 mm long).

(5) Remove idle air control motor from throttle body housing. Ensure O-ring was removed with idle air control motor (Fig. 14).

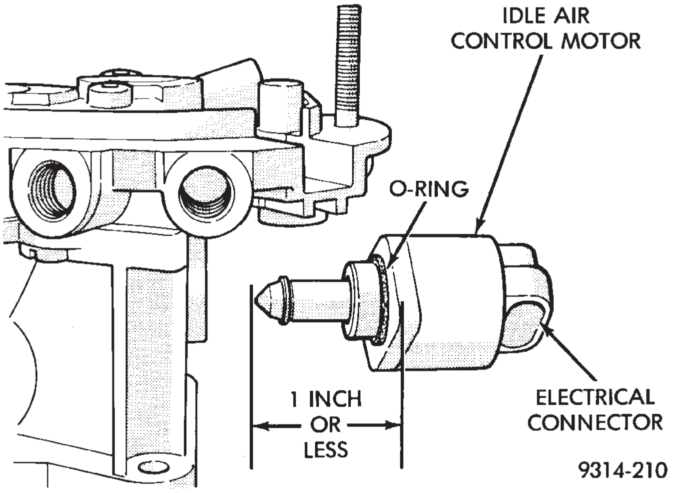


Fig. 14 Servicing Idle Air Control Motor

INSTALLATION

(1) Ensure the idle air control motor pintle is in the retracted position. **If pintle measures more than 1 inch (25 mm)** as shown in Fig. 14, it must be retracted. Use the DRBII scan tool Actuate Outputs Test, IDLE AIR CONTROL MOTOR OPEN/CLOSE (battery must be connected for this operation).

(2) Install new O-ring on idle air control motor.

(3) Install motor into housing, ensuring the O-ring is in place.

(4) Tighten mounting screws to 2 N●m (20 in. lbs.) torque.

(5) Connect harness electrical connector to motor.

(6) Connect negative cable to battery.

MANIFOLD ABSOLUTE PRESSURE SENSOR

The MAP sensor is mounted underhood on the dash panel (Fig. 15)

REMOVAL

(1) Remove vacuum hose and electrical connector from sensor (Fig. 15).

(2) Remove sensor mounting screws. Remove sensor.

(3) Reverse the above procedure for installation. Check the vacuum hose and electrical connections to the sensor.

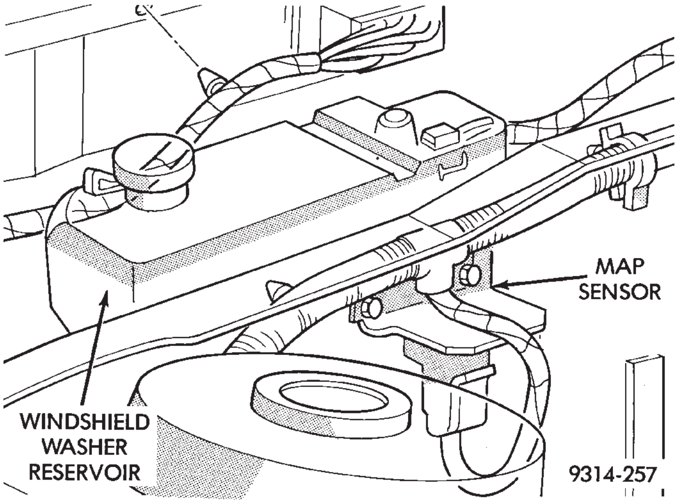


Fig. 15 Manifold Absolute Pressure (MAP) Sensor

CANISTER PURGE SOLENOID

(1) Remove vacuum hose and electrical connector from solenoid (Fig. 16).

(2) Depress tab on top of solenoid and slide the solenoid downward out of mounting bracket.

(3) Reverse the above procedure for installation.

ELECTRIC EXHAUST GAS RECIRCULATION TRANSDUCER (EET) SERVICE

REMOVAL

(1) Disconnect the electrical connector from the electronic EGR transducer solenoid (Fig. 17).

(2) Disconnect vacuum hoses.

INSTALLATION

(1) Connect vacuum hoses.

(2) Connect electrical connector.

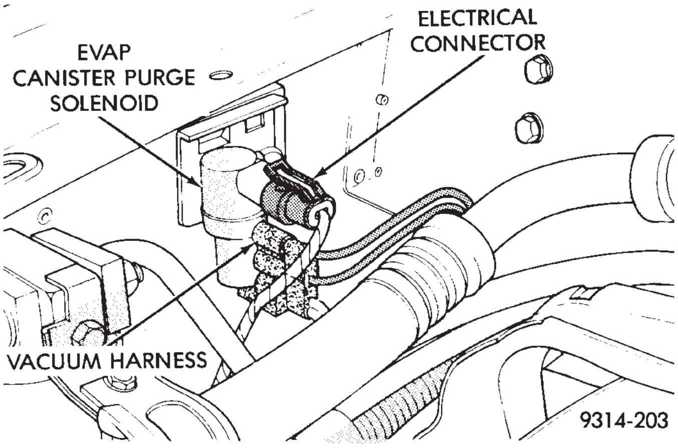


Fig. 16 Canister Purge Solenoid

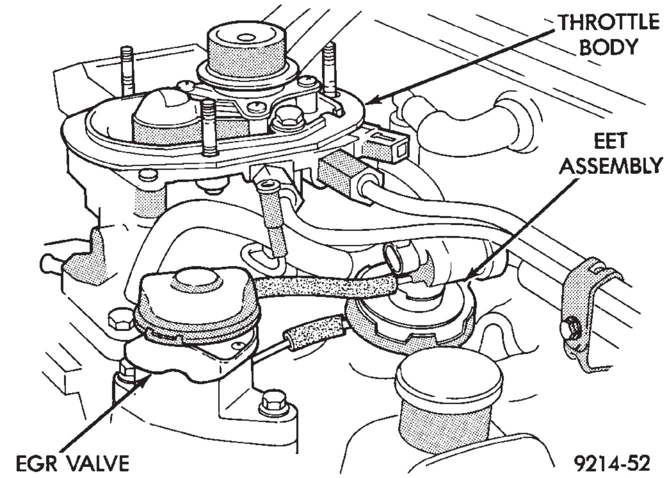


Fig. 17 Electric EGR Transducer

PCM SERVICE

(1) Remove air cleaner duct from PCM.

(2) Remove battery.

(3) Remove PCM mounting screws (Fig. 18).

(4) Remove wiring connector from the PCM. Remove the PCM.

(5) Reverse the above procedure for installation.

HEATED OXYGEN SENSOR (O_2 SENSOR)

The oxygen sensor is installed in the exhaust manifold (Fig. 19).

CAUTION: Do not pull on the oxygen sensor wire when disconnecting the electrical connector.

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

(1) Disconnect oxygen sensor electrical connector (Fig. 20).

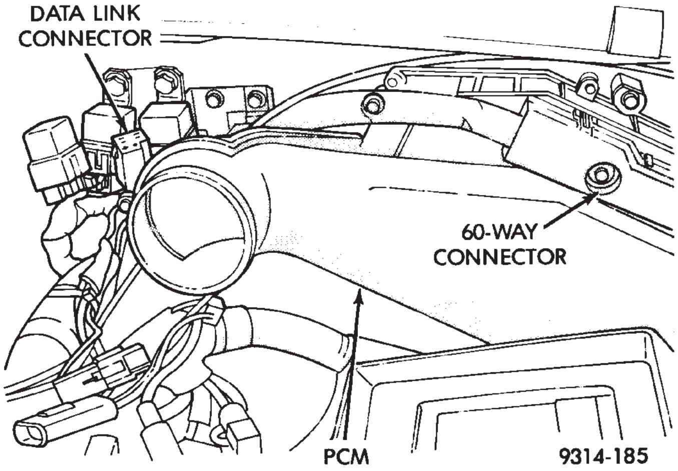


Fig. 18 PCM

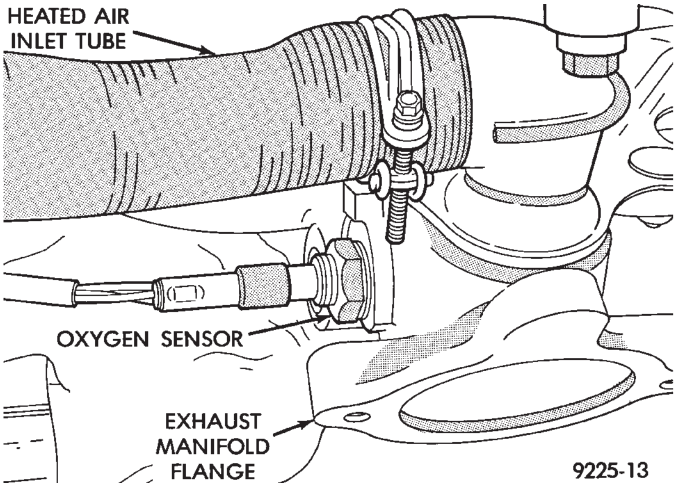


Fig. 19 Heated Oxygen Sensor

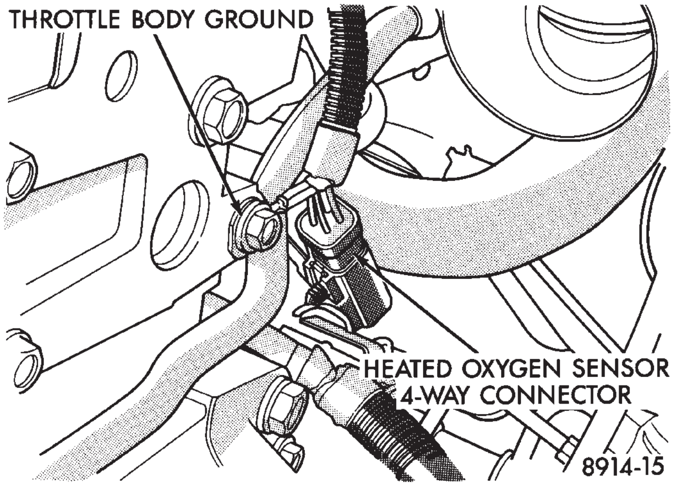


Fig. 20 Oxygen Sensor Electrical Connection

(2) Remove sensor using Tool C-4907 (Fig. 21). Slightly tightening the sensor can ease removal.

When the sensor is removed, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If the same sensor is to be reinstalled, the sensor threads must be coated with an anti-seize compound such as Loctite 771-64 or equivalent. New sensors are packaged with compound on the threads and do not require additional compound. The sensor must be tightened to 27 N•m (20 ft. lbs.) torque.

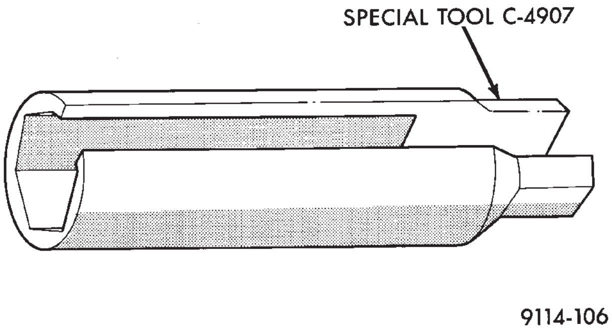


Fig. 21 Oxygen Sensor Socket

2.5L FLEXIBLE FUEL MULTI-PORT FUEL INJECTION—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

In this model year Chrysler began producing AA-Body vehicles designed to operate on a mixture of gasoline and methanol. These automobiles are referred to as Flexible Fuel vehicles. Fuel system components designed for use in flexible fuel vehicles are referred to as Methanol Compatible.

Flexible fuel vehicles can operate on a mixture of up to 85 percent methanol, 15 percent unleaded gasoline. These vehicles also operate on mixtures containing a lower percentage of methanol or just pure unleaded gasoline.

IDENTIFYING FLEXIBLE FUEL COMPONENTS

Flexible Fuel vehicles have unique methanol compatible fuel system components. Chrysler identifies methanol compatible components that could be physically interchanged with gasoline only parts by coloring them green or applying a green label or tag to them. Even though they may appear physically identical, components for gasoline only AA-body vehicles must not be used on flexible fuel vehicles.

FLEXIBLE FUEL COMPONENTS

The fuel system of flexible fuel AA-body vehicles have the following unique methanol compatible components.

- Duty Cycle EVAP Purge Solenoid
- Fuel pump module
- Fuel level sensor
- Fuel gauge (gauge cluster).
- Fuel tank
- Fuel pressure regulator (including O-rings)
- Fuel rail
- Fuel injectors (including O-rings)
- Fuel tubes
- Fuel filter
- EVAP canister
- Fuel filler cap
- Fuel filler tube

- Methanol Concentration Sensor
- Pressure relief/Rollover valve
- PCV Valve
- All fuel system and emission system hoses and tubes

SYSTEM OPERATION

The flexible fuel vehicle's 2.5L engine use a sequential multi-port electronic fuel injection system (Fig. 1). The powertrain control module (PCM) operates the electronic fuel injection system. The PCM provides precise air/fuel ratios and ignition timing for all driving conditions.

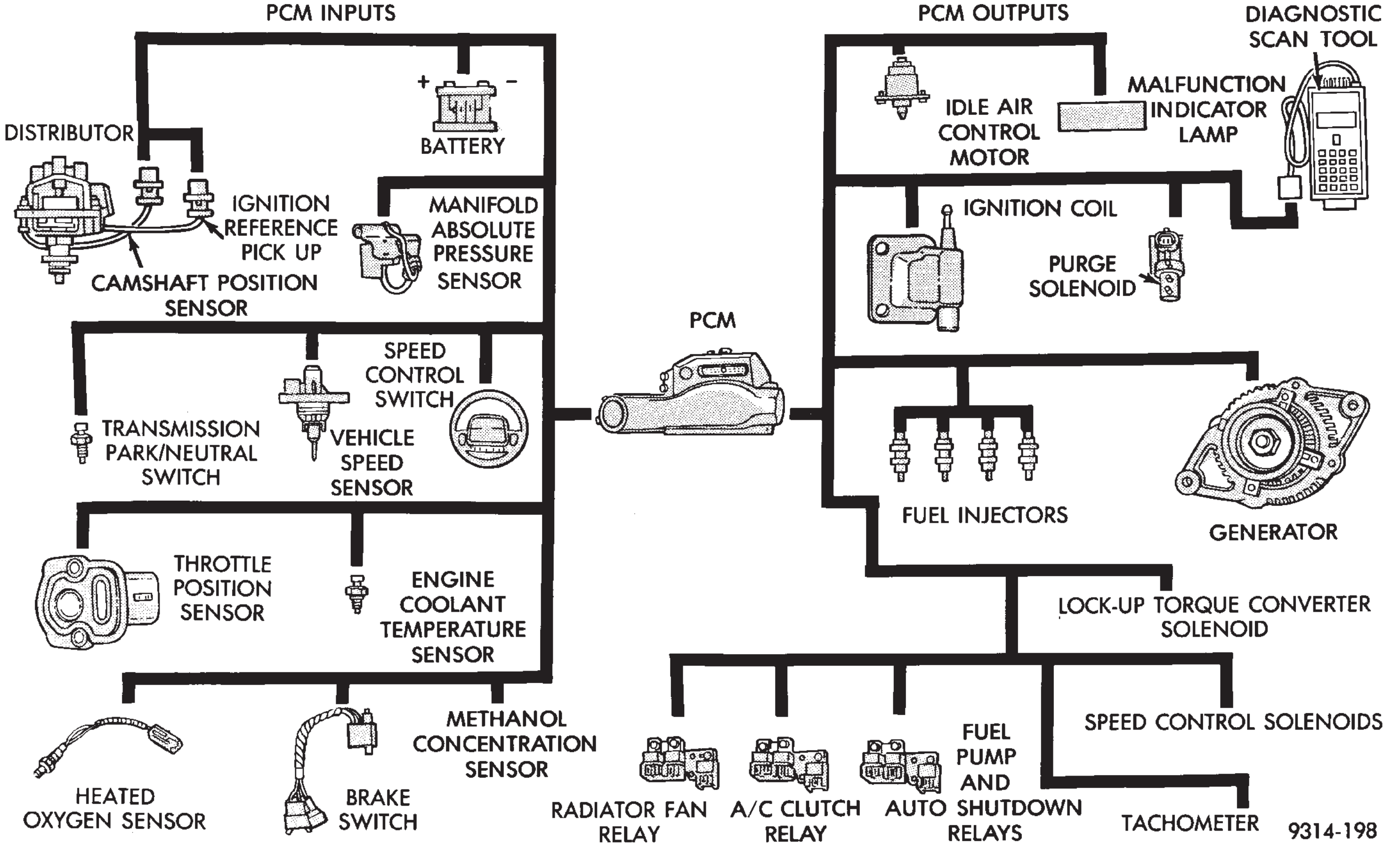


Fig. 1 Flexible Fuel MPI Components

The PCM regulates the air-fuel ratio, ignition coil dwell and idle speed. The PCM also operates the high speed and low speed cooling fans, charging system, speed control system and various emission control devices.

Various sensors and switches provide inputs to the PCM. The PCM converts all inputs into signals and regulates various systems based on the inputs. The PCM adjusts the systems it controls 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 operates the injectors in a specific sequence. The PCM adjusts the air/fuel ratio based on the percentage of methanol in the fuel. The PCM constantly adjusts injector pulse width to obtain the ideal air fuel ratio for the current percentage of methanol in the fuel. Injector pulse width refers to the amount of time an injector operates.

The PCM adjusts injector pulse width by opening and closing the ground path to the injectors. Engine RPM (speed), manifold absolute pressure (air density) and the percentage of methanol in the fuel are the primary inputs that determine injector pulse width.

SYSTEM DIAGNOSIS

The powertrain control module (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 in memory.

Technicians can display stored diagnostic trouble codes by two different methods. The first is to cycle the ignition switch On - Off - On - Off - On within 5 seconds. Then count the number of times the malfunction indicator lamp (check engine lamp) on the instrument panel flashes on and off. The number of flashes represents the trouble code. There is a slight pause between the flashes representing the first and second digits of the code. Longer pauses separate individual trouble codes.

The second method of reading diagnostic trouble codes uses the DRBII scan tool. For diagnostic trouble code information, refer to the On-Board Diagnostics section in this group.

CCD BUS

Various modules exchange information through a communications port called the CCD Bus. The powertrain control module transmits vehicle load data on the CCD Bus.

POWERTRAIN CONTROL MODULE

The powertrain control module (PCM) is a digital computer containing a microprocessor (Fig. 2). The PCM receives input signals from various switches and sensors referred to as Powertrain Control Module Inputs. Based on these inputs, the PCM adjusts various engine and vehicle operations through devices referred to as Powertrain Control Module Outputs.

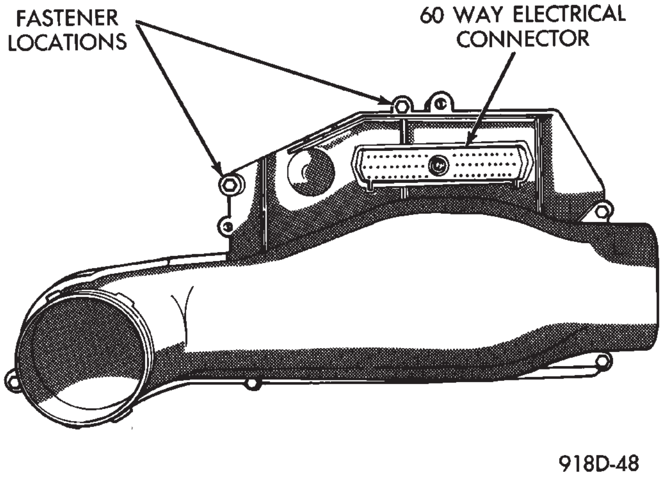


Fig. 2 Powertrain Control Module

PCM Inputs:
- Air Conditioning Controls
- Battery Voltage
- Brake Switch
- Engine Coolant Temperature Sensor
- Camshaft Position Sensor (Distributor Pick-up)
- Manifold Absolute Pressure (MAP) Sensor
- Methanol Concentration Sensor
- Oxygen Sensor
- SCI Receive
- Speed Control System Controls
- Throttle Position Sensor
- Park/Neutral Switch (automatic transaxle)
- Vehicle Speed Sensor

PCM Outputs:
- Air Conditioning Clutch Relay
- Generator Field
- Auto Shutdown (ASD) Relay
- Duty Cycle EVAP Canister Purge Solenoid
- Data Link (Diagnostic) Connector
- Fuel Injectors
- Idle Air Control Motor
- Ignition Coil
- Malfunction Indicator (Check Engine) Lamp
- Radiator Fan Relay
- Speed Control Solenoids
- Tachometer Output
- Torque Converter Clutch Solenoid

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 operation of the radiator fan, A/C and speed control systems. Also, 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
- Coolant temperature
- Exhaust gas content
- Engine speed
- Manifold absolute pressure
- Methanol percentage of fuel
- Throttle position

The PCM adjusts ignition timing based on the following inputs.
- Coolant temperature
- Engine speed
- Manifold absolute pressure
- Methanol percentage of fuel
- Throttle position

The auto shutdown (ASD) and fuel pump relays are mounted externally. The PCM turns both relays on and off through the same circuit.

The camshaft position sensor (distributor pick-up) sends a signal to the PCM. If the PCM does not receive a camshaft position sensor signal within approximately one second of engine cranking, it deactivates the ASD and fuel pump relays. When these relays deactivate, they shut off power to the fuel injectors, fuel pump, ignition coil, methanol concentration sensor and oxygen sensor heater element.

The PCM contains a voltage converter that changes battery voltage to a regulated 8.0 volts to power the distributor pick-up methanol concentration sensor and vehicle speed sensor. The PCM also provides a 5.0 volts supply for the engine coolant temperature sensor, manifold absolute pressure sensor and throttle position sensor.

AIR CONDITIONING SWITCH SENSE—PCM INPUT

When the operator puts the A/C or defrost switch in the ON position and the low pressure and high pressure switches close, the PCM receives an input. The input indicates the operator selected air conditioning. After receiving this input, the PCM activates the A/C compressor clutch by grounding the

A/C clutch relay. To compensate for increased engine load, the PCM also adjusts idle speed to a scheduled RPM.

BATTERY VOLTAGE—PCM INPUT

The powertrain control module (PCM) monitors the battery voltage input to determine fuel injector pulse width and generator field control. If battery voltage is low, the PCM increases injector pulse width to compensate.

BRAKE SWITCH—PCM INPUT

When the brake switch activates, the powertrain control module (PCM) receives an input indicating that the brakes are being applied. After receiving the input, the PCM vents the speed control servo. Venting the servo turns the speed control system off.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The coolant temperature sensor is installed behind the thermostat housing and ignition coil in the thermostat housing (hot box). The PCM supplies 5 volts to the coolant temperature sensor. The sensor provides an input voltage to the PCM (Fig. 3). As coolant temperature varies, the coolant temperature sensor resistance changes resulting in a different input voltage to the PCM.

The PCM demands slightly richer air-fuel mixtures and higher idle speeds until the engine reaches normal operating temperature.

This sensor is also used for cooling fan control.

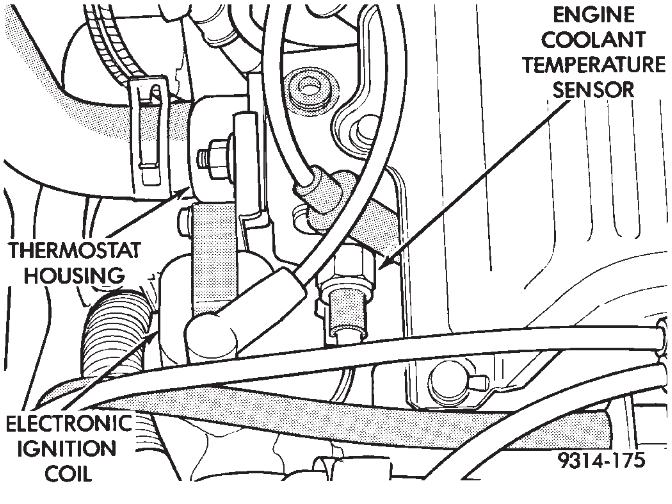


Fig. 3 Coolant Temperature Sensor

CAMSHAFT POSITION SENSOR—PCM INPUT

The camshaft position sensor (distributor pick-up) supplies engine speed and the injector sync signal to the powertrain control module (PCM). The sensor is a Hall Effect device (Fig. 4).

A shutter (sometimes referred to as an interrupter) is attached to the distributor shaft. The shutter contains four blades, one per engine cylinder. A switch plate is mounted to the distributor housing above the shutter. The switch plate contains the camshaft position sensor (distributor pick-up) through which the shutter blades rotate. As the shutter blades pass through the pick-up, they interrupt the magnetic field. The Hall effect device in the pick-up senses the change in the magnetic field and switches on and off (which creates pulses), generating the input signal to the PCM. The PCM calculates engine speed through the number of pulses generated.

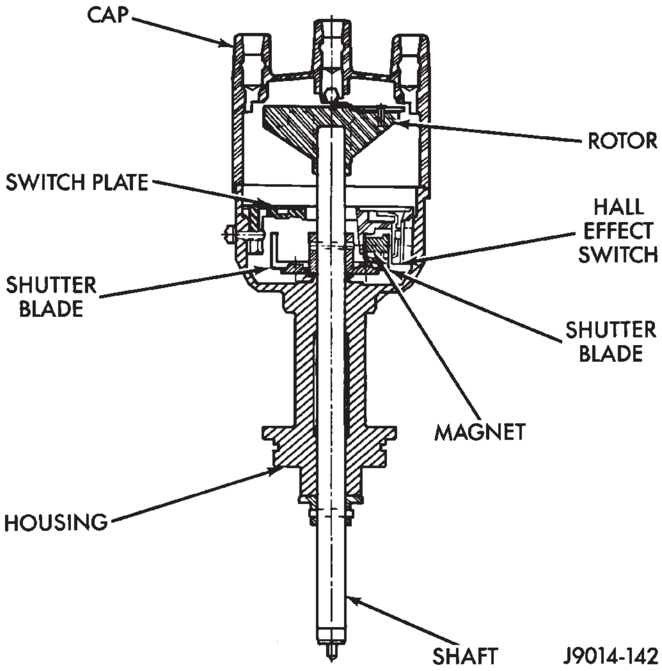


Fig. 4 Camshaft Position Sensor (Distributor Pick-Up)

One of the shutter blades has a window cut into it. The window tells the PCM which injector to energize.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

The powertrain control module (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. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

The MAP sensor mounts on the dash panel inside the engine compartment (Fig. 5). A vacuum hose connects the sensor to the throttle body.

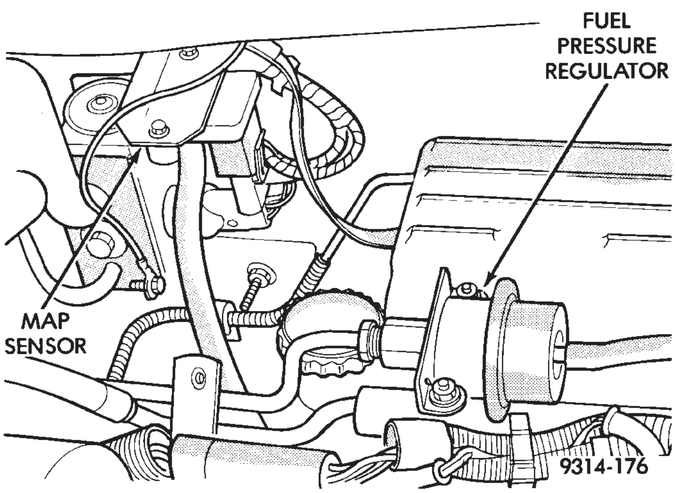


Fig. 5 Manifold Absolute Pressure (MAP) Sensor

METHANOL CONCENTRATION SENSOR—PCM INPUT

The methanol concentration sensor contains a microprocessor that determines the percentage of gasoline and methanol in the fuel system. From the methanol concentration sensor input, the powertrain control module (PCM) determines the amount of methanol in the fuel. The vehicle can operate on a mixtures up to 85 percent methanol, 15 percent gasoline.

The PCM supplies 8 volts to the methanol concentration sensor. The methanol concentration sensor output voltages varies with the percent of methanol in the fuel system. The sensor output voltage (input for PCM) ranges from 0.5 volts for pure gasoline to 4.50 volts for 85 percent methanol. For two seconds at key ON when the operator starts the vehicle, the sensor calibrates the PCM. During the calibration period the sensor sends 4.45 volts to the PCM as a correction factor.

The methanol concentration sensor has a built-in shutdown capability. If the sensor shuts down, the PCM defaults to the previous learned value (output voltage based on methanol percentage of fuel).

The methanol concentration sensor attaches to a bracket at the rear of the fuel tank, next to the fuel filler tube (Fig. 6).

HEATED OXYGEN SENSOR (O_2 SENSOR)—PCM INPUT

The heated oxygen sensor is located in the exhaust manifold. The sensor provides an input voltage to the PCM (Fig. 7). The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

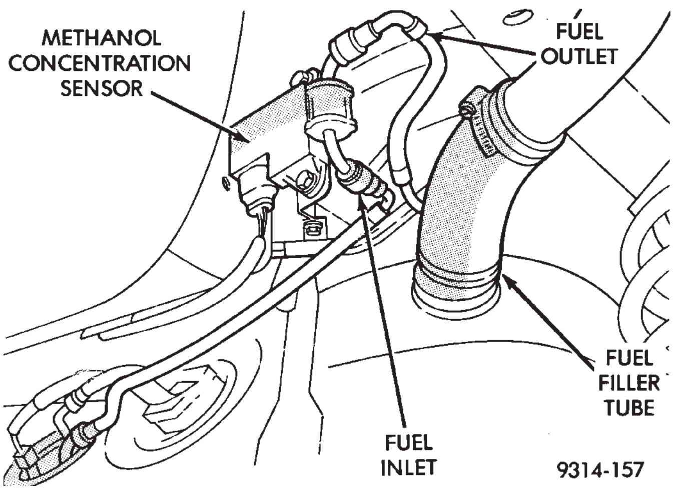


Fig. 6 Methanol Concentration Sensor

Flexible fuel vehicles operate on mixtures of fuel that contain up to 85 percent methanol and 15 percent unleaded gasoline. Different percentages of methanol in the fuel require different air/fuel ratios. The methanol concentration sensor inputs tells the PCM what percentage of methanol is in the fuel. The PCM calculates the ideal air/fuel ratio from the methanol concentration sensor input. The heated oxygen sensor input tells the PCM if it has reached the desired air/fuel ratio.

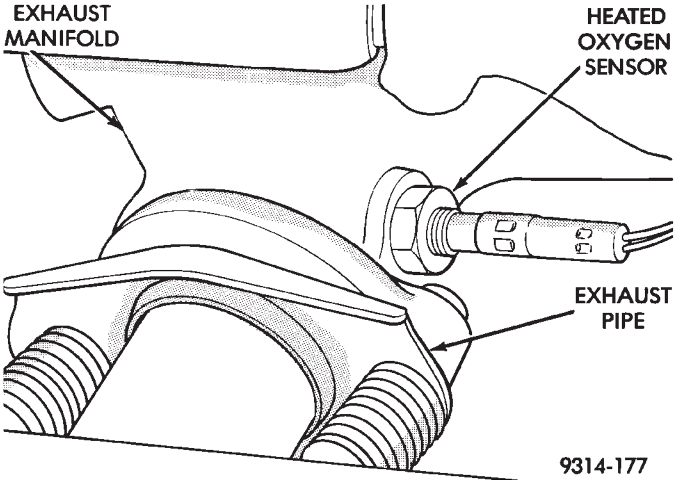


Fig. 7 Heated Oxygen Sensor

The O_2 sensor produces 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 sensor 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 sensor acts as a rich-lean switch.

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors the O_2 sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O_2 sensor input. In Open Loop, the PCM adjusts injector pulse width based on a preprogrammed (fixed) oxygen sensor input value and other inputs.

SPEED CONTROL—PCM INPUT

The speed control system provides four separate voltages (inputs) to the PCM. The voltages correspond to the On/Off, Set, and Resume.

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 a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for further speed control information.

TRANSAXLE PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the automatic transaxle housing (Fig. 8). Manual transaxles do not use park/neutral switches. The switch provides an input to the PCM. The input indicates if the automatic transaxle is in Park, Neutral, or a drive gear selection. The input is used to determine idle speed (varying with gear selection), fuel injector pulse width, and ignition timing advance. The park neutral switch is sometimes referred to as the neutral safety switch.

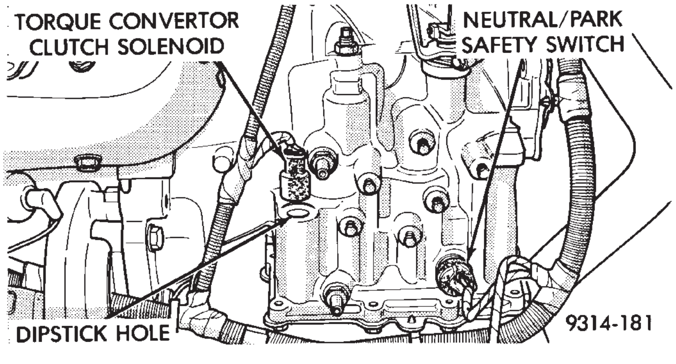


Fig. 8 Park Neutral Switch

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The Throttle Position Sensor (TPS) is mounted on the throttle body and connected to the throttle blade shaft (Fig. 9). The TPS is a variable resistor. The sensor 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.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS varying in an approximate range of from 1 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. The PCM adjusts fuel injector pulse width and ignition timing based on these inputs.

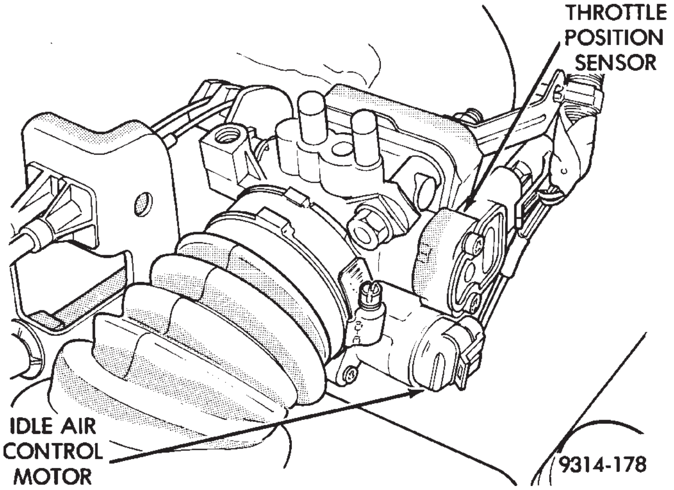


Fig. 9 Throttle Position Sensor (TPS) and Idle Air Control Motor

VEHICLE SPEED SENSOR—PCM INPUT

The vehicle speed sensor (Fig. 10) is located in the transaxle extension housing. The sensor input is used by the PCM to determine vehicle speed and distance traveled.

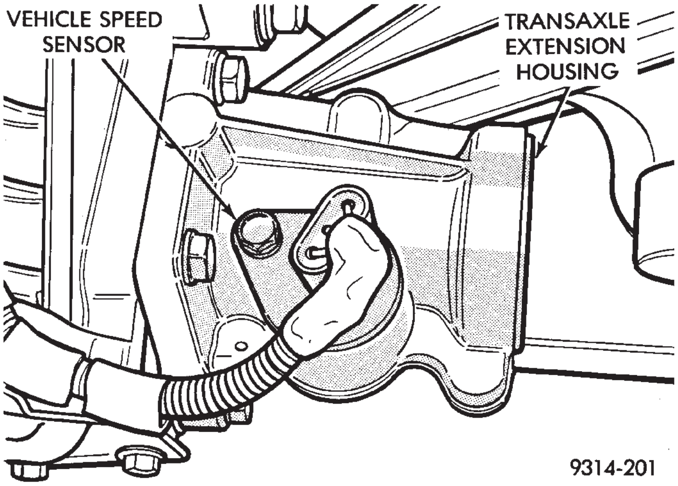


Fig. 10 Vehicle Speed Sensor

The vehicle speed sensor generates 8 pulses per sensor revolution. These 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.

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit. The radiator fan relay supplies battery power to the solenoid side of the A/C clutch relay. The air conditioning clutch relay will not energize unless the radiator fan relay energizes. The PCM energizes the radiator fan relay when the air conditioning or defrost switch is put in the ON position and the low pressure and high pressure switches 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 A/C clutch relay is mounted to the inner fender panel, next to the drivers side strut tower (Fig. 11).

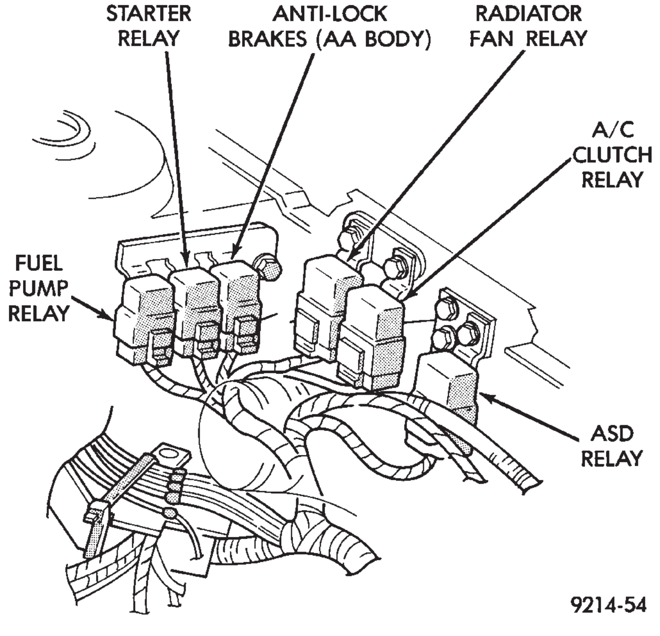


Fig. 11 Relay Identification

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY—PCM OUTPUT

The PCM operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the camshaft position sensor (distributor pick-up) signal to determine engine speed and ignition timing (coil dwell). If the PCM does not receive a camshaft position sensor signal when the ignition switch is in the Run position, it de-energizes both relays. Battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

The ASD relay and fuel pump relay are mounted on the drivers side fender well, next to the strut tower (Fig. 11).

DUTY CYCLE EVAP 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 powertrain control module 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 approximately 5 to 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 EVAP purge solenoid. The solenoid and bracket attach to the EVAP canis-

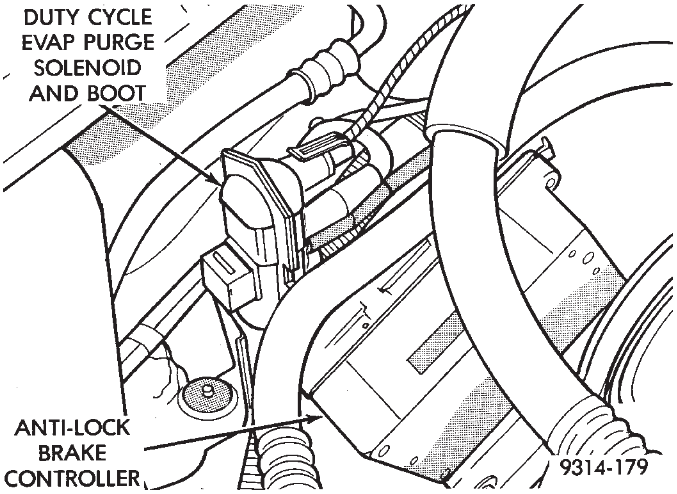


Fig. 12 EVAP Purge Solenoid

ter mounting studs (Fig. 12). The top of the solenoid has the word TOP on it. The solenoid will not operate unless it is installed correctly.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector provides the technician with the means to connect the DRBII scan tool to diagnosis the vehicle.

FUEL INJECTOR—PCM OUTPUT

The Fuel Injectors are electric solenoids driven by the PCM (Fig. 13). Based on sensor inputs, the PCM determines when and how long the fuel injector should operate. The amount of time an injector fires is referred to as injector pulse width. The auto shutdown (ASD) relay supplies battery voltage to the injector. The PCM supplies the ground path. By switching the ground path on and off, the PCM adjusts injector pulse width.

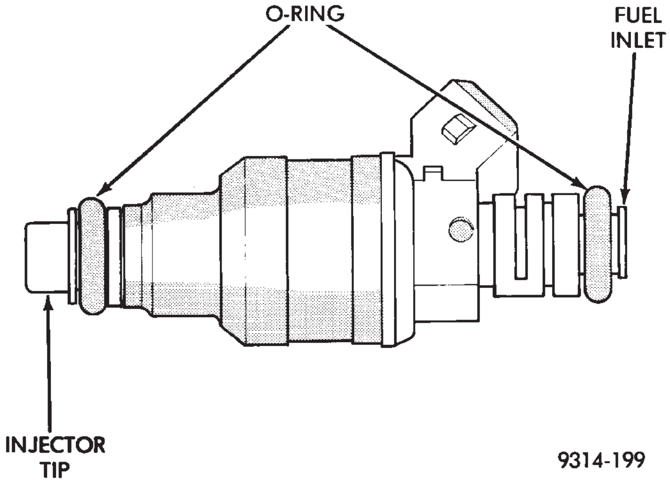


Fig. 13 Fuel Injector

When the PCM supplies a ground path, a spring loaded needle or armature lifts from its seat and fuel flows through the injector orifice.

Fuel is constantly supplied to the injector at regulated 380 Kpa (55 psi). Unused fuel returns to the fuel tank.

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 charging system information.

IDLE AIR CONTROL MOTOR—PCM OUTPUT

The idle speed stepper motor is mounted on the throttle body and is controlled by the PCM (Fig. 9). 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 from the throttle position sensor, speed sensor (distributor pick-up coil), coolant temperature sensor, and various switch operations (brake, park/neutral, air conditioning). Deceleration die out is also prevented by increasing airflow when the throttle is closed quickly.

IGNITION COIL—PCM OUTPUT

The PCM provides a ground contact (circuit) for energizing the ignition coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing the spark. The PCM will deenergize the ASD relay if it does not receive an input from the distributor pick-up. Refer to Auto Shutdown (ASD) Relay/Fuel Pump Relay—PCM Output in this section for relay operation.

The ignition coil is mounted on the hot box next to the thermostat housing (Fig. 14).

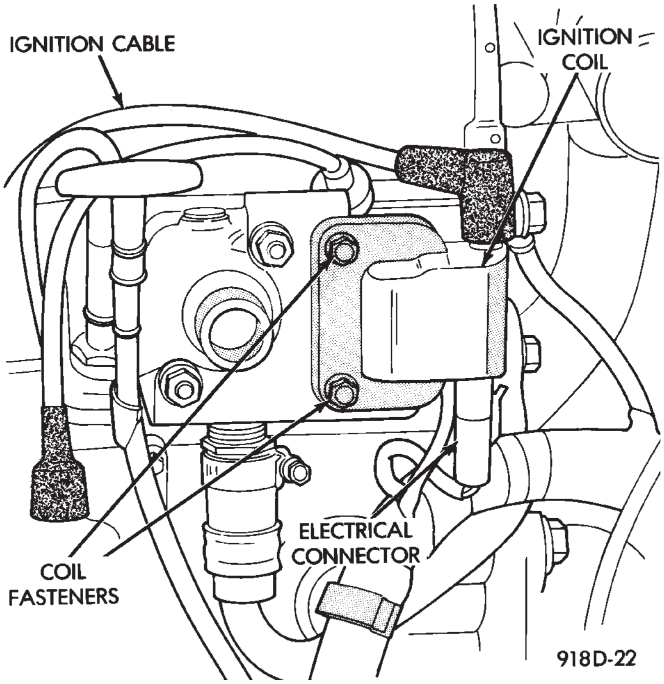


Fig. 14 Ignition Coil

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT

The malfunction indicator lamp (instrument panel 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 warns the operator that the PCM has entered a Limp-in mode. During Limp-in-Mode, the PCM attempts to keep the system operational. The malfunction indicator lamp 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 and by using stored default values.

Signals that can trigger the Malfunction Indicator (Check Engine) Lamp.

- An emission system component
- Battery Voltage Input
- Charging system
- Engine Coolant Temperature Sensor
- Manifold Absolute Pressure Sensor
- Methanol Concentration Sensor
- Throttle Position Sensor

The malfunction indicator lamp can also display diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within five seconds and the PCM displays any diagnostic trouble codes stored in memory. Refer to the 2.5L Flexible Fuel Multi-Port Fuel Injection—On Board Diagnostics section in this group for diagnostic trouble code descriptions.

RADIATOR FAN RELAY—PCM OUTPUT

The radiator fan is energized by the PCM through the radiator fan relay. The PCM grounds the radiator fan relay when engine coolant reaches a predetermined temperature. For more information, refer to Group 7, Cooling Systems.

The radiator fan relay is mounted on the drivers side fender well, next to the strut tower (Fig. 11).

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 blade. When the PCM supplies a ground only to the vent solenoid, the throttle blade holds position. When the PCM removes the ground from both the vacuum and vent solenoids, the throttle blade closes. The PCM balances 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. Refer to Group 8 for tachometer information.

TORQUE CONVERTER CLUTCH SOLENOID—PCM OUTPUT

Three-speed automatic transaxles use a torque converter clutch solenoid. The PCM controls the lock-up of the torque convertor through the solenoid. The transaxle is locked up only in direct drive mode. Refer to Group 21 for transaxle information.

MODES OF OPERATION

As input signals to the PCM change, the PCM adjusts its response to the 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 (O_2) sensor is not monitored during Open Loop modes.

During CLOSED LOOP modes, the PCM does monitor the oxygen (O_2) sensor input. The input indicates if the calculated injector pulse width results in the ideal air-fuel ratio for the current percentage of methanol in the fuel. By monitoring the exhaust oxygen content through the O_2 sensor, the PCM can fine tune the injector pulse width to achieve optimum fuel economy combined with low emissions.

The 2.5L flexible fuel 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. The acceleration, deceleration, and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes (under most operating conditions).

IGNITION SWITCH ON (ZERO RPM) MODE

When the ignition switch cycles and past the On position, the fuel injection system activates and the following actions occur:

- For two seconds at key ON (and during cranking), the methanol concentration sensor calibrates the PCM. During the calibration period the sensor sends 4.45 volts to the PCM as a correction factor. After the calibration period, the methanol concentration sensor output represents the methanol percentage in the fuel.
- The PCM calculates basic fuel strategy by determining atmospheric air pressure from the MAP sensor input.
- 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, the auto shutdown (ASD) relay and fuel pump relay are not energized. Therefore battery voltage is not supplied to the fuel pump, ignition coil, fuel injector 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.

The methanol concentration sensor finishes calibrating the PCM (takes approximately two seconds). After the calibration period, the PCM determines the methanol content of the fuel from the methanol concentration sensor input.

If the PCM receives a camshaft position sensor (distributor pick-up) signal it energizes the auto shutdown (ASD) relay and fuel pump relay. These relays supply battery voltage to the fuel injector, ignition coil and oxygen sensor heating element. If the PCM does not receive a camshaft position sensor signal, it de-energizes the ASD and fuel pump relays after approximately one second.

With the engine idling within ±64 RPM of the target RPM, the PCM compares the current MAP value with the atmospheric pressure value it received during the Ignition Switch On (Zero RPM) Mode. If a minimum difference between the two is not detected, a MAP sensor fault is set into memory.

Once the ASD relay and fuel pump relay have energized, the PCM:

- Supplies a ground path to each injector. The injectors are pulsed four times per engine revolution instead of the normal two pulses per revolution.
- Determines injector pulse width based on engine coolant temperature, methanol concentration sensor input, MAP sensor input, throttle position, and the number of engine revolutions since cranking was initiated.
- Monitors the coolant temperature sensor, camshaft position sensor, MAP sensor, methanol concentration 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
- Engine speed
- Manifold absolute pressure (MAP)
- Methanol percentage in fuel
- Throttle position
- A/C switch
- Battery voltage

The PCM determines the methanol content of the fuel from the methanol concentration sensor input.

The PCM provides a ground path for the injectors and energizes them in sequence. The PCM precisely controls injector pulse width by switching the ground on and off.

The PCM regulates engine idle speed by adjusting the idle air control motor. Also, the PCM adjusts ignition timing.

CRUISE OR IDLE MODE

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
- Methanol percentage in fuel
- Engine speed
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Battery voltage

The PCM determines the methanol content of the fuel from the methanol concentration sensor input.

The PCM provides a ground path for the injectors to precisely control injector pulse width. The PCM controls engine idle speed and ignition timing. The PCM controls 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
- Methanol percentage in fuel
- Engine speed
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Battery voltage

The PCM may receive a closed throttle input from the TPS at the same time it senses an abrupt decrease in manifold absolute pressure. This indicates a hard deceleration. In response, the PCM may modify the injector firing sequence. Modifying the injector firing sequence helps maintain better control of the air-fuel mixture (as sensed through the O_2 sensor).

WIDE OPEN THROTTLE MODE

This is an OPEN LOOP mode. During wide open throttle operation, the following inputs are received by the PCM:

- Engine coolant temperature
- Manifold absolute pressure
- Methanol percentage in fuel
- Engine speed
- Throttle position

When the PCM senses a wide open throttle condition, it de-energizes the air conditioning clutch relay. This disables the air conditioning system.

The exhaust gas oxygen content input is not accepted by the PCM during wide open throttle operation. The PCM will enrichen the air/fuel ratio to increase performance and compensate for increased combustion chamber temperature.

The PCM determines the methanol content of the fuel from the methanol concentration sensor input.

IGNITION SWITCH OFF MODE

This is an OPEN LOOP 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.

THROTTLE BODY

The throttle body houses the throttle position sensor (TPS) and the idle air control motor (Fig. 15). Air flow through the throttle body is controlled by a cable operated throttle blade at the base of the throttle body.

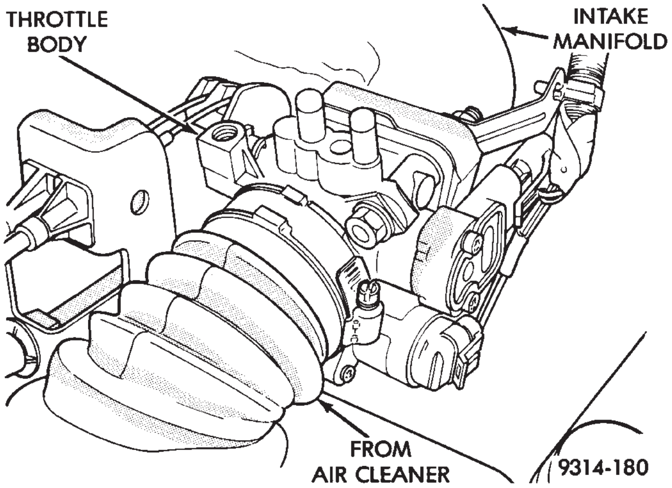


Fig. 15 Throttle Body

FUEL SUPPLY CIRCUIT

Fuel is pumped to the fuel rail by an electrical pump in the fuel tank. A filter, attached to the pump inlet, prevents water and other contaminants from entering the fuel supply circuit.

The vacuum assisted fuel pressure regulator keeps fuel pressure at 380 kPa (55 psi). The regulator uses intake manifold pressure at the vacuum tee as a reference.

FUEL INJECTORS AND FUEL RAIL ASSEMBLY

Four fuel injectors are retained in the fuel rail by lock rings (Fig. 16). The fuel injectors and rail bolt in position with the injectors inserted into recessed holes in the intake manifold.

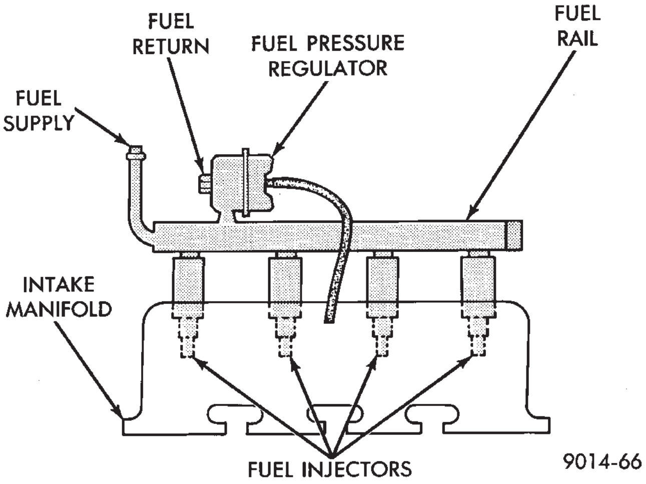


Fig. 16 Fuel Supply System

FUEL PRESSURE REGULATOR

The pressure regulator is located downstream of the fuel injector on the fuel rail (Fig. 17). The regulator maintains constant 380 kPa (55 PSI) fuel pressure across the fuel injector tip.

The regulator has a spring loaded rubber diaphragm that uncovers a fuel return port. When the fuel pump operates, fuel flows past the injector into the regulator. Fuel is restricted from flowing any further by the blocked return port. When fuel pressure reaches 380 kPa (55 PSI), it pushes on the diaphragm, compresses the spring, and uncovers the fuel return port. The diaphragm and spring continually move from an open to closed position keeping the fuel pressure consistent.

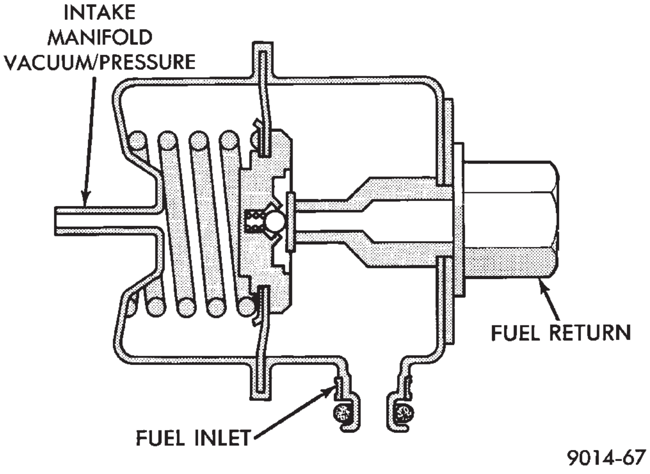


Fig. 17 Fuel Pressure Regulator

2.5L FLEXIBLE FUEL MULTI-PORT FUEL INJECTION—GENERAL DIAGNOSIS

INDEX

FUEL SYSTEM DIAGRAM

Refer to the Component Identification portion of this section for a more complete description of the components shown in Figure 1.

VISUAL INSPECTION

Perform a visual inspection for loose, disconnected, or misrouted wires and hoses before diagnosing or servicing the fuel injection system. A visual check helps save unnecessary test and diagnostic time. A thorough visual inspection includes the following checks:

(1) Check Ignition Coil Electrical Connections (Fig. 2).

(2) Verify the electrical connector is attached to the Canister Purge Solenoid (Fig. 3). Check the vacuum connections at the solenoid and canister.

(3) Verify the electrical connector is attached to the MAP sensor (Fig. 4). Inspect the MAP sensor vacuum hose for damage and leaks.

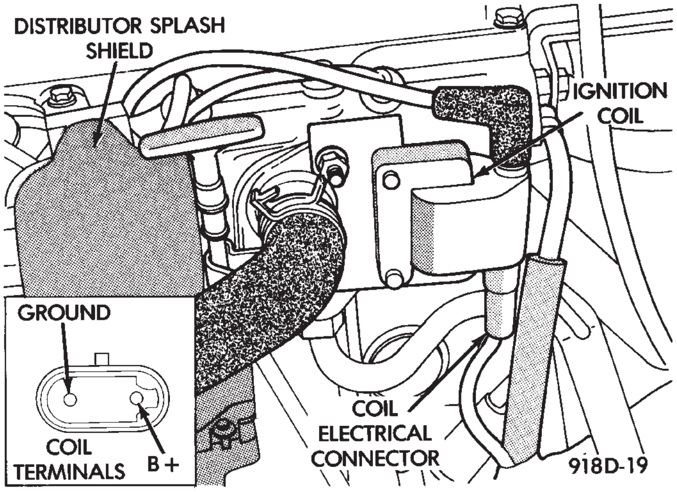


Fig. 2 Ignition Coil Electrical Connection

(4) Verify generator wiring and belt are correctly installed and tightened.

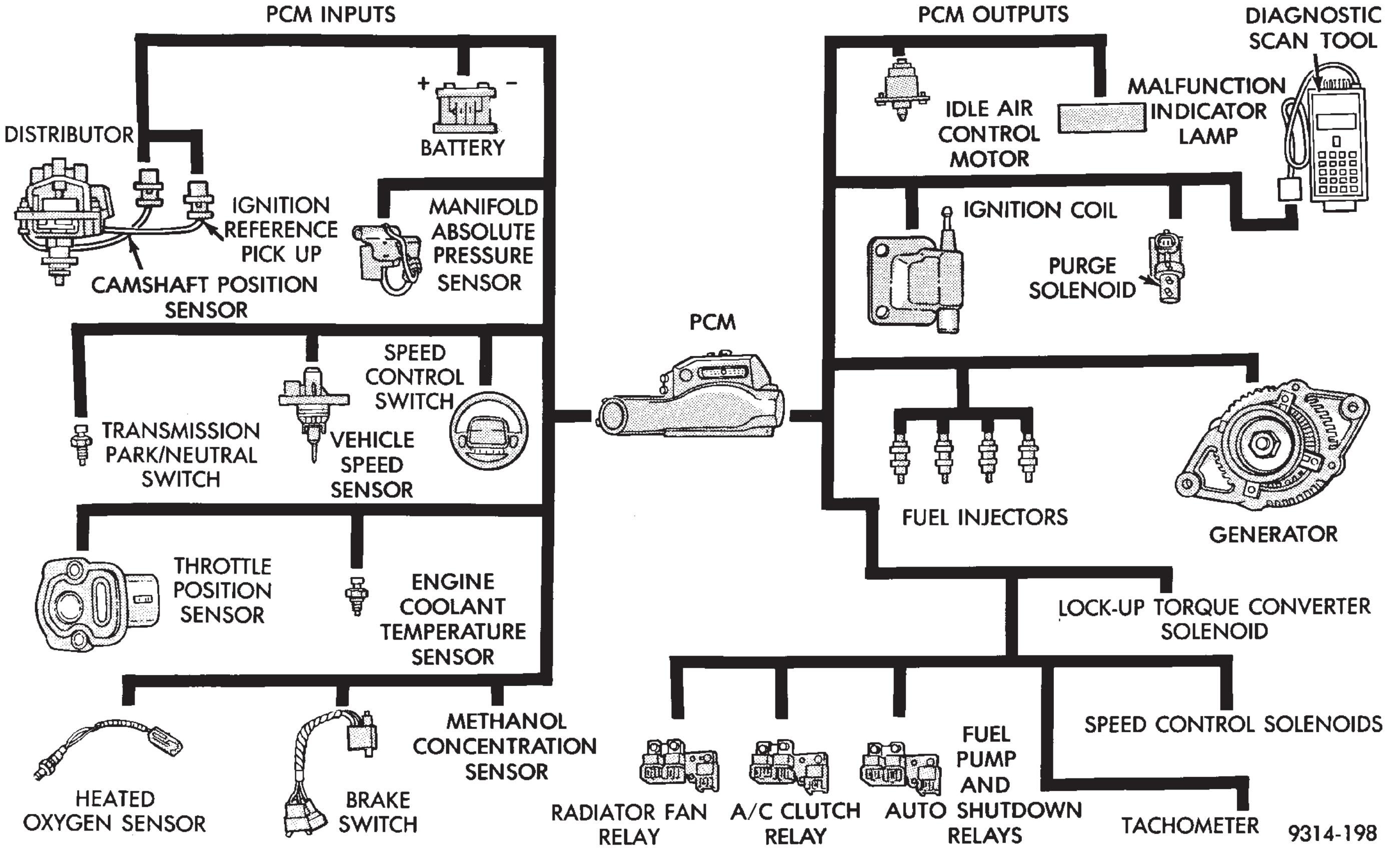


Fig. 1 Flexible Fuel MPI Components

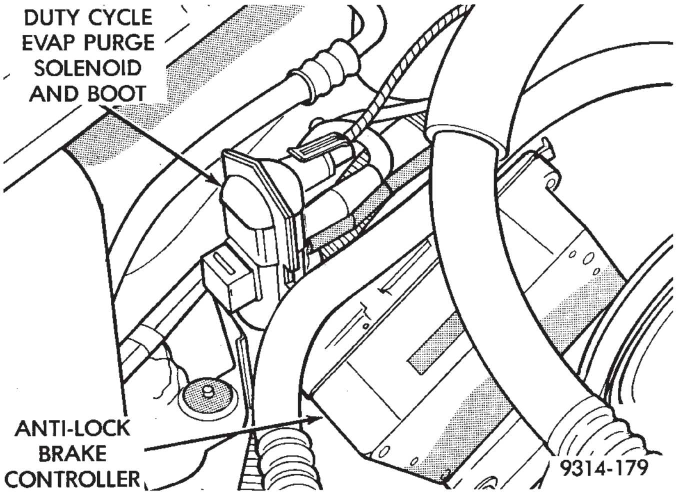


Fig. 3 EVAP Purge Solenoid

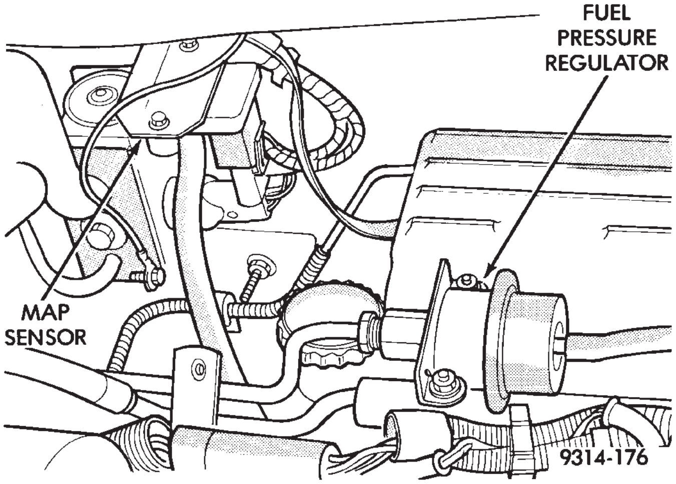


Fig. 4 MAP Sensor

(5) Check Ignition Cable Routing and Attachment (Fig. 5).

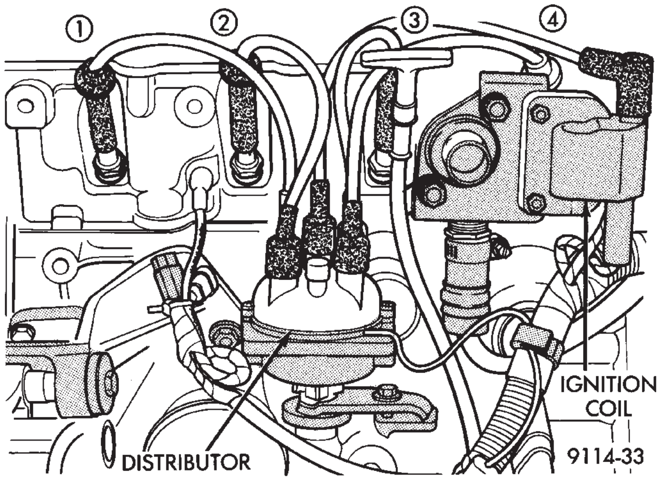


Fig. 5 Ignition Cable Mounting and Attachment

(6) Check both electrical connectors at the distributor.

(7) Check radiator fan electrical connector.

(8) Check the engine coolant temperature sensor electrical connection. Inspect battery ground cable connection (Fig. 6).

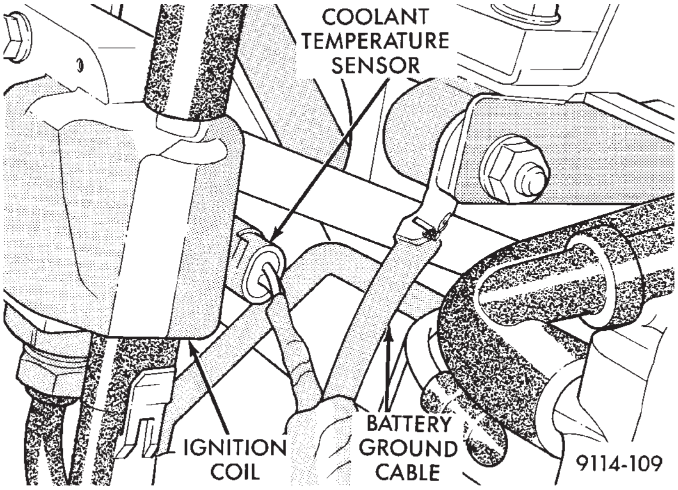


Fig. 6 Engine Coolant Temperature Sensor

(9) Inspect the engine temperature sensor electrical connection (Fig. 7).

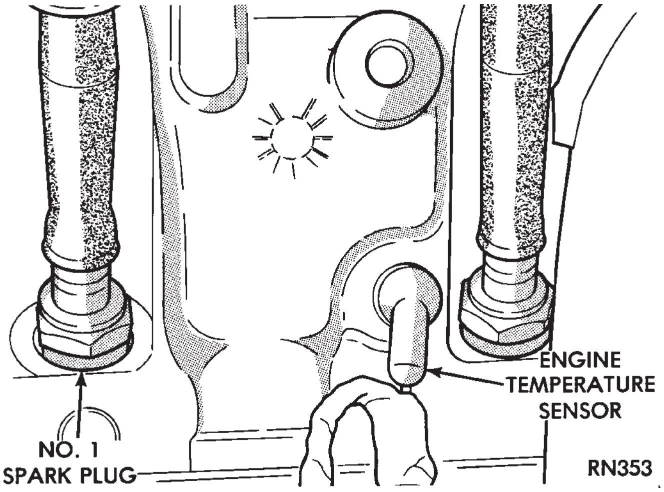


Fig. 7 Engine Temperature Sensor Electrical Connection

(10) Check power brake booster and speed control vacuum connections (Fig. 8).

(11) Check engine harness to main harness electrical connections.

(12) Check park/neutral switch wiring connection (Fig. 9).

(13) Ensure battery connections are clean and tight.

(14) Inspect relay connections (Fig. 10)

(15) Ensure the 60-way connector is fully inserted into the socket on the PCM (Fig. 11). Make sure the wires are not stretched or pulled out of the connector.

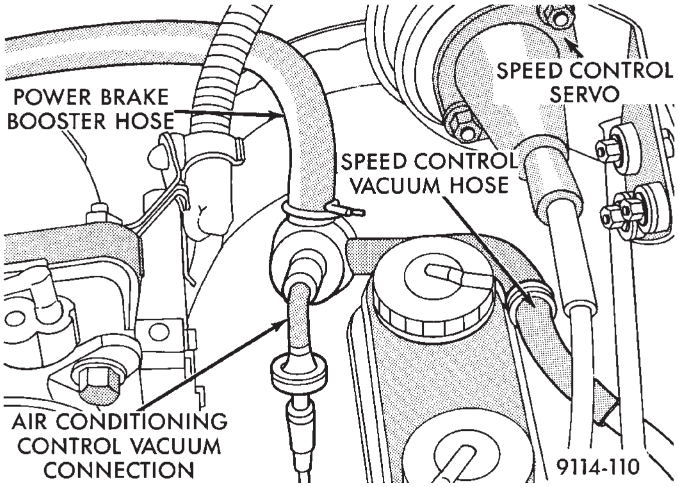


Fig. 8 Power Brake Booster and Speed Control Vacuum Hose Connections

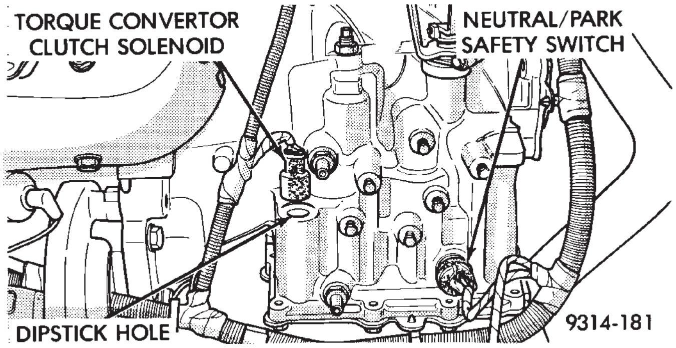


Fig. 9 Automatic Transaxle Electrical Connections

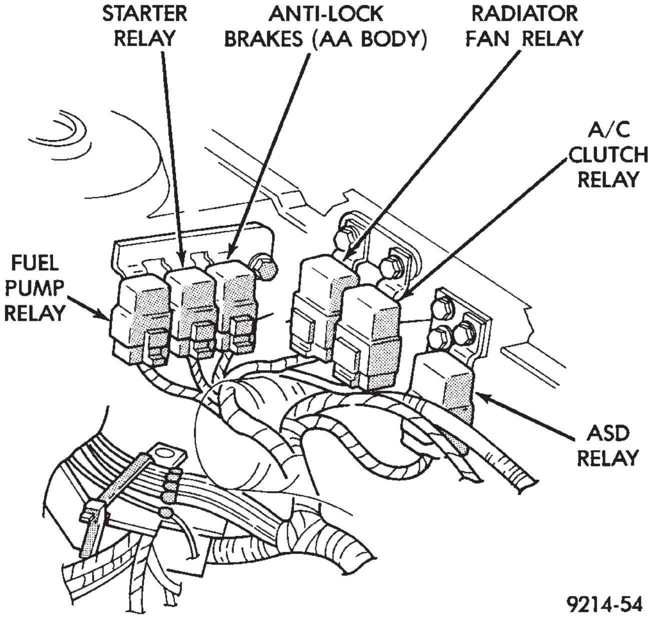


Fig. 10 Relay Identification

(16) Verify the harness connector is attached to idle air control motor (Fig. 12).

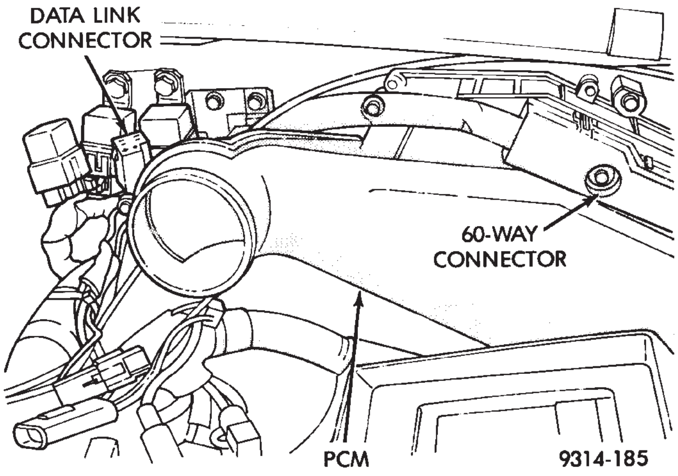


Fig. 11 PCM Electrical Connector

(17) Verify the harness connector is attached to the throttle position sensor (Fig. 12).

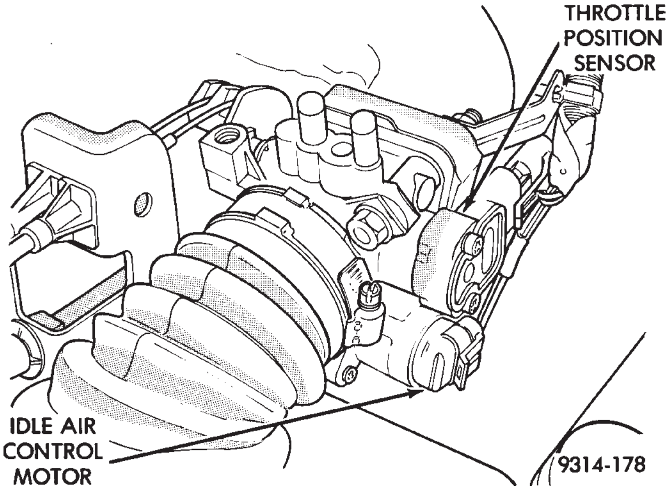


Fig. 12 TPS and Idle Air Control Motor

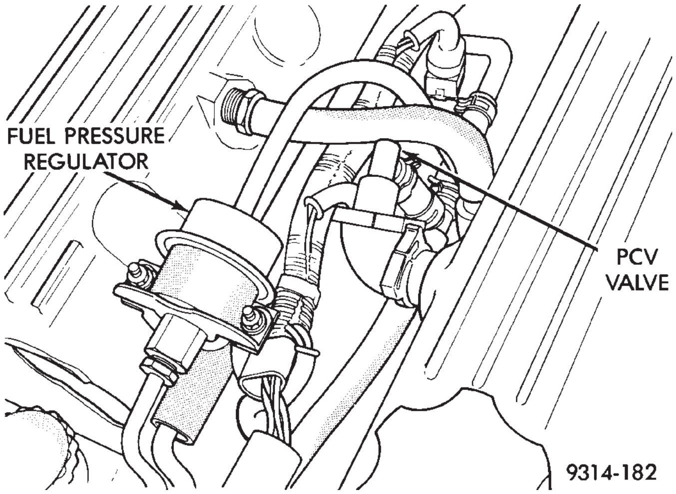


Fig. 13 PCV Valve and Fuel Pressure Regulator

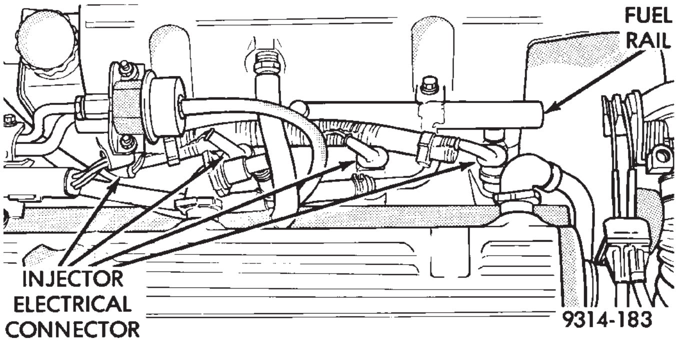


Fig. 14 Fuel Injector Electrical Connectors

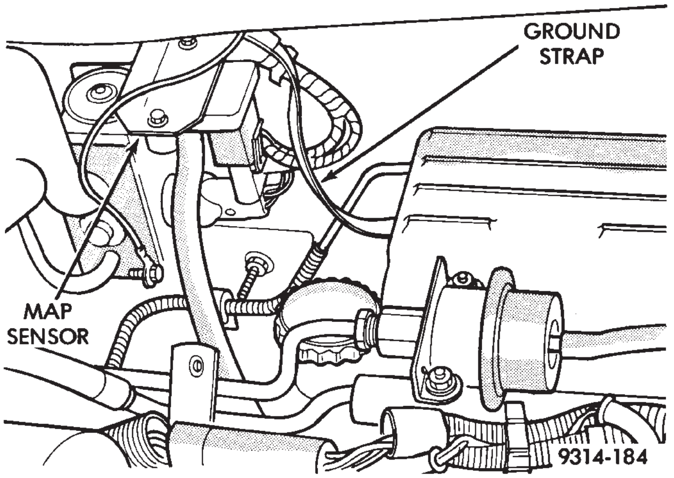


Fig. 15 Ground Strap

(18) Verify hose from PCV valve is securely attached to the intake manifold vacuum port (Fig. 13).

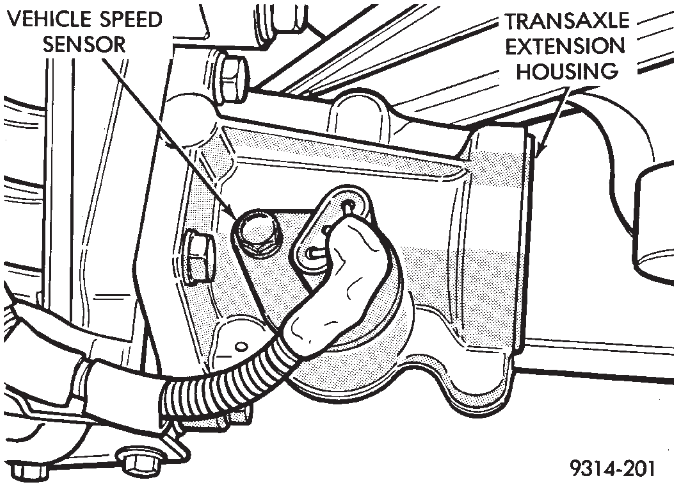


Fig. 16 Vehicle Speed Sensor

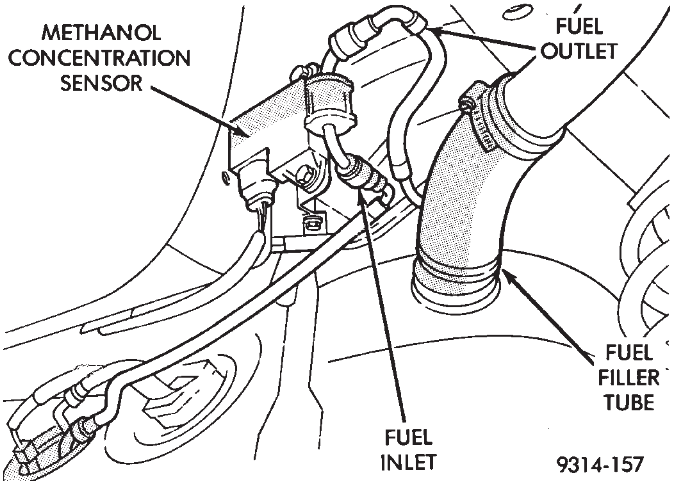


Fig. 17 Methanol Concentration Sensor

(19) Check vacuum hose connection between vacuum source and fuel pressure regulator (Fig. 13).

(20) Inspect electrical connections at the fuel injectors (Fig. 14).

(21) Inspect the heated oxygen sensor electrical connector.

(22) Verify engine ground strap is attached to the intake manifold and the dash panel (Fig. 15).

(23) Inspect all vacuum harness connections and hoses for leaks.

(24) Verify the harness connector is attached to the vehicle speed sensor (Fig. 16). Ensure the sensor and connector are not damaged.

(25) Inspect hose and electrical connections at the fuel pump. Ensure the electrical connector is fully seated over the pump module terminals.

(26) Inspect electrical connections at the methanol concentration sensor (Fig. 17).

2.5L FLEXIBLE FUEL MULTI-PORT FUEL INJECTION—ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

The powertrain control module (PCM) monitors many different circuits in the fuel injection system. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a diagnostic trouble code in the PCM's memory. If the problem is repaired or ceases to exist, the PCM cancels the diagnostic trouble code after 51 vehicle key on/off cycles.

Certain criteria must be met before the PCM stores a diagnostic trouble code 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 diagnostic trouble code for a monitored circuit even though a malfunction has occurred. This may happen because one of the diagnostic trouble code criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria for a certain sensor 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 diagnostic trouble code.

There are several operating conditions for which the PCM monitors and sets diagnostic trouble codes. Refer to Monitored Circuits and Non-Monitored Circuits in this section.

Technicians can display stored diagnostic trouble codes by two different methods. The first is to cycle the ignition switch On - Off - On - Off - On within 5 seconds. Then count the number of times the malfunction indicator lamp (check engine lamp) on the instrument panel flashes on and off. The number of flashes represents the trouble code. There is a slight pause between the flashes representing the first and second digits of the code. Longer pauses separate individual trouble codes.

The second method of reading diagnostic trouble codes uses the DRBII scan tool. The DRBII scan tool connects to the data link (diagnostic) connector in the vehicle (Fig. 1). For diagnostic trouble code information, refer to charts in this section.

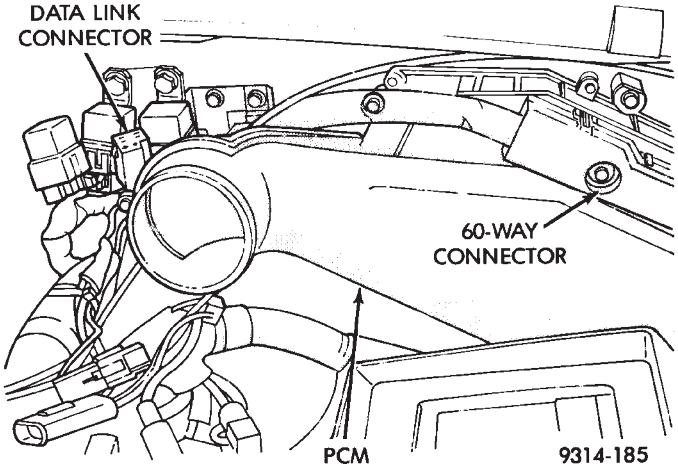


Fig. 1 Data Link (Diagnostic) Connector

MONITORED CIRCUITS

The PCM can detect certain fault conditions in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if the sensor output (input to the PCM) is within proper range. Also, the PCM can determine open or shorted circuits.

Output Device Current Flow - The PCM senses whether output devices are hooked up. If a problem exists within the circuit, the PCM senses whether the circuit is open, shorted to ground, or shorted high.

Heated Oxygen Sensor - Once the system has entered closed loop, the PCM determines if the oxygen sensor is switching between rich and lean. Refer to Modes of Operation in the General Information section of this group for an explanation of closed loop operation.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems. For example, a fuel pressure problem will not register a fault directly, but could cause a rich or lean condition. This could cause the PCM to store an oxygen sensor diagnostic trouble code.

Fuel Pressure - The vacuum assisted fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, stuck open regulator, 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 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.

Engine Timing - The PCM cannot detect an incorrectly indexed timing belt, camshaft sprocket and crankshaft sprocket. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor diagnostic trouble code.

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 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 an oxygen sensor diagnostic trouble code.

Excessive Oil Consumption - Although the PCM monitors exhaust stream 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.

Evaporative System - The PCM cannot detect a disconnected (open vacuum line) restricted, plugged or loaded evaporative purge canister.

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.

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.

DIAGNOSTIC TROUBLE CODES

A diagnostic trouble code indicates the powertrain control module (PCM) has recognized an abnormal condition in the system. Abnormal conditions are usually shorted or open circuits.

The technician can display diagnostic trouble codes in two ways. The first way is to cycle the ignition switch and count the number of times the malfunction indicator lamp (check engine lamp on the instrument panel) flashes on and off. The DRBII scan tool provides the second method of displaying diagnostic trouble codes. Diagnostic trouble codes indicate the results of a circuit failure, but do not directly identify the failed component.

For a list of Diagnostic Trouble Codes, refer to the charts at the end of this section.

OBTAINING DIAGNOSTIC TROUBLE CODES

USING DRBII SCAN TOOL

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST ON AN OPERATING ENGINE.

(1) Connect DRBII scan tool to the data link (diagnostic) connector located in the engine compartment, next to the PCM (Fig. 1).

(2) If possible, start the engine and cycle the **A/C** switch if applicable. Shut off the engine.

(3) Turn the ignition switch on, access Read Fault Screen. Record all the diagnostic trouble codes shown on the DRBII scan tool. [Observe the malfunction indicator lamp (check engine lamp) on the instrument panel. The lamp should light for 2 seconds then go out (bulb check)].

To erase diagnostic trouble codes, use the Erase Trouble Code data screen on the DRBII scan tool.

USING THE MALFUNCTION INDICATOR LAMP

(1) Cycle the ignition key On - Off - On - Off - On within 5 seconds.

(2) Count the number of times the malfunction indicator lamp (check engine lamp on the instrument panel) flashes on and off. The number of flashes represents the trouble code. There is a slight pause be-

tween the flashes representing the first and second digits of the code. Longer pauses separate individual trouble codes.

(3) Refer to the Diagnostic Trouble Code Charts at the end of this group.

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 DRBII scan tool to the vehicle and access the State Display screen. Then access Inputs and Outputs. The following is a list of the engine control system functions accessible through the Inputs and Outputs screen.

- Park/Neutral Switch (automatic transaxle only)
- Speed Control Resume
- Speed Control On/Off
- Speed Control Set
- Brake Switch
- A/C Switch Sense
- S/C Vent Solenoid
- S/C Vacuum Solenoid
- A/C Clutch Relay
- Auto Shutdown Relay
- Radiator Fan Relay
- (Duty Cycle) EVAP Purge Solenoid
- Malfunction Indicator (Check Engine) Lamp

STATE DISPLAY SENSORS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following is a list of the engine control system functions accessible through the Sensor Display screen.

- Oxygen Sensor Signal
- Engine Coolant Temperature
- Engine Coolant Temp Sensor
- Throttle Position
- Minimum Throttle
- Battery Voltage
- MAP Sensor Reading
- Idle Air Control Motor Position
- Adaptive Fuel Factor
- Barometric Pressure
- Min Airflow Idle Spd (Speed)
- Engine Speed
- Fault #1 Key-On Info
- Module Spark Advance
- Speed Control Target
- Fault #2 Key-on Info
- Fault #3 Key-on Info
- Speed Control Status
- Charging System Goal
- Theft Alarm Status
- Battery Temperature
- Flex Fuel (Methanol Concentration) Sensor Voltage
- Methanol Content (percentage)
- Map Sensor Voltage
- Vehicle Speed
- Oxygen Sensor State
- MAP Gauge Reading
- Throttle Opening (percentage)
- Total Spark Advance

CIRCUIT ACTUATION TEST MODE

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the powertrain control module (PCM) cannot 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.

OBTAINING CIRCUIT ACTUATION TEST

Connect the DRBII scan tool to the vehicle and access the Actuators screen. The following is a list of the engine control system functions accessible through Actuators screens. Subordinate screens for each actuator test are also listed.

Stop All Tests
Ignition Coil No. 1
Fuel Injector No. 1
Fuel Injector No. 2
Fuel Injector No. 3
Fuel Injector No. 4
Idle Air Control Motor Open/Close
Fuel System
Radiator Fan Relay
A/C Clutch Relay
Auto Shutdown Relay
EVAP Purge Solenoid
Speed Control Servo Solenoids
Generator Field
Tachometer Output
Torque Converter Clutch Solenoid
All Solenoids/Relays
Speed Control Vent Solenoid
Speed Control Vacuum Solenoid
ASD Fuel System Test

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) Hook-up timing check device and Tachometer.

(3) Disconnect the coolant temperature sensor and set basic timing to 12° BTDC ± 2° BTDC.

(4) Shut off engine. Connect harness connector to coolant temperature sensor.

(5) Disconnect the PCV valve hose from the nipple on the intake manifold.

(6) Attach Air Metering Fitting #6457 (0.125 in. orifice) to the intake manifold PCV nipple (Fig. 2).

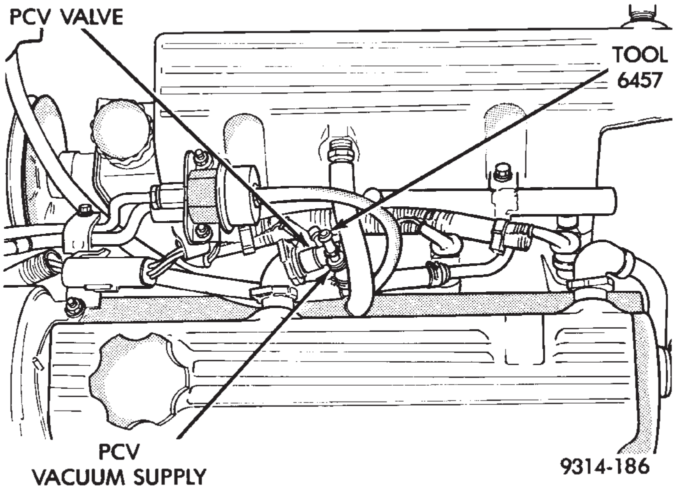


Fig. 2 Checking Minimum Air Flow Using Special Tool 6457

(7) Connect DRBII scan tool to the data link connector. The connector is located next to the powertrain control module (PCM) (Fig. 1).

(8) Restart engine. Allow engine to idle for at least one minute.

(9) Using the DRBII scan tool, access Min. Airflow Idle Spd. The following will then occur:

- idle air control motor fully closes
- Idle spark advance becomes fixed
- The DRBII scan tool displays engine RPM

(10) Check idle RPM with tachometer, if idle RPM is within the specifications then the throttle body minimum airflow is set correctly.

IDLE SPECIFICATIONS

Odometer Reading	Idle RPM
Below 1000 miles	650-1400 RPM
Above 1000 miles	700-1400 RPM

9214-100

If the idle RPM is not within specification, replace the throttle body.

(11) Shut off engine.

(12) Remove Air Metering Fitting #6457 from the intake manifold PCV nipple. Reinstall the PCV valve hose.

(13) Remove DRBII scan tool.

(14) Disconnect timing light and tachometer.

IGNITION TIMING PROCEDURE

Refer to Group 8D Ignition System.

POWERTRAIN CONTROL MODULE 60-WAY CONNECTOR

Check the powertrain control module (PCM) 60-way connector for the following.

- Spread terminals
- Stretched or pulled out wires
- Undertightened or overtightened 60 way connector

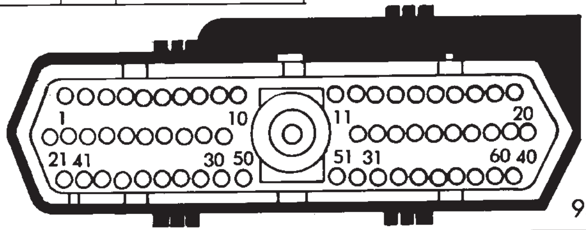
Tighten the PCM connector to 4 N•m (35 in. lbs.) torque. When checking terminal pin outs, refer to the Powertrain Control Module 60-Way Connector Diagram for circuit wire colors and cavity numbers.

~~POWERTRAIN CONTROL MODULE 60-WAY CONNECTOR~~

CAV	WIRE COLOR	DESCRIPTION
1	DG/RD*	MAP SENSOR
2	TN/BK*	ENGINE COOLANT TEMPERATURE SENSOR
3	RD/WT*	DIRECT BATTERY VOLTAGE
4	BK/LB*	SENSOR RETURN
5	BK/WT*	SIGNAL GROUND
6	VT/WT*	5-VOLT OUTPUT (MAP AND TPS)
7	OR	8-VOLT OUTPUT
8		
9	DB	A21 SUPPLY (IGNITION START/RUN)
10		
11	BK/TN*	POWER GROUND
12	BK/TN*	POWER GROUND
13	LB/BR	INJECTOR DRIVER #4
14	YL/WT*	INJECTOR DRIVER #3
15	TN	INJECTOR DRIVER #2
16	WT/DB*	INJECTOR DRIVER #1
17		
18		
19	BK/GY*	IGNITION COIL DRIVER #1
20	DG	GENERATOR FIELD CONTROL
21	BK/RD*	METHANOL CONCENTRATION SENSOR
22	OR/DB*	THROTTLE POSITION SENSOR (TPS)
23	RD/LG*	SPEED CONTROL SENSE
24	GY/BK*	IGNITION REFERENCE PICK-UP
25	PK	SCI TRANSMIT
26	VT/BR*	CCD BUS (+)
27	BR	A/C SWITCH SENSE
28		
29	WT/PK*	BRAKE SWITCH
30	BR/YL*	PARK/NEUTRAL SWITCH (AUTO TRANS.)
31	DB/PK*	RADIATOR FAN RELAY
32	BK/PK*	CHECK ENGINE LAMP
33	TN/RD*	SPEED CONTROL VACUUM SOLENOID
34	DB/OR*	A/C CLUTCH RELAY
35		
36		

CAV	WIRE COLOR	DESCRIPTION
37		
38		
39	GY/RD*	IDLE AIR CONTROL MOTOR TERMINAL #3
40	BR/WT*	IDLE AIR CONTROL MOTOR TERMINAL #1
41	BK/DG*	HEATED OXYGEN SENSOR SIGNAL
42		
43	GY/LB*	TACHOMETER SIGNAL OUTPUT
44	TN/YL*	CAMSHAFT POSITION SENSOR
45	LG	SCI RECEIVE
46	WT/BK*	CCD BUS (–)
47	WT/OR*	VEHICLE SPEED SENSOR
48		
49		
50		
51	DB/YL*	AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY
52	PK/BK*	EVAP PURGE SOLENOID
53	LG/RD*	SPEED CONTROL VENT SOLENOID
54	LG/WT*	TORQUE CONVERTER CLUTCH SOLENOID
55		
56		
57	DG/OR*	A142 CIRCUIT VOLTAGE SENSE
58		
59	VT/BK*	IDLE AIR CONTROL MOTOR TERMINAL #4
60	YL/BK*	IDLE AIR CONTROL MOTOR TERMINAL #2

WIRE COLOR CODES					
		LB	LIGHT BLUE	VT	VIOLET
BK	BLACK	LG	LIGHT GREEN	WT	WHITE
BR	BROWN	OR	ORANGE	YL	YELLOW
DB	DARK BLUE	PK	PINK	*	WITH TRACER
DG	DARK GREEN	RD	RED		
GY	GRAY	TN	TAN		



CONNECTOR
TERMINAL SIDE
SHOWN

9314-187

DIAGNOSTIC TROUBLE CODE DESCRIPTION

Trouble Code	DRB II Display	Description
11	No reference Signal During Cranking	No camshaft position sensor reference signal detected during engine cranking.
13+**	No change in MAP from start to run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
	or	
	Slow change in idle MAP signal	MAP output change is slower and/or smaller than expected.
14+**	MAP voltage too low	MAP sensor input below minimum acceptable voltage.
	or	
	MAP voltage too High	MAP sensor input above maximum acceptable voltage.
15**	No vehicle speed signal	No vehicle distance (speed) sensor signal detected during road load conditions.
17	Engine is cold too long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O_2 signal stays at center	Neither rich or lean condition detected from the oxygen sensor input.
	or	
	O_2 signal shorted to voltage	Oxygen sensor input voltage maintained above the normal operating range.
22+**	Coolant sensor voltage too high	Coolant temperature sensor input above the maximum acceptable voltage.
	or	
	Coolant sensor voltage too low	Coolant temperature sensor input below the minimum acceptable voltage.
24+**	Throttle position sensor voltage high	Throttle position sensor input above the maximum acceptable voltage.
	or	
	Throttle position sensor voltage low	Throttle position sensor input below the minimum acceptable voltage.
25**	Idle air control motor circuits	A shorted condition detected in one or more of the idle air control motor circuits.
27	Injector control circuit	Injector output driver does not respond properly to the control signal. DRBII scan tool specifies injector by cylinder number.
31**	Purge solenoid circuit	An open or shorted condition detected in the duty cycle EVAP purge solenoid circuit.
33	A/C clutch relay circuit	An open or shorted condition detected in the A/C compressor clutch circuit.
34	Speed control solenoid circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.

+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-188

DIAGNOSTIC TROUBLE CODE DESCRIPTION (CONTINUED)

Trouble Code	DRBII Display	Description
35..........	Radiator fan relay circuits	An open or shorted condition detected in the radiator fan relay circuits.
37..........	Torque converter solenoid circuit	An open or shorted condition detected in the torque converter clutch solenoid circuits.
41+**......	Generator field not switching properly	An open or shorted condition detected in the generator field control circuit.
42..........	Auto shutdown relay control circuit	An open or shorted condition detected in the auto shutdown relay circuit.
46+**......	Charging system voltage too high	Battery voltage sense input above target charging voltage during engine operation.
47+**......	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.
51**........	O_2 signal stays below center (lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**........	O_2 signal stays above center (rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53..........	Internal PCM failure	PCM internal fault condition detected.
54**+......	No sync pick-up signal	No fuel sync pick-up signal detected during engine rotation.
62..........	EMR miles	Unsuccessful attempt to update the EMR mileage in the PCM EEPROM.
63..........	PCM Failure EEPROM write denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
64**+......	Flex fuel sensor high	Methanol concentration sensor input above the maximum acceptable voltage.
	or	
	Flex fuel sensor low	Methanol concentration sensor input below the minimum acceptable voltage.
55..........	N/A	Completion of fault code display on Check Engine lamp.

\+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-189

2.5L FLEXIBLE FUEL MULTI-PORT FUEL INJECTION—SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

In this model year Chrysler began producing AA-Body vehicles designed to operate on a mixture of gasoline and methanol. These automobiles are referred to as Flexible Fuel vehicles. Fuel system components designed for use in flexible fuel vehicles are referred to as Methanol Compatible.

Flexible fuel vehicles can operate on a mixture of up to 85 percent methanol, 15 percent unleaded gasoline. These vehicles also operate on mixtures containing a lower percentage of methanol or just pure unleaded gasoline.

SERVICE PRECAUTIONS FOR FLEXIBLE FUEL VEHICLES

Methanol is more toxic than gasoline. Always release fuel system pressure before servicing fuel system components and wear methanol resistant gloves and eye protection.

Avoid breathing methanol vapors or ingesting methanol. Headaches, dizziness and even unconsciousness could result from breathing these vapors. Serious injury, blindness and even death could result from ingesting methanol.

Methanol vapors are extremely flammable and can travel along the ground. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle.

Do not allow methanol to contact skin. Prolonged contact with methanol can cause dry skin or an allergic skin reaction. Also, prolonged contact could result in absorption through the skin.

IDENTIFYING FLEXIBLE FUEL COMPONENTS

Flexible Fuel vehicles have unique methanol compatible fuel system components. Chrysler identifies methanol compatible components that could be physically interchanged with gasoline only parts by coloring them green or applying a green label or tag to them. **Even though they may appear physically identical, components for gasoline only AA-body vehicles must not be used on flexible fuel vehicles.**

FLEXIBLE FUEL COMPONENTS

The fuel system of flexible fuel AA-body vehicles have the following unique methanol compatible components.

- Duty cycle EVAP purge solenoid
- EVAP canister
- Fuel pump module
- Fuel level sensor
- Fuel gauge (gauge cluster).
- Fuel tank
- Fuel pressure regulator (including O-rings)
- Fuel rail
- Fuel injectors (including O-rings)
- Fuel tubes
- Fuel filter
- Fuel filler cap
- Fuel filler tube
- Methanol concentration sensor
- Pressure relief/rollover valve
- PCV Valve
- All fuel system and emission system hoses and tubes

THROTTLE BODY

WARNING: THROTTLE BODIES DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN REPLACING THE THROTTLE BODY OF A FLEXIBLE FUEL VEHICLE, ONLY USE AN ORIGINAL EQUIPMENT REPLACEMENT.

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.

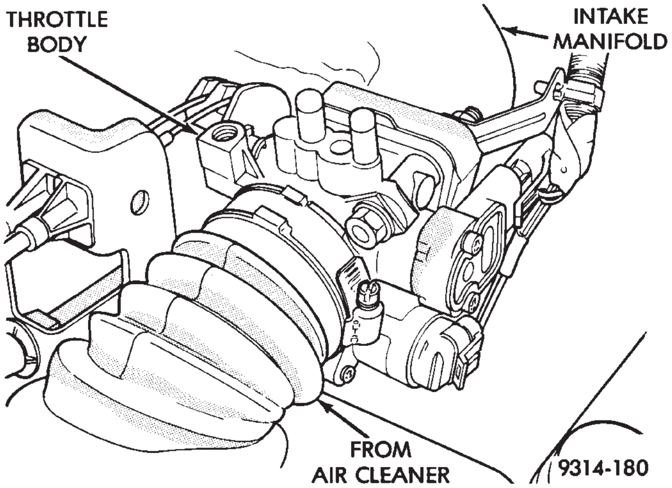


Fig. 1 Throttle Body

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. 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 the protective cap from the fuel pressure test port on the fuel rail (Fig. 2).

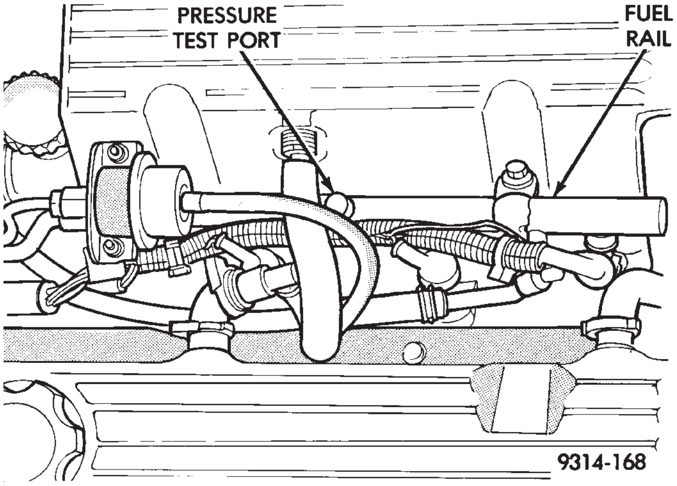


Fig. 2 Fuel Pressure Test Port

(4) Place the open end of fuel pressure release hose, tool number C-4799-1, into a container approved for methanol/gasoline mixtures. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 3). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

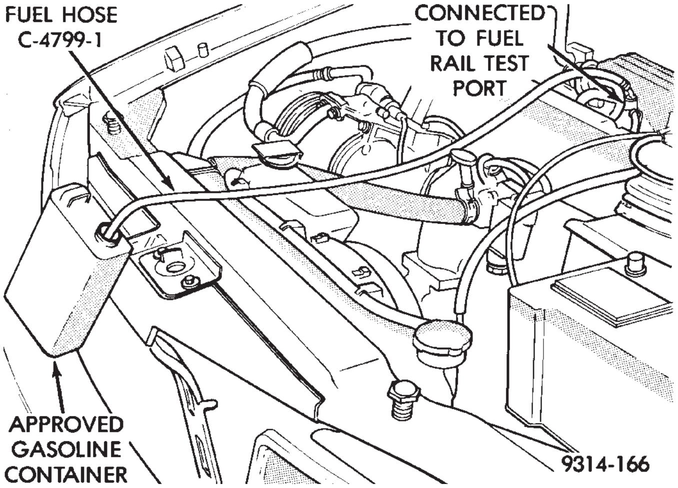


Fig. 3 Releasing Fuel Pressure

THROTTLE POSITION SENSOR (TPS)

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Disconnect harness connector from throttle position sensor (Fig. 4).

(3) Remove throttle position sensor mounting screws.

(4) Lift throttle position sensor off throttle shaft.

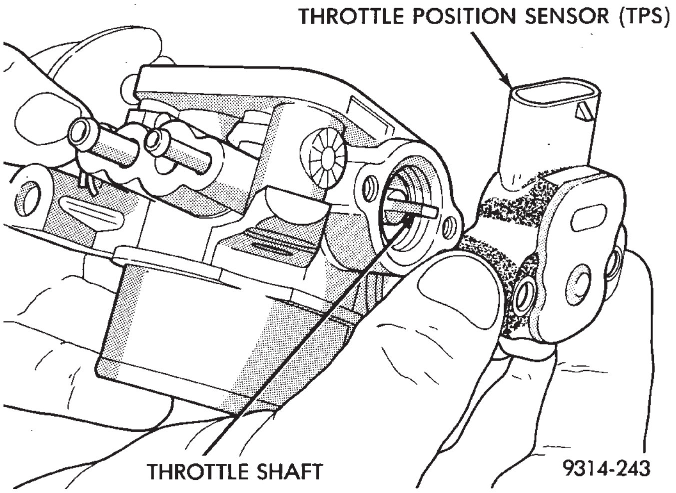


Fig. 4 Servicing Throttle Position Sensor

INSTALLATION

(1) Install throttle position sensor on throttle shaft. Install mounting screws. Tighten screws to 2 N●m (17 in. lbs.) torque.

(2) Attach harness connector to sensor.

(3) Connect negative cable to negative post of the battery.

IDLE AIR CONTROL MOTOR

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect harness connector from idle air control motor (Fig. 5).

(3) Remove idle air control motor mounting screws.

(4) Remove idle air control motor from throttle body (make certain that the O-ring is on motor).

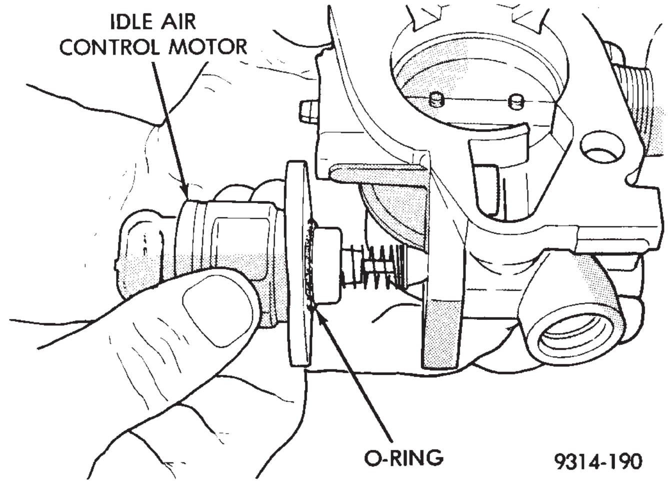


Fig. 5 Servicing Idle Air Control Motor

INSTALLATION

(1) New idle air control motors have a new O-ring installed on them. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the IDLE AIR CONTROL MOTOR OPEN/CLOSE mode of the DRBII scan tool (battery must be reconnected for this operation).

(2) Carefully place idle air control motor into throttle body.

(3) Install 2 mounting screws. Tighten screws to 2 N•m (17 in. lbs.) torque.

(4) Connect harness connector to motor.

(5) Connect negative cable to battery.

THROTTLE BODY REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove clamp from air hose. Remove hose (Fig. 1).

(3) Remove accelerator cable.

(4) Disconnect idle air control motor and throttle position sensor (TPS) electrical connectors.

(5) Remove throttle body mounting nuts.

(6) Remove throttle body and gasket.

(7) Reverse the above procedures for installation.

FUEL INJECTOR RAIL ASSEMBLY

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL

(1) Perform fuel system pressure release procedure.

(2) Disconnect negative cable from battery.

(3) Disconnect the fuel injector harness connector from the engine harness (Fig. 6).

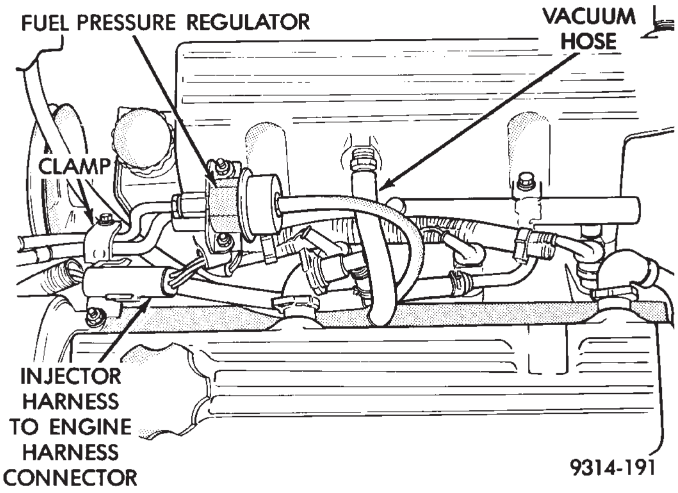


Fig. 6 Injector Harness and Engine Harness Connection

(4) Remove the quick connect fittings from the chassis fuel tubes. Refer to Quick Connect Fittings in the Fuel Delivery section of this group.

(5) Disconnect the vacuum hose from the top of the intake manifold (Fig. 6).

(6) Disconnect vacuum hose from the pressure regulator (Fig. 6).

(7) Remove screw from the fuel tube clamp (Fig. 6).

(8) Remove fuel rail mounting screws.

(9) Pull up on the injector rail. The injectors will pull straight out of the ports. Do not damage the injector O-rings.

(10) Remove fuel rail assembly from vehicle. Do not remove fuel injectors until fuel rail assembly has been completely removed from vehicle.

(11) Plug or cover intake manifold injector ports to prevent dirt from entering the openings (Fig. 7).

INSTALLATION

WARNING: FUEL RAILS, INJECTORS AND PRESSURE REGULATORS DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Ensure injectors are seated into the receiver cup on the fuel rail with the lock ring in place.

(2) Attach harness connectors to injectors. Fasten the harness into wiring clips.

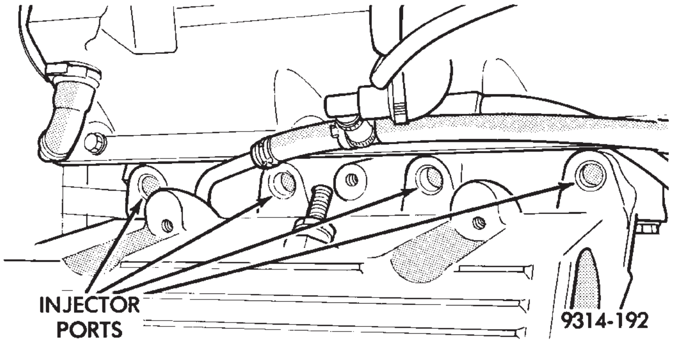


Fig. 7 Fuel Injector Ports

(3) Ensure the injector holes are clean and all plugs have been removed.

(4) Lubricate the injector O-rings with a drop of clean engine oil to ease installation.

(5) Install the injector assembly into their holes. Install mounting screws. Fuel rail assembly must be drawn into the intake manifold evenly making sure each injector enters its own hole. Once all injectors are seated, tighten bolts to 23 N●m (200 in. lbs) torque.

(6) Connect vacuum hose to fuel pressure regulator.

(7) Close fuel tube clip around fuel tubes and install fastener.

(8) Lubricate the ends of the chassis fuel tubes with a light coating of clean 30 weight engine oil. Connect fuel supply and return hoses to chassis fuel tube assembly. Pull back on the quick connect fittings to ensure complete insertion. Refer to Quick Connect Fittings in the Fuel Delivery section of this group.

(9) Connect vacuum hose intake manifold nipple.

(10) Connect negative cable to battery.

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.

(11) With the DRBII scan tool, use the ASD Fuel System Test to pressurize system and check for leaks.

FUEL INJECTOR

The fuel rail must be removed to service the injectors. Refer to Fuel Injector Rail Assembly in this section.

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect electrical connector from injector (Fig. 8).

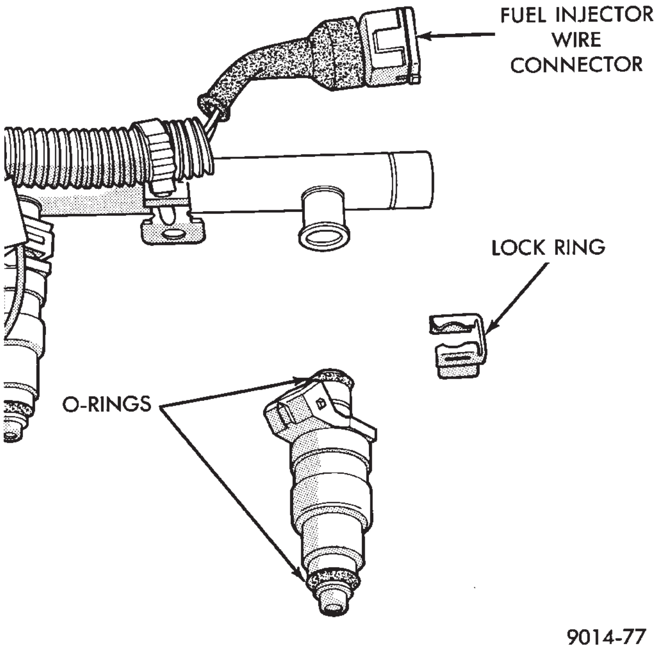


Fig. 8 Servicing Fuel Injectors

(2) Position fuel rail assembly so that the fuel injectors are easily accessible (Fig. 9).

(3) Remove injector lock ring from fuel rail and injector. Pull injector straight out of fuel rail receiver cup.

(4) Check injector O-ring for damage. Replace damaged O-rings. If injector is reused, install a protective cap on the injector tip to prevent damage.

(5) Repeat steps for remaining injectors.

INSTALLATION

WARNING: FUEL INJECTORS AND INJECTOR O-RINGS DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

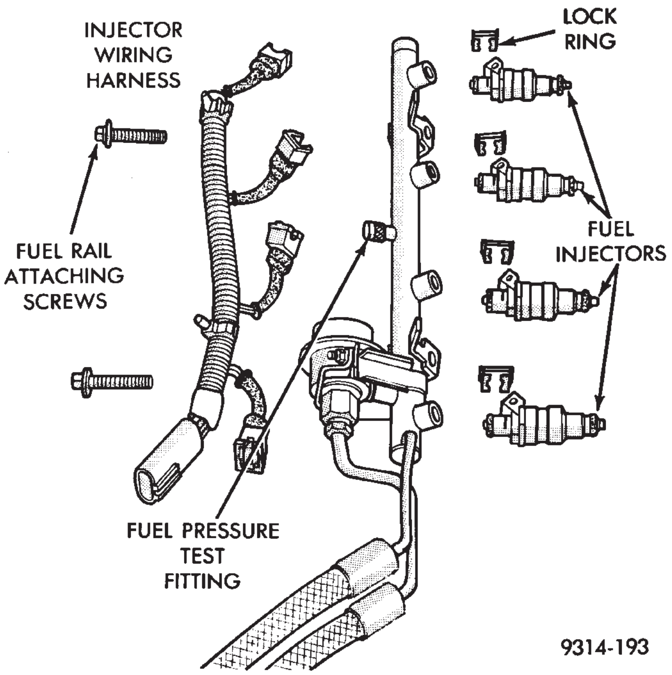


Fig. 9 Fuel Rail and Injector Assembly

(1) Before installing an injector, lubricate O-ring with a drop of clean engine oil.

(2) Being careful not to damage the O-ring, install injector top end into fuel rail receiver cup.

(3) Install injector lock ring by sliding open end into slot of the injector and onto the receiver cup ridge into the side slots of ring (Fig. 8).

(4) Repeat steps for remaining injectors.

(5) Install injector wiring harness to injectors and fasten into wiring clips (Fig. 10).

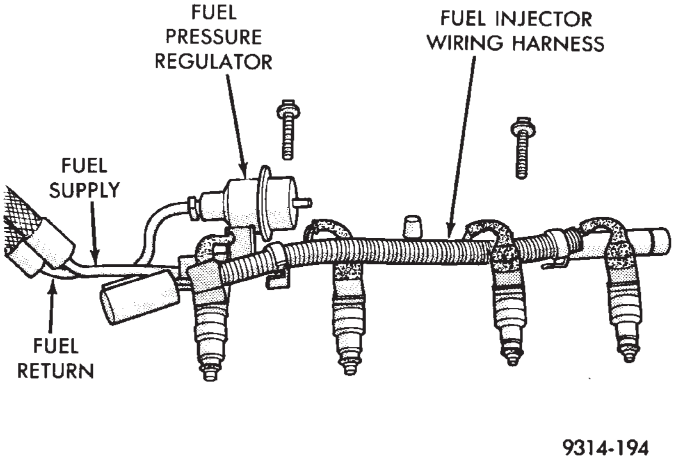


Fig. 10 Fuel Rail Assembly

FUEL PRESSURE REGULATOR

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. WHEN SERVICING FLEXIBLE FUEL VEHICLES, WEAR METHANOL RESISTANT GLOVES AND EYE PROTECTION AND AVOID BREATHING FUMES. DO NOT ALLOW METHANOL/GASOLINE MIXTURES TO CONTACT SKIN. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL

(1) Perform fuel system pressure release procedure.

(2) Disconnect negative cable from battery.

(3) Disconnect vacuum hose from fuel pressure regulator (Fig. 11).

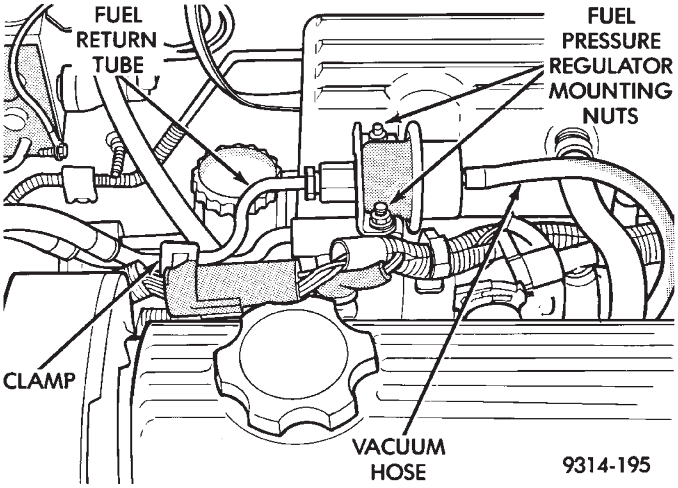


Fig. 11 Servicing Fuel Pressure Regulator

Place a shop towel under fuel pressure regulator to absorb any fuel spillage.

(4) Use 2 tubing wrenches, to loosen the line nut on the fuel return tube (Fig. 12).

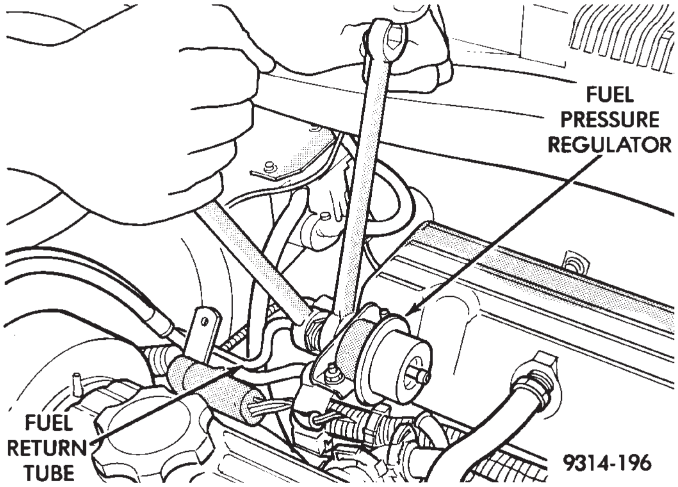


Fig. 12 Removing Fuel Return Tube

(5) Remove fuel pressure regulator mounting nuts (Fig. 11).

(6) Lift pressure regulator up out of fuel rail (Fig. 13). Ensure the O-ring and spacer were removed with the regulator. Discard O-Ring.

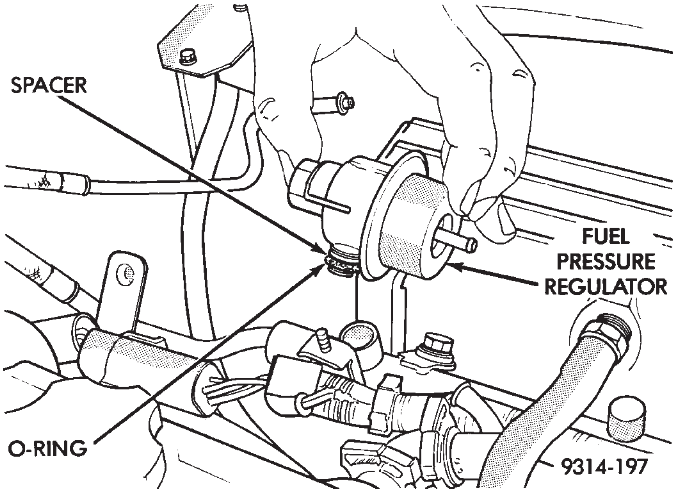


Fig. 13 Fuel Pressure Regulator Removal/Installation

INSTALLATION

WARNING: THE FUEL PRESSURE REGULATOR, O-RING AND SPACER DESIGNED FOR GASOLINE ONLY VEHICLES CANNOT BE USED ON FLEXIBLE FUEL AA-BODY VEHICLES. WHEN SERVICING THE FUEL SYSTEM OF A FLEXIBLE FUEL VEHICLE, ONLY USE ORIGINAL EQUIPMENT OR EQUIVALENT REPLACEMENT COMPONENTS.

(1) Lubricate new O-ring with a drop of clean engine oil. Install spacer and O-ring into the receiver cup on fuel rail (Fig. 13).

(2) Install mounting nuts. Tighten nuts to 7 N●m (65 in. lbs.) torque.

(3) Connect fuel return tube to pressure regulator. Using a wrench to hold the fuel pressure regulator, tighten the nut to 28 N●m (150 in. lbs.) torque.

(4) Connect vacuum hose to pressure regulator. Replace clamp.

(5) Connect negative cable to battery.

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.

(6) With the DRBII scan tool, use the ASD Fuel System Test to pressurize system and check for leaks.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SERVICE

(1) Remove vacuum hose and remove mounting screws from sensor (Fig. 14).

(2) Remove wiring harness and remove sensor.

(3) Reverse the above procedure for installation.

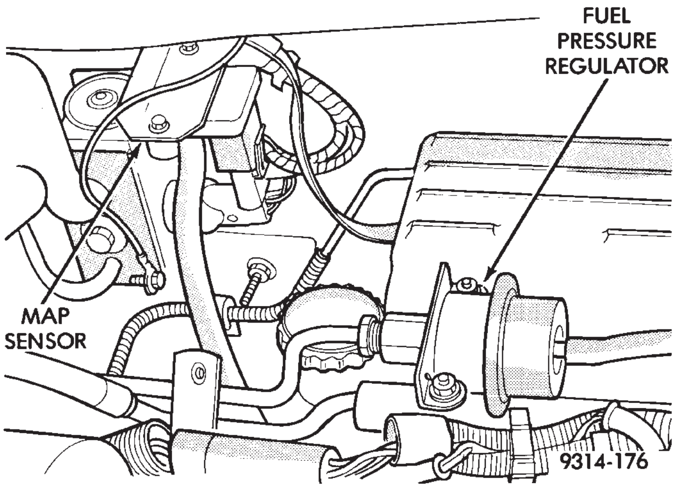


Fig. 14 Manifold Absolute Pressure Sensor

PCM SERVICE

(1) Remove air cleaner duct from PCM.

(2) Remove battery.

(3) Remove PCM mounting screws (Fig. 15).

(4) Remove 60 way wiring connector from module and remove module.

(5) Reverse the above procedure for installation.

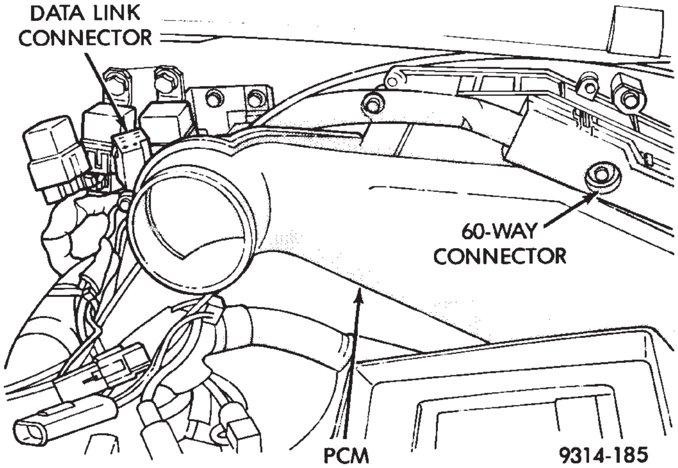


Fig. 15 PCM Removal/Installation

METHANOL CONCENTRATION SENSOR

Refer to the Fuel Delivery section of this group for methanol concentration sensor service.

HEATED OXYGEN SENSOR (O_2 SENSOR)

The oxygen sensor is installed in the exhaust manifold (Fig. 16).

CAUTION: Do not pull on the oxygen sensor wires when disconnecting the electrical connector.

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

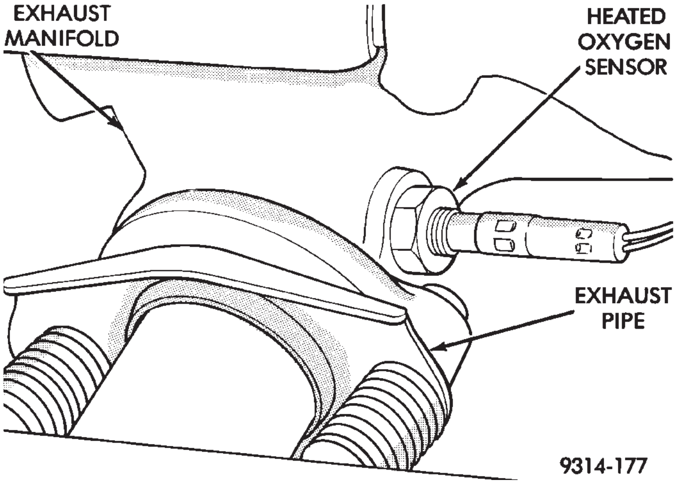


Fig. 16 Heated Oxygen Sensor

(1) Disconnect oxygen sensor electrical connector.

(2) Remove sensor using Tool C-4907 (Fig. 17). Slightly tightening the sensor can ease removal.

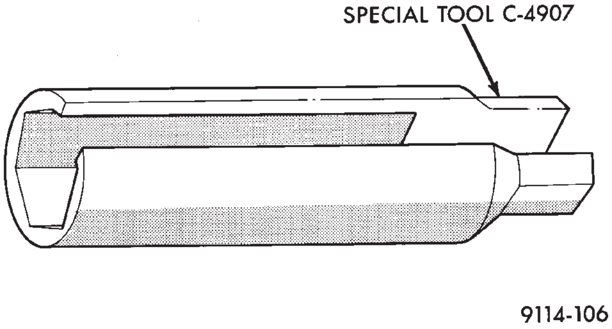


Fig. 17 Oxygen Sensor Socket

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. New sensors are packaged with compound on the threads and do not require additional compound. The sensor must be tightened to 28 N•m (20 ft. lbs.) torque.

2.2L TURBO III MULTI-PORT FUEL INJECTION—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

The turbocharged multi-port electronic fuel injection system combines an electronic fuel and spark advance control system with a turbocharged intake system (Fig. 1). The fuel injection system is controlled by the powertrain control module (PCM).

The PCM regulates ignition timing, air-fuel ratio, emission control devices, cooling fan, charging system, speed control, turbocharger wastegate and idle speed. The PCM adapts its requirement to meet changing operating conditions.

Various sensors provide the inputs necessary for the PCM to correctly regulate fuel flow at the fuel injector. These include the manifold absolute pressure, throttle position, oxygen sensor, coolant temperature, detonation, and vehicle speed sensors. In addition to the sensors, the air conditioning clutch switch and various relays provide important information and system control. The outputs include the auto shutdown relay and fuel pump relay.

All inputs to the PCM are converted into signals. Based on these inputs the PCM adjusts air-fuel ratio, ignition timing, turbocharger wastegate and other

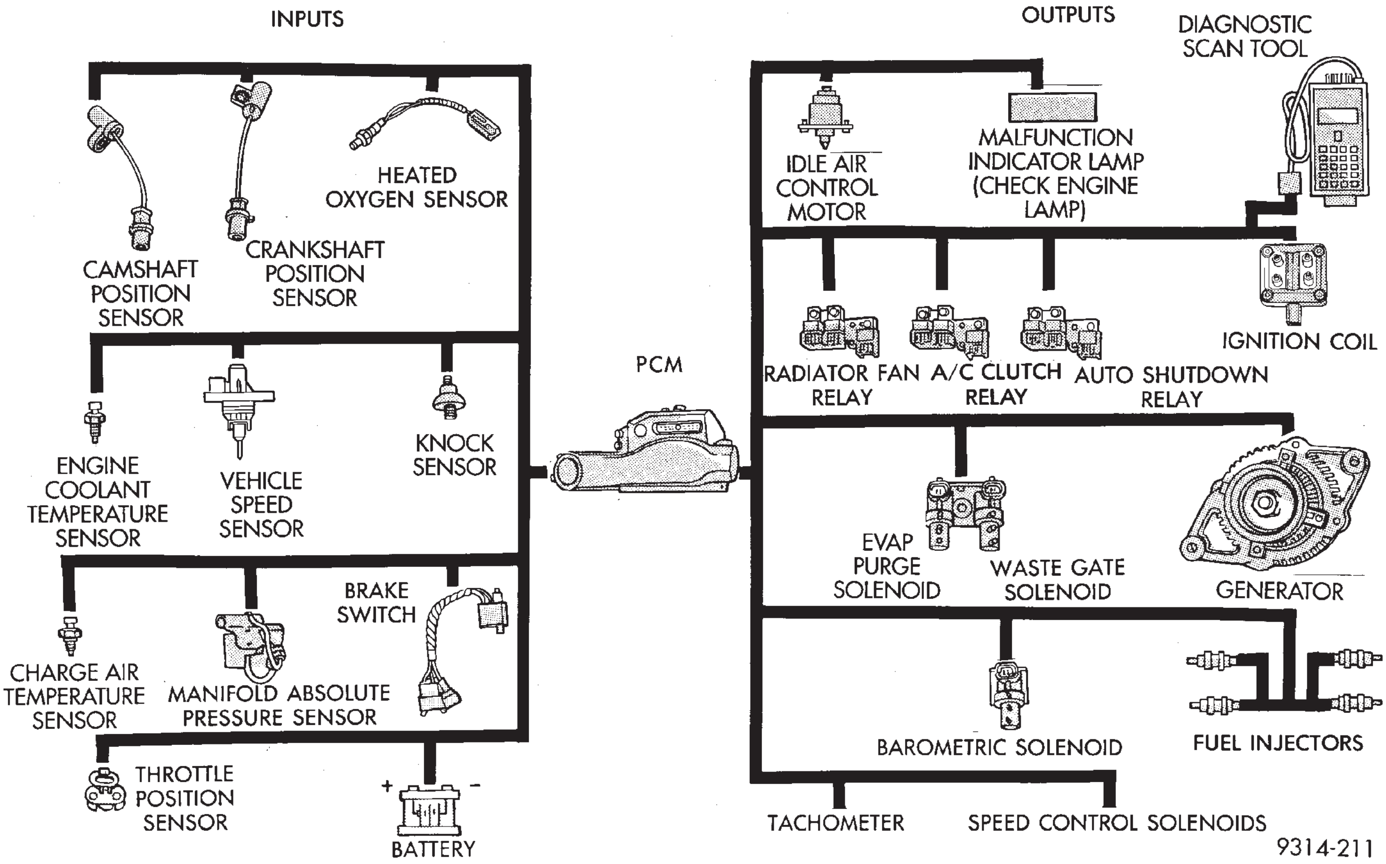


Fig. 1 Electronic Fuel Injection Components

controlled outputs. The PCM adjusts the air-fuel ratio by changing injector pulse width. Injector pulse width is the time an injector is energized.

SYSTEM DIAGNOSIS

The PCM tests many of its own input and output circuits. If a fault is found in a major system, the information is stored in memory. Technicians can display fault information through the malfunction indicator lamp (instrument panel Check Engine lamp). Also, the technician can read fault information by connecting the DRBII scan tool to the data link connector. For diagnostic trouble code information, refer to the 2.2L Turbo III Multi-Port Fuel Injection—On-Board Diagnostics section of this group.

CCD BUS

Various modules exchange information through a communications port called the CCD Bus. The powertrain control module (PCM) transmits vehicle load data on the CCD Bus.

POWERTRAIN CONTROL MODULE

The powertrain control module (PCM) is a digital computer containing a microprocessor (Fig. 2). 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.

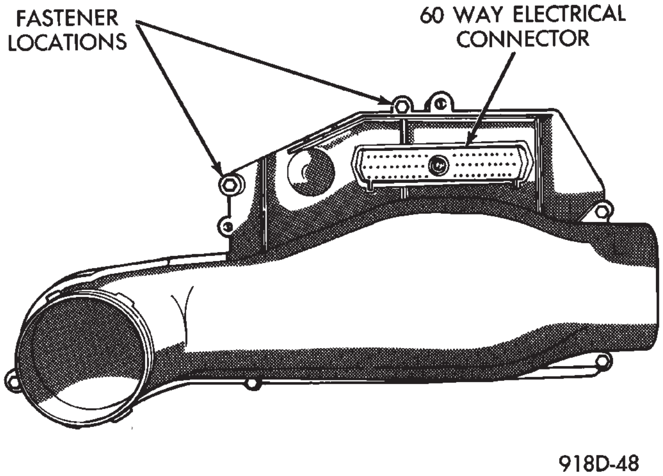


Fig. 2 PCM

PCM Inputs:

- Air Conditioning Controls
- Battery Voltage
- Brake Switch
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Charge Air Temperature Sensor
- Engine Coolant Temperature Sensor
- Knock Sensor

- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensor
- SCI Receive
- Speed Control System Controls
- Throttle Position Sensor
- Vehicle Speed Sensor

PCM Outputs:

- Air Conditioning Clutch Relay
- Generator Field
- Idle Air Control Motor
- Auto Shutdown (ASD) Relay
- Barometric Read Solenoid
- Canister Purge Solenoid
- Malfunction Indicator Lamp (Check Engine Lamp)
- Data Link Connector
- Fuel Injectors
- Ignition Coil
- Radiator Fan Relay
- Speed Control Solenoids
- Tachometer Output
- Wastegate Solenoid

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 operation of the cooling fan, A/C 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
- engine speed (crankshaft position sensor)
- manifold absolute pressure
- throttle position

The PCM adjusts ignition timing based on the following inputs.

- engine coolant temperature
- knock sensor
- engine speed (crankshaft position sensor)
- manifold absolute pressure
- throttle position

The Automatic Shut Down (ASD) and Fuel Pump relays are mounted externally, but turned on and off by the PCM through the same circuit.

The camshaft position sensor 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 injector, 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. The 8.0 volts power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5.0 volts supply for the coolant temperature sensor, manifold absolute pressure sensor and throttle position sensor.

AIR CONDITIONING SWITCH SENSE—PCM INPUT

When the air conditioning or defrost switch is put in the ON position and the low pressure and high pressure switches are closed, the PCM receives an input for air conditioning. 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.

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 vents the speed control servo. Venting the servo turns the speed control system off. The brake switch is mounted on the brake pedal support bracket.

CAMSHAFT POSITION SENSOR—PCM INPUT

Fuel injection synchronization and cylinder identification are provided through the camshaft position sensor (Fig. 3). The sensor generates pulses. The pulse are the input sent to the PCM. The PCM interprets the camshaft position sensor input along with the crankshaft position sensor input to determine crankshaft position. The PCM uses crankshaft position sensor input to determine injector sequence and ignition timing.

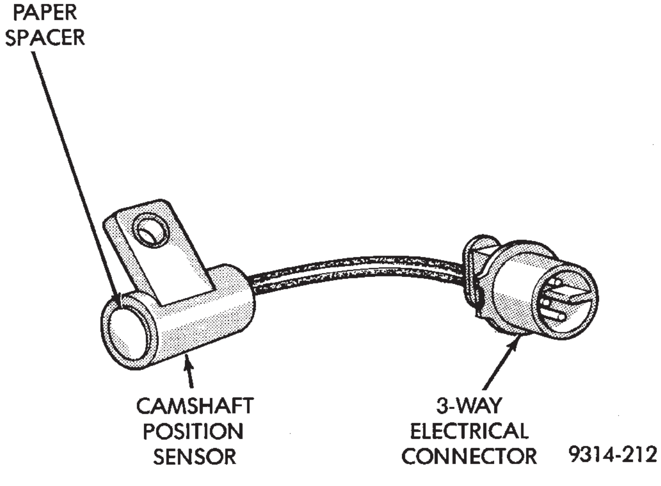


Fig. 3 Camshaft Sensor

The camshaft position sensor senses when a notch in the camshaft gear passes beneath it (Fig. 4). When metal aligns with the sensor, 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 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.

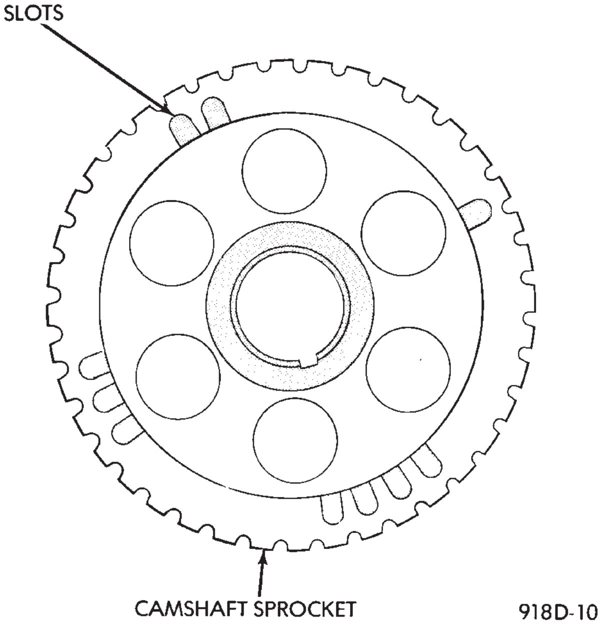


Fig. 4 Camshaft Gear

The camshaft position sensor is mounted on the top of the cylinder head (Fig. 5). 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 2.2L Turbo III Multi-Port Fuel Injection—Service Procedures section in this Group.**

CHARGE AIR TEMPERATURE SENSOR—PCM INPUT

The charge air temperature sensor is mounted to intake manifold. The sensor measures the temperature of the air-fuel mixture (Fig. 6). This information is used by the PCM to modify air/fuel mixture and turbocharger boost level.

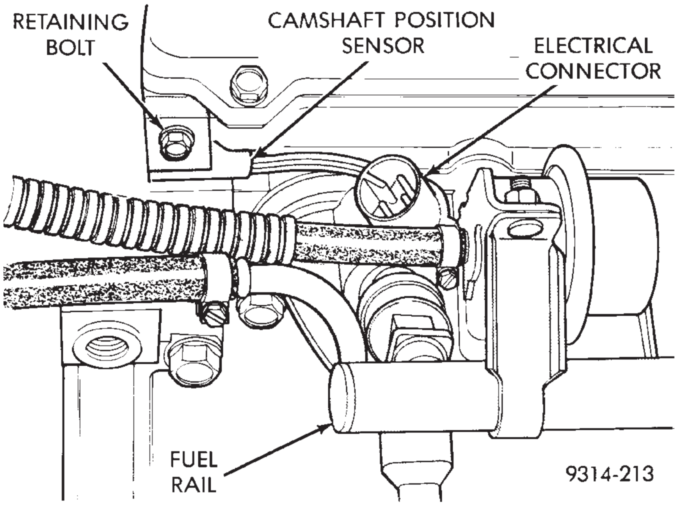


Fig. 5 Camshaft Position Sensor Location

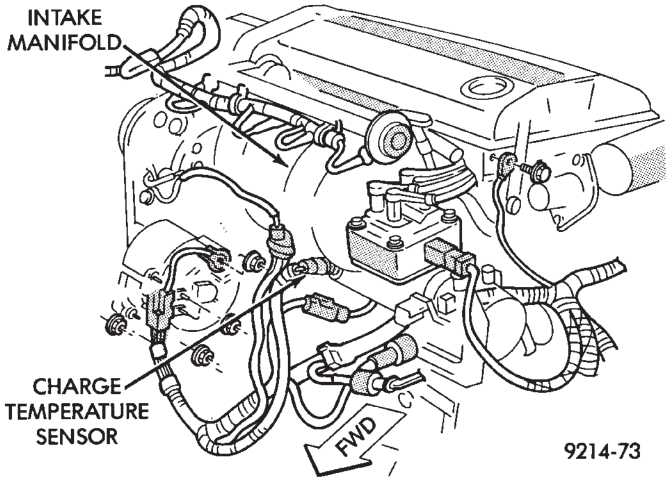


Fig. 6 Charge Air Temperature Sensor

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The coolant temperature sensor is a variable resistor with a range of -40°C to 128°F (-40°F to 265°F). The sensor is installed into the thermostat housing (Fig. 7).

The PCM supplies 5.0 volts to the coolant temperature sensor. The sensor provides an input voltage to the PCM. The PCM determines engine operating temperature from this input. As coolant temperature varies, the sensor resistance changes resulting in a different input voltage to the PCM.

Based on the coolant sensor and charge air temperature sensor inputs the PCM changes certain operating schedules until the engine reaches operating temperature. While the engine warms up, the PCM demands slightly richer air-fuel mixtures, lower boost levels, revised spark advance and higher idle speeds.

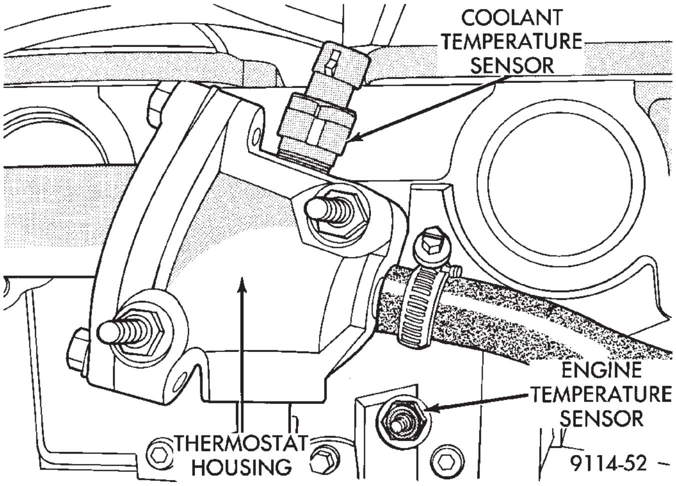


Fig. 7 Coolant Temperature Sensor

CRANKSHAFT POSITION SENSOR—PCM INPUT

The crankshaft position sensor (Fig. 8) senses slots cut into the flywheel. There are a 2 sets of slots. Each set contains 4 slots, for a total of 8 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. 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. The Turbo III engine uses a fixed ignition system. Base timing is not adjustable.

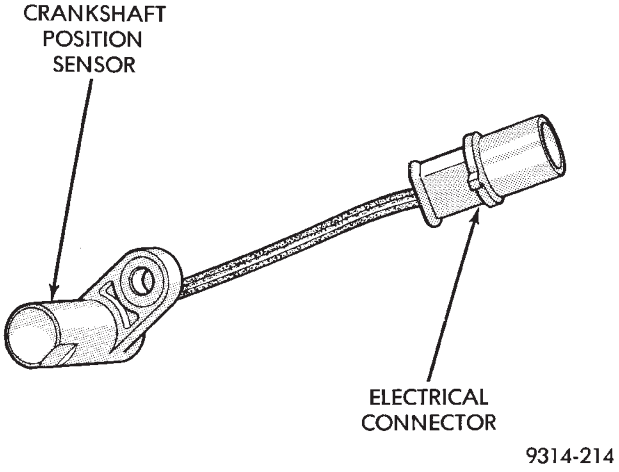


Fig. 8 Crankshaft Position Sensor

The PCM uses the crankshaft position sensor input to determine injector sequence and ignition timing. Once crankshaft position has been determined, the PCM begins energizing the injectors in sequence.

The crankshaft position sensor is located in the transaxle housing, below the throttle body (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 2.2L Turbo III Multi-Port Fuel Injection—Service Procedures section in this Group.**

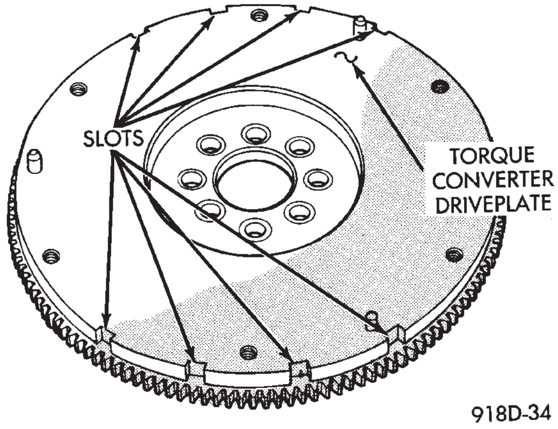


Fig. 9 Timing Slots

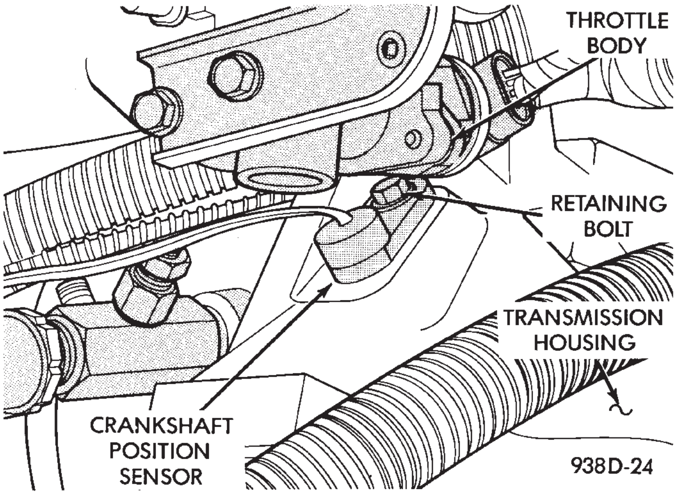


Fig. 10 Crankshaft Position Sensor Location

KNOCK SENSOR—PCM INPUT

The knock sensor generates a signal when spark knock occurs in the combustion chambers. The sensor can detect detonation in the cylinders. The sensor provides information used by the PCM to modify spark advance and boost schedules in order to eliminate detonation.

The knock sensor is installed into the engine, behind the PCV breather/separator (Fig. 11).

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.

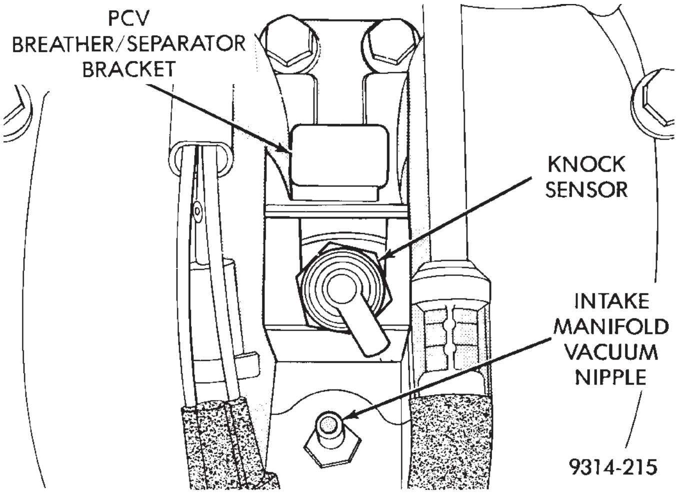


Fig. 11 Knock Sensor

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 and barometric pressure from the MAP sensor voltage. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance, air/fuel mixture and controls the turbocharger wastegate.

The MAP sensor (Fig. 12) mounts underhood on the right side of the engine compartment. The sensor connects electrically to the PCM.

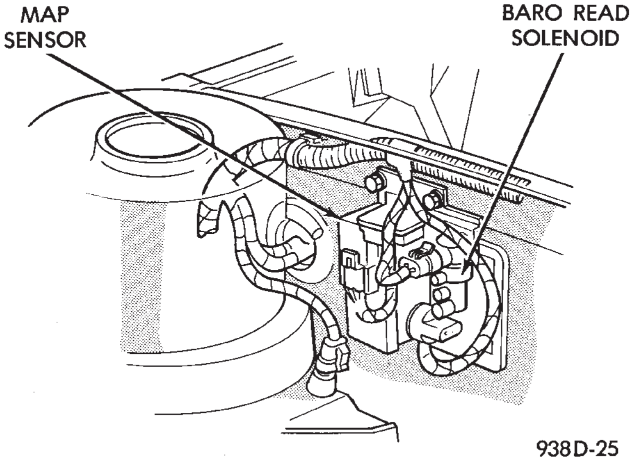


Fig. 12 MAP Sensor

HEATED OXYGEN SENSOR (O_2 SENSOR)—PCM INPUT

The O_2 sensor is located in the turbocharger outlet and provides an input voltage to the PCM (Fig. 13). The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

The O_2 sensor produces 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 sensor 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 sensor acts as a rich-lean switch.

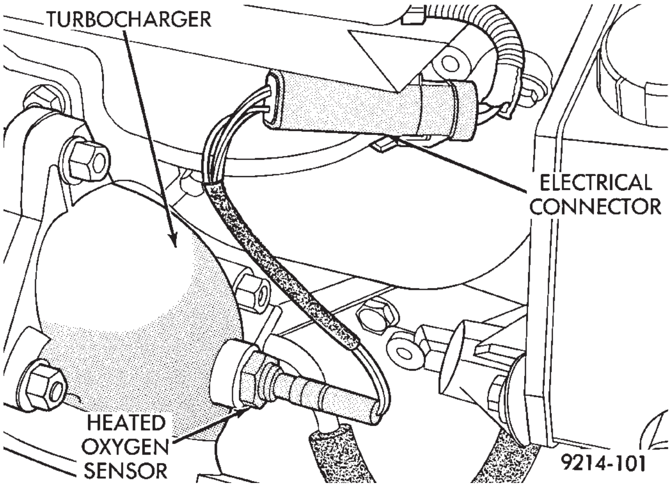


Fig. 13 Heated Oxygen Sensor

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors the O_2 sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O_2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

SPEED CONTROL—PCM INPUT

The speed control system provides four separate voltages (inputs) to the PCM. The voltages correspond to the On/Off, Set, and Resume.

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 a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for further speed control information.

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The Throttle Position Sensor (TPS) is mounted on the throttle body and connected to the throttle blade shaft (Fig. 14). 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.

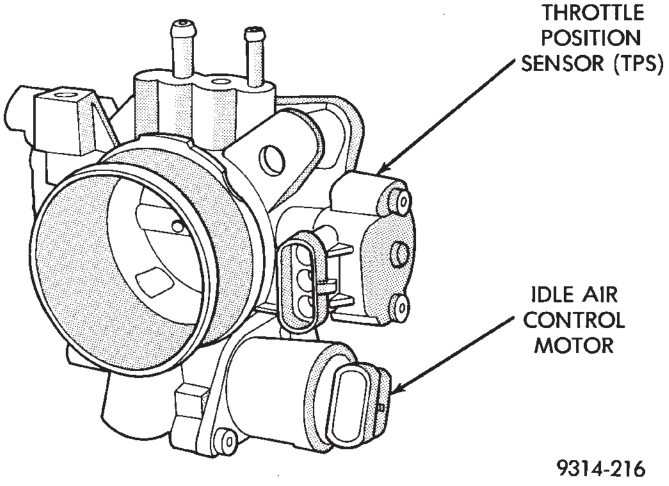


Fig. 14 Throttle Position Sensor and Idle Air Control Motor

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 SENSOR—PCM INPUT

The vehicle speed sensor (Fig. 15) is located on the transaxle extension housing. The sensor input is used by the PCM to determine vehicle speed and distance traveled.

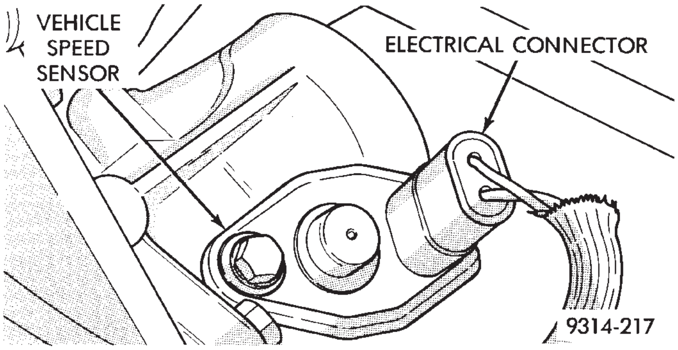


Fig. 15 Vehicle Speed Sensor

The speed sensor generates 8 pulses per sensor revolution. These 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 desired engine speed.

AIR CONDITIONING CLUTCH RELAY—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit. The radiator fan relay supplies battery power to the solenoid side of the A/C clutch relay. The air conditioning clutch relay will not energize unless the radiator fan relay energizes. The PCM energizes the radiator fan relay when the air conditioning or defrost switch is put in the ON position and the low pressure and high pressure switches close. When the PCM senses wide open throttle through the throttle position sensor, or low engine RPM it will de-energize the A/C clutch relay, open it's contacts and prevent air conditioning clutch engagement.

On AG Body vehicles, the relay is located in the power distribution center (Fig. 16).

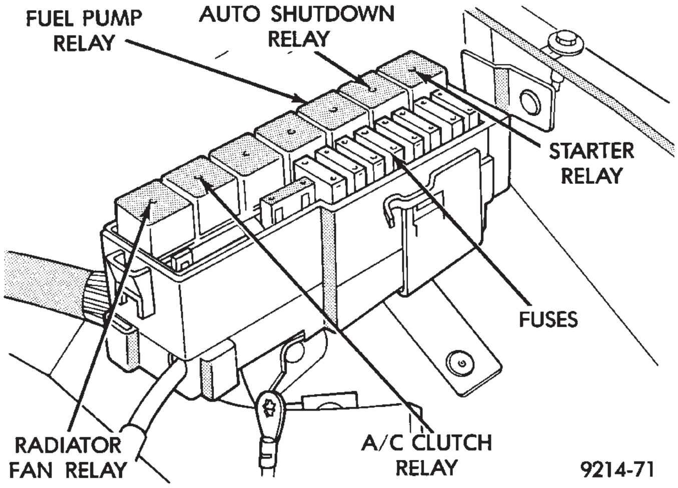


Fig. 16 Power Distribution Center—AG Body

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 charging system information.

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY—PCM OUTPUT

The PCM operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the crankshaft position 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 de-energizes both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

The ASD relay and fuel pump relay are located in the power distribution center (Fig. 16).

IDLE AIR CONTROL MOTOR—PCM OUTPUT

The idle air control motor is mounted on the throttle body (Fig. 14). The PCM operates the motor. 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, camshaft position sensor, crankshaft position sensor, coolant temperature sensor, and various switch operations (brake and air conditioning). Deceleration die out is also prevented by increasing airflow when the throttle is closed quickly after a driving (speed) condition.

BAROMETRIC READ SOLENOID—PCM OUTPUT

The barometric pressure read solenoid is spliced into the manifold absolute pressure (MAP) sensor vacuum hose (Fig. 12). The barometric read solenoid switches the pressure supply to the MAP sensor from either barometric pressure (atmospheric) or manifold vacuum. The PCM operates the solenoid.

Atmospheric pressure is periodically supplied to the MAP sensor to measure barometric pressure. This occurs at closed throttle, once per throttle closure but no more often than once every 3 minutes and within a specified RPM band. Barometric information is used primarily for boost control and start fuel enrichment at various altitudes.

CANISTER PURGE SOLENOID—PCM OUTPUT

Vacuum for the Evaporative Canister is controlled by the Canister Purge Solenoid (Fig. 17). The solenoid is controlled by the PCM.

The PCM operates the solenoid by switching the ground circuit on and off. When grounded, the solenoid energizes and prevents vacuum from reaching the evaporative canister. When not energized the solenoid allows vacuum to flow to the canister.

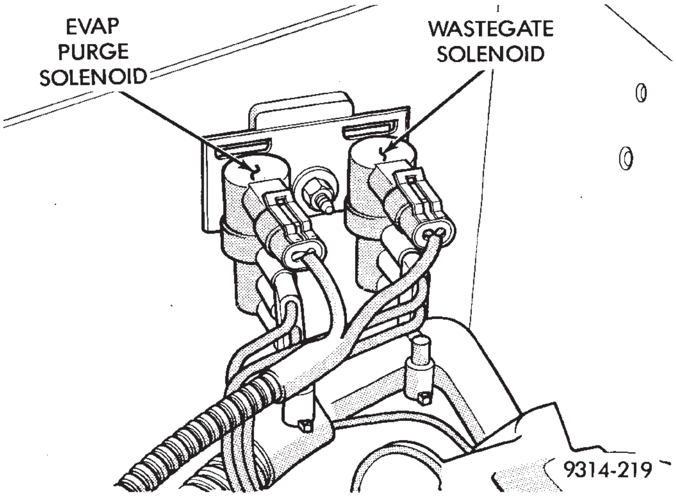


Fig. 17 EVAP Canister Purge Solenoid and Wastegate Control Solenoid

During warm-up and for a specified time period after hot starts the PCM grounds the purge solenoid. Vacuum does not operate the evaporative canister valve.

The PCM removes the ground to the solenoid when the engine reaches a specified temperature and the time delay interval has occurred. When the solenoid is de-energized, vacuum flows to the canister purge valve. Vapors are purged from the canister and flow to the throttle body.

The purge solenoid will also be energized during certain idle conditions, in order to update the fuel delivery calibration.

MALFUNCTION INDICATOR LAMP (CHECK ENGINE)—PCM OUTPUT

The malfunction indicator lamp (instrument panel 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 warns the operator that the PCM has entered a Limp-in mode. During Limp-in-Mode, the PCM attempts to keep the system operational. The malfunction indicator lamp 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.

Signals that can trigger the malfunction indicator lamp (Check Engine Lamp).

- Engine Coolant Temperature Sensor
- Manifold Absolute Pressure Sensor
- Throttle Position Sensor
- Battery Voltage Input
- An Emissions Related System
- Charging system

The malfunction indicator lamp can also be used to display diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within five seconds and any diagnostic trouble codes stored in the PCM will be displayed. Refer to the 2.2L Turbo III Multi-port Fuel Injection—On-Board Diagnostics section of this Group for Diagnostic trouble code Descriptions.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector provides the technician with the means to connect the DRBII scan tool to diagnosis the vehicle.

FUEL INJECTOR—PCM OUTPUT

The Fuel Injectors are electric solenoids driven by the PCM (Fig. 18).

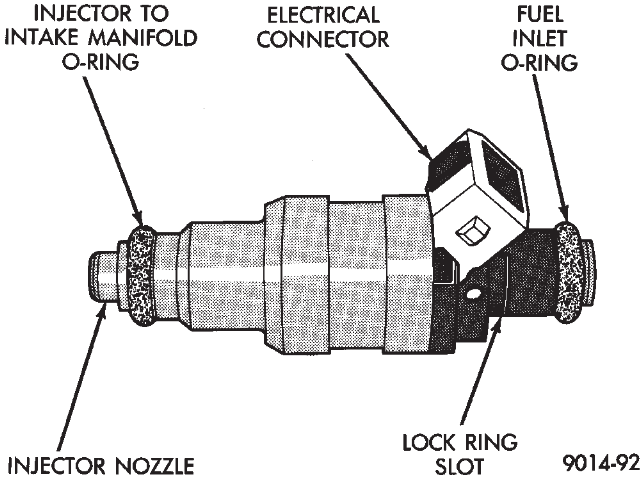


Fig. 18 Fuel Injector

Based on sensor inputs, the PCM determines when and how long the fuel injector should operate. The amount of time an injector fires is referred to as injector pulse width. The auto shutdown (ASD) relay supplies battery voltage to the injector. The PCM supplies the ground path. By switching the ground path on and off, the PCM adjusts injector pulse width.

When the PCM supplies a ground path, a spring loaded needle or armature lifts from its seat and fuel flows through the injector orifice.

Fuel is constantly supplied to the injector at regulated 380 Kpa (55 psi). Unused fuel returns to the fuel tank.

IGNITION COIL—PCM OUTPUT

The Direct Ignition System (DIS) uses a molded coil (Fig. 19). The coil is mounted on the front of the engine. 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.

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/Fuel Pump Relay—PCM Output in this section for relay operation.

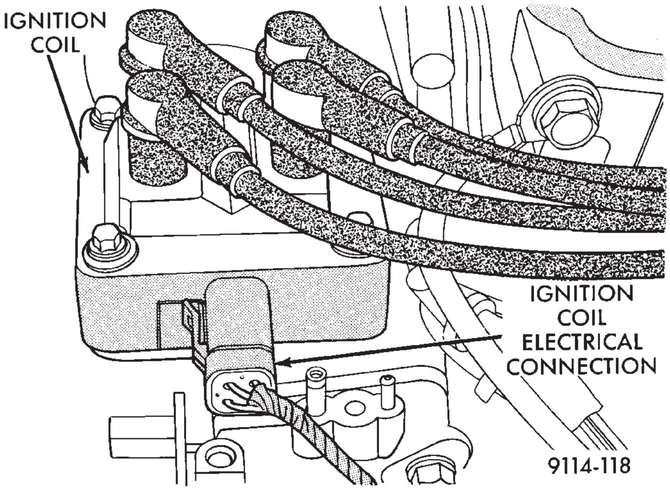


Fig. 19 Ignition Coil

RADIATOR FAN RELAY—PCM OUTPUT

The radiator fan is energized by the PCM through the radiator fan relay. The PCM grounds the radiator fan relay when engine coolant reaches a predetermined temperature. For more information, refer to Group 7, Cooling Systems.

The radiator fan relay is located in the power distribution center (Fig. 16). Refer to the Wiring and Component Identification section of Group 8W.

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 blade. When the PCM supplies a ground only to the vent solenoid, the throttle blade holds position. When the PCM removes the ground from both the vacuum and vent solenoids, the throttle blade closes. The PCM balances 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. Refer to Group 8 for tachometer information.

WASTEGATE CONTROL SOLENOID—PCM OUTPUT

The PCM operates the wastegate control solenoid. The PCM adjusts maximum boost to varying engine conditions by changing the amount of time the solenoid is energized. The solenoid mounts to the passenger side inner fender panel, next to the strut tower (Fig. 17).

MODES OF OPERATION

As input signals to the PCM change, the PCM adjusts its response to the 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 (O_2) sensor is not monitored during OPEN LOOP modes.

During CLOSED LOOP modes, the PCM does monitor the oxygen (O_2) 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 O_2 sensor, the PCM can fine tune the injector pulse width to achieve optimum fuel economy combined with low emissions.

The 2.2L Turbo III 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. The acceleration, deceleration, and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes (under most operating conditions).

IGNITION SWITCH ON (ZERO RPM) MODE

When the ignition switch activates the fuel injection system the following actions occur:

- The PCM calculates basic fuel strategy by determining atmospheric air pressure from the MAP sensor input.
- 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, the auto shutdown (ASD) relay and fuel pump relay are not energized. Therefore battery voltage is not supplied to the fuel pump, ignition coil, fuel injector 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 and crankshaft position sensor signals, it energizes the auto shutdown (ASD) relay and fuel pump relay. These relays supply battery voltage to the fuel pump, fuel injectors, 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 fault into memory.

Once the ASD and fuel pump relays have been energized, the PCM:

- Determines injector pulse width based on coolant temperature, manifold absolute pressure (MAP) and the number of engine revolutions since cranking was initiated.
- Monitors the 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
- knock sensor
- manifold absolute pressure (MAP)
- engine speed (crankshaft position sensor)
- throttle position
- A/C switch
- battery voltage

The PCM provides a ground path for the injectors to precisely control injector pulse width (by switching the ground on and off). The PCM adjusts engine idle speed through the idle air control motor. Also, the PCM regulates ignition timing.

CRUISE OR IDLE MODE

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
- knock sensor
- manifold absolute pressure
- engine speed (crankshaft position sensor)
- throttle position
- exhaust gas oxygen content
- A/C control positions
- battery voltage

The PCM provides a ground path for the injectors to precisely control injector pulse width. The PCM adjusts engine idle speed and ignition timing. The PCM controls 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
- knock sensor
- manifold absolute pressure
- engine speed (crankshaft position sensor)
- 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) at the same time it senses an abrupt decrease in manifold pressure. This indicates a hard deceleration. The PCM modifies the injector sequence. This helps maintain better control of the air-fuel mixture.

WIDE OPEN THROTTLE MODE

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are received by the PCM:

- engine coolant temperature
- knock sensor
- manifold absolute pressure
- engine speed (crankshaft position sensor)
- throttle position

When the PCM senses a wide open throttle condition 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 wide open throttle operation. The PCM will enrichen the air/fuel ratio to increase performance and compensate for increased combustion chamber temperature.

IGNITION SWITCH OFF MODE

This is an OPEN LOOP 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.

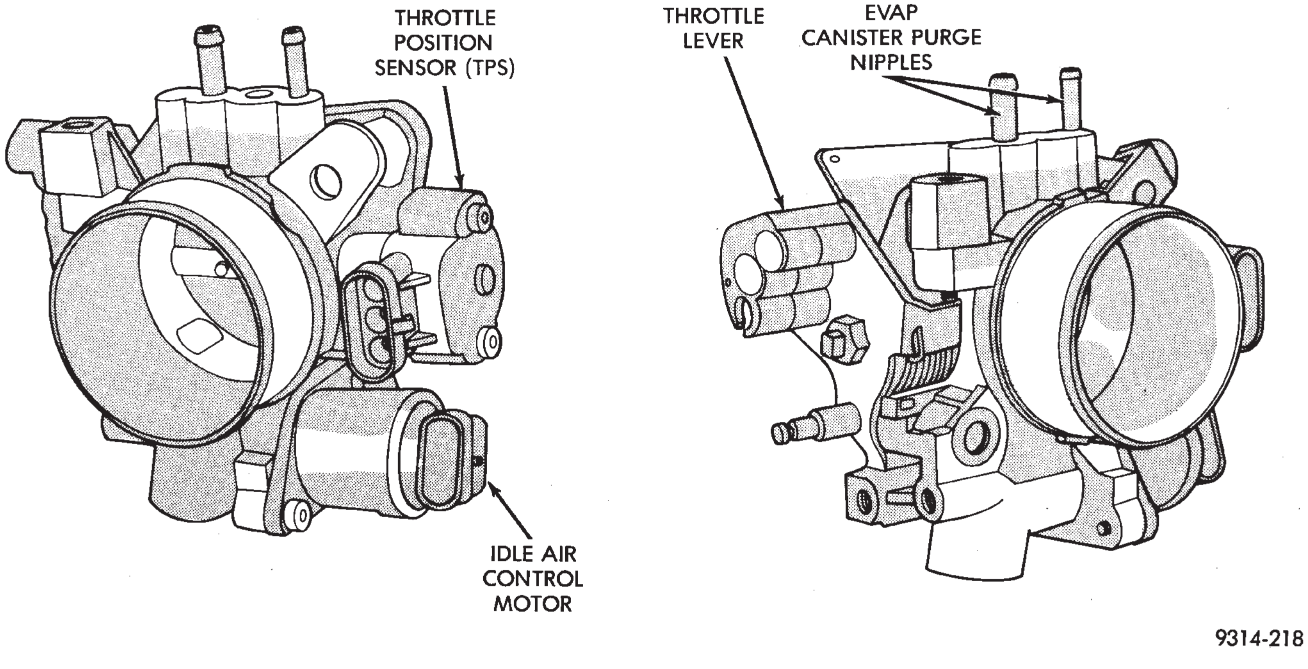


Fig. 20 Throttle Body

THROTTLE BODY

The throttle body assembly is located on the left end of the intake manifold plenum (Fig. 20). 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.

FUEL SUPPLY CIRCUIT

Fuel is pumped to the fuel rail by an electrical pump in the fuel tank. The pump inlet is fitted with a strainer to prevent water and other contaminants from entering the fuel supply circuit.

Fuel pressure is controlled to a preset level above intake manifold pressure by a pressure regulator. The regulator is mounted on the fuel rail (Fig. 21). The regulator uses intake manifold pressure as a reference.

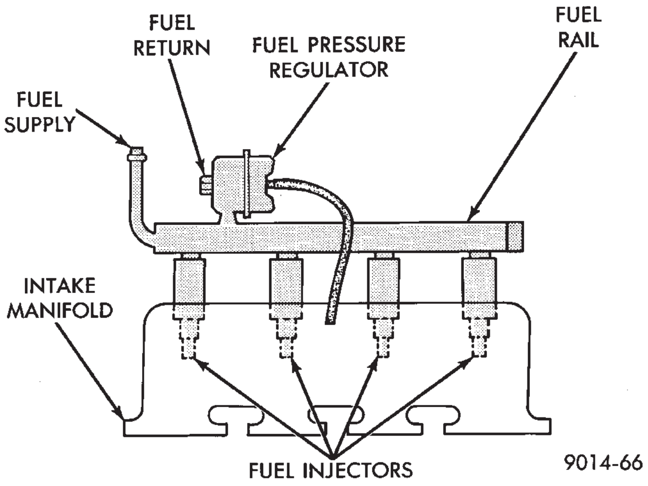


Fig. 21 Fuel Supply Circuit

FUEL INJECTORS AND FUEL RAIL ASSEMBLY

Four fuel injectors are retained in the fuel rail by lock rings. The rail and injector assembly are installed with the injectors inserted into recessed holes in the intake manifold.

FUEL PRESSURE REGULATOR

The pressure regulator is a mechanical device located on the fuel rail, downstream of the fuel injectors (Fig. 22). The regulator maintains a constant 380 kPa (55 psi) across the fuel injector tip.

The regulator contains a spring loaded rubber diaphragm that covers the fuel return port. When the fuel pump is operating, fuel flows past the injectors into the regulator, and is restricted from flowing any further by the blocked return port. When fuel pressure reaches 380 kPa (55 psi) it pushes on the diaphragm, compresses the spring, and uncovers the fuel return port. The diaphragm and spring constantly move from an open to closed position to keep the fuel pressure constant.

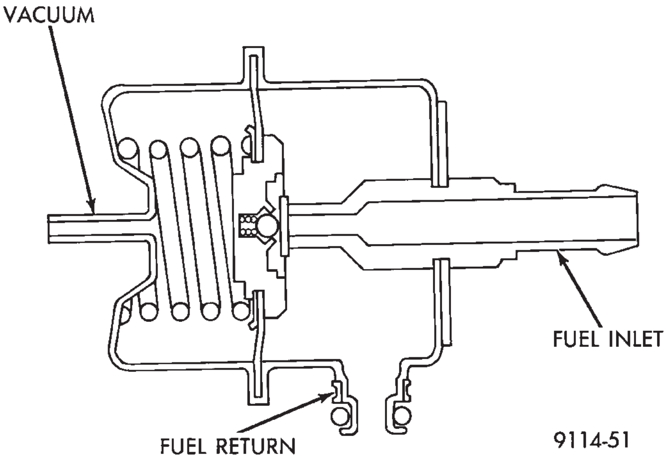


Fig. 22 Fuel Pressure Regulator

2.2L TURBO III MULTI-PORT FUEL INJECTION—GENERAL DIAGNOSIS

INDEX

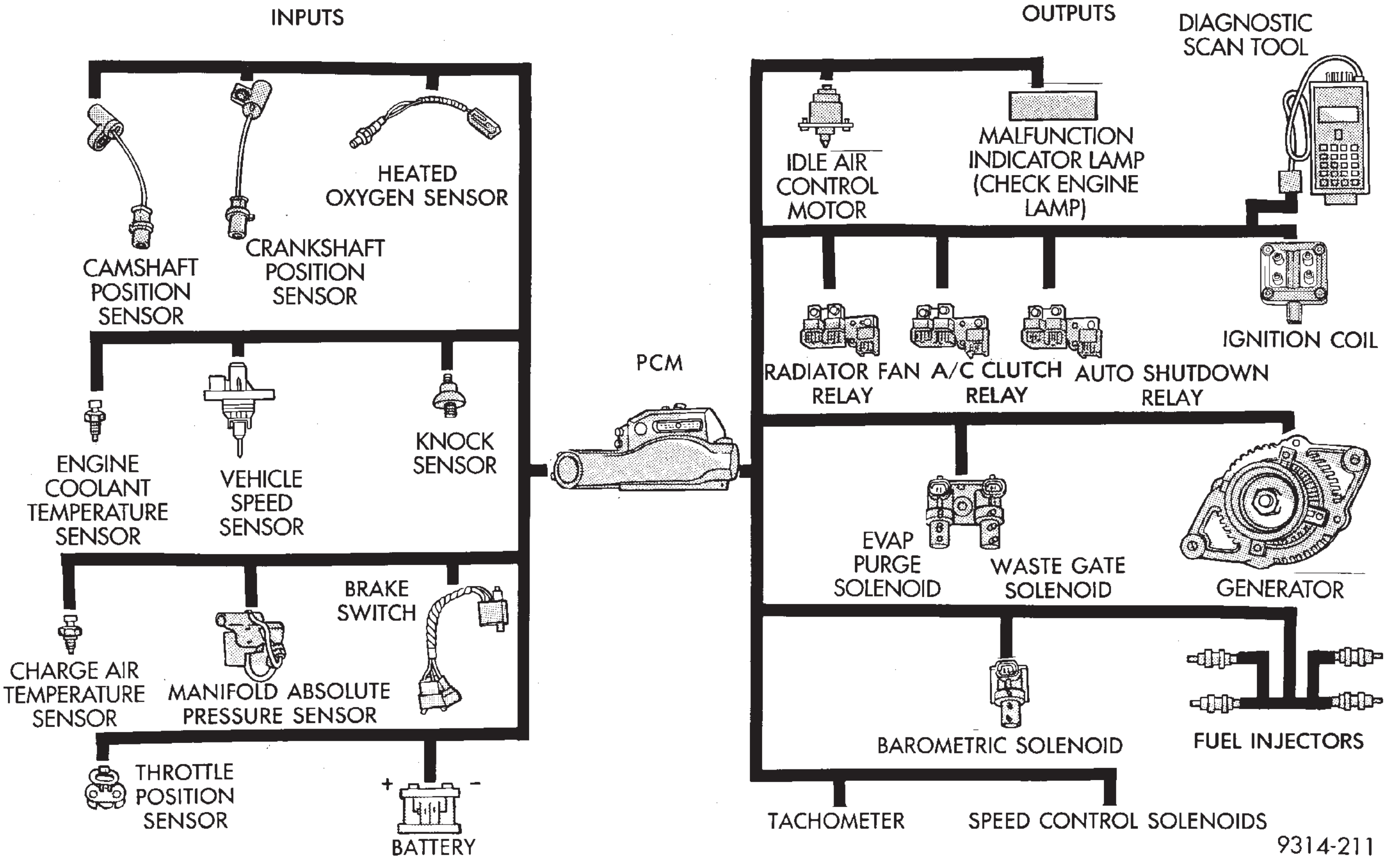


Fig. 1 Multi-port Fuel Injection Components

FUEL SYSTEM DIAGRAM

Refer to the System Operation portion of this section for descriptions of the components shown in Fig. 1.

VISUAL INSPECTION

Perform a visual inspection for loose, disconnected, or misrouted wires and hoses before diagnosing or servicing the fuel injection system. A visual check helps save unnecessary test and diagnostic time. A thorough visual inspection includes the following checks:

(1) Check the ignition coil electrical connections (Fig. 2).

(2) Verify the harness connector is attached to the canister purge solenoid (Fig. 3).

(3) Verify the harness connector is attached to the wastegate solenoid (Figs. 3).

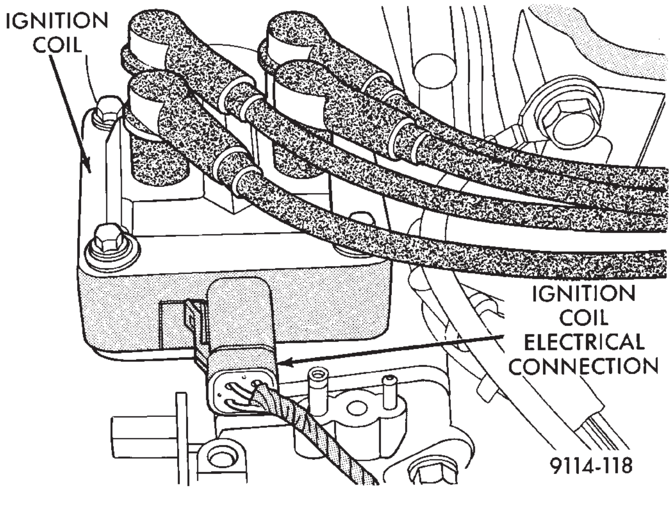


Fig. 2 Ignition Coil Electrical Connection

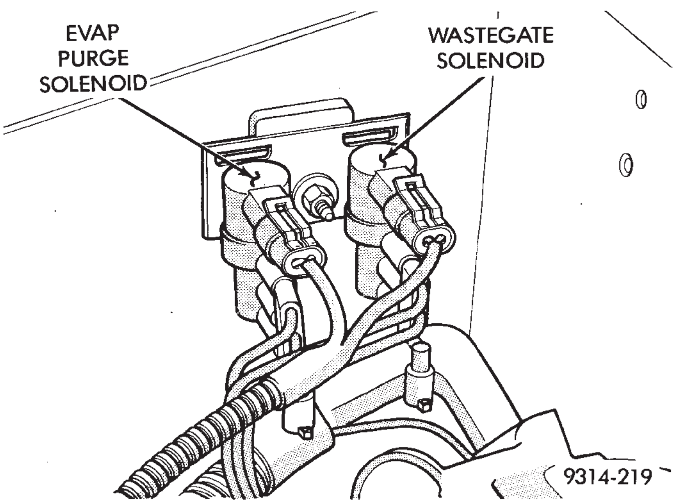


Fig. 3 Solenoid Connections

(4) Verify the harness connector is attached to the MAP sensor (Fig. 4).

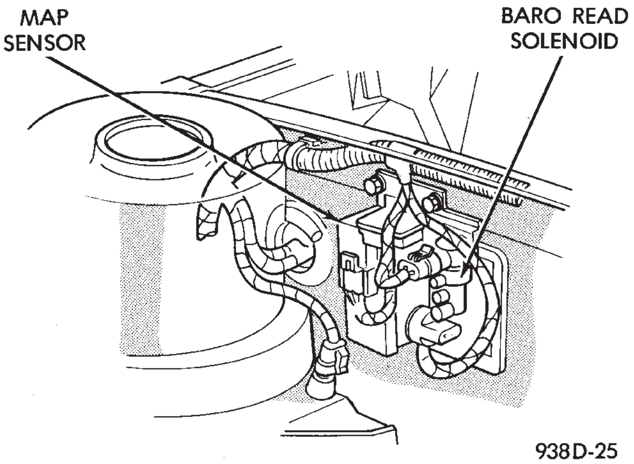


Fig. 4 Barometric/MAP Solenoid Hose Connections

(5) Check vacuum hose connections between vacuum source and canister purge, wastegate, and barometric read solenoids (Figs. 3 and 4).

(6) Verify hoses are securely attached to vapor canister (Fig. 5).

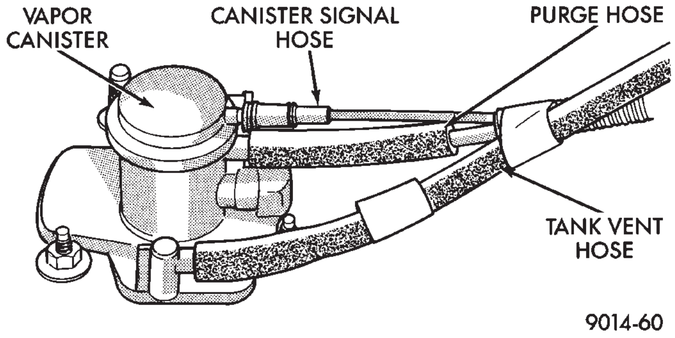


Fig. 5 Vapor Canister

(7) Verify the generator wiring and belt are correctly installed and tightened.

(8) Check ignition cable routing and attachment (Fig. 6).

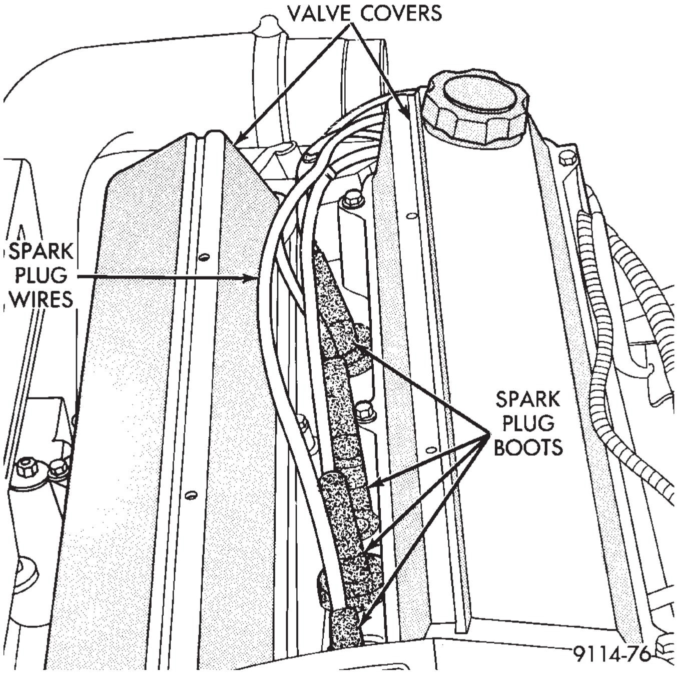


Fig. 6 Ignition Cable Mounting and Attachment

(9) Check oil pressure sending unit electrical connection (Fig. 7).

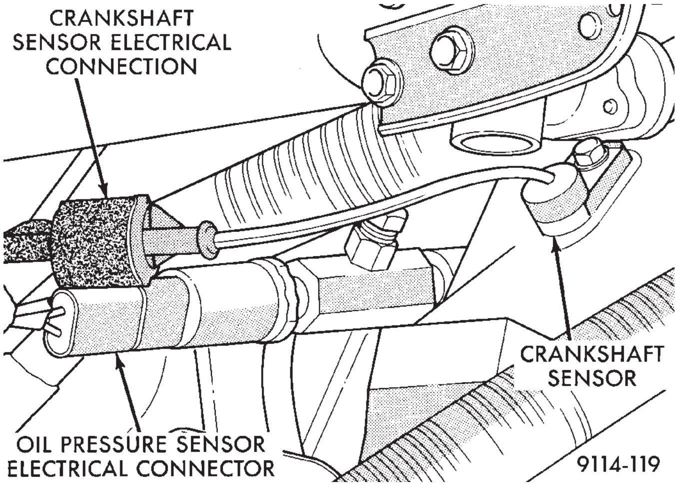


Fig. 7 Oil Pressure Sending Unit and Crankshaft Position Sensor

(10) Check the camshaft position sensor and crankshaft position sensor electrical connections (Figs. 7 and 8).

(11) Check radiator fan electrical connector.

(12) Check electrical connector at the coolant temperature sensor (Fig. 9).

(13) Inspect the engine temperature sensor electrical connection (Fig. 9).

(14) Check the power brake booster and speed control connections (Fig. 10).

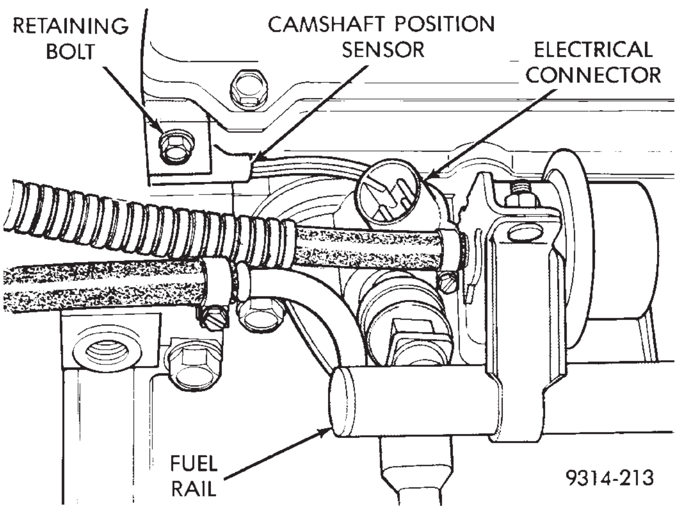


Fig. 8 Camshaft Position Sensor Electrical Connection

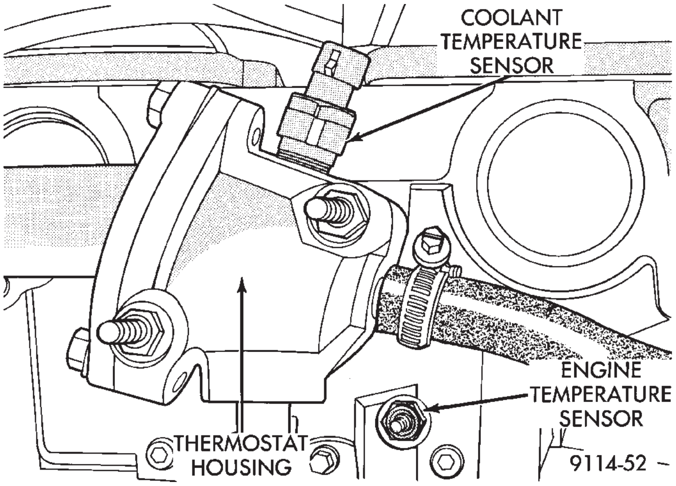


Fig. 9 Coolant Temperature and Engine Temperature Sensor

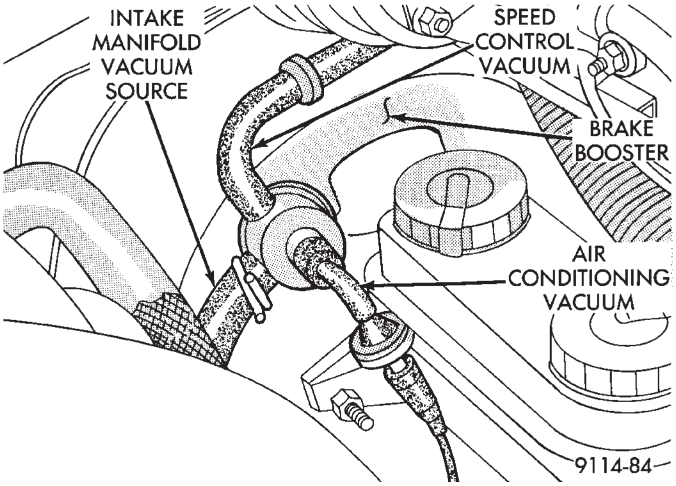


Fig. 10 Power Brake Booster and Speed Control Vacuum Hose Connections

(15) Inspect the engine and fuel injector harness to main harness electrical connections.

(16) Verify that all electrical connectors are fully inserted into relays and that battery connections are clean and tight (Fig. 11).

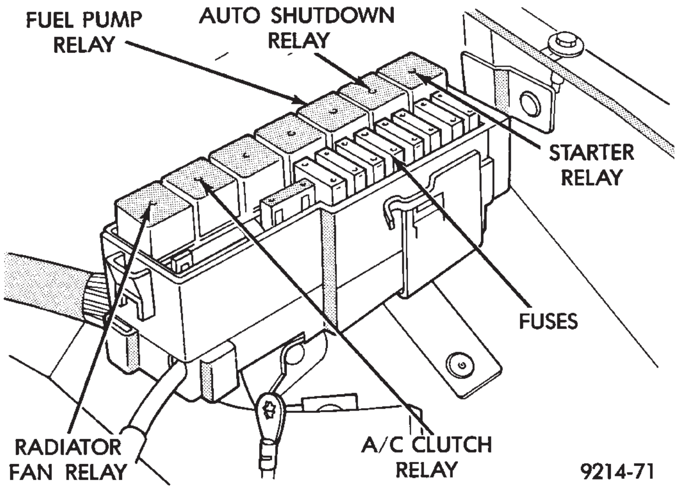


Fig. 11 Power Distribution Center

(17) Check the 60-way electrical connection at the PCM for damage or spread terminals. Verify that the 60-way connector is fully inserted into the socket on the PCM (Fig. 12). Ensure that wires are not stretched or pulled out of the connector.

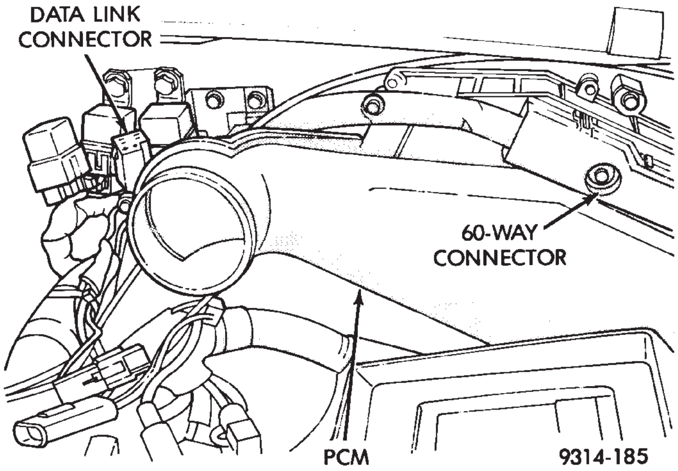


Fig. 12 PCM Electrical Connector

(18) Verify the harness connector is attached to idle air control motor (Fig. 13).

(19) Verify the harness connector is attached to the throttle position sensor (Fig. 13).

(20) Inspect the hose connections at throttle body (Fig. 13).

(21) Verify all hose connections at the intake manifold are secure (Fig. 14).

(22) Check vacuum hose connection between vacuum source and fuel pressure regulator (Fig. 15).

(23) Inspect the charge air temperature sensor electrical connector (Fig. 15).

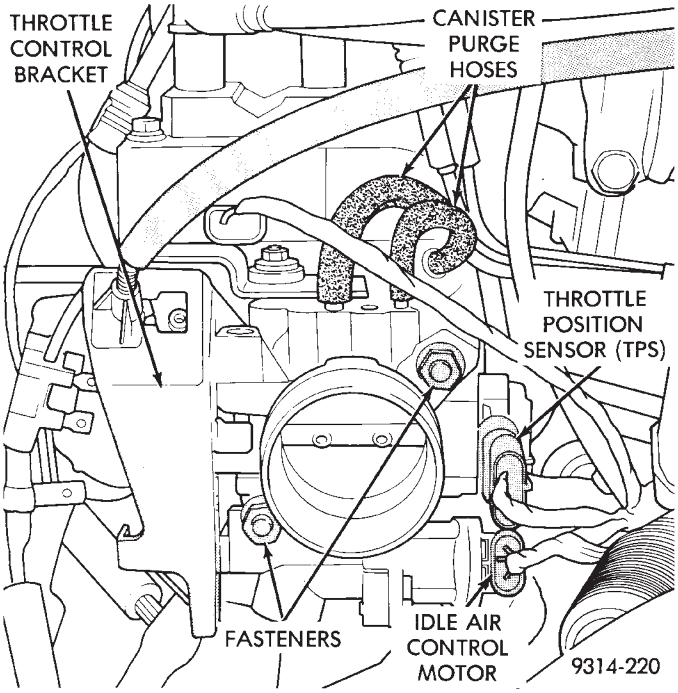


Fig. 13 Throttle Body Electrical and Vacuum Hose Connections

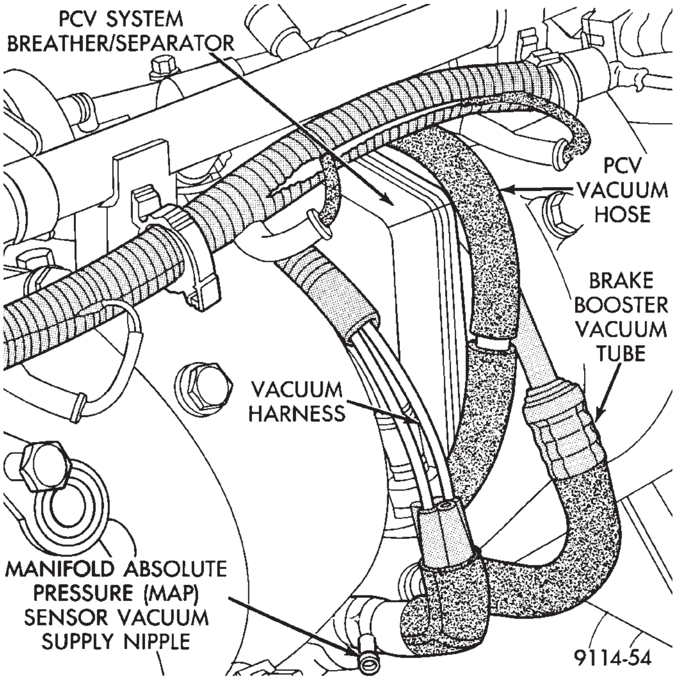


Fig. 14 Intake Manifold Vacuum Connections

(24) Inspect fuel injectors wiring connectors (Fig. 15).

(25) Inspect the knock sensor electrical connector (Fig. 16).

(26) Inspect the heated oxygen sensor electrical connector (Fig. 17).

(27) Verify engine ground strap is attached to the engine and the dash panel.

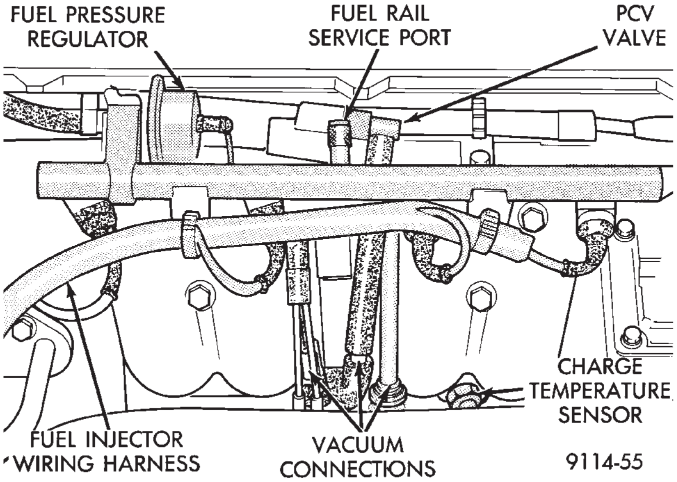


Fig. 15 Vacuum and Electrical Connections

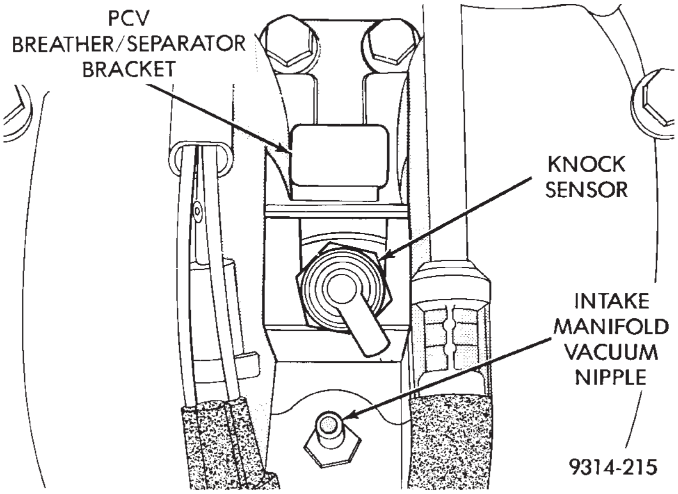


Fig. 16 Knock Sensor

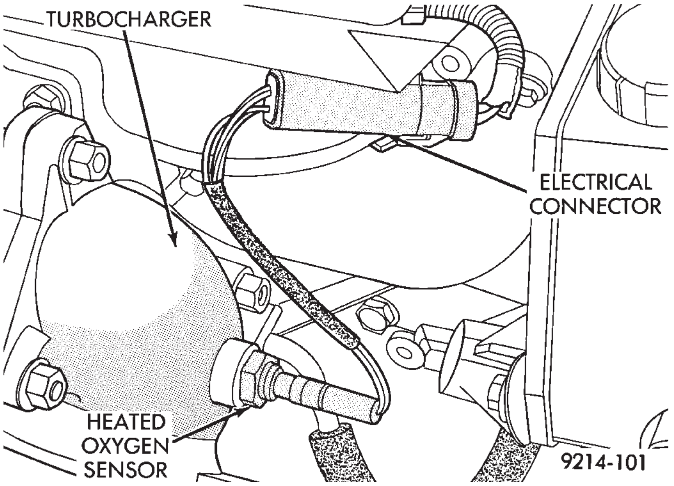


Fig. 17 Heated Oxygen Sensor

(28) Verify the hose connections on the turbo charger are secure (Fig. 18).

(29) Check the turbocharger bypass valve hose connections.

(30) Verify 2-way connector is attached to vehicle speed sensor (Fig. 19).

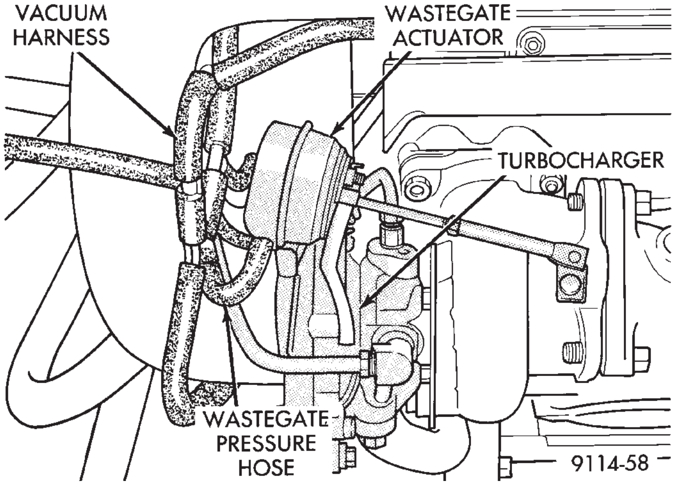


Fig. 18 Hose Connections

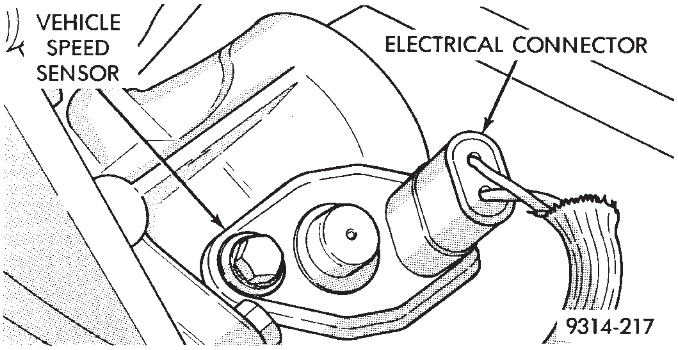


Fig. 19 Vehicle Speed Sensor Wiring Connector

(31) Check hose and wiring connections at fuel pump. Check that wiring connector is making contact with terminals on pump.

2.2L TURBO III MULTI-PORT FUEL INJECTION—ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

The powertrain control module (PCM) has been programmed to monitor many different circuits of the fuel injection system. If a problem is sensed with a monitored circuit often enough to indicate an actual problem, the PCM stores a fault. If the problem is repaired or ceases to exist, the PCM cancels the Diagnostic trouble code after 51 vehicle key on/off cycles.

Certain criteria must be met for a diagnostic trouble code to be entered into PCM memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

It is possible that a diagnostic trouble code for a monitored circuit may not be entered into memory even though a malfunction has occurred. This may happen because one of the diagnostic trouble code criteria for the circuit has not been met. **For example**, assume that one of the diagnostic trouble code criteria for a certain sensor circuit is that the engine must be operating between 750 and 2000 RPM. If the sensor output circuit shorts to ground when engine RPM is above 2400 RPM (resulting in a 0 volt input to the PCM) a diagnostic trouble code will not be entered into memory. This is because the condition does not occur within the specified RPM range.

There are several operating conditions for which the PCM does not monitor and set diagnostic trouble codes. Refer to Monitored Circuits and Non-Monitored Circuits in this section.

Stored diagnostic trouble codes can be displayed either by cycling the ignition key On - Off - On - Off - On, or through use of the DRB II scan tool. The DRBII scan tool connects to the data link connector in the vehicle (Fig. 1).

MONITORED CIRCUITS

The powertrain control module (PCM) can detect certain fault conditions in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if the sensor output (input to PCM) is within proper range. Also, the PCM can determine if the circuit is open or shorted.

Output Device Current Flow - The PCM senses whether the output devices are hooked up. If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground, or shorted high.

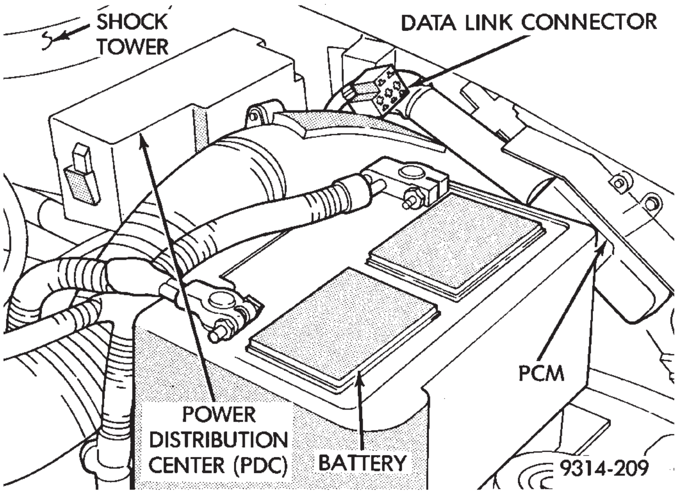


Fig. 1 Data Link Connector Location—AG Body

Oxygen Sensor - The PCM can determine if the oxygen sensor is switching between rich and lean once the system has entered closed loop. Refer to Modes of Operation in this section for an explanation of closed loop operation.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions that result in driveability problems. Diagnostic trouble codes may not be displayed for these conditions. However, problems with these systems may cause diagnostic trouble codes to be displayed for other systems. For example, a fuel pressure problem will not register a fault directly, but could cause a rich or lean condition. This could cause an oxygen sensor fault to be stored in the PCM.

Fuel Pressure - Fuel pressure is controlled by the fuel pressure regulator. The PCM cannot detect a clogged fuel pump inlet strainer, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

Secondary Ignition Circuit - The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

Engine Timing - The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket and crankshaft sprocket. However, these could result in a rich or lean condition causing an oxygen sensor fault.

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, the pintle is sticking or the wrong injector is installed. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

Excessive Oil Consumption - Although the PCM monitors exhaust stream 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.

Evaporative System - The PCM will not detect a restricted, plugged or loaded evaporative purge canister.

Vacuum Assist - Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM. However, these could result in a MAP sensor fault being stored in the PCM.

PCM System Ground - The PCM cannot determine a poor system ground. However, a diagnostic trouble code may be generated as a result of this condition.

PCM Connector Engagement - The PCM cannot determine spread or damaged connector pins. However, a diagnostic trouble code may be generated as a result of this condition.

HIGH AND LOW LIMITS

The powertrain control module (PCM) compares input signal voltages from each input device with established high and low limits that are programmed into it for that device. If the input voltage is not within specifications and other diagnostic trouble code criteria are met, a diagnostic trouble code will be stored 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 a fault condition can be verified.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

When a diagnostic trouble code appears, it indicates the powertrain control module (PCM) has recognized an abnormal condition in the system. Diagnostic trouble codes can be obtained from the malfunction indicator lamp (Check Engine lamp on the instrument panel) or from the DRBII scan tool. Diagnostic trouble codes indicate the results of a failure but do not identify the failed component directly.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
11	No reference Signal During Cranking	No distributor reference signal detected during engine cranking.
13+**	Slow change in Idle MAP signal or No change in MAP from start to run	MAP output change is slower and/or smaller than expected. No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14+**	MAP voltage too low or MAP voltage too High	MAP sensor input below minimum acceptable voltage. MAP sensor input above maximum acceptable voltage.
15**	No vehicle speed signal	No vehicle distance (speed) sensor signal detected during road load conditions.
16	Knock sensor circuit	An open or shorted condition detected in the knock sensor circuit.
17	Engine is cold too long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O_2 signal stays at center or O_2 signal shorted to voltage	Neither rich or lean condition detected from the oxygen sensor input. Oxygen sensor input voltage maintained above the normal operating range.
22+**	Coolant sensor voltage too high or Coolant sensor voltage too low	Coolant temperature sensor input above the maximum acceptable voltage. Coolant temperature sensor input below the minimum acceptable voltage.
23	Charge Temperature voltage low or Charge Temperature voltage high	Charge air temperature sensor input below the minimum acceptable voltage. Charge air temperature sensor input above the maximum acceptable voltage.
24+**	Throttle position sensor voltage high or Throttle position sensor voltage low	Throttle position sensor input above the maximum acceptable voltage. Throttle position sensor input below the minimum acceptable voltage.
25**	Idle air control motor circuits	An open or shorted condition detected in one or more of the idle air control motor circuits.
27	Injector control circuit (DRB II)	Injector output driver does not respond properly to the control signal (DRB II specifies the injector by cylinder number).
31**	Purge solenoid circuit	An open or shorted condition detected in the EVAP purge solenoid circuit.

\+ Check Engine Lamp On

** Check Engine Lamp On (California Only)

9314-244

DIAGNOSTIC TROUBLE CODE DESCRIPTION (CON'T)

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
33	A/C clutch relay circuit	An open or shorted condition detected in the A/C clutch relay circuit.
34	Speed control solenoid circuits	An open or shorted condition detedted in the speed control vacuum or vent solenoid circuits.
35	Radiator fan relay circuits	An open or shorted condition detected in the radiator fan circuit
36+**	Wastegate solenoid circuit	An open or shorted condition detected in the turbocharger wastegate solenoid circuit.
41+**	Generator field not switching properly	An open or shorted condition detected in the generator field control circuit.
42	Auto shutdown relay control circuit	An open or shorted condition detected in the auto shutdown relay circuit.
43	Ignition coil #1 primary circuit or Ignition coil #2 primary circuit	Peak primary circuit current not achieved with maximum dwell time. Peak primary circuit current not achieved with maximum dwell time.
45	Turbo boost limit exceeded	MAP sensor reading above overboost limit detected during engine operation.
46+**	Charging system voltage too high	Battery voltage sense input above target charging voltage during engine operation.
47+**	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 alternator output.
51**	O_2 signal stays below center (lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**	O_2 signal stays above center (rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53	Internal PCM	PCM internal fault condition detected.
54	No camshaft position sensor signal	No camshaft position sensor (fuel sync) signal detected during engine rotation.
61**	Baro read solenoid circuit	An open or shorted condition detected in the baro read solenoid circuit.

+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-245

DIAGNOSTIC TROUBLE CODE DESCRIPTION (CON'T)

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
63	PCM EEPROM write denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
55	N/A	Completion of fault code display on Check Engine lamp.

+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-246

SYSTEM TESTS

Apply parking brake and/or block wheels before performing idle check or adjustment, or any engine running tests.

OBTAINING DIAGNOSTIC TROUBLE CODES

(1) Connect DRBII scan tool to the data link connector (Fig. 1).

(2) Start the engine if possible, cycle the trans mission selector and the **A/C** switch if applicable. Shut off the engine.

(3) Turn the ignition switch on, access Read Fault Screen. Record all the fault messages shown on the DRBII scan tool. Observe the malfunction indicator lamp (check engine lamp on the instrument panel). The lamp should light for 2 seconds then go out (bulb check).

Diagnostic trouble code erasure: access erase diagnostic trouble code data.

STATE DISPLAY TEST MODE

The switch inputs used by the powertrain control module (PCM) have only 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 display changes, assume the entire switch circuit to the PCM is functional. From the state display screen access either State Display Inputs and Outputs or State Display Sensors.

STATE DISPLAY INPUTS AND OUTPUTS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Inputs and Outputs. The following is a list of the engine control system functions accessible through the Inputs and Outputs screen.

Speed Control Resume
Brake Switch
Speed Control On/Off
Speed Control Set
A/C Switch Sense
S/C Vent Solenoid
S/C Vacuum Solenoid
A/C Clutch Relay
Baro Read Solenoid
Wastegate Solenoid
Auto Shutdown Relay
Radiator Fan Relay
Purge Solenoid
Malfunction Indicator Lamp (Check Engine Lamp)

STATE DISPLAY SENSORS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following is a list of the engine control system functions accessible through the Sensor Display screen.

Oxygen Sensor Signal
Coolant Temperature
Coolant Temp Sensor
Throttle Position
Minimum Throttle
Knock Sensor Signal
Battery Voltage
MAP Sensor Reading
Idle Air Control Motor Position
Adaptive Fuel Factor
Barometric Pressure
Min Airflow Idle Spd (speed)
Engine Speed
DIS Sensor Status
Fault #1 Key-On Info
Module Spark Advance
Cyl 1 Knock Retard
Cyl 2 Knock Retard
Cyl 3 Knock Retard
Cyl 4 Knock Retard
Boost Pressure Goal
Charge Temperature
Charge Temp Sensor
Speed Control Target
Fault #2 Key-on Info
Fault #3 Key-on Info
Speed Control Status
Charging System Goal
Theft Alarm Status

Wastegate Duty Cycle
Battery Temperature
Map Sensor Voltage
Vehicle Speed
Oxygen Sensor State
Baro Read Update
MAP Gauge Reading
Throttle Opening (percentage)
Total Spark Advance

CIRCUIT ACTUATION TEST MODE

The purpose of the circuit actuation test mode is to check for the proper operation of output circuits or devices which the powertrain control module (PCM) cannot internally recognize. The PCM can attempt to activate these outputs and allow an observer to verify proper operation. Most of the tests available in this mode provide an audible or visual indication of device operation (click of relay contacts, spray fuel, etc.). With the exception of an intermittent condition, if a device functions properly during its test, assume the device, its associated wiring, and its driver circuit are in working order.

OBTAINING CIRCUIT ACTUATION TEST

Connect the DRBII scan tool to the vehicle and access the Actuators screen. The following is a list of the engine control system functions accessible through Actuators screens.

Stop All Tests
Ignition Coil #1
Ignition Coil #2
Fuel Injector #1
Fuel Injector #2
Fuel Injector #3
Idle Air Control Motor Open/Close
Radiator Fan Relay
A/C Clutch Relay
Auto Shutdown Relay
Purge Solenoid
S/C Serv Solenoids
Generator Field
Tachometer Output
Wastegate Solenoid
Baro Read Solenoid
All Solenoids/Relays
Speed Control Vent Solenoid
Speed Control Vacuum Solenoid
ASD Fuel System Test
Fuel Injector #4

THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE

(1) Warm the engine in neutral until the cooling fan has cycled on and off at least once.

(2) Shut off engine.

(3) Hook-up Tachometer.

(4) Disconnect the PCV valve hose from the nipple on the intake manifold.

(5) Attach air metering fitting, special tool 6457 (0.125 inch orifice), to the intake manifold PCV nipple.

(6) Disconnect 3/16 inch manifold vacuum purge line from the top of the throttle body. Cap the 3/16 inch throttle body nipple.

(7) Connect DRBII scan tool.

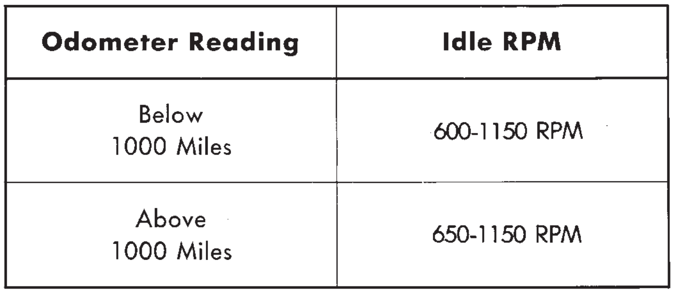
(8) Restart engine. Allow engine to idle for at least one minute.

(9) Using the DRBII scan tool, access Min. Airflow Idle Spd. The following will then occur:

- Idle air control motor will fully close.
- Idle spark advance will become fixed.
- Engine RPM will be displayed on the DRBII scan tool.

(10) Check idle RPM with tachometer, if idle RPM is within the below specification then the throttle body minimum airflow is set correctly.

IDLE SPECIFICATIONS



Odometer Reading	Idle RPM
Below 1000 Miles	600-1150 RPM
Above 1000 Miles	650-1150 RPM

9214-102

If the idle RPM is not within specification, replace the throttle body.

(11) Shut off engine.

(12) Remove air metering fitting 6457 from the intake manifold PCV nipple. Connect the PCV hose to the nipple.

(13) Remove DRBII scan tool.

(14) Disconnect tachometer.

(15) Reconnect purge line to throttle body.

IGNITION TIMING PROCEDURE

Ignition timing cannot be changed or set on the Turbo III engine. Refer to Group 8D for a description of the Direct Ignition System (DIS).

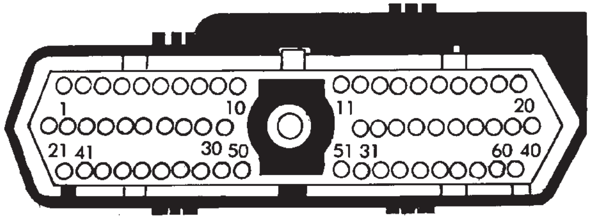
60-WAY PCM WIRING CONNECTOR

Refer to the PCM wiring connector diagram (Fig. 2) for information regarding wire colors and cavity numbers.

CAV	WIRE COLOR	DESCRIPTION
1	DG/RD*	MAP SENSOR
2	TN/BK*	COOLANT SENSOR
3	RD/WT*	DIRECT BATTERY VOLTAGE
4	BK/LB*	SENSOR RETURN
5	BK/WT*	SIGNAL GROUND
6	VT/WT*	5.0 VOLT OUTPUT (MAP AND TPS)
7	OR	8.0 VOLT OUTPUT
8		
9	DB	A21 SUPPLY (IGNITION START/RUN)
10		
11	BK/TN*	POWER GROUND
12	BK/TN*	POWER GROUND
13	LB/BR	INJECTOR DRIVER #4
14	YL/WT*	INJECTOR DRIVER #3
15	TN	INJECTOR DRIVER #2
16	WT/DB*	INJECTOR DRIVER #1
17	DB/YL*	IGNITION COIL DRIVER #2
18		
19	BK/GY*	IGNITION COIL DRIVER #1
20	DG	GENERATOR FIELD CONTROL
21	BK/RD*	CHARGE AIR TEMPERATURE SENSOR
22	OR/DB*	THROTTLE POSITION SENSOR (TPS)
23	RD/LG*	SPEED CONTROL SENSE
24	GY/BK*	CRANKSHAFT POSITION SENSOR
25	PK	SCI TRANSMIT
26	VT/BR*	CCD BUS (+)
27	BR	A/C SWITCH SENSE
28		
29	WT/PK*	BRAKE SWITCH
30	BR/LB*	BACK UP LAMP SWITCH
31	DB/PK*	RADIATOR FAN RELAY
32	BK/PK*	CHECK ENGINE LAMP
33	TN/RD*	SPEED CONTROL VACUUM SOLENOID
34	DB/OR*	A/C CLUTCH RELAY
35		
36	LG/BK*	WASTEGATE SOLENOID
37		
38		
39	GY/RD*	IDLE AIR CONTROL MOTOR DRIVER #3
40	BR/WT*	IDLE AIR CONTROL MOTOR DRIVER #1
41	BK/DG*	OXYGEN SENSOR SIGNAL
42	BK/LG*	KNOCK SENSOR SIGNAL
43	GY/LB*	TACHOMETER SIGNAL OUTPUT
44	TN/YL*	CAMSHAFT POSITION SENSOR
45	LG	SCI RECEIVE
46	WT/BK*	CCD BUS (-)
47	WT/OR*	SPEED SENSOR SIGNAL
48		
49		
50		
51	DB/YL*	AUTO SHUTDOWN (ASD) RELAY
52	PK/BK*	EVAP PURGE SOLENOID
53	LG/RD*	SPEED CONTROL VENT SOLENOID
54		
55	LB	BARO. PRESS. READ SOLENOID
56		
57	DG/OR*	A142 CIRCUIT VOLTAGE SENSE
58		
59	VT/BK*	IDLE AIR CONTROL MOTOR DRIVER #4
60	YL/BK*	IDLE AIR CONTROL MOTOR DRIVER #2

WIRE COLOR CODES					
		LB	LIGHT BLUE	VT	VIOLET
BK	BLACK	LG	LIGHT GREEN	WT	WHITE
BR	BROWN	OR	ORANGE	YL	YELLOW
DB	DARK BLUE	PK	PINK	*	WITH TRACER
DG	DARK GREEN	RD	RED		
GY	GRAY	TN	TAN		

CONNECTOR
TERMINAL SIDE
SHOWN



9314-247

Fig. 2 60-Way PCM Wiring Connector

2.2L TURBO III MULTI-PORT FUEL INJECTION—SERVICE PROCEDURES

INDEX

THROTTLE BODY

When servicing throttle body components, always reassemble components with new O-rings and seals where applicable (Fig. 1). 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.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

CAUTION: The fuel system is under a constant pressure of approximately 380 kPa (55 psi). Before servicing the fuel pump, fuel lines, fuel filter, throttle body, or fuel injectors, the fuel system pressure must be released.

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap.

(3) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 2).

(4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect the other end of hose C-4799-1 to the fuel pressure test port. Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

(5) Continue fuel system service.

THROTTLE POSITION SENSOR (TPS)

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Disconnect harness connector from throttle position sensor (Fig. 3).

(3) Remove throttle position sensor mounting screws.

(4) Lift throttle position sensor off throttle shaft.

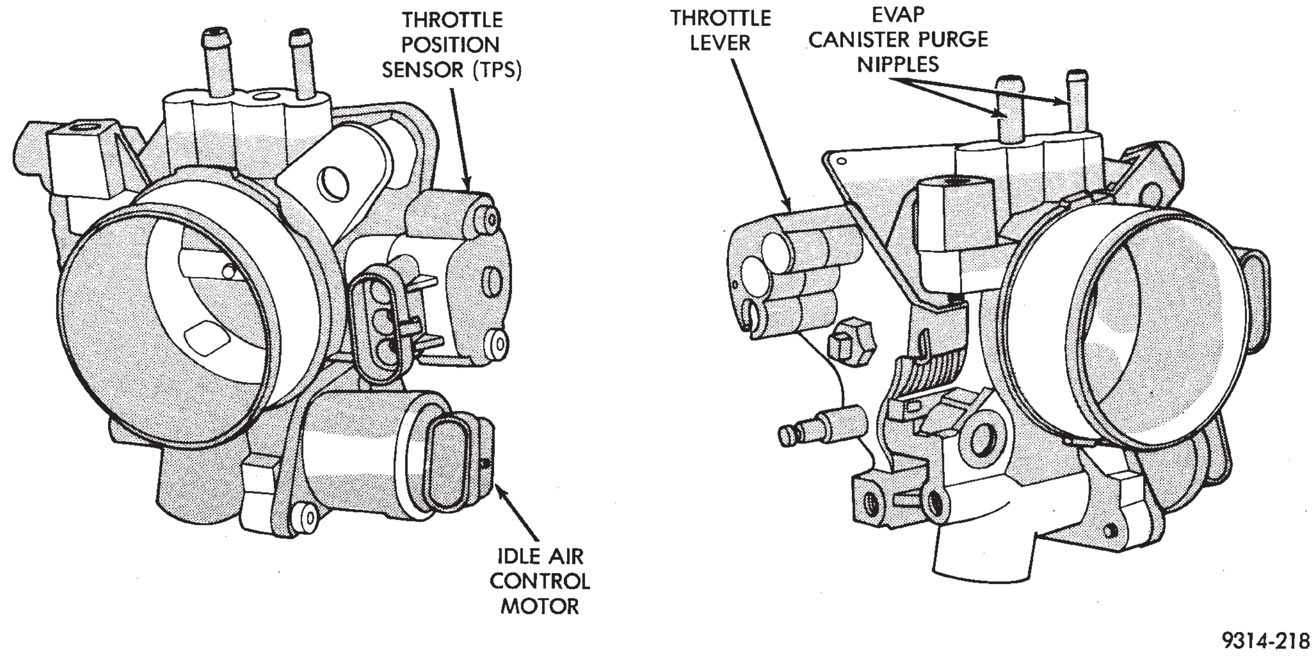


Fig. 1 Throttle Body

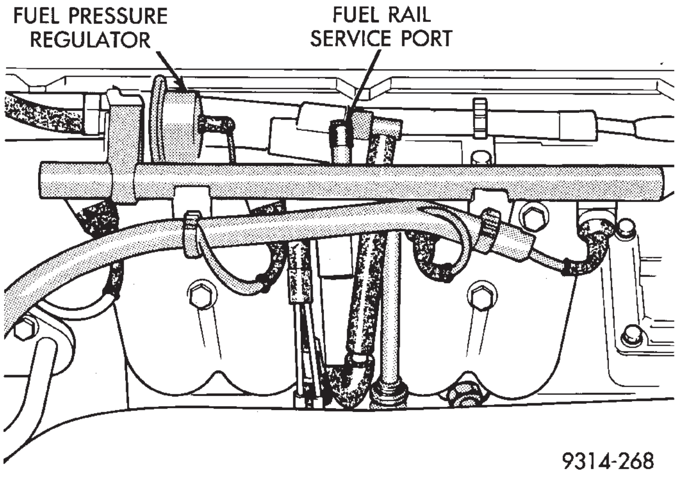


Fig. 2 Fuel Pressure Test Port

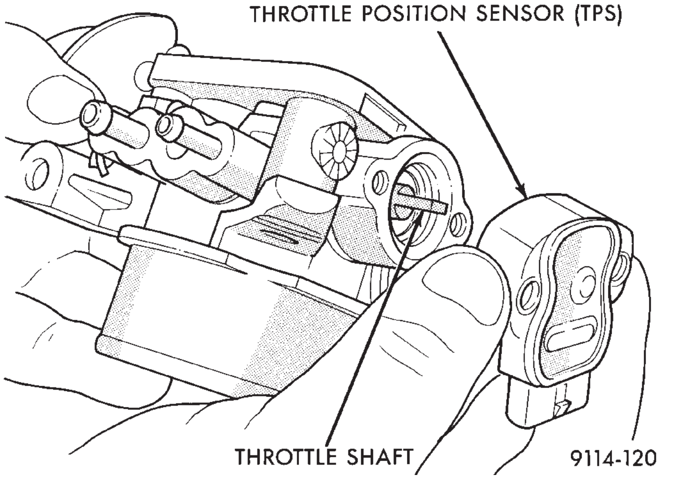


Fig. 3 Throttle Position Sensor

INSTALLATION

(1) Install throttle position sensor on throttle shaft. Install mounting screws. Tighten screws to 2 N●m (17 in. lbs.) torque.

(2) Attach harness connector to sensor.

(3) Connect negative cable to negative post of the battery.

IDLE AIR CONTROL MOTOR

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect harness connector from idle air control motor (Fig. 4).

(3) Remove idle air control motor mounting screws.

(4) Remove the motor from throttle body. Ensure the O-ring is was removed with the idle air control motor.

INSTALLATION

(1) New idle air control motors have a new O-ring installed on them. If pintle measures more than 1 inch (25 mm) it must be retracted by using the IDLE AIR CONTROL MOTOR OPEN/CLOSE mode of the DRBII scan tool.

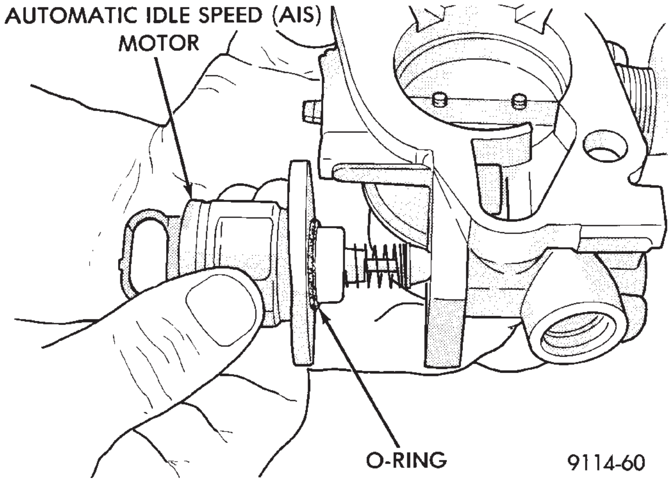


Fig. 4 Idle Air Control Motor

(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 harness connector to motor.

(5) Connect negative cable to battery.

THROTTLE BODY REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove clamp from air hose. Remove hose (Fig. 5).

(3) Remove accelerator cable.

(4) Disconnect idle air control motor and throttle position sensor (TPS) electrical connectors (Fig. 6).

(5) Disconnect vacuum hoses from throttle body.

(6) Remove throttle body to intake manifold attaching nuts (2).

(7) Remove throttle body and gasket.

INSTALLATION

(1) Install throttle body with new gasket.

(2) Install throttle body attaching nuts. Tighten nuts to 25 N●m (225 in. lbs.) torque.

(3) Connect vacuum hoses to the throttle body.

(4) Attach harness connectors to the throttle position sensor (TPS) and the idle air control motor.

(5) Install throttle and speed control cables (if applicable).

(6) Install throttle body intake air hose. Tighten clamp to 4 N●m (30 in. lbs.) torque.

(7) Connect negative cable to battery.

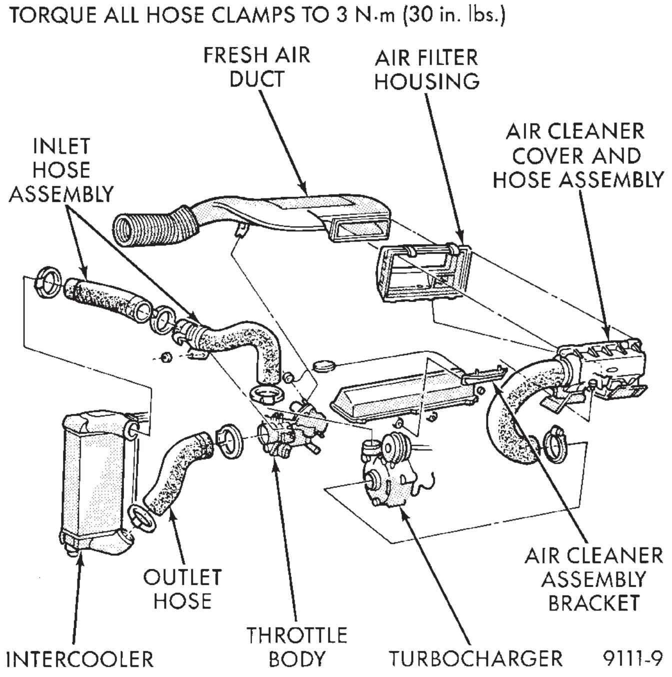


Fig. 5 Air Cleaner Assembly

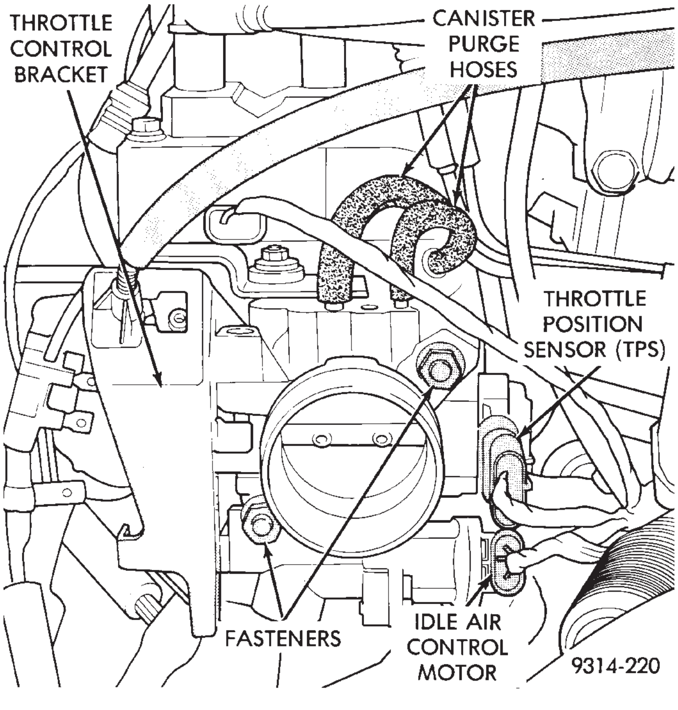


Fig. 6 Throttle Body Assembly

FUEL INJECTOR RAIL ASSEMBLY

WARNING: THE 2.2L TURBO III FUEL SYSTEM IS UNDER A CONSTANT PRESSURE OF APPROXIMATELY 380 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 battery cable.

CAUTION: Place a shop towel should under the fuel hoses to catch any fuel spillage.

(3) Remove quick connect fittings from the chassis fuel tubes (Fig. 7). Refer to Quick Connect Fittings in the Fuel Delivery Section of this manual.

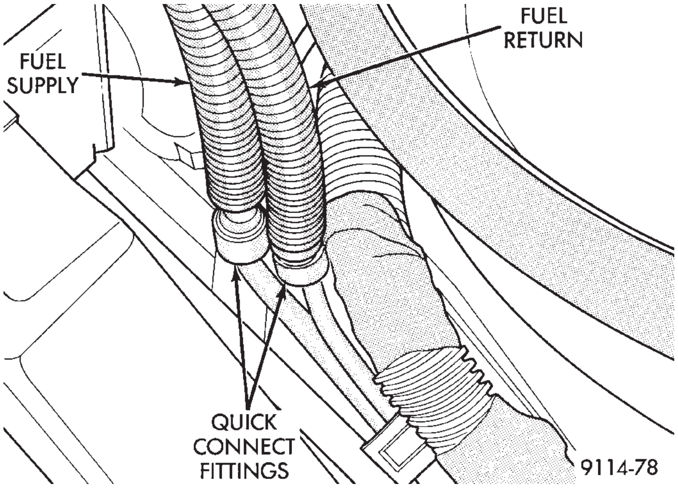


Fig. 7 Quick Connect Fittings

(4) Disconnect the vacuum hose from the fuel pressure regulator (Fig. 8).

(5) Disconnect the fuel injector wiring harness from the main harness.

(6) Place oil separator bracket out of the way and remove the fuel rail support bracket screws.

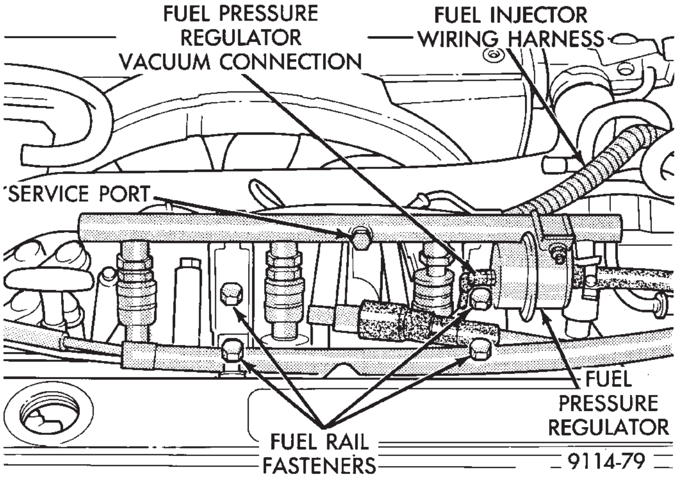


Fig. 8 Fuel Rail Fasteners

(7) Remove the fuel rail and injector assembly by pulling rail so that the injectors come straight out of their ports. Do not damage the rubber injector O-rings after removing the fuel rail.

Do not remove fuel injectors until fuel rail assembly has been completely removed from the vehicle.

(8) Cover or plug the injector ports with while servicing the injectors (Fig. 9).

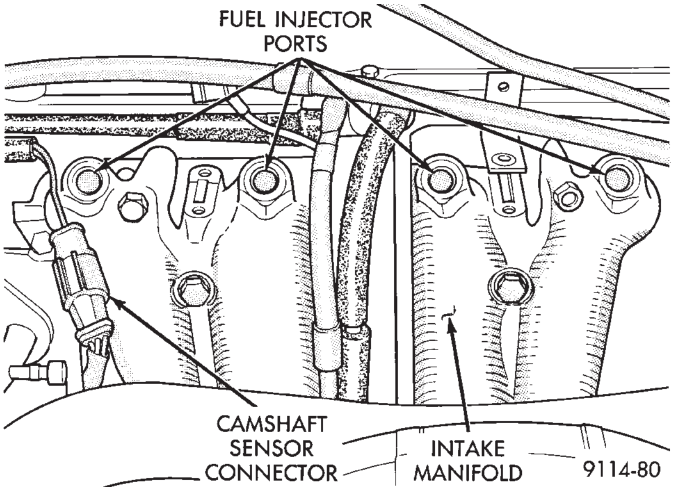


Fig. 9 Fuel Injector Ports

INSTALLATION

(1) Ensure the injectors are seated into the receiver cup, with the lock ring in place.

(2) Ensure the injector wiring connectors are fully inserted into the fuel injectors.

(3) Make sure the injector holes are clean and all plugs have been removed (Fig. 9).

(4) Lubricate the injector O-rings with a drop of clean engine oil.

(5) Install the injector assemblies into their holes and install the attaching bolts. Draw the fuel rail assembly evenly into the intake manifold, making sure each injector enters its own hole. The oil separator bracket must be on top of the fuel rail bracket (Fig. 8).

(6) Once all injectors are evenly seated, tighten the fuel rail attaching bolts to 23 N●m (200 in. lbs.) torque.

(7) Connect the fuel injector wiring harness to the main harness.

(8) Lubricate the ends of the chassis tubes with clean 30 weight engine oil.

(9) Connect fuel hose quick connect fittings to the chassis fuel tubes. Pull on the fittings to ensure complete connection.

Refer to Quick Connect Fittings in the Fuel Delivery Section of this group.

(10) Connect the vacuum hose to the fuel pressure regulator.

(11) Connect negative cable to battery.

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.

(12) With the DRBII scan tool the ASD Fuel System Test to pressurize the fuel system to check for leaks.

FUEL INJECTORS

Remove the fuel rail to service the injectors. Refer to Fuel Injector Rail Assembly in this section.

REMOVAL

(1) Disconnect injector electrical connector from injector. (Fig. 10).

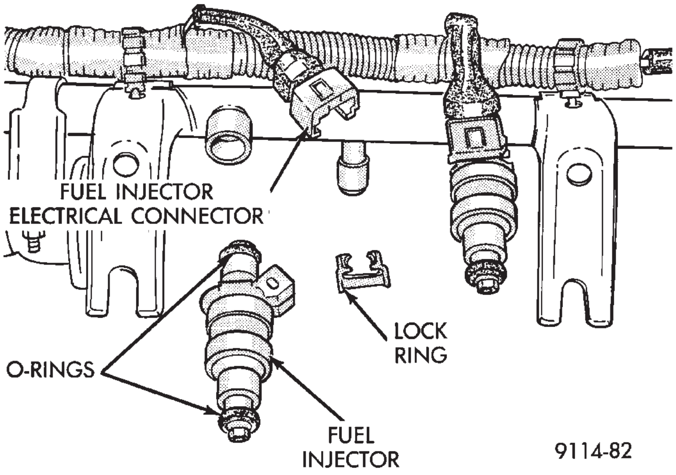


Fig. 10 Fuel Rail and Injector Assembly

(2) Position fuel rail assembly so that the fuel injectors are easily accessible (Fig. 11).

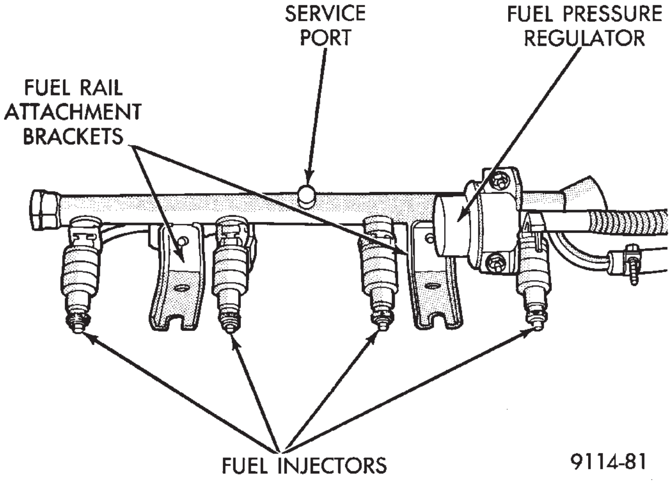


Fig. 11 Servicing Fuel Injectors

(3) Remove injector lock ring off the fuel rail and injector. Pull injector straight out of fuel rail receiver cup (Fig. 11).

(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.

(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) Being careful not to damage the O-ring, install injector top end into fuel rail receiver cup.

(3) Install injector lock ring by sliding open end into slot of the injector and onto the receiver cup ridge into the side slots of ring (Fig. 11).

(4) Repeat steps for remaining injectors.

(5) Install injector wiring harness to injectors. Place harness into retaining clips.

FUEL PRESSURE REGULATOR

WARNING: THE 2.2L TURBO III FUEL SYSTEM IS UNDER A CONSTANT PRESSURE OF APPROXIMATELY 380 KPA (55 PSI). PERFORM FUEL PRESSURE RELEASE PROCEDURE BEFORE SERVICING THE FUEL PRESSURE REGULATOR.

REMOVAL

(1) Perform fuel system pressure release procedure.

(2) Disconnect negative cable from battery.

(3) Disconnect vacuum hose from fuel pressure regulator (Fig. 12).

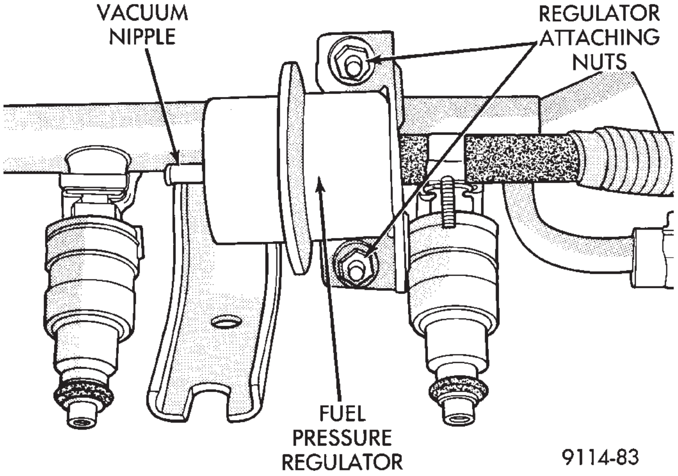


Fig. 12 Servicing Fuel Pressure Regulator

Place a shop towel under fuel pressure regulator to absorb any fuel spillage.

(4) Loosen fuel hose clamp and remove fuel return hose.

(5) Remove fuel pressure regulator mounting nuts. Remove fuel pressure regulator from rail (Fig. 12). Check O-Ring for damage. If O-Ring is damaged it must be replaced.

INSTALLATION

(1) Lubricate O-ring with a drop of clean engine oil. Install O-ring into the receiver cup on fuel rail.

(2) Install fuel pressure regulator mounting nuts. Tighten nuts to 7 N●m (65 in. lbs.) torque.

(3) Connect fuel return hose to pressure regulator. Tighten hose clamp to 1 N●m (10 in. lbs.) torque (Fig. 12).

(4) Install vacuum hose on fuel pressure regulator.

(5) Connect negative cable to battery.

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.

(6) With the DRBII scan tool the ASD Fuel System Test to pressurize system and check for leaks.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SERVICE

(1) Remove vacuum hose from MAP sensor (Fig. 13)

(2) Remove MAP sensor mounting screws (Fig. 13).

(3) Remove electrical connector. Remove sensor.

(4) Reverse the above procedure for installation.

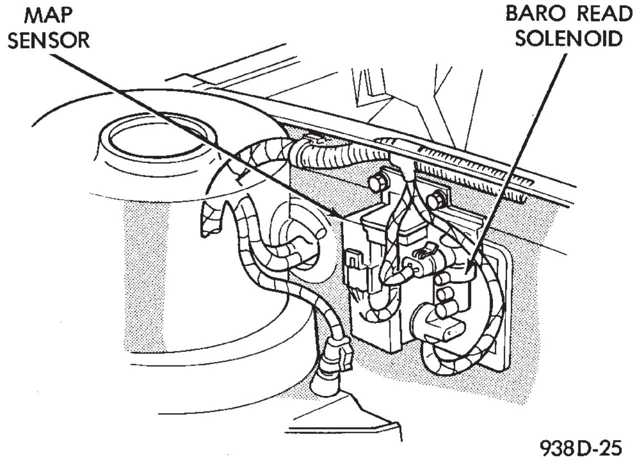


Fig. 13 Manifold Absolute Pressure Sensor

WASTEGATE AND CANISTER PURGE SOLENOID SERVICE

(1) Remove vacuum hoses from sensors (Fig. 14).

(2) Disconnect electrical connector from solenoids (Fig. 14).

(3) Remove solenoid pack mounting nut. Remove solenoid pack.

(4) Depress tab on top of solenoid to be replaced and slide the solenoid downward out of mounting bracket.

(5) Reverse above procedure to install.

PCM SERVICE

(1) Remove air cleaner duct from PCM.

(2) Remove battery.

(3) Remove PCM mounting screws (Fig. 15).

(4) Disconnect the 60-way wiring connector. Remove the PCM.

(5) Reverse the above procedure for installation.

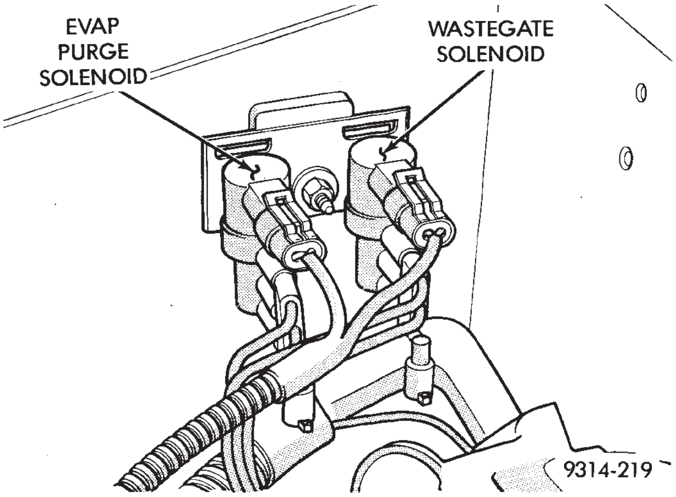


Fig. 14 Solenoid Mounting

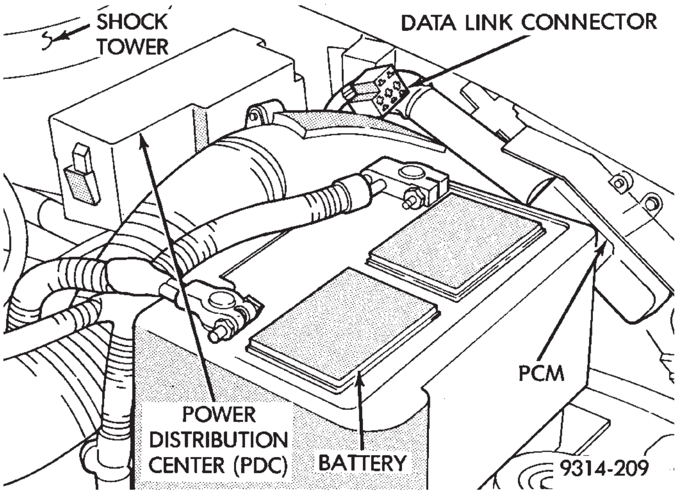


Fig. 15 PCM

HEATED OXYGEN SENSOR (O_2 SENSOR)

The oxygen sensor is installed in the exhaust manifold (Fig. 16).

CAUTION: Do not pull on the oxygen sensor wires when disconnecting the electrical connector.

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

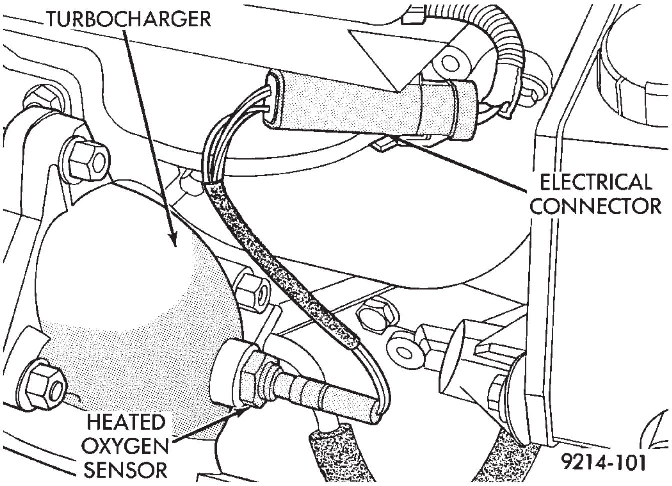


Fig. 16 Heated Oxygen Sensor

(1) Disconnect oxygen sensor electrical connector.

(2) Remove sensor using Tool C-4907 (Fig. 17). Slightly tightening the sensor can ease removal.

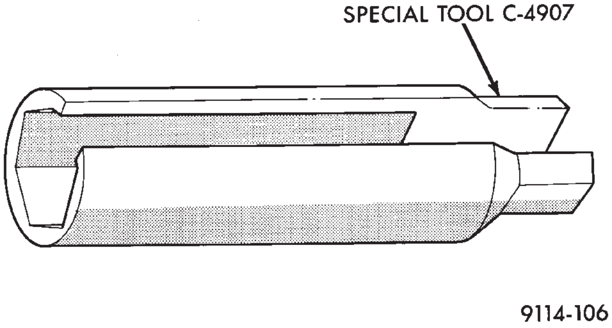


Fig. 17 Oxygen Sensor Socket

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. New sensors are packaged with compound on the threads and do not require additional compound. Tighten the sensor to 27 N●m (20 ft. lbs.) torque.

3.0L MULTI-PORT FUEL INJECTION—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

The 3.0L engine uses a sequential Multi-Port Electronic Fuel Injection system (Fig. 1). The MPI system is computer regulated and provides precise air/fuel ratios for all driving conditions.

The MPI system is operated by the powertrain control module (PCM).

The PCM regulates ignition timing, air-fuel ratio, emission control devices, cooling fan, charging system, idle speed and 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. 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 energized.

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.

SYSTEM DIAGNOSIS

The powertrain control module (PCM) tests many of its own input and output circuits. If a fault is found in a major system, the information is stored in memory. Technicians can display fault information through the malfunction indicator lamp (instrument panel Check Engine lamp) or by connecting the DRBII scan tool. For diagnostic trouble code information, refer to the 3.0 Multi-Port Fuel Injection—On-Board Diagnostics section of this group.

CCD BUS

Various modules exchange information through a communications port called the CCD Bus. The powertrain control module (PCM) transmits the malfunction indicator (instrument panel check engine lamp) On/Off signal, engine RPM and vehicle load data on the CCD Bus.

POWERTRAIN CONTROL MODULE

The powertrain control module (PCM) is a digital computer containing a microprocessor (Fig. 2). 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 referred to as PCM Outputs.

PCM Inputs:

- Air Conditioning Controls
- Battery Voltage
- Brake Switch

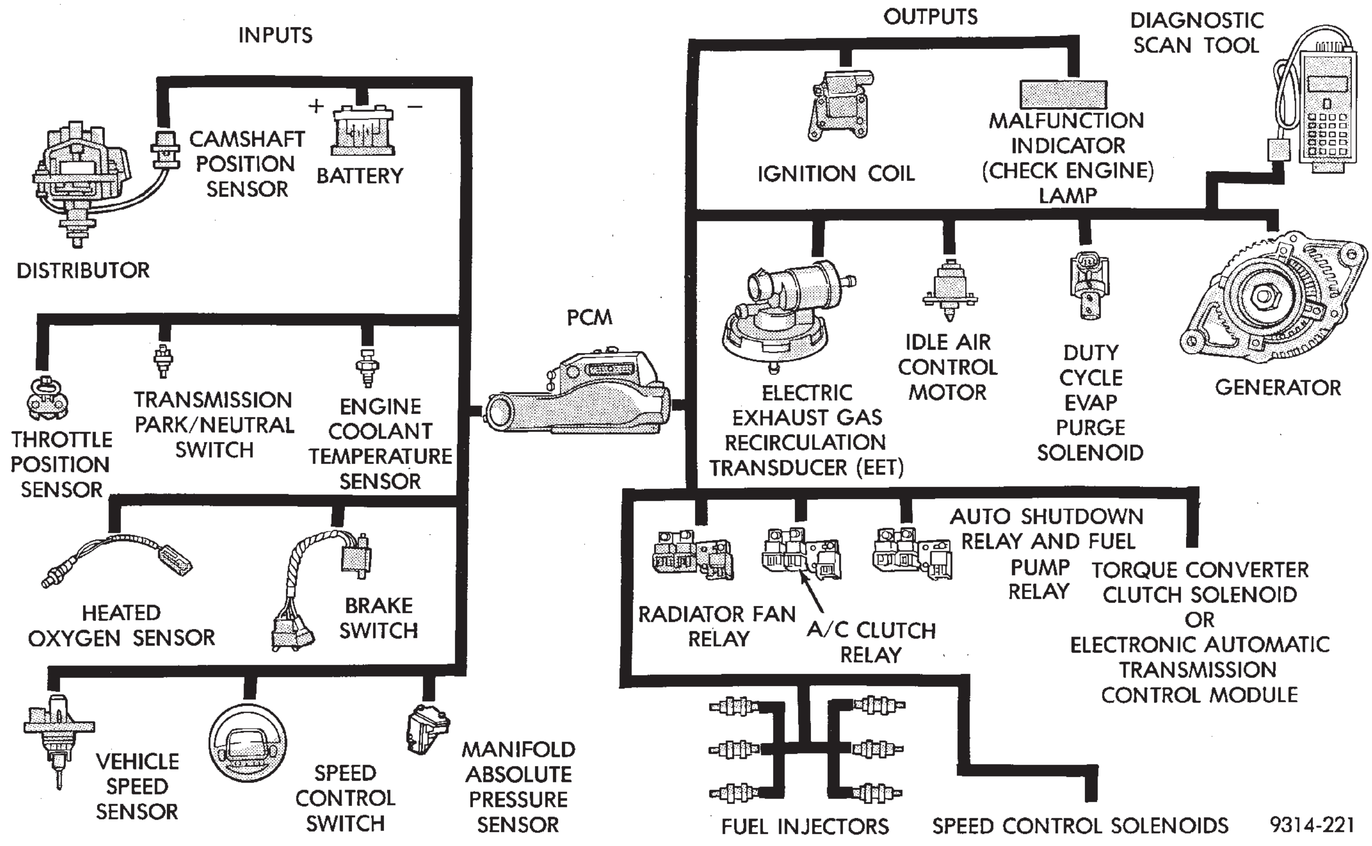


Fig. 1 Multi-Port Fuel Injection Components

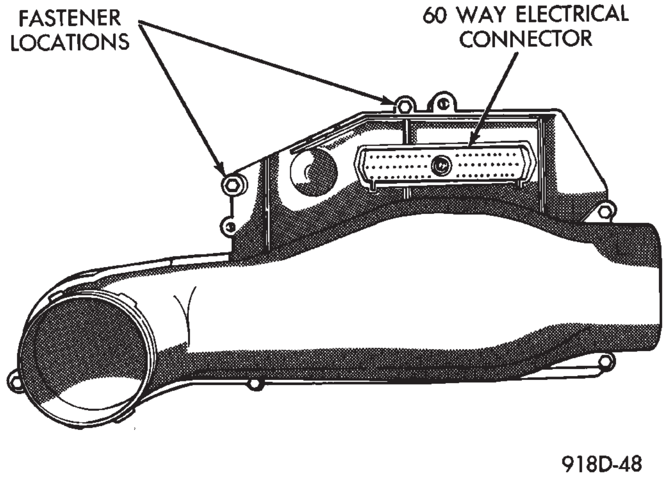


Fig. 2 PCM

- Engine Coolant Temperature Sensor
- Distributor Pick-up
- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensor
- SCI Receive
- Speed Control System Controls
- Throttle Position Sensor
- Park/Neutral Switch (automatic transaxle)
- Vehicle Speed Sensor

PCM Outputs:

- Air Conditioning Clutch Relay
- Generator Field
- Idle Air Control Motor
- Auto Shutdown (ASD) and Fuel Pump Relays
- Canister Purge Solenoid
- Malfunction Indicator Lamp (Check Engine Lamp)
- Data Link Connector
- Electric EGR Transducer (EET)
- Fuel Injectors
- Ignition Coil
- Torque Converter Clutch Solenoid
- Radiator Fan Relay
- Speed Control Solenoids
- Tachometer Output

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
- engine speed (distributor pick-up)
- manifold absolute pressure
- throttle position

The PCM adjusts ignition timing based on the following inputs.

- engine coolant temperature
- engine speed (distributor pick-up)
- manifold absolute pressure
- throttle position

The Automatic Shut Down (ASD) and Fuel Pump relays are mounted externally, but turned on and off by the PCM through the same circuit.

The distributor pick-up signal is sent to the PCM. If the PCM does not receive a distributor signal within approximately one second of engine cranking, the ASD relay and fuel pump relay are deactivated. When these relays are deactivated, power is shut off to the fuel injector, 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. The 8.0 volts power the distributor pick-up and vehicle speed sensor. The PCM also provides a 5.0 volts supply for the coolant temperature sensor, manifold absolute pressure sensor and throttle position sensor.

AIR CONDITIONING SWITCH SENSE (AA, AG, AJ BODY)—PCM INPUT

When the air conditioning or defrost switch is in the ON position and the low pressure and high pressure switches are closed, the PCM receives an input for air conditioning. 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.

AIR CONDITIONING SWITCH SENSE (AC BODY)—PCM INPUT

When the air conditioning or defrost switch is in the ON position and the low pressure, high pressure and ambient temperature switches are closed, the PCM receives an input for air conditioning. 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.

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.

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 the idle air control motor. The brake switch is mounted on the brake pedal support bracket.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The coolant temperature sensor is a variable resistor with a range of -40° to 265°. The sensor is installed next to the thermostat housing.

The PCM supplies 5.0 volts to the coolant temperature sensor. The sensor provides an input voltage to the PCM (Fig. 3). As coolant temperature varies, the sensors resistance changes, resulting in a different input voltage to the PCM.

The PCM demands slightly richer air-fuel mixtures and higher idle speeds until the engine reaches normal operating temperature.

This sensor is also used for cooling fan control.

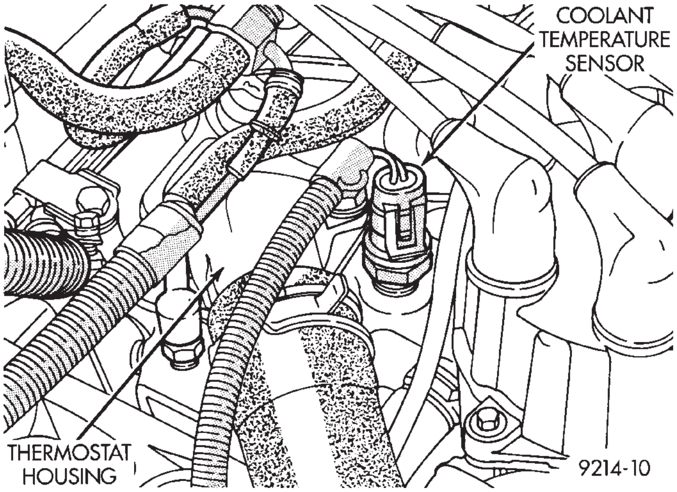


Fig. 3 Coolant Temperature Sensor

DISTRIBUTOR PICK-UP—PCM INPUT

The distributor pick-up provides two inputs to the PCM. From one input the PCM determines RPM (engine speed). From the other input it derives crankshaft position. The PCM regulates injector synchronization and adjusts ignition timing and engine speed based on these inputs.

The distributor pick-up contains two signal generators. The pick-up unit consists of 2 light emitting diodes (LED), 2 photo diodes, and a separate timing disk. The timing disk contains two sets of slots. Each set of slots rotates between a light emitting diode and a photo diode (Fig. 4). The inner set contains 6 large slots, one for each cylinder. The outer set contains several smaller slots.

The outer set of slots on the rotating disk represents 2 degrees of crankshaft rotation. Up to 1200 engine RPM, the PCM uses the input from the outer set of slots to increase ignition timing accuracy.

The outer set of slots contains a 10 degree flat spot (Fig. 5). The flat spot tells the PCM that the next piston at TDC will be number 6. The position of each piston is referenced by one of the six inner slots (Fig. 5).

As each slot on the timing disk passes between the diodes, the beam from the light emitting diode is in-

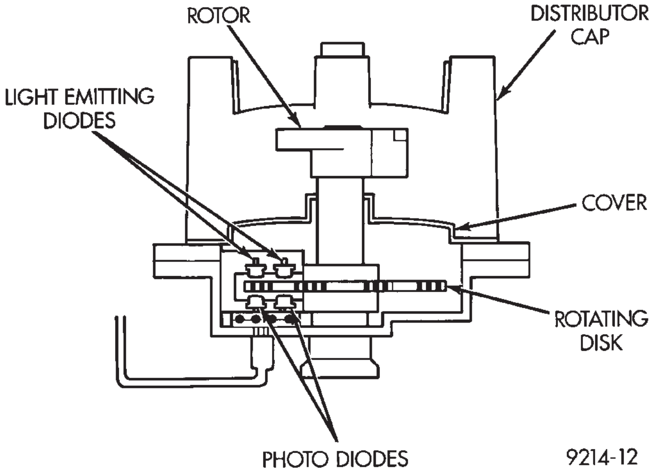


Fig. 4 Distributor Pick-up

terrupted. This creates an alternating voltage in each photo diode which is converted into on-off pulses. The pulses are the input to the PCM.

During cranking, the PCM cannot determine crankshaft position until the 10 degree flat spot on the outer set of slots passes through the optical unit. Once the flat spot is detected, the PCM knows piston number 6 will be the next piston at TDC.

Since the disk rotates at half crankshaft speed, it may take 2 engine revolutions during cranking for the PCM to determine the position of piston number 6. For this reason the PCM will energize all six injectors at the same time until it senses the position of piston number 6.

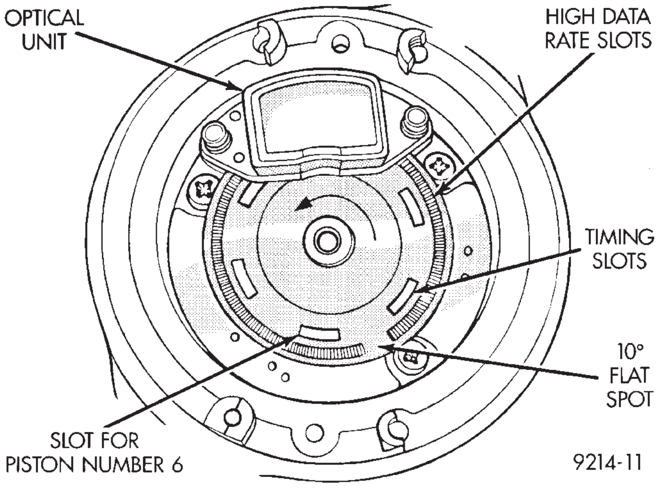


Fig. 5 Inner and Outer Slots of Rotating Disk

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.

Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

The MAP sensor (Fig. 6) mounts on a bracket attached to the generator bracket. The sensor is connected to the throttle body with a vacuum hose and to the PCM electrically.

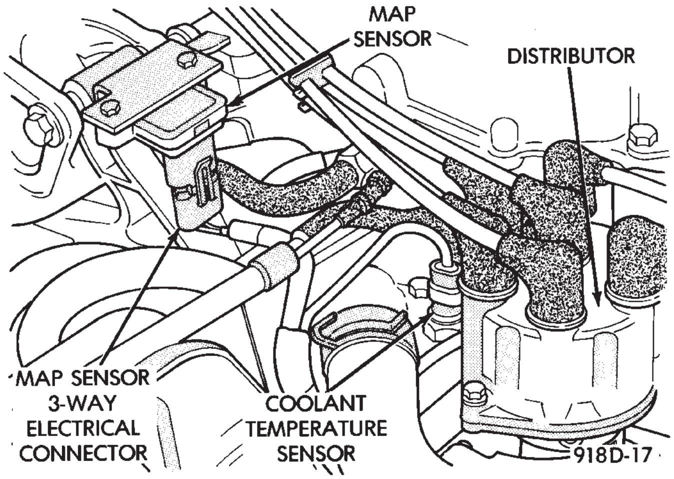


Fig. 6 Map Sensor

HEATED OXYGEN SENSOR (O_2 SENSOR)—PCM INPUT

The O_2 sensor 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. 7). The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

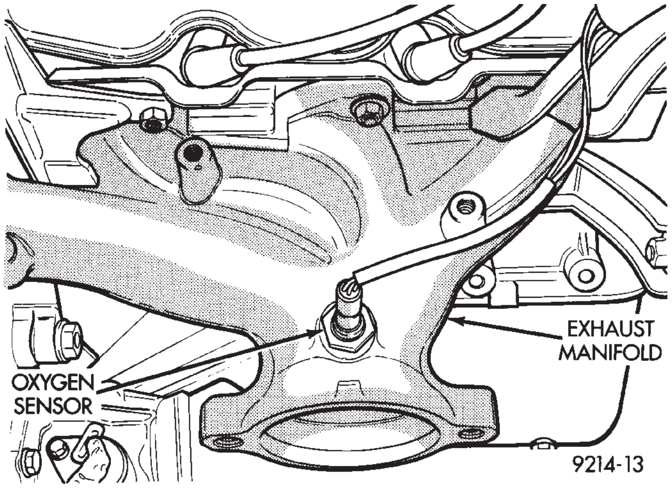


Fig. 7 Heated Oxygen Sensor—3.0L Engine

The O_2 sensor produces voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas. When a large amount of oxygen is present (caused by a lean air-fuel mixture), the sensor 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 sensor acts as a rich-lean switch.

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into Closed Loop operation sooner. Also, it allow the system to remain in Closed Loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors the O_2 sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O_2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and from inputs of other sensors.

SPEED CONTROL—PCM INPUT

The speed control system provides four separate voltages (inputs) to the PCM. The voltages correspond to the On/Off, Set, and Resume.

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 a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for further speed control information.

PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the transaxle housing (Fig. 8 or Fig. 9). 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), fuel injector pulse width, and ignition timing advance. The park/neutral switch is sometimes referred to as the neutral safety switch.

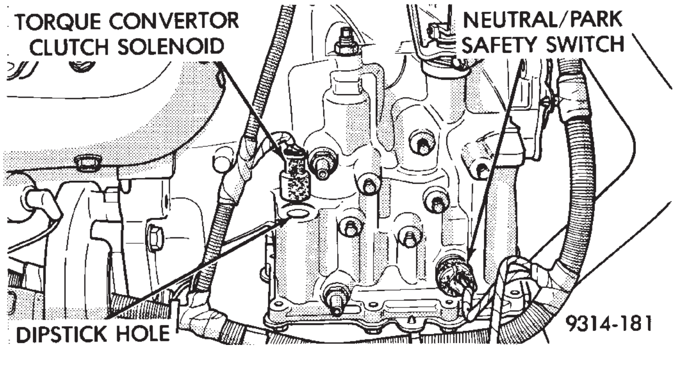


Fig. 8 Park Neutral Switch—3-Speed Automatic Transaxle

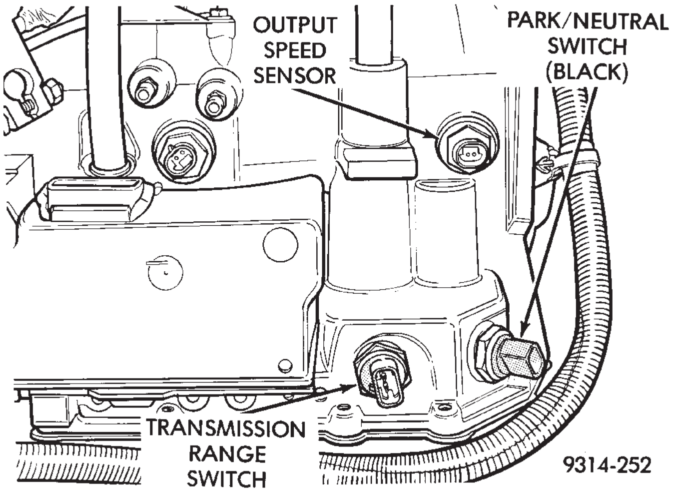


Fig. 9 Park Neutral Switch—4-Speed Electronic Automatic Transaxle

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The Throttle Position Sensor (TPS) is mounted on the throttle body and connected to the throttle blade shaft (Fig. 10). 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.

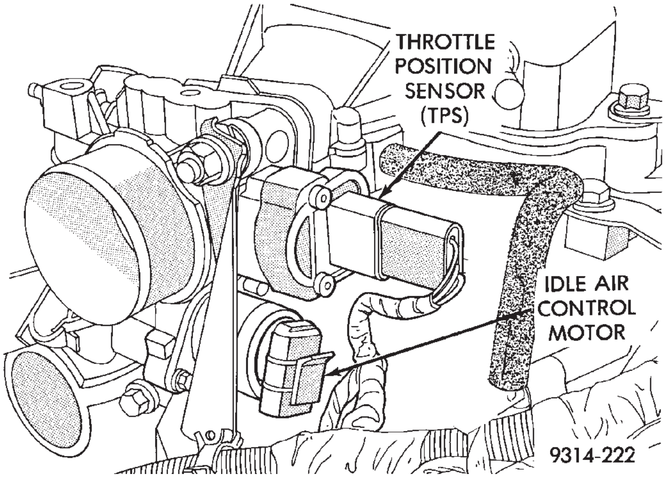


Fig. 10 Throttle Position Sensor

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents throttle blade position. The TPS output voltage to the PCM varies from approximately 0.5 volt at minimum throttle opening (idle) to 3.5 volts at wide open throttle. The wide open throttle input is approximately 3 volts more than the minimum throttle opening value.

Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. After determining the current operating conditions, the PCM adjust fuel injector pulse width and ignition timing.

VEHICLE SPEED AND DISTANCE INPUT—PCM INPUT

On vehicles equipped with an electronic transaxle (41TE), 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. 9).

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.

VEHICLE SPEED SENSOR—PCM INPUT

Vehicles with 3 speed automatic transaxles or manual transaxles use vehicle speed sensors. On both transaxles, the vehicle speed sensor (Fig. 11) is located on the extension housing. The sensor input is used by the PCM to determine vehicle speed and distance traveled.

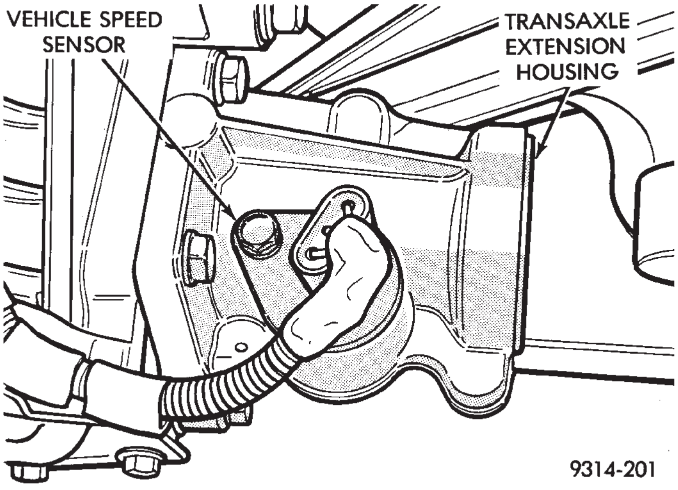


Fig. 11 Vehicle Speed Sensor—Typical

The vehicle speed sensor generates 8 pulses per sensor revolution. These 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.

AIR CONDITIONING (A/C) CLUTCH RELAY (AC BODY)—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit. The ignition switch supplies battery power to the solenoid side of the relay. The A/C fan relay is operated independently of the PCM by the Fan Cutout switch. When the A/C clutch relay energizes, battery voltage powers the A/C compressor clutch.

With the engine operating and the blower motor switch in the On position, the PCM turns the A/C clutch on when the A/C switch closes. 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.

On AC body vehicles, the relay is located in the power distribution center (Fig. 12).

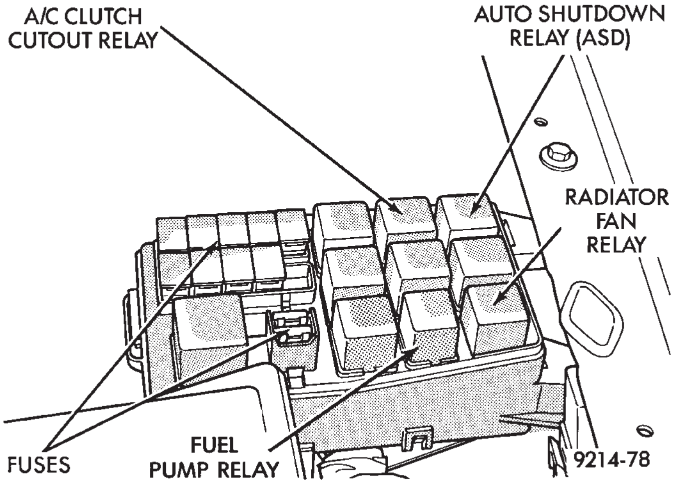


Fig. 12 Relay Identification (AC Body)

AIR CONDITIONING (A/C) CLUTCH RELAY (AA, AG, AJ BODY)—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit. The ignition switch supplies battery power to the solenoid side of the relay. When the A/C clutch relay energizes, battery voltage powers the A/C compressor clutch.

With the engine operating and the blower motor switch in the On position, the PCM cycles the air conditioning clutch on and off when the A/C switch closes. 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.

On AA body vehicles, the relay is located next to the drivers side strut tower (Fig. 13).

On AG and AJ body vehicles, the relay is located in the power distribution center (Fig. 14).

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 charging system information.

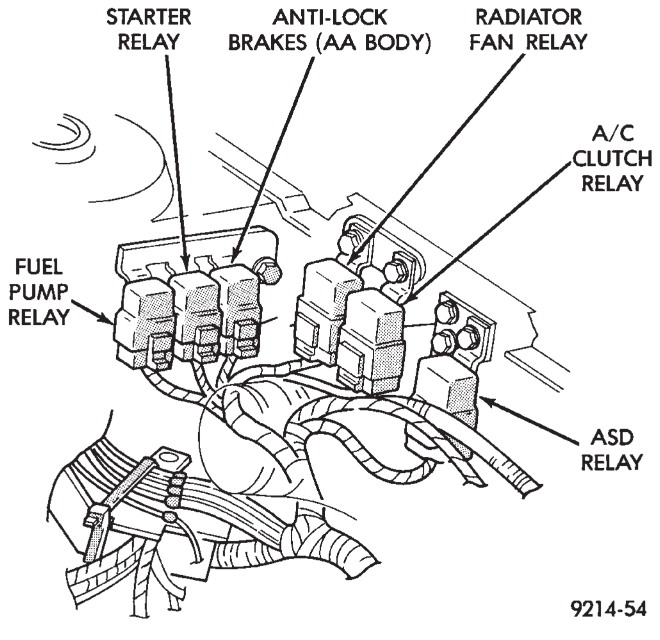


Fig. 13 Relay Identification (AA Body)

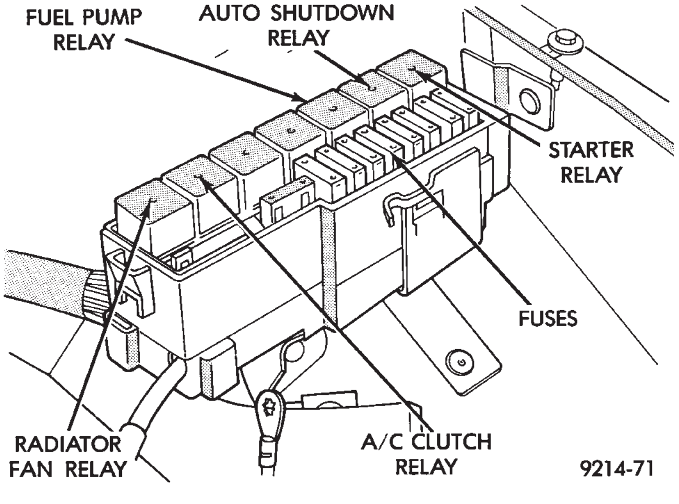


Fig. 14 Relay Identification (AG and AJ Body)

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY—PCM OUTPUT

The PCM operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the distributor pick-up signal to determine engine speed and ignition timing (coil dwell). If the PCM does not receive a distributor signal when the ignition switch is in the Run position, it will de-energize both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

On AA body vehicles, the relays are located next to the drivers side strut tower (Fig. 13).

On AC, AG and AJ body vehicles, the relays are located in the power distribution center (Fig. 12 or Fig. 14).

IDLE AIR CONTROL MOTOR—PCM OUTPUT

The idle air control motor is mounted on the throttle body and is controlled by the PCM (Fig. 10). 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, engine speed sensor (distributor pick-up coil), coolant temperature sensor, and various switch operations (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 powertrain control module 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 approximately 5 to 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 EVAP purge solenoid. The solenoid and bracket attach to the EVAP canister mounting studs (Fig. 15). The top of the solenoid has the word TOP on it. The solenoid will not operate unless it is installed correctly.

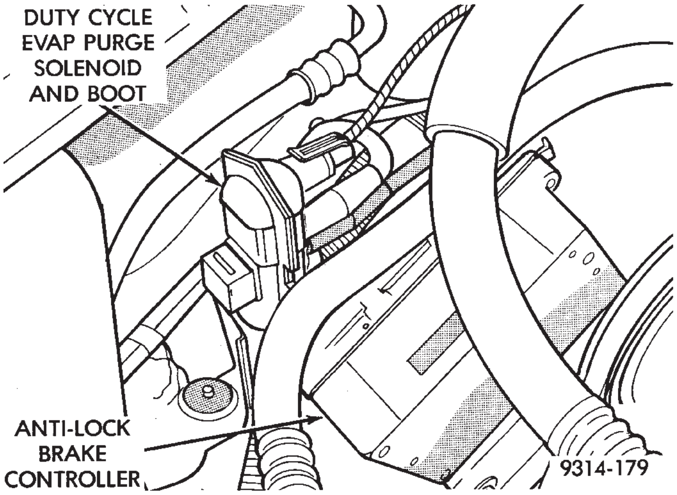


Fig. 15 EVAP Purge Solenoid

MALFUNCTION INDICATOR LAMP (CHECK ENGINE LAMP)—PCM OUTPUT

The malfunction indicator lamp (instrument panel 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 warns the operator that the PCM has entered a Limp-in mode. During Limp-in Mode, the PCM attempts to keep the system operational. The malfunction indicator lamp 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.

Signals that can trigger the malfunction indicator lamp (Check Engine Lamp).

- Engine Coolant Temperature Sensor
- Manifold Absolute Pressure Sensor
- Throttle Position Sensor
- Battery Voltage Input
- An Emission Related System (California vehicles)
- Charging system

The malfunction indicator lamp displays diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within five seconds to display any diagnostic trouble codes stored in the PCM. Refer to the 3.0L Multi-Port Fuel Injection—On-Board Diagnostics section of this Group for Diagnostic trouble code Descriptions.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector provides the technician with the means to connect the DRBII scan tool to diagnosis the vehicle.

TRANSAXLE CONTROL MODULE—PCM OUTPUT

The PCM supplies the following information to the electronic automatic transaxle control module through the CCD Bus:

- battery temperature
- brake switch input
- engine coolant temperature
- manifold absolute pressure (MAP)
- speed control information

FUEL INJECTORS—PCM OUTPUT

The fuel injectors are electrical solenoids (Fig. 16). 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 pintle 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.

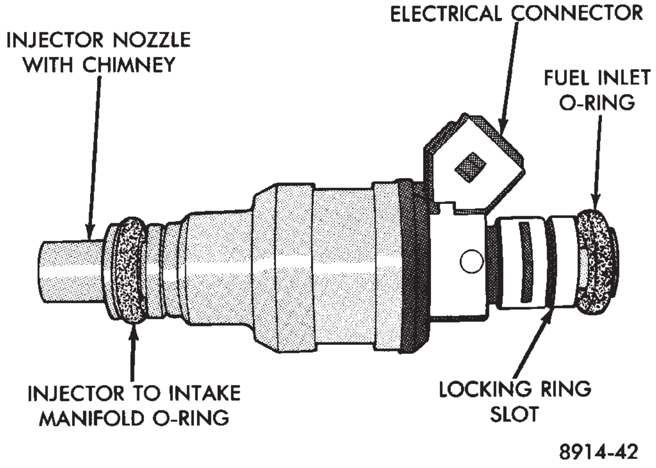


Fig. 16 Fuel Injector—3.0L Engine

The injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port (Fig. 16).

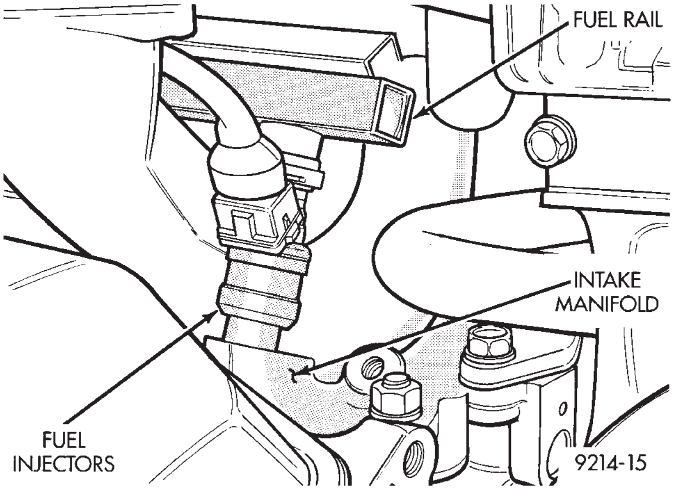


Fig. 17 Fuel Injector Location

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 the PCM determines crankshaft position, it begins energizing the injectors in sequence.

Battery voltage is supplied to the injectors through the ASD relay. 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 auto shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing 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 an input from the distributor pick-up. Refer to Auto Shutdown (ASD) Relay/Fuel Pump Relay—PCM Output in this section for relay operation.

The ignition coil is mounted on a bracket next to the air cleaner (Fig. 18).

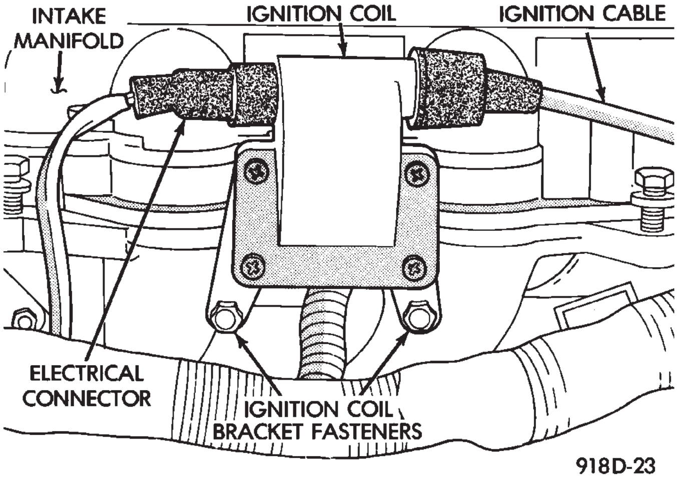


Fig. 18 Ignition Coil

PART THROTTLE UNLOCK SOLENOID—PCM OUTPUT

Three-speed automatic transaxles use a part throttle unlock solenoid. The PCM controls the lock-up of the torque convertor through the part throttle unlock solenoid. The transaxle is locked up only in direct drive mode. Refer to Group 21 for transaxle information.

RADIATOR FAN RELAY—PCM OUTPUT

The radiator fan is energized by the PCM through the radiator fan relay. The radiator fan relay is located on the drivers side fender well near to the PCM. The PCM grounds the relay when engine coolant reaches a predetermined temperature or the air conditioning system turns on.

On AA body vehicles, the relay is located next to the drivers side strut tower (Fig. 13).

On AC, AG and AJ body vehicles, the relay is located in the power distribution center (Fig. 12 or Fig. 14).

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 blade. When the PCM supplies a ground only to the vent solenoid, the throttle blade holds position. When the PCM removes the ground from both the vacuum and vent solenoids, the throttle blade closes. The PCM balances 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.

MODES OF OPERATION

As input signals to the PCM change, the PCM adjusts its response to the output devices. For example, the PCM must calculate a different injector pulse width and ignition timing for idle than 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 (O_2) sensor is not monitored during OPEN LOOP modes.

During CLOSED LOOP modes the PCM does monitor the oxygen (O_2) sensor input. This input indicates to the PCM if the injector pulse width results in an air-fuel ratio of 14.7 parts air to 1 part fuel. By monitoring the exhaust oxygen content through the O_2 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 3.0L sequential MPI 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. The acceleration, deceleration, and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes (under most operating conditions).

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 these inputs.

When the key is in the ON position and the engine is not running (zero rpm), the auto 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 a distributor signal, it energizes the auto shutdown (ASD) relay and fuel pump relay. These relays supply battery voltage to the fuel pump, fuel injectors, ignition coil, and oxygen sensor heating element. If the PCM does not receive a distributor input, the ASD relay and fuel pump relay will be de-energized after approximately one second.

The PCM energizes all six injectors until it determines crankshaft position from the distributor pick-up signals. The PCM determines crankshaft position within 2 engine revolutions.

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 fault into memory.

Once the ASD and fuel pump relays have been energized, the PCM:

- determines injector pulse width based on coolant temperature, manifold absolute pressure (MAP) and the number of engine revolutions since cranking was initiated.
- monitors the coolant temperature sensor, distributor pick-up, 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
- crankshaft position (distributor pick-up)
- manifold absolute pressure (MAP)
- engine speed (distributor pick-up)
- 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 engine idle speed by regulating the idle air control motor and ignition timing.

CRUISE OR IDLE MODE

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
- crankshaft position (distributor pick-up)
- manifold absolute pressure
- engine speed (distributor pick-up)
- 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 controls 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
- crankshaft position (distributor pick-up)
- manifold absolute pressure
- engine speed (distributor pick-up)
- 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 firing to once per engine revolution. This helps maintain better control of the air-fuel mixture.

During a deceleration condition, the PCM grounds the exhaust gas recirculation (EGR) solenoid. When the PCM grounds the solenoid, preventing EGR.

WIDE OPEN THROTTLE MODE

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are received by the PCM:

- engine coolant temperature
- crankshaft position (distributor pick-up)
- manifold absolute pressure
- engine speed (distributor pick-up)
- throttle position

When the PCM senses wide open throttle condition through the throttle position sensor (TPS) it will:

- Provide a ground for the electrical EGR transducer (EET) solenoid. When the PCM grounds the solenoid, the EGR system stops operating.
- 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 wide open throttle operation. The PCM will adjust injector pulse width to supply a predetermined amount of additional fuel.

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.

THROTTLE BODY

The throttle body assembly (Fig. 19) is located at the left end of the air intake 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.

FUEL SUPPLY CIRCUIT

Fuel is supplied to the fuel rail by an electric pump mounted in the fuel tank. The pump inlet is fitted with a strainer to prevent water and other contaminants from entering the fuel supply circuit.

Fuel pressure is controlled to a preset level above intake manifold pressure by a pressure regulator. The pressure regulator is mounted on the fuel rail. The regulator uses intake manifold pressure as a reference.

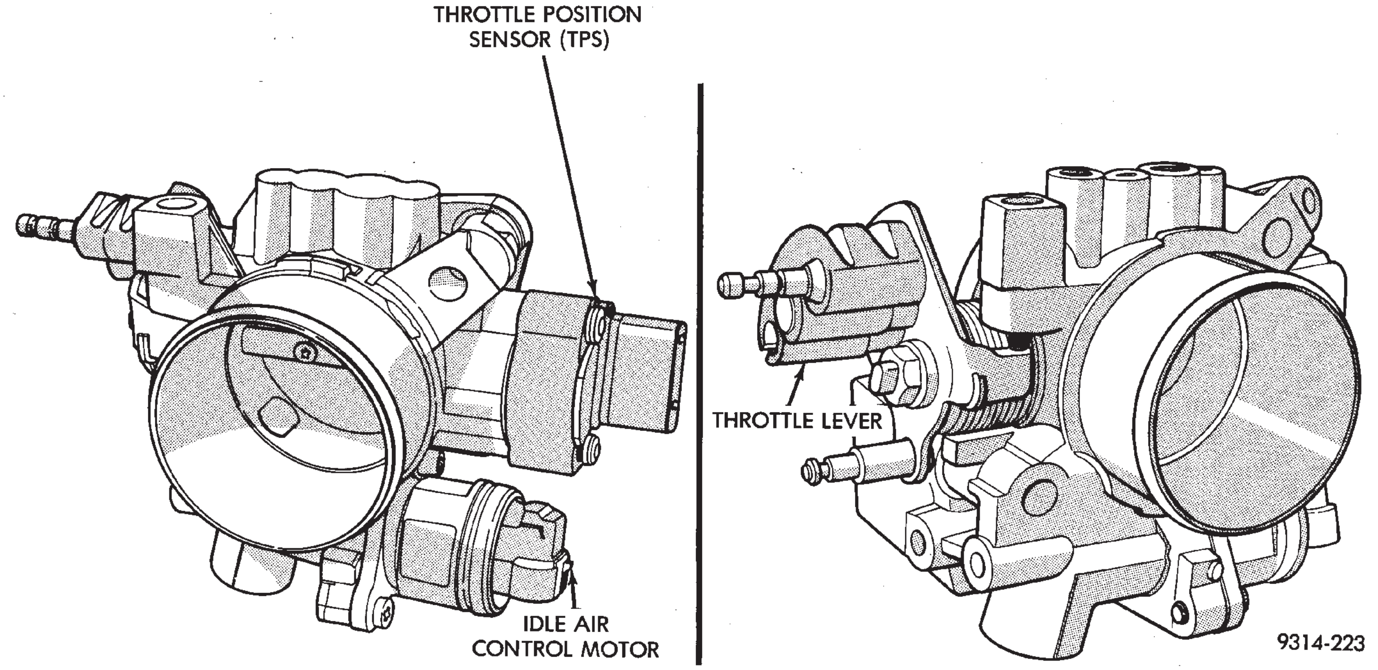


Fig. 19 Throttle Body

FUEL PRESSURE REGULATOR

The pressure regulator is a mechanical device located on the fuel rail, downstream of the fuel injectors (Fig. 20). The regulator maintains a constant 328 kPa (47.6 psi) across the fuel injector tip.

The regulator contains a spring loaded rubber diaphragm that covers the fuel return port. When the fuel pump is operating, fuel flows past the injectors into the regulator. Fuel is restricted from flowing any further by the blocked return port. When fuel pressure reaches 328 kPa (47.6 psi) it pushes on the diaphragm, compresses the spring, and uncovers the fuel return port. The diaphragm and spring constantly move from an open to closed position to keep the fuel pressure constant.

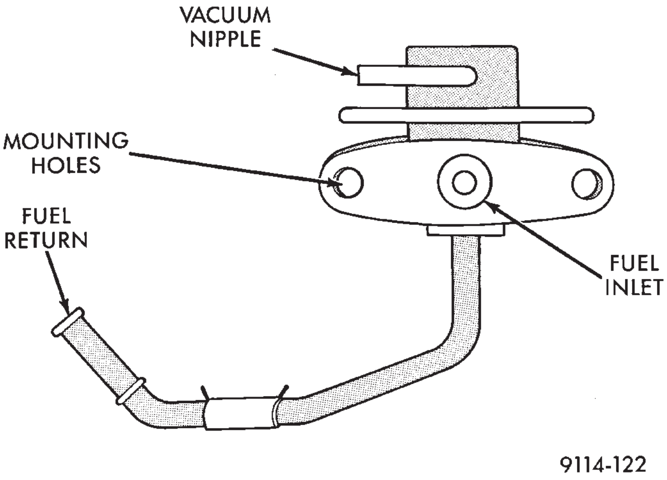


Fig. 20 Fuel Pressure Regulator

3.0L MULTI-PORT FUEL INJECTION—GENERAL DIAGNOSIS

INDEX

FUEL SYSTEM DIAGRAM

The 3.0L MPI system is managed by the PCM. The PCM receives inputs from various switches and sensors (Fig. 1). Based on these inputs, the PCM adjusts ignition timing and idle speed through various output devices. Refer to the Multi-Port Fuel Injection—3.0L Engine section of this group for system and component descriptions.

VISUAL INSPECTION

Perform a visual inspection for loose, disconnected, or misrouted wires and hoses before diagnosing or servicing the fuel injection system. A visual check saves unnecessary test and diagnostic time. A thorough visual inspection includes the following checks:

(1) Check for correct spark plug cable routing. Ensure the cables are completely connected to the spark plugs and distributor.

(2) Check ignition coil electrical connections (Fig. 2).

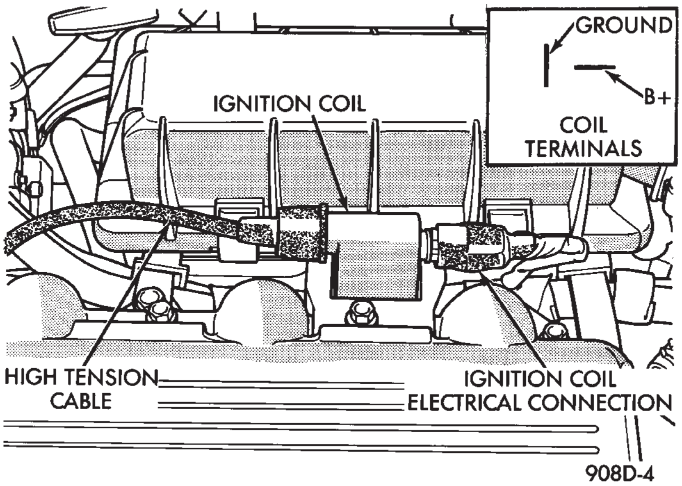


Fig. 2 Ignition Coil Electrical Connection

(3) Verify the electrical connector is attached to the Purge Solenoid (Fig. 3).

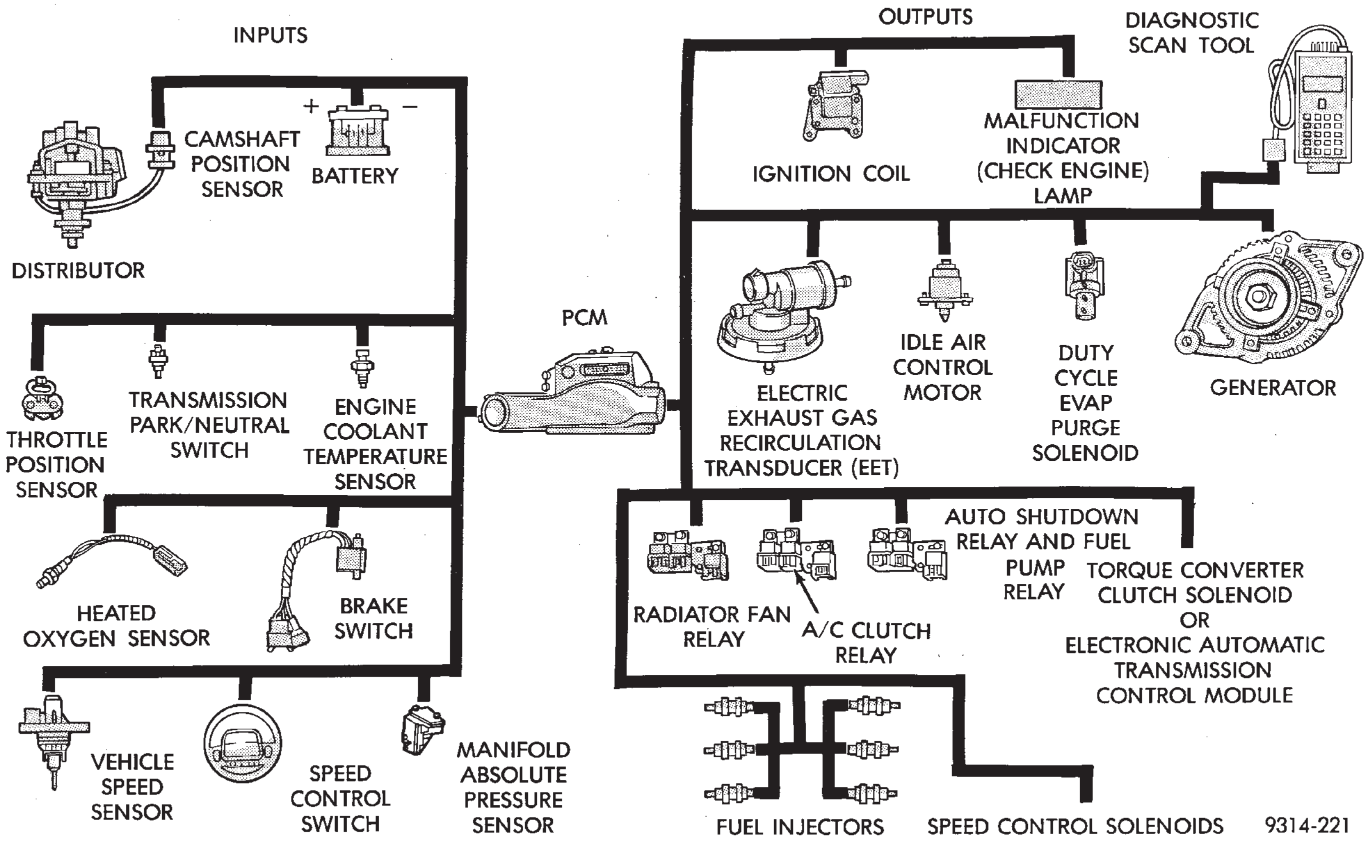


Fig. 1 Multi-Port Fuel Injection Components

(4) Verify vacuum connection at Purge Solenoid is secure and not leaking (Fig. 3).

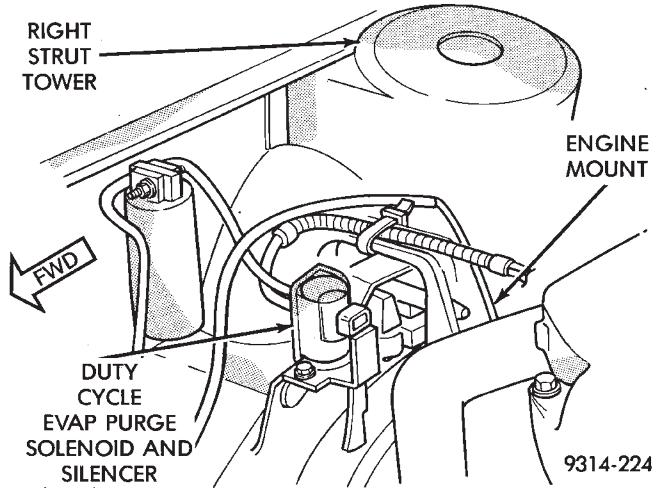


Fig. 3 Duty Cycle EVAP Canister Purge Solenoid

(5) Verify the electrical connector is attached to the MAP sensor (Fig. 4).

(6) Check MAP sensor hose at MAP Sensor Assembly (Fig. 4), and at Vacuum Connection at Intake Plenum Fitting.

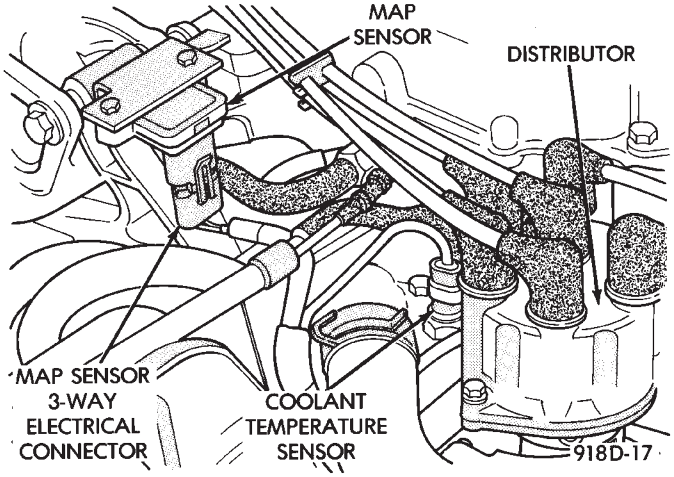


Fig. 4 Map Sensor Electrical and Vacuum Connections

(7) Check generator wiring connections. Ensure the accessory drive belt has proper tension.

(8) Verify hoses are securely attached to the vapor canister (Fig. 5).

(9) Verify the engine ground strap is attached at the engine and dash panel (Fig. 6).

(10) Ensure the heated oxygen sensor connector is connected to the harness connector (Fig. 6).

(11) Verify the distributor connector is connected to the harness connector (Fig. 7).

(12) Verify the coolant temperature sensor connector is connected to the harness connector (Fig. 8).

(13) Check vacuum hose connection at fuel pressure regulator and intake plenum connector (Fig. 8).

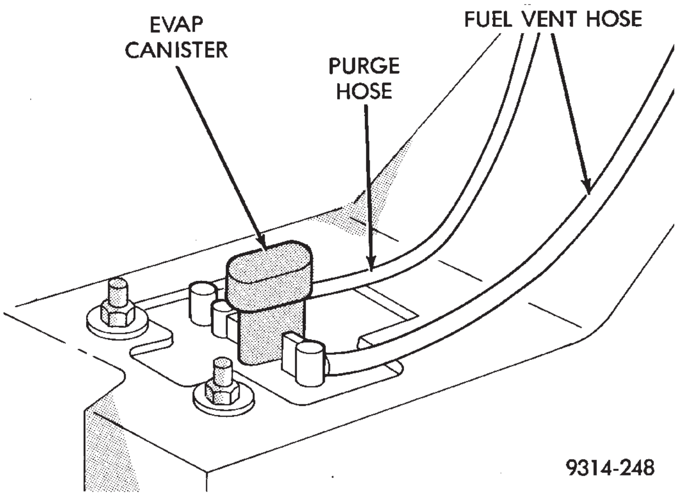


Fig. 5 Vapor Canister

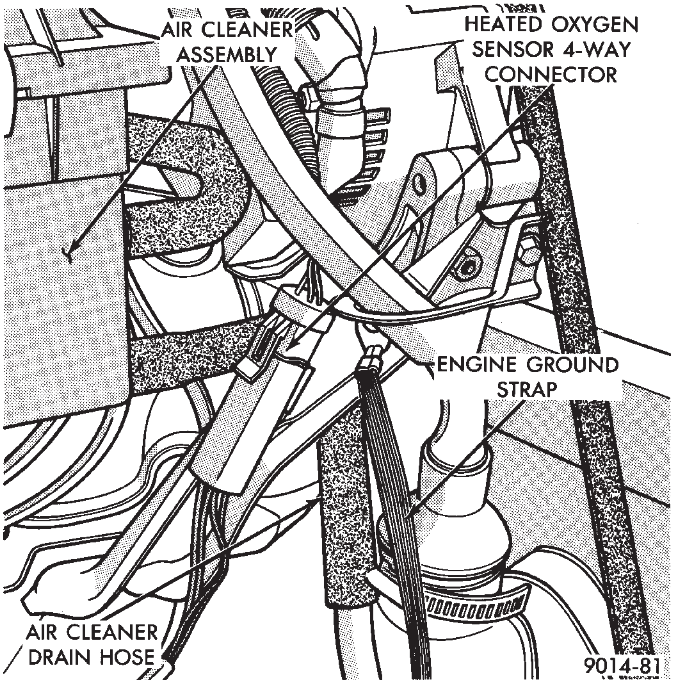


Fig. 6 Oxygen Sensor Connector

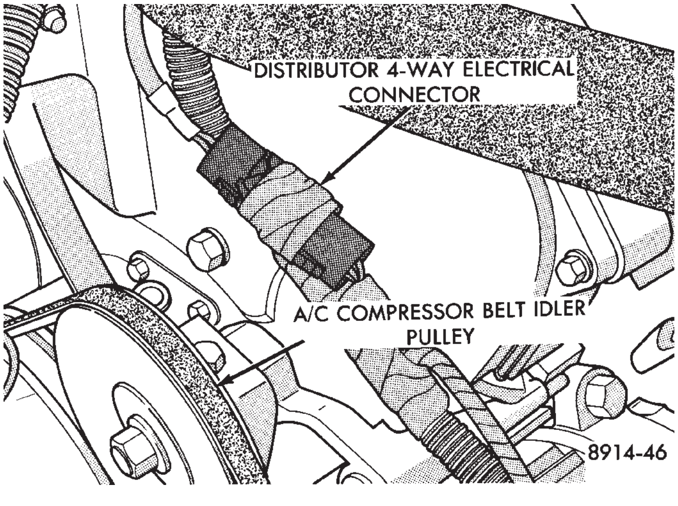


Fig. 7 Distributor Connector

(14) Ensure the harness connector is securely attached to each fuel injector.

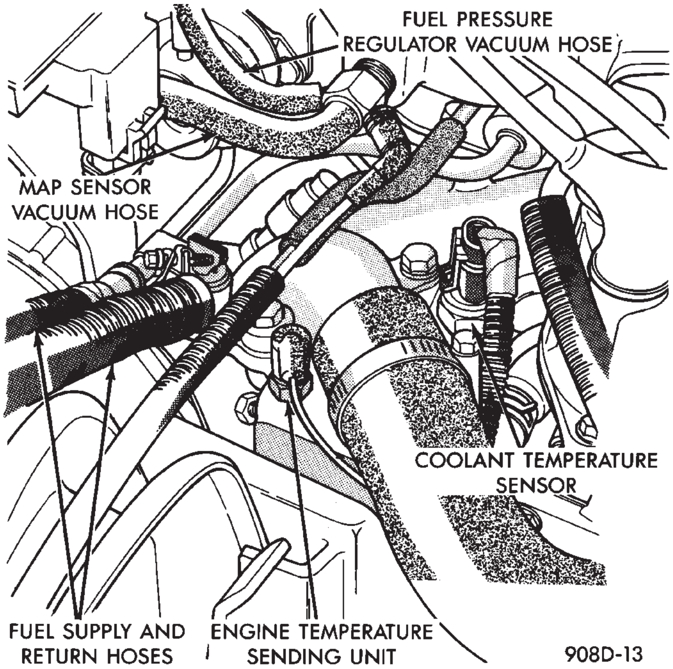


Fig. 8 Coolant Temperature Sensor and Vacuum Connections

(15) Check the oil pressure sending unit electrical connection (Fig. 9).

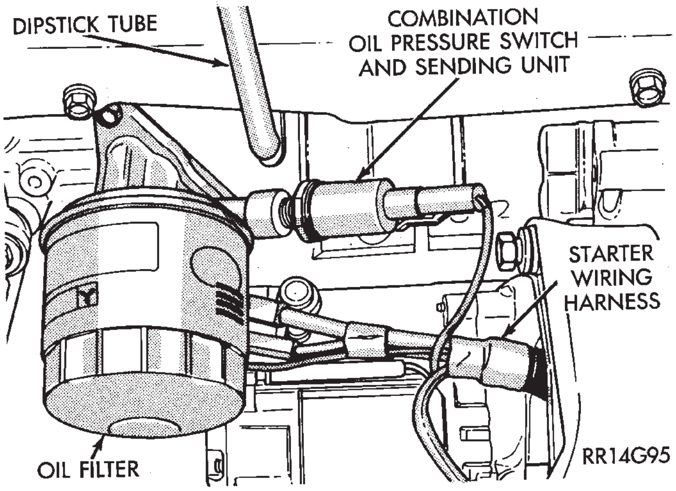


Fig. 9 Oil Pressure Sending Unit Electrical Connection

(16) Check hose connections at throttle body (Fig. 10).

(17) Check throttle body electrical connections (Fig. 10).

(18) Check PCV hose connections (Fig. 11).

(19) If equipped, check EGR system vacuum hose connections (Fig. 12).

(20) If equipped, check EGR tube to intake plenum connections (Fig. 12).

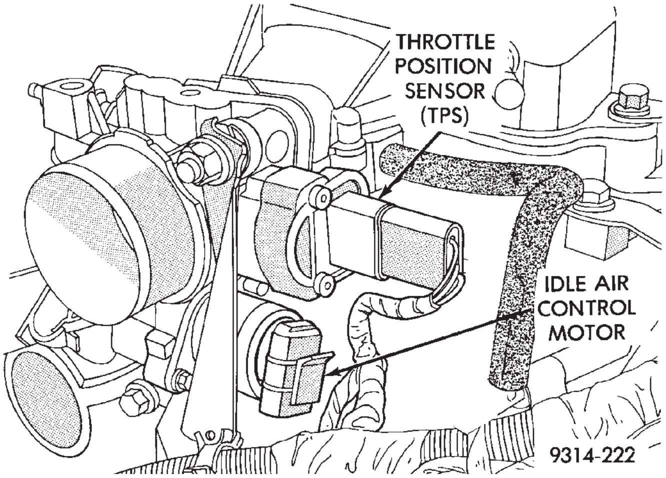


Fig. 10 Throttle Body Electrical and Vacuum Hose Connections

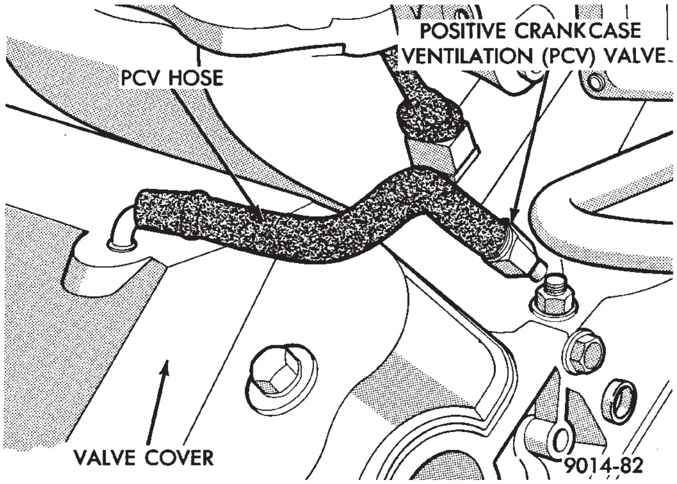


Fig. 11 Positive Crankcase Ventilation (PCV) System

(21) Inspect the electronic EGR transducer solenoid electrical connector.

(22) Ensure the vacuum connections at the electronic EGR transducer is secure and not leaking.

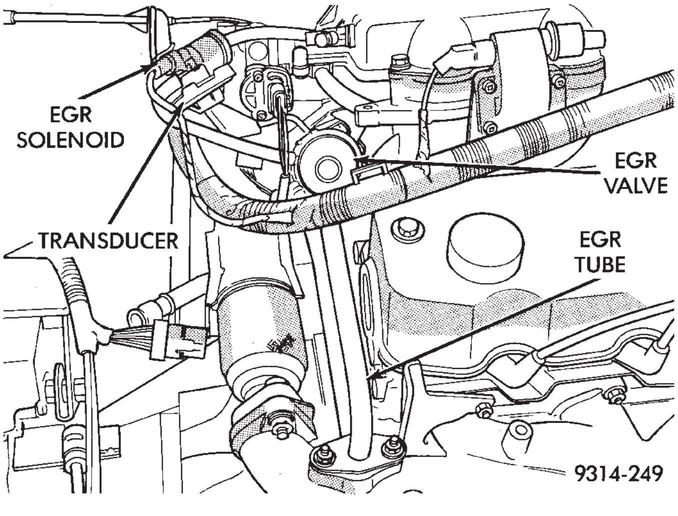


Fig. 12 EGR System Vacuum Hose Connections

(23) Check Power Brake Booster and Speed Connections (Figs. 13 and 14).

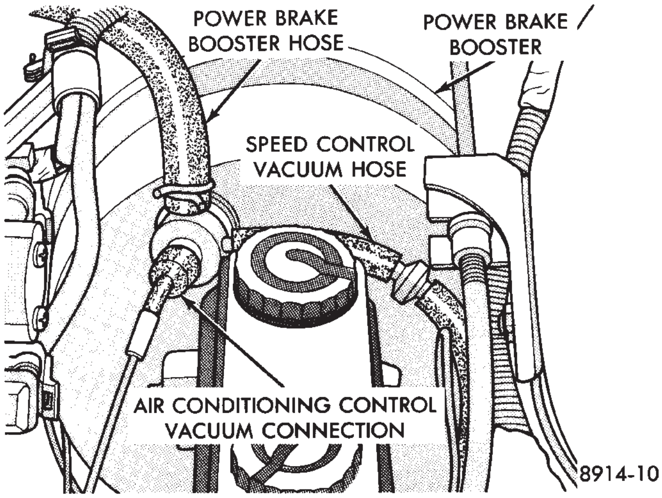


Fig. 13 Power Brake Booster and Speed Control Vacuum Hose Connections (Without Anti-lock Brakes)

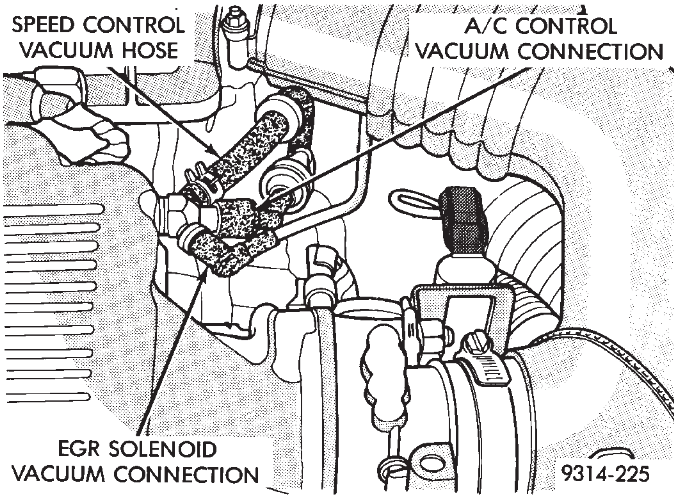


Fig. 14 Speed Control Vacuum Hose Connection (With Anti-lock Brakes)

(24) Inspect engine harness to main harness connections.

(25) Check all automatic transaxle electrical connections (Fig. 15).

(26) Check the vehicle speed sensor electrical connection (Fig. 16).

(27) Inspect the PCM 60-way electrical connector for damage or spread terminals. Verify the 60-way connector is fully inserted into the socket of the PCM. Ensure wires are not stretched or pulled out of the connector (Figs. 17, 18, and 19).

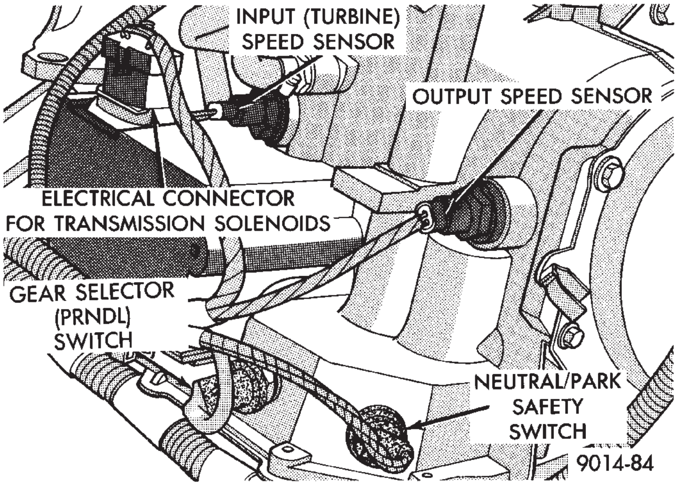


Fig. 15 Automatic Transaxle Electrical Connections

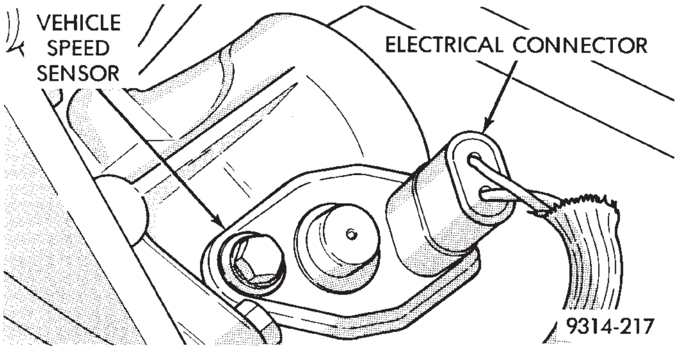


Fig. 16 Vehicle Speed Sensor Electrical Connector

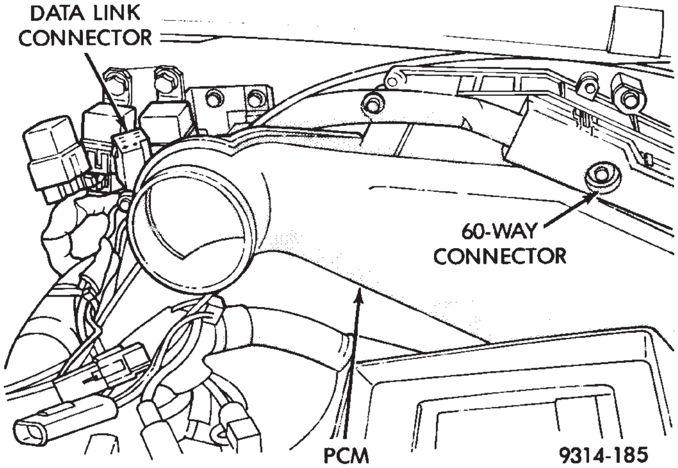


Fig. 17 PCM—AA Body

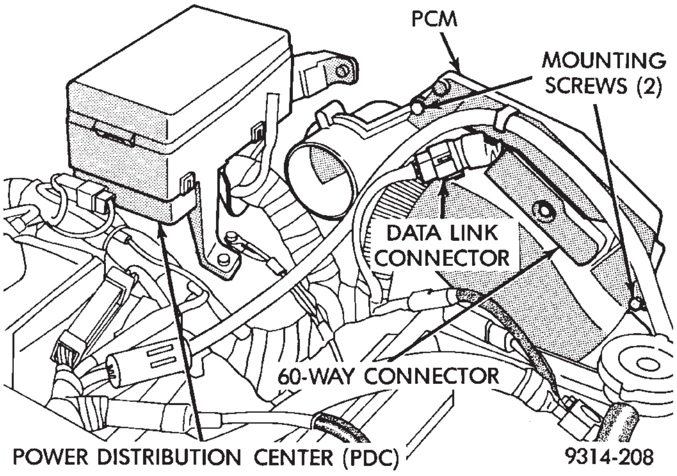


Fig. 18 PCM—AC Body

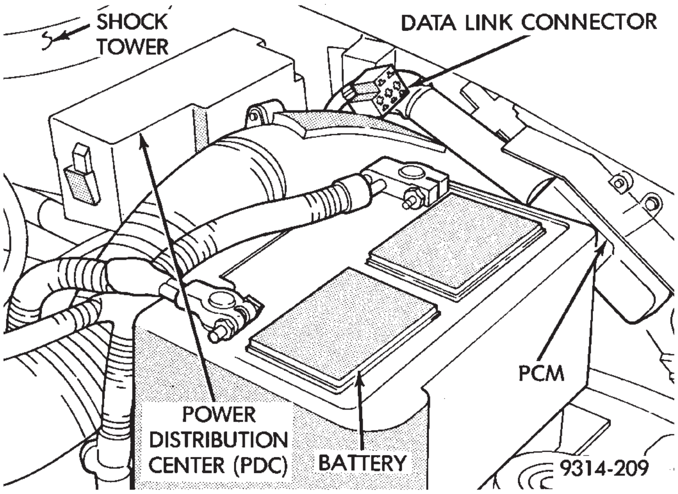


Fig. 19 PCM—AG and AJ Bodies

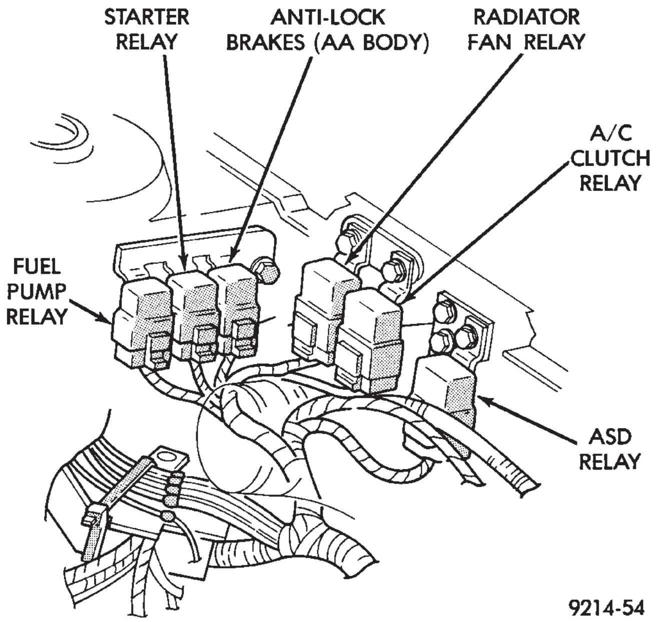


Fig. 20 Relay Identification—AA Body

(28) Check the air conditioning, starter, ASD, fuel pump and radiator fan relay connections (Figs. 20, 21, and 22).

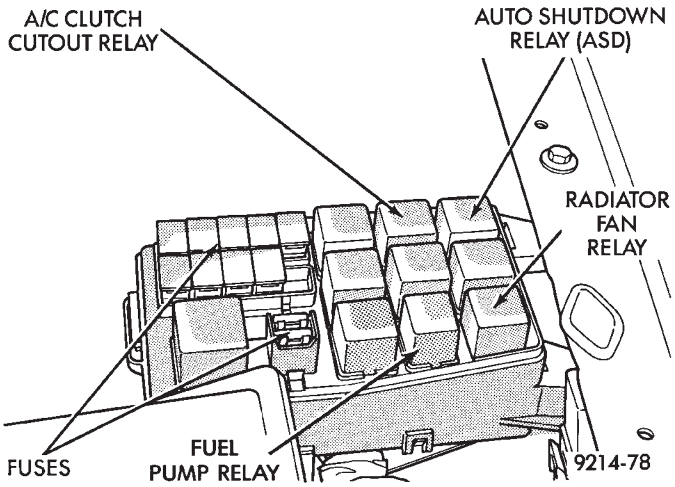


Fig. 21 Relay Identification—AC Body

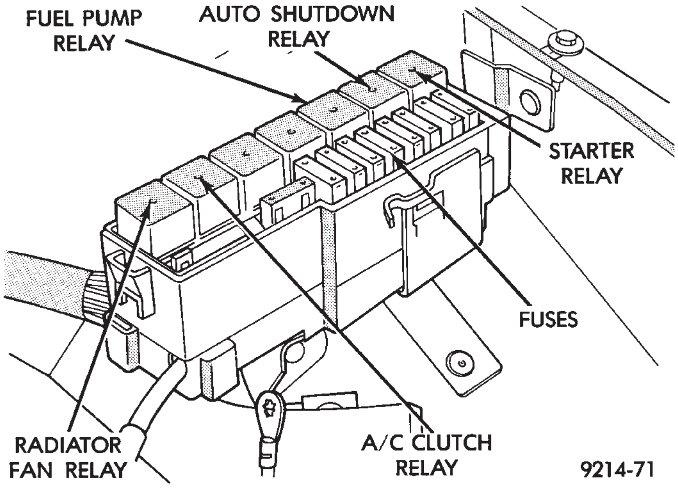


Fig. 22 Relay Identification—AG and AJ Bodies

(29) Check battery cable connections.

(30) Check hose and electrical connections at fuel pump. Ensure connector is making contact with terminals on pump.

3.0L MULTI-PORT FUEL INJECTION—ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

The PCM has been programmed to monitor many different circuits of the fuel injection system. If a problem is sensed with a monitored circuit often enough to indicate an actual problem, the PCM stores a fault. If the problem is repaired or ceases to exist, the PCM cancels the Diagnostic trouble code after 51 vehicle key on/off cycles.

Certain criteria must be met for a diagnostic trouble code to be entered into PCM memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

It is possible a diagnostic trouble code for a monitored circuit may not be entered into memory even though a malfunction has occurred. This may happen because one of the diagnostic trouble code criteria for the circuit has not been met. **For example**, assume one of the diagnostic trouble code criteria for a certain sensor is the engine must be operating between 750 and 2000 RPM. If the sensor output circuit shorts to ground when engine RPM is above 2400 RPM (resulting in a 0 volt input to the PCM) a diagnostic trouble code will not be entered into memory. This is because the condition does not occur within the specified RPM range.

There are several operating conditions that the PCM does not monitor and set diagnostic trouble codes for. Refer to Monitored Circuits and Non-Monitored Circuits in this section.

Stored diagnostic trouble codes can be displayed either by cycling the ignition key On - Off - On - Off - On, or through use of the DRBII scan tool. The DRBII scan tool connects to the data link connector in the vehicle (Fig. 1, Fig. 2 or Fig. 3).

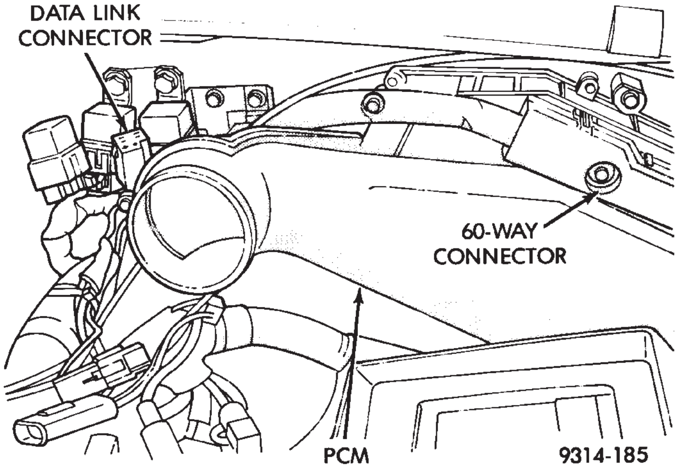


Fig. 1 PCM—AA Body

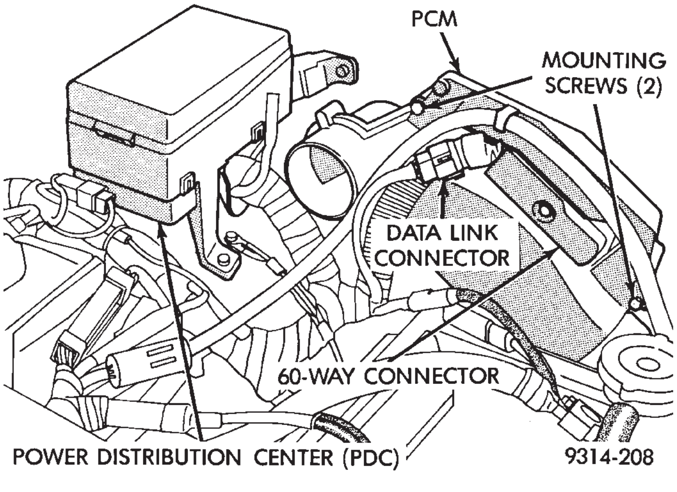


Fig. 2 PCM—AC Body

MONITORED CIRCUITS

The powertrain control module (PCM) can detect certain fault conditions in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if the sensor output (input to PCM) is within proper range. Also, the PCM can determine if the circuit is open or shorted.

Output Device Current Flow - The PCM senses whether the output devices are hooked up. If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground, or shorted high.

Oxygen Sensor - The PCM can determine if the oxygen sensor is switching between rich and lean once the system has entered closed loop. Refer to Modes of Operation in this section for an explanation of closed loop operation.

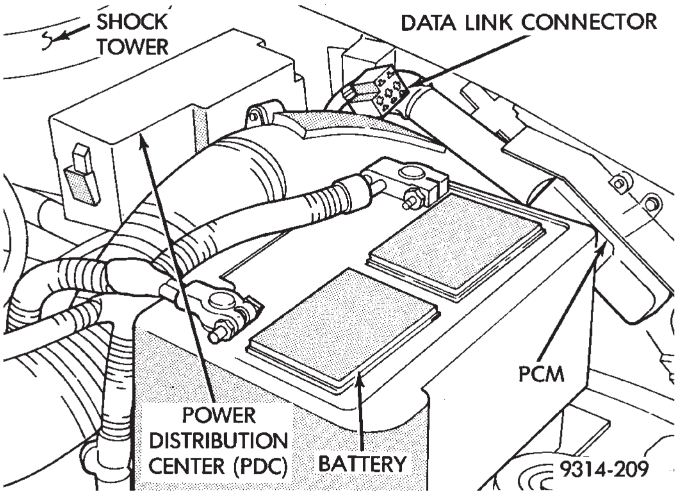


Fig. 3 PCM—AG and AJ Bodies

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions that result in driveability problems. Diagnostic trouble codes may not be displayed for these conditions. However, problems with these systems may cause diagnostic trouble codes to be displayed for other systems. For example, a fuel pressure problem will not register a fault directly, but could cause a rich or lean condition. This could cause an oxygen sensor fault to be stored in the PCM.

Fuel Pressure - Fuel pressure is controlled by the vacuum assisted fuel pressure regulator. 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 an oxygen sensor fault.

Secondary Ignition Circuit - The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

Engine Timing - The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket and crankshaft sprocket. The PCM also cannot detect an incorrectly indexed distributor. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

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, the pintle is sticking or the wrong injector is installed. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

Excessive Oil Consumption - Although the PCM monitors exhaust stream 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.

Evaporative System - The PCM will not detect a restricted, plugged or loaded evaporative purge canister.

Vacuum Assist - Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM. However, these could result in a MAP sensor fault being stored in the PCM.

PCM System Ground - The PCM cannot determine a poor system ground. However, a diagnostic trouble code may be generated as a result of this condition.

PCM Connector Engagement - The PCM cannot determine spread or damaged connector pins. However, a diagnostic trouble code may be generated as a result of this condition.

HIGH AND LOW LIMITS

The powertrain control module (PCM) compares input signal voltages from each input device with established high and low limits that are programmed into it for that device. If the input voltage is not within specifications, and other diagnostic trouble code criteria are met, a diagnostic trouble code will be stored 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 a fault condition can be verified.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

When a diagnostic trouble code appears, it indicates that the Powertrain control module (PCM) has recognized an abnormal condition in the system. Diagnostic trouble codes can be obtained from the malfunction indicator lamp (Check Engine lamp on the Instrument Panel) or from the DRBII scan tool. Diagnostic trouble codes indicate the results of a failure but do not identify the failed component directly.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
11	No reference Signal During Cranking	No camshaft position sensor signal detected during engine cranking.
13+**	No change in MAP from start to run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14+**	MAP voltage too low	MAP sensor input below minimum acceptable voltage.
	or	
	MAP voltage too High	MAP sensor input above maximum acceptable voltage.
15**	No vehicle speed signal	No vehicle distance (speed) sensor signal detected during road load conditions.
17	Engine is cold too long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O_2 signal stays at center	Neither rich or lean condition detected from the oxygen sensor input.
	or	
	O_2 signal shorted to voltage	Oxygen sensor input voltage maintained above the normal operating range.
22+**	Coolant sensor voltage too high	Coolant temperature sensor input above the maximum acceptable voltage.
	or	
	Coolant sensor voltage too low	Coolant temperature sensor input below the minimum acceptable voltage.
24+**	Throttle position sensor voltage high	Throttle position sensor input above the maximum acceptable voltage.
	or	
	Throttle position sensor voltage low	Throttle position sensor input below the minimum acceptable voltage.
25**	Idle air control motor circuits	An open or shorted condition detected in one or more of the idle air control motor circuits.
27	Injector control circuit	Injector output driver does not respond properly to the control signal.
31**	Evap purge solenoid circuit	An open or shorted condition detected in the purge solenoid circuit.
32**	EGR solenoid circuit	An open or shorted condition detected in the EGR transducer solenoid circuit.
	or	
	EGR system failure	Required change in air/fuel ratio not detected during diagnostic test.
33	A/C clutch relay circuit	An open or shorted condition detected in the A/C clutch relay circuit.

+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-253

DIAGNOSTIC TROUBLE CODE DESCRIPTION (CON'T)

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
34	Speed control solenoid circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
35	Radiator fan relay circuits	An open or shorted condition detected in the radiator fan circuit.
37	Torque convertor clutch solenoid CKT	An open or shorted condition detected in the torque convertor clutch solenoid circuit (automatic transmission).
41+**	Generator field not switching properly	An open or shorted condition detected in the generator field control circuit.
42	Auto shutdown relay control circuit	An open or shorted condition detected in the auto shutdown relay circuit.
46+**	Charging system voltage too high	Battery voltage sense input above target charging voltage during engine operation.
47+**	Charging system voltage too low	Battery voltage sense input below target charging voltage during engine operation. Also, no significant change detected in battery voltage during active test of alternator output.
51**	O_2 signal stays below center (lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**	O_2 signal stays above center (rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53	Internal controller failure	Powertrain Control Module internal fault condition detected.
54	No sync pick-up signal	No fuel sync signal detected during engine rotation.
62	Controller Failure EMR miles not stored	Unsuccessful attempt to write to an EEPROM location by the Powertrain Control Module.
63	Controller Failure EEPROM write denied	Unsuccessful attempt to write to an EEPROM location by the Powertrain Control Module.
55	N/A	Completion of fault code display on malfunction indicator lamp (Check Engine lamp).

+Check Engine Lamp On
**Check Engine Lamp ON (California Only)

9314-254

SYSTEM TESTS

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST ON AN OPERATING ENGINE.

OBTAINING DIAGNOSTIC TROUBLE CODES

(1) Connect DRBII scan tool to the data link connector located in the engine compartment near the powertrain control module (PCM).

(2) Start the engine if possible, cycle the transaxle selector and the **A/C** switch if applicable. Shut off the engine.

(3) Turn the ignition switch on, access Read Fault Screen. Record all the fault messages shown on the DRBII scan tool. Observe the malfunction indicator lamp (Check Engine lamp on the instrument panel). The lamp should light for 3 seconds then go out (bulb check).

Diagnostic trouble code erasure; access erase diagnostic trouble code data

STATE DISPLAY TEST MODE

The switch inputs used by the powertrain control module (PCM) have only 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 change is displayed, it can be assumed that the entire switch circuit to the PCM is functional. From the state display screen access either State Display Inputs and Outputs or State Display Sensors.

STATE DISPLAY INPUTS AND OUTPUTS

Connect the DRBII scan tool to the vehicle. Access the State Display screen. Then access Inputs and Outputs. The following is a list of the engine control system functions accessible through the Inputs and Outputs screen.

Park/Neutral Switch
Speed Control Resume
Brake Switch
Speed Control On/Off
Speed Control Set
A/C Switch Sense
S/C Vent Solenoid
S/C Vacuum Solenoid
A/C Clutch Relay
EGR Solenoid
Auto Shutdown Relay
Radiator Fan Relay
Purge Solenoid
Torque Converter Clutch Solenoid
Malfunction Indicator Lamp (Check Engine Lamp)

STATE DISPLAY SENSORS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following is a list of the engine control system functions accessible through the Sensor Display screen.

Battery Temperature
Oxygen Sensor Signal
Engine Coolant Temperature
Engine Coolant Temp Sensor
Throttle Position
Minimum Throttle
Battery Voltage
MAP Sensor Reading
Idle Air Control Motor Position
Adaptive Fuel Factor
Barometric Pressure
Min Airflow Idle Speed
Engine Speed
Fault #1 Key-On Info
Module Spark Advance
Speed Control Target
Fault #2 Key-on Info
Fault #3 Key-on Info
Speed Control Status
Speed Control Switch Voltage
Charging System Goal
Theft Alarm Status
Map Sensor Voltage
Vehicle Speed
Oxygen Sensor State
MAP Gauge Reading
Throttle Opening (percentage)
Total Spark Advance

CIRCUIT ACTUATION TEST MODE

The circuit actuation test mode checks for proper operation of output circuits or devices which the powertrain control module (PCM) cannot internally recognize. The PCM can attempt 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, spray fuel, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit working correctly.

OBTAINING CIRCUIT ACTUATION TEST

Connect the DRBII scan tool to the vehicle and access the Actuators screen. The following is a list of the engine control system functions accessible through Actuators screens.

Stop All Tests
Ignition Coil #1
Fuel Injector #1
Fuel Injector #2
Fuel Injector #3

Fuel Injector #4
Fuel Injector #5
Fuel Injector #6
Idle Air Control Motor Open/Close
Radiator Fan Relay
A/C Clutch Relay
Auto Shutdown Relay
Purge Solenoid
S/C Serv Solenoids
Generator Field
Tachometer Output
Torque Converter Clutch Solenoid
EGR Solenoid
All Solenoids/Relays
ASD Fuel System Test
Speed Control Vacuum Solenoid
Speed Control Vent Solenoid

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) Hook-up the timing check device and tachometer.

(4) Disconnect the coolant temperature sensor and set basic timing to 12° BTDC ± 2° BTDC.

(5) Shut off engine. Reconnect coolant temperature sensor wire.

(6) Disconnect the PCV valve hose from the PCV valve (Fig. 4).

(7) Plug the PCV valve nipple.

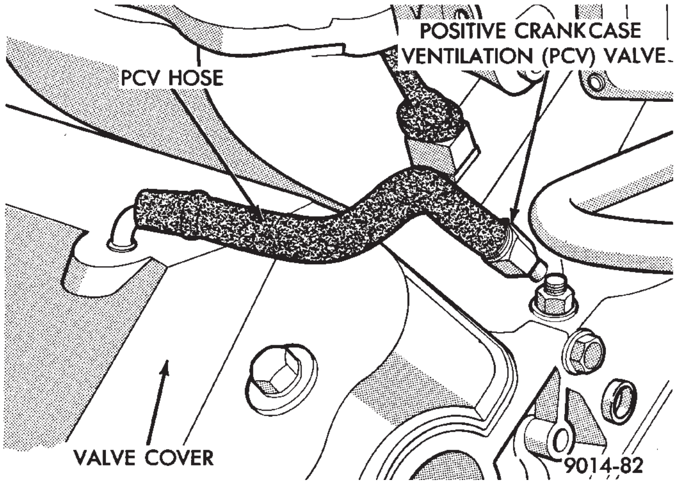


Fig. 4 3.0L PCV Valve

(8) Disconnect the idle purge hose from the vacuum tube under the intake manifold (Fig. 5).

(9) Install Air Metering Fitting #6457 (0.125 inch orifice) in the intake manifold mounted idle purge hose (Fig. 6).

(10) Connect DRBII scan tool.

(11) Restart the engine, allow engine to idle for at least one minute.

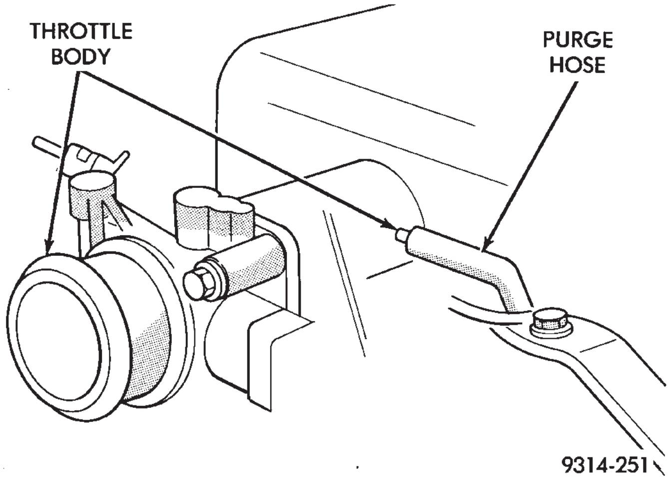


Fig. 5 3.0L Idle Purge Hose

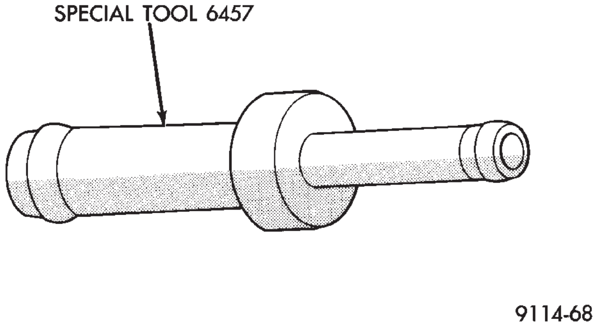


Fig. 6 Air Metering Fitting, Special Tool 6457

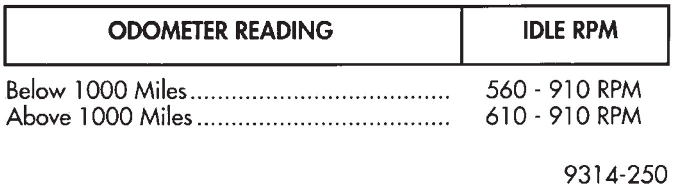
(12) Using the DRBII scan tool, access Min. Airflow Idle Speed.

(13) The following will then occur:

- Idle Air Control Motor will fully close.
- Idle spark advance will become fixed.
- Engine RPM will be displayed on DRBII scan tool

(14) Check idle RPM with tachometer, if idle RPM is within the below specification then the throttle body min. air flow is set correctly.

IDLE SPECIFICATIONS



ODOMETER READING	IDLE RPM
Below 1000 Miles	560 - 910 RPM
Above 1000 Miles	610 - 910 RPM

9314-250

(15) 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 OF 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 is 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.

(16) Shut off engine.

(17) Remove Air Metering Fitting #6457 from the intake manifold idle purge hose. Reconnect the hose to the engine vacuum harness tee.

(18) Remove the plug from the PCV valve. Reconnect the PCV valve hose to the PCV valve.

(19) Disconnect the DRBII scan tool.

IGNITION TIMING PROCEDURE

Refer to Group 8D Ignition System.

60-WAY PCM WIRING CONNECTOR

Refer to the PCM wiring connector description (Fig. 7) for information regarding wire colors and cavity numbers.

CAV	WIRE COLOR	DESCRIPTION
1	DG/RD*	MAP SENSOR
2	TN/BK*	COOLANT SENSOR
3	RD/WT*	DIRECT BATTERY VOLTAGE
4	BK/LB*	SENSOR RETURN
5	BK/WT*	SIGNAL GROUND
6	VT/WT*	5.0 VOLT OUTPUT (MAP AND TPS)
7	OR	8.0 VOLT OUTPUT
8		
9	DB	A21 SUPPLY (IGNITION START/RUN)
10		
11	BK/TN*	POWER GROUND
12	BK/TN*	POWER GROUND
13	LB/BR*	INJECTOR DRIVER #4
14	YL/WT*	INJECTOR DRIVER #3
15	TN	INJECTOR DRIVER #2
16	WT/DB*	INJECTOR DRIVER #1
17		
18		
19	BK/GY*	IGNITION COIL DRIVER #1
20	DG	GENERATOR FIELD CONTROL
21		
22	OR/DB*	THROTTLE POSITION SENSOR (TPS)
23	RD/LG*	SPEED CONTROL SENSE
24	GY/BK*	CAMSHAFT POSITION SENSOR (IGNITION PICK-UP)
25	PK	SCI TRANSMIT
26	VT/BR*	CCD BUS (+)
27	BR	A/C SWITCH SENSE
28		
29	WT/PK*	BRAKE SWITCH
30	BR/LB*	PARK/NEUTRAL SWITCH
31	DB/PK*	RADIATOR FAN RELAY
32	BK/PK*	MALFUNCTION INDICATOR LAMP (CHECK ENGINE)
33	TN/RD*	SPEED CONTROL VACUUM SOLENOID
34	DB/OR*	A/C CLUTCH RELAY
35	GY/YL*	EGR SOLENOID
36		
37		
38	GY	INJECTOR DRIVER #5
39	GY/RD*	IDLE AIR CONTROL MOTOR #3 DRIVER
40	BR/WT*	IDLE AIR CONTROL MOTOR #1 DRIVER
41	BK/DG*	OXYGEN SENSOR SIGNAL
42		
43	GY/LB*	TACHOMETER SIGNAL OUTPUT
44	TN/YL*	CAMSHAFT POSITION SENSOR (INJECTOR SYNC.)
45	LG	SCI RECEIVE
46	WT/BK	CCD BUS (-)
47	WT/OR*	VEHICLE SPEED SIGNAL
48		
49		
50		
51	DB/YL*	AUTO SHUTDOWN (ASD) RELAY
52	PK/BK*	DUTY CYCLE EVAP PURGE SOLENOID
53	LG/RD*	SPEED CONTROL VENT SOLENOID
54		
55		
56		
57	DG/OR*	A142 CIRCUIT VOLTAGE SENSE
58	BR/DB*	INJECTOR DRIVER #6
59	VT/BK*	IDLE AIR CONTROL MOTOR #4 DRIVER
60	YL/BK*	IDLE AIR CONTROL MOTOR #2 DRIVER

WIRE COLOR CODES		LB	LIGHT BLUE	VT	VIOLET
BK	BLACK	LG	LIGHT GREEN	WT	WHITE
BR	BROWN	OR	ORANGE	YL	YELLOW
DB	DARK BLUE	PK	PINK	*	WITH TRACER
DG	DARK GREEN	RD	RED		
GY	GRAY	TN	TAN		

CONNECTOR
TERMINAL SIDE
SHOWN

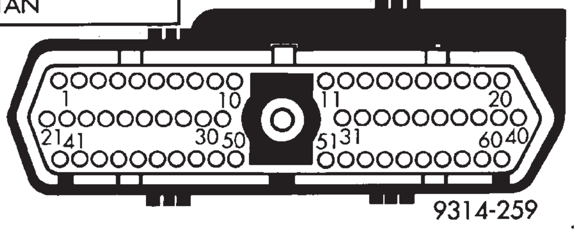


Fig. 7 60-Way PCM Wiring Connector—3.0L Engine

3.0L MULTI-PORT FUEL INJECTION—SERVICE PROCEDURES

INDEX

THROTTLE BODY SERVICE

(1) Disconnect negative battery cable.

(2) Remove air cleaner hose clamp to throttle body and remove hose. (Fig. 1)

(3) Remove throttle cable and transaxle linkage.

(4) Disconnect idle air control motor and throttle position sensor (TPS) wiring connectors.

(5) Disconnect vacuum hoses from throttle body.

(6) Remove throttle body to intake manifold attaching nuts. Remove engine harness wiring bracket.

(7) Remove throttle body and gasket.

(8) Reverse the above procedures for installation. Tighten throttle body mounting nuts to 25 N●m (225 in. lbs.) torque.

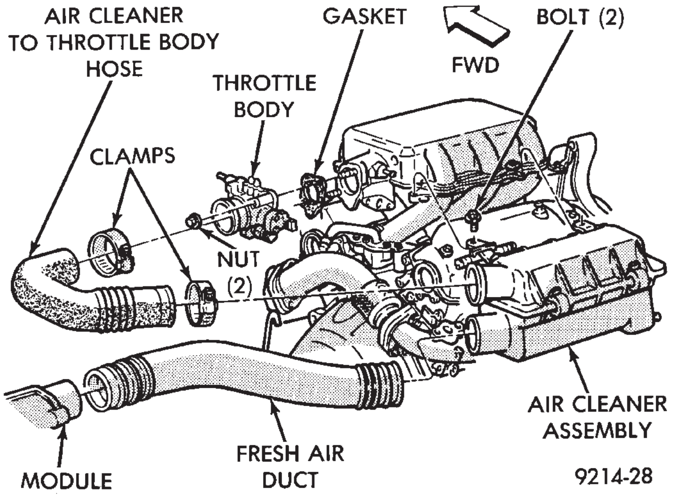


Fig. 1 Throttle Body

THROTTLE BODY

When servicing body components, always assemble components with new O-rings and seals where applicable (Fig. 2). 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.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

The 3.0L MPI fuel system is under a constant pressure of approximately 330 kPa (48 psi). Before servicing the fuel pump, fuel lines, fuel filter, throttle body or fuel injectors, the fuel system pressure must be released.

(1) Loosen fuel filler cap to release fuel tank pressure.

(2) Disconnect injector wiring harness from engine harness. Refer to Group 8W, Wiring Diagrams.

(3) Connect one end of a jumper wire to the A142 circuit terminal of the fuel rail harness connector.

(4) Connect the other end of the jumper wire to a 12 volt power source.

(5) Connect one end of a jumper wire to a good ground source.

(6) Momentarily ground one of the injectors by connecting the other end of the jumper wire to an injector terminal in the harness connector. Repeat procedure for 2 to 3 injectors.

(7) Continue fuel system service.

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 (Fig. 3).

(4) Lift throttle position sensor off throttle shaft.

INSTALLATION

(1) Install throttle position sensor on throttle shaft. Install mounting screws. Tighten screw to 2 N●m (17 in. lbs.) torque.

(2) Connect electrical connector to throttle position sensor.

(3) Connect negative cable to battery.

IDLE AIR CONTROL MOTOR

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. 4).

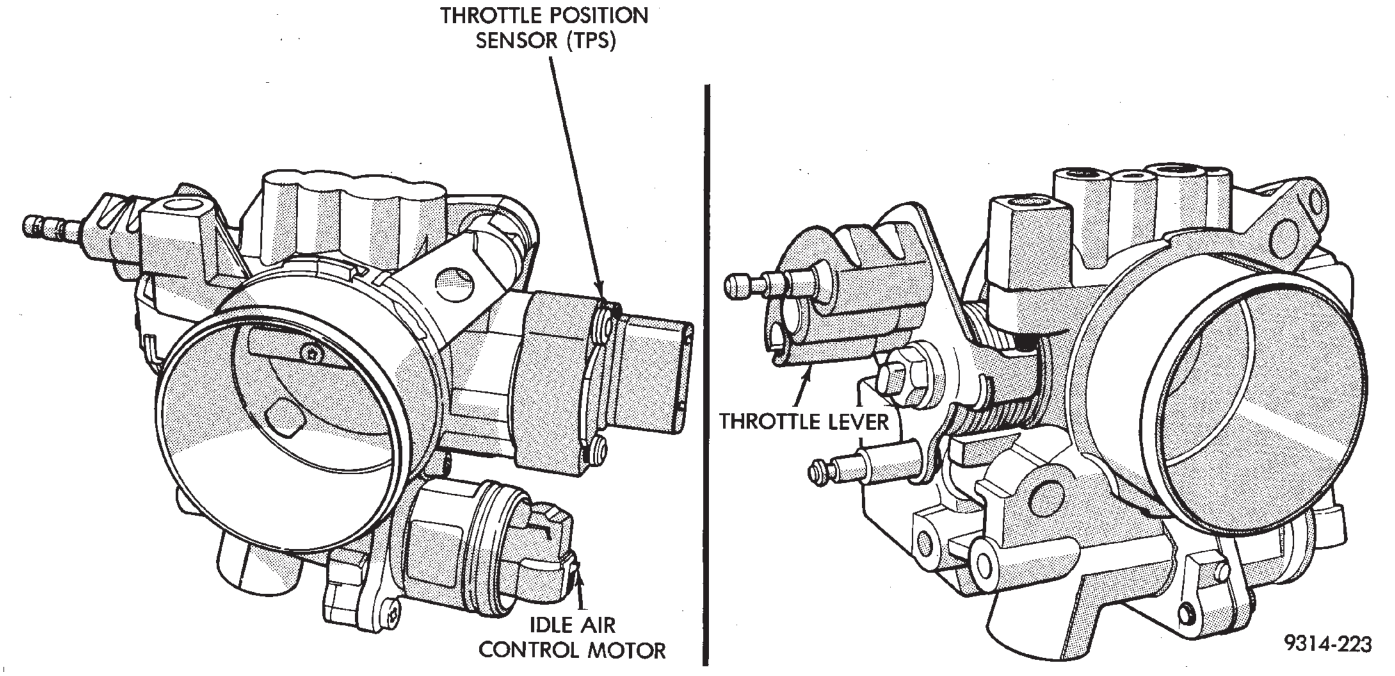


Fig. 2 Throttle Body 3.0L

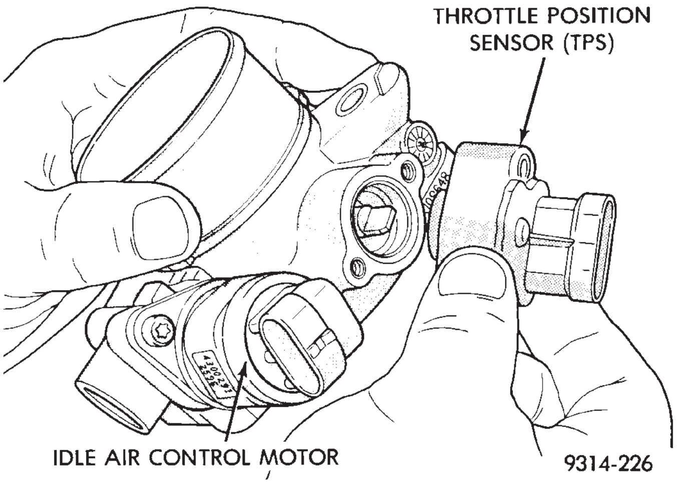


Fig. 3 Servicing Throttle Position Sensor

(4) Remove idle air control motor from throttle body. Ensure the O-ring is removed with the motor.

INSTALLATION

(1) New idle air control motors have a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRBII scan tool Idle Air Control Motor Open/Close Test to retract the pintle.

(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 motor.

(5) Connect negative cable to battery.

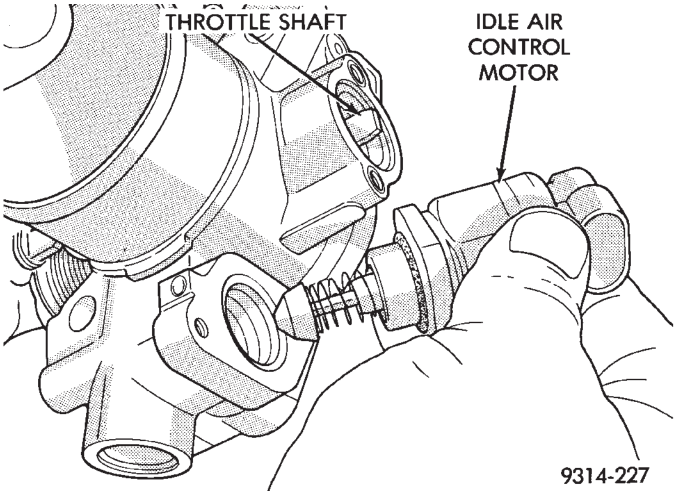


Fig. 4 Servicing Idle Air Control Motor

FUEL INJECTOR RAIL ASSEMBLY

REMOVAL

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.

(1) Perform the Fuel Pressure Release Procedure.

(2) Disconnect negative cable from battery.

(3) Remove air cleaner to throttle body hose.

(4) Remove throttle cable (Fig. 5).

(5) Disconnect electrical connectors from the idle air control motor and throttle position sensor (TPS).

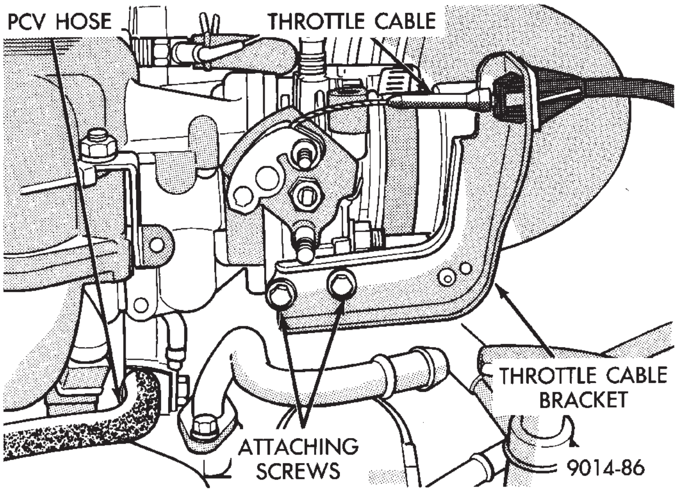


Fig. 5 Throttle Cable Attachment

(6) Remove vacuum hose harness from throttle body (Fig. 6).

(7) Remove vacuum hoses from air intake plenum (Fig. 6).

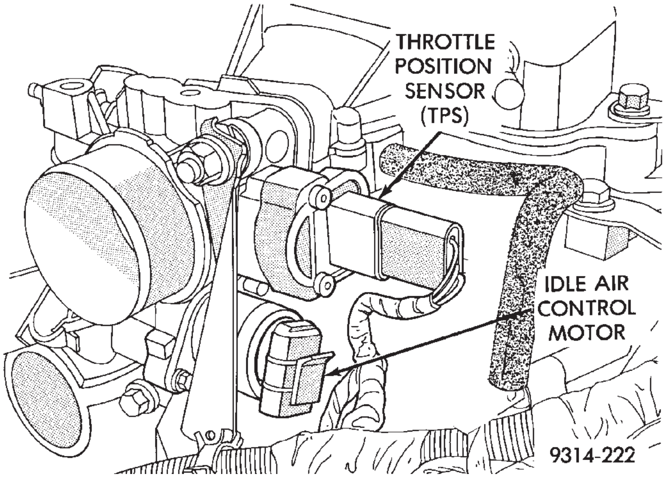


Fig. 6 Electrical and Vacuum Connection to Throttle Body

(8) If equipped with EGR, remove the EGR tube flange from intake plenum (Fig. 7).

(9) Remove the wiring connector from the coolant temperature sensor (Fig. 8).

(10) Remove vacuum connections from air intake plenum vacuum connector (Fig. 8).

(11) Remove fuel hoses from fuel rail (Fig. 8).

(12) Remove air intake plenum to intake manifold mounting fasteners (Fig. 9).

(13) Remove ignition coil.

(14) Remove air intake plenum (Fig. 10).

(15) Cover intake manifold while servicing injector fuel rail (Fig. 11).

(16) Remove vacuum hoses from fuel rail (Fig. 11).

(17) Disconnect fuel injector wiring harness from engine wiring harness (Fig. 12).

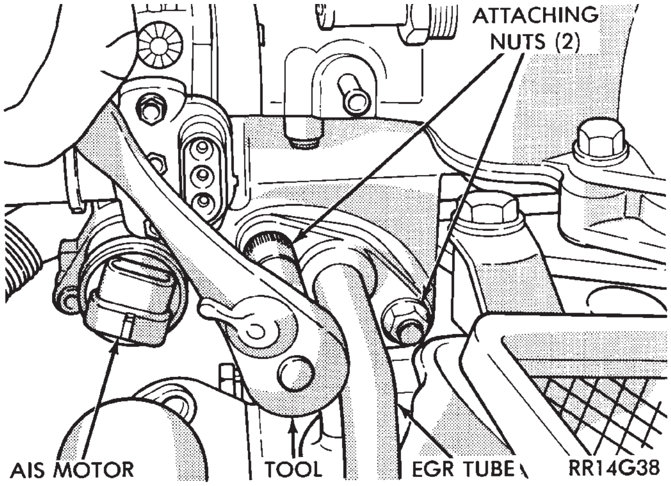


Fig. 7 EGR Tube to Intake Plenum

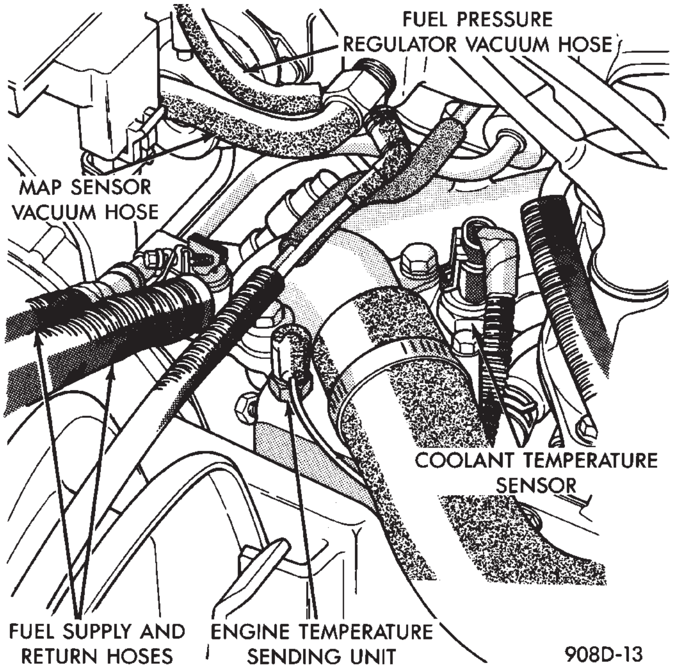


Fig. 8 Coolant Temperature Sensor

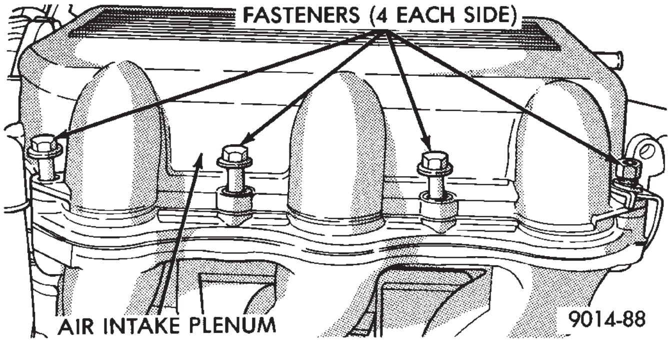


Fig. 9 Air Intake Plenum to Intake Manifold Attaching Fasteners

CAUTION: Do not damage the injector O-Rings when removing the injectors and fuel rail assembly.

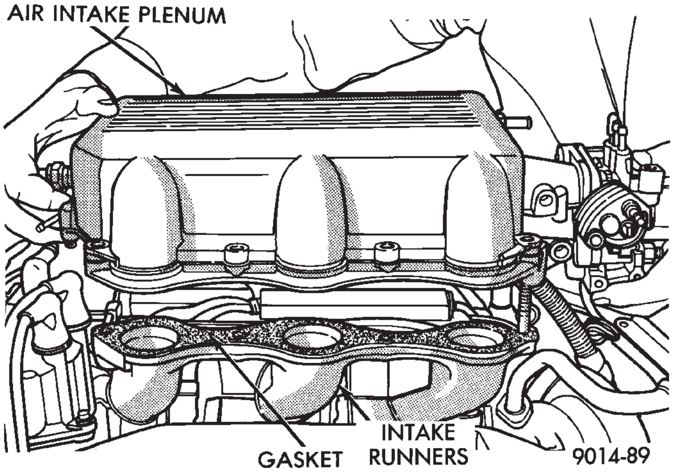


Fig. 10 Removing Air Intake Plenum

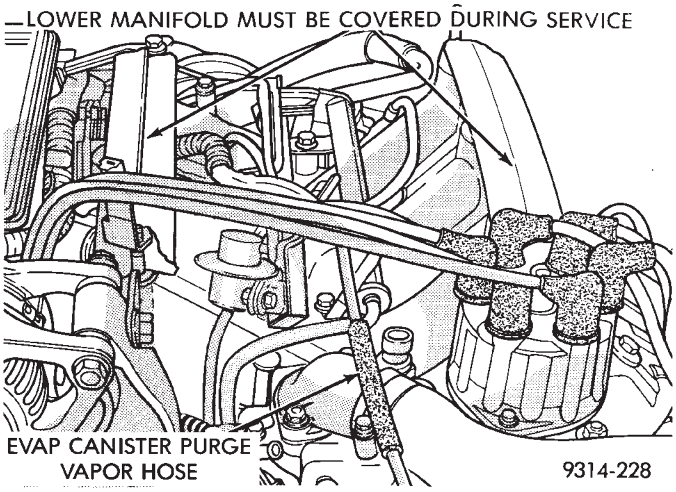


Fig. 11 Vacuum Connections at the Fuel Rail

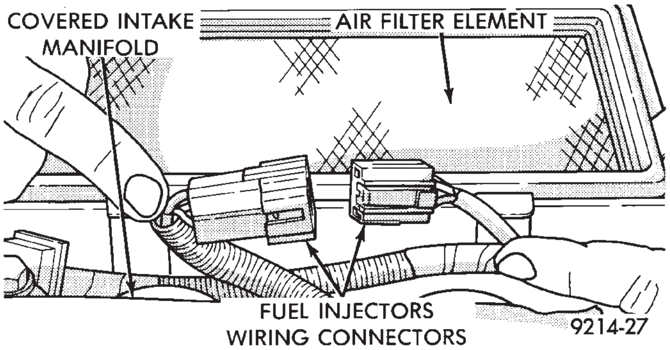


Fig. 12 Fuel Injector Wiring Harness

(18) Remove fuel rail mounting bolts. Lift fuel rail assembly off of intake manifold.

INSTALLATION

(1) Be sure injectors are seated into the receiver cup with lock ring in place.

(2) Make sure the injector holes are clean and all plugs have been removed.

(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) Connect vacuum harness to fuel rail assembly.

(9) Remove covering from lower intake manifold and clean surface.

(10) Place intake manifold gaskets **with beaded sealer up** on lower manifold. Put air intake in place. Install ignition coil. Install attaching fasteners and tighten to 13 N●m (115 in. lbs.) torque.

(11) Connect fuel lines to fuel rail. Tighten hose clamps to 1 N●m (10 in. lbs.) torque.

(12) Connect vacuum harness to air intake plenum and fuel pressure regulator.

(13) Connect coolant temperature sensor electrical connector to sensor.

(14) Connect EGR tube flange to intake plenum. Tighten mounting nuts to 22 N●m (200 in. lbs.) torque.

(15) Connect PCV and brake booster supply hose to intake plenum.

(16) Connect idle air control motor and throttle position sensor (TPS) electrical connectors.

(17) Connect vacuum vapor harness to throttle body.

(18) Install throttle cable.

(19) Install air inlet hose assembly.

(20) Connect negative cable to battery.

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.

(21) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL PRESSURE REGULATOR SERVICE

REMOVAL

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 PRESSURE REGULATOR.

(1) Perform the Fuel Pressure Release Procedure.

(2) Disconnect negative cable from battery.

(3) Loosen fuel return hose clamp and remove fuel return hose from nipple.

(4) Remove vacuum hose from fuel pressure regulator. (Fig. 13).

(5) Remove screw holding fuel return tube to the intake manifold.

(6) Remove fuel pressure regulator screws. Remove fuel pressure regulator from engine.

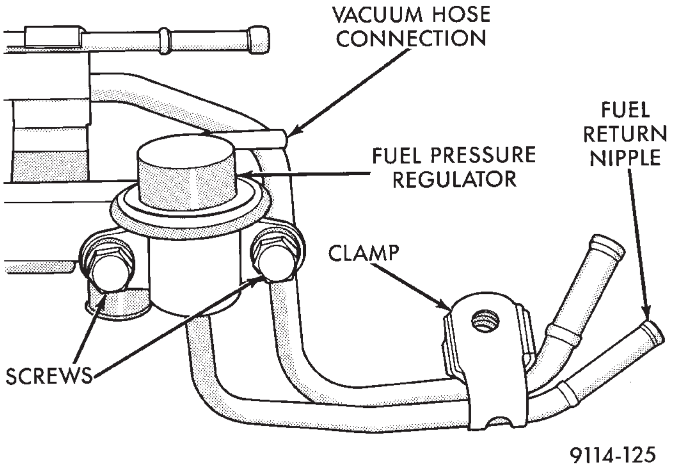


Fig. 13 Fuel Pressure Regulator

INSTALLATION

(1) Lubricate O-ring on fuel pressure regulator with clean 30 weight engine oil.

(2) Install fuel pressure regulator into fuel rail. Tighten screws to 10 N●m (90 in. lbs.) torque.

(3) Install screw holding fuel return tube clamp in place. Tighten screw to 10 N●m (95 in. lbs.) torque.

(4) Connect vacuum hose to fuel pressure regulator.

(5) Connect fuel return hose to fuel return tube. Tighten hose clamp to 1 N●m (10 in. lbs.) torque.

(6) Connect negative battery cable.

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.

(7) With the ignition key in ON position, access the DRBII scan tool's ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL INJECTORS

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.

The fuel rail must be removed first to service the injectors. Refer to Fuel Injector Rail Assembly Removal in this section.

(3) Label each injector connector with its cylinder number. Disconnect electrical connector from injector.

(4) Position fuel rail assembly so that the fuel injectors are easily accessible.

(5) Remove injector clip from fuel rail and injector (Fig. 14).

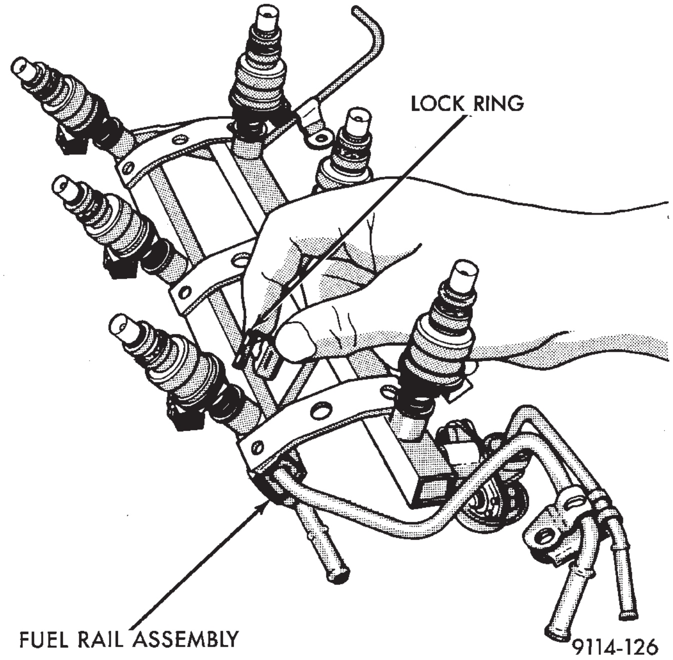


Fig. 14 Fuel Injector and Rail

(6) Pull injector straight out of fuel rail receiver cup (Fig. 15).

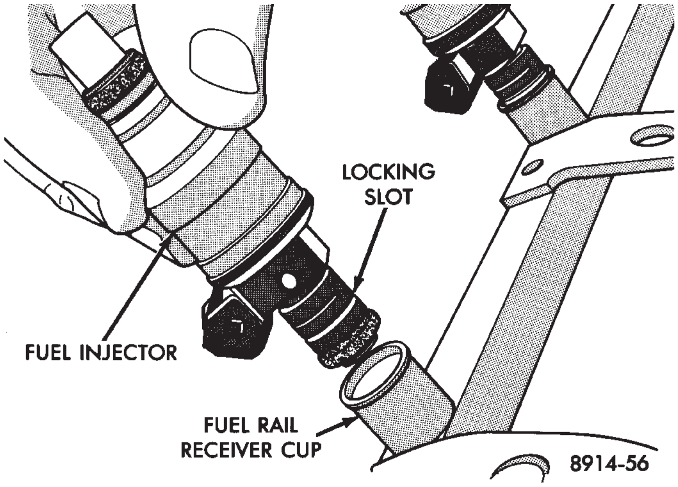


Fig. 15 Servicing Fuel Injector

(7) Check injector O-ring for damage. If O-ring is damaged, it must be replaced. If injector is to be re-used, a protective cap must be installed on the injector tip to prevent damage.

(8) 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 (Fig. 15).

(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. 14).

(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 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.

(8) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

(1) Remove vacuum hose and mounting screws from manifold absolute pressure (MAP) sensor (Fig. 16).

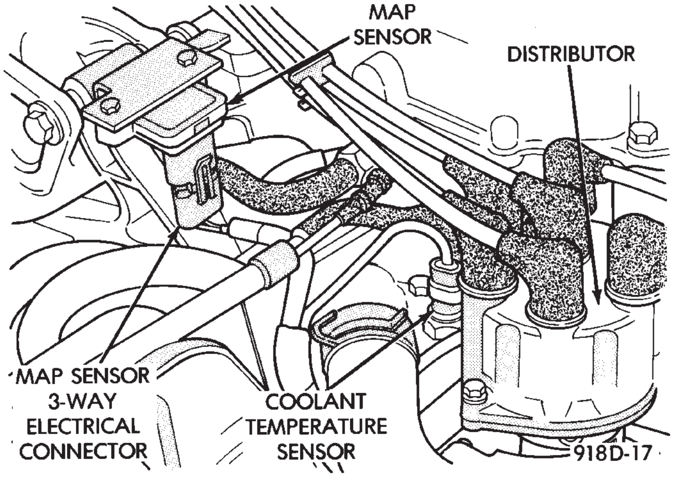


Fig. 16 Manifold Absolute Pressure Sensor

(2) Disconnect electrical connector from sensor. Remove sensor.

(3) Reverse the above procedure for installation.

CANISTER PURGE SOLENOID SERVICE

(1) Remove vacuum hose and electrical connector from solenoid (Fig. 17).

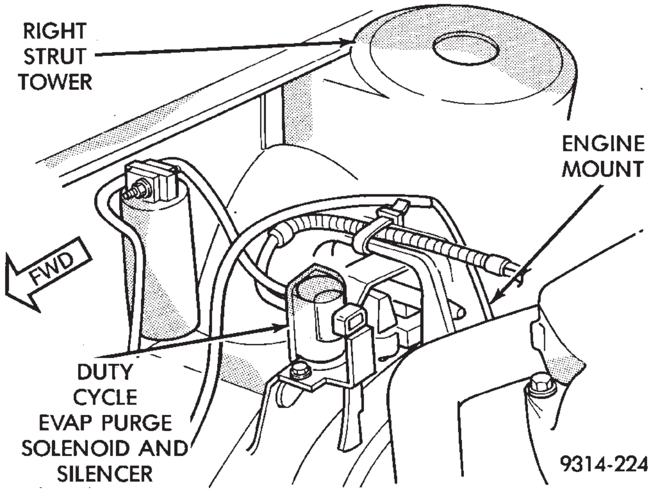


Fig. 17 Canister Purge Solenoid

(2) Slide solenoid and silencer assembly off of bracket.

(3) Reverse above procedure to install.

PCM

(1) Remove air cleaner duct from PCM.

(2) Disconnect negative cable from battery. Disconnect positive cable from battery.

(3) Remove battery holddown. Remove battery.

(4) Remove PCM mounting screws (Fig. 18, Fig. 19 or Fig. 20).

(5) Remove the electrical connector from PCM. Remove PCM.

(6) Reverse the above procedure for installation.

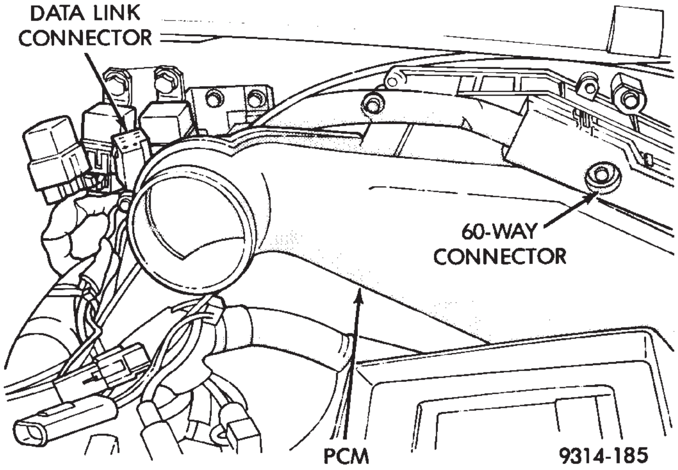


Fig. 18 PCM—AA Body

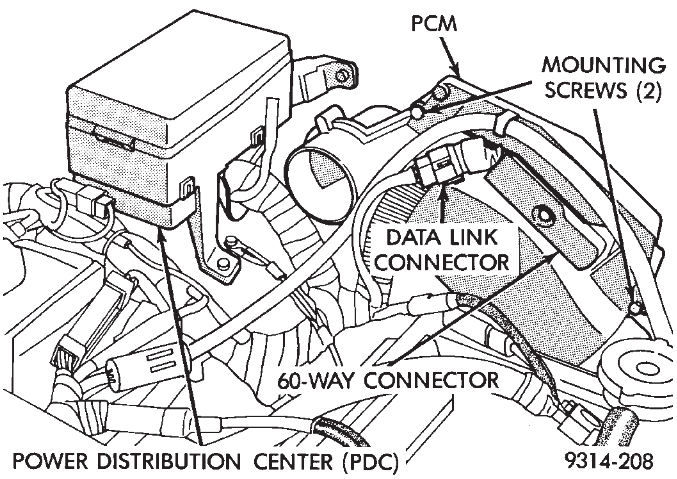


Fig. 19 PCM—AC Body

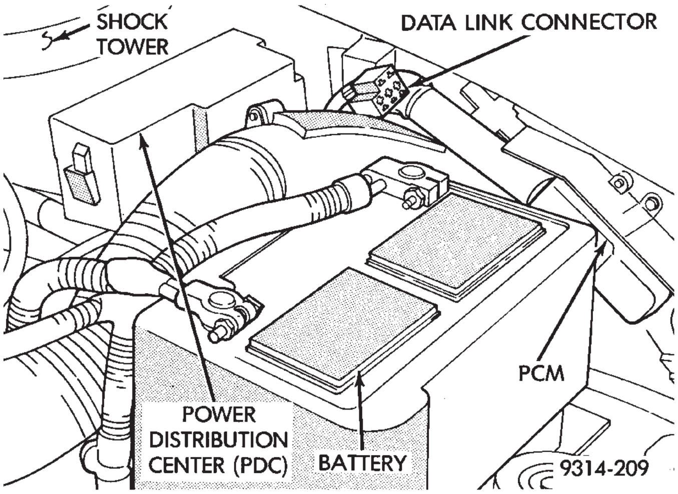


Fig. 20 PCM—AG and AJ Bodies

HEATED OXYGEN SENSOR (O_2 SENSOR)

The oxygen sensor is installed in the exhaust manifold (Fig. 21).

CAUTION: Do not pull on the oxygen sensor wires when disconnecting the electrical connector.

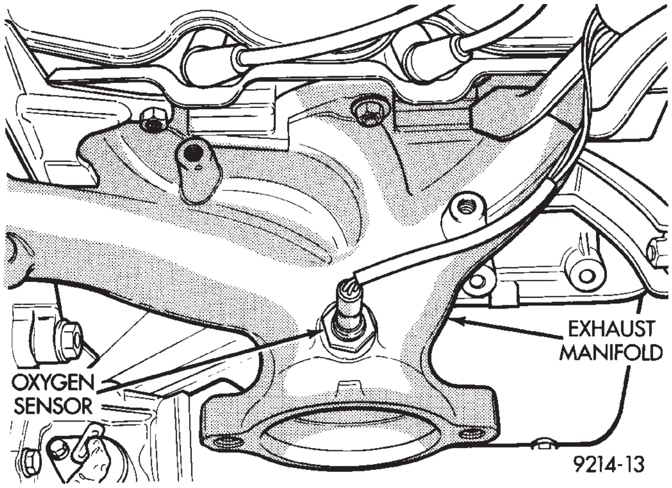


Fig. 21 Heated Oxygen Sensor

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

(1) Disconnect oxygen sensor electrical connector.

(2) Remove sensor using Tool C-4907 (Fig. 22). Slightly tightening the sensor can ease removal.

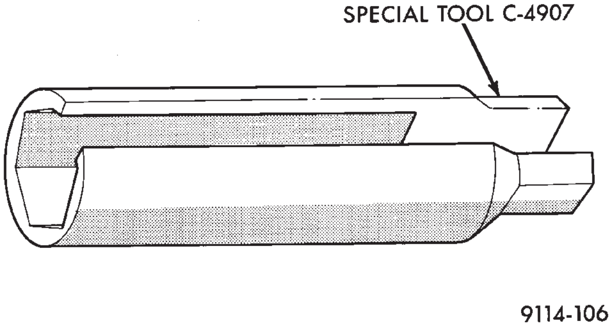


Fig. 22 Oxygen Sensor Socket

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. New sensors are packaged with compound on the threads and do not require additional compound. The sensor must be tightened to 27 N●m (20 ft. lbs.) torque.

3.3L AND 3.8L MULTI-PORT FUEL INJECTION—SYSTEM OPERATION

INDEX

GENERAL INFORMATION

3.3L and 3.8L engines use a sequential Multi-port Electronic Fuel Injection system (Fig. 1). The MPI system is computer regulated and provides precise air/fuel ratios for all driving conditions.

The MPI system is operated by the powertrain control module (PCM).

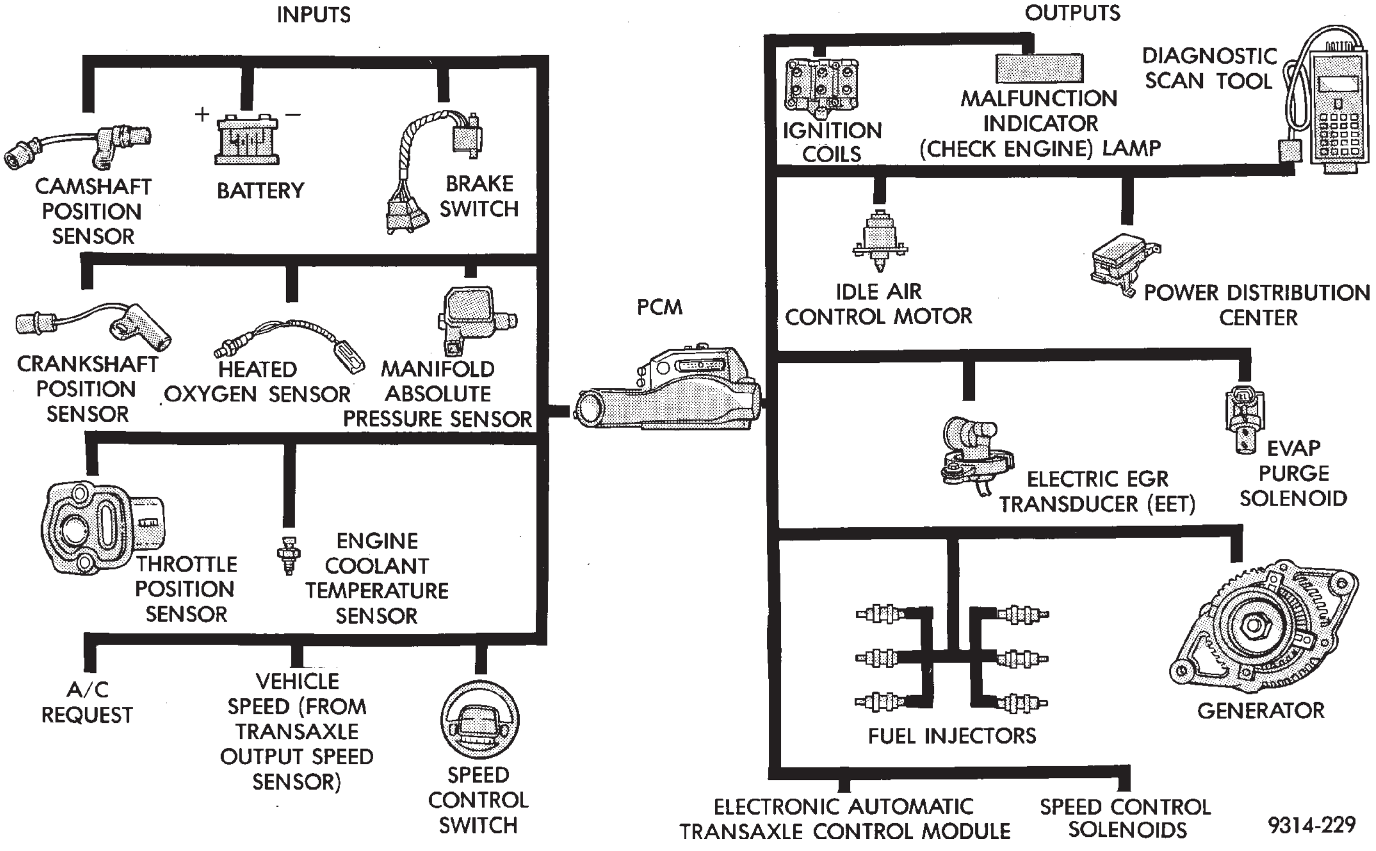


Fig. 1 Multi-Port Fuel Injection Components

The PCM regulates ignition timing, air-fuel ratio, emission control devices, cooling fan, charging system, idle speed and 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. 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 energized.

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.

SYSTEM DIAGNOSIS

The PCM tests many of its own input and output circuits. If a fault is found in a major system, the information is stored in memory. Technicians can display fault information through the malfunction indicator lamp (instrument panel Check Engine lamp) or by connecting the DRBII scan tool. For diagnostic trouble code information, refer to the 3.3L/3.8L Multi-Point Fuel Injection—On-Board Diagnostics section of this group.

CCD BUS

Various modules exchange information through a communications port called the CCD Bus. The powertrain control module (PCM) transmits engine RPM and vehicle load information on the CCD Bus.

POWERTRAIN CONTROL MODULE

The powertrain control module (PCM) is a digital computer containing a microprocessor (Fig. 2). 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.

PCM Inputs:
- Air Conditioning Controls
- Battery Voltage
- Brake Switch
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Engine Coolant Temperature Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensor
- SCI Receive

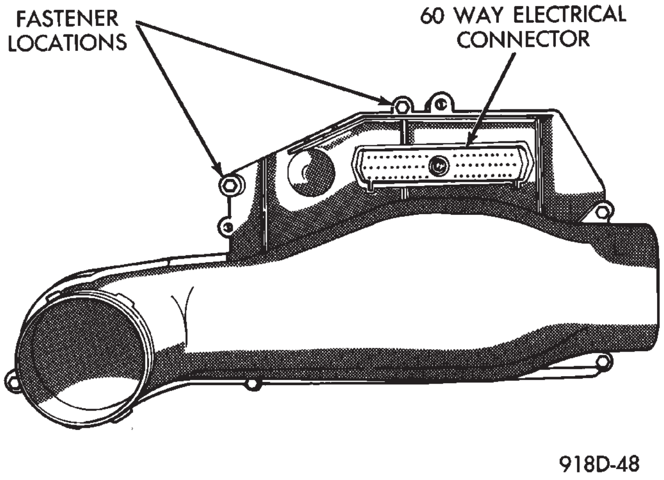


Fig. 2 PCM

- Speed Control System Controls
- Throttle Position Sensor
- Transaxle Park/Neutral Switch (automatic transaxle)
- Vehicle Speed Sensor

PCM Outputs:
- Air Conditioning Clutch Relay
- Generator Field
- Idle Air Control Motor
- Auto Shutdown (ASD) and Fuel Pump Relays
- Canister Purge Solenoid
- Malfunction Indicator Lamp (Check Engine Lamp)
- Data Link Connector
- Electronic EGR Transducer
- Fuel Injectors
- Ignition Coil
- Radiator Fan Relay
- Speed Control Solenoids
- Tachometer Output

Based on inputs it receives, the PCM adjusts the EGR system, 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 oxygen content (oxygen sensor)
- engine speed (crankshaft position sensor)
- manifold absolute pressure
- throttle position

The PCM adjusts ignition timing based on the following inputs.
- engine coolant temperature
- engine speed (crankshaft position sensor)
- 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.

- brake switch
- engine coolant temperature
- engine speed (crankshaft position sensor)
- throttle position
- transaxle gear selection (park/neutral switch)
- vehicle speed

The auto shutdown (ASD) and fuel pump relays are mounted externally, but turned on and off by the PCM through the same circuit.

The camshaft position sensor 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 and fuel pump relays. When these relays are deactivated, power is shut off to the fuel injector, 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. The 8.0 volts power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5.0 volts supply for the coolant temperature sensor, manifold absolute pressure sensor and throttle position sensor.

AIR CONDITIONING SWITCH SENSE—PCM INPUT

When the air conditioning or defrost switch is put in the ON position and the low pressure, high pressure and ambient temperature switches are closed, the PCM receives an input for air conditioning. After receiving this input, the PCM activates the A/C compressor clutch by grounding the A/C clutch relay.

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.

BRAKE SWITCH—PCM INPUT

When the brake switch is activated, the PCM receives an input indicating that the brakes are being applied. the brake signal cancels speed control and unlocks the torque convertor. The brake switch is mounted on the brake pedal support bracket.

CAMSHAFT POSITION SENSOR—PCM INPUT

The camshaft position sensor provides cylinder identification to the powertrain control module (PCM) (Fig. 3). The sensor generates pulses as groups of notches on the camshaft sprocket pass underneath it (Fig. 4). 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.

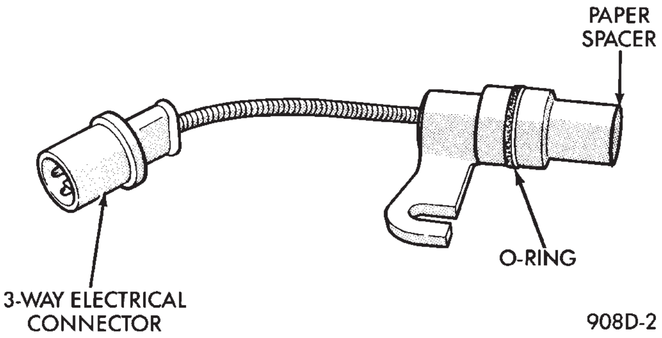


Fig. 3 Camshaft Position Sensor

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. 4). The PCM can synchronize on cylinders 1 or 4.

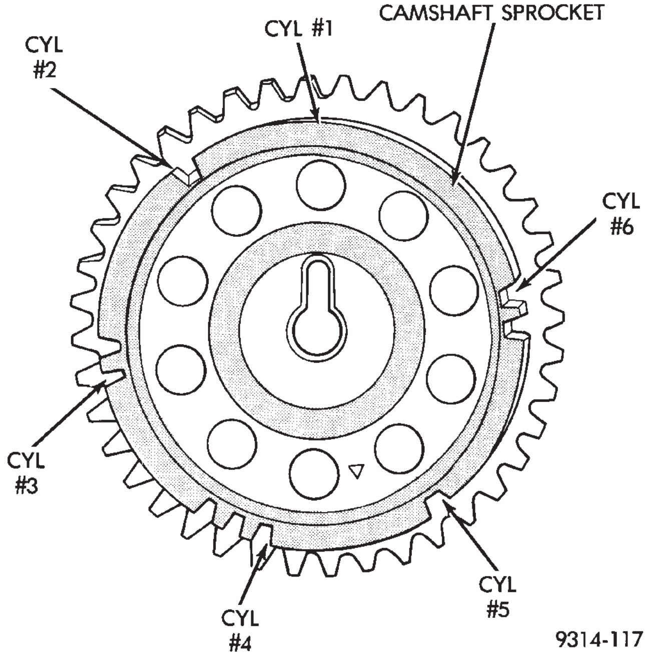


Fig. 4 Camshaft Sprocket

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.

The camshaft position sensor is mounted to the top of the timing case cover (Fig. 5). 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.**

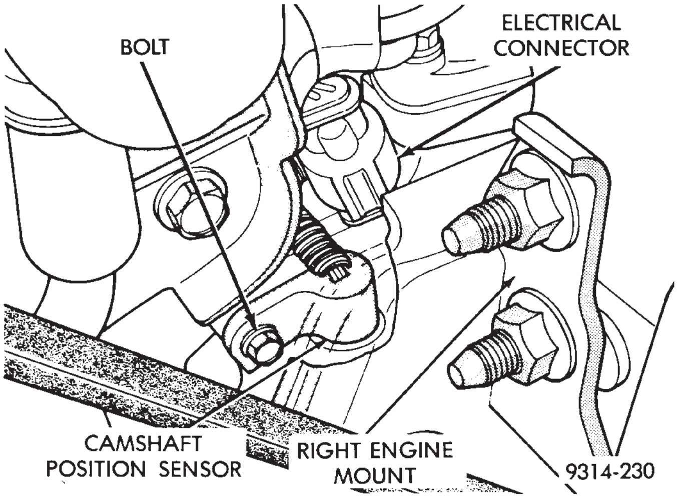


Fig. 5 Camshaft Position Sensor Location

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The coolant temperature sensor is a variable resistor with a range of -40°F to 265°F. The sensor is installed next to the thermostat housing (Fig. 6).

The PCM supplies 5.0 volts to the coolant temperature sensor. The 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 coolant sensor is also used for cooling fan control.

CRANKSHAFT POSITION SENSOR—PCM INPUT

The crankshaft position sensor (Fig. 7) senses slots cut into the transaxle driveplate extension. There are a 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 8). Basic timing is determined 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. 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 during cranking.

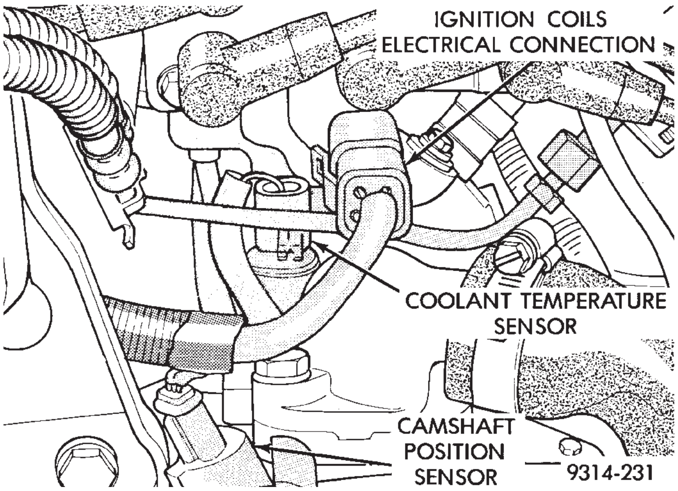


Fig. 6 Coolant Temperature Sensor

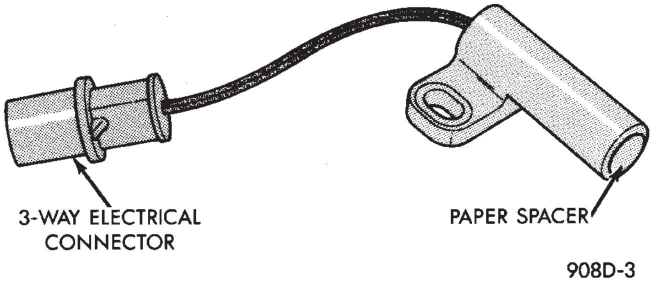


Fig. 7 Crankshaft Position Sensor

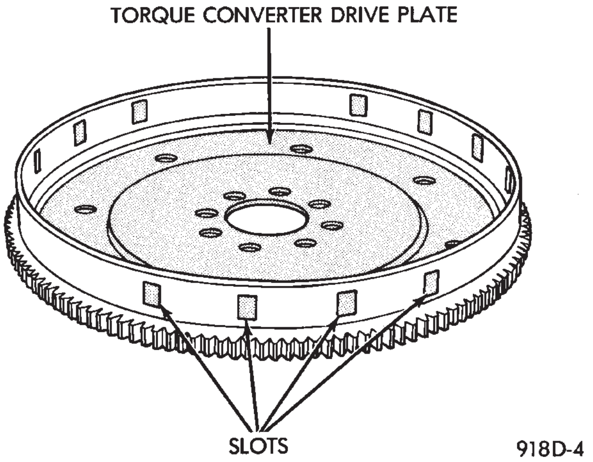


Fig. 8 Timing Slots

The PCM uses the camshaft position sensor to determine injector sequence. The PCM determines ignition timing from the crankshaft position sensor. Once crankshaft position has been determined, the PCM begins energizing the injectors in sequence.

The crankshaft position sensor is located in the transaxle housing, above the vehicle speed sensor (Fig. 9). 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 Multi-Port Fuel Injection Service Procedures—3.3L Engine section in this Group.**

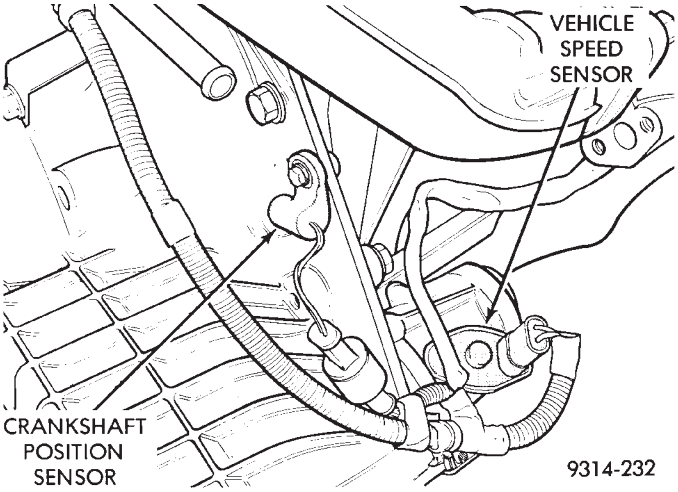


Fig. 9 Crankshaft Position Sensor Location

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. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

The MAP sensor (Fig. 10) mounts to the side of the intake manifold, below the positive crankcase ventilation (PCV) valve. The sensor connects electrically to the PCM.

HEATED OXYGEN SENSOR (O_2 SENSOR)—PCM INPUT

The O_2 sensor 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. 11). The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

The O_2 sensor produces 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 sensor 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 sensor acts as a rich-lean switch.

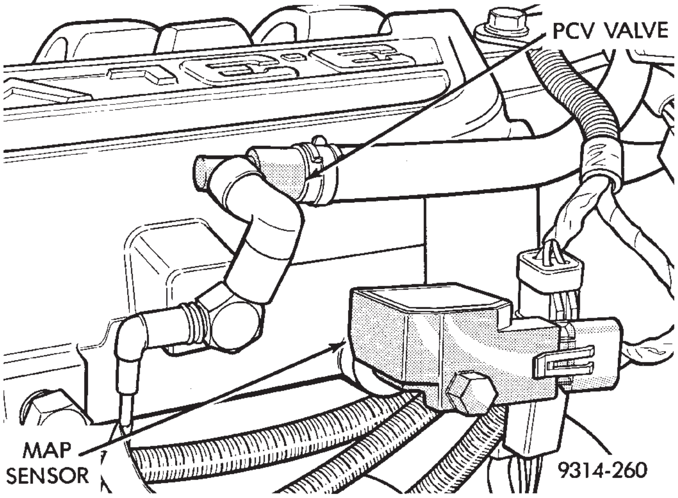


Fig. 10 Map Sensor

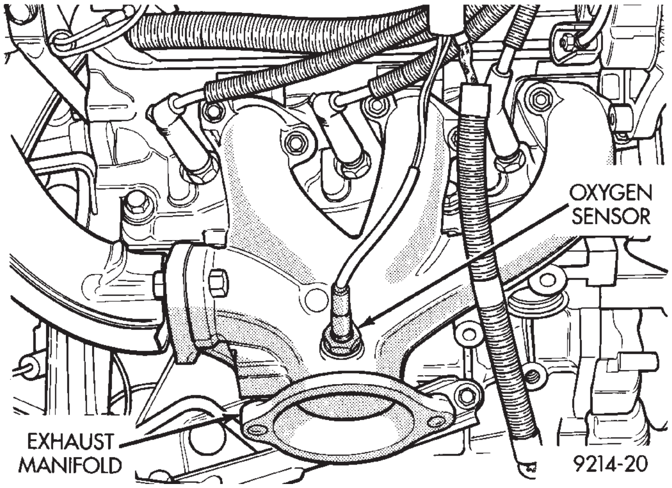


Fig. 11 Heated Oxygen Sensor—3.3L Engine

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors the O_2 sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O_2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

SPEED CONTROL—PCM INPUT

The speed control system provides four separate voltages (inputs) to the PCM. The voltages correspond to the On/Off, Set, and Resume.

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 a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control OFF voltage tells the PCM that the speed control system has been deactivated. Refer to Group 8H for further speed control information.

TRANSAXLE PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the transaxle housing (Fig. 12). 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.

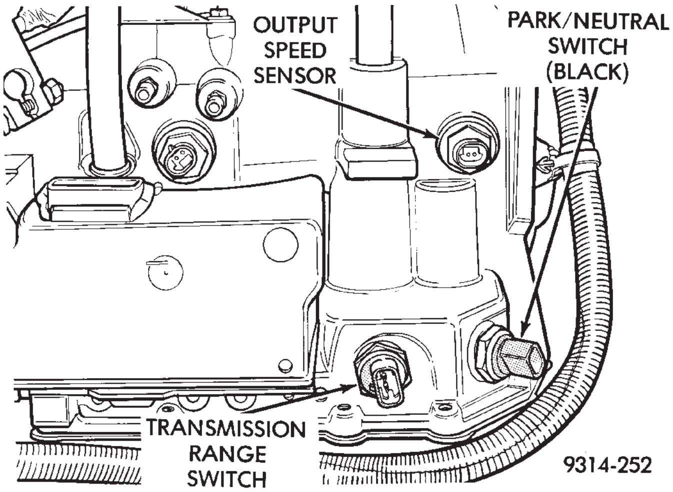


Fig. 12 Park Neutral Switch—4-Speed Electronic Automatic Transaxle

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The Throttle Position Sensor (TPS) is mounted on the throttle body and connected to the throttle blade shaft (Fig. 13). The TPS is a variable resistor that provides the 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 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 3.5 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 adjust fuel injector pulse width and ignition timing based on these inputs.

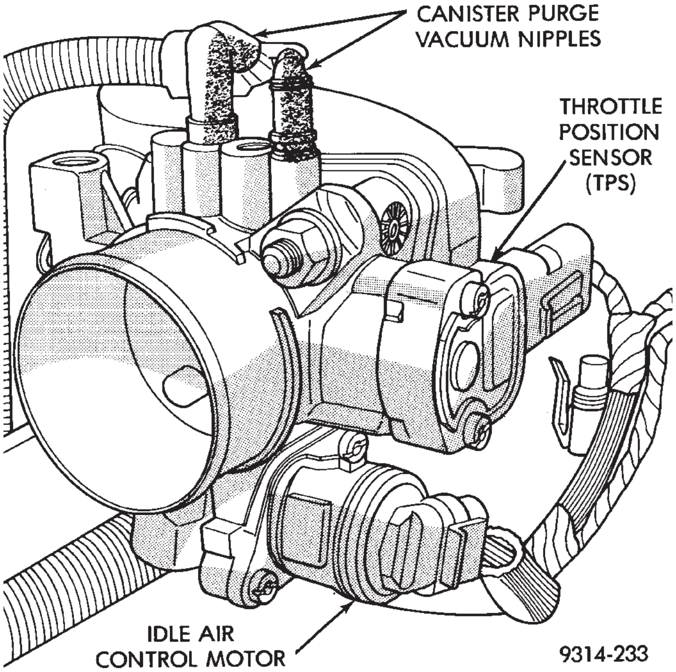


Fig. 13 Throttle Position Sensor

VEHICLE SPEED AND DISTANCE INPUT—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. 12).

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.

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

The PCM operates the air conditioning clutch relay ground circuit (Fig. 14). The ignition switch supplies battery voltage to the solenoid side of the relay. When the A/C clutch relay energizes, battery voltage powers the A/C compressor clutch.

With the engine operating and the blower motor switch in the On position, the PCM cycles the air conditioning clutch on and off when the A/C switch closes. 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.

GENERATOR FIELD—PCM OUTPUT

The PCM regulates the charging system voltage

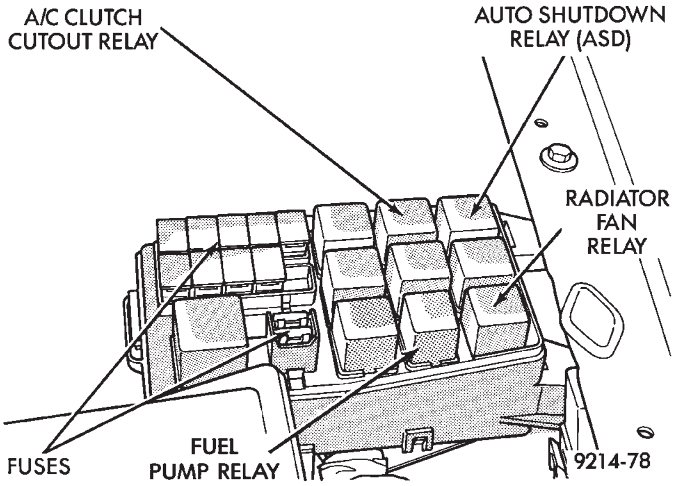


Fig. 14 Relay Identification

within a range of 12.9 to 15.0 volts. Refer to Group 8A for charging system information.

AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY—PCM OUTPUT

The PCM operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates the relays by switching the ground path on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injector and ignition coil. The fuel pump relay connects battery voltage to the fuel pump and oxygen sensor heating element.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. 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 de-energizes both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injector, ignition coil, fuel pump and oxygen sensor heating element.

The ASD relay and fuel pump relay are located in the power distribution center (Fig. 14).

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. 13). 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 (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.

CANISTER PURGE SOLENOID—PCM OUTPUT

Vacuum for the Evaporative Canister is controlled by the Canister Purge Solenoid (Fig. 15). The solenoid is controlled by the PCM.

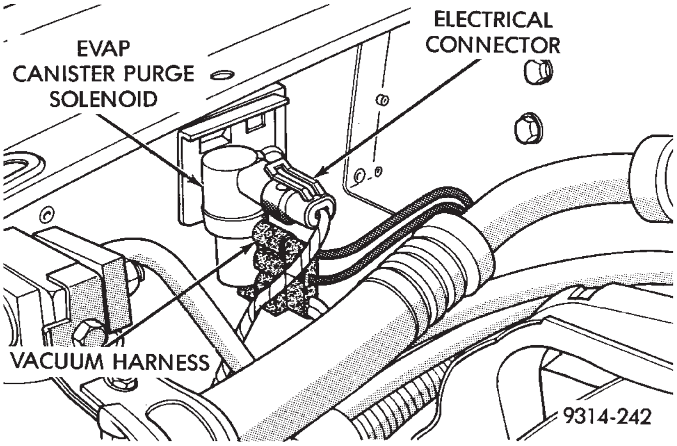


Fig. 15 Canister Purge Solenoid

The PCM operates the solenoid by switching the ground circuit on and off based on engine operating conditions. When energized, the solenoid prevents vacuum from reaching the evaporative canister. When not energized the solenoid allows vacuum to flow to the canister.

The PCM removes the ground to the solenoid when the engine reaches a specified temperature and the time delay interval has occurred. When the solenoid is de-energized, vacuum flows to the canister purge valve. Vapors are purged from the canister and flow to the throttle body.

The purge solenoid will also be energized during certain idle conditions, in order to update the fuel delivery calibration.

MALFUNCTION INDICATOR LAMP (CHECK ENGINE LAMP)—PCM OUTPUT

The malfunction indicator lamp (instrument panel 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 warns the operator that the PCM has entered a Limp-in mode. During Limp-in Mode, the PCM attempts to keep the system operational. The malfunction indicator 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.

Signals that can trigger the Malfunction Indicator lamp (Check Engine Lamp).

- Engine Coolant Temperature Sensor
- Manifold Absolute Pressure Sensor
- Throttle Position Sensor
- Battery Voltage Input
- An Emission Related System (California vehicles)
- Charging system

The malfunction indicator (Check Engine Lamp) can also display diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within five seconds and any diagnostic trouble codes stored in the PCM will be displayed. Refer to the 3.3L and 3.8L Multi-Port Fuel Injection—On-Board Diagnostics section of this Group for Diagnostic Trouble Code Descriptions.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector provides the technician with the means to connect the DRBII scan tool to diagnosis the vehicle.

TRANSAXLE CONTROL MODULE—PCM OUTPUT

The PCM supplies the following information to the electronic automatic transaxle control module through the CCD Bus:

- battery temperature
- brake switch input
- engine coolant temperature
- manifold absolute pressure (MAP)
- speed control information

ELECTRIC EGR TRANSDUCER (EET) SOLENOID—PCM OUTPUT

The electronic EGR transducer (EET) contains an electrically operated solenoid and a back-pressure transducer (Fig. 16). 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 EGR valve. Vacuum flows to the EGR valve 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 by 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 provides the correct amount of exhaust gas recirculation for different operating conditions.

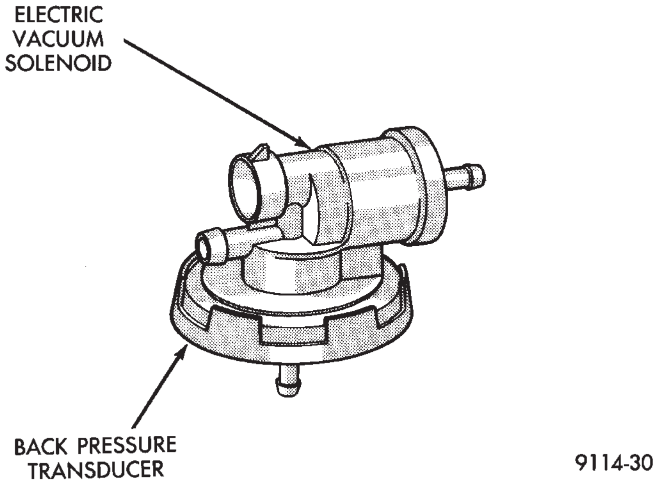


Fig. 16 Electric EGR Transducer (EET) Assembly

FUEL INJECTORS—PCM OUTPUT

The fuel injectors are electrical solenoids (Fig. 17). 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.

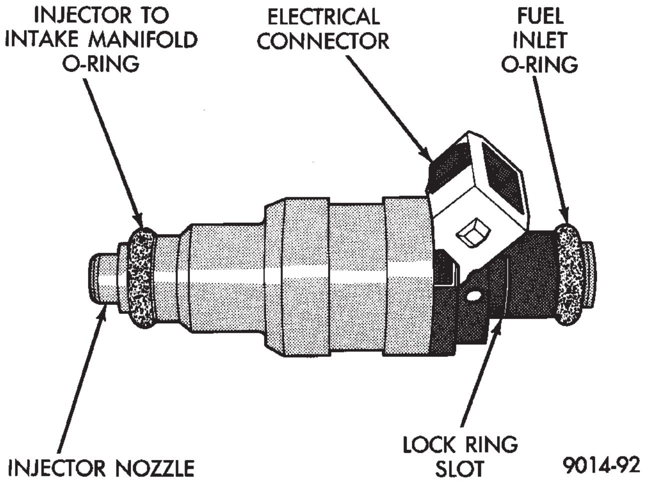


Fig. 17 Fuel Injector—3.3L Engine

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 the PCM determines crankshaft position, it begins energizing the injectors in sequence.

The auto 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 3 molded coils together (Fig. 18). 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.

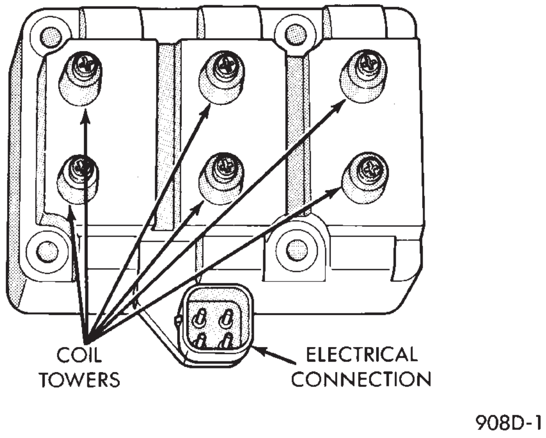


Fig. 18 Coil Pack—3.3L Engine

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/Fuel Pump Relay—PCM Output in this section for relay operation.

RADIATOR FAN RELAY—PCM OUTPUT

The radiator fan is energized by the PCM through the radiator fan relay. The radiator fan relay is located on the drivers side fender well near the PCM (Fig. 14). The PCM grounds the radiator fan relay when engine coolant reaches a predetermined temperature or the A/C system head pressure is high.

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 blade. When the PCM supplies a ground only to the vent solenoid, the throttle blade holds position. When the PCM removes the ground from both the vacuum and vent solenoids, the throttle blade closes. The PCM balances 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.

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 (O_2) sensor is not monitored during Open Loop modes.

During Closed Loop modes the PCM does monitor the oxygen (O_2) 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 O_2 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 3.3L 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 auto 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 auto shutdown (ASD) relay and fuel pump relay. These relays supply battery voltage to the fuel pump, fuel injectors, 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 six 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 fault into memory.

Once the ASD and fuel pump relays have been energized, the PCM:

- Determines injector pulse width based on battery voltage, coolant temperature, engine rpm and the number of engine revolutions since cranking was initiated.

ENGINE WARM-UP MODE

This is a OPEN LOOP mode. The following inputs are received by the PCM:

- engine coolant temperature
- manifold absolute pressure (MAP)
- 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

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 will reduce injector pulse width. This helps maintain better control of the air-fuel mixture (as sensed through the O_2 sensor).

During a closed throttle deceleration condition, the PCM grounds the exhaust gas recirculation (EGR) solenoid. When the solenoid is grounded, EGR function stops.

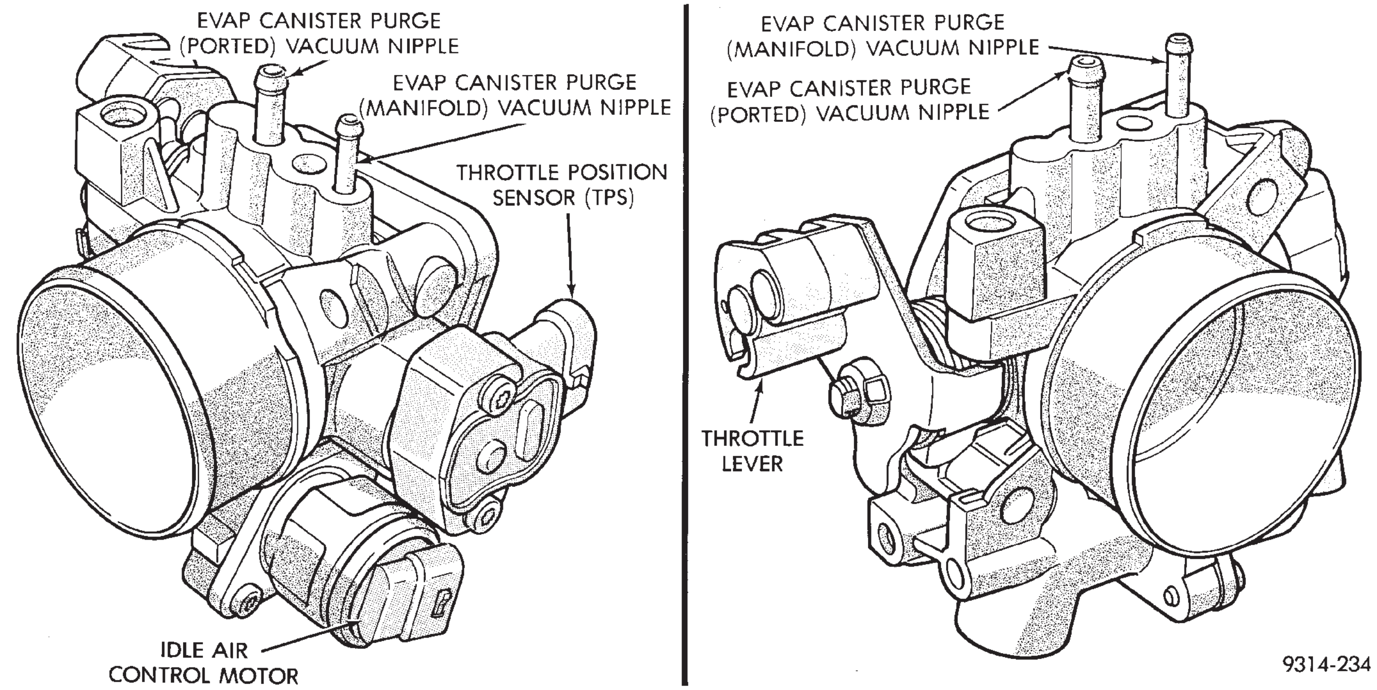


Fig. 19 Throttle Body

WIDE OPEN THROTTLE MODE

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are received by the PCM:

- battery voltage
- engine coolant temperature
- manifold absolute pressure
- engine speed
- throttle position

When the PCM senses wide open throttle condition through the throttle position sensor (TPS) it will:

- De-energize the air conditioning relay. This disables the air conditioning system.
- Provide a ground for the electrical EGR transducer (EET) solenoid. When the PCM grounds the solenoid, the EGR system stops operating.

The exhaust gas oxygen content input is not accepted by the PCM during wide open throttle operation. The PCM will adjust injector pulse width to supply a predetermined amount of additional fuel.

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.

THROTTLE BODY

The throttle body assembly is located on the left side of the intake manifold plenum (Fig. 19). 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.

FUEL SUPPLY CIRCUIT

Fuel is pumped to the fuel rail by an electrical pump in the fuel tank. The pump inlet is fitted with a strainer to prevent water and other contaminants from entering the fuel supply circuit.

Fuel pressure is controlled to a preset level above intake manifold pressure by a pressure regulator. The regulator is mounted on the fuel rail. The regulator uses intake manifold pressure as a reference.

FUEL INJECTORS AND FUEL RAIL ASSEMBLY

Six fuel injectors are retained in the fuel rail by lock rings (Fig. 20). The rail and injector assembly is installed in position with the injectors inserted in recessed holes in the intake manifold.

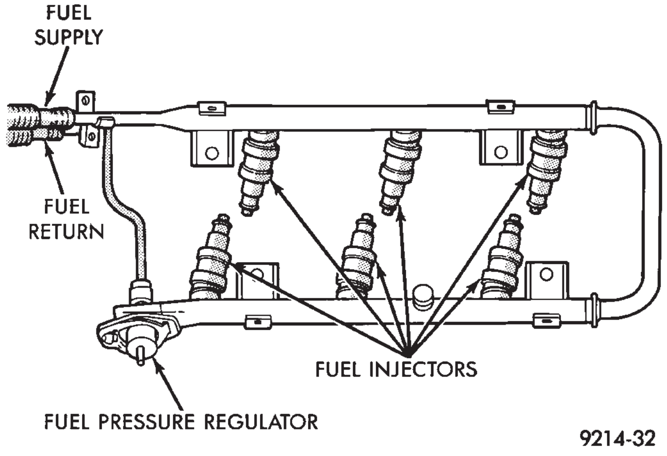


Fig. 20 Fuel Rail Assembly

FUEL PRESSURE REGULATOR

The pressure regulator is a mechanical device located on the fuel rail, downstream of the fuel injectors (Fig. 21). The regulator maintains a constant 330 kPa (48 psi) across the fuel injector tip.

The regulator contains a spring loaded rubber diaphragm that covers the fuel return port. When the fuel pump is operating, fuel flows past the injectors into the regulator, and is restricted from flowing any further by the blocked return port. When fuel pressure reaches 330 kPa (48 psi) it pushes on the diaphragm, compresses the spring, and uncovers the fuel return port. The diaphragm and spring constantly move from an open to closed position keeping fuel pressure consistent.

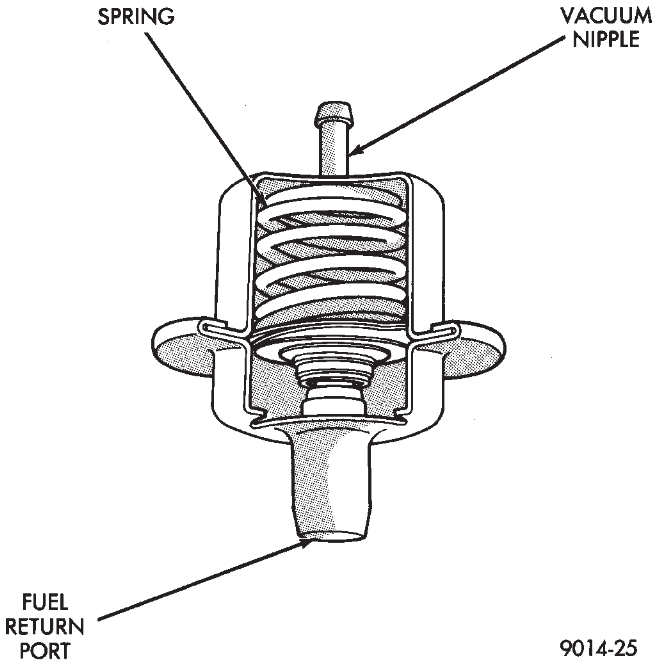


Fig. 21 Fuel Pressure Regulator

3.3L AND 3.8L MULTI-PORT FUEL INJECTION—GENERAL DIAGNOSIS

INDEX

FUEL SYSTEM DIAGRAM

Refer to the Component Identification portion of this section for a more complete description of the components shown in Fig. 1.

VISUAL INSPECTION

Perform a visual inspection for loose, disconnected, or misrouted wires and hoses before diagnosing or servicing the fuel injection system. A visual check saves unnecessary test and diagnostic time. A thorough visual inspection includes 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 (Fig. 2).

(3) Verify the camshaft position sensor electrical connector is connected to the harness and not damaged (Fig. 3).

(4) Ensure the engine temperature sensor electrical connector is connected to the sensor and not damaged (Fig. 3).

(5) Ensure the coolant temperature sensor electrical connector is connected to the sensor and not damaged (Fig. 4).

(6) Verify the quick connect fuel fittings are fully inserted on the fuel supply and return tubes.

(7) Check the vacuum hose connection at the fuel pressure regulator for damage or leakage (Fig. 5).

(8) Check the oil pressure sending unit electrical connection (Fig. 6).

(9) Verify the electrical connector is attached to the Purge Solenoid (Fig. 7) and not damaged.

(10) Verify the vacuum connection at the purge solenoid is secure and not leaking (Fig. 7).

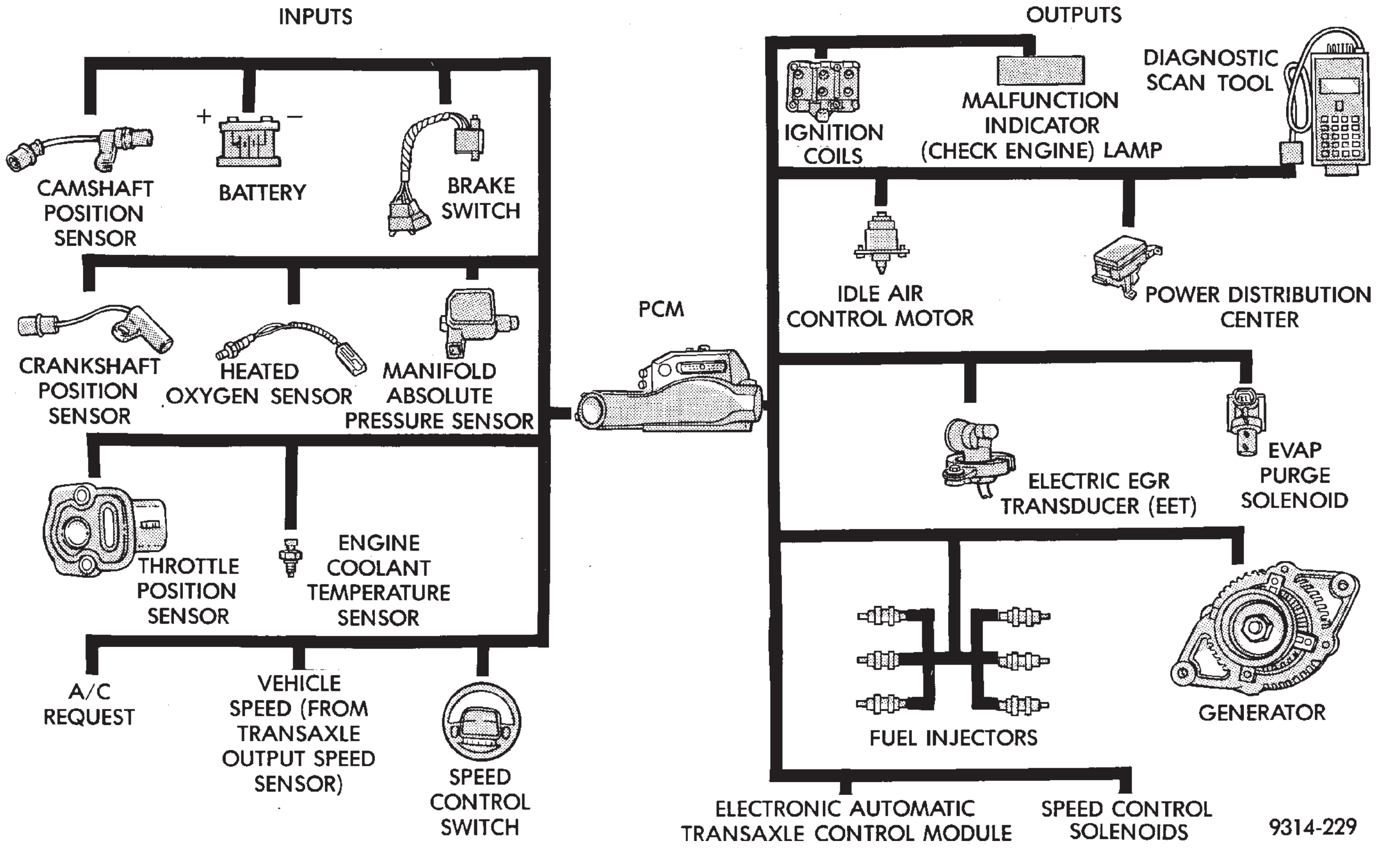


Fig. 1 Multi-Port Fuel Injection Components

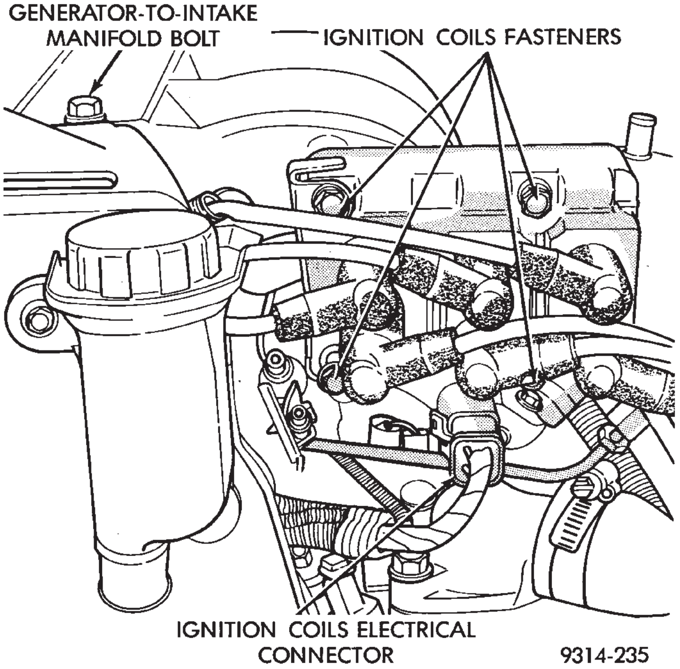


Fig. 2 Ignition Coils Electrical Connection

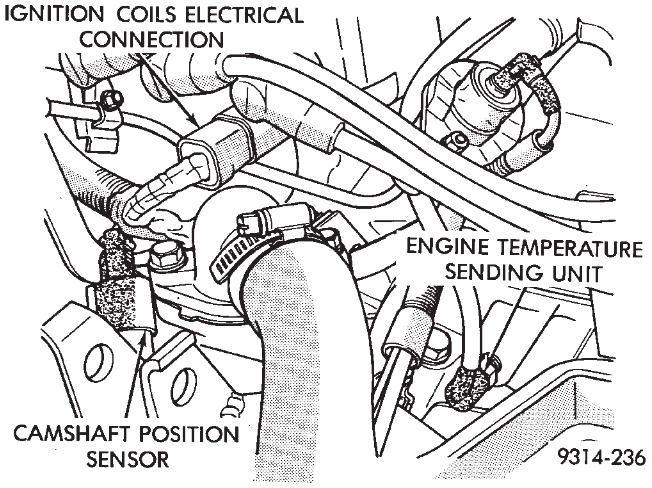


Fig. 3 Camshaft Position Sensor

(11) Verify the hoses are securely attached to the vapor canister (Fig. 8).

(12) Ensure the harness connectors for the fuel injector are attached to the correct injector and not damaged.

(13) Verify the fuel injector harness and engine wiring harness connectors are fully inserted into the main wiring harness.

(14) Check the vacuum connections at the throttle body (Fig. 9).

(15) Ensure the idle air control motor and TPS electrical connectors are fully seated and not damaged (Fig. 9).

(16) Verify the harness connector is attached to the electric EGR transducer solenoid (Fig. 9).

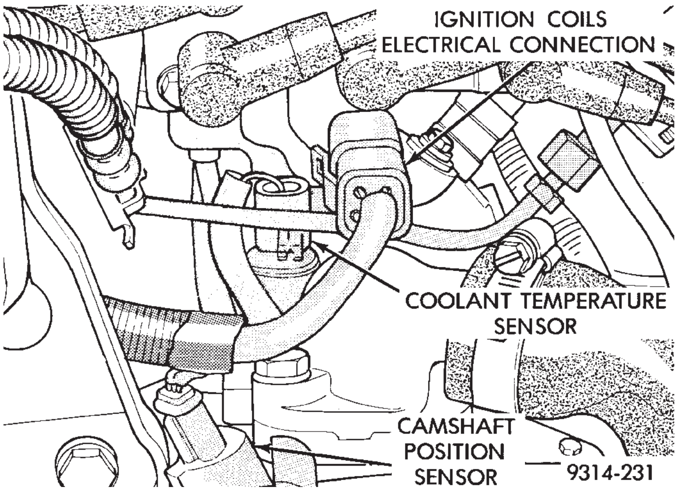


Fig. 4 Engine Coolant Temperature Sensor

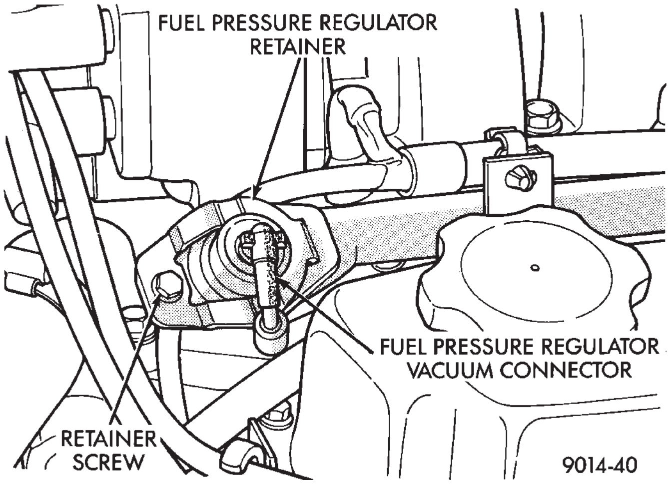


Fig. 5 Fuel Pressure Regulator Vacuum Connection

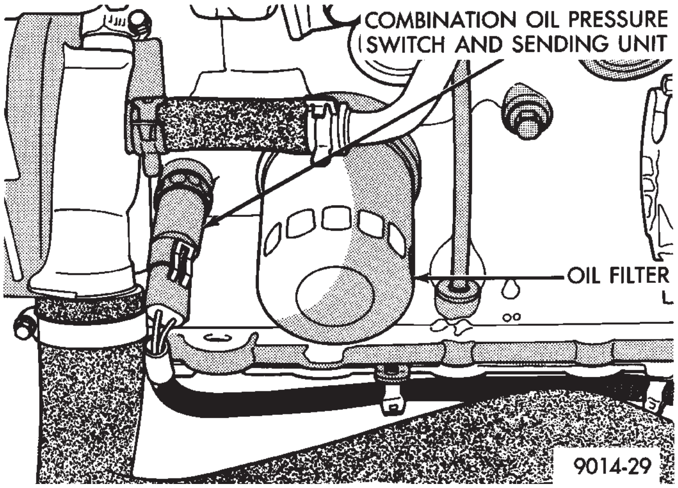


Fig. 6 Oil Pressure Sending Unit Electrical Connection

(17) Verify the vacuum connections at the transducer are secure (Fig. 9). Check all EGR system vacuum hoses for secure connections. Inspect the EGR tube.

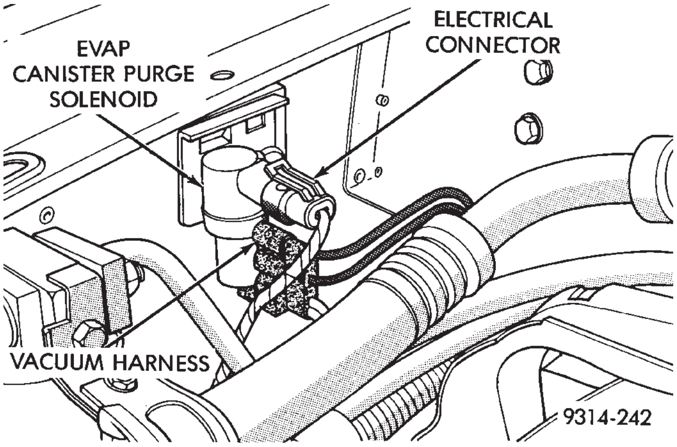


Fig. 7 Canister Purge Solenoid

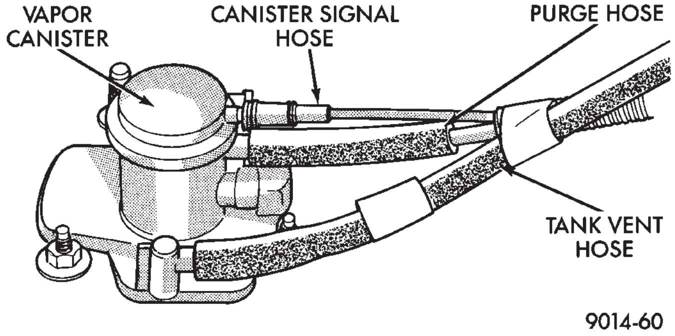


Fig. 8 Vapor Canister

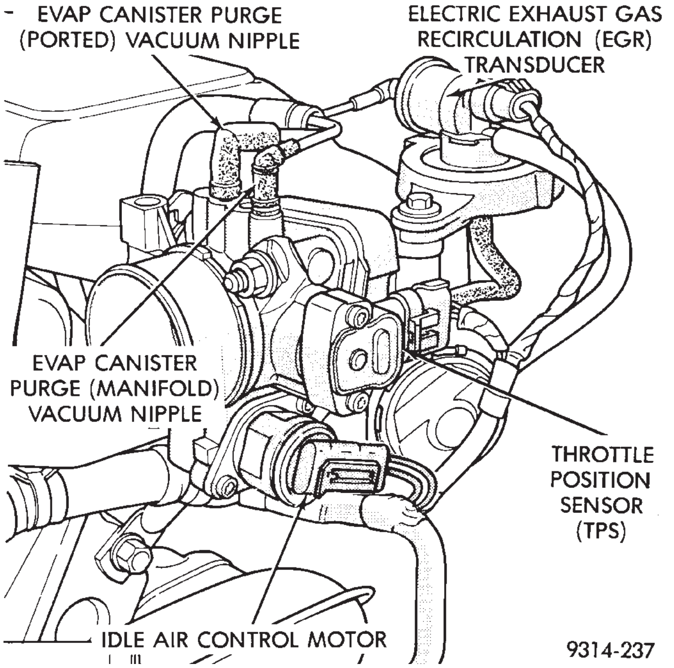


Fig. 9 Throttle Body Electrical and Vacuum Connections

(18) Inspect the park/neutral switch wiring connection for damage. Ensure the automatic transaxle electrical connections are not damaged (Fig. 10).

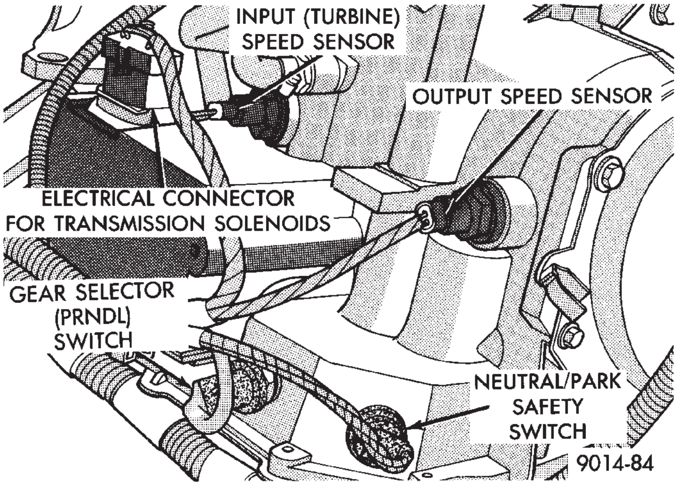


Fig. 10 Automatic Transaxle Electrical Connections

(19) Check the Vacuum Hose Harness connections at the Intake Plenum (Fig. 11).

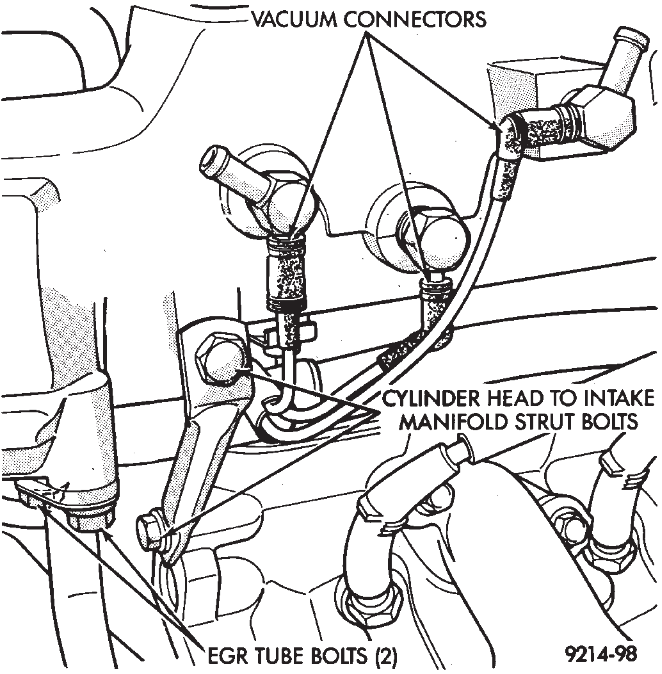


Fig. 11 Vacuum Hose Connections

(20) Inspect the PCV system connections for damage (Fig. 12).

(21) Inspect the crankshaft position sensor electrical connector for damage (Fig. 13).

(22) Ensure the vehicle speed sensor electrical connector is attached to the sensor and not damaged (Fig. 13).

(23) Verify the manifold absolute pressure (map) sensor electrical connector is attached to the sensor and not damaged (Fig. 14).

(24) Verify the engine ground strap is attached at the engine (below the MAP sensor) and dash panel (Fig. 14). Inspect the strap for corrosion or damage.

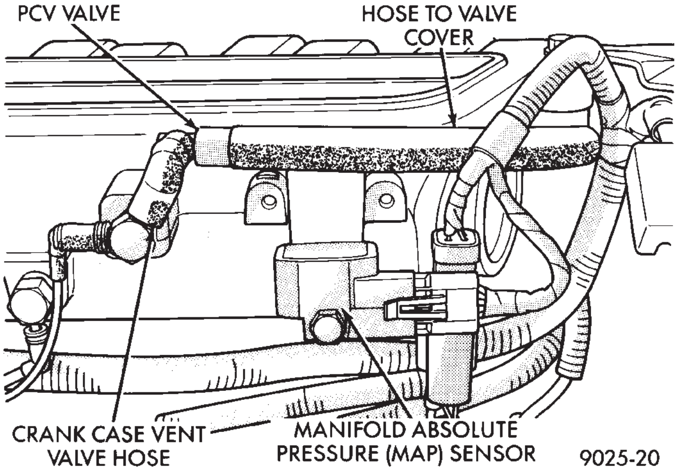


Fig. 12 PCV System

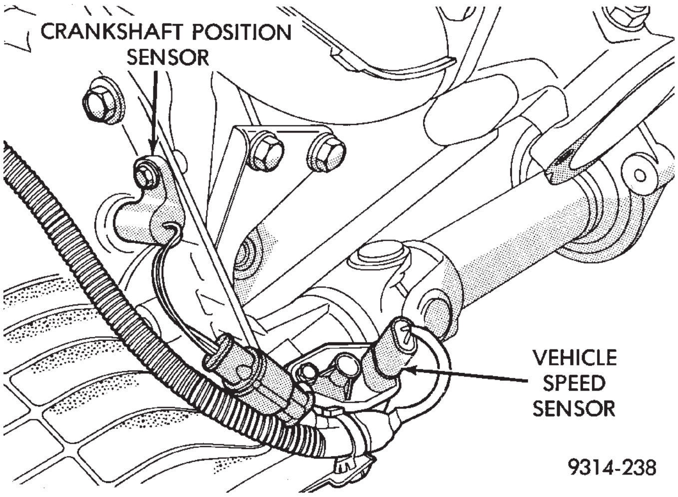


Fig. 13 Crankshaft Position Sensor and Vehicle Speed Sensor

(25) Check the heated oxygen sensor electrical connector for damage (Fig. 14).

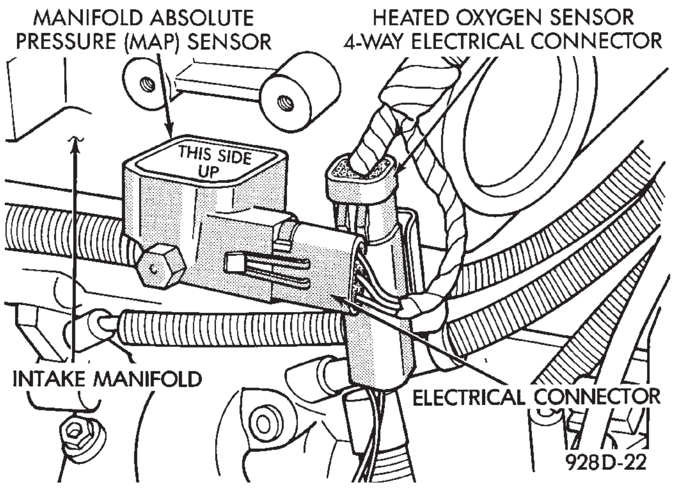


Fig. 14 MAP Sensor and Heated Oxygen Sensor

(26) Inspect the generator wiring connections for damage.

(27) Check the accessory drive belt tension.

(28) Check the 60-way electrical connection at the PCM (Fig. 15) for damage or spread terminals. Verify that the 60-way connector is fully inserted into the PCM socket. Ensure the wires are not stretched or pulled out of the connector.

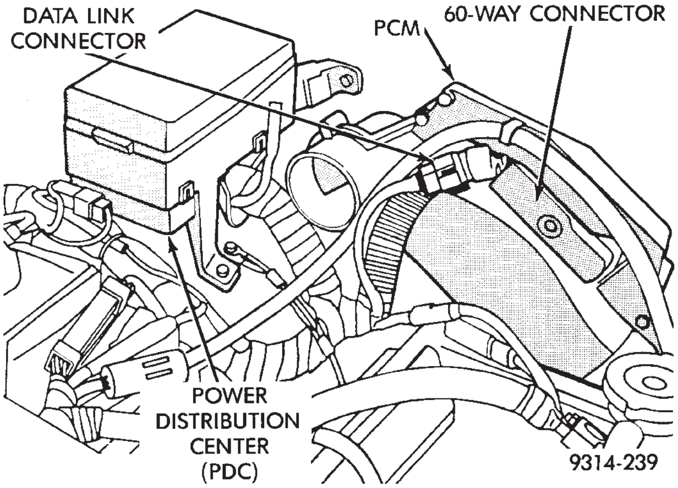


Fig. 15 Powertrain Control Module (PCM)

(29) Check for full insertion of the relays in the power distribution center (Fig. 16).

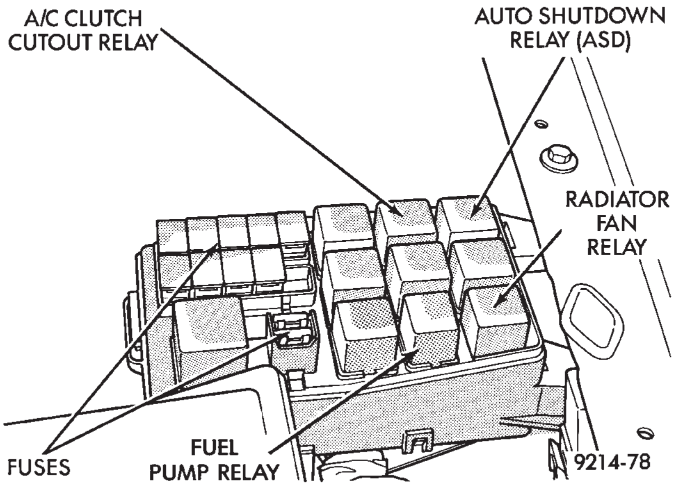


Fig. 16 Power Distribution Center

(30) Check battery cable connections.

(31) Check the power brake booster hose connection (without Anti-lock Brake Systems) (Fig. 17).

(32) Check the speed control vacuum connection (Fig. 18).

(33) Inspect hose and wiring connections at fuel pump. Check that wiring connector is making contact with terminals on pump.

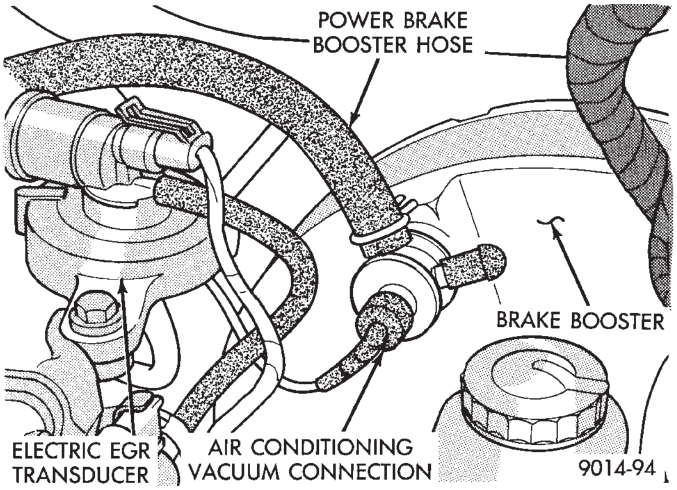


Fig. 17 Power Brake Booster Hose

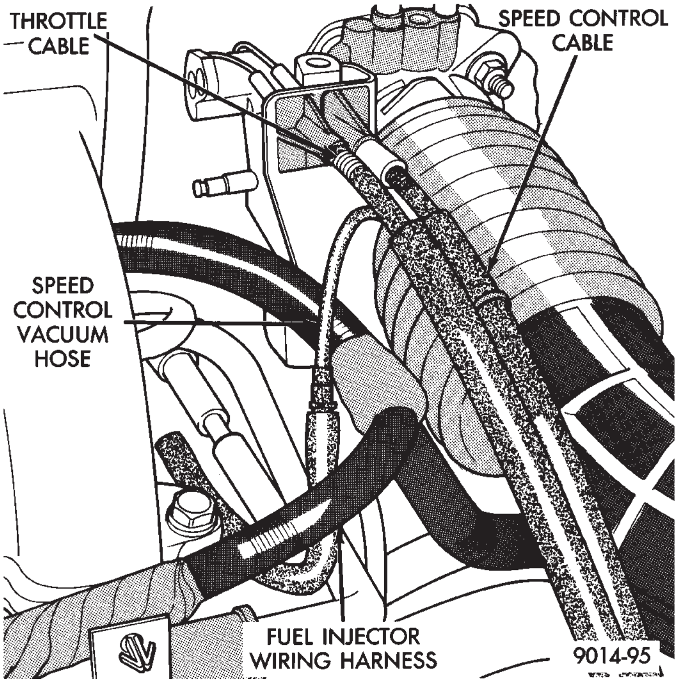


Fig. 18 Speed Control Vacuum

3.3L AND 3.8L MULTI-PORT FUEL INJECTION—ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

The powertrain control module (PCM) has been programmed to monitor many different circuits of the fuel injection system. If a problem is sensed with a monitored circuit often enough to indicate an actual problem, the PCM stores a fault. If the problem is repaired or ceases to exist, the PCM cancels the Diagnostic trouble code after 51 vehicle key on/off cycles.

Certain criteria must be met for a diagnostic trouble code to be entered into the PCM memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

It is possible a diagnostic trouble code for a monitored circuit may not be entered into memory even though a malfunction has occurred. This may happen because one of the diagnostic trouble code criteria for the circuit has not been met. **For example**, assume one of the diagnostic trouble code criteria for a sensor circuit is the engine must be operating between 750 and 2000 RPM. If the sensor output circuit shorts to ground when engine RPM is above 2400 RPM (resulting in a 0 volt input to the PCM) a diagnostic trouble code will not be entered into memory. This is because the condition does not occur within the specified RPM range.

There are several operating conditions that the PCM does not monitor and set diagnostic trouble codes for. Refer to Monitored Circuits and Non-Monitored Circuits in this section.

Stored diagnostic trouble codes can be displayed either by cycling the ignition key On - Off - On - Off - On, or through use of the DRBII scan tool. The DRBII scan tool connects to the data link connector in the vehicle (Fig. 1).

MONITORED CIRCUITS

The powertrain control module (PCM) can detect certain fault conditions in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if the sensor output (input to PCM) is within proper range. Also, the PCM can determine if the circuit is open or shorted.

Output Device Current Flow - The PCM senses whether the output devices are hooked up. If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground, or shorted high.

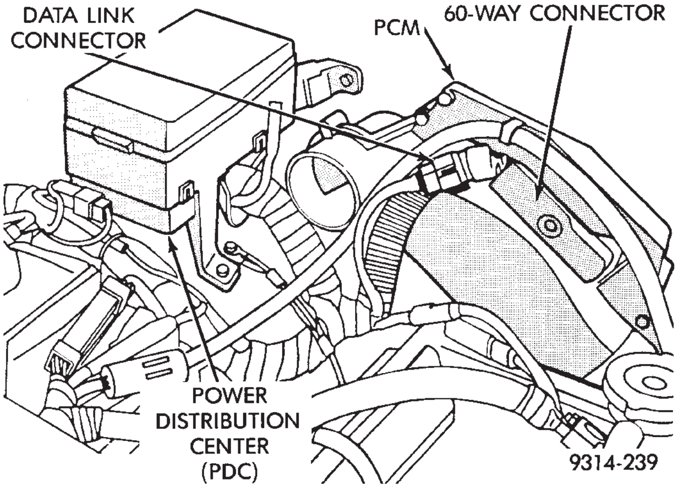


Fig. 1 Powertrain Control Module (PCM)

Oxygen Sensor - The PCM can determine if the oxygen sensor is switching between rich and lean once the system has entered closed loop. Refer to Modes of Operation in this section for an explanation of closed loop operation.

NON-MONITORED CIRCUITS

The powertrain control module (PCM) does not monitor the following circuits, systems and conditions that could have malfunctions that result in driveability problems. Diagnostic trouble codes may not be displayed for these conditions. However, problems with these systems may cause diagnostic trouble codes to be displayed for other systems. For example, a fuel pressure problem will not register a fault directly, but could cause a rich or lean condition. This could cause an oxygen sensor fault to be stored in the PCM.

Fuel Pressure - Fuel pressure is controlled by the vacuum assisted fuel pressure regulator. 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 an oxygen sensor fault to be stored in the PCM.

Secondary Ignition Circuit - The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

Engine Timing - The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket and crankshaft sprocket. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

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 a fuel injector is clogged, the needle is sticking or the wrong injector is installed. However, these could result in a rich or lean condition causing an oxygen sensor fault to be stored in the PCM.

Excessive Oil Consumption - Although the PCM monitors exhaust stream 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.

Evaporative System - The PCM will not detect a restricted, plugged or loaded evaporative purge canister.

Vacuum Assist - Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM. However, these could result in a MAP sensor fault being stored in the PCM.

PCM System Ground - The PCM cannot determine a poor system ground. However, a diagnostic trouble code may be generated as a result of this condition.

PCM Connector Engagement - The PCM cannot determine spread or damaged connector pins. However, a diagnostic trouble code may be generated as a result of this condition.

HIGH AND LOW LIMITS

The powertrain control module (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 diagnostic trouble code criteria are met, a diagnostic trouble code will be stored 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 a fault condition can be verified.

DIAGNOSTIC TROUBLE CODE DESCRIPTION

A diagnostic trouble code indicates that the powertrain control module (PCM) has recognized an abnormal condition in the system. Diagnostic trouble codes can be obtained from the malfunction indicator lamp (Check Engine lamp on the instrument panel) or from the DRBII scan tool. Diagnostic trouble codes indicate the results of a failure but do not identify the failed component directly.

SYSTEM TESTS

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST ON AN OPERATING ENGINE.

OBTAINING DIAGNOSTIC TROUBLE CODES

(1) Connect the DRBII scan tool to the data link connector located in the engine compartment near the driver side strut tower (Fig. 1).

(2) Start the engine if possible, cycle the transaxle selector and the **A/C** switch if applicable. Shut off the engine.

(3) Turn the ignition switch on, access Read Fault Screen. Record all the fault messages shown on the DRBII scan tool. Observe the malfunction indicator lamp (check engine lamp on the instrument panel). The lamp should light for 2 seconds then go out (bulb check).

Diagnostic trouble code erasure; access erase diagnostic trouble code data

STATE DISPLAY TEST MODE

The switch inputs used by the powertrain control module (PCM) have only 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 change is displayed, it can be assumed that the entire switch circuit to the PCM is functional. From the state display screen access either State Display Inputs and Outputs or State Display Sensors.

STATE DISPLAY INPUTS AND OUTPUTS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Inputs and Outputs. The following is a list of the engine control system functions accessible through the Inputs and Outputs screen.

Park/Neutral Switch
Speed Control Resume
Brake Switch
Speed Control On/Off
Speed Control Set
A/C Switch Sense
S/C Vent Solenoid

DIAGNOSTIC TROUBLE CODE DESCRIPTION

TROUBLE CODE	DRB II DISPLAY	DESCRIPTION
11	No reference Signal During Cranking	No camshaft position sensor signal detected during engine cranking.
13+**	No change in MAP from start to run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14+**	MAP voltage too low	MAP sensor input below minimum acceptable voltage.
	or	
	MAP voltage too High	MAP sensor input above maximum acceptable voltage.
15**	No vehicle speed signal	No vehicle distance (speed) sensor signal detected during road load conditions.
17	Engine is cold too long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O_2 signal stays at center	Neither rich or lean condition detected from the oxygen sensor input.
	or	
	O_2 signal shorted to voltage	Oxygen sensor input voltage maintained above the normal operating range.
22+**	Coolant sensor voltage too high	Coolant temperature sensor input above the maximum acceptable voltage.
	or	
	Coolant sensor voltage too low	Coolant temperature sensor input below the minimum acceptable voltage.
24+**	Throttle position sensor voltage high	Throttle position sensor input above the maximum acceptable voltage.
	or	
	Throttle position sensor voltage low	Throttle position sensor input below the minimum acceptable voltage.
25**	Idle air control motor circuits	An open or shorted condition detected in one or more of the idle air control motor circuits.
27	Injector control circuit	Injector output driver does not respond properly to the control signal.
31**	Evap purge solenoid circuit	An open or shorted condition detected in the purge solenoid circuit.
32**	EGR solenoid circuit	An open or shorted condition detected in the EGR transducer solenoid circuit.
	or	
	EGR system failure	Required change in air/fuel ratio not detected during diagnostic test.
33	A/C clutch relay circuit	An open or shorted condition detected in the A/C clutch relay circuit.

+ Check Engine Lamp On
** Check Engine Lamp On (California Only)

9314-253

DIAGNOSTIC TROUBLE CODE DESCRIPTION (CON'T)

Trouble Code	DRB II Display	Description
34	Speed control solenoid circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
35	Radiator fan relay circuits	An open or shorted condition detected in the radiator fan circuit
41+**	Generator field not switching properly	An open or shorted condition detected in the generator field control circuit.
42	Auto shutdown relay control circuit	An open or shorted condition detected in the auto shutdown relay circuit.
43+**	Ignition coil #1 primary circuit	Peak primary circuit current not achieved with maximum dwell time.
	or Ignition coil #2 primary circuit	Peak primary circuit current not achieved with maximum dwell time.
	or Ignition coil #3 primary circuit	Peak primary circuit current not achieved with maximum dwell time.
44	Battery temp voltage	An open or shorted condition exists in the coolant temperature sensor circuit or a problem exists in the engine controller's battery temperature voltage circuit.
46+**	Charging system voltage too high	Battery voltage sense input above target charging voltage during engine operation.
47+**	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 alternator output.
51**	O_2 signal stays below center (lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**	O_2 signal stays above center (rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53	Internal PCM failure	PCM internal fault condition detected.
62	PCM Failure EMR miles not stored	Unsuccessful attempt to update EMR mileage in the PCM EEPROM.
63	Control Failure EEPROM write denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
55	N/A	Completion of fault code display on malfunction indicator lamp (Check Engine).

\+ Check Engine Lamp On

** Check Engine Lamp On (California Only)

9314-262

S/C Vacuum Solenoid
A/C Clutch Relay
EGR Solenoid
Auto Shutdown Relay
Radiator Fan Relay
Purge Solenoid
Malfunction Indicator Lamp (Check Engine Lamp)

STATE DISPLAY SENSORS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following is a list of the engine control system functions accessible through the Sensor Display screen.

Oxygen Sensor Signal
Engine Coolant Temperature
Engine Coolant Temp Sensor
Throttle Position
Minimum Throttle
Battery Voltage
MAP Sensor Reading
Idle Air Control Motor Position
Adaptive Fuel Factor
Barometric Pressure
Min Airflow Idle Spd (speed)
Engine Speed
DIS Sensor Status
Fault #1 Key-On Info
Module Spark Advance
Speed Control Target
Fault #2 Key-on Info
Fault #3 Key-on Info
Speed Control Status
Speed Control Switch Voltage
Charging System Goal
Theft Alarm Status
Map Sensor Voltage
Vehicle Speed
Oxygen Sensor State
MAP Gauge Reading
Throttle Opening (percentage)
Total Spark Advance

CIRCUIT ACTUATION TEST MODE

The circuit actuation test mode checks for proper operation of output circuits or devices which the powertrain control module (PCM) cannot internally recognize. The PCM can attempt 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, spray fuel, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit working correctly.

OBTAINING CIRCUIT ACTUATION TEST

Connect the DRBII scan tool to the vehicle and access the Actuators screen. The following is a list of the engine control system functions accessible through Actuators screens.

Stop All Tests
Ignition Coil #1
Ignition Coil #2
Ignition Coil #3
Fuel Injector #1
Fuel Injector #2
Fuel Injector #3
Fuel Injector #4
Fuel Injector #5
Fuel Injector #6
Idle Air Control Motor Open/Close
Radiator Fan Relay
A/C Clutch Relay
Auto Shutdown Relay
EVAP Purge Solenoid
S/C Servo Solenoids
Generator Field
EGR Solenoid
All Solenoids/Relays
ASD Fuel System Test
Speed Control Vacuum Solenoid
Speed Control Vent Solenoid

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) Disconnect the PCV valve hose from the intake manifold nipple.

(5) Attach Air Metering Fitting #6457 (0.125 in. orifice) to the intake manifold PCV nipple (Fig. 2).

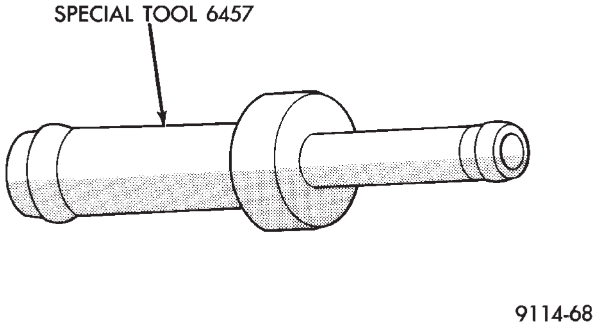


Fig. 2 Air Metering Fitting #6457

(6) Disconnect the 3/16 inch idle purge line from the throttle body nipple. Cap the 3/16 inch nipple.

(7) Connect DRBII scan tool to vehicle.

(8) Restart the engine. Allow engine to idle for at least one minute.

(9) Using the DRBII scan tool, access Min. Airflow Idle Spd.

(10) The following will then occur:

- Idle air control motor will fully close.
- Idle spark advance will become fixed.
- Engine RPM will be displayed on DRBII scan tool.

(11) If idle RPM is within the range shown in the Idle Specification chart, throttle body minimum airflow is set correctly.

IDLE SPECIFICATIONS

Odometer Reading	Idle RPM
Below 1000 Miles	525 – 875 RPM
Above 1000 Miles	575 – 875 RPM

9314-270

(12) 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 OF 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 is 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 caused by the throttle body. Replace the throttle body.

(13) Shut off engine.

(14) Remove Air Metering Fitting #6457 from the intake manifold PCV nipple. Reinstall the PCV valve hose.

(15) Uncap the throttle body idle purge nipple and connect the idle purge line.

(16) Remove DRBII scan tool.

60-WAY PCM WIRING CONNECTOR

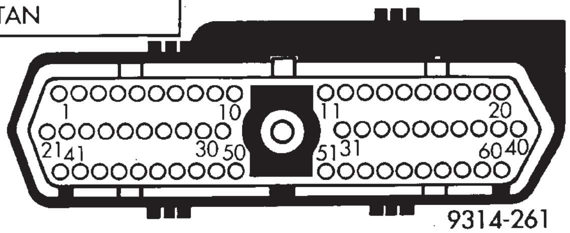
Refer to the PCM wiring connector diagram (Fig. 3) for wire colors and cavity numbers.

CAV	WIRE COLOR	DESCRIPTION
1	DG/RD*	MAP SENSOR
2	TN/BK*	COOLANT SENSOR
3	RD/WT*	DIRECT BATTERY
4	BK/LB*	SENSOR RETURN
5	BK/WT*	SIGNAL GROUND
6	VT/WT*	5.0 VOLT OUTPUT (MAP AND TPS)
7	OR	8.0 VOLT OUTPUT
8		
9	DB	A21 SUPPLY (IGNITION START/RUN)
10		
11	BK/TN*	POWER GROUND
12	BK/TN*	POWER GROUND
13	LB/BR*	INJECTOR DRIVER #4
14	YL/WT*	INJECTOR DRIVER #3
15	TN	INJECTOR DRIVER #2
16	WT/DB*	INJECTOR DRIVER #1
17	DB/TN*	IGNITION COIL DRIVER #2
18	DB/GY*	IGNITION COIL DRIVER #3
19	BK/GY*	IGNITION COIL DRIVER #1
20	DG	GENERATOR FIELD CONTROL
21		
22	OR/DB*	THROTTLE POSITION SENSOR (TPS)
23		
24	GY/BK*	CRANKSHAFT POSITION SENSOR
25	PK	SCI TRANSMIT
26	VT/BR*	CCD BUS (+)
27	BR	A/C SWITCH SENSE
28		
29	WT/PK*	BRAKE SWITCH
30	BR/YL*	PARK/NEUTRAL SWITCH
31	DB/PK*	RADIATOR FAN RELAY
32	BK/PK*	MALFUNCTION INDICATOR LAMP (CHECK ENGINE)
33	TN/RD*	SPEED CONTROL VACUUM SOLENOID
34	DB/OR*	A/C CLUTCH RELAY
35	GY/YL*	EGR SOLENOID
36		

CAV	WIRE COLOR	DESCRIPTION
37		
38	GY	INJECTOR DRIVER #5
39	GY/RD*	IDLE AIR CONTROL MOTOR #3 DRIVER
40	BR/WT*	IDLE AIR CONTROL MOTOR #1 DRIVER
41	BK/DG*	OXYGEN SENSOR SIGNAL
42		
43	GY/LB*	TACHOMETER SIGNAL OUTPUT
44	TN/YL*	CAMSHAFT POSITION SENSOR
45	LG	SCI RECEIVE
46	WT/BK	CCD BUS (-)
47	WT/OR*	VEHICLE SPEED SIGNAL
48		
49		
50		
51	DB/YL*	AUTO SHUTDOWN (ASD) RELAY
52	PK/BK*	EVAP PURGE SOLENOID
53	LG/RD*	SPEED CONTROL VENT SOLENOID
54		
55		
56		
57	DG/OR*	A142 CIRCUIT VOLTAGE SENSE
58	BR/DB*	INJECTOR DRIVER #6
59	VT/BK*	IDLE AIR CONTROL MOTOR #4 DRIVER
60	YL/BK*	IDLE AIR CONTROL MOTOR #2 DRIVER

WIRE COLOR CODES					
BK	BLACK	LB	LIGHT BLUE	VT	VIOLET
BR	BROWN	LG	LIGHT GREEN	WT	WHITE
DB	DARK BLUE	OR	ORANGE	YL	YELLOW
DG	DARK GREEN	PK	PINK	*	WITH TRACER
GY	GRAY	RD	RED		
		TN	TAN		

CONNECTOR
TERMINAL SIDE
SHOWN



9314-261

Fig. 3 60-Way PCM Wiring Connector

3.3L AND 3.8L MULTI-PORT FUEL INJECTION—SERVICE PROCEDURES

INDEX

THROTTLE BODY REMOVAL

(1) Disconnect negative battery cable.

(2) Remove the air cleaner to throttle body hose clamp. Remove the nut holding the air cleaner assembly to the air cleaner bracket. Remove the air cleaner (Fig. 1).

(3) Remove throttle and the speed control cables.

(4) Disconnect electrical connectors from the idle air control motor and throttle position sensor (TPS).

(5) Disconnect vacuum hoses from throttle body.

(6) Remove throttle body to intake manifold attaching nuts.

(7) Remove throttle body and gasket.

(8) Reverse the above procedure for installation.

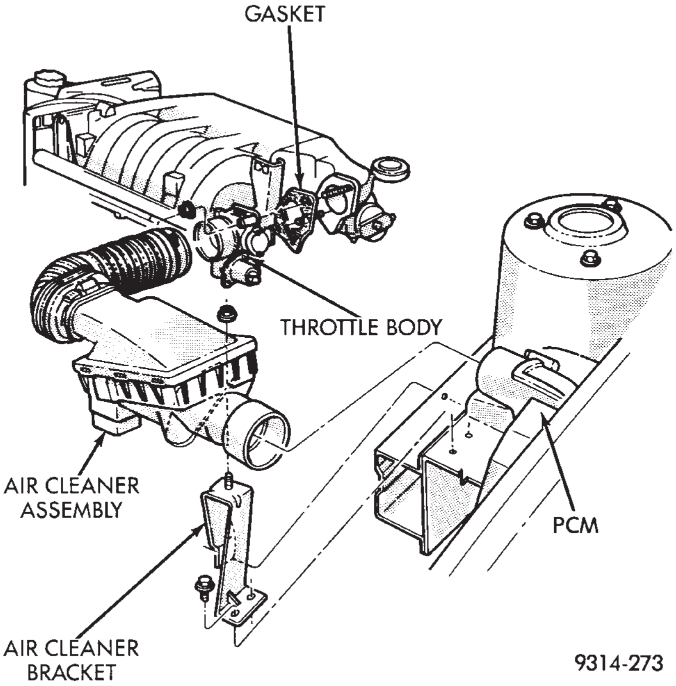


Fig. 1 Throttle Body Assembly

THROTTLE BODY

When servicing throttle body components, always reassemble components with new O-rings and seals where applicable (Fig. 2). 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.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: THE 3.3L AND 3.8L MPI FUEL SYSTEMS ARE UNDER A CONSTANT PRESSURE OF APPROXIMATELY 330 KPA (48 PSI). RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING THE FUEL PUMP, FUEL LINES, FUEL FILTER, THROTTLE BODY OR FUEL INJECTORS.

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap.

(3) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 3).

(4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect the other end of hose C-4799-1 to the fuel pressure test port. Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

(5) Continue fuel system service.

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 (Fig. 4).

(4) Lift throttle position sensor off throttle shaft.

INSTALLATION

(1) Install throttle position sensor on throttle shaft. Install mounting screws. Tighten screw to 2 N●m (17 in. lbs.) torque.

(2) Connect electrical connector to throttle position sensor.

(3) Connect negative cable to battery.

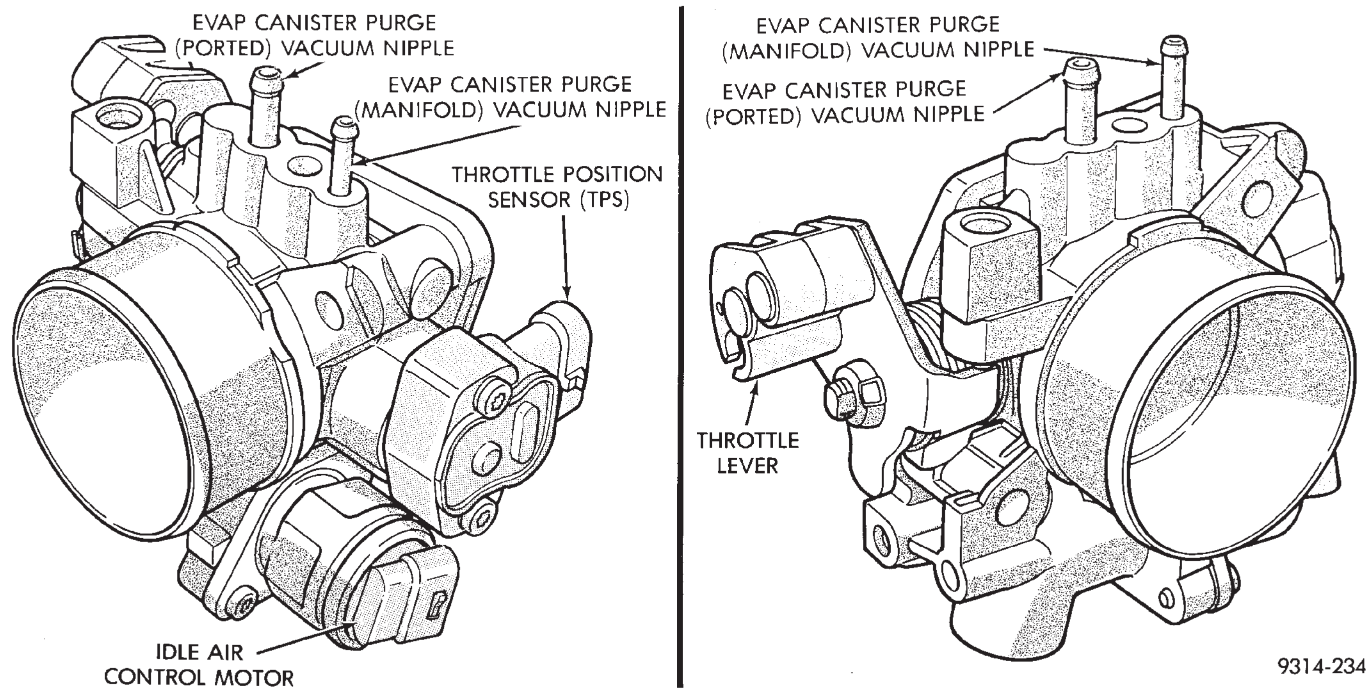


Fig. 2 Throttle Body

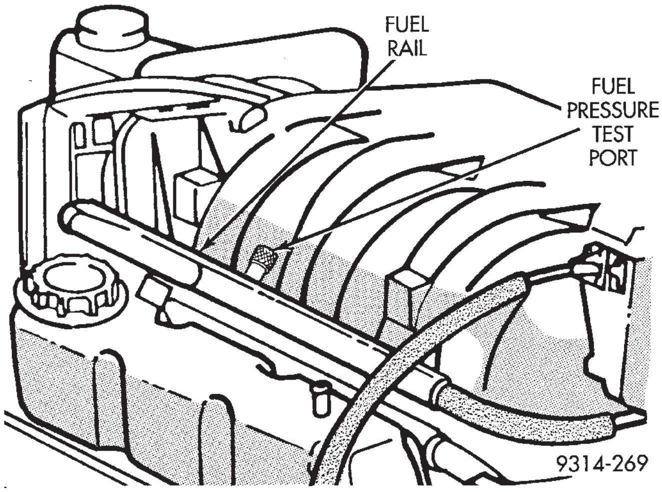


Fig. 3 Fuel Pressure Test Port

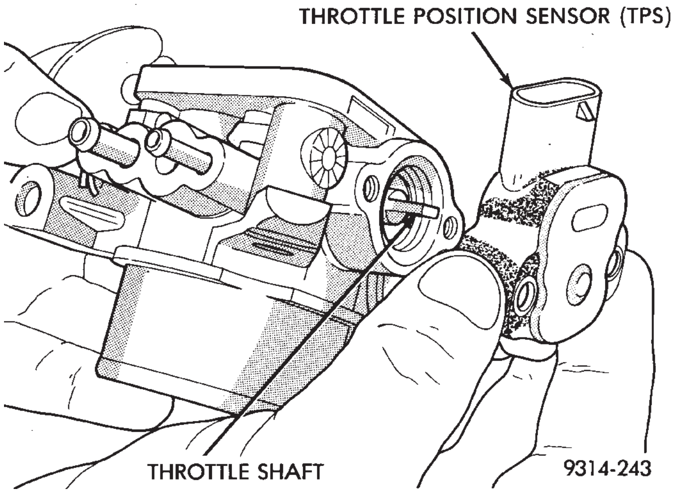


Fig. 4 Servicing Throttle Position Sensor

IDLE AIR CONTROL MOTOR

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. 5).

(4) Remove idle air control motor from throttle body. Ensure the O-ring is removed with the motor.

INSTALLATION

(1) New idle air control motors have a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRBII scan tool 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.

FUEL INJECTOR RAIL ASSEMBLY

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 and hose assembly (Fig. 1).

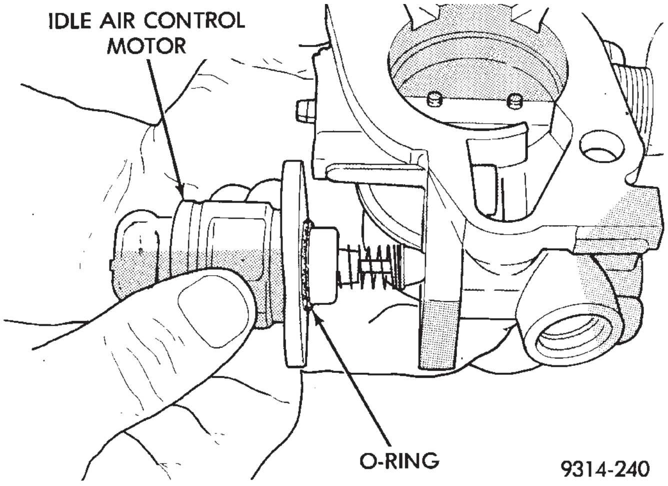


Fig. 5 Servicing Idle Air Control Motor

(4) Remove throttle cable (Fig. 6). Remove wiring harness from throttle cable bracket and intake manifold water tube.

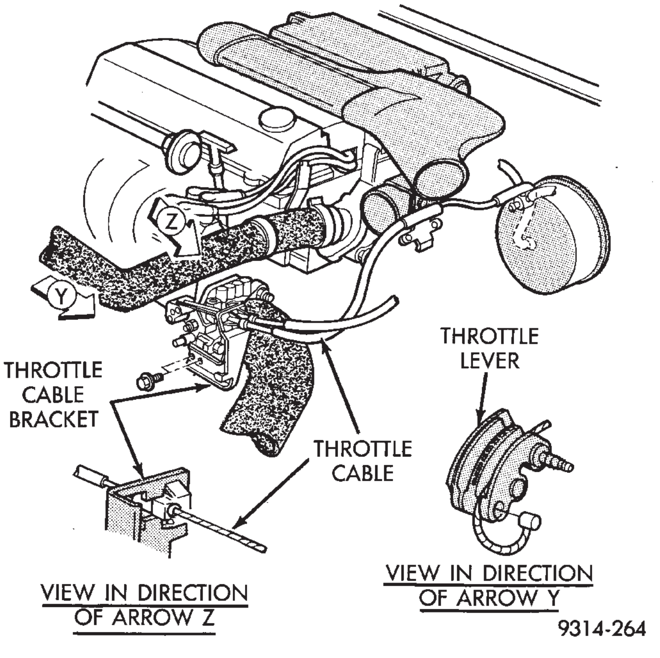


Fig. 6 Throttle Cable Attachment

(5) Disconnect idle air control motor and throttle position sensor (TPS) electrical connectors (Fig. 7). Refer to Idle Air Control Motor and Throttle Position Sensor in this section.

(6) Remove vacuum hose harness from throttle body (Fig. 7).

(7) Remove PCV and brake booster vacuum hoses from air intake plenum.

(8) Remove EGR tube to intake manifold flange bolts (Fig. 8).

(9) Remove vacuum harness connectors from intake plenum (Fig. 8).

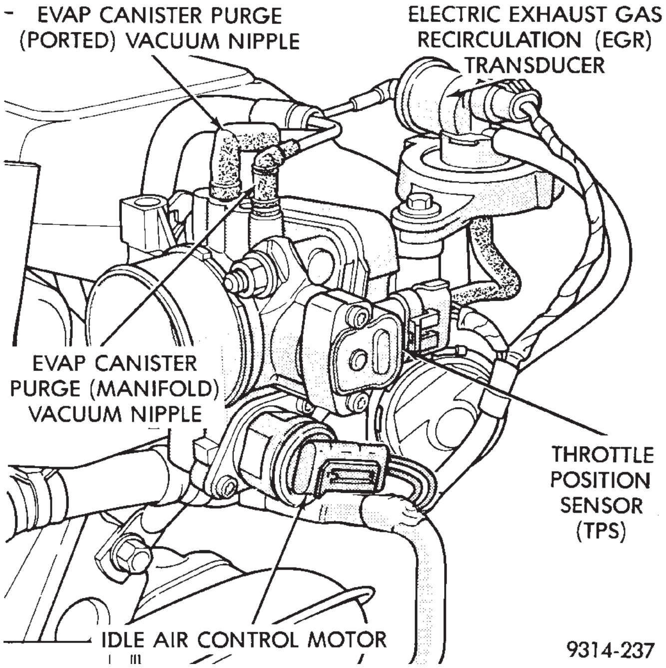


Fig. 7 Electrical and Vacuum Connection to Throttle Body

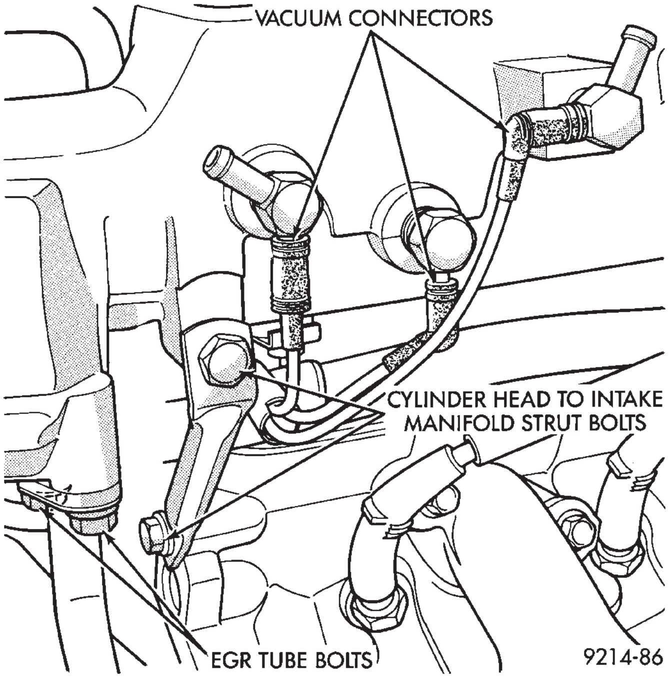


Fig. 8 EGR Tube

(10) Remove cylinder head to intake plenum strut (Fig. 8).

(11) Disconnect electrical connectors from the MAP sensor and heated oxygen sensor electrical connection. Remove the engine mounted ground strap (Fig. 9).

WARNING: WRAP A SHOP TOWEL AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

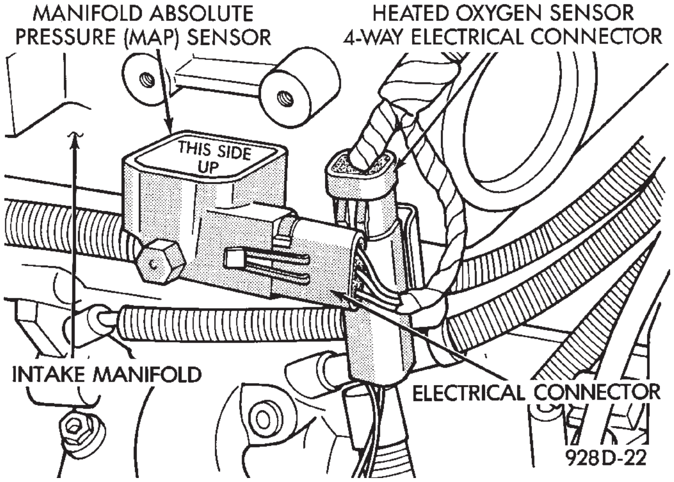


Fig. 9 MAP Sensor Electrical Connector

(12) Remove the fuel hose quick connect fittings from the chassis tubes. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group.** Place a shop towel under the connections to absorb any fuel spilled. fittings.

(13) Remove direct ignition system (DIS) coils and generator bracket to intake manifold bolt (Fig. 10).

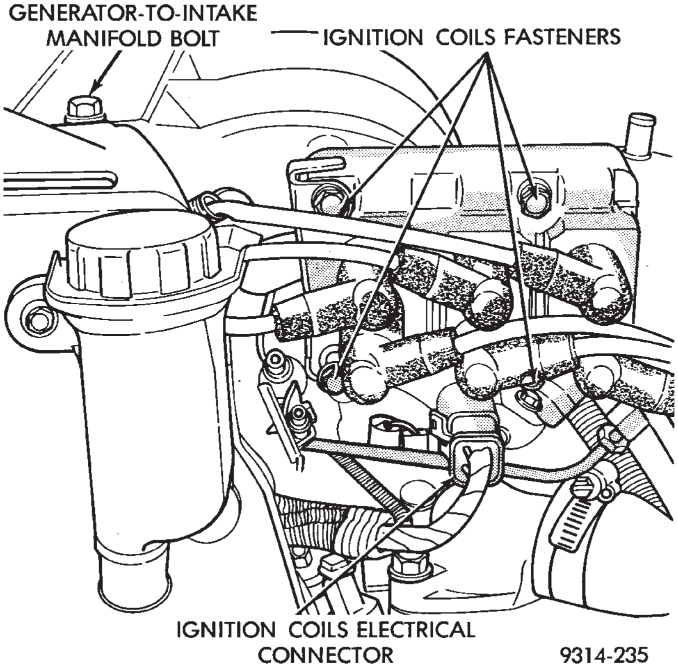


Fig. 10 Ignition Coils

(14) Remove intake mounting manifold bolts and rotate manifold back over rear valve cover (Fig. 11).

(15) Cover intake manifold with suitable cover when servicing (Fig. 12).

(16) Remove vacuum harness connector from Fuel Pressure Regulator.

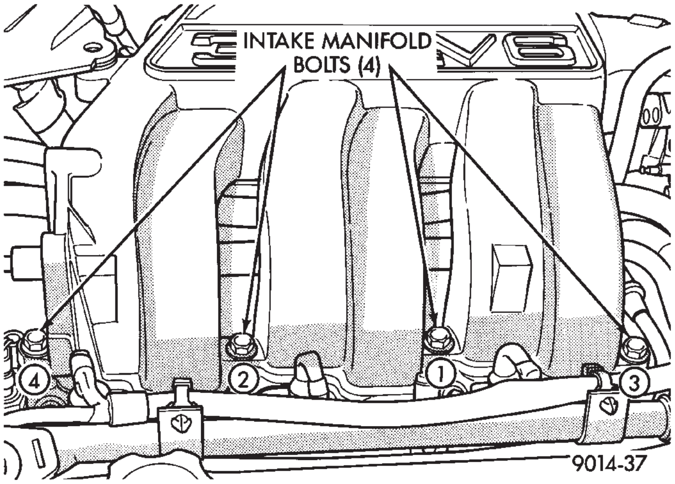


Fig. 11 Intake Manifold Bolts

(17) Remove fuel tube retainer bracket screw and fuel rail attaching bolts (Fig. 12). Spread the retainer bracket to allow fuel tube removal clearance.

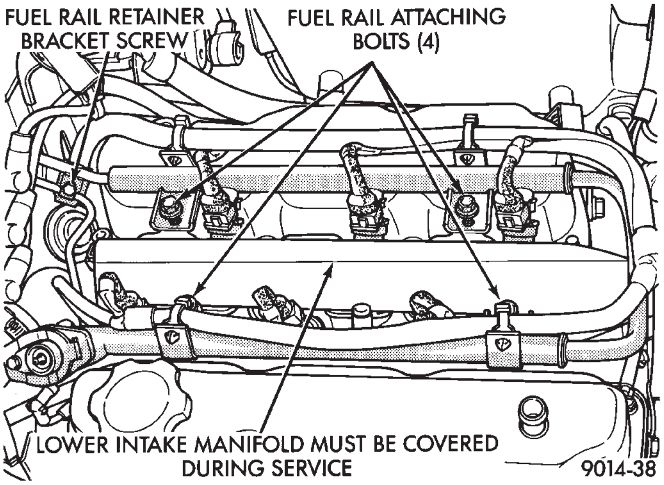


Fig. 12 Fuel Rail Attaching Bolts

(18) Remove fuel rail injector wiring clip from the generator bracket (Fig. 13).

(19) Disconnect camshaft position sensor, coolant temperature sensor, and engine temperature sensors (Fig. 13).

(20) Remove fuel rail. Be careful not to damage the injector O-rings upon removal from their ports (Fig. 14).

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 (Fig. 14).

(4) Install the fuel rail mounting bolts. Tighten bolts to 22 N●m (200 in. lbs.) torque (Fig. 12).

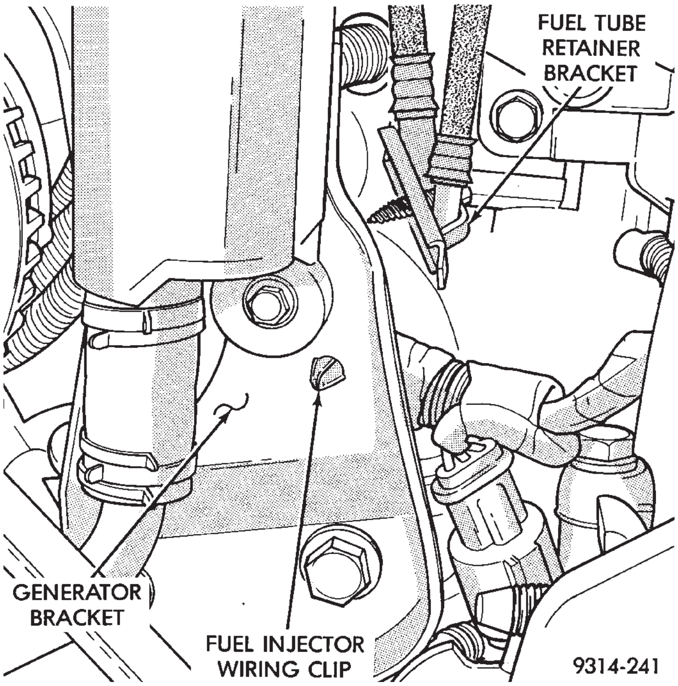


Fig. 13 Fuel Injector Wiring Clip

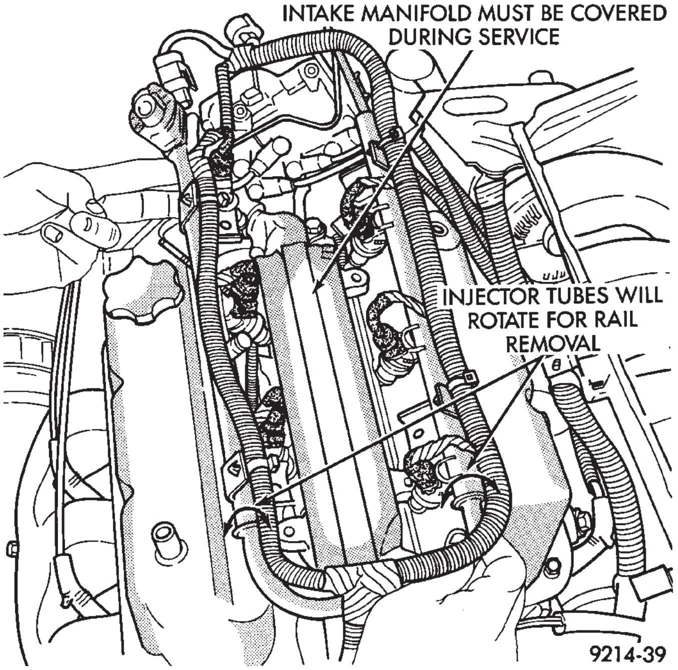


Fig. 14 Fuel Rail Removal

(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, coolant temperature sensor and engine temperature sensors (Fig. 13).

(7) Install fuel injector harness wiring clips on the generator bracket and intake manifold water tube (Fig. 13).

(8) Connect vacuum line to fuel pressure regulator.

(9) Remove covering on lower intake manifold and clean surface.

(10) Place intake manifold gasket on lower manifold. Put upper manifold into place and install bolts finger tight.

(11) Install the generator bracket to intake manifold bolt and the cylinder head to intake manifold strut bolts. (Do not tighten.)

(12) Following the tightening sequence in Figure 11, tighten intake manifold bolts to 28 N●m (250 in. lbs.) torque.

(13) Tighten generator bracket to intake manifold bolt to 54 N●m (40 ft. lbs.) torque (Fig. 13).

(14) Tighten the cylinder head to intake manifold strut bolts to 54 N●m (40 ft. lbs.) torque (Fig. 8).

(15) Connect ground strap, MAP and heated oxygen sensor electrical connectors.

(16) Connect vacuum harness to intake plenum. Connect PCV system hoses.

(17) Using a new gasket, connect the EGR tube to the intake manifold plenum. Tighten screws to 22 N●m (200 in. lbs.) torque.

(18) Clip wiring harness into the hole in the throttle cable bracket.

(19) Connect electrical connectors to the throttle position sensor (TPS) and idle air control motor.

(20) Connect vacuum harness to throttle body.

(21) Install the direct ignition system (DIS) coils. Tighten fasteners to 12 N●m (105 in. lbs.) torque.

(22) Install fuel hose quick connectors fittings to chassis tubes. **Refer to Fuel Hoses, Clamps and Quick Connect Fittings in the Fuel Delivery Section of this Group.** Push the fittings onto the chassis tubes until they click into place. Pull on the fittings to ensure complete insertion. Fuel supply fitting is 5/16 inch and fuel return fitting is 1/4 inch.

(23) Install throttle cable.

(24) Install air cleaner and hose assembly.

(25) Connect negative cable to battery.

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.

(26) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL PRESSURE REGULATOR

REMOVAL

(1) Perform fuel system pressure release procedure before attempting any repairs. Refer to Fuel Pressure Regulator Procedure in this section.

(2) Remove fuel pressure regulator vacuum connector. (Fig. 15).

(3) Remove regulator retainer screw (Fig. 15).

(4) Remove the fuel pressure regulator retainer (Fig. 15).

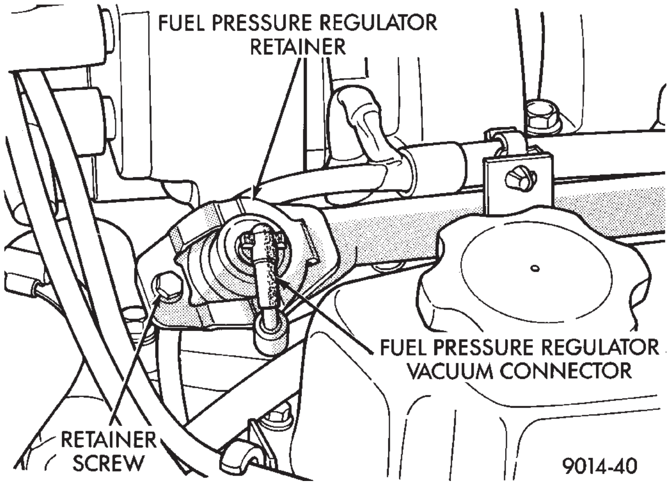


Fig. 15 Fuel Pressure Regulator

WARNING: PLACE A SHOP TOWEL UNDER FUEL PRESSURE REGULATOR TO ABSORB ANY FUEL SPILLAGE.

(5) Remove fuel pressure regulator and O-rings (Fig. 16).

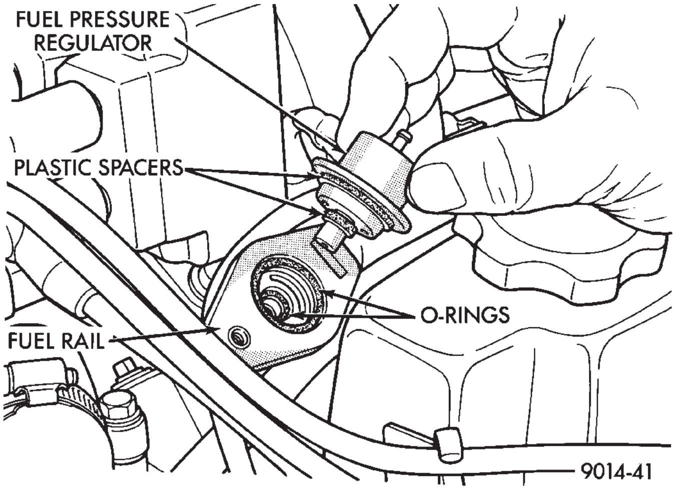


Fig. 16 Fuel Pressure Regulator Removal/Installation

INSTALLATION

(1) Ensure fuel pressure regulator has two plastic spacers (Fig. 16). Place O-rings in the fuel pressure regulator cavity (Fig. 17). Do not install O-rings on the fuel pressure regulator.

(2) Insert fuel pressure regulator into the fuel rail.

(3) Install fuel pressure regulator retainer (Fig. 15).

(4) Install retainer screw. Tighten to 7 N●m (60 in. lbs.) torque.

(5) Connect vacuum line to the fuel pressure regulator.

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.

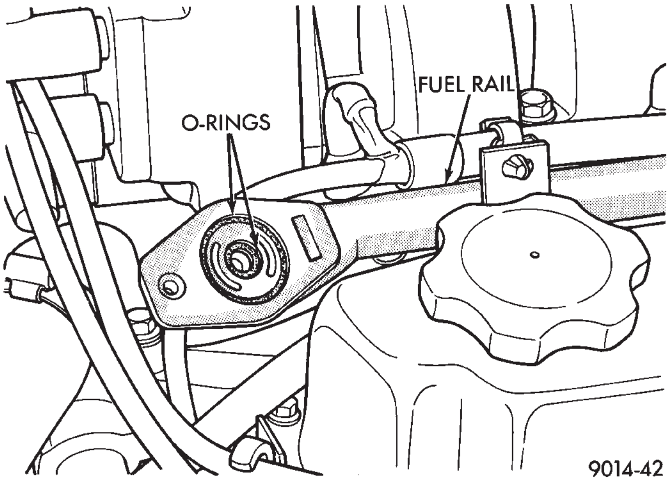


Fig. 17 Fuel Pressure Regulator O-Rings

(6) With the ignition key in ON position, access the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL INJECTOR

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. 18).

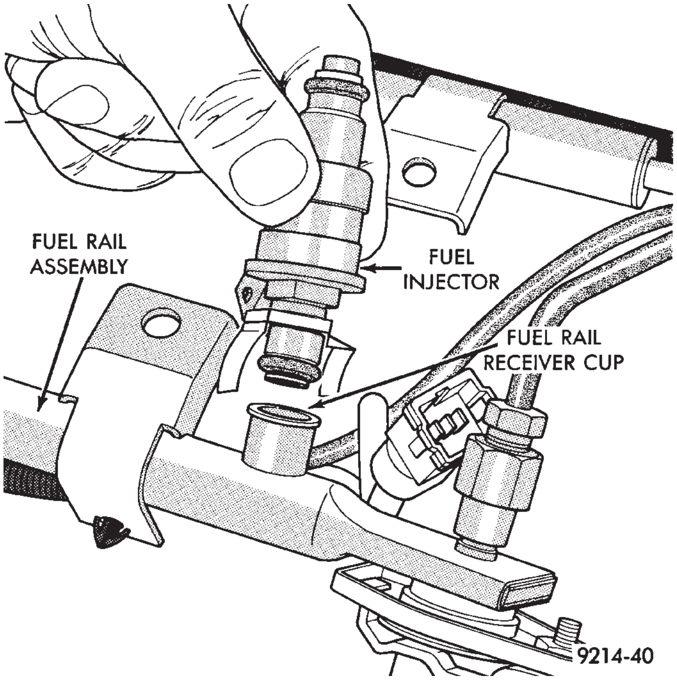


Fig. 18 Fuel Injector and Rail—Typical

(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 **top slot** of the injector. The edge of the receiver cup will slide into the side slots of clip (Fig. 19).

(3) Install injector top end into fuel rail receiver cap. Be careful not to damage O-ring during installation (Fig. 19).

(4) Repeat steps for remaining injectors.

(5) Connect fuel injector wiring.

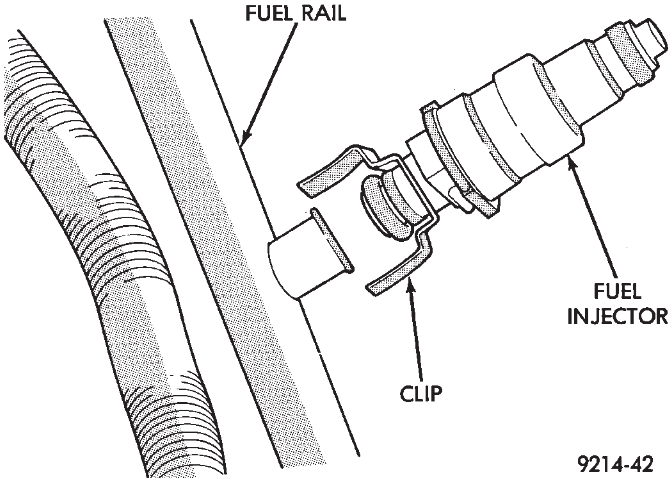


Fig. 19 Servicing Fuel Injector—Typical

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The alignment of the MAP sensor is critical to the sensors performance. The top of the sensor is marked This Side Up (Fig. 20).

(1) Disconnect electrical connector from MAP sensor.

(2) Remove sensor by unscrewing from the intake manifold (Fig. 20).

(3) Reverse the above procedure for installation.

EVAP CANISTER PURGE SOLENOID SERVICE

(1) Remove vacuum hose and electrical connector from solenoid (Fig. 21).

(2) Depress tab on top of solenoid and slide the solenoid downward out of mounting bracket.

(3) Reverse above procedure for installation.

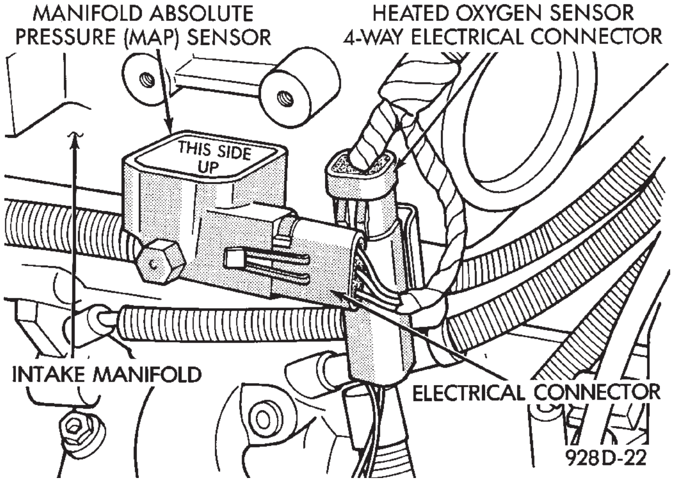


Fig. 20 Manifold Absolute Pressure Sensor

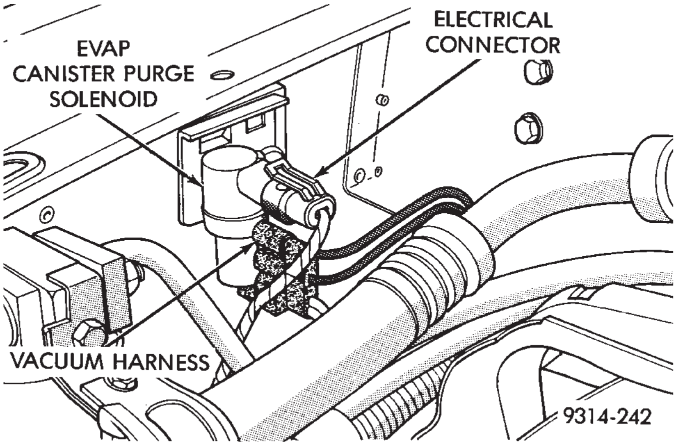


Fig. 21 Canister Purge Solenoid

PCM SERVICE

(1) Remove air cleaner duct from PCM.

(2) Remove battery.

(3) Remove PCM mounting screws (Fig. 22).

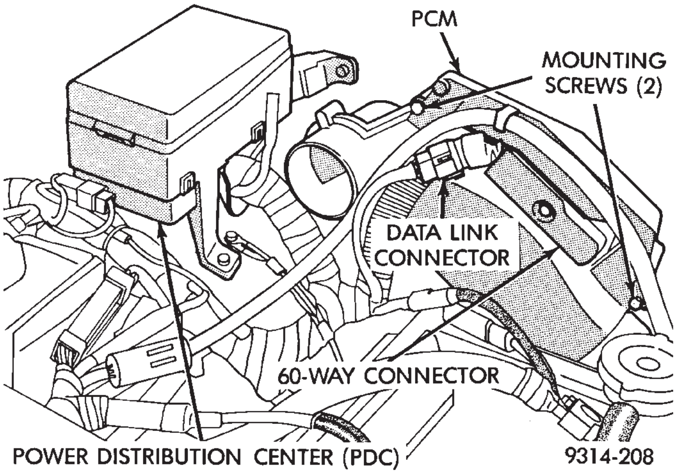


Fig. 22 PCM Removal

(4) Remove 60-way electrical connector from PCM.

(5) Reverse the above procedure for installation.

CRANKSHAFT POSITION SENSOR

REMOVAL

(1) Disconnect crankshaft position sensor electrical connector from the wiring harness connector (Fig. 23).

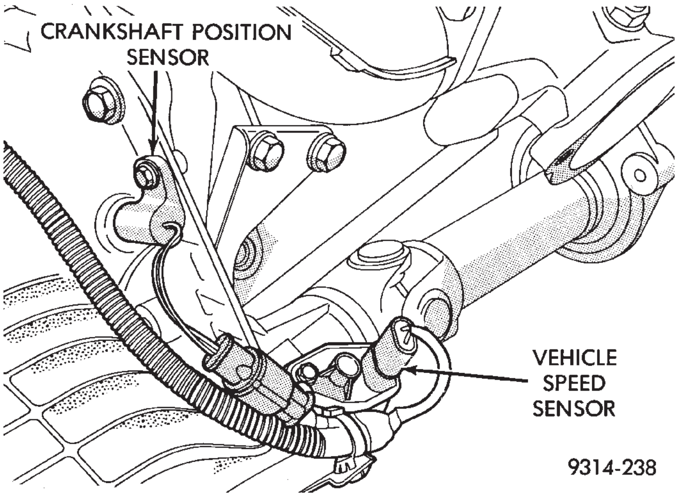


Fig. 23 Crankshaft Position Sensor

(2) Remove crankshaft position sensor retaining bolt.

(3) Pull sensor straight up out of the transaxle housing.

INSTALLATION

If installing the original sensor, 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. 24).

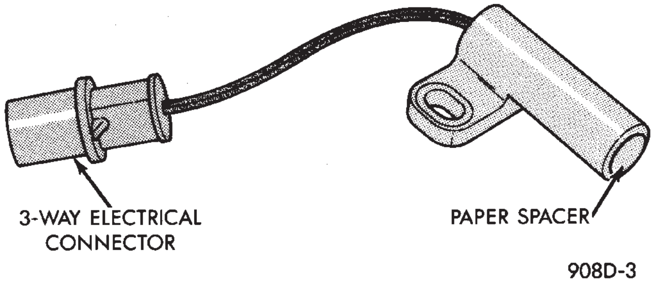


Fig. 24 Crankshaft Position Sensor and Spacer

(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 12 N●m (105 in. lbs.) torque.

(2) Connect crankshaft position sensor electrical connector to the wiring harness connector.

CAMSHAFT POSITION SENSOR SERVICE

REMOVAL

(1) Disconnect camshaft position sensor electrical connector from the wiring harness connector (Fig. 25).

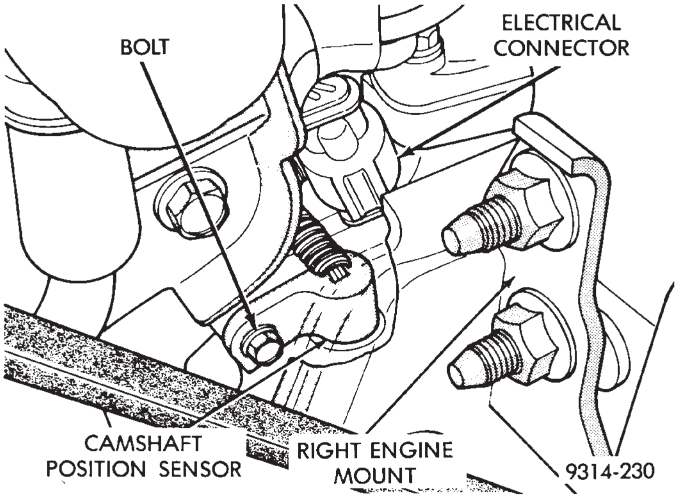


Fig. 25 Camshaft Position Sensor

(2) Loosen camshaft position sensor retaining bolt enough to allow slot in sensor to slide past the bolt.

(3) 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 installing the original sensor, 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. 26).

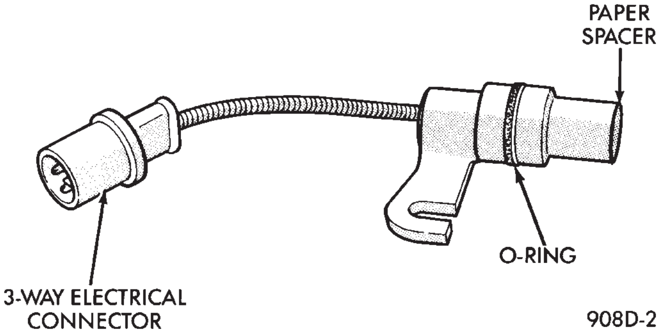


Fig. 26 Camshaft Position Sensor

(1) Apply a couple drops of clean engine oil to the O-ring prior to installation. Install sensor in the chain case cover and push sensor down until contact

is made with the camshaft gear. While holding the sensor in this position, install and tighten the retaining bolt 12 N●m (105 in. lbs.) torque.

(2) Connect camshaft position sensor electrical connector to harness connector. Position connector away from the accessory belt.

HEATED OXYGEN SENSOR (O_2 SENSOR) SERVICE

The oxygen sensor is installed in the exhaust manifold (Fig. 27).

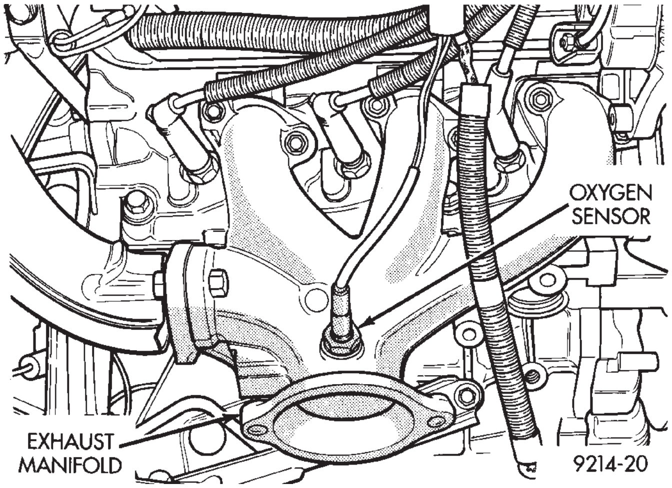


Fig. 27 Oxygen Sensor—3.3L Engine

CAUTION: Do not pull on the oxygen sensor wire when disconnecting the electrical connector.

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

(1) Disconnect oxygen sensor electrical connector (Fig. 28).

(2) Remove sensor using Tool C-4907 (Fig. 29). Slightly tightening the sensor can ease removal.

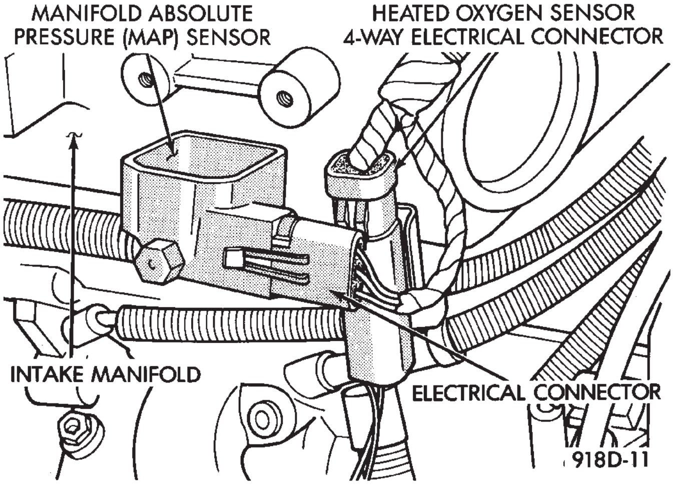


Fig. 28 Oxygen Sensor Connector

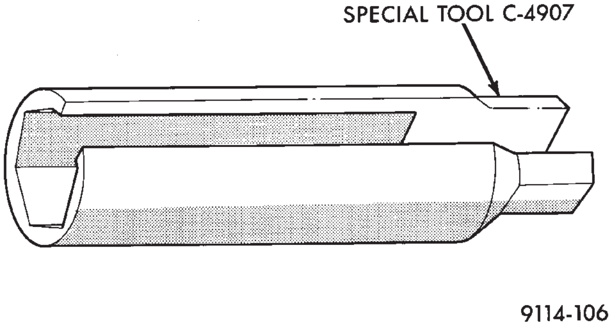
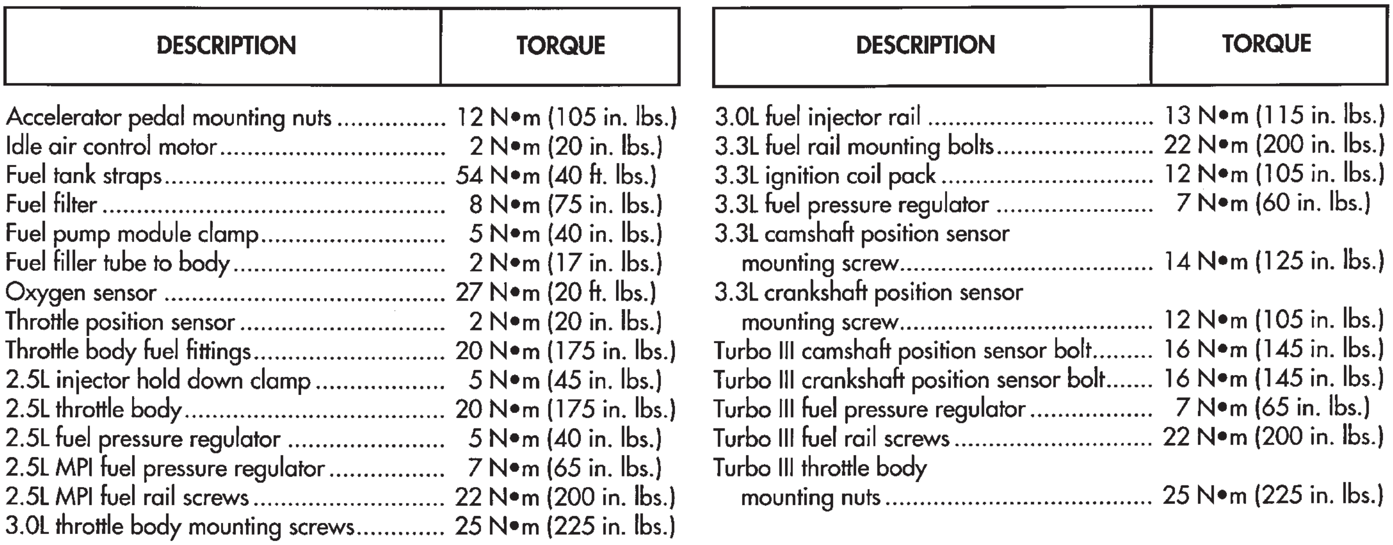


Fig. 29 Oxygen Sensor Socket

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. New sensors are packaged with compound on the threads and do not require additional compound. The sensor must be tightened to 27 N●m (20 ft. lbs.) torque.

SPECIFICATIONS

TORQUE



DESCRIPTION	TORQUE
Accelerator pedal mounting nuts	12 N•m (105 in. lbs.)
Idle air control motor	2 N•m (20 in. lbs.)
Fuel tank straps	54 N•m (40 ft. lbs.)
Fuel filter	8 N•m (75 in. lbs.)
Fuel pump module clamp	5 N•m (40 in. lbs.)
Fuel filler tube to body	2 N•m (17 in. lbs.)
Oxygen sensor	27 N•m (20 ft. lbs.)
Throttle position sensor	2 N•m (20 in. lbs.)
Throttle body fuel fittings	20 N•m (175 in. lbs.)
2.5L injector hold down clamp	5 N•m (45 in. lbs.)
2.5L throttle body	20 N•m (175 in. lbs.)
2.5L fuel pressure regulator	5 N•m (40 in. lbs.)
2.5L MPI fuel pressure regulator	7 N•m (65 in. lbs.)
2.5L MPI fuel rail screws	22 N•m (200 in. lbs.)
3.0L throttle body mounting screws	25 N•m (225 in. lbs.)
3.0L fuel injector rail	13 N•m (115 in. lbs.)
3.3L fuel rail mounting bolts	22 N•m (200 in. lbs.)
3.3L ignition coil pack	12 N•m (105 in. lbs.)
3.3L fuel pressure regulator	7 N•m (60 in. lbs.)
3.3L camshaft position sensor mounting screw	14 N•m (125 in. lbs.)
3.3L crankshaft position sensor mounting screw	12 N•m (105 in. lbs.)
Turbo III camshaft position sensor bolt	16 N•m (145 in. lbs.)
Turbo III crankshaft position sensor bolt	16 N•m (145 in. lbs.)
Turbo III fuel pressure regulator	7 N•m (65 in. lbs.)
Turbo III fuel rail screws	22 N•m (200 in. lbs.)
Turbo III throttle body mounting nuts	25 N•m (225 in. lbs.)

9314-271

EMISSION CONTROL SYSTEMS

CONTENTS

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter designation. The Introduction Section at the front of this manual contains a chart showing the breakdown of the designations.

EVAPORATIVE EMISSION CONTROLS

INDEX

VEHICLE EMISSION CONTROL INFORMATION LABEL

All models have a Vehicle Control Information (VECI) Label. Chrysler permanently attaches the label to the middle of the hood (Fig. 1, 2, or 3). It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. Route all hoses according to the diagram on the VECI label.

If any difference exists between the label and the Service Manual, refer to the label. **The labels shown are examples.**

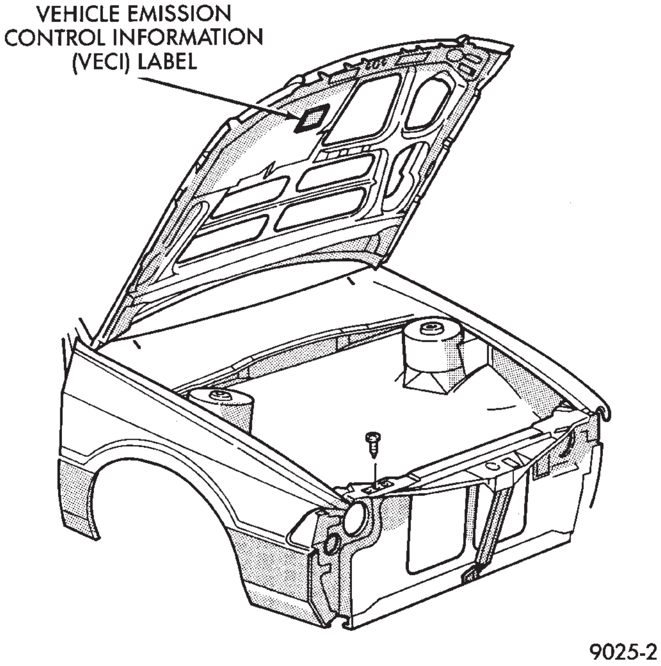


Fig. 1 Underhood Label Location—AA Body

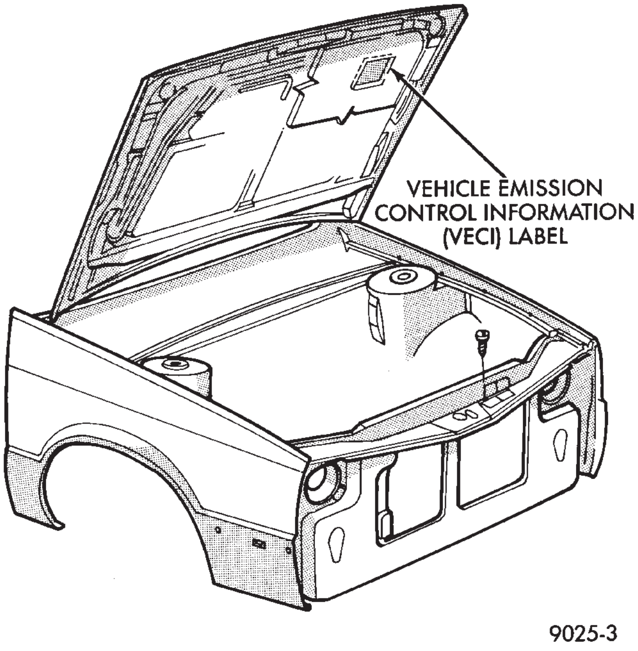


Fig. 2 Underhood Label Location—AC, AP and AY Bodies

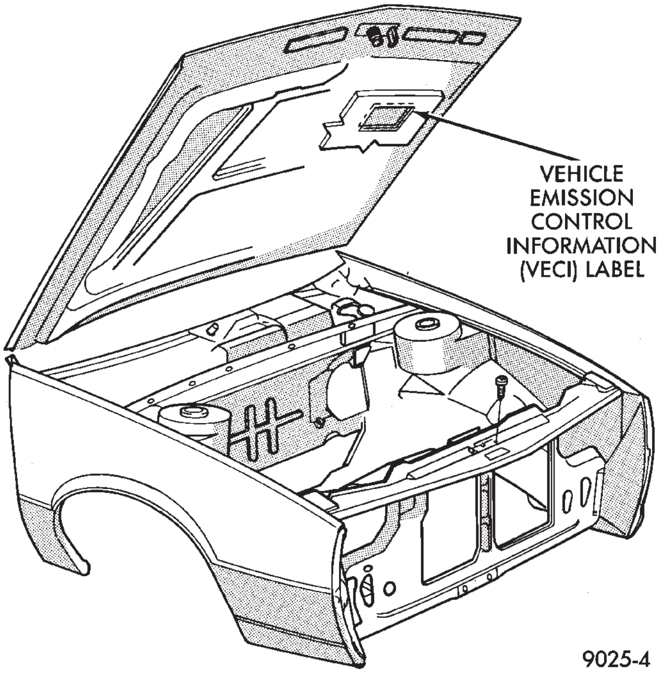
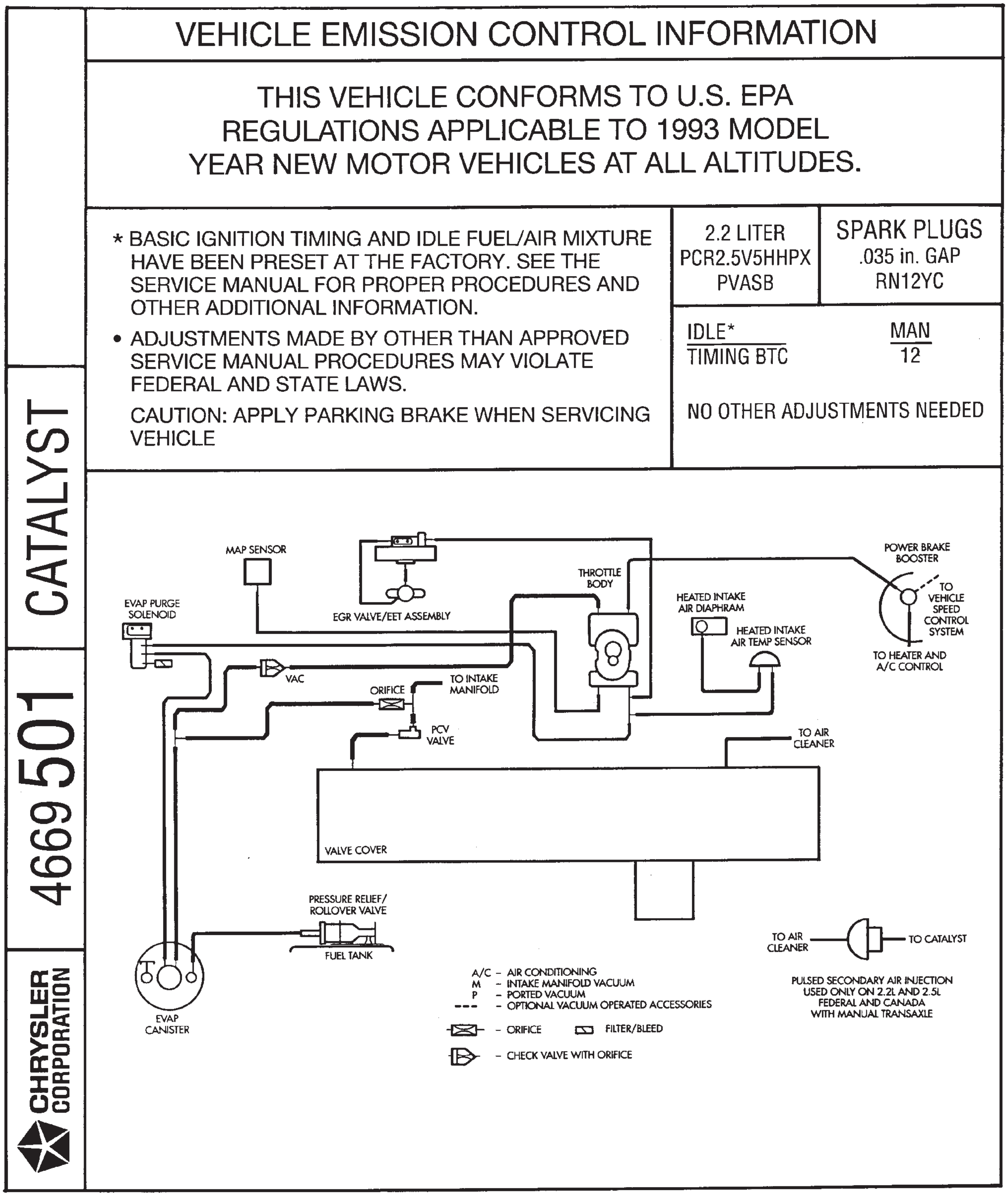


Fig. 3 Underhood Label Location—AG and AJ Bodies

VACUUM SCHEMATICS

If any difference exists between the vacuum schematics on the VECI label and the schematics in the Service Manual, refer to the label.



VEHICLE EMISSION CONTROL INFORMATION

THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS APPLICABLE TO 1993 MODEL YEAR NEW MOTOR VEHICLES AT ALL ALTITUDES.

* BASIC IGNITION TIMING AND IDLE FUEL/AIR MIXTURE HAVE BEEN PRESET AT THE FACTORY. SEE THE SERVICE MANUAL FOR PROPER PROCEDURES AND OTHER ADDITIONAL INFORMATION.

- ADJUSTMENTS MADE BY OTHER THAN APPROVED SERVICE MANUAL PROCEDURES MAY VIOLATE FEDERAL AND STATE LAWS.

CAUTION: APPLY PARKING BRAKE WHEN SERVICING VEHICLE

2.2 LITER
PCR2.5V5HHPX
PVASB

SPARK PLUGS
.035 in. GAP
RN12YC

IDLE* TIMING BTC	MAN 12

NO OTHER ADJUSTMENTS NEEDED

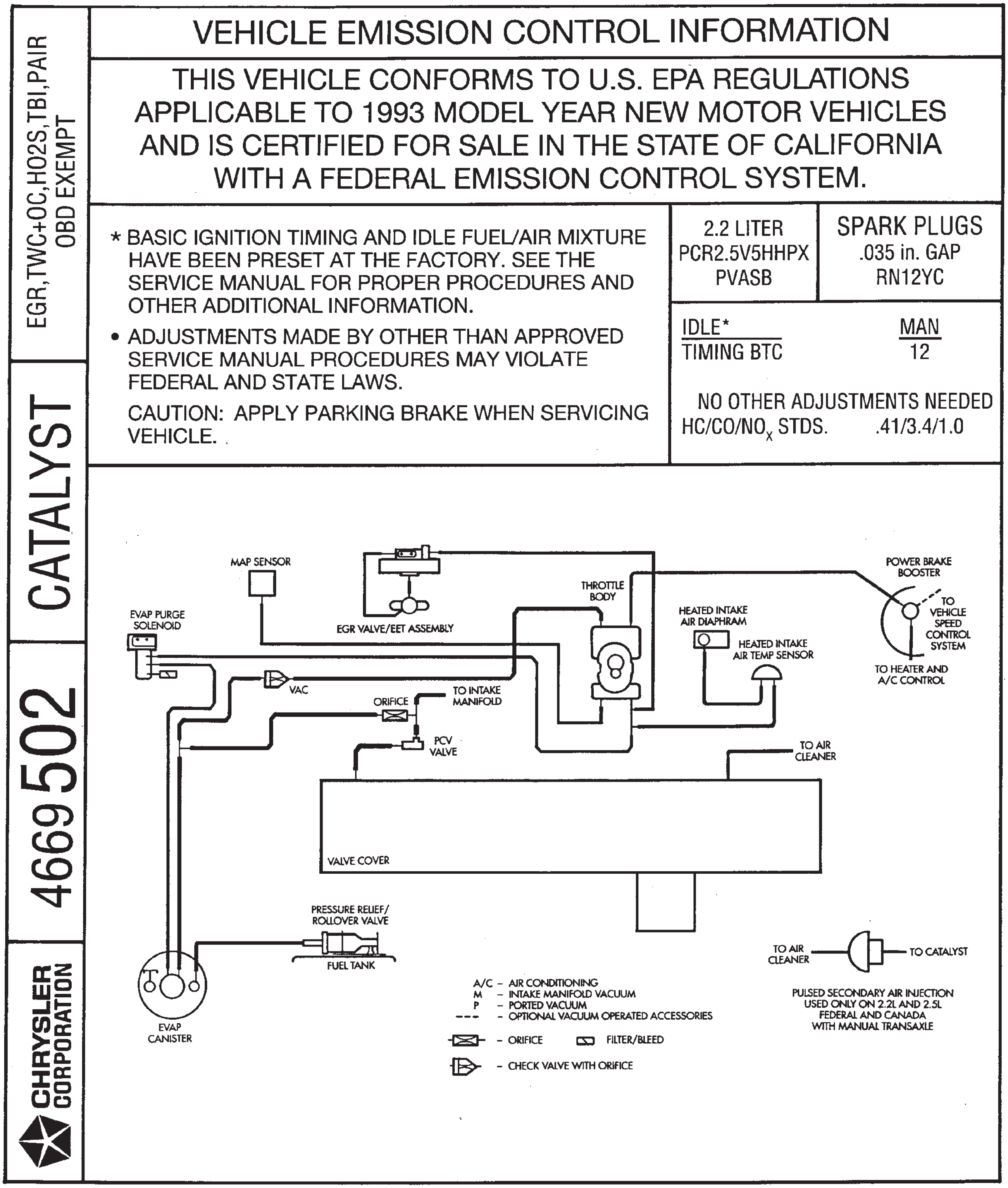
CATALYST

4669501

CHRYSLER CORPORATION

9325-41

FEDERAL EMISSION CONTROL INFORMATION LABEL—TYPICAL



EGR,TWC+OC,HO2S,TBI,PAIR
OBD EXEMPT

CATALYST

4669502

CHRYSLER
CORPORATION

VEHICLE EMISSION CONTROL INFORMATION

THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS APPLICABLE TO 1993 MODEL YEAR NEW MOTOR VEHICLES AND IS CERTIFIED FOR SALE IN THE STATE OF CALIFORNIA WITH A FEDERAL EMISSION CONTROL SYSTEM.

* BASIC IGNITION TIMING AND IDLE FUEL/AIR MIXTURE HAVE BEEN PRESET AT THE FACTORY. SEE THE SERVICE MANUAL FOR PROPER PROCEDURES AND OTHER ADDITIONAL INFORMATION.

- ADJUSTMENTS MADE BY OTHER THAN APPROVED SERVICE MANUAL PROCEDURES MAY VIOLATE FEDERAL AND STATE LAWS.

CAUTION: APPLY PARKING BRAKE WHEN SERVICING VEHICLE.

2.2 LITER
PCR2.5V5HHPX
PVASB

SPARK PLUGS
.035 in. GAP
RN12YC

IDLE*	MAN
TIMING BTC	12

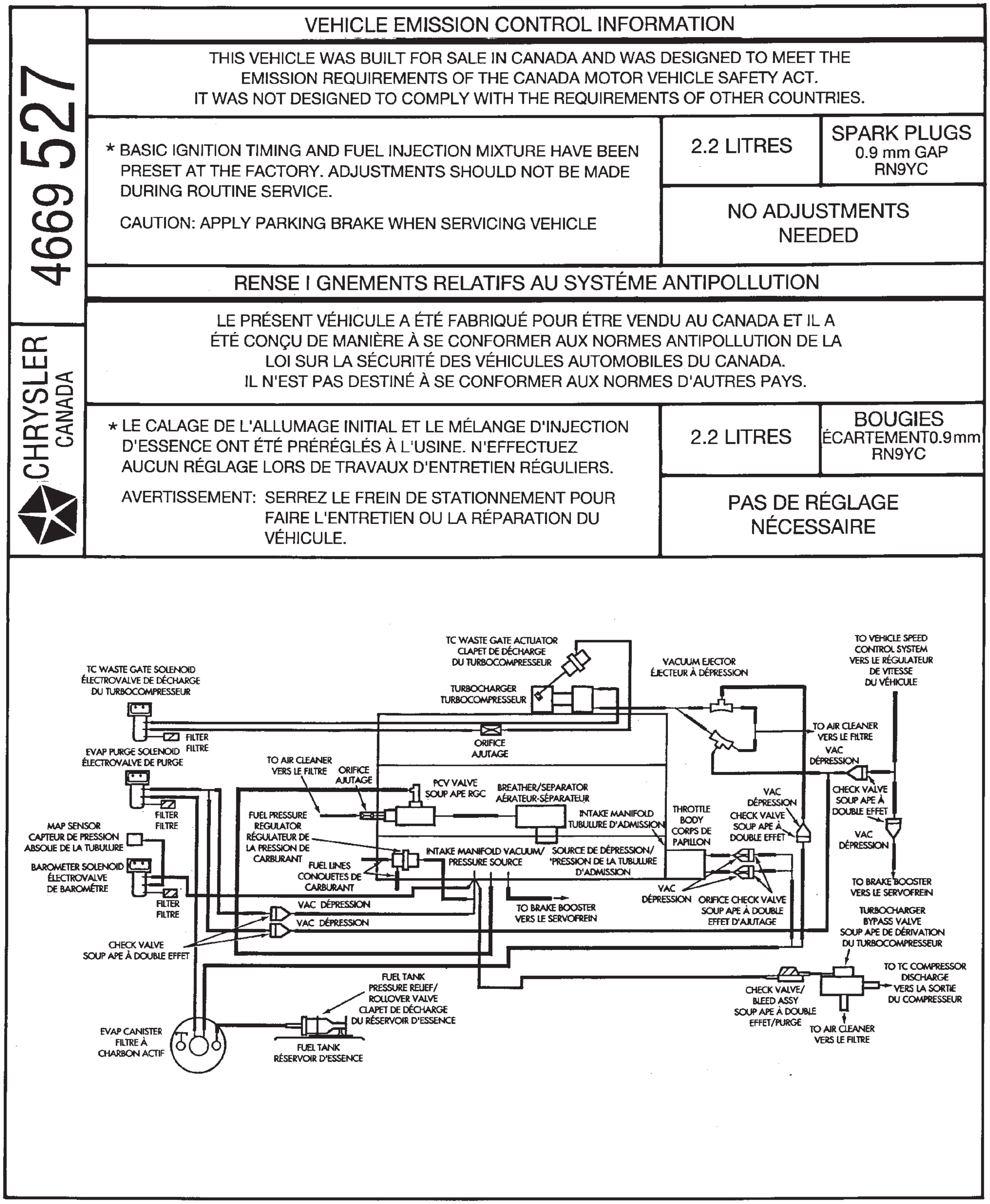
NO OTHER ADJUSTMENTS NEEDED
HC/CO/NO_X STDS. .41/3.4/1.0

A/C - AIR CONDITIONING
M - INTAKE MANIFOLD VACUUM
P - PORTED VACUUM
--- - OPTIONAL VACUUM OPERATED ACCESSORIES
⊠ - ORIFICE ▭ FILTER/BLEED
▷ - CHECK VALVE WITH ORIFICE

PULSED SECONDARY AIR INJECTION USED ONLY ON 2.2L AND 2.5L FEDERAL AND CANADA WITH MANUAL TRANSAXLE

9325-42

CALIFORNIA VEHICLE CONTROL INFORMATION LABEL—TYPICAL



4669 527

CHRYSLER
CANADA

VEHICLE EMISSION CONTROL INFORMATION

THIS VEHICLE WAS BUILT FOR SALE IN CANADA AND WAS DESIGNED TO MEET THE EMISSION REQUIREMENTS OF THE CANADA MOTOR VEHICLE SAFETY ACT. IT WAS NOT DESIGNED TO COMPLY WITH THE REQUIREMENTS OF OTHER COUNTRIES.

* BASIC IGNITION TIMING AND FUEL INJECTION MIXTURE HAVE BEEN PRESET AT THE FACTORY. ADJUSTMENTS SHOULD NOT BE MADE DURING ROUTINE SERVICE.

CAUTION: APPLY PARKING BRAKE WHEN SERVICING VEHICLE

2.2 LITRES

SPARK PLUGS
0.9 mm GAP
RN9YC

NO ADJUSTMENTS NEEDED

RENSEIGNEMENTS RELATIFS AU SYSTÉME ANTIPOLLUTION

LE PRÉSENT VÉHICULE A ÉTÉ FABRIQUÉ POUR ÉTRE VENDU AU CANADA ET IL A ÉTÉ CONÇU DE MANIÈRE À SE CONFORMER AUX NORMES ANTIPOLLUTION DE LA LOI SUR LA SÉCURITÉ DES VÉHICULES AUTOMOBILES DU CANADA. IL N'EST PAS DESTINÉ À SE CONFORMER AUX NORMES D'AUTRES PAYS.

* LE CALAGE DE L'ALLUMAGE INITIAL ET LE MÉLANGE D'INJECTION D'ESSENCE ONT ÉTÉ PRÉRÉGLÉS À L'USINE. N'EFFECTUEZ AUCUN RÉGLAGE LORS DE TRAVAUX D'ENTRETIEN RÉGULIERS.

AVERTISSEMENT: SERREZ LE FREIN DE STATIONNEMENT POUR FAIRE L'ENTRETIEN OU LA RÉPARATION DU VÉHICULE.

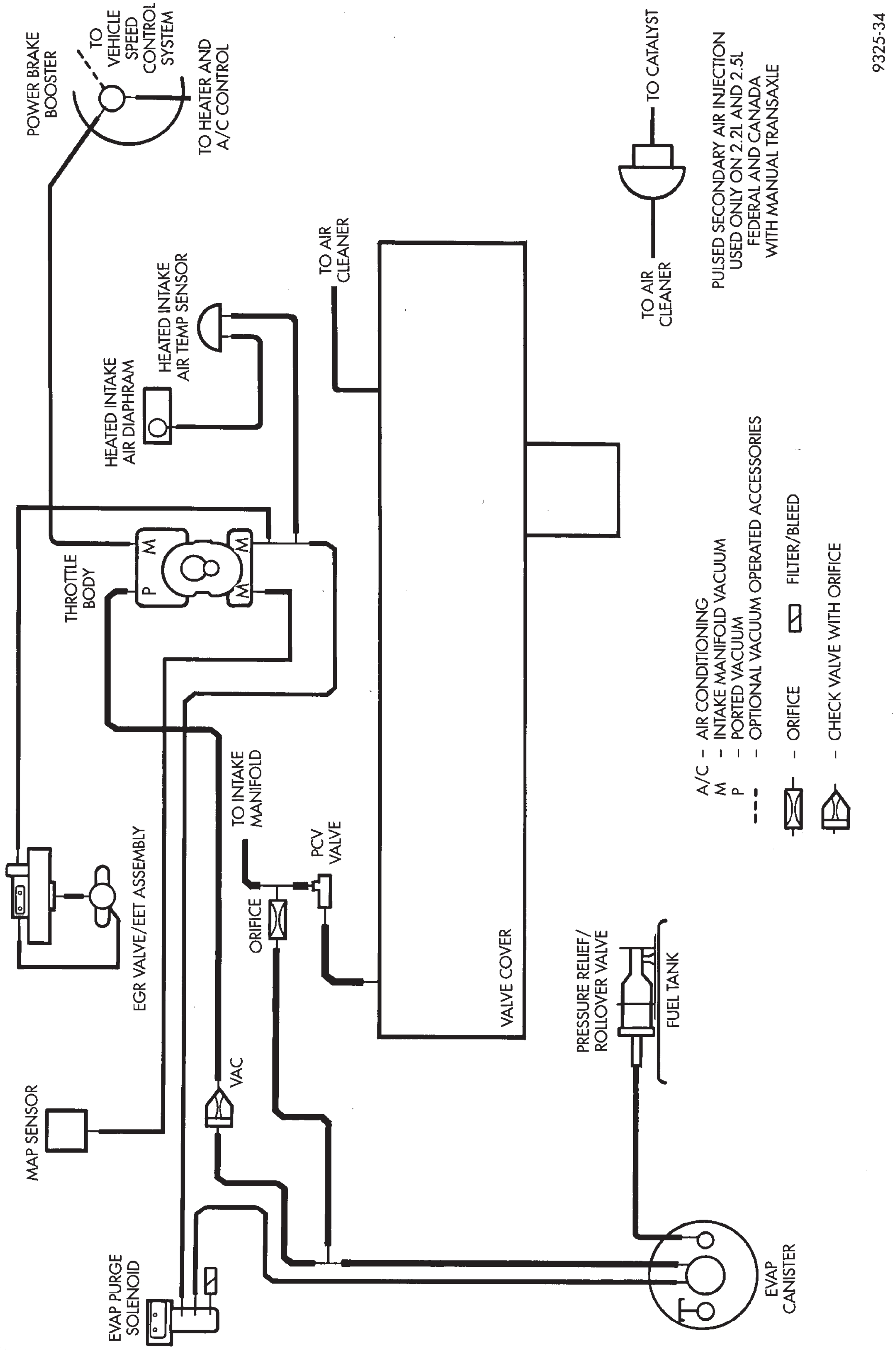
2.2 LITRES

BOUGIES
ÉCARTEMENT0.9mm
RN9YC

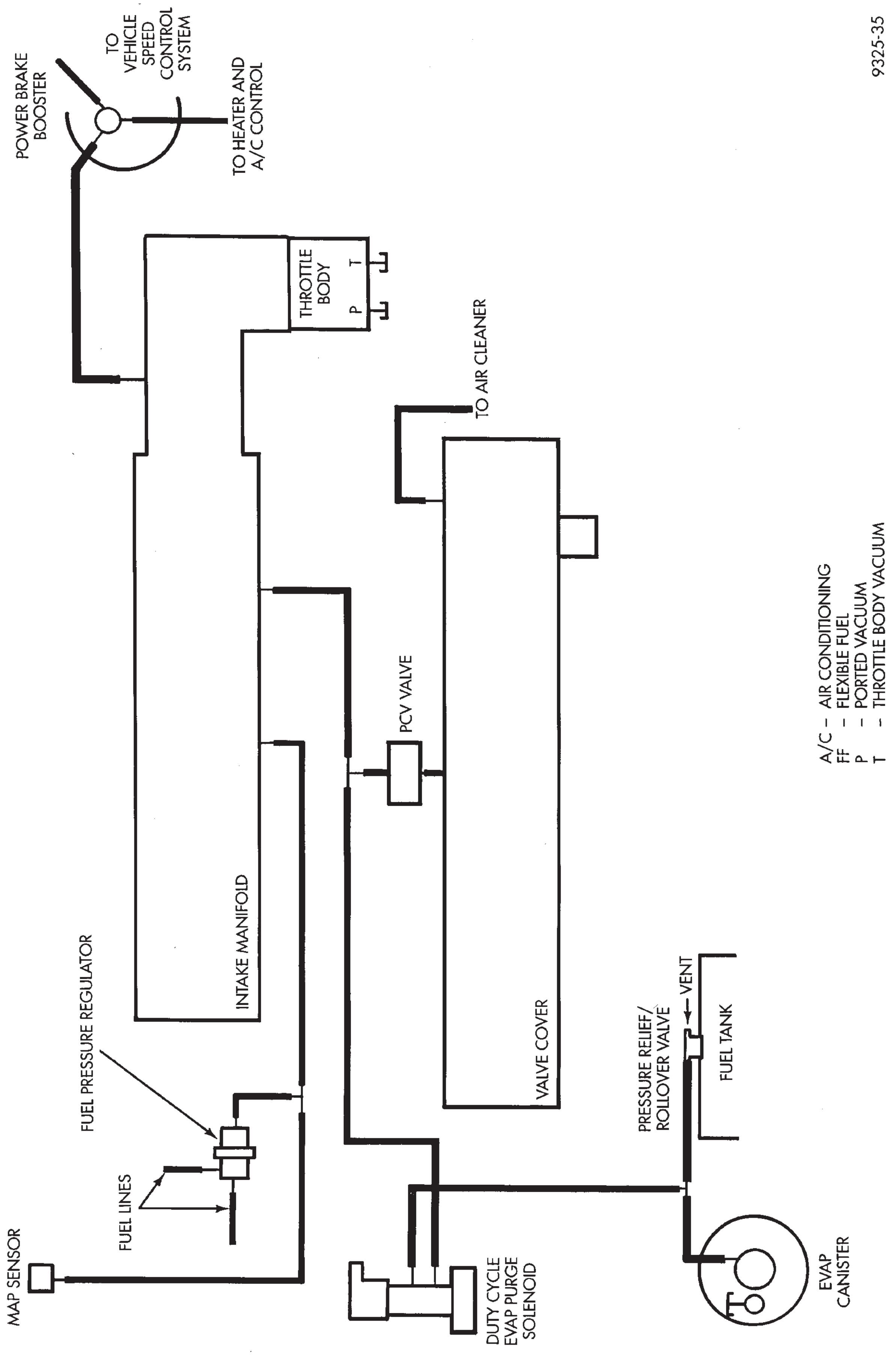
PAS DE RÉGLAGE NÉCESSAIRE

9325-43

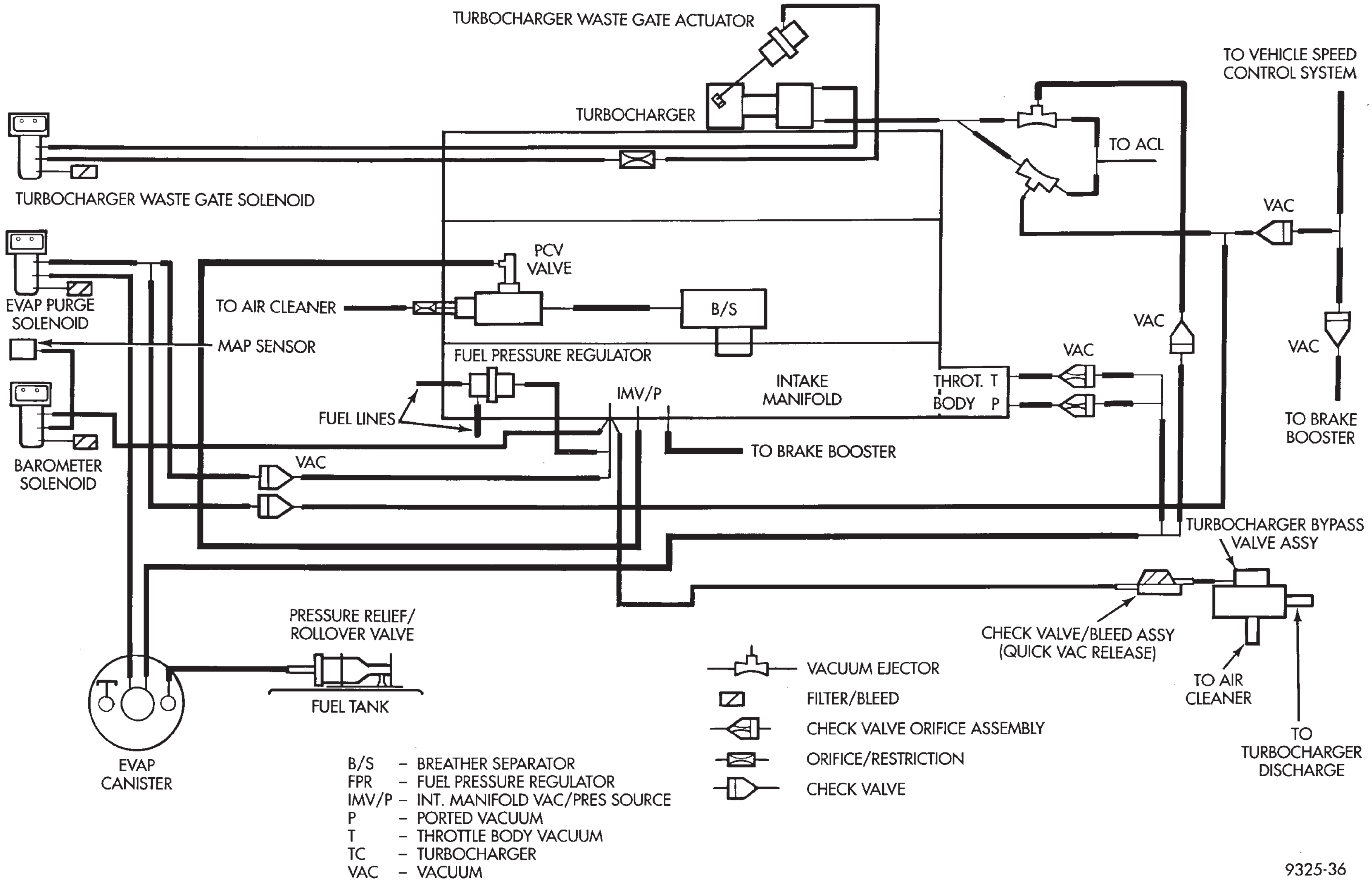
CANADA VEHICLE EMISSION CONTROL INFORMATION LABEL—TYPICAL



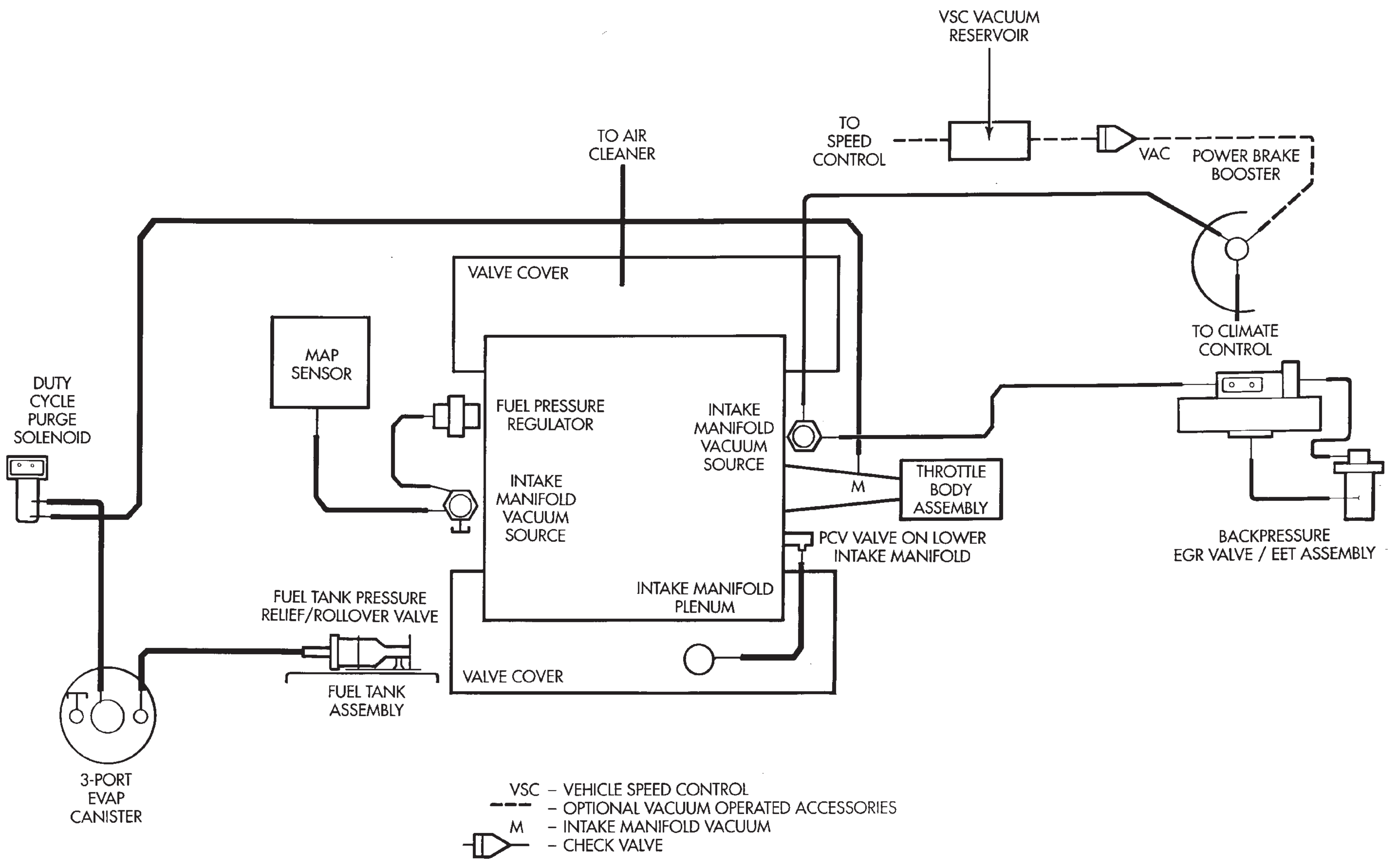
ENGINE VACUUM SCHEMATIC—2.2L/2.5L TBI



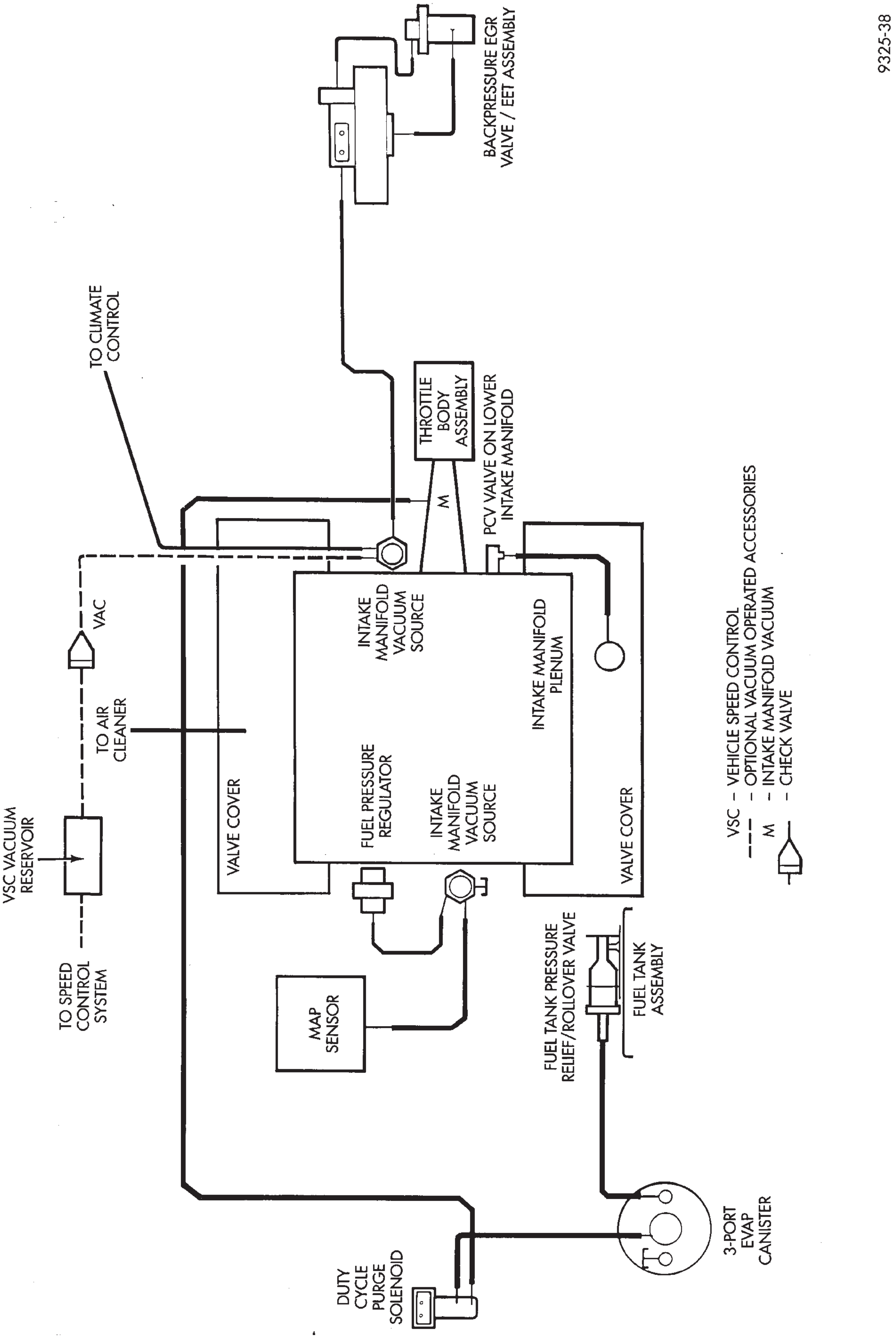
ENGINE VACUUM SCHEMATIC—2.5L MPI FLEXIBLE FUEL AA-BODY



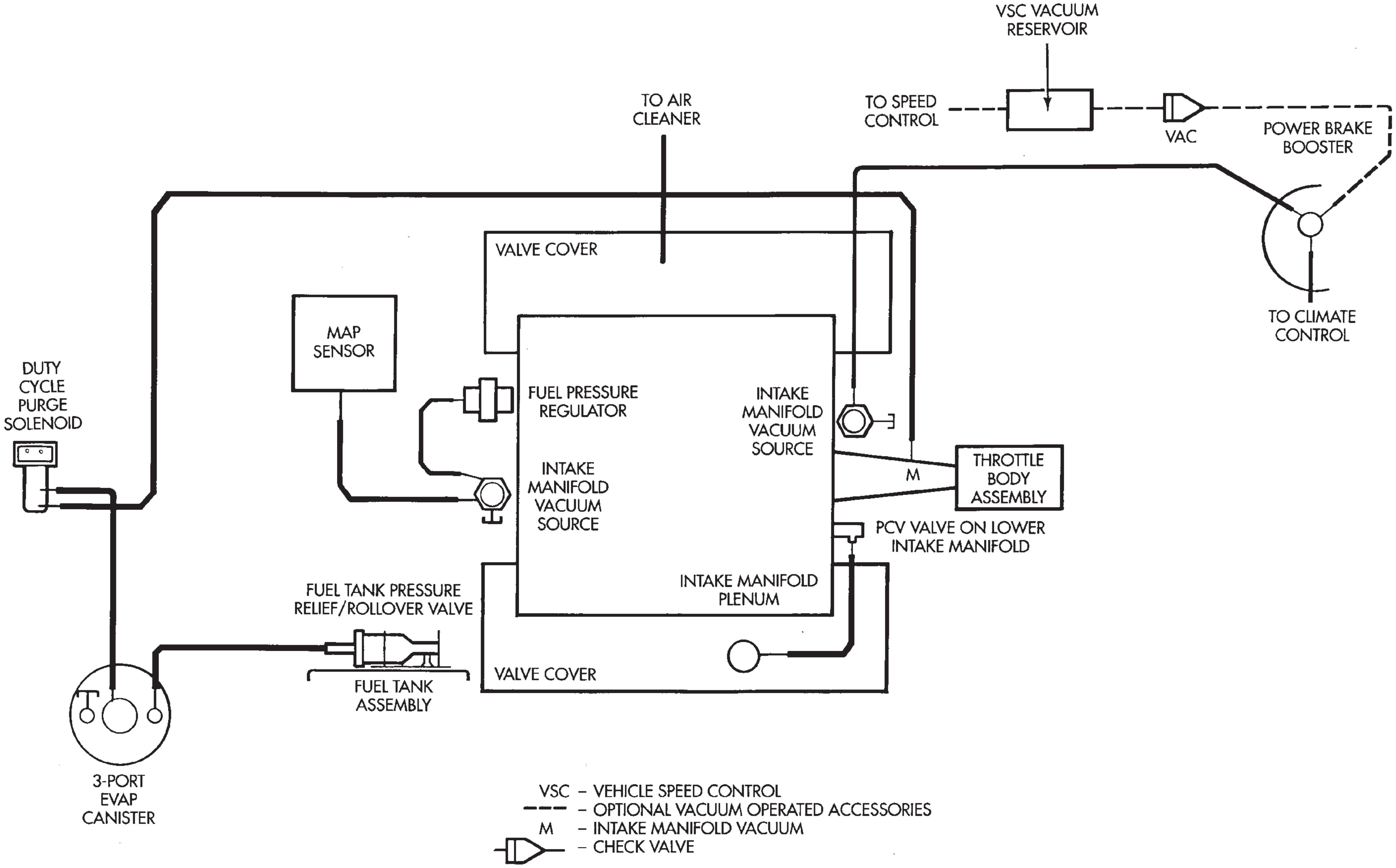
ENGINE VACUUM SCHEMATIC—2.2L TURBO III



ENGINE VACUUM SCHEMATIC—3.0L, AUTOMATIC TRANSAXLE, ALL WITHOUT ABS AND AA, AG, AJ, AP, WITH ABS

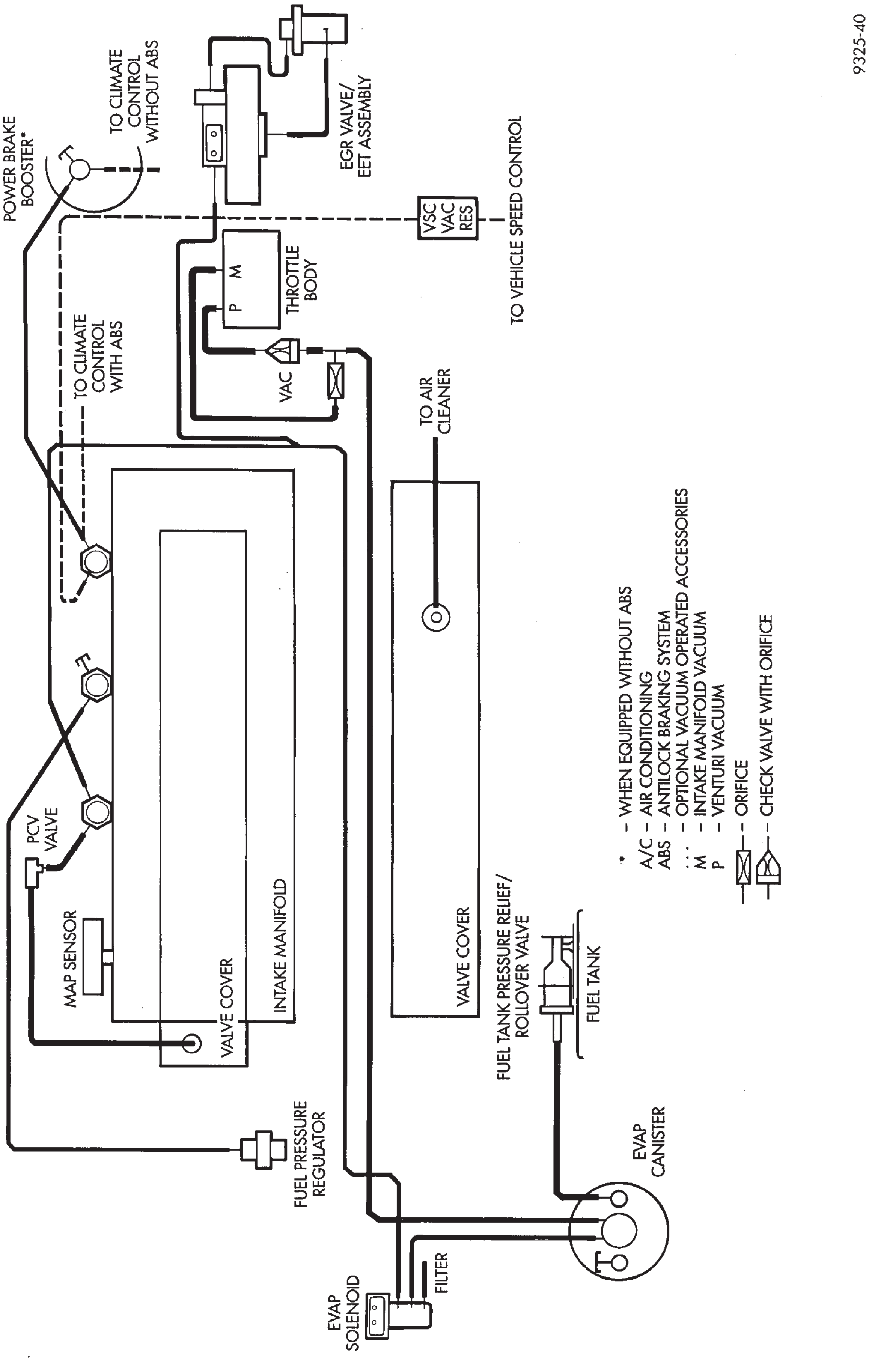


ENGINE VACUUM SCHEMATIC—3.0L, AUTOMATIC TRANSAXLE, AC BODY WITH ABS



9325-39

ENGINE VACUUM SCHEMATIC—3.0L, MANUAL TRANSAXLE, AG, AJ, AP



ENGINE VACUUM SCHEMATIC—3.3L/3.8L AC, AY

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 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. The PCM uses the canister purge solenoid to regulate vapor flow.

On 2.2L and 2.5L TBI, 3.3L, and 3.8L engines, manifold vacuum purges the vapors at idle as well as off idle. These engines use a bi-level purge system. The system uses 2 sources of vacuum remove fuel vapors from the canister.

Turbo III engines use a tri-level canister purge system. In this system, fuel vapors are drawn into the engine through the throttle body and air cleaner. Fuel vapors are drawn in at closed throttle, part throttle, and wide open throttle (in boost).

The 2.5L MPI (flexible fuel AA-Body) and 3.0L have a duty cycle purge system. The powertrain control module PCM controls vapor flow by operating the duty cycle EVAP purge solenoid. Refer to Duty Cycle EVAP Purge Solenoid in this section.

The evaporative system uses specially manufactured hoses. If they need replacement, only use fuel resistant hose.

PRESSURE RELIEF/ROLLOVER VALVE

All vehicles have a combination pressure relief and rollover valve. The dual function valve relieves fuel tank pressure. The valve also prevents fuel flow through the fuel tank vent valve hoses if the vehicle accidentally rolls over. All vehicles pass a 360° rollover.

The pressure relief valve opens at a certain pressure. When fuel tank pressure increases above the calibrated pressure, the valve opens to release fuel tank vapors pressure. The evaporative (charcoal) canister stores the vapors. For pressure relief/rollover valve service, refer to the Fuel Tank section of Group 14.

EVAPORATIVE CANISTER

All vehicles use a sealed, maintenance free, evaporative (charcoal) canister. The canister mounts to the inner wheel well area of the engine compartment (Fig. 4 or Fig. 5).

Fuel tank pressure vents into the canister. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the combustion chamber. The canister purge solenoid purges vapors from the canister at predetermined intervals and engine conditions.

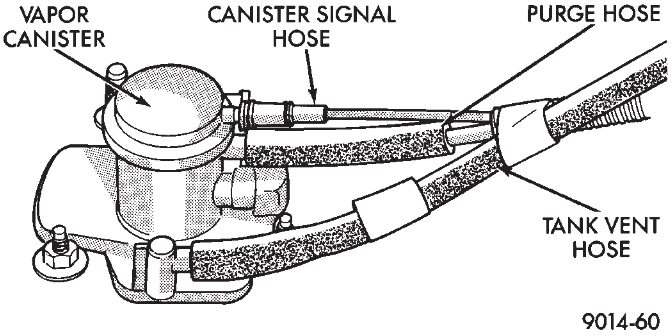


Fig. 4 Evaporative Canister—Except 3.0L and 2.5L MPI

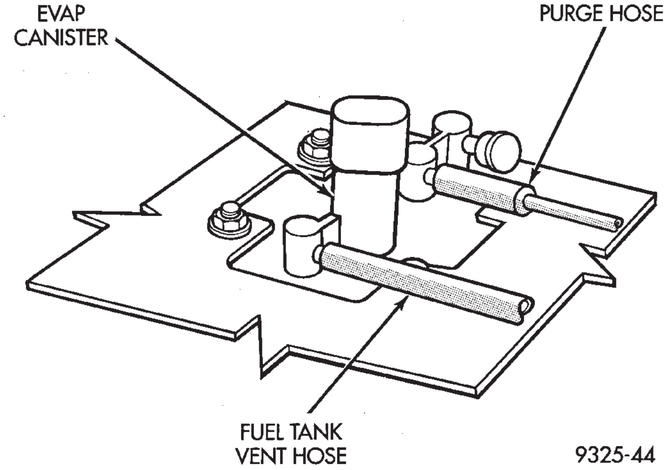


Fig. 5 Evaporative Canister—3.0L and 2.5L MPI

CANISTER PURGE SOLENOID—EXCEPT 3.0L AND 2.5L MPI

The powertrain control module (PCM) operates the canister purge solenoid (Fig. 6). During warm-up and for a specified period after hot starts, the PCM grounds the purge solenoid causing it to energize. When the PCM grounds the solenoid, vacuum does not reach the charcoal canister valve.

When the engine reaches a specified operating temperature and the time delay interval has occurred, the PCM de-energizes the solenoid by turning off the ground. When the PCM de-energizes the solenoid, vacuum flows to the canister purge valve. Intake manifold vacuum purges fuel vapors through the throttle body. The PCM also energizes the purge solenoid during certain idle conditions to update the fuel delivery calibration.

DUTY CYCLE EVAP PURGE SOLENOID

Vehicles equipped with a 3.0L engine and the Flexible Fuel AA-Body with the 2.5L MPI engine use a duty cycle EVAP purge solenoid. The duty cycle EVAP purge solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The powertrain control module operates the solenoid.

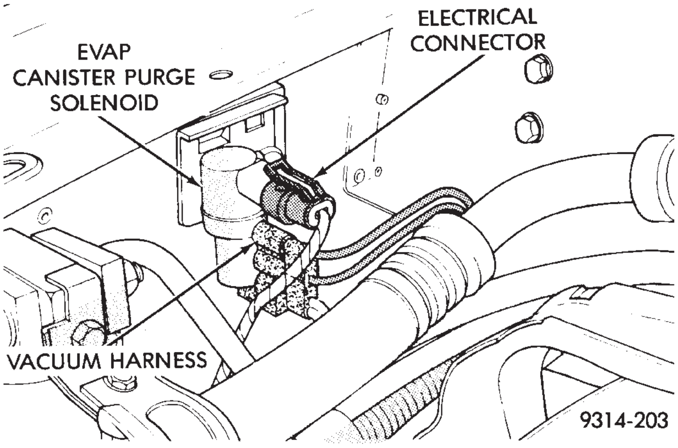


Fig. 6 Canister Purge Solenoid—Except 3.0L and 2.5L MPI

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 approximately 5 to 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. The PCM adjusts solenoid pulse width based on engine air flow.

A rubber boot covers the duty cycle EVAP purge solenoid. On 2.5L MPI flexible fuel AA-body vehicles, the solenoid and bracket attach to the EVAP canister mounting studs (Fig. 7). On vehicles with 3.0L engines, the solenoid attaches to a bracket mounted to the right engine mount (Fig. 8). The top of the solenoid has the word TOP on it. The solenoid will not operate unless it is installed correctly.

PRESSURE-VACUUM FILLER CAP

CAUTION: Remove the fuel filler cap to relieve fuel tank pressure. Remove the cap before disconnecting fuel system components or servicing the fuel tank.

A pressure-vacuum relief cap seals the fuel tank (Fig. 9). 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. Removing the cap breaks the seal and relieves fuel tank pressure.

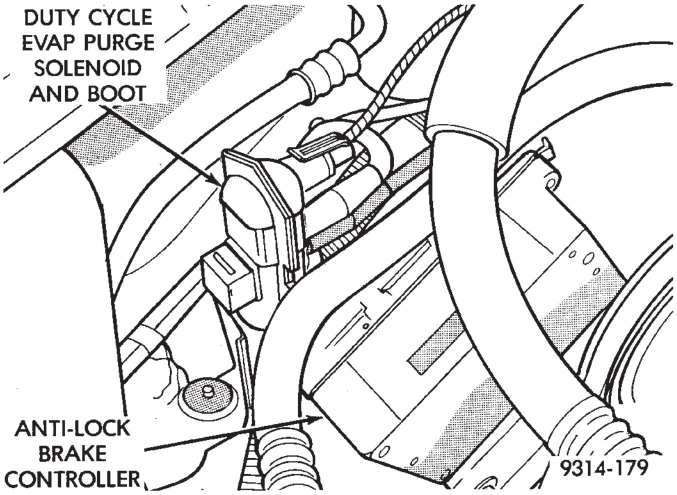


Fig. 7 Duty Cycle EVAP Purge Solenoid—2.5L MPI Flexible Fuel AA-Body

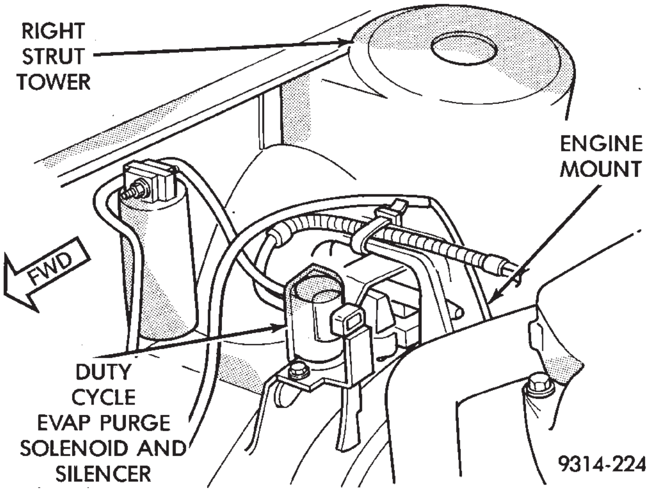


Fig. 8 Duty Cycle EVAP Purge Solenoid—3.0L Engine

If the filler cap needs replacement, only use a similar unit.

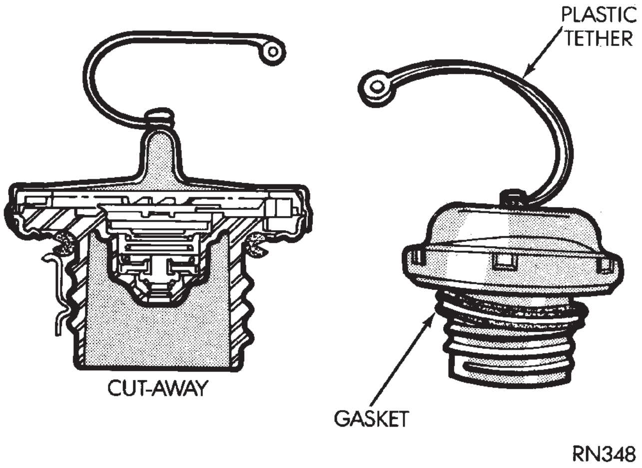


Fig. 9 Pressure Vacuum Filler Cap

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEMS

Intake manifold vacuum removes crankcase vapors and piston blow-by from the engine. The emissions 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 air does not enter the crankcase (Figs. 10, 11, 12, 13, 14, 15, and 16).

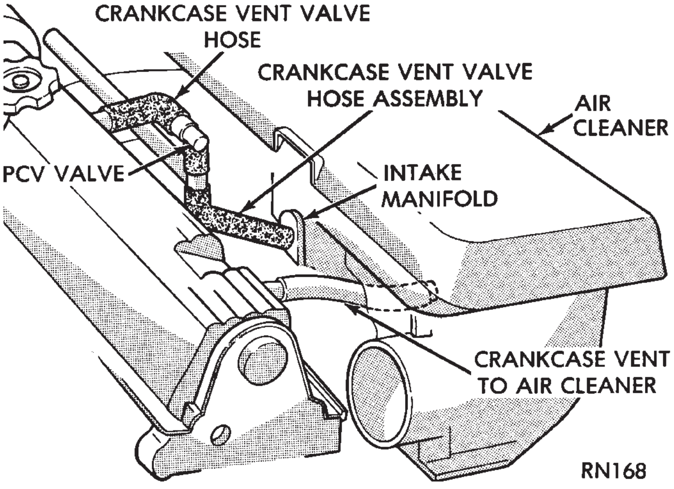


Fig. 10 PCV Valve—2.5L TBI Engine

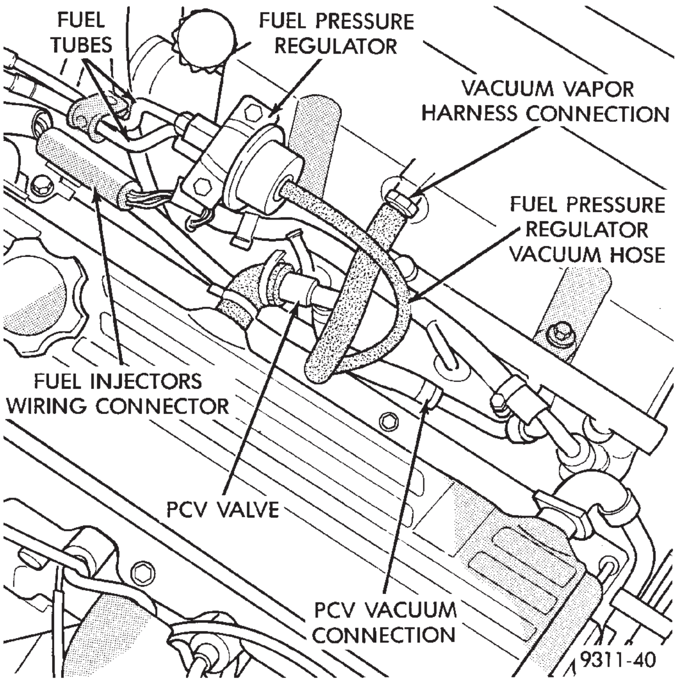


Fig. 11 PCV System—2.5L MPI (Flexible Fuel)

PCV VALVE TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST OR ADJUSTMENT WITH THE ENGINE OPERATING.

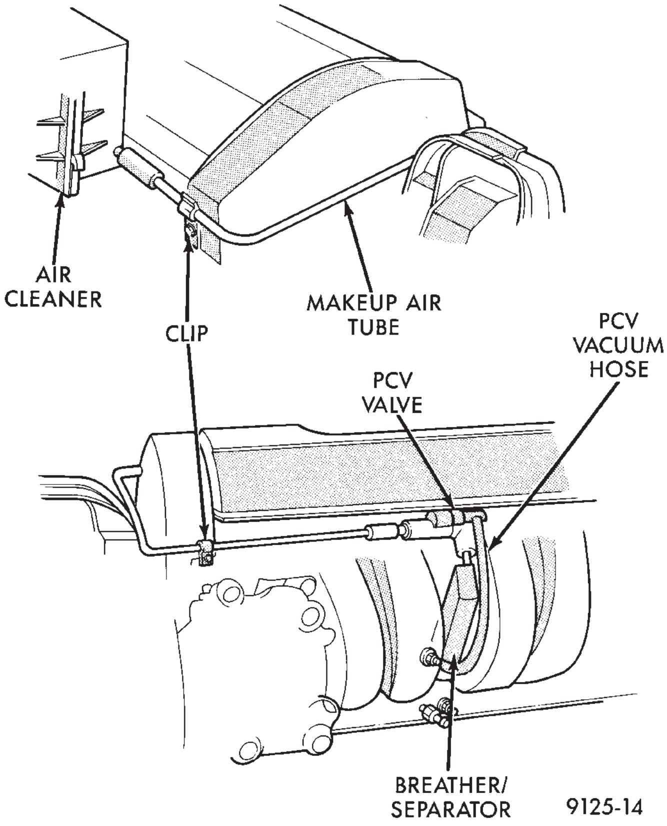


Fig. 12 PCV System—Turbo III Engine

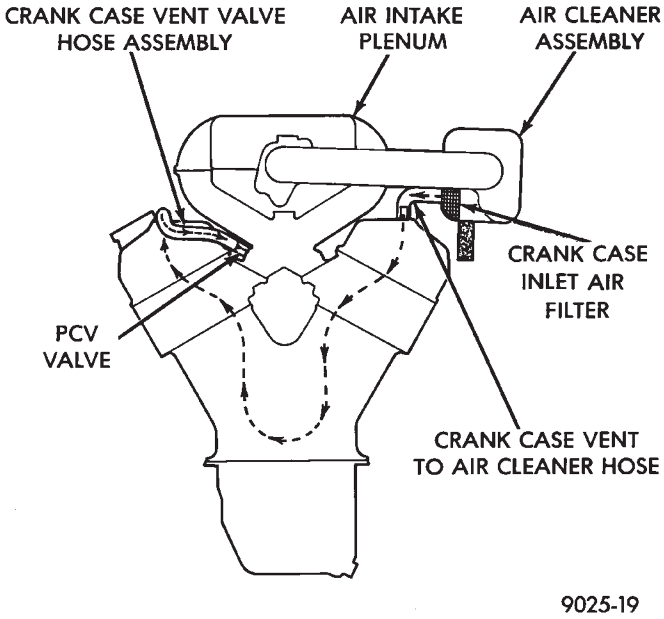


Fig. 13 PCV System—3.0L Engine

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. 17). With the engine off, the 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.**

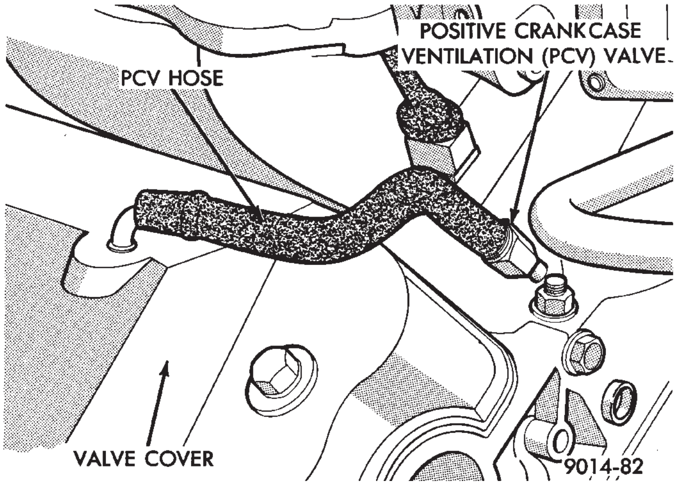


Fig. 14 PCV Valve—3.0L Engine

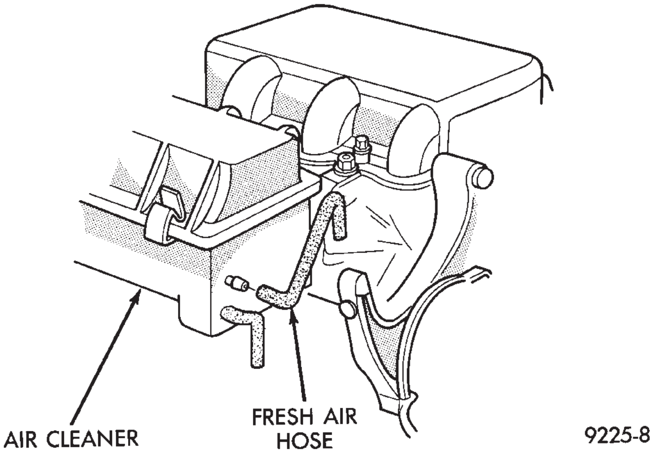


Fig. 15 PCV System Fresh Air Hose—3.0L Engine

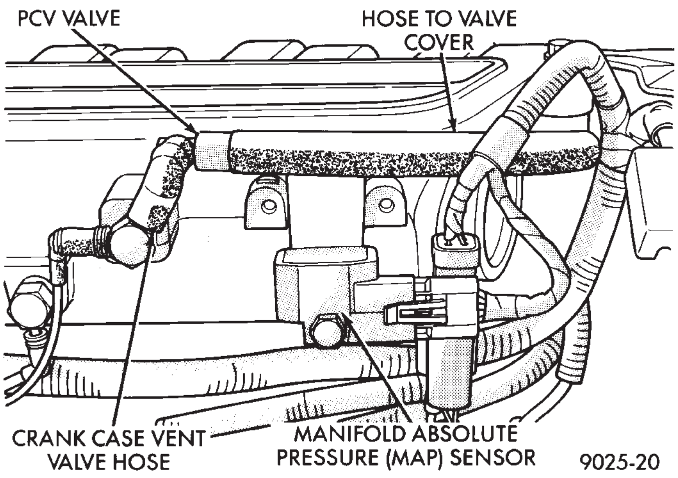


Fig. 16 PCV System—3.3L/3.8L Engines

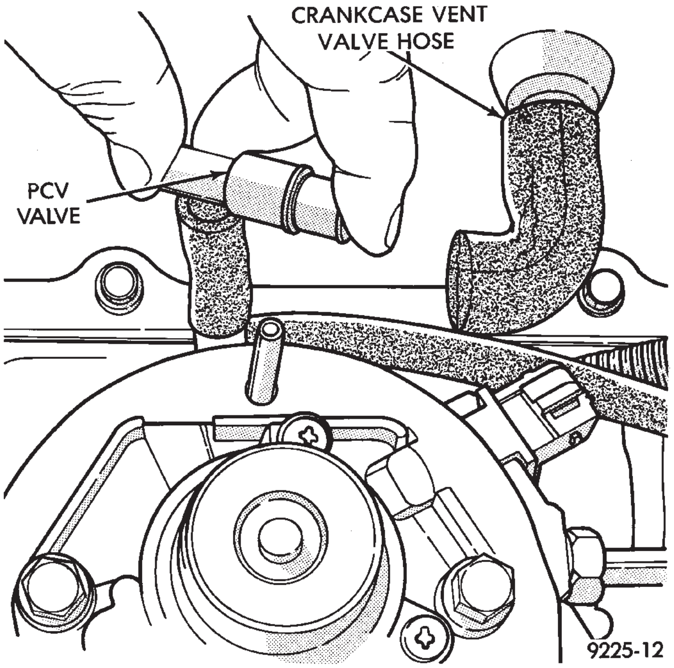


Fig. 17 Typical PCV Test

CRANKCASE VENT FILTER

All engines have a crankcase vent filter. The filter cleans outside air before it enters the PCV system. On 2.5L engines, the filter mounts to the upper shell assembly of the air cleaner. On 2.5L MPI (Flexible Fuel AA-body) and Turbo III engines, the filter attaches to the inside of the filter element box, next to the filter element. On 3.0L engines, it attaches to the inside of the filter element box under the filter element. On the 3.3L engines, the filter mounts to the bottom of the filter element box. Refer to Group 0 for mileage intervals and service procedures.

EXHAUST EMISSION CONTROLS

INDEX

HEATED INLET AIR SYSTEM

2.5L MPI (Flexible Fuel AA-body), Turbo III, 3.0L, 3.3L and 3.8L engines do not use a heated inlet air system.

2.2L and 2.5L TBI air cleaners have a heated air assembly (Fig. 1). When ambient temperatures are low, the assembly warms the air before it enters the throttle body. The heated air assembly reduces hydrocarbon emissions, improves engine warm-up characteristics and minimizes icing.

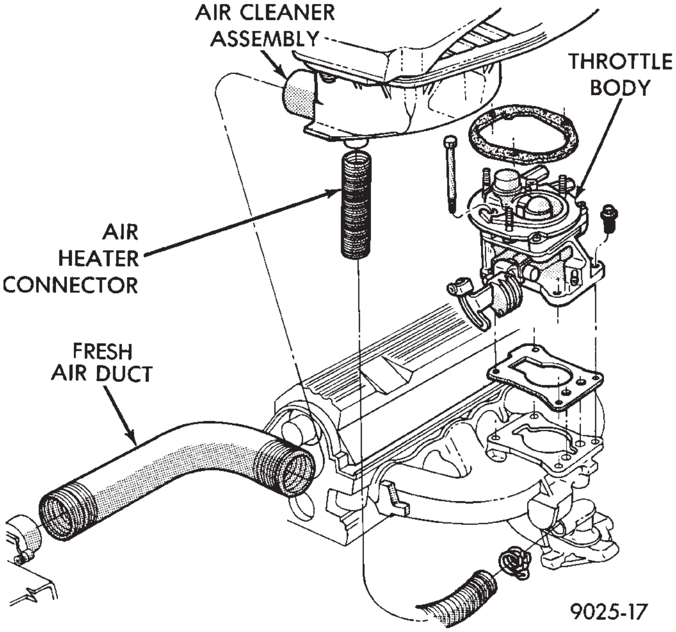


Fig. 1 Heated Air Inlet System

The heated air assembly contains a vacuum operated blend door. The blend door opens to either heated air from a stove on the exhaust manifold or ambient air (outside air). A vacuum diaphragm operates the door. A spring opposes the vacuum diaphragm. A temperature sensor controls the vacuum diaphragm (Fig. 2). Adjustment of inlet air temperature occurs only at road load throttle positions or when the intake manifold vacuum exceeds the vacuum diaphragm spring rate.

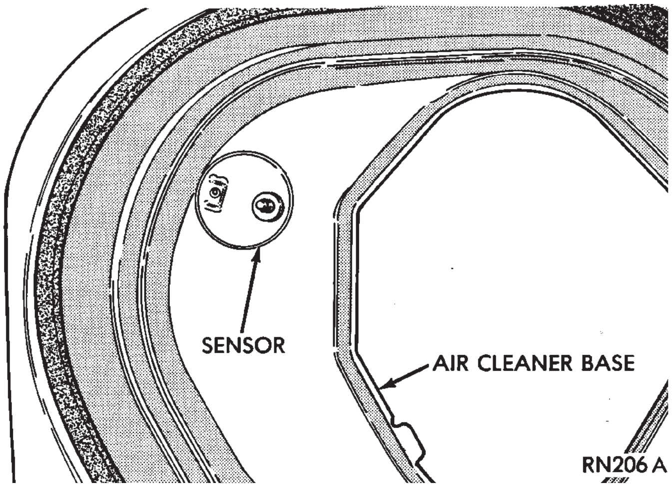


Fig. 2 Heated Air Temperature Sensor

Air flows through the outside air inlet when ambient air temperature is 8°C (15°F) or more above the air temperature sensor control temperature.

When ambient air temperature falls below the control temperature, air flows through both the ambient and heated circuits. This occurs after the engine has been started and the exhaust manifold starts to give off heat. Colder ambient air cause greater air flow through the heat stove on the exhaust manifold. Warmer ambient air results in greater ambient air flow through the air cleaner snorkel.

HEATED INLET AIR SYSTEM SERVICE

Heated air inlet system malfunctions may affect driveability and vehicle exhaust emissions.

Use the following procedure to determine if the system functions properly.

(1) Inspect the condition of the heat stove to air cleaner flexible connector and all vacuum hoses. Inspect them for proper attachment. Replace as necessary.

(2) With a cold engine and ambient temperature less than 46°C (115°F.), the heat control door (valve plate) should be in the **up (heat on position)**.

(3) With the engine warmed up and running, check the temperature of the air entering the snorkel or passing the sensor. When the temperature of the

air entering the outer end of snorkel is 60°C (140°F.) or higher, the door should be in the **down (heat off) position.**

(4) Remove the air cleaner from the engine and allow it to cool down to 46°C (115°F). With 20 inches of vacuum applied to the sensor, the door should be in the **up (heat on position).** If the door does not rise to the **heat on** position, check the vacuum diaphragm for proper operation.

(5) To test the diaphragm, apply 20 inches of vacuum to it with vacuum pump tool number C-4207 or equivalent (Fig. 3). The diaphragm should not bleed down more than 10 inches of vacuum in 5 minutes. The door should not lift off the bottom of the snorkel at less than 2 inches of vacuum. The door should be in the full **up** position with no more than 4 inches of vacuum.

(6) If the vacuum diaphragm does not perform adequately, replace the heated air assembly.

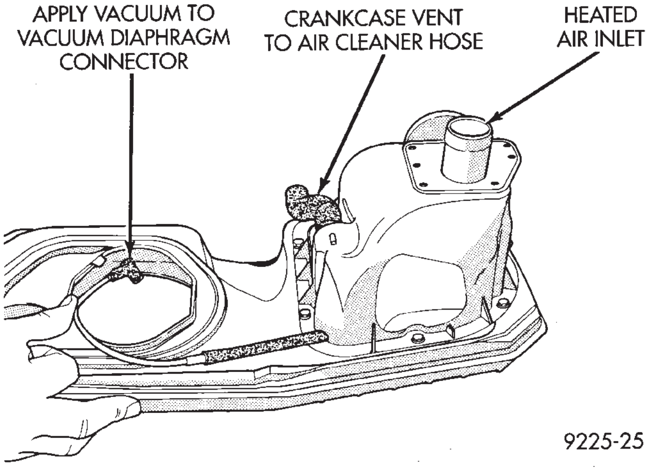


Fig. 3 Testing Vacuum Diaphragm on Heated Air Inlet Systems

(7) If the vacuum diaphragm performs adequately but proper temperature is not maintained, replace the sensor and repeat the temperature checks in steps 2 and 3.

HEATED AIR TEMPERATURE SENSOR SERVICE

REMOVAL

(1) Remove air cleaner housing from vehicle.

(2) Disconnect vacuum hoses from air temperature sensor. Remove and discard retainer clips, new clips are supplied with a new sensor (Fig. 4).

(3) Remove and discard sensor and gasket.

INSTALLATION

(1) Position gasket on the sensor. Install sensor (Fig. 5).

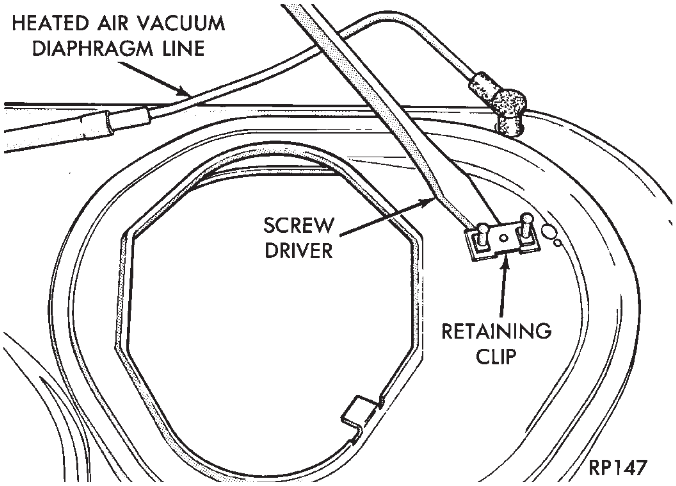


Fig. 4 Removing Sensor Clips

(2) While supporting the sensor on outer diameter, install new retainer clips securely. Ensure the gasket compresses to form an air seal. **Do not attempt to adjust the sensor.**

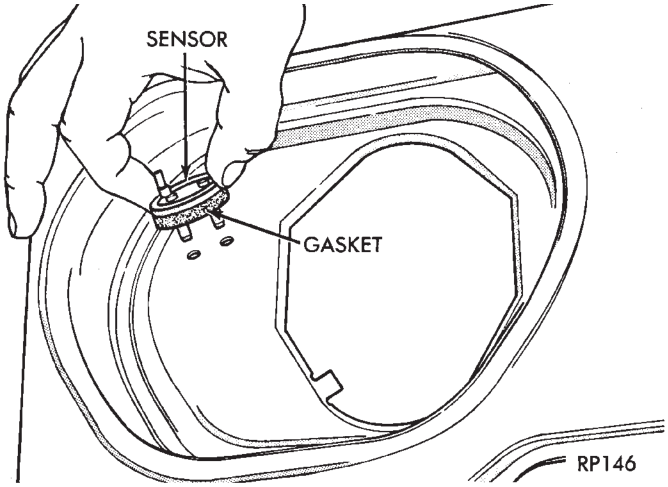


Fig. 5 Air Temperature Sensor Installation

HEATED OXYGEN SENSOR (O_2 SENSOR)

The O_2 sensor threads into the exhaust manifold. It provides an input voltage to the powertrain control module (PCM). The input tells the PCM the oxygen content of the exhaust gas (Fig. 6, 7, 8, 9, or 10). The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

The O_2 sensor produces 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 sensor produces a low voltage. When there is a lesser amount of oxygen present (rich air-fuel mixture), the sensor produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

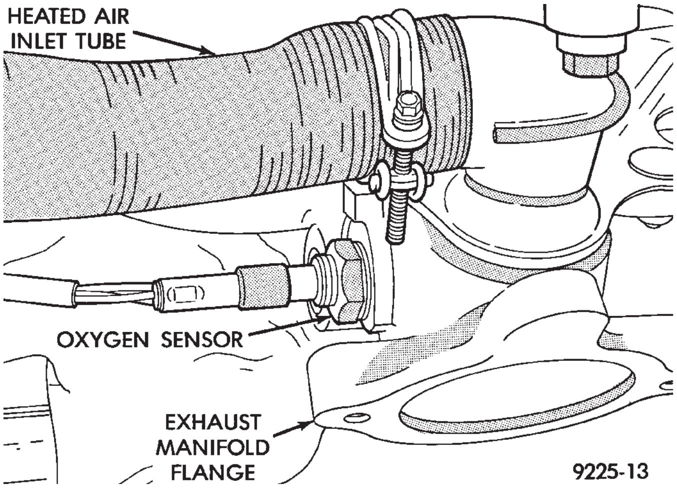


Fig. 6 Heated Oxygen Sensor—2.5L Engine

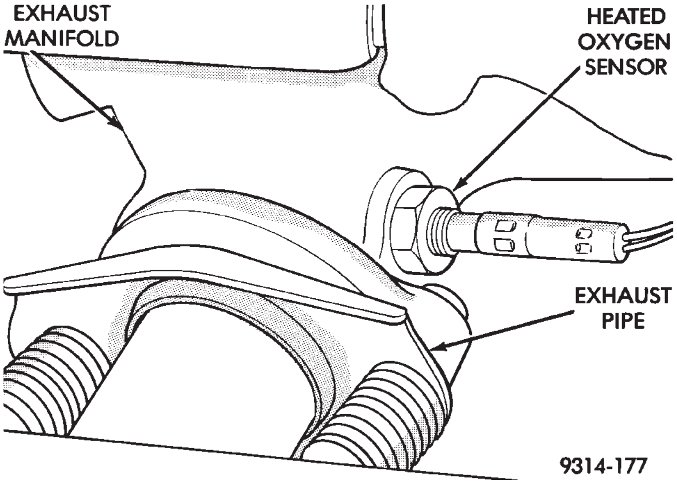


Fig. 7 Heated Oxygen Sensor—2.5L MPI Engine (Flexible Fuel AA-body)

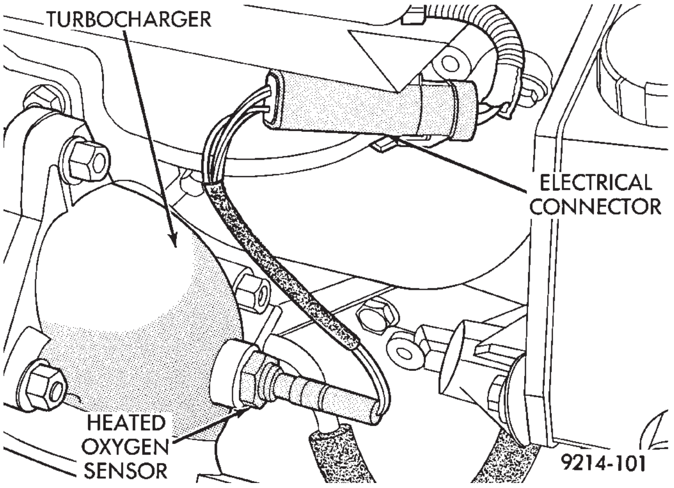


Fig. 8 Heated Oxygen Sensor—Turbo III Engine

The oxygen sensor contains a heating element that keeps it at proper temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner and remain in closed loop during periods of extended idle.

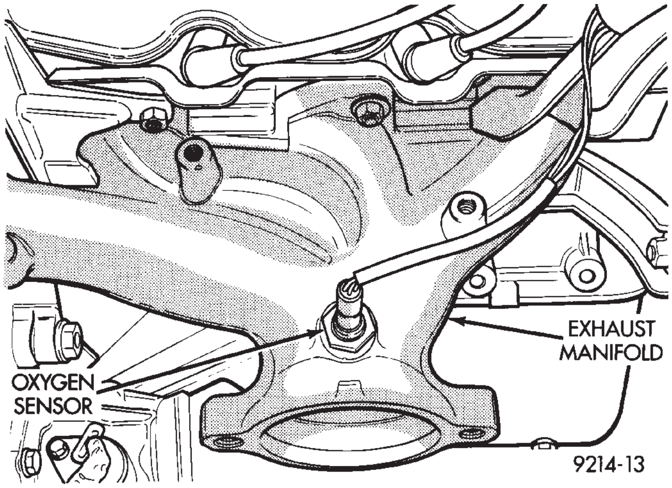


Fig. 9 Heated Oxygen Sensor—3.0L Engine

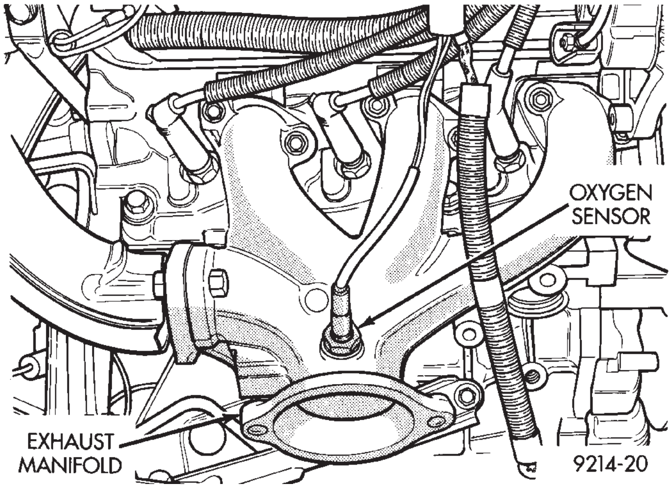


Fig. 10 Heated Oxygen Sensor—3.3L/3.8L Engine

In Closed Loop operation the powertrain control module (PCM) monitors the O_2 sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O_2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) oxygen sensor input values and the current inputs from other sensors.

REMOVAL

CAUTION: Do not pull on the oxygen sensor wire when disconnecting the electrical connector.

WARNING: THE EXHAUST MANIFOLD MAY BE EXTREMELY HOT. USE CARE WHEN SERVICING THE OXYGEN SENSOR.

(1) Disconnect oxygen sensor electrical connector.
(2) Remove sensor using Tool C-4907 (Fig. 11).

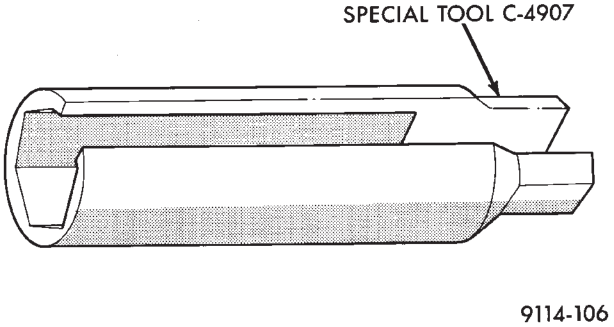


Fig. 11 Heated Oxygen Sensor Socket

After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite 771-64 or equivalent. New sensors have compound on the threads and do not require additional compound. Tighten the sensor to 27 N•m (20 ft. lbs.) torque.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Certain vehicles equipped with either a 2.2L, 2.5L, 3.0L, 3.3L or 3.8L engines may use a back-pressure type Exhaust Gas Recirculation (EGR) system (Fig. 12, 13, or 14). 2.5L MPI (Flexible Fuel AA-body) and Turbo III engines do not use an EGR system.

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 (EET)
- Connecting hoses

The electronic EGR transducer (EET) contains an electrically operated solenoid and a back-pressure transducer (Fig. 15). The powertrain control module (PCM) operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back-pressure controls the transducer.

When the PCM 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.

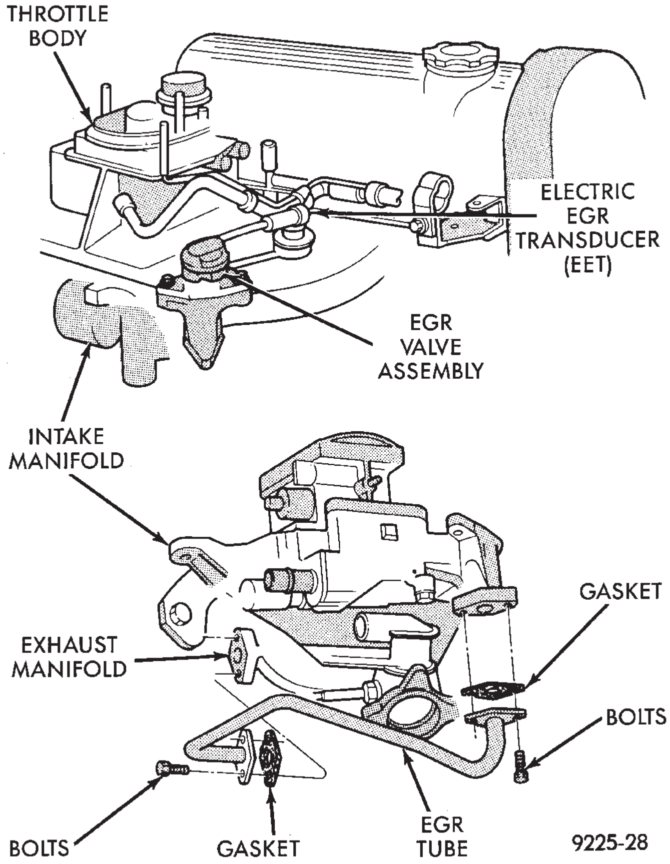


Fig. 12 EGR System—2.2L and 2.5L TBI Engines

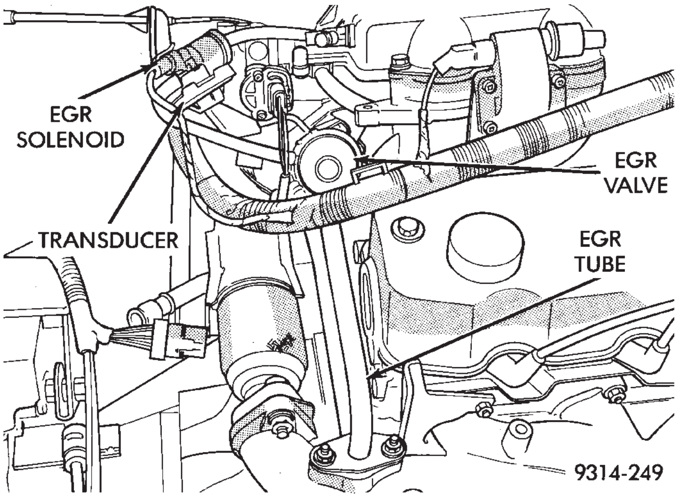


Fig. 13 EGR System—3.0L Engines

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of by 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 provides the correct amount of exhaust gas recirculation for different operating conditions.

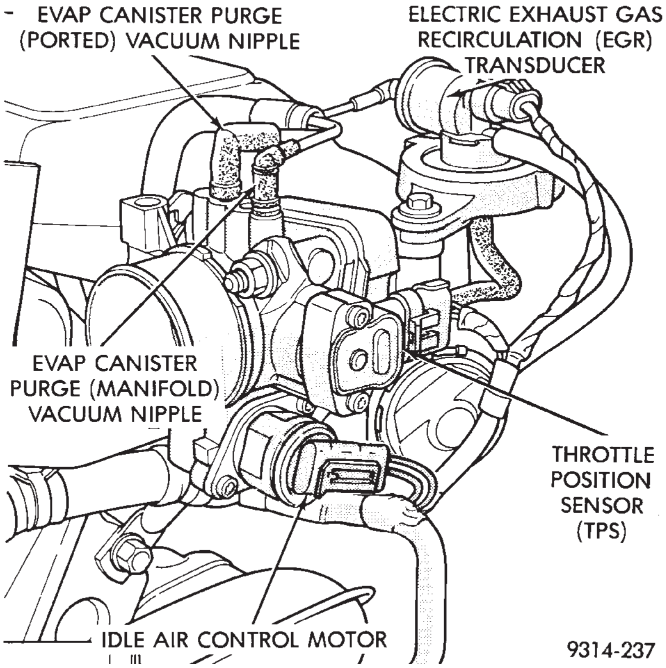


Fig. 14 EGR Mounting—3.3L and 3.8L Engines

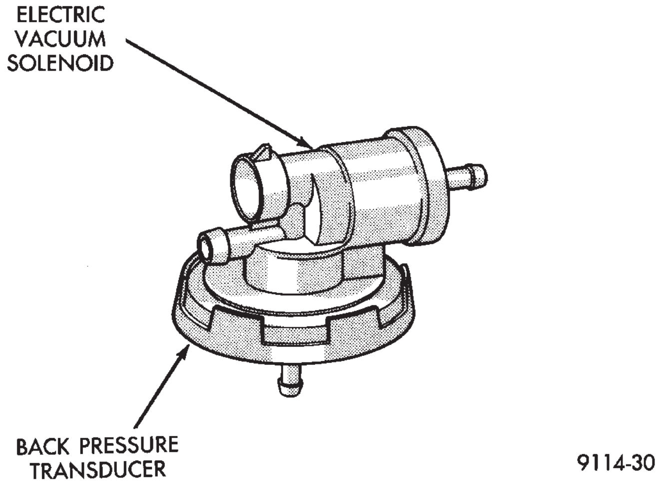


Fig. 15 Electric EGR Transducer (EET) Assembly

These systems do not allow EGR at idle. The 2.2L/2.5L EGR systems operate at all temperatures. The 3.0L, 3.3L and 3.8L EGR systems do not operate when coolant temperature is below 4.5°C (40°)F at start-up. These systems activate when coolant temperature reaches 77°C (170°F).

EGR SYSTEM ON-BOARD DIAGNOSTICS

The powertrain control module (PCM) performs an on-board diagnostic check of the EGR system on all California vehicles with EGR systems. The diagnostic system uses the Electric EGR Transducer (EET) 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 oxygen sensor signal. If the air-fuel mixture goes lean, the PCM will attempt to enrichen the mixture. The PCM registers a fault if the EGR system has failed or degraded. After registering a fault, the PCM turns on the malfunction indicator lamp (instrument panel Check Engine light). The malfunction indicator lamp indicates the need for immediate service.

If a problem is indicated by the malfunction indicator lamp and a diagnostic trouble code for the EGR system, check for proper operation of the EGR system. Use the System Test, EGR Gas Flow Test and EGR Diagnosis Chart. If the EGR system tests properly, check the system using the DRBII scan tool. Refer to On-Board Diagnosis in the General Diagnosis sections of Group 14. Also, refer to the DRBII scan tool and the appropriate Powertrain Diagnostics Procedure manual.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING EGR SYSTEM TEST.

A failed or malfunctioning EGR system can cause engine spark knock, sags or hesitation, rough idle, and/or engine stalling. To ensure proper operation of the EGR system, all passages and moving parts must be free of deposits that could cause plugging or sticking. Ensure system hoses do not leak. Replace leaking components.

Inspect hose connections between the throttle body, intake manifold, EGR solenoid and transducer, and EGR valve. Replace hardened, cracked, or melted hoses. Repair or replace faulty connectors.

Check the EGR control system and EGR valve with the engine fully warmed up and running (engine coolant temperature over 150°F). With the transmission in neutral and the throttle closed, allow the engine to idle for 70 seconds. Abruptly accelerate the engine to approximately 2000 rpm, but not over 3000 rpm. The EGR valve stem should move when accelerating the engine (the relative position of the groove on the EGR valve stem should change). Repeat the test several times to confirm movement. If the EGR valve stem moves, the control system is operating normally. If the control system is not operating normally, refer to the EGR Diagnosis Chart to determine the cause.

EGR GAS FLOW TEST

The following procedure should be used to determine if exhaust gas is flowing through the EGR system.

Connect a hand vacuum pump to the EGR valve vacuum motor. With engine running at idle speed, slowly apply vacuum. Engine speed should begin to drop when applied vacuum reaches 2.0 to 3.5 inches.

Engine speed may drop quickly or engine may even stall. This indicates that EGR gas is flowing through the system.

If both the EGR Gas Flow Check, System Check and Diagnosis Chart are completed satisfactorily, then the EGR system functions normally.

If engine speed does not drop off when performing the test, remove both the EGR valve and EGR tube and check for plugged passages. Also, check the intake manifold inlet passage. Clean or replace these components for restoration of proper flow.

EGR VALVE SERVICE—2.2L AND 2.5L TBI ENGINES

REMOVAL

(1) Disconnect electrical connector and vacuum line from the electric EGR transducer (Fig. 12).

(2) Remove EGR valve bolts from intake manifold.

(3) Remove EGR valve from intake manifold.

(4) Clean gasket surface and discard old gasket. Check for any signs of leakage or cracked surfaces.

INSTALLATION

(1) Assemble EGR valve with new gasket onto the intake manifold.

(2) Install EGR valve mounting bolts. Tighten to 22 N●m (200 in. lbs.) torque.

(3) Reconnect vacuum line and electrical connector to Electric EGR Transducer.

EGR TUBE SERVICE—2.2L AND 2.5L TBI ENGINES

REMOVAL

(1) Remove EGR tube attaching bolts from intake and exhaust manifolds.

(2) Remove EGR tube.

(3) Clean intake and exhaust manifold gasket surfaces and EGR tube flange gasket surfaces. Discard old gaskets.

(4) Check for signs of leakage or cracked surfaces on either manifolds or tube. Replace as necessary.

INSTALLATION

(1) Loosely position EGR tube and new gaskets in place on intake and exhaust manifolds. Install mounting bolts.

(2) Tighten attaching bolts to 22 N●m (200 in. lbs.) torque.

EGR VALVE SERVICE—3.0L ENGINES

REMOVAL

(1) Disconnect the electric and vacuum connectors from the electric EGR transducer (EET) (Fig. 16).

(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.

EGR TUBE SERVICE—3.0L ENGINES

REMOVAL

(1) Remove EGR tube flange nuts from exhaust manifold (Fig. 16).

(2) Remove EGR valve nuts at intake manifold (Fig. 16). 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 VALVE SERVICE—3.3L AND 3.8L ENGINES

REMOVAL

(1) Disconnect vacuum tube from electric EGR transducer (EET). Inspect vacuum tube for damage (Fig. 17).

(2) Remove electrical connector from EET.

(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 EET.

EGR TUBE SERVICE—3.3L AND 3.8L ENGINES

REMOVAL

(1) Remove EGR tube attaching bolts from intake and exhaust manifolds.

(2) Clean intake and exhaust manifold gasket surfaces. Discard old gasket.

EGR DIAGNOSIS CHART

NOTE: ALL TESTS MUST BE MADE WITH FULLY WARM ENGINE RUNNING CONTINUOUSLY FOR AT LEAST TWO MINUTES

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS OR ADJUSTMENTS.

Condition	Possible Cause	Correction
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST.	(a) Cracked, leaking, disconnected or plugged hoses.	(a) Verify correct hose connections and leak check and confirm that all hoses are open. If defective hoses are found, replace hose harness. (b) Disconnect hose harness from EGR vacuum transducer and connect auxiliary vacuum supply. Raise engine rpm to 2000 rpm and hold. Apply 10″ Hg vacuum while checking valve movement. If no valve movement occurs, replace valve/transducer assy. If valve opens (approx. 3mm or 1/8″ travel), hold supply vacuum to check for diaphragm leakage. Valve should remain open 30 seconds or longer. If leakage occurs, replace valve/transducer assy. If valve is satisfactory, check control system.
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST. OPERATES NORMALLY ON EXTERNAL VACUUM SOURCE.	(a) Defective control system—Plugged passages.	(a) Remove throttle body and inspect port (slot type) in throttle bore and associated passage in throttle body. Use suitable solvent to remove deposits and check for flow with light air pressure. Normal operation should be restored to EGR system.
	(b) Defective control system—solenoid or solenoid control circuit.	(b) Refer to Group 14. General Diagnosis "On Board Diagnostics" to check solenoid.
ENGINE WILL NOT IDLE. DIES OUT ON RETURN TO IDLE OR IDLE IS VERY ROUGH OR SLOW.	(a) High EGR valve leakage in closed position.	(a) If removal of vacuum hose from EGR valve does not correct rough idle, (a1) Turn engine off. Remove the air cleaner exposing the inlet to the throttle body. (a2) Disconnect the backpressure hose from the EGR valve. (a3) Using a nozzle with a rubber grommet connection, direct compressed air (50 to 60 psi) down through the steel backpressure tube on the EGR valve while opening and closing the throttle blade. (a4) If the sound from the compressed air changes distinctly in step a3, the poppet is leaking and air is entering the intake manifold. Replace the EGR valve.
	(b) EGR tube to intake manifold leak.	(b) Remove tube and visually inspect tube seal on gasket. Tube end should be uniformally indented on gasket with no signs of leak. If signs of exhaust gas leakage are present, replace gaskets and tighten flange nuts to 23 N·m (200 in. lbs.). If an intake plenum leak persists, replace EGR tube and gaskets, following installation instructions.
	(c) Solenoid or control signal to solenoid failure.	(c) Verify correct hose connections and leak check and confirm that all hoses are open. If defective hoses are found, replace hose harness. (c1) Refer to Group 14, General Diagnosis "On Board Diagnostics" to check solenoid.

NOTE: DO NOT ATTEMPT TO CLEAN BACK-PRESSURE EGR VALVE, REPLACE ENTIRE VALVE/TRANSDUCER ASSEMBLY IF NECESSARY.

9225-26

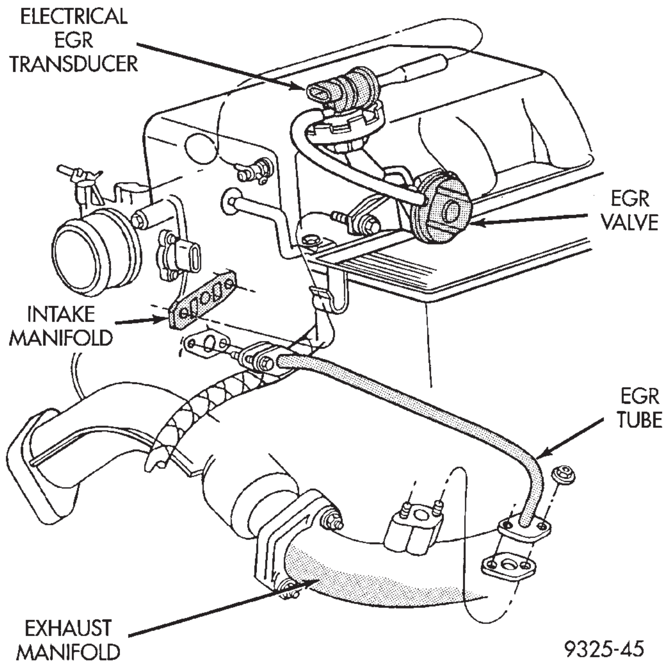


Fig. 16 EGR System Service—3.0L Engines

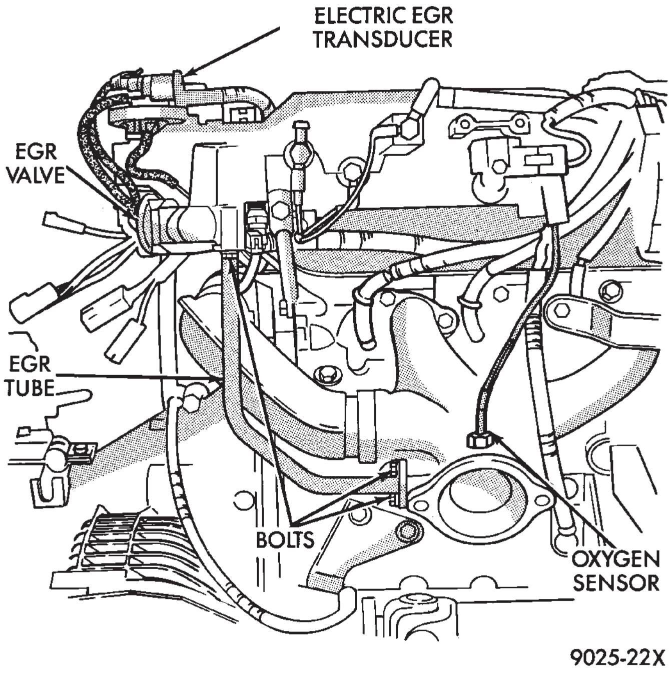


Fig. 17 EGR System—3.3L and 3.8L Engines

(3) Check for signs of leakage or cracked surfaces on either manifolds or tube. Repair or replace as necessary.

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.

AIR ASPIRATION SYSTEM

Certain vehicles equipped with the 2.2L or 2.5L TBI engines have an aspirator valve (Fig. 18). The valve uses exhaust pressure pulsation to draw fresh air from the air cleaner into the exhaust system. This reduces carbon monoxide (CO) and hydrocarbon (HC) emissions. The aspirator valve works most efficiently at idle and slightly off-idle, where the negative pulses are strongest. The aspirator valve remains closed at higher engine speeds.

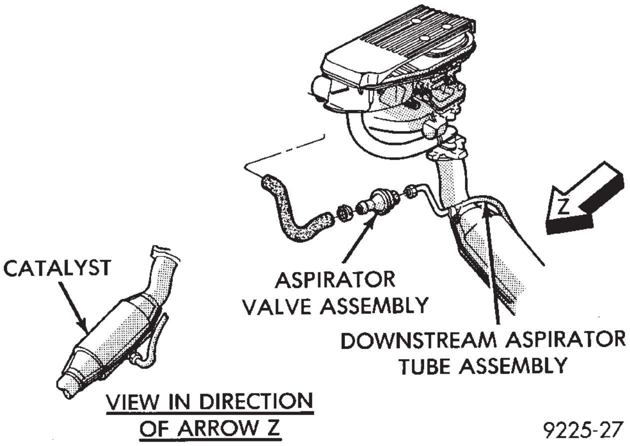


Fig. 18 Air Aspirator System

DIAGNOSIS

The aspirator valve is not repairable. Replace the valve if it operates incorrectly. Valve failure results in excessive underhood exhaust system noise at idle and hardening of the rubber hose from the valve to the air cleaner. Check for leakage at the aspirator tube/catalyst assembly joint. Also, inspect the hose connections at the aspirator valve and air cleaner for leakage. If the aspirator tube/ catalyst assembly joint is leaking, tighten the aspirator tube nut to 54 N●m (40 ft. lbs) torque. If either hose connection leaks, and the hose has not hardened, install hose clamps.

To determine if the aspirator valve has failed, disconnect the hose from the aspirator inlet. With the engine at idle in neutral, the negative (vacuum) exhaust pulses can be felt at the aspirator inlet. If hot exhaust gas is escaping from the aspirator inlet, the valve has failed. Replace the valve.

REMOVAL

(1) Disconnect the air hose from the aspirator valve inlet.

(2) Remove aspirator tube assembly from catalyst.

INSTALLATION

(1) Install aspirator tube. Tighten the nut to 54 N●m (40 ft. lbs) torque.

(2) Install aspirator tube bracket screw. Tighten screw to 11 N●m (95 in. lbs) torque.

(3) Connect air hose to aspirator valve inlet and air cleaner nipple.

COMPONENT AND SYSTEM INDEX

CHRYSLER CORPORATION

WIRING DIAGRAMS SERVICE MANUAL

1993 FRONT WHEEL DRIVE PASSENGER VEHICLES

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

CHRYSLER CORPORATION

NEXT PAGE ▶

FOREWORD

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

These diagrams contain the latest information at the time of publication and incorporate the wiring schematic for the basic vehicle and available optional equipment.

The diagrams are grouped by body type and sales division. The body codes are explained in the General Information section. (Example—AP-D, P=Shadow, Sundance). To locate a system or component refer to the black index tabs on the next page. The tab will assist you in locating the desired area of the manual.

An alphabetical index is provided at the beginning of each section to help you in locating a system or component. All diagrams are identified by SHEET NUMBER which is found in the lower right- or left-hand corner of the page.

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

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

> NOTE: The acronyms, terminology and nomenclature used to identify emissions related components in this manual may have changed from prior publications. These new terms are in compliance with S.A.E. recommended practice J1930. This terminology standard (J1930) is required to comply with the 1993 California Air Research Board (CARB) requirements.

FOR INFORMATION NOT CONTAINED IN THIS MANUAL, REFER TO THE FRONT WHEEL DRIVE PASSENGER VEHICLES ENGINE—CHASSIS—BODY OR ELECTRICAL—FUEL—EMISSIONS SERVICE MANUALS.

NEXT PAGE ▶

GROUP TAB LOCATOR

GENERAL INFORMATION

CONTENTS

The wiring diagrams contain the latest information at the time of publication. 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 below.

SECONDARY IGNITION WIRING

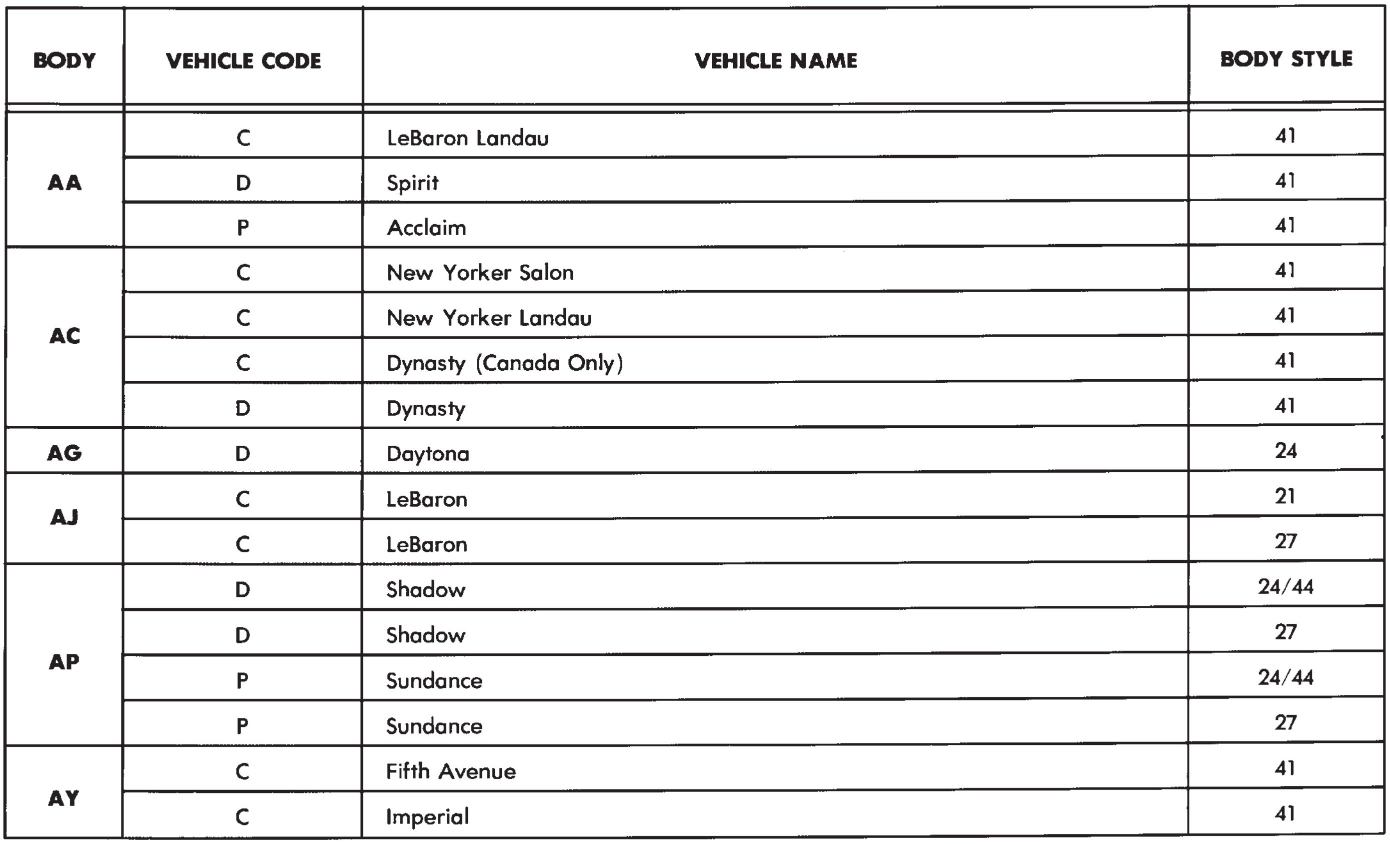
Secondary ignition wiring is shown in Figures 1, 2, 3, 4, and 5. For information on distributor operation or ignition systems refer to Group 8D Ignition Systems.

WIRING DIAGRAM SHEETS AND INDEXES

The diagrams are organized to show the basic vehicle and all of its options. Add-on or non-factory options are not covered. The diagram pages are identified by a sheet number which is located at the lower right or left hand corner of each sheet. **Page numbers at the top of each page do not apply to diagram sheets.**

Diagram sheets show all information relating to the system. This includes feeds, grounds, switch internal circuity, connectors, splices, and pin identification for controllers and modules.

1993 MODEL CHART



BODY	VEHICLE CODE	VEHICLE NAME	BODY STYLE
AA	C	LeBaron Landau	41
	D	Spirit	41
	P	Acclaim	41
AC	C	New Yorker Salon	41
	C	New Yorker Landau	41
	C	Dynasty (Canada Only)	41
	D	Dynasty	41
AG	D	Daytona	24
AJ	C	LeBaron	21
	C	LeBaron	27
AP	D	Shadow	24/44
	D	Shadow	27
	P	Sundance	24/44
	P	Sundance	27
AY	C	Fifth Avenue	41
	C	Imperial	41

918W-147

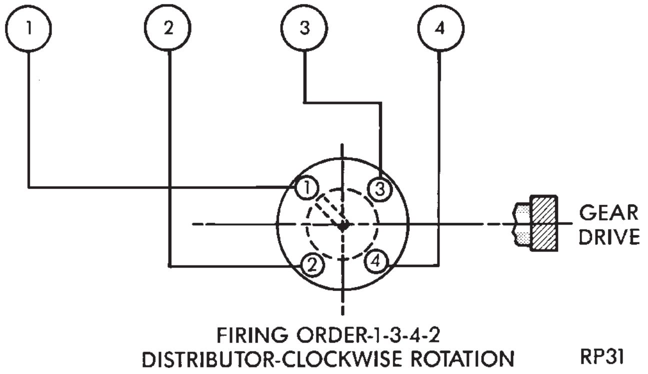


Fig. 1 Secondary Ignition Wiring 2.2L and 2.5L Engine

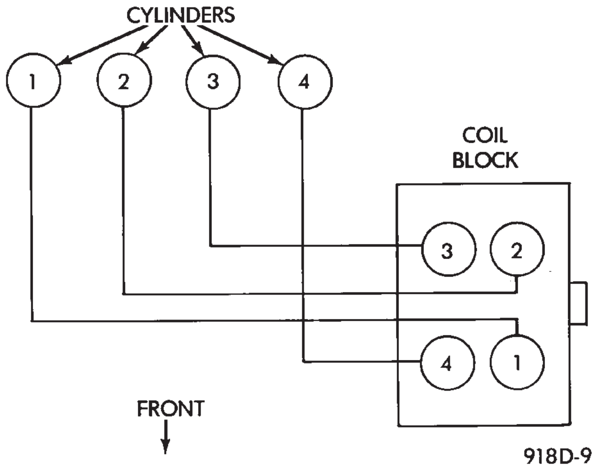


Fig. 2 Secondary Ignition Wiring 2.2L Turbo III

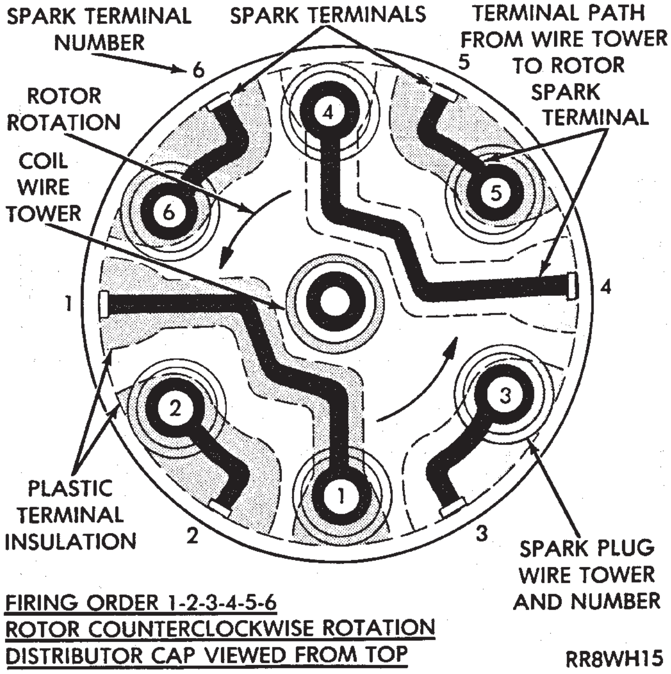


Fig. 3 Distributor Cap 3.0L V6 Engine

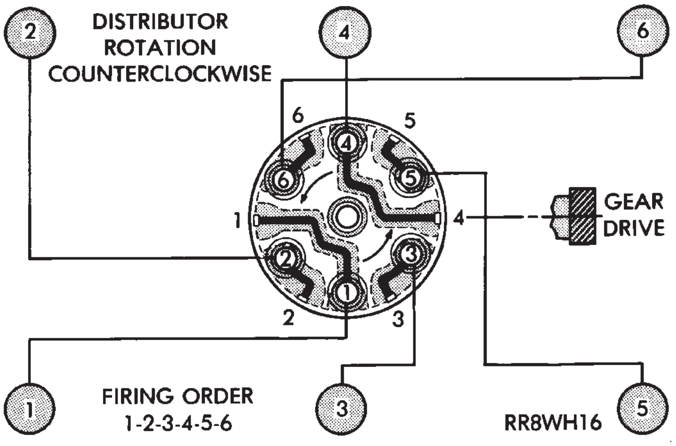


Fig. 4 Secondary Ignition Wiring 3.0L V6 Engine

In certain instances a wire may be referenced to another sheet. When this happens, the wire will be identified as to what it is ie: feed, ground, etc, and where its going (Fig. 6). This has been done to aid in the diagnosis of wiring and component problems.

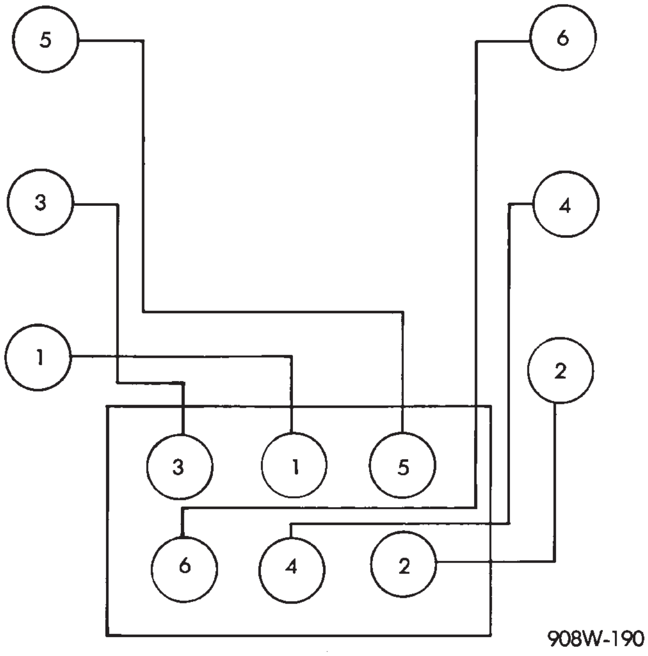


Fig. 5 Secondary Ignition Wiring 3.3L and 3.8L V6 Engine

The index used for the diagrams is located at the beginning of the section. And is in alphabetical order to identify the main system and all related components.

WIRE CODE IDENTIFICATION

Each wire shown in the diagrams contains a code (Fig. 7) which identifies the main circuit, part of the main circuit, gauge of wire, and color. The color is shown as a two letter code which can be identified by referring to the Wire Color Code Chart (Fig. 8). If the wire has a tracer and it is a standard color an asterisk will follow the main wire color. If the tracer

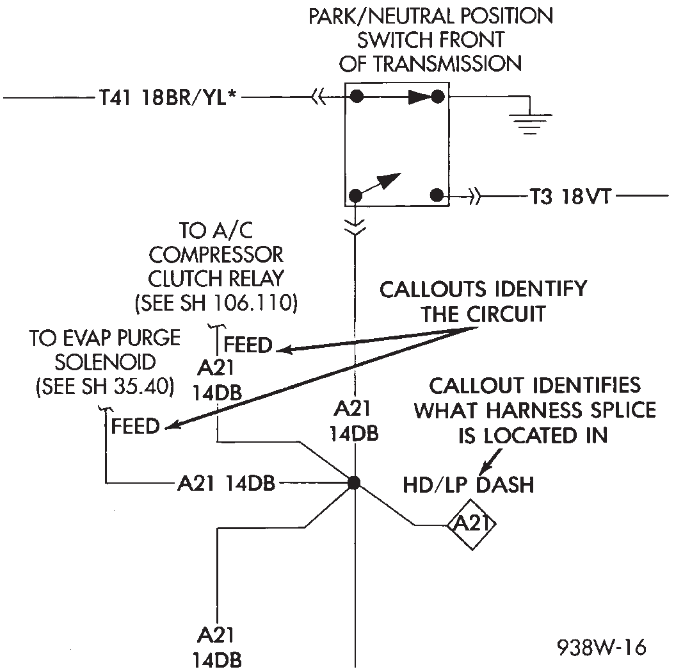


Fig. 6 Wiring Diagram Page Sample

is non-standard the main wire color will have a slash (/) after it followed by the tracer color.

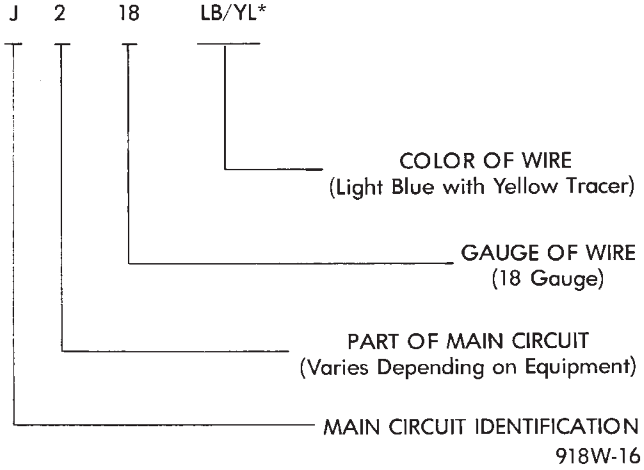


Fig. 7 Wire Color Code Identification

CIRCUIT IDENTIFICATION

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.

LOCATING A SYSTEM

To locate a system or component in the diagrams, refer to the alphabetical index at the front of the diagrams. Determine the diagram sheet number. Sheet numbers are located at the lower right or left hand corner of each sheet. **Page numbers at the top of the page do not apply to diagram sheets.**

COLOR CODE	COLOR	STANDARD TRACER COLOR	COLOR CODE	COLOR	STANDARD TRACER CODE
BL	BLUE	WT	OR	ORANGE	BK
BK	BLACK	WT	PK	PINK	BK OR WT
BR	BROWN	WT	RD	RED	WT
DB	DARK BLUE	WT	TN	TAN	WT
DG	DARK GREEN	WT	VT	VIOLET	WT
GY	GRAY	BK	WT	WHITE	BK
LB	LIGHT BLUE	BK	YL	YELLOW	BK
LG	LIGHT GREEN	BK	*	WITH TRACER	

918W-136

Fig. 8 Wire Color Code Chart

The diagram index identifies the main system and all components in that system. There are also sections of the index that identify specific components only (for example modules, lamps, etc.). Refer to a components name in the index if you are unclear as to what a system may be called.

Diagram pages are arranged starting with the battery and fuses. Then working into charging, starting, and ignition systems. After this they start at the front of the vehicle and work to rear of the vehicle. The diagrams end with connector identification pages.

COMPONENT IDENTIFICATION

When looking for a components location on the vehicle refer to the wiring and components section. This section shows the wire harness routing and the components location in the vehicle. To use this section refer to the wiring diagrams for the location of the component. Then use the component identification index to locate the proper figure number.

SPLICE LOCATIONS

Splices are indicated in the diagrams by a diamond with a splice circuit code within it (Fig. 9 example 1). If there is more than one splice per circuit a small box will be connected to it with the splice number in it (Fig. 9 example 2).

To locate a splice in the wiring harness determine the splice number from the wiring diagrams then refer to the splice location index. This section shows the general location of the splice in the harness.

MAIN CIRCUIT IDENTIFICATION

CIRCUIT	DESCRIPTION	CIRCUIT	DESCRIPTION
A	Battery Feed: Fused and Unfused	P	Power Assist System: Locks, Mirrors
B	ABS System	Q	Power Assist System: Windows
C	Air Conditioning System	R	Airbag System
D	CCD (+), CCD (-)	S	Air Suspension, Automatic Load Leveling
E	Interior Lamp Illumination	T	Electronic Automatic Transaxle
F	Battery Feed: Fused and Unfused	V	Windshield Wipers and Washers, Vehicle Speed Control System
G	Sensors, Sending Units, Switches		
K	Powertrain Central Module	W	Power Assist System: Windows
L	Exterior Lighting, Stop Lamp Switch	X	Horn, Radio, Radio Speakers, Power Locks
M	Interior Lamps	Z	Ground Circuits: Includes power and signal grounds for PCM

938W-17

The wiring diagrams also indicate what harness the splice is located in. To identify the harness an abbreviated call out is placed next to the main splice (Fig. 6).

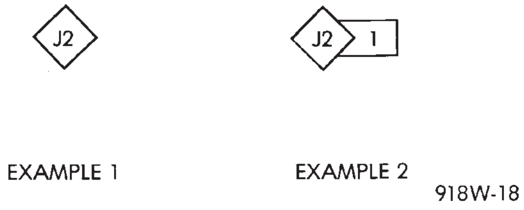


Fig. 9 Wiring Splice Examples

CONNECTORS

Connectors shown in the diagram sheets are viewed from the terminal end unless otherwise specified. For viewing bulkhead, powertrain control module, and transmission control module connectors refer to the rear of the wiring diagrams. This area shows major connectors for pin and cavity information.

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below.

(1) Verify the problem.

(2) Verify any related symptoms. Perform operational checks on components that are in the same circuit as the problem area. Refer to the wiring diagram fuse application chart.

(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 circuit repaired. Refer to the wiring diagram fuse application chart.

FUSIBLE LINKS

Vehicle wiring harnesses are equipped with fusible links to protect the harness in the event of a short in the system. Fusible links are color coded to indicate wire gauge and size. Refer to the fusible link chart for color and gauge identification (Fig. 10).

Wire and Gauge	Color Code	Color
12 Ga.	BK	Black
14 Ga.	RD	Red
16 Ga.	DB	Dark Blue
18 Ga.	GY	Gray
20 Ga.	OR	Orange
22 Ga.	WT	White

918W-19

Fig. 10 Fusible Link Chart

HARNESS REPAIR

FUSIBLE LINK REPLACEMENT

CAUTION: Do not replace blown fusible links with a standard wire. Only use fusible type wire with hypalon insulation or damage to the electrical system could occur. Also make sure correct gauge of wiring is used. Refer to the wiring diagrams for proper gauge and color.

When a fusible link blows it is important to find out what the problem is. They are placed in the system for protection against shorts. Which can be caused by a component failure or wiring failures. **Do not just replace the fusible link to correct the problem.**

When diagnosing a faulty fusible link it is important to check the wire carefully. In some instances the link may be blown and it will not show through the insulation, the wire should be checked over its entire length for internal breaks.

(1) Disconnect battery negative cable.

(2) Cut out the blown portion of the fusible link.

(3) Strip 1 inch of insulation from each end of the existing fusible link.

(4) Place a piece of heat shrink tubing over one side of the fusible link. Make sure the tubing will be long enough to cover and seal the entire repair area.

(5) Cut a replacement piece of fusible link approximately two inches longer than the piece removed.

(6) Remove one inch of insulation from each end of the replacement fusible link.

(7) Spread the strands of wire apart on each of the exposed wires (Fig. 11 example 1).

(8) Push the two ends of the wire together until the strands of wire are close to the insulation (Fig. 11 example 2).

(9) Twist the wires together (Fig. 11 example 3).

(10) Solder the wires together using rosin core type solder only. **Do not use acid core type solder.**

(11) 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.

(12) Secure the fusible link to the existing ones to prevent chafing or damage to the insulation.

(13) Connect battery and test all affected systems.

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gauge 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 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 wires (Fig. 11 example 1).

(5) Push the two ends of wire together until the strands of wire are close to the insulation (Fig. 11 example 2).

(6) Twist the wires together (Fig. 11 example 3).

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

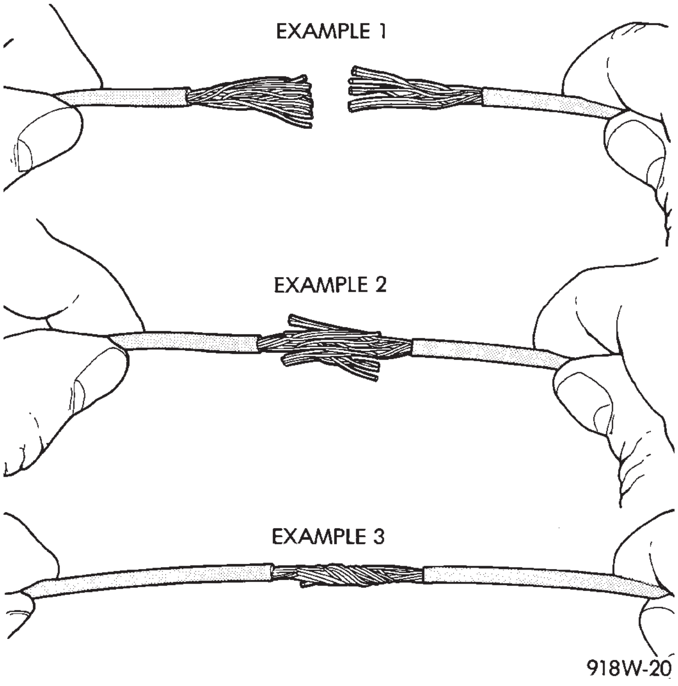


Fig. 11 Wire Repair

(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.

CONNECTOR REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector that is to be repaired from its mating half.

(3) Remove connector locking wedge (Fig. 12).

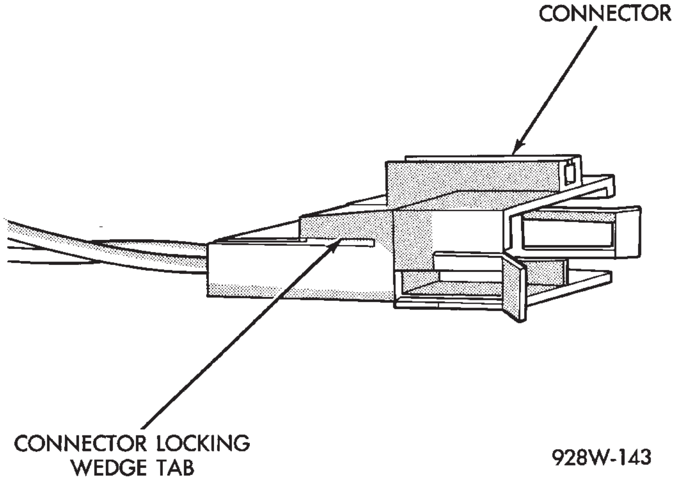


Fig. 12 Connector Locking Wedge Tab

(4) Position the connector locking finger away from the terminal. Pull on the wire to remove the terminal from the connector (Fig. 13).

(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 thru six for each wire in the connector. Check that all wires are inserted into the proper cavities. For connector pin out identification refer to the wiring diagrams.

(8) Insert the connector locking wedge into the repaired connector.

(9) Connect connector to its mating half.

(10) Connect battery and test all affected systems.

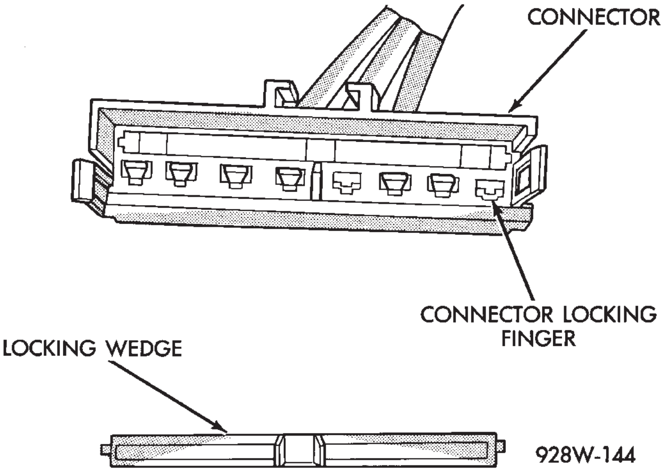


Fig. 13 Connector Locking Finger and Locking Wedge

CONNECTOR AND TERMINAL ASSEMBLY REPLACEMENT

(1) Disconnect Battery.

(2) Disconnect the connector being repaired form its mating half.

(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 about 1/2 inch apart (Fig. 14).

(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. 14).

(7) Remove 1 inch of insulation from each wire.

(8) 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.

(9) Spread the strands of the wire apart on each part of the exposed wires (Fig. 11 example 1).

(10) Push the two ends of wire together until the strands of wire are close to the insulation (Fig. 11 example 2).

(11) Twist the wires together (Fig. 11 example 3).

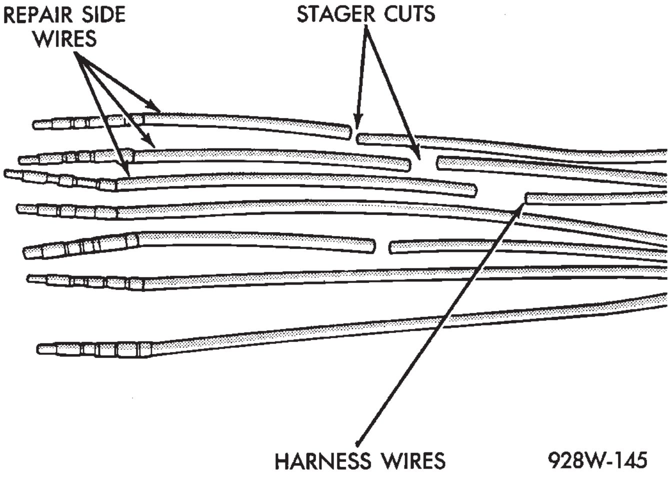


Fig. 14 Stagger Cutting Wires

(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 thru 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) Reconnect the repaired connector.

(17) Connect battery and test all affected systems.

TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector being repaired form its mating half.

(3) Remove connector locking wedge (Fig. 12).

(4) Position the connector locking finger away from the terminal. Pull on the wire to remove the terminal from the connector (Fig. 13).

(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.

(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.

(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 (Fig. 11 example 1).

(11) Push the two ends of wire together until the strands of wire are close to the insulation (Fig. 11 example 2).

(12) Twist the wires together (Fig. 11 example 3).

(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 and reconnect the connector to its mating half.

(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.

SYMBOLS, FUSES AND RELAYS

Various symbols are used throughout the wiring diagrams. These symbols can be identified by referring to the symbol identification chart (Fig. 15).

For fuse block, relay bank, or power distribution center information refer to the fuse charts and relay bank section.

CAUTION: When replacing a blown fuse it is important to replace it with a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in an electrical overload. If a proper rated fuse continues to blow, it indicates a problem that should be corrected.

	LEGEND OF SYMBOLS USED ON WIRING DIAGRAMS		
+	POSITIVE		CONNECTOR
−	NEGATIVE		MALE CONNECTOR
	GROUND		FEMALE CONNECTOR
	FUSE		DENOTES WIRE CONTINUES ELSEWHERE
	GANG FUSES WITH BUSS BAR		DENOTES WIRE GOES TO ONE OF TWO CIRCUITS
	CIRCUIT BREAKER		SPLICE
	CAPACITOR	J2 2	SPLICE IDENTIFICATION
	OHMS		THERMAL ELEMENT
	RESISTOR	TIMER	TIMER
	VARIABLE RESISTOR		MULTIPLE CONNECTOR
	SERIES RESISTOR		OPTIONAL WIRING WITH WIRING WITHOUT
	COIL		"Y" WINDINGS
	STEP UP COIL	88:88	DIGITAL READOUT
	OPEN CONTACT		SINGLE FILAMENT LAMP
	CLOSED CONTACT		DUAL FILAMENT LAMP
	CLOSED SWITCH		L.E.D. — LIGHT EMITTING DIODE
	OPEN SWITCH		THERMISTOR
	CLOSED GANGED SWITCH		GAUGE
	OPEN GANGED SWITCH		SENSOR
	TWO POLE SINGLE THROW SWITCH		FUEL INJECTOR
	PRESSURE SWITCH	#36	DENOTES WIRE GOES THROUGH BULKHEAD DISCONNECT
	SOLENOID SWITCH	#19 STRG COLUMN	DENOTES WIRE GOES THROUGH STEERING COLUMN CONNECTOR
	MERCURY SWITCH	INST PANEL #14	DENOTES WIRE GOES THROUGH INSTRUMENT PANEL CONNECTOR
	DIODE OR RECTIFIER	ENG #7	DENOTES WIRE GOES THROUGH GROMMET TO ENGINE COMPARTMENT
	BY-DIRECTIONAL ZENER DIODE		DENOTES WIRE GOES THROUGH GROMMET
	MOTOR		HEATED GRID ELEMENTS
	ARMATURE AND BRUSHES		908W-191

Fig. 15 Symbol Identification

FUSE CHARTS AND RELAY BANKS

INDEX

CAVITY	FUSE/ COLOR	ITEMS FUSED
1	5 AMP TN	HEATED MIRRORS
2	10 AMP RD	TIME DELAY RELAY, RADIO ELECTRONICS, ENGINE ELECTRONICS, MINI TRIP COMPUTER; GLOVE BOX, TRUNK, VANITY MIRROR, DOME, MAP, IGNITION SWITCH, DOOR COURTESY, READING, UNDERHOOD & UNDERPANEL COURTESY LAMPS
3	10 AMP RD	RIGHT HEADLAMP, FOG LAMPS
4	10 AMP RD	LEFT HEADLAMP
5	4 AMP PK	ILLUMINATION LAMPS FOR A/C AND HEATER CONTROL, ASH RECEIVER, CLUSTER, RADIO, CONSOLE GEAR SELECTOR, CIGAR LIGHTER, CONSOLE GLOVE BOX & MINI TRIP COMPUTER, HEATER REAR WINDOW
6	20 AMP YL	NAME BRAND SPEAKER AMPLIFIER, HORN RELAY
7	2 AMP WT	SPEED CONTROL SWITCH
8	5 AMP TN	FUEL VOLTAGE, OIL AND TEMPERATURE GAUGES, CHIMES, WARNING LAMP MODULE, SEAT BELT WARNING & BRAKE WARNING LAMPS; MECHANICAL CLUSTER PRINTED CIRCUIT BOARD; SPEED CONTROL
9	30 AMP LG	A/C OR HEATER BLOWER MOTOR
10	30 AMP C/BRKR	POWER WINDOWS
11	10 AMP RD	BACK-UP LAMPS, ENGINE STARTER SYSTEM, HEATED REAR WINDOW, OVERHEAD CONSOLE
12	20 AMP YL	HAZARD FLASHER
13	30 AMP C/BRKR	POWER SEATS AND DOOR LOCK MOTORS
14	20 AMP YL	FOG LAMP RELAY, TAIL LAMPS
15	20 AMP YL	CIGAR LIGHTER, CHIMES
16	20 AMP YL	STOP LAMPS, ABS

CAVITY	FUSE/ COLOR	ITEMS FUSED
17		NOT USED
18	20 AMP YL	WINDSHIELD WIPERS
19	10 AMP RD	TURN SIGNAL LAMPS AND FLASHER
20	10 AMP RD	RADIO

AMPS	FUSE	COLOR CODE
2	WT	WHITE
4	PK	PINK
5	TN	TAN
10	RD	RED
20	YL	YELLOW
25	NAT	NATURAL
30	LG	LIGHT GREEN

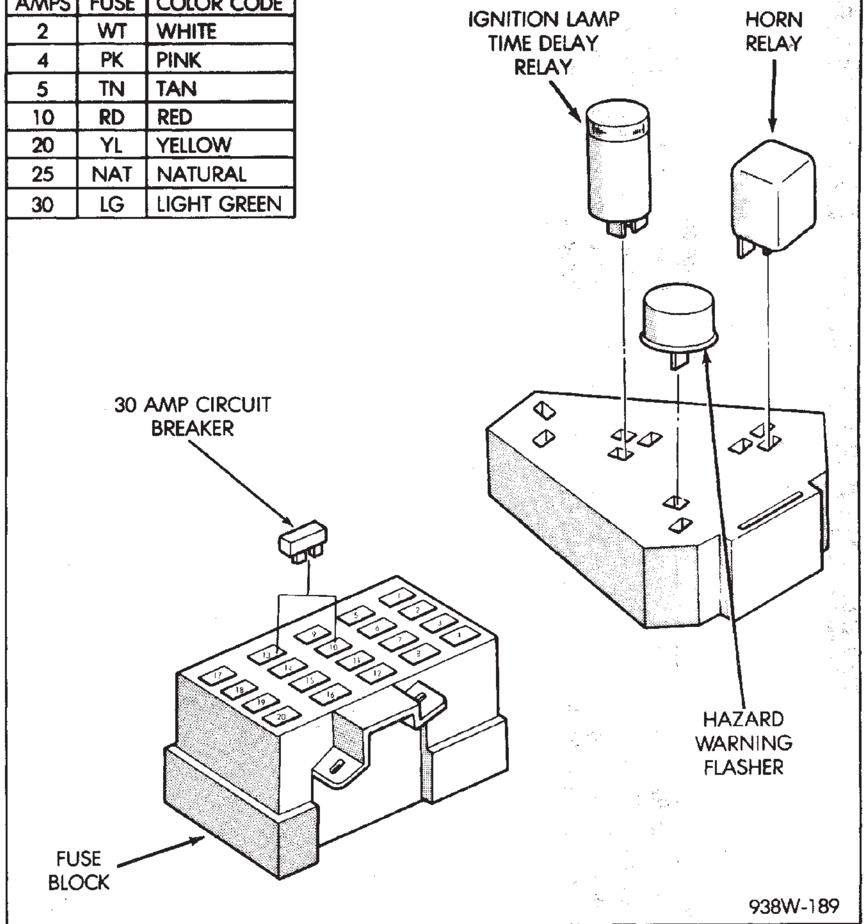
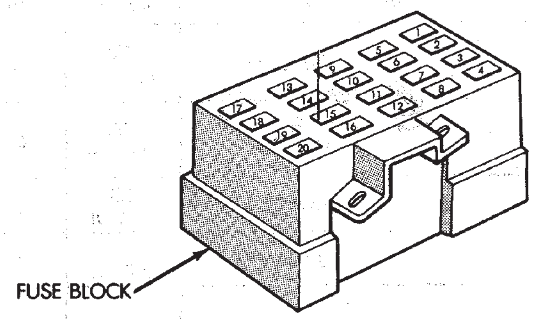


Fig. 1 Fuse Block and Relay Bank AA-Body

CAVITY	FUSE/ COLOR	ITEMS FUSED
1	20 AMP YL	OPTICAL HORN
2	20 AMP YL	VEHICLE SPEED CONTROL
3	10 AMP RD	RIGHT LOW BEAM
4	10 AMP RD	LEFT LOW BEAM
5	4 AMP PK	ILLUMINATION LAMPS FOR, CLUSTER, HEATED REAR WINDOW SWITCH, RADIO, HEADLAMP SWITCH, A/C & ATC CONTROL, ASH RECEIVER, INCANDESCENT MESSAGE CENTER & TRAVELER
6	2 AMP GY	SPEED CONTROL
7	20 AMP YL	POWER SUNROOF, AIR SUSPENSION
8	5 AMP TN	BODY COMPUTER-INCANDESCENT MESSAGE CENTER, MECHANICAL & ELECTRONIC CLUSTERS, AIRBAG MODULE, SECURITY ALARM, TRAVELER, KEYLESS ENTRY
9	10 AMP RD	CORNERING LAMPS, AUTO DAY/NITE MIRROR, ATC CONTROL, HEATED REAR WINDOW
10	30 AMP GN	BLOWER MOTOR
11	15 AMP LB	NOT USED
12	15 AMP LB	DOOR COURTESY LAMPS, READING LAMPS, TRUNK; VANITY LAMPS, ILLUMINATED ENTRY, ULTRA-LIGHT MIRROR, REAR CIGAR LIGHTERS
13	15 AMP LB	HALO LAMP, REMOTE KEYLESS ENTRY, GLOVE BOX MODULE, ELECTRONIC CLUSTER, BODY COMPUTER
14	20 AMP YL	PARK, TAIL, SIDE MARKER & LICENSE LAMPS, RADIO, SAM
15	20 AMP YL	DECK-LID RELEASE, HORN, CIGAR LIGHTER, DOOR LOCKS, ANTENNA, SAM, POWER SEATS, CELLULAR PHONE, AIRBAG
16	15 AMP LB	RADIO AMPLIFIER
17	10 AMP RD	HEATED MIRRORS
18	20 AMP YL	WINDSHIELD WIPERS
19	20 AMP YL	TURN SIGNALS
20	10 AMP RD	RADIO, CELLULAR PHONE

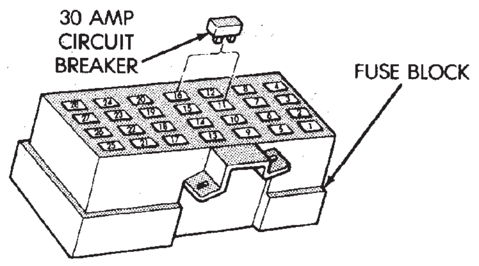
AMPS	FUSE	COLOR CODE
2	WT	WHITE
4	PK	PINK
5	TN	TAN
10	RD	RED
15	LB	LIGHT BLUE
20	YL	YELLOW
30	LG	LIGHT GREEN



938W-190

Fig. 2 Fuse Block AC, AY Body

CAVITY	FUSE/ COLOR	ITEMS FUSED
1	30 AMP LG	BLOWER MOTOR
2	30 AMP C/BRKR	POWER WINDOWS
3	30 AMP C/BRKR	POWER SEAT, HORN, POWER DOOR LOCKS, POWER TOP (AJ ONLY)
4		NOT USED
5	20 AMP YL	BACK-UP LAMPS, A/C, POWER TOP, HEATED REAR WINDOW, OVERHEAD CONSOLE
6	20 AMP YL	TURN SIGNAL AND SIDEMARKER LAMPS
7	20 AMP YL	REAR WINDOW WIPER (AG ONLY)
8	5 AMP TN	BODY COMPUTER, EXTERIOR LIGHTING
9	20 AMP YL	FOG LAMPS (AG ONLY)
10	20 AMP YL	LICENSE LAMPS, PARK LAMPS, TAIL LAMPS
11	20 AMP YL	NBS, VISUAL MESSAGE CENTER, SAM, CIGAR LIGHTER, AIRBAG SYSTEM DIAGNOSTIC MODULE
12	20 AMP YL	RS AMPLIFIER
13		NOT USED
14	5 AMP TN	MECHANICAL OR ELECTRONIC CLUSTER, BODY COMPUTER, MESSAGE CENTER, AIR BAG, SECURITY ALARM, TRIP COMPUTER
15	2 AMP GY	SPEED CONTROL
16		OPEN
17	10 AMP RD	HEADLAMPS
18	10 AMP RD	HEADLAMPS
19	10 AMP RD	HEADLAMPS
20	10 AMP RD	HEADLAMPS
21	20 AMP YL	STOP LAMPS, CHMSL
22	20 AMP YL	HORN
23		OPEN
24		OPEN
25	5 AMP TN	POWER MIRRORS
26	10 AMP RD	DOOR COURTESY, CARGO, GLOVE BOX, AND VANITY LAMP, POWER MIRRORS, EVIC, RADIO MEMORY CLUSTER, SECURITY ALARM
27	10 AMP RD	RADIO
28	20 AMP YL	WINDSHIELD WIPERS



AMPS	FUSE	COLOR CODE
2	WT	WHITE
4	PK	PINK
5	TN	TAN
10	RD	RED
20	YL	YELLOW
25	NAT	NATURAL
30	LG	LIGHT GREEN

938W-191

Fig. 3 Fuse Block AG, AJ Body

CAVITY	FUSE/ COLOR	ITEMS FUSED
1	4 AMP PK	FRONT END LIGHTING, A/C-HEATER SWITCH ILLUMINATION, OVERHEAD CONSOLE, RADIO, HEATED REAR WINDOW
2	15 AMP LT/BL	POWER DOOR LOCKS
3		SPEED CONTROL
4	5 AMP TN	CHIME, CLUSTER
5	20 AMP YL	HAZARD FLASHER
6	10 AMP RD	BACK-UP LAMPS, RADIATOR FAN & HEATED REAR WINDOW RELAY
7	30 AMP LG	A/C HEATER BLOWER MOTOR
8	30 AMP C/BRKR	POWER WINDOWS
9	20 AMP YL	HORN, HORN RELAY, CIGAR LIGHTER, NBS
10	20 AMP YL	LICENSE, SIDE MARKER, PARK, TAIL & FOG LAMPS, RADIO DISPLAY INTENSITY, OVERHEAD CONSOLE
11	30 AMP C/BRKR	POWER SEAT
12	20 AMP YL	CHIMES, STOP LAMPS, ABS
13	10 AMP RD	DOME, CARGO, KEY-IN & GLOVE BOX LAMPS; RADIO MEMORY, TIME DELAY, POWER MIRRORS & UNDER HOOD LAMP, OVERHEAD CONSOLE
14	20 AMP YL	WINDSHIELD WIPER & WASHER MOTOR
15	10 AMP RD	TURN SIGNALS
16	10 AMP RD	RADIO

AMPS	FUSE	COLOR CODE
2	GY	GRAY
4	PK	PINK
5	TN	TAN
10	RD	RED
20	YL	YELLOW
25	NAT	NATURAL
30	LG	LIGHT GREEN

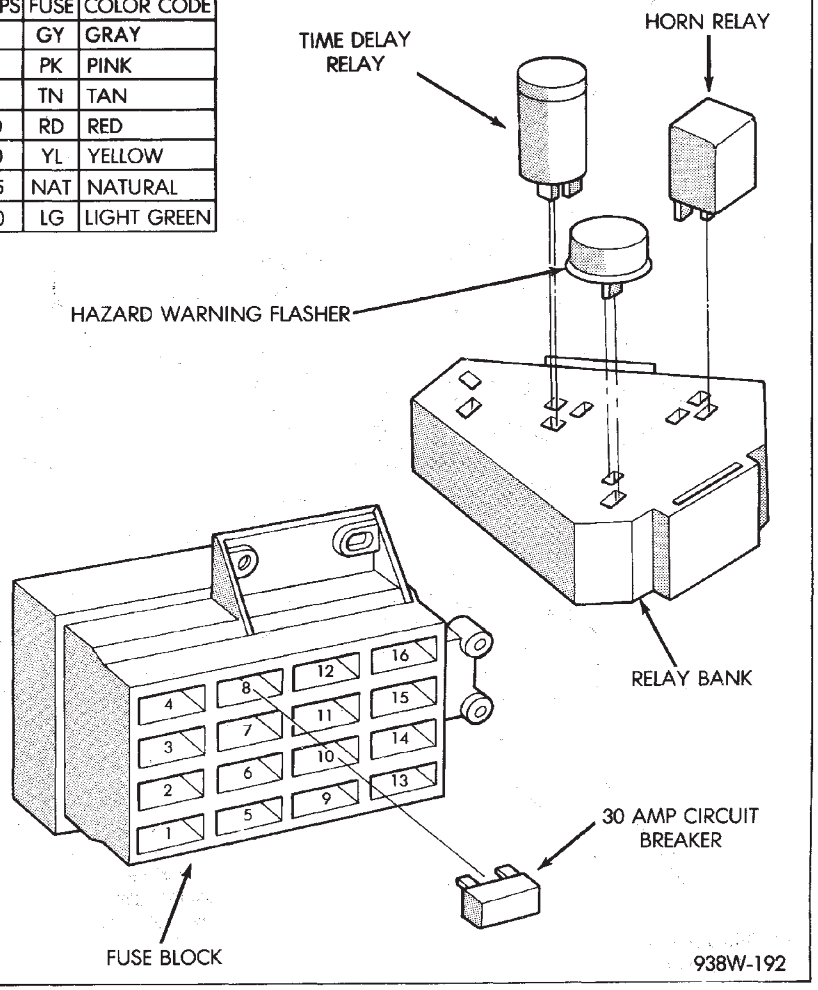


Fig. 4 Fuse Block and Relay Bank AP-Body

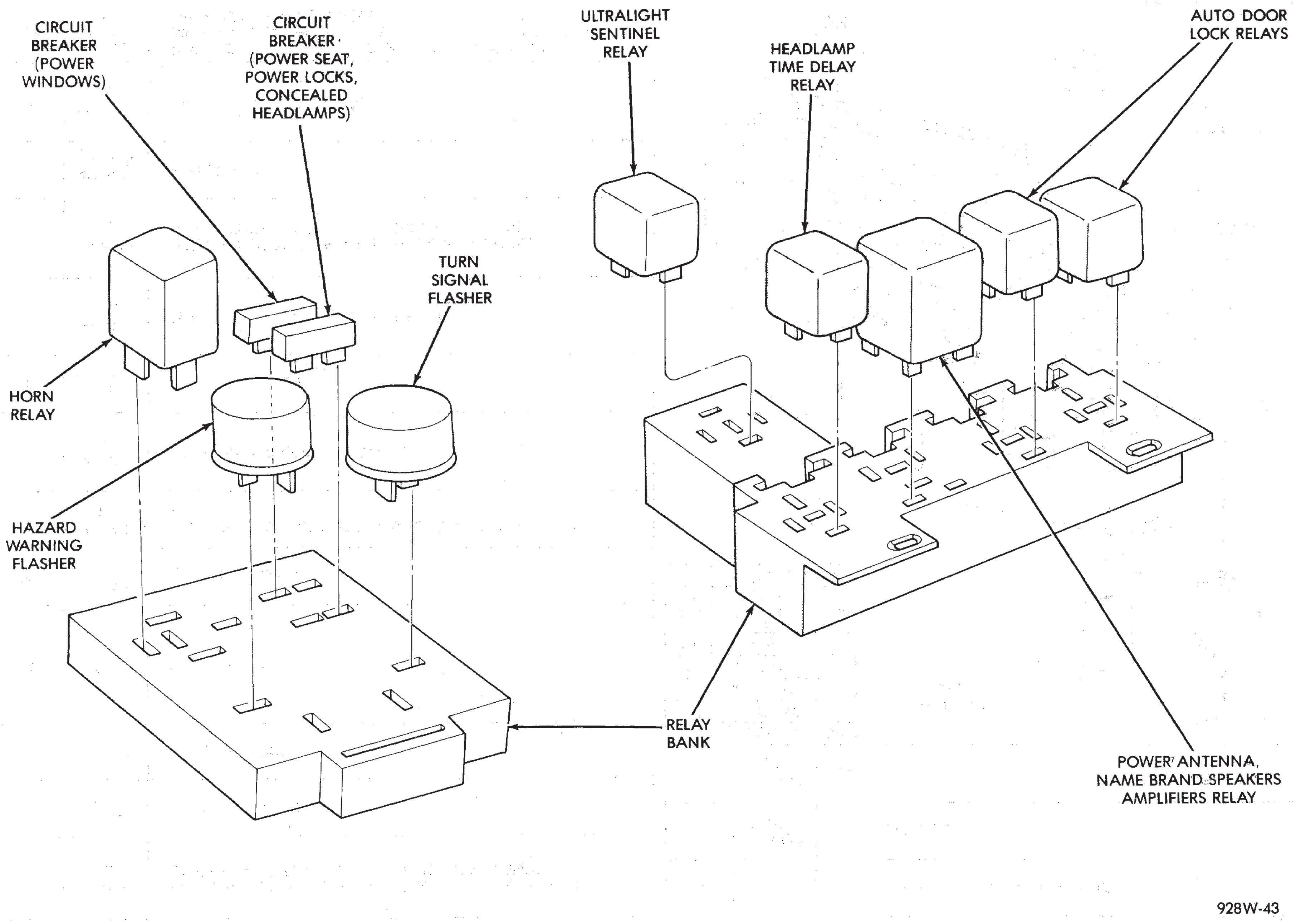
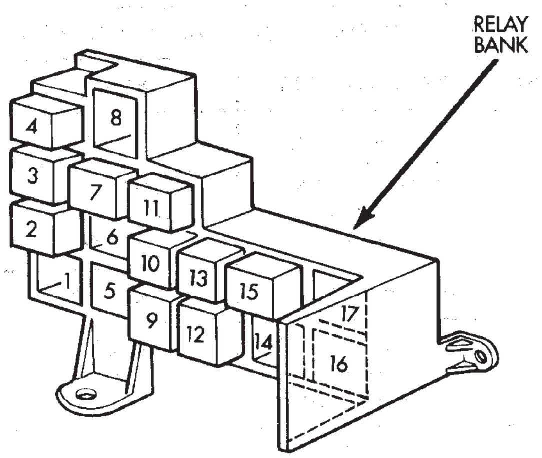


Fig. 5 Relay Bank AC, AY Body

RELAY NUMBER	DESCRIPTION
1	NAME BRAND SPEAKERS
2	HIGH BEAM HEADLAMPS
3	LOW BEAM HEADLAMPS
4	PARK LAMPS
5	AUTO DOOR LOCK
6	NOT USED
7	NOT USED
8	NOT USED
9	RIGHT REAR TURN SIGNAL AND STOP LAMP
10	LEFT REAR TURN SIGNAL AND STOP LAMP
11	DIODE PACKAGE
12	RIGHT FRONT TURN SIGNAL
13	LEFT FRONT TURN SIGNAL
14	FOG LAMPS
15	HORN
16	RIGHT CORNERING LAMP
17	LEFT CORNERING LAMP



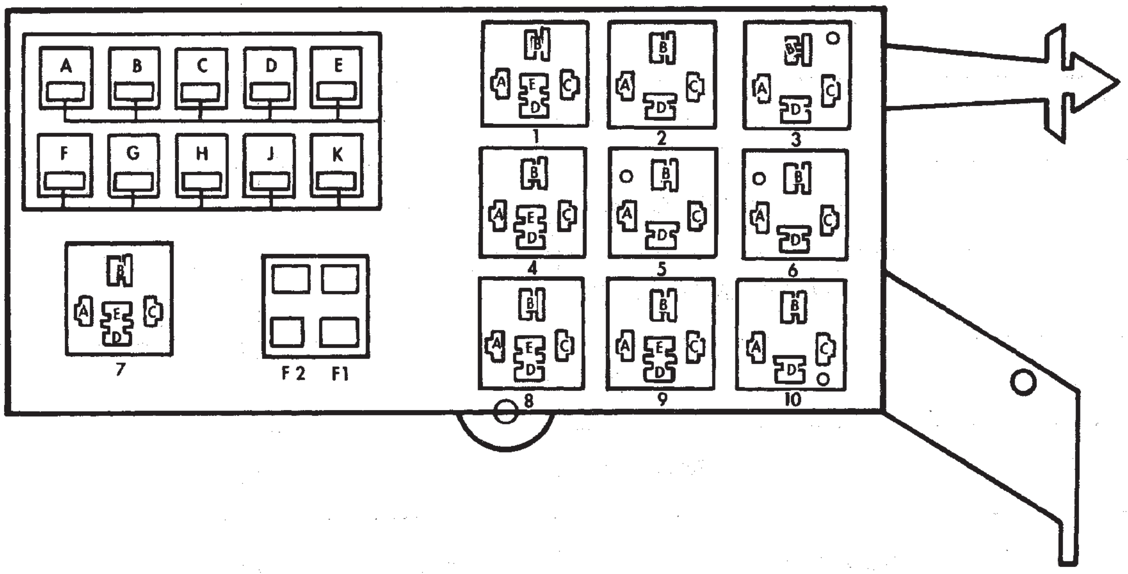
938W-193

Fig. 6 Relay Bank AG, AJ Body

RELAYS	
NUMBER	FUNCTION
1	CONCEALED HEADLAMP OPEN
2	A/C COMPRESSOR CLUTCH
3	AUTOMATIC SHUT DOWN
4	CONCEALED HEADLAMP CLOSE
5	BACK-UP LAMP RELAY
6	FUEL PUMP RELAY
7	ABS PUMP MOTOR
8	ENGINE STARTER
9	FUEL PUMP
10	RADIATOR FAN CONTROL

CARTRIDGE FUSES		
CAVITY	AMPS/COLOR	FUNCTION
A	30/PINK	ABS SYSTEM
B	30/PINK	ABS PUMP MOTOR
C	50/RED	VEHICLE LAMPS
D	30/PINK	RADIATOR FAN
E	40/GREEN	HEATED REAR WINDOW
F	50/RED	PARK LAMPS
G	40/GREEN	IGNITION SYSTEM
H	50/RED	BLOWER MOTOR
J	30/PINK	FUEL PUMP/TRANSMISSION
K	IGNITION-OFF-DRAW FUSE SHIPMENT POSITION ONLY	

FUSE	
NUMBER	FUNCTION
F1	HEATED REAR WINDOW
F2	HAZARD FLASHER



NOTE

FUSE CAVITY K IS USED FOR VEHICLE SHIPMENT ONLY. AFTER SHIPMENT FUSE MUST BE PLACED IN CAVITY E.

938W-194

Fig. 7 Power Distribution Center AC, AY Body

CAVITY	DESCRIPTION
36	HAZARD FLASHER FEED
37	HAZARD FLASHER B+
38	
39	
40	A/C COMPRESSOR CLUTCH
41	
42	FUSED IGNITION
43	IGNITION START/RUN
44	
45	IGNITION
46	INTERIOR LAMP FUSE FEED
47	MINI FUSE FEED
48	ANTILOCK BRAKE SYSTEM B+
49	
50	GENERATOR OUTPUT
51	IGNITION SWITCH B+ FEED (RUN)
52	RADIATOR FAN AND A/C RELAYS B+
53	HEATED REAR WINDOW
54	
55	IGNITION SWITCH (RUN-START-ACC)
56	FUSE BLOCK B+ (INSTRUMENT PANEL)
57	FUSE BLOCK
58	GENERATOR OUTPUT (FUSED BATTERY)

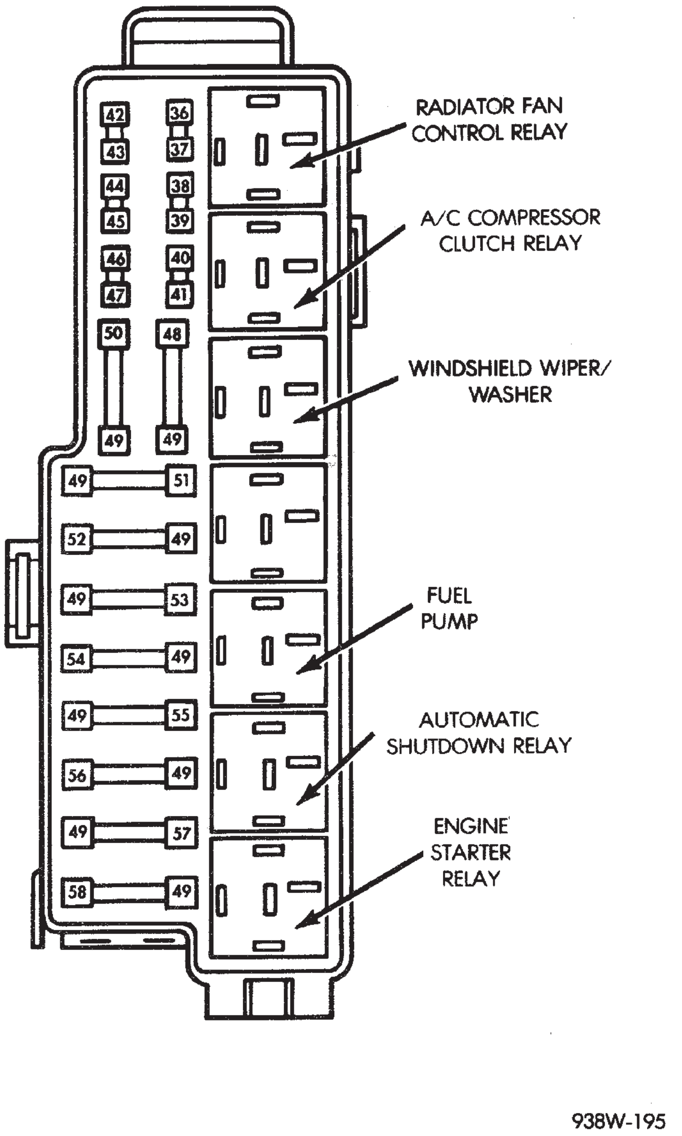


Fig. 8 Power Distribution Center AG, AJ Body

WIRING AND COMPONENT IDENTIFICATION

CONTENTS

The wiring and components shown in this section are divided into groups by vehicle line. When locating a specific harness routing or component, first turn to the appropriate index, then look up the **figure number** that applies. **Page numbers at the top of each page do not refer to figure numbers.**

Throughout this section references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these is shown in the general information section.

AA BODY C, D, P

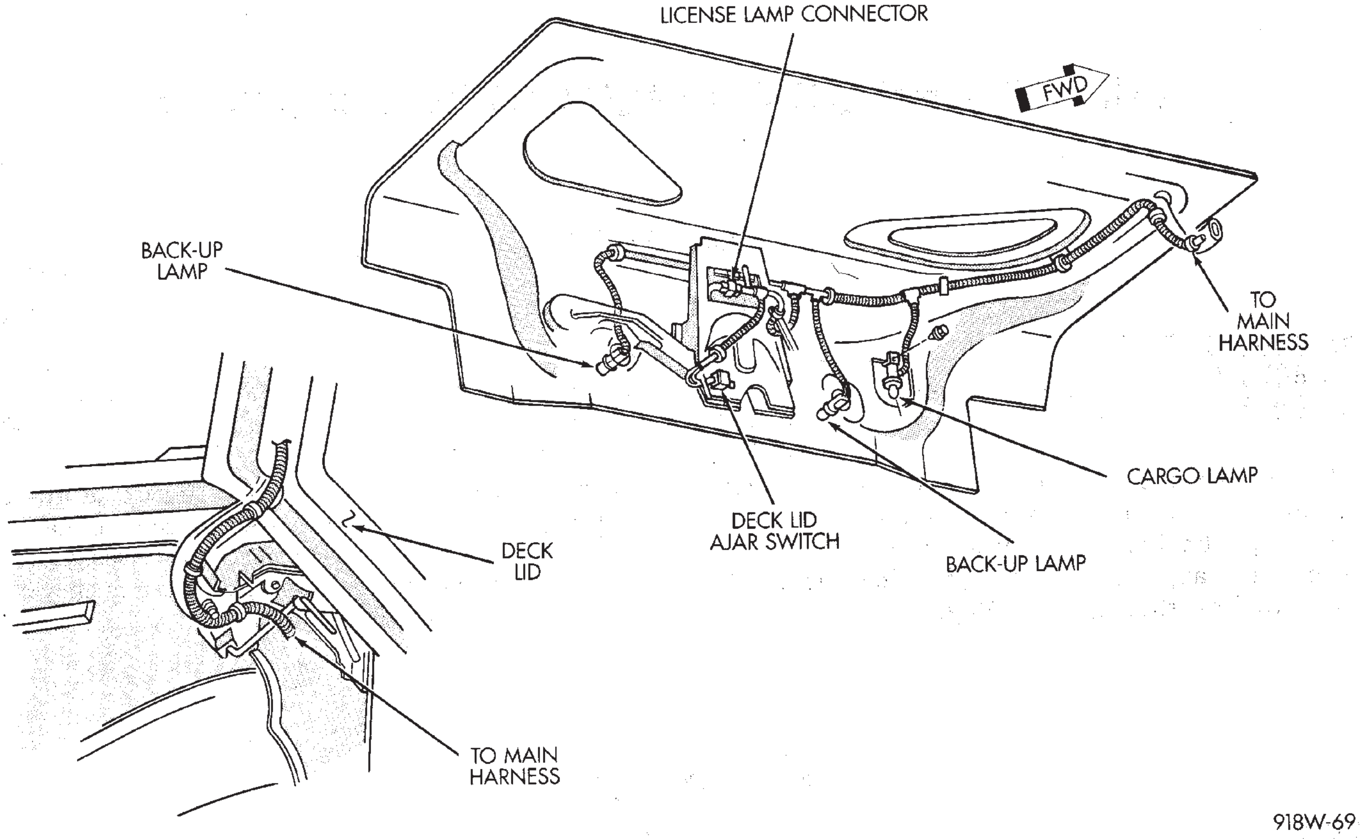


Fig. 1 Deck Lid Wiring AA Body

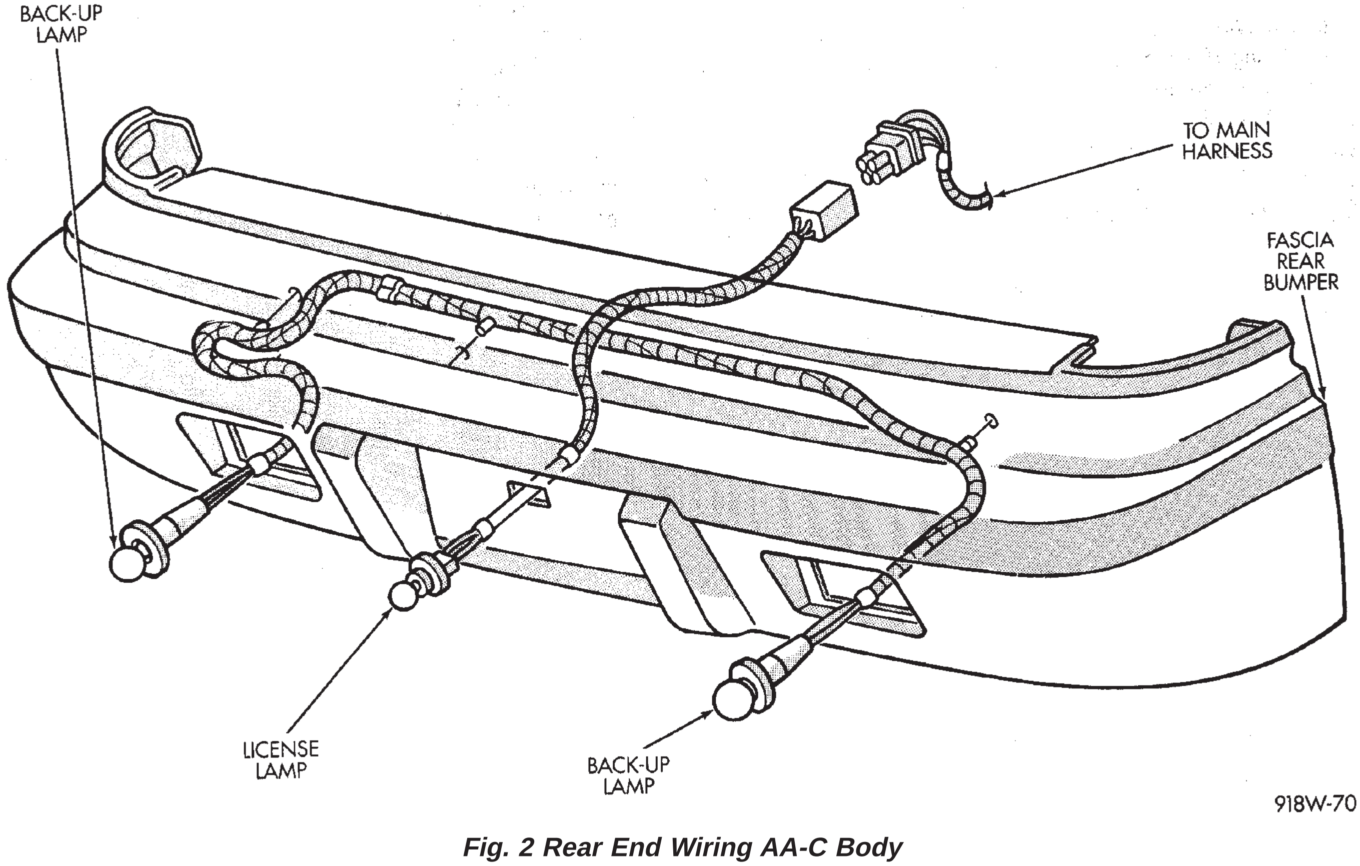


Fig. 2 Rear End Wiring AA-C Body

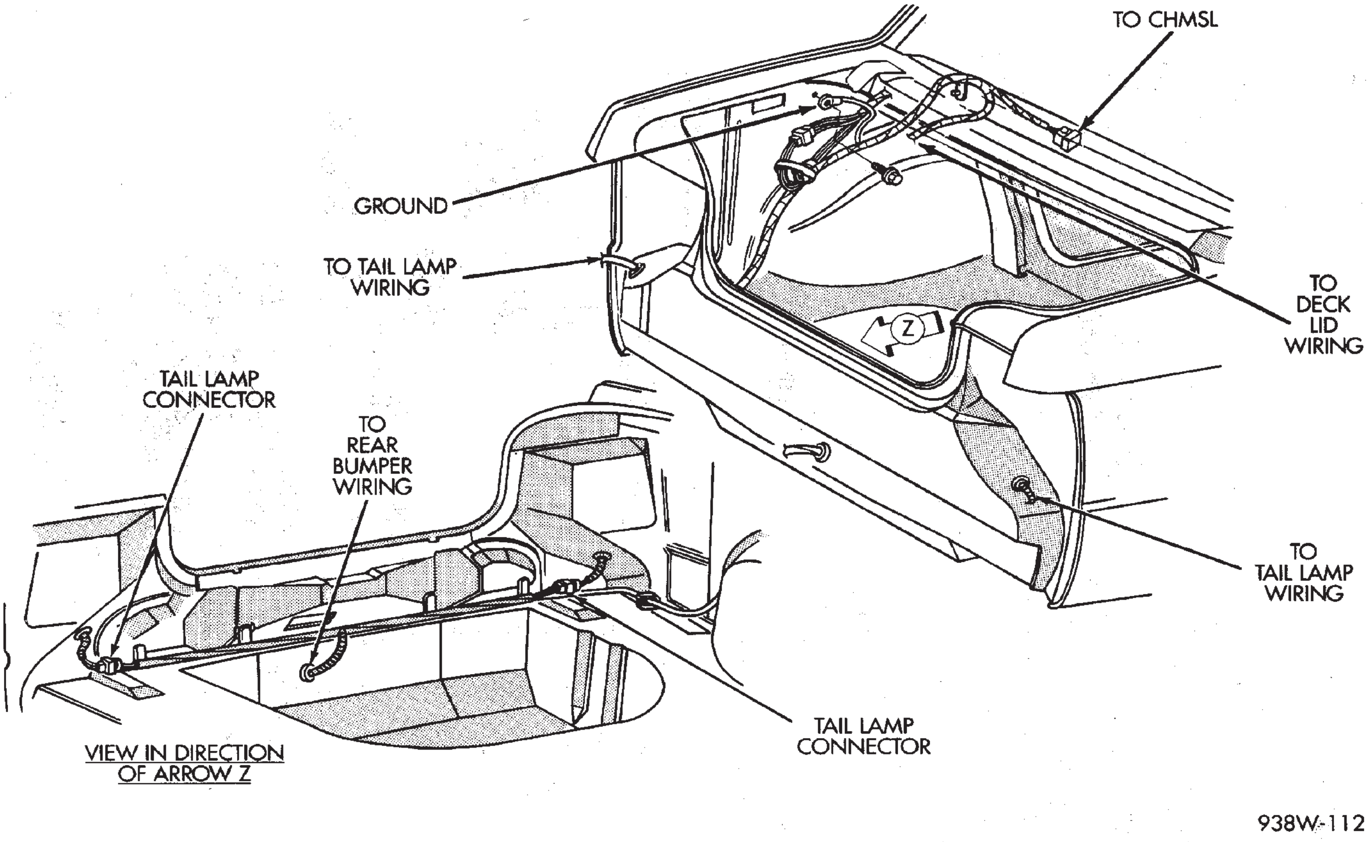


Fig. 3 Trunk Wiring AA Body

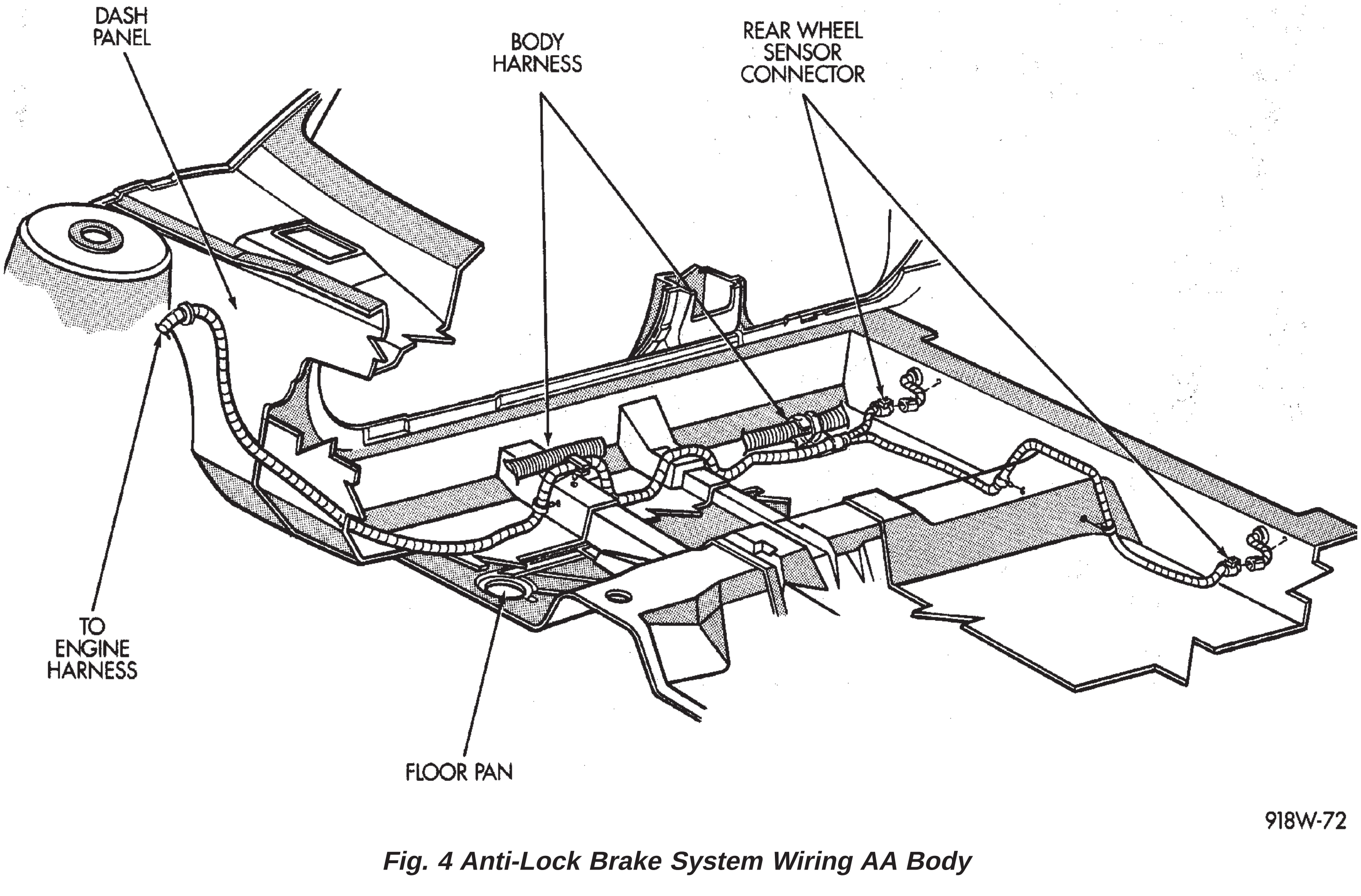


Fig. 4 Anti-Lock Brake System Wiring AA Body

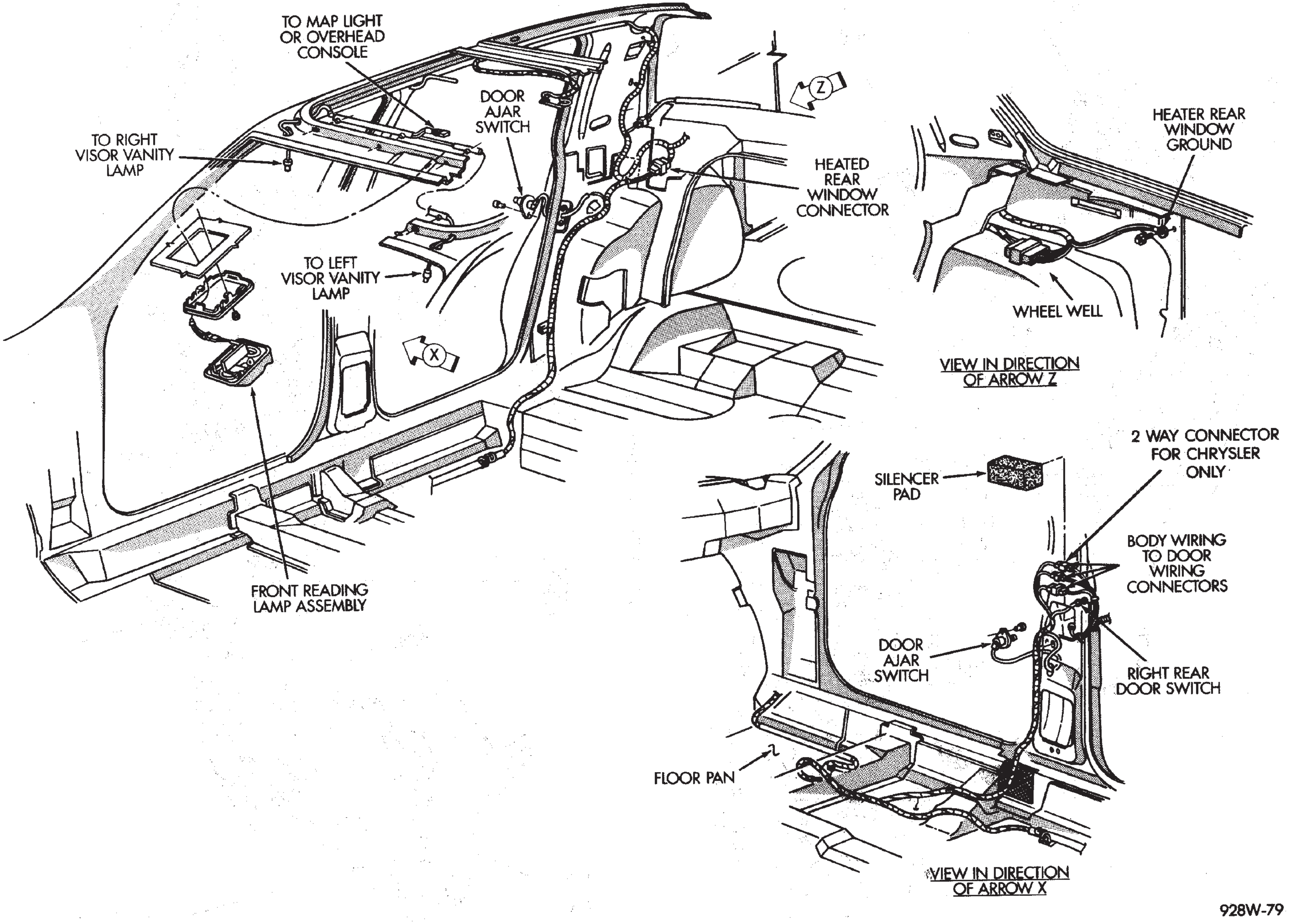


Fig. 5 Body Right Side Wiring AA Body

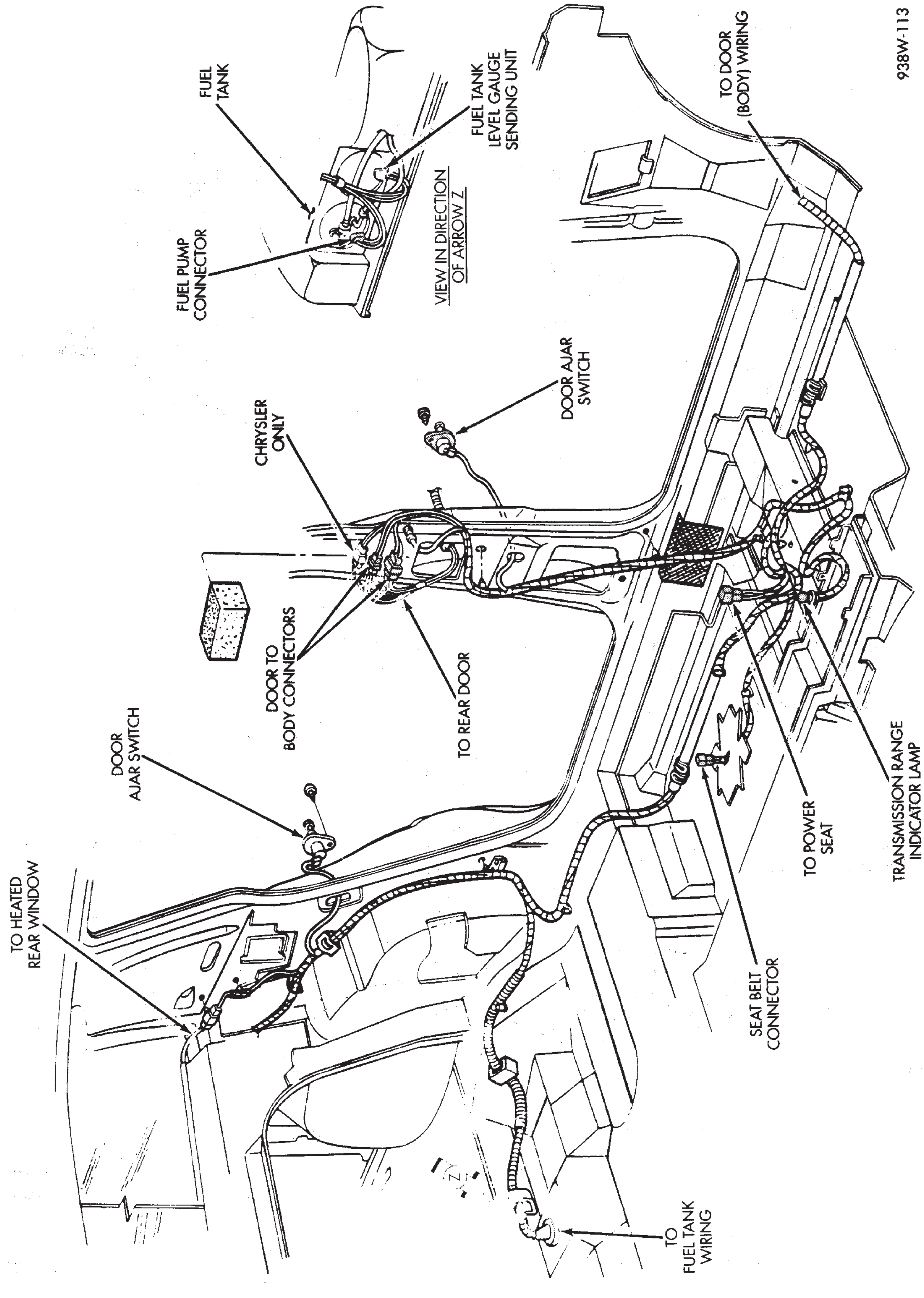


Fig. 6 Body Left Side Wiring AA Body

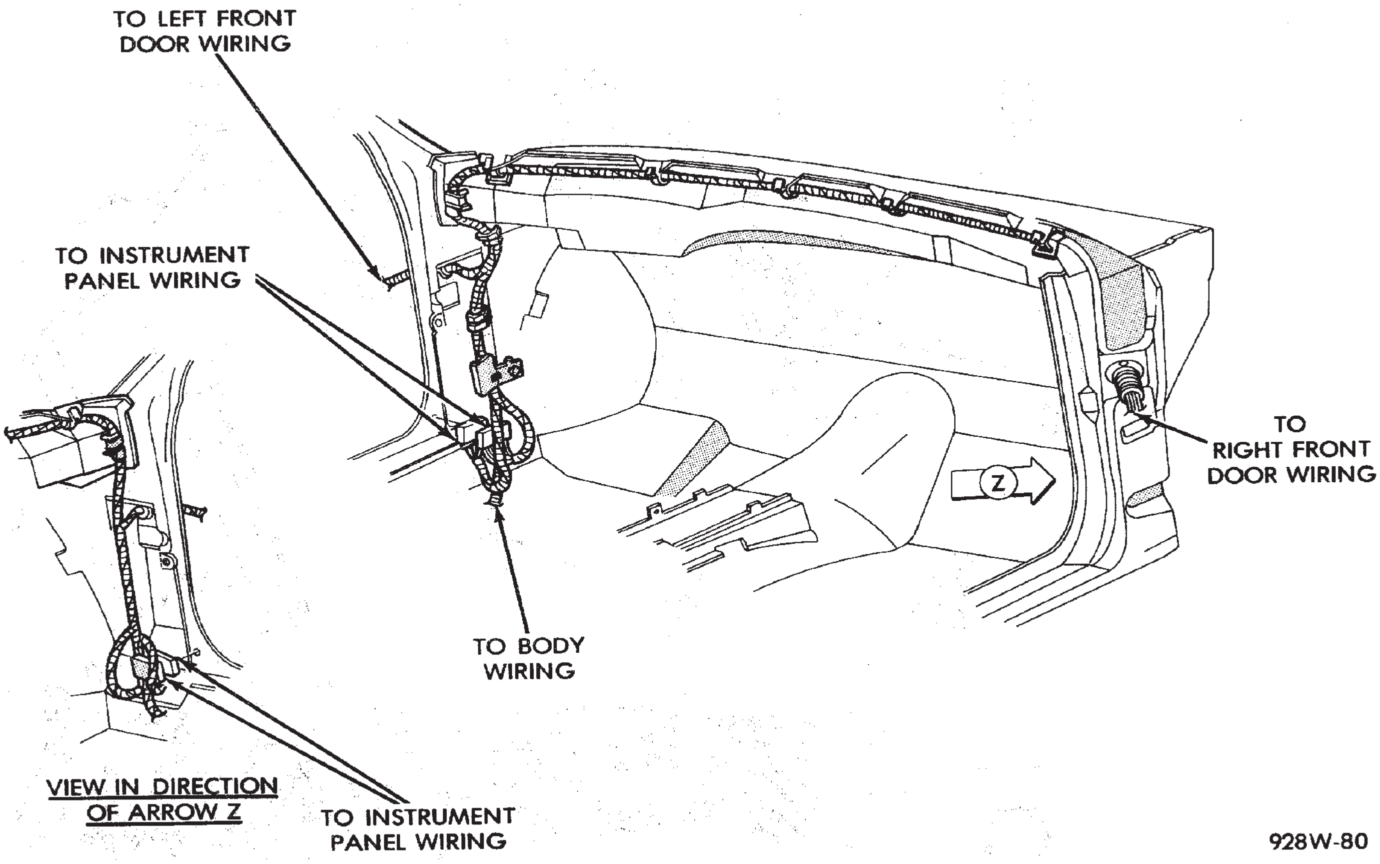


Fig. 7 Door Wiring (Body Side) AA Body

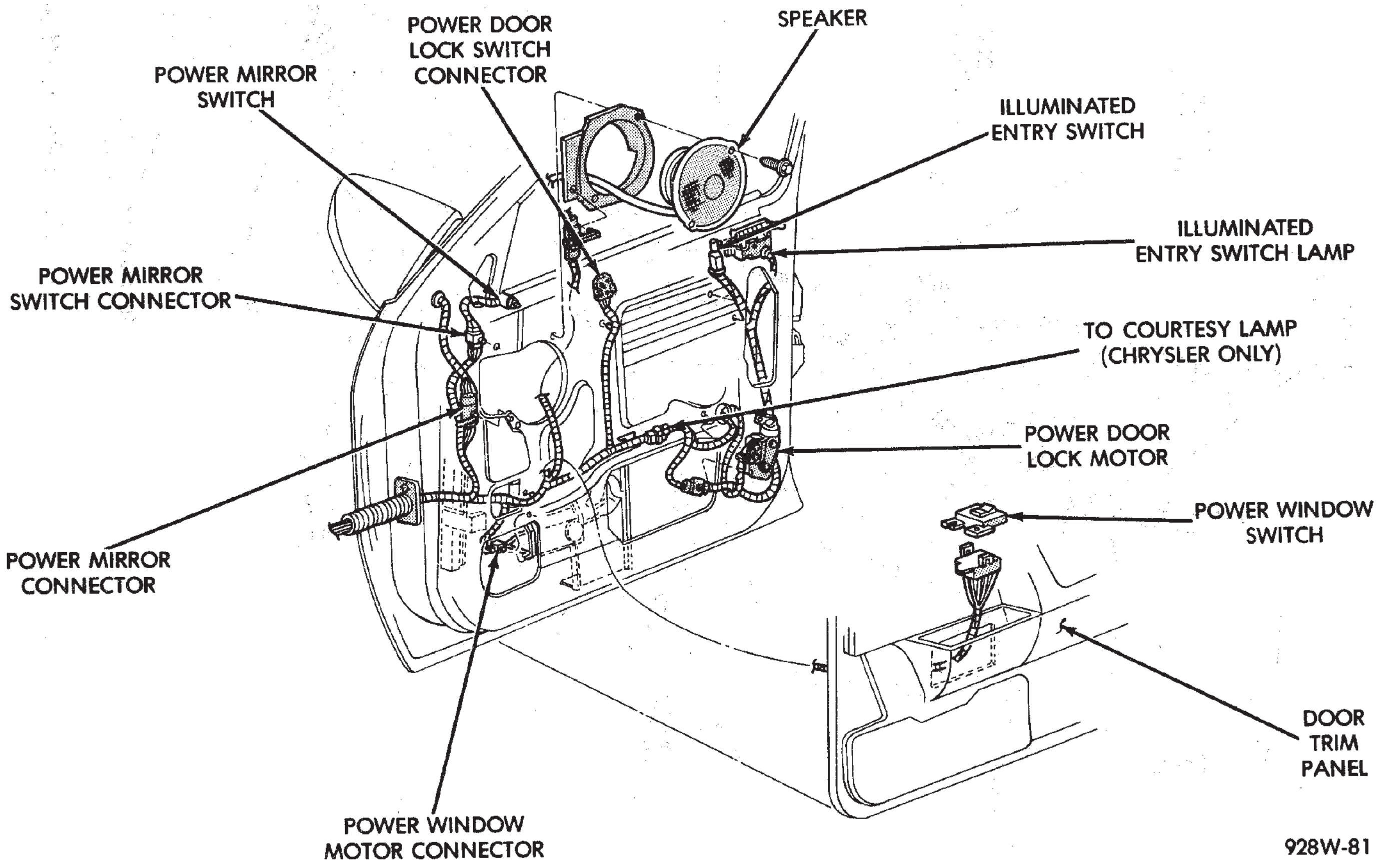


Fig. 8 Door Wiring (Front) AA Body

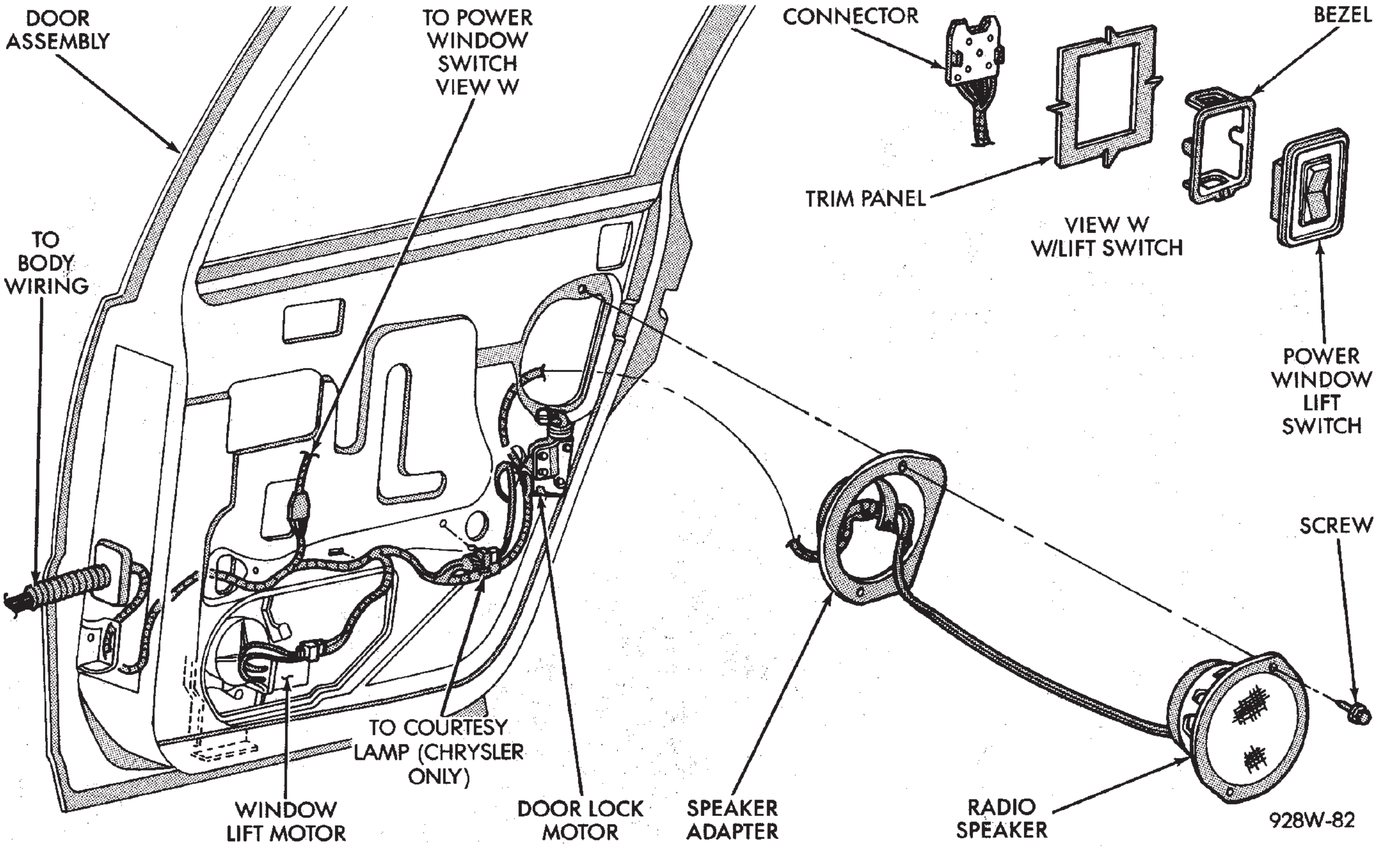


Fig. 9 Door Wiring (Rear) AA Body

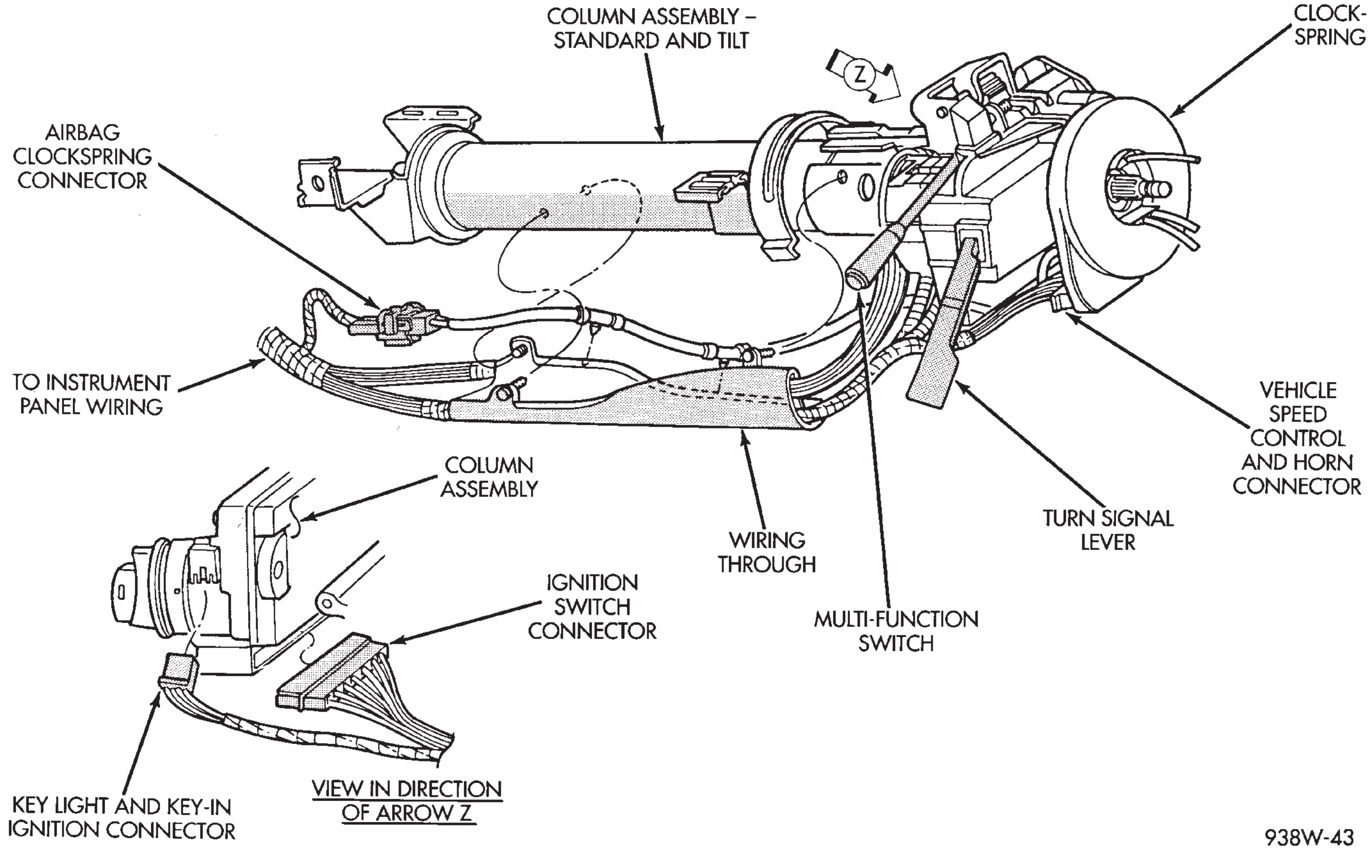


Fig. 10 Steering Column Wiring AA Body

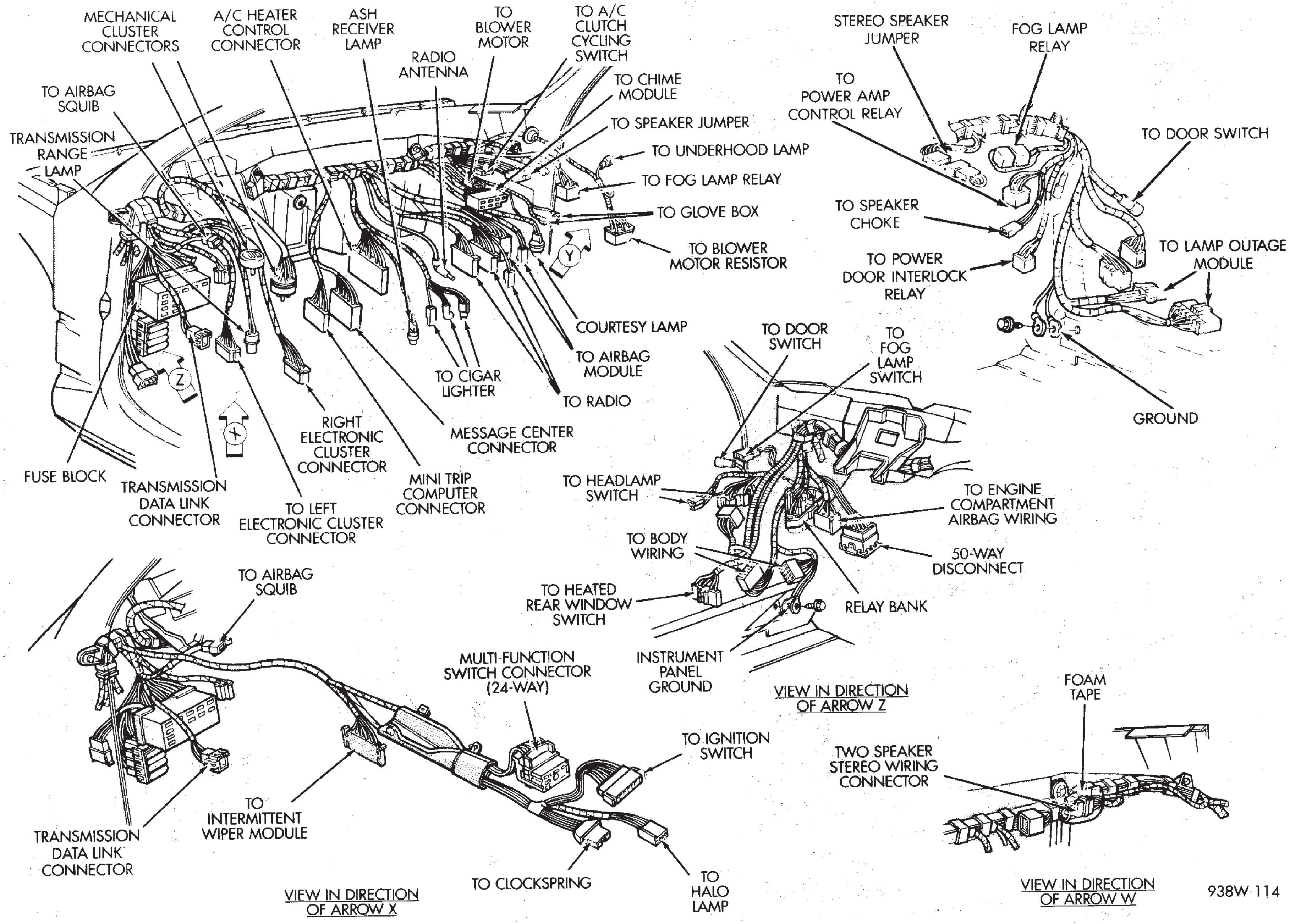


Fig. 11 Instrument Panel Wiring (Routing) AA Body

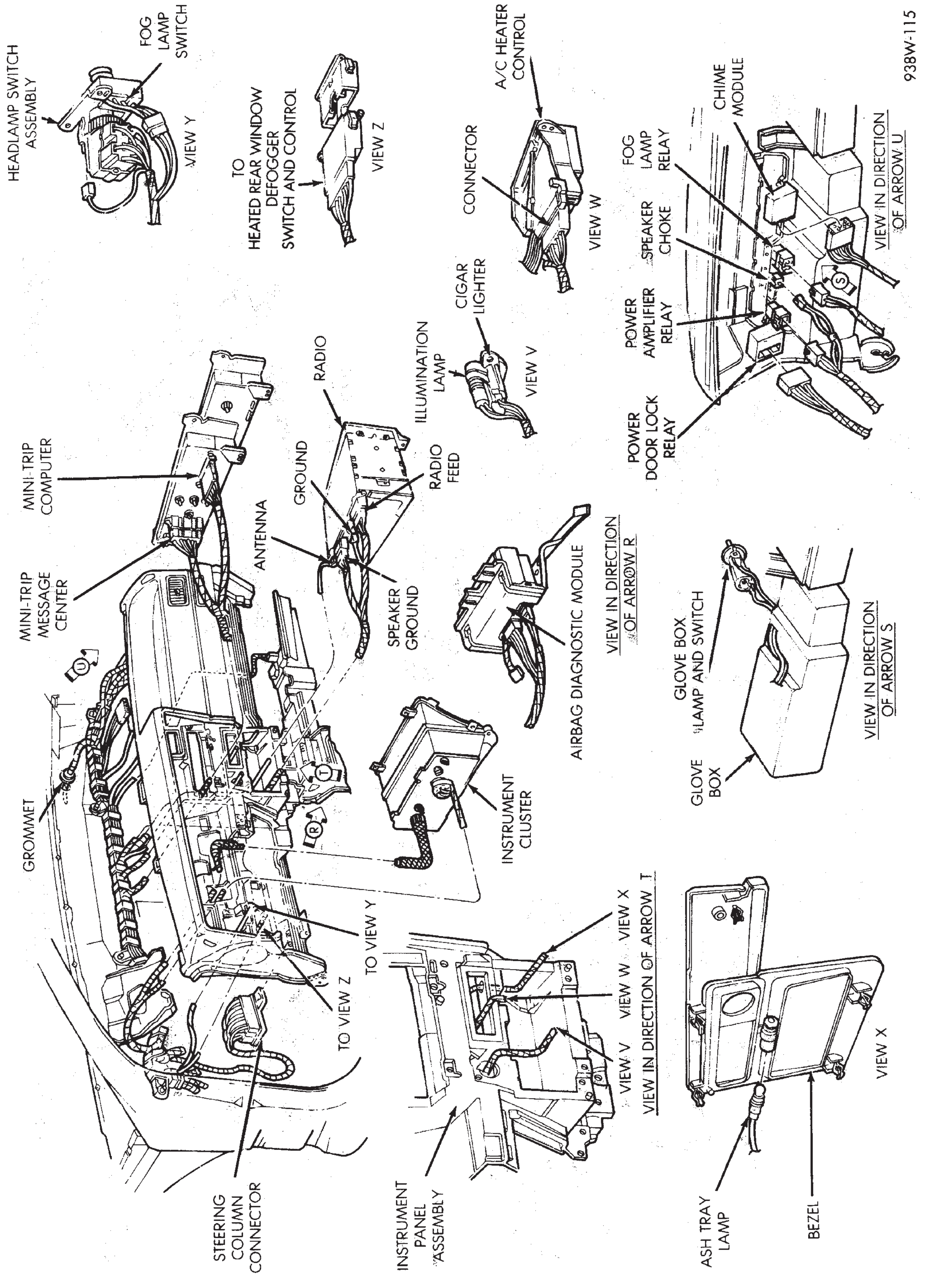


Fig. 12 Instrument Panel Wiring (Connections) AA Body

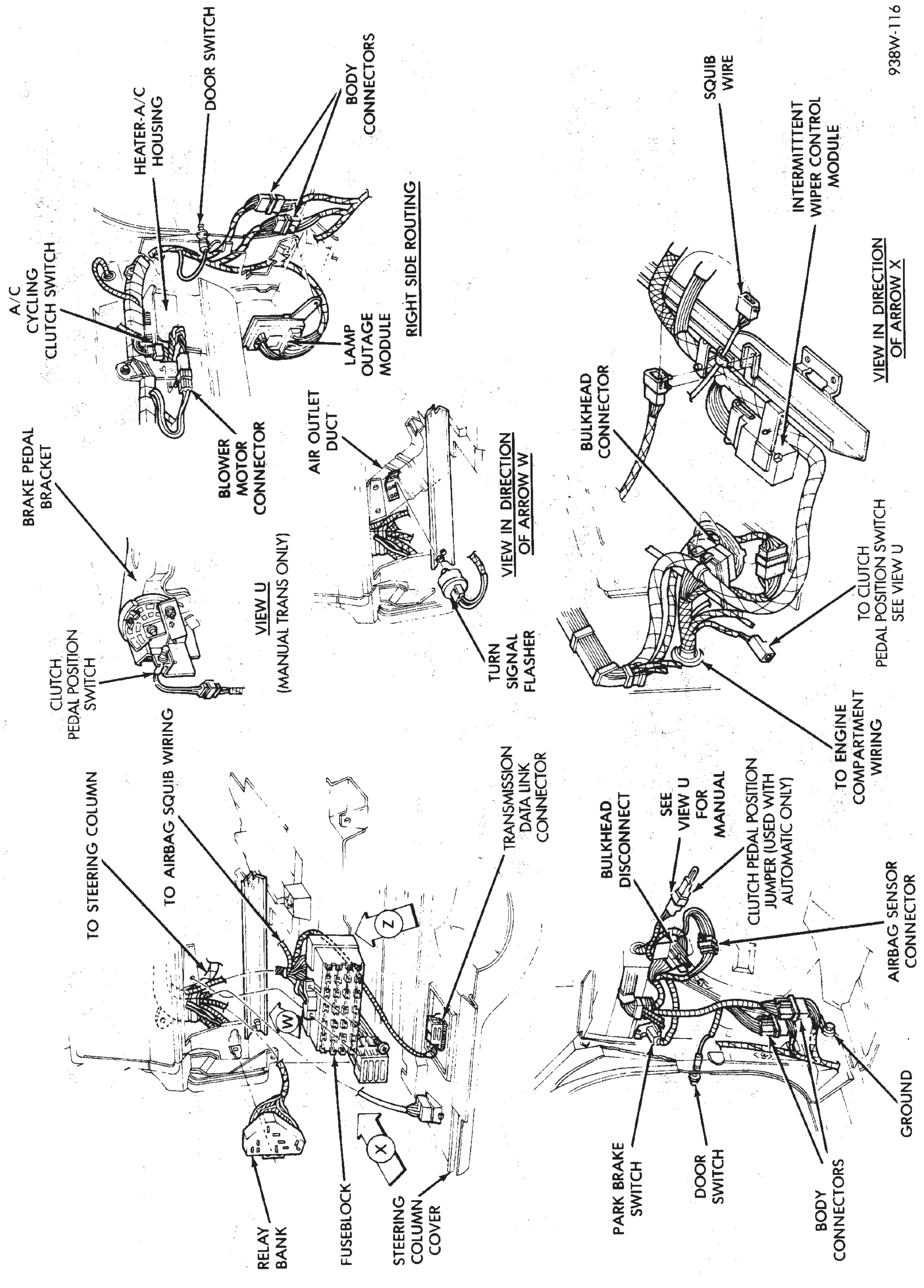


Fig. 13 Instrument Panel Wiring (I.P. to Main Harness Hook-Up) AA Body

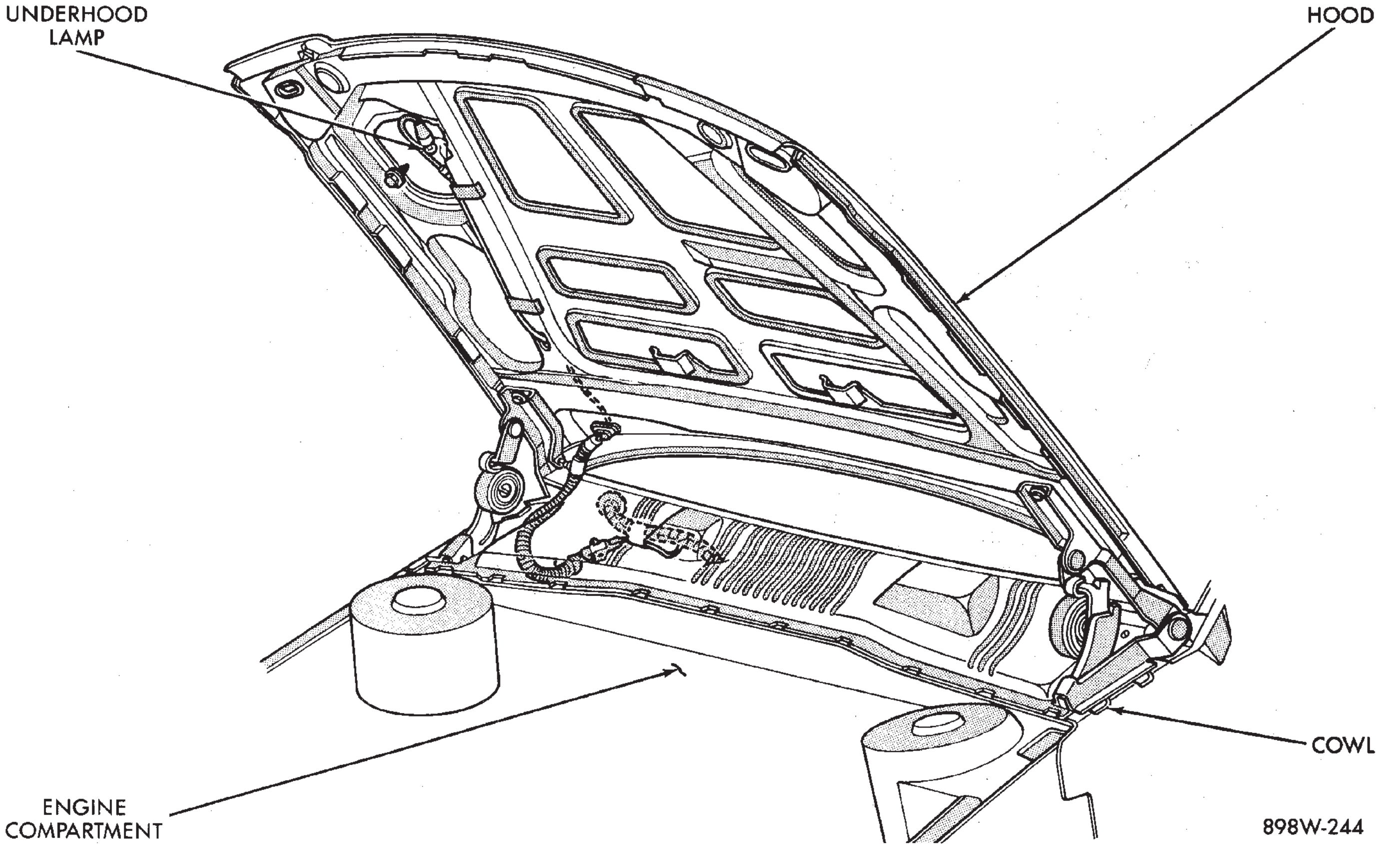


Fig. 14 Underhood Lamp Wiring AA Body

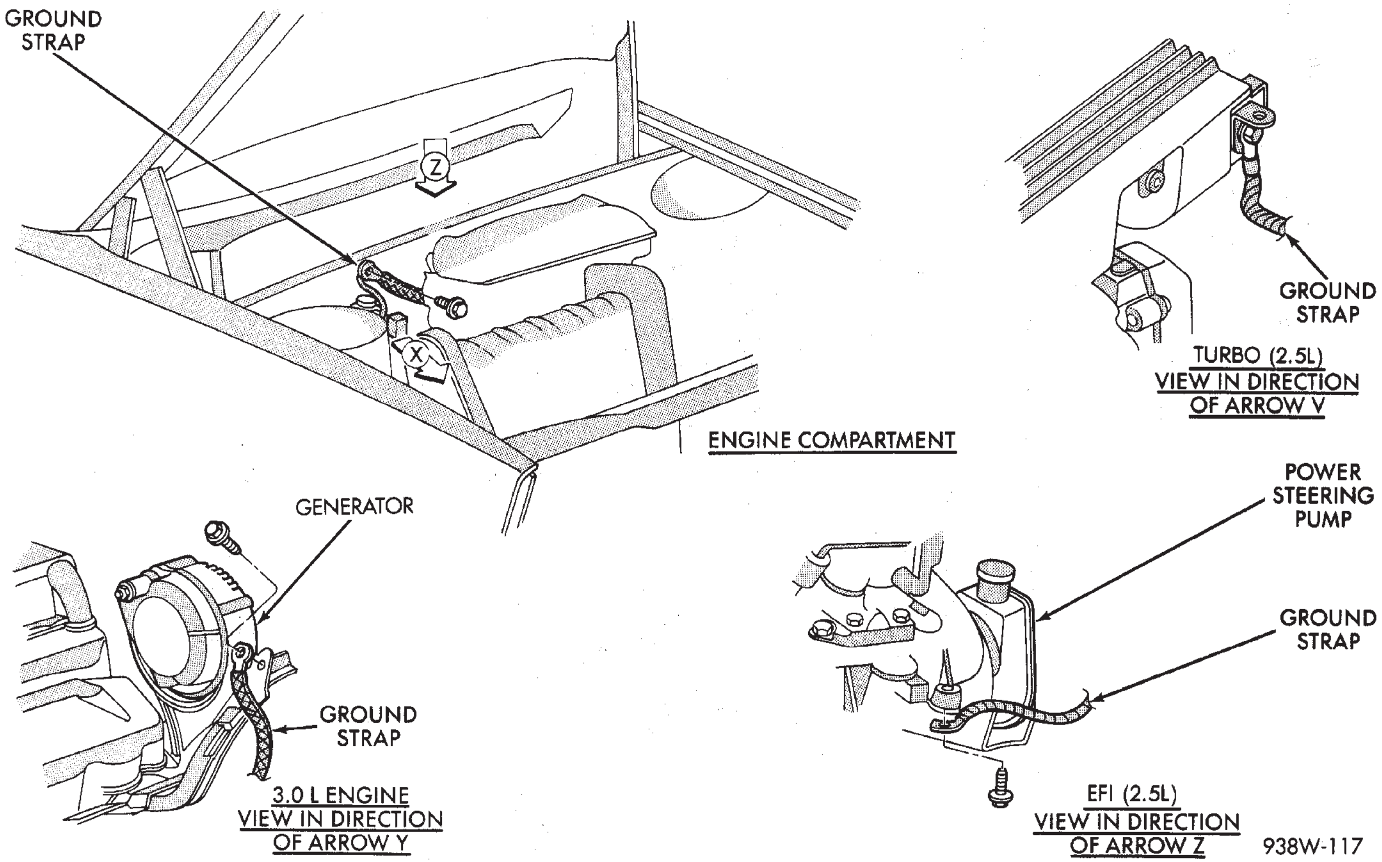


Fig. 15 Ground Strap Location AA Body

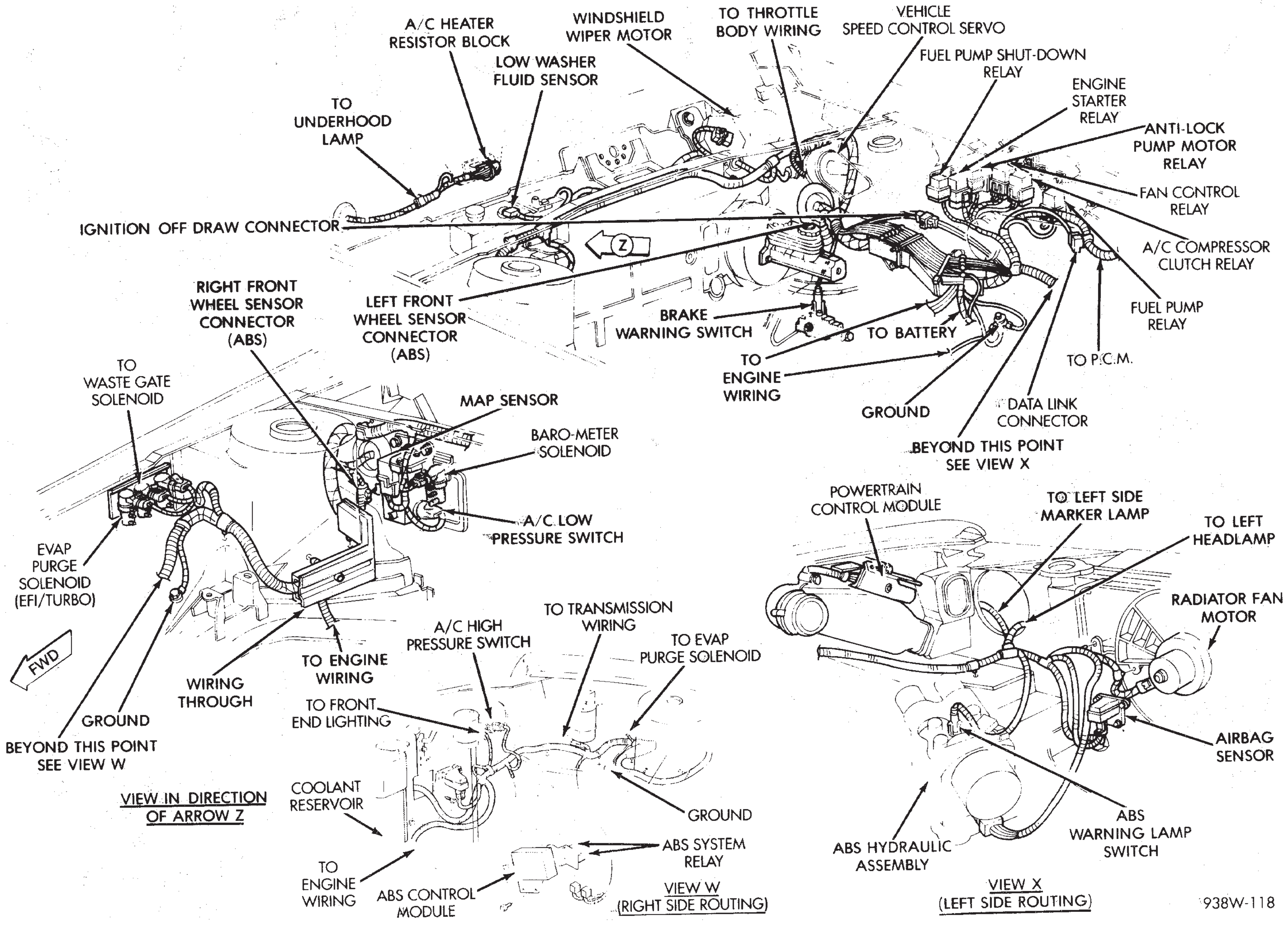


Fig. 16 Engine Compartment Wiring AA Body

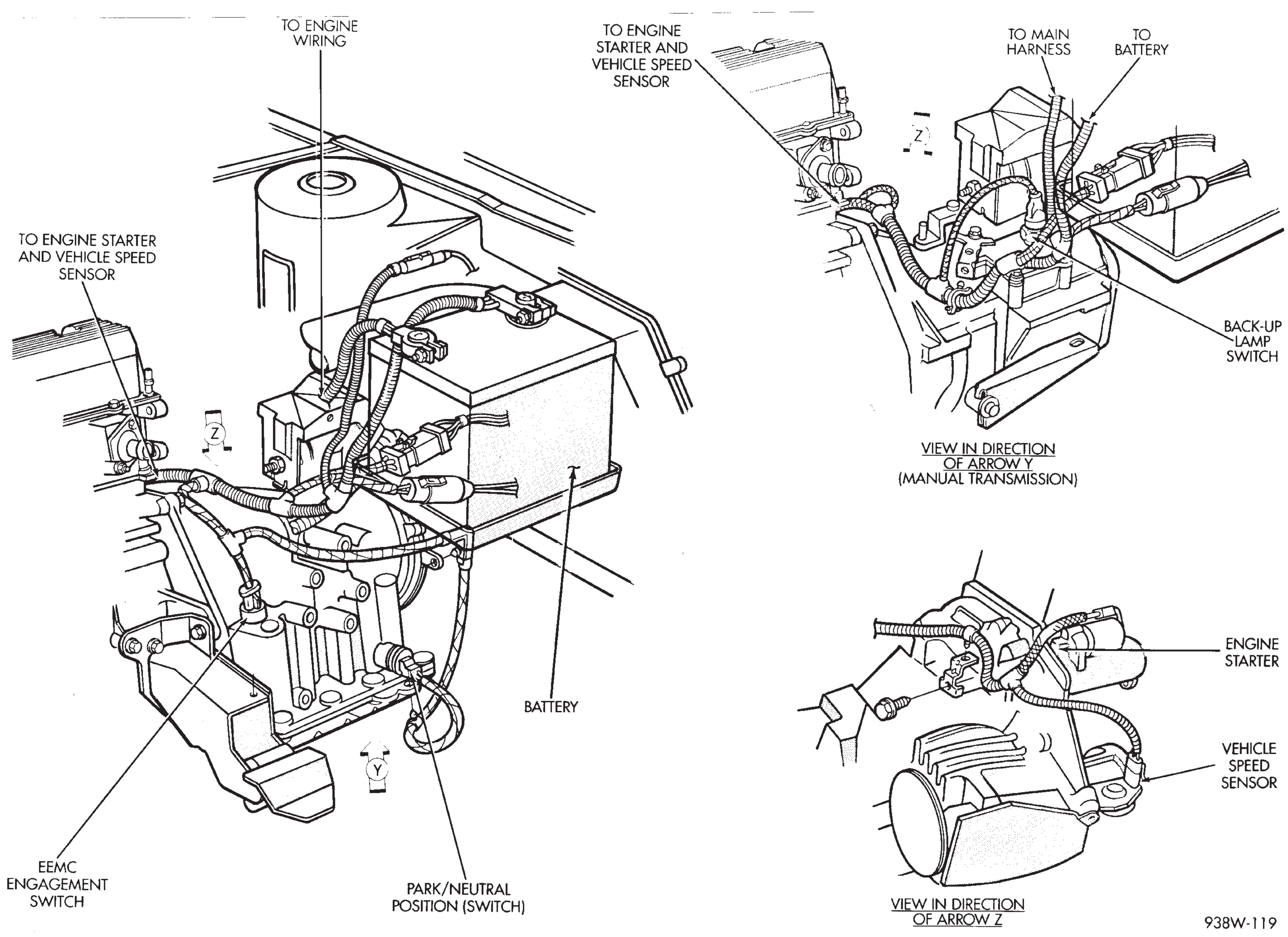


Fig. 17 Transmission Wiring AA Body

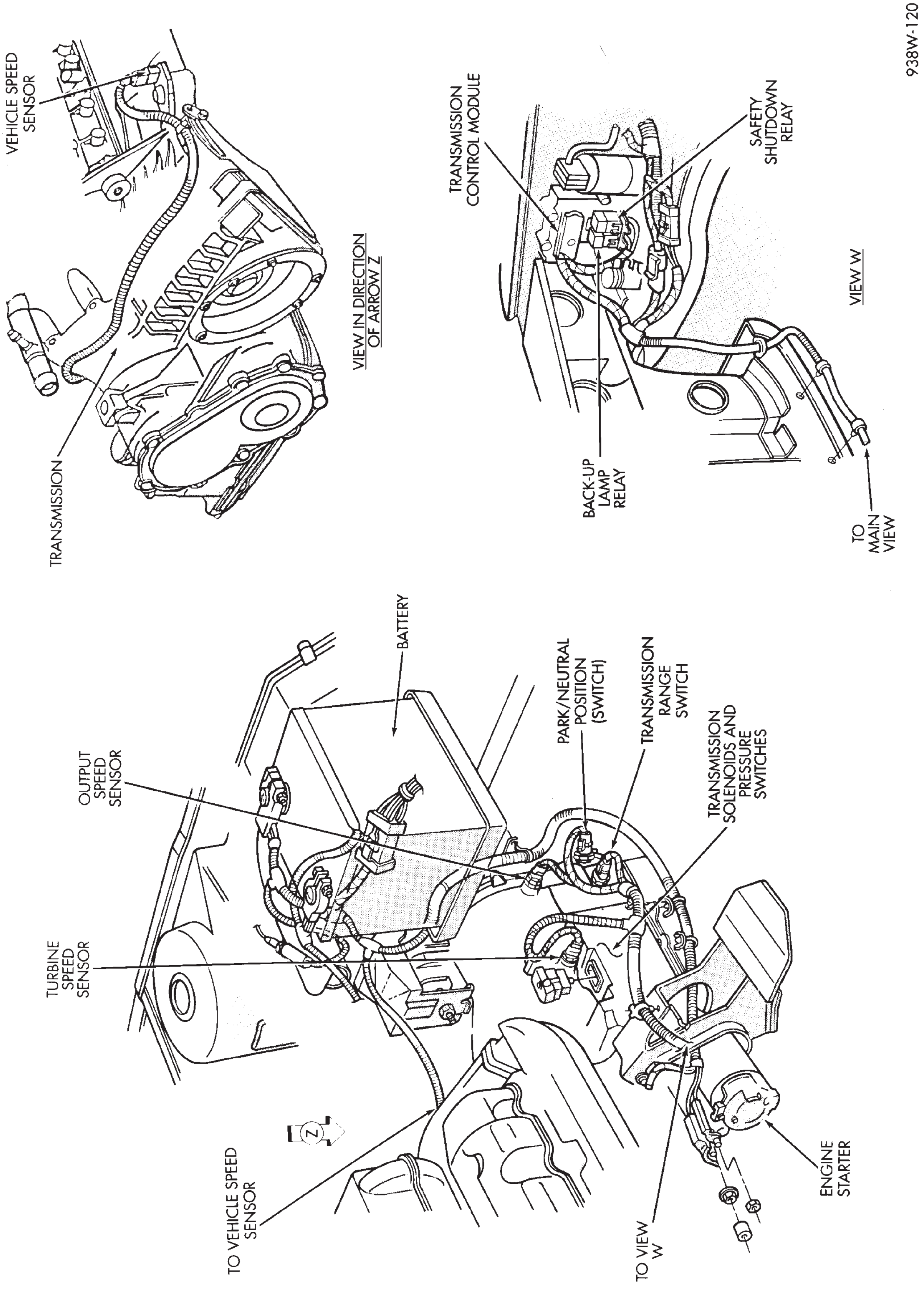


Fig. 18 Transmission Wiring 41TE AA Body

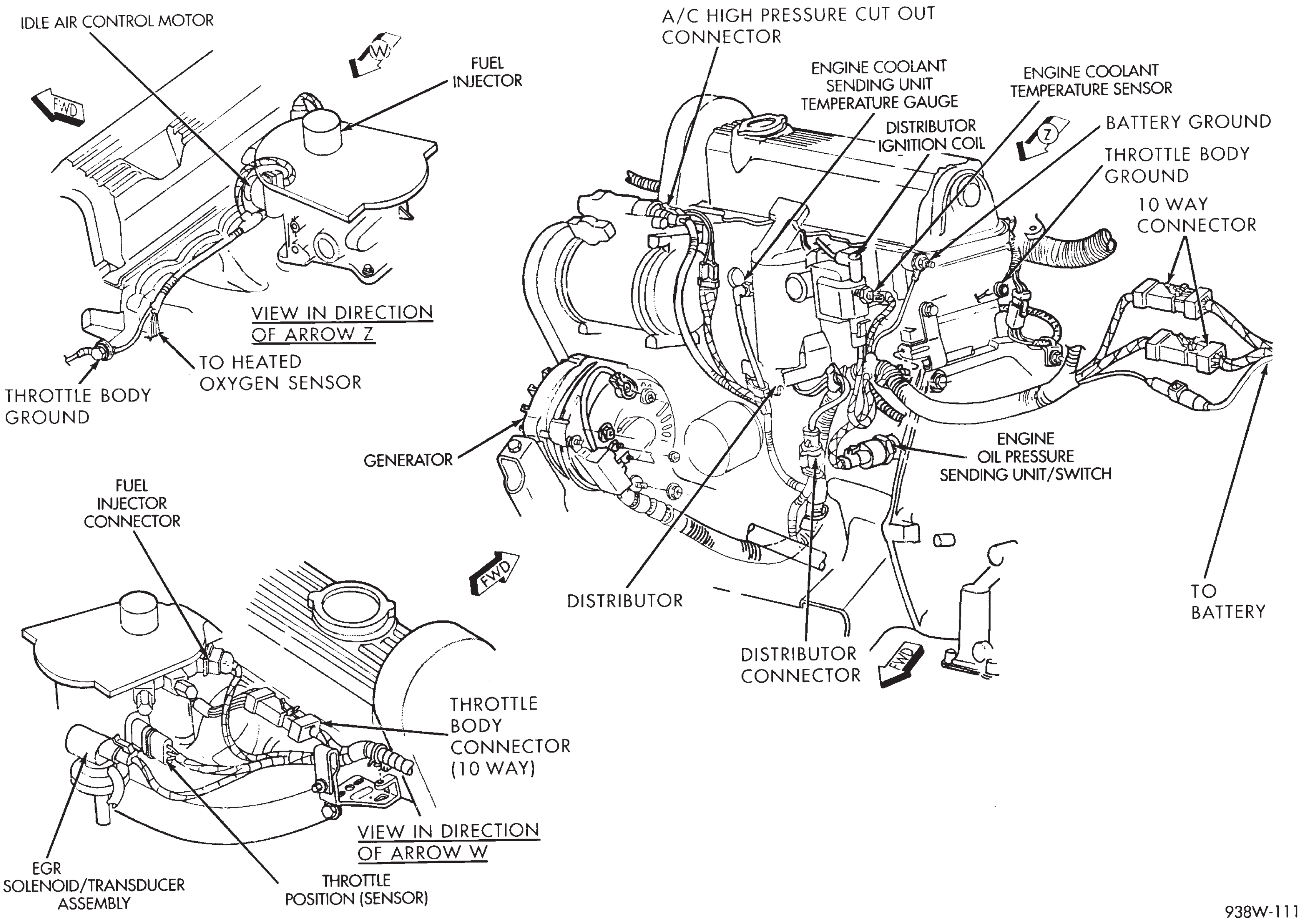


Fig. 19 Engine Wiring 2.5L EFI AA Body

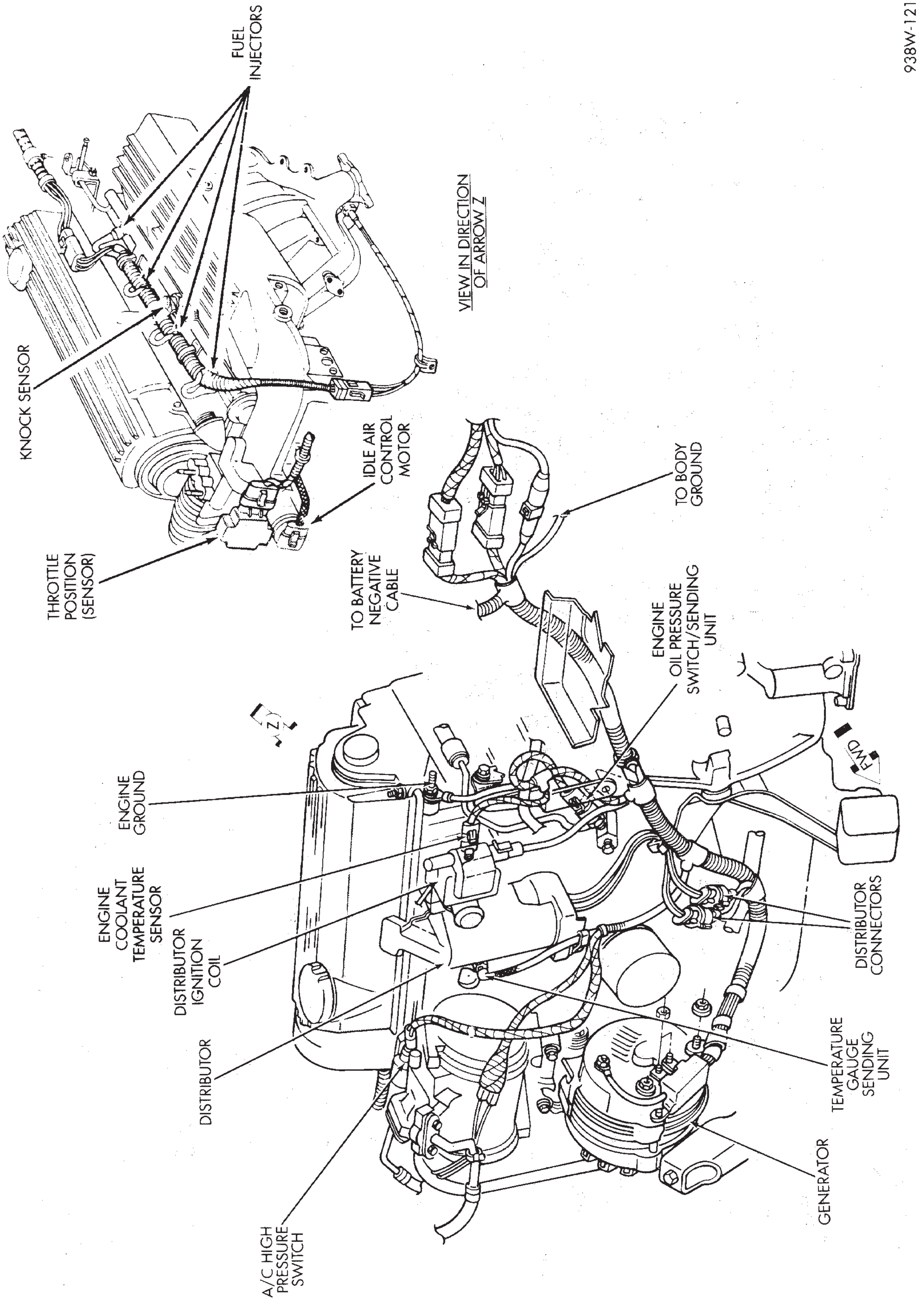


Fig. 20 Engine Wiring 2.5L Flex Fuel AA Body

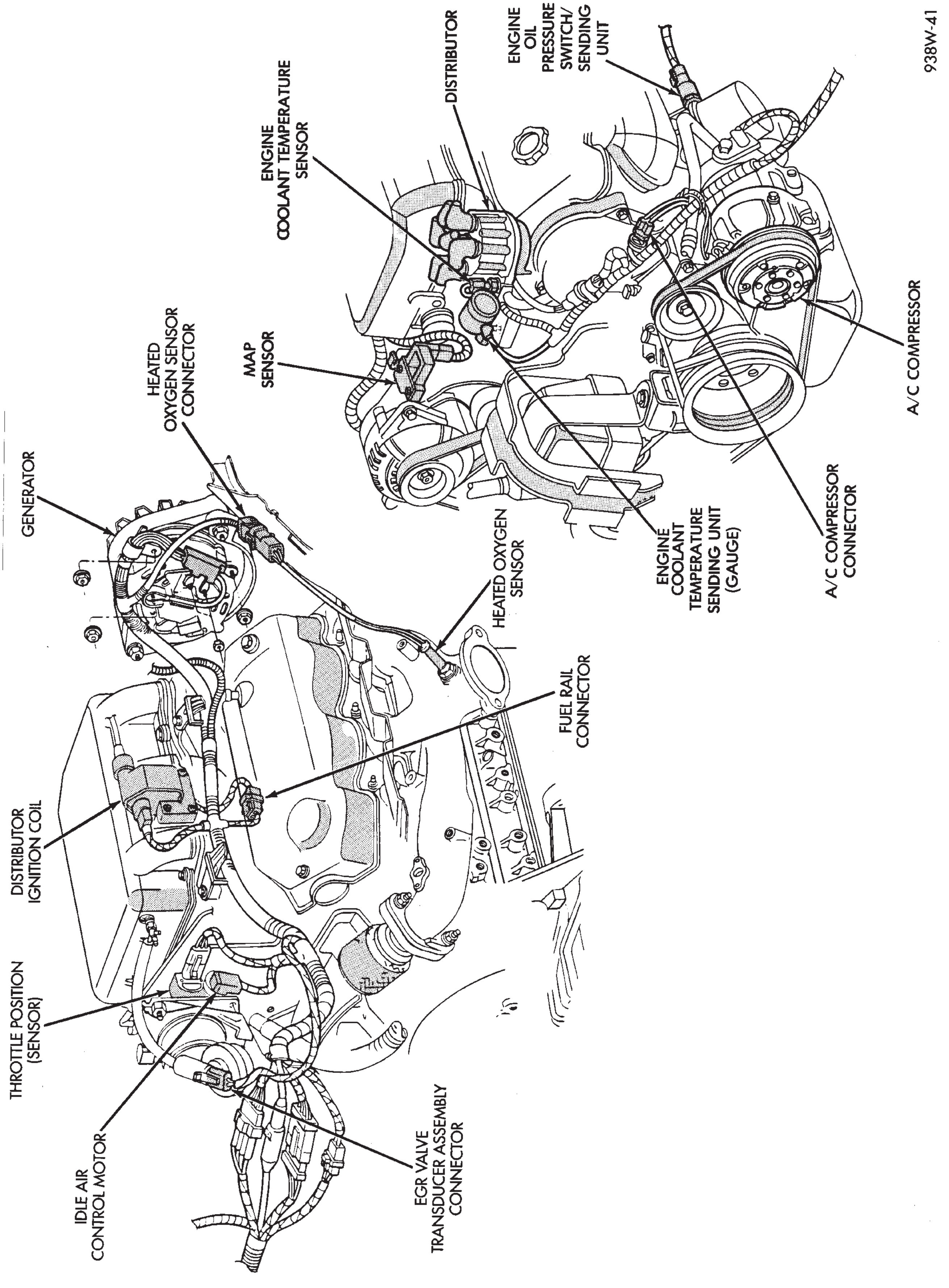


Fig. 21 Engine Wiring 3.0L AA Body

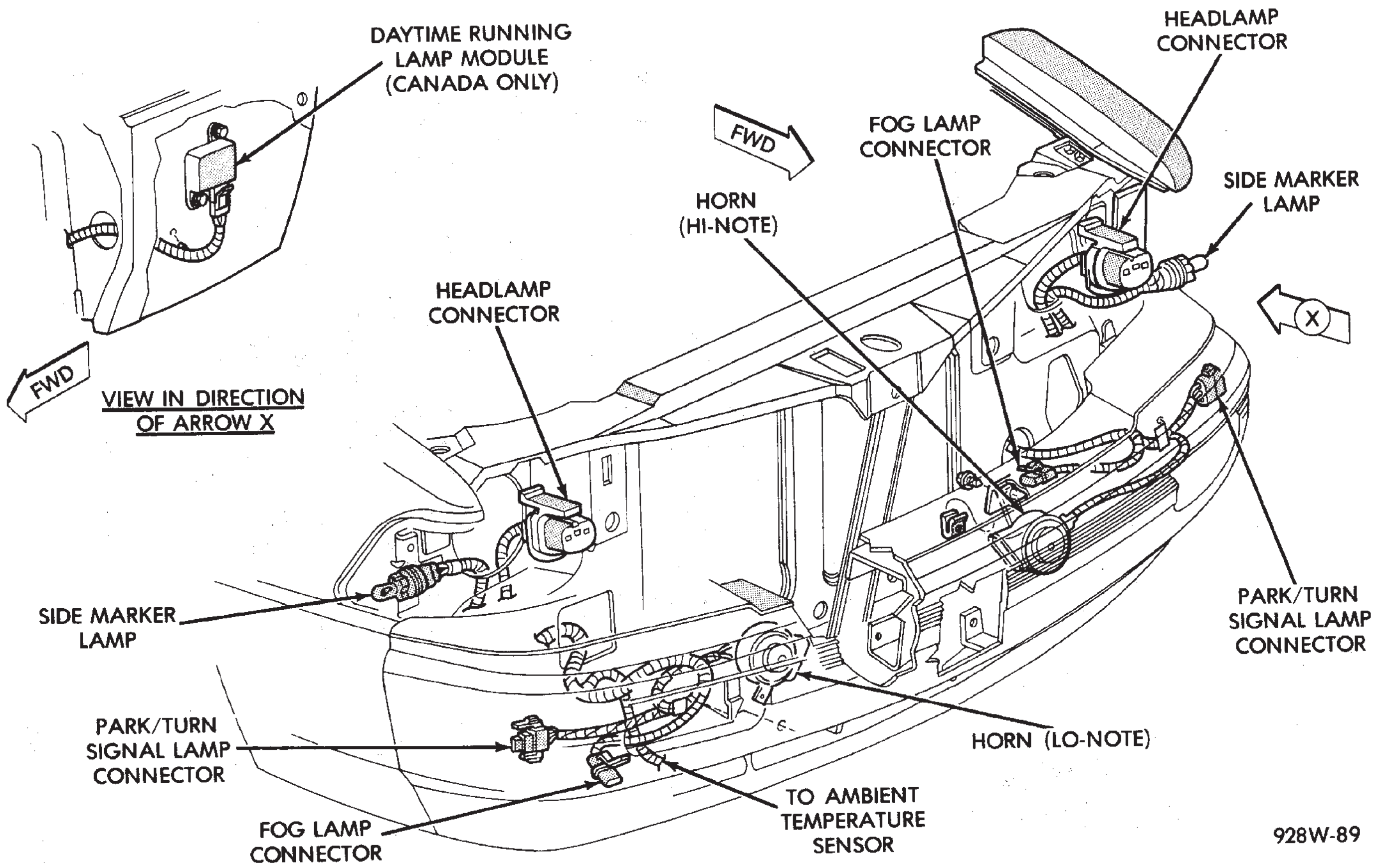


Fig. 22 Front End Wiring AA Body

AC BODY C,D

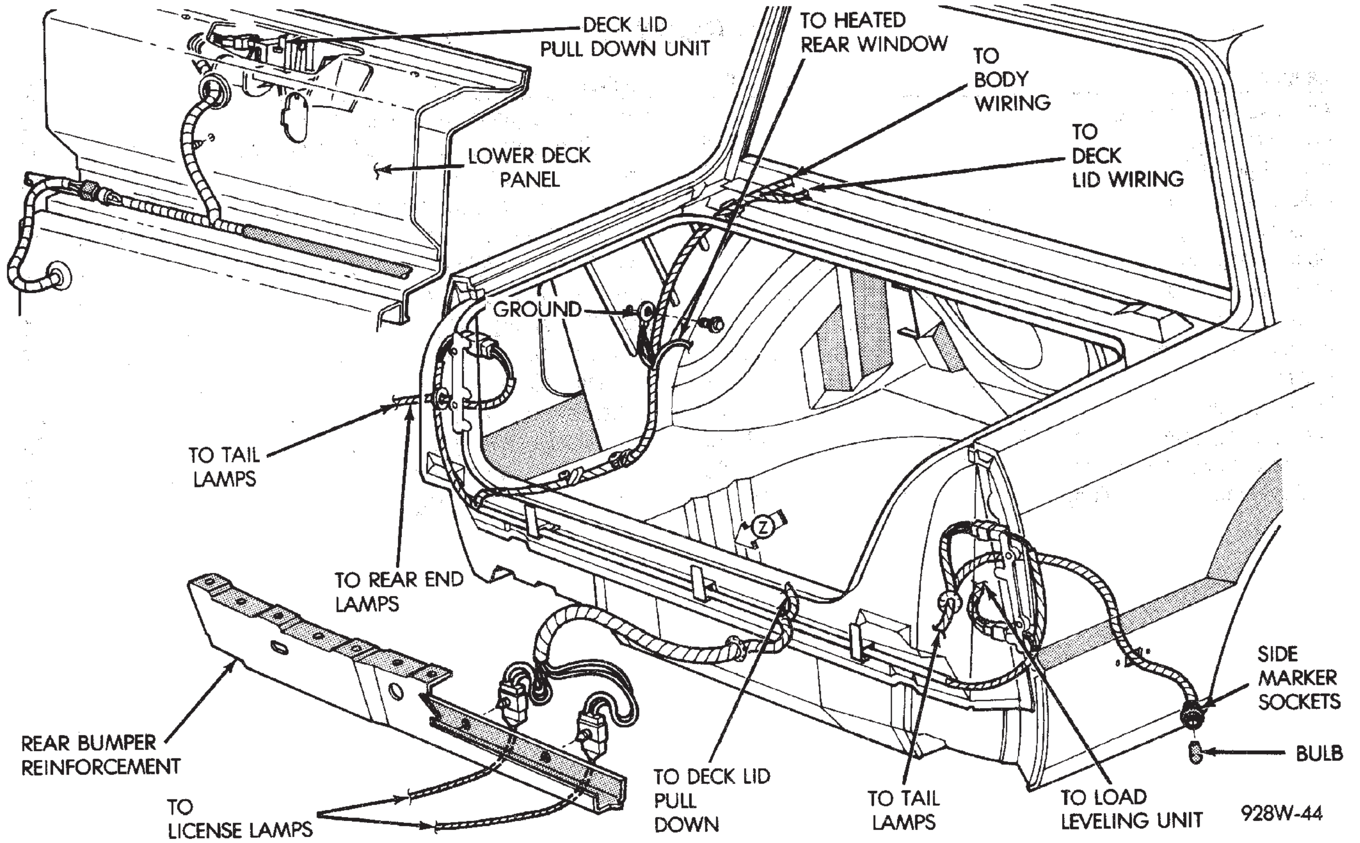


Fig. 1 Rear End Wiring AC Body C

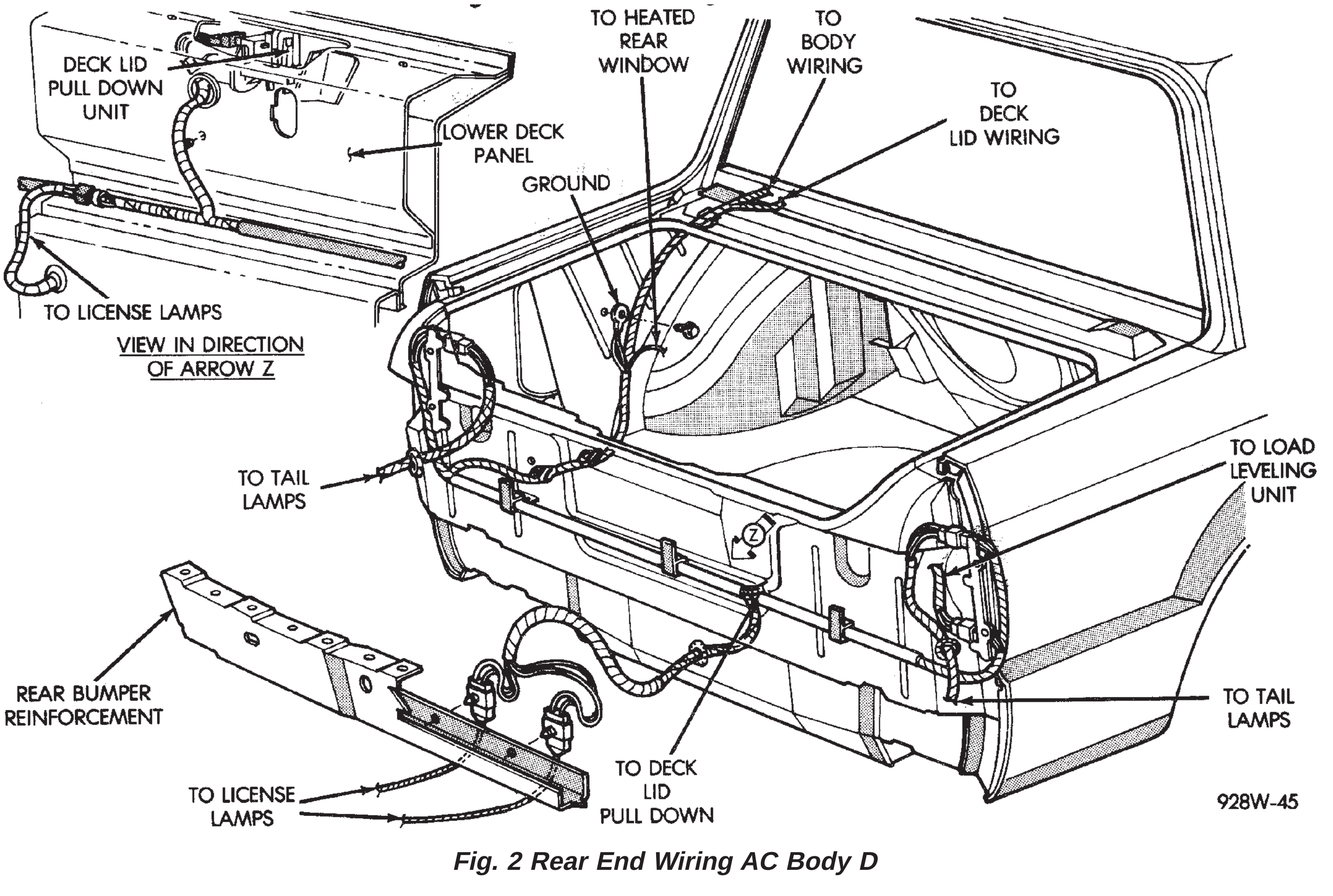


Fig. 2 Rear End Wiring AC Body D

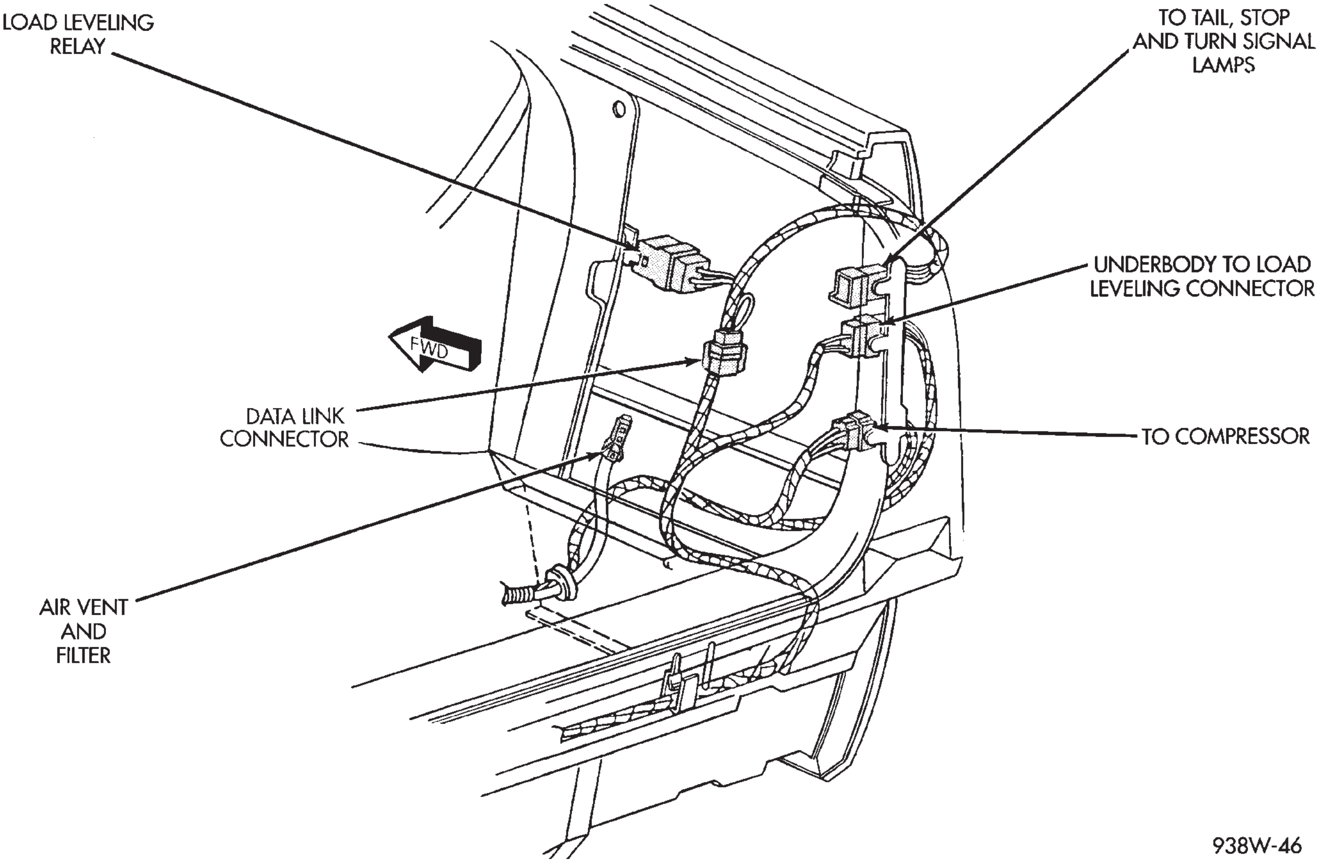


Fig. 3 Load Leveling Wiring AC Body

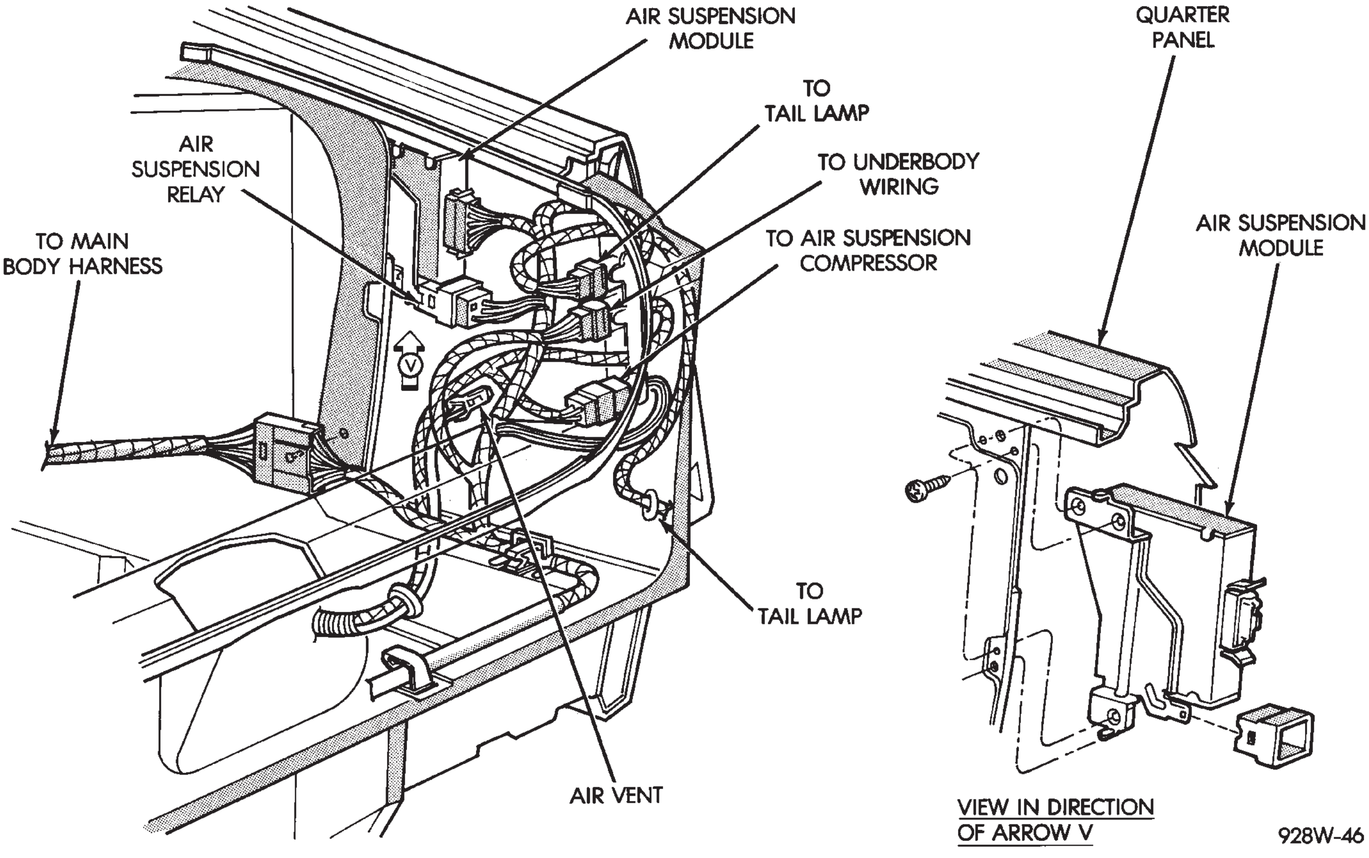


Fig. 4 Air Suspension Wiring AC Body

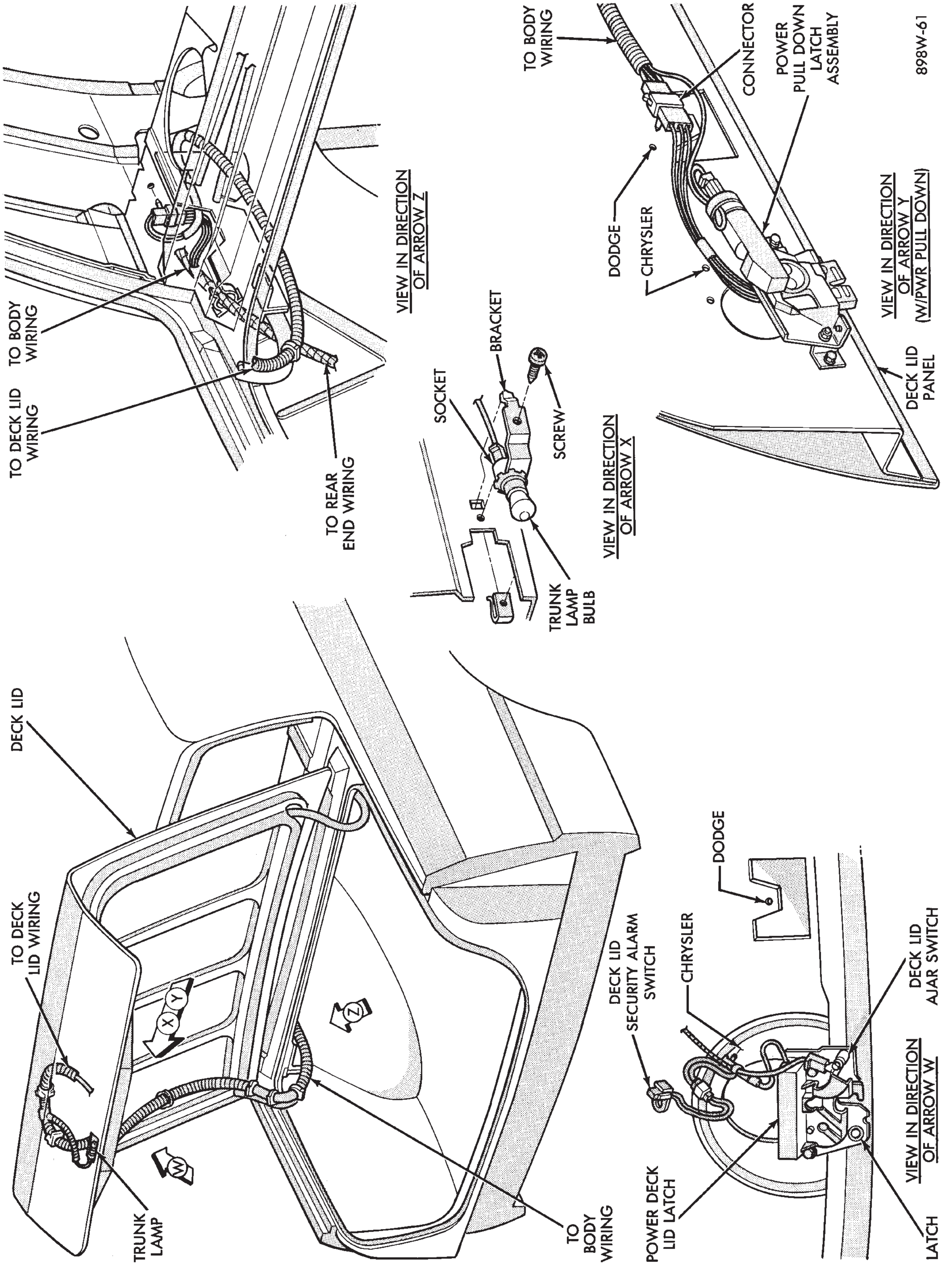


Fig. 5 Deck Lid Wiring AC Body

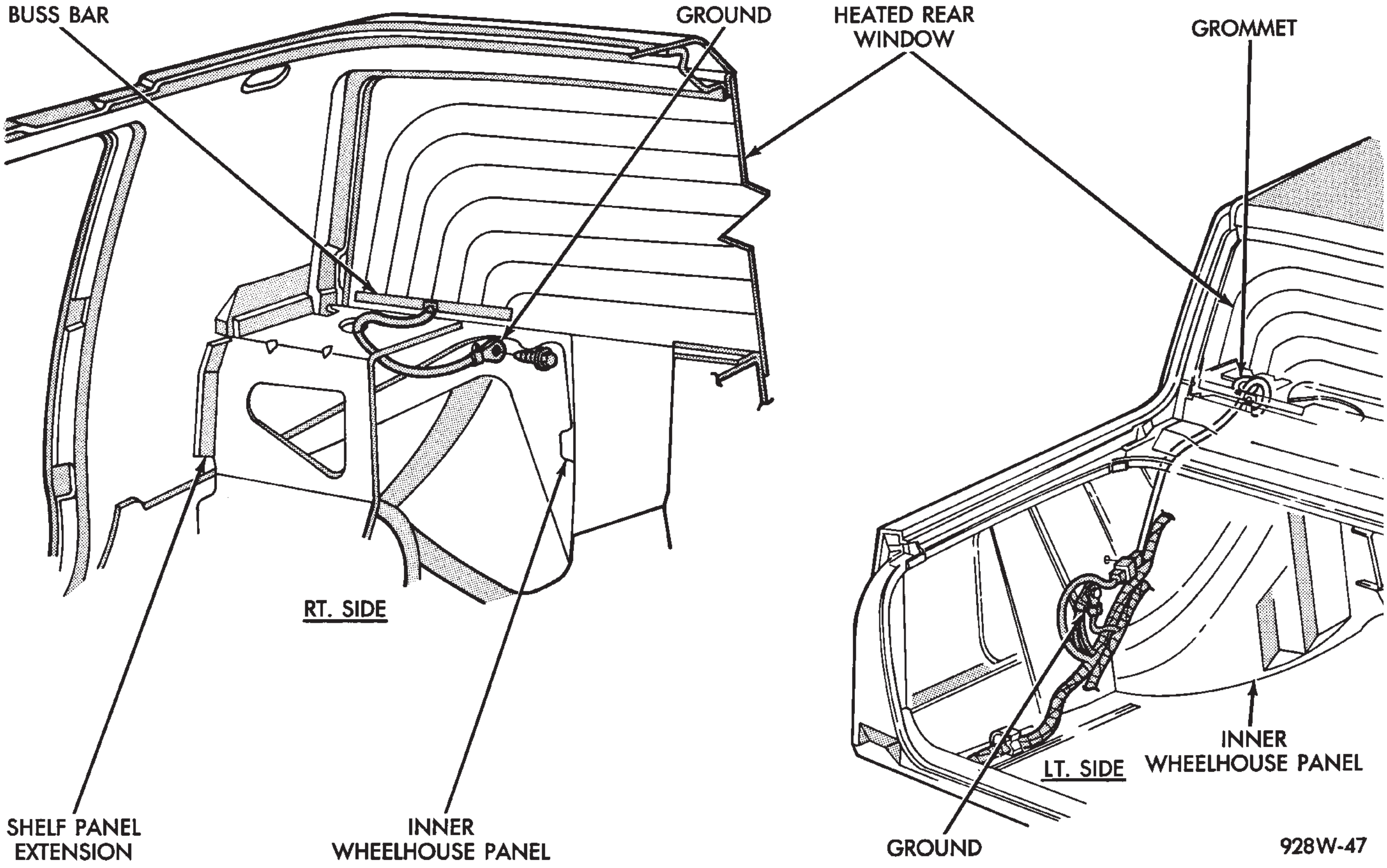


Fig. 6 Heated Rear Window Wiring AC Body

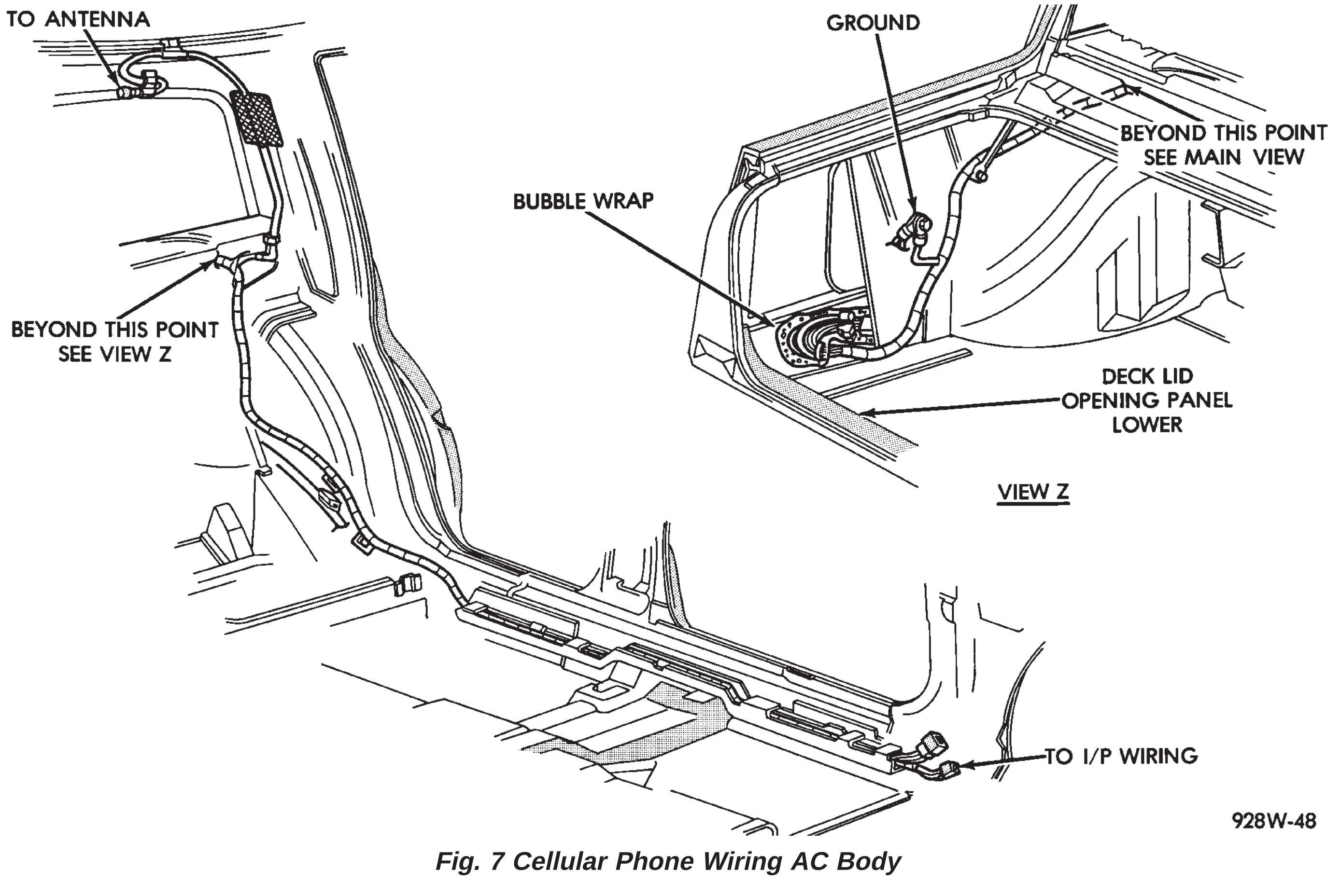


Fig. 7 Cellular Phone Wiring AC Body

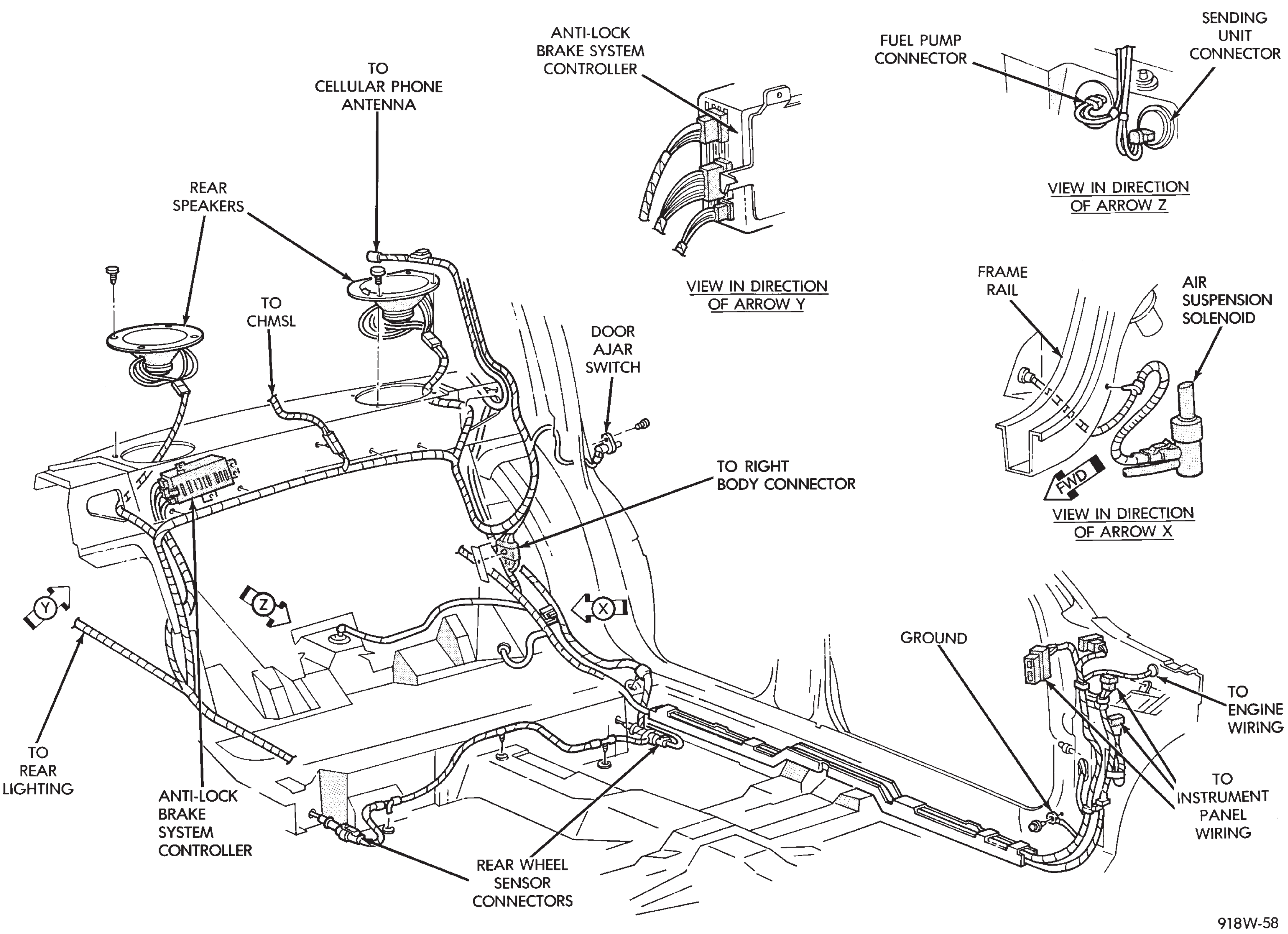


Fig. 8 Body Left Side Wiring AC Body

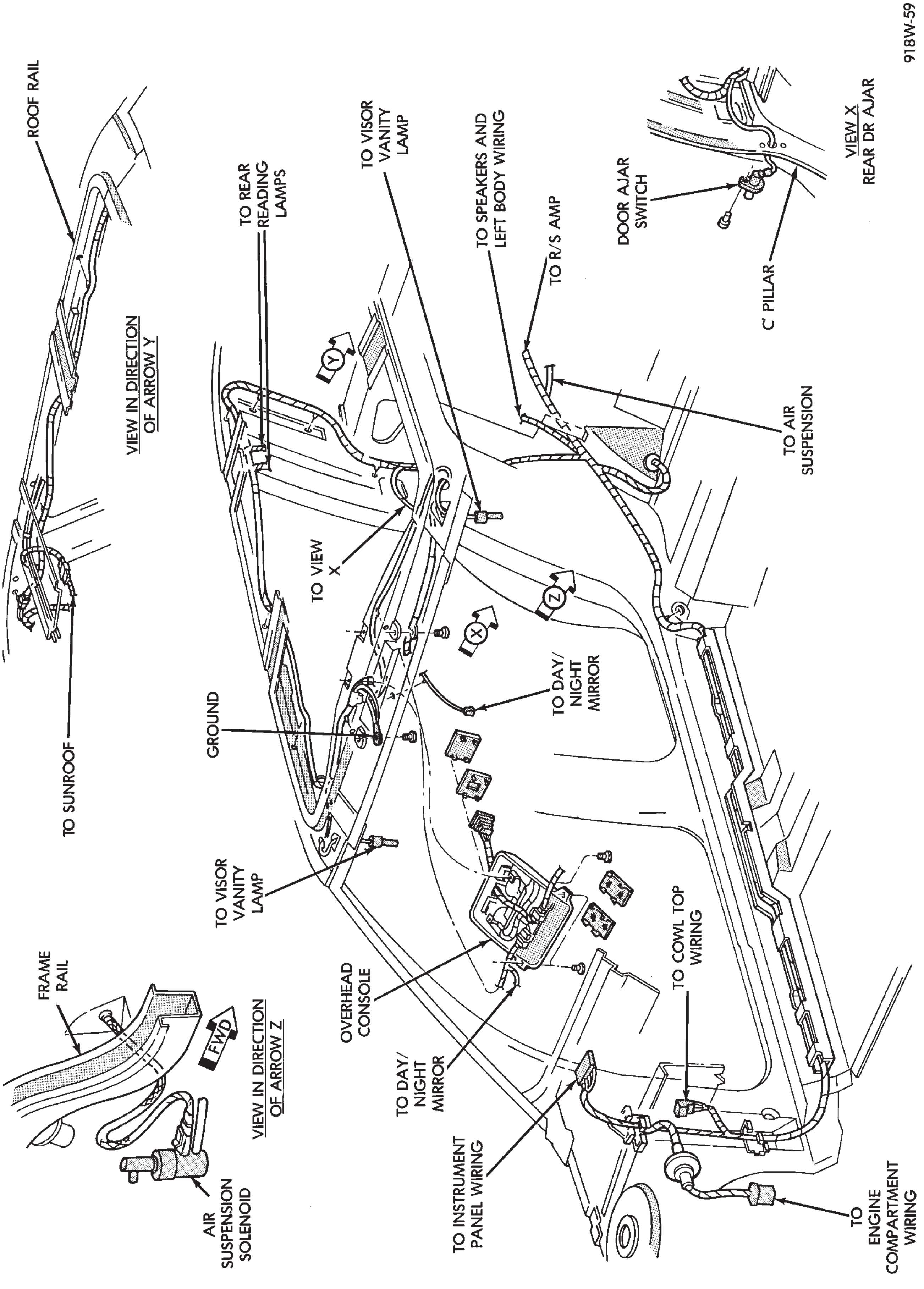


Fig. 9 Body Right Side Wiring AC Body

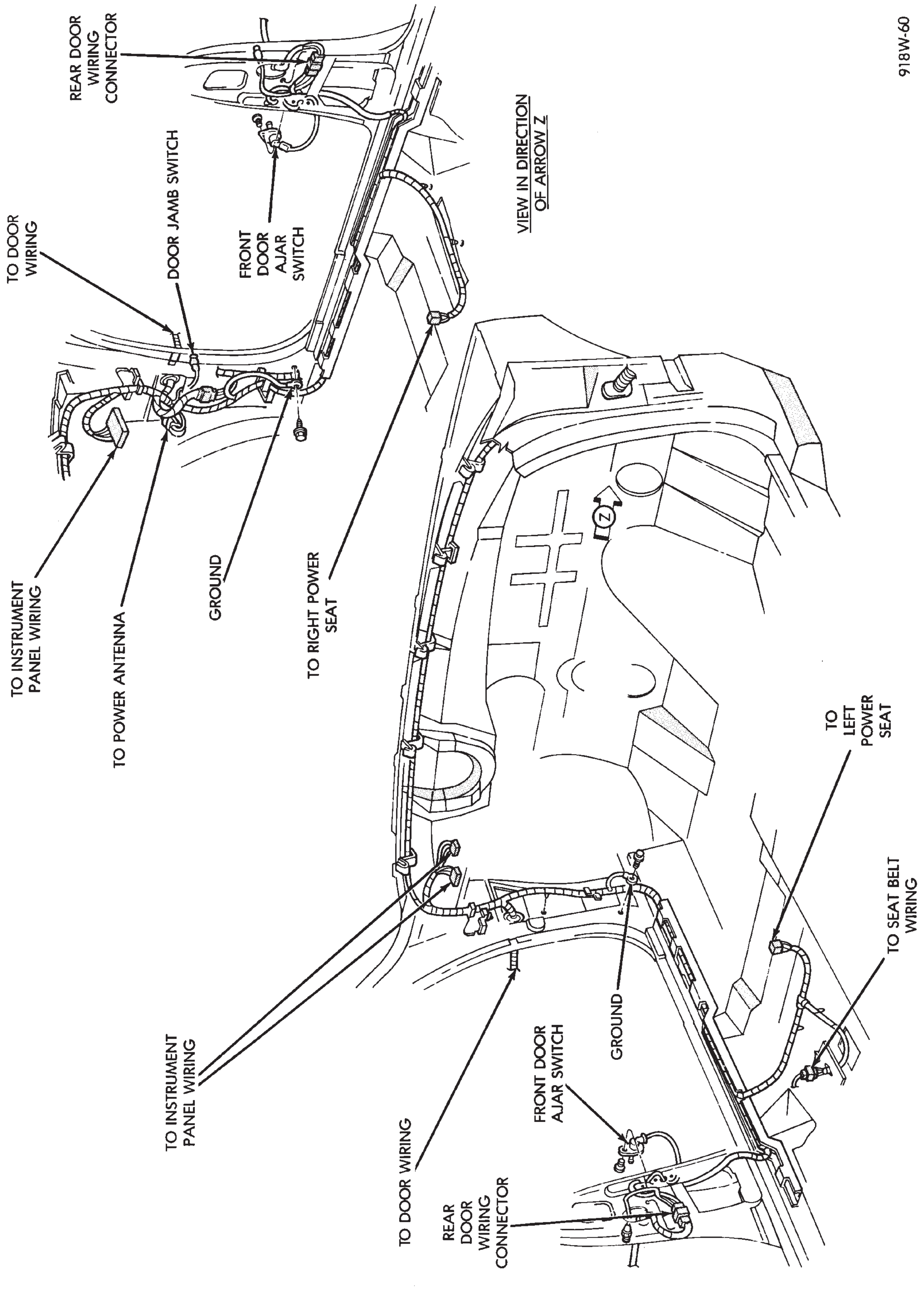


Fig. 10 Door Wiring (Body) AC Body

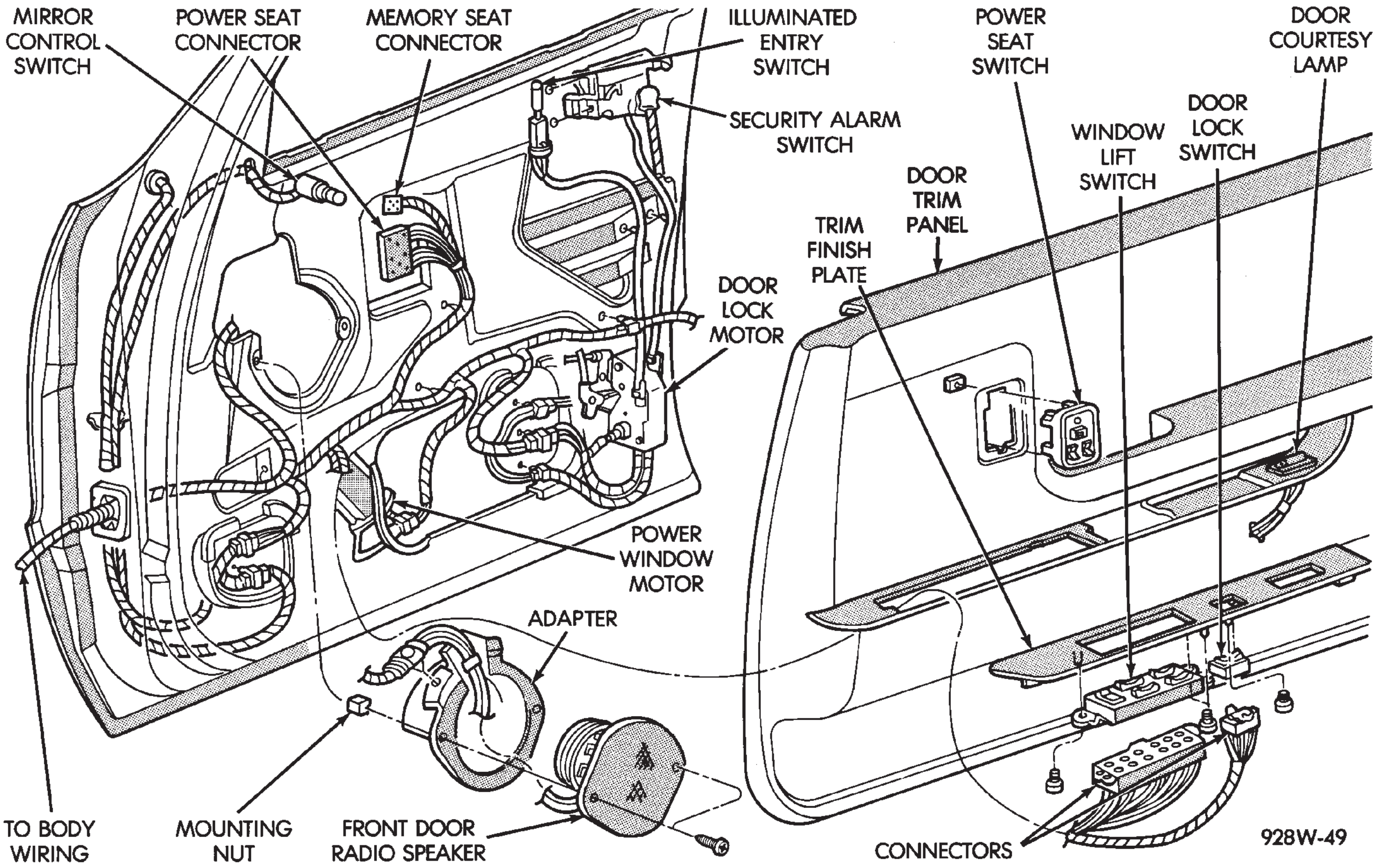


Fig. 11 Door Wiring (Front) AC Body

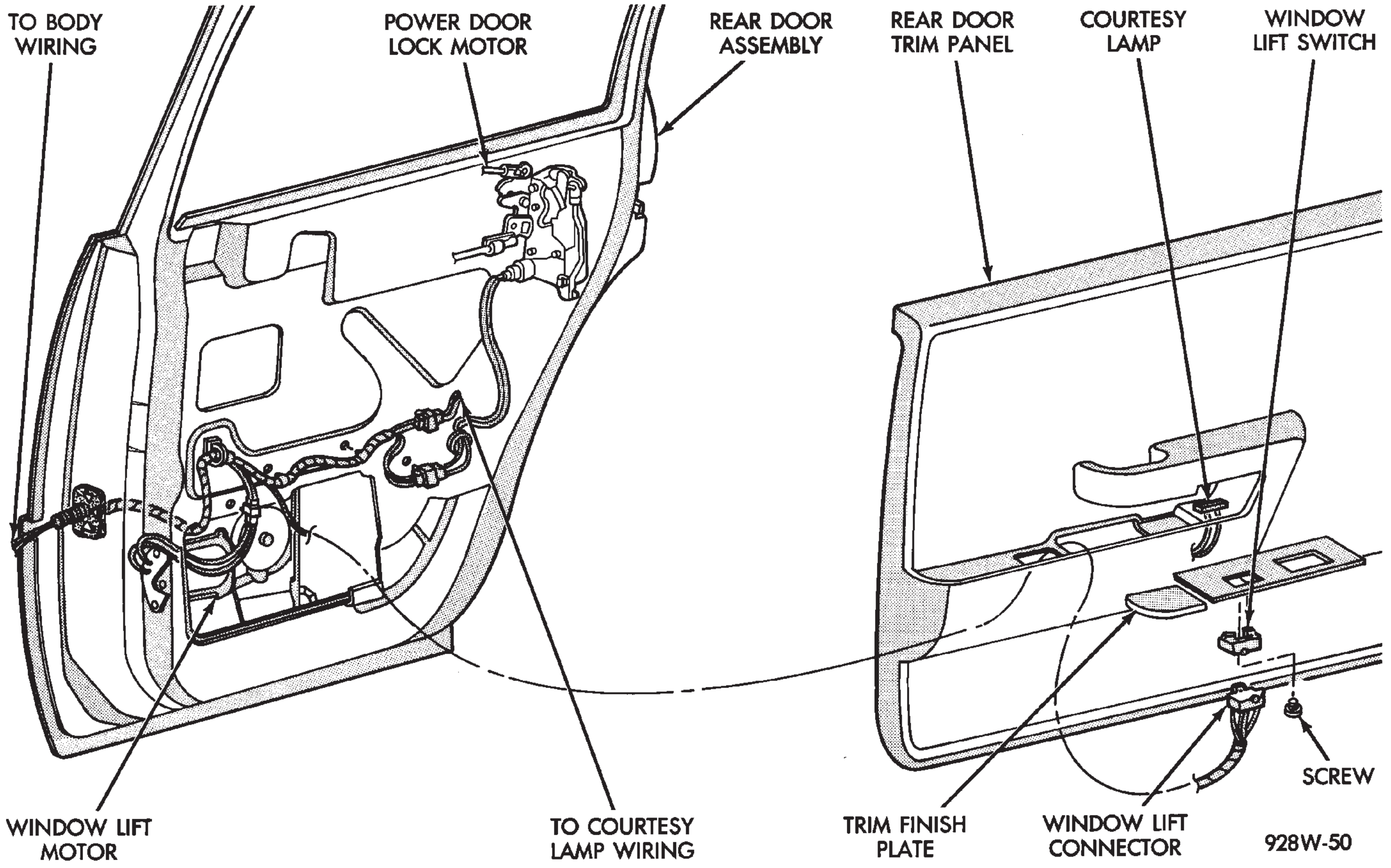


Fig. 12 Door Wiring (Rear) AC Body

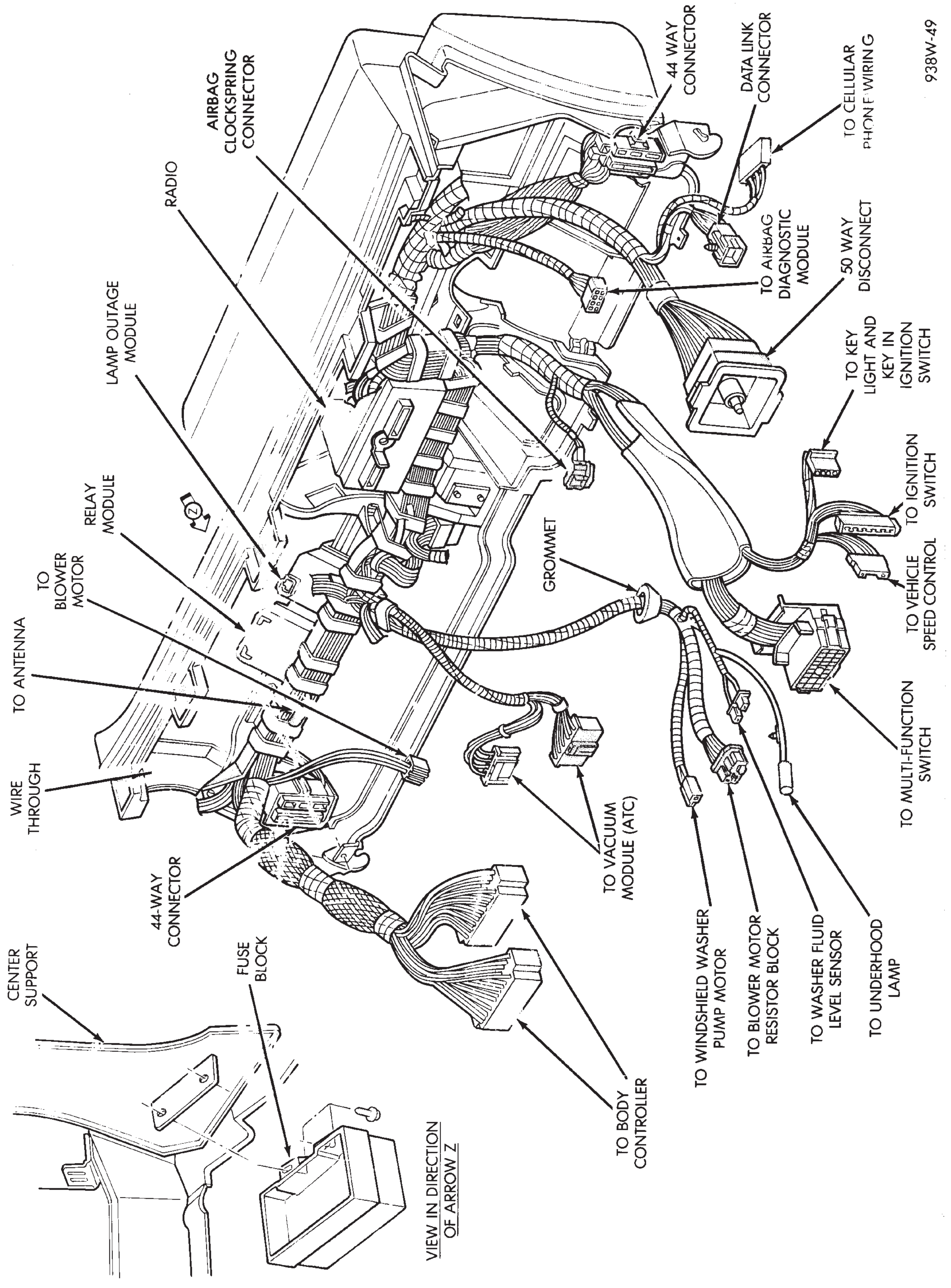


Fig. 13 Instrument Panel Wiring (Routing) AC Body

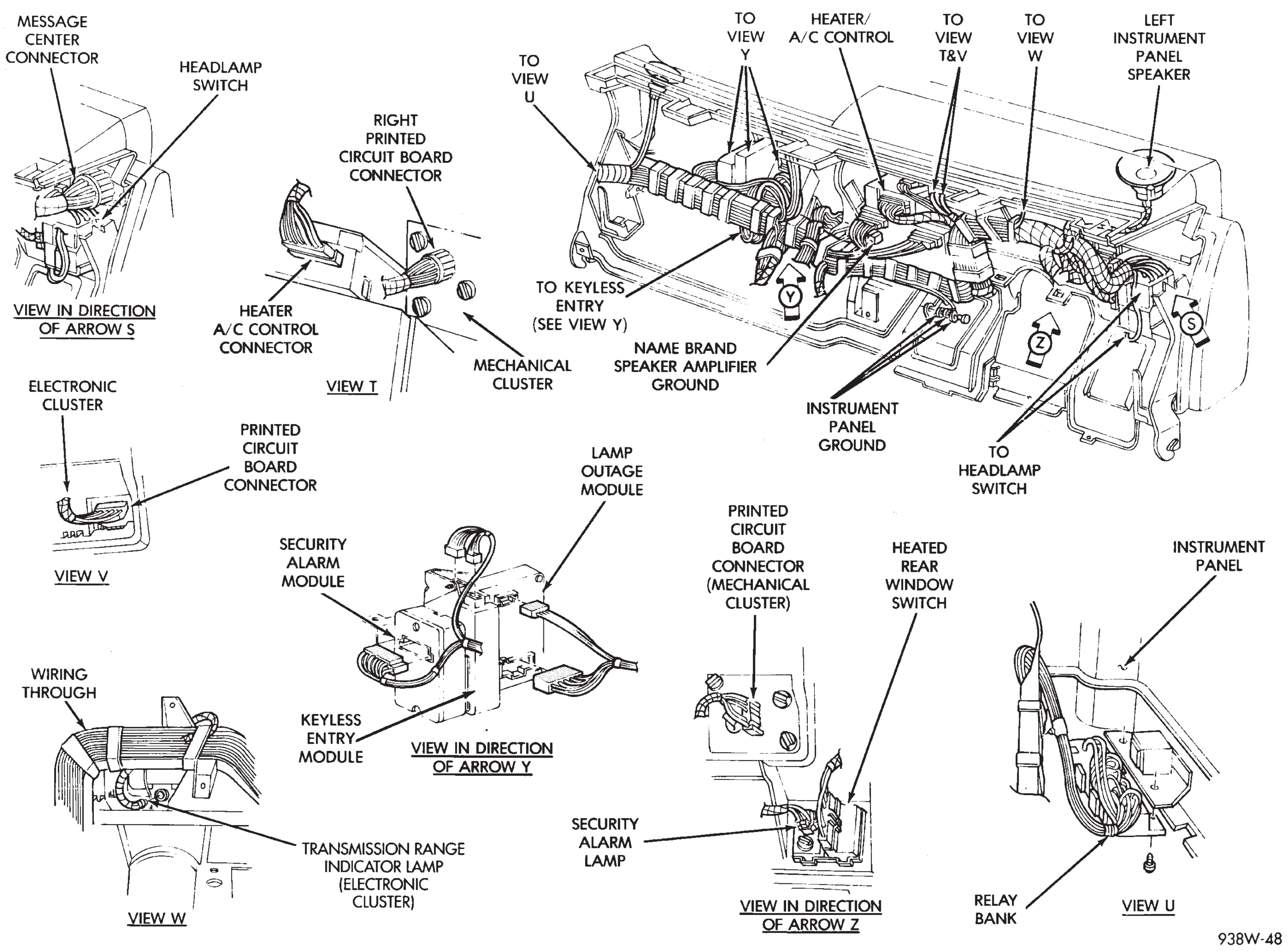


Fig. 14 Instrument Panel Wiring (Connections) AC Body

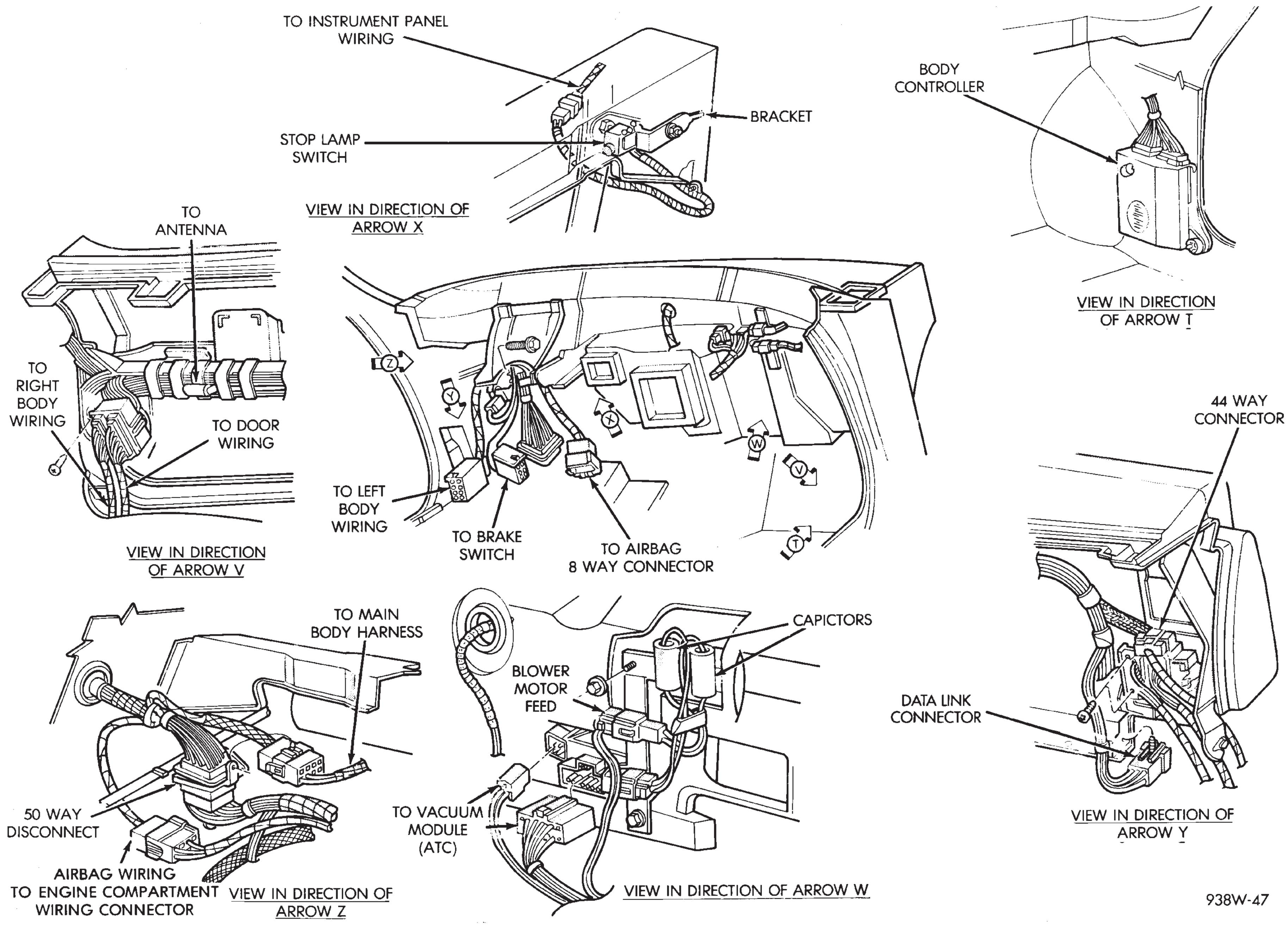


Fig. 15 Instrument Panel Wiring (I.P to Body Connections) AC Body

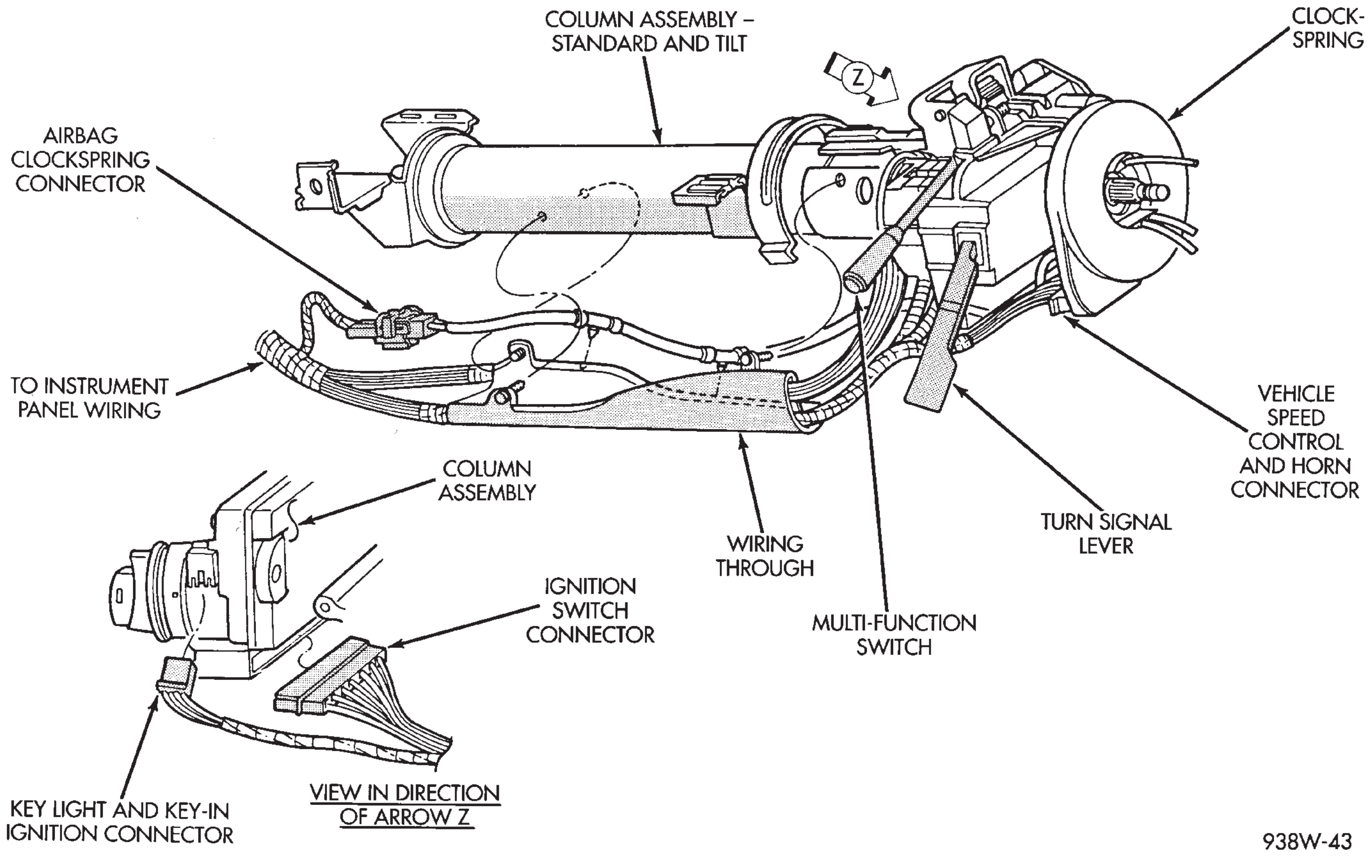


Fig. 16 Steering Column Wiring AC Body

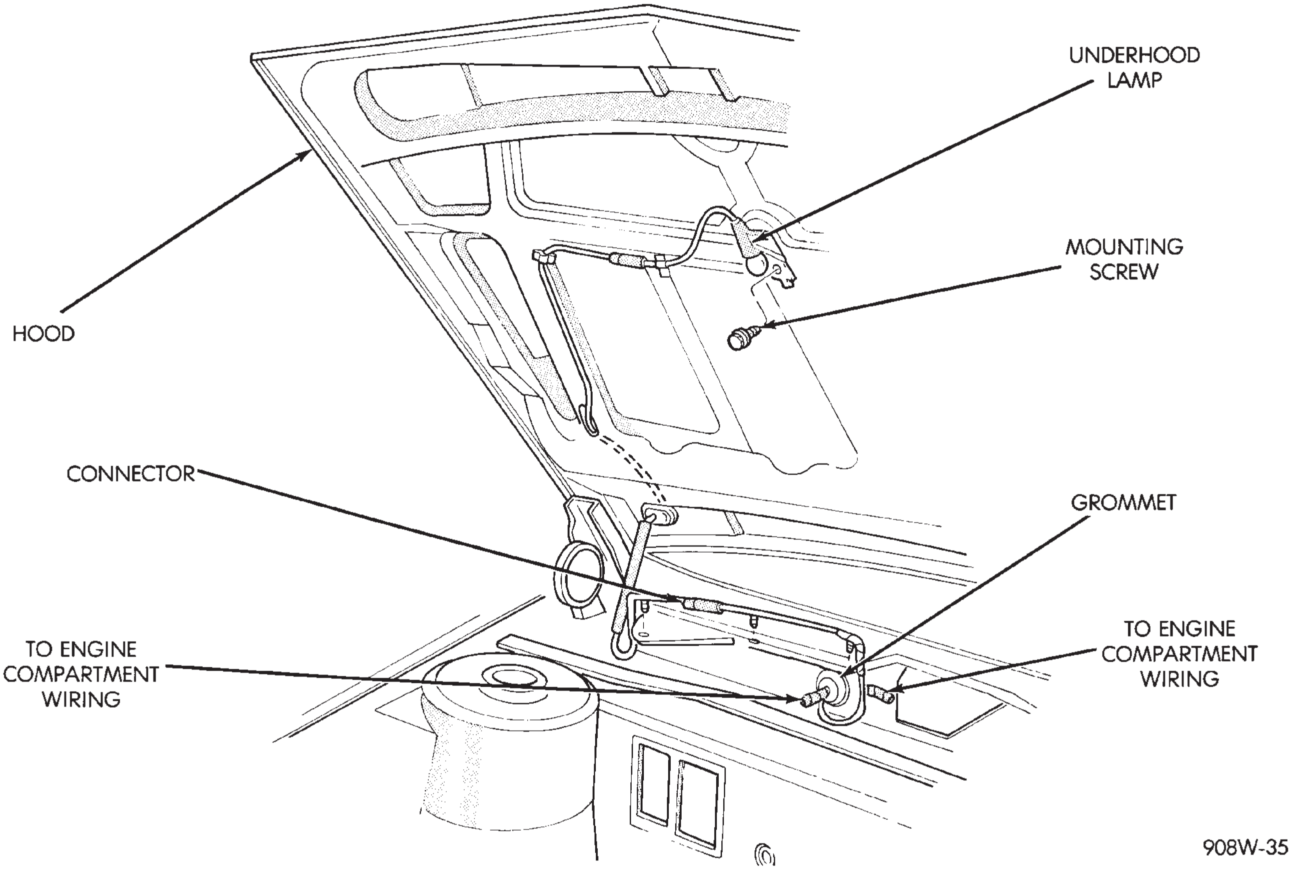


Fig. 17 Underhood Lamp Wiring

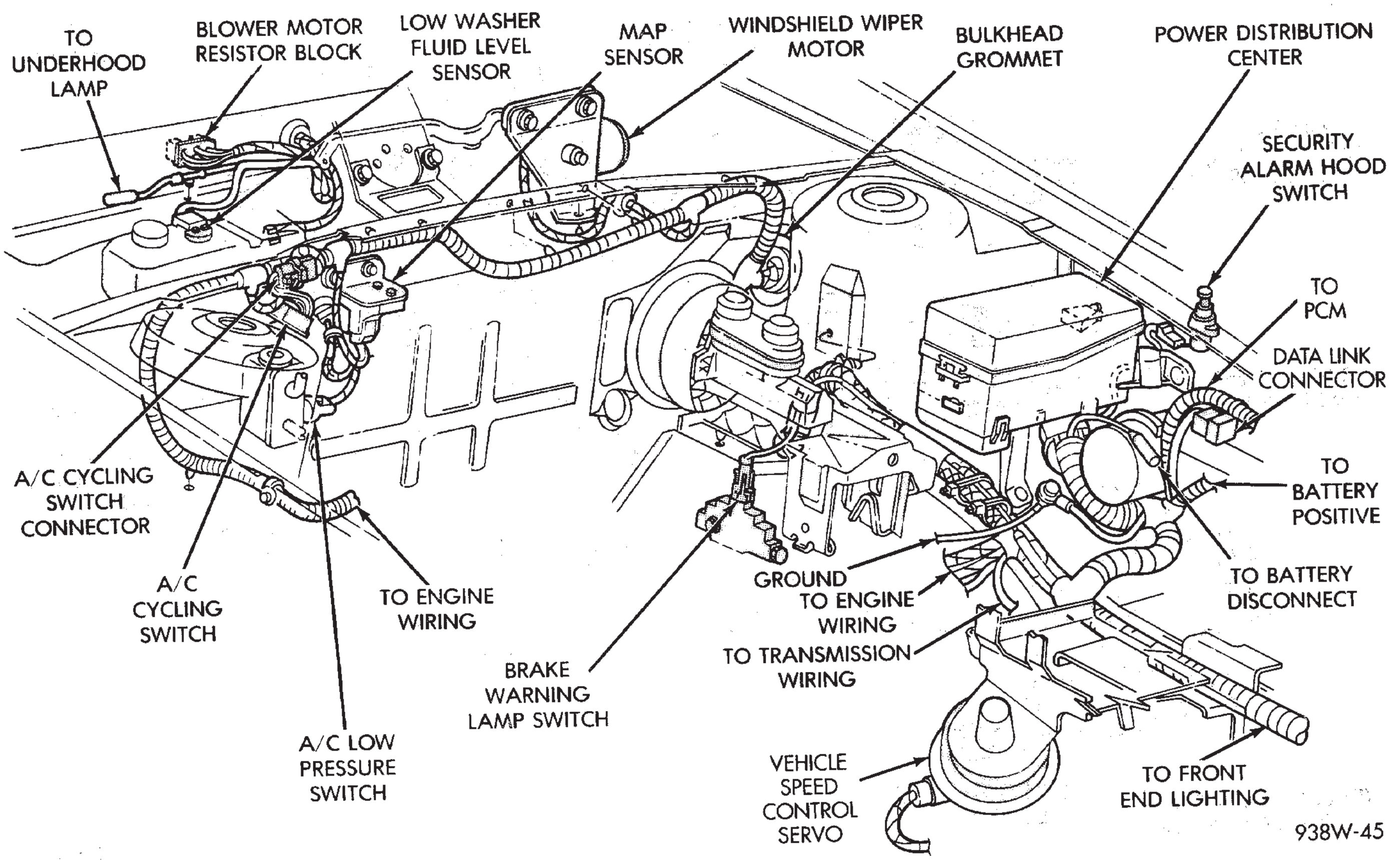


Fig. 18 Engine Compartment Wiring 2.5L AC Body

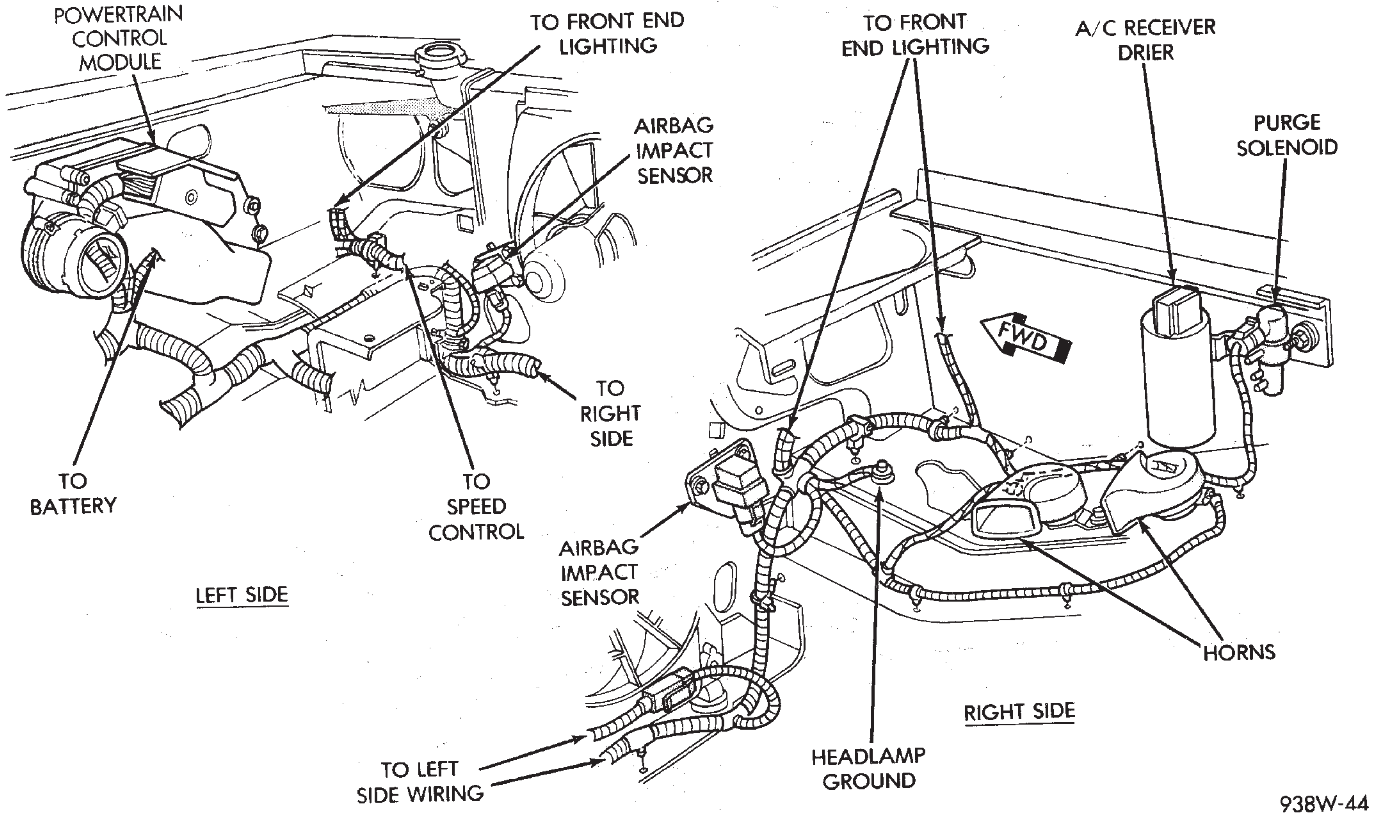


Fig. 19 Engine Compartment Wiring 2.5L AC Body

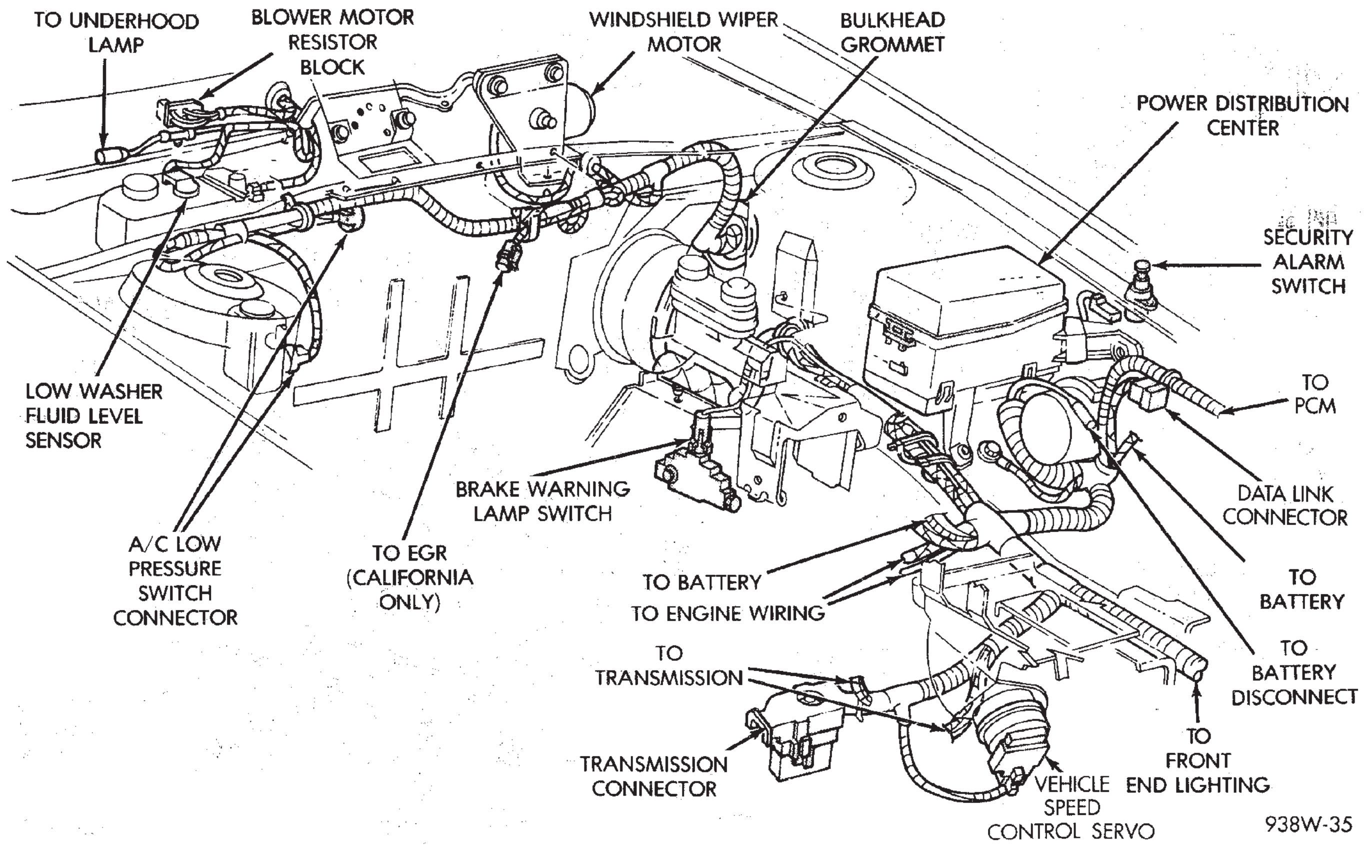


Fig. 20 Engine Compartment Wiring 3.0L AC Body

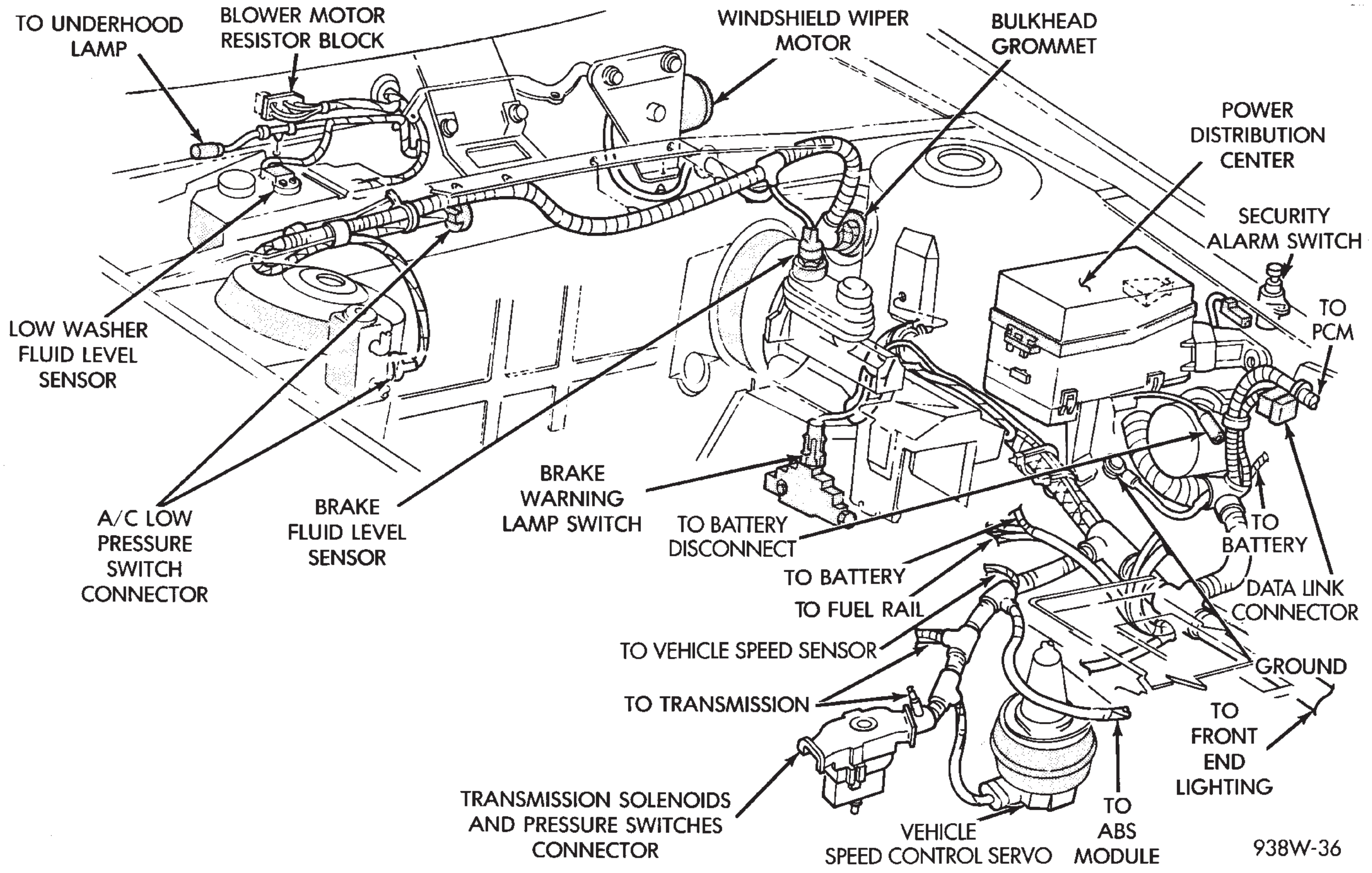


Fig. 21 Engine Compartment Wiring 3.3L, 3.8L AC Body

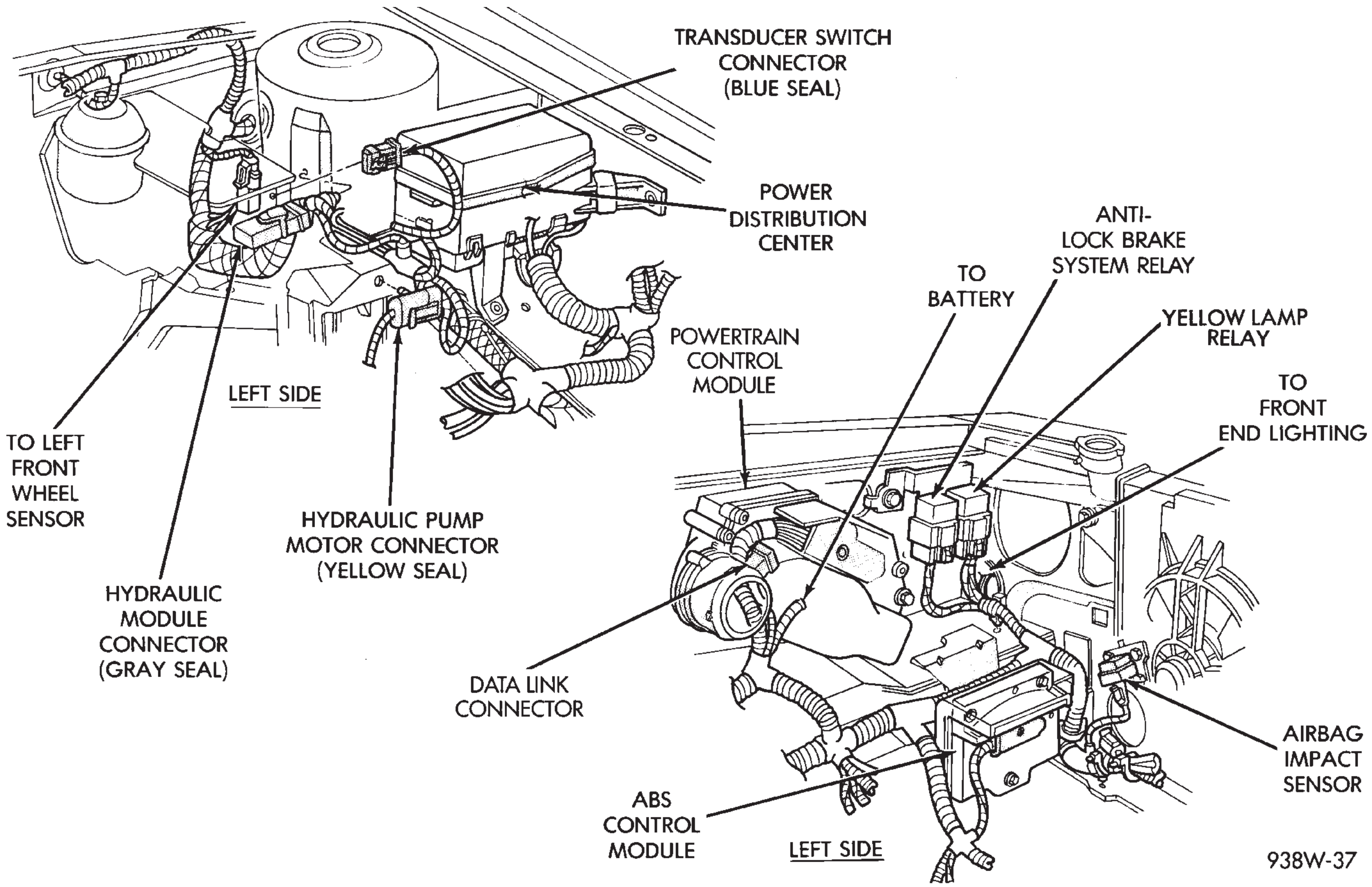


Fig. 22 Engine Compartment Wiring 3.0L and 3.3L, 3.8L AC Body

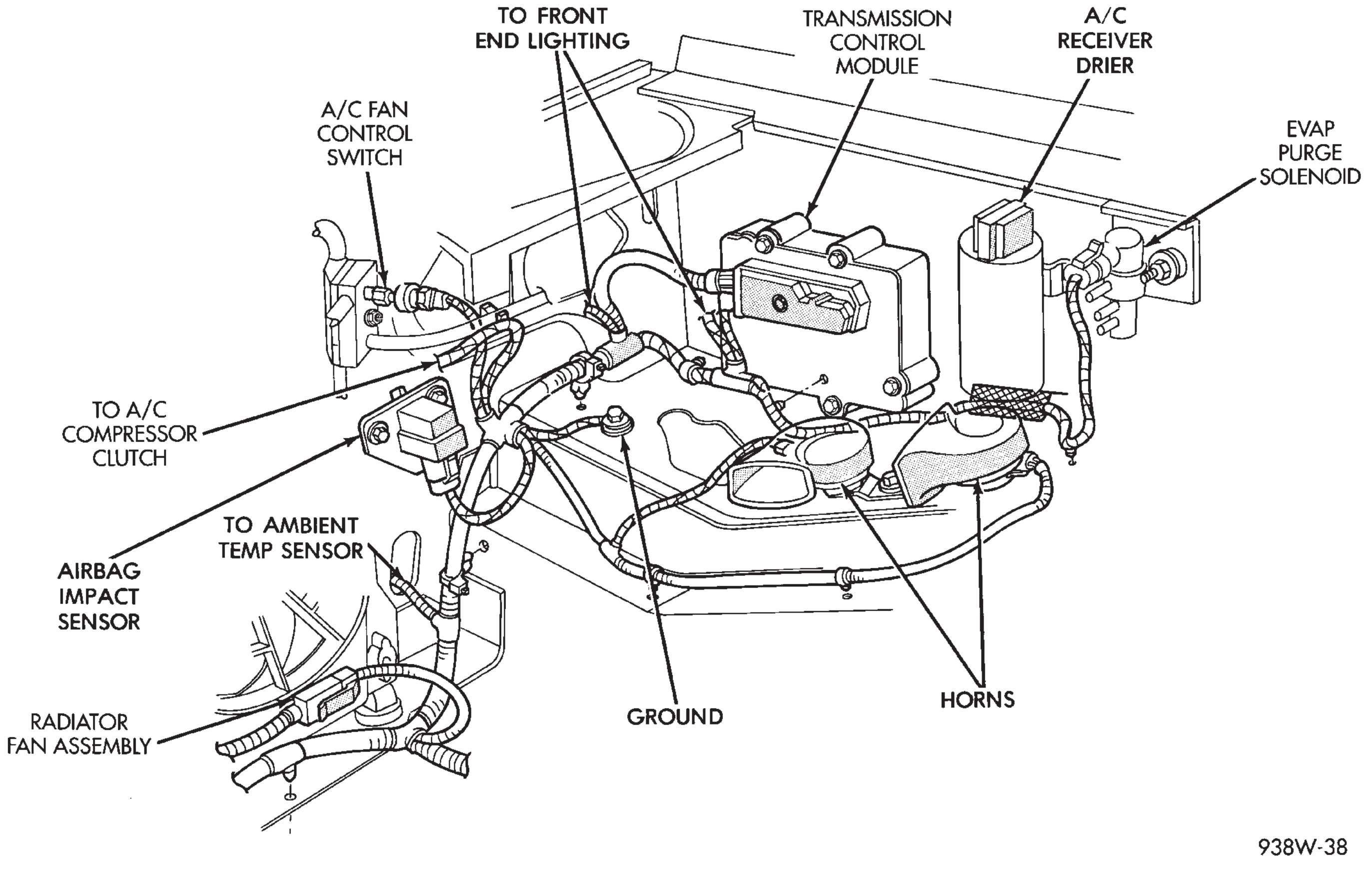


Fig. 23 Engine Compartment Wiring 3.0L and 3.3L, 3.8L AC Body

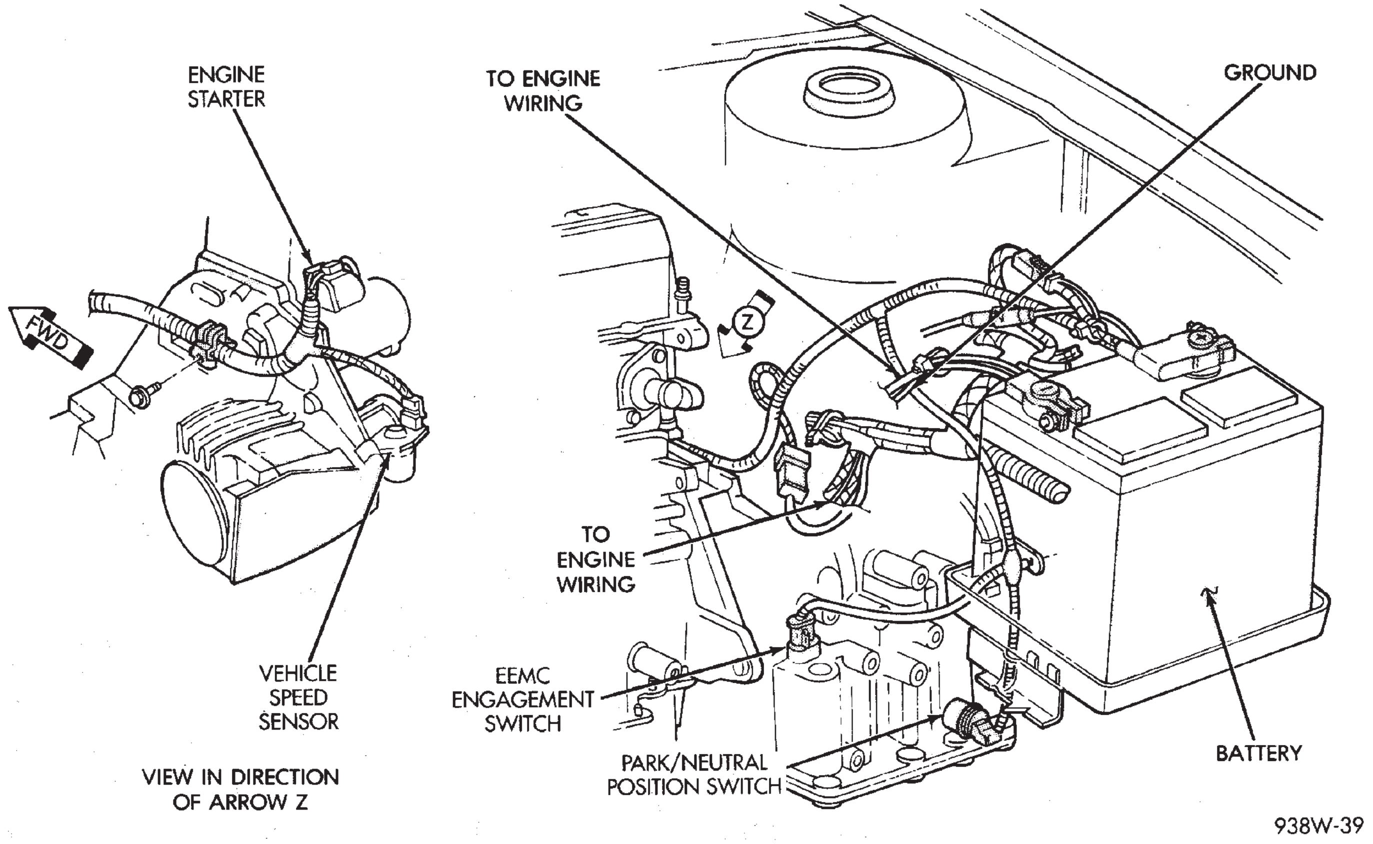


Fig. 24 Transmission Wiring 2.5L AC Body

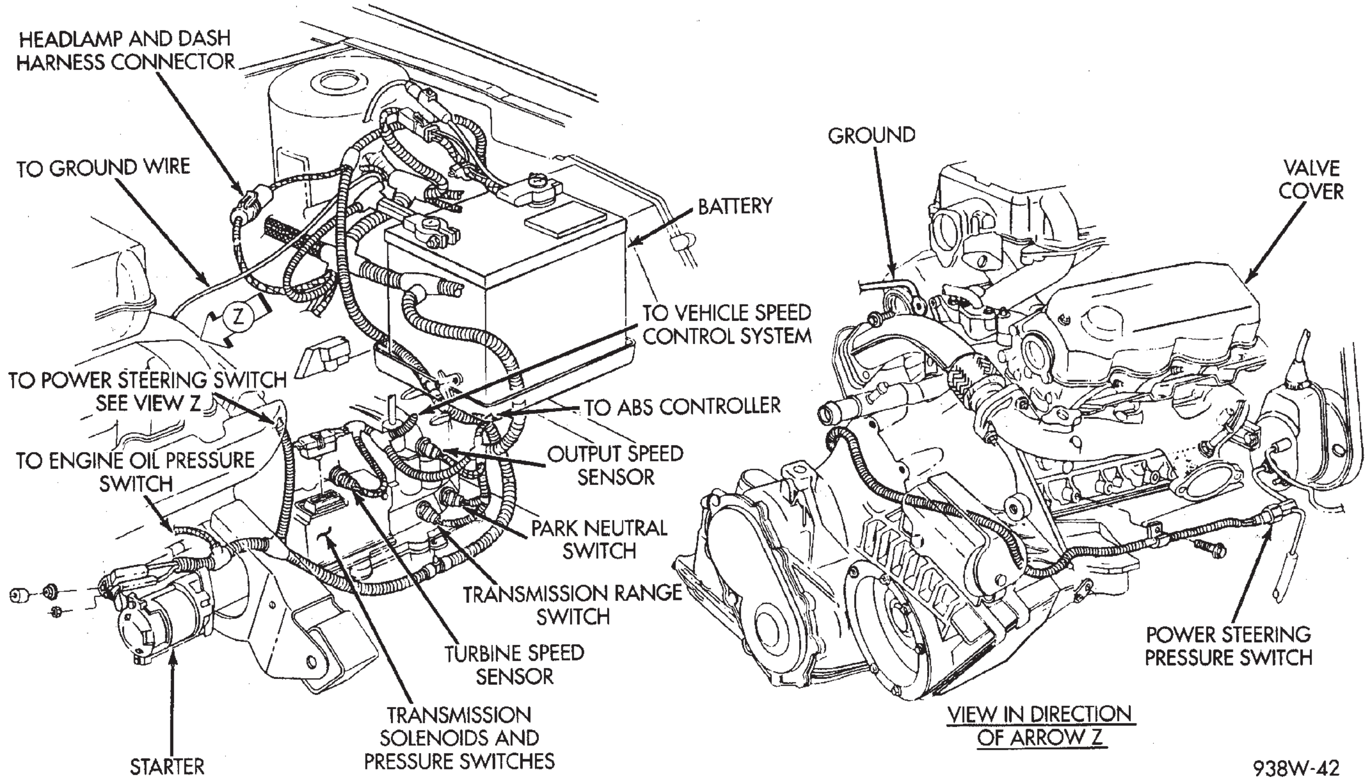


Fig. 25 Transmission Wiring 3.0L AC Body

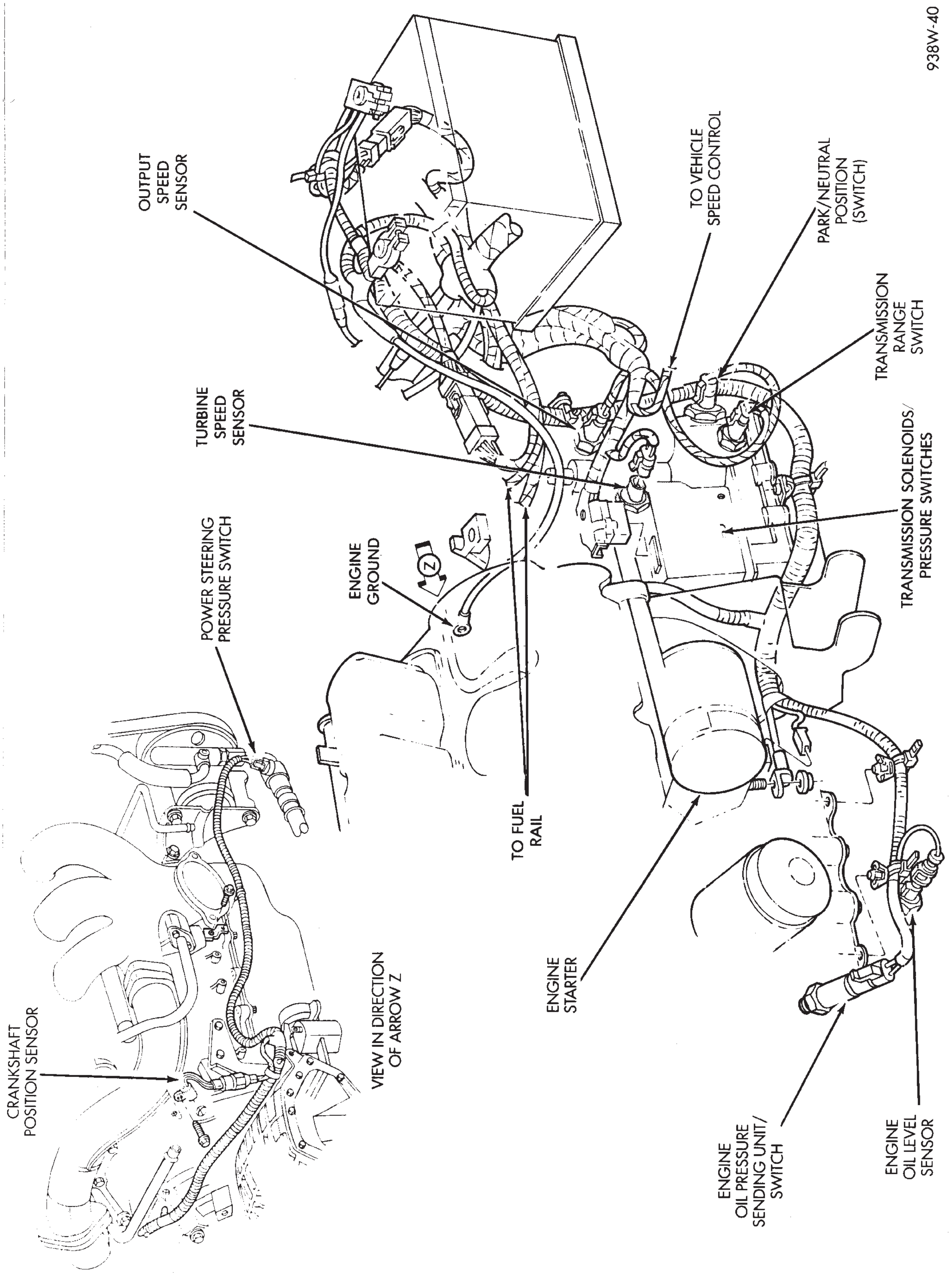


Fig. 26 Transmission Wiring 3.3L, 3.8L AC Body

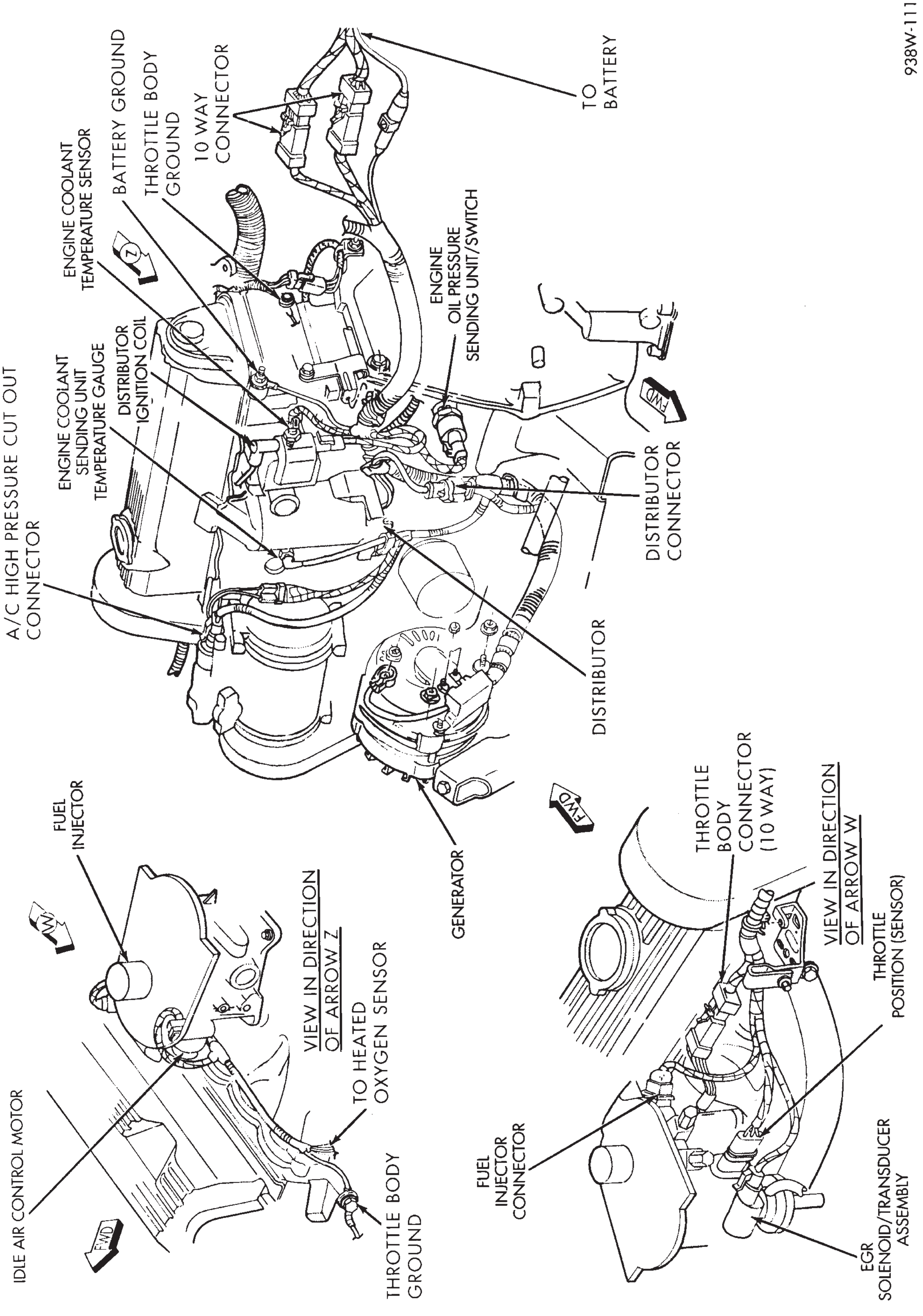


Fig. 27 Engine Wiring 2.5L

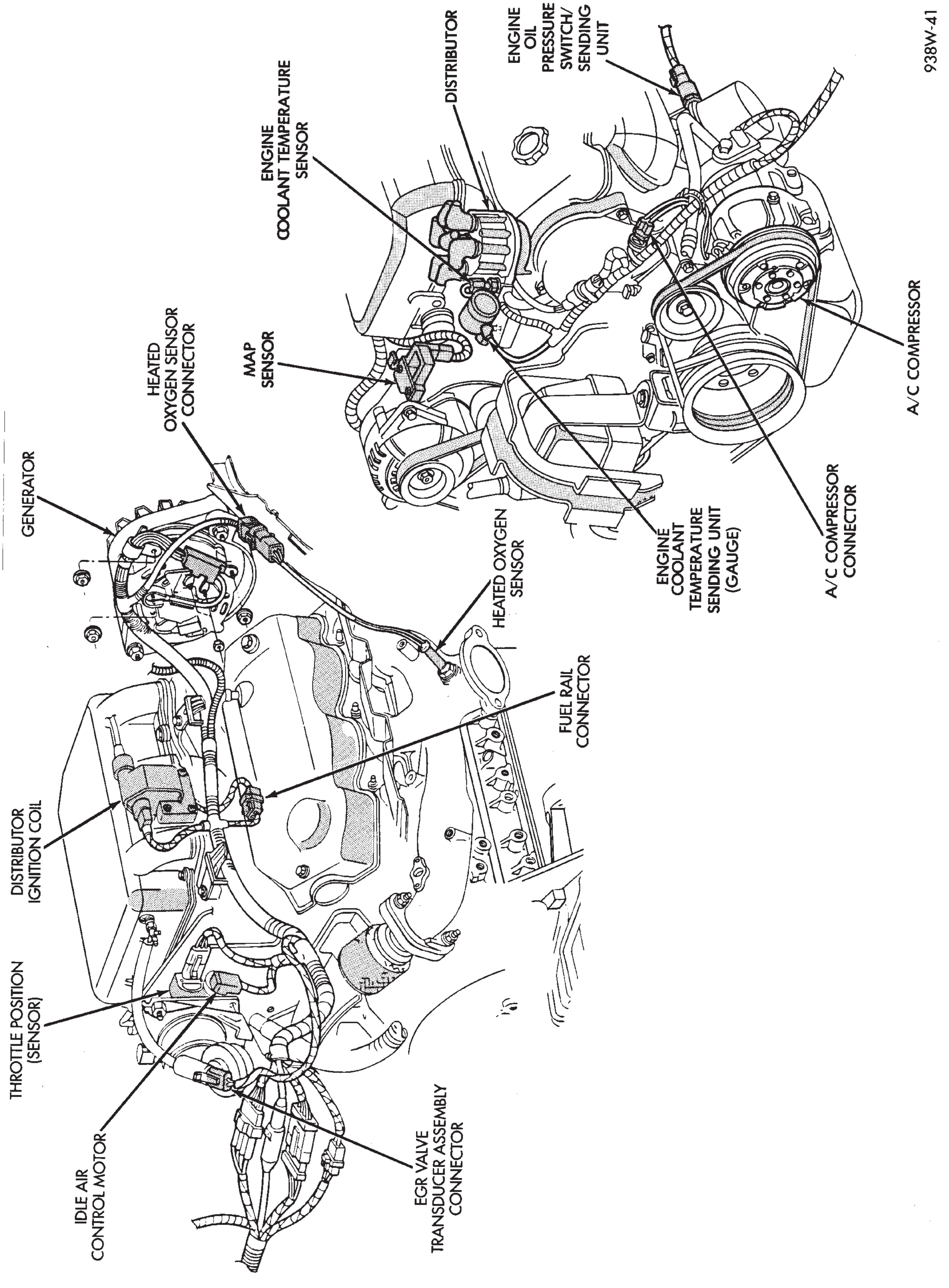


Fig. 28 Engine Wiring 3.0L AC Body

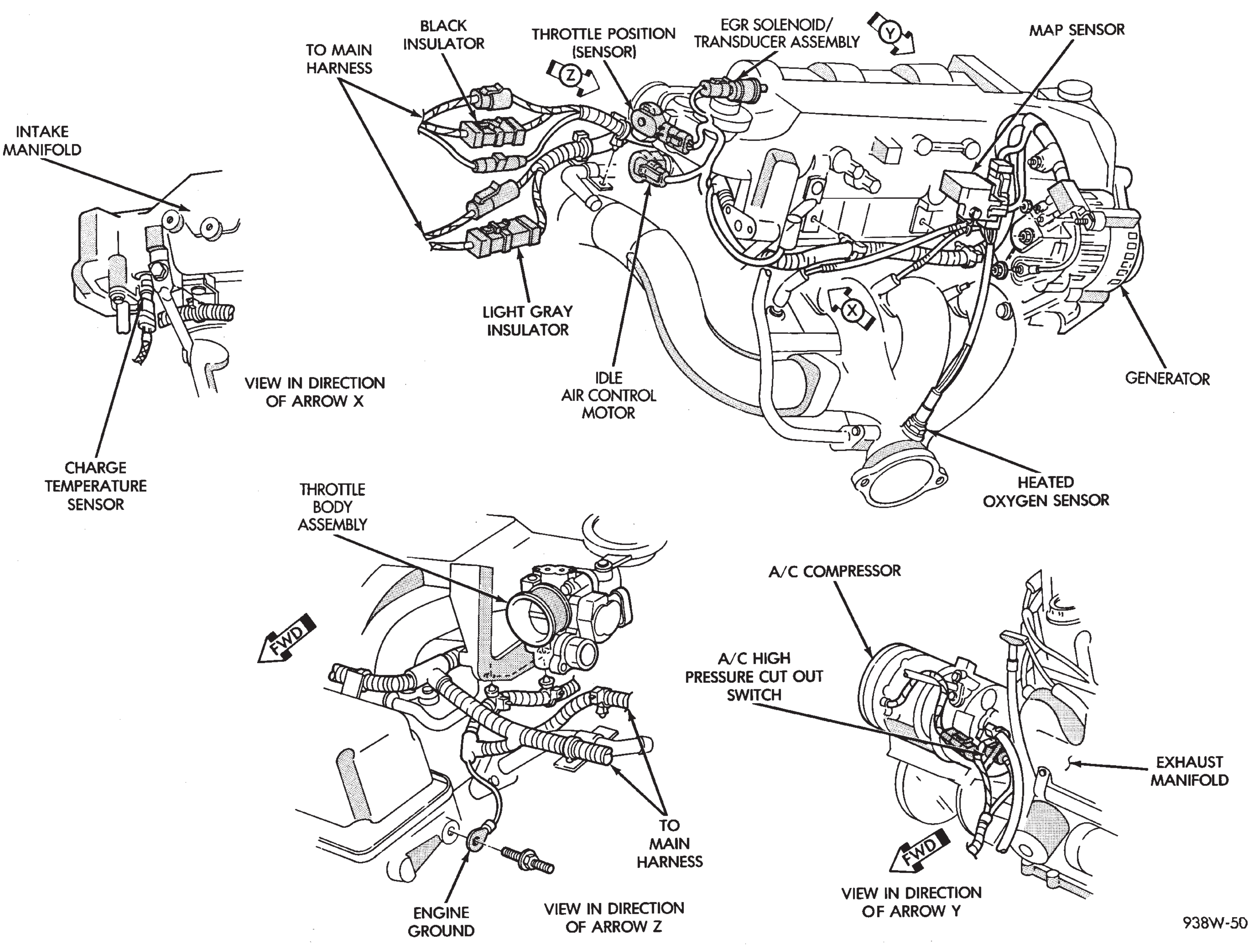


Fig. 29 Engine Wiring 3.3L, 3.8L AC Body

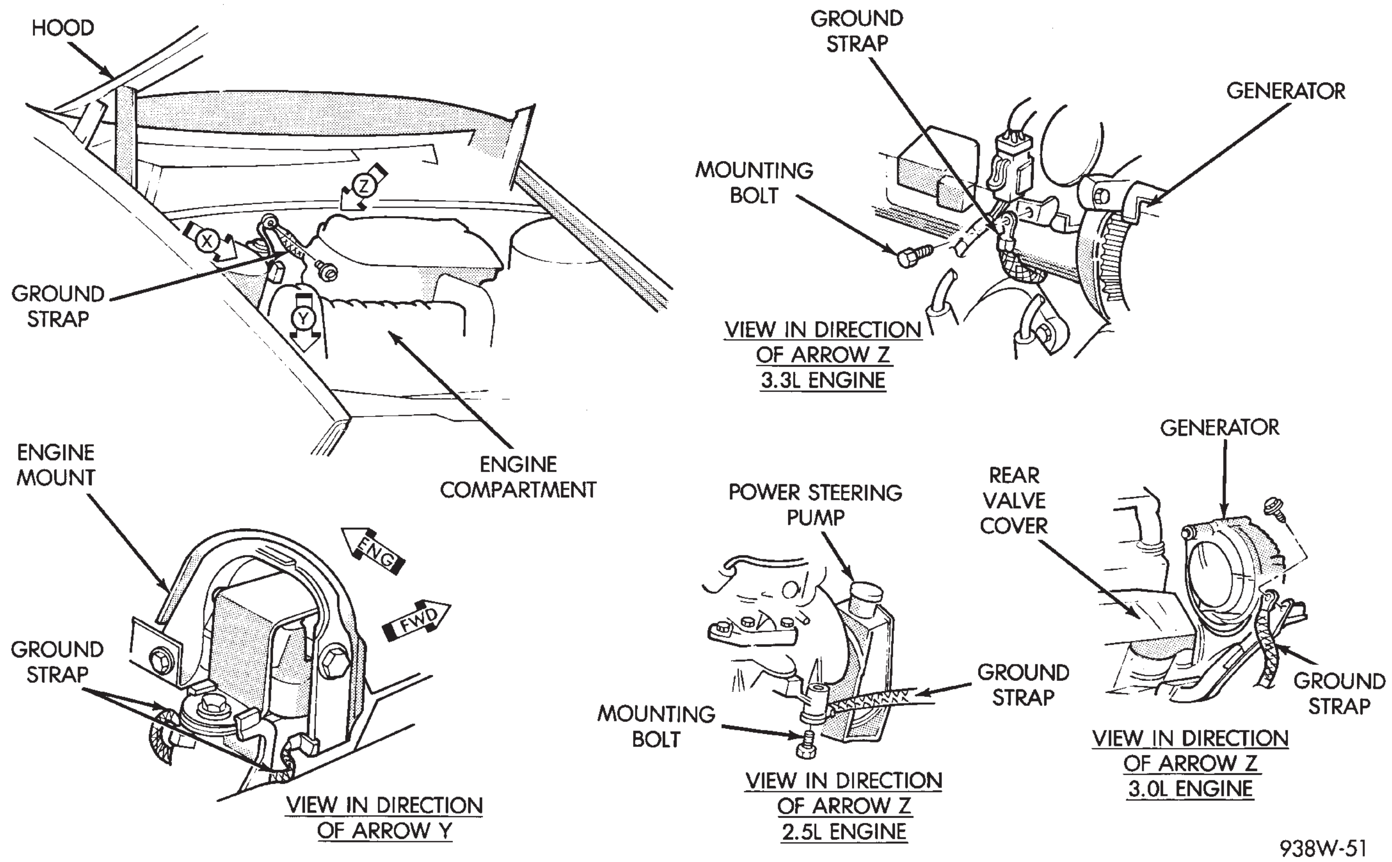


Fig. 30 Ground Strap Locations AC Body

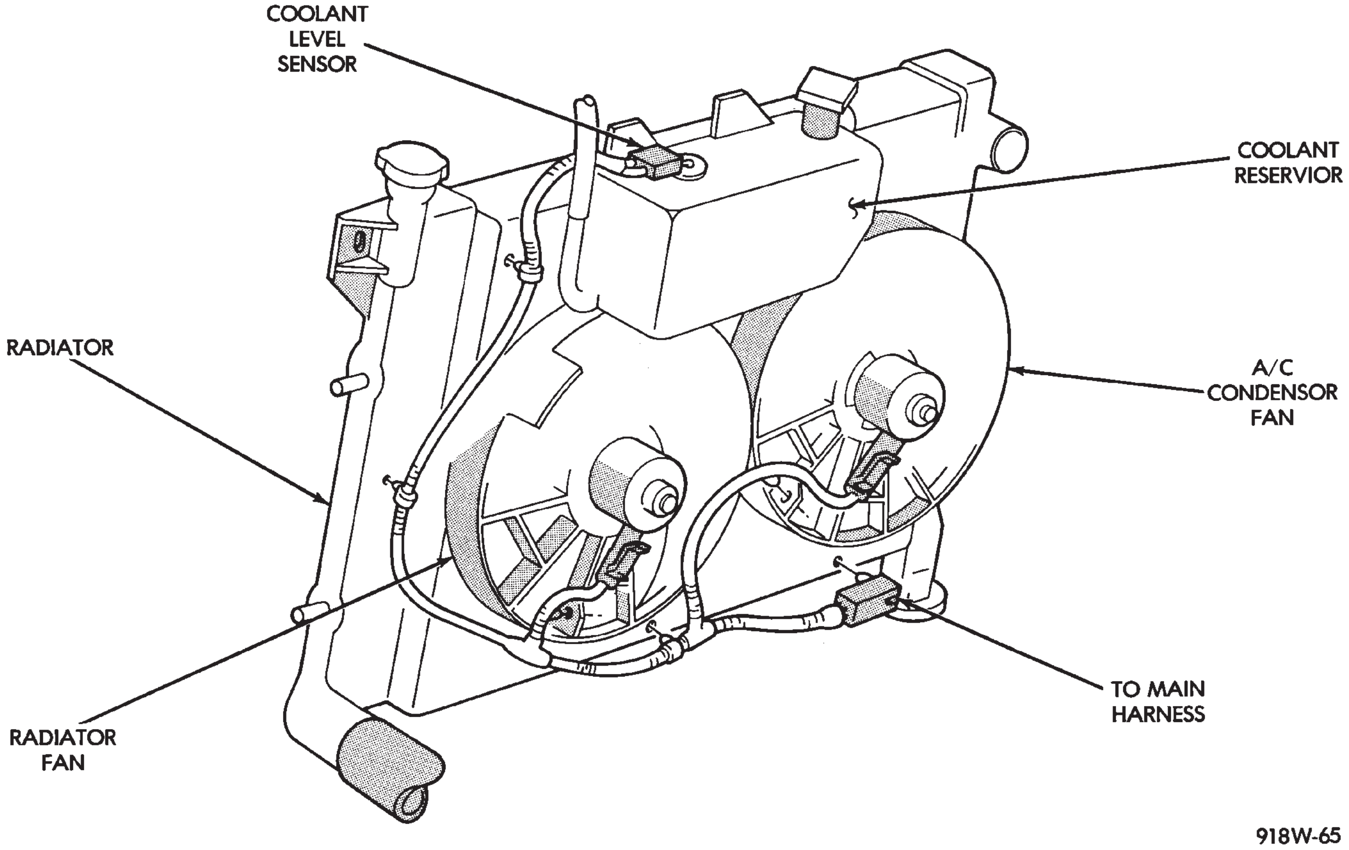


Fig 31 Radiator Fan Assembly AC Body

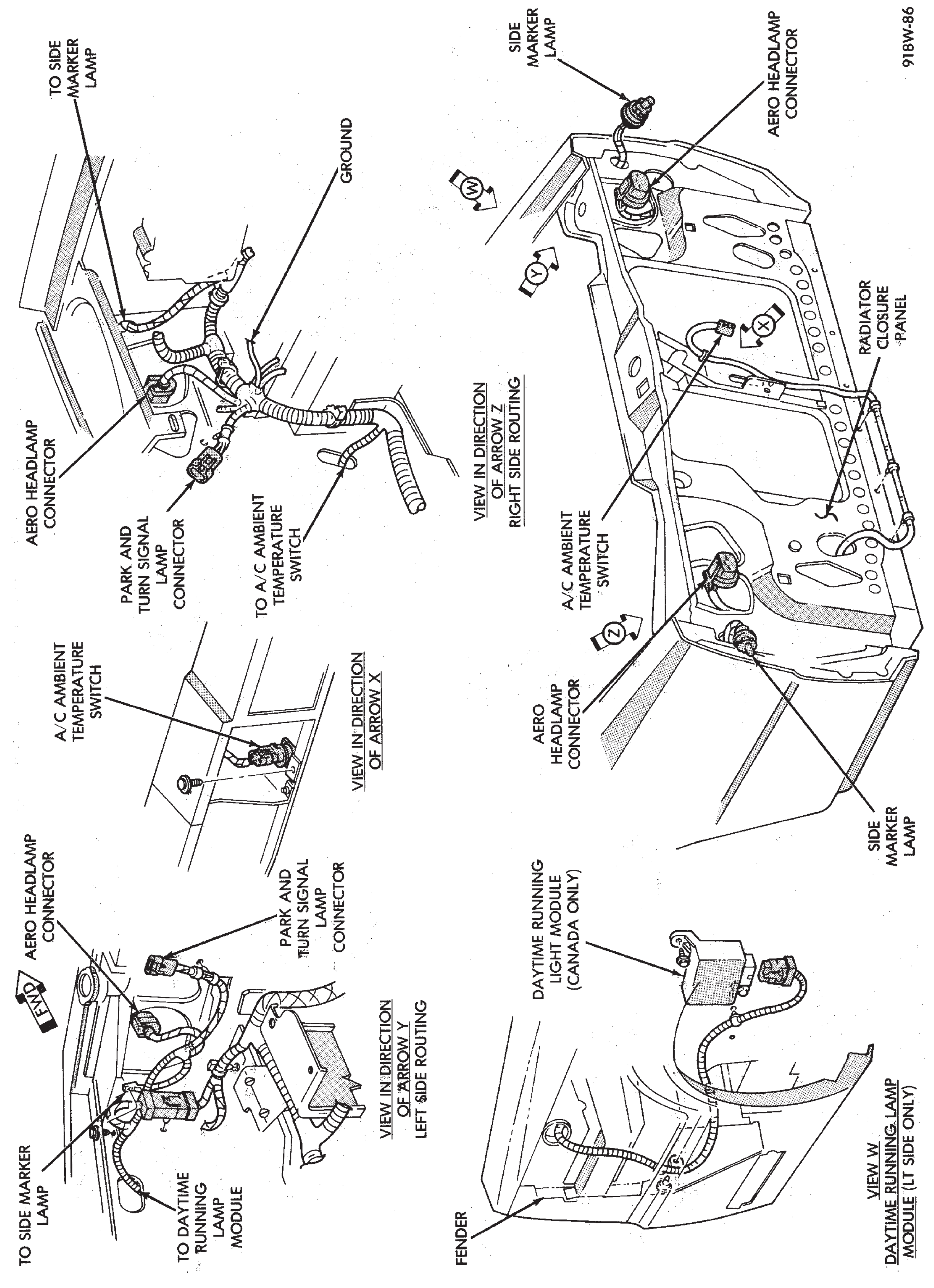


Fig. 32 Front End Lighting Wiring (Aero Headlamps) AC Body

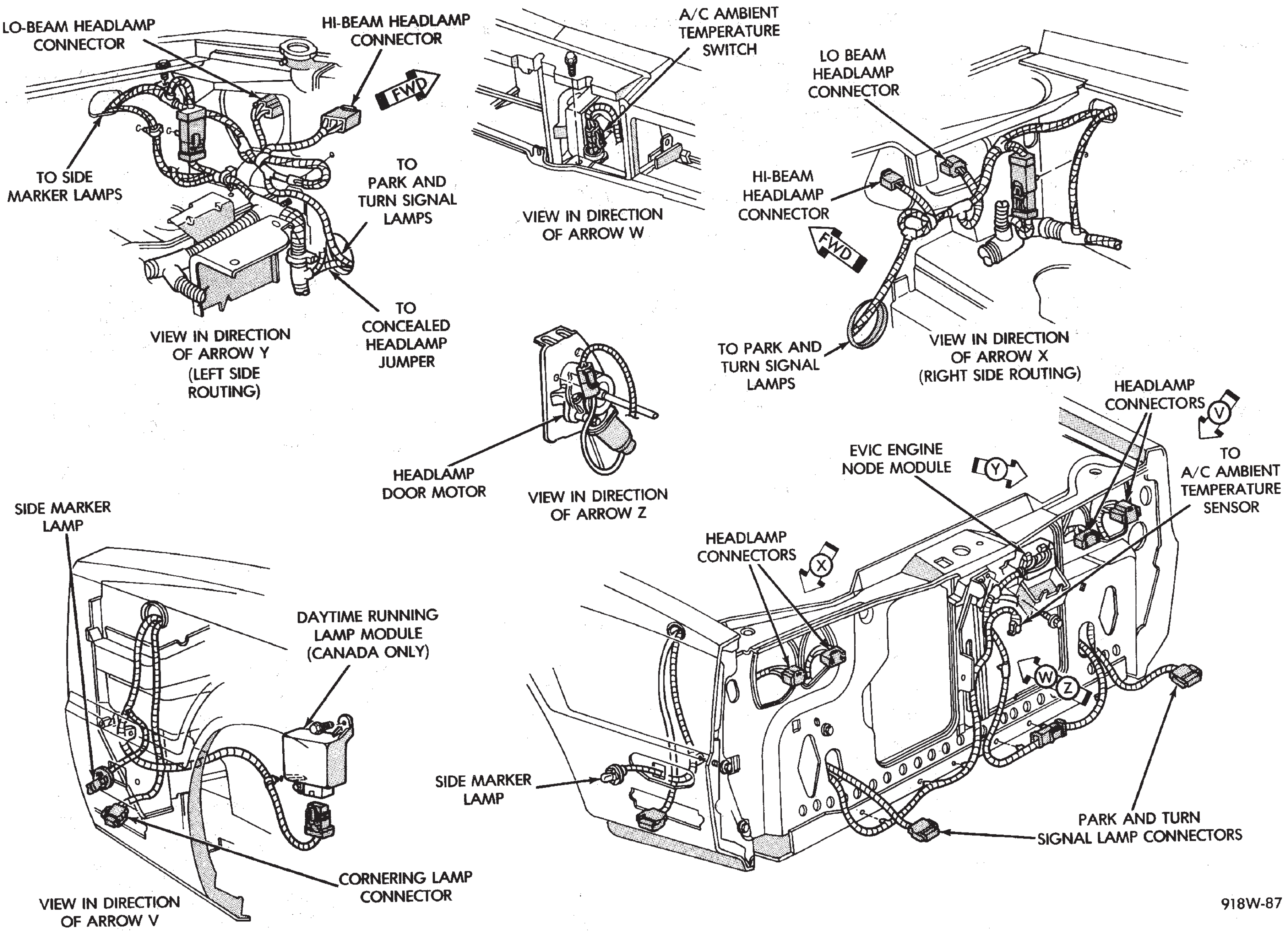


Fig. 33 Front End Lighting Wiring (Concealed Headlamps) AC Body

AG BODY

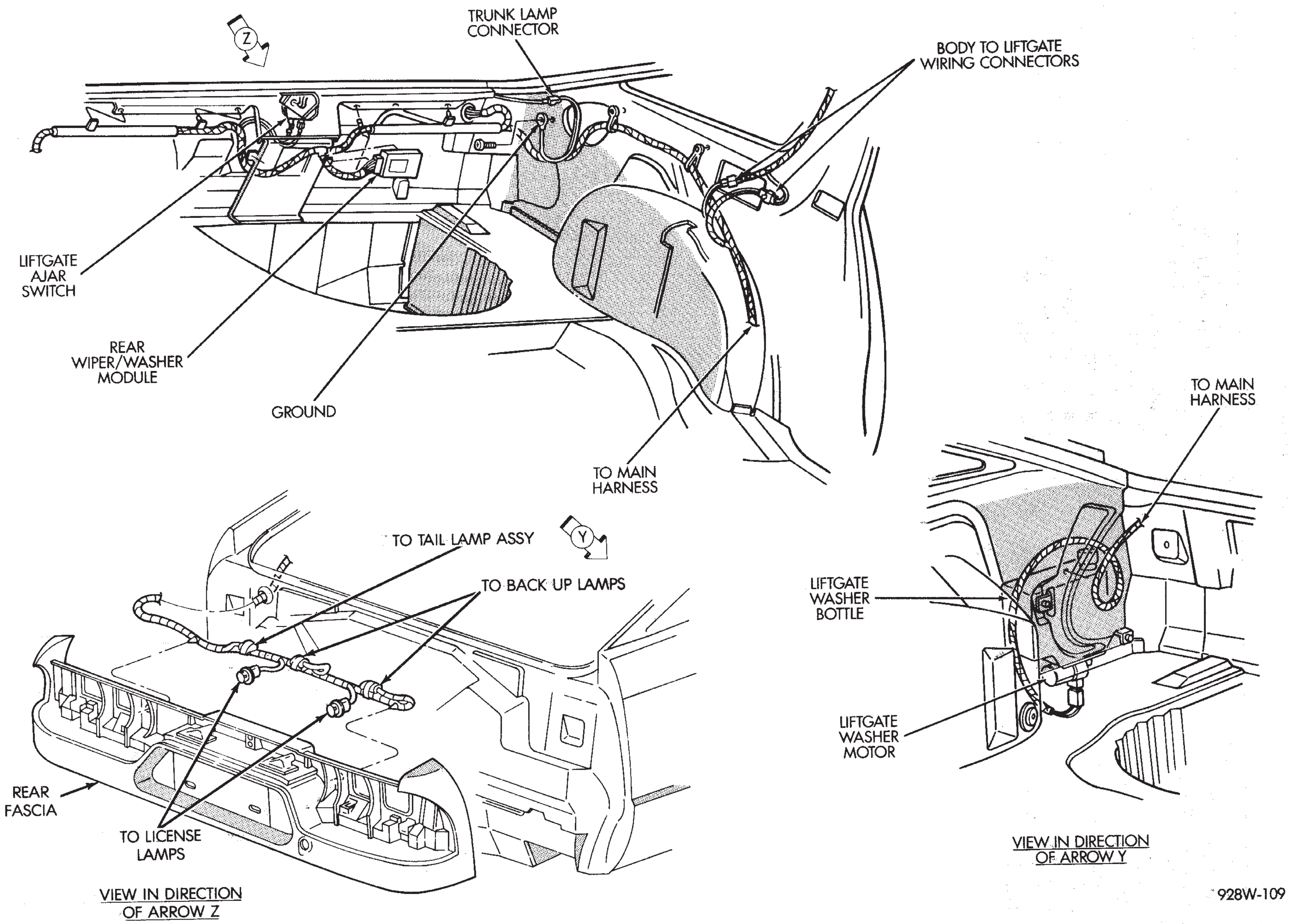


Fig. 1 Rear End Wiring AG Body

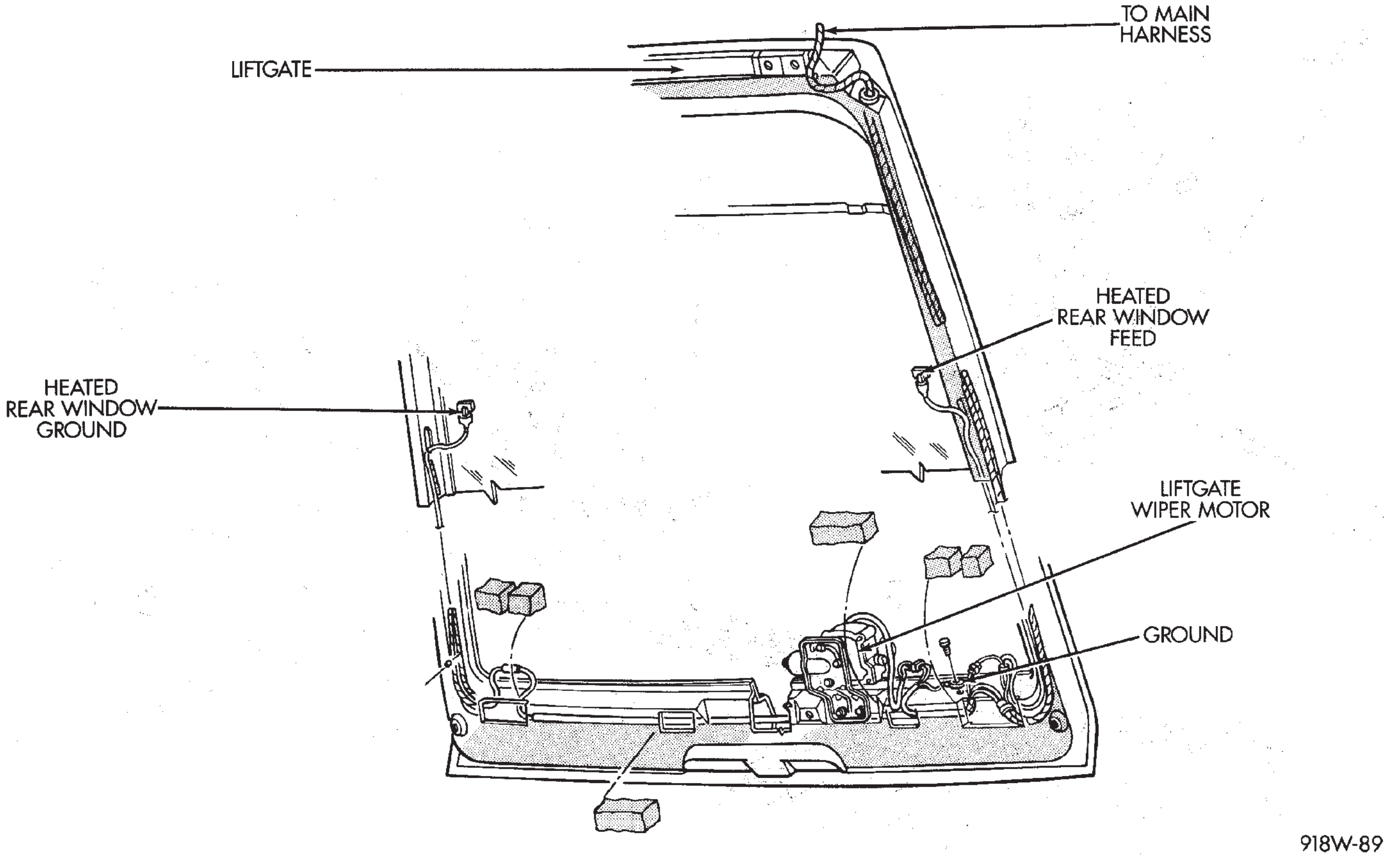


Fig. 2 Liftgate Wiring AG Body

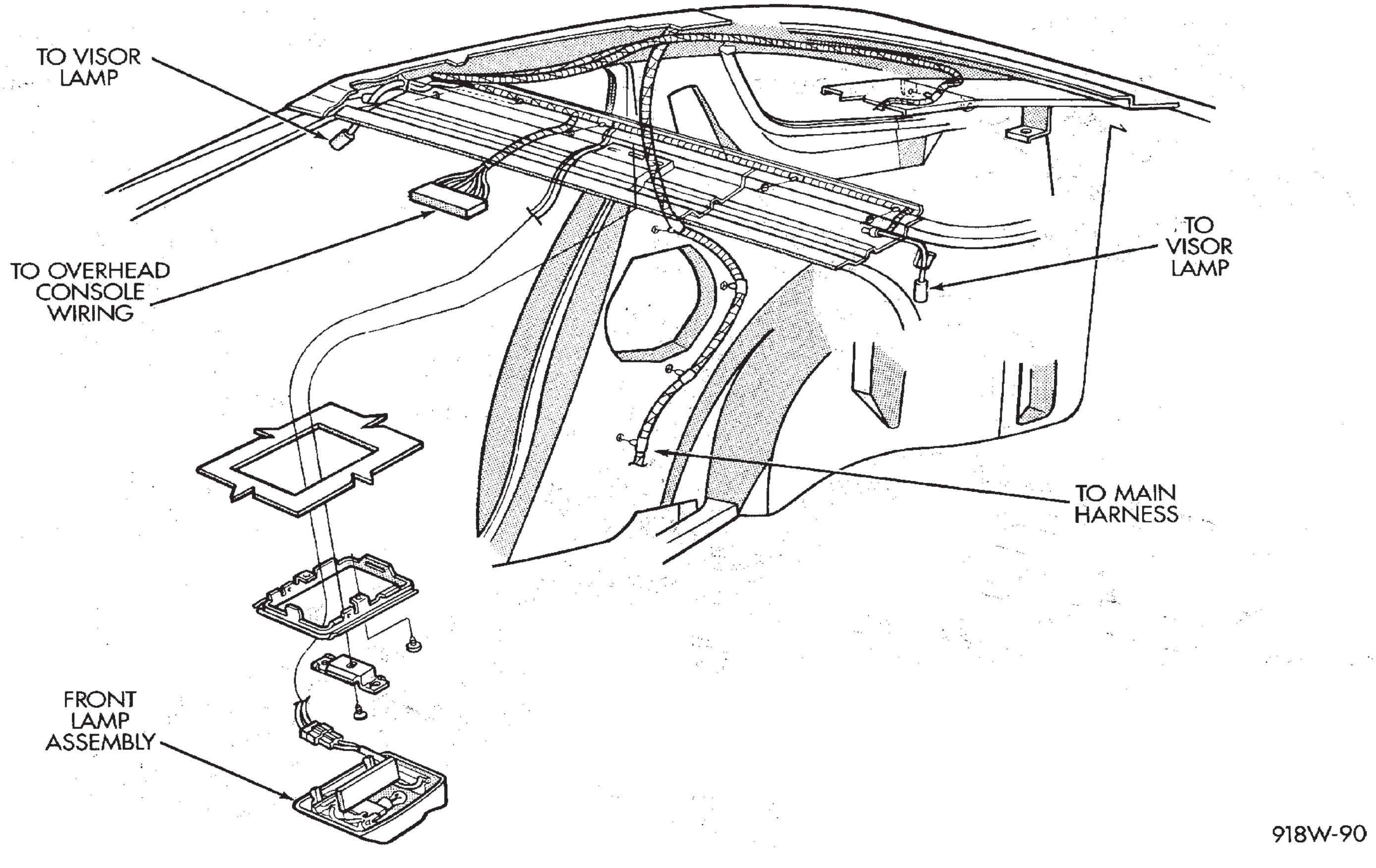


Fig. 3 Roof Wiring AG Body

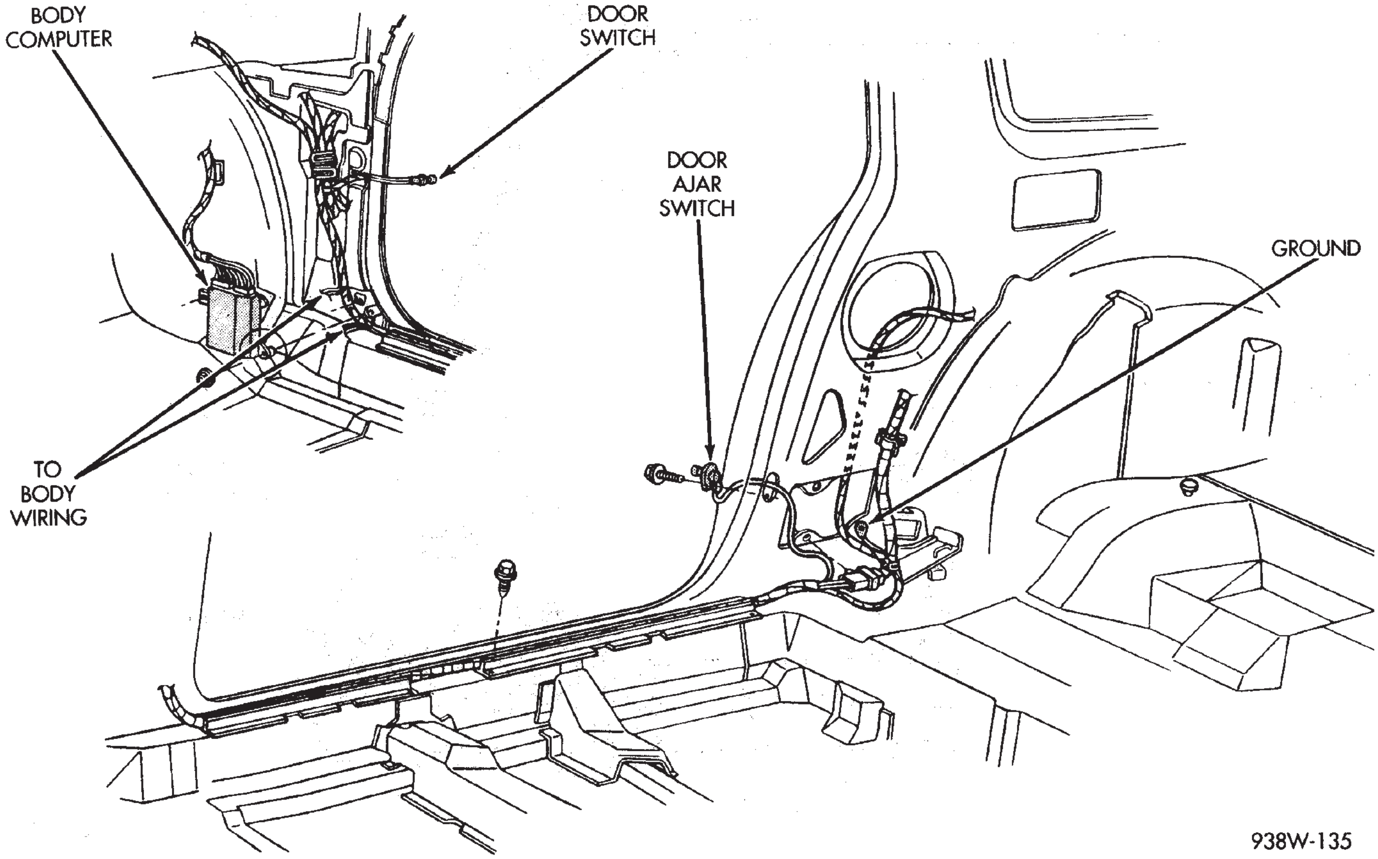


Fig. 4 Body Right Side Wiring AG Body

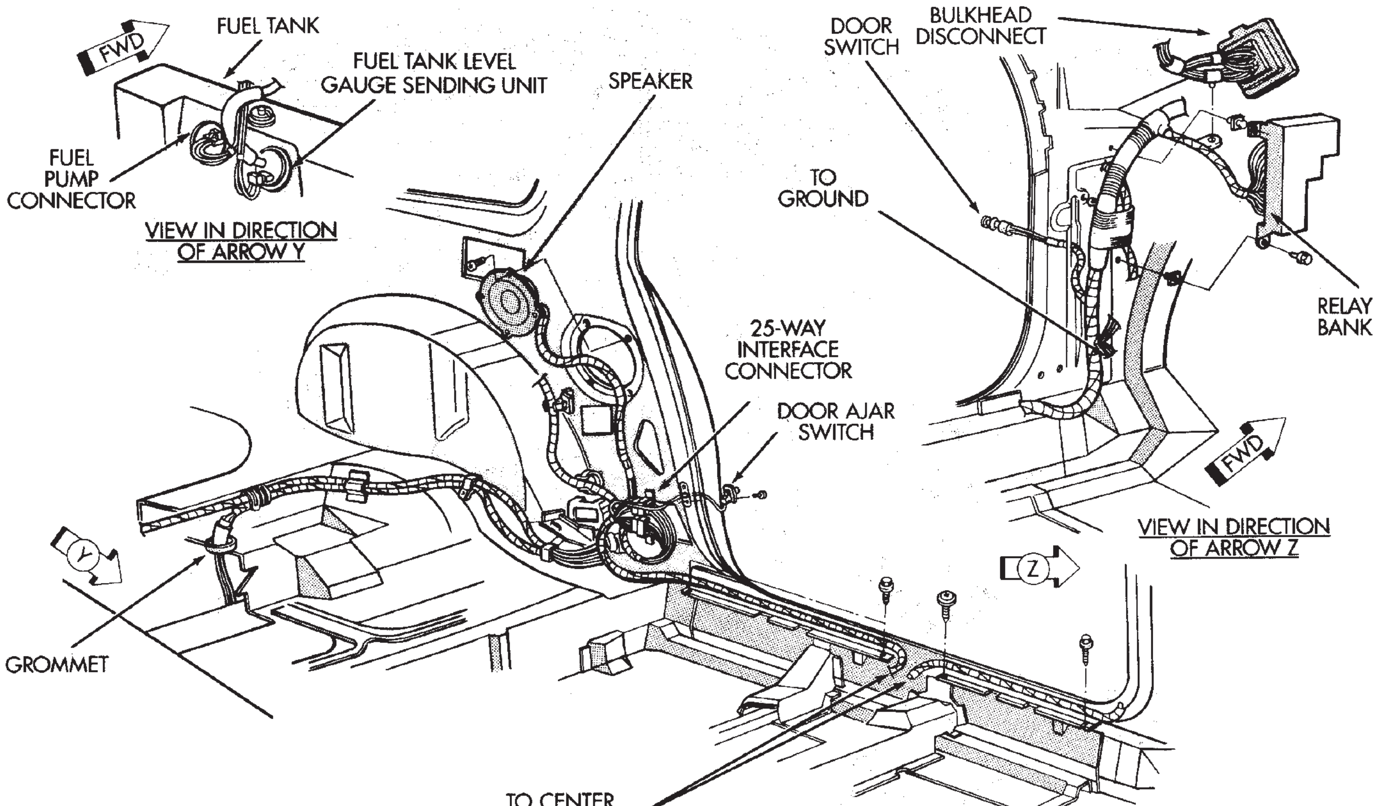


Fig. 5 Body Left Side Wiring AG Body

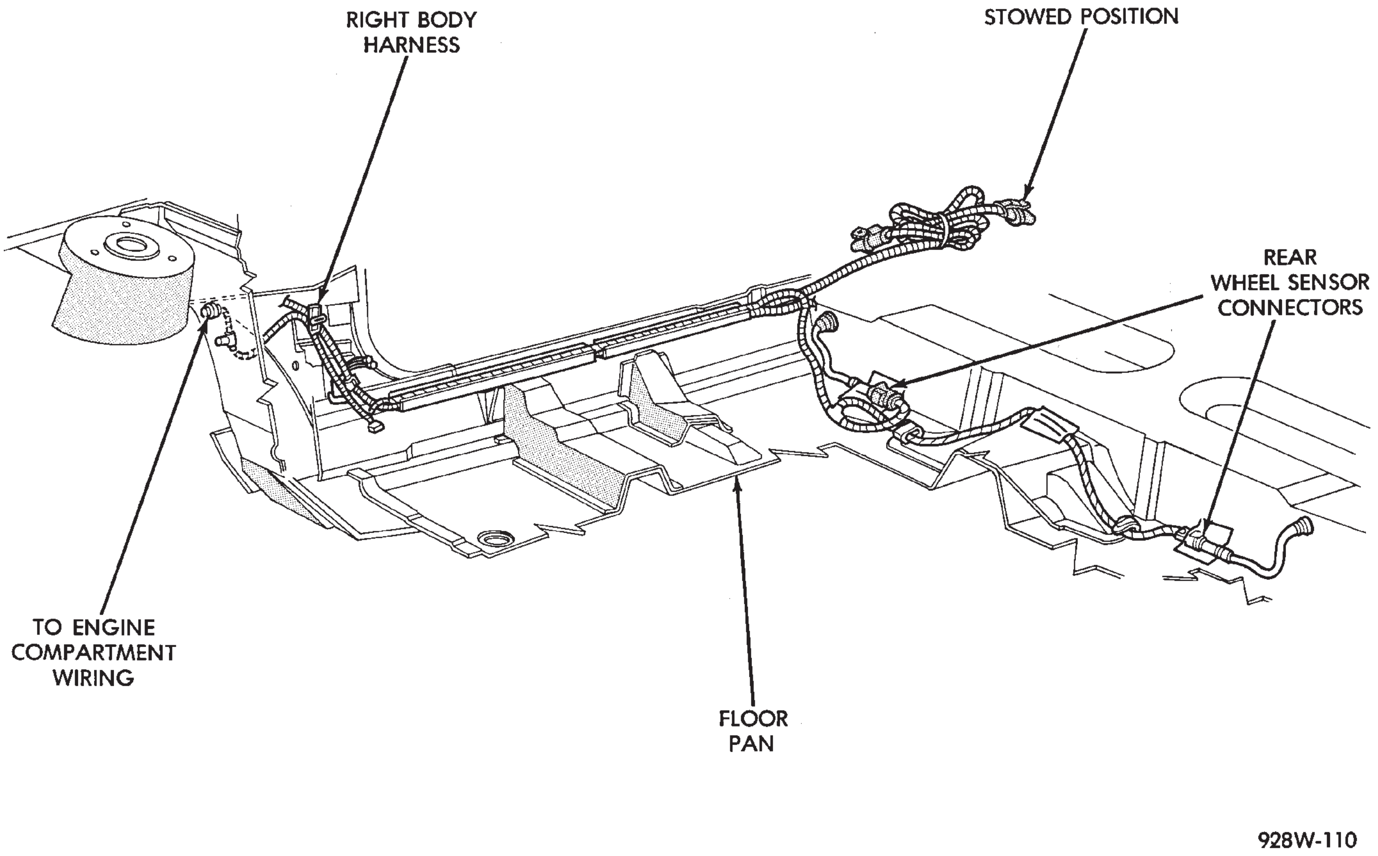


Fig. 6 Anti-Lock Brake System Wiring AG Body

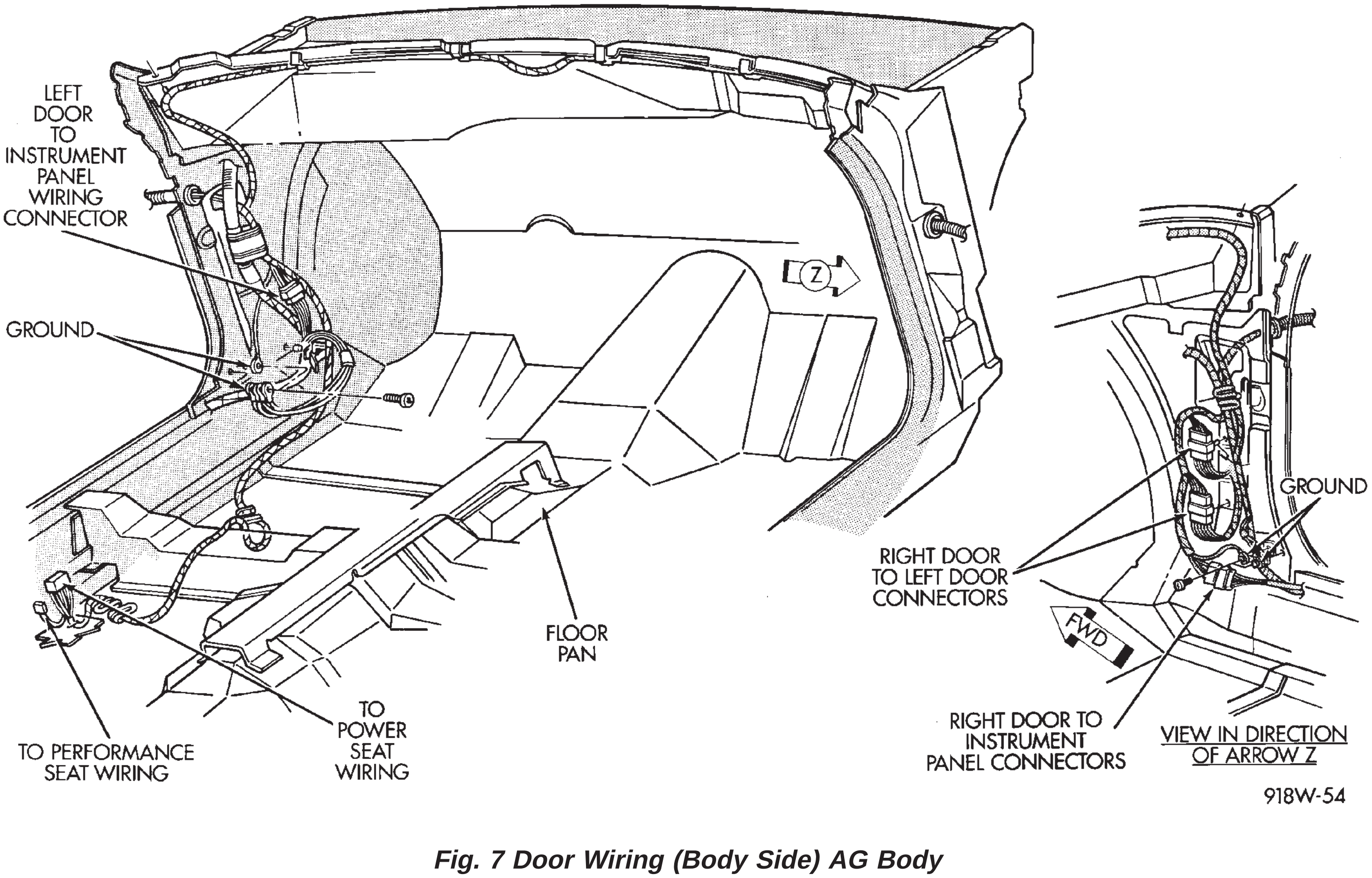


Fig. 7 Door Wiring (Body Side) AG Body

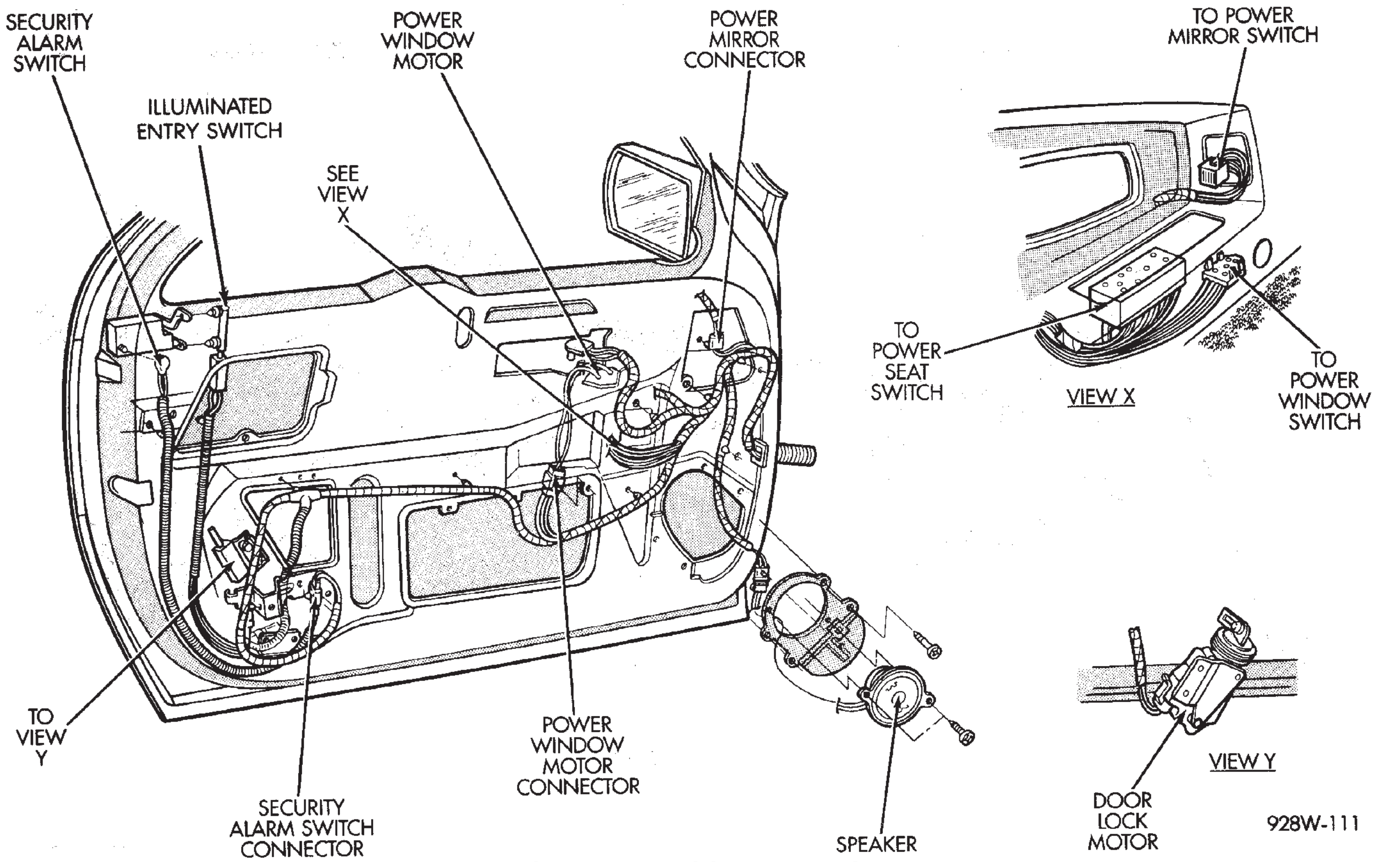


Fig. 8 Door Wiring AG Body

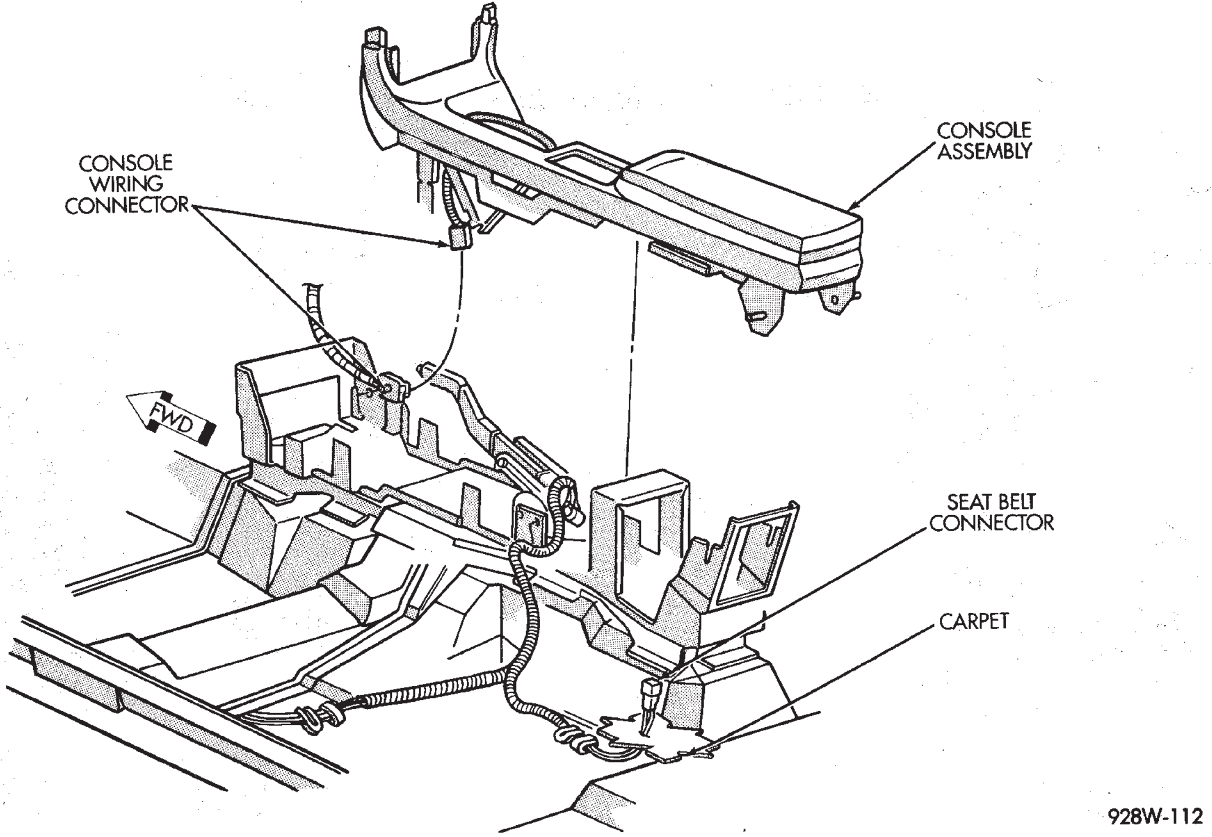


Fig. 9 Console Wiring AG Body

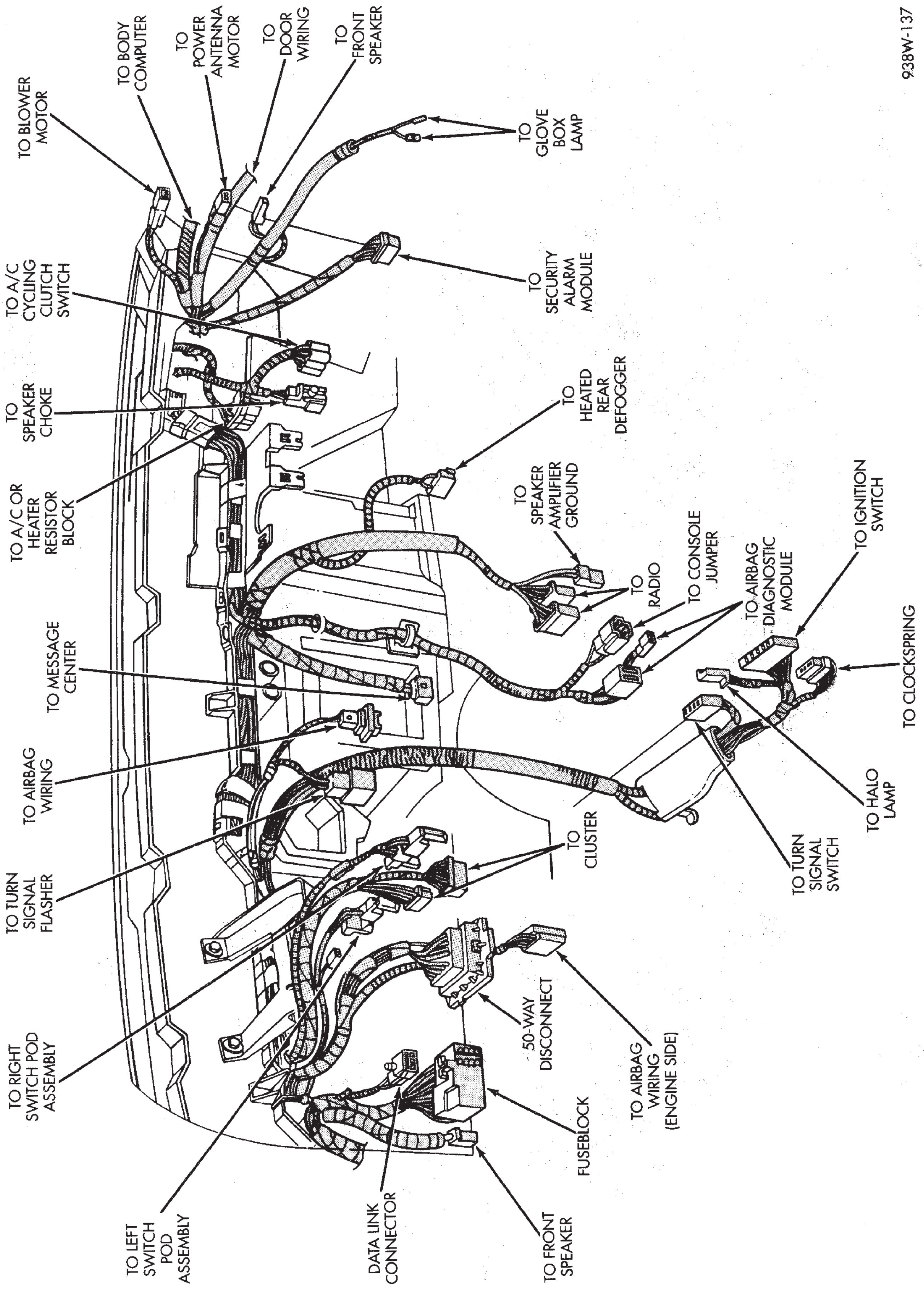


Fig. 10 Instrument Panel Wiring (Routing) AG Body

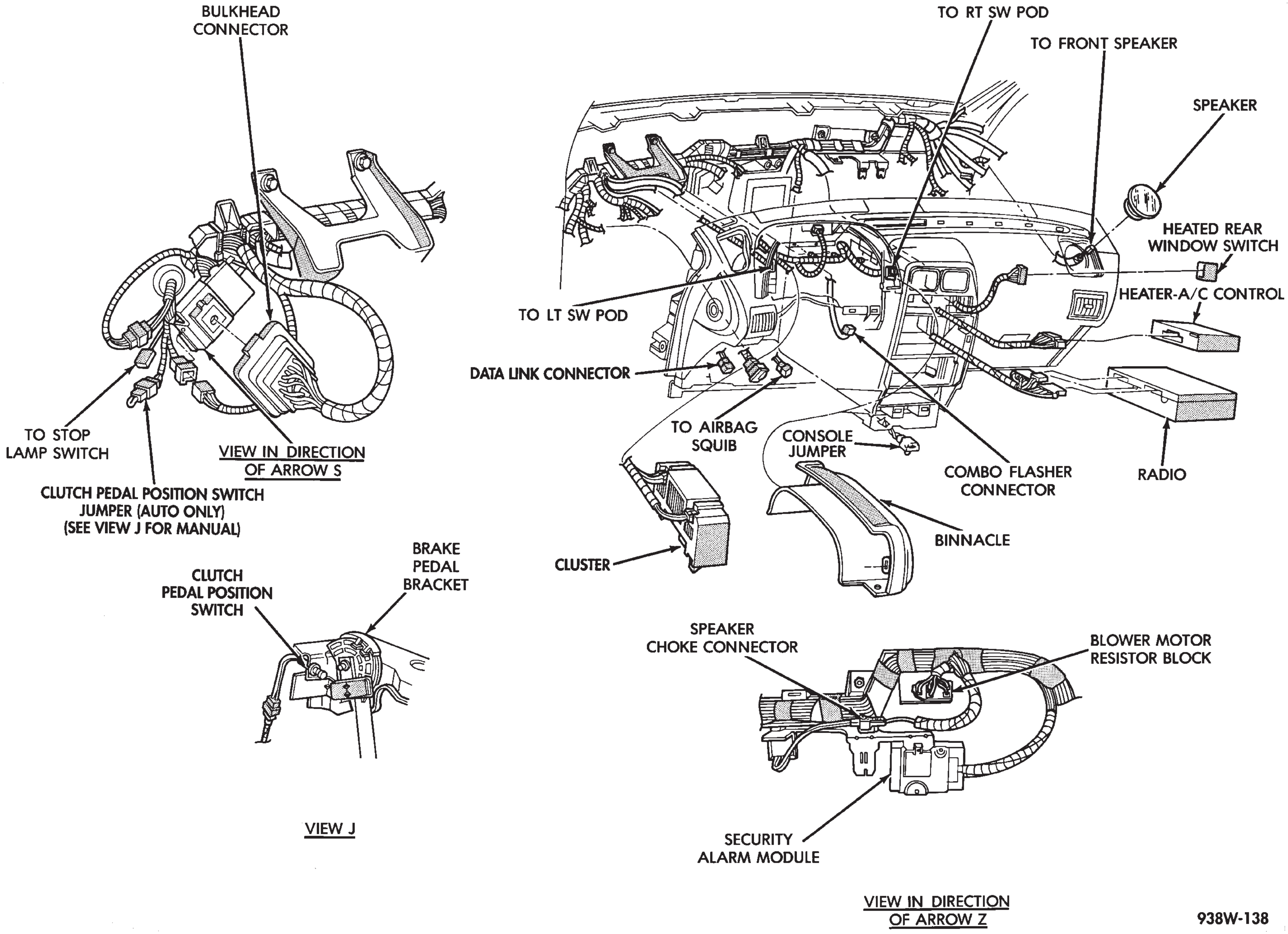


Fig. 11 Instrument Panel Wiring (Connections) AG Body

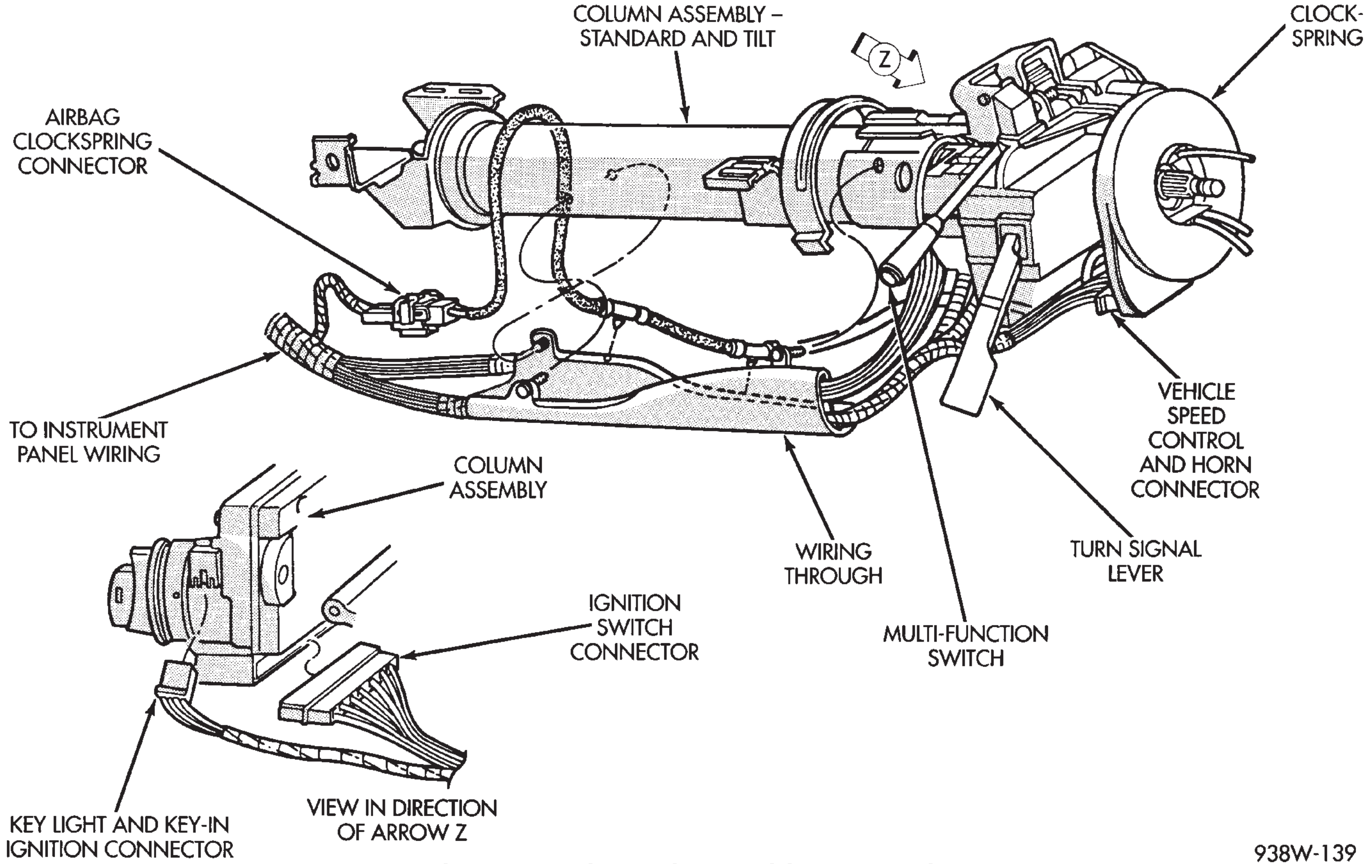


Fig. 12 Steering Column Wiring AG Body

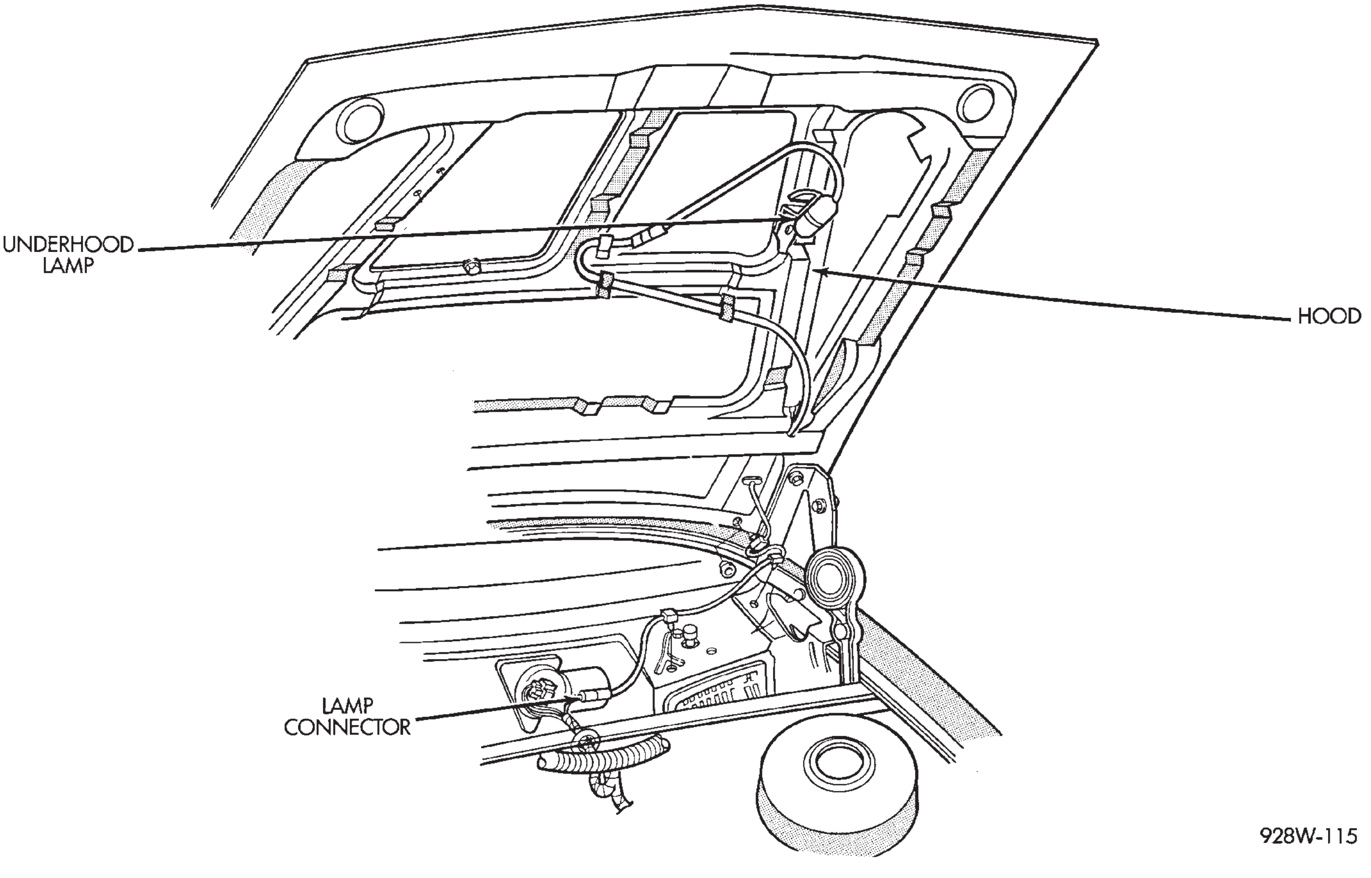


Fig. 13 Underhood Lamp Wiring AG Body

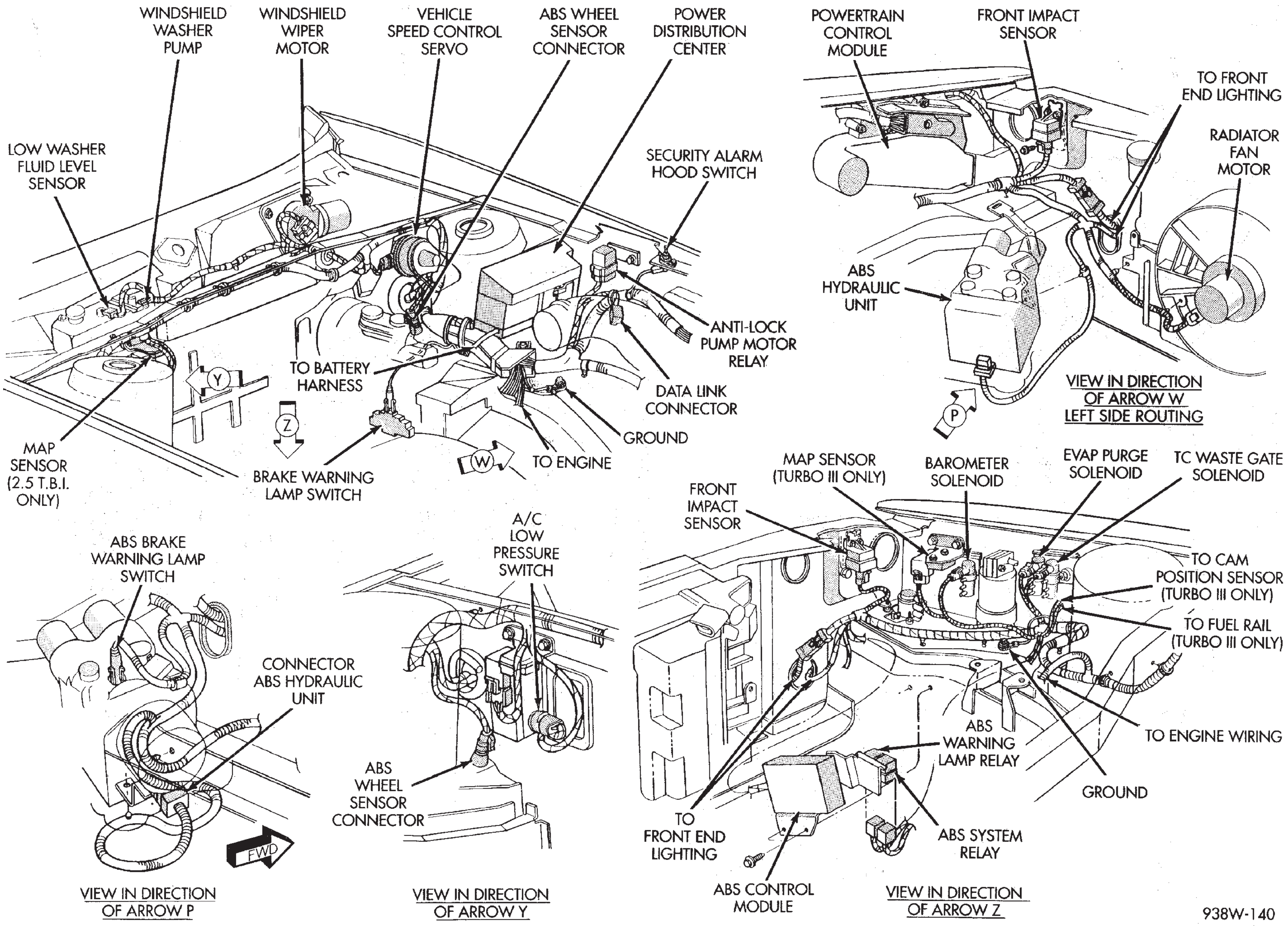


Fig. 14 Engine Compartment Wiring AG Body

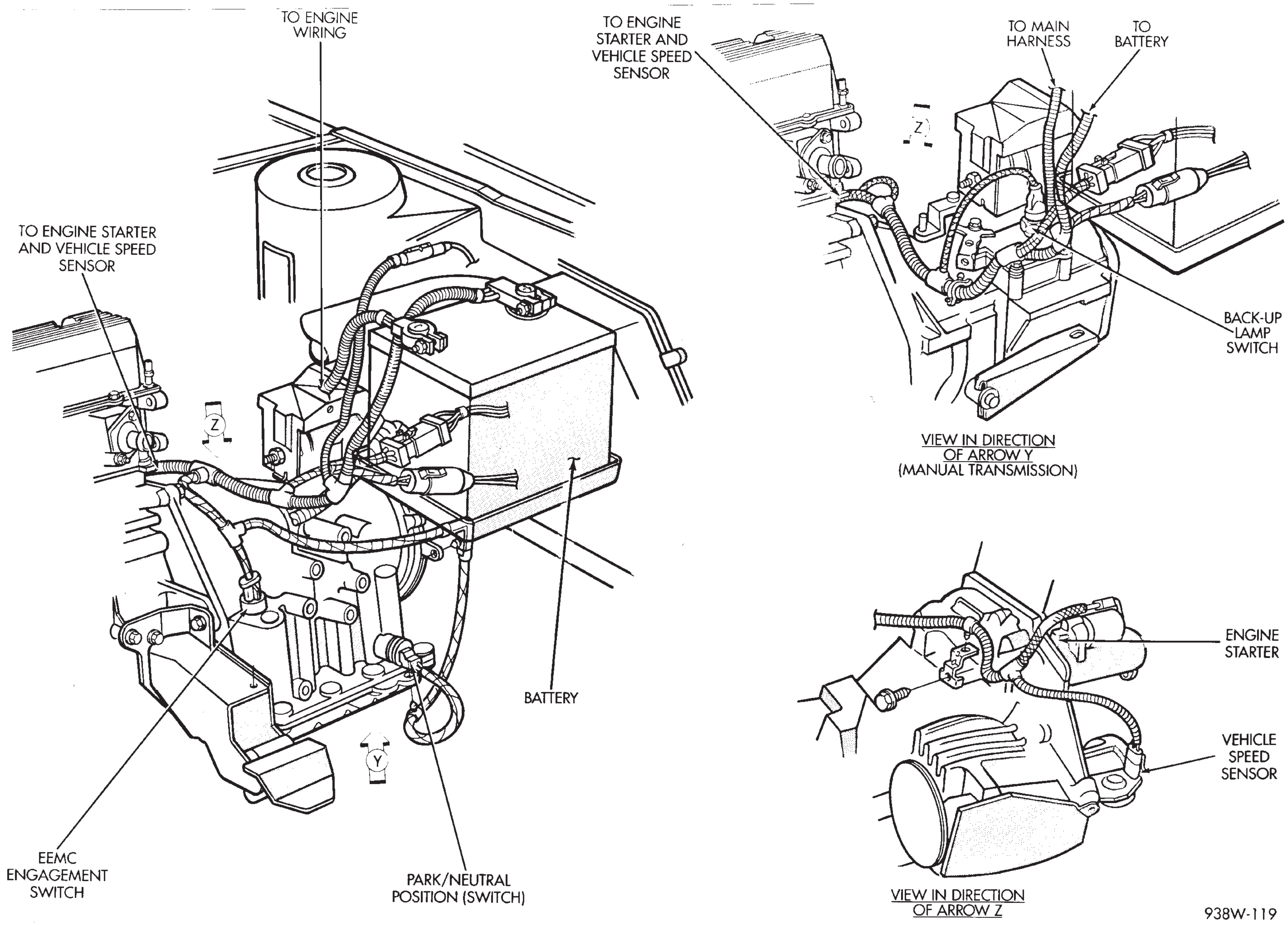


Fig. 15 Transmission Wiring AG Body

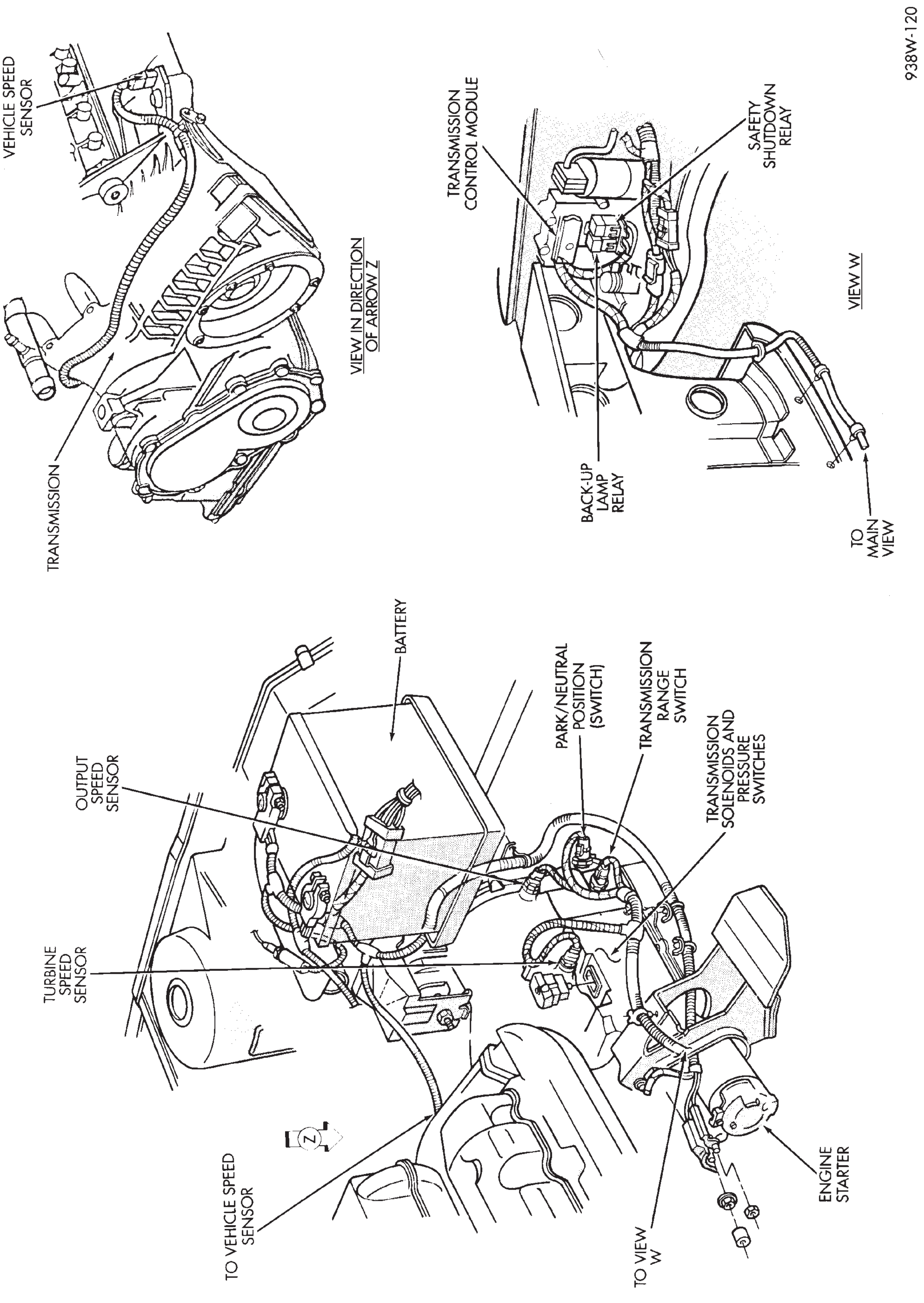


Fig. 16 Transmission Wiring 41TE AG Body

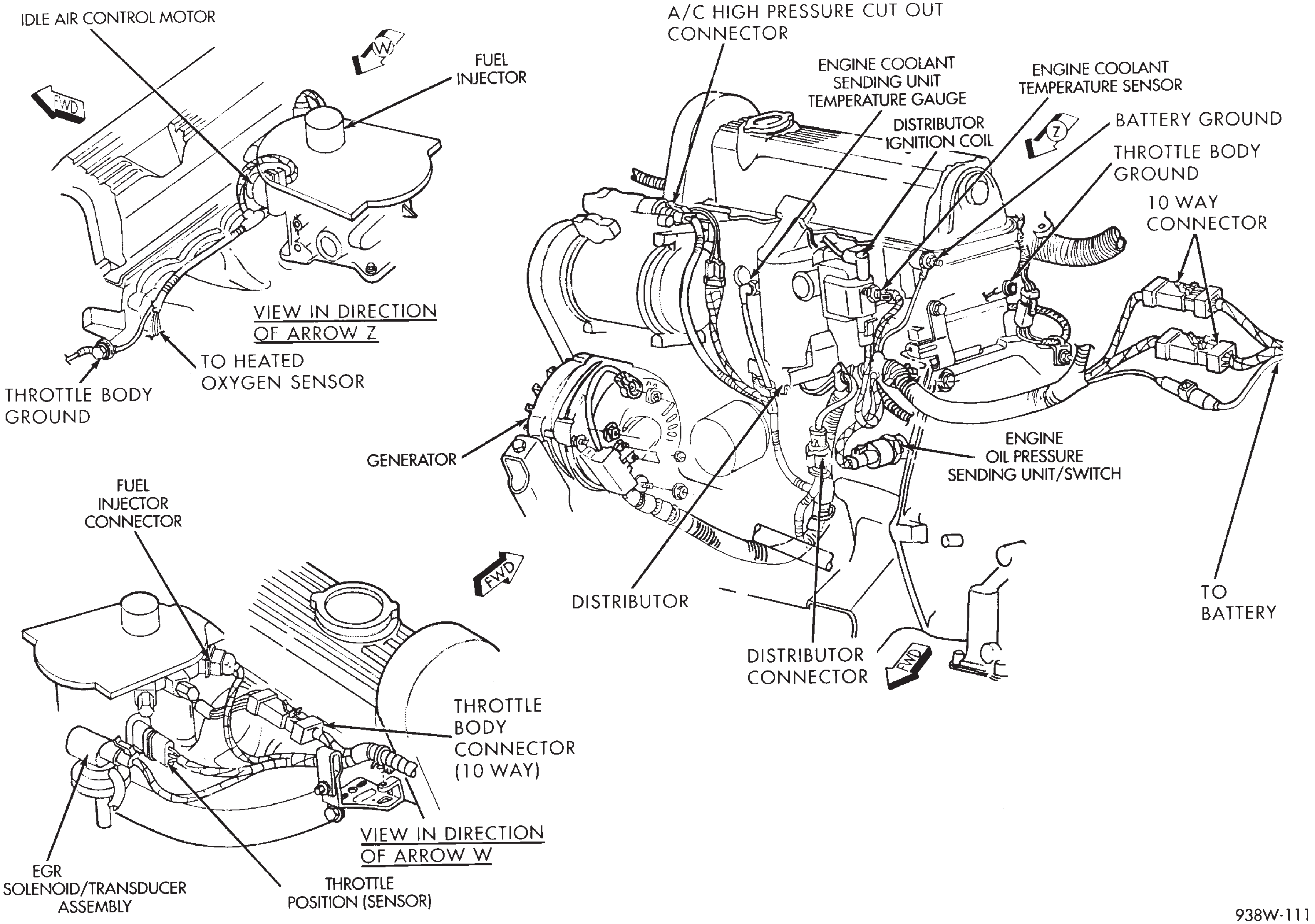


Fig. 17 Engine Wiring 2.5L EFI AG Body

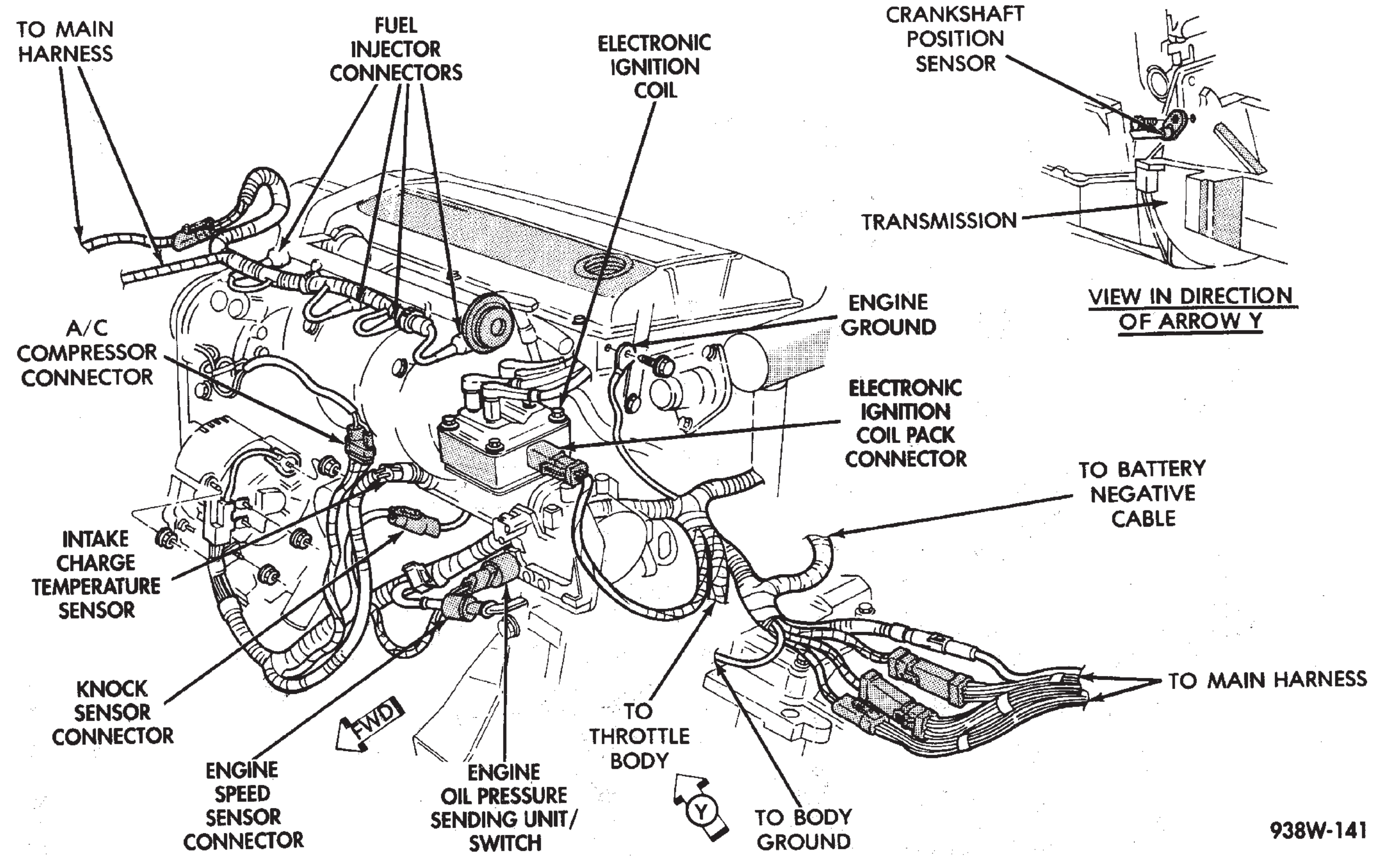


Fig. 18 Engine Wiring Turbo III AG Body

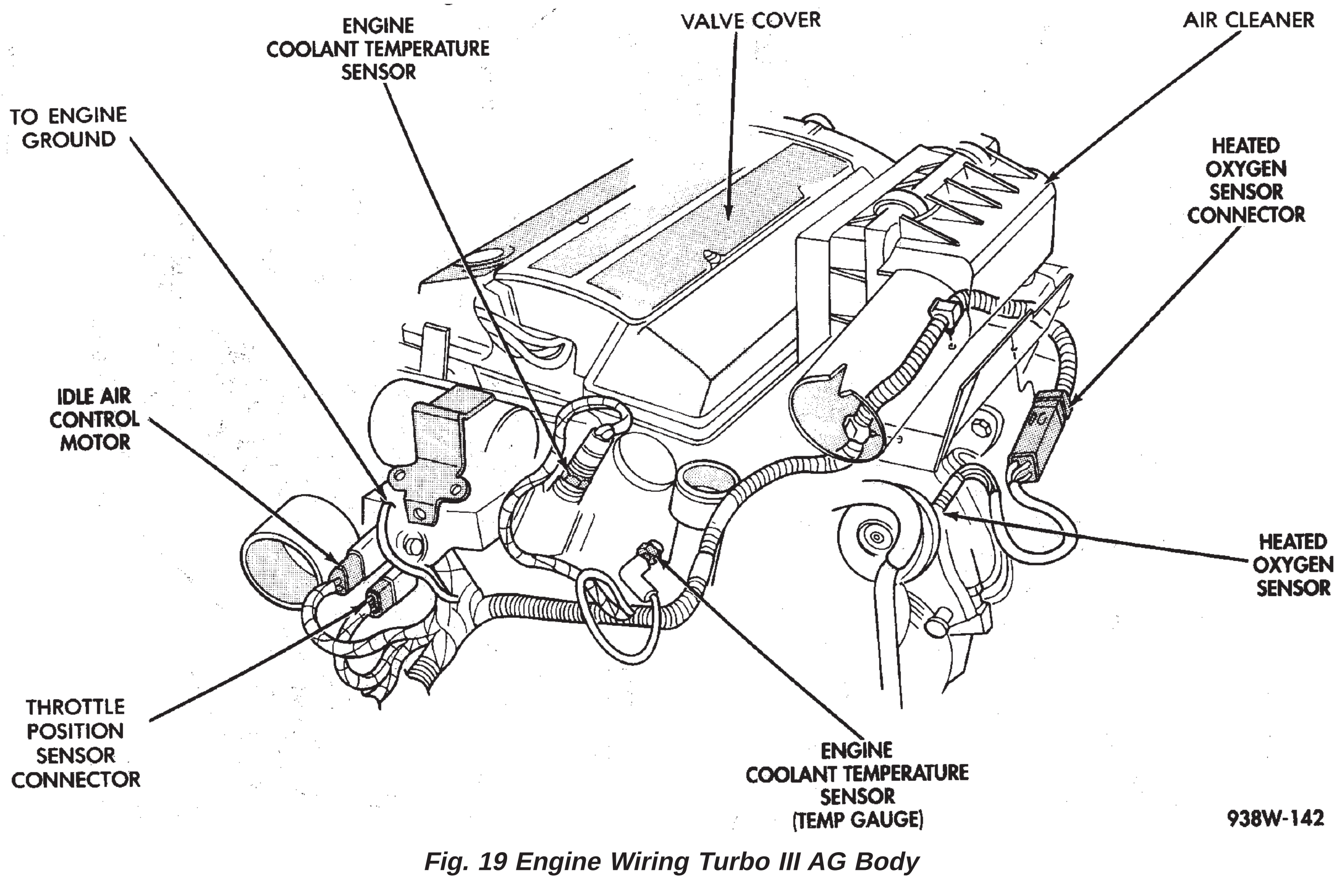


Fig. 19 Engine Wiring Turbo III AG Body

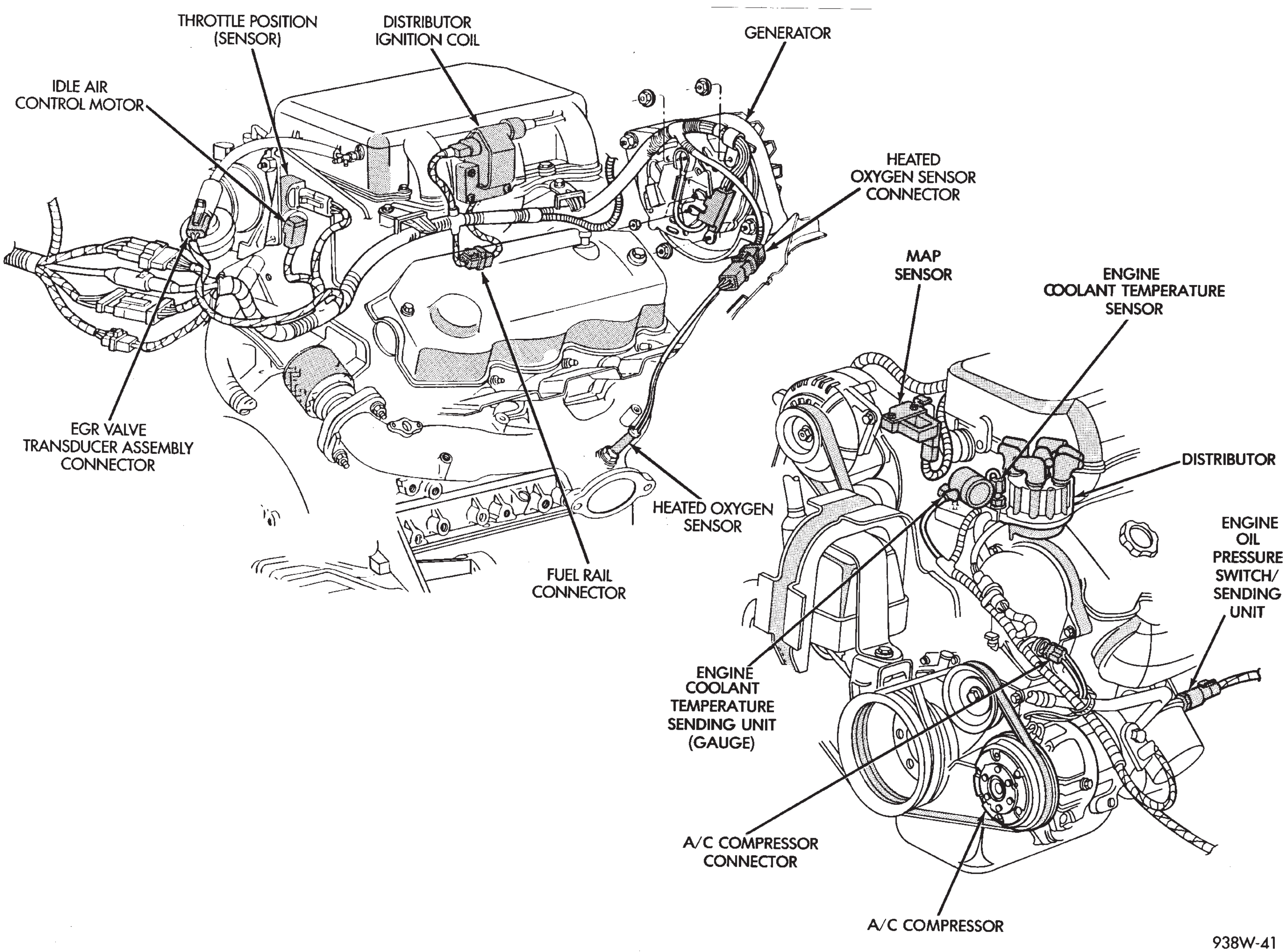


Fig. 20 Engine Wiring 3.0L AG Body

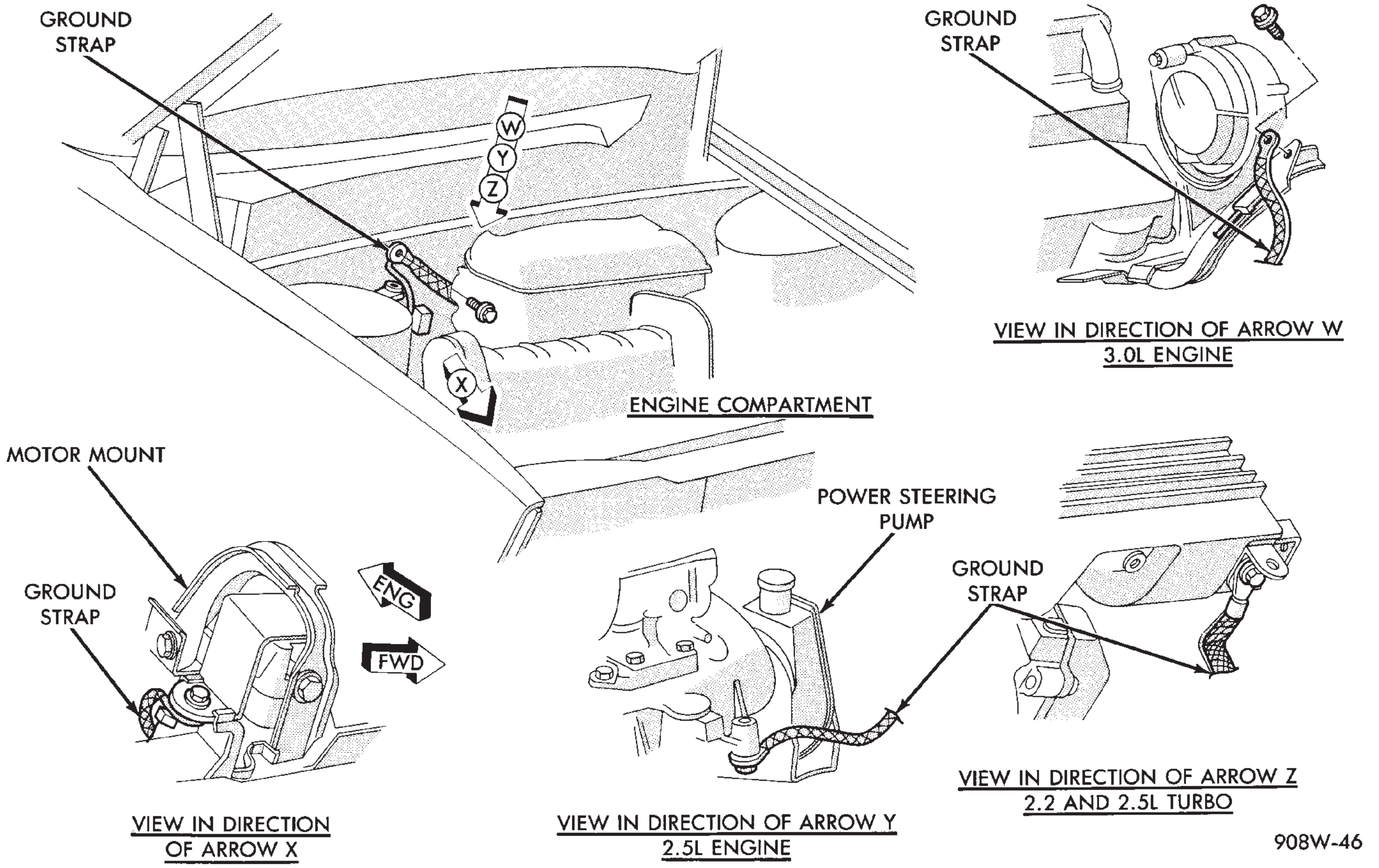


Fig. 21 Ground Strap Location AG Body

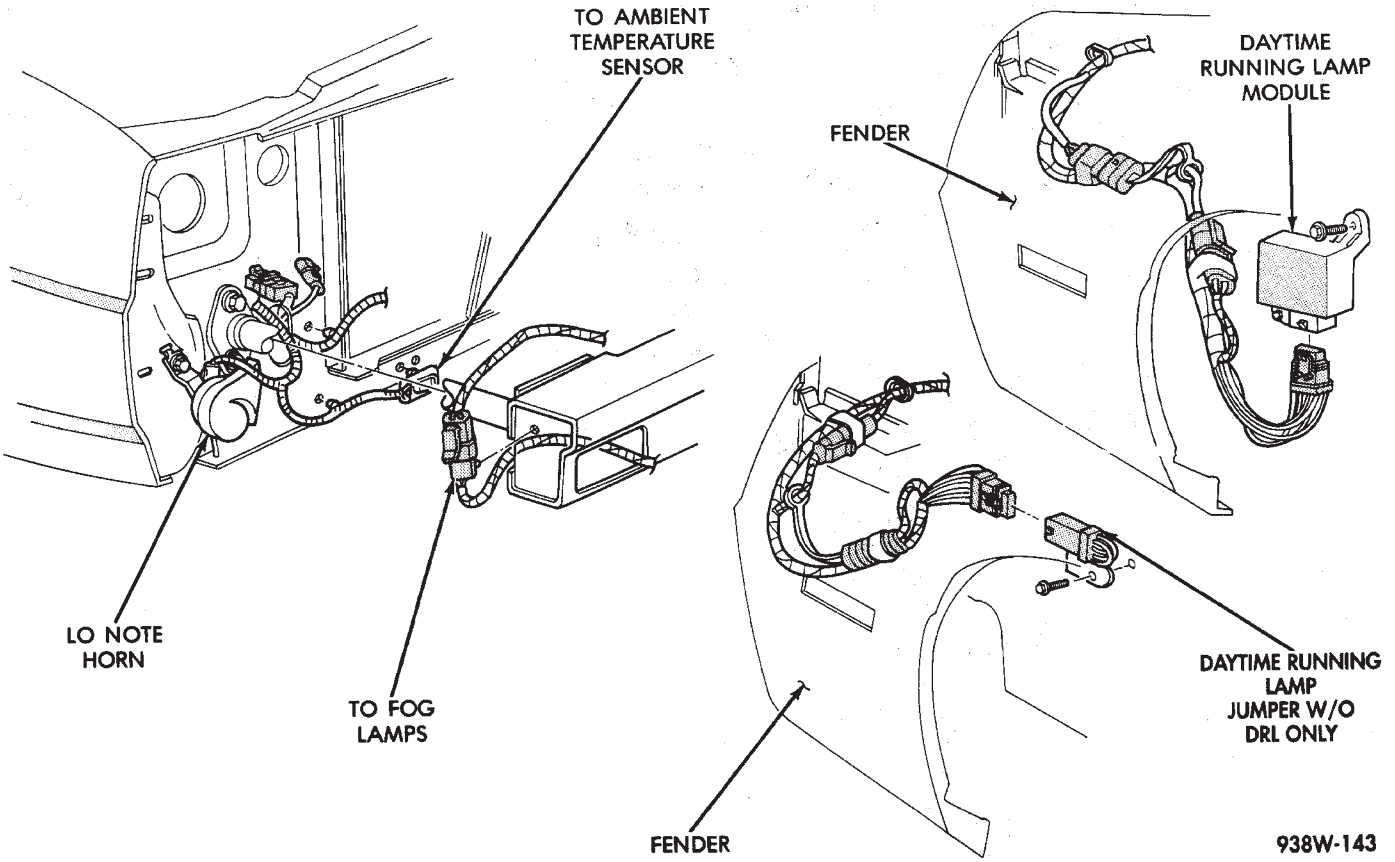


Fig. 22 Front End Wiring AG Body

AJ BODY

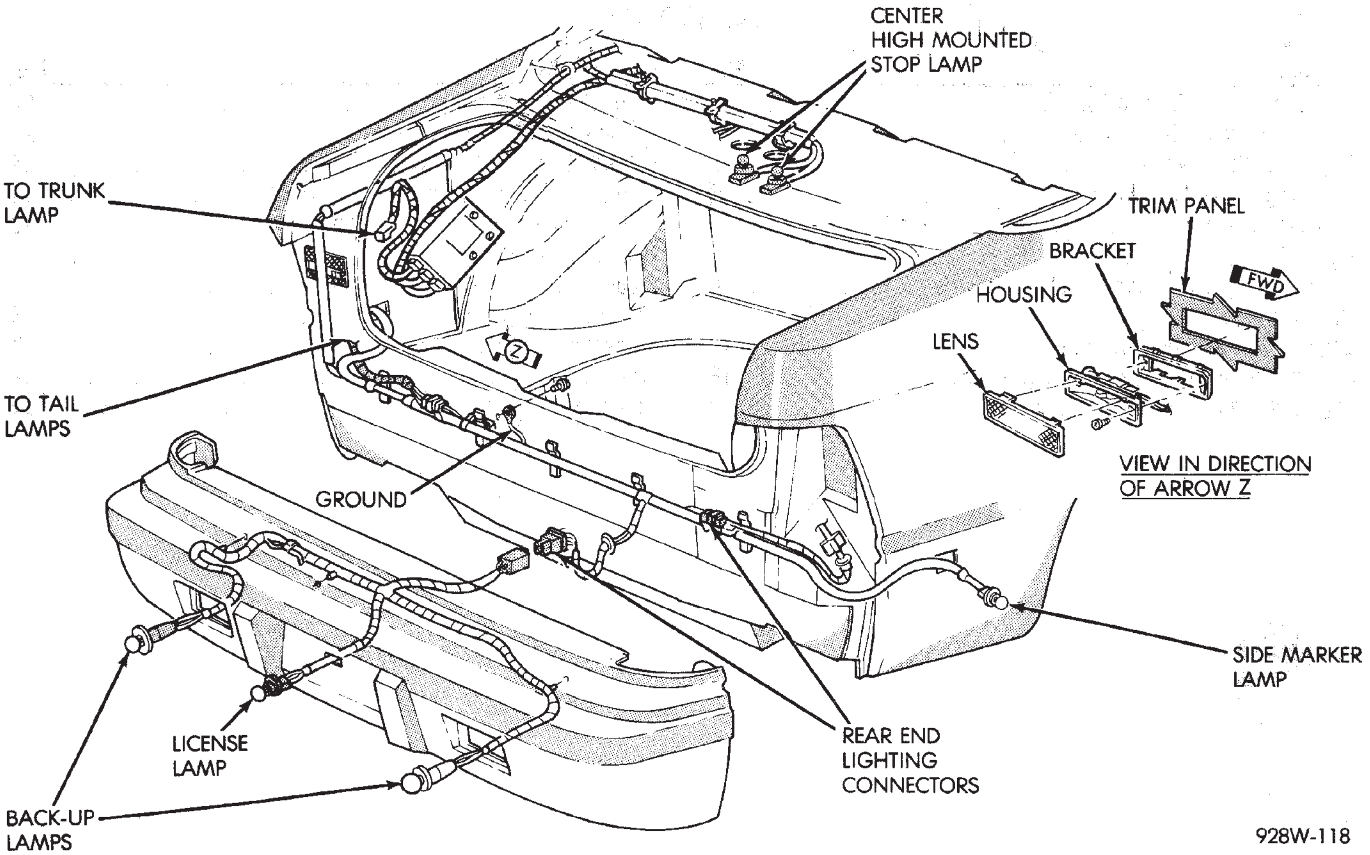


Fig. 1 Rear End Wiring AJ-Body

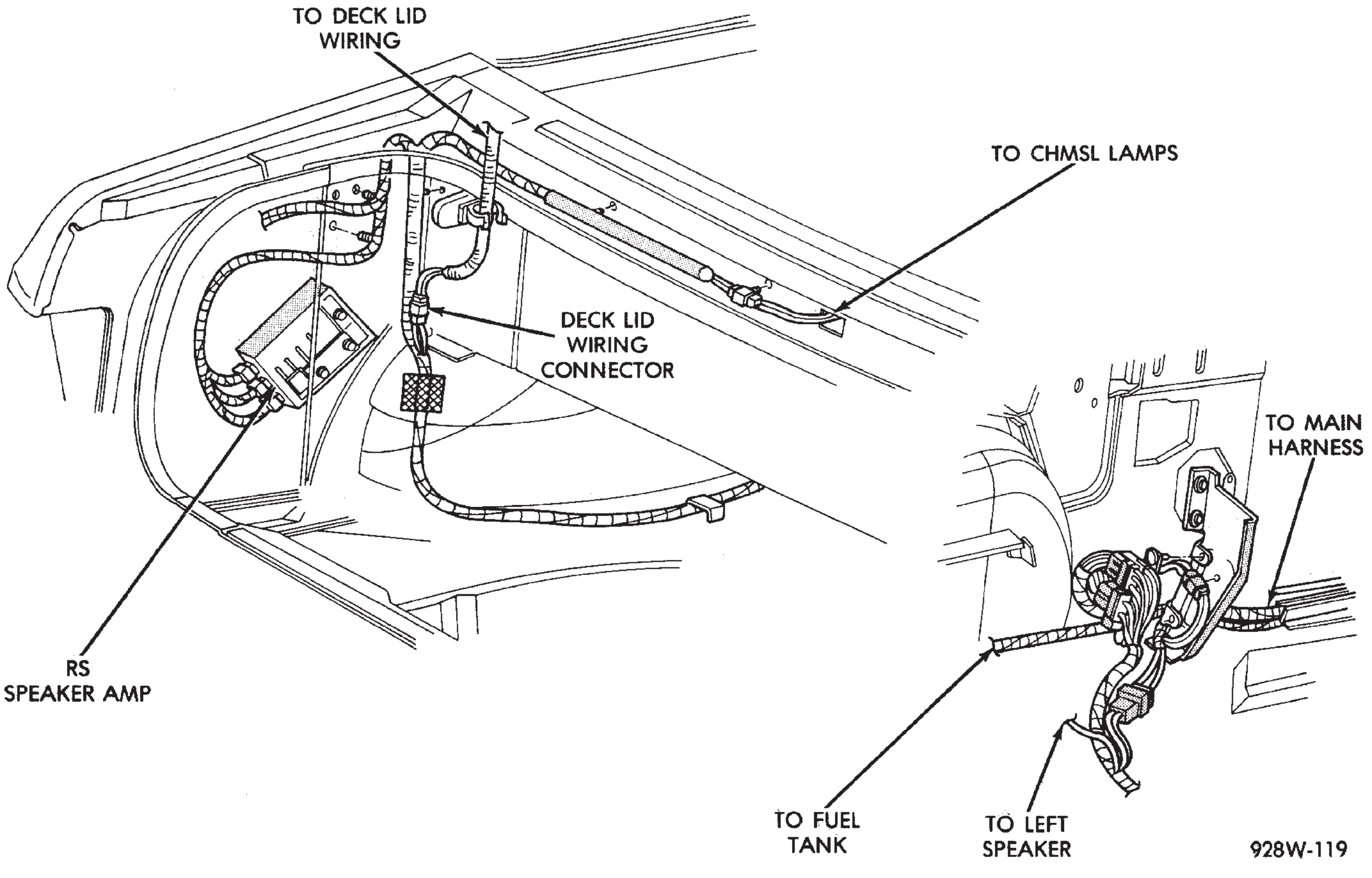


Fig. 2 Trunk Wiring AJ-Body

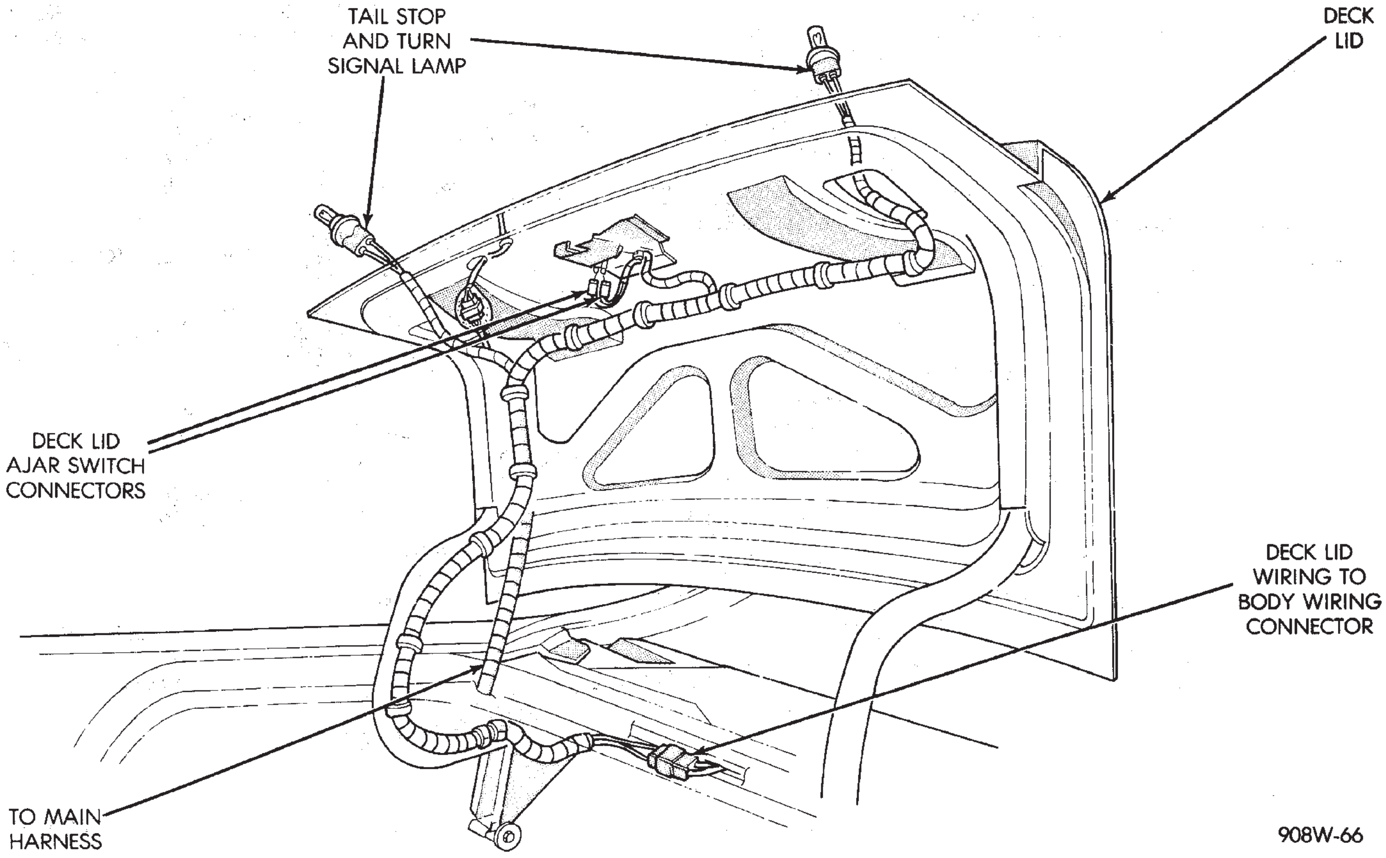


Fig. 3 Deck Lid Wiring AJ-Body

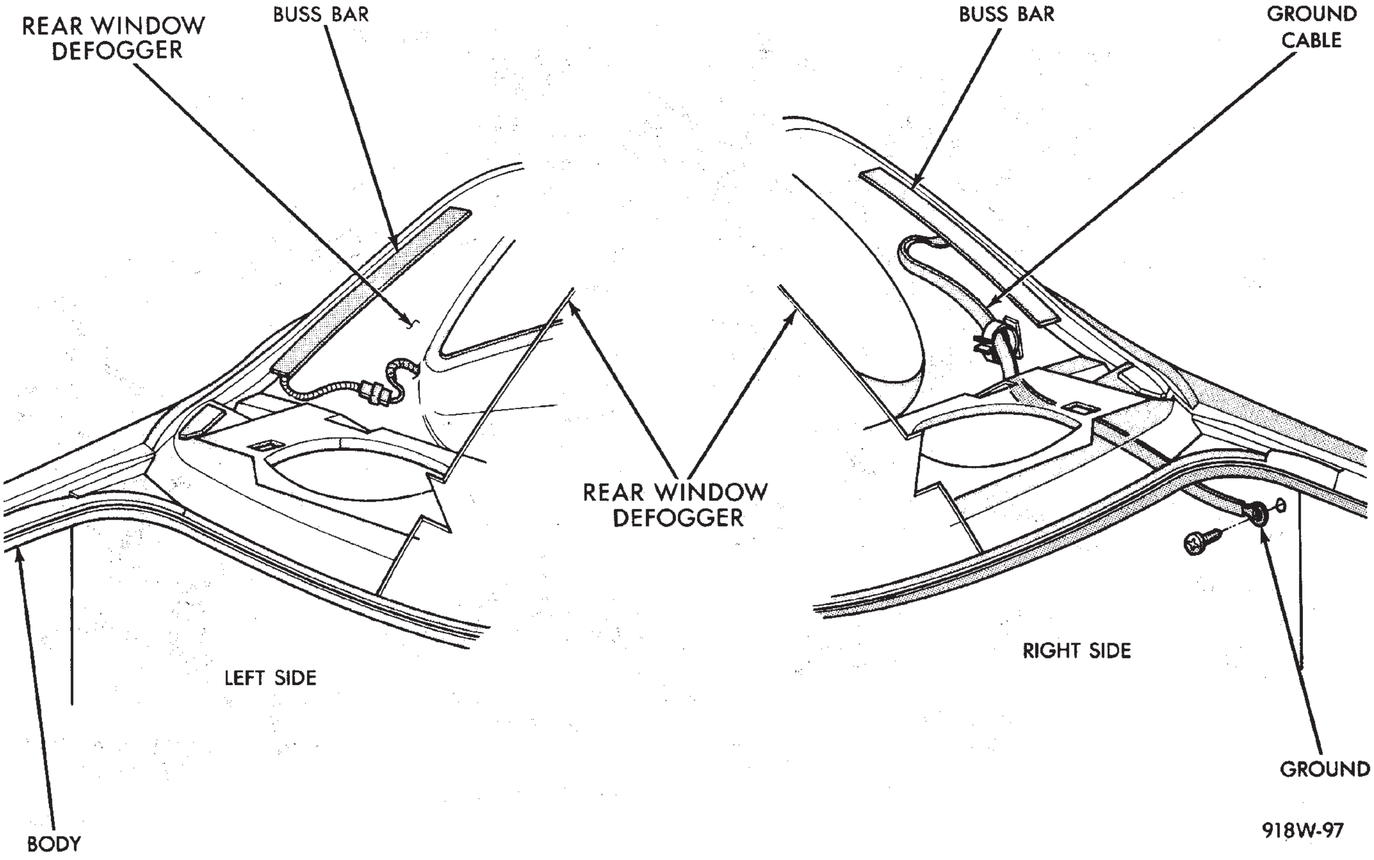


Fig. 4 Heated Rear Window Wiring AJ-Body

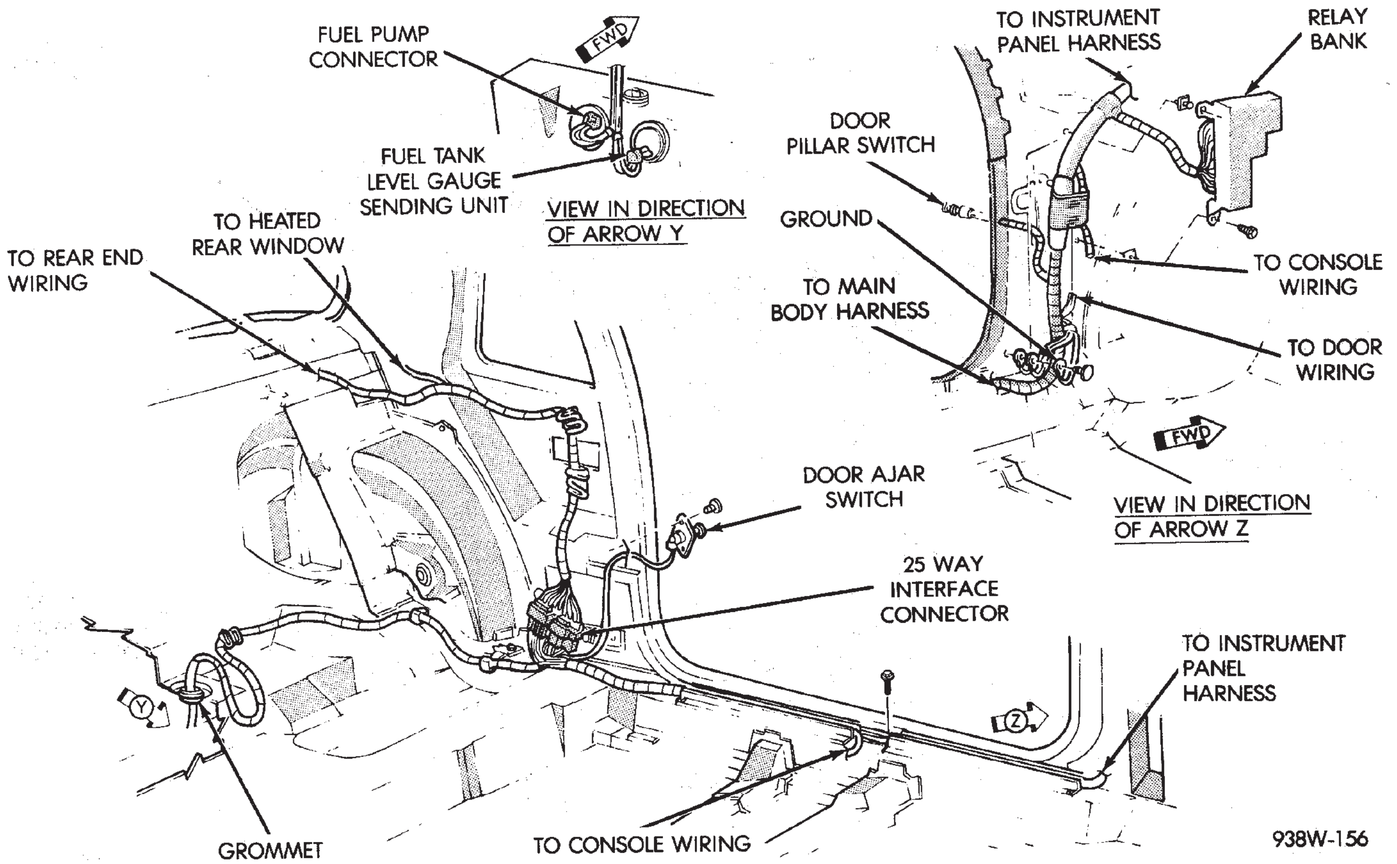


Fig. 5 Body Left Side Wiring AJ-Body

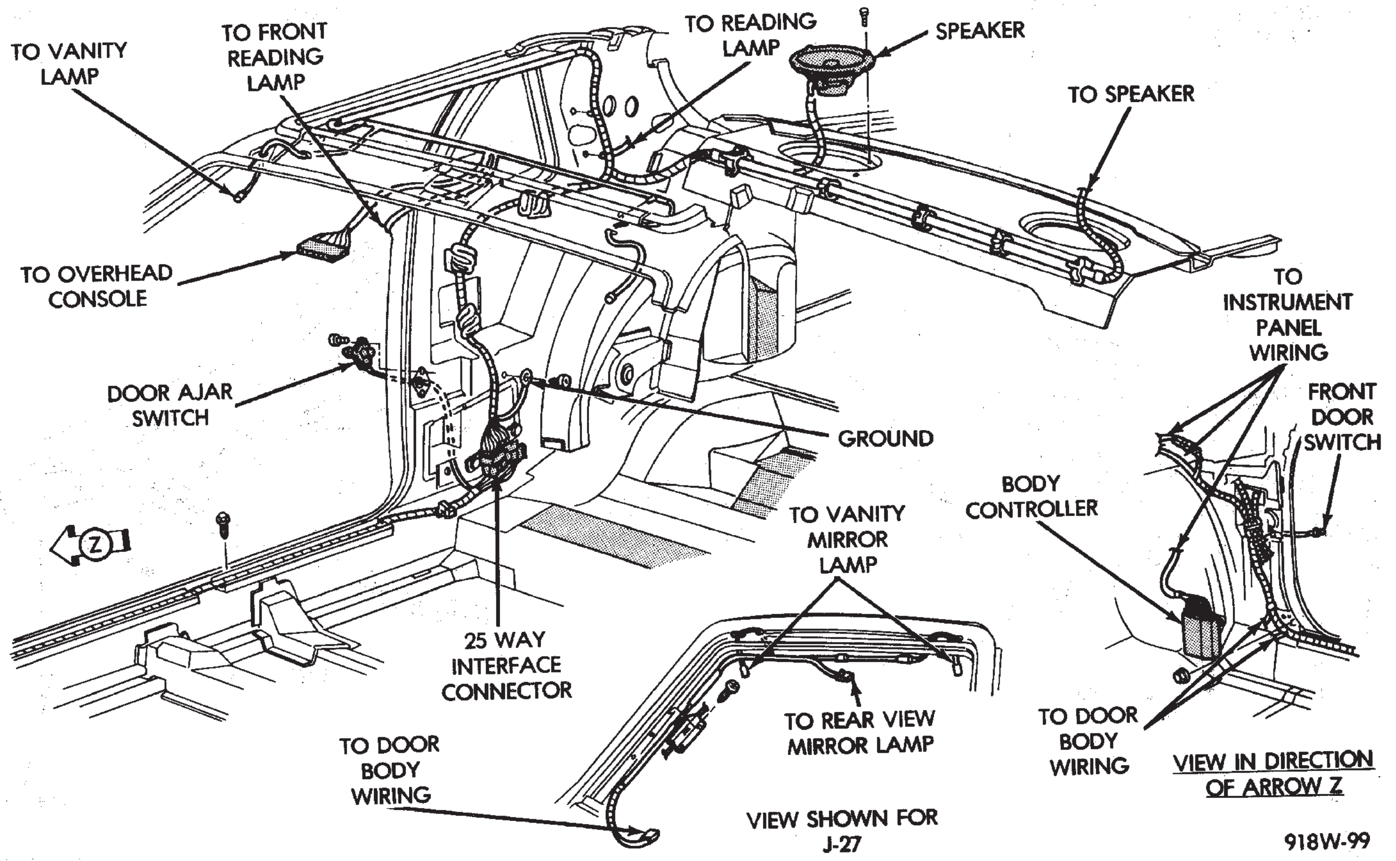


Fig. 6 Body Right Side Wiring AJ-Body

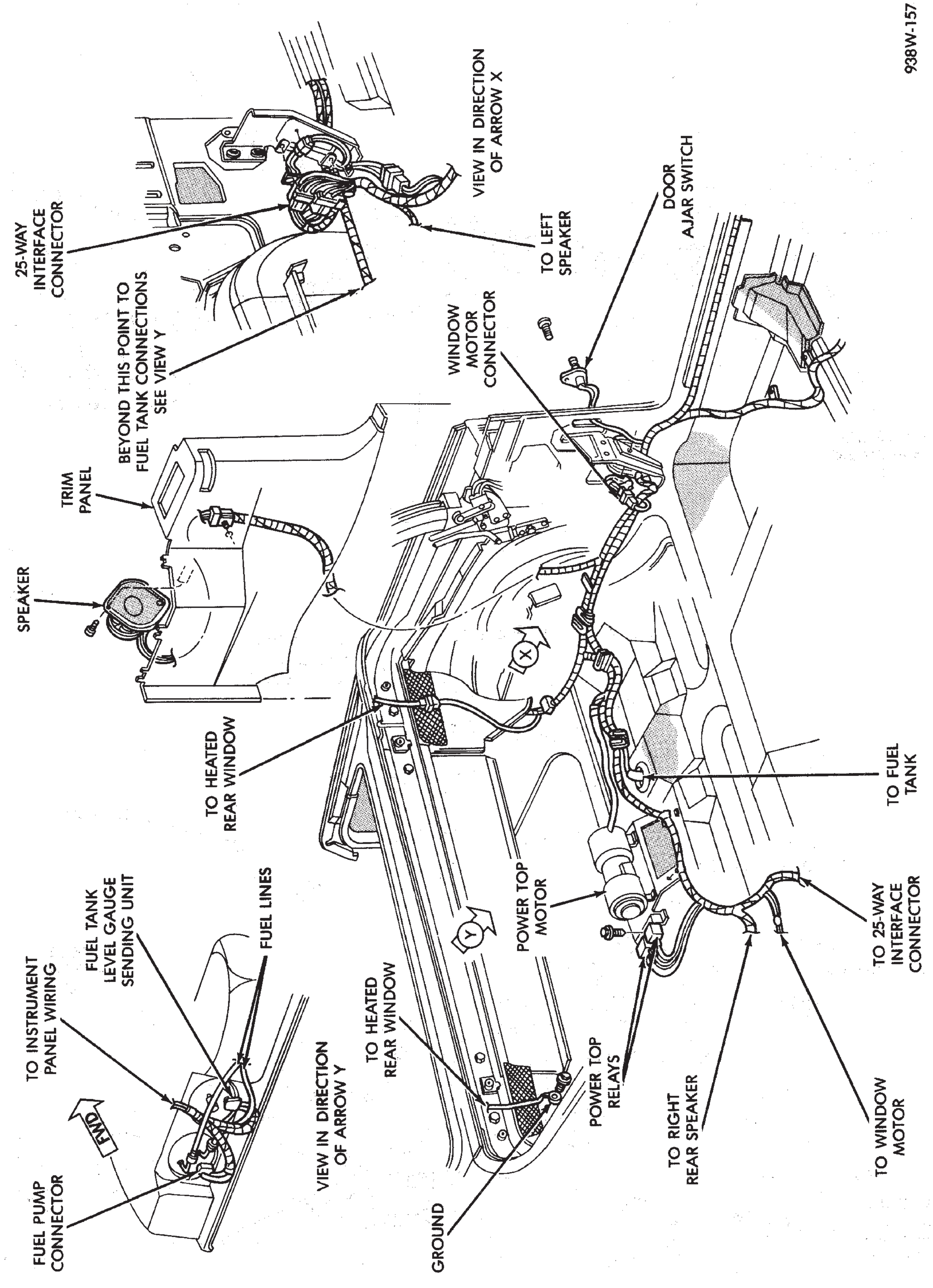


Fig. 7 Body Left Side Wiring (AJ-27)

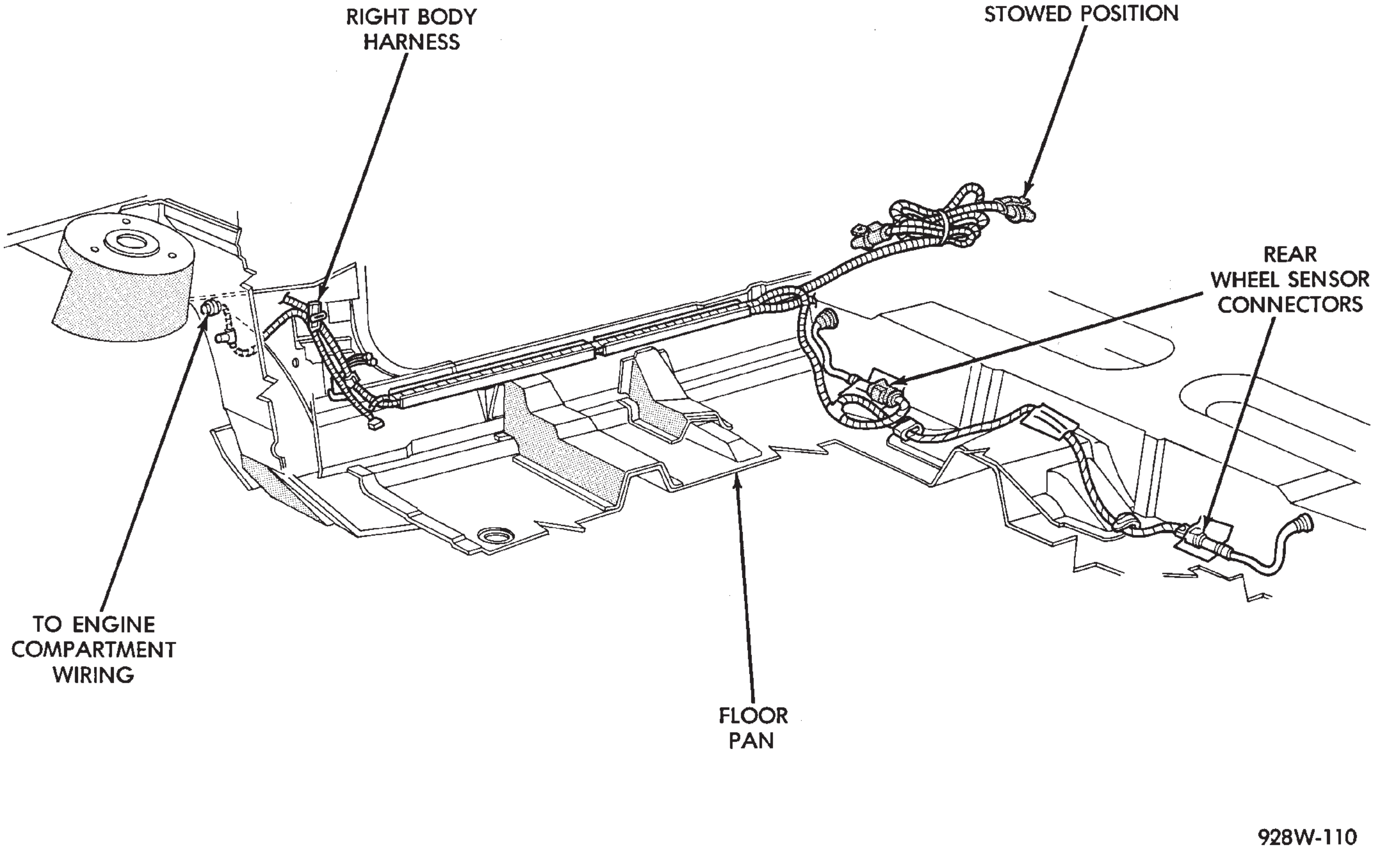


Fig. 8 Anti-Lock Brake System Wiring AJ-Body

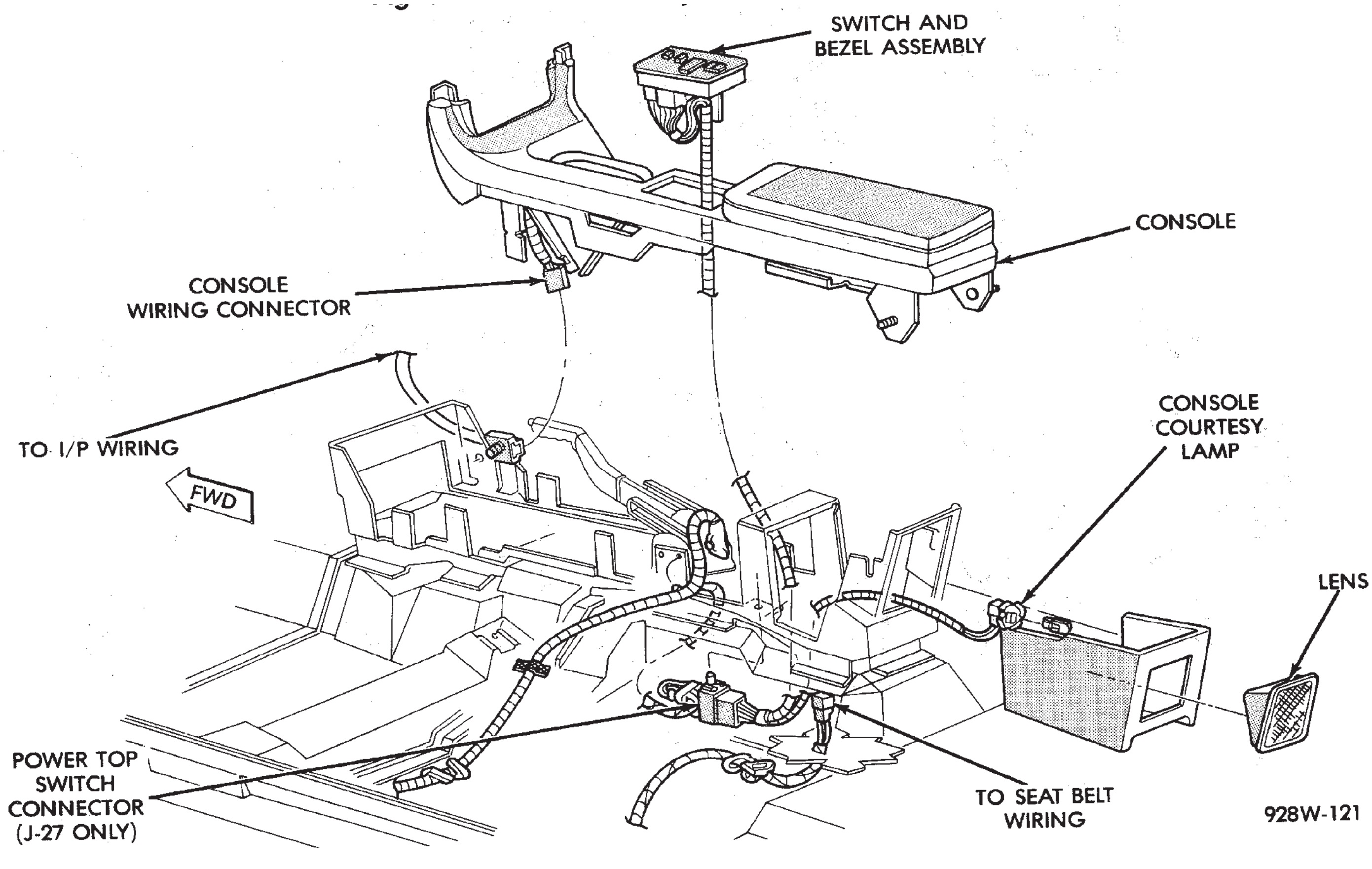


Fig. 9 Console Wiring AJ-Body

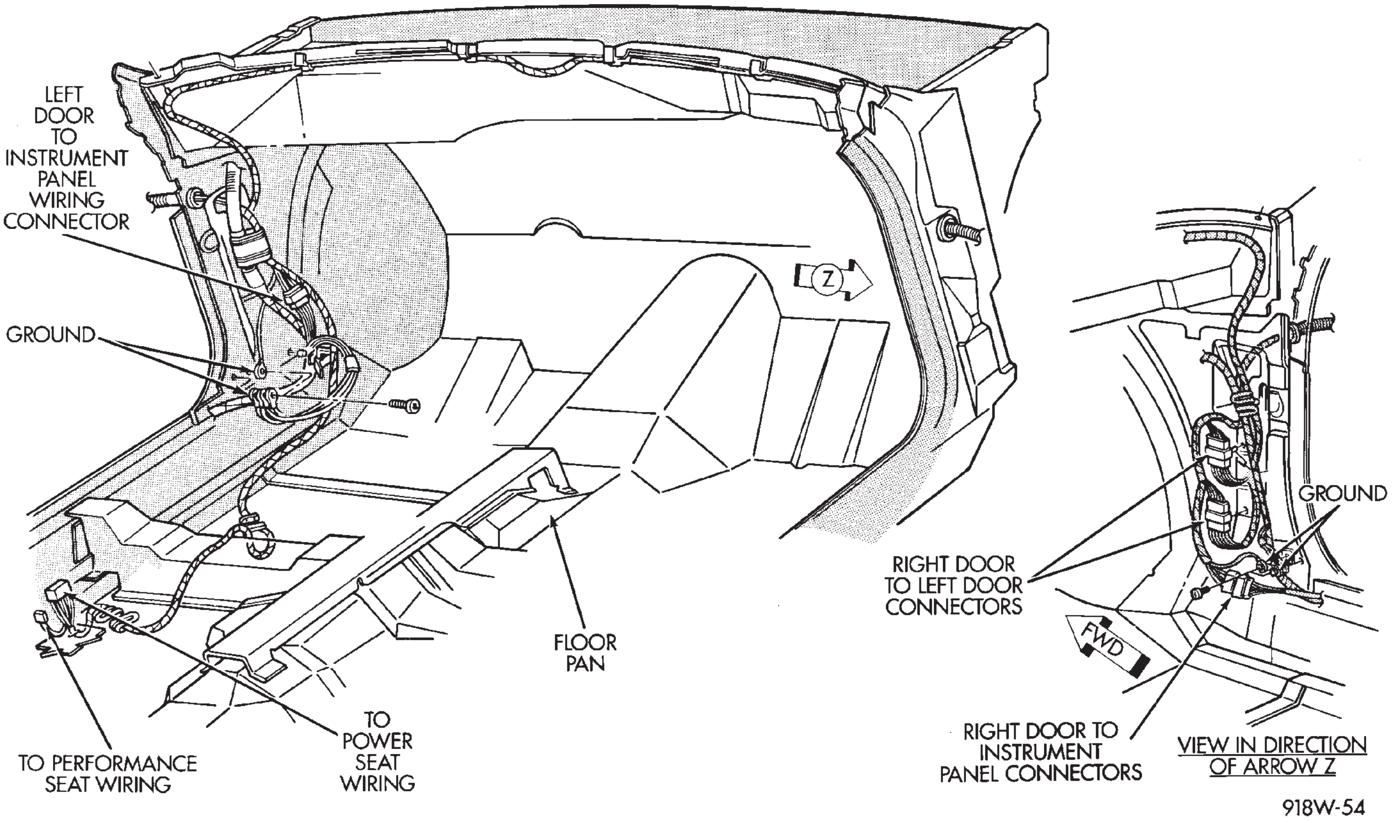


Fig. 10 Door Wiring (Body Side) AJ-Body

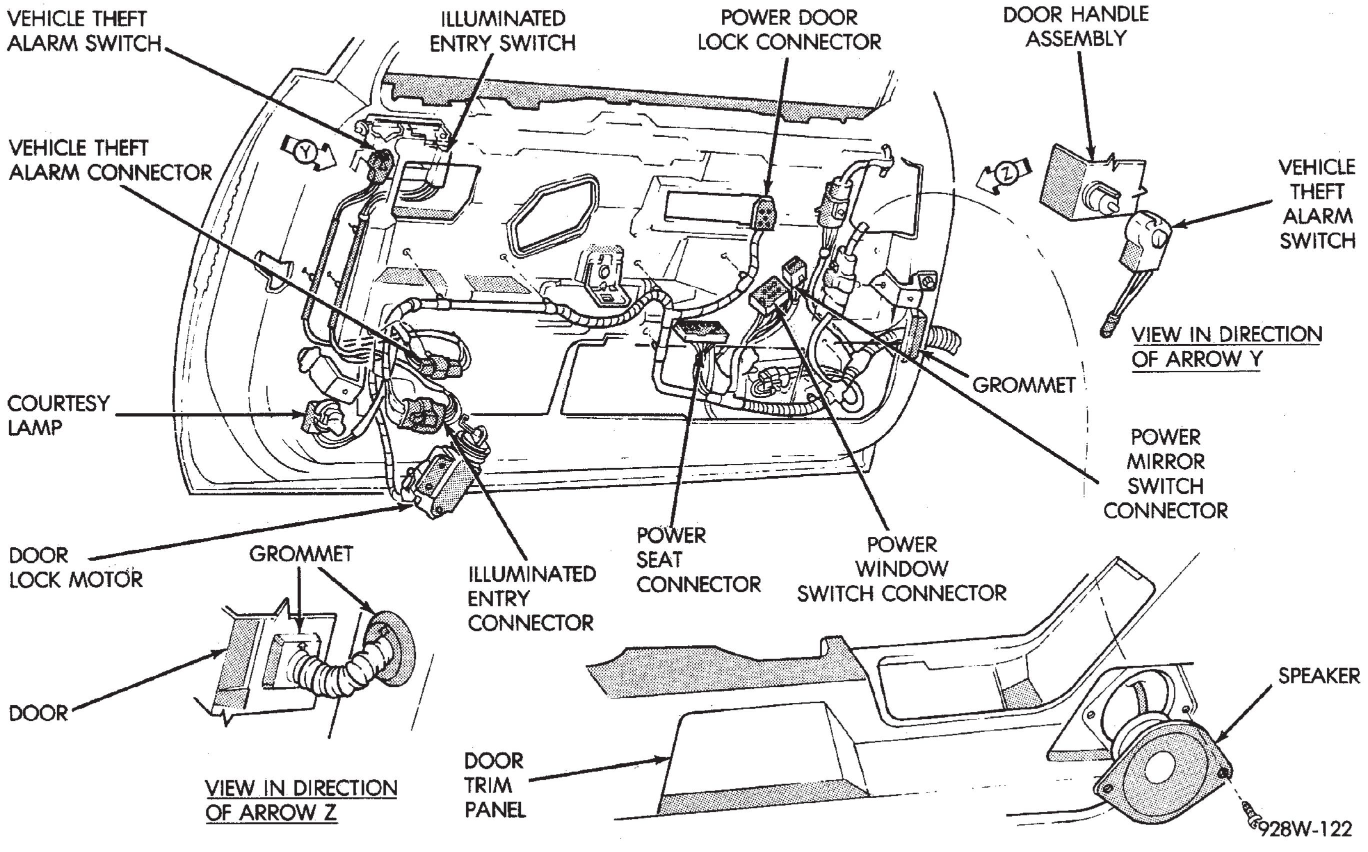


Fig. 11 Door Wiring AJ-Body

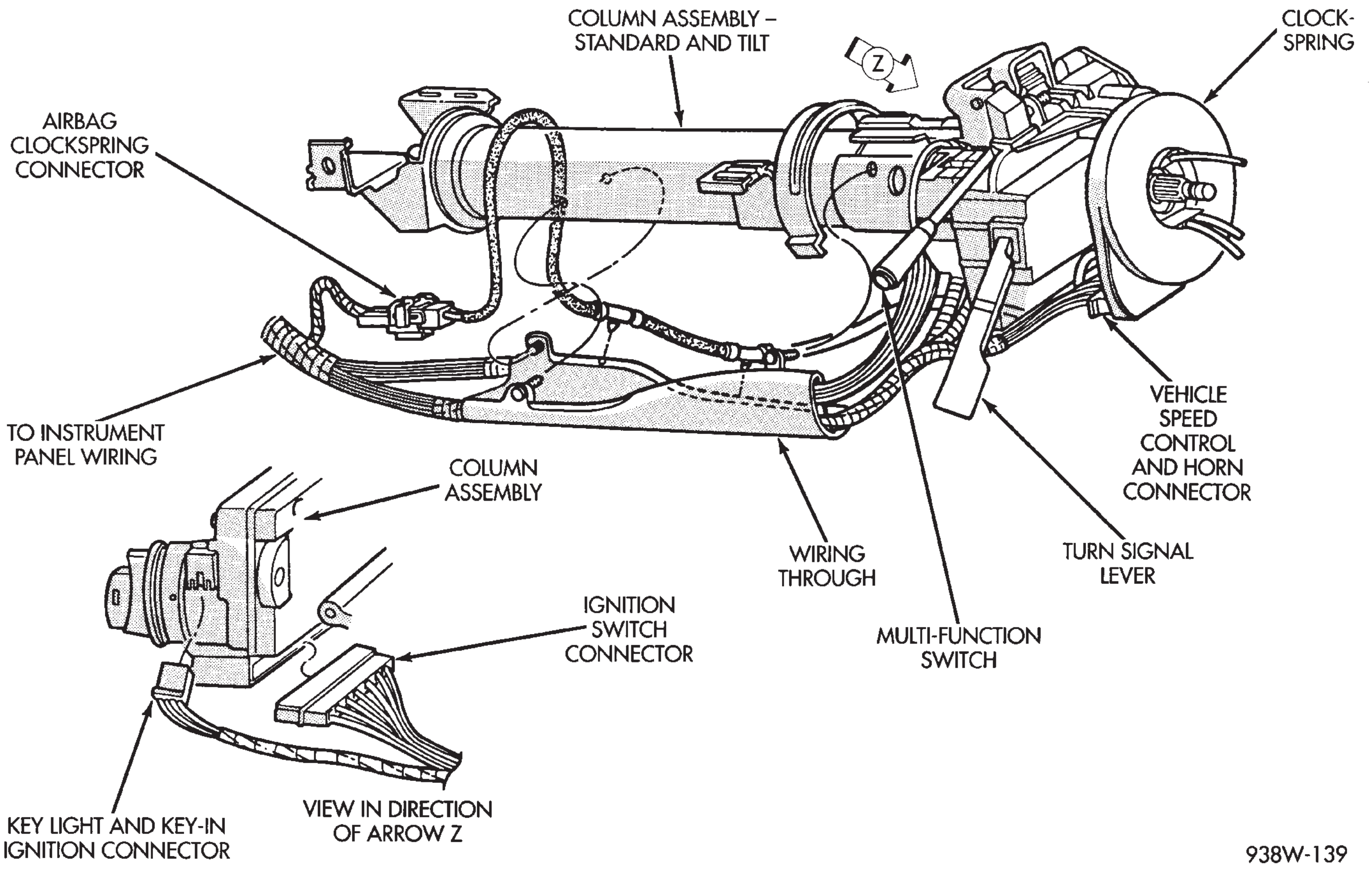


Fig. 12 Steering Column Wiring AJ-Body

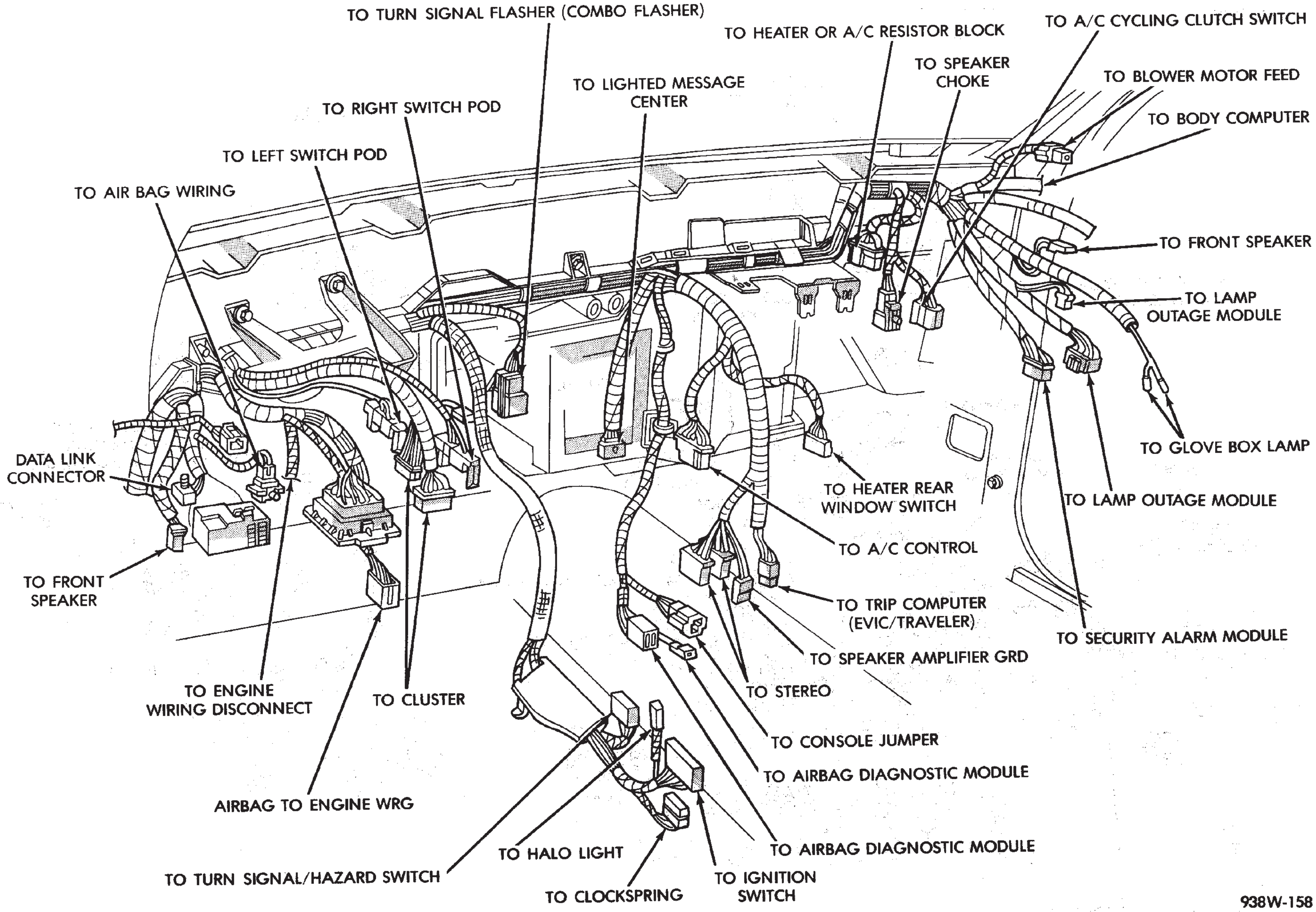


Fig. 13 Instrument Panel Wiring (Routing) AJ-Body

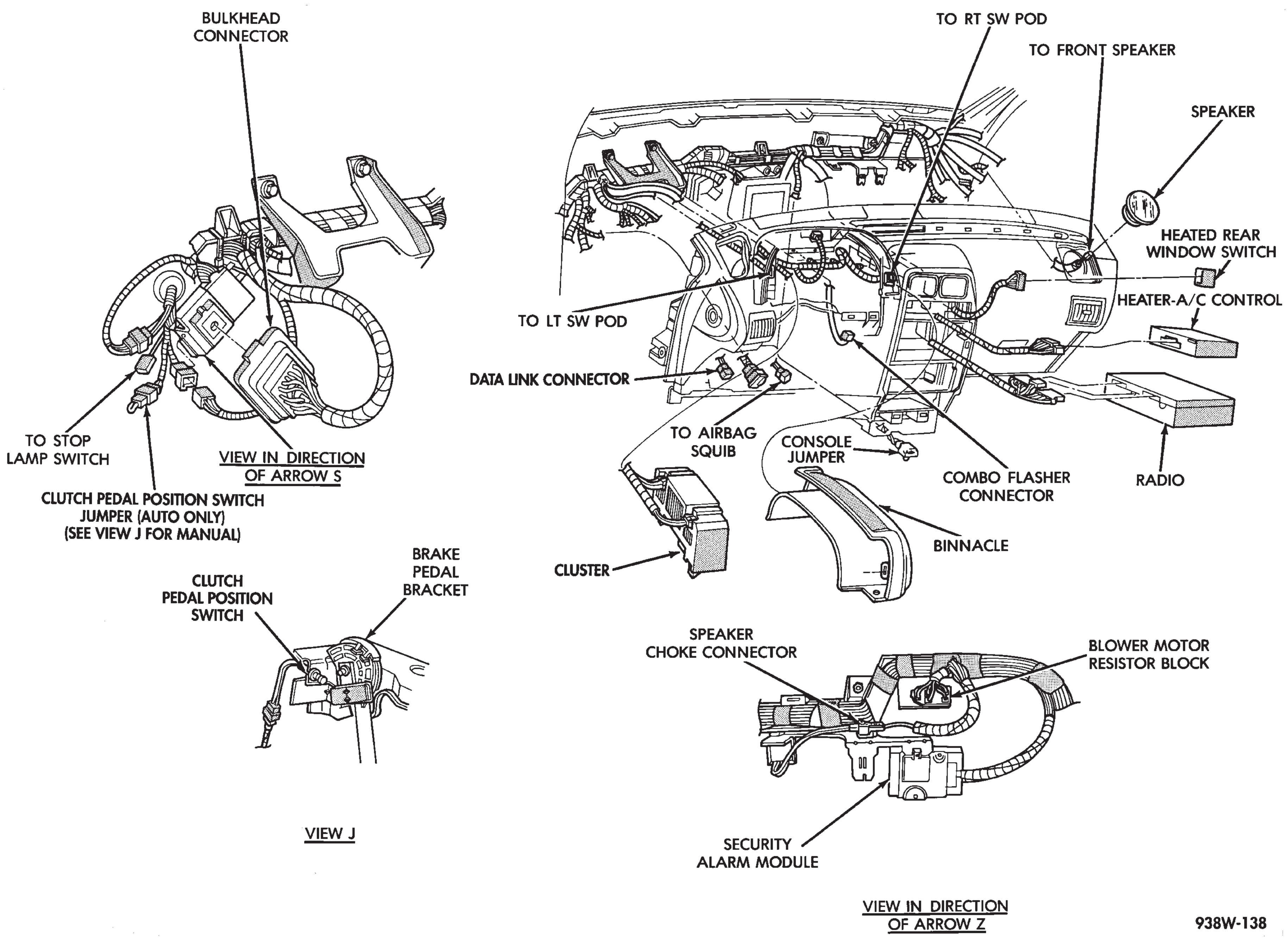


Fig. 14 Instrument Panel Wiring (Connections) AJ-Body

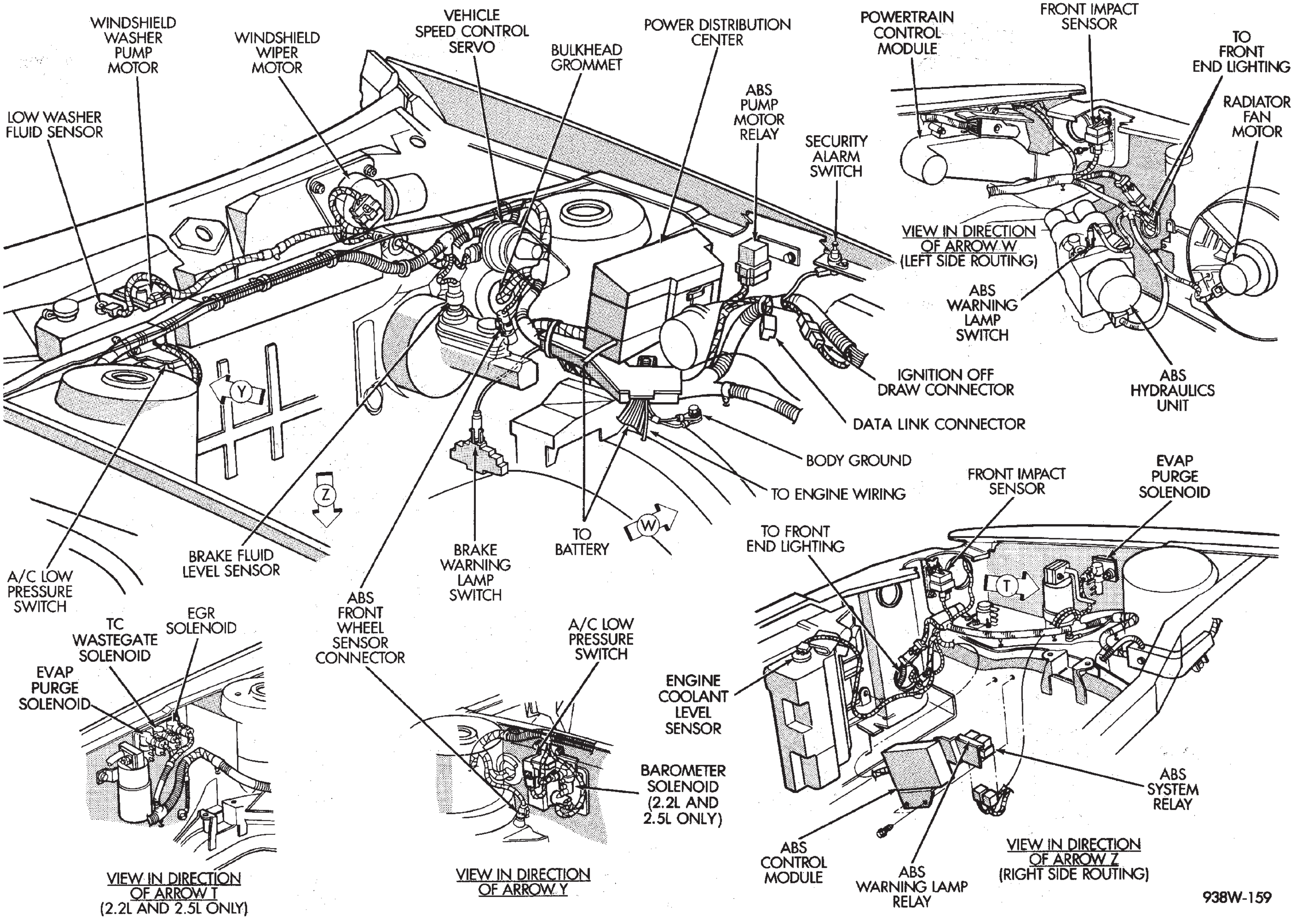


Fig. 15 Engine Compartment Wiring AJ-Body

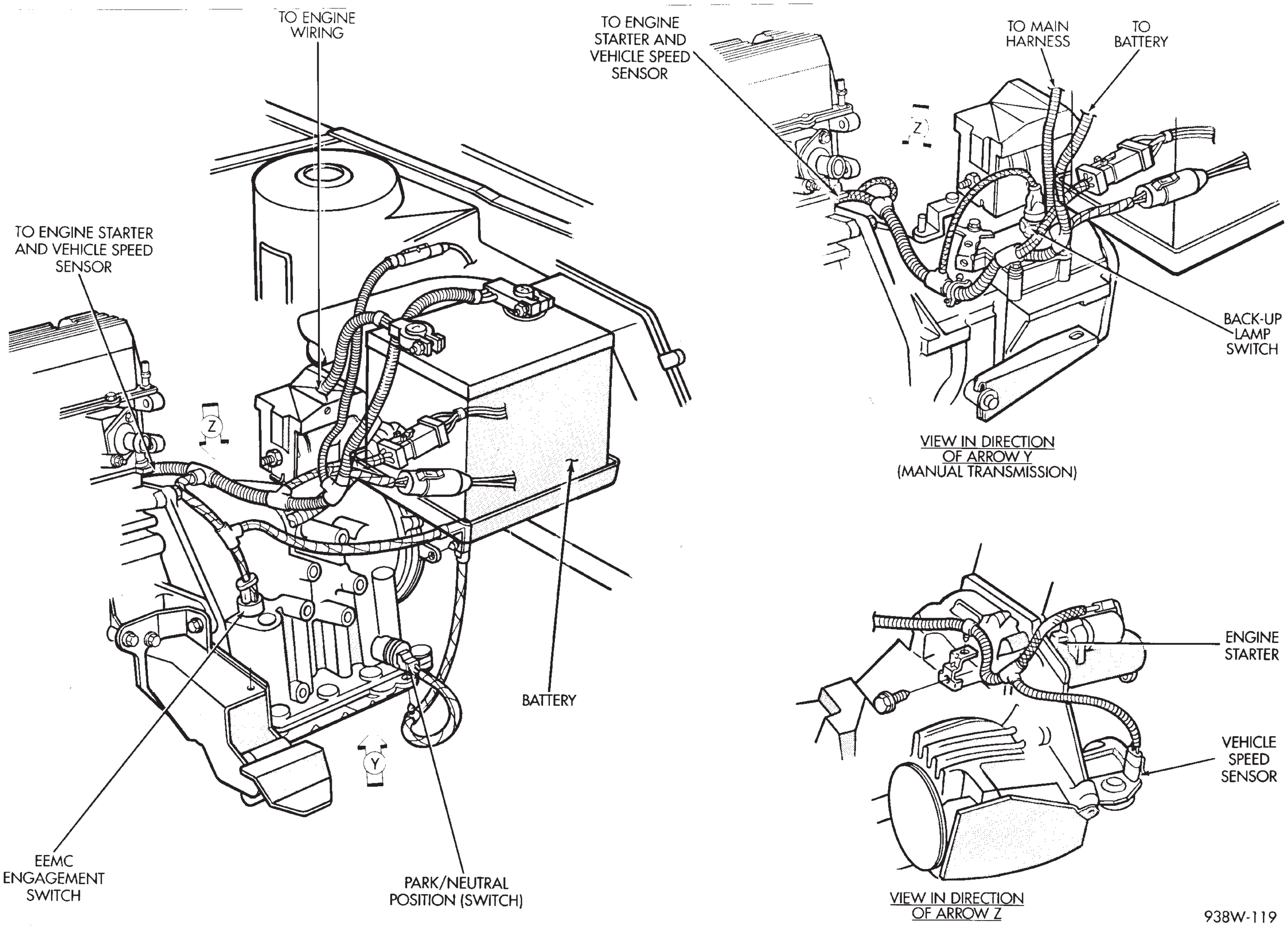


Fig. 16 Transmission Wiring AJ-Body

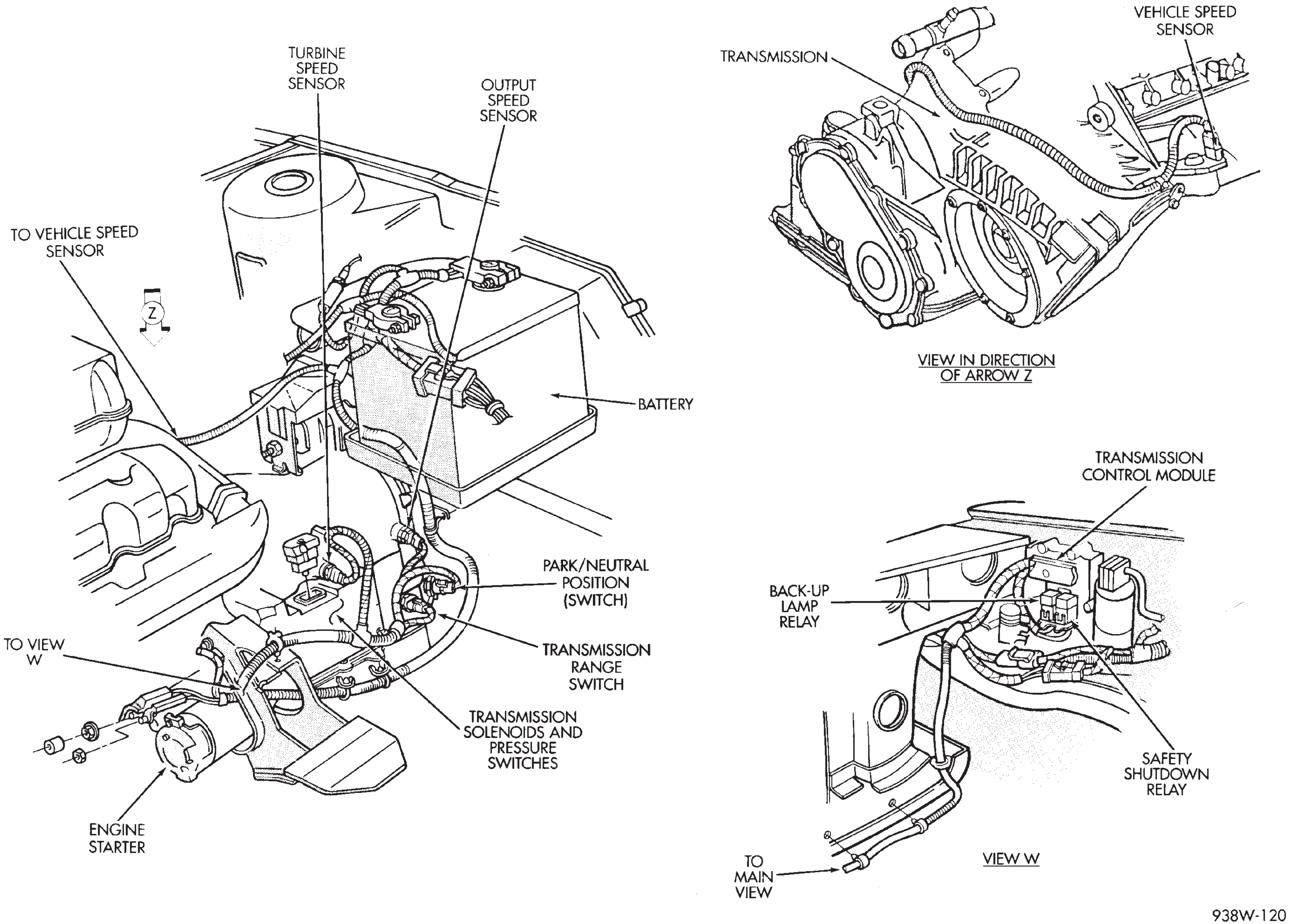


Fig. 17 Transmission Wiring 41TE AJ-Body

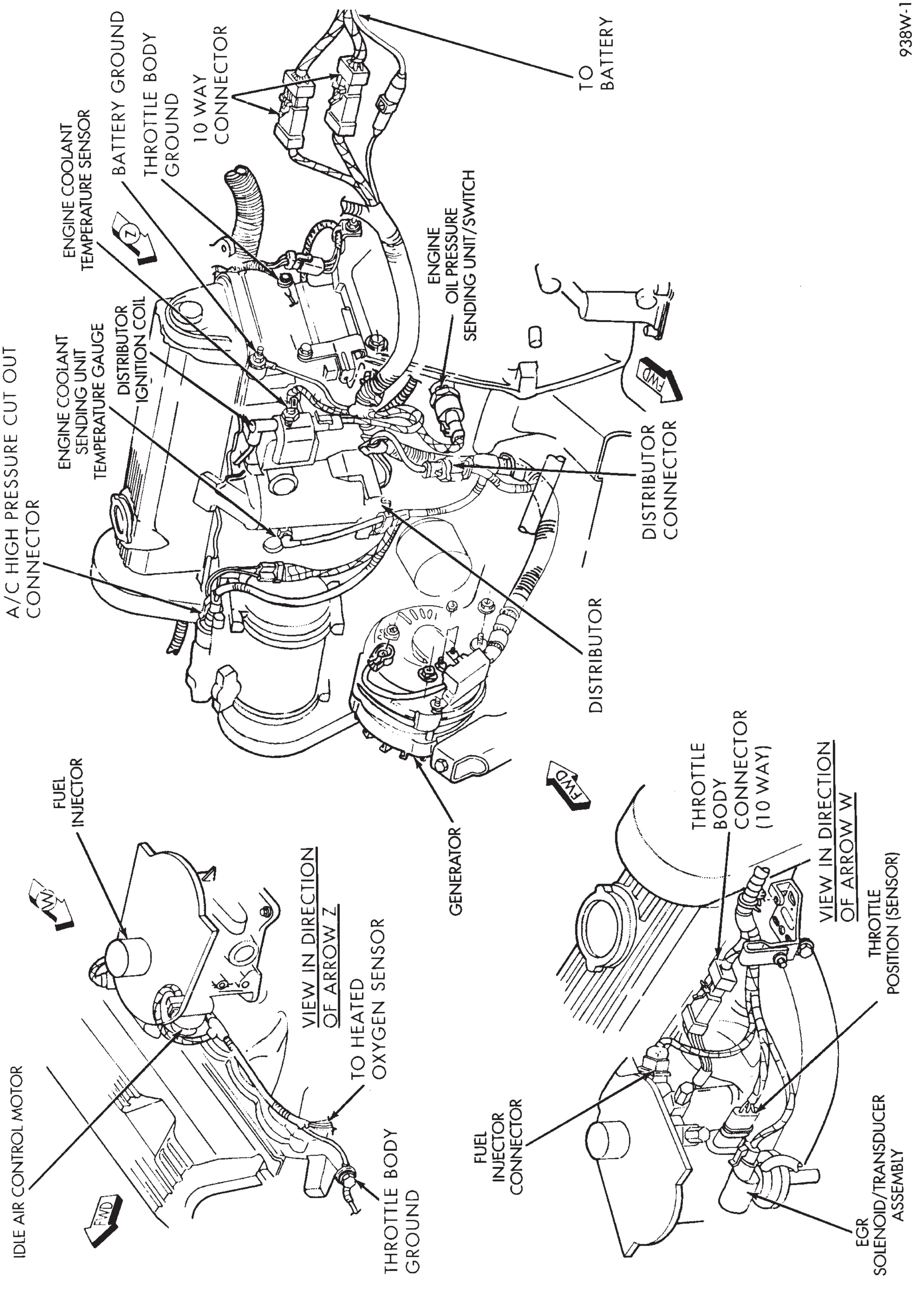


Fig. 18 Engine Wiring EFI AJ-Body

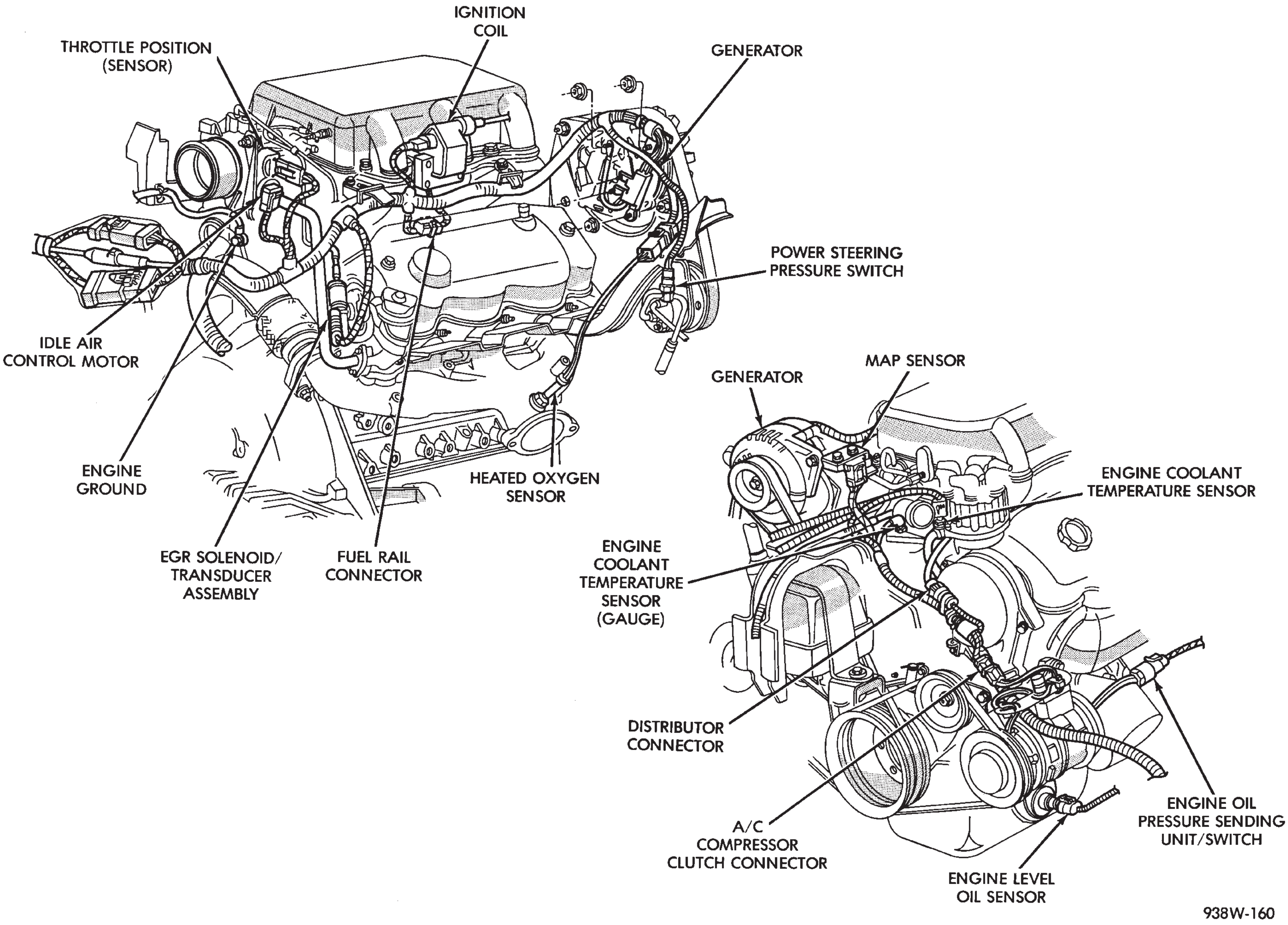


Fig. 19 Engine Wiring 3.0L AJ-Body

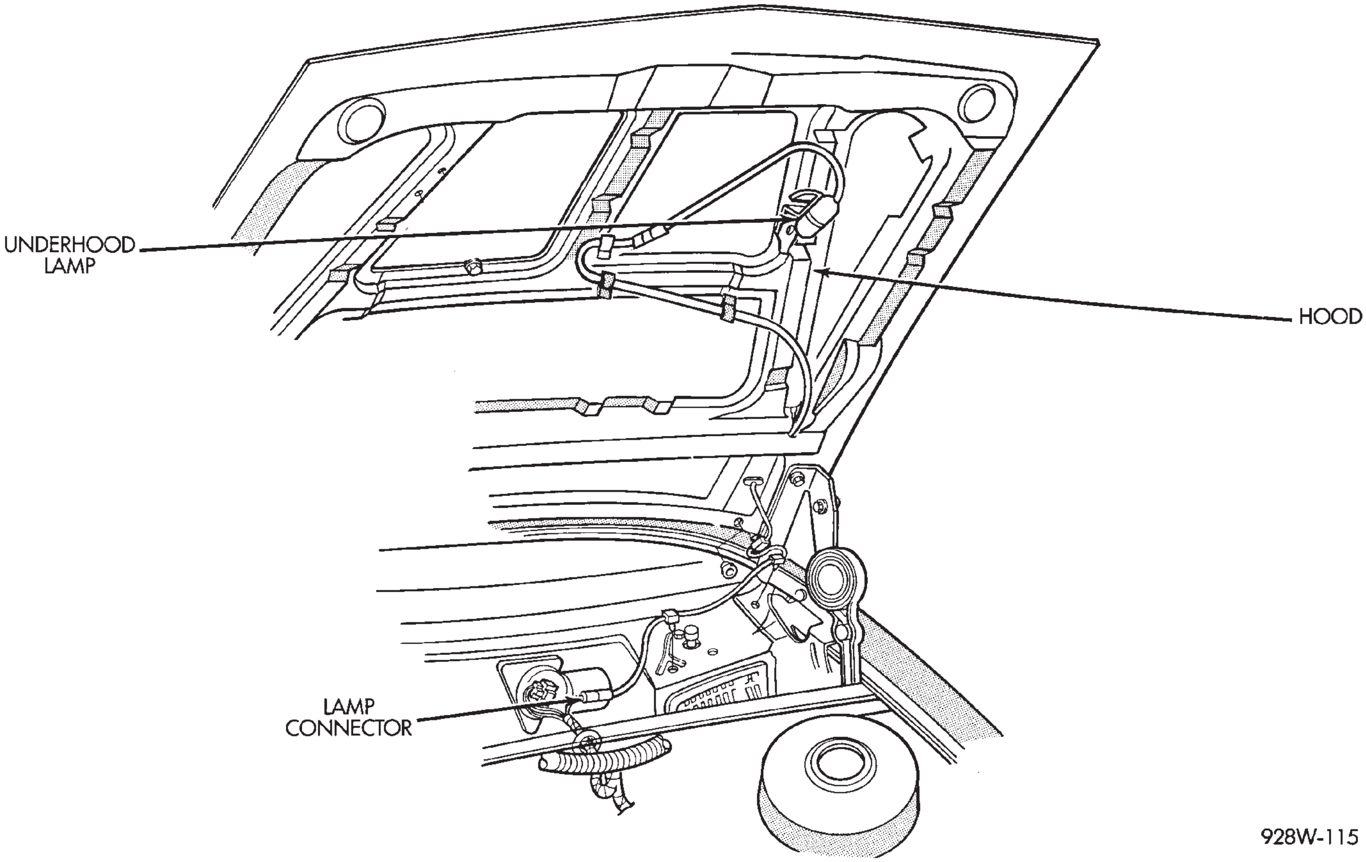


Fig. 20 Underhood Lamp Wiring AJ-Body

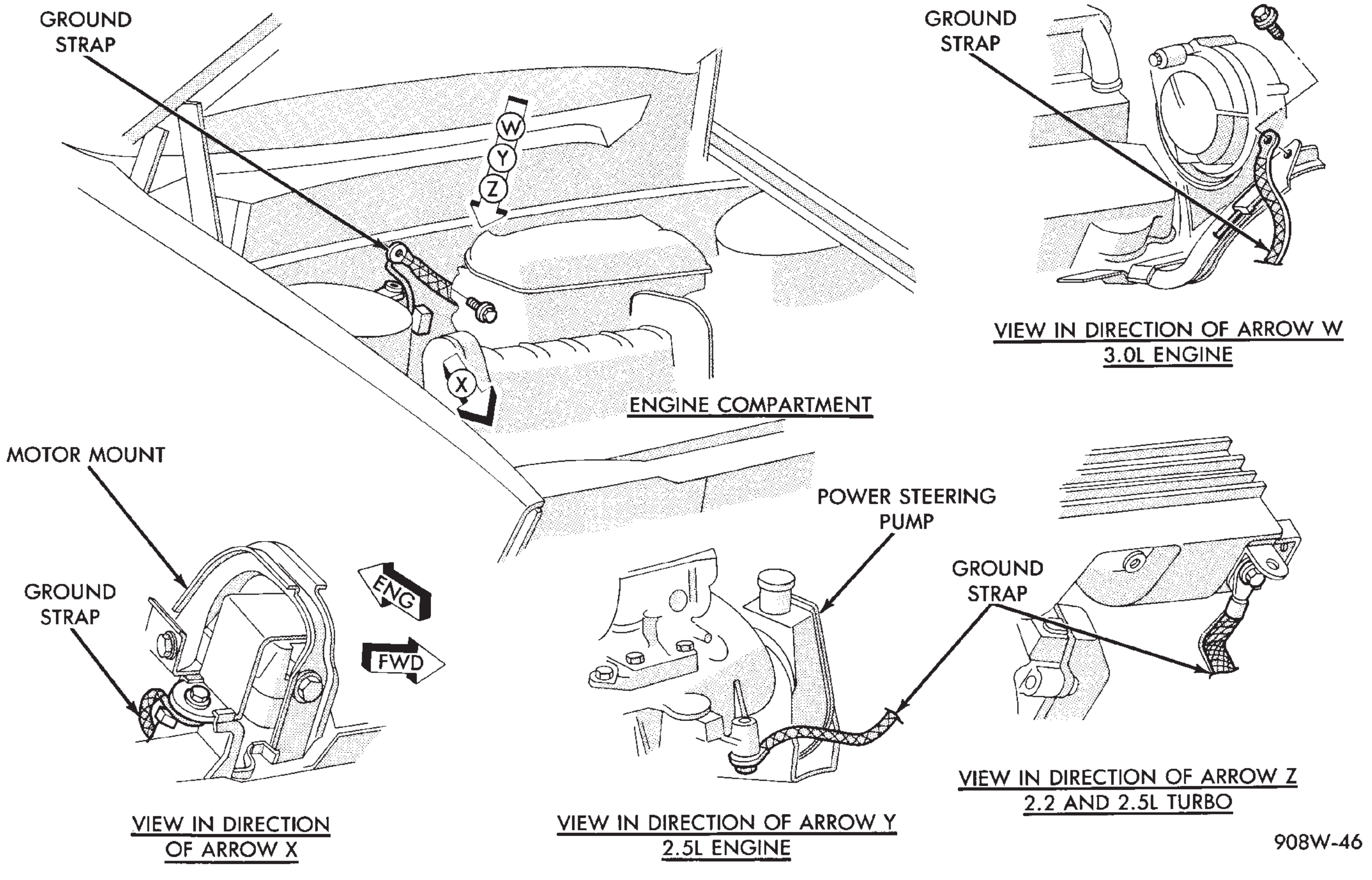


Fig. 21 Ground Strap Locations AJ-Body

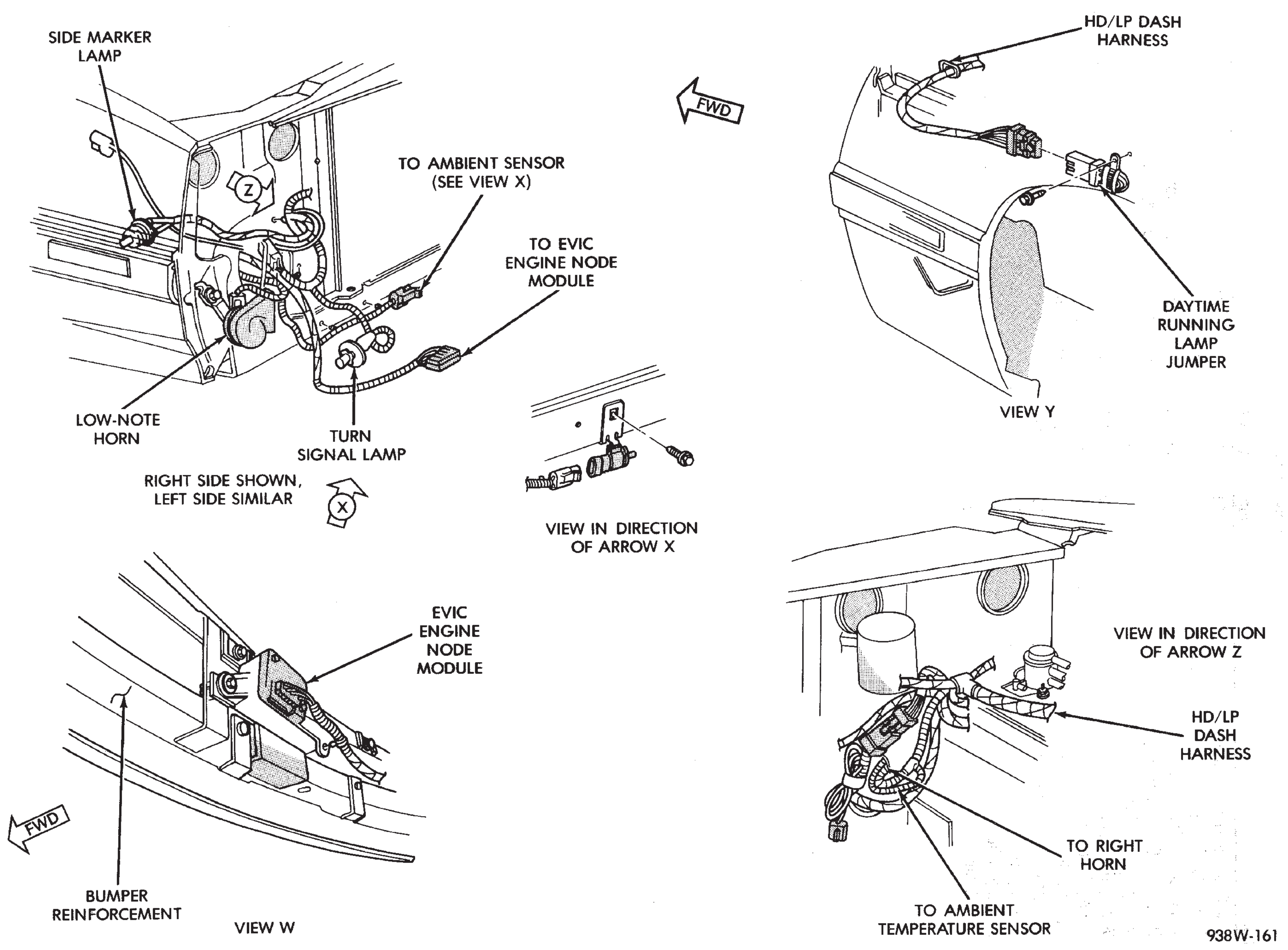


Fig. 22 Front End Wiring AJ-Body

AP BODY D, P

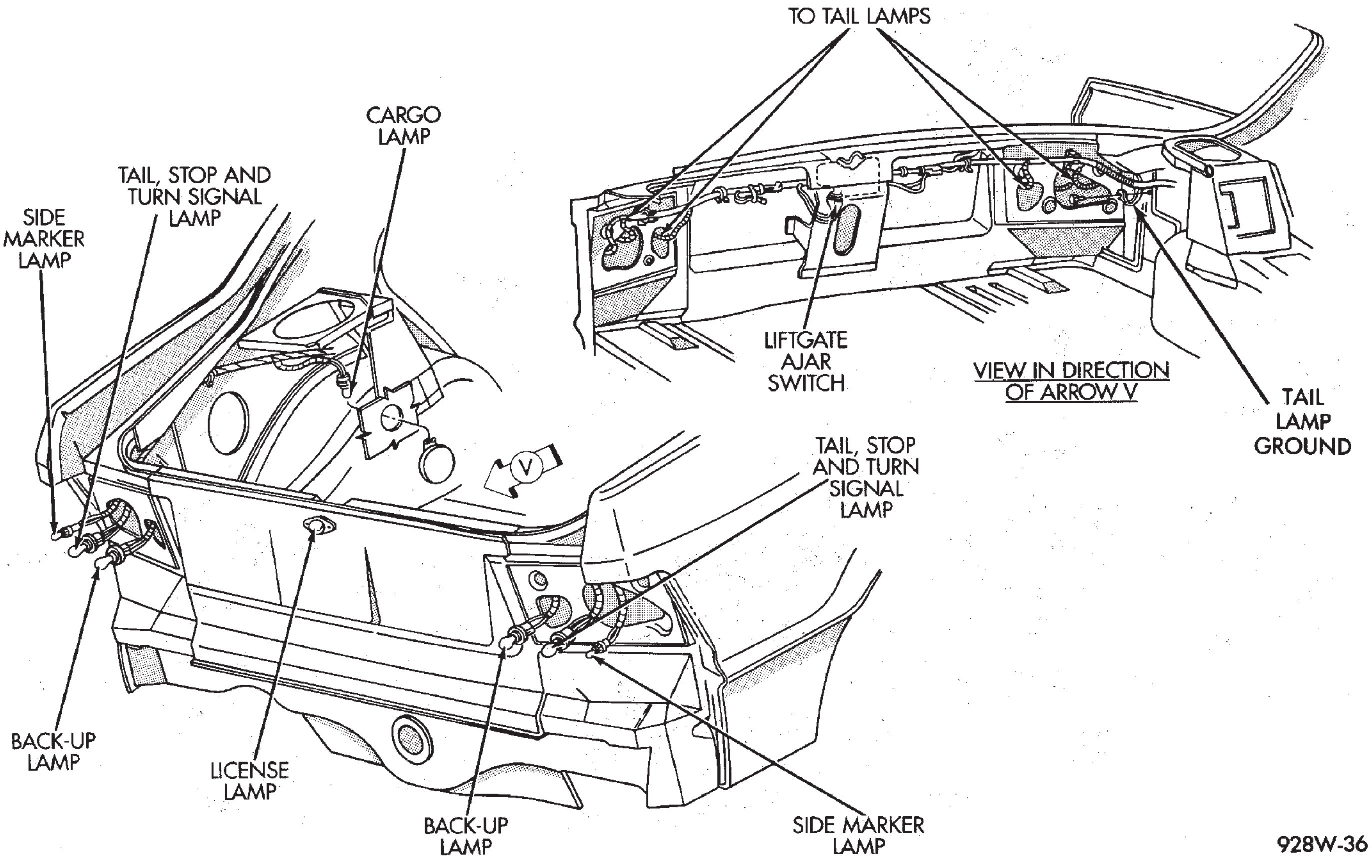


Fig. 1 Rear End Wiring AP-Body

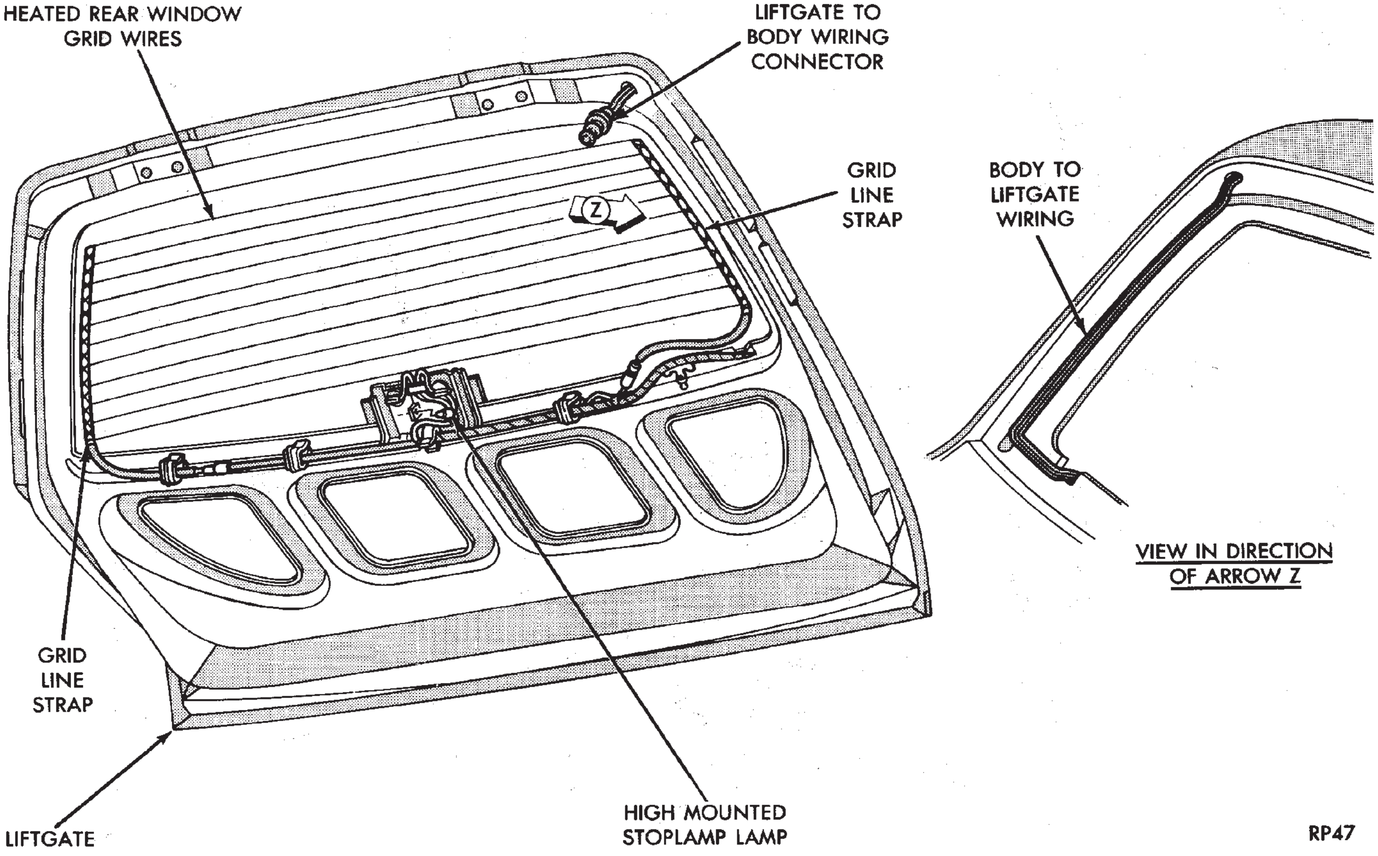


Fig. 2 Liftgate Wiring AP-Body

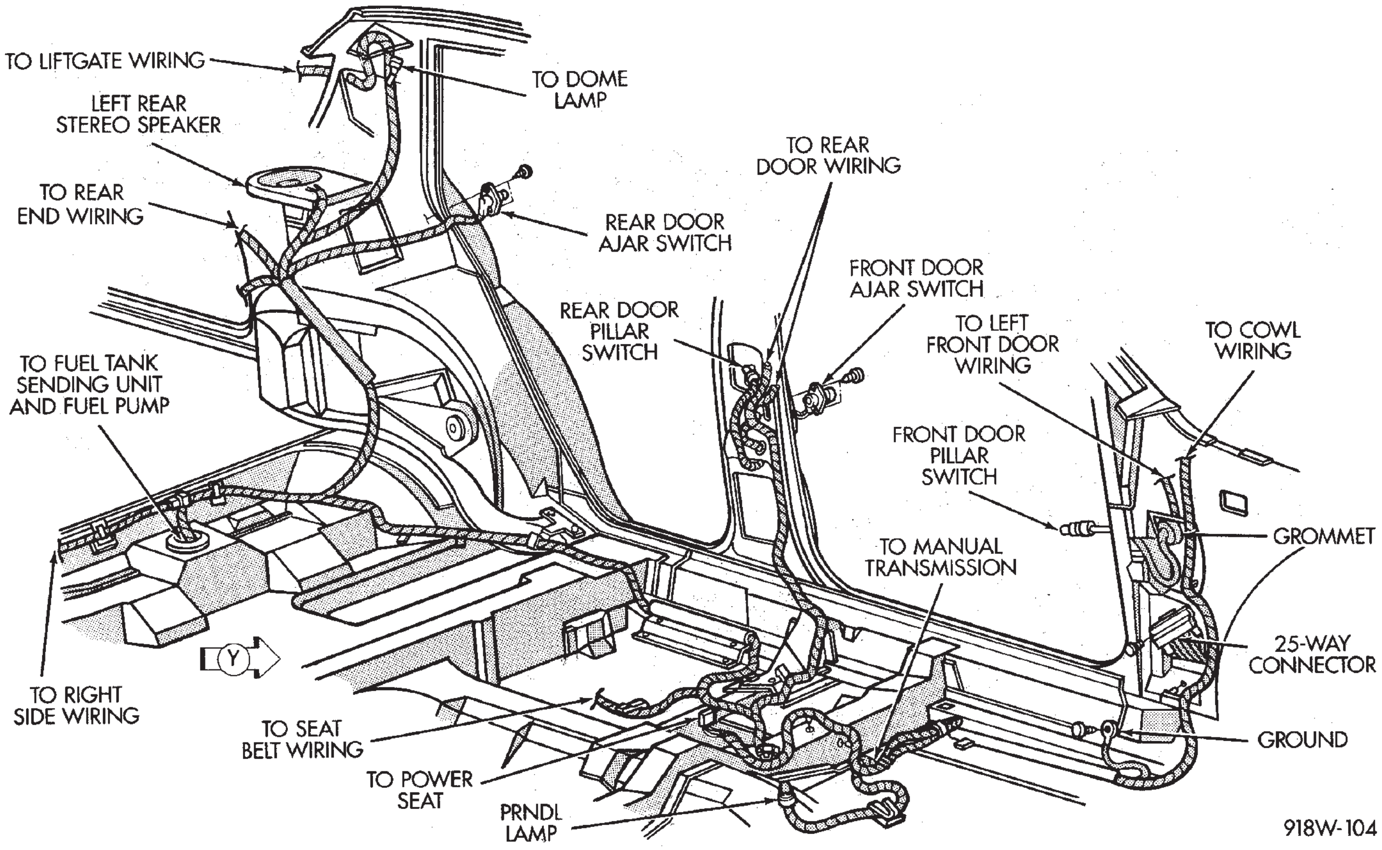


Fig. 3 Body Left Side Wiring AP-Body

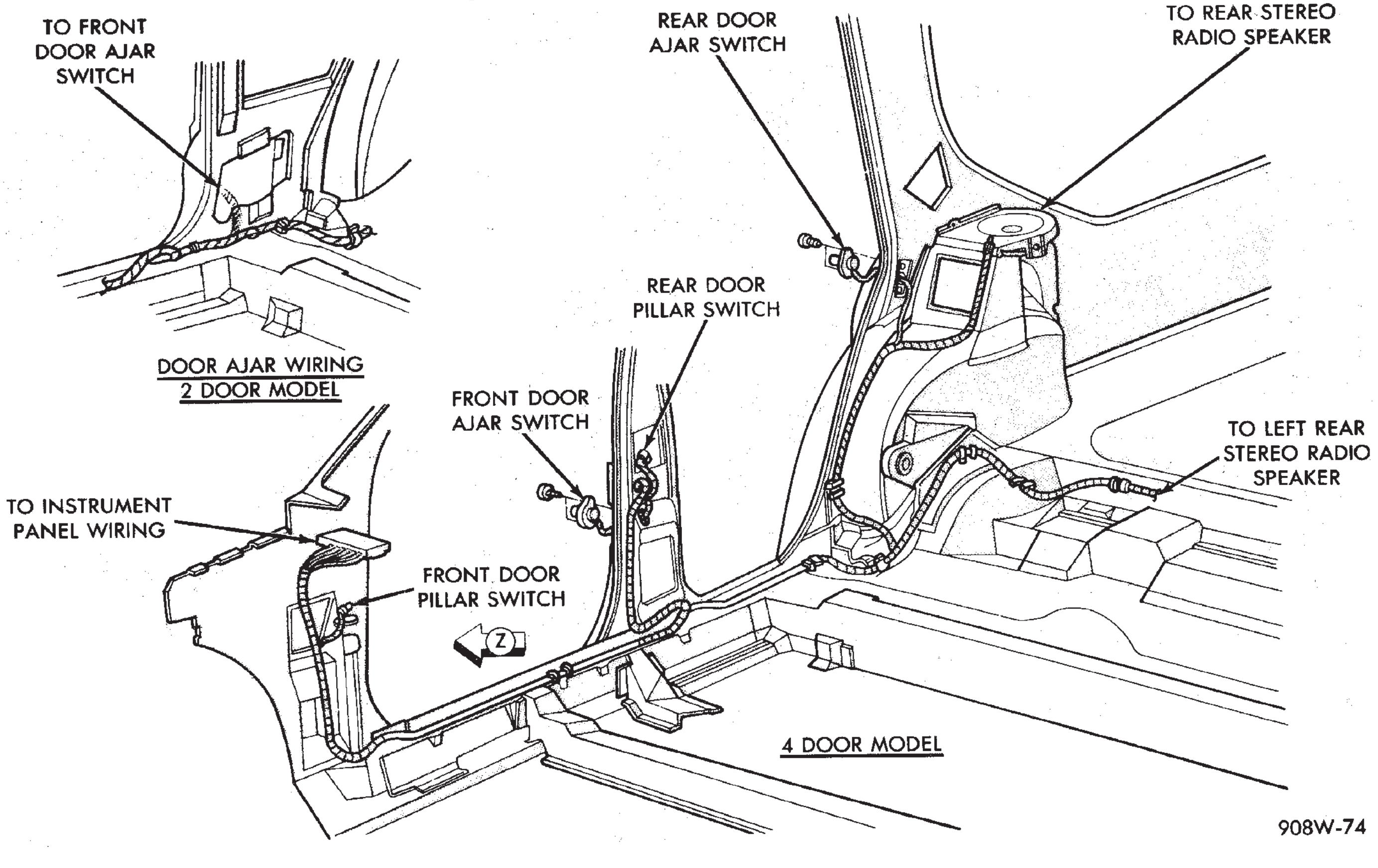


Fig. 4 Body Right Side Wiring AP-Body

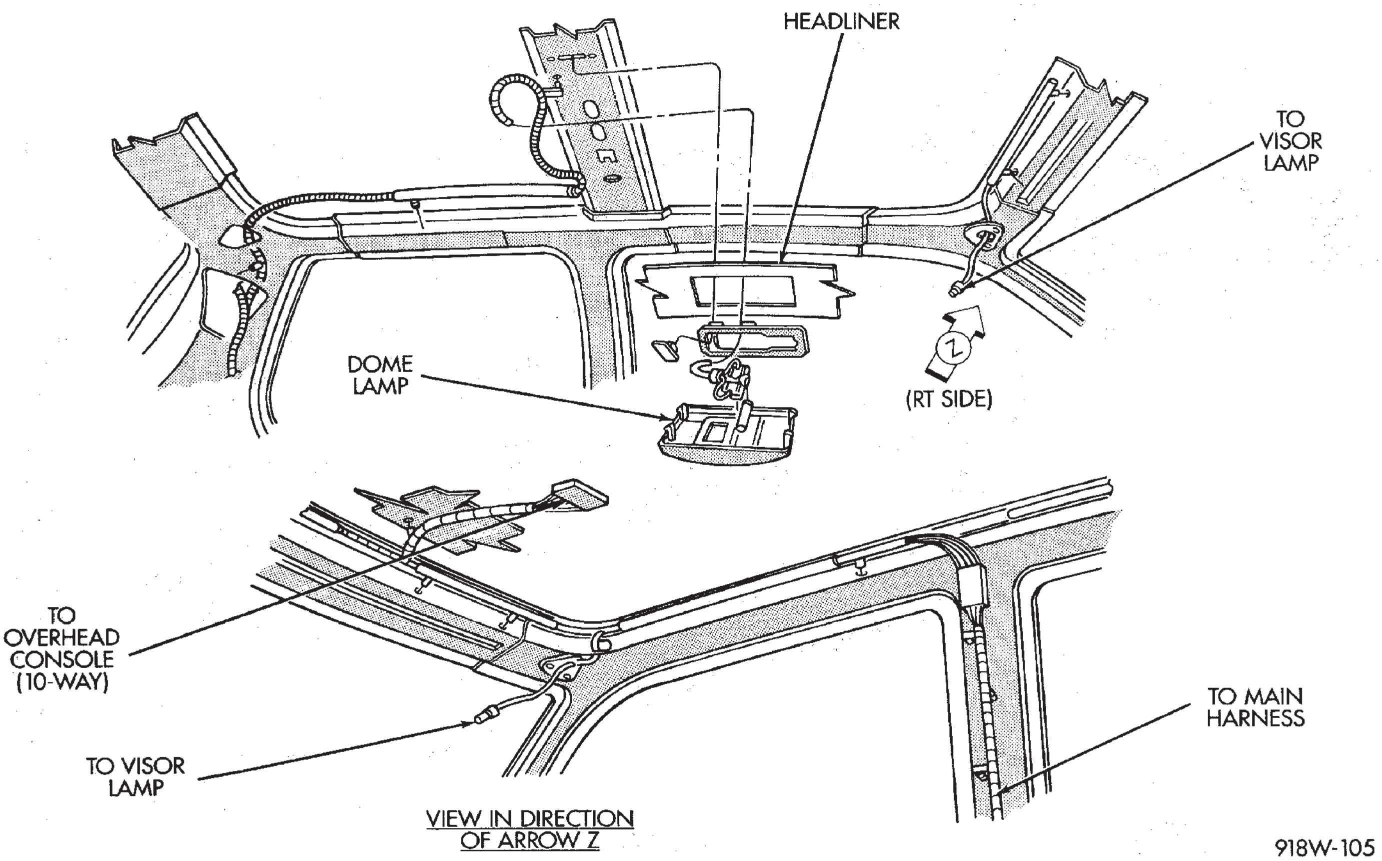


Fig. 5 Roof Wiring AP-Body

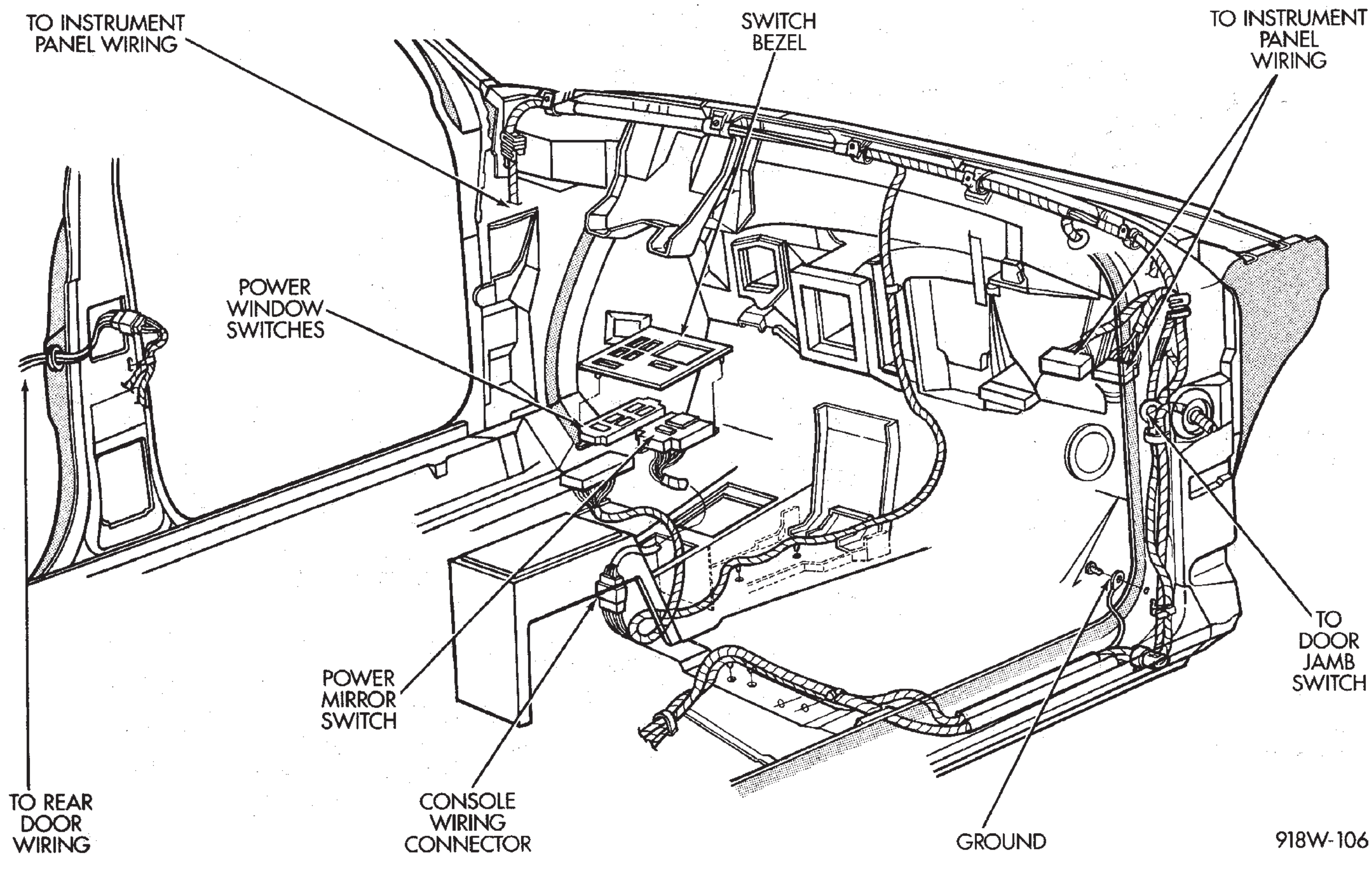


Fig. 6 Cowl Panel and Console Wiring AP-Body

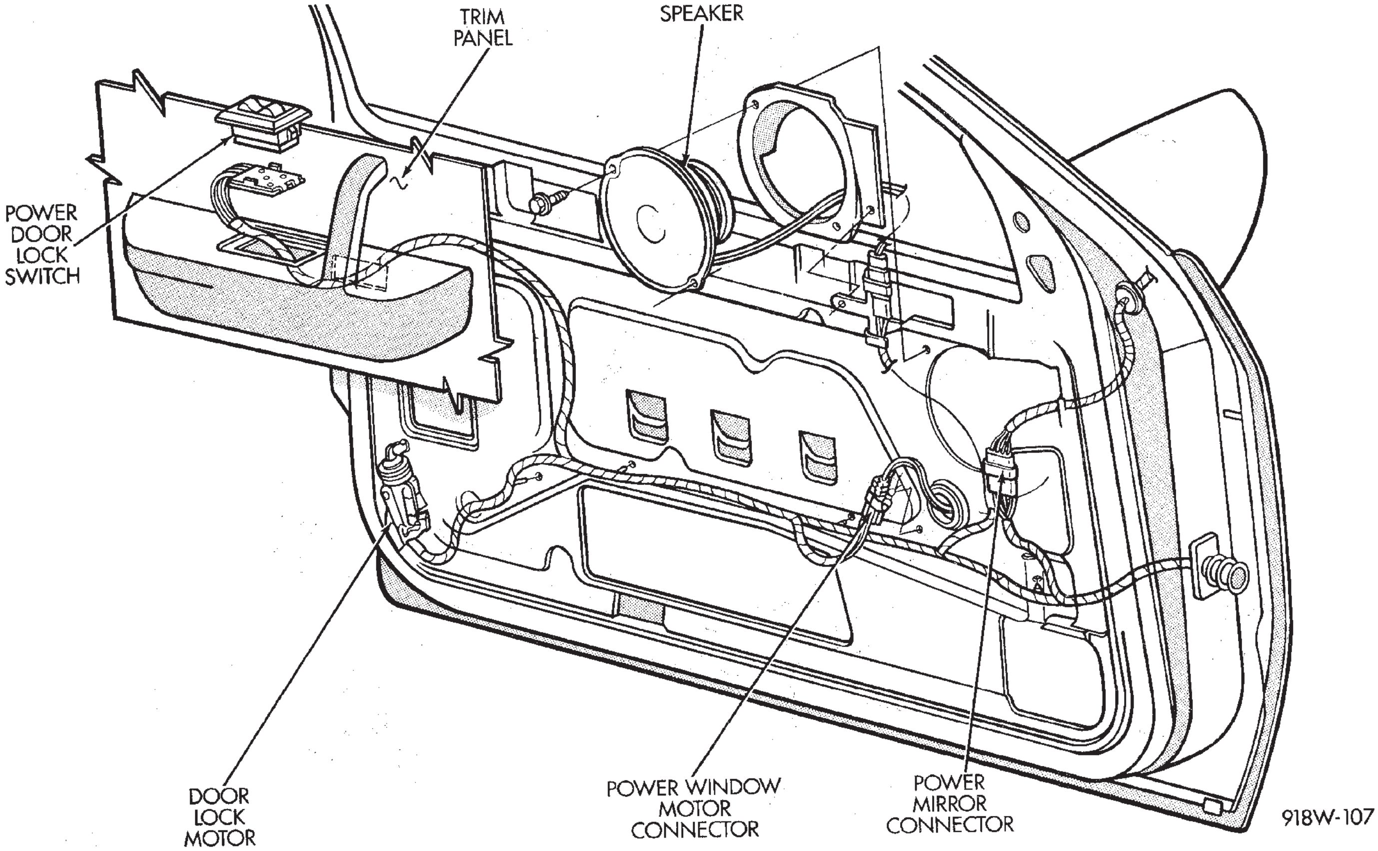


Fig. 7 Door Wiring (Front) 2dr AP-Body

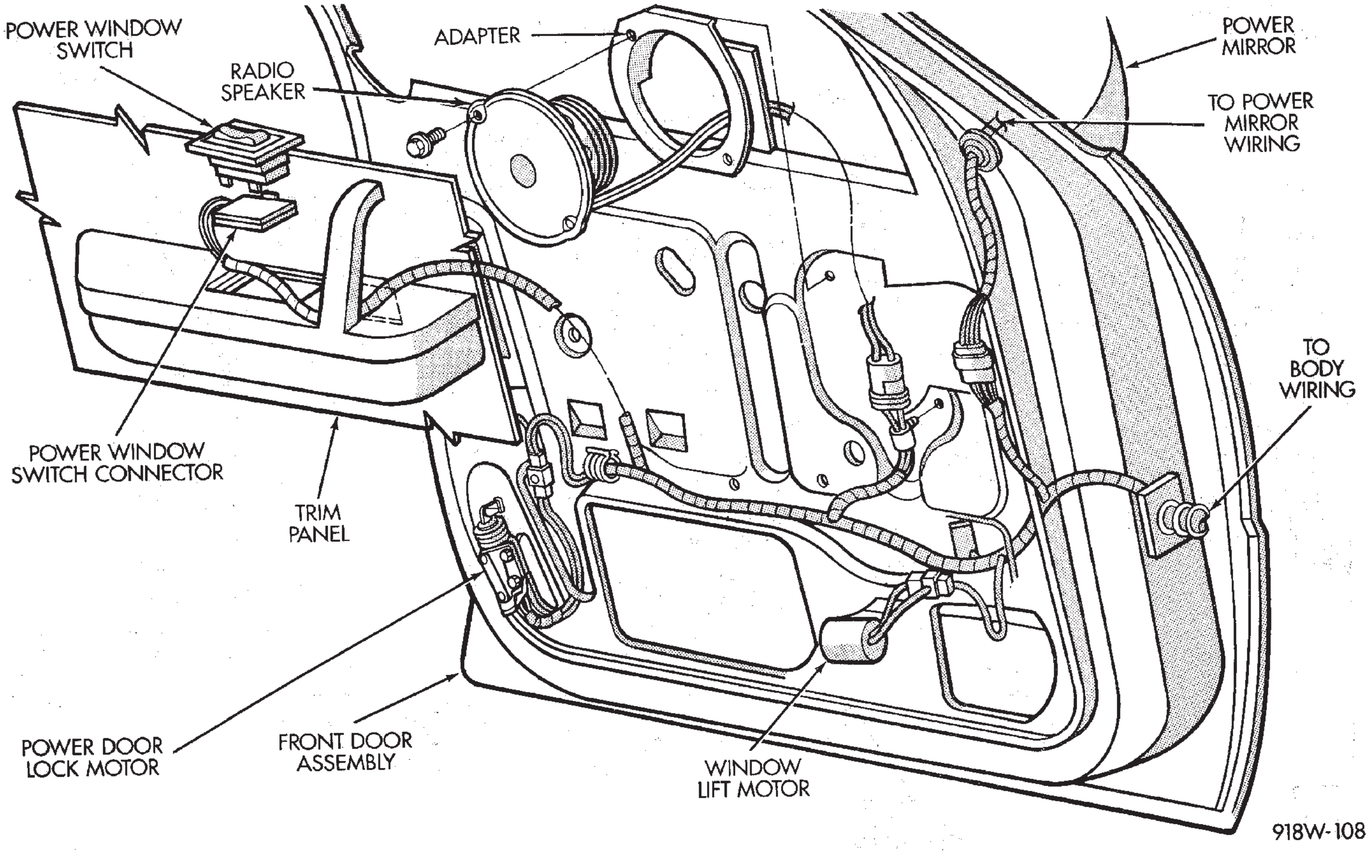


Fig. 8 Door Wiring (Front) 4dr AP-Body

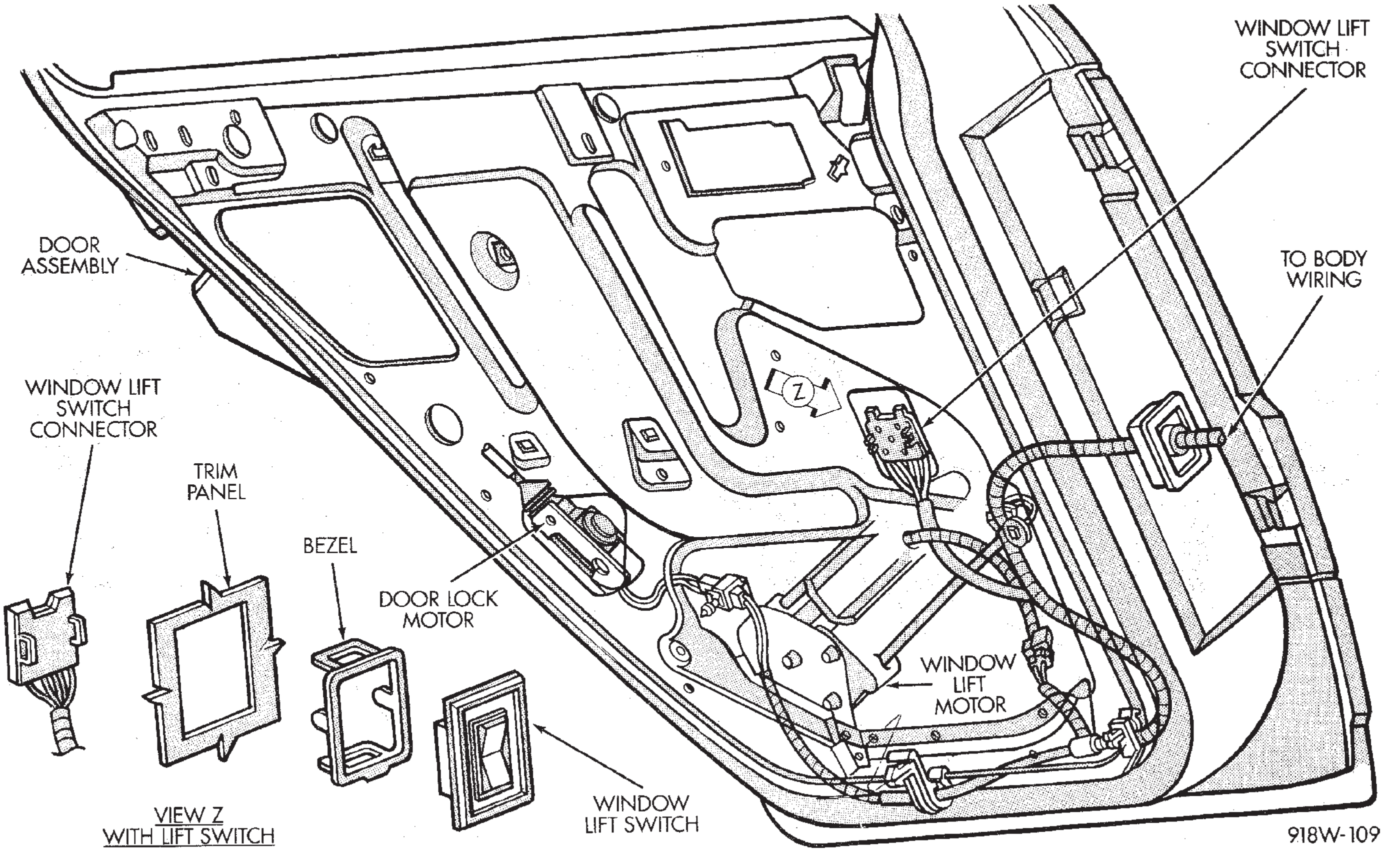


Fig. 9 Door Wiring (Rear) 4dr AP-Body

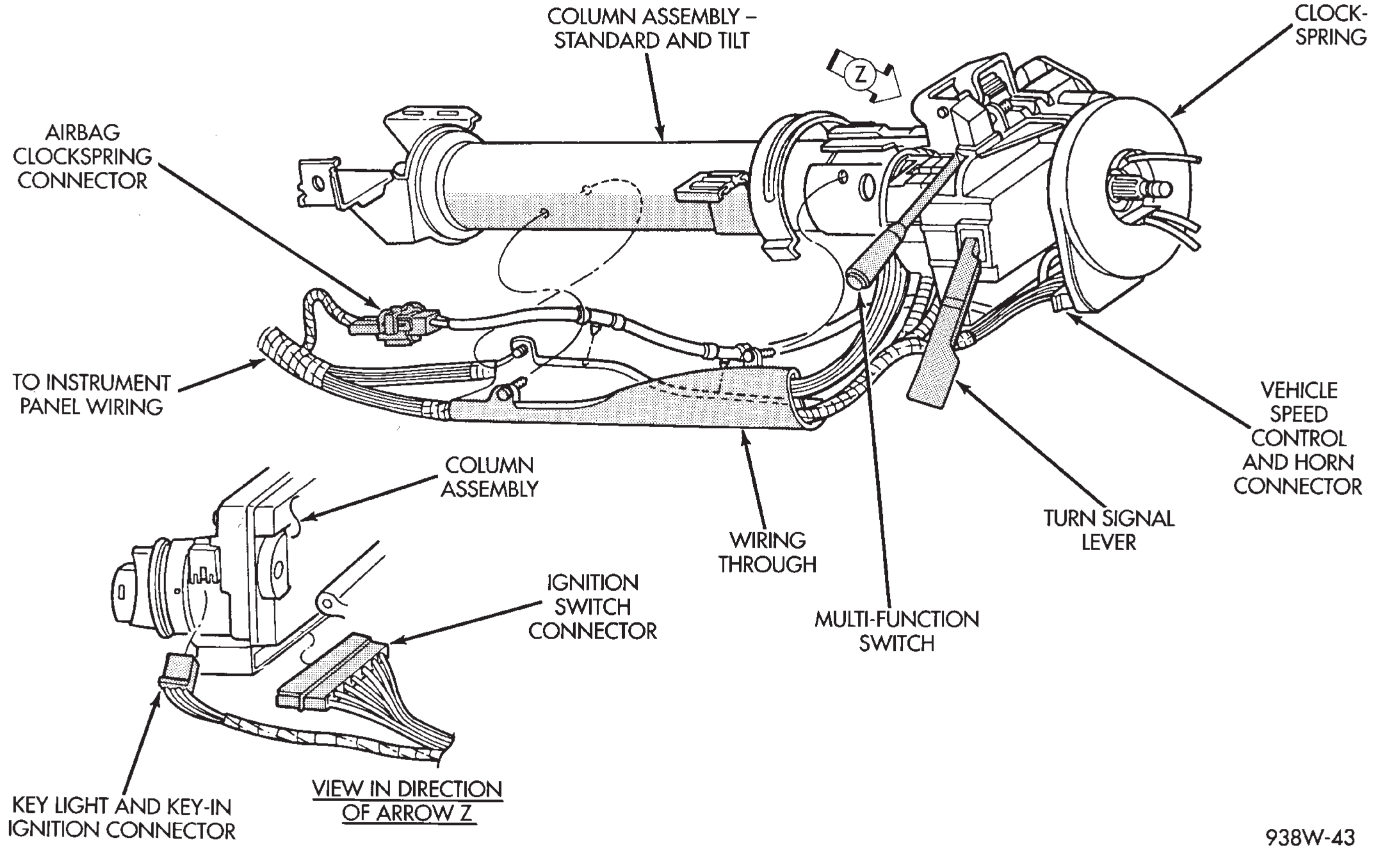


Fig. 10 Steering Column Wiring AP-Body

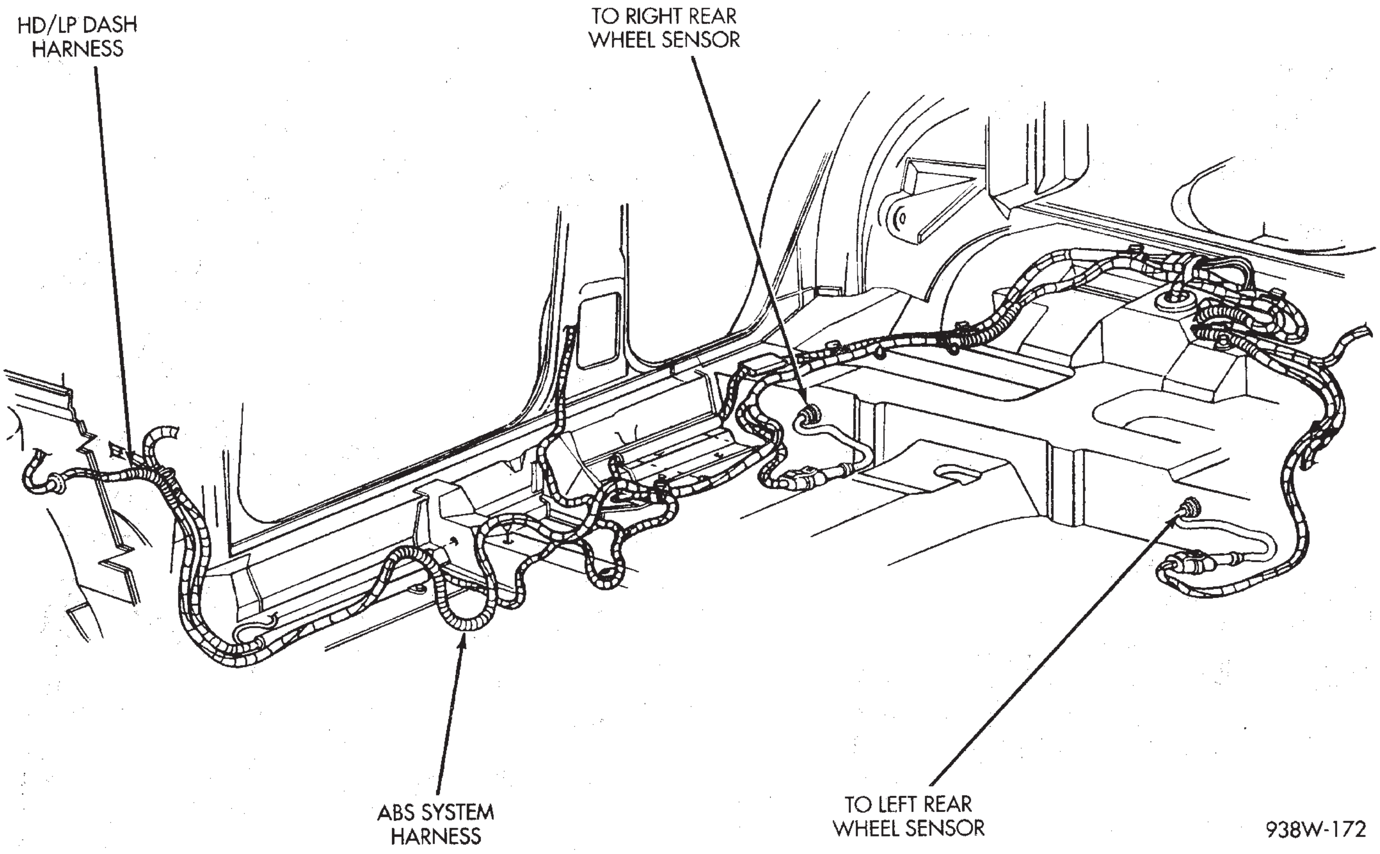


Fig. 11 Anti-Lock Brake System Wiring AP-Body

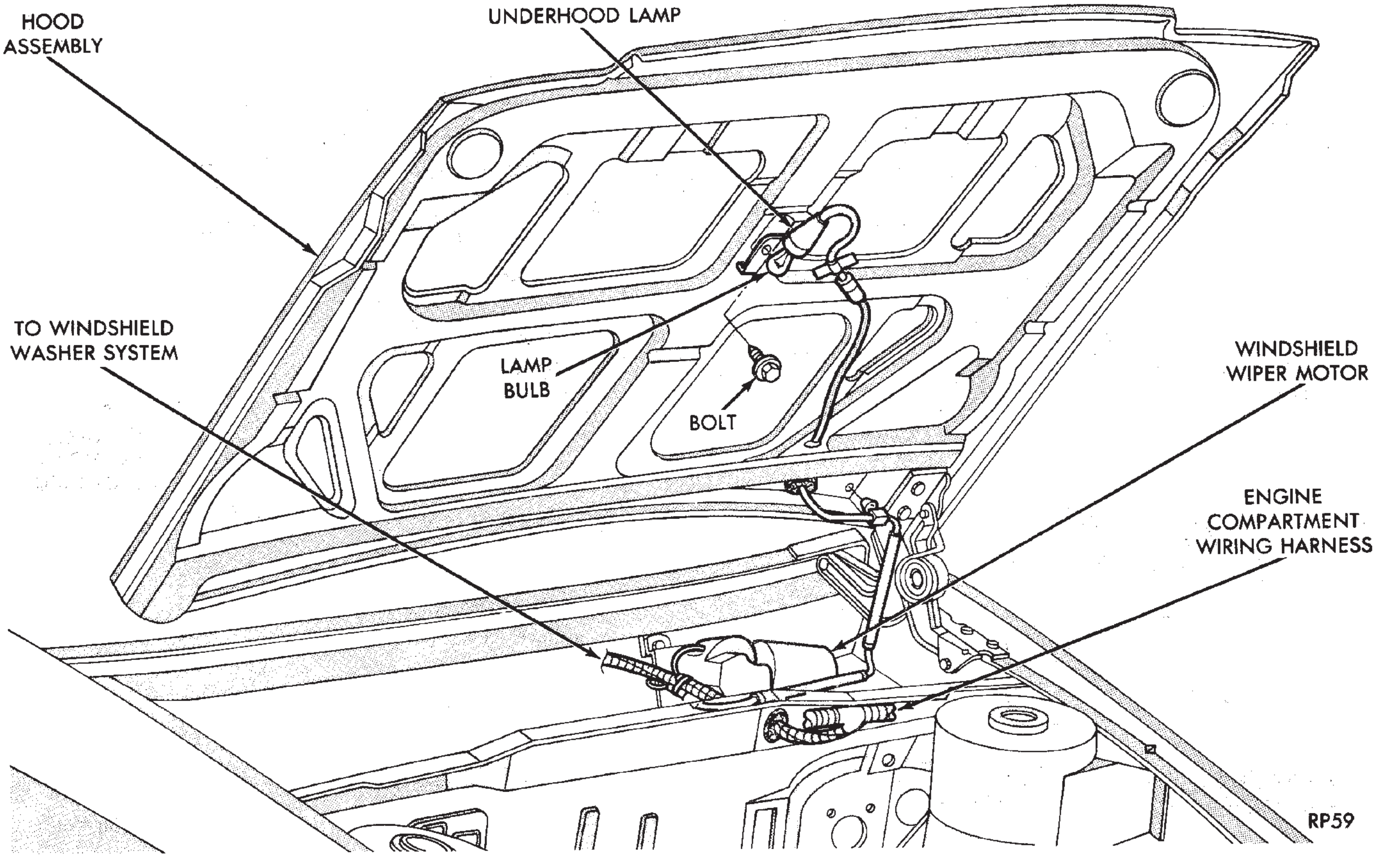


Fig. 12 Underhood Lamp Wiring AP-Body

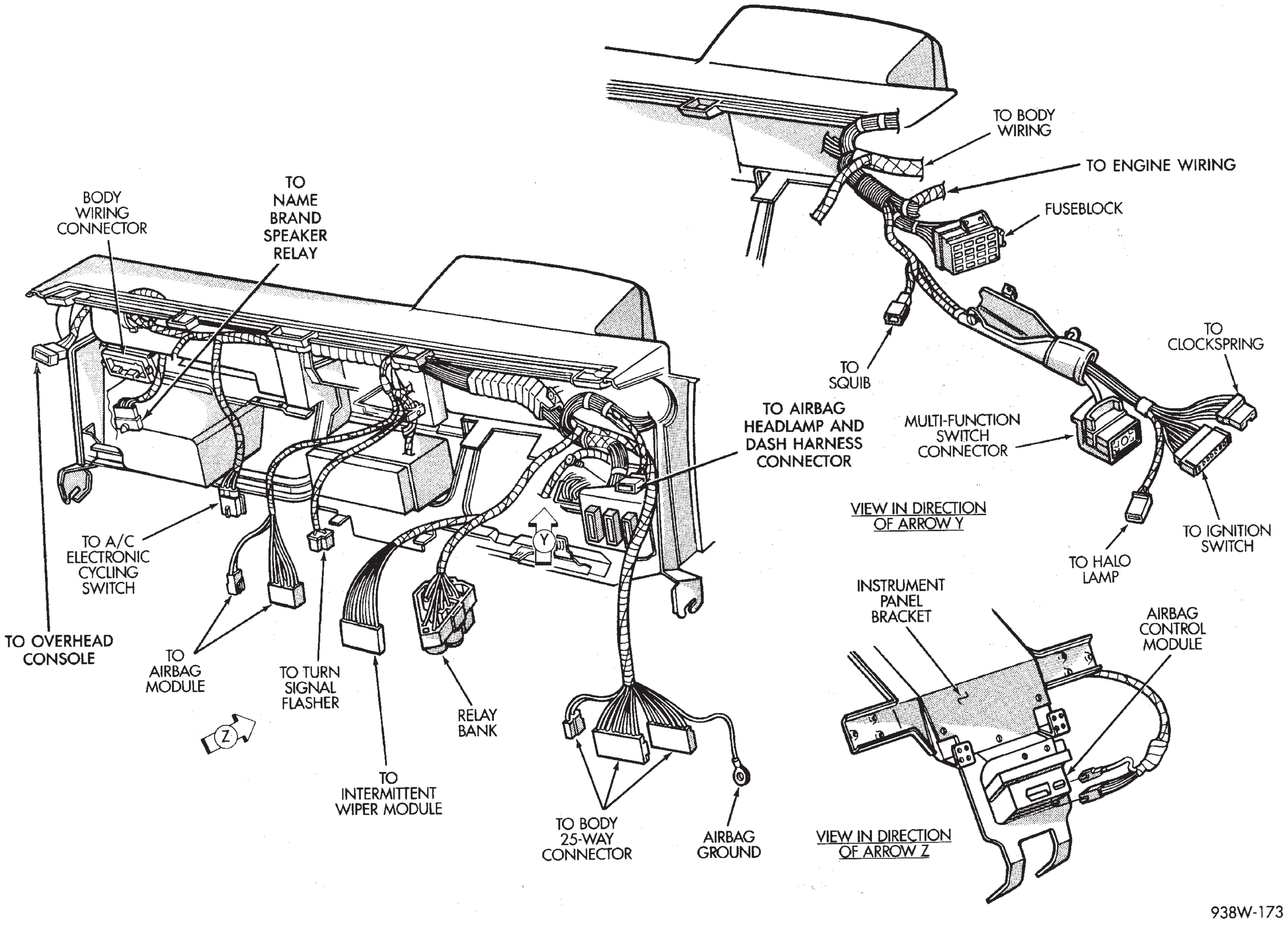


Fig. 13 Instrument Panel Wiring (Routing) AP-Body

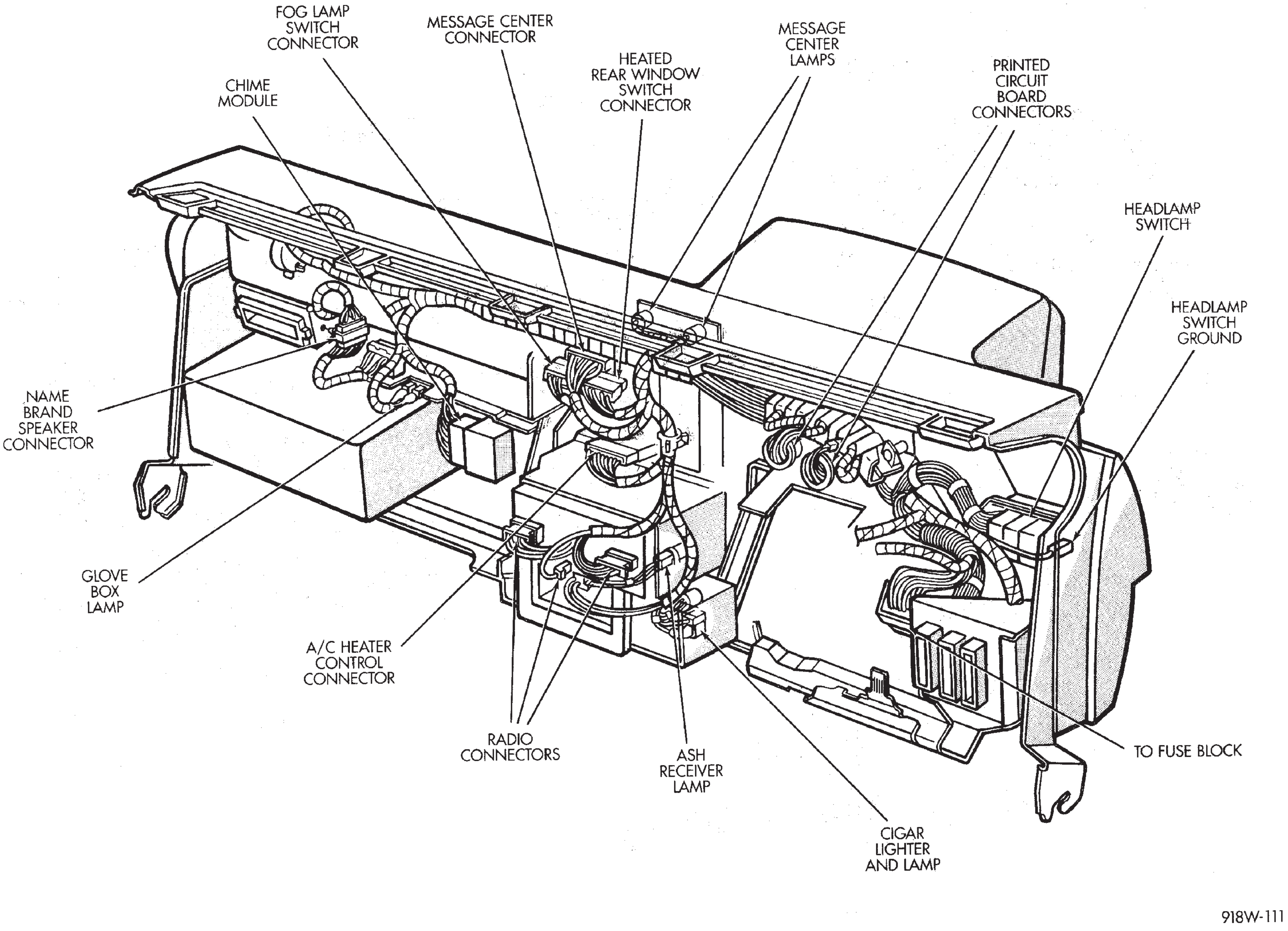


Fig. 14 Instrument Panel Wiring (Connections) AP-Body

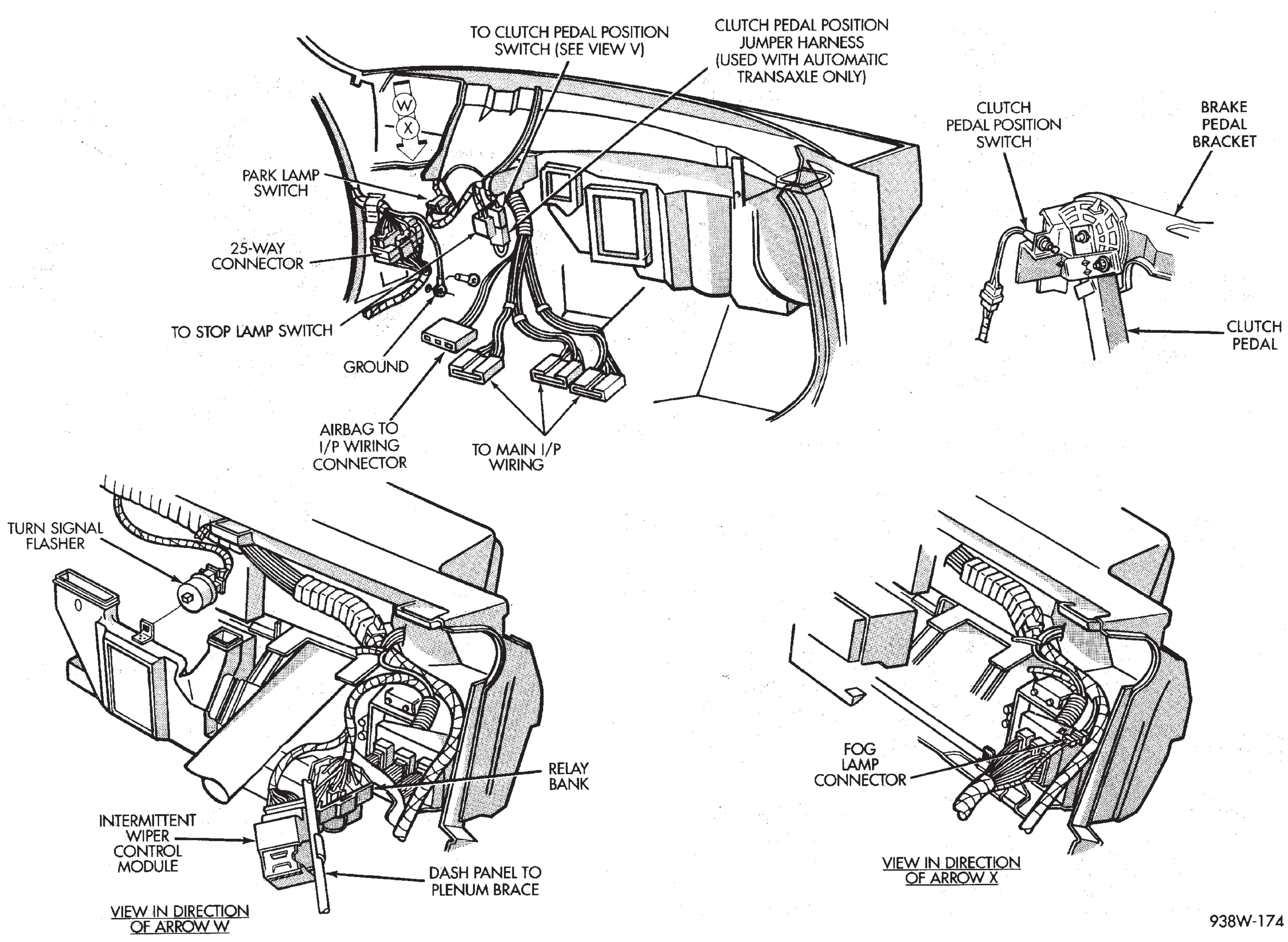


Fig. 15 Instrument Panel to Body Wiring AP-Body

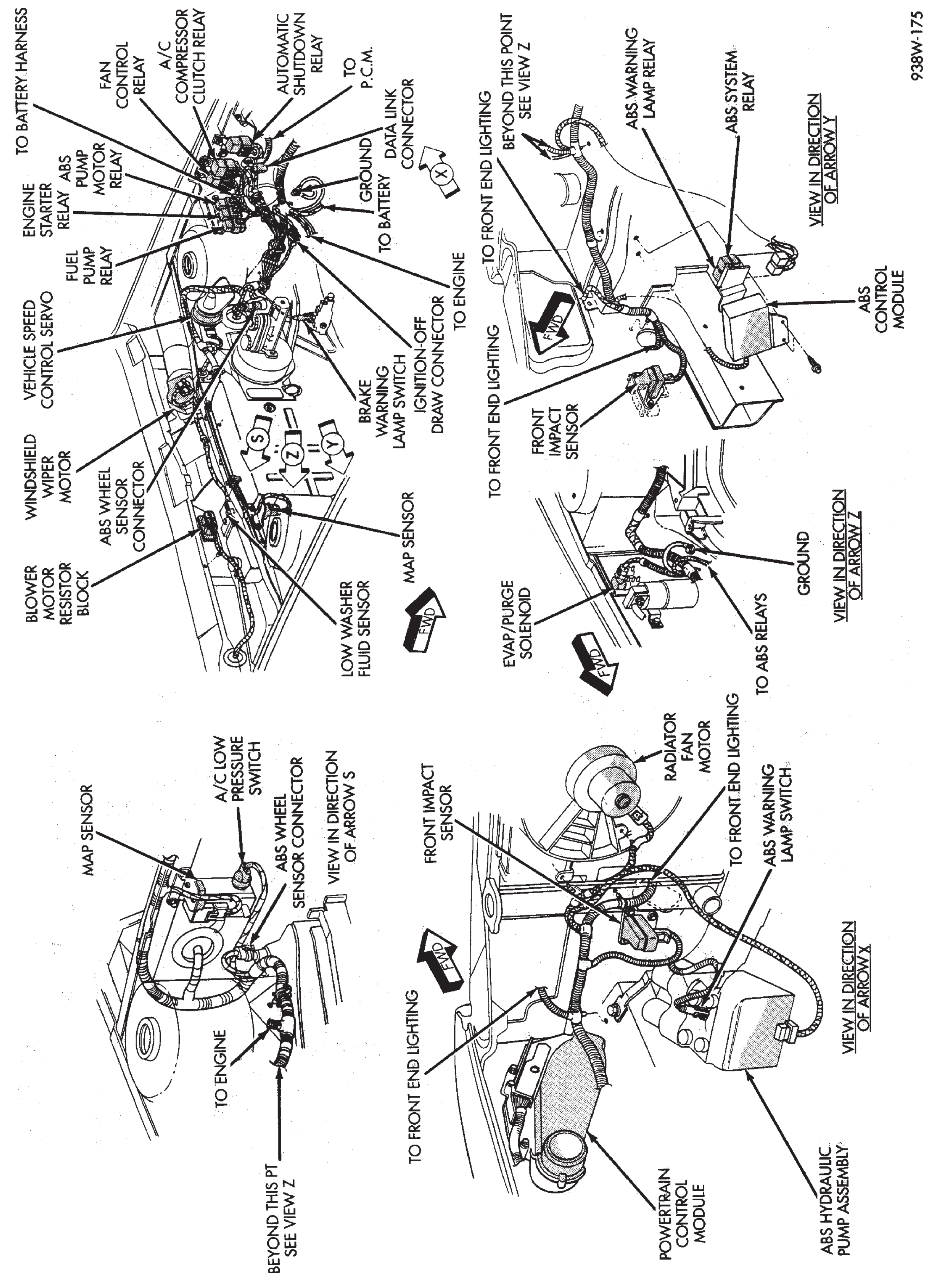


Fig. 16 Engine Compartment Wiring EFI AP-Body

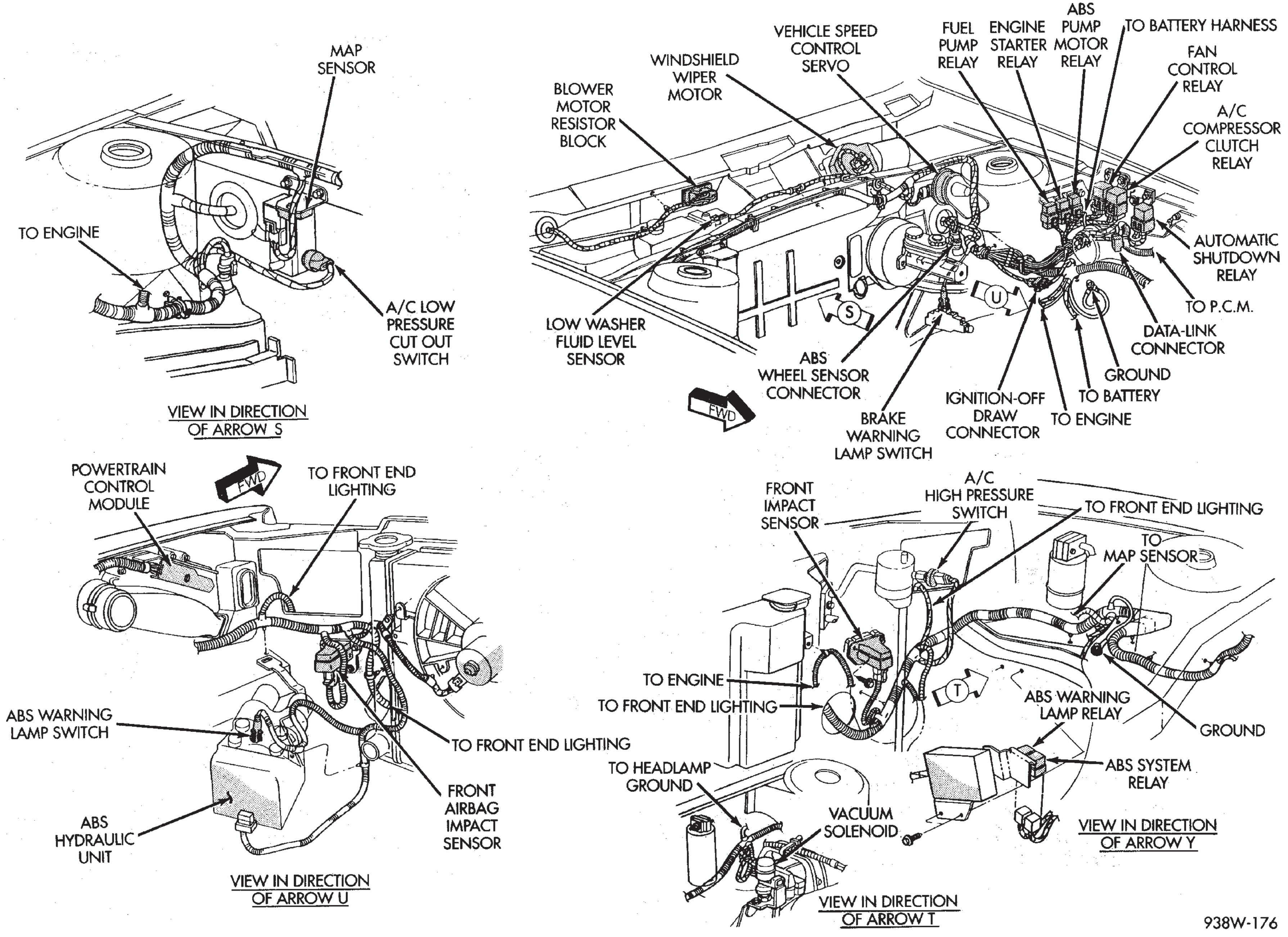


Fig. 17 Engine Compartment Wiring 3.0L AP-Body

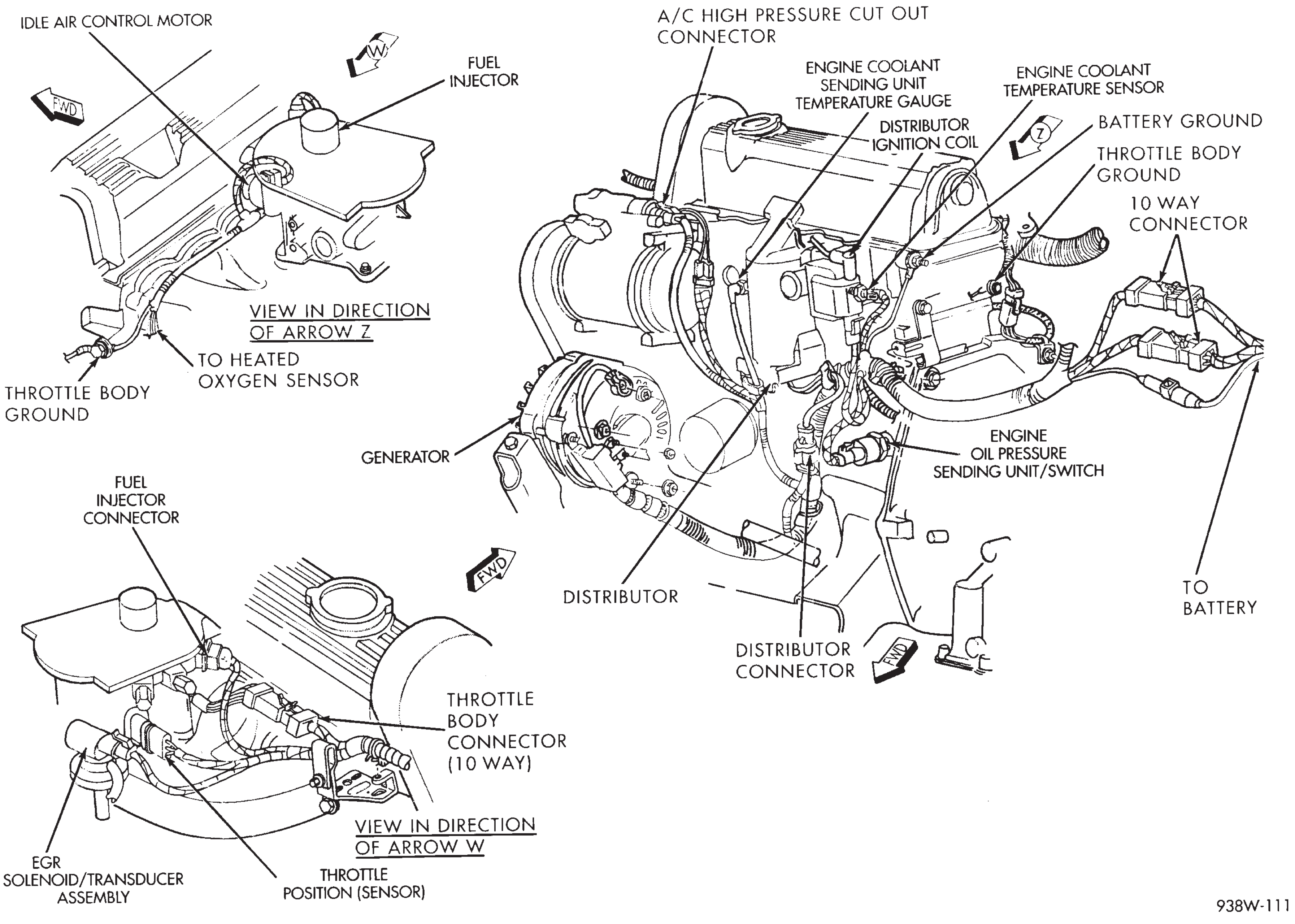


Fig. 18 Engine Wiring EFI AP-Body

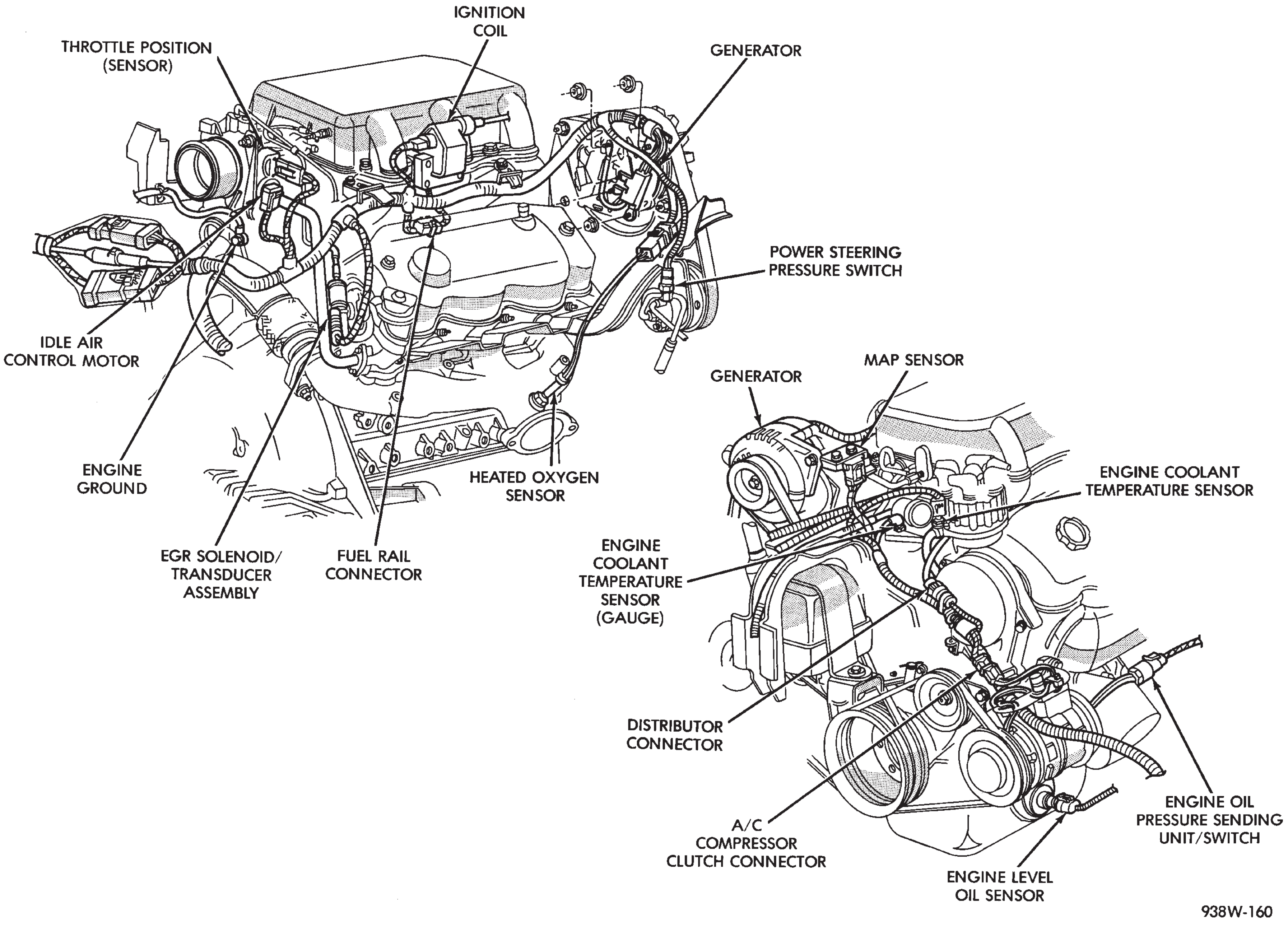


Fig. 19 Engine Wiring 3.0L AP-Body

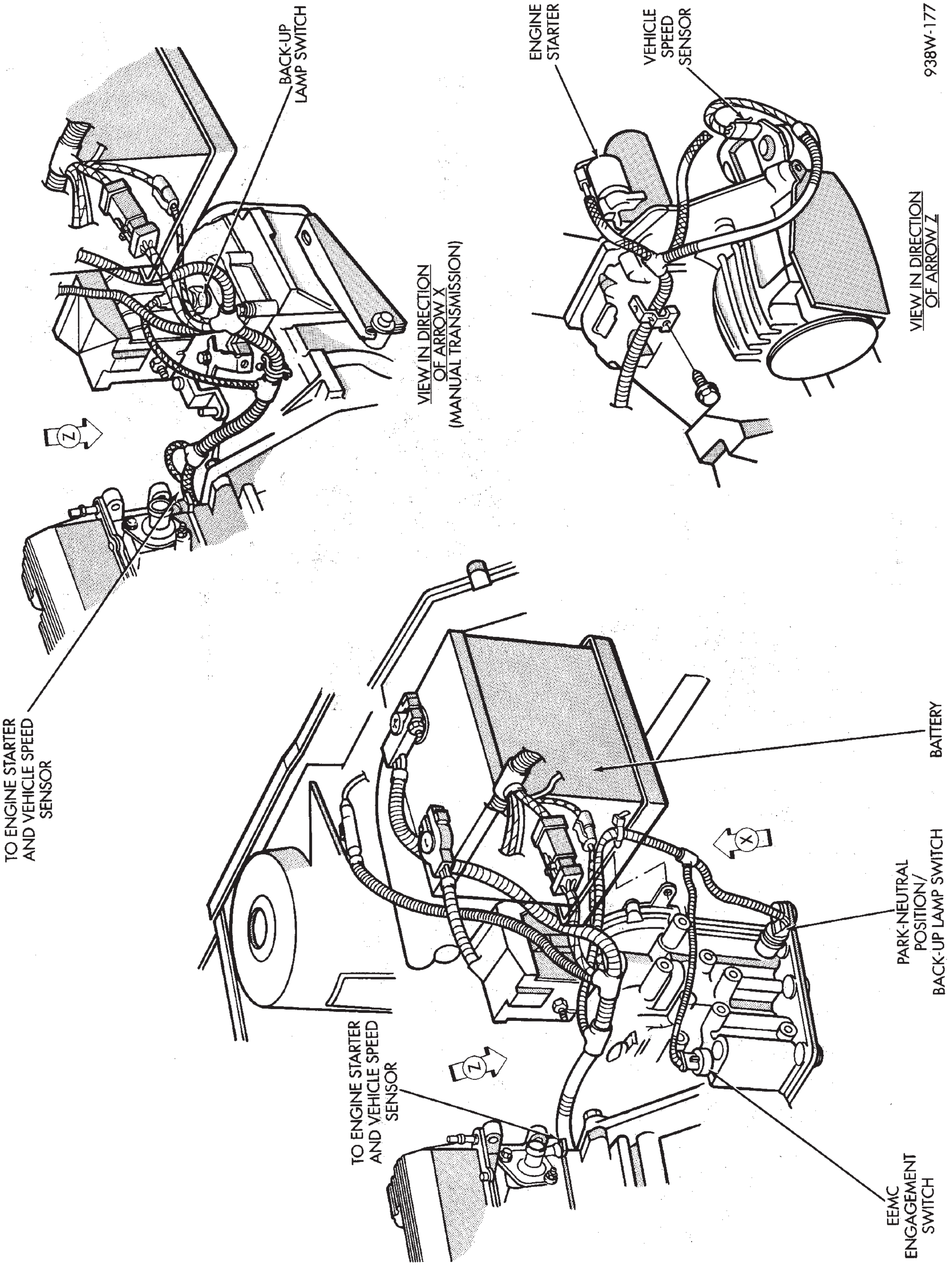


Fig. 20 Transmission Wiring AP-Body

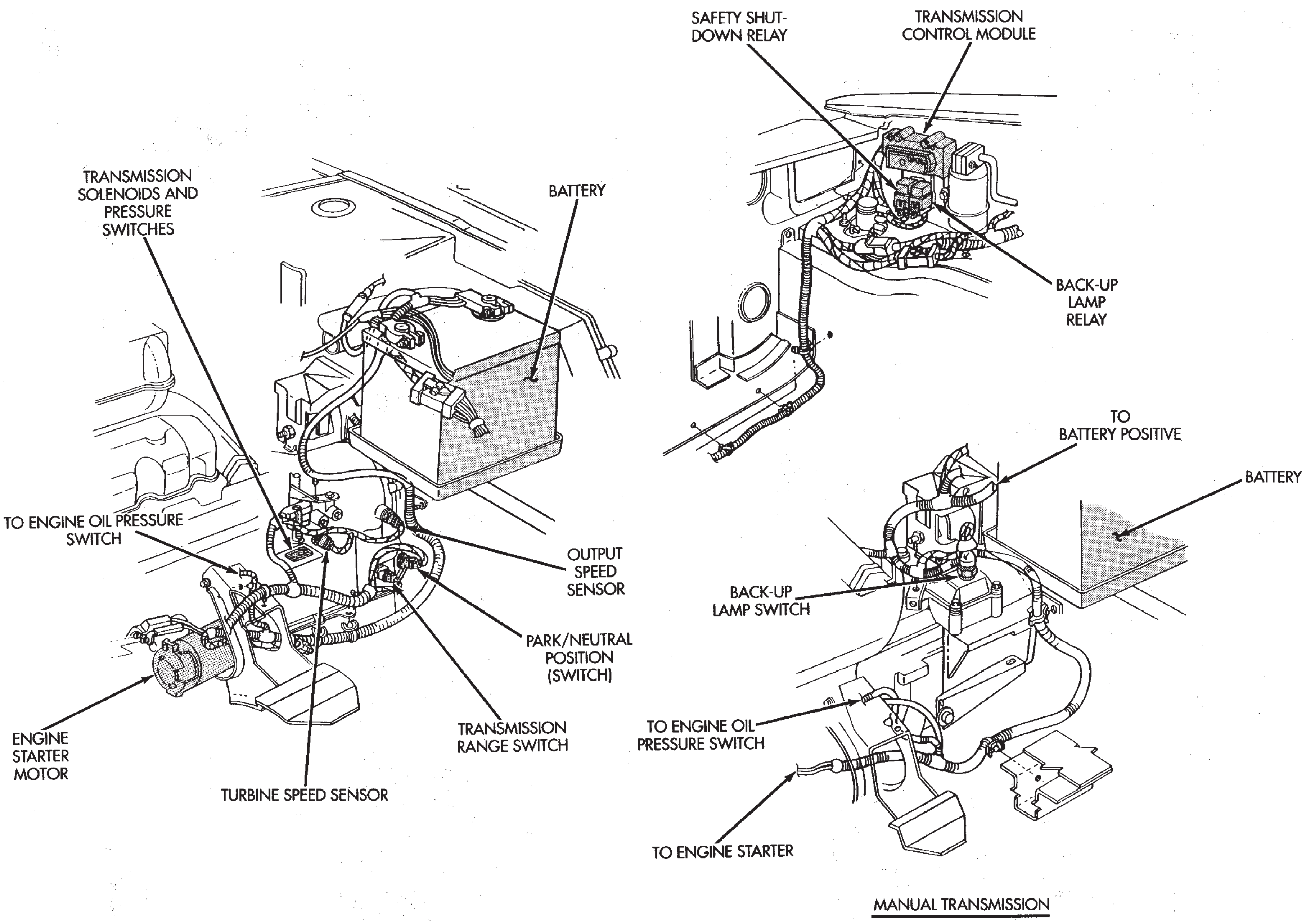


Fig. 21 Transmission Wiring 41TE AP-Body

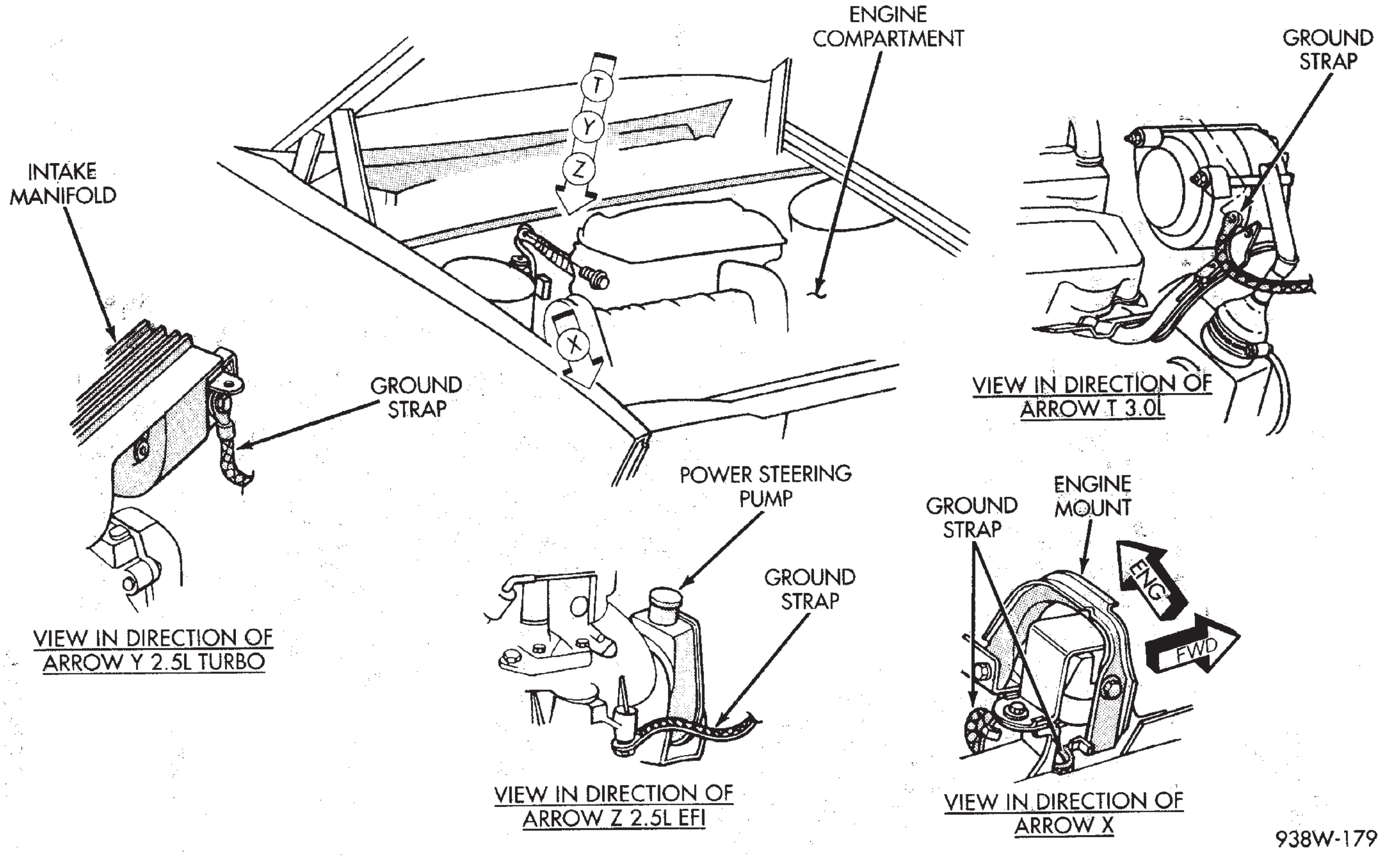


Fig. 22 Ground Strap Locations AP-Body

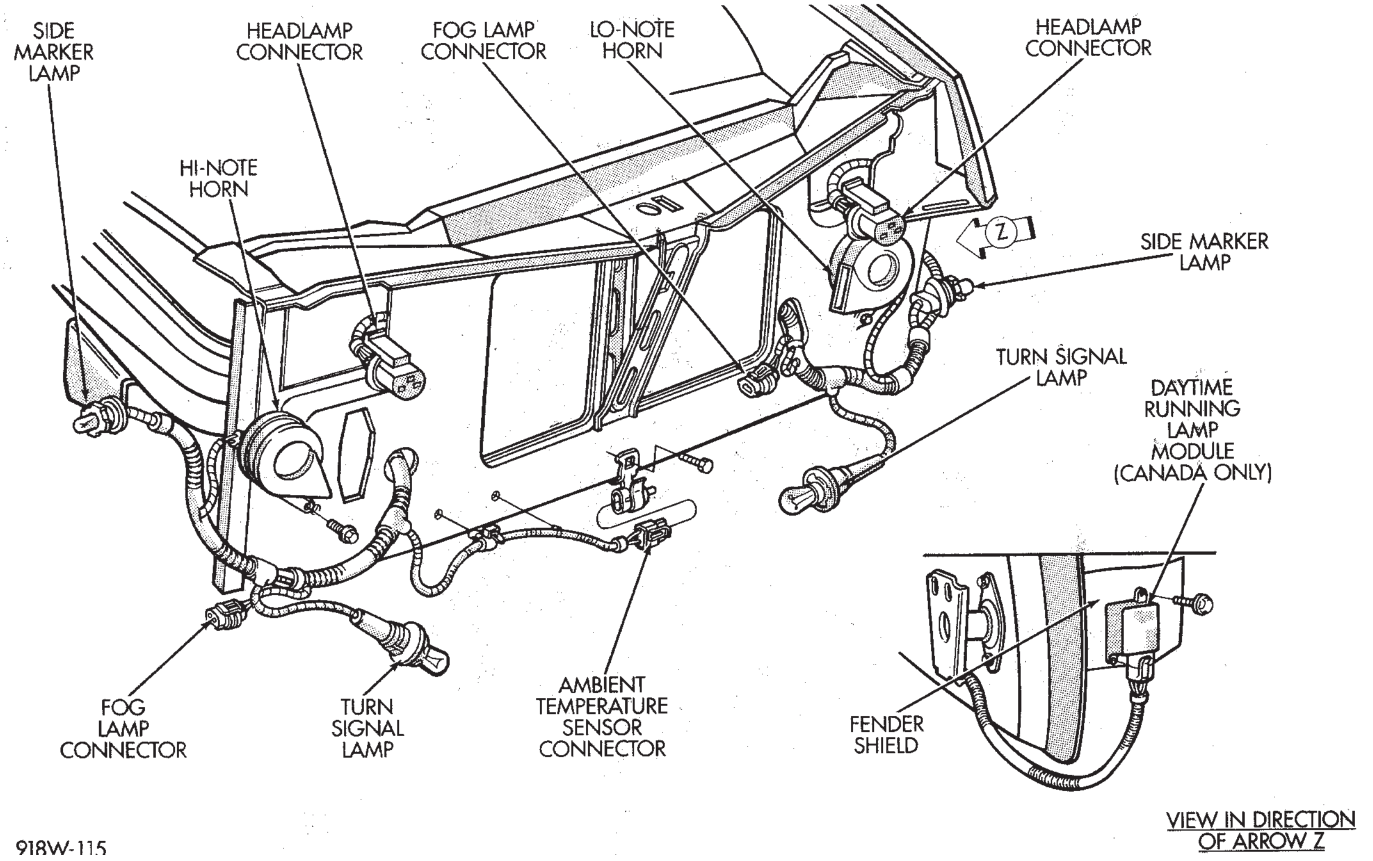


Fig. 23 Front End Wiring AP-Body

AY BODY-C

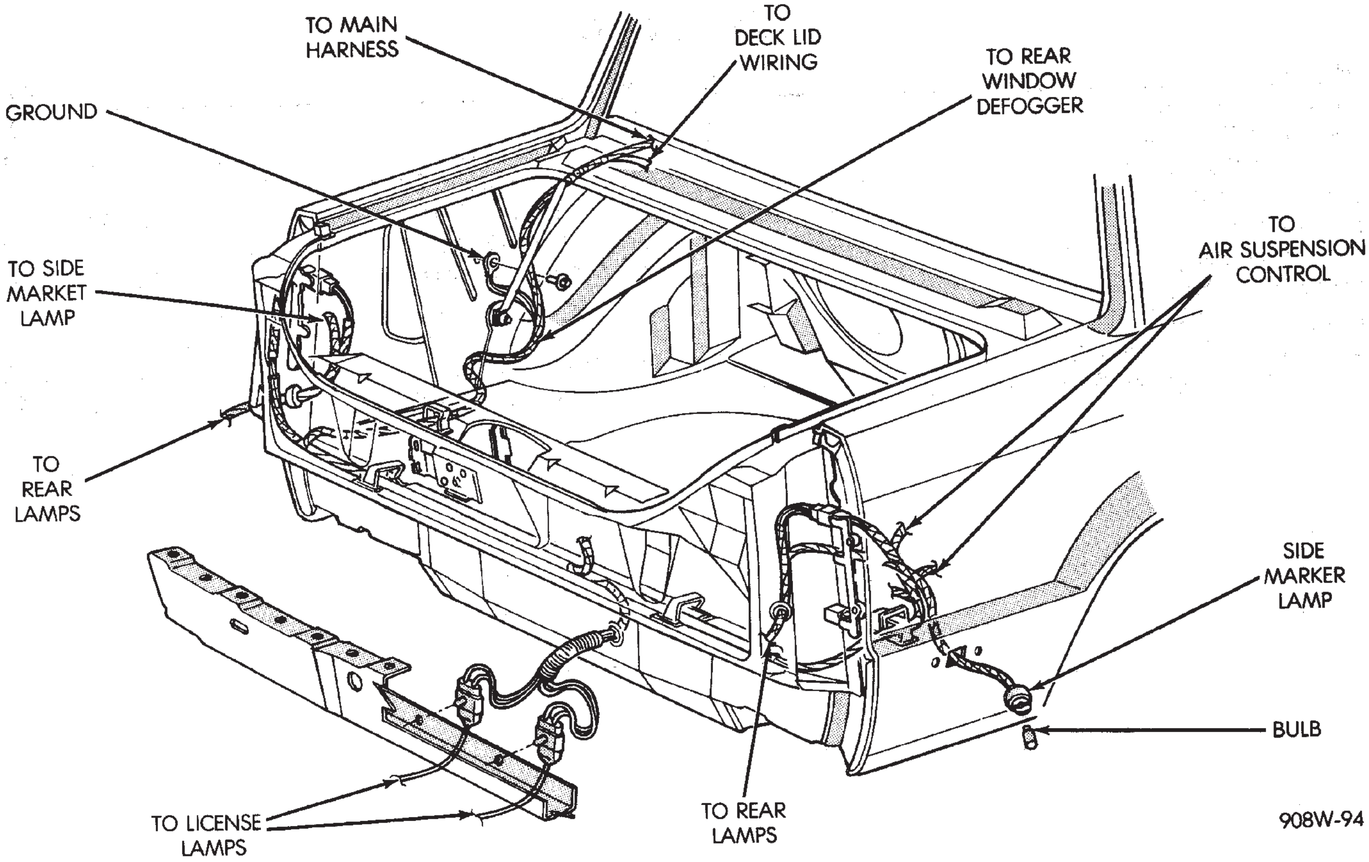


Fig. 1 Rear End Wiring AY Body

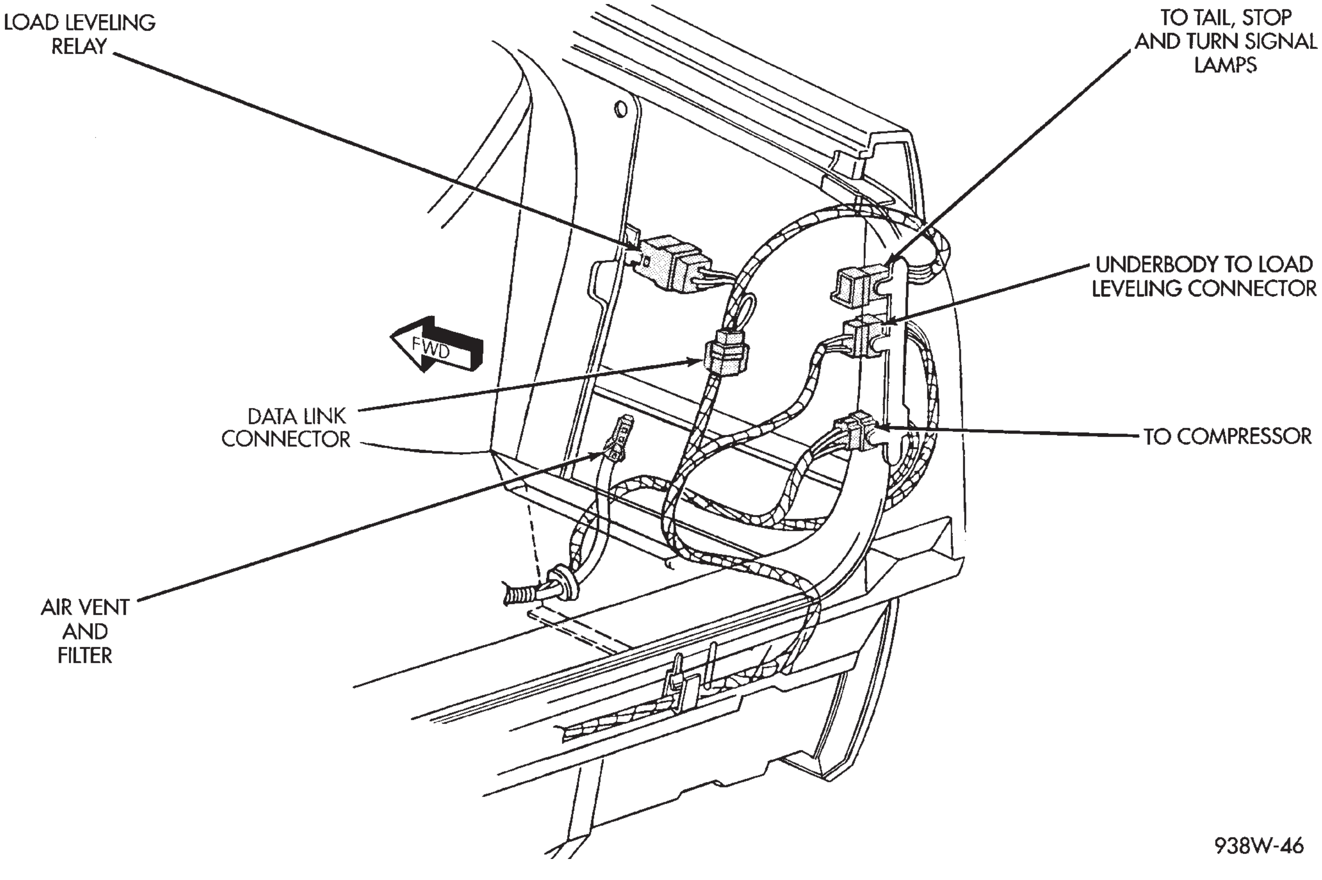


Fig. 2 Load Leveling Wiring AY Body

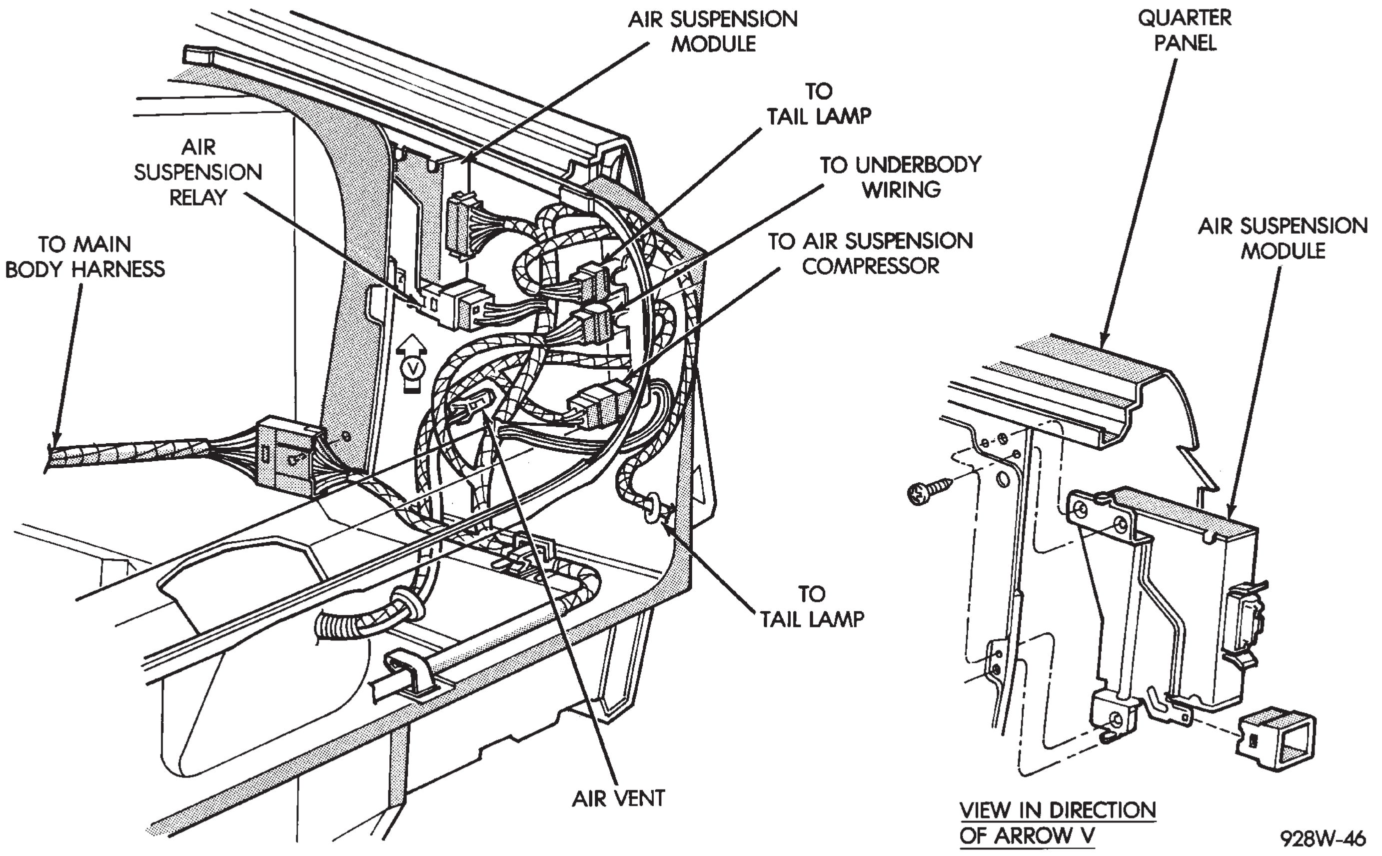


Fig. 3 Air Suspension Wiring AY Body

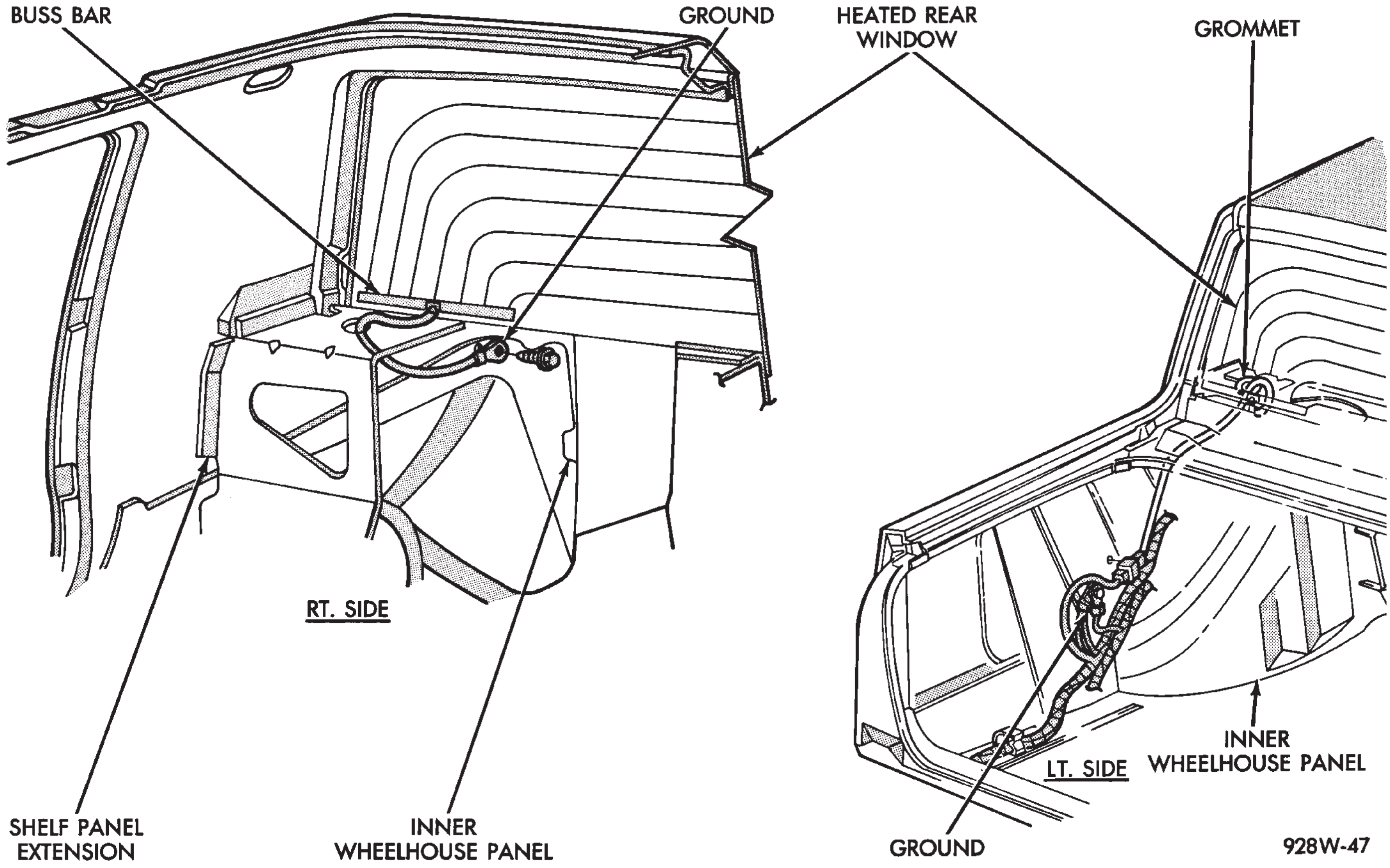


Fig. 4 Heated Rear Window Wiring AY Body

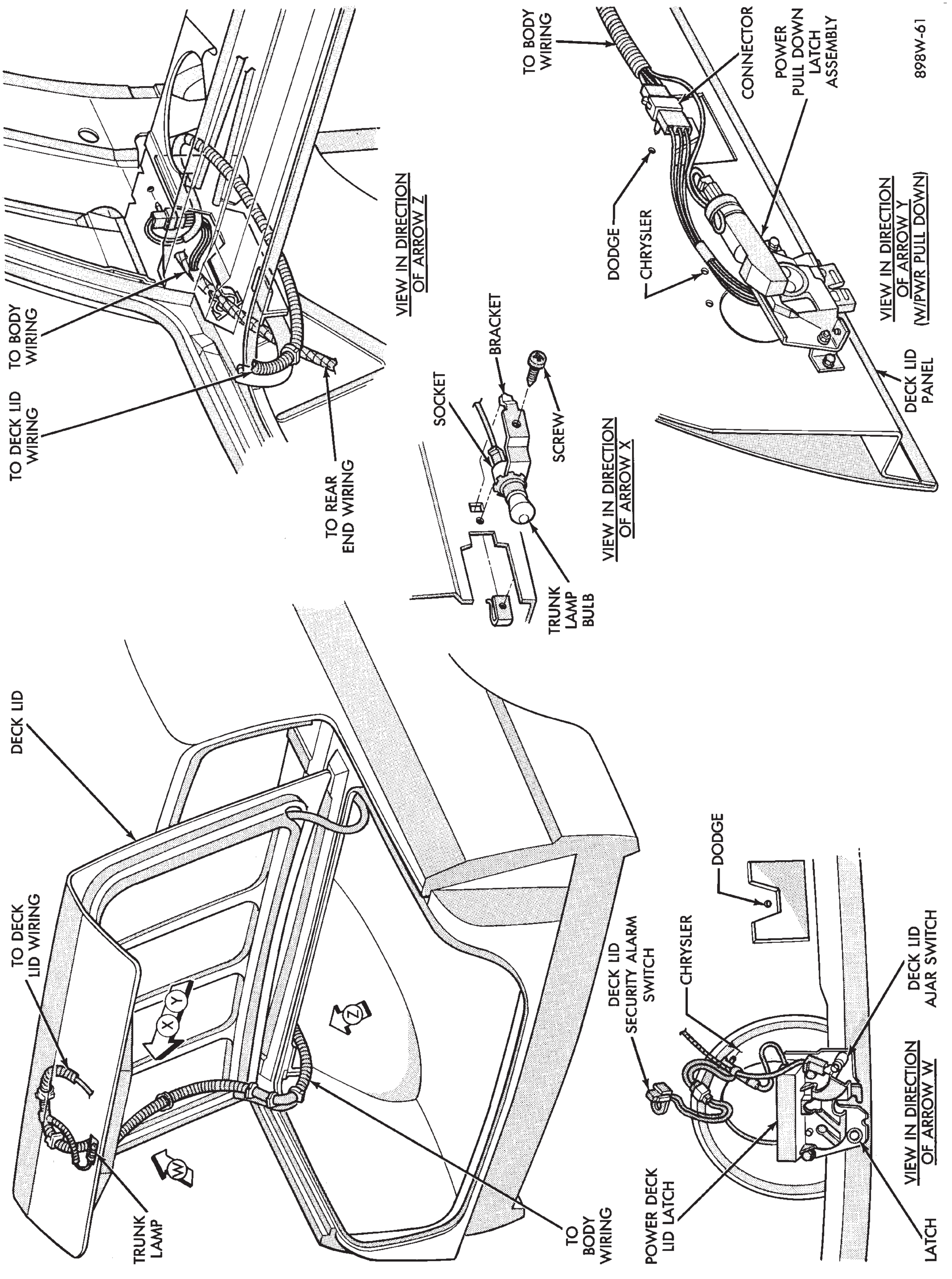


Fig. 5 Deck Lid Wiring AY Body

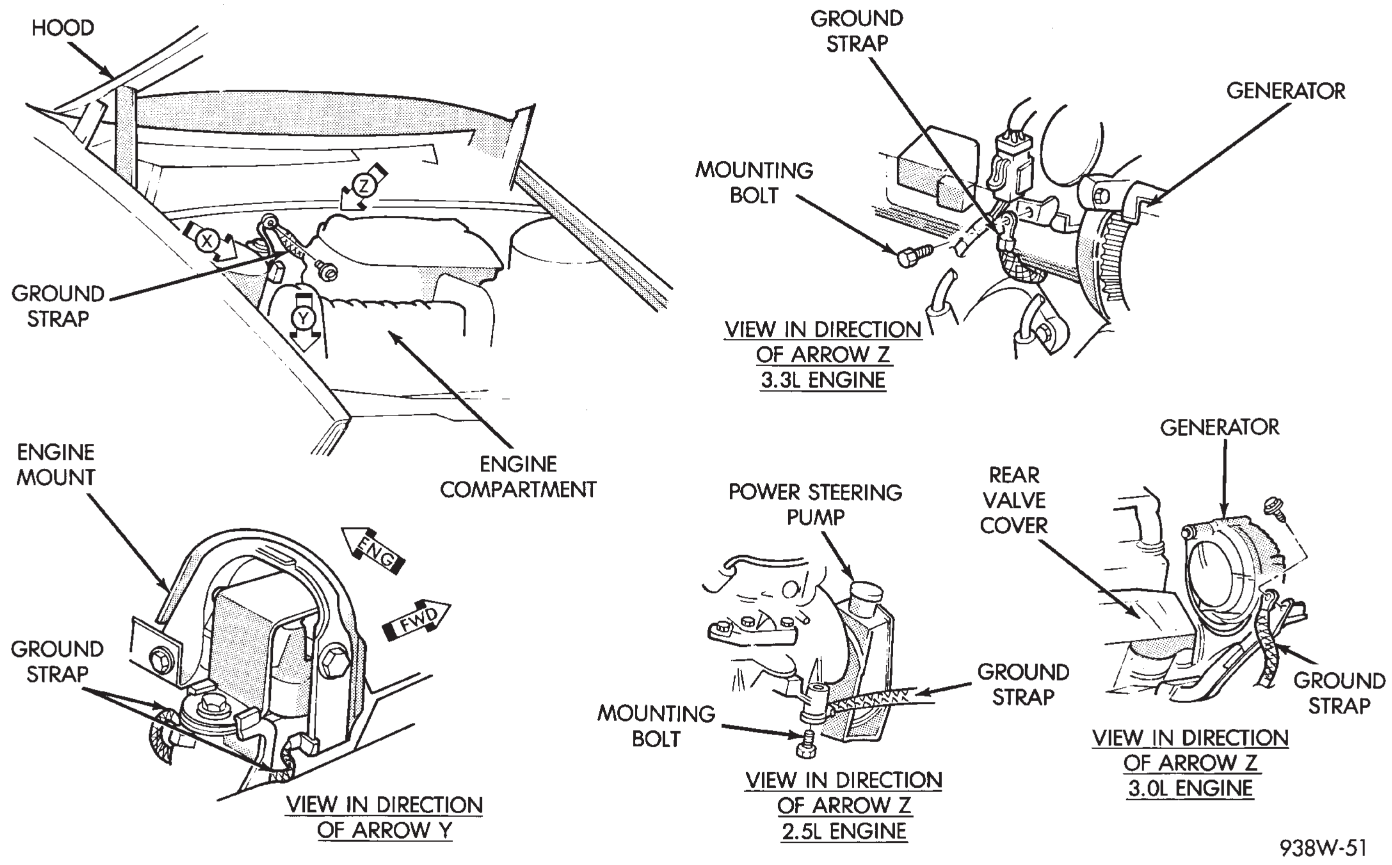


Fig. 6 Ground Strap Locations AY Body

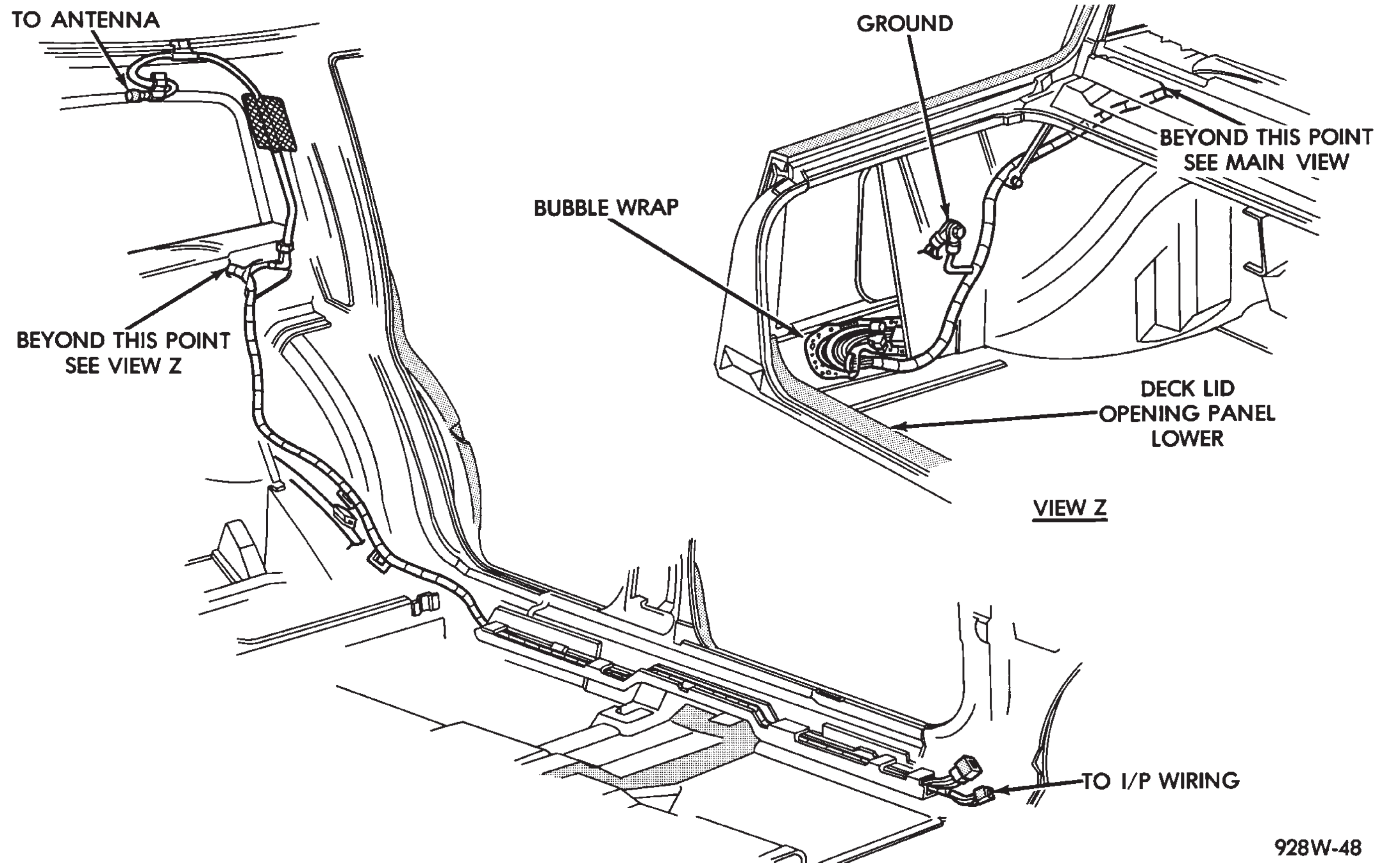


Fig. 7 Cellular Phone Wiring AY Body

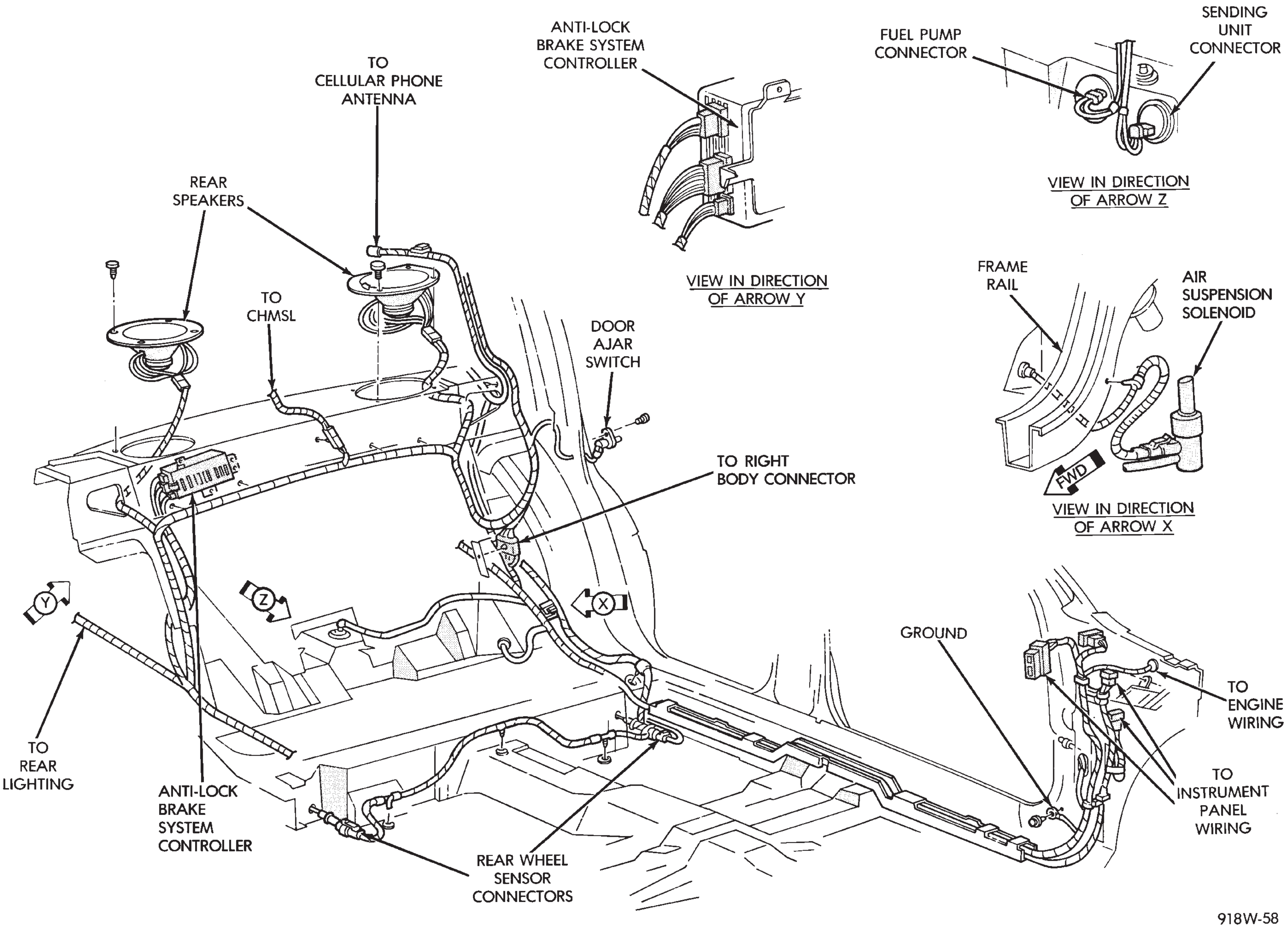


Fig. 8 Body Left Side Wiring AY Body

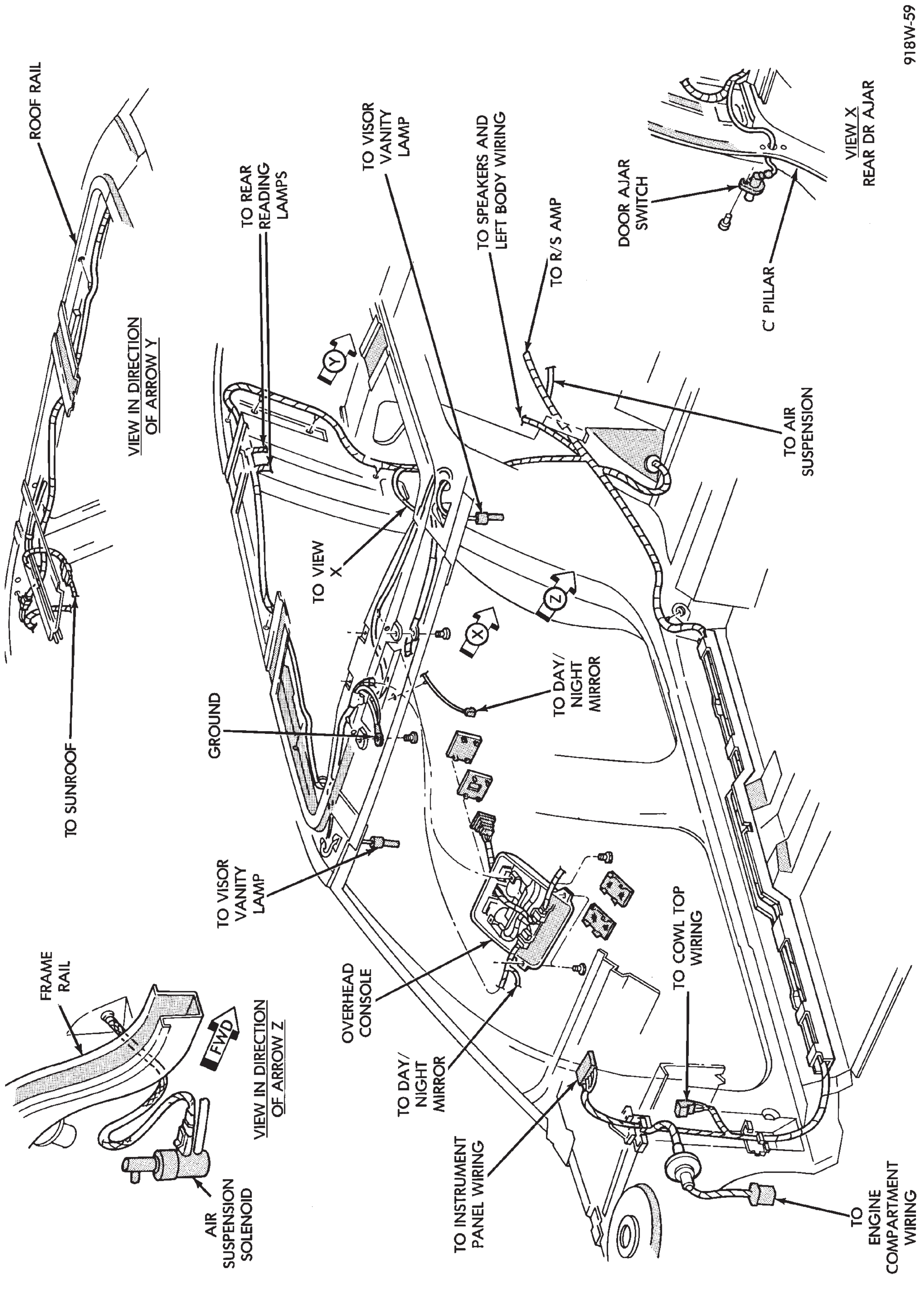


Fig. 9 Body Right Side Wiring AY Body

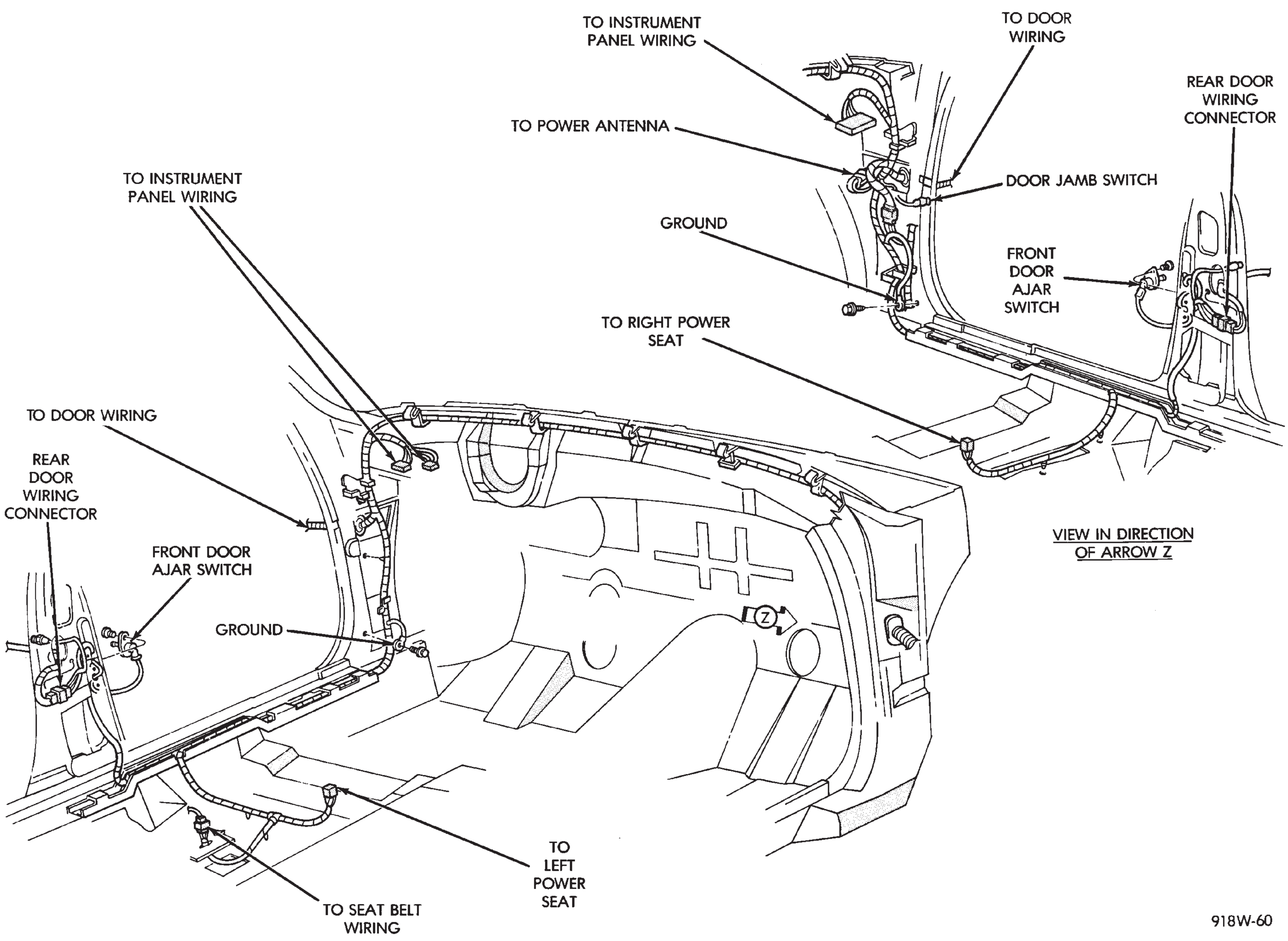


Fig. 10 Door Wiring (Body) AY Body

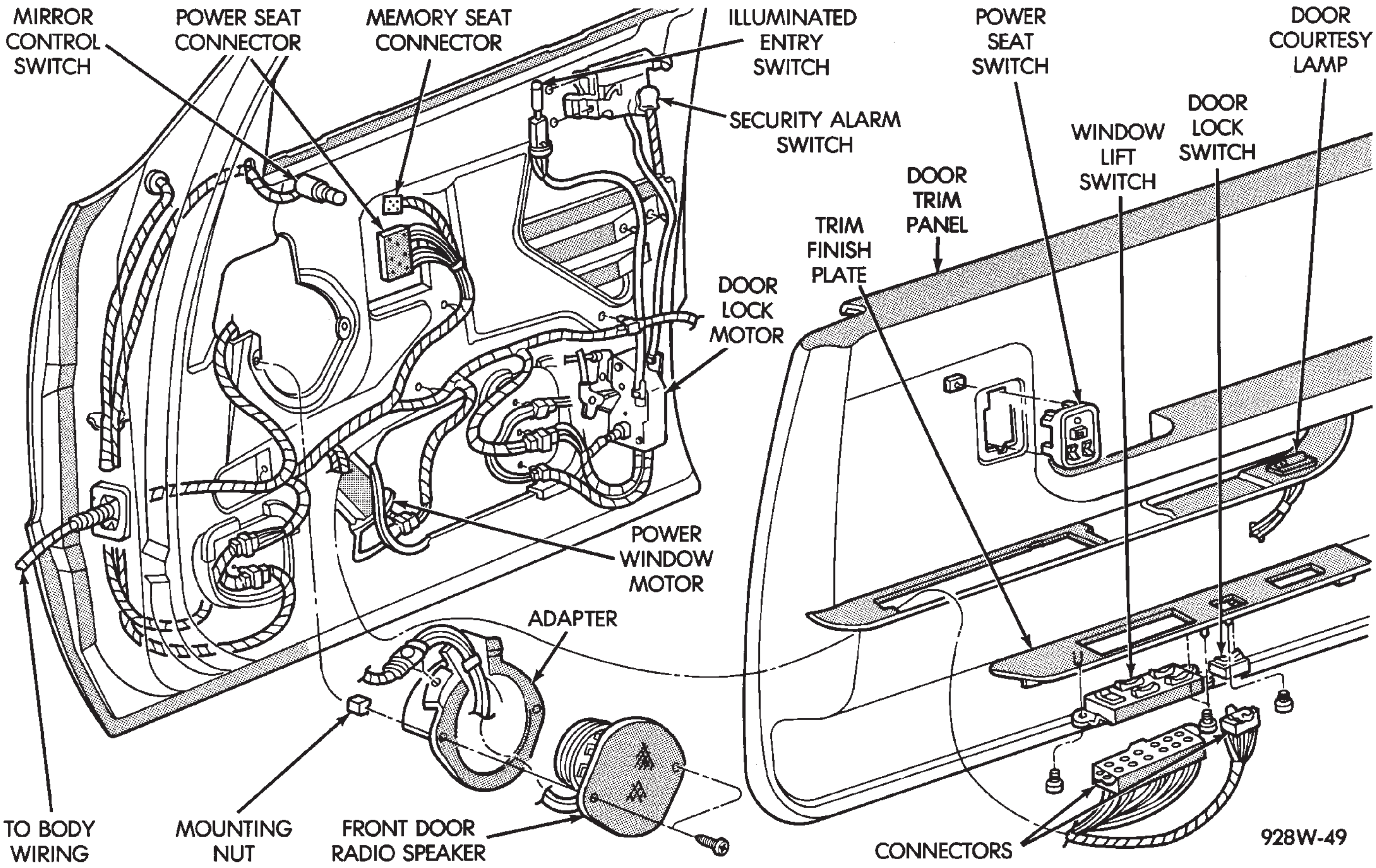


Fig. 11 Door Wiring (Front) AY Body

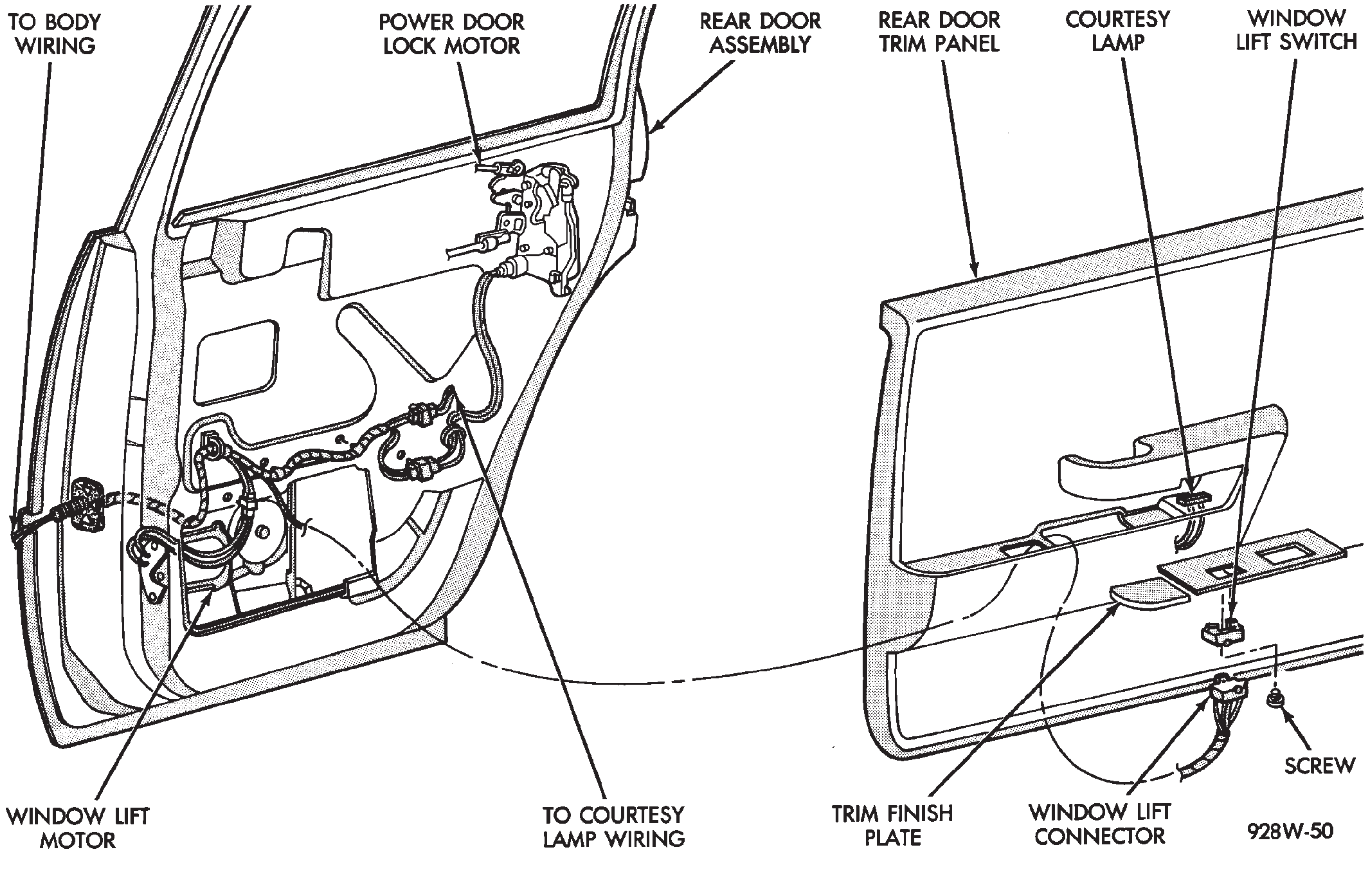


Fig. 12 Door Wiring (Rear) AY Body

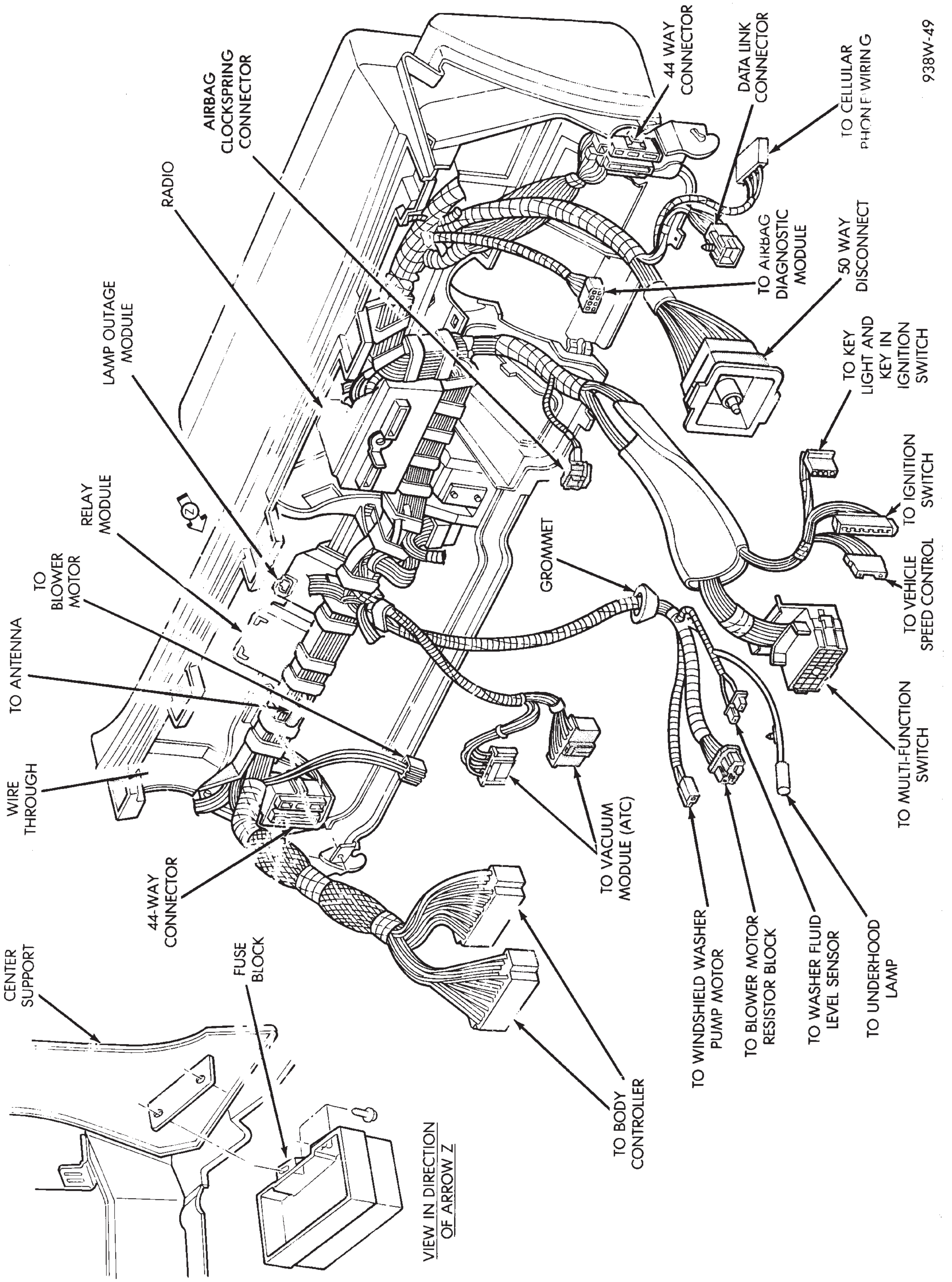


Fig. 13 Instrument Panel Wiring (Routing) AY Body

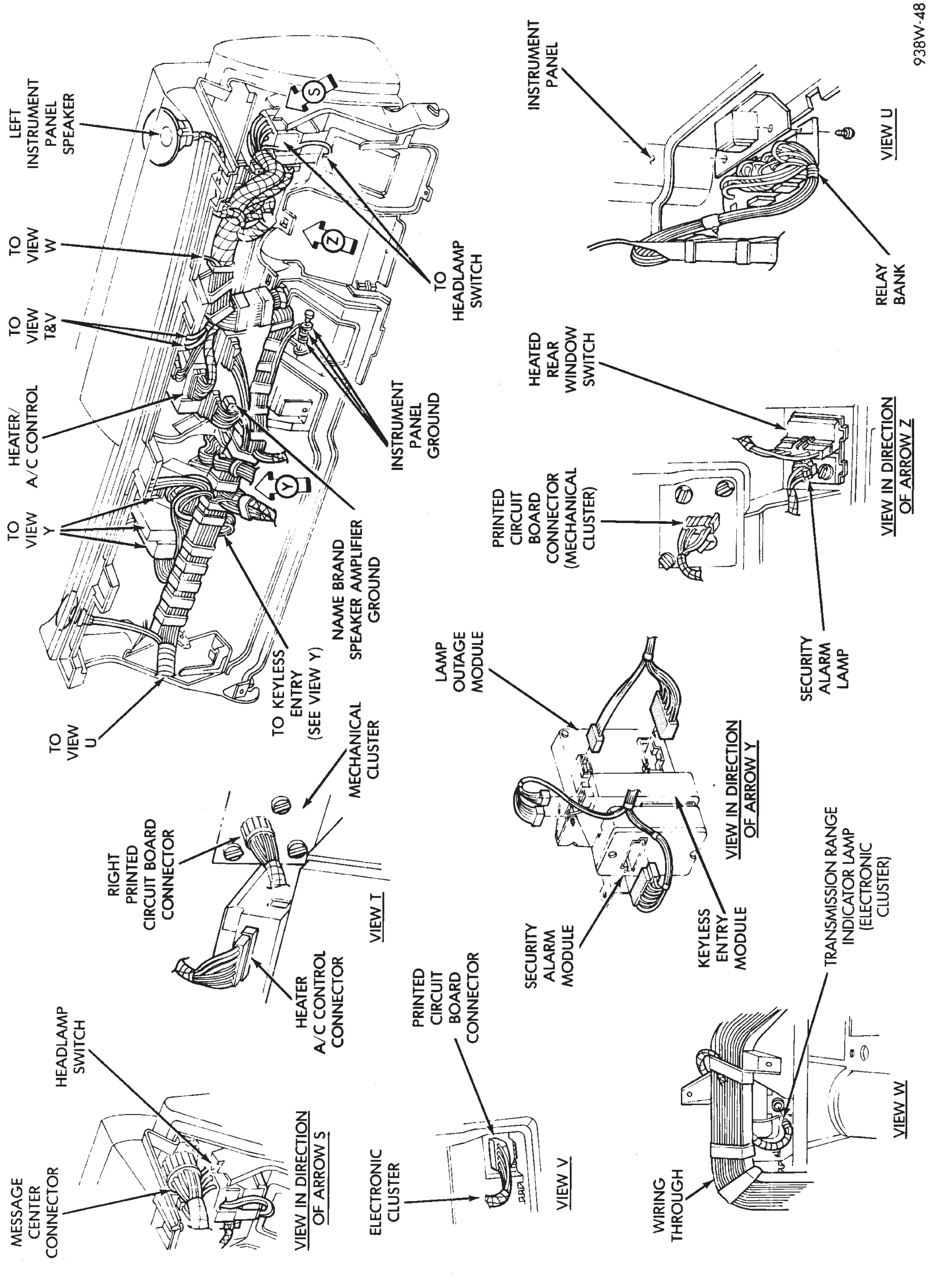


Fig. 14 Instrument Panel Wiring (Connections) AY Body

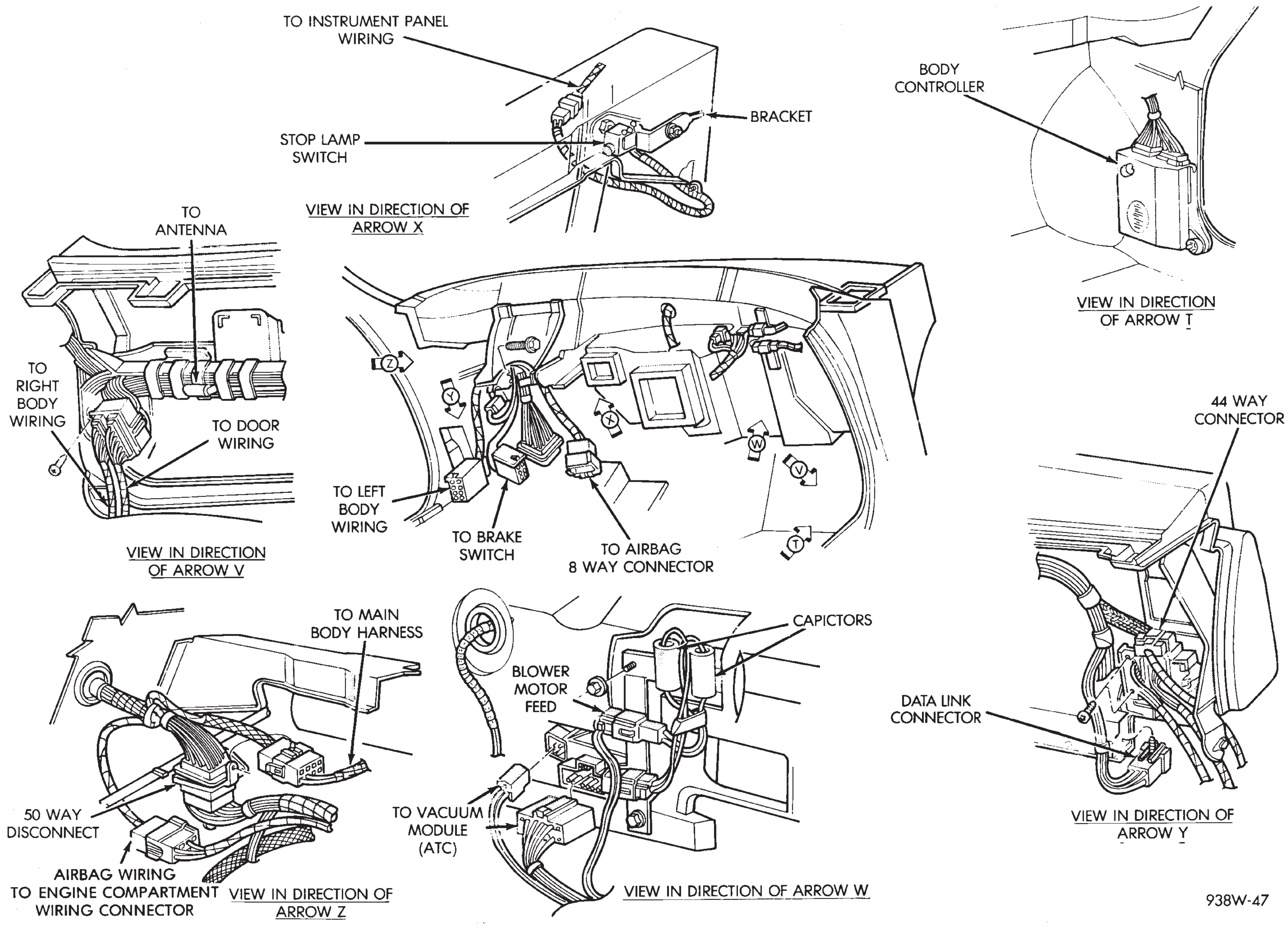


Fig. 15 Instrument Panel Wiring (I.P. to Body Connections) AY Body

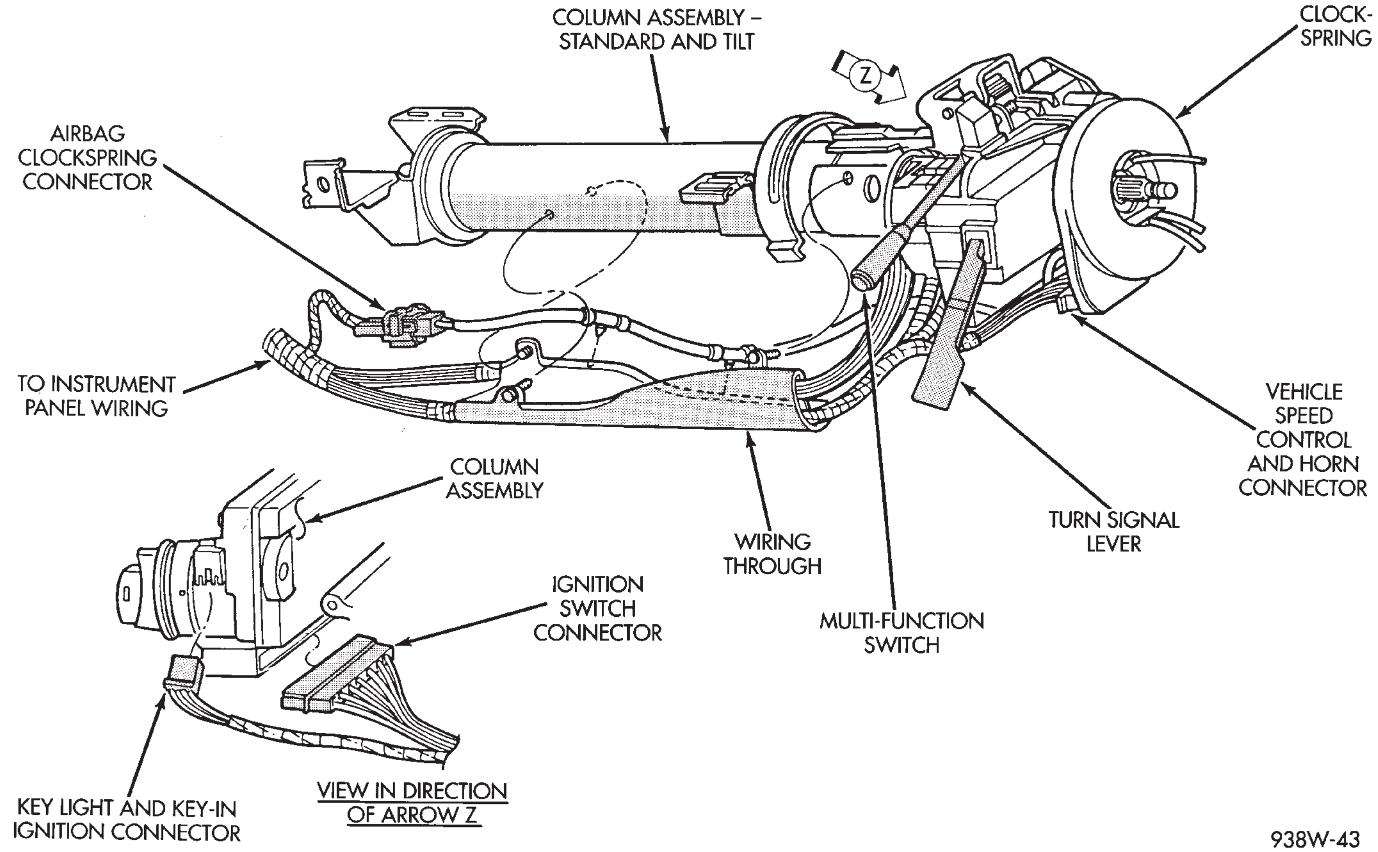


Fig. 16 Steering Column Wiring AY Body

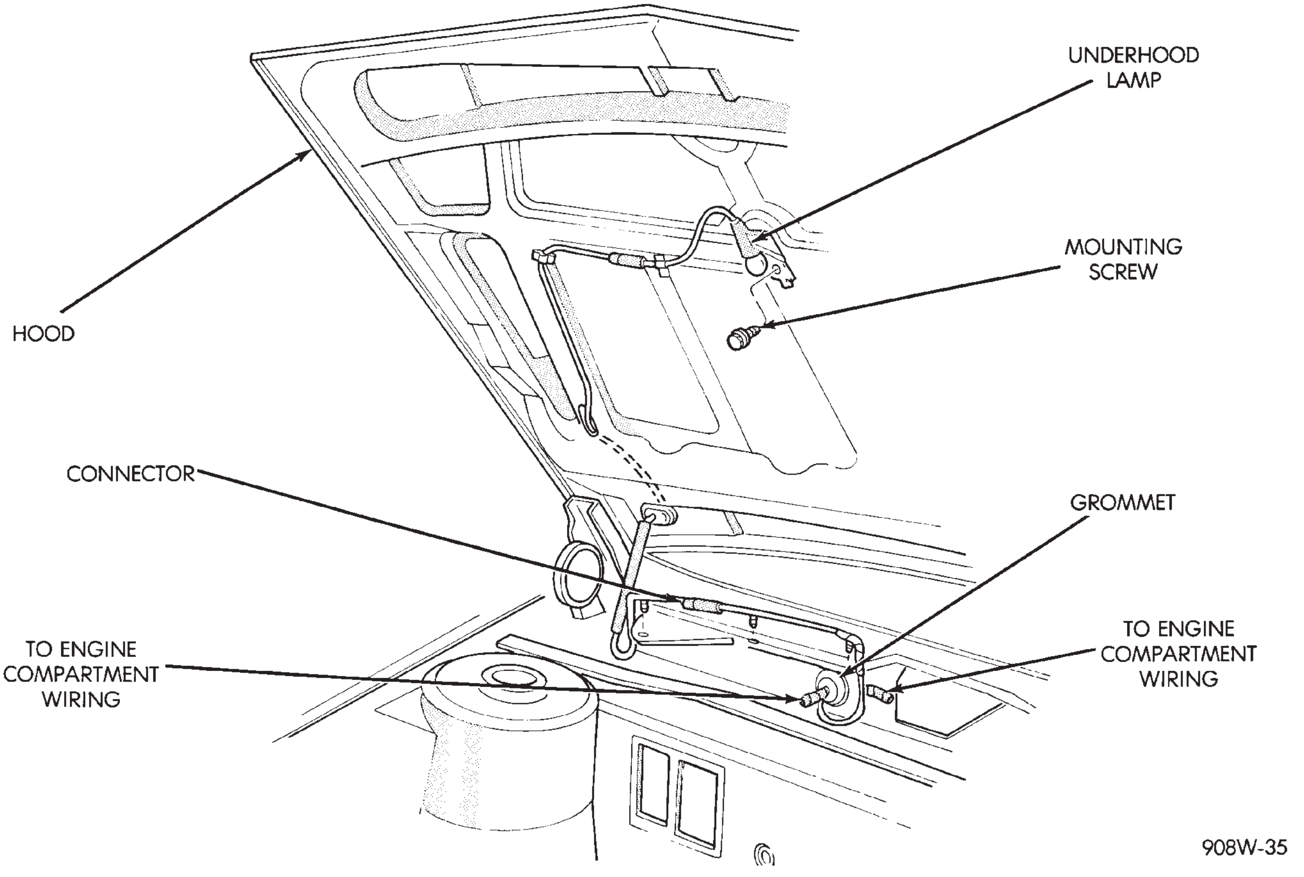


Fig. 17 Underhood Lamp Wiring AY Body

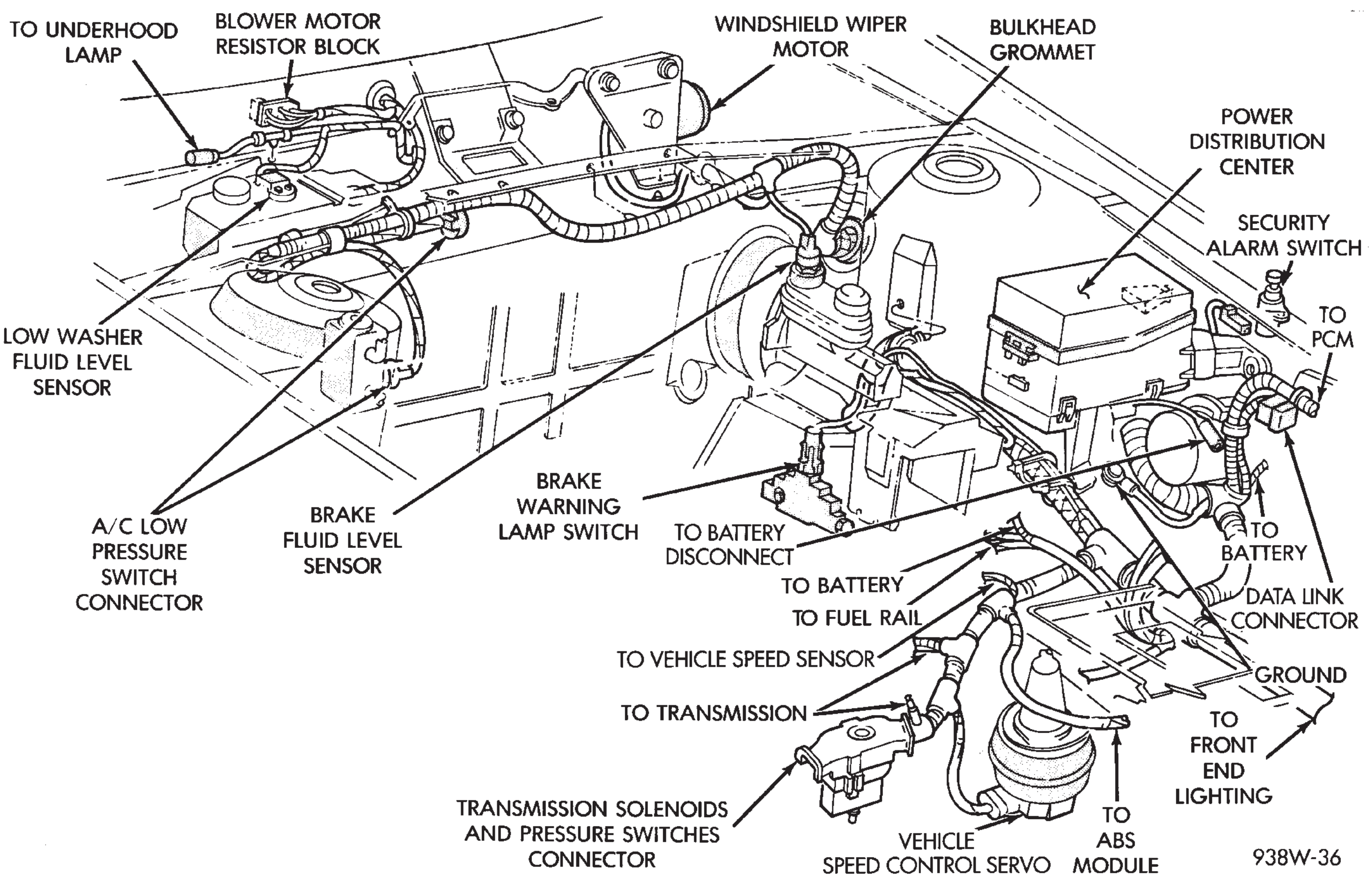


Fig. 18 Engine Compartment Wiring 3.3L and 3.8L AY Body

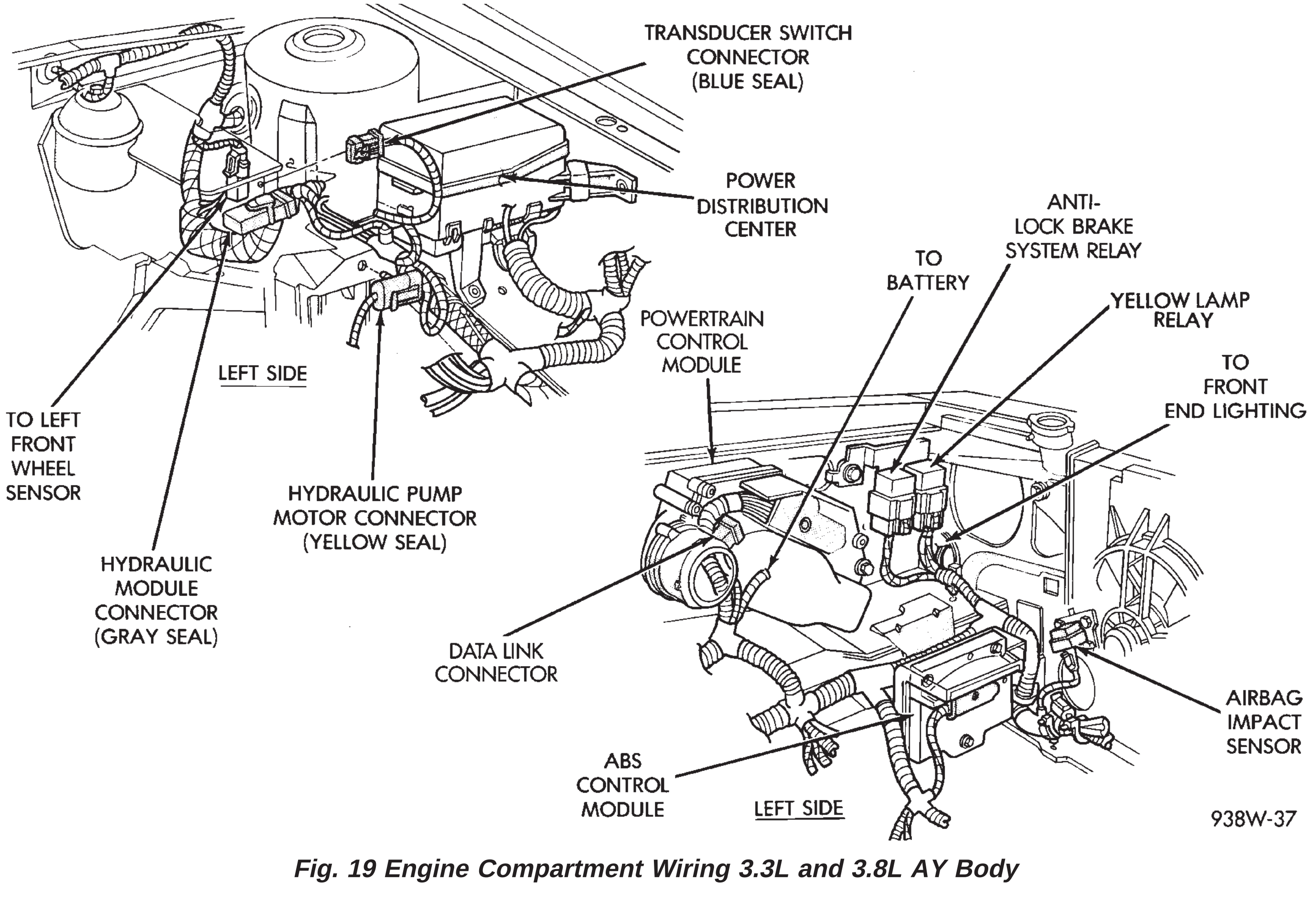


Fig. 19 Engine Compartment Wiring 3.3L and 3.8L AY Body

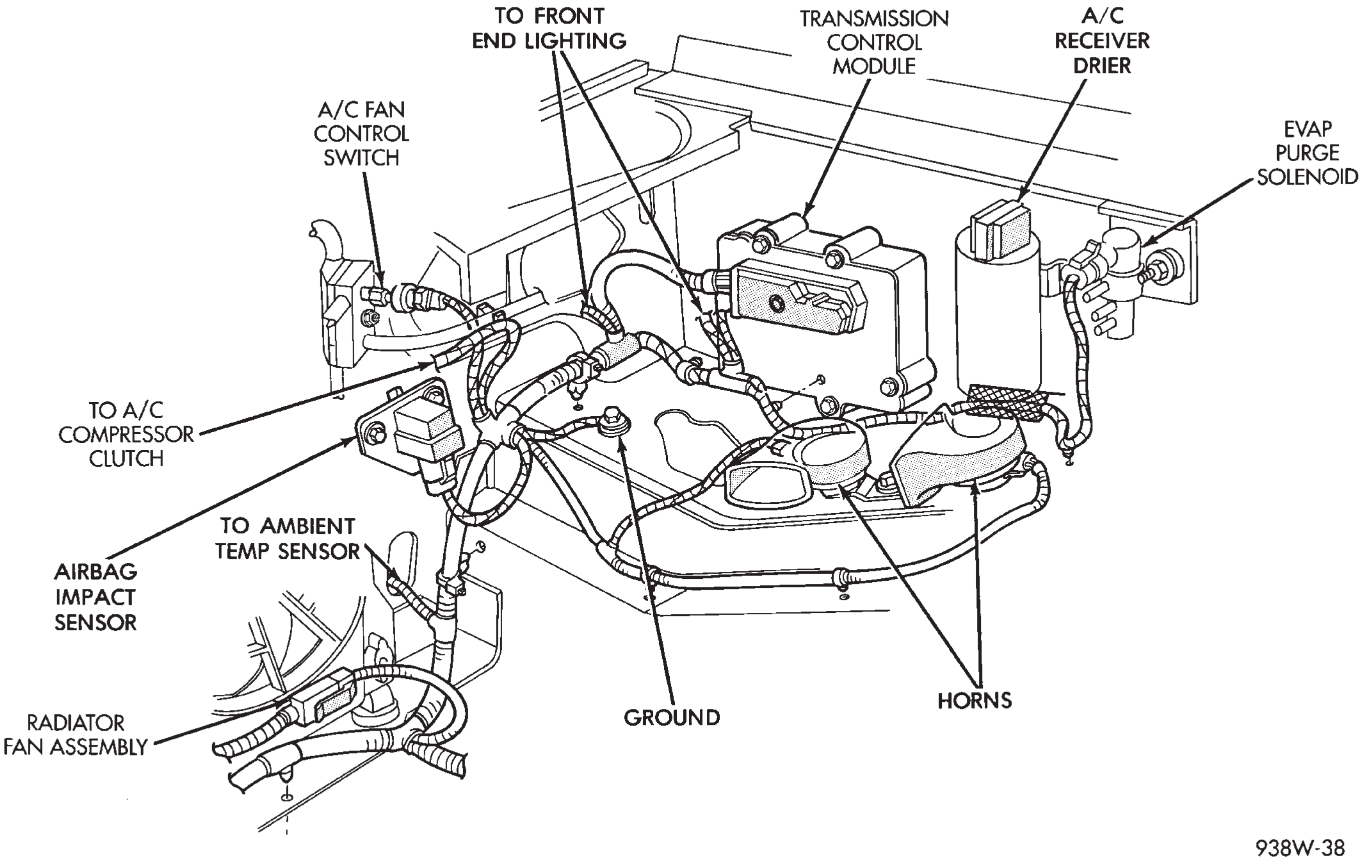


Fig. 20 Engine Compartment Wiring 3.3L and 3.8L AY Body

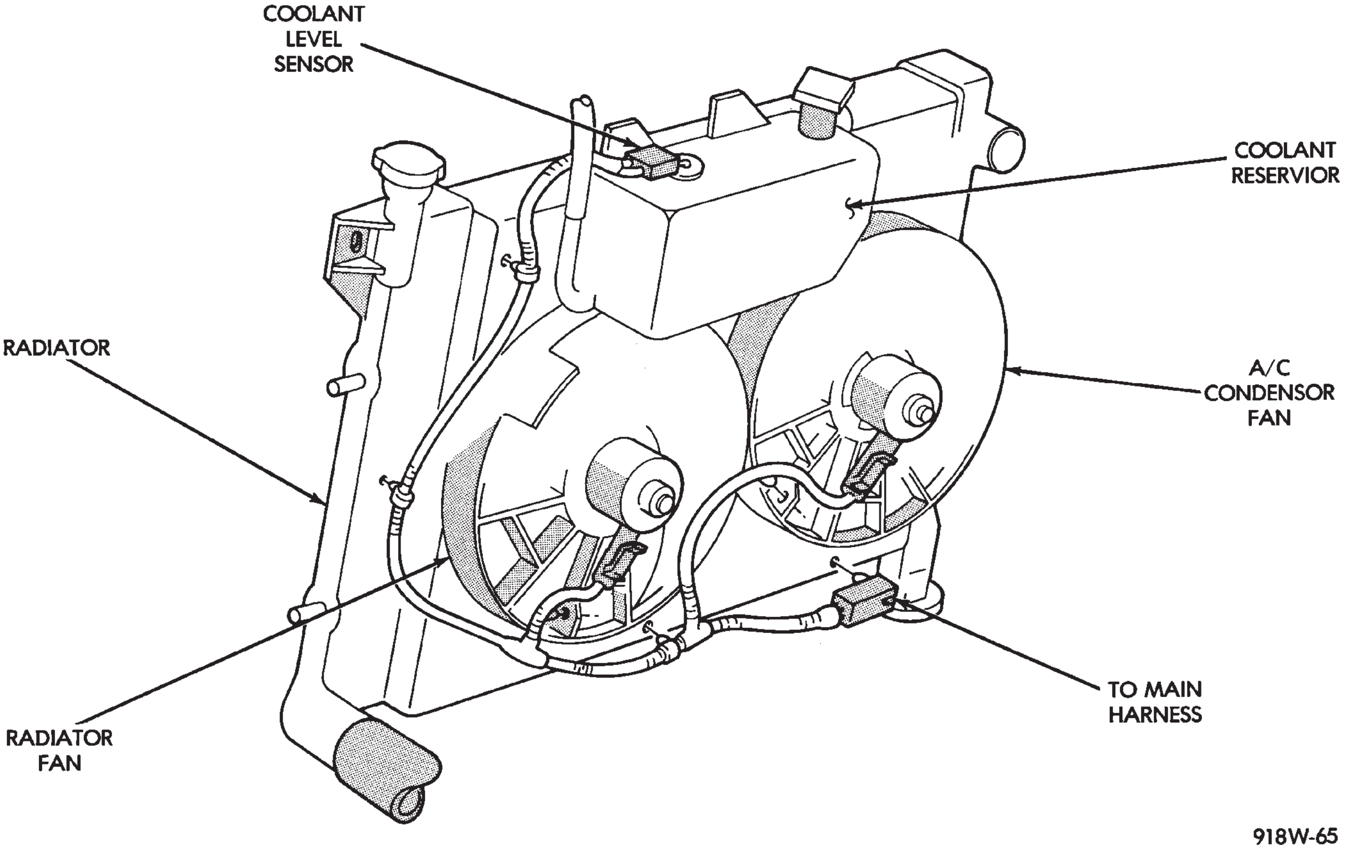


Fig 21 Radiator Fan Assembly AY Body

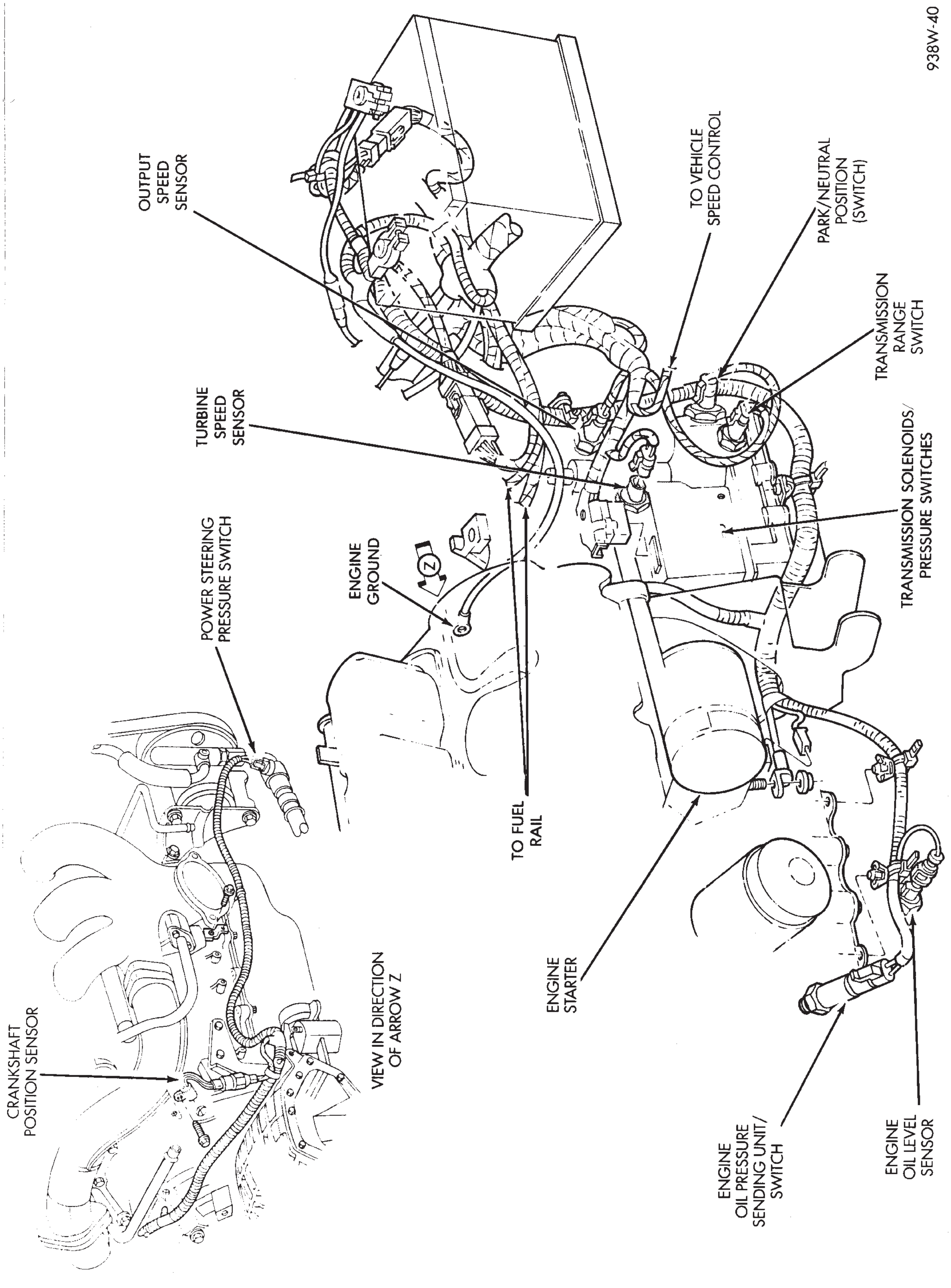


Fig. 22 Transmission Wiring 3.3L and 3.8L AY Body

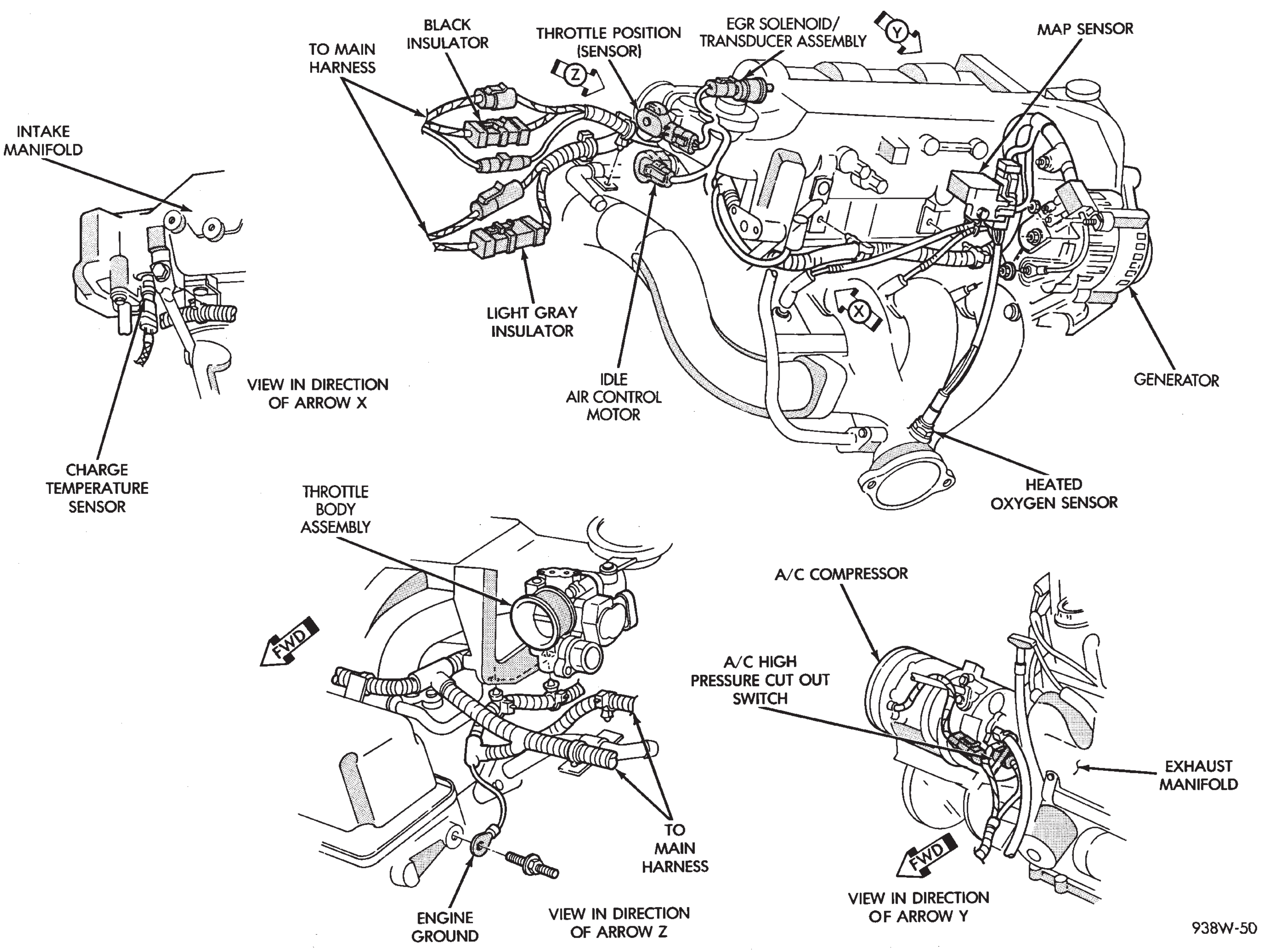


Fig. 23 Engine Wiring 3.3L and 3.8L AY Body

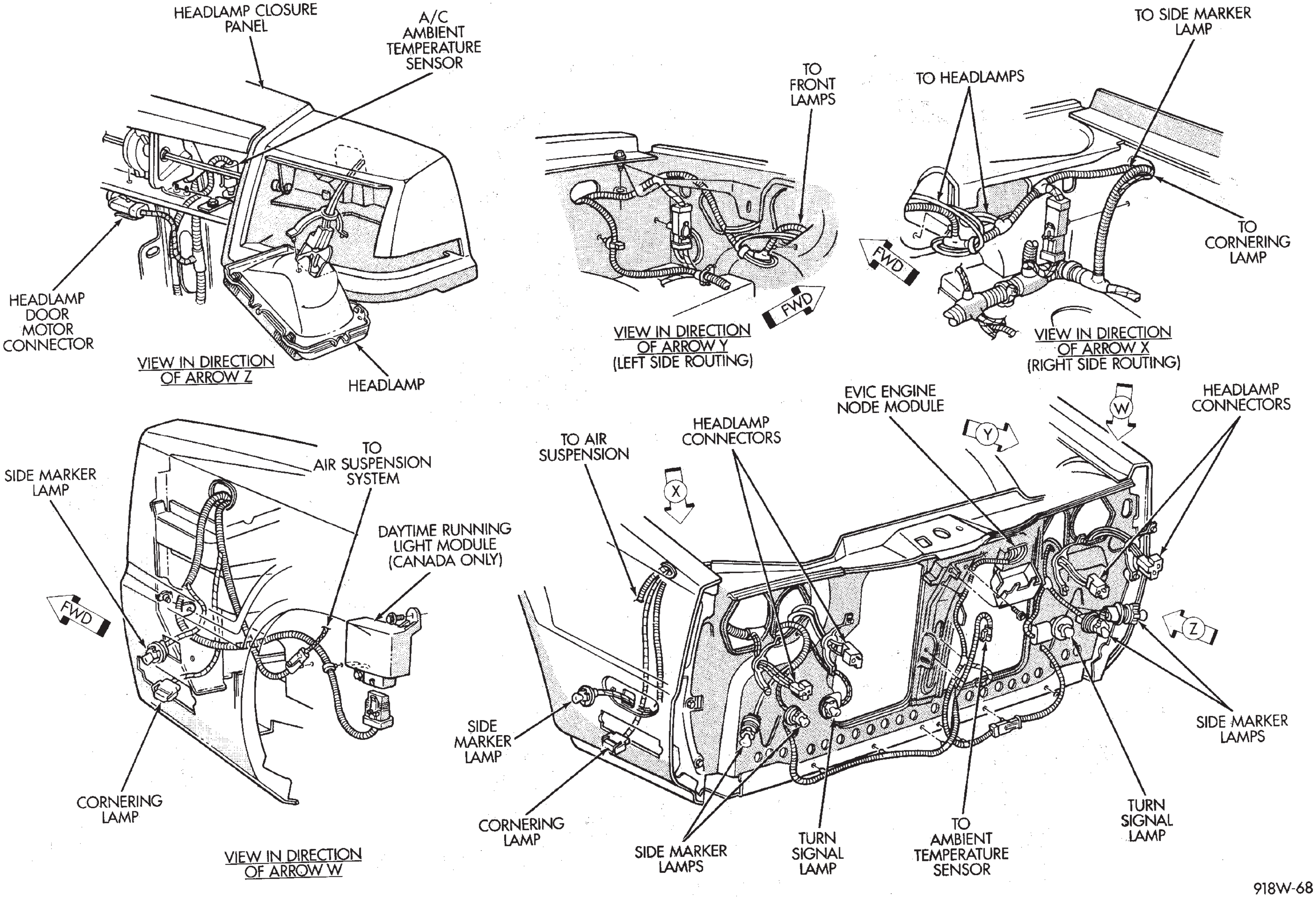


Fig. 24 Front End Lighting AY Body

SPLICE LOCATIONS

CONTENTS

The splice locations shown in this section are divided into sections by vehicle line. When locating a specific splice, first turn to the appropriate index, then look up the **figure number** that refers to the splice. **Page numbers at the top of each page do not refer to figure numbers.**

AA C, D, P SPLICE LOCATIONS

Splice Number	Fig.
A0 2.5L EFI and Flex Fuel	7
A0 3.0L	9
A0-1 2.5L EFI and Flex Fuel	7
A1 2.5L EFI and Flex Fuel	7
A3	4
A14 2.5L EFI and Flex Fuel	7
A14 3.0L	9
A20 2.5L EFI and Flex Fuel	7
A20 3.0L	9
A21-1 2.5L EFI and Flex Fuel	7
A21-1 3.0L	9
A21-2 2.5L EFI and Flex Fuel	8
A21-2 3.0L	10
A21-3 3.0L	10
A41 3.0L	9
A142 2.5L EFI	11
A142 3.0L	13
A142-1 2.5L EFI and Flex Fuel	7
A142-1 Flex Fuel	12
A142-1 3.0L	9
A142-2 3.0L	13
A142-3 3.0L	13
A142-4 3.0L	13
B47 2.5L EFI and Flex Fuel	7
B47 3.0L	9
B120 2.5L EFI and Flex Fuel	7
B120 3.0L	9
C7	4
D1 2.5L EFI and Flex Fuel	7
D1 3.0L	9
D2 2.5L EFI and Flex Fuel	7
D2 3.0L	9
E2-1	4
E2-2	4
E17	4
F20	4
F30	4
F35	5
F35-1	2
G5	4
G7-1 2.5L EFI and Flex Fuel	8
G7-1 3.0L	10
G16	4
G26	4
K4 3.0L	13
K4-1 2.5L EFI and Flex Fuel	7
K4-2 2.5L EFI	11
K4-2 Flex Fuel	12
K4-2 3.0L	13
K6 2.5L EFI and Flex Fuel	7
K6 3.0L	9
K7 EFI Only	7
K7 Flex Fuel	12
K7 3.0L	13
K7-1 Flex Fuel	12
K22 3.0L	9
K24 3.0L	9
L1	1
L3 2.5L EFI and Flex Fuel	8
L3 3.0L	10
L7	4
L7-1 2.5L EFI and Flex Fuel	8
L7-1 3.0L	10
L7-2 2.5L EFI and Flex Fuel	8
L7-2 3.0L	10
L7-3	1
L20	4
L39 2.5L EFI and Flex Fuel	8
L39 3.0L	10
L43 2.5L EFI and Flex Fuel	8
L43 3.0L	10
L50	2
L60 2.5L EFI and Flex Fuel	8
L60 3.0L	10
L61 2.5L EFI and Flex Fuel	8
L61 3.0L	10
M1	3
M1-2	4
M1-3	5
M1-4	2

Splice Number	Fig.
M1-5	4
M2	3
M2-3	4
M2-4	2
M2-5	3
P33	5
P34	5
Q1-1	5
T13 3.0L	14
T16 3.0L	10
T41 3.0L	9
V6	6
X13	5
X15	5
Z0 2.5L EFI and Flex Fuel	7
Z0 3.0L	9
Z1 2.5L EFI and Flex Fuel	7
Z1 3.0L	9
Z1 Optional EFI and Flex Fuel	7

Splice Number	Fig.
Z1 Optional 3.0L	9
Z1-1	4
Z1-1 2.5L EFI and Flex Fuel	8
Z1-1 3.0L	10
Z1-2	4
Z1-2 2.5L EFI and Flex Fuel	8
Z1-2 3.0L	10
Z1-3 2.5L EFI and Flex Fuel	8
Z1-3 3.0L	10
Z1-4	3
Z1-5	1
Z1-7	1
Z1-8	3
Z1-16	3
Z2	4
Z12 2.5L EFI and Flex Fuel	8
Z12 3.0L	10
Z13-1 3.0L	10
Z14 3.0L	10

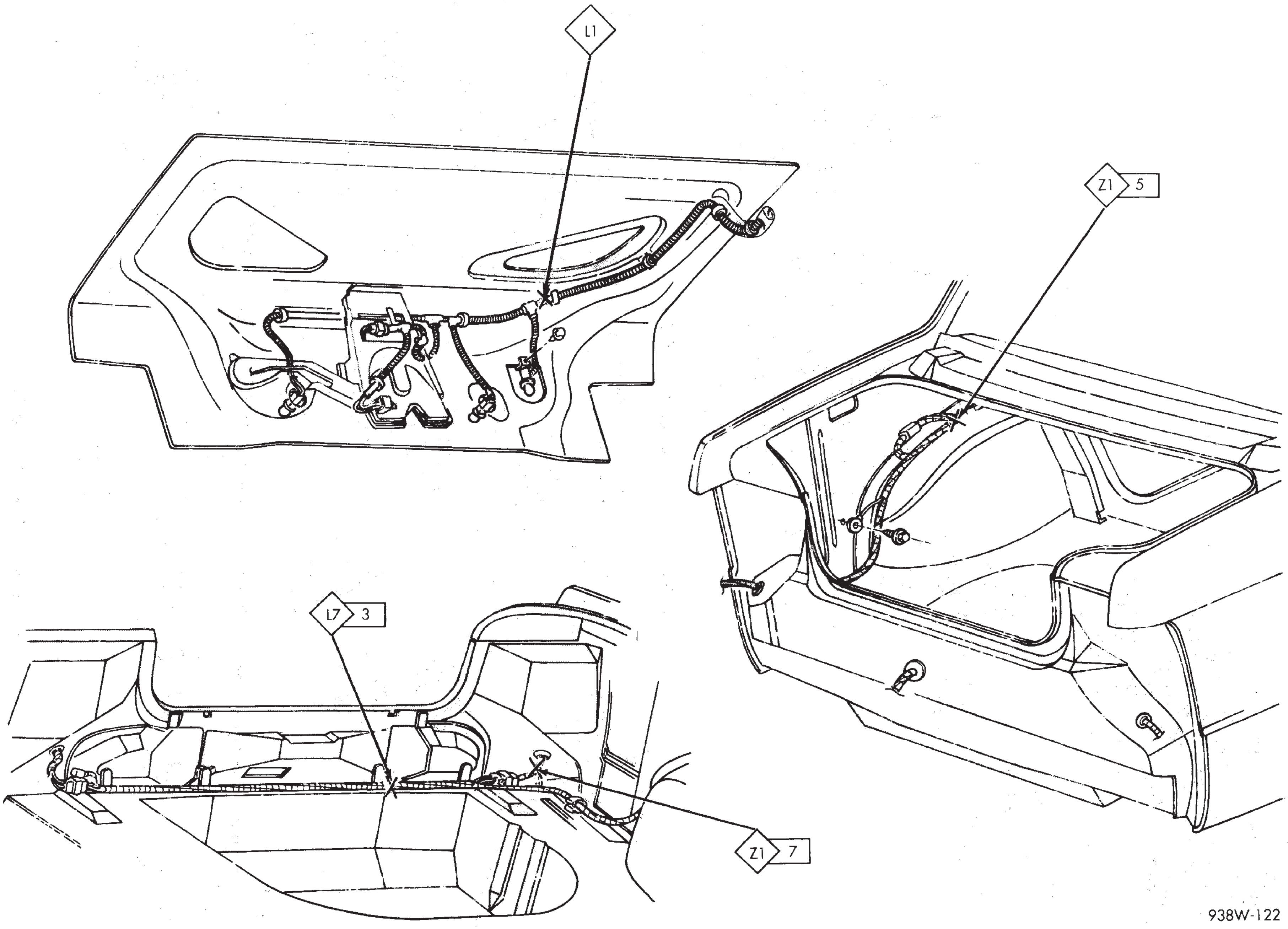


Fig. 1 Rear End Splices AA-Body

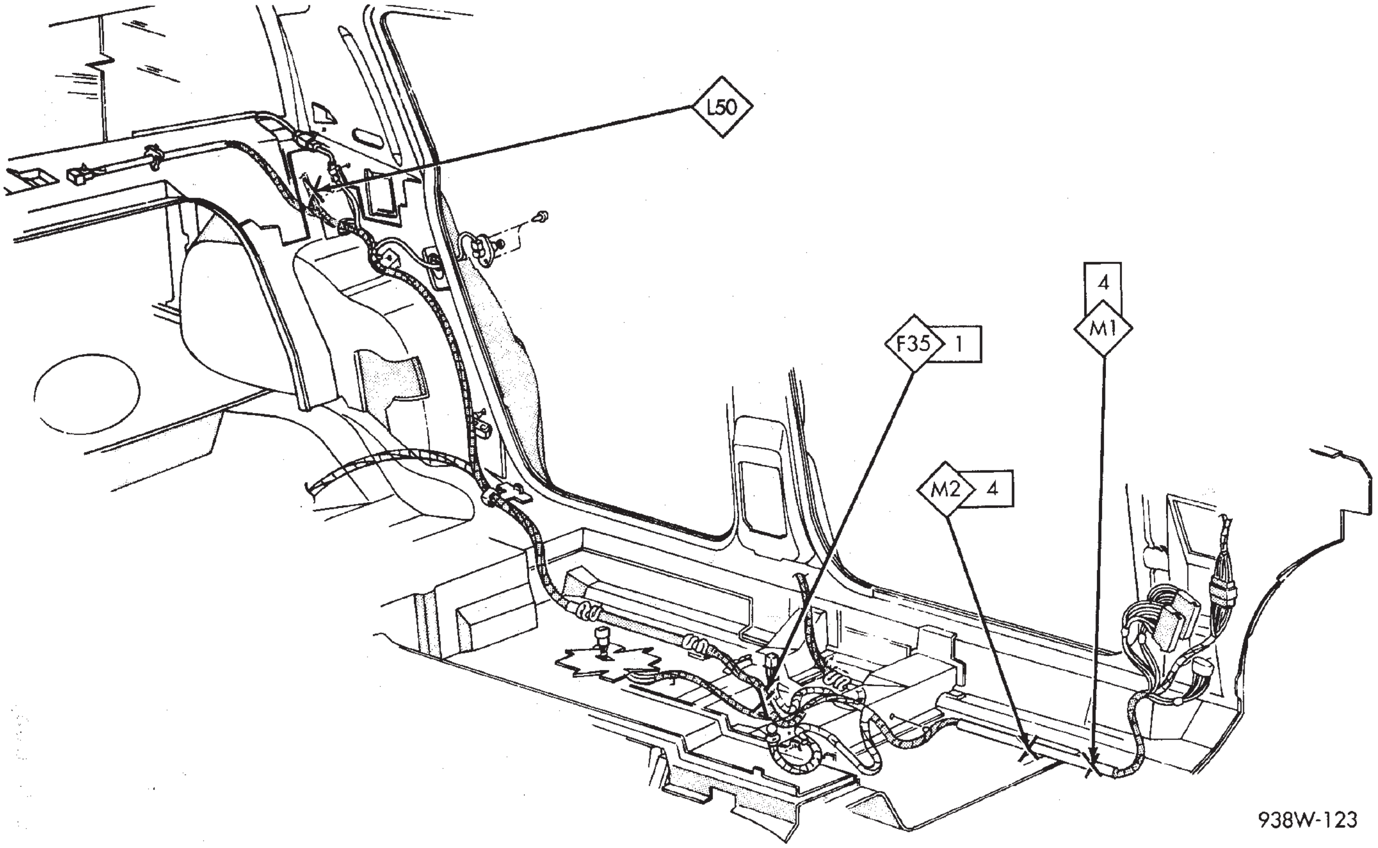


Fig. 2 Body Left Side Splices AA-Body

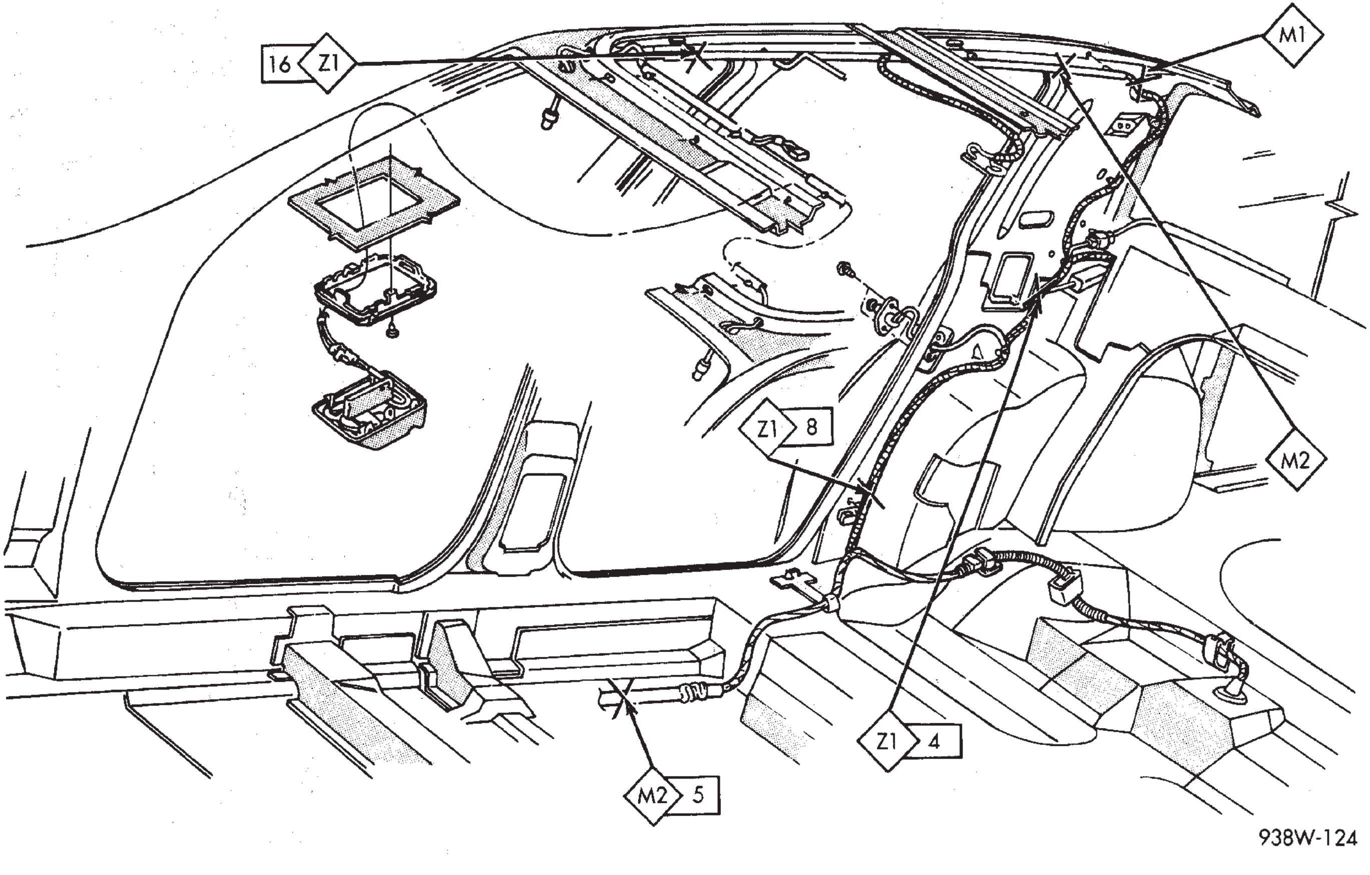


Fig. 3 Body Right Side Splices AA-Body

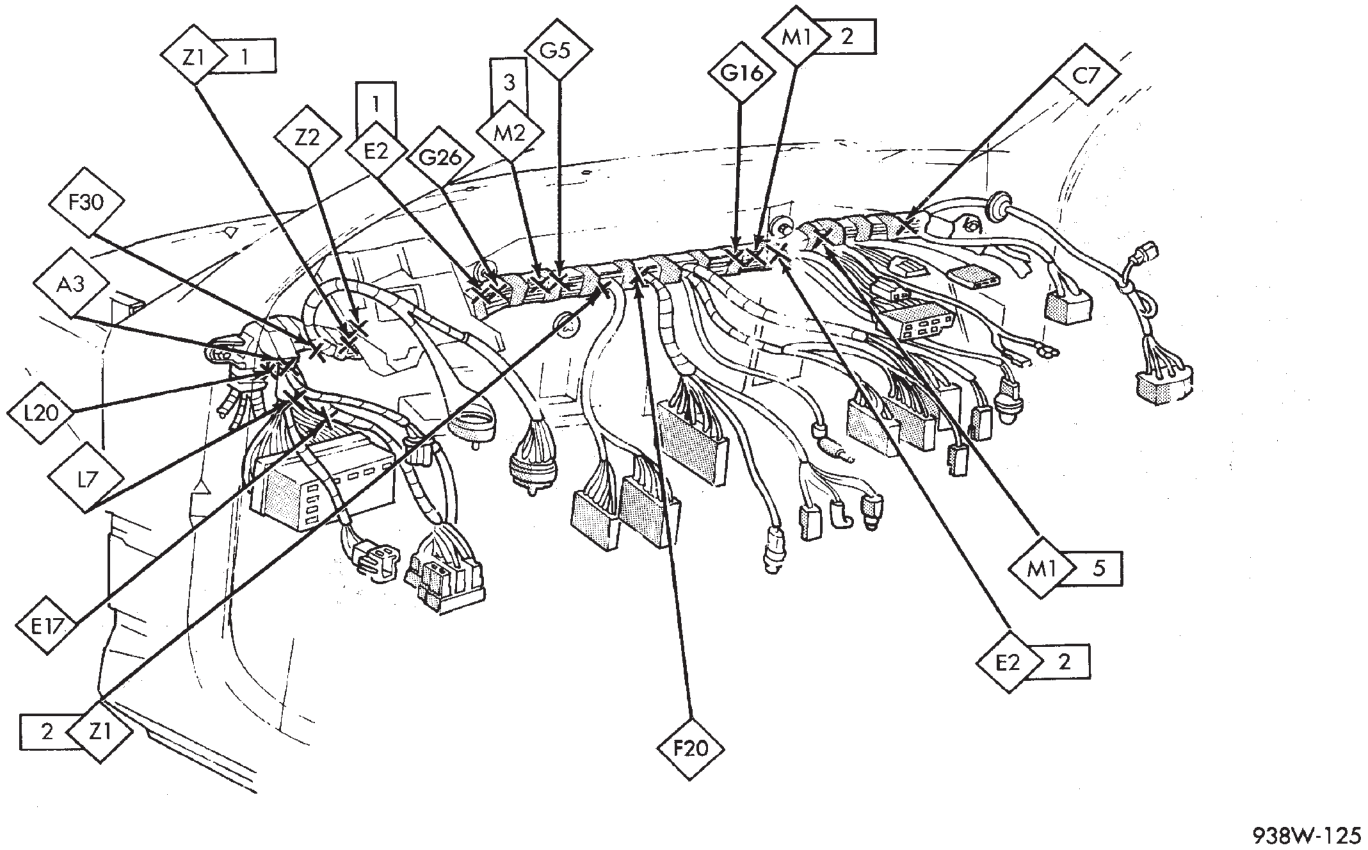


Fig. 4 Instrument Panel Splices AA-Body

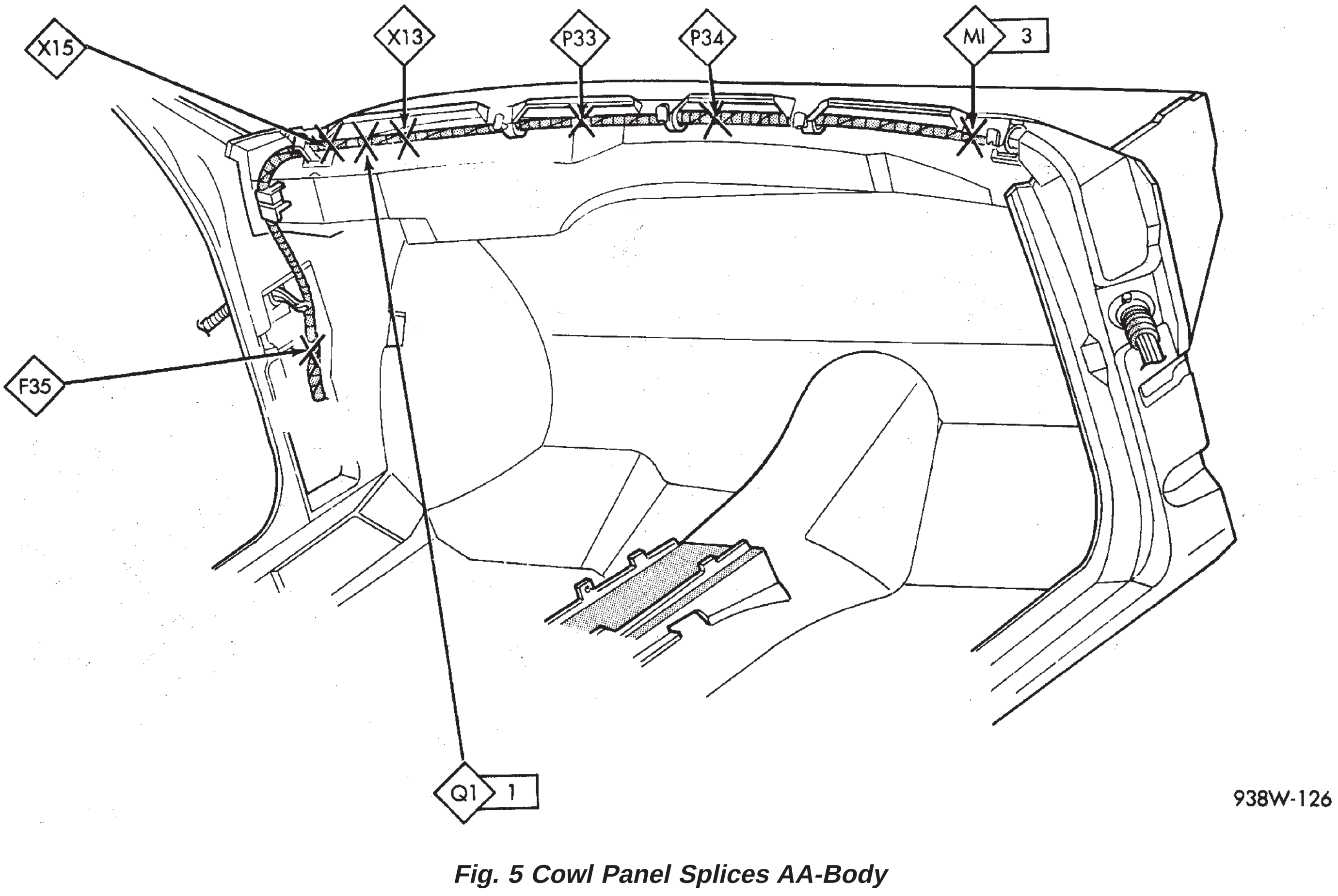


Fig. 5 Cowl Panel Splices AA-Body

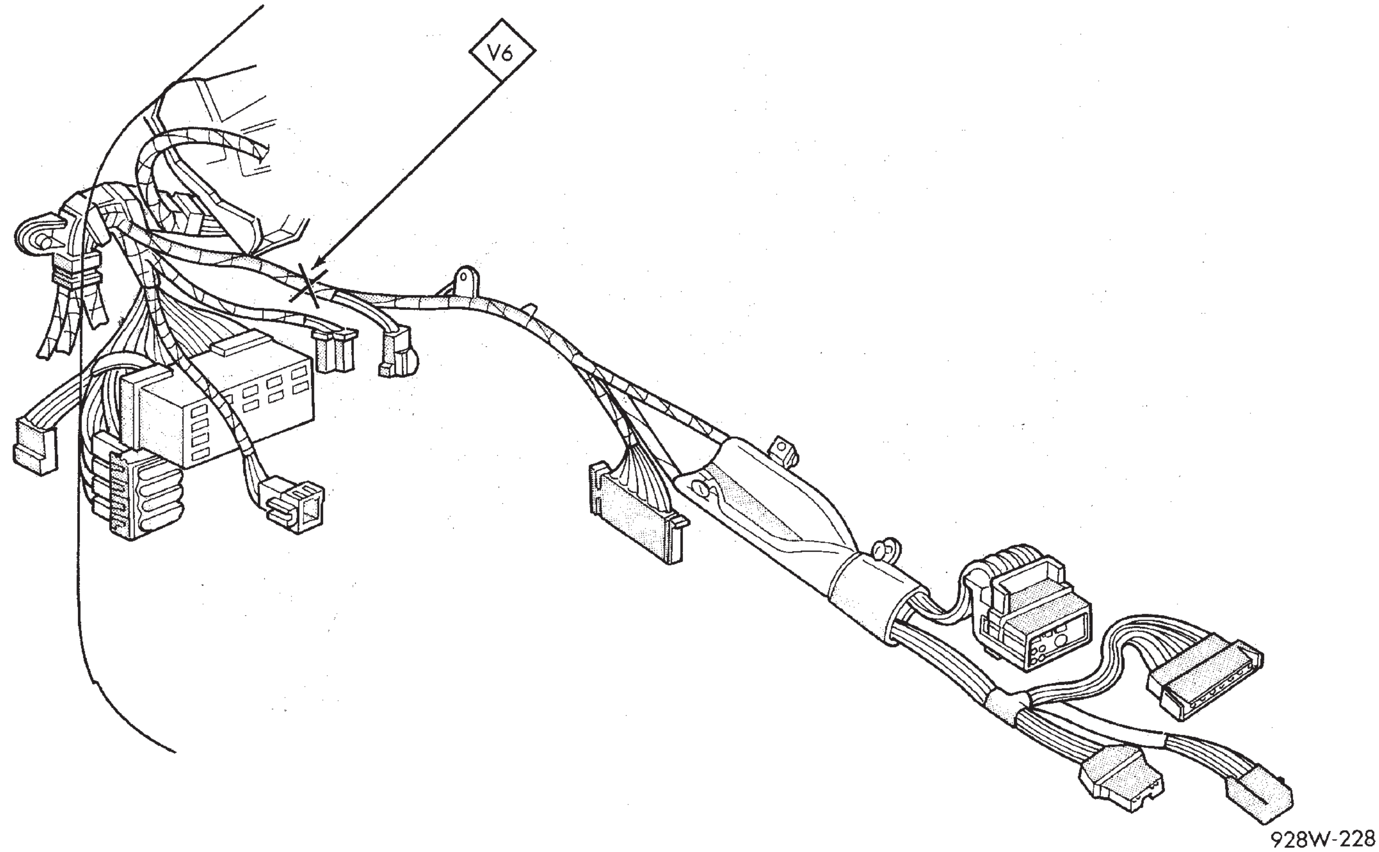


Fig. 6 Steering Column Splices AA-Body

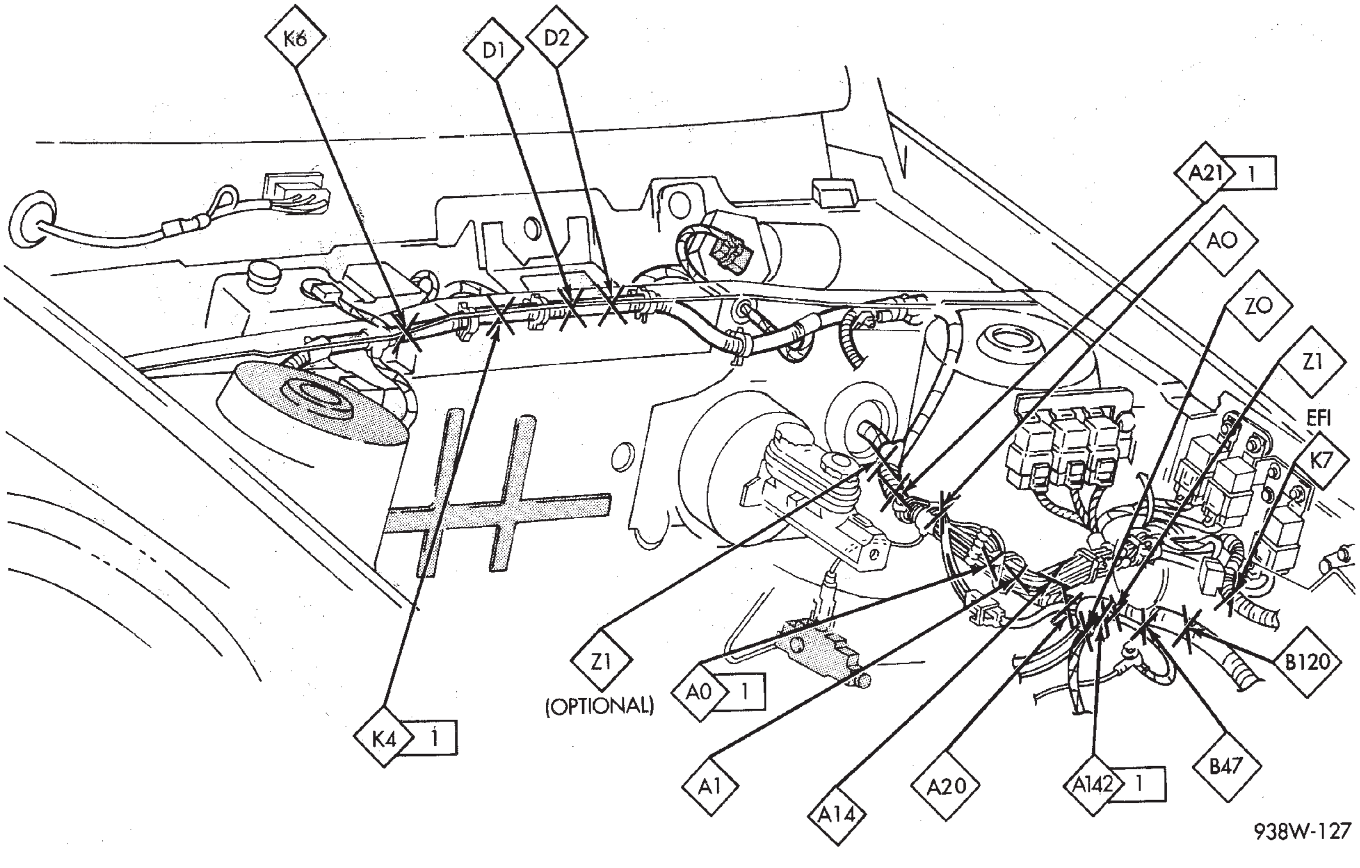


Fig. 7 Engine Compartment Splices EFI and Flex Fuel AA-Body

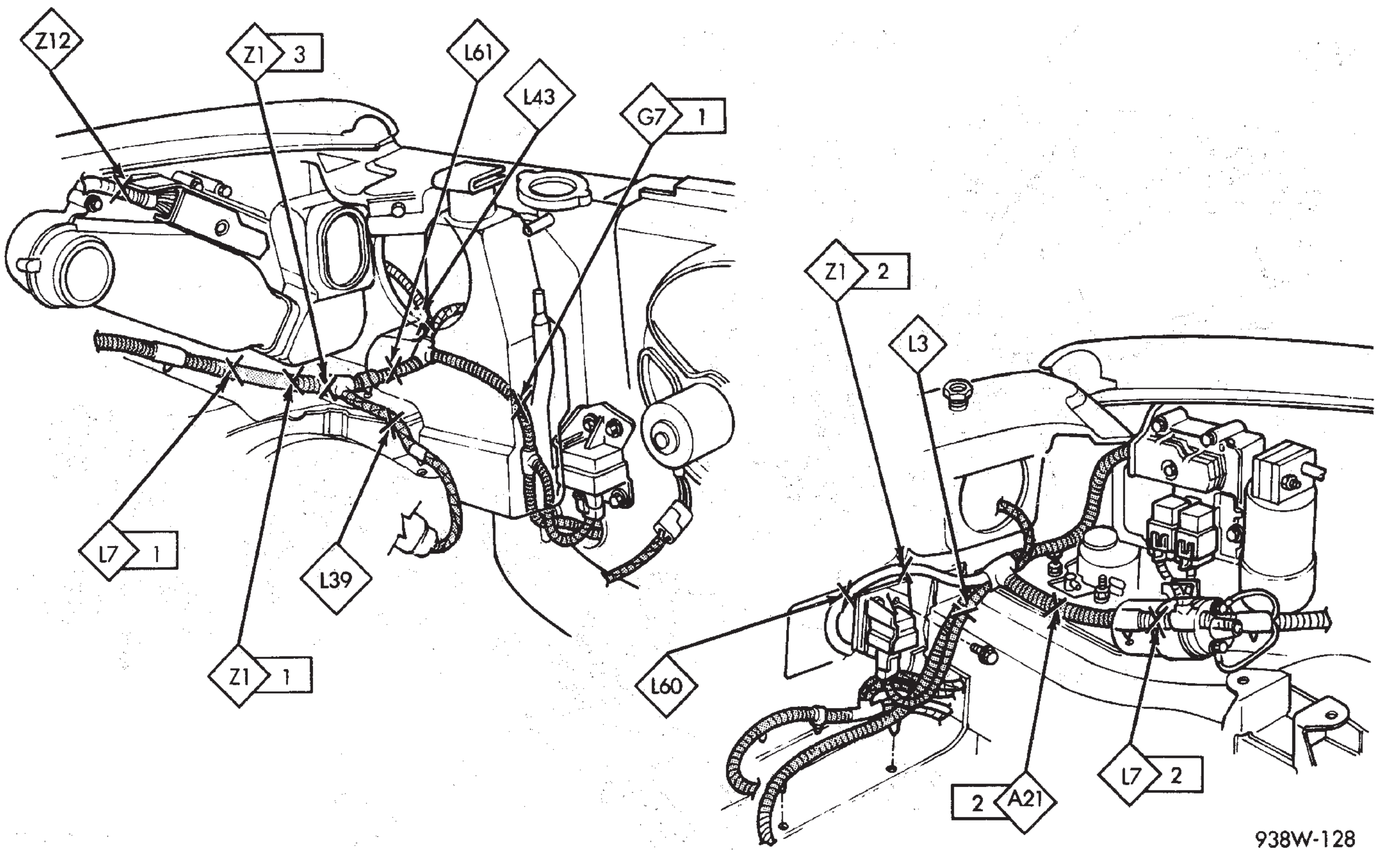


Fig. 8 Engine Compartment Splices EFI and Flex Fuel AA-Body

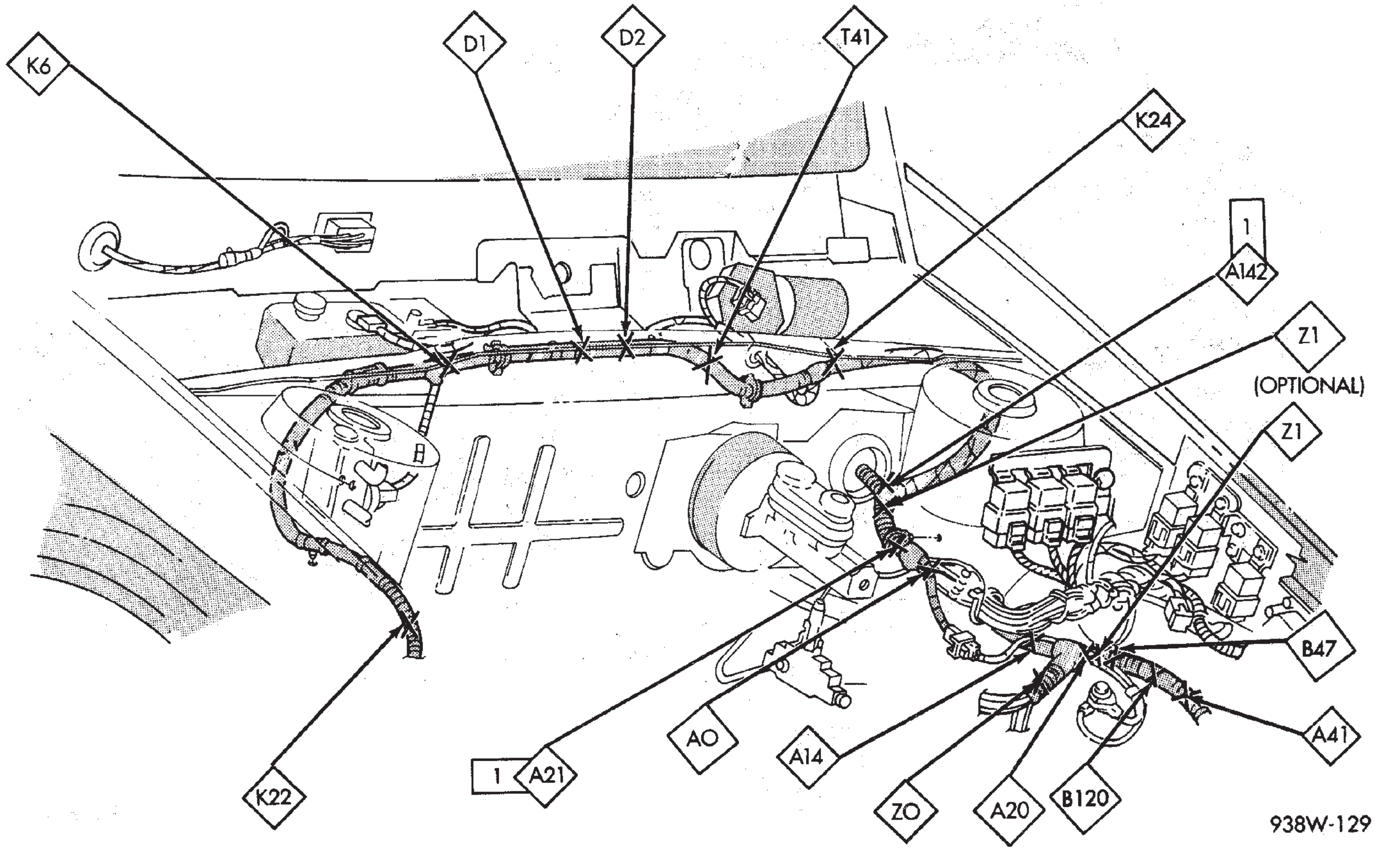


Fig. 9 Engine Compartment Splices 3.0L AA-Body

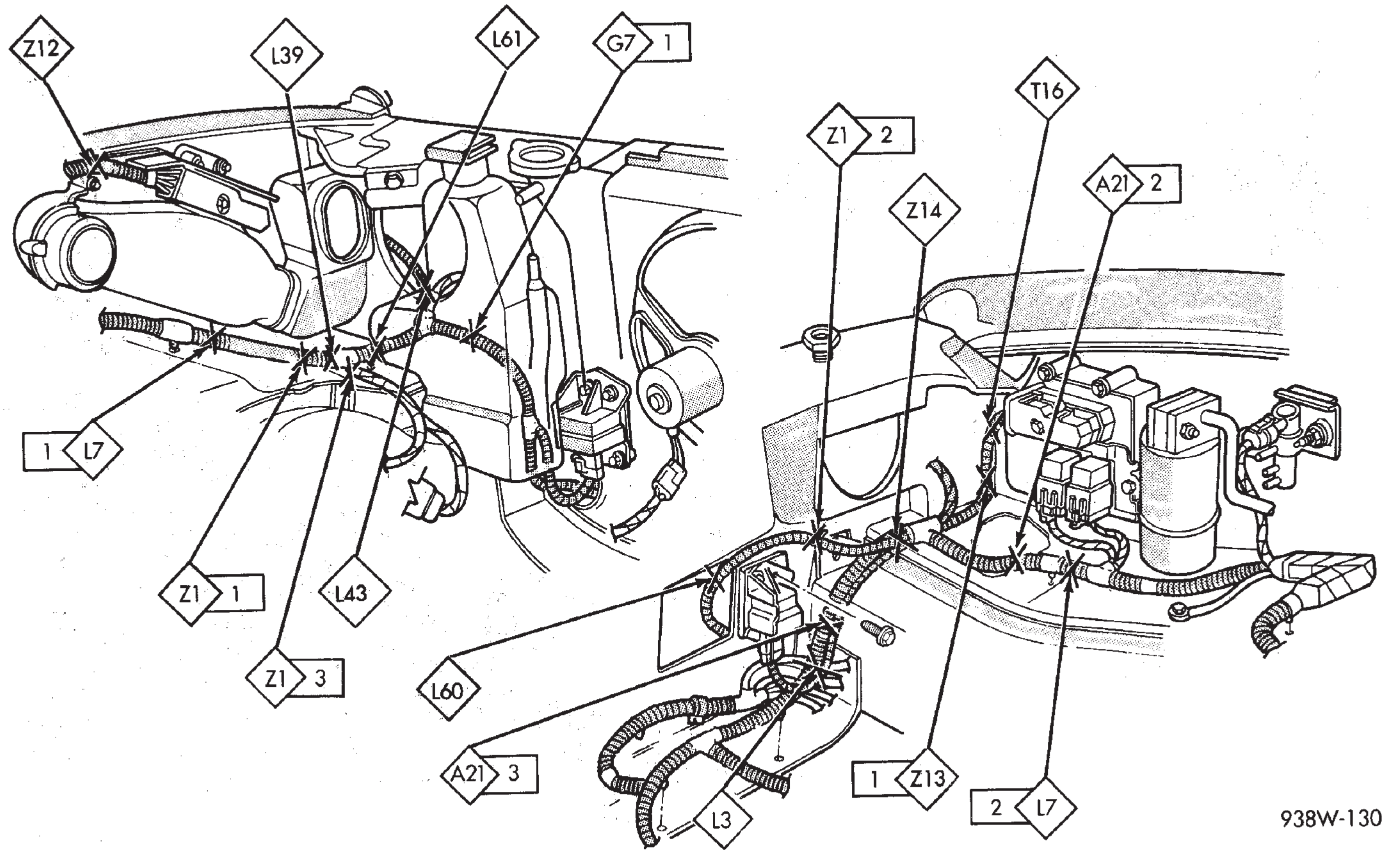


Fig. 10 Engine Compartment Splices 3.0L AA-Body

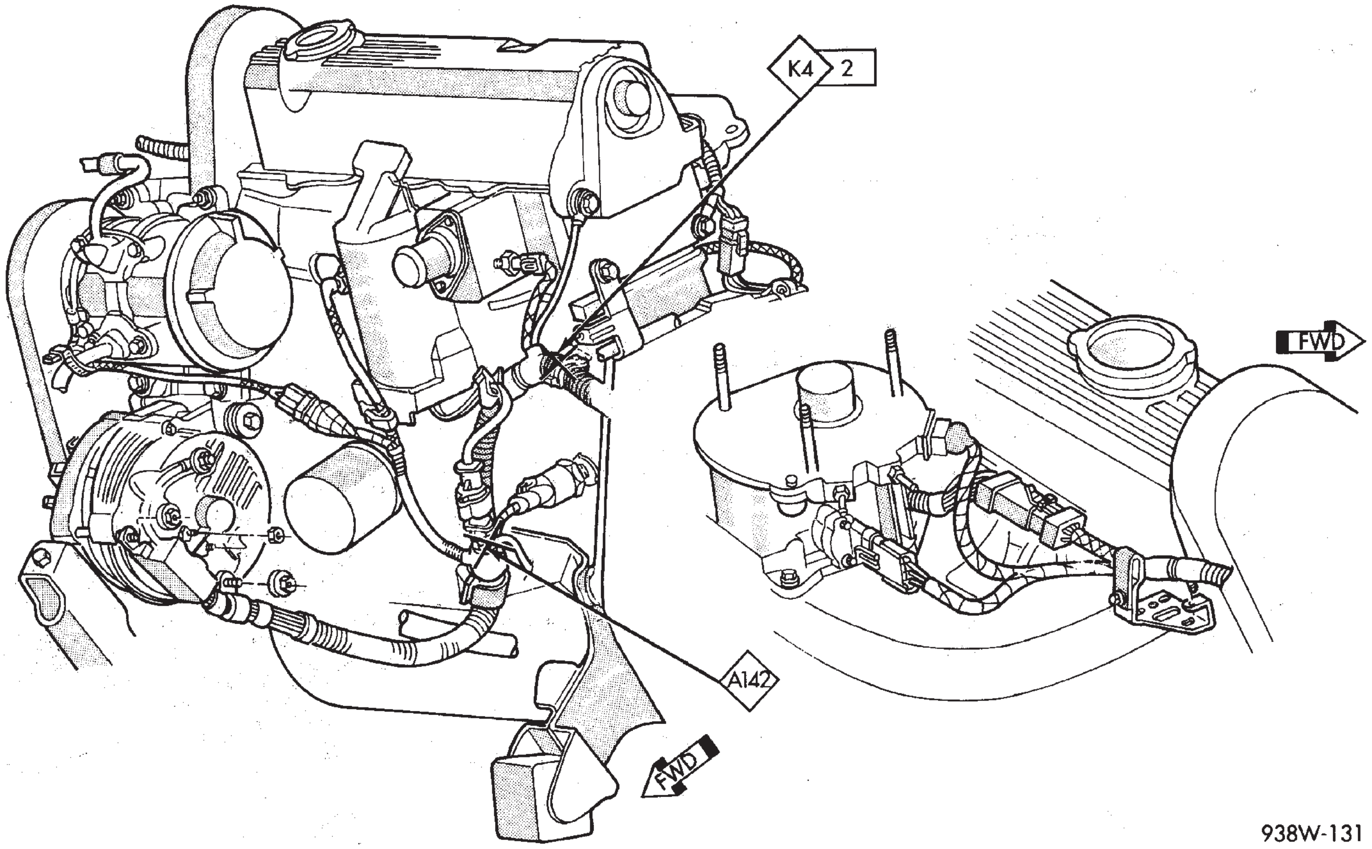


Fig. 11 Engine Splices EFI AA-Body

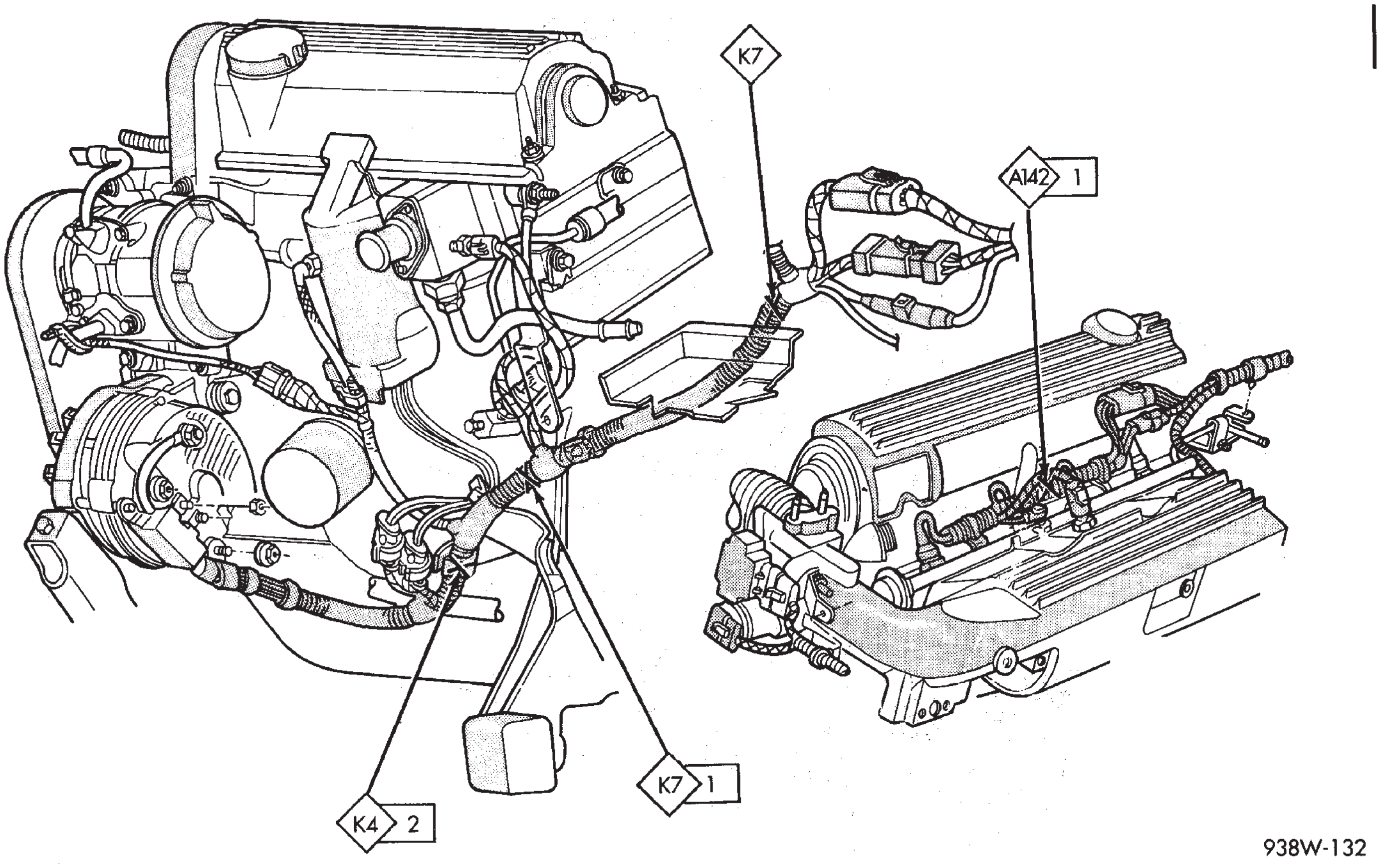


Fig. 12 Engine Splices Flex Fuel AA-Body

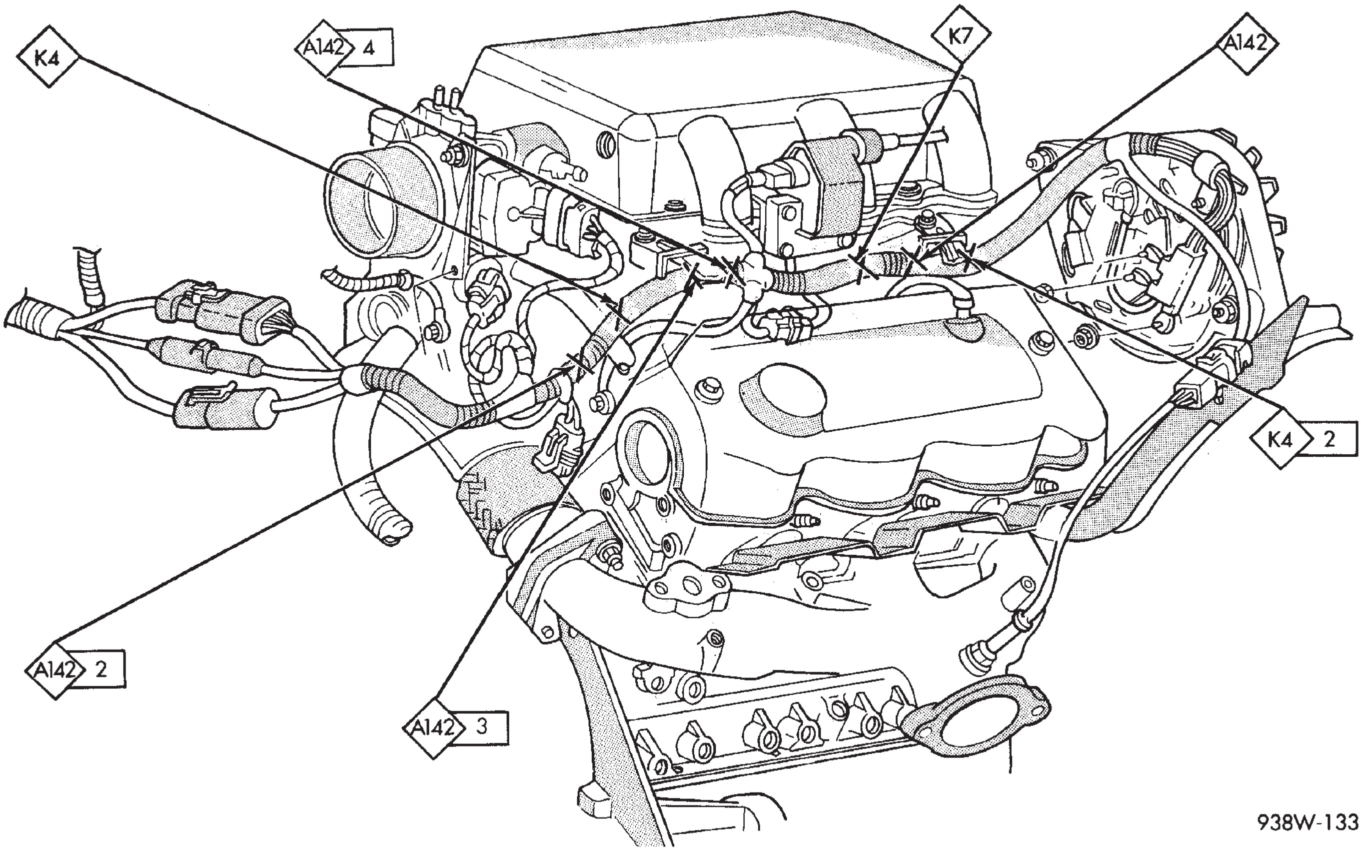


Fig. 13 Engine Splices 3.0L AA-Body

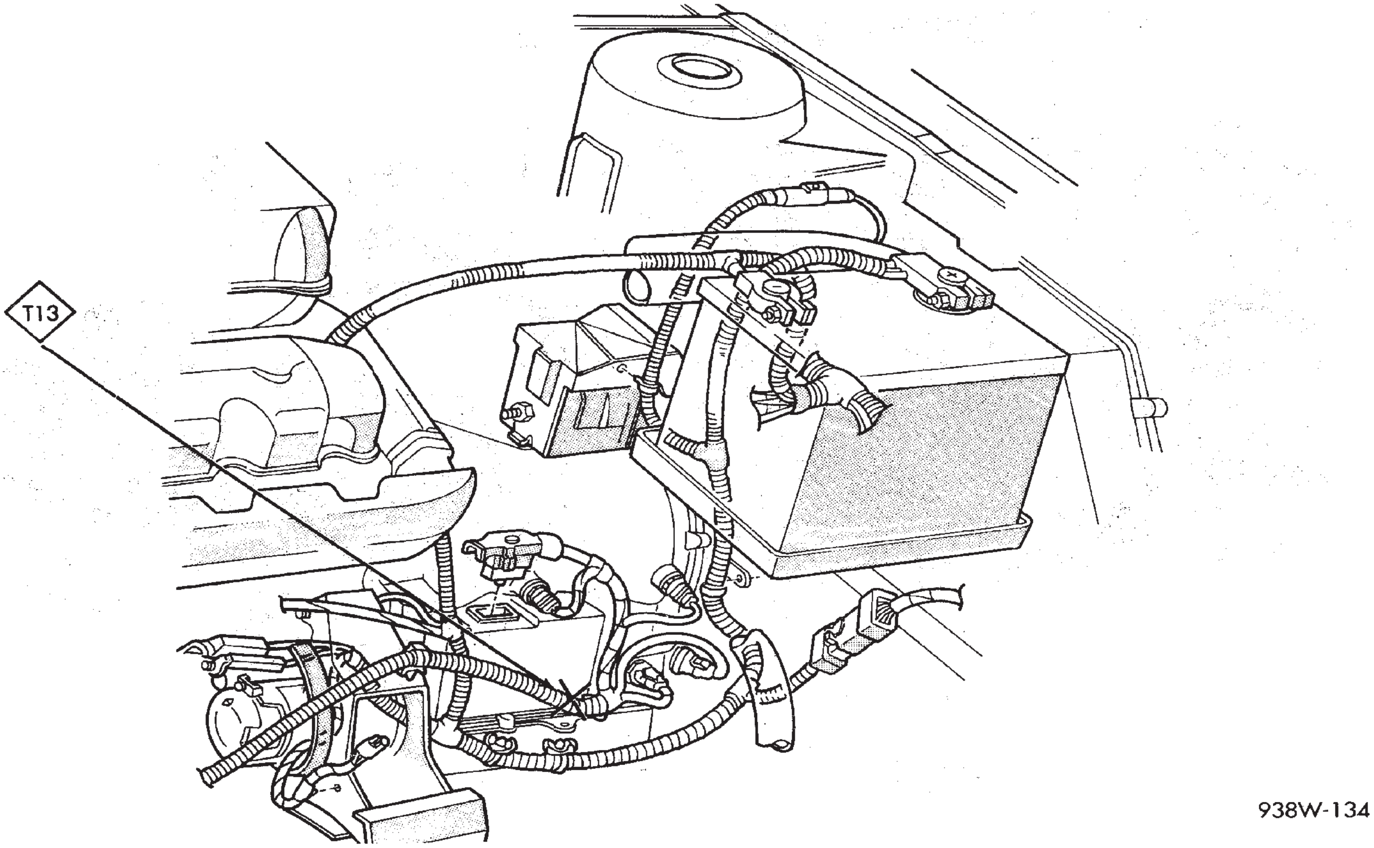


Fig. 14 Engine Splices 3.0L AA-Body

AC-AY SPLICE LOCATIONS

Splice Number	Fig.
A1 2.5L	10
A1 3.0L	12
A1 3.3L, 3.8L	14
A3	9
A3 3.0L	12
A3-1 2.5L	10
A3-1 3.3L, 3.8L	14
A4	9
A4-1 2.5L	10
A4-1 3.0L	12
A4-1 3.3L, 3.8L	14
A14 2.5L	10
A14 3.0L	12
A14 3.3L, 3.8L	14
A16 2.5L	10
A16 3.0L	12
A16 3.3L, 3.8L	14
A21 2.5L	10
A21 3.0L	12
A21 3.3L, 3.8L	14
A21-1 3.0L	13
A21-1 3.3L, 3.8L	14, 15
A21-2	9
A21-2 3.0L	13
A21-2 3.3L, 3.8L	15
A22	9
A41 3.0L	12
A41 3.3L, 3.8L	14
A141 2.5L	10
A141 3.0L	12
A141 3.3L, 3.8L	14
A142 2.5L	16
A142 3.0L	17
A142-1 3.0L	17
A142-2 2.5L	10
A142-2 3.0L	12
A142-2 3.3L, 3.8L	14, 18
B47 3.0L	12
B47 3.3L, 3.8L	14
C15	9
C25 3.0L	13
C25 3.3L, 3.8L	15
C27 3.0L	13
C27 3.3L, 3.8L	15
C34	9
C57	9
C57-1	9
C57-2	9
D1 2.5L	10
D1 3.0L	12
D1 3.3L, 3.8L	14
D1-1	9
D1-2	4
D2 2.5L	10
D2 3.0L	12
D2 3.3L, 3.8L	14
D2-1	9
D2-2	4
E2	9
F10	5
F10-1	4
F13	9
F20 2.5L	10
F20-1 (AY Body)	21
F22	9
F30-2	6
F30-3	9
F30-4	9
F30-5	8
F33	9
F35	9
F35-1	6
F35-2	9
G5	9
G5-1	9
G7 2.5L	10
G7 3.0L	13
G7 3.3L, 3.8L	15
G9 3.0L	13
G9 3.3L, 3.8L	15
G10	6
K4 3.0L	12
K4 3.3L, 3.8L	18
K4-1 3.3L, 3.8L	14
K4-2 2.5L	16
K4-3 3.0L	17
K4-3 3.3L, 3.8L	18
K4-4 2.5L	10
K4-4 3.0L	12
K4-4 3.3L, 3.8L	14
K6 3.0L	17
K6 3.3L, 3.8L	18
K6-1 2.5L	10
K7 2.5L	11
K7 3.3L, 3.8L	14
K22 3.0L	13
K22 3.3L, 3.8L	15
K24 3.0L	12
K24 3.3L, 3.8L	14
L3	9
L3-1 (AC-Dodge)	19
L3-1 (AY)	21
L3-2 2.5L	11
L3-2 3.0L	13
L3-2 3.3L, 3.8L	15
L4-3 (AC-Dodge)	19
L7	9
L7-2 2.5L	11
L7-2 3.0L	13
L7-2 3.3L, 3.8L	15
L7-3 (AC-Dodge)	19
L7-4 (AC-Dodge)	19

Splice Number	Fig.
L7-4 RT (AY)	21
L7-4 LT (AC-Chrysler)	20
L43 (AC-Chrysler)	20
L43 (AY)	21
L50 (Chrysler)	1
L50 (Dodge)	2
L60-1 (AC-Chrysler)	20
L60-1 (AY)	21
L60-2 2.5L	11
L60-2 3.0L	13
L60-2 3.3L, 3.8L	15
L61 (AC-Chrysler)	20
L61 (AC-Dodge)	19
L61 (AY)	21
M1	5
M1-1	7
M1-2	6
M1-3	7
M2	7
M2-3	6
M2-4	6
M11-1	9
M31	9
P33	7
P34	7
P36	9
P38	9
Q1	6
S3-1 3.0L	13
S3-1 3.3L, 3.8L	15
S3-2 3	3
S33 3.0L	13
S33 3.3L, 3.8L	15
T1 3.0L	13
T1 3.3L, 3.8L	15
T13 3.0L	12
T13 3.3L, 3.8L	14
T16 3.0L	13
T16 3.3L, 3.8L	15
T41 3.0L	13
T41 3.3L, 3.8L	15
V9	9
X2	9
X3	9
X13	7
Z0 2.5L	10
Z0 3.0L	12
Z0 3.3L, 3.8L	14
Z0-1 2.5L	16
Z0-2 2.5L	16
Z1 3.3L, 3.8L	18
Z1-1 2.5L	11
Z1-1 3.0L	13
Z1-1 3.3L, 3.8L	15
Z1-2 2.5L	10
Z1-2 3.0L	12
Z1-2 3.3L, 3.8L	14
Z1-3 3.0L	12
Z1-3 3.3L, 3.8L	14
Z1-4 3.0L	13
Z1-4 3.3L, 3.8L	15
Z1-6 (Chrysler)	1
Z1-6 (Dodge)	2
Z1-7 Chrysler)	1
Z1-7 (Dodge)	2
Z1-8	9
Z1-9	9
Z1-10 2.5L	11
Z1-10 3.0L	12
Z1-10 3.3L, 3.8L	14
Z1-11 RT (Chrysler)	1
Z1-12 (AC-Chrysler)	20
Z1-12 (AC-Dodge)	19
Z1-12 (AY Body)	21
Z1-13	4
Z1-14	8
Z1-15	6
Z1-16	8
Z1-17 2.5L	11
Z1-17 3.0L	13
Z1-17 3.3L, 3.8L	15
Z1-18 (Chrysler)	1
Z1-18 (Dodge)	2
Z1-19 (AC-Chrysler)	20
Z1-19 (AC-Dodge)	19
Z1-19 RT (AC-Chrysler)	20
Z1-19 RT (AY)	21
Z2	9
Z2-1 RT 3.0L	13
Z2-1 RT 3.3L, 3.8L	15
Z2-2	5
Z12 2.5L	10
Z12 3.0L	13
Z12 3.3L, 3.8L	15
Z13 3.0L	13
Z13 3.3L, 3.8L	15
Z14 3.0L	13
Z14 3.3L, 3.8L	15

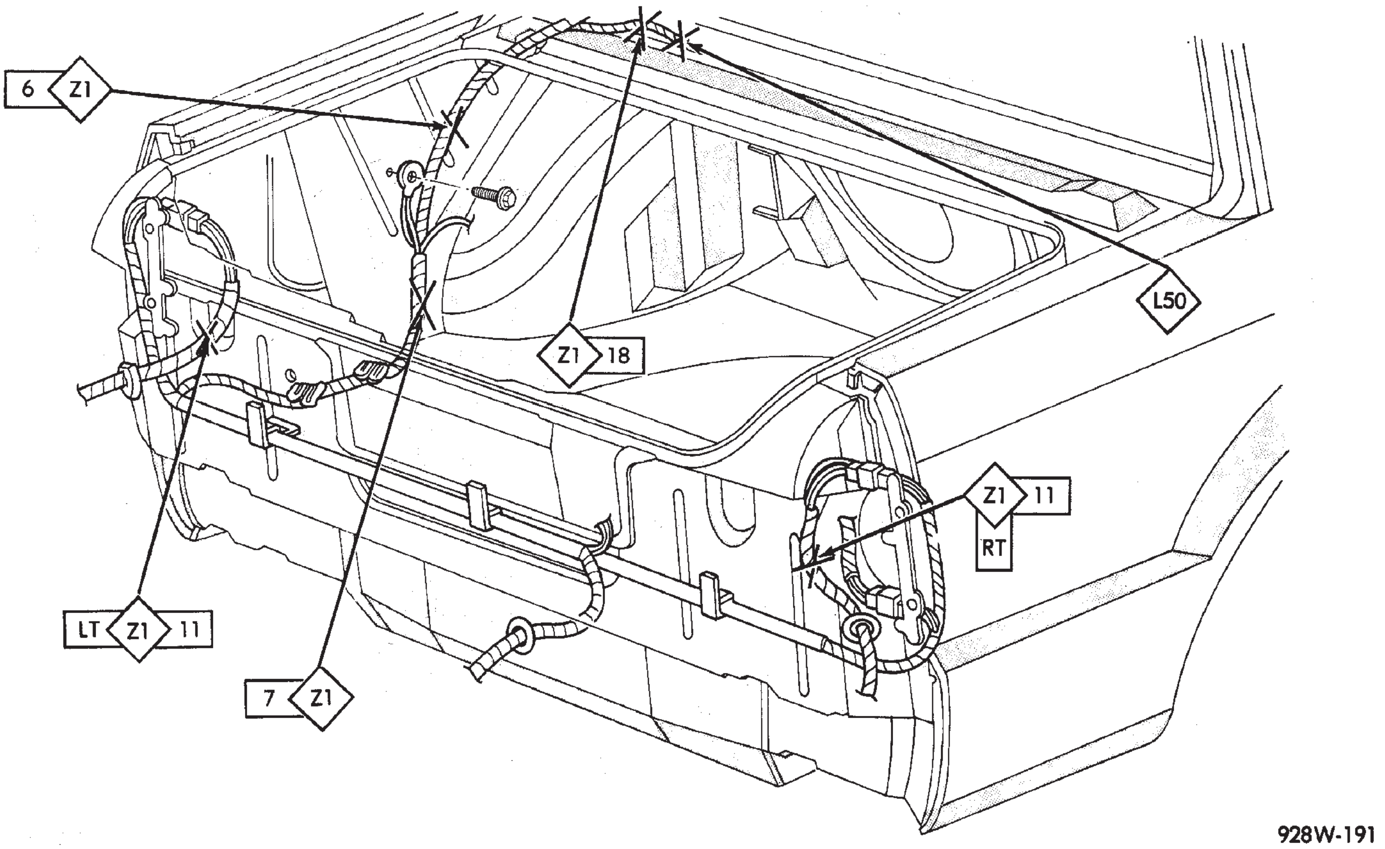


Fig. 1 Rear End Splices AC-C, AY-C Body

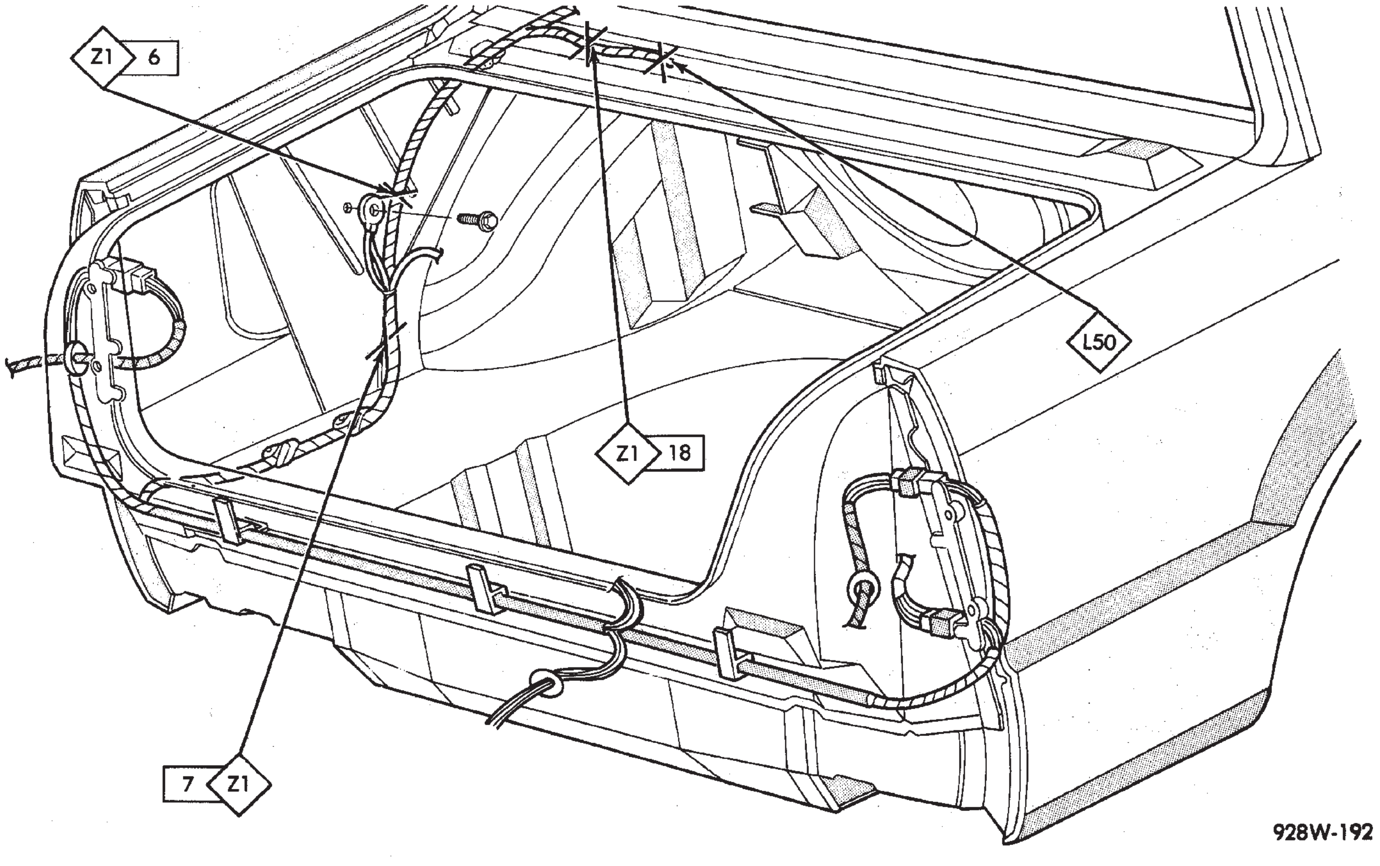


Fig. 2 Rear End Splices AC-D Body

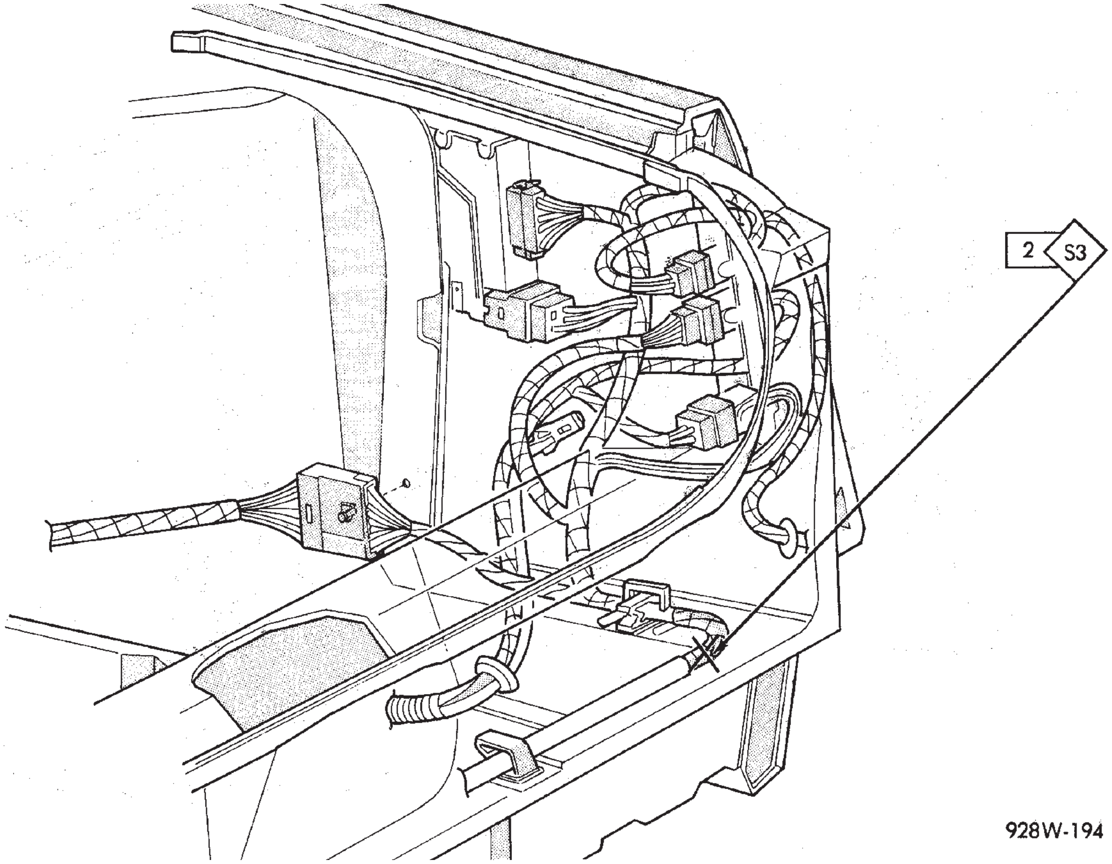


Fig. 3 Air Suspension Splices AC, AY Body

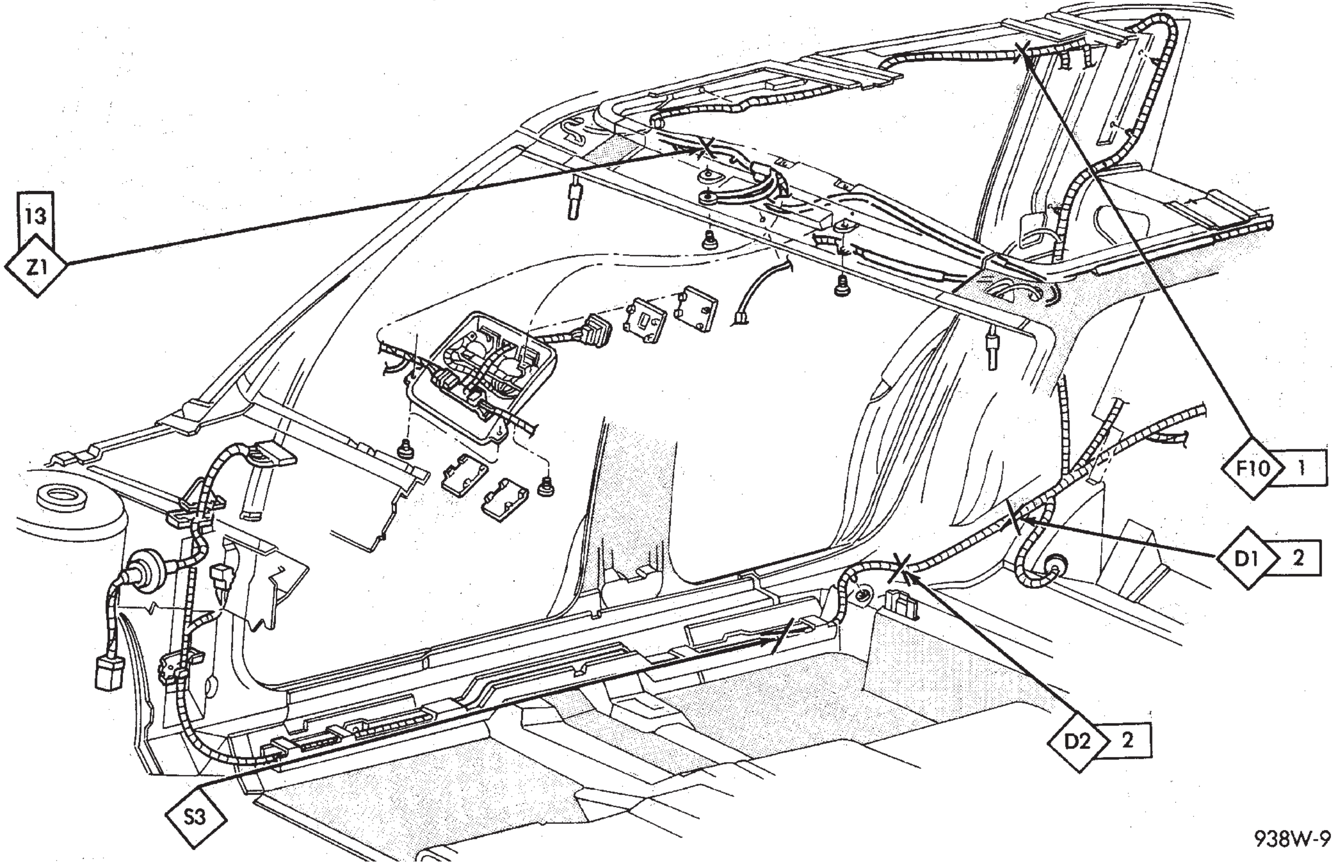


Fig. 4 Right Side Splices AC, AY Body

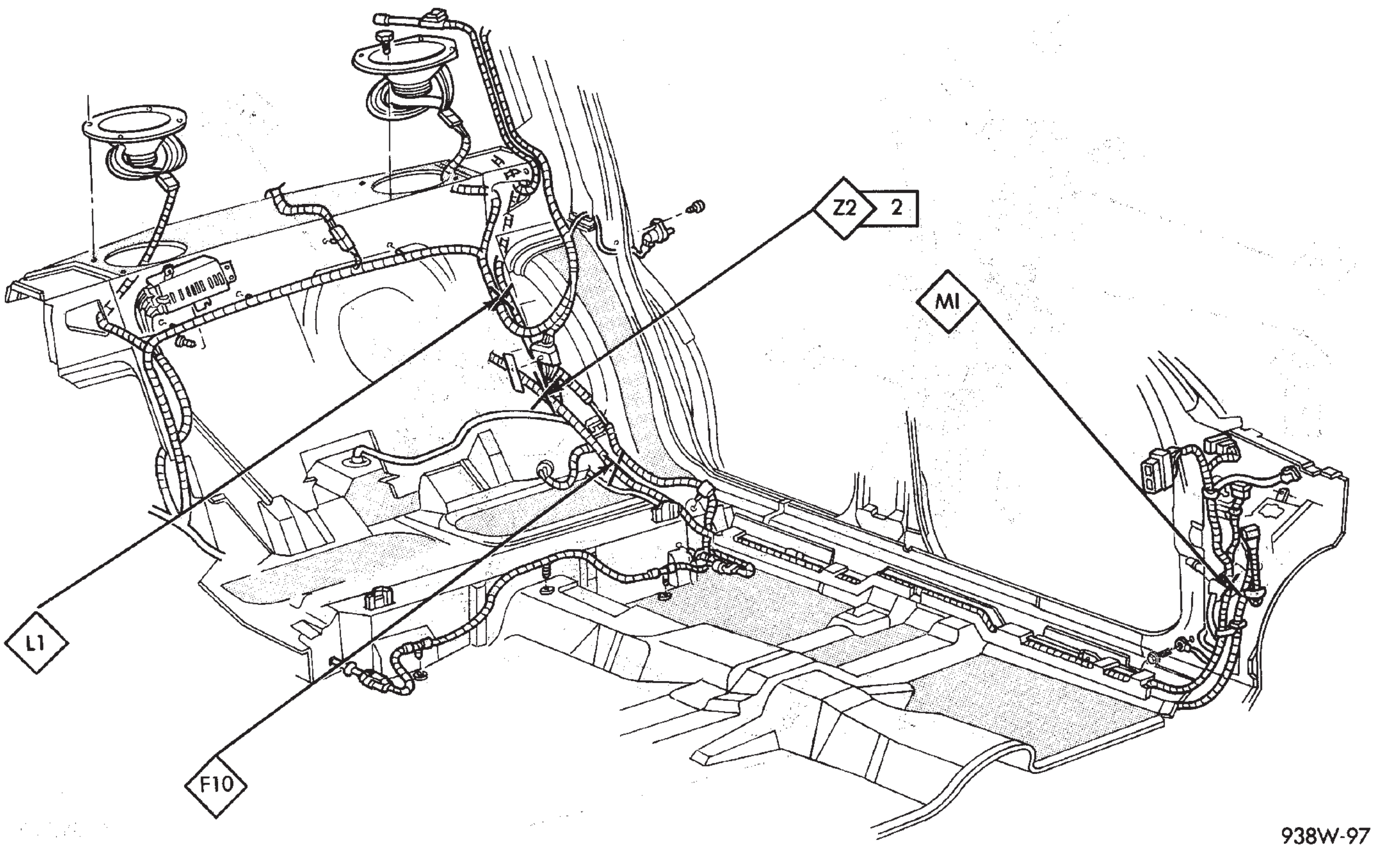


Fig. 5 Left Side Splices AC, AY Body

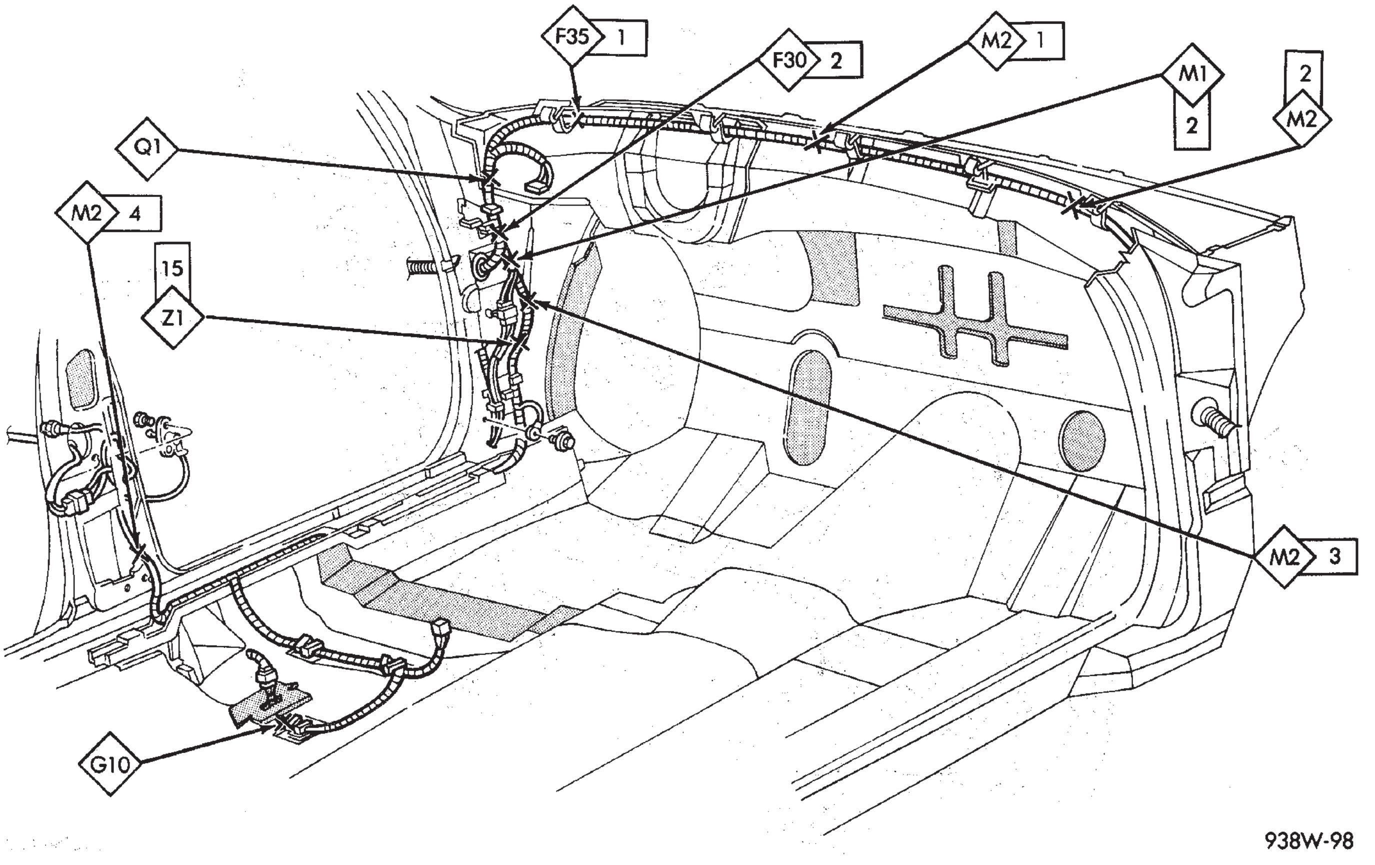


Fig. 6 Left Side Splices AC, AY Body

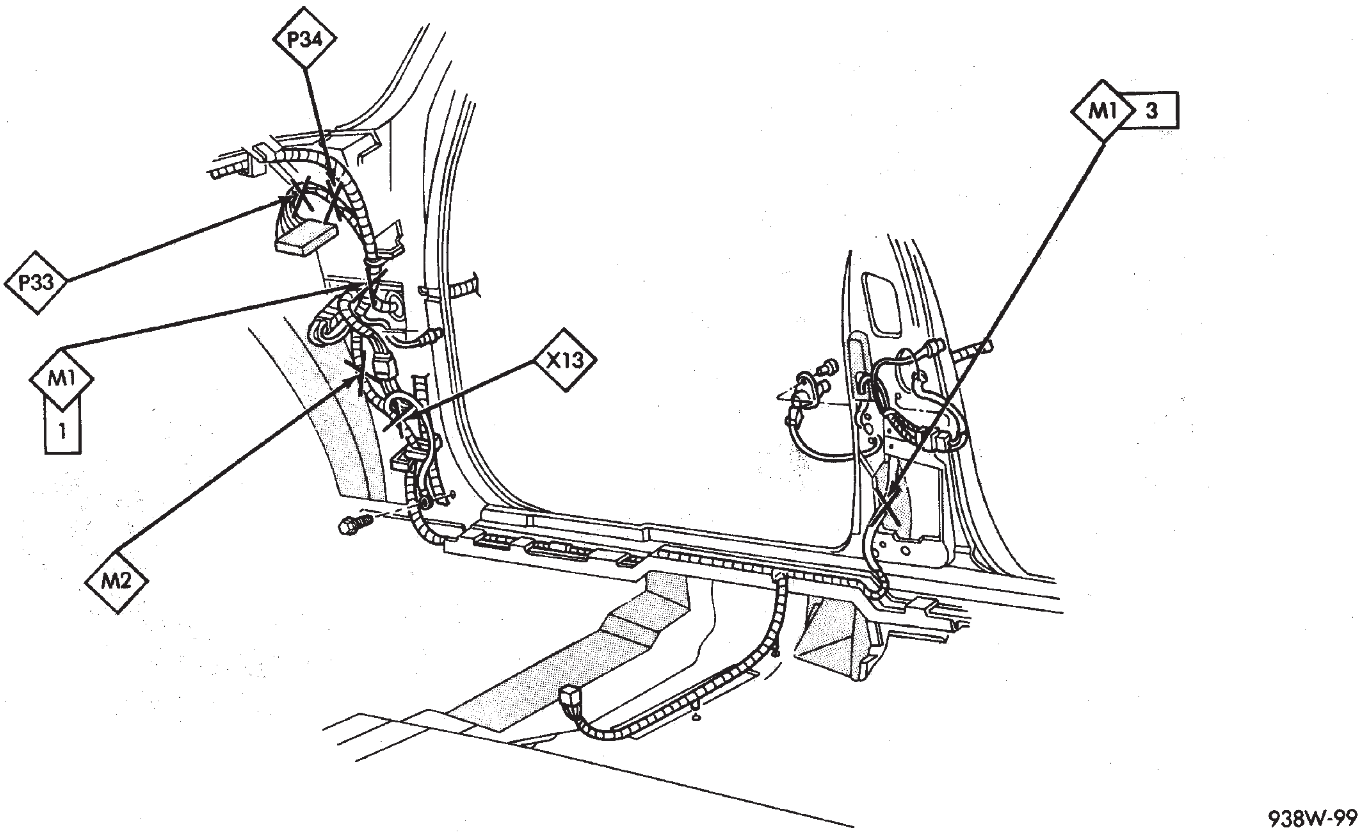


Fig. 7 Right Side Splices AC, AY Body

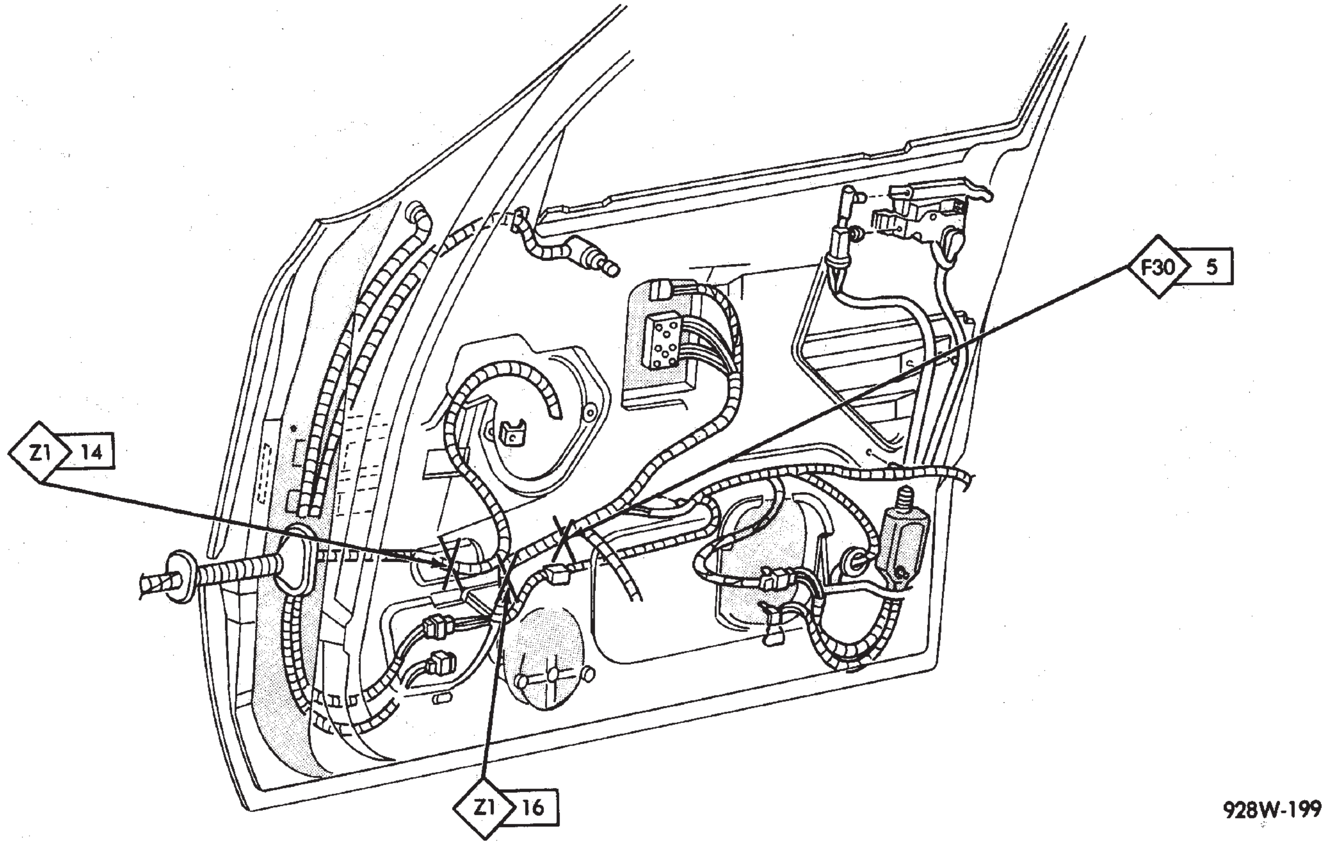


Fig. 8 Door Splices AC, AY Body

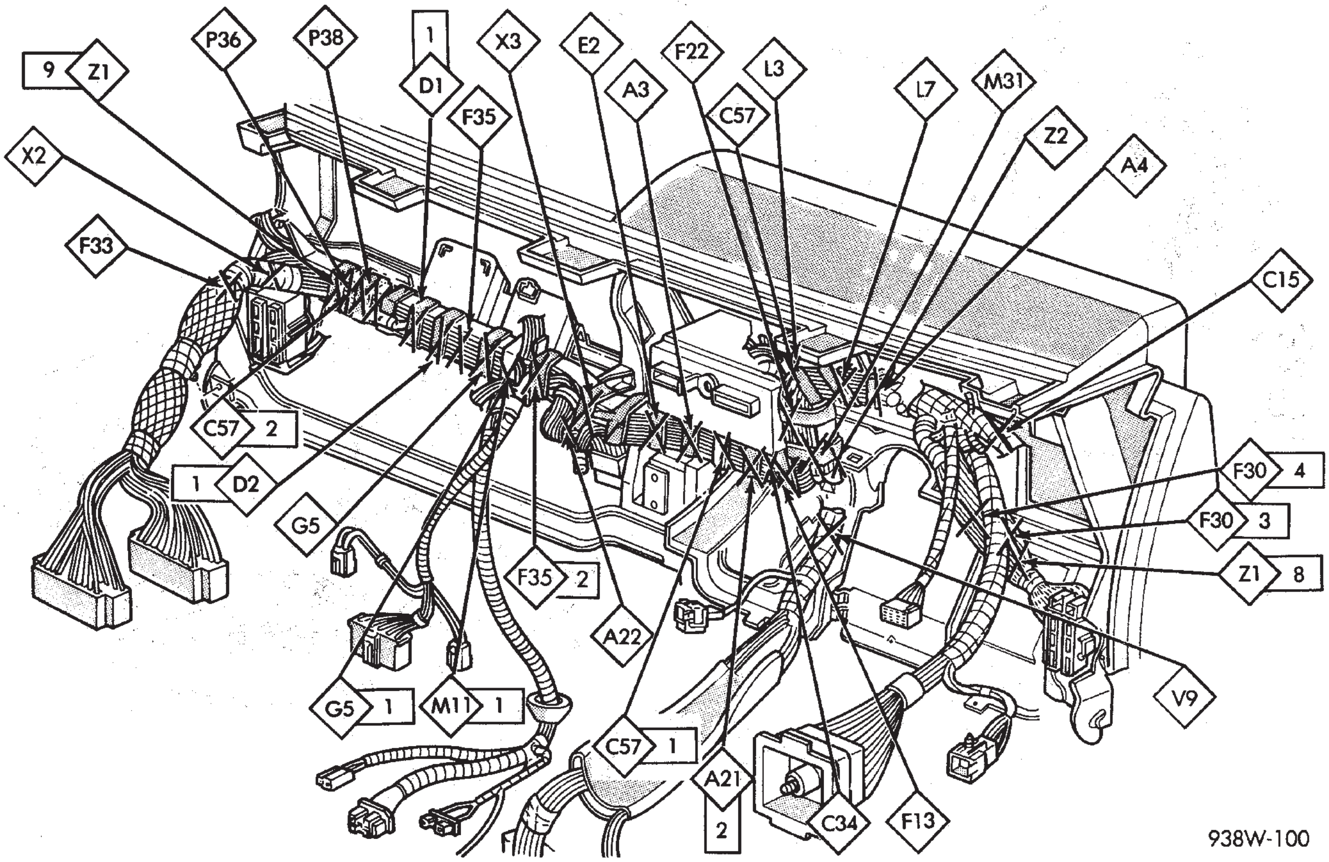


Fig. 9 Instrument Panel Splices AC, AY Body

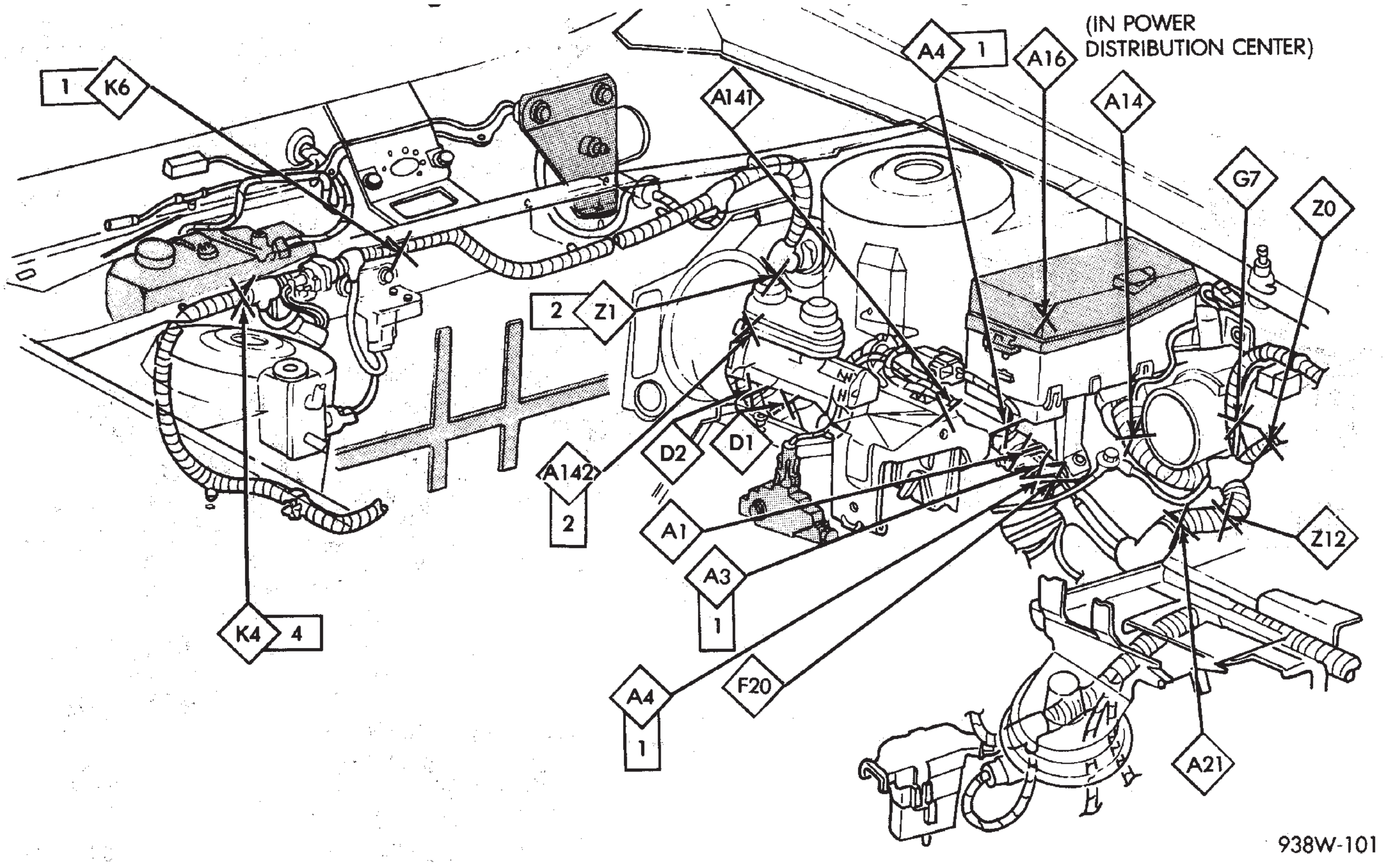


Fig. 10 Engine Compartment Splices 2.5L AC Body

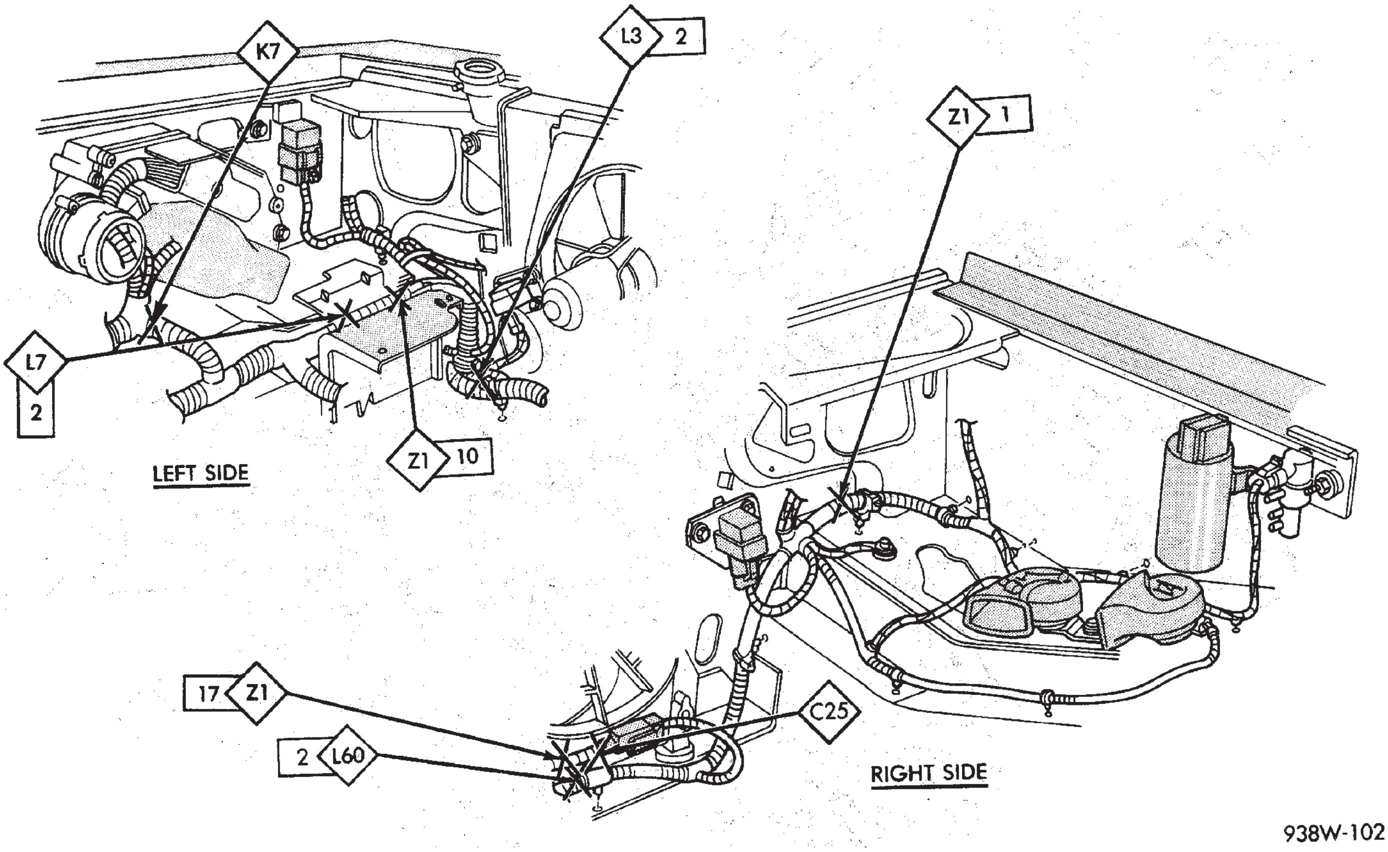


Fig. 11 Engine Compartment Splices 2.5L AC Body

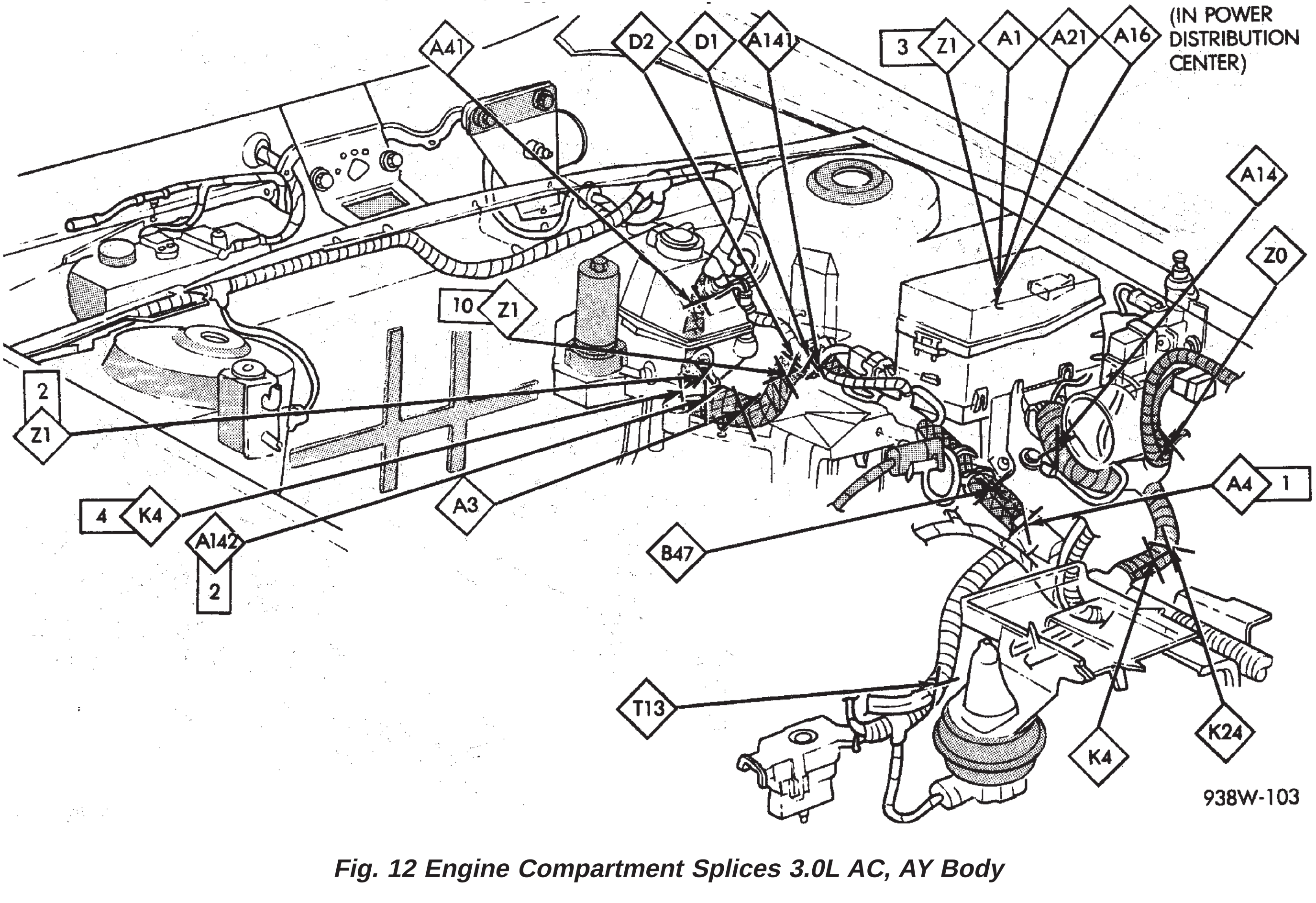


Fig. 12 Engine Compartment Splices 3.0L AC, AY Body

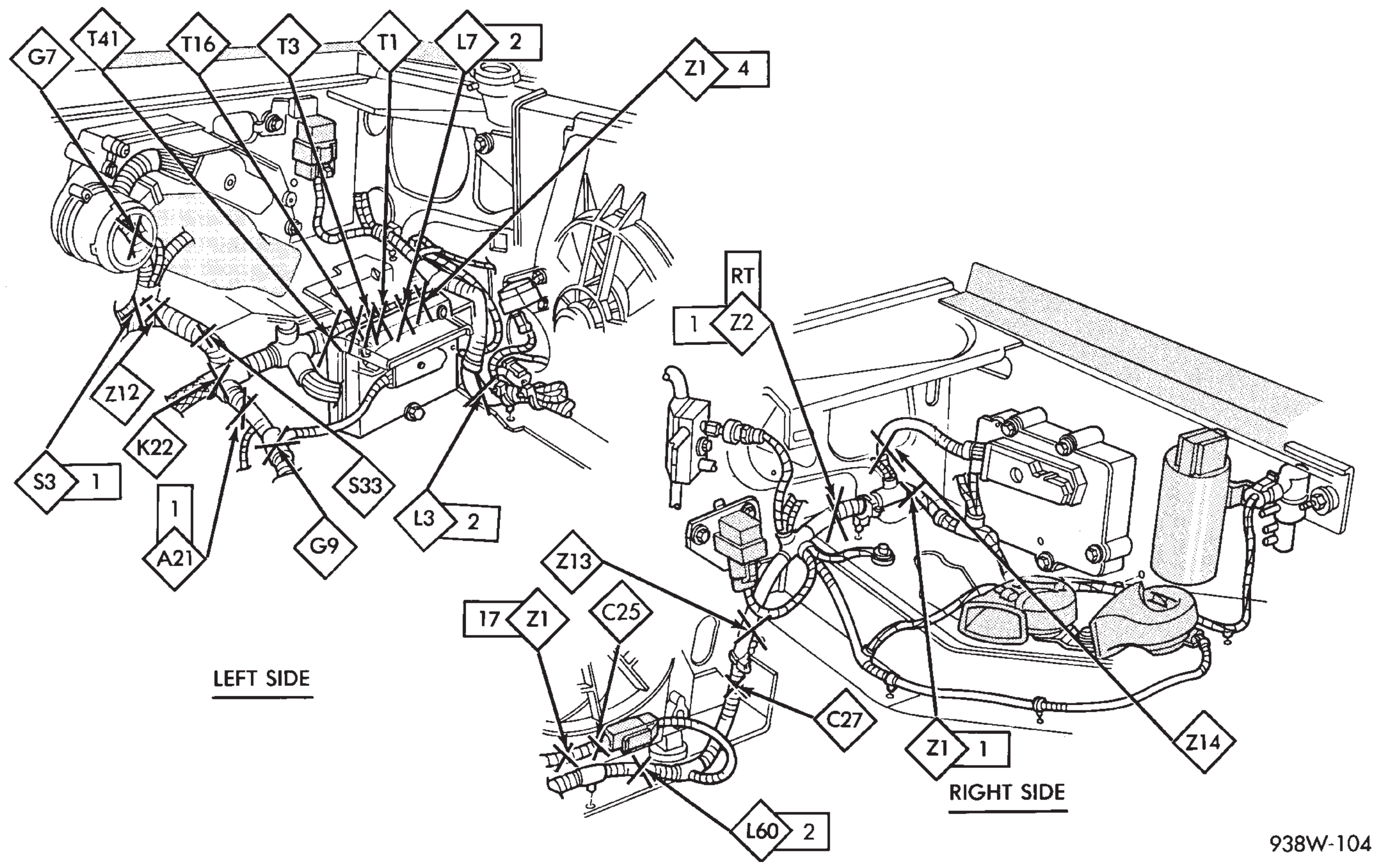


Fig. 13 Engine Compartment Splices 3.0L AC, AY Body

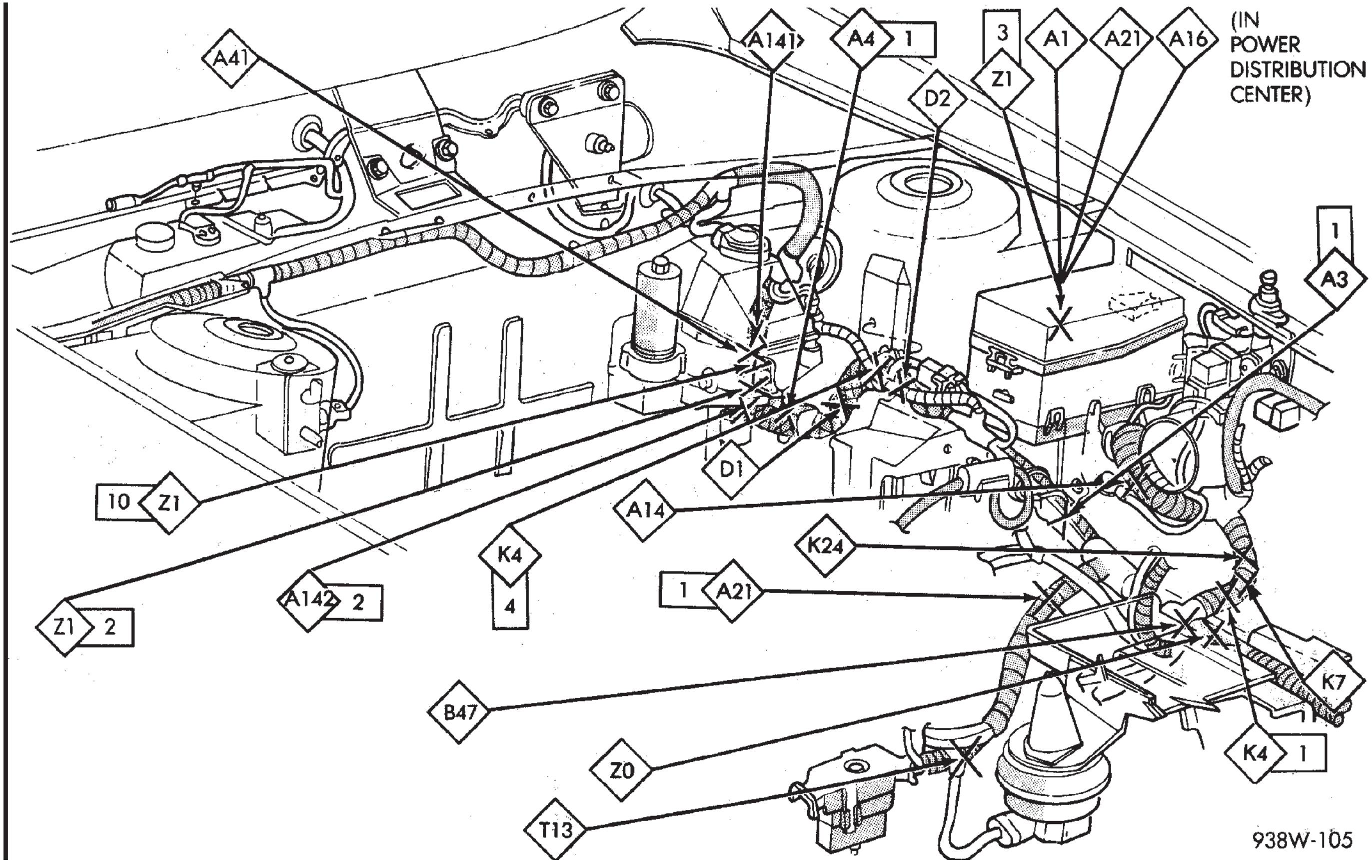


Fig. 14 Engine Compartment Splices 3.3L, 3.8L AC, AY Body

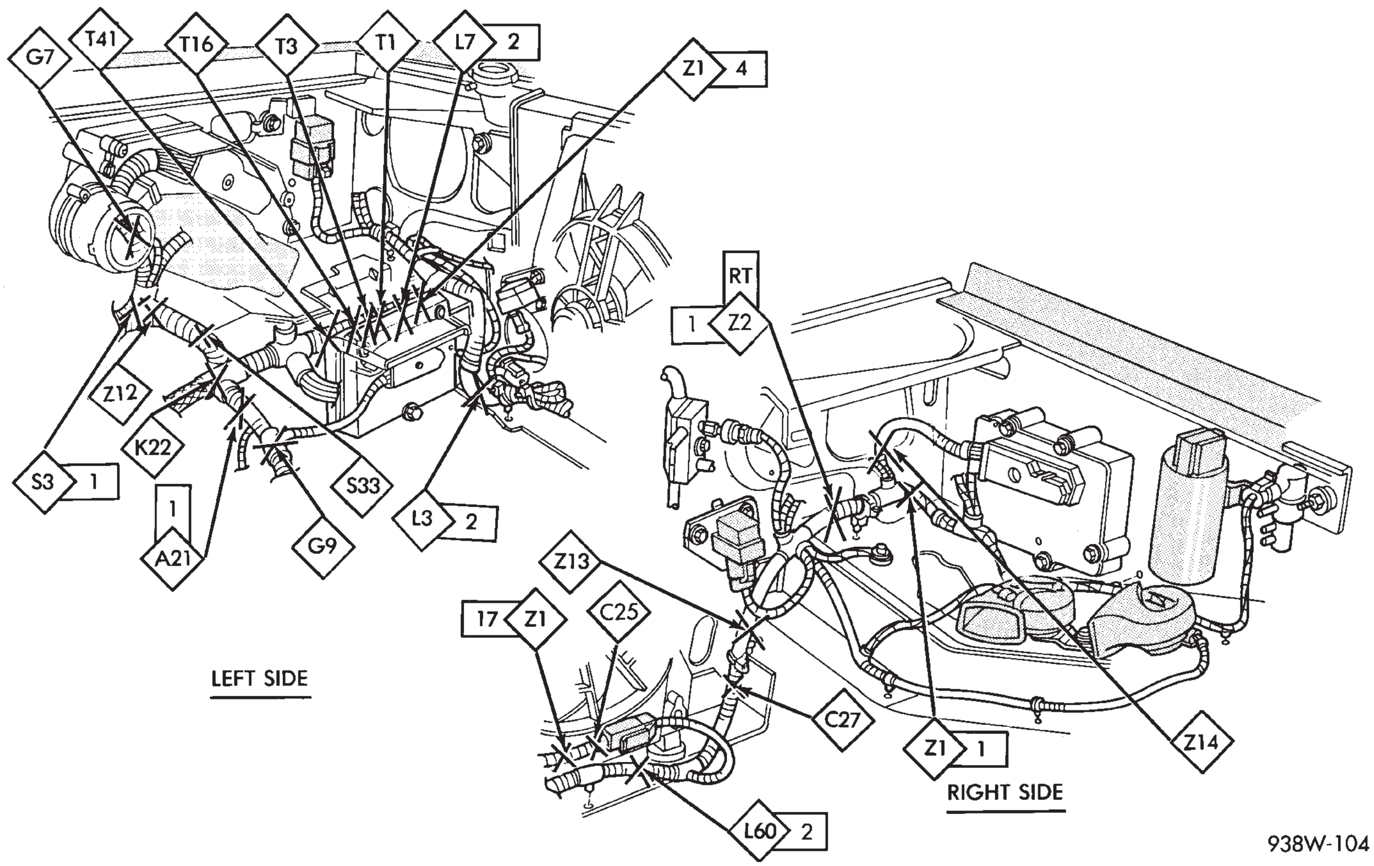


Fig. 15 Engine Compartment Splices 3.3L, 3.8L AC, AY Body

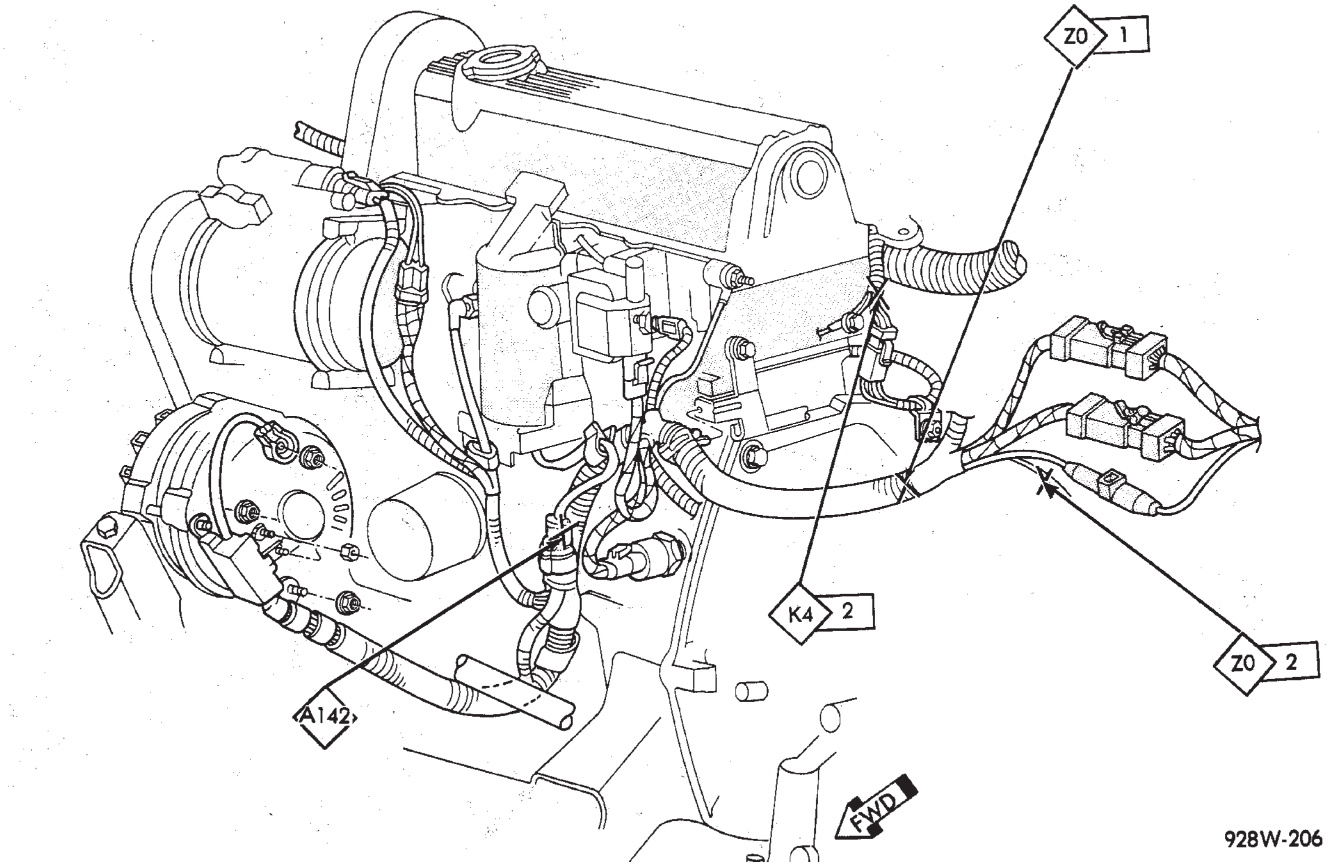


Fig. 16 Engine Splices 2.5L AC Body

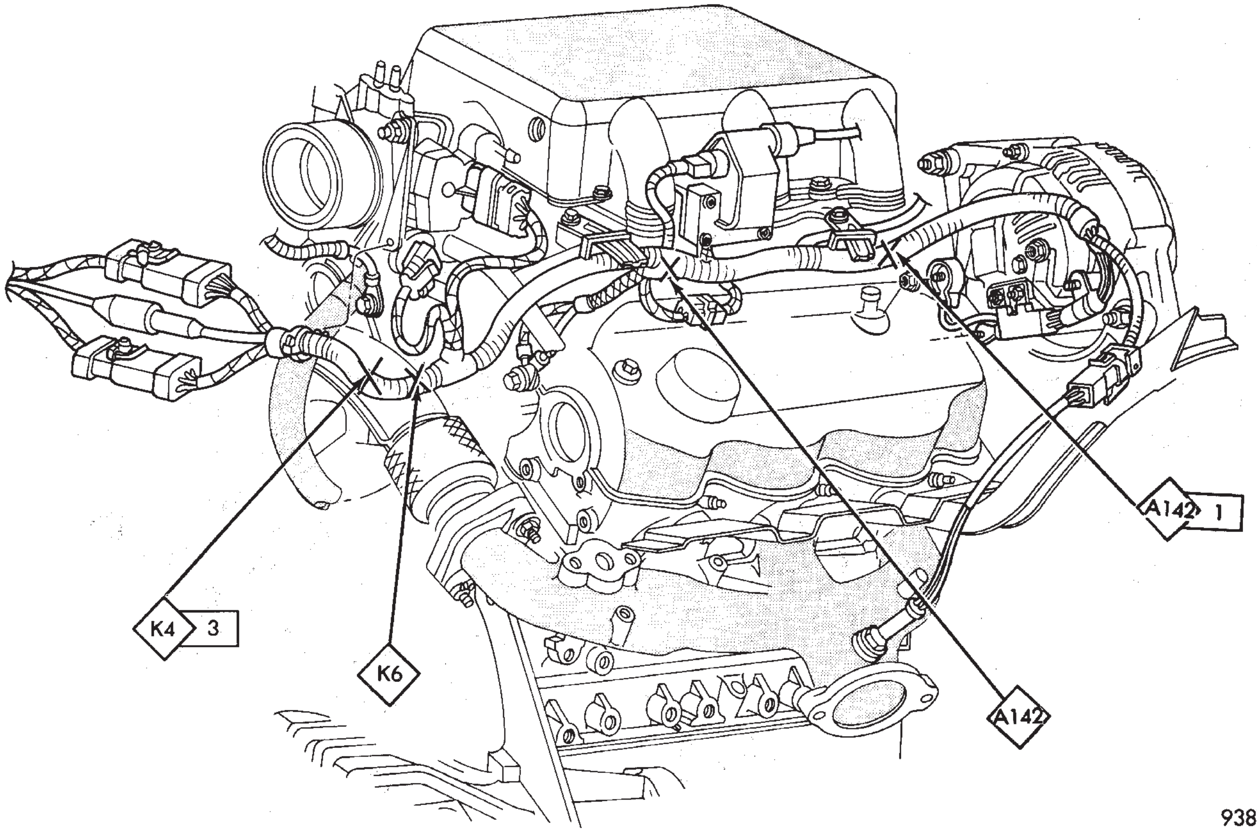


Fig. 17 Engine Splices 3.0L AC, AY Body

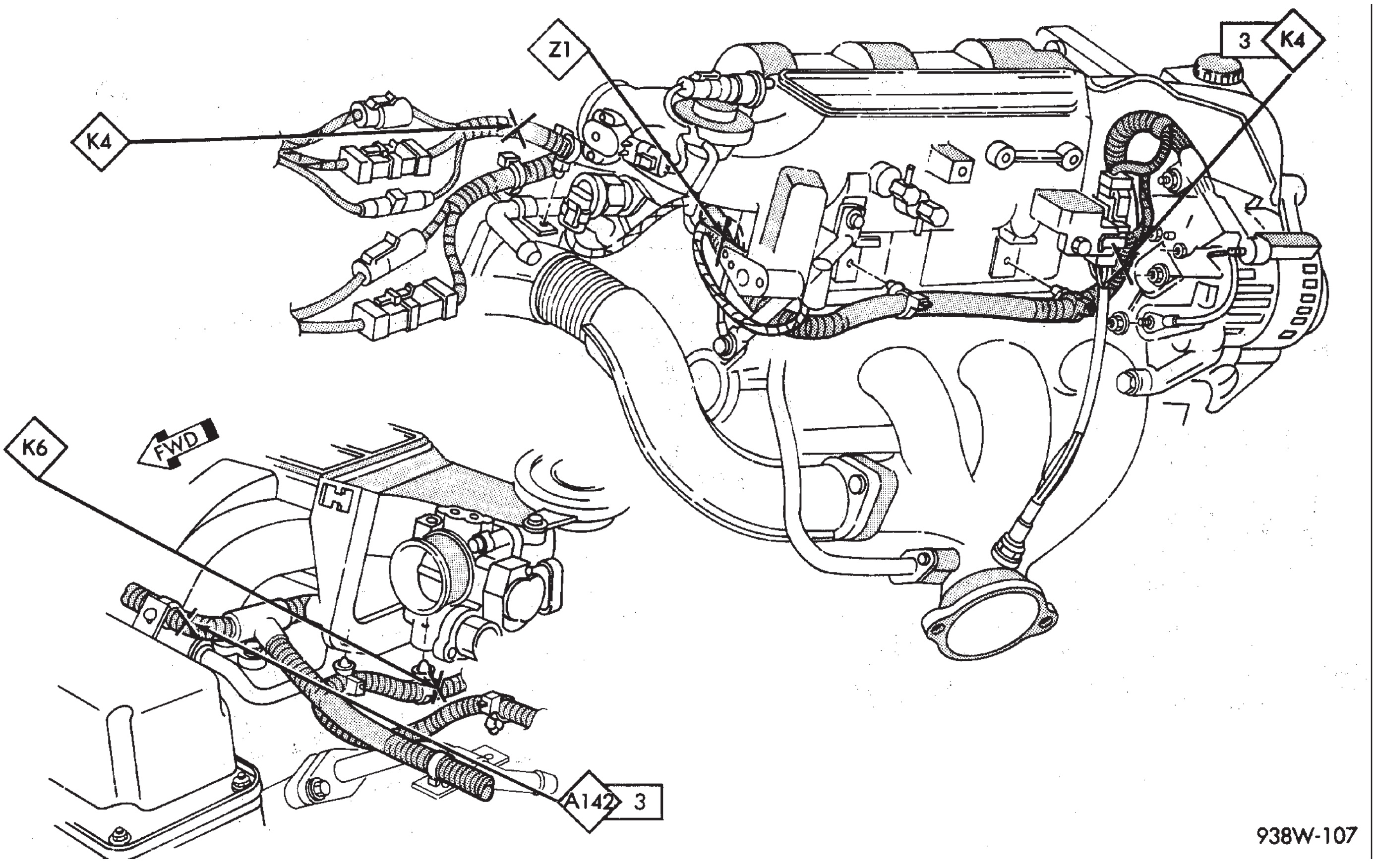


Fig. 18 Engine Splices 3.3L, 3.8L AC, AY Body

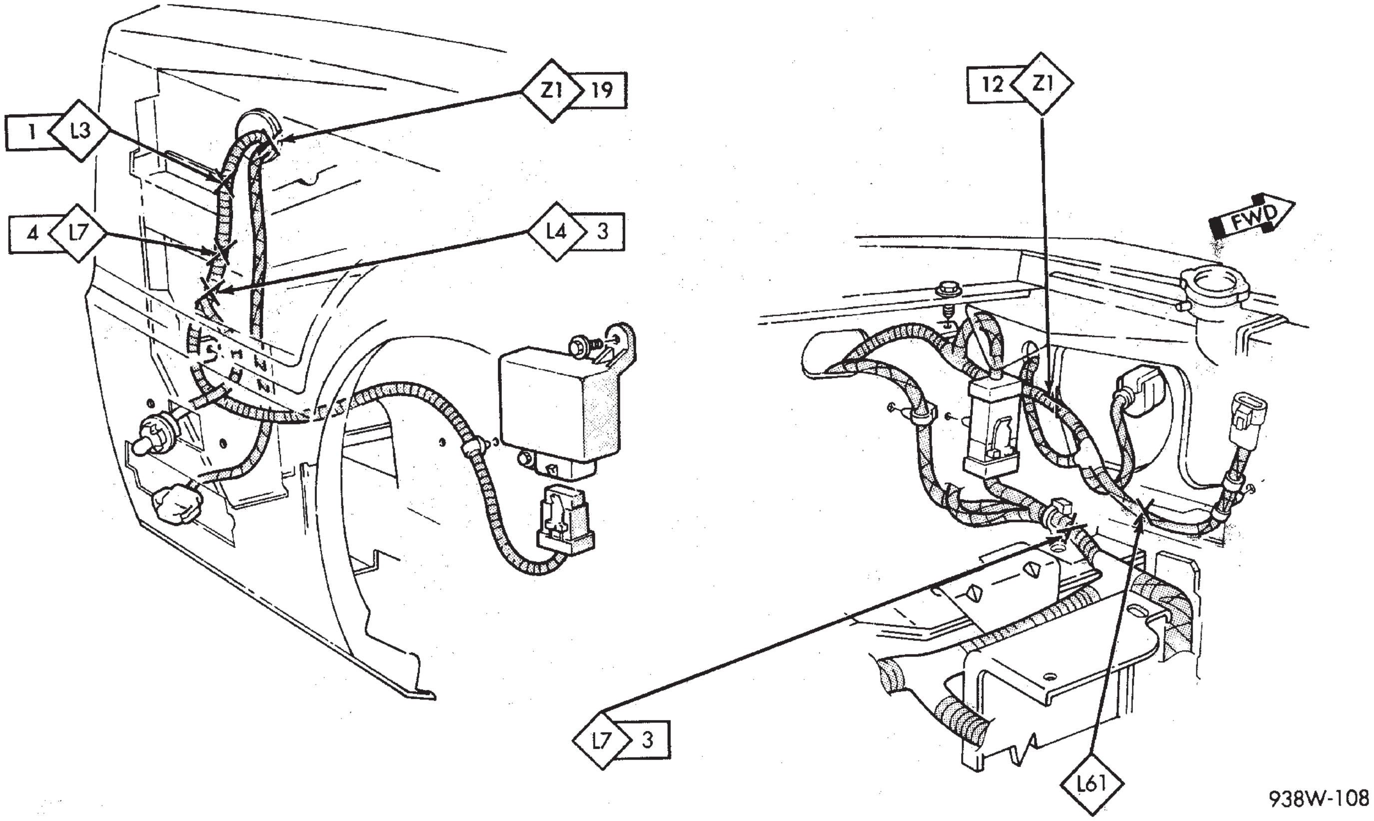


Fig. 19 Front End Splices AC-D

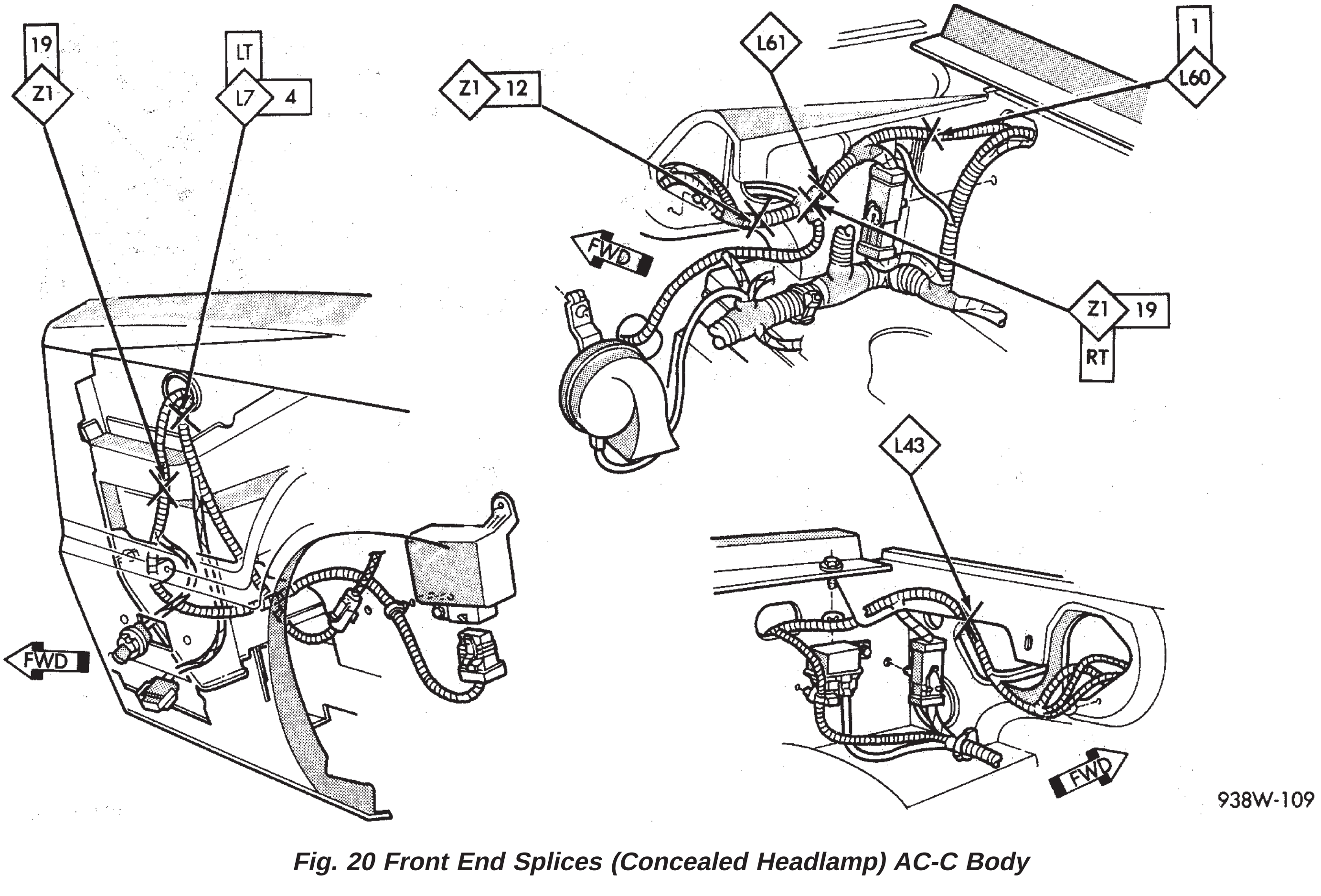


Fig. 20 Front End Splices (Concealed Headlamp) AC-C Body

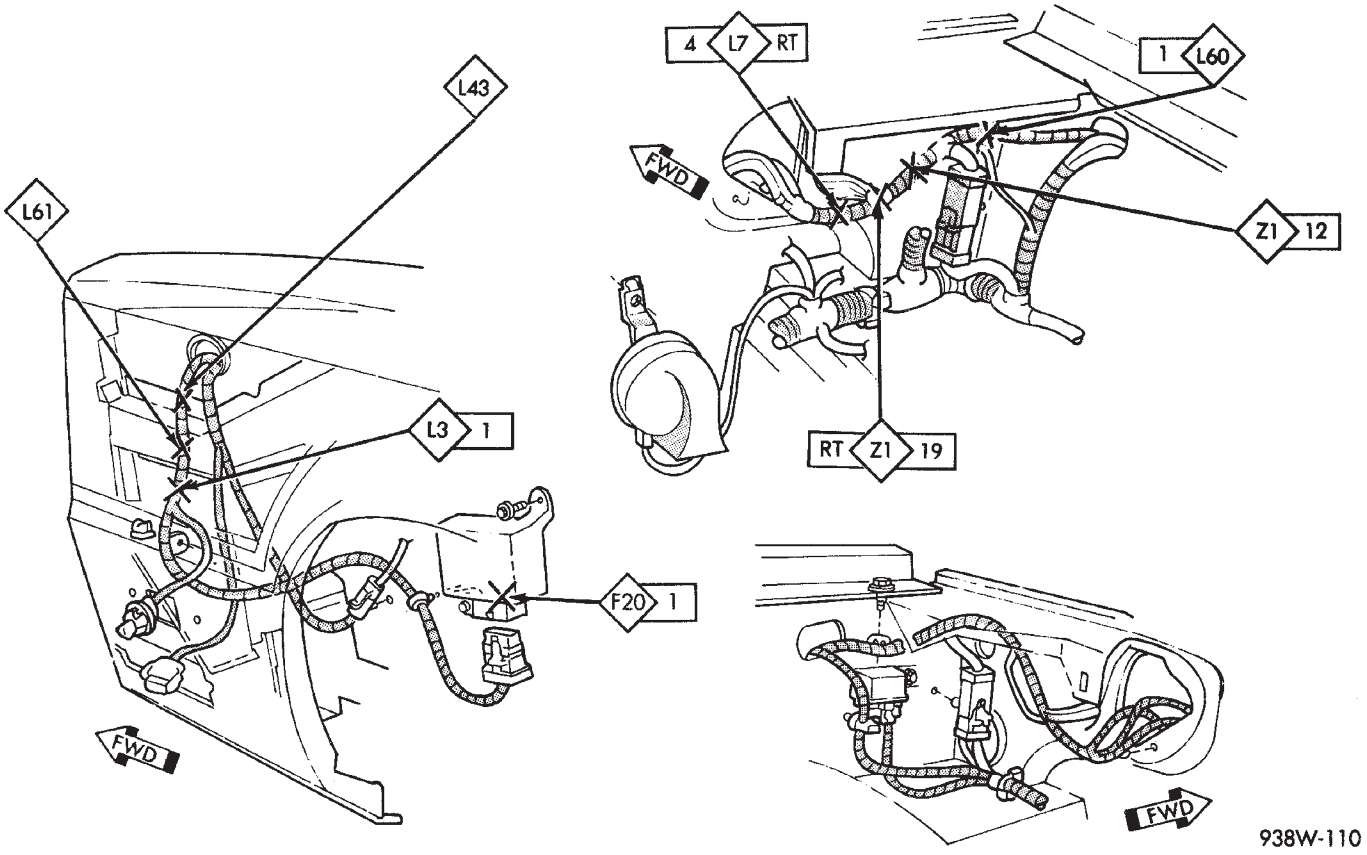


Fig. 21 Front End Splices AY Body

AG-BODY SPLICE LOCATIONS

Splice Number	Fig.
A0	9
A2	9
A3	9
A4	9
A11	9
A15	9
A16	9
A21-1	9
A21-2	8
A142	9
A142 3.0L	11
A142-1 2.5L EFI	10
A142-1 Turbo III	12
A142-1 3.0L	11
A142-2 3.0L	11
A142-3 Turbo III	12
A142-3 3.0L	11
B47	8
C7	5
C15	5
D1	5
D1-1	9
D2	5
D2-1	9
E2	5
E17	5
F12-1	9
F12-2	7
F13	5
F20	5
F21-2	3
F30	5
F35-1	3
F35-2	3
F35-3	3
G5-1	5
G5-2	4
G7	9
G9	5
G74	4
G75	3
K4 2.5L EFI	10
K4 Turbo III	12
K4-1	9
K4-1 2.5L EFI	10
K4-2 Turbo III	12
K4-3 3.0L	11
K6	9
K7 2.5L EFI	10
K7 Turbo III	12
K7 3.0L	11
K22	9
K24	9
L1	1
L7	5
L7-3	1
L7-4	1
L7-5	1
L61	5
L62	1
L63	1
L94	4
M1-1	5
M1-2	5
M1-4	5
M2	4
M2-1	5
P34	6
P76-1	6
T13	8
T16	8
T24	7
T41	7
V23	1
X13	5
X13-2	2
X15	5
X15-2	2
X60	2
Z0	9
Z1	9
Z1-2	7
Z1-3	9
Z1-4	7
Z1-5	8
Z1-6	8
Z1-7	5
Z1-8	7
Z1-9	3
Z1-11	1
Z1-12	1
Z1-14	1
Z1-15	1
Z1-16	1
Z1-20	8
Z1-21	6
Z2	5
Z2	9
Z2-1	3
Z3	5
Z3-1	3
Z12	7
Z13	8
Z14	8

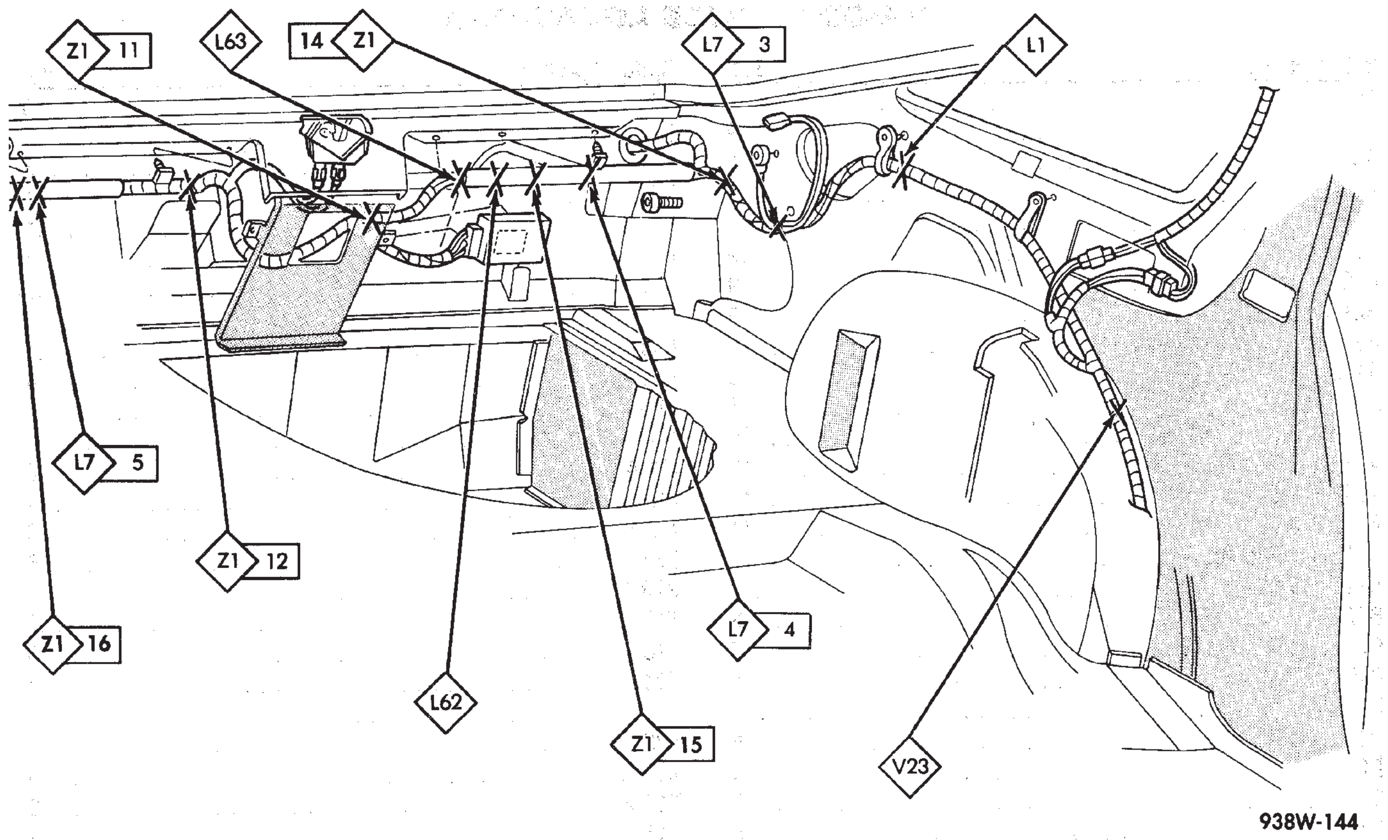


Fig. 1 Rear End Splices AG-Body

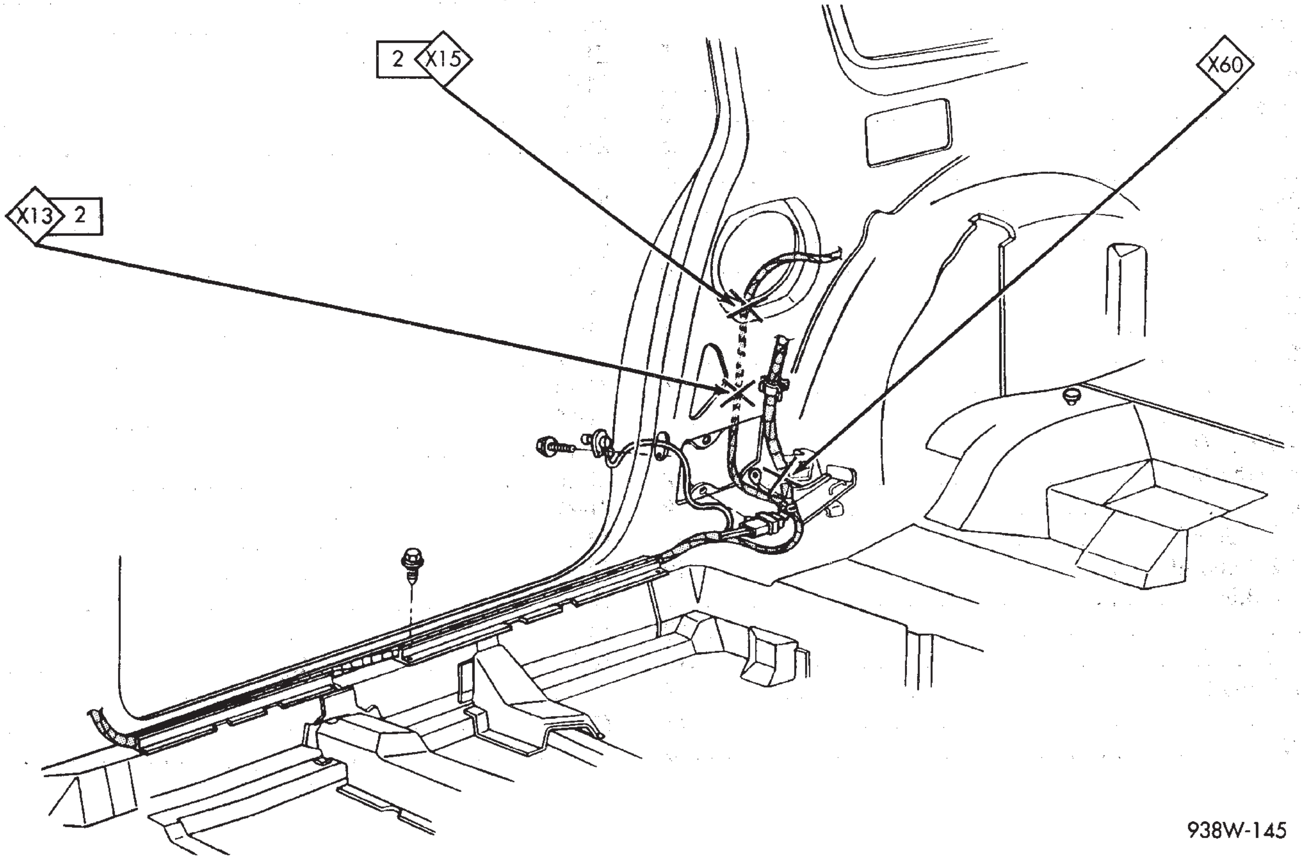


Fig. 2 Body Splices (Right Side) AG-Body

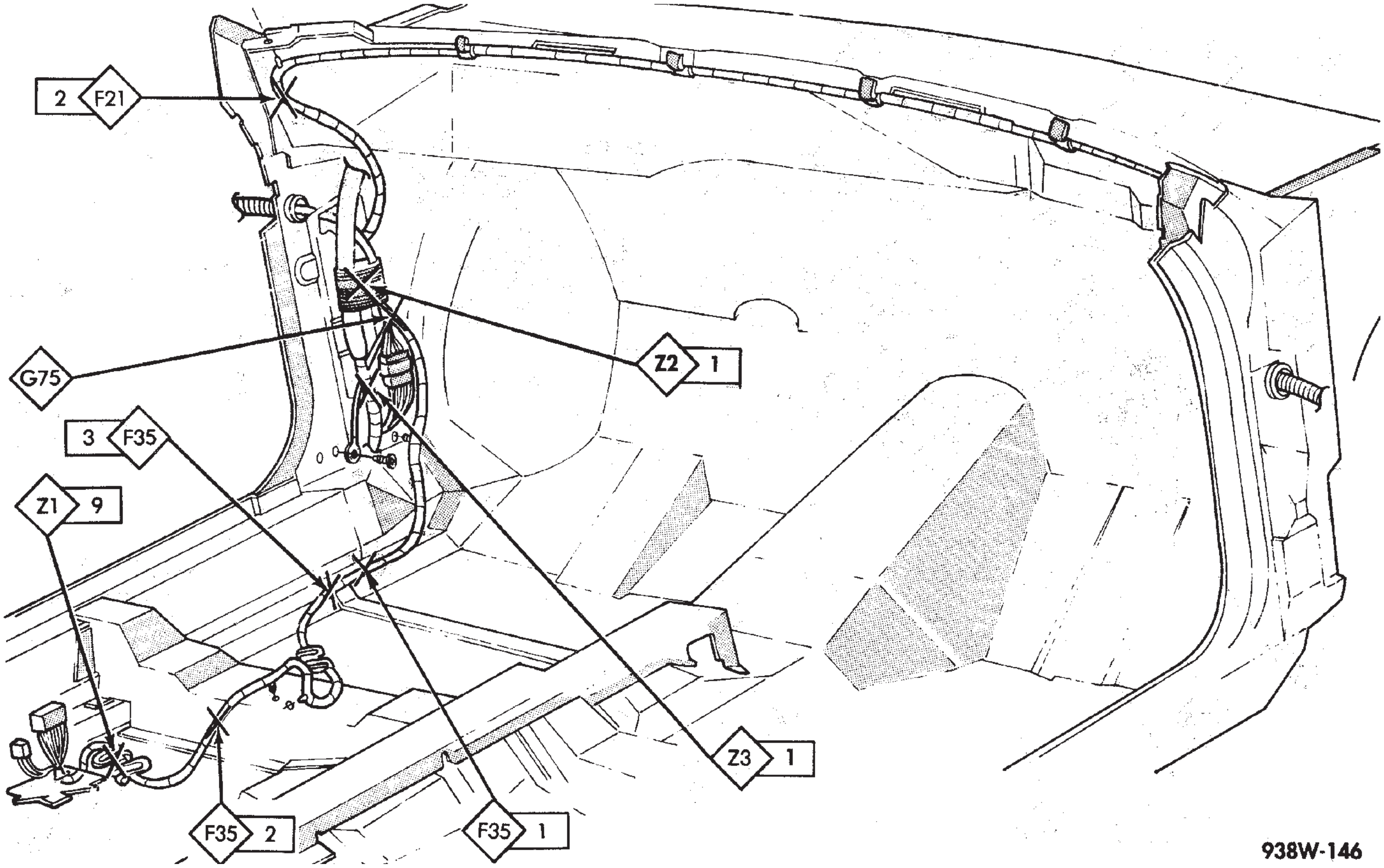


Fig. 3 Cowl Splices AG-Body

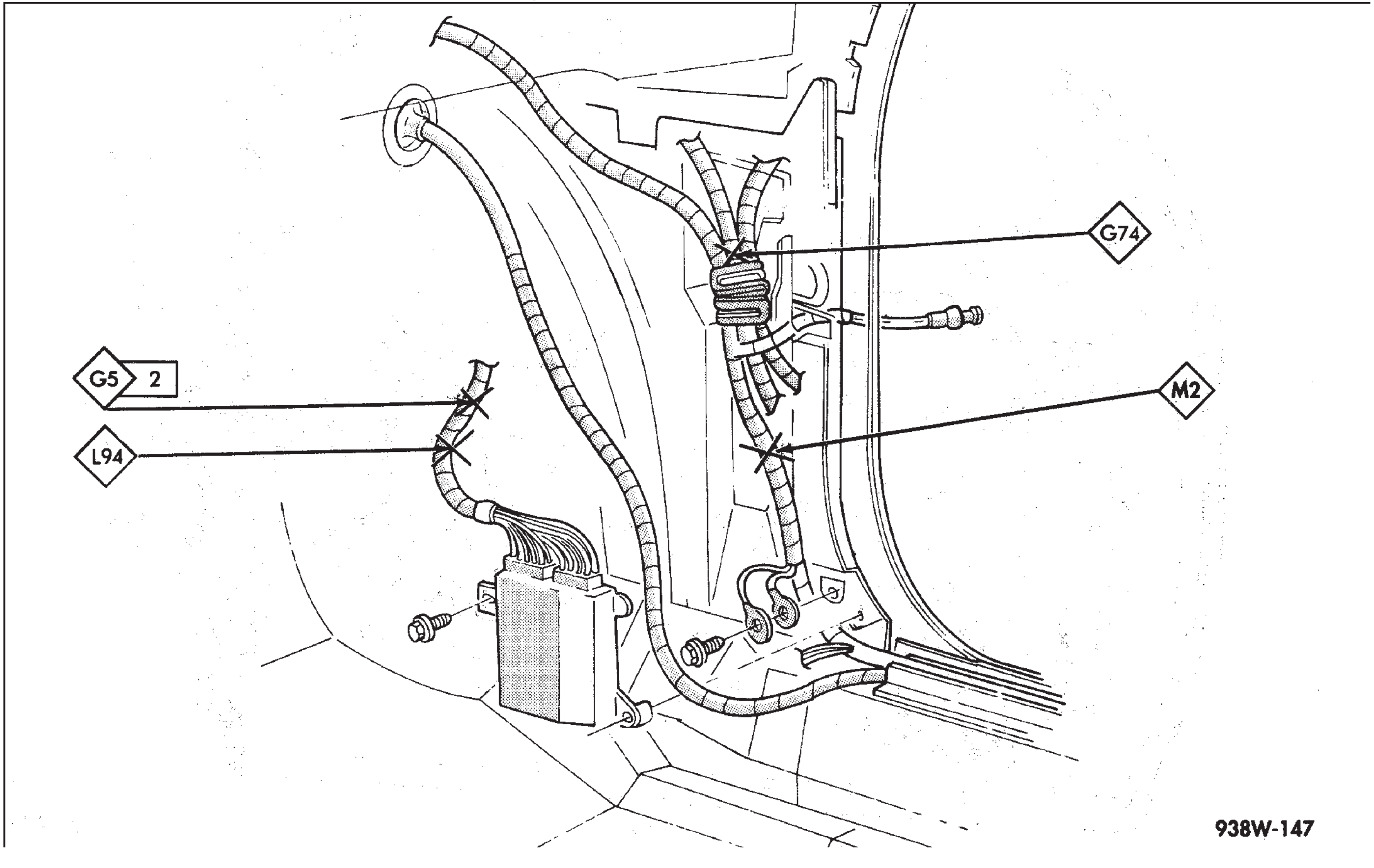


Fig. 4 Cowl Splices (Right Side) AG-Body

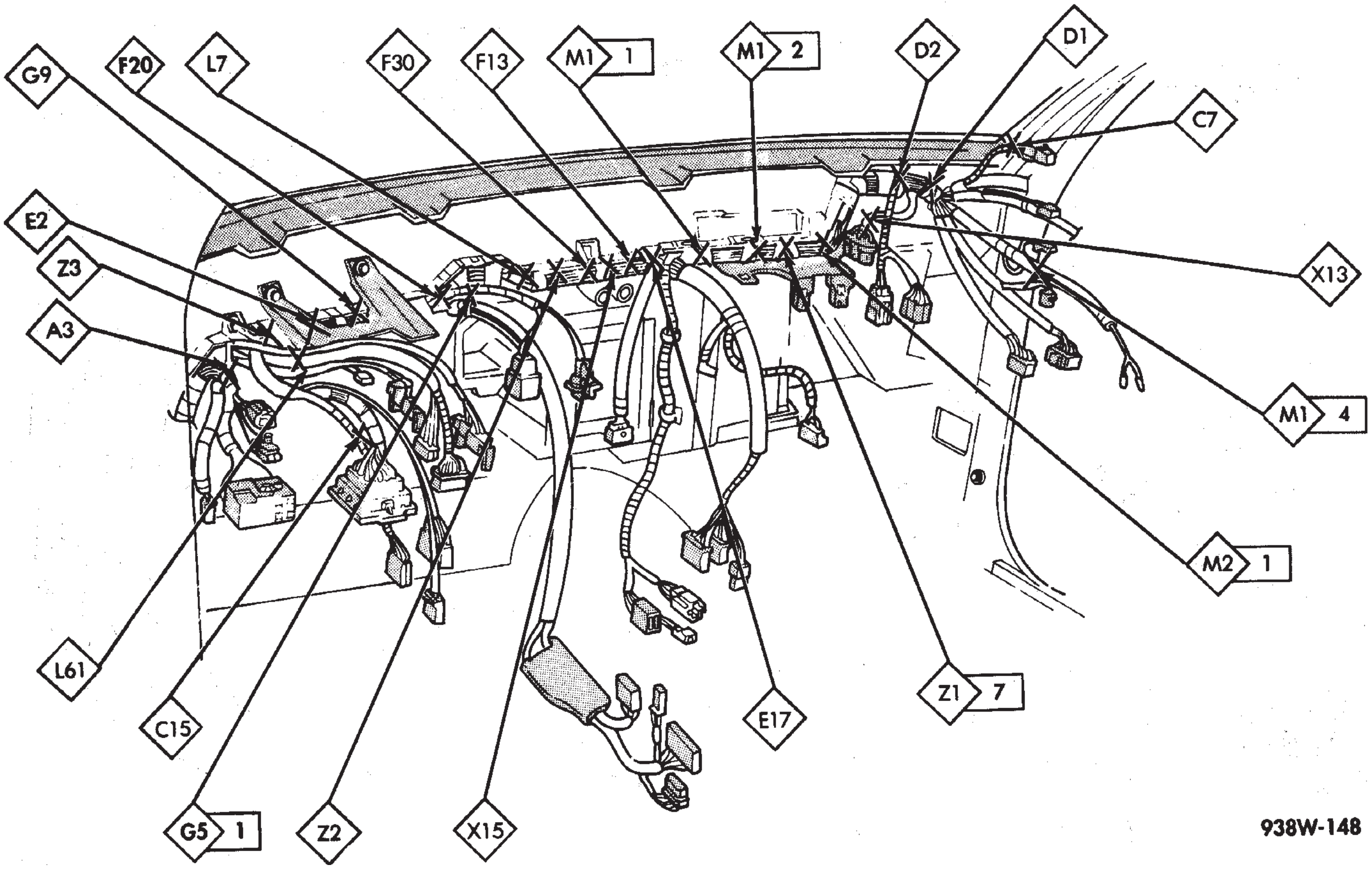


Fig. 5 Instrument Panel Splices AG-Body

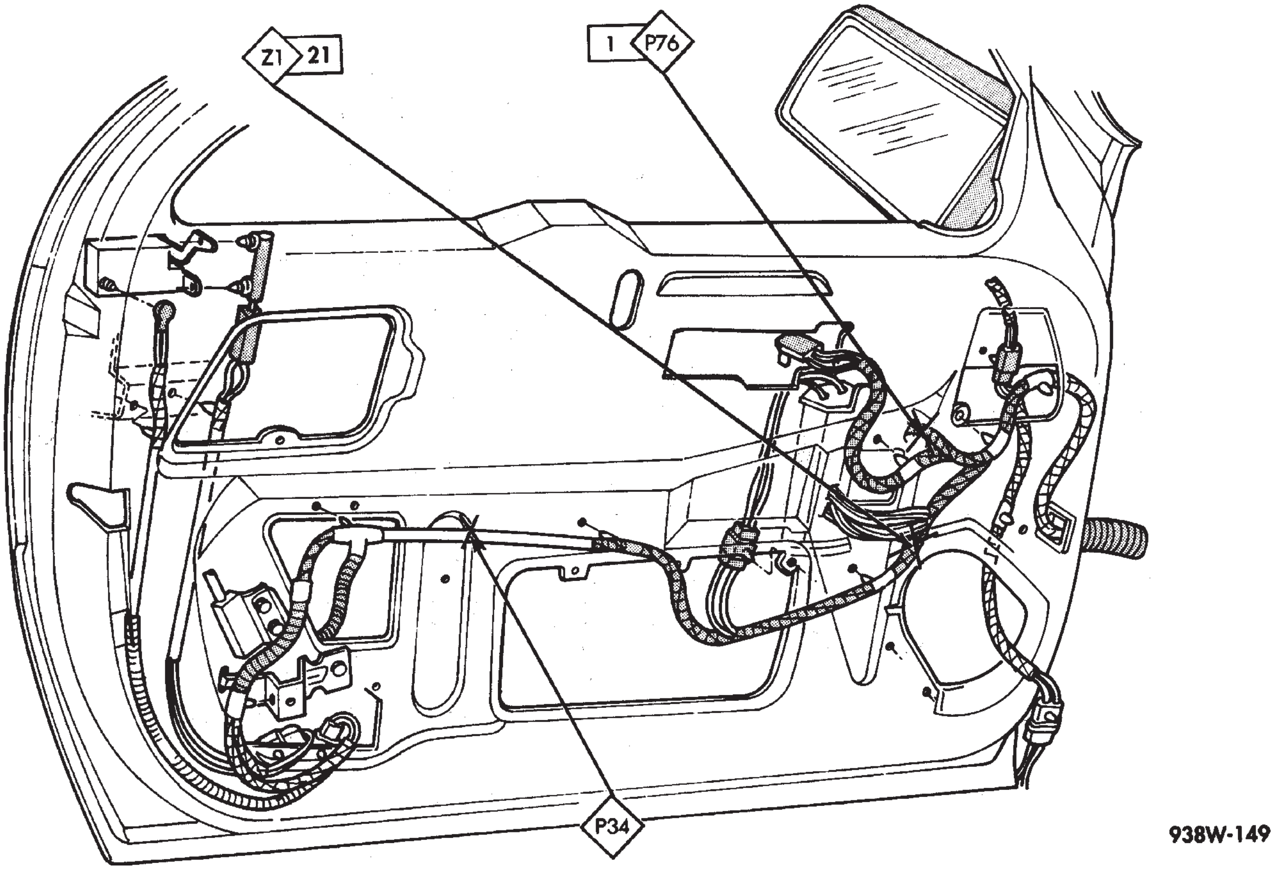


Fig. 6 Door Splices AG-Body

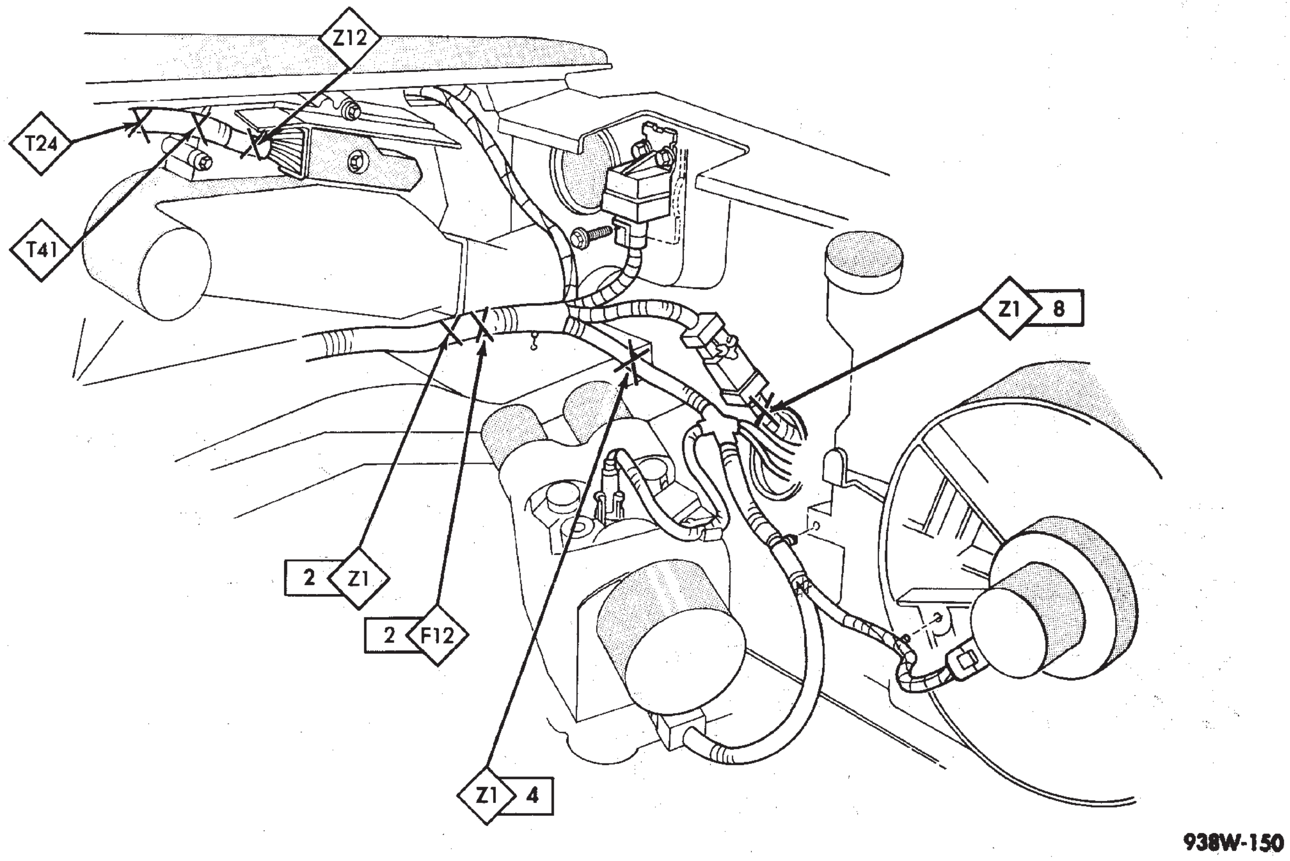


Fig. 7 Engine Compartment Splices AG-Body

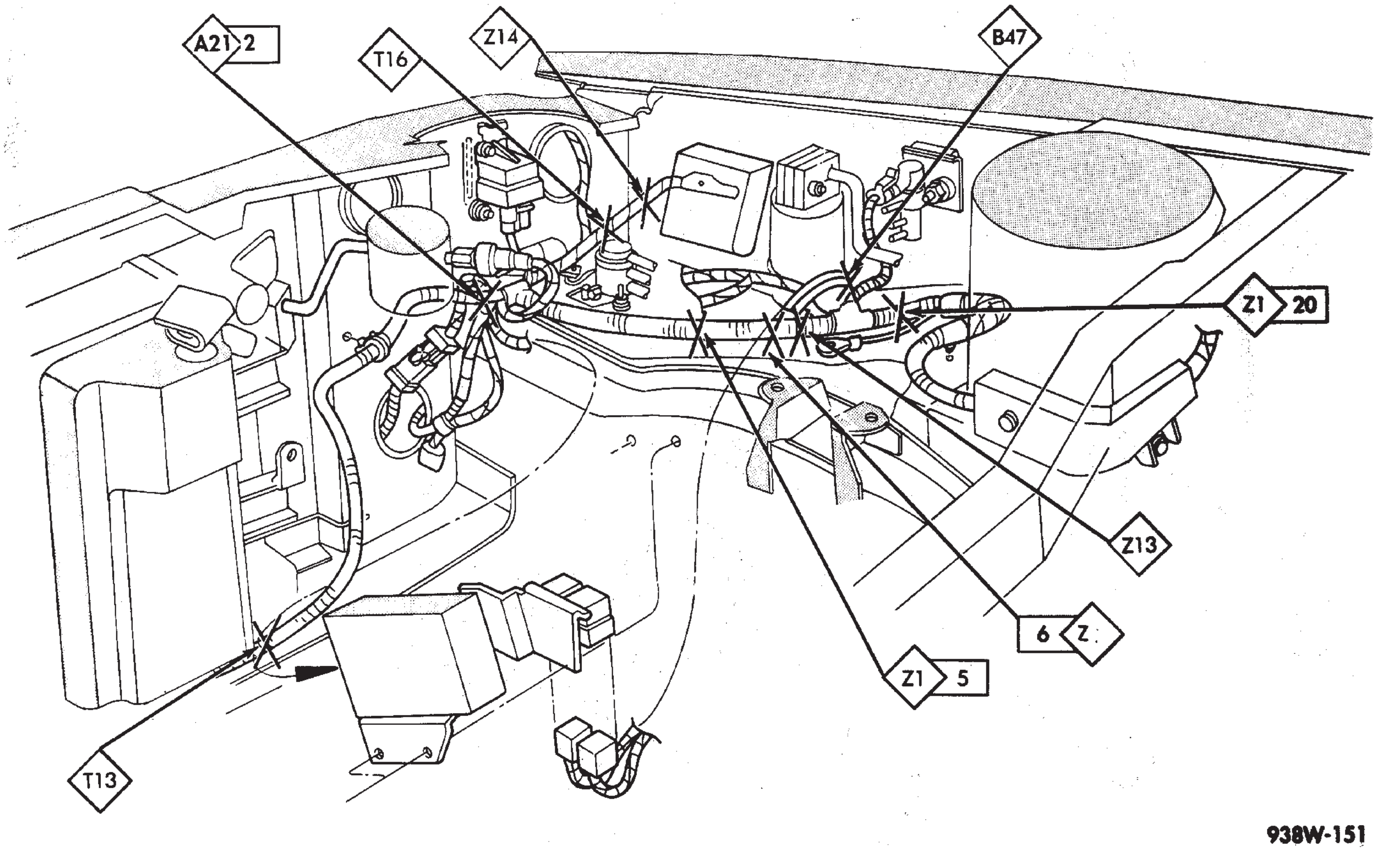


Fig. 8 Engine Compartment Splices AG-Body

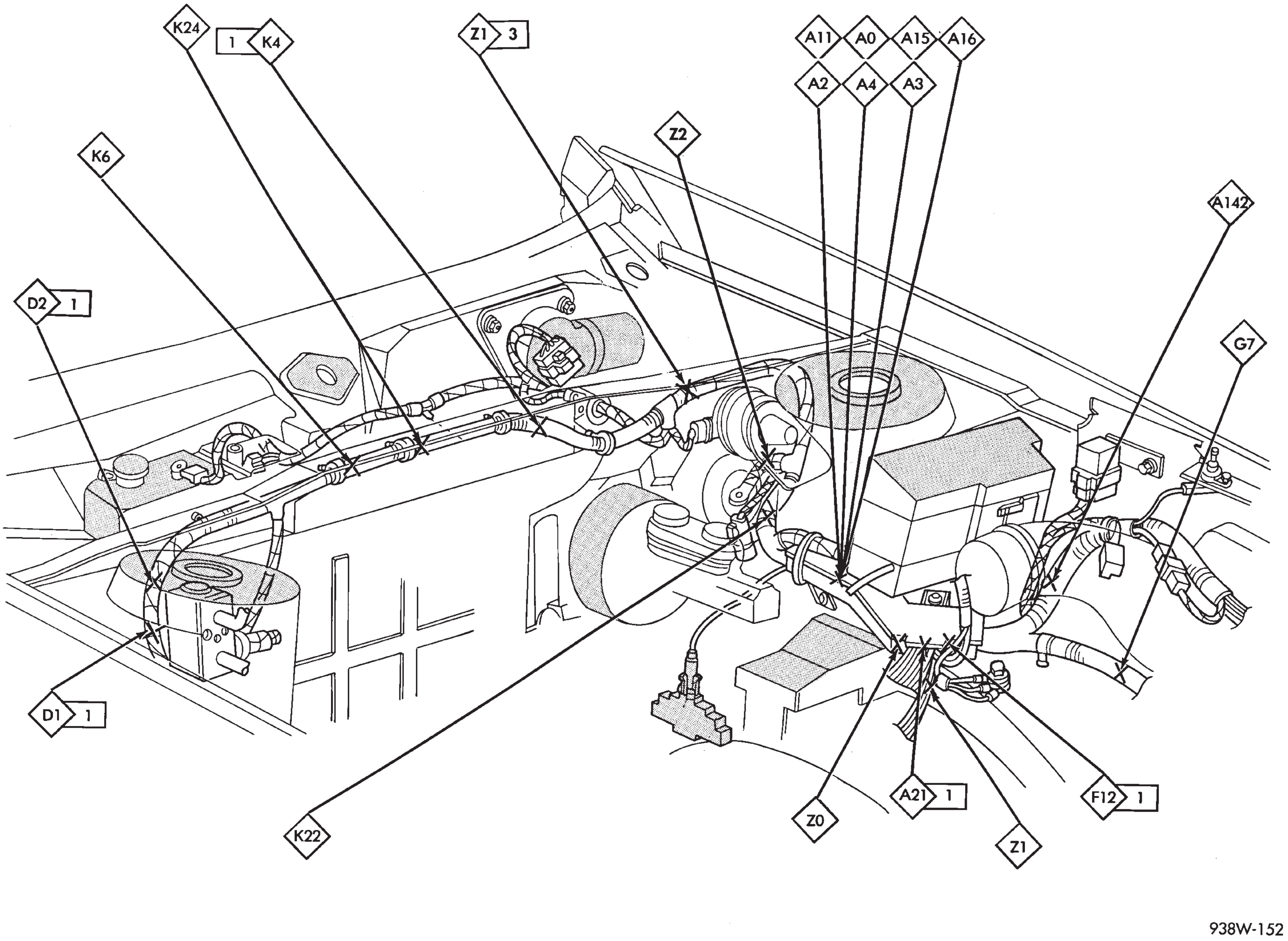


Fig. 9 Engine Compartment Splices AG-Body

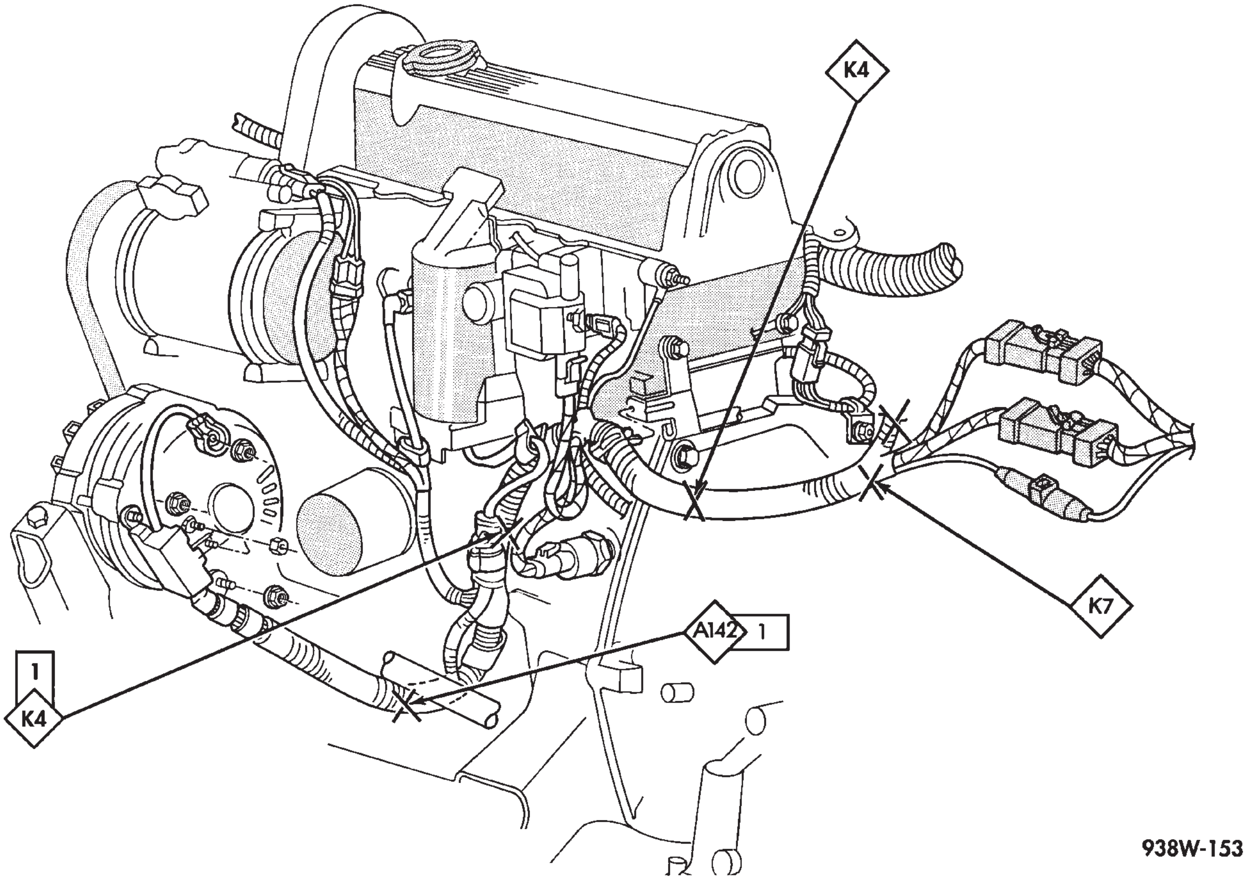


Fig. 10 Engine Splices EFI AG-Body

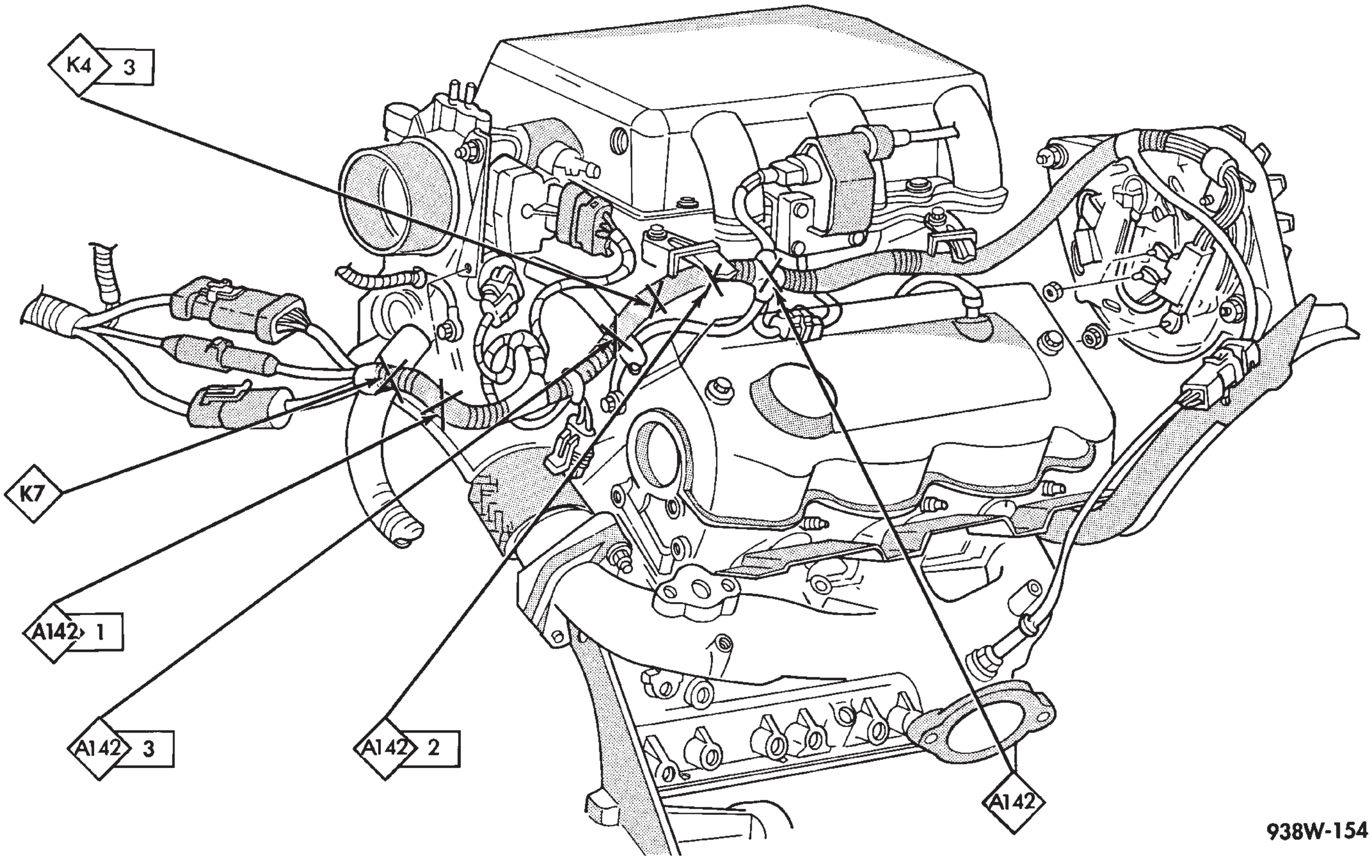


Fig. 11 Engine Splices 3.0L AG-Body

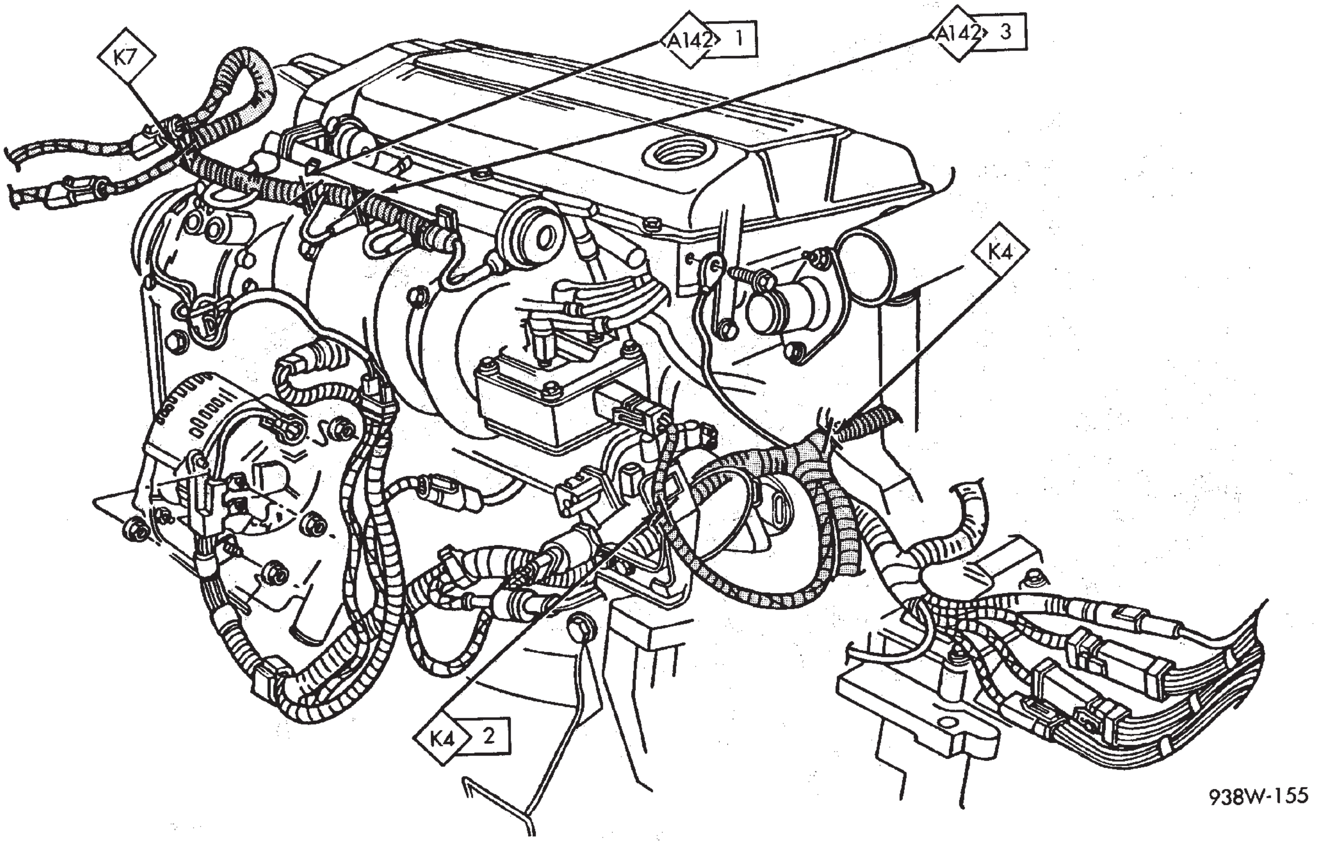


Fig. 12 Engine Splices Turbo III AG-Body

AJ-BODY SPLICE LOCATIONS

Splice Number	Fig.
A0	11
A2	11
A3	8
A4	11
A11	11
A15	11
A16	11
A21-1	11
A21-2	10
A142 2.5L EFI	11
A142 3.0L	13
A142-1 2.5L EFI	12
A142-1 3.0L	13
A142-2	13
A142-3	13
B47	10
C7	8
C15	8
D1	8
D1-1	11
D2	8
D2-1	11
E2	8
E17	8
F12-1	11
F12-2	9
F13	8
F20	8
F30	8
F35-1	5
F35-3	5
G5-1	8
G5-2	7
G7	11
G9	8
G74	7
G75	5
K4	12
K4-1 2.5L EFI	11
K4-1 3.0L	12
K4-3	13
K6	11
K7	13
K7-1	12
K22	11
K24	11
L1	1
L7	8

Splice Number	Fig.
L7-1	10
L7-2	8
L7-6	1
L7-7	2
L33	9
L43	10
L50	1
L61	8
L94	7
M1-1	8
M1-2	8
M1-4	8
M1-5	7
M1-6	6
M2	8
P76-1	4
T13	10
T16	10
T24	9
T41	9
X13	8
X13-2	3
X15	8
X15-2	3
X60	3
Z0	11
Z1	11
Z1-2	9
Z1-4	9
Z1-5	10
Z1-6	10
Z1-7	6
Z1-8	9
Z1-9	5
Z1-11	5
Z1-12	1
Z1-17	2
Z1-18	1
Z1-19	7
Z1-20	10
Z2	11
Z2-1	8
Z3	8
Z3-1	8
Z12	9
Z13	10
Z14	10

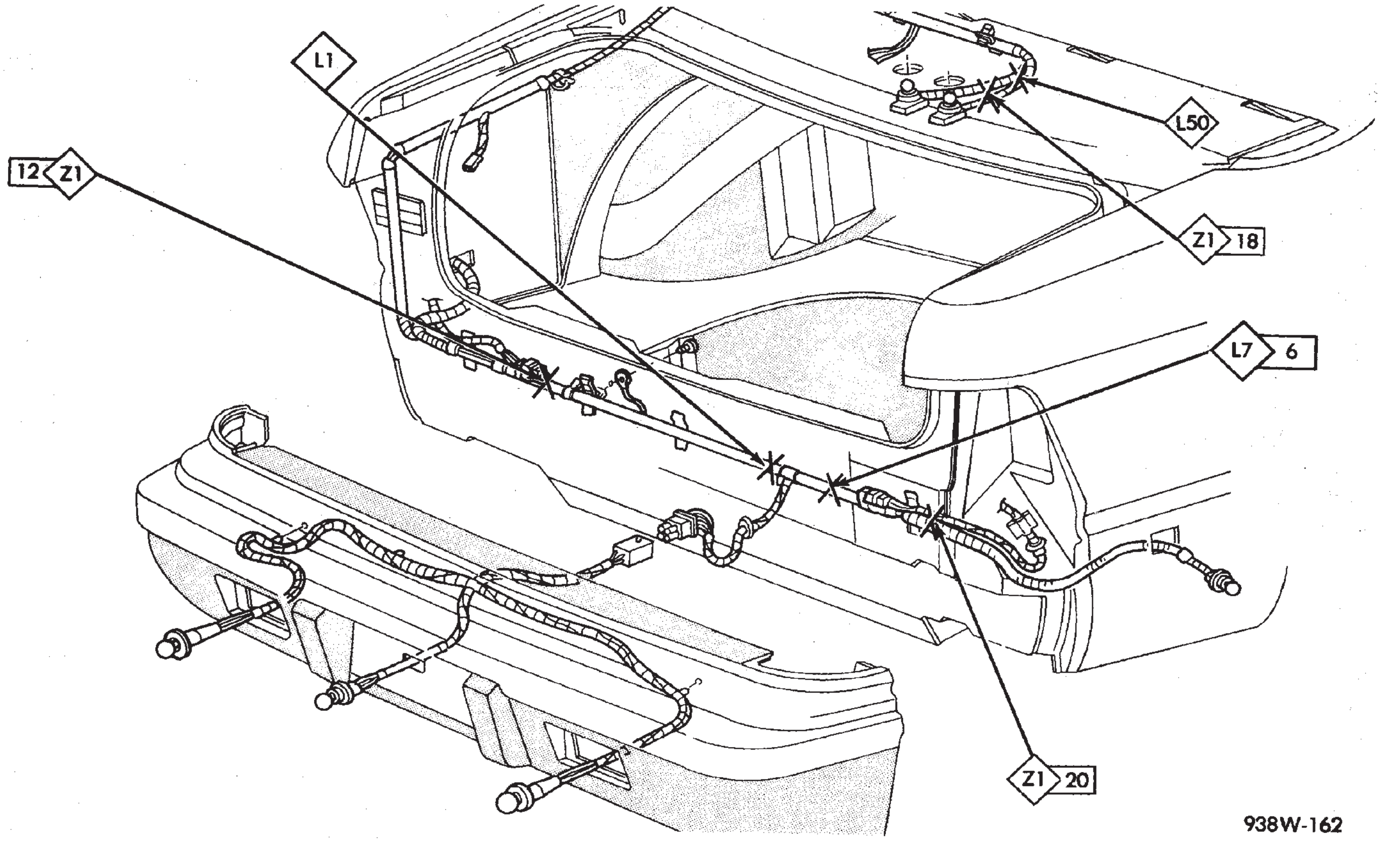


Fig. 1 Rear End Splices AJ-Body

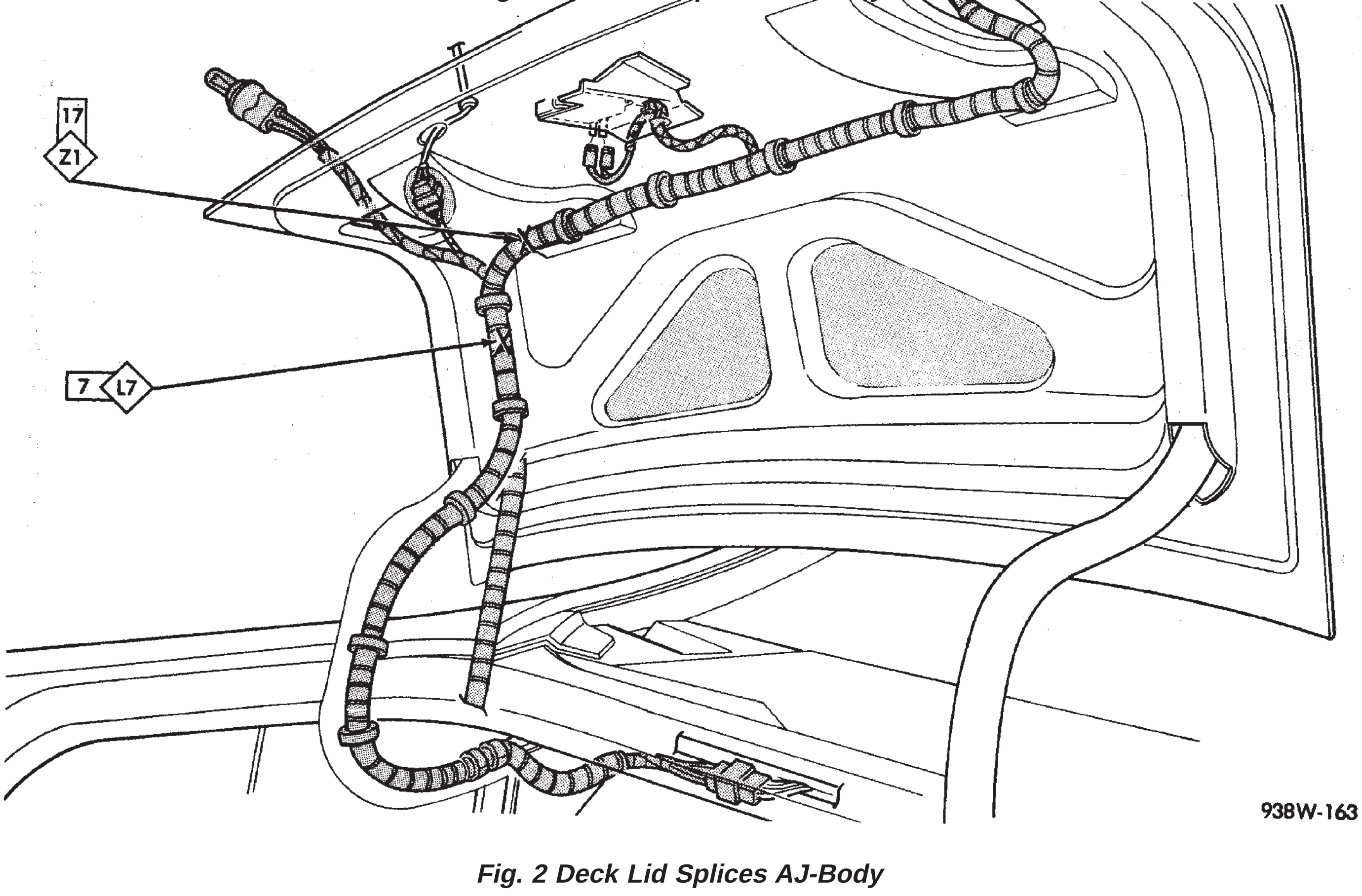


Fig. 2 Deck Lid Splices AJ-Body

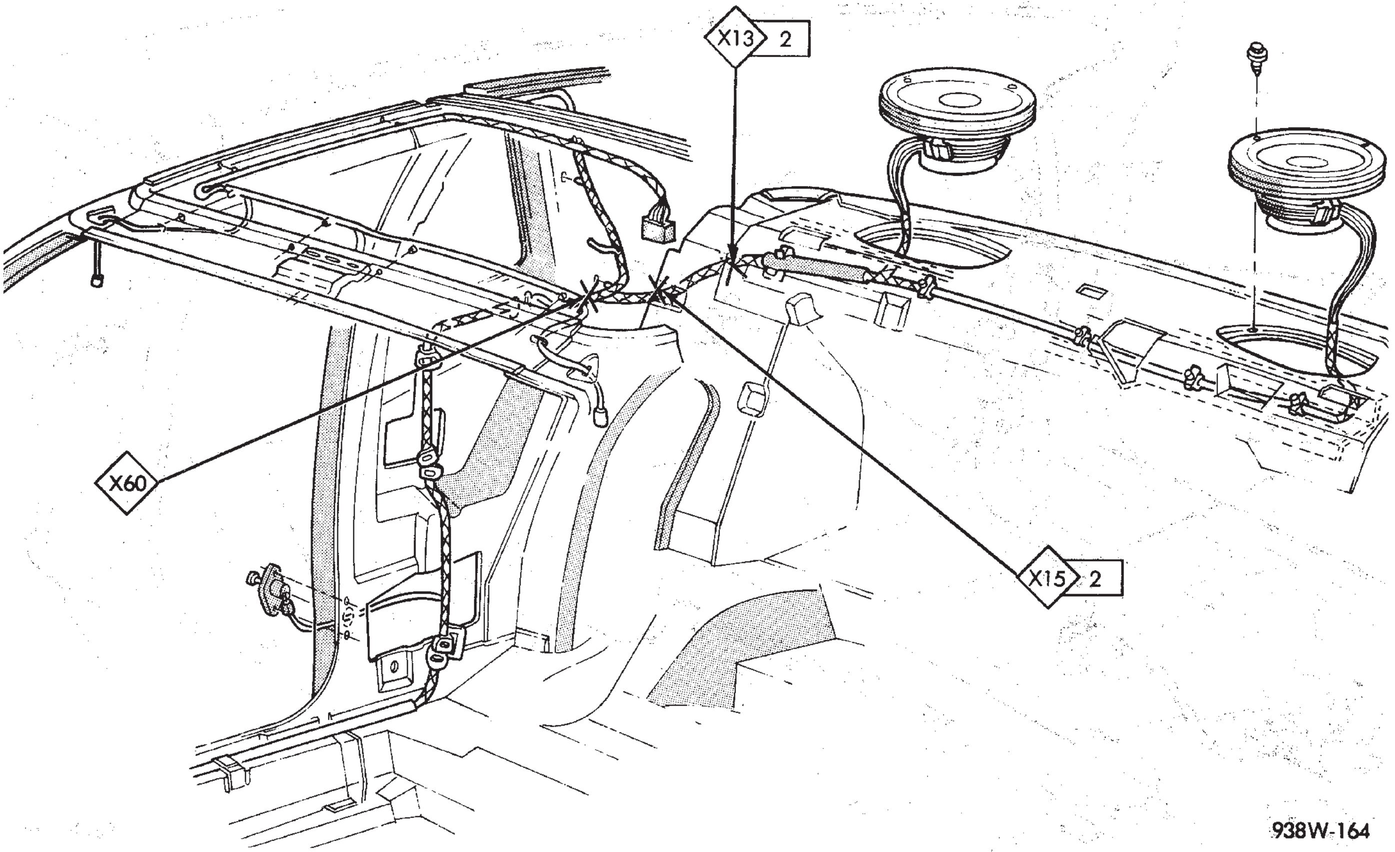


Fig. 3 Body Splices (Right Side) AJ-Body

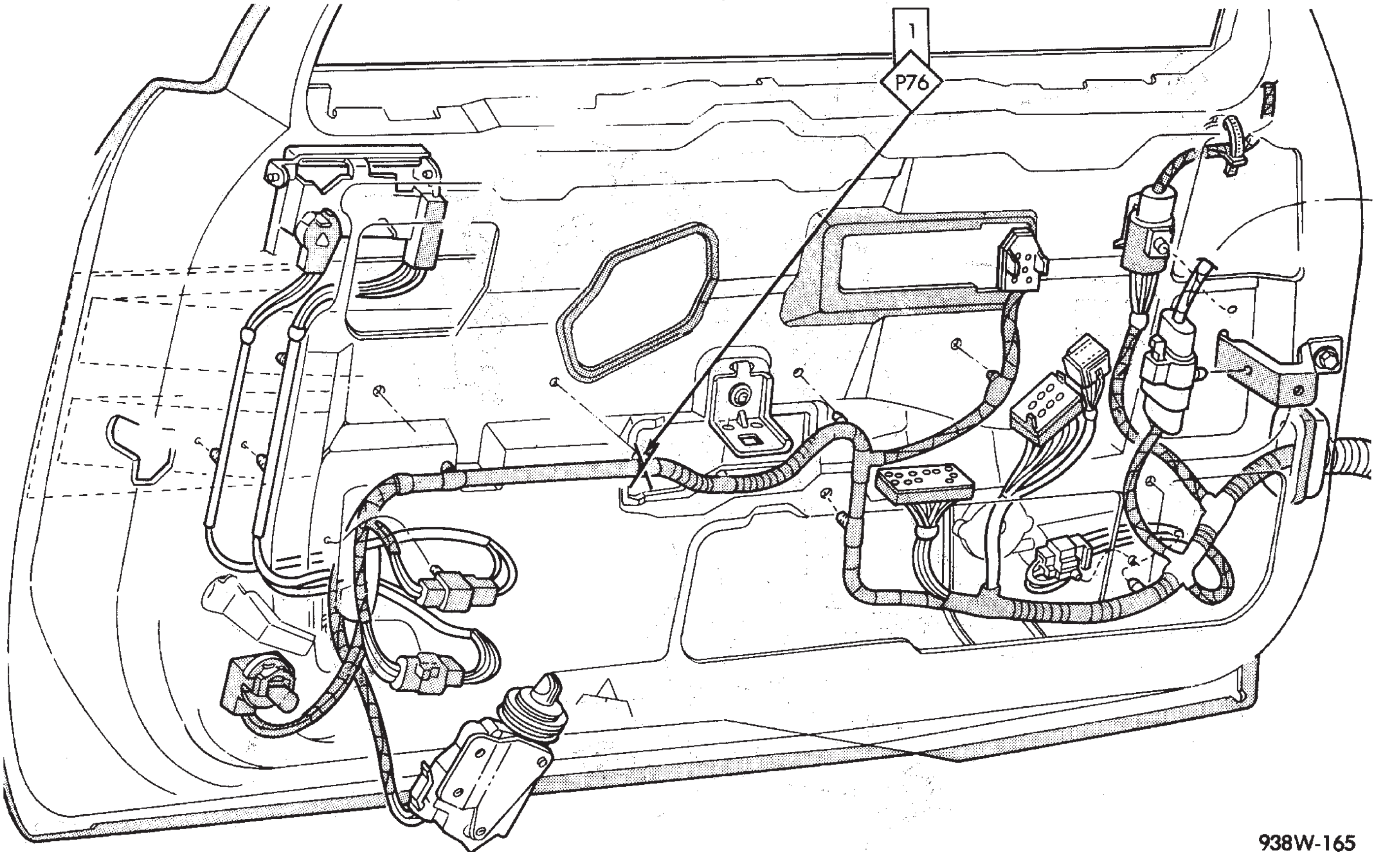


Fig. 4 Door Splices

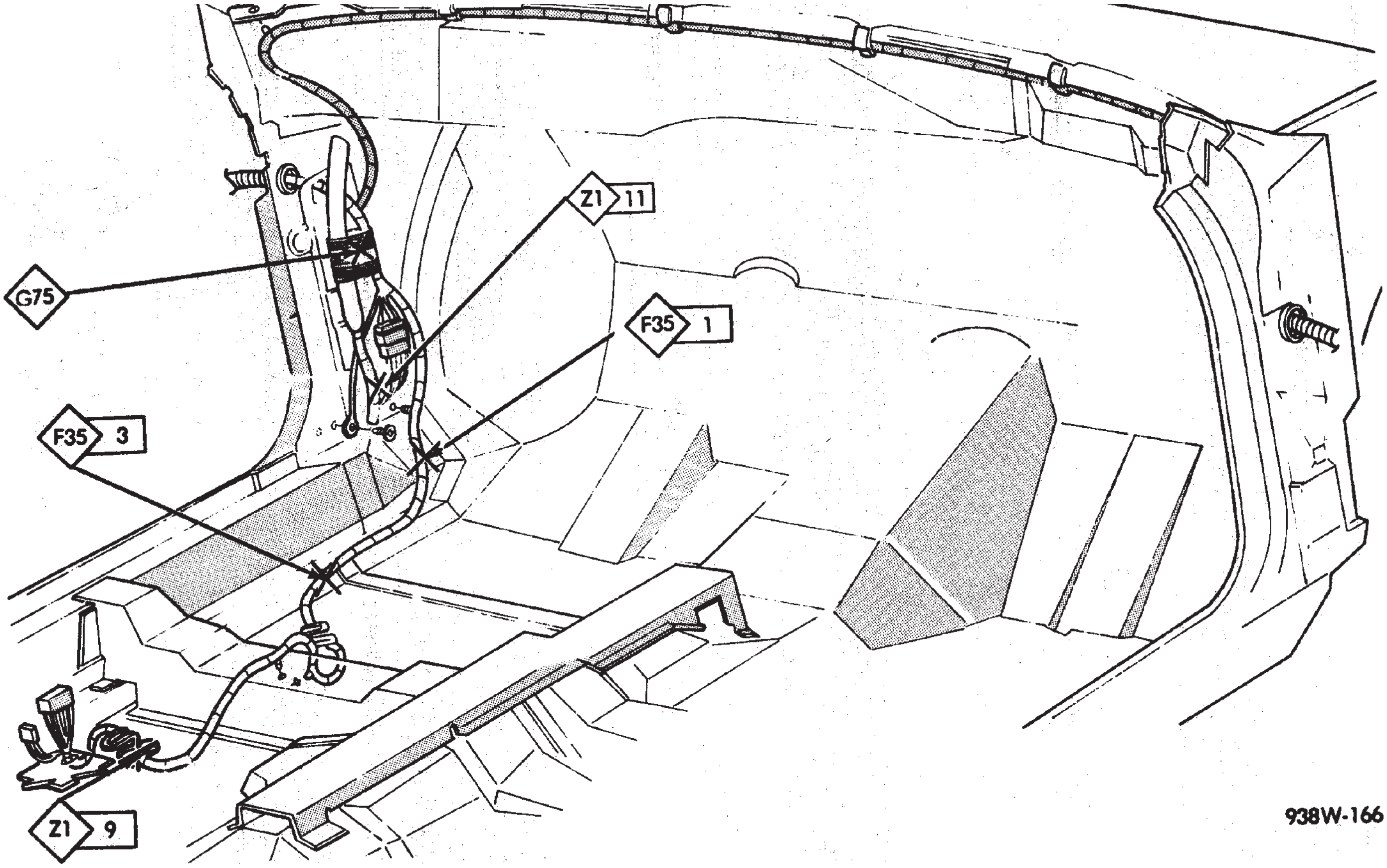


Fig. 5 Cowl Panel Splices AJ-Body

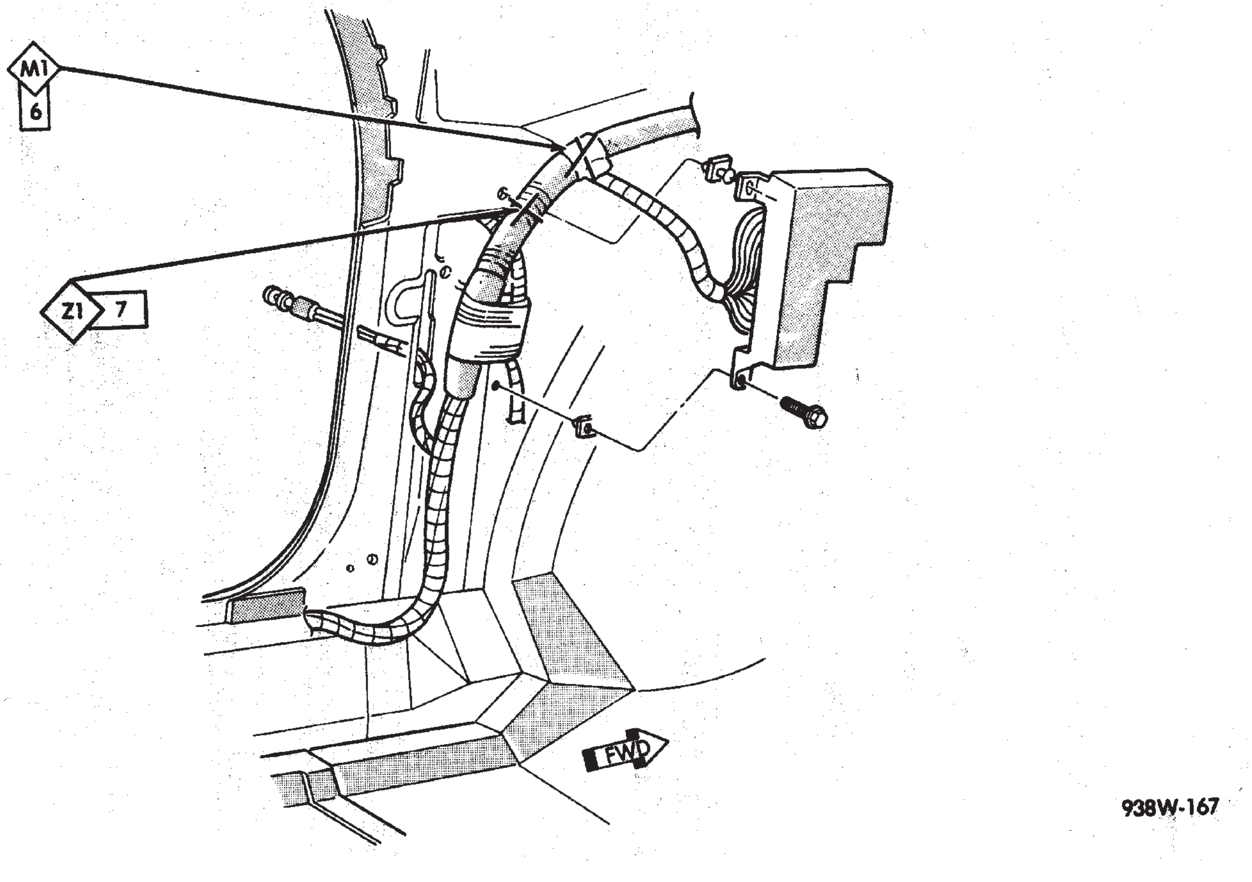


Fig. 6 Cowl Panel Splices (Left Side) AJ-Body

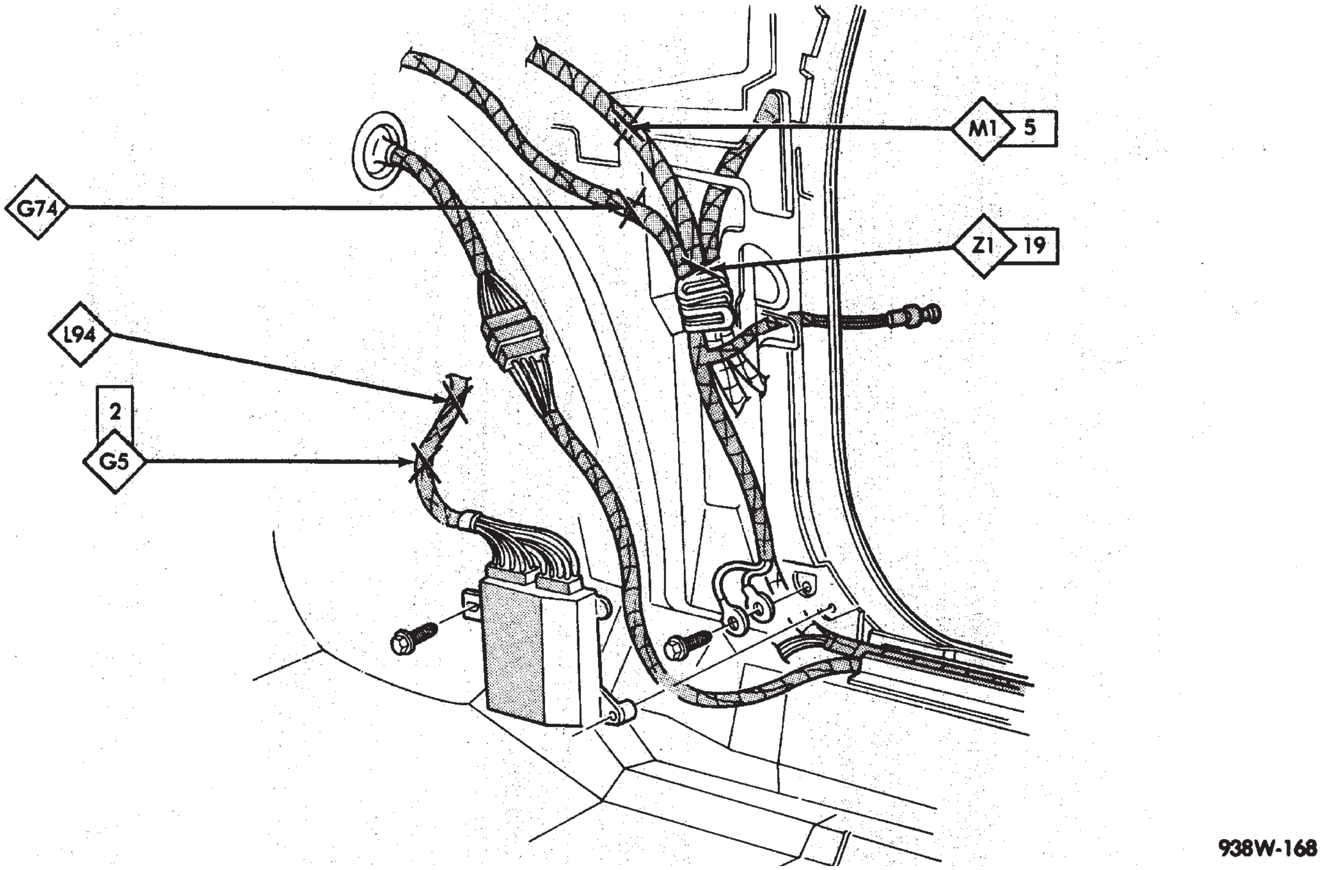


Fig. 7 Cowl Panel Splices (Right Side) AJ-Body

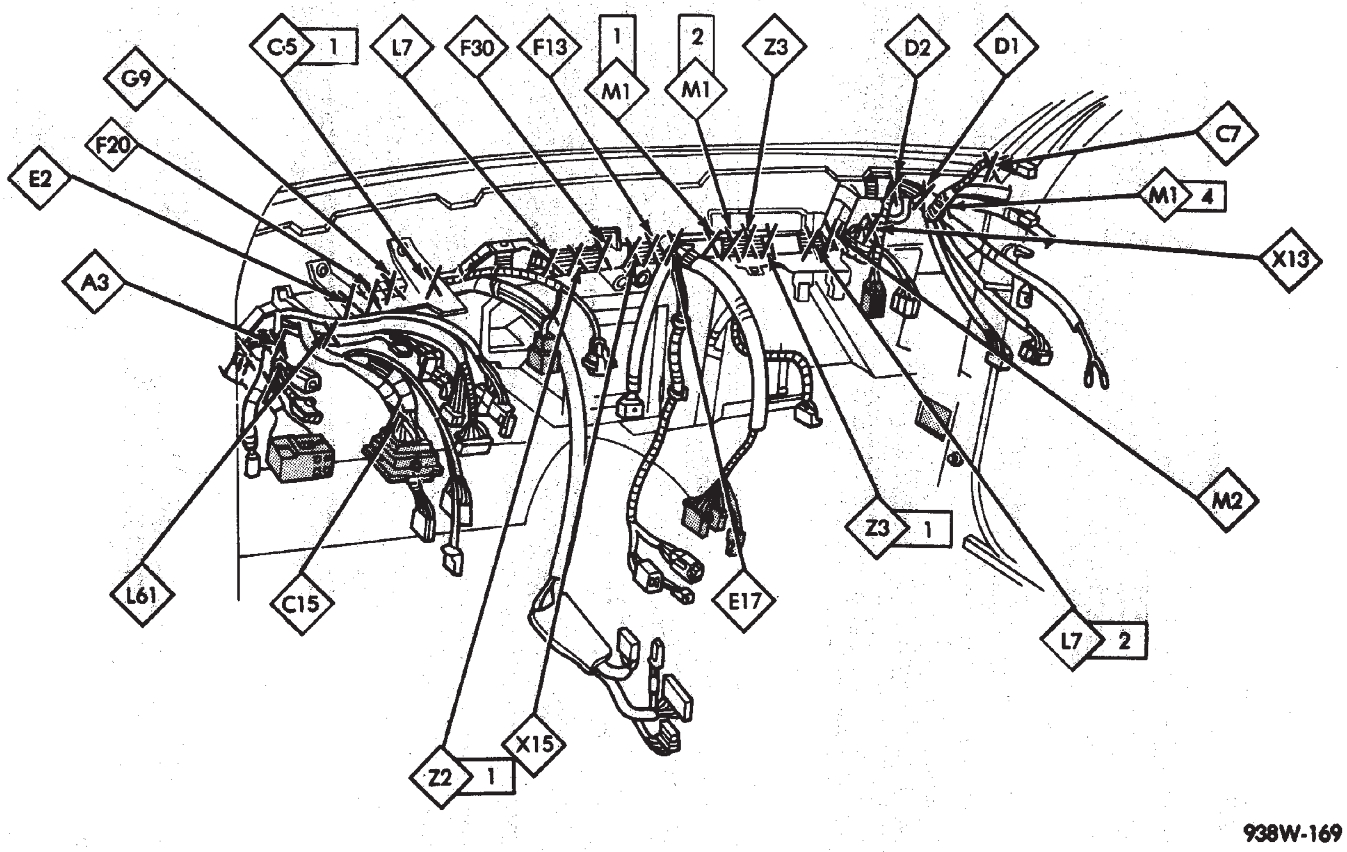


Fig. 8 Instrument Panel Splices AJ-Body

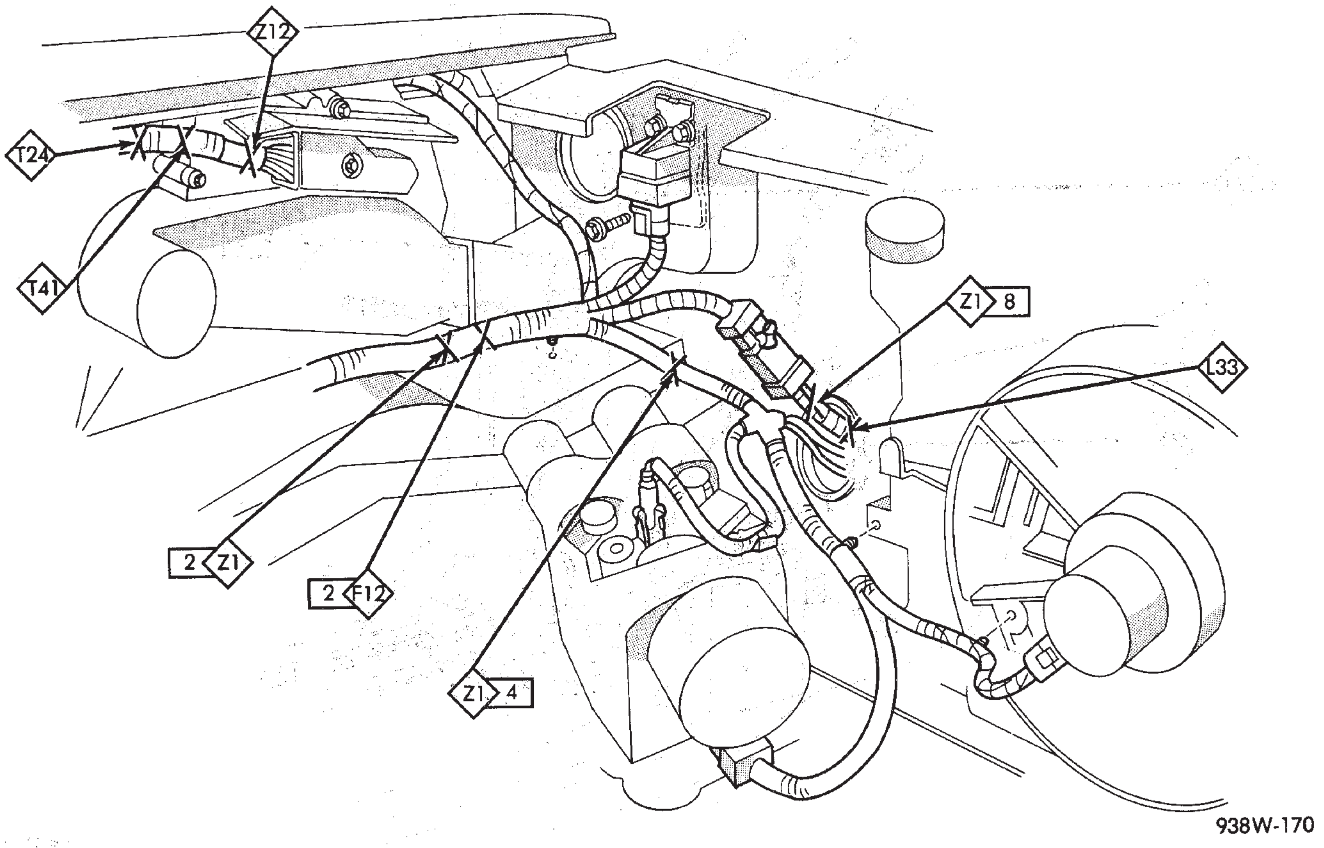


Fig. 9 Engine Compartment Splices AJ-Body

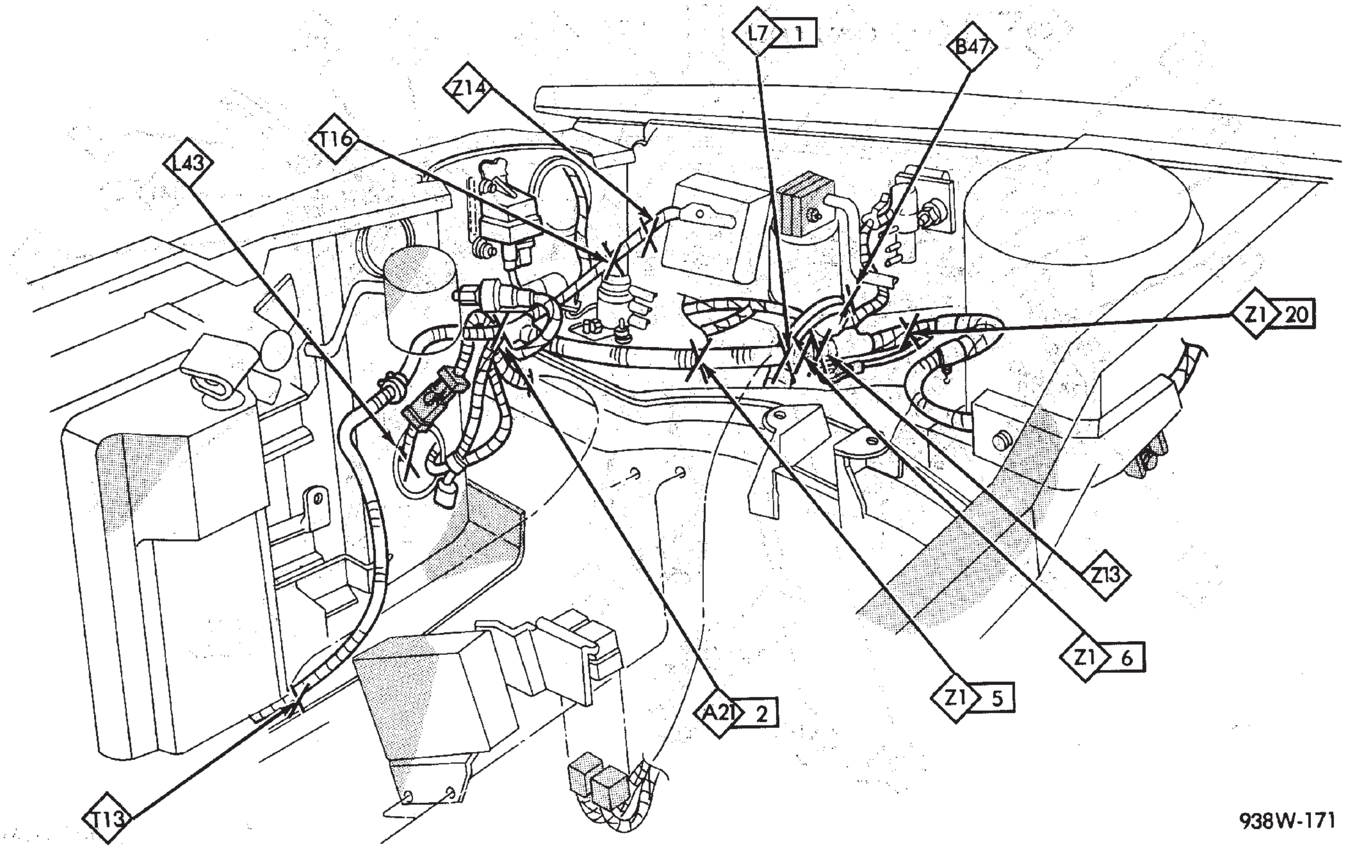


Fig. 10 Engine Compartment Splices AJ-Body

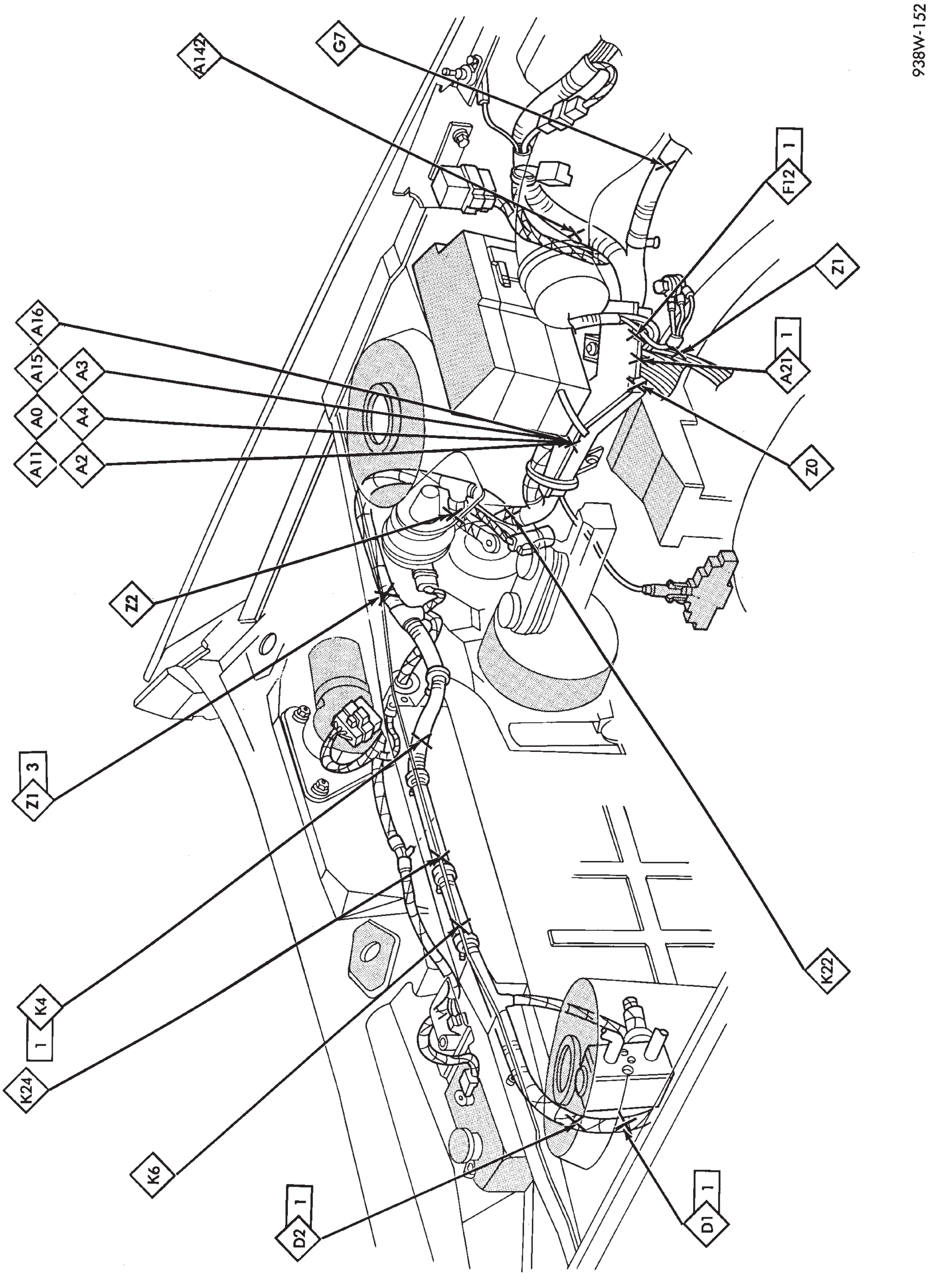


Fig. 11 Engine Compartment Splices AJ-Body

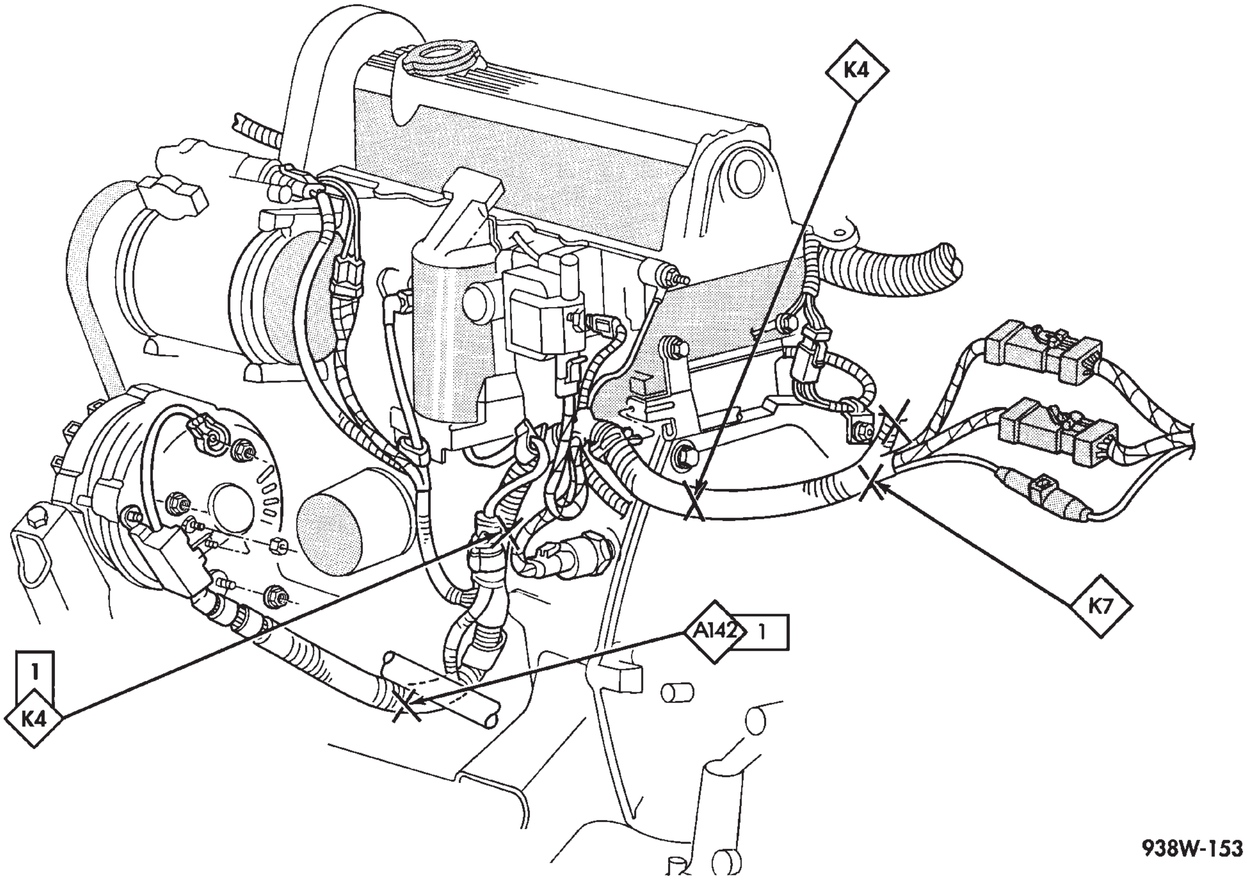


Fig. 12 Engine Splices 2.5L EFI AJ-Body

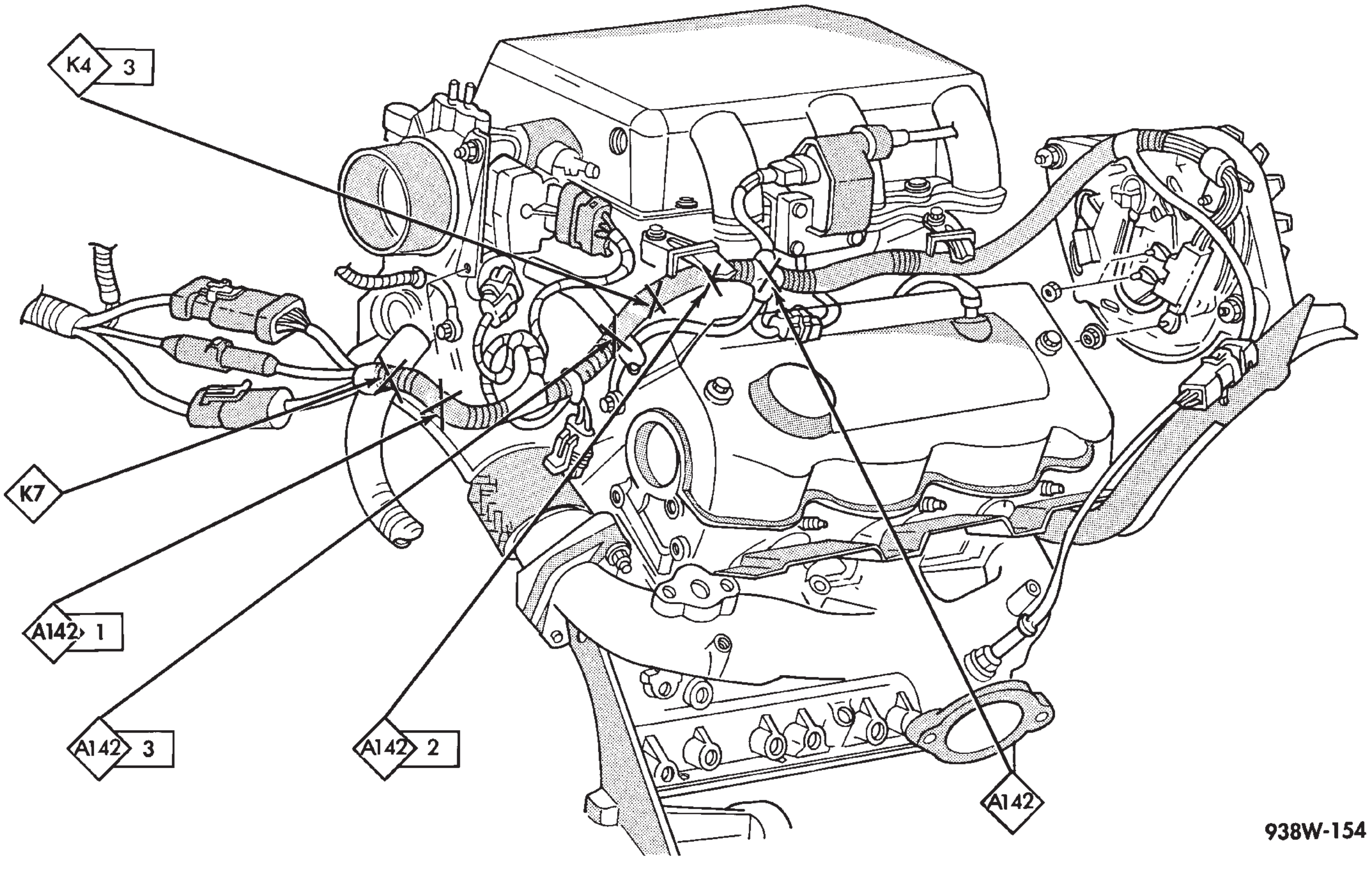


Fig. 13 Engine Splices 3.0L AJ-Body

AP-BODY SPLICE LOCATIONS

Splice Number	Fig.
A0-1 2.2L-2.5L	7
A0-1 3.0L	8
A0-2 2.2L-2.5L	7
A0-2 3.0L	8
A1 2.2L-2.5L	7
A1 3.0L	8
A3	3
A4	3
A10 2.2L-2.5L	7
A10 3.0L	8
A14 2.2L-2.5L	7
A14 3.0L	8
A14-1 2.2L-2.5L	7
A14-2 3.0L	8
A16 3.0L	8
A20 2.2L-2.5L	7
A20 3.0L	8
A21	3
A21 3.0L	8
A21-1 2.2L-2.5L	7
A21-1 3.0L	8
A21-2 2.2L-2.5L	7
A21-2 3.0L	8
A142-1 2.2L-2.5L	7
A142-1 3.0L	11
A142-2 2.2L-2.5L	10
A142-2 3.0L	11
B47 2.2L-2.5L	7
B47 3.0L	8
C7	3
D1 3.0L	8
D2 3.0L	8
E2	3
E2-1	3
F20	3
F20-1 2.2L-2.5L	7
F20-1 3.0L	8
F30	3
F35	6
G5	3
G7 2.2L-2.5L	7
G7 3.0L	8
K4 2.2L-2.5L	10
K4-1 2.2L-2.5L	7
K4-1 3.0L	8
K4-3 3.0L	11
K6 2.2L-2.5L	10
K6 3.0L	11
K7-1 2.2L-2.5L	7
K7-1 3.0L	8
K22 3.0L	8
K24 3.0L	8
L3 2.2L-2.5L	7
L3 3.0L	8
L4 2.2L-2.5L	7
L4 3.0L	8

Splice Number	Fig.
L7-1 2.2L-2.5L	7
L7-1 3.0L	8
L7-2 2.2L-2.5L	7
L7-2 3.0L	8
L7-3	3
L7-4	1
L7-5 2.2L-2.5L	7
L7-5 3.0L	8
L20	3
L39 2.2L-2.5L	7
L39 3.0L	8
L50	3
L60 2.2L-2.5L	7
L60 3.0L	8
L60-1	3
L61 2.2L-2.5L	7
L61 3.0L	8
L61-1	3
M1-1	3
M1-3	5
M2-1	5
M2-2	4
P33	6
P34	6
Q1	6
T13	9
T16	9
T41	9
T41-1 3.0L	8
X2 2.2L-2.5L	7
X2 3.0L	8
X2-1 2.2L-2.5L	7
X2-1 3.0L	8
X13	6
X15	6
Z0 2.2L-2.5L	10
Z0-1 2.2L-2.5L	10
Z0-2 3.0L	8
Z1	5
Z1-1	3
Z1-2 2.2L-2.5L	7
Z1-2 3.0L	8
Z1-3 2.2L-2.5L	7
Z1-3 3.0L	8
Z1-4 2.2L-2.5L	7
Z1-5	6
Z1-6	3
Z1-7	4
Z1-8	2
Z1-10 2.2L-2.5L	7
Z1-10 3.0L	8
Z1-11 2.2L-2.5L	7
Z1-11 3.0L	8
Z1-12	1
Z1-13 2.2L-2.5L	7
Z1-13 3.0L	8

Splice Number	Fig.
Z1-14 2.2l-2.5L	7
Z1-14 3.0L	8
Z2	3
Z12 2.2L-2.5L	7
Z12 3.0L	8
Z13	9
Z14 3.0L	8
Z14 3.0L	8

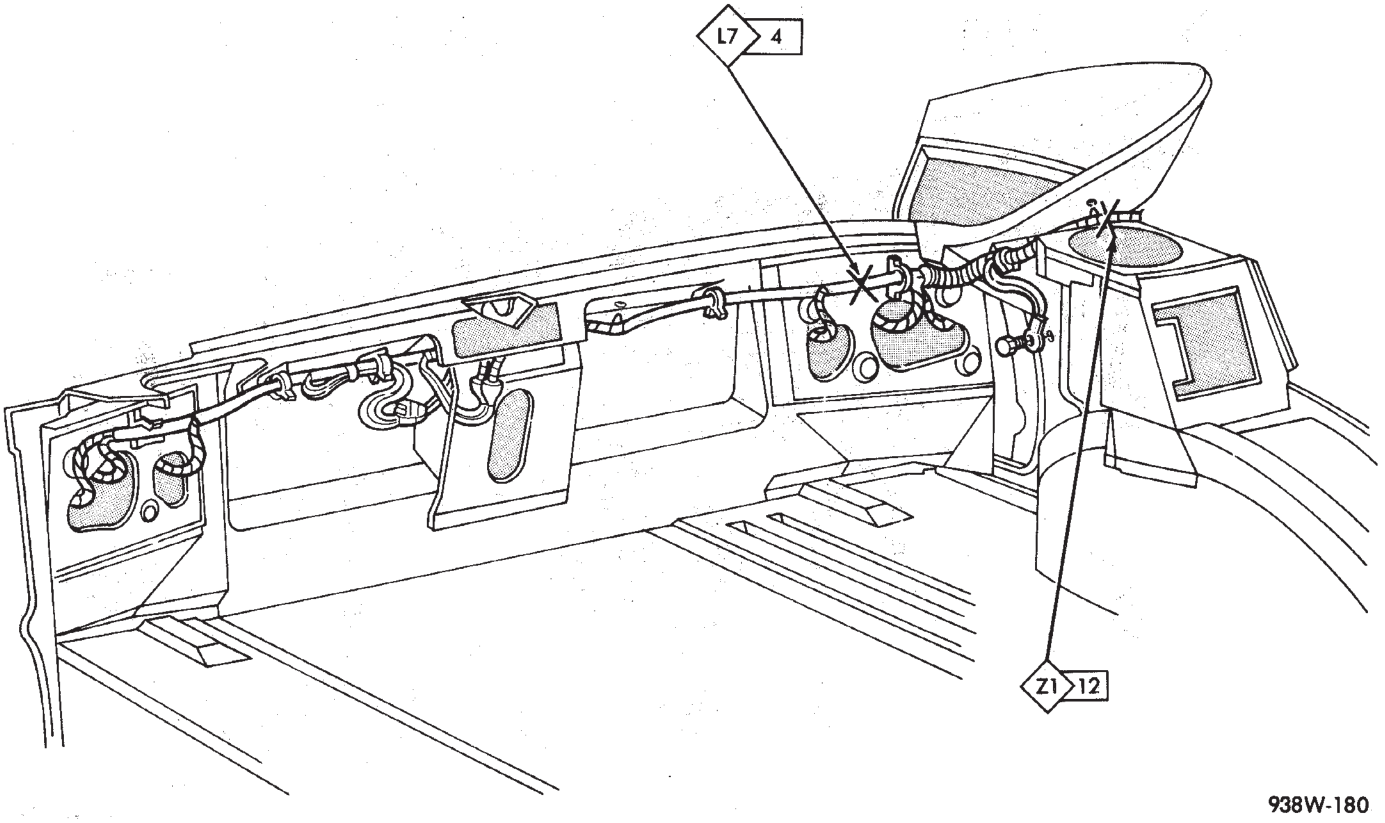


Fig. 1 Rear End Splices AP-Body

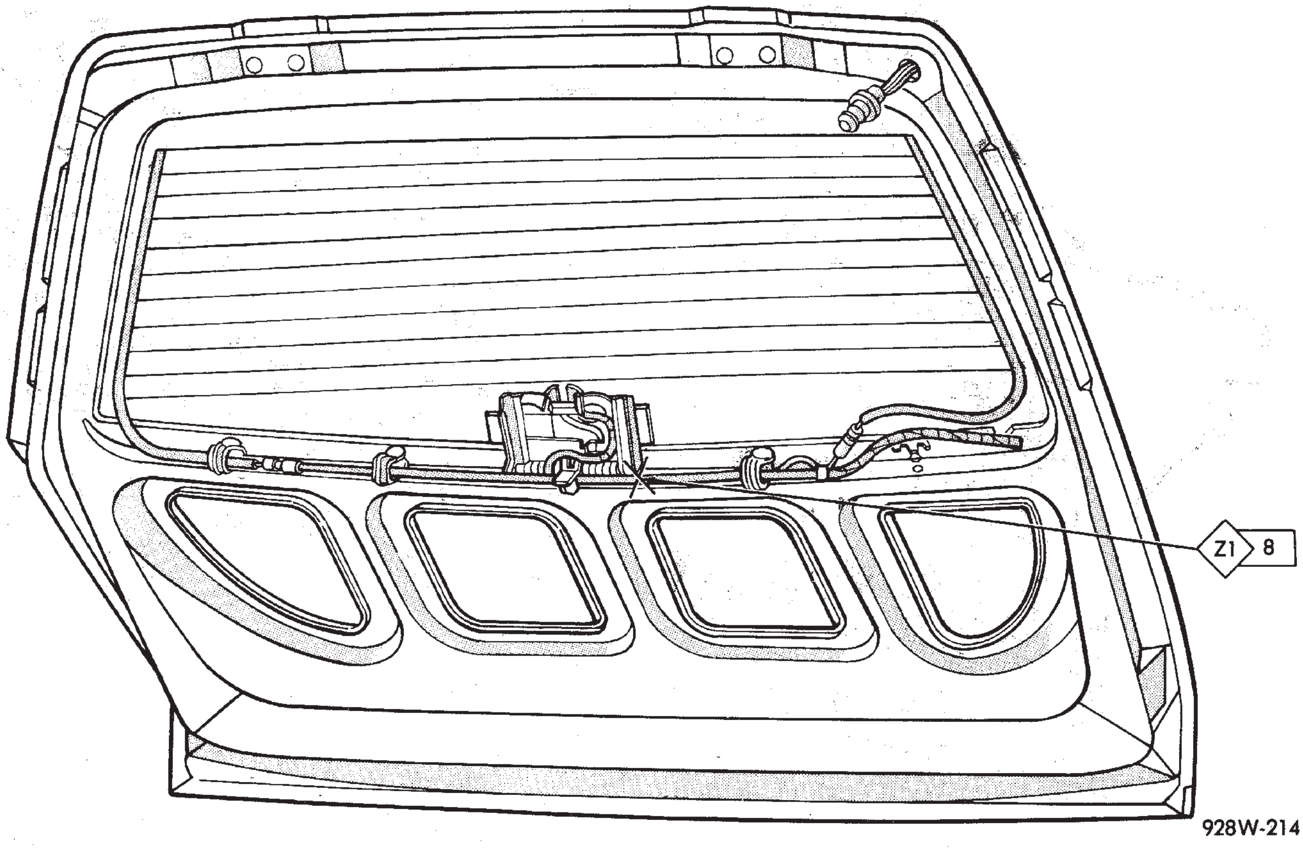


Fig. 2 Liftgate Splices AP-Body

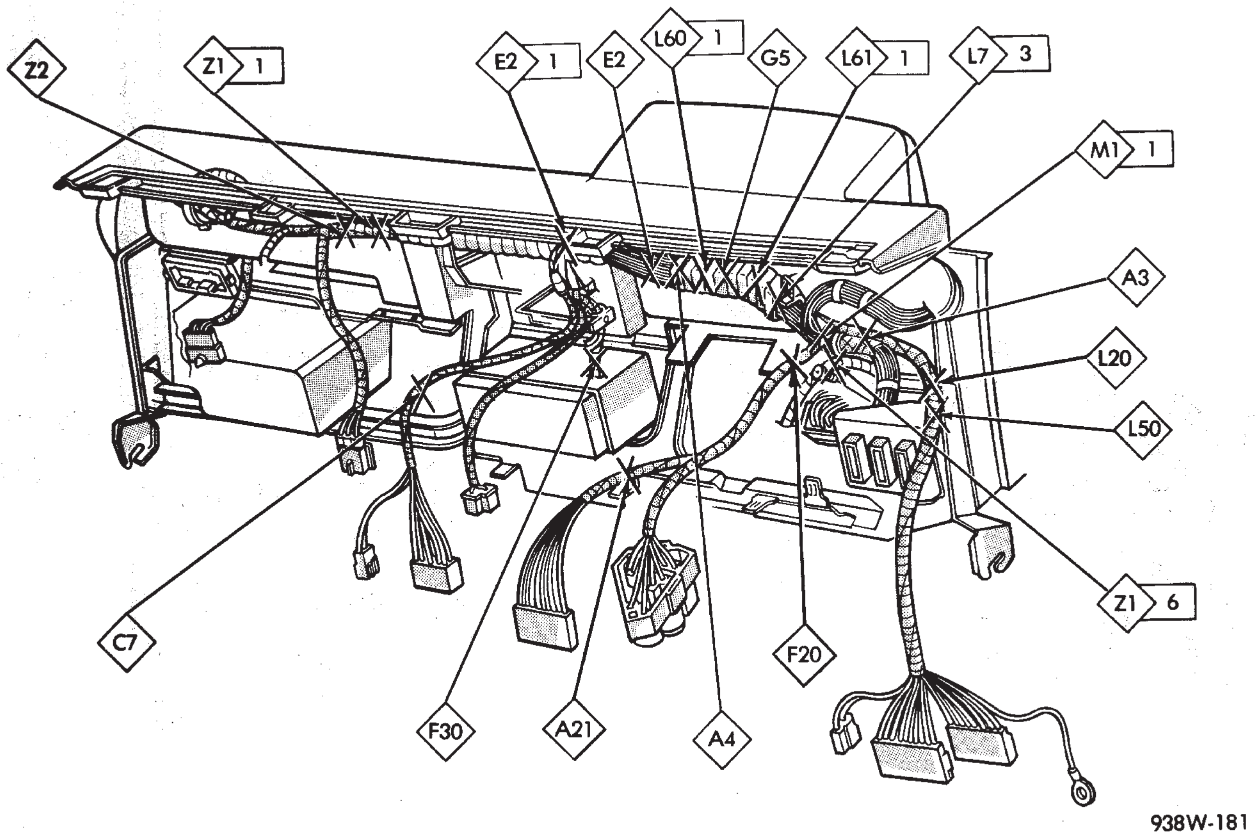


Fig. 3 Instrument Panel Splices AP-Body

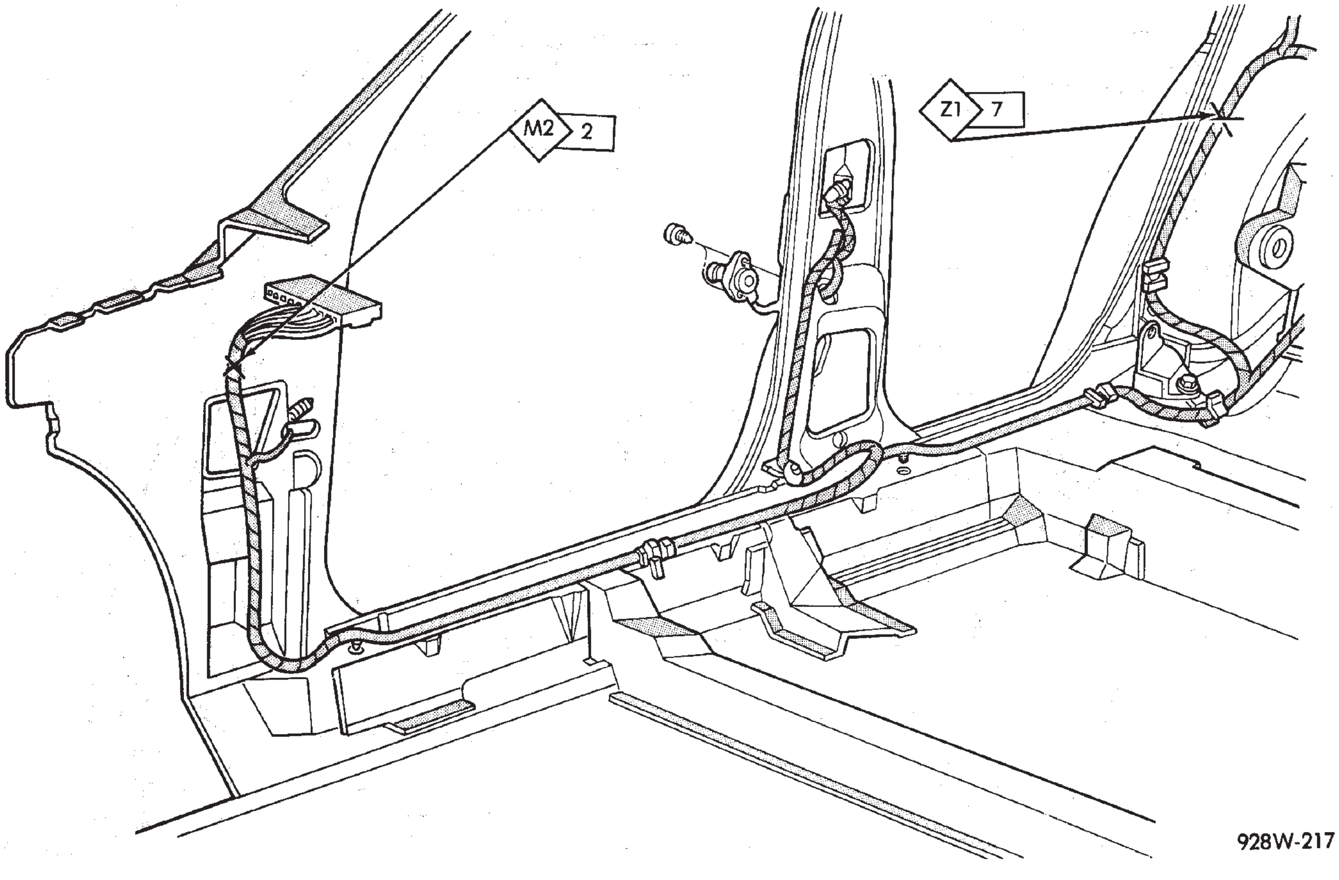


Fig. 4 Body Splices (Right Side) AP-Body

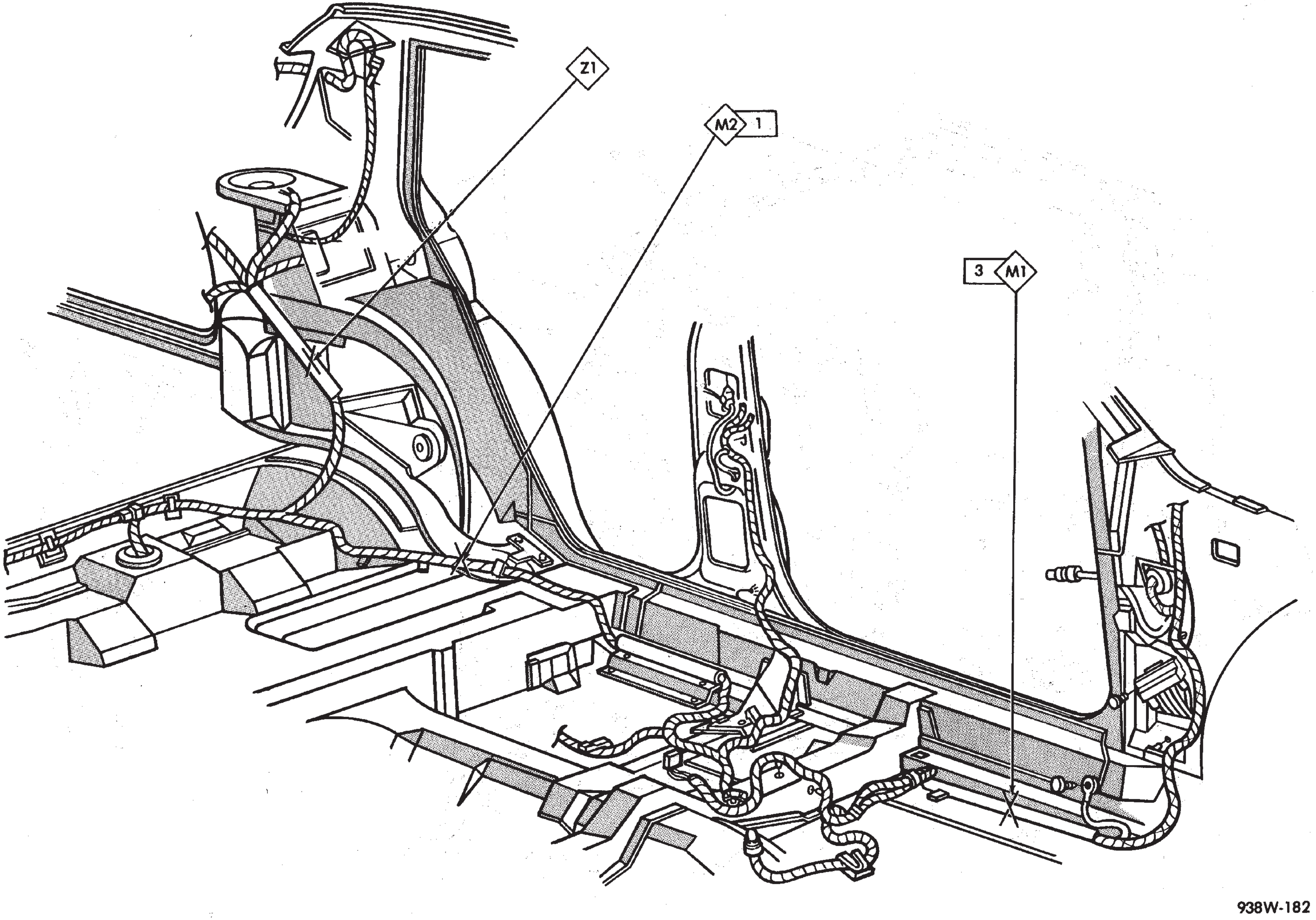


Fig. 5 Body Splices (Left Side) AP-Body

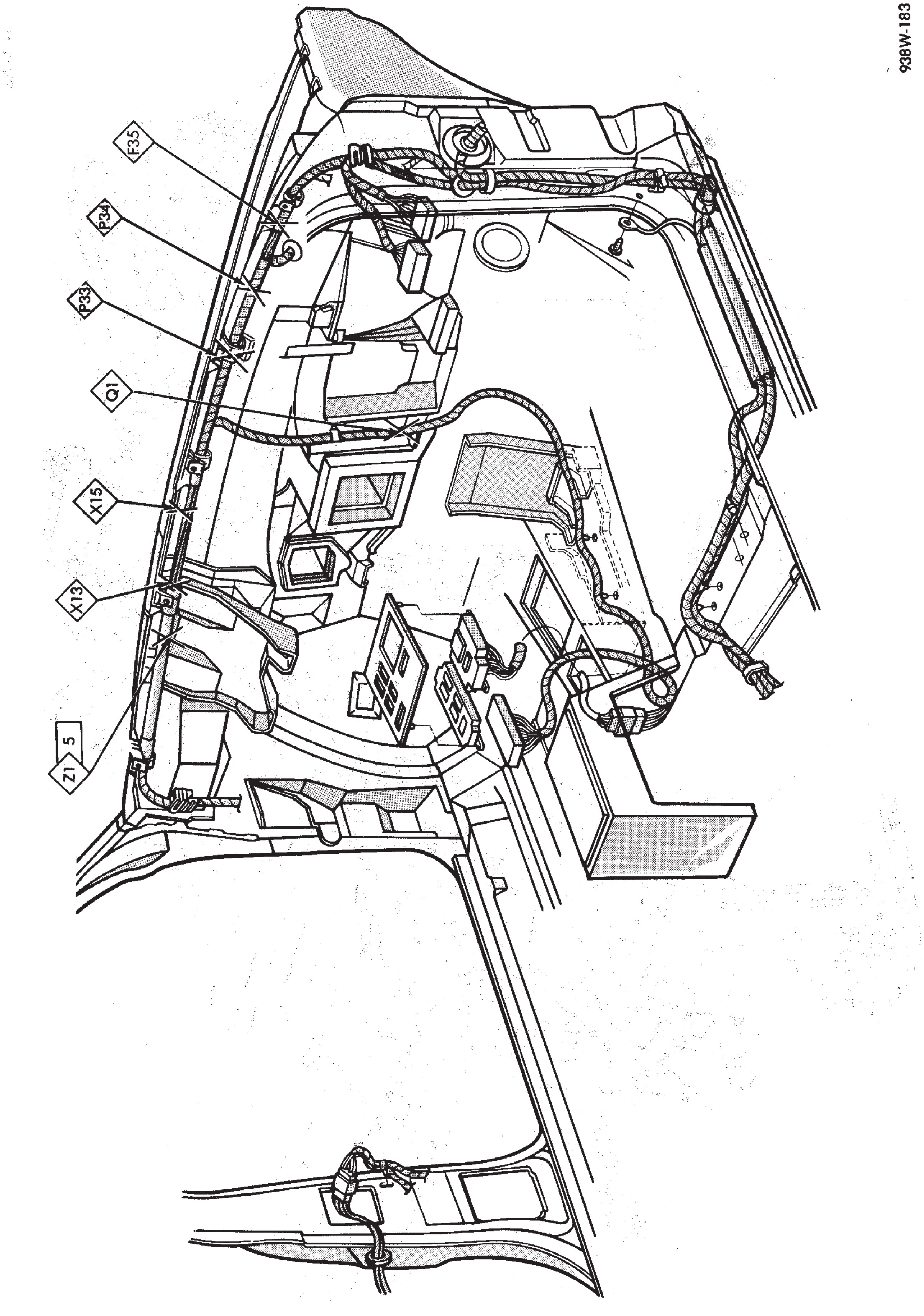


Fig. 6 Cowl Panel Splices AP-Body

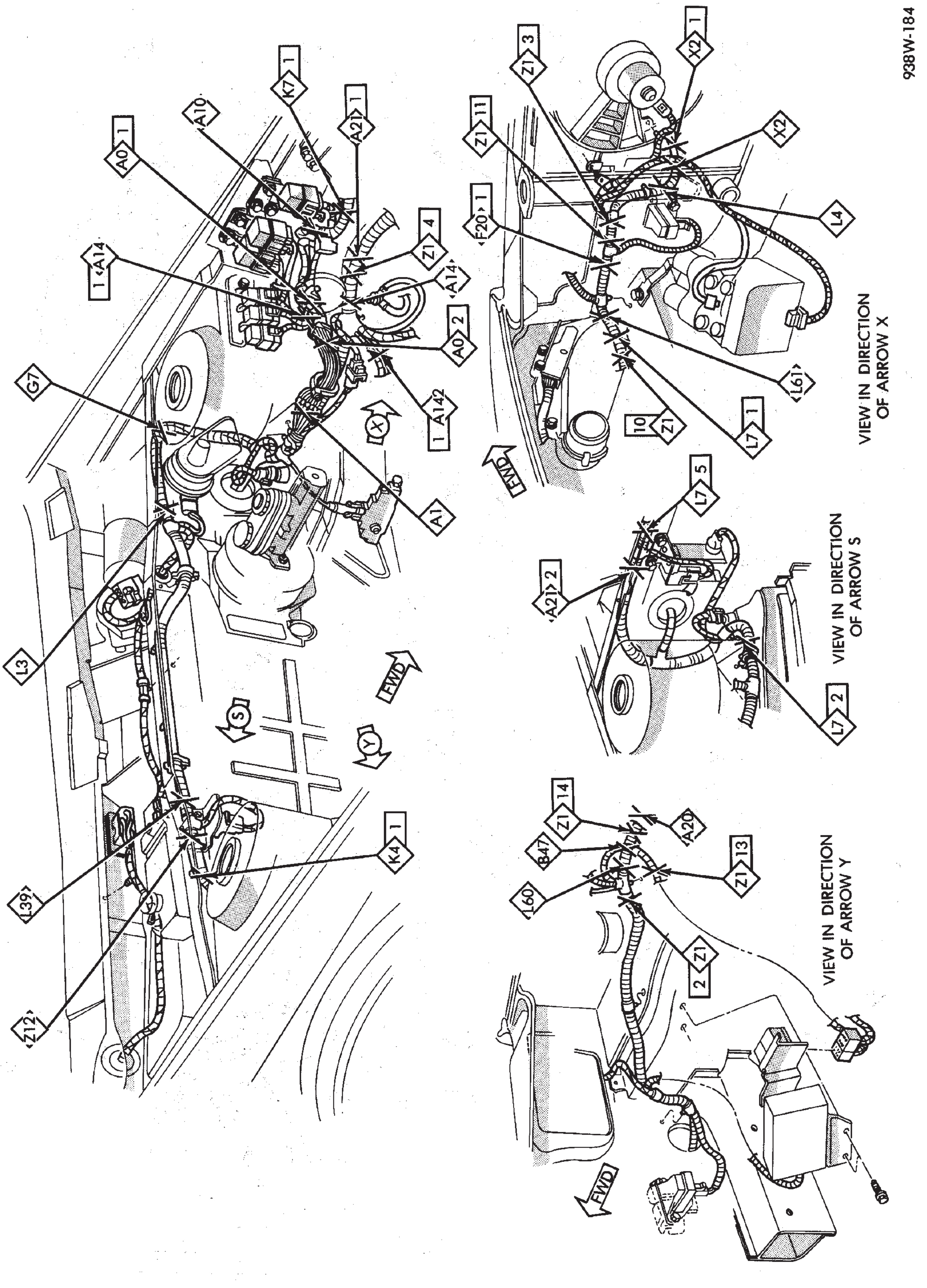


Fig. 7 Engine Compartment Splices 2.2L-2.5L AP-Body

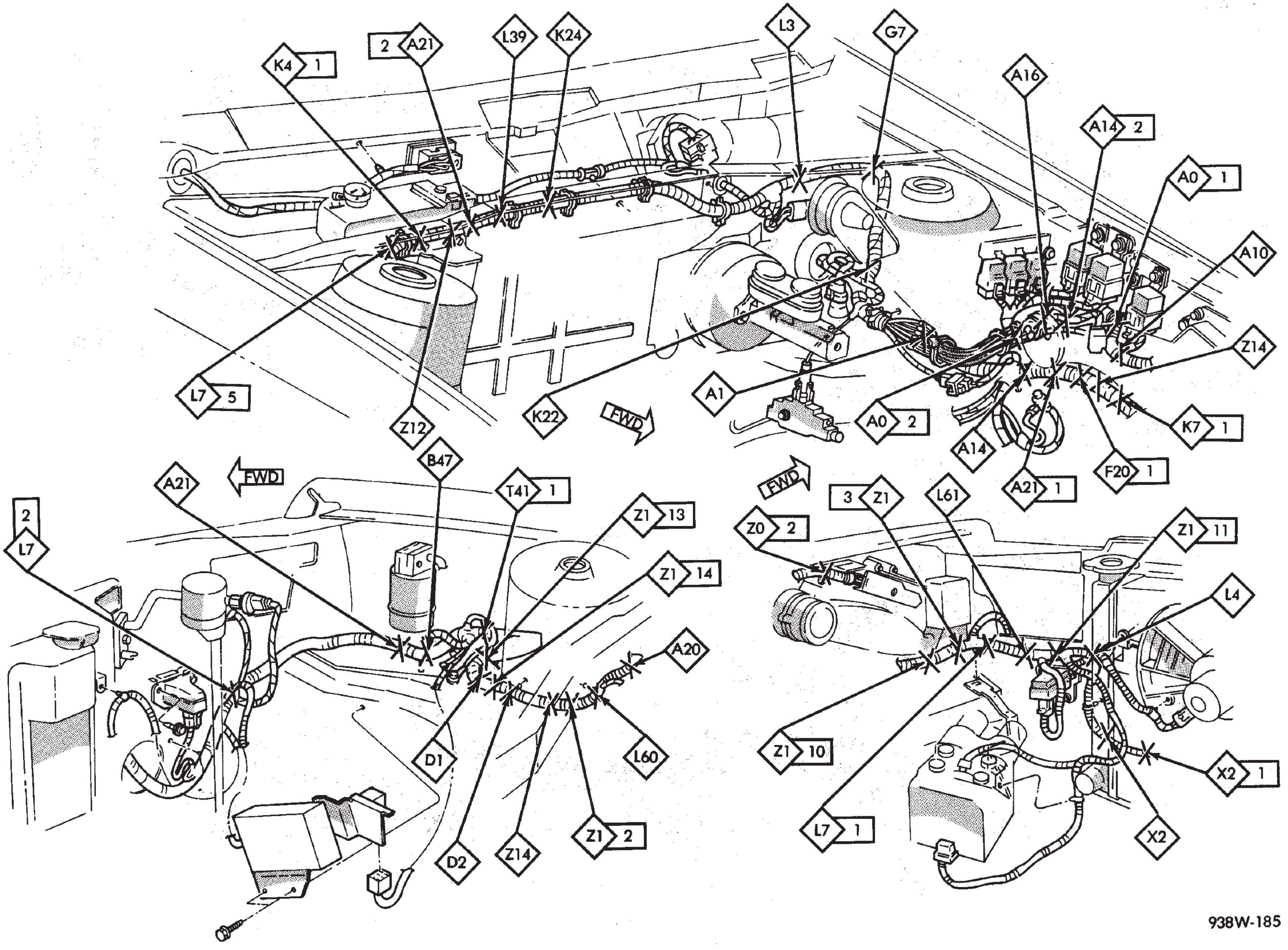


Fig. 8 Engine Compartment Splices 3.0L AP-Body

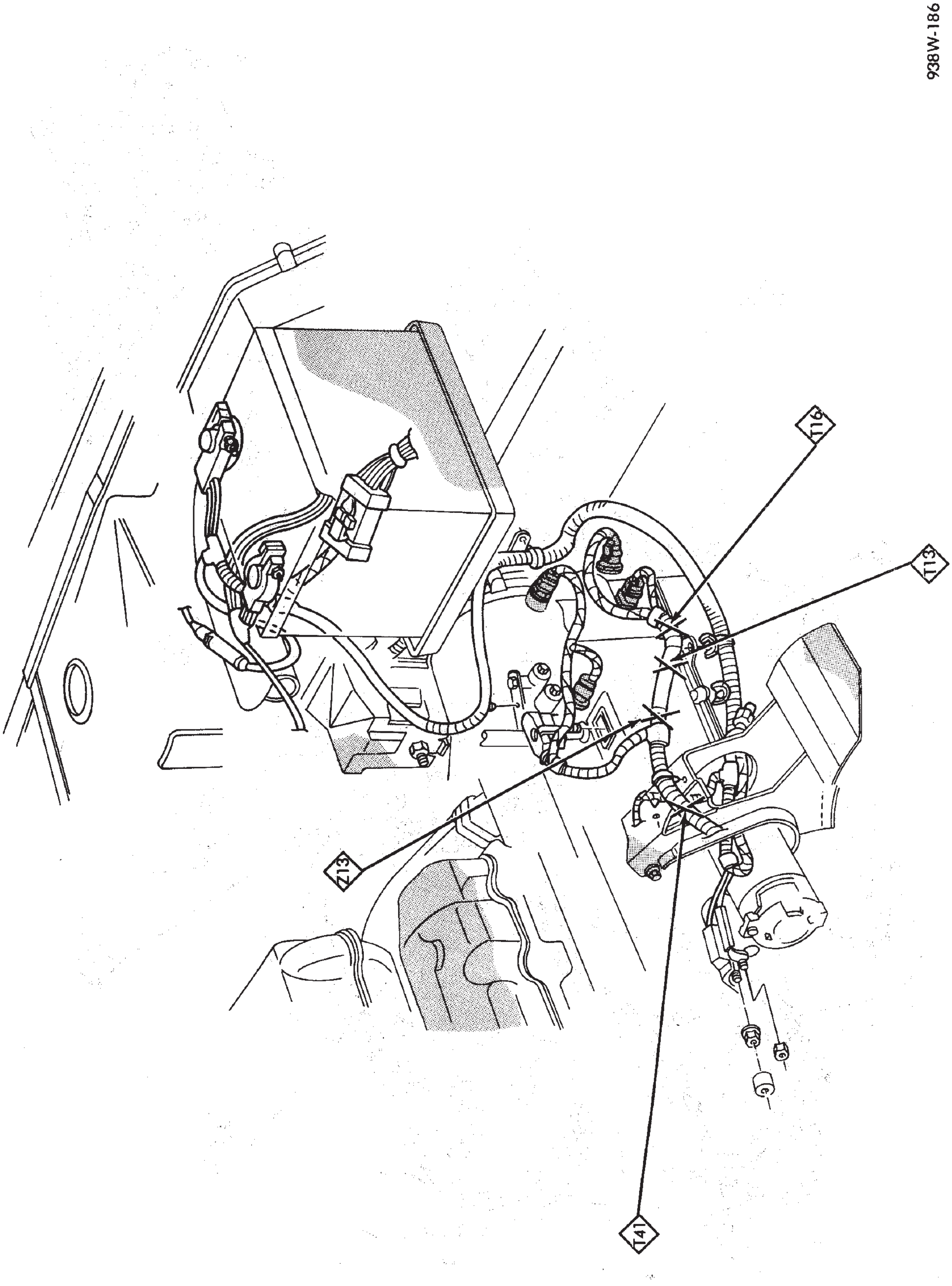


Fig. 9 Transmission Splices 41TE AP-Body

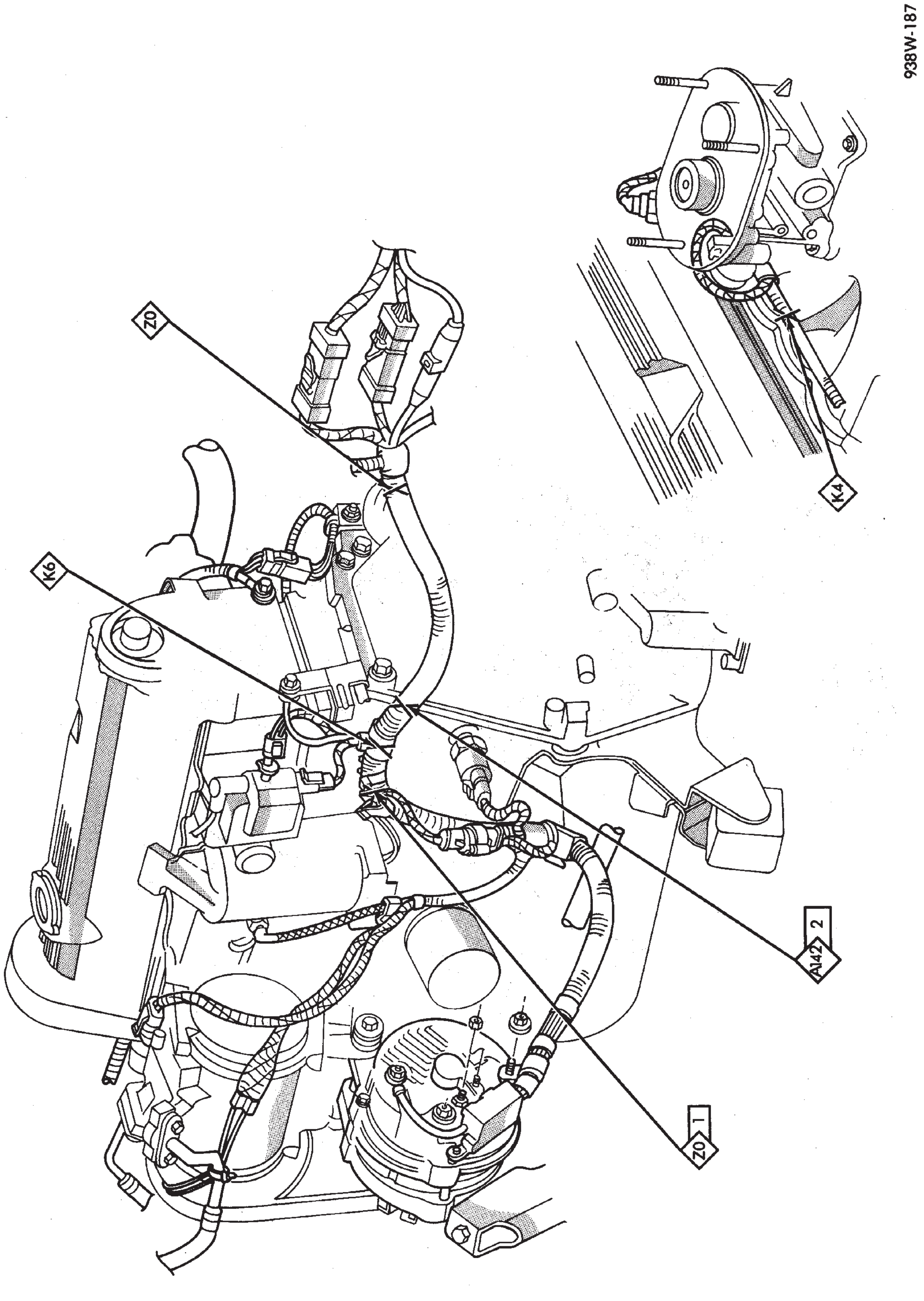


Fig. 10 Engine Splices 2.2L-2.5L AP-Body

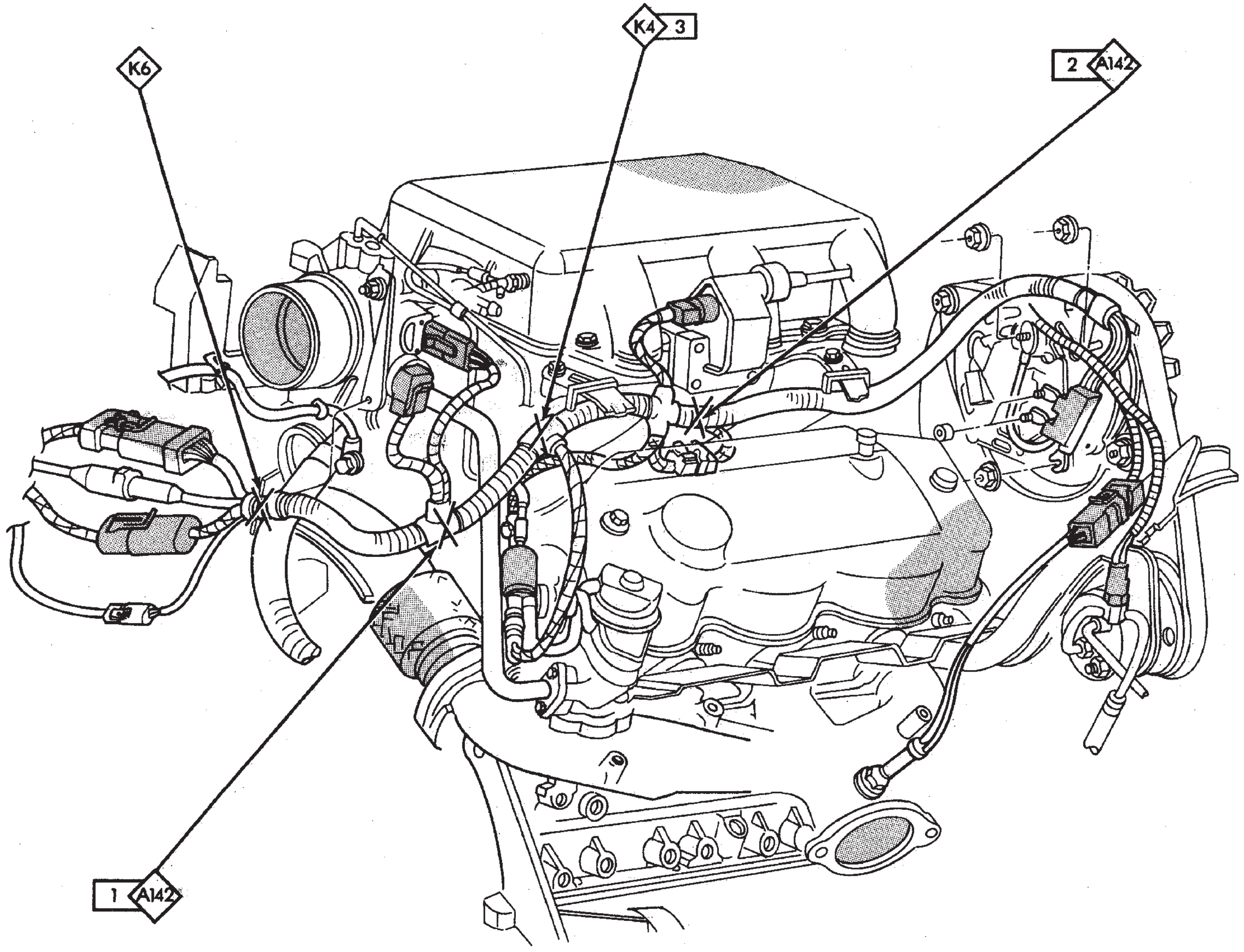
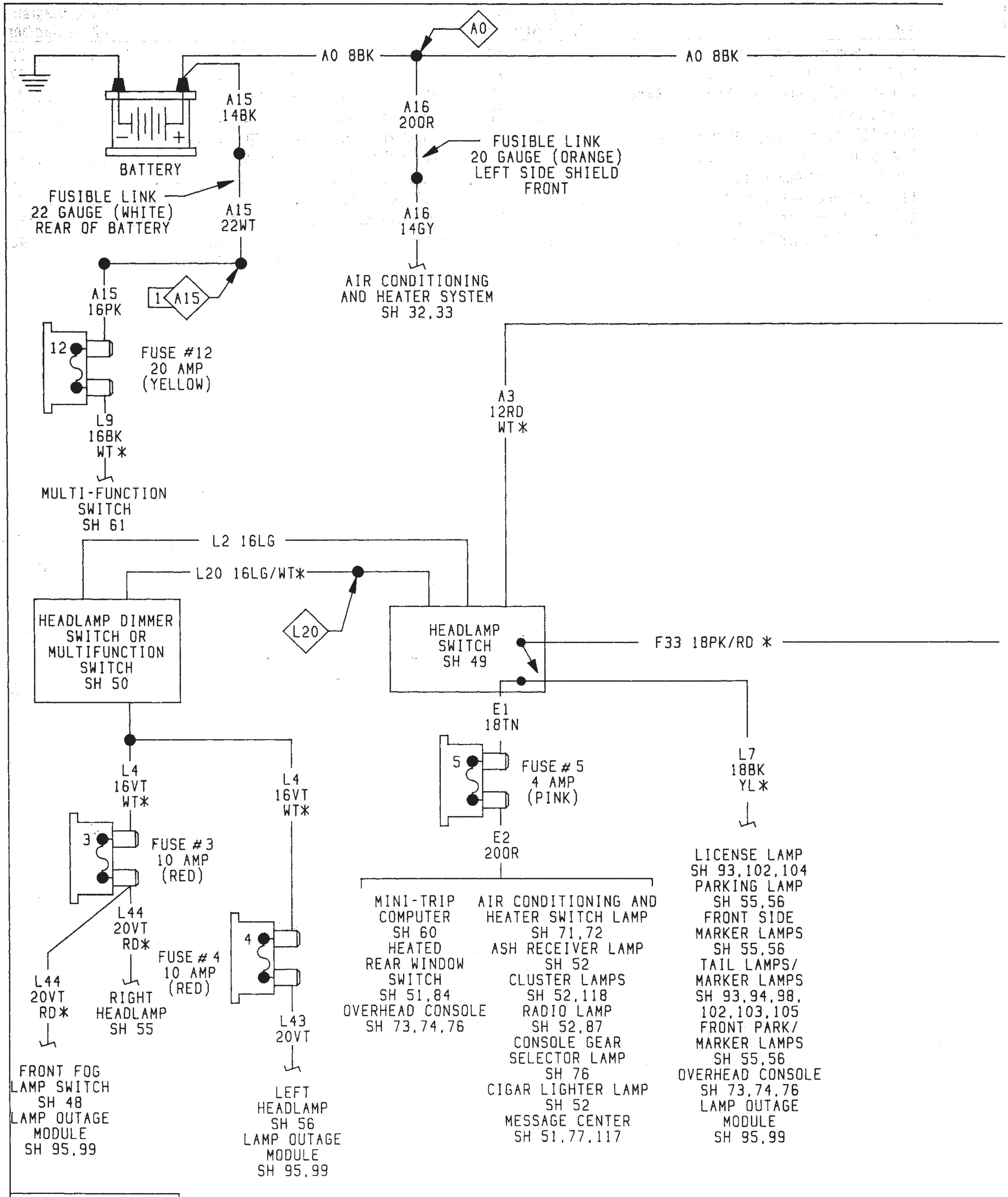


Fig. 11 Engine Splices 3.0L AP-Body

WIRING DIAGRAMS AA-BODY

INDEX

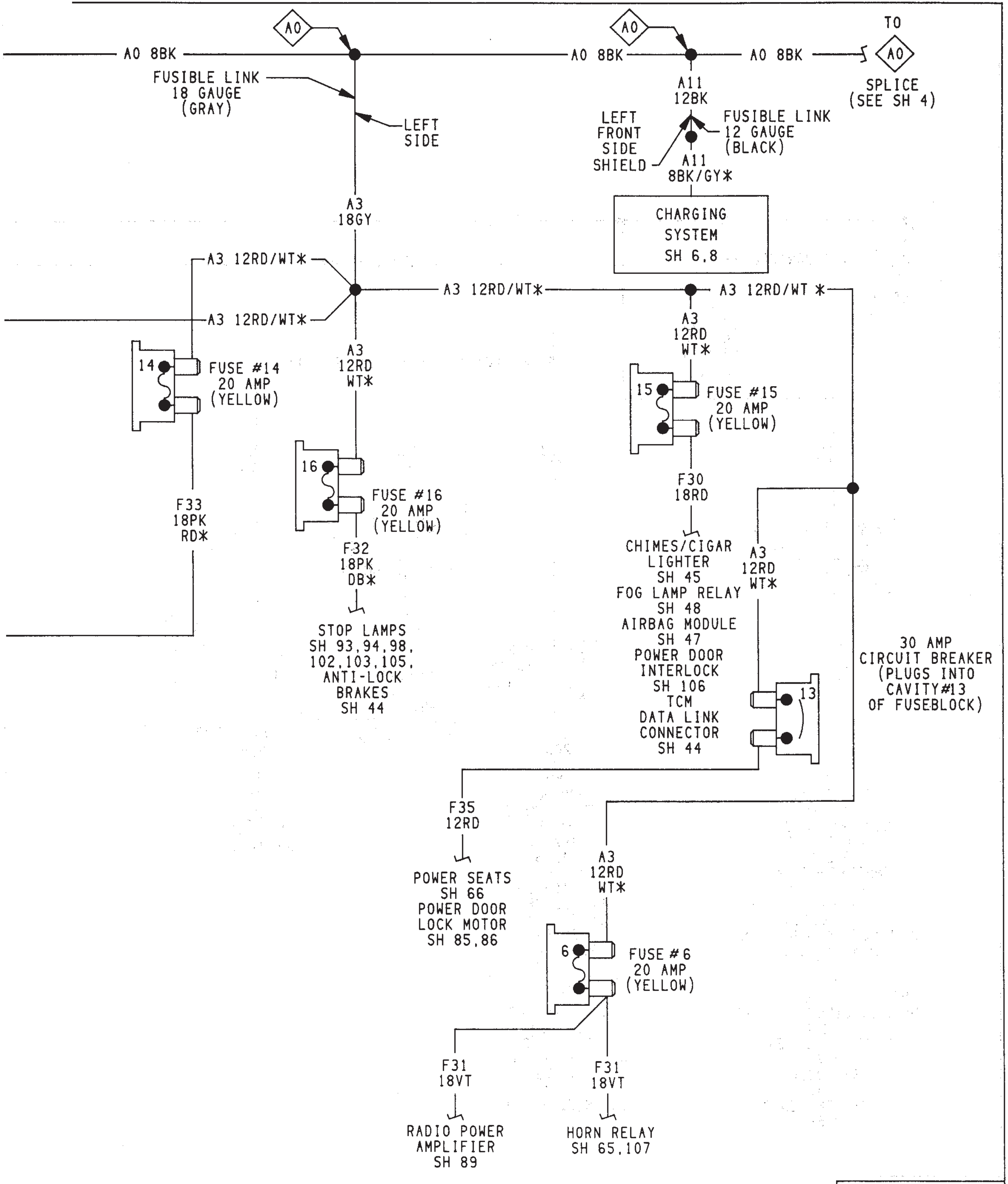
Name	Wiring Diagram Sheet Number
Splice Z1-8	58
Splice Z1-10	73, 84
Splice Z2	34, 63, 95, 99
Splice Z12	14, 20, 29, 36
Splice Z13-1	35
Splice Z14	36
Starter System (3.0L)	10
Engine Starter Relay	10
Field Coil Engine Starter Motor	10
Switches	
A/C Cycling Switch	71, 72
A/C Damped Pressure Switch	71, 72
A/C Blower Switch	71, 72
A/C Heater Control Switch	71, 72
A/C High Pressure Switch	32, 72
Automatic Transmission Park/Neutral Position Switch	9
Back-up Lamp Switch	9
Blower Switch	71
Brake Switch	59
Brake Warning Lamp Switch	11
Deck Lid Ajar Courtesy Lamp Switch	78
Defrost A/C Switch	71, 72
Engine Oil Pressure Switch	39, 40
Fog Lamp Switch	48
Front Reading Lamp Switch	75
Glove Box Lamp Switch	54
Headlamp Switch	1, 49
Headlamp Dimmer Switch	1, 50
Heated Rear Window Switch	4, 5, 84
Heater Bi-Level Control Switch	68
Heater Control Switch	68
Horn Switch	65
Ignition Switch	4, 11, 44
Key-In Switch	46
Left Door Illuminated Entry Switch	58
Left Front Door Jamb Switch	46, 53, 75
Left Rear Door Ajar Switch	78
Left Rear Door Jamb Switch	76
Low Fuel Switch	69
Manual Transmission Back-Up Lamp Switch	9
Mercury Switch	39, 40
Multi-Function Switch	50, 62, 63
Optical Horn and Headlamp Dimmer Switch	50
Park Brake Switch	11, 44
Park/Neutral Position Switch	37
Power Door Lock Left Front Switch	85
Power Door Lock Right Front Switch	86
Power Mirror Switch	79
Power Seat Switch-Left	66
Power Steering Pressure Switch	25
Power Window Left Front Master Switch	81
Power Window Left Rear Switch	81
Power Window Right Front Switch	82
Power Window Right Rear Switch	82
Right Door Illuminated Entry Switch	58
Right Front Door Ajar Switch	78
Right Front Door Jamb Switch	54, 74
Right Rear Door Jamb Switch	73
Rotary Ignition Switch	11
Seat Belt Switch	46
Stop Lamp Switch	59
Transmission Range Switch	36
Transmission Solenoids & Pressure Switch	35
Vehicle Speed Control Switch	59
TCM Harness Connectors	111
Throttle Body Fuel Injection Ignition System (2.5L)	12, 13, 14, 15, 16
Automatic Shut-down Relay	14
Distributor	15
Engine Coolant Sensor	15
EVAP/Purge Solenoid	13
Exhaust Gas Recirculation Diagnostic Solenoid	13
Heated Oxygen Sensor	12
Idle Air Control Motor	12
Ignition Coil	14
Injector	16
MAP Sensor	13
Powertrain Control Module	12, 13, 14, 15, 16
Throttle Position (Sensor)	12
Vehicle Speed Sensor	15
Time Delay Relay System	53, 54
Glove Box Lamp and Switch	54
Halo Lamp	54
Left Front Door Jamb Switch	53
Right Front Door Jamb Switch	54
Time Delay Relay	54
Transmission Control System (3.0L Engine Only)	34, 35, 36, 37, 38
Back-Up Lamp Relay	37
Output Speed Sensor	38
Park/Neutral Position Switch	37
Powertrain Control Module	34, 36
Safety Shut-Down Relay	35
Transmission Control Module	34, 35, 36, 37, 38
Transmission Range Switch	36
Transmission Solenoids and Pressure Switch	35
Turbine Speed Sensor	38
Traveler and Message Center	60
Turn & Hazard Flasher Systems	61, 62
Hazard Flasher	61
Multi-Function Switch	62
Turn Signal Flasher	61
Underhood Lamp	39, 40
Battery	39, 40
Mercury Switch	39, 40
Underhood Lamp	39, 40
Unified Body to Rear Body Wiring	122
Vehicle Speed Control Servo	59
Vehicle Speed Control System and Stop Lamp Switch	59
Clockspring	59
Powertrain Control Module	59
Stop Lamp Switch with Vehicle Speed Control	59
Stop Lamp Switch without Vehicle Speed Control	59
Vehicle Speed Control Servo	59



AA-CDP 1

FUSE APPLICATION CHART

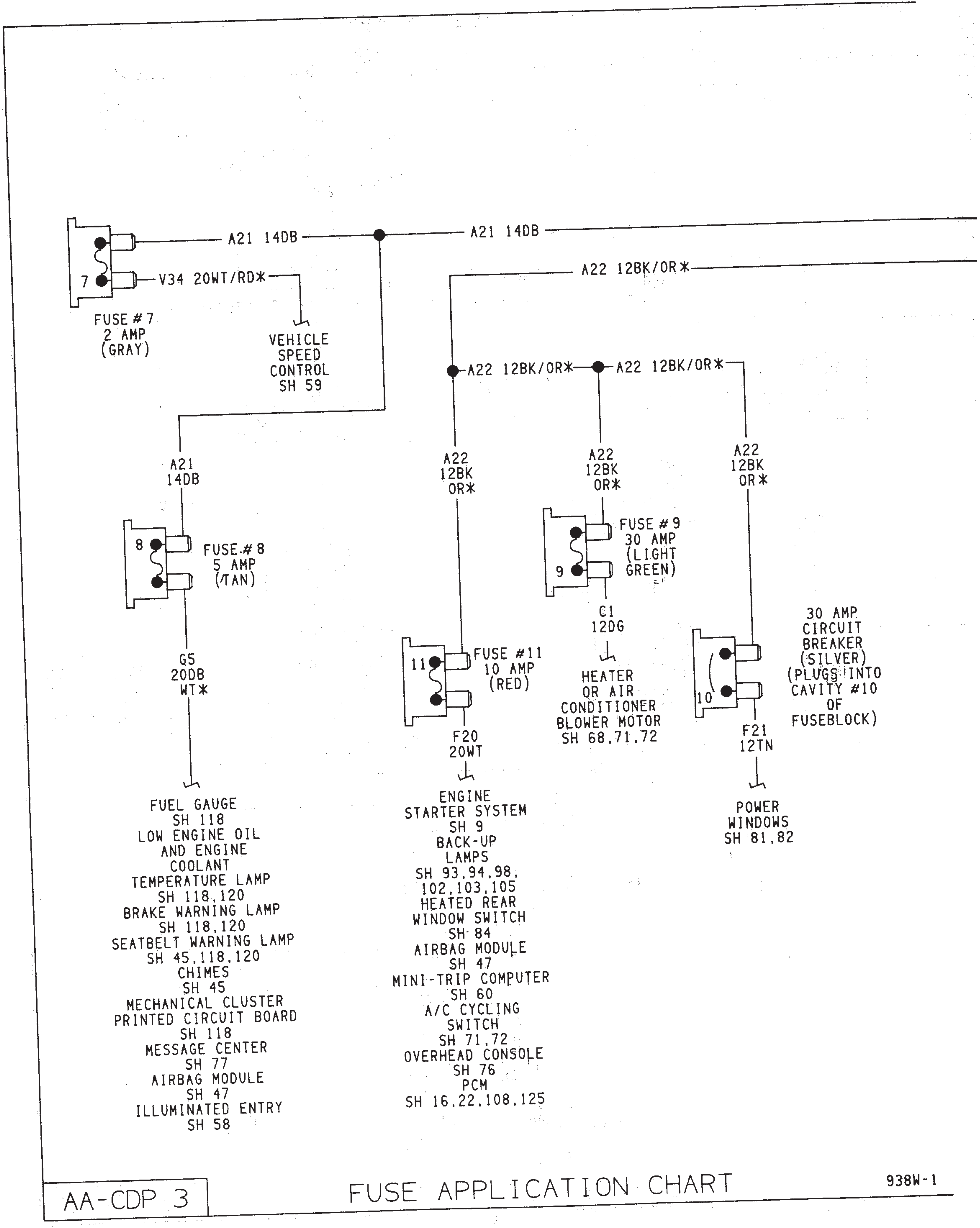
938W-1



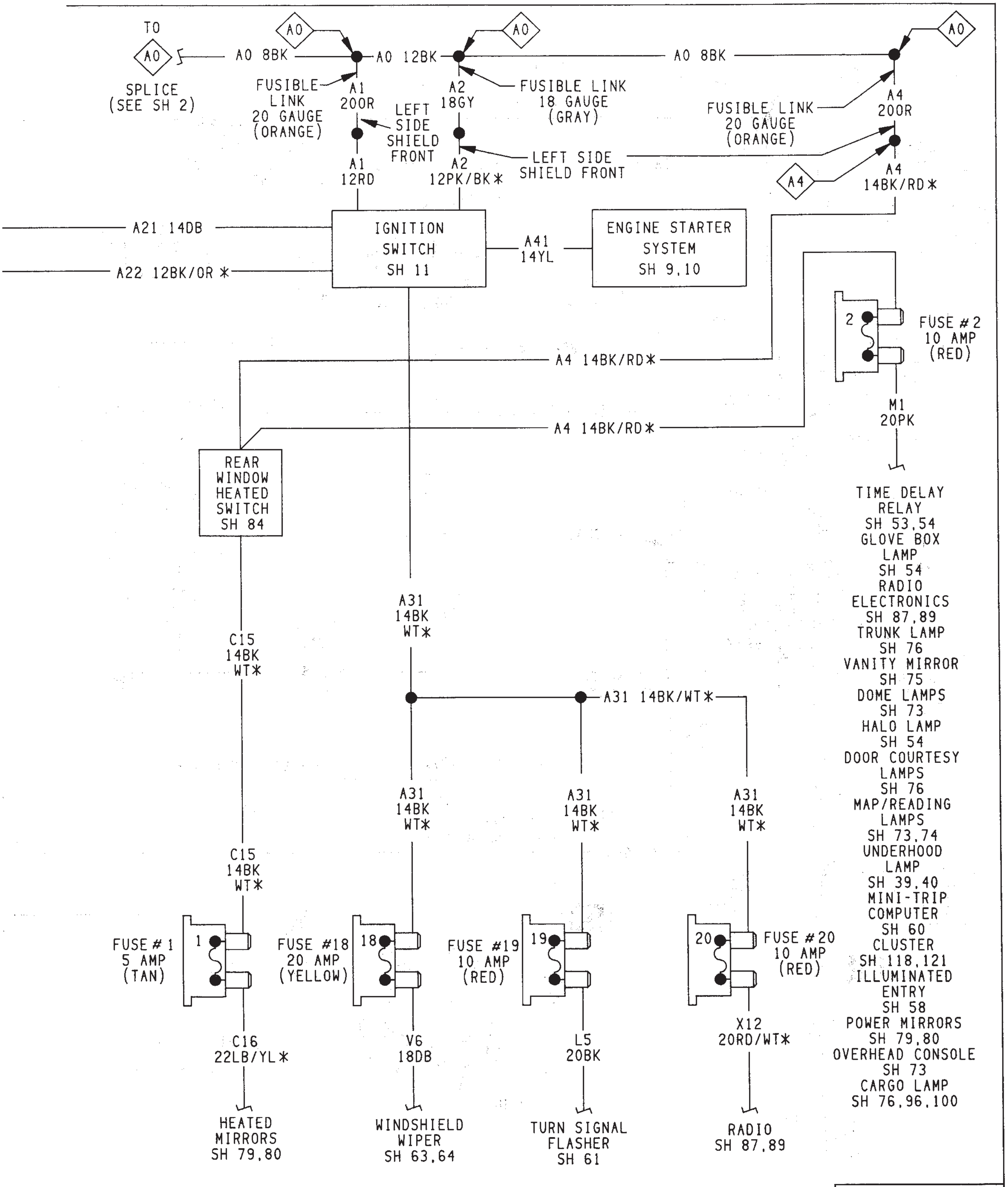
938W-1

FUSE APPLICATION CHART

AA-CDP 2



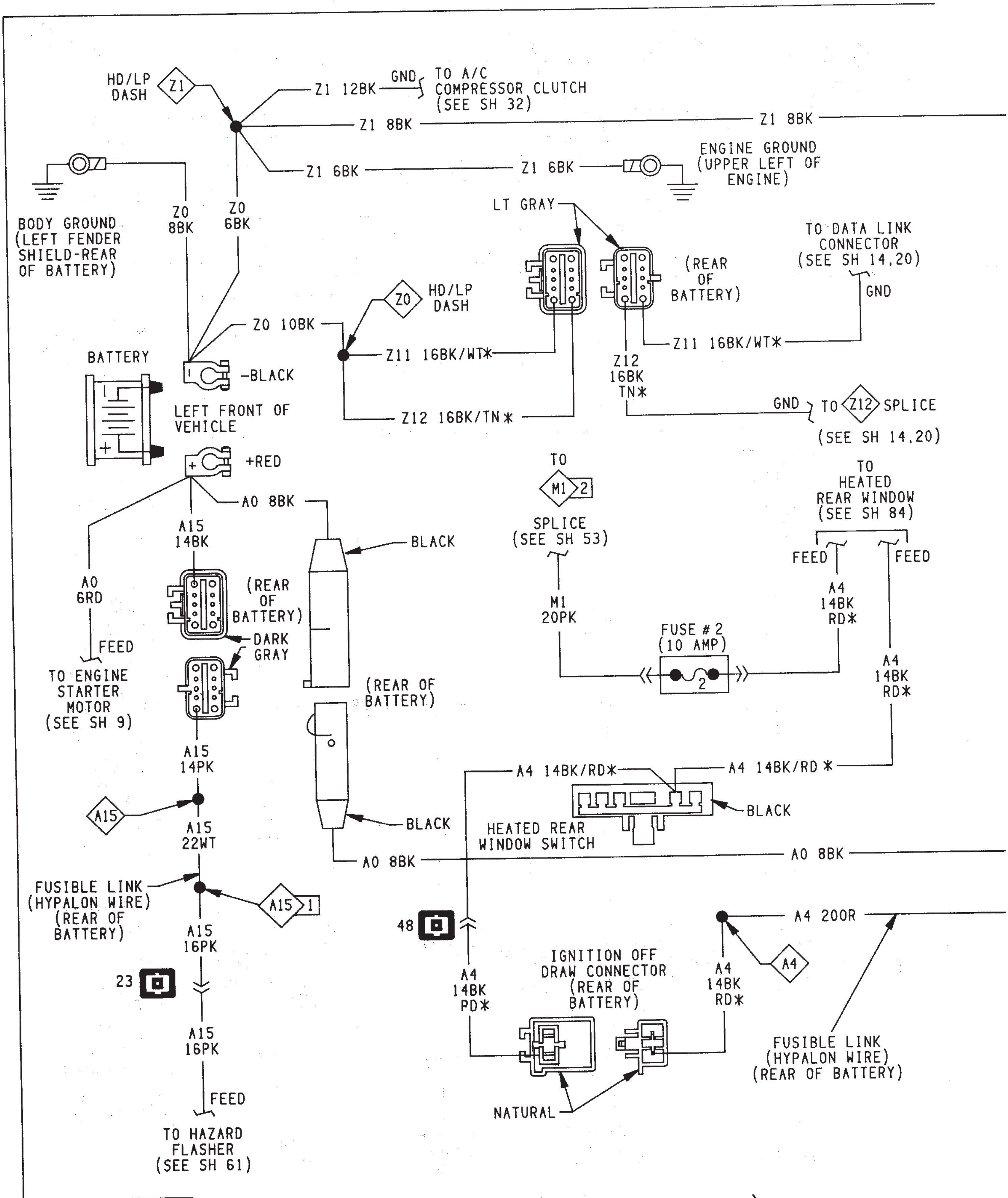
FUSE APPLICATION CHART



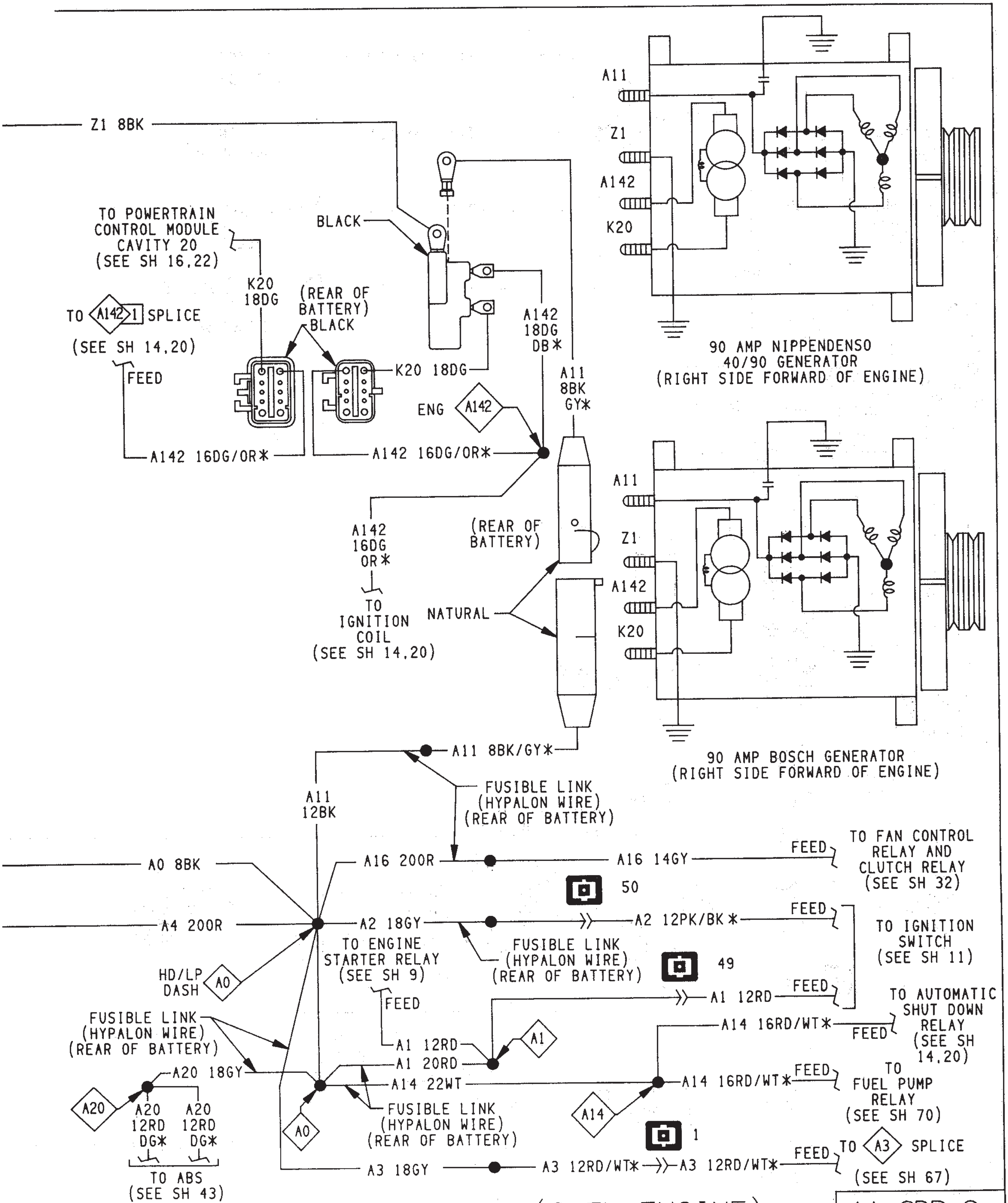
938W-1

FUSE APPLICATION CHART

AA-CDP 4



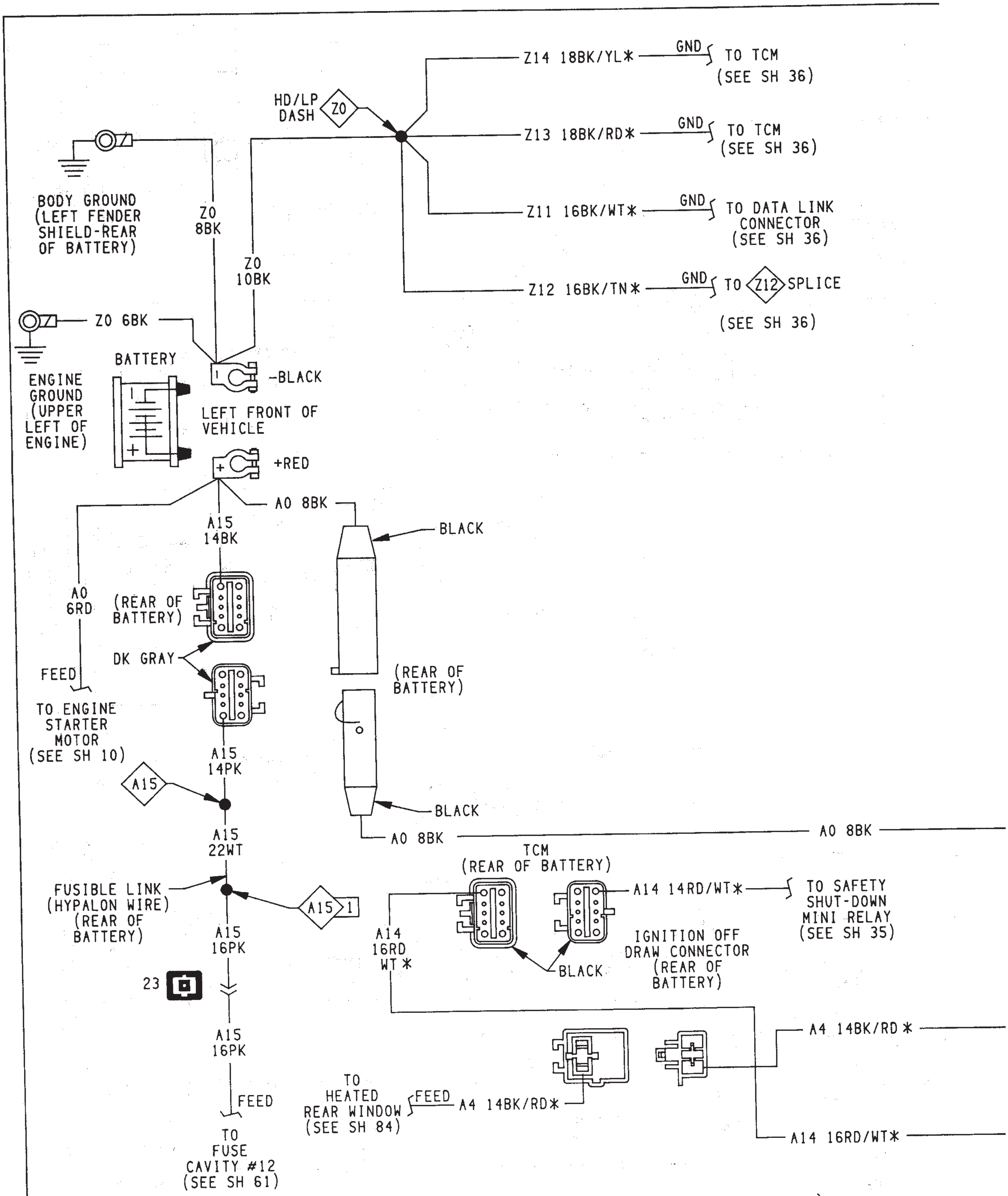
AA-CDP 5	CHARGING SYSTEM (2.5L ENGINE)	938W-1



938W-1

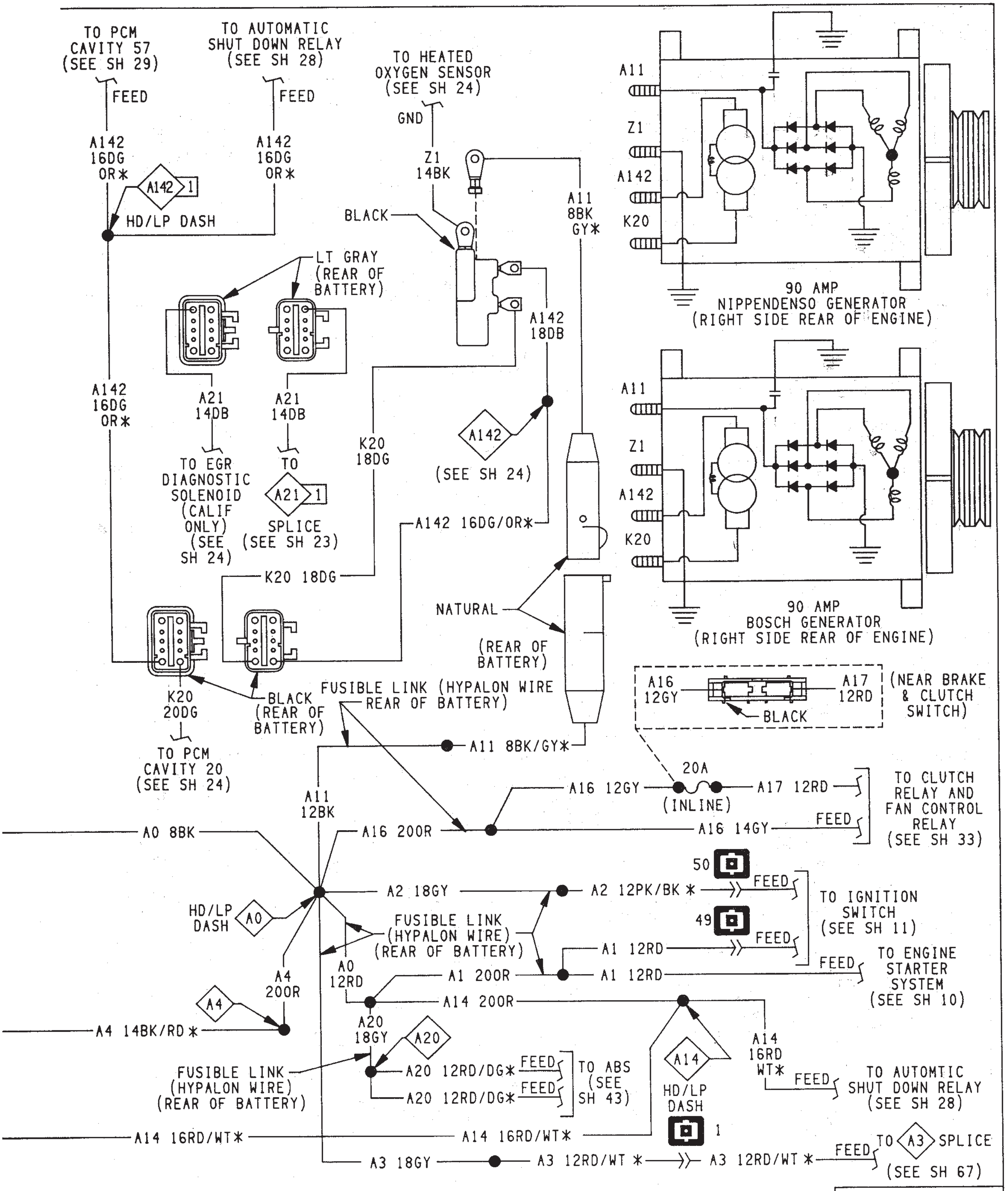
CHARGING SYSTEM (2.5L ENGINE)

AA-CDP 6



CHARGING SYSTEM (3.0L ENGINE)

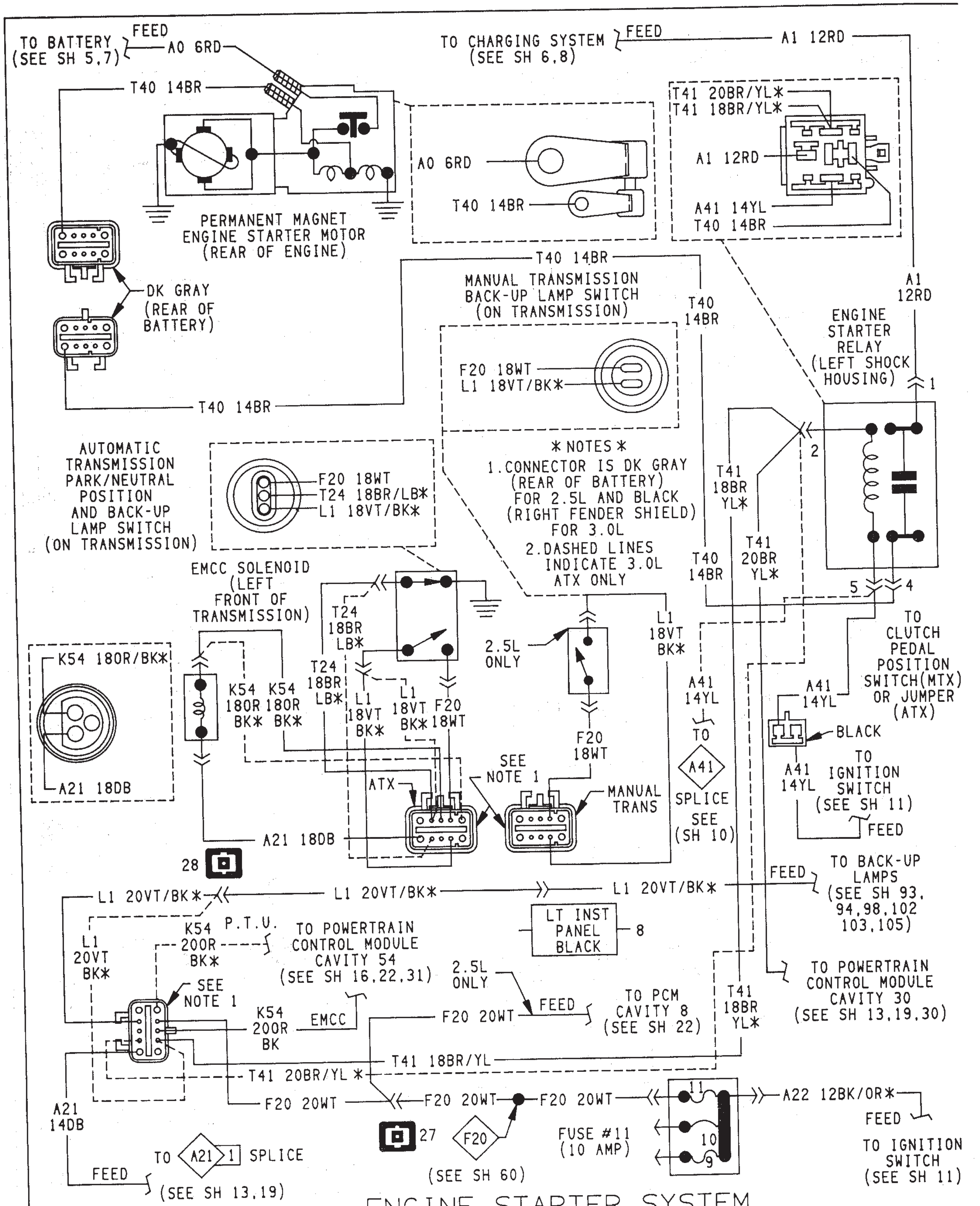
938W-1



938W-1

CHARGING SYSTEM (3.0L ENGINE)

AA-CDP 8

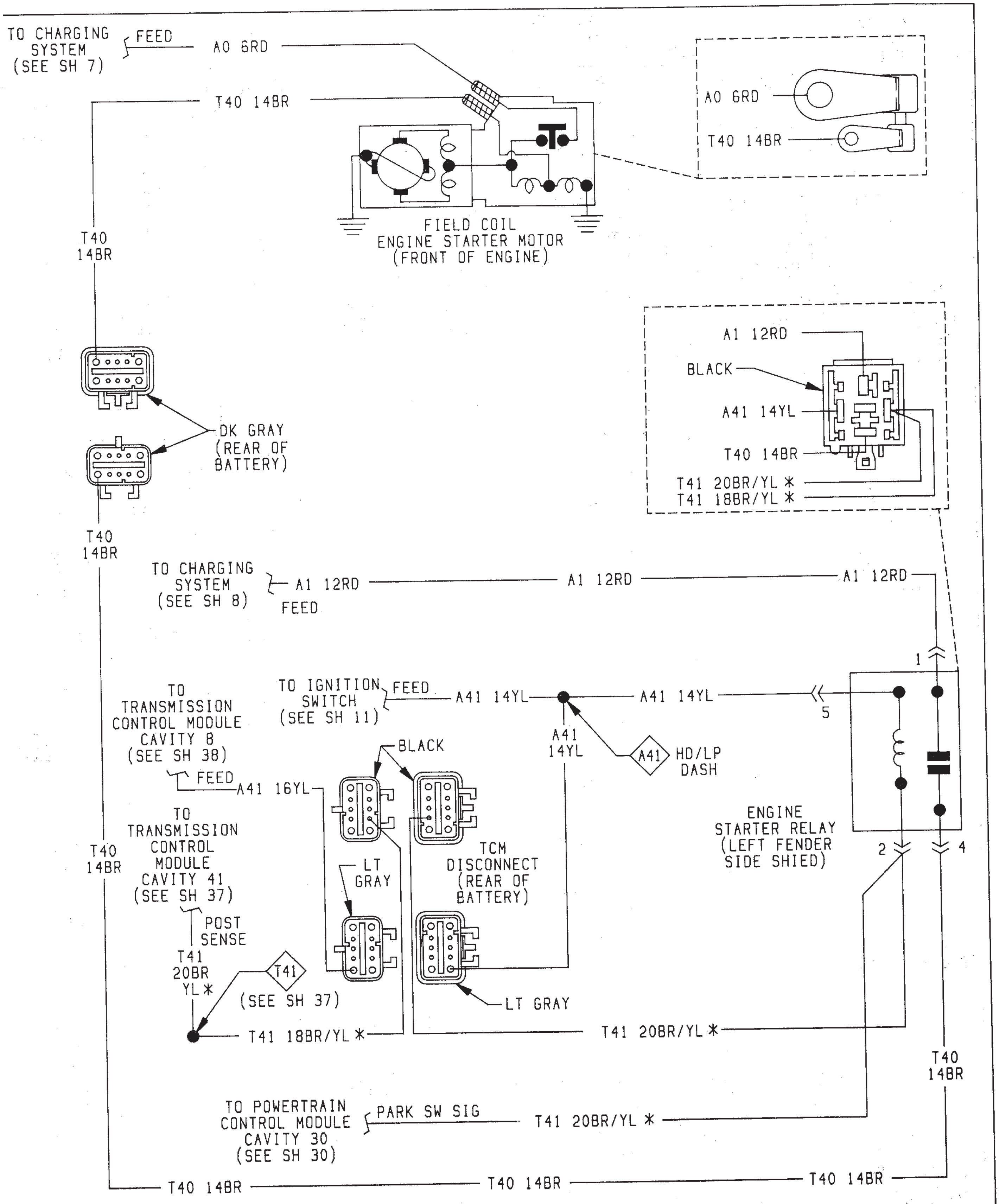


NOTES
1. CONNECTOR IS DK GRAY (REAR OF BATTERY) FOR 2.5L AND BLACK (RIGHT FENDER SHIELD) FOR 3.0L
2. DASHED LINES INDICATE 3.0L ATX ONLY

ENGINE STARTER SYSTEM
(2.5L ENGINE & 3.0L ENGINE ATX)

AA-CDP 9

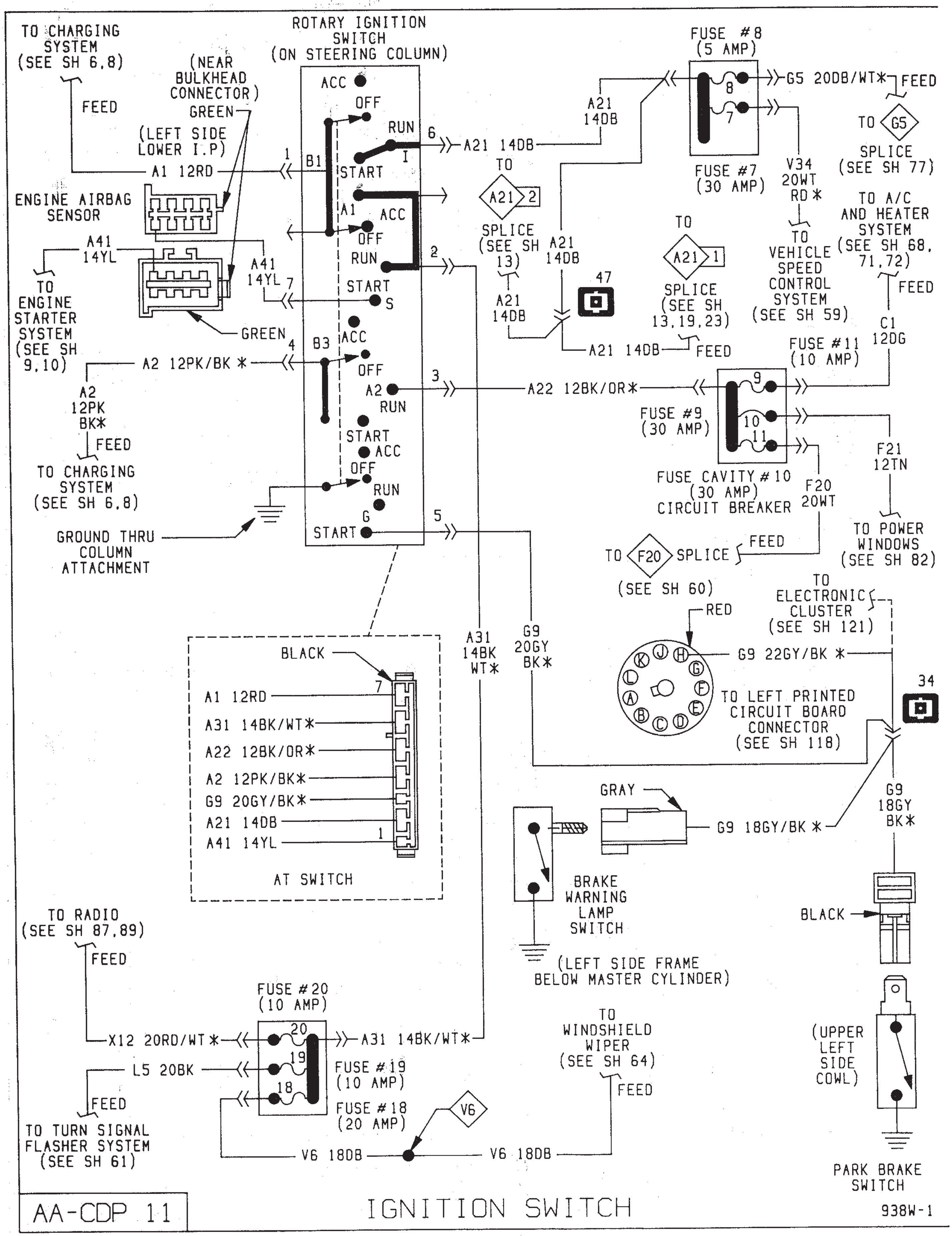
938W-1



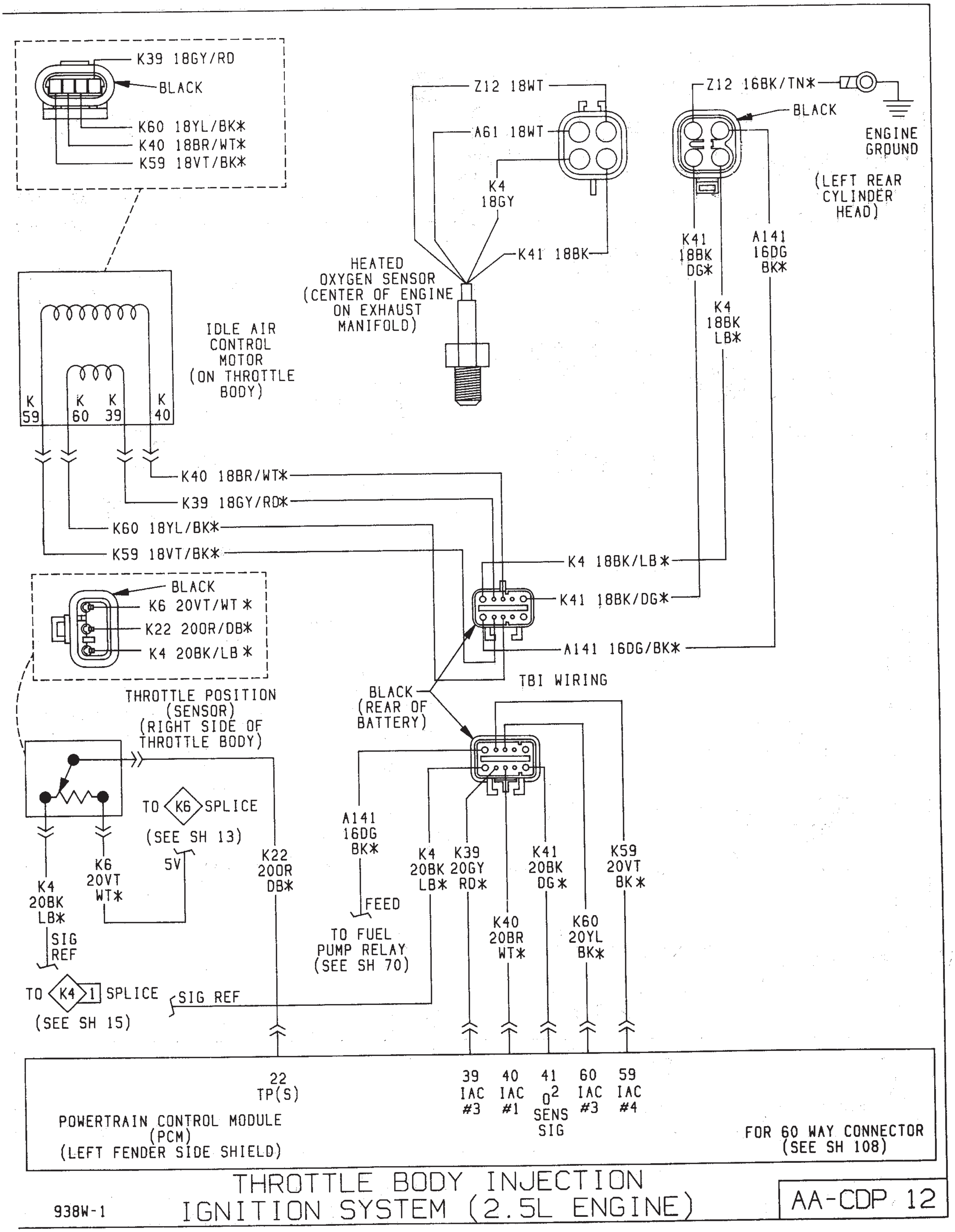
ENGINE STARTER SYSTEM
(3.0L ENGINE EATX)

AA-CDP 10

938W-1



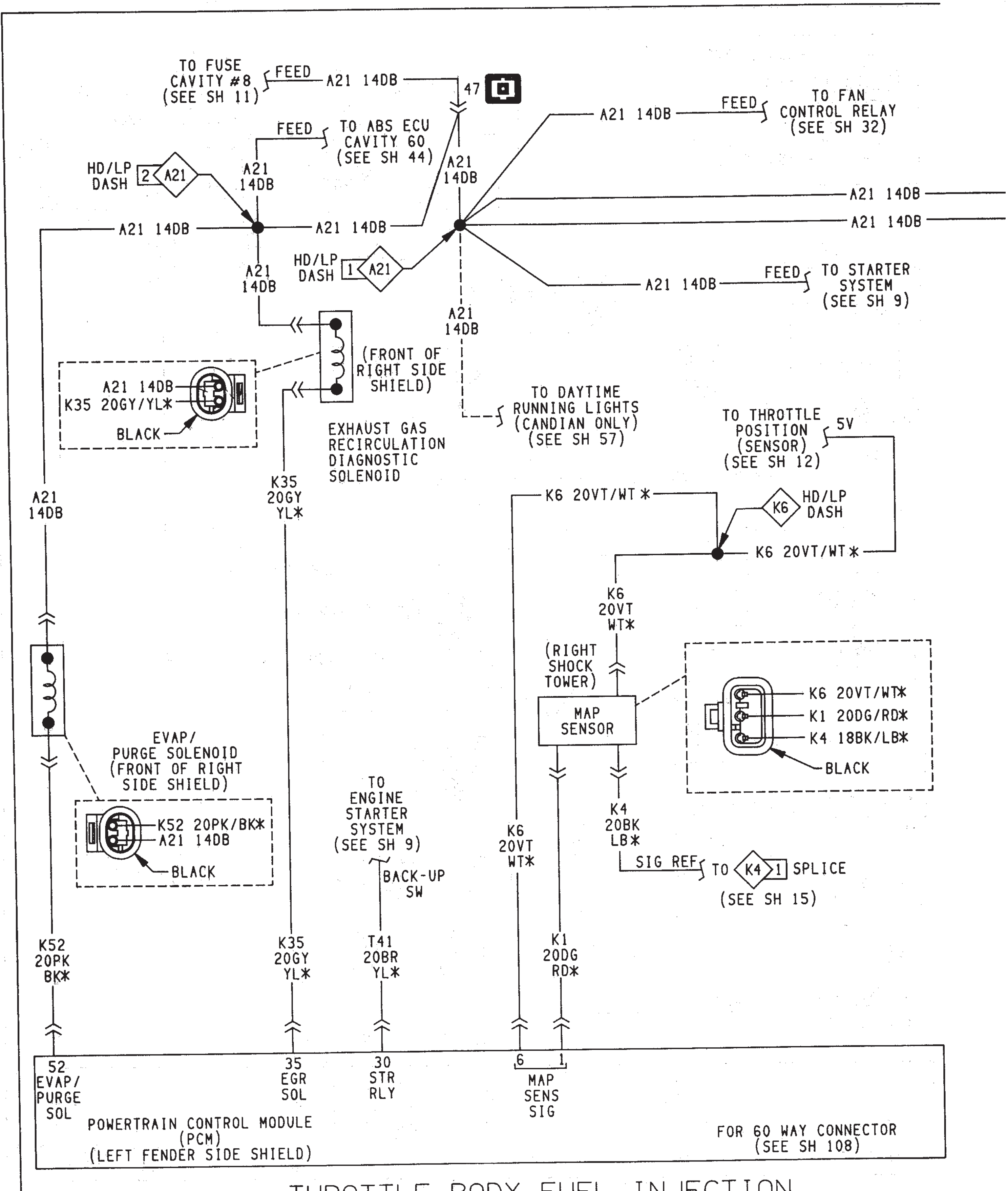
IGNITION SWITCH



THROTTLE BODY INJECTION IGNITION SYSTEM (2.5L ENGINE)

938W-1

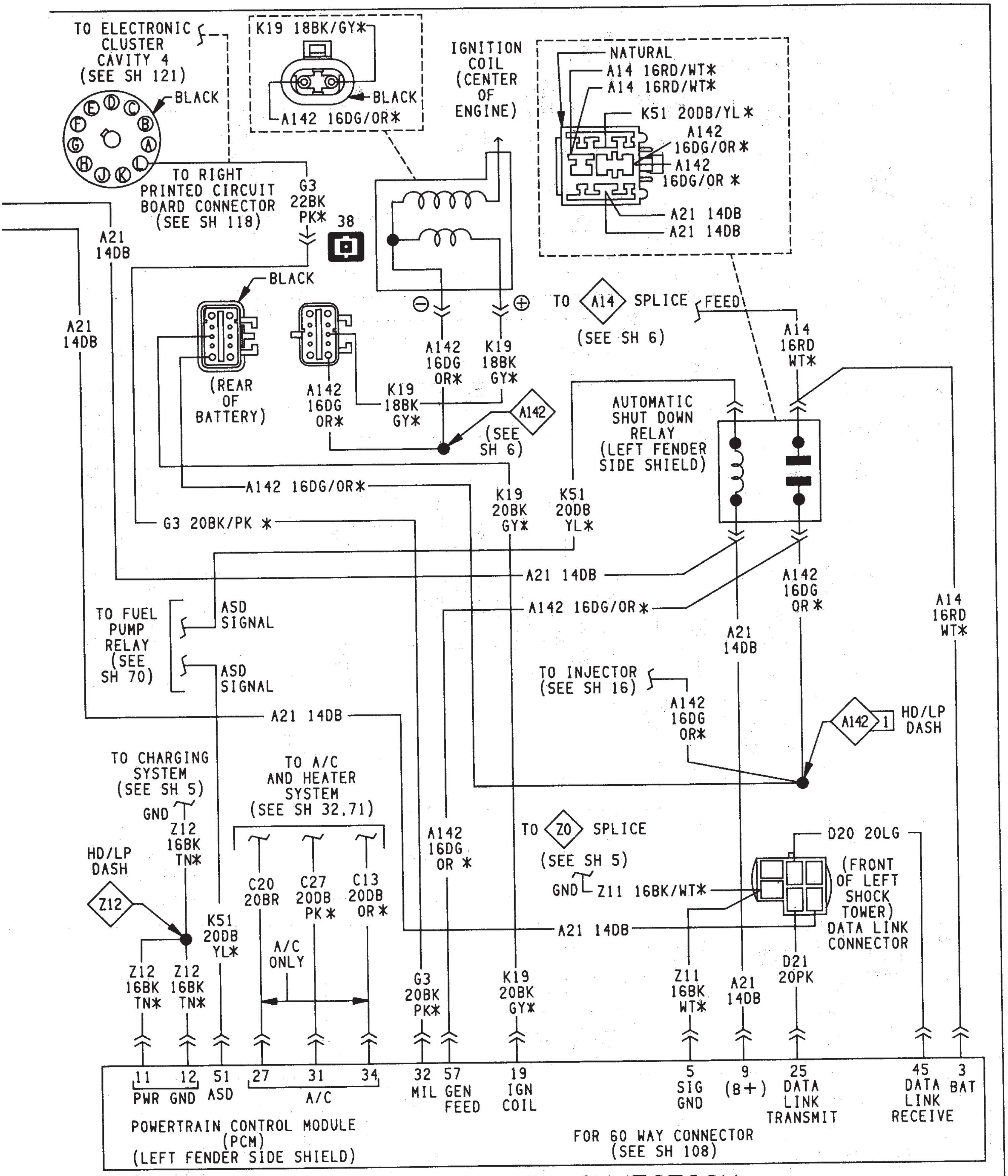
AA-CDP 12



AA-CDP 13

THROTTLE BODY FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

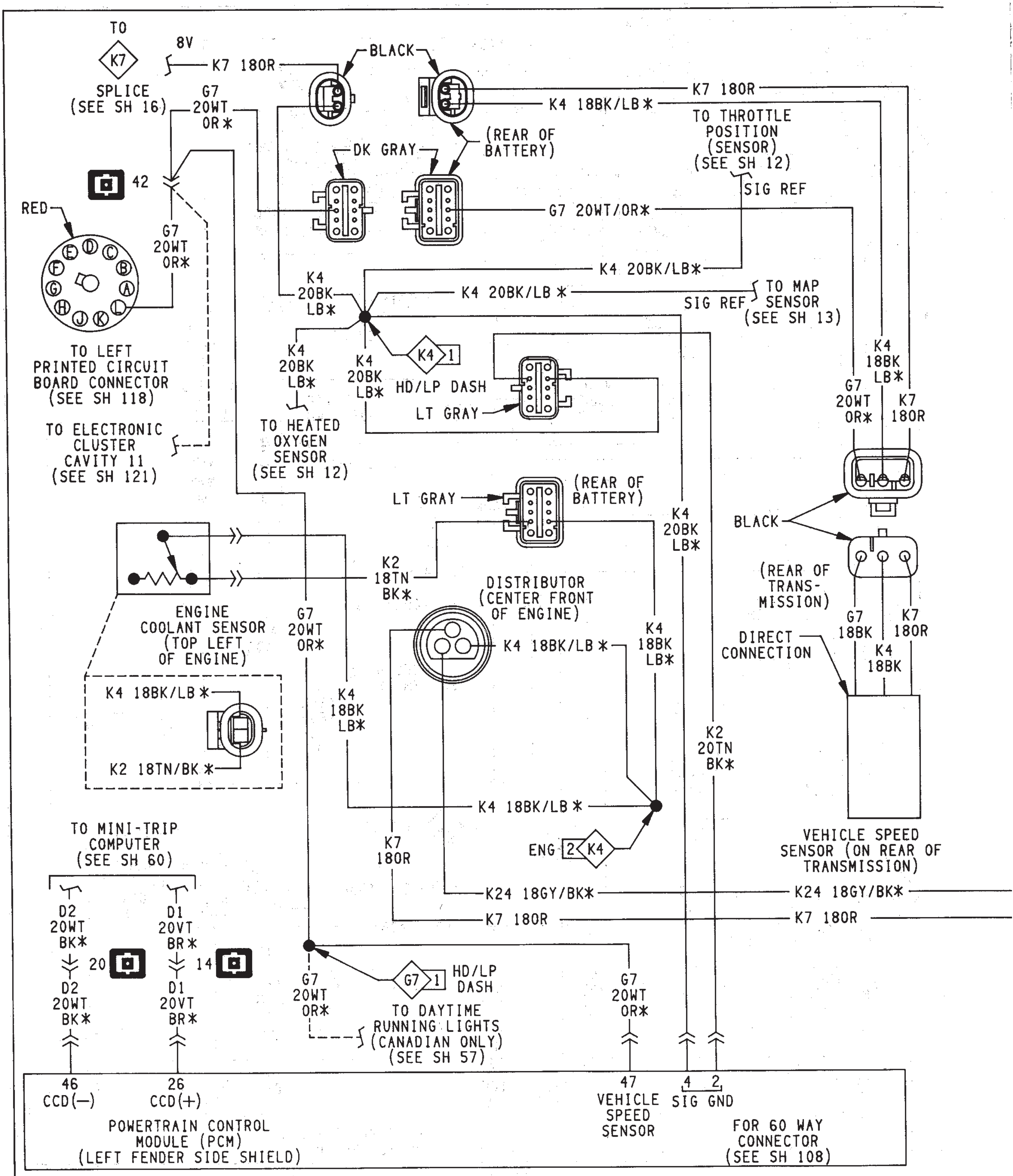
938W-1



THROTTLE BODY FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

AA-CDP 14

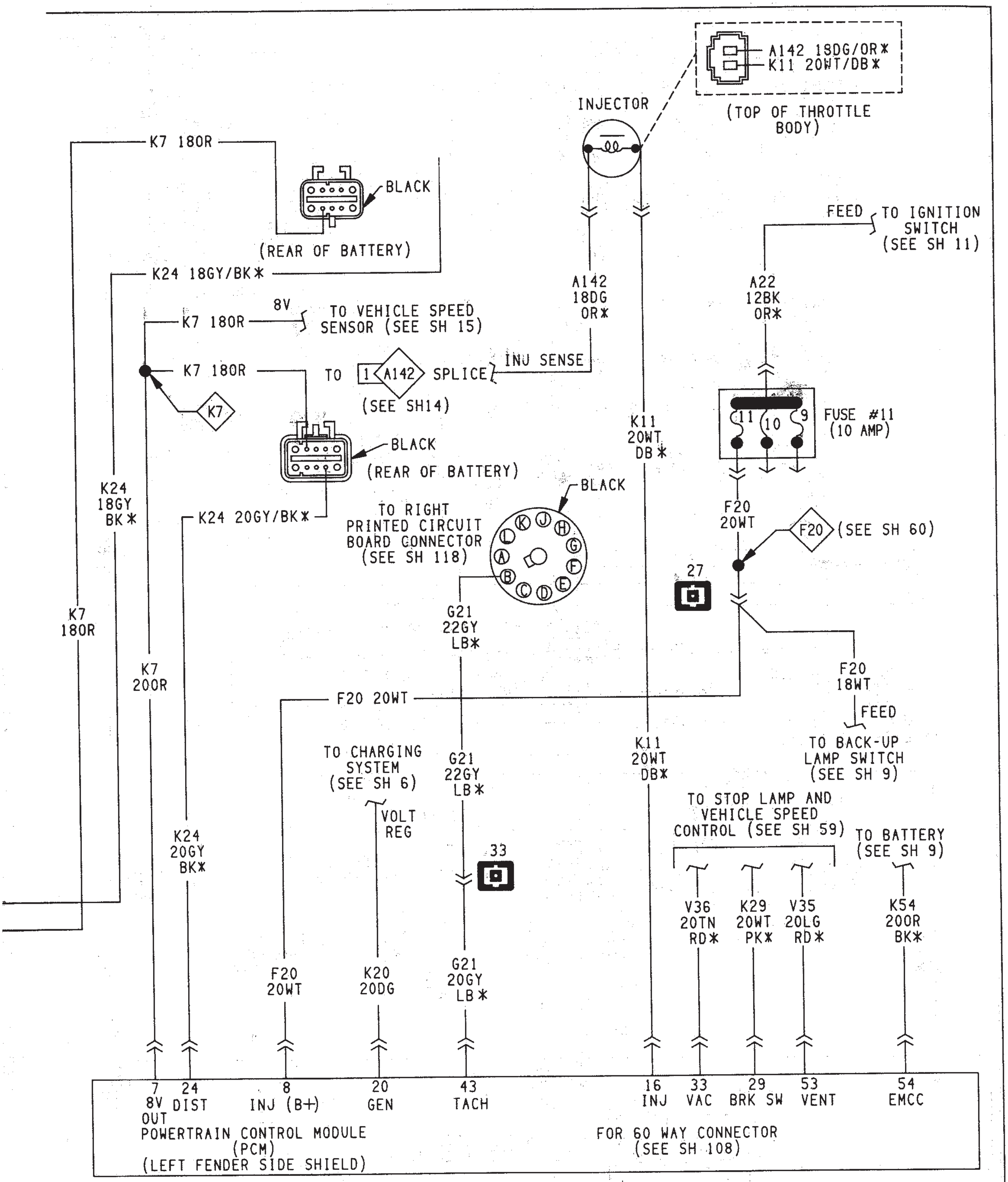
938W-1



AA-CDP 15

THROTTLE BODY FUEL INJECTION IGNITION SYSTEM (2.5L ENGINE)

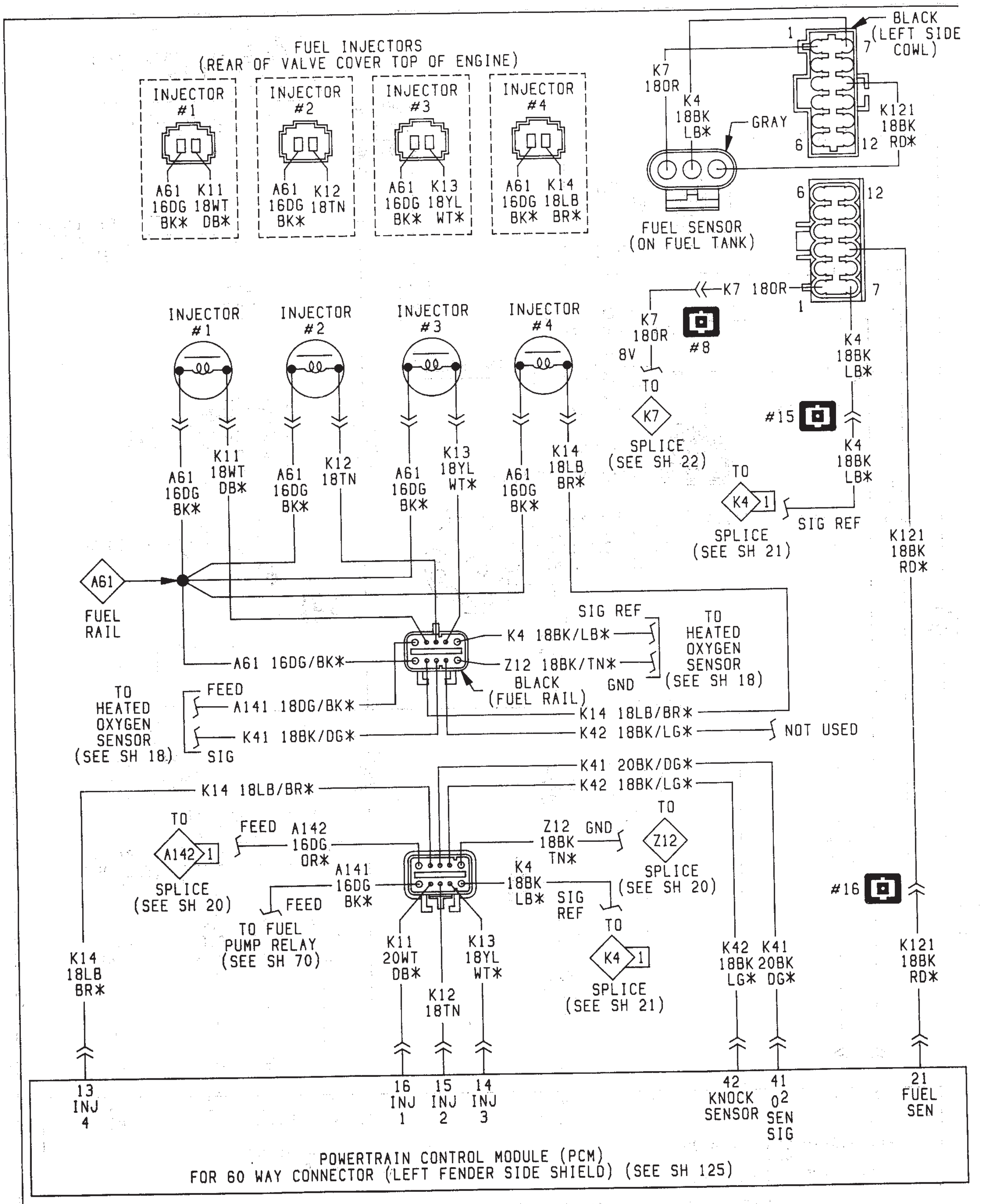
938W-1



THROTTLE BODY FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

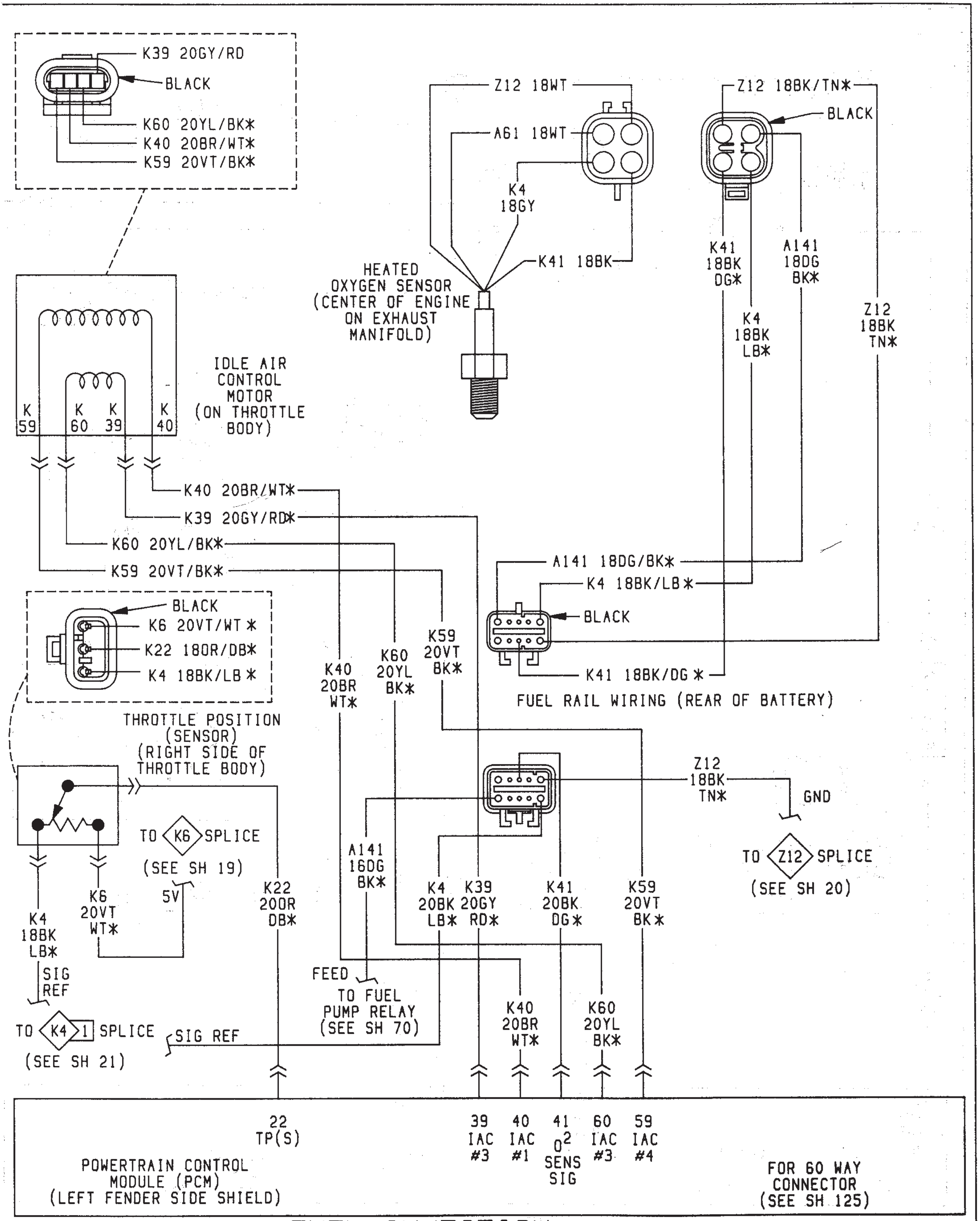
938W-1

AA-CDP 16



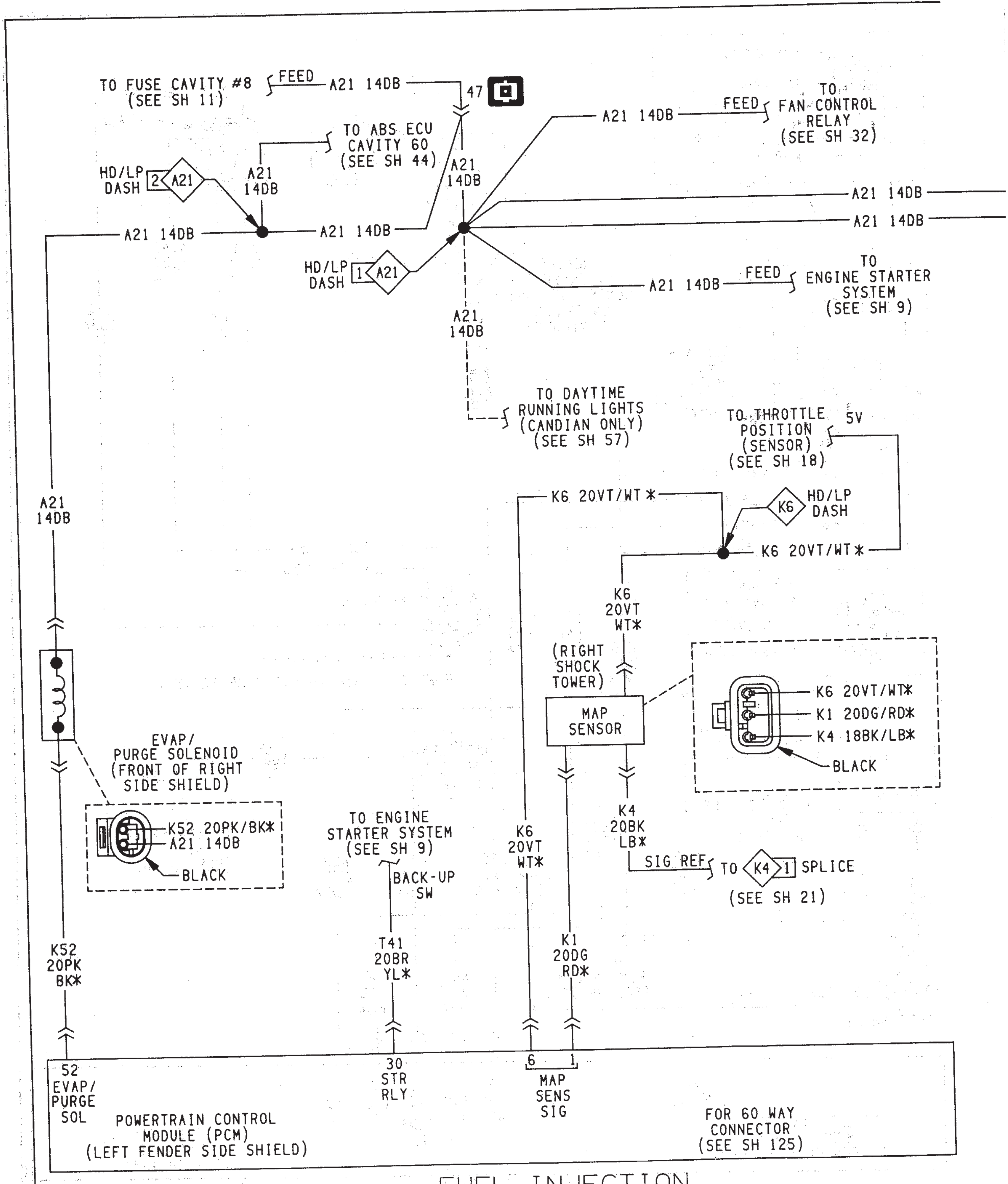
FUEL INJECTION

AA-CDP 17 IGNITION SYSTEM FLEX FUEL (2.5L ENGINE) 938W-1



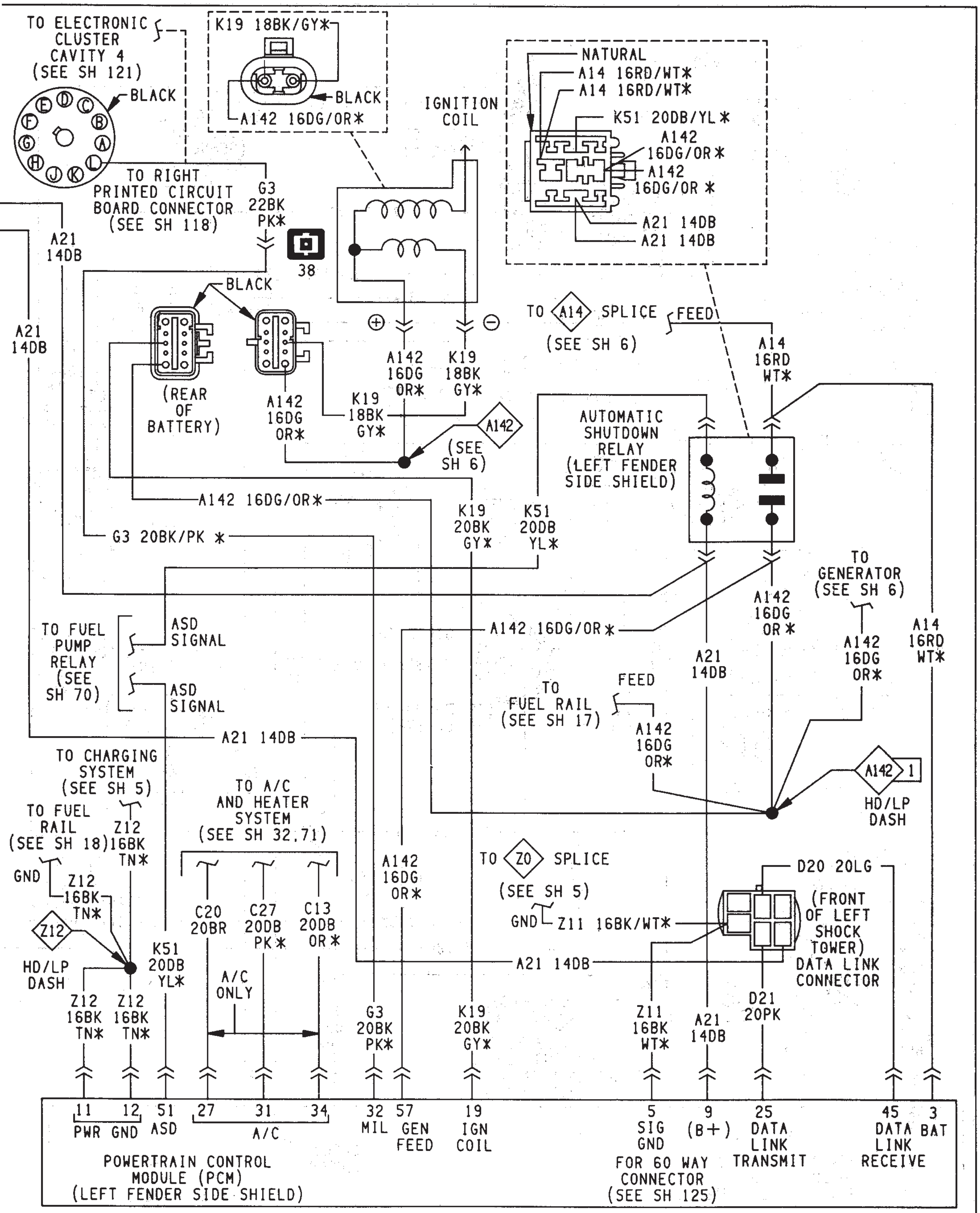
FUEL INJECTION

938W-1 IGNITION SYSTEM FLEX FUEL (2.5L ENGINE) AA-CDP 18



FUEL INJECTION

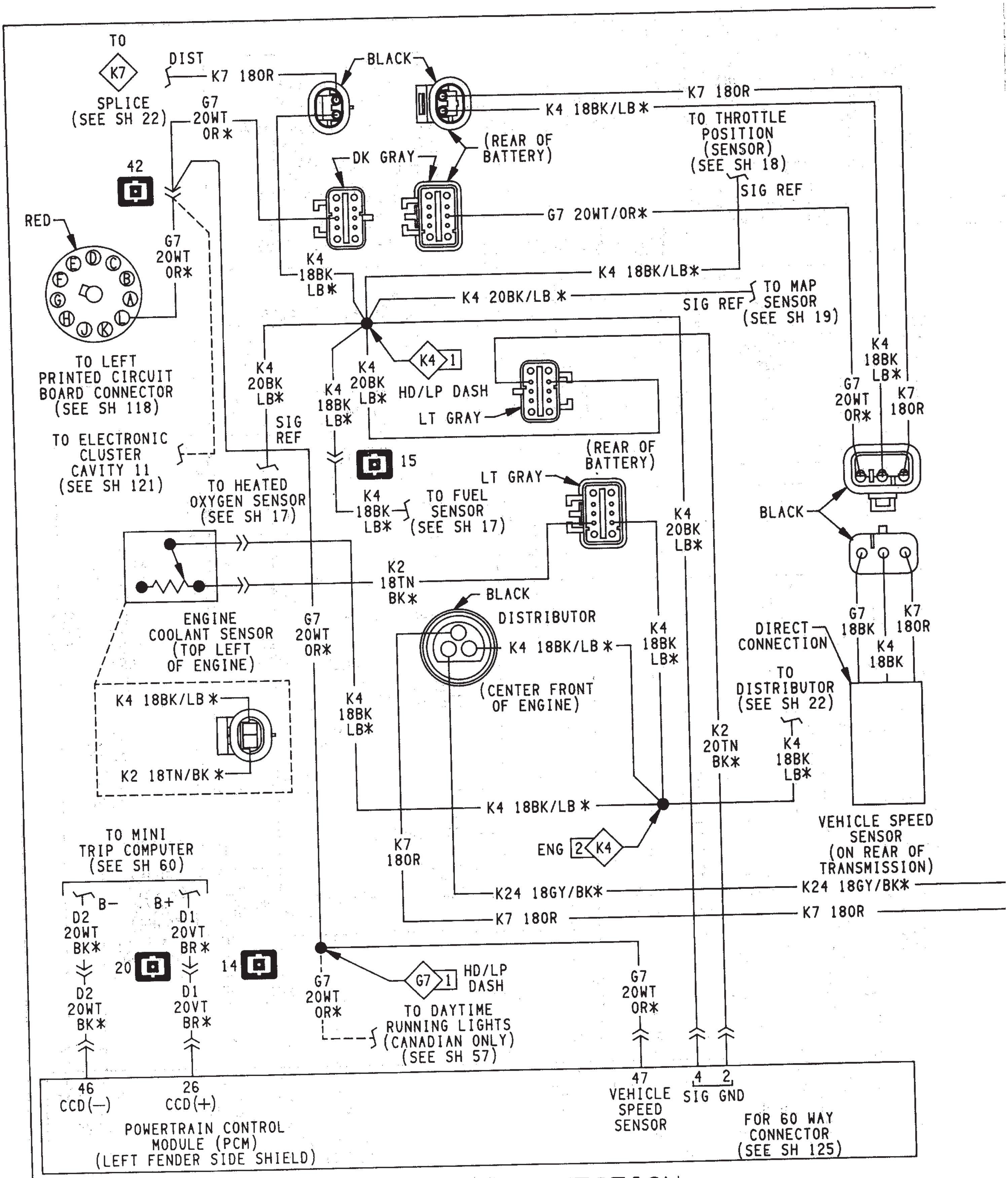
AA-CDP 19 IGNITION SYSTEM FLEX FUEL (2.5L ENGINE) 938W-1



FUEL INJECTION

938W-1 IGNITION SYSTEM FLEX FUEL (2.5L ENGINE)

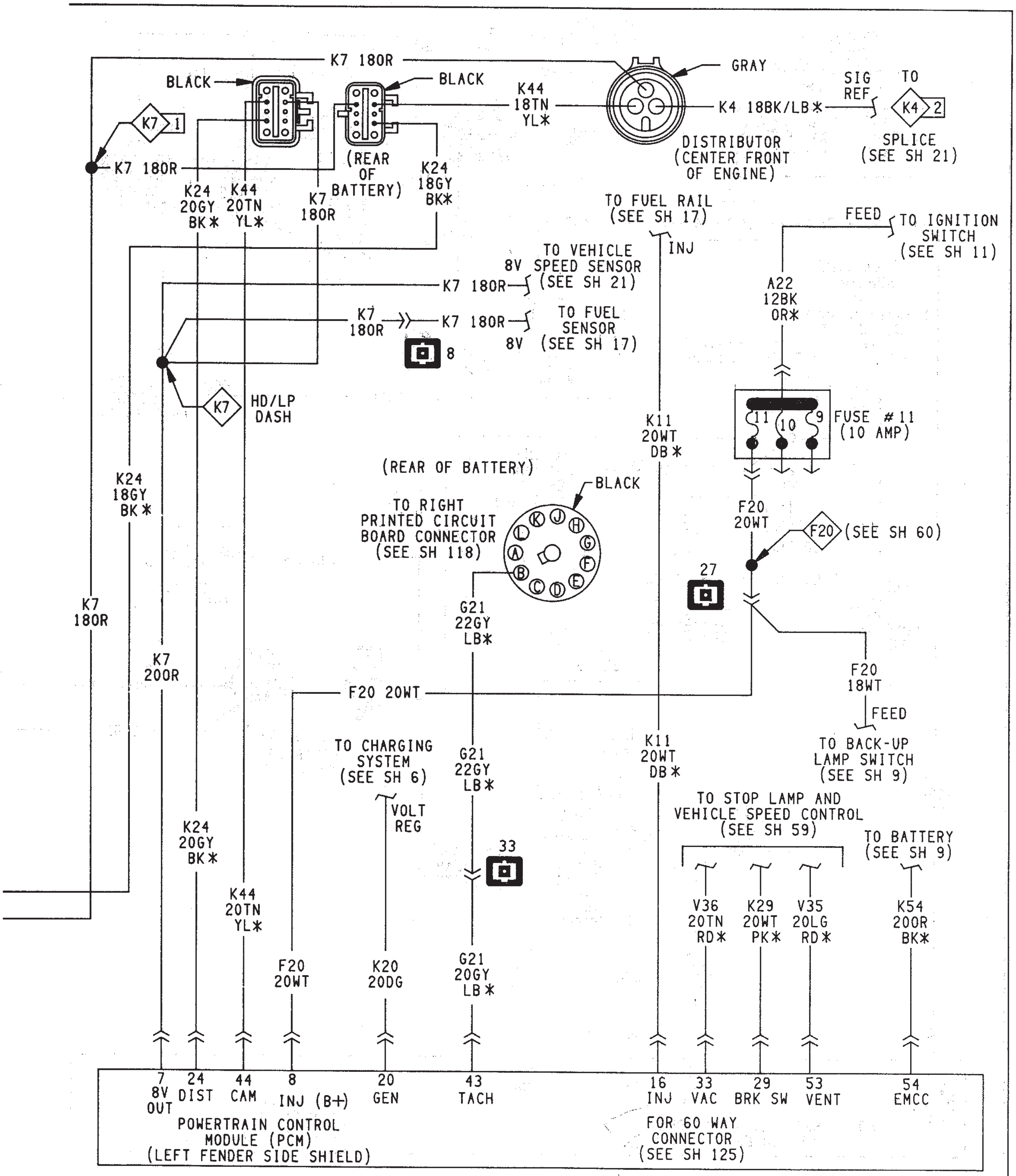
AA-CDP 20



AA-CDP 21

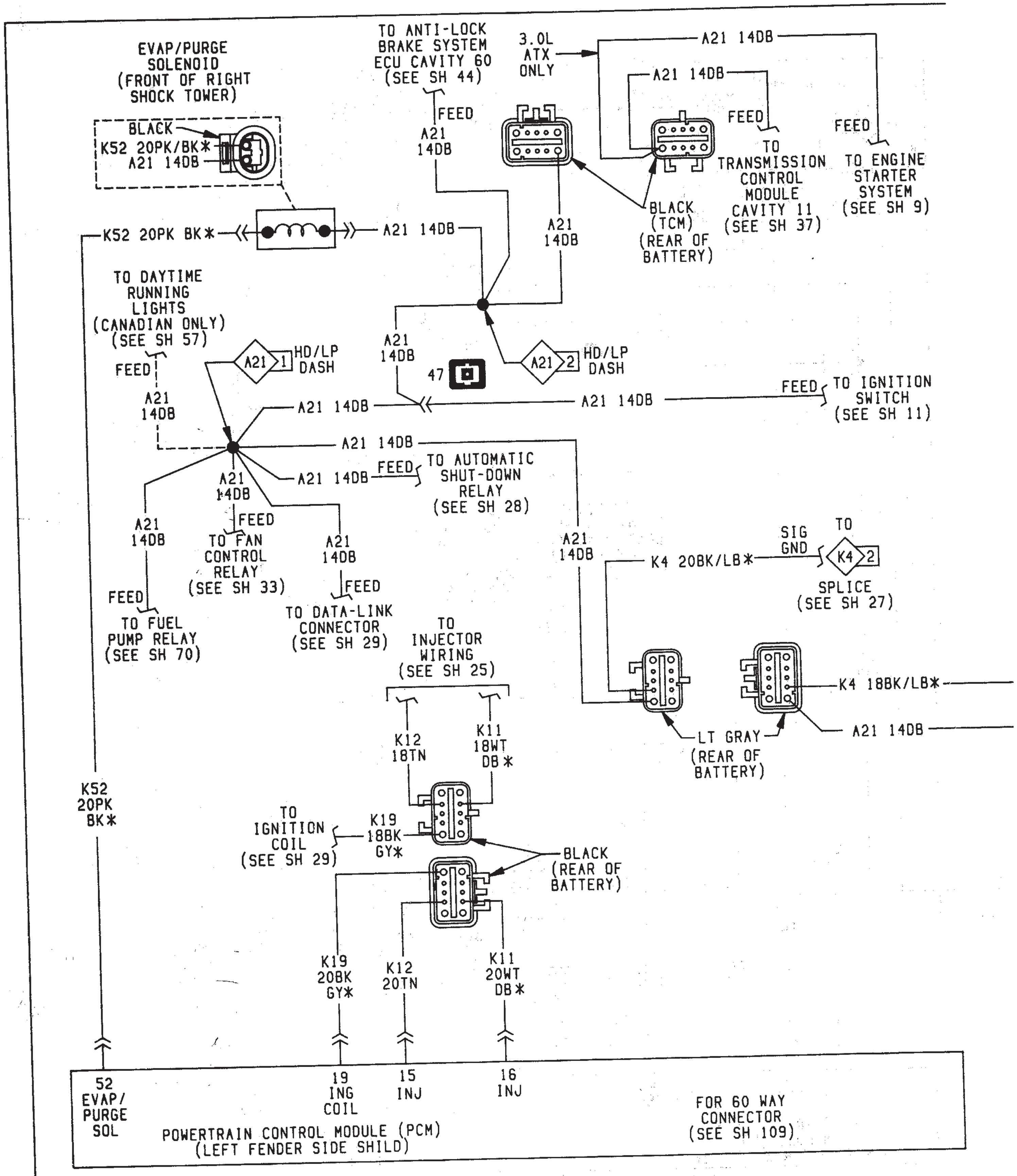
FUEL INJECTION
IGNITION SYSTEM FLEX FUEL (2.5L ENGINE)

938W-1



FUEL INJECTION

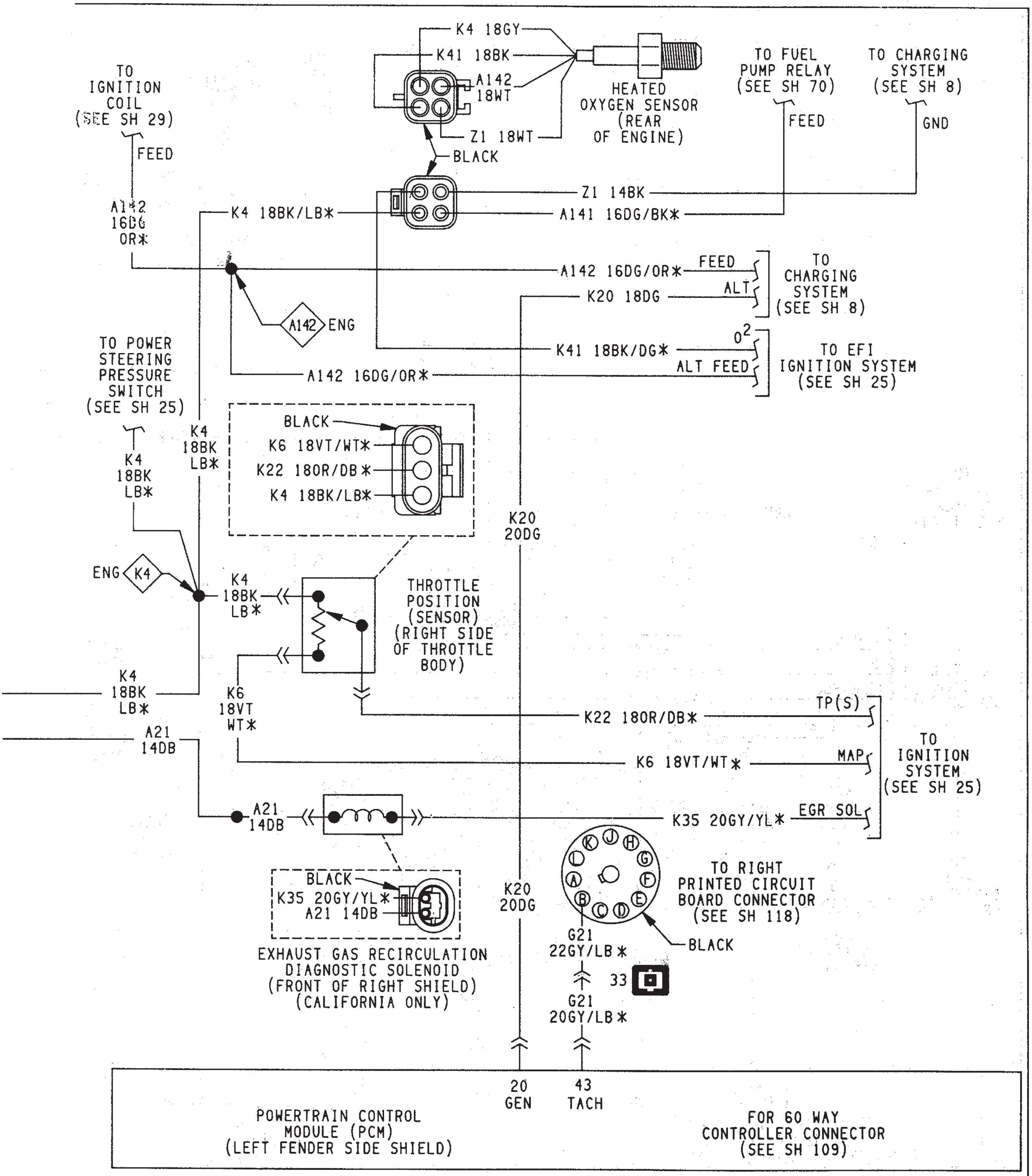
938W-1 IGNITION SYSTEM-FLEX FUEL (2.5L ENGINE) AA-CDP 22



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

AA-CDP 23

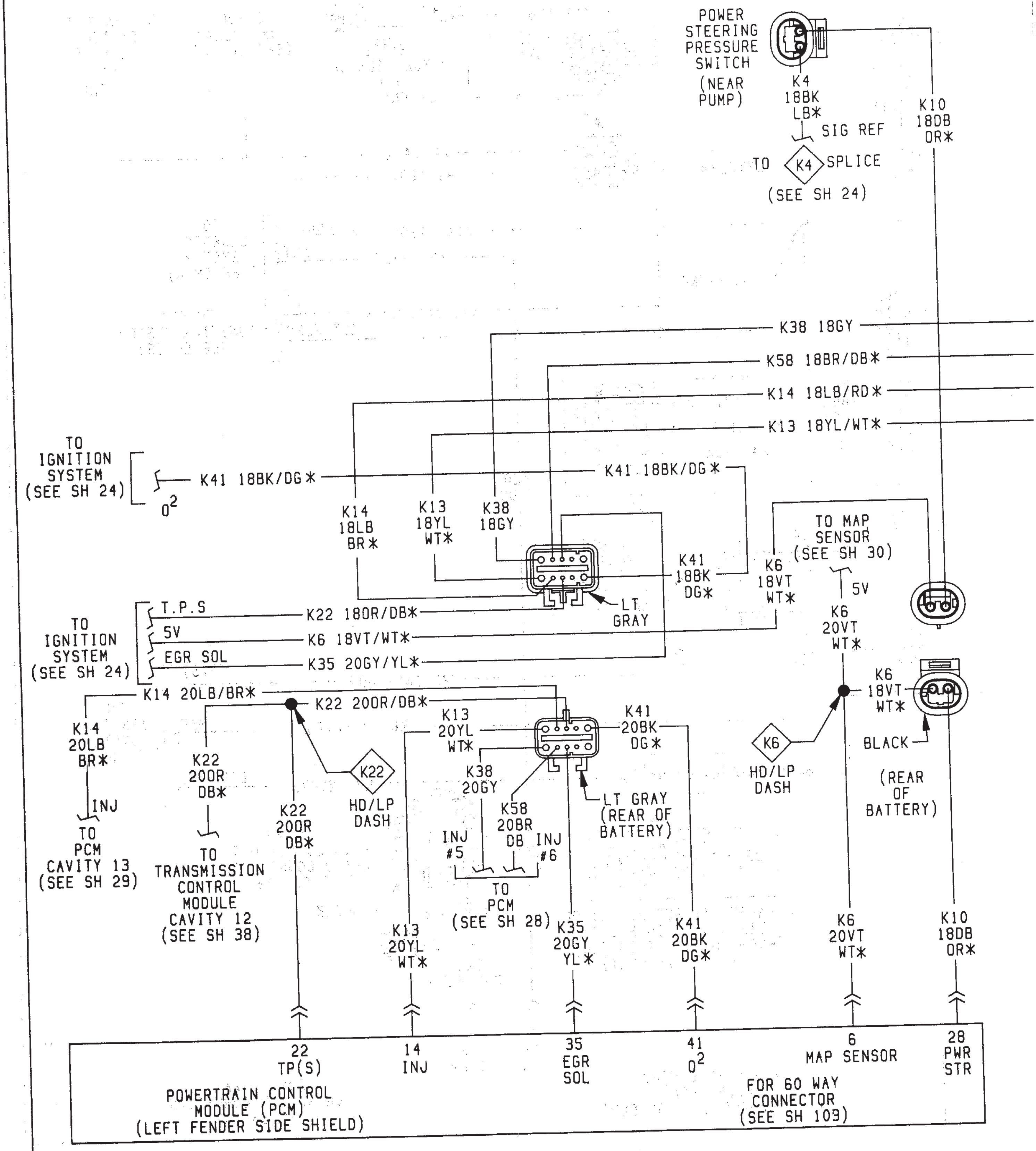
938W-1



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-1

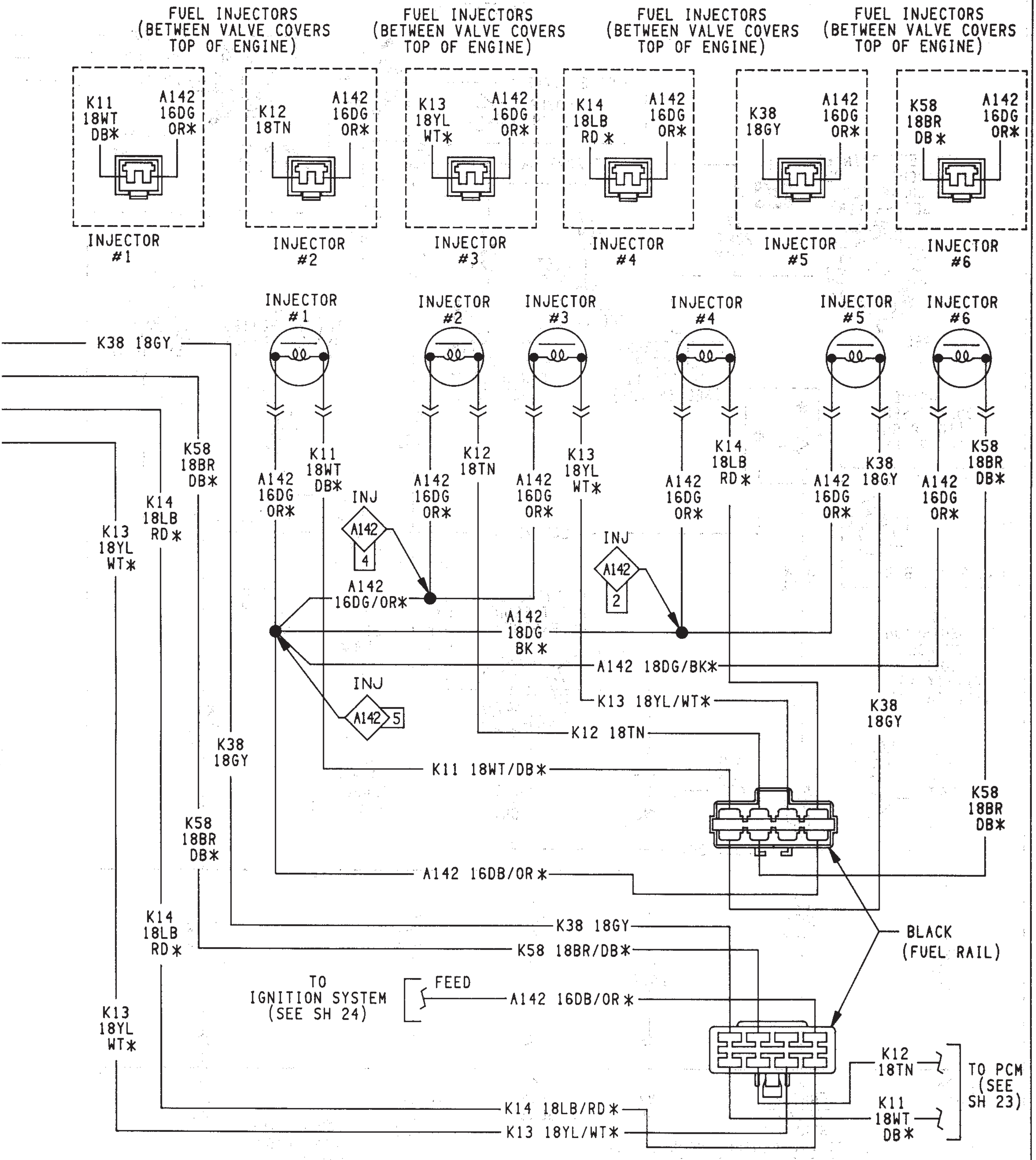
AA-CDP 24



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

AA-CDP 25

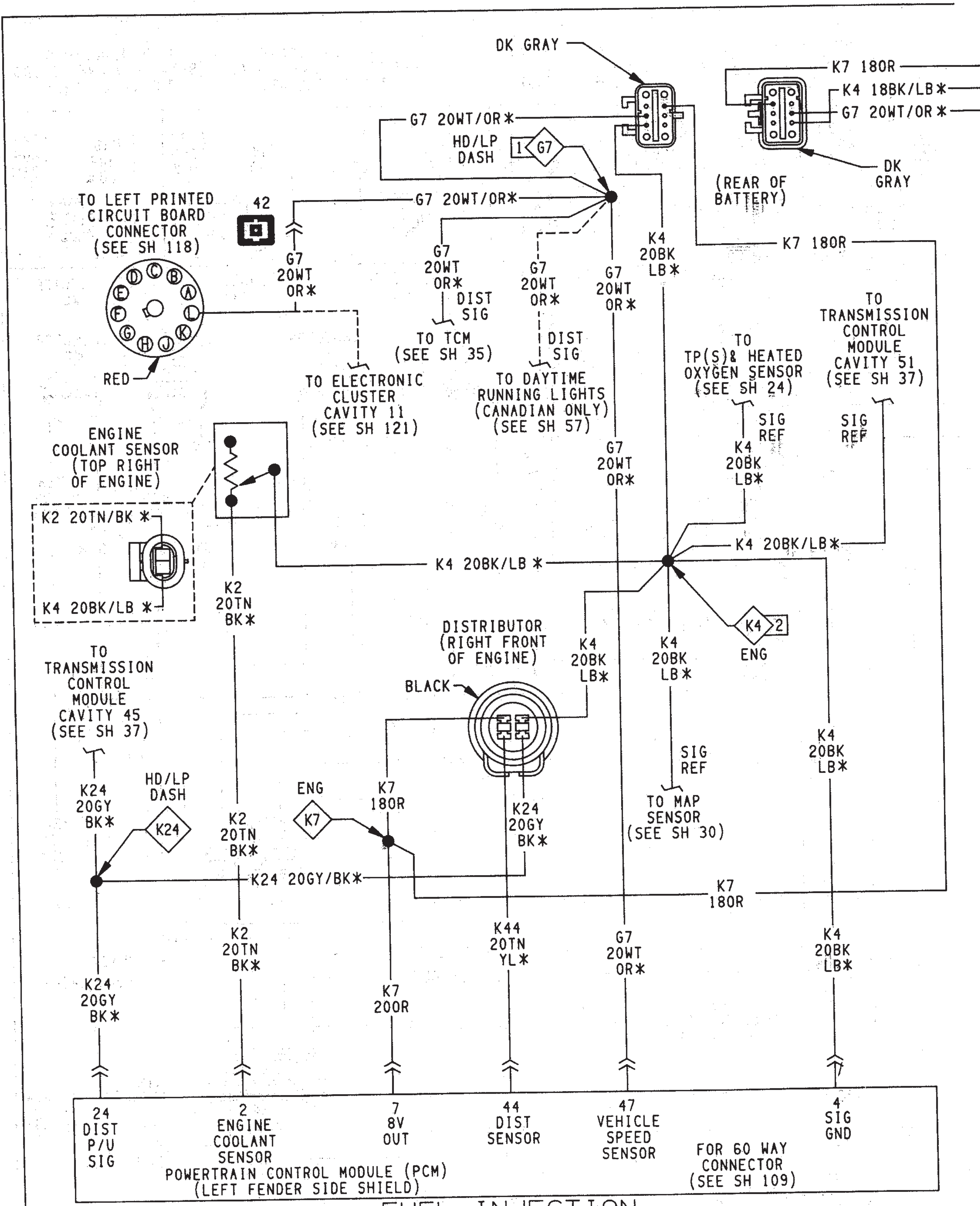
938W-1



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-1

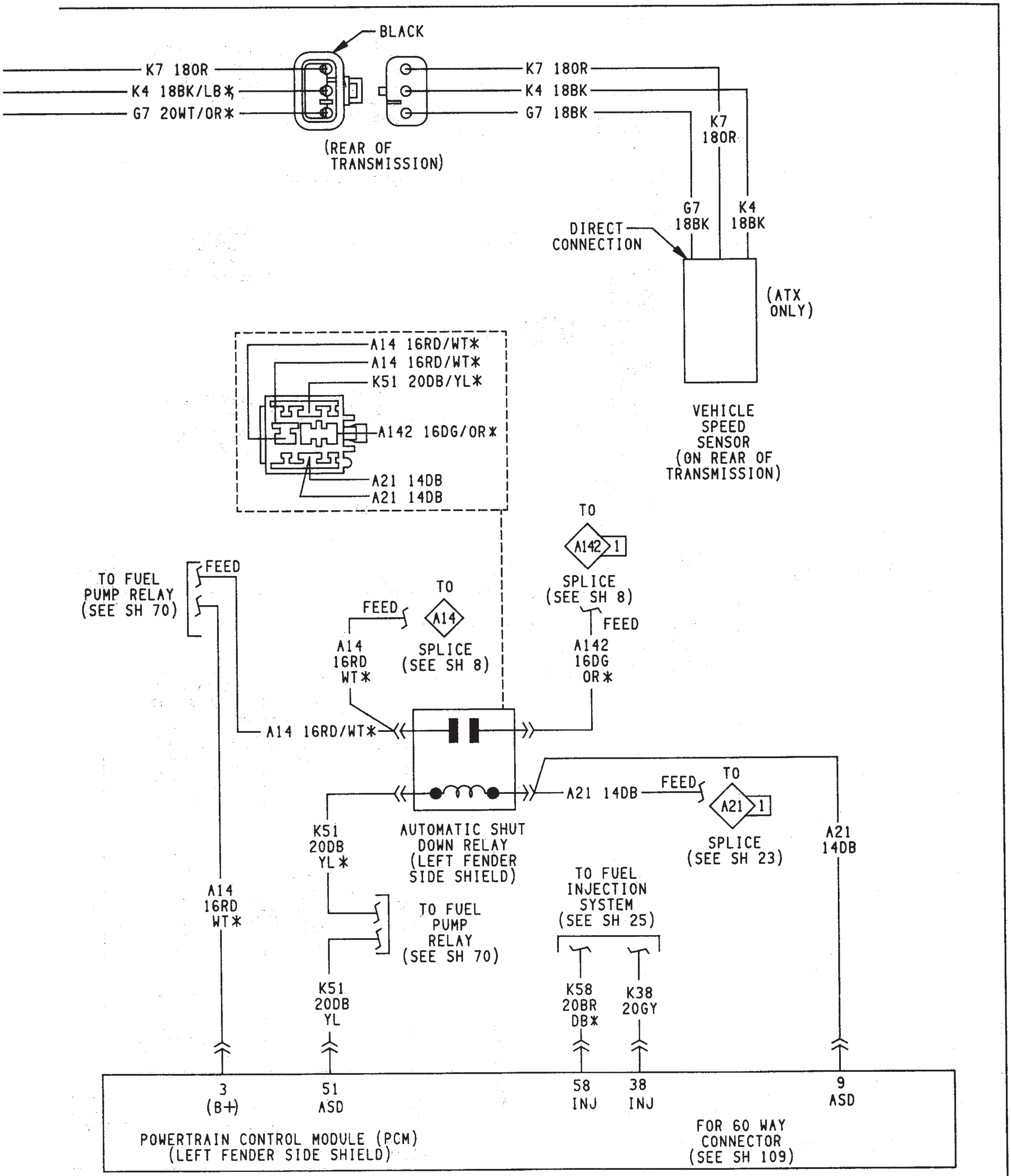
AA-CDP 26



AA-CDP 27

FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

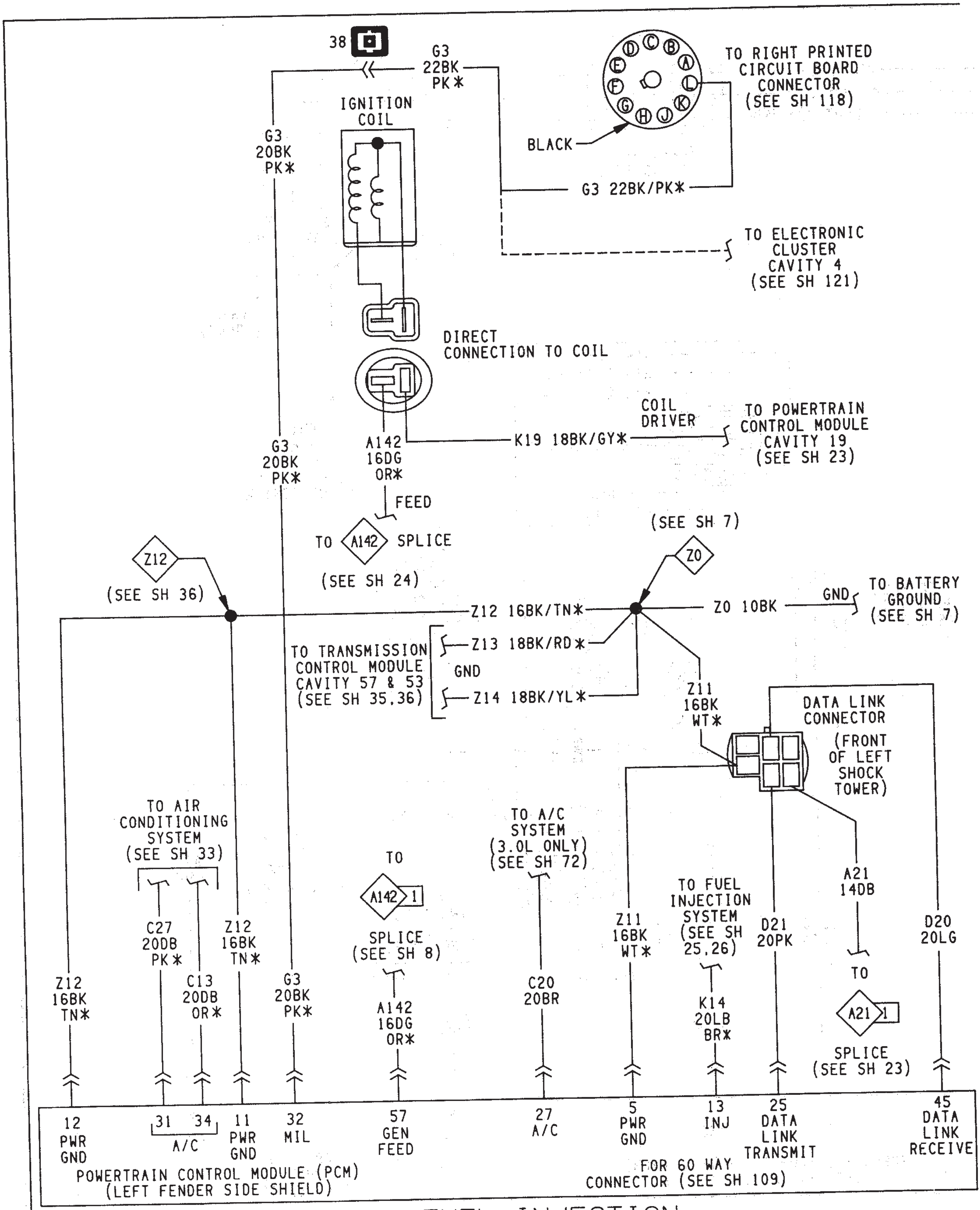
938W-1



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-1

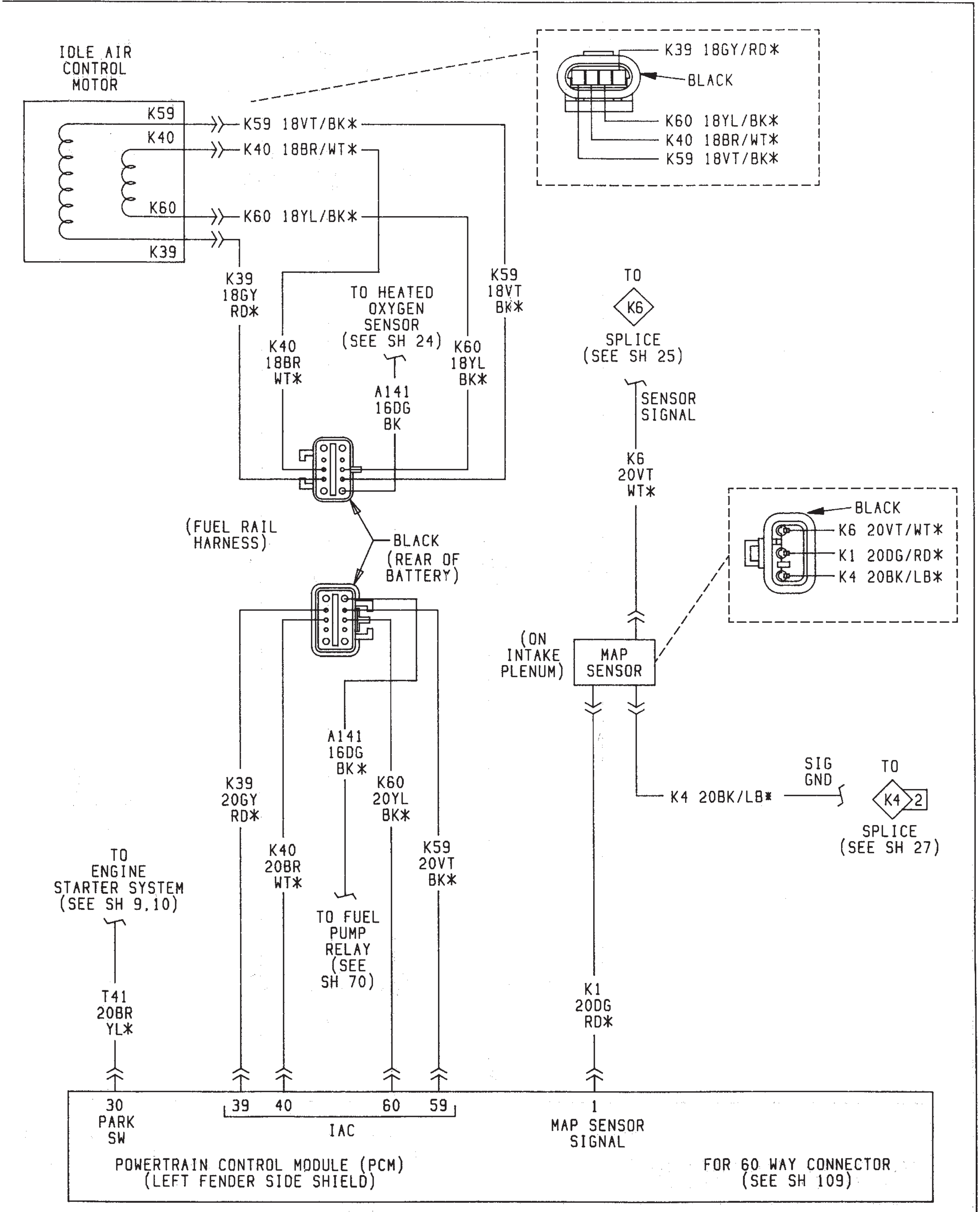
AA-CDP 28



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

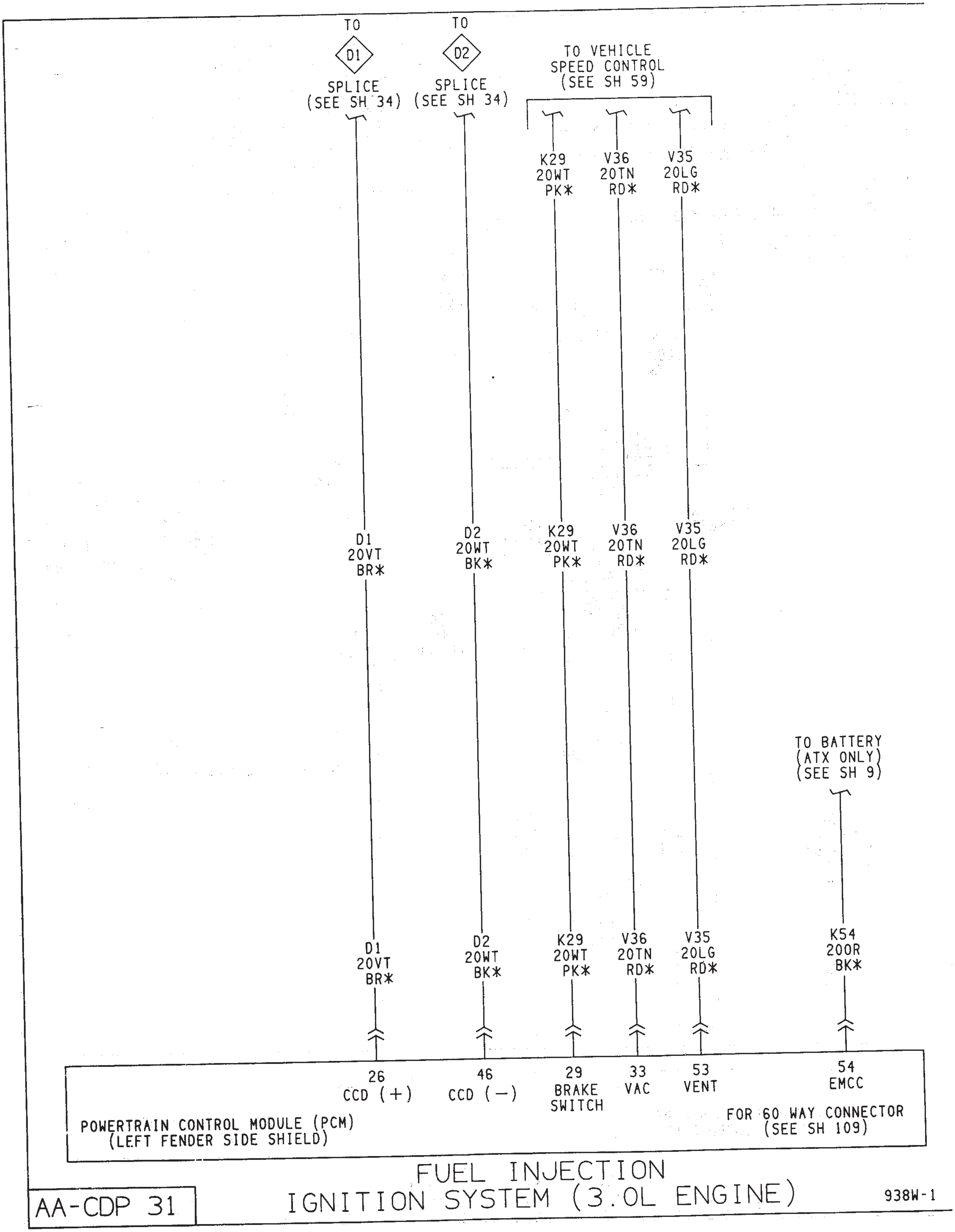
AA-CDP 29

938W-1



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

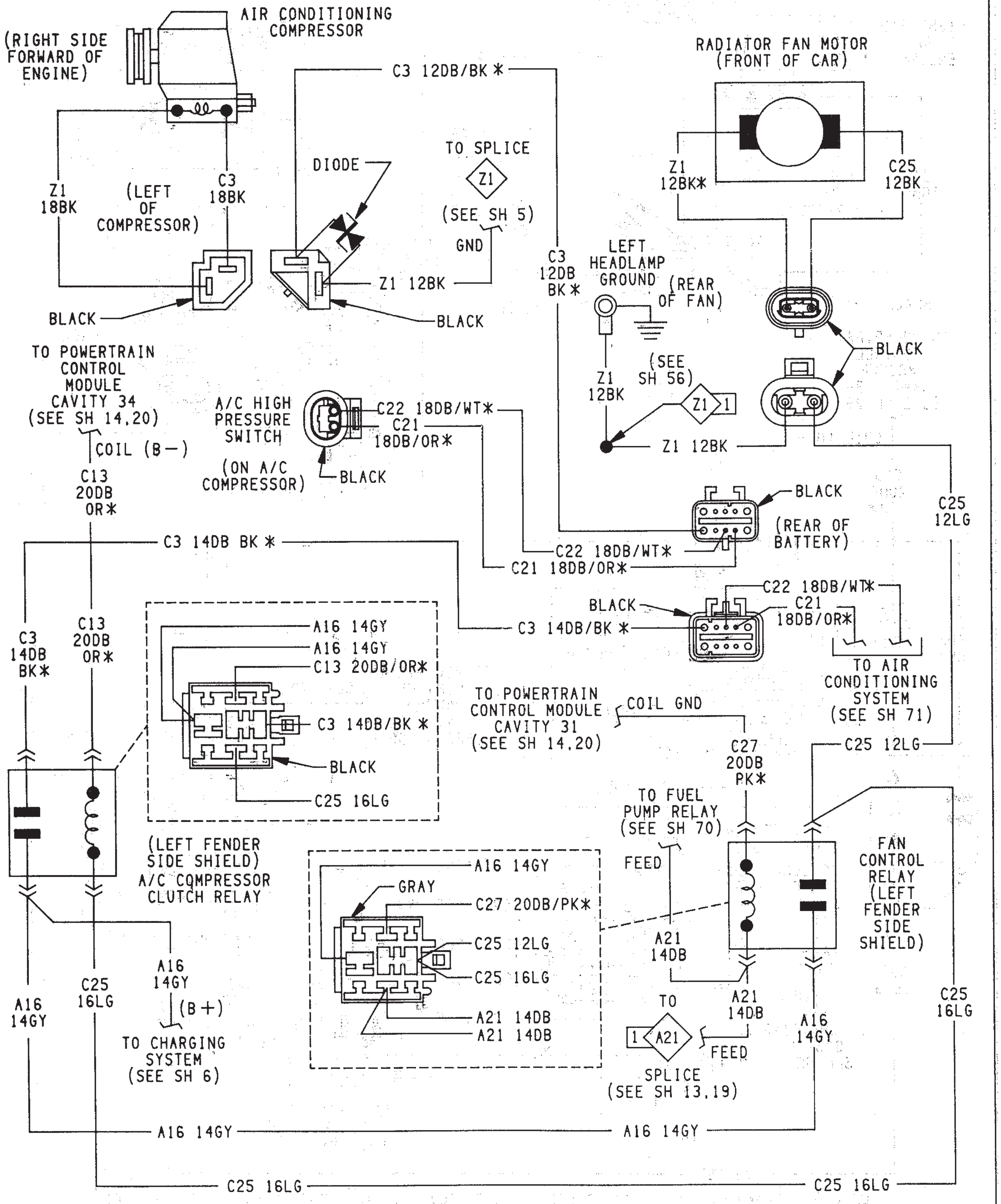
AA-CDP 30



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

AA-CDP 31

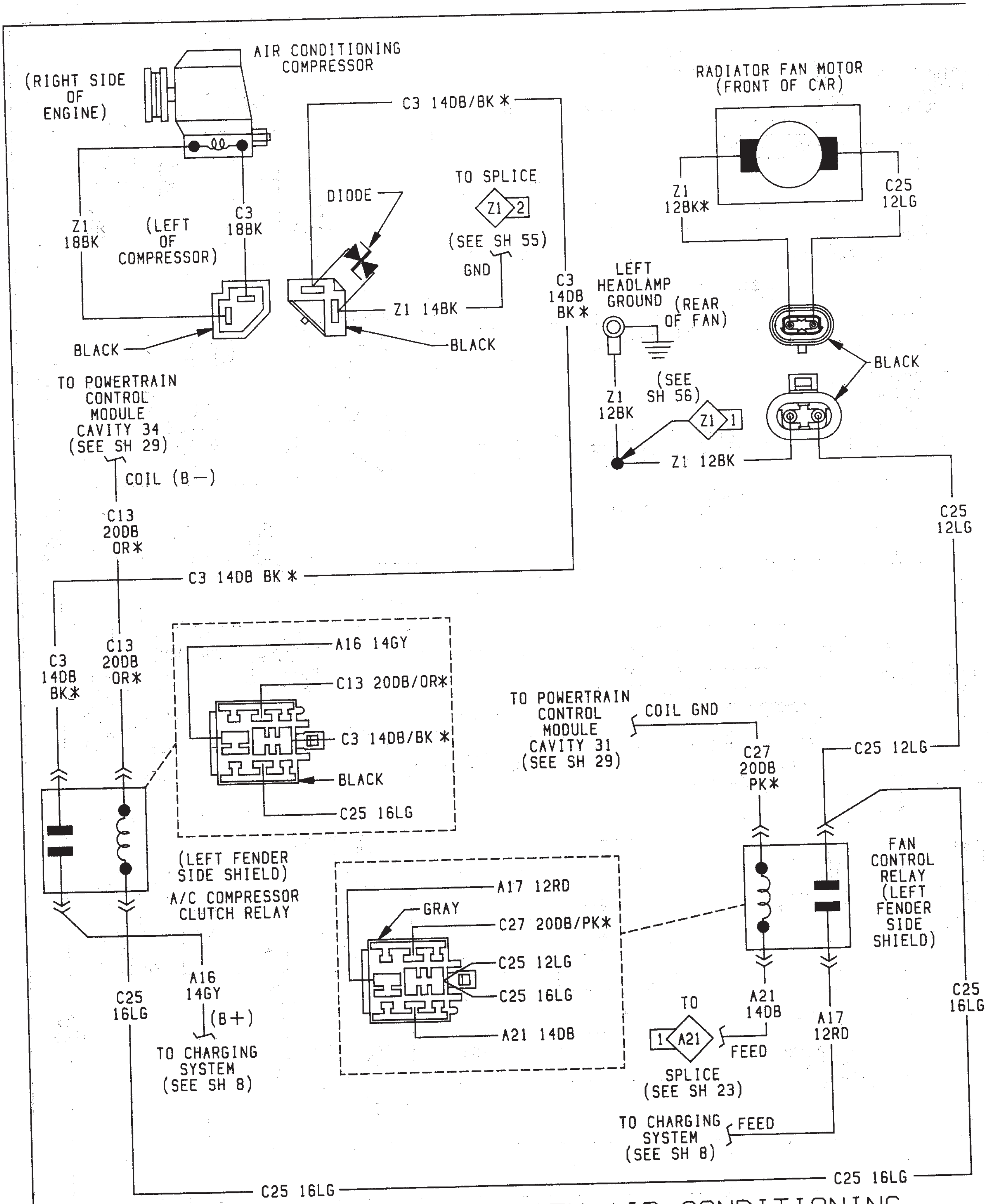
938W-1



FAN CONTROL SYSTEM WITH AIR CONDITIONING AND HEATER SYSTEM (2.5L ENGINE)

938W-1

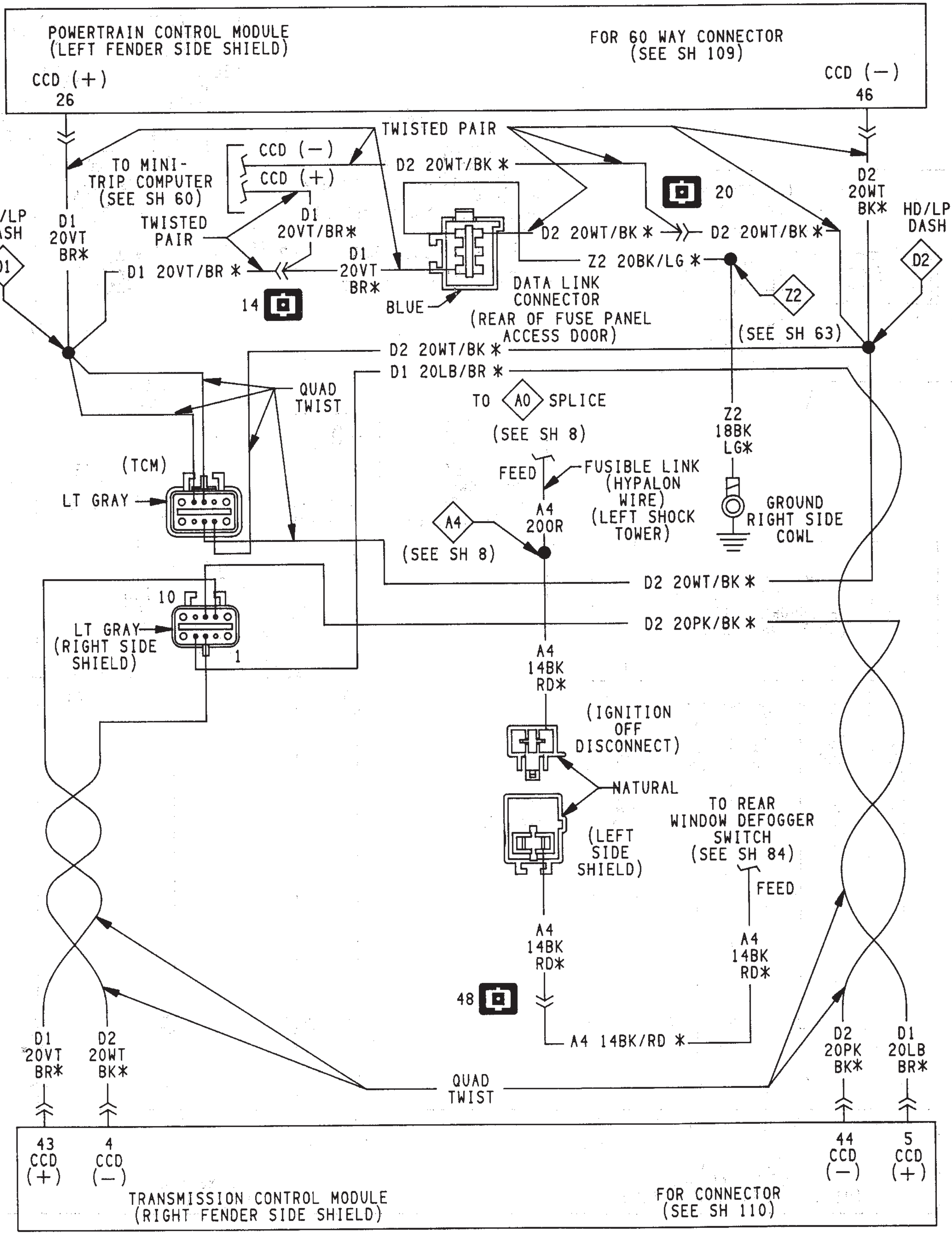
AA-CDP 32



FAN CONTROL SYSTEM WITH AIR CONDITIONING AND HEATER SYSTEM (3.0L ENGINE)

AA-CDP 33

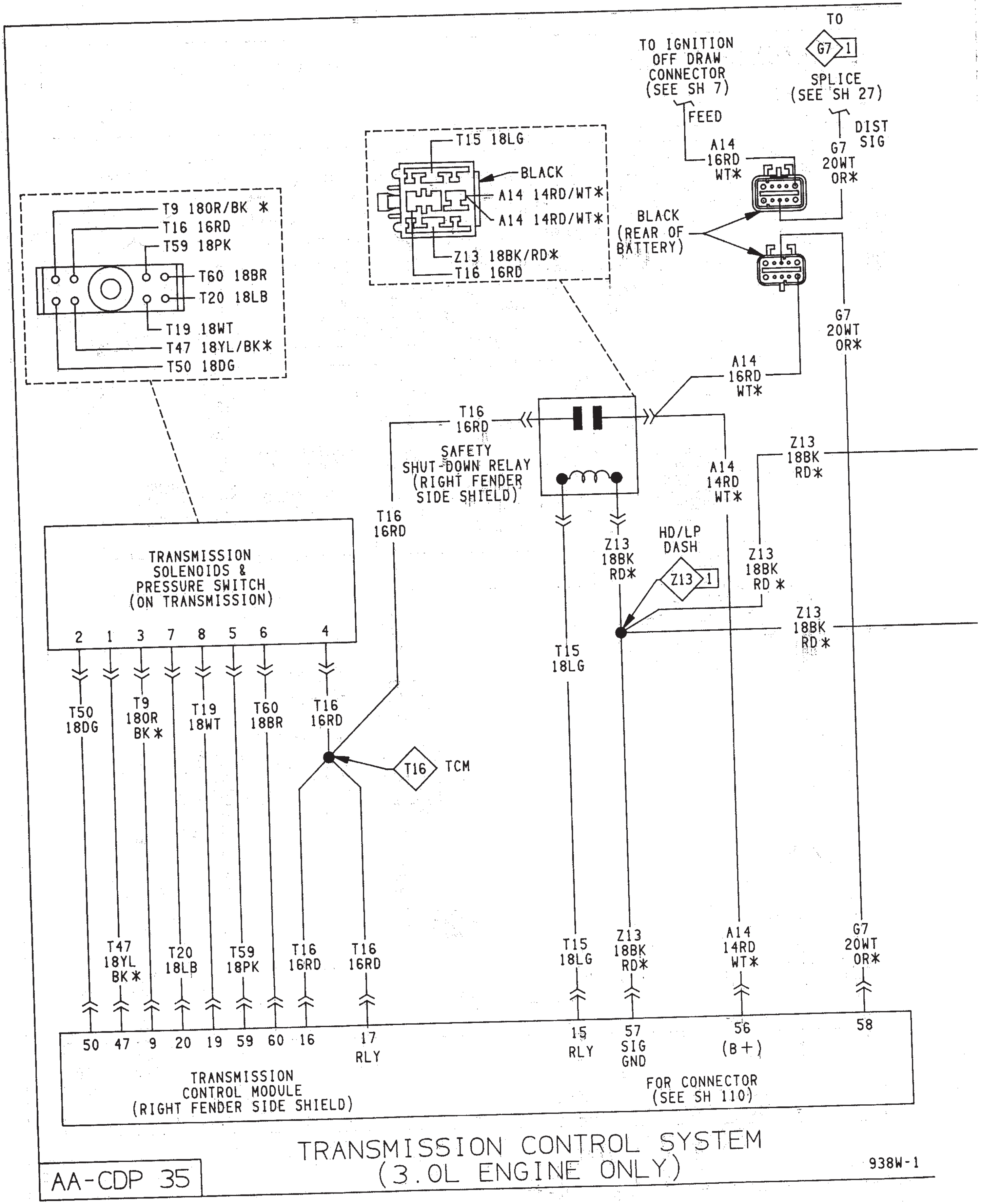
938W-1



TRANSMISSION CONTROL SYSTEM
(3.0L ENGINE ONLY)

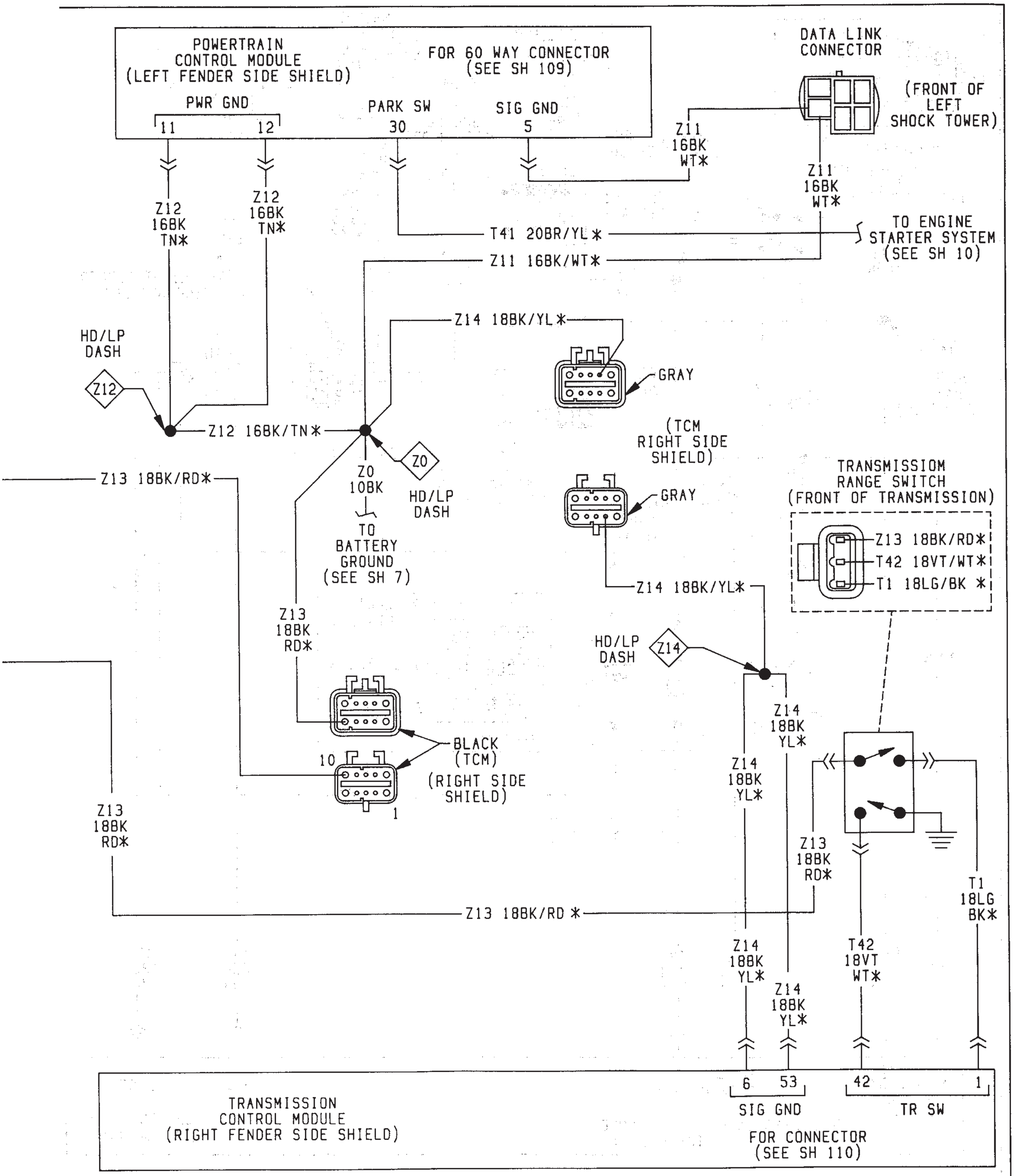
938W-1

AA-CDP 34



TRANSMISSION CONTROL SYSTEM
(3.0L ENGINE ONLY)

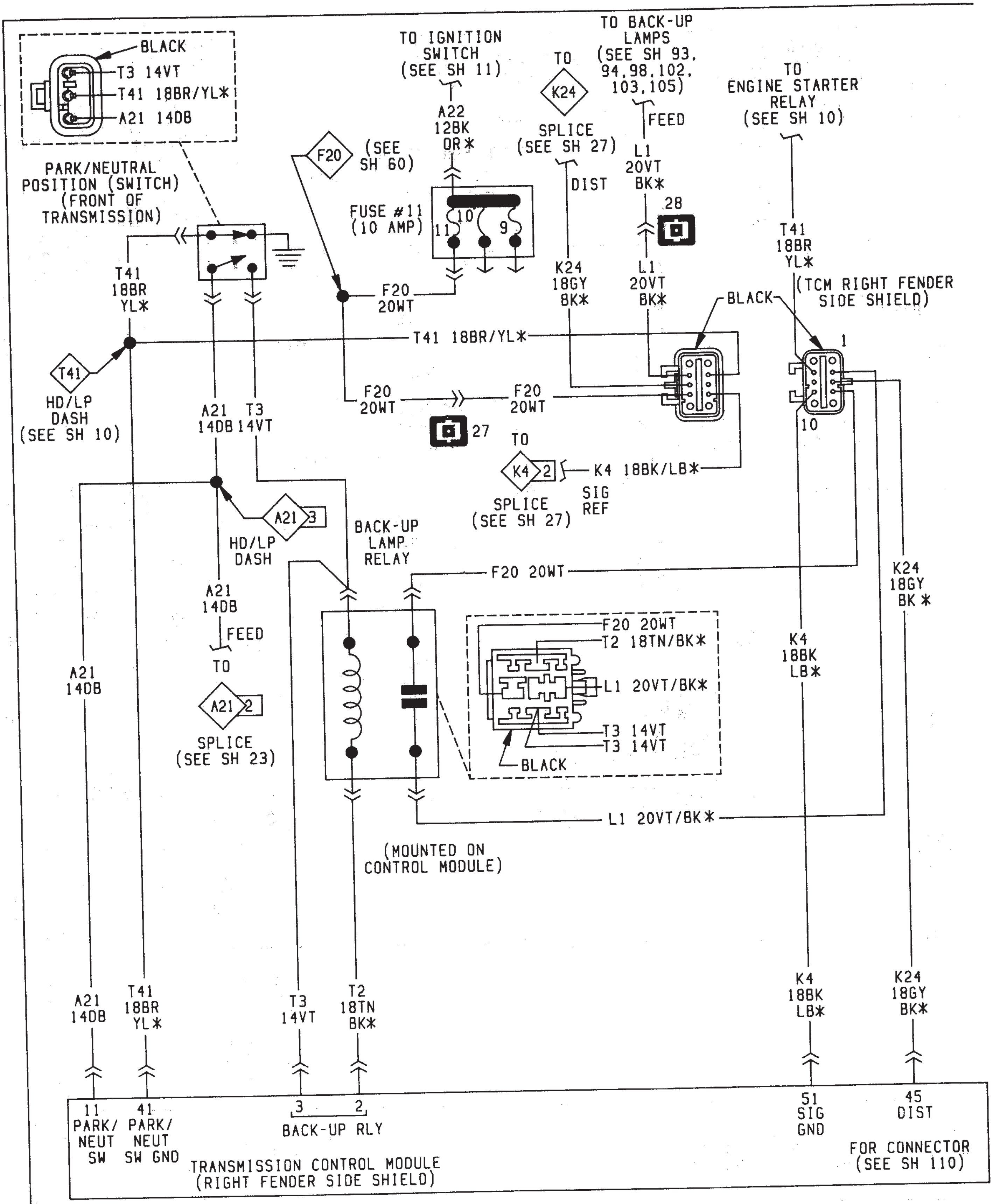
938W-1



TRANSMISSION CONTROL SYSTEM
(3.0L ENGINE ONLY)

938W-1

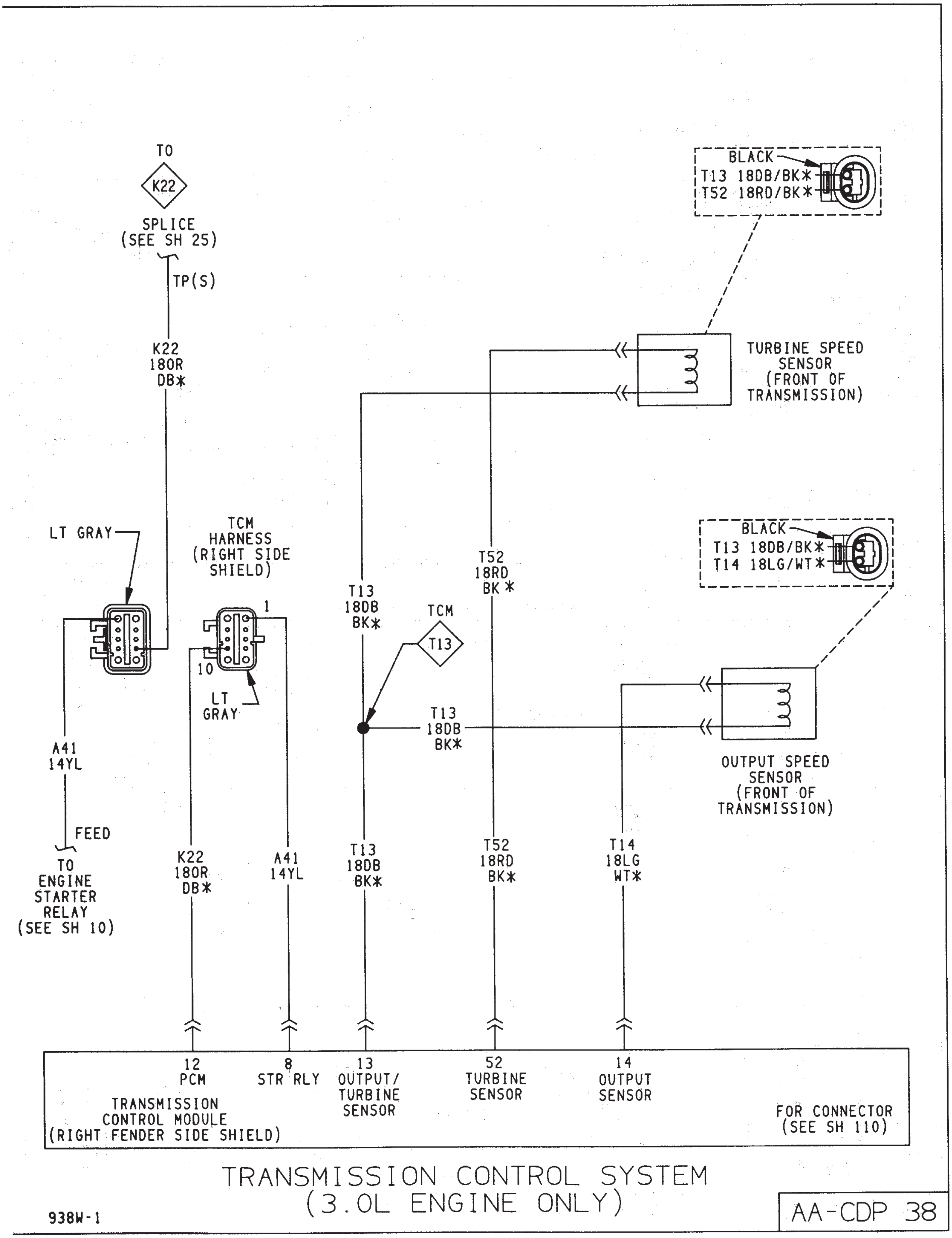
AA-CDP 36



TRANSMISSION CONTROL SYSTEM
(3.0L ENGINE ONLY)

938W-1

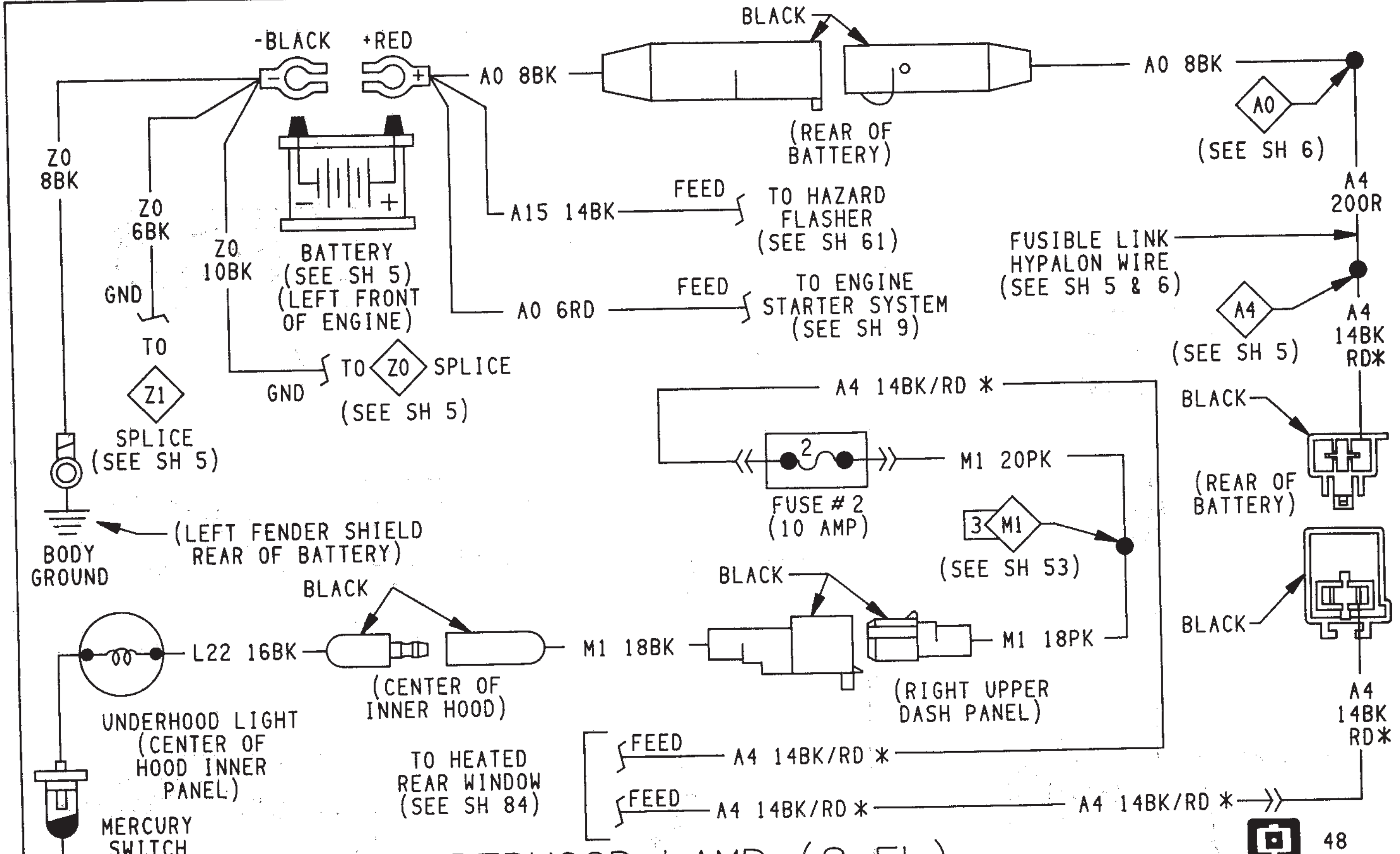
AA-CDP 37



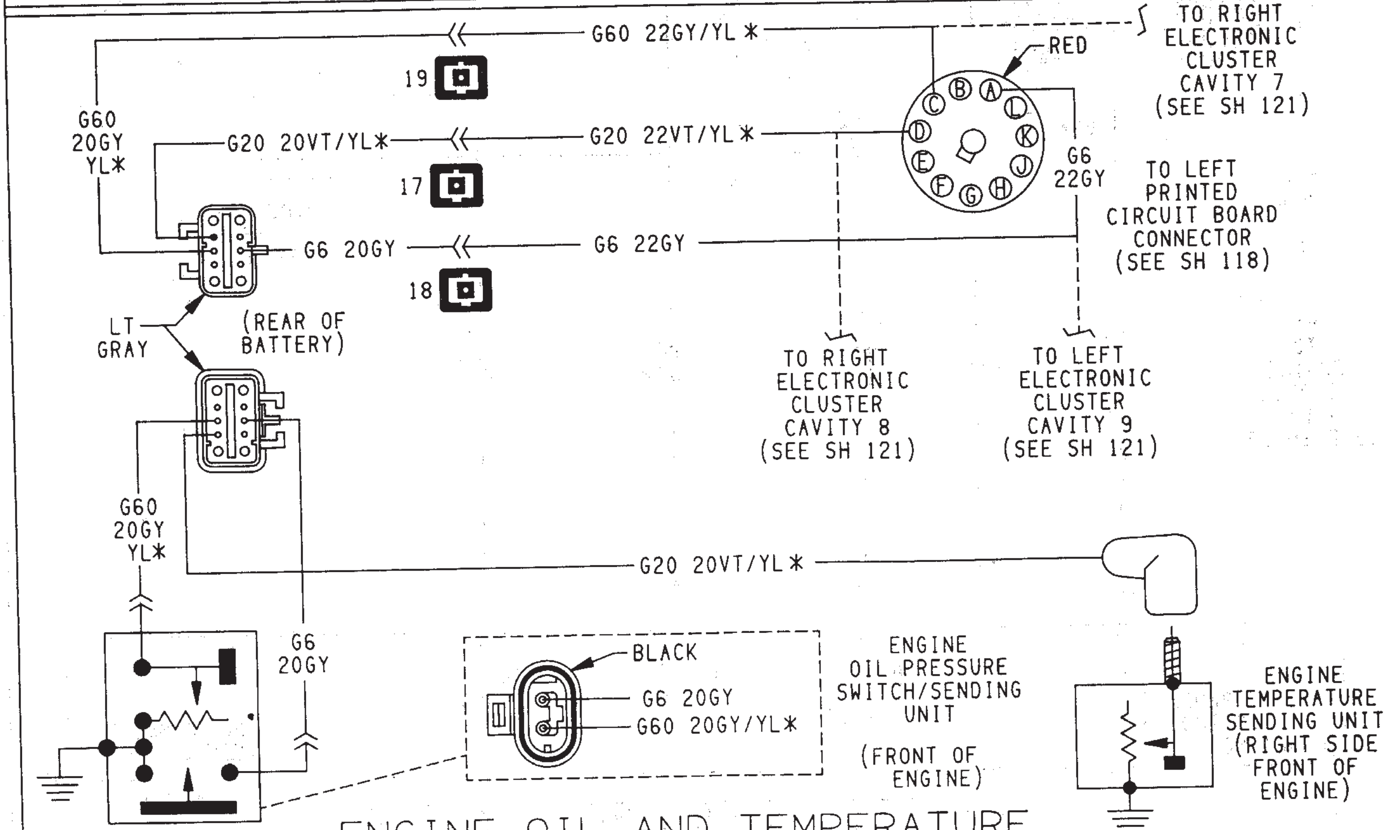
TRANSMISSION CONTROL SYSTEM
(3.0L ENGINE ONLY)

938W-1

AA-CDP 38



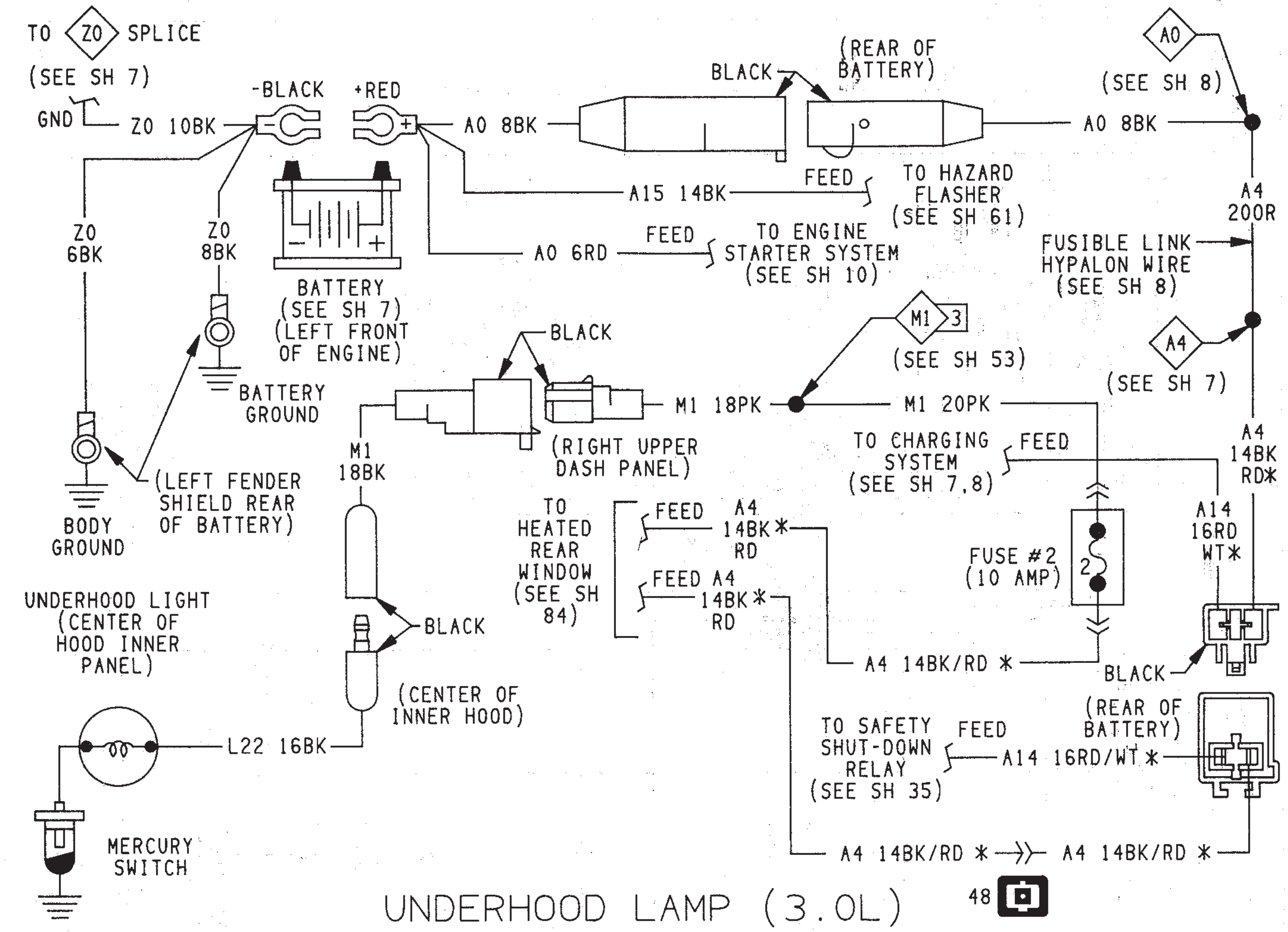
UNDERHOOD LAMP (2.5L)



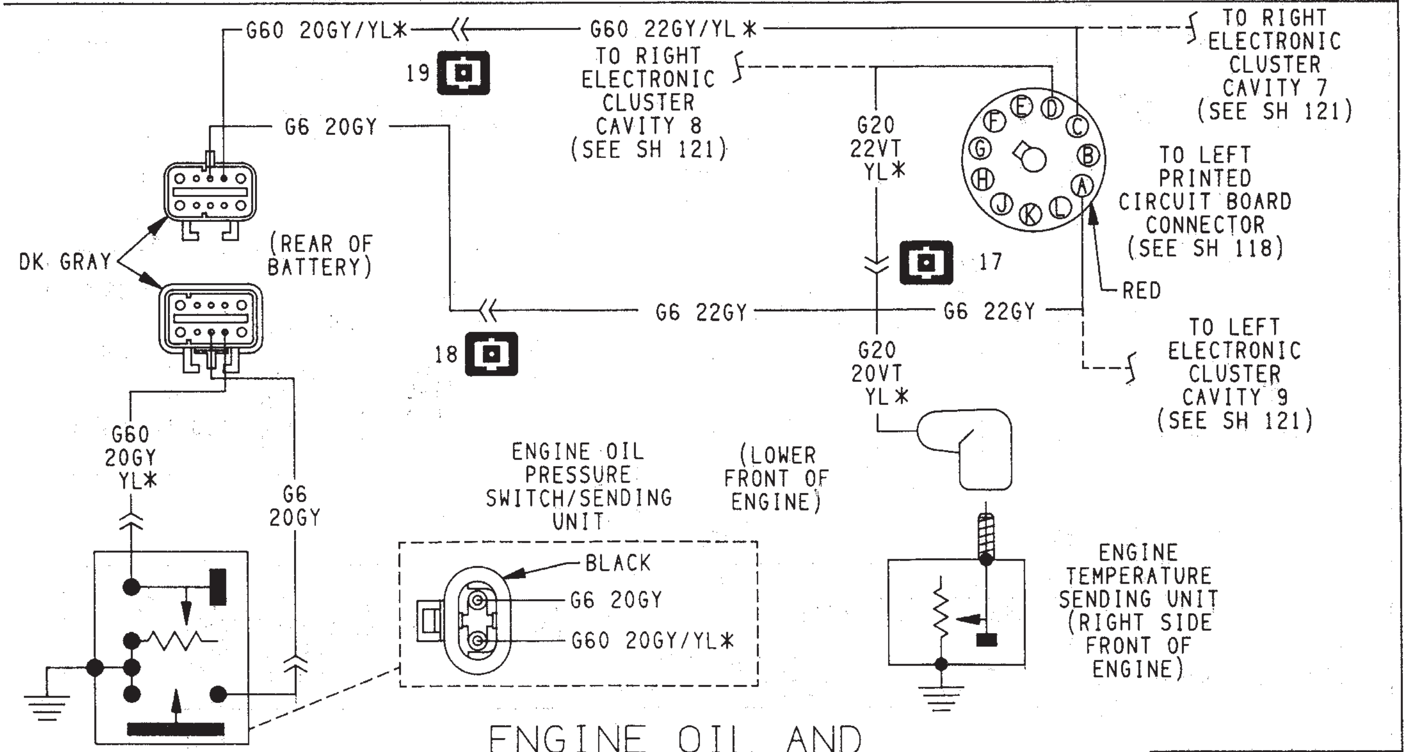
ENGINE OIL AND TEMPERATURE WARNING SYSTEM (2.5L)

AA-CDP 39

938W-1



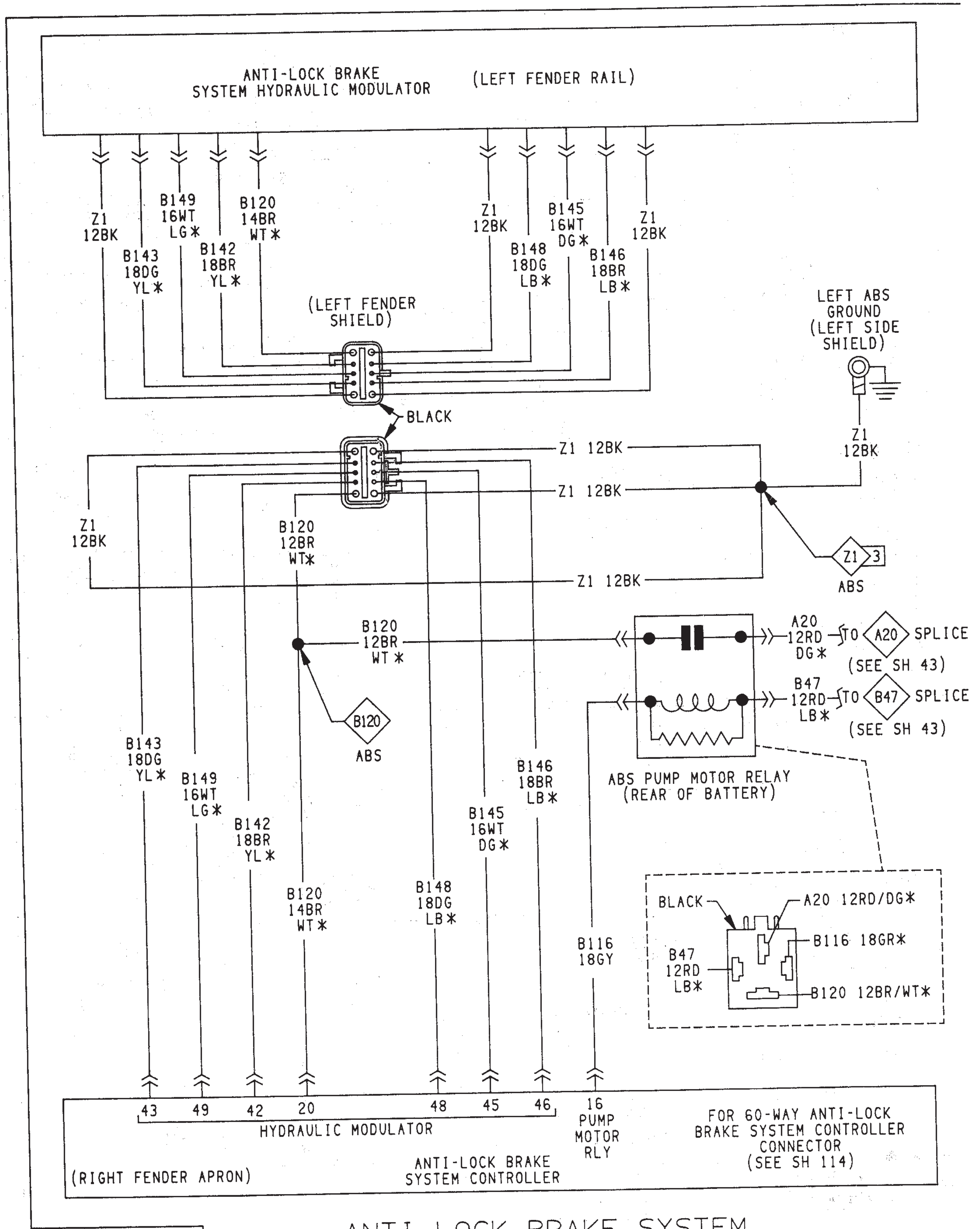
UNDERHOOD LAMP (3.0L)



938W-1

ENGINE OIL AND TEMPERATURE WARNING SYSTEM (3.0L)

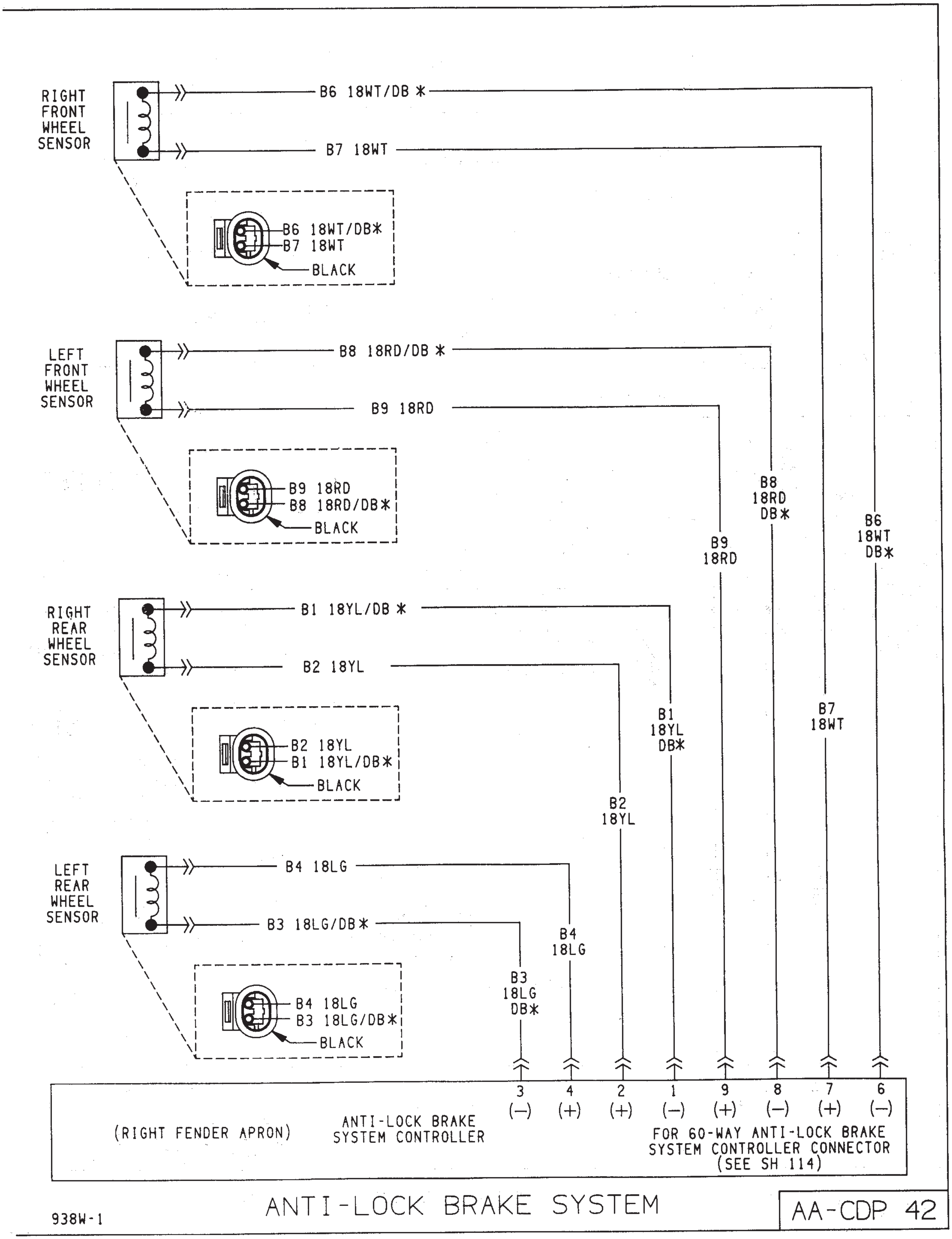
AA-CDP 40

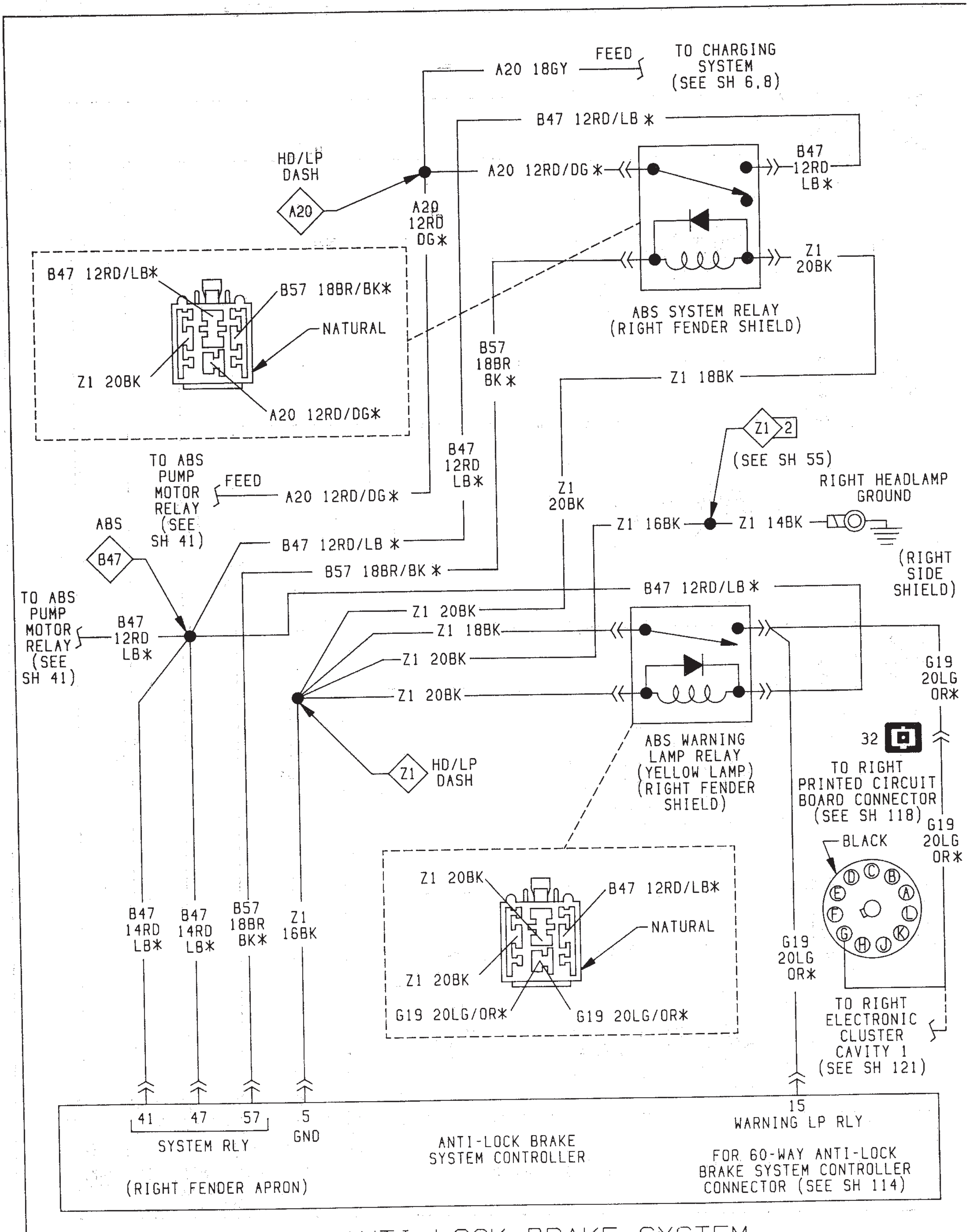


AA-CDP 41

ANTI-LOCK BRAKE SYSTEM

938W-1

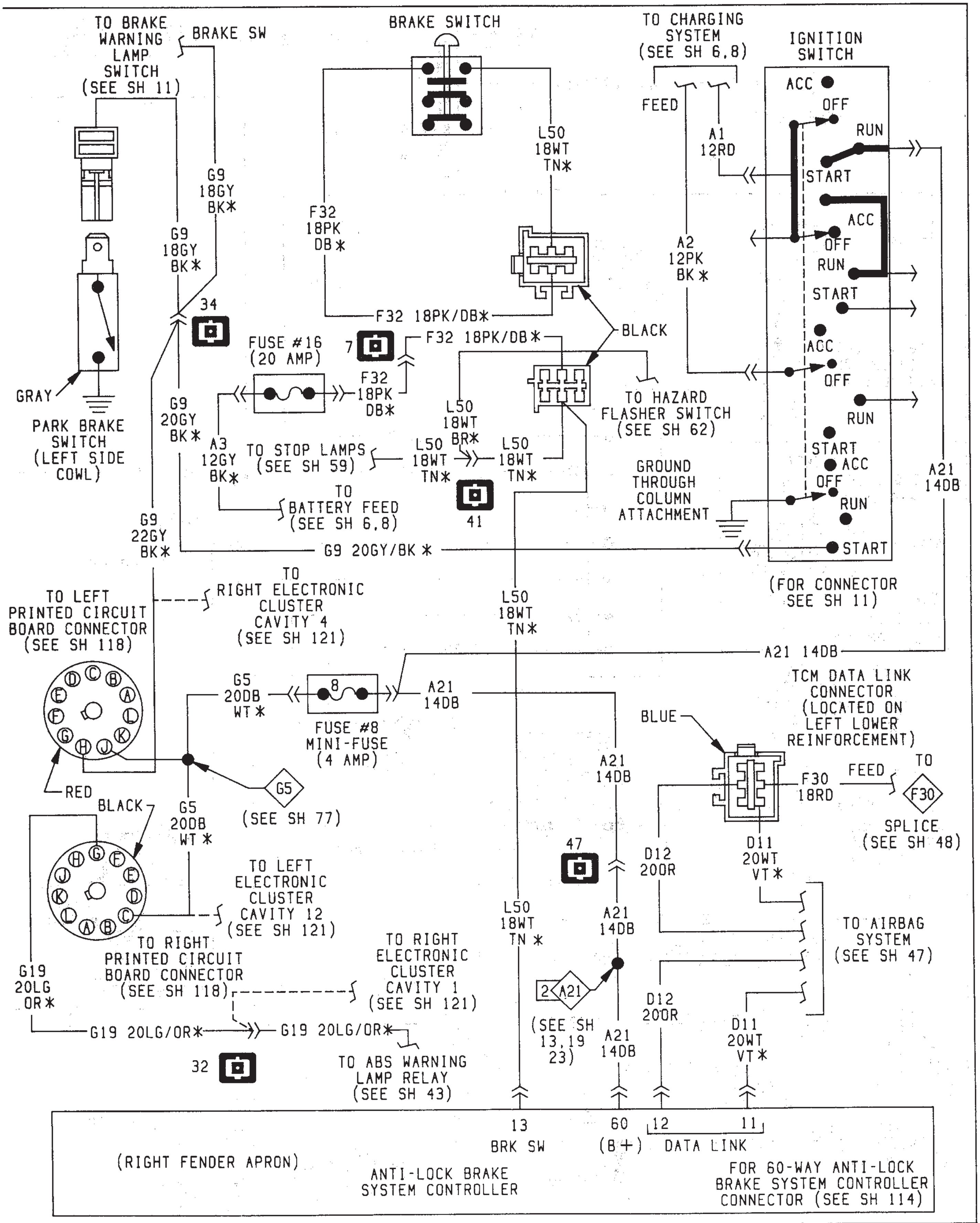

RIGHT FRONT WHEEL SENSOR
B6 18WT/DB *
B7 18WT
B6 18WT/DB*
B7 18WT
BLACK
LEFT FRONT WHEEL SENSOR
B8 18RD/DB *
B9 18RD
B9 18RD
B8 18RD/DB*
BLACK
RIGHT REAR WHEEL SENSOR
B1 18YL/DB *
B2 18YL
B2 18YL
B1 18YL/DB*
BLACK
LEFT REAR WHEEL SENSOR
B4 18LG
B3 18LG/DB*
B4 18LG
B3 18LG/DB*
BLACK
B8 18RD DB*
B6 18WT DB*
B9 18RD
B1 18YL DB*
B7 18WT
B2 18YL
B4 18LG
B3 18LG DB*
3 (−)
4 (+)
2 (+)
1 (−)
9 (+)
8 (−)
7 (+)
6 (−)
(RIGHT FENDER APRON)
ANTI-LOCK BRAKE SYSTEM CONTROLLER
FOR 60-WAY ANTI-LOCK BRAKE SYSTEM CONTROLLER CONNECTOR (SEE SH 114)
938W-1
ANTI-LOCK BRAKE SYSTEM
AA-CDP 42



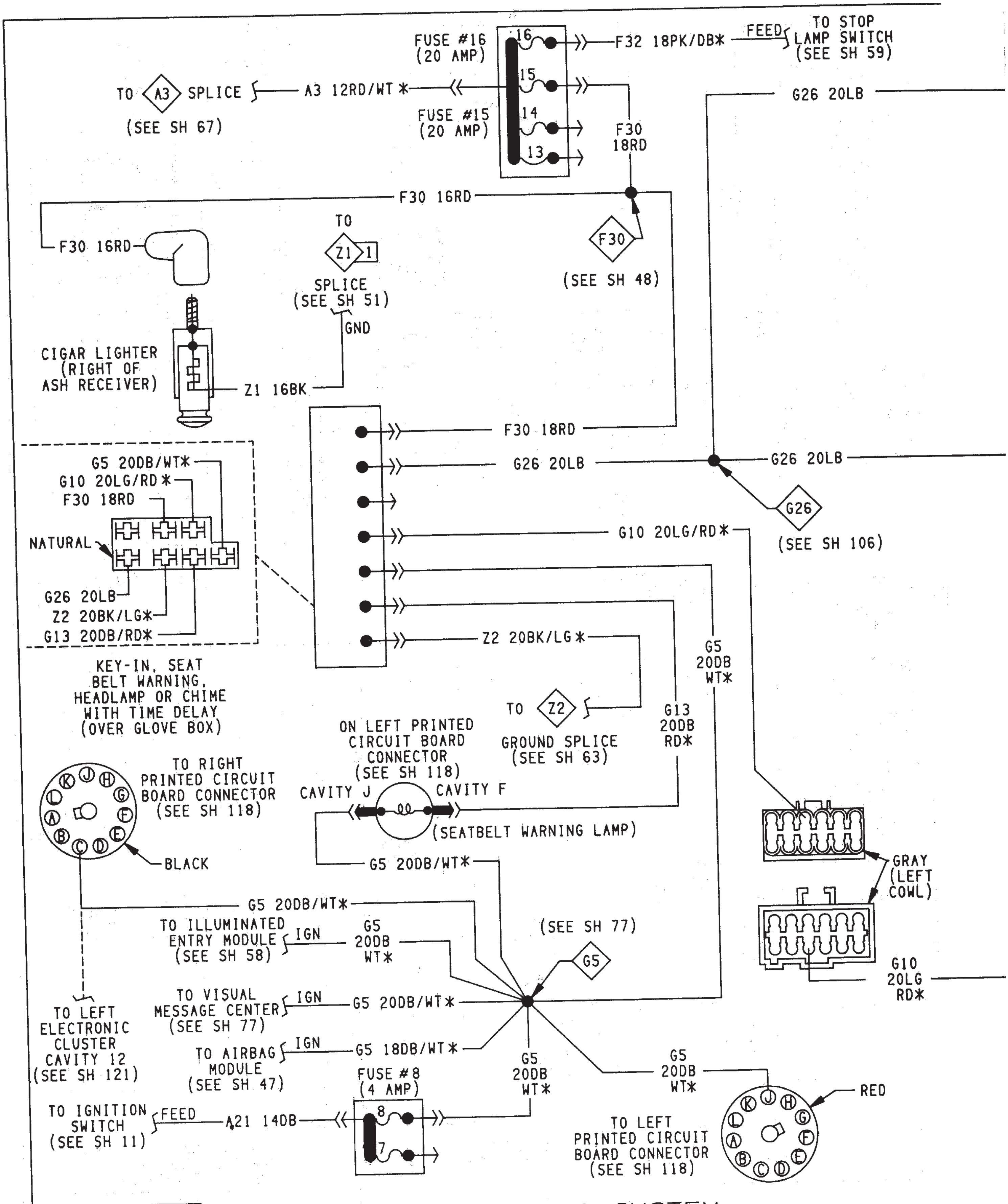
AA-CDP 43

ANTI-LOCK BRAKE SYSTEM

938W-1



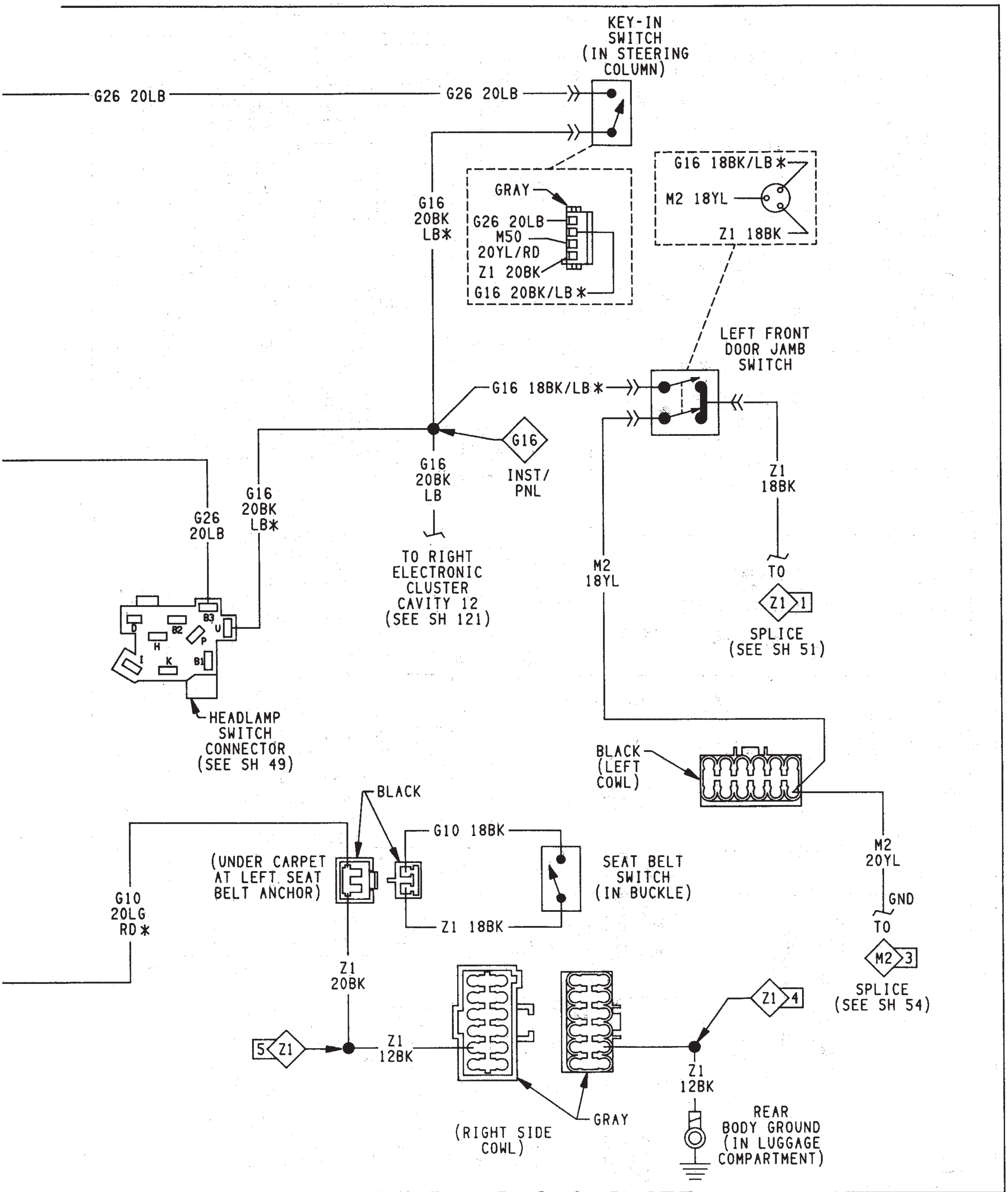
ANTI-LOCK BRAKE SYSTEM



AA-CDP 45

SEAT BELT WARNING SYSTEM

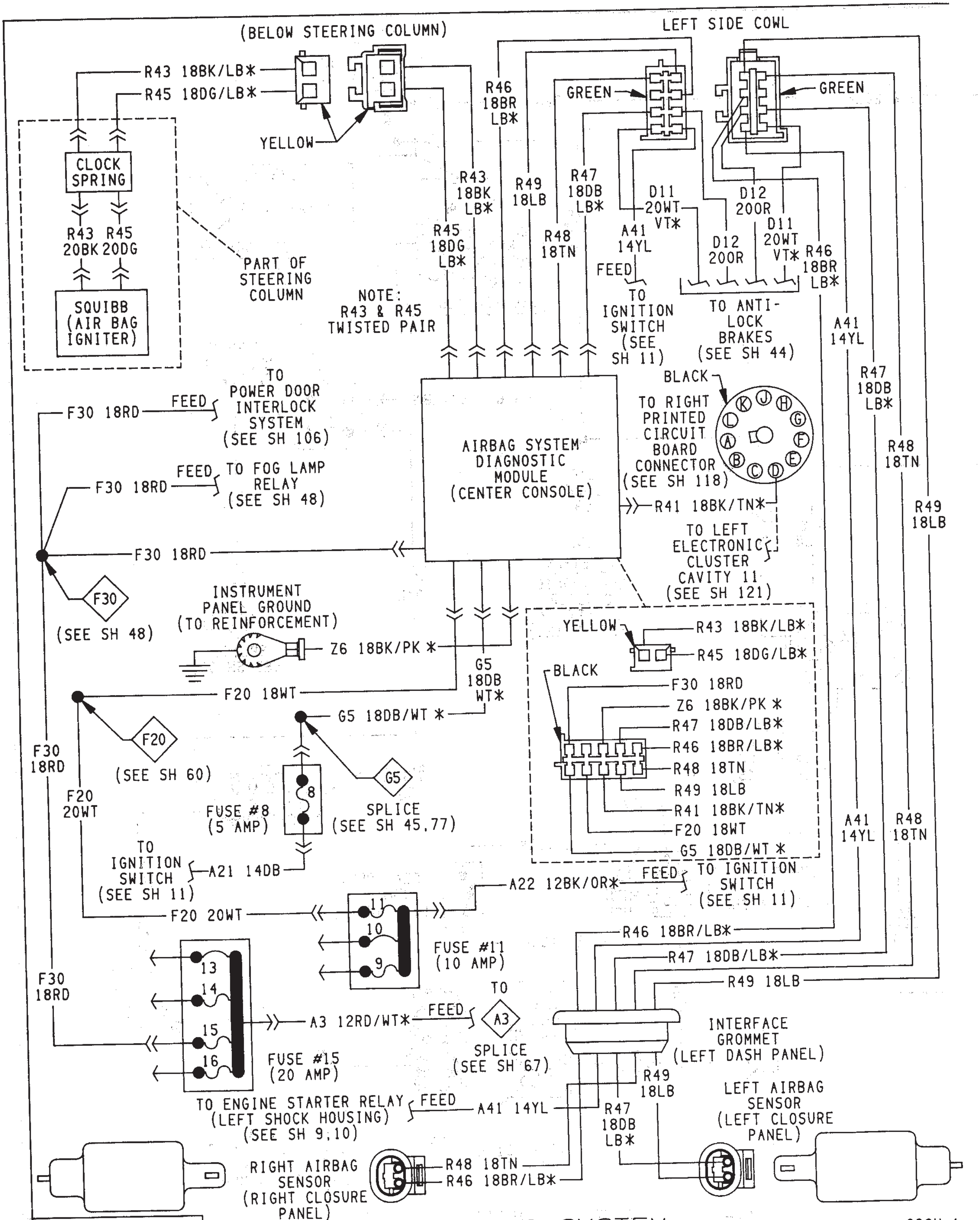
938W-1



SEAT BELT WARNING SYSTEM

938W-1

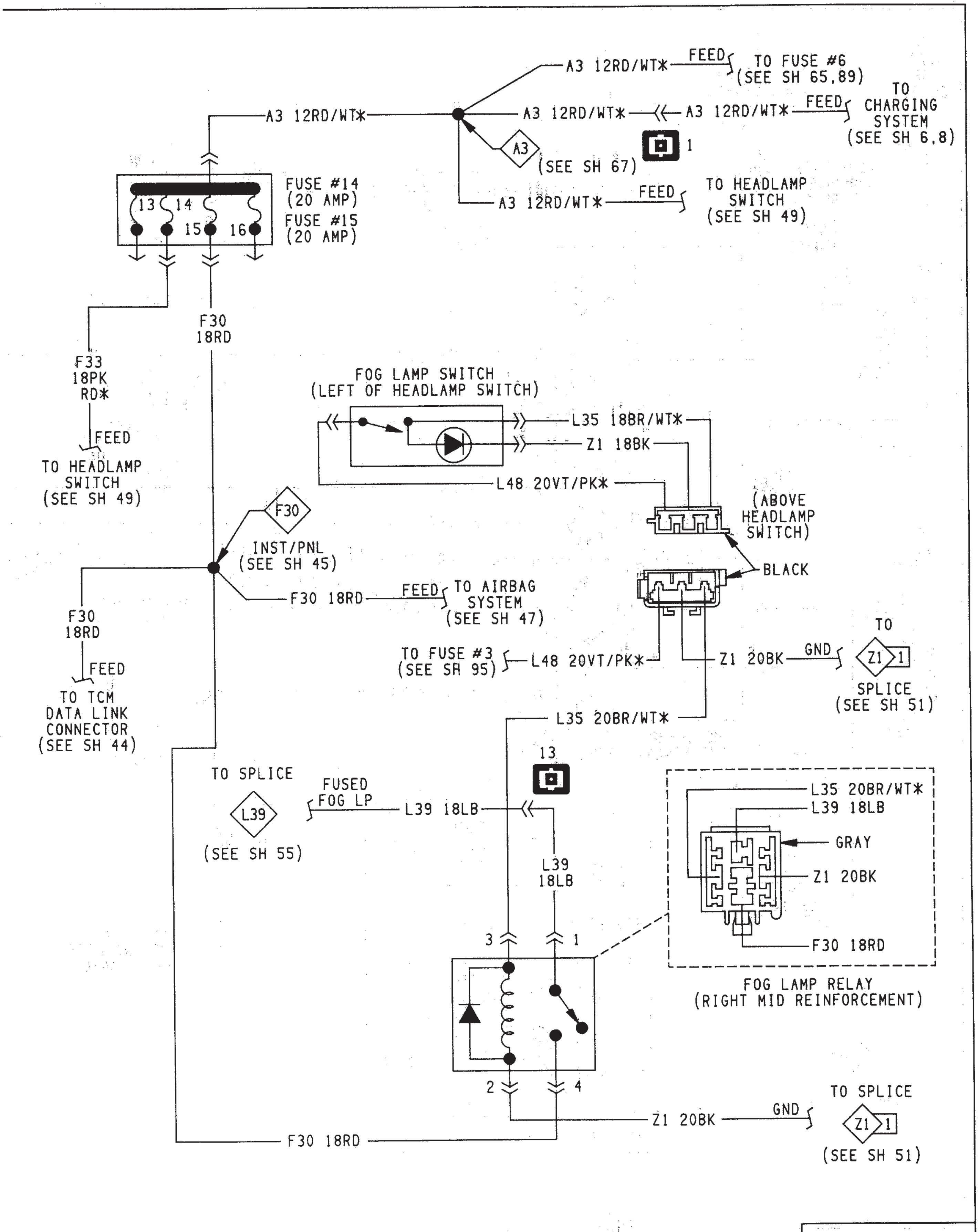
AA-CDP 46



AA-CDP 47

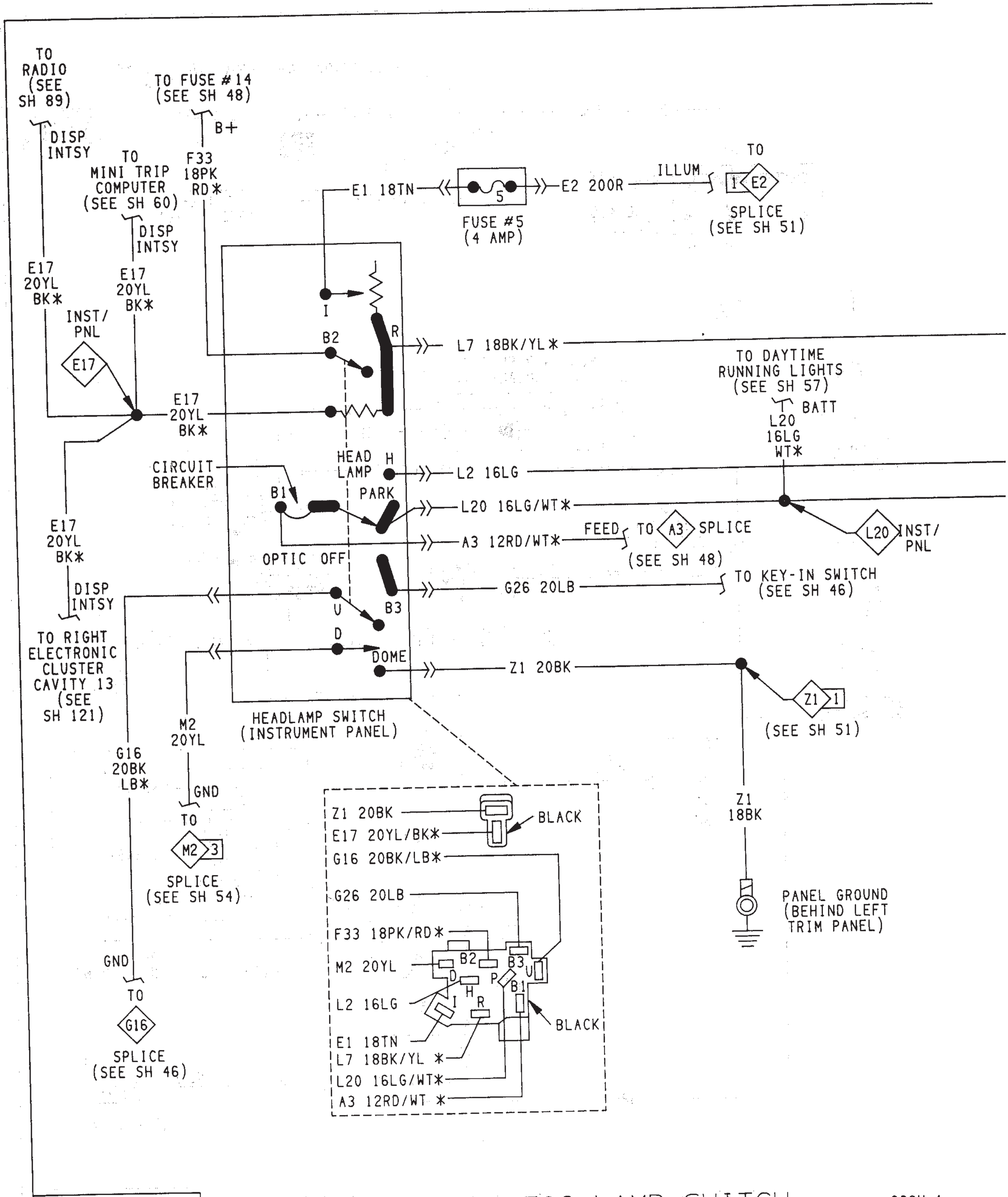
AIRBAG SYSTEM

938W-1



938W-1

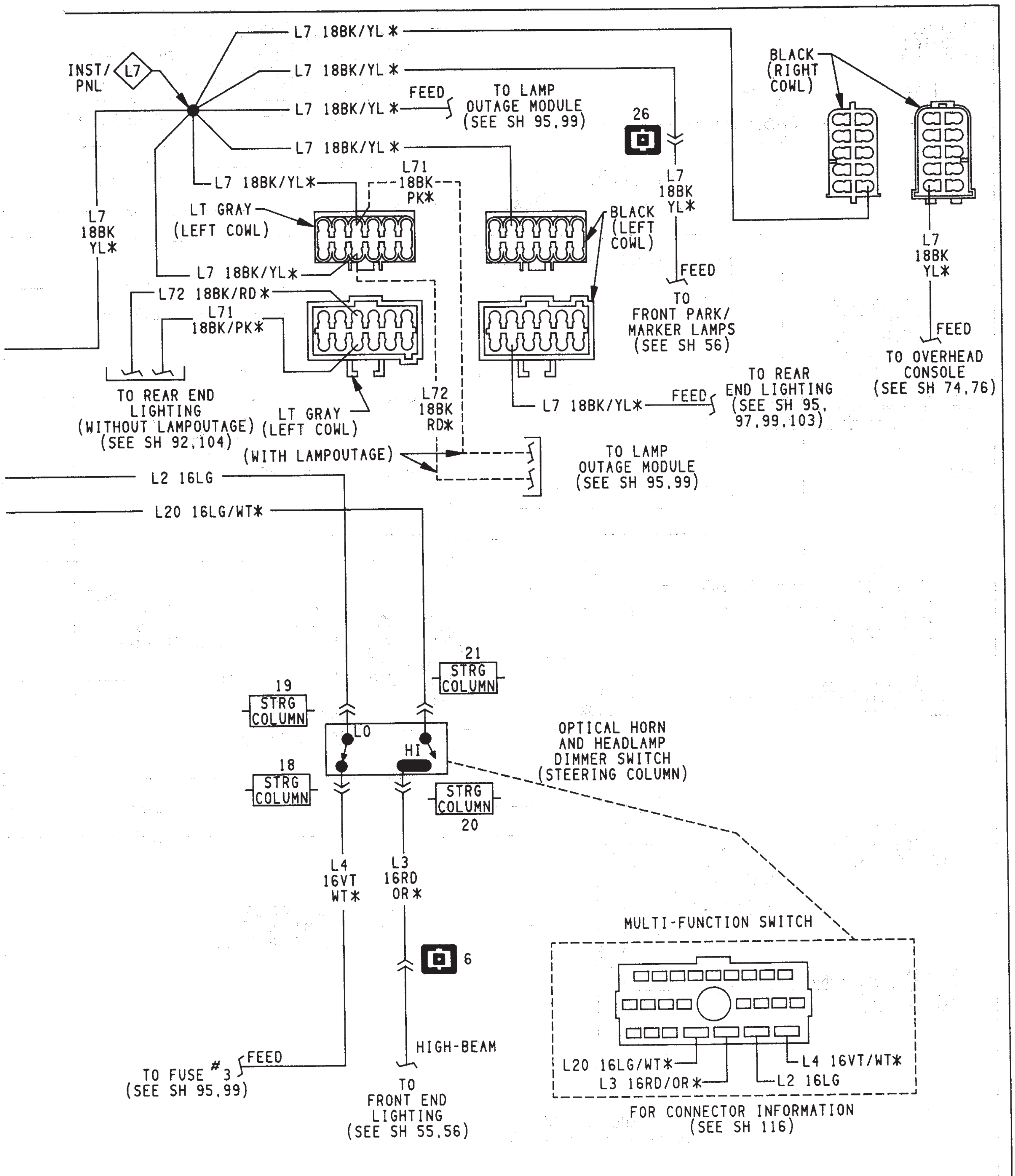
HEADLAMP AND FOG LAMP SWITCH



AA-CDP 49

HEADLAMP AND FOG LAMP SWITCH

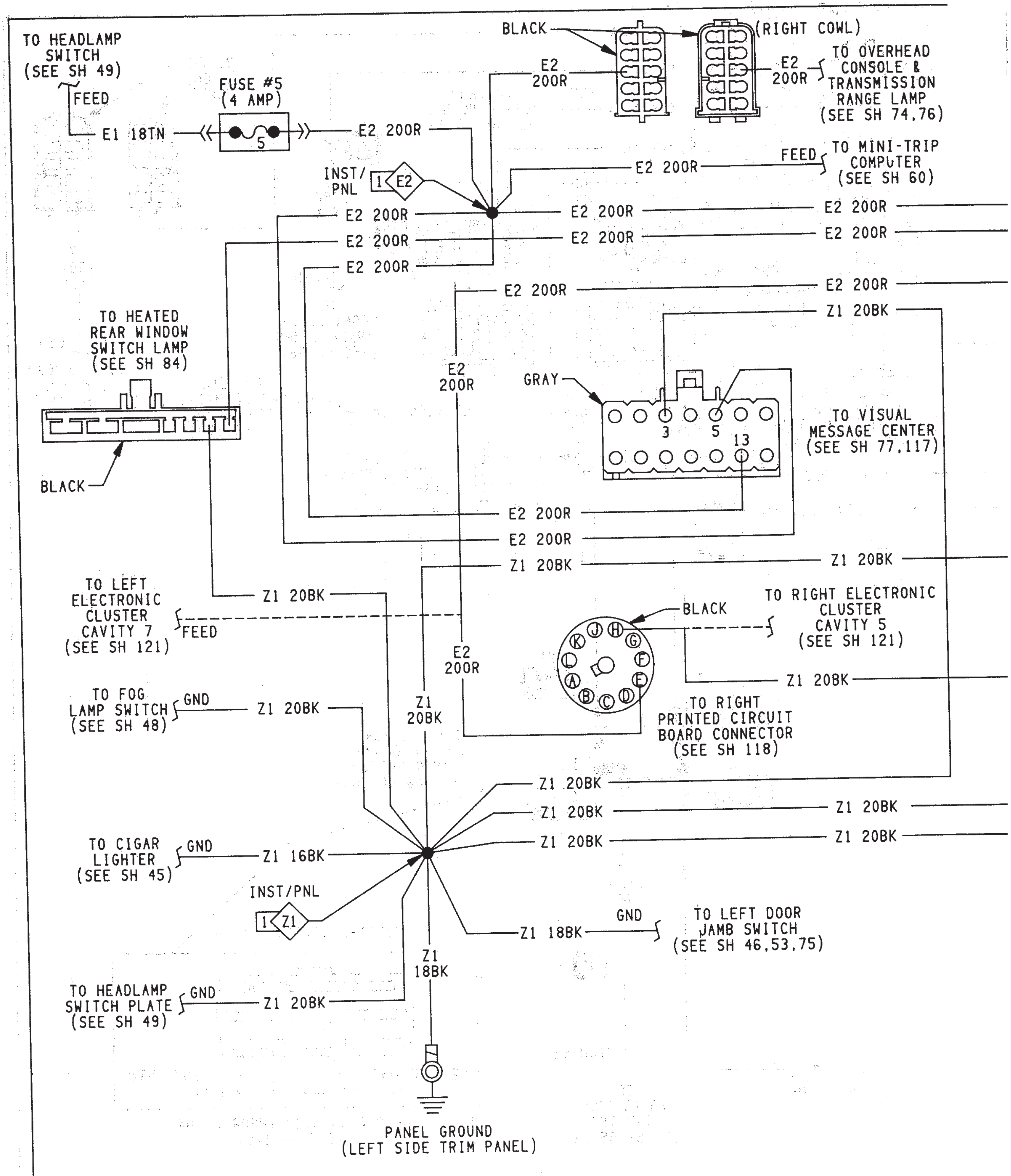
938W-1



938W-1

HEADLAMP AND FOG LAMP SWITCH

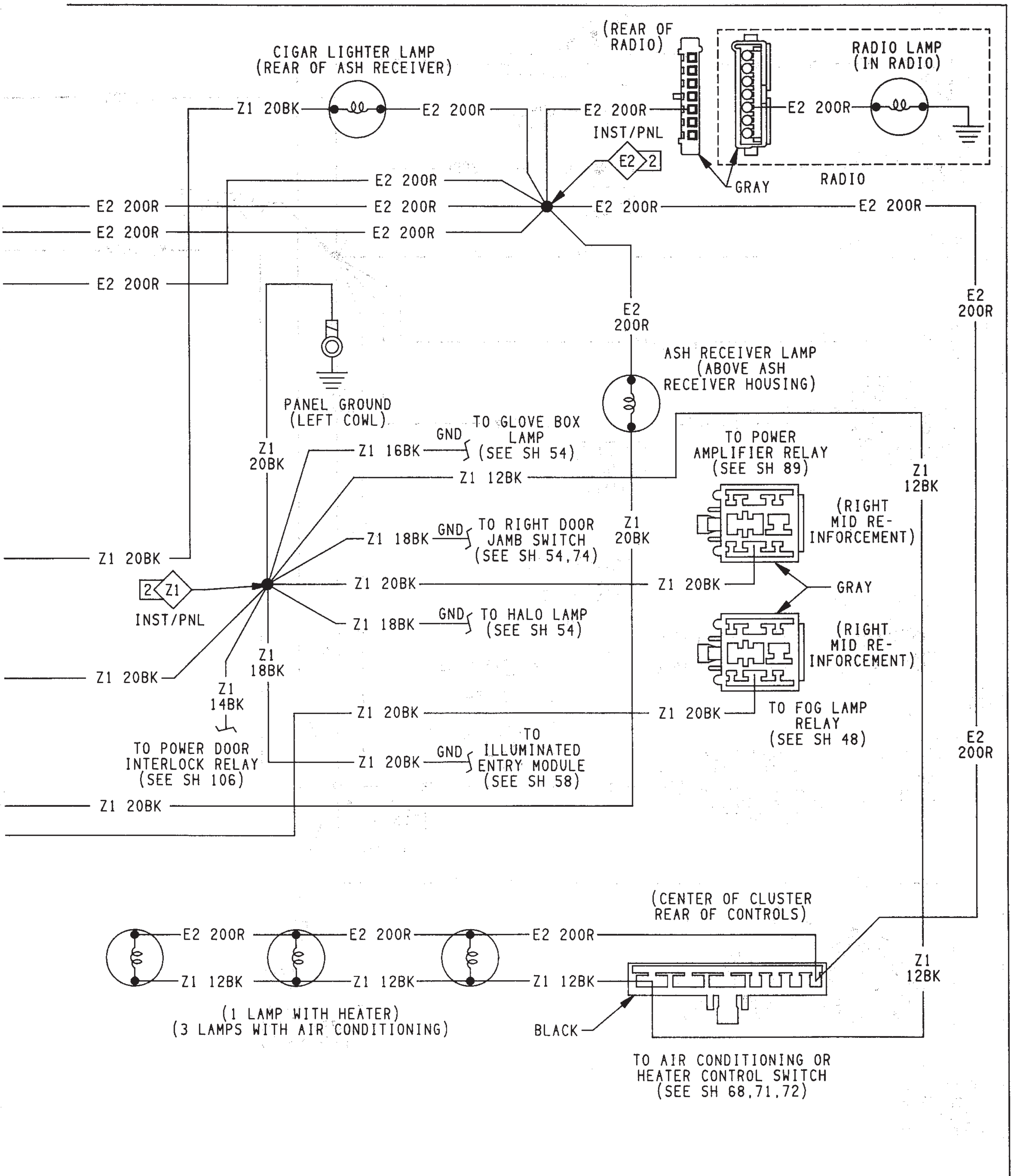
AA-CDP 50



AA-CDP 51

HEADLAMP SWITCH
CONTROLLED INTERIOR LIGHTING

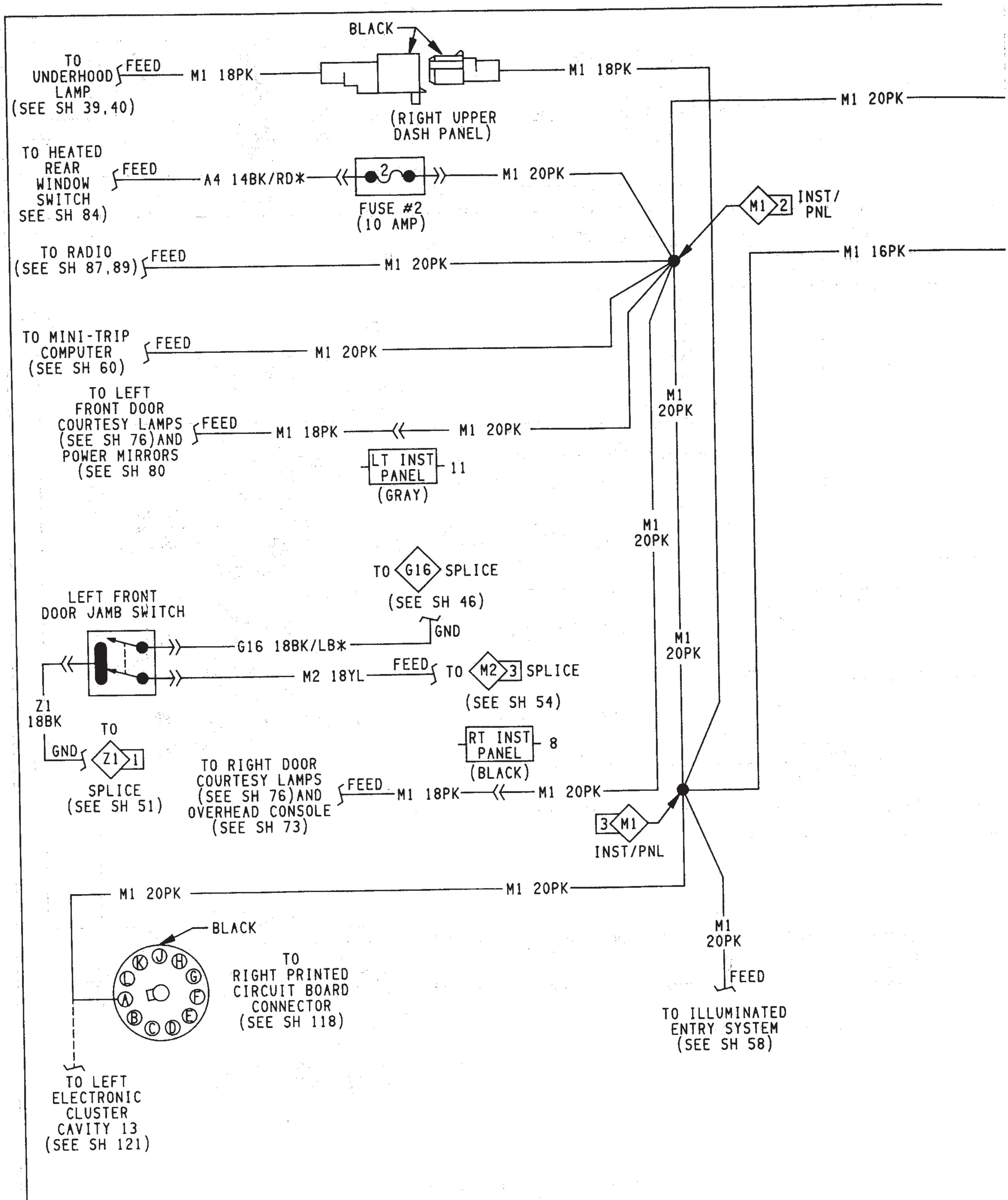
938W-1



HEADLAMP SWITCH
CONTROLLED INTERIOR LIGHTING

938W-1

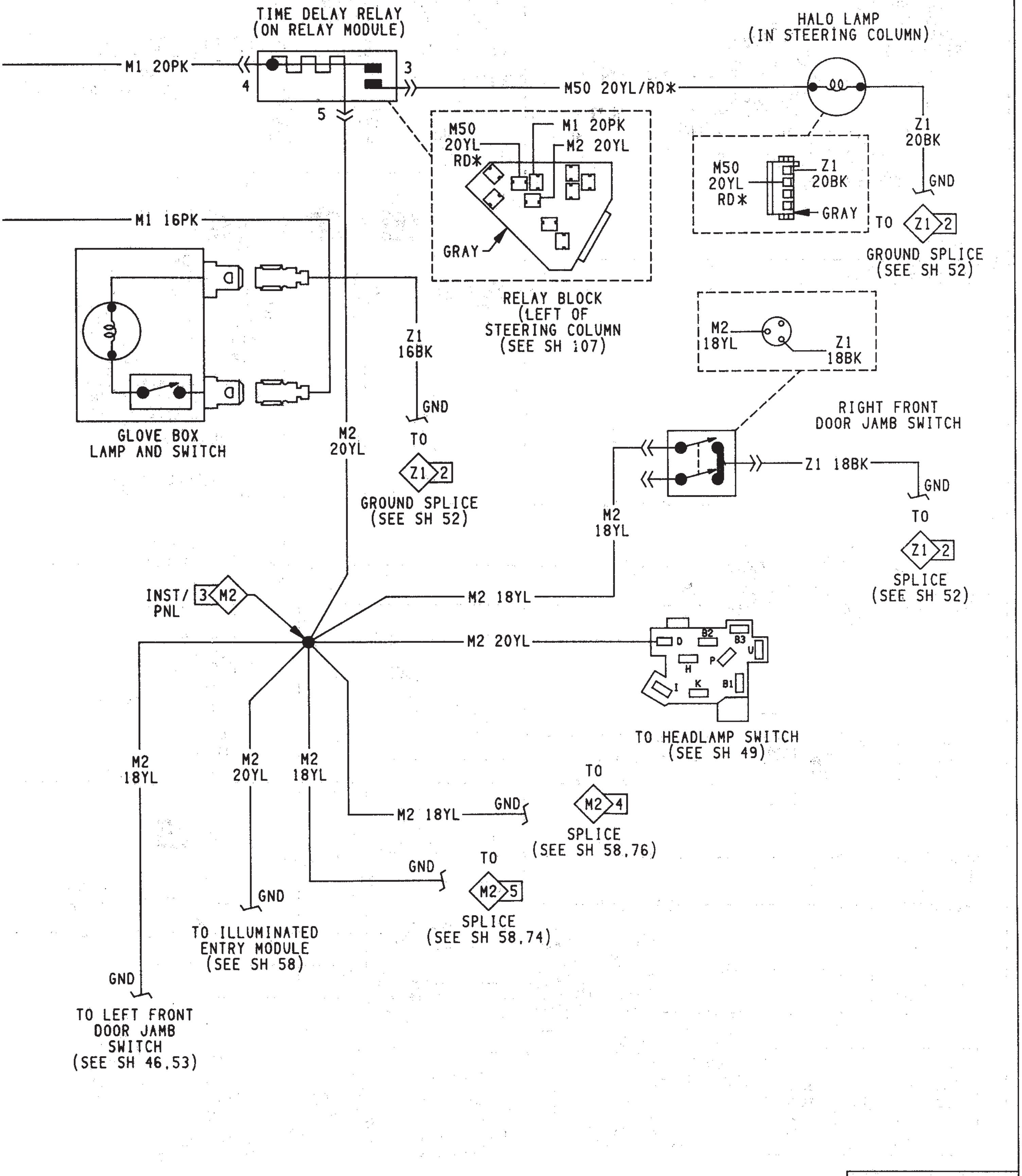
AA-CDP 52



AA-CDP 53

TIME DELAY RELAY SYSTEM

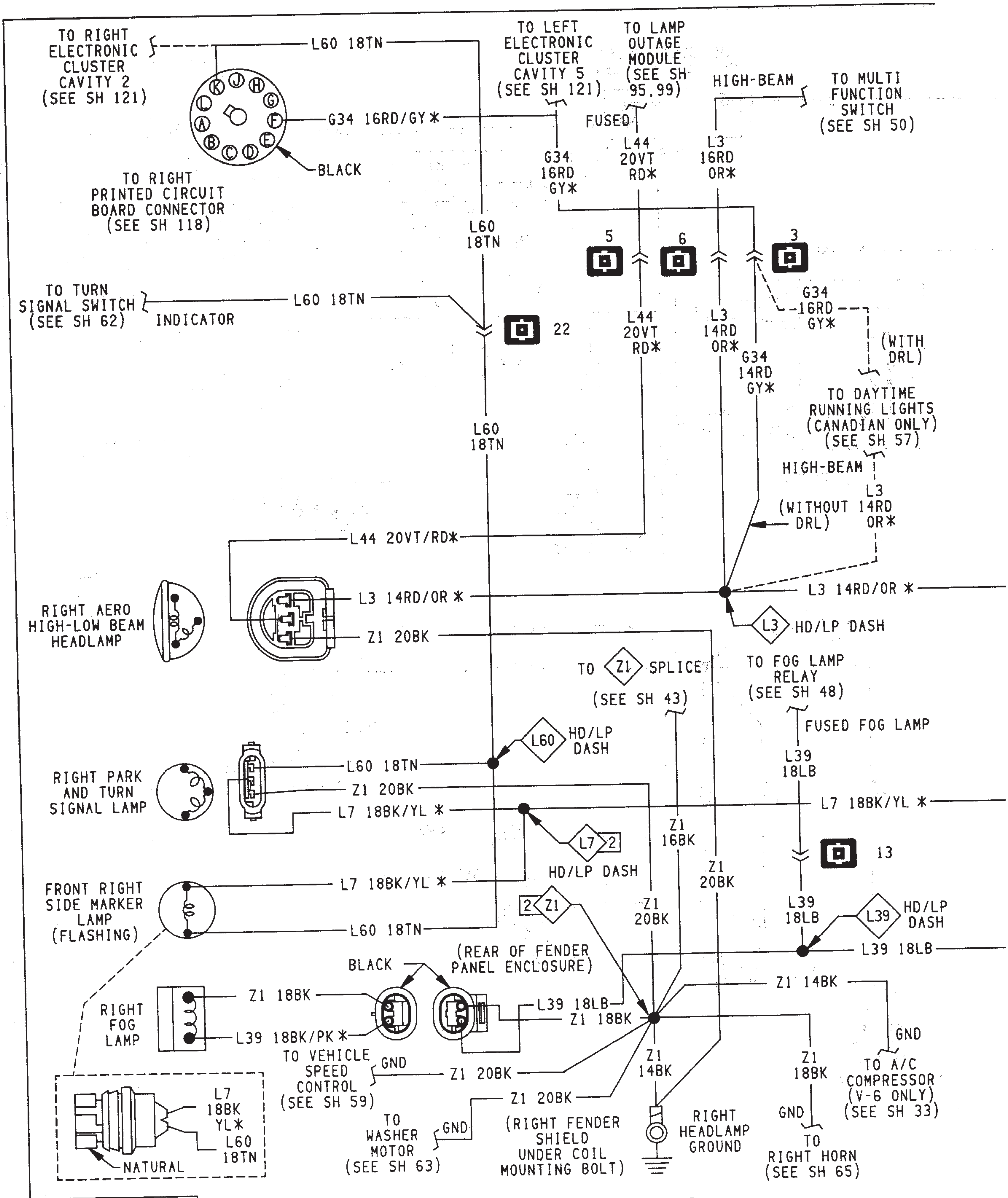
938W-1



938W-1

TIME DELAY RELAY SYSTEM

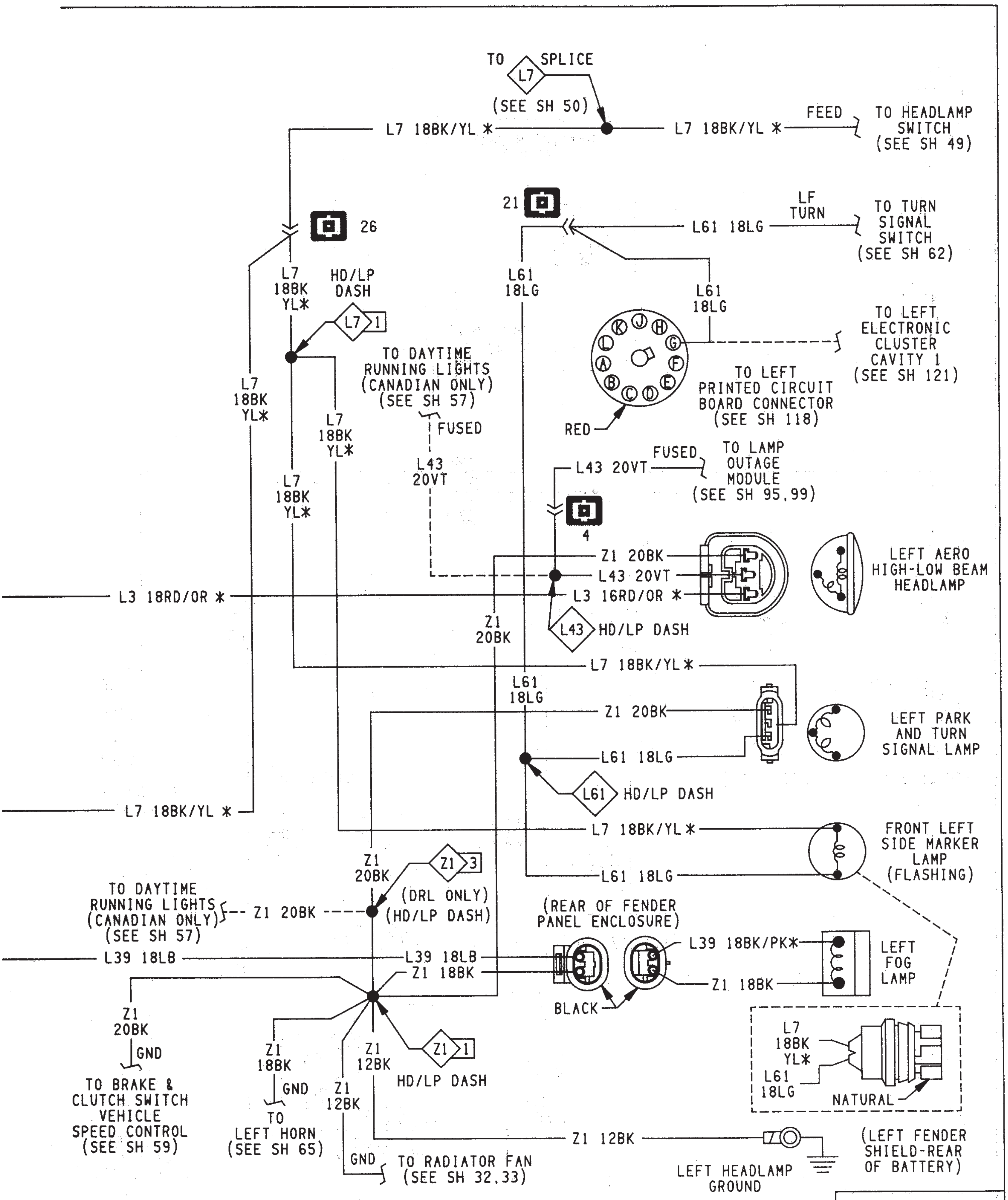
AA-CDP 54



AA-CDP 55

FRONT END LIGHTING

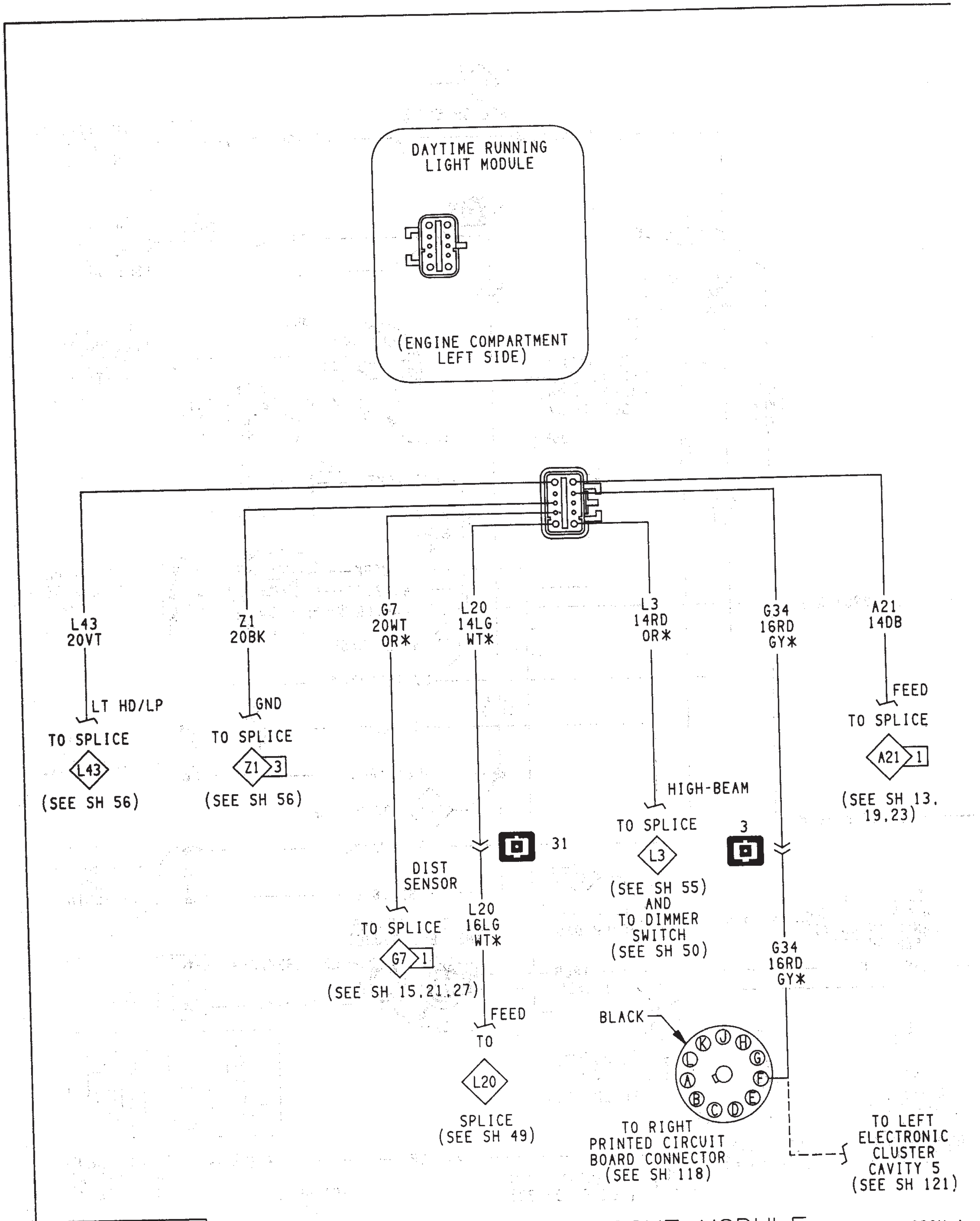
938W-1



938W-1

FRONT END LIGHTING

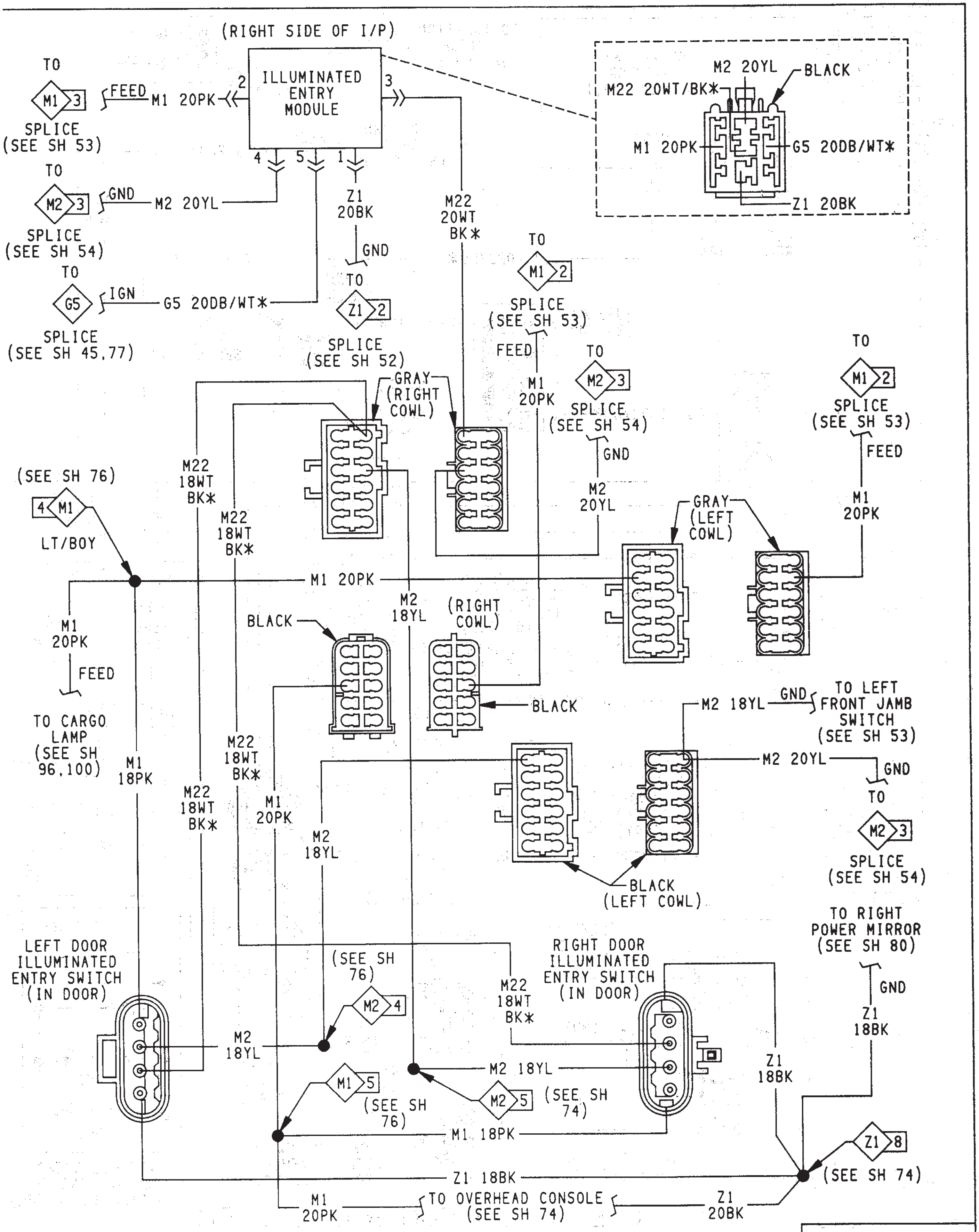
AA-CDP 56



AA-CDP 57

DAYTIME RUNNING LIGHT MODULE

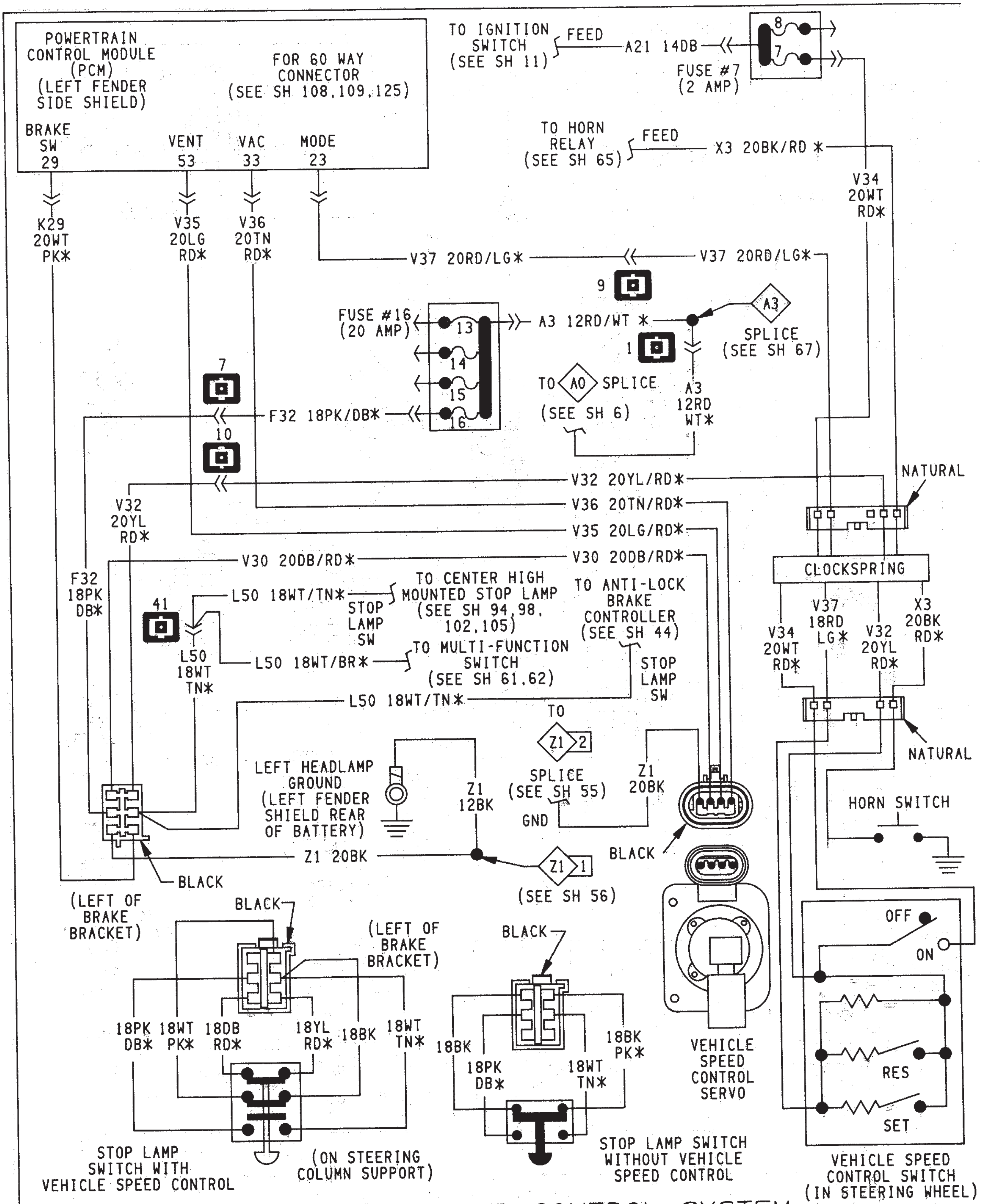
938W-1



938W-1

ILLUMINATED ENTRY

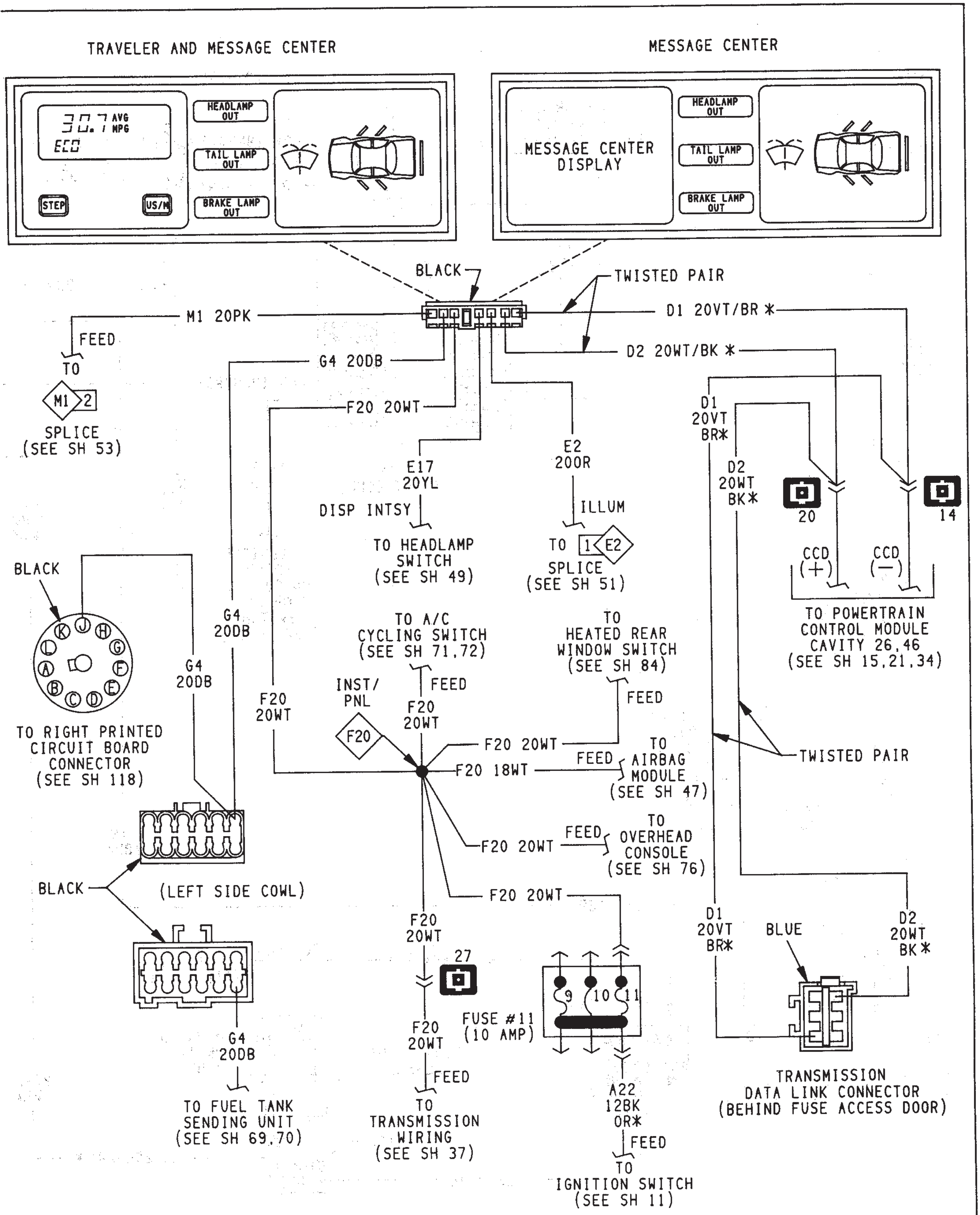
AA-CDP 58



VEHICLE SPEED CONTROL SYSTEM AND STOP LAMP SWITCH

AA-CDP 59

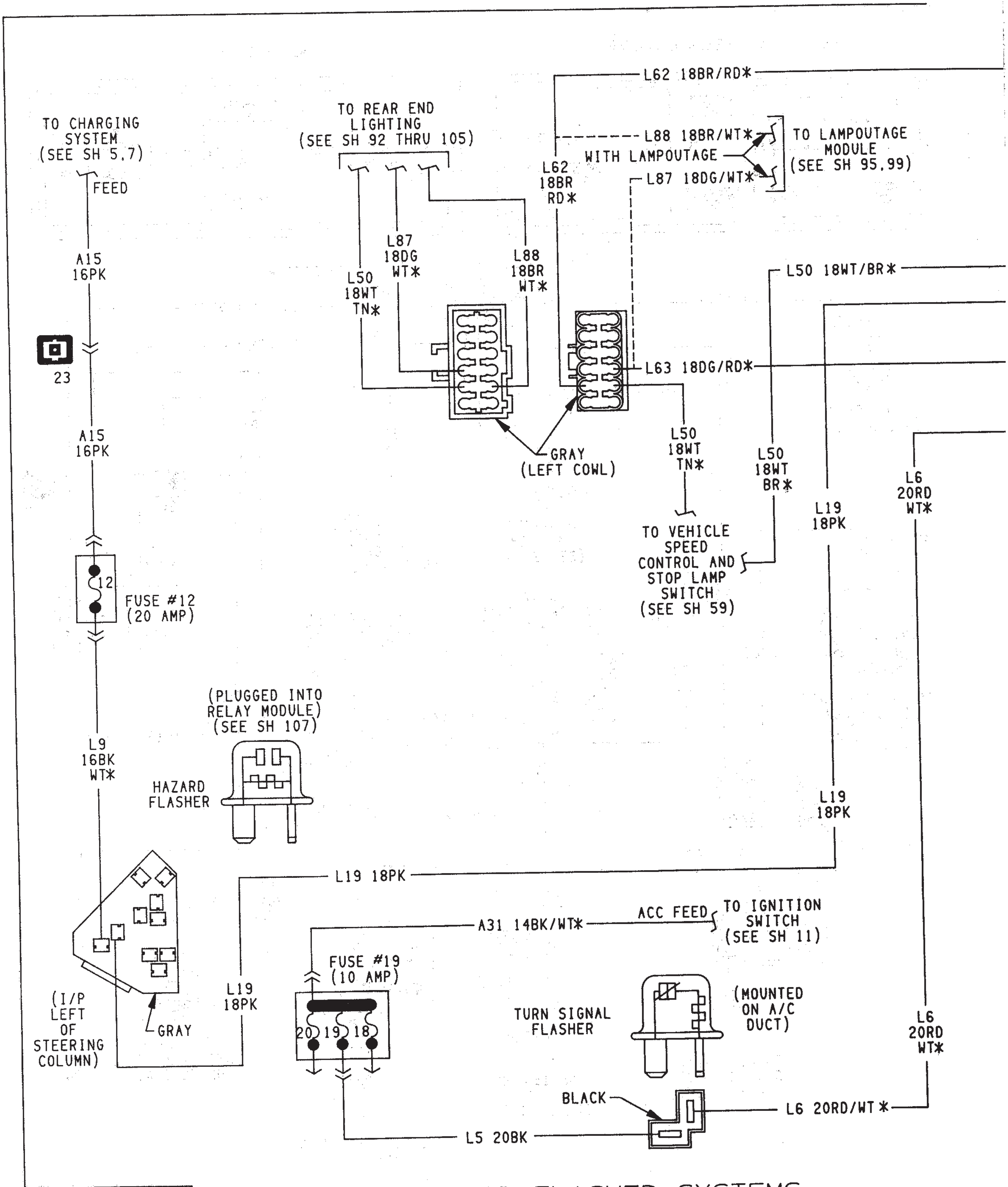
938W-1



MINI-TRIP COMPUTER

AA-CDP 60

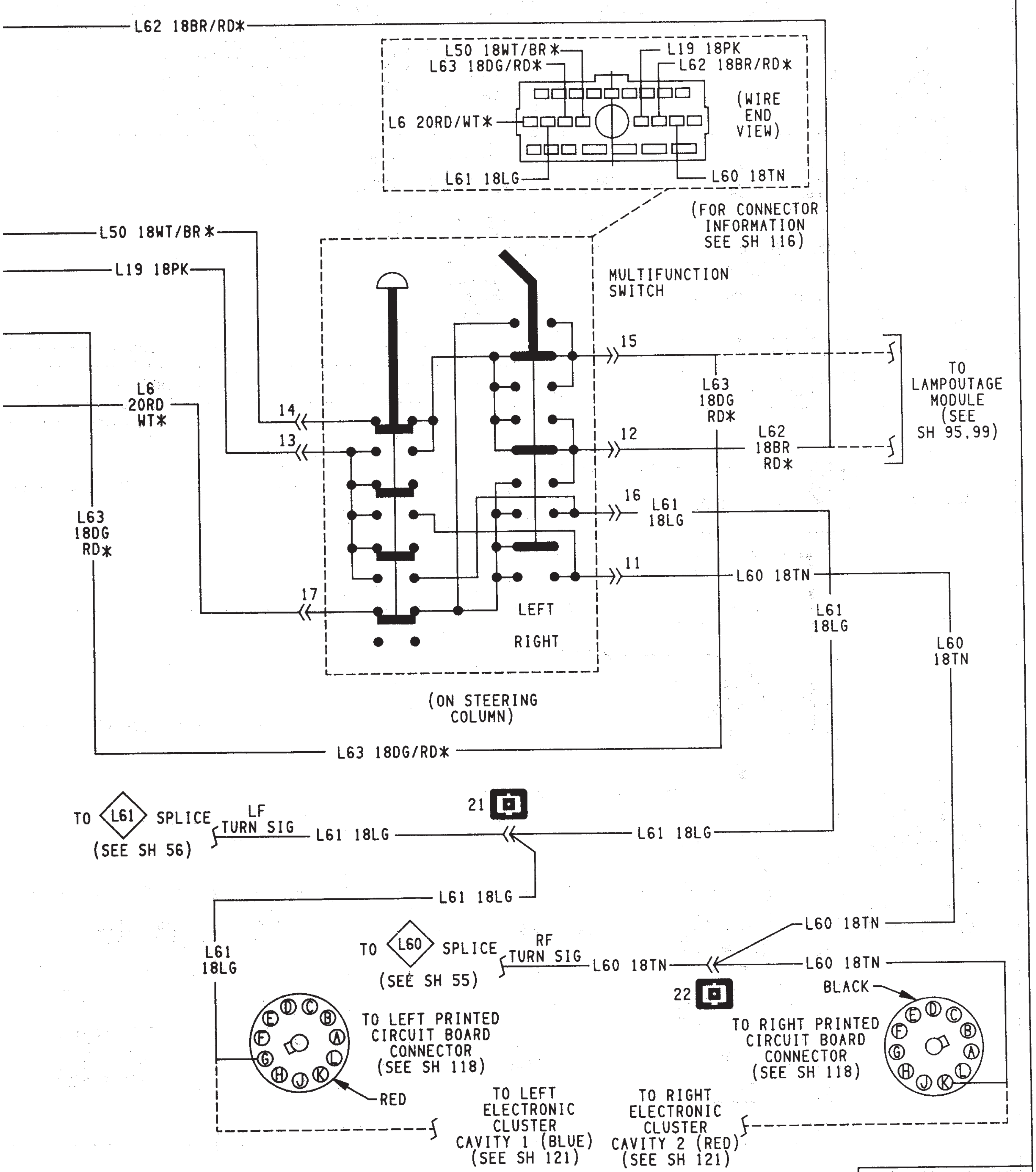
938W-1



AA-CDP 61

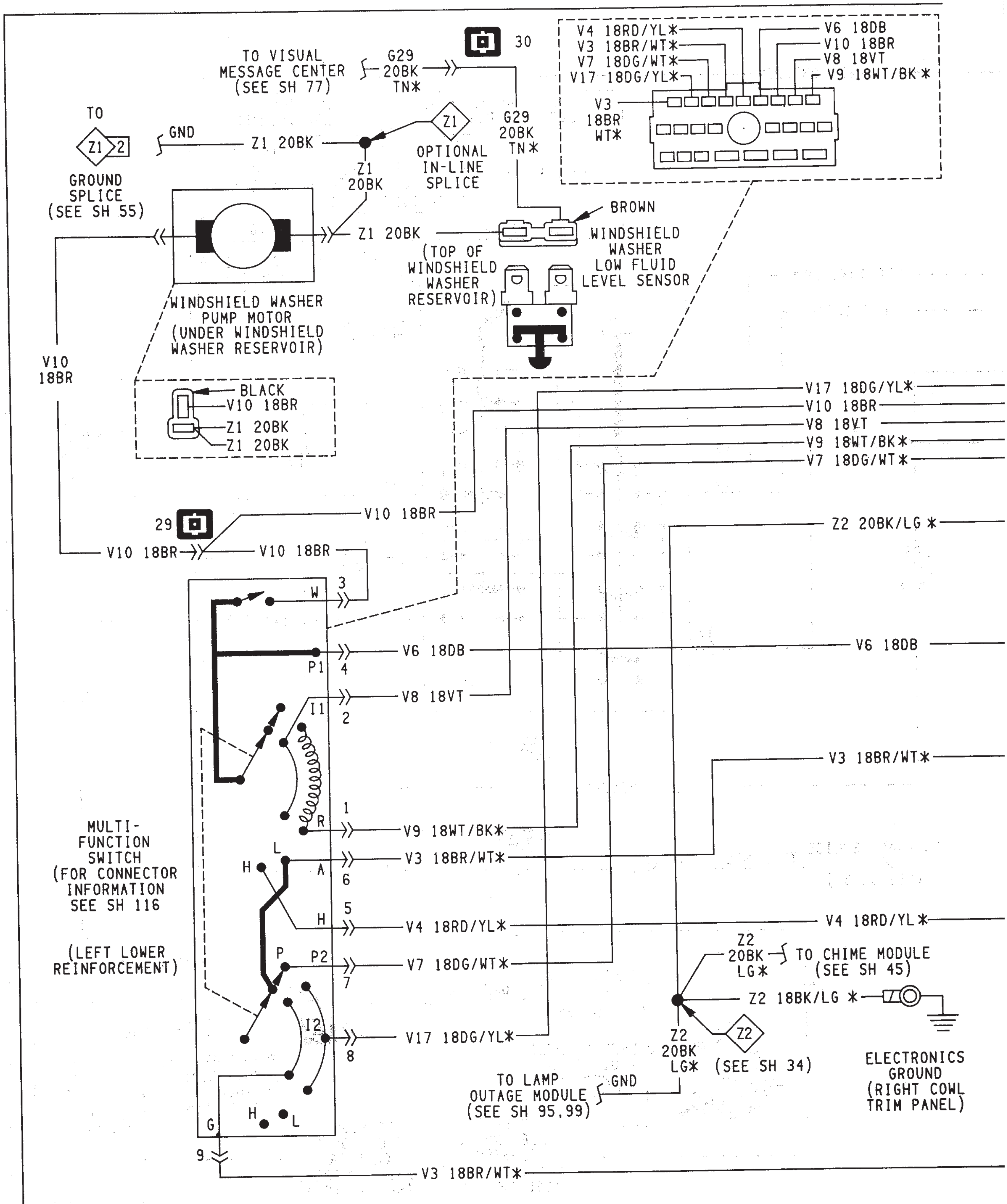
TURN AND HAZARD FLASHER SYSTEMS

938W-1



938W-1 TURN AND HAZARD FLASHER SYSTEMS

AA-CDP 62

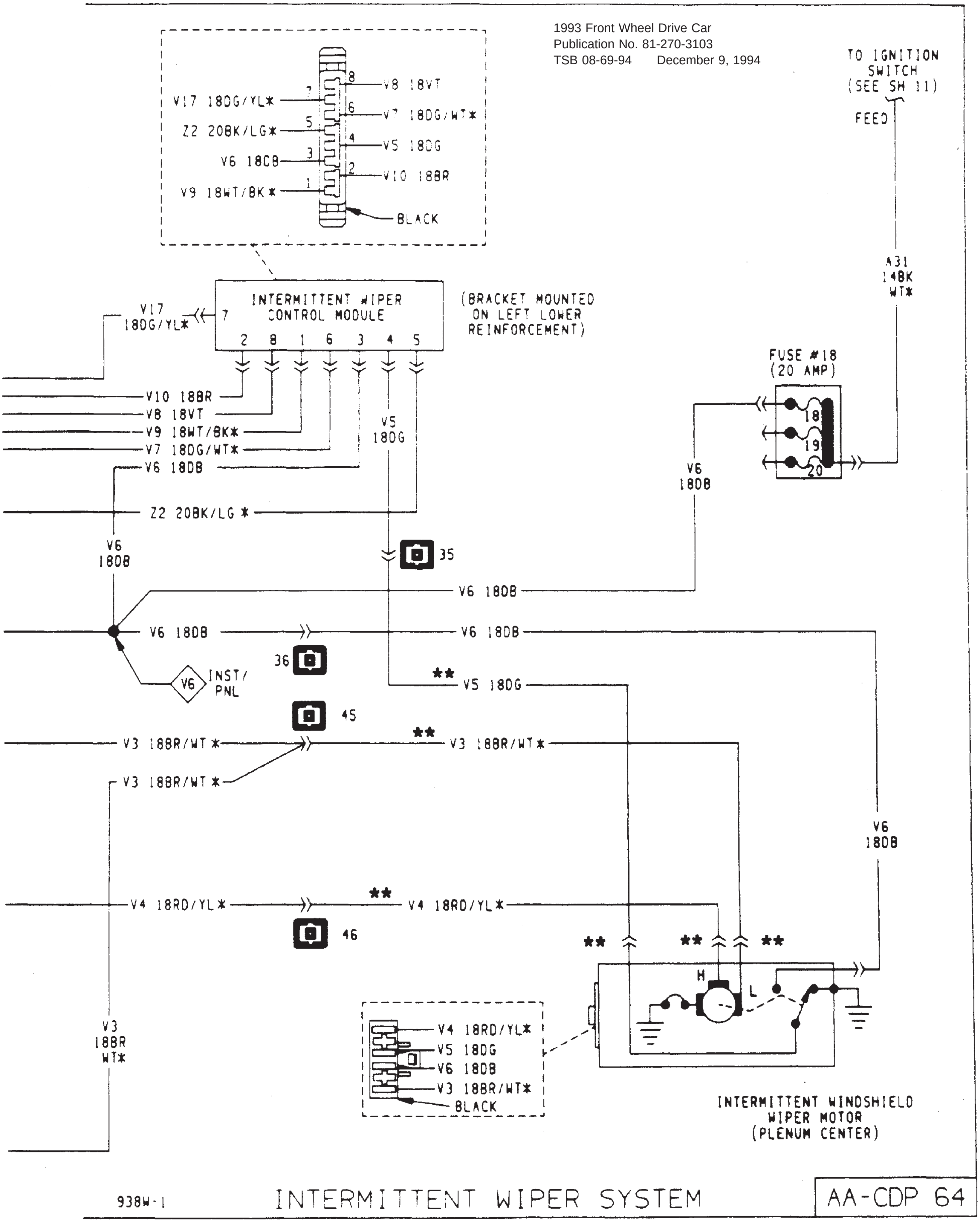


AA-CDP 63

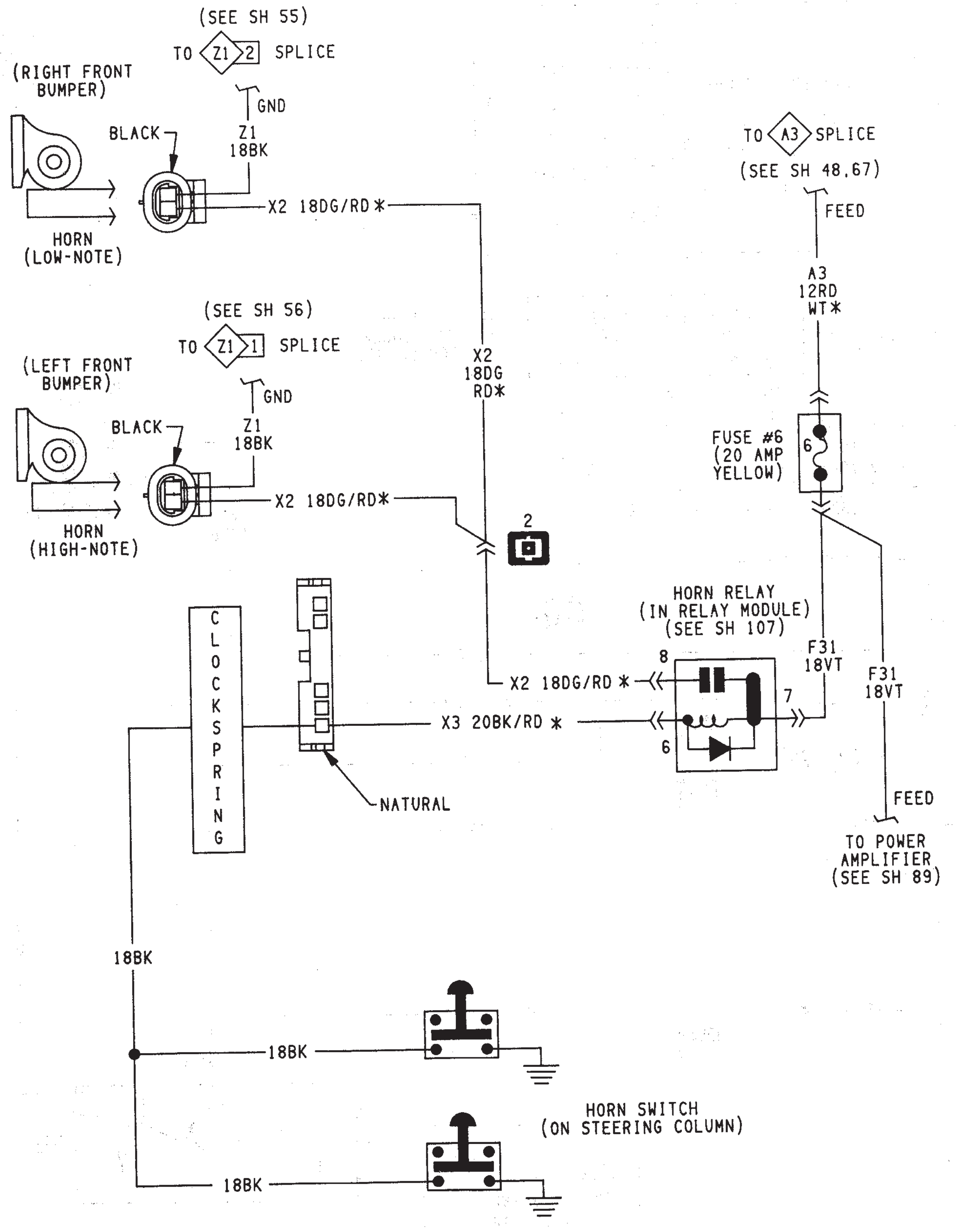
INTERMITTENT WIPER SYSTEM

938W-1

1993 Front Wheel Drive Car
Publication No. 81-270-3103
TSB 08-69-94 December 9, 1994



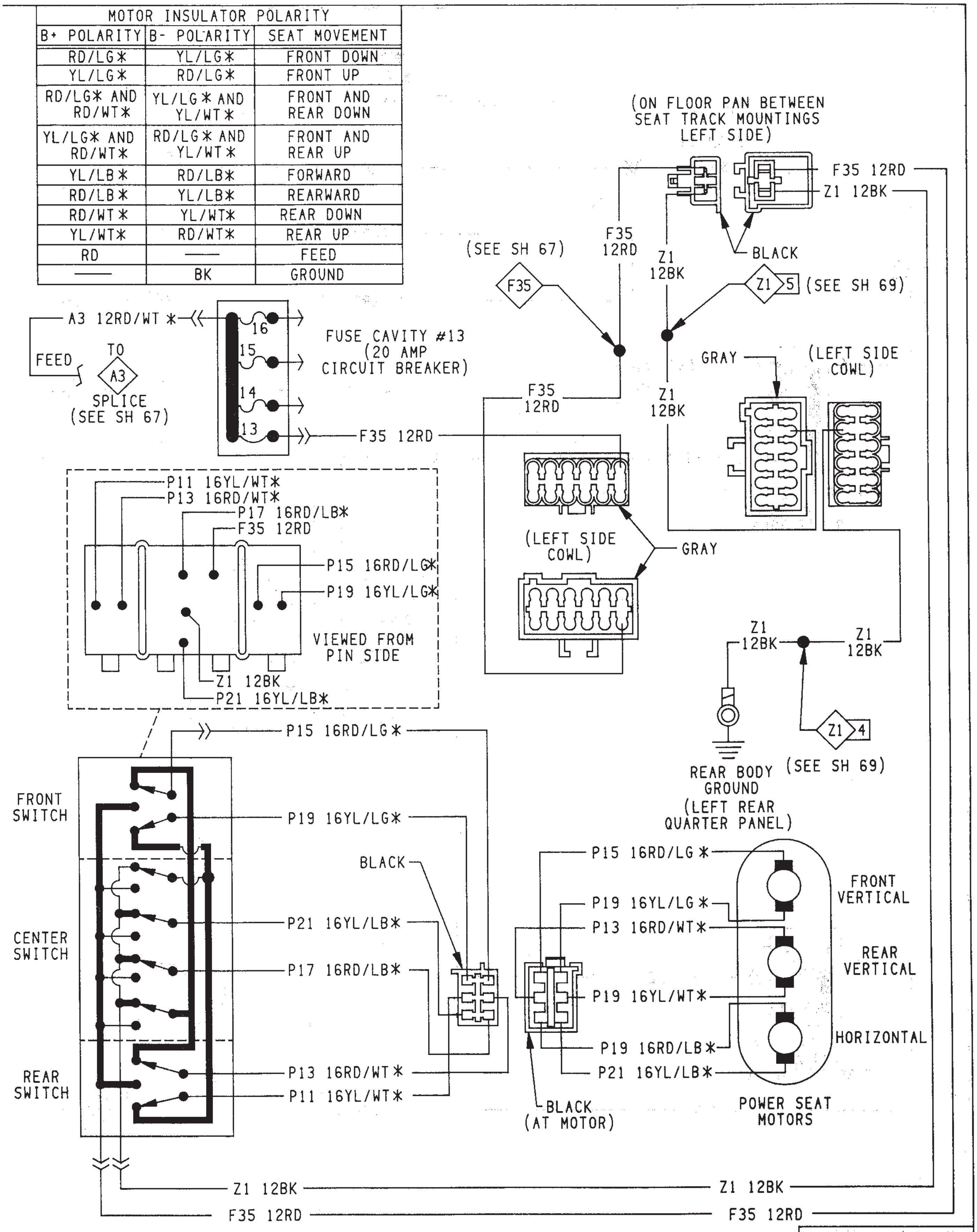
938W-1 INTERMITTENT WIPER SYSTEM AA-CDP 64



AA-CDP 65

HORN SYSTEM

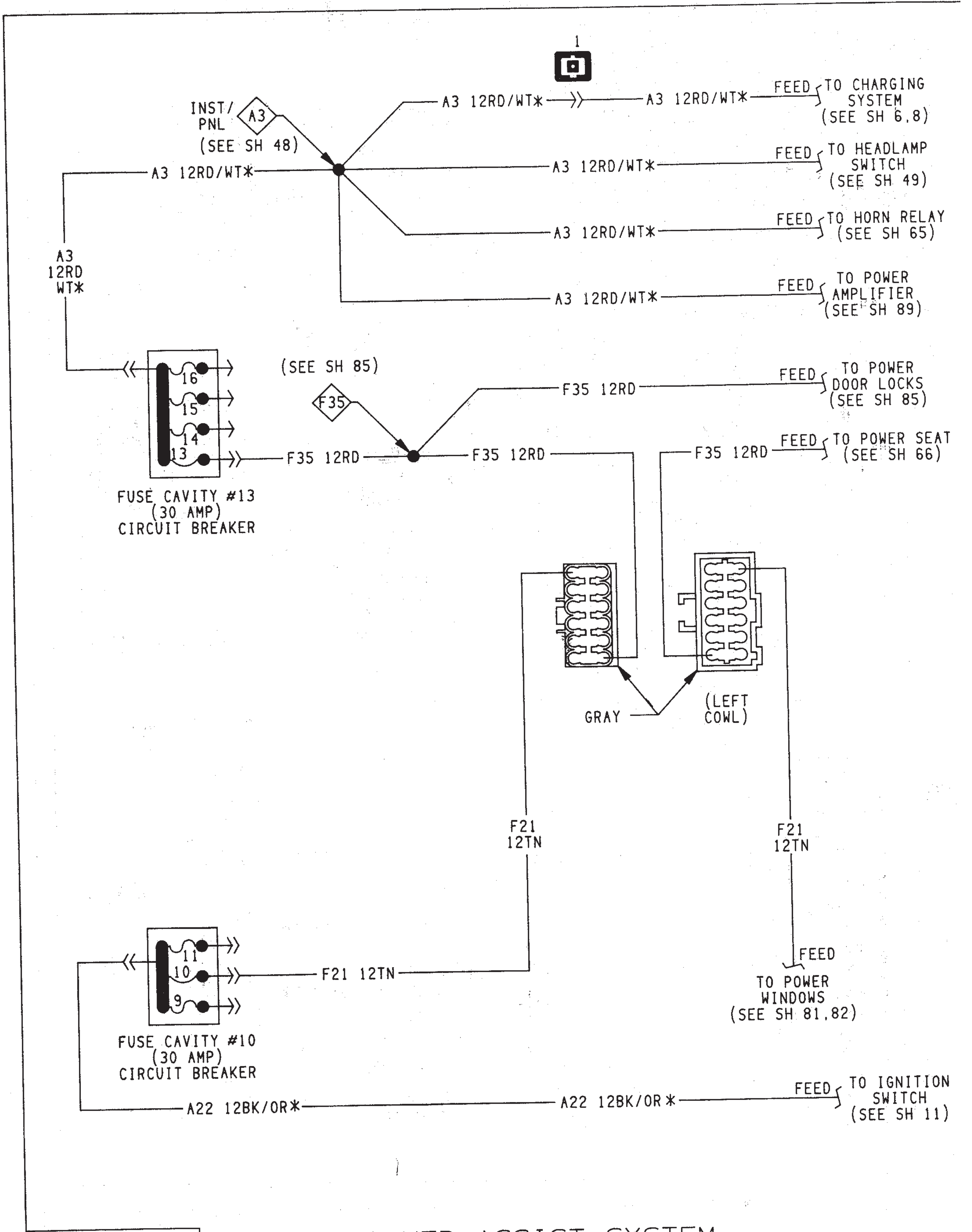
938W-1



MOTOR INSULATOR POLARITY		
B+ POLARITY	B- POLARITY	SEAT MOVEMENT
RD/LG*	YL/LG*	FRONT DOWN
YL/LG*	RD/LG*	FRONT UP
RD/LG* AND RD/WT*	YL/LG* AND YL/WT*	FRONT AND REAR DOWN
YL/LG* AND RD/WT*	RD/LG* AND YL/WT*	FRONT AND REAR UP
YL/LB*	RD/LB*	FORWARD
RD/LB*	YL/LB*	REARWARD
RD/WT*	YL/WT*	REAR DOWN
YL/WT*	RD/WT*	REAR UP
RD	——	FEED
——	BK	GROUND

938W-1

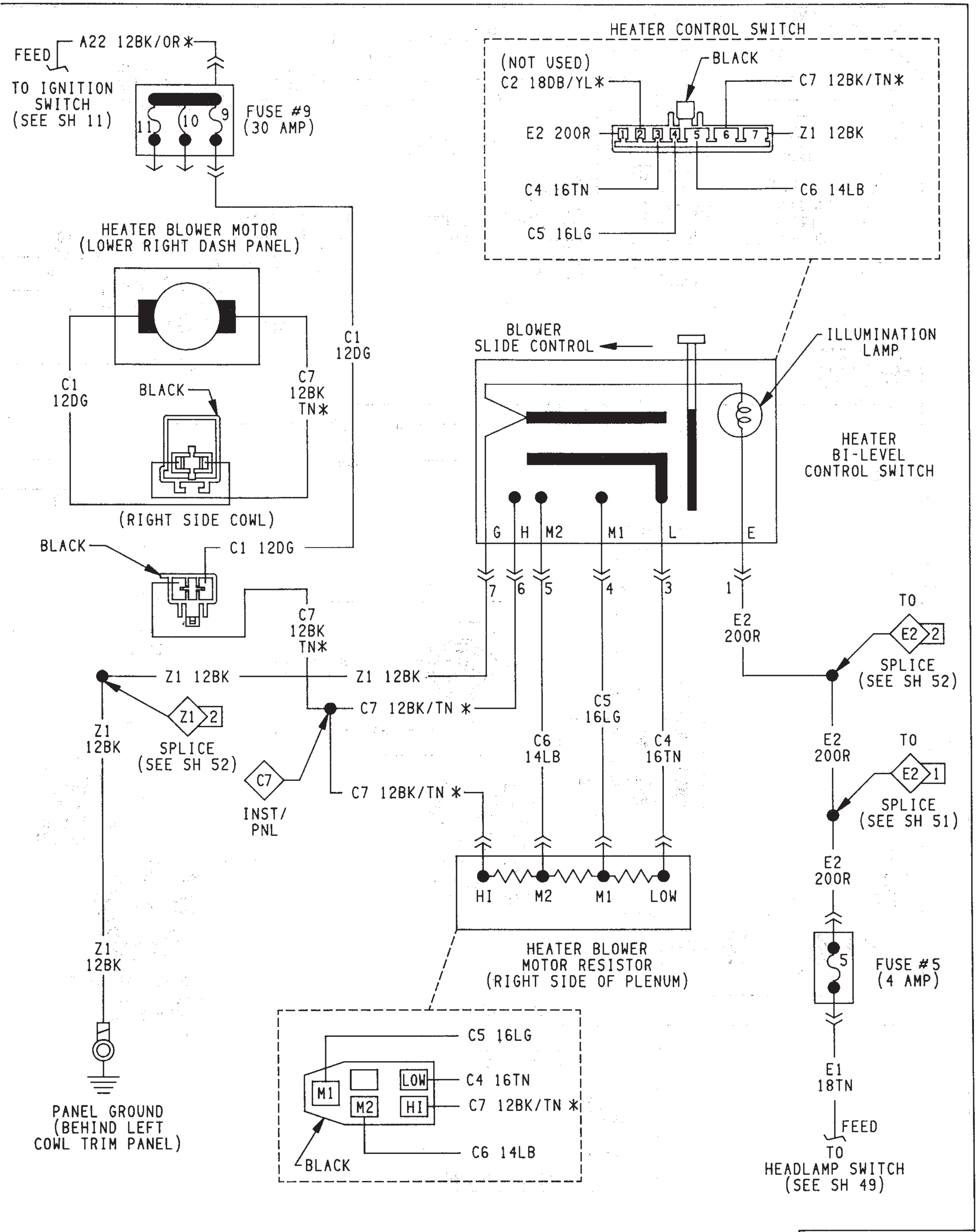
LEFT POWER SEAT SYSTEM



AA-CDP 67

POWER ASSIST SYSTEM

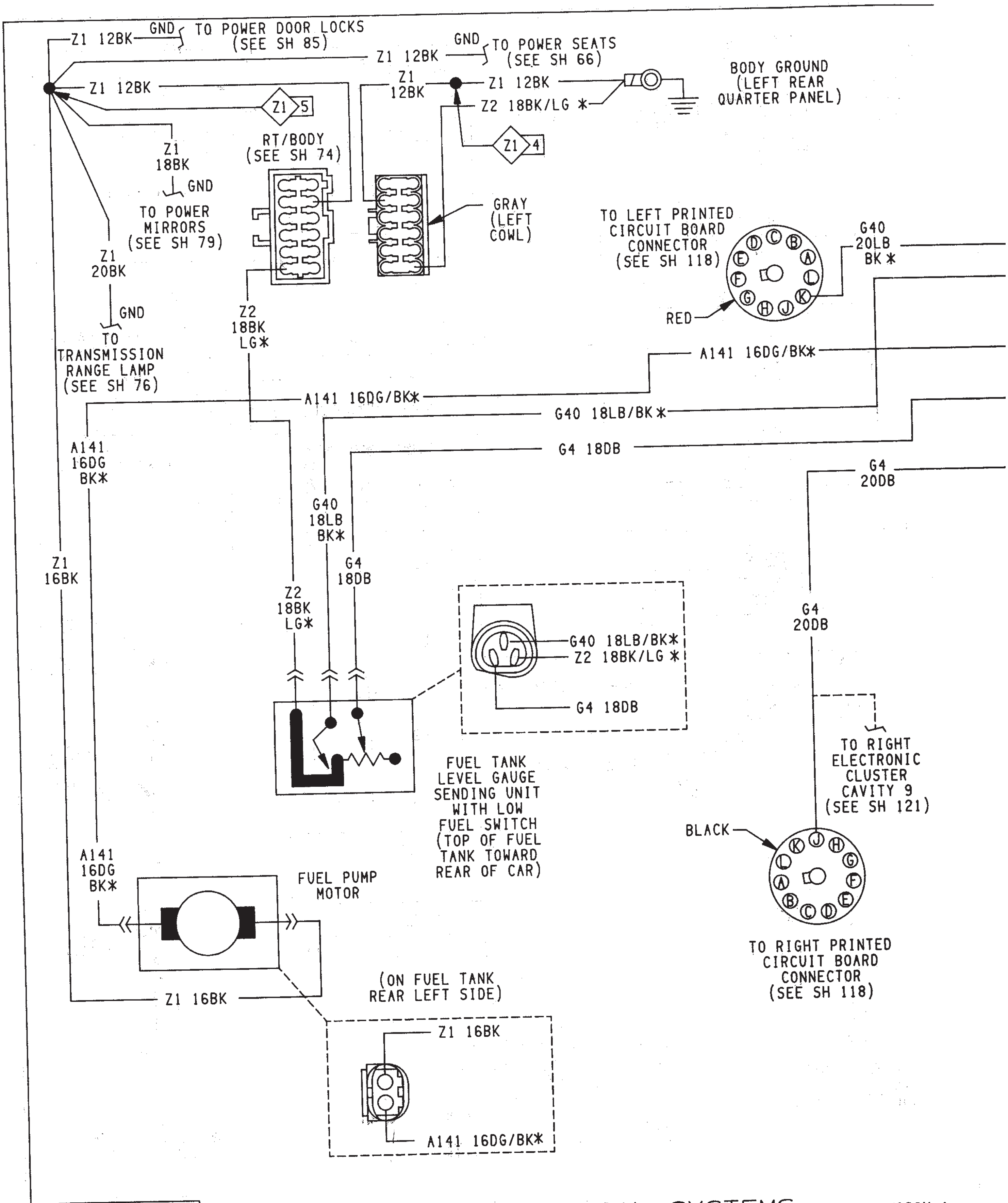
938W-1



938W-1

HEATER SYSTEM

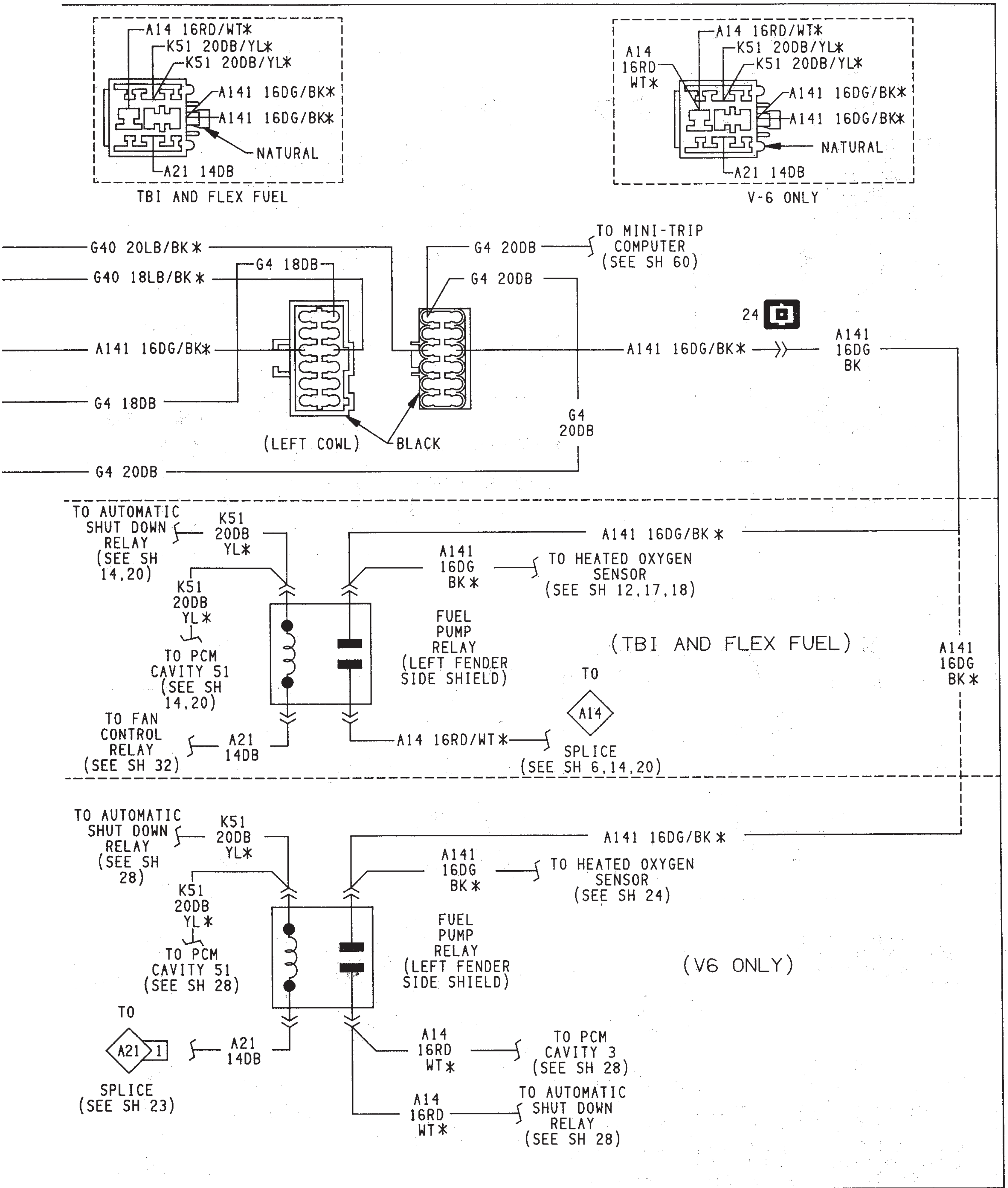
AA-CDP 68



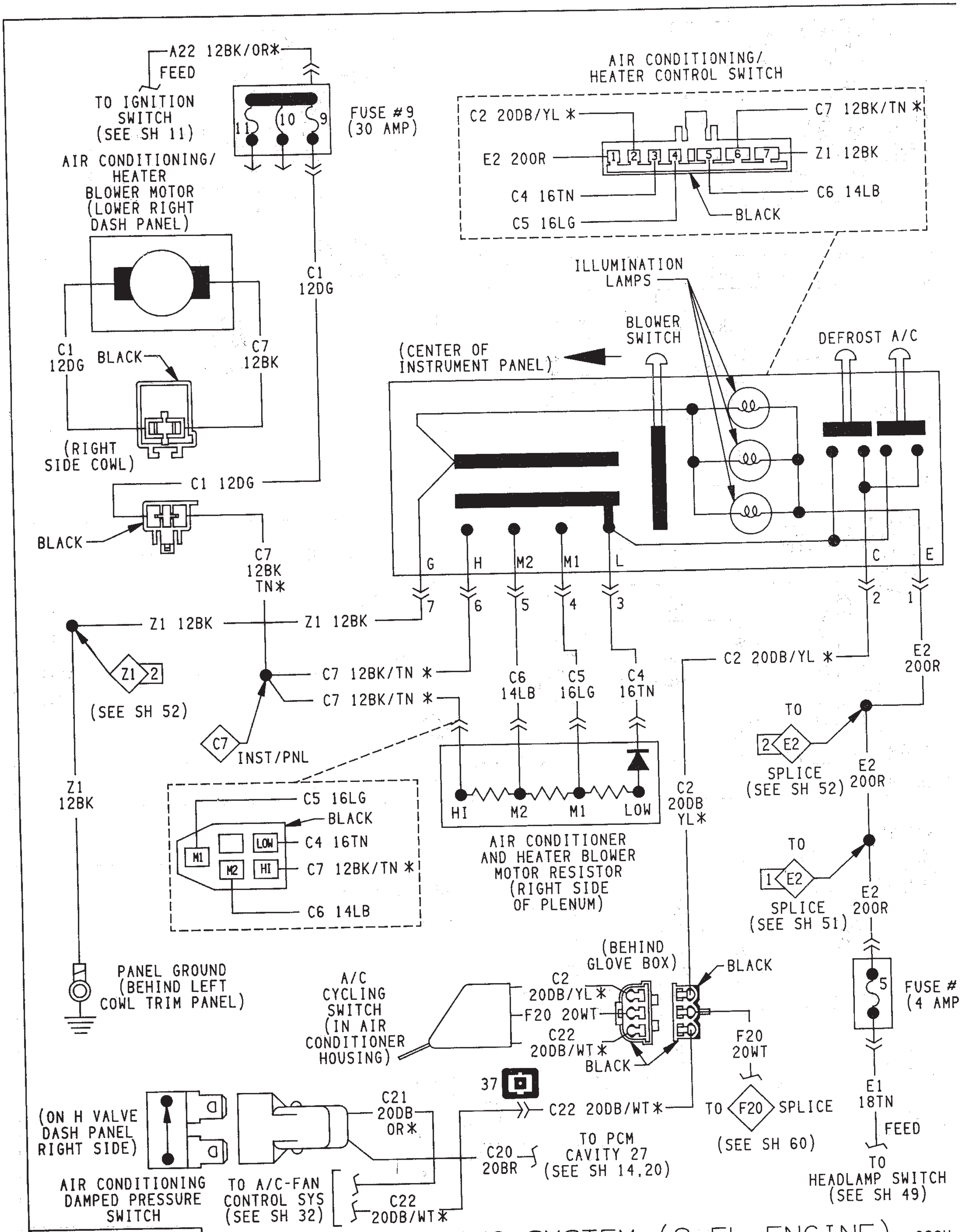
AA-CDP 69

FUEL TANK ELECTRICAL SYSTEMS

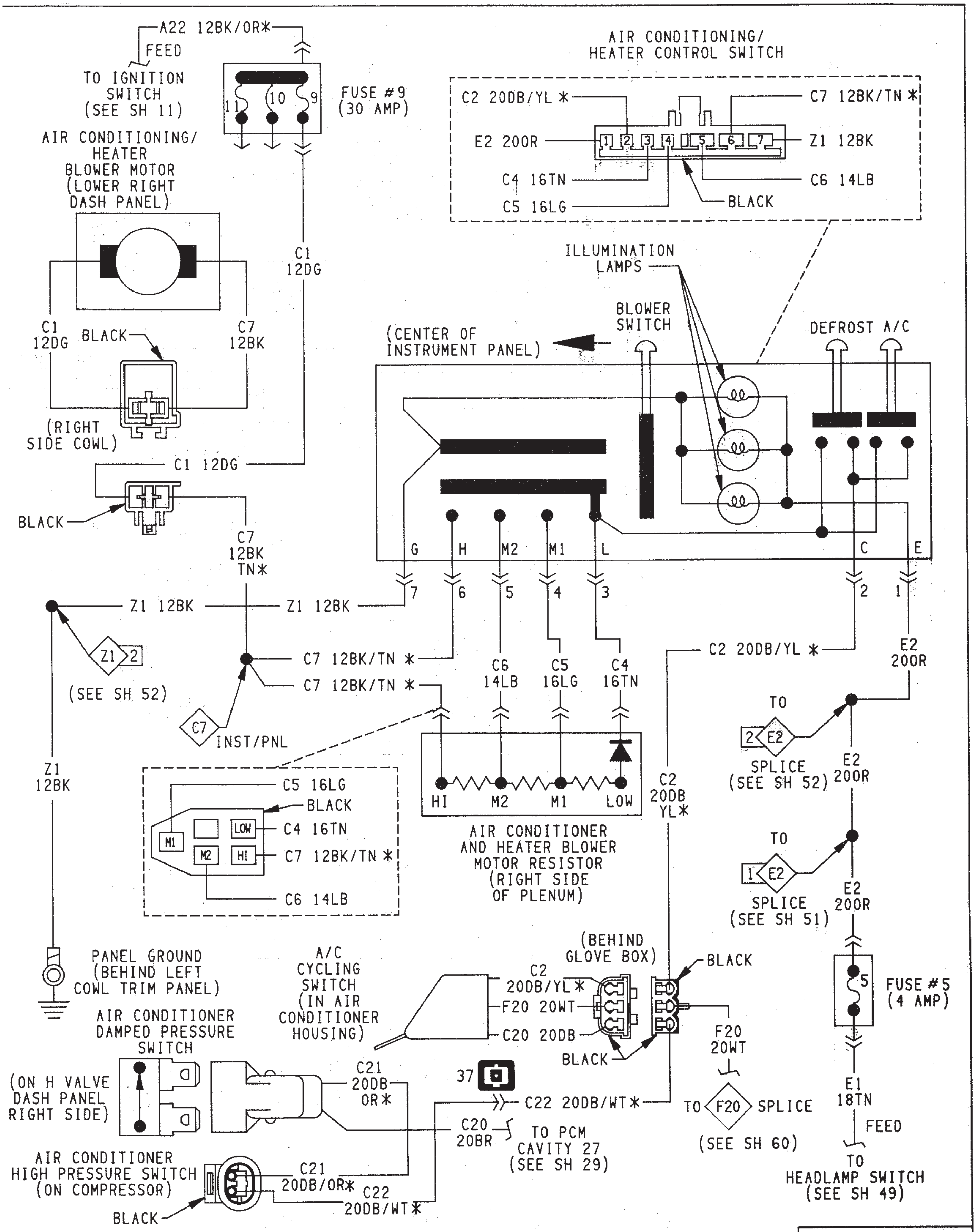
938W-1



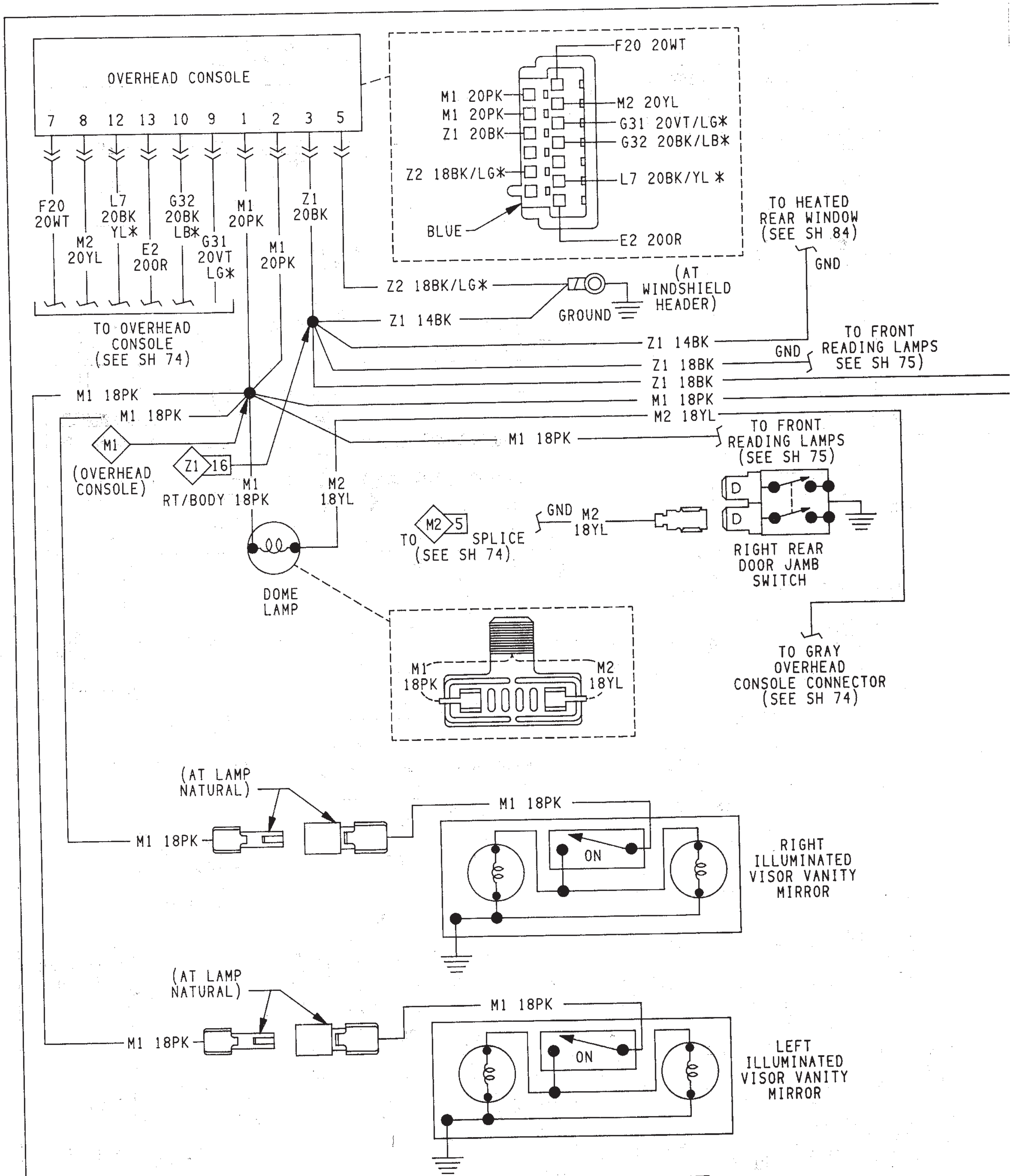
938W-1 FUEL TANK ELECTRICAL SYSTEMS AA-CDP 70



AA-CDP 71 | AIR CONDITIONING SYSTEM (2.5L ENGINE) 938W-1



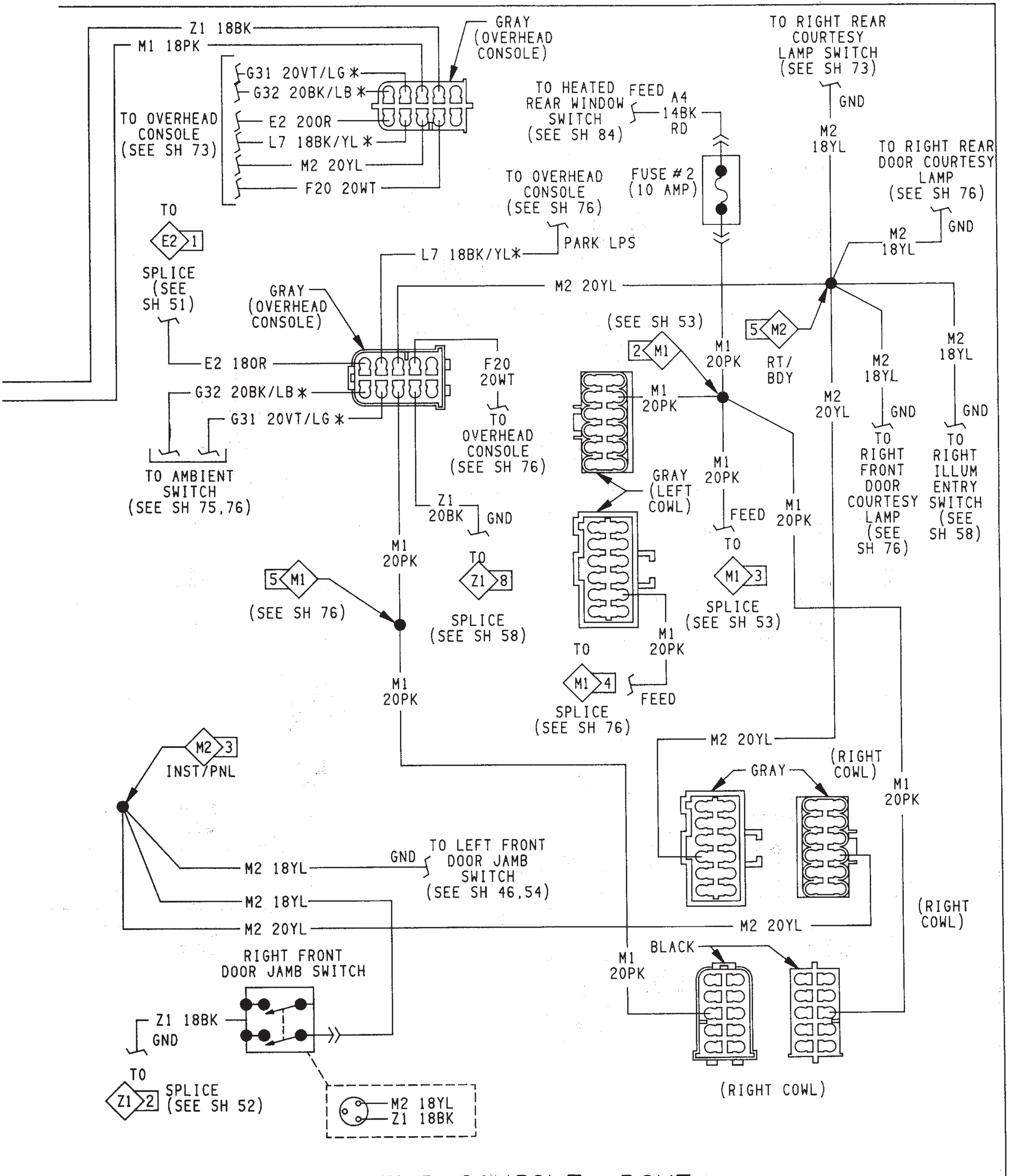
938W-1 AIR CONDITIONING SYSTEM (3.0L ENGINE) AA-CDP 72



OVERHEAD CONSOLE, DOME, READING & VISOR VANITY LAMPS

AA-CDP 73

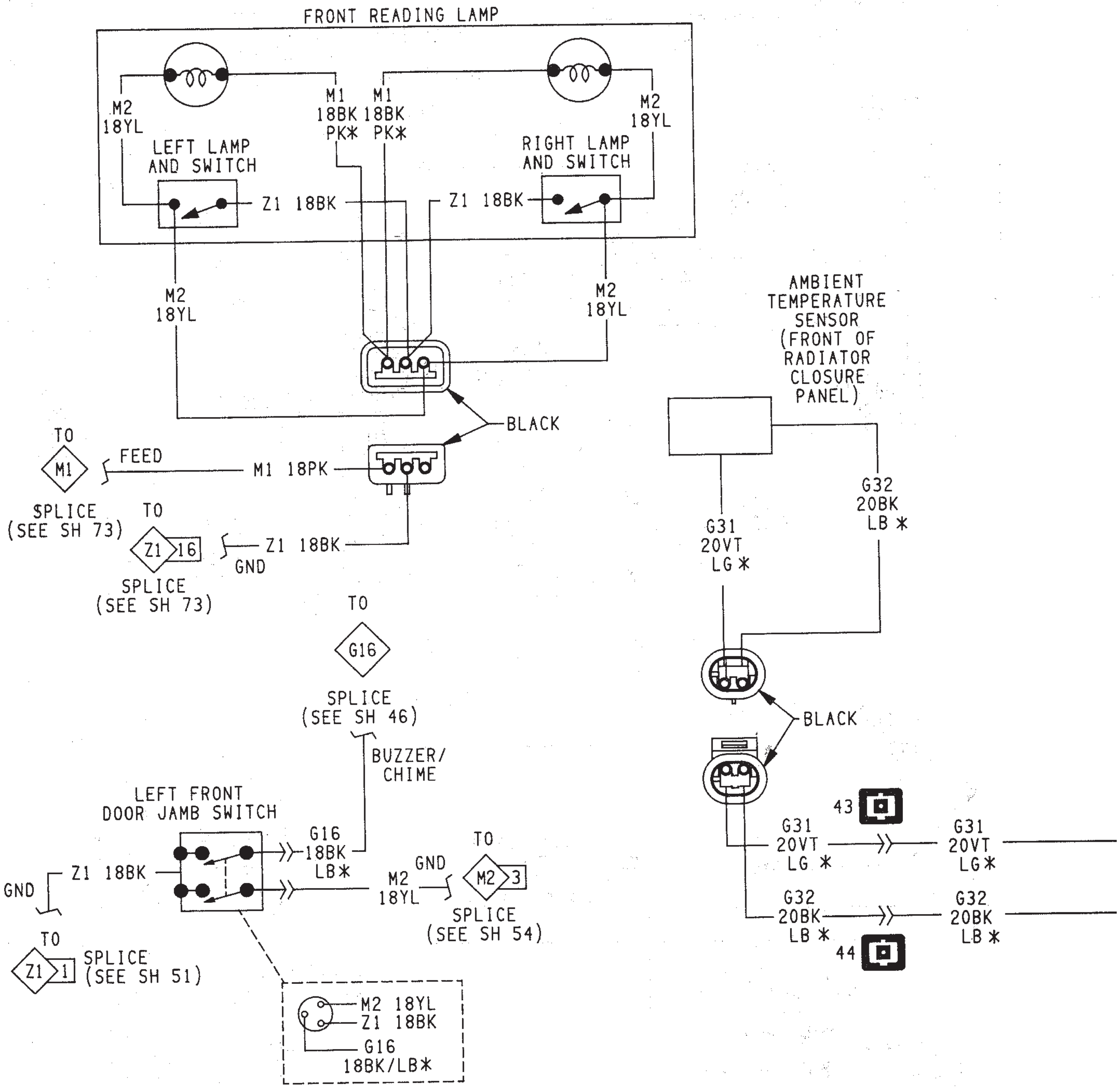
938W-1



938W-1

OVERHEAD CONSOLE, DOME,
READING & VISOR VANITY LAMPS

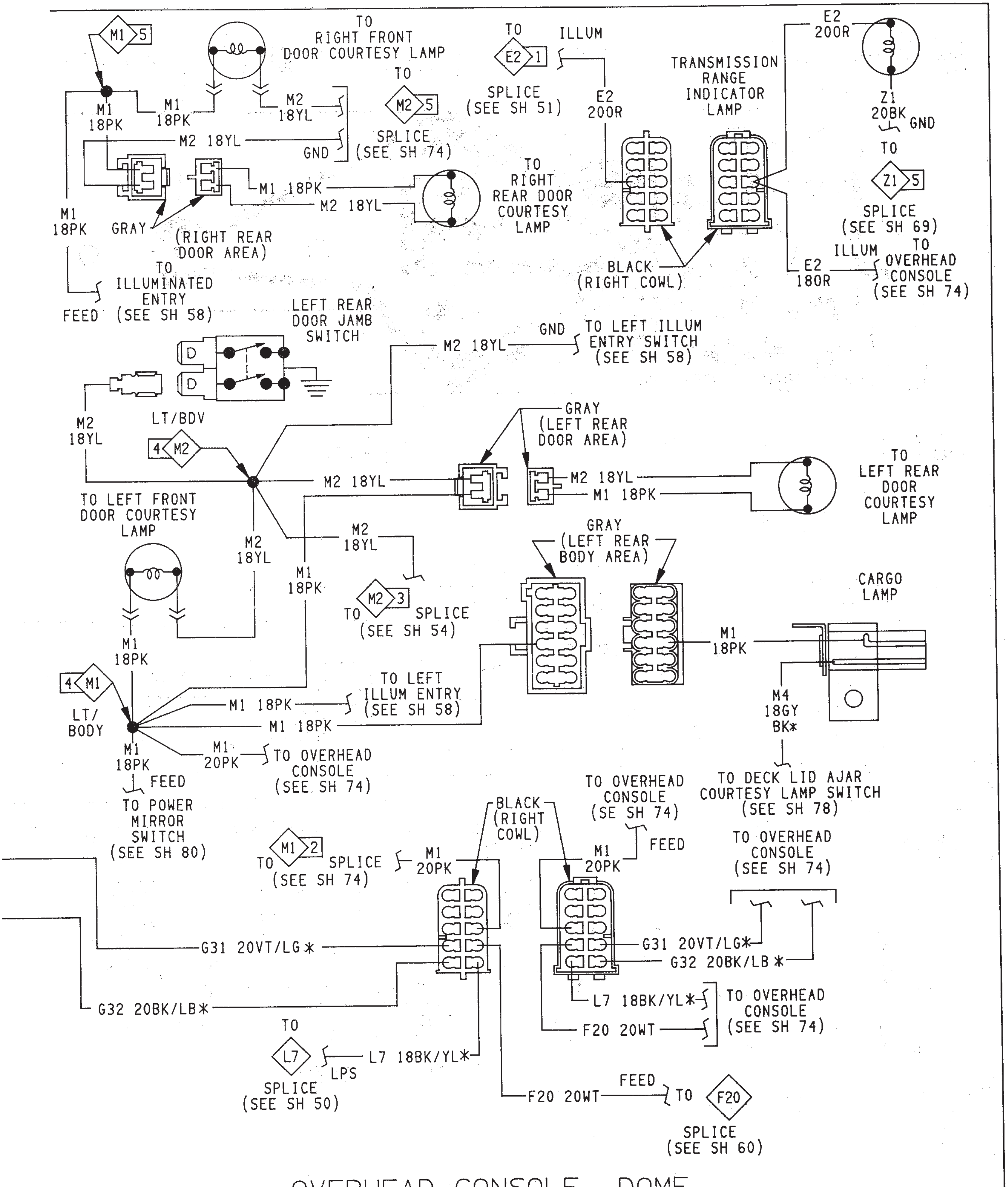
AA-CDP 74



AA-CDP 75

OVERHEAD CONSOLE, DOME,
READING & VISOR VANITY LAMPS

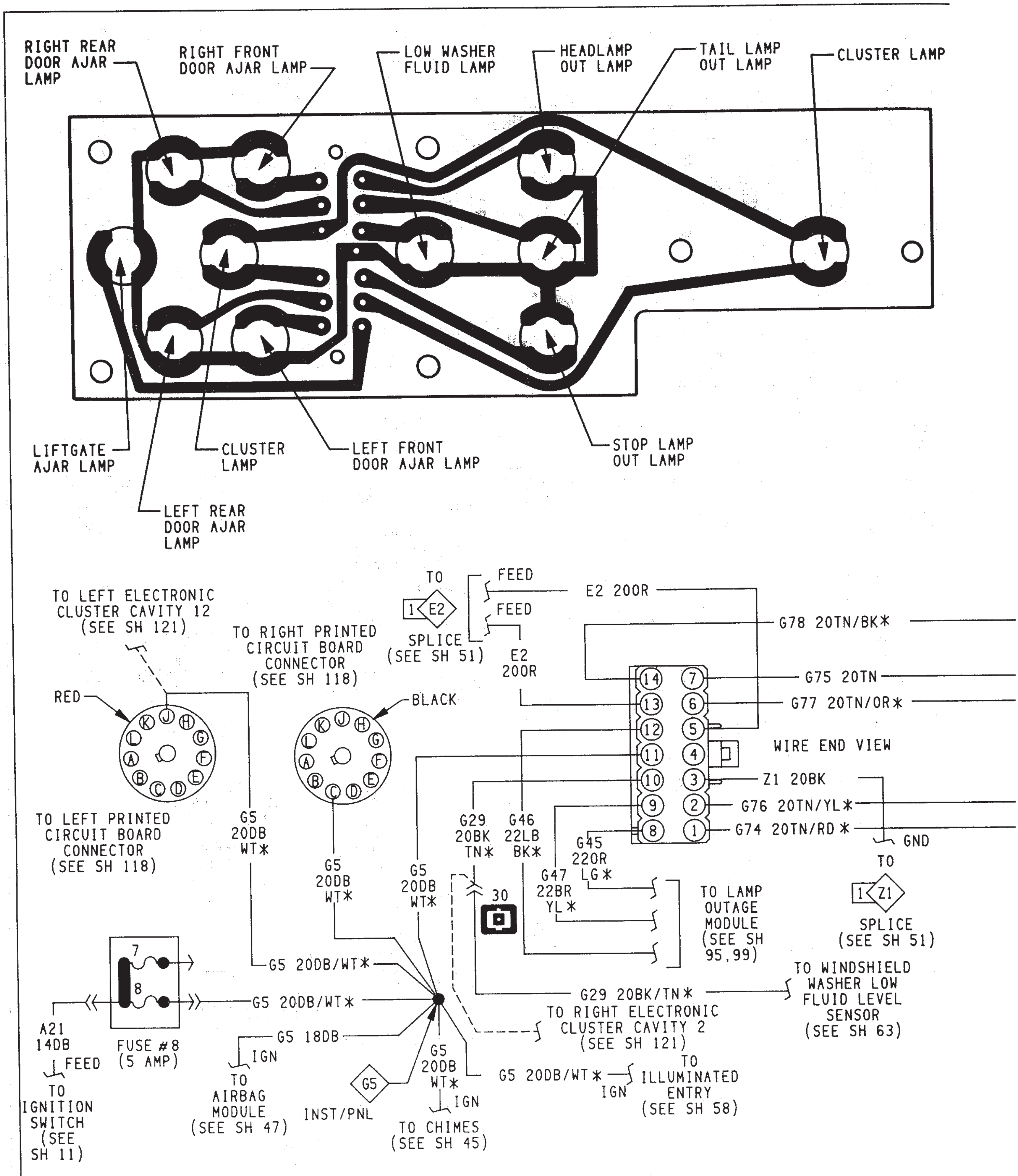
938W-1



938W-1

OVERHEAD CONSOLE, DOME,
READING & VISOR VANITY LAMPS

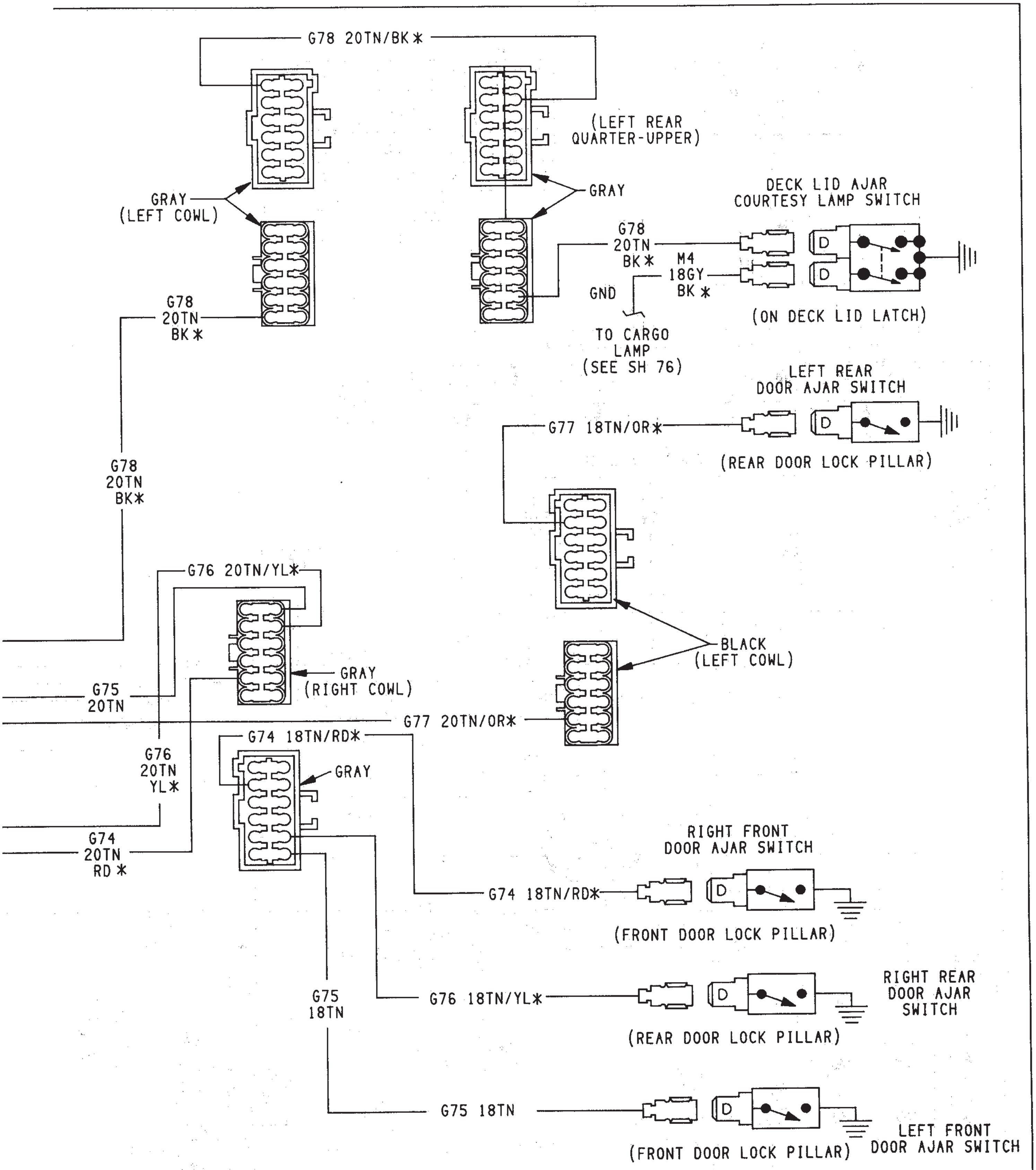
AA-CDP 76



VISUAL MESSAGE CENTER & DOOR AJAR SWITCHES

AA-CDP 77

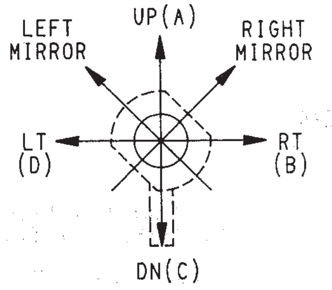
938W-1



VISUAL MESSAGE CENTER & DOOR AJAR SWITCHES

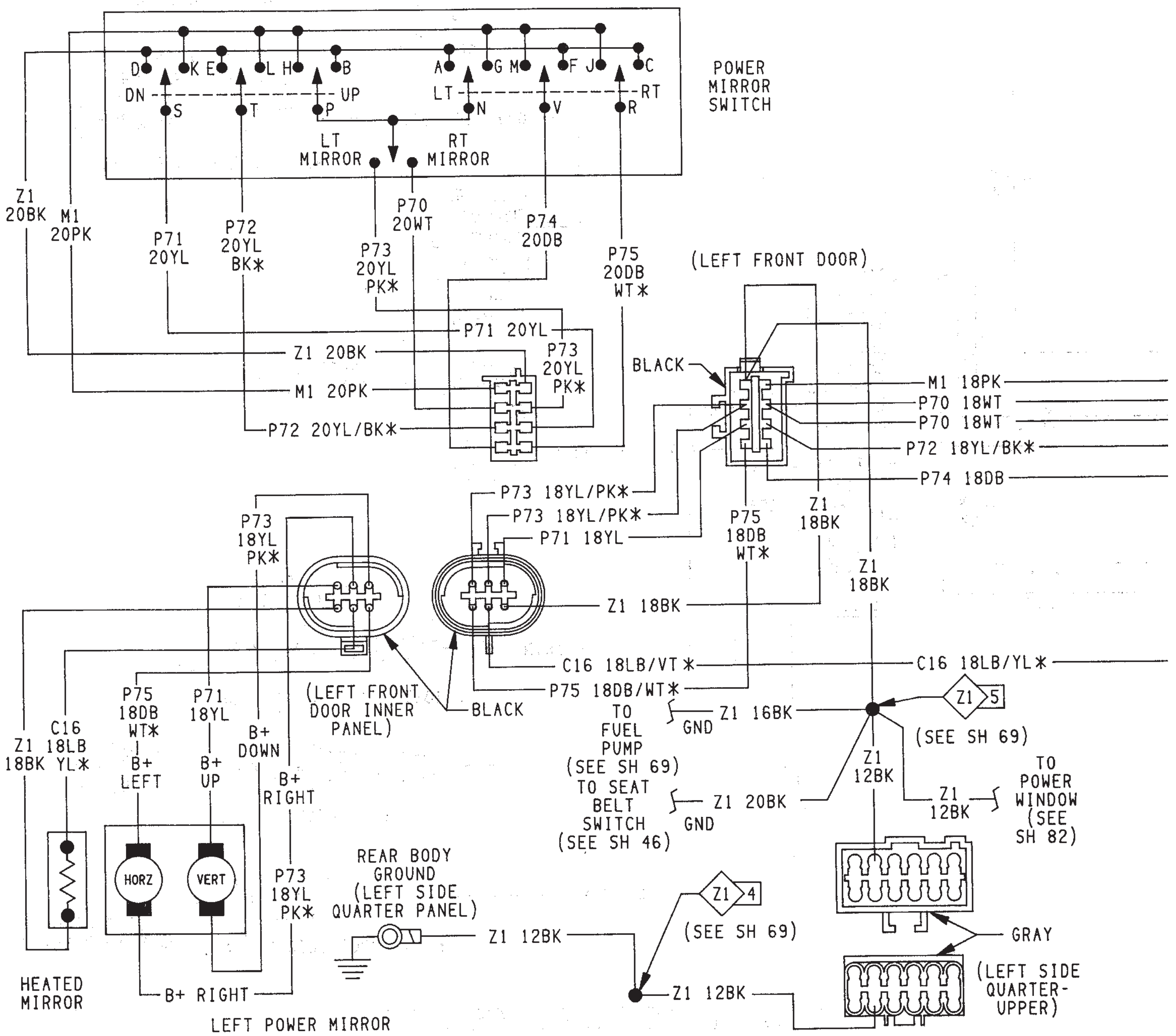
938W-1

AA-CDP 78



VIEW OF SWITCH INDEXING
FROM FRONT OF SWITCH

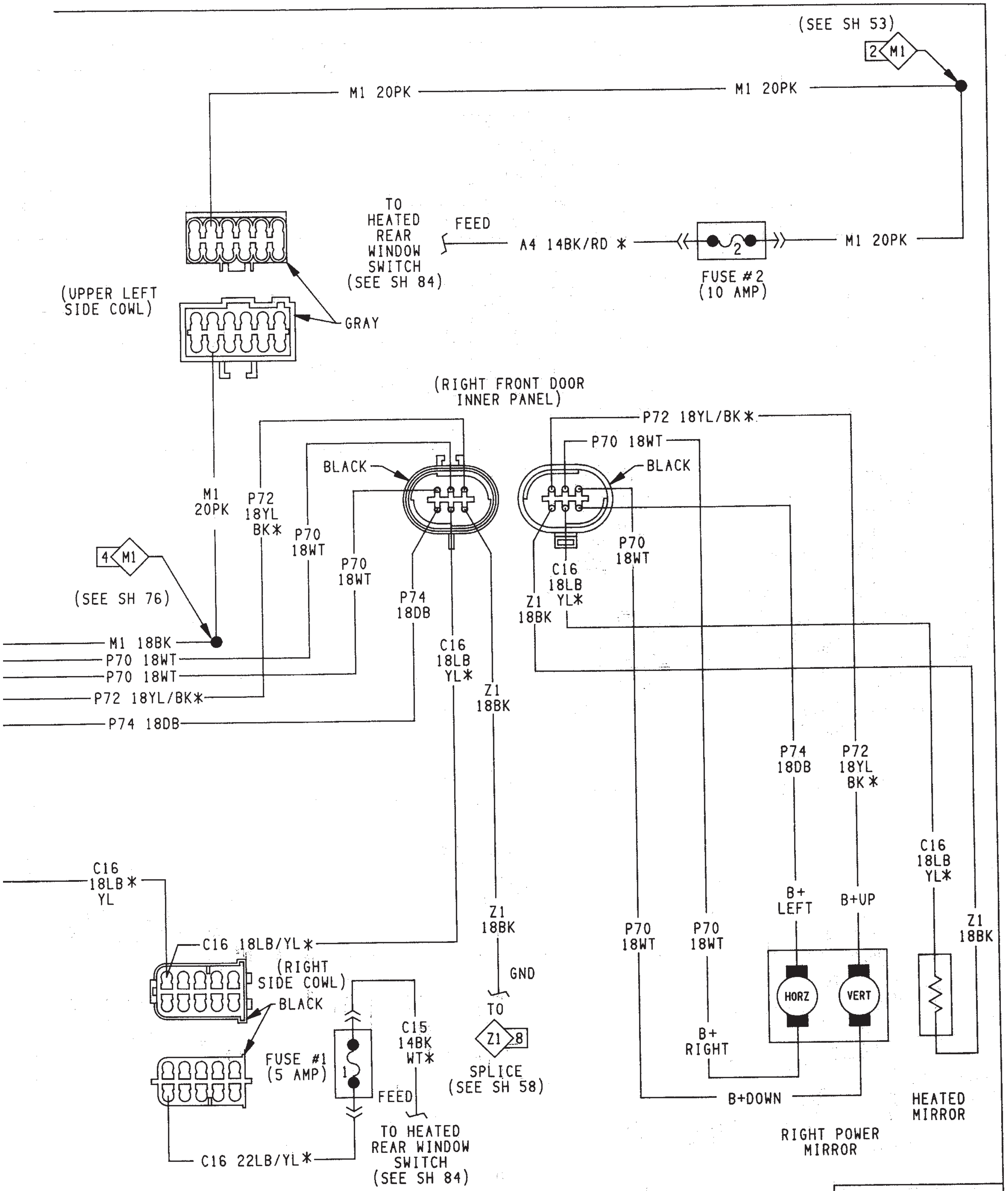
POWER MIRROR SWITCH FUNCTION		
LEVER POSITION	CIRCUIT	MIRROR DIRECTION
A	SK,TL,PB	UP
B	NG,VF,RC	RIGHT
C	SD,TE,PH	DOWN
D	NA,VM,RJ	LEFT



AA-CDP 79

POWER REMOTE HEATED MIRRORS

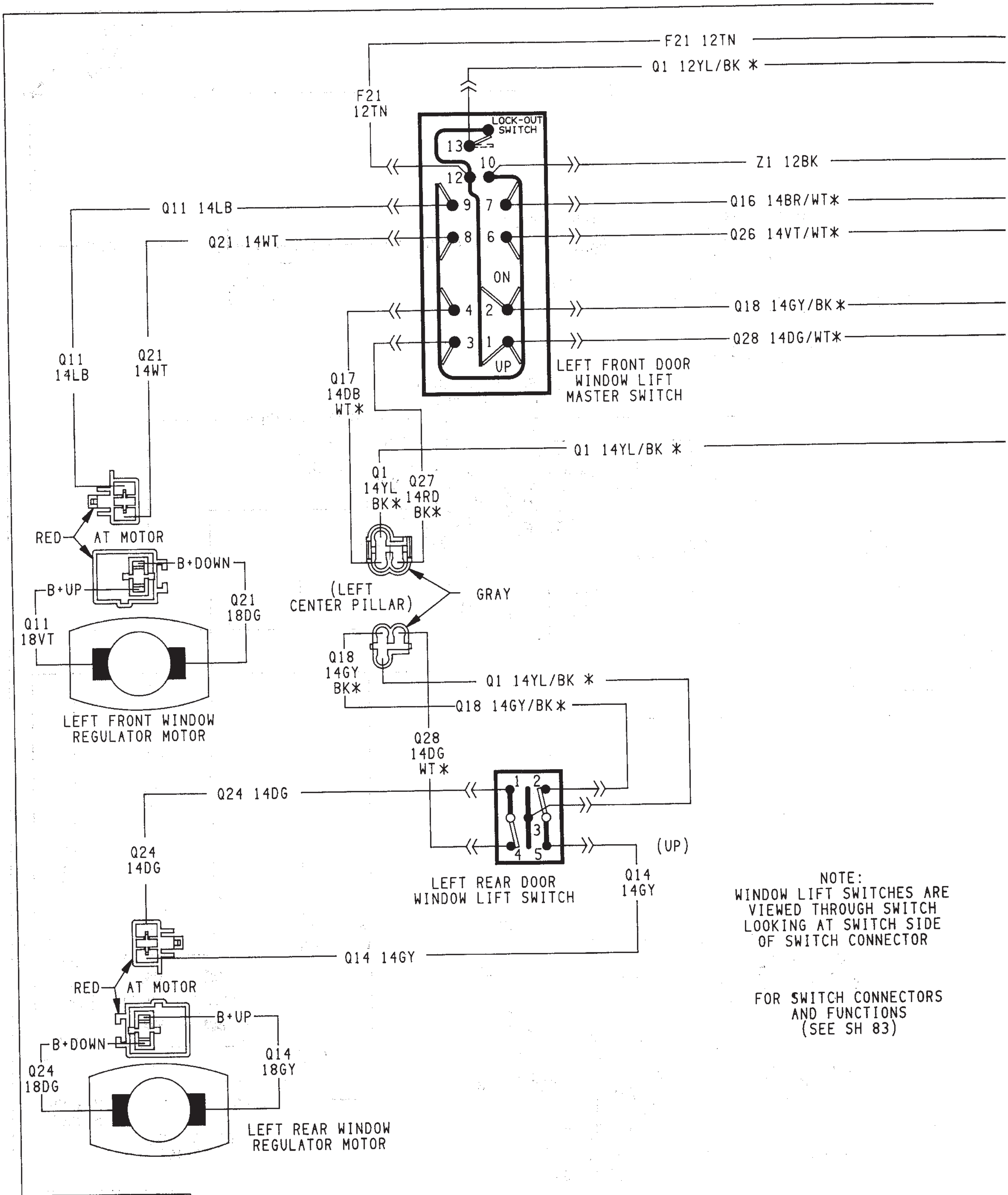
938W-1



938W-1

POWER REMOTE HEATED MIRRORS

AA-CDP 80



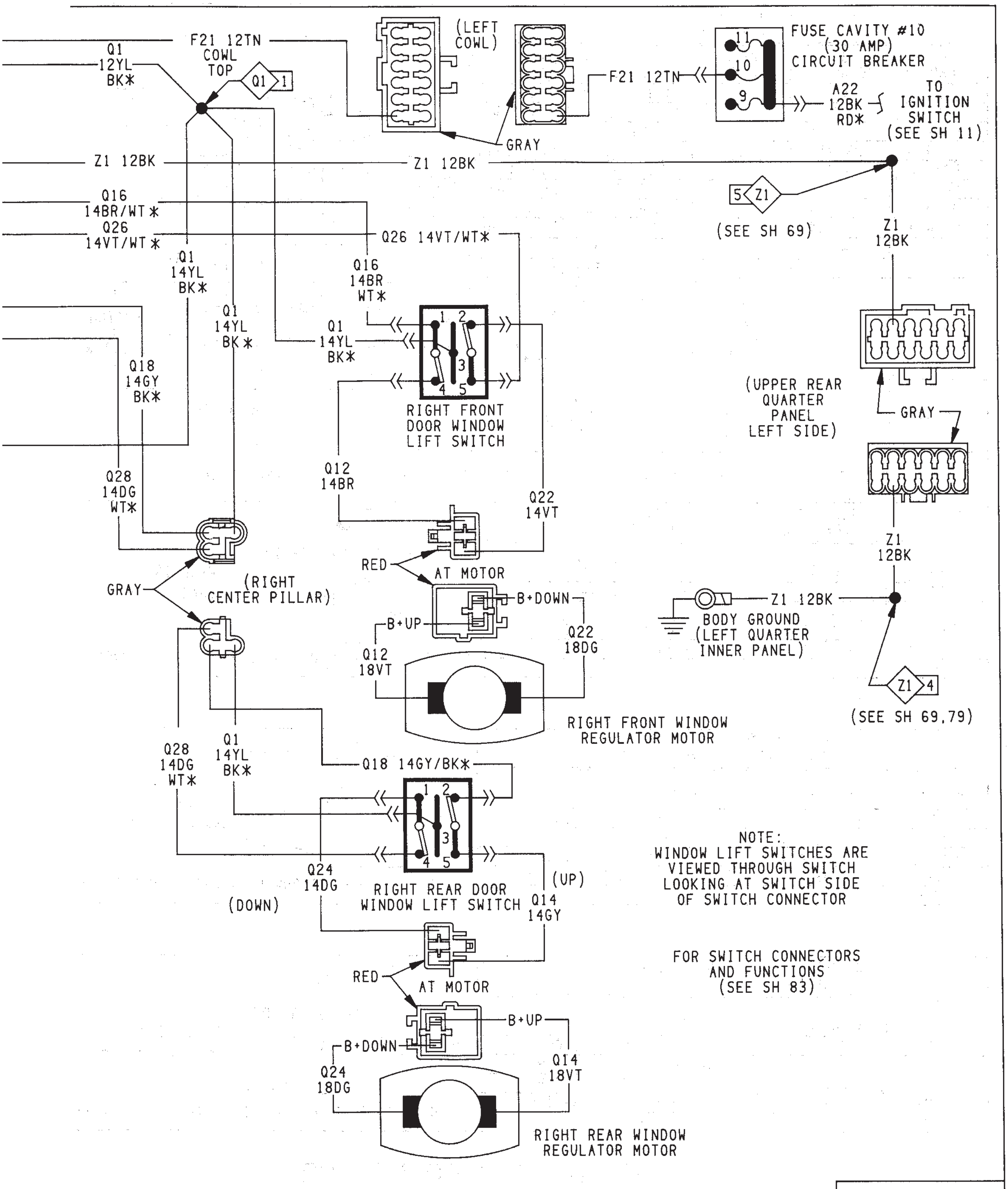
NOTE:
WINDOW LIFT SWITCHES ARE
VIEWED THROUGH SWITCH
LOOKING AT SWITCH SIDE
OF SWITCH CONNECTOR

FOR SWITCH CONNECTORS
AND FUNCTIONS
(SEE SH 83)

AA-CDP 81

POWER WINDOW SYSTEM

938W-1



NOTE:
WINDOW LIFT SWITCHES ARE
VIEWED THROUGH SWITCH
LOOKING AT SWITCH SIDE
OF SWITCH CONNECTOR

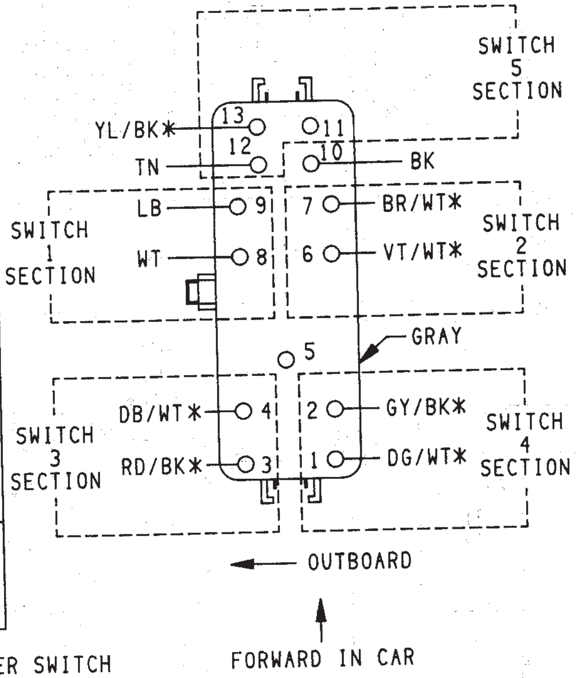
FOR SWITCH CONNECTORS
AND FUNCTIONS
(SEE SH 83)

938W-1

POWER WINDOW SYSTEM

LEFT FRONT DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

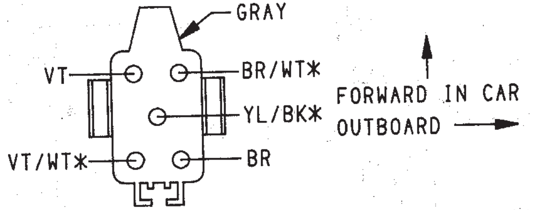
B+ POLARITY	B- POLARITY	SWITCH SECTION	WINDOW AND WINDOW MOVEMENT
LB	WT	1	LEFT FRONT WINDOW UP
WT	LB	1	LEFT FRONT WINDOW DOWN
BR/WT*	VT/WT*	2	RIGHT FRONT WINDOW UP
VT/WT*	BR/WT*	2	RIGHT FRONT WINDOW DOWN
DB/WT*	RD/BK*	3	LEFT REAR WINDOW UP
RD/BK*	DB/WT*	3	LEFT REAR WINDOW DOWN
GY/BK*	DG/WT*	4	RIGHT REAR WINDOW UP
DG/WT*	GY/BK*	4	RIGHT REAR WINDOW DOWN
---	BK	N/A	GROUND B-
TN	---	5	FEED B+
OPEN	---	5 SWITCH ROCKER INBOARD	RIGHT FRONT AND BOTH REAR WINDOW LIFT SWITCHES LOCKED OUT OF SYSTEM
YL/BK*	---	5 SWITCH ROCKER CENTERED	ALL WINDOW LIFT SWITCHES IN SYSTEM



CONNECTOR-5 GANG WITH LOCK-OUT LEFT FRONT DOOR MASTER SWITCH

RIGHT FRONT DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

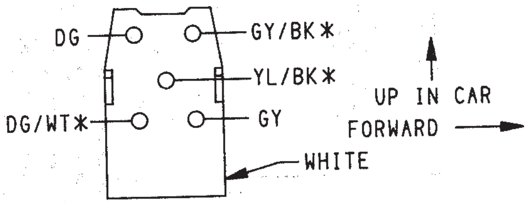
B+ POLARITY	B- POLARITY	WINDOW MOVEMENT
BR	VT	UP FROM DOOR SWITCH
VT	BR	DOWN FROM DOOR SWITCH
BR/WT*	VT/WT*	UP FROM MASTER SWITCH
VT/WT*	BR/WT*	DOWN FROM MASTER SWITCH
YL/BK*	---	FEED B+



RIGHT FRONT DOOR WINDOW LIFT SWITCH CONNECTOR

LEFT REAR DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

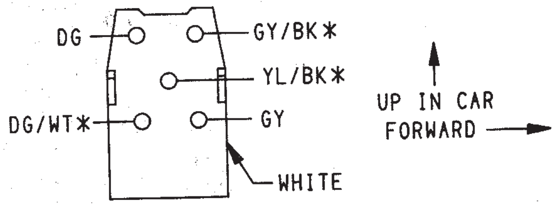
B+ POLARITY	B- POLARITY	WINDOW MOVEMENT
GY	DG	UP FROM DOOR SWITCH
DG	GY	DOWN FROM DOOR SWITCH
GY/BK*	DG/WT*	UP FROM MASTER SWITCH
DG/WT*	GY/BK*	DOWN FROM MASTER SWITCH
YL/BK*	---	FEED B+



LEFT REAR DOOR WINDOW LIFT SWITCH CONNECTOR

RIGHT REAR DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

B+ POLARITY	B- POLARITY	WINDOW MOVEMENT
GY	DG	UP FROM DOOR SWITCH
DG	GY	DOWN FROM DOOR SWITCH
GY/BK*	DG/WT*	UP FROM MASTER SWITCH
DG/WT*	GY/BK*	DOWN FROM MASTER SWITCH
YL/BK*	---	FEED B+

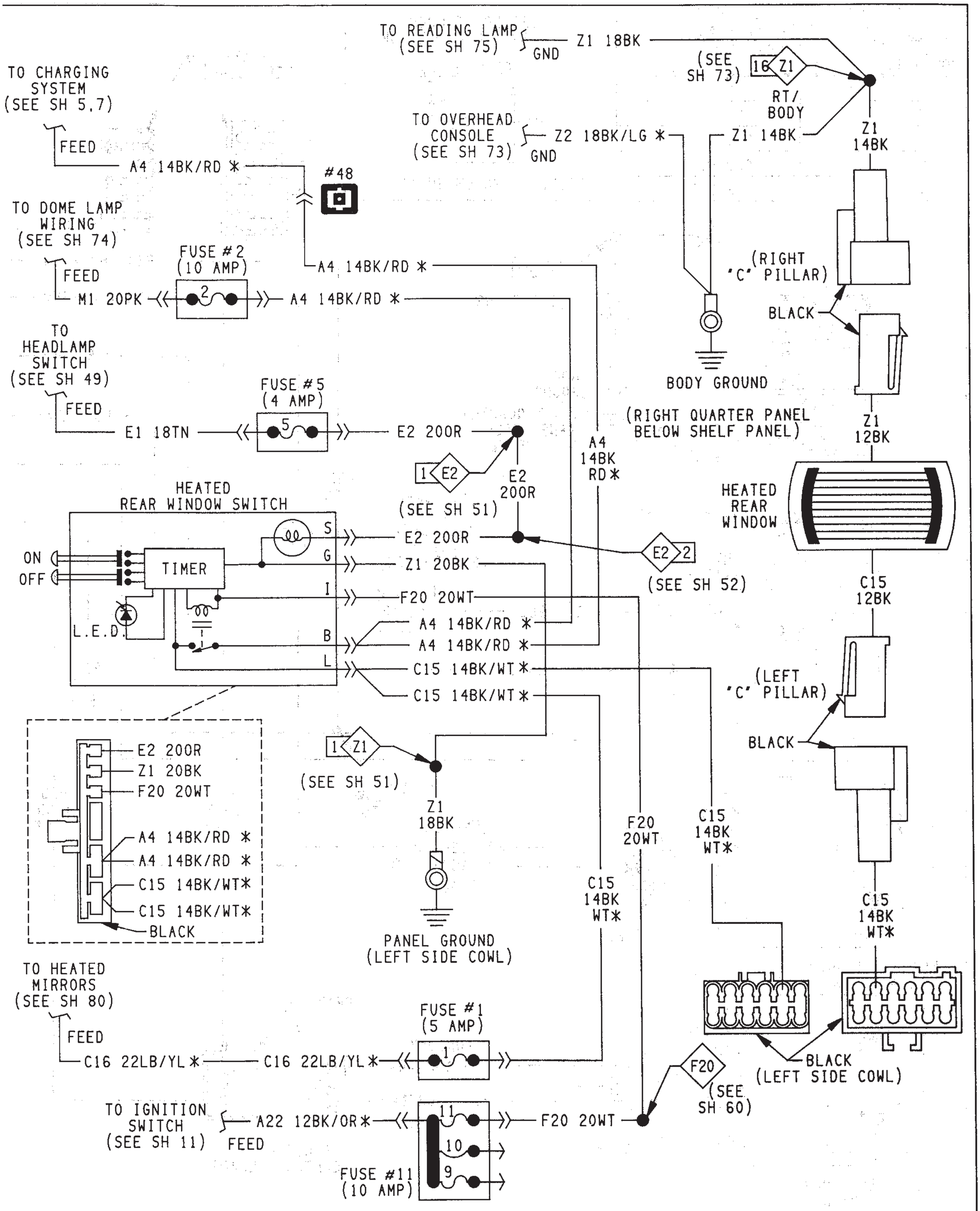


RIGHT REAR DOOR WINDOW LIFT SWITCH CONNECTOR

POWER WINDOW CONNECTOR AND SWITCH FUNCTION

AA-CDP 83

938W-1



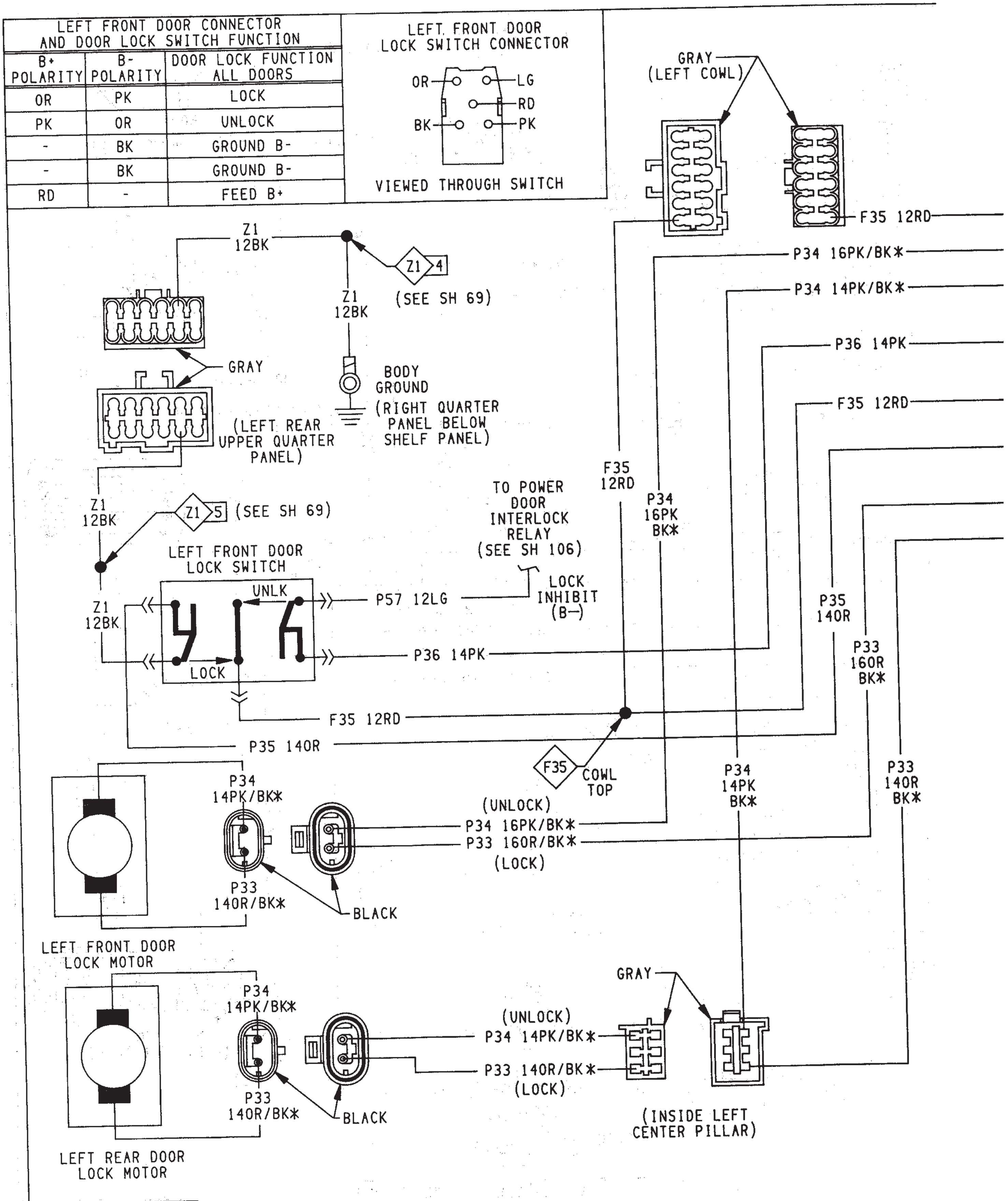
ELECTRICALLY HEATED
REAR WINDOW

938W-1

AA-CDP 84

LEFT FRONT DOOR CONNECTOR AND DOOR LOCK SWITCH FUNCTION

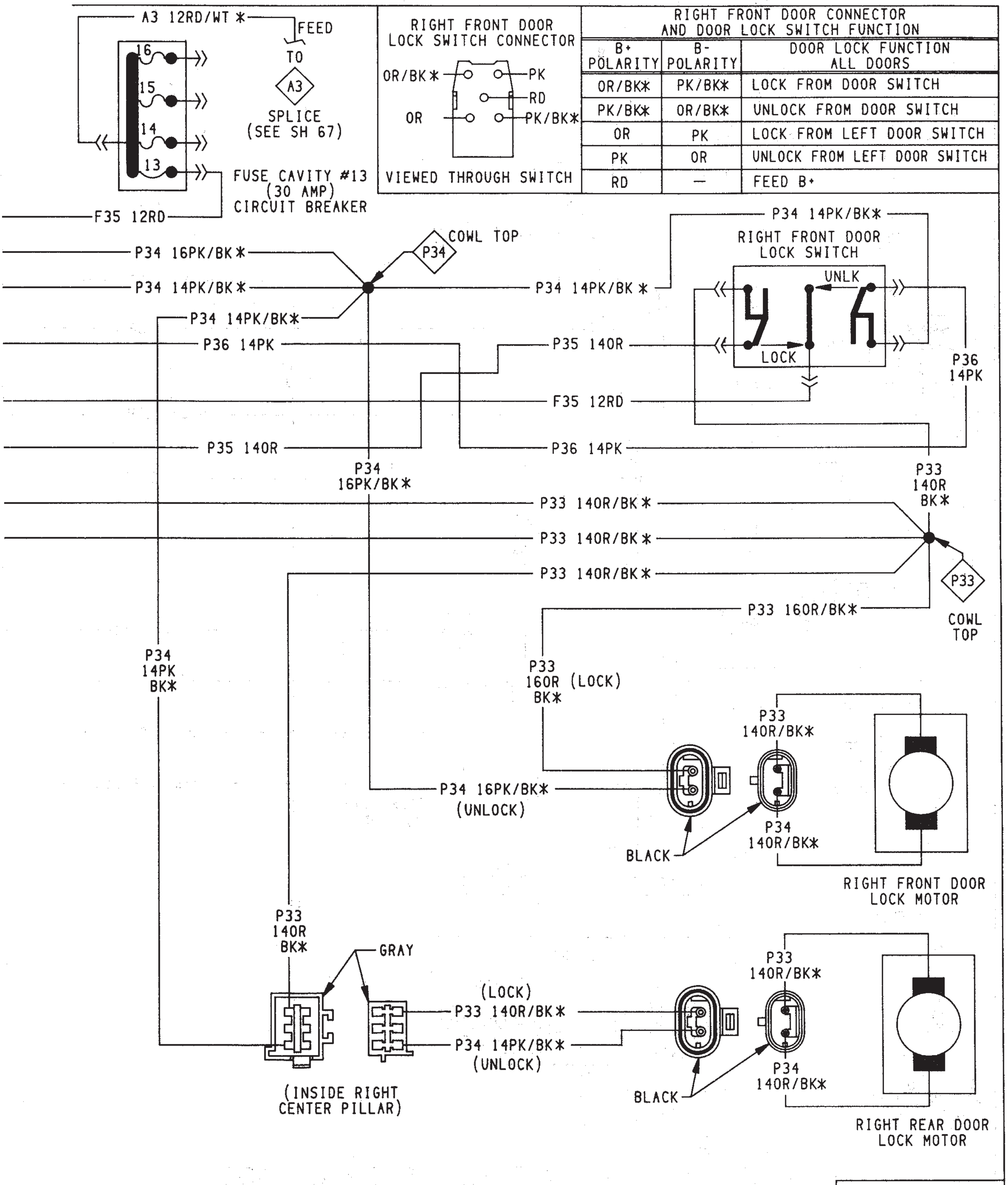
B+ POLARITY	B- POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR	PK	LOCK
PK	OR	UNLOCK
-	BK	GROUND B-
-	BK	GROUND B-
RD	-	FEED B+



AA-CDP 85

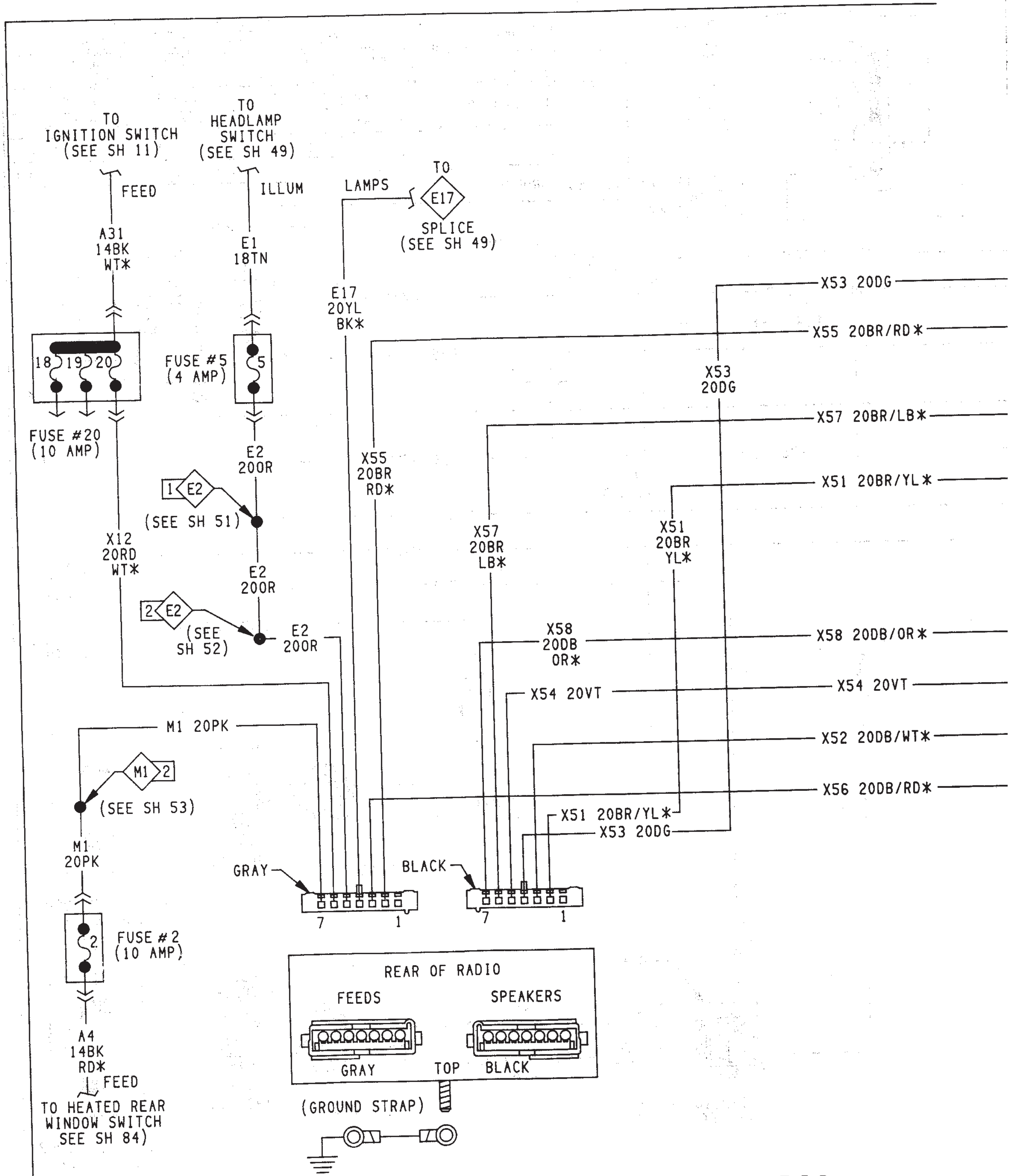
POWER DOOR LOCK SYSTEM

938W-1



RIGHT FRONT DOOR CONNECTOR AND DOOR LOCK SWITCH FUNCTION		
B+ POLARITY	B- POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR/BK*	PK/BK*	LOCK FROM DOOR SWITCH
PK/BK*	OR/BK*	UNLOCK FROM DOOR SWITCH
OR	PK	LOCK FROM LEFT DOOR SWITCH
PK	OR	UNLOCK FROM LEFT DOOR SWITCH
RD	—	FEED B+

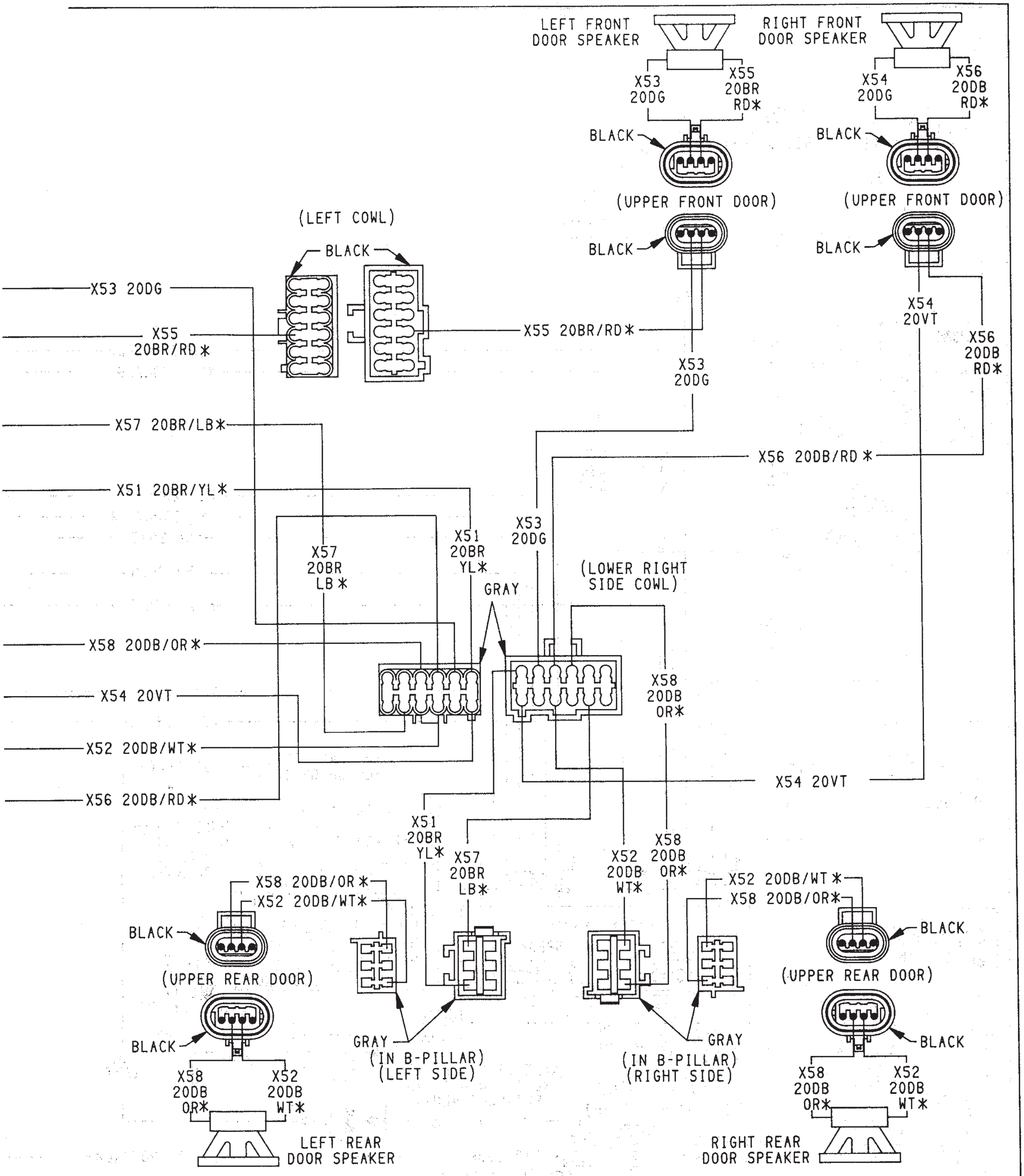
938W-1 POWER DOOR LOCK SYSTEM AA-CDP 86



ELECTRONICALLY TUNED STEREO RADIO
WITHOUT NAME BRAND SPEAKERS

AA-CDP 87

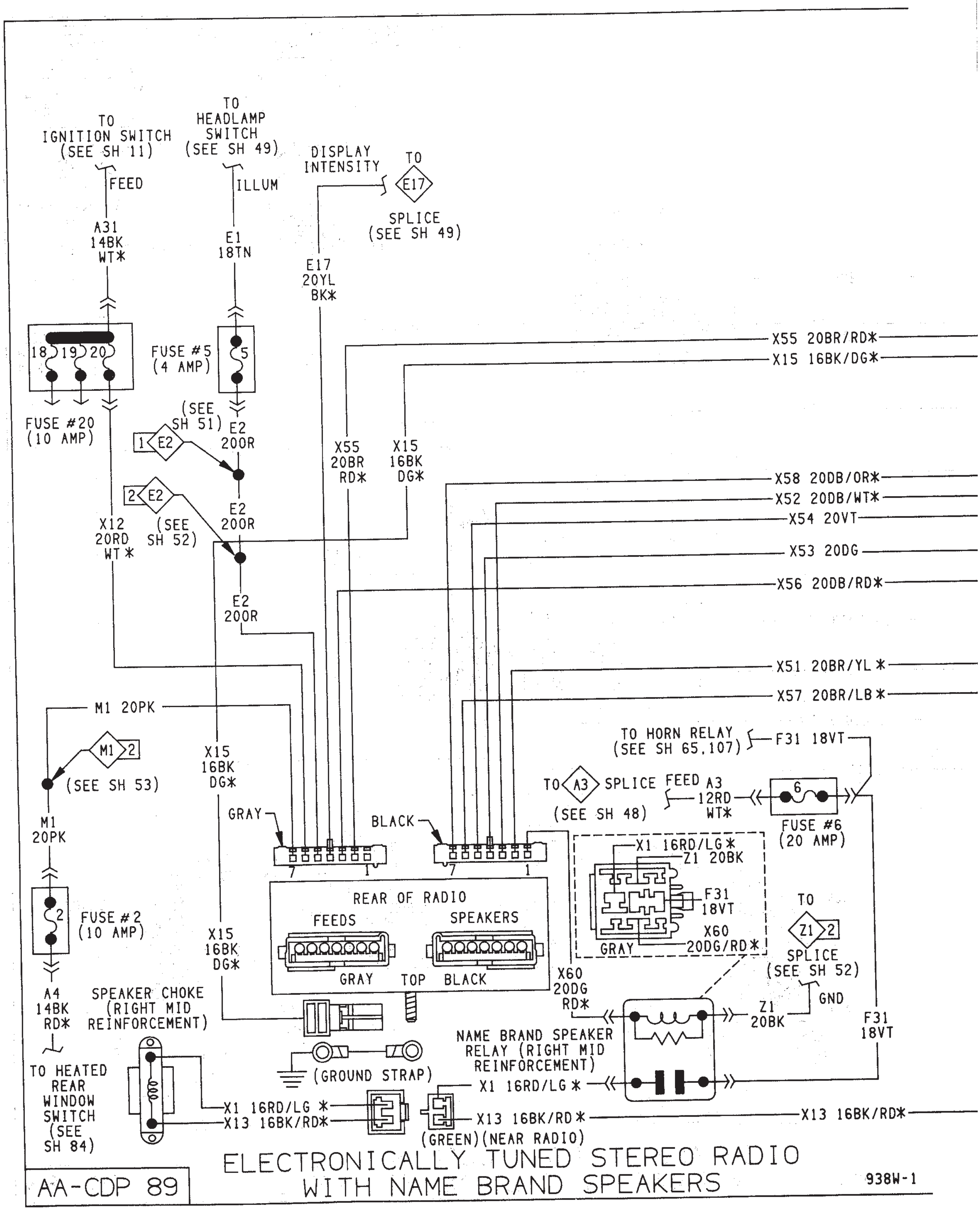
938W-1



SPEAKERS FRONT DOOR AND REAR
WITHOUT NAME BRAND SPEAKERS

938W-1

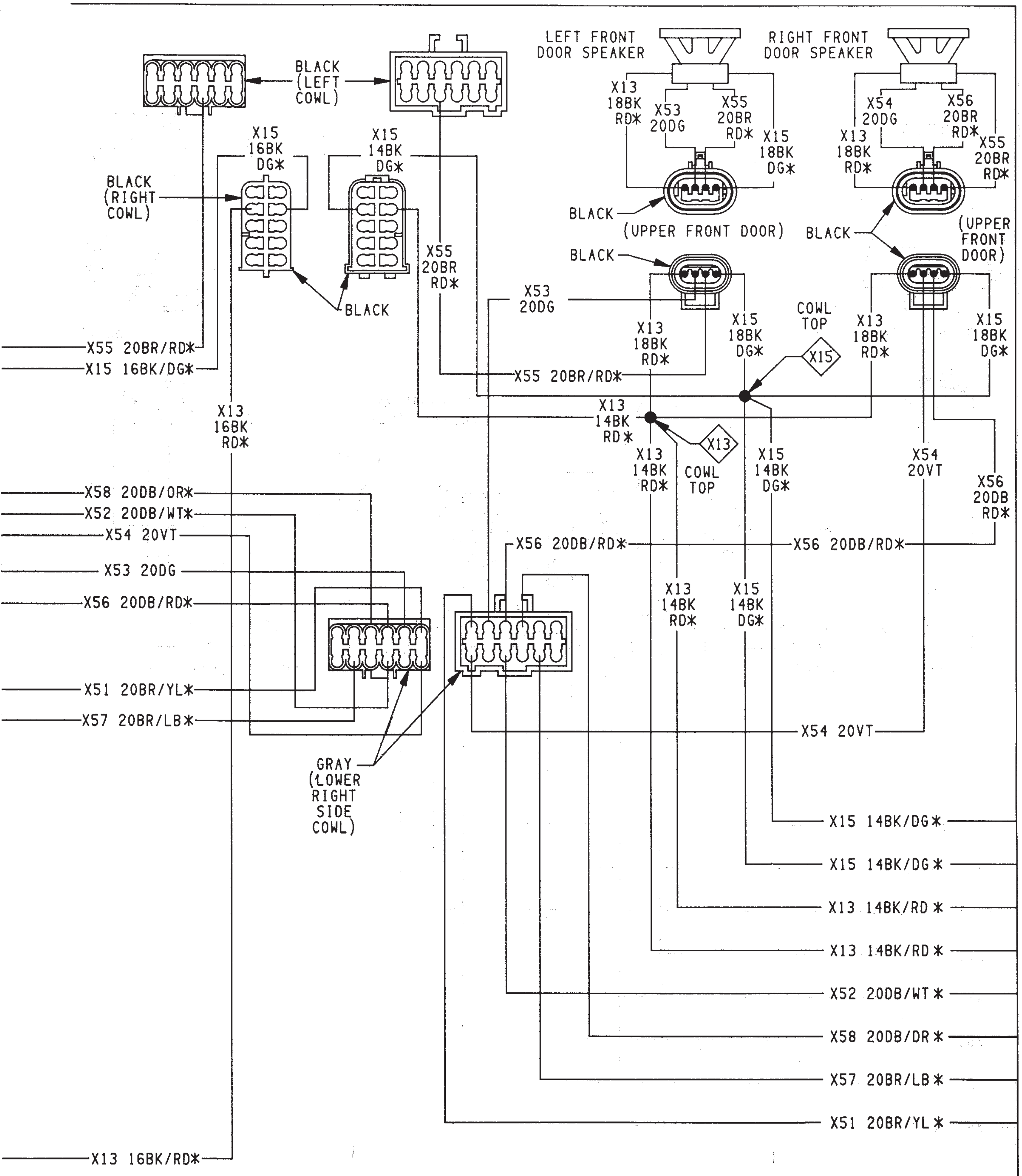
AA-CDP 88



ELECTRONICALLY TUNED STEREO RADIO WITH NAME BRAND SPEAKERS

AA-CDP 89

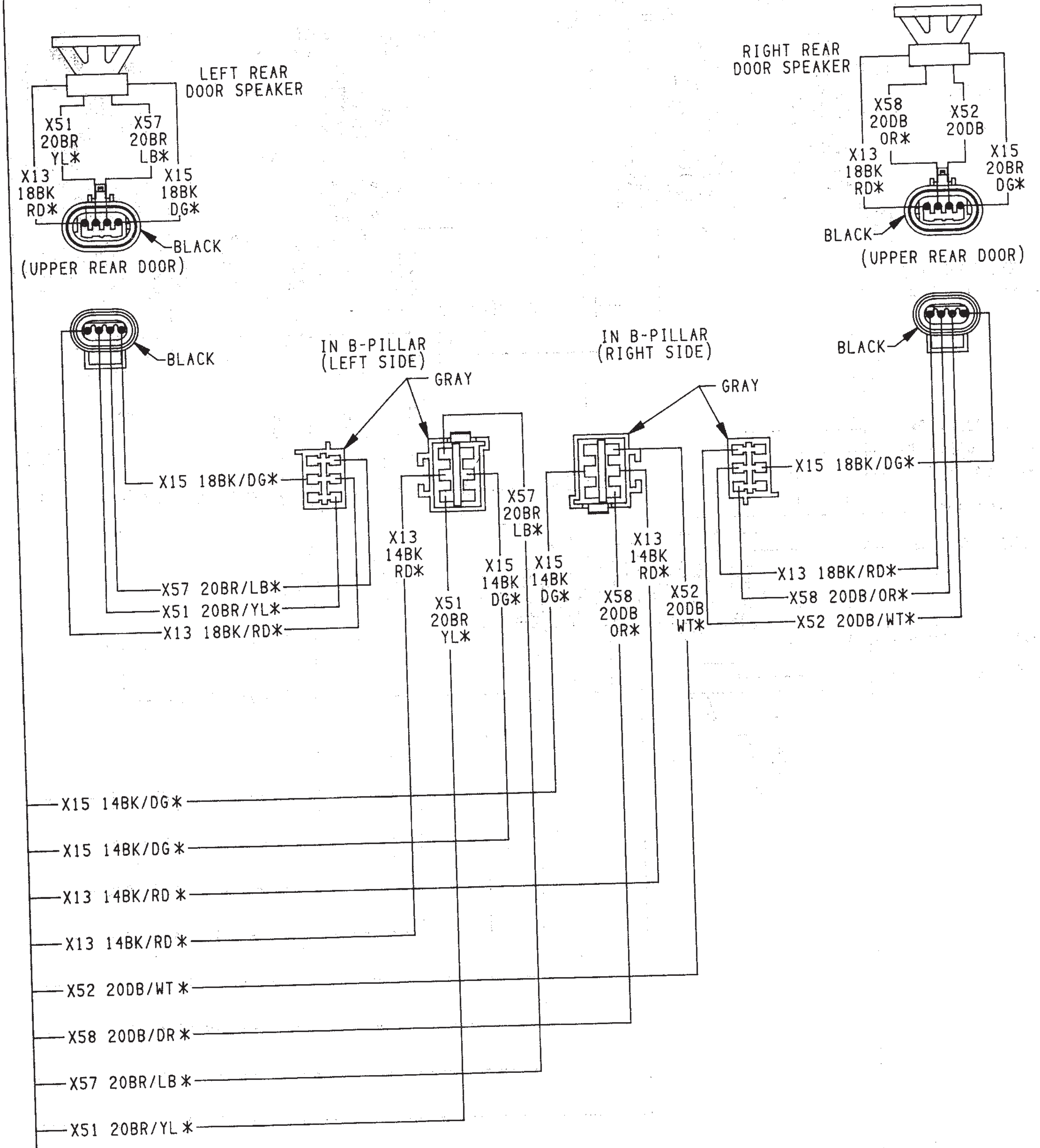
938W-1



SPEAKERS FRONT DOOR AND REAR WITH NAME BRAND SPEAKERS

938W-1

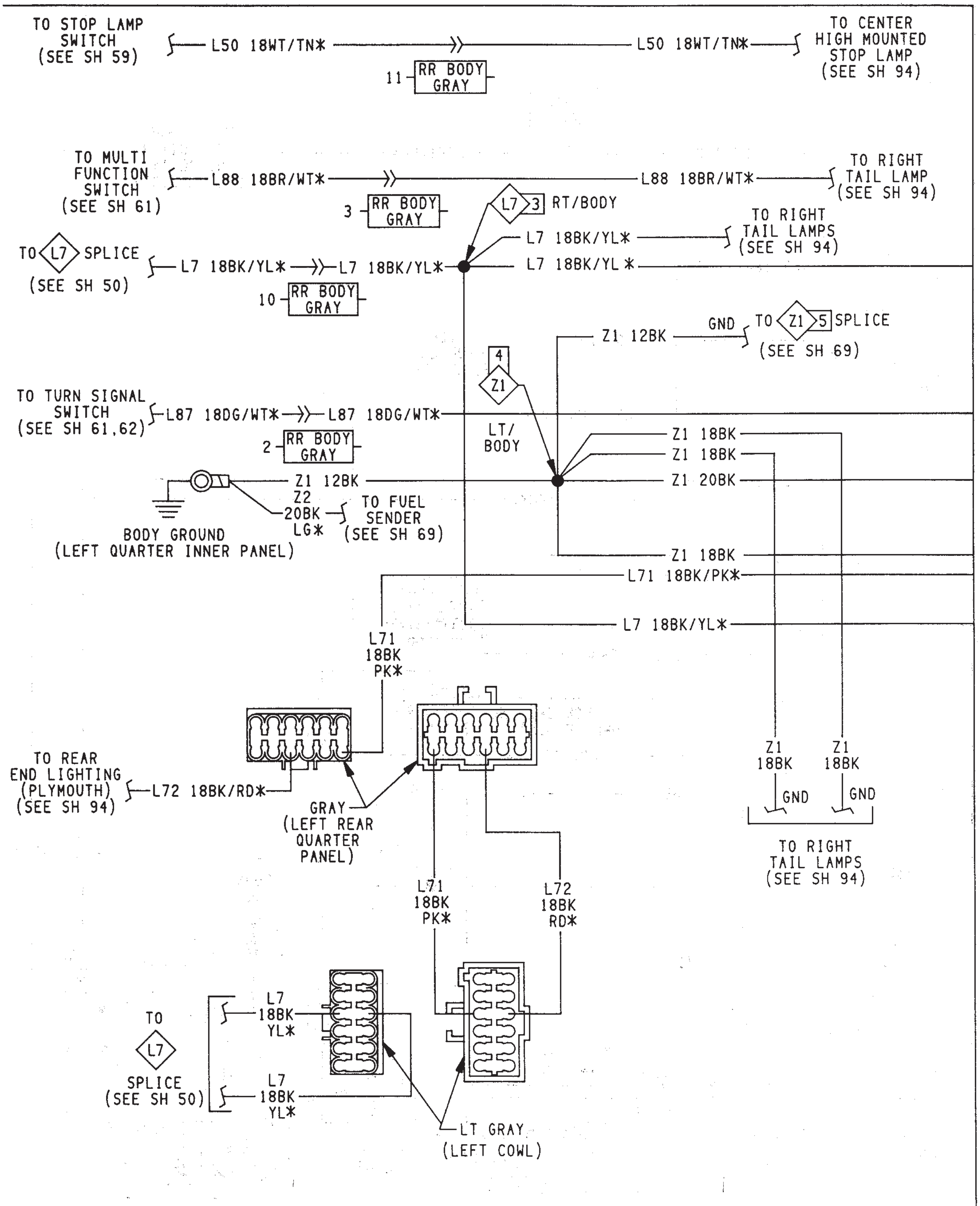
AA-CDP 90



SPEAKERS FRONT DOOR AND REAR
WITH NAME BRAND SPEAKERS

938W-1

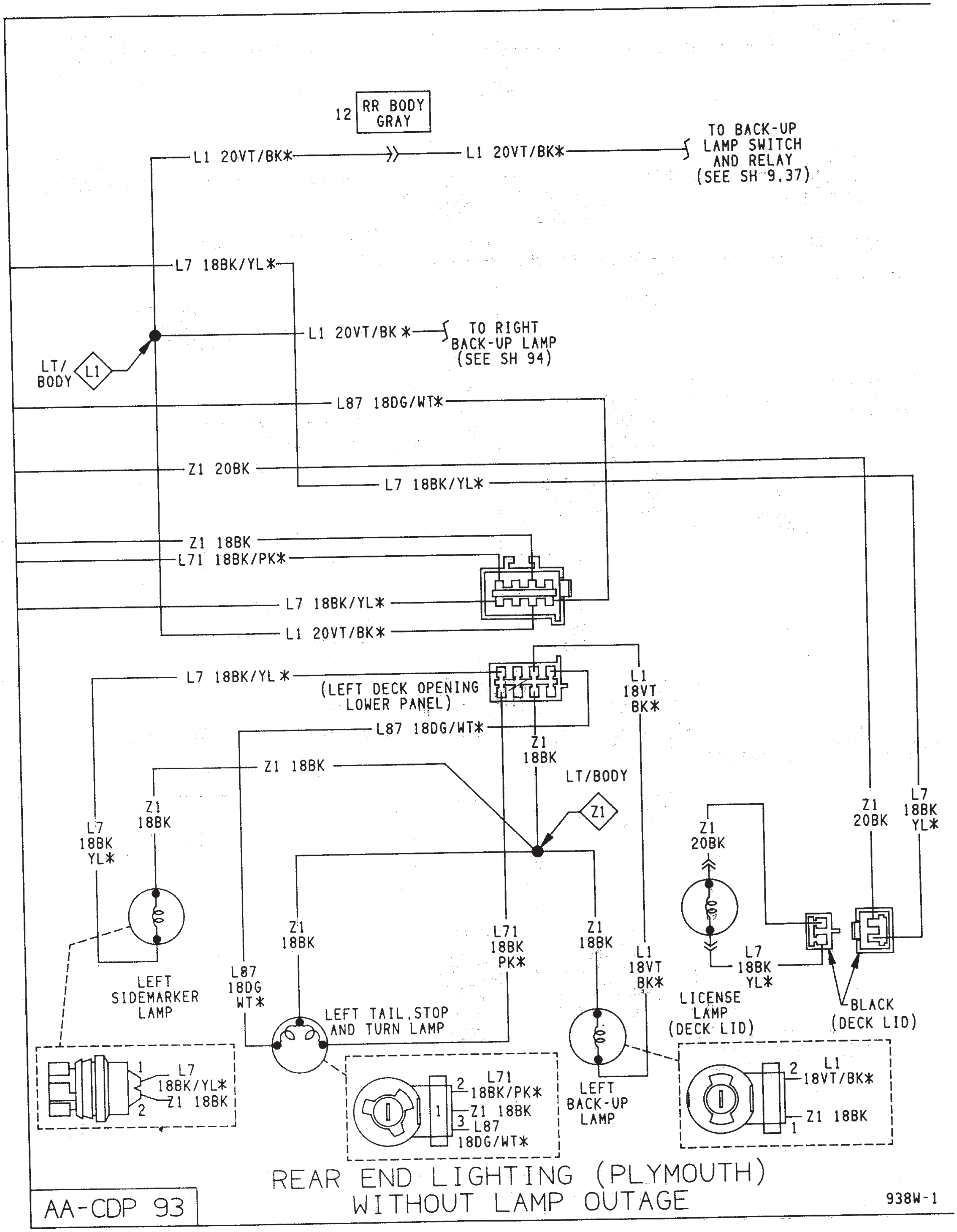
AA-CDP 91



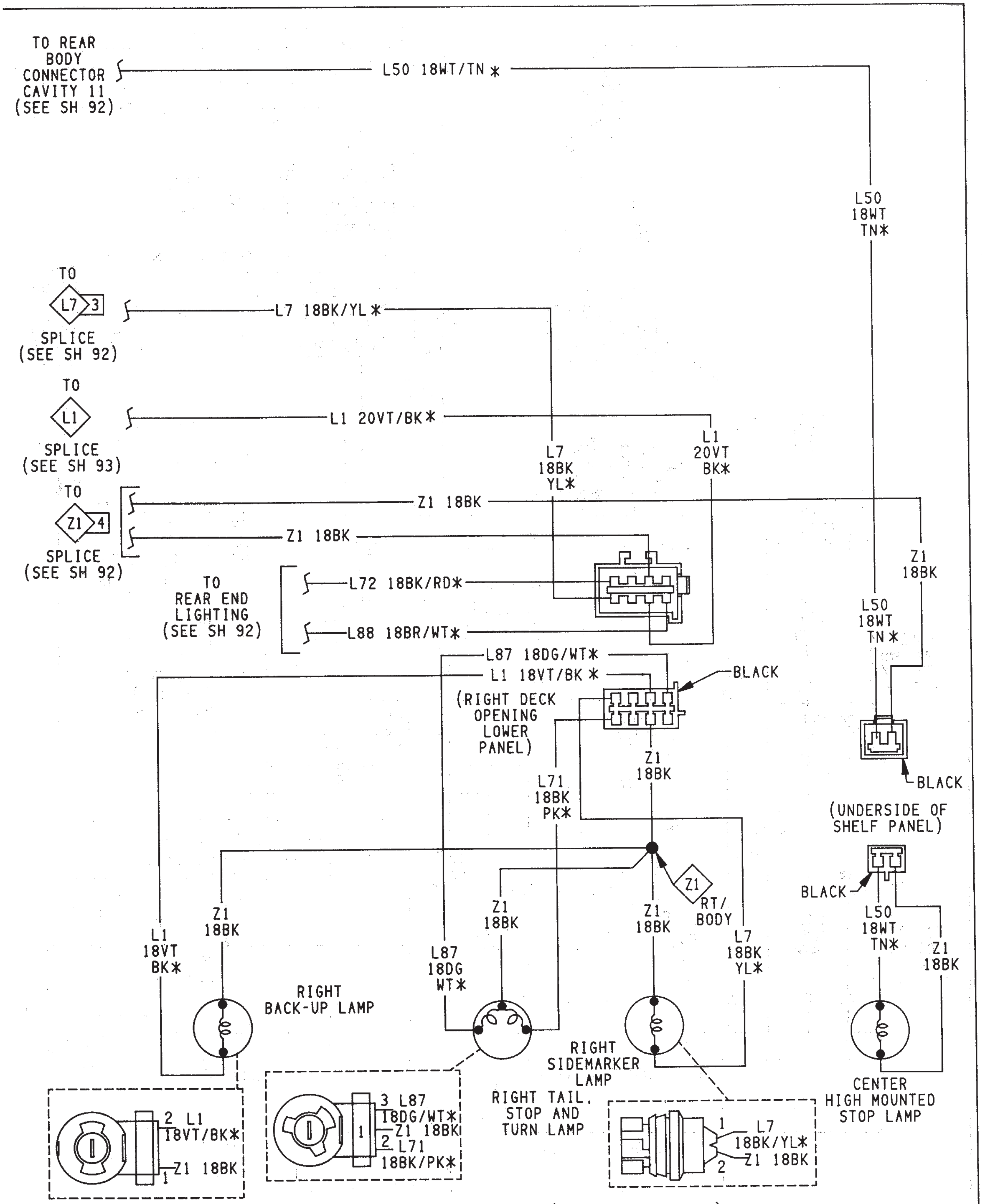
REAR END LIGHTING (PLYMOUTH) WITHOUT LAMP OUTAGE

938W-1

AA-CDP 92



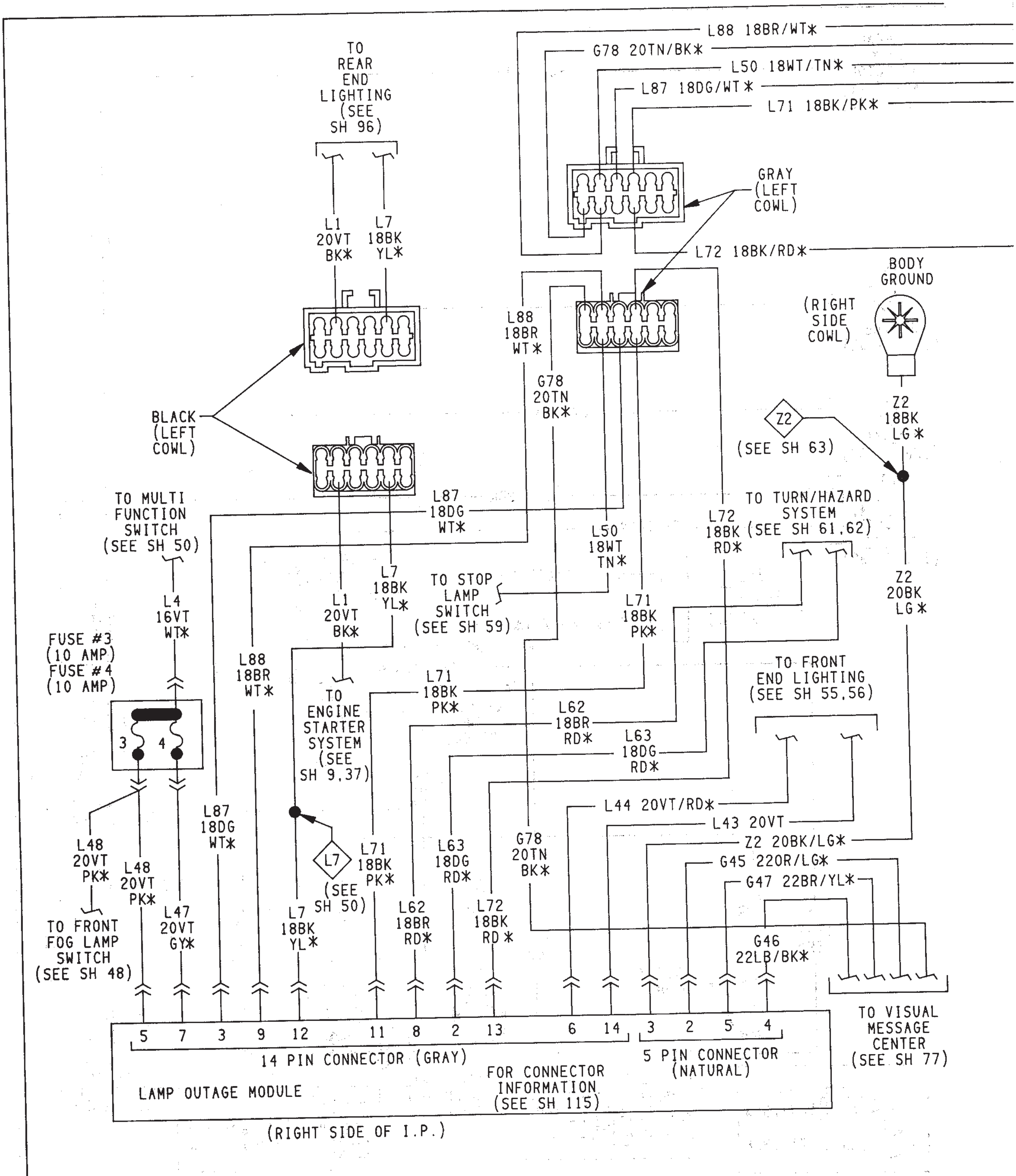
REAR END LIGHTING (PLYMOUTH) WITHOUT LAMP OUTAGE



REAR END LIGHTING (PLYMOUTH)
WITHOUT LAMP OUTAGE

938W-1

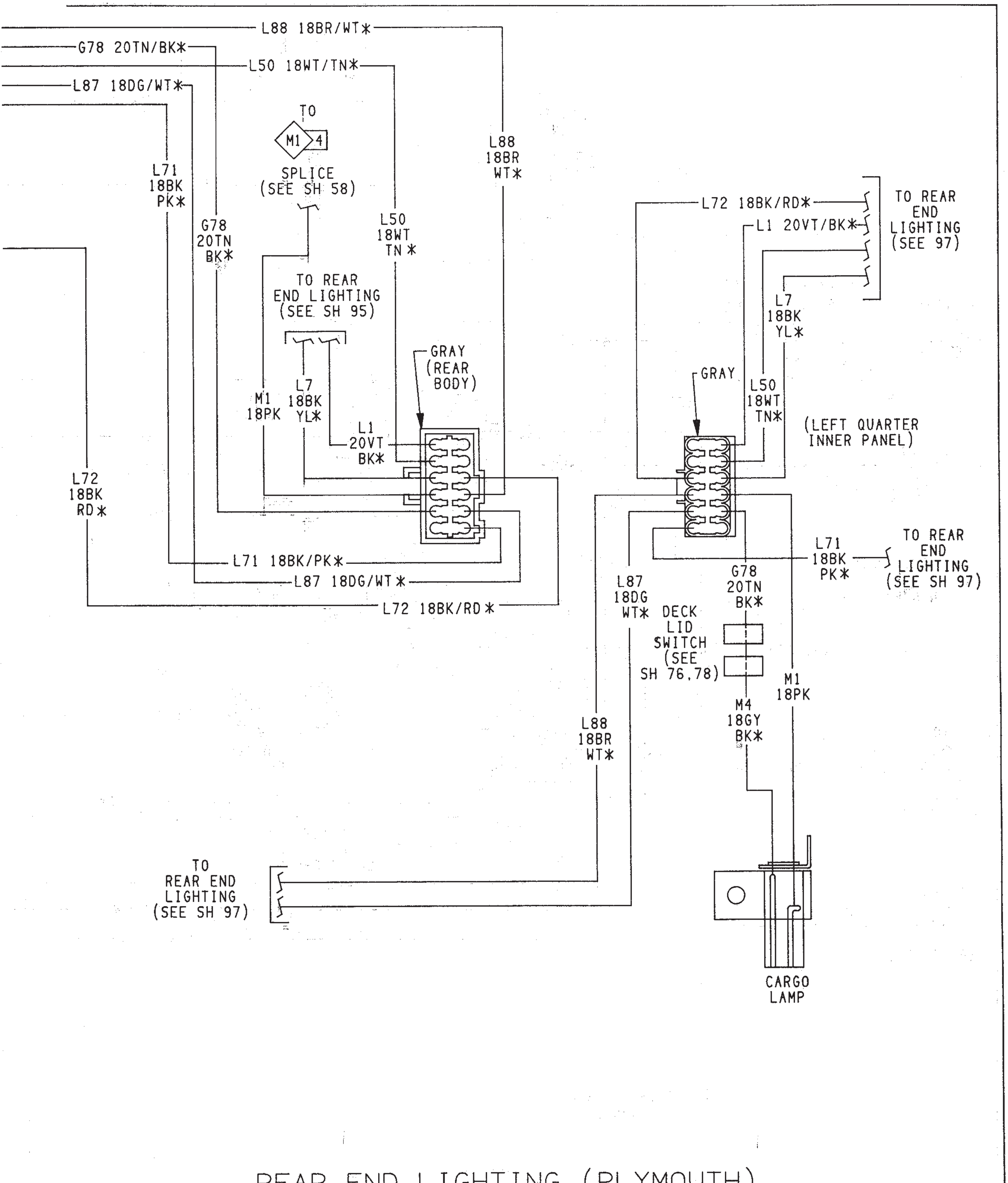
AA-CDP 94



REAR END LIGHTING (PLYMOUTH)
WITH LAMP OUTAGE

AA-CDP 95

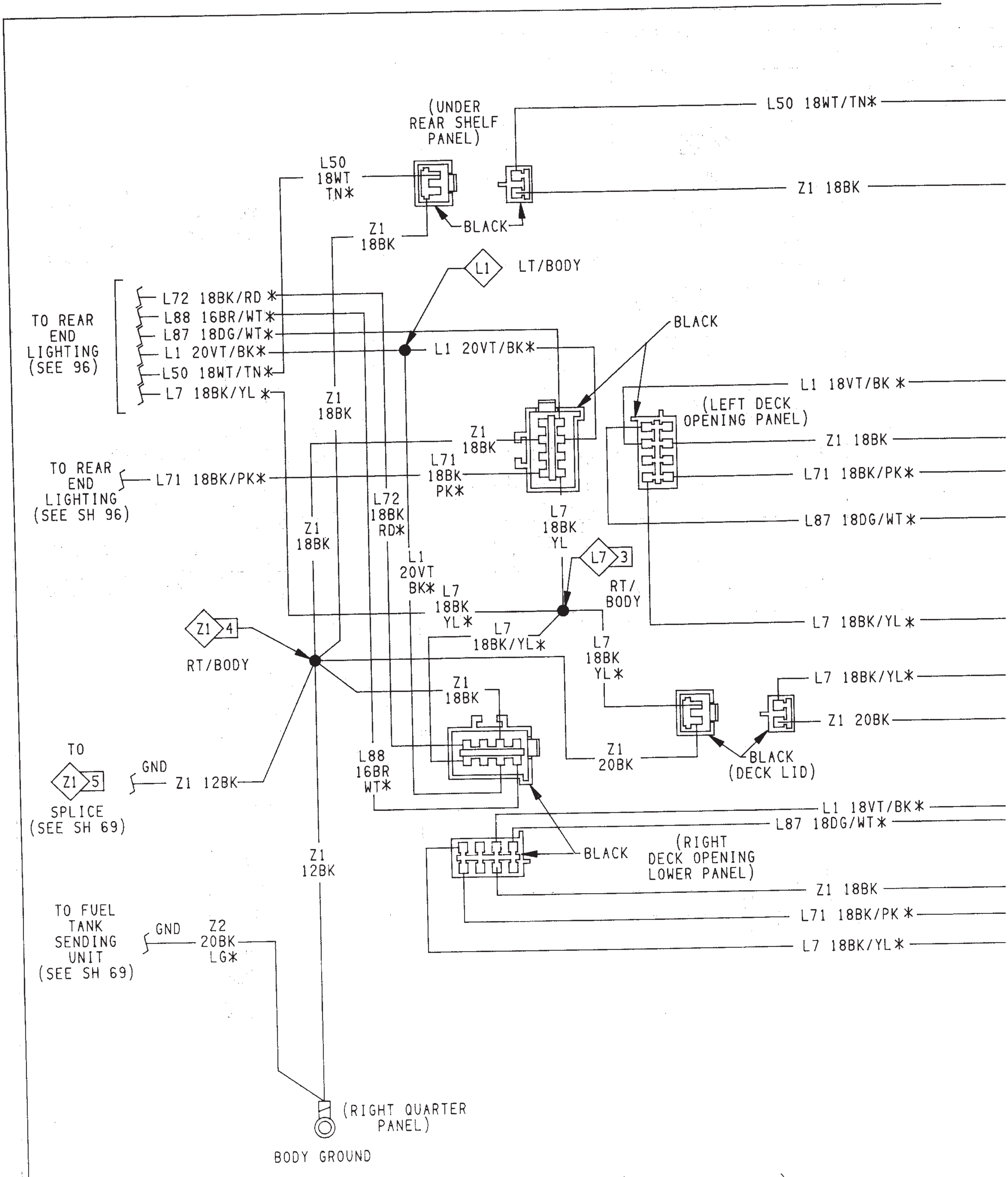
938W-1



REAR END LIGHTING (PLYMOUTH)
WITH LAMP OUTAGE

938W-1

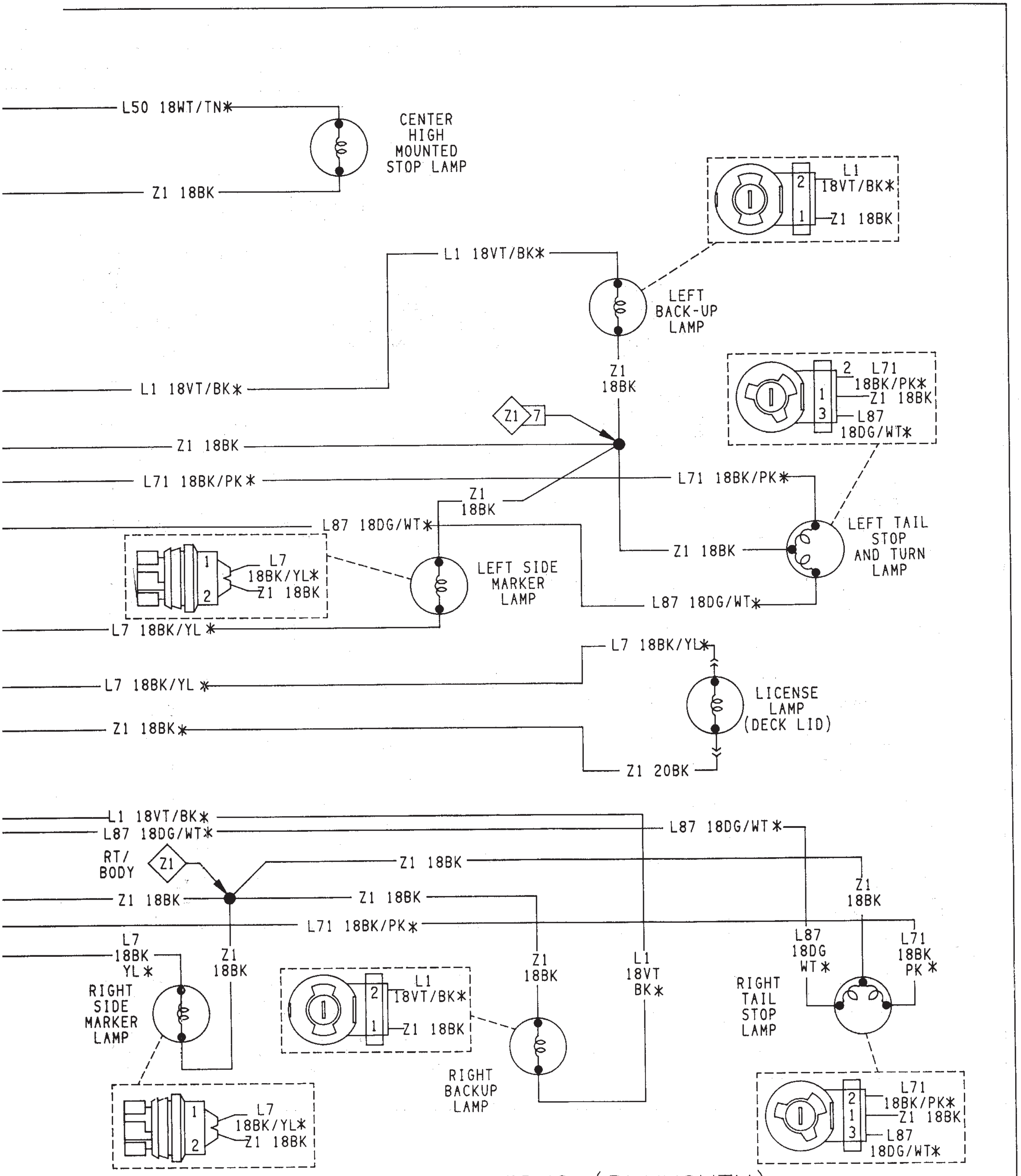
AA-CDP 96



REAR END LIGHTING (PLYMOUTH)
WITH LAMP OUTAGE

AA-CDP 97

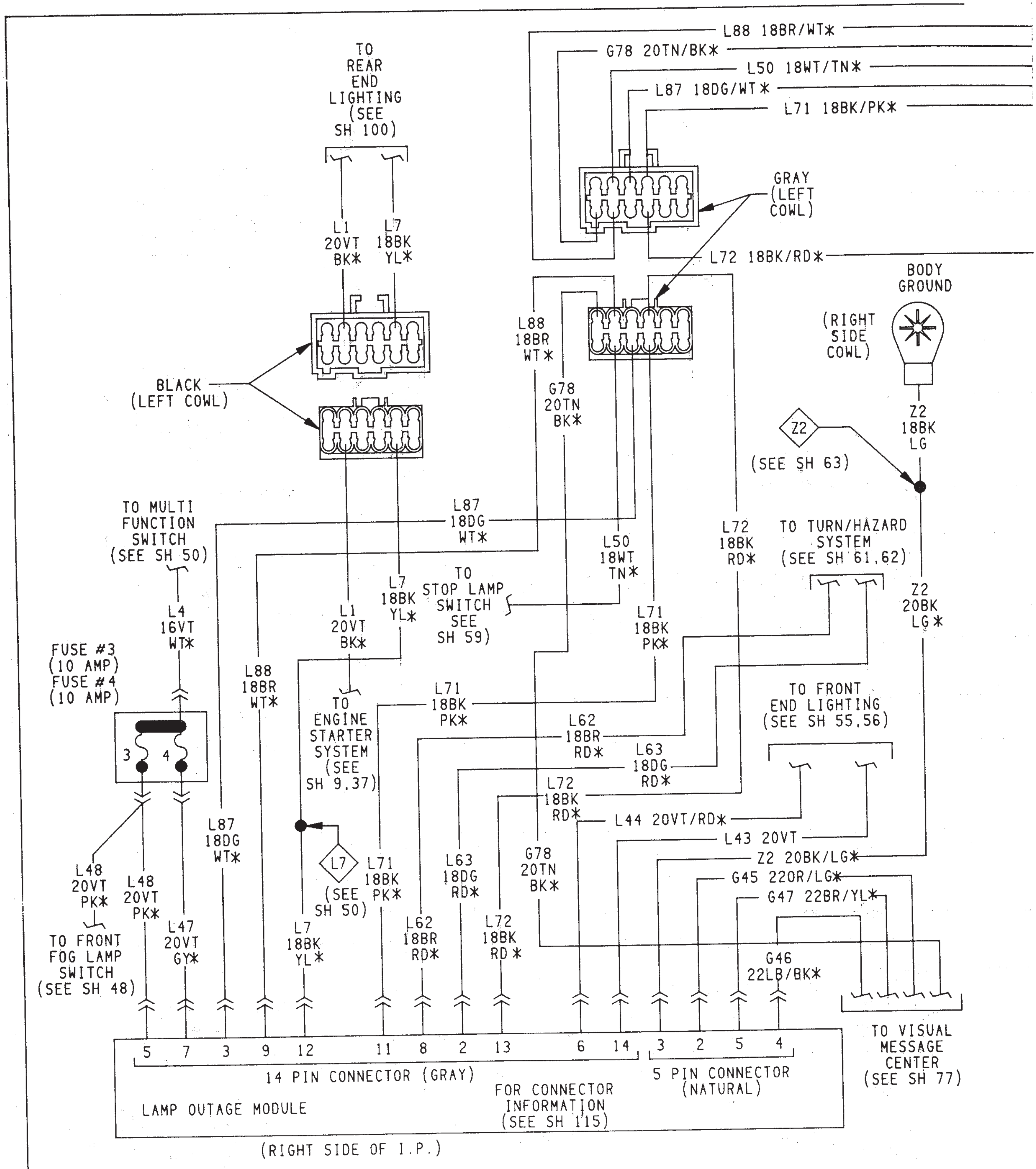
938W-1



REAR END LIGHTING (PLYMOUTH)
WITH LAMP OUTAGE

938W-1

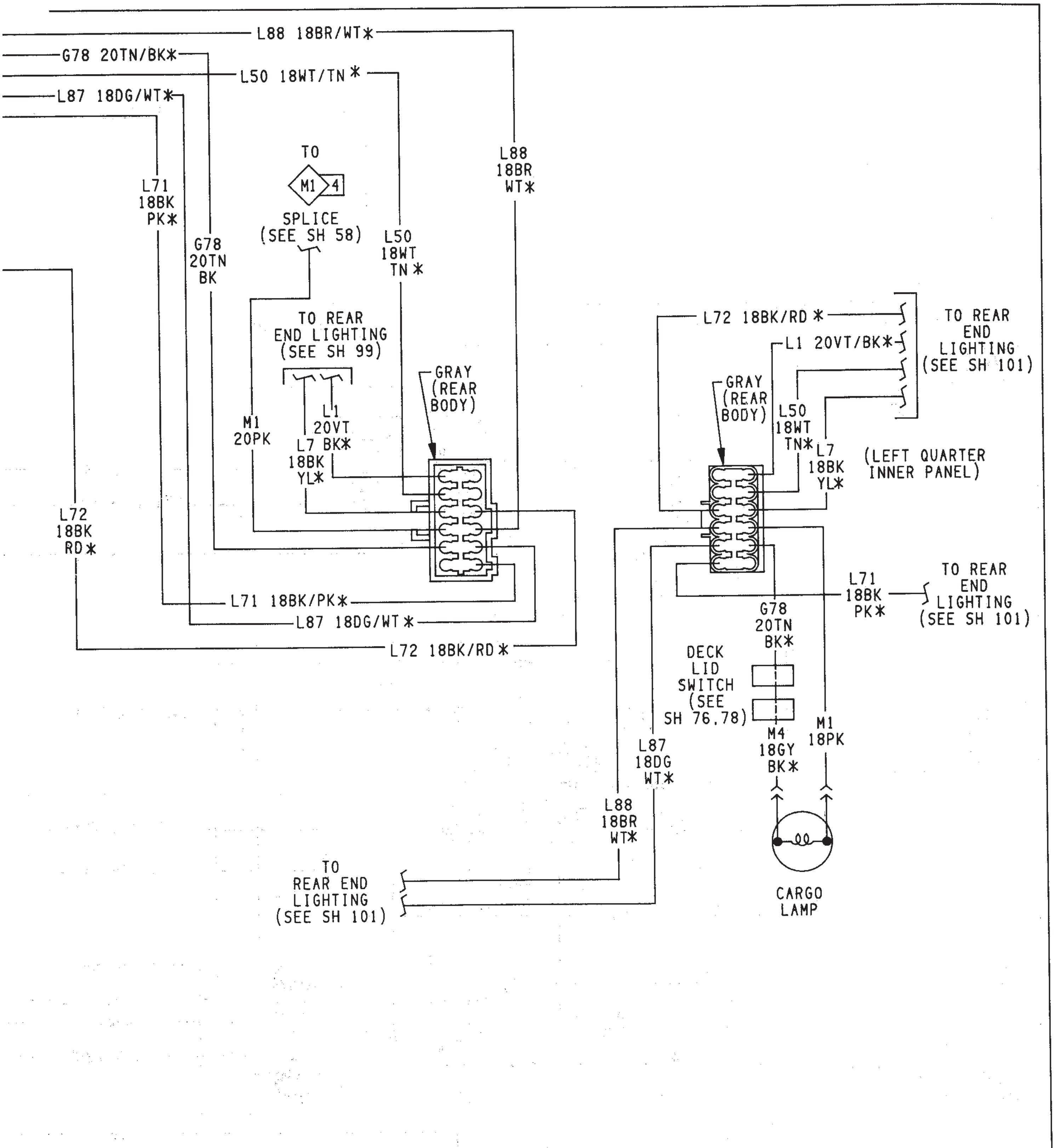
AA-CDP 98



AA-CDP 99

REAR END LIGHTING (CHRYSLER/DODGE) WITH LAMP OUTAGE

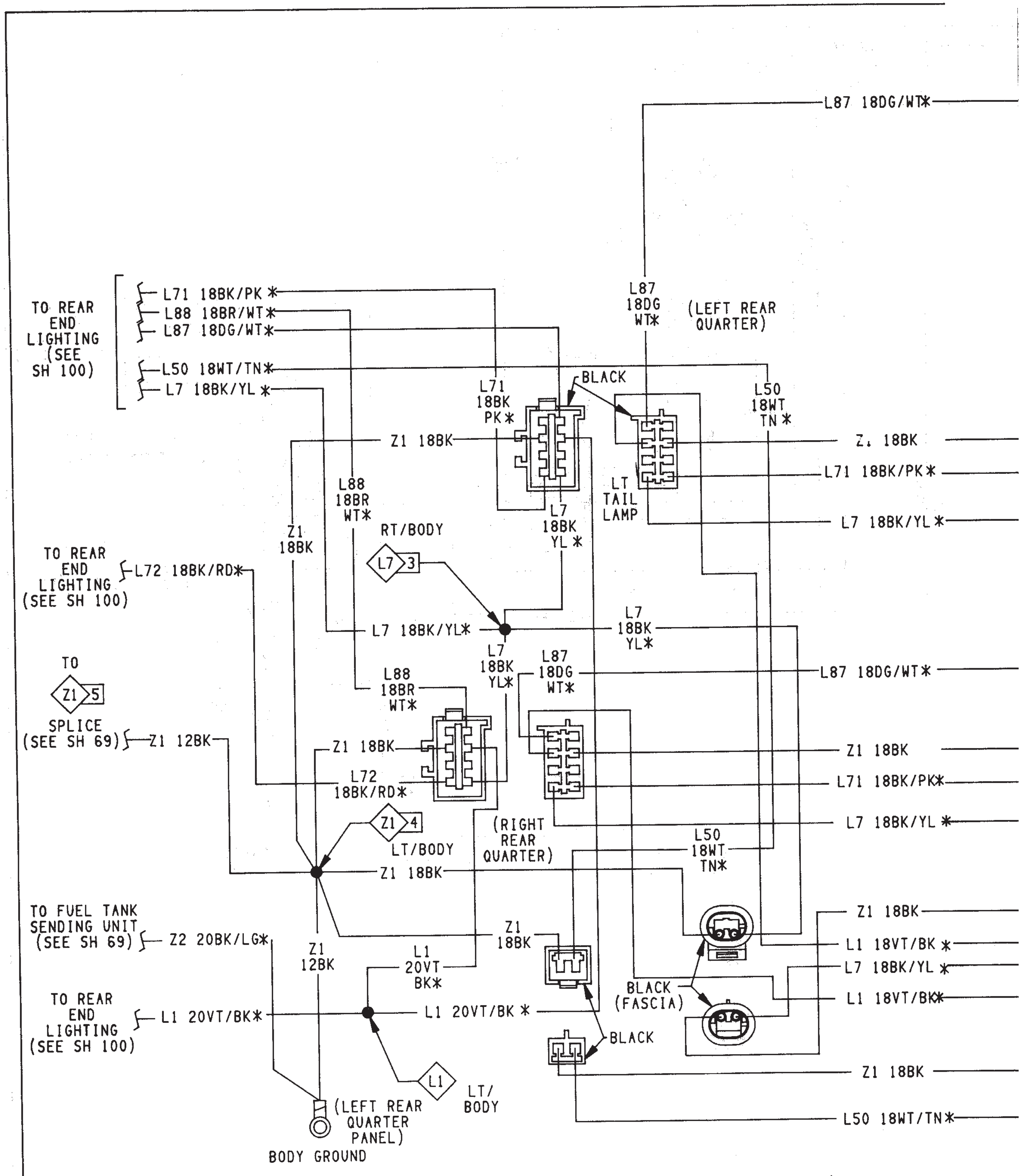
938W-1



REAR END LIGHTING (CHRYSLER/DODGE)
WITH LAMP OUTAGE

938W-1

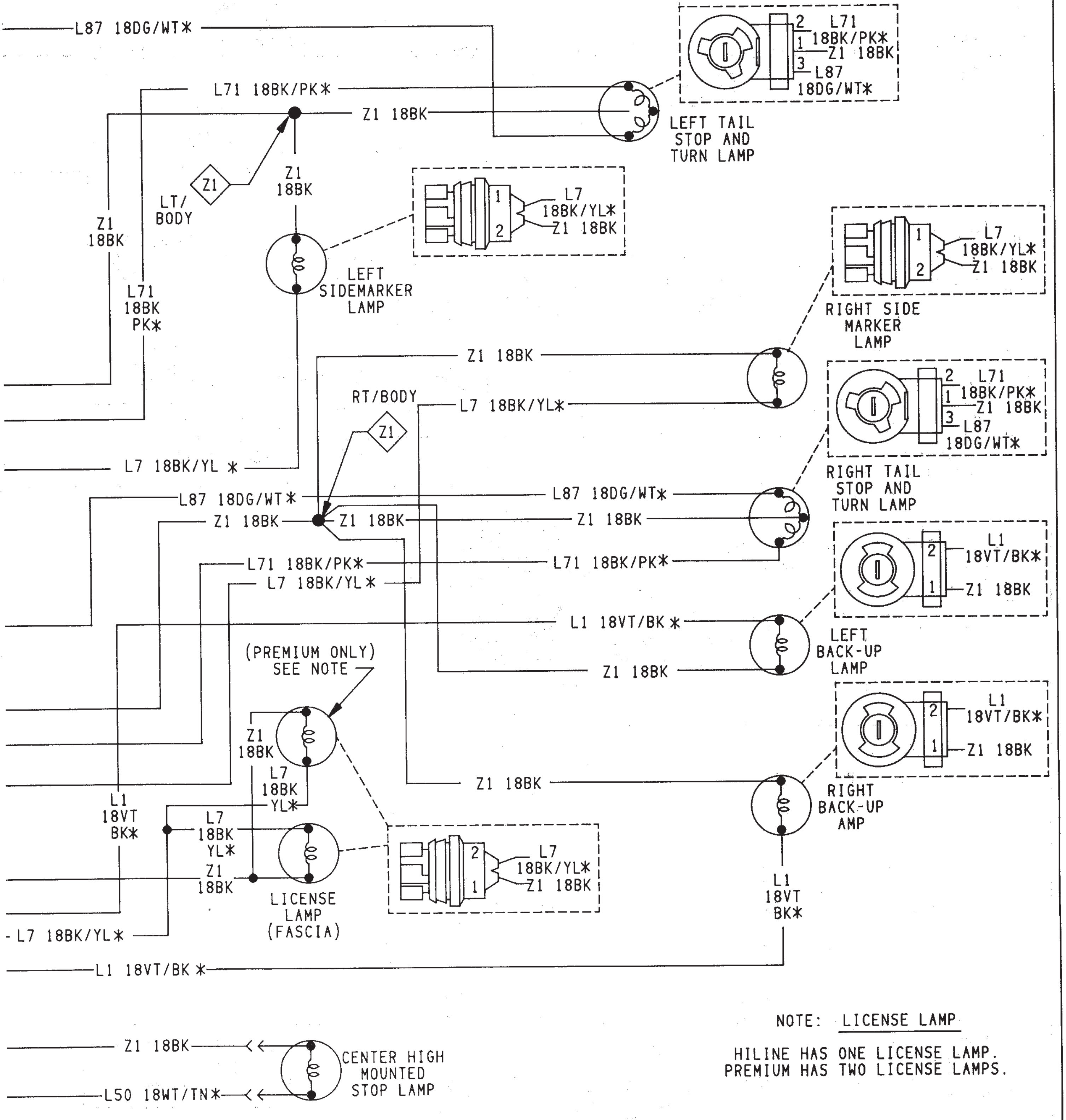
AA-CDP 100



REAR END LIGHTING (CHRYSLER/DODGE)
WITH LAMP OUTAGE

AA-CDP 101

938W-1



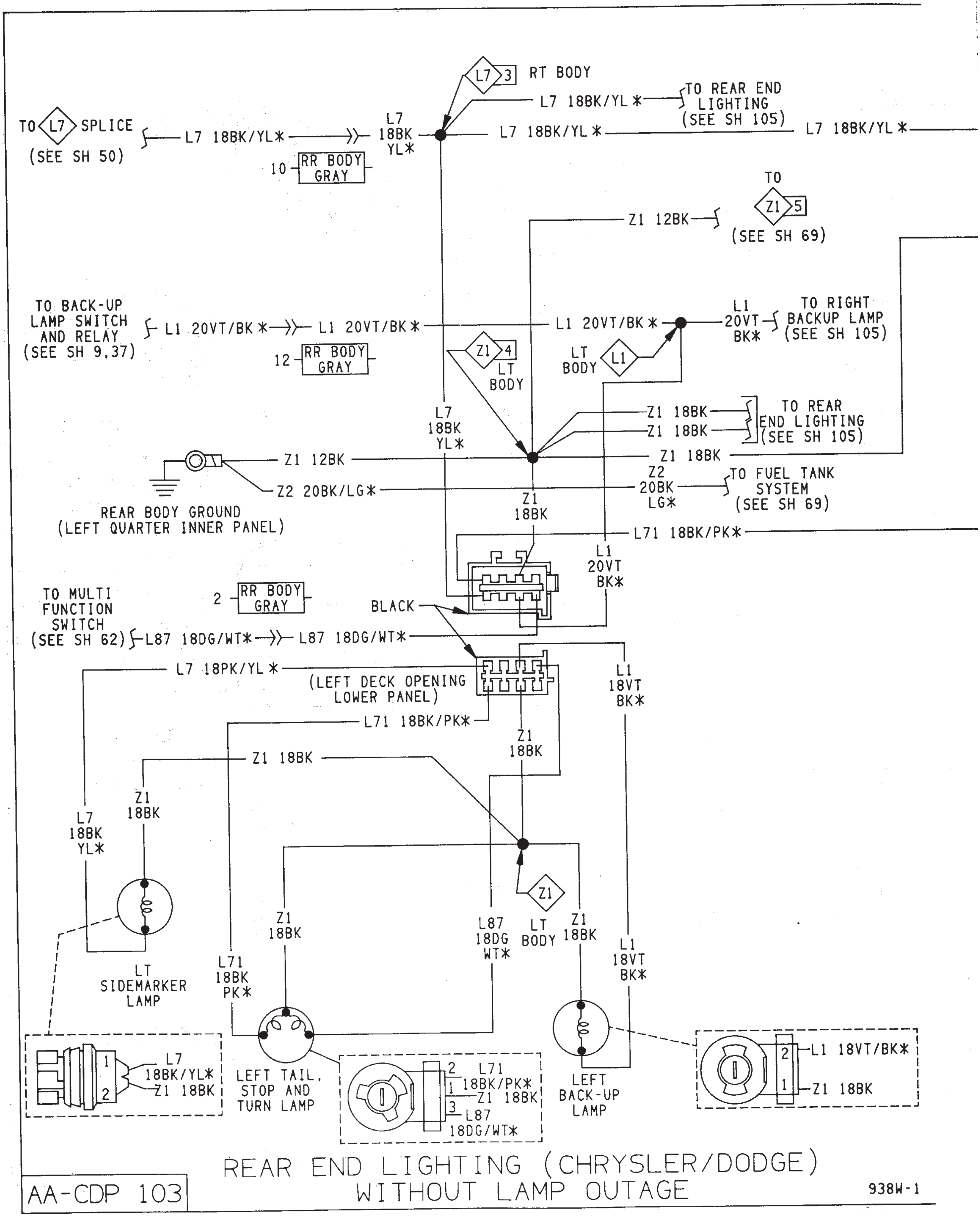
NOTE: LICENSE LAMP

HILINE HAS ONE LICENSE LAMP.
PREMIUM HAS TWO LICENSE LAMPS.

REAR END LIGHTING (CHRYSLER/DODGE)
WITH LAMP OUTAGE

938W-1

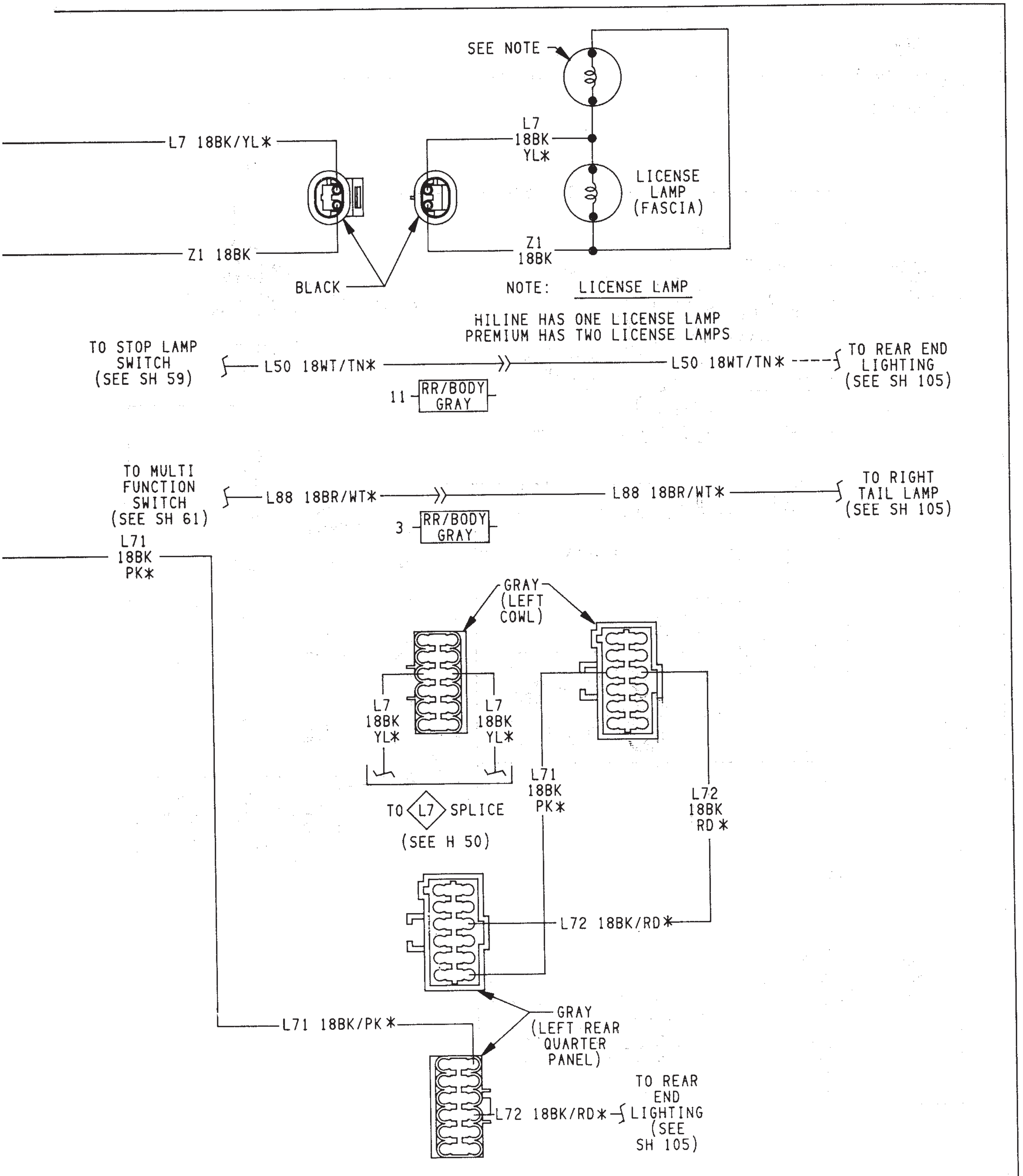
AA-CDP 102



REAR END LIGHTING (CHRYSLER/DODGE)
WITHOUT LAMP OUTAGE

AA-CDP 103

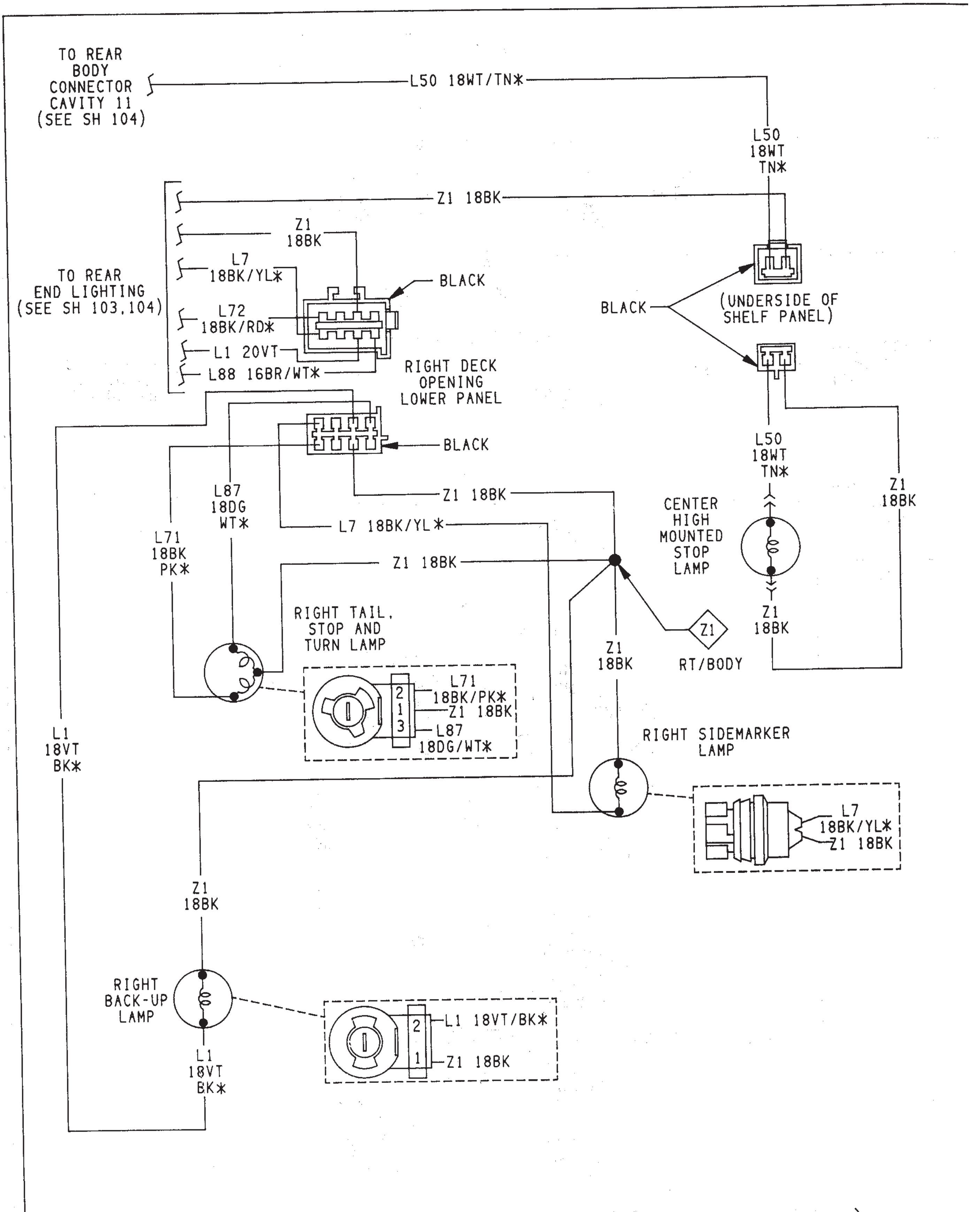
938W-1



REAR END LIGHTING (CHRYSLER/DODGE)
WITHOUT LAMP OUTAGE

AA-CDP 104

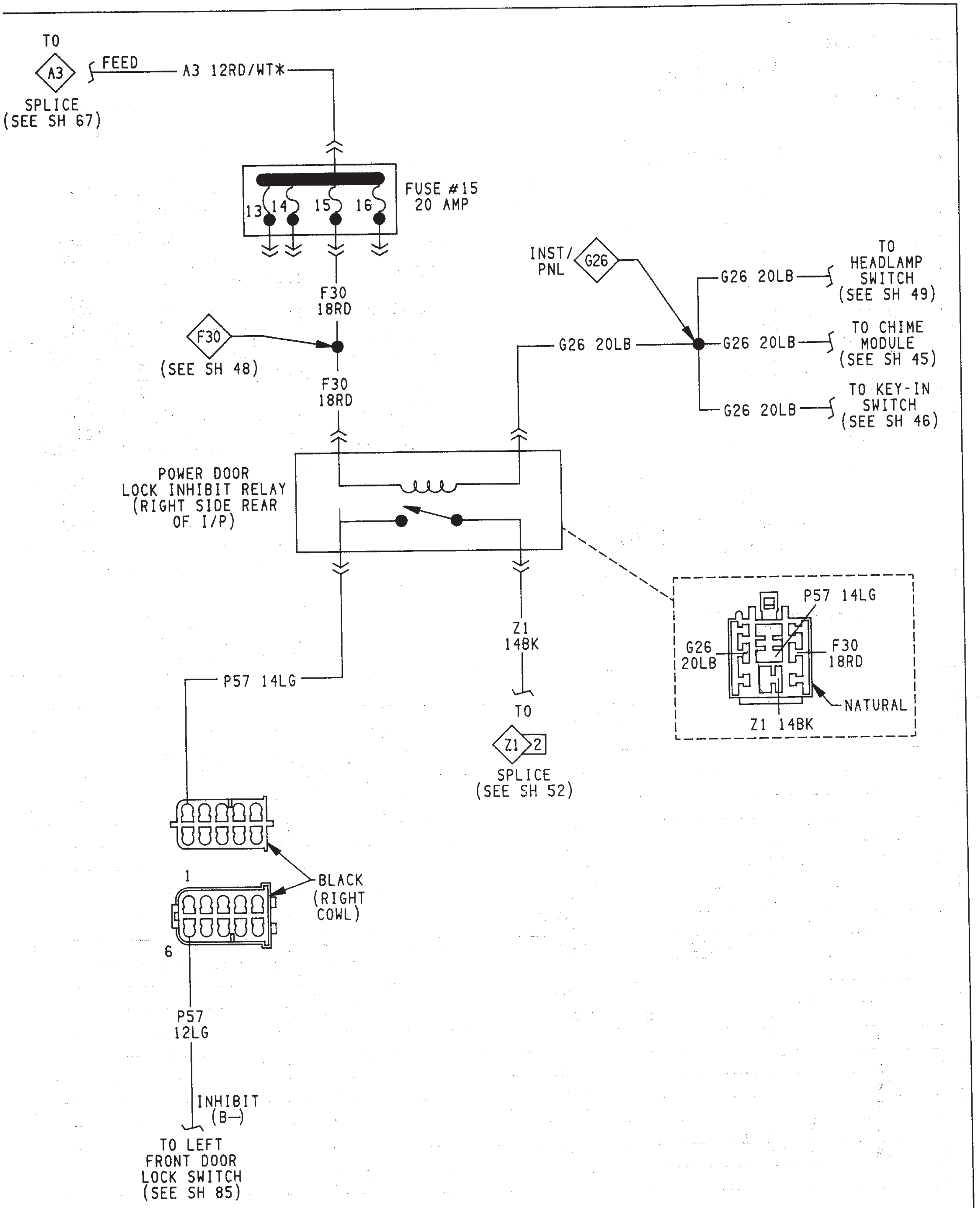
938W-1



REAR END LIGHTING (CHRYSLER/DODGE)
WITHOUT LAMP OUTAGE

AA-CDP 105

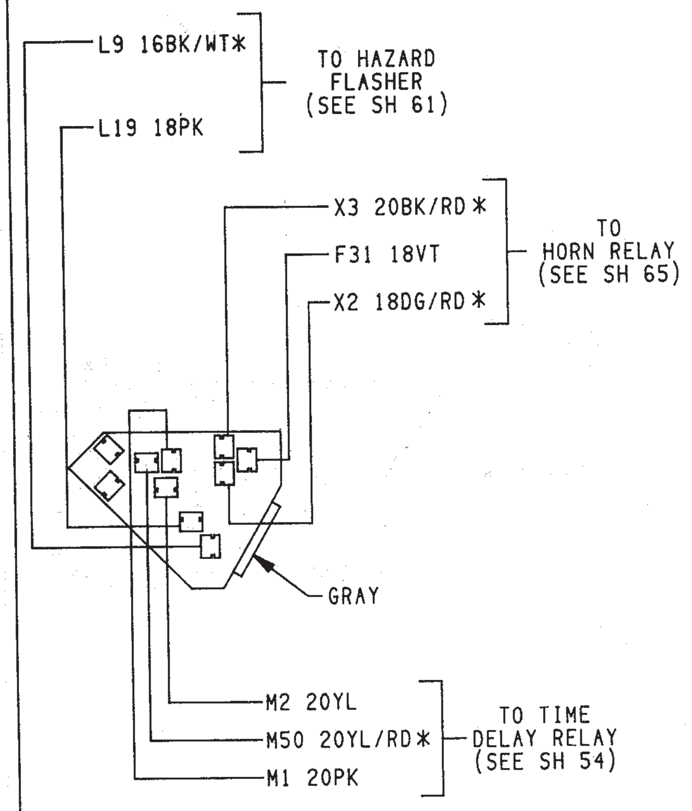
938W-1



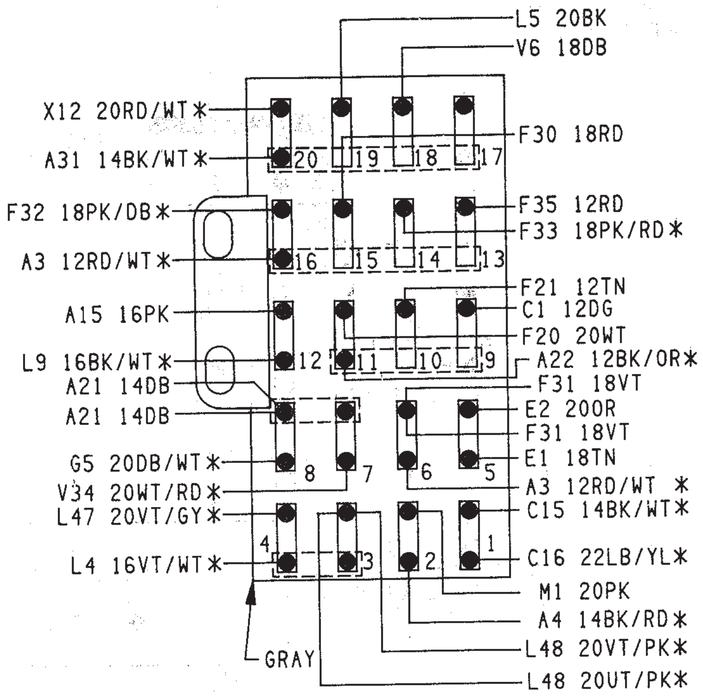
POWER DOOR INTERLOCK SYSTEM

938W-1

AA-CDP 106



RELAY MODULE MOUNTED
ON RIGHT LOWER END
OF INSTRUMENT PANEL

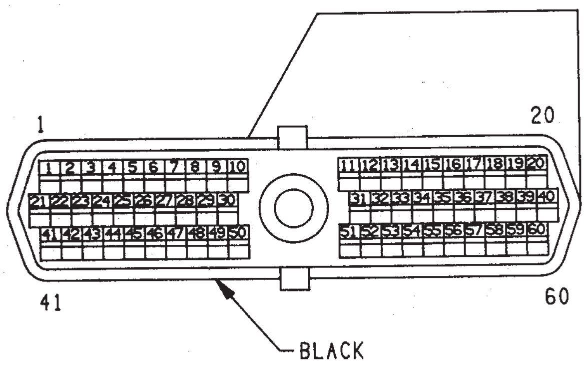


FUSEBLOCK IS MOUNTED
ON RIGHT LOWER END
OF INSTRUMENT PANEL
LEFT OF RELAY MODULE

FUSE #	AMPS	COLOR	SHEET
1	5	TAN	4,80,84
2	10	RED	4,5,39,40,53,74,80,84,87,89
3	10	RED	1,95,99
4	10	RED	1,95,99
5	4	PINK	1,49,51,68,71,72,84,87,89
6	20	YELLOW	2,65,89
7	2	GRAY	3,11,59
8	5	TAN	3,11,44,45,47,77
9	30	LT GREEN	3,11,68,71,72
10	30	CIRCUIT BREAKER (POWER WINDOW) OPTION	3,11,67,82
11	10	RED	3,9,11,16,22,37,47,60,84
12	20	YELLOW	1,61
13	30	CIRCUIT BREAKER	2,66,67,86
14	20	YELLOW	2,48
15	20	YELLOW	2,45,47,48,106
16	20	YELLOW	2,44,45,59
17	—	—	—
18	20	YELLOW	4,11,64
19	10	RED	4,11,61
20	10	RED	4,11,87,89

AA-CDP 107 FUSEBLOCK MODULE AND RELAY BANK 938W-1

CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	K1 20DG/RD*	MAP SENSOR SIGNAL	13
2	K2 20TN/BK*	ENGINE TEMP SENSOR SIGNAL	15
3	A14 16RD/WT*	DIRECT BATTERY FEED	14
4	K4 20BK/LB*	SIGNAL GROUND	15
5	Z11 16BK/WT*	SIGNAL GROUND	14
6	K6 20VT/WT*	MAP SENSOR SIGNAL	13
7	K7 20OR	8 VOLT OUTPUT	16
8	F20 20WT	INJECTOR POWER (+)	16
9	A21 14DB	SOLENOID POWER(+)	14
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	14
12	Z12 16BK/TN*	POWER GROUND	14
13	—	—	—
14	—	—	—
15	—	—	—
16	K11 20WT/DB*	INJECTOR	16
17	—	—	—
18	—	—	—
19	K19 20BK/GY*	DISTRIBUTOR IGNITION COIL	14
20	K20 20DG	GENERATOR	16
21	—	—	—
22	K22 20OR/DB*	THROTTLE POSITION (SENSOR)	12
23	V37 20RD/LG*	VEH SPD CONT MODE SELECT SIG	59
24	K24 20GY/BK*	DISTRIBUTOR PICKUP SIGNAL	16
25	D21 20PK	DATA LINK (TRANSMIT)	14
26	D1 20VT/BR*	CCD BUSS(+)	15
27	C20 20BR	A/C PRESSURE SWITCH	14
28	—	—	—
29	K29 20WT/PK*	BRAKE SWITCH SIGNAL	16,59
30	T41 20BR/YL*	ENGINE STARTER RELAY	13
31	C27 20DB/PK*	FAN CONTROL RELAY	14
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	14
33	V36 20TN/RD*	VEHICLE SPD CONTROL (VACUUM)	16,59
34	C13 20DB/OR*	A/C COMP CLUTCH RELAY SIG	14
35	K35 20GY/YL*	EGR SOLENOID SIGNAL (CALIFORNIA)	13
36	—	—	—
37	—	—	—
38	—	—	—
39	K39 20GY/RD*	IDLE AIR CONTROL MOTOR (IAC-3)	12
40	K40 20BR/WT*	IDLE AIR CONTROL MOTOR (IAC-1)	12
41	K41 20BK/DG*	HEATED OXYGEN SENSOR SIGNAL	12
42	—	—	—
43	G21 20GY/LB*	TACHOMETER SIGNAL	16
44	—	—	—
45	D20 20LG	DATA LINK (RECEIVE)	14
46	D2 20WT/BK*	CCD BUSS —	15
47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	15
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN SIGNAL	14
52	K52 20PK/BK*	EVAP/PURGE SOLENOID SIGNAL	13
53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	16,59
54	K54 20OR/BK*	EMCC	16
55	—	—	—
56	—	—	—
57	A142 16DG/OR*	GENERATOR FEED	14
58	—	—	—
59	K59 20VT/BK*	IDLE AIR CONTROL MOTOR (IAC-4)	12
60	K60 20YL/BK*	IDLE AIR CONTROL MOTOR (IAC-3)	12



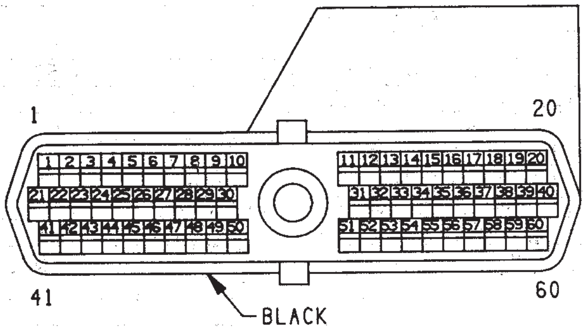
CONNECTOR
VIEWED FROM TERMINAL
END OF CONNECTOR

POWERTRAIN CONTROL MODULE CONNECTOR (2.5L ENGINE)

938W-1

AA-CDP 108

CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	K1 20DG/RD*	MAP SENSOR SIGNAL	30
2	K2 20TN/BK*	ENGINE TEMP SENSOR SIGNAL	27
3	A14 16RD/WT*	DIRECT BATTERY FEED	28
4	K4 20BK/LB*	SIGNAL GROUND	27
5	Z11 16BK/WT*	SIGNAL GROUND	29,36
6	K6 20VT/WT*	MAP SENSOR SIGNAL	25
7	K7 20OR	8 VOLT OUTPUT	27
8	—	—	—
9	A21 14DB	AUTOMATIC SHUT DOWN RELAY	28
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	29,36
12	Z12 16BK/TN*	POWER GROUND	29,36
13	K14 20LB/BR	INJECTOR #4	29
14	K13 20YL/WT*	INJECTOR #3	25
15	K12 20TN	INJECTOR #2	23
16	K11 20WT/DB*	INJECTOR #1	23
17	—	—	—
18	—	—	—
19	K19 20BK/GY*	DISTRIBUTOR IGNITION COIL	23
20	K20 20DG	GENERATOR	24
21	—	—	—
22	K22 20OR/DB*	THROTTLE POSITION (SENSOR)	25
23	V37 20RD/LG*	VEH SPD CONT MODE SELECT	59
24	K24 20GY/BK*	DISTRIBUTOR PICKUP SIGNAL	27
25	D21 20PK	DATA LINK (TRANSMIT)	29
26	D1 20VT/BR*	CCD BUSS(+)	31,34
27	C20 20BR	A/C CLUTCH LOW PRESSURE SW	29
28	K10 18DB/OR*	PWR STEERING PRESS SWITCH	25
29	K29 20WT/PK*	BRAKE SWITCH SIGNAL	31,59
30	T41 20BR/YL*	PARK/NEUTRAL SWITCH SIGNAL	30,36
31	C27 20DB/PK*	FAN CONTROL RELAY	29
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	29
33	V36 20TN/RD*	VEHICLE SPD CONTROL (VACUUM)	31,59
34	C13 20DB/OR*	A/C CLUTCH RELAY SIGNAL	29
35	K35 20GY/YL*	EGR SOLENOID SIGNAL (CALIF)	25
36	—	—	—
37	—	—	—
38	K38 20GY	INJECTOR	28
39	K39 20GY/RD*	IDLE AIR CONTROL MOTOR (IAC-3)	30
40	K40 20BR/WT*	IDLE AIR CONTROL MOTOR (IAC-1)	30
41	K41 20BK/DG*	HEATED OXYGEN SENSOR SIGNAL	25
42	—	—	—
43	G21 20GY/LB*	TACHOMETER SIGNAL	24
44	K44 20TN/YL*	DISTRIBUTOR	27
45	D20 20LG	DATA LINK (RECEIVE)	29
46	D2 20WT/BK*	CCD BUSS —	31,34
47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	27
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN SIGNAL	28
52	K52 20PK/BK*	EVAP/PURGE SOLENOID SIGNAL	23
53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	31,59
54	K54 20OR/BK*	EMCC	31
55	—	—	—
56	—	—	—
57	A142 16DG/OR*	GENERATOR FEED	29
58	K58 20BR/DB*	INJECTOR #5	28
59	K59 20VT/BK*	IDLE AIR CONTROL MOTOR (IAC-4)	30
60	K60 20YL/BK*	IDLE AIR CONTROL MOTOR (IAC-3)	30



CONNECTOR

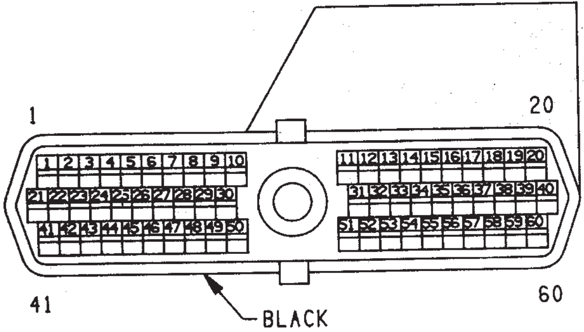
VIEWED FROM TERMINAL
END OF CONNECTOR

POWERTRAIN CONTROL MODULE CONNECTOR (3.0L ENGINE)

AA-CDP 109

938W-1

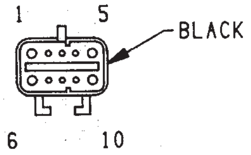
CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	T1 18LG/BK*	TRANSMISSION RANGE SWITCH	36
2	T2 18TN/BK*	BACK-UP LIGHT RELAY	37
3	T3 14VT	BACK-UP LIGHT RELAY	37
4	D2 20WT/BK*	CCD BUS—	34
5	D1 20LB/BR*	CCD BUS+	34
6	Z14 18BK/YL*	SIGNAL GROUND	36
7	—	—	—
8	A41 14YL	ENGINE STARTER RELAY	38
9	T9 18OR/BK*	TRANS. SOLENOIDS & PRESSURE SWITCH	35
10	—	—	—
11	A21 14DB	PARK/NEUTRAL POSITION SWITCH	37
12	K22 18OR/DB*	(PCM) POWERTRAIN CONTROL MODULE	38
13	T13 18DB/BK*	OUTPUT & TURBINE SPEED SENSOR	38
14	T14 18LG/WT*	OUTPUT SPEED SENSOR	38
15	T15 18LG	SAFETY SHUTDOWN RELAY	35
16	T16 16RD	TRANS. SOLENOIDS & PRESSURE SWITCH	35
17	T16 16RD	SAFETY SHUTDOWN RELAY	35
18	—	—	—
19	T19 18WT	TRANS. SOLENOIDS & PRESSURE SWITCH	35
20	T20 18LB	TRANS. SOLENOIDS & PRESSURE SWITCH	35
21	—	—	—
22	—	—	—
23	—	—	—
24	—	—	—
25	—	—	—
26	—	—	—
27	—	—	—
28	—	—	—
29	—	—	—
30	—	—	—
31	—	—	—
32	—	—	—
33	—	—	—
34	—	—	—
35	—	—	—
36	—	—	—
37	—	—	—
38	—	—	—
39	—	—	—
40	—	—	—
41	T41 20BR/YL*	PARK/NEUTRAL POSITION SWITCH	37
42	T42 18VT/WT*	TRANSMISSION RANGE SWITCH	36
43	D1 20VT/BR*	CCD BUS+	34
44	D2 20PK/BK*	CCD BUS—	34
45	K24 18GY/BK*	DISTRIBUTOR	37
46	—	—	—
47	T47 18YL/BK*	TRANS. SOLENOIDS & PRESSURE SWITCH	35
48	—	—	—
49	—	—	—
50	T50 18DG	TRANS. SOLENOIDS & PRESSURE SWITCH	35
51	K4 18BK/LB*	SIGNAL GROUND	37
52	T52 18RD/BK*	TURBINE SPEED SENSOR	38
53	Z14 18BK/YL*	SIGNAL GROUND	36
54			
55	—	—	—
56	A14 16RD/WT*	DIRECT BATTERY FEED	35
57	Z13 18BK/RD*	SIGNAL GROUND	35
58	G7 20WT/OR*	VEH SPEED SENS	35
59	T59 18PK	TRANS. SOLENOIDS & PRESSURE SWITCH	35
60	T60 18BR	TRANS. SOLENOIDS & PRESSURE SWITCH	35



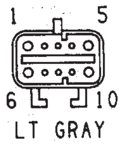
CONNECTOR

VIEWED FROM TERMINAL
END OF CONNECTOR

TRANSMISSION CONTROL MODULE CONNECTOR (3.0L ENGINE)



CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	A14 14RD/WT*	AUTOMATIC SHUT DOWN RELAY CONTACT	35
2	L1 20VT/BK*	BACK-UP LAMP RELAY CONTACT	37
3	K24 18GY/BK*	DISTRIBUTOR PICK-UP SIGNAL	37
4	F20 20WT	BACK-UP LAMP FEED TO RELAY CONTACT	37
5	—	—	—
6	A21 14DB	IGNITION START/RUN	23
7	T41 18BR/YL*	ENGINE STARTER RELAY PARK/NEUTRAL POSITION SWITCH	37
8	G7 20WT/OR*	VEHICLE SPEED SENSOR	35
9	K4 18BK/LB *	SIGNAL REFERENCE	37
10	Z13 18BK/RD*	GROUND	36

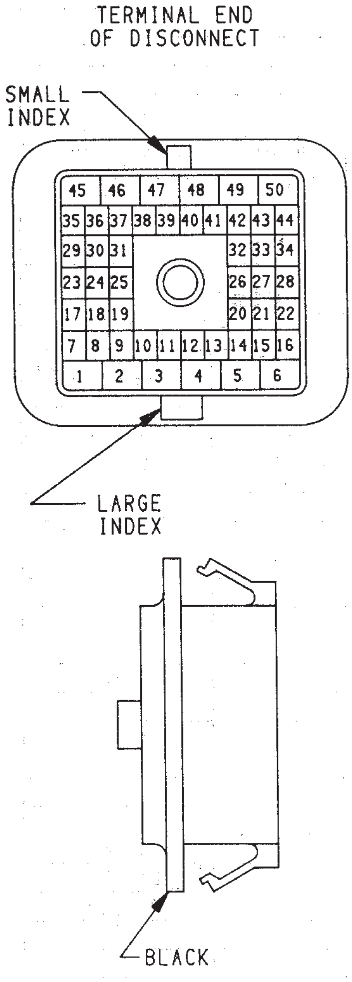


CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	A41 14YL	ENGINE STARTER RELAY-IGN	38
2	Z14 18BK/YL*	SIGNAL GROUND	36
3	D1 20VT/BR*	SERIAL BUS B+	34
4	D1 20LB/BR*	SERIAL BUS B+	34
7	D2 20WT/BK*	SERIAL BUS B—	34
8	D2 20PK/BK*	SERIAL BUS B—	34
9	K22 18OR/DB*	THROTTLE POSITION SIGNAL	38

AA-CDP 111

TCM HARNESS CONNECTORS

938W-1



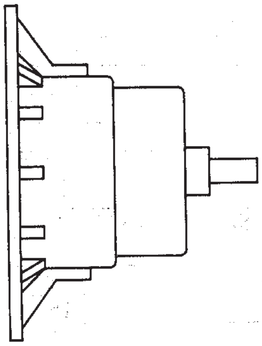
CAVITY	ENGINE COMPARTMENT CIRCUITS		SHEET
1	A3 12RD/WT *	BATTERY FEED	6,8,48 59,67
2	X2 18DG/RD * X2 18DG/RD *	LEFT HORN RIGHT HORN	65
3	G34 14RD/GY*	HIGH BEAM INDICATOR	55,57
4	L43 20VT	LEFT AERO HEADLAMP	56
5	L44 20VT/RD*	RIGHT AERO HEADLAMP	55
6	L3 14RD/OR *	HIGH BEAM	50,55
7	F32 18PK/DB*	BATTERY FEED STOP LAMP SWITCH	44,59
8	K7 18OR	FLEX FUEL SENSE SUPPLY	17,22
9	V37 20RD/LG*	VEHICLE SPEED CTL MODE SELECT SWITCH	59
10	V32 20YL/RD*	VEHICLE SPEED CONTROL SWITCH (IGNITION FEED)	59
11	——	——	——
12	——	——	——
13	L39 18LB	FOG LAMPS	48,55
14	D1 20VT/BR*	CCD BUS+	21,34,60,15
15	K4 18BK/LB*	FLEX FUEL REFERENCE	17,21
16	K121 18BK/RD*	FLEX FUEL SENSE	17
17	G20 20VT/YL*	ENGINE COOLANT TEMPERATURE SENDING UNIT	39,40
18	G6 20GY	ENGINE OIL PRESSURE SWITCH	39,40
19	G60 20GY/YL*	ENGINE OIL PRESSURE SENDING UNIT	39,40
20	D2 20WT/BK *	CCD BUS-	15,21,34,60
21	L61 18LG	LEFT TURN SIGNAL LAMP	56,62
22	L60 18TN	RIGHT TURN SIGNAL LAMP	55,62
23	A15 16PK	BATTERY HAZARD FLASHER	5,7,61
24	A141 16DG/BK*	FUEL PUMP	70
25	——	——	——
26	L7 18BK/YL * L7 18BK/YL *	FRONT RUNNING LAMPS	50,56
27	F20 20WT	BACK-UP LAMP SWITCH FEED	9,16,22,37,60
28	L1 20VT/BK *	BACK-UP LAMP SWITCH OUTPUT	9,37
29	V10 18BR	WINDSHIELD WASHER MOTOR	63
30	G29 20BK/TN*	LOW WASHER FLUID INDICATOR LEVEL SENSOR	63,77
31	L20 14LG/WT*	HEADLAMP SWITCH OPTICAL HORN	57
32	G19 18LG/OR*	ABS WARNING LAMP RELAY	43,44
33	G21 20GY/LB*	TACHOMETER	16,22,24
34	G9 18GY/BK * G9 18GY/BK *	BRAKE WARNING SWITCH	11,44
35	V5 18DG	WINDSHIELD WIPER MOTOR FEED	64
36	V6 18DB	WINDSHIELD WIPER MOTOR	64
37	C22 20DB/WT*	AIR CONDITIONING LOW PRESSURE SWITCH	71,72
38	G3 20BK/PK *	MALFUNCTION INDICATOR LAMP	20,29,14
39	——	——	——
40	——	——	——
41	L50 18WT/TN*	STOP LAMPS	44,59
42	G7 20WT/OR *	VEHICLE SPEED SENSOR INDICATOR	21,27
43	G31 20VT/LG*	OVERHEAD CONSOLE	75
44	G32 20BK/LB*	OVERHEAD CONSOLE	75
45	V3 18BR/WT *	WINDSHIELD WIPER MOTOR	64
46	V4 18RD/YL *	WINDSHIELD WIPER MOTOR	64
47	A21 14DB A21 14DB	SPLICE-IGNITION RUN START CIRCUIT	11,13,19, 23,44
48	A4 14BK/RD *	HEATED REAR WINDOW & IGNITION OFF DRAW	5,34,39,40, 84
49	A1 12RD	IGNITION SWITCH FEED RUN START ACC.	6,8
50	A2 12PK/BK *	IGNITION SWITCH FEED RUN ONLY	6,8

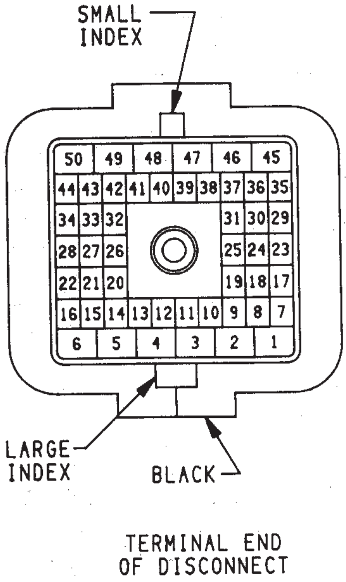
50 WAY BULKHEAD DISCONNECT

938W-1

AA-CDP 112

CAVITY	INSTRUMENT PANEL CIRCUITS		SHEET
1	A3 12RD/WT ✱	BATTERY FEED	6,8,48,59,67
2	X2 18DG/RD✱	HEADLAMP FEED	65
3	G34 16RD/GY✱	HIGH BEAM INDICATOR LAMP	55,57
4	L43 20VT	LEFT HEADLAMP OUTAGE SENSE	56
5	L44 20VT/RD✱	RIGHT HEADLAMP OUTAGE SENSE	55
6	L3 16RD/OR ✱	HEADLAMP HIGH BEAM	50,55
7	F32 18PK/DB✱	STOP LAMP SWITCH FEED	44,59
8	K7 18OR	FLEX FUEL SENSE FEED	17,22
9	V37 20RD/LG✱	VEHICLE SPEED CONTROL SWITCH MODE	59
10	V32 20YL/RD✱	VEHICLE SPEED CONTROL SWITCH IGNITION FEED	59
11	——	——	—
12	——	——	—
13	L39 18LB	FOG LAMPS	48,55
14	D1 20VT/BR✱ D1 20VT/BR✱	CCD BUS+ DATA LINK CONNECTOR	15,21,34,60
15	K4 18BK/LB✱	FLEX FUEL SENSE COMMON	17,21
16	K121 18BK/RD✱	FLEX FUEL SENSE	17
17	G20 22VT/YL✱	ENGINE COOLANT TEMPERATURE GAUGE	39,40
18	G6 22GY	ENGINE OIL PRESSURE LAMP	39,40
19	G60 22GY/YL✱	ENGINE OIL PRESSURE LAMP	39,40
20	D2 20WT/BK ✱ D2 20WT/BK✱	CCD BUS— DATA LINK CONNECTOR	15,21,34,60
21	L61 18LG	LEFT TURN SIGNAL LAMP	56,62
22	L60 18TN	RIGHT TURN SIGNAL LAMP	55,62
23	A15 16PK	BATTERY-HAZARD FLASHER	5,7,61
24	A141 16DG/BK✱	FUEL PUMP	70
25	——	——	—
26	L7 18BK/YL✱	SIDEMARKER AND PARKING LAMPS	50,56
27	F20 20WT	BACK-UP LAMP SWITCH FEED	9,16,22,37,60
28	L1 20VT/BK✱	BACK-UP LAMP SWITCH	9,37
29	V10 18BR	WINDSHIELD WASHER MOTOR	63
30	G29 20BK/TN✱	LOW WASHER FLUID INDICATOR LAMP	63,77
31	L20 16LG/WT✱	HEADLAMP SWITCH OPTICAL HORN	57
32	G19 20LG/OR✱	ABS WARNING LAMP RELAY	43,44
33	G21 22GY/LB✱	TACHOMETER	16,22,24
34	G9 22GY/BK✱ G9 20GY/BK✱	BRAKE WARNING LAMP SWITCH	11,44
35	V5 18DG	WINDSHIELD WIPER MOTOR	64
36	V6 18DB	WINDSHIELD WIPER MOTOR	64
37	C22 20DB/WT✱	AIR CONDITIONER CLUTCH	71,72
38	G3 22BK/PK✱	MALFUNCTION INDICATOR LAMP	14,20,29
39	—	—	—
40	—	—	—
41	L50 18WT/BR✱	STOP SW TO MULTI FUNCTION SW.	61,62
41	L50 18WT/TN✱	BRAKE SENSOR	44,59
42	G7 20WT/OR✱	VEHICLE SPEED SENSOR	21,27
43	G31 20VT/LG✱	OVERHEAD CONSOLE	75
44	G32 20BK/LB✱	OVERHEAD CONSOLE	75
45	V3 18BR/WT✱	WINDSHIELD WIPER LOW SPEED FEED	64
46	V4 18RD/YL✱	WINDSHIELD WIPER HIGH SPEED FEED	64
47	A21 14DB	IGNITION RUN/START	11,13,19,23,44
48	A4 14BK/RD✱	HEATED REAR WINDOW	5,34,39,40,84
49	A1 12RD	IGNITION SWITCH	6,8
50	A2 12PK/BK✱	IGNITION SWITCH	6,8

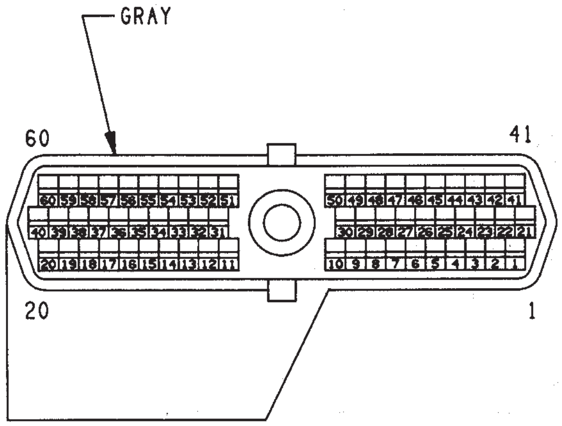




AA-CDP 113

50 WAY (IN CAR) BULKHEAD DISCONNECT

938W-1

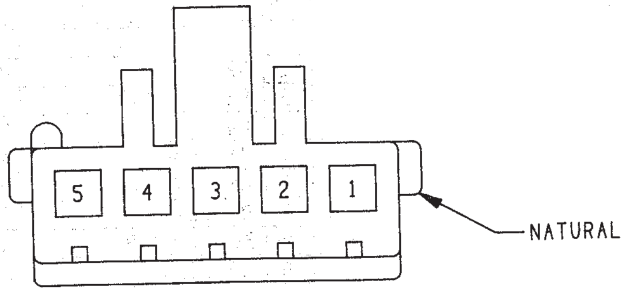


CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	B1 18YL/DB *	RIGHT REAR WHEEL SENSOR	42
2	B2 18YL	RIGHT REAR WHEEL SENSOR	42
3	B3 18LG/DB *	LEFT REAR SHEEL SENSOR	42
4	B4 18LG	LEFT REAR SHEEL SENSOR	42
5	Z1 16BK	ABS GROUND	43
6	B6 18WT/DB *	RIGHT FRONT WHEEL SENSOR	42
7	B7 18WT	RIGHT FRONT WHEEL SENSOR	42
8	B8 18RD/DB *	LEFT FRONT WHEEL SENSOR	42
9	B9 18RD	LEFT FRONT WHEEL SENSOR	42
10	—	—	—
11	D11 20WT/VT *	DATA LINK CONNECTOR	44
12	D12 20OR	DATA LINK CONNECTOR	44
13	L50 18WT/TN *	STOP LAMP	44
14	—	—	—
15	G19 20LG/OR *	ABS WARNING LAMP RELAY	43
16	B116 18GY	ABS PUMP MOTOR RELAY	41
17	—	—	—
18	—	—	—
19	—	—	—
20	B120 14BR/WT *	ABS SYSTEM HYDRAULIC MODULATOR	41
21	—	—	—
22	—	—	—
23	—	—	—
24	—	—	—
25	—	—	—
26	—	—	—
27	—	—	—
28	—	—	—
29	—	—	—
30	—	—	—
31	—	—	—
32	—	—	—
33	—	—	—
34	—	—	—
35	—	—	—
36	—	—	—
37	—	—	—
38	—	—	—
39	—	—	—
40	—	—	—
41	B47 14RD/LB *	ABS SYSTEM RELAY	43
42	B142 18BR/YL *	ABS SYSTEM HYDRAULIC MODULATOR	41
43	B143 18DG/YL *	ABS SYSTEM HYDRAULIC MODULATOR	41
44	—	—	—
45	B145 16WT/DG *	ABS SYSTEM HYDRAULIC MODULATOR	41
46	B146 18BR/LB *	ABS SYSTEM HYDRAULIC MODULATOR	41
47	B47 14RD/LB *	ABS SYSTEM RELAY	43
48	B148 18DG/LB *	ABS SYSTEM HYDRAULIC MODULATOR	41
49	B149 16WT/LG *	ABS SYSTEM HYDRAULIC MODULATOR	41
50	—	—	—
51	—	—	—
52	—	—	—
53	—	—	—
54	—	—	—
55	—	—	—
56	—	—	—
57	B57 18BR/BK *	ABS SYSTEM RELAY	43
58	—	—	—
59	—	—	—
60	A21 14DB	IGNITION SWITCH	44

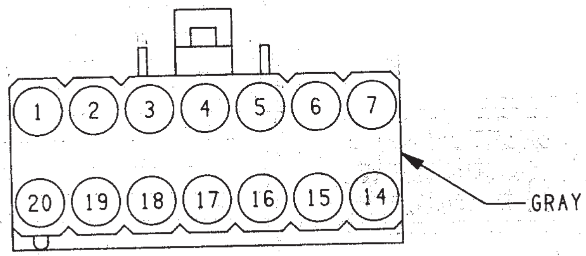
ANTI-LOCK BRAKE SYSTEM
CONTROLLER CONNECTOR

938W-1

AA-CDP 114



CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	—	—	—		—
2	G45	22	OR/LG*	HEADLAMP OUT	95,99
3	Z2	20	BK/LG*	ELECTRONIC GROUND	95,99
4	G46	22	LB/BK*	STOP/TURN LAMP OUT	95,99
5	G47	22	BR/YL*	TAIL LAMP OUT	95,99

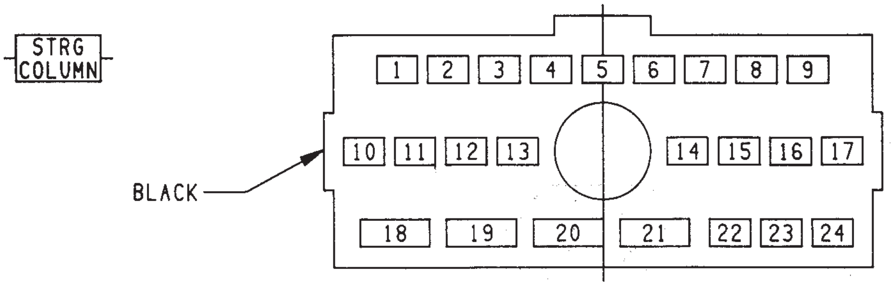


CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	—	—	—		—
2	L63	18	DG/RD*	LEFT STOP LAMP FEED	95,99
3	L87	18	DG/WT*	LEFT STOP LAMP (BULB)	95,99
4	—	—	—		—
5	L48	20	VT/PK*	RIGHT HEADLAMP SENSE (LOW BEAM)	95,99
6	L44	20	VT/RD*	RIGHT HEADLAMP FEED (LOW BEAM)	95,99
7	L47	20	VT/GY*	LEFT HEADLAMP SENSE (LOW BEAM)	95,99
8	L62	18	BR/RD*	RIGHT STOP LAMP FEED	95,99
9	L88	18	BR/WT*	RIGHT STOP LAMP (BULB)	95,99
10	—	—	—		—
11	L71	18	BK/PK*	LEFT TAIL LAMP (BULBS)	95,99
12	L7	18	BK/YL*	TAIL LAMP FEED	95,99
13	L72	18	BK/RD*	RIGHT TAIL LAMP (BULBS)	95,99
14	L43	20	VT	LEFT HEADLAMP FEED (LOW BEAM)	95,99

AA-CDP 115

LAMP OUTAGE MODULE

938W-1



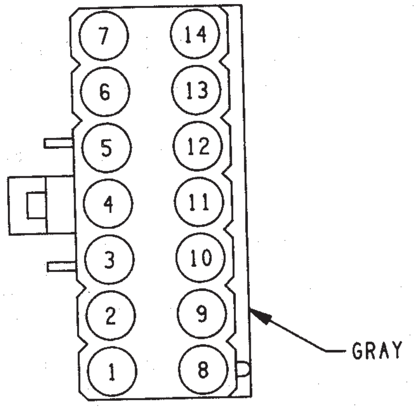
CONNECTOR VIEWED FROM WIRE END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	V9	18	WT/BK*	INTERMITTENT WIPER LEVEL	63
2	V8	18	VT	INTERMITTENT WIPER FEED	63
3	V10	18	BR	WINDSHIELD WASHER MOTOR	63
4	V6	18	DB	WINDSHIELD WIPER IGNITION FEED	63
5	V4	18	RD/YL*	WINDSHIELD WIPER HIGH SPEED	63
6	V3	18	BR/WT*	WINDSHIELD WIPER LOW SPEED	63
7	V7	18	DG/WT*	WINDSHIELD WIPER DWELL	63
8	V17	18	DG/YL*	WINDSHIELD WIPER DWELL	63
9	V3	18	BR/WT*	WINDSHIELD WIPER LOW SPEED	63
10	—	—	—	—	—
11	L60	18	TN	RIGHT FRONT TURN SIGNAL	62
12	L62	18	BR/RD*	RIGHT REAR TURN SIGNAL	62
13	L19	18	PK	HAZARD FLASHER FEED	62
14	L50	18	WT/BR*	BRAKE SWITCH FEED	62
15	L63	18	DG/RD*	LEFT REAR TURN SIGNAL	62
16	L61	18	LG	LEFT FRONT TURN SIGNAL	62
17	L6	20	RD/WT*	TURN SIGNAL FLASHER FEED	62
18	L4	16	VT/WT*	HEADLAMP LOW BEAM	50
19	L2	16	LG	HEADLAMP DIMMER SWITCH FEED	50
20	L3	16	RD/OR*	HEADLAMP HIGH BEAM	50
21	L20	16	LG/WT*	OPTICAL HORN SWITCH FEED	50
22	—	—	—	—	—
23	—	—	—	—	—
24	—	—	—	—	—

INSTRUMENT PANEL TO MULTI-FUNCTION SWITCH WIRING

938W-1

AA-CDP 116



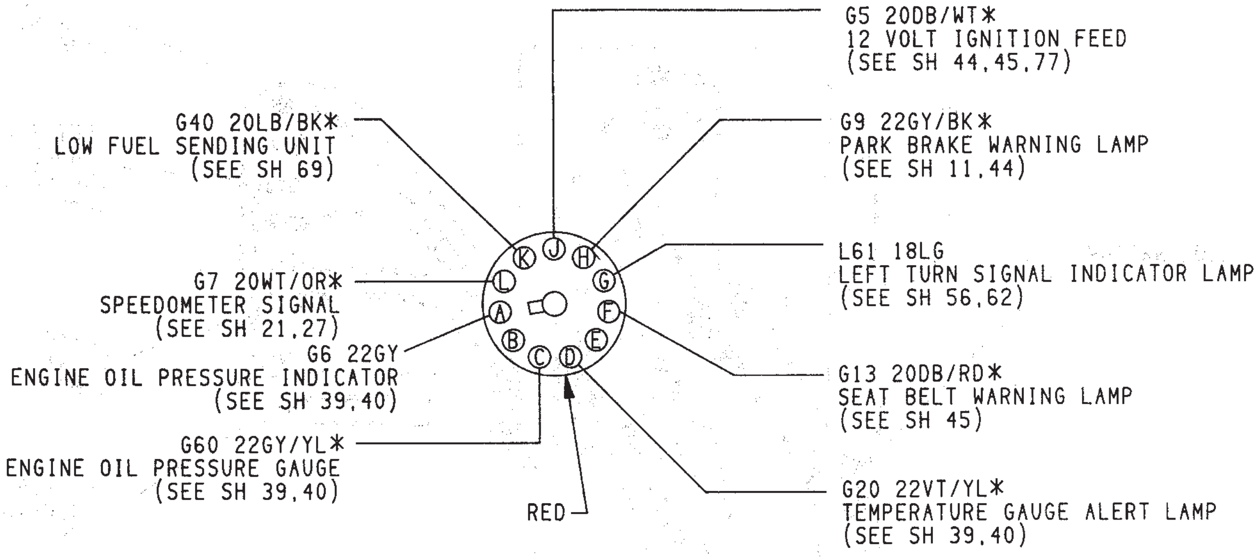
PIN END SHOWN

CAV	WIRE CODE	CIRCUIT FUNCTION	SHEET
1	G74 20TN/RD*	RIGHT FRONT DOOR AJAR (GROUND)	77
2	G76 20TN/YL*	RIGHT REAR DOOR AJAR (GROUND)	77
3	Z1 20BK	BODY GROUND	51,77
4	—	—	—
5	E2 20OR	CLUSTER LAMP FEED	51,77
6	G77 20TN/OR*	LEFT REAR DOOR AJAR (GROUND)	77
7	G75 20TN	LEFT FRONT DOOR AJAR (GROUND)	77
8	G45 22OR/LG*	HEADLAMP OUT (GROUND)	77
9	G47 22BR/YL*	TAIL LAMP OUT (GROUND)	77
10	G29 20BK/TN*	WINDSHIELD WASHER FLUID (GROUND)	77
11	G5 20DB/WT *	IGNITION FEED	77
12	G46 22LB/BK*	STOPLAMP OUT (LAMP GROUND)	77
13	E2 20OR	CLUSTER LAMP FEED	51,77
14	G78 22TN/BK*	LIFTGATE AJAR (GROUND)	77

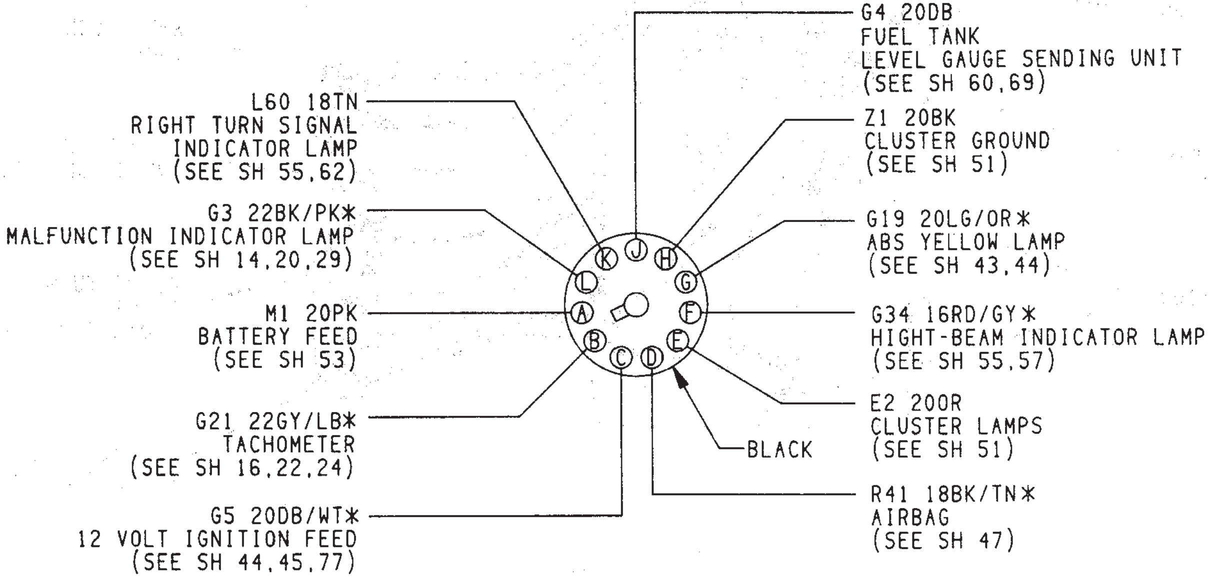
AA-CDP 117

VISUAL MESSAGE CENTER CONNECTOR

938W-1



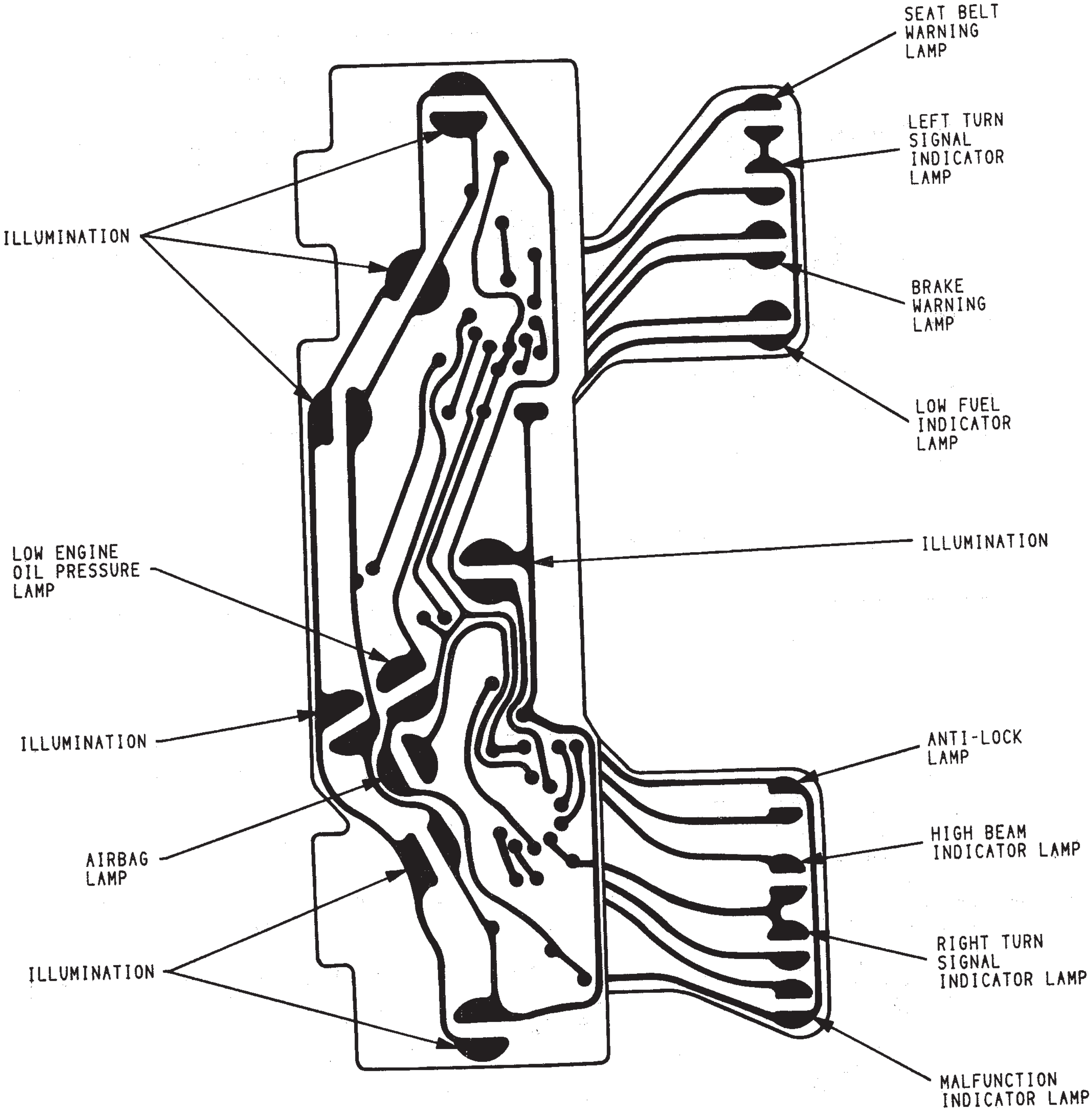
LEFT PRINTED CIRCUIT BOARD CONNECTOR



RIGHT PRINTED CIRCUIT BOARD CONNECTOR

CLUSTER PRINTED CIRCUIT BOARD CONNECTORS

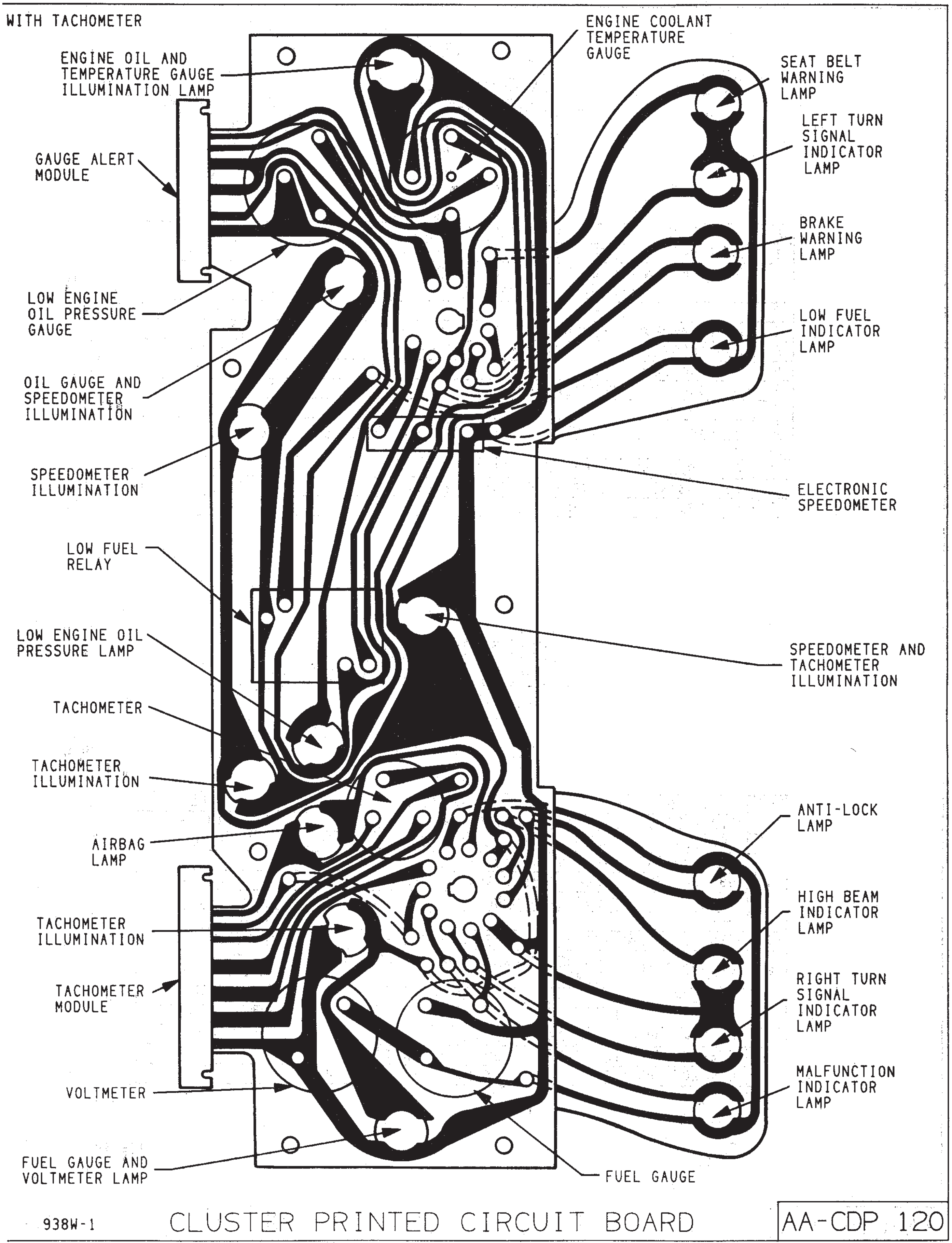
WITHOUT TACHOMETER



AA-CDP 119

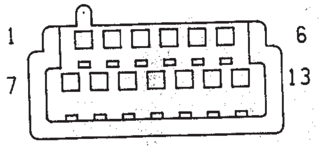
CLUSTER PRINTED CIRCUIT BOARD

938W-1



CLUSTER PRINTED CIRCUIT BOARD

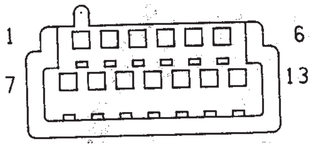
AA-CDP 120



ELECTRONIC CLUSTER
LEFT SIDE (BLUE)

(VIEW OF WIRE END)

CAV	WIRE CODE	DESCRIPTION	SHEET
1	L61 18LG	LEFT TURN SIGNAL INDICATOR LAMP	56,62
2	G29 20BK/TN*	LOW FLUID LEVEL SENSOR WINDSHIELD WASHER	77
3	—	—	—
4	G3 22BK/PK*	MALFUNCTION INDICATOR LAMP	14,20,29
5	G34 16RD/GY*	HIGH BEAM INDICATOR LAMP	55,57
6	Z2 20BK/LG*	GROUND	
7	E2 20OR	CLUSTER LAMPS	51
8	—	—	—
9	G6 22GY	ENGINE OIL PRESSURE INDICATOR LAMP	39,40
10	—	—	—
11	R41 18BK/TN*	AIRBAG-WARNING LAMP	47
12	G5 20DB/WT*	12 VOLT IGNITION SWITCH	44,45,77
13	M1 20PK	BATTERY FEED	53



ELECTRONIC CLUSTER
RIGHT SIDE (RED)

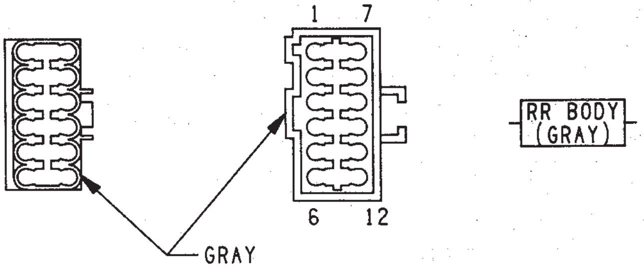
(VIEW OF WIRE END)

CAV	WIRE CODE	DESCRIPTION	SHEET
1	G19 20LG/OR*	ABS-YELLOW LAMP	43,44
2	L60 18TN	RIGHT TURN SIGNAL INDICATOR LAMP	55,62
3	G13 20DB/RD*	SEAT BELT WARNING LAMP	
4	G9 22GY/BK*	PARK BRAKE WARNING LAMP	11,44
5	Z1 20BK	CLUSTER GROUND	51
6	—	—	—
7	G60 22GY/YL*	ENGINE OIL PRESSURE GAUGE	39,40
8	G20 22VT/YL*	ENGINE COOLANT TEMPERATURE GAUGE ALERT LAMP	39,40
9	G4 20DB	FUEL GAUGE SENDING UNIT	69
10	—	—	—
11	G7 20WT/OR*	SPEEDOMETER SIGNAL	15,21,27
12	G16 20BK/LB*	LEFT FRONT DOOR JAMB SWITCH	46
13	E17 20YL/BK*	ELECT. DISPLAY INTENSITY CONTROL	49

AA-CDP 121

ELECTRONIC CLUSTER

938W-1

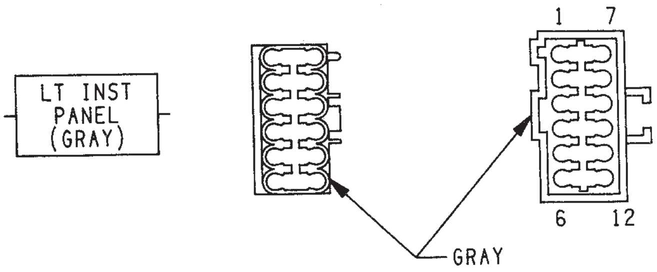


CAV	WIRE CODE	DESCRIPTION	SHEET
1	L71 18BK/PK	LAMP OUTAGE LT TAIL LAMP BULBS	92,93, 96,100,104
2	L87 18DG/WT	LAMP OUTAGE LEFT STOP LAMP FEED OUTPUT TO LAMP	92,96,100,103
3	L88 16BR/WT	LAMP OUTAGE LEFT STOP LAMP FEED OUTPUT TO LAMP	92,96,100,104
4	L72 18BK/RD	LAMP OUTAGE RT TAIL LAMP BULBS	92,93,94 96,100,104
5	Z1 12BK	SYSTEM GROUND	69,79,82,85
7	Z2 20BK/LG*	FUEL TANK LEVEL GAUGE SENDING UNIT GROUND	69
8	G78 20TN/BK	LIFTGATE/DECK LID AJAR SWITCH	78,96,100
9	M1 18PK	COURTESY LAMPS SWITCH	96,100
10	L7 18BK/YL	PARK LAMP FEED	92,96,100,103
11	L50 18WT/TN	STOP LAMP SWITCH	92,96,100,104
12	L1 20VT/BK	BACK UP LAMPS FEED	93,96,100,103

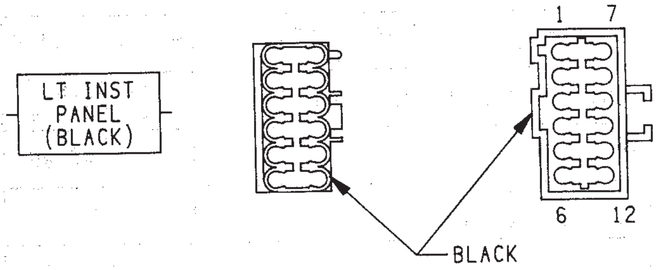
938W-1

UNIFIED BODY TO REAR BODY WIRING

AA-CDP 122



CAV	WIRE CODE	DESCRIPTION	SHEET
1	G78 20TN/BK*	LIFTGATE/DECK LID AJAR SWITCH	78,95,99
2	L62 18BR/RD*	RT RR STOP AND TURN SIGNAL LAMP	61,95,99
2	L88 18BR/WT*	RT RR STOP/TURN (WITH LAMPOUT)	
3	G10 20LG/RD*	SEAT BELT WARNING SWITCH	45
4	L72 18BK/RD*	LAMP OUTAGE RT TAIL LAMP BULBS	50,95,99
5	—	—	—
6	F21 12TN	POWER WINDOW LEFT FRONT DOOR MASTER SWITCH FEED WITH LOCKOUT	67,82
7	F35 12RD	(BATTERY FEED) POWER SEATS	66,67,85
8	L50 18WT/TN*	STOP LAMP SIGNAL TO LAMPS	61,95,99
9	L63 18DG/RD*	LAMP OUTAGE LT TAIL LAMP BULBS	61,95,99
9	L87 18DG/WT*	LT RR STOP/TURN (WITH LAMPOUT)	
10	L71 18BK/PK*	LT RR STOP AND TURN SIGNAL LAMP	50,95,99
11	M1 20PK	COURTESY, DOME, VISOR, ILLUMINATED ENTRY, FOG LPS AND POWER MIRROR FEED	53,58,74,80

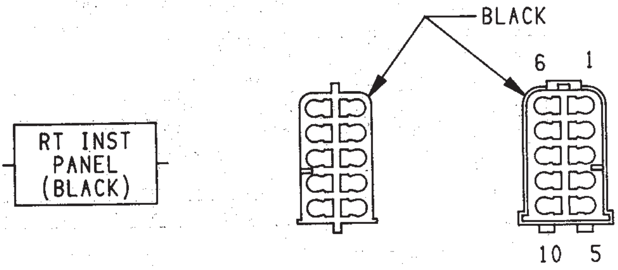


CAV	WIRE CODE	DESCRIPTION	SHEET
1	K7 18OR	FLEX FUEL SENSE	17
2	G77 20TN/OR*	DOOR AJAR SWITCH LEFT REAR DOOR	78
3	X55 20BR/RD*	LEFT FRONT DOOR SPR (B —)	88,90
4	G40 20LB/BK*	LOW FUEL WARNING	70
5	C15 14BK/WT*	HEATED REAR WINDOW READY TO BACK LIGHT	84
6	G4 20DB	FUEL GAUGE FROM TANK MINITRIP COMPUTER	60,70
7	K4 18BK/LBT*	FLEX FUEL SENSE	17
8	L1 20VT/BK*	BACK-UP LAMPS FEED	9,95,99
9	K121 18BK/RD*	FLEX FUEL SENSE	17
10	A141 16DG/BK*	FUEL PUMP RELAY, OUTPUT TO FUEL PUMP, FUEL INJECTOR	70
11	L7 18BK/YL*	PARK LAMP FEED	50,95,99
12	M2 20YL	DOOR JAMB SWITCH	46,58

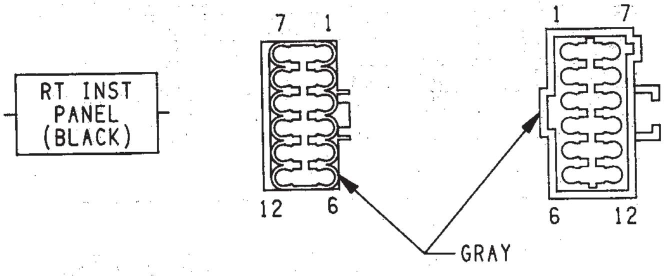
INSTRUMENT PANEL WIRING TO LEFT BODY

AA-CDP 123

938W-1



CAV	WIRE CODE	DESCRIPTION	SHEET
1	C16 22LB/YL*	HEATED MIRROR FEED	80
2	X13 16BK/RD*	FRONT DOOR SPEAKER (B+)	90
3	E2 20OR	CONTROLLED DIMMABLE LAMPS	51
4	G31 20VT/LG*	AMBIENT AIR SENSOR	76
5	G32 20BK/LB*	AMBIENT AIR SENSOR RETURN	76
6	P57 14LG	POWER DOOR LOCK	106
7	X15 16BK/DG*	NAME BRAND SPEAKER AMPLIFIER (B−) FRONT DOOR (REAR SHELF)	90
8	M1 20PK	DOME/COURTESY SWITCH	58,74,76
9	F20 20WT	REAR LIGHTING LAMP SWITCH FEED	76
10	L7 18BK/YL*	PARK LAMP	50,76



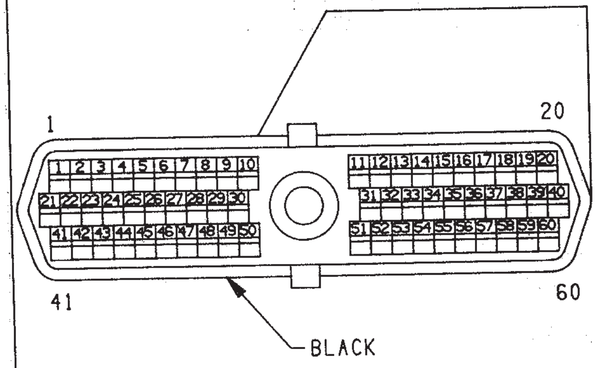
CAV	WIRE CODE	DESCRIPTION	SHEET
1	X54 20VT	RIGHT FRONT SPEAKER (B+)	88,90
2	G74 20TN/RD*	RT FRONT DOOR AJAR SWITCH	78
3	X52 20DB	RIGHT REAR SPEAKER (B+)	88,90
4	M2 20YL	DOOR JAMB SWITCHES	58
5	X57 20BR/LB*	LEFT FRONT DOOR SPEAKER (B+)	88,90
6	M22 18WT/BK*	ILLUMINATED ENTRY	58
7	X51 20BR/YL*	LT RR SPEAKER (B+)	88,90
8	X53 20DG	LEFT FRONT DOOR SPEAKER (B+)	88,90
9	X56 20DB/RD*	RIGHT FRONT SPEAKER (B−)	88,90
10	X58 20DB/OR*	RIGHT REAR SPEAKER (B−)	88,90
11	G76 20TN/YL*	RIGHT REAR DOOR AJAR SWITCH	78
12	G75 20TN	LT FRONT DOOR AJAR SWITCH	78

INSTRUMENT PANEL WIRING TO RIGHT BODY

938W-1

AA-CDP 124

CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	K1 20DG/RD*	MAP SENSOR SIGNAL	19
2	K2 20TN/BK*	ENGINE TEMP SENSOR SIGNAL	21
3	A14 16RD/WT*	DIRECT BATTERY FEED	20
4	K4 20BK/LB*	SIGNAL GROUND	21
5	Z11 16BK/WT*	SIGNAL GROUND	20
6	K6 20VT/WT*	MAP SENSOR SIGNAL	19
7	K7 200R	8 VOLT OUTPUT	22
8	F20 20WT	INJECTOR POWER (+)	22
9	A21 14DB	AUTOMATIC SHUT DOWN RELAY	20
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	20
12	Z12 16BK/TN*	POWER GROUND	20
13	K14 18LB/BR	INJECTOR #4	17
14	K13 18YL/WT	INJECTOR #3	17
15	K12 18TN	INJECTOR #2	17
16	K11 18WT/DB*	INJECTOR #1	17,22
17	—	—	—
18	—	—	—
19	K19 20BK/GY*	DISTRIBUTOR IGNITION COIL	20
20	K20 20DG	GENERATOR	22
21	K121 18BK/RD*	FLEX FUEL SENSOR	17
22	K22 080R/DB*	THROTTLE POSITION (SENSOR)	18
23	V37 20RD/LG*	VEHICLE SPD CONTROL MODE SELECT SIG	59
24	K24 20GY/BK*	DISTRIBUTOR PICKUP SIGNAL	22
25	D21 20PK	DATA LINK (TRANSMIT)	20
26	D1 20VT/BR*	CCD BUSS(+)	21
27	C20 20BR	A/C LOW PRESSURE SWITCH	20
28	—	—	—
29	K29 20WT/PK*	BRAKE SWITCH SIGNAL	22,59
30	T41 20BR/YL*	ENGINE STARTER RELAY	19
31	C27 20DB/PK*	FAN CONTROL RELAY	20
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	20
33	V36 20TN/RD*	VEHICLE SPD CONTROL (VACUUM)	22,59
34	C13 20DB/OR*	A/C COMP CLUTCH RELAY SIGNAL	20
35	—	—	—
36	—	—	—
37	—	—	—
38	—	—	—
39	K39 20GY/RD*	IDLE AIR CONTROL MOTOR	18
40	K40 20BR/WT*	IDLE AIR CONTROL MOTOR	18
41	K41 20BK/DG*	HEATED OXYGEN SENSOR SIGNAL	17,18
42	—	—	—
43	G21 20GY/LB*	TACHOMETER SIGNAL	22
44	K44 18TN/YL*	CAMSHAFT POSITION SENSOR	22
45	D20 20LG	DATA LINK (RECEIVE)	20
46	D2 20WT/BK*	CCD BUSS —	21
47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	21
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN SIGNAL	20
52	K52 20PK/BK*	EVAP/PURGE SOLENOID SIGNAL	19
53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	22,59
54	K54 200R/BK*	EMCC	9,22
55	—	—	—
56	—	—	—
57	A142 16DG/OR*	GENERATOR FEED	20
58	—	—	—
59	K59 20VT/BK*	IDLE AIR CONTROL MOTOR	18
60	K60 20YL/BK*	IDLE AIR CONTROL MOTOR	18



CONNECTOR
VIEWED FROM TERMINAL
END OF CONNECTOR

POWERTRAIN CONTROL MODULE FLEX FUEL CONNECTOR (2.5L ENGINE)

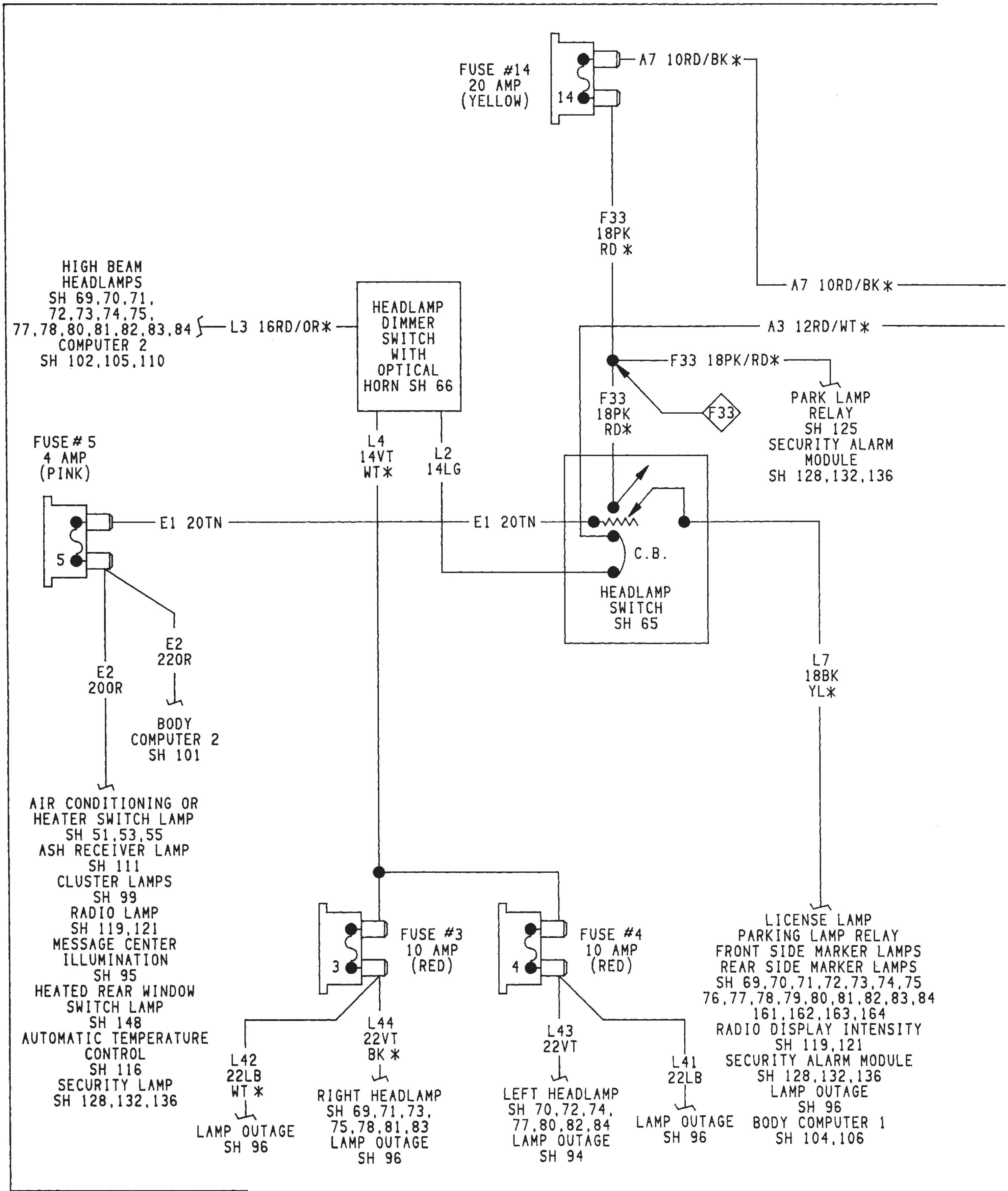
AA-CDP 125

938W-1

WIRING DIAGRAMS AC-AY BODY

INDEX

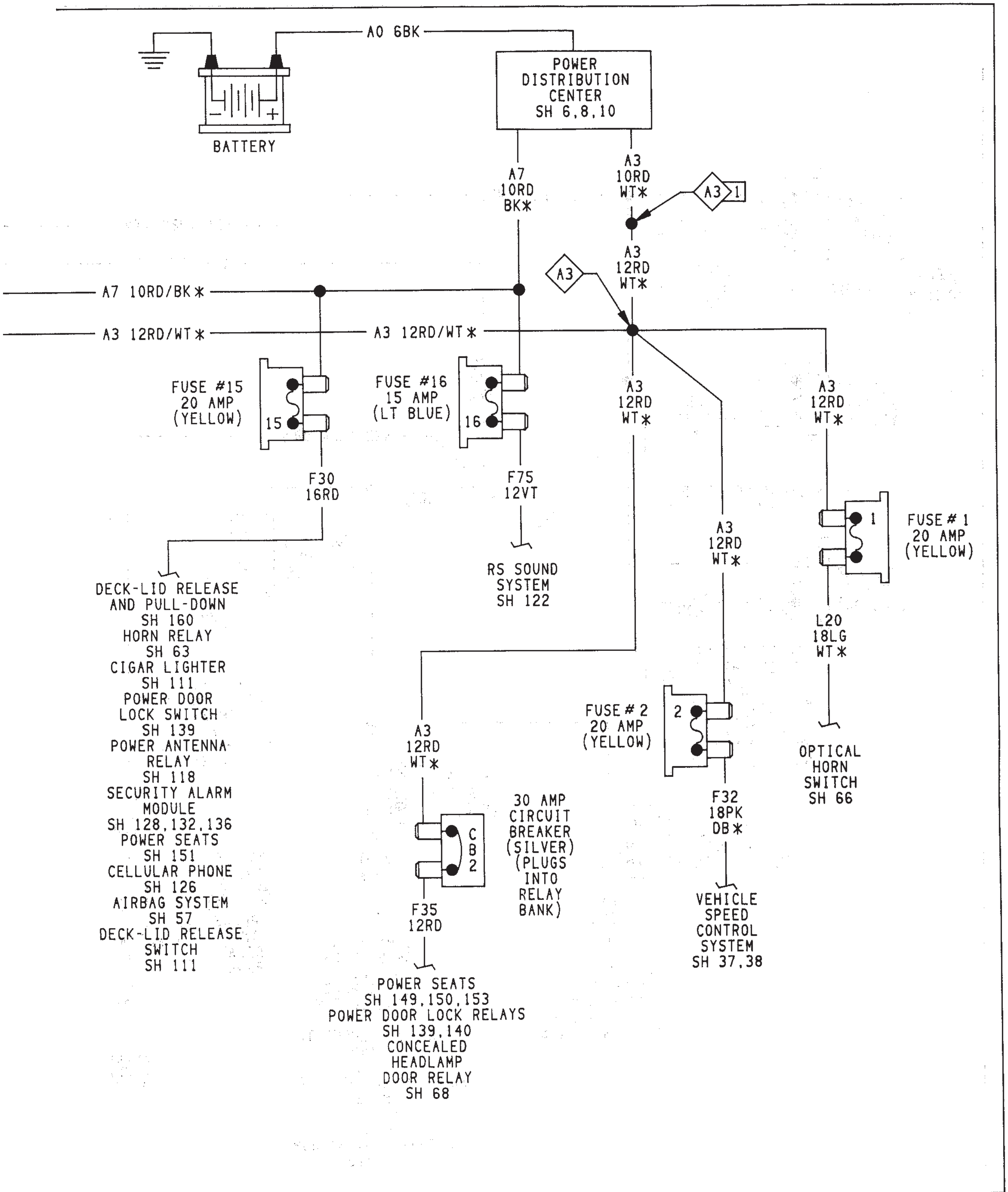
Name	Wiring Diagram Sheet Number
Splice A4	4, 159
Splice A4-1	4, 5, 7, 9
Splice A11	6, 8, 10
Splice A11-1	6, 8, 10
Splice A14	5, 7, 9, 23
Splice A16	52, 54, 56, 114
Splice A21	15, 22, 27
Splice A21-1	22, 27, 33
Splice A21-2	4, 11, 15, 22, 27, 41, 67
Splice A22	3, 11, 158
Splice A41	13
Splice A141	36
Splice A142	6, 8
Splice A142-1	20
Splice A142-2	15, 19, 24
Splice A142-3	24
Splice B47	49
Splice C15	4, 148
Splice C25	54, 56, 113
Splice C27	56, 114
Splice C34	117
Splice C57	115
Splice C57-1	116
Splice C57-2	117
Splice D1	97, 100, 103, 106, 110
Splice D1-1	97, 100, 103, 106, 108, 130, 134, 138
Splice D1-2	89
Splice D2	97, 100, 103, 106, 110
Splice D2-1	97, 100, 103, 106, 108, 130, 134, 138
Splice D2-2	89
Splice E2	51, 53, 55, 85, 95, 99, 116, 119, 121, 128, 132, 136, 148
Splice F10	41, 147
Splice F10-1	147
Splice F13	62, 103, 106, 108, 130, 134, 137
Splice F20	12, 54
Splice F20-1	79
Splice F22	57, 115, 124, 125, 148
Splice F30-2	139, 151
Splice F30-3	57, 64, 118, 126, 128, 132, 136, 139, 151, 160
Splice F30-4	64, 126, 128, 132, 136, 139, 151, 160
Splice F30-5	139, 151
Splice F33	1, 64
Splice F35	68, 139, 149, 153, 155
Splice F35-1	149, 155
Splice F35-2	39
Splice G5	57, 67, 95, 100, 102, 104, 107, 109, 128, 132, 135, 141
Splice G5-1	67, 102, 104, 107
Splice G7	17, 19, 25
Splice G9	11, 45
Splice G10	67
Splice K4	19, 25, 28
Splice K4-1	25
Splice K4-2	17
Splice K4-3	19, 21, 25, 26
Splice K4-4	17, 18, 19, 25
Splice K6	21, 26
Splice K6-1	18
Splice K7	17, 28
Splice K22	21, 26
Splice K24	19, 28
Splice L1	124, 125, 161, 163
Splice L3	66, 73, 75, 78, 81, 83, 102, 105, 110
Splice L3-1	70, 72, 76, 79, 82, 84
Splice L3-2	69, 71, 73, 76, 79, 81, 83
Splice L7	119, 121
Splice L7-1	161, 163
Splice L7-2	69, 71, 74, 76, 79, 82, 84
Splice L7-3	69, 71
Splice L7-4	70, 72, 73, 74, 75, 77, 78, 80, 81, 82, 83, 84
Splice L43	72, 76, 79, 84
Splice L50	161, 163
Splice L60-1	81
Splice L60-2	69, 71, 73, 76, 79, 81, 83
Splice L61	70, 72, 74, 77, 80, 82
Splice M1	89, 159
Splice M1-1	89
Splice M1-2	87, 91, 112
Splice M1-3	88, 91, 112
Splice M2	90
Splice M2-1	87, 91
Splice M2-2	87, 91
Splice M2-3	87
Splice M2-4	87
Splice M11-1	99, 159
Splice M31	94, 108, 133
Splice P33	140
Splice P34	140
Splice P36	129, 133, 137, 142
Splice P38	104, 107, 109, 129, 133, 137, 139, 142
Splice P46	152
Splice Q1	157
Splice S3	41
Splice S3-1	44
Splice S3-2	41
Splice S33	44
Splice T1	35
Splice T3	33
Splice T13	34
Splice T16	35
Splice T41	13, 33
Splice V9	61, 104, 107, 109
Splice X2	63
Splice X3	63, 130, 134, 138, 142
Splice X13	122
Splice Z0	7, 9, 38, 46, 54, 70, 72, 74, 77, 80, 82, 84
Splice Z0-1	16
Splice Z0-2	5, 53
Splice Z1	10
Splice Z1-1	55, 63, 69, 71, 73, 75, 78, 81, 83, 113
Splice Z1-2	38, 70, 72



AC-CD, AY-C 1

FUSE APPLICATION CHART

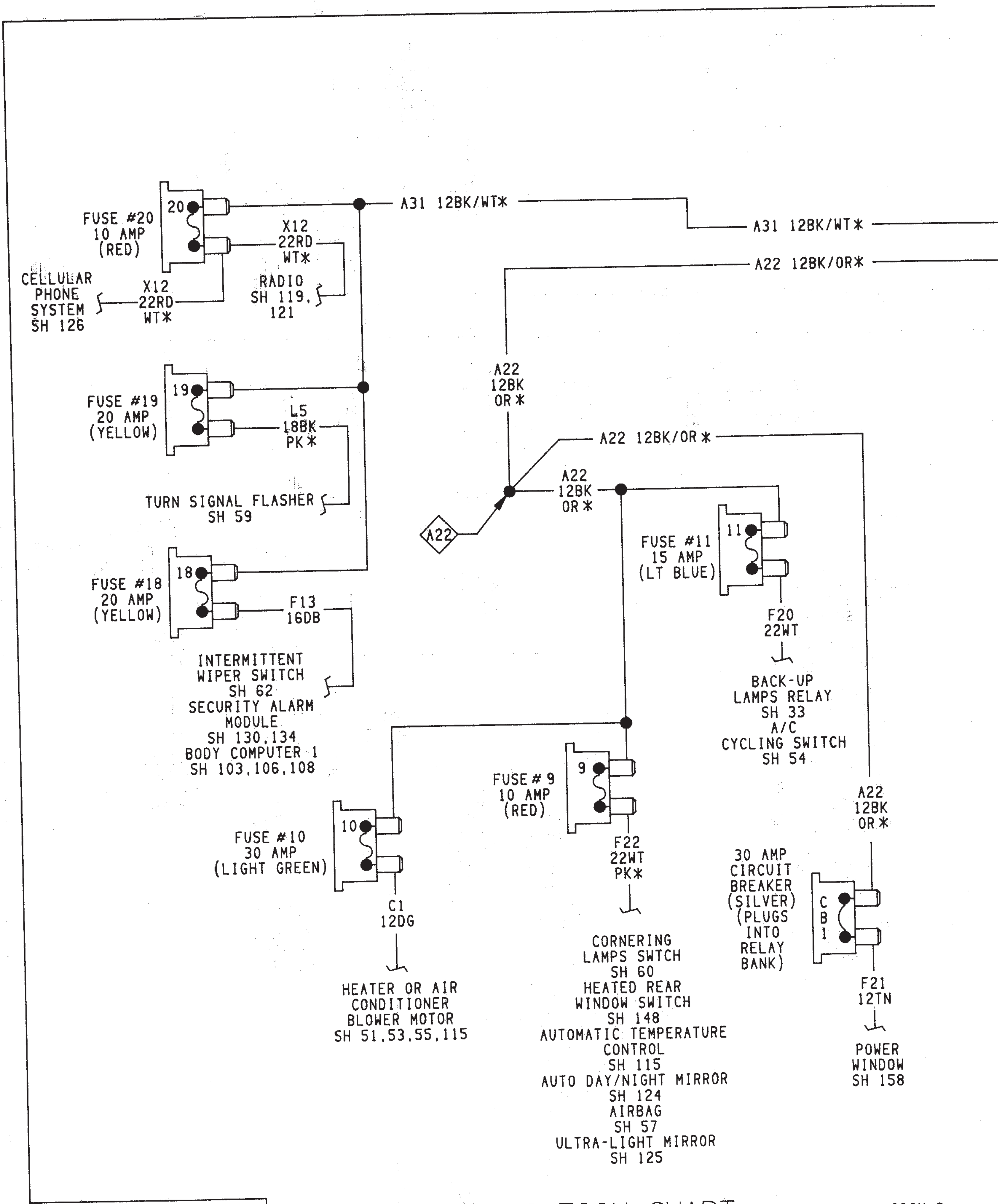
938W-3



938W-3

FUSE APPLICATION CHART

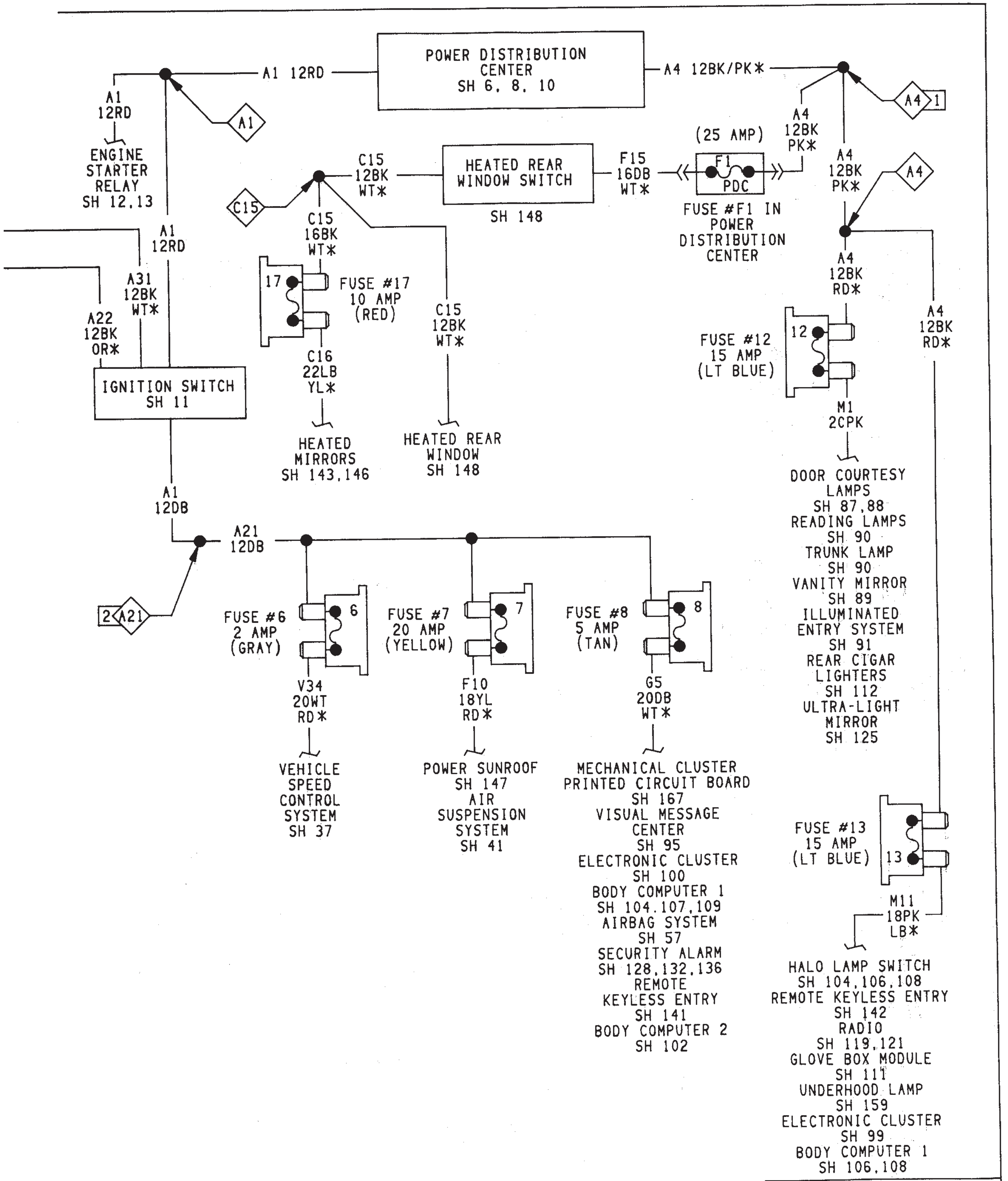
AC-CD, AY-C 2



AC-CD, AY-C 3

FUSE APPLICATION CHART

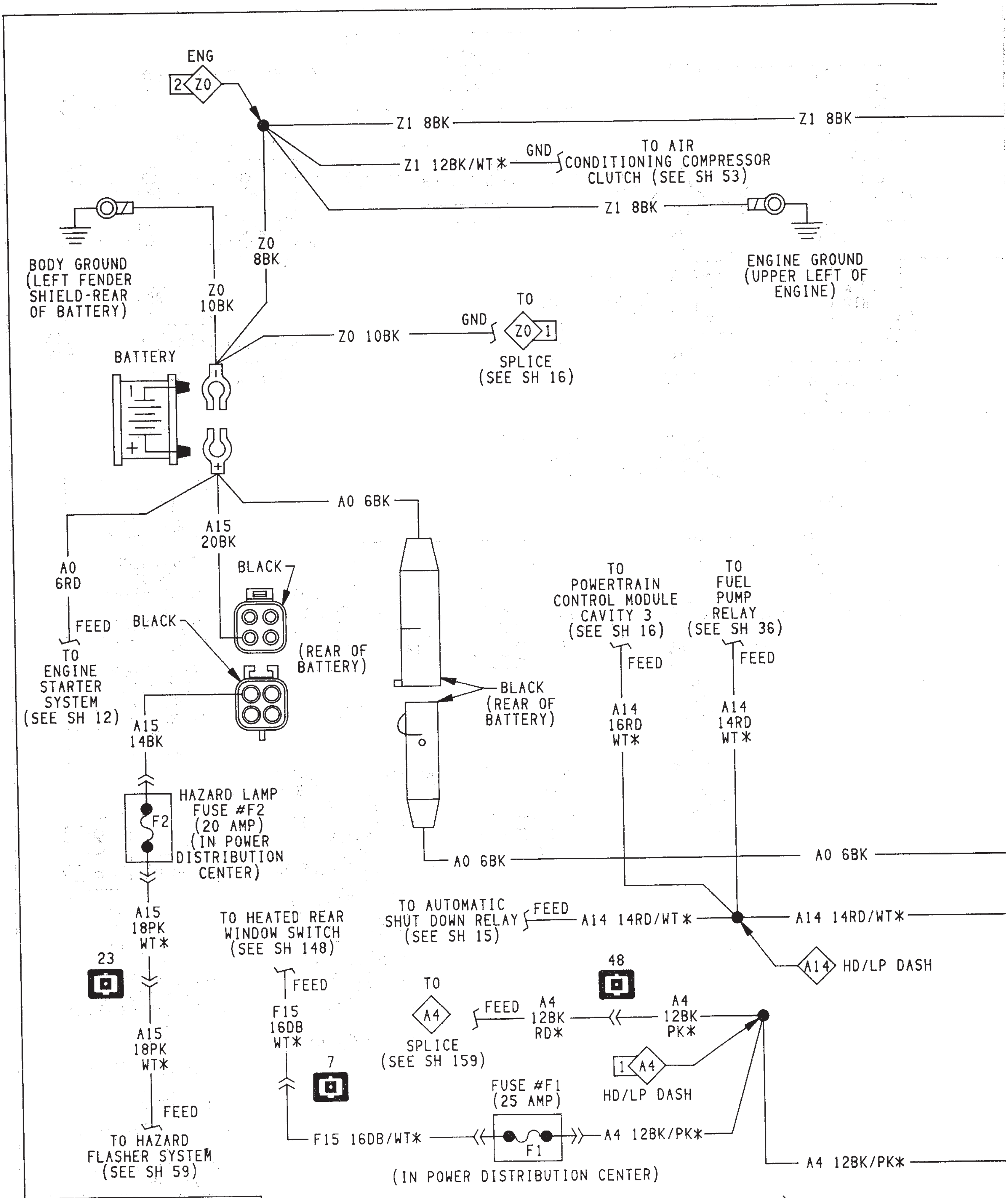
938W-3



938W-3

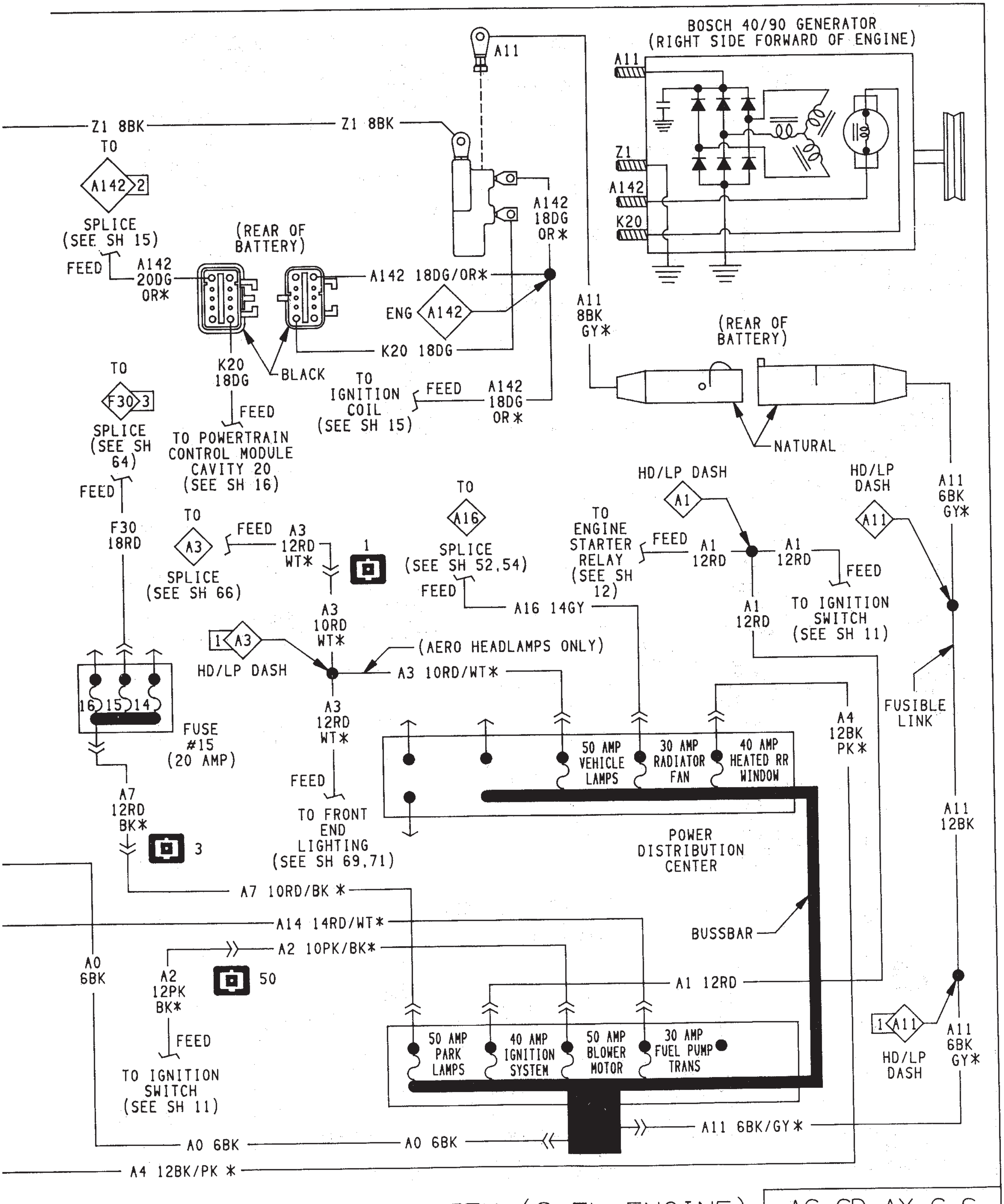
FUSE APPLICATION CHART

AC-CD,AY-C 4

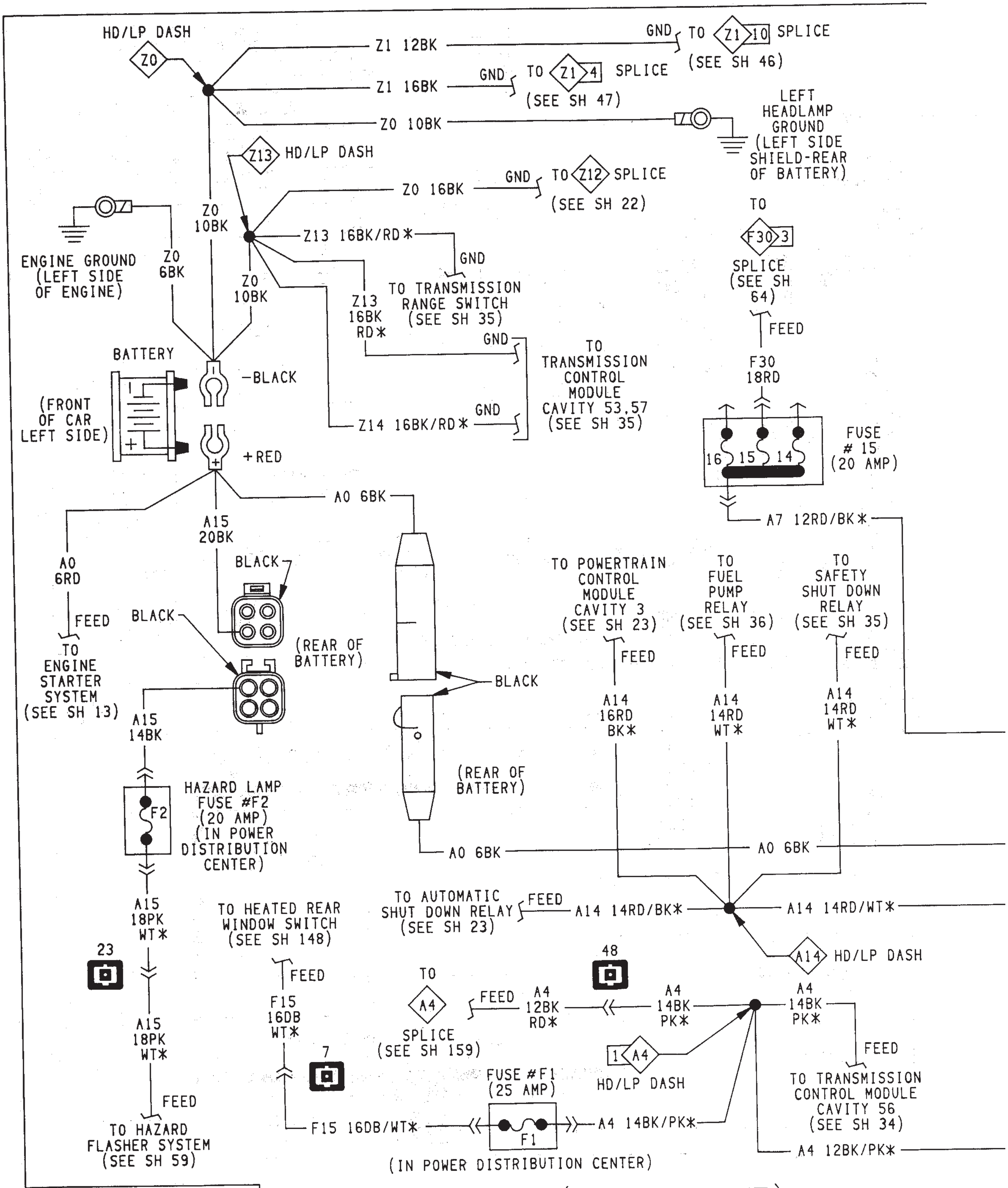


AC-CD, AY-C 5 | CHARGING SYSTEM (2.5L ENGINE)

938W-3

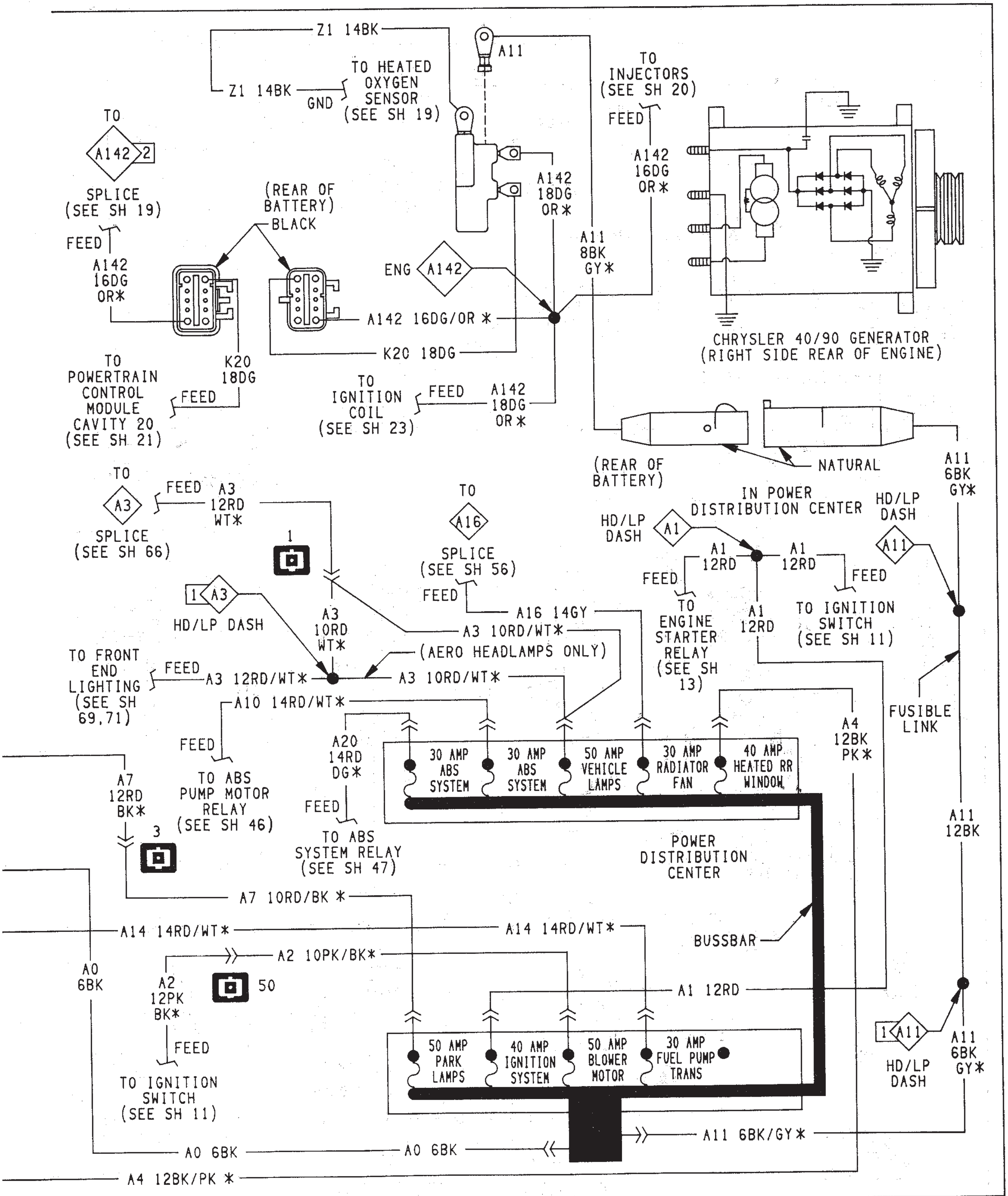


938W-3 CHARGING SYSTEM (2.5L ENGINE) AC-CD,AY-C 6



AC-CD,AY-C 7 | CHARGING SYSTEM (3.0L ENGINE)

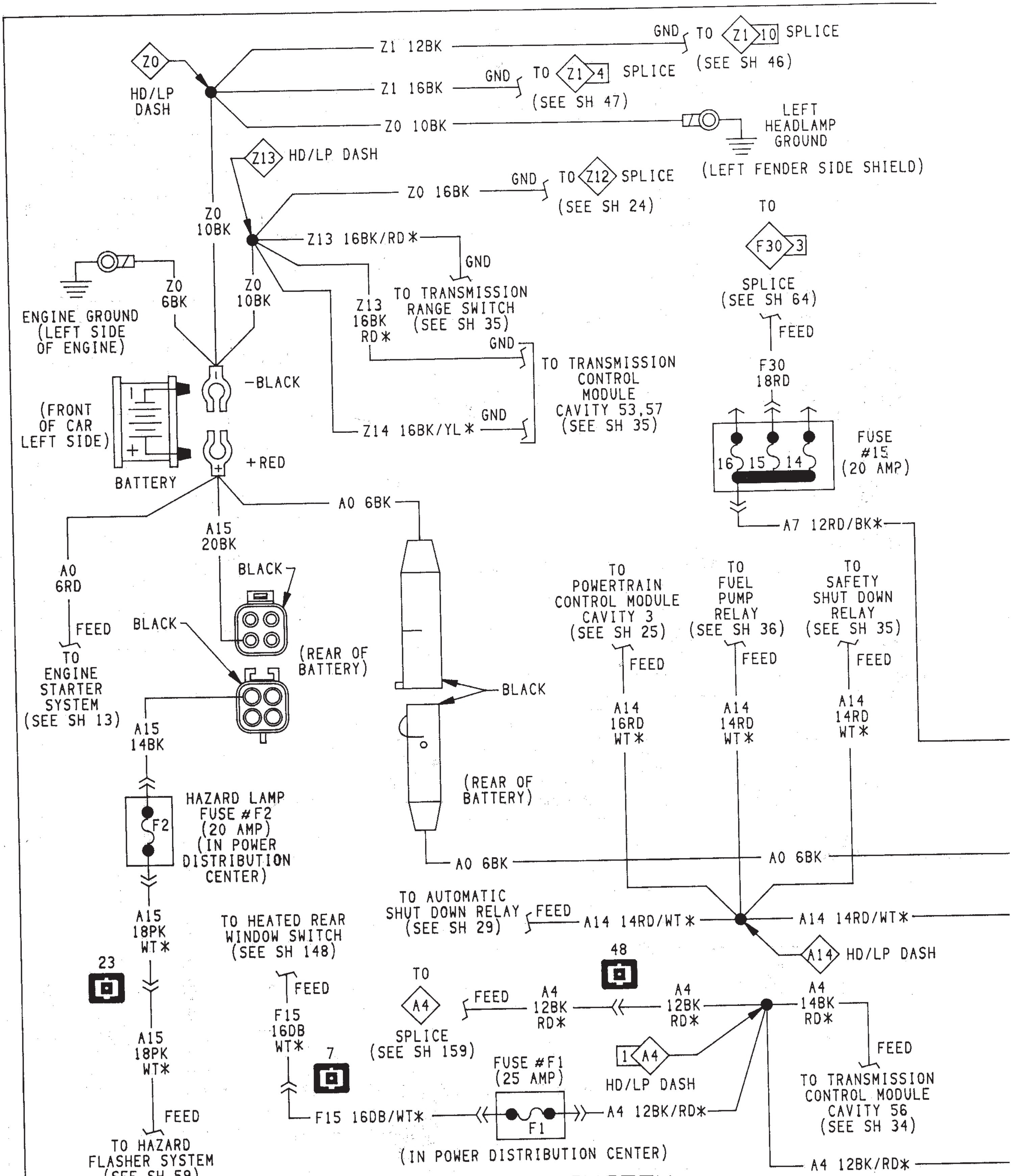
938W-3



938W-3

CHARGING SYSTEM (3.0L ENGINE)

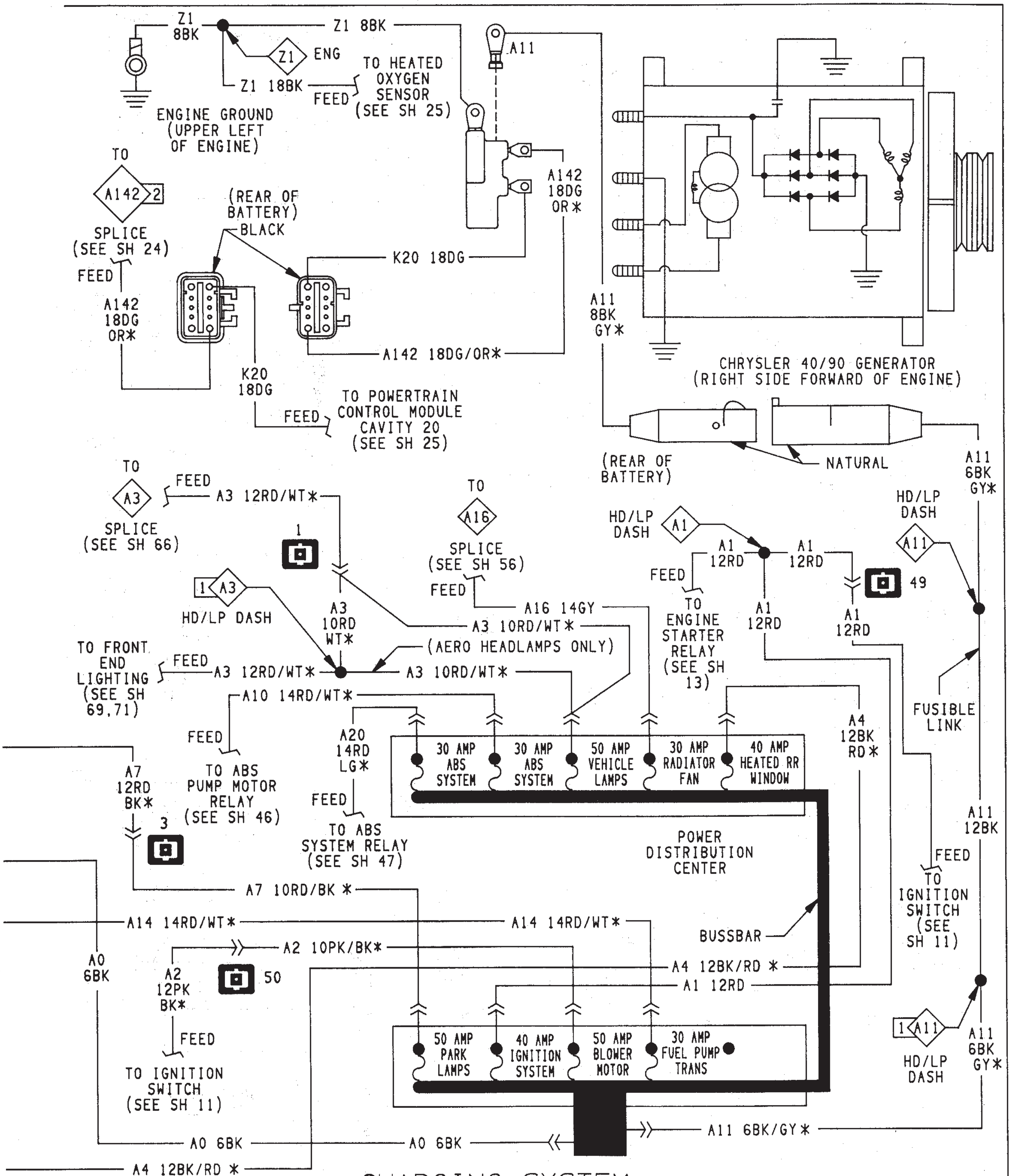
AC-CD, AY-C 8



CHARGING SYSTEM
(3.3L AND 3.8L ENGINE)

AC-CD, AY-C 9

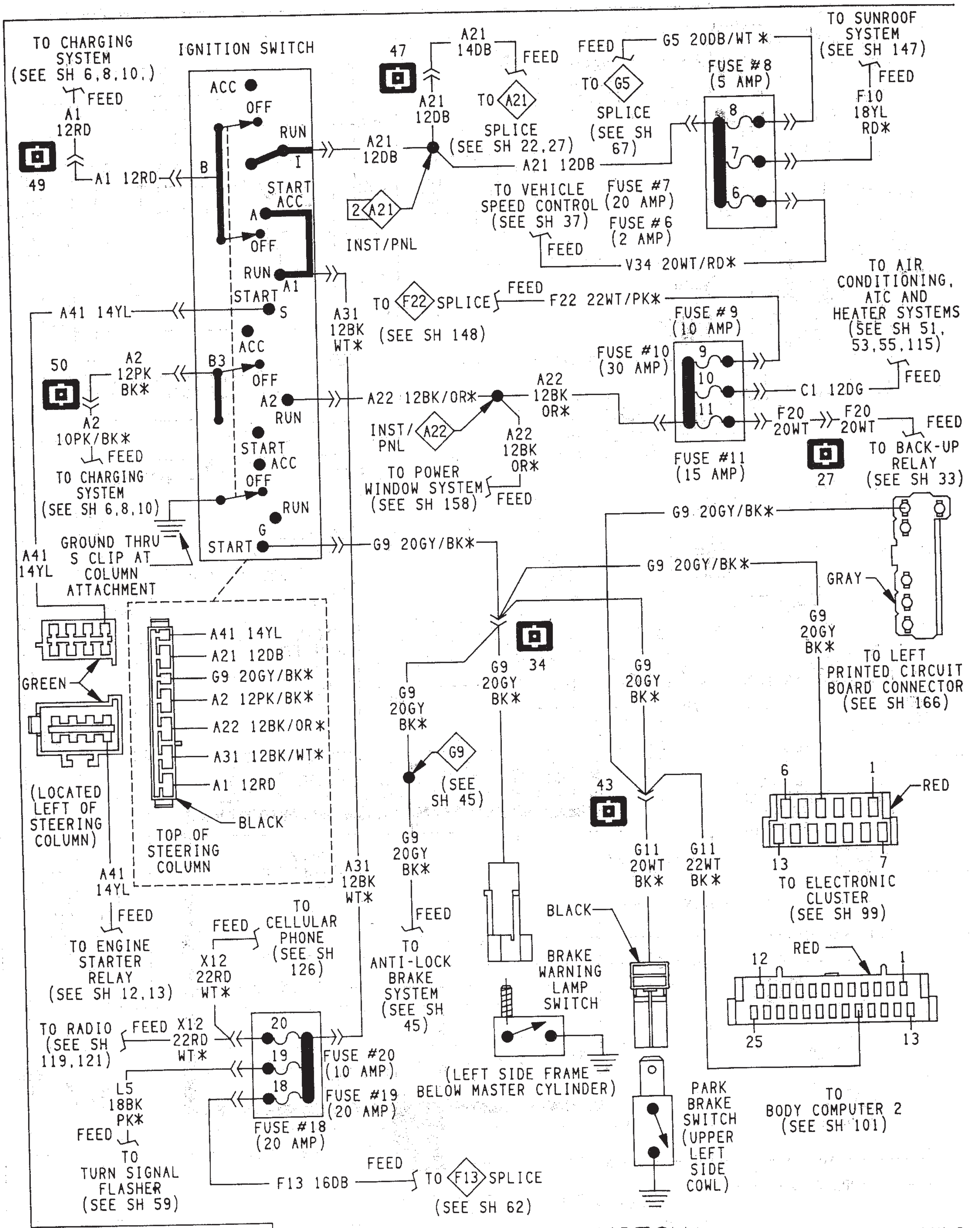
938W-3



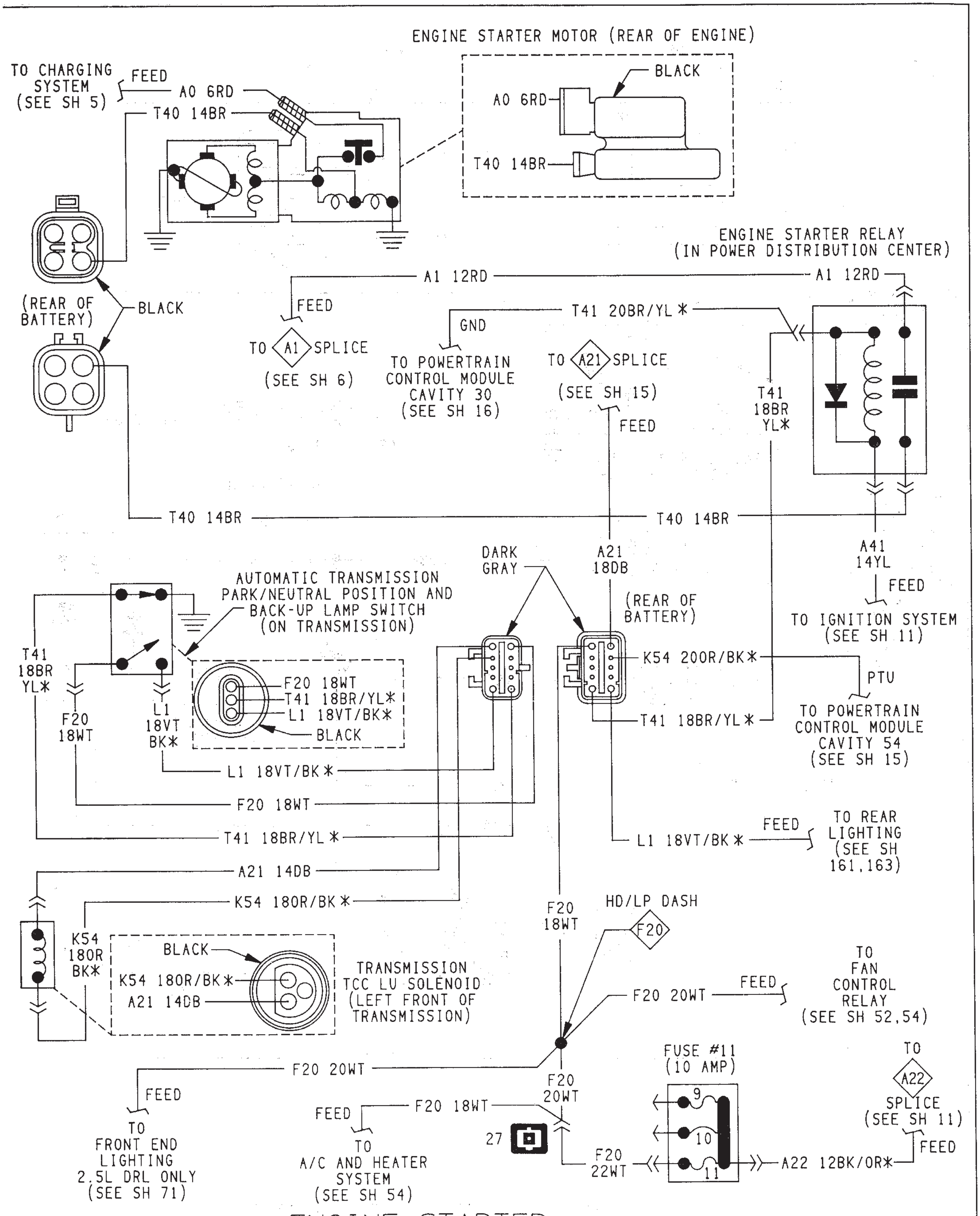
CHARGING SYSTEM
(3.3L AND 3.8L ENGINE)

938W-3

AC-CD, AY-C 10

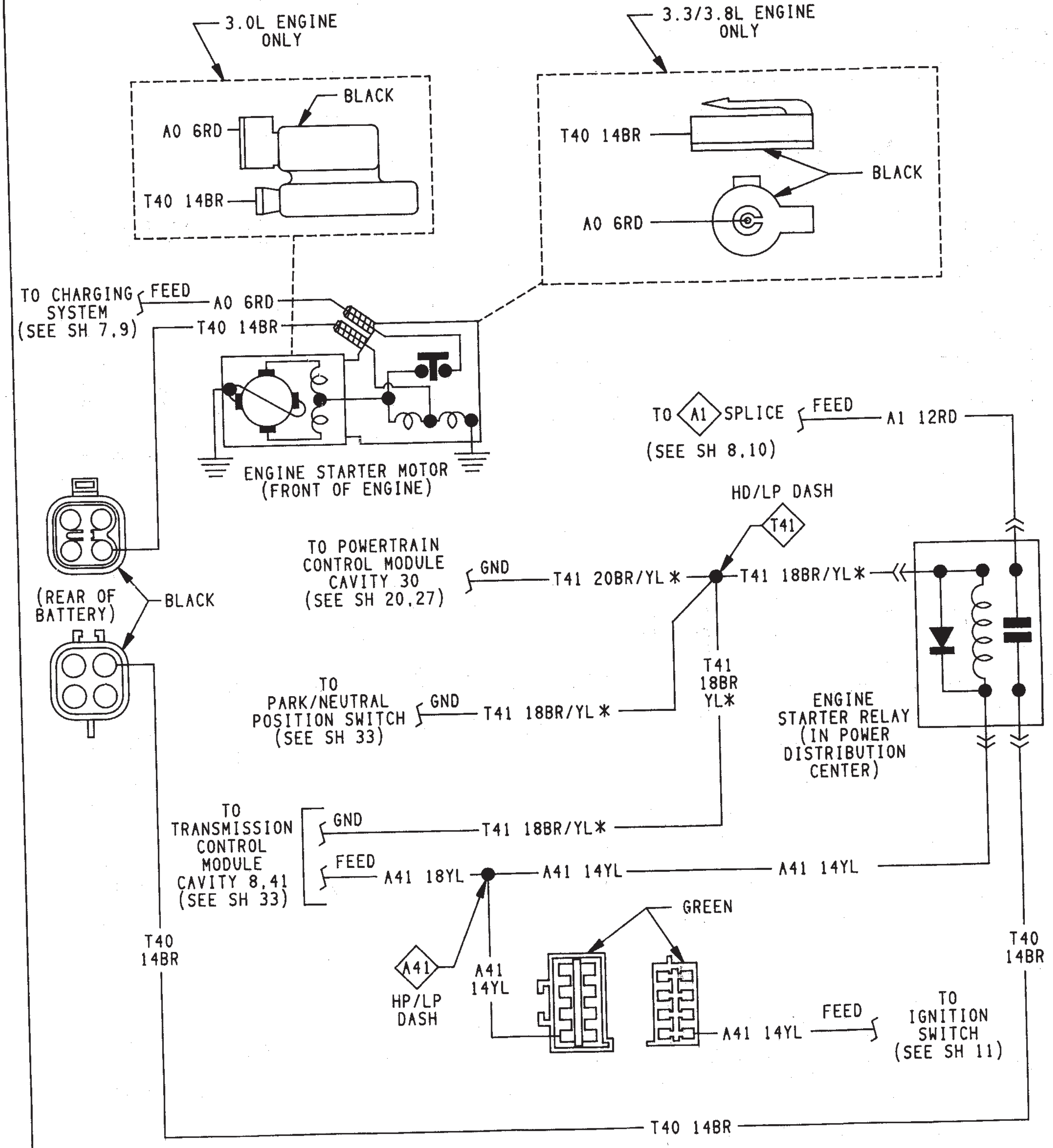


IGNITION SWITCH



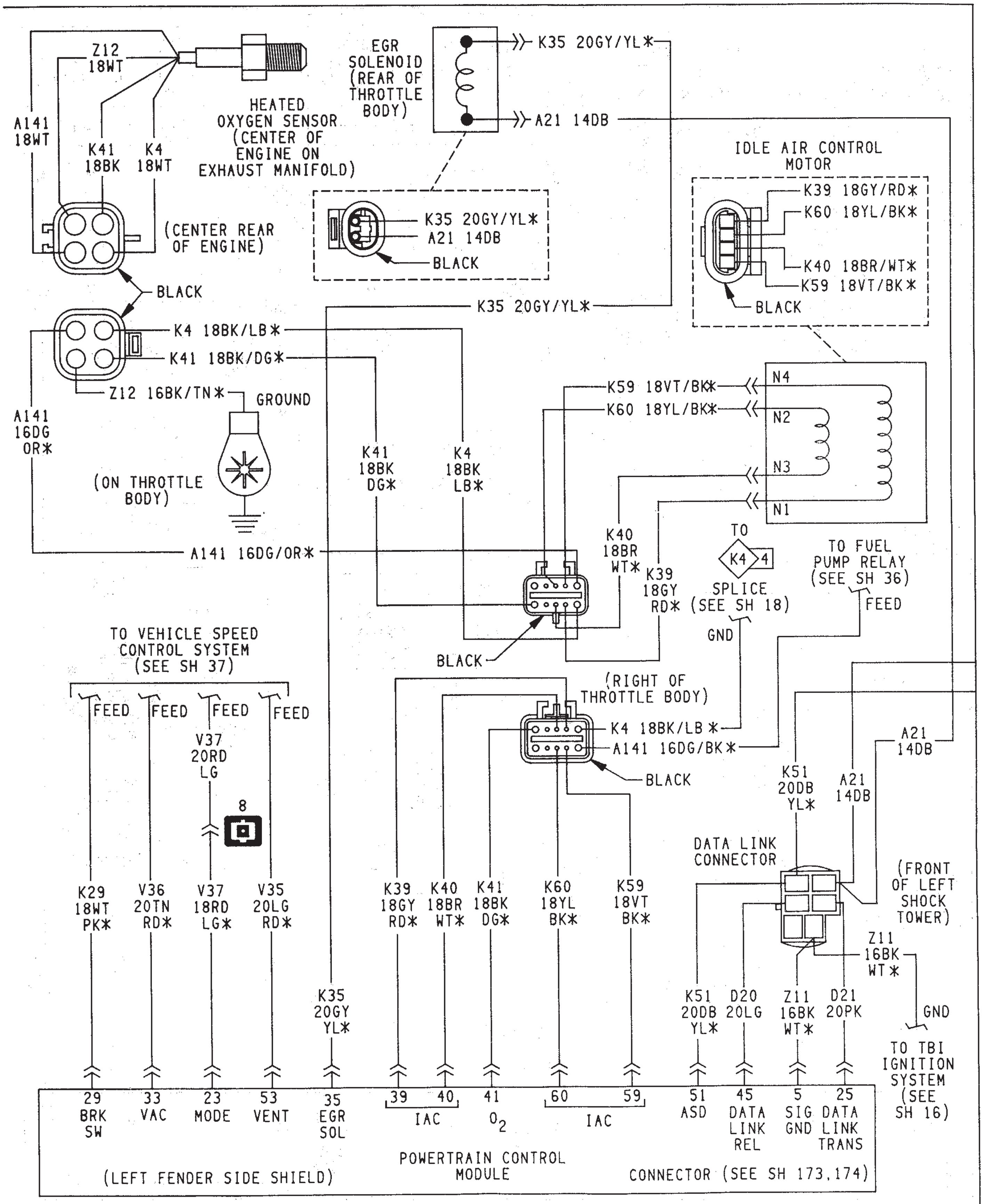
ENGINE STARTER SYSTEM (2.5L ENGINE)

938W-3



ENGINE STARTER SYSTEM
(3.0L, 3.3L AND 3.8L ENGINE)

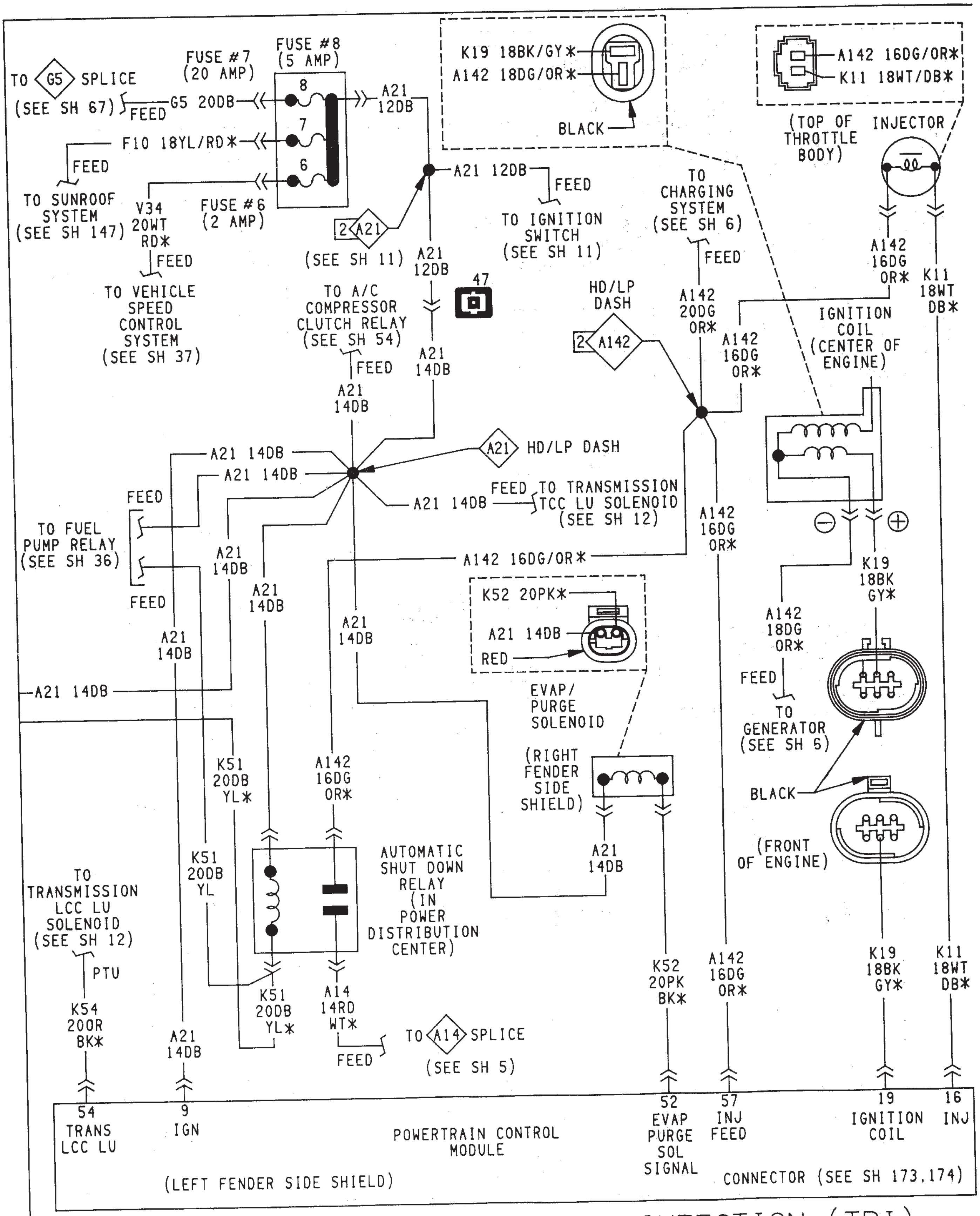
938W-3



THROTTLE BODY FUEL INJECTION (TBI) IGNITION SYSTEM (2.5L ENGINE)

938W-3

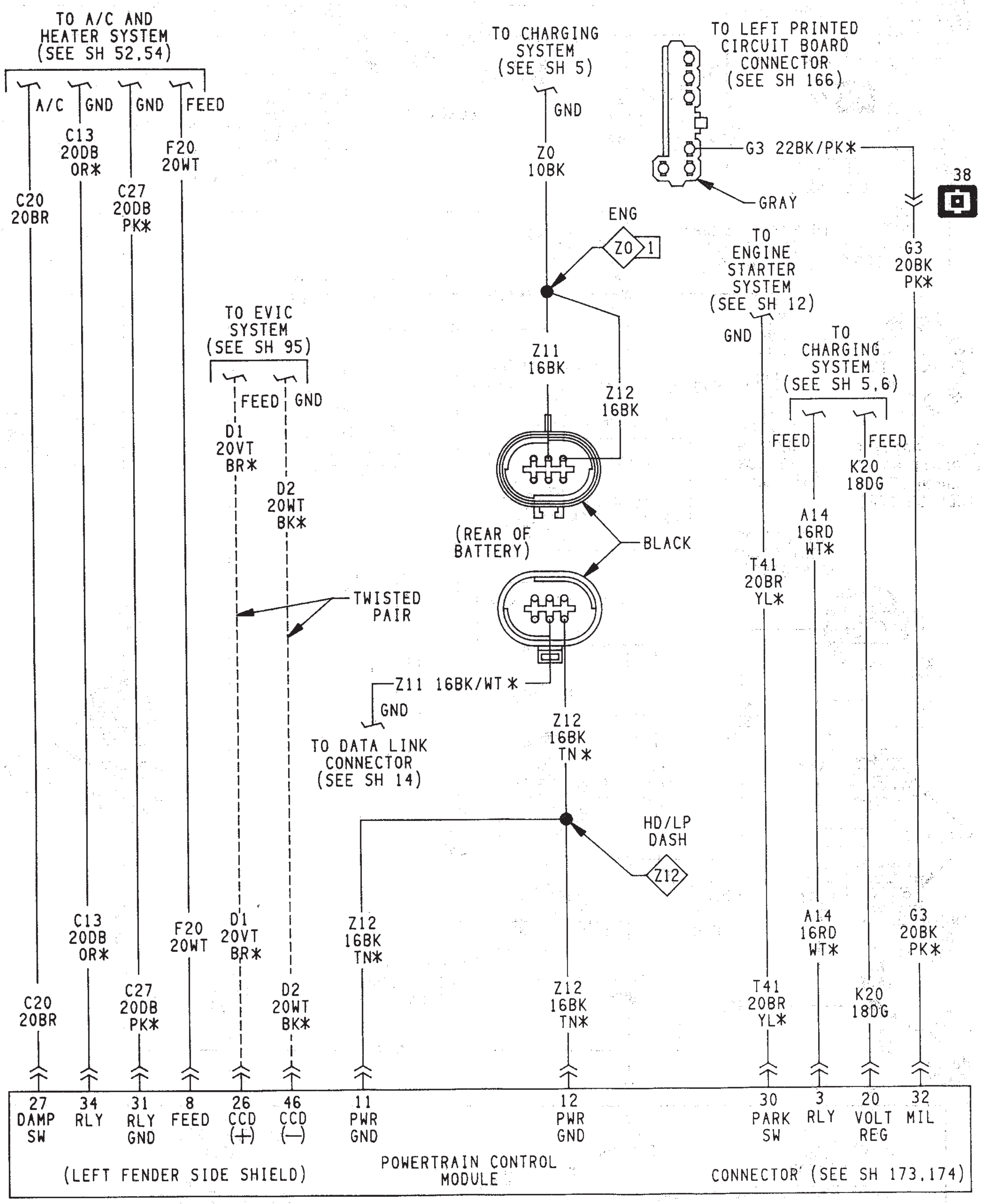
AC-CD, AY-C 14



THROTTLE BODY FUEL INFECTION (TBI)
IGNITION SYSTEM (2.5L ENGINE)

AC-CD, AY-C 15

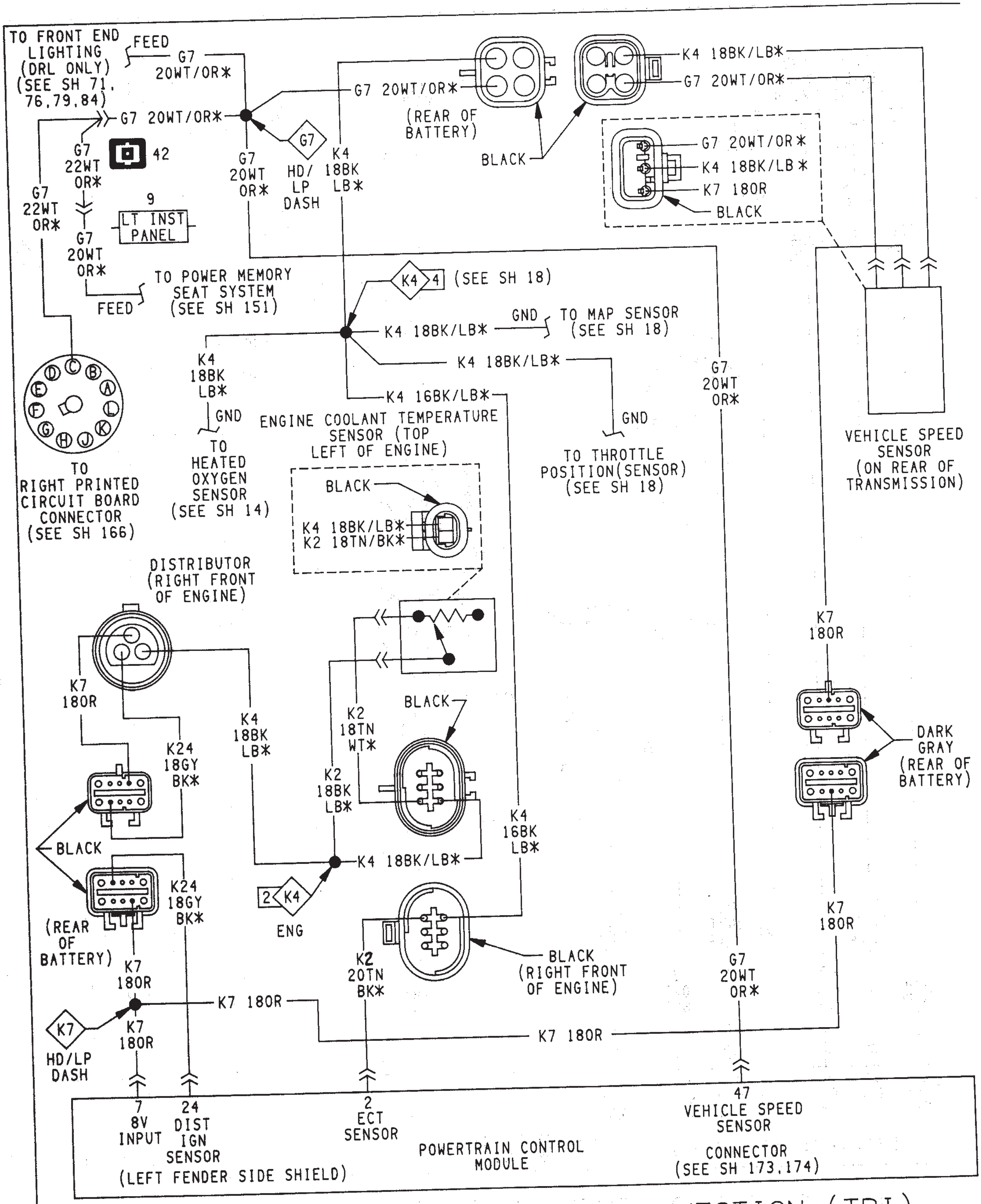
938W-3



THROTTLE BODY FUEL INFECTION (TBI)
IGNITION SYSTEM (2.5L ENGINE)

938W-3

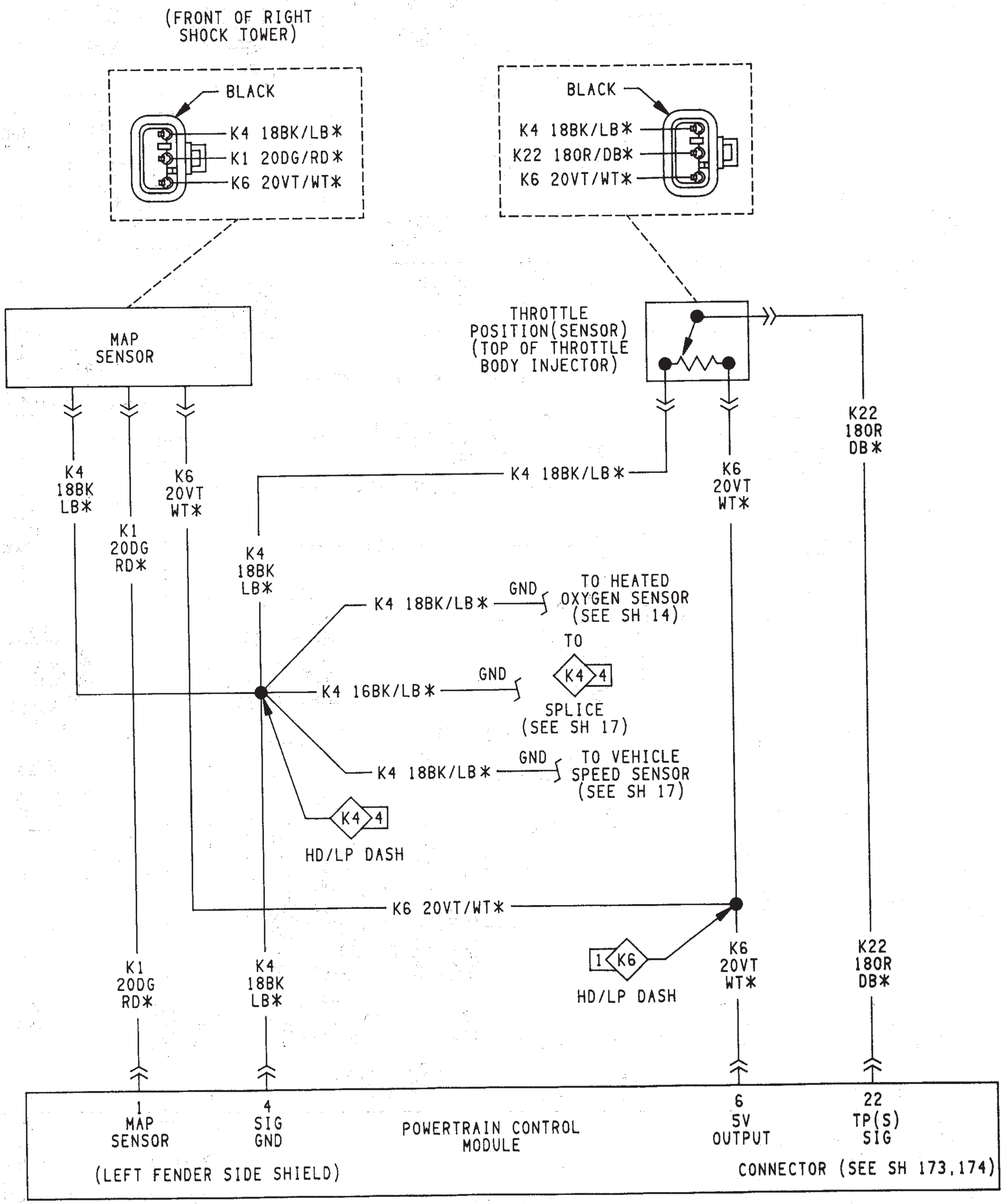
AC-CD, AY-C 16



THROTTLE BODY FUEL INJECTION (TBI) IGNITION SYSTEM (2.5L ENGINE)

AC-CD, AY-C 17

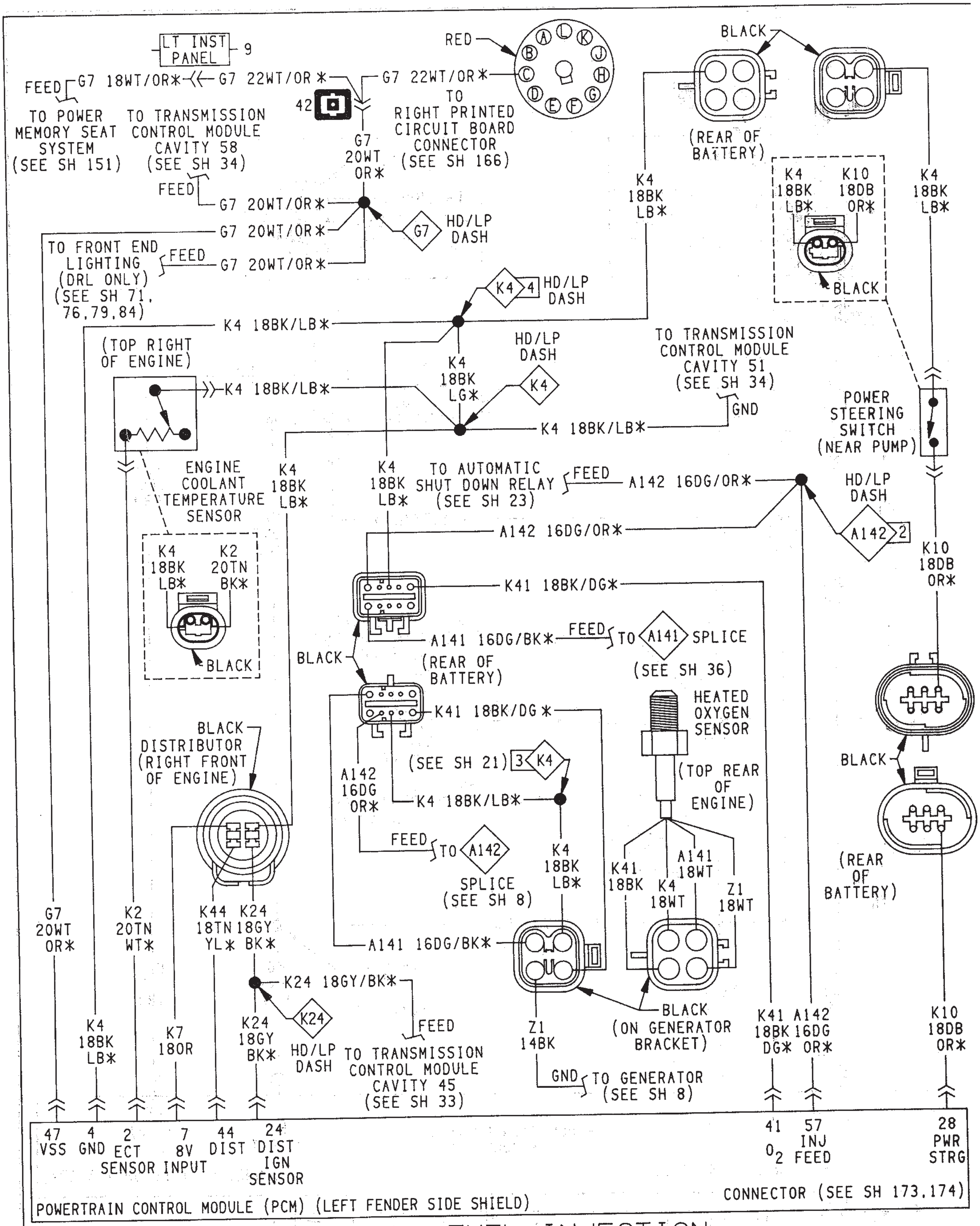
938W-3



THROTTLE BODY FUEL INJECTION (TBI)
IGNITION SYSTEM (2.5L ENGINE)

938W-3

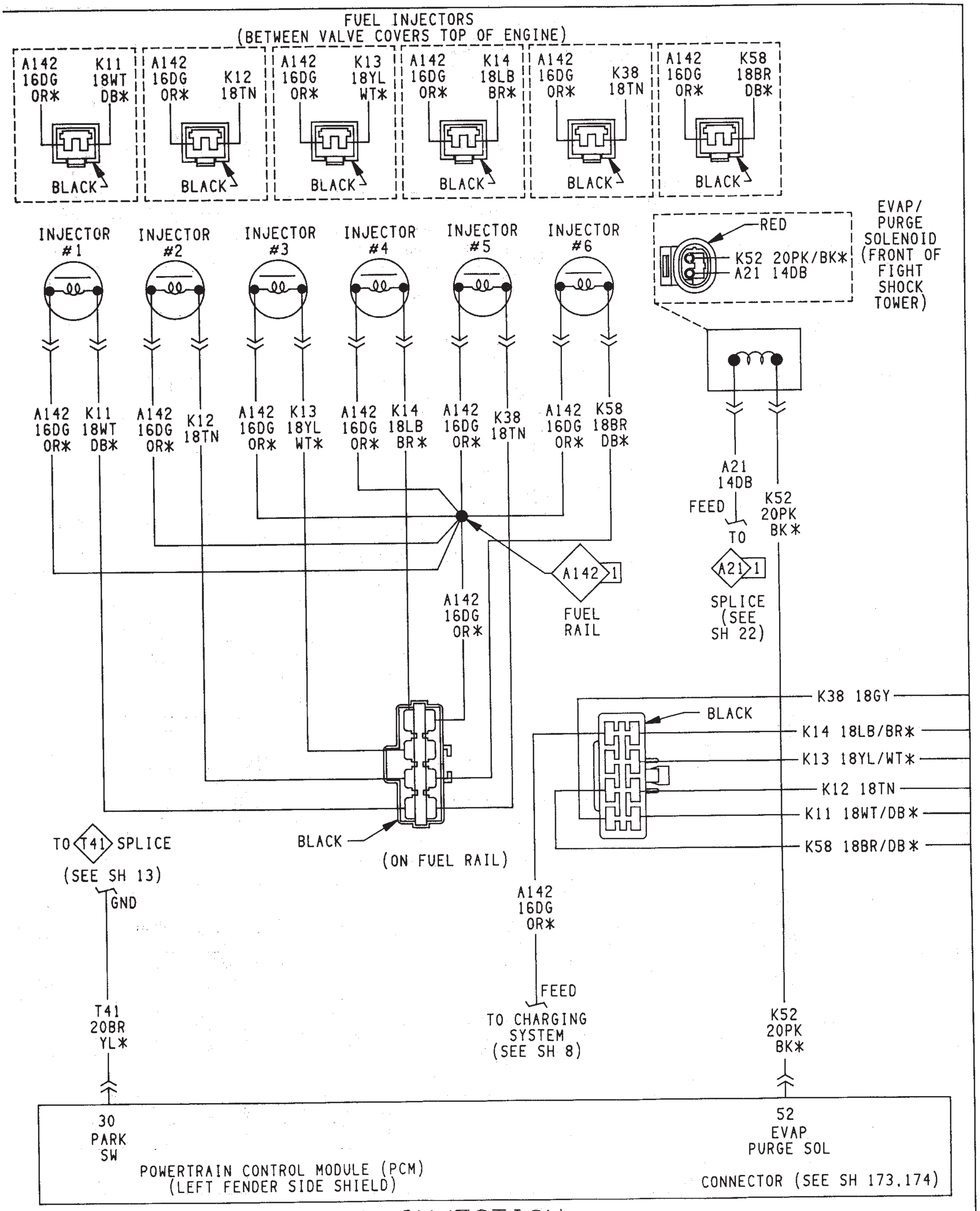
AC-CD,AY-C 18



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

AC-CD, AY-C 19

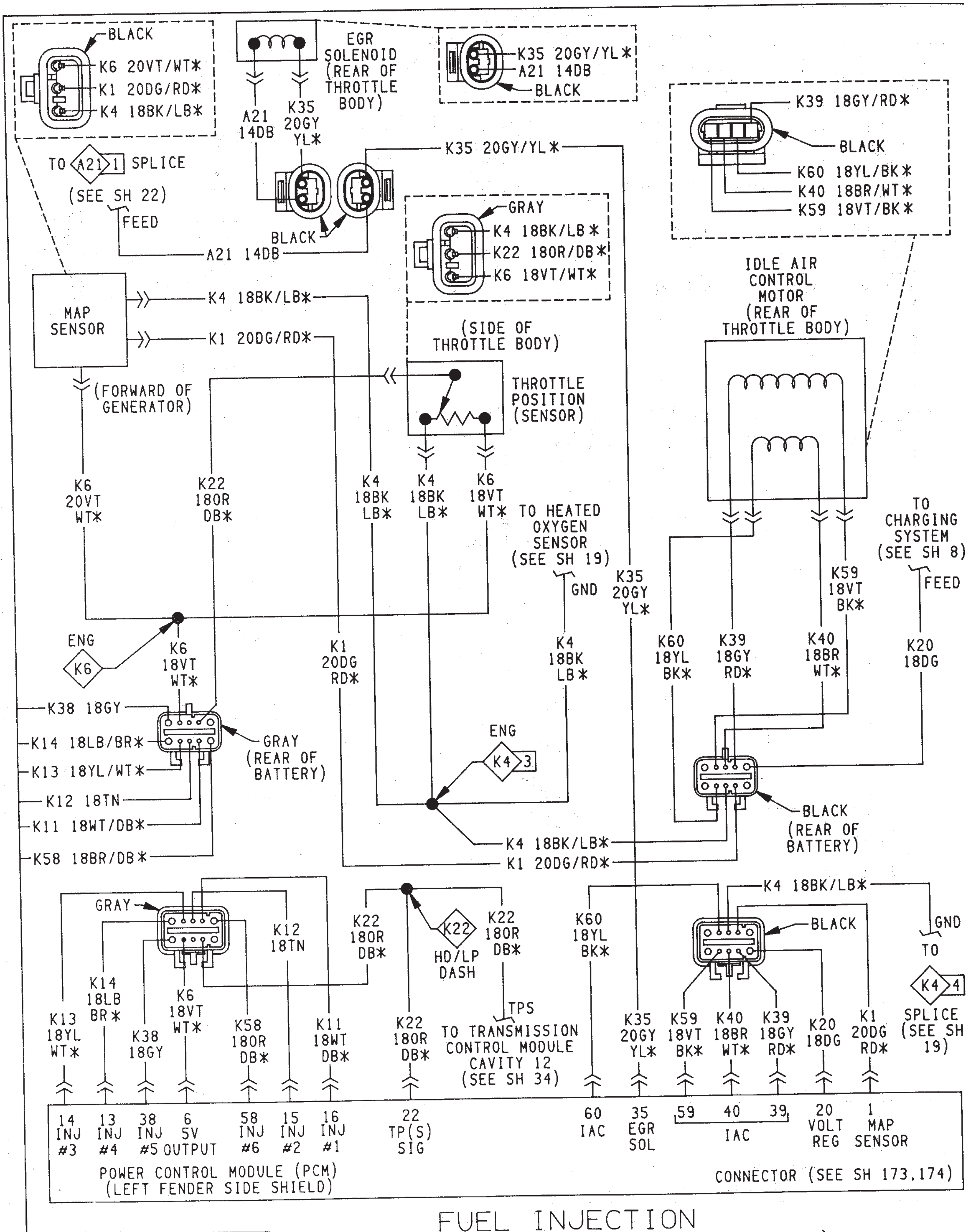
938W-3



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

AC-CD, AY-C 20

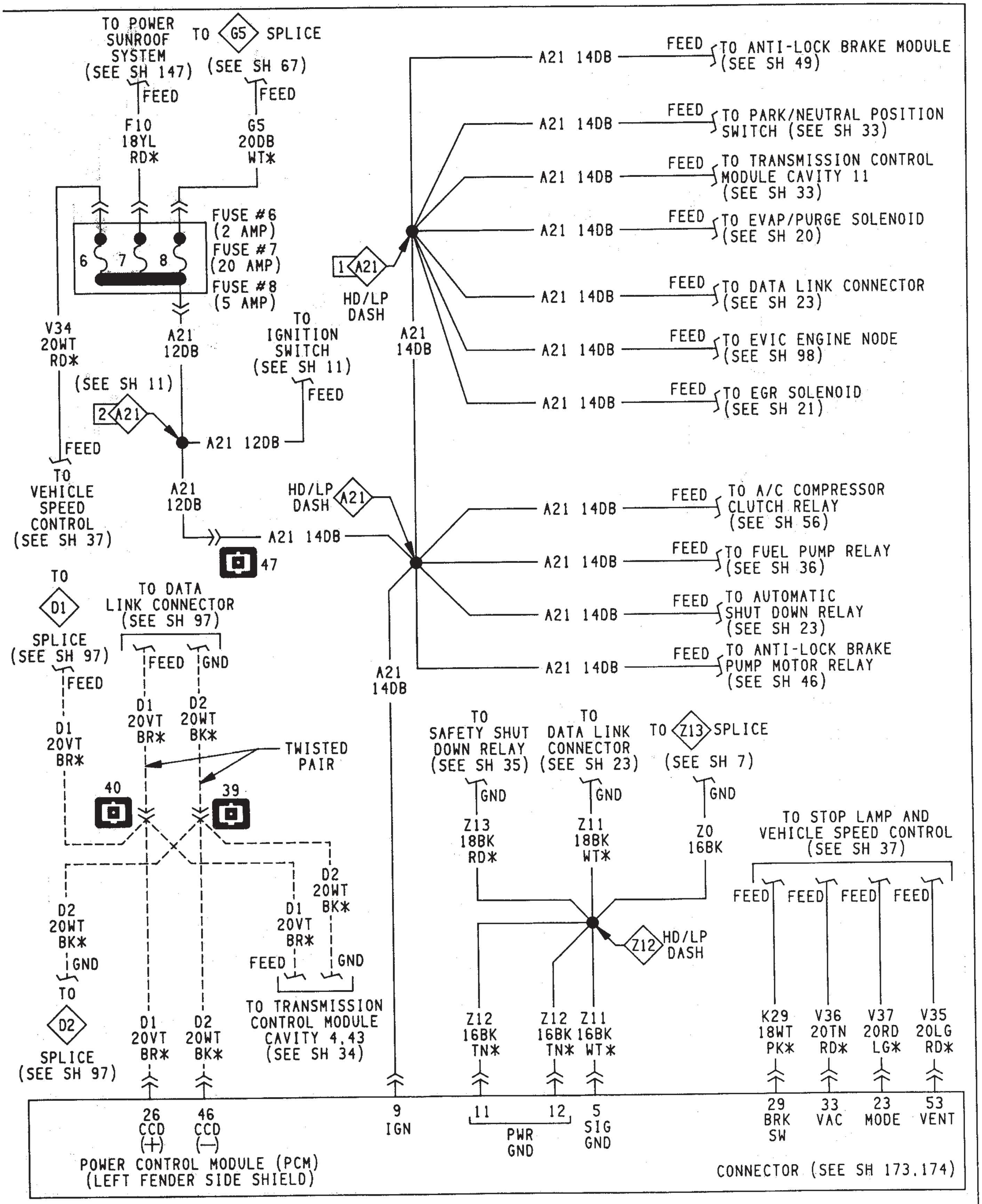
938W-3



FUEL INJECTION IGNITION SYSTEM (3.0L ENGINE)

AC-CD, AY-C 21

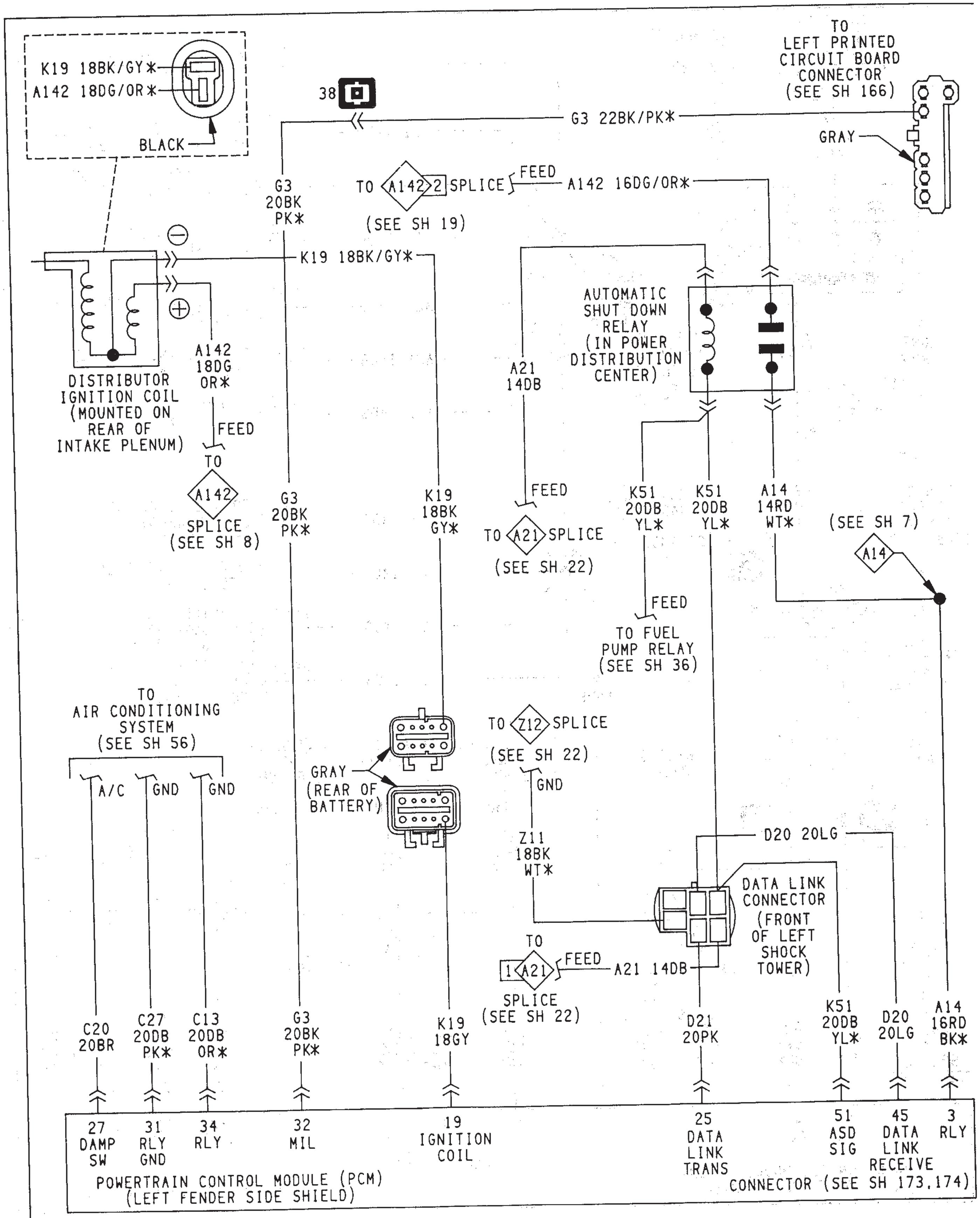
938W-3



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-3

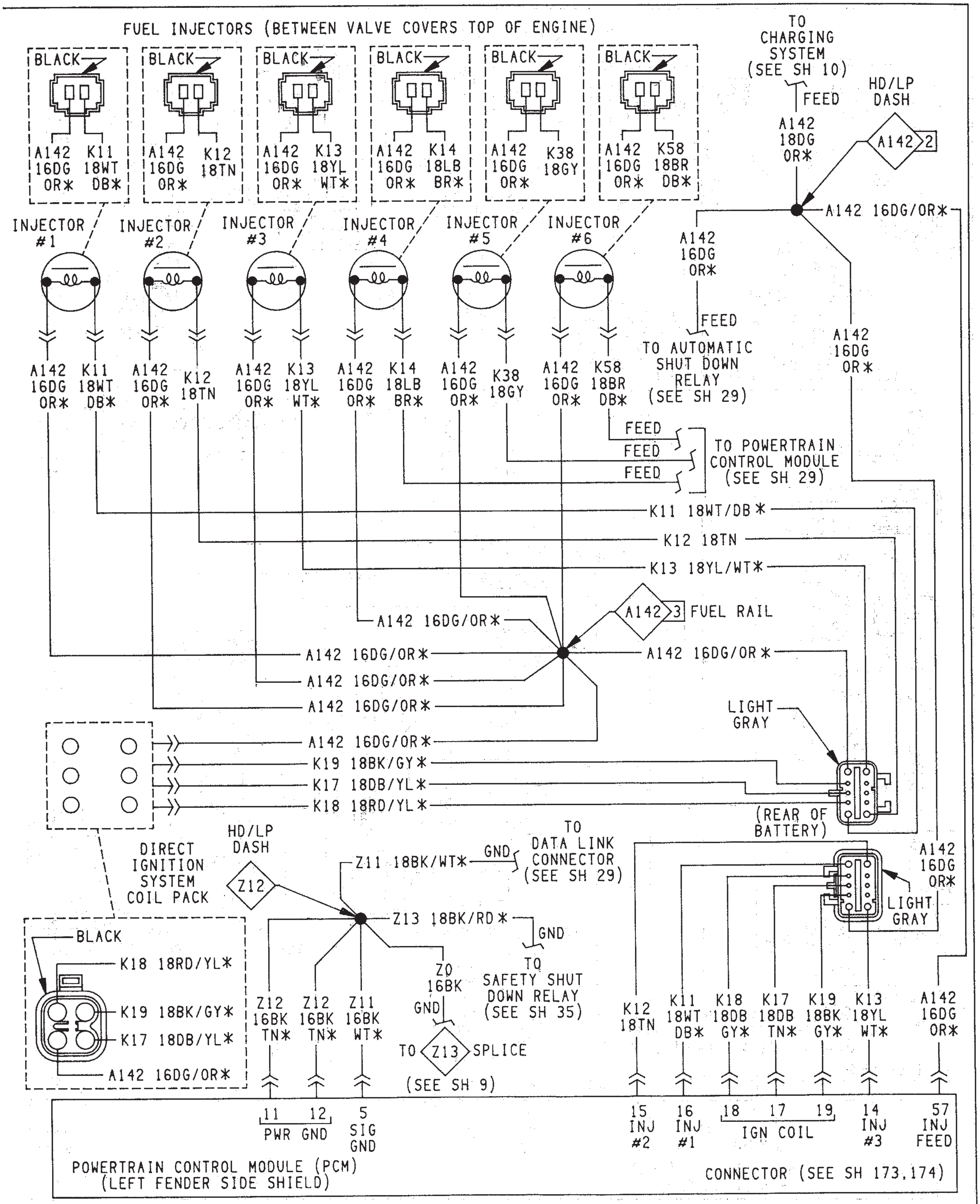
AC-CD, AY-C 22



AC-CD, AY-C 23

FUEL INJECTION
IGNITION SYSTEM (3.0 L ENGINE)

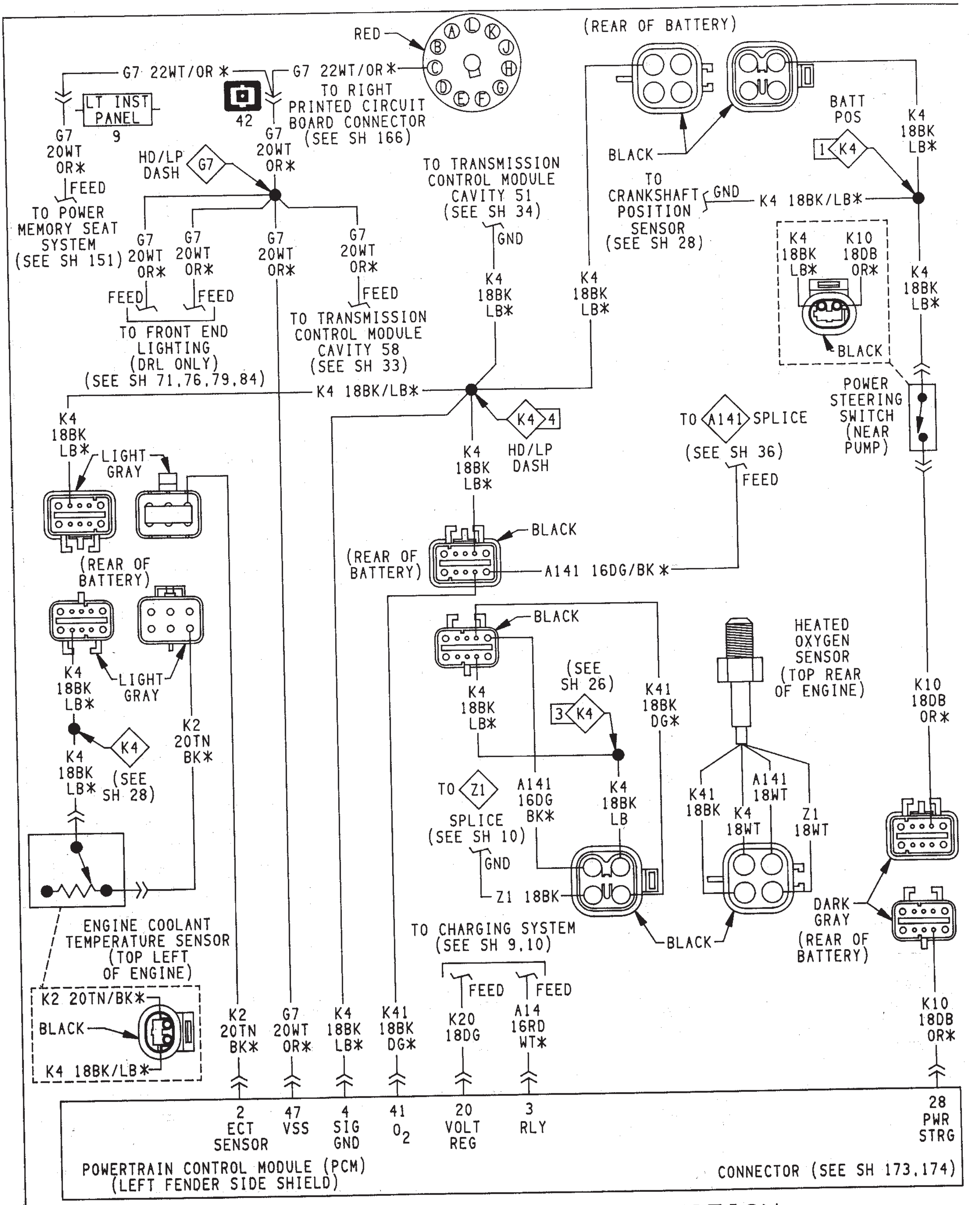
938W-3



FUEL INJECTION IGNITION SYSTEM (3.3L & 3.8L ENGINE)

AC-CD, AY-C 24

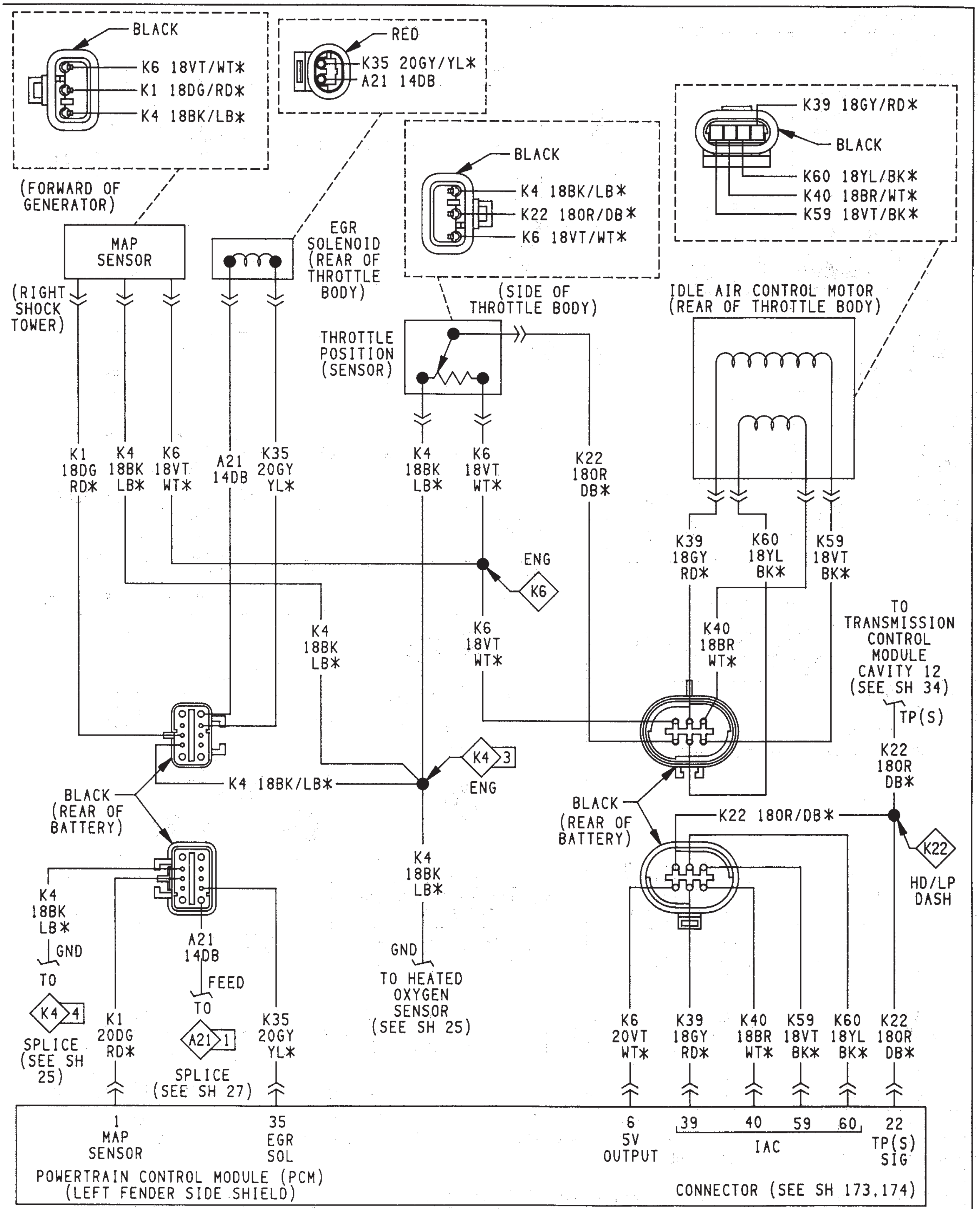
938W-3



AC-CD, AY-C 25

FUEL INJECTION IGNITION SYSTEM (3.3L & 3.8L ENGINE)

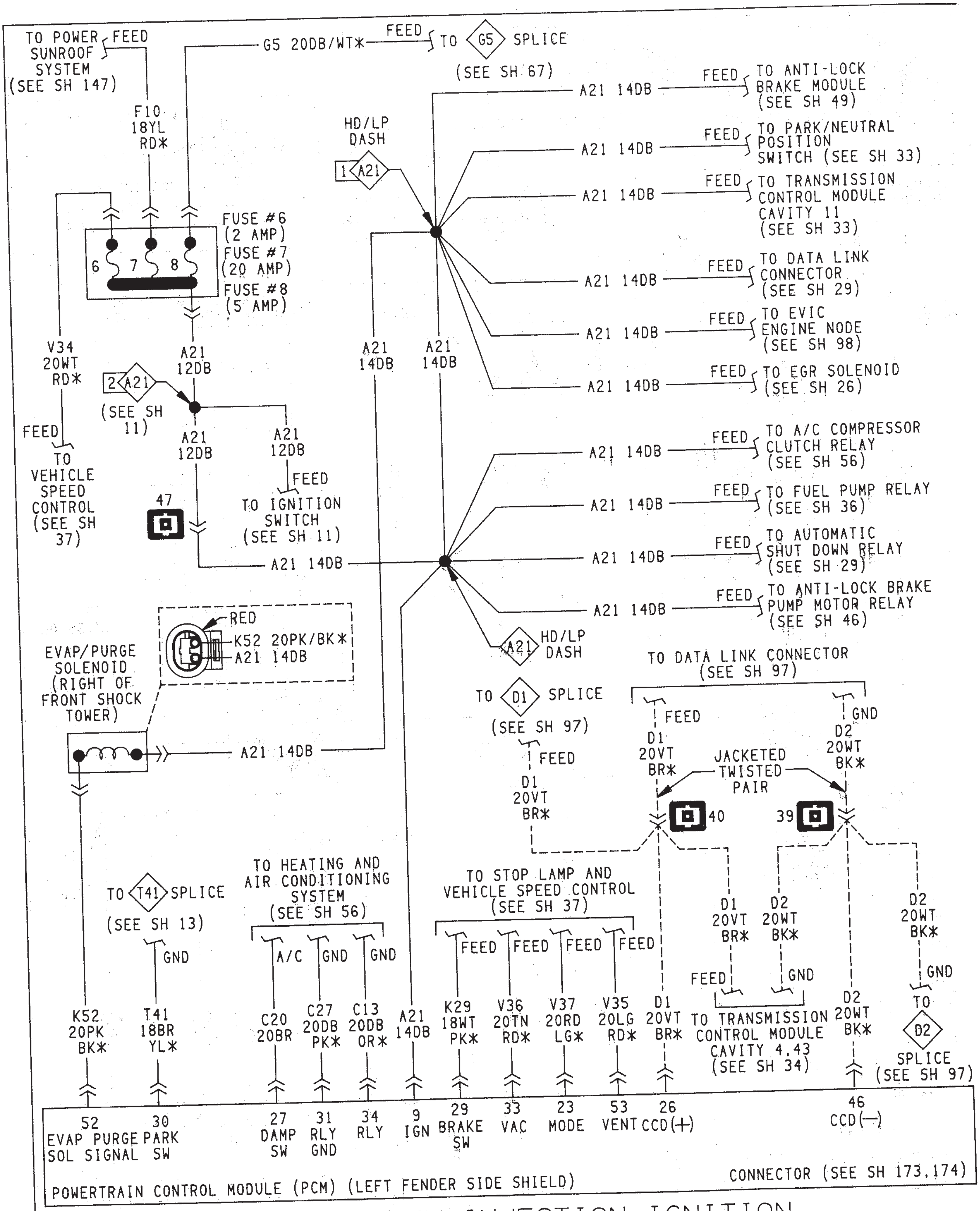
938W-3



FUEL INJECTION IGNITION SYSTEM (3.3L & 3.8L ENGINE)

938W-3

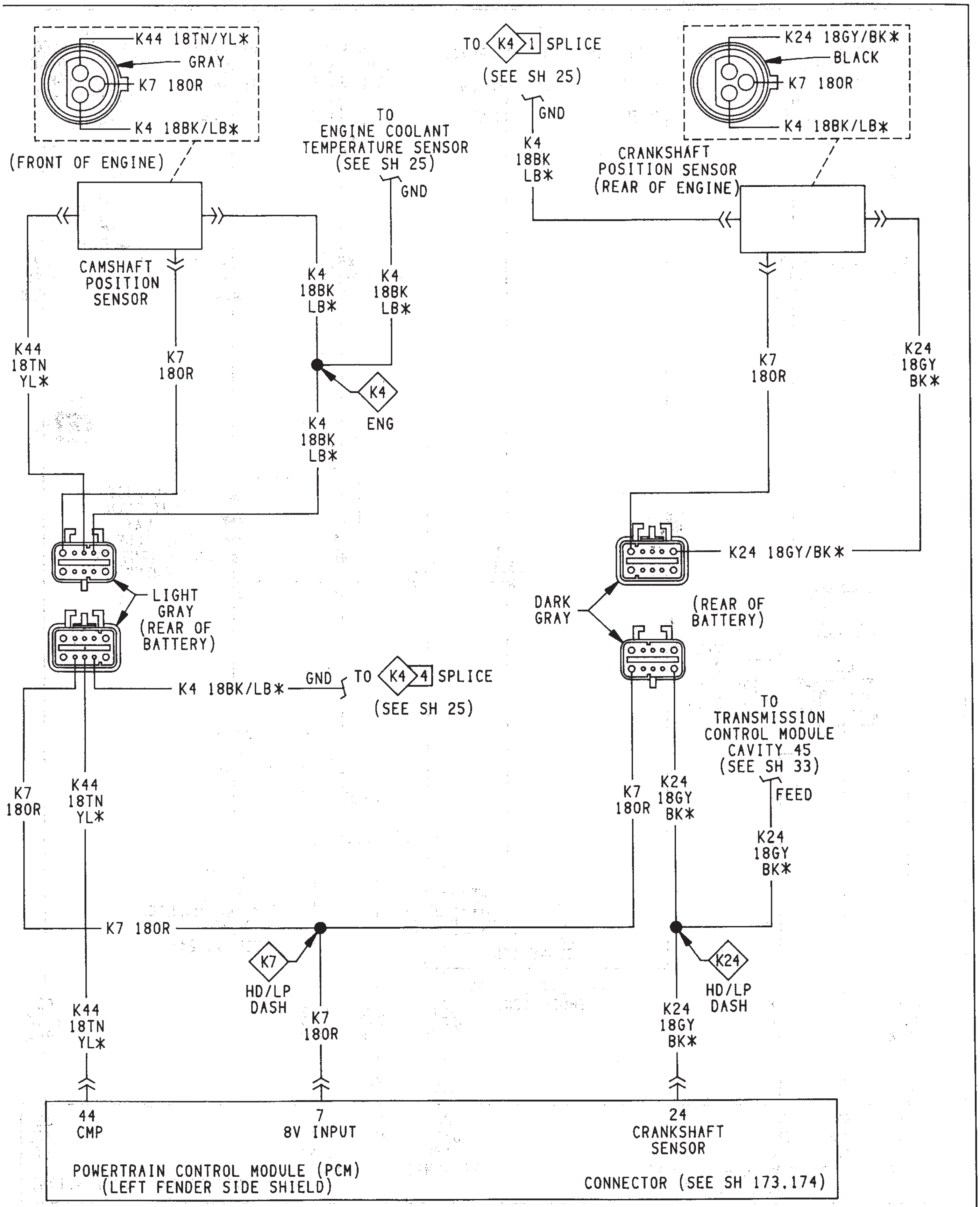
AC-CD, AY-C 26



FUEL INJECTION IGNITION SYSTEM (3.3L & 3.8L ENGINE)

AC-CD, AY-C 27

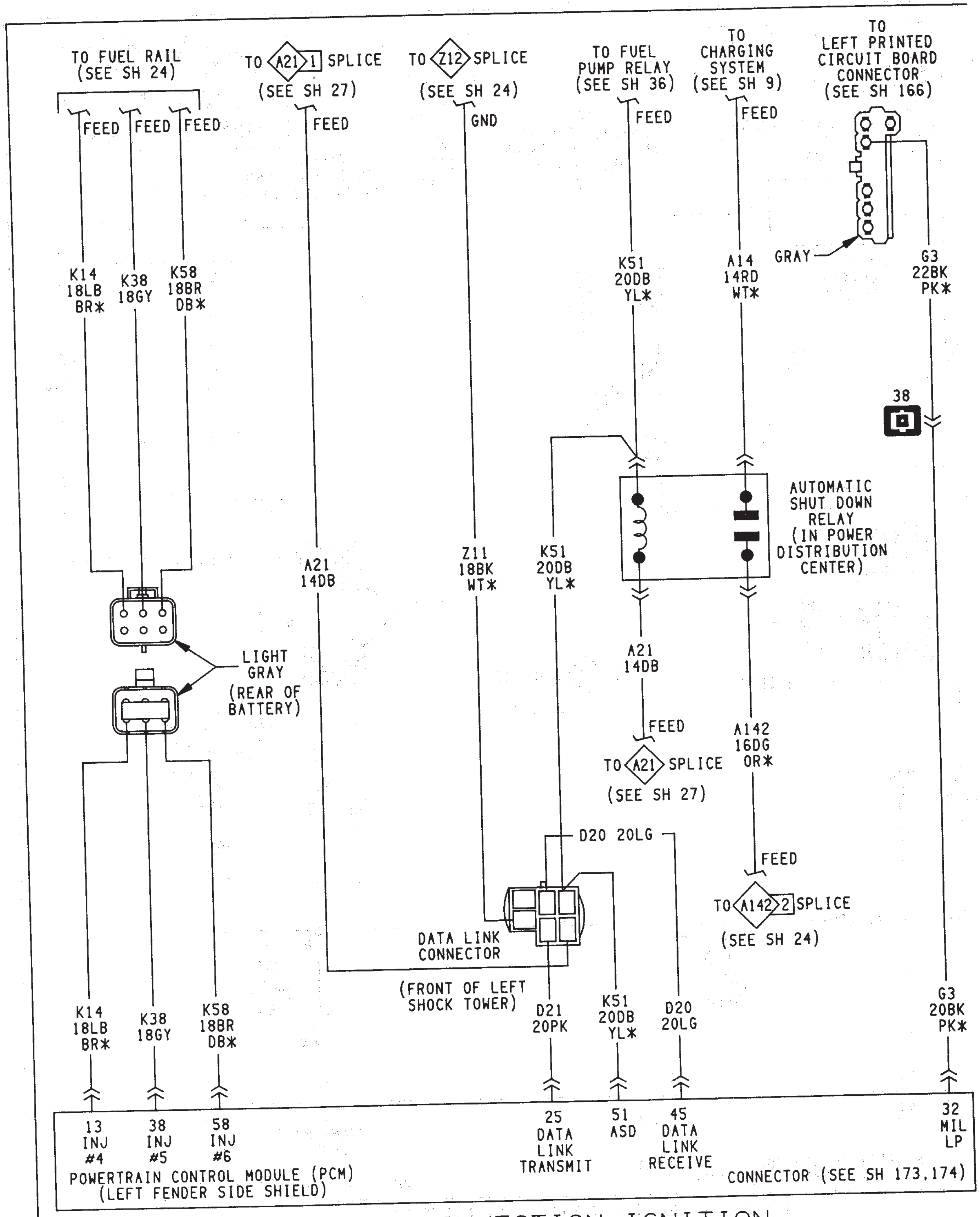
938W-3



FUEL INJECTION IGNITION
SYSTEM (3.3L & 3.8L ENGINE)

938W-3

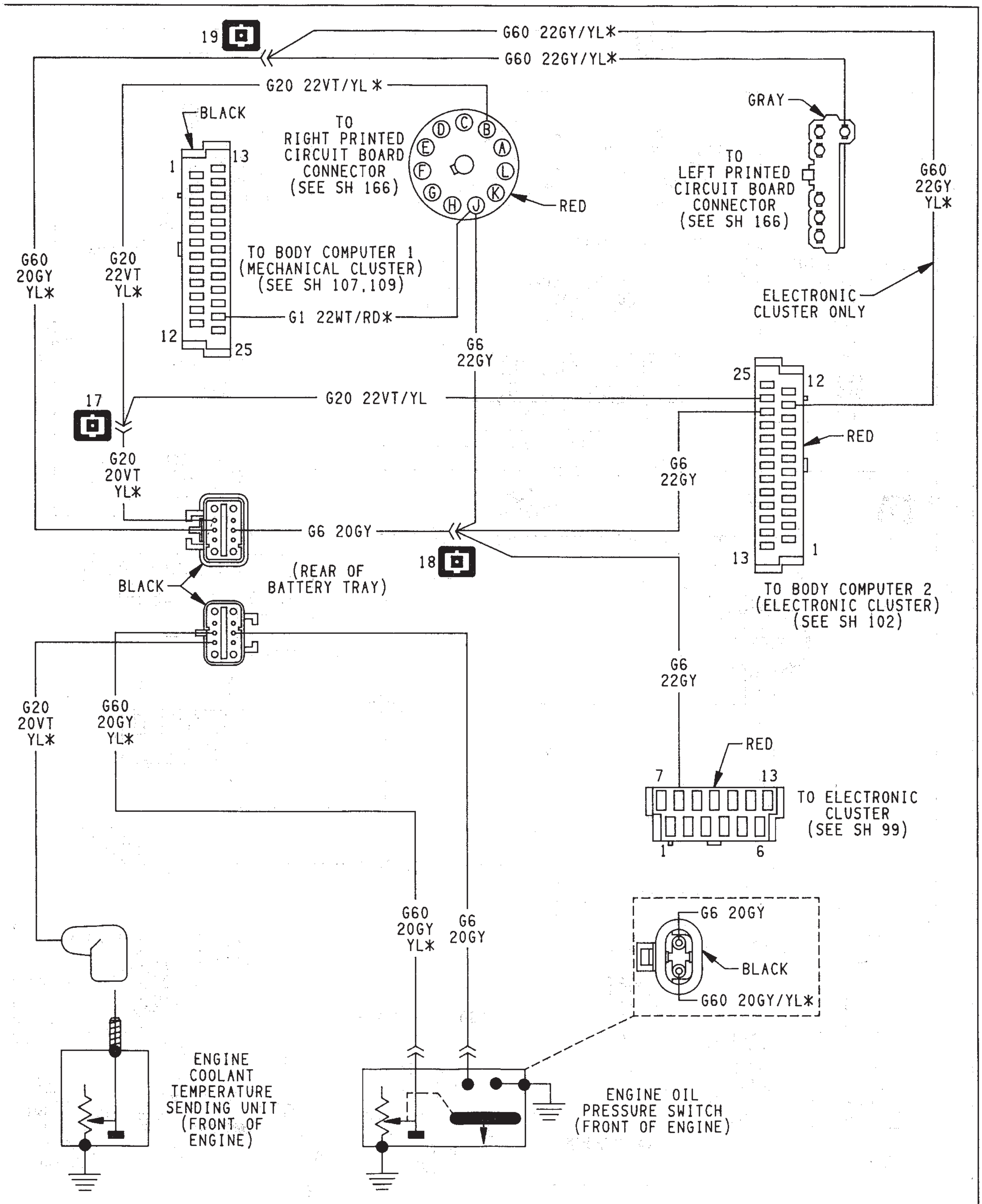
AC-CD,AY-C 28



AC-CD, AY-C 29

FUEL INJECTION IGNITION SYSTEM (3.3L & 3.8L ENINE)

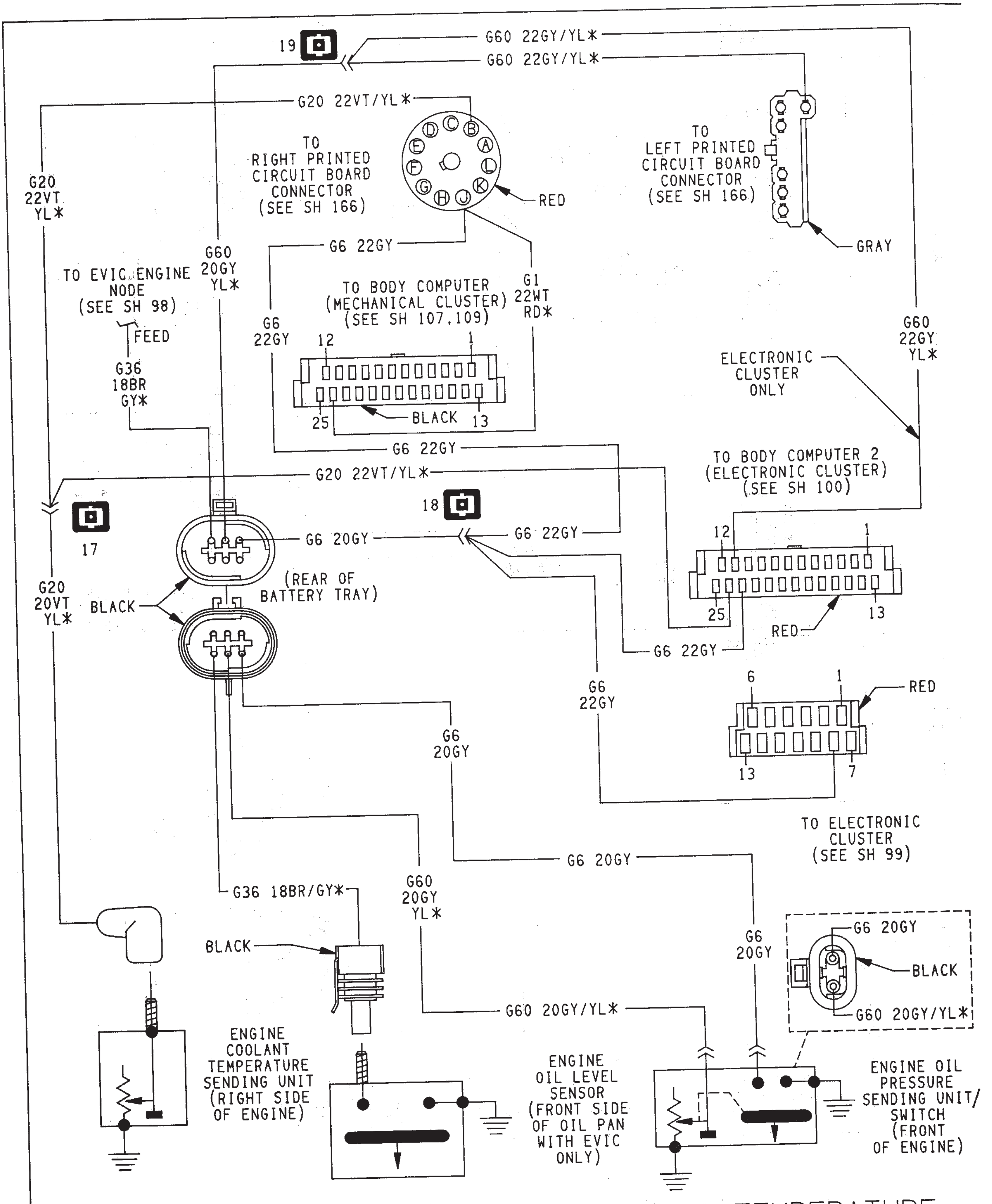
938W-3



ENGINE OIL PRESSURE AND TEMPERATURE WARNING SYSTEM (2.5L ENGINE)

938W-3

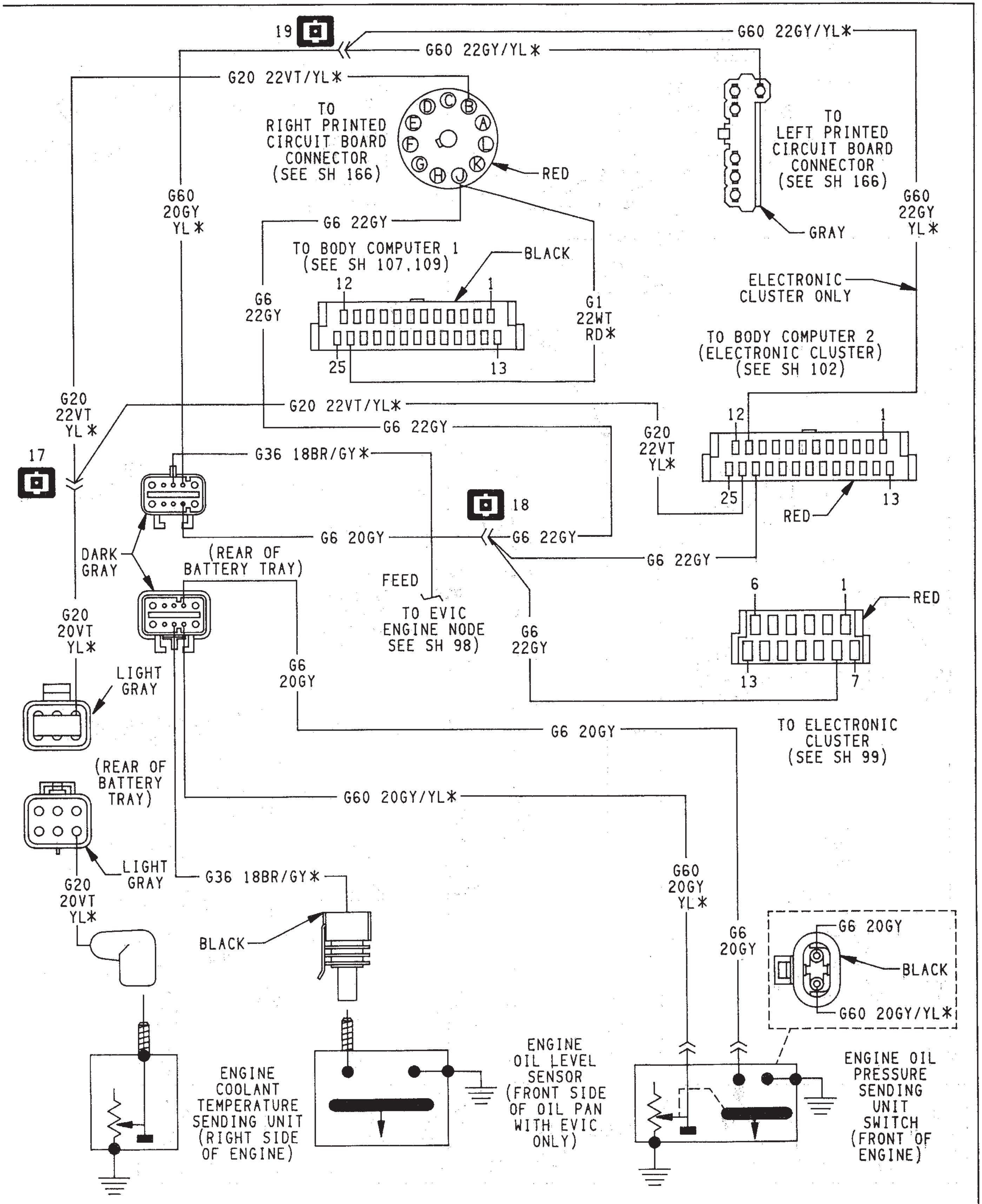
AC-CD, AY-C 30



ENGINE OIL PRESSURE AND TEMPERATURE WARNING SYSTEM (3.0L ENGINE)

938W-3

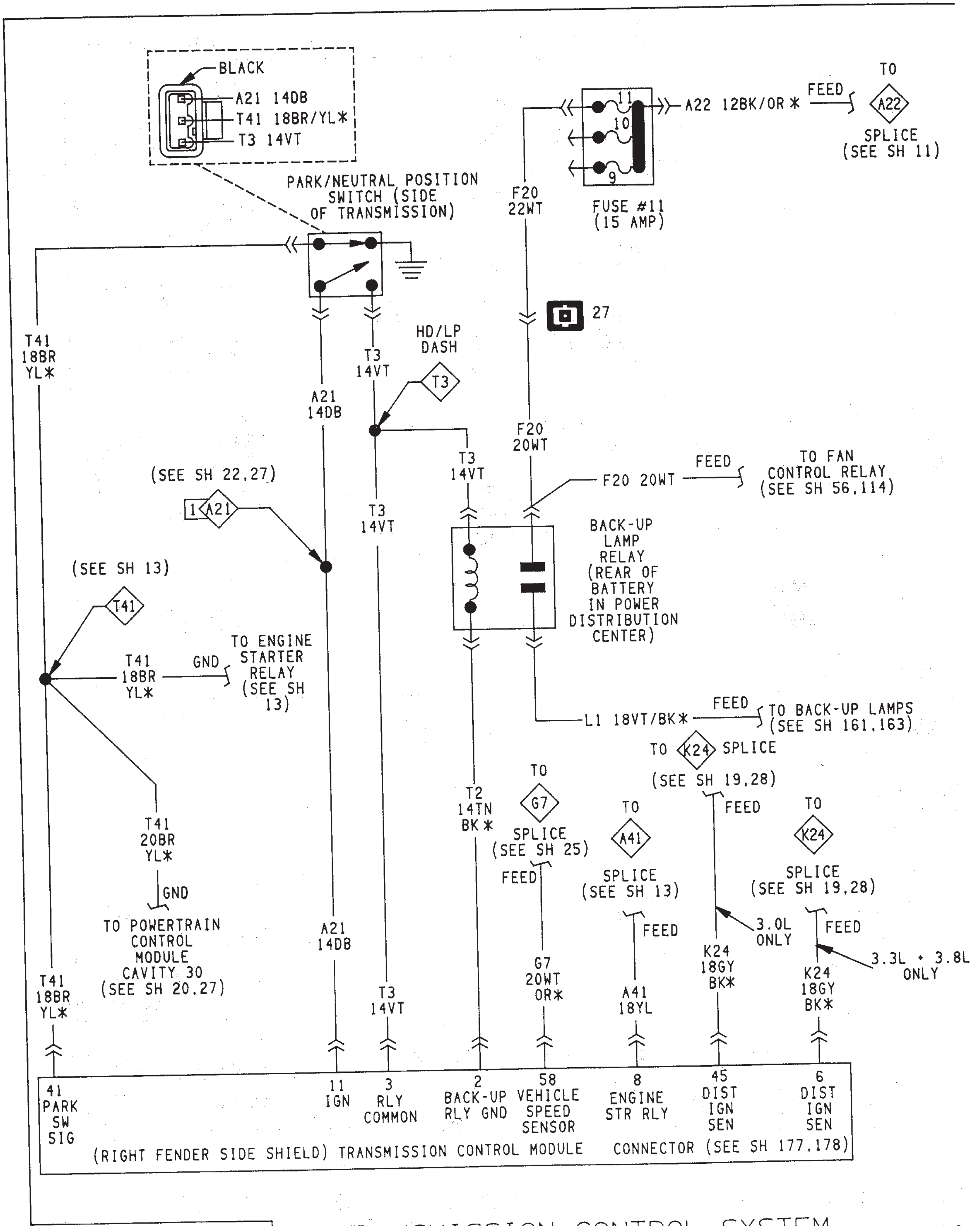
AC-CD, AY-C 31



ENGINE OIL PRESSURE AND TEMPERATURE WARNING SYSTEM (3.3L AND 3.8L ENGINE)

938W-3

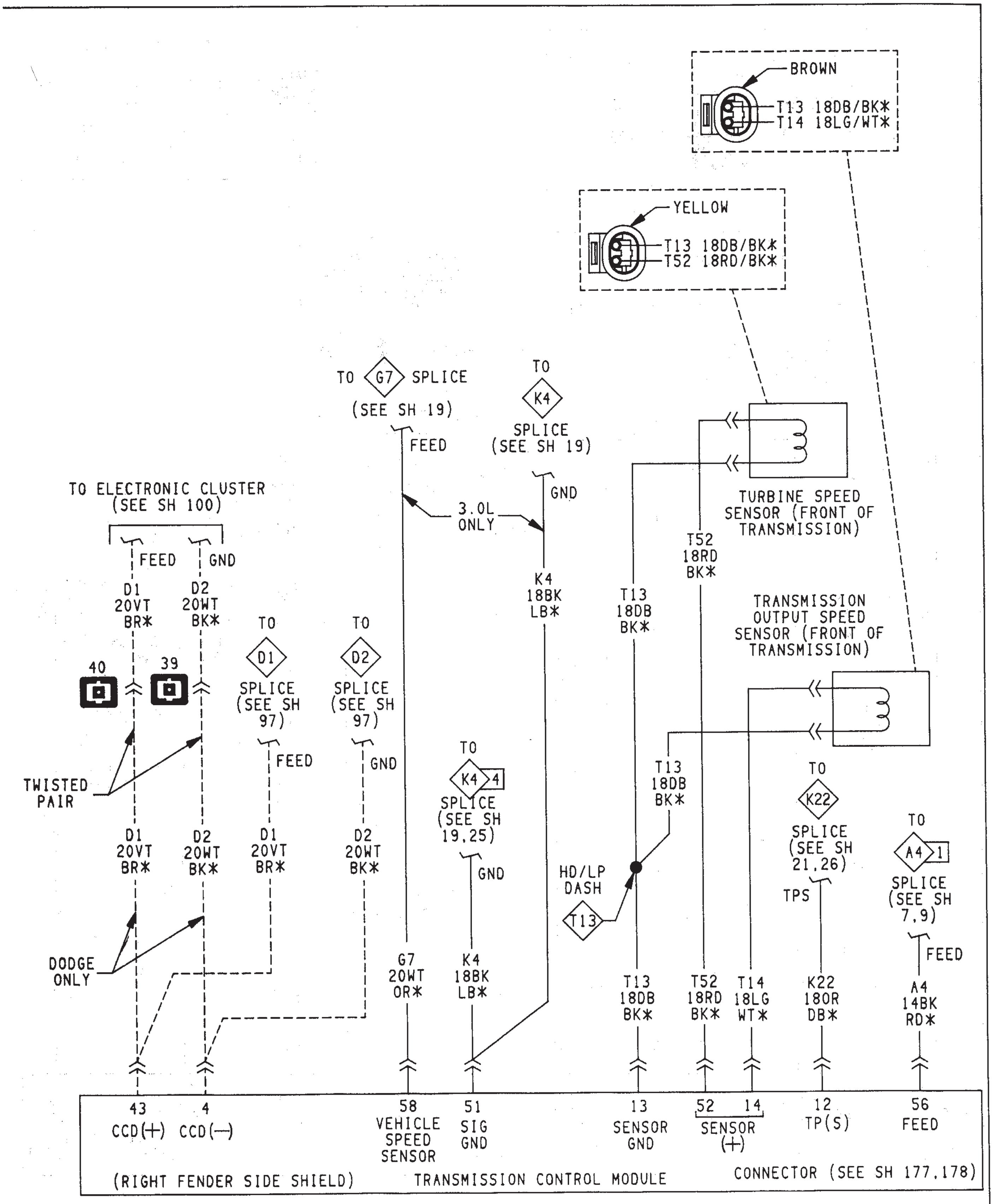
AC-CD,AY-C 32



AC-CD, AY-C 33

TRANSMISSION CONTROL SYSTEM

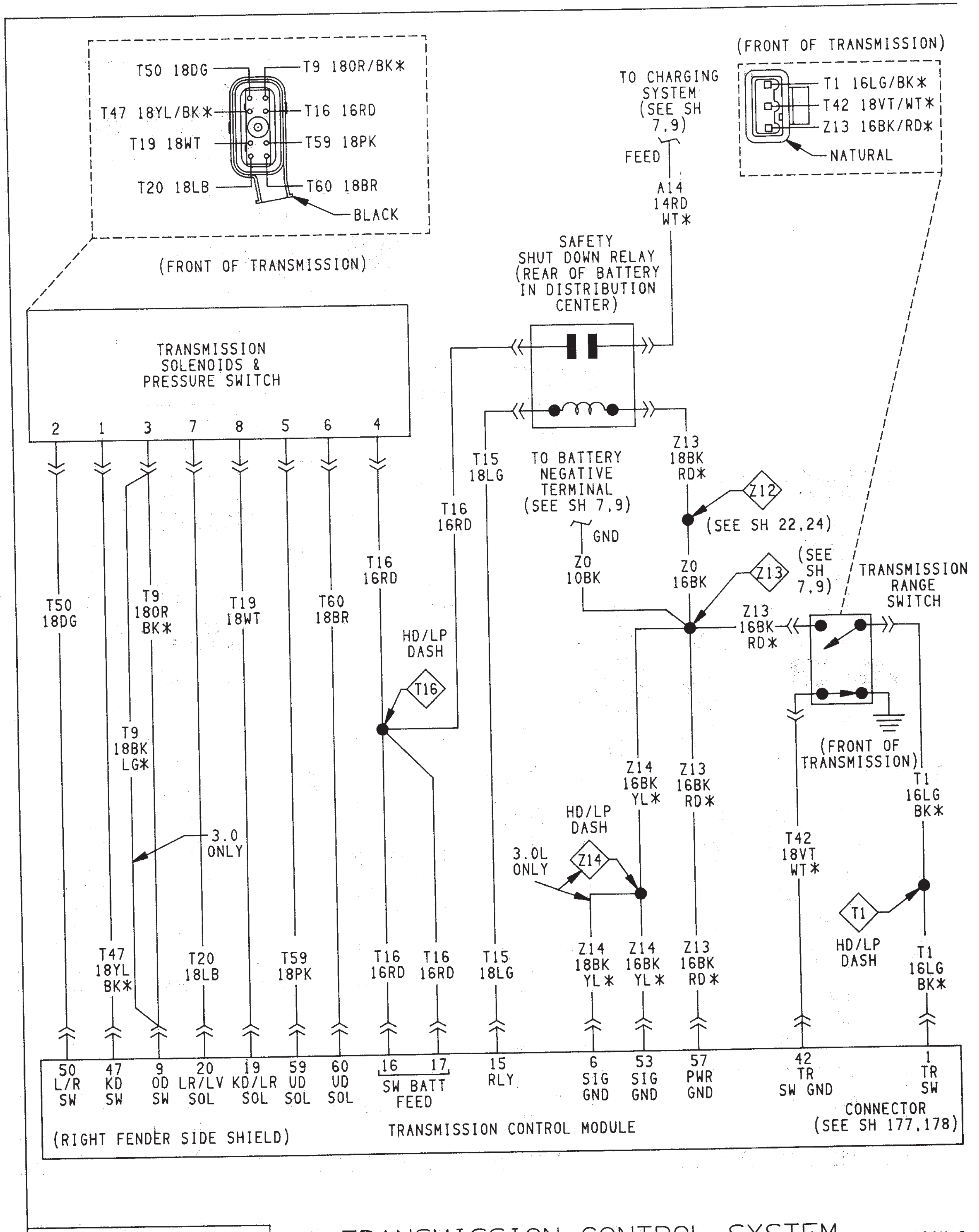
938W-3



938W-3

TRANSMISSION CONTROL SYSTEM

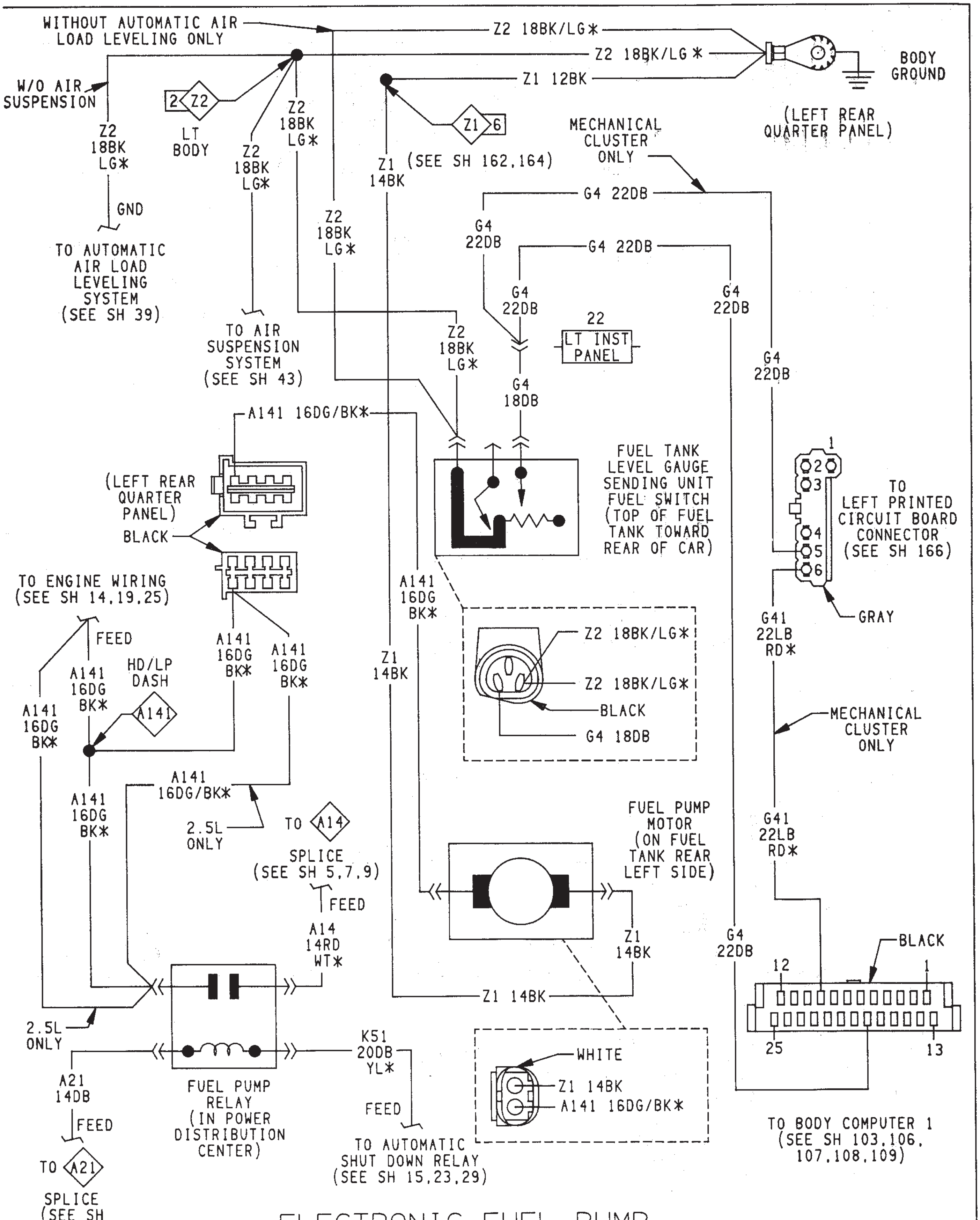
AC-CD,AY-C 34



AC-CD,AY-C 35

TRANSMISSION CONTROL SYSTEM

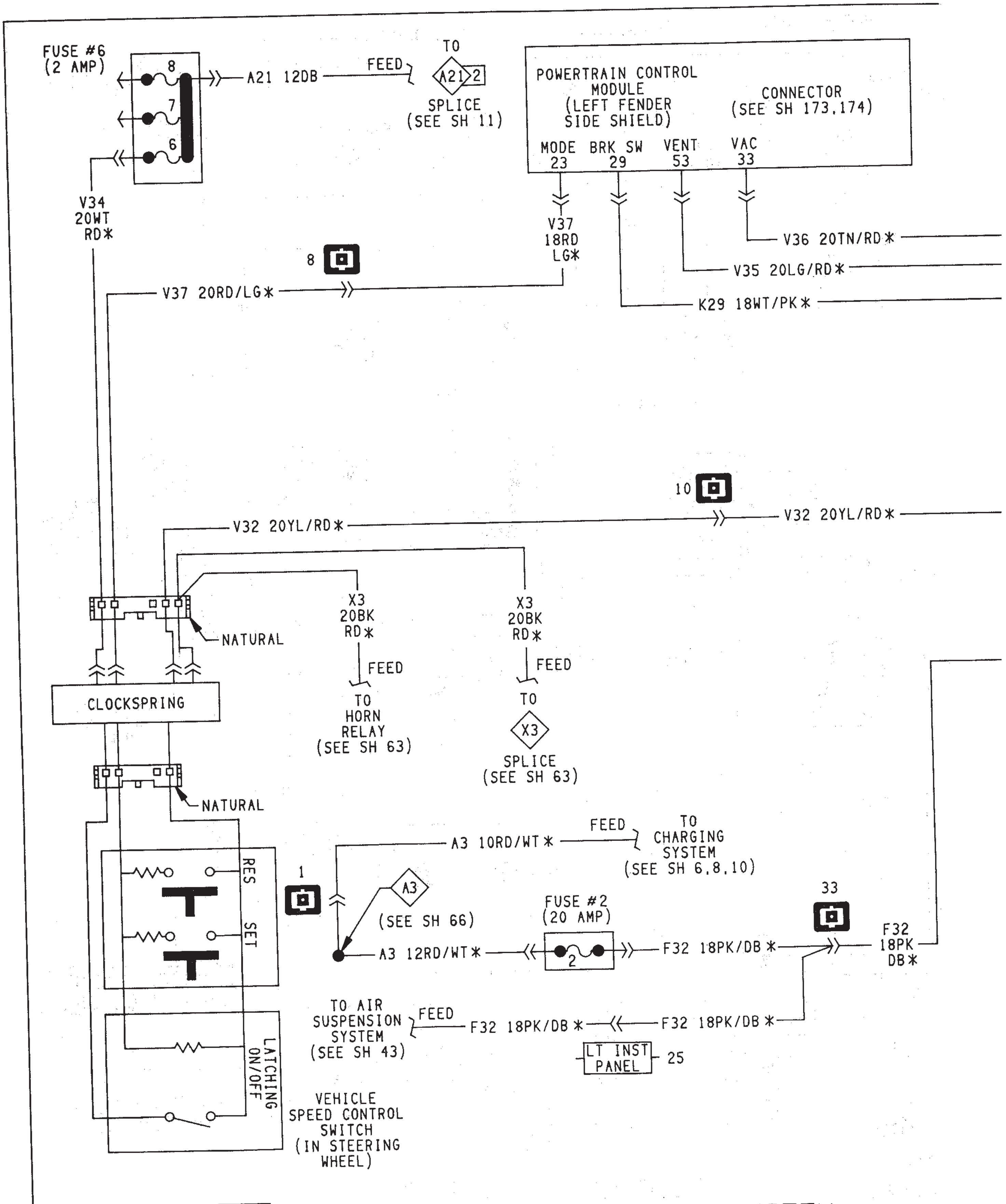
938W-3



ELECTRONIC FUEL PUMP
AND GAUGE SYSTEM

AC-CD, AY-C 36

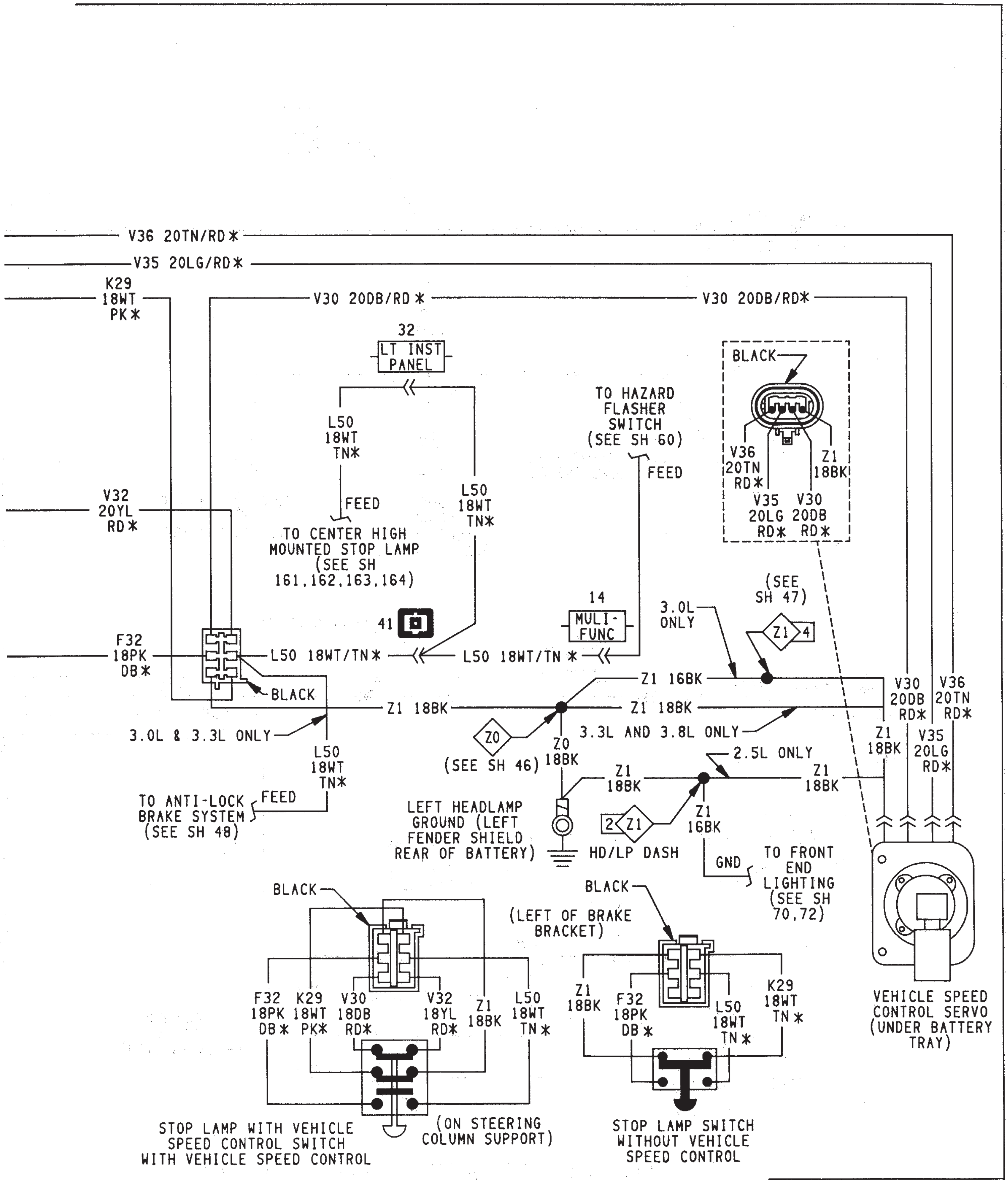
938W-3



AC-CD, AY-C 37

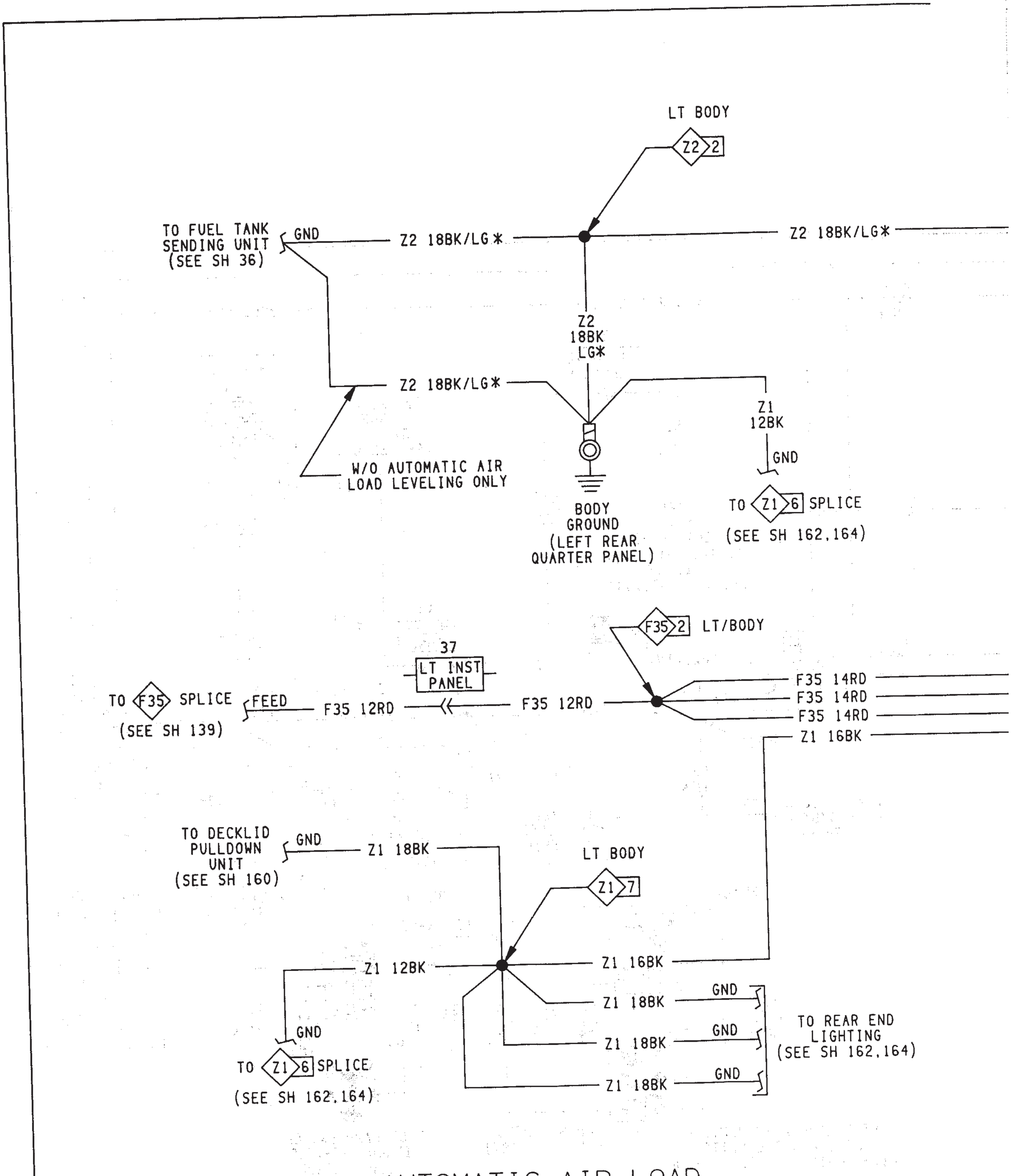
VEHICLE SPEED CONTROL SYSTEM

938W-3



938W-3 VEHICLE SPEED CONTROL SYSTEM

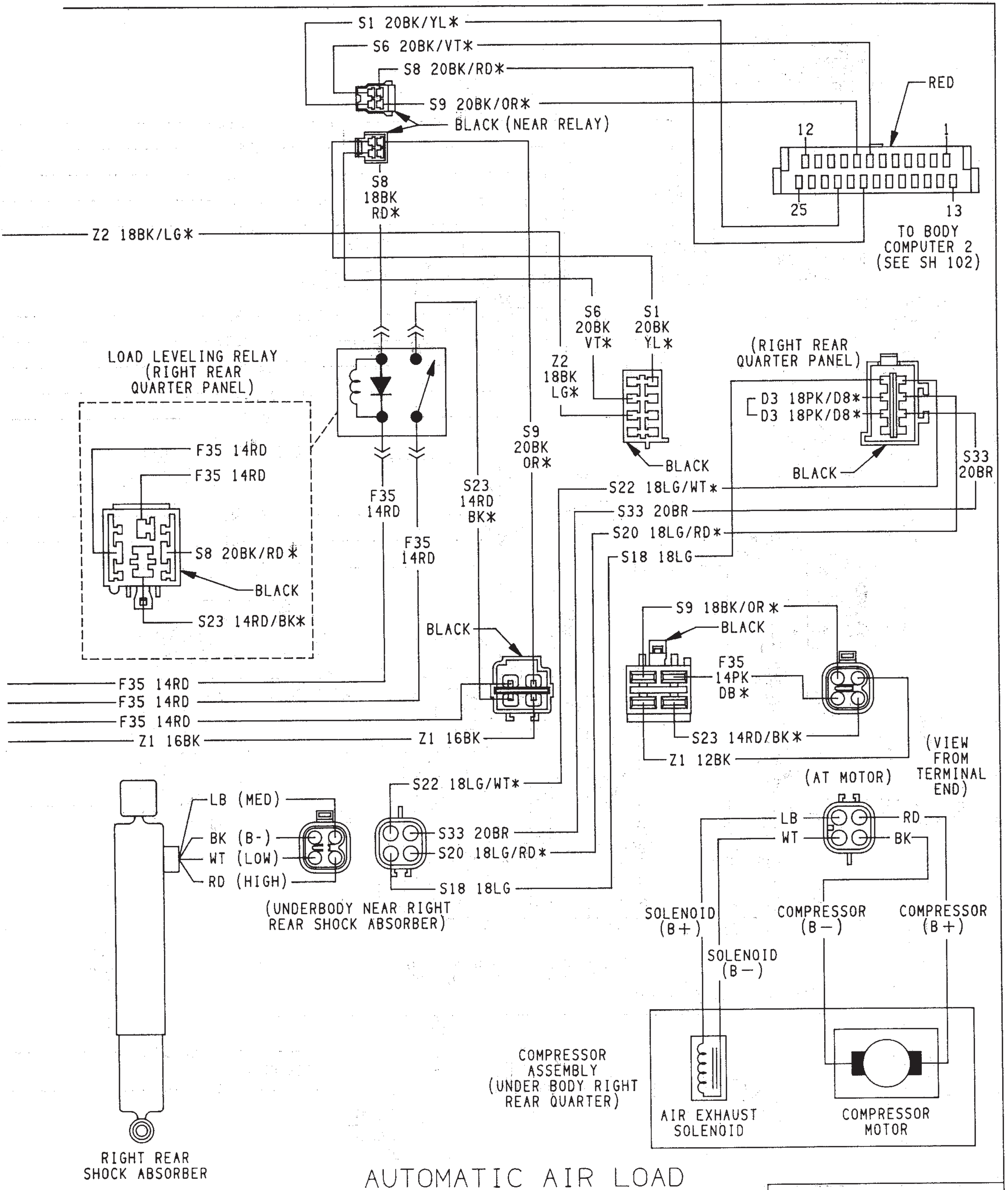
AC-CD, AY-C 38



AUTOMATIC AIR LOAD LEVELING SYSTEM

AC-CD,AY-C 39

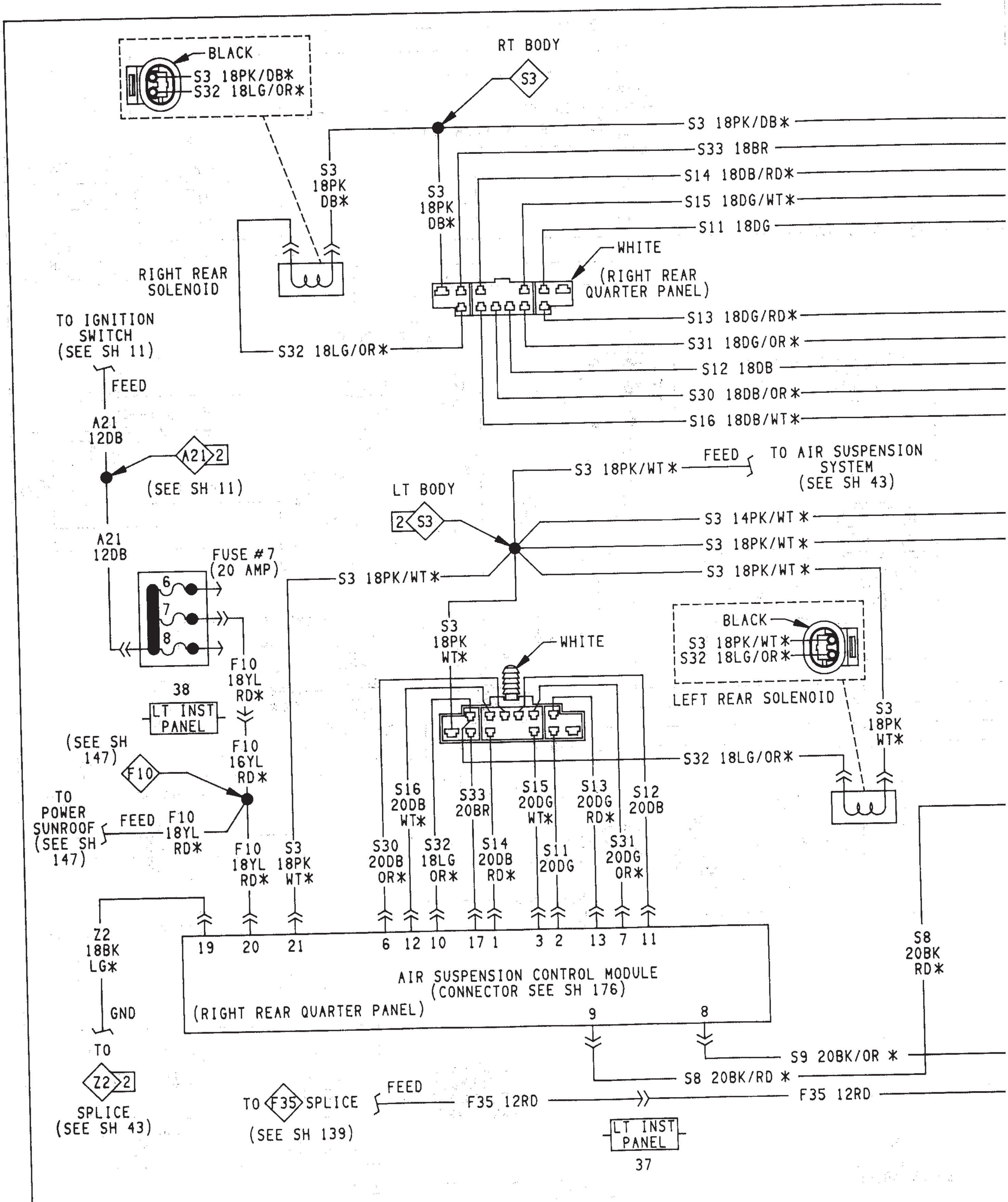
938W-3



938W-3

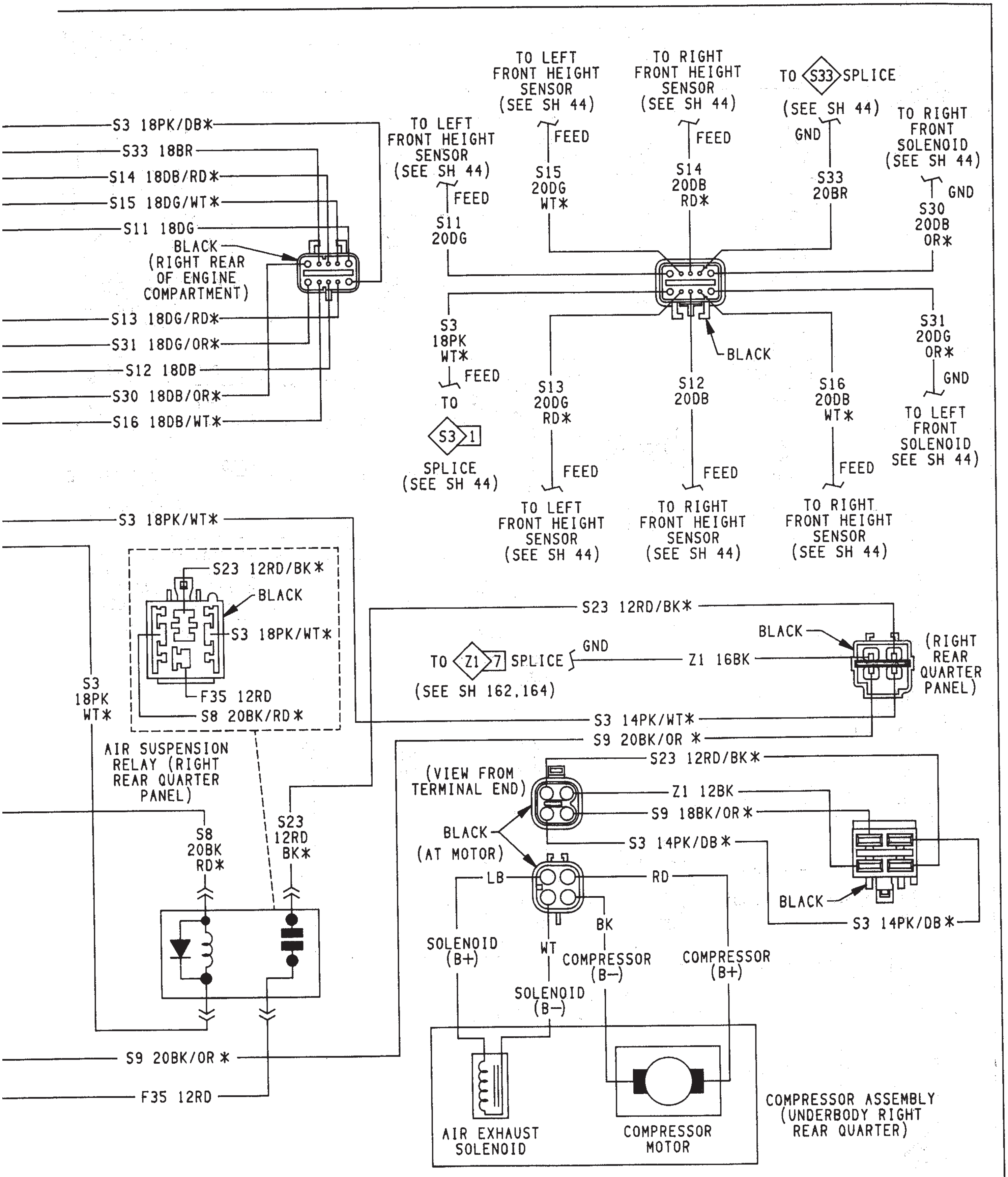
AUTOMATIC AIR LOAD
LEVELING SYSTEM

AC-CD, AY-C 40



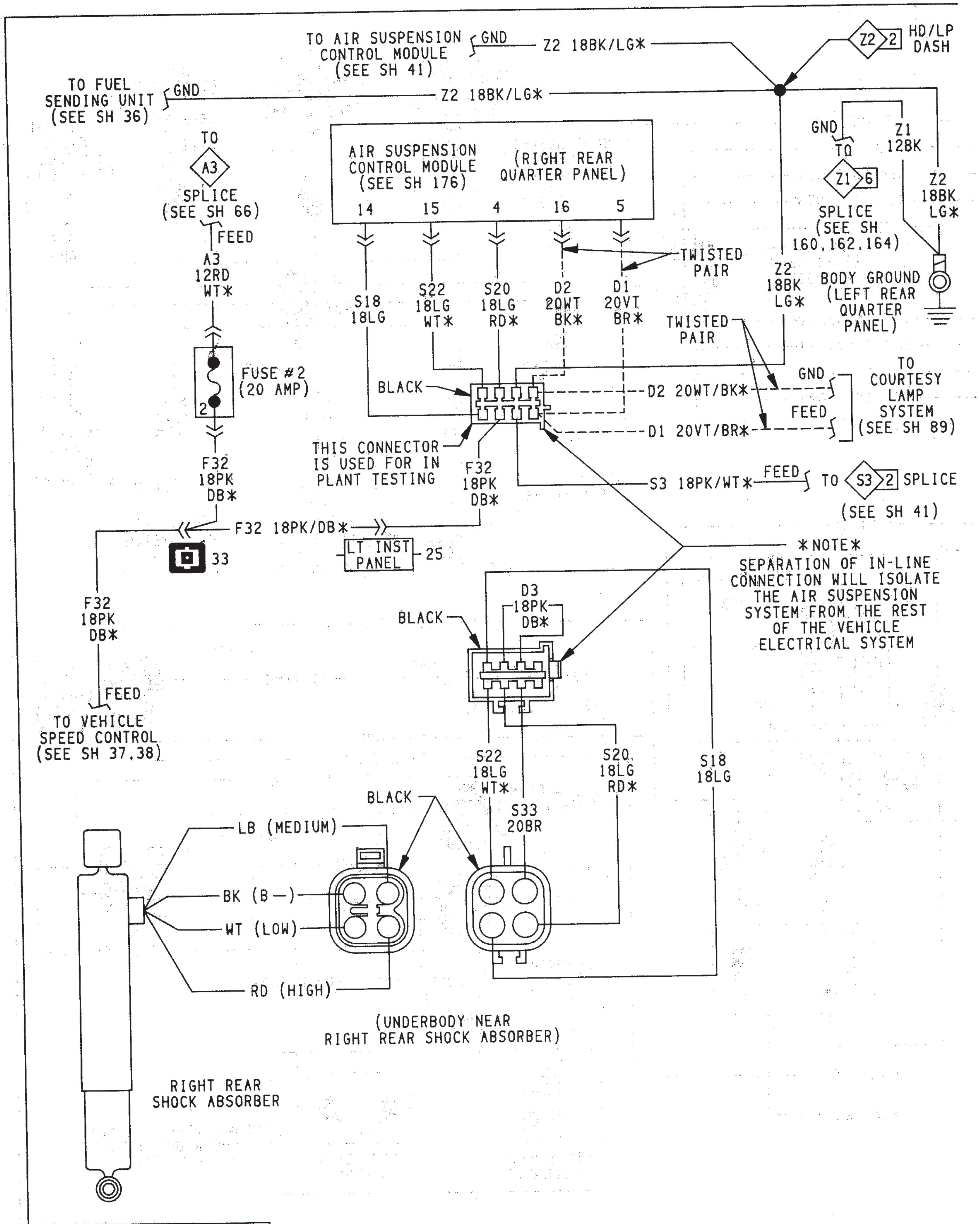
AIR SUSPENSION SYSTEM

938W-3



938W-3

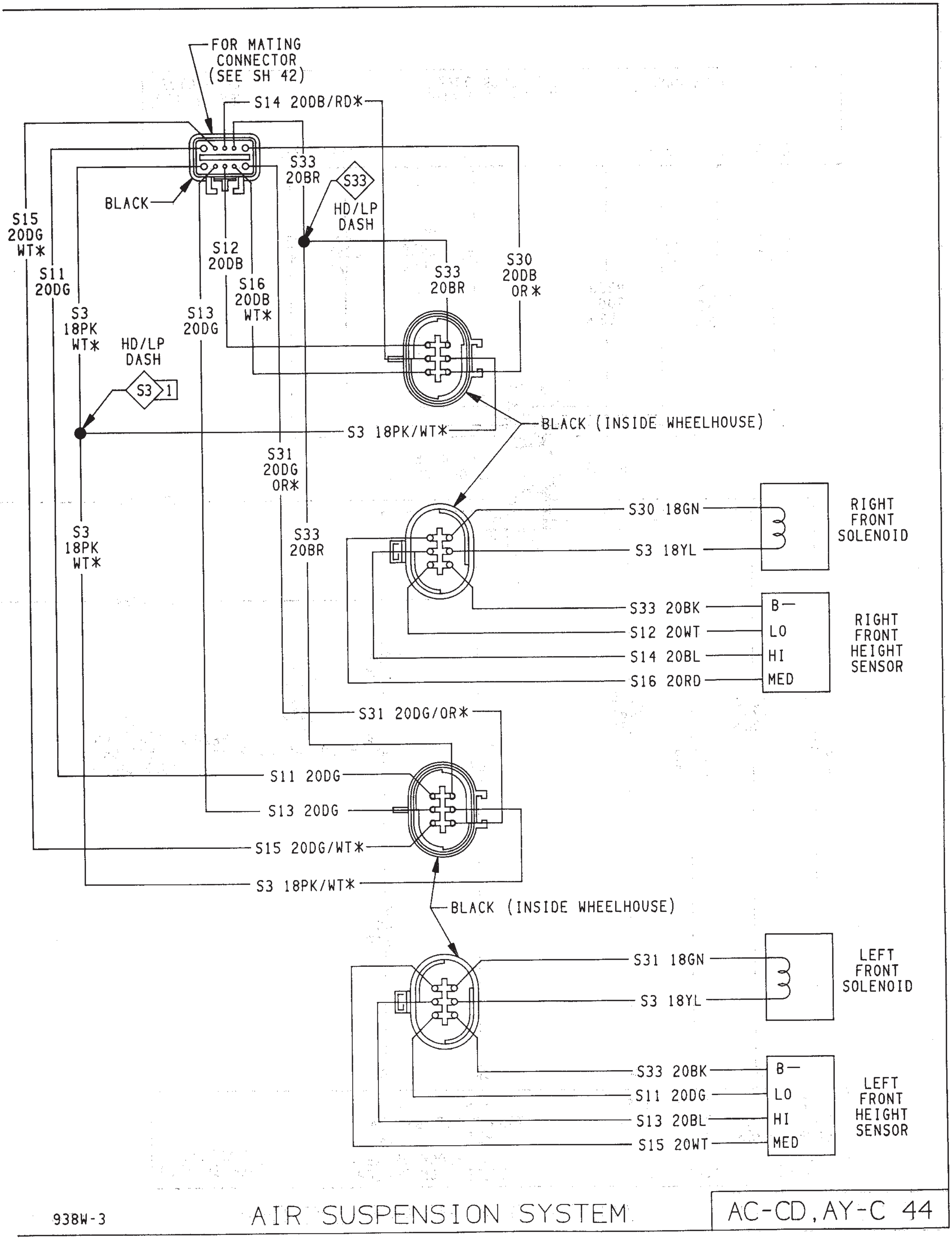
AIR SUSPENSION SYSTEM



AC-CD, AY-C 43

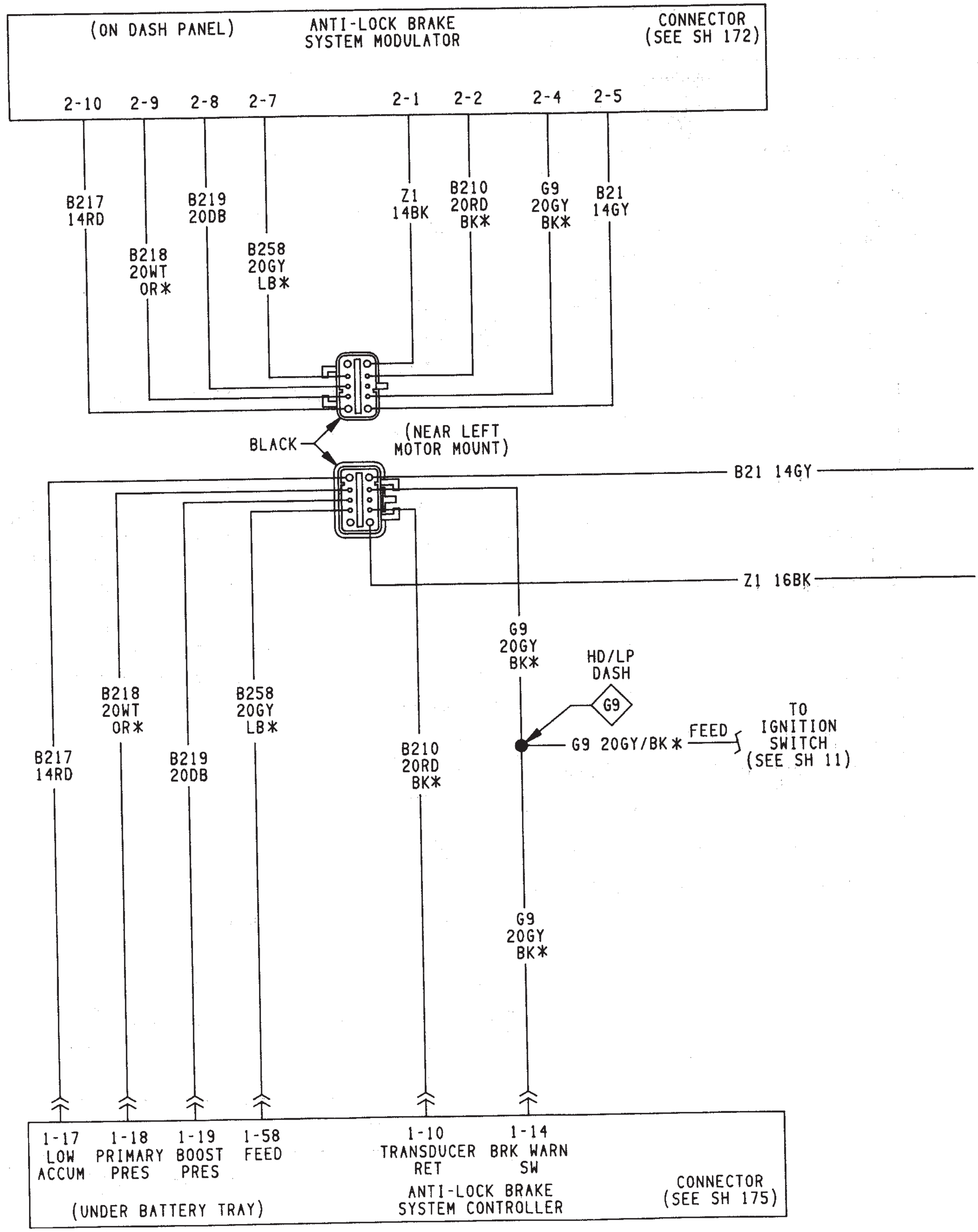
AIR SUSPENSION SYSTEM

938W-3

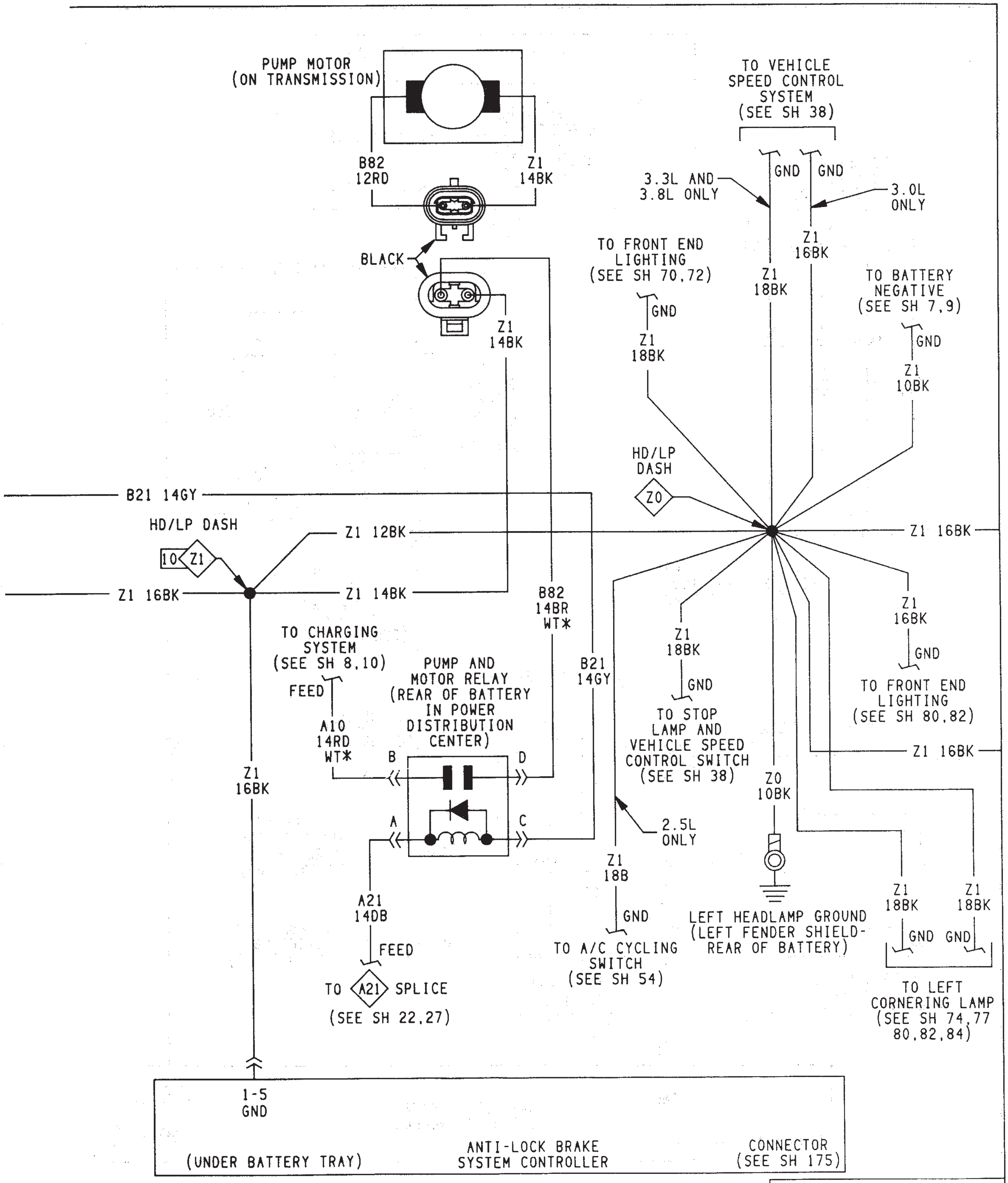


938W-3

AIR SUSPENSION SYSTEM



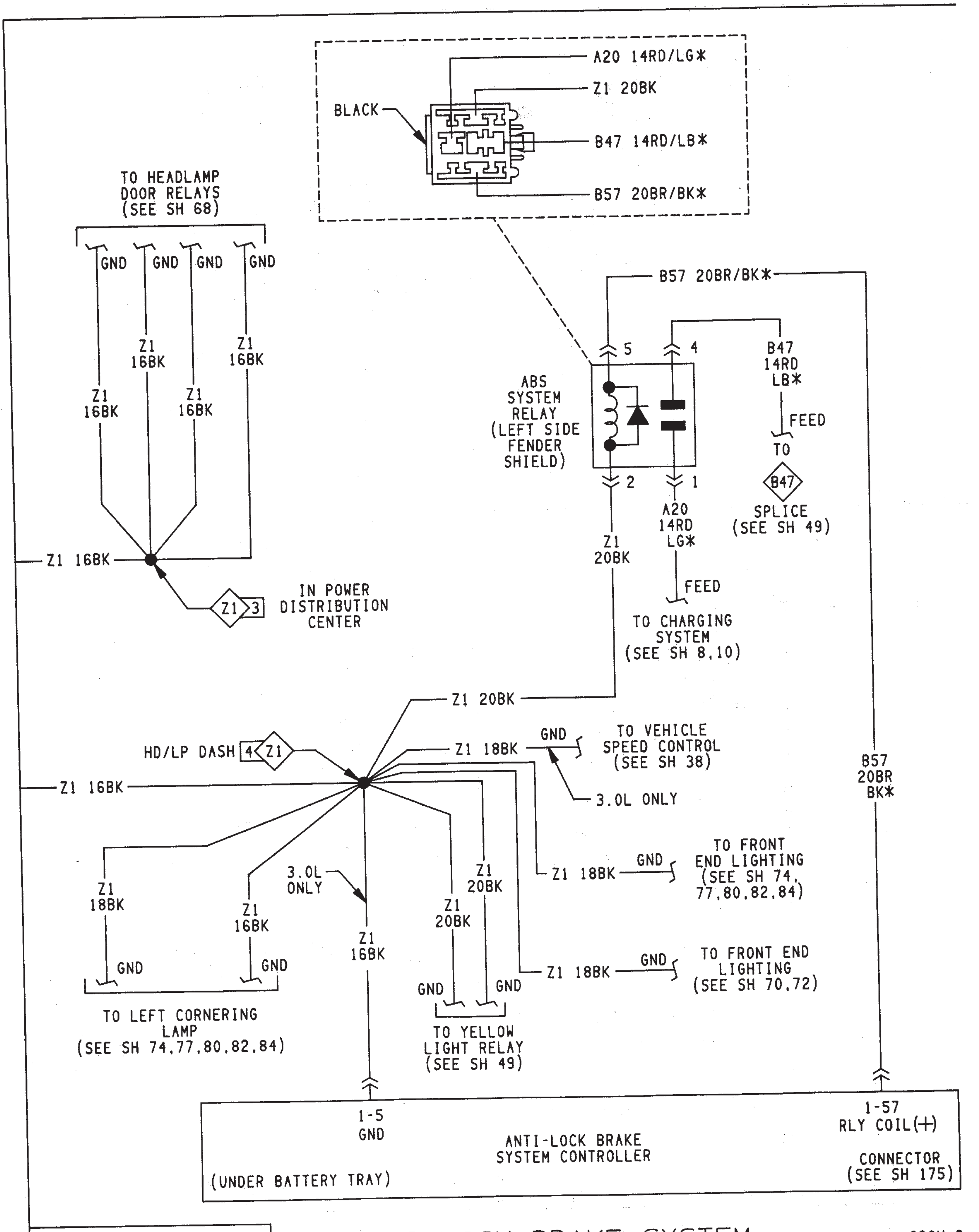
ANTI-LOCK BRAKE SYSTEM



938W-3

ANTI-LOCK BRAKE SYSTEM

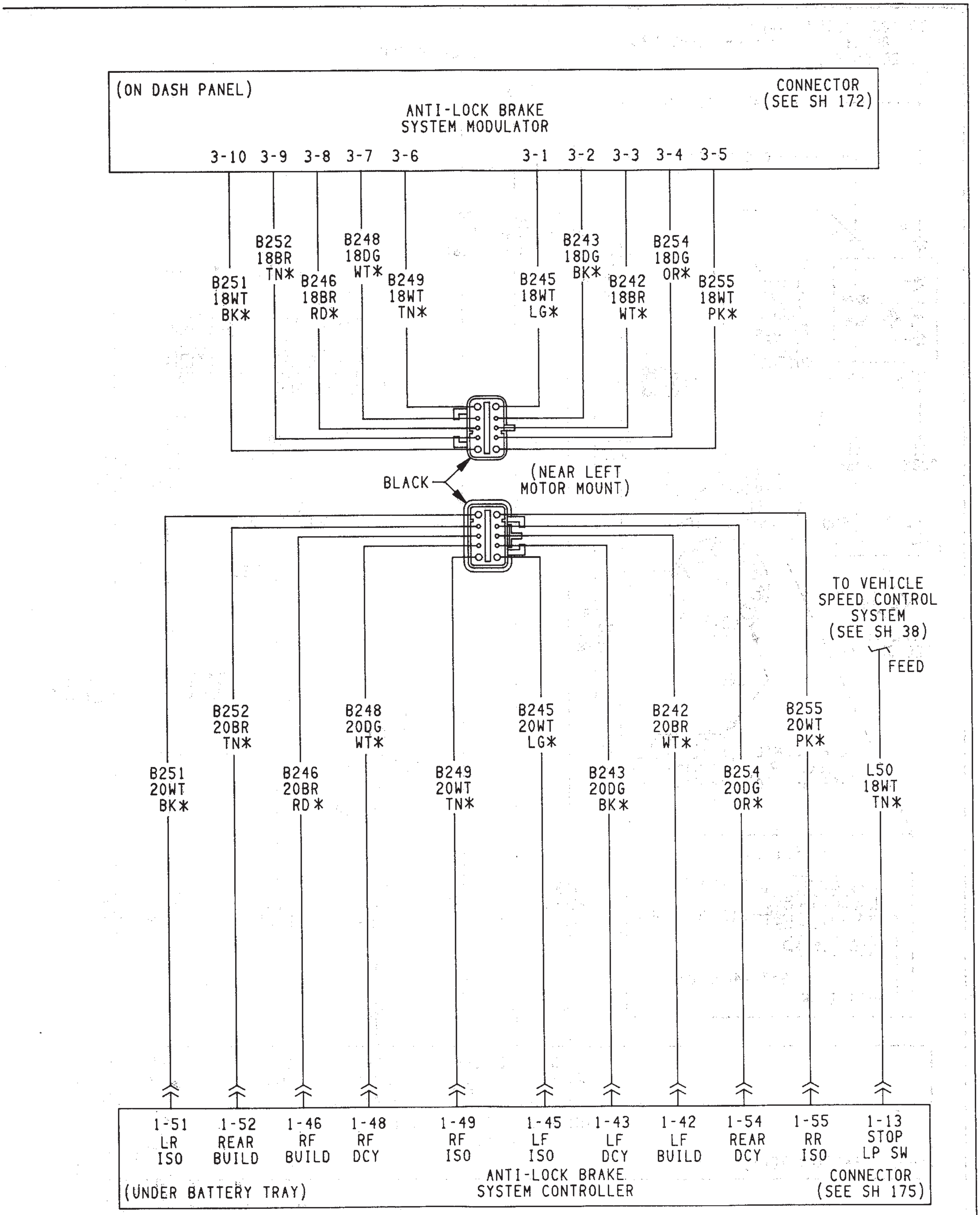
AC-CD, AY-C 46



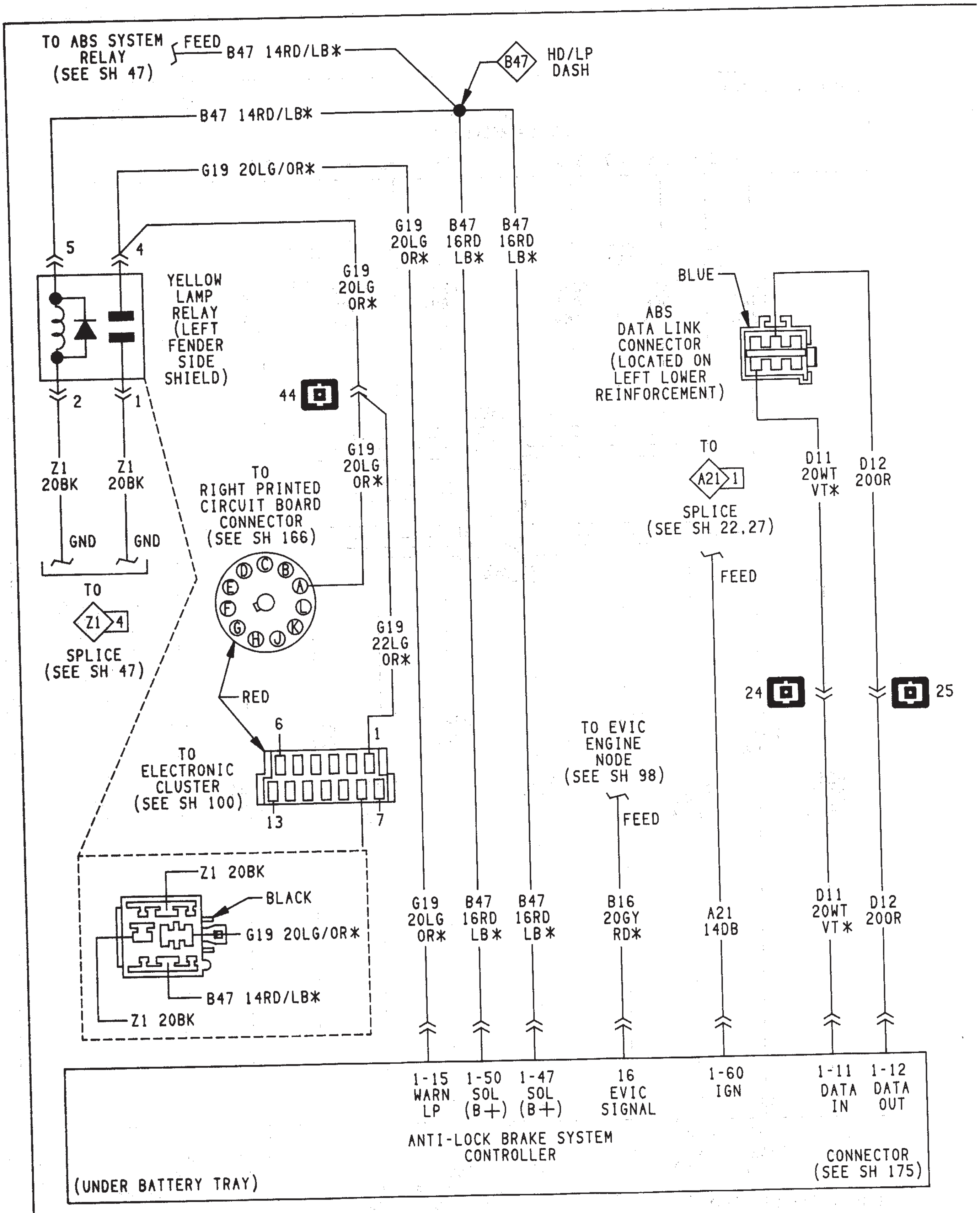
AC-CD,AY-C 47

ANTI-LOCK BRAKE SYSTEM

938W-3



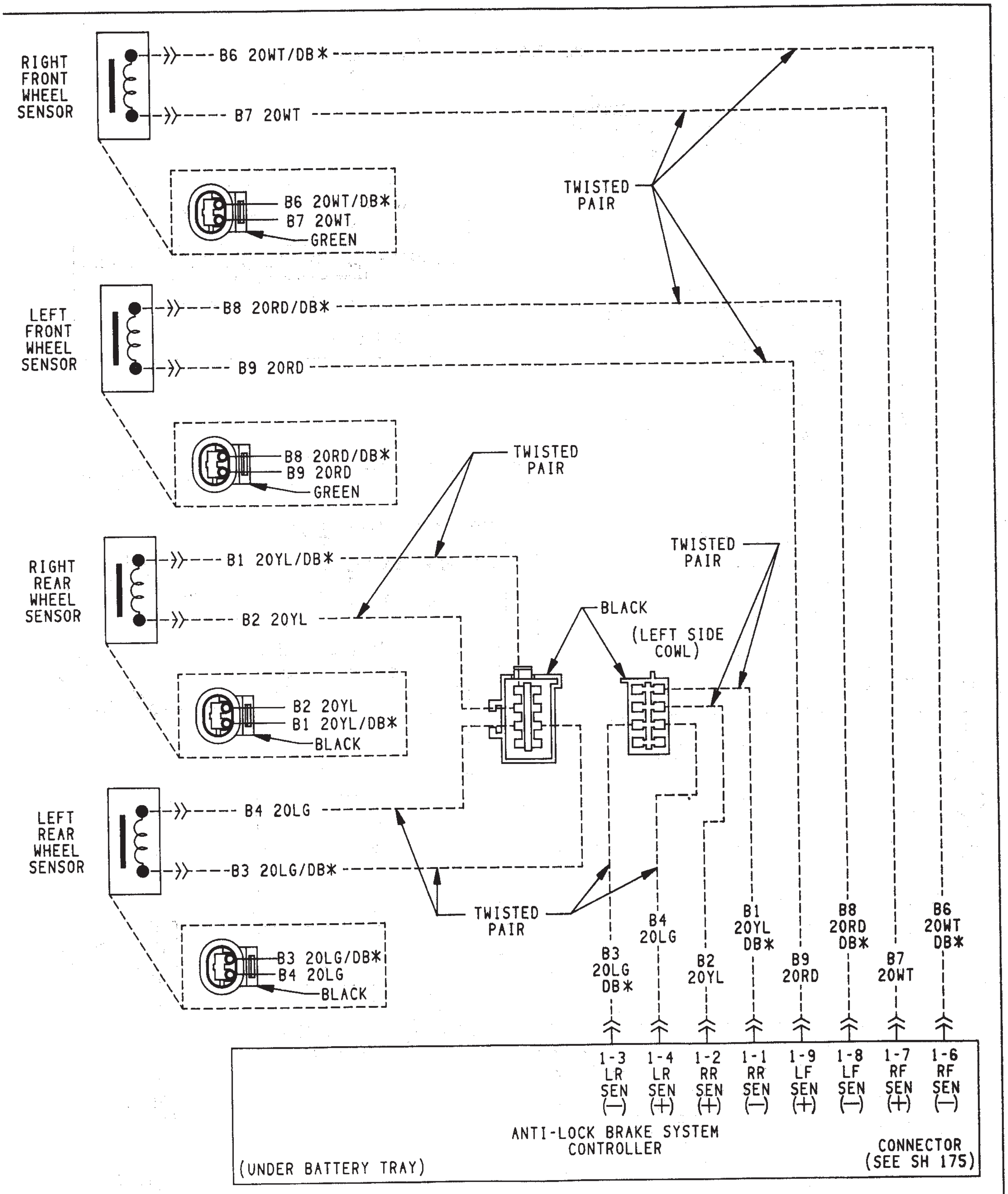
938W-3 ANTI-LOCK BRAKE SYSTEM AC-CD,AY-C 48



AC-CD, AY-C 49

ANTI-LOCK BRAKE SYSTEM

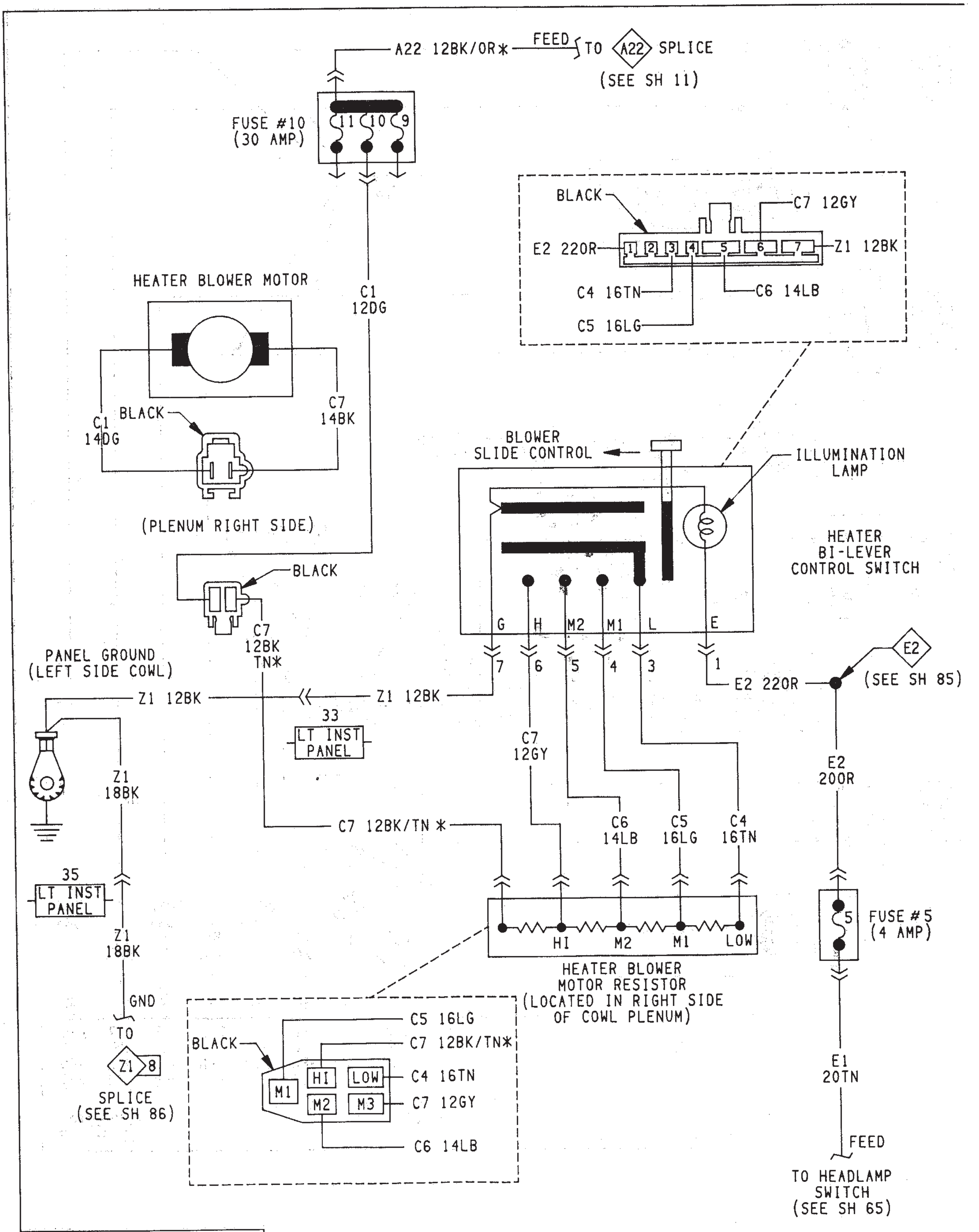
938W-3



938W-3

ANTI-LOCK BRAKE SYSTEM

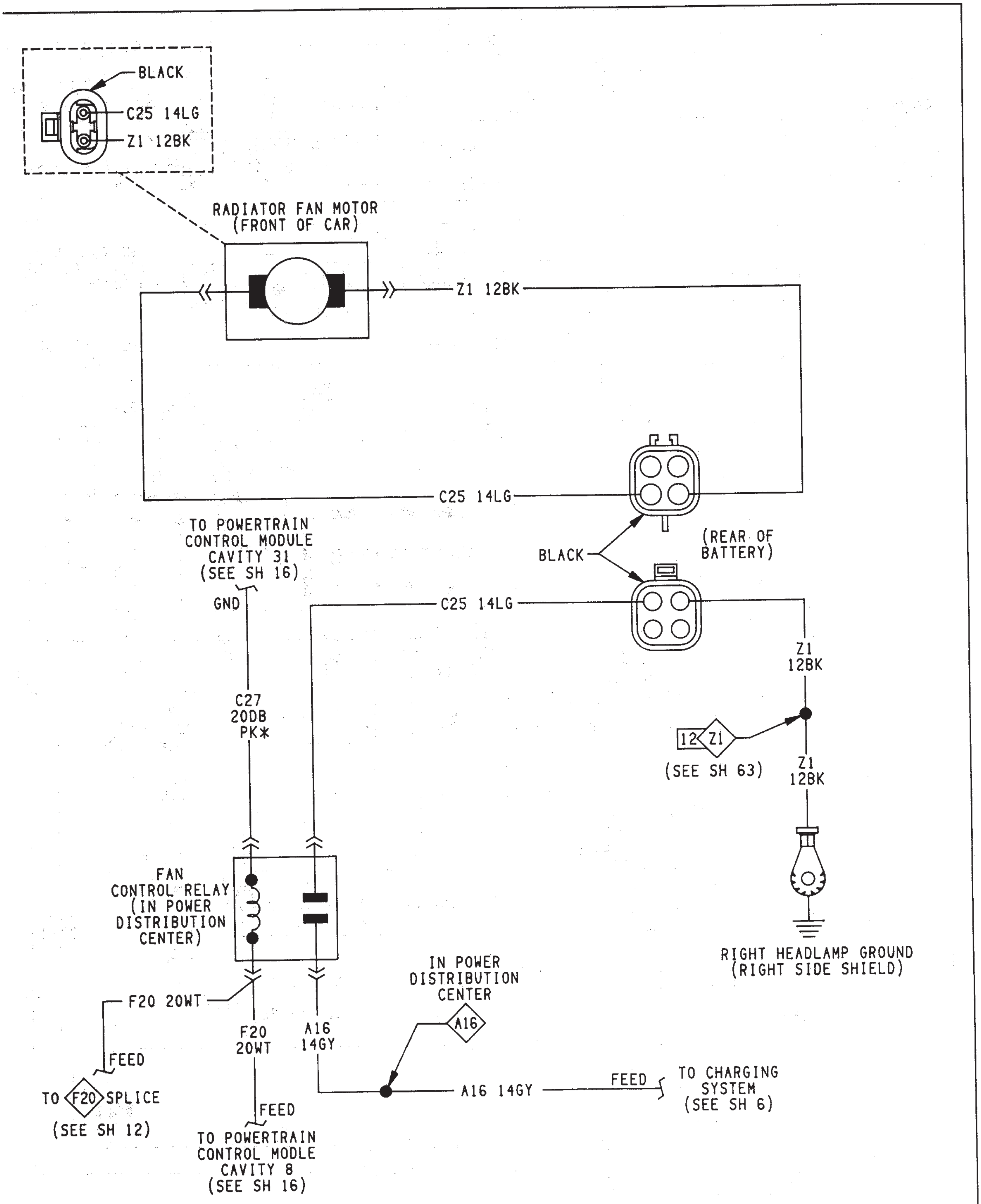
AC-CD, AY-C 50



AC-CD, AY-C 51

HEATER SYSTEM

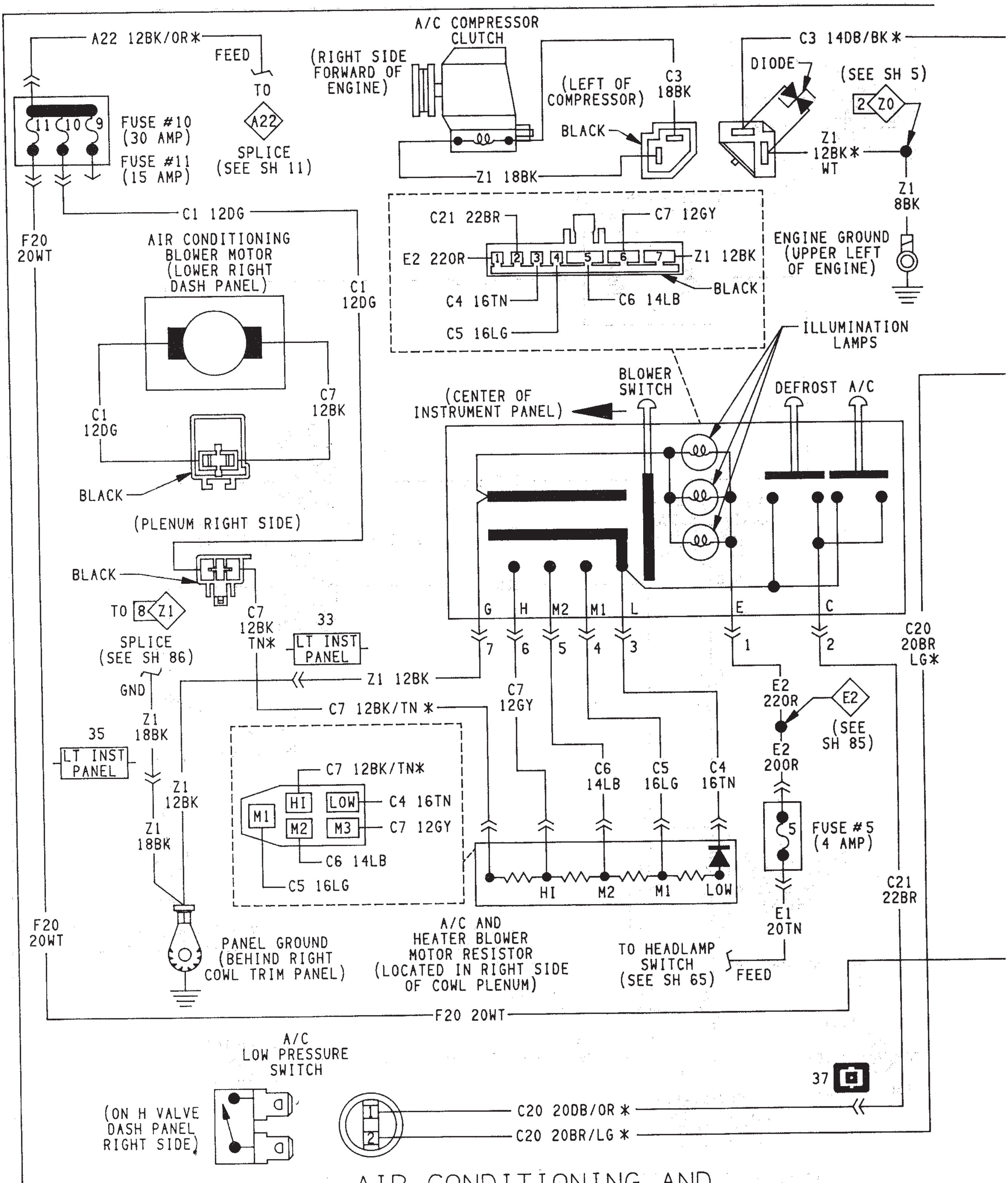
938W-3



RADIATOR FAN SYSTEM WITH HEATER
(2.5L ENGINE)

AC-CD, AY-C 52

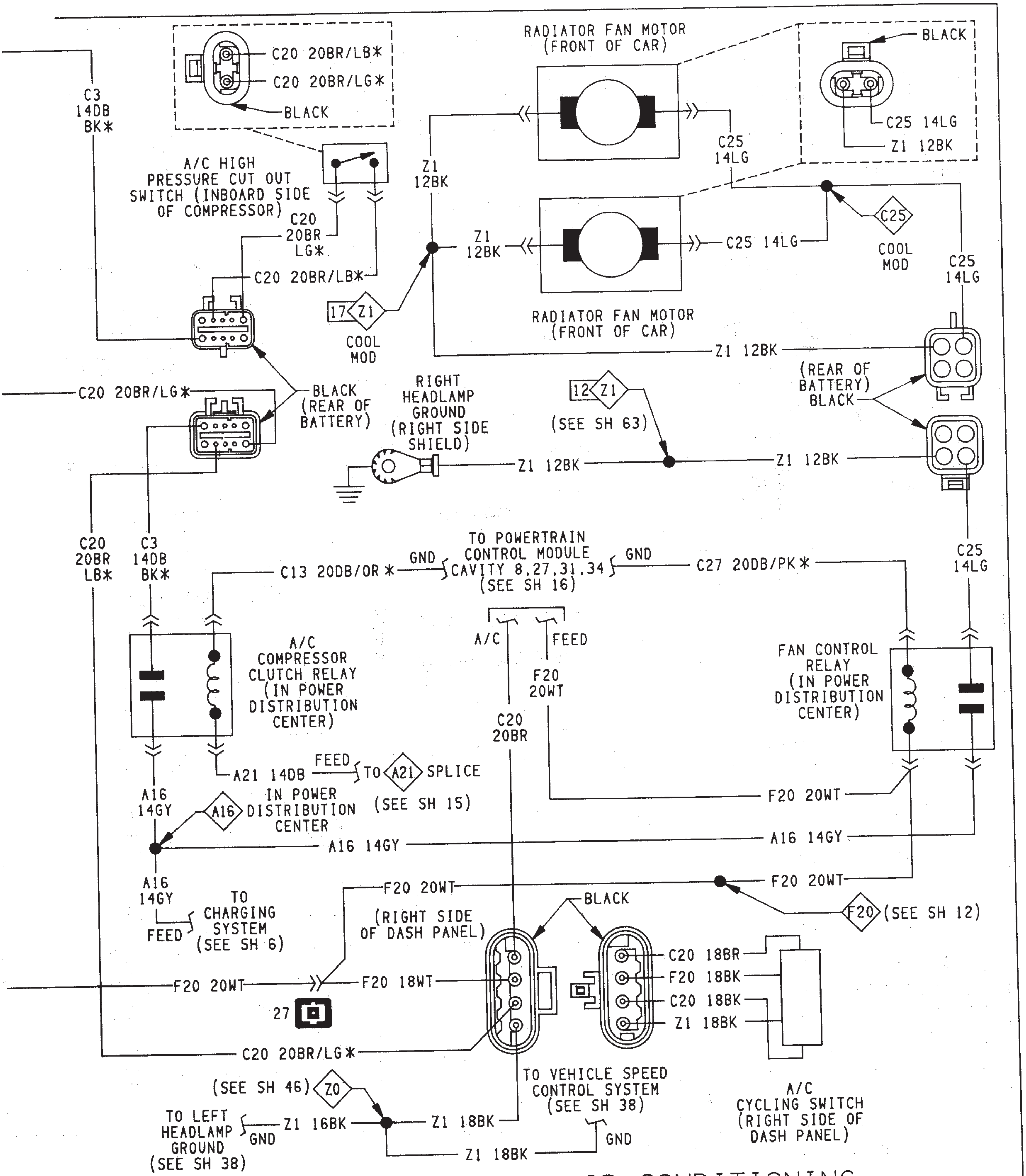
938W-3



AC-CD, AY-C 53

AIR CONDITIONING AND HEATER SYSTEM (2.5L ENGINE)

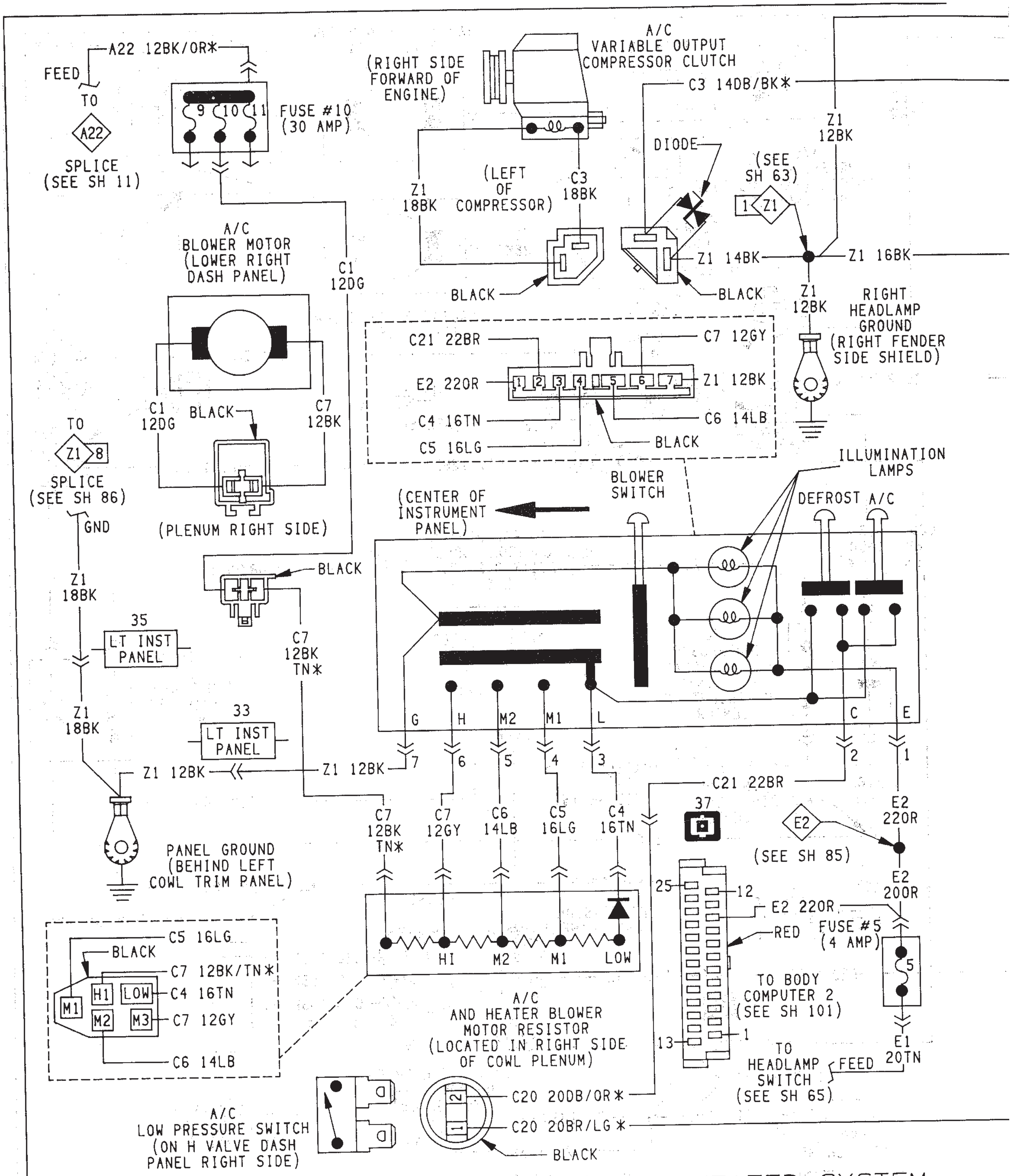
938W-3



RADIATOR FAN SYSTEM WITH AIR CONDITIONING
AND HEATER SYSTEM (2.5L ENGINE)

AC-CD,AY-C 54

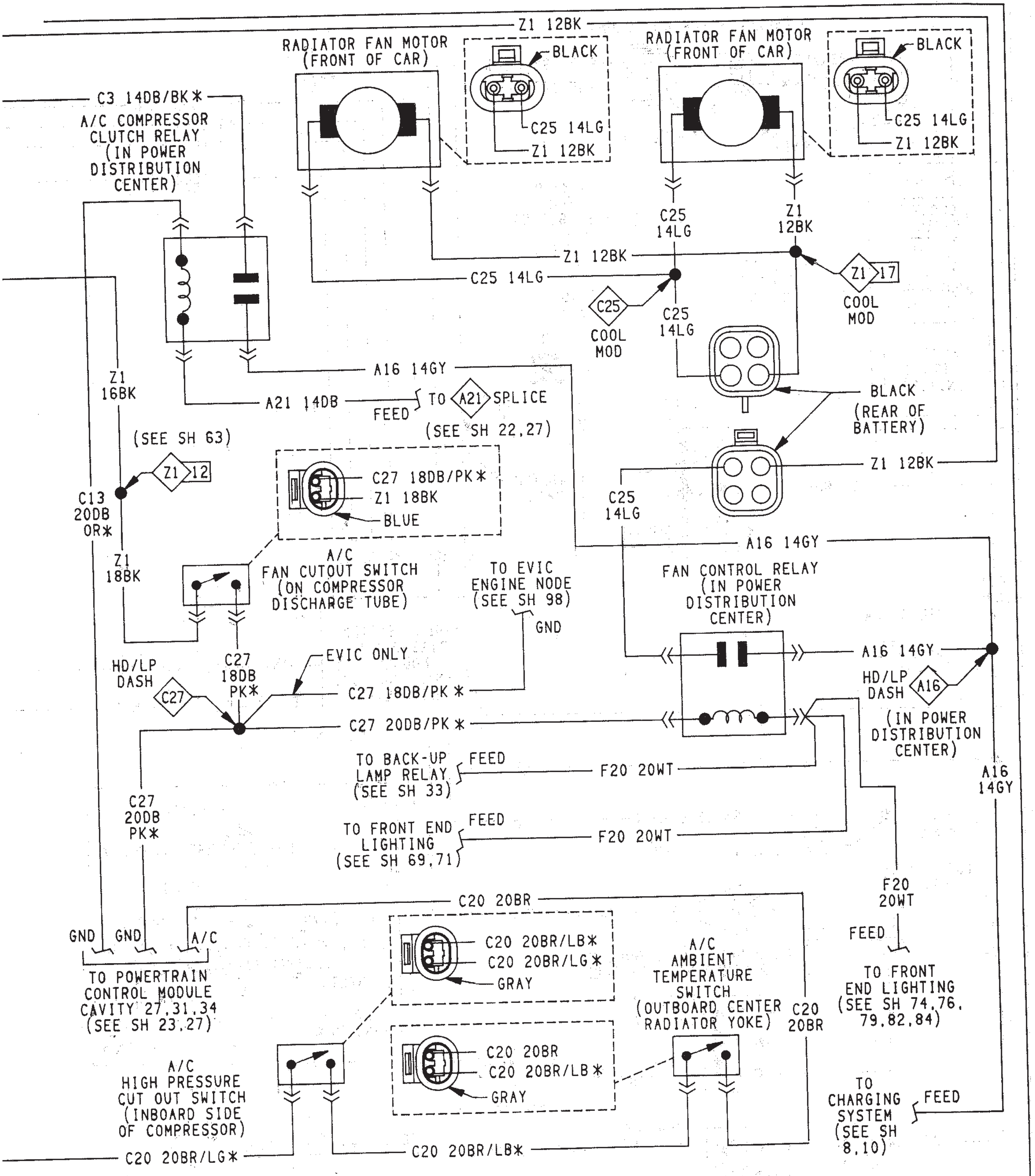
938W-3



ENGINE AIR CONDITIONING AND HEATER SYSTEM
(3.0L, 3.3L & 3.8L ENGINE)

AC-CD, AY-C 55

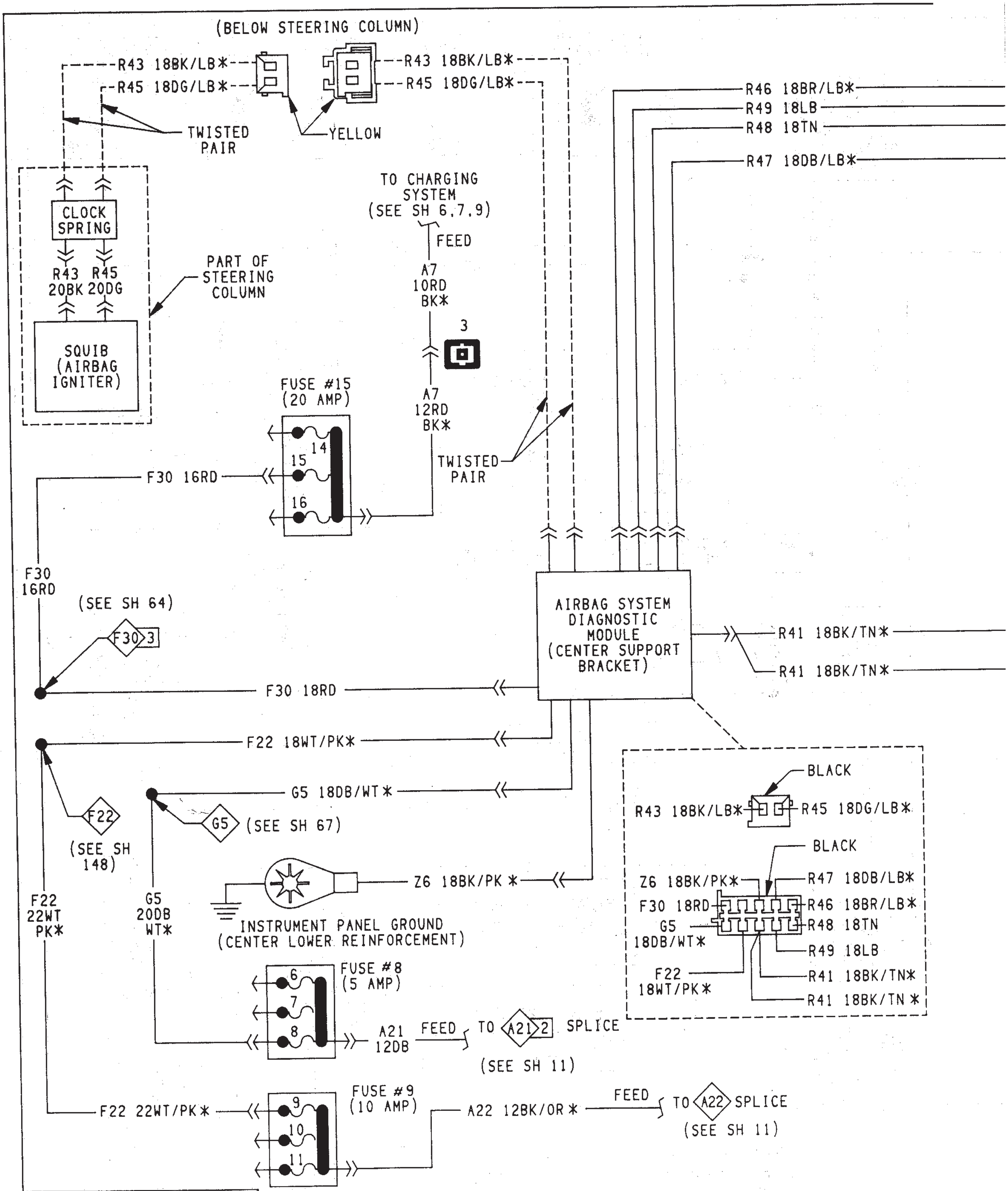
938W-3



RADIATOR FAN SYSTEM WITH AIR
CONDITIONING AND HEATER SYSTEM
(3.0L, 3.3L & 3.8L ENGINE)

AC-CD,AY-C 56

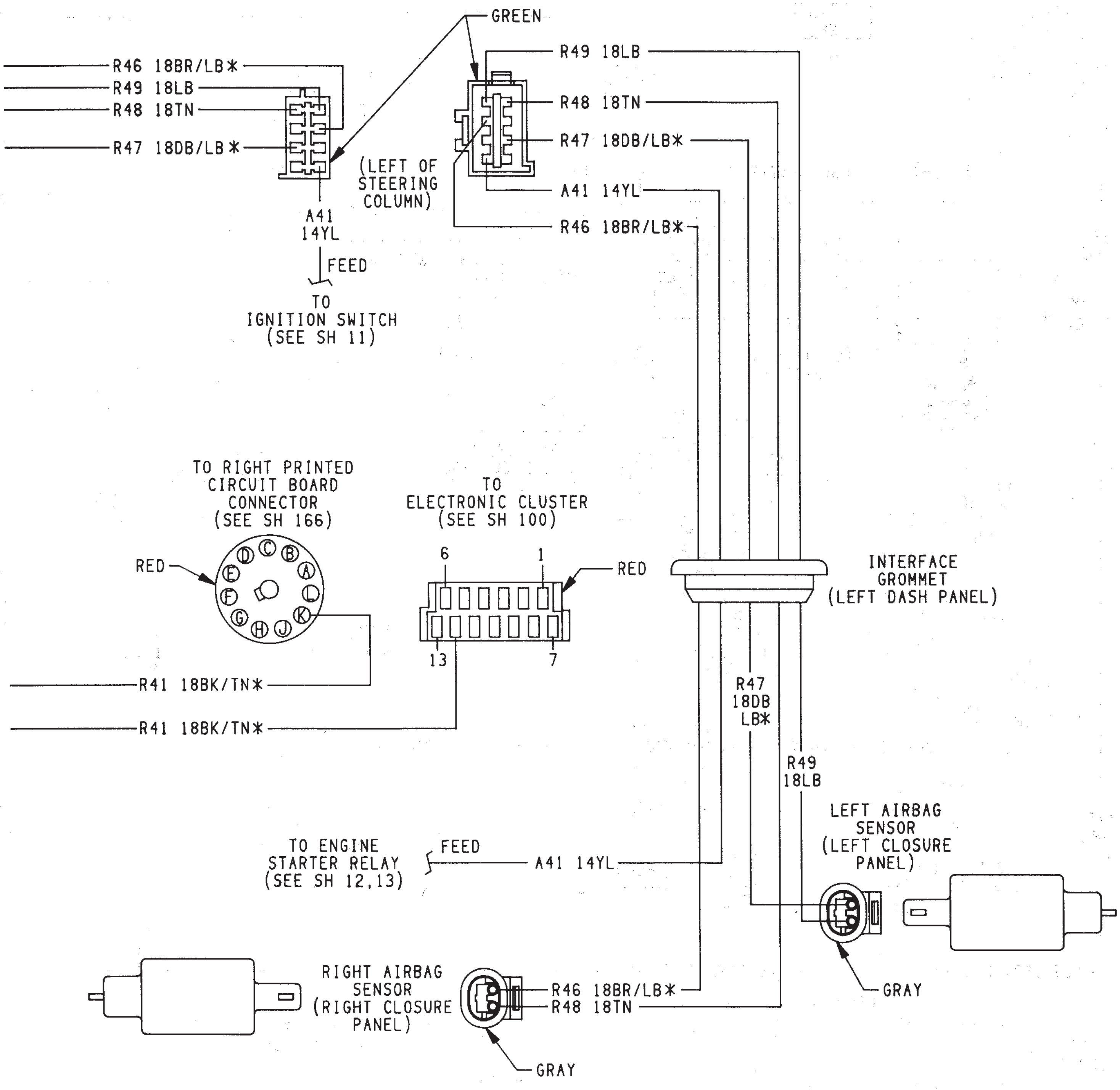
938W-3



AC-CD, AY-C 57

AIRBAG SYSTEM

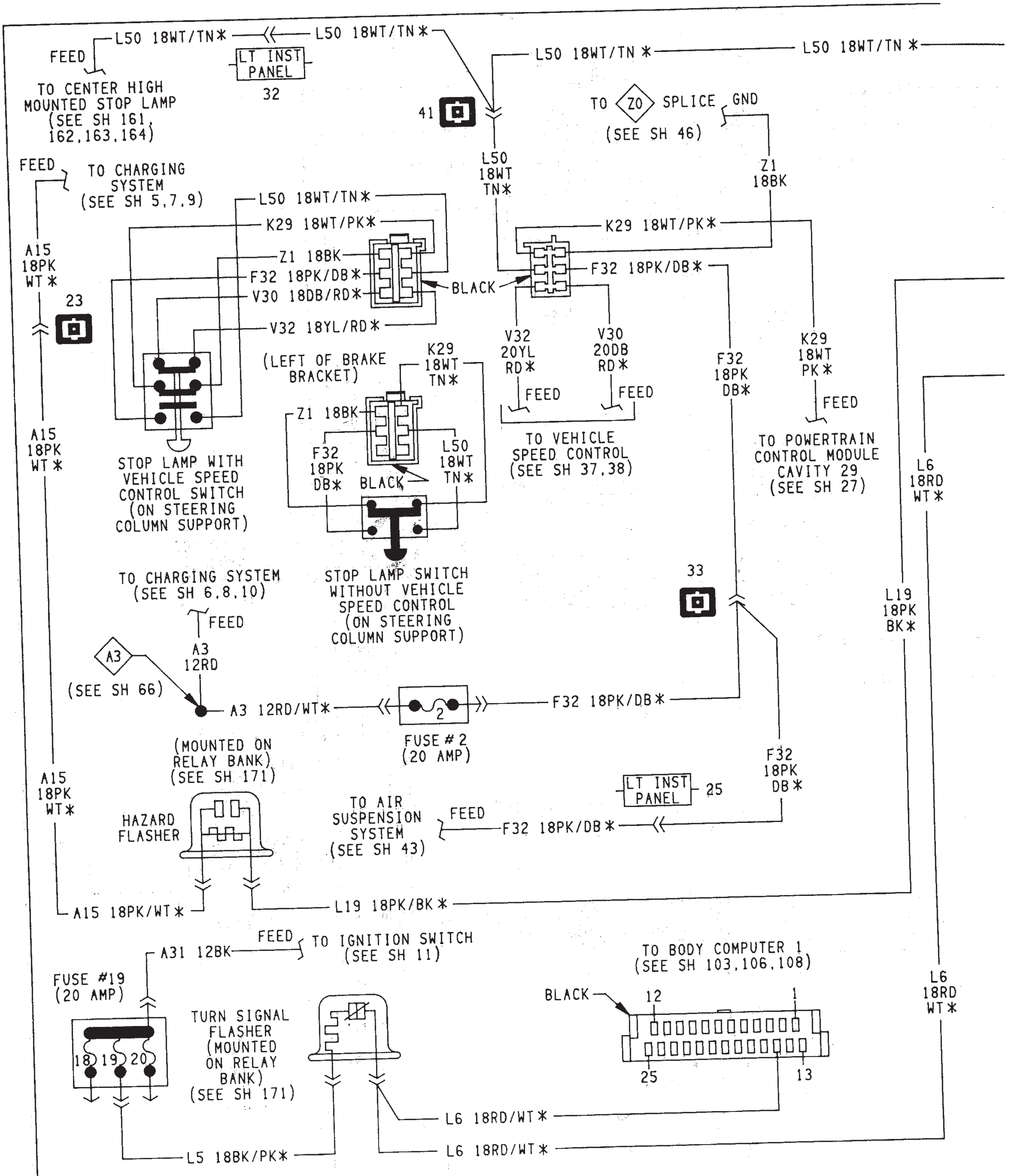
938W-3



938W-3

AIRBAG SYSTEM

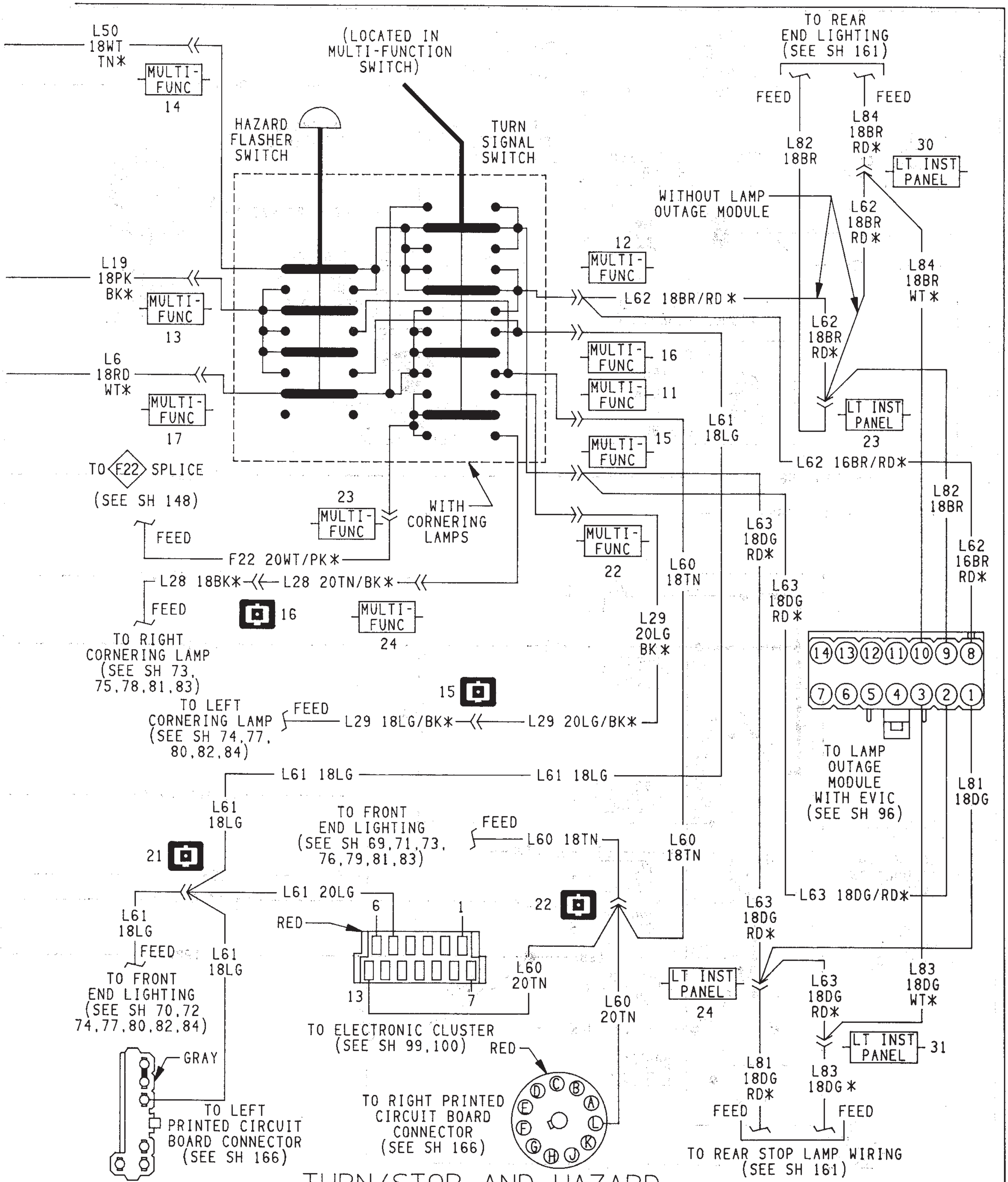
AC-CD, AY-C 58



TURN/STOP AND HAZARD FLASHER SYSTEMS

AC-CD, AY-C 59

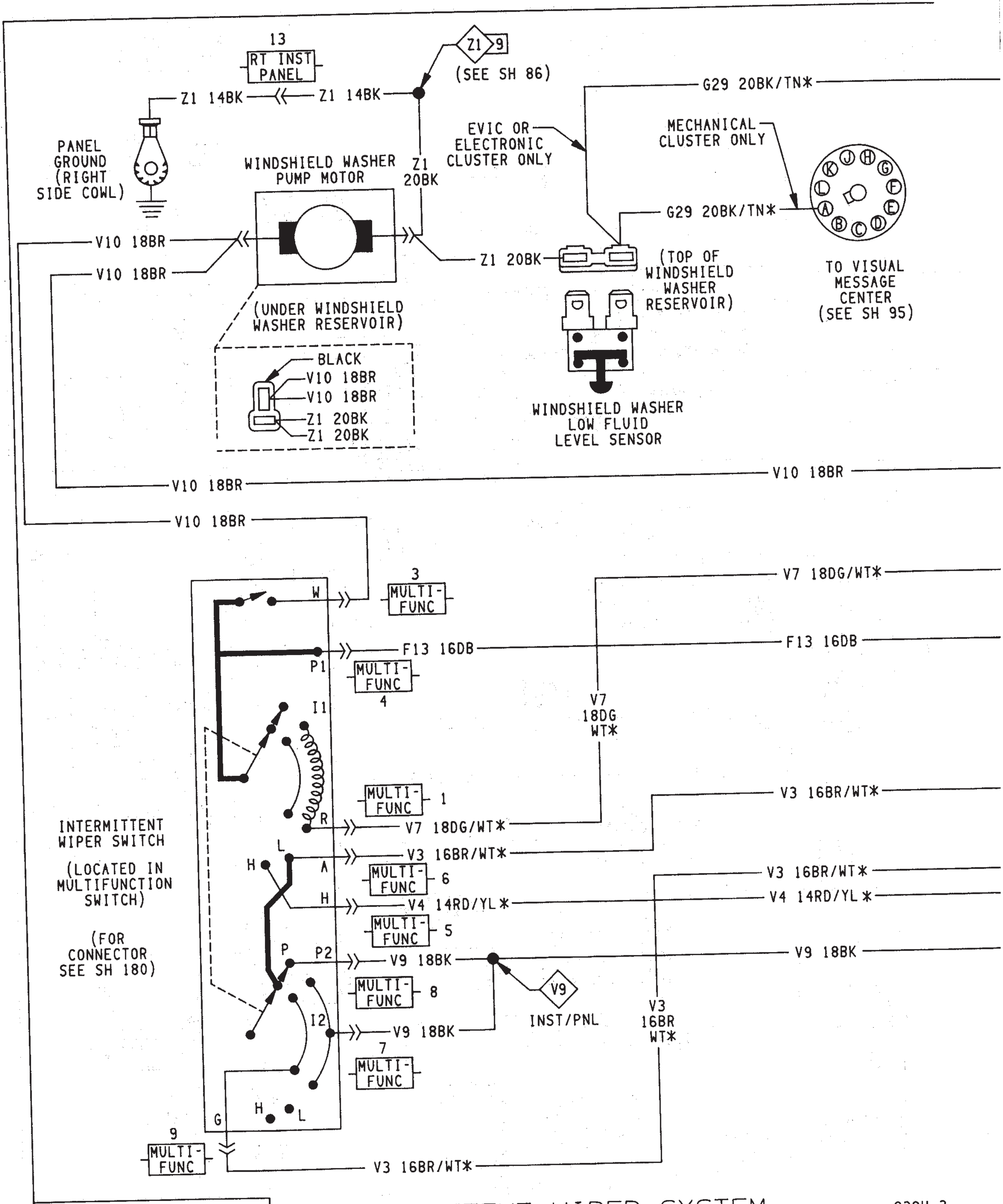
938W-3



TURN/STOP AND HAZARD
FLASHER SYSTEMS

938W-3

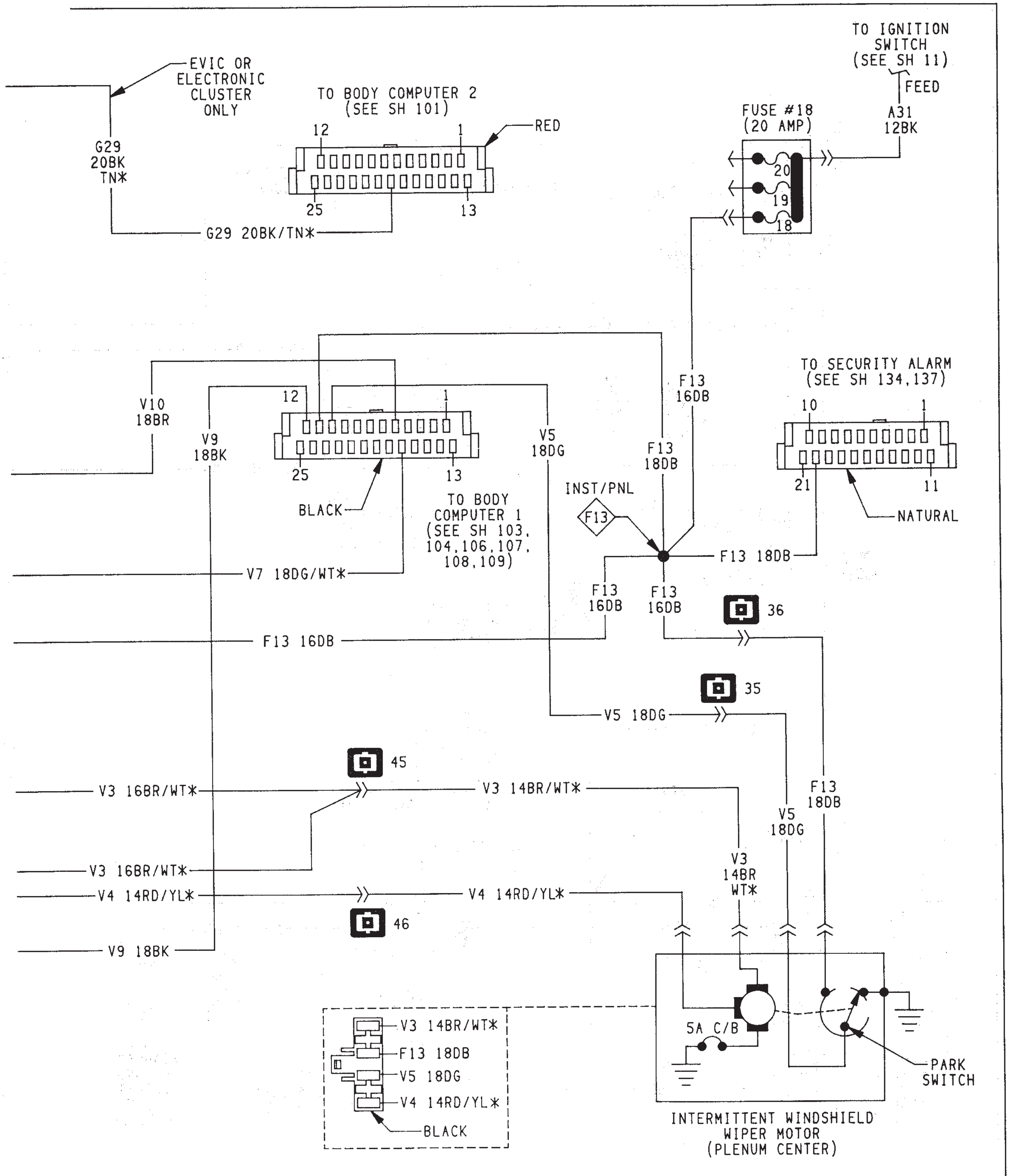
AC-CD, AY-C 60



AC-CD, AY-C 61

INTERMITTENT WIPER SYSTEM

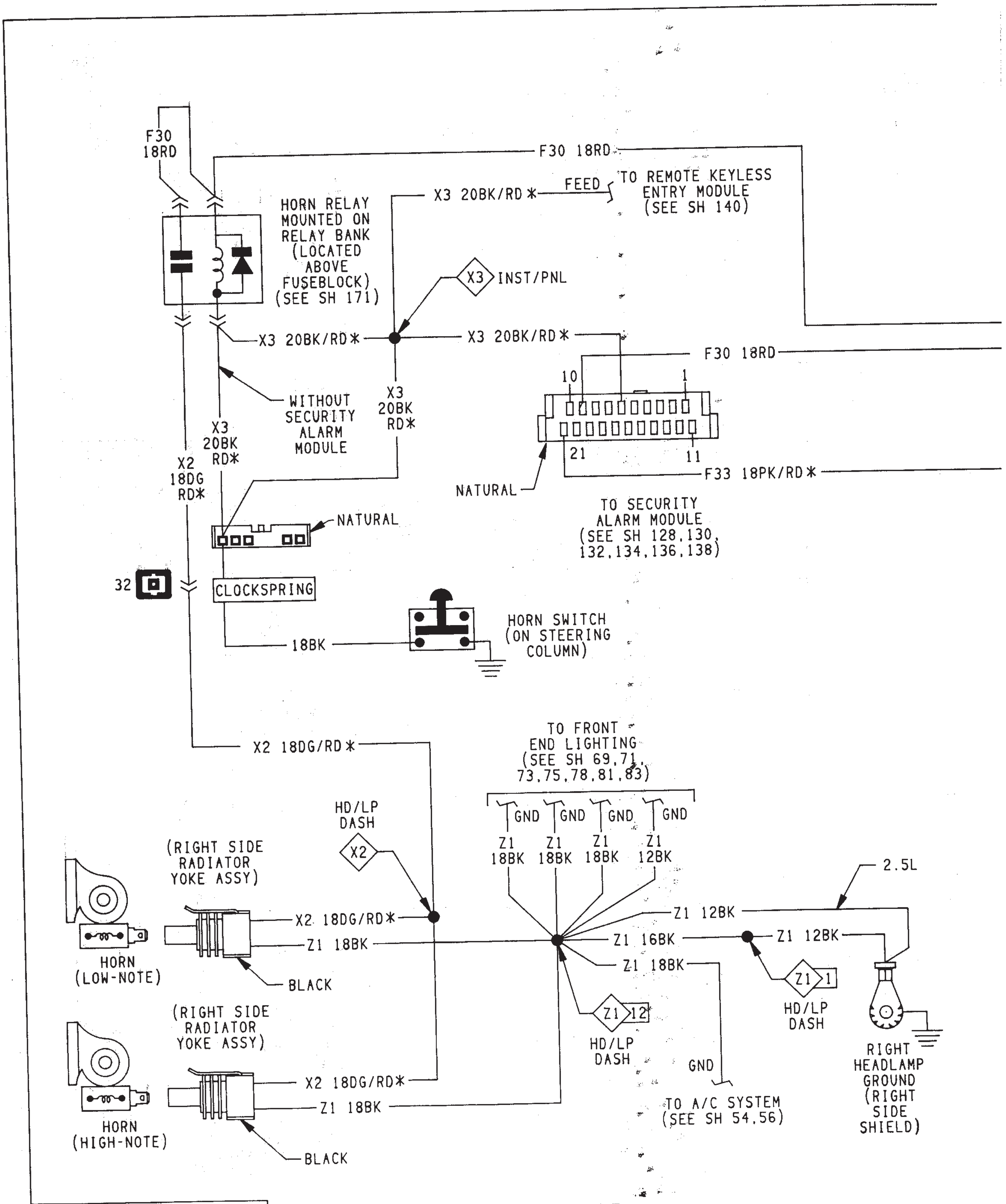
938W-3



938W-3

INTERMITTENT WIPER SYSTEM

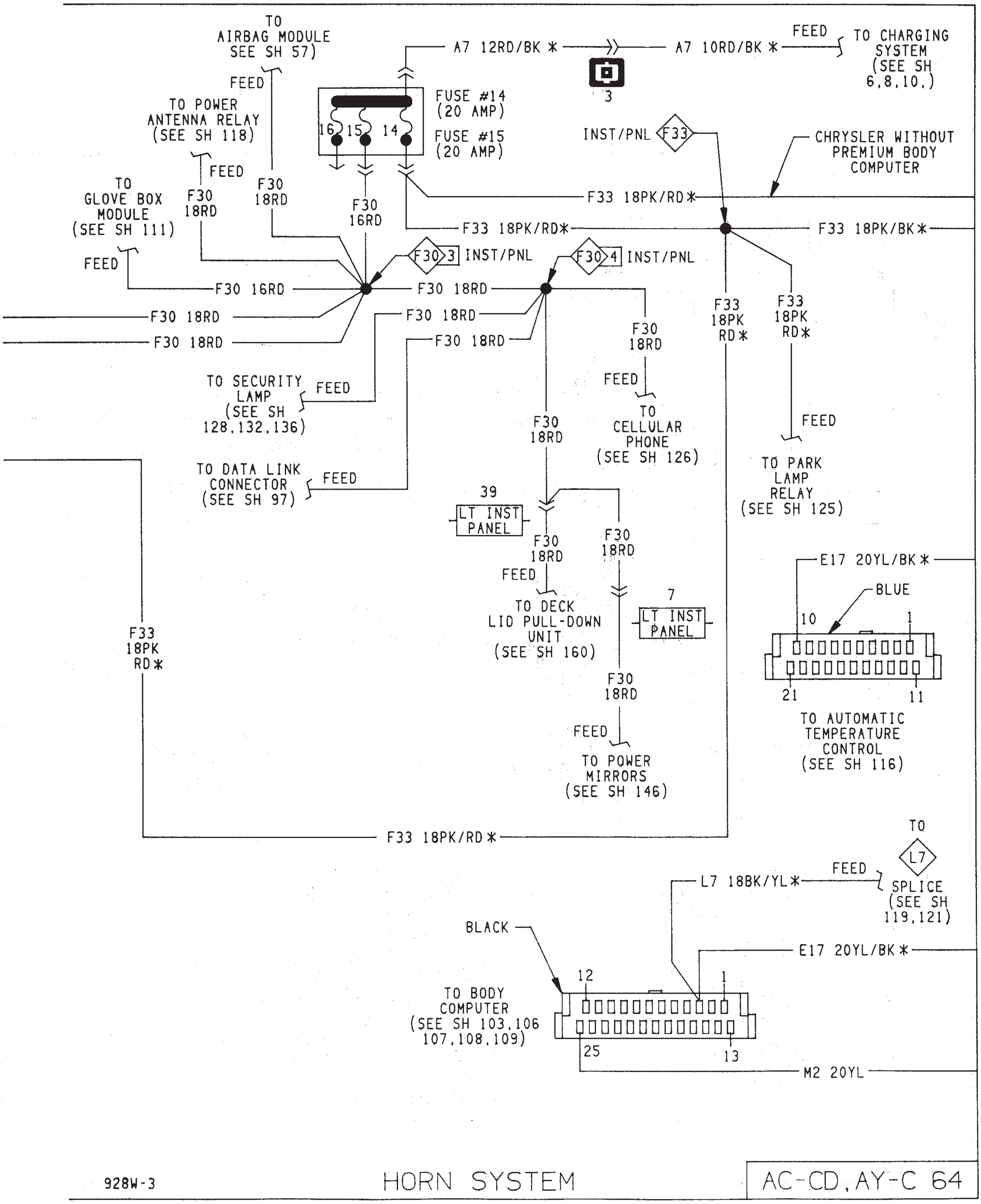
AC-CD,AY-C 62



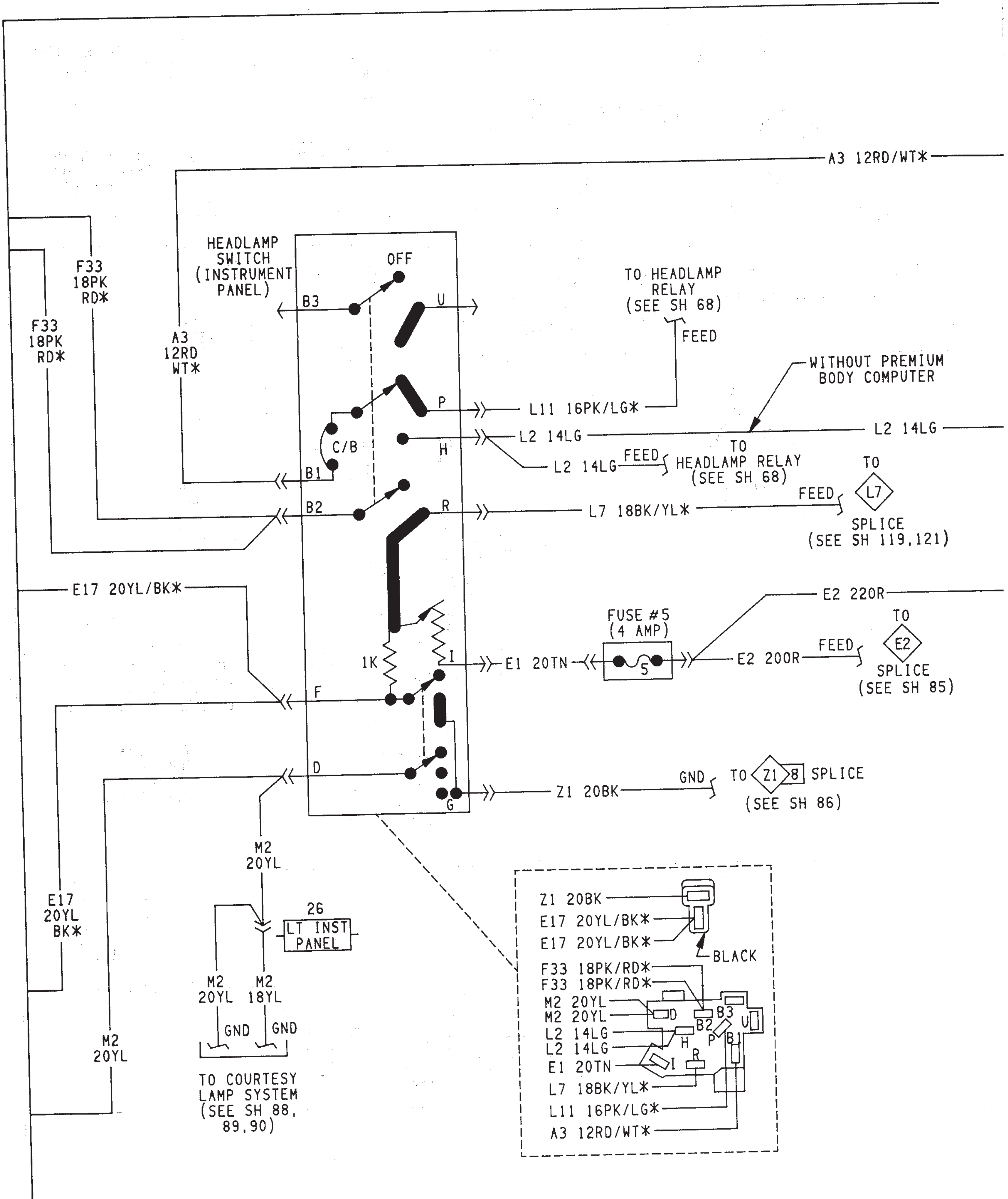
AC-CD, AY-C 63

HORN SYSTEM

938W-3


TO AIRBAG MODULE SEE SH 57)
FEED
A7 12RD/BK *
A7 10RD/BK *
FEED
TO CHARGING SYSTEM (SEE SH 6,8,10,)
3
FUSE #14 (20 AMP)
FUSE #15 (20 AMP)
16
15
14
TO POWER ANTENNA RELAY (SEE SH 118)
FEED
INST/PNL
F33
CHRYSLER WITHOUT PREMIUM BODY COMPUTER
F30 18RD
F30 18RD
F30 16RD
F33 18PK/RD*
F33 18PK/RD*
F33 18PK/BK*
TO GLOVE BOX MODULE (SEE SH 111)
FEED
F30 3 INST/PNL
F30 4 INST/PNL
F30 16RD
F30 18RD
F30 18RD
F30 18RD
F30 18RD
F30 18RD
F33 18PK RD*
F33 18PK RD*
F30 18RD
FEED
TO CELLULAR PHONE (SEE SH 126)
TO SECURITY LAMP (SEE SH 128,132,136)
FEED
F30 18RD
FEED
TO PARK LAMP RELAY (SEE SH 125)
TO DATA LINK CONNECTOR (SEE SH 97)
FEED
39
LT INST PANEL
F30 18RD
F30 18RD
FEED
TO DECK LID PULL-DOWN UNIT (SEE SH 160)
7
LT INST PANEL
E17 20YL/BK*
BLUE
10
1
21
11
TO AUTOMATIC TEMPERATURE CONTROL (SEE SH 116)
F33 18PK RD*
F30 18RD
FEED
TO POWER MIRRORS (SEE SH 146)
F33 18PK/RD*
TO
L7
FEED
L7 18BK/YL*
SPLICE (SEE SH 119,121)
BLACK
E17 20YL/BK*
12
1
TO BODY COMPUTER (SEE SH 103,106 107,108,109)
25
13
M2 20YL

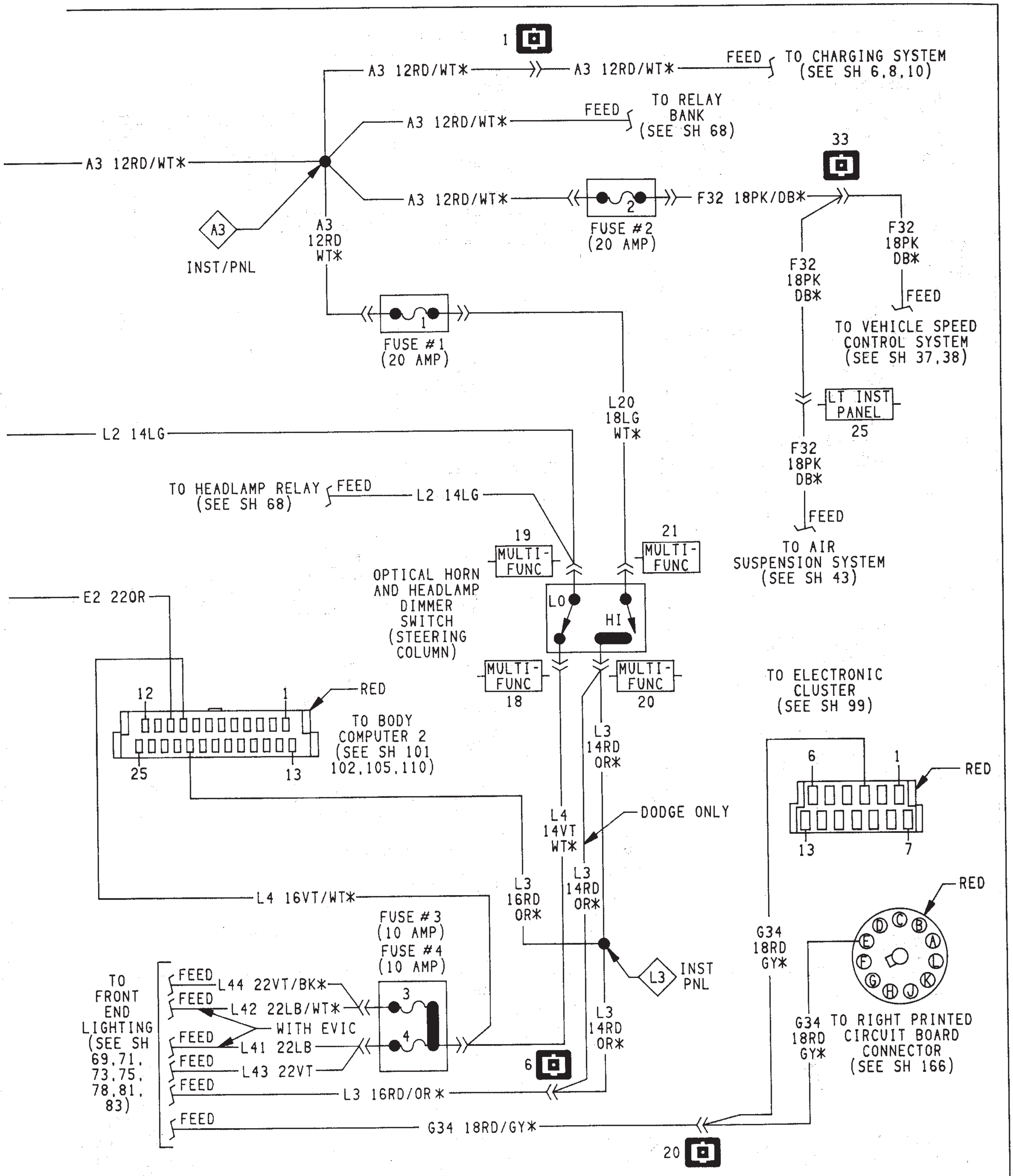
HORN SYSTEM



AC-CD, AY-C 65

HEADLAMP SWITCH

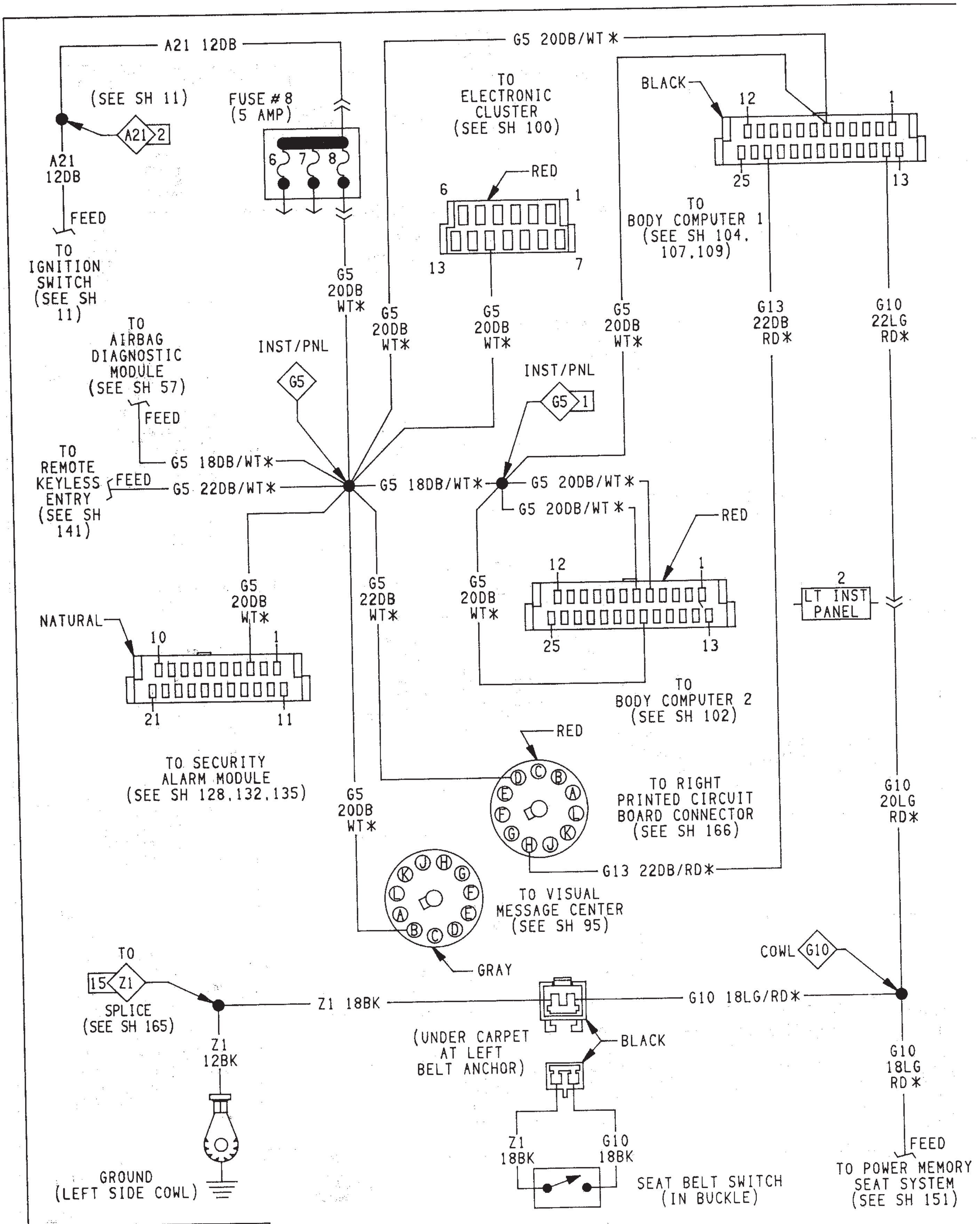
938W-3



938W-3

HEADLAMP SWITCH

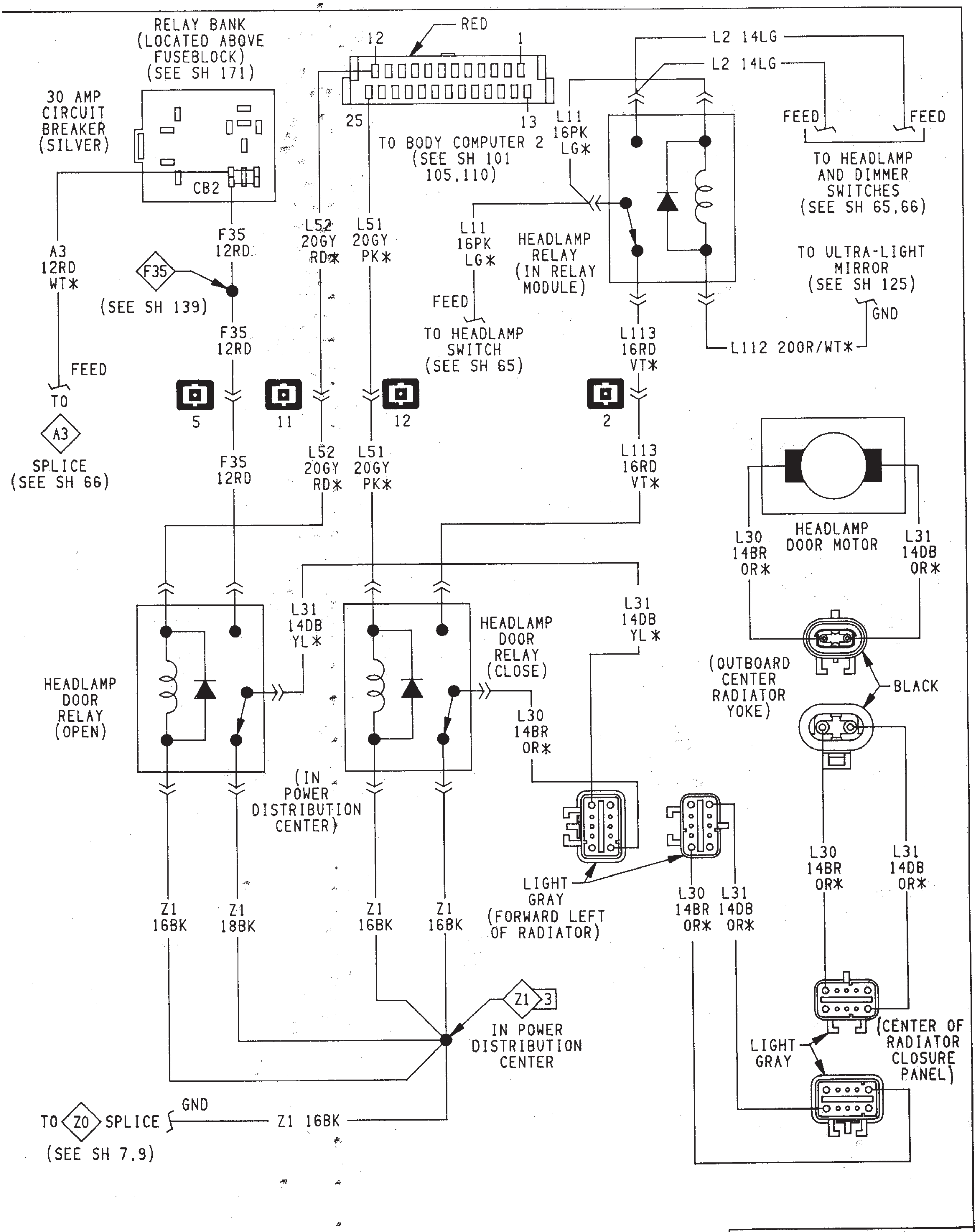
AC-CD,AY-C 66



AC-CD, AY-C 67

SEAT BELT WARNING SYSTEM

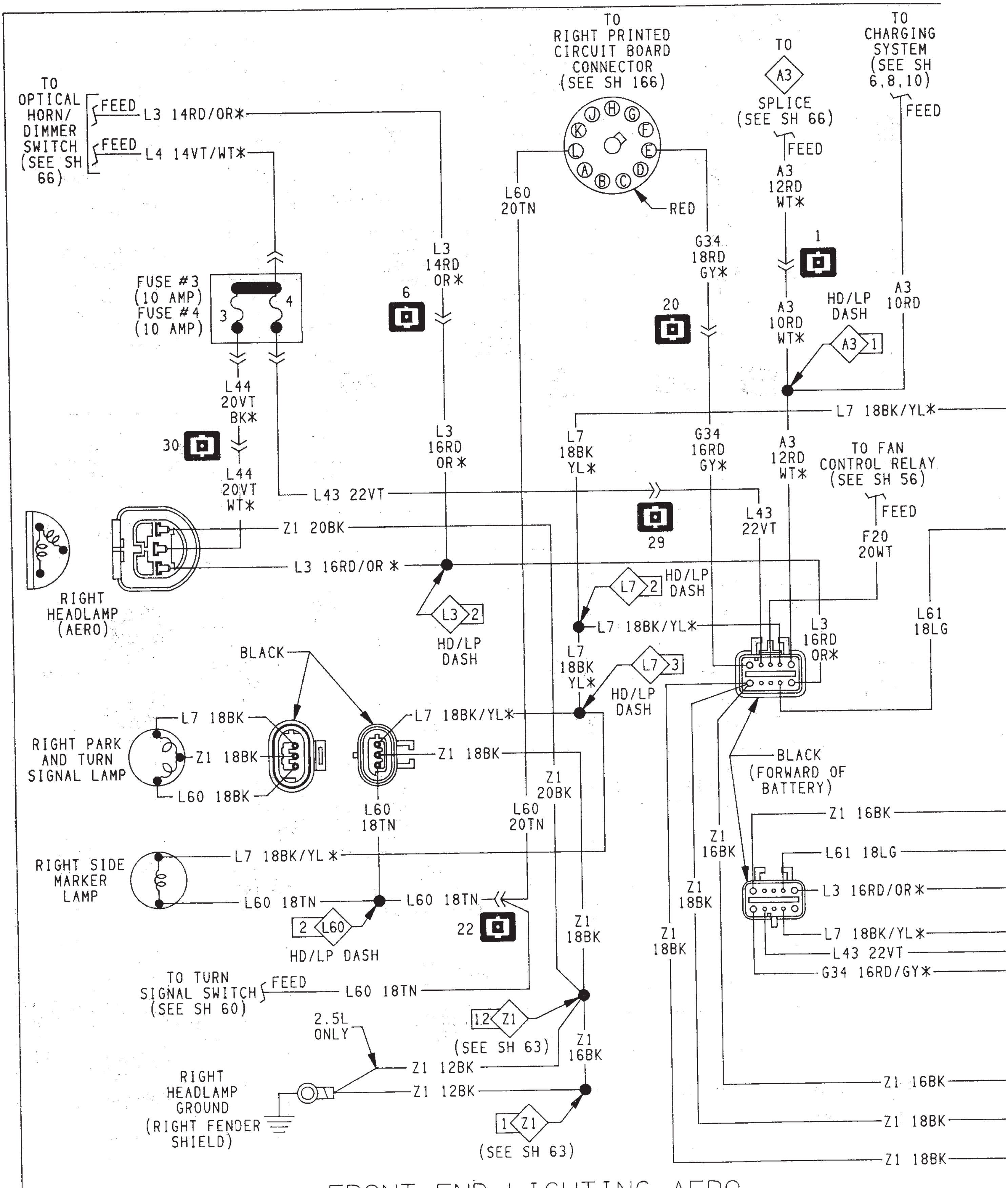
938W-3



938W-3

CONCEALED HEADLAMP CONTROLS

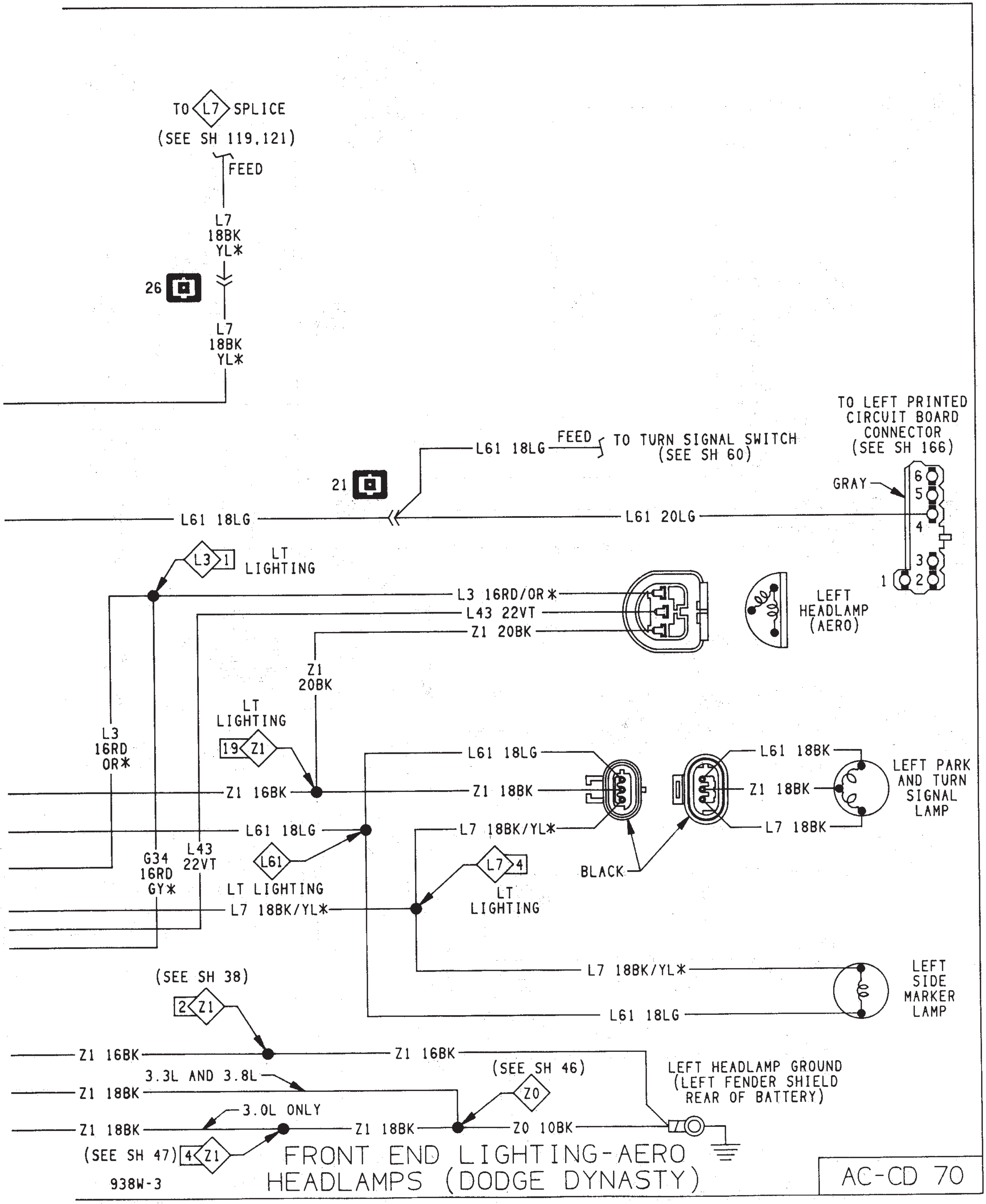
AC-CD,AY-C 68



AC-CD 69

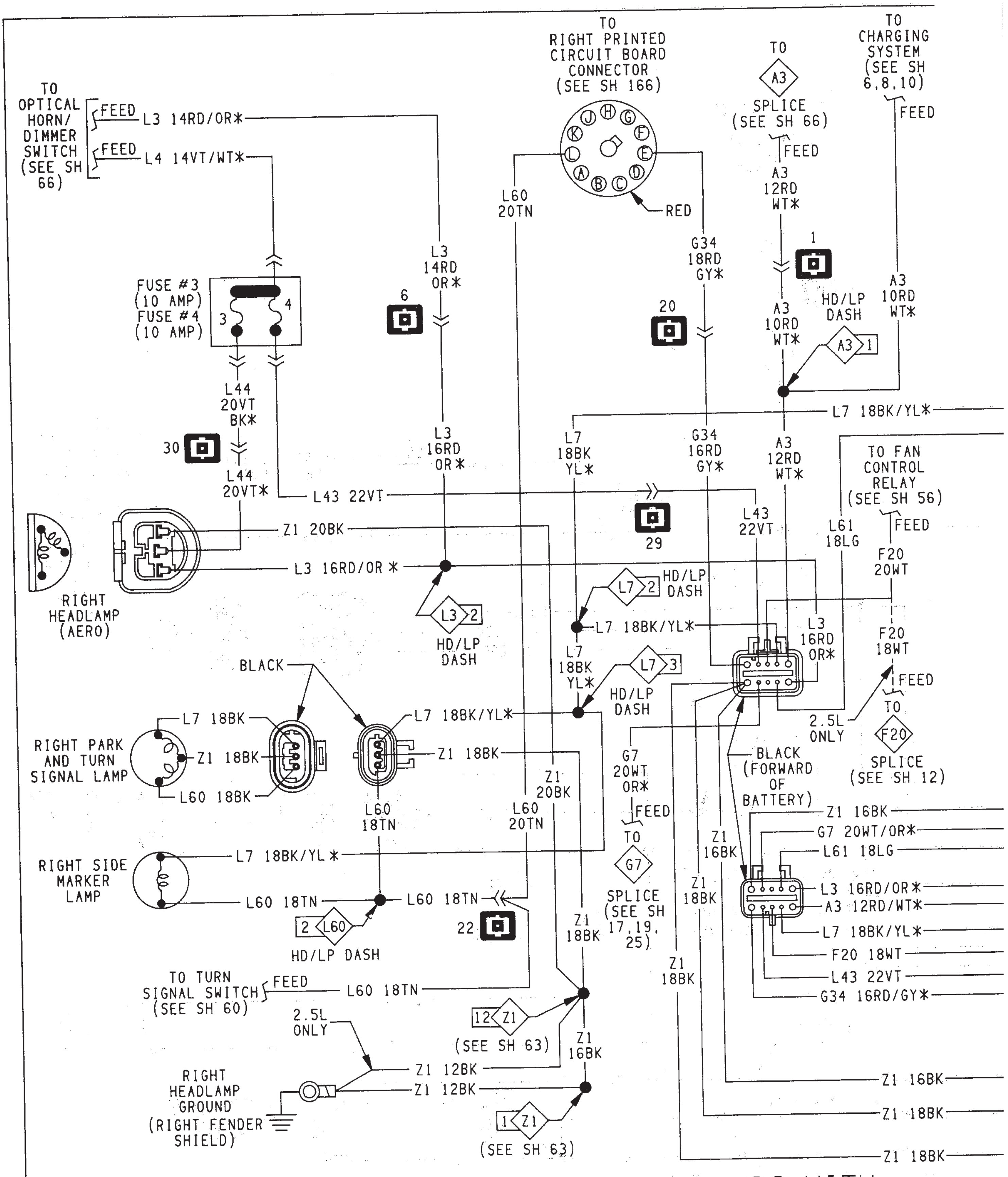
FRONT END LIGHTING-AERO HEADLAMPS (DODGE DYNASTY)

938W-3



FRONT END LIGHTING-AERO
HEADLAMPS (DODGE DYNASTY)

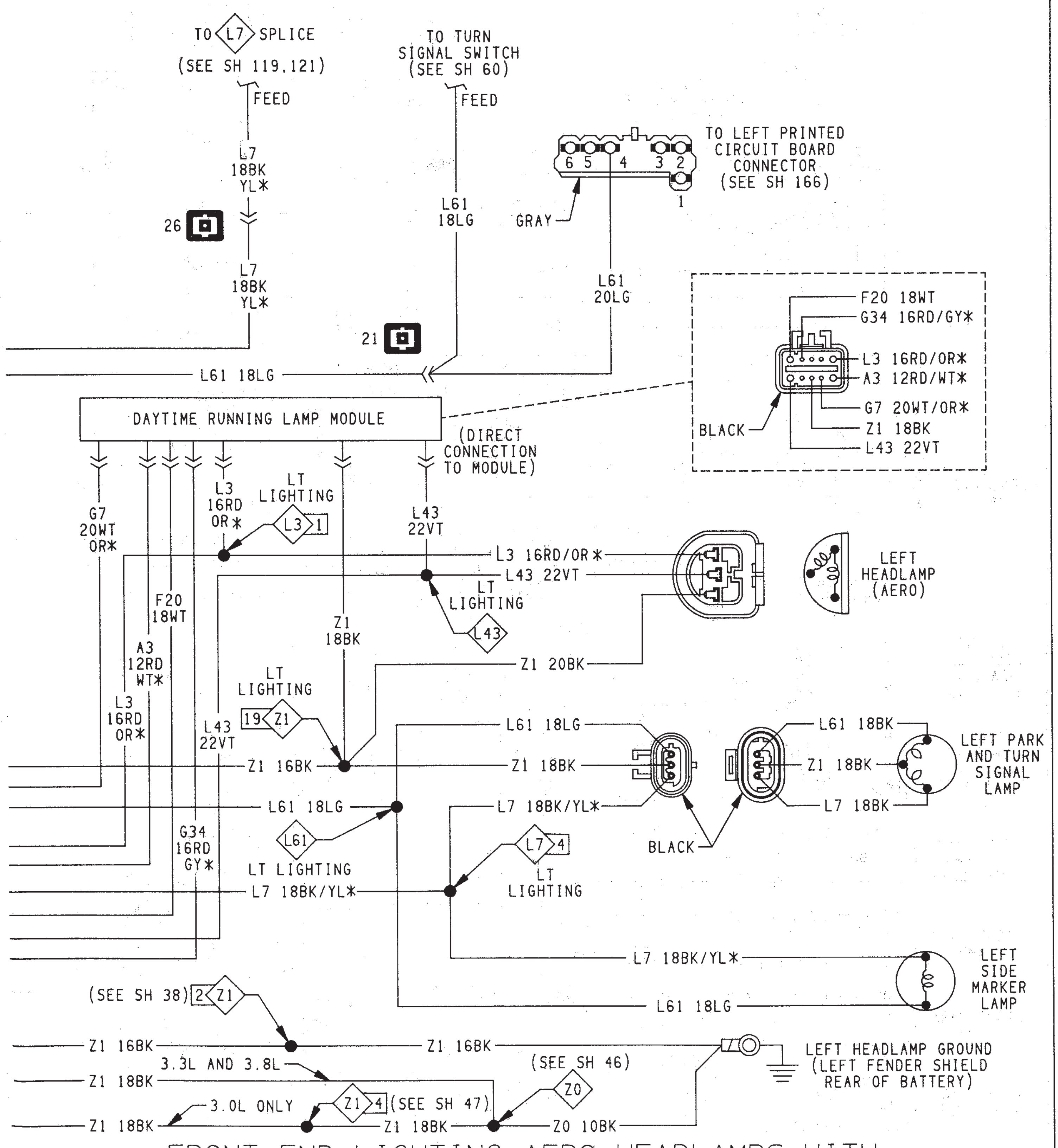
AC-CD 70



AC-CD 71

FRONT END LIGHTING-AERO HEADLAMPS WITH DAYTIME RUNNING LIGHTS (DODGE DYNASTY)

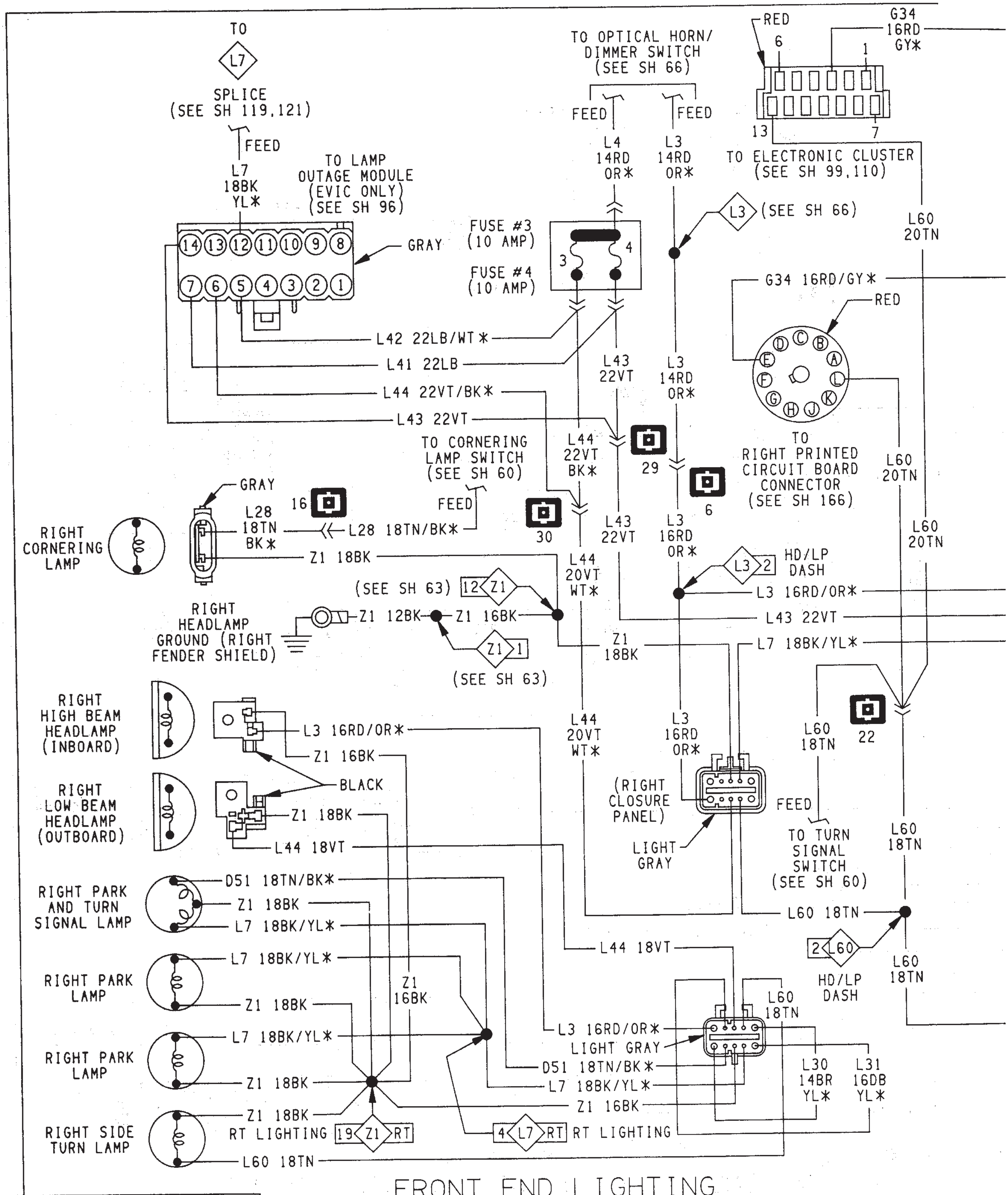
938W-3



FRONT END LIGHTING-AERO HEADLAMPS WITH DAYTIME RUNNING LIGHTS (DODGE DYNASTY)

938W-3

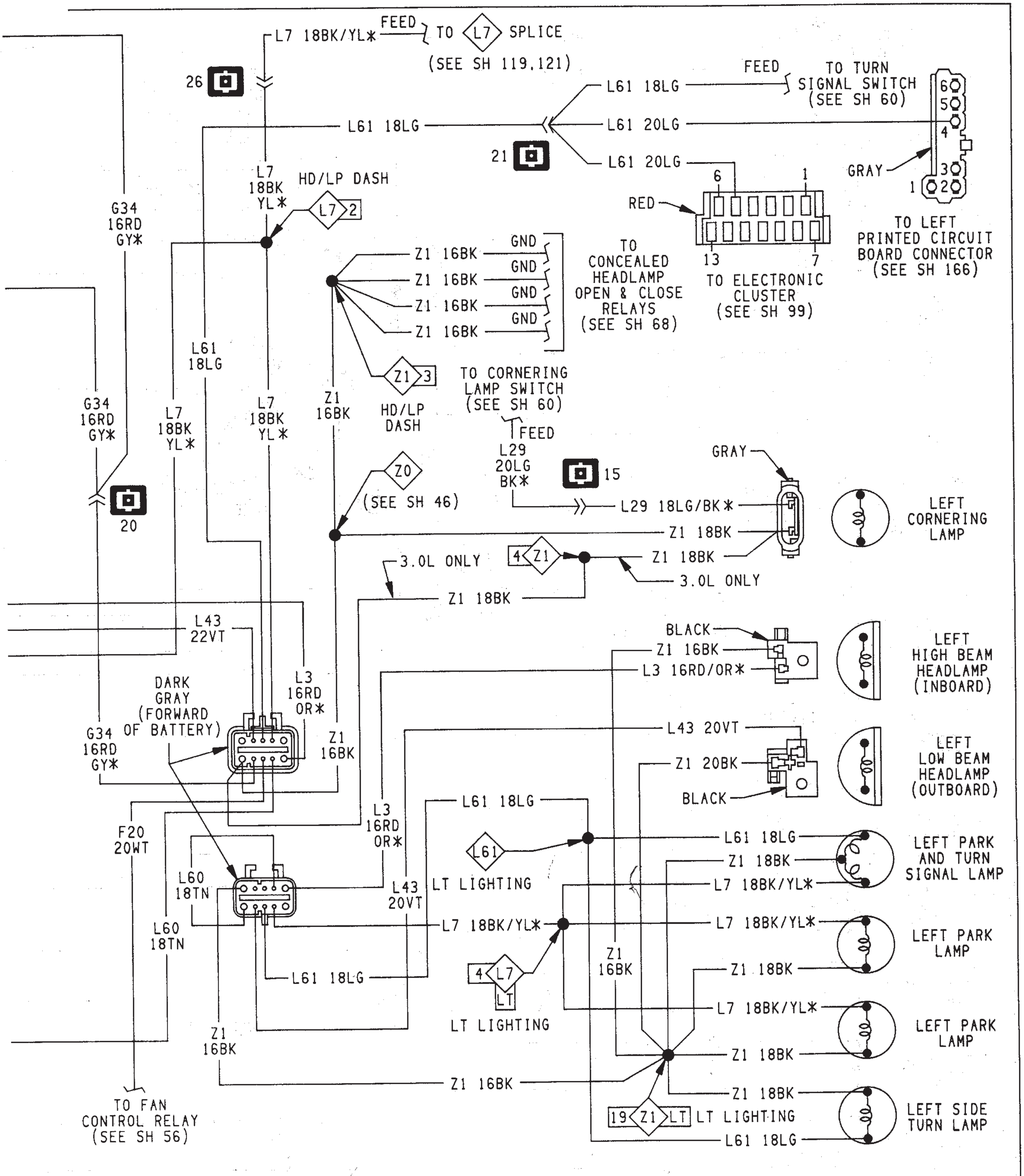
AC-CD 72



AY-C 73

FRONT END LIGHTING
CONCEALED HEADLAMPS (IMPERIAL)

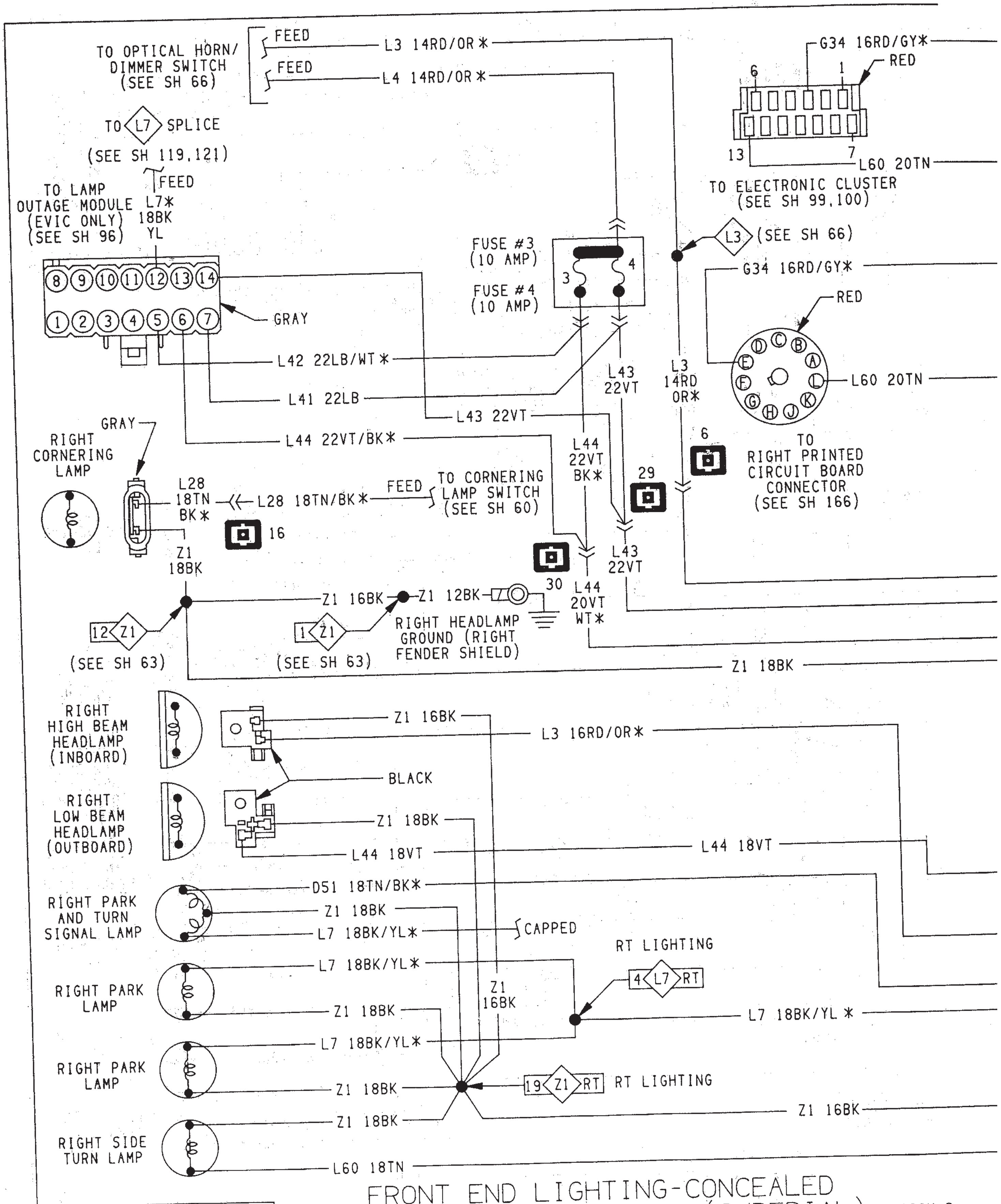
938W-3



938W-3

FRONT END LIGHTING
CONCEALED HEADLAMPS (IMPERIAL)

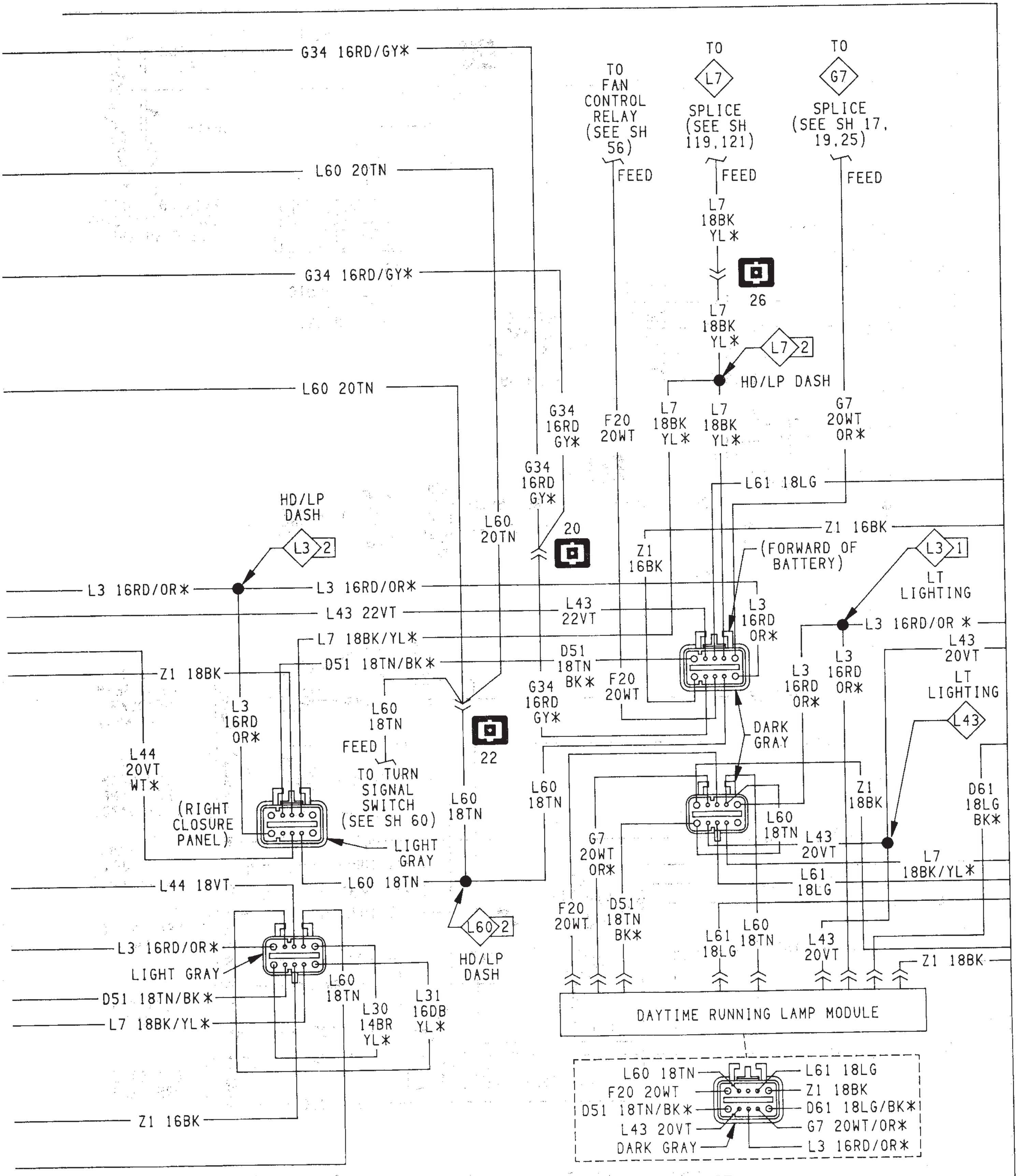
AY-C 74



AY-C 75

FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L.1(IMPERIAL)

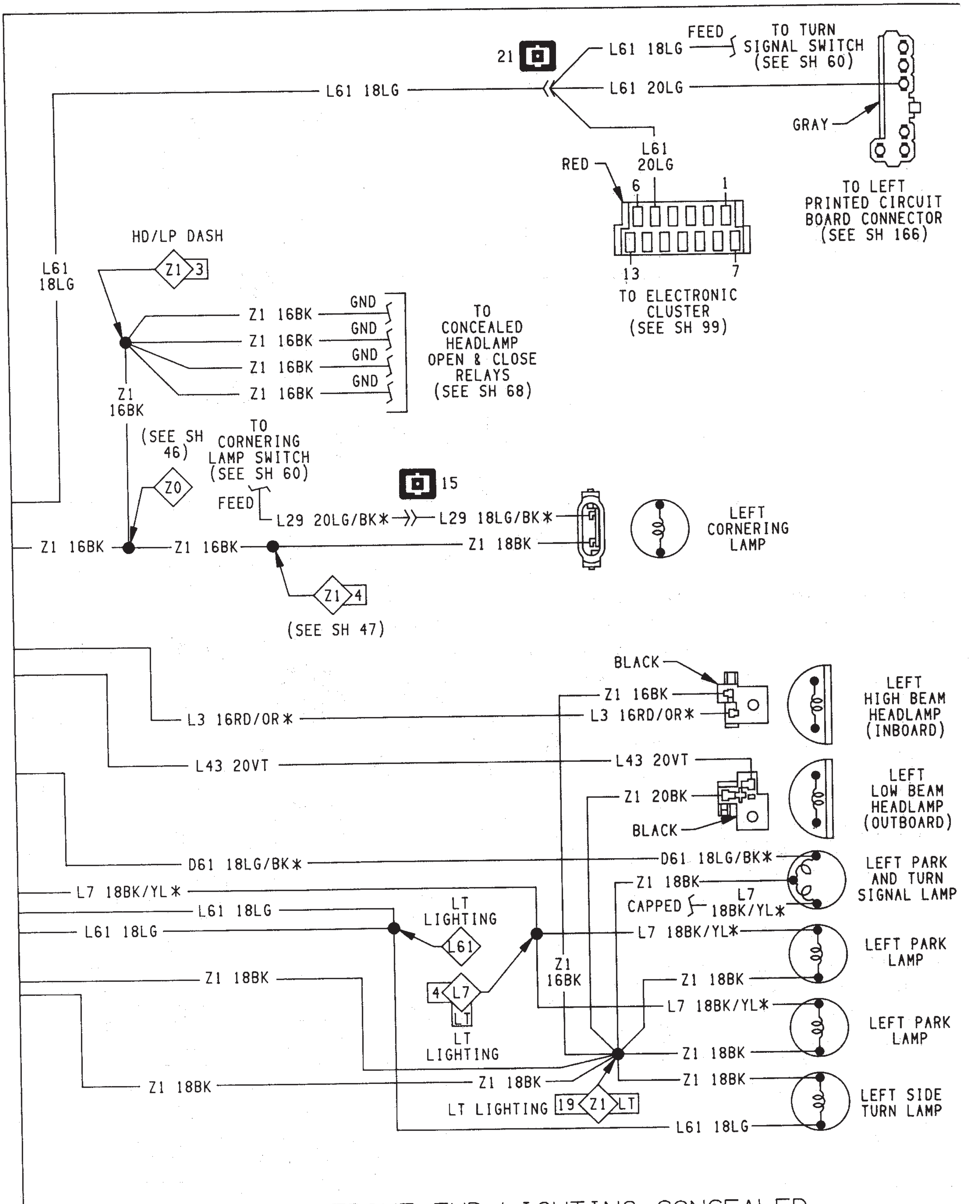
938W-3



938W-3

FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L. 1 (IMPERIAL)

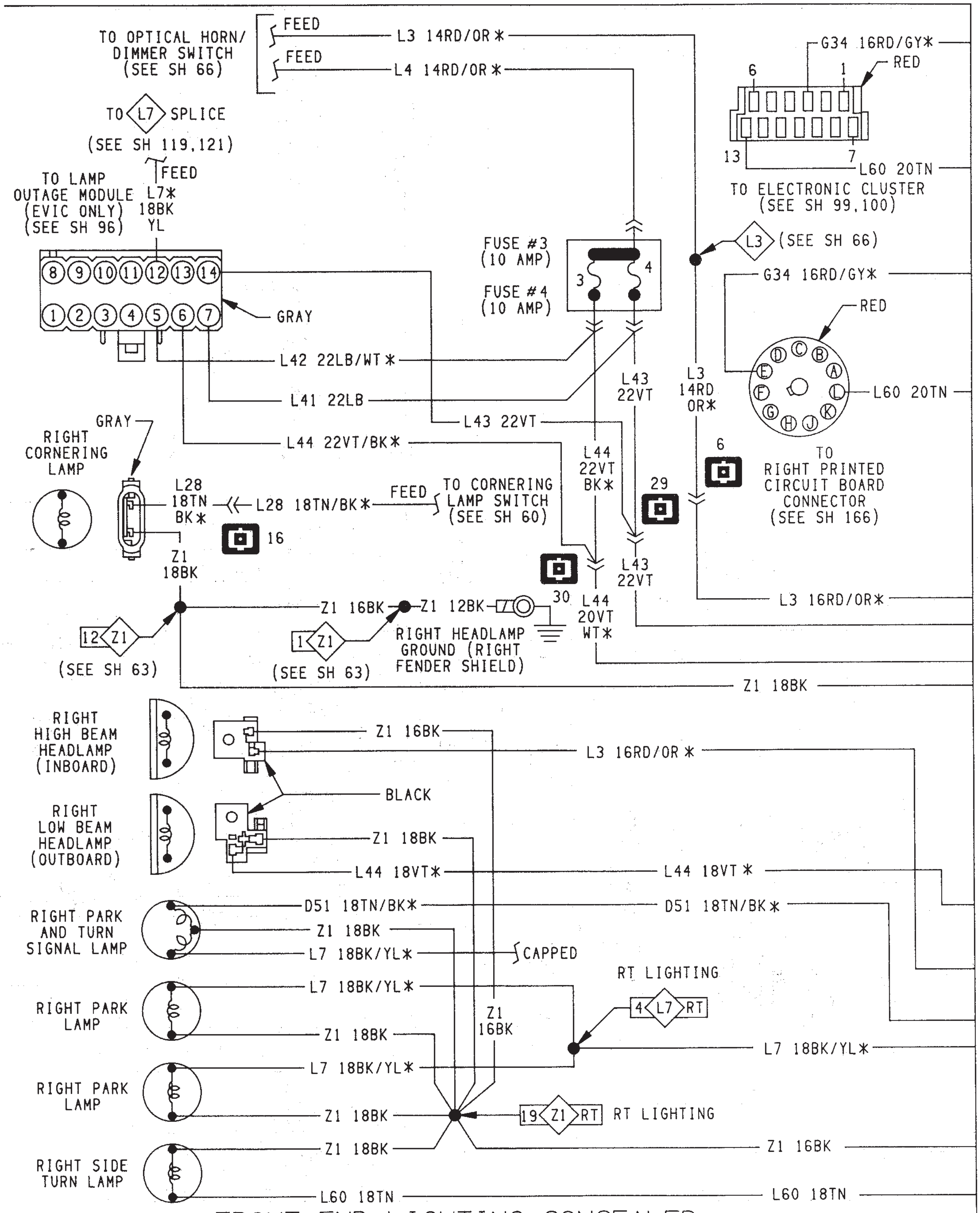
AY-C 76



FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L.1(IMPERIAL)

AY-C 77

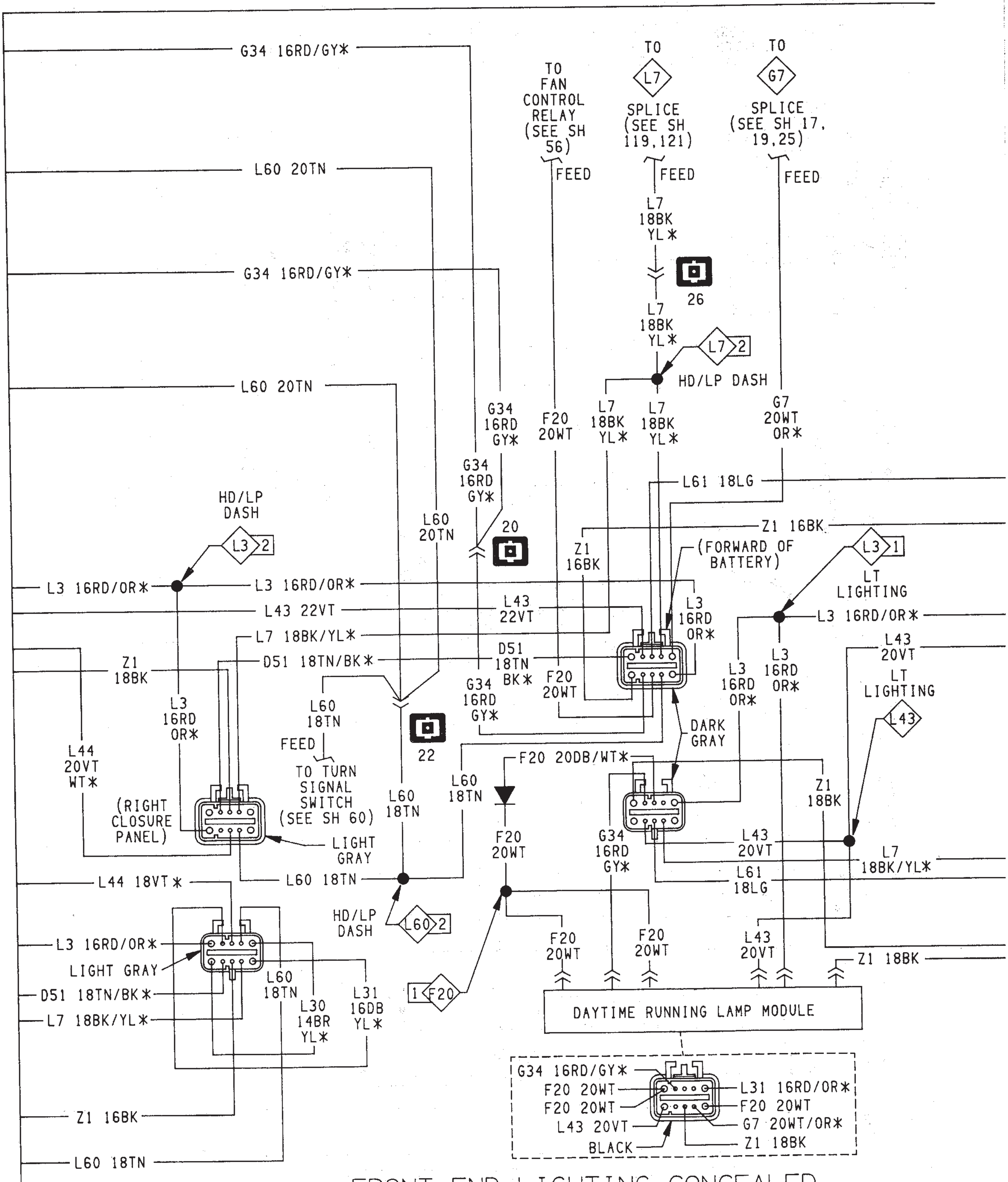
938W-3



FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L.2(IMPERIAL)

938W-9

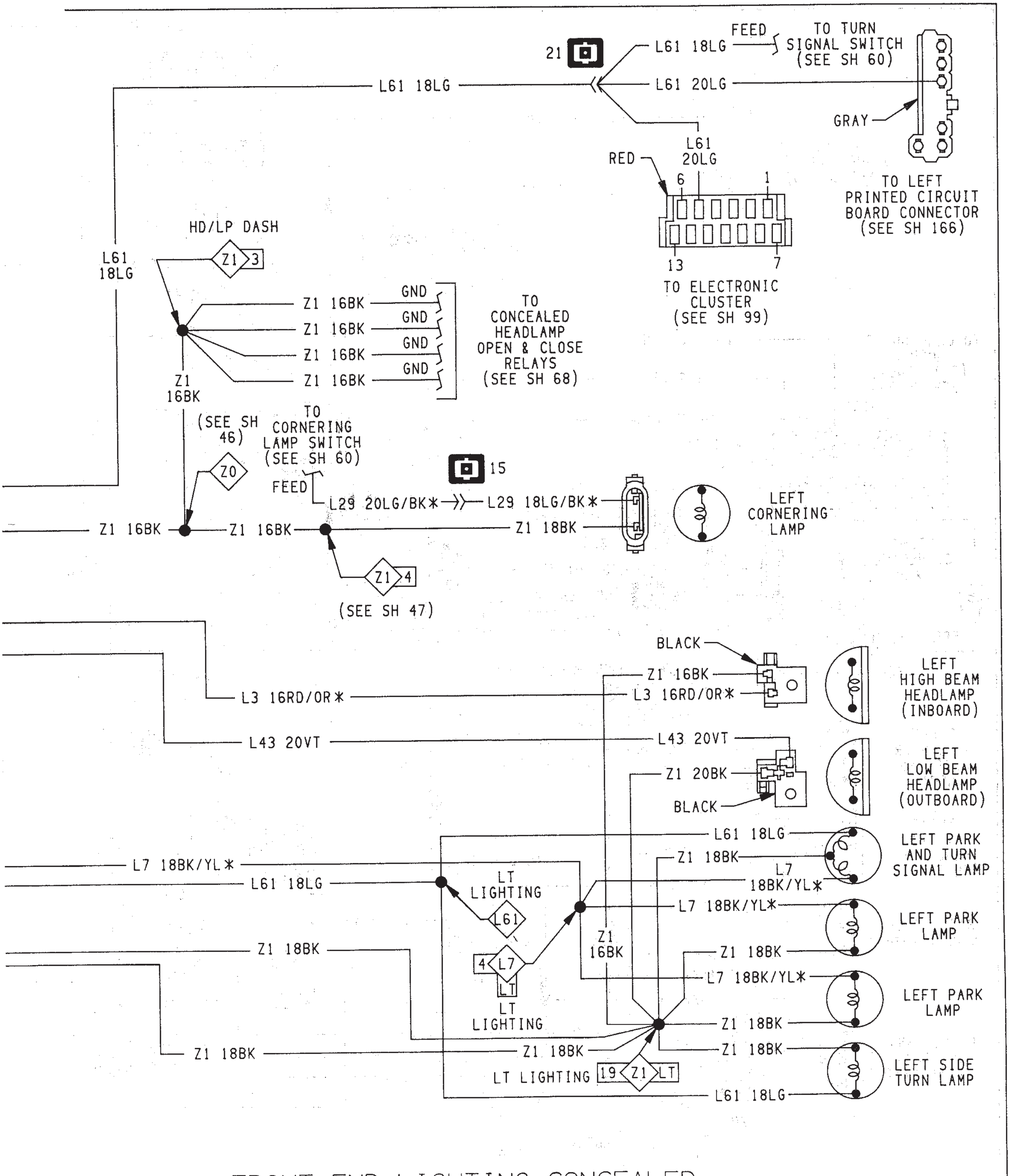
AY-C 78



AY-C 79

FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L.2(IMPERIAL)

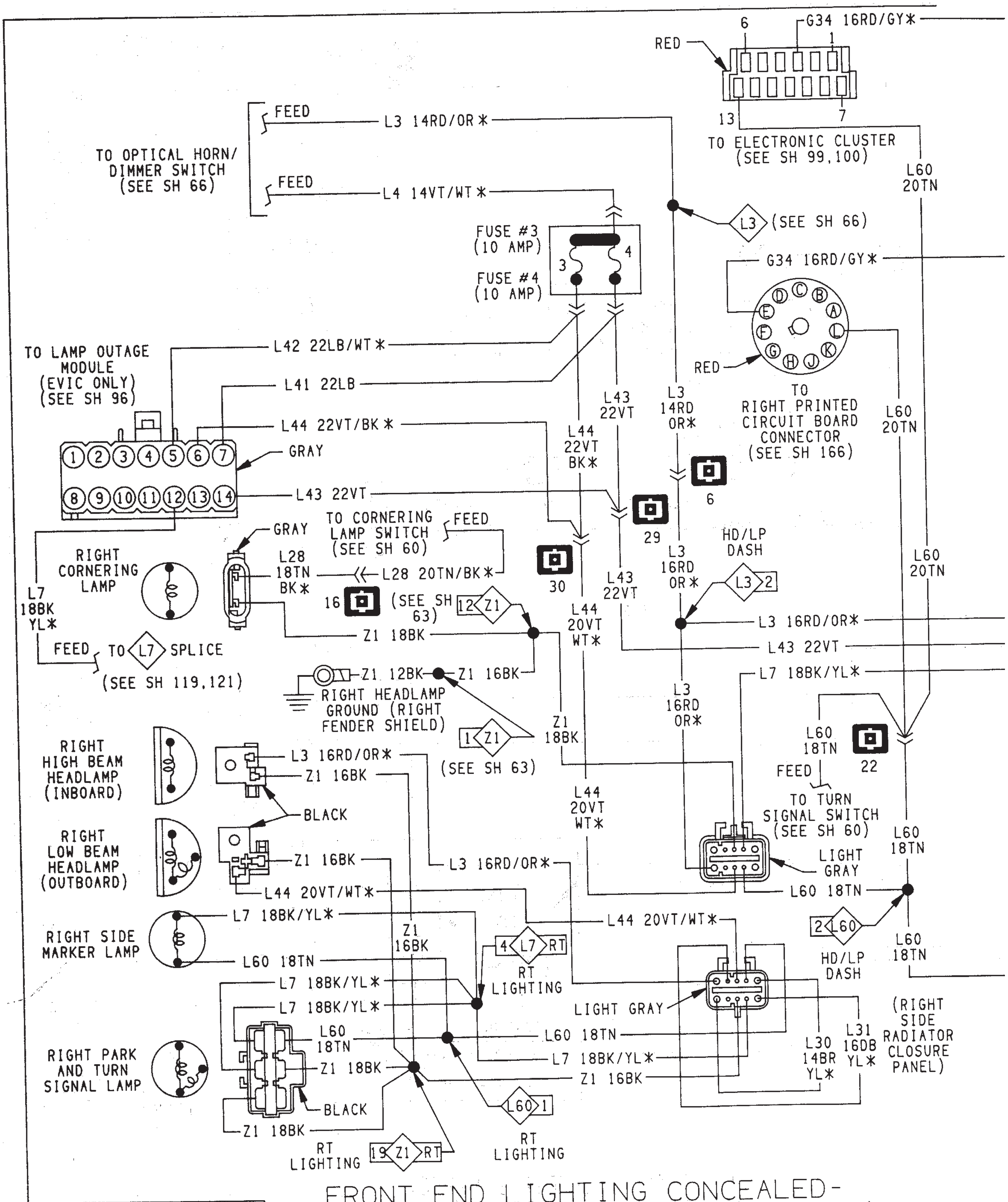
938W-3



938W-9

FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L.2(IMPERIAL)

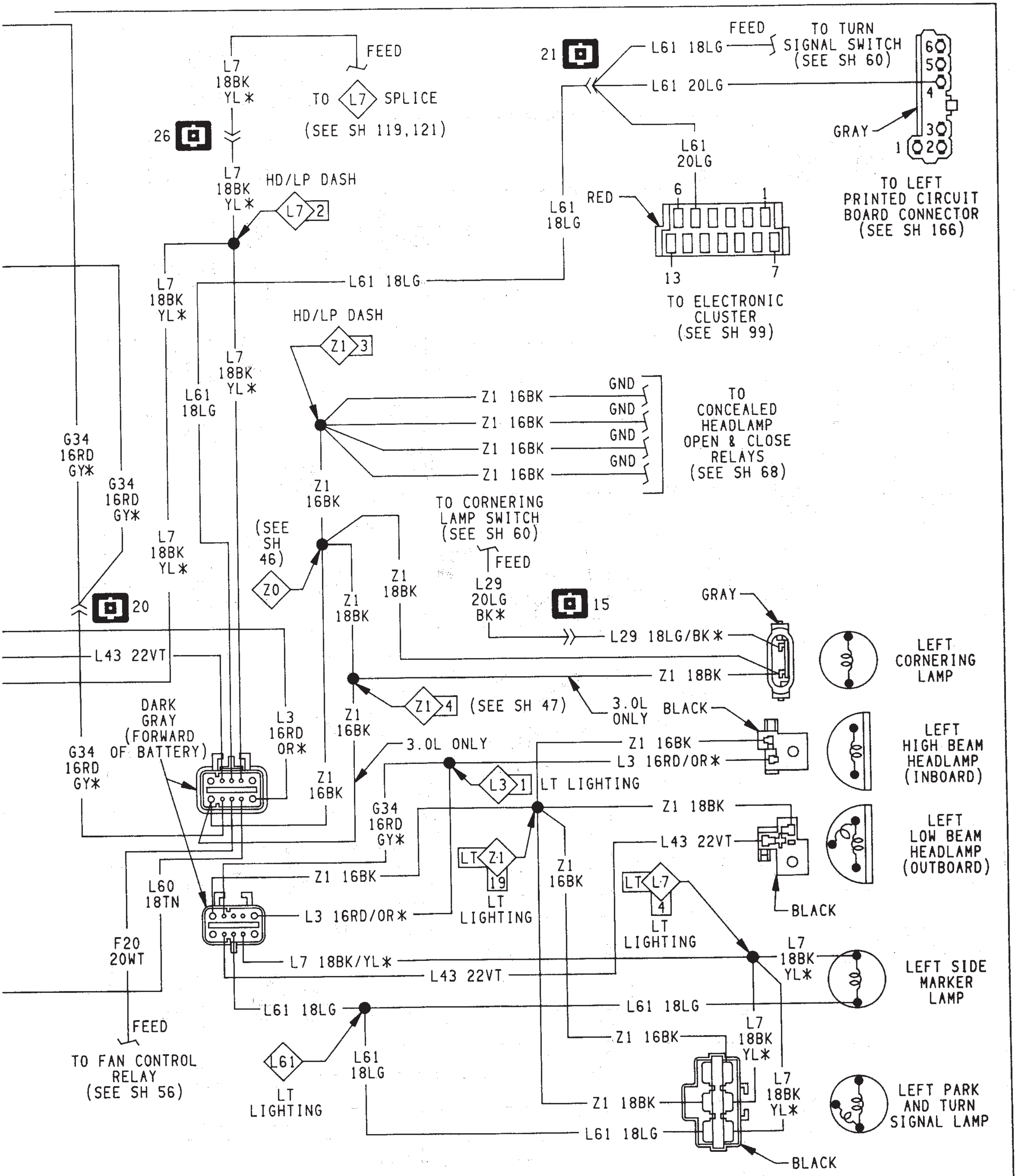
AY-C 80



AY-C 81

FRONT END LIGHTING CONCEALED-HEADLAMPS (NEW YORKER/5TH AVENUE)

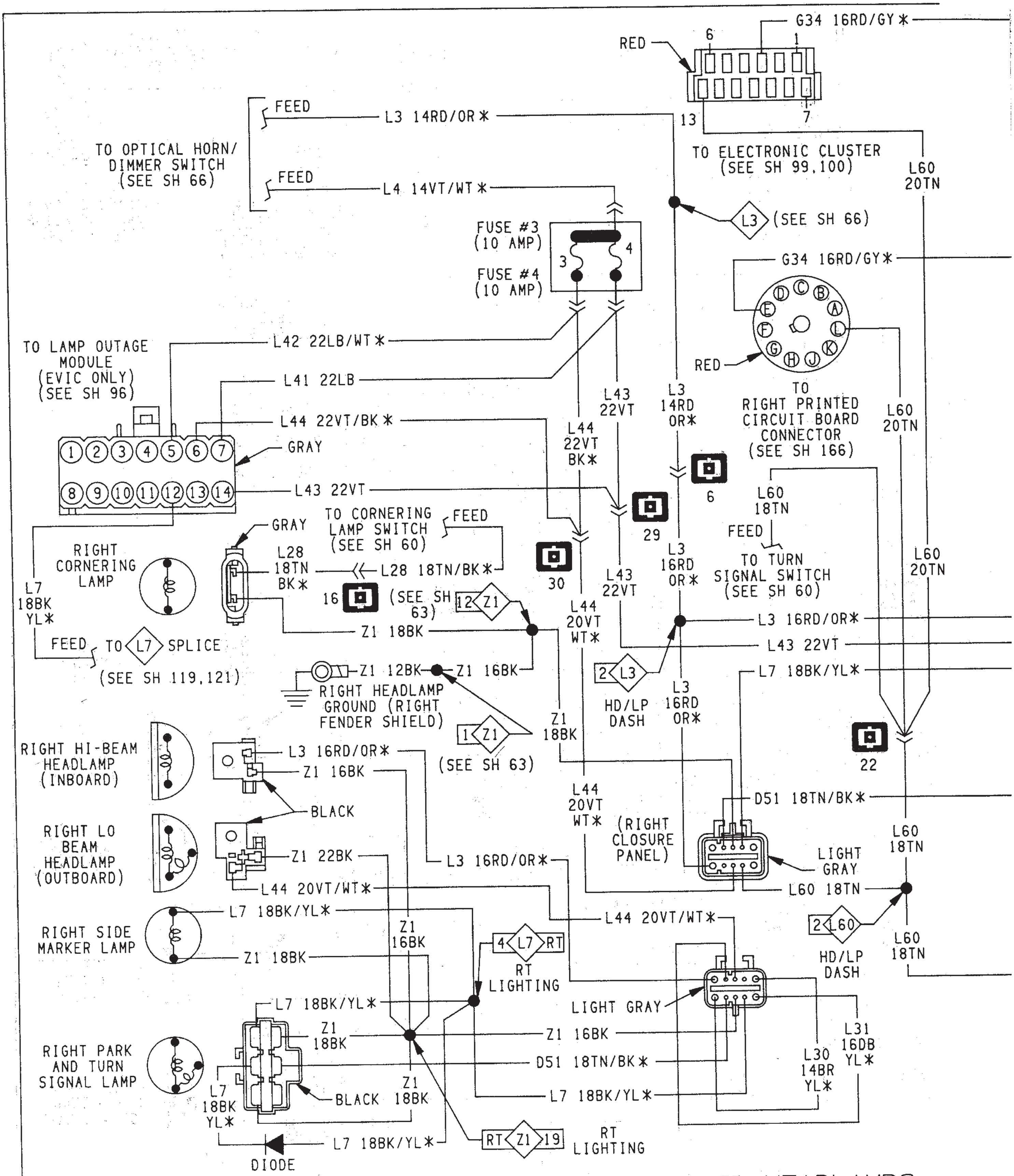
938W-3



FRONT END LIGHTING CONCEALED-HEADLAMPS (NEW YORKER/5TH AVENUE)

938W-3

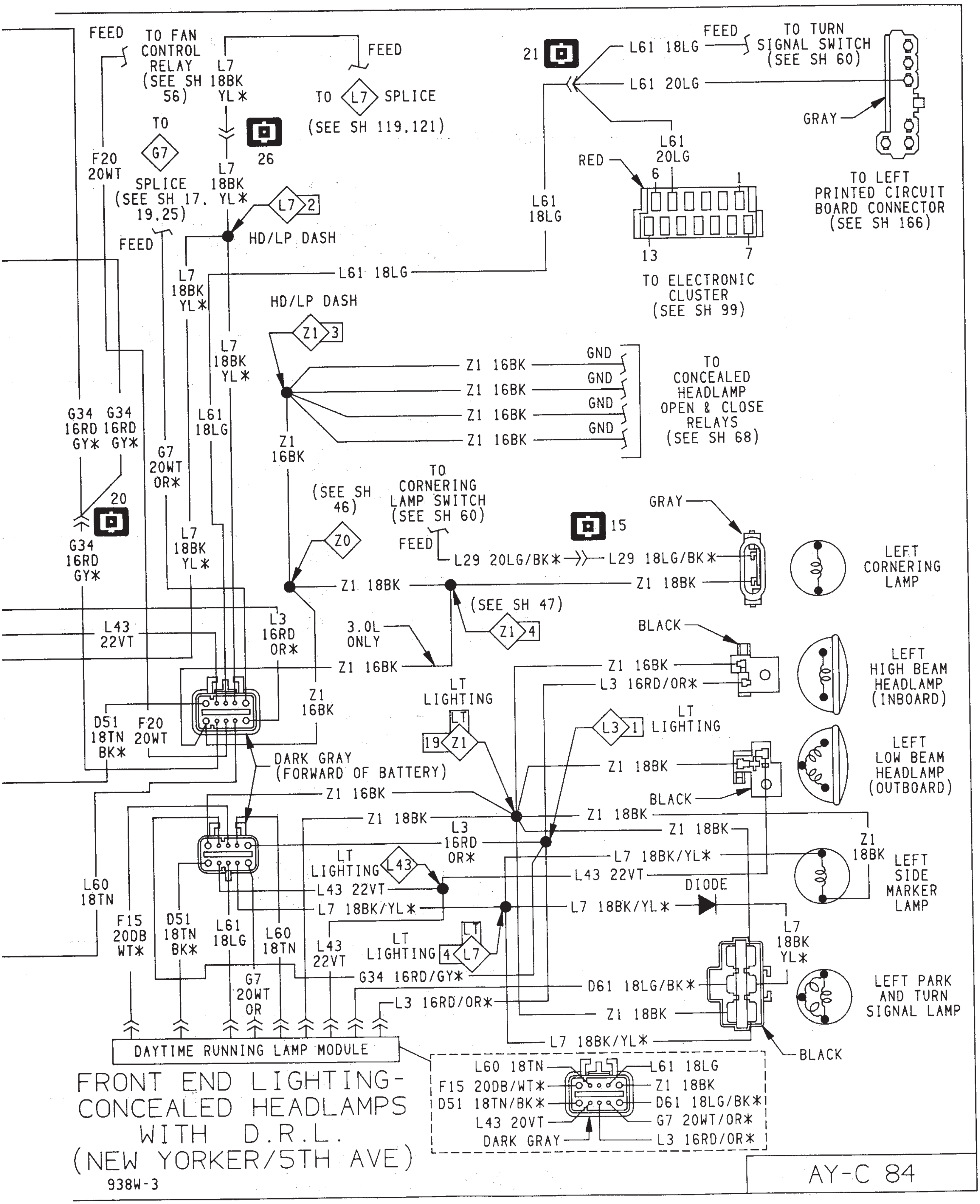
AY-C 82



AY-C 83

FRONT END LIGHTING-CONCEALED HEADLAMPS WITH D.R.L. (NEW YORKER/5TH AVE)

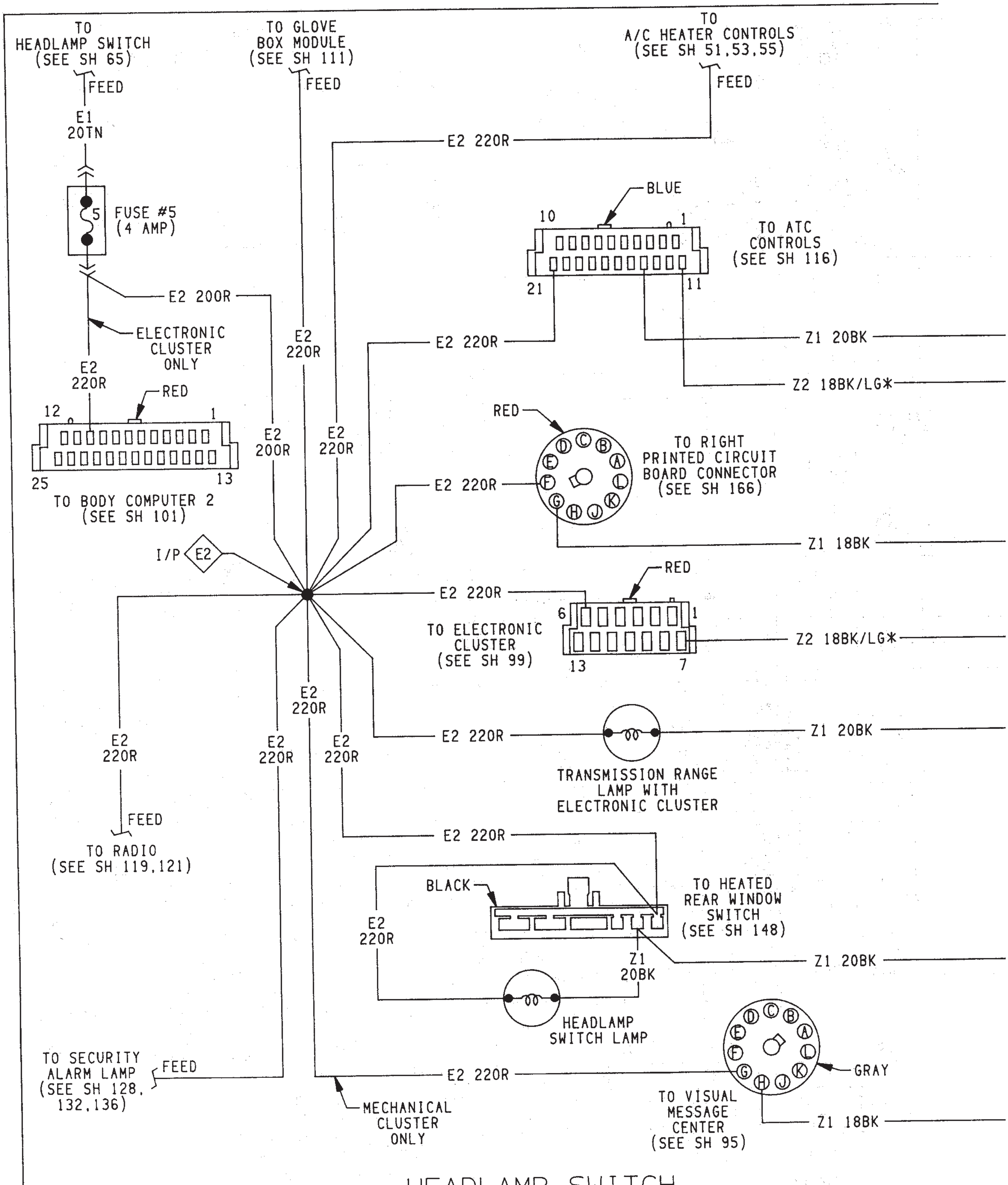
938W-3



FRONT END LIGHTING-
CONCEALED HEADLAMPS
WITH D.R.L.
(NEW YORKER/5TH AVE)

938W-3

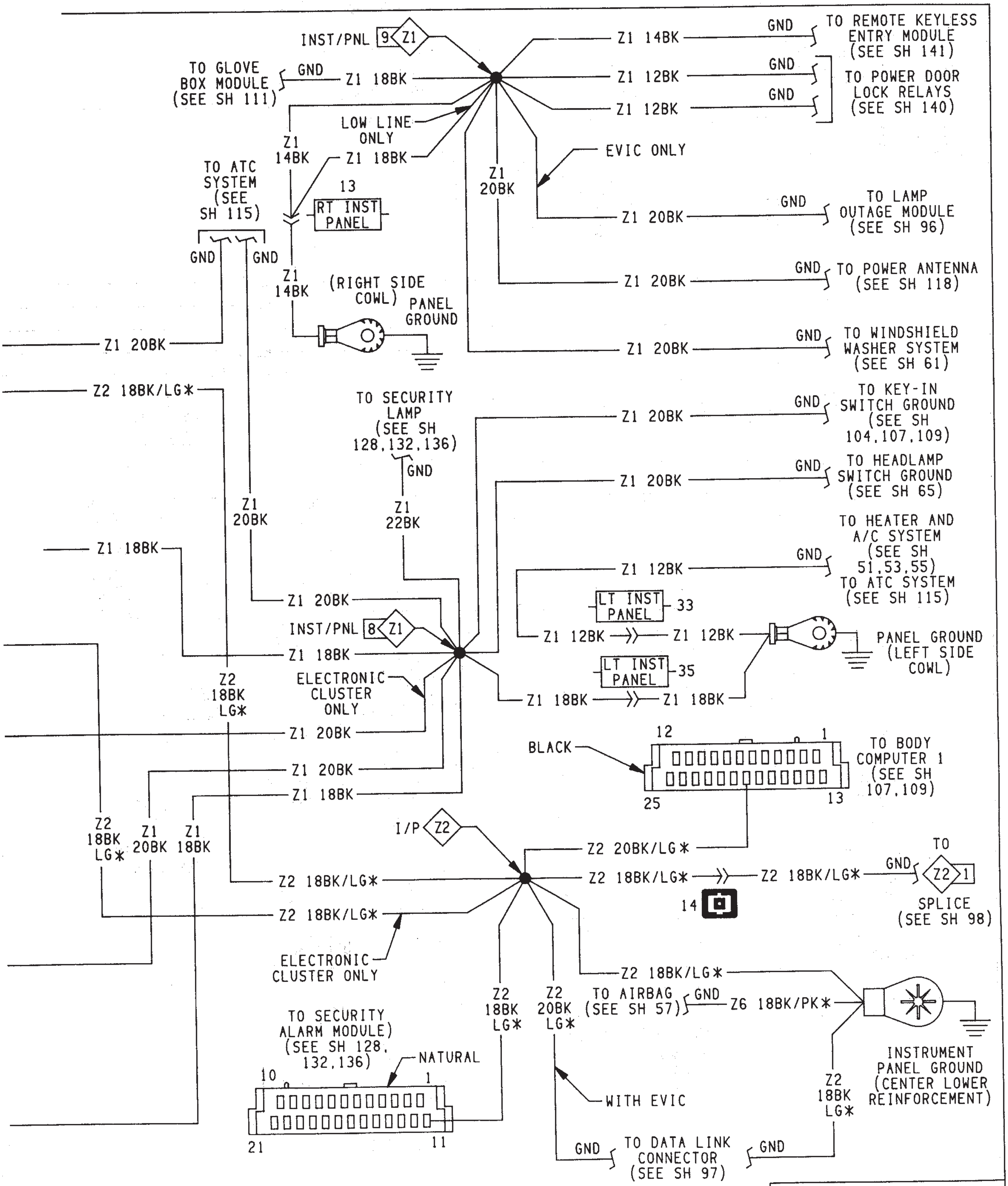
AY-C 84



HEADLAMP SWITCH CONTROLLED INTERIOR LIGHTING

AC-CD, AY-C 85

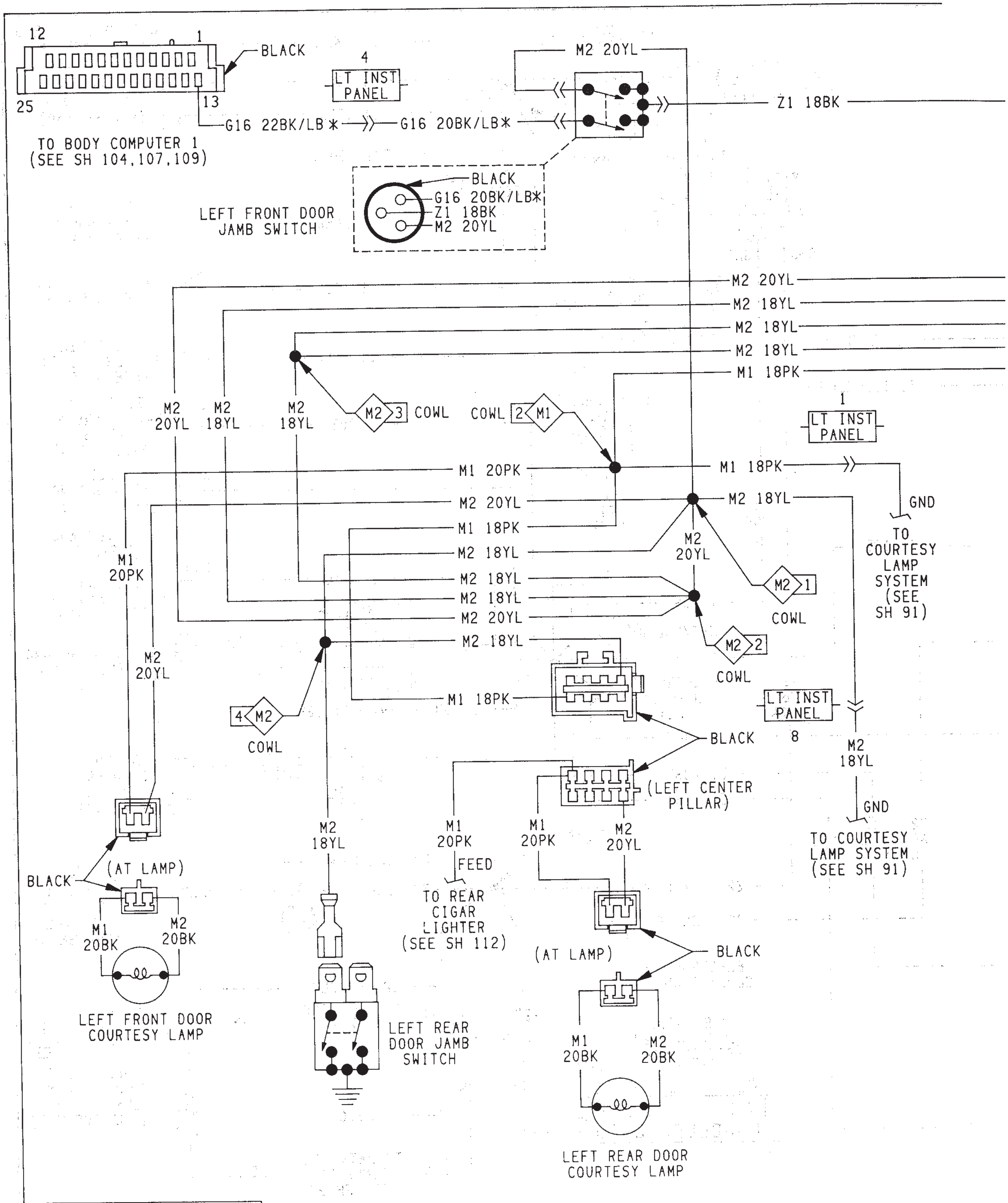
938W-3



938W-3

INSTRUMENT PANEL GROUND SYSTEM

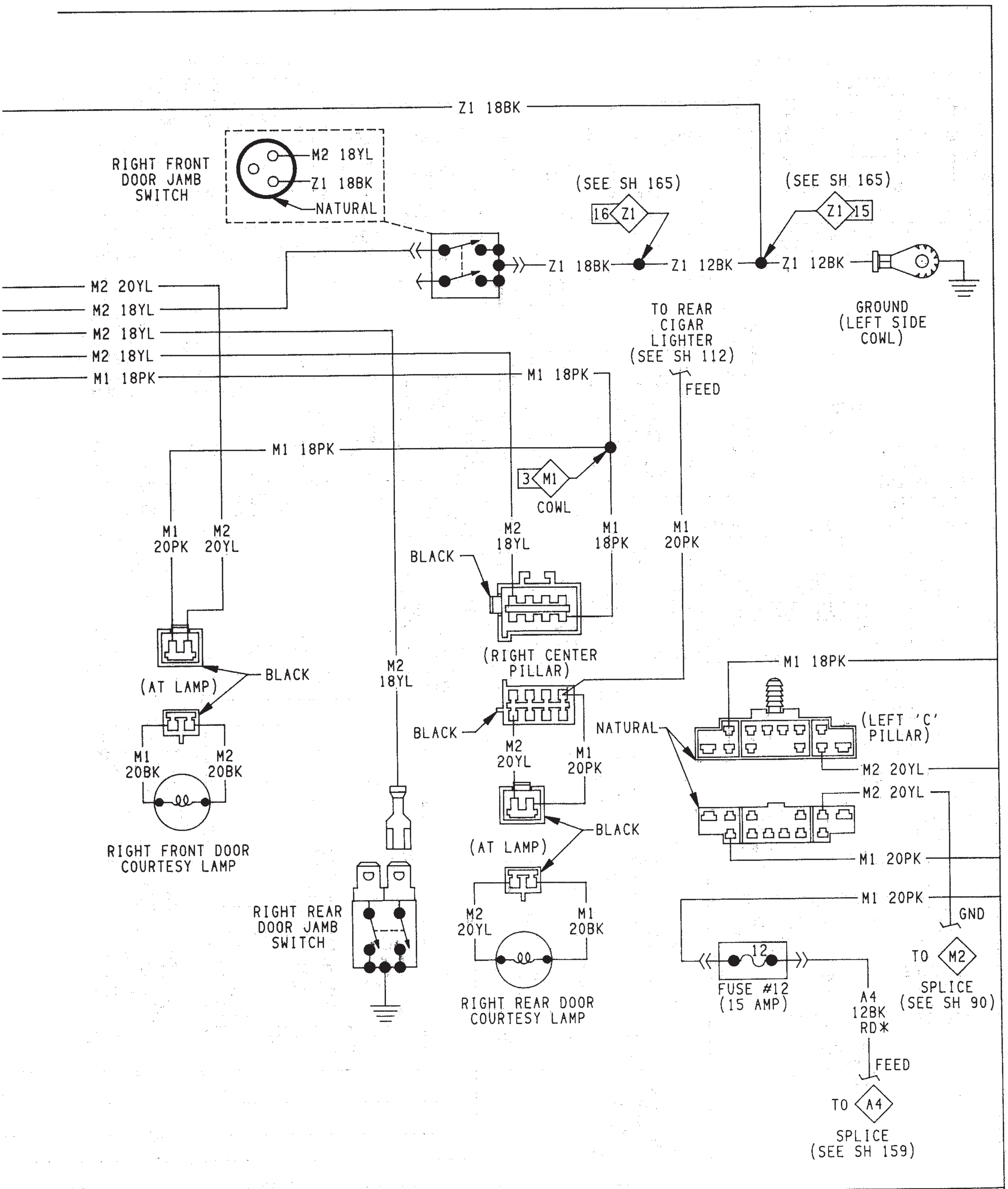
AC-CD, AY-C 86



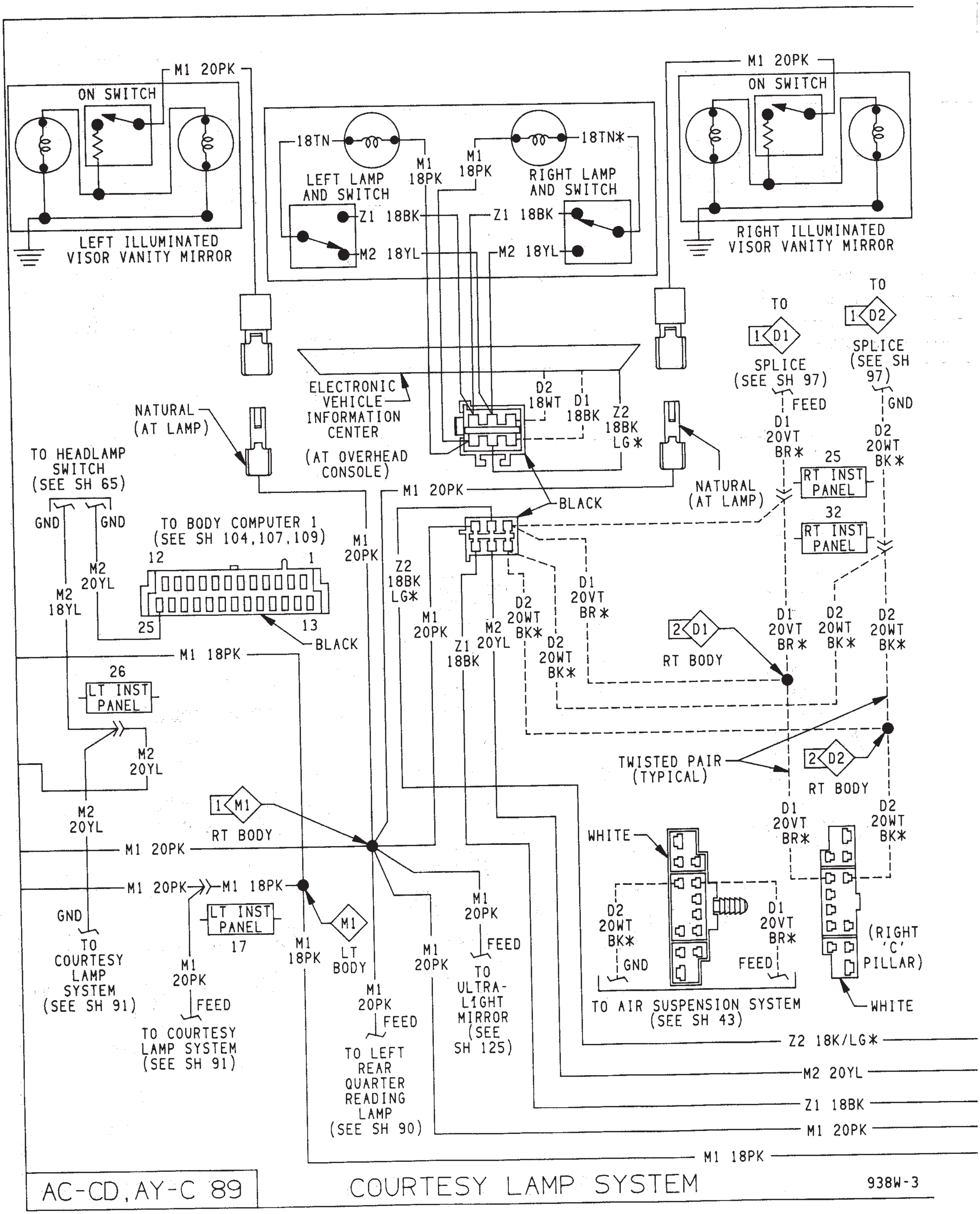
AC-CD, AY-C 87

COURTESY LAMP SYSTEM

938W-3



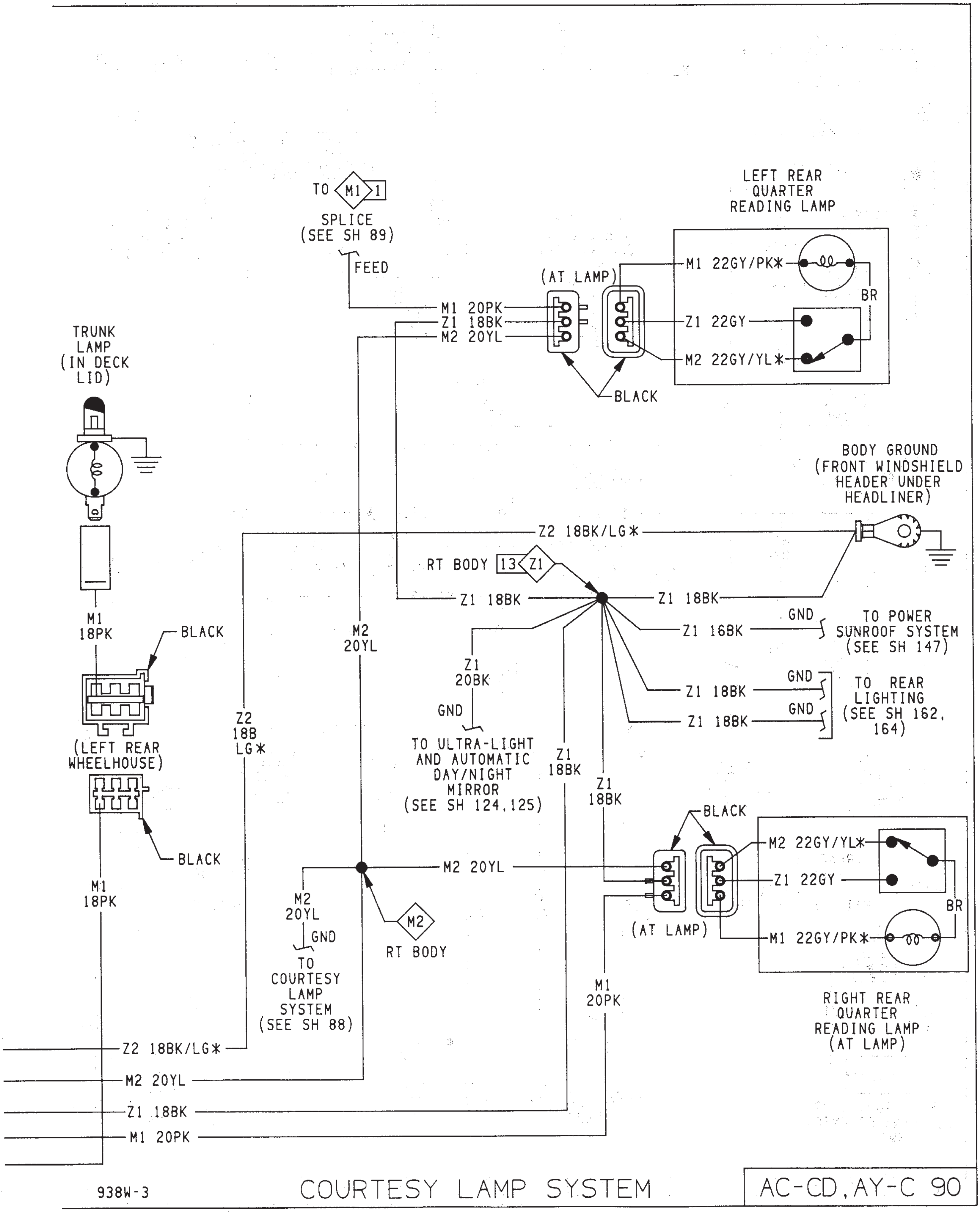
COURTESY LAMP SYSTEM



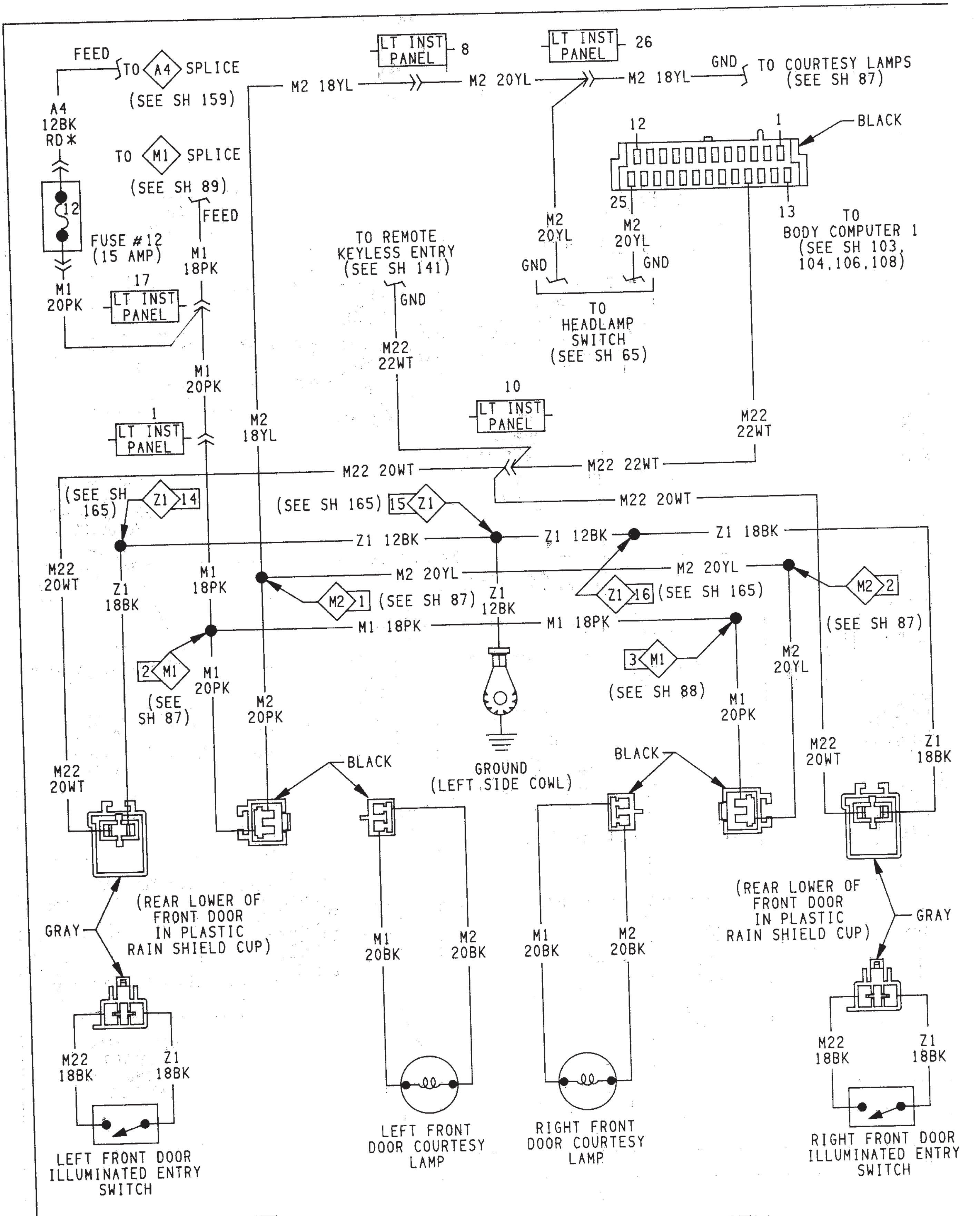
AC-CD, AY-C 89

COURTESY LAMP SYSTEM

938W-3



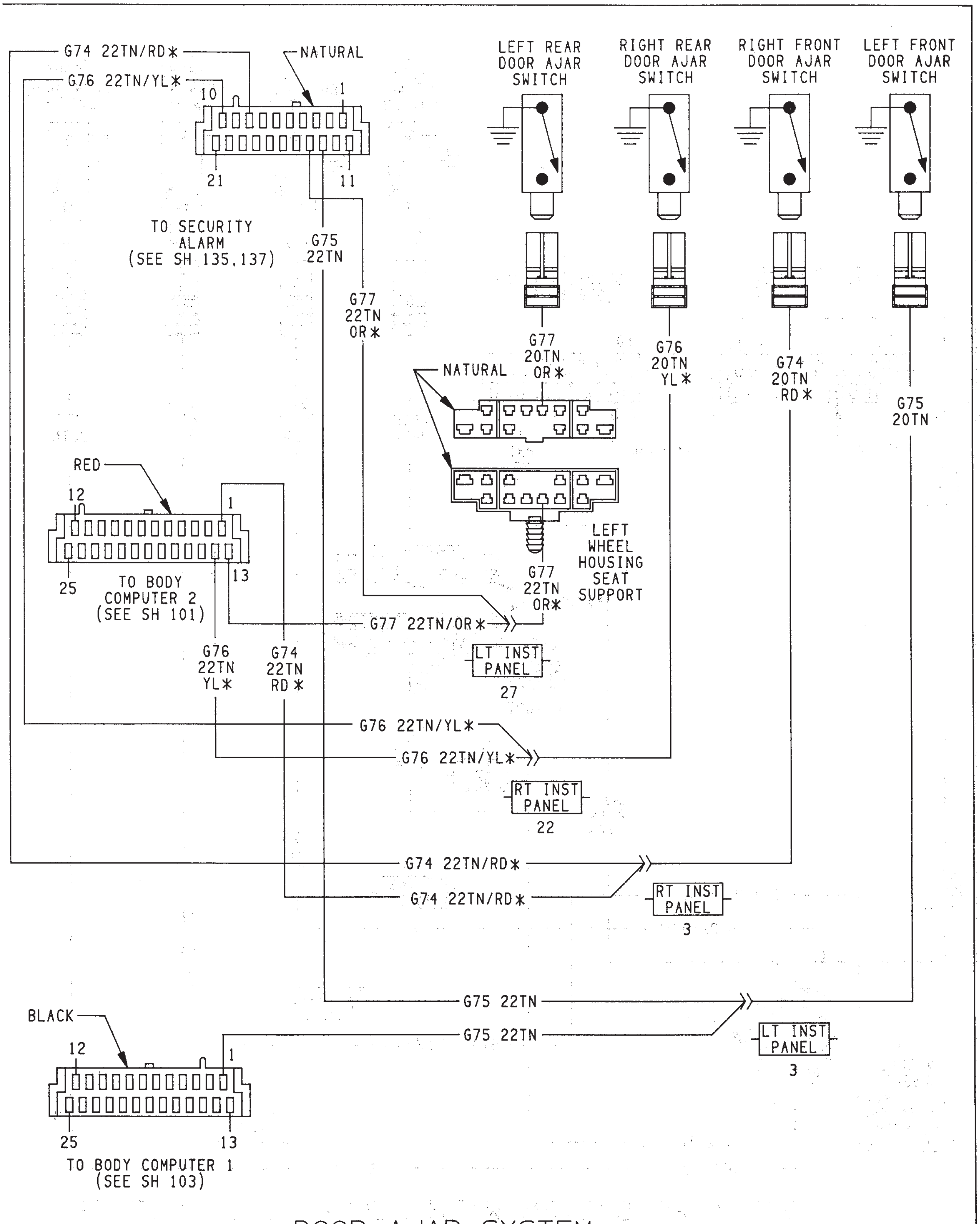
COURTESY LAMP SYSTEM



AC-CD, AY-C 91

ILLUMINATED ENTRY SYSTEM

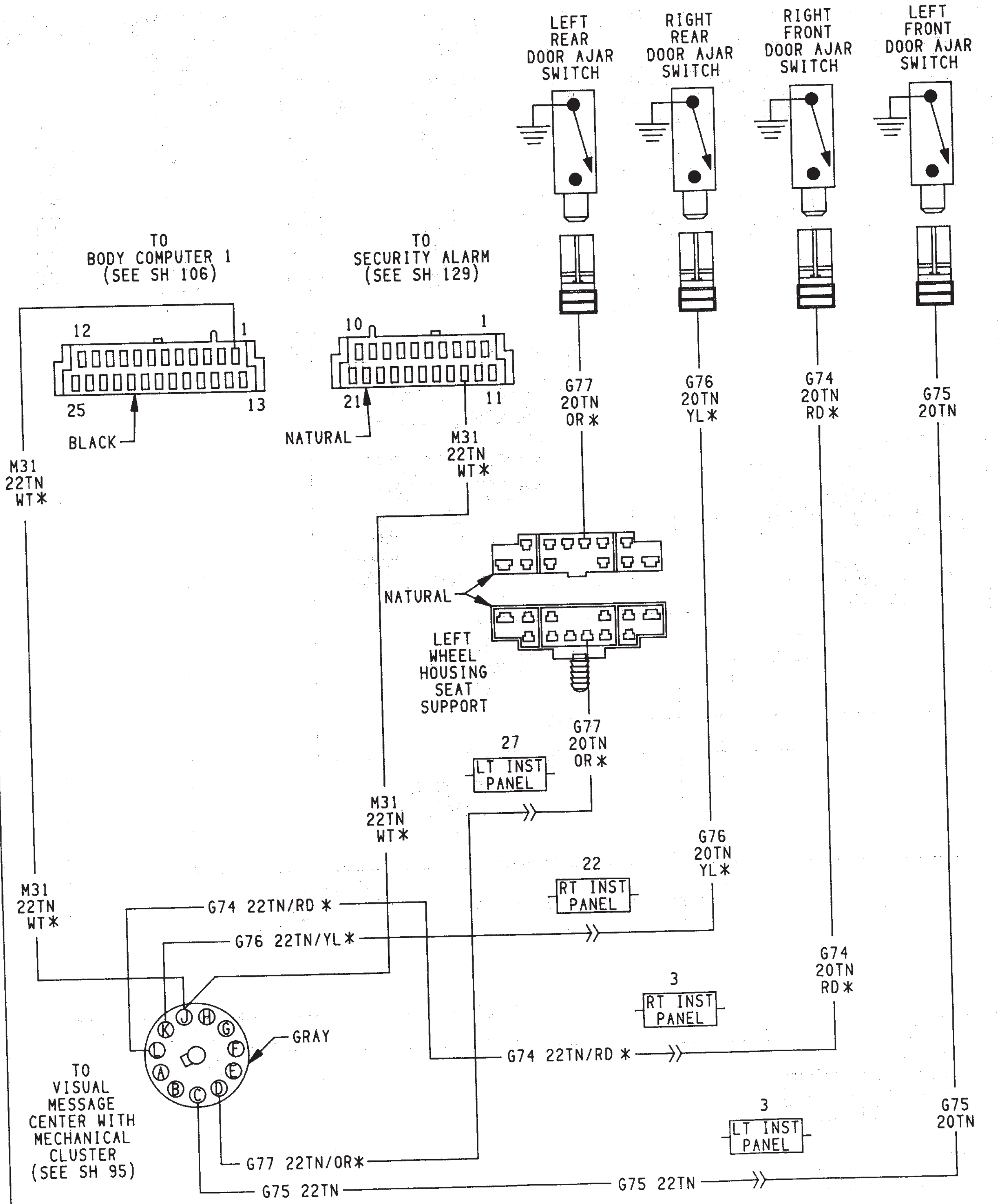
938W-3



DOOR AJAR SYSTEM WITH ELECTRONIC CLUSTER

938W-3

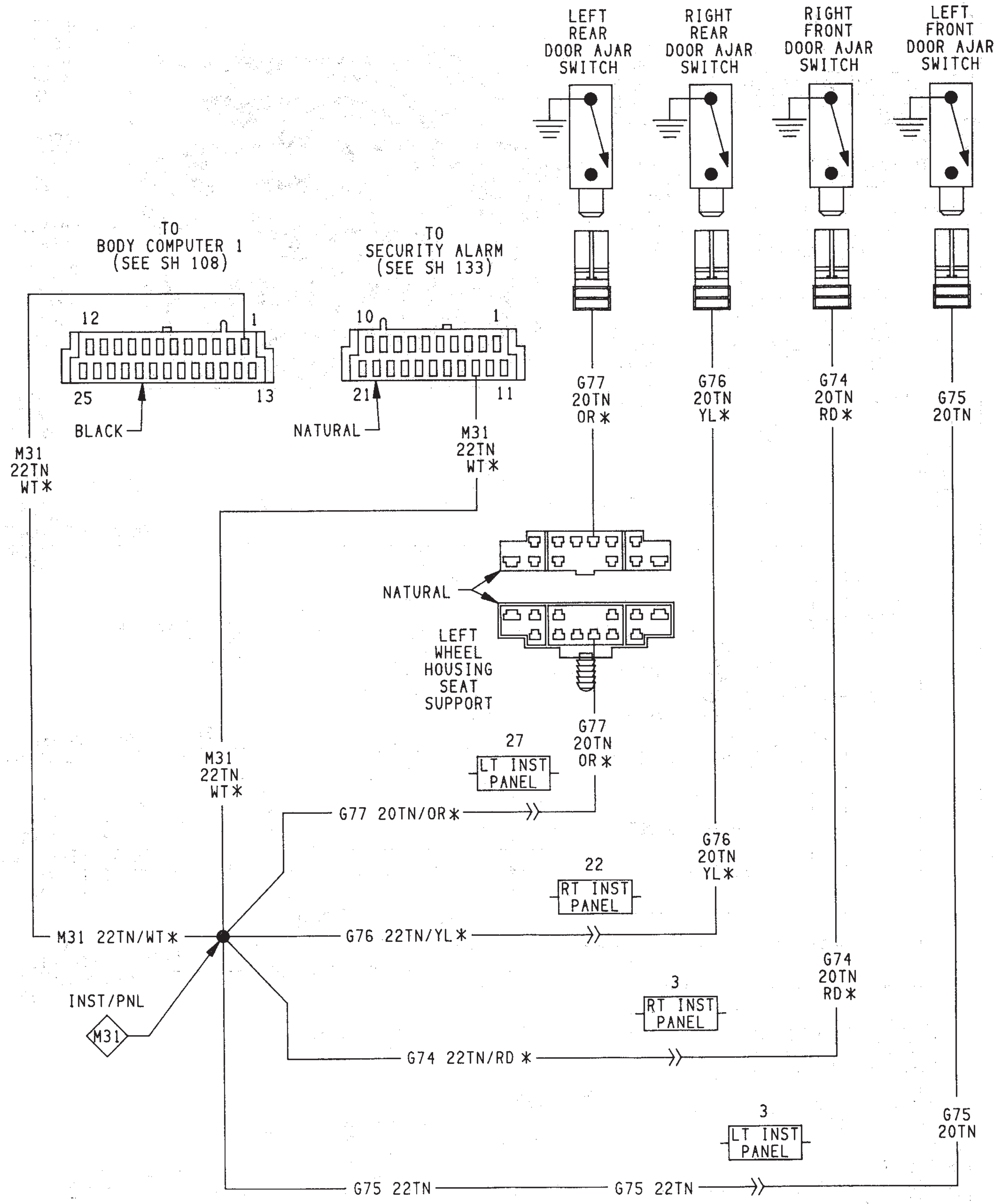
AC-CD,AY-C 92



DOOR AJAR SYSTEM WITH MECHANICAL CLUSTER AND VISUAL MESSAGE CENTER

938W-3

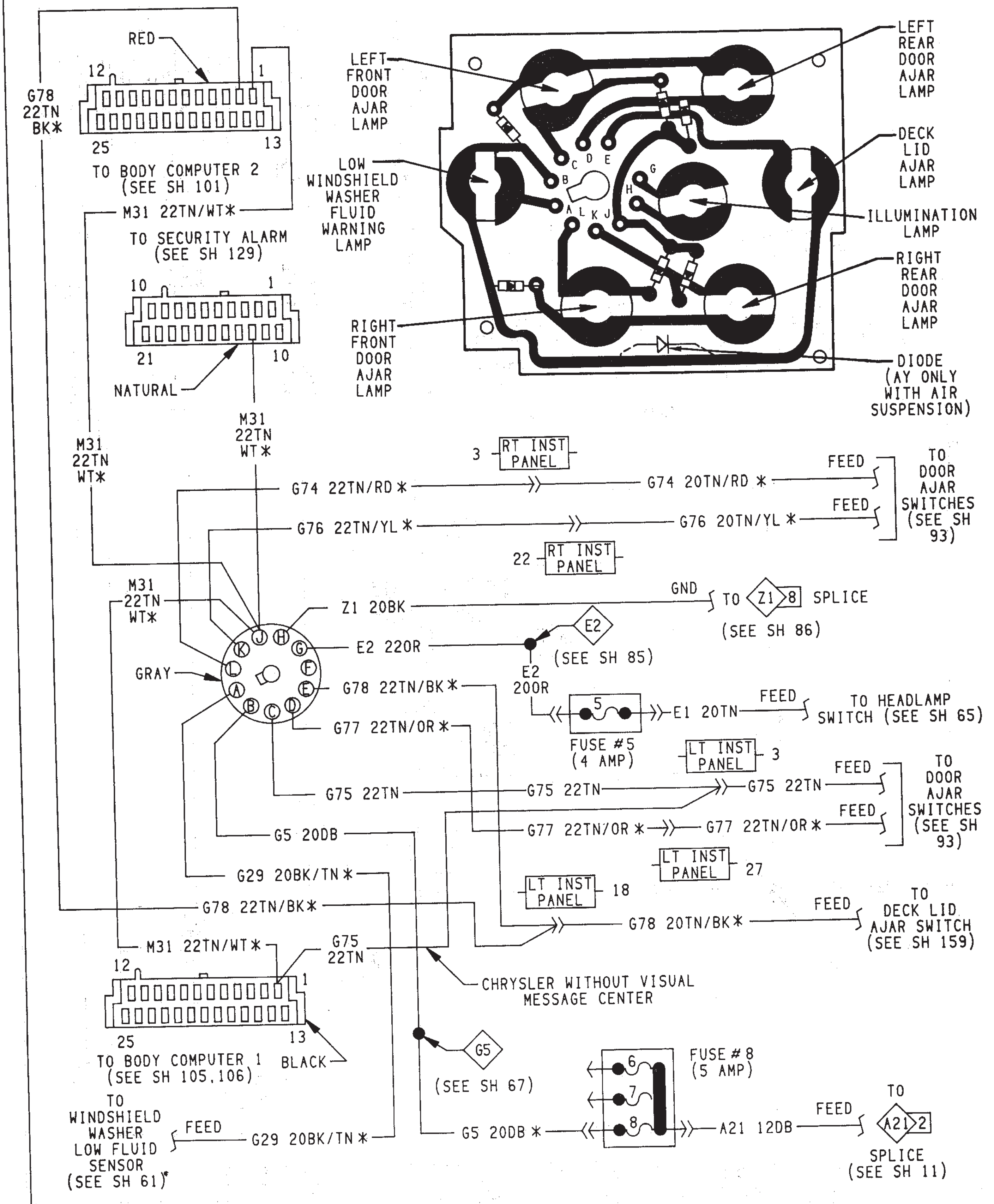
AC-CD, AY-C 93



DOOR AJAR SYSTEM WITH MECHANICAL CLUSTER
WITHOUT VISUAL MESSAGE CENTER

938W-3

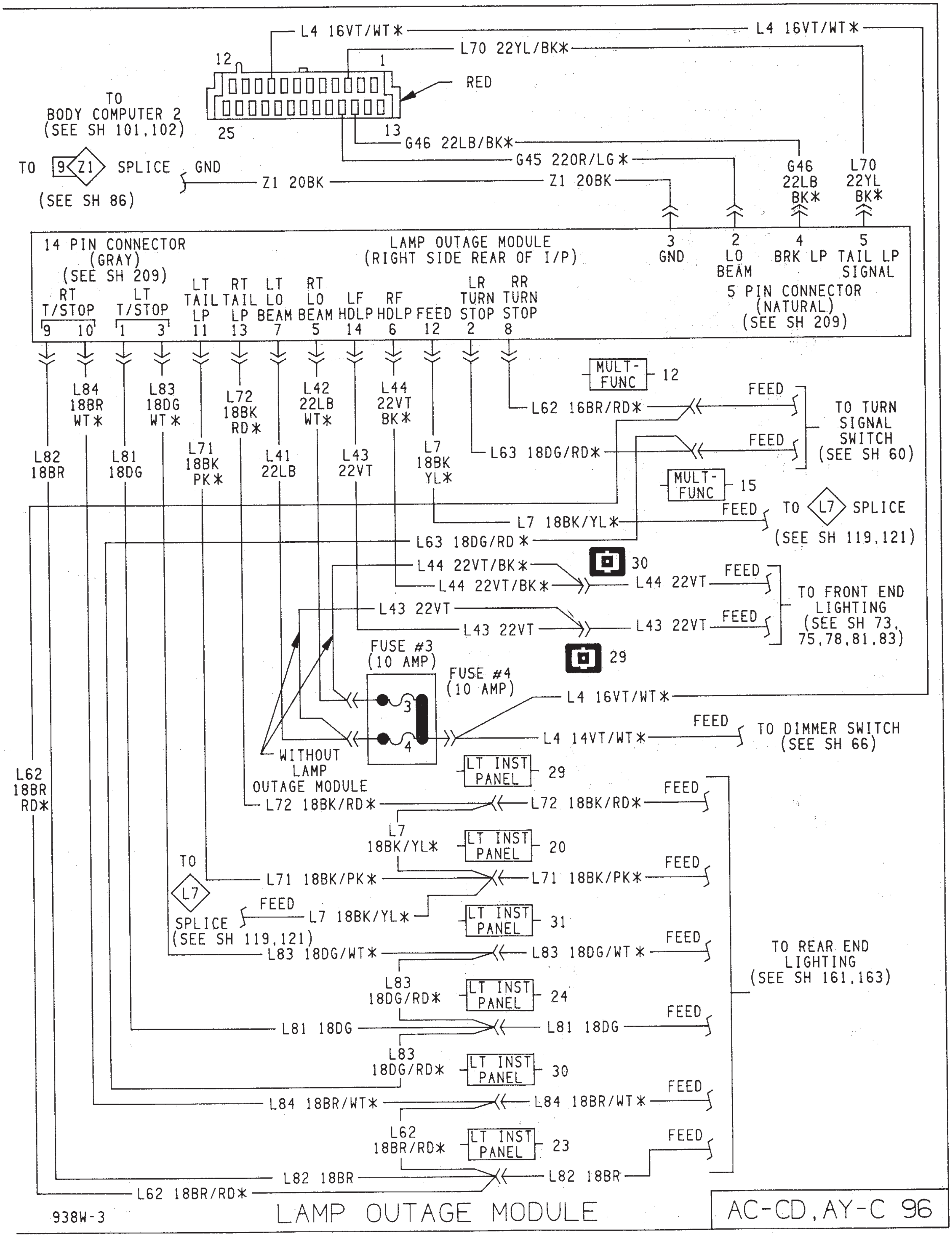
AC-CD, AY-C 94



AC-CD, AY-C 95

VISUAL MESSAGE CENTER

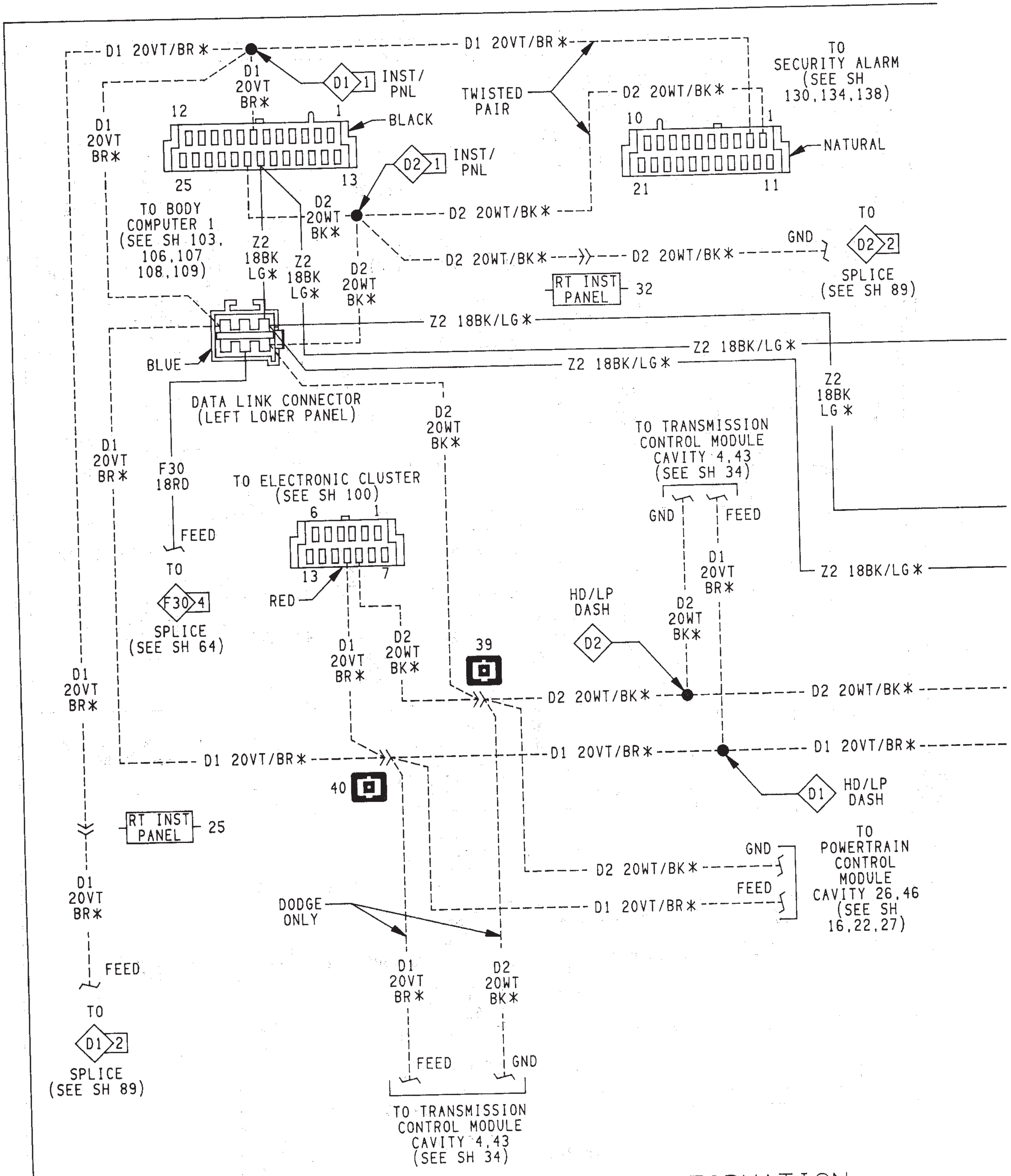
938W-3



938W-3

LAMP OUTAGE MODULE

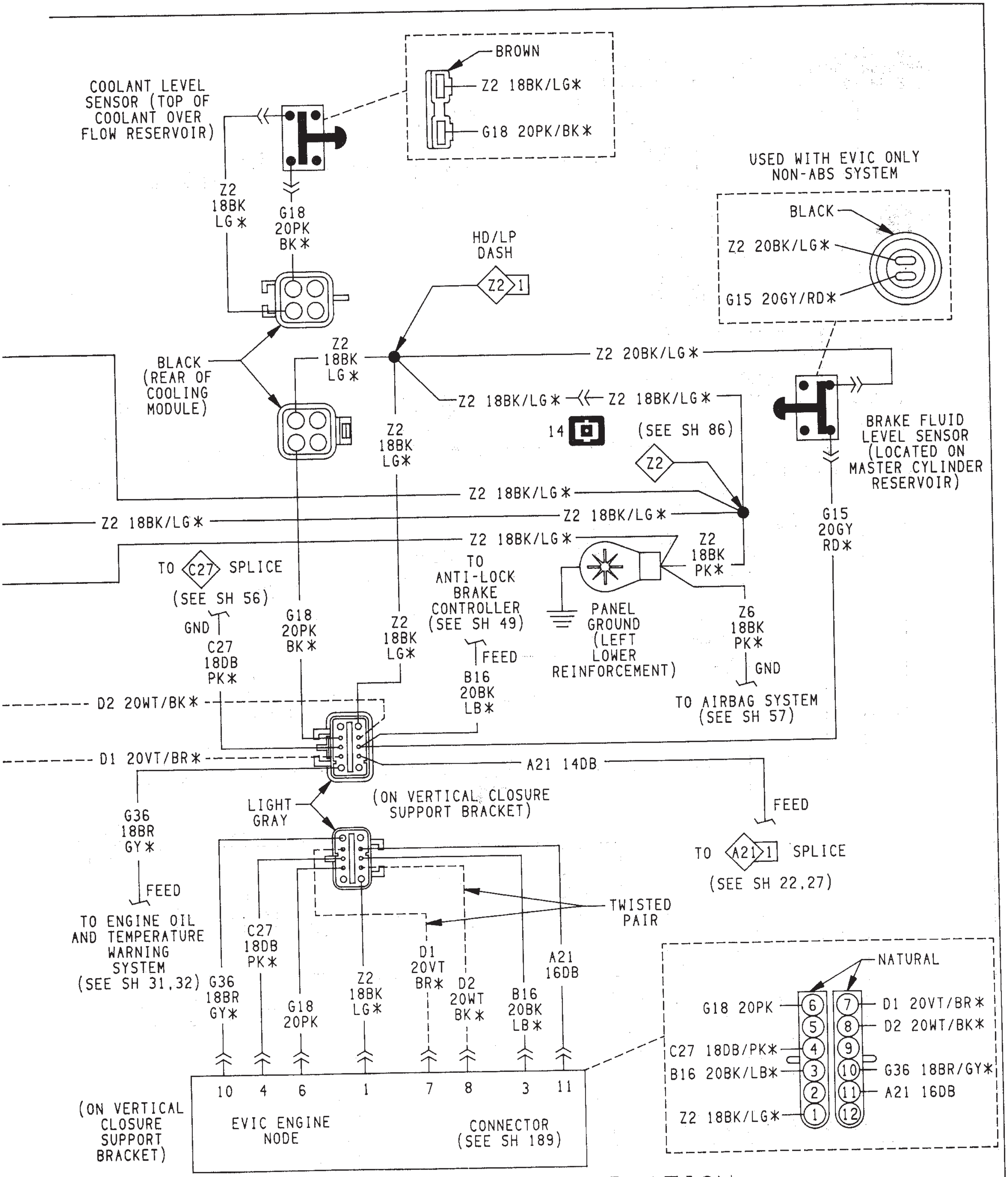
AC-CD,AY-C 96



ELECTRONIC VEHICLE INFORMATION CENTER ENGINE COMPARTMENT SENSORS

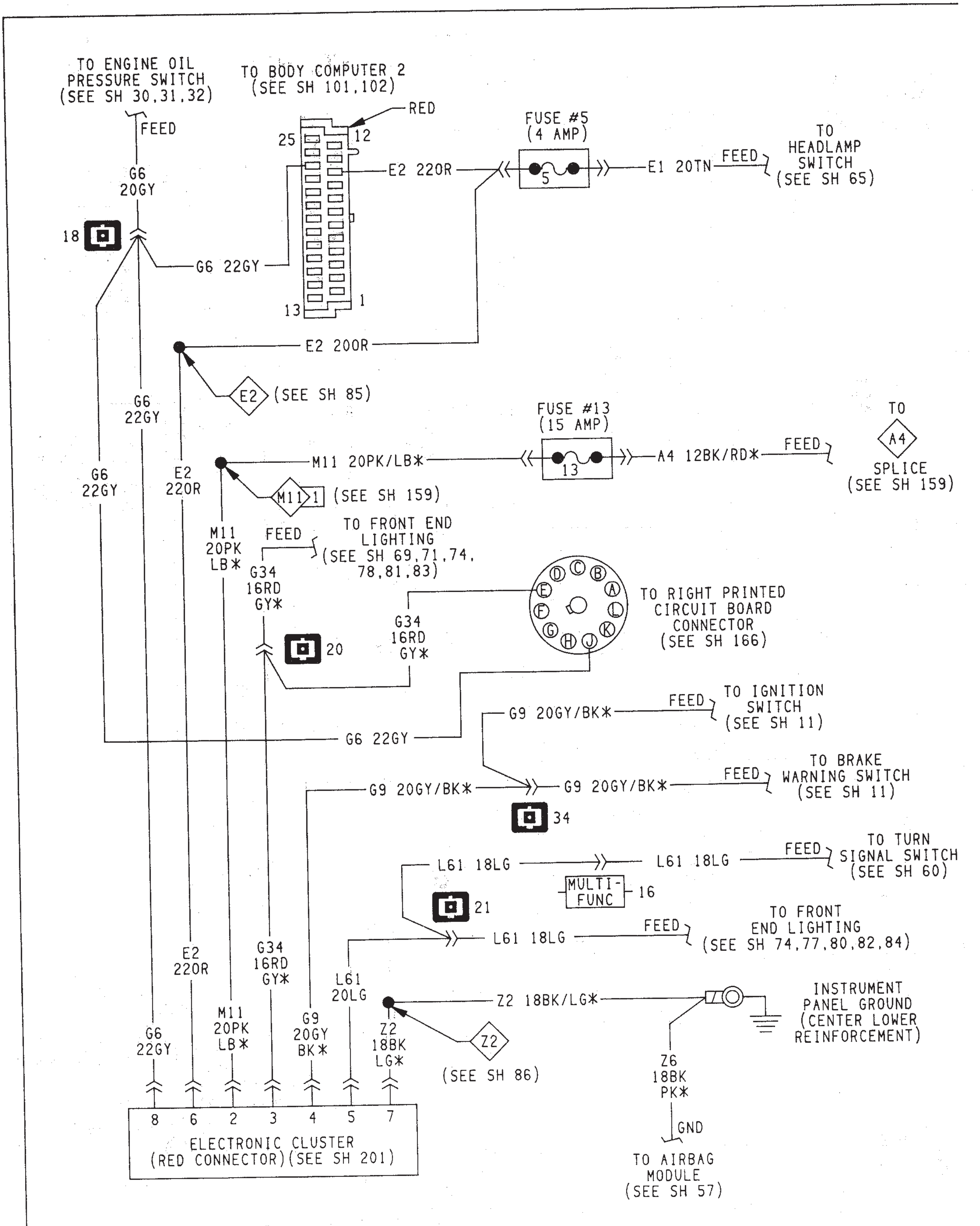
AC-CD, AY-C 97

938W-3



ELECTRONIC VEHICLE INFORMATION
938W-3 CENTER ENGINE COMPARTMENT SENSORS

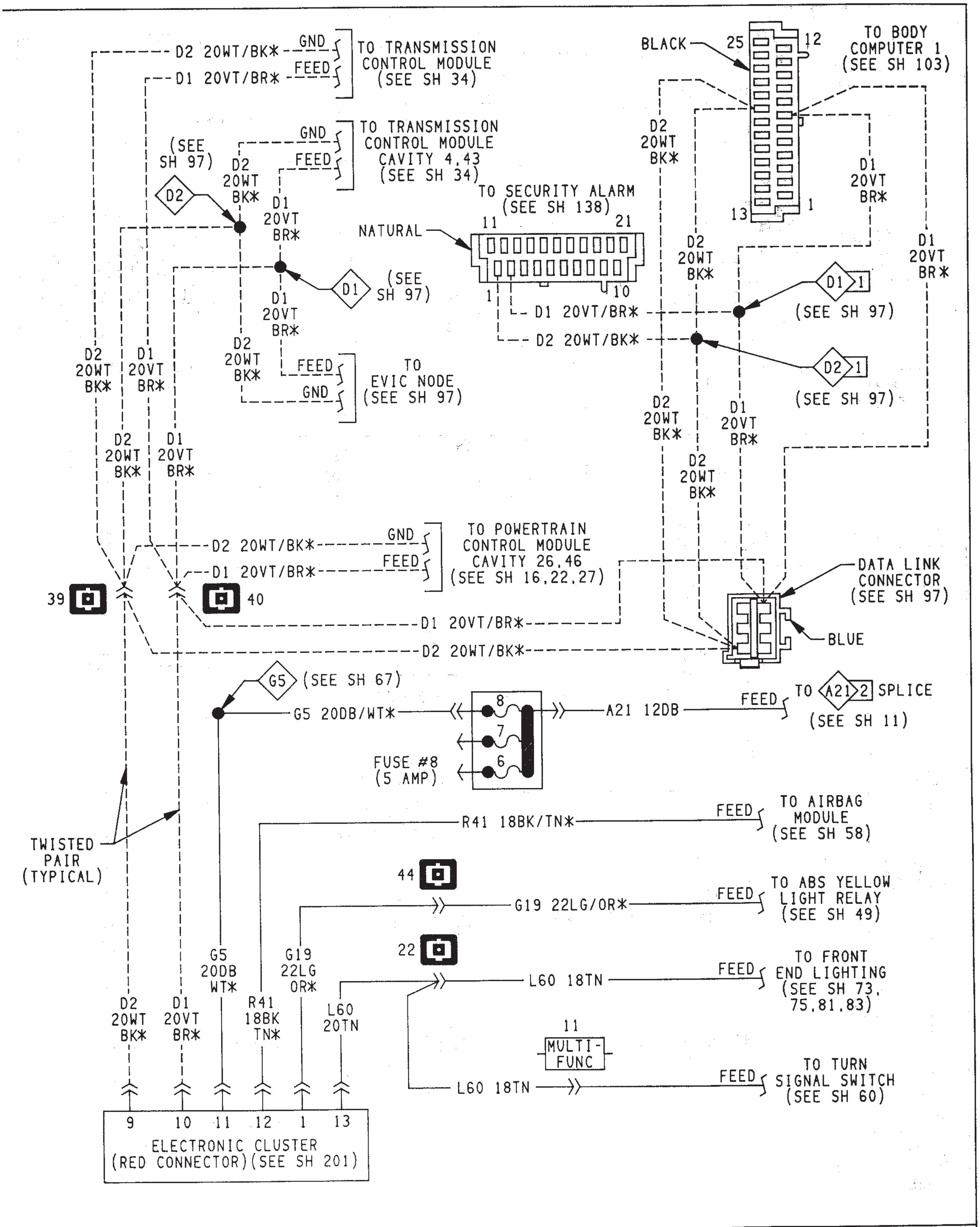
AC-CD,AY-C 98



AC-CD,AY-C 99

ELECTRONIC CLUSTER

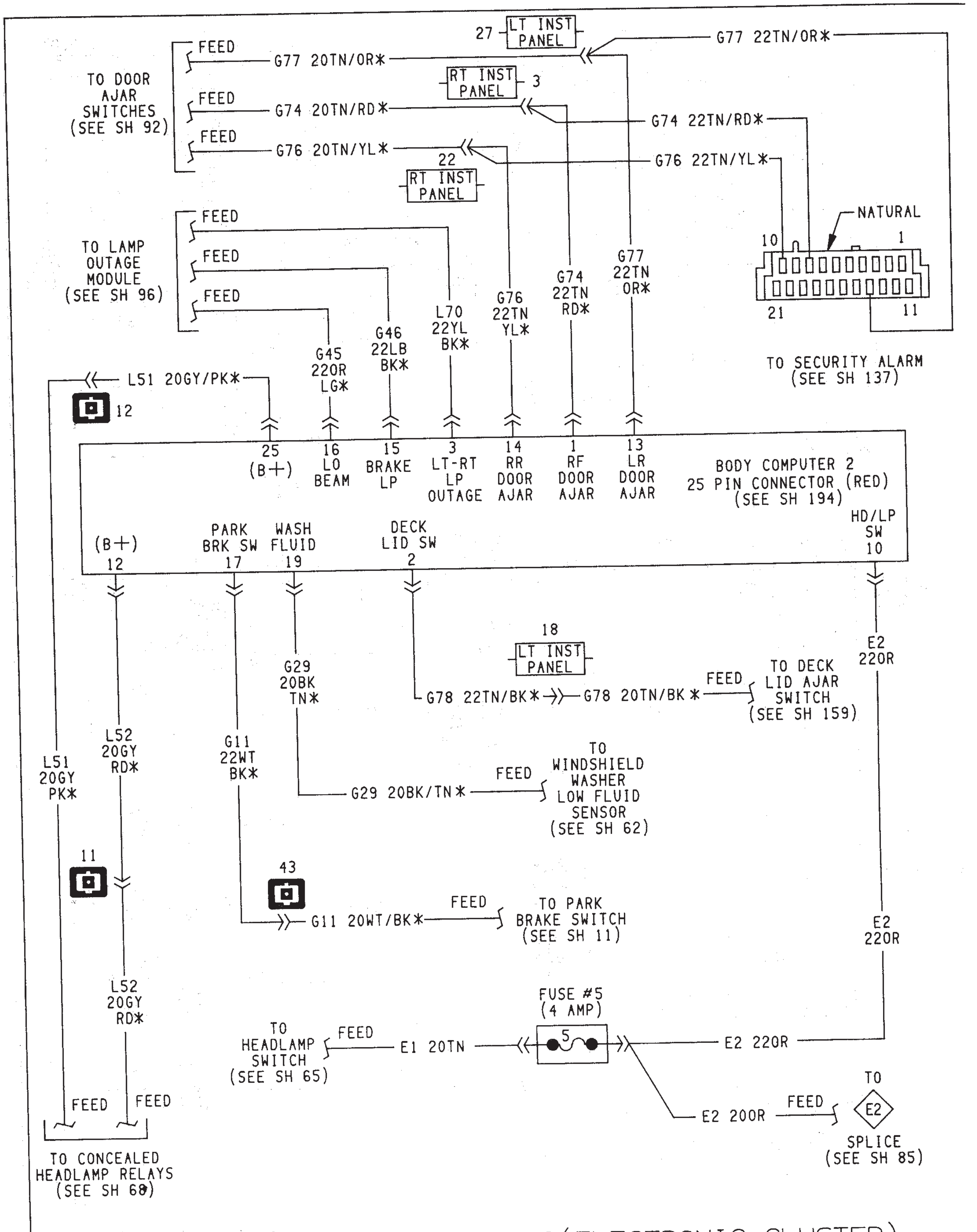
938W-3



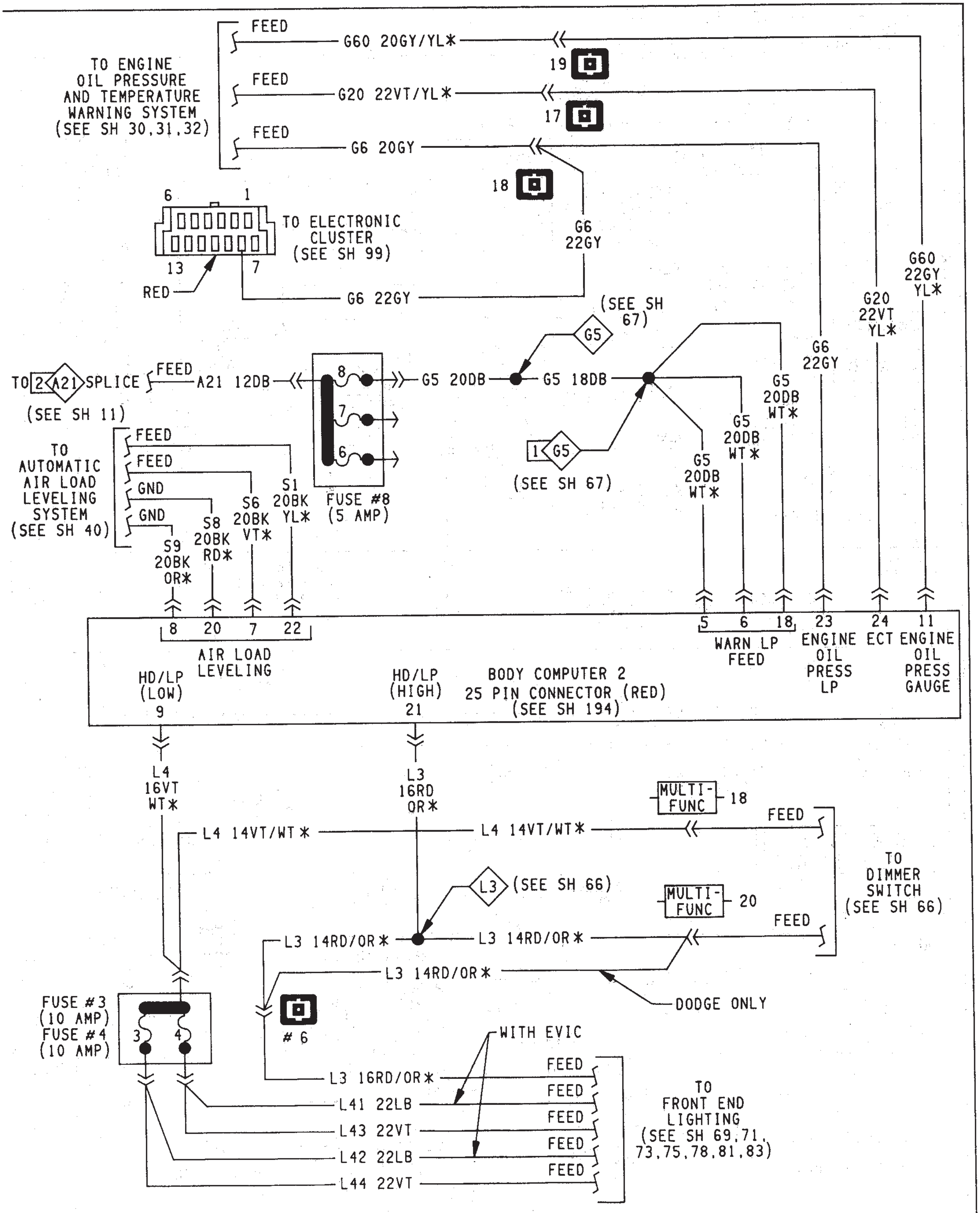
938W-3

ELECTRONIC CLUSTER

AC-CD, AY-C 100

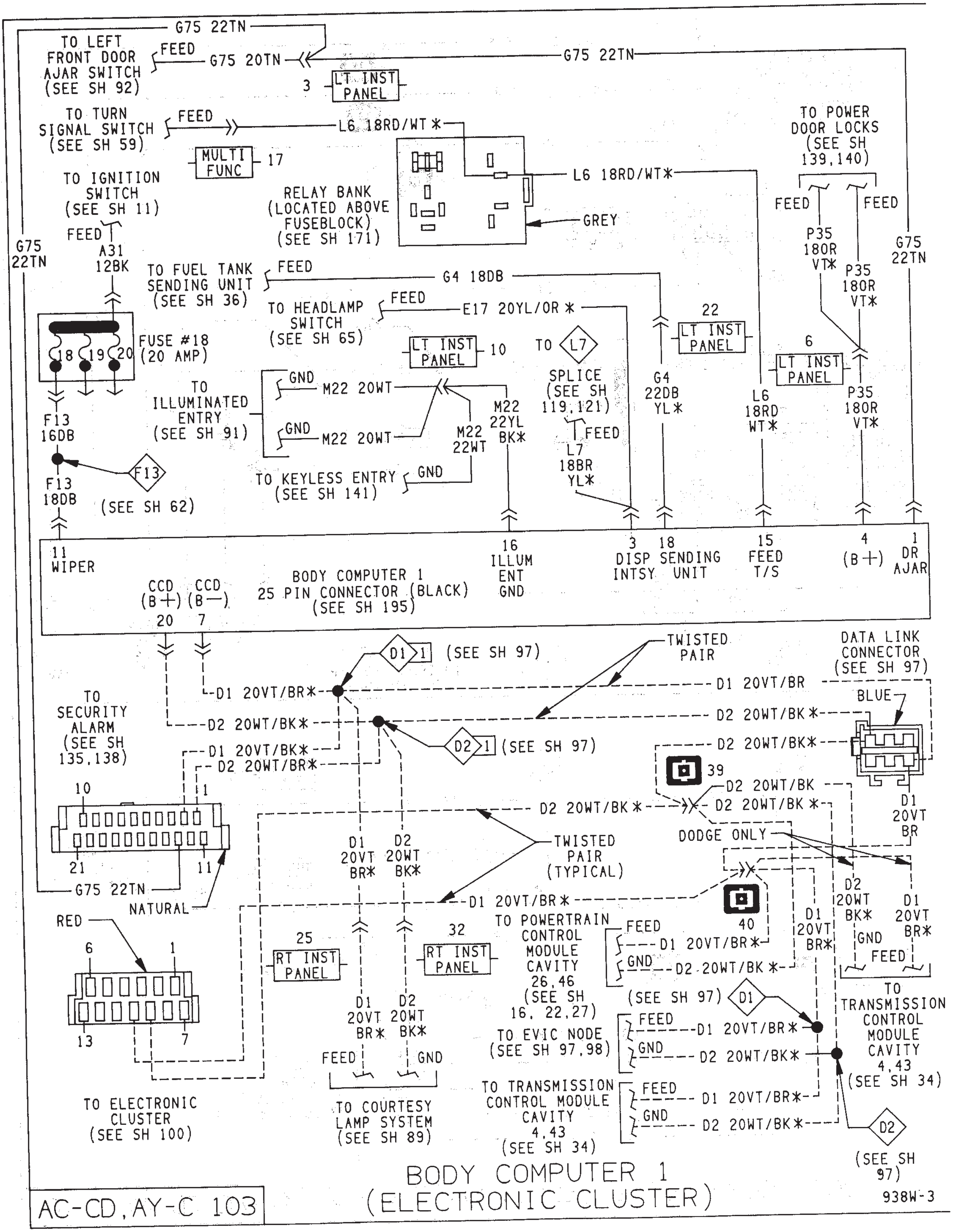


AC-CD, AY-C 101 BODY COMPUTER 2 (ELECTRONIC CLUSTER) 938W-3



938W-3 BODY COMPUTER 2 (ELECTRONIC CLUSTER)

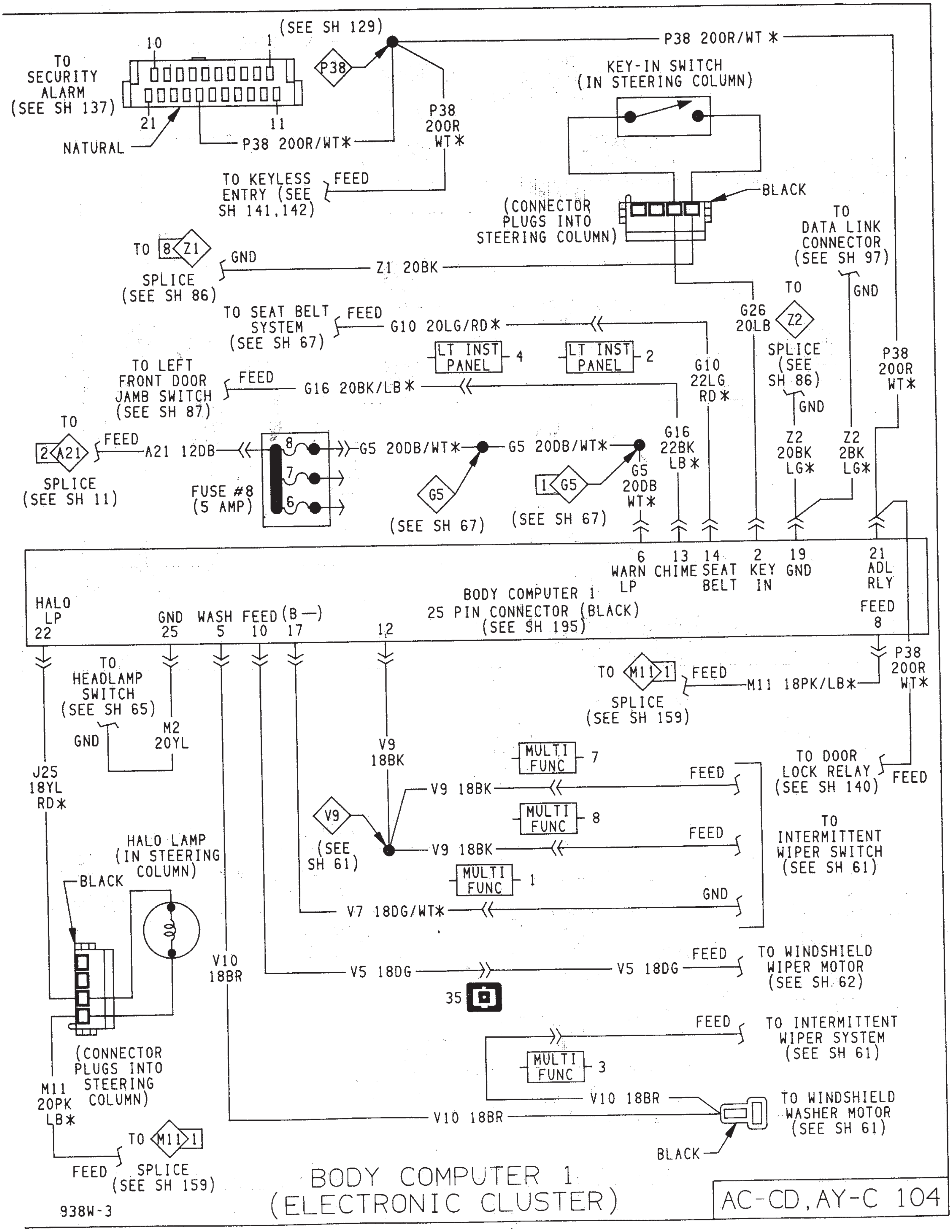
AC-CD, AY-C 102



BODY COMPUTER 1
(ELECTRONIC CLUSTER)

938W-3

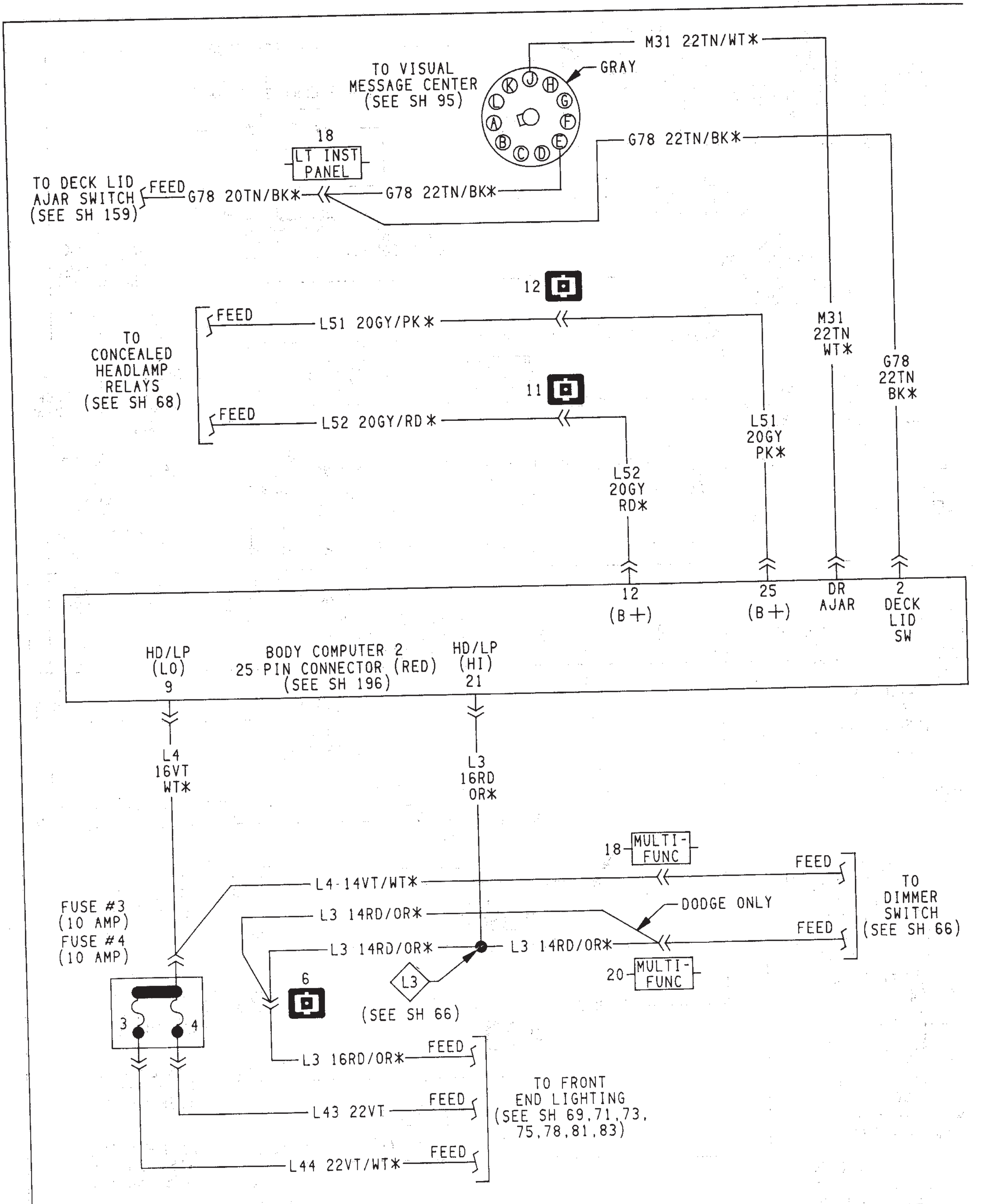
AC-CD, AY-C 103



BODY COMPUTER 1
(ELECTRONIC CLUSTER)

938W-3

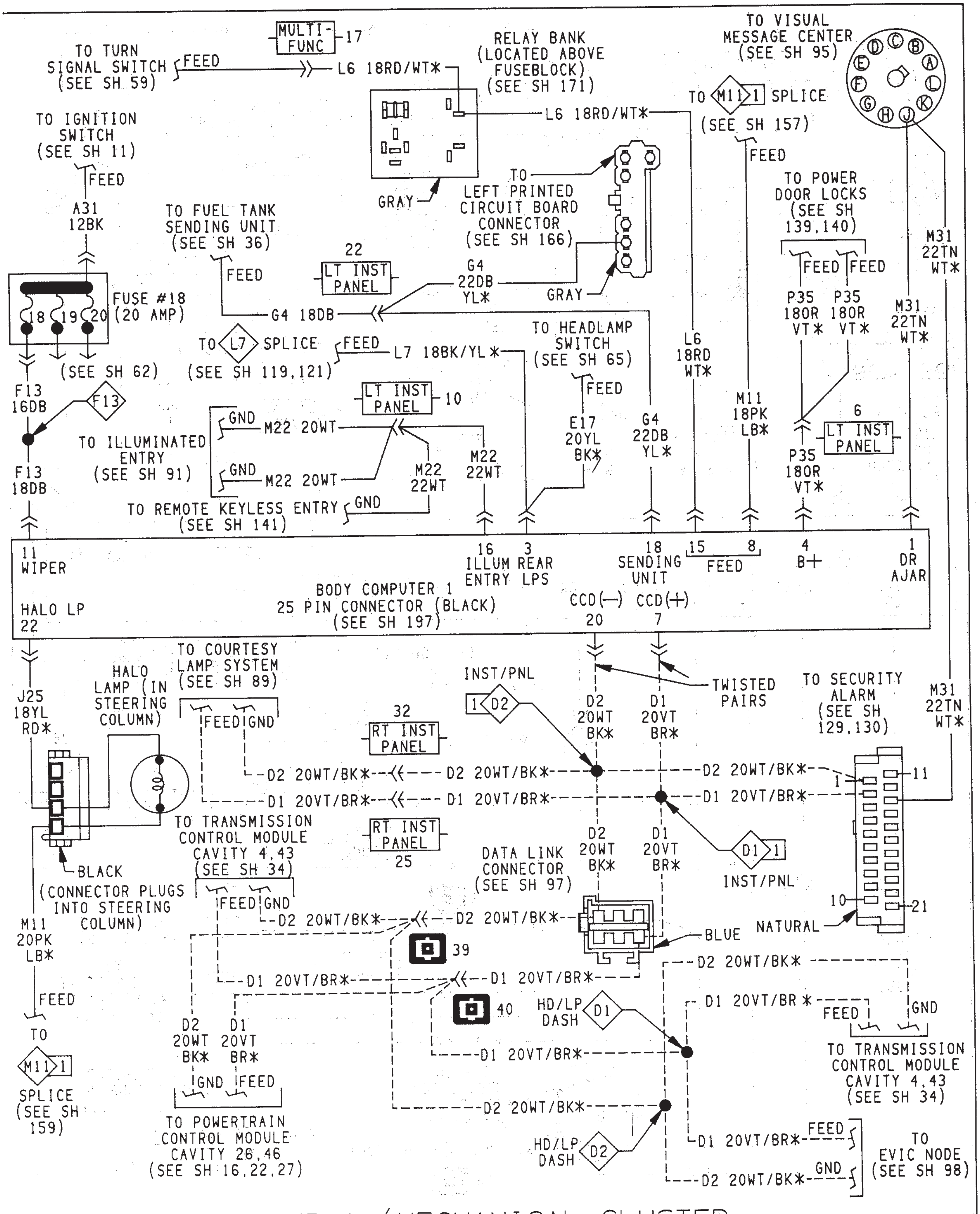
AC-CD, AY-C 104



AC-CD, AY-C 105

BODY COMPUTER 2 (MECHANICAL CLUSTER WITH VISUAL MESSAGE CENTER)

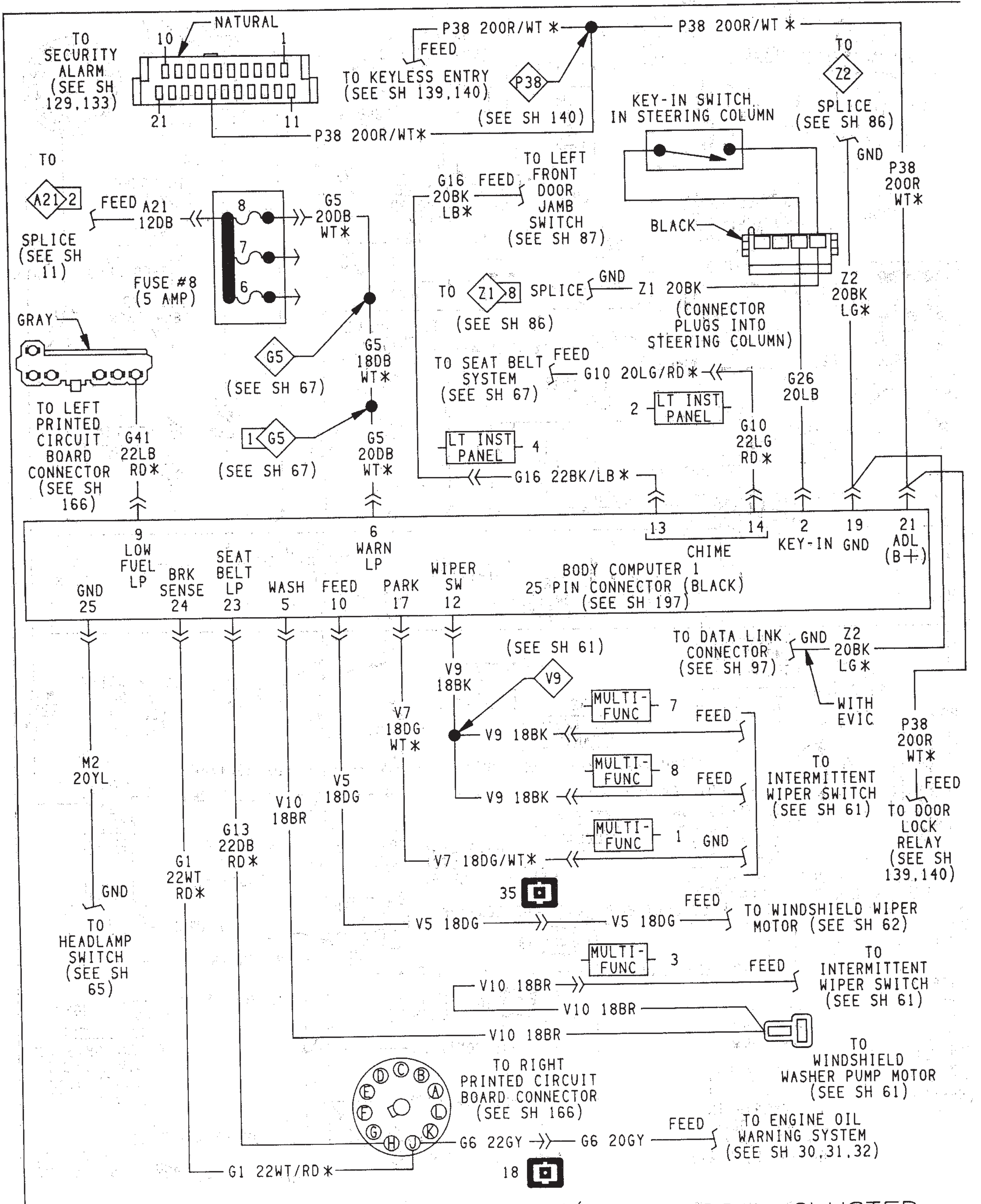
938W-3



BODY COMPUTER 1 (MECHANICAL CLUSTER WITH VISUAL MESSAGE CENTER)

938W-3

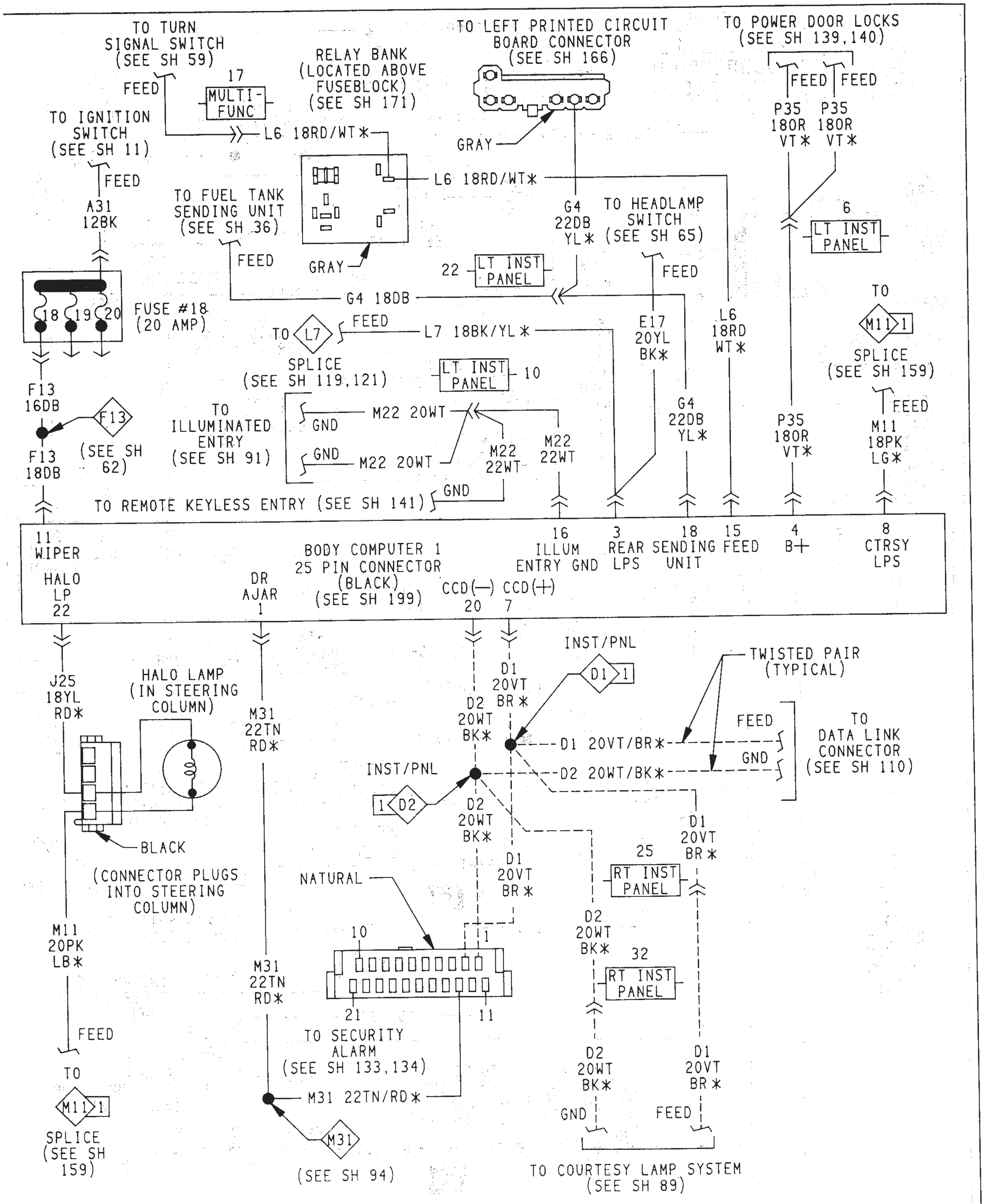
AC-CD,AY-C 106



BODY COMPUTER 1 (MECHANICAL CLUSTER WITH VISUAL MESSAGE CENTER)

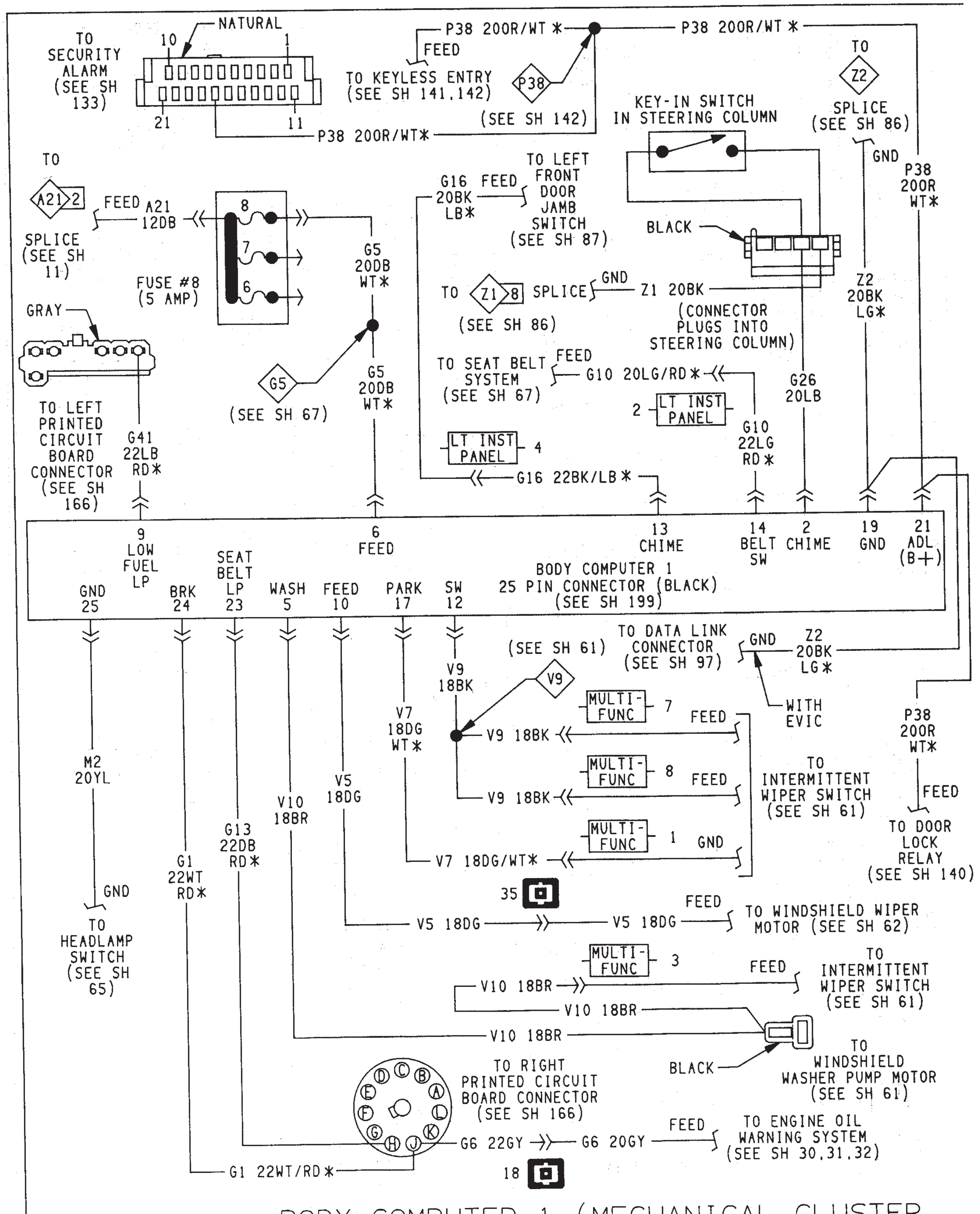
AC-CD,AY-C 107

938W-3



BODY COMPUTER 1 (MECHANICAL CLUSTER
938W-3 WITHOUT VISUAL MESSAGE CENTER)

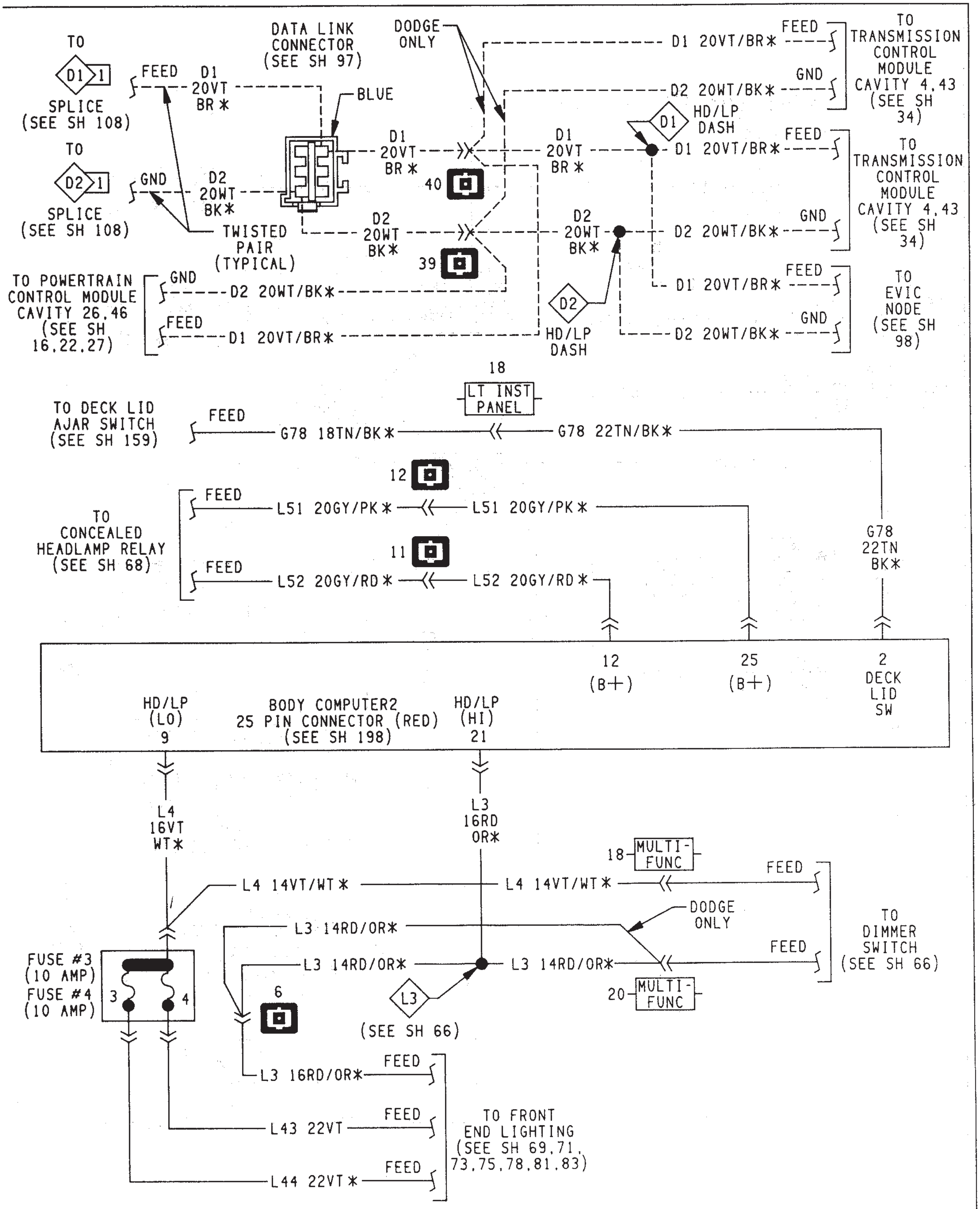
AC-CD, AY-C 108



AC-CD, AY-C 109

BODY COMPUTER 1 (MECHANICAL CLUSTER WITHOUT VISUAL MESSAGE CENTER)

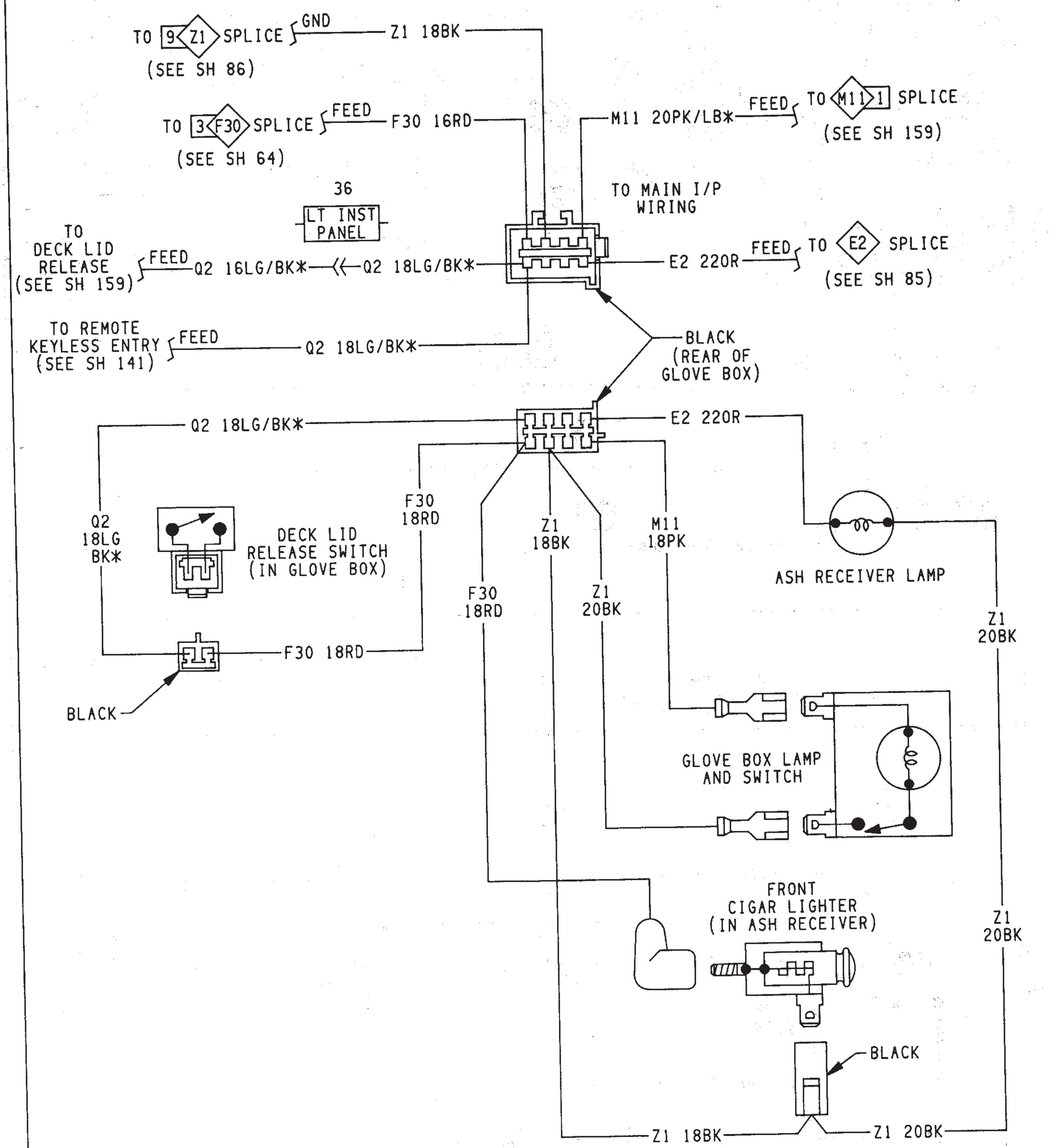
938W-3



BODY COMPUTER 2 (MECHANICAL CLUSTER WITHOUT VISUAL MESSAGE CENTER)

938W-3

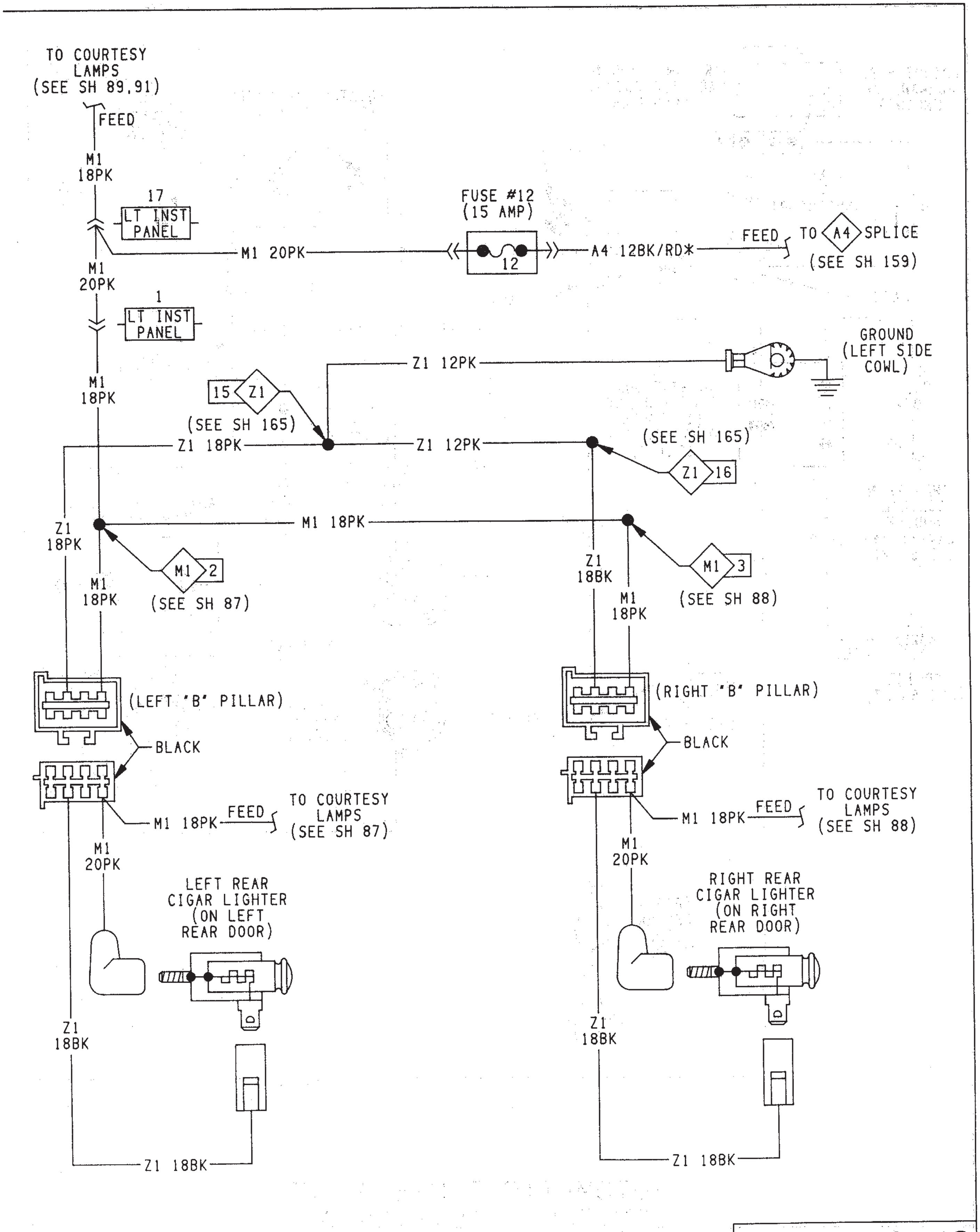
AC-CD, AY-C 110



GLOVE BOX MODULE AND FRONT CIGAR LIGHTER

AC-CD, AY-C 111

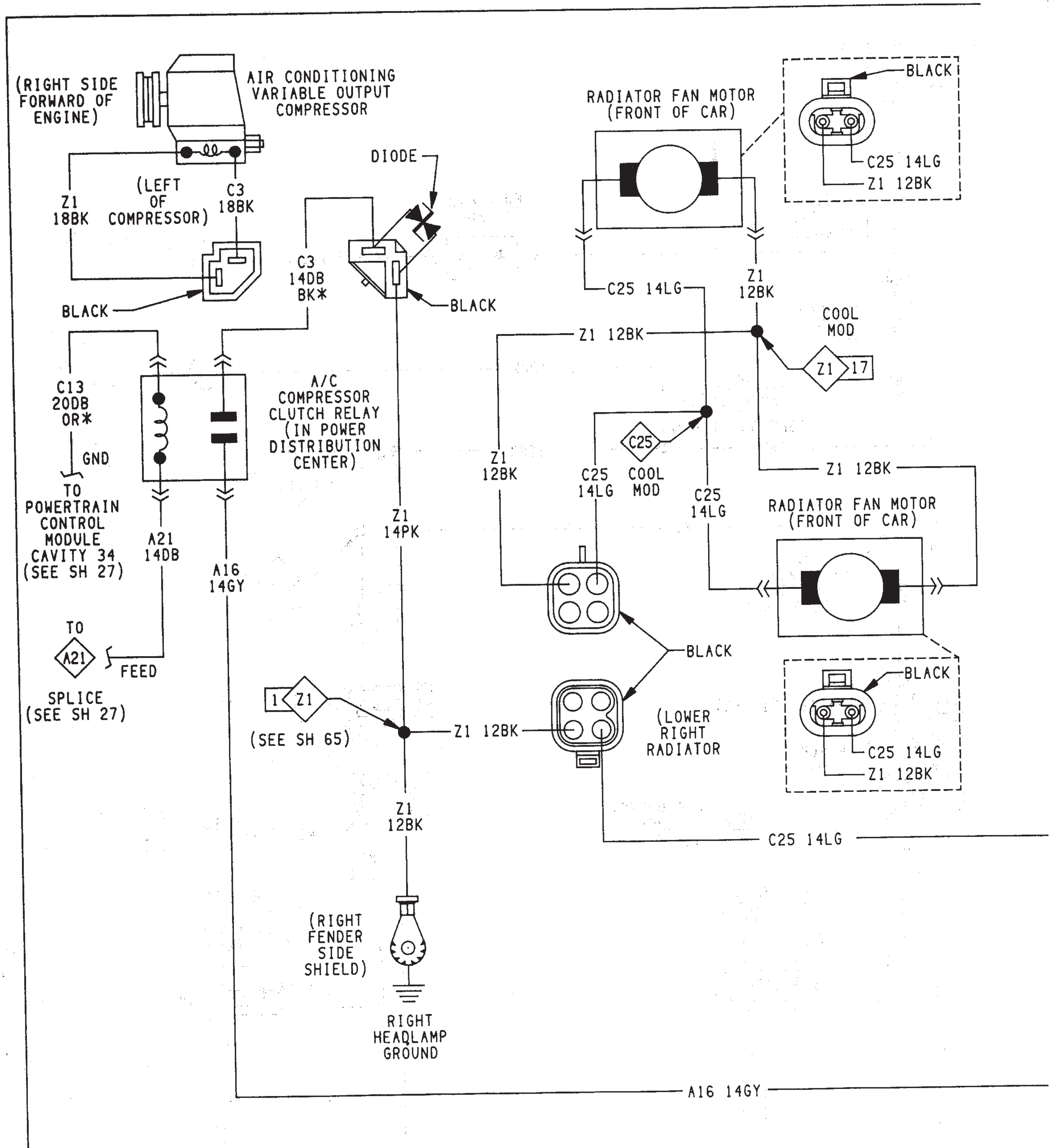
938W-3



938W-3

REAR CIGAR LIGHTERS

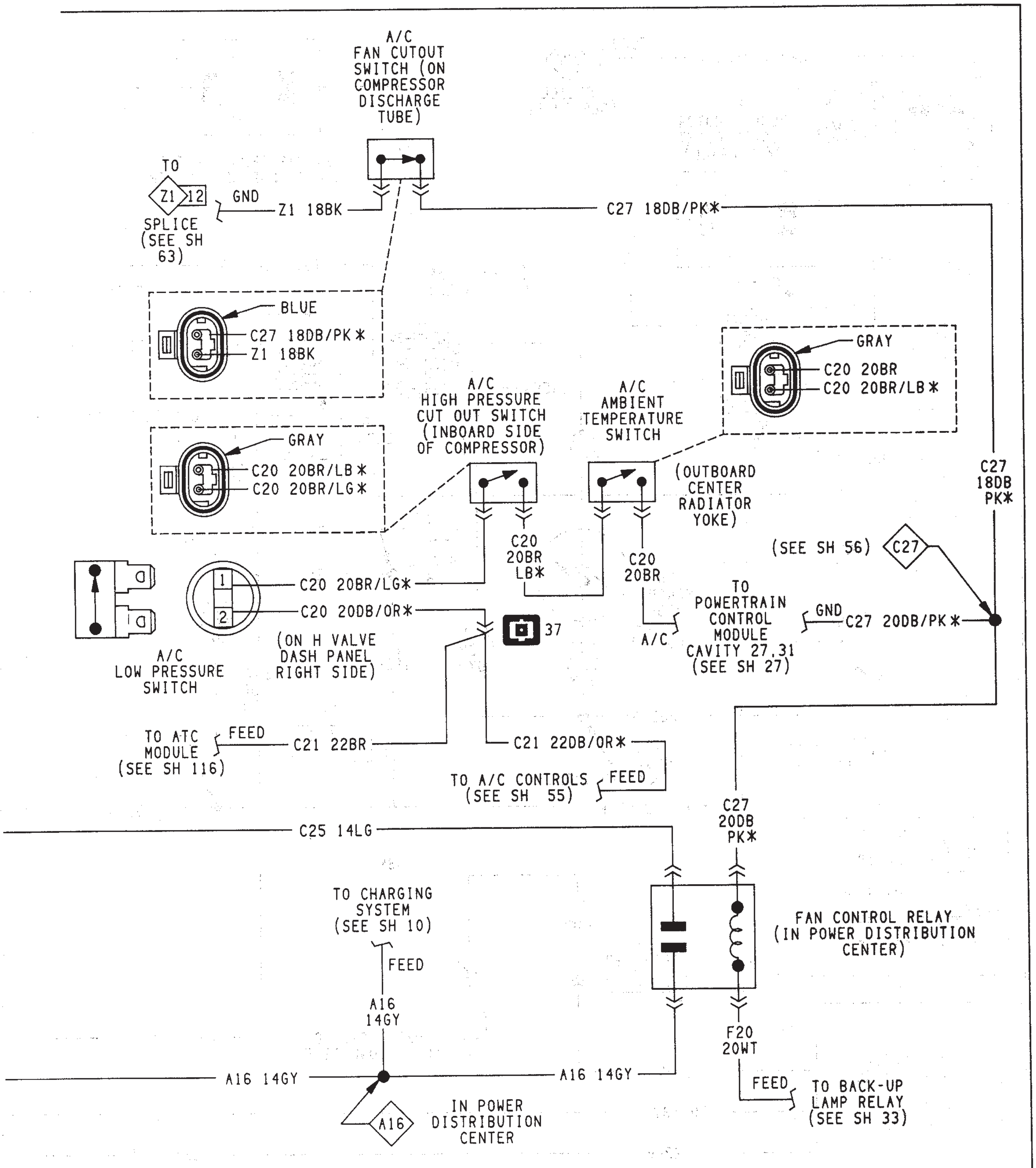
AC-CD, AY-C 112



AUTOMATIC TEMPERATURE CONTROL (RADIATOR AND COMPRESSOR 3.3L AND 3.8L)

AC-CD, AY-C 113

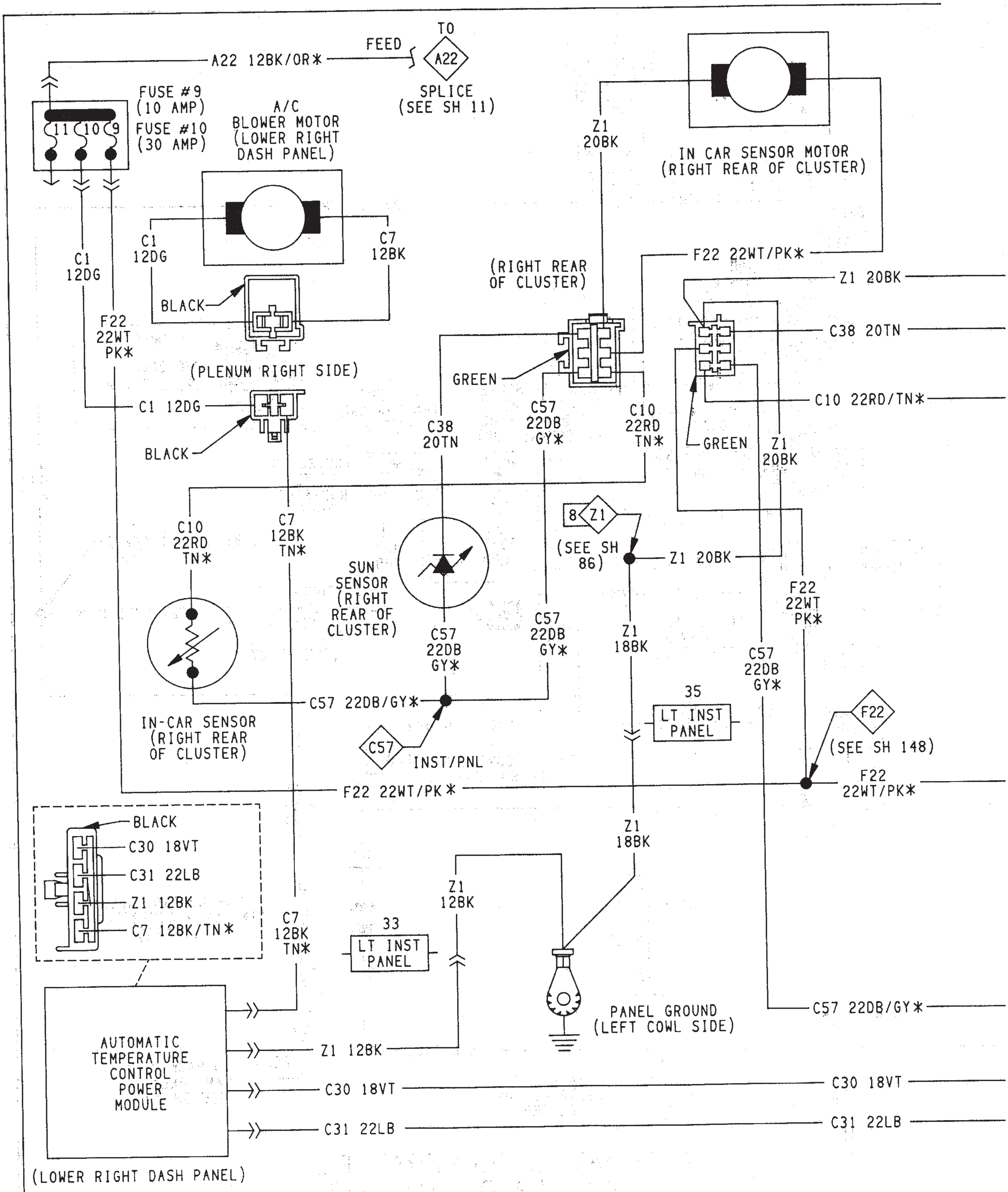
938W-3



AUTOMATIC TEMPERATURE
CONTROL (RADIATOR AND
COMPRESSOR 3.3L AND 3.8L)

938W-3

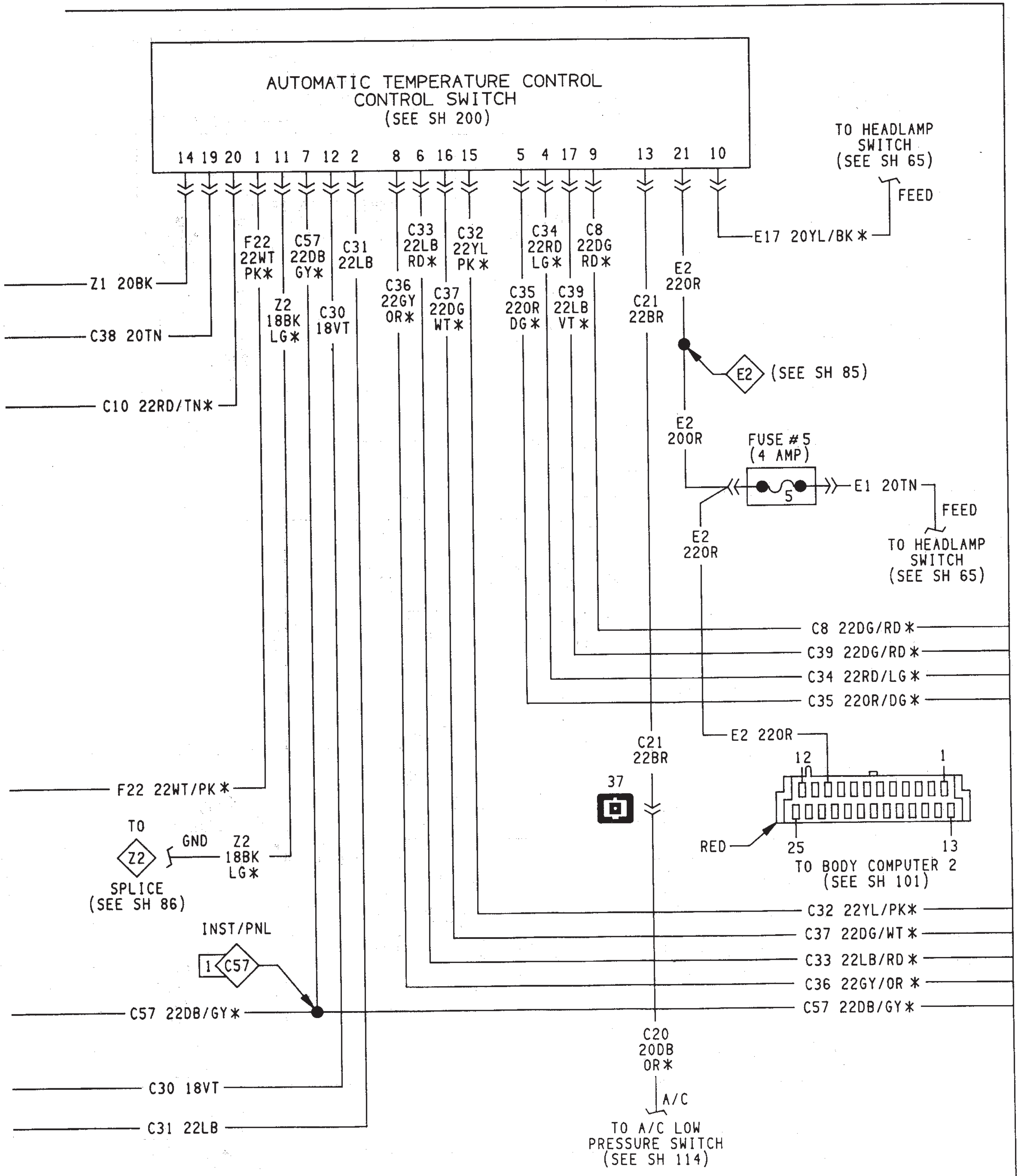
AC-CD,AY-C 114



AC-CD, AY-C 115

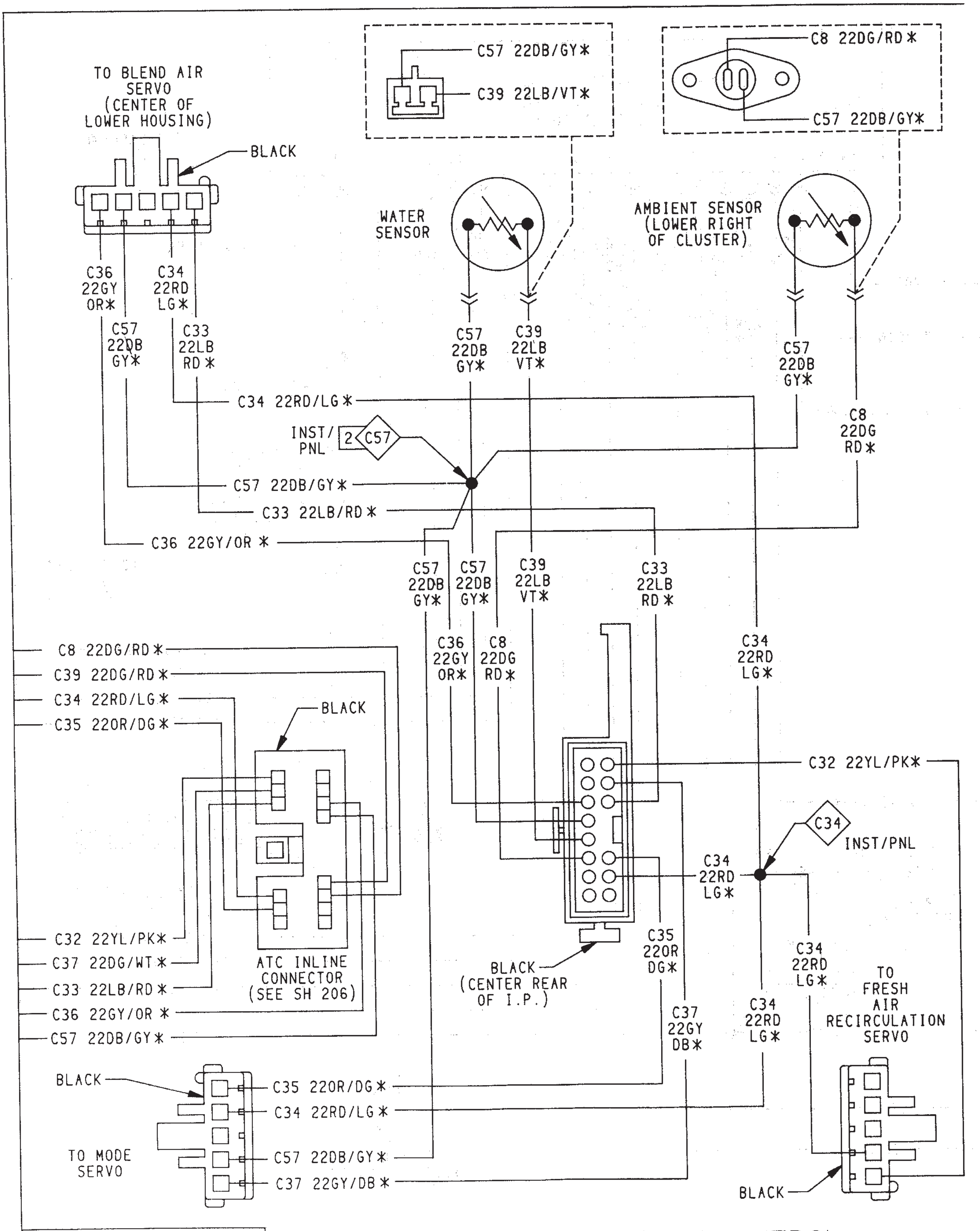
AUTOMATIC TEMPERATURE CONTROL

938W-3



938W-3

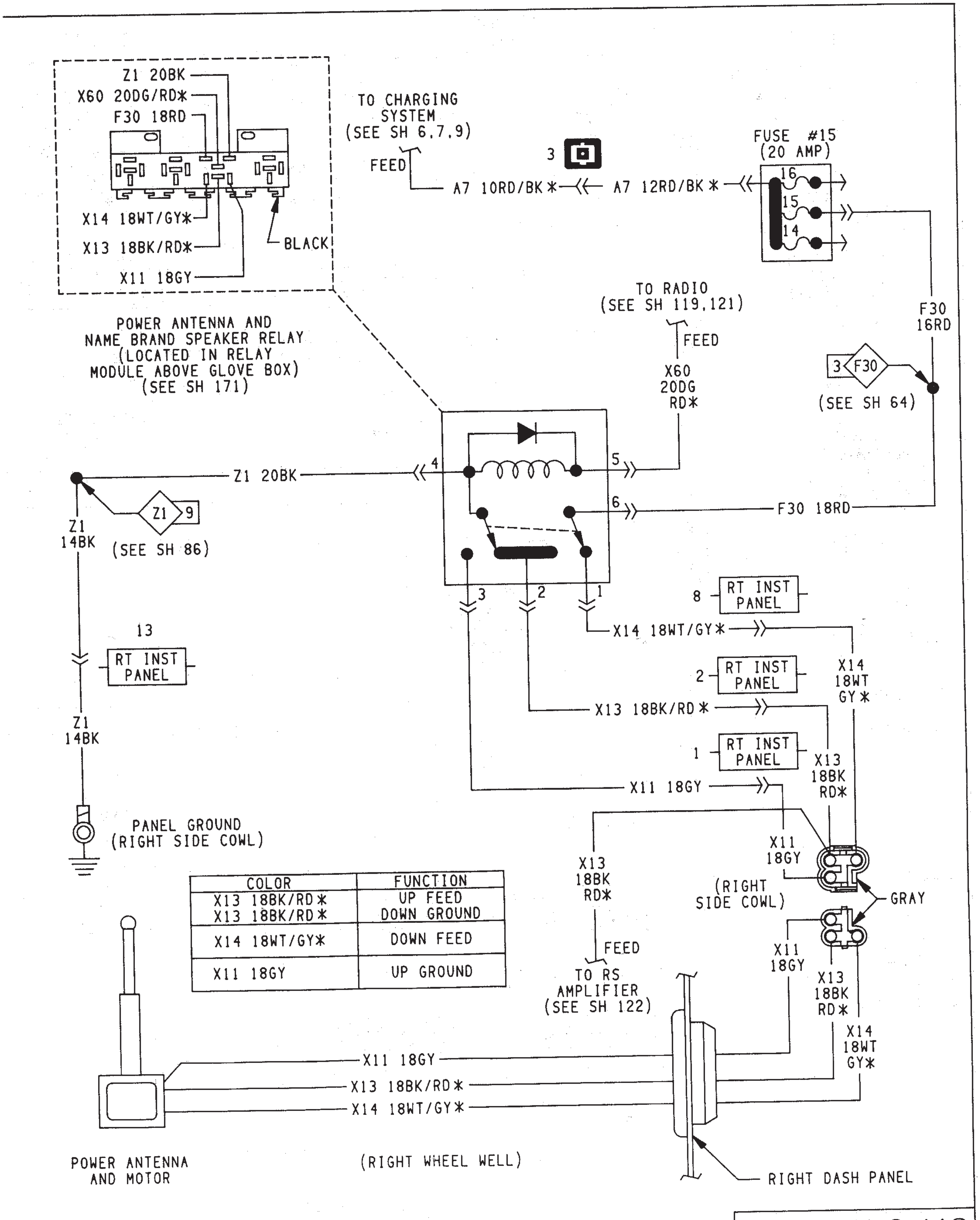
AUTOMATIC TEMPERATURE CONTROL



AC-CD, AY-C 117

AUTOMATIC TEMPERATURE CONTROL

938W-3

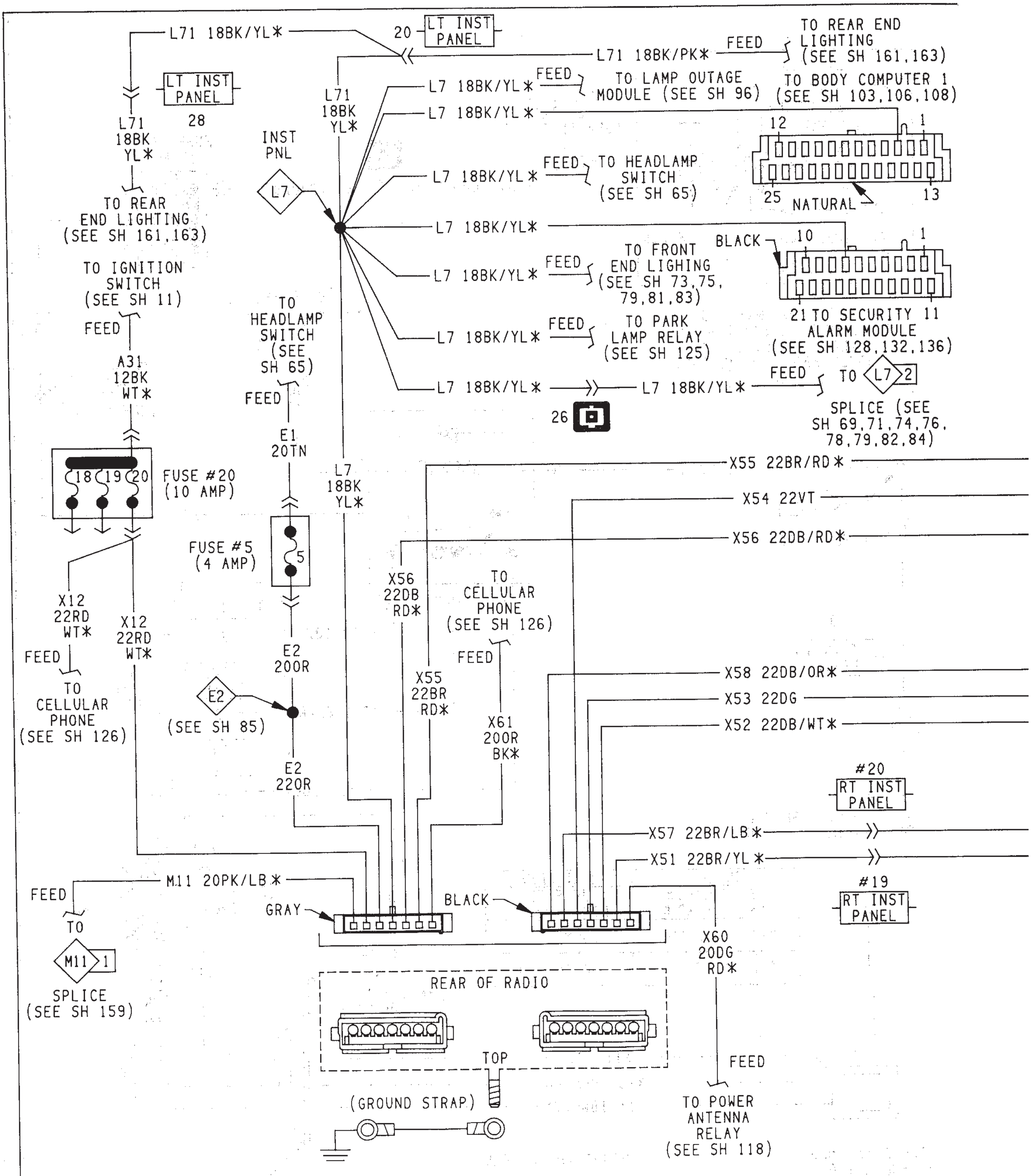


COLOR	FUNCTION
X13 18BK/RD✱ X13 18BK/RD✱	UP FEED DOWN GROUND
X14 18WT/GY✱	DOWN FEED
X11 18GY	UP GROUND

938W-3

POWER ANTENNA SYSTEM

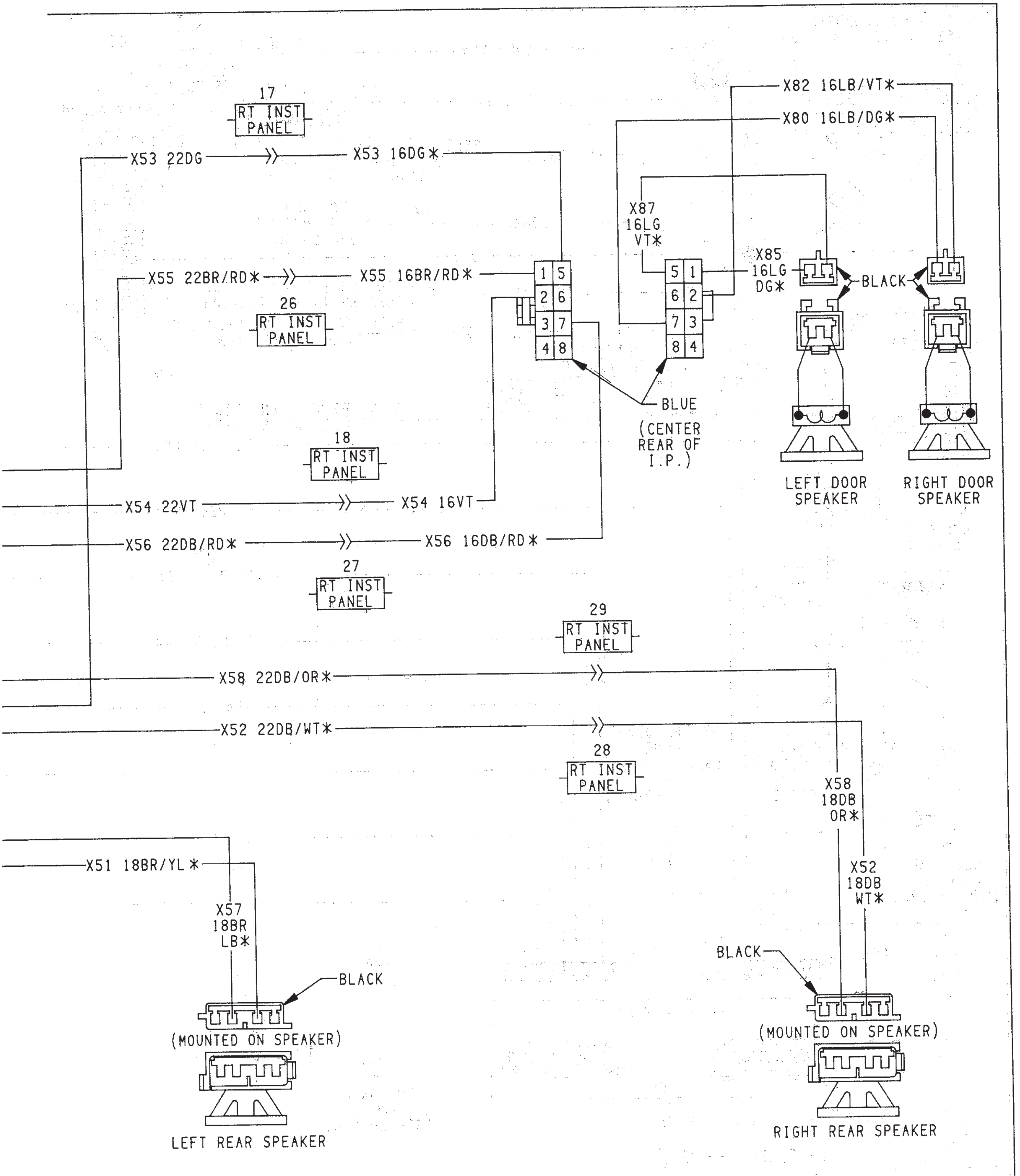
AC-CD, AY-C 118



ELECTRONICALLY TUNED STEREO RADIO

AC-CD, AY-C 119

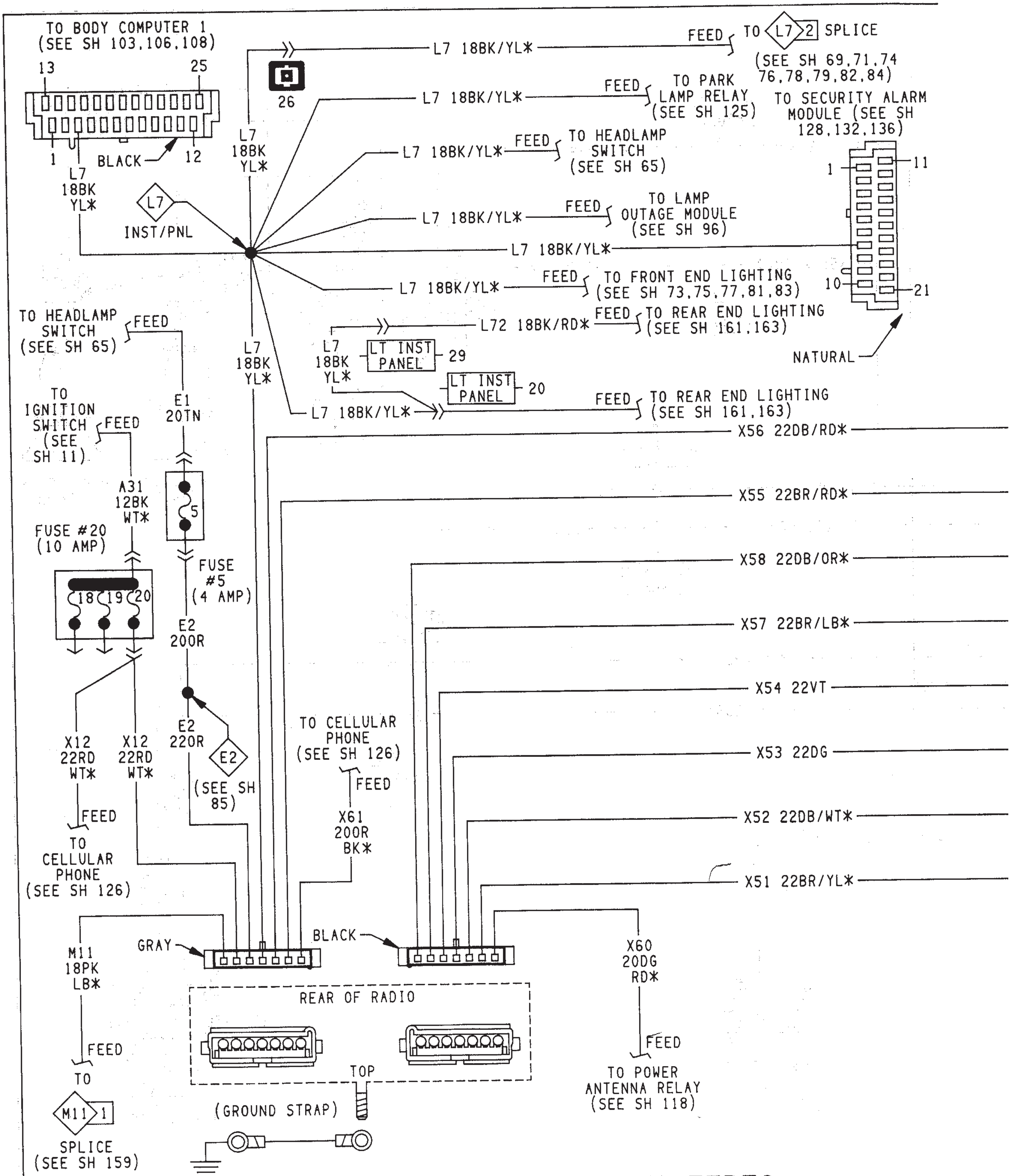
938W-3



ELECTRONICALLY TUNED
STEREO RADIO

938W-3

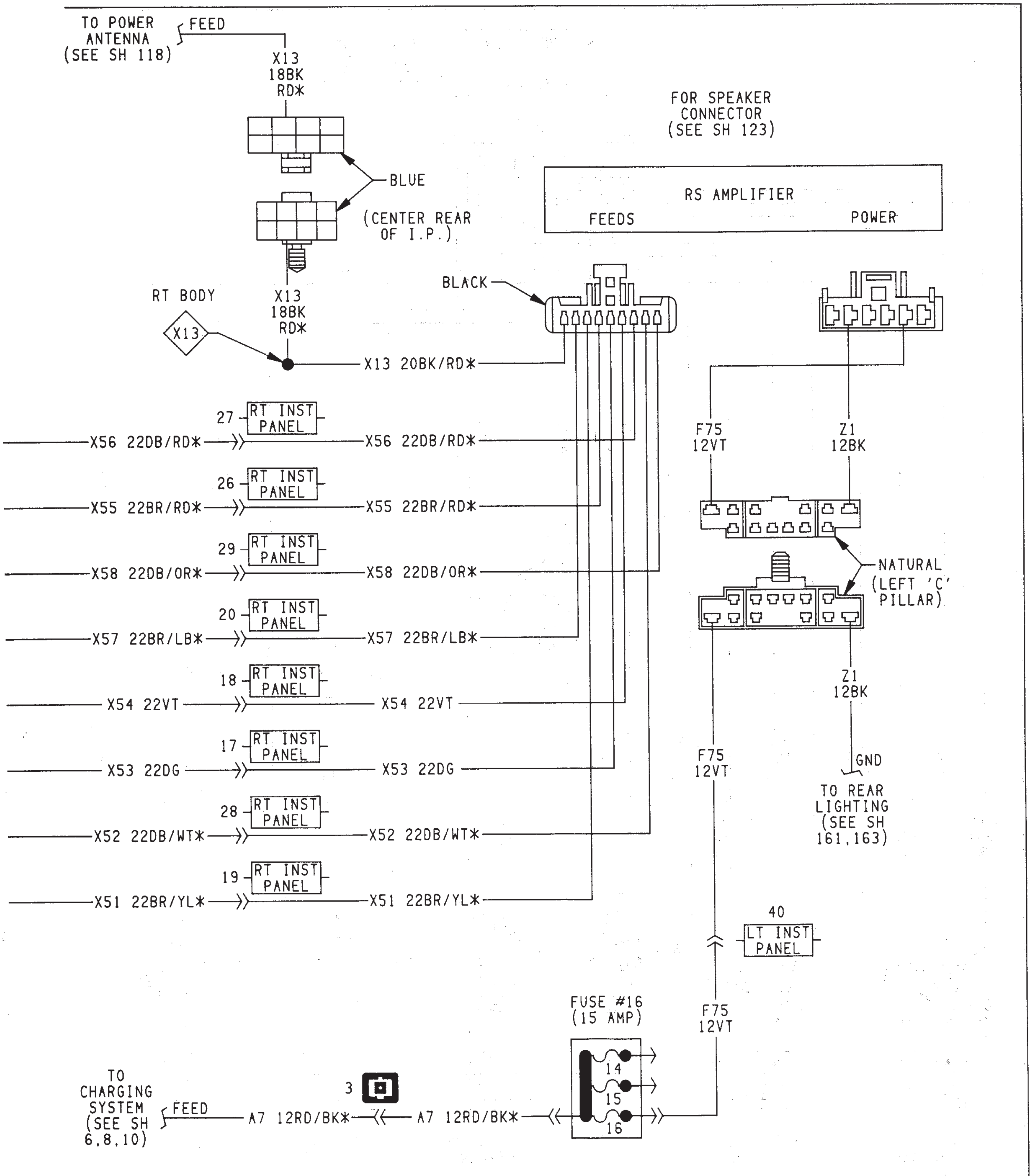
AC-CD, AY-C 120



ELECTRONICALLY TUNED STEREO
RADIO WITH RS AMPLIFIER

AC-CD, AY-C 121

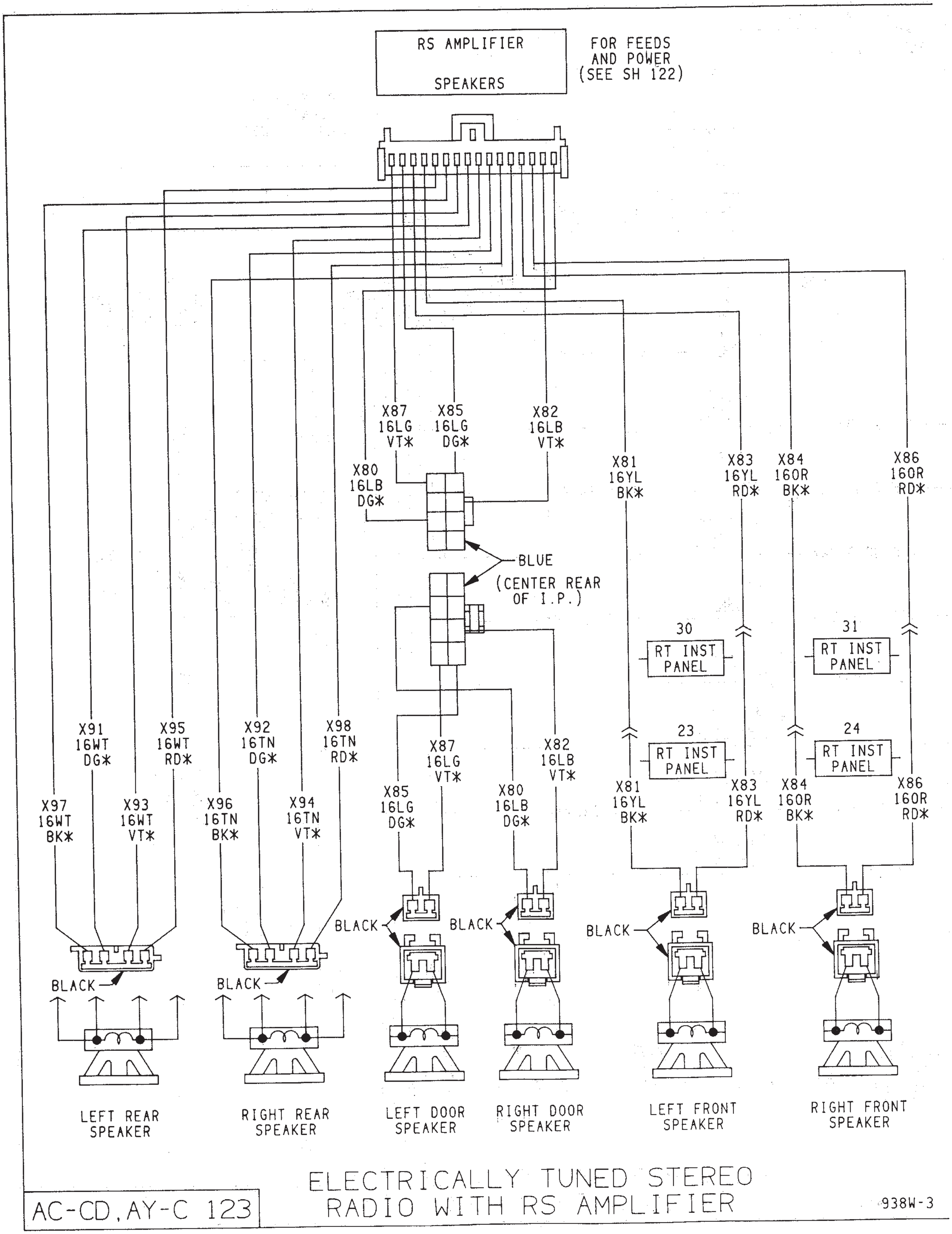
938W-3



ELECTRONICALLY TUNED STEREO RADIO WITH RS AMPLIFIER

938W-3

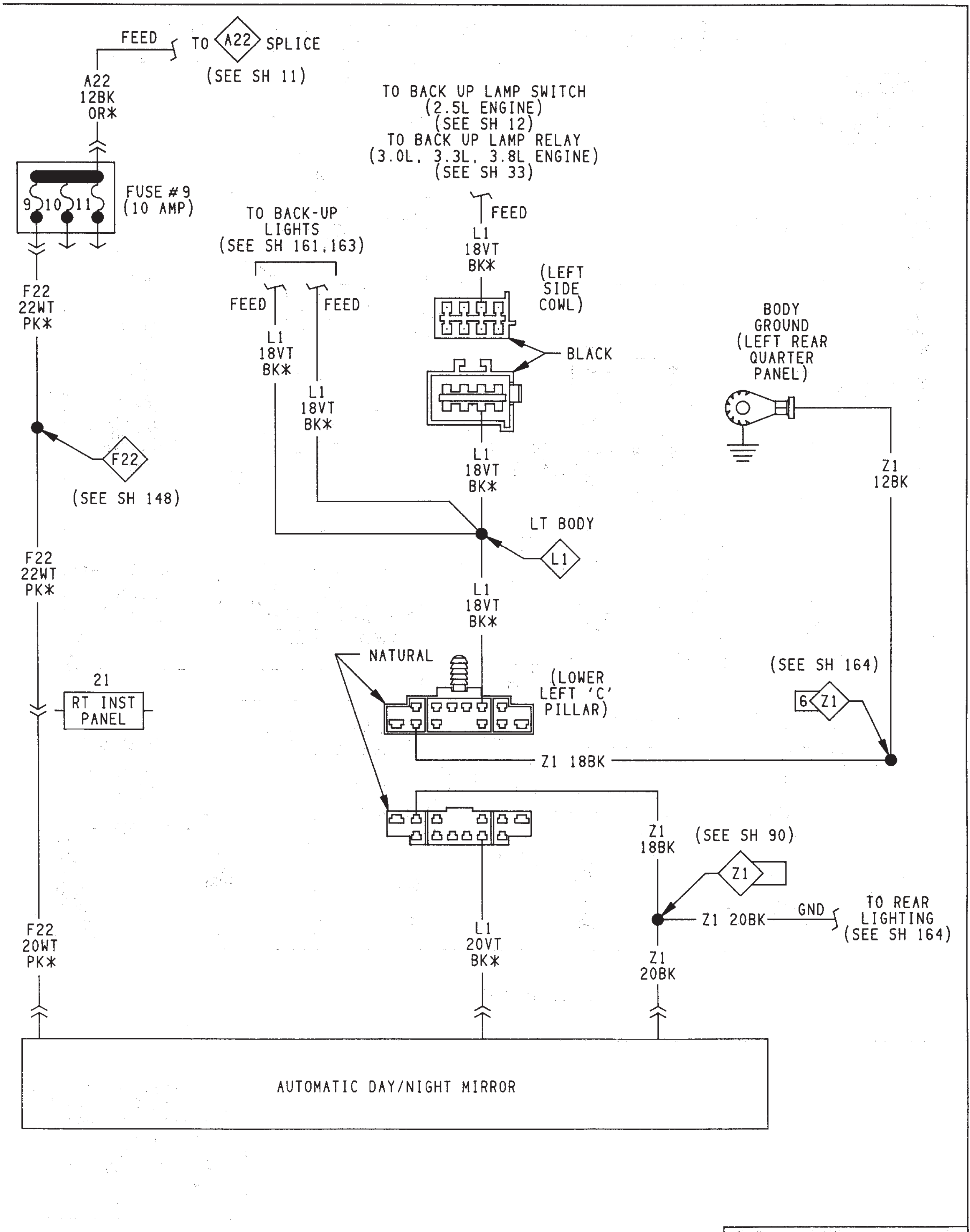
AC-CD, AY-C 122



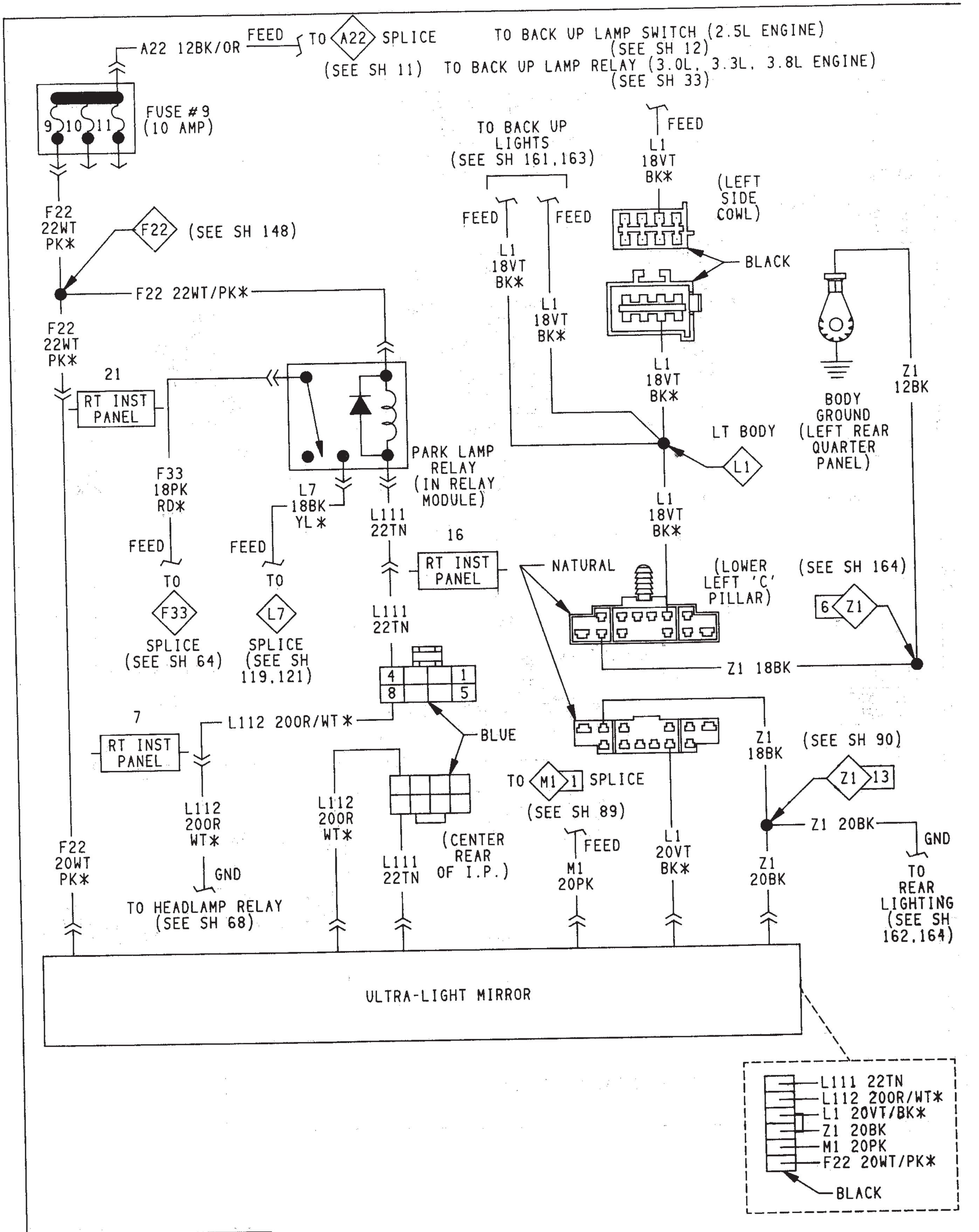
ELECTRICALLY TUNED STEREO RADIO WITH RS AMPLIFIER

AC-CD, AY-C 123

938W-3



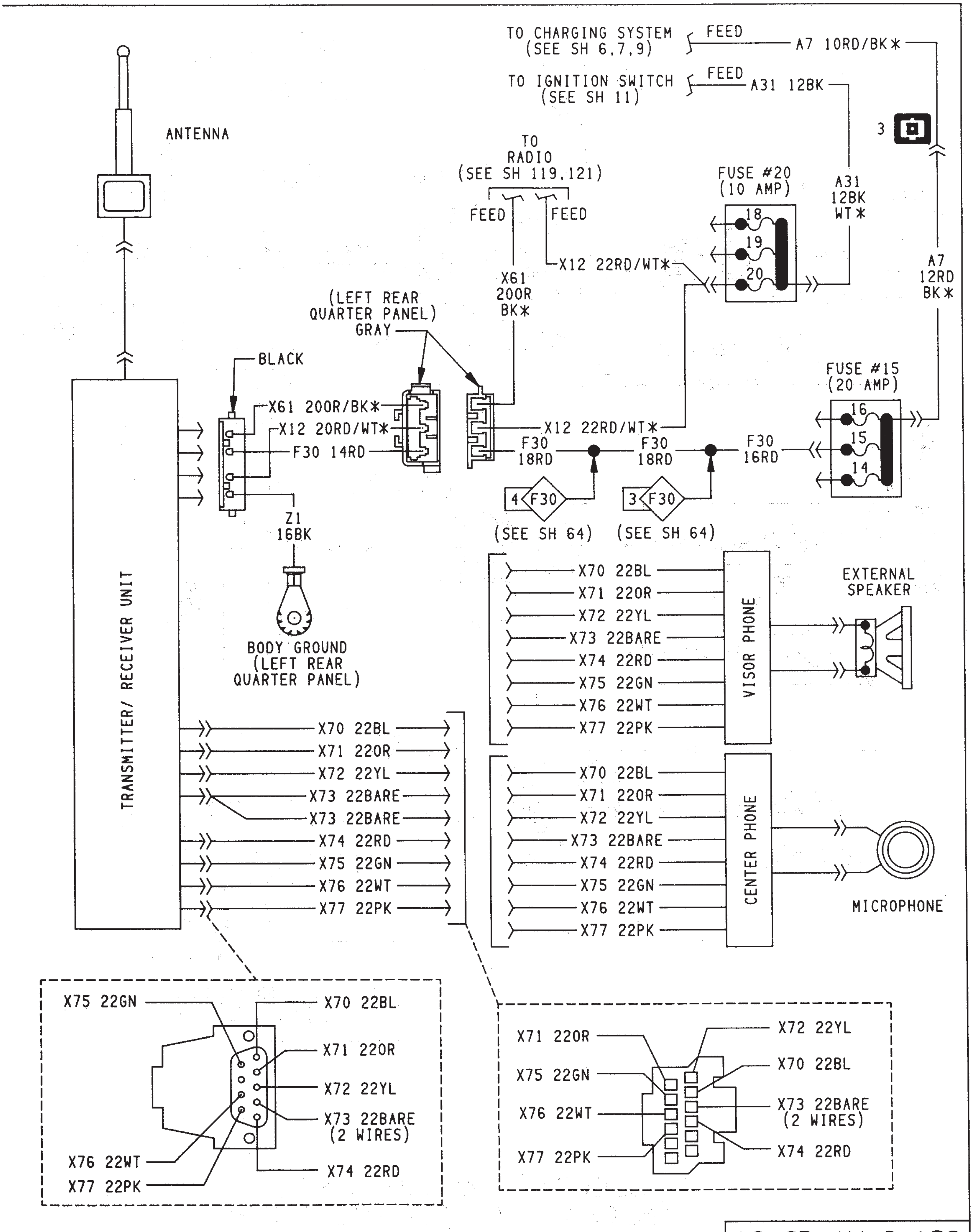
938W-3 AUTOMATIC DAY/NIGHT MIRROR AC-CD, AY-C 124



AC-CD, AY-C 125

ULTRA-LIGHT MIRROR

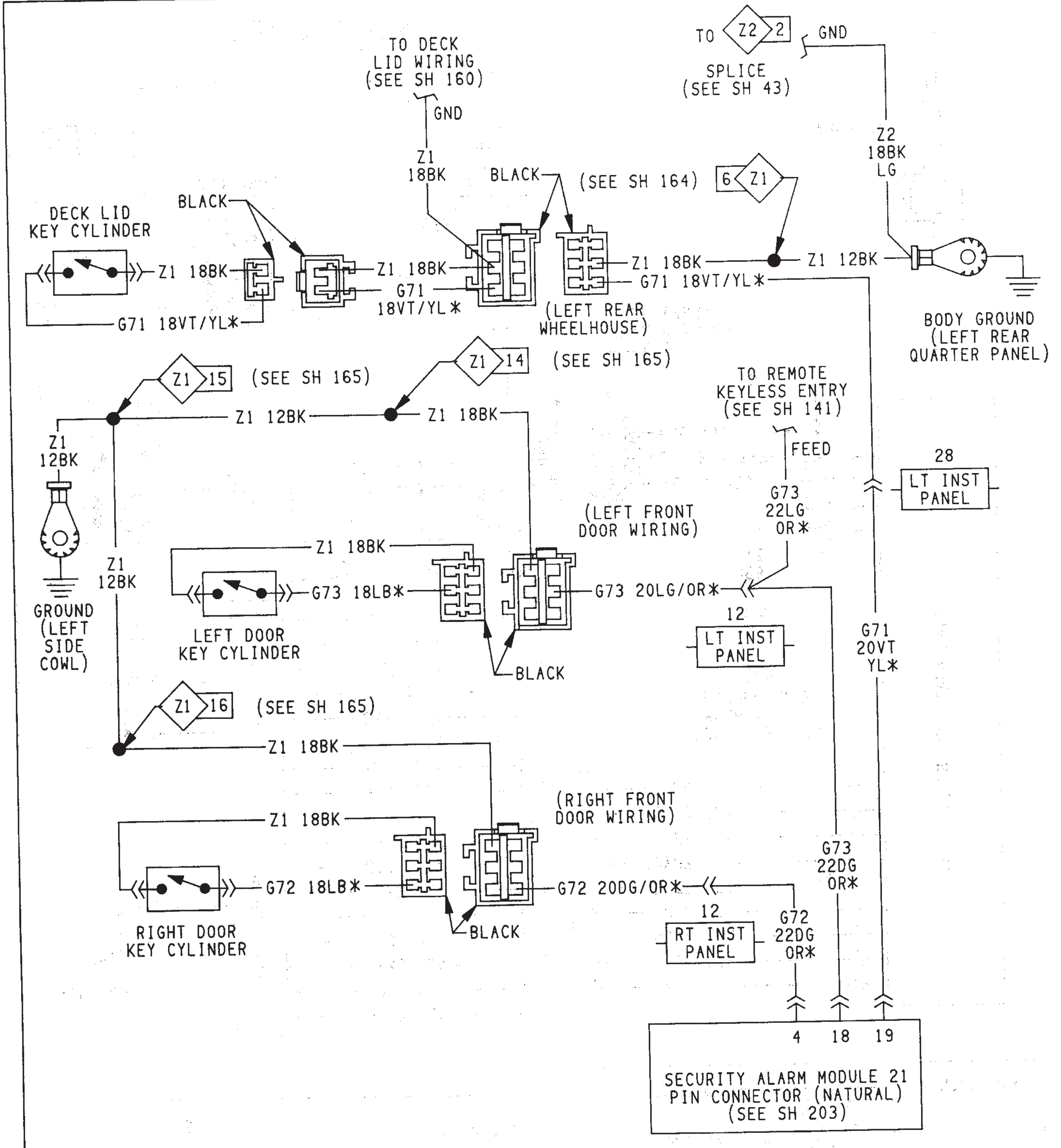
938W-3



938W-3

CELLULAR PHONE SYSTEM

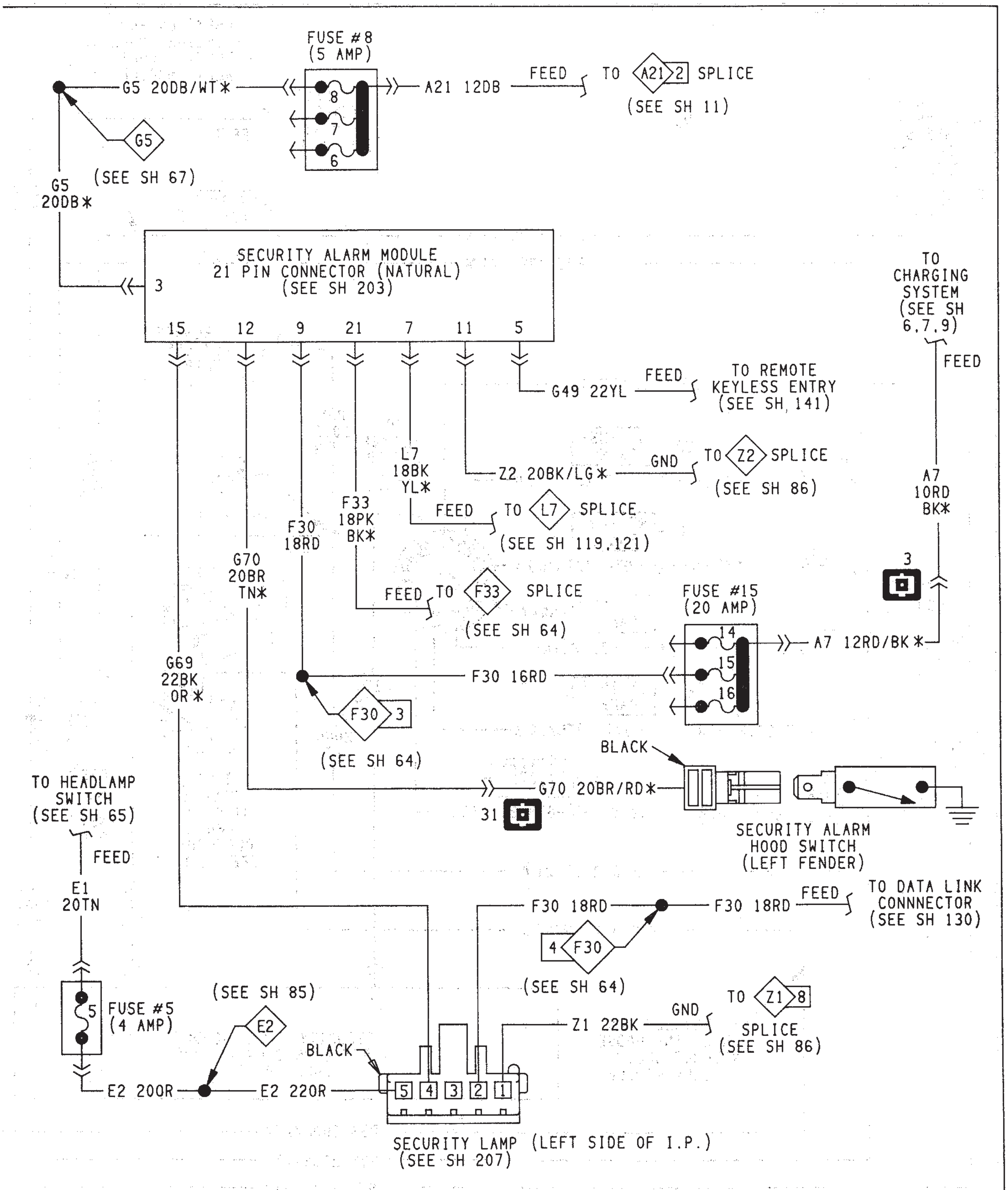
AC-CD, AY-C 126



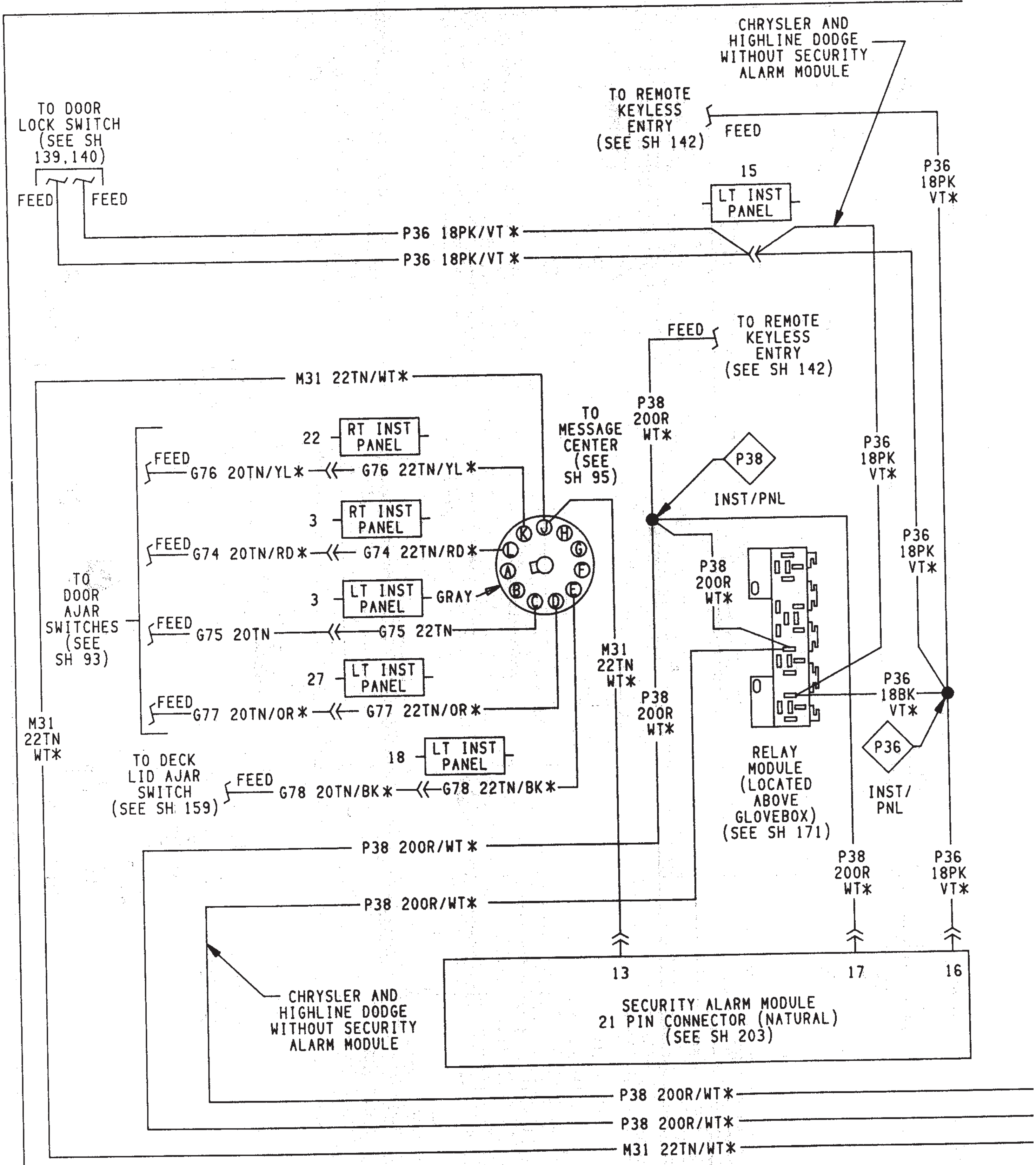
SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITH
VISUAL MESSAGE CENTER)

AC-CD, AY-C 127

938W-3



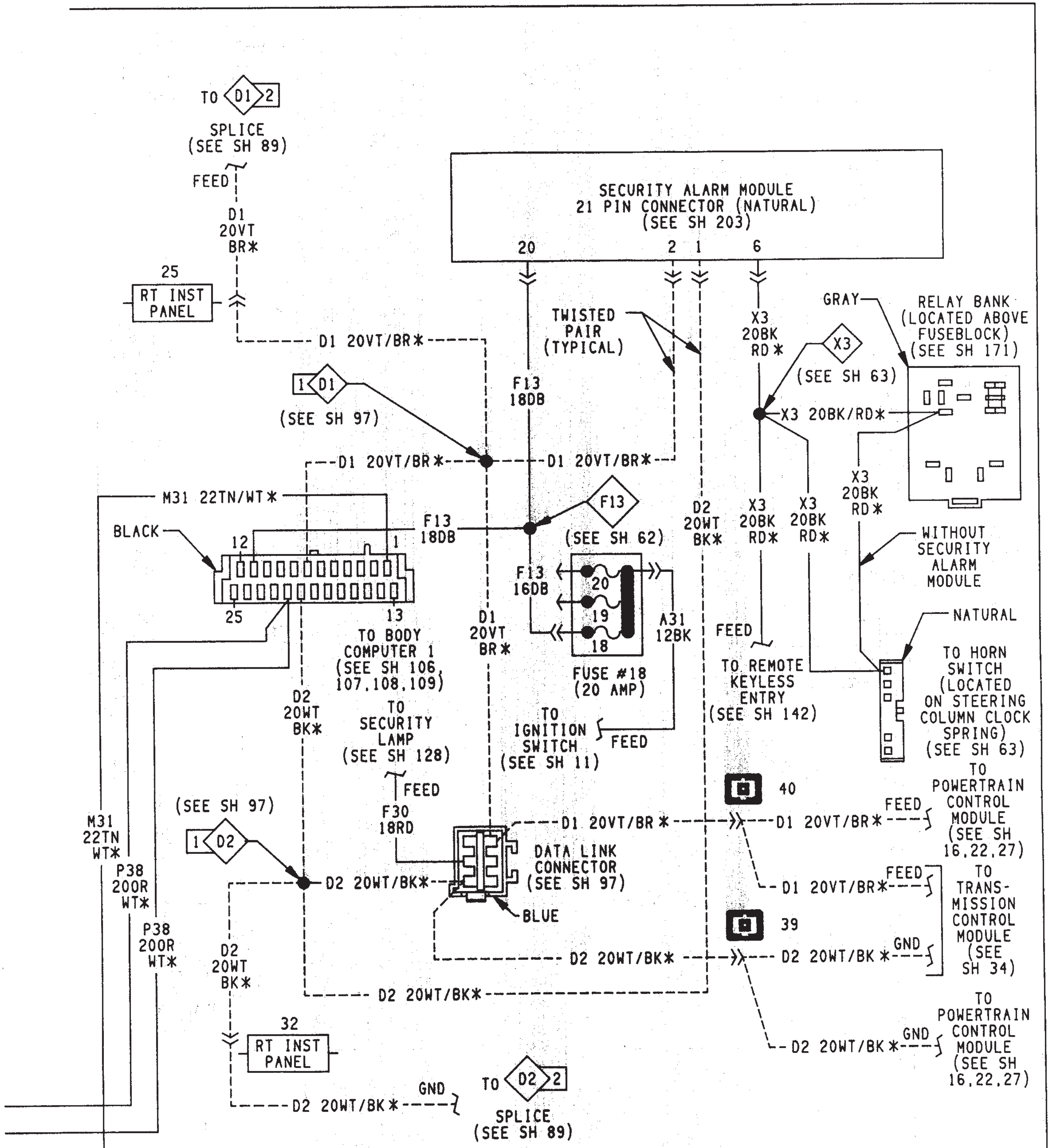
SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITH
VISUAL MESSAGE CENTER)



SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITH
VISUAL MESSAGE CENTER)

AC-CD, AY-C 129

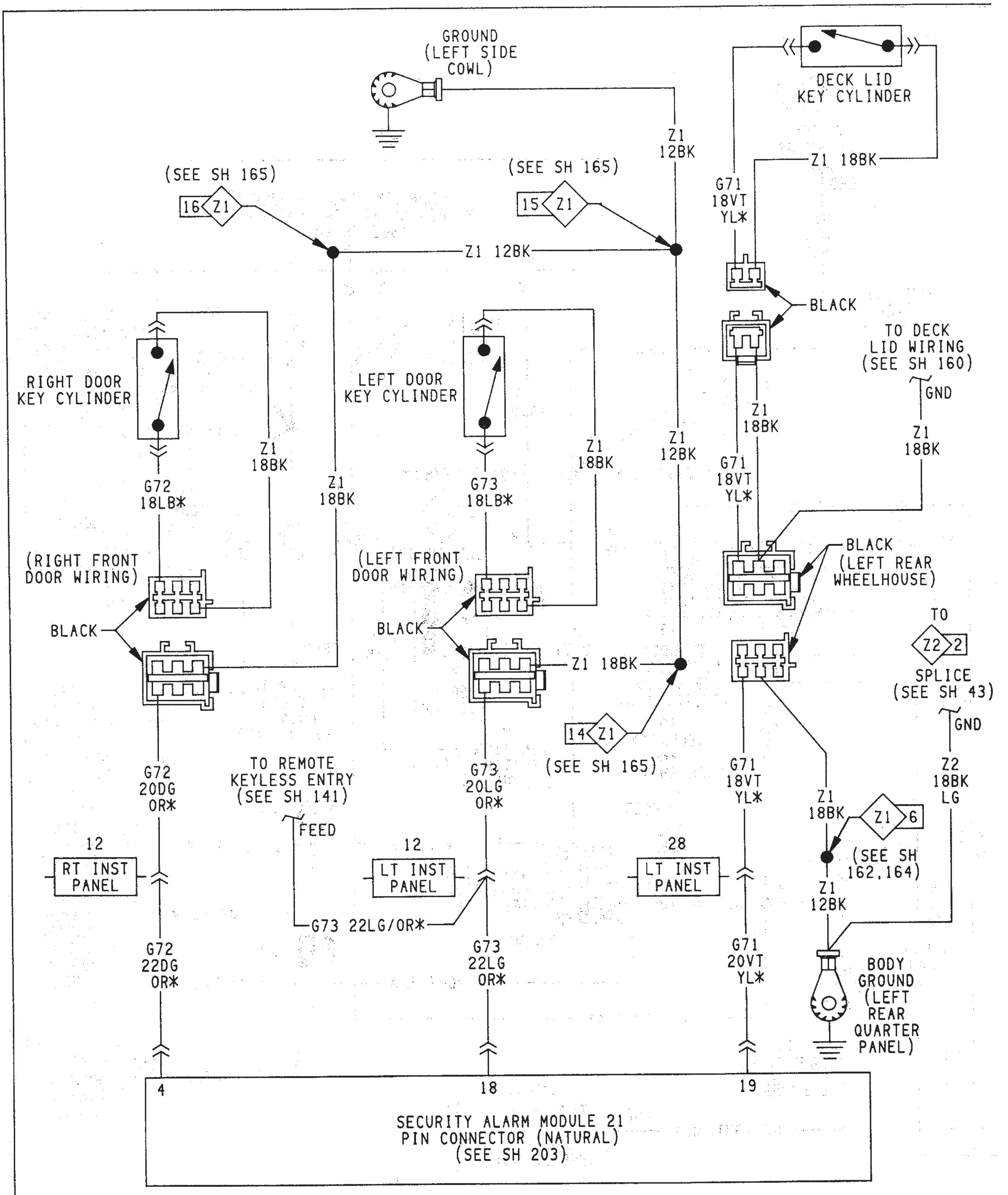
938W-3



SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITH
VISUAL MESSAGE CENTER)

938W-3

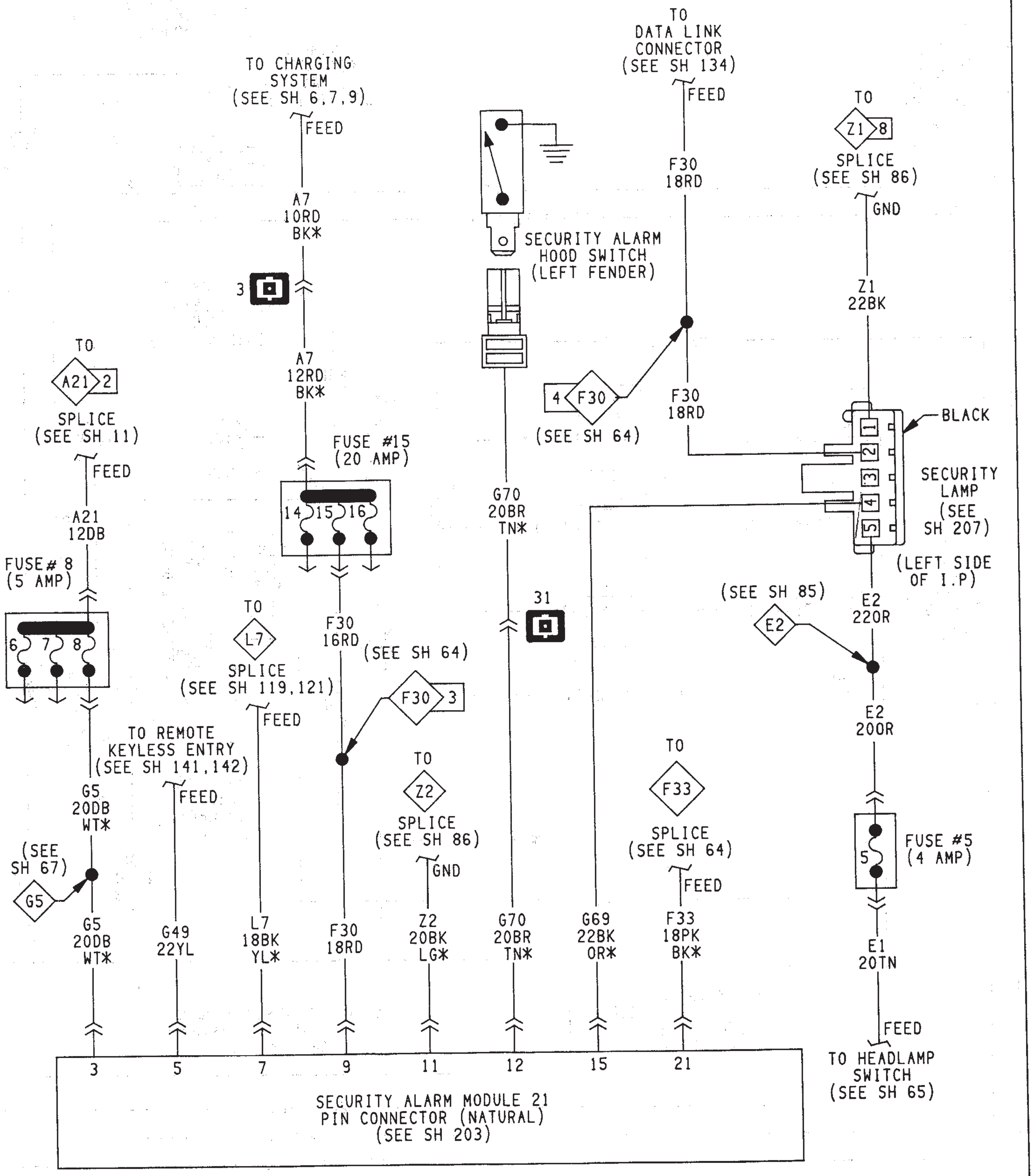
AC-CD,AY-C 130



SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITHOUT
VISUAL MESSAGE CENTER)

AC-CD,AY-C 131

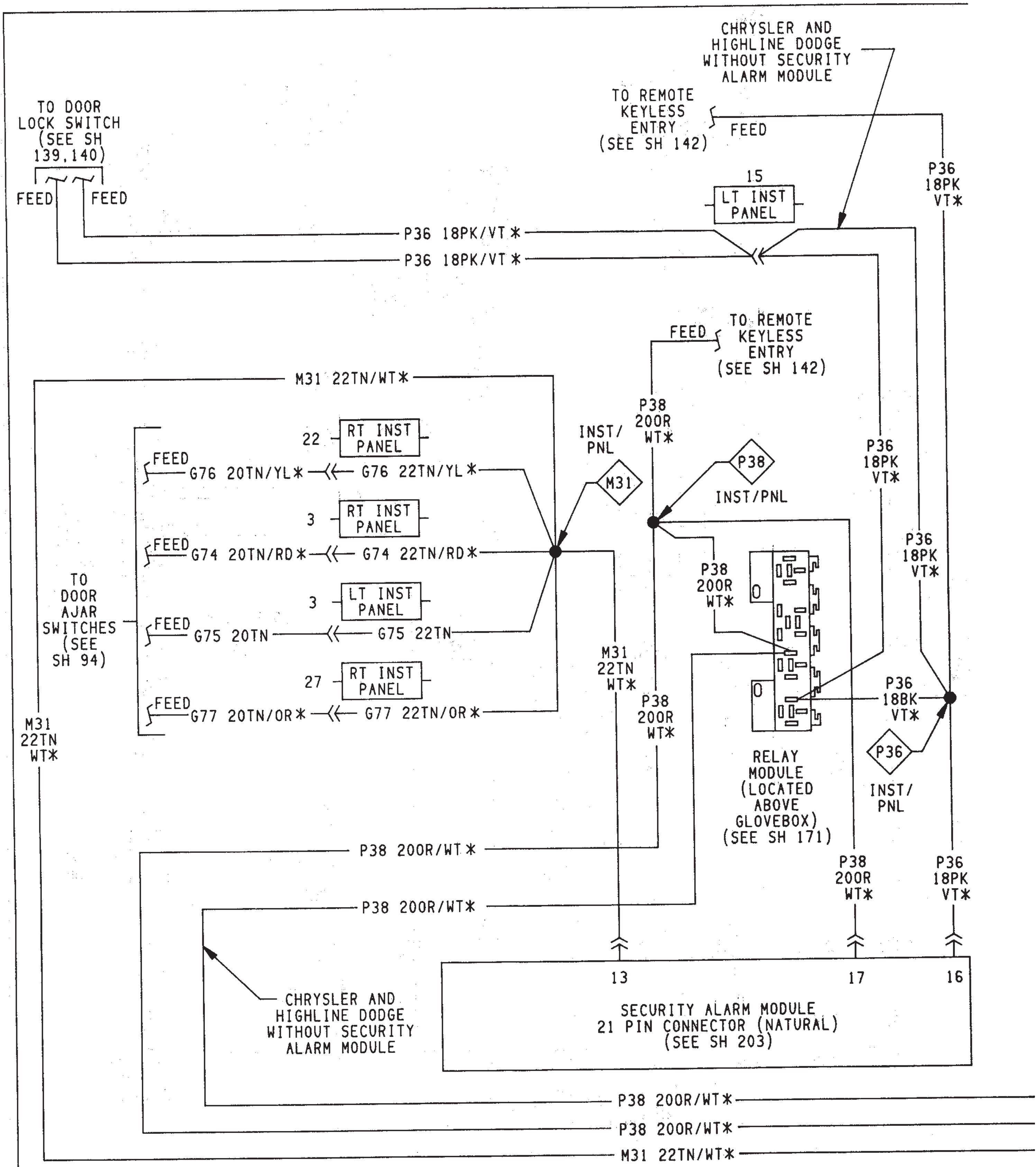
928W-3



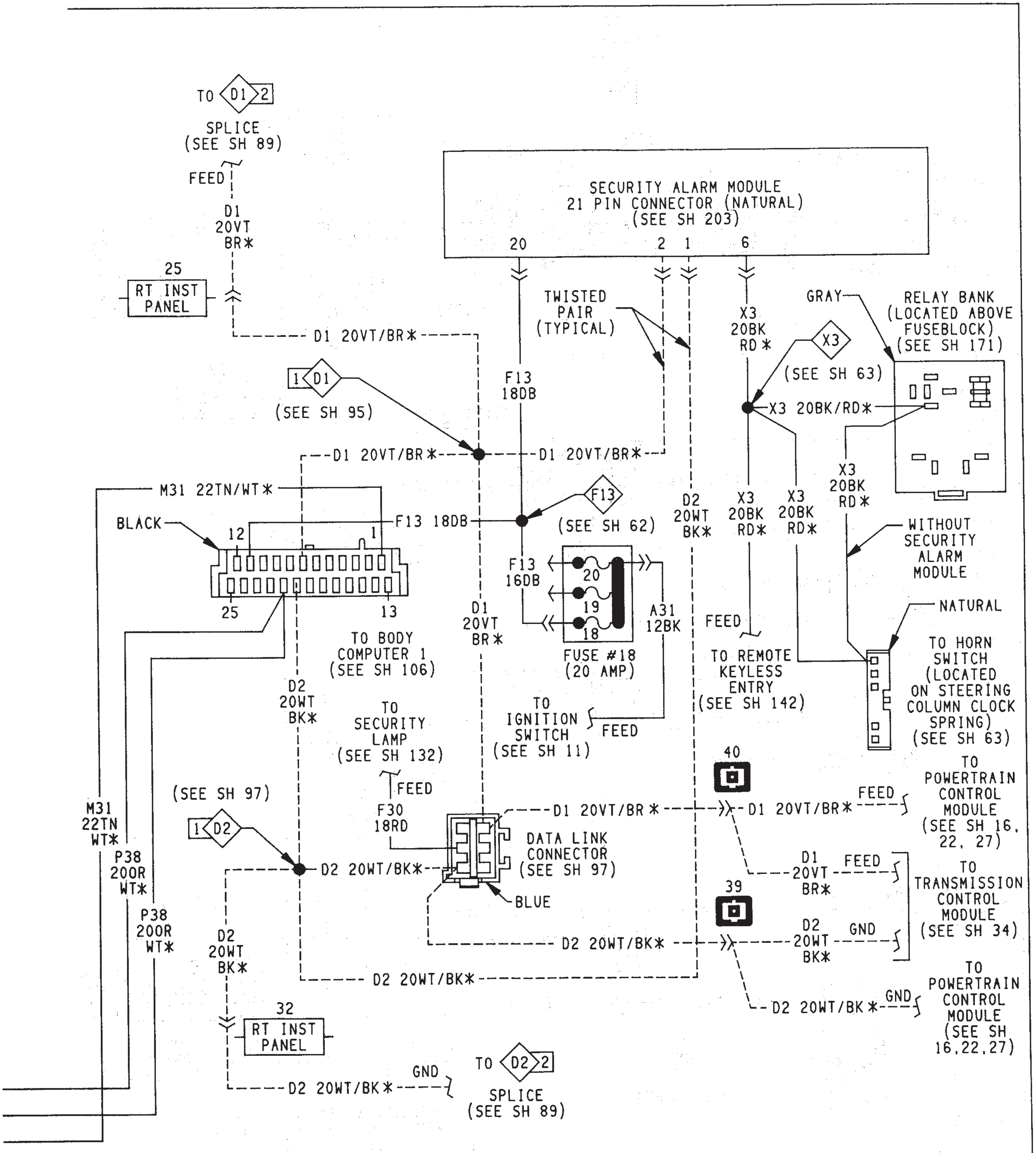
SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITHOUT
VISUAL MESSAGE CENTER)

928W-3

AC-CD,AY-C 132



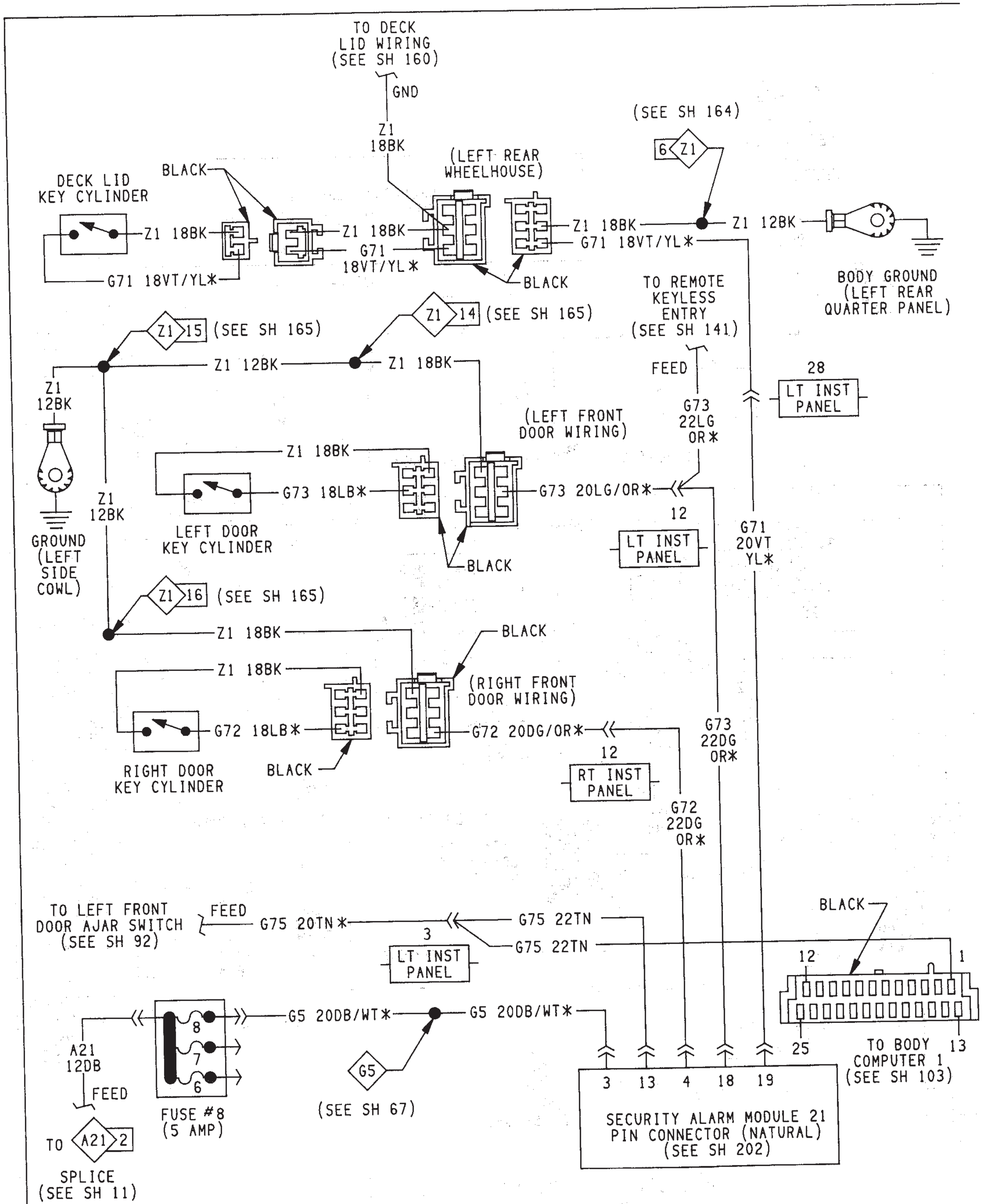
SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITHOUT
VISUAL MESSAGE CENTER)



SECURITY ALARM SYSTEM
(MECHANICAL CLUSTER WITHOUT
VISUAL MESSAGE CENTER)

938W-3

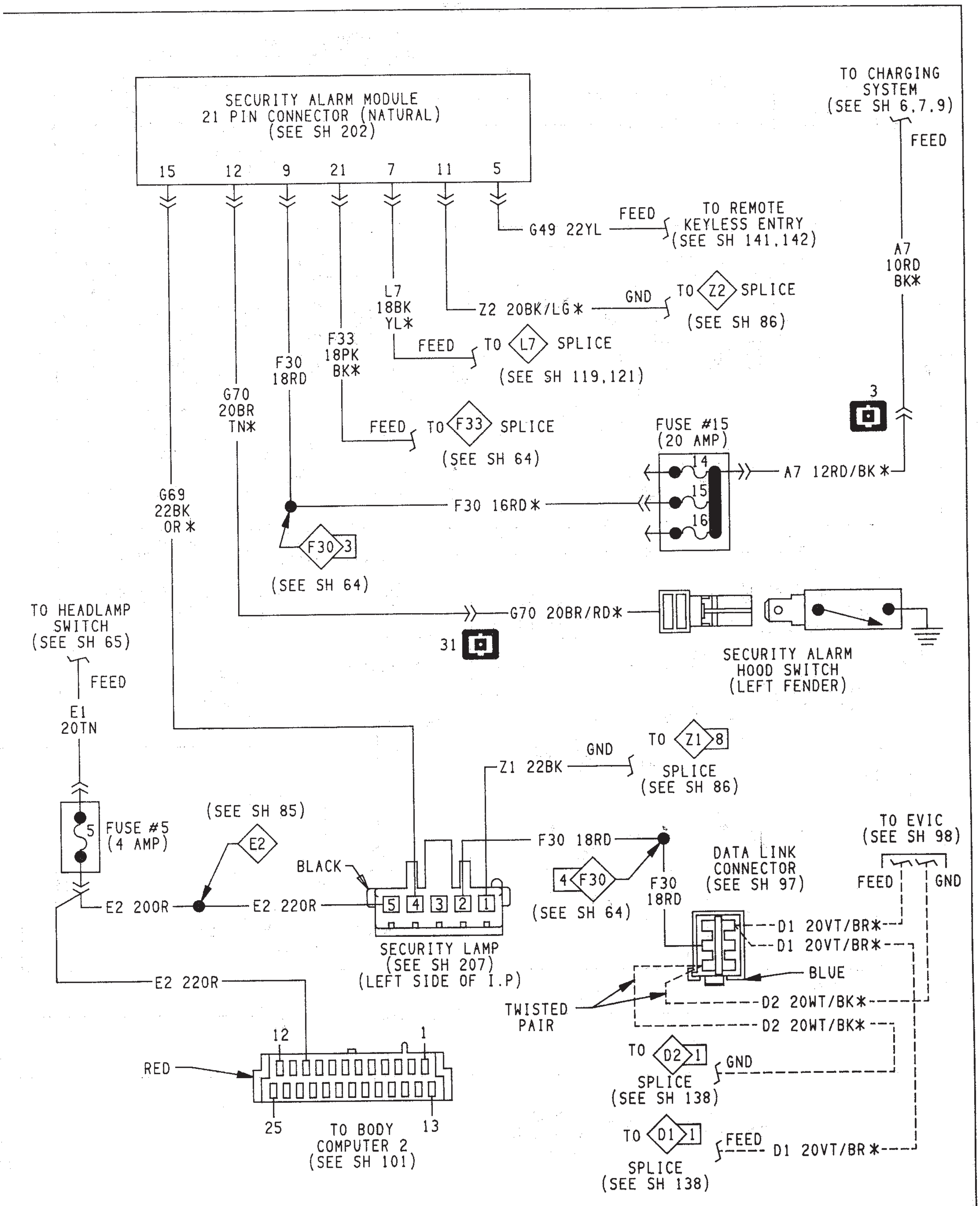
AC-CD, AY-C 134



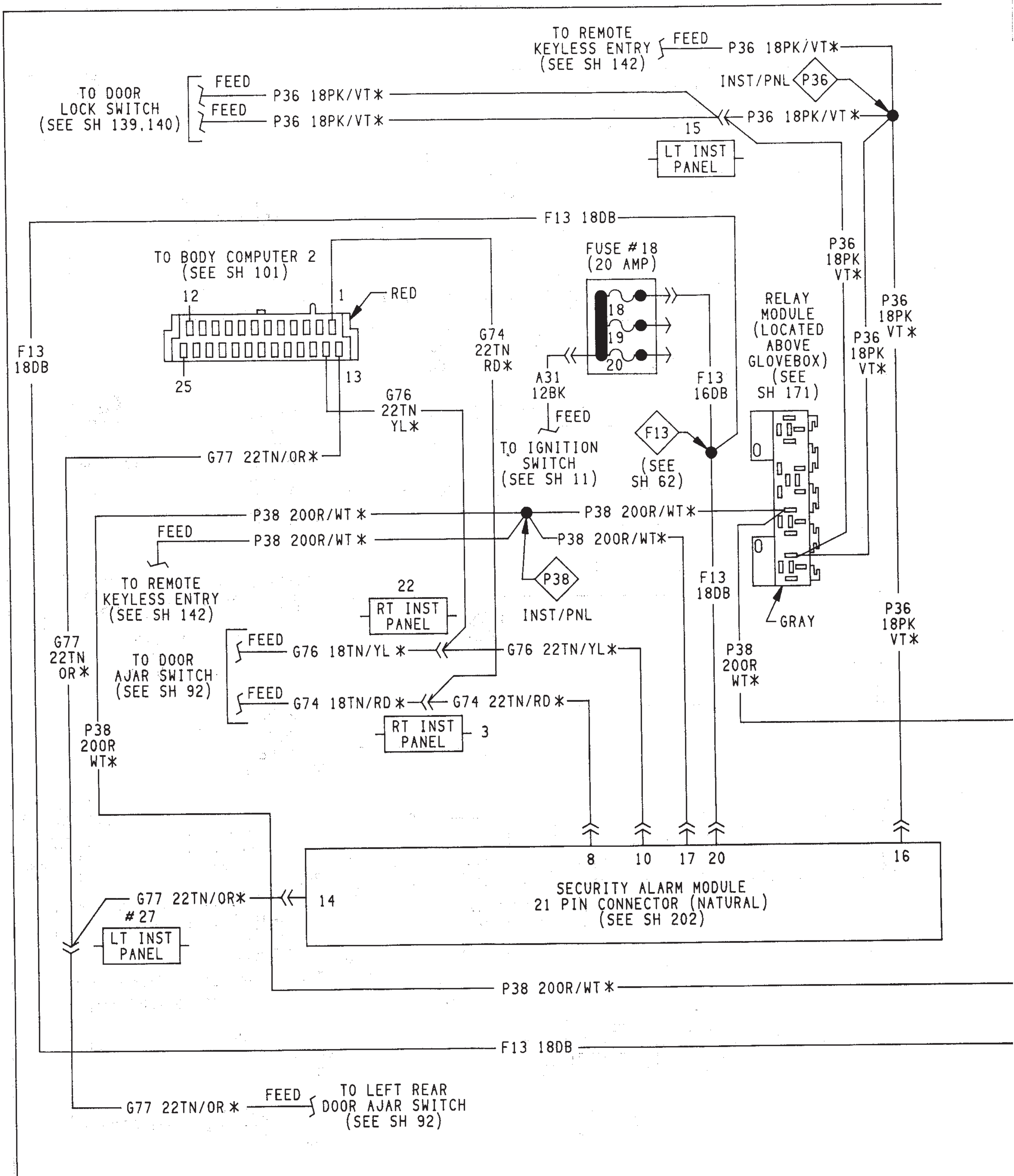
SECURITY ALARM SYSTEM (ELECTRONIC CLUSTER)

AC-CD, AY-C 135

938W-3



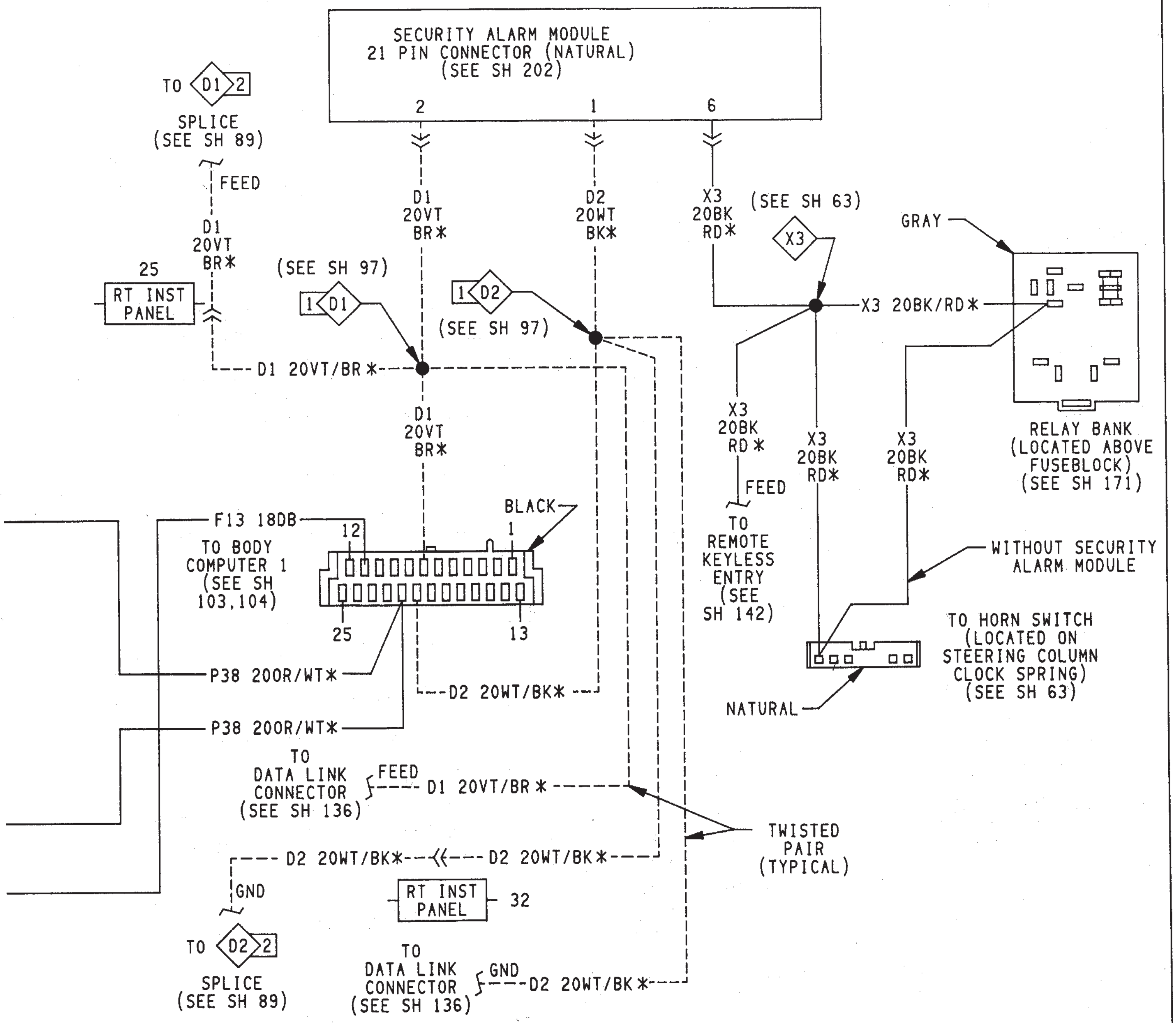
SECURITY ALARM SYSTEM
(ELECTRONIC CLUSTER)



AC-CD, AY-C 137

SECURITY ALARM SYSTEM (ELECTRONIC CLUSTER)

938W-3



938W-3

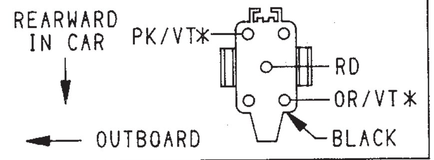
SECURITY ALARM
SYSTEM (ELECTRONIC CLUSTER)

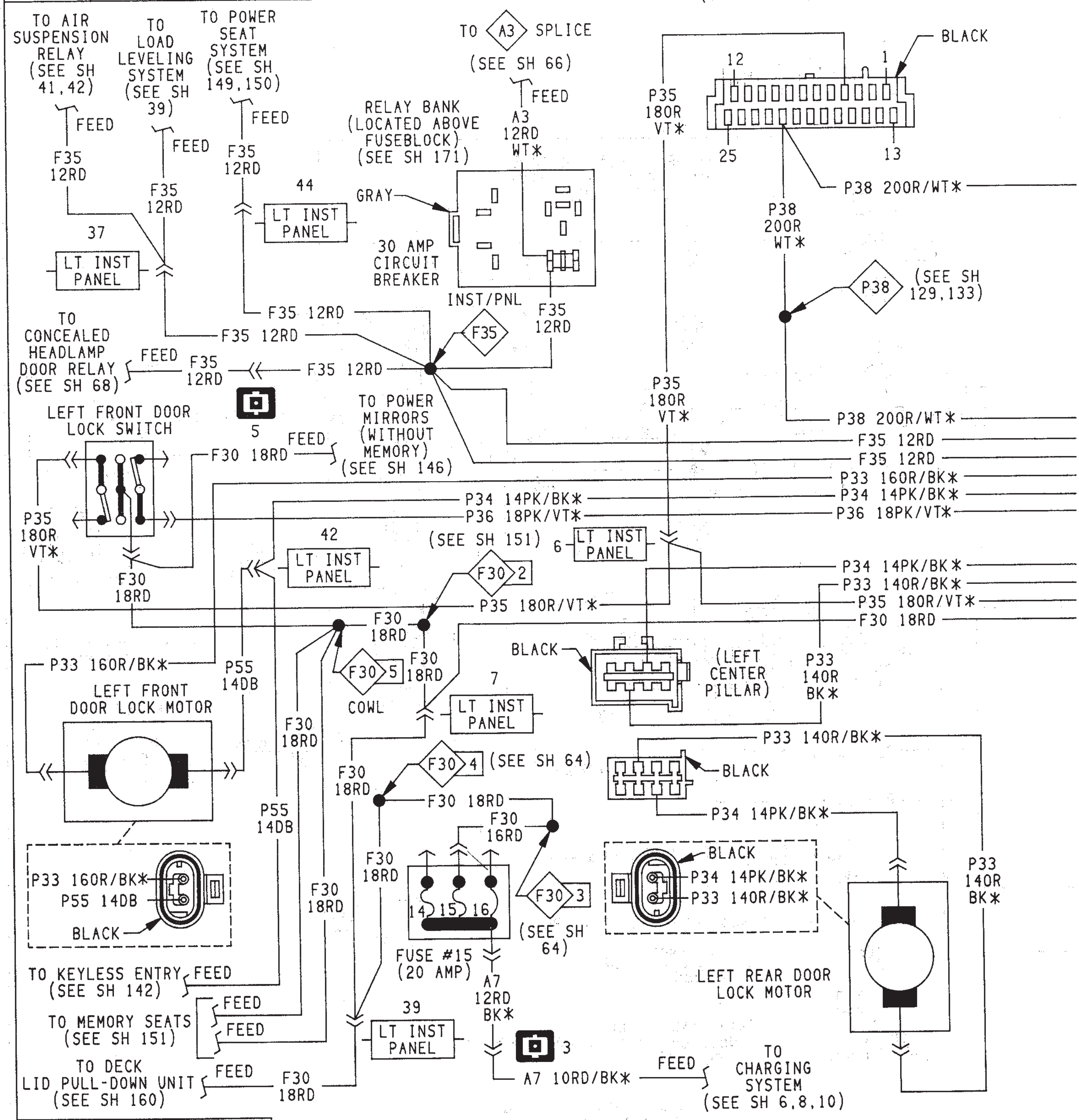
AC-CD, AY-C 138

LEFT FRONT DOOR CONNECTOR AND DOOR LOCK SWITCH FUNCTION

B+ POLARITY	B− POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR/VT*	PK/VT*	LOCK
PK/VT*	OR/VT*	UNLOCK
RD	—	FEED B+

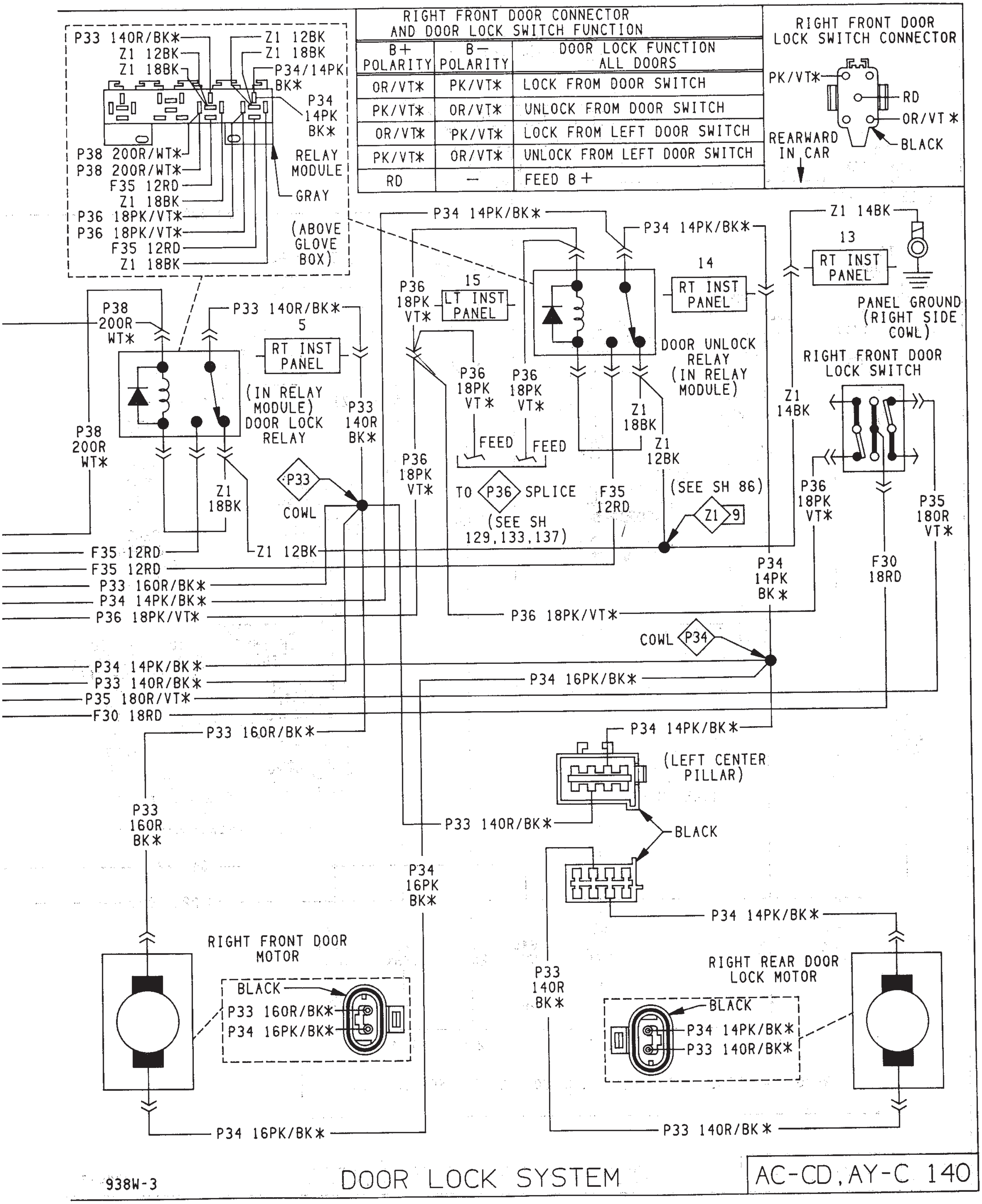
LEFT FRONT DOOR LOCK SWITCH CONNECTOR





DOOR LOCK SYSTEM

938W-3



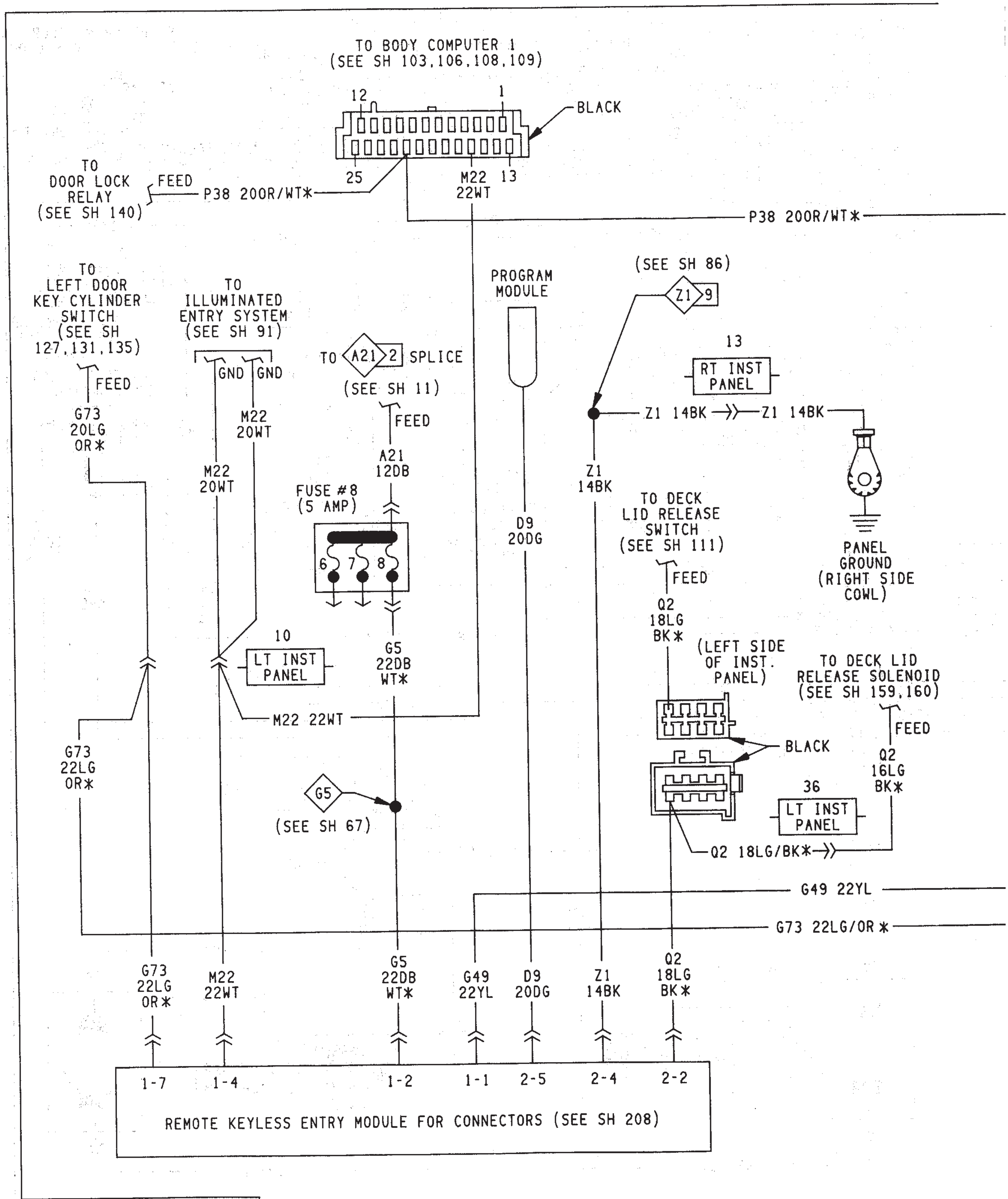
RIGHT FRONT DOOR CONNECTOR AND DOOR LOCK SWITCH FUNCTION

B+ POLARITY	B− POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR/VT*	PK/VT*	LOCK FROM DOOR SWITCH
PK/VT*	OR/VT*	UNLOCK FROM DOOR SWITCH
OR/VT*	PK/VT*	LOCK FROM LEFT DOOR SWITCH
PK/VT*	OR/VT*	UNLOCK FROM LEFT DOOR SWITCH
RD	—	FEED B+

938W-3

DOOR LOCK SYSTEM

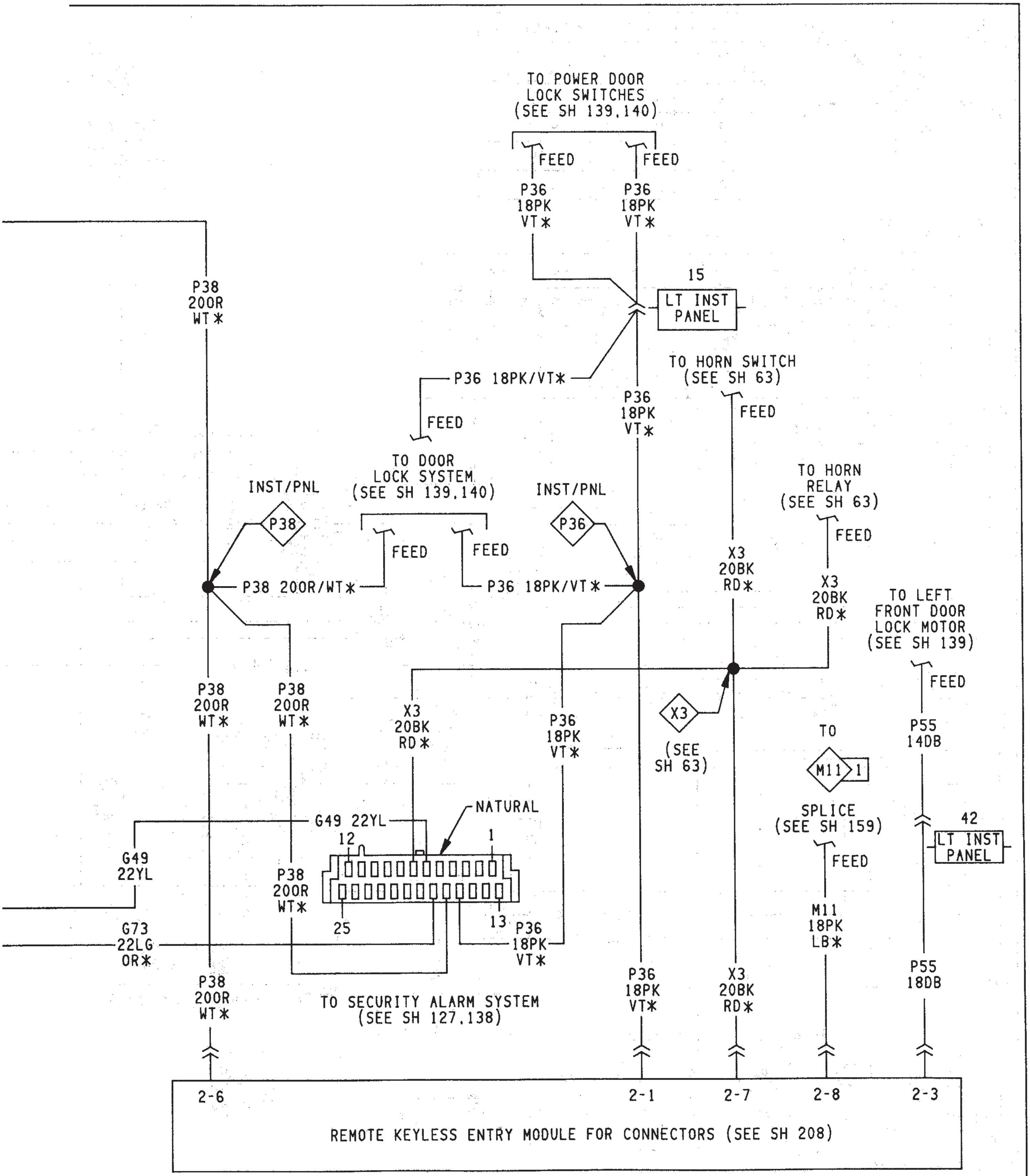
AC-CD, AY-C 140



AC-CD,AY-C 141

REMOTE KEYLESS ENTRY

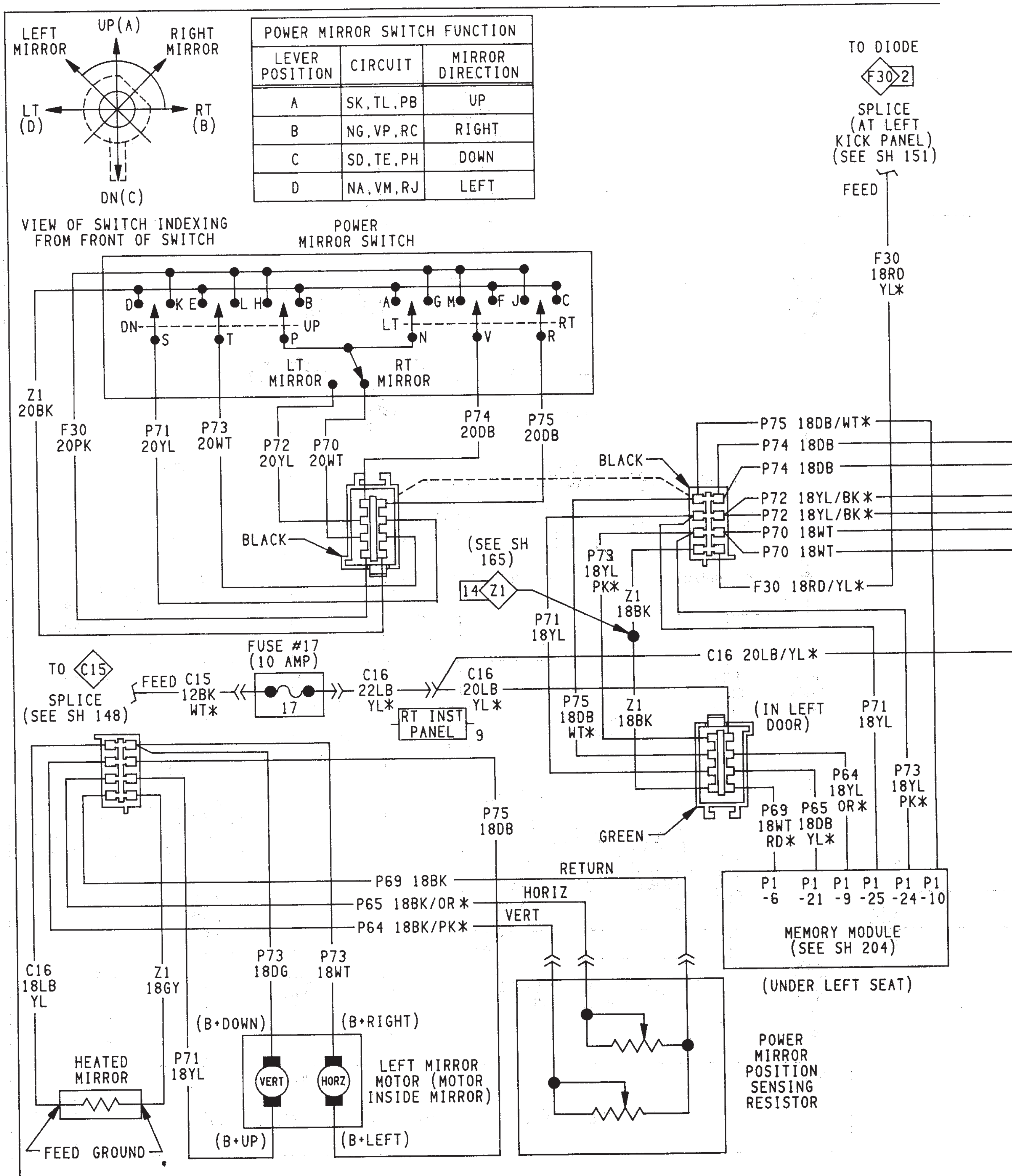
938W-3



938W-3

REMOTE KEYLESS ENTRY

AC-CD, AY-C 142



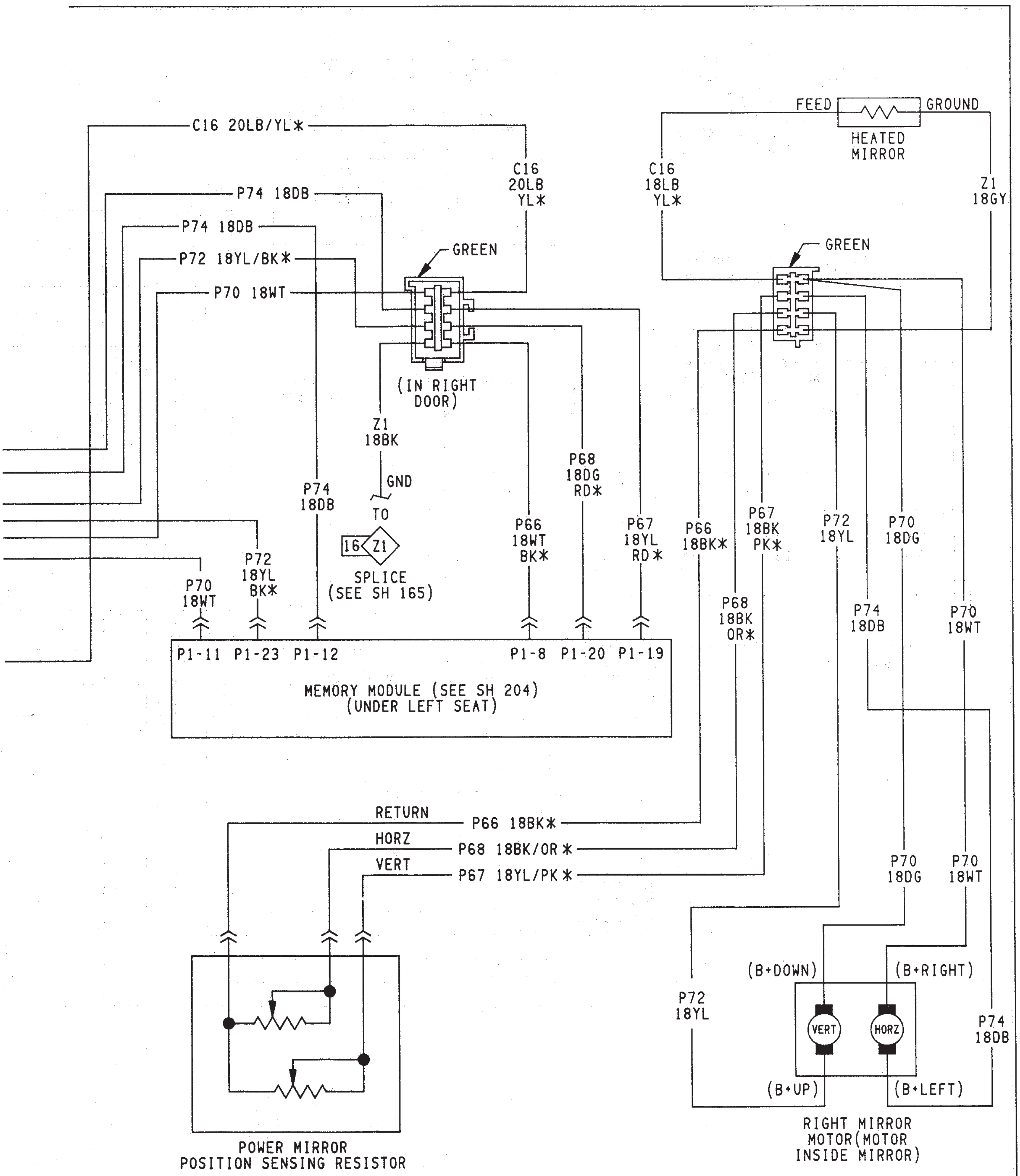
POWER MIRROR SWITCH FUNCTION

LEVER POSITION	CIRCUIT	MIRROR DIRECTION
A	SK,TL,PB	UP
B	NG,VP,RC	RIGHT
C	SD,TE,PH	DOWN
D	NA,VM,RJ	LEFT

POWER HEATED MEMORY MIRROR SYSTEM

AC-CD, AY-C 143

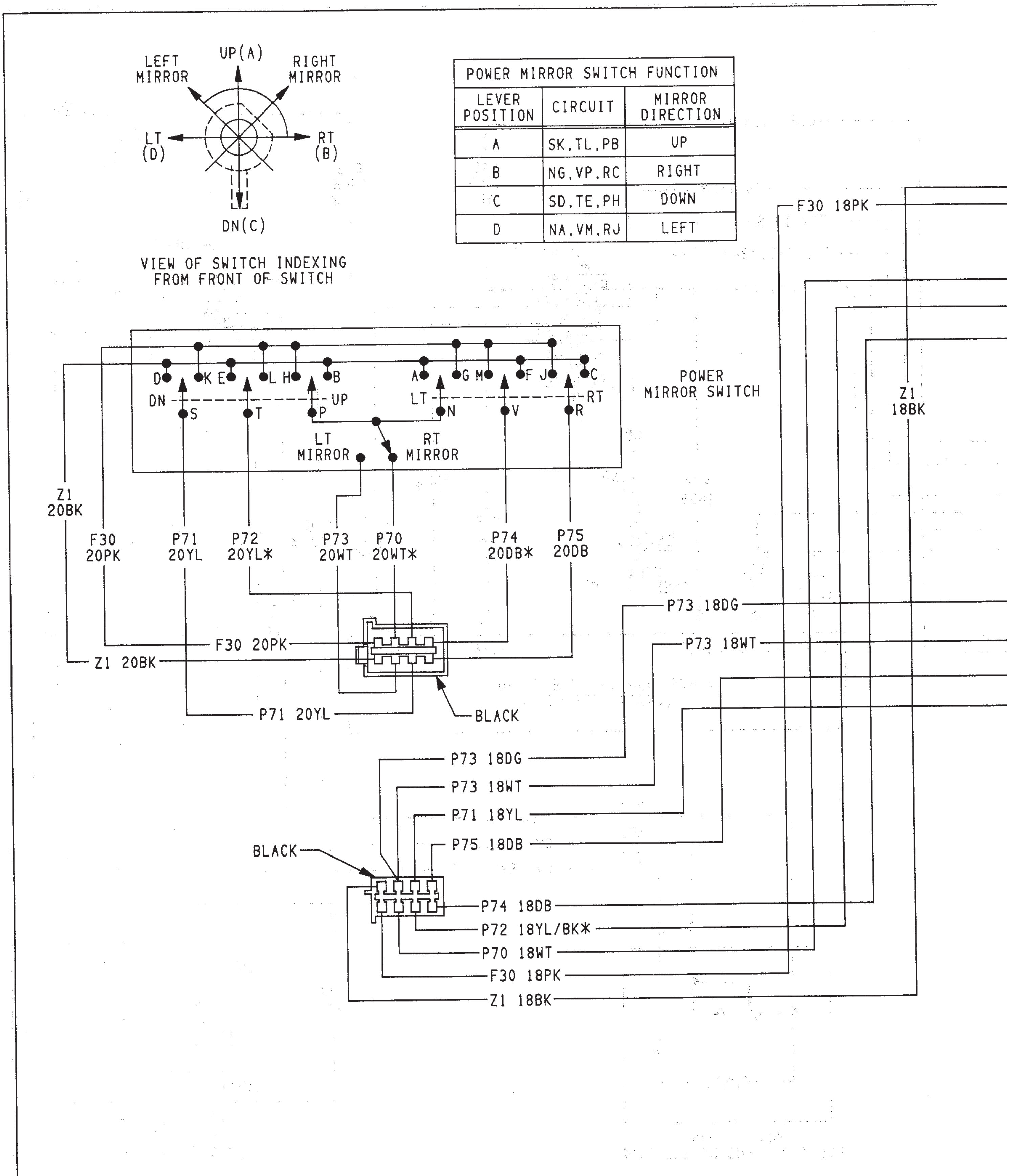
938W-3



POWER HEATED MEMORY
MIRROR SYSTEM

938W-3

AC-CD,AY-C 144



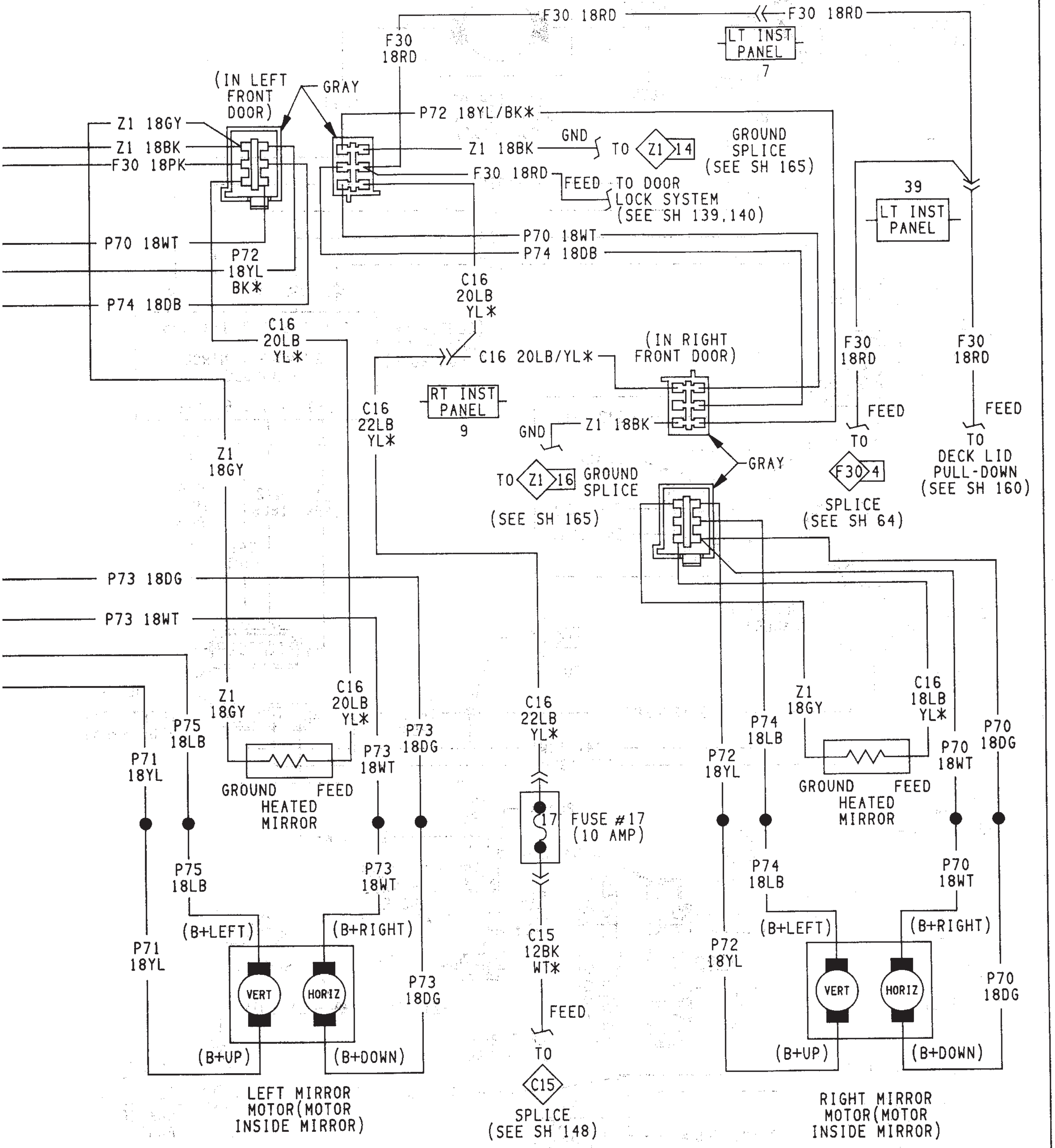
POWER MIRROR SWITCH FUNCTION

LEVER POSITION	CIRCUIT	MIRROR DIRECTION
A	SK, TL, PB	UP
B	NG, VP, RC	RIGHT
C	SD, TE, PH	DOWN
D	NA, VM, RJ	LEFT

POWER HEATED MIRRORS
(WITHOUT MEMORY)

AC-CD, AY-C 145

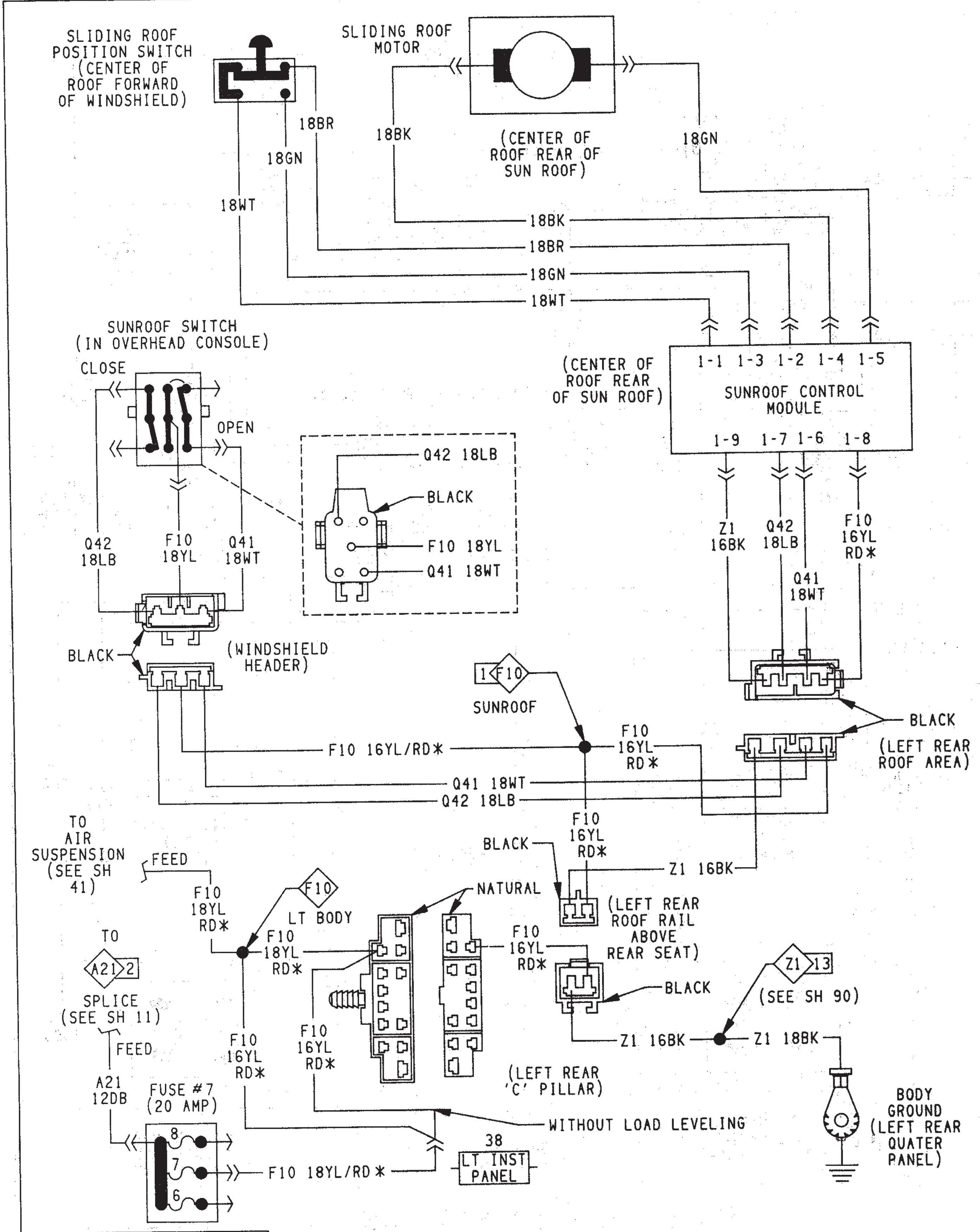
938W-3



POWER HEATED MIRRORS (WITHOUT MEMORY)

938W-3

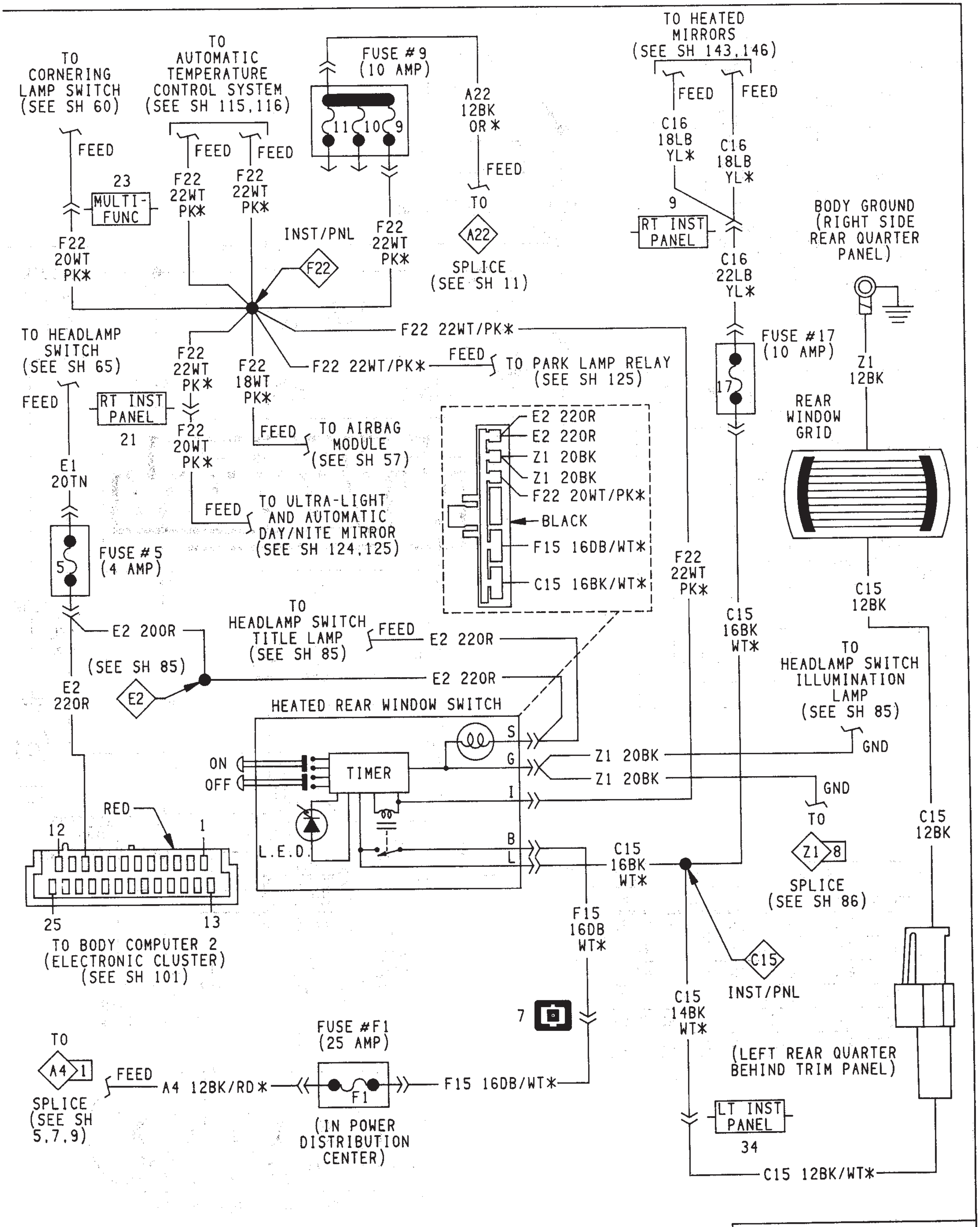
AC-CD, AY-C 146



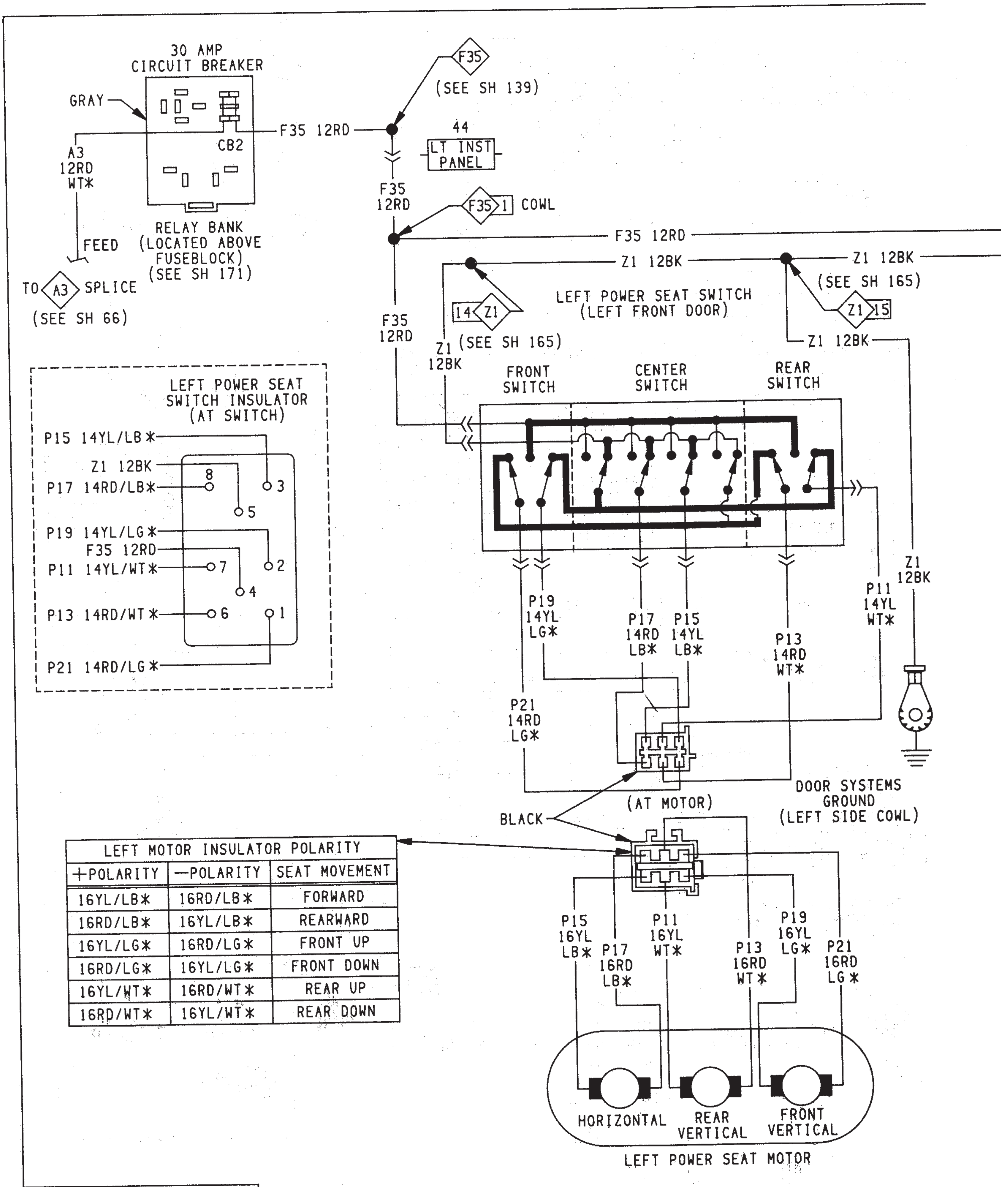
AC-CD, AY-C 147

POWER SUNROOF SYSTEM

938W-3

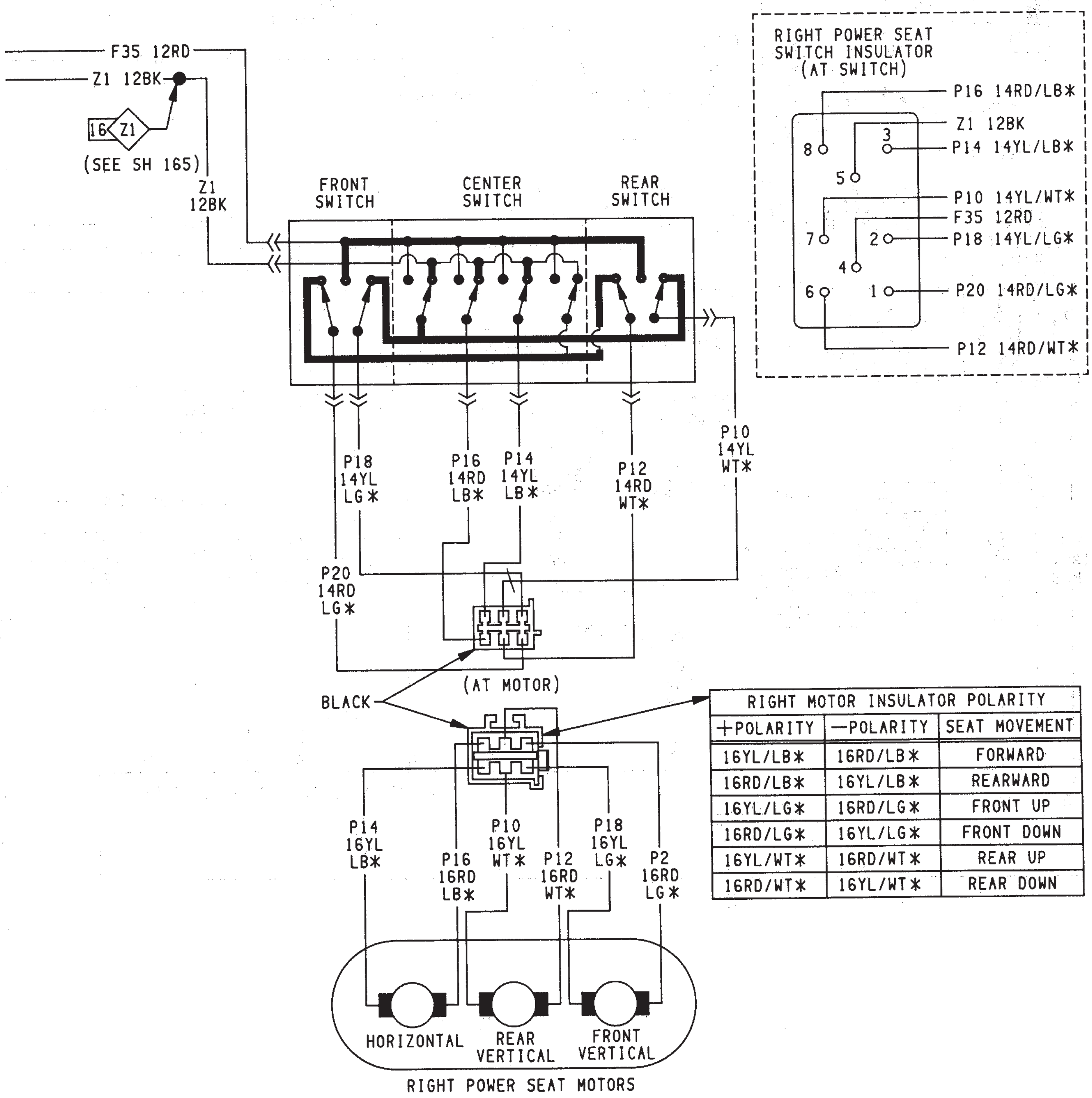


938W-3 HEATED REAR WINDOW AC-CD, AY-C 148



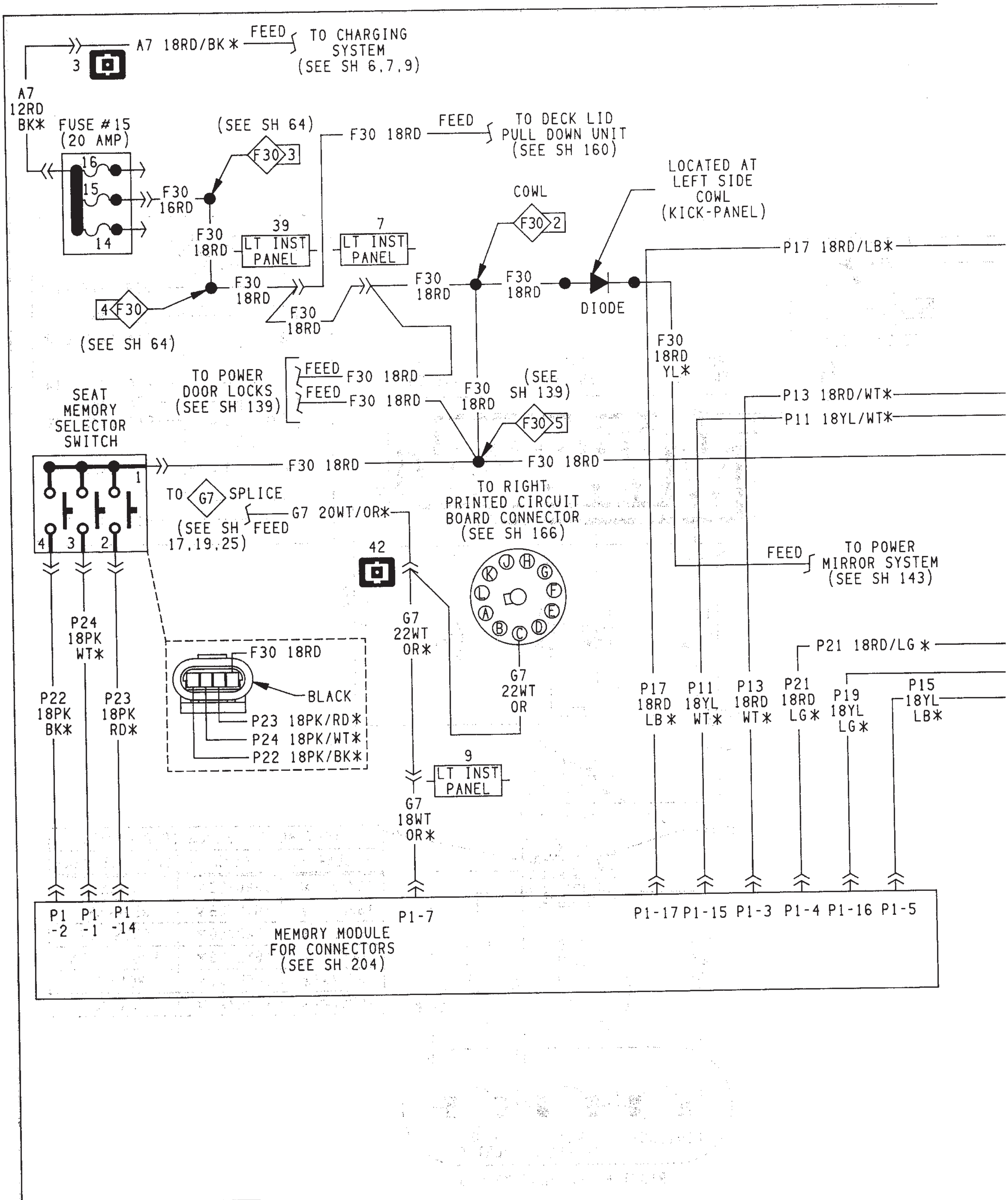
LEFT MOTOR INSULATOR POLARITY		
+POLARITY	−POLARITY	SEAT MOVEMENT
16YL/LB*	16RD/LB*	FORWARD
16RD/LB*	16YL/LB*	REARWARD
16YL/LG*	16RD/LG*	FRONT UP
16RD/LG*	16YL/LG*	FRONT DOWN
16YL/WT*	16RD/WT*	REAR UP
16RD/WT*	16YL/WT*	REAR DOWN

POWER SEAT SYSTEM



RIGHT MOTOR INSULATOR POLARITY		
+POLARITY	—POLARITY	SEAT MOVEMENT
16YL/LB*	16RD/LB*	FORWARD
16RD/LB*	16YL/LB*	REARWARD
16YL/LG*	16RD/LG*	FRONT UP
16RD/LG*	16YL/LG*	FRONT DOWN
16YL/WT*	16RD/WT*	REAR UP
16RD/WT*	16YL/WT*	REAR DOWN

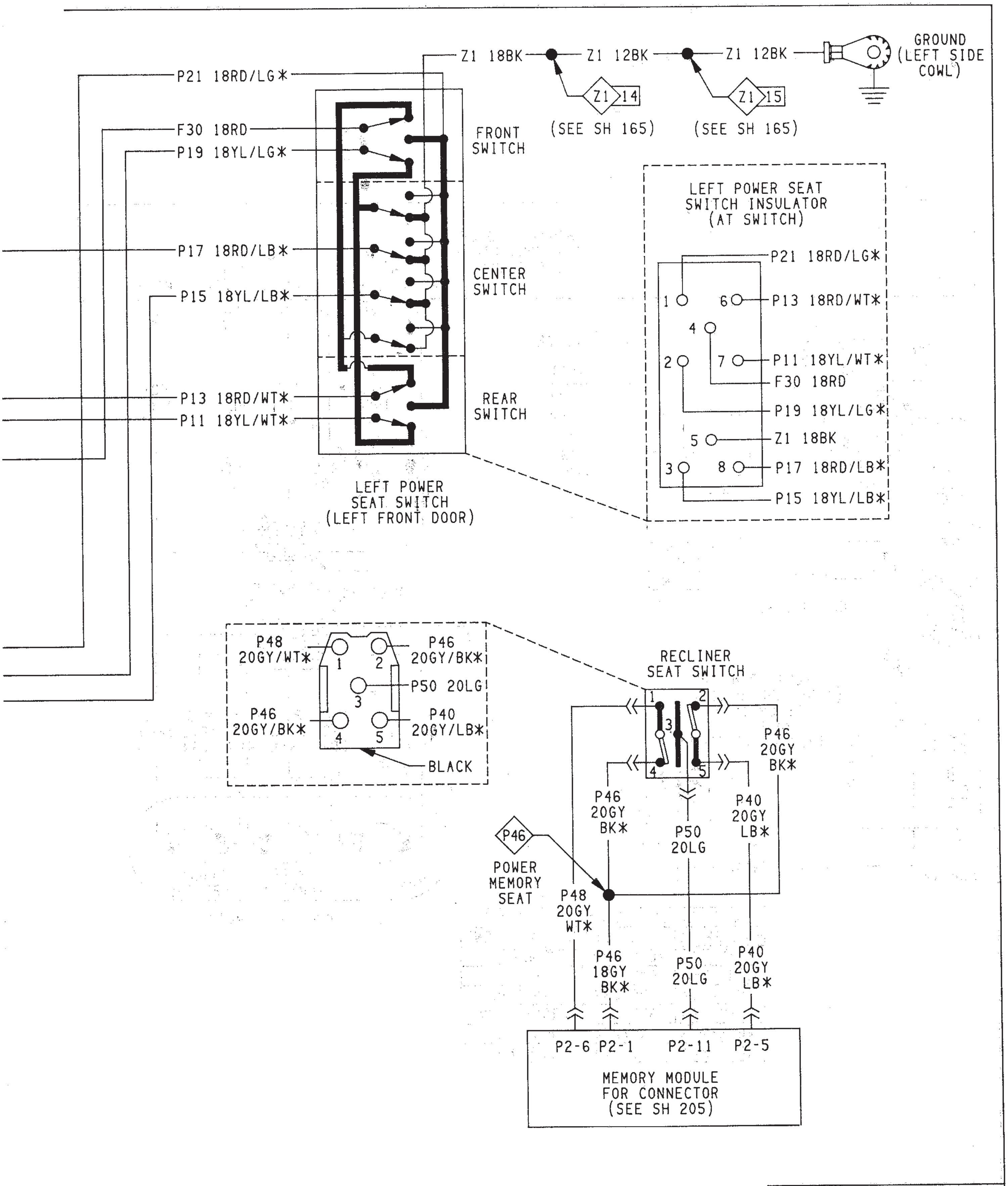
POWER SEAT SYSTEM



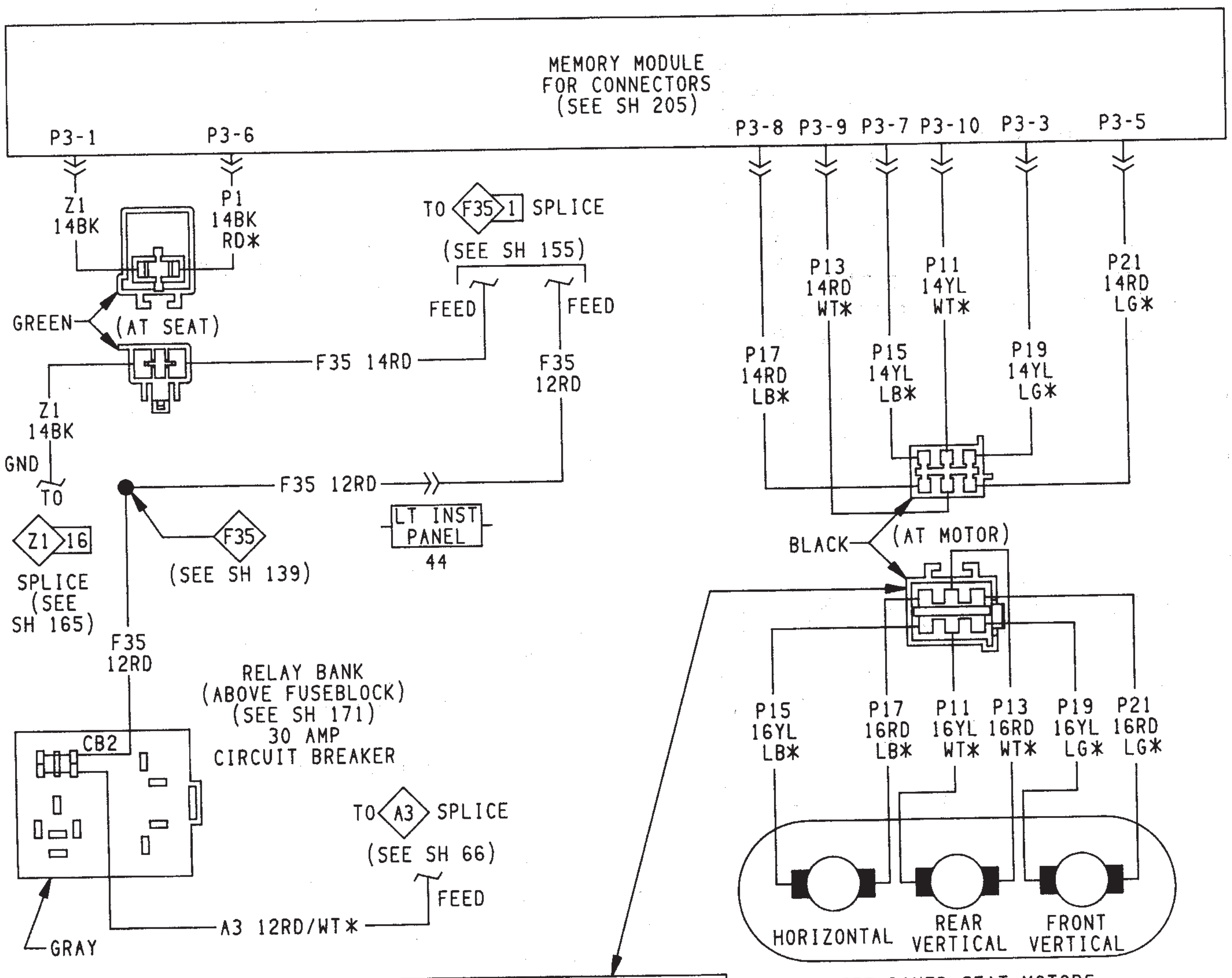
AC-CD, AY-C 151

MEMORY POWER SEAT SYSTEM

938W-3



MEMORY POWER SEAT SYSTEM

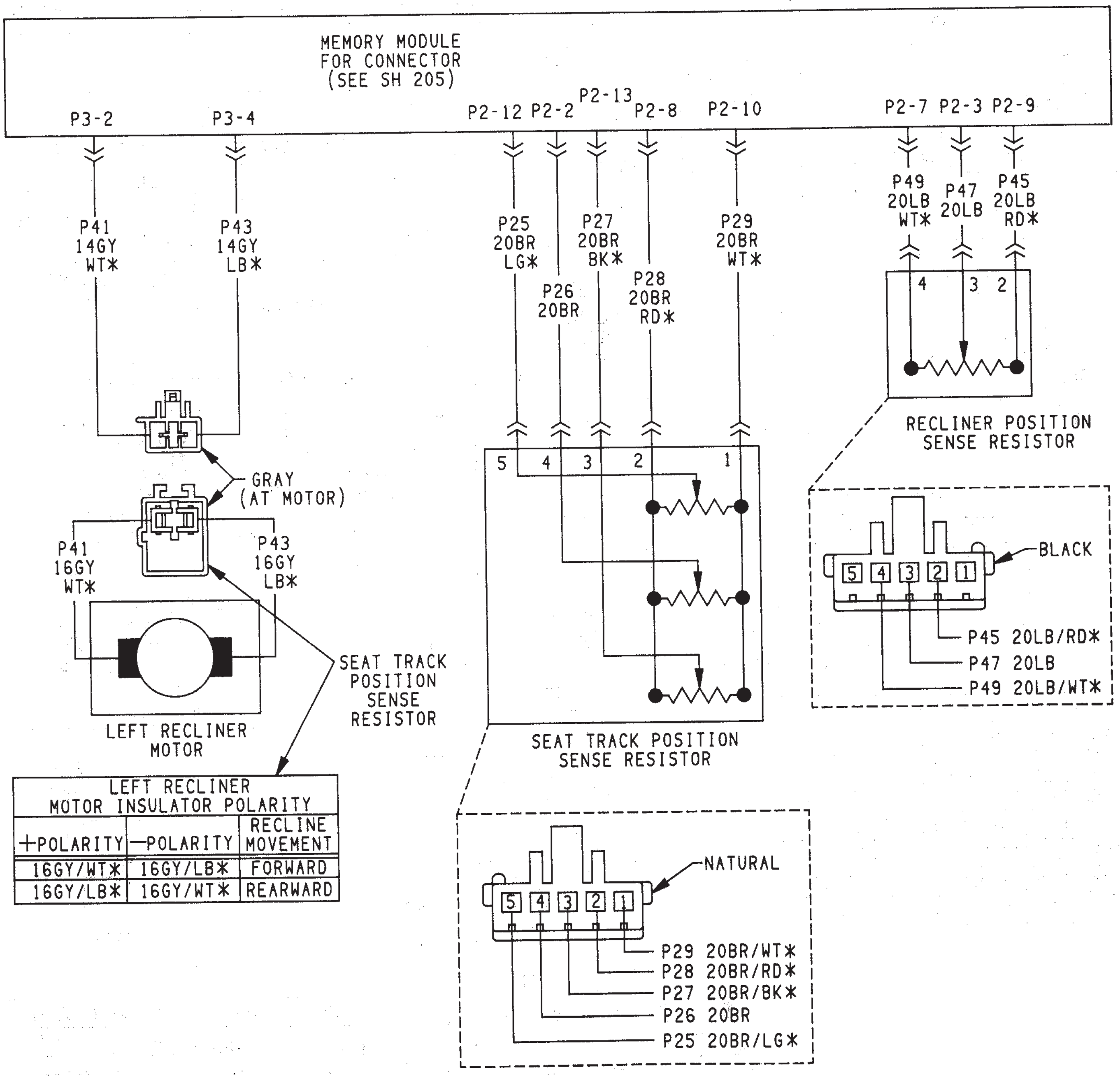


LEFT MOTOR INSULATOR POLARITY		
+POLARITY	−POLARITY	SEAT MOVEMENT
16YL/LB*	16RD/LB*	FORWARD
16RD/LB*	16YL/LB*	REARWARD
16YL/LG*	16RD/LG*	FRONT UP
16RD/LG*	16YL/LG*	FRONT DOWN
16YL/WT*	16RD/WT*	REAR UP
16RD/WT*	16YL/WT*	REAR DOWN

AC-CD, AY-C 153

MEMORY POWER SEAT SYSTEM

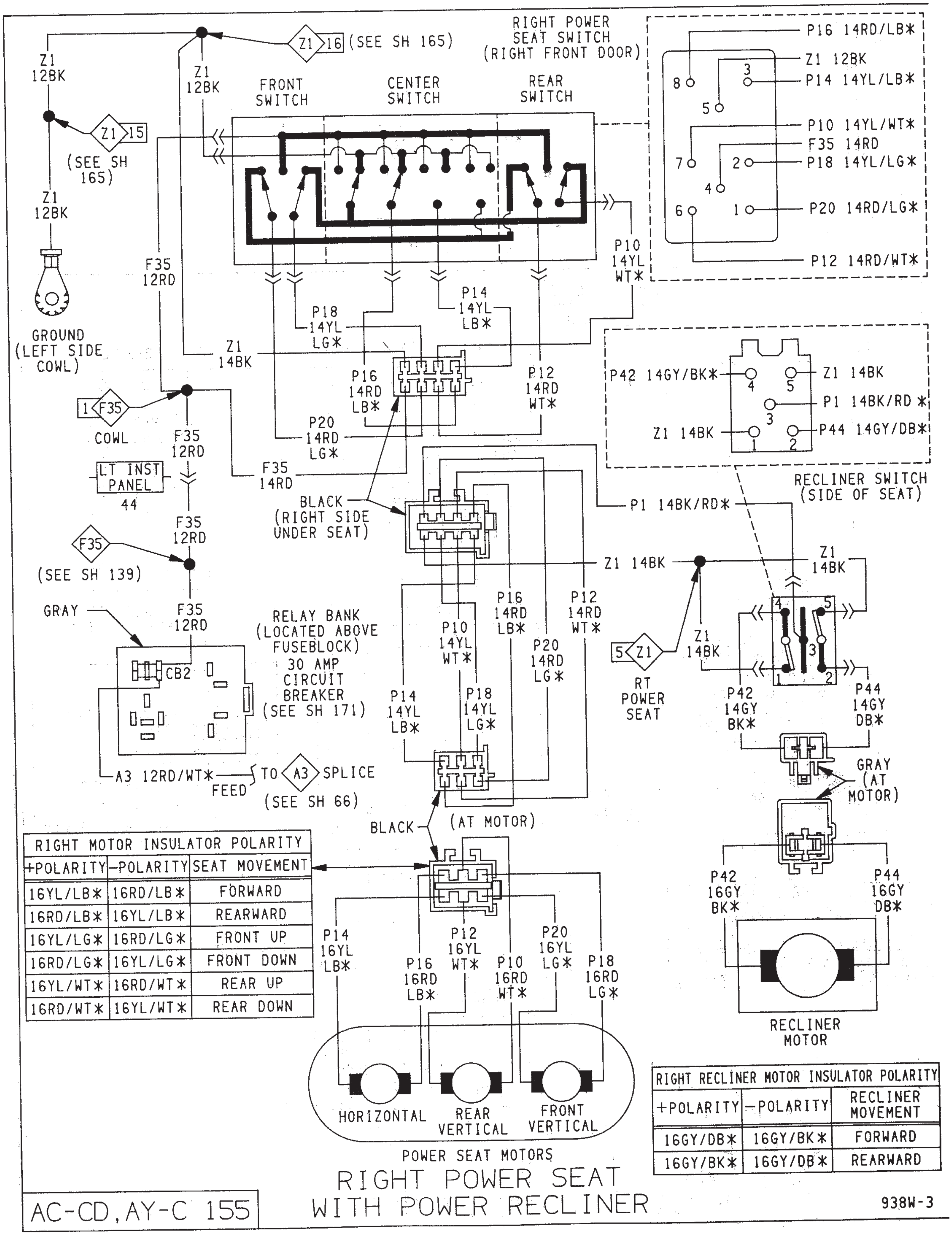
938W-3



LEFT RECLINER MOTOR INSULATOR POLARITY

+POLARITY	−POLARITY	RECLINE MOVEMENT
16GY/WT*	16GY/LB*	FORWARD
16GY/LB*	16GY/WT*	REARWARD

MEMORY POWER SEAT SYSTEM



RIGHT MOTOR INSULATOR POLARITY

+POLARITY	-POLARITY	SEAT MOVEMENT
16YL/LB*	16RD/LB*	FORWARD
16RD/LB*	16YL/LB*	REARWARD
16YL/LG*	16RD/LG*	FRONT UP
16RD/LG*	16YL/LG*	FRONT DOWN
16YL/WT*	16RD/WT*	REAR UP
16RD/WT*	16YL/WT*	REAR DOWN

RIGHT RECLINER MOTOR INSULATOR POLARITY

+POLARITY	-POLARITY	RECLINER MOVEMENT
16GY/DB*	16GY/BK*	FORWARD
16GY/BK*	16GY/DB*	REARWARD

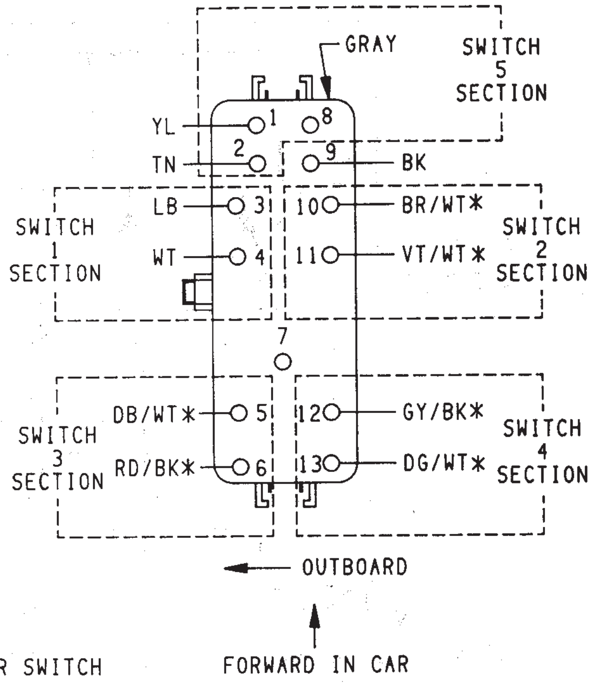
RIGHT POWER SEAT WITH POWER RECLINER

AC-CD,AY-C 155

938W-3

LEFT FRONT DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

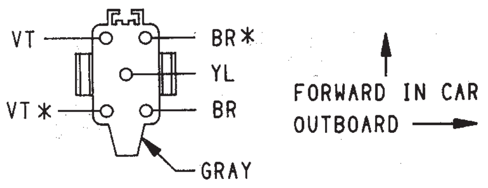
B+ POLARITY	B− POLARITY	SWITCH SECTION	WINDOW AND WINDOW MOVEMENT
LB	WT	1	LEFT FRONT WINDOW UP
WT	LB	1	LEFT FRONT WINDOW DOWN
BR *	VT *	2	RIGHT FRONT WINDOW UP
VT *	BR *	2	RIGHT FRONT WINDOW DOWN
DB *	RD/BK *	3	LEFT REAR WINDOW UP
RD/BK *	DB *	3	LEFT REAR WINDOW DOWN
GY *	DG *	4	RIGHT REAR WINDOW UP
DG *	GY *	4	RIGHT REAR WINDOW DOWN
---	BK	N/A	GROUND B-
TN	---	5	FEED B+
OPEN	---	5 SWITCH ROCKER INBOARD	RIGHT FRONT AND BOTH REAR WINDOW LIFT SWITCHES LOCKED OUT OF SYSTEM
YL	---	5 SWITCH ROCKER CENTERED	ALL WINDOW LIFT SWITCHES IN SYSTEM



CONNECTOR-5 GANG WITH LOCK-OUT LEFT FRONT DOOR MASTER SWITCH

RIGHT FRONT DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

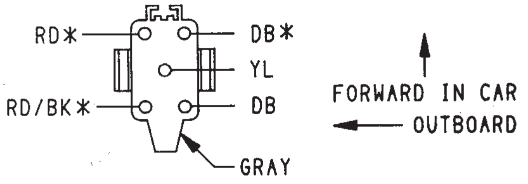
B+ POLARITY	B− POLARITY	WINDOW MOVEMENT
BR	WT	UP FROM DOOR SWITCH
WT	BR	DOWN FROM DOOR SWITCH
BR *	VT *	UP FROM MASTER SWITCH
VT *	BR *	DOWN FROM MASTER SWITCH
YL	---	FEED B+



RIGHT FRONT DOOR WINDOW LIFT SWITCH CONNECTOR

LEFT REAR DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

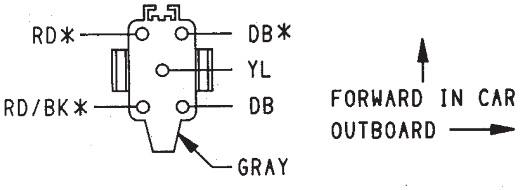
B+ POLARITY	B− POLARITY	WINDOW MOVEMENT
DB	RD *	UP FROM DOOR SWITCH
RD *	DB	DOWN FROM DOOR SWITCH
DB *	RD/BK *	UP FROM MASTER SWITCH
RD/BK *	DB	DOWN FROM MASTER SWITCH
YL	---	FEED B+



LEFT REAR DOOR WINDOW LIFT SWITCH CONNECTOR

RIGHT REAR DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

B+ POLARITY	B− POLARITY	WINDOW MOVEMENT
DB *	RD *	UP FROM DOOR SWITCH
RD *	DB *	DOWN FROM DOOR SWITCH
DB *	RD/BK *	UP FROM MASTER SWITCH
RD/BK *	DB *	DOWN FROM MASTER SWITCH
YL	---	FEED B+

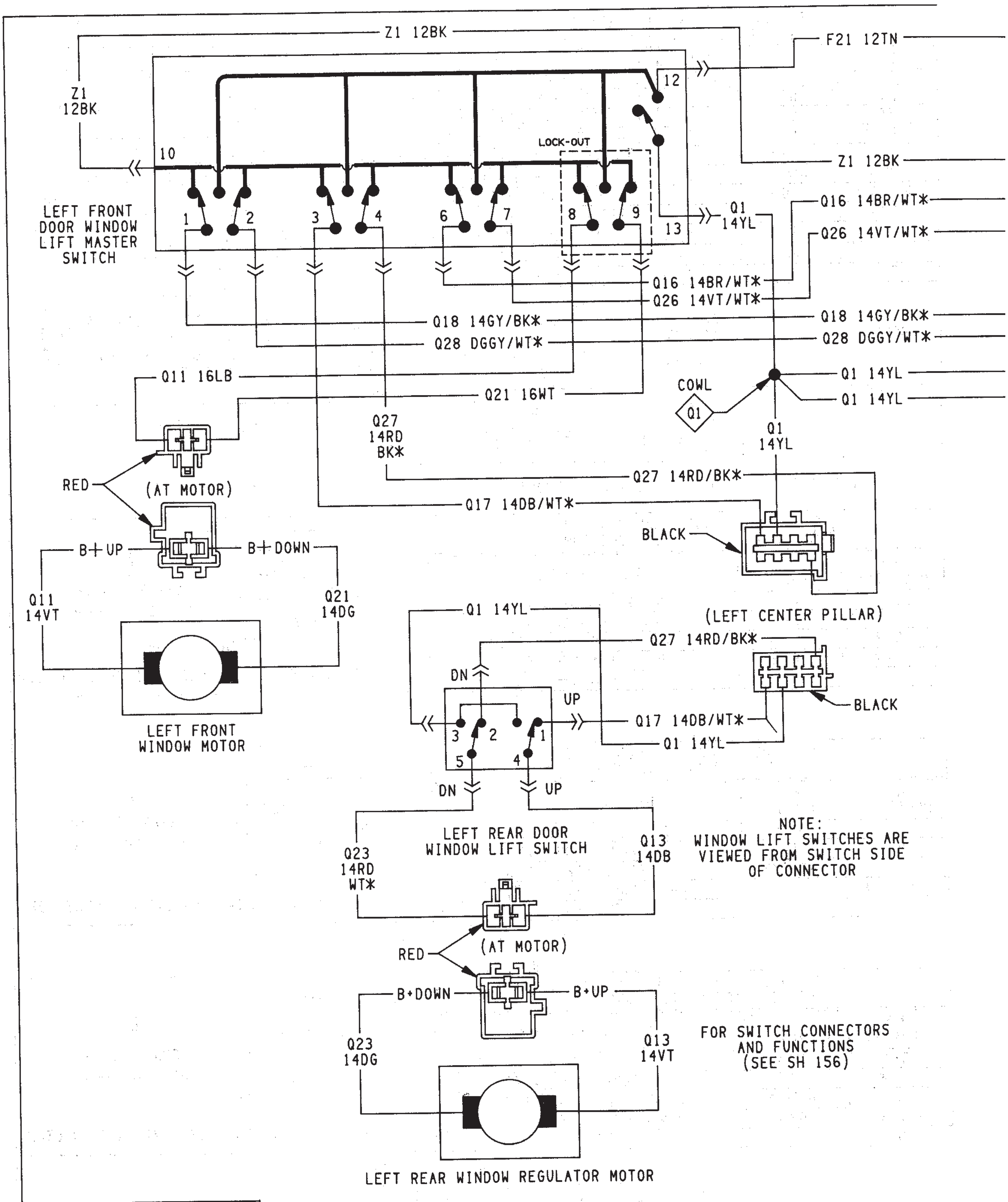


RIGHT REAR DOOR WINDOW LIFT SWITCH CONNECTOR

POWER WINDOW CONNECTOR AND SWITCH FUNCTION

938W-3

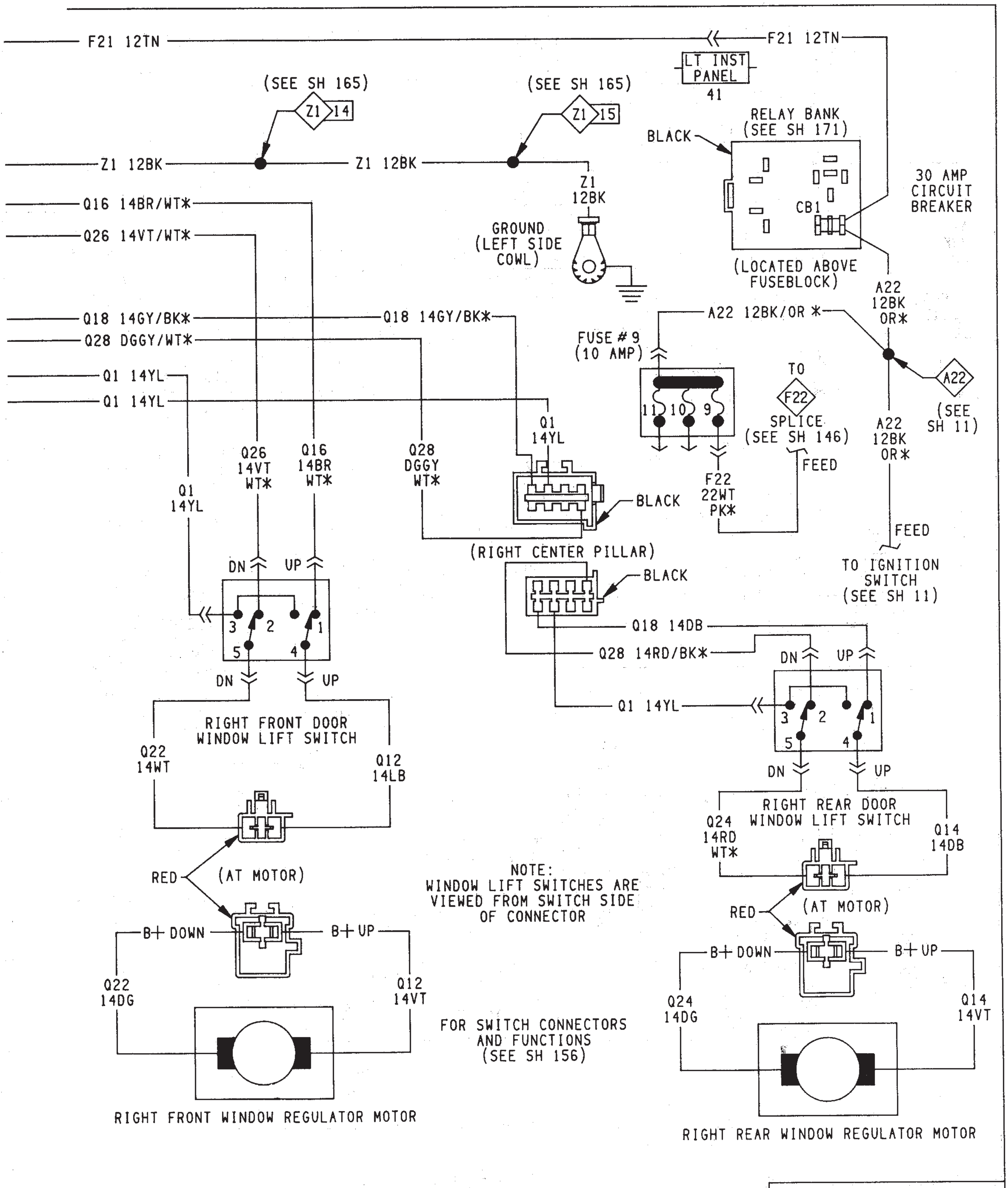
AC-CD,AY-C 156



AC-CD, AY-C 157

POWER WINDOW SYSTEM

938W-3



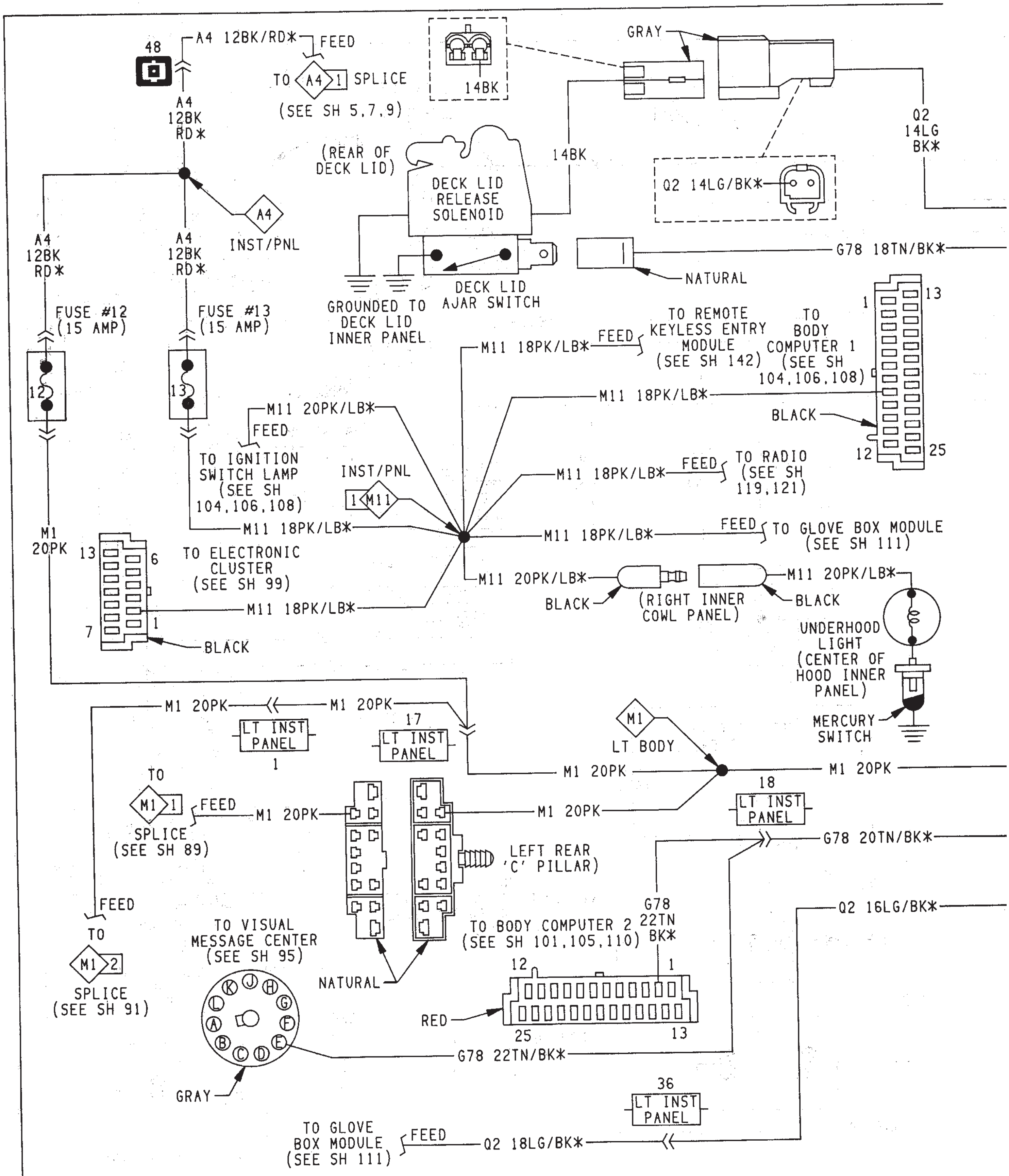
NOTE:
WINDOW LIFT SWITCHES ARE VIEWED FROM SWITCH SIDE OF CONNECTOR

FOR SWITCH CONNECTORS AND FUNCTIONS (SEE SH 156)

938W-3

POWER WINDOW SYSTEM

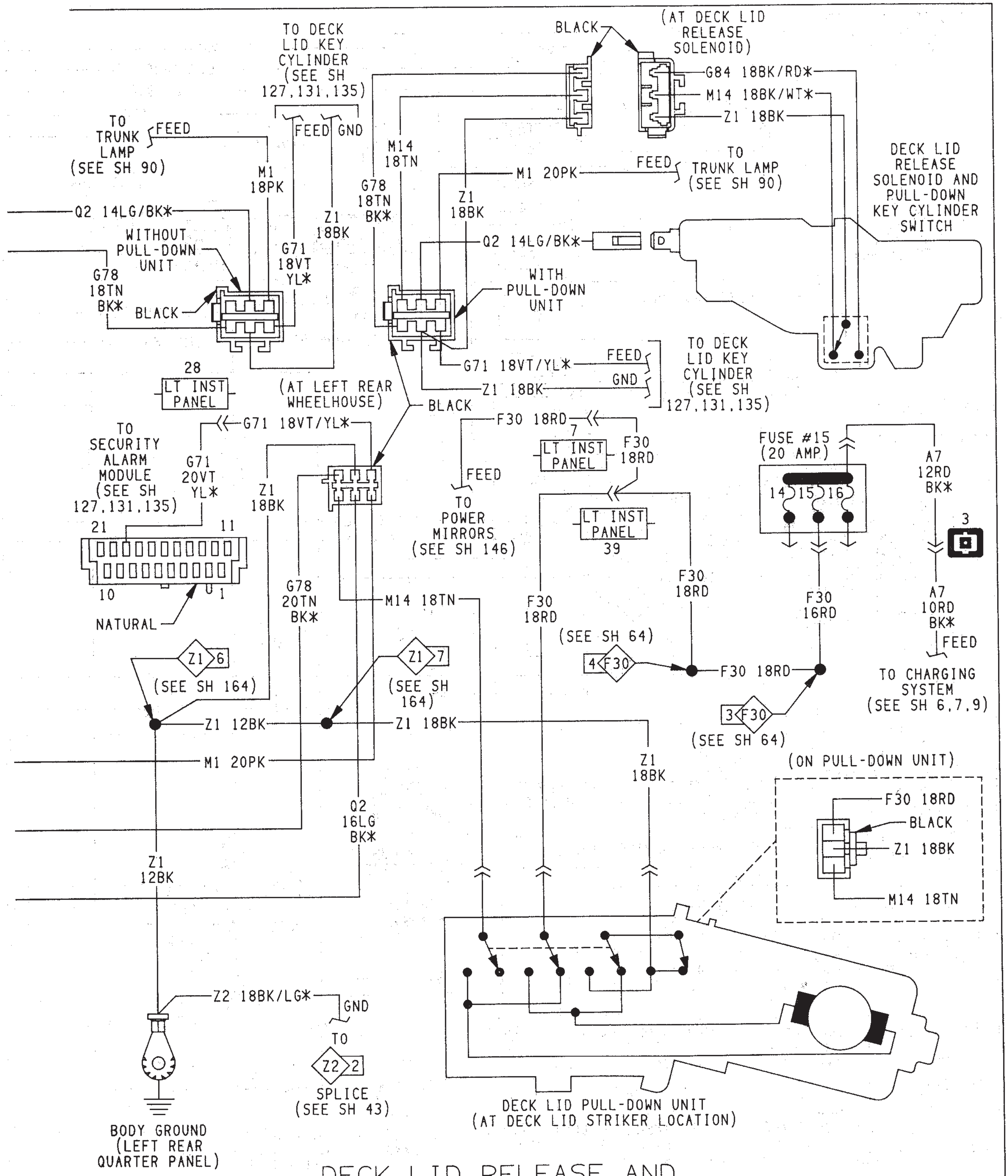
AC-CD, AY-C 158



AC-CD, AY-C 159

DECK LID RELEASE AND DECK LID PULL-DOWN SYSTEM

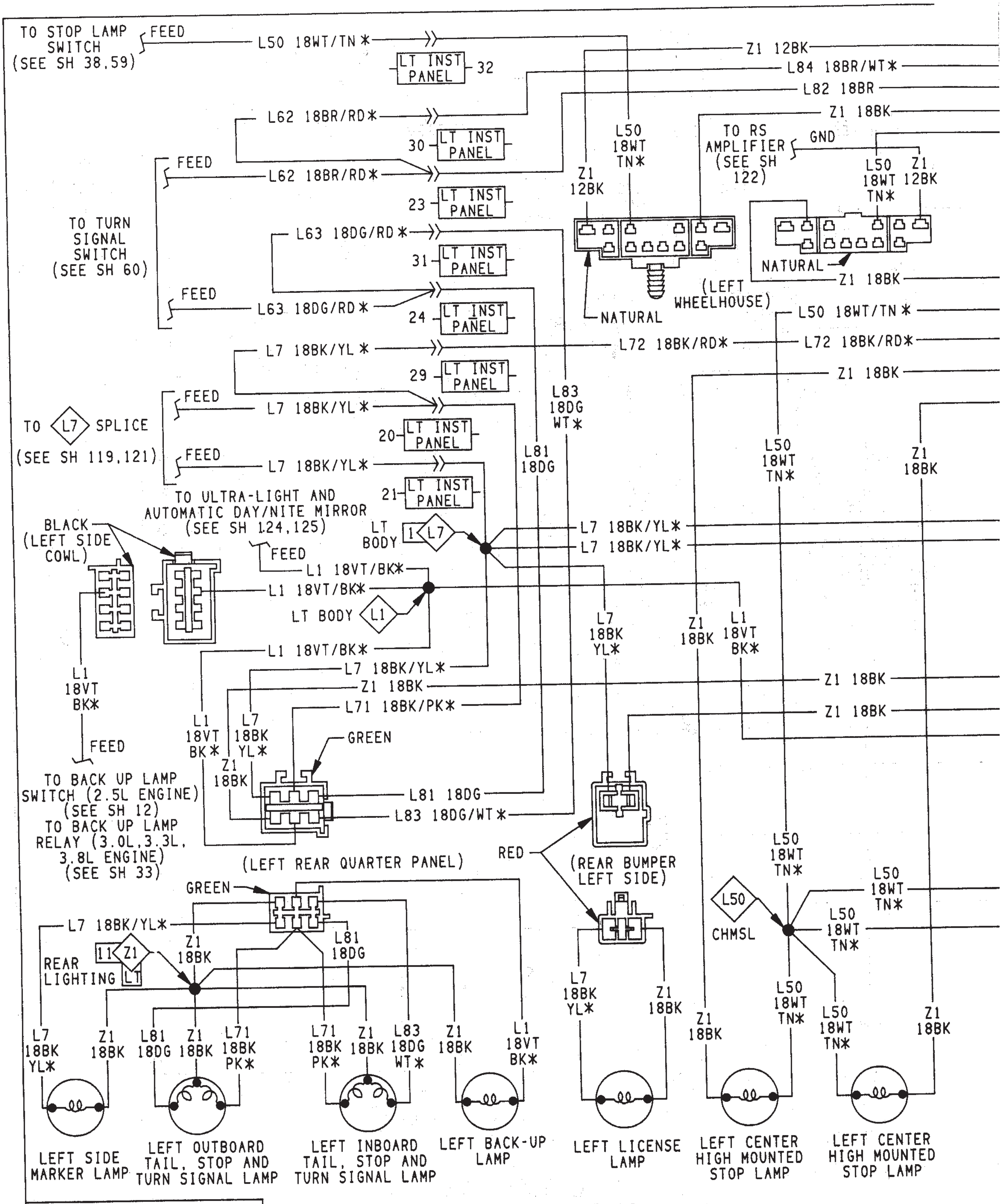
938W-3



938W-3

DECK LID RELEASE AND DECK LID PULL-DOWN SYSTEM

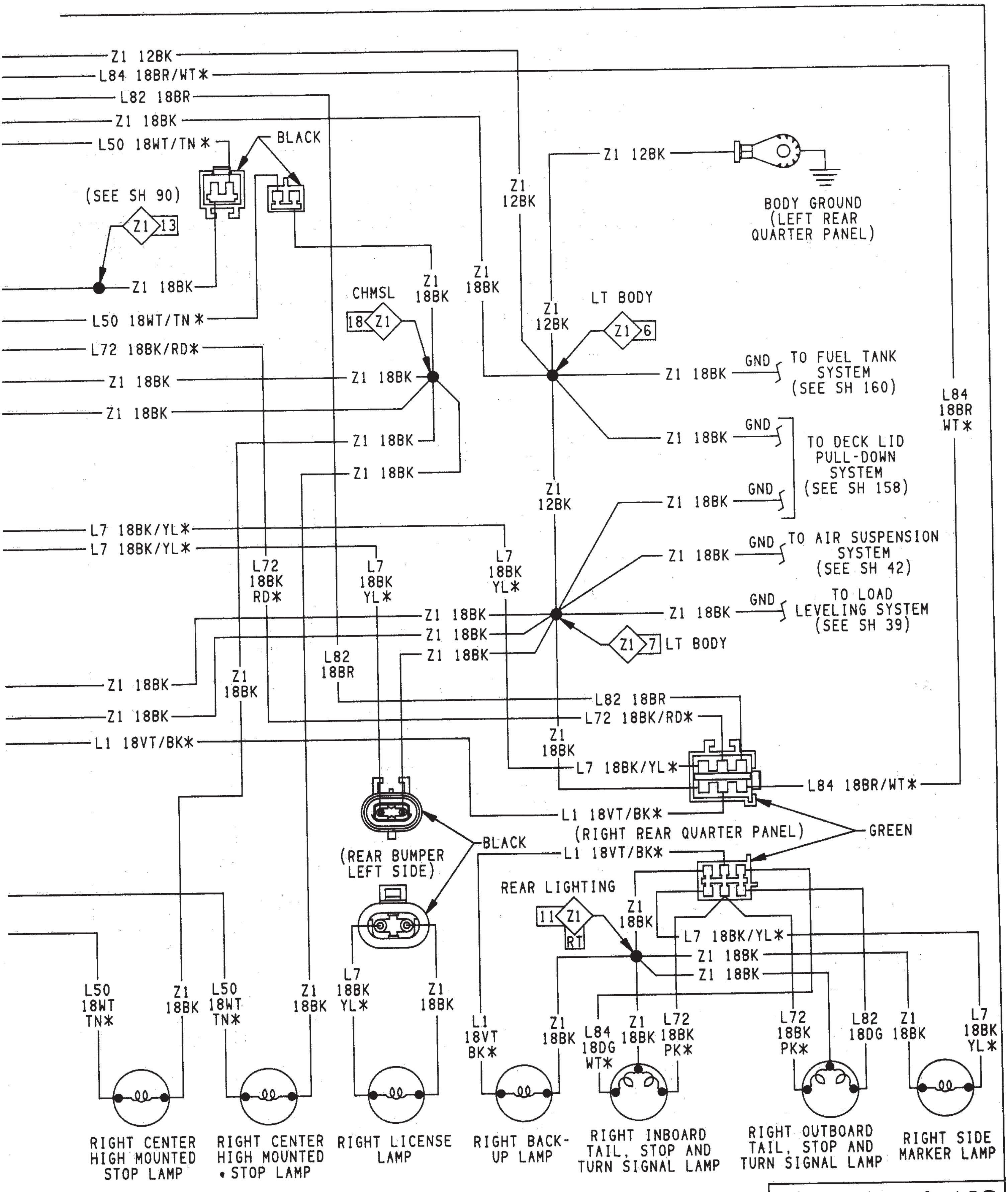
AC-CD,AY-C 160



AC-CD, AY-C 161

REAR LIGHTING

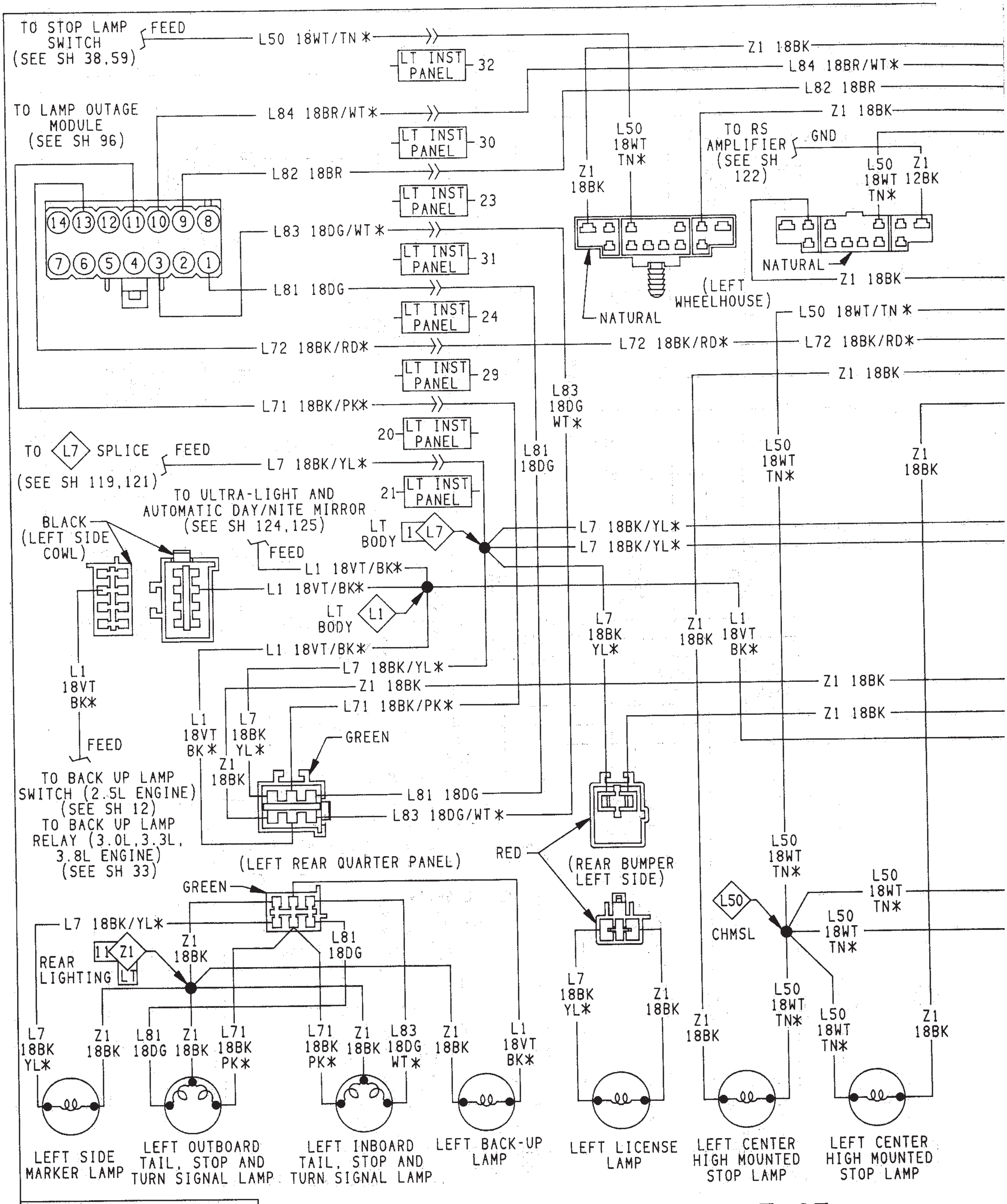
938W-3



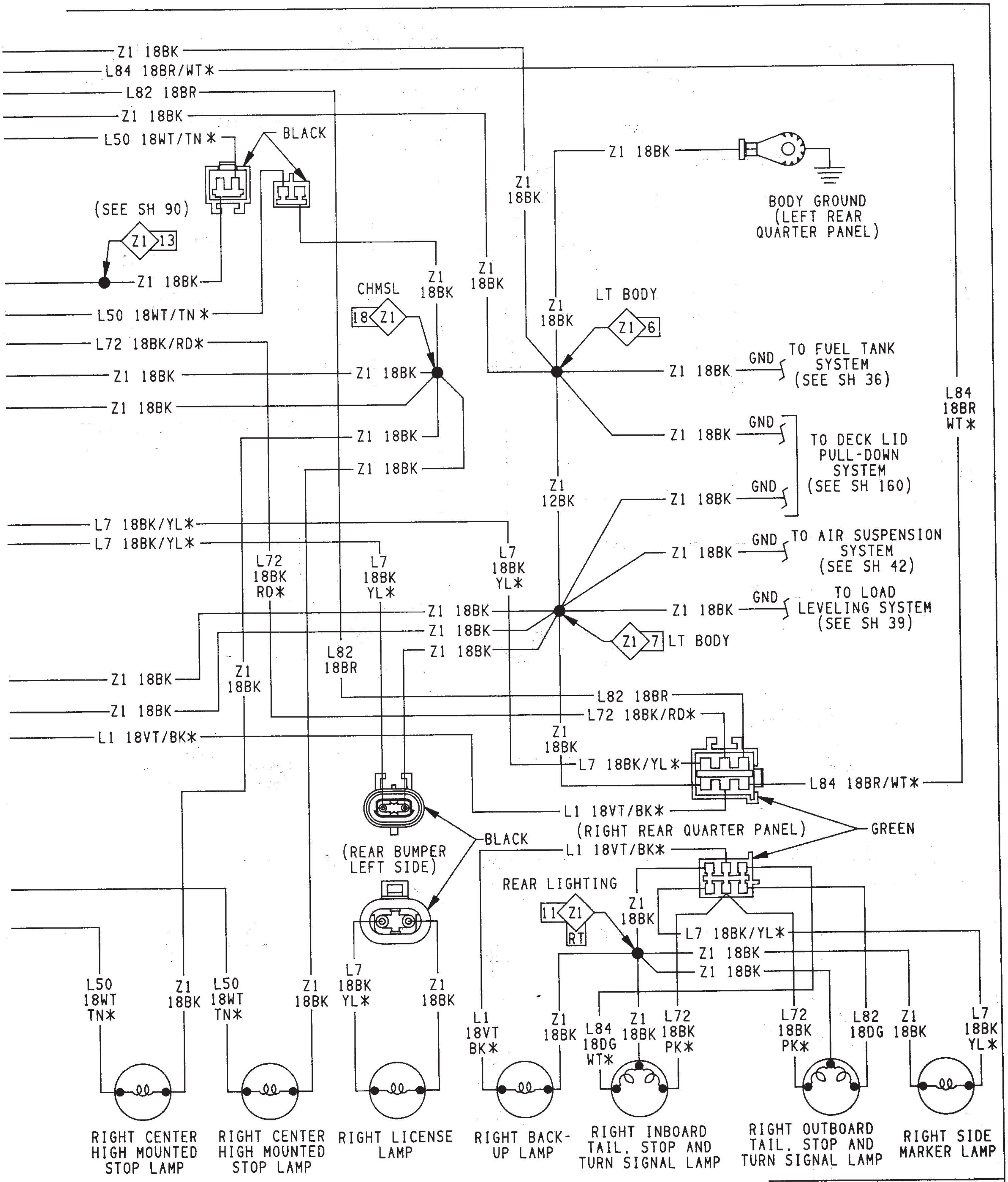
938W-3

REAR LIGHTING

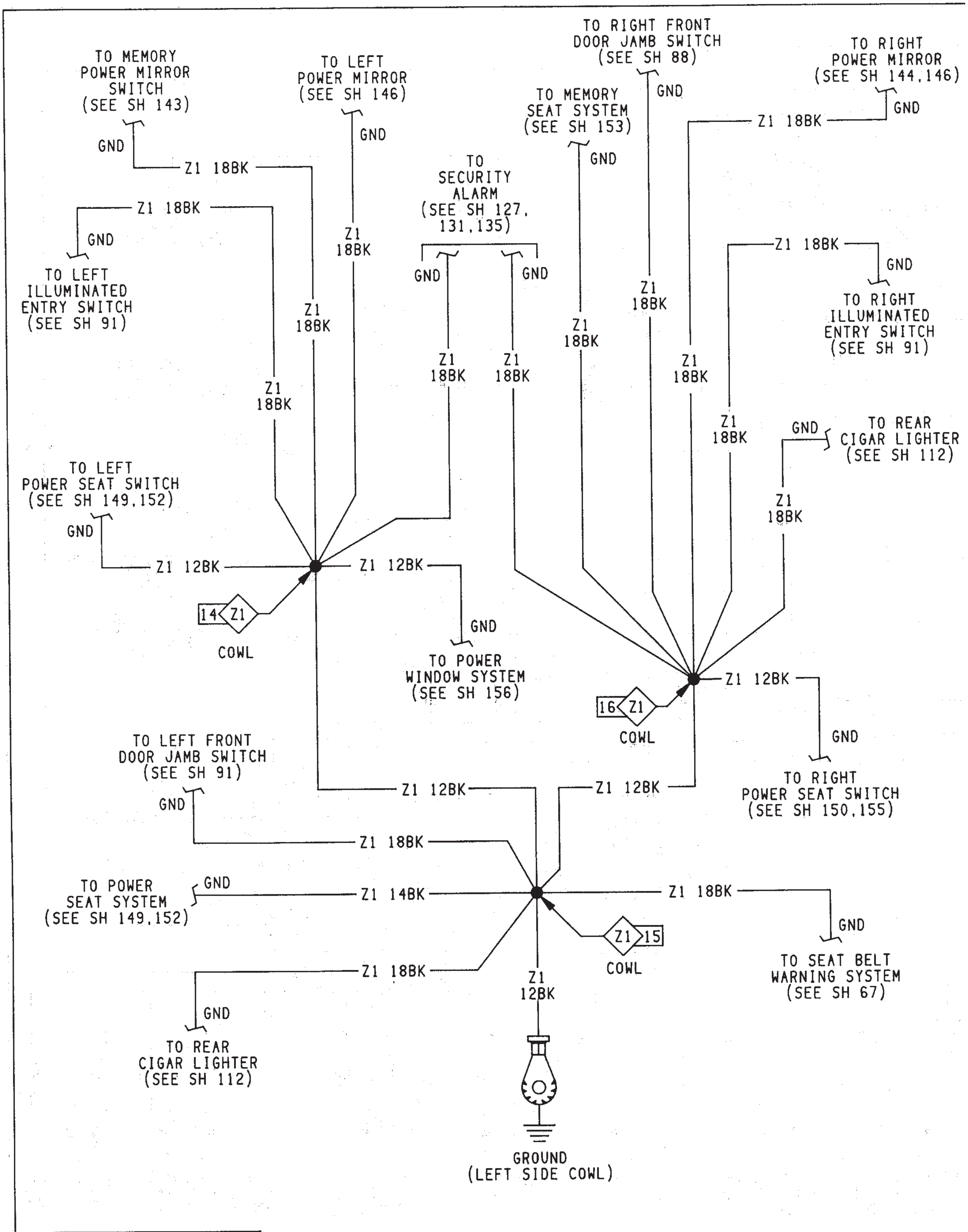
AC-CD, AY-C 162



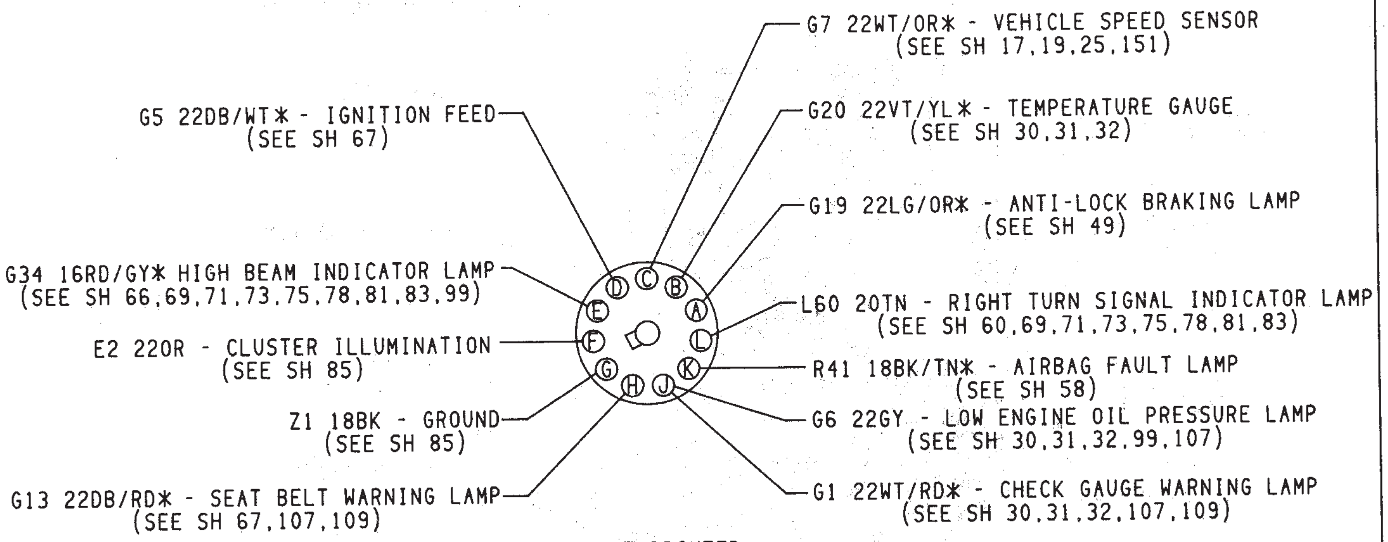
AC-CD, AY-C 163 REAR LIGHTING WITH LAMP OUTAGE 938W-3



938W-3 REAR LIGHTING WITH LAMP OUTAGE AC-CD, AY-C 164

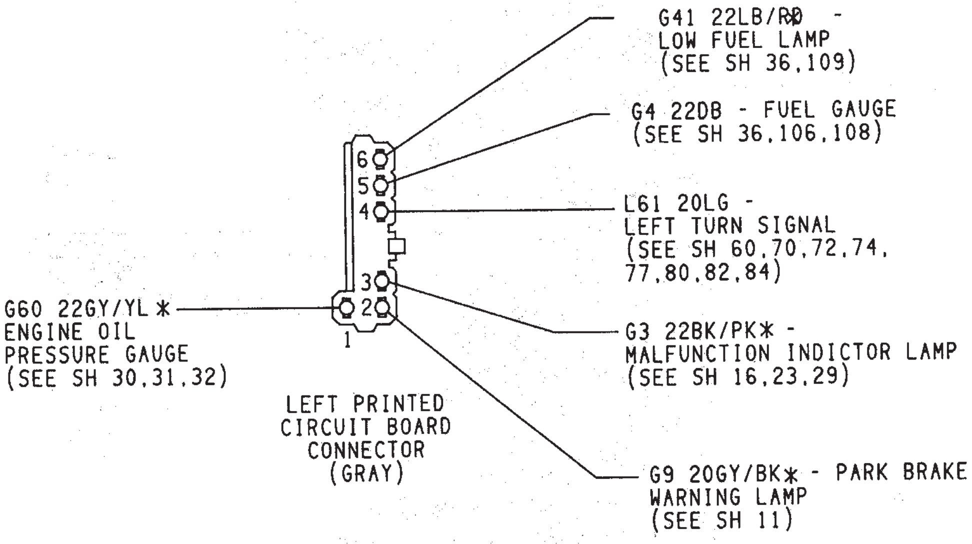


AC-CD, AY-C 165 DOOR ELECTRICAL GROUND SYSTEMS 938W-3



RIGHT PRINTED
CIRCUIT BOARD
CONNECTOR
(RED)

VIEWED FROM TERMINAL END



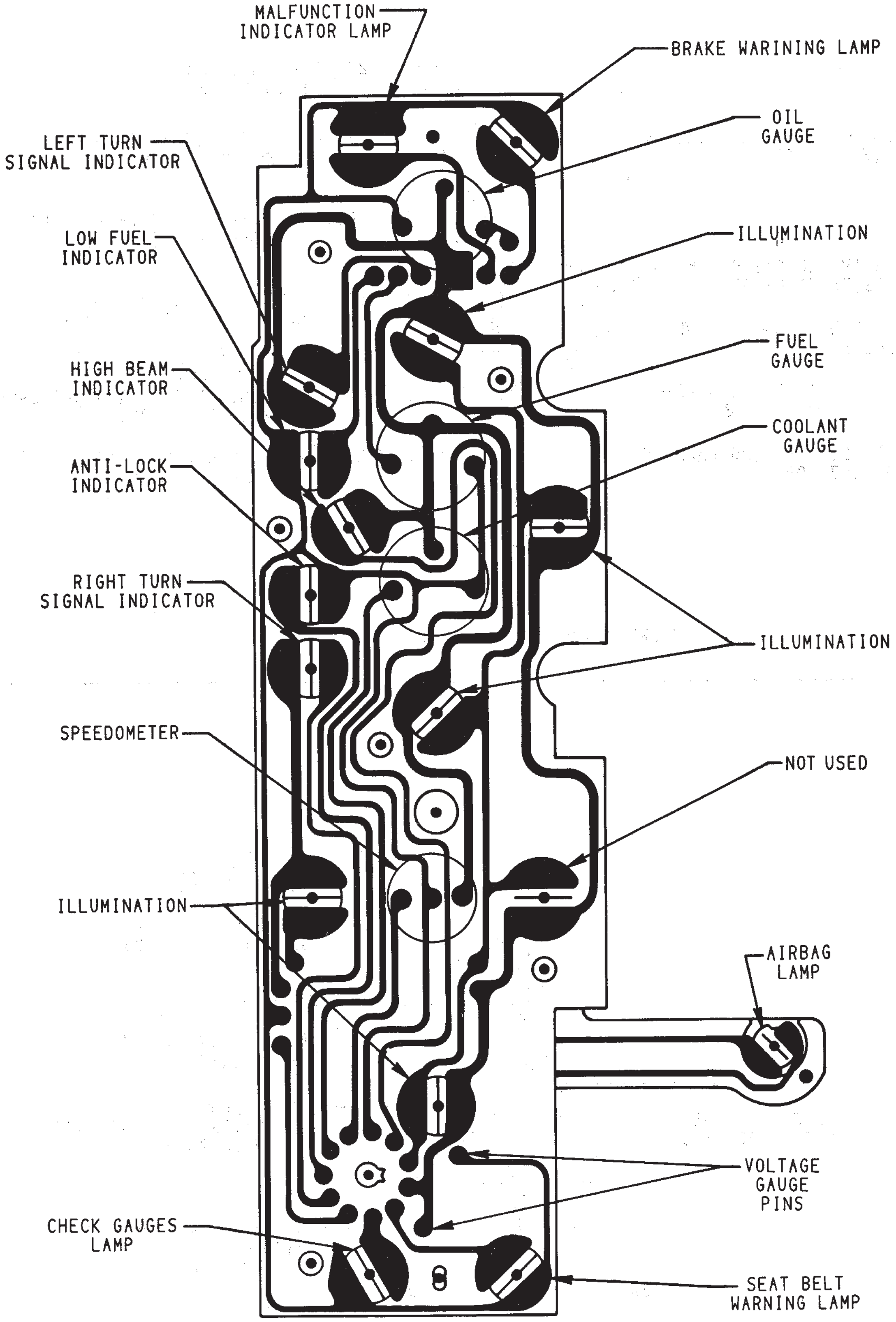
LEFT PRINTED
CIRCUIT BOARD
CONNECTOR
(GRAY)

VIEWED FROM TERMINAL END

MECHANICAL CLUSTER PRINTED CIRCUIT BOARD CONNECTORS

AC-CD, AY-C 166

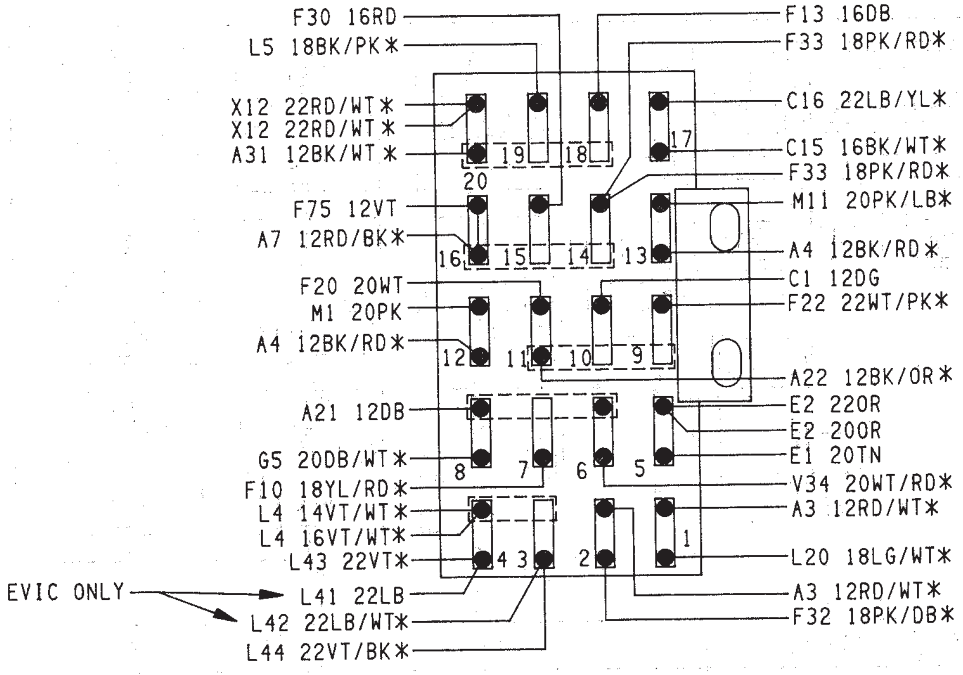
938W-3



MECHANICAL CLUSTER PRINTED CIRCUIT BOARD

AC-CD, AY-C 167

938W-3



FRONT OF FUSE BLOCK

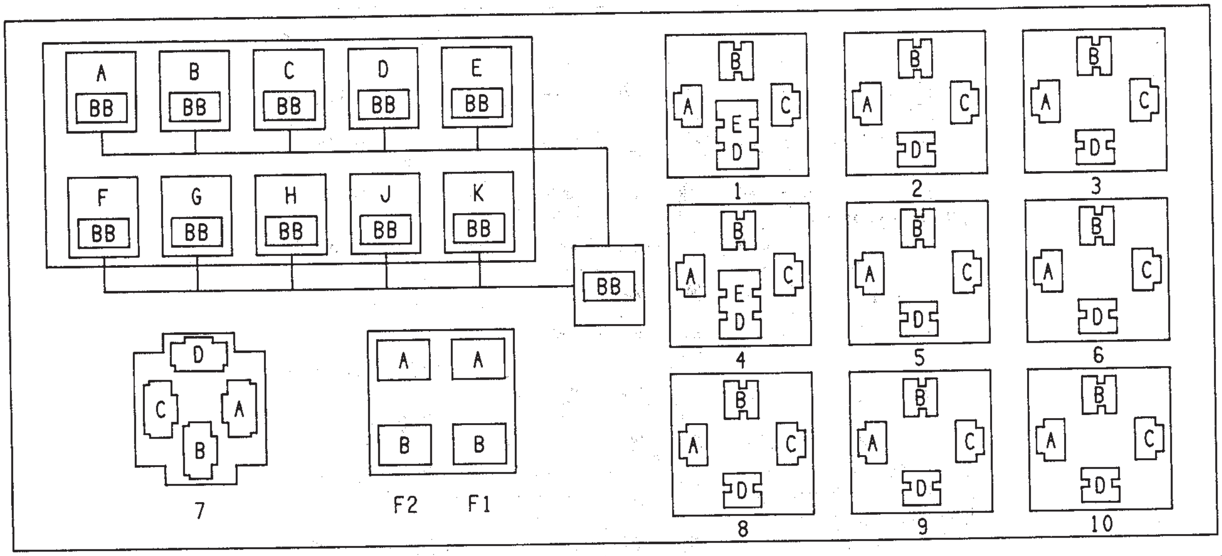
FUSEBLOCK IS MOUNTED AT
LEFT OF GLOVE BOX ON
CENTER SUPPORT BRACKET

FUSE #	AMPS	COLOR	SHEET
1	20	YELLOW	2,66
2	20	YELLOW	2,37,43,59,66
3	10	RED	1,66,69,71,73,75,78,81,83,96,102,105,110
4	10	RED	1,66,69,71,73,75,78,81,83,96,102,105,110
5	4	PINK	1,51,53,55,65,85,95,99,101,116,119,121,128,132,136,148
6	2	GRAY	4,11,15,22,27,37
7	20	YELLOW	4,11,15,22,27,41,147
8	5	TAN	4,11,15,22,27,57,67,95,100,102,104,107,109,128,132,135,141
9	10	RED	3,11,57,115,124,125,148,158
10	30	LIGHT GREEN	3,11,51,53,55,115
11	15	LIGHT BLUE	3,11,12,33,53
12	15	LIGHT BLUE	4,88,91,112,159
13	15	LIGHT BLUE	4,99,159
14	20	YELLOW	1,64
15	20	YELLOW	2,6,7,9,57,64,118,126,128,132,136,139,151,160
16	15	LIGHT BLUE	2,122
17	10	RED	4,143,146,148
18	20	YELLOW	3,11,62,103,106,108,130,134,137
19	20	YELLOW	3,11,59
20	10	RED	3,11,119,121,126

938W-3

FUSE BLOCK MODULE

AC-CD, AY-C 168



FUSE	AMPS	CIRCUIT	FUNCTION	SHEET
A	30	A20 14RD/LG*	ABS SYSTEM	8,10
B	30	A10 14RD/WT*	ABS SYSTEM	8,10
C	50	A3 10RD/WT*	VEHICLE LAMPS	6,8,10
C	50	A3 10RD/WT*	VEHICLE LAMPS	6,8,10
D	30	A16 14GY	RADIATOR FAN	6,8,10
E	40	A4 12BK/PK *	HEATED REAR WINDOW	6,8,10
F	50	A7 10RD/BK*	PARK LAMPS	6,8,10
G	40	A1 12RD	IGNITION SYSTEM	6,8,10
H	50	A2 10PK/BK*	BLOWER MOTOR	6,8,10
J	30	A14 14RD/WT*	FUEL PUMP TRANS	6,8,10
F1	25	A4 12BK/PK* F15 16DB/WT *	HEATED REAR WINDOW FEED	4,5,7,9 148
F2	20	A15 14BK A15 18PK/WT*	HAZARD FLASHER FEED	5,7,9

CAV	CIRCUITS	FUNCTION	SHEET
BB	A0 6BK	BATTERY FEED	6,8,10
BB	A11 6BK/GY*	GENERATOR FEED	6,8,10

AC-CD,AY-C 169

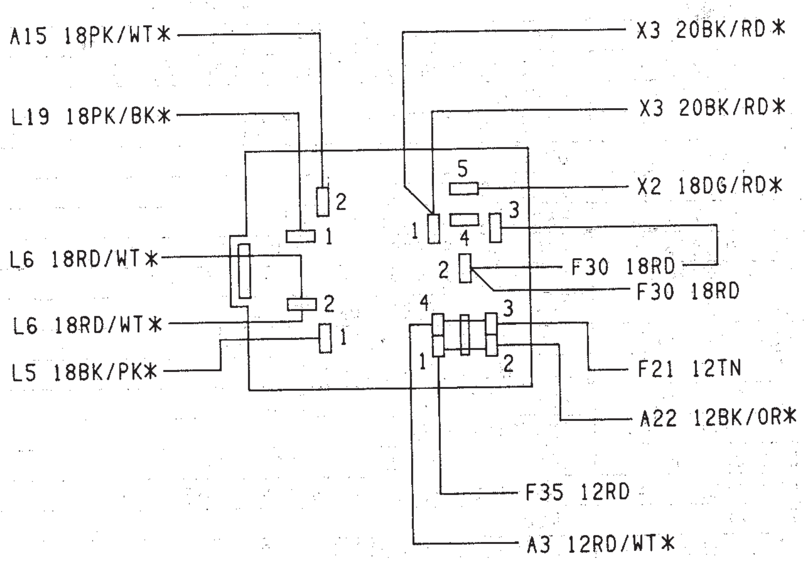
POWER DISTRIBUTION CENTER

938W-3

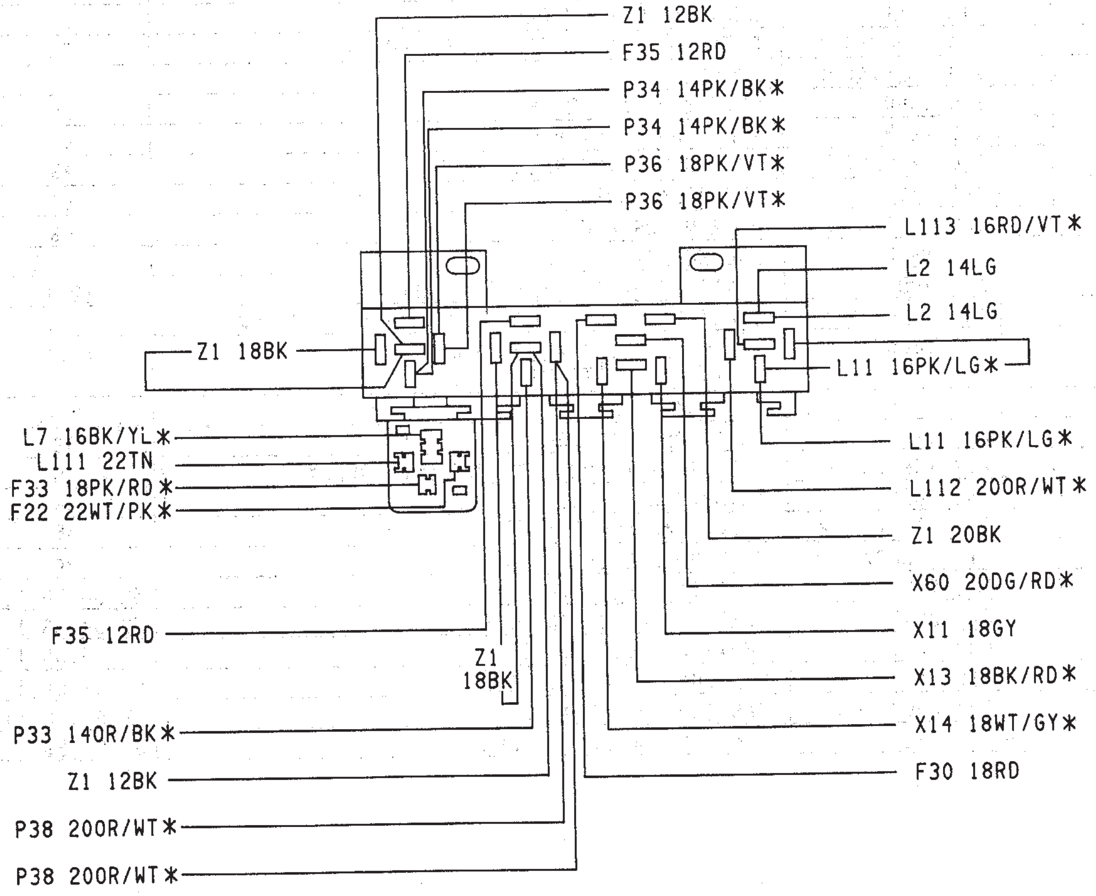
RELAY	CAV	CIRCUIT	FUNCTION	SHEET
1	A	L52 20GY/RD*	CONCEALED HEADLAMP OPEN (B+)	68
	B	L31 14DB/YL*	CONCEALED HEADLAMP MOTOR OPEN (B+)	68
	C	Z1 16BK	GROUND	68
	D	F35 12RD	POWER SEATS (BATTERY FEED)	68
	E	Z1 16BK	GROUND	68
2	A	A21 14DB	IGNITION START/RUN	54,56,113
	B	A16 14GY	FAN CONTROL RELAY FEED	54,56,113
	C	C13 20DB/OR*	A/C COMPRESSOR CLUTCH RELAY COIL GROUND	54,56,113
	D	C3 14DB/BK*	A/C COMPRESSOR CLUTCH FEED (B+)	54,56,113
3	A	A21 14DB	IGNITION START/RUN	15,23,29
	B	A14 14RD/WT*	FUEL PUMP AUTOMATIC SHUT DOWN RELAY	15,23,29
	C	K51 20DB/YL*	AUTOMATIC SHUT DOWN SIGNAL	15,23,29
	C	K51 20DB/YL*	AUTOMATIC SHUT DOWN SIGNAL	15,23,29
	D	A142 16DG/OR*	INJECTOR FEED	15,23,29
4	A	L51 20GY/PK*	CONCEALED HEADLAMP CLOSE (B+)	68
	B	L30 14BR/YL*	CONCEALED HEADLAMP MOTOR CLOSE (B+)	68
	C	Z1 16BK	GROUND	68
	D	L113 16RD/VT*	OPTICAL HORN SWITCH FEED	68
	E	Z1 16BK	GROUND	68
5	A	T3 14VT	RELAY COMMON	33
	B	F20 20WT	BACK-UP LAMP RELAY FEED	33
	B	F20 20WT	BACK-UP LAMP RELAY FEED	33
	C	T2 14TN/BK*	BACK-UP LAMP RELAY GROUND (B−)	33
	D	L1 18VT/BK*	BACK-UP LAMP FEED	33
6	A	T15 18LG	SHUT DOWN RELAY POWER	35
	B	A14 14RD/WT*	FUEL PUMP AUTOMATIC SHUT DOWN RELAY	35
	C	Z13 18BK/RD*	GROUND	35
	D	T16 16RD	SWITCHED BATTERY FEED	35
7	A	A21 14DB	IGNITION START/RUN	46
	B	A10 14RD/WT*	ABS PUMP MOTOR RELAY FEED	46
	C	B21 14GY	ABS RELAY COIL	46
	D	B82 14BR/WT*	PUMP MOTOR FEED	46
8	A	A41 14YL	ENGINE STARTER RELAY	12,13
	B	A1 12RD	IGNITION SWITCH BATTERY FEED	12,13
	C	T41 18BR/YL*	STARTER RELAY PARK/NEUTRAL (POSITION) SWITCH	12,13
	C	T41 18BR/YL*	ENGINE STARTER RELAY PARK/ NEUTRAL (POSITION) SWITCH	12,13
	D	T40 14BR	SOLENOID FEED	12,13
9	A	A21 14DB	IGNITION START/RUN	36
	B	A14 14RD/WT*	FUEL PUMP AUTOMATIC SHUT DOWN RELAY	36
	C	K51 20DB/YL*	AUTOMATIC SHUTDOWN SIGNAL	36
	D	A141 16DG/BK*	FUEL PUMP RELAY FEED	36
	D	A141 16DG/BK*	FUEL PUMP RELAY FEED	36
10	A	F20 20WT	IGNITION FEED FOR EVIC	52,54,56,114
	A	F20 20WT	IGNITION FEED FOR EVIC	52,54,56,114
	A	F20 20WT	IGNITION FEED FOR EVIC	52,54,56,114
	B	A16 14GY	FAN CONTROL RELAY FEED	52,54,56,114
	C	C27 20DB/PK*	FAN CONTROL RELAY FEED	52,54,56,114
	D	C25 14LG	FAN CONTROL RELAY FEED	52,54,56,114

POWER DISTRIBUTION CENTER

AC-CD,AY-C 170

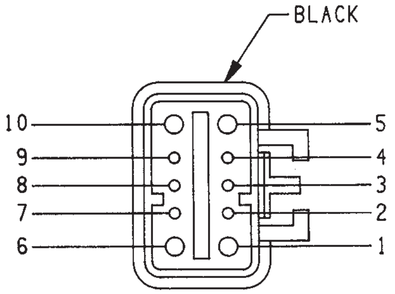


RELAY BANK
(LOCATED ABOVE FUSEBLOCK)



RELAY MODULE
(LOCATED ABOVE GLOVEBOX)

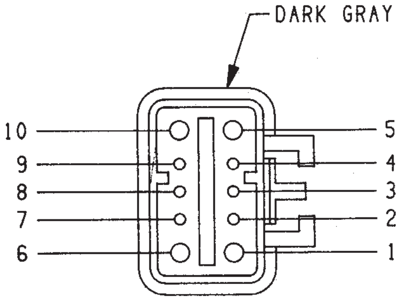
VIEWED FROM TERMINAL END
CONNECTOR #2



TRANSDUCER & SWITCHES
CONNECTOR

CAV	CIRCUIT	FUNCTION	SHEET
1	Z1 16BK	GROUND	45
2	B210 20RD/BK	TRANSDUCER RETURN	45
3	—	—	—
4	G9 20GY/BK	BRAKE WARNING LAMP SWITCH	45
5	B21 14GY	PUMP MOTOR RELAY COIL	45
6	—	—	—
7	B258 20GY/LB	TRANSDUCER FEED (+)	45
8	B219 20DB	BOOST PRESSURE	45
9	B218 20WT/OR	PRIMARY PRESSURE/DPA	45
10	B217 14RD	LOW ACCUMULATOR	45

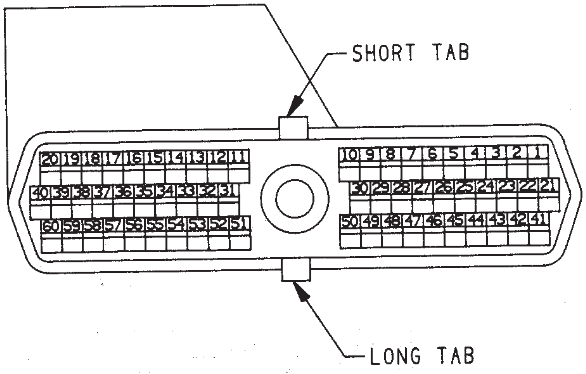
VIEWED FROM TERMINAL END
CONNECTOR #3



MODULATOR
CONNECTOR

CAV	CIRCUIT	FUNCTION	SHEET
1	B245 20WT/LG*	LEFT REAR ISOLATION VALVE	48
2	B243 20DG/BK*	LEFT FRONT DECAY VALVE	48
3	B242 20BR/WT*	LEFT FRONT BUILD VALVE	48
4	B254 20DG/OR*	REAR DECAY VALVE	48
5	B255 20WT/PK*	RIGHT REAR ISOLATION VALVE	48
6	B249 20WT/TN*	RIGHT FRONT ISOLATION VALVE	48
7	B248 20DG/WT*	RIGHT FRONT DECAY VALVE	48
8	B246 20BR/RD*	RIGHT FRONT BUILD VALVE	48
9	B252 20BR/TN*	REAR BUILD VALVE	48
10	B251 20WT/BK*	LEFT REAR ISOLATION VALVE	48

ANTI-LOCK BRAKE SYSTEM
MODULATOR CONNECTORS



CONNECTOR
VIEWED FROM WIRE END

	CAV	CIRCUIT	FUNCTION	SHEET
	1	K1 20DG/RD*	MAP SENSOR SIGNAL	18,21,26
	2	K2 20TN/BK*	ENGINE COOLANT TEMPERATURE SENSOR	17,19,25
2.5L & 3.3L	3	A14 16RD/WT*	FUEL PUMP A.S.D. RELAY	16,25
	3	A14 16RD/BK*	FUEL PUMP AUTOMATIC SHUTDOWN RELAY	16,23,25
	4	K4 18BK/LB*	SIGNAL GROUND	18,19,25
	5	Z11 16BK/WT*	SIGNAL GROUND	14,22,24
2.5L & 3.3L	6	K6 20VT/WT*	5 VOLT OUTPUT	18,26
3.0L	6	K6 18VT/WT*	5 VOLT OUTPUT	21,26
	7	K7 18OR	8 VOLT INPUT	17,19,28
2.5L	8	F20 20WT	IGNITION FEED	16
	9	A21 14DB	IGNITION START/RUN	15,22,27
	10	—	—	—
	11	Z12 16BK/TN*	POWER GROUND	16,22,24
	12	Z12 16BK/TN*	POWER GROUND	16,22,24
3.0L & 3.3L	13	K14 18LB/BR*	INJECTOR DRIVER 4	21,29
3.0L & 3.3L	14	K13 18YL/WT*	INJECTOR DRIVER 3	21,24
3.0L & 3.3L	15	K12 18TN	INJECTOR DRIVER 2	21,24
	16	K11 18WT/DB*	INJECTOR DRIVER 1	15,21,24
3.3L	17	K17 18DB/TN*	IGN COIL DRIVER #2	24
3.3L	18	K18 18DB/GY*	IGN COIL DRIVER #3	24
	19	K19 18BK/GY*	IGNITION COIL DRIVER #1	15,23,24
	20	K20 18DG	VOLTAGE REGULATOR	16,21,25
	21	—	—	—
	22	K22 18OR/DB*	THROTTLE POSITION SIGNAL	18,21,26
	23	V37 18RD/LG*	VEHICLE SPEED CONTROL MODE	14,22,27,37
	24	K24 18GY/BK*	DISTRIBUTOR IGNITION SENSOR	17,19,28
	25	D21 20PK	DATA LINK TRANSMIT	14,23,29
●	26	D1 20VT/BR*	CCD BUSS(B+)	16,22,27
	27	C20 20BR	A/C DAMPED PRESSURE SWITCH	16,23,27
3.0L & 3.3L	28	K10 18DB/OR*	POWER STEERING PRESSURE SWITCH	19,25
	29	K29 18WT/PK*	BRAKE SWITCH SIGNAL	14,22,27,37

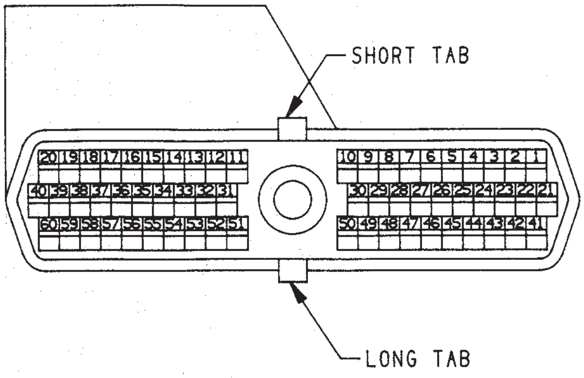
(CONTINUED ON NEXT PAGE)

● TWISTED PAIR

POWERTRAIN CONTROL MODULE CONNECTOR

AC-CD, AY-C 173

938W-3



CONNECTOR
VIEWED FROM WIRE END

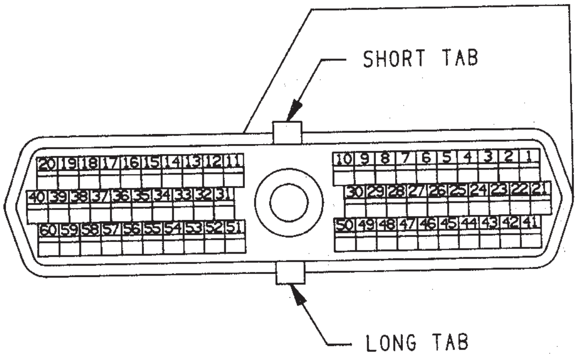
	CAV	CIRCUIT	FUNCTION	SHEET
	30	T41 20BR/YL*	PARK/NEUTRAL SWITCH SIGNAL	16,20,27
	31	C27 20DB/PK*	FAN CONTROL RELAY COIL GROUND	16,23,27
	32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	16,23,29
	33	V36 20TN/RD*	VEHICLE SPEED CONTROL (VACUUM)	14,22,27,37
	34	C13 20DB/OR*	A/C COMPRESSOR CLUTCH RELAY	16,23,27
	35	K35 20GY/YL*	EGR SOLENOID (CALIFORNIA)	14,21,26
	36	—	—	—
	37	—	—	—
3.0L & 3.3L	38	K38 18GY	INJECTOR DRIVER 5	21,29
	39	K39 18GY/RD*	IDLE AIR CONTROL MOTOR (OPEN)	14,21,26
	40	K40 18BR/WT*	IDLE AIR CONTROL MOTOR (CLOSE)	14,21,26
	41	K41 18BK/DG*	HEATED OXYGEN SENSOR SIGNAL	14,19,25
	42	—	—	—
	43	—	—	—
3.0L & 3.3L	44	K44 18TN/YL*	DISTRIBUTOR IGNITION SENSOR	19,28
	45	D20 20LG	DATA LINK RECEIVE	14,23,29
●	46	D2 20WT/BK*	CCD BUSS(B—)	16,22,27
	47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	17,19,25
	48	—	—	—
	49	—	—	—
	50	—	—	—
	51	K51 20DB/YL*	AUTOMATIC SHUTDOWN RELAY	14,23,29
	52	K52 20PK/BK*	EVAP/PURGE SOLENOID SIGNAL	15,20,27
	53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	14,22,27,37
2.5L	54	K54 20OR/BK*	TRANSMISSION TCC LU SOLENOID	15
	55	—	—	—
	56	—	—	—
	57	A142 16DG/OR*	INJECTOR FEED	15,19,24
3.0L & 3.3L	58	K58 18BR/DB*	INJECTOR DRIVER 6	21,29
	59	K59 18VT/BK*	IDLE AIR CONTROL MOTOR (CLOSE)	14,21,26
	60	K60 18YL/BK*	IDLE AIR CONTROL MOTOR (CLOSE)	14,21,26

● TWISTED PAIR

POWERTRAIN CONTROL MODULE CONNECTOR

938W-3

AC-CD,AY-C 174



CONNECTOR #1

VIEWED FROM WIRE END

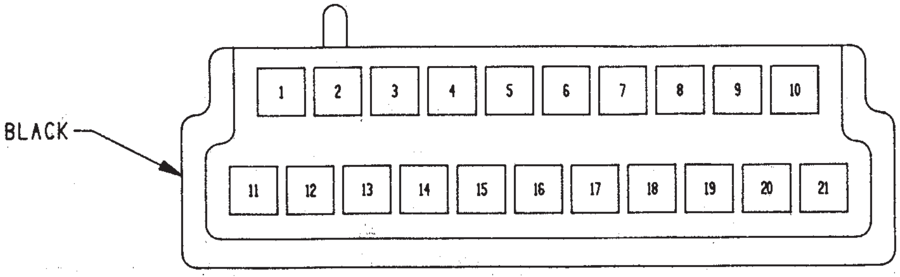
●TWISTED PAIR

CAV	CIRCUIT	FUNCTION	SHEET
1	B1 20YL/DB*	RIGHT REAR WHEEL SENSOR (−)	50
2	B2 20YL	RIGHT REAR WHEEL SENSOR (+)	50
3	B3 20LG/DB*	LEFT REAR WHEEL SENSOR (−)	50
4	B4 20LG	LEFT REAR WHEEL SENSOR (+)	50
5	Z1 16BK	GROUND	46,47
6	B6 20WT/DB*	RIGHT FRONT WHEEL SENSOR (−)	50
7	B7 20WT	RIGHT FRONT WHEEL SENSOR (+)	50
8	B8 20RD/DB*	LEFT FRONT WHEEL SENSOR (−)	50
9	B9 20RD	LEFT FRONT WHEEL SENSOR (+)	50
10	B210 20RD/BK*	TRANSDUCER RETURN (−)	45
11	D11 20WT/VT*	DIAGNOSTIC ENABLE(SIGNAL DATA IN)	49
12	D12 20OR	DIAG ENABLE (SIGNAL DATA OUT)	49
13	L50 18WT/TN*	STOP LAMP SWITCH	48
14	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	45
15	G19 20LG/OR*	WARNING LAMP (AMBER)	49
16	B16 20GY/RD*	EVIC SIGNAL (3.3L ONLY)	49
17	B217 14RD	LOW ACCUMULATOR	45
18	B218 20WT/OR*	PRIMARY PRESSURE/DPA	45
19	B219 20DB	BOOST PRESSURE	45
20	—	—	—
21	—	—	—
22	—	—	—
23	—	—	—
24	—	—	—
25	—	—	—
26	—	—	—
27	—	—	—
28	—	—	—
29	—	—	—
30	—	—	—
31	—	—	—
32	—	—	—
33	—	—	—
34	—	—	—
35	—	—	—
36	—	—	—
37	—	—	—
38	—	—	—
39	—	—	—
40	—	—	—
41	—	—	—
42	B242 20BR/WT	LEFT FRONT BUILD VALVE	48
43	B243 20DG/BK	LEFT FRONT DECAY VALVE	48
44	—	—	—
45	B245 20WT/LG	LEFT FRONT ISOLATION VALVE	48
46	B246 20BR/RD	RIGHT FRONT BUILD VALVE	48
47	B47 16RD/LB	SOLENOID FEED	49
48	B248 20DG/WT	RIGHT FRONT DECAY VALVE	48
49	B249 20WT/TN	RIGHT FRONT ISOLATION VALVE	48
50	B47 16RD/LB	SOLENOID FEED	49
51	B251 20WT/BK	LEFT REAR ISOLATION VALVE	48
52	B252 20BR/TN	REAR BUILD VALVE	48
53	—	—	—
54	B254 20DG/OR	REAR DECAY VALVE	48
55	B255 20WT/PK	RIGHT REAR ISOLATION VALVE	48
56	—	—	—
57	B57 20BR/BK	SYSTEM RELAY COIL (+)	47
58	B258 20GY/LB	TRANSDUCER FEED (+)	45
59	—	—	—
60	A21 14DB	IGNITION START RUN	49

AC-CD, AY-C 175

ANTI-LOCK BRAKE SYSTEM CONTROLLER CONNECTOR

938W-3



VIEWED FROM WIRE END

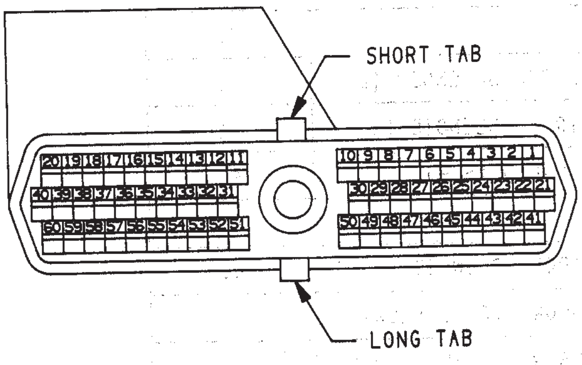
CAV	CIRCUIT	FUNCTION	SHEET
1	S14 20DB/RD*	FRONT RIGHT HEIGHT SENSOR SIGNAL (HI)	41
2	S11 20DG	FRONT LEFT HEIGHT SENSOR SIGNAL (LOW)	41
3	S15 20DG/WT*	FRONT LEFT HEIGHT SENSOR SIGNAL (MEDIUM)	41
4	S20 18LG/RD*	REAR RIGHT HEIGHT SENSOR SIGNAL (HI)	43
● 5	D1 20VT/BR*	CCD BUSS (B+)	43
6	S30 20DB/OR*	FRONT RIGHT HEIGHT CONTROL SOLENOID (B—)	41
7	S31 20DG/OR*	FRONT LEFT HEIGHT CONTROL SOLENOID (B—)	41
8	S9 20BK/OR*	COMPRESSOR EXHAUST SOLENOID (B—)	41
9	S8 20BK/RD*	COMPRESSOR RELAY (B—)	41
10	S32 18LG/OR*	REAR RIGHT HEIGHT CONTROL SOLENOID (B—)	41
11	S12 20DB	FRONT RIGHT HEIGHT SENSOR SIGNAL (LOW)	41
12	S16 20DB/WT*	FRONT RIGHT HEIGHT SENSOR SIGNAL (MEDIUM)	41
13	S13 20DG/RD*	FRONT LEFT HEIGHT SENSOR SIGNAL (HI)	41
14	S18 18LG	REAR RIGHT HEIGHT SENSOR SIGNAL (LOW)	43
15	S22 18LG/WT*	REAR RIGHT HEIGHT SENSOR SIGNAL (MEDIUM)	43
● 16	D2 20WT/BK*	CCD BUSS (B—)	43
17	S33 20BR	HEIGHT SENSOR COMMON (B—)	41
18	—	—	—
19	Z2 18BK/LG*	SENSOR GROUND (B—)	41
20	F10 18YL/LG*	LEVELING FEED	41
21	S3 18PK/WT*	COMPRESSOR FEED (B+)	41

● TWISTED PAIR

AIR SUSPENSION CONTROL MODULE

	CAV	CIRCUIT	FUNCTION	SHEET
	1	T1 16LG/BK*	TRANSMISSION RANGE SWITCH	35
	2	T2 14TN/BK*	BACK-UP RELAY GROUND (B−)	33
	3	T3 14VT	RELAY COMMON	33
●	4	D2 20WT/BK*	CCD BUSS (B−)	34
●	4	D2 20WT/BK*	CCD BUSS (B−)	34
	5	—	—	—
3.3L	6	K24 18GY/BK*	DISTRIBUTOR IGNITION SENSOR SIGNAL	33,35
3.0L	6	K24 18BK/YL*	TRANSMISSION SIGNAL GROUND	33,35
	7	—	—	—
	8	A41 18YL	ENGINE STARTER RELAY	33
	9	T9 18BK/LG*	OVERDRIVE PRESSURE SWITCH	35
	10	—	—	—
	11	A21 14DB	IGNITION START/RUN	33
	12	K22 18OR/DB*	THROTTLE POSITION (SENSOR)	34
	13	T13 18DB/BK*	VEHICLE SPEED SENSOR GROUND (B−)	34
	14	T14 18LG/WT*	OUTPUT SPEED SENSOR (B+)	34
	15	T15 18LG	SHUTDOWN RELAY POWER	35
	16	T16 16RD	SWITCHED BATTERY FEED	35
	17	T16 16RD	SWITCHED BATTERY FEED	35
	18	—	—	—
	19	T19 18WT	KICK-DOWN/LOW AND REVERSE	35
	20	T20 18LB	LR/LU SOLENOID	35
	21	—	—	—
	22	—	—	—
	23	—	—	—
	24	—	—	—
	25	—	—	—
	26	—	—	—
	27	—	—	—
	28	—	—	—
	29	—	—	—
	30	—	—	—

(CONTINUED ON NEXT PAGE)

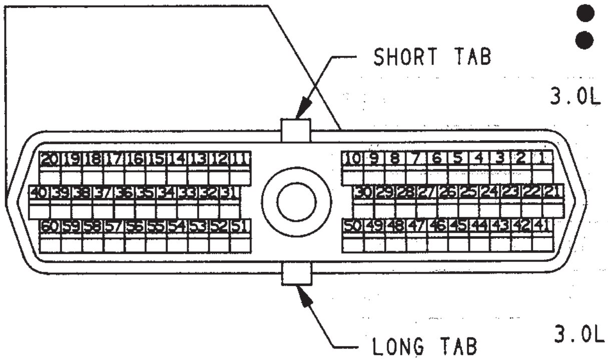


CONNECTOR #1
VIEWED FROM WIRE
END OF CONNECTOR

● TWO SETS OF
TWISTED PAIRS
D1 AND D2

AC-CD, AY-C 177 TRANSMISSION CONTROLLER CONNECTOR 938W-3

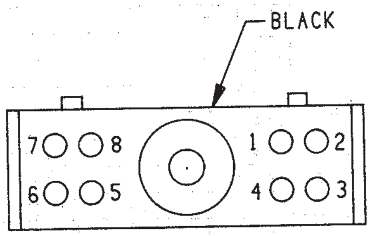
	CAV	CIRCUIT	FUNCTION	SHEET
	31	—	—	—
	32	—	—	—
	33	—	—	—
	34	—	—	—
	35	—	—	—
	36	—	—	—
	37	—	—	—
	38	—	—	—
	39	—	—	—
	40	—	—	—
	41	T41 18BR/YL✻	PARK/NEUTRAL (POSITION) SW SIG	33
	42	T42 18VT/WT✻	TRANSMISSION RANGE SWITCH GROUND	35
●	43	D1 20VT/BR✻	CCD BUSS(B+)	34
●	43	D1 20VT/BR✻	CCD BUSS(B+)	34
	44	—	—	—
3.0L	45	K24 18GY/BK✻	DISTRIBUTOR IGNITION SENSOR SIGNAL	33
	46	—	—	—
	47	T47 18YL/BK✻	KICK-DOWN PRESSURE SWITCH	35
	48	—	—	—
	49	—	—	—
	50	T50 18DG	LOW REVERSE PRESSURE SWITCH	35
	51	K4 18BK/LB✻	SIGNAL GROUND	34
	52	T52 18RD/BK✻	INPUT SPEED SENSOR (+)	34
3.0L	53	Z14 18BK/YL✻	TRANSMISSION CONTROL MODULE SIGNAL GROUND	35
3.3L	53	Z14 16BK/YL✻	TRANSMISSION CONTROL MODULE SIGNAL GROUND	35
	54	—	—	—
	55	—	—	—
3.0L	56	A4 14BK/PK✻	BATTERY FEED	34
3.3L	56	A4 14BK/PK✻	BATTERY FEED	34
	57	Z13 16BK/RD✻	TRANSMISSION CONTROL MODULE POWER GROUND	35
	58	G7 20WT/OR✻	VEHICLE DISTANCE SENSOR SIGNAL	33,34
	59	T59 18PK	UD SOLENOID	35
	60	T60 18BR	UD SOLENOID	35



CONNECTOR #1
VIEWED FROM WIRE
END OF CONNECTOR

● TWO SETS OF
TWISTED PAIRS
D1 AND D2

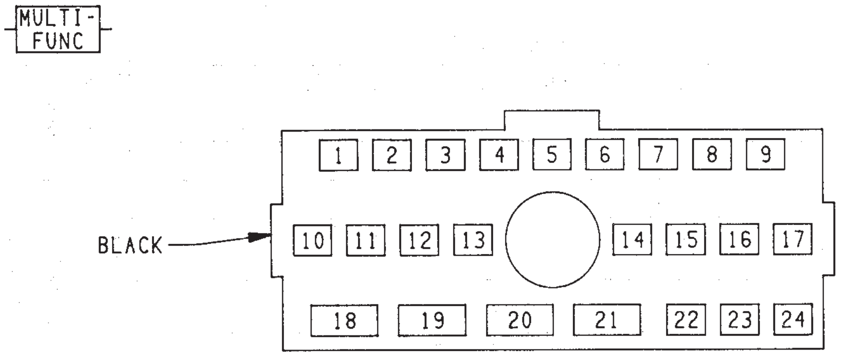
938W-3 TRANSMISSION CONTROLLER CONNECTOR AC-CD,AY-C 178



VIEW FROM
TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	T47 18YL/BK*	KICK-DOWN PRESSURE SWITCH	35
2	T50 18DG	LOW REVERSE PRESSURE SWITCH	35
3	T9 18OR/BK*	OVERDRIVE PRESSURE SWITCH	35
4	T16 16RD	SWITCHED BATTERY FEED	35
5	T59 18PK	UD SOLENOID	35
6	T60 18BR	OD SOLENOID	35
7	T20 18LB	LR/LU SOLENOID	35
8	T19 18WT	KICK-DOWN/LOW AND REVERSE	35

TRANSMISSION SOLENOID CONNECTOR

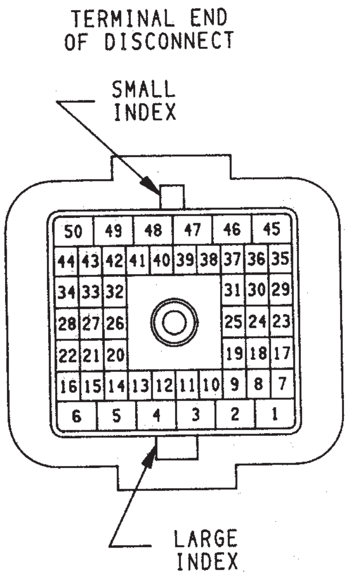


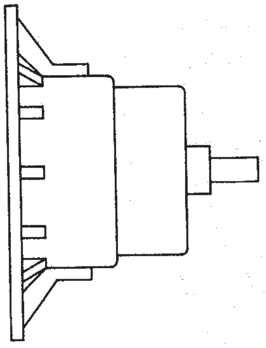
CONNECTOR VIEWED FROM WIRE END

CAV	CIRCUIT	FUNCTION	SHEET
1	V7 18DG/WT*	PULSE WIPE PARK (B—) DWELL	61,104,107,109
2	—	—	—
3	V10 18BR	WINDSHIELD WIPER MOTOR	61,104,107,109
4	F13 16DB	FRONT WIPER PARK	61
5	V4 14RD/YL*	WINDSHIELD WIPER HIGH FEED	61
6	V3 16BR/WT*	WINDSHIELD WIPER LOW FEED	61
7	V9 18BK	WINDSHIELD WIPER DWELL	61,104,107,109
8	V9 18BK	WINDSHIELD WIPER DWELL	61,104,107,109
9	V3 16BR/WT*	WINDSHIELD WIPER LOW FEED	61
10	—	—	—
11	L60 18TN	RIGHT FRONT TURN SIGNAL	60,100
12	L62 16BR/RD*	RIGHT REAR STOP AND TURN SIGNAL	60,96
12	L62 18BR/RD*	RIGHT REAR STOP AND TURN SIGNAL	60,96
13	L19 18PK/BK*	HAZARD FLASHER FEED SWITCH	60
14	L50 18WT/TN*	STOP LAMP SWITCH	38,60
15	L63 18DG/RD*	LEFT REAR STOP AND TURN SIGNAL	60,96
15	L63 18DG/RD*	LEFT REAR STOP AND TURN SIGNAL	60,96
16	L61 18LG	LEFT FRONT TURN SIGNAL	60,99
17	L6 18RD/WT*	TURN SIGNAL FLASHER FEED	60,103,106,108
18	L4 14VT/WT*	HEADLAMP LOW BEAM	66,102,105,110
19	L2 14LG	HEADLAMP DIMMER SWITCH FEED	66
19	L2 14LG	HEADLAMP DIMMER SWITCH FEED	66
20	L3 14RD/OR*	HEADLAMP HIGH BEAM	66,102,105,110
20	L3 14RD/OR*	HEADLAMP HIGH BEAM	66,102,105,110
21	L20 18LG/WT*	OPTICAL HORN BATTERY FEED	66
22	L29 20LG/BK*	LEFT CORNERING LAMP	60
23	F22 20WT/PK*	ACCESSORY FEED	60,148
24	L28 20TN/BK*	RIGHT CORNERING LAMP	60

INSTRUMENT PANEL TO MULTI-FUNCTION SWITCH WIRING

AC-CD,AY-C 180



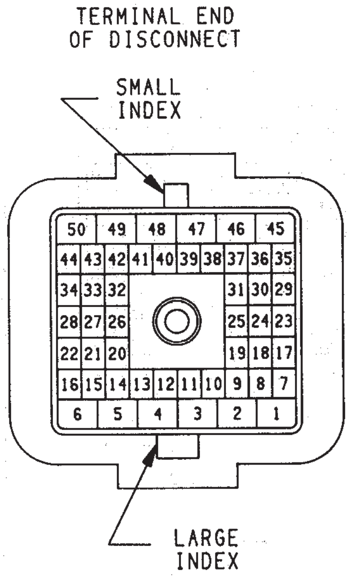


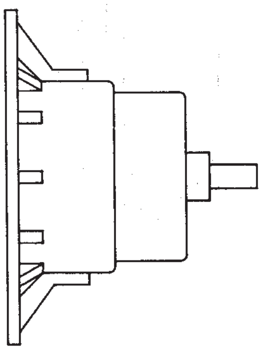
CAV	CIRCUIT	FUNCTION	SHEET
1	A3 12RD/WT*	HEADLAMP SWITCH BATTERY FEED	6,8,10,37,66,69,71
2	L113 16RD/VT*	CONCEALED HEADLAMP DOOR MOTOR RELAY(CLOSE)	68
3	A7 12RD/BK*	FUSEBLOCK BATTERY FEED	6,8,10,57,64,118 122,126,128,132, 136,139,151,160
4	—	—	—
5	F35 12RD	POWER SEATS BATTERY FEED	68,139
6	L3 14RD/OR*	HEADLAMP HIGH BEAM	66,69,71,73,75,78, 81,83,102,105,110
6	L3 14RD/OR*	HEADLAMP HIGH BEAM	66,69,71,73,75,78, 81,83,102,105,110
7	F15 16DB/WT*	IGNITION FEED	5,7,9,148
8	V37 20RD/LG*	VEHICLE SPEED CONTROL MODE SIGNAL	14,37
9	—	—	—
10	V32 20YL/RD*	VEHICLE SPEED CONTROL ON/OFF	37
11	L52 20GY/RD*	CONCEALED HEADLAMP OPEN (B+)	68,101,105,110
12	L51 20GY/PK*	CONCEALED HEADLAMP CLOSE (B+)	68,101,105,110
13	—	—	—
14	Z2 18BK/LG*	GROUND	86,98
15	L29 20LG/BK*	LEFT CORNERING LAMP	60,74,77,80,82,84
16	L28 20TN/BK*	RIGHT CORNERING LAMP	60,73,75,78,81,83
17	G20 22VT/YL*	ENGINE COOLANT TEMP SENDING UNIT	30,31,32,102
17	G20 22VT/YL*	ENGINE COOLANT TEMP SENDING UNIT	30,31,32,102
18	G6 22GY	ENGINE OIL PRESSURE WARNING LAMP	30,31,32,99,102, 107,109
18	G6 22GY	ENGINE OIL PRESSURE WARNING LAMP	30,31,32,99,102, 107,109
18	G6 22GY	ENGINE OIL PRESSURE WARNING LAMP	30,31,32,99,102, 107,109
19	G60 22GY/YL*	ENGINE OIL PRESSURE SENDING UNIT	30,31,32,102
19	G60 22GY/YL*	ENGINE OIL PRESSURE SENDING UNIT	30,31,32,102
20	G34 16RD/GY*	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76,79, 82,84,99
20	G34 16RD/GY*	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76,79, 82,84,99
21	L61 18LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
21	L61 20LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
21	L61 20LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
22	L60 18TN	RIGHT TURN SIGNAL LAMP	60,69,71,73,76, 79,81,83,100
22	L60 20TN	RIGHT TURN SIGNAL LAMP	60,69,71,73,76, 79,81,83,100
22	L60 20TN	RIGHT TURN SIGNAL LAMP	60,69,71,73,76, 79,81,83,100
23	A15 18PK/WT*	HAZARD FLASHER BATTERY FEED	5,7,9,59
24	D11 20WT/VT*	ANTI-LOCK DATA LINK	49
25	D12 20OR	ANTI-LOCK DATA LINK	49

50-WAY BULKHEAD DISCONNECT

938W-3

26	L7 18BK/YL *	LIGHTING FEED	70,72,74,76,79,82, 84,119,121
27	F20 22WT	IGNITION FEED	11,12,33,54
28	—	—	—
29	L43 22VT	LEFT HEADLAMP FEED	69,71,73,75,78, 81,83,96
29	L43 22VT	LEFT HEADLAMP FEED	69,71,73,75,78, 81,83,96
30	L44 22VT/BK*	RIGHT HEADLAMP FEED	69,71,73,75,78, 81,83,96
30	L44 22VT/BK*	RIGHT HEADLAMP FEED	69,71,73,75,78, 81,83,96
31	G70 20BR/TN*	SECURITY ALARM SWITCH (HOOD)	128,132,136
32	X2 18DG/RD*	HORN FEED	63
33	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
33	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
35	V5 18DG	WINDSHIELD WIPER MOTOR FEED	62,104,107,109
36	F13 16DB	FRONT WIPER PARK	62
37	C21 22BR	A/C DAMPED PRESSURE SWITCH	53,55,114,116
37	C21 22BR	A/C DAMPED PRESSURE SWITCH	53,55,114,116
38	G3 22BK/PK*	MALFUNCTION INDICATOR LAMP	16,23,29
39	D2 20WT/BK*	CCD BUSS (B—)	22,27,34,97,100,103, 106,110,130,134
39	D2 20WT/BK*	CCD BUSS (B—)	22,27,34,97,100,103, 106,110,130,134
39	D2 20WT/BK*	CCD BUSS (B—)	22,27,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	22,27,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	22,27,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	22,27,34,97,100,103, 106,110,130,134
41	L50 18WT/TN*	STOP LAMP SWITCH	38,59
41	L50 18WT/TN*	STOP LAMP SWITCH	38,59
42	G7 22WT/OR*	VEHICLE SPEED SENSOR	17,19,25,151
42	G7 22WT/OR*	VEHICLE SPEED SENSOR	17,19,25,151
43	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,101
43	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,101
43	G11 22WT/BK*	PARK BRAKE SWITCH	11,101
44	G19 22LG/OR*	ANTI-LOCK BRAKING SYSTEM	49,100
44	G19 22LG/OR*	ANTI-LOCK BRAKING SYSTEM	49,100
45	V3 16BR/WT *	WINDSHIELD WIPER MOTOR (LOW)	62
45	V3 16BR/WT*	WINDSHIELD WIPER MOTOR (LOW)	62
46	V4 14RD/YL*	WINDSHIELD WIPER MOTOR (HIGH)	62
47	A21 12DB	IGNITION START/RUN	11,15,22,27
48	A4 12BK/RD*	HEATED REAR WINDOW FEED	5,7,9,159
49	A1 12RD	IGNITION SWITCH BATTERY FEED	10,11
50	A2 12PK/BK*	IGNITION SWITCH BATTERY FEED	6,8,10,11

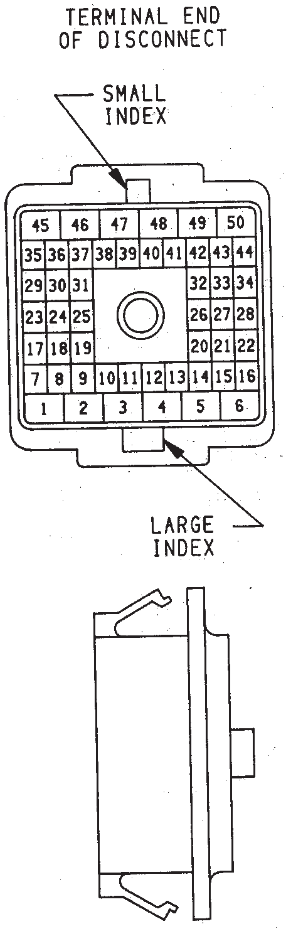




938W-3

50-WAY BULKHEAD DISCONNECT

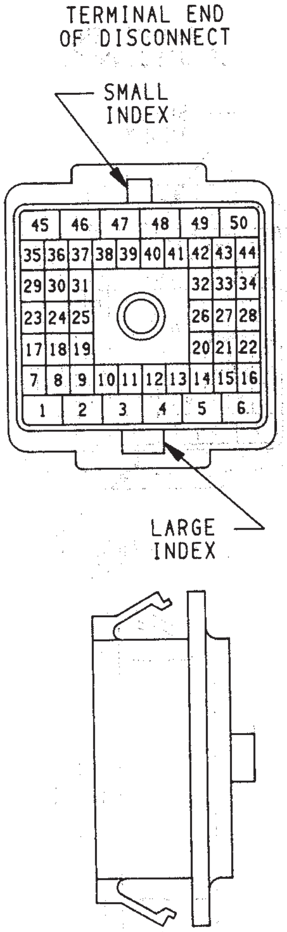
AC-CD,AY-C 182



CAV	CIRCUIT	FUNCTION	SHEET
1	A3 10RD/WT✻	HEADLAMP SWITCH BATTERY FEED	6,37,66,69,71
2	—	—	—
3	A7 10RD/BK✻	FUSEBLOCK BATTERY FEED	6,57,64,118,122, 126,128,132,136, 139,151,160
4	—	—	—
5	—	—	—
6	L3 16RD/OR✻	HEADLAMP HIGH BEAM	66,69,71,73,75,78, 81,83,102,105,110,
7	F15 16DB/WT✻	IGNITION FEED	5,148
8	V37 18RD/LG✻	VEHICLE SPEED CONTROL MODE SIGNAL	14,37
9	—	—	
10	V32 20YL/RD✻	VEHICLE SPEED CONTROL ON/OFF	37
11	—	—	—
12	—	—	—
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	G20 20VT/YL✻	ENGINE COOLANT TEMP SENDING UNIT	30,102
18	G6 20GY	ENGINE OIL PRESSURE WARNING LAMP	30,99,102,107,109
19	G60 20GY/YL✻	ENGINE OIL PRESSURE SENDING LAMP	30,102
20	G34 16RD/GY✻	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76, 79,82,84,99
21	L61 18LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
22	L60 18TN	RIGHT TURN SIGNAL LAMP	60,69,71,73,76, 79,81,83,100
23	A15 18PK/WT✻	HAZARD FLASHER BATTERY FEED	5,59
24	—	—	—
25	—	—	—

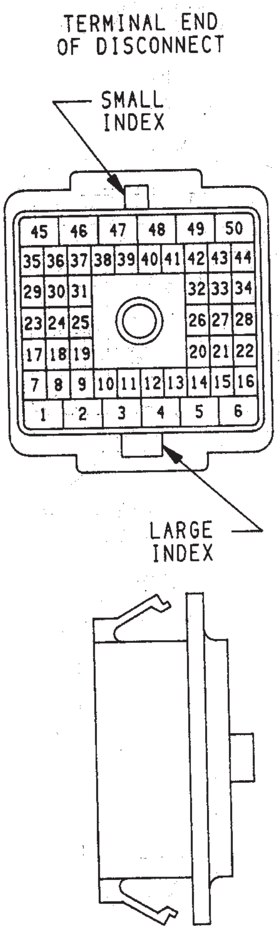
50-WAY BULKHEAD DISCONNECT
(2.5L ENGINE)

CAV	CIRCUIT	FUNCTION	SHEET
26	L7 18BK/YL*	LIGHTING FEED	70,72,74,76,79, 82,84,119,121
27	F20 18WT	IGNITION FEED	11,12,33,54
	F20 20WT	IGNITION FEED	11,12,33,54
28	—	—	
29	L43 22VT	LEFT HEADLAMP FEED	69,71,73,75, 78,81,83,96
30	L44 20VT/WT*	RIGHT HEADLAMP FEED	69,71,73,75, 78,81,83,96
31	G70 20BR/TN*	SECURITY ALARM SWITCH (HOOD)	128,132,136
32	X2 18DG/RD*	HORN FEED	63
33	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
35	V5 18DG	WINDSHIELD WIPER MOTOR FEED	62,104,107,109
36	F13 18DB	FRONT WIPER PARK	62
37	C20 20DB/OR*	A/C DAMPED PRESSURE SWITCH	53
38	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	16
39	D2 20WT/BK*	CCD BUSS (B–)	34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	34,97,100,103, 106,110,130,134
41	L50 18WT/TN*	STOP LAMP SWITCH	38,59
42	G7 20WT/OR*	VEHICLE SPEED SENSOR	17,151
43	G11 20WT/BK*	PARK BRAKE SWITCH	11,101
44	—	—	—
45	V3 14BR/WT*	WINDSHIELD WIPER MOTOR (LOW)	62
46	V4 14RD/YL*	WINDSHIELD WIPER MOTOR (HIGH)	62
47	A21 14DB	IGNITION START/RUN	11,15
48	A4 12BK/PK*	HEATED REAR WINDOW FEED	5,159
49	A1 12RD	IGNITION SWITCH BATTERY FEED	11
50	A2 10PK/BK*	IGNITION SWITCH BATTERY FEED	6,11



50-WAY BULKHEAD DISCONNECT (2.5L ENGINE)

AC-CD,AY-C 184



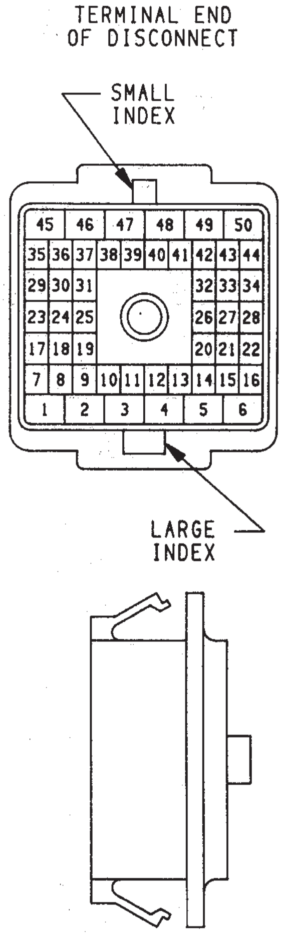
CAV	CIRCUIT	FUNCTION	SHEET
1	A3 10RD/WT*	HEADLAMP SWITCH BATTERY FEED	8,37,66,69,71
1	A3 10RD/WT*	HEADLAMP SWITCH BATTERY FEED	8,37,66,69,71
2	L113 16RD/WT*	CONCEALED HEADLAMP DOOR MOTOR RELAY (CLOSE)	68
3	A7 10RD/BK*	FUSEBLOCK BATTERY FEED	8,57,64,118,122, 126,128,132,136, 139,151,160
4	—	—	—
5	F35 12RD	POWER SEATS BATTERY FEED	68,139
6	L3 16RD/OR*	HEADLAMP HIGH BEAM	66,69,71,73,75,78, 81,83,102,105,110
7	F15 16DB/WT*	IGNITION FEED	7,148
8	V37 18RD/LG*	VECHICLE SPEED CONTROL MODE SIGNAL	37
9	—	—	—
10	V32 20YL/RD*	VEHICLE SPEED CONTROL (ON/OFF)	37
11	L52 20GY/RD*	CONCEALED HEADLAMP OPEN (B+)	68,101,105,110
12	L51 20GY/PK*	CONCEALED HEADLAMP CLOSE (B+)	68,101,105,110
13	—	—	—
14	Z2 18BK/LG*	GROUND	86,98
15	L29 18LG/BK*	LEFT CORNERING LAMP	60,74,77,80,82,84
16	L28 18TN/BK*	RIGHT CORNERING LAMP	60,73,75,78,81,83
17	G20 20VT/YL*	ENGINE COOLANT TEMP SENDING UNIT	31,102
18	G6 20GY	ENGINE OIL PRESSURE WARNING LAMP	31,99,102,107,109
19	G60 20GY/YL*	ENGINE OIL PRESSURE SENDING LAMP	31,102
20	G34 16RD/GY*	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76, 79,82,84,99
20	G34 16RD/GY*	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76, 79,82,84,99
21	L61 18LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
21	L61 18LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
22	L60 18TN	RIGHT TURN SIGNAL LAMP	60,69,71,73,76, 79,81,83,100
23	A15 18PK/WT*	HAZARD FLASHER BATTERY FEED	7,59
24	D11 20WT/VT*	ANTI-LOCK DATA LINK	49
25	D12 20OR	ANTI-LOCK DATA LINK	49

AC-CD, AY-C 185

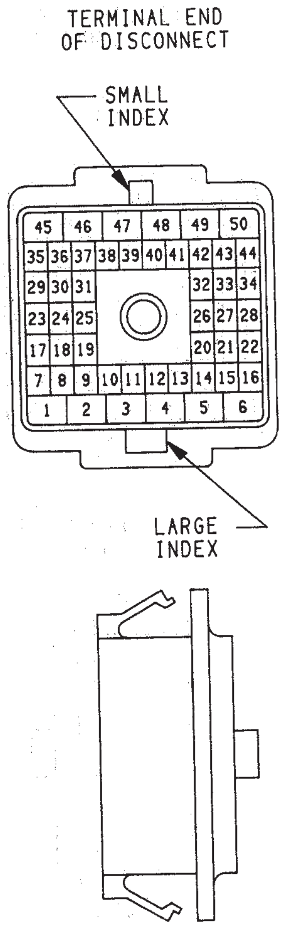
50-WAY BULKHEAD DISCONNECT
(3.0L ENGINE)

938W-3

CAV	CIRCUIT	FUNCTION	SHEET
26	L7 18BK/YL*	LIGHTING FEED	70,72,74,76,79, 82,84 119,121
27	F20 20WT	IGNITION FEED	11,33,59
28	——	——	——
29	L43 22VT	LEFT HEADLAMP FEED	69,71,73,75,78, 81,83,96
29	L43 22VT	LEFT HEADLAMP FEED	69,71,73,75,78, 81,83,96
30	L44 20VT/WT*	RIGHT HEADLAMP FEED	69,71,73,75,78, 81,83,96
30	L44 20VT/WT*	RIGHT HEADLAMP FEED	69,71,73,75,78, 81,83,96
31	G70 20BR/TN*	SECURITY ALARM SWITCH (HOOD)	128,132,136
32	X2 18DG/RD*	HORN FEED	63
33	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
35	V5 18DG	WINDSHIELD WIPER MOTOR FEED	62,104,107,109
36	F13 18DB	FRONT WIPER PARK	62
37	C20 20DB/OR*	A/C DAMPED PRESSURE SWITCH	55
38	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	23
39	D2 20WT/BK*	CCD BUSS (B —)	22,34,97,100,103, 106,110,130,134
39	D2 20WT/BK*	CCD BUSS (B —)	22,34,97,100,103, 106,110,130,134
39	D2 20WT/BK*	CCD BUSS (B —)	22,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B +)	22,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B +)	22,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B +)	22,34,97,100,103, 106,110,130,134
41	L50 18WT/TN*	STOP LAMP SWITCH	38,59
42	G7 20WT/OR*	VEHICLE SPEED SENSOR	19,151
43	G11 20WT/BK*	PARK BRAKE SWITCH	11,101
44	G19 20LG/OR*	ANTI-LOCK BRAKE SYSTEM	49,100
45	V3 14BR/WT*	WINDSHIELD WIPER MOTOR (LOW)	62
46	V4 14RD/YL*	WINDSHIELD WIPER MOTOR (HIGH)	62
47	A21 14DB	IGNITION START/RUN	11,22
48	A4 12BK/PK*	HEATED REAR WINDOW FEED	7,159
49	A1 12RD	IGNITION SWITCH BATTERY FEED	11
50	A2 10PK/BK*	IGNITION SWITCH BATTERY FEED	8,11



50-WAY BULKHEAD DISCONNECT
(3.0L ENGINE)



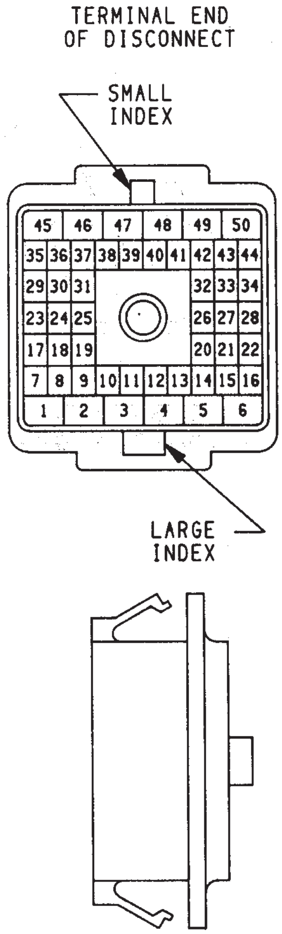
CAV	CIRCUIT	FUNCTION	SHEET
1	A3 10RD/WT*	HEADLAMP SWITCH BATTERY FEED	10,37,66,69,71
1	A3 10RD/WT*	HEADLAMP SWITCH BATTERY FEED	10,37,66,69,71
2	L113 16RD/WT*	CONCEALED HEADLAMP DOOR MOTOR RELAY (CLOSE)	68
3	A7 10RD/BK*	FUSEBLOCK BATTERY FEED	10,57,64,118,122, 126,128,132,136, 139,151,160
4	—	—	—
5	F35 12RD	POWER SEATS BATTERY FEED	68,139
6	L3 16RD/OR*	HEADLAMP HIGH BEAM	66,69,71,73,75,78, 81,83,102,105,110
7	F15 16DB/WT*	IGNITION FEED	9,148
8	V37 18RD/LG*	VECHICLE SPEED CONTROL MODE SIGNAL	37
9	—	—	—
10	V32 20YL/RD*	VEHICLE SPEED CONTROL (ON/OFF)	37
11	L52 20GY/RD*	CONCEALED HEADLAMP OPEN (B+)	68,101,105,110
12	L51 20GY/PK*	CONCEALED HEADLAMP CLOSE (B+)	68,101,105,110
13	—	—	—
14	Z2 18BK/LG*	GROUND	86,98
15	L29 18LG/BK*	LEFT CORNERING LAMP	60,74,77,80,82,84
15	L29 18LG/BK*	LEFT CORNERING LAMP	60,74,77,80,82,84
16	L28 18TN/BK*	RIGHT CORNERING LAMP	60,73,75,78,81,83
16	L28 18TN/BK*	RIGHT CORNERING LAMP	60,73,75,78,81,83
17	G20 20VT/YL*	ENGINE COOLANT TEMP SENDING UNIT	32,102
18	G6 20GY	ENGINE OIL PRESSURE WARNING LAMP	32,99,102,107,109
19	G60 20GY/YL*	ENGINE OIL PRESSURE SENDING LAMP	32,102
20	G34 16RD/GY*	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76, 79,82,84,99
20	G34 16RD/GY*	HEADLAMP HIGH BEAM INDICATOR LAMP	66,69,71,74,76, 79,82,84,99
21	L61 18LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
21	L61 18LG	LEFT TURN SIGNAL LAMP	60,70,72,74,77, 80,82,84,99
22	L60 18TN	RIGHT TURN SIGNAL LAMP	60,69,71,73,76, 79,81,83,100
23	A15 18PK/WT*	HAZARD FLASHER BATTERY FEED	9,59
24	D11 20WT/VT*	ANTI-LOCK DATA LINK	49
25	D12 200R	ANTI-LOCK DATA LINK	49

AC-CD, AY-C 187

50-WAY BULKHEAD DISCONNECT (3.3L AND 3.8L ENGINE)

938W-3

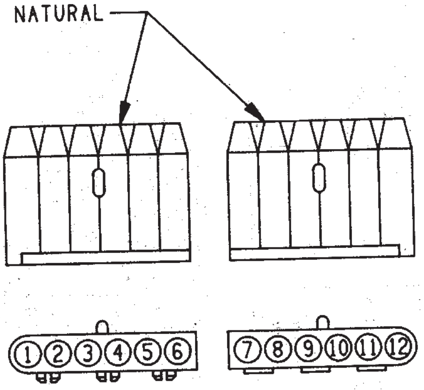
CAV	CIRCUIT	FUNCTION	SHEET
26	L7 18BK/YL*	LIGHTING FEED	70,72,74,76,79, 82,84 119,121
27	F20 20WT	IGNITION FEED	11,33
28	—	—	—
29	L43 22VT	LEFT HEADLAMP FEED	69.71,73,75,78, 81,83,96
29	L43 22VT	LEFT HEADLAMP FEED	69.71,73,75,78, 81,83,96
30	L44 20VT/WT*	RIGHT HEADLAMP FEED	69.71,73,75,78, 81,83,96
30	L44 20VT/WT*	RIGHT HEADLAMP FEED	69.71,73,75,78, 81,83,96
31	G70 20BR/TN*	SECURITY ALARM SWITCH (HOOD)	128,132,136
32	X2 18DG/RD*	HORN FEED	63
33	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
34	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11,99
35	V5 18DG	WINDSHIELD WIPER MOTOR FEED	62,104,107,109
36	F13 18DB	FRONT WIPER PARK	62
37	C20 20DB/OR*	A/C DAMPED PRESSURE SWITCH	55,114,116
38	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	29
39	D2 20WT/BK*	CCD BUSS (B—)	27,34,97,100,103, 106,110,130,134
39	D2 20WT/BK*	CCD BUSS (B—)	27,34,97,100,103, 106,110,130,134
39	D2 20WT/BK*	CCD BUSS (B—)	27,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	27,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	27,34,97,100,103, 106,110,130,134
40	D1 20VT/BR*	CCD BUSS (B+)	27,34,97,100,103, 106,110,130,134
41	L50 18WT/TN*	STOP LAMP SWITCH	38,59
42	G7 20WT/OR*	VEHICLE SPEED SENSOR	25,151
43	G11 20WT/BK*	PARK BRAKE SWITCH	11,101
44	G19 20LG/OR*	ANTI-LOCK BRAKE SYSTEM	49,100
45	V3 14BR/WT*	WINDSHIELD WIPER MOTOR (LOW)	62
46	V4 14RD/YL*	WINDSHIELD WIPER MOTOR (HIGH)	62
47	A21 14DB	IGNITION START/RUN	11,27
48	A4 12BK/PK*	HEATED REAR WINDOW FEED	9,159
49	A1 12RD	IGNITION SWITCH BATTERY FEED	10,11
50	A2 10PK/BK*	IGNITION SWITCH BATTERY FEED	10,11



50-WAY BULKHEAD DISCONNECT
(3.3L AND 3.8L ENGINE)

938W-3

AC-CD,AY-C 188



ELECTRONIC VEHICLE INFORMATION CENTER ENGINE NODE CONNECTOR

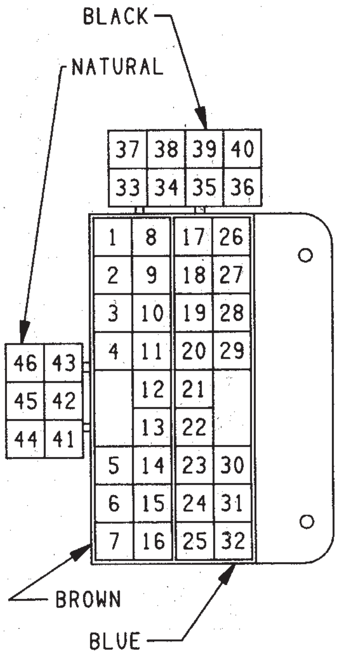
	CAV	CIRCUIT	FUNCTION	SHEET
	1	Z2 18BK/LG*	GROUND	98
	2	—	—	—
	3	B16 20BK/LB*	ABS EVIC SIGNAL	98
	4	C27 18DB/PK*	FAN CONTROL RELAY COIL GROUND	98
	5	—	—	—
	6	G18 20PK	ENGINE COOLANT LEVEL SENSOR	98
●	7	D1 20VT/BR *	CCD BUSS (B+)	98
●	8	D2 20WT/BK *	CCD BUSS (B—)	98
	9	—	—	—
	10	G36 18BR/GY *	ENGINE OIL LEVEL SENSOR	98
	11	A21 16DB	IGNITION START/RUN	98
	12	—	—	—

● TWISTED PAIR

ELECTRONIC VEHICLE INFORMATION CENTER CONNECTOR

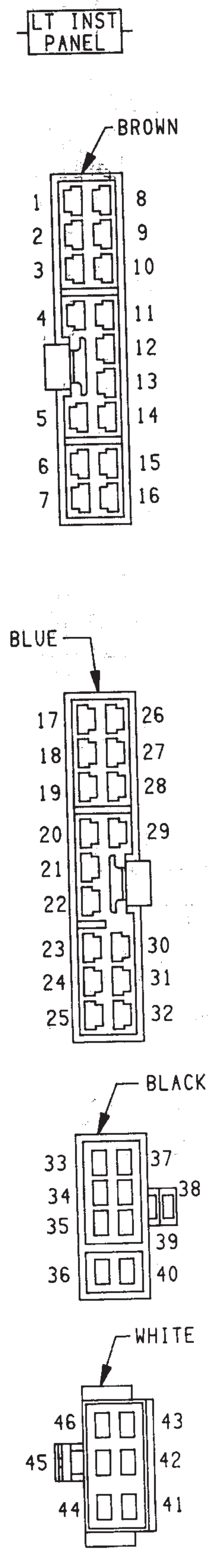
LT INST PANEL

CAV	CIRCUIT	FUNCTION	SHEET
1	M1 20PK	COURTESY LAMP FEED	87,91,112,159
2	G10 22LG/RD*	SEAT BELT WARNING SWITCH	67,104,107,109
3	G75 22TN	LEFT FRONT DOOR AJAR LAMP	92,93,94,95,103,129,133,135
3	G75 22TN	LEFT FRONT DOOR AJAR LAMP	92,93,94,95,103,129,133,135
3	G75 22TN	LEFT FRONT DOOR AJAR LAMP	92,93,94,95,103,129,133,135
4	G16 22BK/LB*	BUZZER/CHIME/PASSIVE RESTRANT SYSTEM GROUND	87,104,107,109
6	P35 18OR/VT*	POWER DOOR LOCK (B+) LOCK SWITCH	103,106,108,139
6	——	——	——
7	F30 18RD	CONSOLE CIGAR LIGHTER FEED	64,139,146,151,160
7	——	——	——
8	M2 20YL	DOOR JAMB SWITCH	87,91
9	G7 22WT/OR*	VEHICLE SPEED SENSOR SIGNAL	17,19,25,151
10	M22 22WT	ILLUMINATED ENTRY RELAY GROUND	91,103,106,108,141
10	M22 22WT	ILLUMINATED ENTRY RELAY GROUND	91,103,106,108,141
12	G73 22LG/OR*	S.A.M. LEFT FRONT DOOR KEY CYLINDER SWITCH	127,131,135,141
12	G73 22LG/OR*	S.A.M. LEFT FRONT DOOR KEY CYLINDER SWITCH	127,131,135,141
15	P36 18PK/VT*	POWER DOOR LOCK (B+) UNLOCK SWITCH	129,133,137,140,142
15	P36 18PK/VT*	POWER DOOR LOCK (B+) UNLOCK SWITCH	129,133,137,140,142
17	M1 20PK	COURTESY LAMP FEED	89,91,112,159
17	M1 20PK	COURTESY LAMP FEED	89,91,112,159
18	G78 22TN/BK*	DECKLID AJAR LAMP	95,101,105,110,129,159
18	G78 22TN/BK*	DECKLID AJAR LAMP	95,101,105,110,129,159
20	L7 18BK/YL*	LIGHTING FEED	96,119,121,161,163
20	L7 18BK/YL*	LIGHTING FEED	96,119,121,161,163
20	L71 18BK/PK*	LEFT SIDE TAIL LAMP	96,119,121,161,163
21	L7 18BK/YL*	LIGHTING FEED	161,163
22	G4 22DB	FUEL TANK SENDING UNIT	36,103,106,108
22	G4 22DB	FUEL TANK SENDING UNIT	36,103,106,108
23	L62 18BR/RD*	RIGHT REAR STOP AND TURN SIGNAL	60,96,161,163
23	L62 18BR/RD*	RIGHT REAR STOP AND TURN SIGNAL	60,96,161,163
23	L82 18BR	RIGHT OUTBOARD STOP AND TURN SIGNAL	60,96,161,163
24	L83 18DG/RD*	LEFT REAR STOP AND TURN SIGNAL	60,96,161,163
24	L83 18DG/RD*	LEFT REAR STOP AND TURN SIGNAL	60,96,161,163
24	L81 18DG	LEFT OUTBOARD STOP AND TURN SIGNAL	60,96,161,163
25	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
26	M2 20YL	DOOR JAMB SWITCH	65,89,91
26	M2 20YL	DOOR JAMB SWITCH	65,89,91
27	G77 22TN/OR*	LEFT REAR DOOR AJAR LAMP	92,93,94,95,129,133,137
27	G77 22TN/OR*	LEFT REAR DOOR AJAR LAMP	92,93,94,95,129,133,137
27	G77 22TN/OR*	LEFT REAR DOOR AJAR LAMP	92,93,94,95,129,133,137
27	G77 22TN/OR*	LEFT REAR DOOR AJAR LAMP	92,93,94,95,129,133,137
28	G71 20VT/YL*	S.A.M. ARMED WARNING LAMP	119,127,131,135,160
29	L7 18BK/YL*	LIGHTING FEED	96,121,161,163
29	L72 18BK/RD*	RIGHT SIDE TAIL LAMP	96,121,161,163
30	L62 18BR/RD*	RIGHT REAR STOP AND TURN SIGNAL	60,96,161,163
30	L84 18BR/WT*	RIGHT INBOARD STOP AND TURN SIGNAL	60,96,161,163
31	L63 18DG/RD*	LEFT REAR STOP AND TURN SIGNAL	60,96,161,163
31	L83 18DG/WT*	LEFT INBOARD STOP AND TURN SIGNAL	60,96,161,163
32	L50 18WT/TN*	STOP LAMP SWITCH	38,59,161,163
33	Z1 18BK	GROUND	111,141,159
34	C15 14BK/WT*	HEATED REAR WINDOW FEED	51,53,55,86,115
35	Z1 12BK	GROUND	148
35	Z1 12BK	GROUND	51,53,55,86,115
36	Q2 18LG/BK*	DECKLID RELEASE SWITCH	51,53,55,86,115
37	F35 12RD	POWER SEATS BATTERY FEED	39,41,139
38	F10 18YL/RD*	LEVELING FEED	41,147
39	F30 18RD	CONSOLE CIGAR LIGHTER FEED	64,139,146,151,160
39	F30 18RD	CONSOLE CIGAR LIGHTER FEED	64,139,146,151,160
40	F75 12VT	RS AMPLIFIER FEED	122
41	F21 12TN	POWER WINDOW SWITCH	158
42	P55 14DB	DOOR UNLOCK RF KEYLESS	139,142
42	P34 14PK/BK	POWER DOOR LOCK MOTOR (B+) LOCK SWITCH	139
44	F35 12RD	POWER SEATS BATTERY FEED	139,149,153,155



CONNECTOR
VIEWED FROM
WIRE END

INSTRUMENT PANEL
TO LEFT BODY WIRING



CAV	CIRCUIT	FUNCTION	SHEET
1	M1 20PK	COURTESY LAMP FEED	87,91,112,159
2	G10 20LG/RD*	SEAT BELT WARNING SWITCH	67,104,107,109
3	G75 20TN	LEFT FRONT DOOR AJAR LAMP	92,93,94,95,103,129,133,135
3	—	—	—
3	—	—	—
4	G16 20BK/LB*	BUZZER/CHIME/PASSIVE RESTRANT SYSTEM GROUND	87,104,107,109
6	P35 18OR/VT*	POWER DOOR LOCK (B+) LOCK SWITCH	103,106,108,139
6	P35 18OR/VT*	POWER DOOR LOCK (B+) LOCK SWITCH	103,106,108,139
7	F30 18RD	CONSOLE CIGAR LIGHTER FEED	64,139,146,151,160
7	F30 18RD	CONSOLE CIGAR LIGHTER FEED	64,139,146,151,160
8	M2 20YL	DOOR JAMB SWITCH	87,91
9	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	17,19,25,151
10	M22 20WT	ILLUMINATED ENTRY RELAY GROUND	91,103,106,108,141
10	M22 20WT	ILLUMINATED ENTRY RELAY GROUND	91,103,106,108,141
12	G73 20LG/OR*	S.A.M. LEFT FRONT DOOR KEY CYLINDER SWITCH	127,131,135,141
12	—	—	—
15	P36 18PK/WT*	POWER DOOR LOCK (B+) UNLOCK SWITCH	129,133,137,140,142
15	P36 18PK/WT*	POWER DOOR LOCK (B+) UNLOCK SWITCH	129,133,137,140,142
17	M1 20PK	COURTESY LAMP FEED	89,91,112,159
17	—	—	—
18	G78 20TN/BK*	DECKLID AJAR LAMP	95,101,105,110,129,159
18	—	—	—
20	L71 18BK/PK*	LEFT SIDE TAIL LAMP	96,119,121,161,163
20	—	—	—
20	—	—	—
21	L7 18BK/YL*	LIGHTING FEED	161,163
22	G4 18DB	FUEL TANK SENDING UNIT	36,103,106,108
22	—	—	—
23	L82 18BR	RIGHT OUTBOARD STOP AND TURN SIGNAL	60,96,161,163
23	—	—	—
23	—	—	—
24	L81 18DG	LEFT OUTBOARD STOP AND TURN SIGNAL	60,96,161,163
24	—	—	—
24	—	—	—
25	F32 18PK/DB*	STOP LAMP SWITCH BATTERY FEED	37,43,59,66
26	M2 20YL	DOOR JAMB SWITCH	65,89
26	—	—	—
27	G77 20TN/OR*	LEFT REAR DOOR AJAR LAMP	92,93,94,95,129,133,137
27	—	—	—
27	—	—	—
27	—	—	—
28	G71 18VT/YL*	S.A.M. ARMED WARNING LAMP	119,127,131,135,160
29	L72 18BK/RD*	RIGHT SIDE TAIL LAMP	96,121,161,163
29			
30	L84 18BR/WT*	RIGHT INBOARD STOP AND TURN SIGNAL	60,96,161,163
30	—	—	—
31	L83 18DG/WT*	LEFT INBOARD STOP AND TURN SIGNAL	60,96,161,163
31	—	—	—
32	L50 18WT/TN*	STOP LAMP SWITCH	38,59,161,163
33	Z1 12BK	GROUND	51,53,55,86,115
33	—	—	—
34	C15 12BK/WT*	HEATED REAR WINDOW FEED	148
35	Z1 18BK	GROUND	51,53,55,86,115
36	Q2 16LG/BK*	DECKLID RELEASE SWITCH	111,141,159
37	F35 12RD	POWER SEATS BATTERY FEED	39,41,139
38	F10 16YL/RD*	LEVELING FEED	41,147
39	F30 18RD	CONSOLE CIGAR LIGHTER FEED	64,139,146,151,160
39	—	—	—
40	F75 12VT	RS AMPLIFIER FEED	122
41	F21 12TN	POWER WINDOW SWITCH	158
42	P55 14DB	DOOR UNLOCK RF KEYLESS	139,142
42	—	—	—
44	F35 12RD	POWER SEATS BATTERY FEED	139,149,153,155

LEFT BODY WIRING
TO INSTRUMENT PANEL

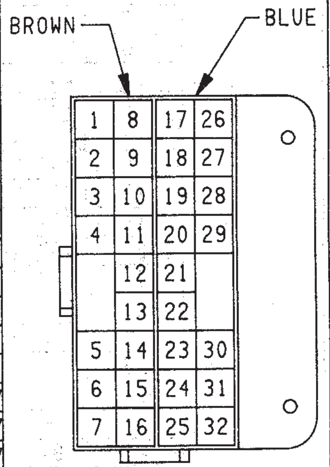
938W-3

AC-CD, AY-C 191

RT INST PANEL

CAV	CIRCUIT	FUNCTION	SHEET
1	X11 18GY	POWER ANTENNA SWITCHED (B−) GROUND	118
2	X13 18BK/RD✱	POWER ANTENNA (B+) UP	118
3	G74 22TN/RD✱	RIGHT FRONT DOOR AJAR LAMP	92,93,94,95,101,129,132,137
3	G74 22TN/RD✱	RIGHT FRONT DOOR AJAR LAMP	92,93,94,95,101,129,132,137
3	G74 22TN/RD✱	RIGHT FRONT DOOR AJAR LAMP	92,93,94,95,101,129,132,137
3	G74 22TN/RD✱	RIGHT FRONT DOOR AJAR LAMP	92,93,94,95,101,129,132,137
4	—	—	—
5	P33 14OR/BK✱	POWER DOOR LOCK MOTOR (B+) LOCK SW	140
6	—	—	—
7	L112 20OR/WT✱	HEADLAMP RELAY COIL (B−)	125
8	X14 18WT/GY✱	POWER ANTENNA (B+) DOWN	118
9	C16 22LB/YL✱	HEATED MIRROR FEED	143,146,148
9	—	—	—
10	—	—	—
11	—	—	—
12	G72 22DG/OR✱	S.A.M. RT FRONT DOOR KEY CYLINDER SW	127,131,135
13	Z1 18BK	GROUND	61,86,118,140,141
13	Z1 14BK	GROUND	61,86,118,140,141
14	P34 14PK/BK✱	POWER DOOR LOCK MOTOR (B+) LOCK SW	140
15	—	—	—
16	L111 22TN	PARK LAMP RELAY COIL (B−)	125
17	X53 22DG	LEFT FRONT DOOR SPEAKER (B+)	120,122
17	—	—	—
18	X54 22VT	RIGHT FRONT DOOR SPEAKER (B+)	120,122
18	—	—	—
19	X51 22BR/YL✱	LEFT REAR SPEAKER (B+)	119,122
19	—	—	—
20	X57 22BR/YL✱	LEFT REAR SPEAKER (B−)	119,122
20	—	—	—
21	F22 22WT/PK✱	ACCESSORY FEED	124,125,148
22	G76 22TN/YL✱	RIGHT REAR DOOR AJAR LAMP	92,93,94,95,101,129,133,137
22	G76 22TN/YL✱	RIGHT REAR DOOR AJAR LAMP	92,93,94,95,101,129,133,137
22	G76 22TN/YL✱	RIGHT REAR DOOR AJAR LAMP	92,93,94,95,101,129,133,137
22	G76 22TN/YL✱	RIGHT REAR DOOR AJAR LAMP	92,93,94,95,101,129,133,137
23	X81 16YL/BK✱	−HI LF (RS SOUND)	123
24	X84 16OR/BK✱	−HI LF (RS SOUND)	123
● 25	D1 20VT/BR✱	CCD BUSS (B+)	89,97,103,106,108, 130,134,138
25	—	—	—
26	X55 22BR/RD✱	LEFT FRONT DOOR SPEAKER (B−)	120,122
26	—	—	—
27	X56 22DB/RD✱	RIGHT FRONT DOOR SPEAKER (B−)	120,122
27	—	—	—
28	X52 22DB/WT✱	RIGHT REAR SPEAKER (B+)	120,122
28	—	—	—
29	X58 22DB/OR✱	RIGHT REAR SPEAKER (B−)	120,122
29	—	—	—
30	X83 16YL/RD✱	+HI LF (RS SOUND)	123
31	X86 16OR/RD✱	+HI LF (RS SOUND)	123
● 32	D2 20WT/BK	CCD BUSS (B−)	89,97,103,106, 108,130,134,138
32	—	—	—

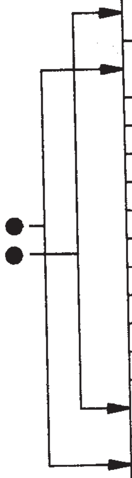
● TWISTED PAIR



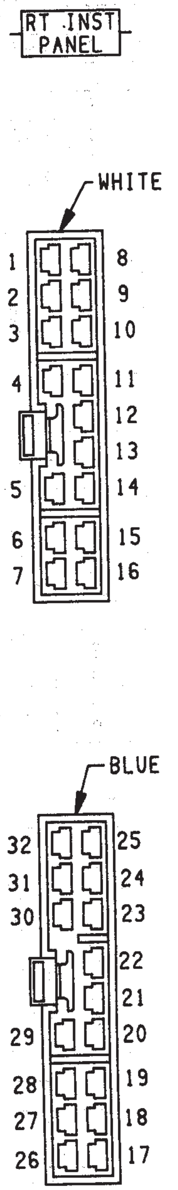
CONNECTOR VIEWED FROM WIRE END

INSTRUMENT PANEL
TO RIGHT BODY WIRING

CAV	CIRCUIT	FUNCTION	SHEET
1	X11 18GY	POWER ANTENNA SWITCHED (B–) GROUND	118
2	X13 18BK/RD*	POWER ANTENNA (B+) UP	118
3	G74 20TN/RD*	RIGHT FRONT DOOR AJAR LAMP	92,93,94,95,101,129,133,137
3	—	—	—
3	—	—	—
3	—	—	—
4	—	—	—
5	P33 14OR/BK*	POWER DOOR LOCK MOTOR (B+) LOCK SW	140
6	—	—	—
7	L112 20OR/WT*	HEADLAMP RELAY COIL (B–)	125
8	X14 18WT/GY*	POWER ANTENNA (B+) DOWN	118
9	C16 20LB/YL*	HEATED MIRROR FEED	143,146,148
9	C16 20LB/YL*	HEATED MIRROR FEED	143,146,148
10	—	—	—
11	—	—	—
12	G72 20DG/OR*	S.A.M. RT FRONT DOOR KEY CYLINDER SW	127,131,135
13	Z1 18BK	GROUND	61,86,118,140,141
13	—	—	—
14	P34 14PK/BK*	POWER DOOR LOCK MOTOR (B+) LOCK SW	140
15	—	—	—
16	L111 22TN	PARK LAMP RELAY COIL (B–)	125
17	X53 16DG	LEFT FRONT DOOR SPEAKER (B+)	120,122
17	X53 20DG	LEFT FRONT DOOR SPEAKER (B+)	120,122
18	X54 16VT	RIGHT FRONT DOOR SPEAKER (B+)	120,122
18	X54 20VT	RIGHT FRONT DOOR SPEAKER (B+)	120,122
19	X51 18BR/YL*	LEFT REAR SPEAKER (B+)	119,122
19	X51 20BR/YL*	LEFT REAR SPEAKER (B+)	119,122
20	X57 18BR/LB*	LEFT REAR SPEAKER (B–)	119,122
20	X57 20BR/LB*	LEFT REAR SPEAKER (B–)	119,122
21	F22 20WT/PK*	ACCESSORY FEED	124,125,148
22	G76 20TN/YL*	RIGHT REAR DOOR AJAR LAMP	92,93,94,95,101,129,133,137
22	—	—	—
22	—	—	—
22	—	—	—
23	X81 16YL/BK*	–HI LF (RS SOUND)	123
24	X84 16OR/BK*	–HI LF (RS SOUND)	123
25	D1 20VT/BR*	CCD BUSS (B+)	89,97,103,106, 108,130,134,138
25	D1 20VT/BR*	CCD BUSS (B+)	89,97,103,106, 108,130,134,138
26	X55 16BR/RD*	LEFT FRONT DOOR SPEAKER (B–)	120,122
26	X55 20BR/RD*	LEFT FRONT DOOR SPEAKER (B–)	120,122
27	X56 16DB/RD*	RIGHT FRONT DOOR SPEAKER (B–)	120,122
27	X56 20DB/RD*	RIGHT FRONT DOOR SPEAKER (B–)	120,122
28	X52 18DB/WT*	RIGHT REAR SPEAKER (B+)	120,122
28	X52 18DB/WT*	RIGHT REAR SPEAKER (B+)	120,122
29	X58 18DB/OR*	RIGHT REAR SPEAKER (B–)	120,122
29	X58 20DB/OR*	RIGHT REAR SPEAKER (B–)	120,122
30	X83 16YL/RD*	+HI LF (RS SOUND)	123
31	X86 16OR/RD*	+HI LF (RS SOUND)	123
32	D2 20WT/BK*	CCD BUSS (B–)	89,97,103,106, 108,130,134,138
32	D2 20WT/BK*	CCD BUSS (B–)	89,97,103,106, 108,130,134,138



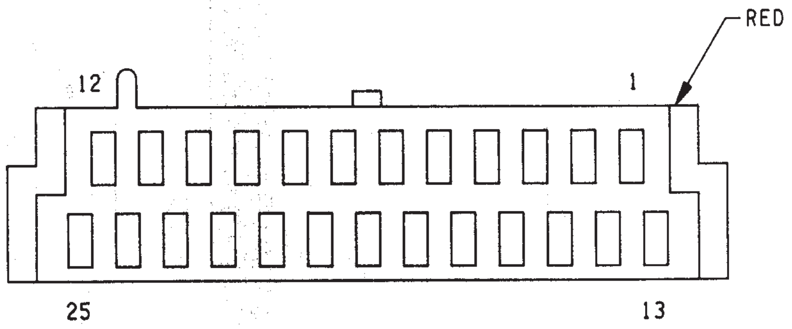
● TWISTED PAIR



RIGHT BODY WIRING TO INSTRUMENT PANEL

AC-CD, AY-C 193

938W-3

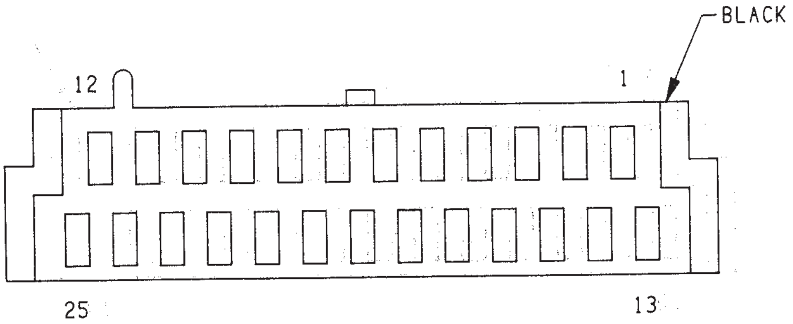


CONNECTOR VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	G74 22TN/RD*	RIGHT FRONT DOOR AJAR LIGHT	101
2	G78 22TN/BK*	DECK LID AJAR SWITCH	101
3	L70 22BR/YL*	LEFT AND RIGHT TAIL LAMP OUTAGE	101
4	——	——	——
5	G5 20DB/WT*	WARNING LAMP FEED	102
6	G5 20DB/WT*	WARNING LAMP FEED	102
7	——	——	——
8	——	——	——
9	L4 16VT/WT*	HEADLAMP (LOW-BEAM)	102
10	E2 22OR	HEADLAMP SWITCHED DIMMABLE LAMP	101
11	G60 22GY/YL*	ENGINE OIL PRESSURE SENDING UNIT	102
12	L52 20GY/RD*	B+TO CONCEALED HEADLAMP	101
13	G77 22TN/OR*	LEFT REAR DOOR AJAR LIGHT	101
14	G76 22TN/YL*	RIGHT REAR DOOR AJAR LIGHT	101
15	G46 22LB/BK*	BRAKE LAMP OUTAGE SIGNAL	101
16	G45 22OR/LG*	LOW-BEAM OUTAGE INDICATOR	101
17	G11 22WT/BK*	PARK BRAKE SWITCH	101
18	G5 20DB/WT*	WARNING LAMP FEED	102
19	G29 20BK/TN*	LOW WASHER FLUID INDICATOR	101
20	——	——	——
21	L3 16RD/OR*	HEADLAMP (HIGH-BEAM)	102
22	——	——	——
23	G6 22GY	LOW ENGINE OIL PRESSURE WARNING LAMP	102
24	G20 22VT/YL*	WATER TEMPERATURE SENDING UNIT	102
25	L51 20GY/PK*	B+TO CONCEALED HEADLAMP	101

BODY COMPUTER 2
(ELECTRONIC CLUSTER)

AC-CD,AY-C 194



CONNECTOR VIEWED FROM TERMINAL END

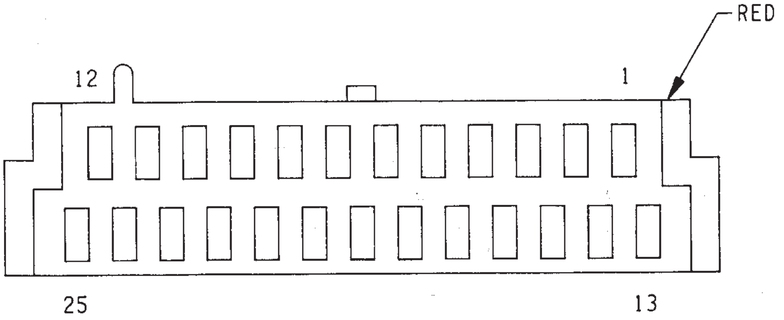
CAV	CIRCUIT	FUNCTION	SHEET
1	G75 22TN	DOOR AJAR LIGHTS	103
2	G26 20LB	KEY-IN BUZZER/CHIME	104
3	E17 20YL/BK*	ELECTRONIC DISPLAY INTENSITY	103
4	P35 18OR/VT*	POWER DOOR LOCK (B+)	103
5	V10 18BR	WINDSHIELD WASHER	104
6	G5 20DB/WT*	WARNING LAMP FEED	104
● 7	D1 20VT/BR*	SERIAL BUSS (B+)	103
8	M11 18PK/LB*	COURTESY LAMP FEED	104
9	—	—	—
10	V5 18DG	WINDSHIELD WIPER MOTOR FEED	104
11	F13 18DB	FRONT WIPER PARK	103
12	V9 18BK	ANALOG IN SWITCH	104
13	G16 22BK/LB*	BUZZER/CHIME PASSIVE RESTRAINT	104
14	G10 22LG/RD*	SEAT BELT WARNING SWITCH	104
15	L6 18RD/WT*	FEED FROM TURN SIGNAL FLASHER	103
16	M22 22WT	ILLUMINATED ENTRY RELAY GROUND	103
17	V7 18WT/BK*	PULSE WIPE PARK (B−)	104
18	G4 22DB/YL*	FUEL TANK SENDING UNIT	103
● 19	Z2 20BK/LG*	SENSOR GROUND	104
19	Z2 20BK/LG*	SENSOR GROUND	104
20	D2 20WT/BK*	CCD BUSS (B−)	103
21	P38 20OR/WT*	AUTO DOOR LOCK RELAY COIL (B+)	104
22	J25 18YL/RD*	IGNITION SWITCH LAMP	104
23	—	—	—
24	—	—	—
25	M2 20YL	DOOR AND LIFT GROUND SWITCHES	104

● TWISTED PAIR

BODY COMPUTER
(ELECTRONIC CLUSTER)

AC-CD, AY-C 195

938W-3



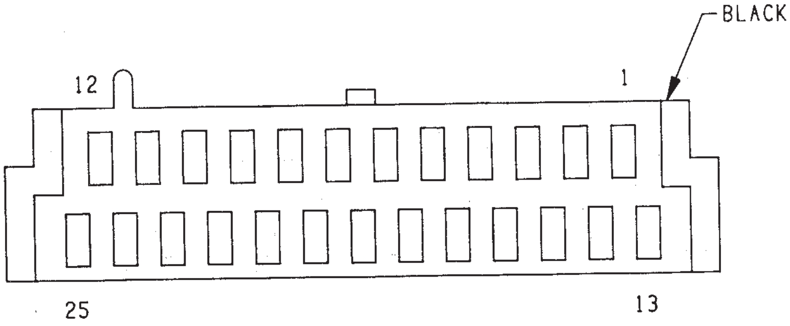
CONNECTOR VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	M31 22TN/WT*	DOOR AJAR LIGHTS	105
2	G78 22TN/BK*	DECK LID AJAR SWITCH	105
3	—	—	—
3	—	—	—
4	—	—	—
5	—	—	—
6	—	—	—
7	—	—	—
8	—	—	—
9	L4 16VT/WT*	HEADLAMP (LOW-BEAM)	105
10	—	—	—
11	—	—	—
12	L52 20GY/RD*	B+TO CONCEALED HEADLAMP	105
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	—	—	—
19	—	—	—
20	—	—	—
21	L3 16RD/OR*	HEADLAMP (HIGH-BEAM)	105
22	—	—	—
23	—	—	—
24	—	—	—
25	L51 20GY/PK*	B+TO CONCEALED HEADLAMP	105

BODY COMPUTER (MECHANICAL CLUSTER WITH VISUAL MESSAGE CENTER)

938W-3

AC-CD,AY-C 196

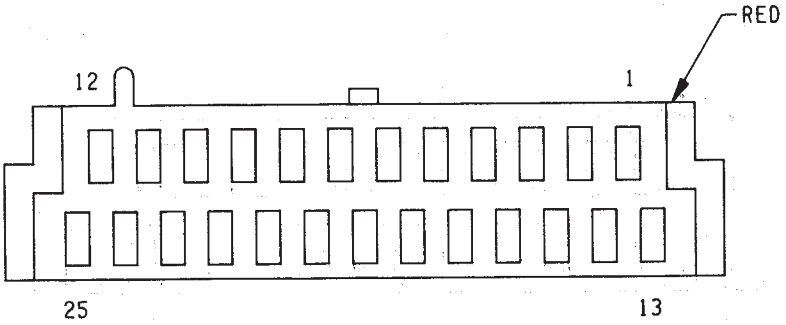


CONNECTOR VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	M31 22TN/RD*	DOOR AJAR LIGHTS	106
2	G26 20LB	KEY-IN BUZZER/CHIME	107
3	L7 18BK/YL*	TAIL, LICENSE, SIDE MARKER LAMP	106
3	E17 20YL/BK*	ELECTRONIC DISPLAY INTENSITY	106
4	P35 18OR/VT*	POWER DOOR LOCK (B+)	106
5	V10 18BR	WINDSHIELD WASHER	107
6	G5 20DB/WT*	WARNING LAMP FEED	107
● 7	D1 20VT/BR*	CCD BUSS (B+)	106
8	M11 18PK/LB*	COURTESY LAMP FEED	106
9	G41 22LB/RD*	LOW FUEL OUTPUT	107
10	V5 18DG	WINDSHIELD WIPER MOTOR FEED	107
11	F13 18DB	FRONT WIPER PARK	106
12	V9 18BK	ANALOG IN SWITCH	107
13	G16 22BK/LB*	BUZZER/CHIME PASSIVE RESTRAINT	107
14	G10 22LG/RD*	SEAT BELT WARNING SWITCH	107
15	L6 18RD/WT*	FEED FROM TURN SIGNAL FLASHER	106
16	M22 22WT	ILLUMINATED ENTRY RELAY GROUND	106
17	V7 18WT/BK*	PULSE WIPE PARK (B−)	107
18	G4 22DB/YL*	FUEL TANK SENDING UNIT	106
19	Z2 20BK/LG*	SENSOR GROUND	107
19	Z2 20BK/LG*	SENSOR GROUND	107
● 20	D2 20WT/BK*	CCD BUSS (B−)	106
21	P38 20OR/WT*	AUTO DOOR LOCK RELAY COIL (B+)	107
22	J25 18YL/RD*	IGNITION SWITCH LAMP	106
23	G13 22DB/RD*	SEAT BELT LAMP	107
24	G1 22WT/RD*	BRAKE PAD WEAR SENSOR	107
25	M2 20YL	DOOR AND LIFT GROUND SWITCHES	107

● TWISTED PAIR

BODY COMPUTER (MECHANICAL CLUSTER WITH VISUAL MESSAGE CENTER)



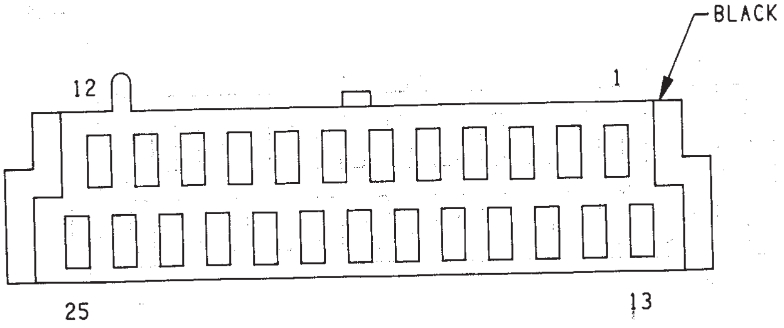
CONNECTOR VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	—	—	—
2	G78 22TN/BK*	DECK LID AJAR SWITCH	110
3	—	—	—
3	—	—	—
4	—	—	—
5	—	—	—
6	—	—	—
7	—	—	—
8	—	—	—
9	L4 16VT/WT*	HEADLAMP (LOW-BEAM)	110
10	—	—	—
11	—	—	—
12	L52 20GY/RD*	B+TO CONCEALED HEADLAMP	110
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	—	—	—
19	—	—	—
20	—	—	—
21	L3 16RD/OR*	HEADLAMP (HIGH-BEAM)	110
22	—	—	—
23	—	—	—
24	—	—	—
25	L51 20GY/PK*	B+TO CONCEALED HEADLAMP	110

BODY COMPUTER (MECHANICAL CLUSTER WITHOUT VISUAL MESSAGE CENTER)

938W-3

AC-CD, AY-C 198



CONNECTOR VIEWED FROM TERMINAL END

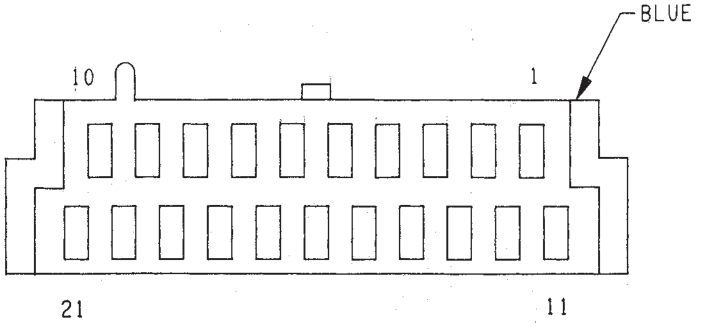
CAV	CIRCUIT	FUNCTION	SHEET
1	M31 22TN/RD*	DOOR AJAR LIGHTS	108
2	G26 20LB	KEY-IN BUZZER/CHIME	109
3	L7 18BK/YL*	TAIL, LICENSE, SIDE MARKER LAMP	108
3	E17 20YL/BK*	ELECTRONIC DISPLAY INTENSITY	108
4	P35 18OR/VT*	POWER DOOR LOCK (B+)	108
5	V10 18BR	WINDSHIELD WASHER	109
6	G5 20DB/WT*	WARNING LAMP FEED	109
● 7	D1 20VT/BR*	SERIAL BUSS (B+)	108
8	M11 18PK/LB*	COURTESY LAMP FEED	108
9	G41 22LB/RD*	LOW FUEL OUTPUT	109
10	V5 18DG	WINDSHIELD WIPER MOTOR FEED	109
11	F13 18DB	FRONT WIPER PARK	108
12	V9 18BK	ANALOG IN SWITCH	109
13	G16 22BK/LB*	BUZZER/CHIME PASSIVE RESTRAINT	109
14	G10 22LG/RD*	SEAT BELT WARNING SWITCH	109
15	L6 18RD/WT*	FEED FROM TURN SIGNAL FLASHER	108
16	M22 22WT	ILLUMINATED ENTRY RELAY GROUND	108
17	V7 18WT/BK*	PULSE WIPE PARK (B−)	109
18	G4 22DB/YL*	FUEL TANK SENDING UNIT	108
19	Z2 20BK/LG*	SENSOR GROUND	109
19	Z2 20BK/LG*	SENSOR GROUND	109
● 20	D2 20WT/BK*	SERIAL BUSS (B−)	108
21	P38 20OR/WT*	AUTO DOOR LOCK RELAY COIL (B+)	109
22	J25 18YL/RD*	IGNITION SWITCH LAMP	108
23	G13 22DB/RD*	SEAT BELT LAMP	109
24	G1 22WT/RD*	BRAKE PAD WEAR SENSOR	109
25	M2 20YL	DOOR AND LIFT GROUND SWITCHES	109

● TWISTED PAIR

AC-CD, AY-C 199

BODY COMPUTER (MECHANICAL CLUSTER WITHOUT VISUAL MESSAGE CENTER)

938W-3



CONNECTOR VIEWED FROM TERMINAL END

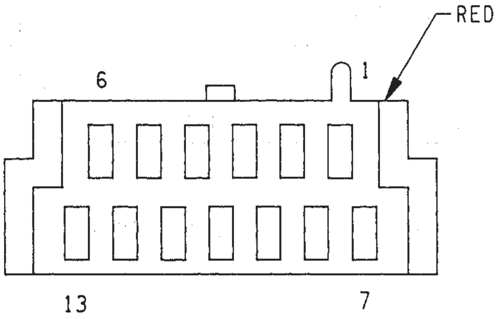
CAV	CIRCUIT	FUNCTION	SHEET
1	F22 22WT/PK✱	ACCESSORY FEED	116
2	C31 22LB	BLOWER SIGNAL	116
3	——	——	——
4	C34 22RD/LG✱	REFERENCE SIGNAL TO ACTUATORS	116
5	C35 22OR/DG ✱	MODE ACTUATOR	116
6	C33 22LB/RD✱	BLEND AIR ACTUATOR	116
7	C57 22DB/GY✱	SENSOR/ACTUATOR GROUND	116
8	C36 22GY/OR✱	BLEND AIR FEEDBACK SIGNAL	116
9	C8 22DG/RD ✱	AMBIENT TEMP SIGNAL FROM SENSOR	116
10	E17 20YL/BK✱	DISPLAY INTENSITY	116
11	Z2 18BK/LG ✱	GROUND	116
12	C30 18VT	BLOWER MODULE FEED	116
13	C21 22BR	A/C DAMPED PRESSURE SWITCH	116
14	Z1 20BK	GROUND	116
15	C32 22YL/PK✱	RECIRCULATION ACTUATOR	116
16	C37 22DG/WT✱	MODE ACTUATOR FEEDBACK SIGNAL	116
17	C39 22LB/VT✱	WATER SENSOR SIGNAL	116
18	——	——	——
19	C38 20TN	SUN SENSOR SIGNAL	116
20	C10 22RD/TN✱	IN-CAR TEMPERATURE SENSOR SIGNAL	116
21	E2 22OR	ILLUMINATION LAMPS	116

AUTOMATIC TEMPERATURE CONTROL MODULE CONNECTOR

938W-3

AC-CD, AY-C 200

CONNECTOR VIEWED FROM TERMINAL END



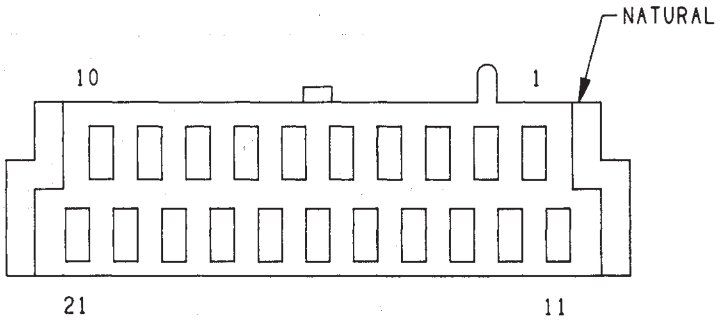
CAV	CIRCUIT	FUNCTION	SHEET
1	G19 22LG/OR*	ANTI-LOCK BRAKE SYSTEM	100
2	M11 20PK/LB*	SWITCHED COURTESY LAMP FEED	99
3	G34 16RD/GY*	HIGH BEAM INDICATOR	99
4	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	99
5	L61 20LG	LEFT FRONT TURN SIGNAL	99
6	E2 22OR	ILLUMINATION LAMPS	99
7	Z2 18BK/LG*	GROUND	99
8	G6 22GY	ENGINE OIL PRESSURE WARNING LAMP	99
● 9	D2 20WT/BK*	CCD BUSS (B—)	100
● 10	D1 20VT/BR*	CCD BUSS (B+)	100
11	G5 20DB/WT*	WARNING LAMPS FEED	100
12	R41 18BK/TN*	AIRBAG WARNING LAMP	100
13	L60 20TN	RIGHT FRONT TURN SIGNAL	100

● TWISTED PAIR

AC-CD, AY-C 201

ELECTRONIC CLUSTER
PRINTED CIRCUIT BOARD CONNECTOR

938W-3



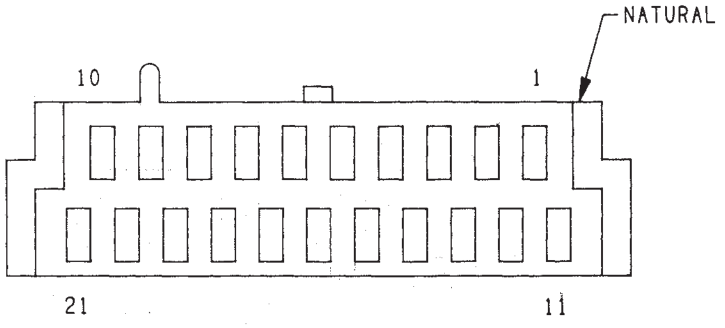
CAV	CIRCUIT	FUNCTION	SHEET
● 1	D2 20WT/BK *	CCD BUSS (B−)	138
● 2	D1 20VT/BR *	CCD BUSS (B+)	138
3	G5 20DB/WT *	WARNING LAMP FEED	135
4	G72 22DG/OR *	SECURITY ALARM RIGHT FRONT DOOR	135
5	G49 22YL	SECURITY ALARM KEYLESS ENTRY	136
6	X3 20BK/RD *	HORN RELAY COIL SWITCH	138
7	L7 18BK/YL *	TAIL, LICENSE, SIDE MARKER LAMP	136
8	G74 22TN/RD *	RIGHT FRONT DOOR AJAR LIGHT	137
9	F30 18RD	CONSOLE CIGAR LIGHTER FEED	136
10	G76 22TN/YL *	RIGHT REAR DOOR AJAR LIGHT	137
11	Z2 20BK/LG *	SENSOR GROUND	136
12	G70 20BR/TN *	SECURITY ALARM HOOD OPEN SIGNAL	136
13	G75 22TN	LEFT FRONT DOOR AJAR LIGHT	135
13	M31 22TN/WT *	LEFT FRONT DOOR AJAR LIGHT	135
13	M31 22TN/WT *	LEFT FRONT DOOR AJAR LIGHT	135
14	G77 22TN/OR *	LEFT REAR DOOR AJAR LIGHT	137
15	G69 22BK/OR *	SECURITY ALARM ARMED WARNING LIGHT	136
16	P36 18PK/VT *	POWER DOOR LOCK (B+) UNLOCKED	137
17	P38 20OR/WT *	DOOR LOCK RELAY LOW	137
18	G73 22LG/OR *	SECURITY ALARM LEFT FRONT DOOR	135
19	G71 20VT/YL *	SECURITY ALARM DECK LID KEY CYCLING SWITCH	135
20	F13 18DB	FRONT WIPER PARK	137
21	F33 18PK/RD *	FUSED BATTERY FEED TO HEADLAMP	136

●TWISTED PAIR

SECURITY ALARM MODULE CONNECTOR
(ELECTRONIC CLUSTER)

938W-3

AC-CD, AY-C 202



CONNECTOR VIEWED FROM TERMINAL END

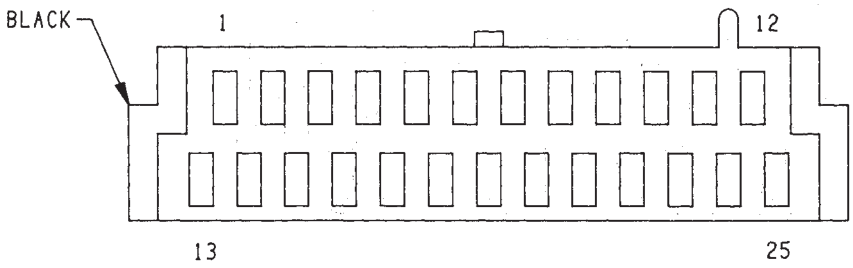
CAV	CIRCUIT	FUNCTION	SHEET
● 1	D2 20WT/BK *	CCD BUSS (B−)	130,134
● 2	D1 20VT/BR *	CCD BUSS (B+)	130,134
3	G5 20DB/WT *	WARNING LAMP FEED	128,132
4	G72 22DG/OR *	SECURITY ALARM RIGHT FRONT DOOR	127,131
5	G49 22YL	SECURITY ALARM KEYLESS ENTRY	128,132
6	X3 20BK/RD *	HORN RELAY COIL SWITCH	130,134
7	L7 18BK/YL *	TAIL, LICENSE, SIDE MARKER LAMP	128,132
8	—	—	—
9	F30 18RD	CONSOLE CIGAR LIGHTER FEED	128,132
10	—	—	—
11	Z2 20BK/LG *	SENSOR GROUND	128,132
12	G70 20BR/TN *	SECURITY ALARM HOOD OPEN SIGNAL	128,132
13	M31 22TN/WT *	LEFT FRONT DOOR AJAR LIGHT	129,133
14	—	—	—
15	G69 22BK/OR *	SECURITY ALARM ARMED WARNING LIGHT	128,132
16	P36 18PK/VT *	POWER DOOR LOCK (B+) UNLOCKED	129,133
17	P38 20OR/WT *	DOOR LOCK RELAY LOW	129,133
18	G73 22LG/OR *	SECURITY ALARM LEFT FRONT DOOR	127,131
19	G71 20VT/YL *	SECURITY ALARM DECK LID KEY CYCLING SWITCH	127,131
20	F13 18DB	FRONT WIPER PARK	130,134
21	F33 18PK/RD *	FUSED BATTERY FEED TO HEADLAMP	128,132

● TWISTED PAIR

AC-CD,AY-C 203

SECURITY ALARM MODULE CONNECTOR
(MECHANICAL CLUSTER)

938W-3



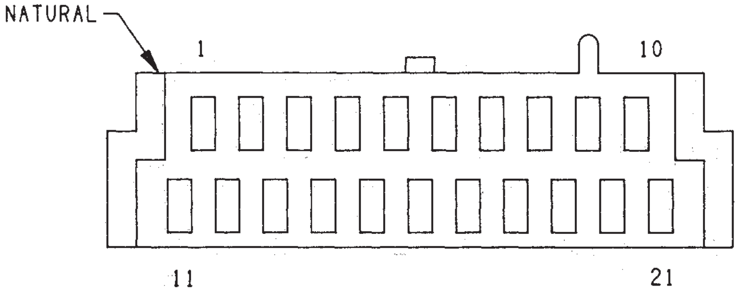
CONNECTOR #1 VIEWED FROM WIRE END

CAV	CIRCUIT	FUNCTION	SHEET
1	P24 18PK/WT*	MEMORY SYSTEM SWITCH (MEMORY POSITION TWO)	151
2	P22 18PK/BK*	MEMORY SYSTEM SWITCH (SET FUNCTION)	151
3	P13 18RD/WT*	POWER SEAT REAR (DOWN)	151
4	P21 18RD/LG*	POWER SEAT FRONT (DOWN)	151
5	P15 18YL/LB*	POWER SEAT HORIZONTAL (FORWARD)	151
6	P69 18WT/RD*	POWER MIRROR LEFT (RETURN)	143
7	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	151
8	P67 18YL/RD*	POWER MIRROR RIGHT (UP AND DOWN)	144
9	P64 18YL/OR*	POWER MIRROR LEFT (UP AND DOWN)	143
10	P75 18DB/WT*	POWER MIRROR LEFT (B+ LEFT)	143
11	P70 18WT	POWER MIRROR RIGHT (B+ RIGHT AND B+ DOWN)	144
12	P74 18DB	POWER MIRROR RIGHT (B+ LEFT)	144
13	—	—	—
14	P23 18PK/RD*	MEMORY SYSTEM SWITCH (MEMORY POSITION ONE)	151
15	P11 18YL/WT*	POWER SEAT REAR (UP)	151
16	P19 18YL/LG*	POWER SEAT FRONT (UP)	151
17	P17 18RD/LB*	POWER SEAT HORIZONTAL (REARWARD)	151
18	—	—	—
19	P66 18WT/BK*	POWER MIRROR RIGHT (RETURN)	144
20	P68 18DG/RD*	POWER MIRROR RIGHT (IN AND OUT)	144
21	P65 18DB/YL*	POWER MIRROR LEFT (IN AND OUT)	143
22	—	—	—
23	P72 18YL/BK*	POWER MIRROR RIGHT (B+ UP)	144
24	P73 18YL/PK*	POWER MIRROR LEFTT (B+ DOWN AND B+ RIGHT)	143
25	P71 18YL	POWER MIRROR LEFT (B+ UP)	143

MEMORY POWER SEAT & MIRROR CONNECTOR

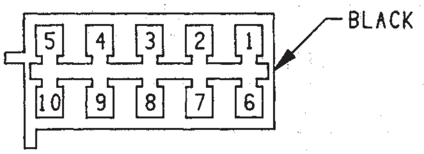
938W-3

AC-CD, AY-C 204



CONNECTOR #2 VIEWED FROM WIRE END

CAV	CIRCUIT	DESCRIPTION	SHEET
1	P46 18GY/BK*	MEMORY MODULE (GROUND)	152
2	P26 20BR	SEAT MEMORY POT (FRONT UP AND DOWN)	154
3	P47 20LB	SEATBACK RECLINER POT (SEATBACK)	154
4	—	—	—
5	P40 20GY/LB*	MEMORY MODULE (SEATBACK UP)	152
6	P48 20GY/WT*	MEMORY MODULE (SEATBACK RECLINE)	152
7	P49 20LB/WT*	SEATBACK RECLINER POT (RETURN)	154
8	P28 20BR/RD*	SEAT MEMORY POT (RETURN)	154
9	P45 20LB/RD*	SEATBACK RECLINER POT (FEED)	154
10	P29 20BR/WT*	SEAT MEMORY POT (FEED)	154
11	P50 20LG	MEMORY-MODULE (FEED)	152
12	P25 20BR/LG*	SEAT MEMORY POT (FORWARD AND REARWARD)	154
13	P27 20BR/BK*	SEAT MEMORY POT (REAR UP AND DOWN)	154
14	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	—	—	—
20	—	—	—
21	—	—	—



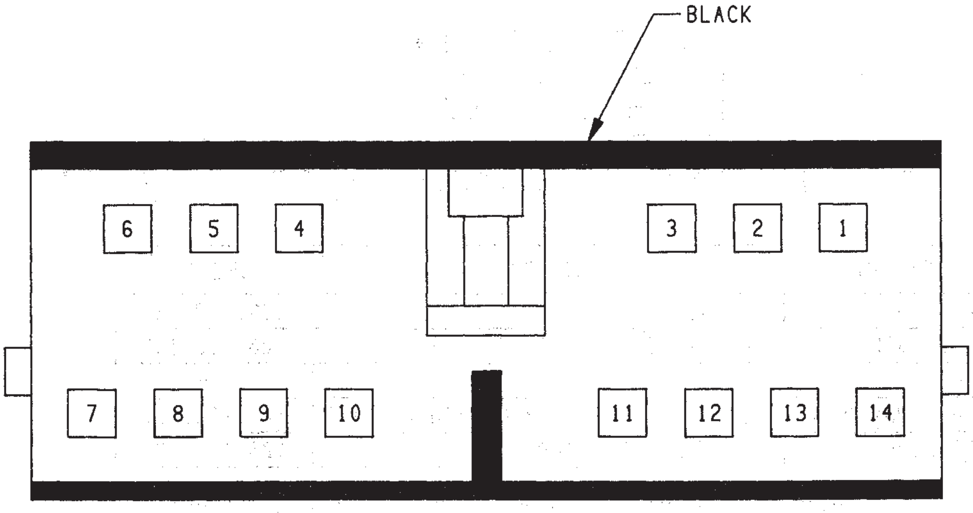
CONNECTOR #3 VIEWED FROM WIRE END

CAV	CIRCUIT	DESCRIPTION	SHEET
1	Z1 14BK	GROUND	153
2	P41 14GY/WT*	POWER SEATBACK RECLINER MOTOR DOWN	154
3	P19 14YL/LG*	POWER SEAT FRONT UP	153
4	P43 14GY/LB*	POWER SEATBACK RECLINER MOTOR UP	154
5	P21 14RD/LG*	POWER SEAT FRONT DOWN	153
6	P1 14BK/RD*	TO BODY HARNESS	153
7	P15 14YL/LB*	POWER SEAT HORIZONTAL FORWARD	153
8	P17 14RD/LB*	POWER SEAT HORIZONTAL REARWARD	153
9	P13 14RD/WT*	POWER SEAT REAR DOWN	153
10	P11 14YL/WT*	POWER SEAT REAR UP	153

MEMORY POWER SEAT SYSTEM CONNECTORS

AC-CD, AY-C 205

938W-3



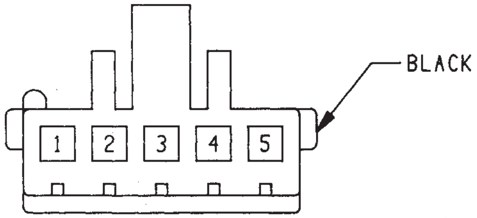
CONNECTOR VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	C32 22YL/PK*	RECIRCLATION ACTUATOR	117
2	C37 22DG/WT*	MODE ACTUATOR FEEDBACK SIGNAL	117
3	C33 22LB/RD*	BLEND AIR ACTUATOR	117
4	C35 22OR/DG*	MODE ACTUATOR	117
5	C34 22RD/LG*	REFERENCE SIGNAL TO ACTUATORS	117
6	—	—	—
7	—	—	—
8	—	—	—
9	C8 22DG/RD*	AMBIENT TEMP SIGNAL FROM SENSOR	117
10	C39 22LB/VT*	WATER SENSOR SIGNAL	117
11	C57 22DB/GY*	SENSOR/ACTUATOR GROUND	117
12	C36 22GY/OR*	BLEND AIR FEEDBACK SIGNAL	117
13	—	—	—
14	—	—	—

938W-3

AUTOMATIC TEMPERATURE CONTROL INLINE CONNECTOR

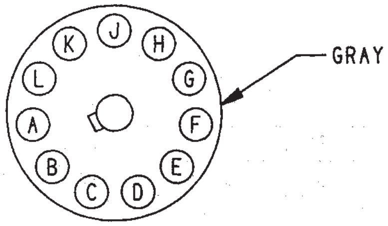
AC-CD, AY-C 206



VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	Z1 22BK	GROUND	128,132,136
2	F30 18RD	CONSOLE CIGAR LIGHTER FEED	128,132,136
3	——	——	——
4	G69 22BK/OR ✱	SECURITY ALARM ARMED WARNING LAMP	128,132,136
5	E2 220R	ILLUMINATION LAMPS	128,132,136

SECURITY ALARM LAMP

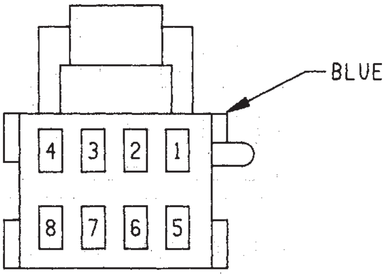


CAV	CIRCUIT	FUNCTION	SHEET
A	G29 20BK/TN✱	LOW WINDSHIELD FLUID SENSOR	61,95
B	G5 20DB/WT✱	WARNING LAMPS FEED	67,95
C	G75 22TN	LEFT FRONT DOOR AJAR LAMP	93,95,129
D	G77 22TN/OR✱	LEFT REAR DOOR AJAR LAMP	93,95,129
E	G78 22TN/BK✱	DECK LID AJAR LAMP	95,105,129,159
E	G78 22TN/BK✱	DECK LID AJAR LAMP	95,105,129,159
F	——	——	——
G	E2 220R	ILLUMINATION LAMPS	85,95
H	Z1 20BK	GROUND	85,95
J	M31 22TN/WT✱	TO BODY COMPUTER	93,95,105,106,129
J	M31 22TN/WT✱	TO SECURITY ALARM MODULE	93,95,105,106,129
J	M31 22TN/WT✱	TO SECURITY ALARM MODULE	93,95,105,106,129
K	G76 22TN/YL✱	RIGHT REAR DOOR AJAR LAMP	93,95,129
L	G74 22TN/RD✱	RIGHT FRONT DOOR AJAR LAMP	93,95,129

MESSAGE CENTER

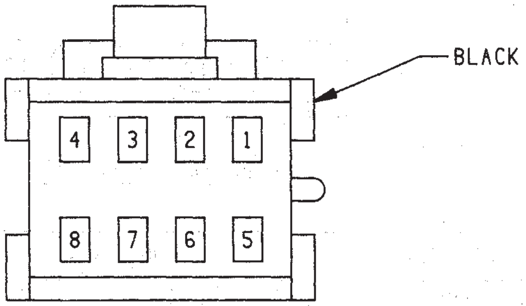
AC-CD, AY-C 207

938W-3



CONNECTOR #1 VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	G49 22YL	SECURITY ALARM 'REM ARM' RF	141
2	G5 22DB/WT*	WARNING LAMPS FEED	141
3	—	—	—
4	M22 22WT	ILLUMINATED ENTRY RELAY GROUND	141
5	—	—	—
6	—	—	—
7	G73 22LG/OR*	S.A.M. LEFT FRONT DOOR KEY CYLINDER SWITCH	141
8	—	—	—

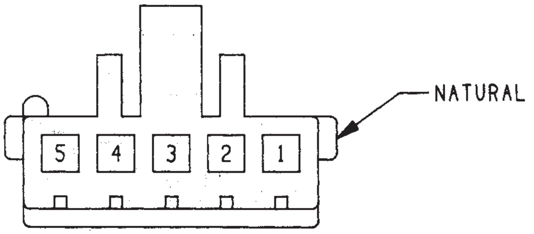


CONNECTOR #2 VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	P36 18PK/VT*	POWER DOOR LOCK B+ UNLOCK SWITCH	142
2	Q2 18LG/BK*	DECKLID RELEASE SWITCH	141
3	P55 18DB	DOOR UNLOCK RF KEYLESS	142
4	Z1 14BK	GROUND	141
5	D9 20DG	RF KEYLESS PROGRAM CIRCUIT	141
6	P38 20OR/WT*	RELAY LOCK COIL (B+)	142
7	X3 20BK/RD*	HORN RELAY COIL SWITCH	142
8	M11 18PK/LB*	SWITCHED COURTESY LAMP FEED	142

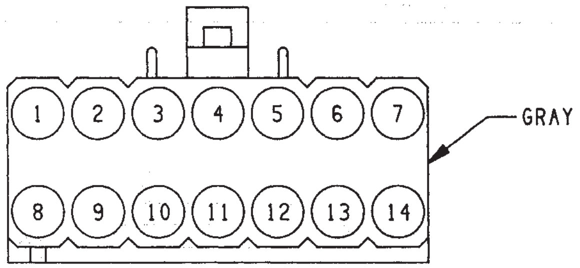
KEYLESS ENTRY CONNECTORS

AC-CD, AY-C 208



VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	—	—	—
2	G45 22OR/LG*	LO-BEAM OUT INDICATOR	96
3	Z1 20BK	GROUND	96
4	G46 22LB/BK*	BRAKE LAMP OUT SIGNAL	96
5	L70 22YL/BK*	TAIL LAMPS SIGNAL	96



VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	L81 18DG	LEFT OUTBOARD TURN/STOP	96
2	L63 18DG/RD*	LEFT REAR TURN/STOP	96
3	L83 18DG/WT*	LEFT INBOARD TURN/STOP	96
4	—	—	—
5	L42 22LB/WT*	RIGHT HEADLAMP LOW BEAM FEED	96
6	L44 22VT/BK*	RIGHT HEADLAMP FEED	96
7	L41 22LB	LEFT HEADLAMP LOW BEAM FEED	96
8	L62 16BR/RD*	RIGHT REAR TURN/STOP	96
9	L82 18BR	RIGHT OUTBOARD TURN/STOP	96
10	L84 18BR/WT*	RIGHT INBOARD TURN/STOP	96
11	L71 18BK/PK*	LEFT SIDE TAIL LAMP	96
12	L7 18BK/YL*	LIGHTING FEED	96
13	L72 18BK/RD*	RIGHT SIDE TAIL LAMP	96
14	L43 22VT	LEFT HEADLAMP FEED	96

AC-CD, AY-C 209

LAMP OUTAGE MODULE

938W-3

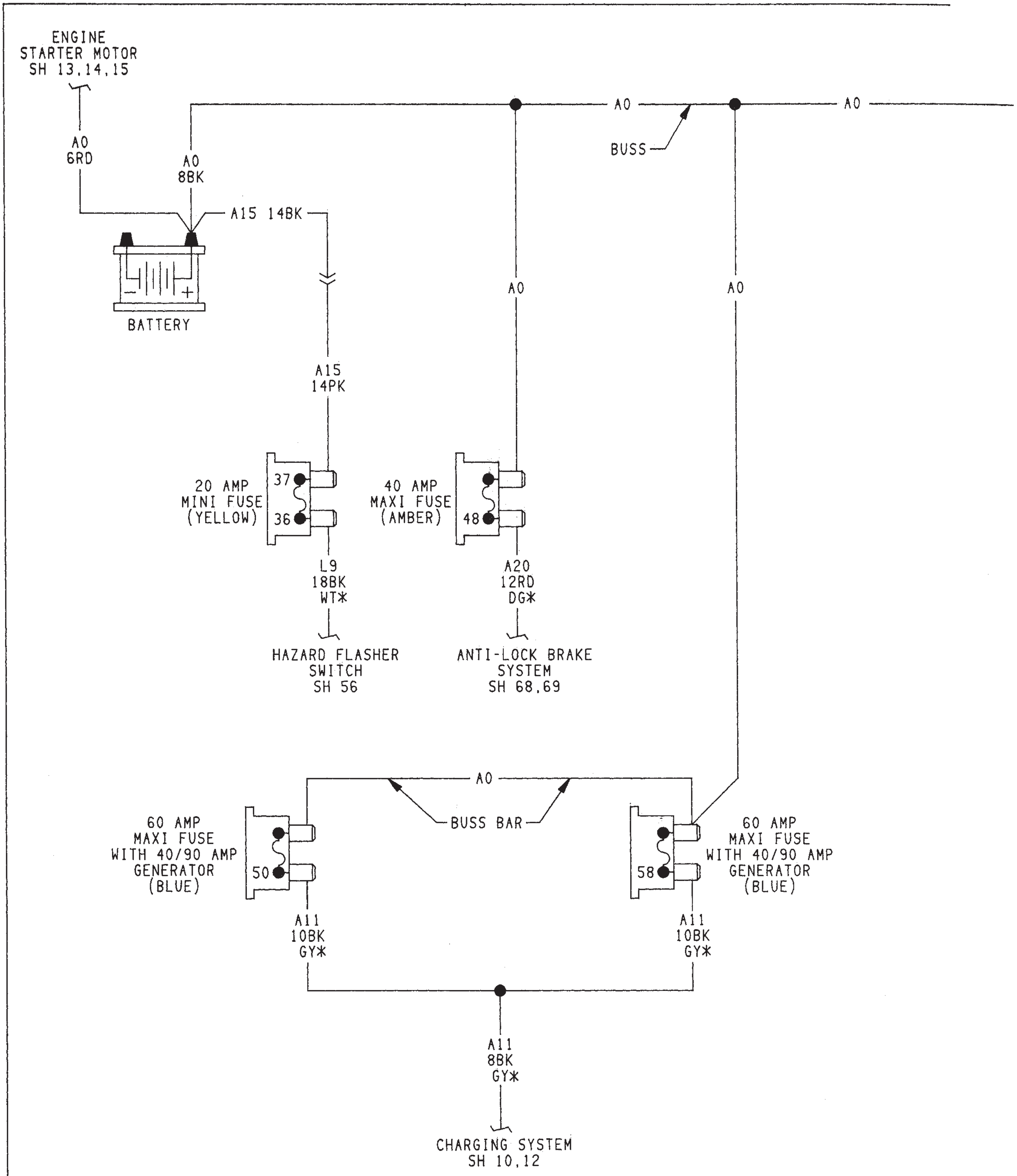
WIRING DIAGRAMS AG-AJ BODY

ALPHABETICAL INDEX

Name — **Wiring Diagram Sheet Number**

Name — **Wiring Diagram Sheet Number**

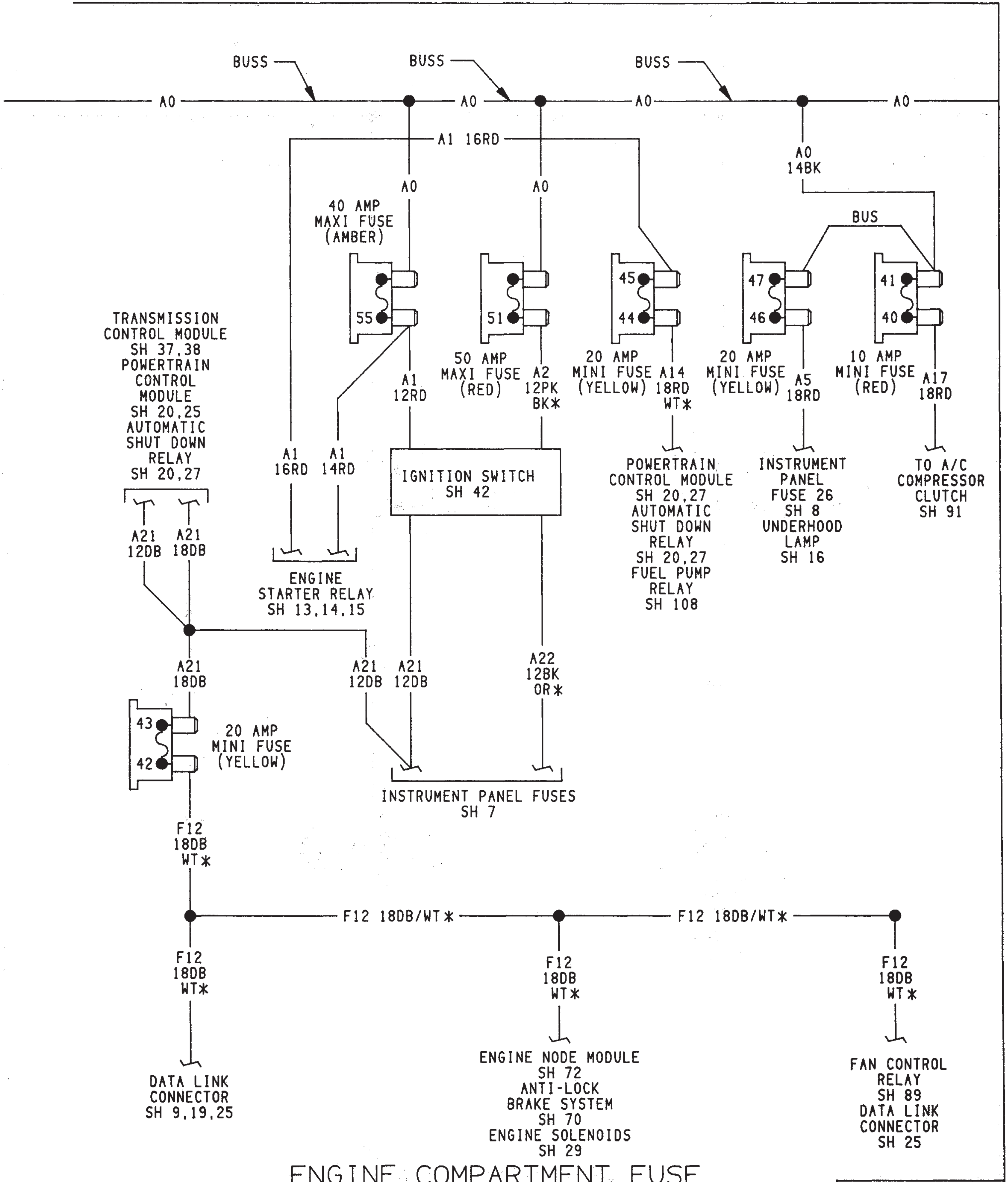
Name — **Wiring Diagram Sheet Number**



ENGINE COMPARTMENT FUSE APPLICATION CHART

AG-AJ 1

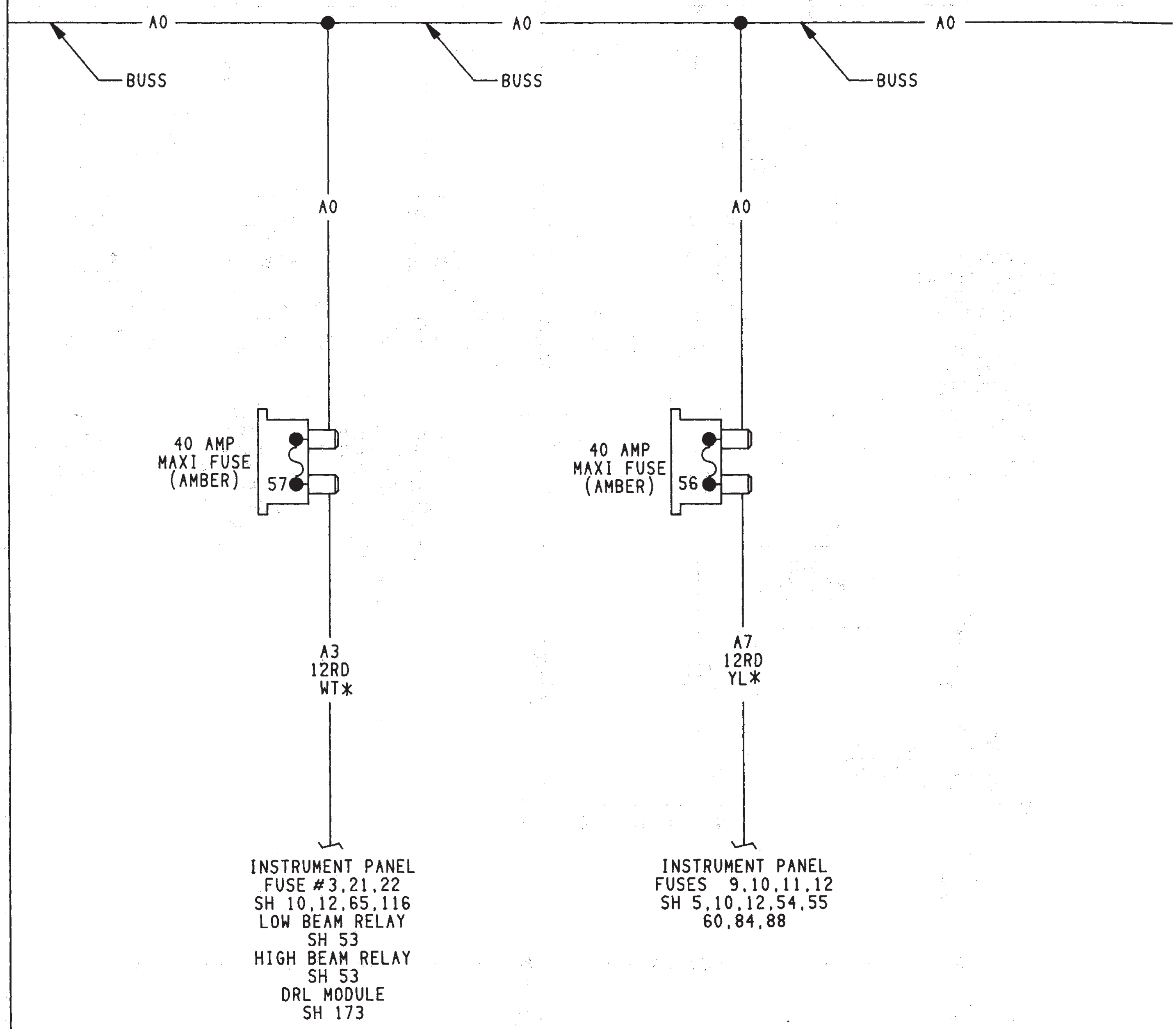
938W-5



ENGINE COMPARTMENT FUSE APPLICATION CHART

938W-5

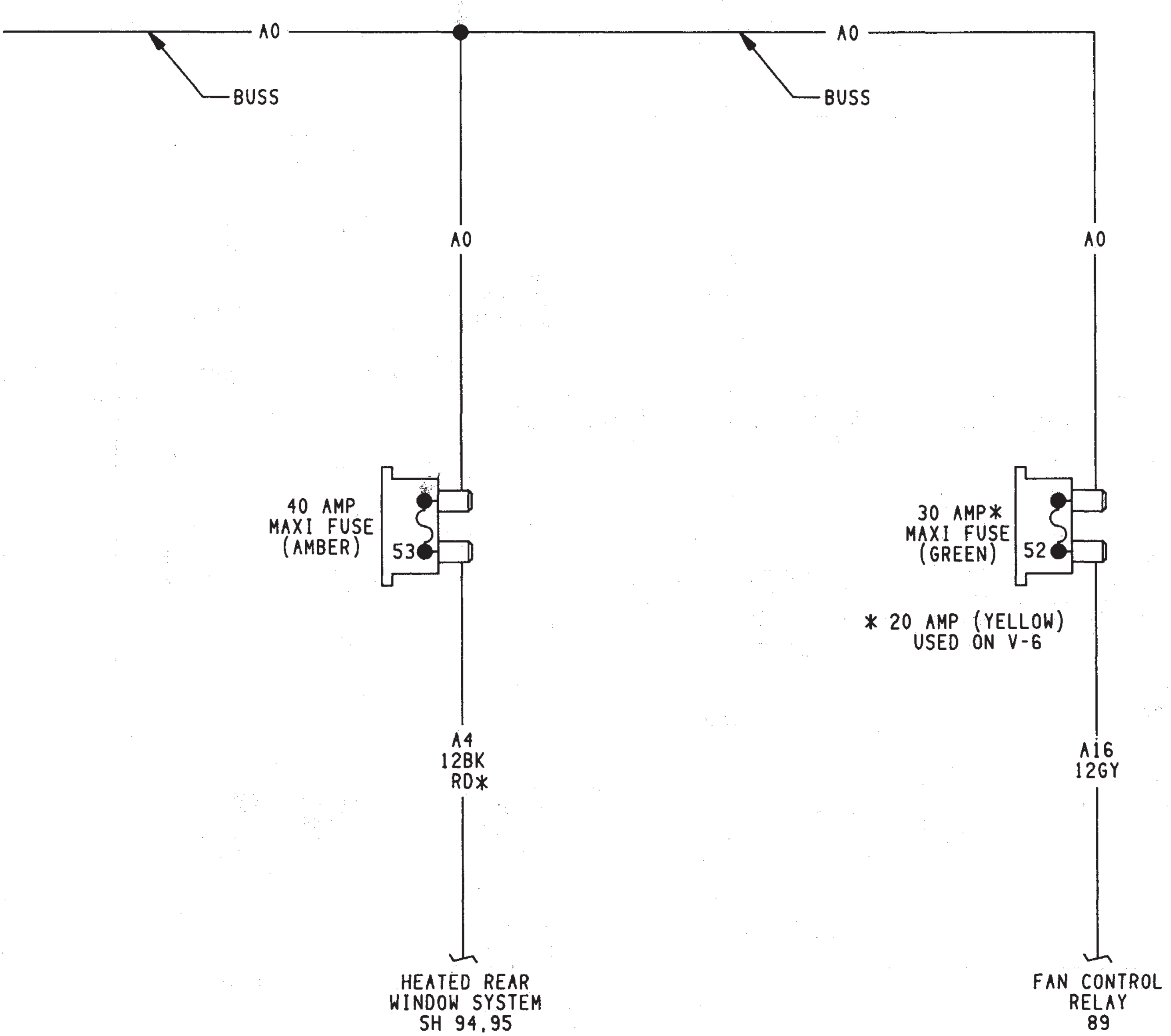
AG-AJ 2



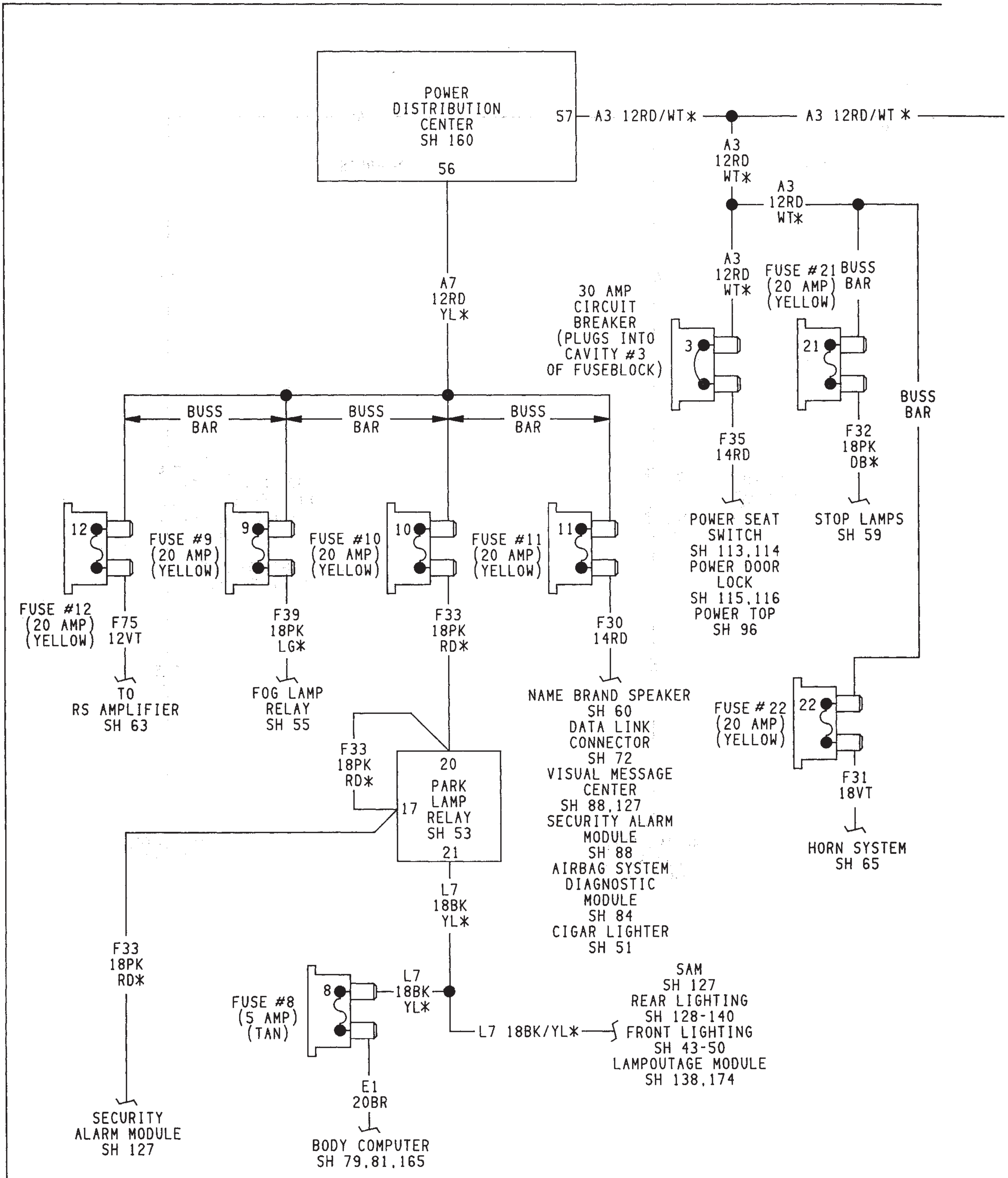
AG-AJ 3

ENGINE COMPARTMENT FUSE APPLICATION CHART

938W-5



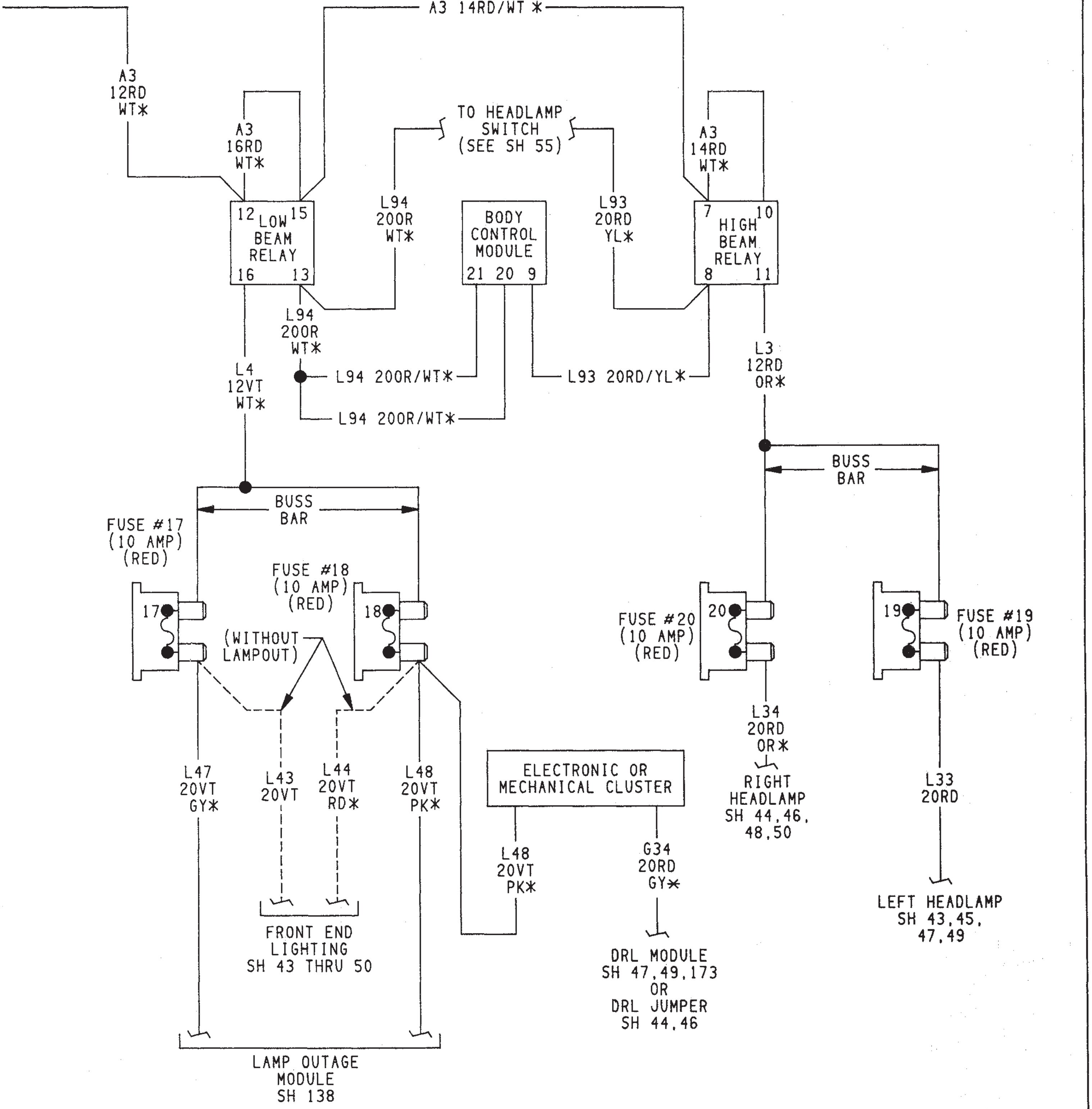
ENGINE COMPARTMENT FUSE APPLICATION CHART



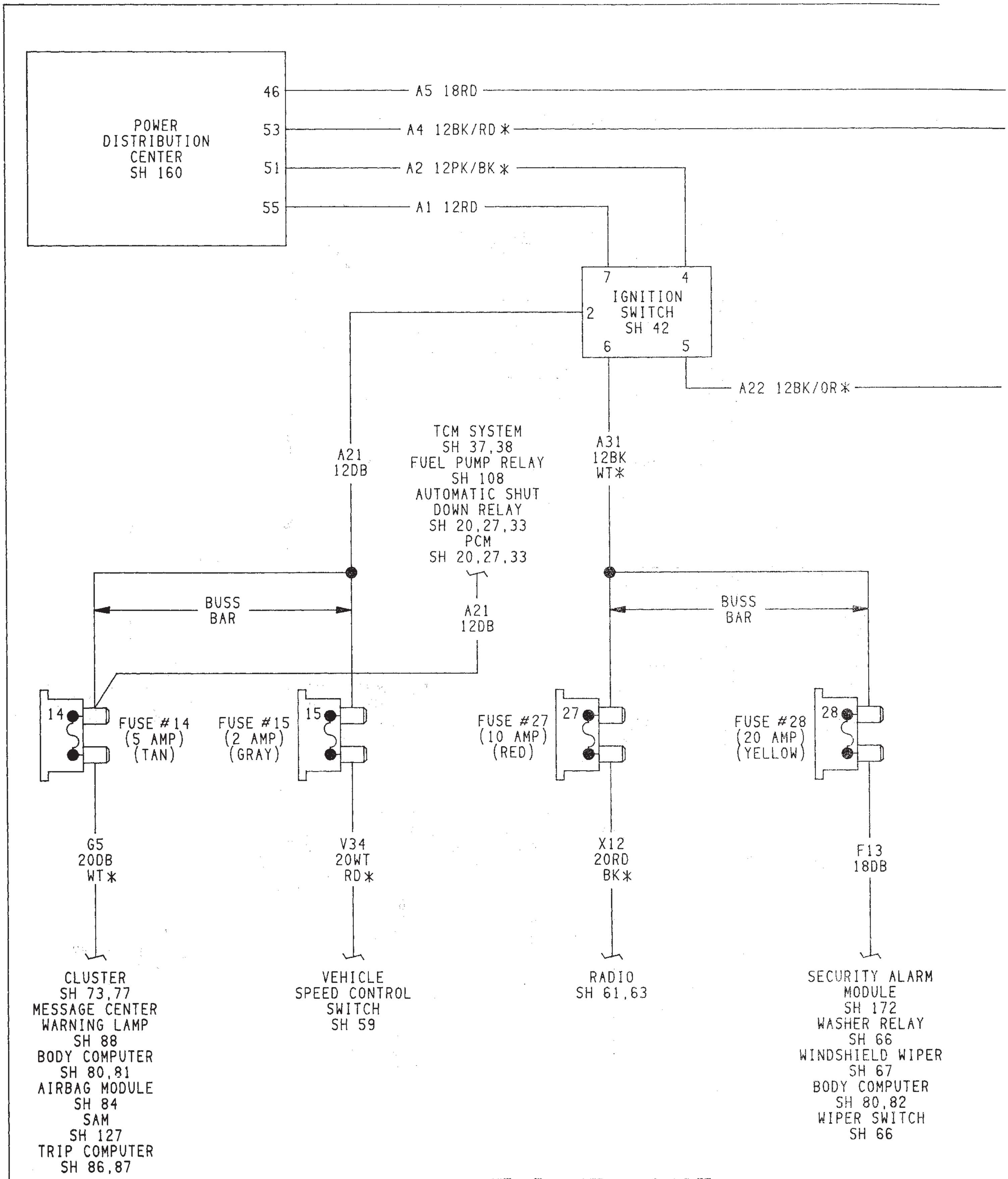
INSTRUMENT PANEL FUSE APPLICATION CHART

AG-AJ 5

938W-5



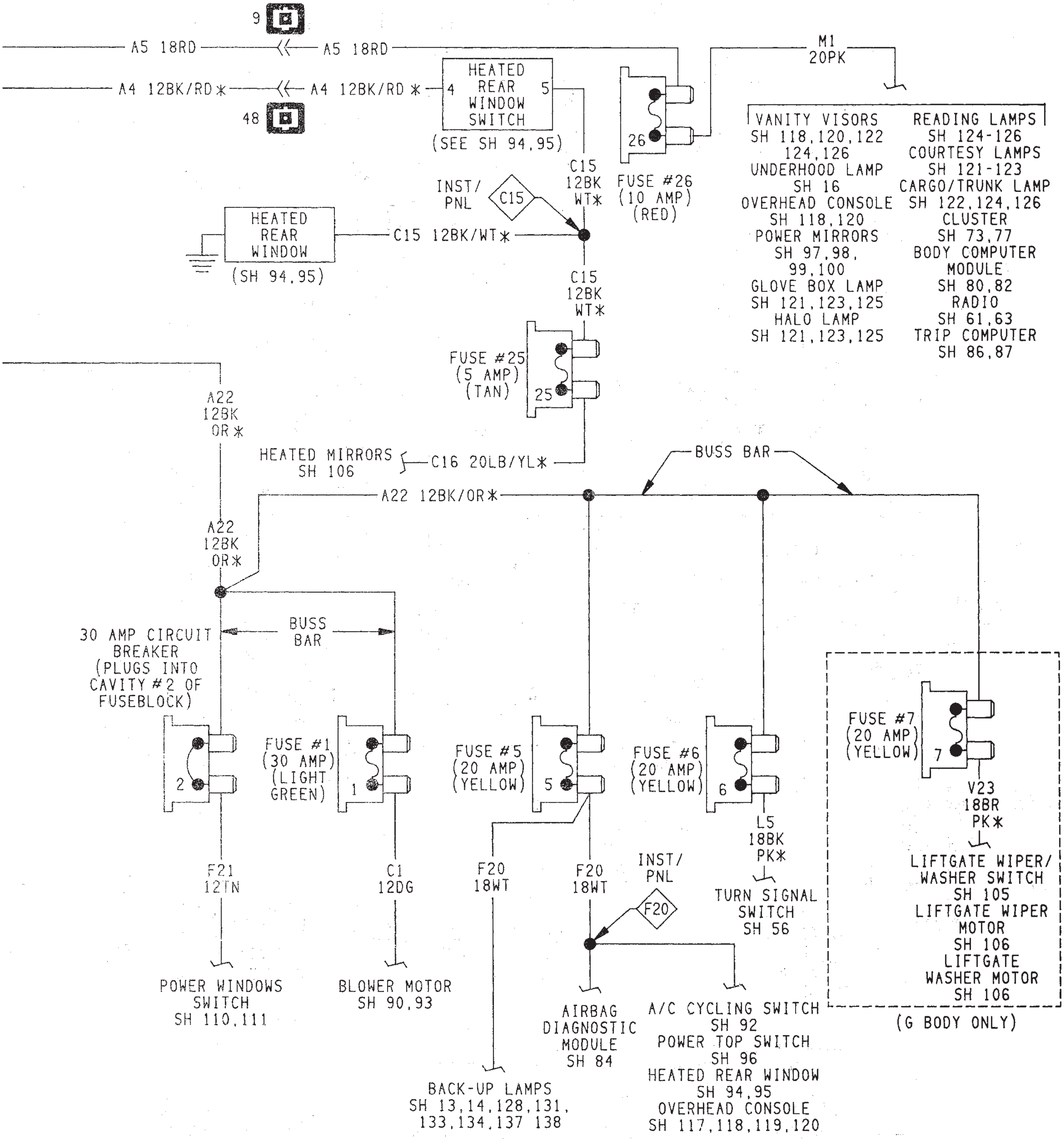
INSTRUMENT PANEL FUSE APPLICATION CHART



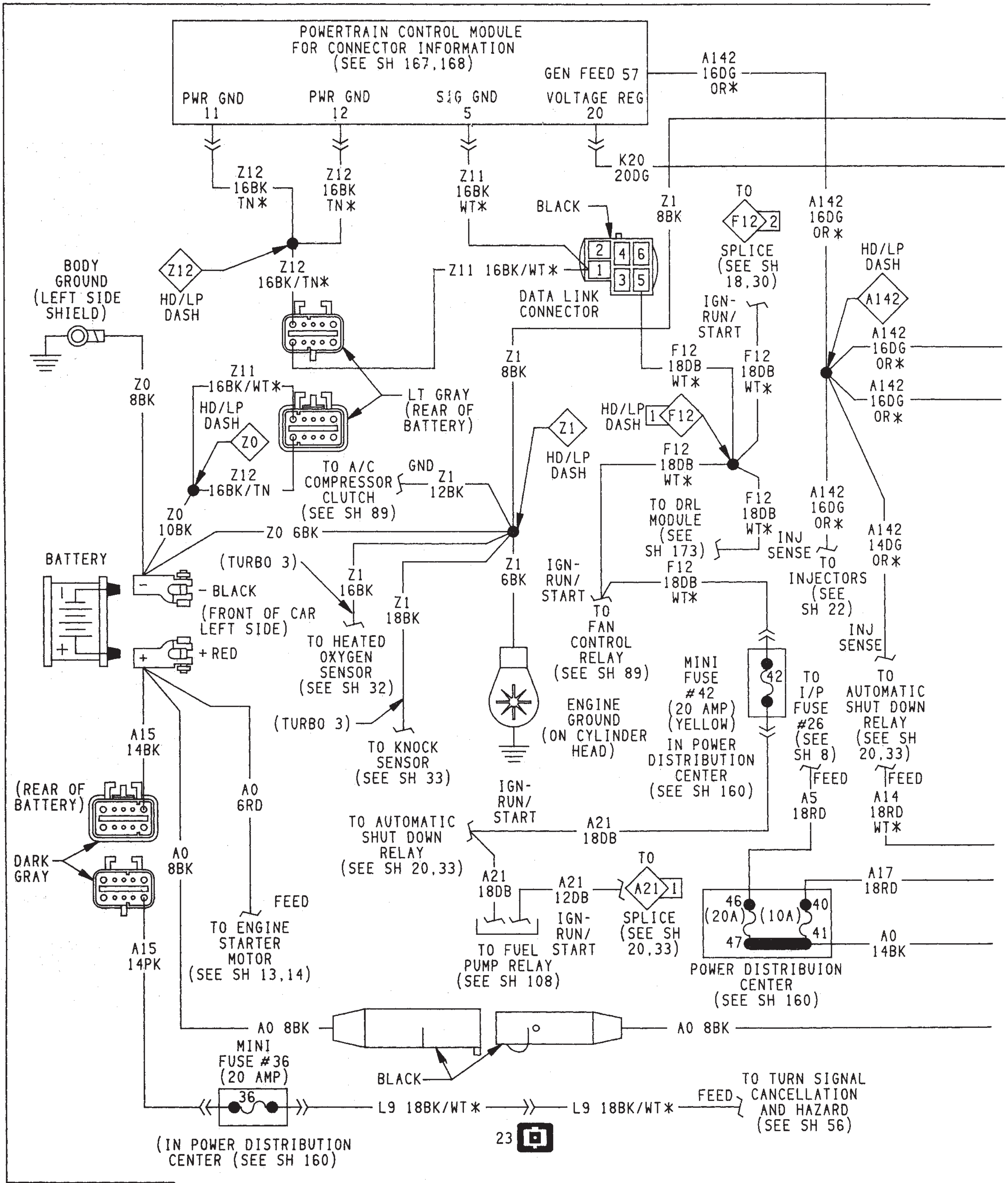
AG-AJ 7

INSTRUMENT PANEL FUSE APPLICATION CHART

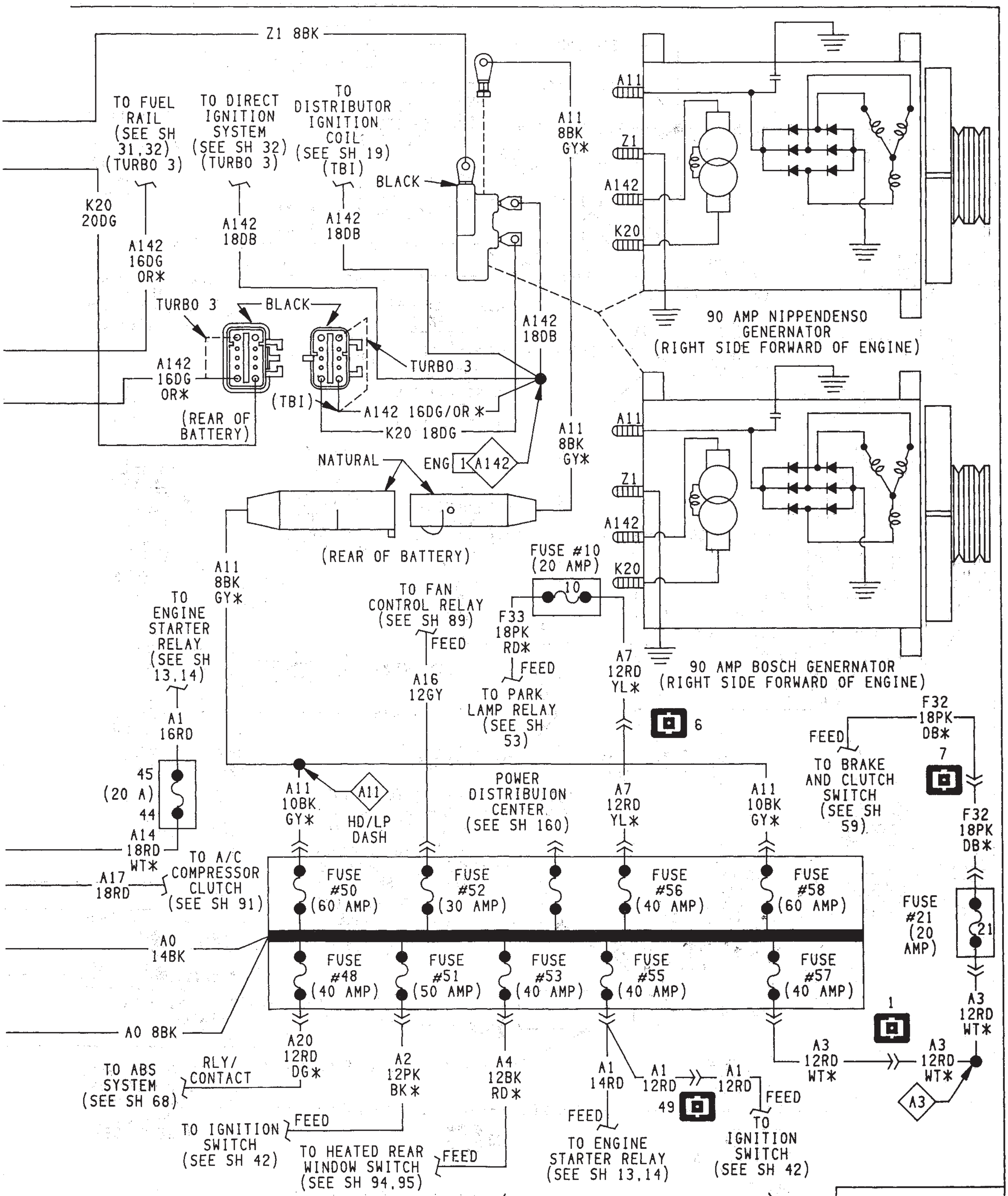
938W-5



INSTRUMENT PANEL FUSE
APPLICATION CHART



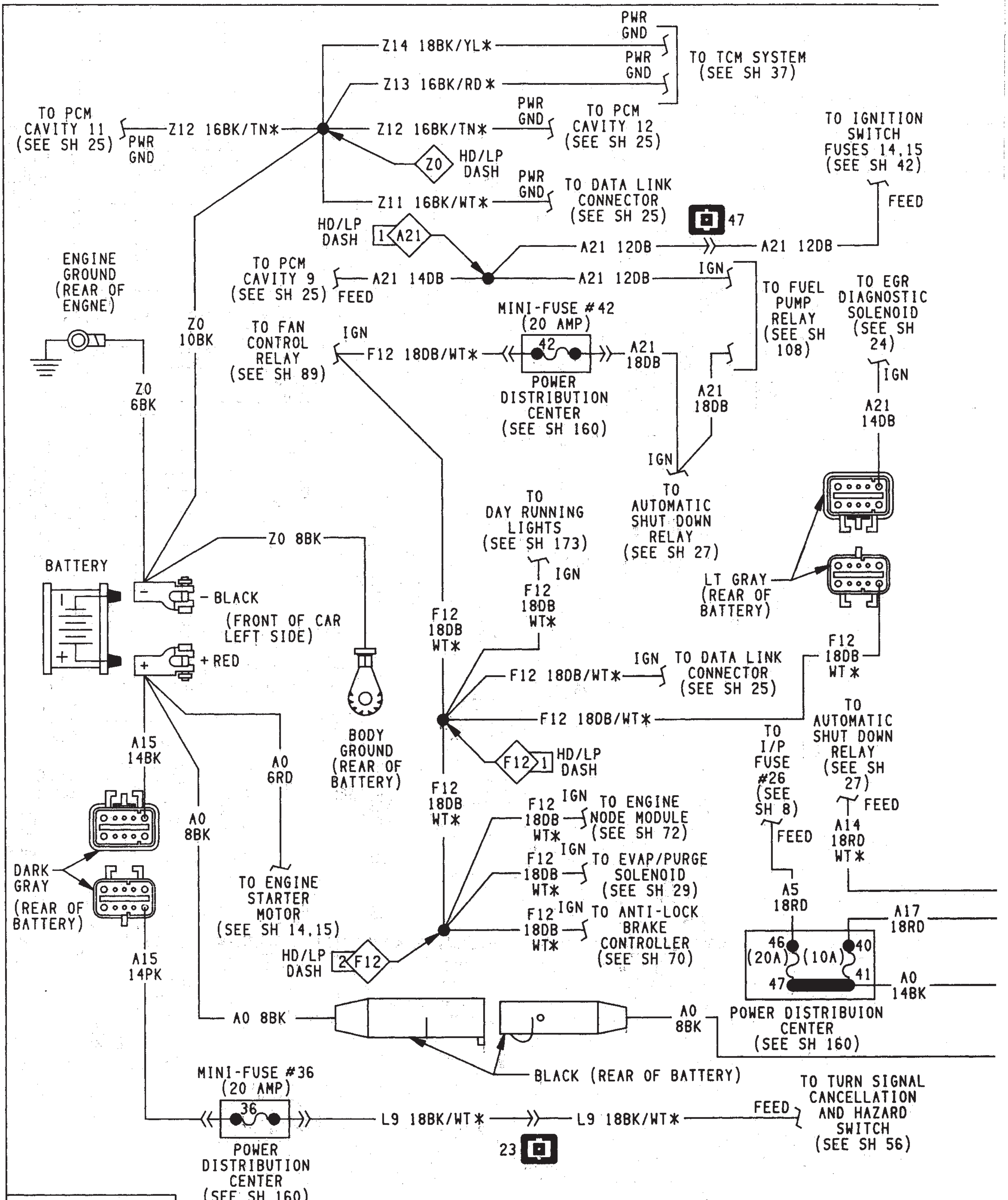
AG-AJ 9 CHARGING SYSTEM (2.5L & TURBO 3) 938W-5



938W-5

CHARGING SYSTEM (2.5L & TURBO 3)

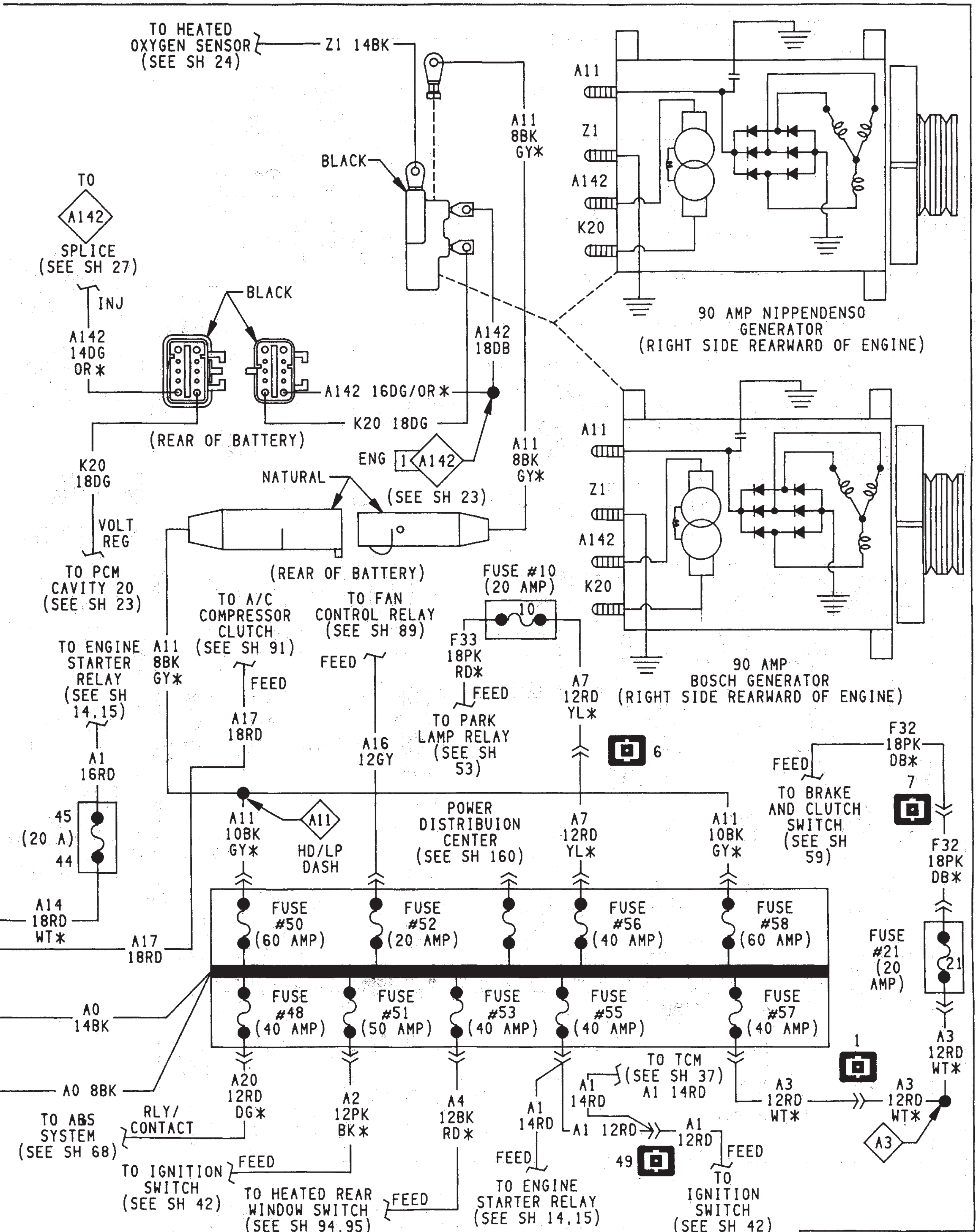
AG-AJ 10



AG-AJ 11

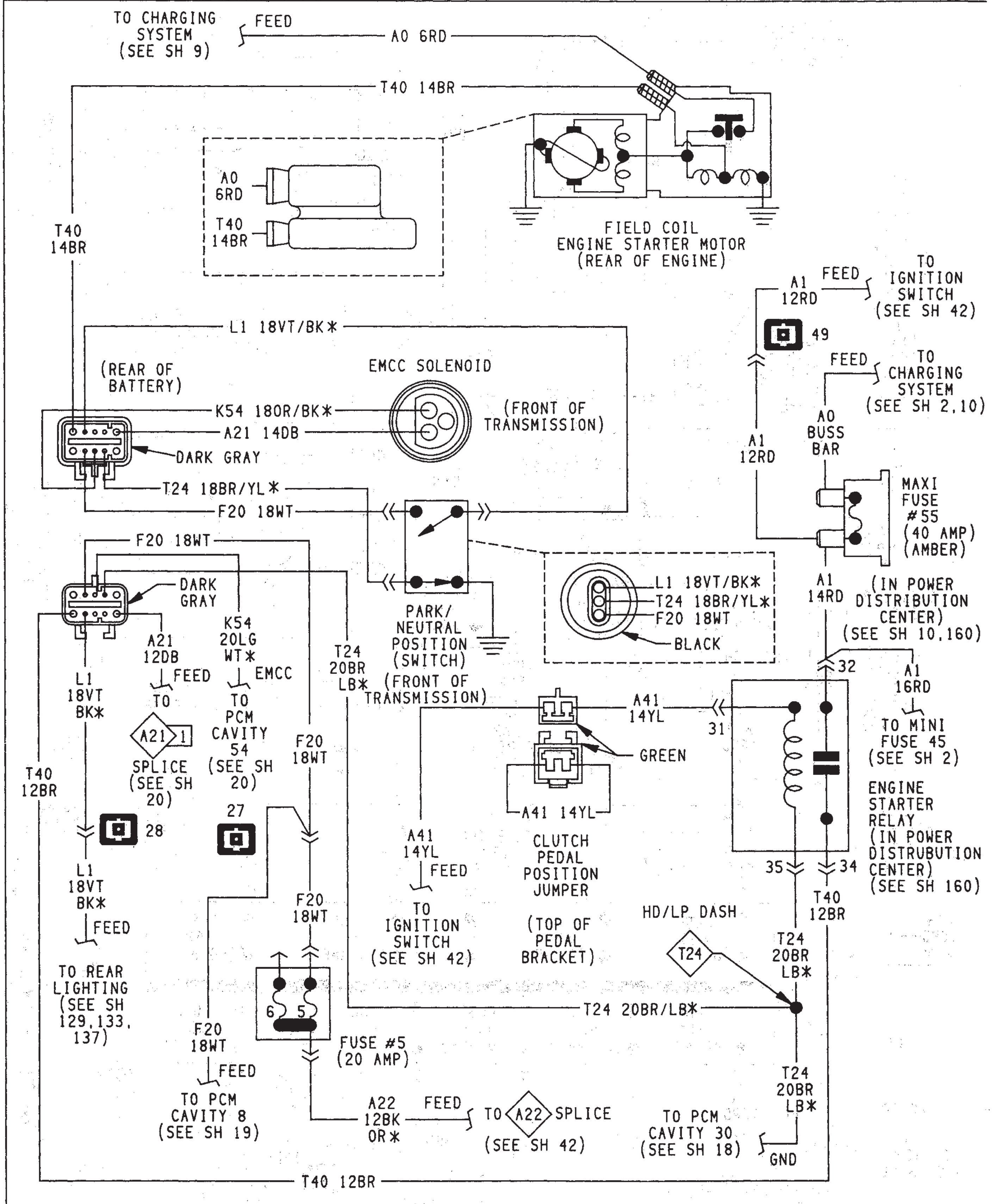
CHARGING SYSTEM (3.0L)

938W-5



938W-5

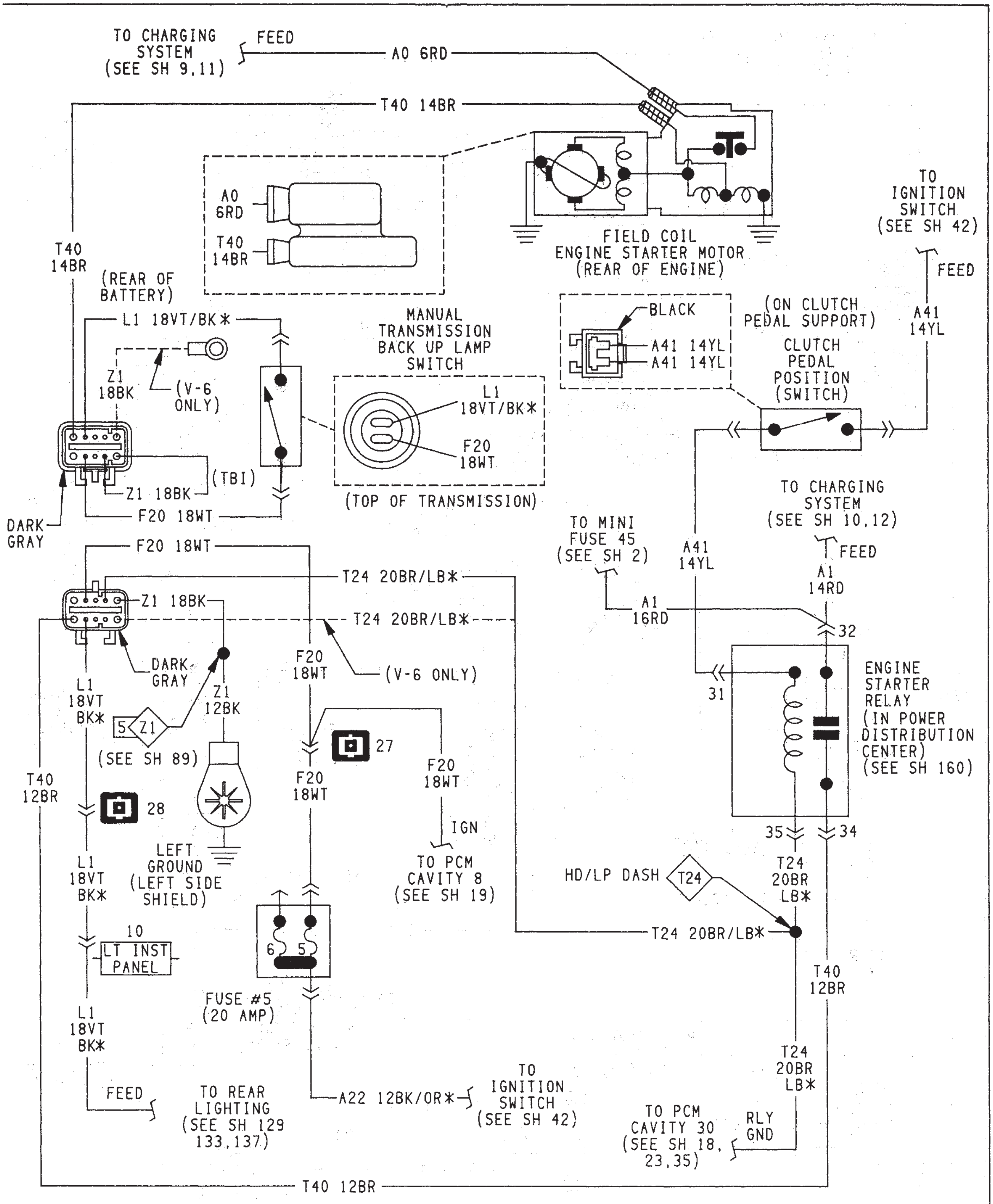
CHARGING SYSTEM (3.0L)



ENGINE STARTER SYSTEM
(2.5L AUTOMATIC TRANSMISSION)

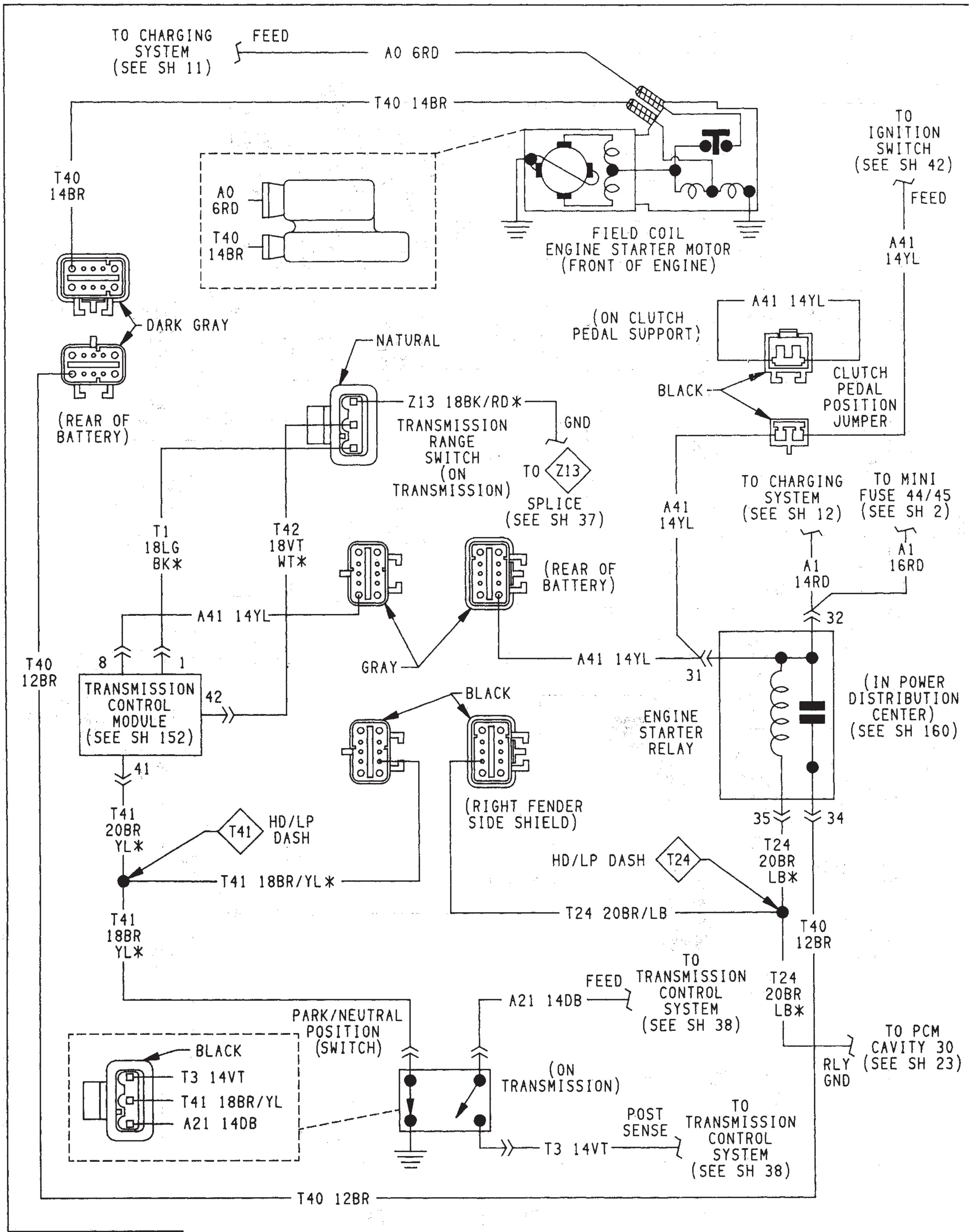
AG-AJ 13

938W-5



ENGINE STARTER SYSTEM
(MANUAL TRANSMISSION)

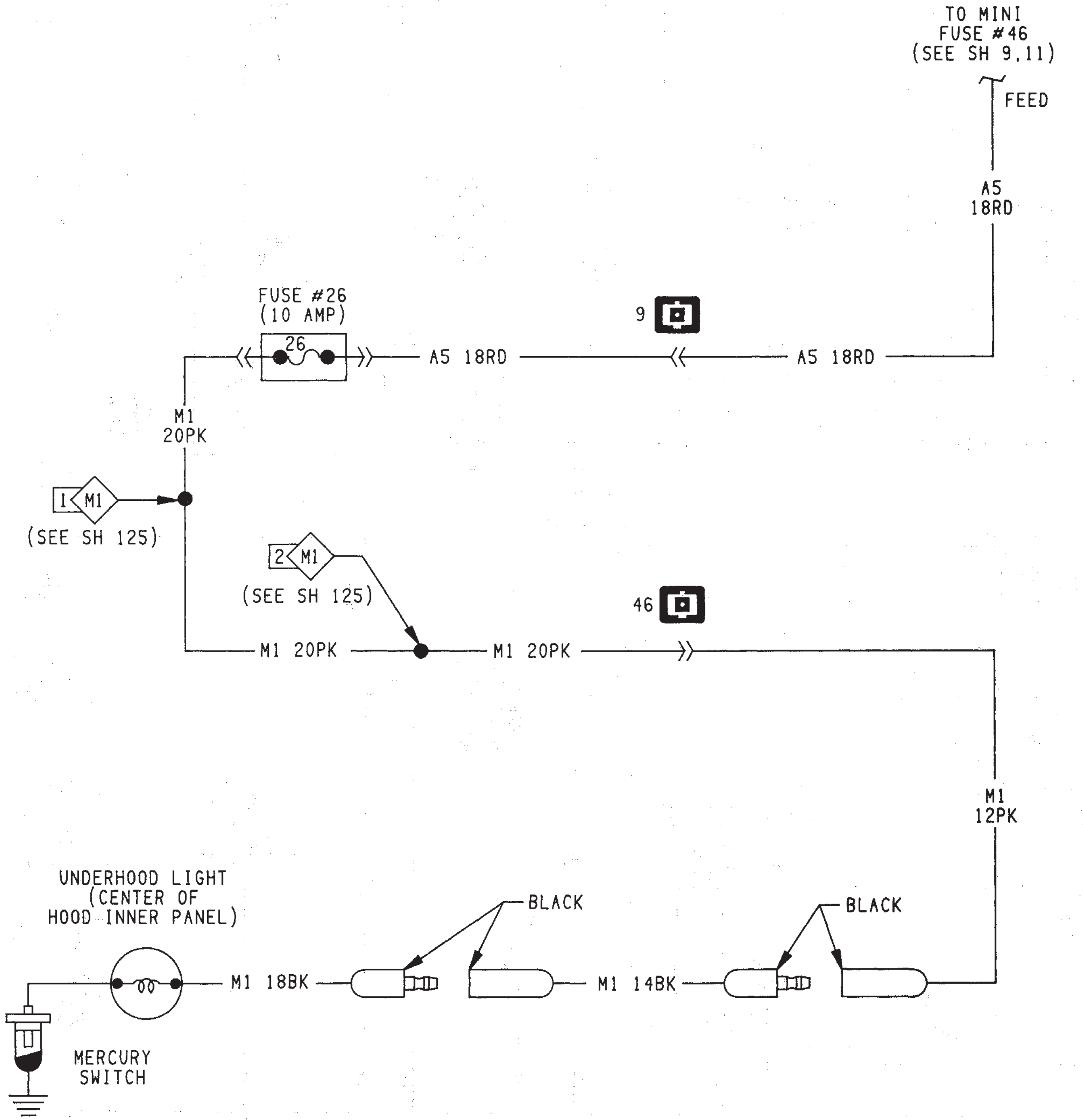
938W-5



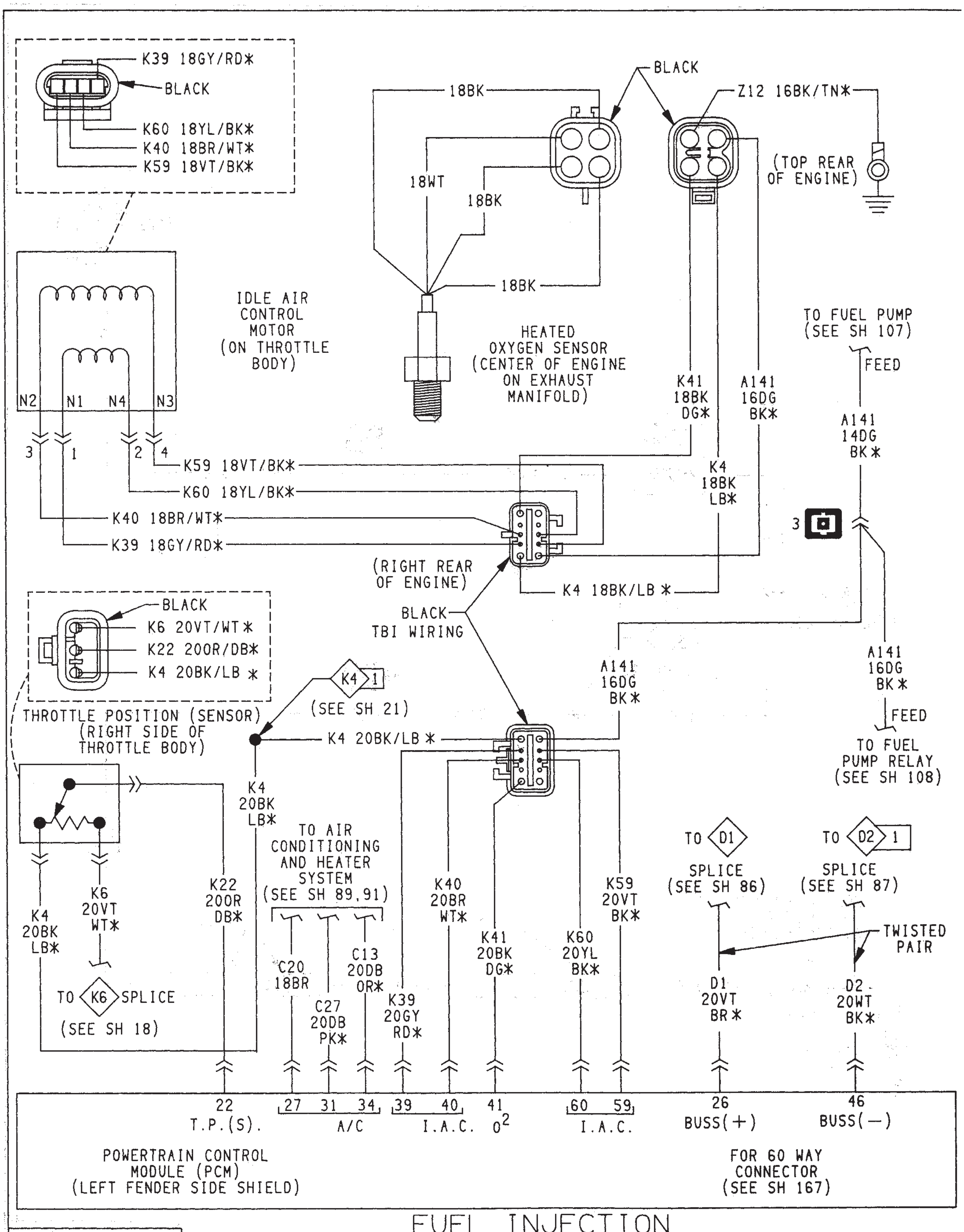
AG-AJ 15

ENGINE STARTER SYSTEM (3.0L)

938W-5



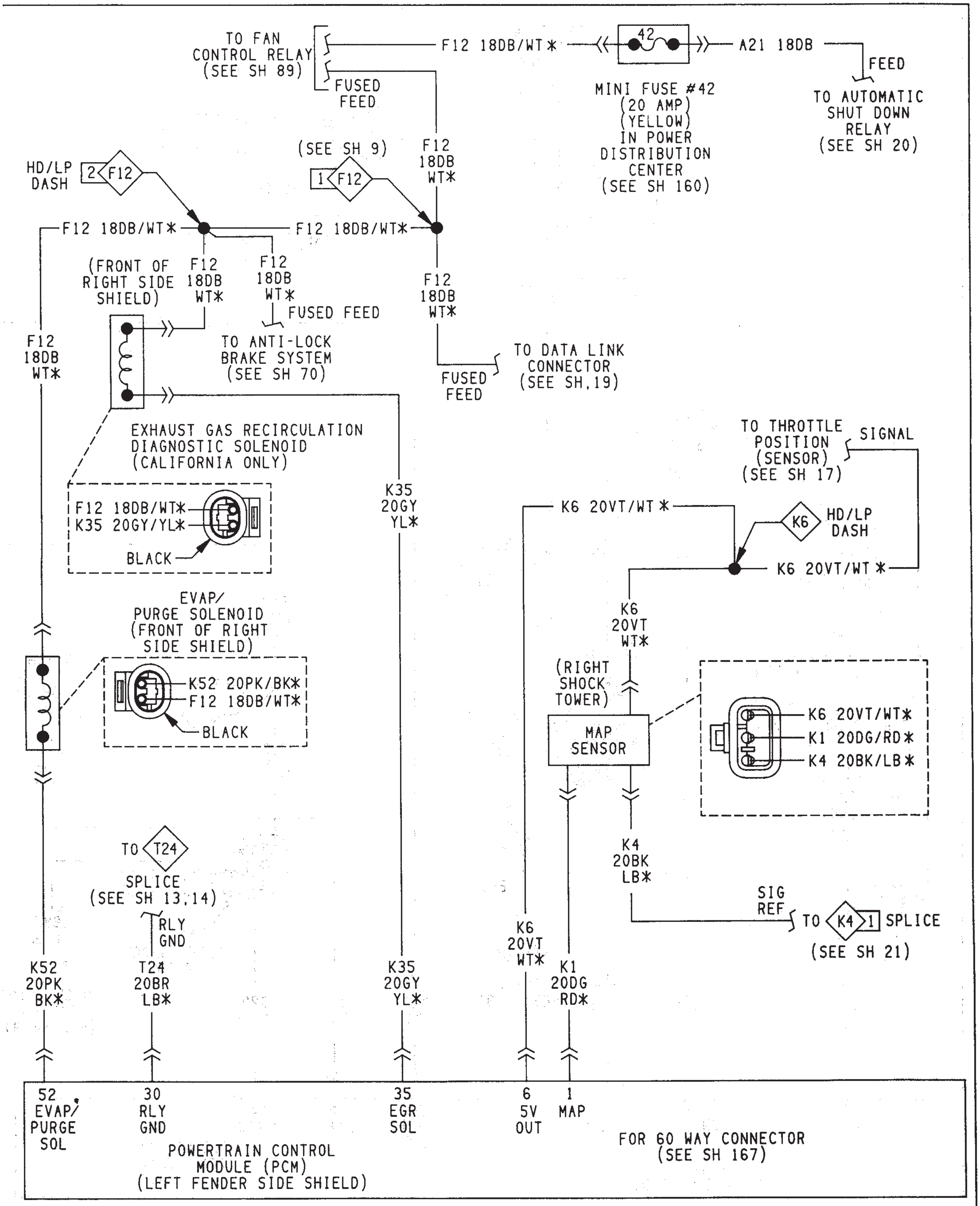
UNDERHOOD LAMP



AG-AJ 17

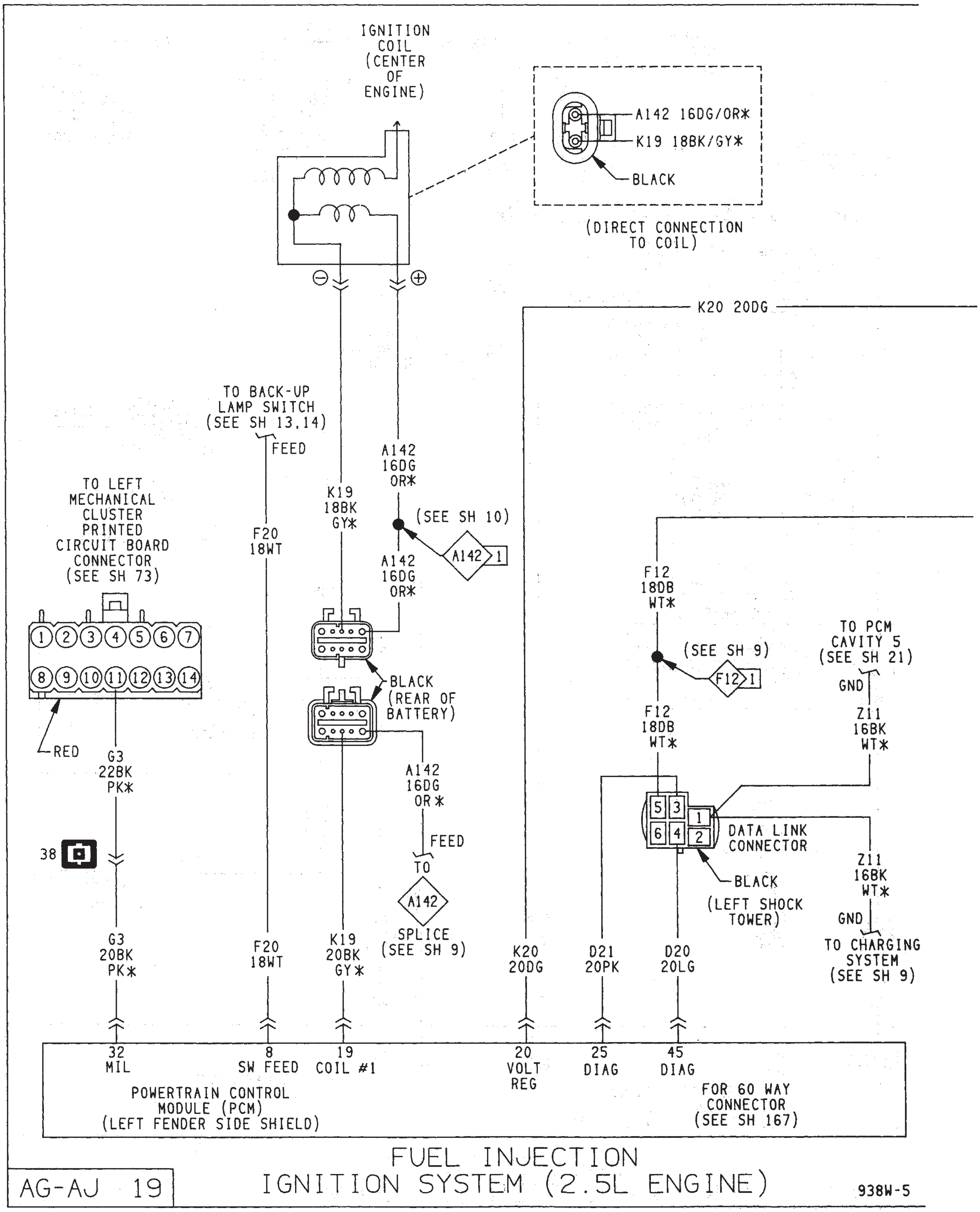
FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

938W-5

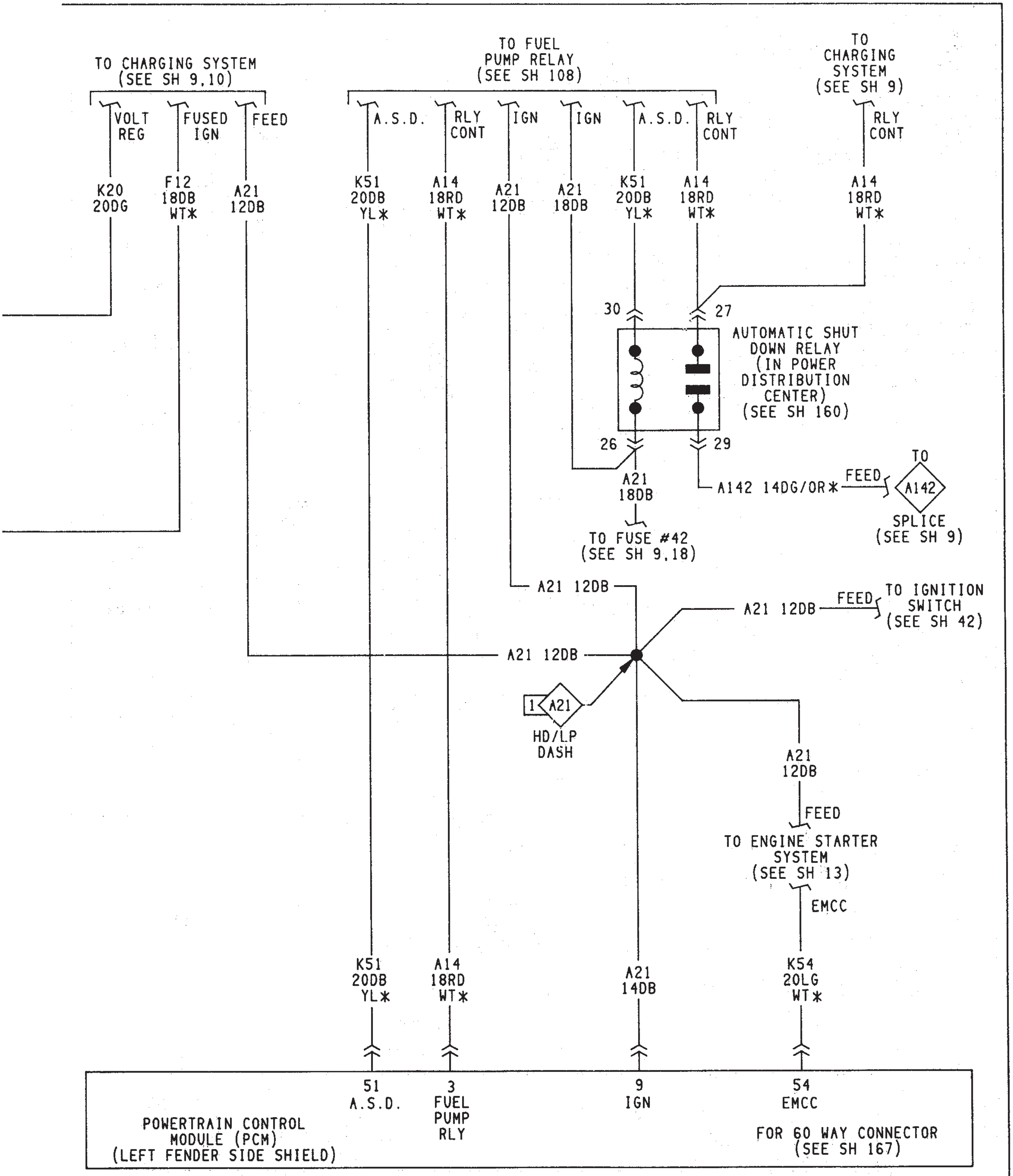


938W-5

FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)



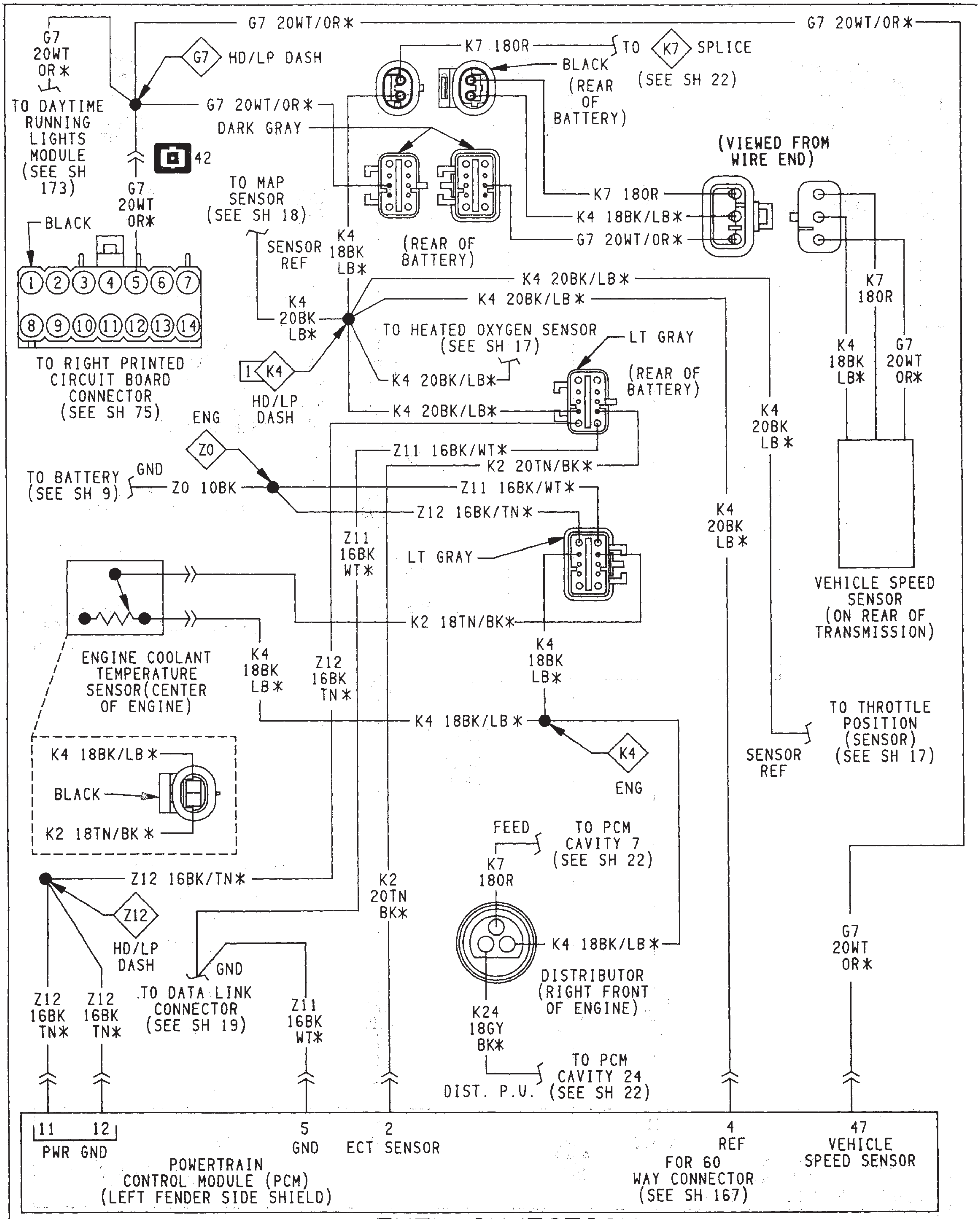
FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)



FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

938W-5

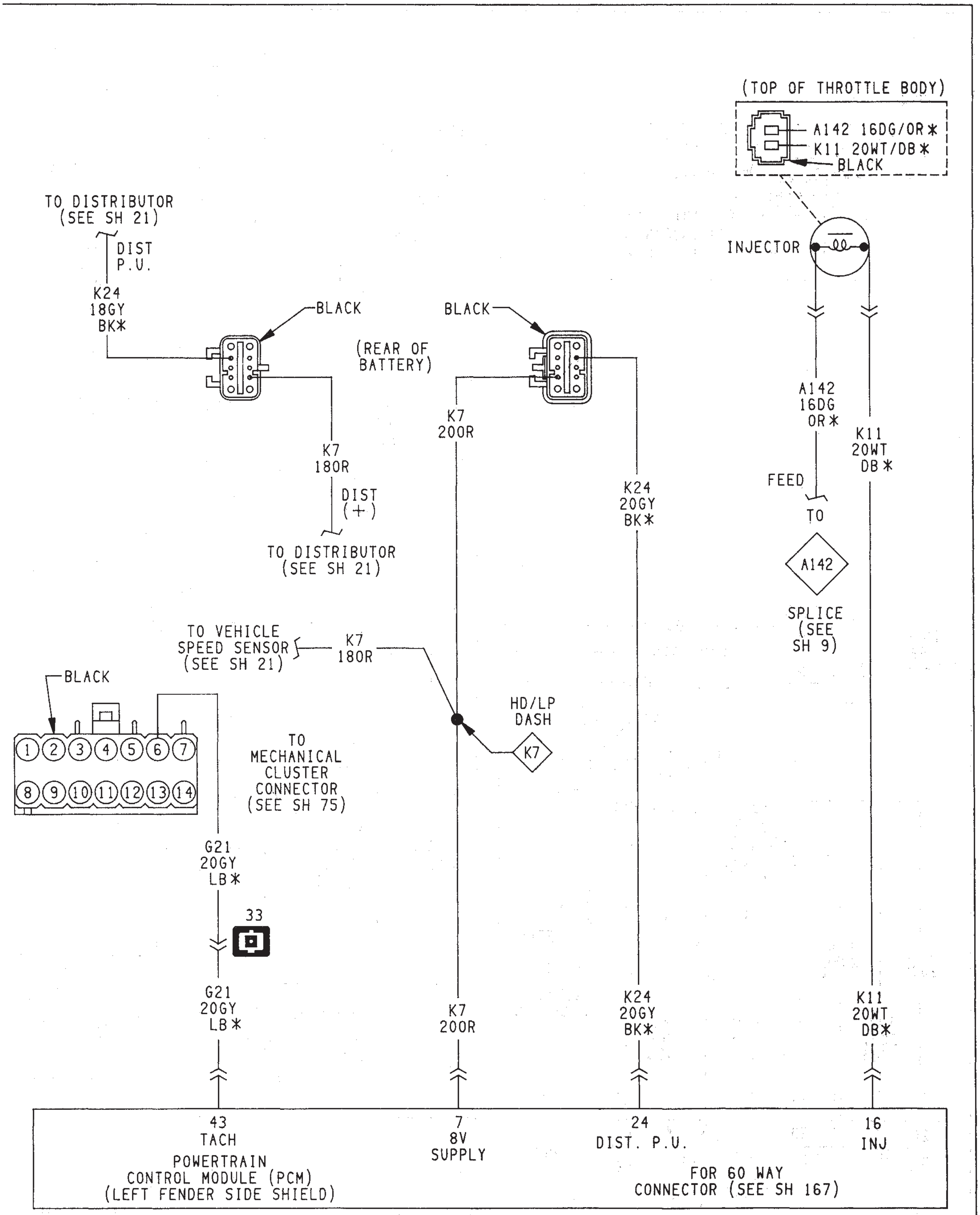
AG-AJ 20



FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

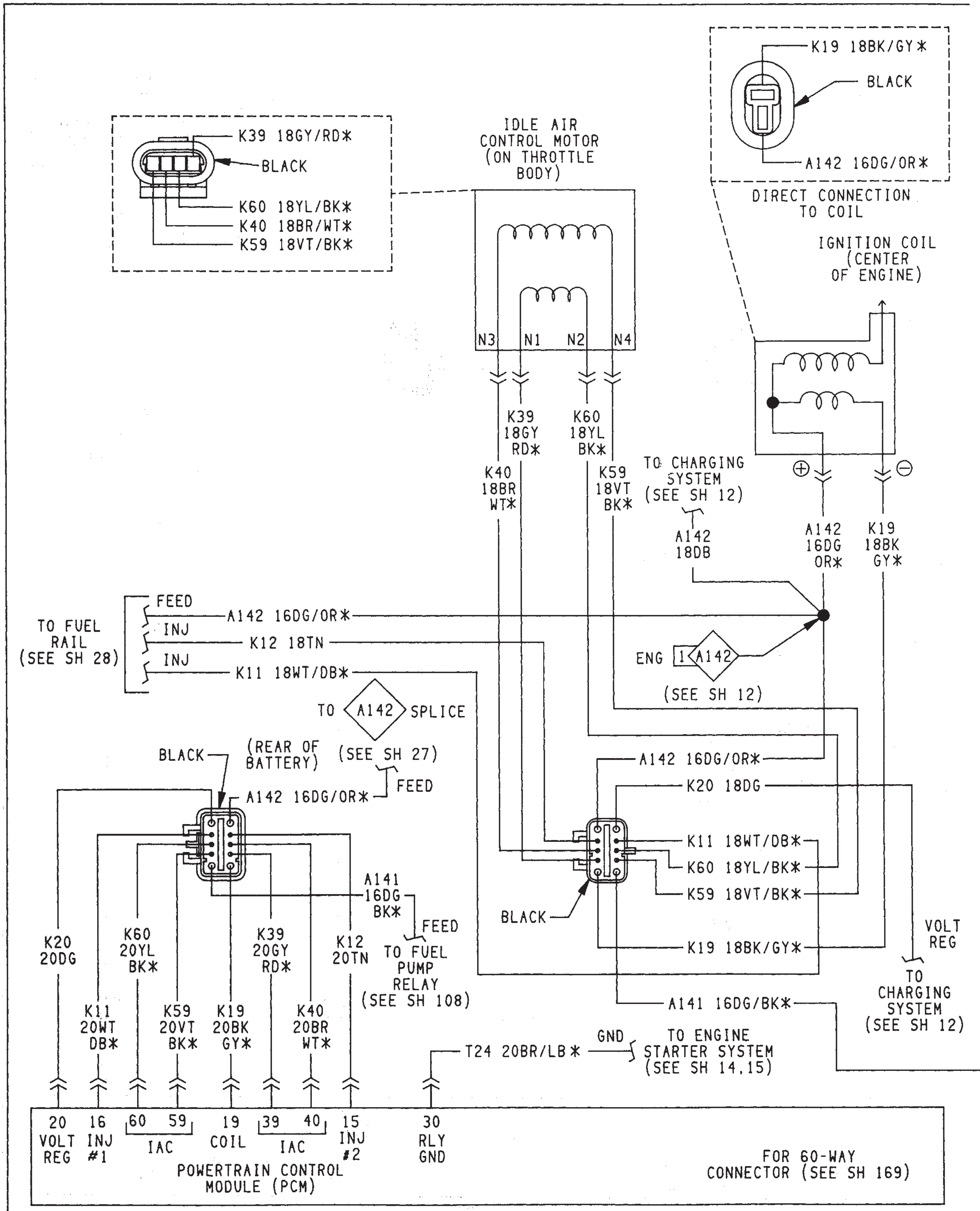
AG-AJ 21

938W-5



FUEL INJECTION
IGNITION SYSTEM (2.5L ENGINE)

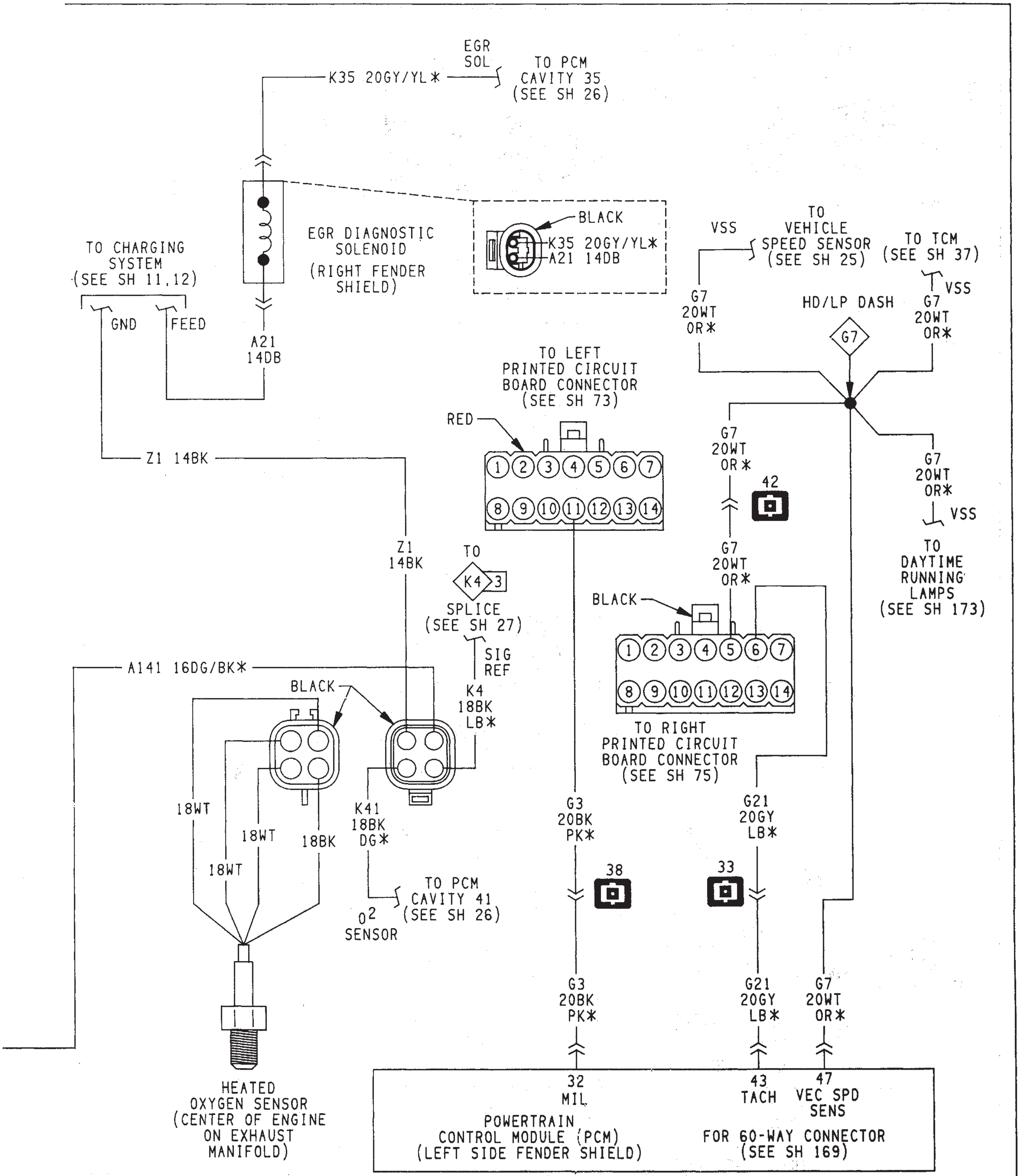
938W-5



AG-AJ 23

FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

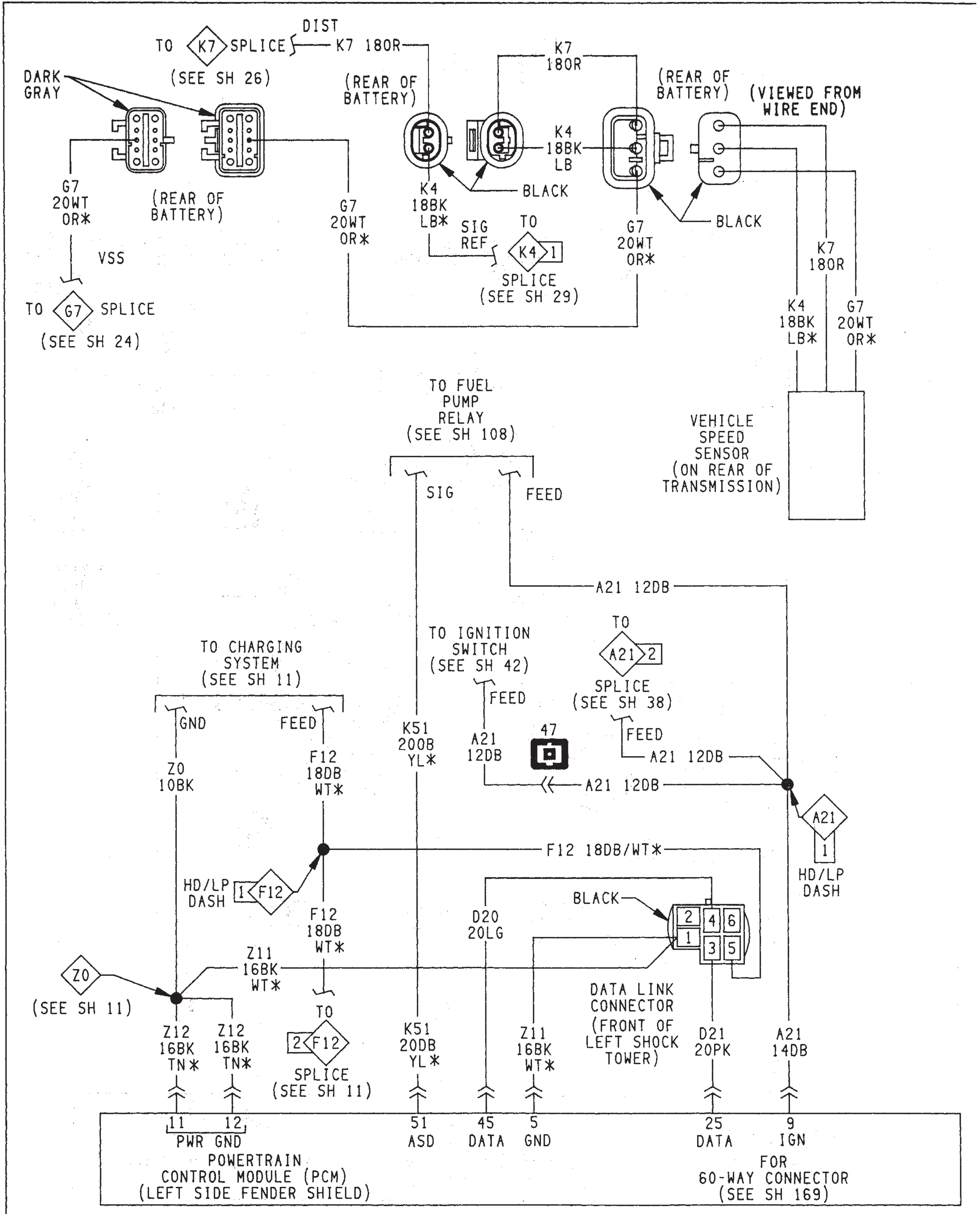
938W-5



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-5

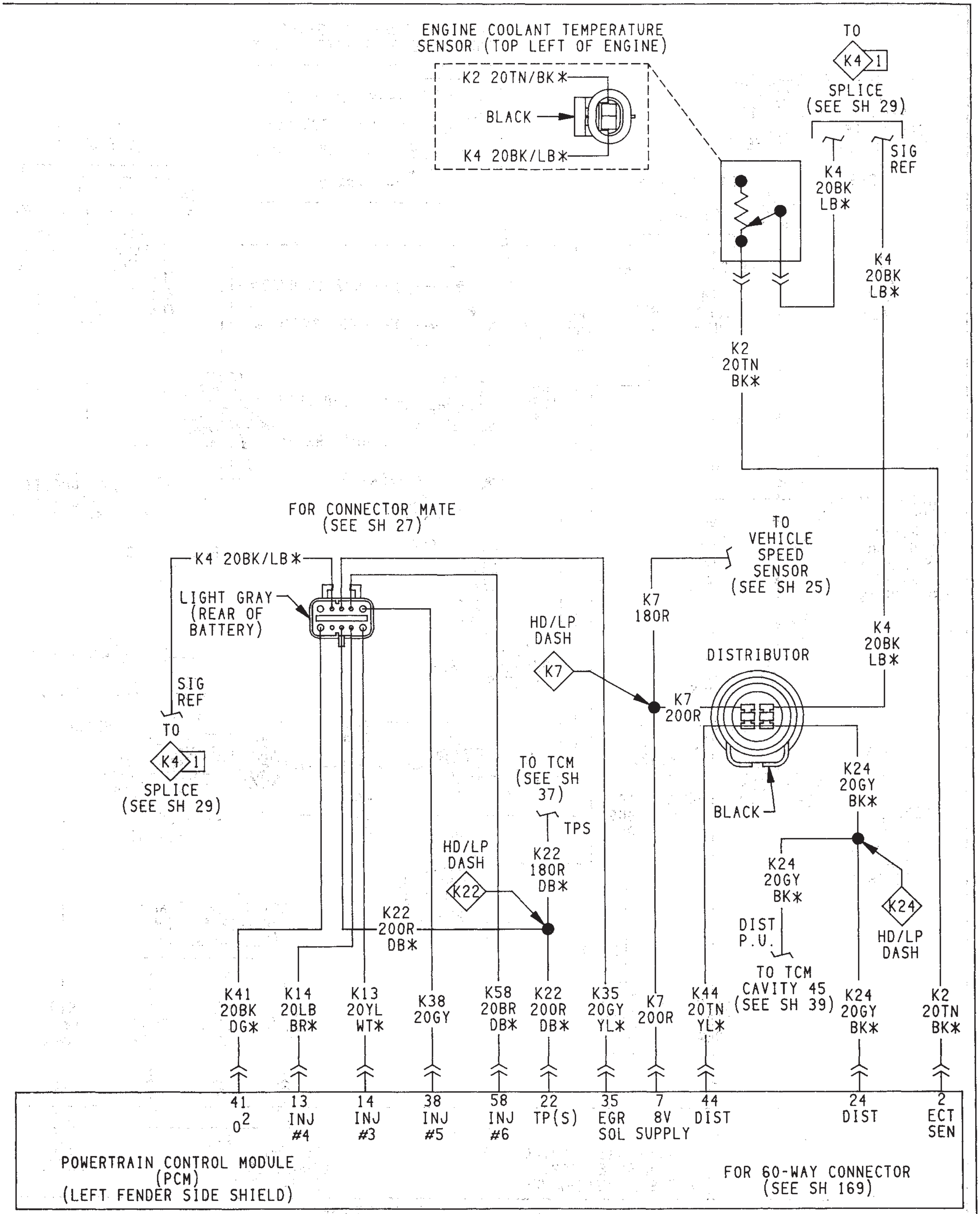
AG-AJ 24



AG-AJ 25

FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

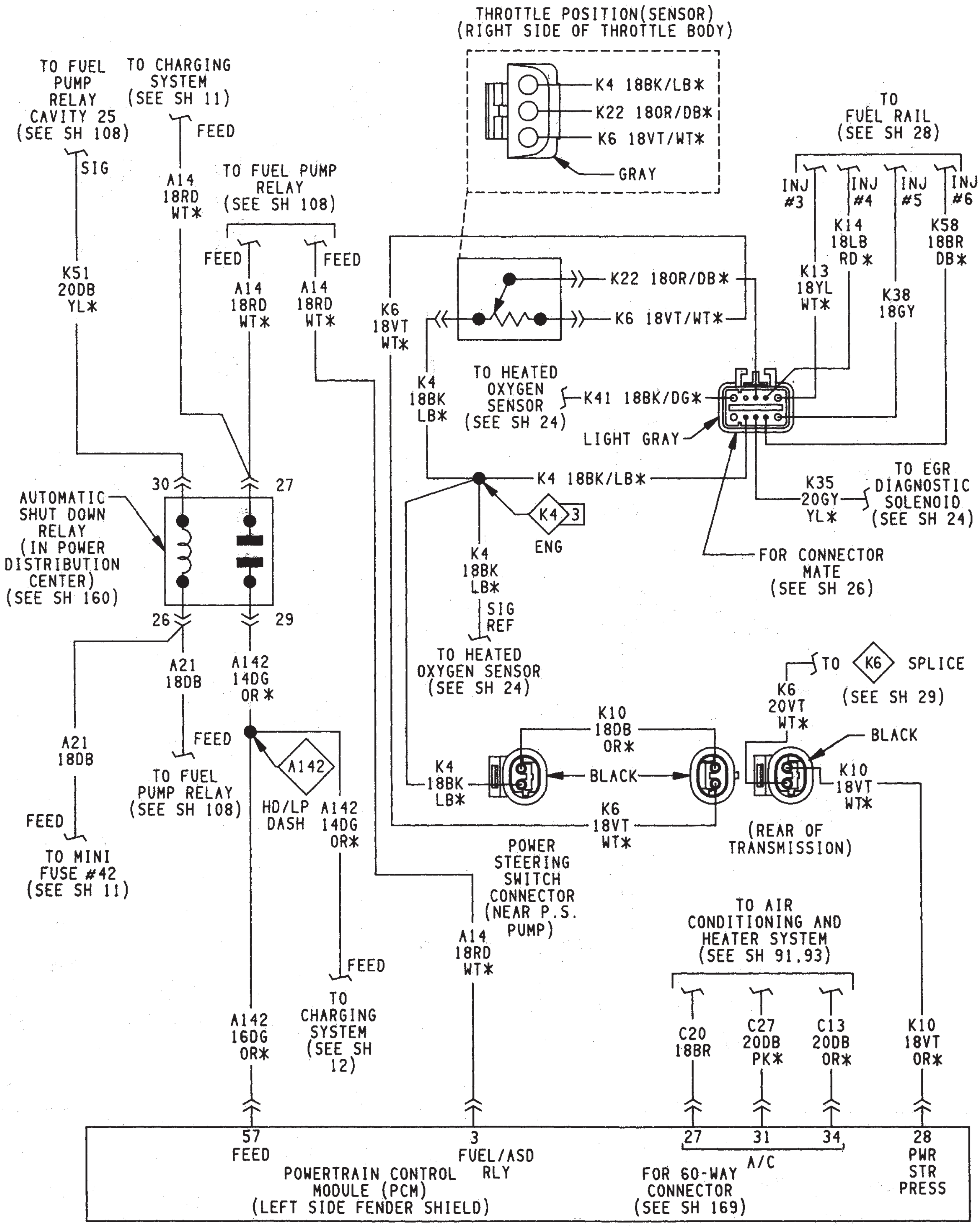
938W-5



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-5

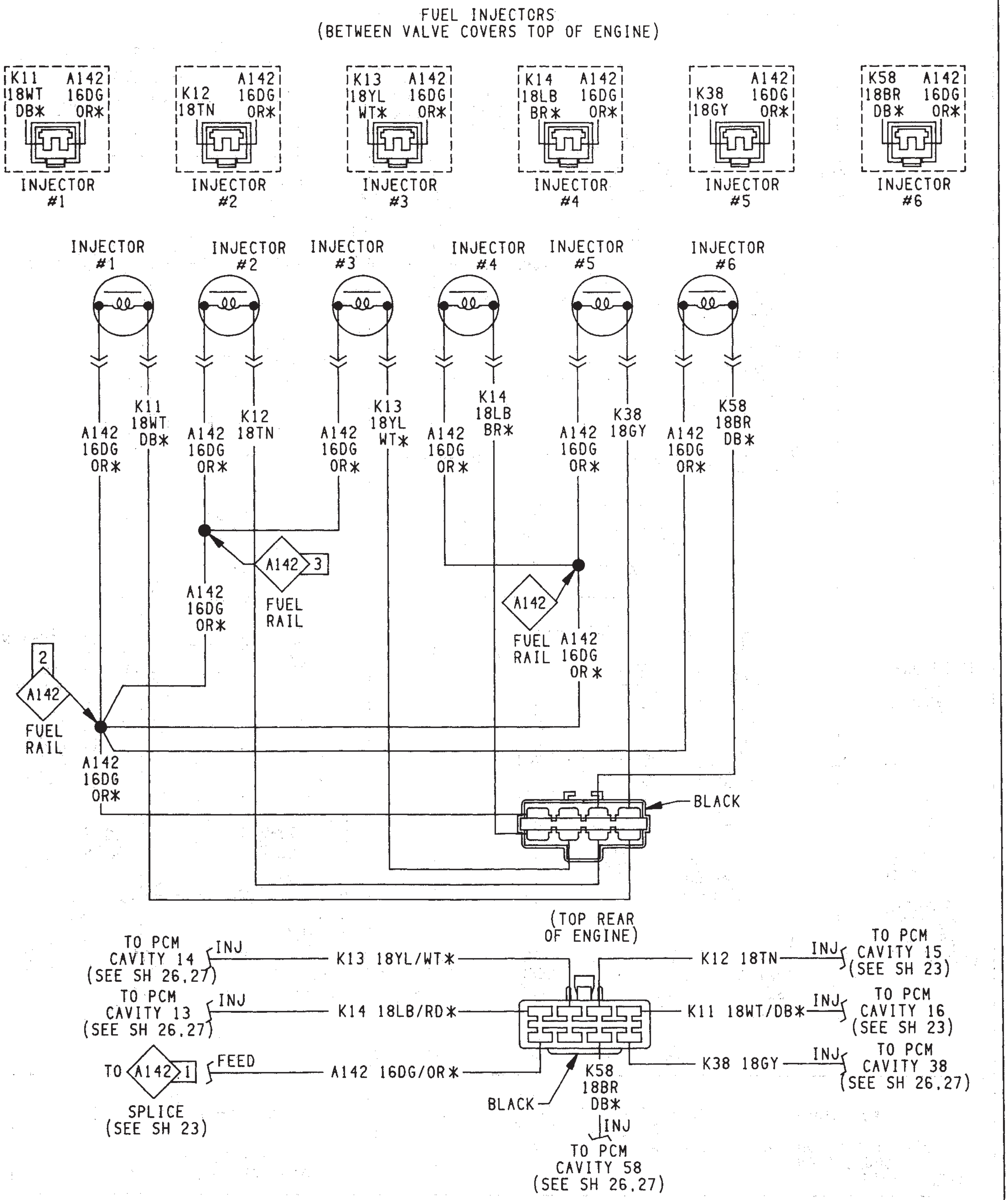
AG-AJ 26



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

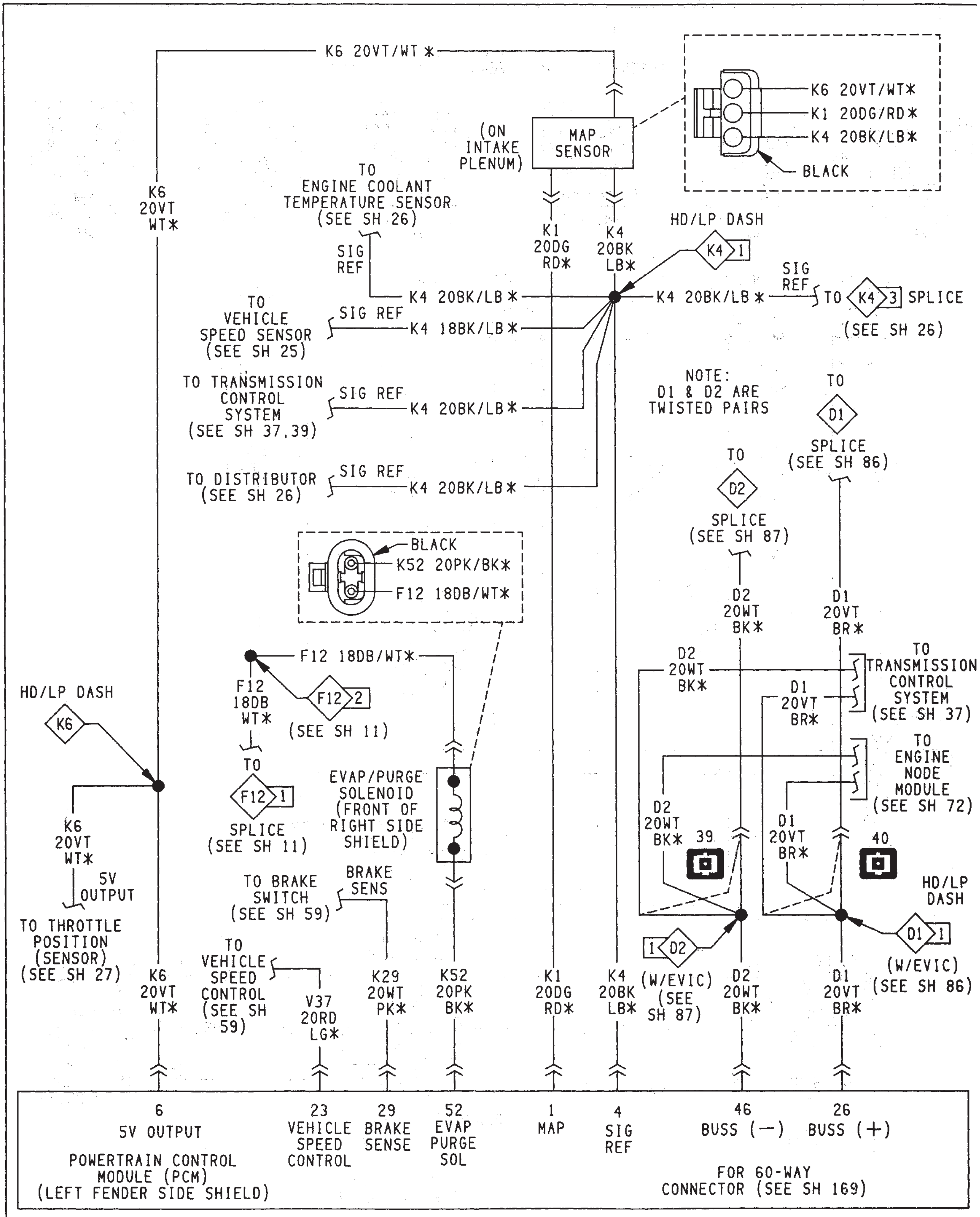
AG-AJ 27

938W-5



938W-5

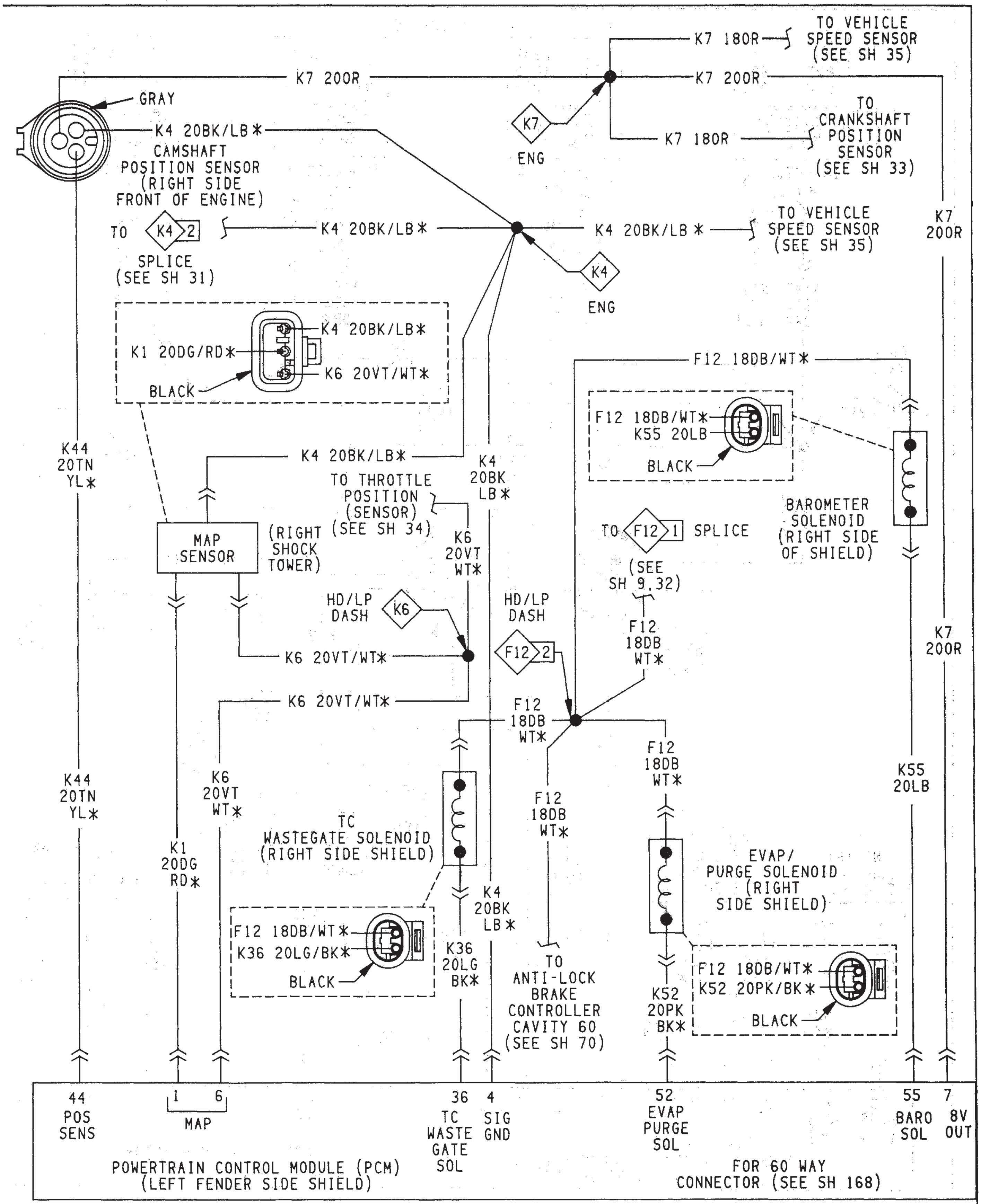
FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)



AG-AJ 29

FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

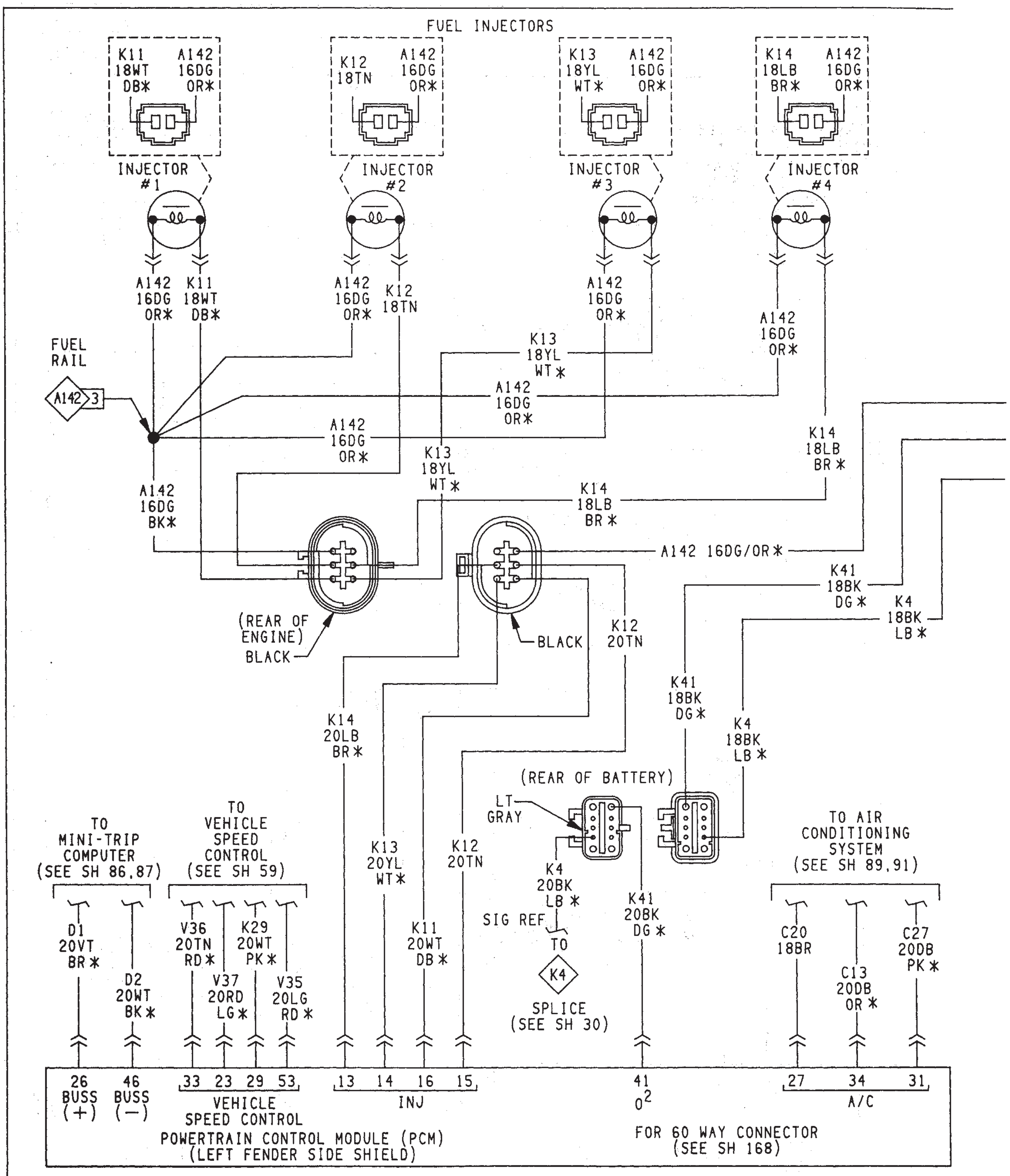
938W-5



FUEL INJECTION
IGNITION SYSTEM (TURBO III)

938W-5

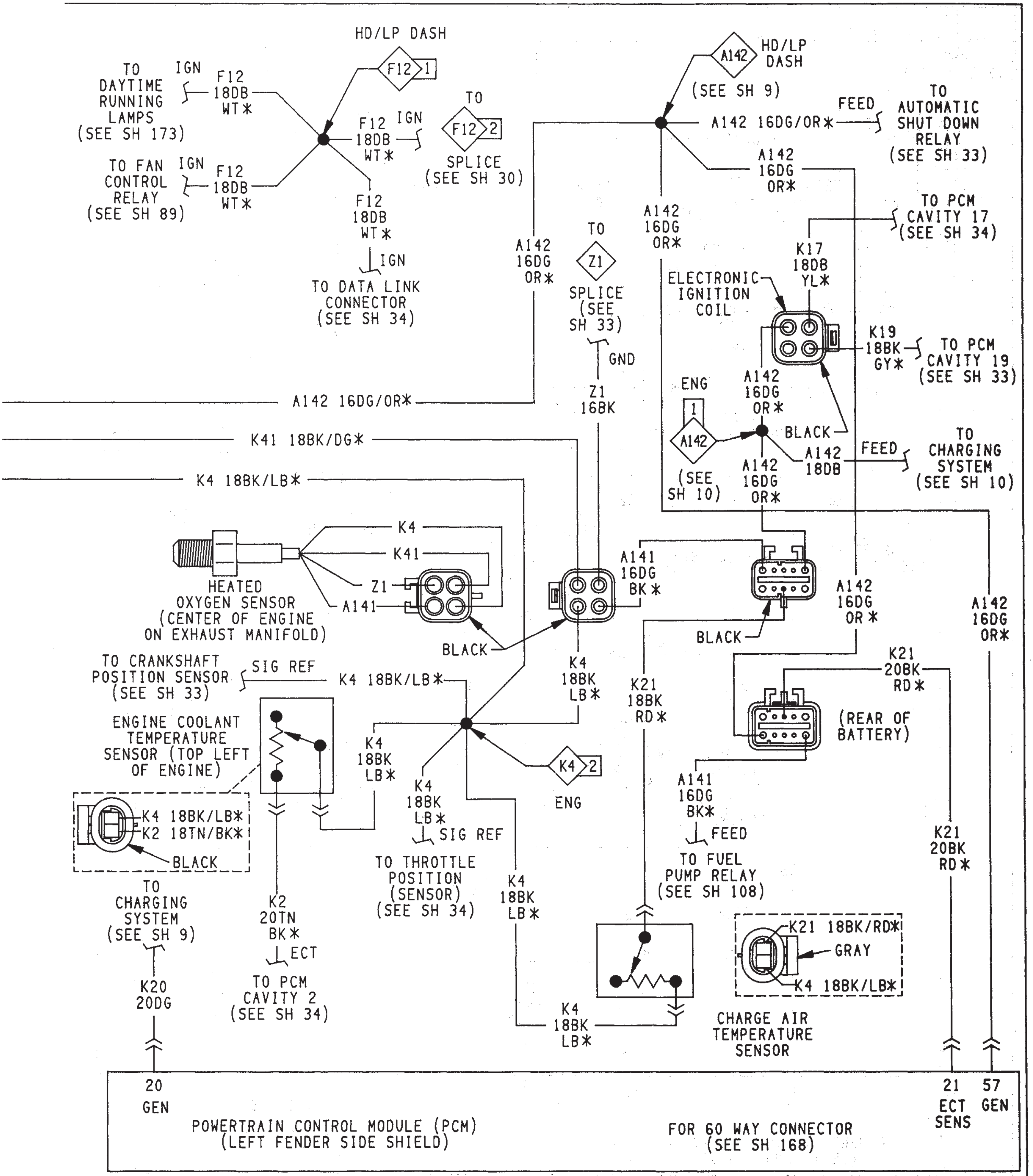
AG 30



FUEL INJECTION
IGNITION SYSTEM (TURBO III)

AG 31

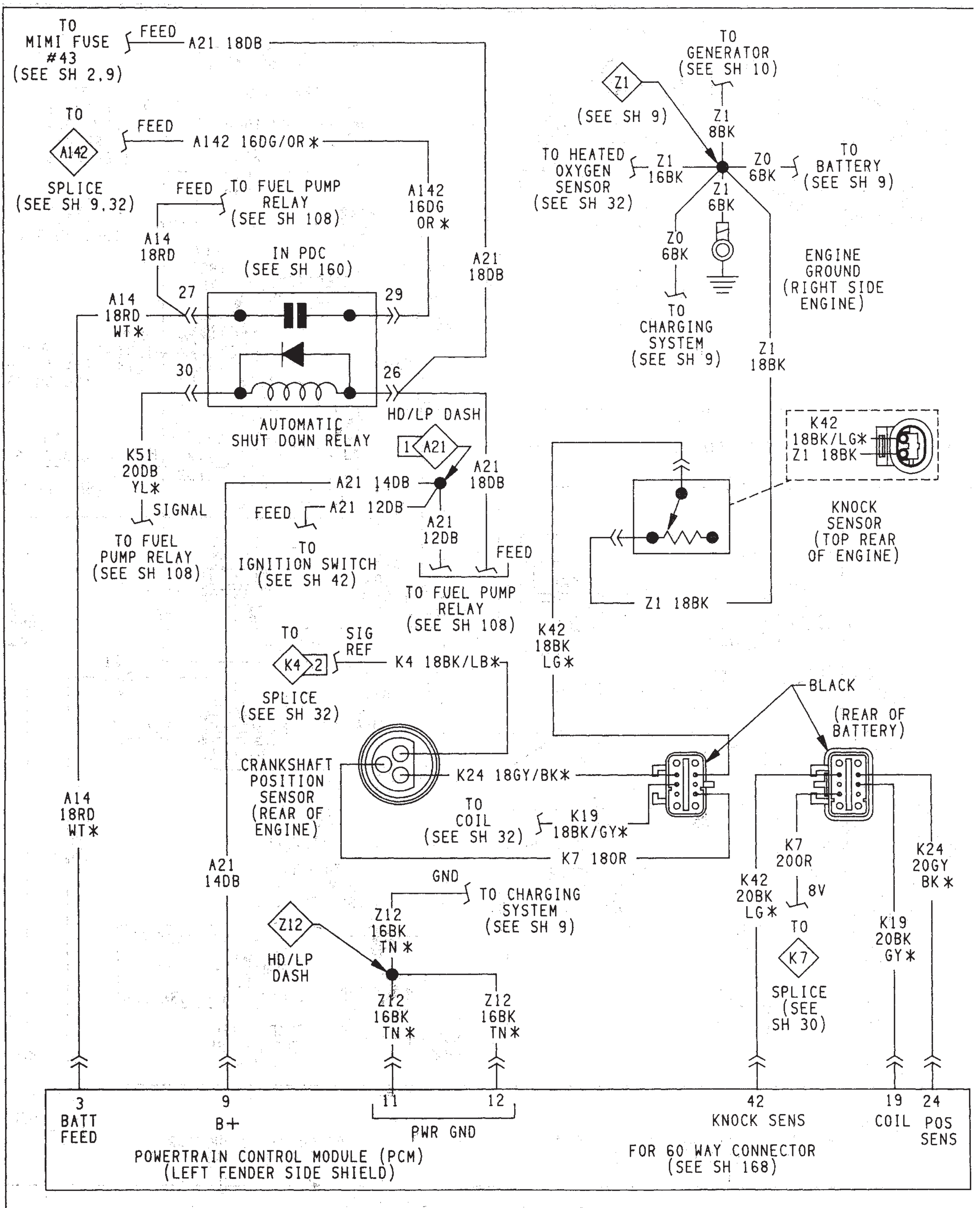
938W-5



FUEL INJECTION
IGNITION SYSTEM (TURBO III)

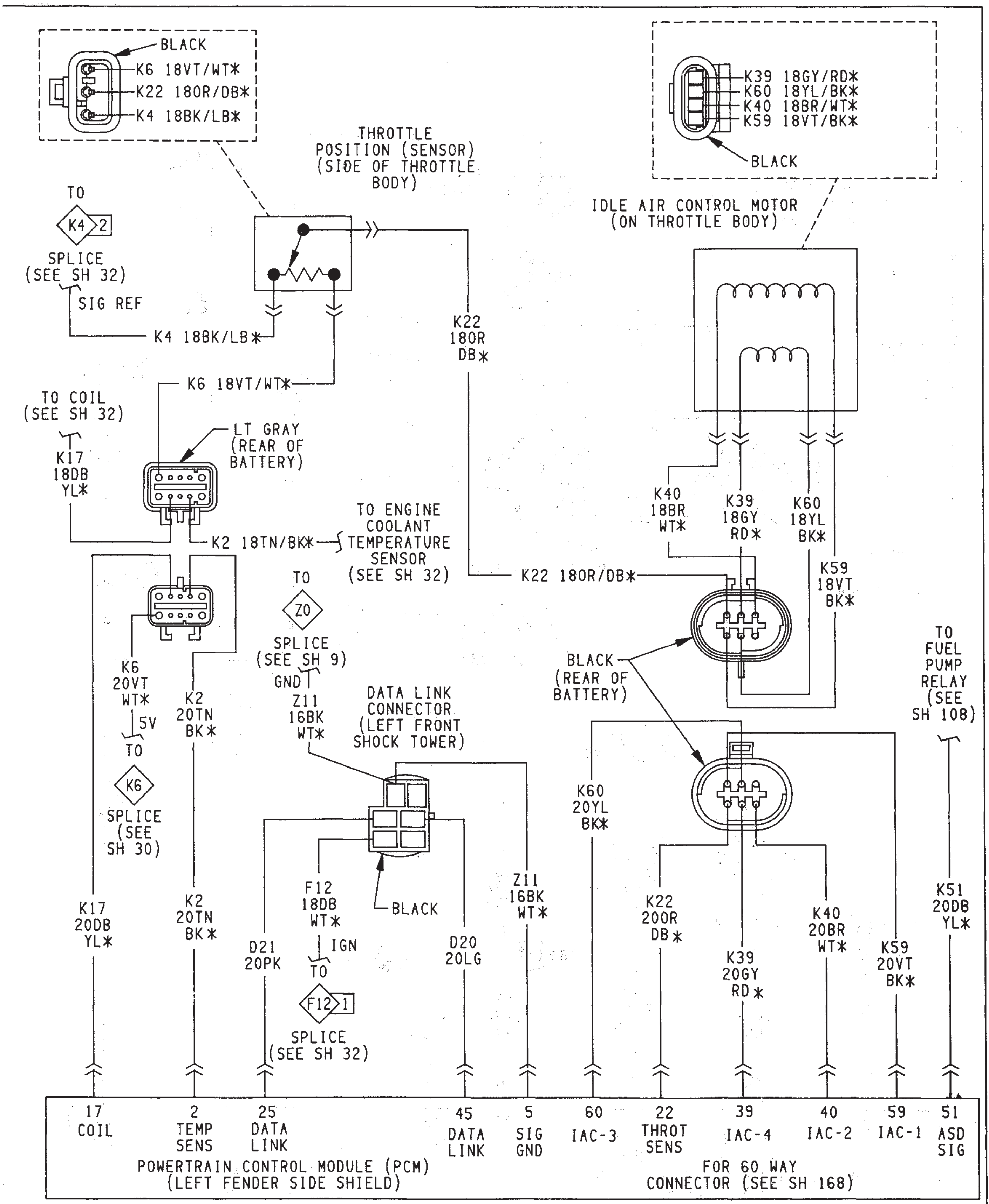
938W-5

AG 32



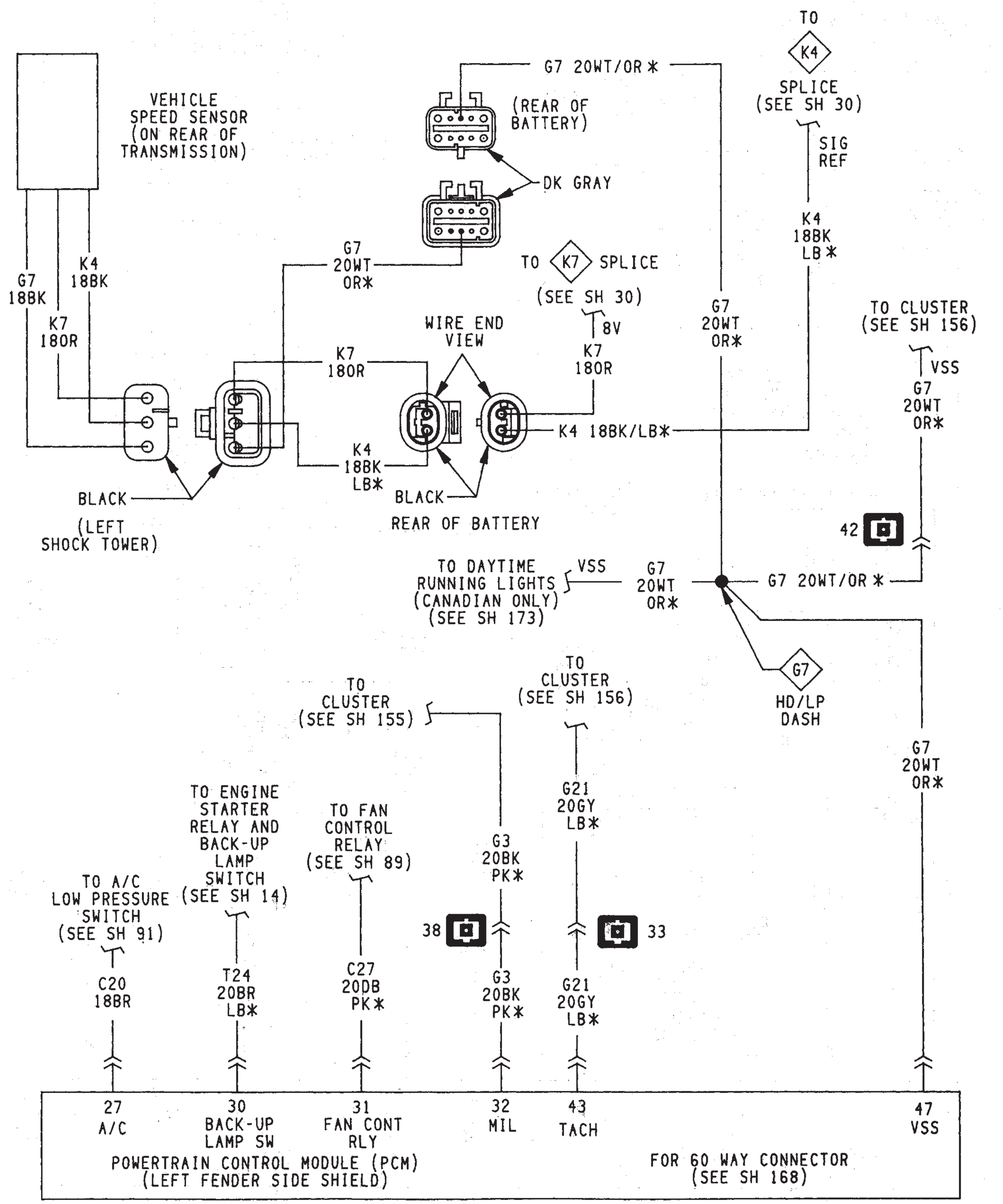
FUEL INJECTION
IGNITION SYSTEM (TURBO III)

938W-5



FUEL INJECTION IGNITION SYSTEM (TURBO III)

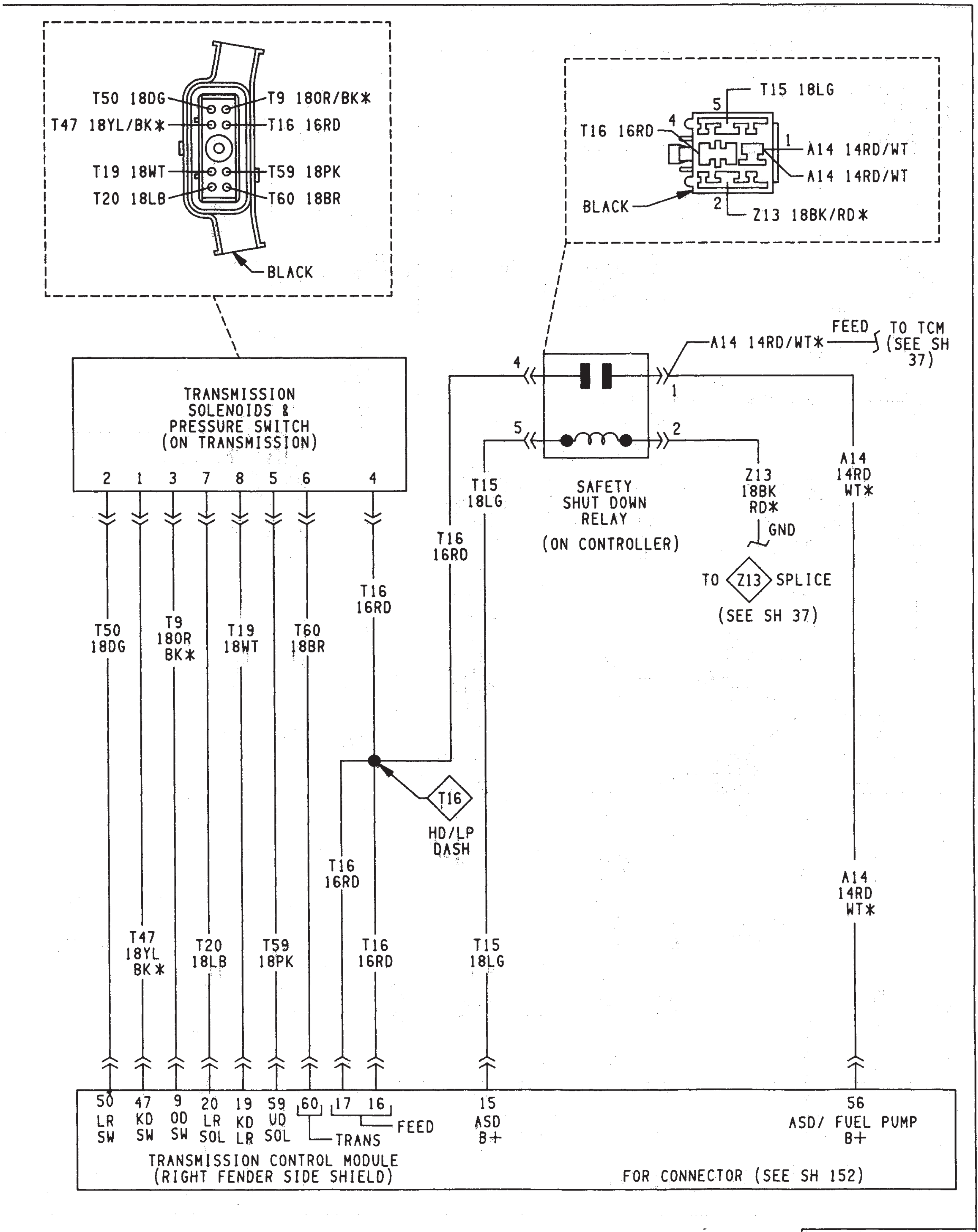
938W-5



AG 35

FUEL INJECTION
IGNITION SYSTEM (TURBO III)

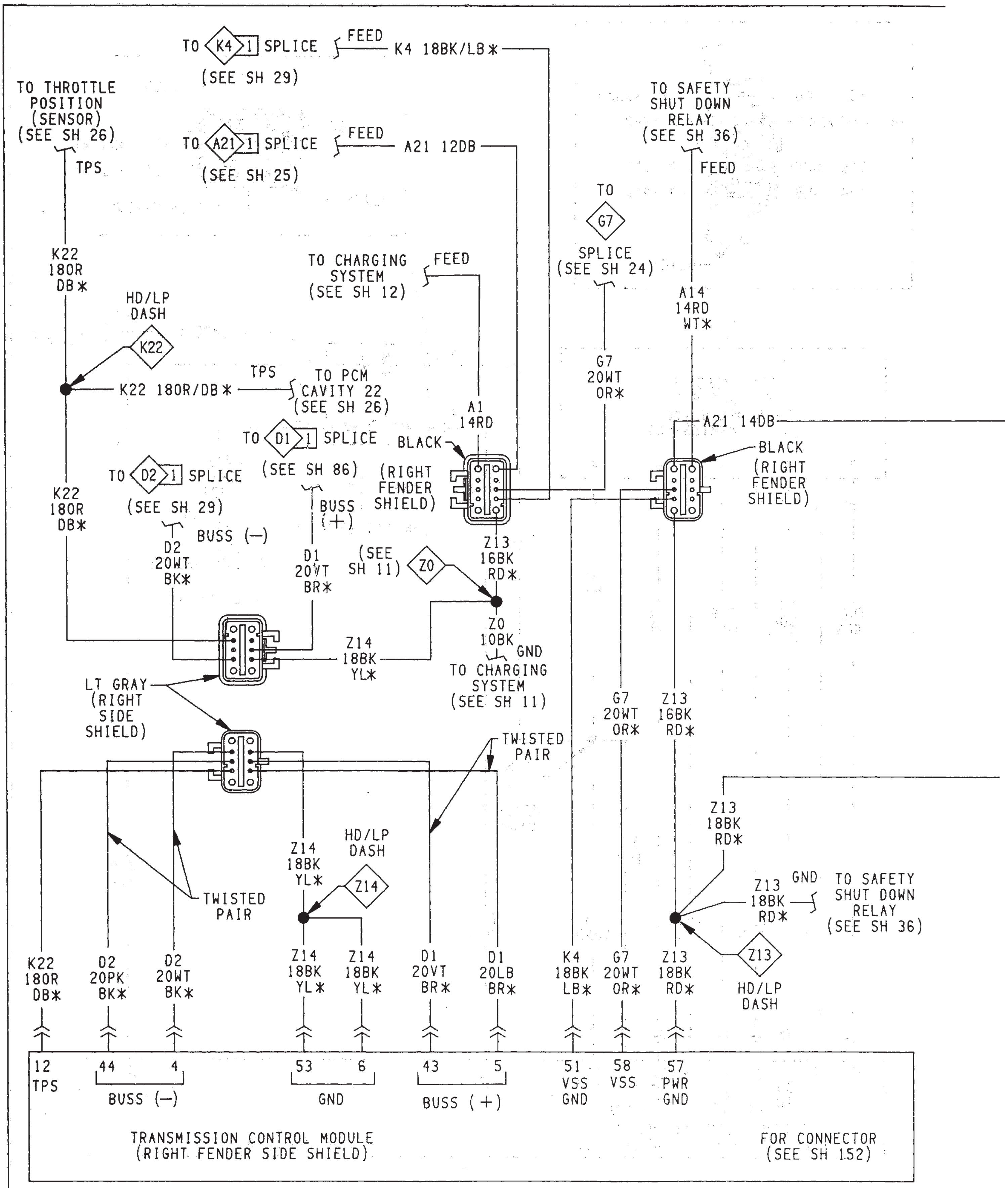
938W-5



938W-5

TRANSMISSION CONTROL SYSTEM

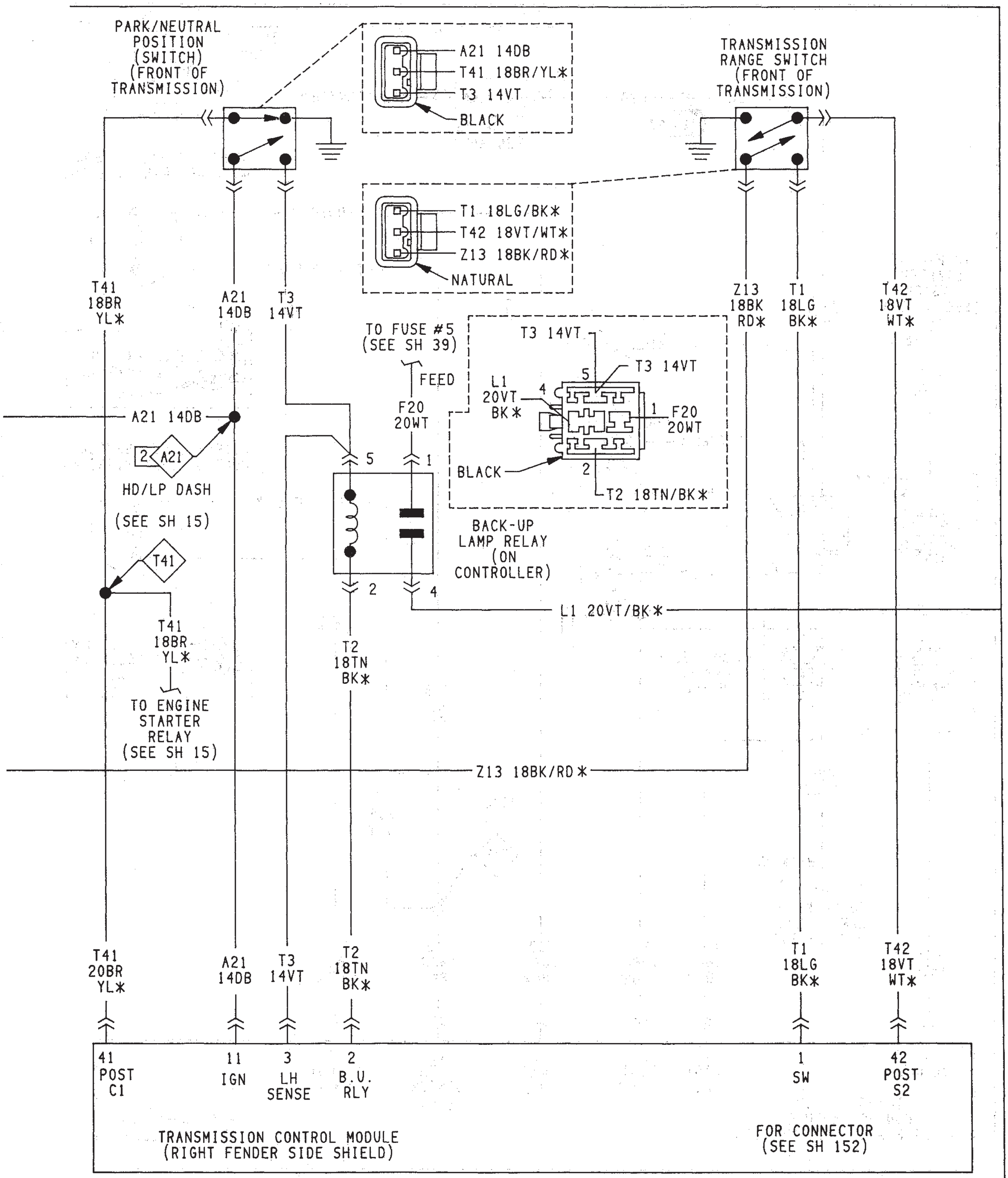
AG-AJ 36



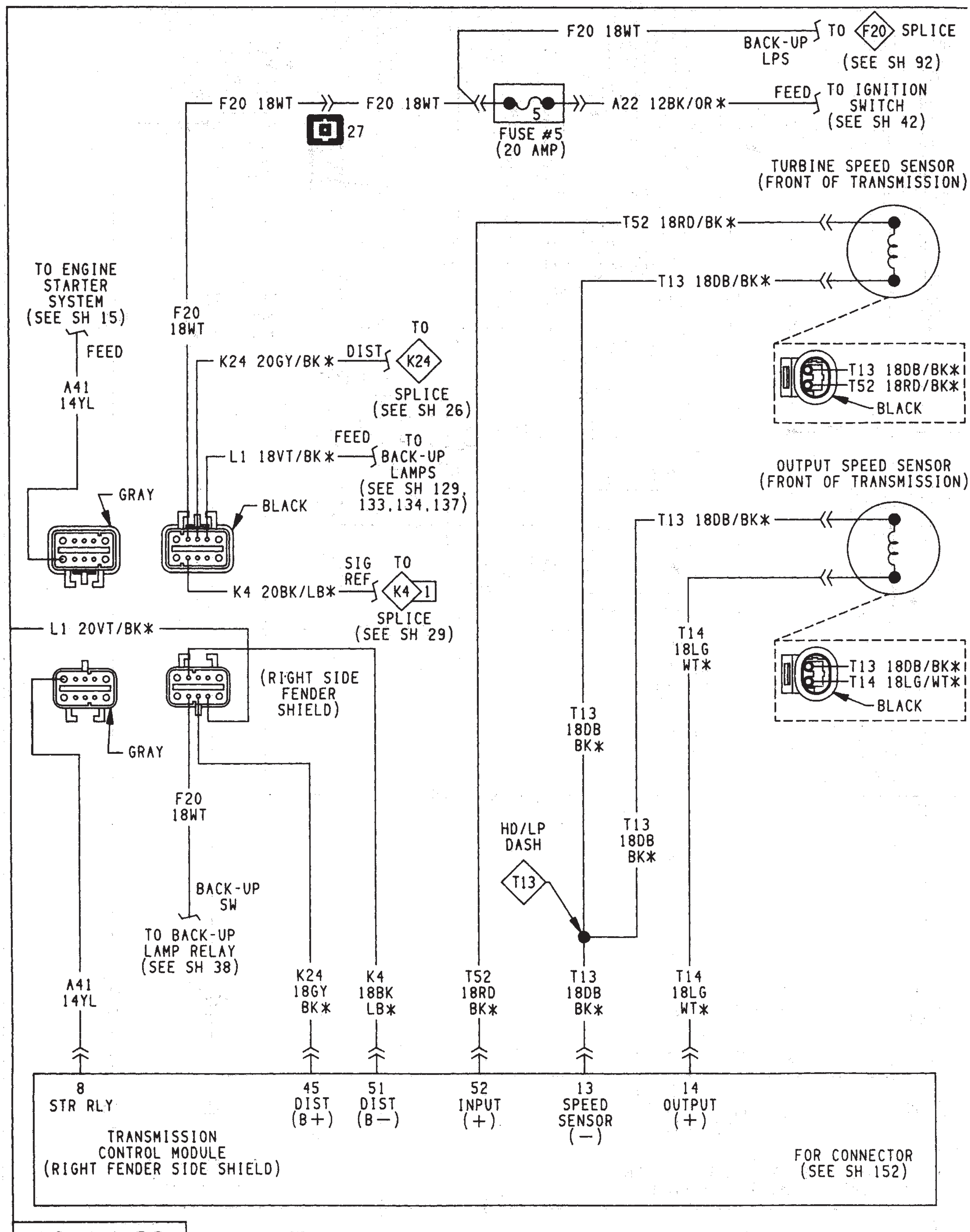
AG-AJ 37

TRANSMISSION CONTROL SYSTEM

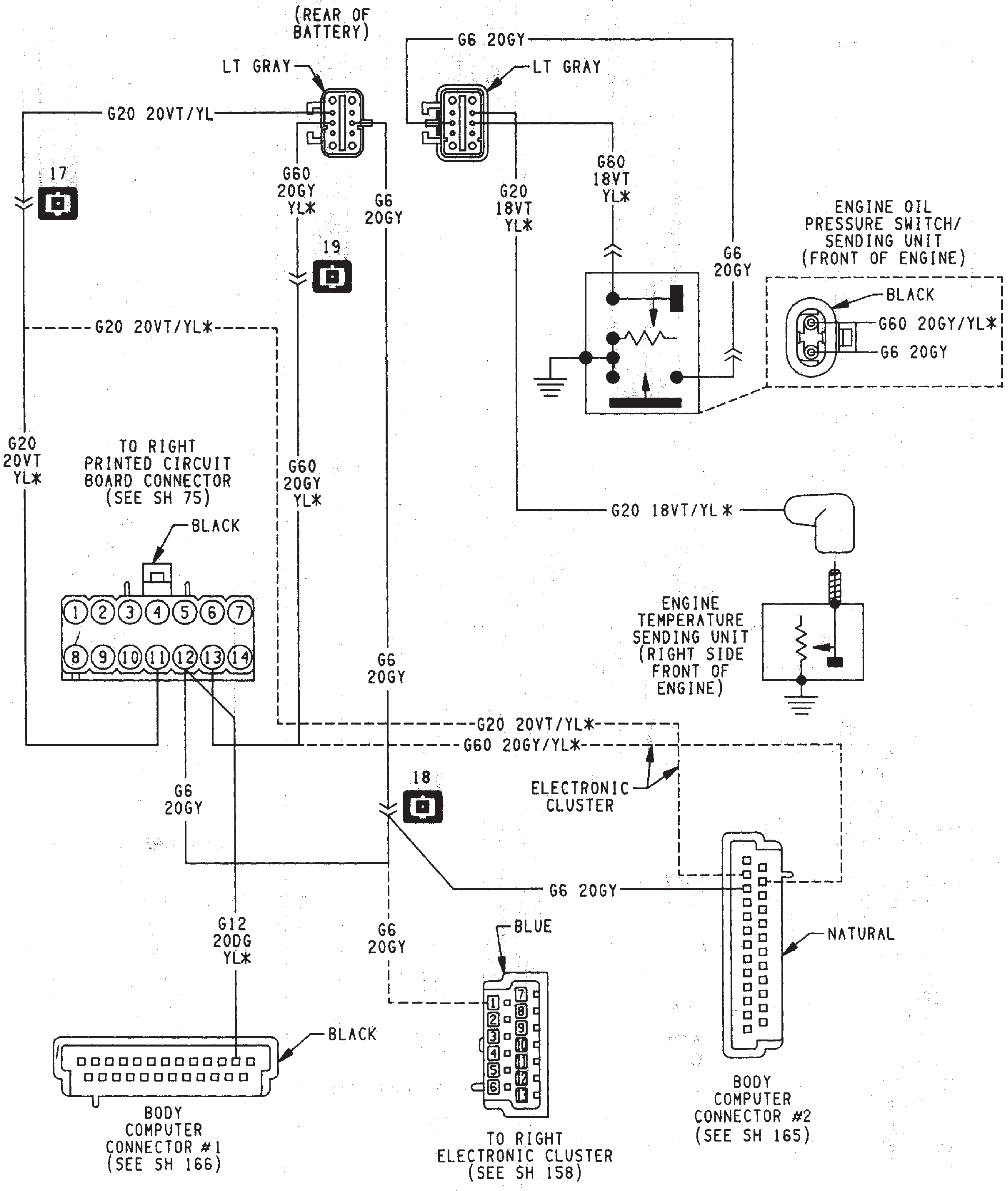
938W-5



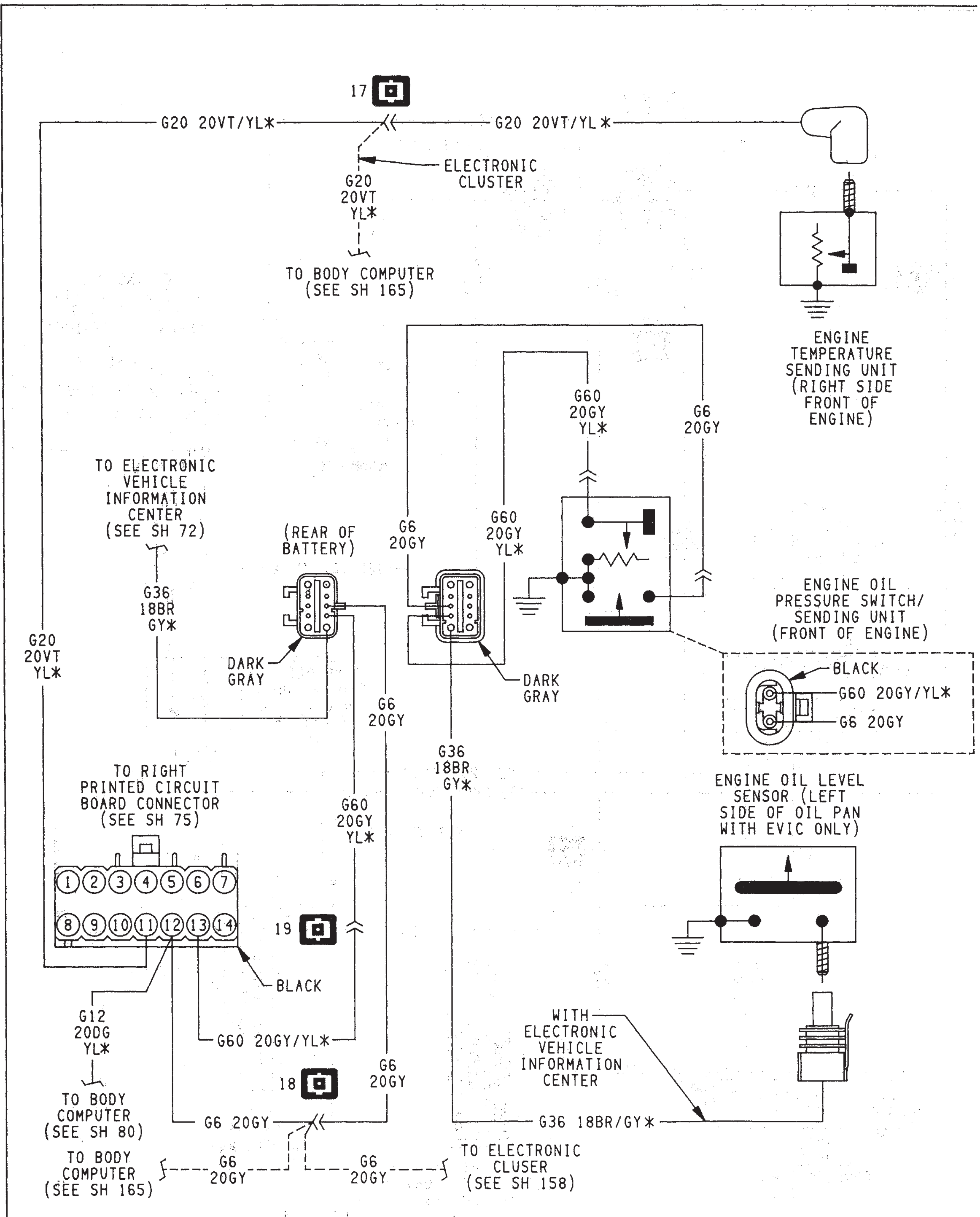
938W-5 TRANSMISSION CONTROL SYSTEM AG-AJ 38



AG-AJ 39 TRANSMISSION CONTROL SYSTEM 938W-5



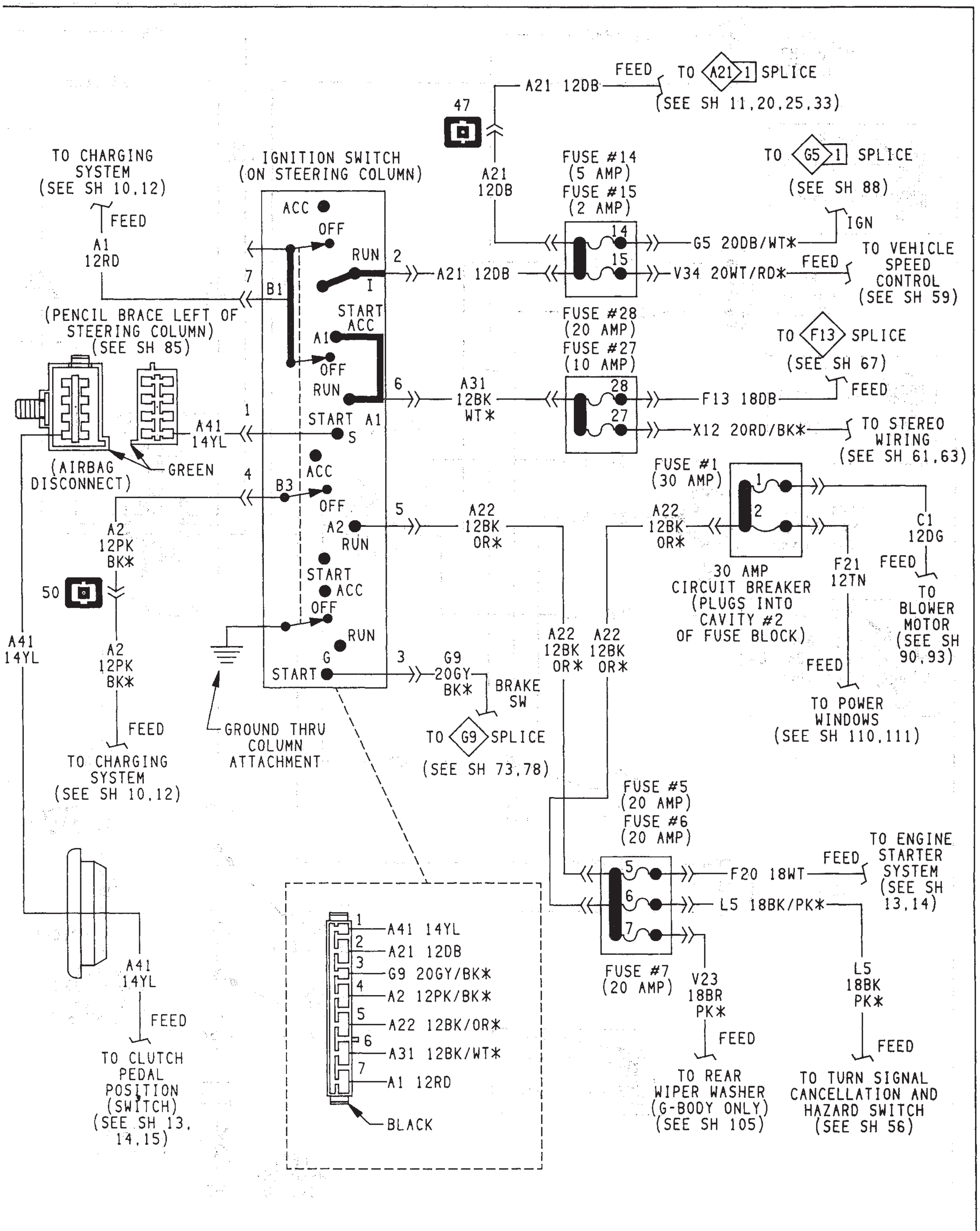
ENGINE OIL AND TEMPERATURE WARNING SYSTEM (EXCEPT 3.0L)



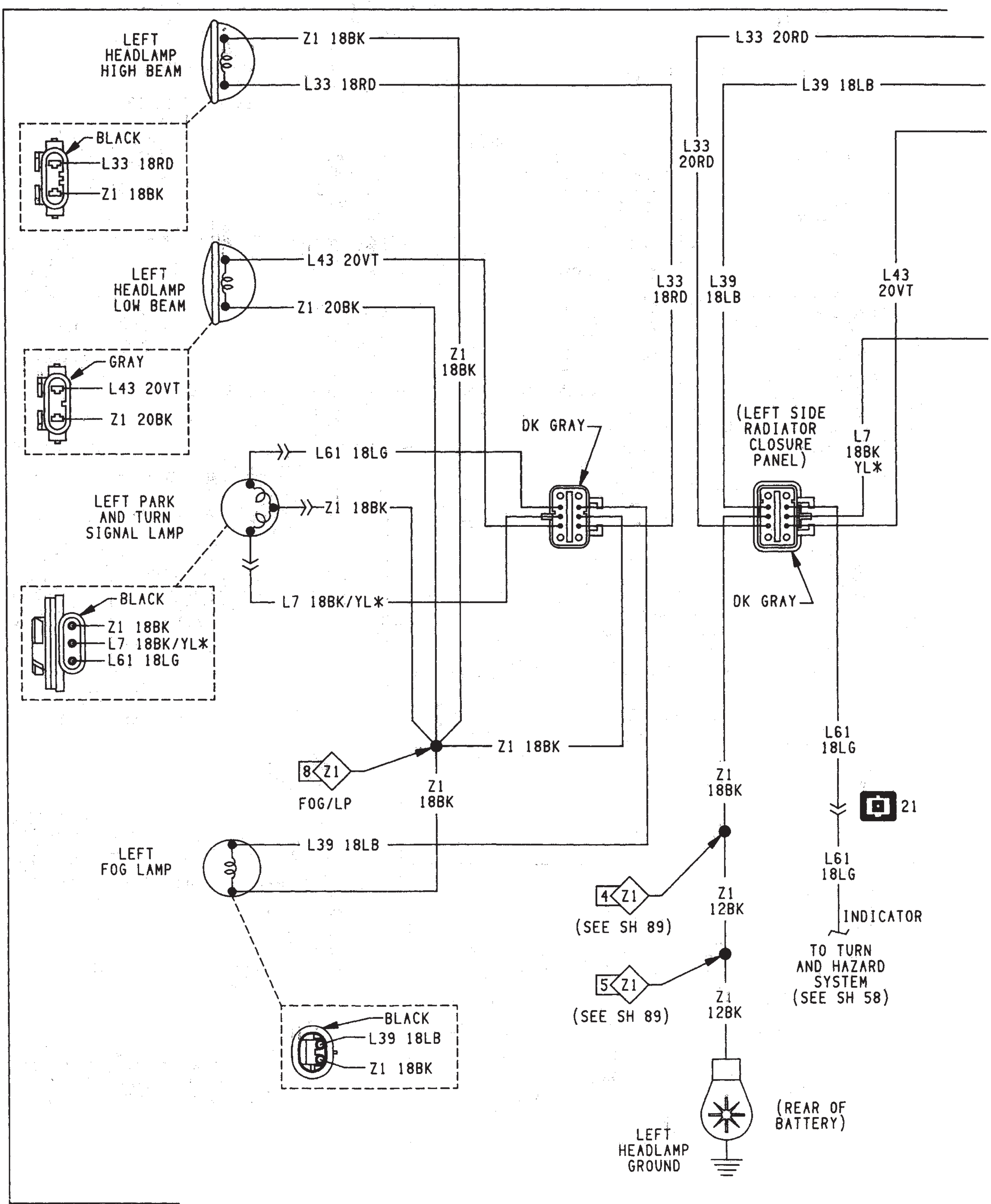
ENGINE OIL AND TEMPERATURE WARNING SYSTEM (3.0L)

AG-AJ 41

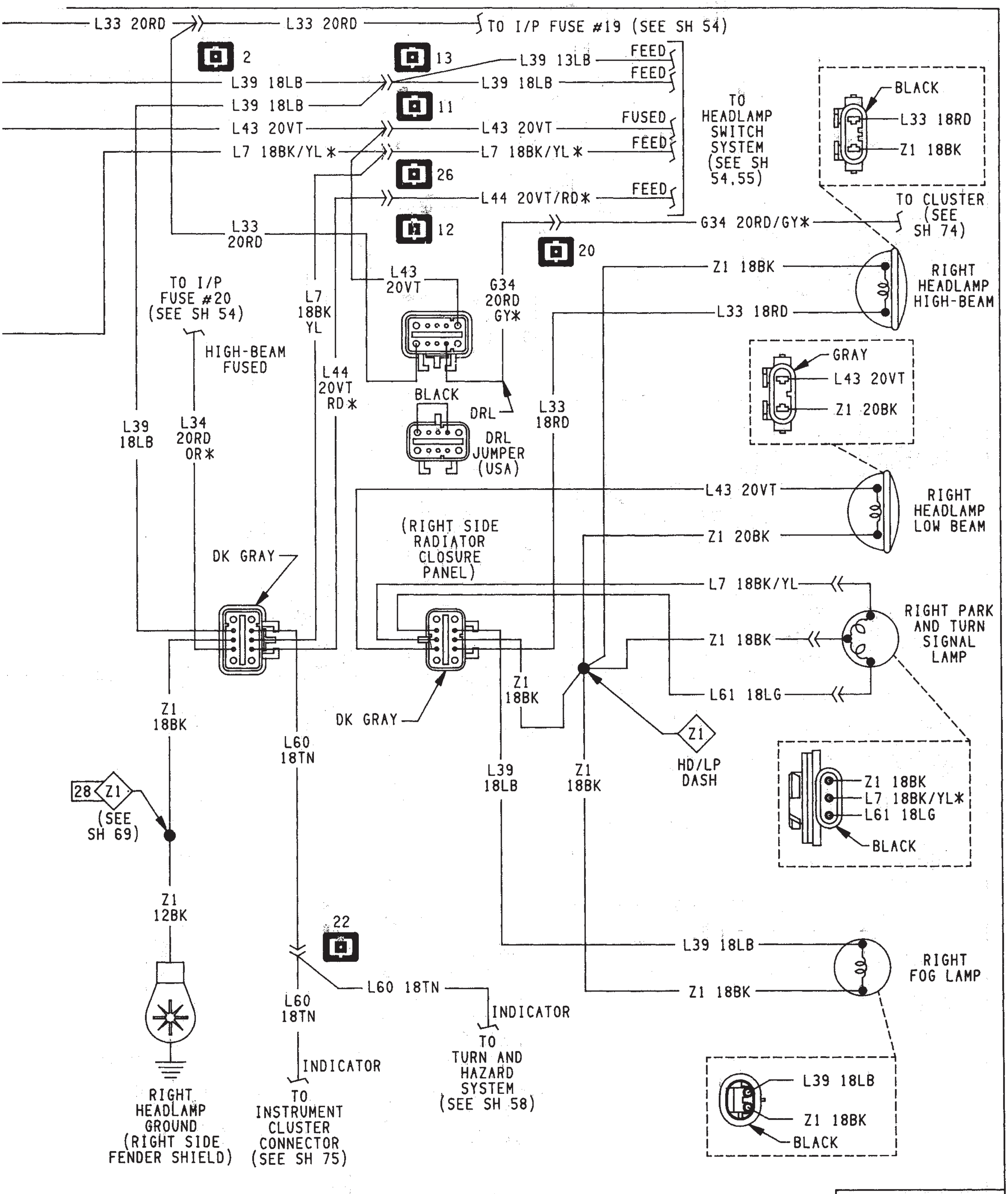
938W-5



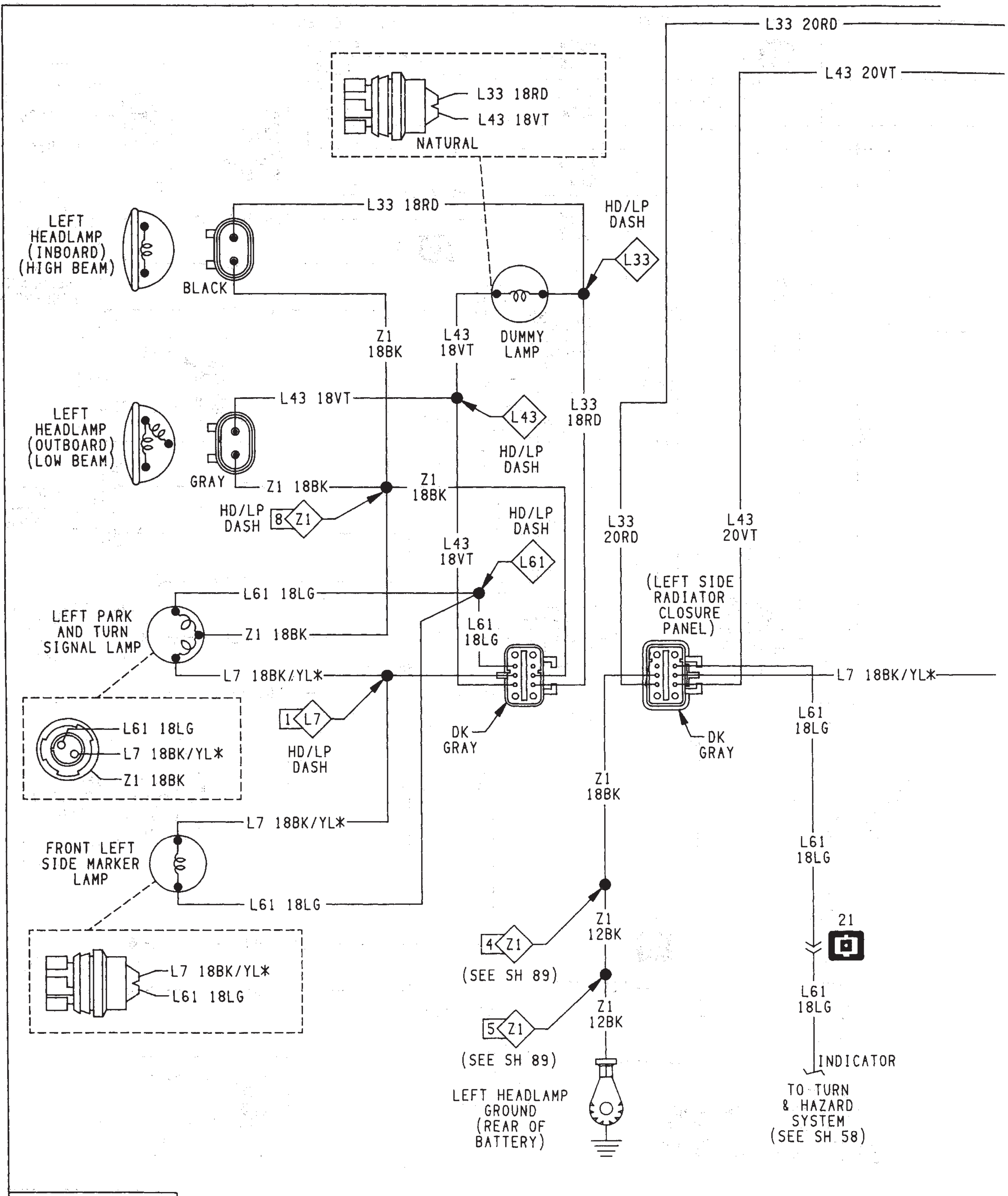
IGNITION SWITCH



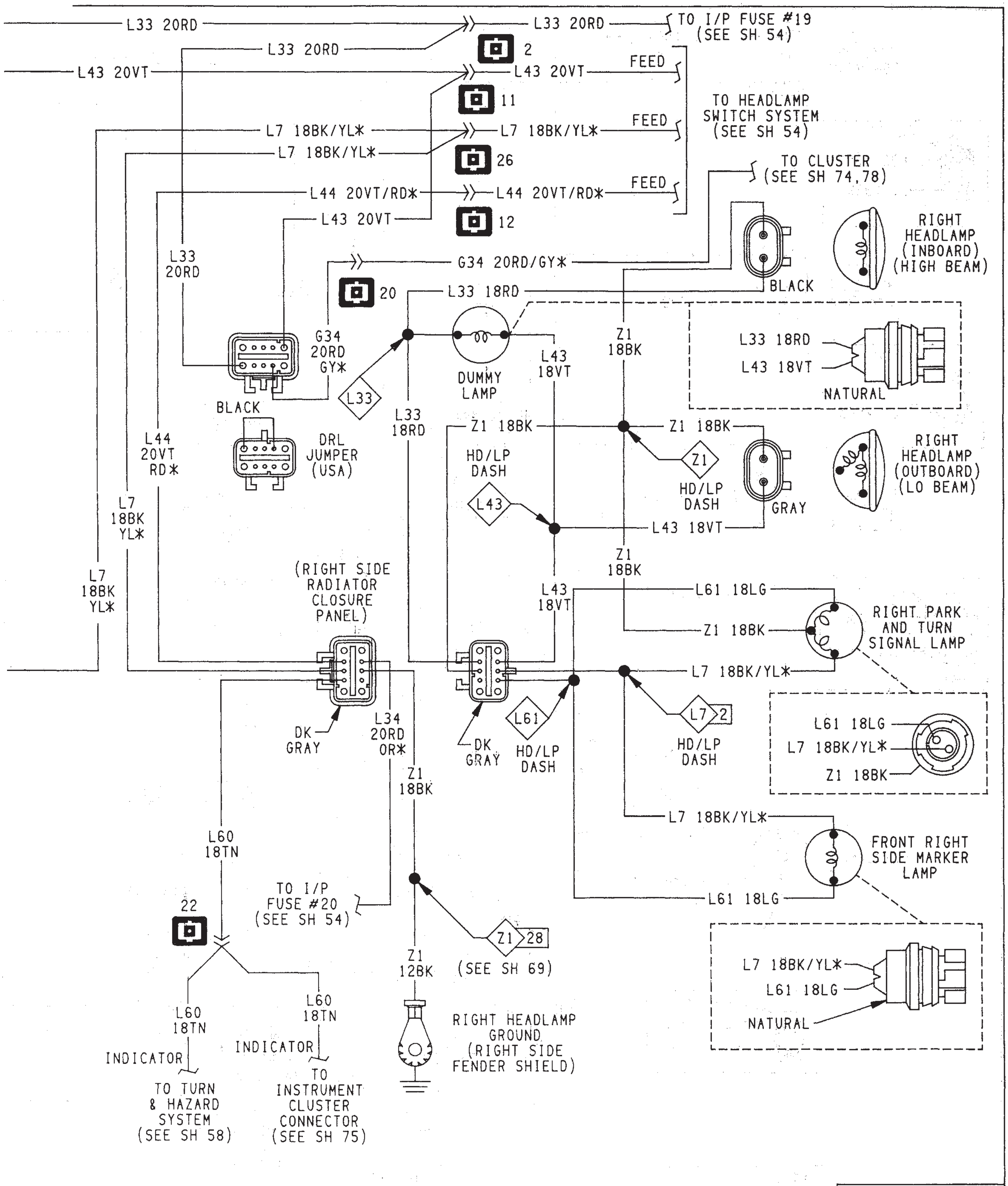
AG 43 FRONT END LIGHTING (G BODY ONLY) 938W-5



938W-5 FRONT END LIGHTING (G BODY ONLY)



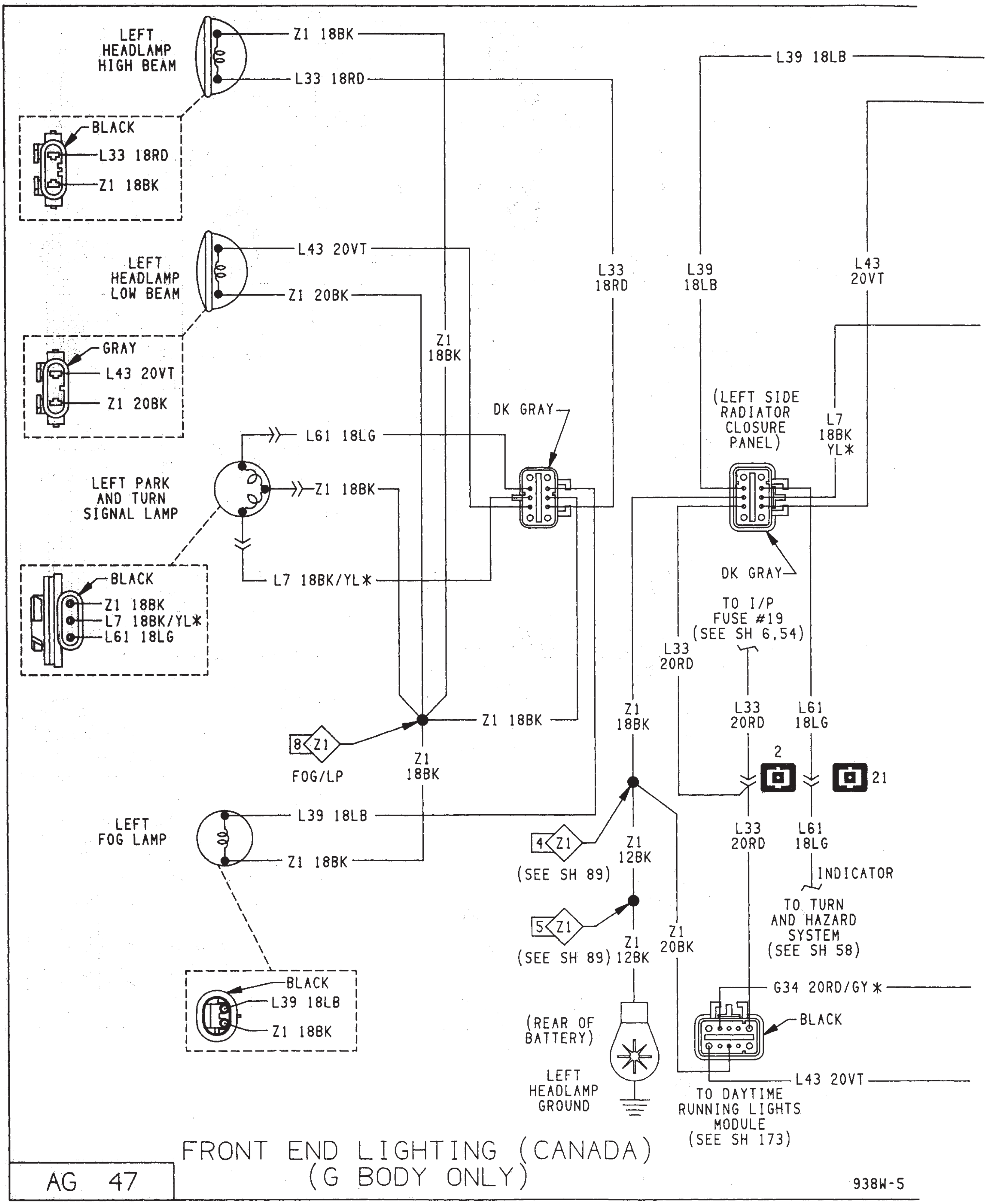
AJ 45 FRONT END LIGHTING (J BODY ONLY) 938W-5



938W-5

FRONT END LIGHTING (J BODY ONLY)

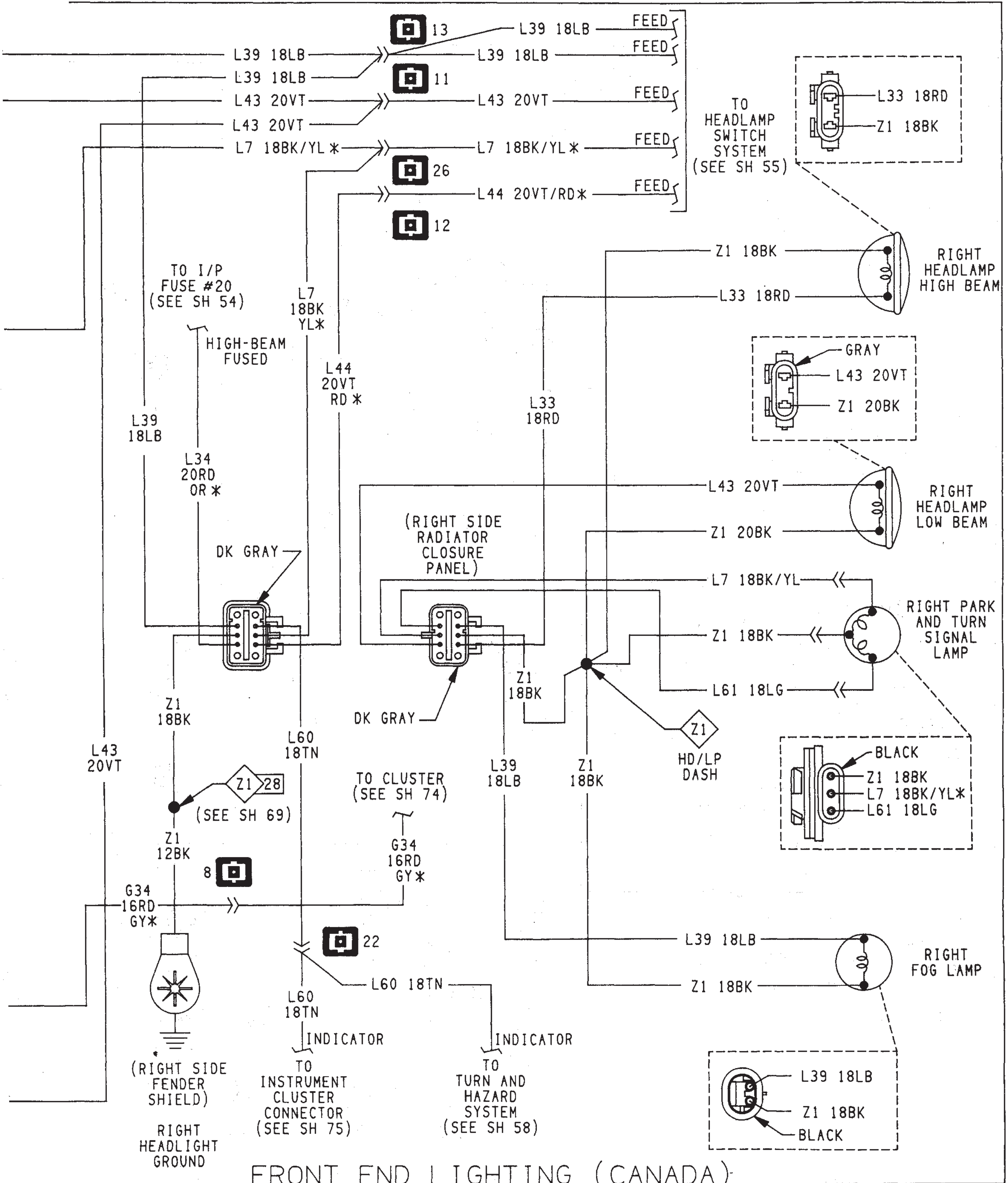
AJ 46



FRONT END LIGHTING (CANADA)
(G BODY ONLY)

AG 47

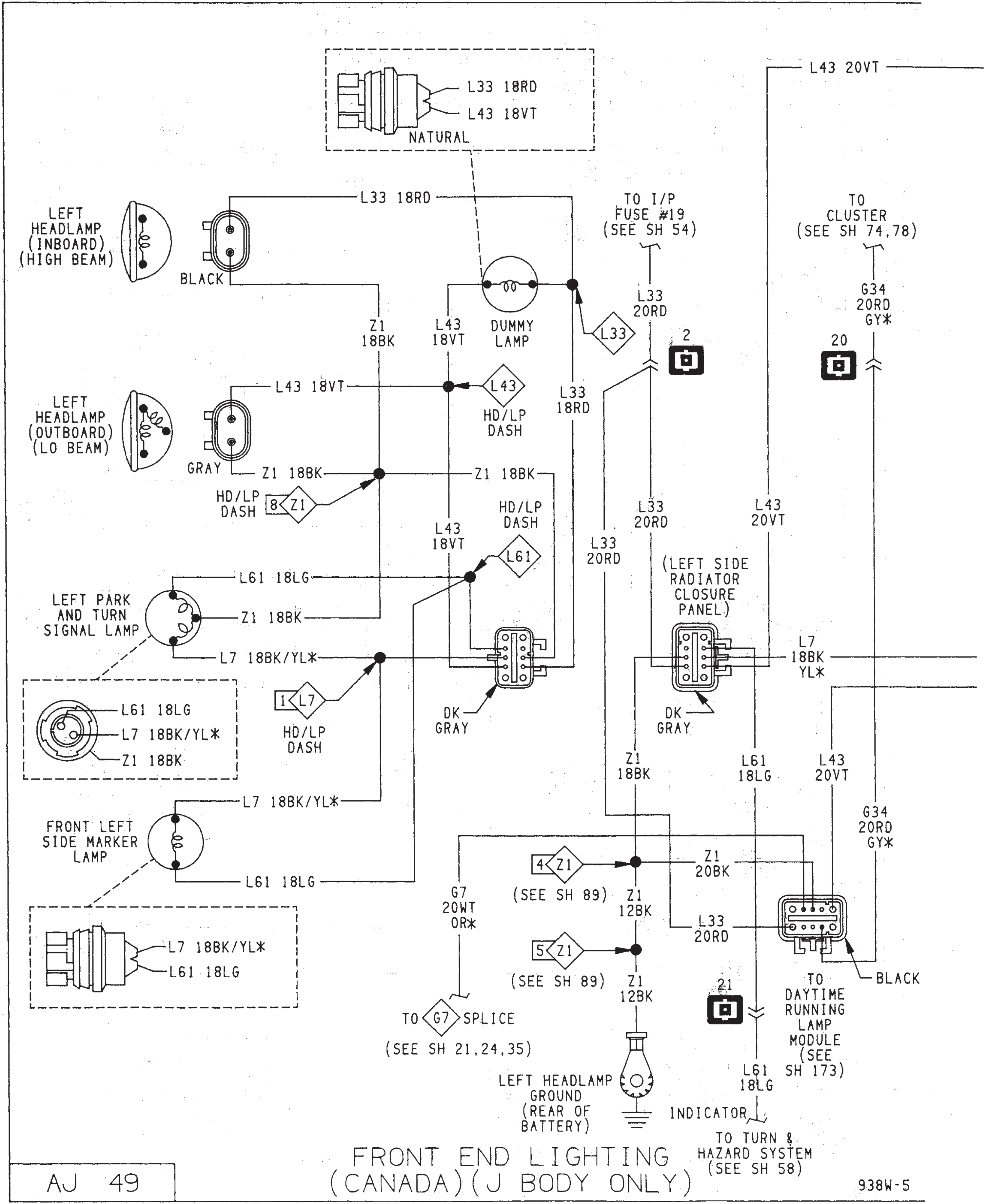
938W-5



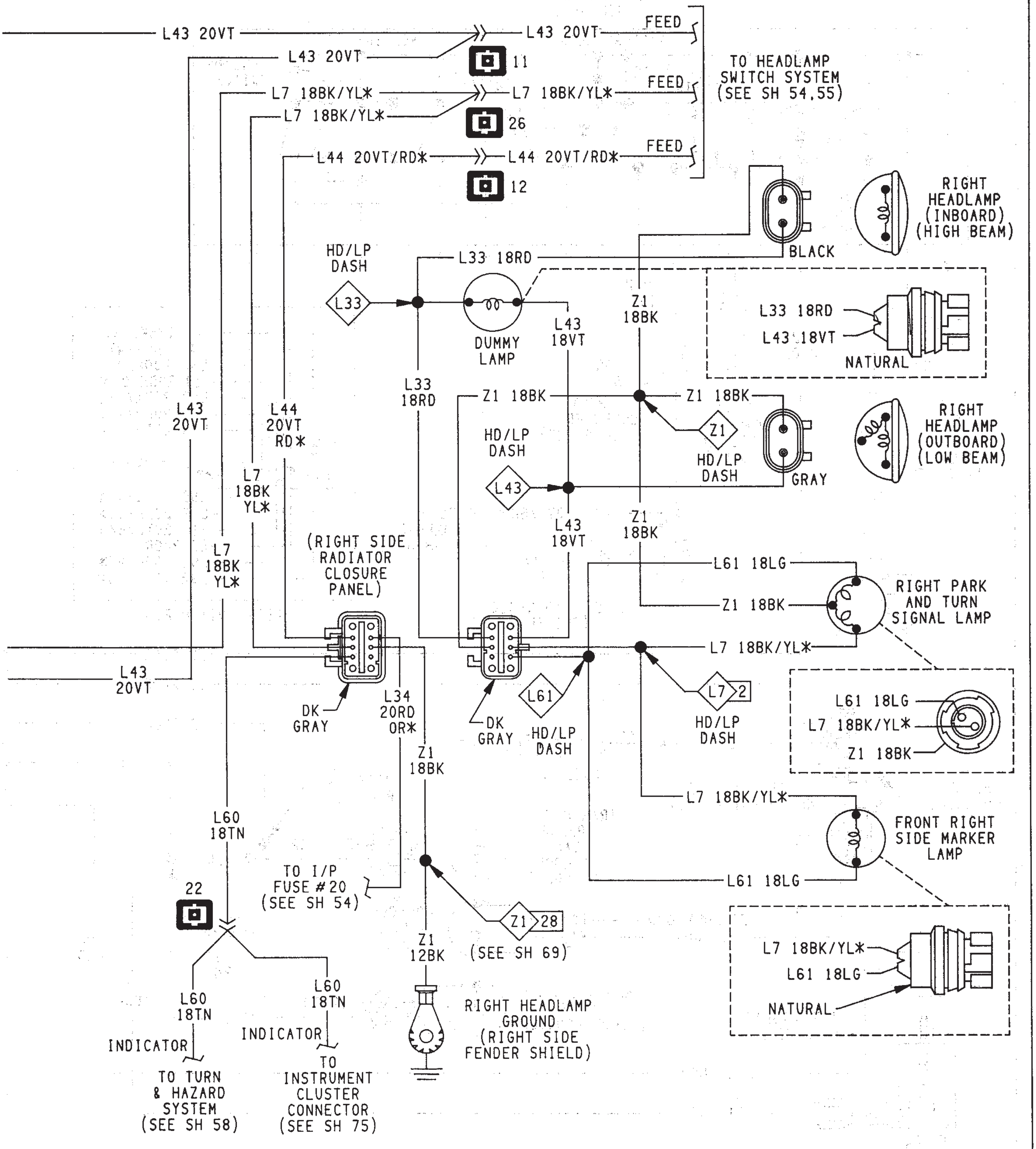
FRONT END LIGHTING (CANADA)
(G BODY ONLY)

938W-5

AG 48



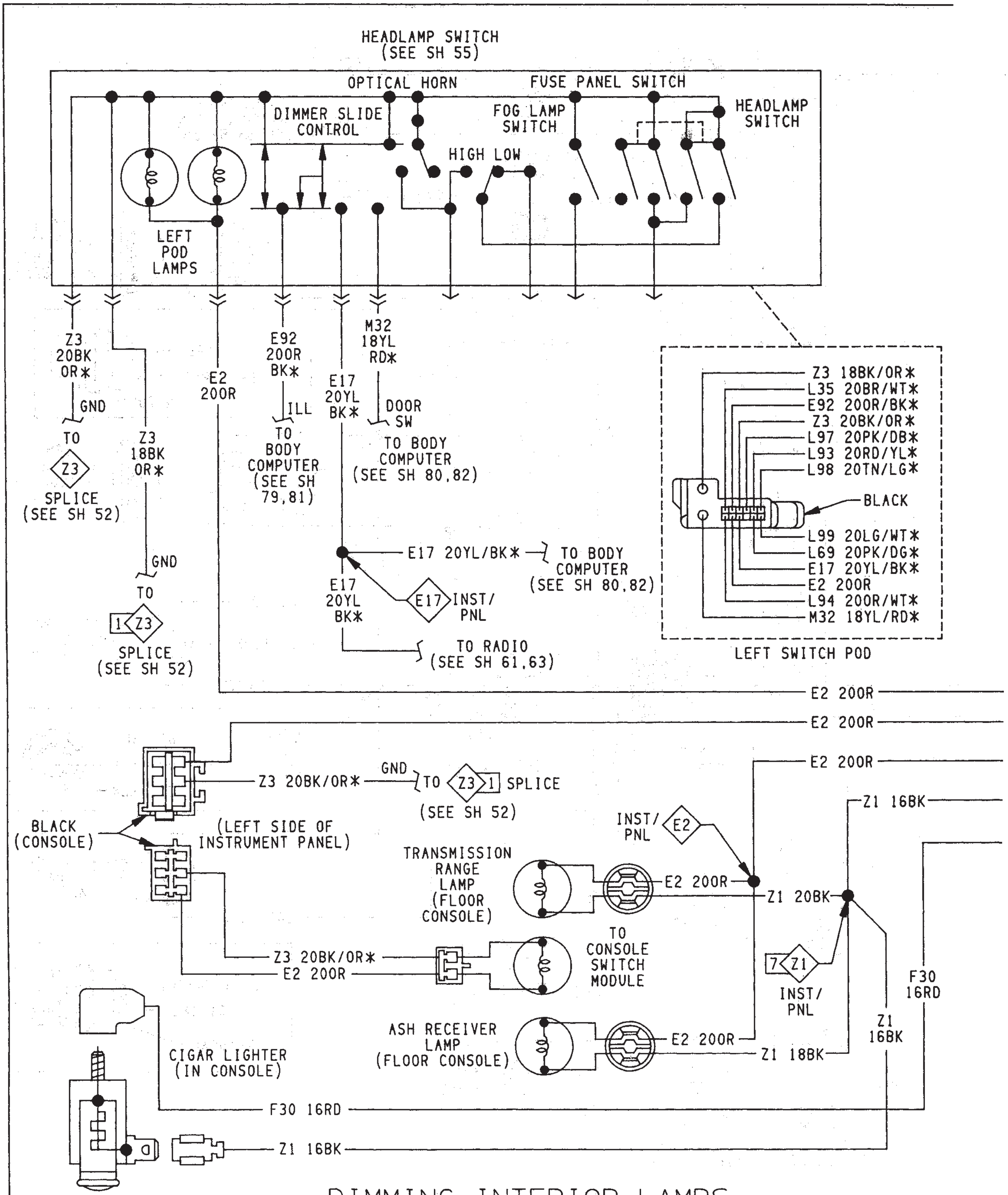
FRONT END LIGHTING
(CANADA) (J BODY ONLY)



938W-5

FRONT END LIGHTING
(CANADA)(J BODY ONLY)

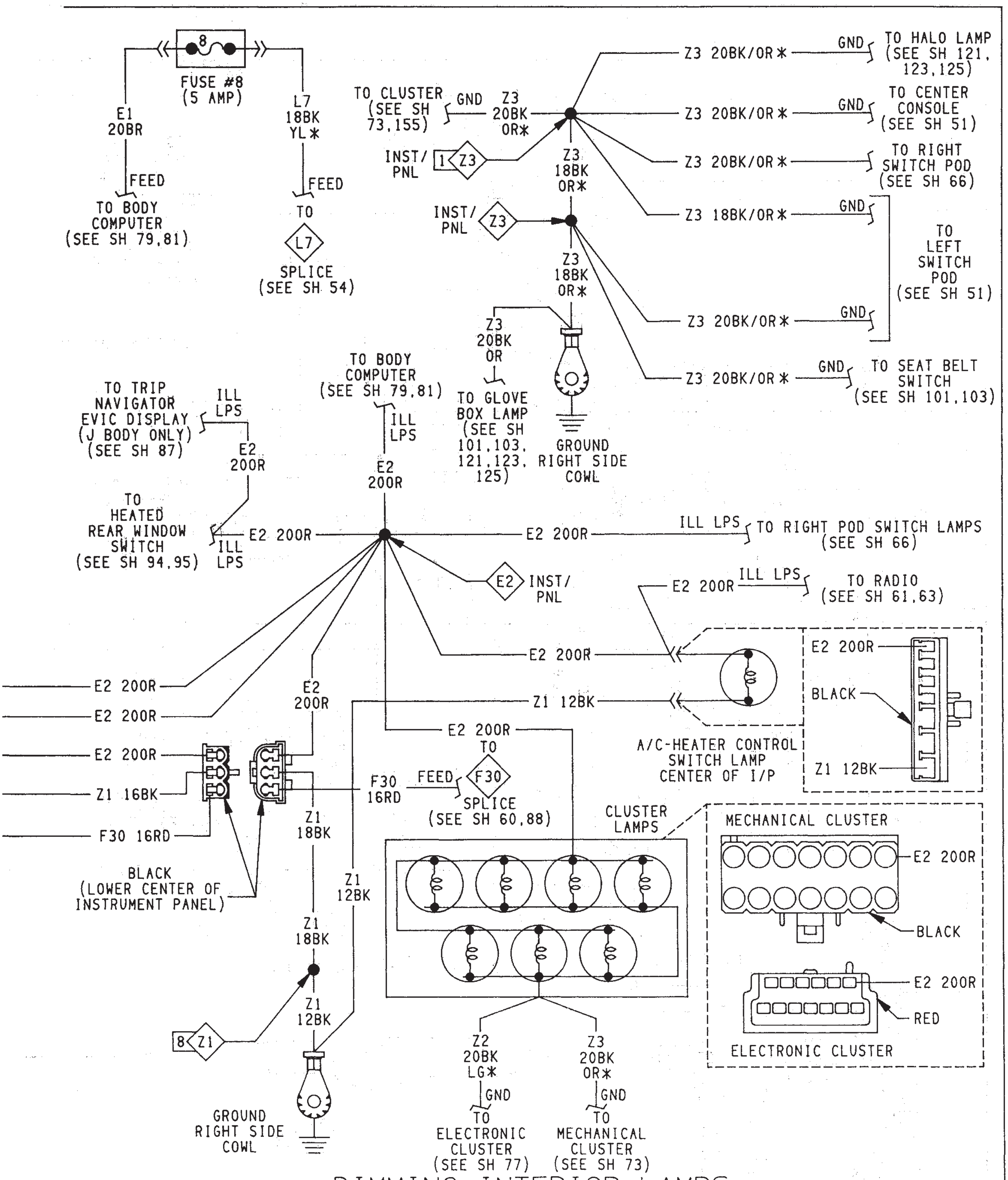
AJ 50



DIMMING INTERIOR LAMPS
AND HEADLAMP SWITCH

AG-AJ 51

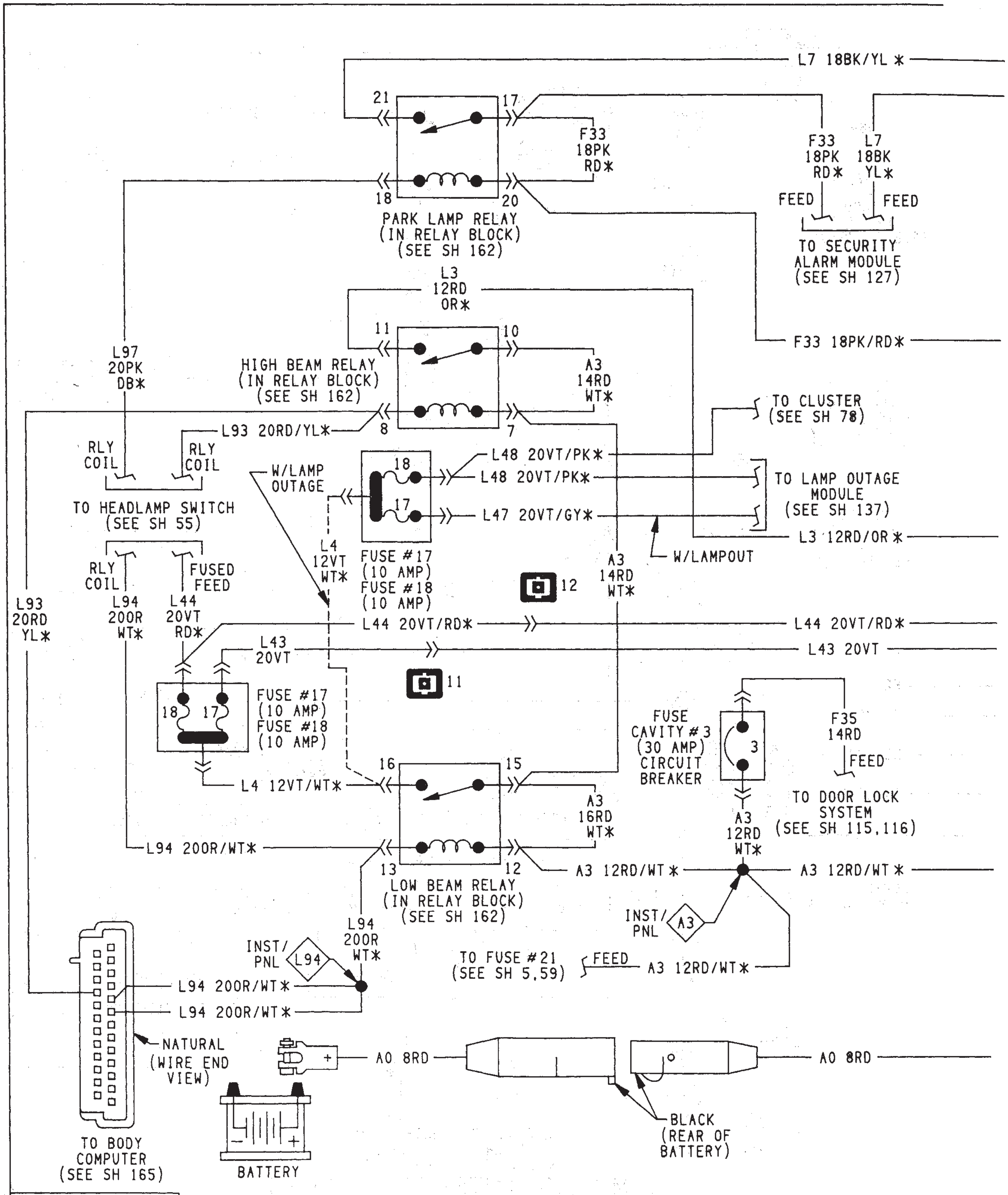
938W-5



DIMMING INTERIOR LAMPS
AND HEADLAMP SWITCH

938W-5

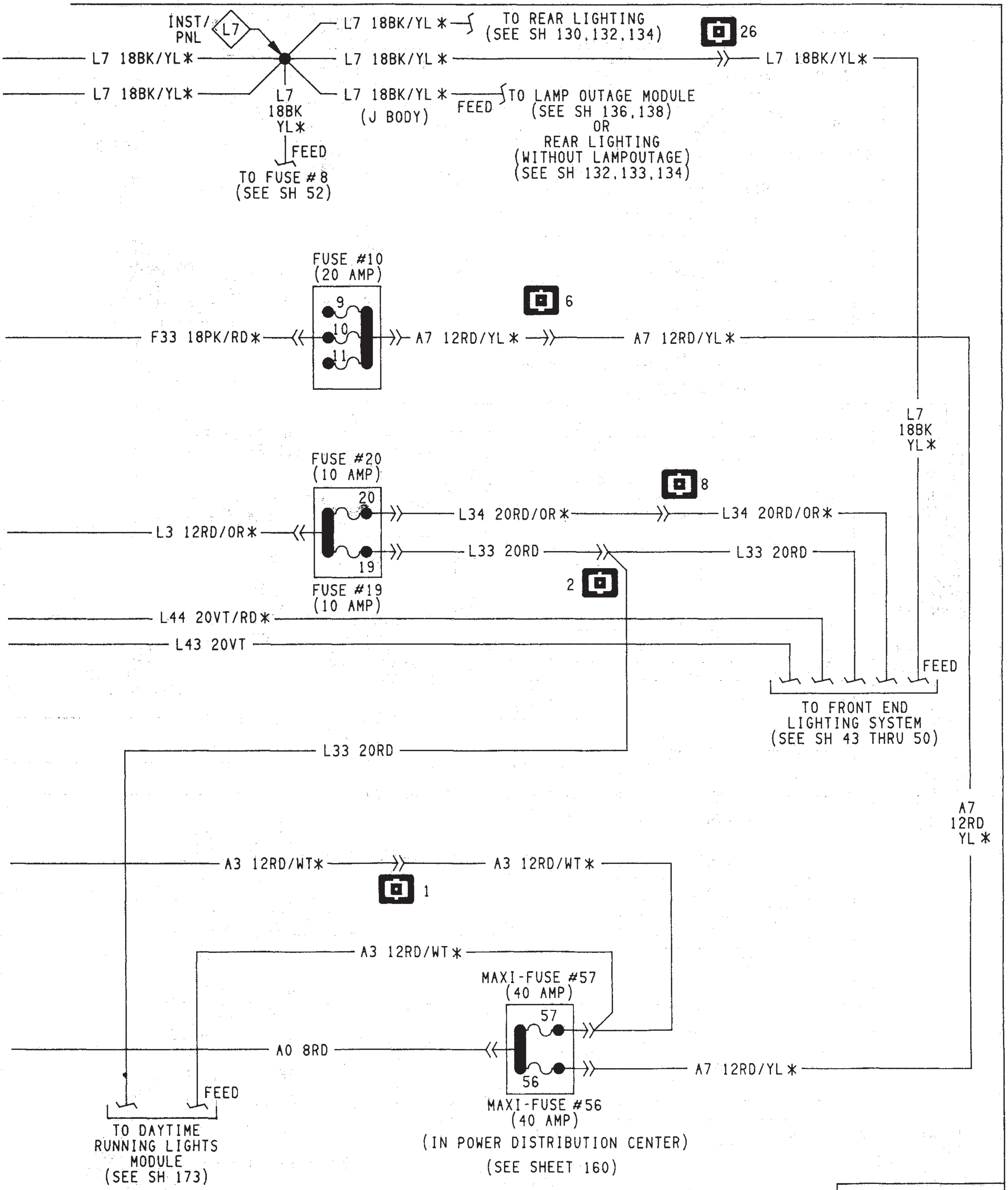
AG-AJ 52



AG-AJ 53

HEADLAMP SWITCH SYSTEM

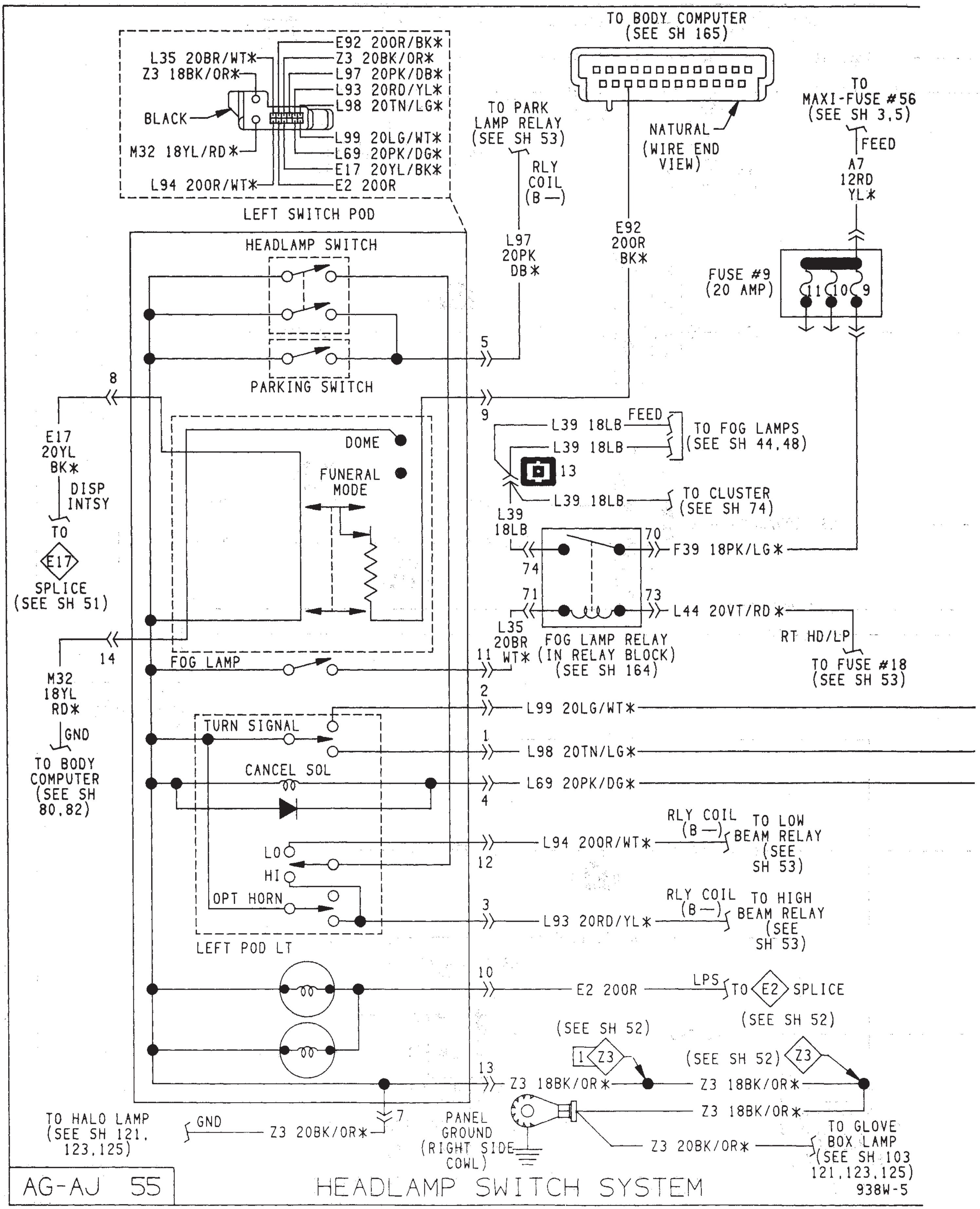
938W-5



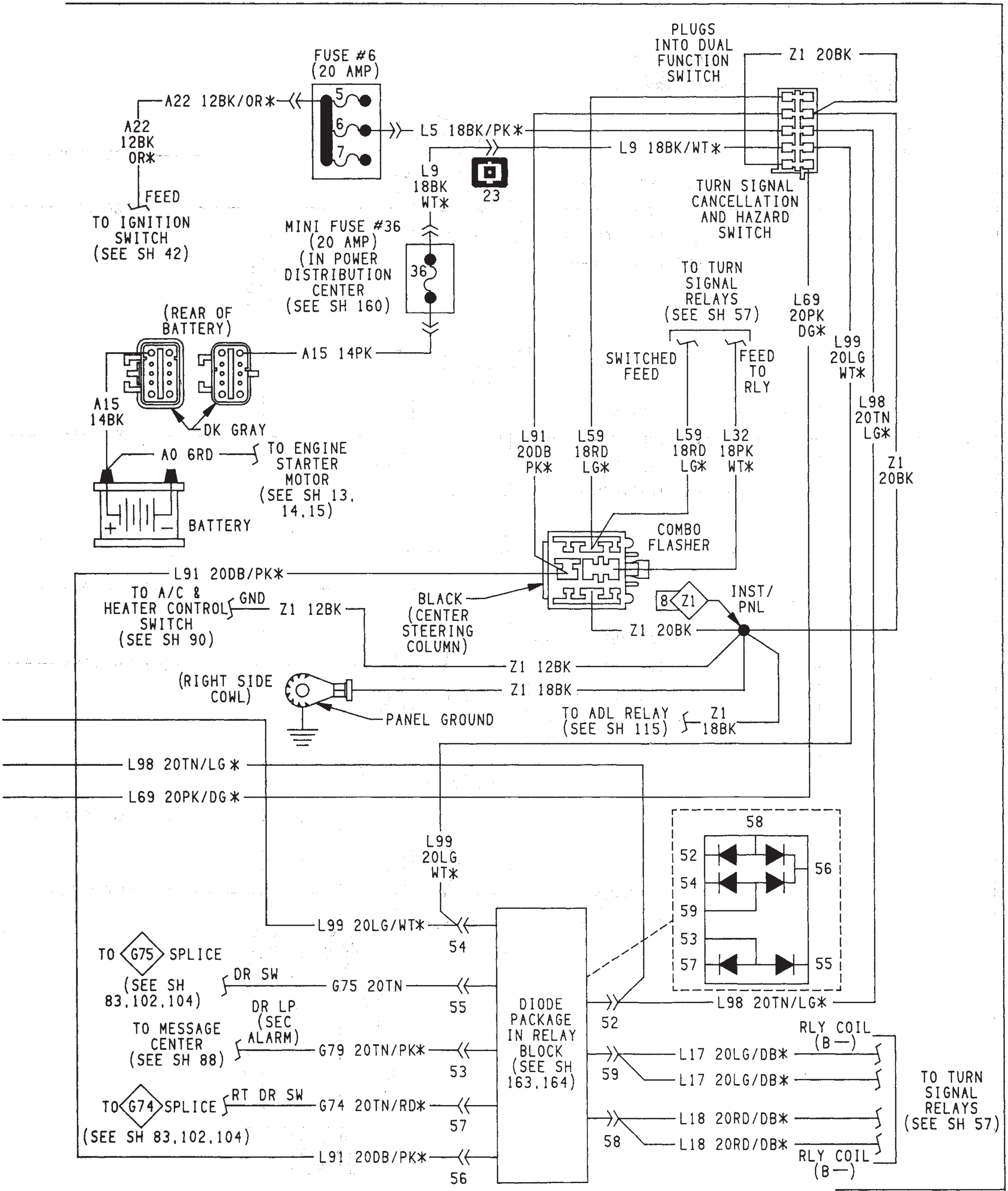
938W-5

HEADLAMP SWITCH SYSTEM

AG-AJ 54



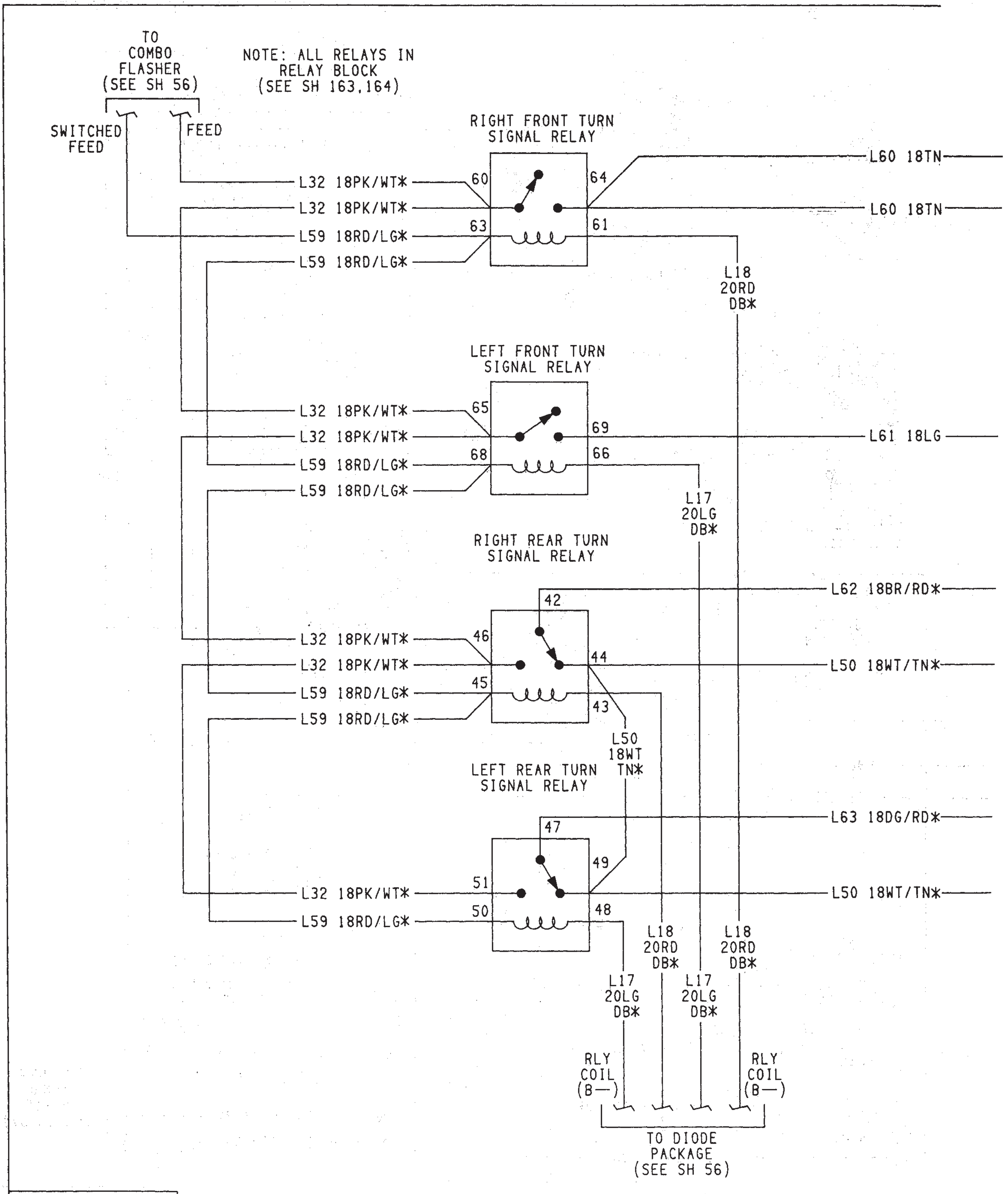
HEADLAMP SWITCH SYSTEM



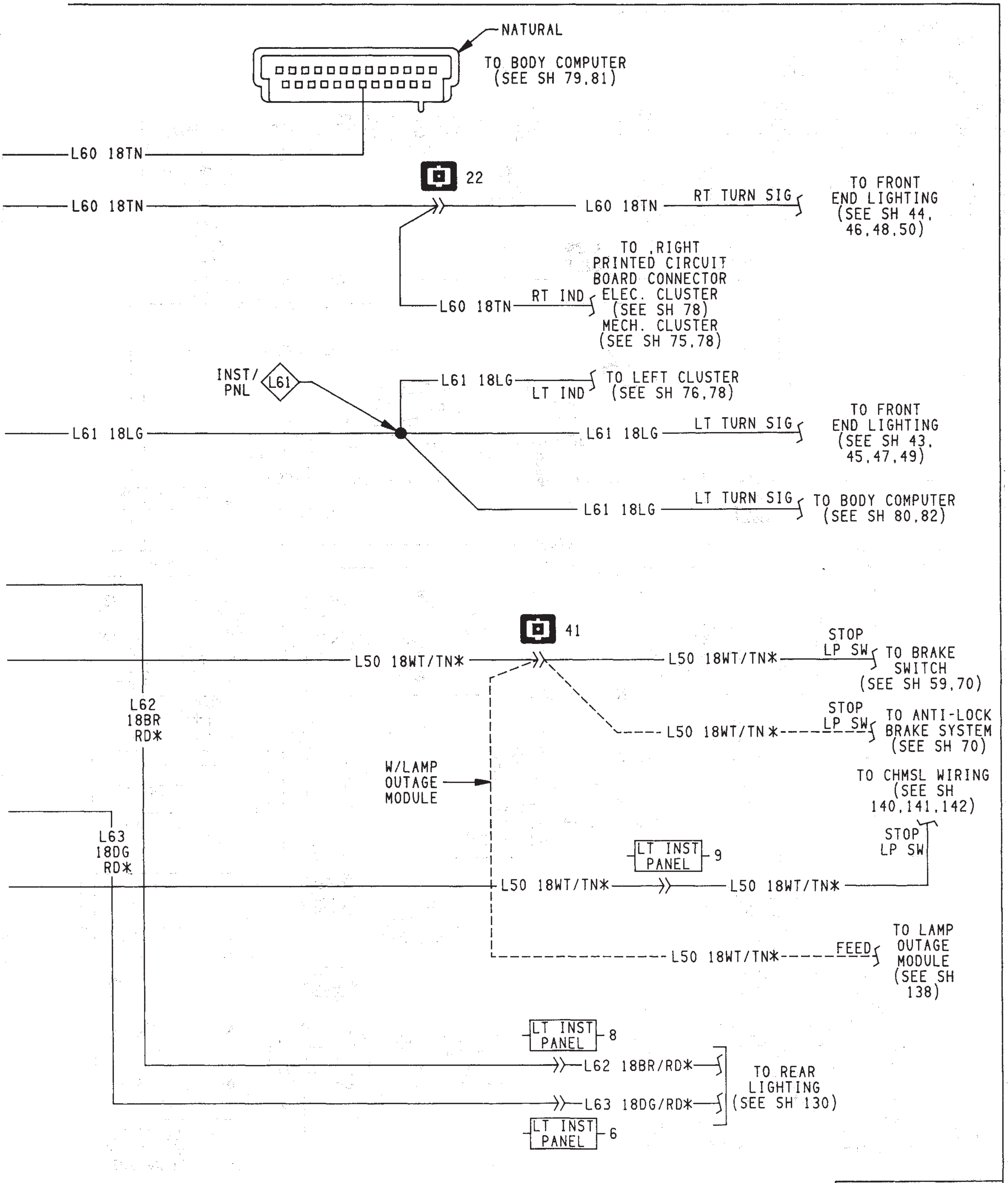
938W-5

TURN AND HAZARD FLASHER SYSTEMS

AG-AJ 56



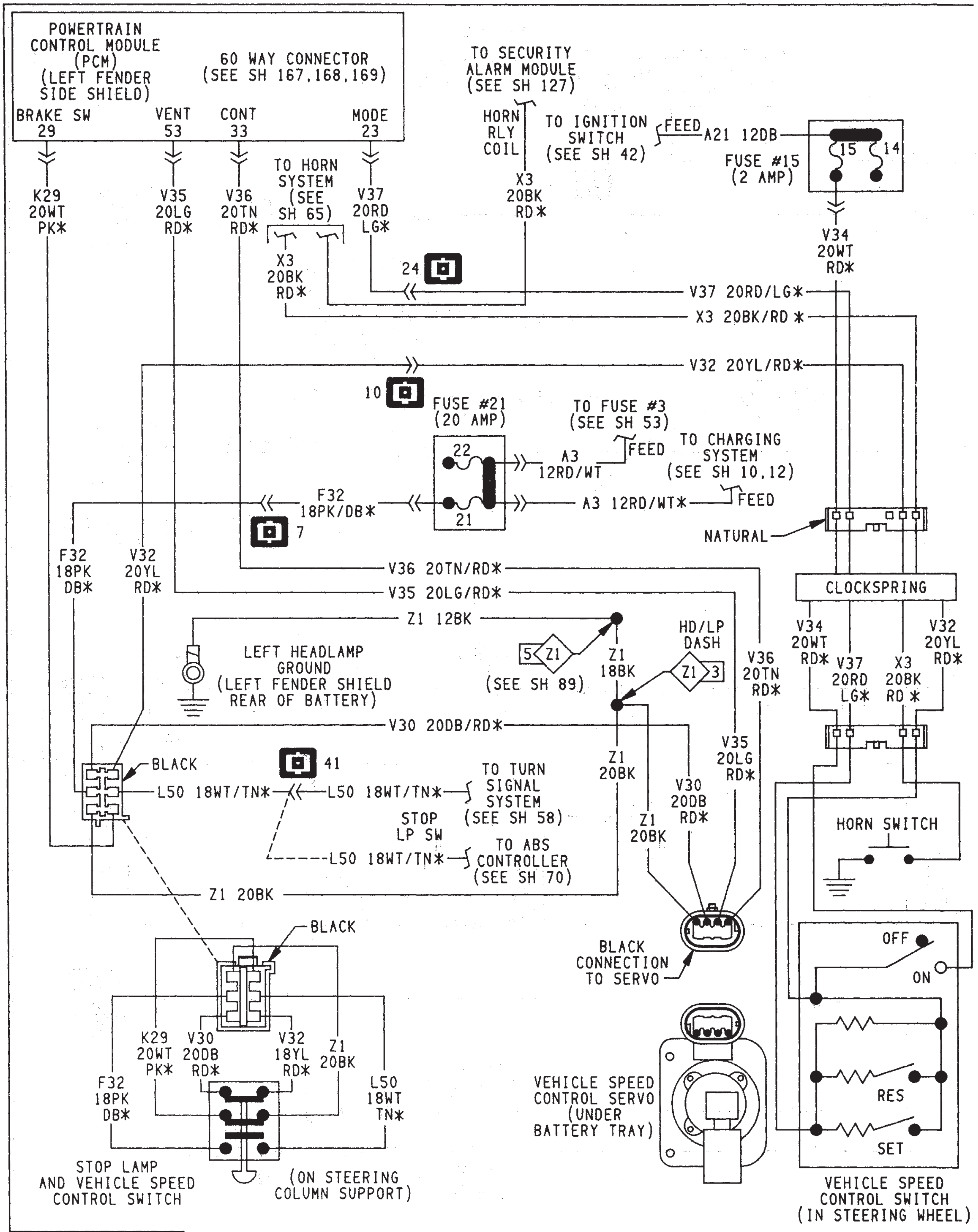
AG-AJ 57 TURN AND HAZARD FLASHER SYSTEMS 938W-5



938W-5

TURN AND HAZARD FLASHER SYSTEMS

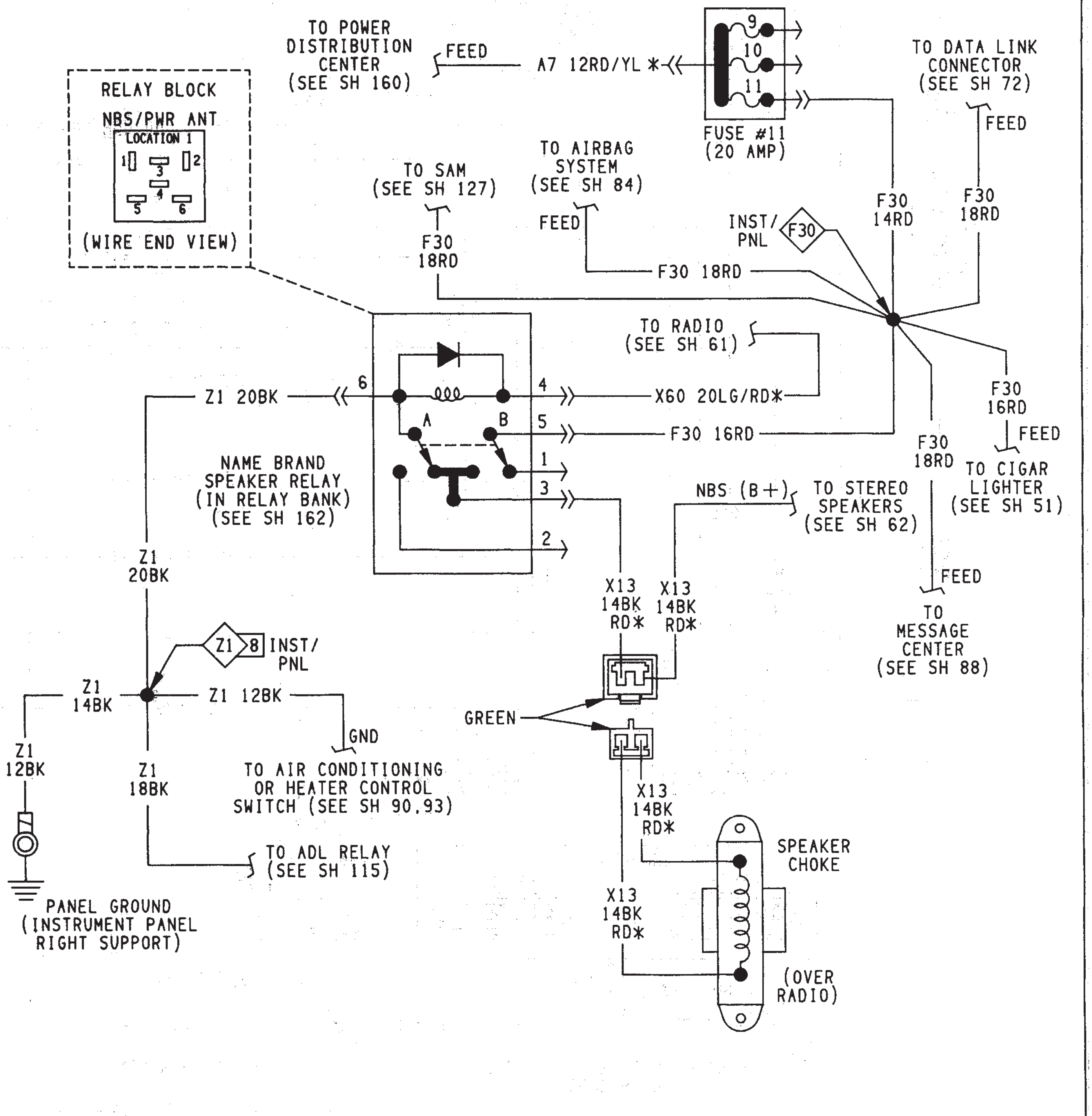
AG-AJ 58



AG-AJ 59

VEHICLE SPEED CONTROL SYSTEM

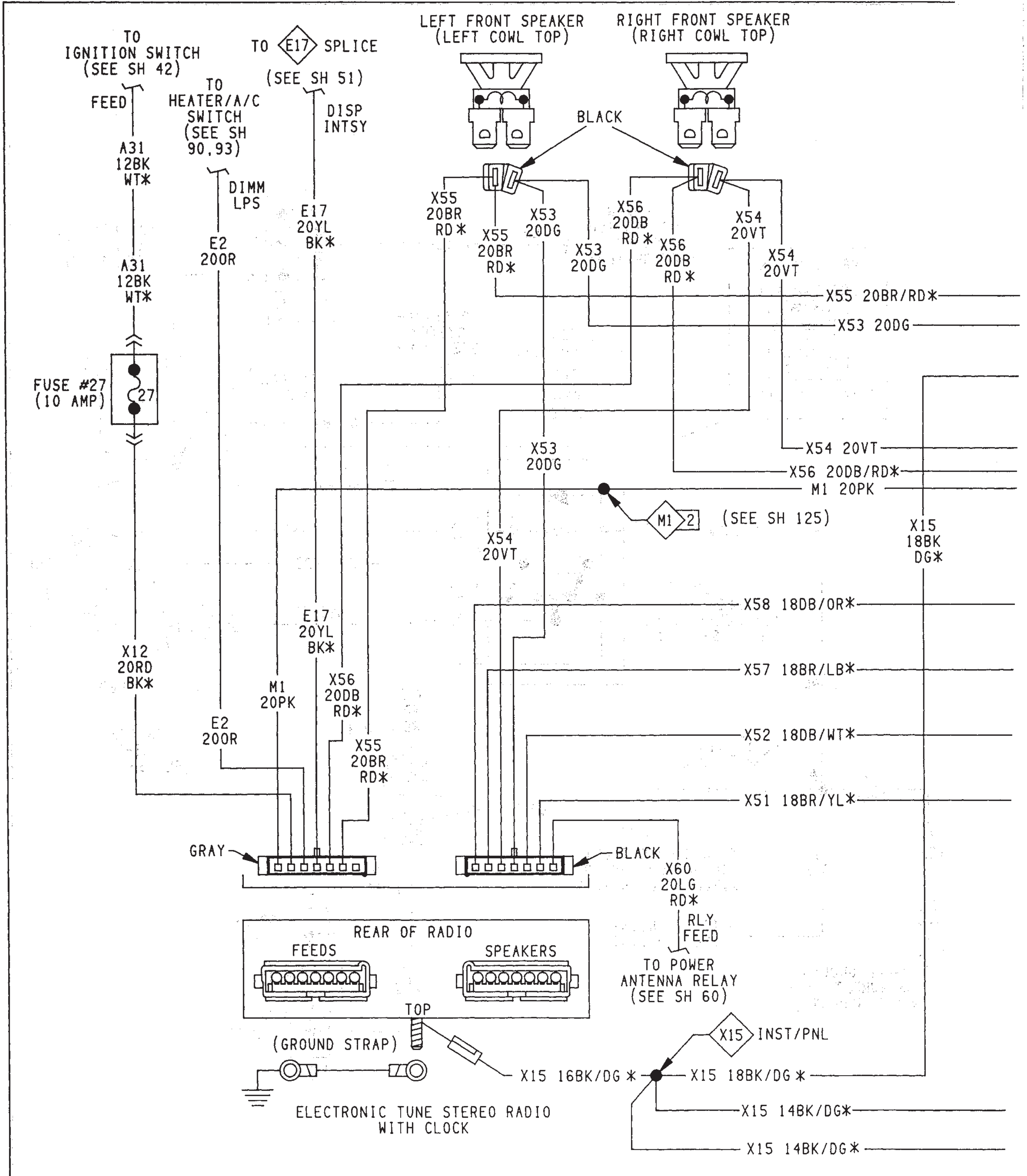
938W-5



NAME BRAND SPEAKER RELAY SYSTEM

938W-5

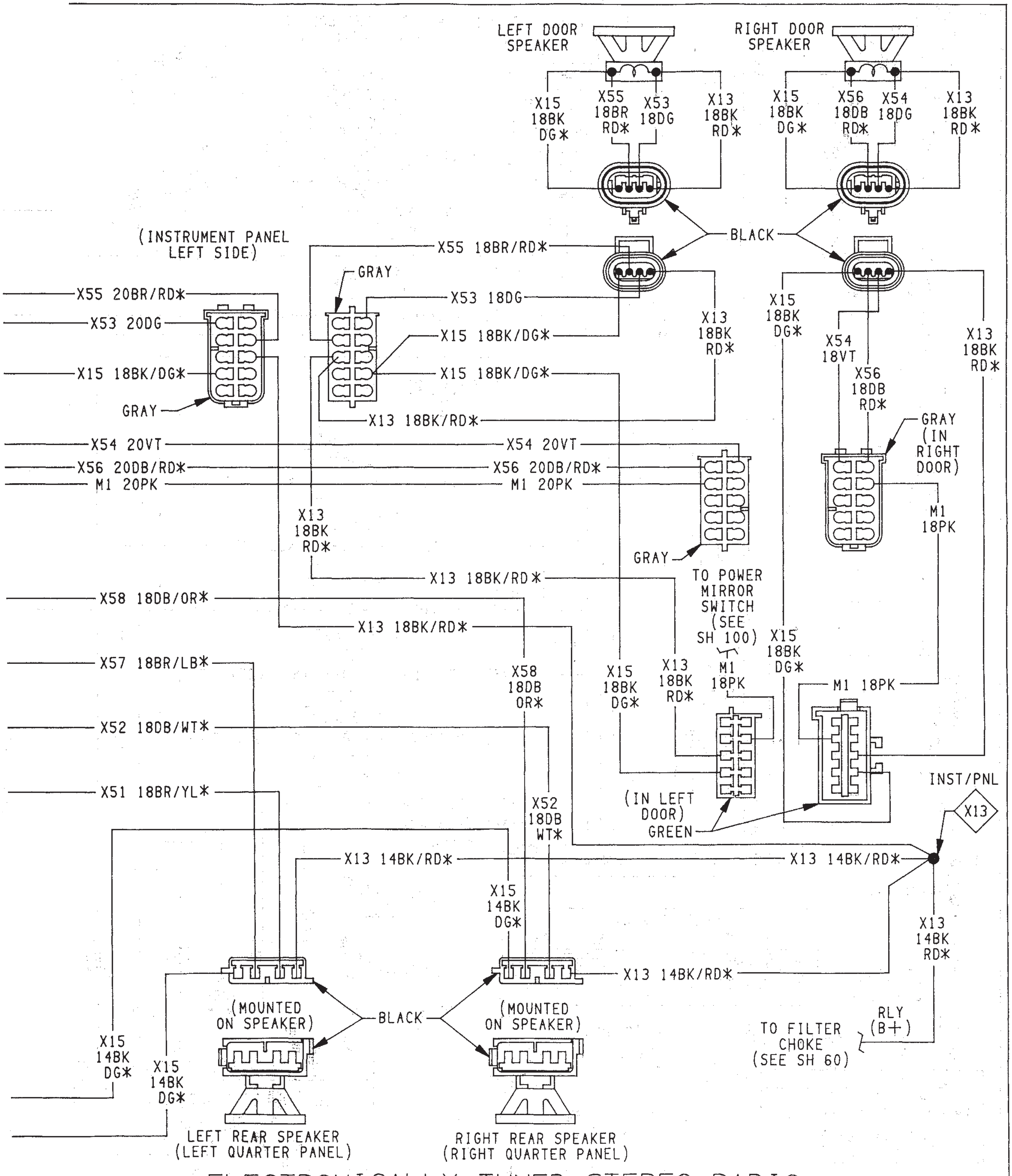
AG 60



ELECTRONICALLY TUNED STEREO RADIO
WITH NAME BRAND SPEAKERS

AG 61

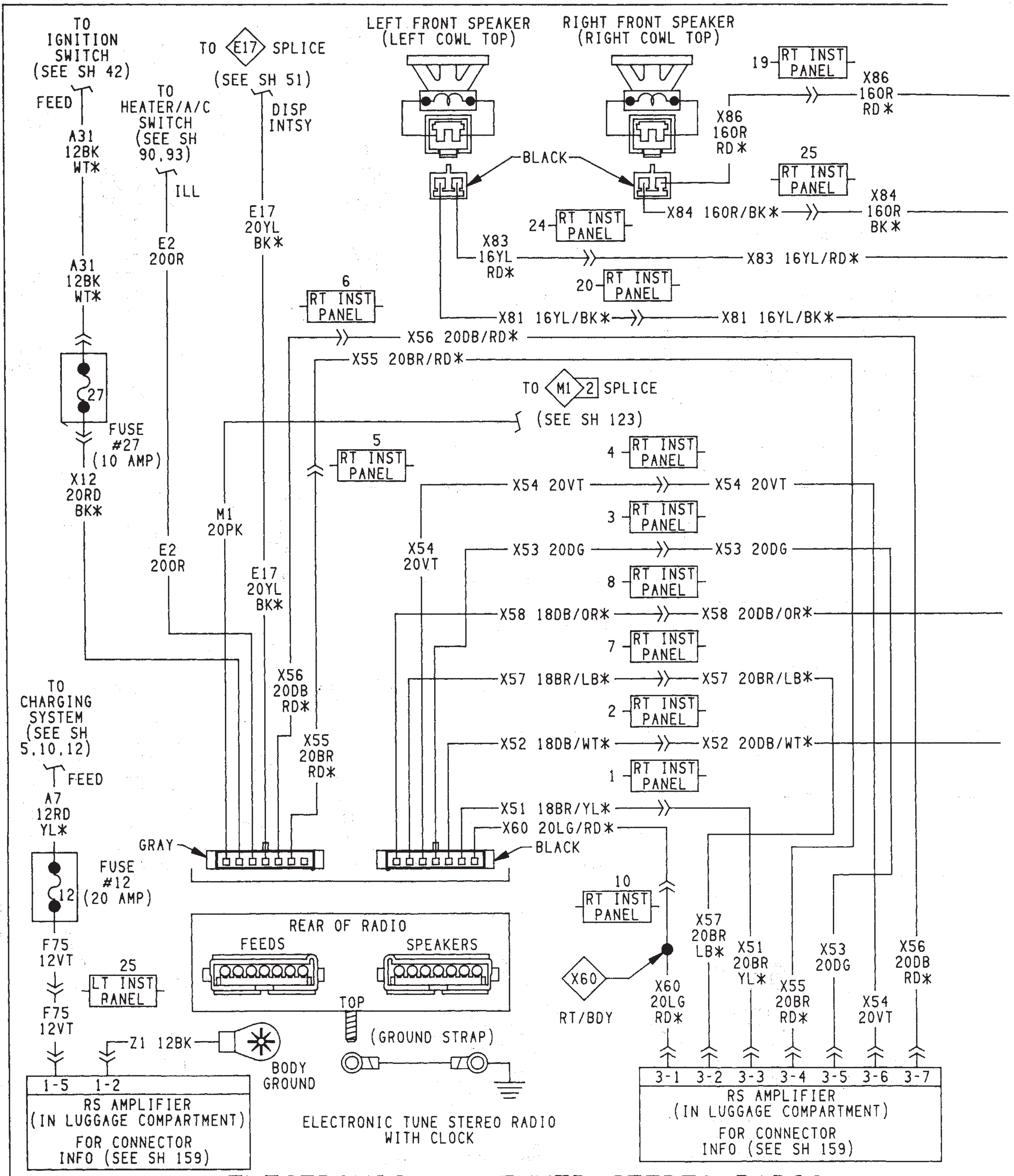
938W-5



ELECTRONICALLY TUNED STEREO RADIO
WITH NAME BRAND SPEAKERS

938W-5

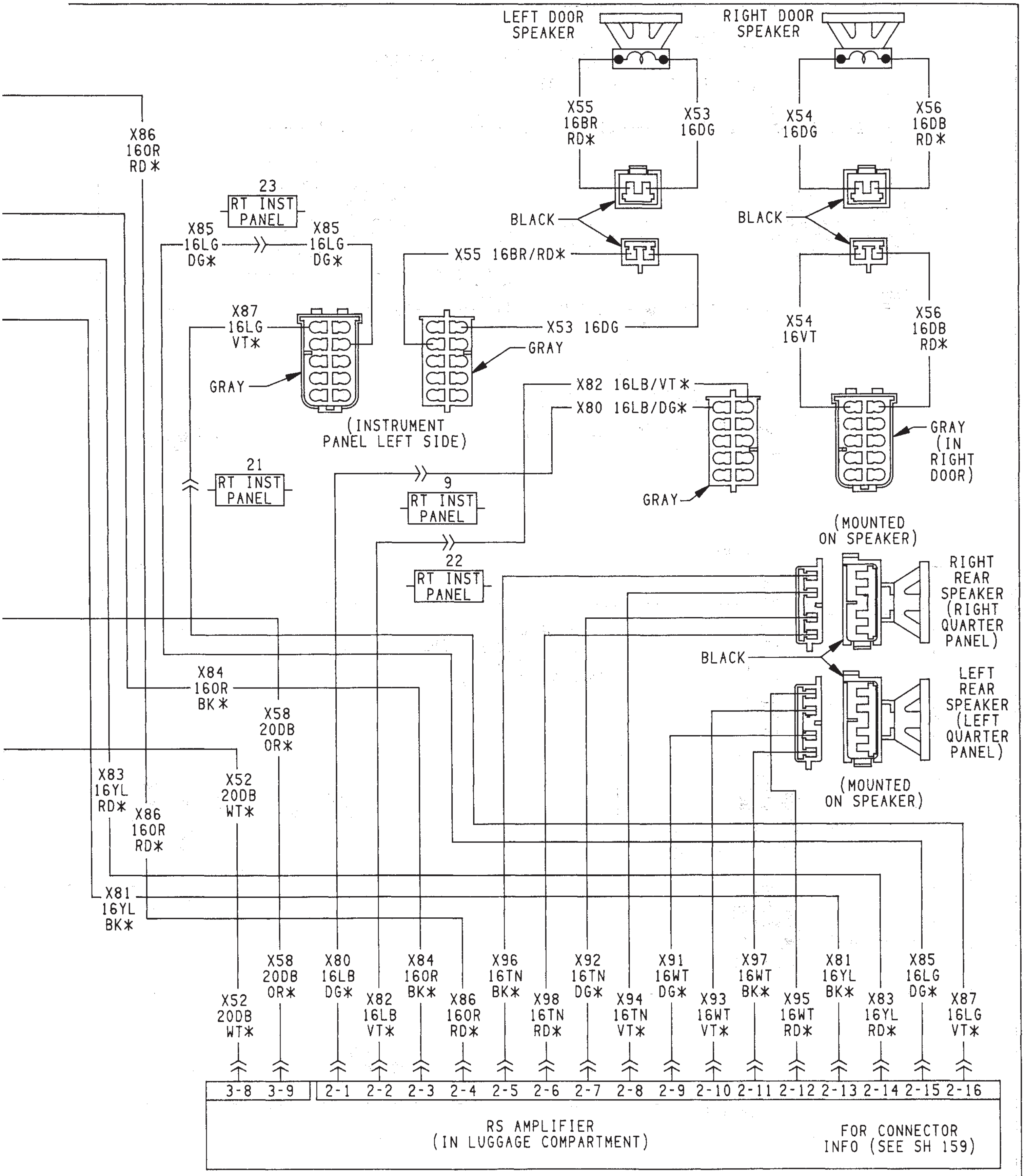
AG 62



ELECTRONICALLY TUNED STEREO RADIO
WITH RS SYSTEM

AJ 63

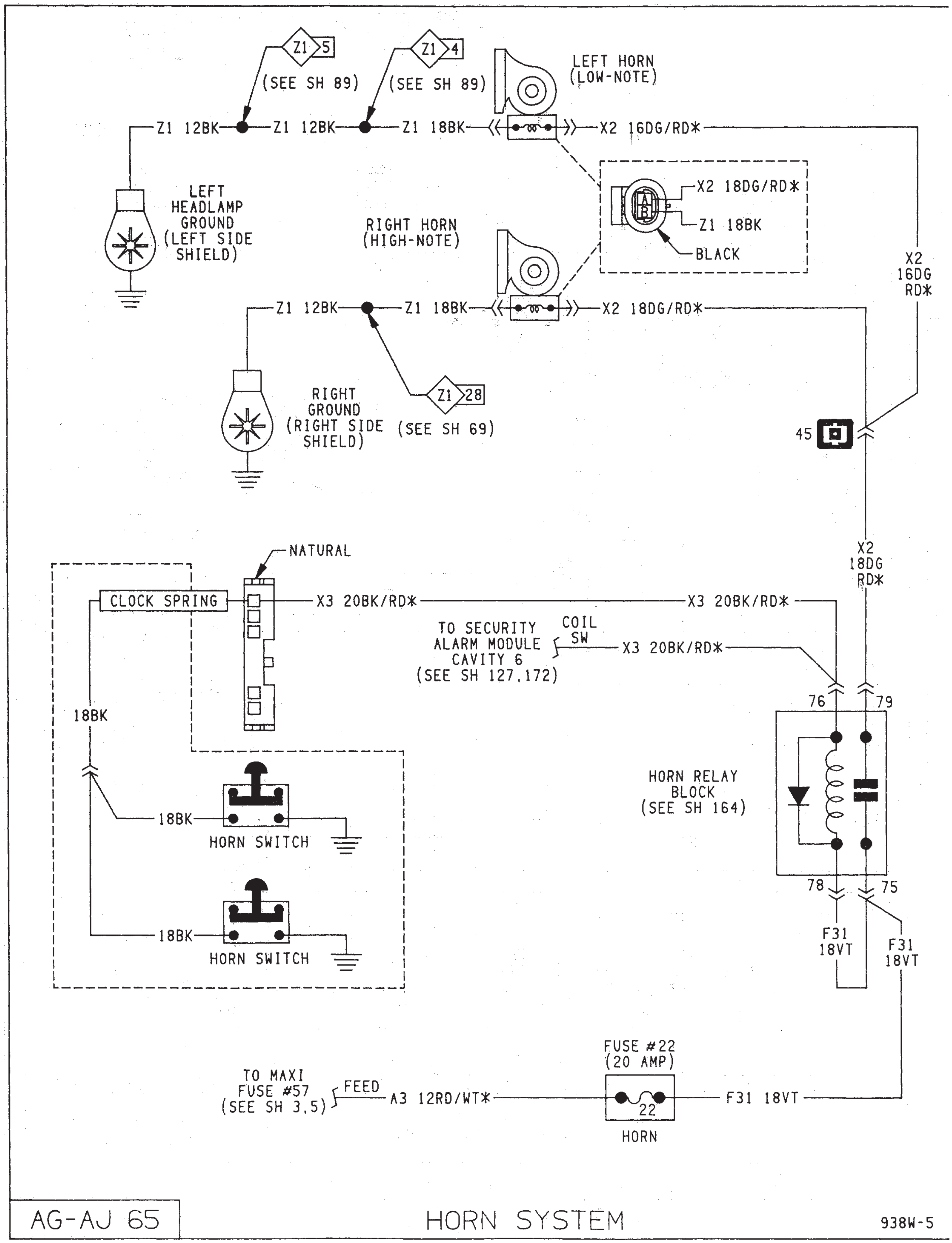
938W-5



ELECTRONICALLY TUNED STEREO RADIO
WITH RS SYSTEM

938W-5

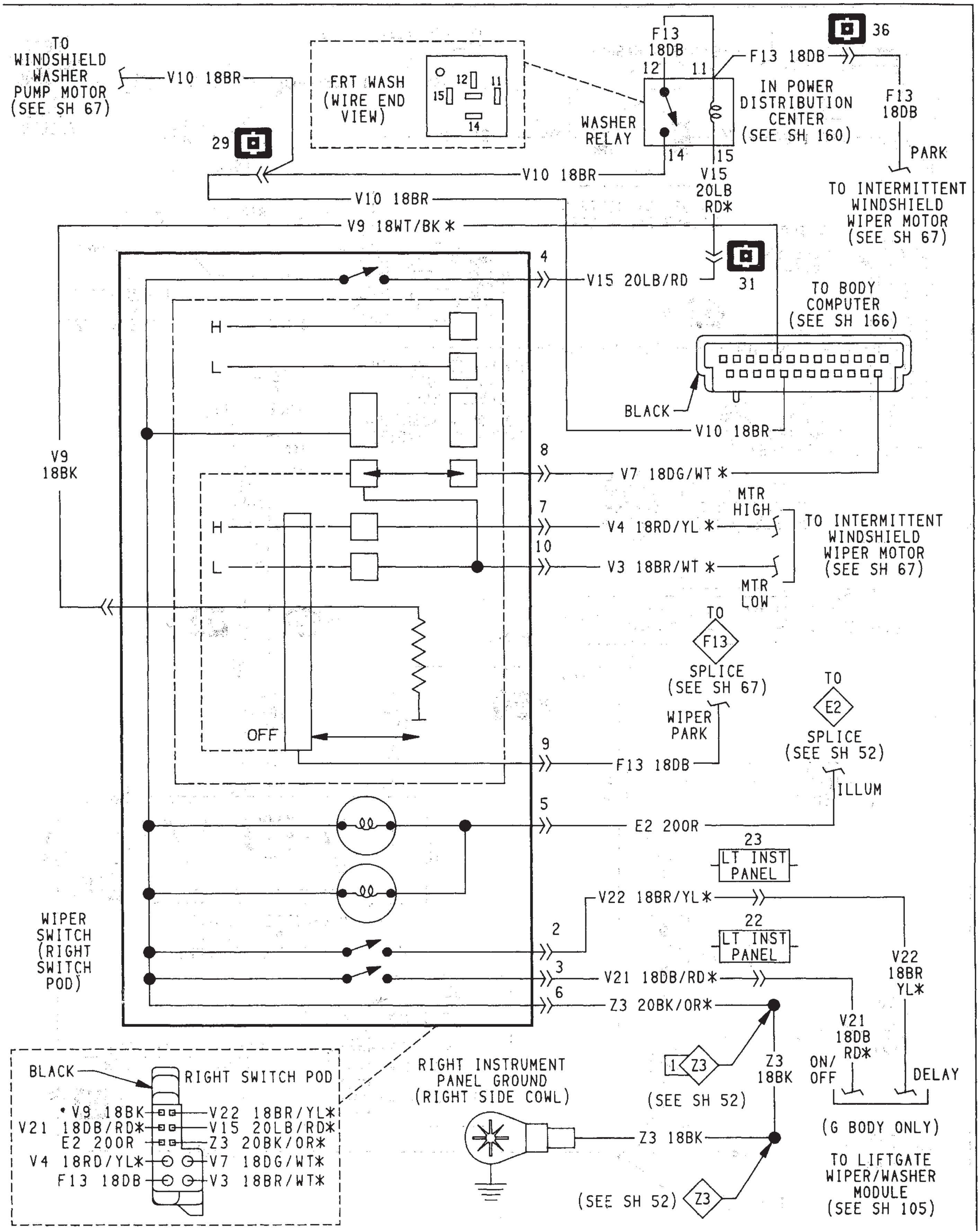
AJ 64



AG-AJ 65

HORN SYSTEM

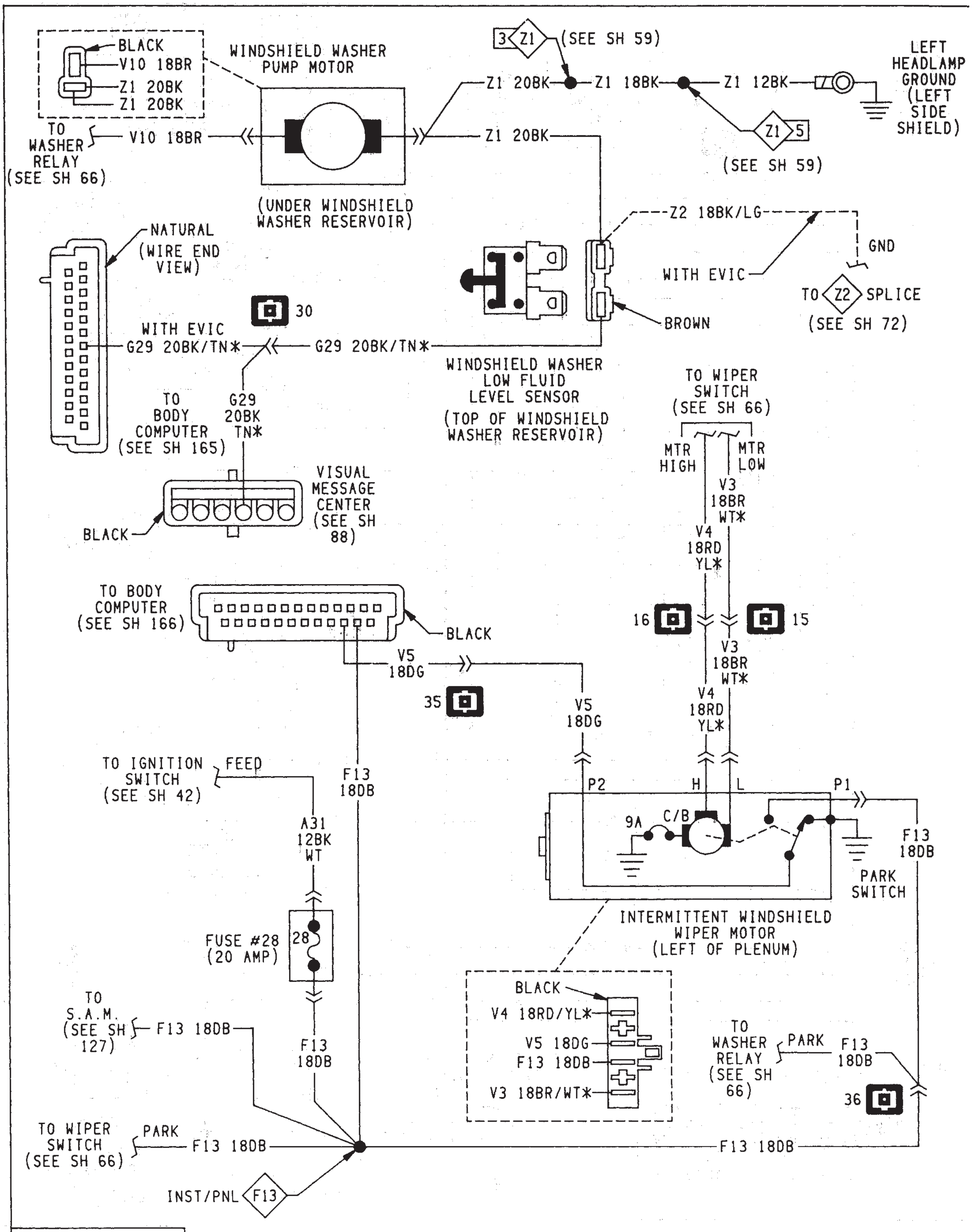
938W-5



938W-5

INTERMITTENT WIPER SYSTEM

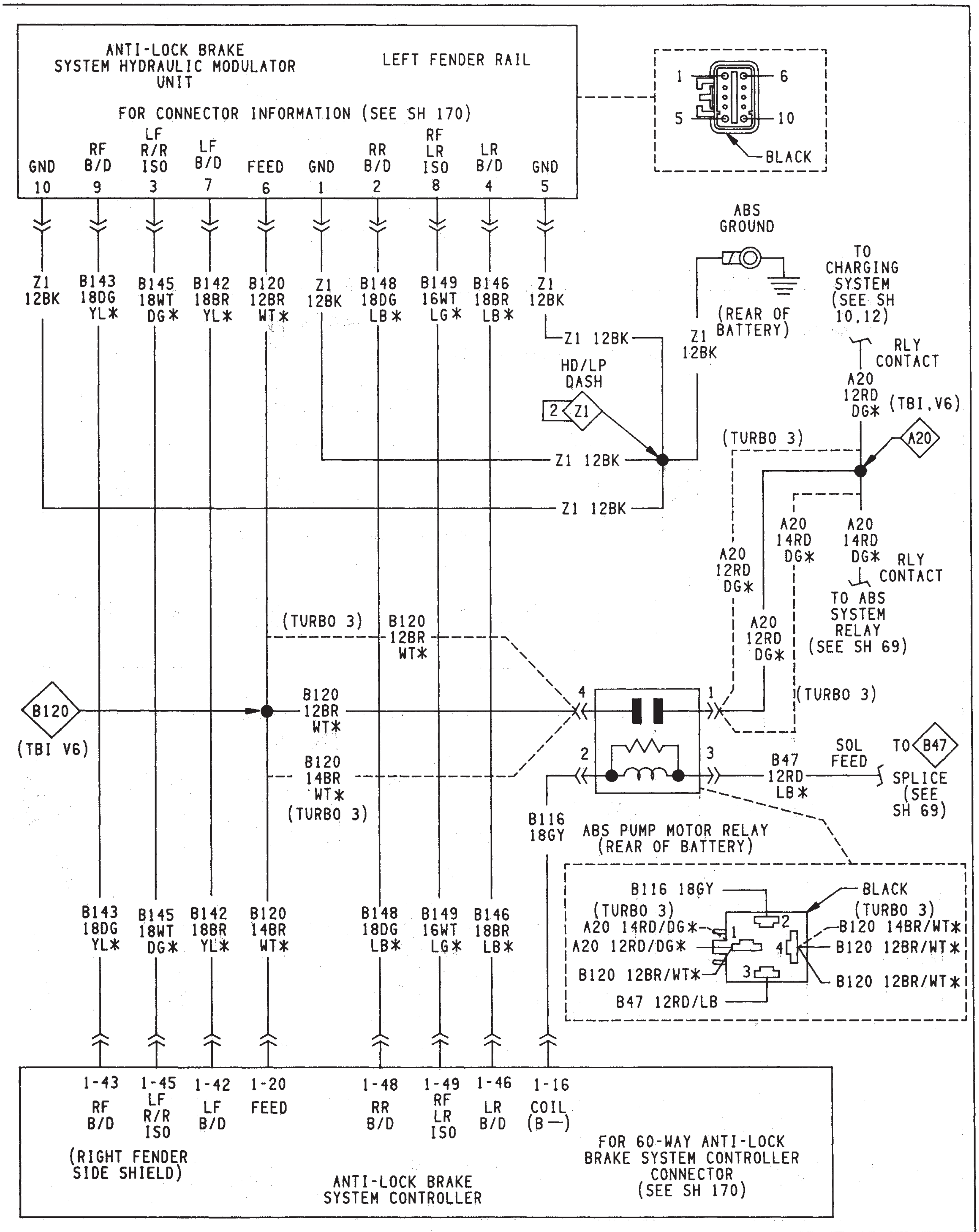
AG-AJ 66



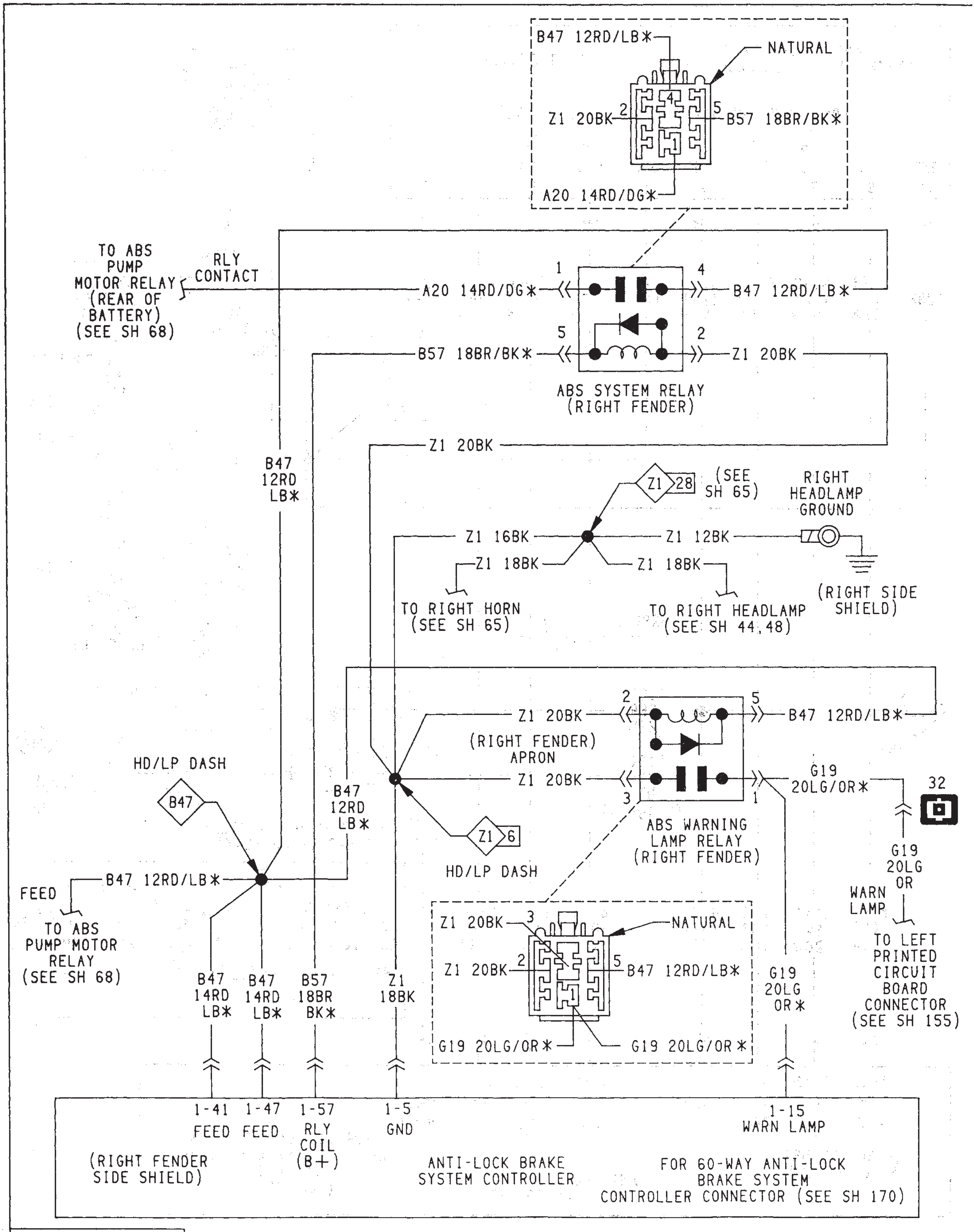
AG-AJ 67

INTERMITTENT WIPER SYSTEM

938W-5



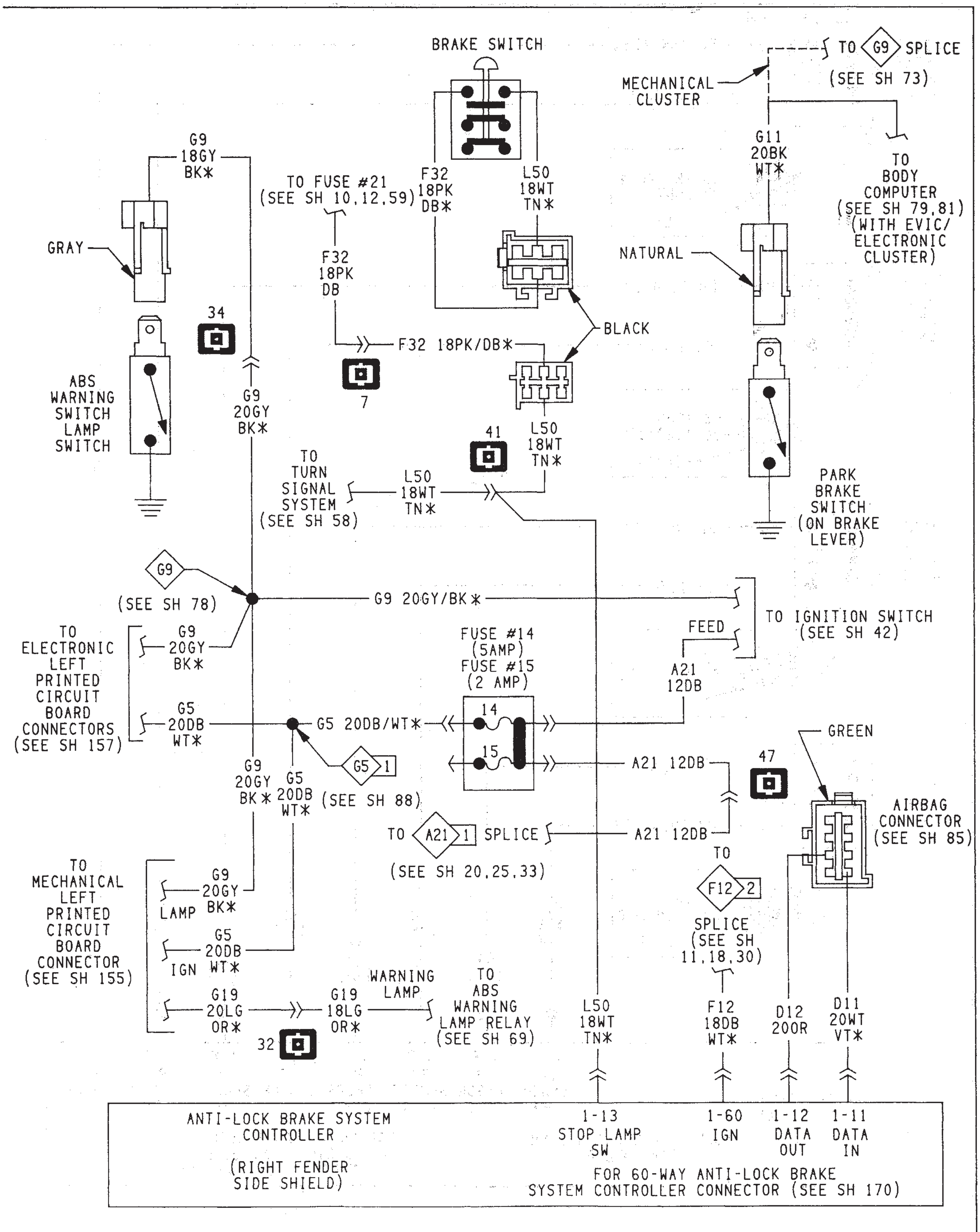
ANTI-LOCK BRAKE SYSTEM



AG-AJ 69

ANTI-LOCK BRAKE SYSTEM

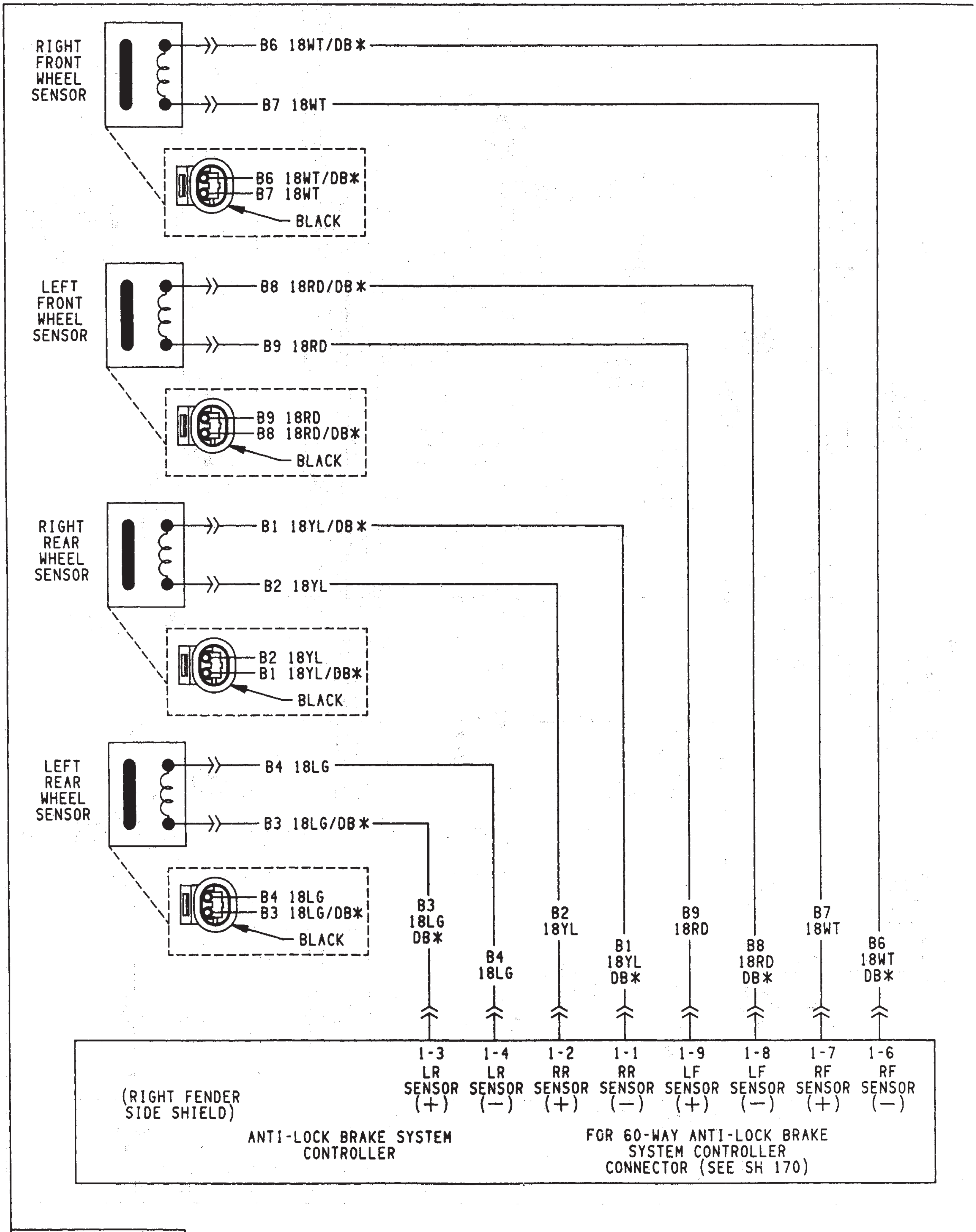
938W-5



938W-5

ANTI-LOCK BRAKE SYSTEM

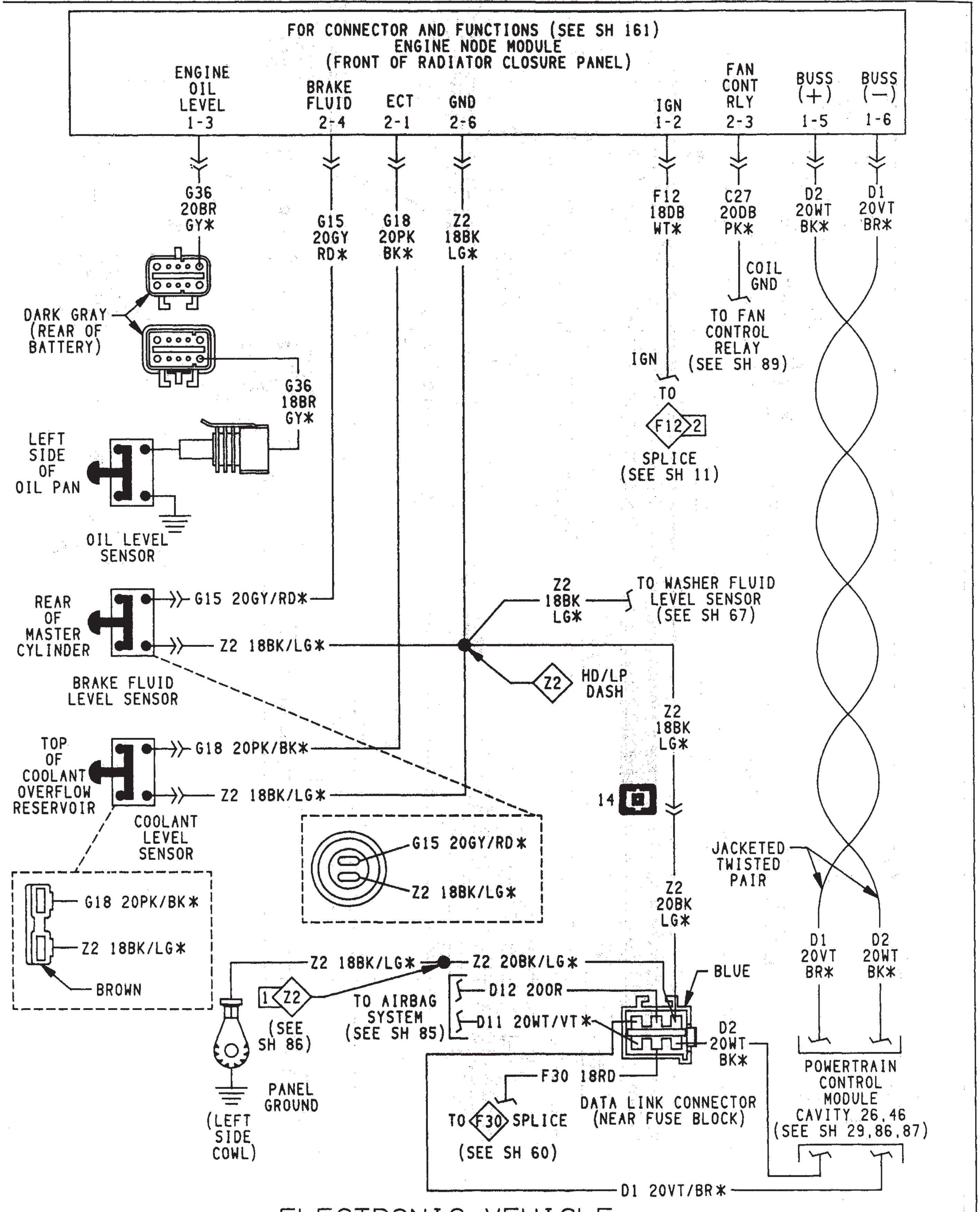
AG-AJ 70



AG-AJ 71

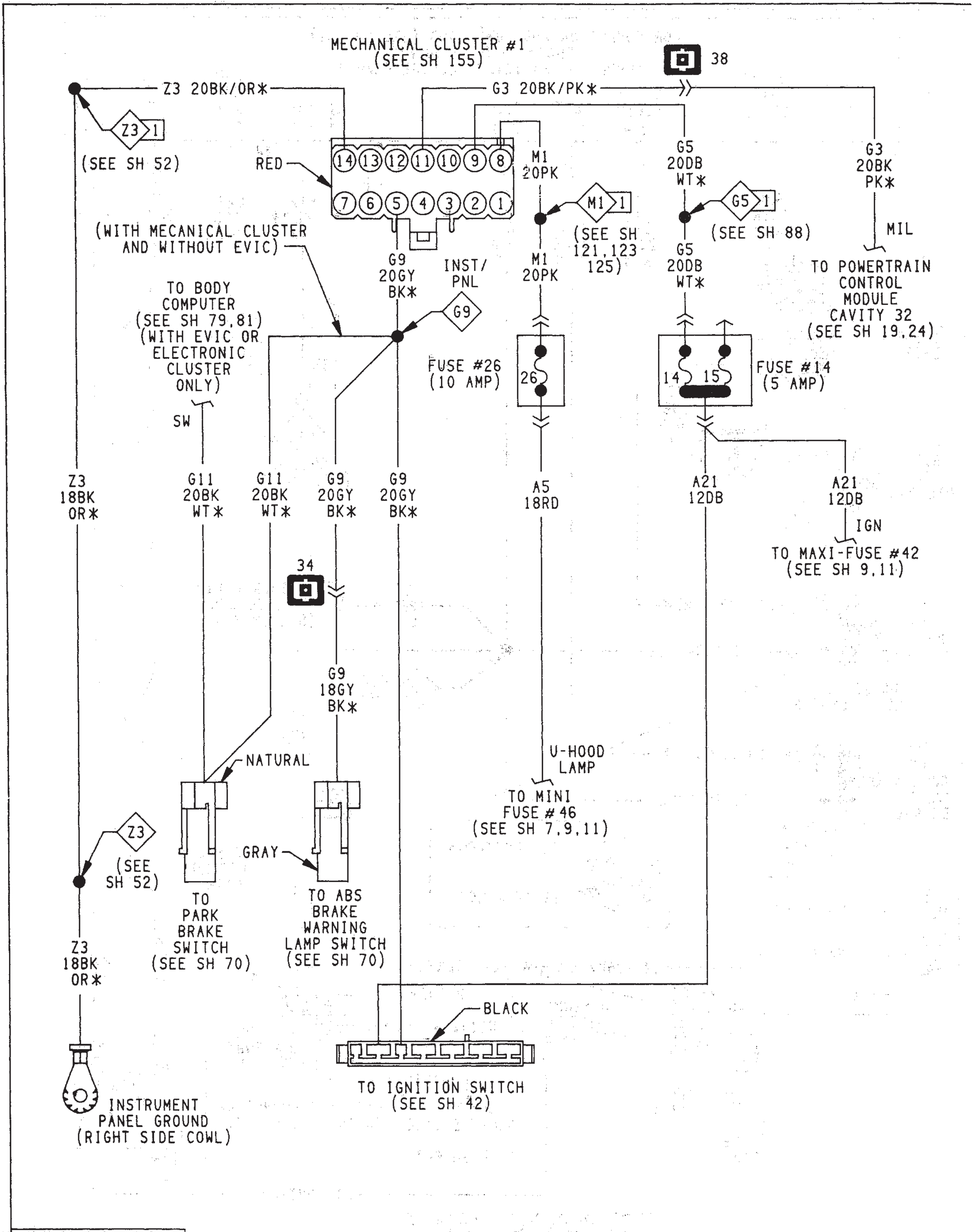
ANTI-LOCK BRAKE SYSTEM

938W-5



ELECTRONIC VEHICLE INFORMATION CENTER

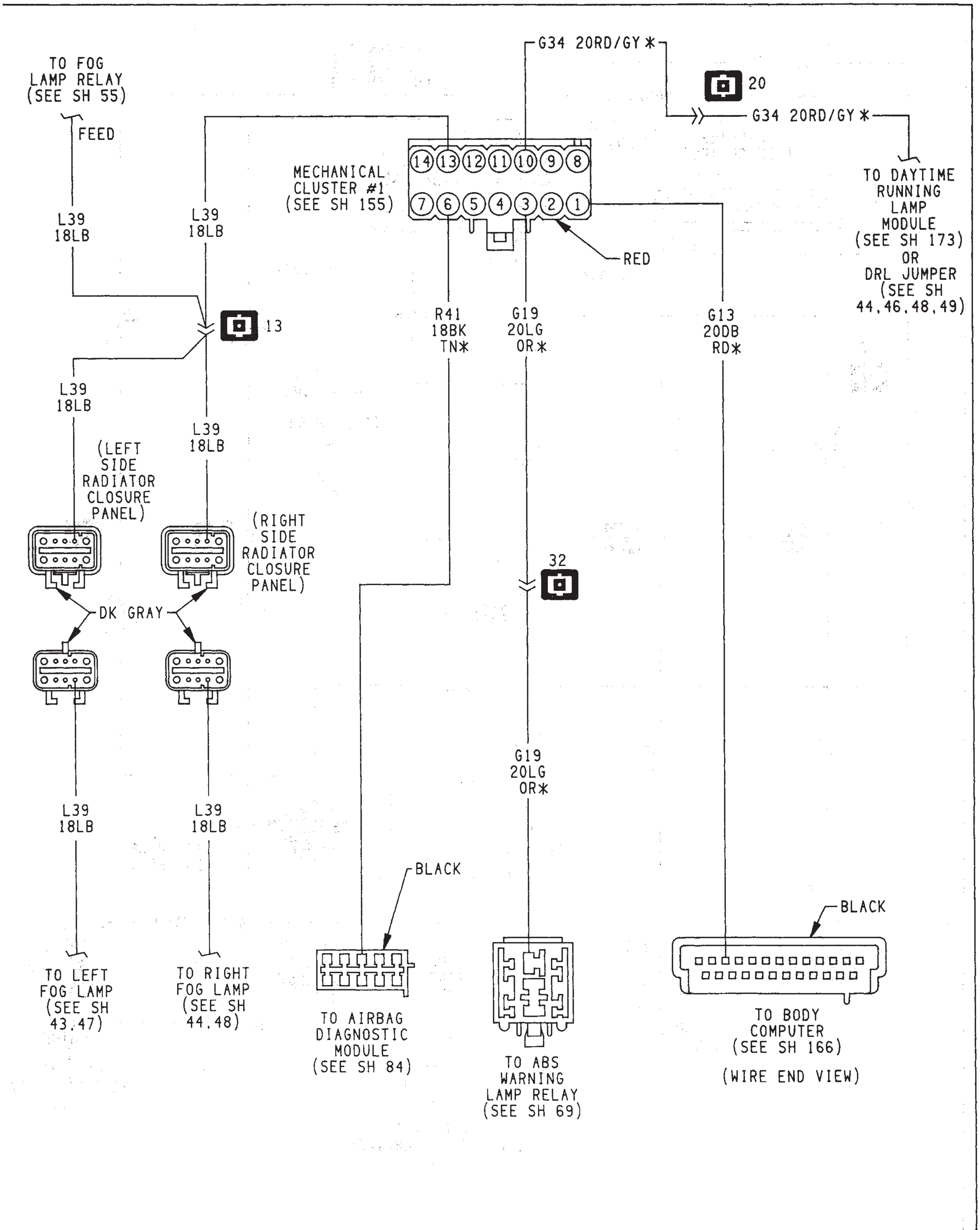
938W-5



AG-AJ 73

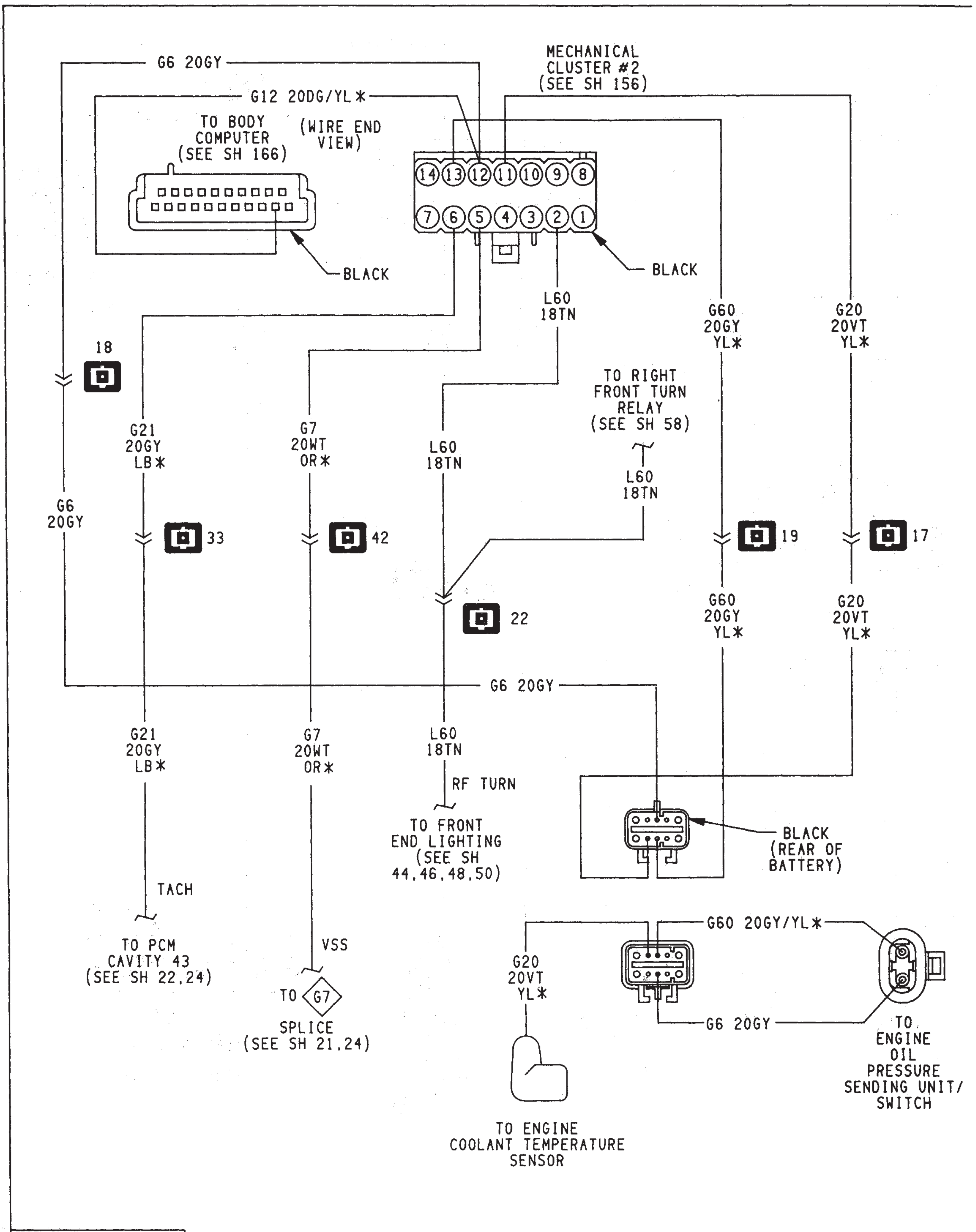
MECHANICAL CLUSTER #1

938W-5



938W-5

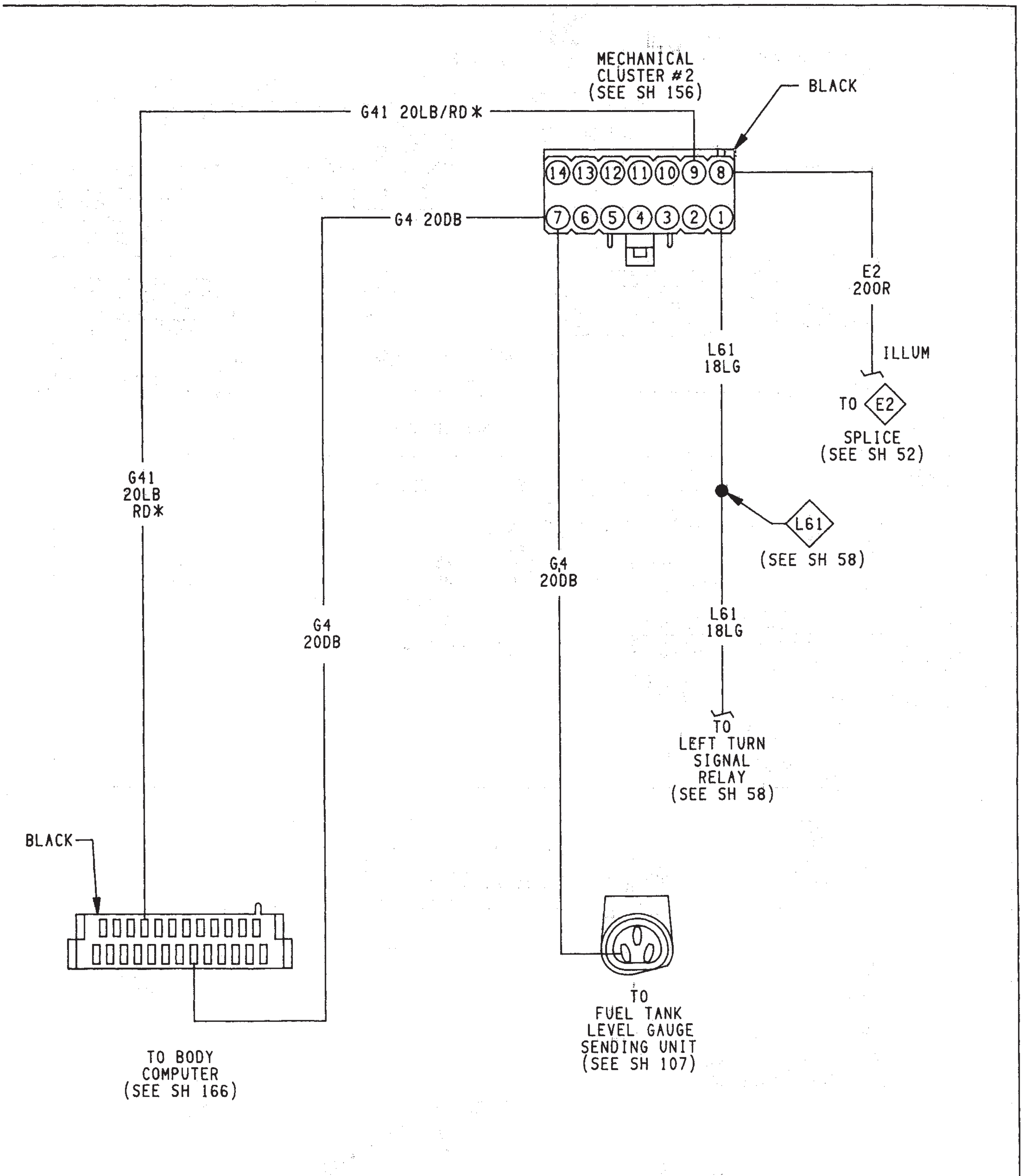
MECHANICAL CLUSTER #1

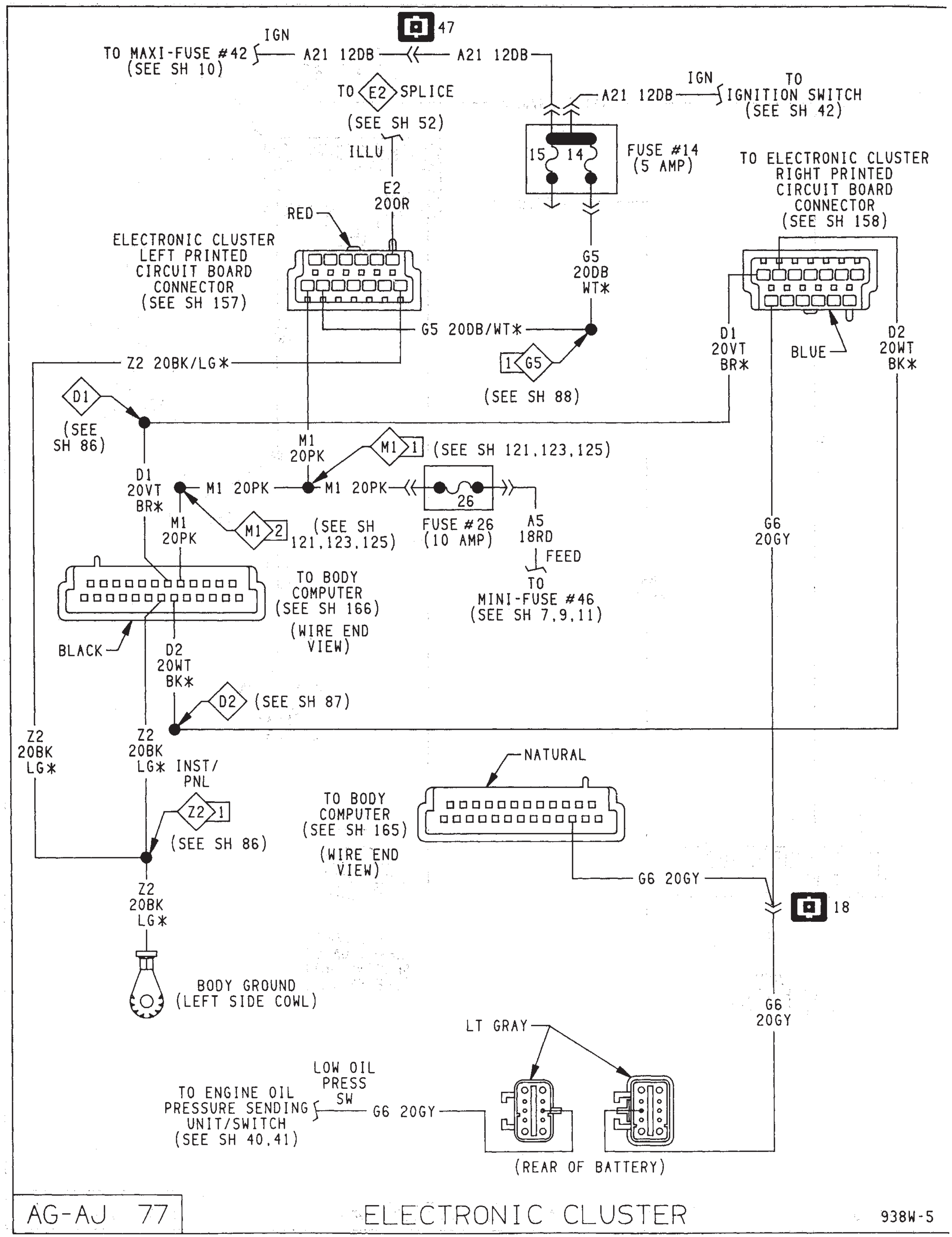


AG-AJ 75

MECHANICAL CLUSTER #2

938W-5

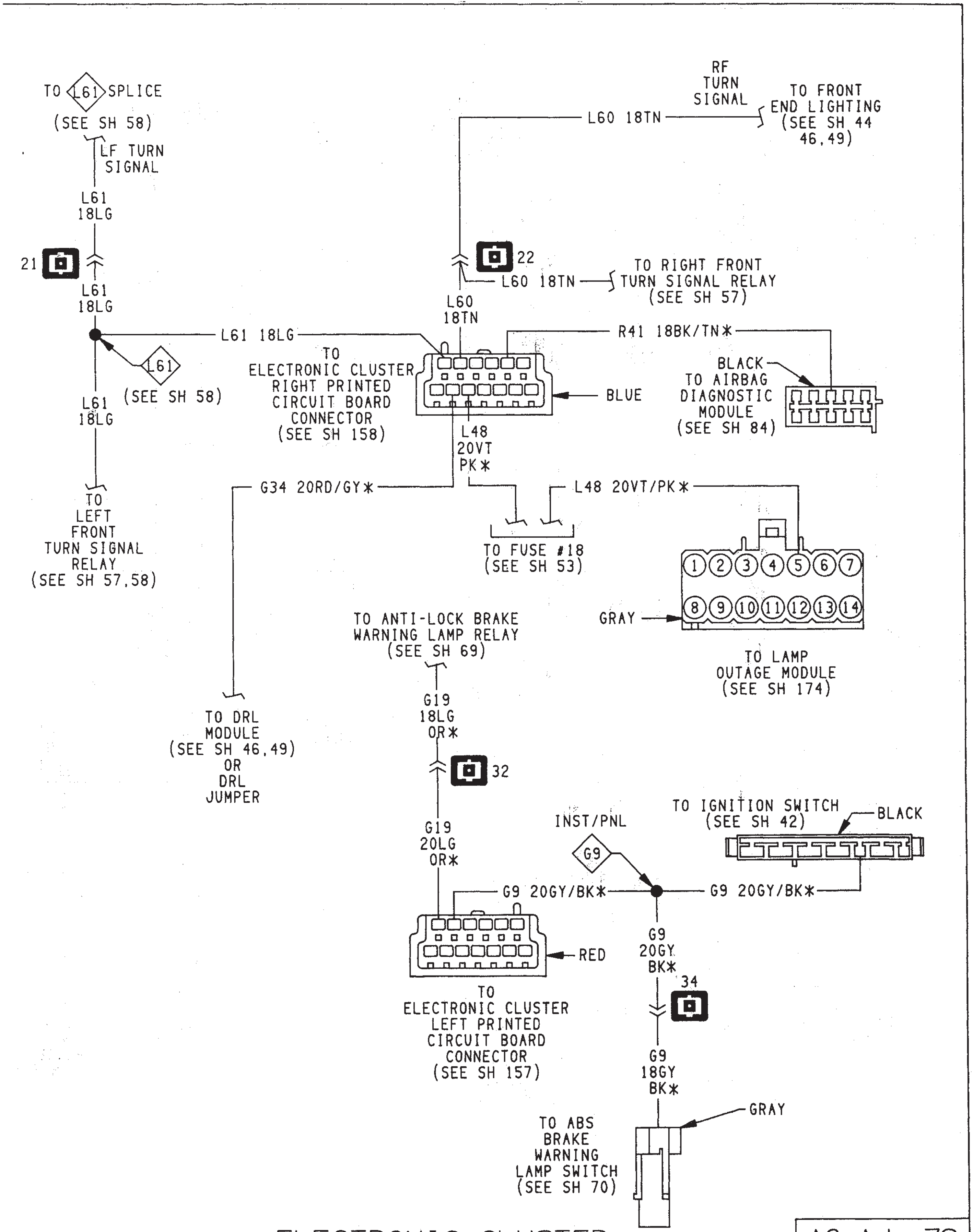

MECHANICAL
CLUSTER #2
(SEE SH 156)
BLACK
G41 20LB/RD*
14 13 12 11 10 9 8
7 6 5 4 3 2 1
G4 20DB
E2
20OR
ILLUM
TO E2
SPLICE
(SEE SH 52)
L61
18LG
L61
(SEE SH 58)
L61
18LG
TO
LEFT TURN
SIGNAL
RELAY
(SEE SH 58)
G41
20LB
RD*
G4
20DB
G4
20DB
BLACK
TO BODY
COMPUTER
(SEE SH 166)
TO
FUEL TANK
LEVEL GAUGE
SENDING UNIT
(SEE SH 107)



AG-AJ 77

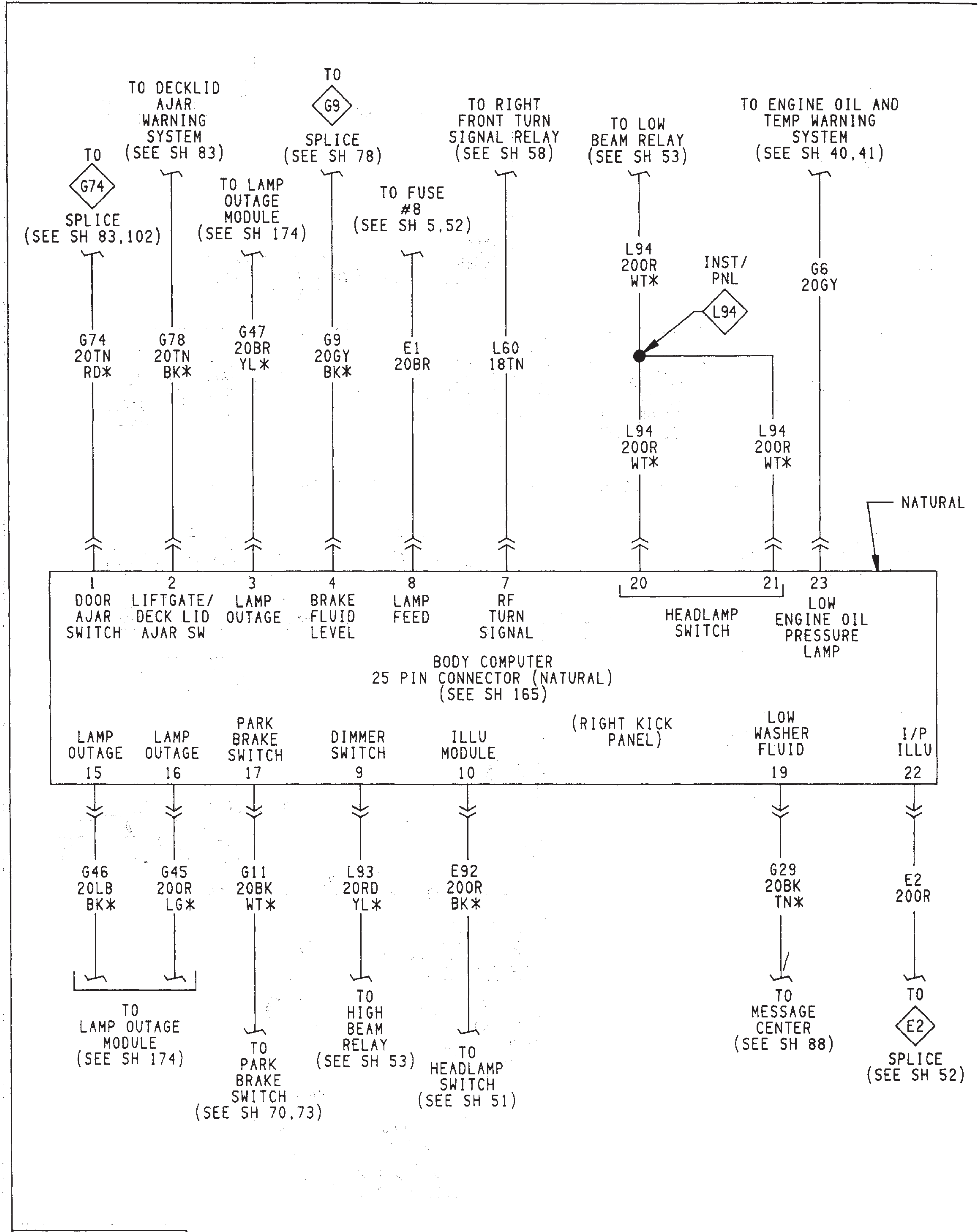
ELECTRONIC CLUSTER

938W-5

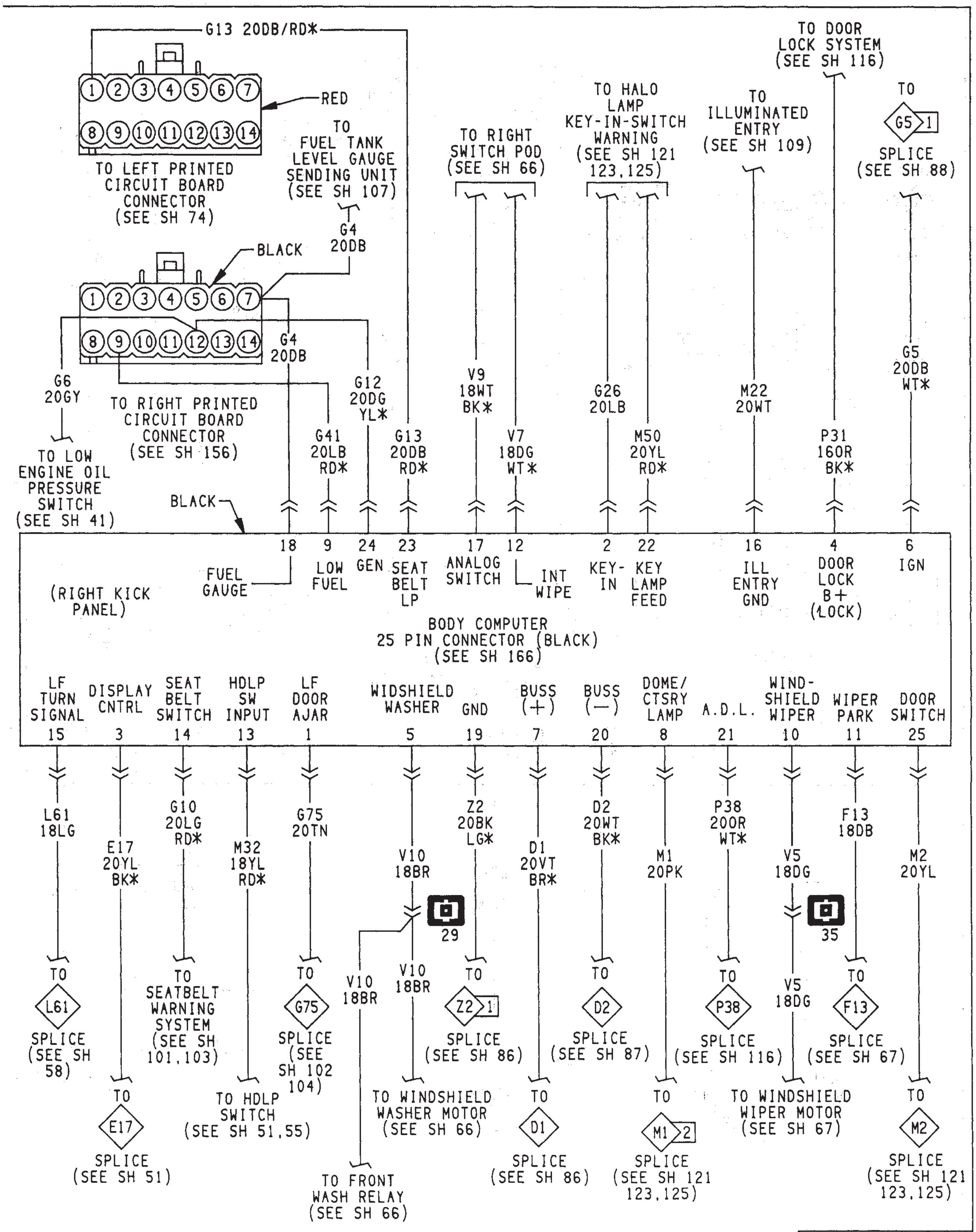


938W-5

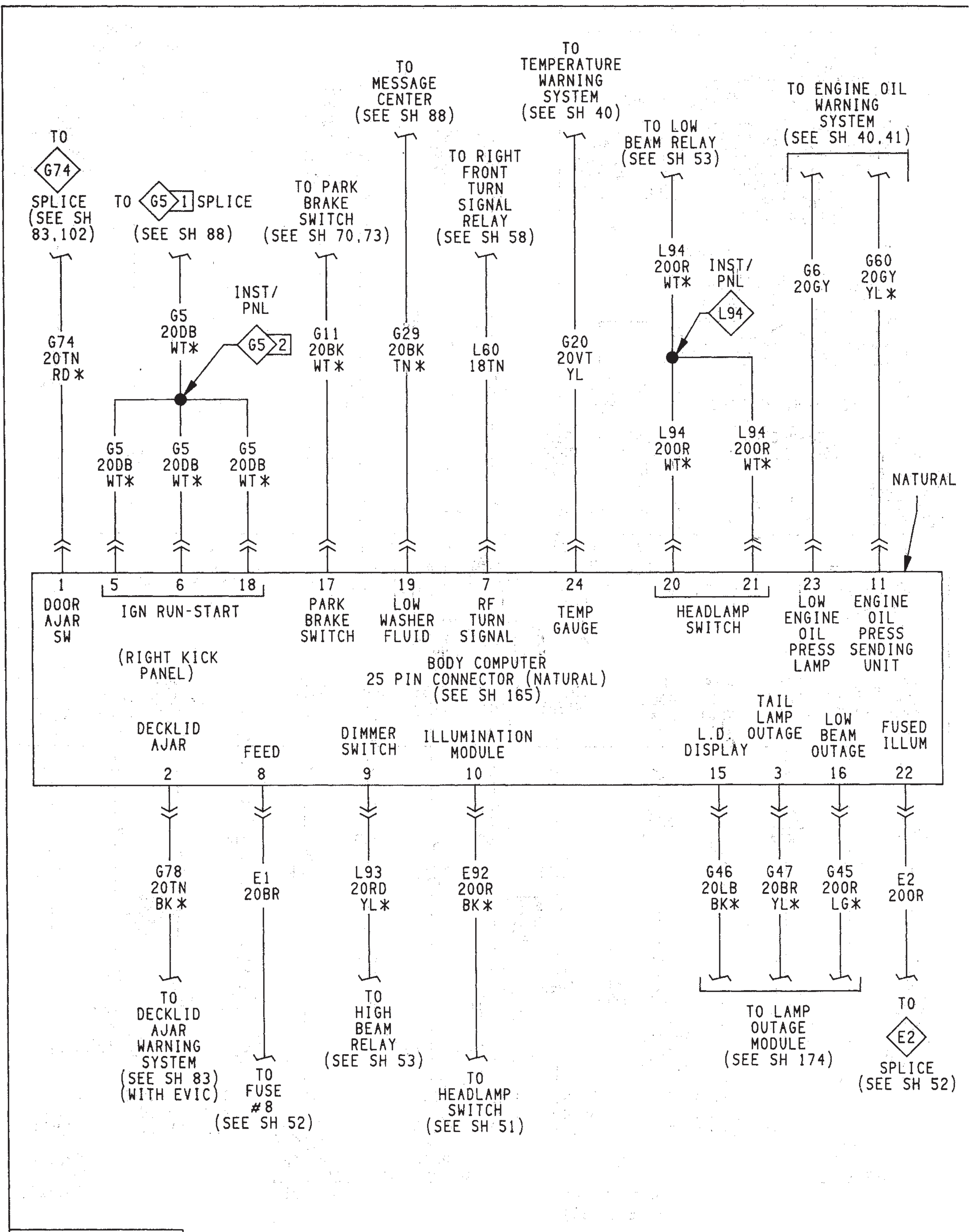
ELECTRONIC CLUSTER



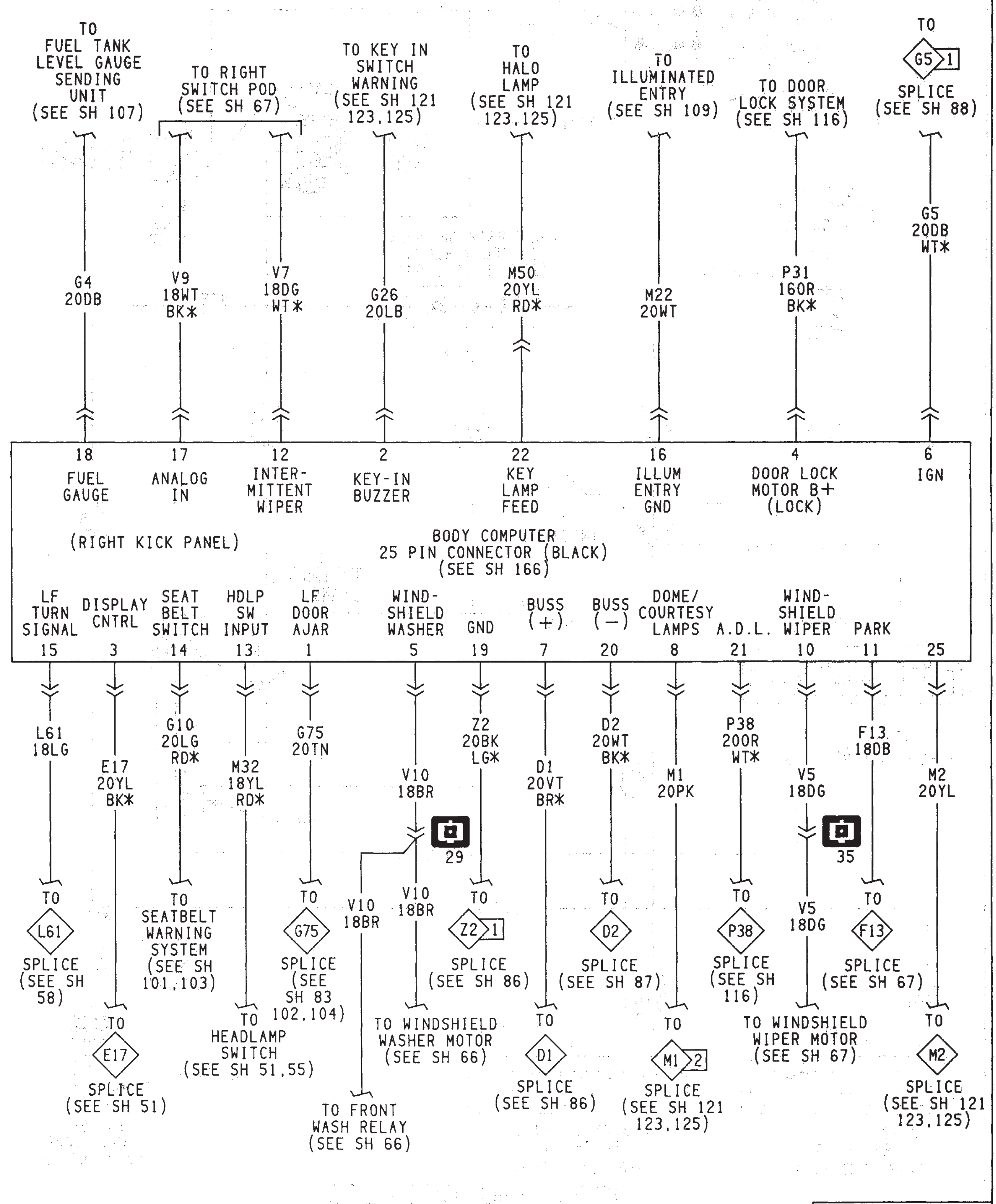
AG-AJ 79 BODY COMPUTER (MECHANICAL CLUSTER) 938W-5



938W-5 BODY COMPUTER (MECHANICAL CLUSTER) AG-AJ 80

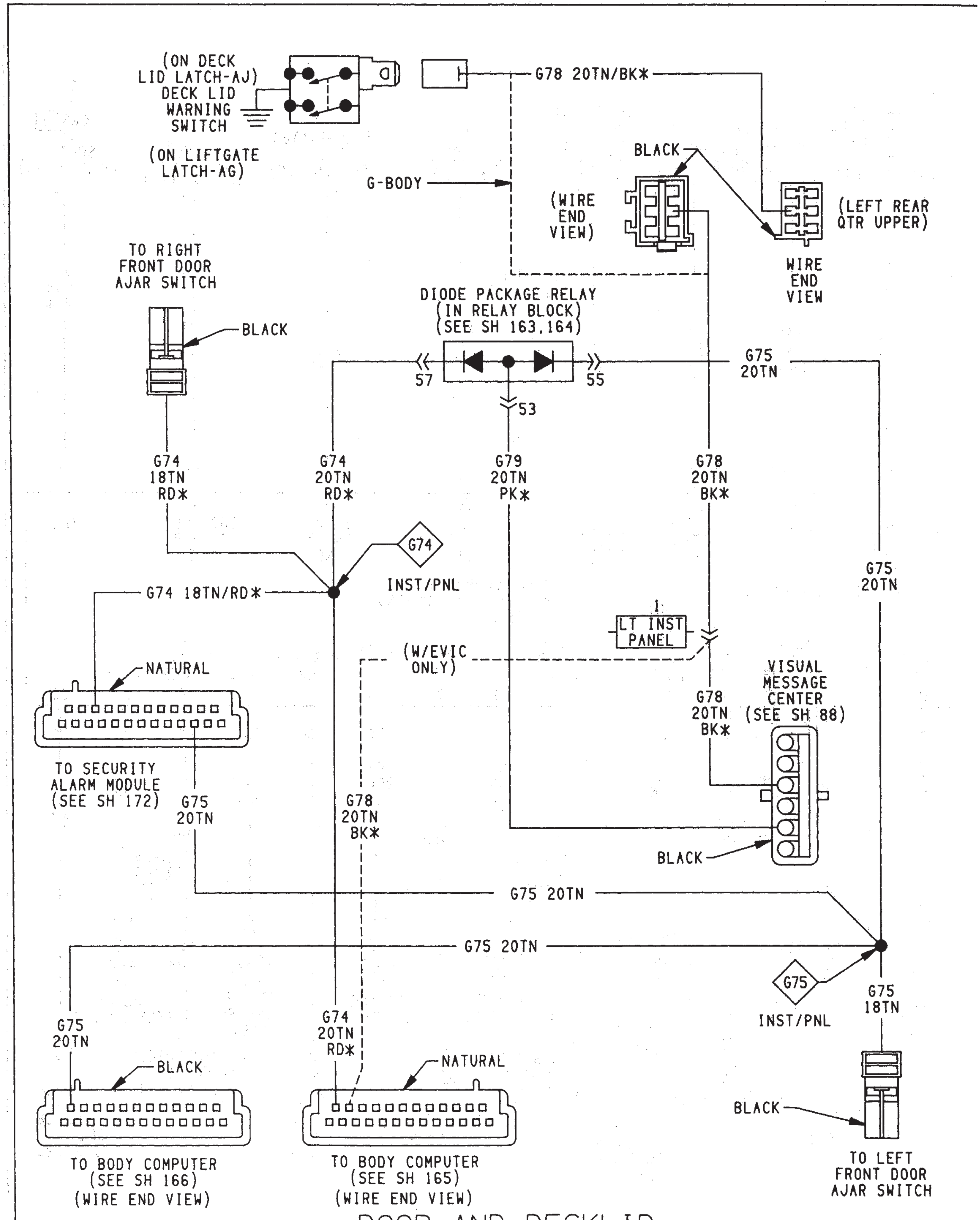


AJ 81 BODY COMPUTER (ELECTRONIC CLUSTER) 938W-5



938W-5 BODY COMPUTER (ELECTRONIC CLUSTER)

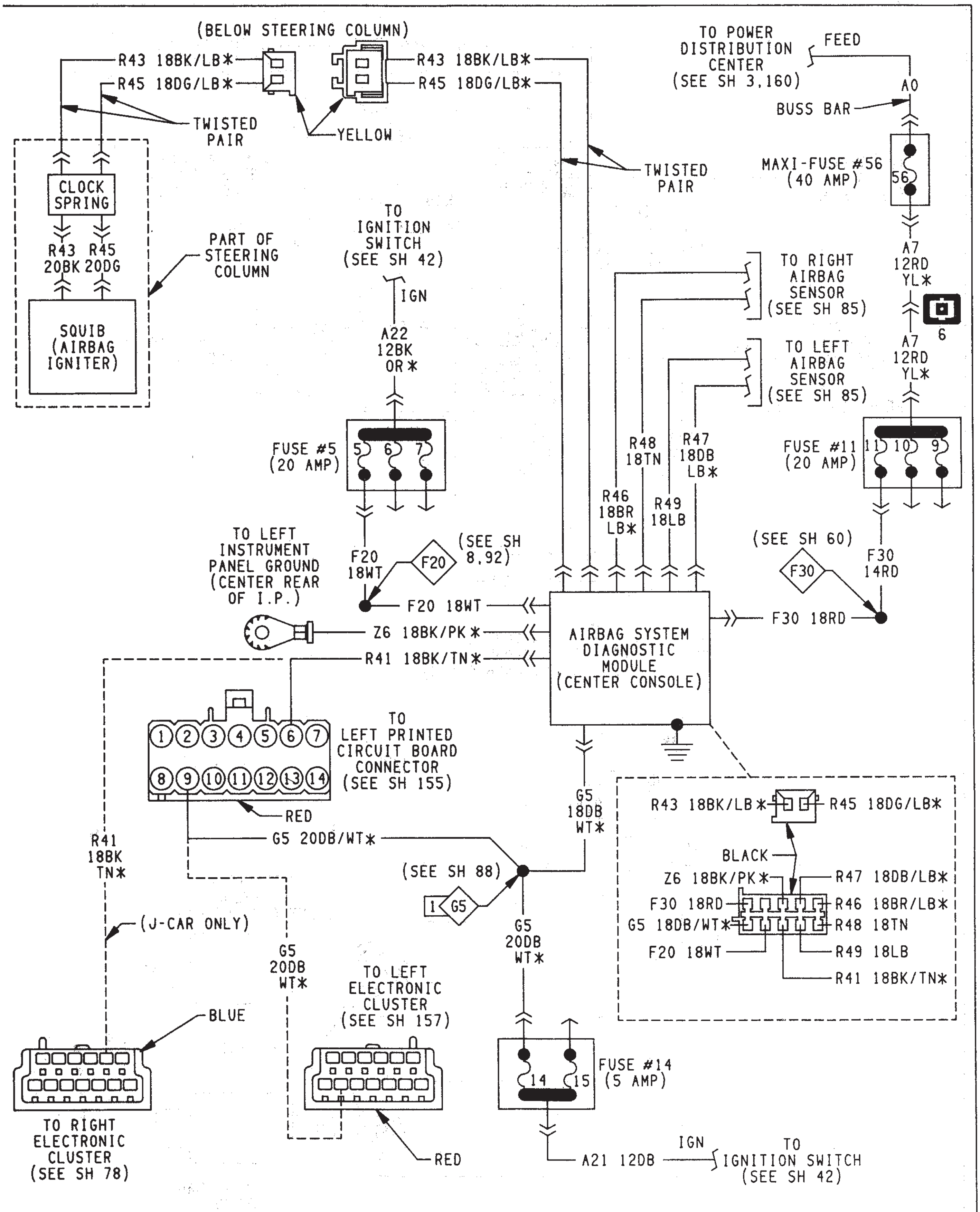
AJ 82



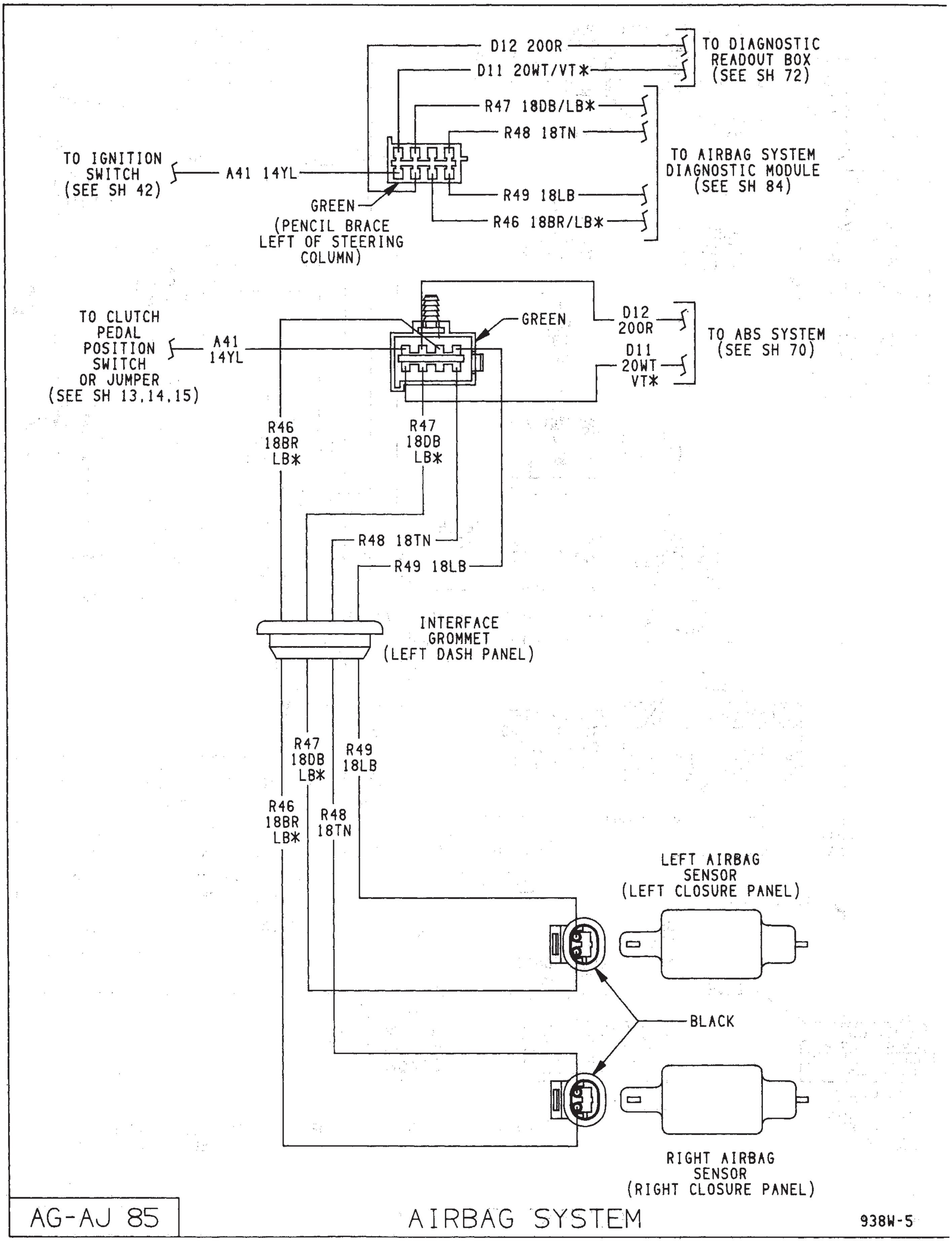
AG-AJ 83

DOOR AND DECKLID
OR LIFTGATE AJAR WARNING SYSTEM

938W-5

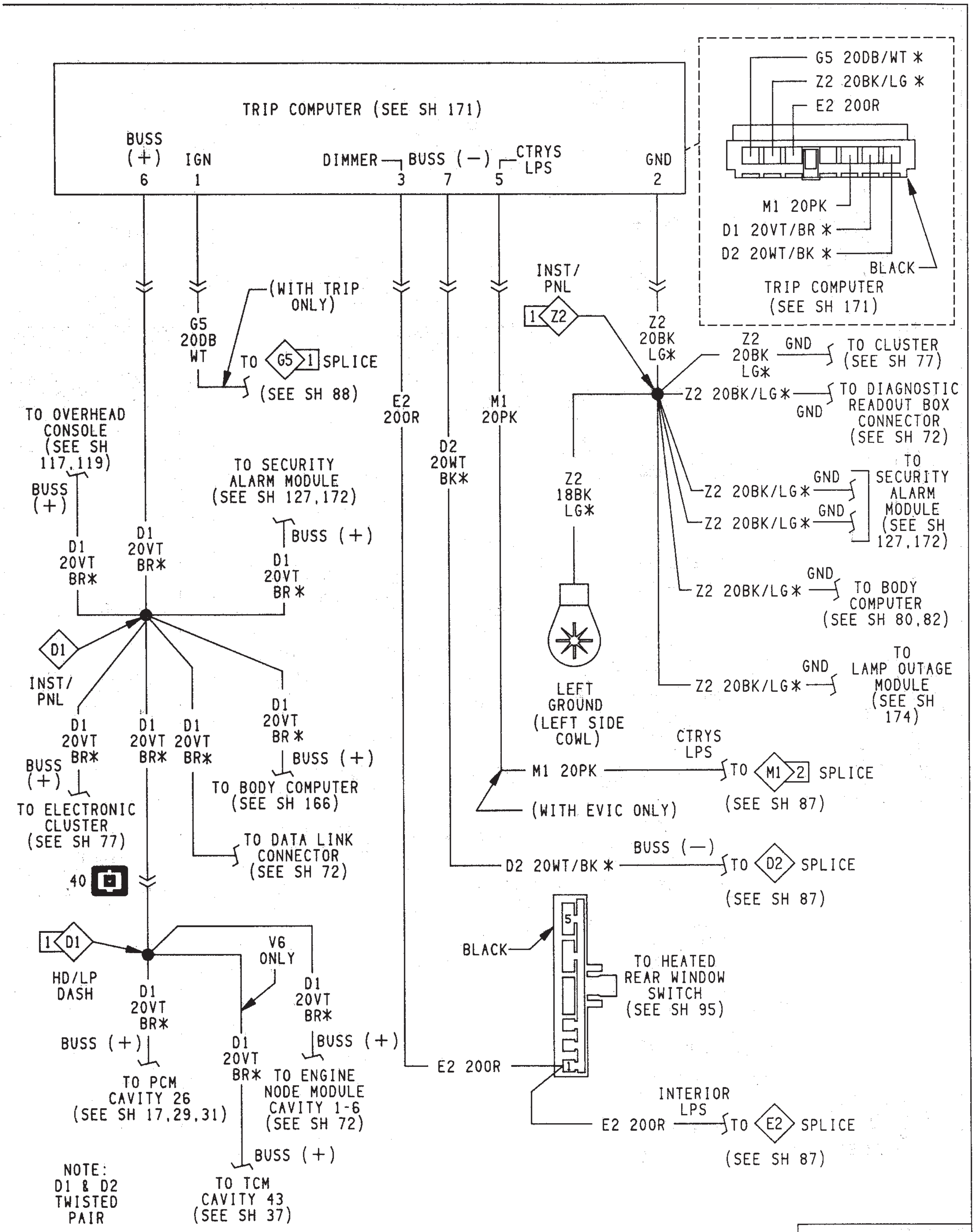


AIRBAG SYSTEM

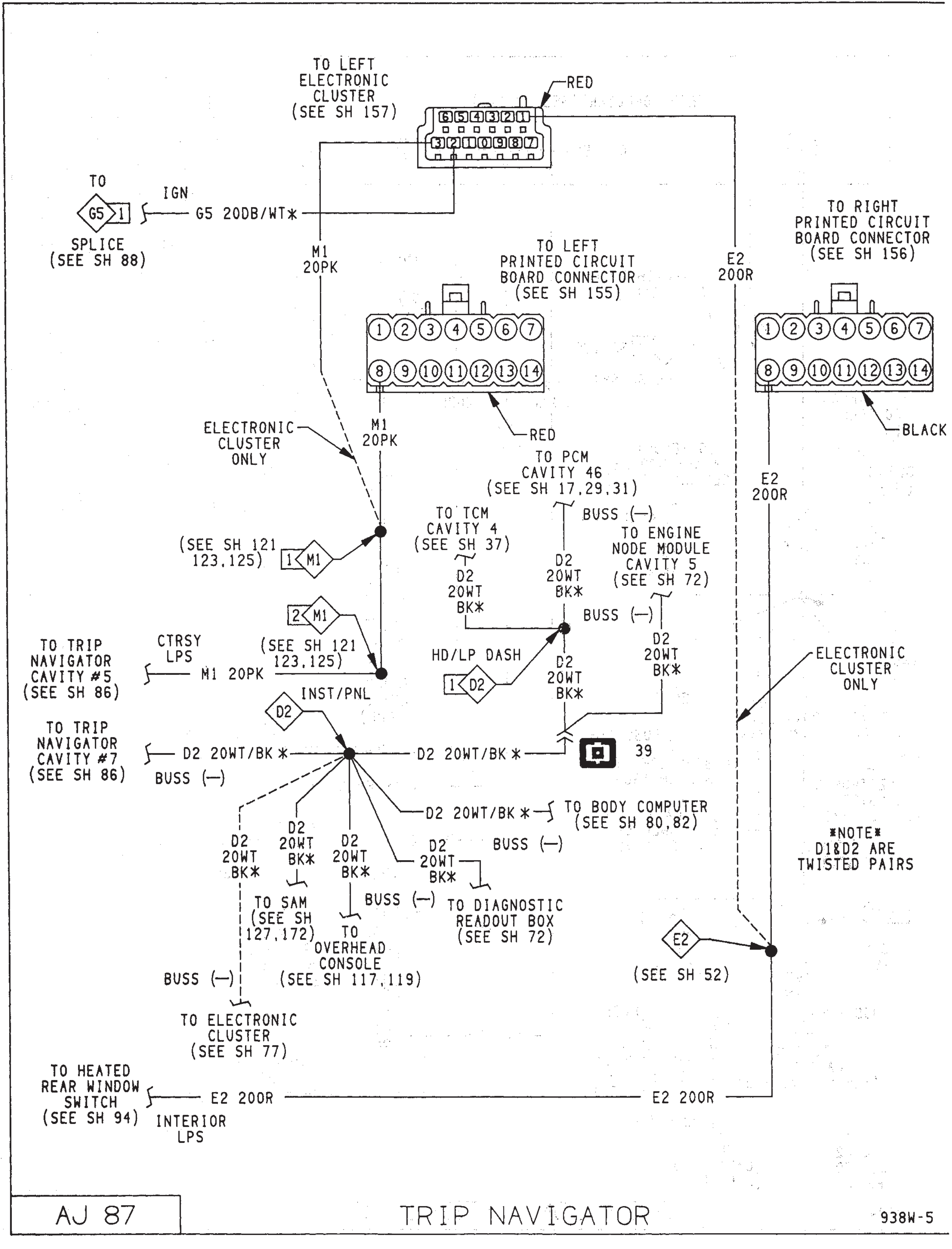


AIRBAG SYSTEM

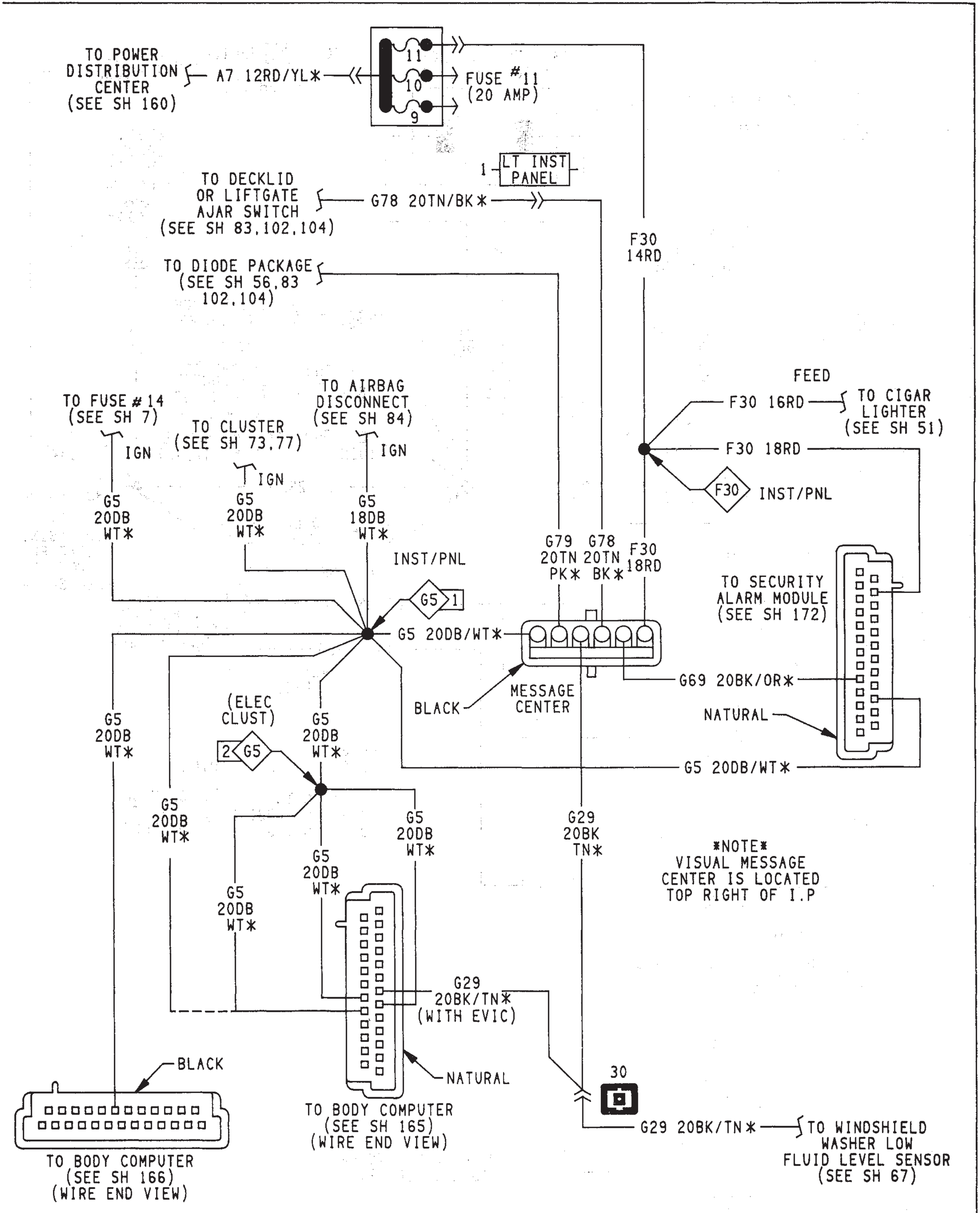
938W-5



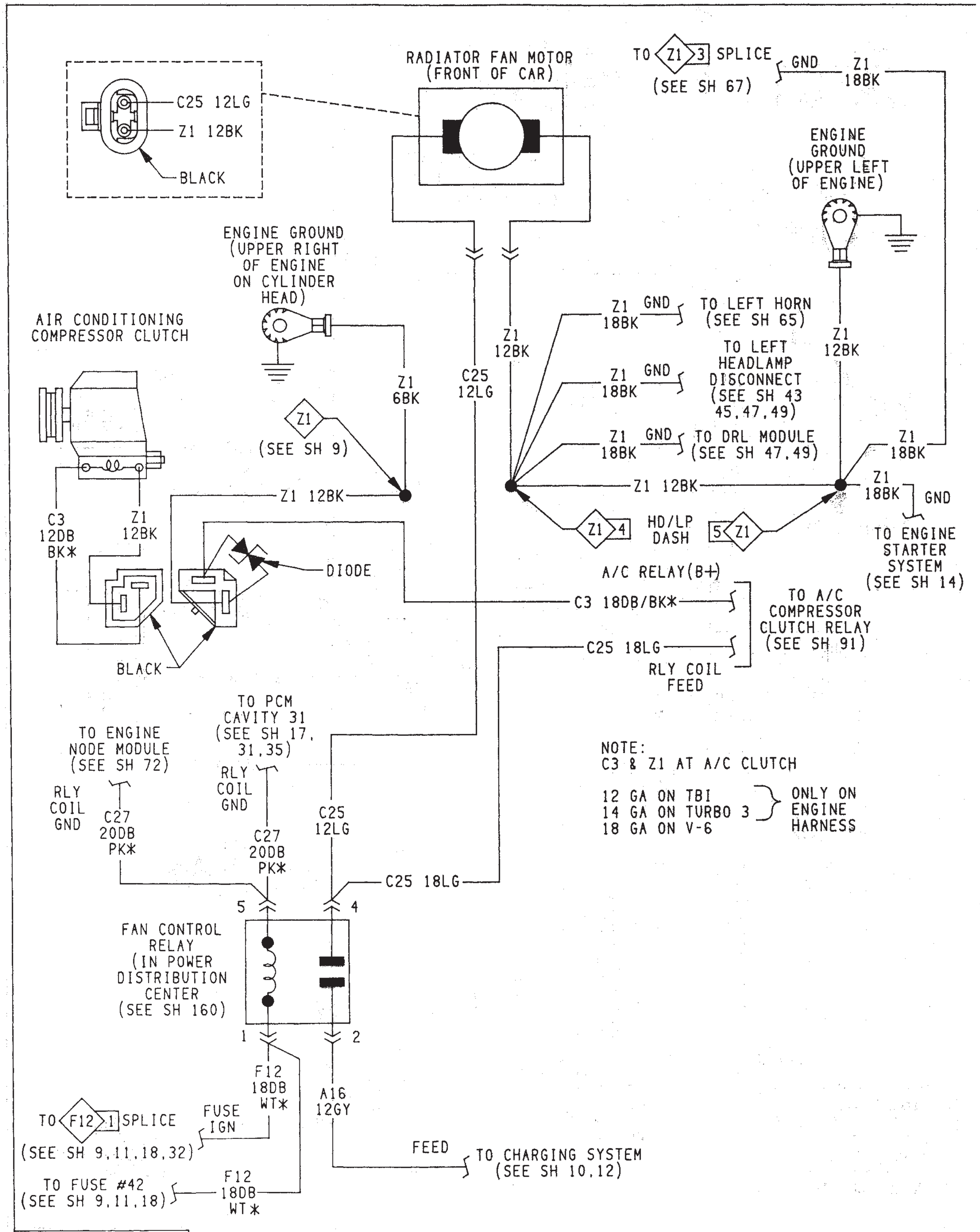
TRIP COMPUTER/EVIC



AJ 87 TRIP NAVIGATOR 938W-5



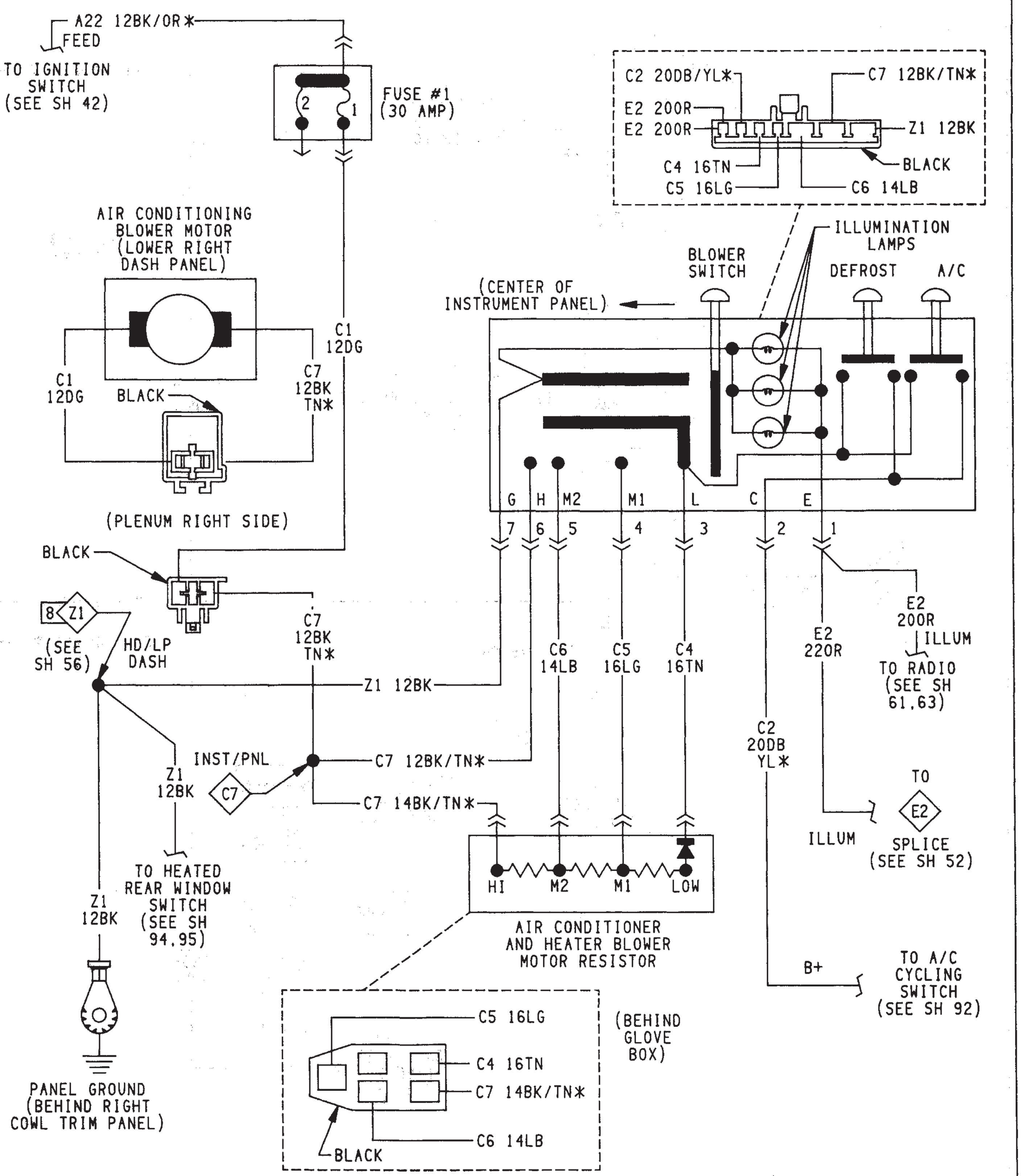
938W-5 VISUAL MESSAGE CENTER CONNECTOR



AG-AJ 89

FAN CONTROL SYSTEM

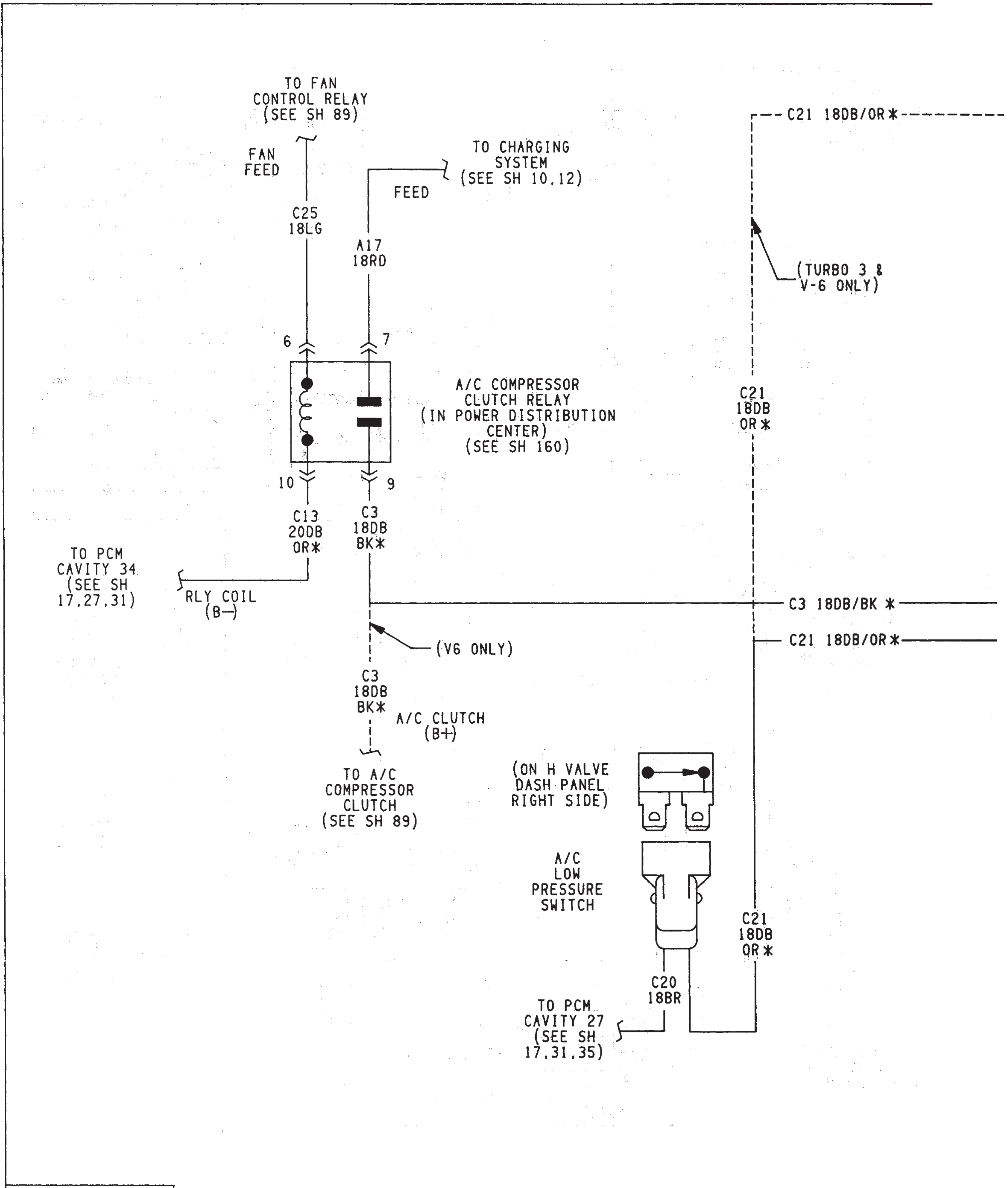
938W-5



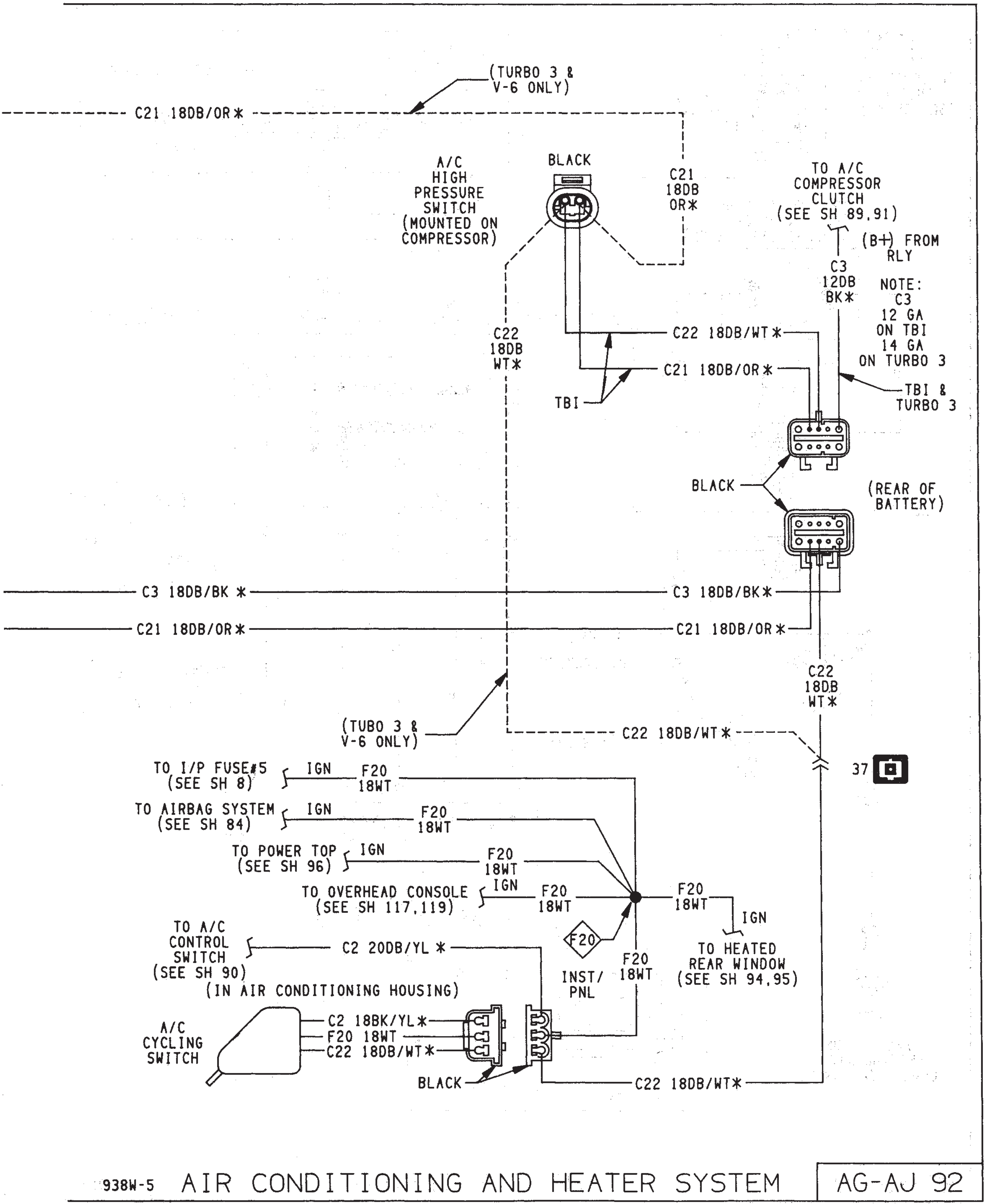
938W-5

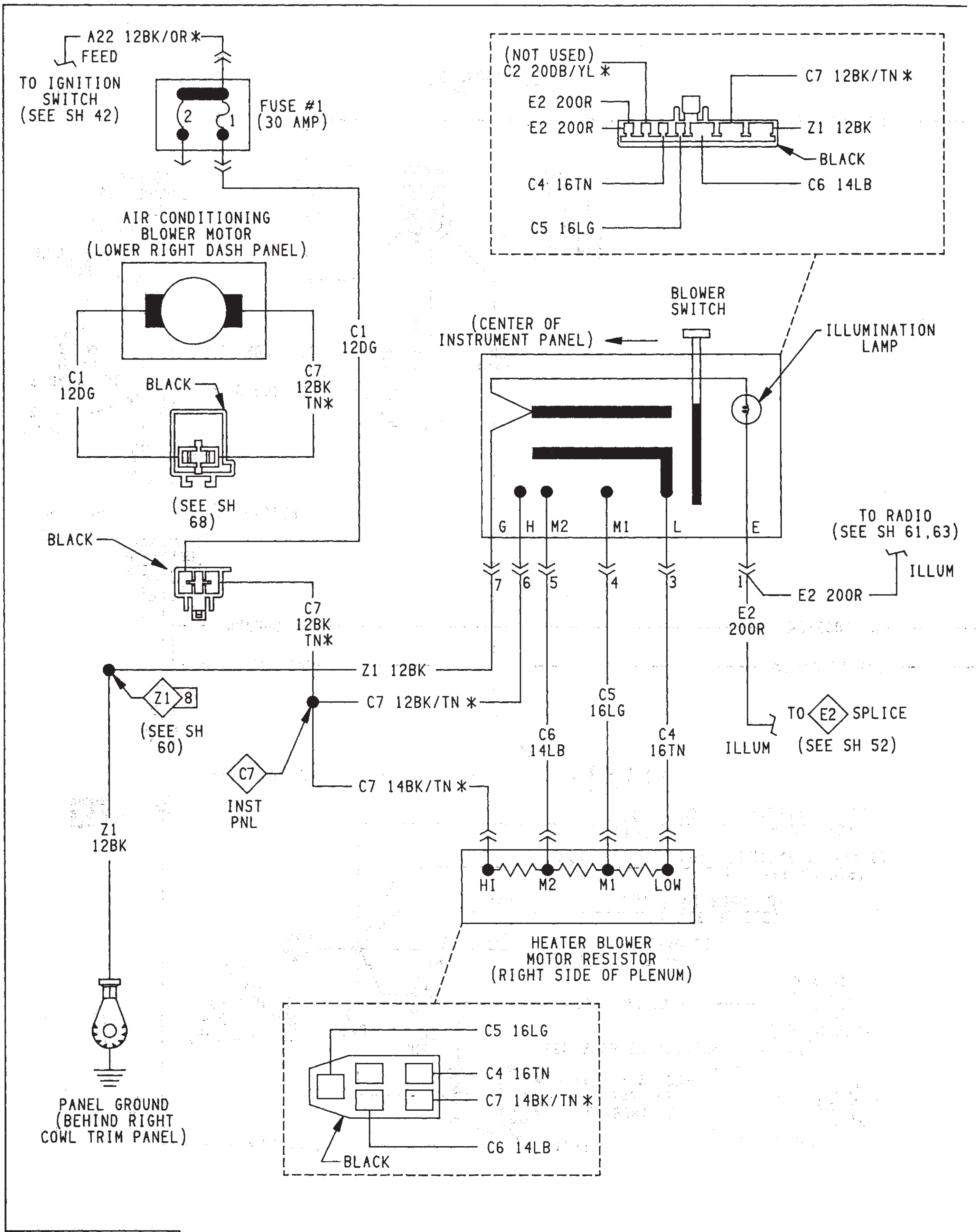
AIR CONDITIONING

AG-AJ 90

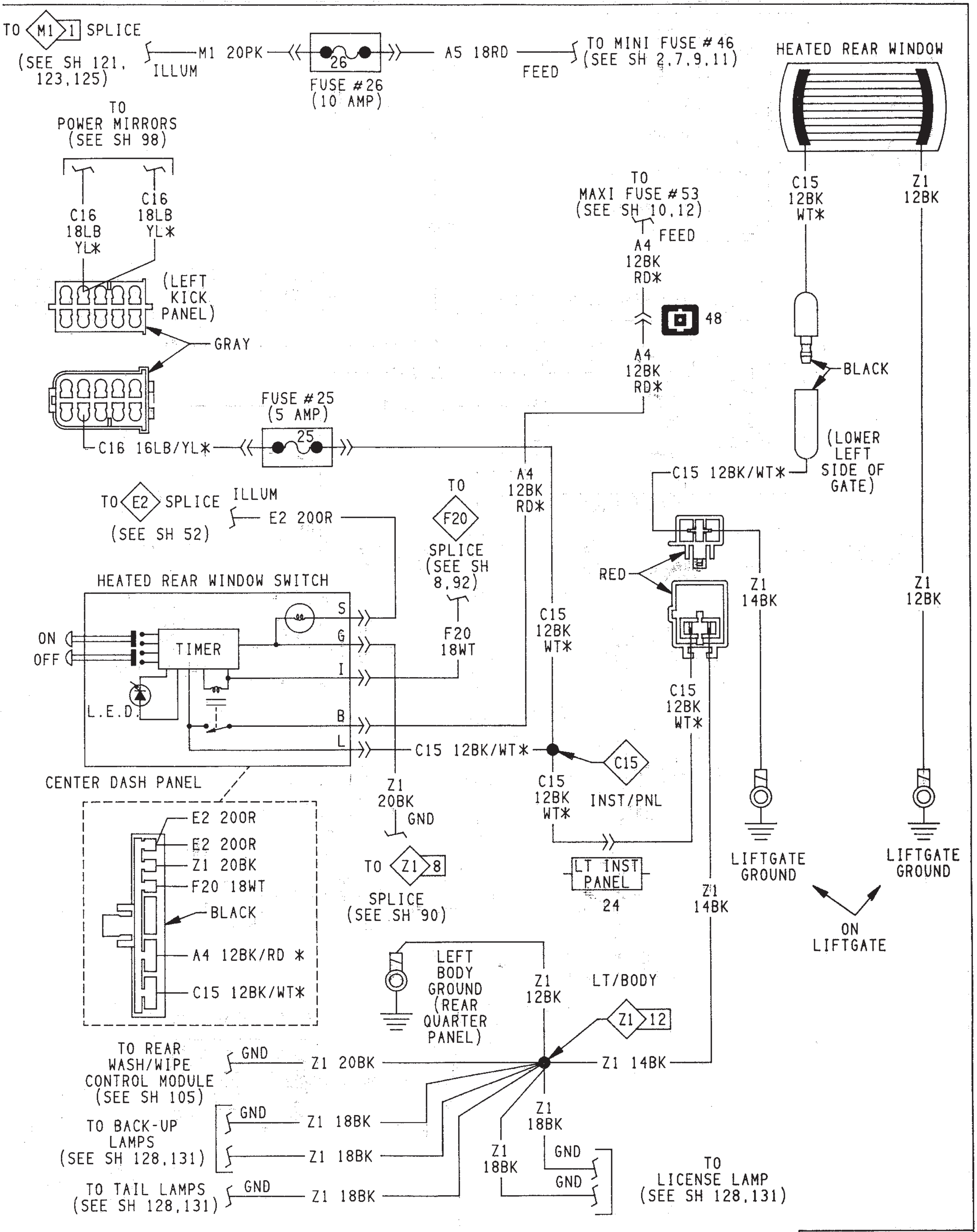


AG-AJ 91 AIR CONDITIONING AND HEATER SYSTEM 938W-5


(TURBO 3 & V-6 ONLY)
C21 18DB/OR*
BLACK
A/C HIGH PRESSURE SWITCH (MOUNTED ON COMPRESSOR)
C21 18DB OR*
TO A/C COMPRESSOR CLUTCH (SEE SH 89,91)
(B+) FROM RLY
C3 12DB BK*
NOTE: C3 12 GA ON TBI 14 GA ON TURBO 3
C22 18DB WT*
C22 18DB/WT*
C21 18DB/OR*
TBI
TBI & TURBO 3
BLACK
(REAR OF BATTERY)
C3 18DB/BK *
C3 18DB/BK*
C21 18DB/OR*
C21 18DB/OR*
C22 18DB WT*
(TUBO 3 & V-6 ONLY)
C22 18DB/WT*
37
TO I/P FUSE#5 (SEE SH 8)
IGN
F20 18WT
TO AIRBAG SYSTEM (SEE SH 84)
IGN
F20 18WT
TO POWER TOP (SEE SH 96)
IGN
F20 18WT
TO OVERHEAD CONSOLE (SEE SH 117,119)
IGN
F20 18WT
F20 18WT
IGN
TO HEATED REAR WINDOW (SEE SH 94,95)
F20
INST/ PNL
F20 18WT
TO A/C CONTROL SWITCH (SEE SH 90)
C2 20DB/YL *
(IN AIR CONDITIONING HOUSING)
A/C CYCLING SWITCH
C2 18BK/YL*
F20 18WT
C22 18DB/WT*
BLACK
C22 18DB/WT*



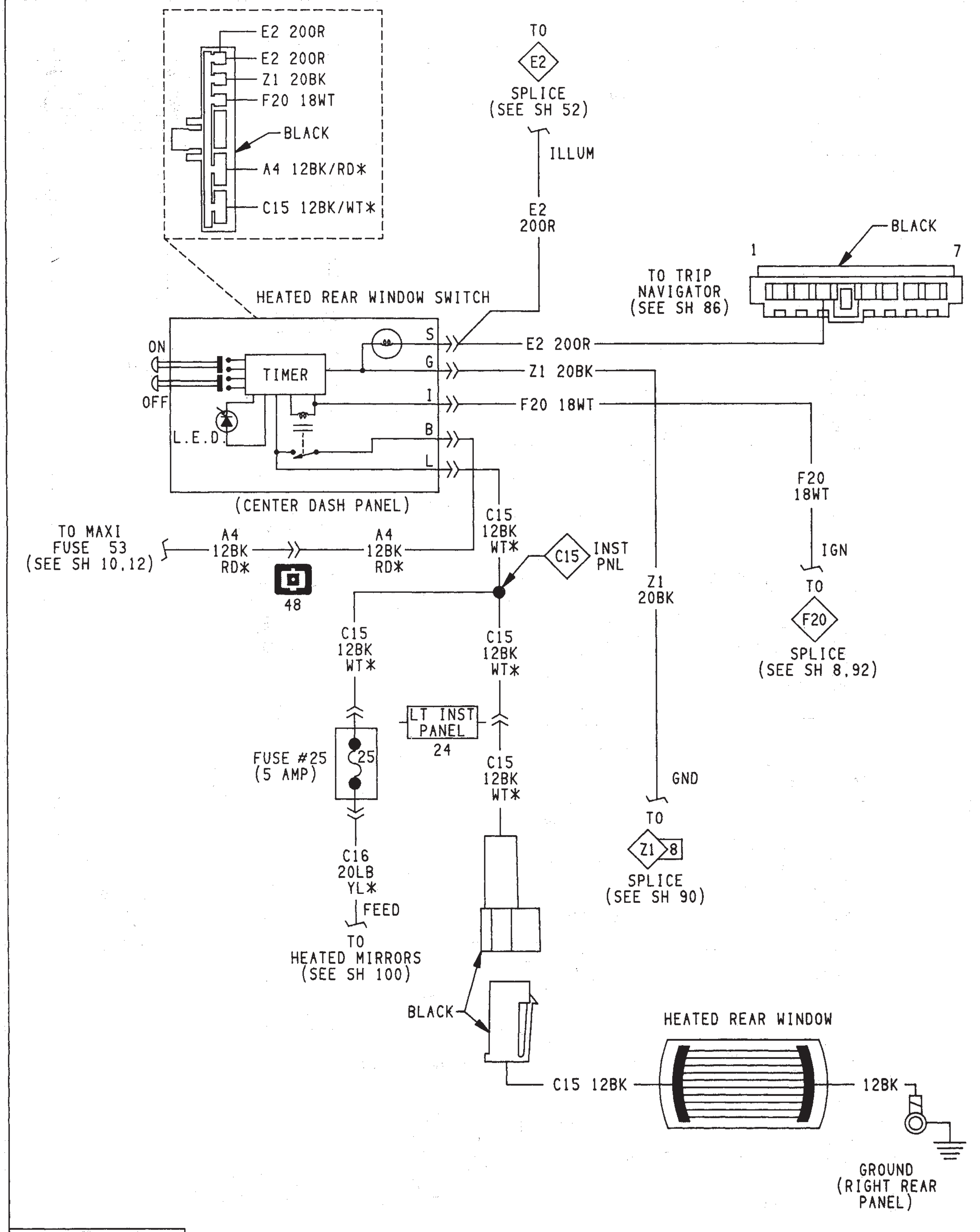
AG-AJ 93 HEATER SYSTEM 938W-5



938W-5

HEATED REAR WINDOW SYSTEM

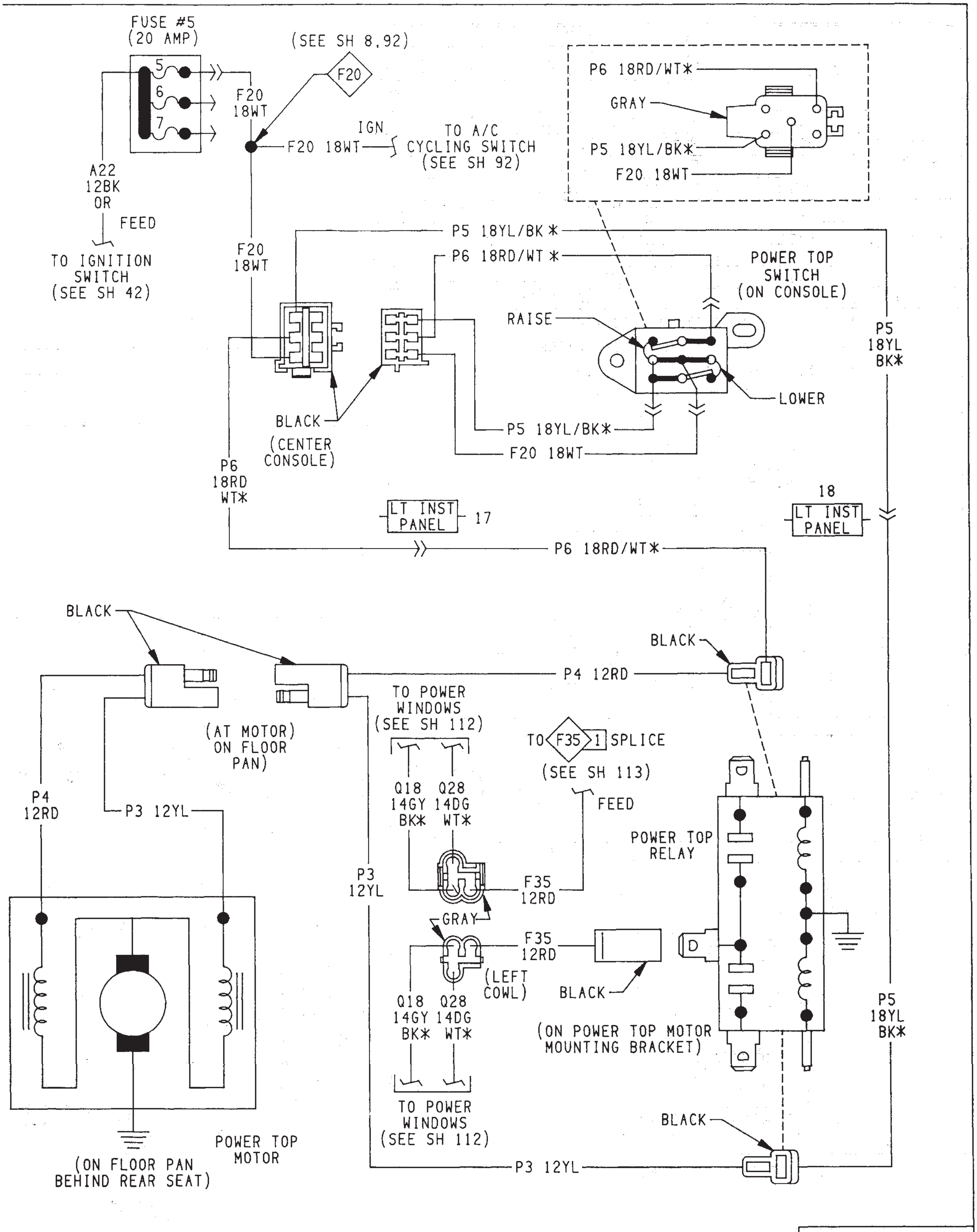
AG 94



AJ 95

HEATED REAR WINDOW SYSTEM

938W-5



938W-5

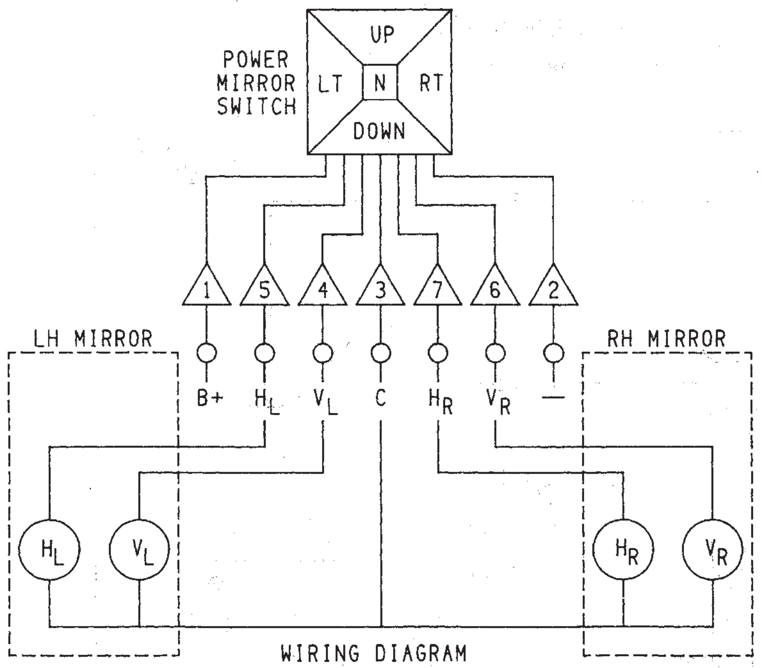
POWER TOP SYSTEM (CONVERTIBLE)

AJ 96
]

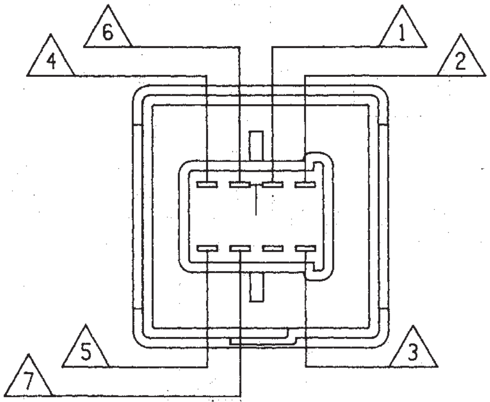
SYSTEM SCHEMATIC

MIRROR	DIRECTION	CIRCUIT SYMBOL B+	CIRCUIT SYMBOL —	CIRCUIT SYMBOL C	CIRCUIT SYMBOL V_L	CIRCUIT SYMBOL H_L	CIRCUIT SYMBOL V_R	CIRCUIT SYMBOL H_R
LEFT HAND	UP	●	●		●	●		
	DOWN	●	●	●	●			
	LEFT	●	●		●	●		
	RIGHT	●	●	●		●		
RIGHT HAND	UP	●	●				●	●
	DOWN	●	●	●			●	
	LEFT	●	●				●	●
	RIGHT	●	●	●				●
OFF POSITION		NO CONTACTS						

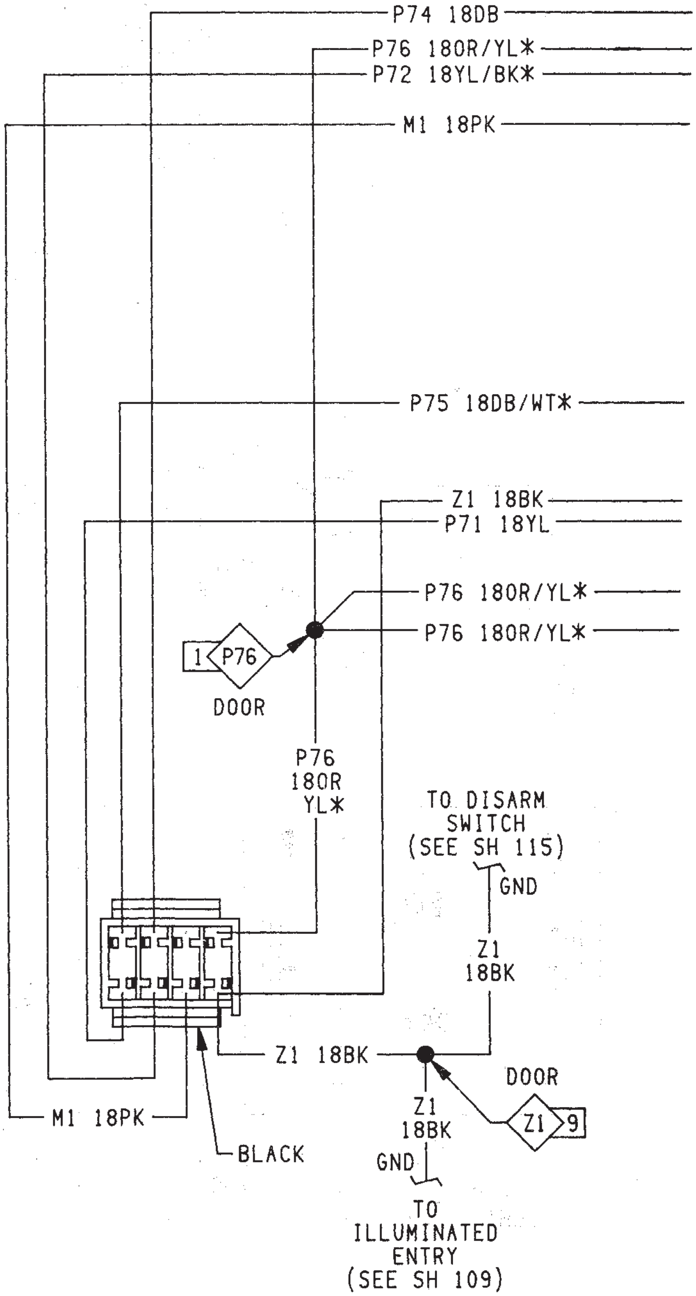
V_L: LH MIRROR UP/DOWN OPERATION
H_L: LH MIRROR RIGHT/LEFT OPERATION
V_R: RH MIRROR UP/DOWN OPERATION
H_R: RH MIRROR RIGHT/LEFT OPERATION



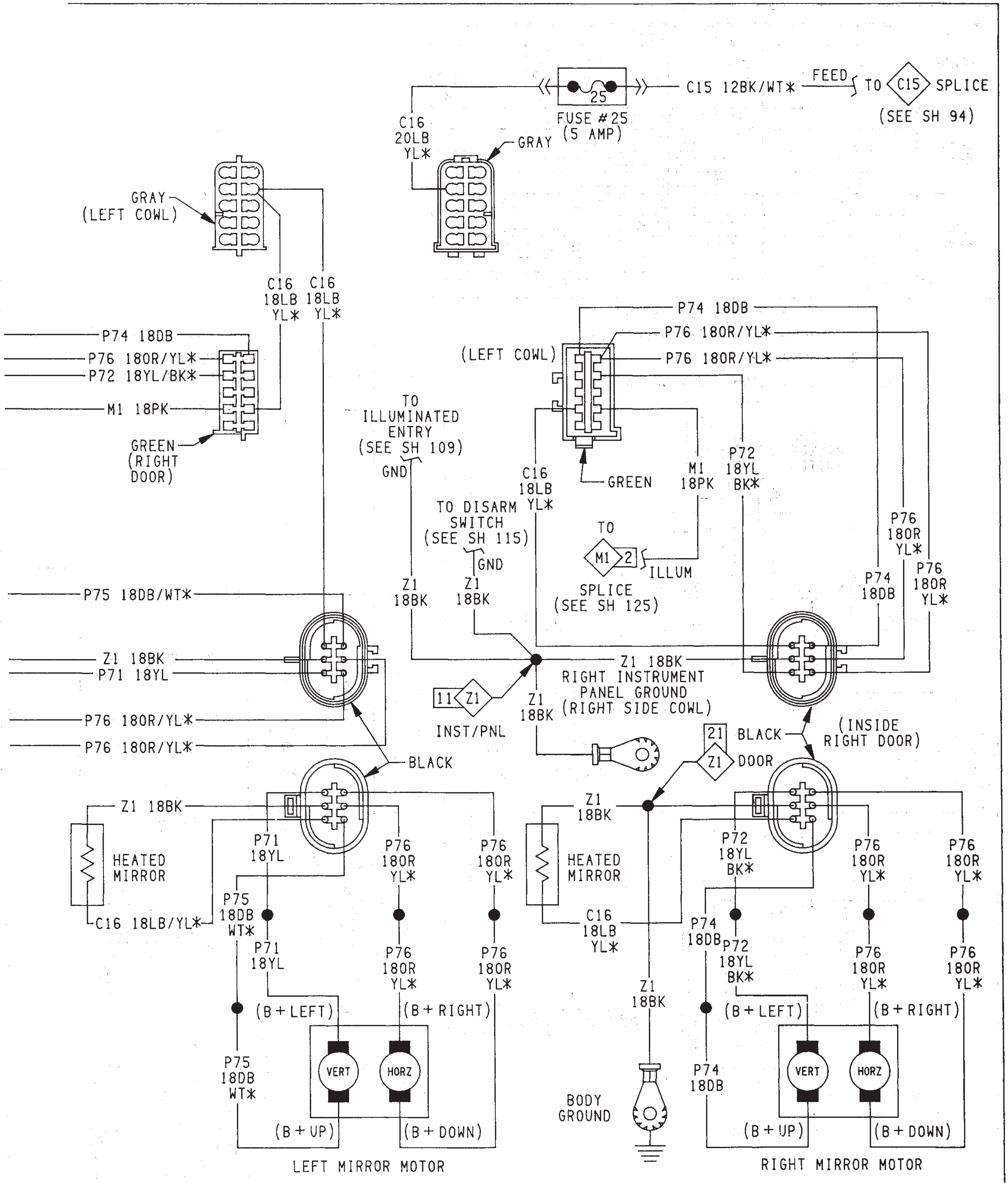
WIRING DIAGRAM



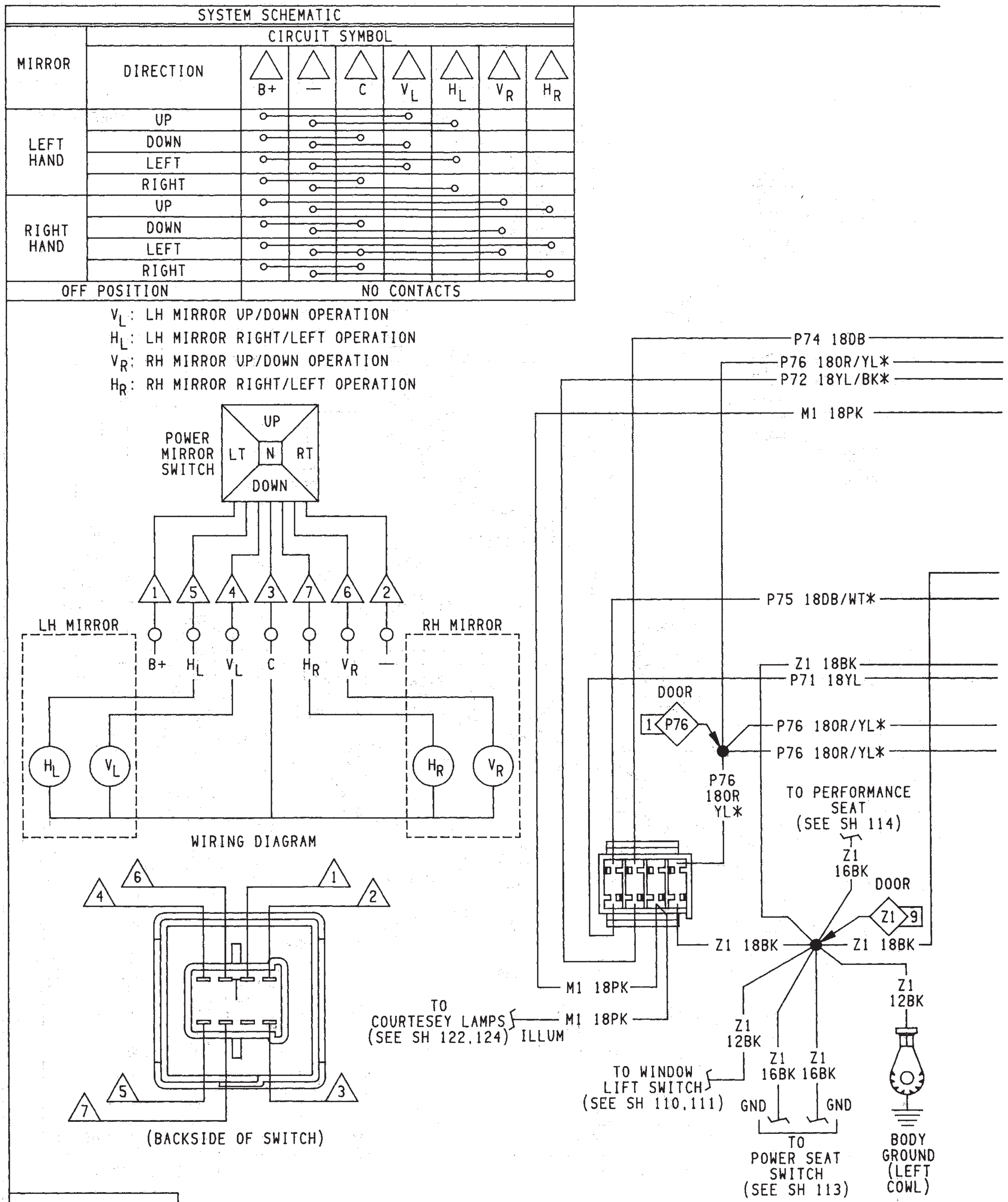
(BACKSIDE OF SWITCH)



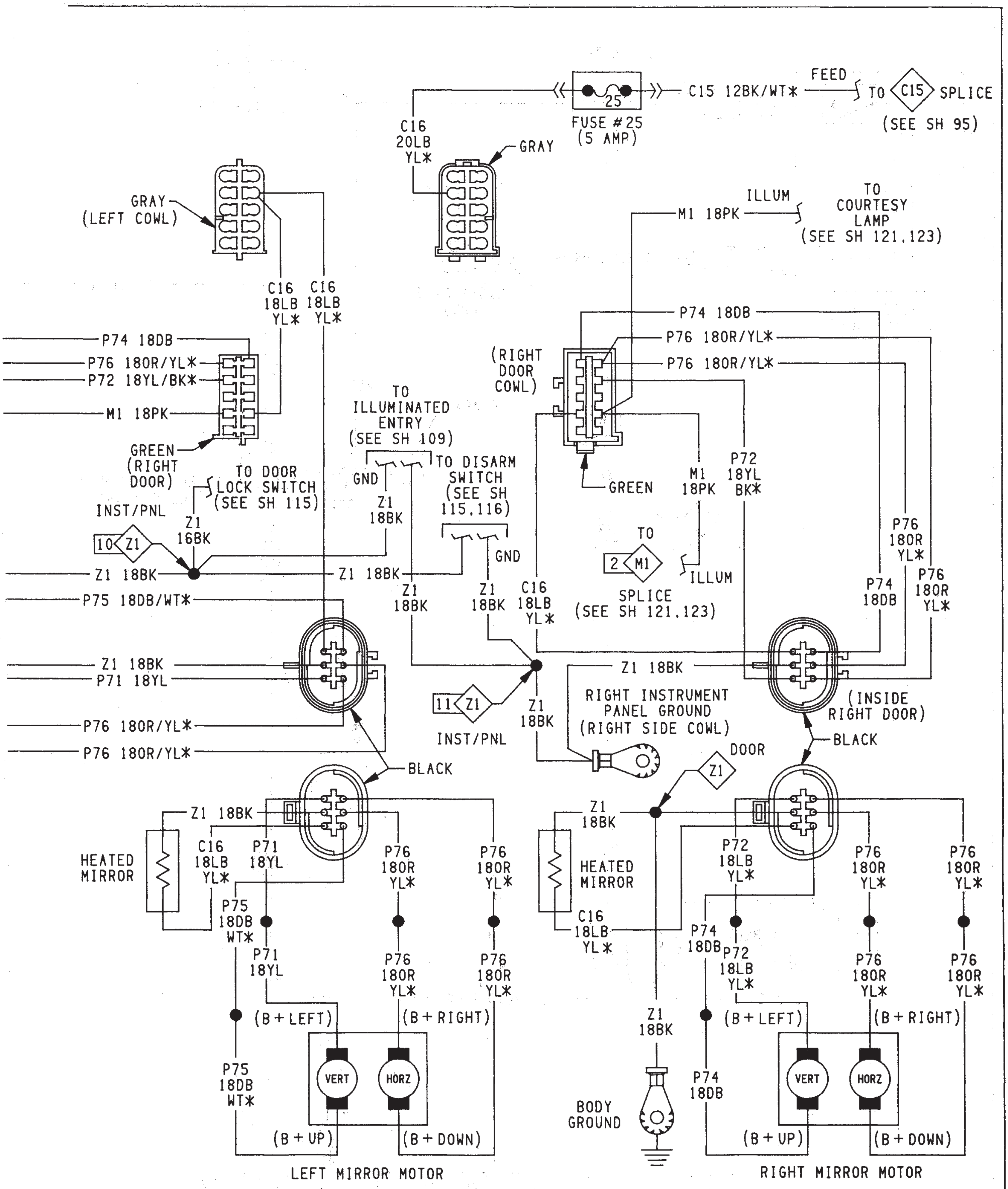
AG 97 | POWER REMOTE AND HEATED MIRRORS | 938W-5



938W-5 POWER REMOTE AND HEATED MIRRORS AG 98



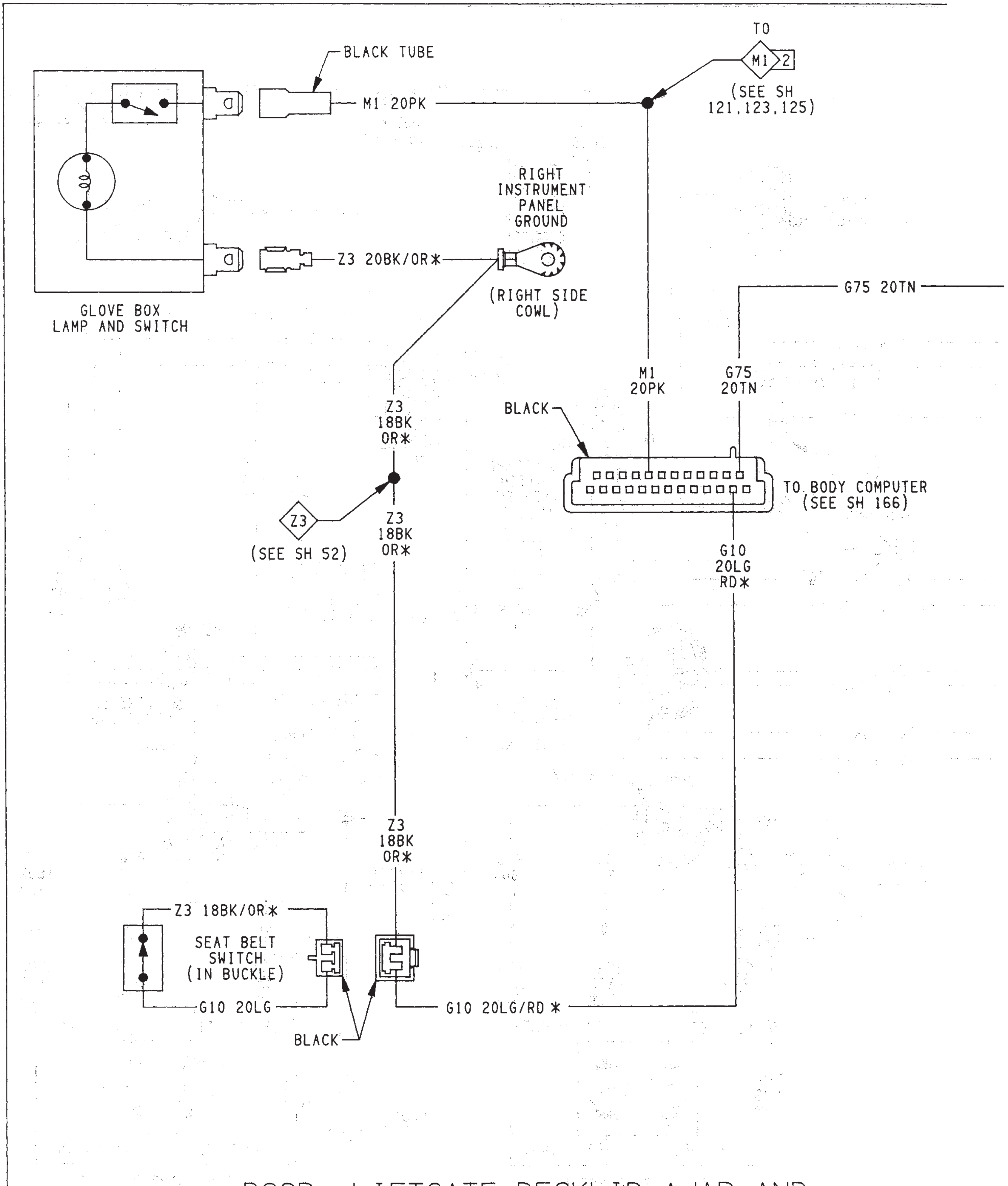
POWER REMOTE AND HEATED MIRRORS



938W-5

POWER REMOTE AND HEATED MIRRORS

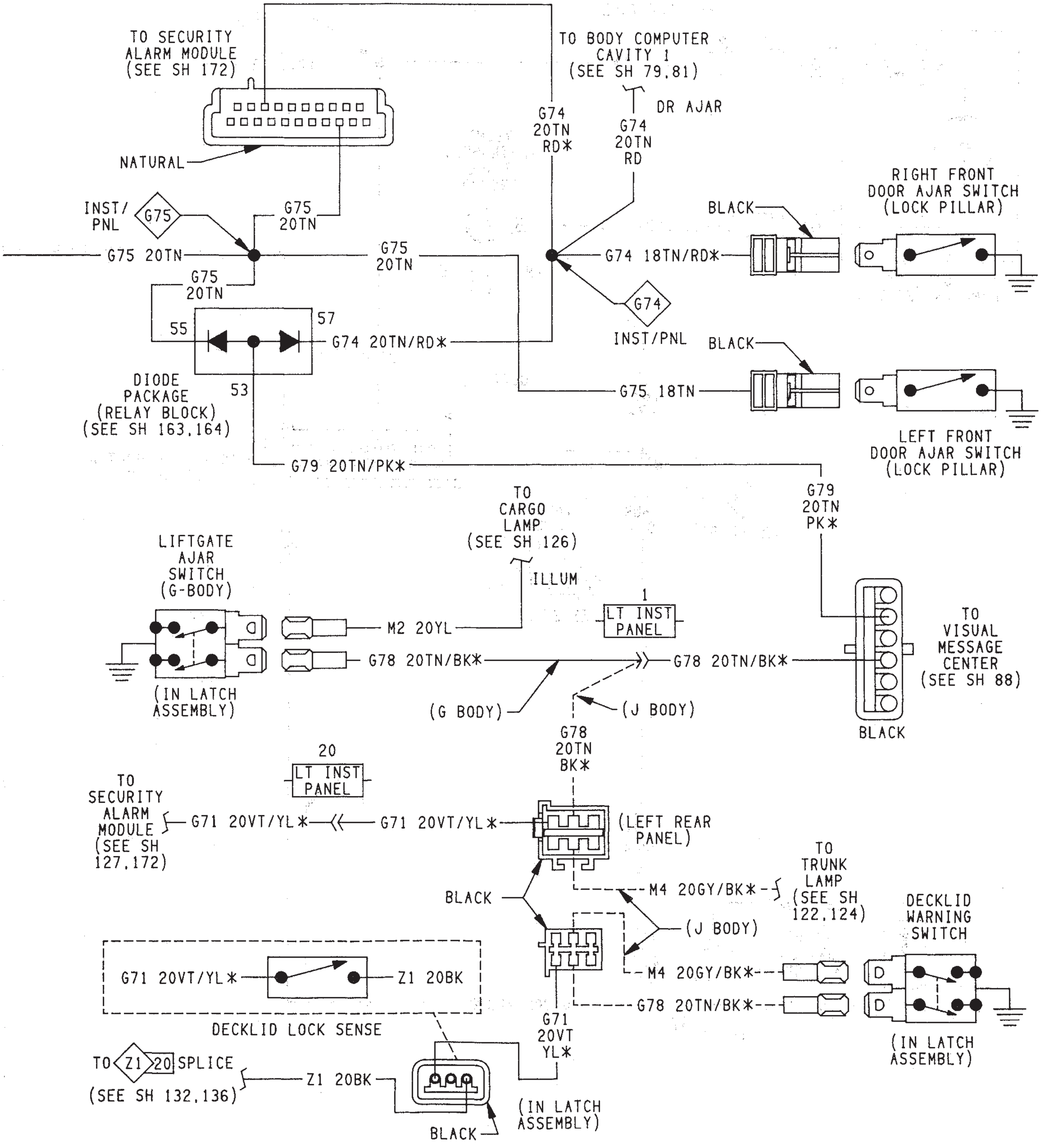
AJ 100



AG-AJ 101

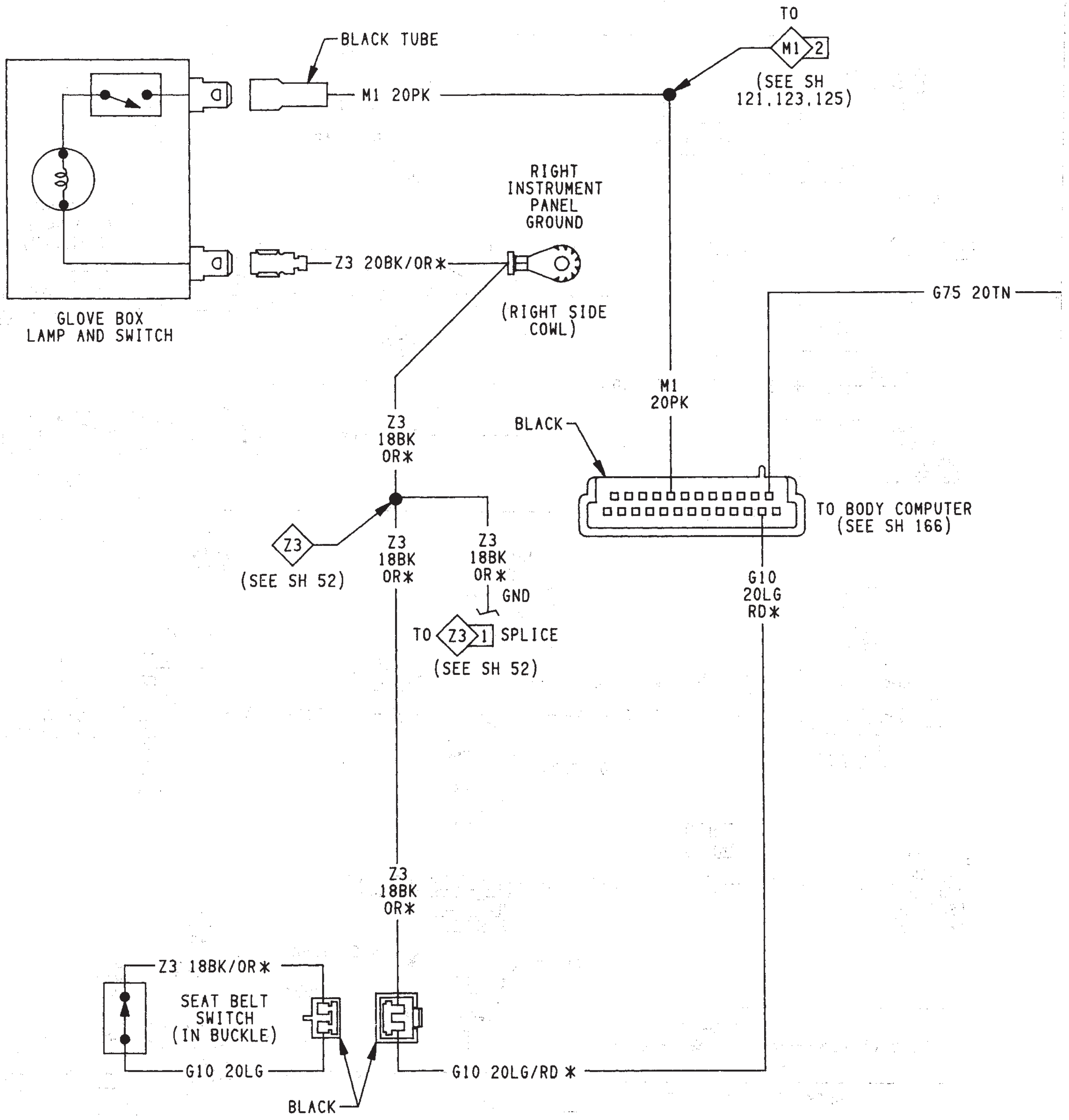
DOOR, LIFTGATE-DECKLID AJAR AND SEATBELT WARNING SYSTEM WITHOUT EVIC

938W-5



DOOR, LIFTGATE-DECKLID AJAR AND
938W-5 SEATBELT WARNING SYSTEM WITHOUT EVIC

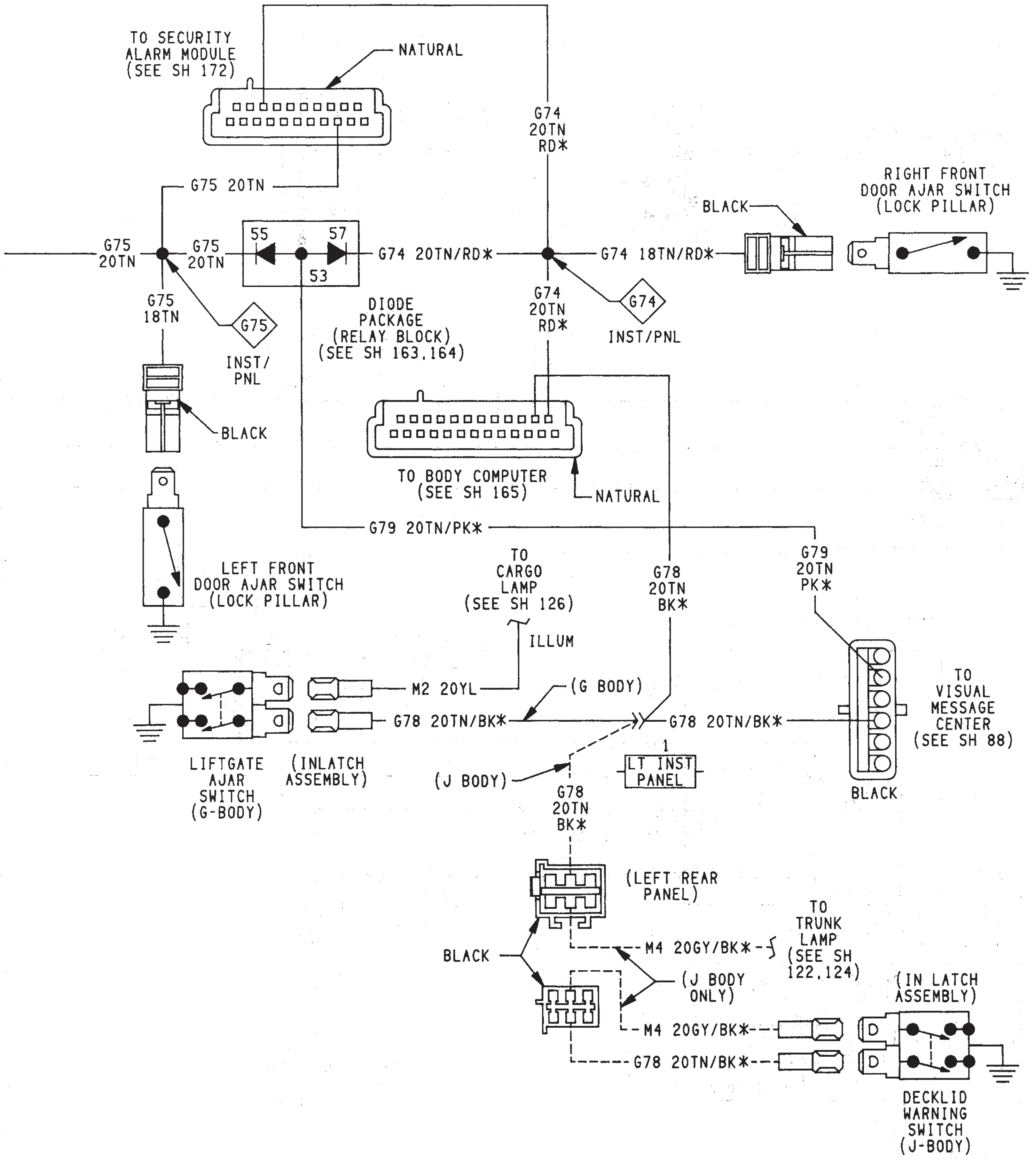
AG-AJ 102



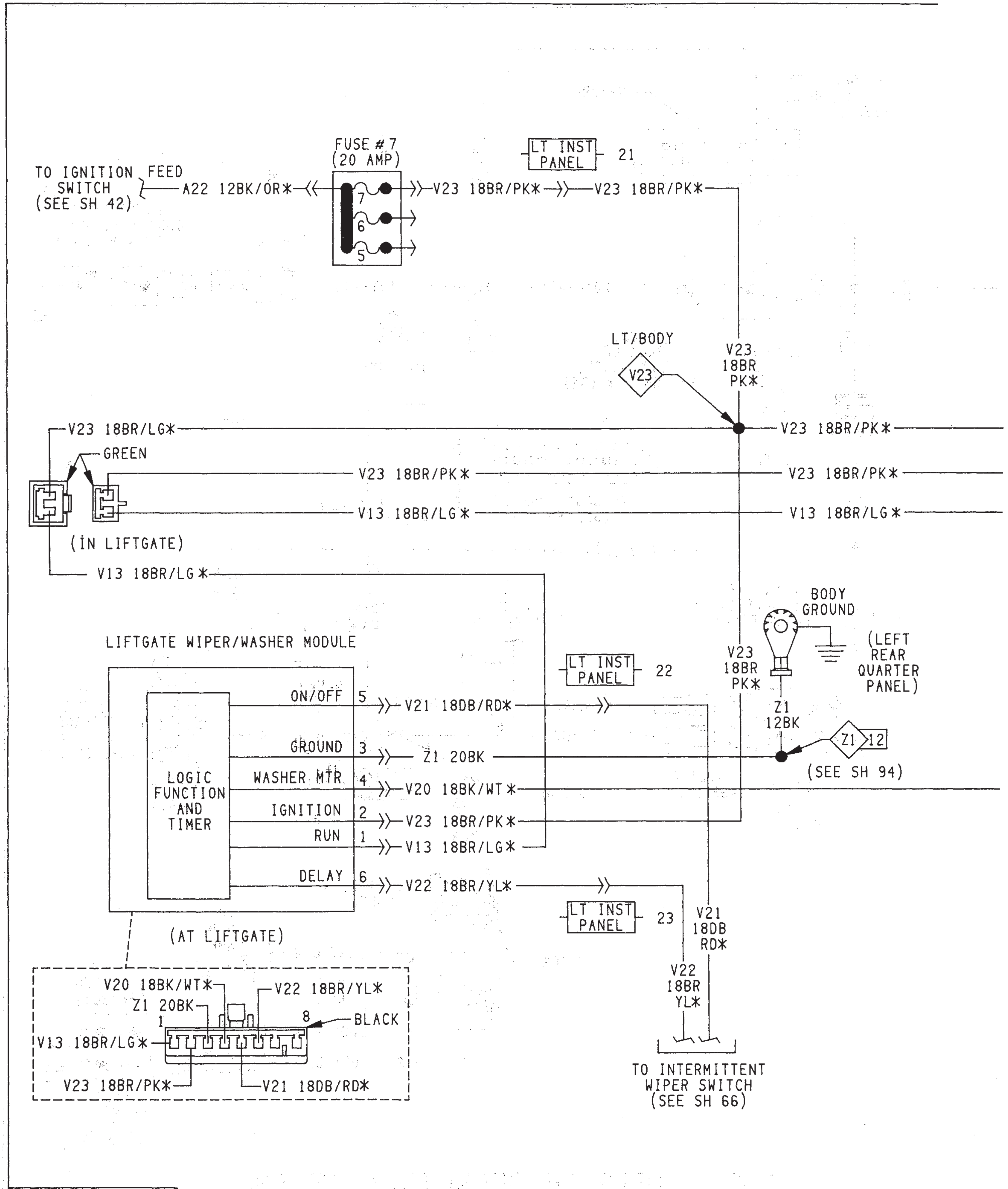
AG-AJ 103

DOOR, LIFTGATE-DECKLID AJAR AND SEATBELT WARNING SYSTEM WITH EVIC

938W-5

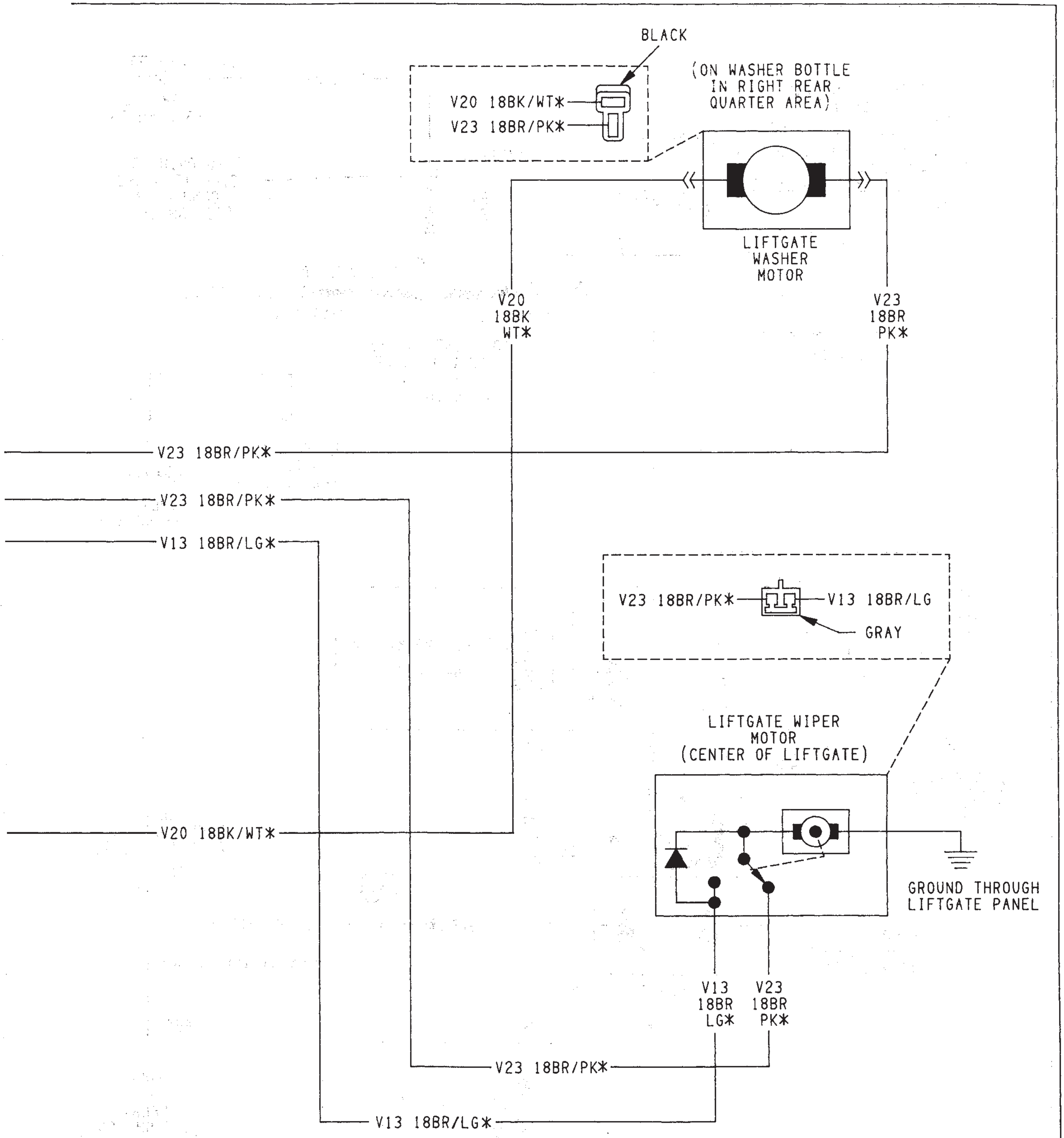


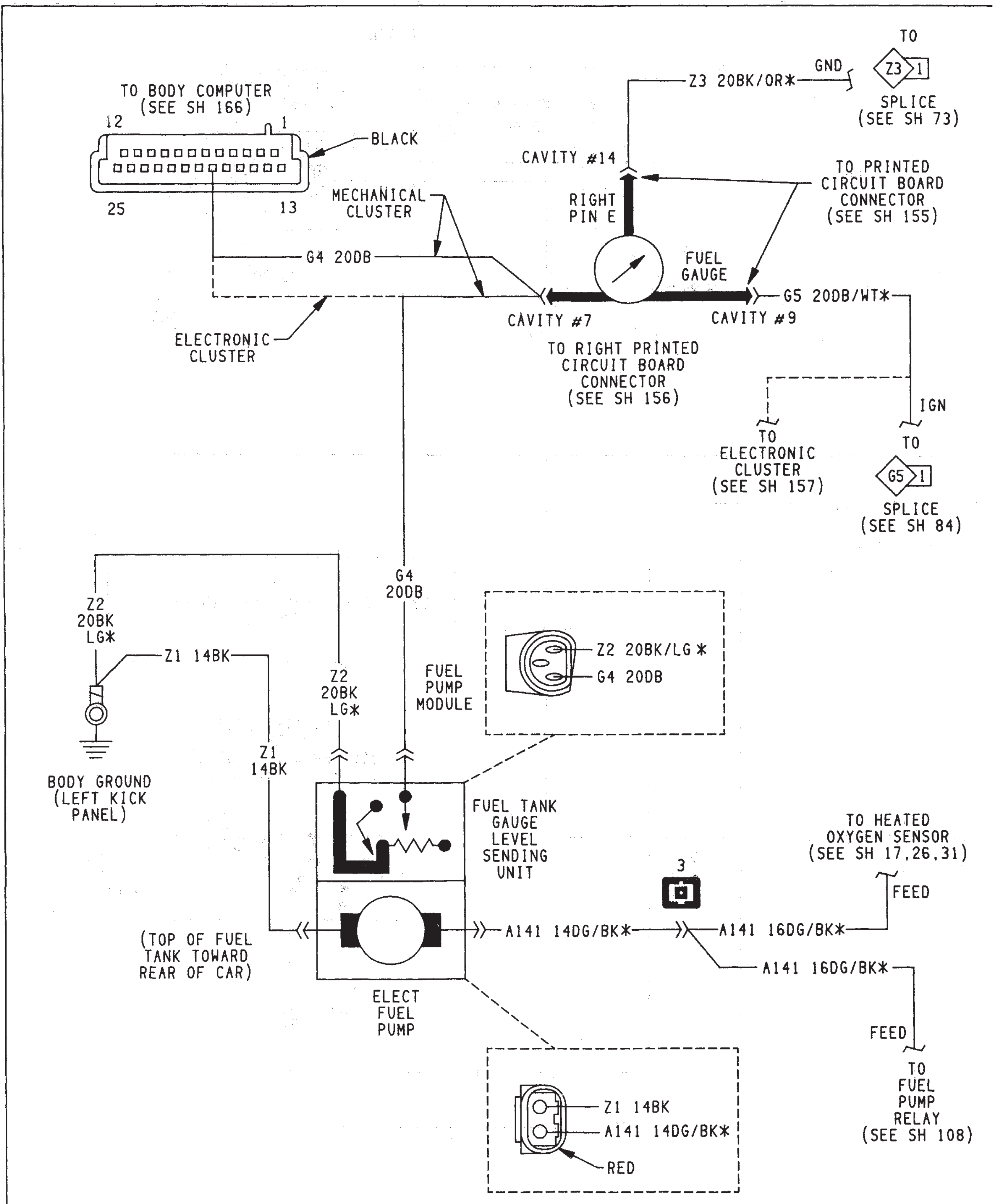
DOOR, LIFTGATE-DECKLID AJAR AND
SEATBELT WARNING SYSTEM WITH EVIC



AG 105 LIFTGATE WIPER AND WASHER SYSTEM

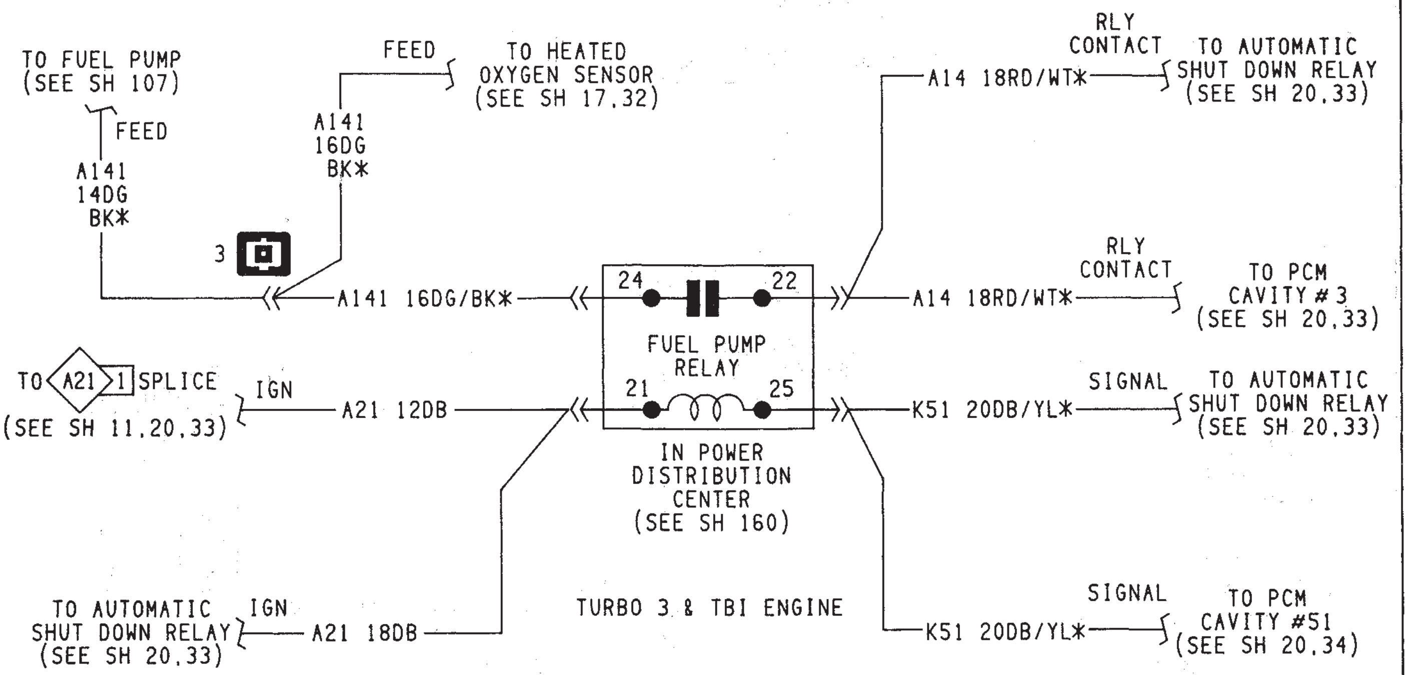
938W-5

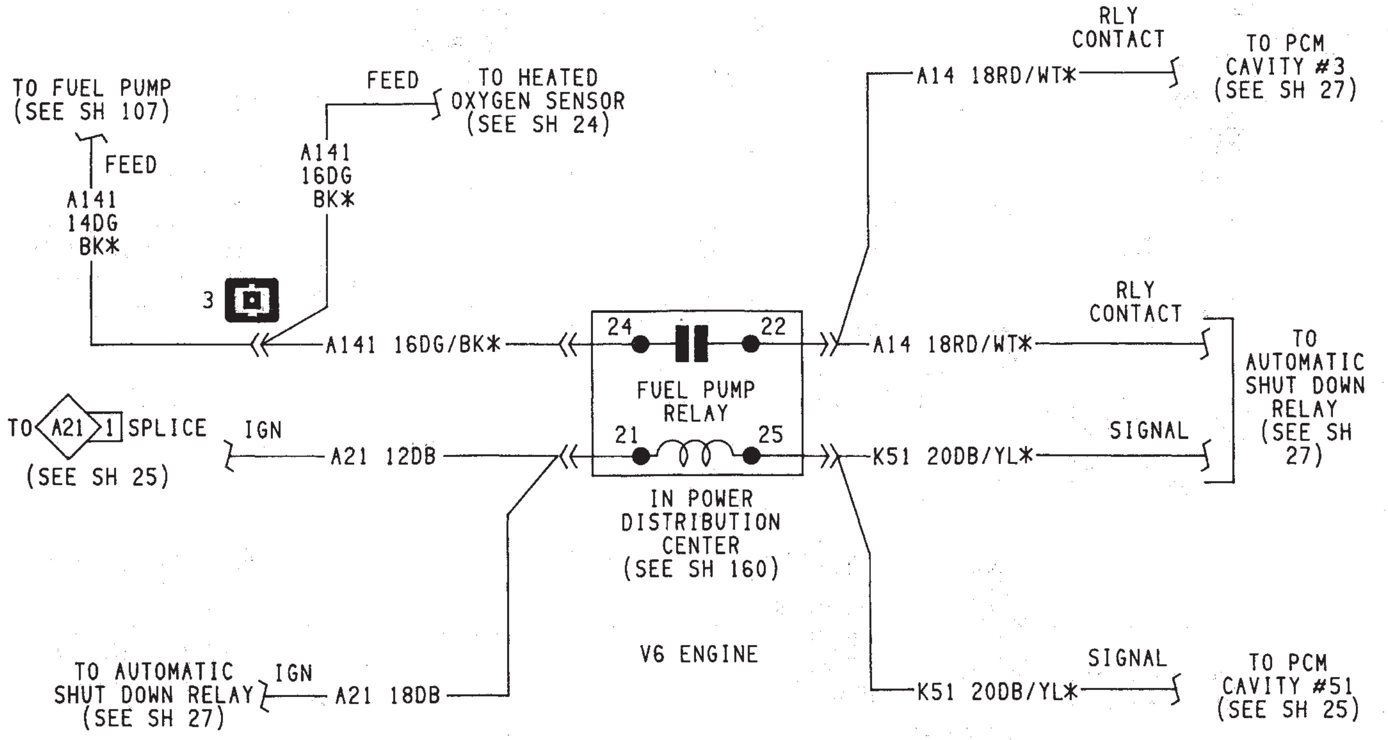

BLACK
V20 18BK/WT*
V23 18BR/PK*
(ON WASHER BOTTLE IN RIGHT REAR QUARTER AREA)
LIFTGATE WASHER MOTOR
V20 18BK WT*
V23 18BR PK*
V23 18BR/PK*
V23 18BR/PK*
V13 18BR/LG*
V23 18BR/PK*
V13 18BR/LG
GRAY
LIFTGATE WIPER MOTOR (CENTER OF LIFTGATE)
V20 18BK/WT*
GROUND THROUGH LIFTGATE PANEL
V13 18BR LG*
V23 18BR PK*
V23 18BR/PK*
V13 18BR/LG*



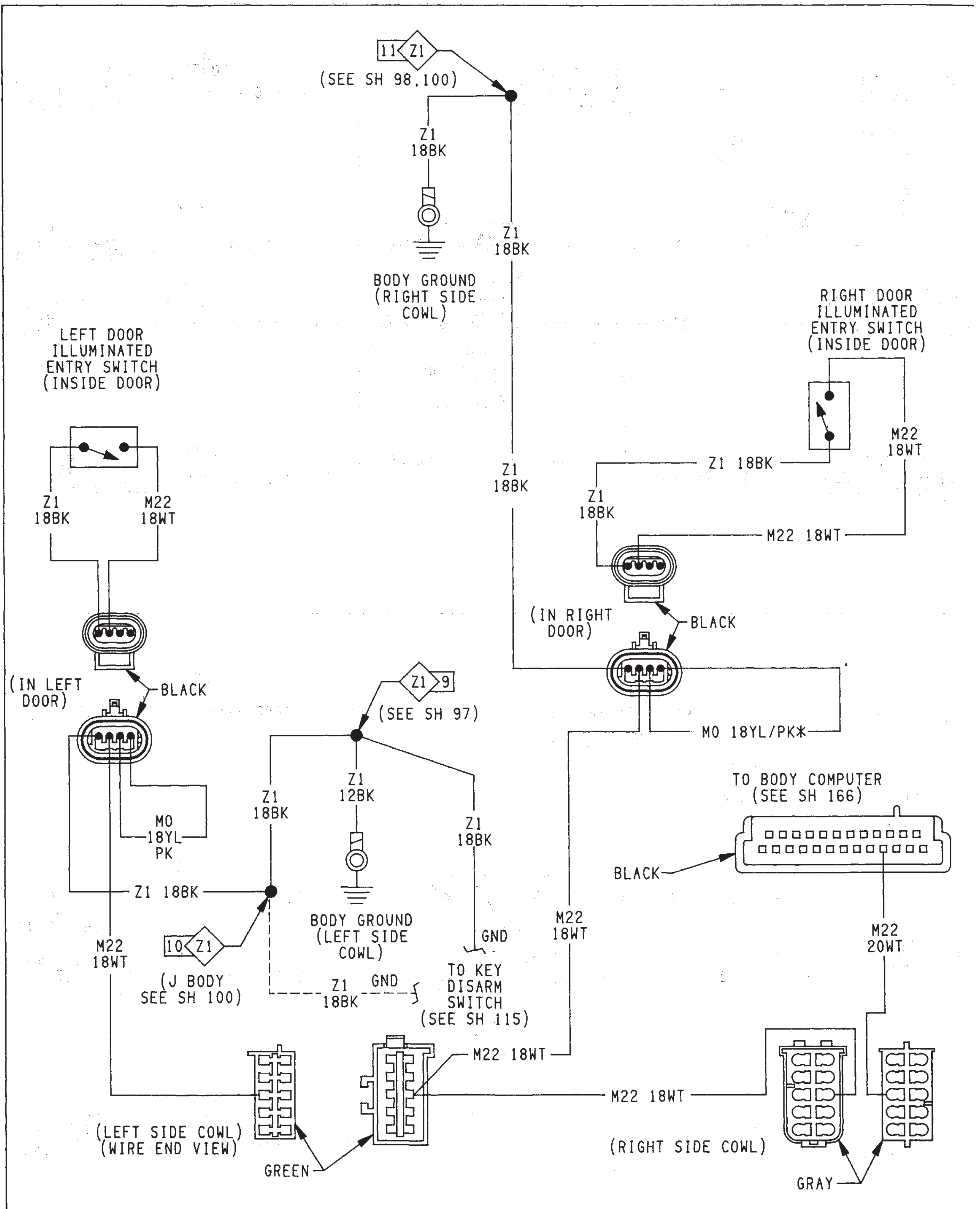
FUEL TANK SYSTEM

938W-5





FUEL TANK SYSTEM

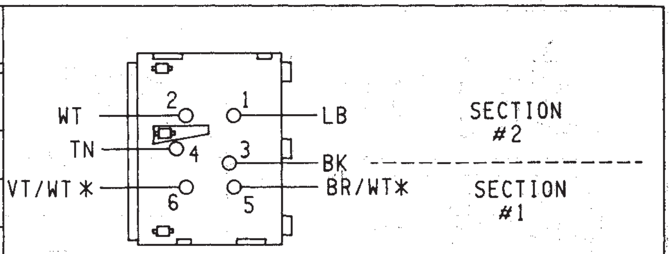


DOOR COURTESY LAMPS AND ILLUMINATED ENTRY

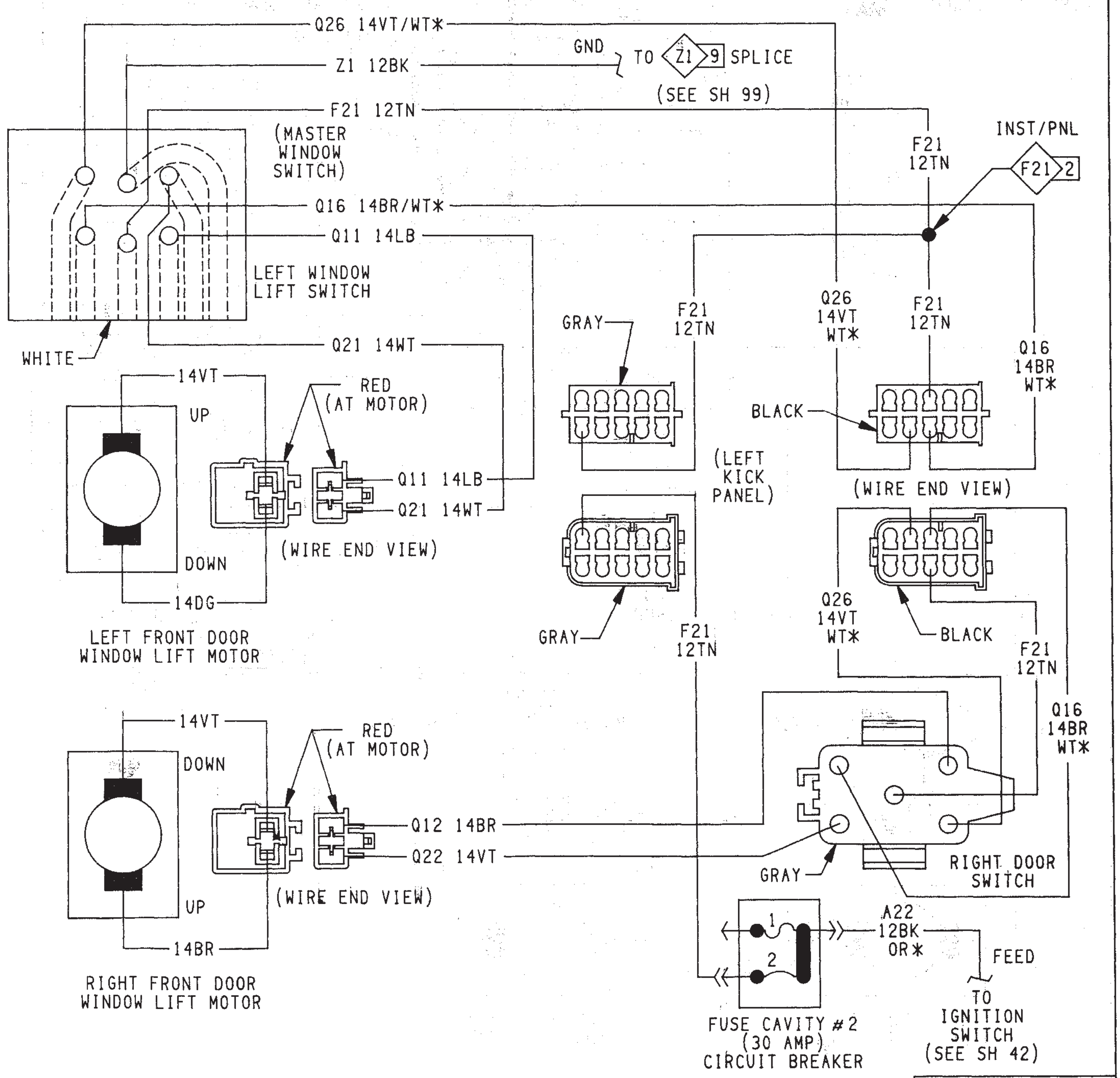
938W-5

WINDOW LIFT CONNECTOR AND LIFT SWITCH FUNCTION

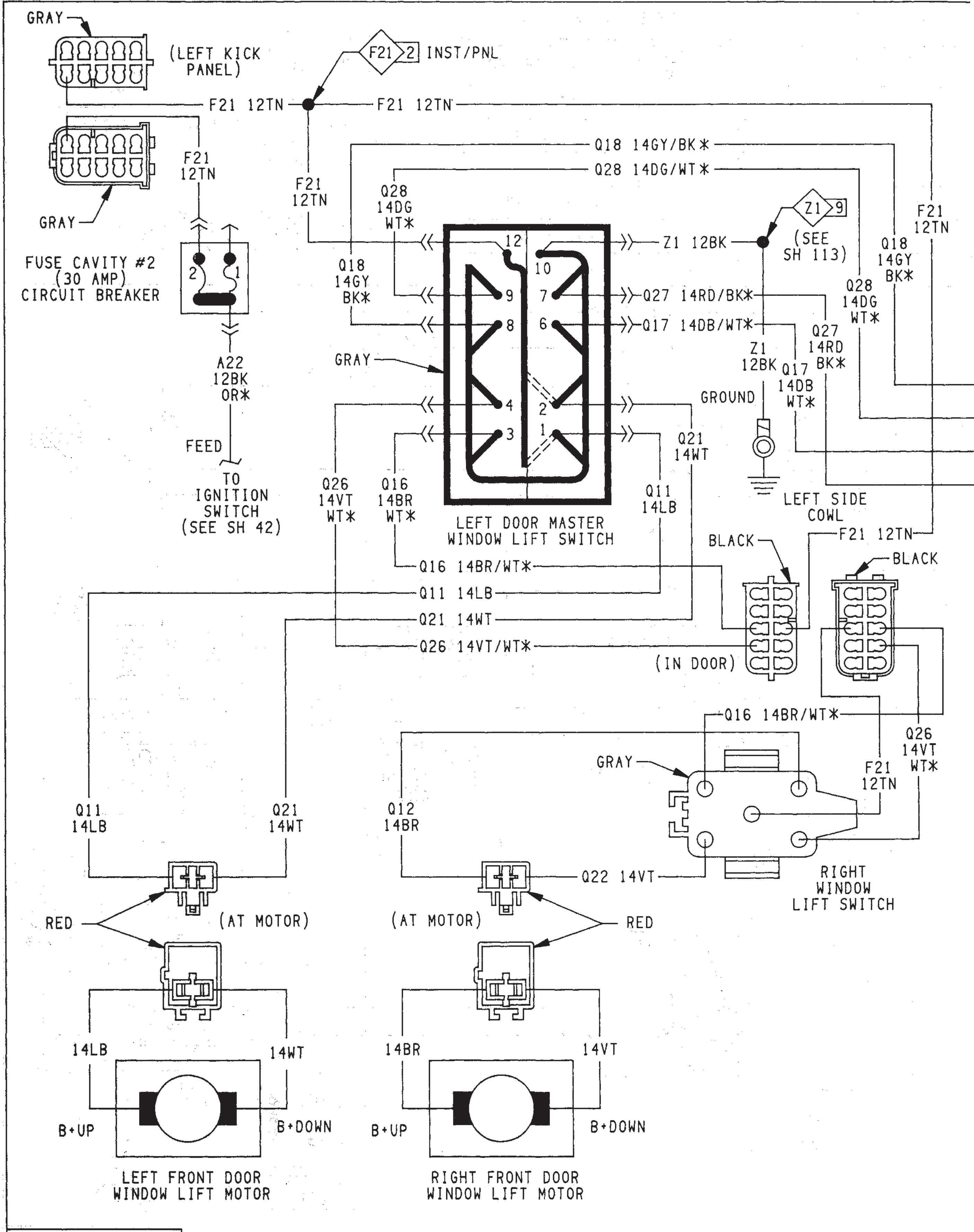
B+ POLARITY	B- POLARITY	SWITCH SECTION	WINDOW MOVEMENT
WT	LB	2	LEFT UP
LB	WT	2	LEFT DOWN
VT/WT*	BR/WT*	1	RIGHT UP
BR/WT*	VT/WT*	1	RIGHT DOWN
-	BK	1	GROUND B-
TN	-	2	GROUND B+



FORWARD IN CAR
CENTER CONSOLE MASTER WINDOW LIFT
SWITCH CONNECTOR-2 GANG



938W-5 POWER WINDOW SYSTEM (J21) AJ 110



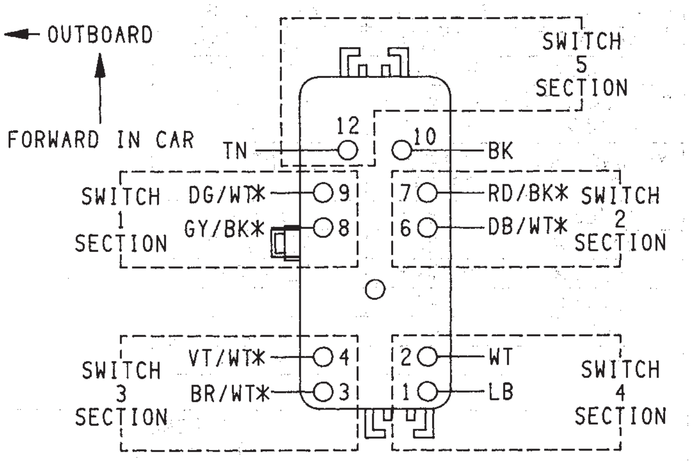
AG-AJ111

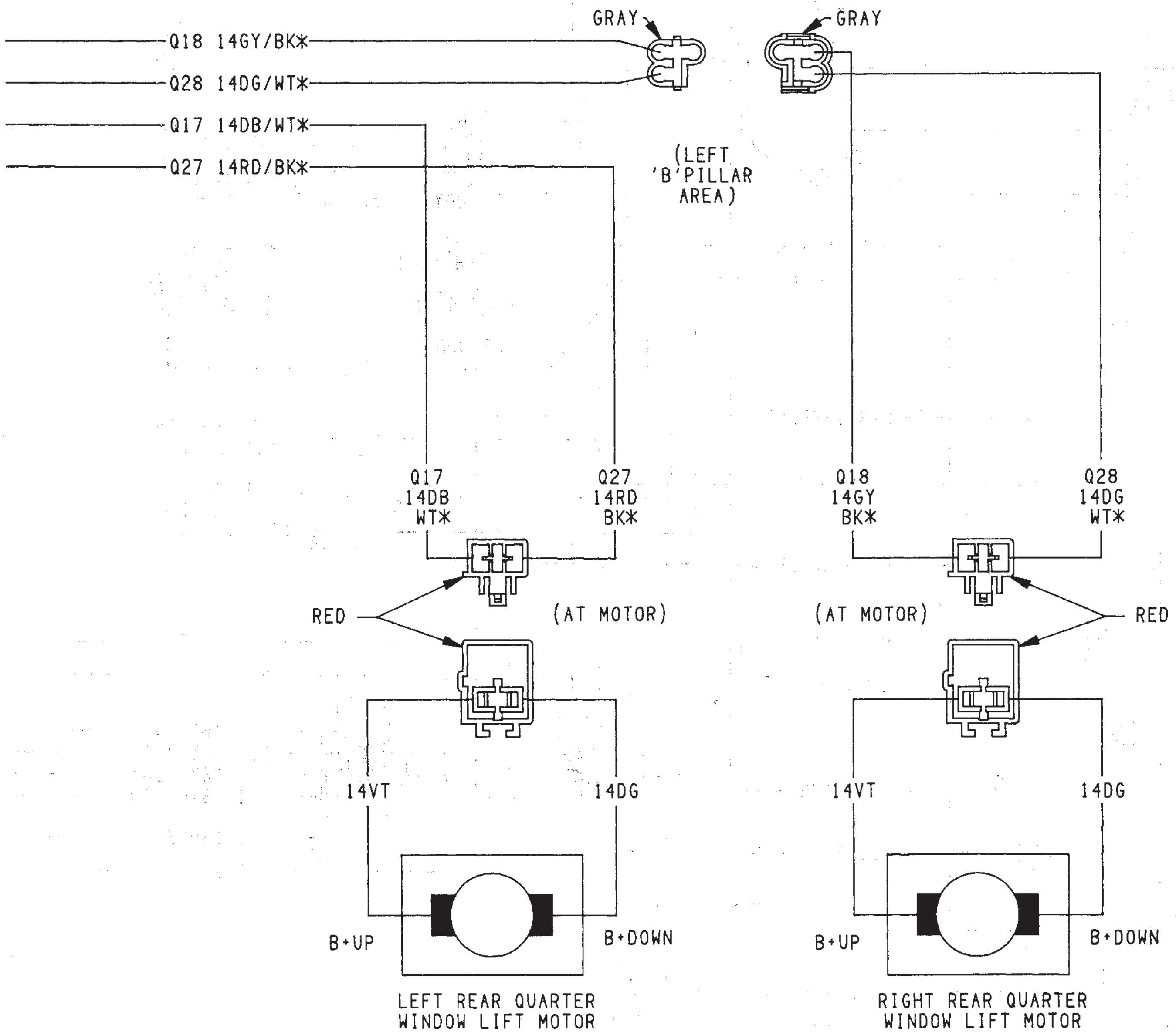
POWER WINDOW SYSTEM

938W-5

CENTER CONSOLE
CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

B+ POLARITY	B- POLARITY	SWITCH SECTION	WINDOW MOVEMENT
WT	LB	4	LEFT FRONT UP
LB	WT	4	LEFT FRONT DOWN
VT/WT*	BR/WT*	3	RIGHT FRONT UP
BR/WT*	VT/WT*	3	RIGHT FRONT DOWN
RD/BK*	DB/WT*	2	LEFT REAR UP
DB/WT*	RD/BK*	2	LEFT REAR DOWN
DG/WT*	GY/BK*	1	RIGHT REAR UP
GY/BK*	DG/WT*	1	RIGHT REAR DOWN
——	BK	N/A	GROUND B-
TN	——	5	GROUND B+



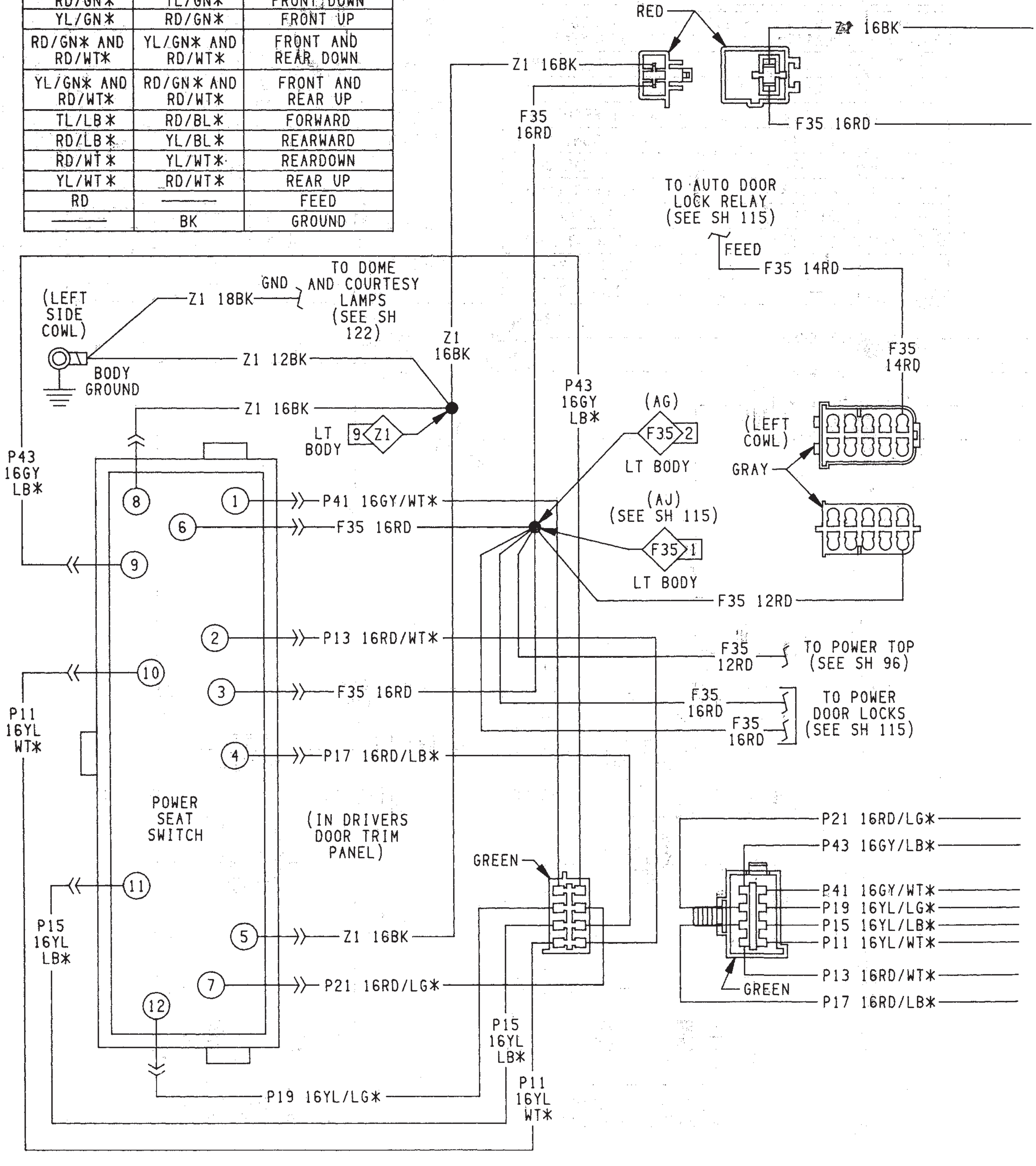


LEFT REAR QUARTER
WINDOW LIFT MOTOR

RIGHT REAR QUARTER
WINDOW LIFT MOTOR

POWER WINDOW SYSTEM (J-27)

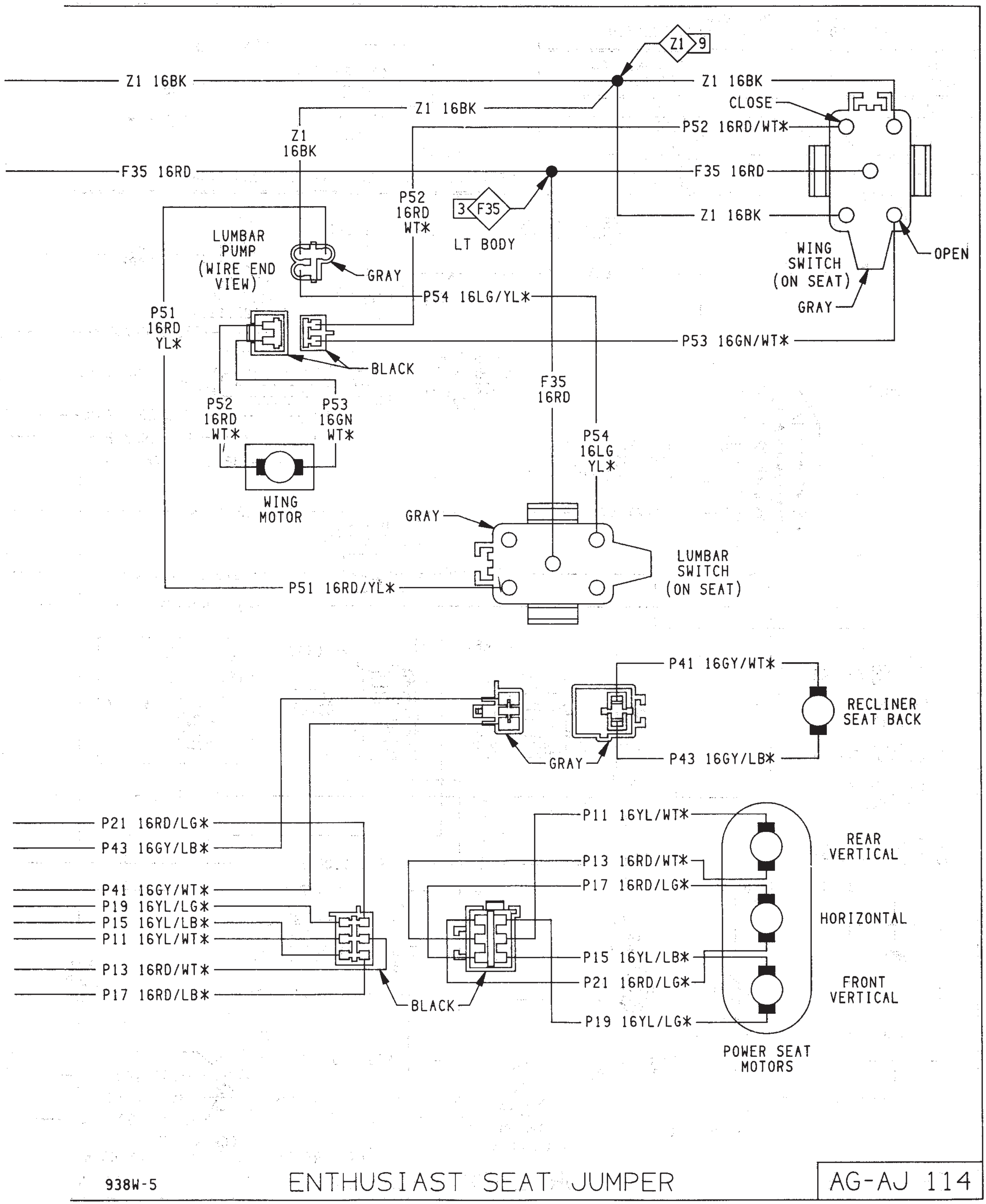
MOTOR INSULATOR POLARITY		
B+POLARITY	B-POLARITY	SEAT MOVEMENT
RD/GN*	YL/GN*	FRONT DOWN
YL/GN*	RD/GN*	FRONT UP
RD/GN* AND RD/WT*	YL/GN* AND RD/WT*	FRONT AND REAR DOWN
YL/GN* AND RD/WT*	RD/GN* AND RD/WT*	FRONT AND REAR UP
TL/LB*	RD/BL*	FORWARD
RD/LB*	YL/BL*	REARWARD
RD/WT*	YL/WT*	REARDOWN
YL/WT*	RD/WT*	REAR UP
RD	———	FEED
———	BK	GROUND



AG-AJ 113

LEFT BUCKET POWER SEAT SYSTEM

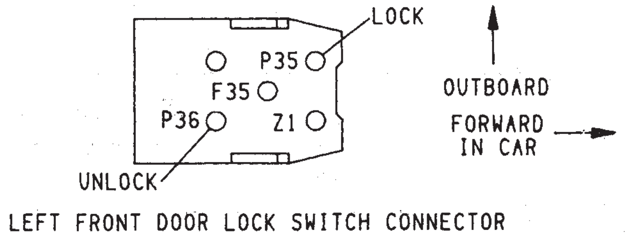
938W-5



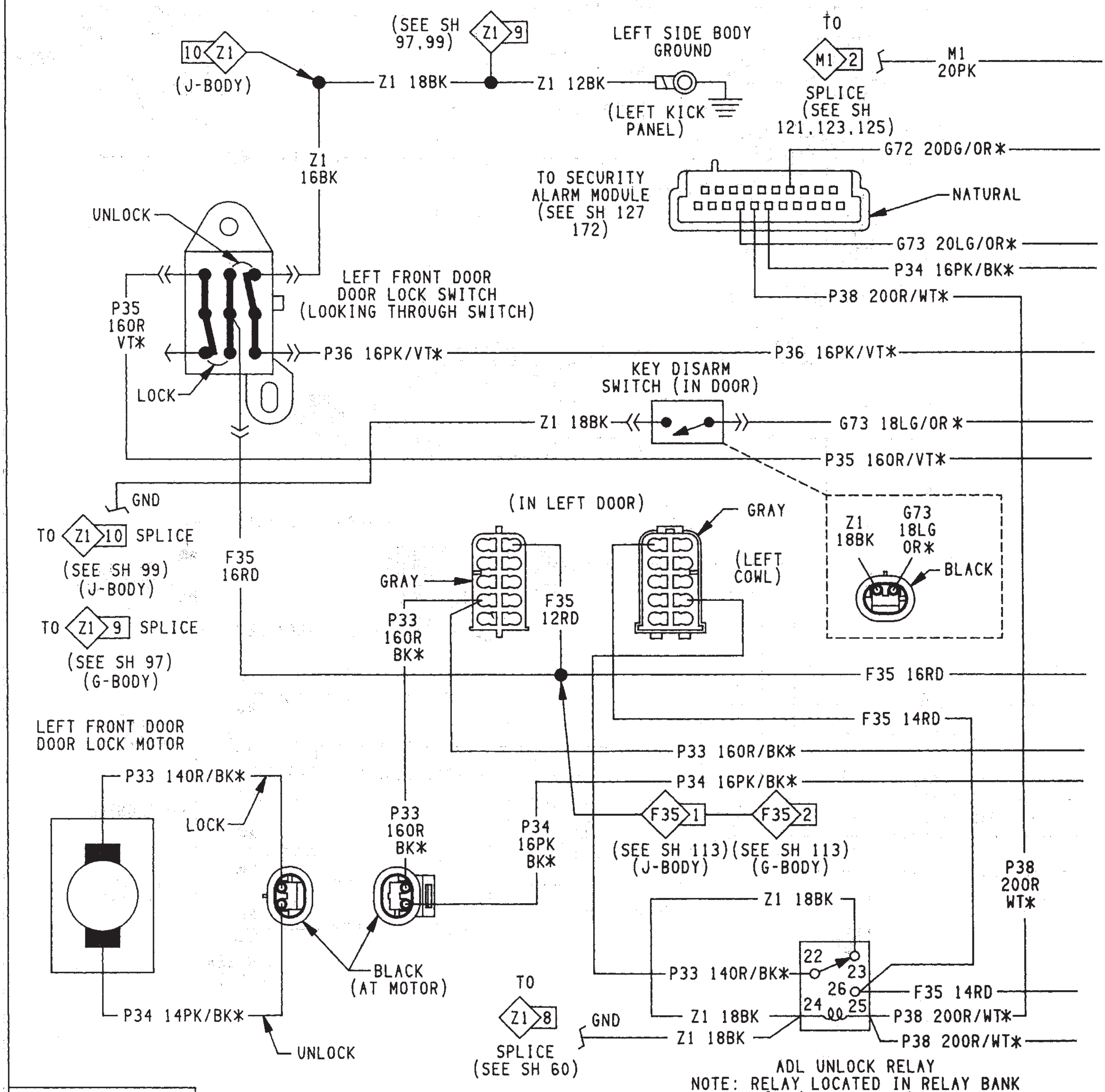
ENTHUSIAST SEAT JUMPER

LEFT FRONT DOOR
CONNECTOR AND DOOR LOCK SWITCH FUNCTION

B+ POLARITY	B- POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR	PK	LOCK
PK	OR	UNLOCK
--	BK	GROUND B-
--	BK	GROUND B-
RD	--	FEED B+



LEFT FRONT DOOR LOCK SWITCH CONNECTOR



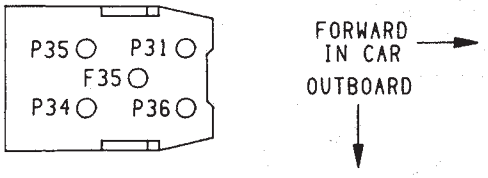
NOTE: RELAY LOCATED IN RELAY BANK (SEE SH 162)

DOOR LOCK SYSTEM

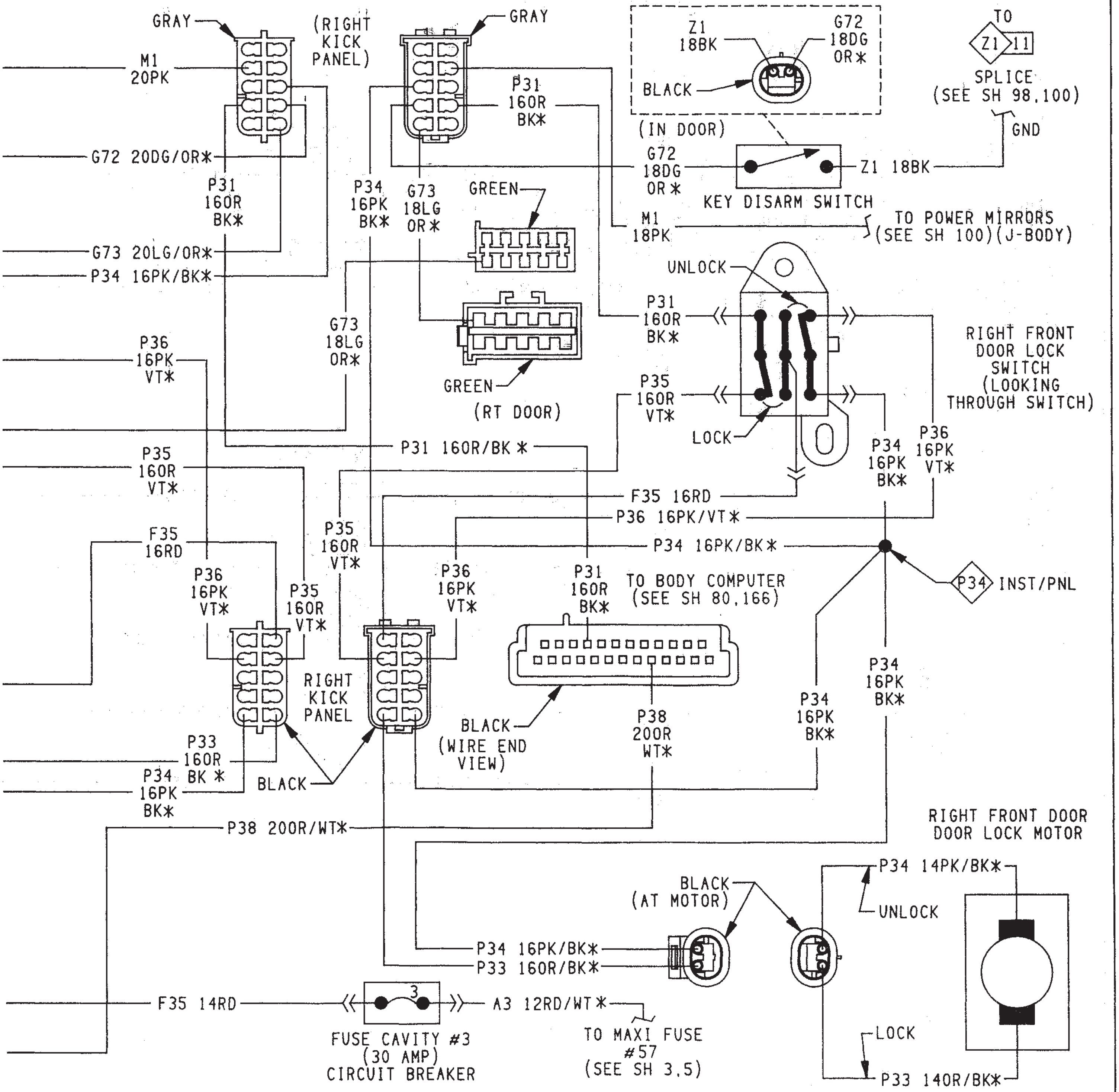
938W-5

RIGHT FRONT DOOR CONNECTOR AND DOOR LOCK SWITCH FUNCTION

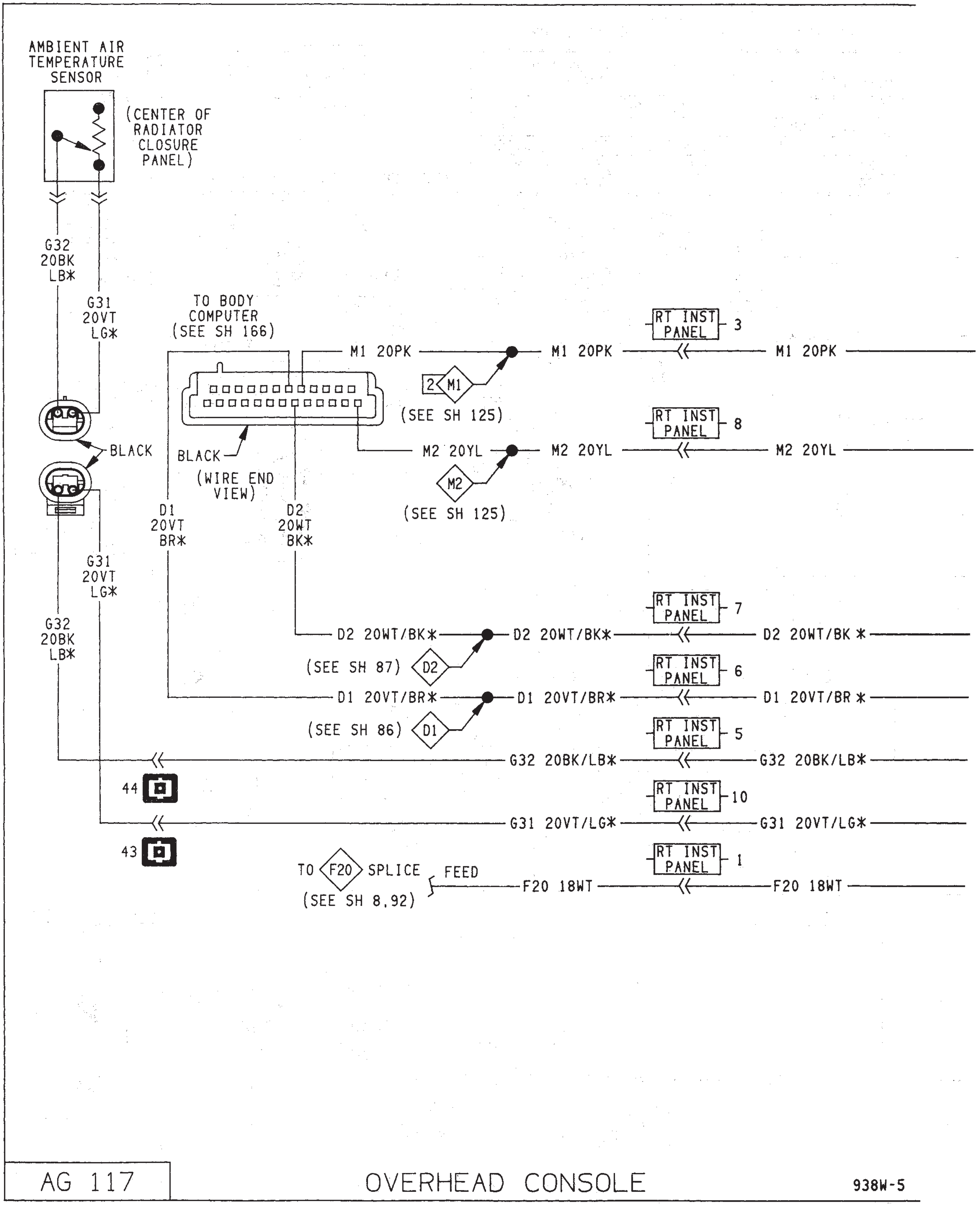
B+ POLARITY	B- POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR/BK*	PK/BK*	LOCK FROM DOOR SWITCH
PK/BK*	OR/BK*	UNLOCK FROM DOOR SWITCH
OR	PK	LOCK FROM LEFT DOOR SWITCH
PK	OR	UNLOCK FROM LEFT DOOR SWITCH
RD	--	FEED B+



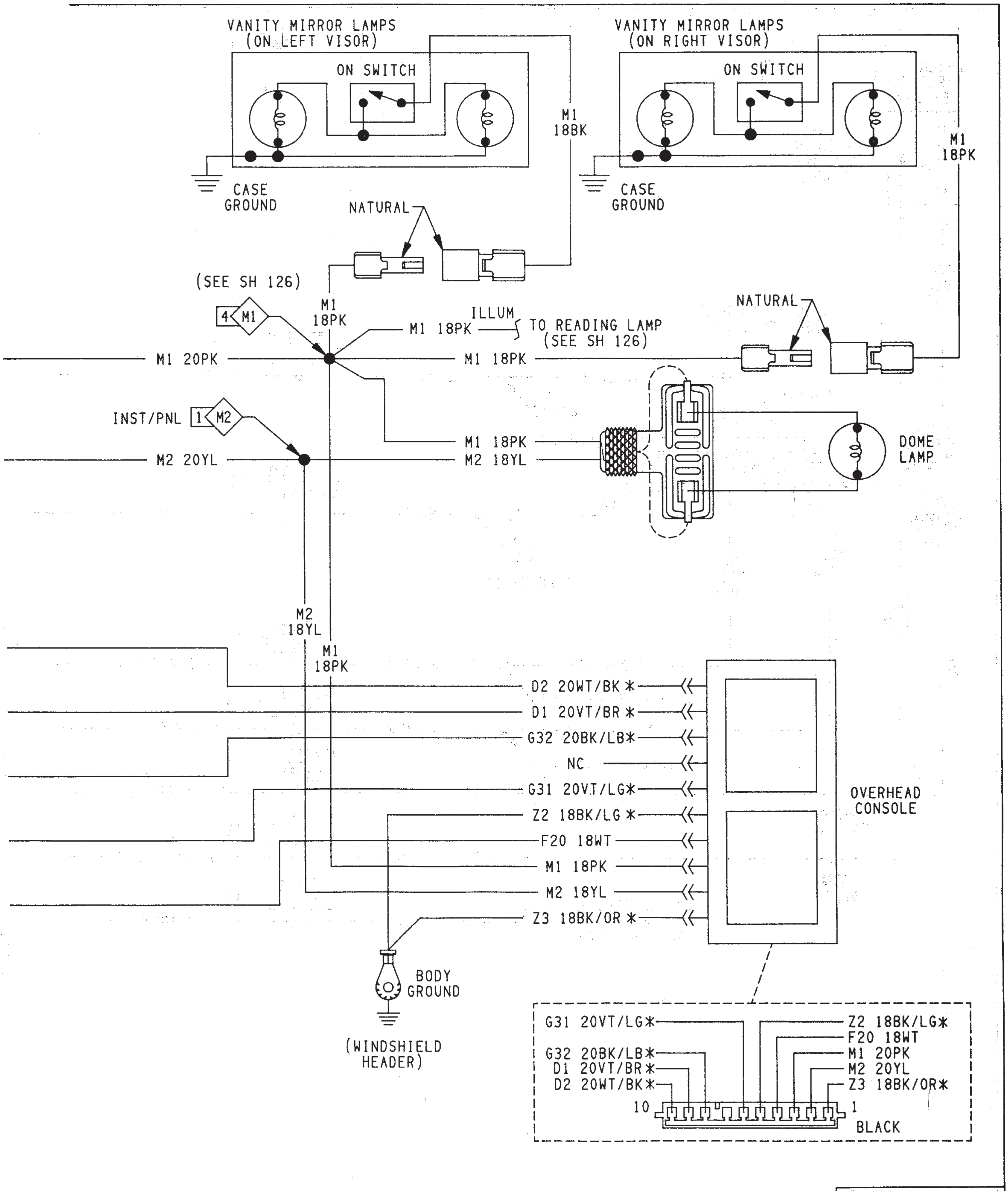
RIGHT FRONT DOOR LOCK SWITCH CONNECTOR



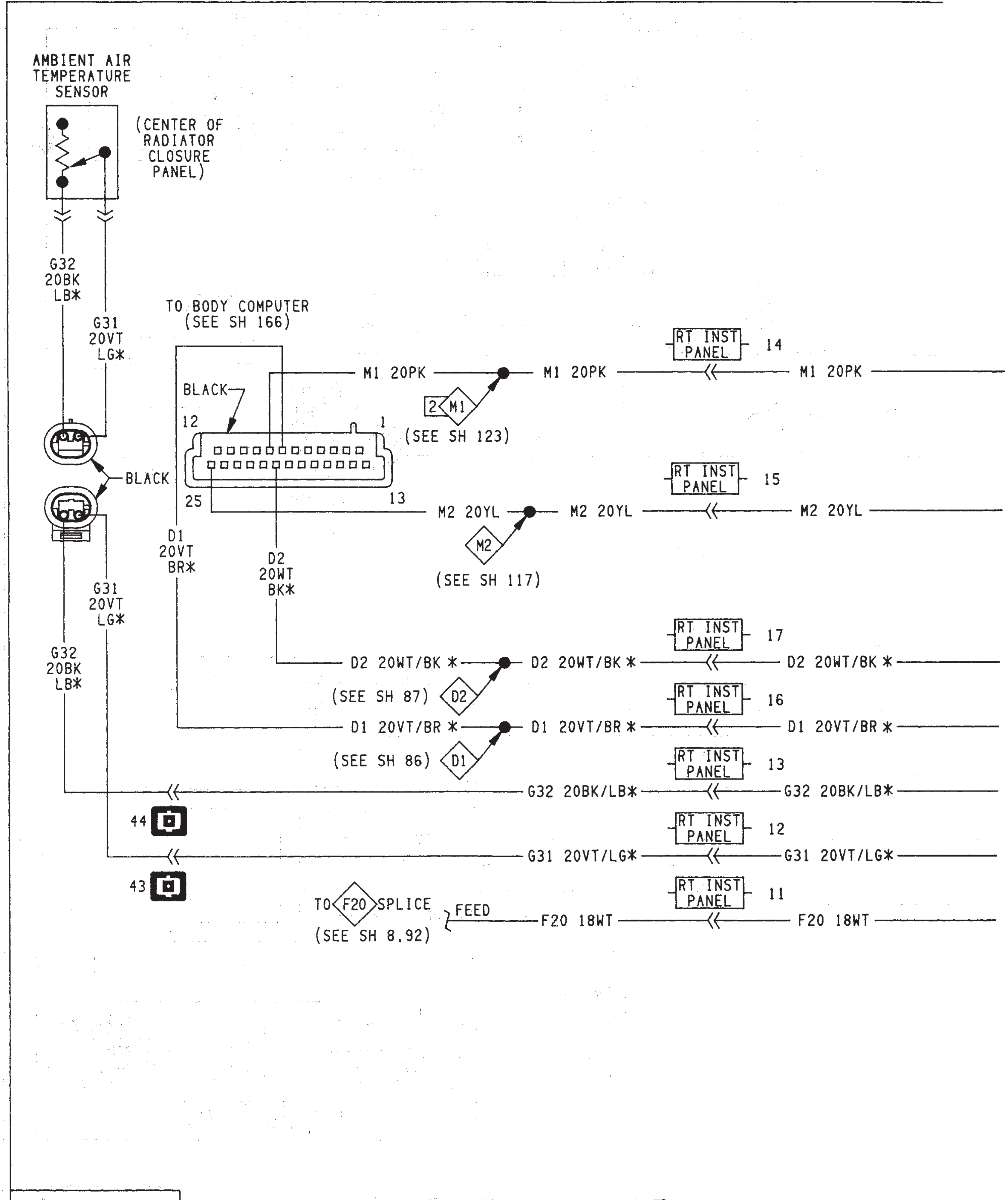
DOOR LOCK SYSTEM



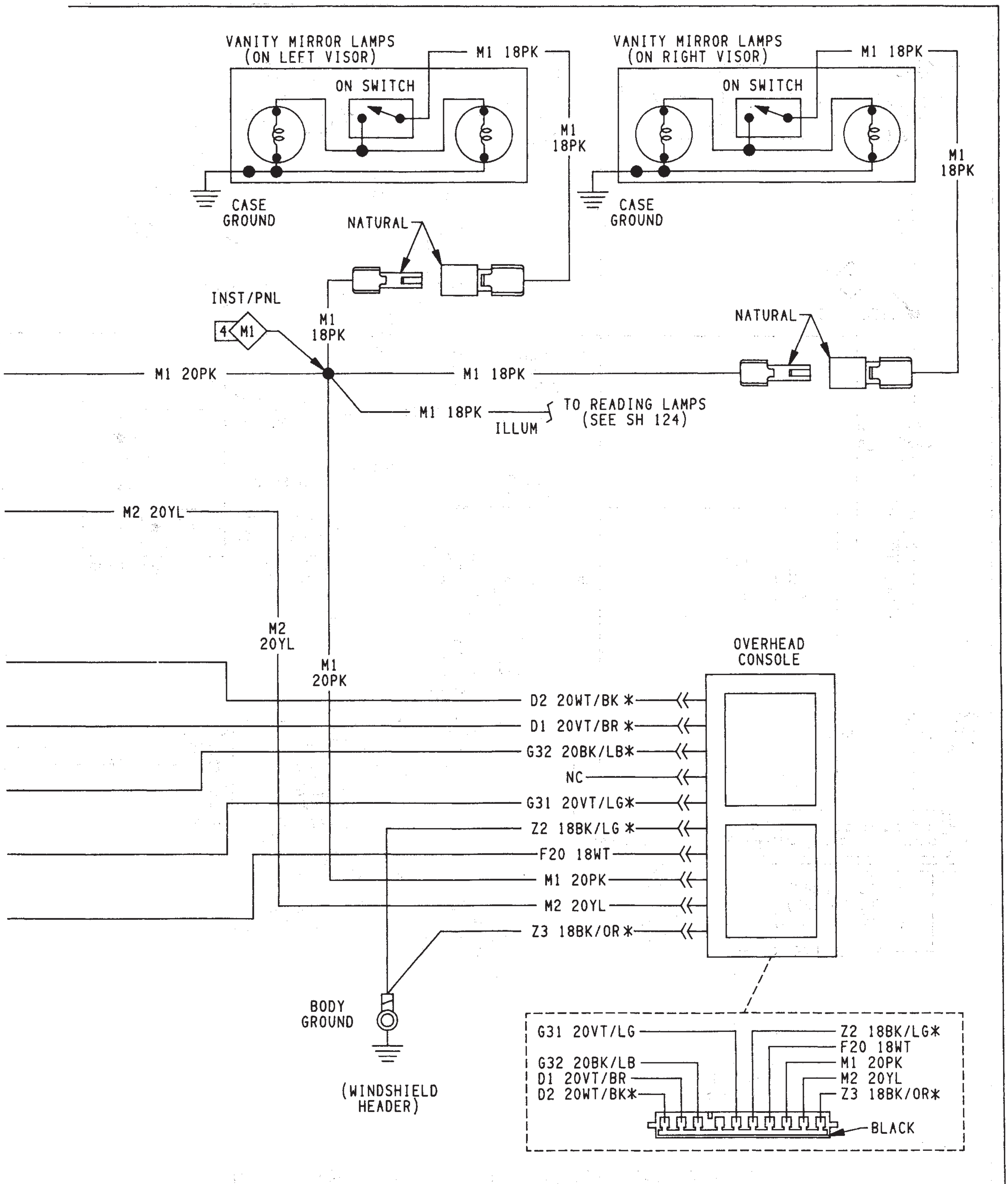
AG 117 OVERHEAD CONSOLE 938W-5



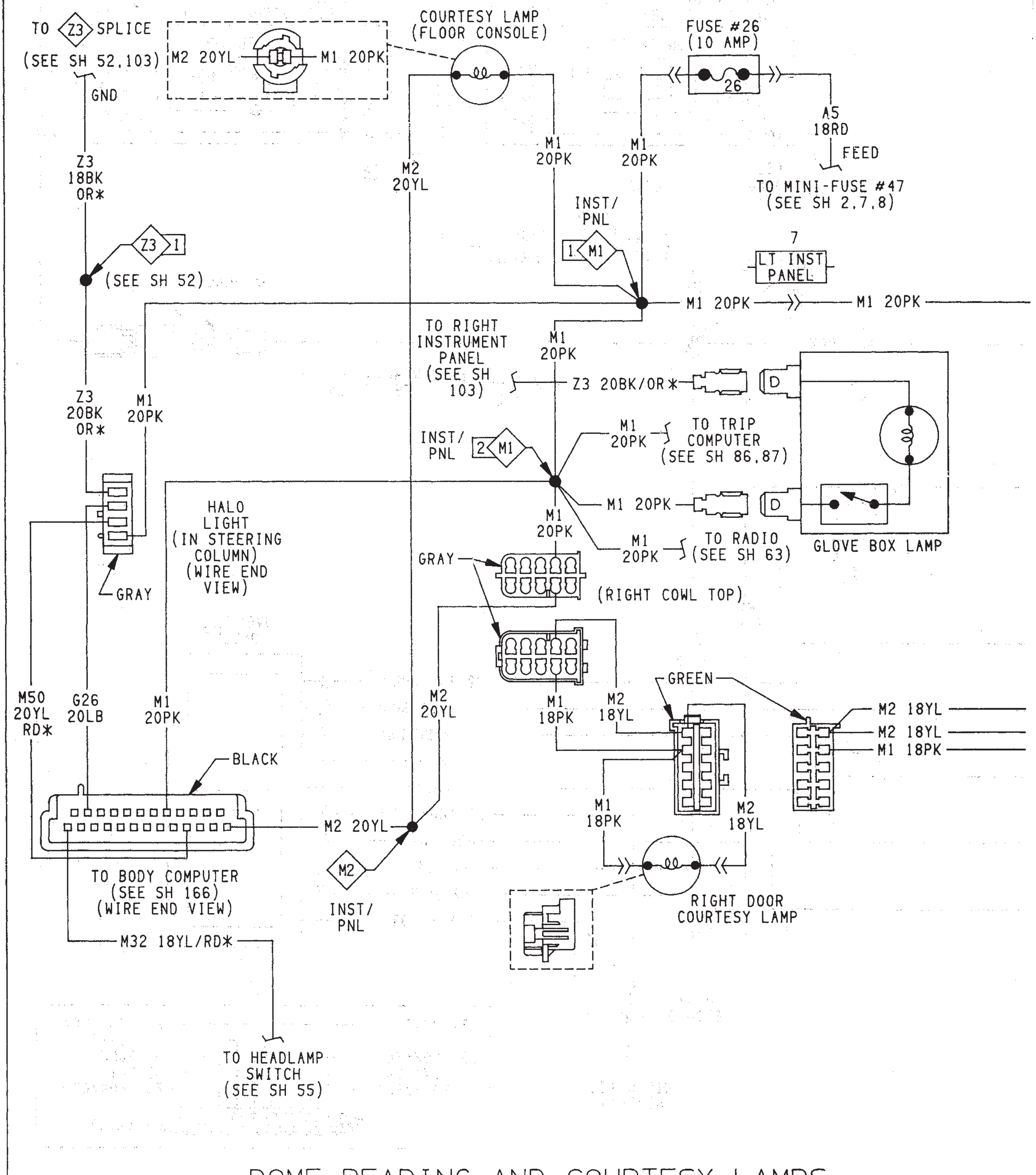
OVERHEAD CONSOLE



AJ 119 OVERHEAD CONSOLE 938W-5



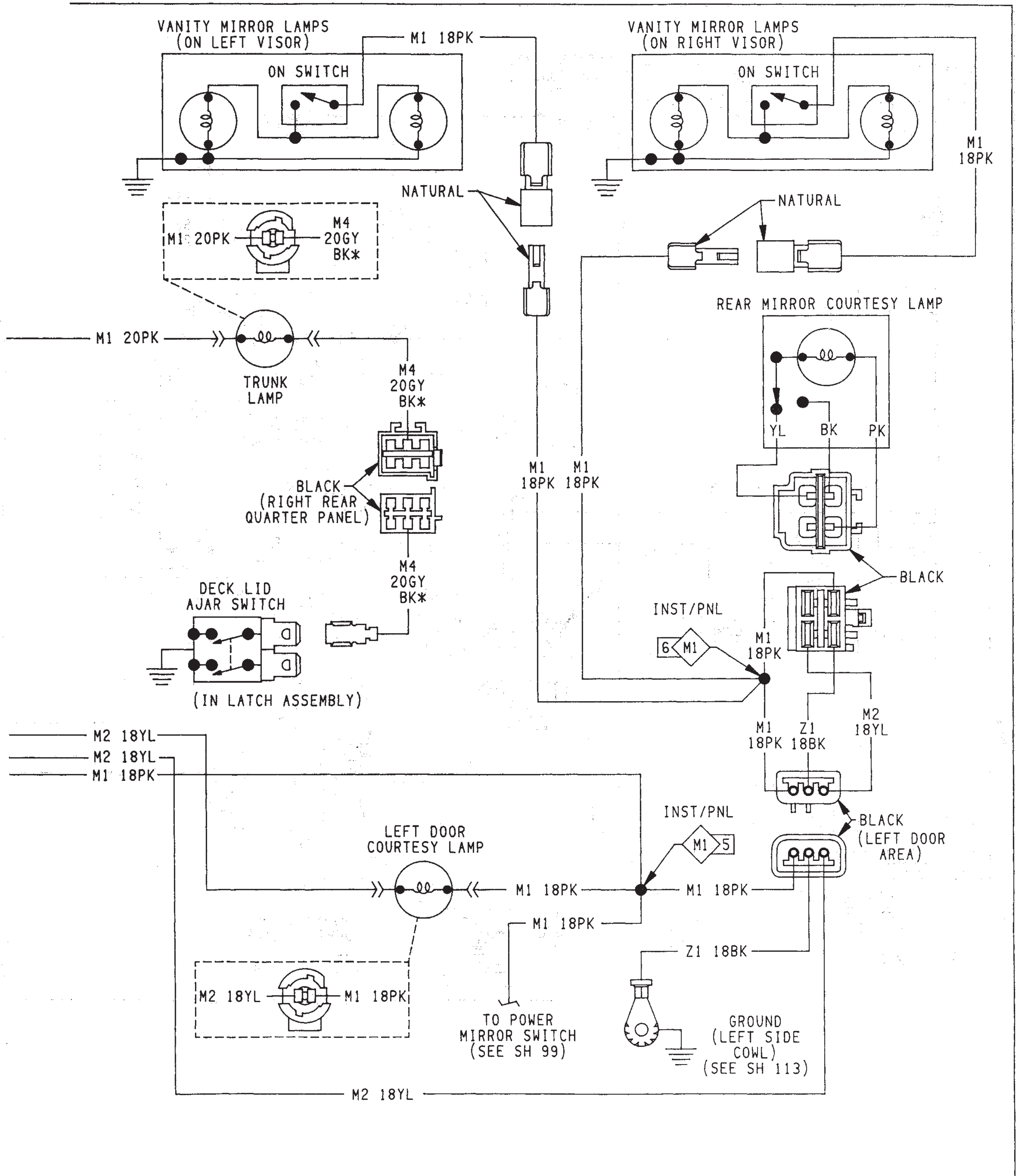
OVERHEAD CONSOLE



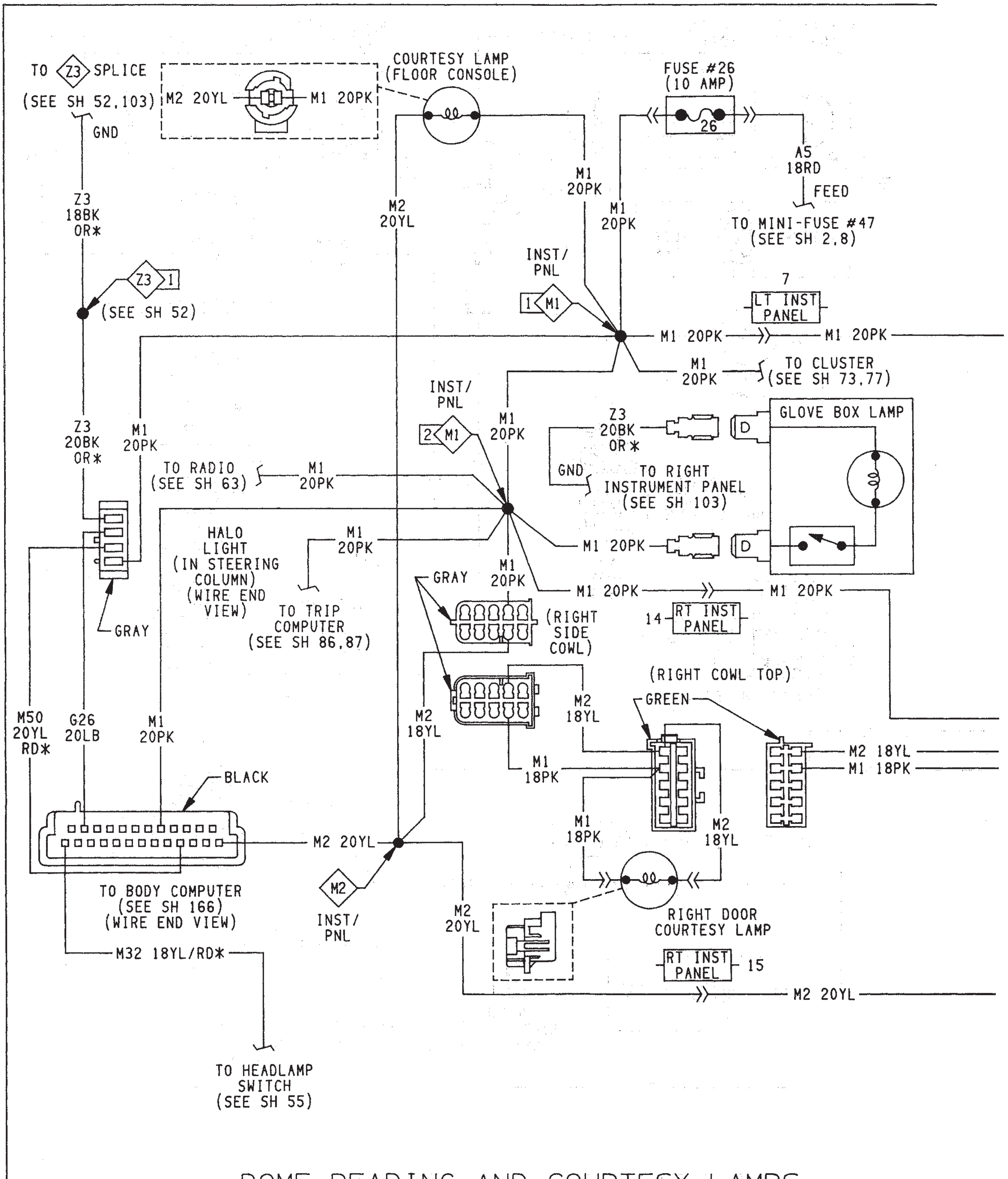
DOME, READING AND COURTESY LAMPS
(J-27 ONLY)

AJ 121

938W-5



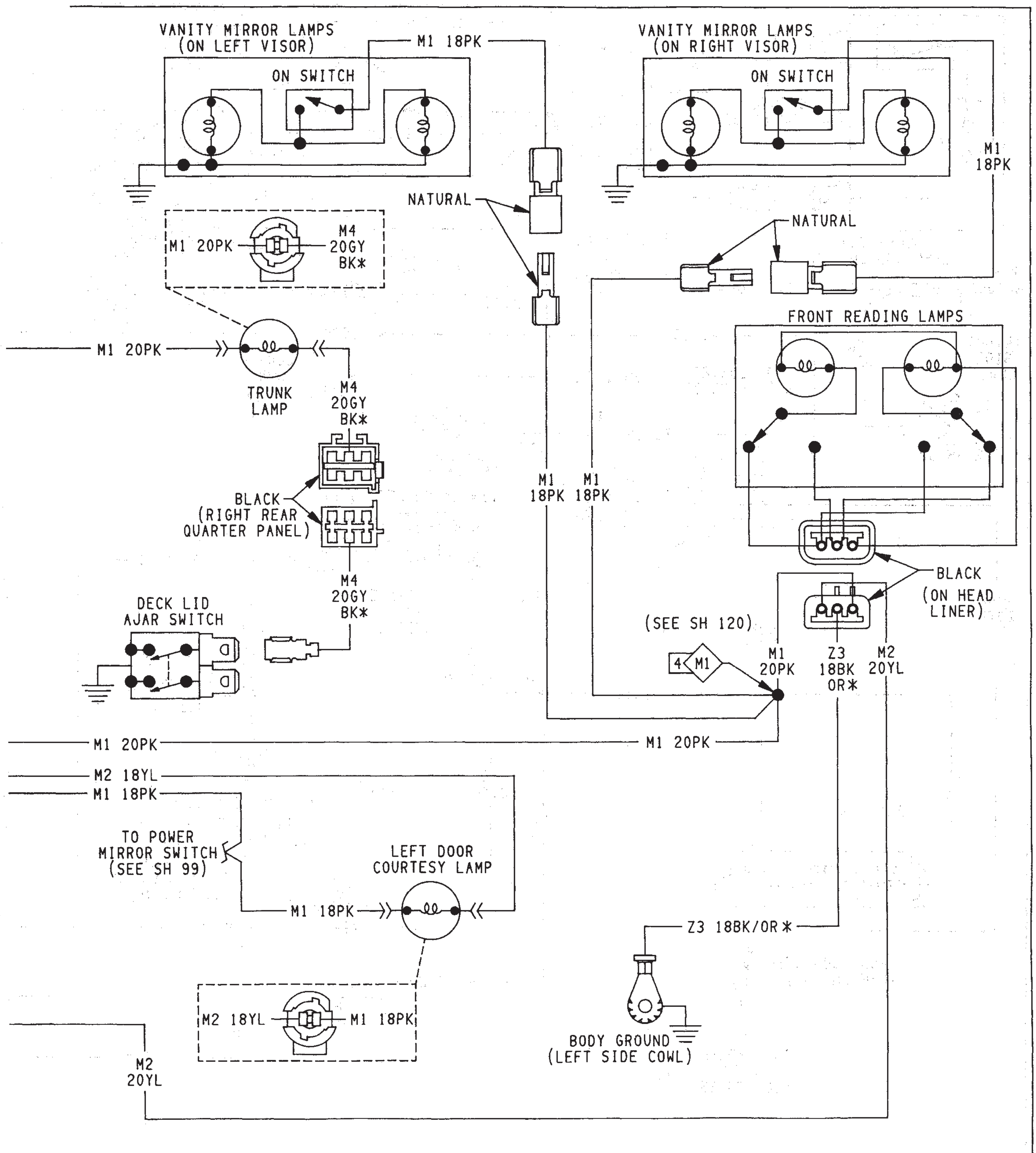
DOME, READING AND COURTESY LAMPS
(J-27 ONLY)



DOME, READING AND COURTESY LAMPS
(J-21 ONLY)

AJ 123

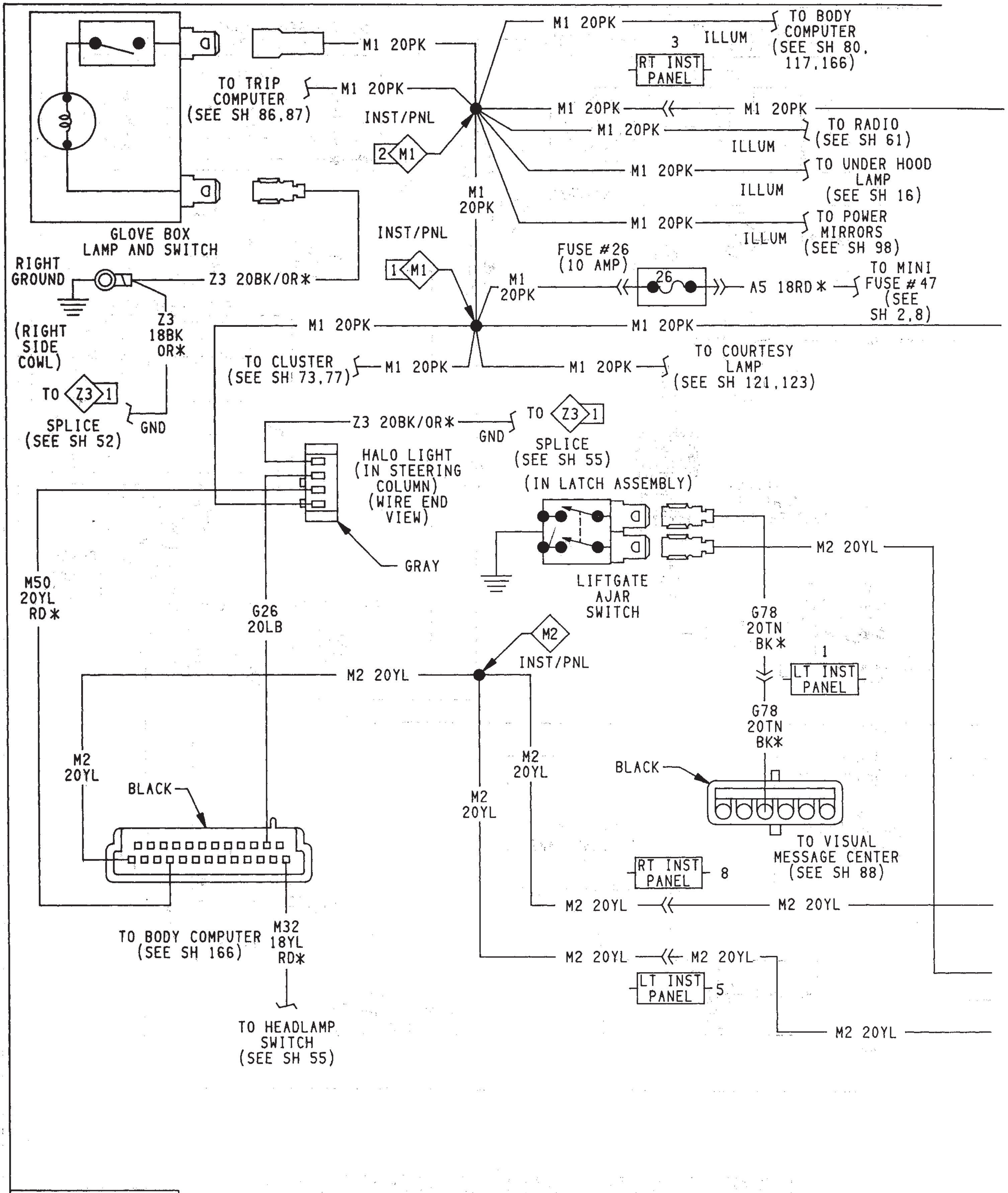
938W-5



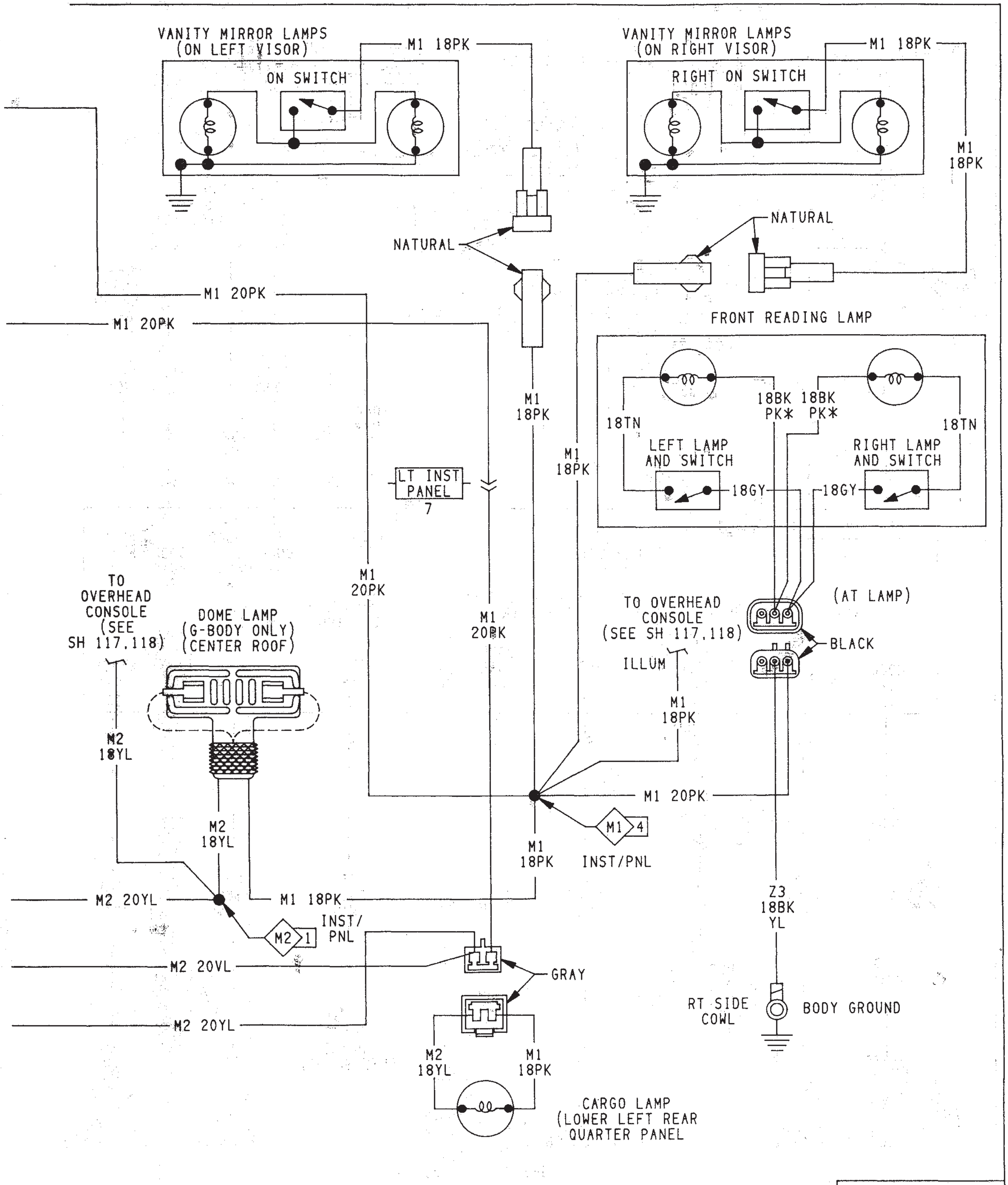
DOME, READING AND COURTESY LAMPS (J-21 ONLY)

938W-5

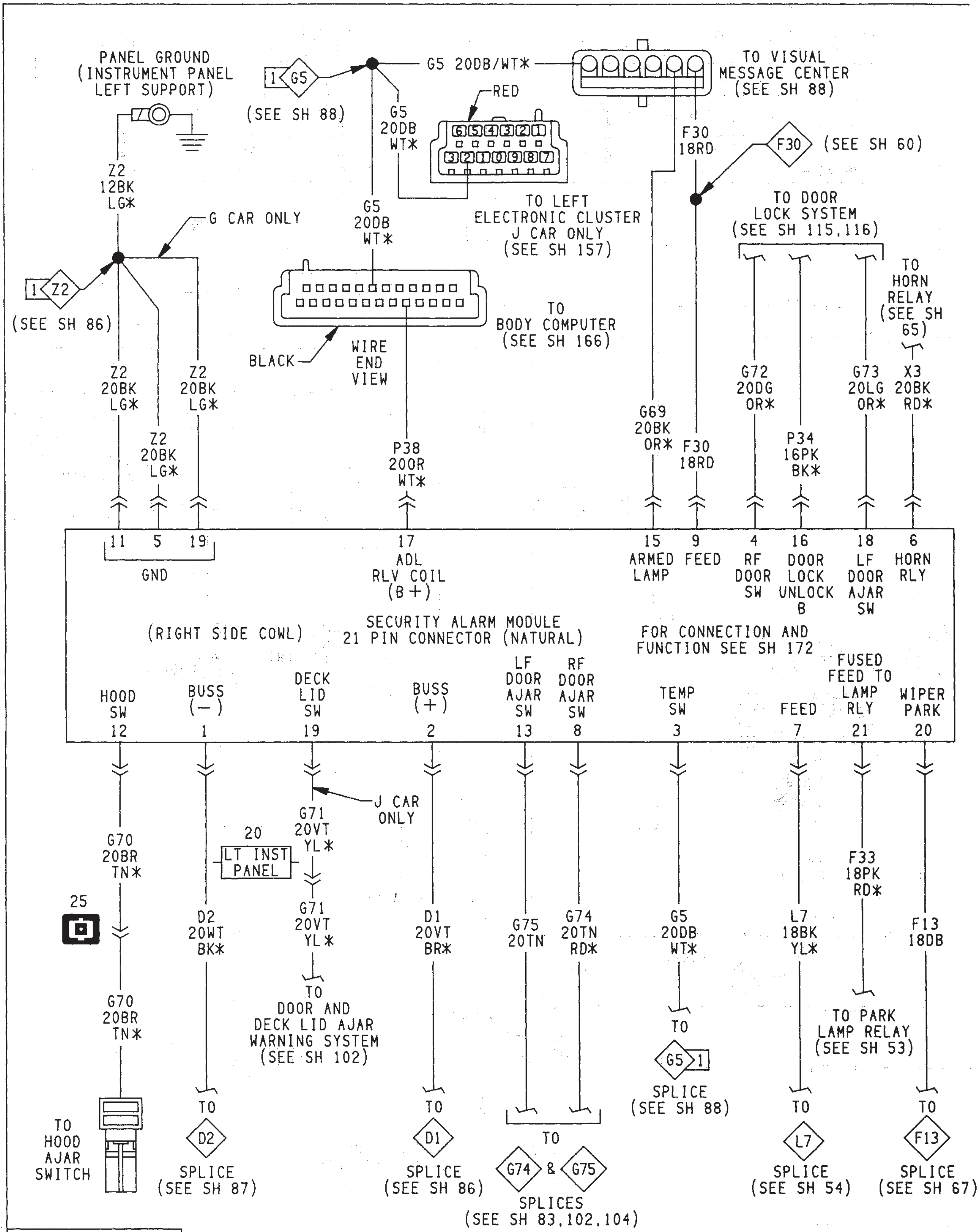
AJ 124



AG 125	DOME AND COURTESY LAMPS (AG ONLY)	938W-5



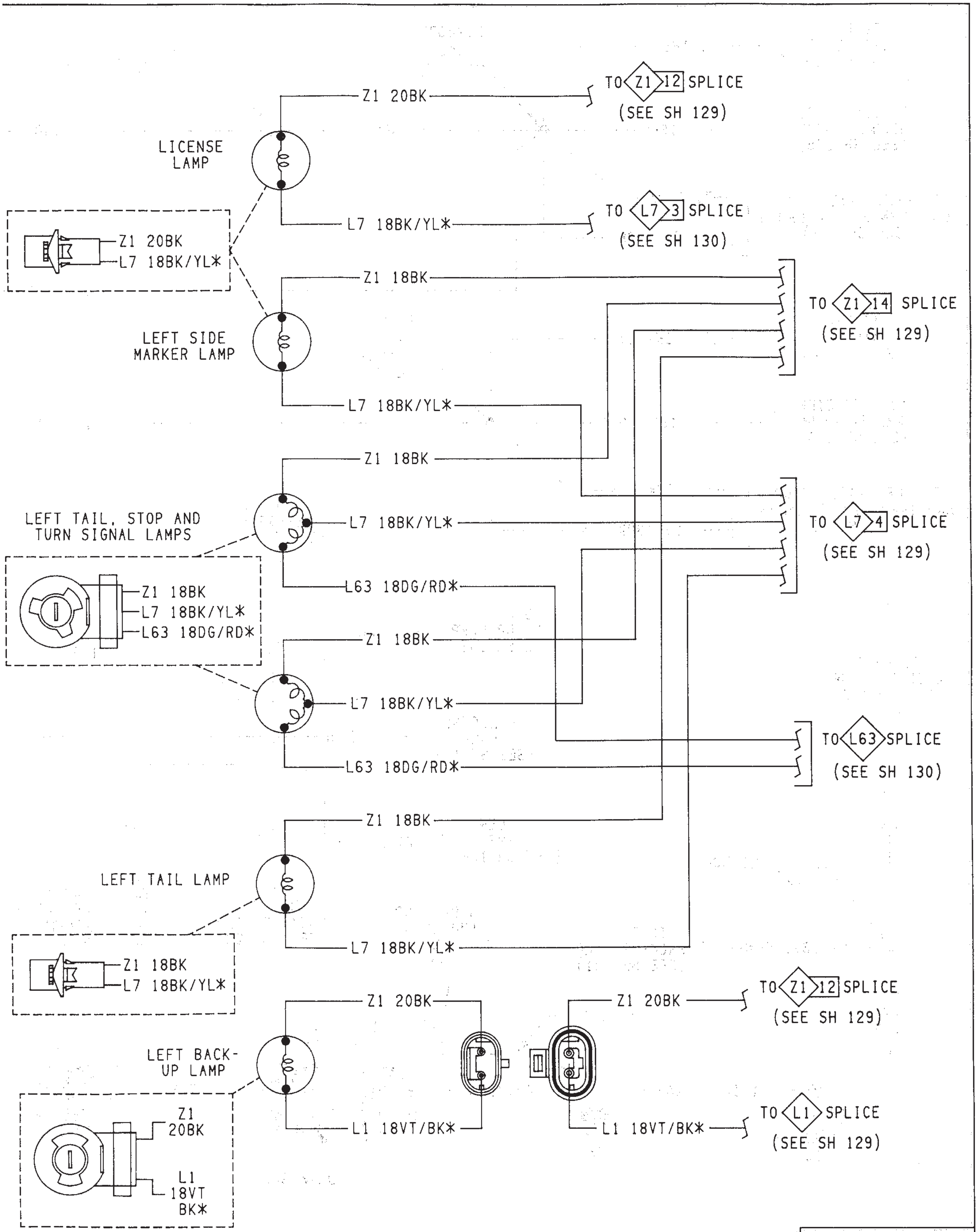
DOME AND COURTESY LAMPS (AG ONLY)



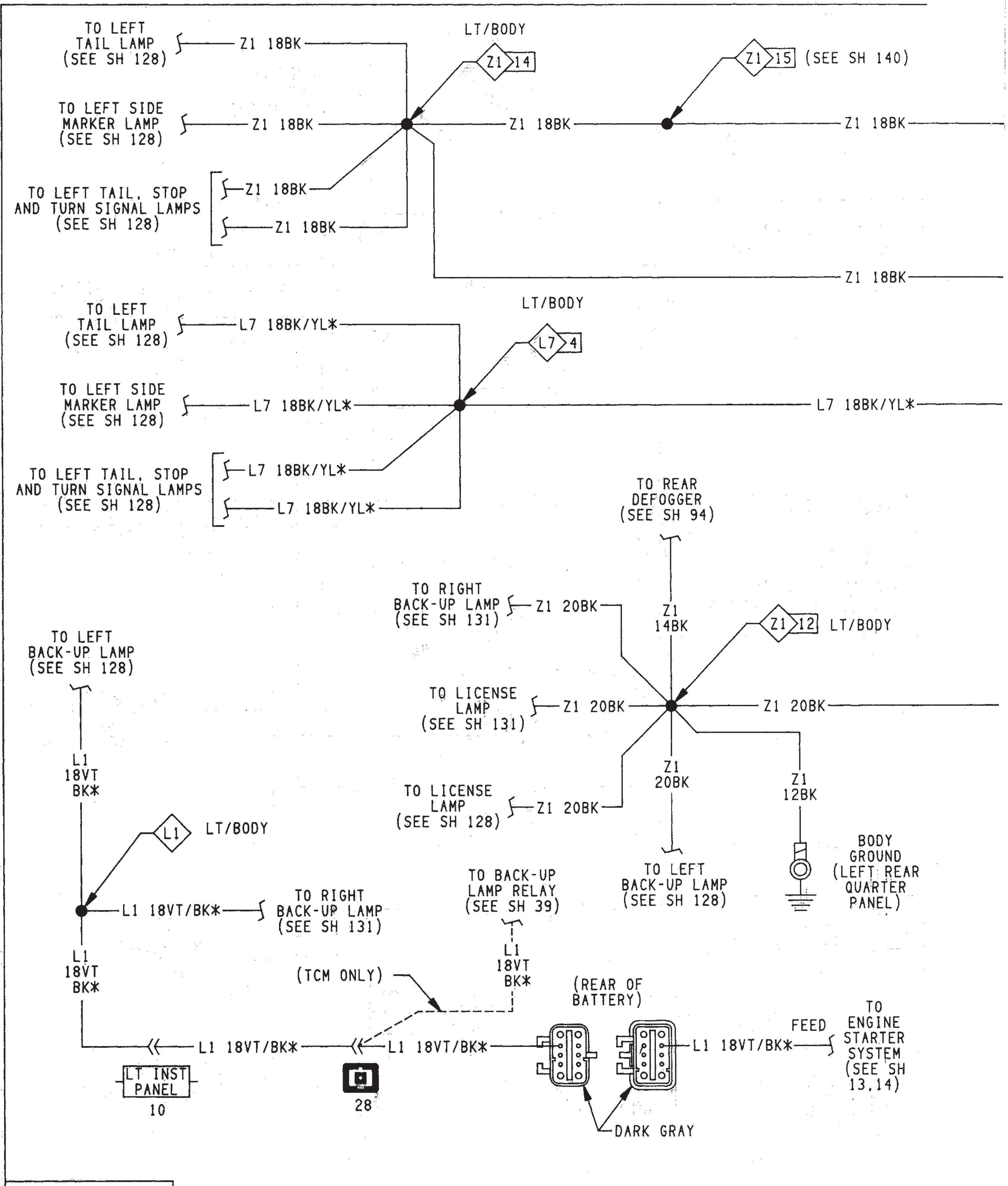
AG-AJ 127

SECURITY ALARM SYSTEM

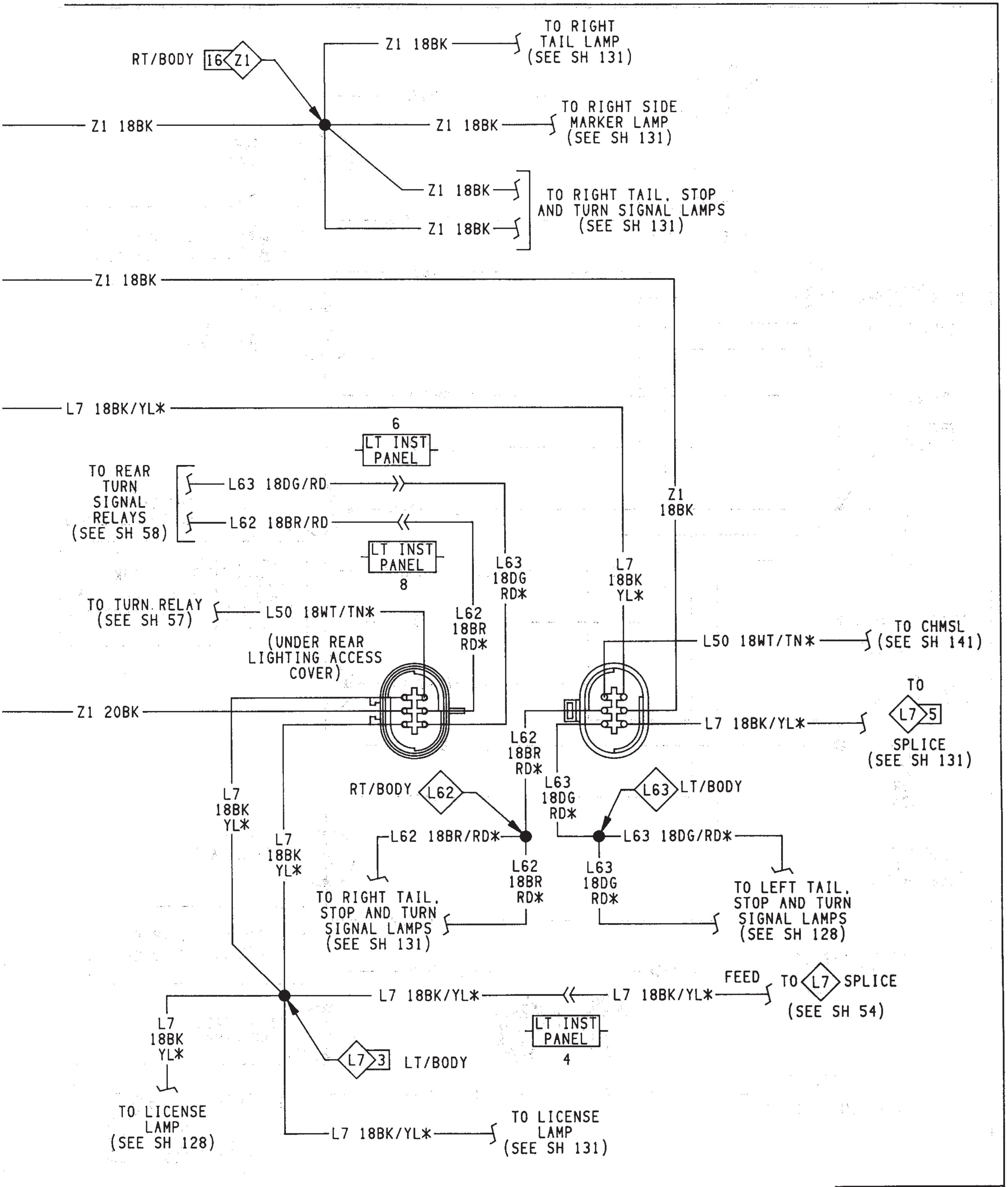
938W-5



REAR LIGHTING



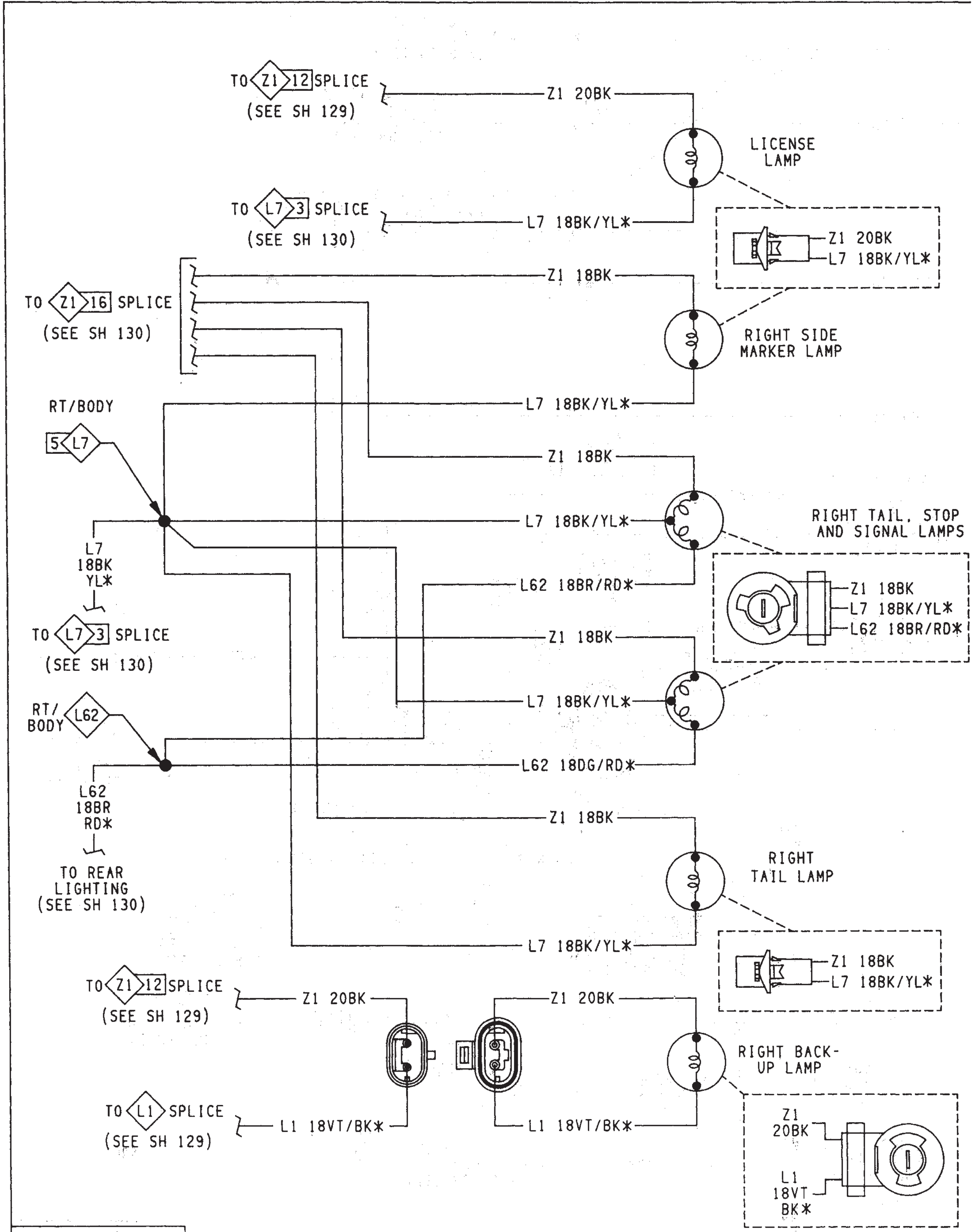
AG 129	REAR LIGHTING	938W-5



938W-5

REAR LIGHTING

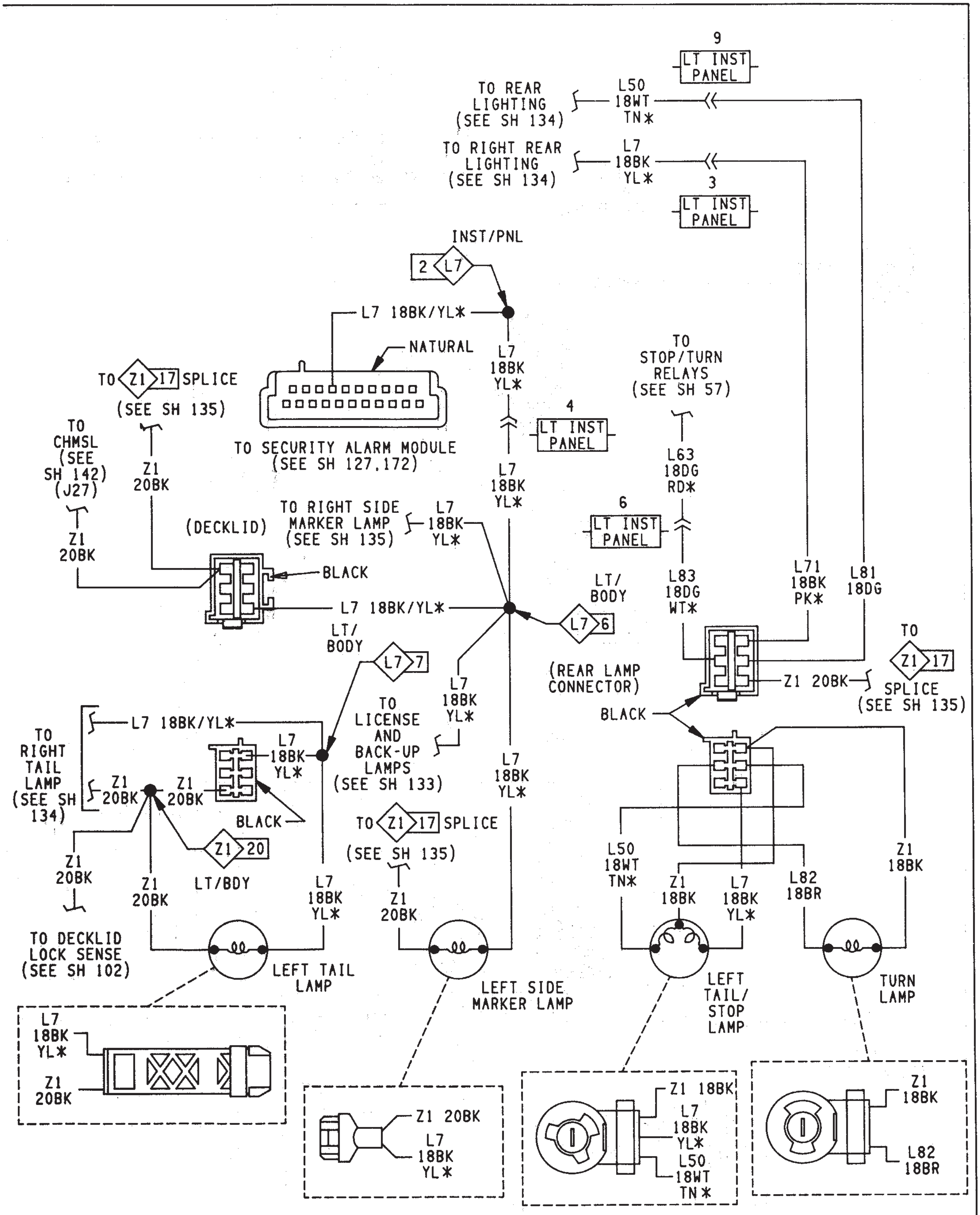
AG 130



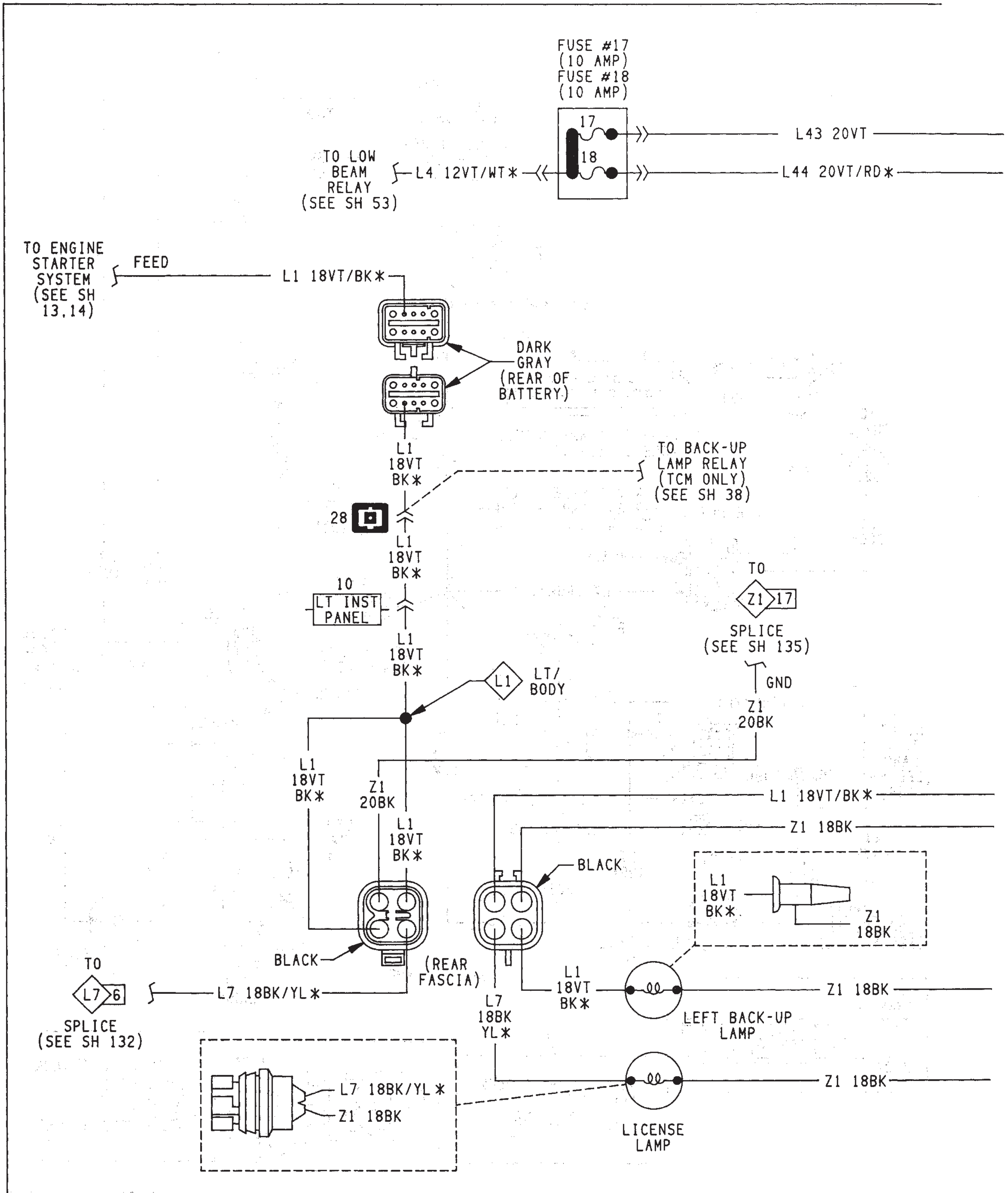
AG 131

REAR LIGHTING

938W-5

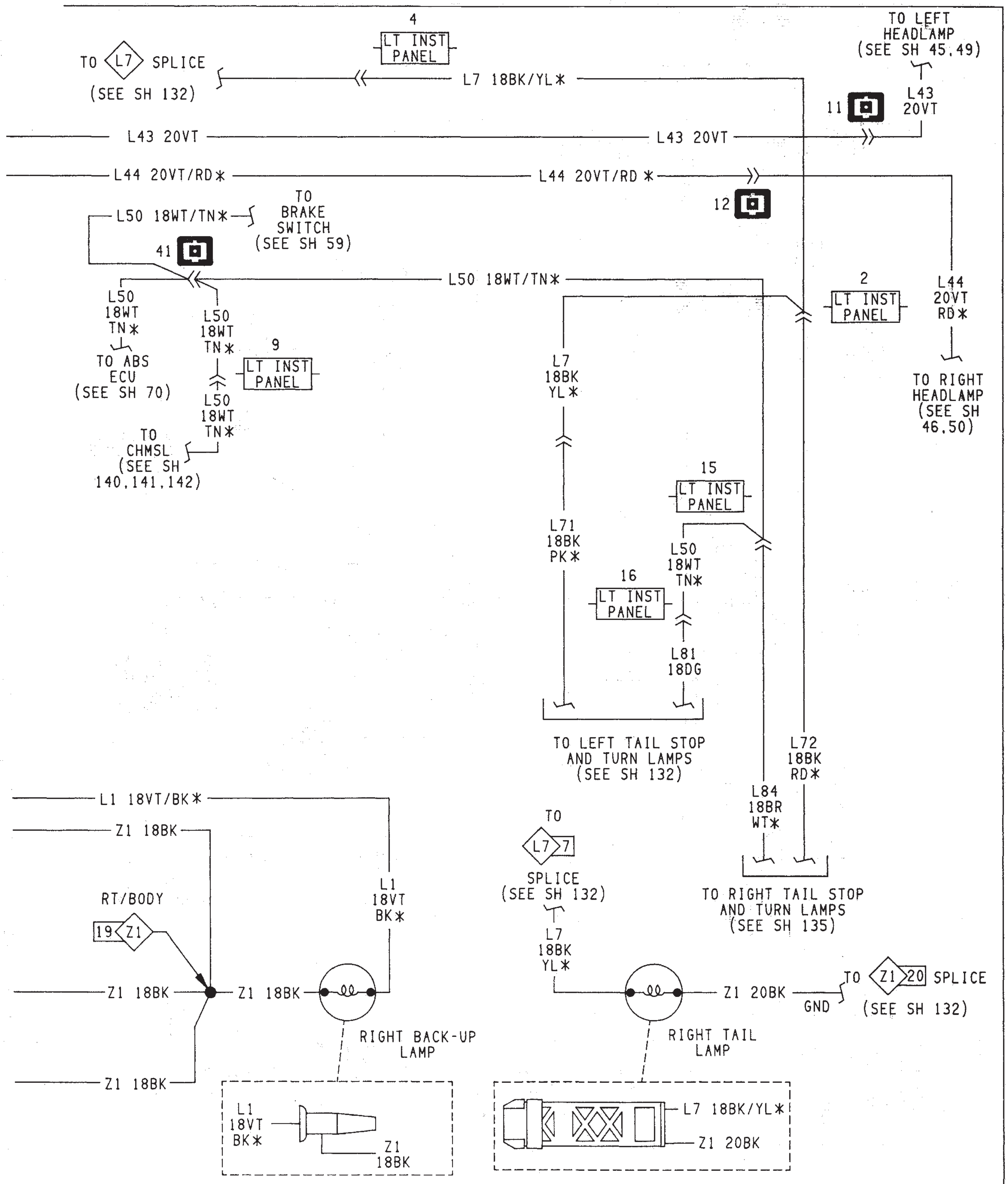


REAR LIGHTING WITHOUT LAMP OUTAGE

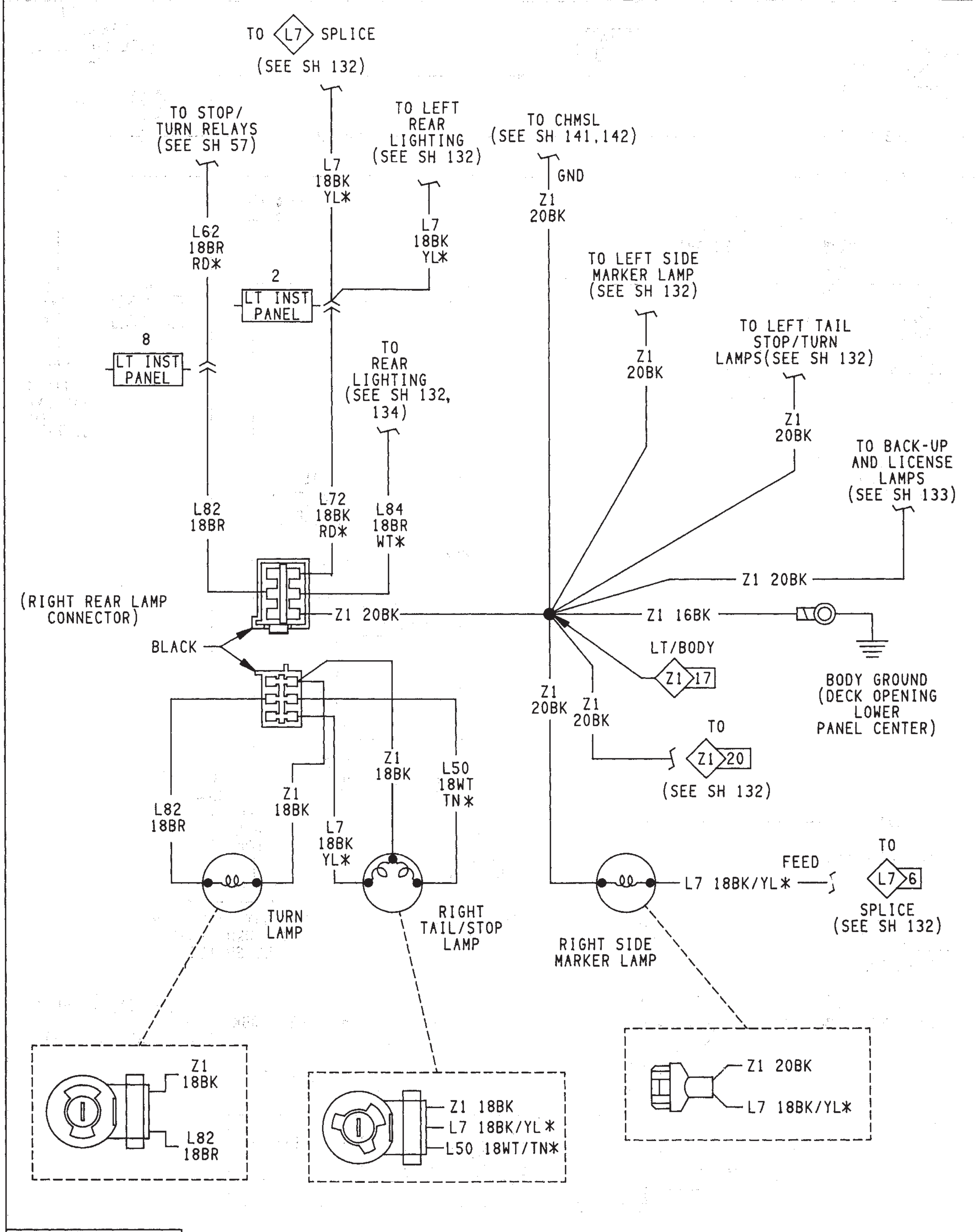


AJ 133 REAR LIGHTING WITHOUT LAMP OUTAGE

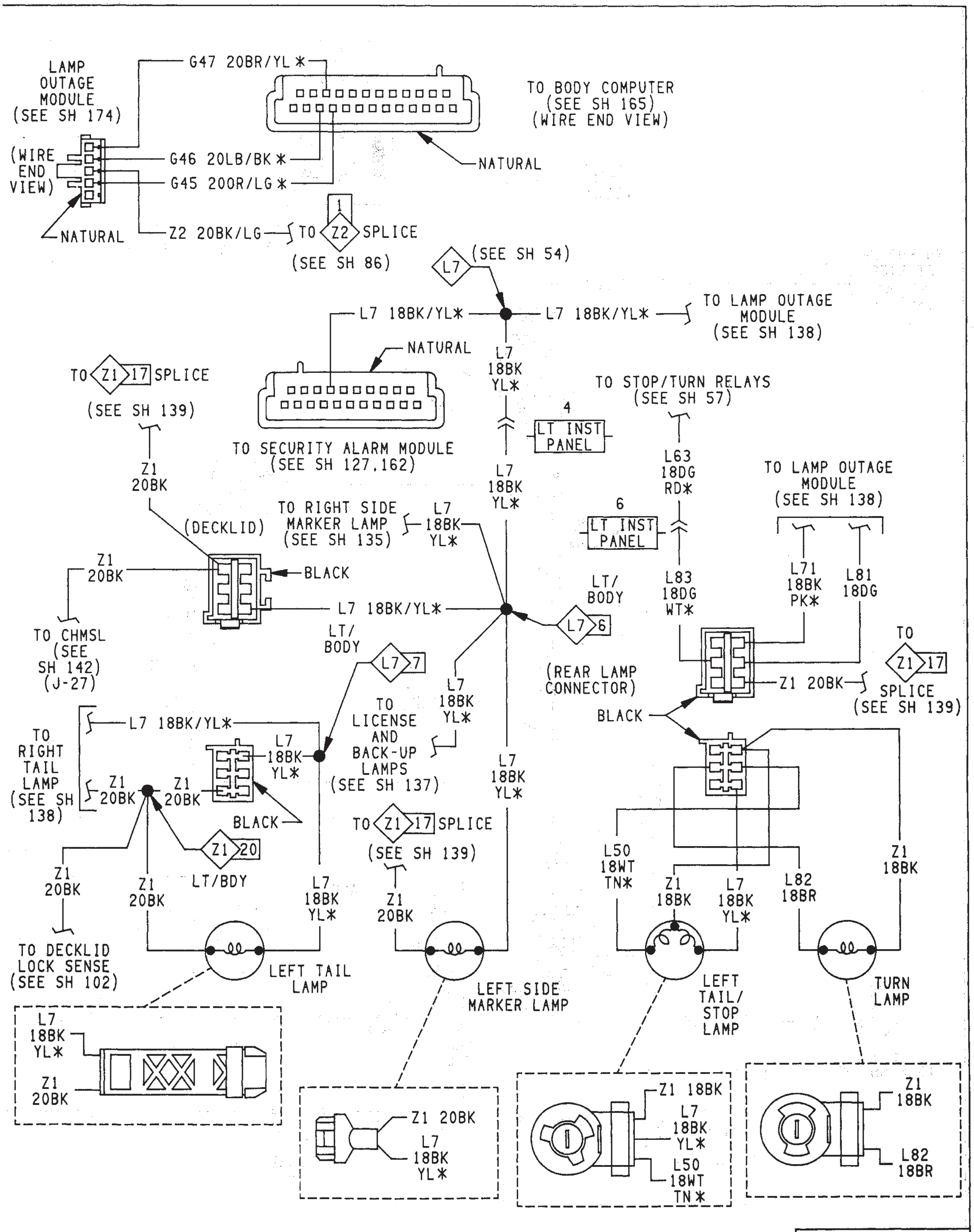
928W-5



REAR LIGHTING WITHOUT LAMP OUTAGE



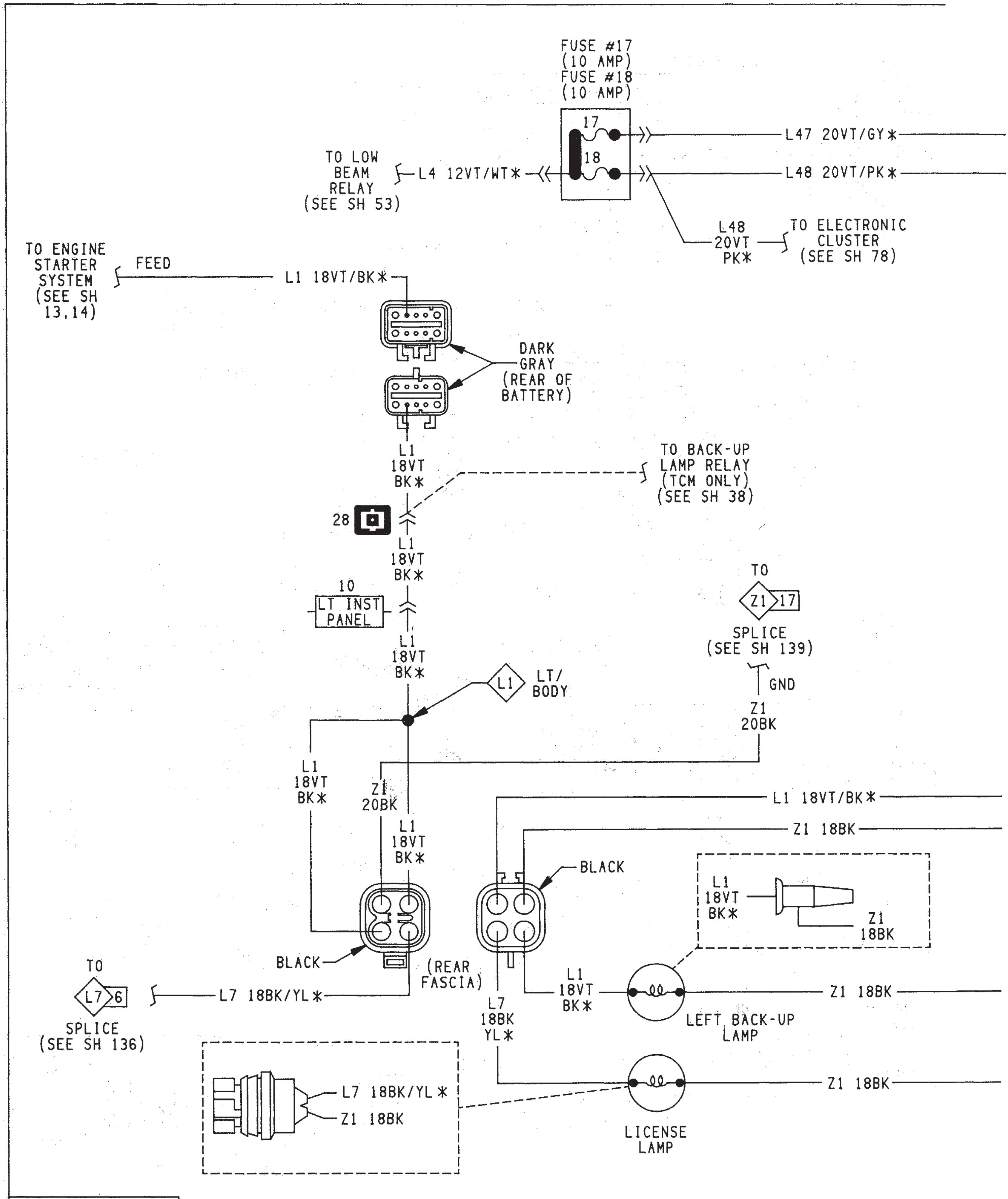
AJ 135 REAR LIGHTING WITHOUT LAMP OUTAGE 928W-5



938W-5

REAR LIGHTING WITH LAMP OUTAGE

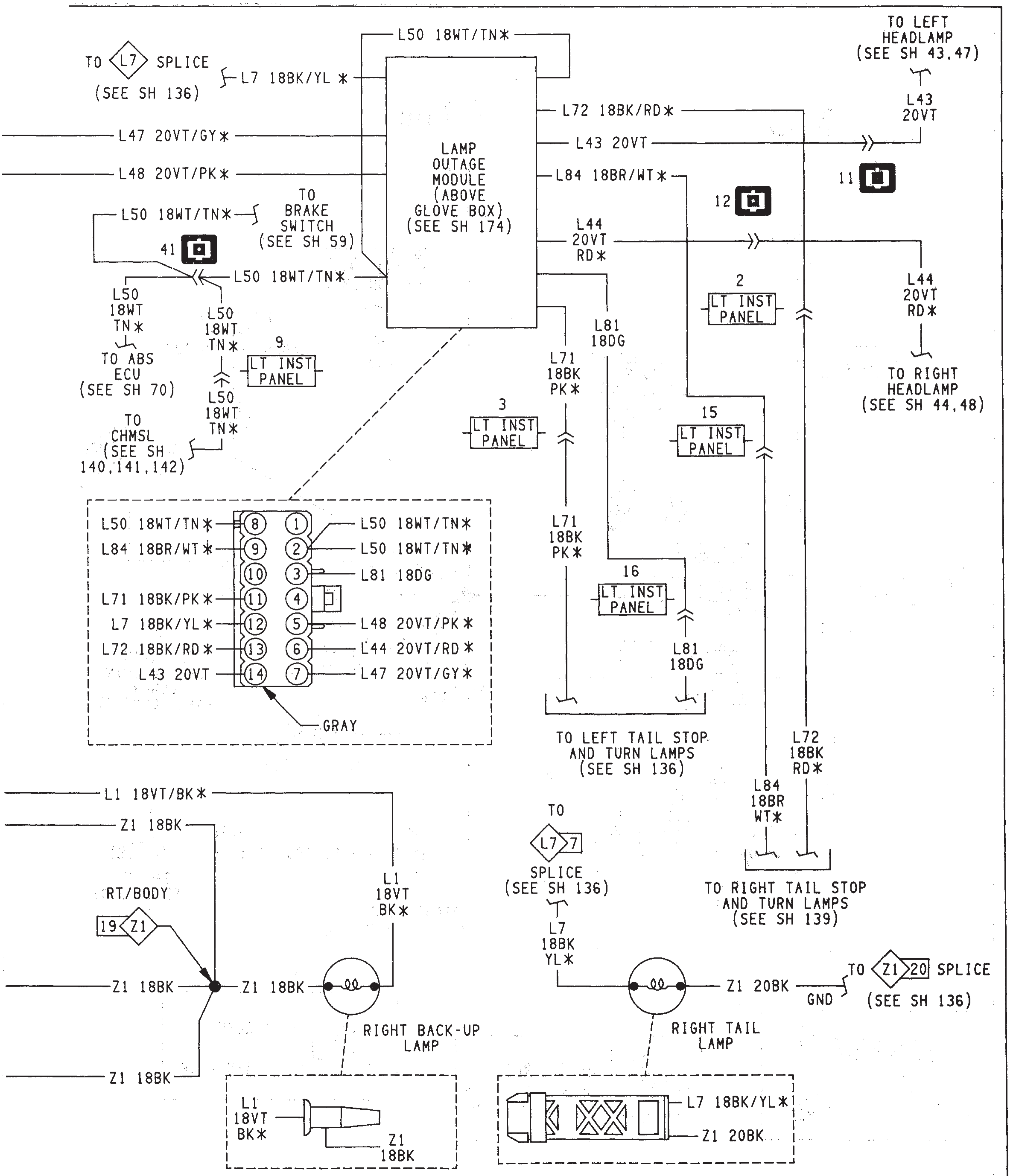
AJ 136



AJ 137

REAR LIGHTING WITH LAMP OUTAGE

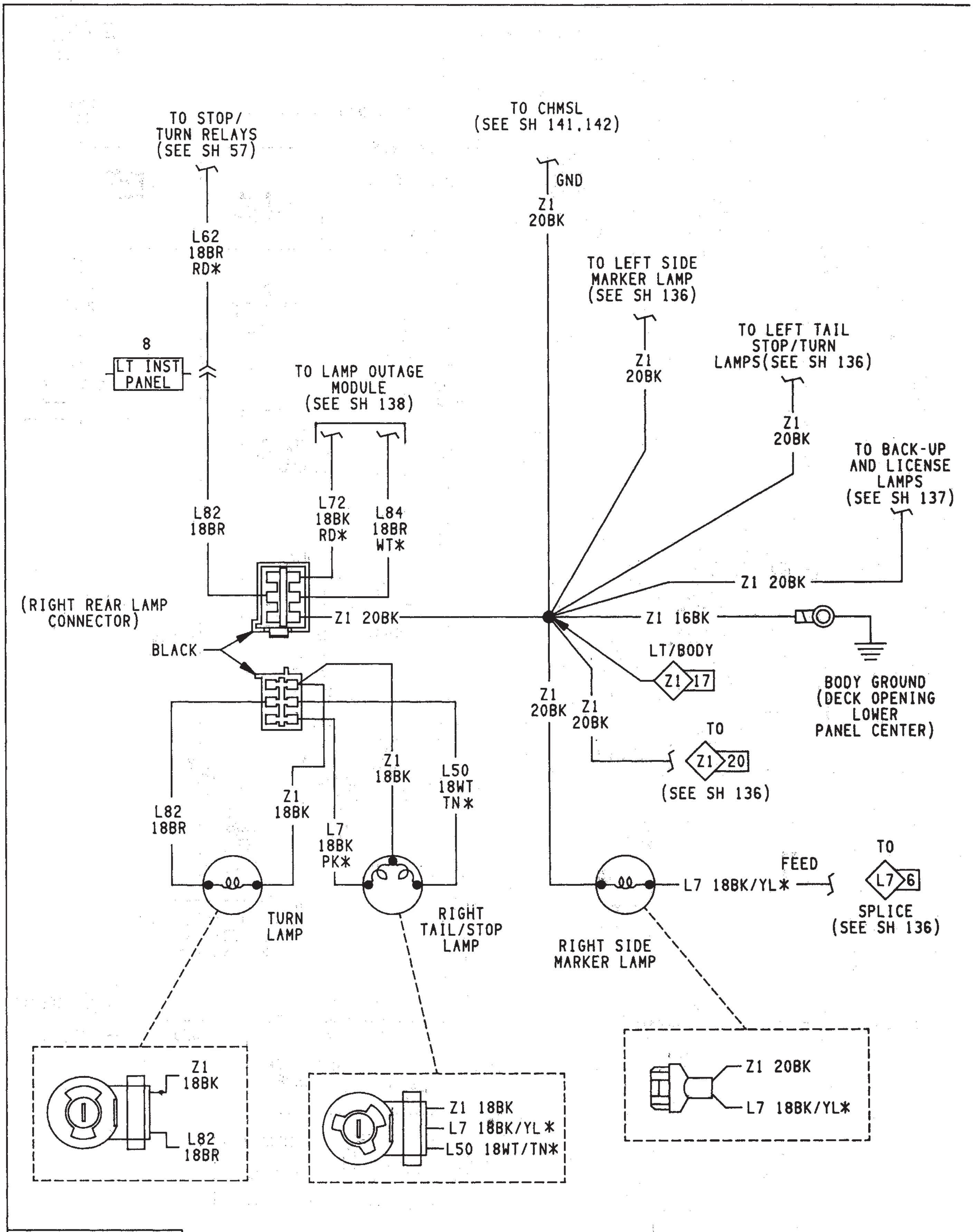
938W-5



938W-5

REAR LIGHTING WITH LAMP OUTAGE

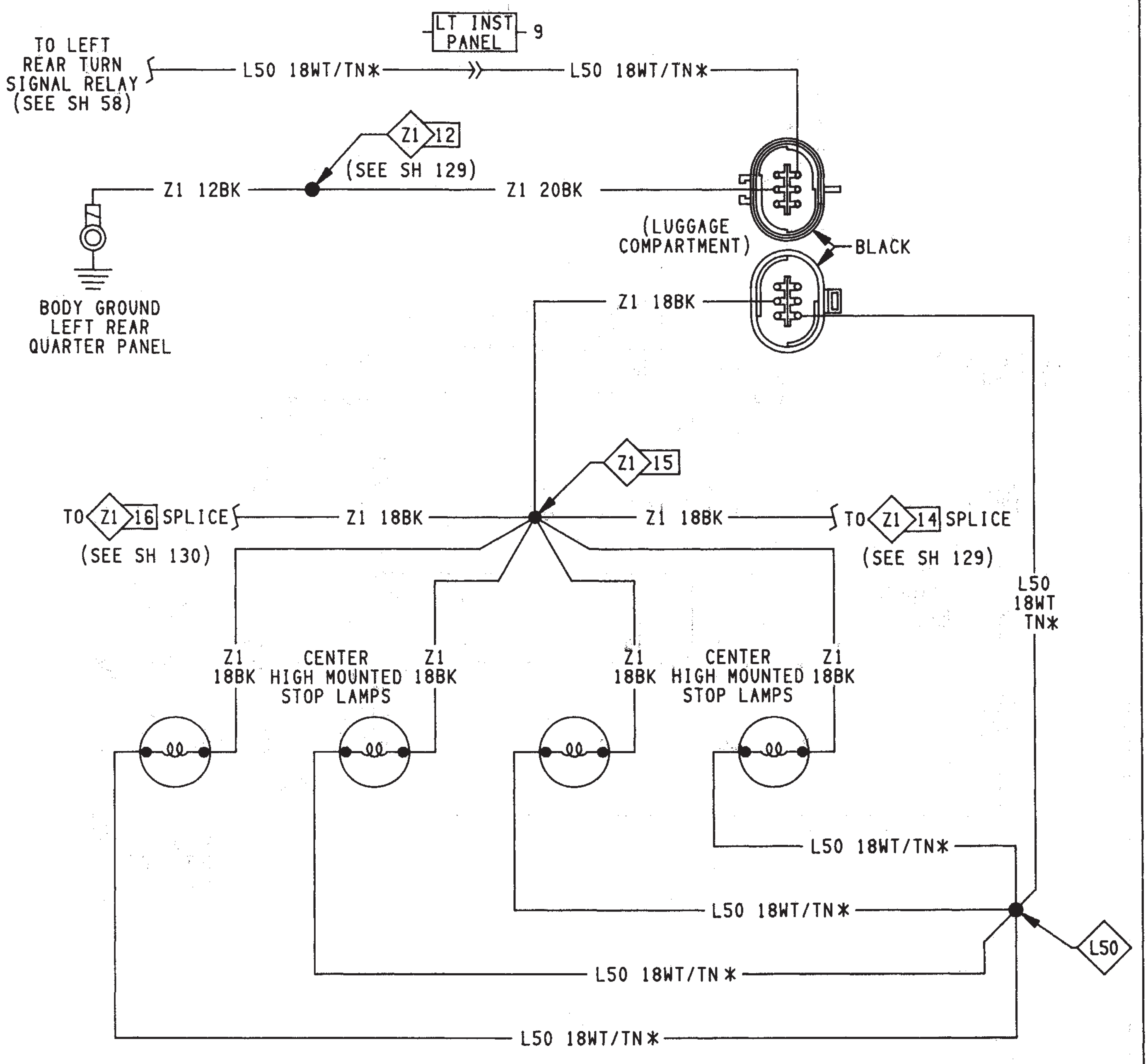
AJ 138

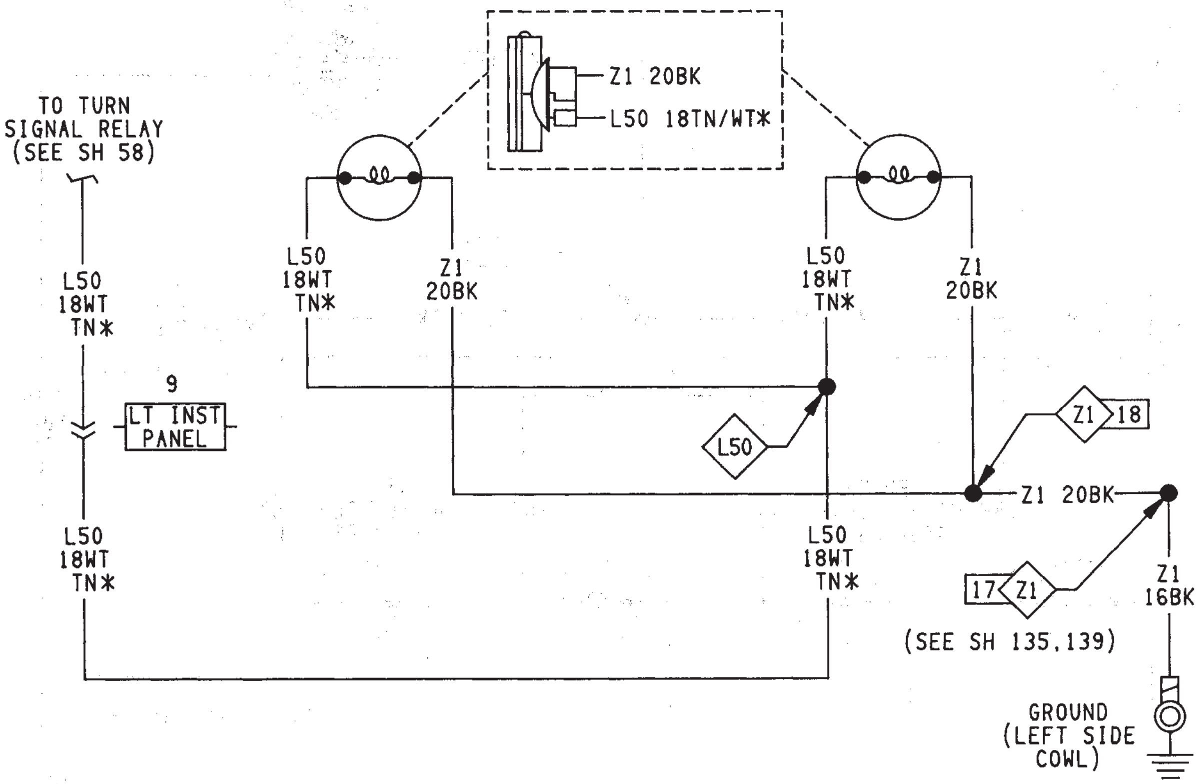


AJ 139

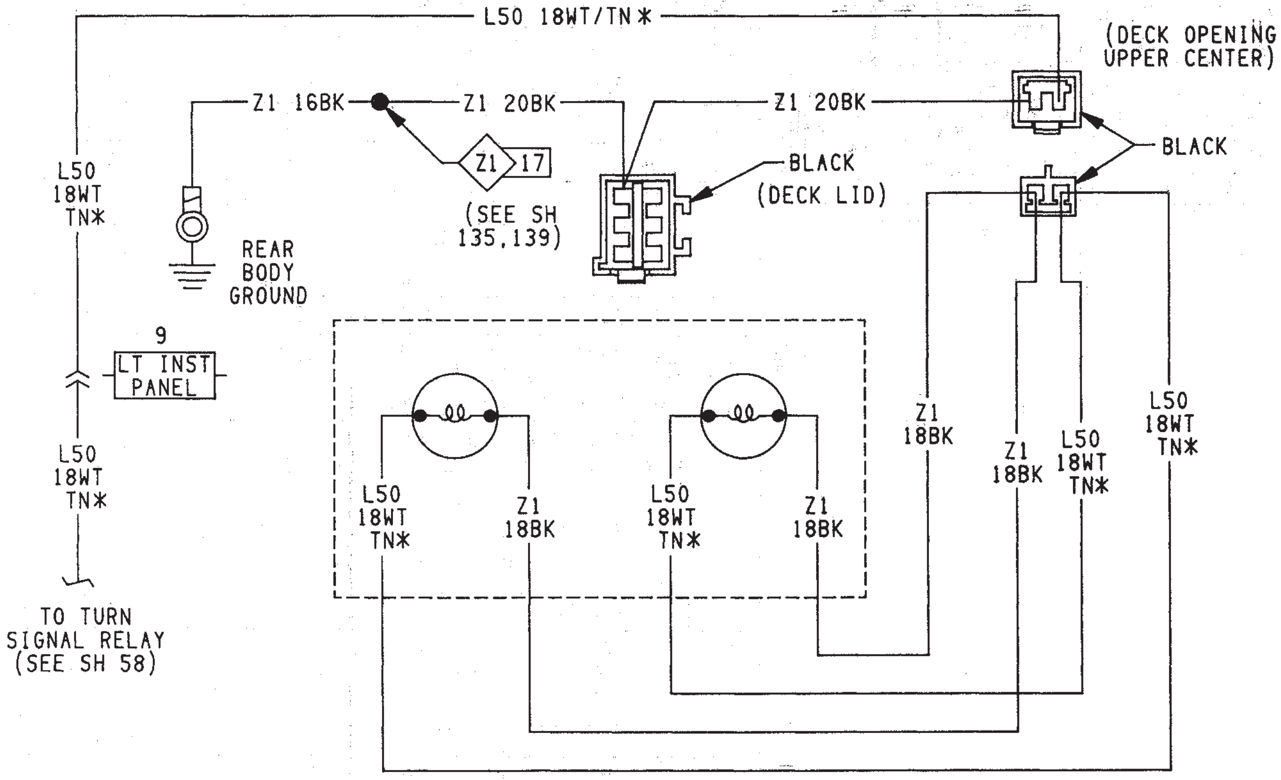
REAR LIGHTING WITH LAMP OUTAGE

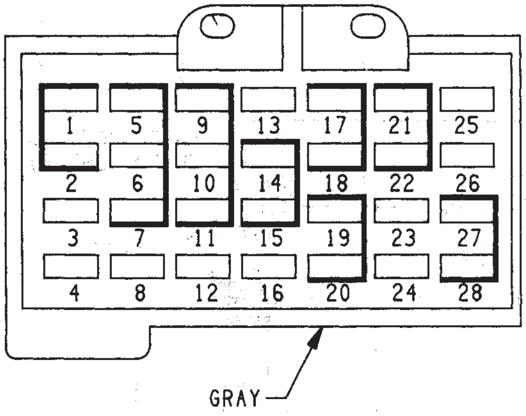
938W-5


TO LEFT
REAR TURN
SIGNAL RELAY
(SEE SH 58)
L50 18WT/TN*
LT INST
PANEL
9
L50 18WT/TN*
Z1
12
(SEE SH 129)
Z1 12BK
Z1 20BK
(LUGGAGE
COMPARTMENT)
BLACK
BODY GROUND
LEFT REAR
QUARTER PANEL
Z1 18BK
Z1
15
TO
Z1
16
SPLICE
(SEE SH 130)
Z1 18BK
Z1 18BK
TO
Z1
14
SPLICE
(SEE SH 129)
L50
18WT
TN*
Z1
18BK
CENTER
HIGH MOUNTED
STOP LAMPS
Z1
18BK
Z1
18BK
CENTER
HIGH MOUNTED
STOP LAMPS
Z1
18BK
L50 18WT/TN*
L50 18WT/TN*
L50 18WT/TN*
L50 18WT/TN*
L50



AJ 141 CENTER HIGH MOUNTED STOP LAMP (J-21) 938W-5


L50 18WT/TN*
(DECK OPENING UPPER CENTER)
Z1 16BK
Z1 20BK
Z1 20BK
BLACK
Z1 17
(SEE SH 135,139)
BLACK (DECK LID)
L50 18WT TN*
REAR BODY GROUND
9
LT INST PANEL
L50 18WT TN*
TO TURN SIGNAL RELAY (SEE SH 58)
L50 18WT TN*
Z1 18BK
L50 18WT TN*
Z1 18BK
Z1 18BK
Z1 18BK
L50 18WT TN*
L50 18WT TN*

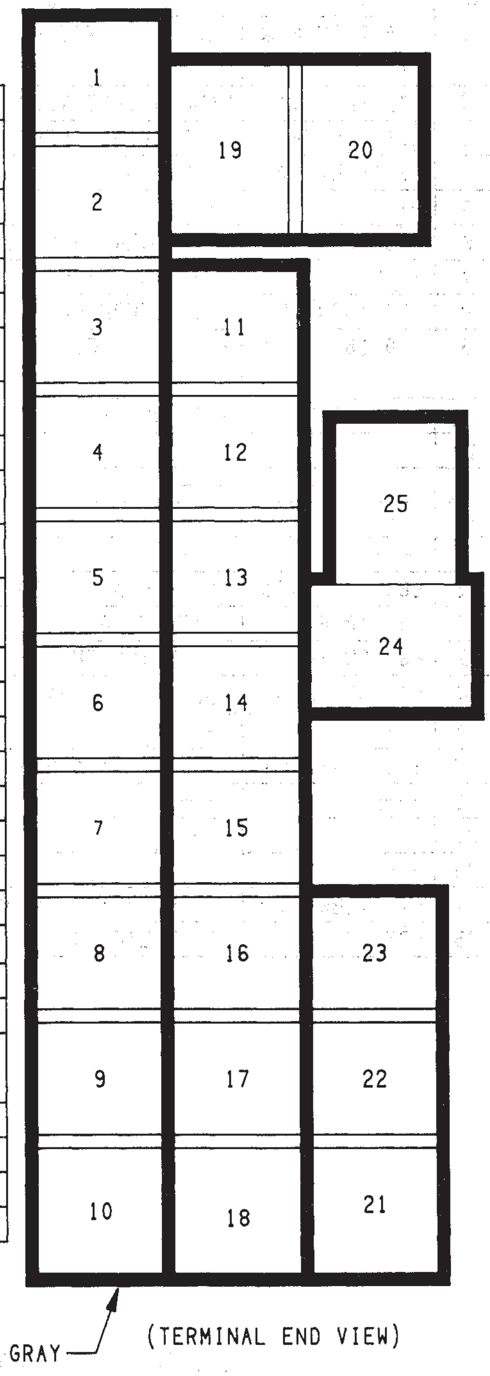


FUSE BLOCK			
CAV	CIRCUIT INFO	DESCRIPTION	SHEET
1	C1 12DG	BLOWER MOTOR FEED	8,42,90,93
2	A22 12BK/OR* F21 12TN	IGNITION SWITCH FEED POWER WINDOWS	8,42,110,111
3	A3 12RD/WT* F35 14RD	HEADLAMP SWITCH RELAY BATTERY FEED POWER SEATS	5,53,116
5	F20 18WT	LAMP SWITCH FEED, BACKUP	8,13,14,39,42,84,96
6	A22 12BK/OR* L5 18BK/PK*	IGNITION SWITCH FEED HIGH BEAM RELAY	8,42,56
7	V23 18BR/PK*	REAR WIPER FEED (G BODY)	8,42,105
8	L7 18BK/YL* E1 20BR	RIGHT TAIL LAMP CLUSTER LAMP FEED	5,52
9	F39 18PK/LG*	FOG LAMPS FEED (G BODY)	5,55
10	F33 18PK/RD* A7 12RD/YL*	FUSED BATTERY FEED FUSED BLOCK FEED	5,10,12,54
11	F30 14RD	CIGAR LIGHTER FEED	5,60,84,88
12	F75 12VT	RS AMPLIFIER FEED	5,63
14	G5 20DB/WT* A21 12DB	FEED FOR WARNING LAMPS & GAUGES IGNITION START/RUN	7,42,70,73,77,84
15	V34 20WT/RD*	SPEED CONTROL SYSTEM	7,42,59
17	L47 20VT/GY* (L43 20VT W/O LAMPOUTAGE)	LAMP OUTAGE MODULE HEADLAMP FEED	6,53,133,137
18	L4 12VT/WT* L48 20VT/PK* L48 20VT/PK* (L44 20VT/RD* W/O LAMPOUTAGE)	TO HEADLAMP HEADLAMP (RT) OR OUTAGE MODULE (L48) HEADLAMP (RT) OR OUTAGE MODULE (L48)	6,53,133,137
19	L3 12RD/OR* L33 20RD	HIGH-BEAM FEED LEFT HIGH-BEAM	6,54
20	L34 20RD/OR*	RIGHT HIGH-BEAM	6,54
21	A3 12RD/WT* F32 18PK/DB*	HEADLAMP SWITCH FEED STOP LAMP SWITCH	5,10,12,59
22	A3 12RD/WT* F31 18VT	HORN FEED SWITCH	5,65
25	C16 20LB/YL* C15 12BK/WT*	HEATED MIRROR FEED HEATED REAR WINDOW RELAY	8,94,95,98,100
26	A5 18RD M1 20PK	COURTESY LAMPS FEED DOME AND COURTESY LAMP SWITCH	8,16,73,77,94,121,123,125
27	X12 20RD/BK*	RADIO FEED	7,42,61,63
28	F13 18DB A31 12BK/WT*	FRONT WIPER PARK IGNITION SWITCH ACC	7,42,67

FUSE BLOCK

LT INST
PANEL

CAV	CIRCUIT	DESCRIPTION	SHEET
1	G78 20TN/BK*	DECK LID SWITCH	88,102,104, 125
2	—	—	
3	—	—	
4	L7 18BK/YL*	LAMP FEED	130
5	M2 20YL	DOOR JAMB SWITCHES (CARGO LP 'G')	125
6	—	—	
6	L63 18DG/RD*	LEFT TURN/STOP (G CAR ONLY)	58,130
7	M1 20PK	COURTESY LAMPS	126
8	—	—	
8	L62 18BR/RD*	LAMP OUTAGE RIGHT TURN/STOP (G CAR ONLY)	58,130
9	L50 18WT/TN*	STOP LAMP SWITCH	58,142
10	L1 18VT/BK*	BACK-UP LAMPS FEED	14,129
11	—	—	
12	—	—	
13	—	—	
14	—	—	
15	—	—	
16	—	—	
17	—	—	
18	—	—	
19	—	—	
20	—	—	
21	V23 18BR/PK*	IGNITION FEED LIFTGATE & WIPER/WASHER (G-CAR)	105
22	V21 18DB/RD*	ON/OFF SWITCH REAR WIPER (G-CAR)	66,105
23	V22 18BR/YL*	WASH/DELAY (G-CAR)	66,105
24	C15 12BK/WT*	HEATED REAR WINDOW	94
25	—	—	



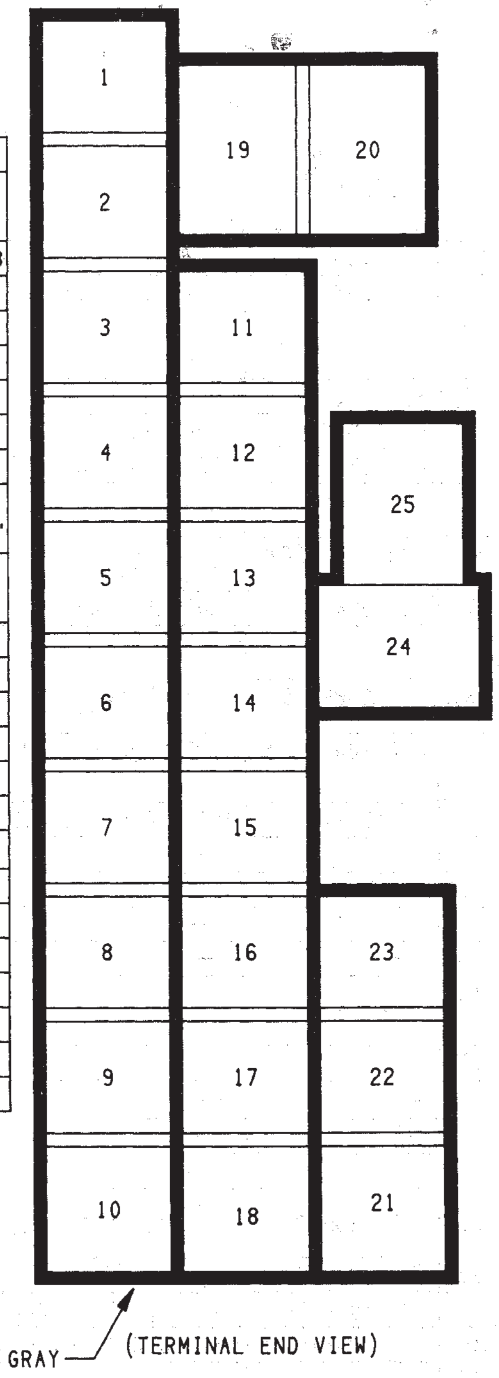
LEFT INSTRUMENT
PANEL TO BODY WIRING

938W-5

AG 144

LT INST PANEL

CAV	CIRCUIT	DESCRIPTION	SHEET
1	G78 20TN/BK* G78 20TN/BK*	DECK LID SWITCH	83,88,102,104
2	L72 18BK/RD*	LAMP OUTAGE RIGHT TAIL	134,135,138
3	L71 18BK/PK*	LAMP OUTAGE LEFT TAIL	134,138
4	L7 18BK/YL*	LAMP FEED	132,136
5	——	——	
6	L63 18DG/RD*	LEFT TURN LAMP FEED	58,132,136
7	M1 20PK	COURTESY LAMPS	121,123
8	L62 18BR/RD*	RIGHT TURN LAMP FEED	58,135,139
9	L50 18WT/TN*	STOP LAMP SIGNAL	58,132,134,138,140,141,142
10	L1 18VT/BK*	BACK-UP LAMP FEED	14,133,137
11	——	——	
12	——	——	
13	——	——	
14	——	——	
15	L84 18BR/WT*	LAMP OUTAGE RIGHT TURN/STOP (J-CAR)	134,138
16	L81 18DG	LAMP OUTAGE LEFT TURN/STOP (J-CAR)	134,138
17	P6 18RD/WT*	POWER TOP SWITCH UP (J-CAR)	96
18	P5 18YL/BK*	POWER TOP SWITCH DOWN (J-CAR)	96
19	——	——	
20	G71 20VT/YL*	SECURITY ALARM-DECK LID KEY	102,127
21	——	——	
22	——	——	
23	——	——	
24	C15 12BK/WT*	HEATED REAR WINDOW	95
25	F75 12VT	RS AMPLIFIER FEED	63



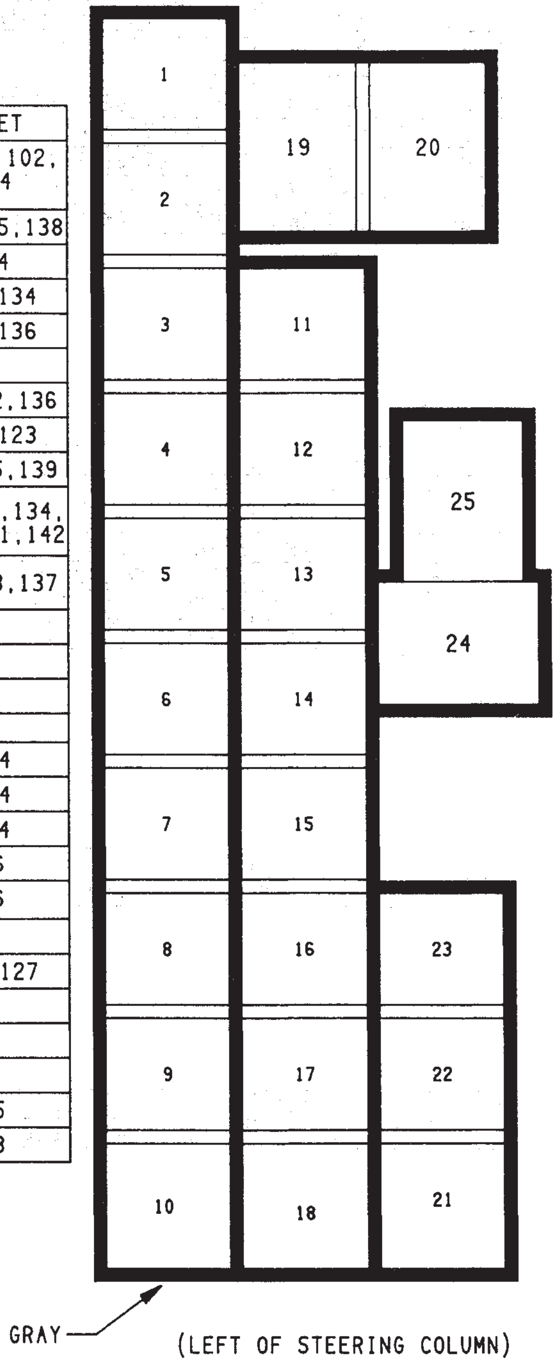
LEFT INSTRUMENT PANEL TO BODY WIRING WITH LAMP OUTAGE

AJ 145

938W-5

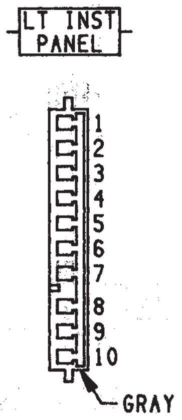
LT INST PANEL

CAV	CIRCUIT	DESCRIPTION	SHEET
1	G78 20TN/BK*	DECK LID SWITCH	83,88,102, 104
2	L7 18BK/YL*	LAMP FEED	134,135,138
2	L7 18BK/YL*	LAMP FEED	134
3	L7 18BK/YL*	LAMP FEED	132,134
4	L7 18BK/YL*	LAMP FEED	132,136
5	—	—	
6	L63 18DG/RD*	LEFT TURN LAMP FEED	58,132,136
7	M1 20PK	COURTESY LAMPS	121,123
8	L62 18BR/RD*	RIGHT TURN LAMP FEED	58,135,139
9	L50 18WT/TN*	STOP LAMP SIGNAL	58,132,134, 140,141,142
10	L1 18VT/BK*	BACK-UP LAMPS FEED	14,133,137
11	—	—	
12	—	—	
13	—	—	
14	—	—	
15	L50 18WT/TN*	STOP LAMP SIGNAL	134
15	L50 18WT/TN*	STOP LAMP SIGNAL	134
16	L50 18WT/TN*	STOP LAMP SIGNAL	134
17	P6 18RD/WT*	POWER TOP SWITCH UP (J-CAR)	96
18	P5 18YL/BK*	POWER TOP SWITCH DOWN (J-CAR)	96
19	—	—	
20	G71 20VT/YL*	SECURITY ALARM-DECK LID KEY	102,127
21	—	—	
22	—	—	
23	—	—	
24	C15 12BK/WT*	HEATED REAR WINDOW	95
25	F75 12VT	RS AMPLIFIER FEED	63

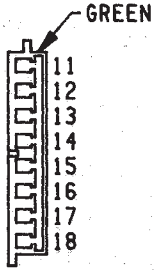


(LEFT OF STEERING COLUMN)
(TERMINAL END VIEW)

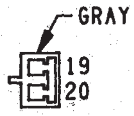
LEFT INSTRUMENT PANEL TO BODY WIRING WITHOUT LAMP OUTAGE



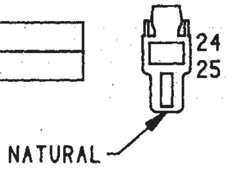
CAV	CIRCUIT	DESCRIPTION	SHEET
1	G78 20TN/BK*	DECK LID SWITCH	83,88,102,104
2	L72 18BK/RD*	RIGHT TAIL LAMP OUTAGE (J-CAR)	134,135
3	L71 18BK/PK*	LEFT TAIL LAMP OUTAGE (J-CAR)	132,134,138
4	L7 18BK/YL*	REAR LAMP FEED	132,136
5	—	—	—
6	L83 18DG/WT*	LAMP OUTAGE LEFT TURN/STOP	58,132,136
7	M1 20PK	COURTESY LAMPS	121,123
8	L82 18BR	LAMP OUTAGE RIGHT TURN/STOP	58,135,139
9	L50 18WT/TN*	STOP LAMP SWITCH	58,132,134,138,140,141,142
10	L1 18VT/BK*	BACK-UP LAMPS FEED	14,133,137



11	—	—	—
12	—	—	—
13	—	—	—
14	—	—	—
15	L84 18BR/WT*	RIGHT TURN/STOP OUTAGE (J-CAR)	134,138
16	L81 18DG	LEFT TURN/STOP OUTAGE (J-CAR)	134,138
17	P6 18RD/WT*	POWER TOP SWITCH UP (J-CAR)	96
18	P5 18YL/BK*	POWER TOP SWITCH DOWN (J-CAR)	96



19	—	—	—
20	G71 20VT/YL*	SECURITY ALARM-DECK LID KEY	102,127

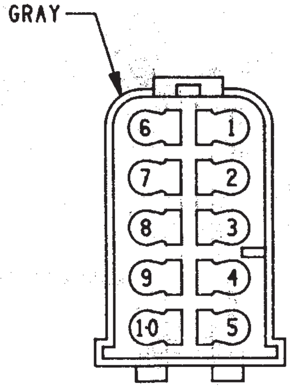


24	C15 12BK/WT*	HEATED REAR WINDOW	95
25	F75 12VT	RS POWER AMP FEED (J-CAR)	63

AJ 147

BODY WIRING TO LEFT
INSTRUMENT PANEL

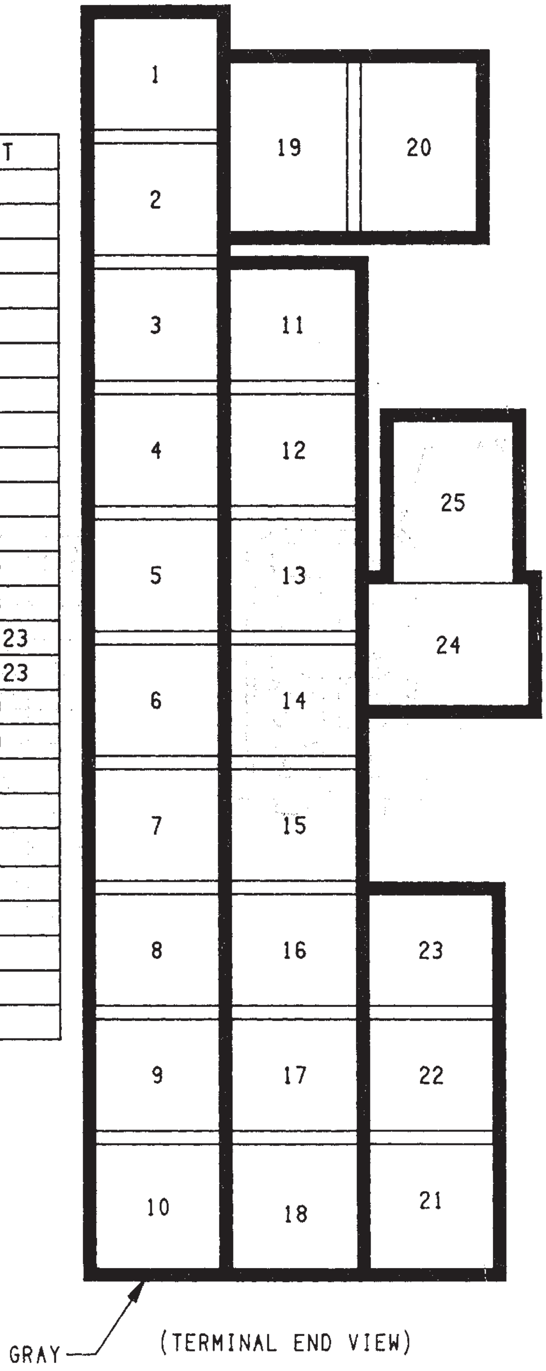
938W-5



CAV	CIRCUIT	DESCRIPTION	SHEET
1	F20 18WT	REAR WIRING FEED	117
2	—	—	—
3	M1 20PK	DOME AND COURTESY LAMPS	117,125
4	—	—	—
5	G32 20BK/LB*	AMBIENT AIR SENSOR RETURN	117
6	D1 20VT/BR*	SERIAL BUSS+	117
7	D2 20WT/BK*	SERIAL BUSS−	117
8	M2 20YL	DOOR JAMB SWITCHES	117,125
9	—	—	—
10	G31 20VT/LG*	AMBIENT AIR SENSOR SIGNAL	117

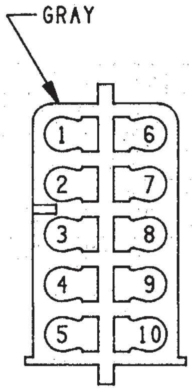
RT INST
PANEL

CAV	CIRCUIT	DESCRIPTION	SHEET
1	X51 18BR/YL*	LEFT REAR SPEAKER B+	63
2	X52 18DB/WT*	RIGHT REAR SPEAKER B+	63
3	X53 20DG	LEFT FRONT SPEAKER B+	63
4	X54 20VT	RIGHT FRONT SPEAKER B+	63
5	X55 20BR/RD*	LEFT FRONT SPEAKER B−	63
6	X56 20DB/RD*	RIGHT FRONT SPEAKER B−	63
7	X57 18BR/LB*	LEFT REAR SPEAKER B−	63
8	X58 18DB/OR*	RIGHT REAR SPEAKER B−	63
9	X80 16LB/DG*	RS AMPLIFIER B−	64
10	X60 20LG/RD*	RS AMPLIFIER B+	63
11	F20 18WT	REAR WIRING FEED	119
12	G31 20VT/LG*	AMBIENT AIR SENSOR SIGNAL	119
13	G32 20BK/LB*	AMBIENT AIR SENSOR RETURN	119
14	M1 20PK	DOME AND COURTESY LAMPS	119,123
15	M2 20YL	DOOR JAMB SWITCHES	119,123
16	D1 20VT/BR*	SERIAL BUSS+	119
17	D2 20WT/BK*	SERIAL BUSS−	119
18	——	——	
19	X86 16OR/RD*	RIGHT FRONT I/P SPEAKER B− (RS)	63
20	X81 16YL/BK*	LEFT FRONT I/P SPEAKER B− (RS)	63
21	X87 16LG/VT*	LEFT FRONT DOOR SPEAKER B+ (RS)	64
22	X82 16LB/VT*	RIGHT FRONT DOOR SPEAKER B+	64
23	X85 16LG/DG*	LEFT FRONT DOOR SPEAKER B− (RS)	64
24	X83 16YL/RD*	LEFT FRONT I/P SPEAKER B+ (RS)	63
25	X84 16OR/BK*	HI RF (RS) SYSTEM	63



AJ 149 RIGHT INSTRUMENT PANEL TO BODY WIRING 938W-5

CAV	CIRCUIT	DESCRIPTION	SHEET
1	F20 18WT	REAR WIRING FEED	117
2	—	—	—
3	M1 20PK	DOME AND COURTESY LAMPS	117,125
4	—	—	—
5	G32 20BK/LB*	EXTERNAL TEMPERATURE SENSOR	117
6	D1 20VT/BR*	SERIAL BUSS B+	117
7	D2 20WT/BK*	SERIAL BUSS B−	117
8	M2 20YL	DOOR JAMB SWITCHES	117,125
9	—	—	—
10	G31 20VT/LG*	AMBIENT AIR SENSOR	117



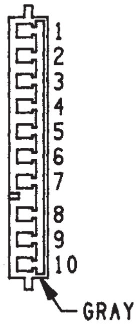
938W-5

BODY WIRING TO RIGHT INSTRUMENT PANEL

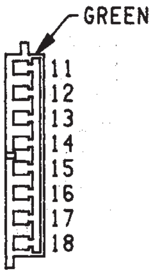
AG 150

RT INST PANEL

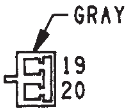
CAV	CIRCUIT	DESCRIPTION	SHEET
1	X51 20BR/YL*	LEFT REAR SPEAKER (B+) (RS AMP)	63
2	X52 20DB/WT*	RIGHT REAR SPEAKER (B+) (RS AMP)	63
3	X53 20DG	LEFT FRONT DOOR SPEAKER (B+)(W/O RS AMP)	63
4	X54 20VT	RIGHT FRONT DOOR SPEAKER (B+)(W/O RS AMP)	63
5	X55 20BR/RD*	LEFT FRONT DOOR SPEAKER (B−)(W/O RS AMP)	63
6	X56 20DB/RD*	RIGHT FRONT DOOR SPEAKER (B−)(W/O RS AMP)	63
7	X57 20BR/LB*	LEFT REAR SPEAKER (B−) (RS)	63
8	X58 20DB/OR*	RIGHT REAR SPEAKER (B−) (RS)	63
9	X80 16LB/DG*	RS AMP (B−)	64
10	X60 18LG/RD*	RS AMP (B+)	64



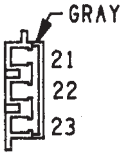
11	F20 18WT	REAR WIRING FEED	119
12	G31 20VT/LG*	AMBIENT AIR SENSOR	119
13	G32 20BK/LB*	EXTERNAL TEMPERATURE SENSOR	119
14	M1 20PK	DOME AND COURTESY LAMPS	119,123
15	M2 20YL	DOOR JAMB SWITCHES	119,123
16	D1 20VT/BR*	SERIAL BUSS B+	119
17	D2 20WT/BK*	SERIAL BUSS B−	119
18	—	—	—



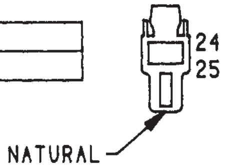
19	X86 16OR/RD*	RIGHT FRONT I/P SPEAKER (B+) RS AMP	63
20	X81 16YL/BK*	LEFT FRONT I/P SPEAKER (B−) RS AMP	63



21	X85 16LG/DG*	LEFT DOOR SPEAKER (B−) RS AMP	64
21	X55 16BR/RD*	LF DOOR SPEAKER (B−) (W/O RS AMP)	64
22	X82 16LB/VT*	LEFT FRONT DOOR SPEAKER (B+) RS AMP	64
22	X54 16VT	RF DOOR SPEAKER (B+) (W/O RS AMP)	64
23	X87 16LG/VT*	LEFT DOOR SPEAKER (B+) RS AMP	64
23	X53 16DG	LF DOOR SPEAKER (B+) (W/O RS AMP)	64



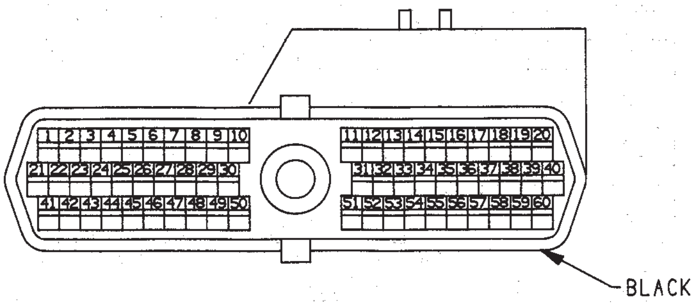
24	X83 16YL/RD*	LEFT FRONT I/P SPEAKER (B+)	63
25	X84 16OR/BK*	HI RF (RS SOUND)	63



BODY WIRING TO RIGHT INSTRUMENT PANEL

AJ 151

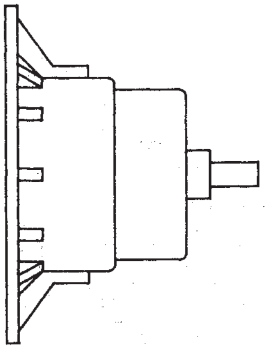
938W-5

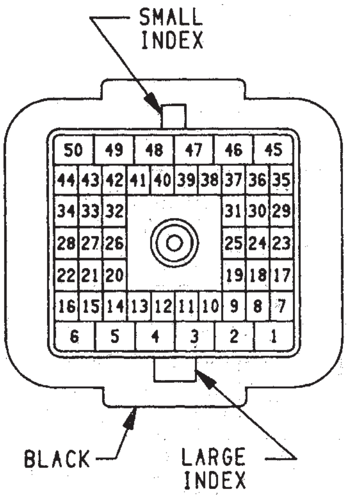


VIEW FROM TERMINAL END

TCM			
CAV	CIRCUIT INFO	CIRCUIT FUNCTION	SHEET
1	T1 18LG/BK*	TRANSMISSION RANGE SWITCH	15,38
2	T2 18TN/BK*	BACK-UP LAMP RELAY	38
3	T3 14VT	LH POSITION SENSOR	38
4	D2 20WT/BK*	SERIAL BUSS (B −)	37
5	D1 20LB/BR*	SERIAL BUSS (B +)	37
6	Z14 18BK/YL*	SIGNAL GROUND	37
8	A41 14YL	ENGINE STARTER RELAY	15,39
9	T9 18OR/BK*	OVERDRIVE PRESSURE SWITCH	36
11	A21 14DB	IGNITION START RUN	38
12	K22 18OR/DB*	THROTTLE POSITION (SENSOR)	37
13	T13 18DB/BK*	VEHICLE SPEED SENSOR GROUND (−)	39
14	T14 18LG/WT*	OUTPUT SPEED SENSOR (+)	39
15	T15 18LG	SAFETY SHUTDOWN RELAY POWER	36
16	T16 16RD	SWITCHED BATTERY FEED	36
17	T16 16RD	SWITCHED BATTERY FEED	36
19	T19 18WT	KICK DOWN/LOW AND REVERSE	36
20	T20 18LB	LR/LU SOLENOID	36
41	T41 20BR/YL*	POSITION SENSOR C1	15,38
42	T42 18VT/WT*	POSITION SENSOR C2	15,38
43	D1 20VT/BR*	SERIAL BUSS (B +)	37
44	D2 20PK/BK*	SERIAL BUSS (B −)	37
45	K24 18GY/BK*	DISTRIBUTOR PICK-UP SIGNAL (B +)	39
47	T47 18YL/BK*	KICK-DOWN PRESSURE SWITCH	36
50	T50 18DG	LOW REVERSE PRESSURE SWITCH	36
51	K4 18BK/LB*	DISTRIBUTOR GROUND TO MODULE	37,39
52	T52 18RD/BK*	INPUT SPEED SENSOR (+)	39
53	Z14 18BK/YL*	SIGNAL GROUND	37
56	A14 14RD/WT*	FUEL PUMP A.S.D. RELAY	36
57	Z13 16BK/RD*	POWER GROUND (B −)	38
58	G7 20WT/OR*	VEHICLE SPEED SENSOR	38
59	T59 18PK	UD SOLENOID	36
60	T60 18BR	TRANSMISSION SOLENOID	36

938W-5 TRANSMISSION CONTROL MODULE CONNECTOR AJ 152





TERMINAL END OF DISCONNECT

(INSTRUMENT PANEL)

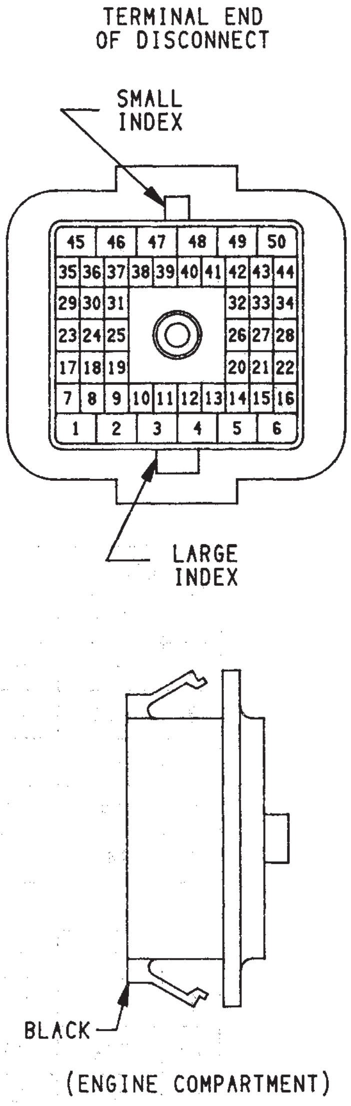
CAVITY	CIRCUIT	ENGINE COMPARTMENT CIRCUITS	SHEET
1	A3 12RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	10,12,54
2	L33 20RD	HIGH BEAM RELAY TO HEADLAMP	44,46,47,49,54
3	A141 14DG/BK*	FUEL PUMP FEED	17,107,108
4	—	—	—
5	—	—	—
6	A7 12RD/YL*	FUSE BLOCK FEED	10,12,54,84
7	F32 18PK/DB*	STOP LAMP SWITCH (B+)	10,12,59,70
8	L34 20RD/OR*	RIGHT HIGH BEAM FUSE TO HEADLAMP	48,54
9	A5 18RD	BATTERY FEED	8,16,37
10	V32 20YL/RD*	VEH SPD CONTROL SWITCH IGNITION FEED	59
11	L43 20VT	LEFT LOW BEAM FUSE TO HDLP	44,46,48,50,53,134,138
12	L44 20VT/RD*	RIGHT LOW BEAM FUSE TO HDLP	44,46,48,50,53,134,138
13	L39 18LB	FOG LAMPS FEED 'G' BODY	44,48,55,74
14	Z2 20BK/LG *	GROUND	72
15	V3 18BR/WT *	WINDSHIELD WIPER- LOW SPEED	67
16	V4 18RD/YL *	WINDSHIELD WIPER- HIGH SPEED	67
17	G20 20VT/YL*	ENGINE COOLANT TEMPERATURE SENDING UNIT	40,41,75
18	G6 20GY	LOW ENGINE OIL PRES WARNING SWITCH	40,41,75,77
18	G6 20GY	LOW ENGINE OIL PRES WARNING SWITCH	40,41,75,77
19	G60 20GY/YL*	ENGINE OIL PRES GAUGE SENDING UNIT	40,41,75
20	G34 20RD/GY*	HIGH BEAM INDICATOR	44,46,49,74
21	L61 18LG	LEFT FRONT TURN SIGNAL/INDICATOR	43,45,47,49,78
22	L60 18TN	RT FRT TURN SIGNAL/INDICATOR	44,46,48,50,58,75 78
22	L60 18TN	RT FRT TURN SIGNAL/INDICATOR	44,46,48,50,58,75 78
23	L9 18BK/WT *	BATTERY-HAZARD FLASHER FEED	9,11,56
24	V37 20RD/LG *	VEHICLE SPEED CONTROL MODE SELECT	59
25	G70 20BR/TN *	SECURITY ALARM-HOOD	127
26	L7 18BK/YL *	REAR LIGHTING AND PARKING LAMP FEED	44,46,48,50,54
27	F20 18WT	BACK-UP LAMP SWITCH FEED	13,14,39
28	L1 18VT/BK*	BACK-UP LAMPS FEED	13,14,129,133 137
29	V10 18BR	WASH/WIPER SYSTEM	66,80,82
30	G29 20BK/TN *	LOW WASHER FLUID	67,88
31	V15 20LB/RD *	FRNT WASH RELAY COIL (B−) TO SW POD	66
32	G19 20LG/OR*	ANTI-LOCK BRAKE WARNING	69,70,74,78
33	G21 20GY/LB*	TACHOMETER SIGNAL	22,24,35,75
34	G9 20GY/BK *	BRAKE WARNING	70,73,78
35	V5 18DG	WASH WIPER SYSTEM	67,80,82
36	F13 18DB	FRONT WIPER PARK/RUN	66,67
37	C22 18DB/WT *	A/C CYCLING SWITCH	92
38	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	19,24,35,73
39	D2 20WT/BK*	SERIAL BUSS B−	29,87
40	D1 20VT/BR*	SERIAL BUSS B+	29,86
41	L50 18WT/TN*	STOP LAMP SWITCH	58,59,134,138
42	G7 20WT/OR*	VEHICLE SPEED SENSOR	21,24,35,75
43	G31 20VT/LG*	AMBIENT AIR SENSOR	117,119
44	G32 20BK/LB*	AMBIENT AIR SENSOR RETURN	117,119
45	X2 18DG/RD*	HORN FEED	65
46	M1 20 PK	UNDERHOOD LAMP (G-BODY)	16
47	A21 12DB	IGNITION START/RUN	11,25,42,70,77
48	A4 12BK/RD*	HEATED REAR WINDOW	8,94,95
49	A1 12RD	BATTERY FEED TO IGNITION SWITCH	10,12,13
50	A2 12PK/BK	BATTERY FEED TO IGNITION SWITCH	42

50-WAY BULKHEAD DISCONNECT

AG-AJ 153

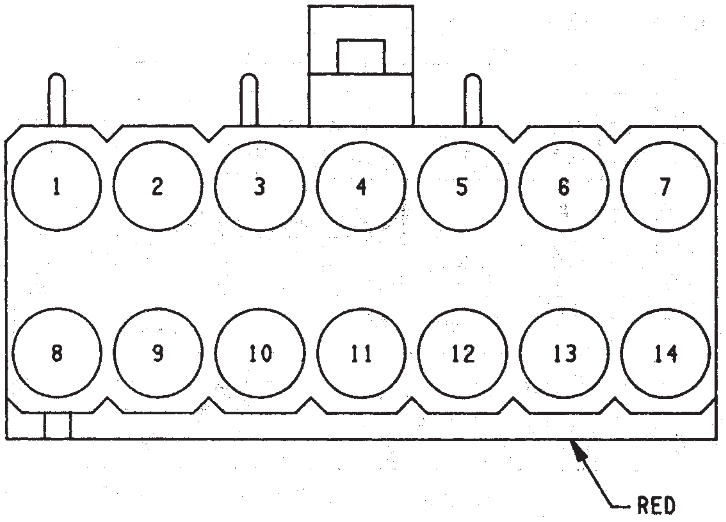
938W-5

CAVITY	CIRCUIT	ENGINE COMPARTMENT CIRCUITS	SHEET
1	A3 12RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	10,12,54
2	L33 20RD *	HIGH BEAM FEED TO HEADLAMP	44,46,47,49,54
3	A141 14DG/BK*	FUEL PUMP FEED/OXYGEN SENSOR	17,107,108
3	A141 14DG/BK*	FUEL PUMP FEED/OXYGEN SENSOR	
4	——	——	——
5	——	——	——
6	A7 12RD/YL*	FUSE BLOCK FEED	10,12,54,84
7	F32 18PK/DB*	STOP LIGHT SWITCH (B+)	10,12,59,70
8	L34 20RD/OR*	RIGHT HIGH BEAM FUSE TO HEADLAMP	48,54
9	A5 18RD	BATTERY FEED	8,16,37
10	V32 20YL/RD*	VEH SPD CONTROL SWITCHED IGNITION	59
11	L43 20VT	LEFT LOW BEAM FUSE TO HDLP	44,46,48,50,53,134,138
12	L44 20VT/RD*	RIGHT LOW BEAM FUSE TO HDLP	44,46,48,50,53,134,138
13	L39 18LB	FOG LAMPS FEED 'G' BODY	44,48,55,74
13	L39 18LB	FOG LAMPS FEED	
14	Z2 18BK/LG *	GROUND (J CAR)	72
15	V3 18BR/WT *	WINDSHIELD WIPER-LOW SPEED	67
16	V4 18RD/YL *	WINDSHIELD WIPER-HIGH SPEED	67
17	G20 20VT/YL*	ENGINE COOLANT TEMPERATURE SENDING UNIT	40,41,75
18	G6 20GY	LOW ENGINE OIL PRES WARNING SWITCH	40,41,75,77
19	G60 20GY/YL*	ENGINE OIL PRES GAUGE SENDING UNIT	40,41,75
20	G34 20RD/GY*	HIGH BEAM INDICATOR	44,46,49,74
21	L61 18LG	LEFT FRONT TURN SIGNAL/INDICATOR	43,45,47,49,78
22	L60 18TN	RT FRT TURN SIGNAL/INDICATOR	44,46,48,50,58,75 78
23	L9 18BK/WT *	BATTERY-HAZARD FLASHER FEED	9,11,56
24	V37 20RD/LG*	VEH SPD CONTROL MODE SELECT SWITCH	59
25	G70 20BR/TN*	SECURITY ALARM-HOOD	127
26	L7 18BK/YL*	REAR LIGHTING AND PARKING LAMP FEED	44,46,48,50,54
26	L7 18BK/YL*	REAR LIGHTING AND PARKING LAMP FEED	
27	F20 18WT	BACK-UP LAMP SWITCH FEED	13,14,39
28	L1 18VT/BK*	BACK-UP LAMPS FEED	13,14,129,133 137
29	V10 18BR	WASH/WIPER SYSTEM	66,80,82
29	V10 18BR	WASH/WIPER SYSTEM	
30	G29 20BK/TN*	LOW WASHER FLUID	67,88
31	V15 20LB/RD*	FRNT WASH RELAY COIL (B−) TO SW POD	66
32	G19 20LG/OR*	ANTI-LOCK BRAKE WARNING	69,70,74,78
33	G21 20GY/LB*	TACHOMETER SIGNAL	22,24,35,75
34	G9 18GY/BK *	BRAKE WARNING	70,73,78
35	V5 18DG	WASH WIPER SYSTEM	67,80,82
36	F13 18DB	FRONT WIPER PARK/RUN	66,67
37	C22 18DB/WT*	A/C CYCLING SWITCH	92
38	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	19,24,35,73
39	D2 20WT/BK*	SERIAL BUSS B−	29,87
40	D1 20VT/BR*	SERIAL BUSS B+	29,86
41	L50 18WT/TN*	STOP LAMP SWITCH	58,59,134,138
41	L50 18WT/TN*	STOP LAMP SWITCH	
42	G7 20WT/OR*	VEHICLE SPEED SENSOR	21,24,35,75
43	G31 20VT/LG*	AMBIENT AIR SENSOR	117,119
44	G32 20BK/LB*	AMBIENT AIR SENSOR RETURN	117,119
45	X2 18DG/RD*	HORN FEED	65
46	M1 12PK	UNDERHOOD LAMP (G BODY)	16
47	A21 12DB	IGNITION START/RUN	11,25,42,70,77
48	A4 12BK/RD*	HEATED REAR WINDOW	8,94,95
49	A1 12RD	BATTERY FEED TO IGNITION SWITCH	10,12,13
50	A2 12PK/BK*	BATTERY FEED TO IGNITION SWITCH	42



(ENGINE COMPARTMENT)

50-WAY
BULKHEAD
DISCONNECT



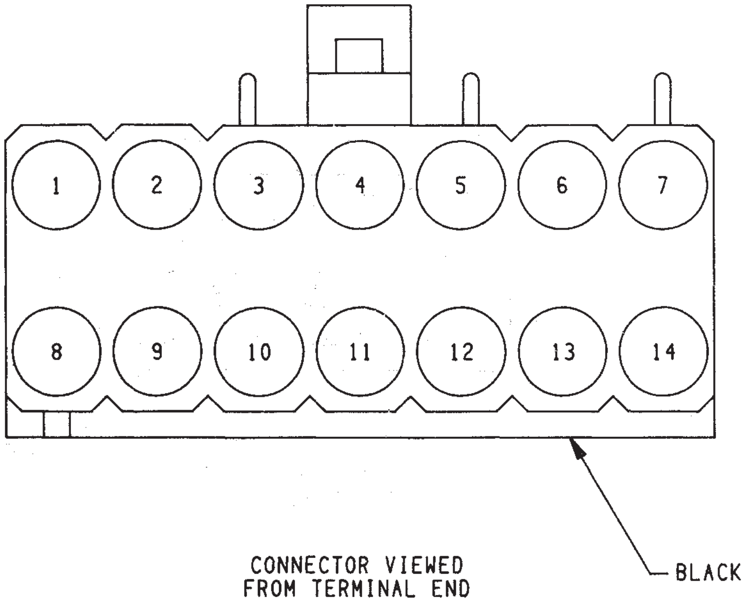
CONNECTOR VIEWED
FROM TERMINAL END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	G13	20	DB/RD*	SEAT BELT LAMP	74
2	—	—	—	—	—
3	G19	20	LG/OR*	ANTI-LOCK BRAKES WARNING LAMP	69,70,74
4	—	—	—	—	—
5	G9	20	GY/BK*	BRAKE WARNING	70,73
6	R41	18	BK/TN*	AIRBAG SYSTEM WARNING LAMP	74,84
7	—	—	—	—	—
8	M1	20	PK	DOME AND COURTESY LAMPS	73,87
9	G5	20	DB/WT*	WARNING LAMPS AND GAUGES FEED	70,73,84,107
10	G34	20	RD/GY*	RIGHT HIGH-BEAM FUSE	74
11	G3	20	BK/PK*	MALFUNCTION INDICATOR LAMP	19,24,35,73
12	—	—	—	—	—
13	L39	18	LB	FOG LAMPS FEED 'G' BODY ONLY	74
14	Z3	20	BK/OR*	INSTRUMENT PANEL GROUND	52,73,107

AG-AJ 155

MECHANICAL CLUSTER #1 LEFT PRINTED CIRCUIT BOARD CONNECTOR

938W-5

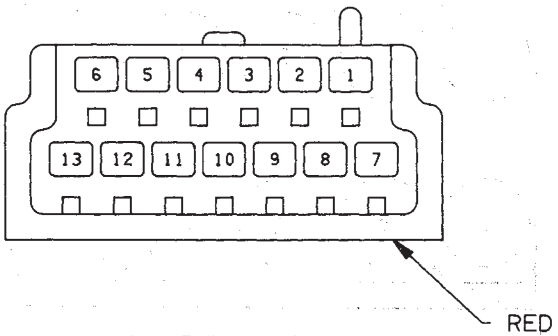


CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	L61	18	LG	LEFT FRONT TURN SIGNAL	76
2	L60	18	TN	RIGHT FRONT TURN SIGNAL	75
3	—	—	—	—	—
4	—	—	—	—	—
5	G7	20	WT/OR*	VEHICLE SPEED SENSOR	21,35,75
6	G21	20	GY/LB*	TACHOMETER SIGNAL	22,35,75
7	G4	20	DB	FUEL GAUGE	76
7	G4	20	DB	FUEL GAUGE LEVEL TANK SENDING UNIT	76,107
8	E2	20	OR	DIMMABLE HEADLAMPS	76,87
9	G41	20	LB/RD*	LOW FUEL OUTPUT	76
10	—	—	—	—	—
11	G20	20	VT/YL*	ENGINE COOLANT TEMPERATURE SENDING UNIT	40,75
12	G6	20	GY	LOW ENGINE OIL PRESSURE WARNING SWITCH	40,75
12	G12	20	DG/YL*	CHECK GAUGE LAMP	40,75
13	G60	20	GY/YL*	ENGINE OIL PRESSURE GAUGE SENDING UNIT	40,75
14	—	—	—	—	—

MECHANICAL CLUSTER #2 RIGHT PRINTED CIRCUIT BOARD CONNECTOR

938W-5

AG-AJ 156



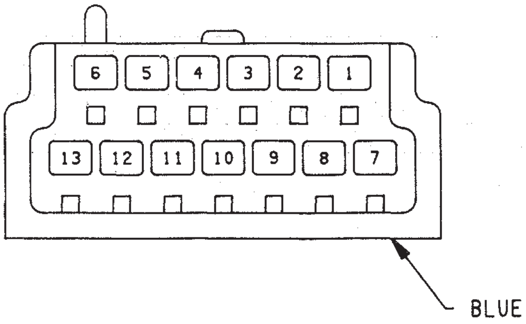
CONNECTOR VIEWED
FROM TERMINAL END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	E2	20	OR	DIMMABLE HEADLIGHTS	77,87
2	—	—	—	—	—
3	—	—	—	—	—
4	—	—	—	—	—
5	G9	20	GY/BK*	BRAKE WARNING	70,78
6	G19	20	LG/OR*	ANTI-LOCK BRAKES WARNING LAMP	78
7	Z2	20	BK/LG*	ELECTRONICS GROUND	77
8	—	—	—	—	—
9	—	—	—	—	—
10	—	—	—	—	—
11	—	—	—	—	—
12	G5	20	DB/WT*	WARNING LAMPS AND GAUGES FEED	70,77,84, 87,107,127
13	M1	20	PK	DOME AND COURTESY LAMPS	77,87

AJ 157

ELECTRONIC CLUSTER LEFT PRINTED CIRCUIT BOARD CONNECTOR

938W-5



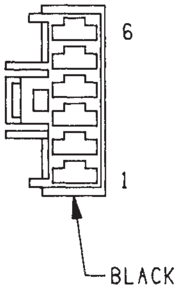
CONNECTOR VIEWED
FROM TERMINAL END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	G6	20	GY	LOW ENGINE OIL PRESSURE WARNING SWITCH	40,41,77
2	R41	18	BK/TN*	AIRBAG SYSTEM WARNING LAMP	78
3	—	—	—	—	—
4	—	—	—	—	—
5	L60	18	TN	RIGHT FRONT TURN SIGNAL	78
6	L61	18	LG	LEFT FRONT TURN SIGNAL	78
7	D1	20	VT/BR*	SERIAL BUS B+	77
8	D2	20	WT/BK*	SERIAL BUS B−	77
9	—	—	—	—	—
10	—	—	—	—	—
11	L48	20	VT/PK*	RIGHT LOW BEAM FUSE	78
12	G34	20	RD/GY*	RIGHT HIGH BEAM FUSE	78
13	—	—	—	—	—

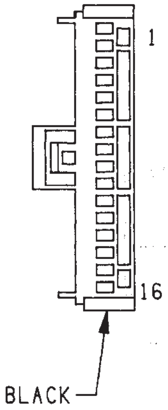
938W-5

ELECTRONIC CLUSTER RIGHT
PRINTED CIRCUIT BOARD CONNECTOR

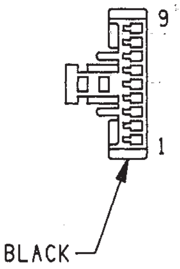
AJ 158



RS AMP #1			
CAV	CIRCUIT	DESCRIPTION	SHEET
2	Z1 12BK	AMPLIFIER GROUND	63
5	F75 12VT	FUSED FEED TO AMPLIFIER	63

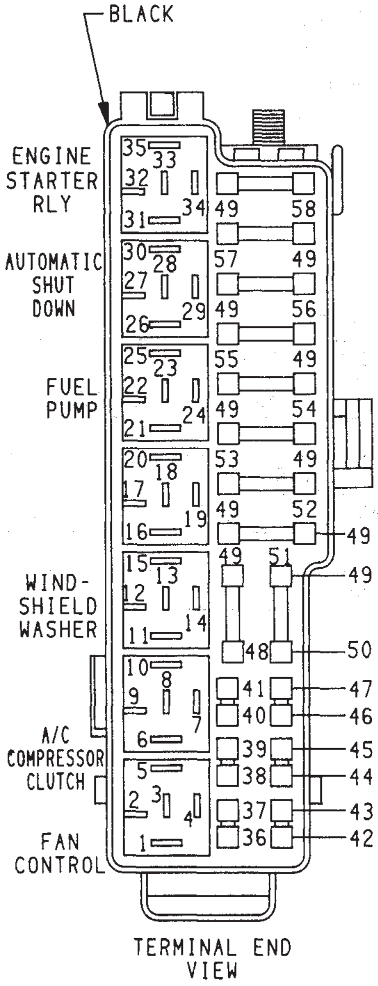


RS AMP #2			
CAV	CIRCUIT	DESCRIPTION	SHEET
1	X80 16LB/DG*	– LO RF (RS SOUND)	64
2	X82 16LB/VT*	+ LO RF (RS SOUND)	64
3	X84 16OR/BK*	– HI RF (RS SOUND)	64
4	X86 16OR/RD*	+ HI RF (RS SOUND)	64
5	X96 16TN/BK*	– HI RR (RS SOUND)	64
6	X98 16TN/RD*	+ HI RR (RS SOUND)	64
7	X92 16TN/DG*	– LO RR (RS SOUND)	64
8	X94 16TN/VT*	+ LO RR (RS SOUND)	64
9	X91 16WT/DG*	– LO LR (RS SOUND)	64
10	X93 16WT/VT*	+ LO LR (RS SOUND)	64
11	X97 16WT/BK*	– HI LR (RS SOUND)	64
12	X95 16WT/RD*	+ HI LR (RS SOUND)	64
13	X81 16YL/BK*	– HI LF (RS SOUND)	64
14	X83 16YL/RD*	+ HI LF (RS SOUND)	64
15	X85 16LG/DG*	– LO LF (RS SOUND)	64
16	X87 16LG/VT*	+ LO LF (RS SOUND)	64



RS AMP #3			
CAV	CIRCUIT	DESCRIPTION	SHEET
1	X60 20LG/RD*	RS B+ SIGNAL FROM RADIO	63
2	X57 20BR/LB*	LEFT REAR SPEAKER B–	63
3	X51 20BR/YL*	LEFT REAR SPEAKER B+	63
4	X55 20BR/RD*	LEFT FRONT DOOR SPEAKER B–	63
5	X53 20DG	LEFT FRONT DOOR SPEAKER B+	63
6	X54 20VT	RIGHT FRONT DOOR SPEAKER B+	63
7	X56 20DB/RD*	RIGHT FRONT DOOR SPEAKER B–	63
8	X52 20DB/WT*	RIGHT REAR SPEAKER B+	64
9	X58 20DB/OR*	RIGHT REAR SPEAKER B–	64

RS AMPLIFIER CONNECTORS



CAV	PDC CIRCUIT	DESCRIPTION	SHEET
1	F12 18DB/WT*	FUSED IGNITION (R-5)	89
1	F12 18DB/WT*	FUSED IGNITION (R-5)	89
2	A16 12GY	FAN CONTROL RELAY CONTACT BAT FEED (B+)	89
4	C25 18LG	ENGINE COOLING FAN	89
4	C25 12LG	ENGINE FAN FEED	89
5	C27 20DB/PK*	FAN CONTROL RELAY (GND)	89
6	C25 18LG	FAN CTRL FEED A/C CLUTCH RELAY COIL (B+)	91
7	A17 18RD	FAN CONTROL	91
9	C3 18DB/BK*	A/C COMPRESSOR CLUTCH (B+) FROM RELAY	91
10	C13 20DB/OR*	A/C COMPRESSOR CLUTCH RELAY COIL (B−)	91
11	F13 18DB	FRONT WIPER PARK	66
11	F13 18DB	FRONT WIPER PARK	66
12	F13 18DB	FRONT WIPER PARK	66
14	V10 18BR	FRONT W/WASHER PUMP MOTOR FEED	66
15	V15 20LB/RD*	FRONT WASHER RELAY COIL (B−) TO SW POD	66
16	—	—	—
17	—	—	—
18	—	—	—
19	—	—	—
20	—	—	—
21	A21 12DB	IGN START/RUN FUEL PUMP COIL (B+)	108
21	A21 18DB	IGN START/RUN ASD RELAY COIL(B+)	108
22	A14 18RD/WT*	FUEL PUMP TO ASD RELAY (CONTACT)	108
22	A14 18RD/WT*	FUEL PUMP TO ASD RELAY (CONTACT)	108
24	A141 16DG/BK*	FUEL PUMP RELAY TO FUEL PUMP	108
25	K51 20DB/YL*	AUTOMATIC SHUTDOWN SIG TO FUEL PUMP RLY CONN	108
25	K51 20DB/YL*	AUTOMATIC SHUTDOWN SIGNAL	108
26	A21 18DB	IGNITION RUN/START	20,27,33
26	A21 18DB	IGNITION START/RUN	20,27,33
27	A14 18RD/WT*	FUEL PUMP ASD RELAY	20,27,33
27	A14 18RD/WT*	FUEL PUMP ASD RELAY	20,27,33
29	A142 14DG/OR*	INJ/SENSE/ALT FEED	20,27,33
30	K51 20DB/YL*	AUTOMATIC SHUTDOWN SIGNAL	20,27,33
31	A41 14YL	ENG STARTER RELAY COIL+ (B) FROM IGN SW	13,14,15
31	A41 14YL	ENG STARTER RELAY TO CLUTCH SWITCH	13,14,15
32	A1 14RD	BAT FEED TO IGN SWITCH	13,14,15
32	A1 16RD	BATTERY FEED TO MINI FUSE 44/45	2,13,14,15
34	T40 12BR	ENGINE STARTER RELAY TO SOLENOID	13,14,15
35	T24 20BR/LB*	ENGINE STARTER RELAY GND	13,14,15
36	L9 18BK/WT*	FUSED HAZARD FLASHER FEED	1,9,11,56
37	A15 14PK	HAZARD FLASHER FEED	1,9
40	A17 18RD	A/C COMPRESSOR CLUTCH FEED	2,9,11
41	A0 14BK	MINI FUSE 40 & 46 FEED (BUS)	2
42	F12 18DB/WT*	FUSED IGN RUN/START	2,9,11,18
43	A21 18DB	IGNITION START/RUN	2,11,18
44	A14 18RD/WT*	FUEL PUMP ASD RELAY FEED	2,10,12
45	A1 16RD	IGN (B+) RSA	2,10,12
46	A5 18RD	INT LAMP FUSE FEED	2,9,11
48	A20 12RD/DG*	ABS SYSTEM RELAY	1,10,12
50	A11 10BK/GY*	GENERATOR OUTPUT	1,10,12
51	A2 12PK/BK*	BAT FEED TO IGN SWITCH	2,7,10,12
52	A16 12GY	FEED TO FAN CONTROL	4,10,12
53	A4 12BK/RD*	ELEC HTD REAR RT WINDOW	4,7,10,12
55	A1 12RD	BATT FEED TO IGN SW (R-S-A)	2,7,10,12
55	A1 14RD	BATT FEED TO IGN SW (R-S-A)	2,7,10,12
56	A7 12RD/YL*	BATT FEED TO FUSE BLOCK	3,5,10,12,54,60,84,88
57	A3 12RD/WT*	UNFUSED BATT TO FUSE BLOCK	3,5,10,12,54
58	A11 10BK/GY*	BATT FUSED ALT OUTPUT	1,10,12
59	A0 8BK	BUS BAR FEED (B+)	1,10,11,12
59	A0 14BK	MINI-FUSE 41,47 FEED (B+)	2,10,11,12

938W-5

POWER DISTRIBUTION CENTER

AG-AJ 160

CONNECTOR #1

CAV	IGNITION SYSTEM CIRCUITS		SHEET
1			
2	F12 18DB/WT*	FUSED IGNITION RUN/START	72
3	G36 20BR/GY*	ENGINE OIL LEVEL SENSOR	72
4			
5	D2 20WT/BK*	SERIAL BUSS B−	72
6	D1 20VT/BR*	SERIAL BUSS B+	72

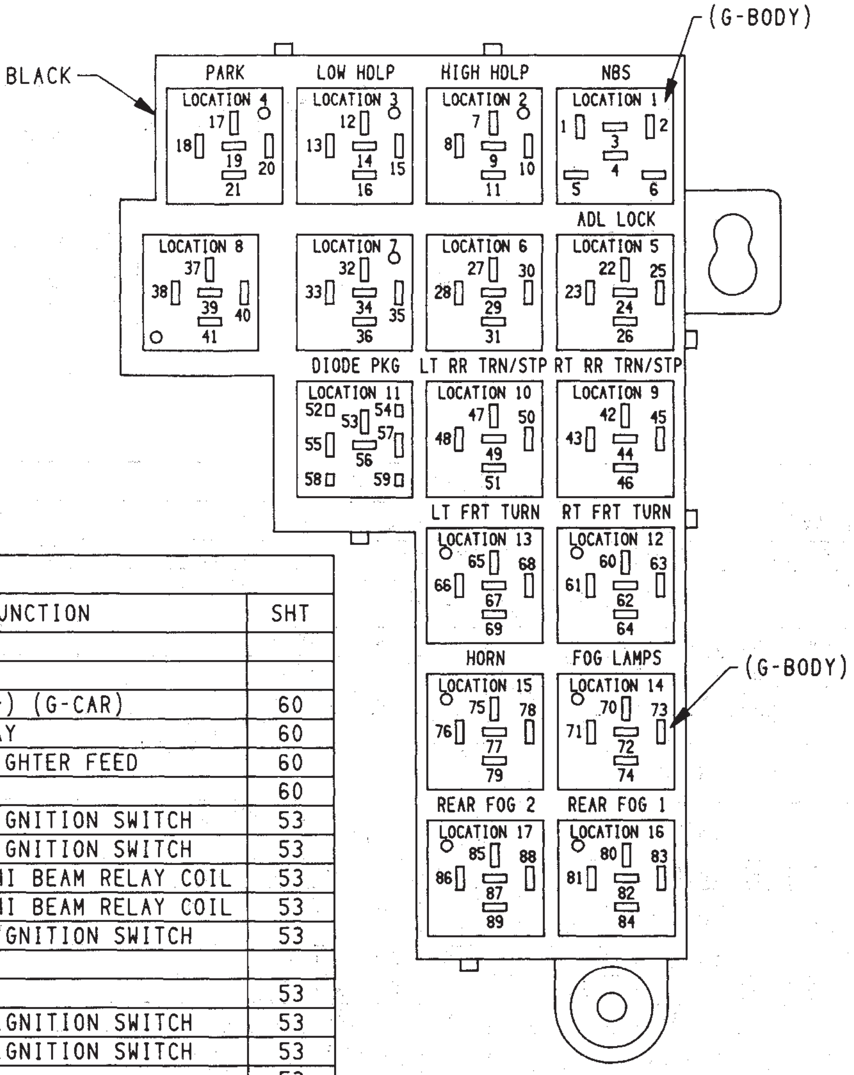
CONNECTOR #2

CAV	IGNITION SYSTEM CIRCUITS		SHEET
1	G18 20PK/BK*	ENGINE COOLANT LEVEL SENSOR	72
2			
3	C27 20DB/PK*	FAN CONTROL RELAY	72
4	G15 20GY/RD*	BRAKE FLUID LEVEL	72
5			
6	Z2 18BK/LG*	GROUND	72

AG-AJ 161

ENGINE NODE MODULE CONNECTOR

938W-5



RELAY BLOCK
(VIEW OF WIRE END)

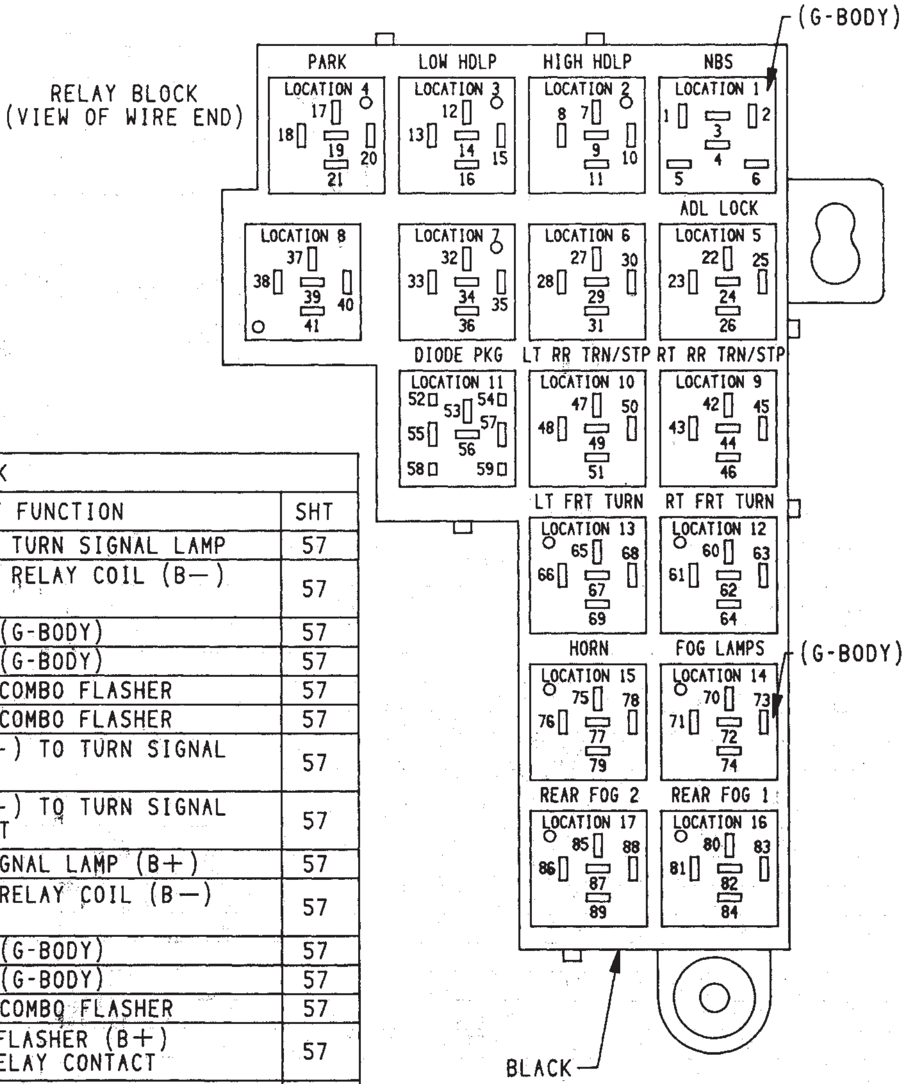
RELAY BLOCK

CAV	CIRCUIT(S)	CIRCUIT FUNCTION	SHT
1	—	—	
2	—	—	
3	X13 14BK/RD*	NBS SPEAKER AMP (B+) (G-CAR)	60
4	X60 20LG/RD*	RADIO TO RS AMP RELAY	60
5	F30 16RD	CONSOLE CIGARETTE LIGHTER FEED	60
6	Z1 20BK	ENGINE GROUND	60
7	A3 14RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
7	A3 14RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
8	L93 20RD/YL*	HEADLAMP SWITCH TO HI BEAM RELAY COIL	53
8	L93 20RD/YL*	HEADLAMP SWITCH TO HI BEAM RELAY COIL	53
10	A3 14RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
11	L3 12RD/OR*	HEADLAMP (HI BEAM)	53
12	A3 12RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
12	A3 16RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
13	L94 20OR/WT*	LOW BEAM REQUEST	53
13	L94 20OR/WT*	LOW BEAM REQUEST	53
15	A3 16RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
15	A3 14RD/WT*	UNFUSED BATTERY TO IGNITION SWITCH	53
16	L4 12VT/WT*	SWITCH TO LOCK RELAY	53
17	F33 18PK/RD*	FUSED BATTERY FEED TO PARK LAMP RELAY	53
17	F33 18PK/RD*	FUSED BATTERY FEED TO PARK LAMP RELAY	53
18	L97 20PK/DB*	TAIL,LICENSE,PARK RELAY (B—) COIL	53
20	F33 18PK/RD*	FUSED BATTERY FEED TO PARK LAMP RELAY	53
20	F33 18PK/RD*	FUSED BATTERY FEED TO PARK LAMP RELAY	53
21	L7 18BK/YL*	PARK LAMP FEED	53
22	P33 14OR/BK*	POWER DOOR LOCK MOTOR (B+) LOCK	115
23	Z1 18BK	ENGINE GROUND	115
24	Z1 18BK	ENGINE GROUND	115
24	Z1 18BK	ENGINE GROUND	115
25	P38 20OR/WT*	BODY COMPUTER TO AUTO DOOR LOCK	115
25	P38 20OR/WT*	S.A.M. TO POWER DOOR LOCK	115
26	F35 14RD	POWER DOOR LOCKS (B+)	115
26	F35 14RD	POWER DOOR LOCKS (B+)	115
27			
28			
28			
29			
29			

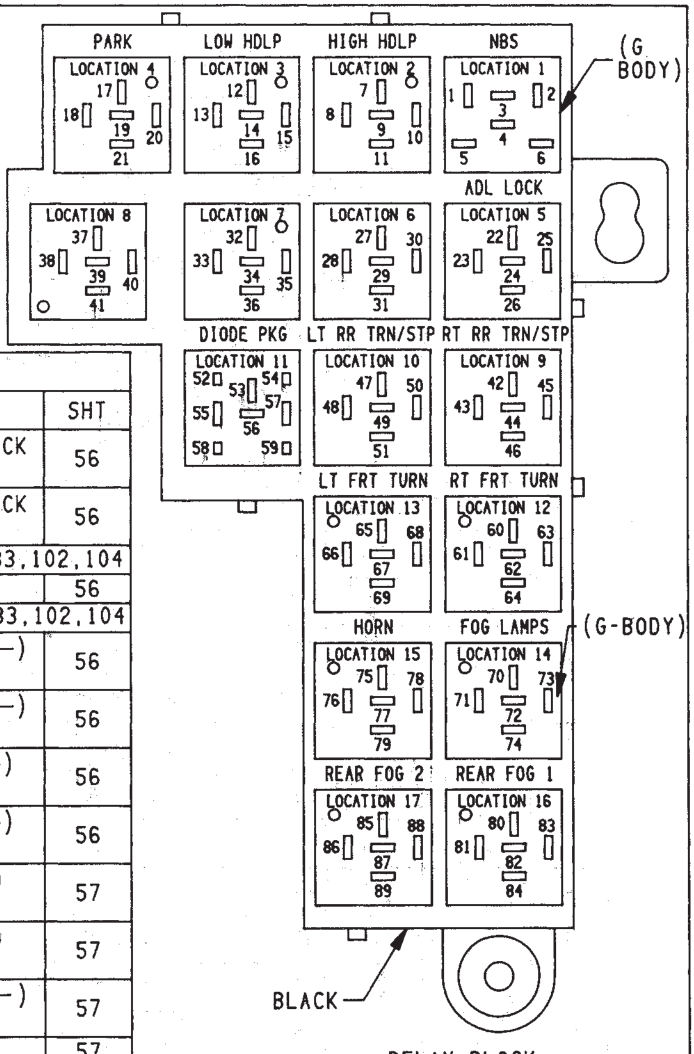
938W-5

RELAY BLOCK

AG-AJ 162



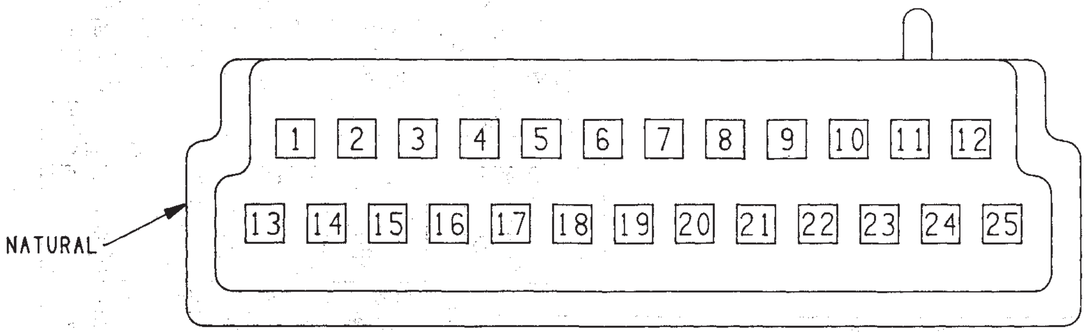
RELAY BLOCK			
CAV	CIRCUIT(S)	CIRCUIT FUNCTION	SHT
42	L62 18BR/RD	RIGHT REAR STOP & TURN SIGNAL LAMP	57
43	L18 20RD/DB*	RIGHT TURN/HAZARD RELAY COIL (B−) TO DIODE PACK	57
44	L50 18WT/TN*	STOP LAMP SWITCH (G-BODY)	57
44	L50 18WT/TN*	STOP LAMP SWITCH (G-BODY)	57
45	L59 18RD/LG*	SWITCHED FEED TO COMBO FLASHER	57
45	L59 18RD/LG*	SWITCHED FEED TO COMBO FLASHER	57
46	L32 18PK/WT*	COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT	57
46	L32 18PK/WT*	COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT UNIT	57
47	L63 18DG/RD*	LEFT REAR TURN SIGNAL LAMP (B+)	57
48	L17 20LG/DB*	LEFT TURN/HAZARD RELAY COIL (B−) TO DIODE PACK	57
49	L50 18WT/TN*	STOP LAMP SWITCH (G-BODY)	57
49	L50 18WT/TN*	STOP LAMP SWITCH (G-BODY)	57
50	L59 18RD/LG*	SWITCHED FEED TO COMBO FLASHER	57
51	L32 18PK/WT*	FEED FROM COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT	57
52	L98 20TN/LG*	CONTROL (B−) RIGHT TURN	56
52	L98 20TN/LG*	CONTROL (B−) RIGHT TURN	56
53	G79 20TN/PK*	SECURITY ALARM DIODE PACK TO DOOR AJAR INDICATOR LAMP	56,83 102,104



RELAY BLOCK
(VIEW OF WIRE END)

RELAY BLOCK

CAV	CIRCUIT(S)	CIRCUIT FUNCTION	SHT
54	L99 20LG/WT	CONTROL (B—) LEFT TURN DIODE PACK TO TURN SIGNAL	56
54	L99 20LG/WT	CONTROL (B—) LEFT TURN DIODE PACK TO TURN SIGNAL	56
55	G75 20TN	LEFT DOOR AJAR SWITCH	56,83,102,104
56	L91 20DB/PK✱	DIODE PACK/COMBO FLASHER UNIT	56
57	G74 20TN/PK✱	RIGHT DOOR AJAR SWITCH	56,83,102,104
58	L18 20RD/DB✱	RIGHT TURN/HAZARD RELAY COIL (B—) TO DIODE PACK	56
58	L18 20RD/DB✱	RIGHT TURN/HAZARD RELAY COIL (B—) TO DIODE PACK	56
59	L17 20LG/DB✱	LEFT TURN/HAZARD RELAY COIL (B—) TO DIODE PACK	56
59	L17 20LG/DB✱	LEFT TURN/HAZARD RELAY COIL (B—) TO DIODE PACK	56
60	L32 18PK/WT✱	FEED FROM COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT	57
60	L32 18PK/WT✱	FEED FROM COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT	57
61	L18 20RD/DB✱	RIGHT TURN/HAZARD RELAY COIL (B—) TO DIODE PACK	57
63	L59 18RD/LG✱	SWITCHED FEED TO COMBO FLASHER	57
63	L59 18RD/LG✱	SWITCHED FEED TO COMBO FLASHER	57
64	L60 18TN	RIGHT FRONT TURN SIGNAL	57
64	L60 18TN	RIGHT FRONT TURN SIGNAL	57
65	L32 18PK/WT✱	FEED FROM COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT	57
65	L32 18PK/WT✱	FEED FROM COMBO FLASHER (B+) TO TURN SIGNAL RELAY CONTACT	57
66	L17 20LG/DB✱	LEFT TURN/HAZARD RELAY COIL (B—) TO DIODE PACK	57
68	L59 18RD/LG✱	SWITCHED FEED TO COMBO FLASHER	57
68	L59 18RD/LG✱	SWITCHED FEED TO COMBO FLASHER	57
69	L61 18LG	LEFT FRONT TURN SIGNAL	57
70	F39 18PK/LG✱	FUSED BATT TO FOG LAMP RELAY CONTACT G-BODY	55
71	L35 20BR/WT✱	FOG LAMP RELAY COIL (B—) TO SWITCH G-BODY	55
73	L44 20VT/RD✱	RIGHT HEADLAMP FUSE TO FOG LAMP RELAY COIL (B+) (G-BODY)	55
74	L39 18LB	FUSED FOG LAMP FEED (G-BODY)	55
75	F31 18VT	HORN RLY BATT FEED	65
75	F31 18VT	HORN RLY BATT FEED	65
76	X3 20BK/RD✱	HORN RLY COIL (B—) TO SAM	65
76	X3 20BK/RD✱	HORN RLY COIL (B—) TO SAM	65
78	F31 18VT	HORN RLY BATT FEED	65
79	X2 18DG/RD✱	HORN FEED (FROM RELAY)	65



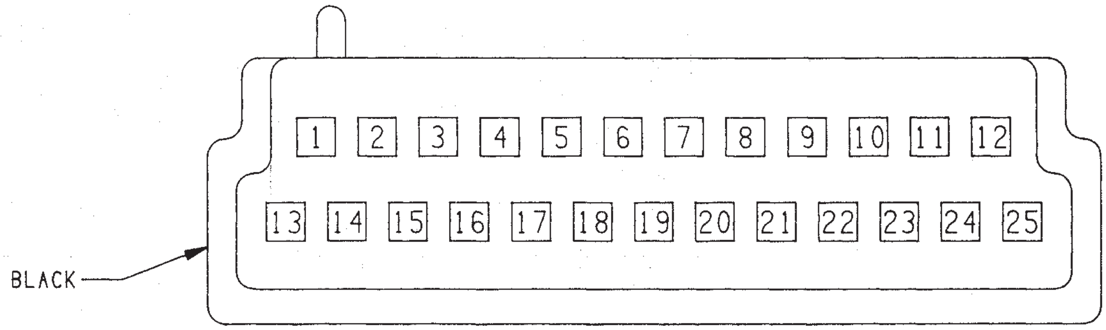
CONNECTOR VIEWED FROM WIRE END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	G74	20	TN/RD*	DOOR AJAR SWITCH/LAMP	79,81,83,104
2	G78	20	TN/BK*	LIFTGATE/DECK/DECK LID AJAR SWITCH	79,81,83,104
3	G47	20	BR/YL*	(J CAR ONLY) TAIL LAMP OUTAGE	79,81,136
4	G9	20	GY/BK*	BRAKE LEVEL AND BRAKE SWITCH SENSOR	79
5	G5	20	DB/WT*	IGNITION RUN/START	81,88
6	G5	20	DB/WT*	IGNITION RUN/START	81,88
7	L60	18	TN	RIGHT FRONT TURN SIGNAL	58,79,81
8	E1	20	BR	CLUSTER LAMP FEED	79,81
9	L93	20	RD/YL*	HEADLAMP SWITCH SWITCH TO DIMMER	53,79,81
10	E92	20	OR/BK*	ILLUMINATION MODULE (DIMMER)	51,55,79,81
11	G60	20	GY/YL*	ENGINE OIL PRESSURE GAUGE SENDING UNIT	40,81
12	—	—	—	—	—
13	—	—	—	—	—
14	—	—	—	—	—
15	G46	20	LB/BK*	(J CAR ONLY) LAMP OUTAGE DISPLAY	79,81,136
16	G45	20	OR/LG*	(J CAR ONLY) LAMP OUTAGE LOW BEAM	79,81,136
17	G11	20	BK/WT*	PARK BRAKE SWITCH	79,81
18	G5	20	DB/WT*	IGNITION RUN/START	81,88
19	G29	20	BK/TN*	LOW WASHER FLUID SENSOR	67,79,81,88
20	L94	20	OR/WT*	HEADLAMP SWITCH TO RELAY-LOW BEAM	53,79,81
21	L94	20	OR/WT*	HEADLAMP SWITCH TO RELAY-LOW BEAM	53,79,81
22	E2	20	OR	I/P FUSED ILLUMINATION-DIMMABLE	52,79,81
23	G6	20	GY	(J CAR ONLY) LOW OIL PRESSURE LAMP	40,41,77,79,81
24	G20	20	VT/YL*	ENGINE OIL PRESSURE GAUGE SENDING UNIT	40,41,81
25	—	—	—	—	—

AG-AJ 165

BODY COMPUTER

938W-5

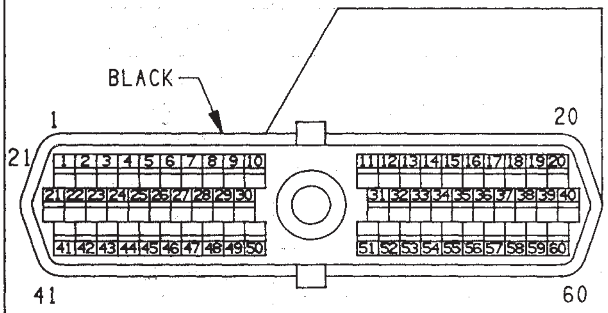


CONNECTOR VIEWED FROM WIRE END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	G75	20	TN	LEFT FRONT DOOR AJAR	80,82,83, 101,103
2	G26	20	LB	KEY IN BUZZER	80,82,121, 123,125
3	E17	20	YL/BK*	ELECTRONIC DISPLAY CONTROL	51,80,82
4	P31	16	OR/BK*	POWER DOOR LOCK MOTOR (B+) LOCK	80,82,116
5	V10	18	BR	WINDSHIELD WIPE/WASH SYSTEM	66,80,82
6	G5	20	DB/WT*	IGNITION RUN START	80,82,88,127
7	D1	20	VT/BR*	SERIAL BUSS B+	77,80,82, 117,119
8	M1	20	PK	DOME AND COURTESY LAMP SYSTEM	77,80,82,101,103, 117,119,121,123,125
9	G41	20	LB/RD*	LOW FUEL OUTPUT	76,80
10	V5	18	DG	WINDSHIELD WIPER SYSTEM	67,80,82
11	F13	18	DB	FRONT WIPER PARK/RUN	67,80,82
12	V7	18	DG/WT*	PULSE, WIPE, PARK B-DWELL	66,80,82
13	M32	18	YL/RD *	LEFT FRONT DOOR SYSTEM GROUND	80,82,121, 123,125
14	G10	20	LG/RD *	SEAT BELT SWITCH	80,82,101,103
15	L61	18	LG	LEFT FRONT TURN SIGNAL	80,82
16	M22	20	WT	ILLUMINATED ENTRY GROUND	80,82,109
17	V9	18	WT/BK*	ANALOG IN SWITCH TO B-CONTROL MODULE	66,80,82
18	G4	20	DB	FUEL GAUGE	76,80,82,107
19	Z2	20	BK/LG	GROUND	77,80,82
20	D2	20	WT/BK*	SERIAL BUSS B—	77,80,82, 117,119
21	P38	20	OR/WT*	AUTO DOOR LOCK	80,82, 116,127
22	M50	20	YL/RD*	IGNITION KEY LAMP FEED	80,82,121, 123,125
23	G13	20	DB/RD*	SEAT BELT LAMP	74
24	G12	20	DG/YL*	GENERATOR WARNING LAMP	40,75,80
25	M2	20	YL	DOOR JAMB SWITCHES	82,117,119, 121,123,125

BODY COMPUTER

CAV	IGNITION SYSTEM CIRCUITS		SHEET
1	K1 20DG/RD*	MAP SENSOR	18
2	K2 20TN/BK*	ENGINE COOLANT TEMP SENSOR	21
3	A14 18RD/WT*	FUEL PUMP/AUTOMATIC SHUT DOWN	20
4	K4 20BK/LB*	SIGNAL REFERENCE (LOGIC)	21
5	Z11 16BK/WT*	SIGNAL GROUND	9,21
6	K6 20VT/WT*	5V OUTPUT MAP AND TPS	18
7	K7 20OR	8V SUPPLY	22
8	F20 18WT	BACK-UP LAMP SWITCH FEED	19
9	A21 14DB	IGNITION START/RUN	20
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	9,21
12	Z12 16BK/TN*	POWER GROUND	9,21
13	—	—	—
14	—	—	—
15	—	—	—
16	K11 20WT/DB*	INJECTOR	22
17	—	—	—
18	—	—	—
19	K19 20BK/GY*	IGNITION COIL DRIVER #1	19
20	K20 20DG	VOLTAGE REGULATOR	9,19
21	—	—	—
22	K22 20OR/DB*	THROTTLE POSITION (SENSOR)	17
23	V37 20RD/LG*	SPEED CONTROL MODE SELECT	59
24	K24 20GY/BK*	DISTRIBUTOR PICK-UP	22
25	D21 20PK	PCM DATA LINK	19
26	D1 20VT/BR*	SERIAL BUSS B+	17
27	C20 18BR	A/C DAMPED PRESSURE SWITCH	17
28	—	—	—
29	K29 20WT/PK*	BRAKE SENSE SIGNAL	59
30	T24 20BR/LB*	ENGINE STARTER RELAY GROUND	18
31	C27 20DB/PK*	FAN CONTROL RELAY	17
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	19
33	V36 20TN/RD*	VEHICLE SPEED CONTROL	59
34	C13 20DB/OR*	A/C COMPRESSION CLUTCH RELAY	17
35	K35 20GY/YL*	EGR DIAGNOSTIC SOLENOID	18
36	—	—	—
37	—	—	—
38	—	—	—
39	K39 20GY/RD*	IDLE AIR CONTROL (#3)	17
40	K40 20BR/WT*	IDLE AIR CONTROL (#1)	17
41	K41 20BK/DG*	HEATED OXYGEN SENSOR	17
42	—	—	—
43	G21 20GY/LB*	TACHOMETER SIGNAL	22
44	—	—	—
45	D20 20LG	PCM (RECEIVE)	19
46	D2 20WT/BK*	SERIAL BUSS B—	17
47	G7 20WT/OR*	VEHICLE SPEED SENSOR	21
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN	20
52	K52 20PK/BK*	EVAP/PURGE SOLENOID	18
53	V35 20LG/RD*	VEHICLE SPEED CONTROL VENT	59
54	K54 20LG/WT*	EMCC	20
55	—	—	—
56	—	—	—
57	A142 16DG/OR*	INJ/SENSE/ALT FEED	9
58	—	—	—
59	K59 20VT/BK*	IDLE AIR CONTROL (#4)	17
60	K60 20YL/BK*	IDLE AIR CONTROL (#2)	17



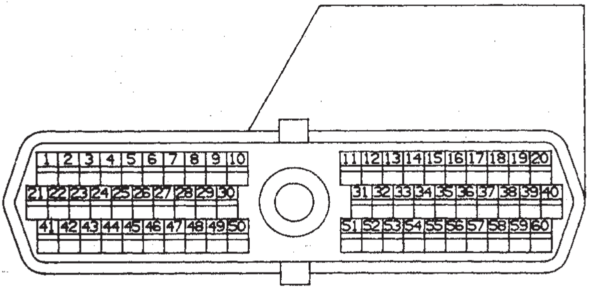
VIEWED FROM TERMINAL
END OF CONNECTOR

AG-AJ 167

POWERTRAIN CONTROL MODULE CONNECTOR (2.5L ENGINE)

938W-5

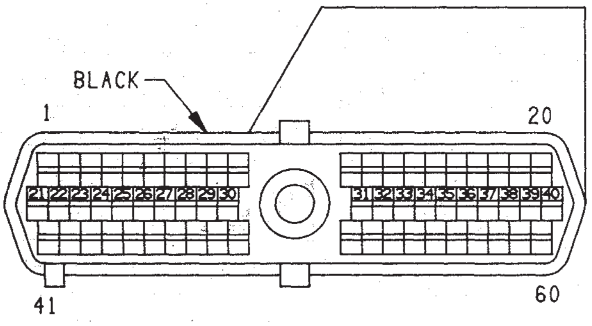
CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	K1 20DG/RD*	MAP SENSOR SIGNAL	30
2	K2 20TN/BK*	ECT SENSOR SIGNAL	34
3	A14 18RD/WT*	DIRECT BATTERY FEED	33
4	K4 20BK/LB*	SIGNAL GROUND	30
5	Z11 16BK/WT*	SIGNAL GROUND	9,34
6	K6 20VT/WT*	MAP SENSOR SIGNAL	30
7	K7 20OR	8 VOLT OUTPUT	30
8	—	—	—
9	A21 14DB	IGNITION START/RUN	33
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	9,33
12	Z12 16BK/TN*	POWER GROUND	9,33
13	K14 20LB/BR*	INJECTOR	31
14	K13 20YL/WT*	INJECTOR	31
15	K12 20TN	INJECTOR	31
16	K11 20WT/DB*	INJECTOR	31
17	K17 20DB/YL*	IGNITION COIL	34
18	—	—	—
19	K19 20BK/GY*	IGNITION COIL	33
20	K20 20DG	GENERATOR	9,32
21	K21 20BK/RD*	CHARGE AIR TEMPERATURE SENSOR	32
22	K22 20OR/DB*	THROTTLE POSITION (SENSOR)	34
23	V37 20RD/LG*	SPD CNTRL MODE SELECT SWITCH	31,59
24	K24 20GY/BK*	CRANKSHAFT POSITION SENSOR	33
25	D21 20PK	DATA LINK (TRANSMIT)	34
26	D1 20VT/BR*	CCD BUSS(+)	31
27	C20 18BR	A/C COMPRESSOR CLUTCH INPUT	31,35
28	—	—	—
29	K29 20WT/PK*	BRAKE SWITCH SIGNAL	31,59
30	T24 20BR/LB*	BACK-UP LAMP SWITCH	35
31	C27 20DB/PK*	FAN CONTROL RELAY	31,35
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	35
33	V36 20TN/RD*	VEHICLE SPEED CONTROL (VACUUM)	31,59
34	C13 20DB/OR*	A/C COMPRESSOR CLUTCH RELAY SIGNAL	31
35	—	—	—
36	K36 20LG/BK	TC WASTE GATE SOLENOID	30
37	—	—	—
38	—	—	—
39	K39 20GY/RD*	IDLE AIR CONTROL MOTOR(AIS-4)	34
40	K40 20BR/WT*	IDLE AIR CONTROL MOTOR(AIS-2)	34
41	K41 20BK/DG*	HEATED OXYGEN SENSOR SIGNAL	31
42	K42 20BK/LG*	KNOCK SENSOR	33
43	G21 20GY/LB*	TACHOMETER SIGNAL	35
44	K44 20TN/YL*	CRANKSHAFT POSITION SENSOR	30
45	D20 20LG	DATA LINK (RECEIVE)	34
46	D2 20WT/BK*	CCD BUSS —	31
47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	35
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN SIGNAL	34
52	K52 20PK/BK*	EVAP/PURGE SOLENOID SIGNAL	30
53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	31,59
54	—	—	—
55	K55 20LB	BAROMETRIC READ SOLENOID	30
56	—	—	—
57	A142 16DG/OR*	GENERATOR FEED	9,32
58	—	—	—
59	K59 20VT/BK*	IDLE AIR CONTROL MOTOR(AIS-1)	34
60	K60 20YL/BK*	IDLE AIR CONTROL MOTOR(AIS-3)	34



CONNECTOR
VIEWED FROM TERMINAL
END OF CONNECTOR

POWERTRAIN CONTROL MODULE CONNECTOR (TURBO III)

CAV	IGNITION SYSTEM CIRCUITS		SHEET
1	K1 20DG/RD ✱	MAP SENSOR	29
2	K2 20TN/BK ✱	ENGINE COOLANT TEMP SENSOR	26
3	A14 18RD/WT✱	FUEL PUMP/AUTOMATIC SHUTDOWN	27
4	K4 20BK/LB ✱	SIGNAL REFERENCE (LOGIC)	29
5	Z11 16BK/WT✱	SIGNAL GROUND	25
6	K6 20VT/WT ✱	5V OUTPUT MAP AND TPP	29
7	K7 20OR	8V SUPPLY	26
8	—	—	—
9	A21 14DB	IGNITION START/RUN	25
10	—	—	—
11	Z12 16BK/TN✱	POWER GROUND	25
12	Z12 16BK/TN✱	POWER GROUND	25
13	K14 20LB/BR✱	FUEL INJECTOR #4	26
14	K13 20YL/WT✱	FUEL INJECTOR #3	26
15	K12 20TN	FUEL INJECTOR #2	23
16	K11 20WT/DB✱	FUEL INJECTOR #1	23
17	—	—	—
18	—	—	—
19	K19 20BK/GY✱	IGNITION COIL DRIVER #1	23
20	K20 20DG	VOLTAGE REGULATOR	23
21	—	—	—
22	K22 20OR/DB✱	THROTTLE POSITION (SENSOR)	26
23	V37 20RD/LG✱	VEH SPD CONT MODE SELECT	29,59
24	K24 20GY/BK✱	DISTRIBUTOR PICK-UP	26
25	D21 20PK	PCM DATA LINK	25
26	D1 20VT/BR ✱	SERIAL BUSS B+	26
27	C20 18BR	A/C DAMPED PRESSURE SWITCH	27
28	K10 18DB/OR✱	POWER STEERING PRESS	27
29	K29 20WT/PK✱	BRAKE SENSE SIGNAL	29,59
30	T24 20BR/LB✱	ENG STARTER RELAY GROUND	23
31	C27 20DB/PK✱	FAN CONTROL RELAY	27
32	G3 20BK/PK ✱	MALFUNCTION INDICATOR LAMP	24
33	V36 20TN/RD✱	VEHICLE SPEED CONTROL	59
34	C13 20DB/OR✱	A/C COMP. CLUTCH RELAY	27
35	K35 20GY/YL✱	EGR DIAGNOSTIC SOLENOID	26
36	—	—	—
37	—	—	—
38	K38 20GY	FUEL INJECTOR #5	26
39	K39 20GY/RD✱	IDLE AIR CONTROL (#3)	23
40	K40 20BR/WT✱	IDLE AIR CONTROL (#1)	23
41	K41 20BK/DG✱	HEATED OXYGEN SENSOR	26
42	—	—	—
43	G21 20GY/LB✱	TACHOMETER SIGNAL	24
44	K44 20TN/YL ✱	DISTRIBUTOR SYNC PICUP	26
45	D20 20LG	PCM (RECEIVE)	25
46	D2 20WT/BK ✱	SERIAL BUSS B−	29
47	G7 20WT/OR ✱	VEHICLE SPEED SENSOR	24
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL✱	AUTOMATIC SHUT DOWN	25
52	K52 20PK/BK✱	EVAP/PURGE SOLENOID	29
53	V35 20LG/RD✱	VEHICLE SPEED CONTROL VENT	59
54	—	—	—
55	—	—	—
56	—	—	—
57	A142 16DG/OR✱	INJ/SENSE/ALT FEED	27
58	K58 20BR/DB ✱	FUEL INJECTOR #6	26
59	K59 20VT/BK✱	IDLE AIR CONTROL (#4)	23
60	K60 20YL/BK✱	IDLE AIR CONTROL (#2)	23

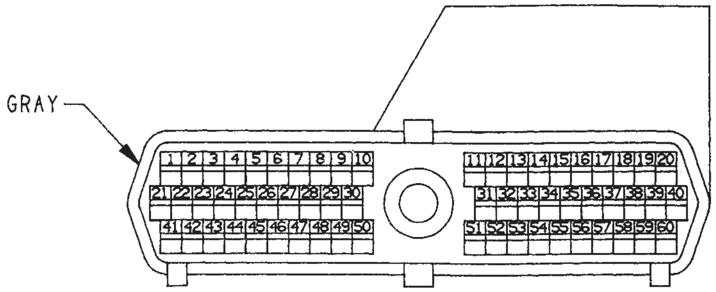


VIEWED FROM TERMINAL
END OF CONNECTOR

AG-AJ 169

POWERTRAIN CONTROL MODULE CONNECTOR (3.0L ENGINE)

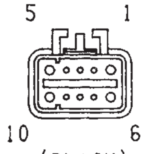
938W-5



VIEWED FROM TERMINAL
END OF CONNECTOR

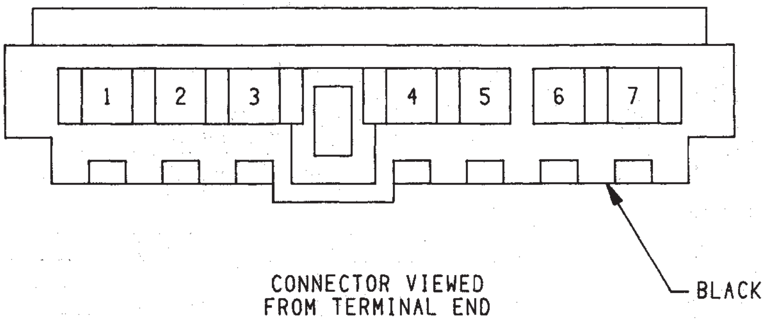
ABS CONT			
CAV	CIRCUIT INFO	MS CIRCUIT FUNCTION	SHEET
1	B1 18YL/DB*	(ABS) RT REAR WHEEL SENSOR (−)	71
2	B2 18YL	(ABS) RT REAR WHEEL SENSOR (+)	71
3	B3 18LG/DB*	(ABS) LT REAR WHEEL SENSOR (−)	71
4	B4 18LG	(ABS) LT REAR WHEEL SENSOR (+)	71
5	Z1 18BK	BODY GROUND	69
6	B6 18WT/DB*	(ABS) RT FRONT WHEEL SENSOR (−)	71
7	B7 18WT	(ABS) RT FRONT WHEEL SENSOR (+)	71
8	B8 18RD/DB*	(ABS) LT FRONT WHEEL SENSOR (−)	71
9	B9 18RD	(ABS) LT FRONT WHEEL SENSOR (+)	71
11	D11 20WT/VT*	DIAGNOSTIC A.B.S. (SIGNAL DATA IN)	70
12	D12 20OR	DIAGNOSTIC A.B.S. (SIGNAL DATA OUT)	70
13	L50 18WT/TN*	STOP LAMP SWITCH	70
15	G19 20LG/OR*	A.B.S. WARNING LAMP (AMBER)	69
16	B116 18GY	(ABS) PUMP RELAY COIL (B−) 'LCI'	68
20	B120 14BR/WT*	(ABS) PUMP MOTOR FEED/MONITOR 'LCI'	68
41	B47 14RD/LB*	(ABS) SOLENOID FEED	69
42	B142 18BR/YL*	(ABS) LT FRONT BUILD/DECAY 'LCI'	68
43	B143 18DG/YL*	(ABS) RT FRONT BUILD/DECAY 'LCI'	68
45	B145 18WT/DG*	(ABS) LT FRONT RT REAR 'LCI'	68
46	B146 18BR/LB*	(ABS) LT REAR BUILD/DECAY 'LCI'	68
47	B47 14RD/LB*	(ABS) SOLENOID FEED	69
48	B148 18DG/LB*	(ABS) RT REAR BUILD/DECAY 'LCI'	68
49	B149 16WT/LG*	(ABS) RT FRONT AND LEFT REAR ISOLATION 'LCI'	68
57	B57 18BR/BK*	(ABS) SYSTEM RELAY COIL (+)	69
60	F12 18DB/WT*	FUSED IGNITION RUN/START	70

ABS HYDRAULICS UNIT



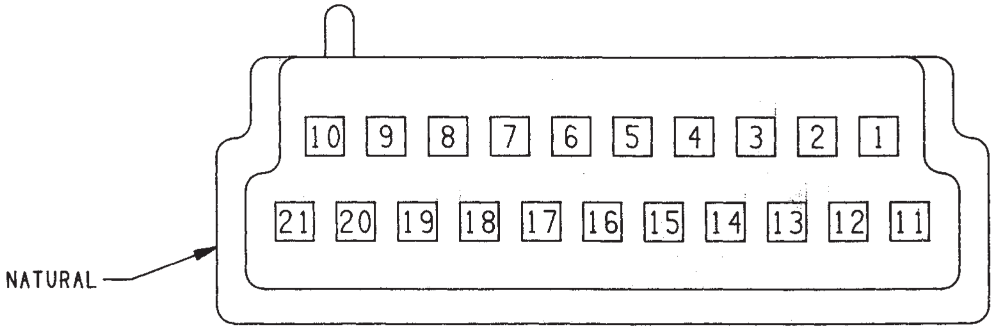
(BLACK)

ABS HYD			
CAV	CIRCUIT INFO		SHEET
1	Z1 12BK	ABS GROUND	68
2	B148 18DG/LB*	(ABS) RIGHT REAR BUILD/DECAY/	68
3	B145 18WT/DG*	(ABS) LEFT FRONT/RIGHT REAR ISO	68
4	B146 18BR/LB*	(ABS) LEFT REAR BUILD/DECAY/	68
5	Z1 12BK	ABS GROUND	68
6	B120 12BR/WT*	(ABS) PUMP MONITOR/MOTOR FEED	68
7	B142 18BR/YL*	(ABS) LEFT FRONT BUILD/DECAY	68
8	B149 16WT/LG*	(ABS) RIGHT FRONT & LEFT REAR ISO	68
9	B143 18DG/YL*	(ABS) RIGHT FRONT BUILD/DECAY	68
10	Z1 12BK	ABS GROUND	68



CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	G5	20	DB/WT*	IGNITION (WITH TRIP ONLY)	86
2	Z2	20	BK/LG*	ELECTRONIC GROUND	86
3	E2	20	OR	DIMMABLE HEADLAMPS	86,94,95
4	—	—	—	—	—
5	M1	20	PK	DOME AND COURTESY LAMPS (WITH EVIC ONLY)	86
6	D1	20	VT/BR*	SERIAL BUSS B +	86
7	D2	20	WT/BK*	SERIAL BUSS B —	86

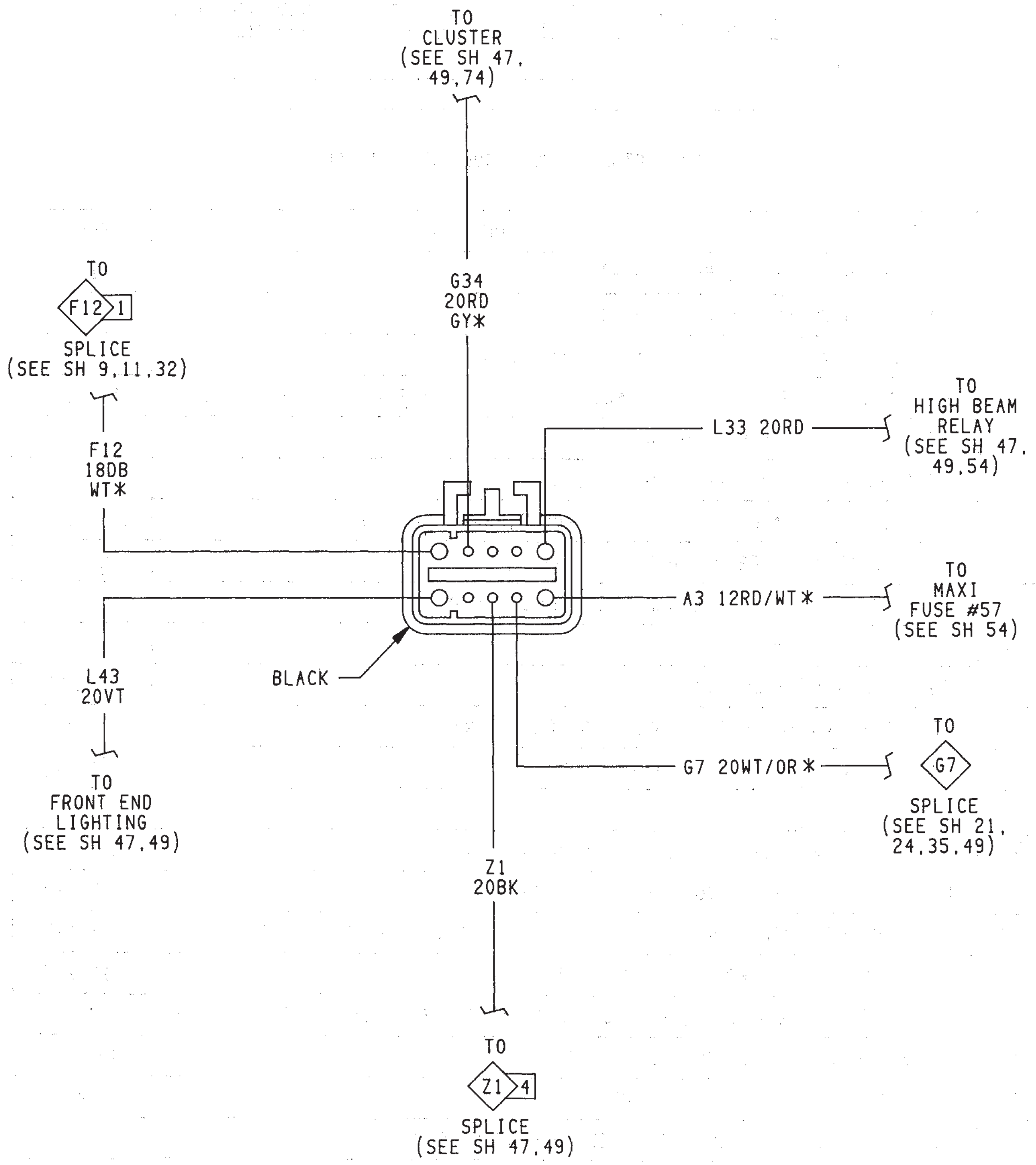
AG-AJ 171 TRIP COMPUTER CONNECTOR WITH EVIC 938W-5



CONNECTOR VIEWED FROM TERMINAL END

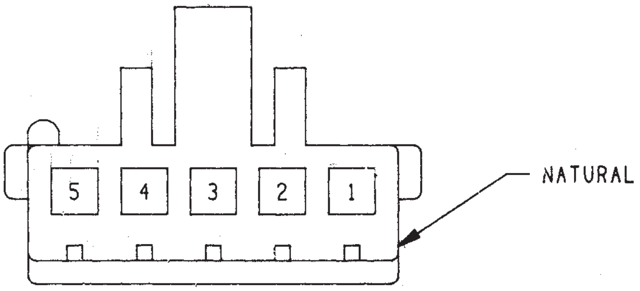
CAV	CIRCUIT	FUNCTION	SHEET
1	D2 20WT/BK*	SERIAL BUSS (B−)	127
2	D1 20VT/BR*	SERIAL BUSS (B+)	127
3	G5 20DB/WT*	TEMPERATURE SWITCH (FOR LAMP)	88,127
4	G72 20DG/OR*	SECURITY ALARM MODULE RT FRONT DOOR KEY CYCLE SWITCH	115,127
5	Z2 20BK/LG*	SENSOR GROUND	127
6	X3 20BK/RD*	HORN RELAY COIL SWITCH	65,127
7	L7 18BK/YL*	TAIL,LICENSE,SIDE MARKER,PARK LAMP FEED	127,132,136
8	G74 20TN/RD*	RT FRONT DOOR AJAR SWITCH	83,102, 104,127
9	F30 18RD	CONSOLE CIGARETTE LIGHTER FEED	88,127
10	—	—	—
11	Z2 20BK/LG*	SENSOR GROUND	86,127
12	G70 20BR/TN*	SECURITY ALARM HOOD OPEN SIGNAL	127
13	G75 20TN	LEFT FRONT DOOR AJAR LIGHT	83,102, 104,127
14	—	—	—
15	G69 20BK/OR*	SECURITY ALARM 'ARMED' WARNING LAMP	88,127
16	P34 16PK/BK*	POWER DOOR LOCK MOTOR B+ UNLOCK	115,127
17	P38 20OR/WT*	BODY COMPUTER TO AUTO DOOR LOCK RELAY COIL (B+)	115,127
18	G73 20LG/OR*	LT FRONT DOOR AJAR SWITCH	115,127
19	G71 20VT/YL*	SECURITY ALARM MODULE DECK LID KEY CYCLE SWITCH (J-CAR)	102,127
19	Z2 20BK/LG*	SENSOR GROUND (G-CAR)	86,127
20	F13 18DB	FRONT WIPER PARK	127
21	F33 18PK/RD*	FUSED BATTERY FEED TO PARK LAMP RELAY	127

SECURITY ALARM MODULE

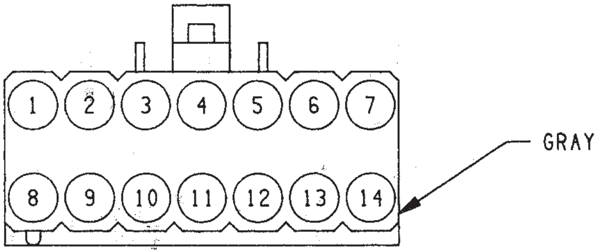


DAYTIME RUNNING LIGHTS
MODULE CONNECTOR

938W-5



CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	—	—	—	—	—
2	G45	20	OR/LG*	LOW BEAM OUT WARNING	79,81,136
3	Z2	20	BK/LG*	ELECTRONIC GROUND	86,136
4	G46	20	LB/BK*	STOP/TURN LAMPOUT WARNING	79,81,136
5	G47	20	BR/YL*	TAIL LAMPOUT WARNING	79,81,136



VIEWED FROM TERMINAL END

CAV	CIRCUIT	GAUGE	COLOR	FUNCTION	SHEET
1	—	—	—	—	—
2	L50	18	WT/TN*	STOP LAMP FEED	138
2	L50	18	WT/TN*	STOP LAMP FEED	138
3	L81	18	DG	LEFT OUTBOARD TURN/STOP	138
4	—	—	—	—	—
5	L48	20	VT/PK*	RIGHT LOW BEAM FUSE	78,138
6	L44	20	VT/RD*	FUSE TO RIGHT HEADLAMP	138
7	L47	20	VT/GY*	LEFT LOW BEAM FUSE	138
8	L50	18	WT/TN*	STOP LAMP FEED	138
9	L84	18	BR/WT*	RIGHT INBOARD TURN/STOP OUTAGE	138
10	—	—	—	—	—
11	L71	18	BK/PK*	LEFT TAIL LAMP OUTAGE	138
12	L7	18	BK/YL*	REAR LIGHTING FEED	138
13	L72	18	BK/RD*	RIGHT TAIL LAMP OUTAGE	138
14	L43	20	VT	FUSE TO LEFT HEADLAMP	138

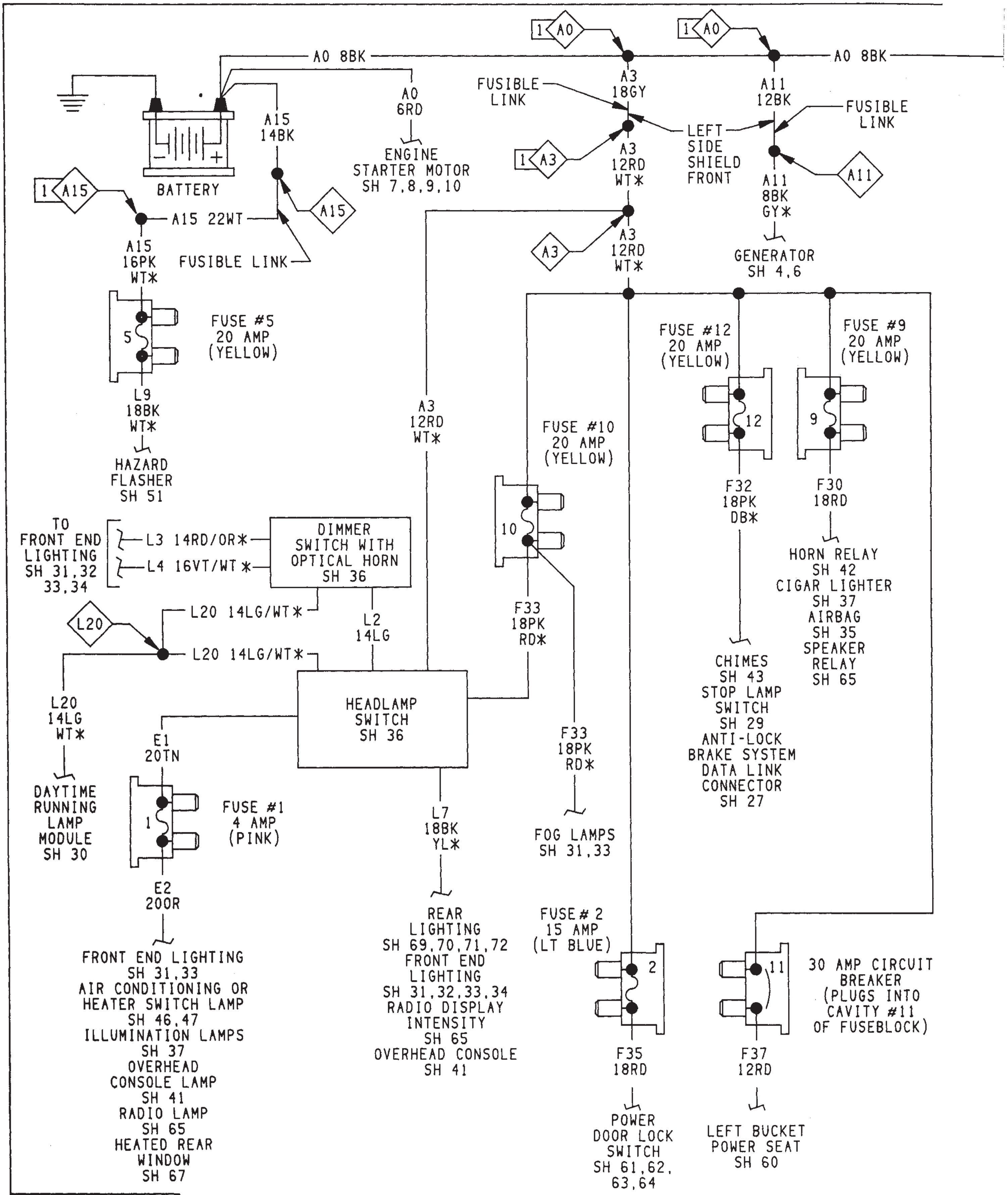
938W-5

LAMP OUTAGE MODULE CONNECTORS J BODY

AJ 174

WIRING DIAGRAMS AP BODY D-P

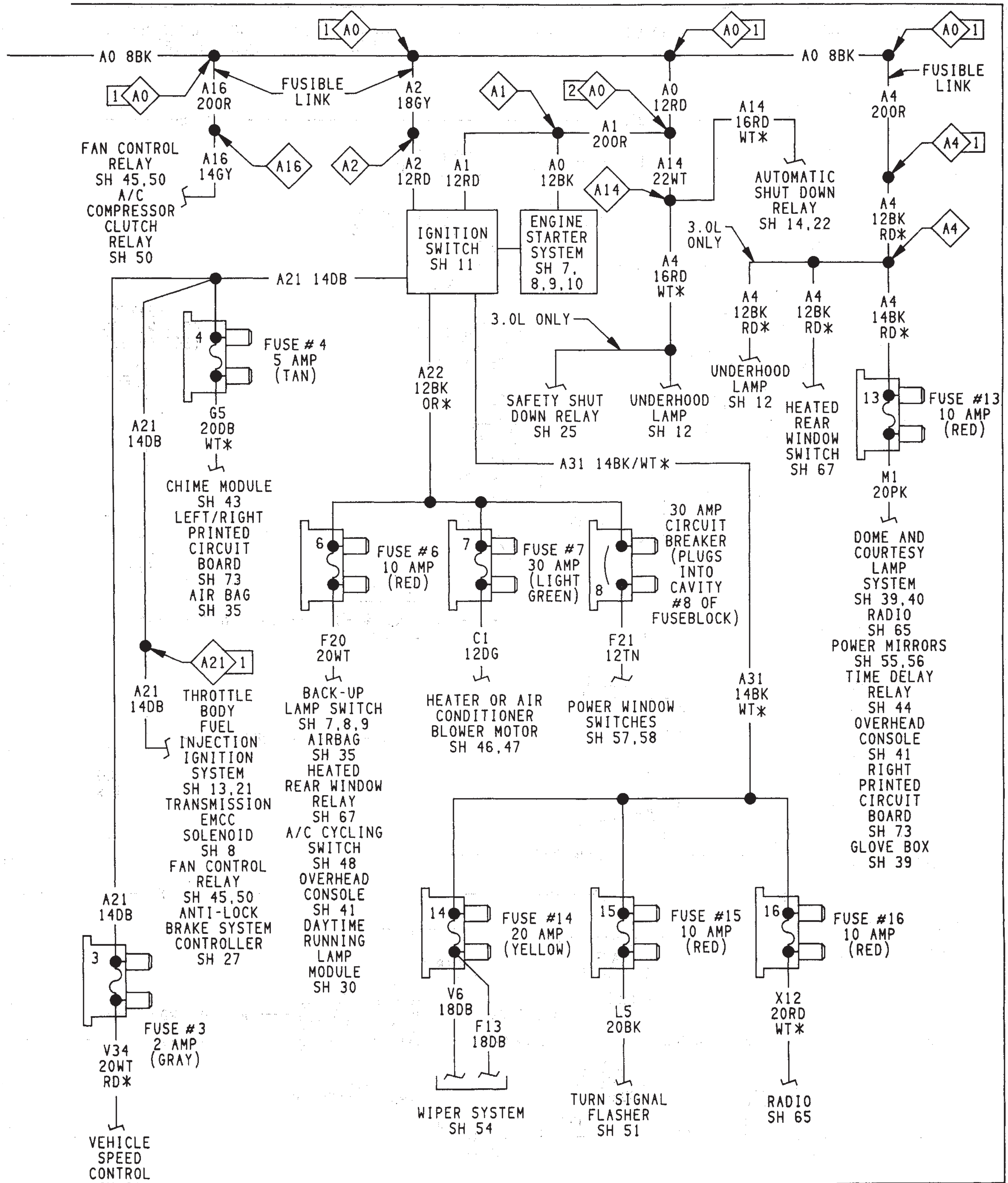
ALPHABETICAL INDEX



AP-PD 1

FUSE APPLICATION CHART

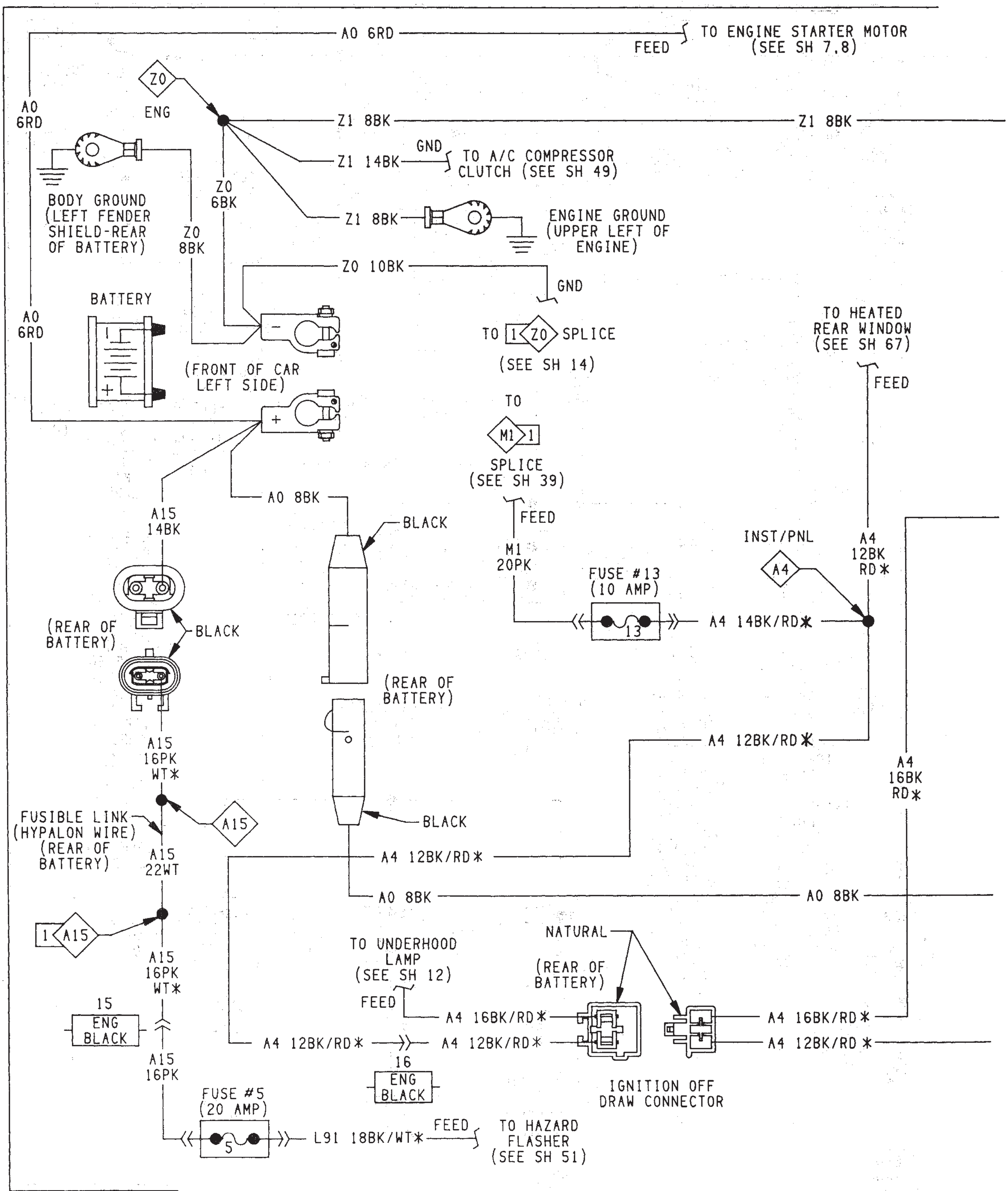
938W-6



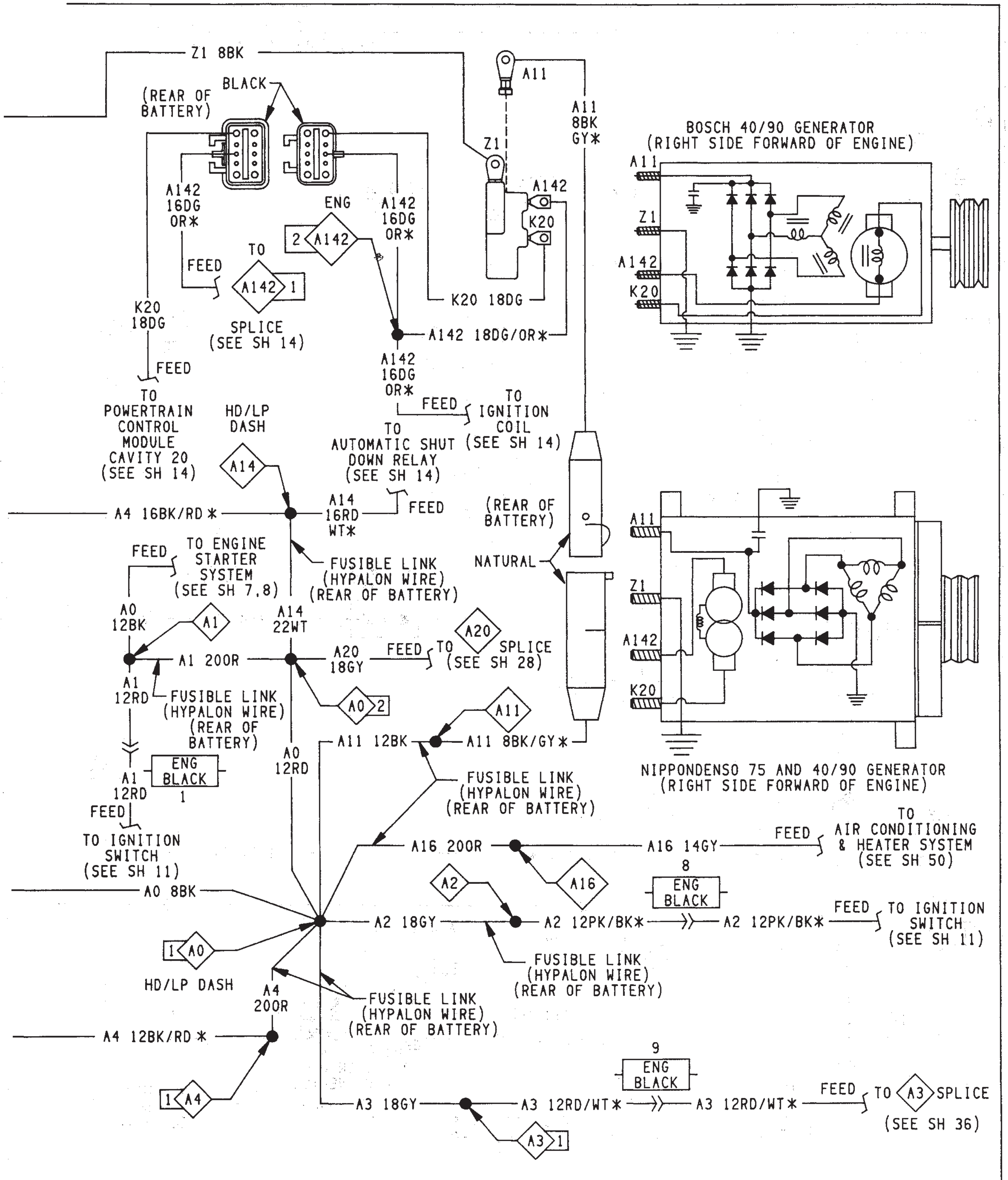
938W-6

FUSE APPLICATION CHART

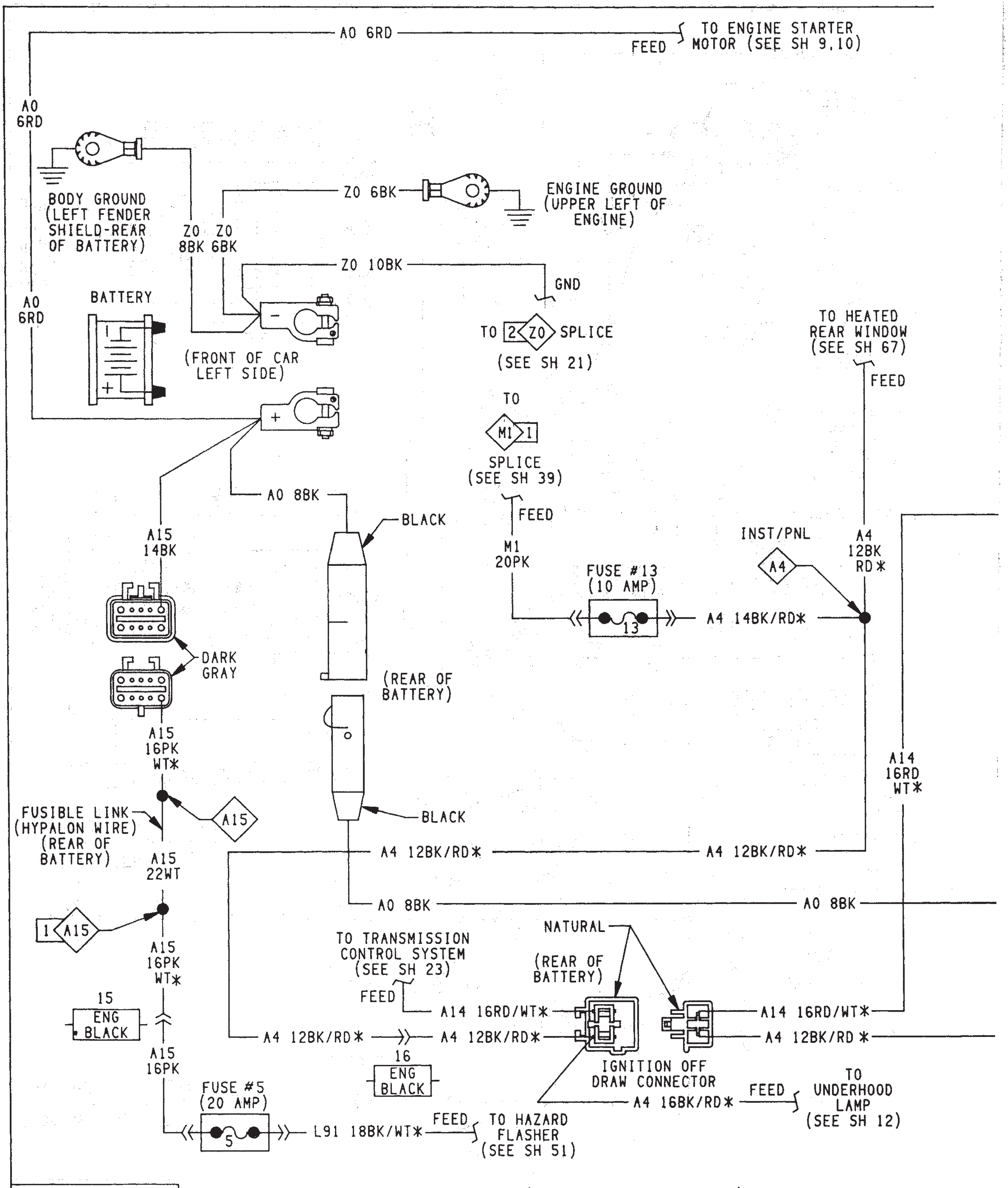
AP-PD 2



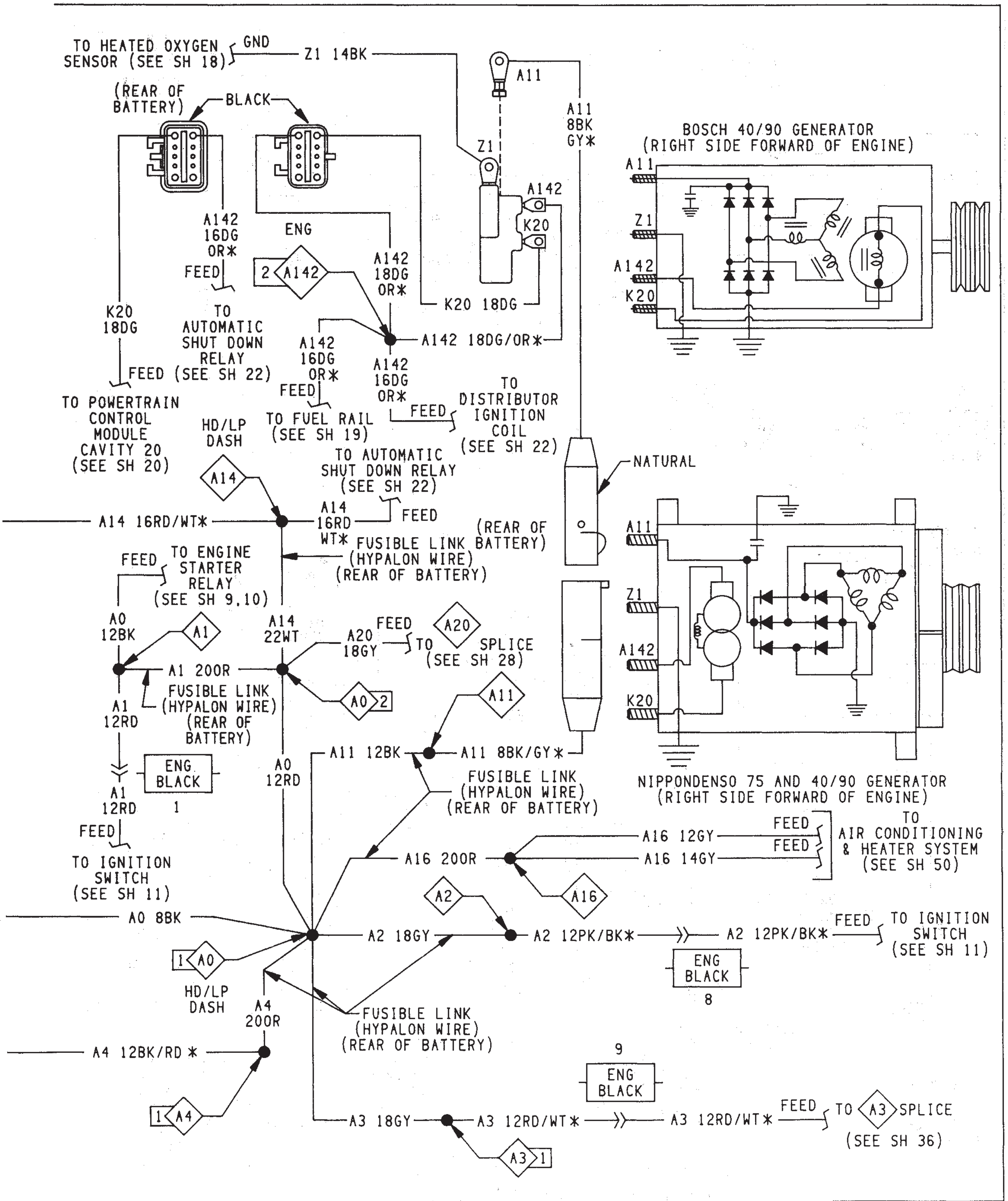
AP-PD 3 CHARGING SYSTEM (2.2L AND 2.5L ENGINE) 938W-6



938W-6 CHARGING SYSTEM (2.2L AND 2.5L ENGINE)



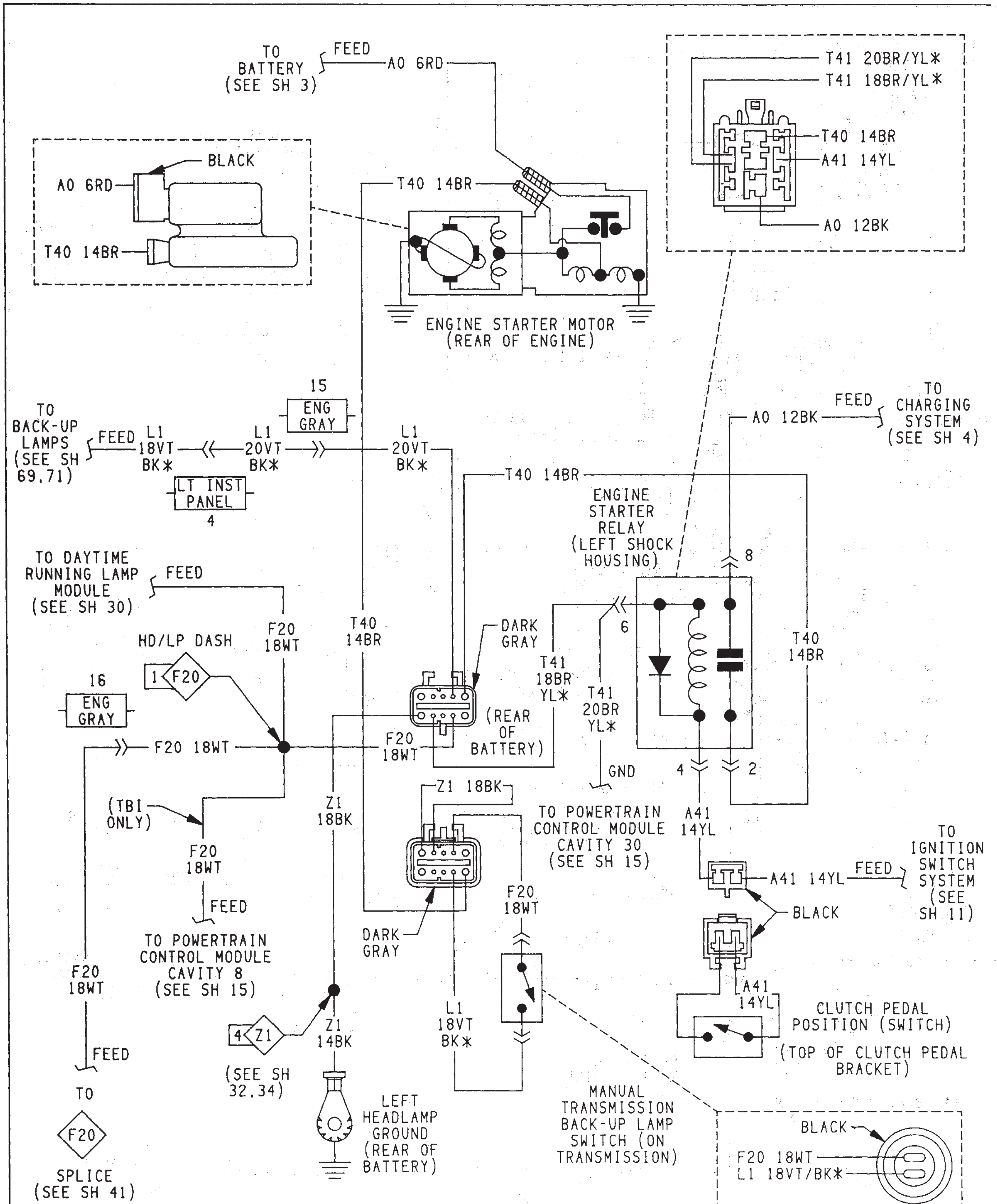
AP-PD 5 CHARGING SYSTEM (3.0L ENGINE) 938W-6



938W-6

CHARGING SYSTEM (3.0L ENGINE)

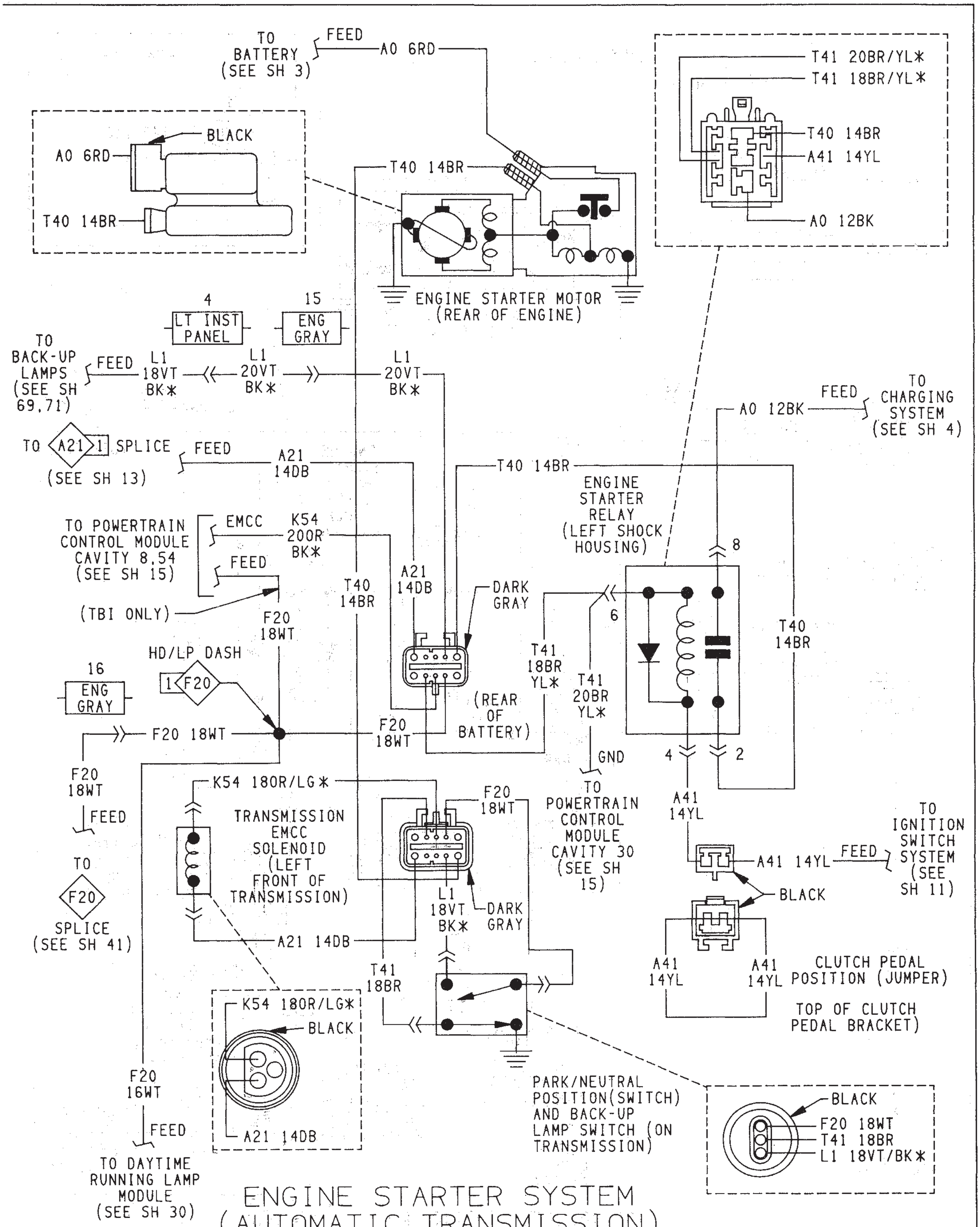
AP-PD 6



ENGINE STARTER SYSTEM
(MANUAL TRANSMISSION)
2.2L AND 2.5L ENGINE

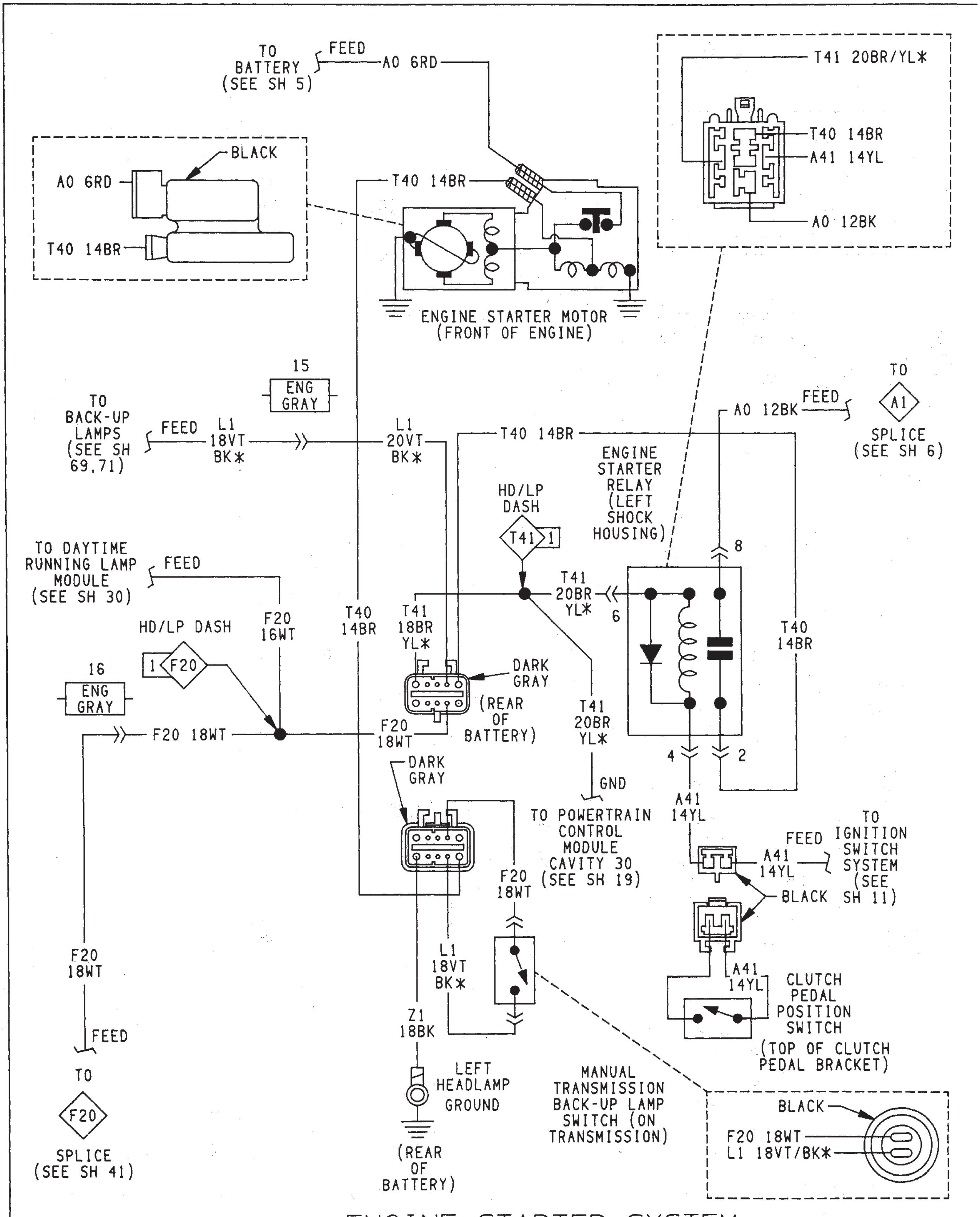
AP-PD 7

938W-6



ENGINE STARTER SYSTEM
(AUTOMATIC TRANSMISSION)
(2.2L AND 2.5L ENGINE)

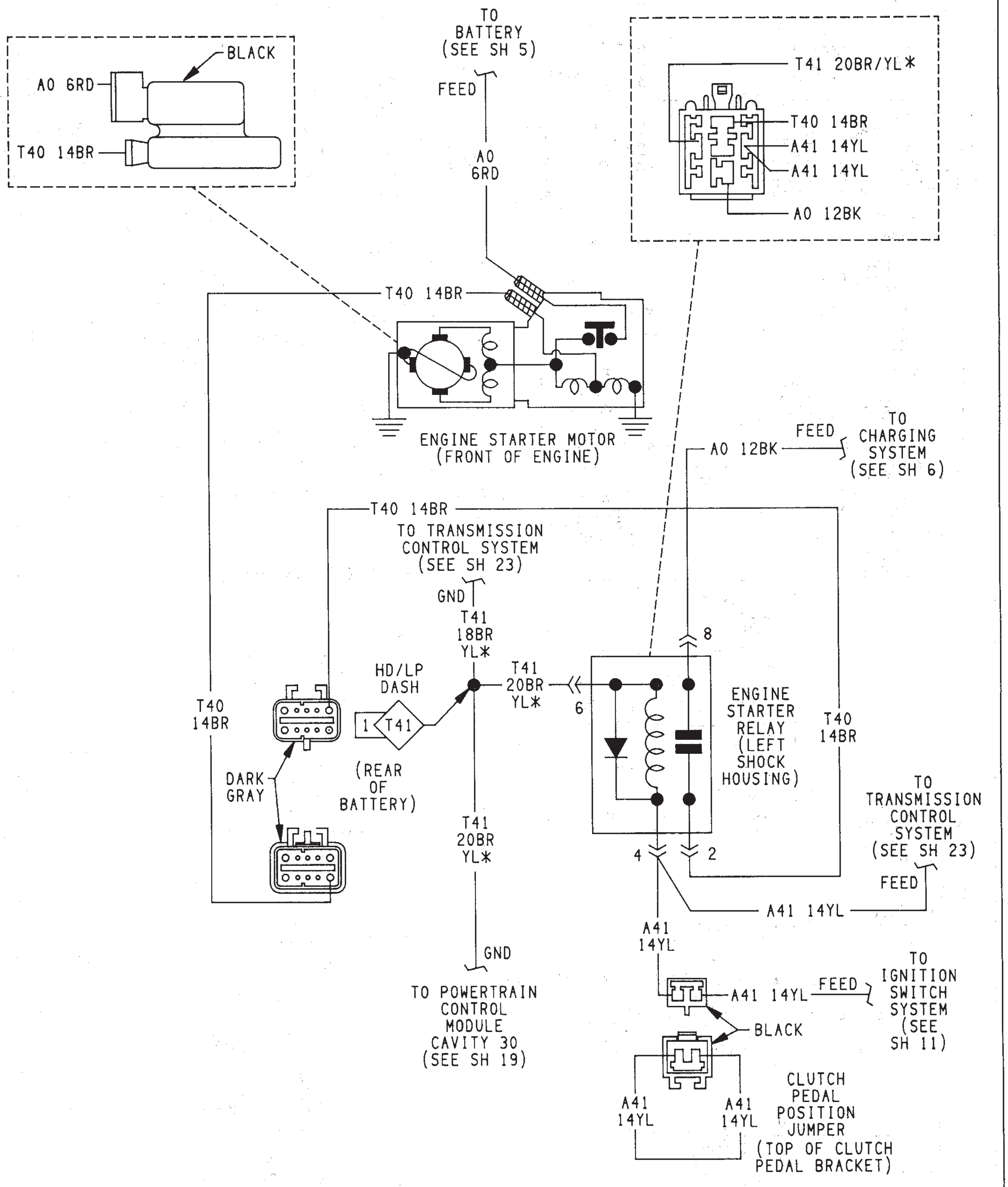
938W-6



ENGINE STARTER SYSTEM
(MANUAL TRANSMISSION) (3.0L ENGINE)

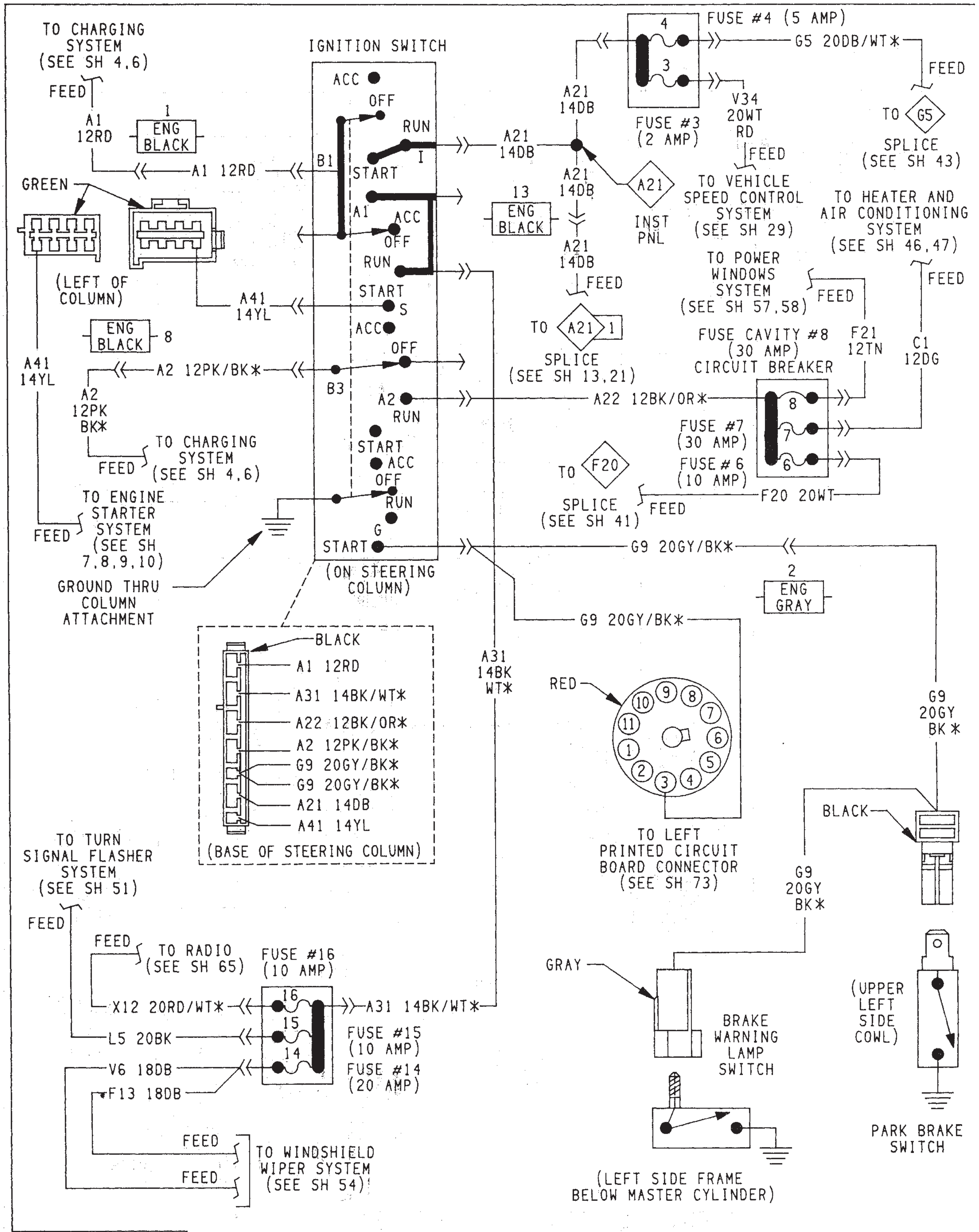
AP-PD 9

938W-6



ENGINE STARTER SYSTEM
938W-6 (AUTOMATIC TRANSMISSION) (3.0L ENGINE)

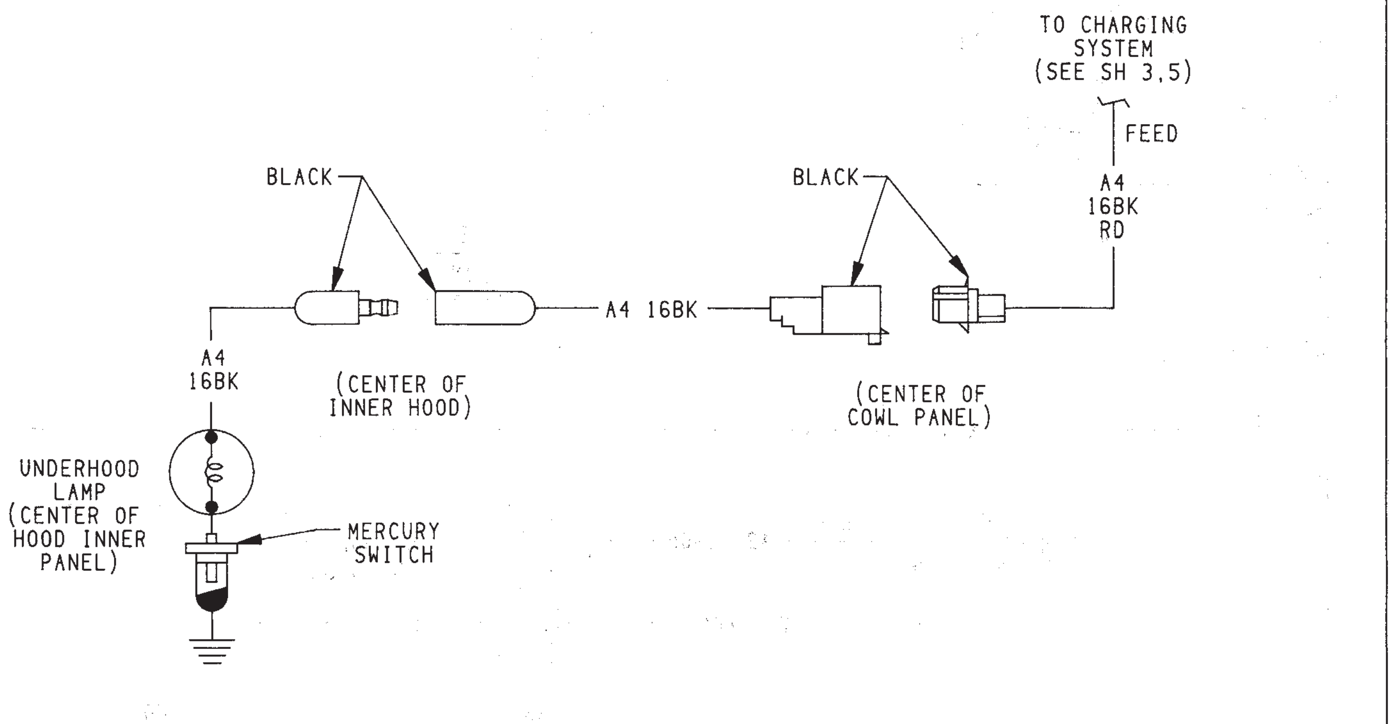
AP-PD 10



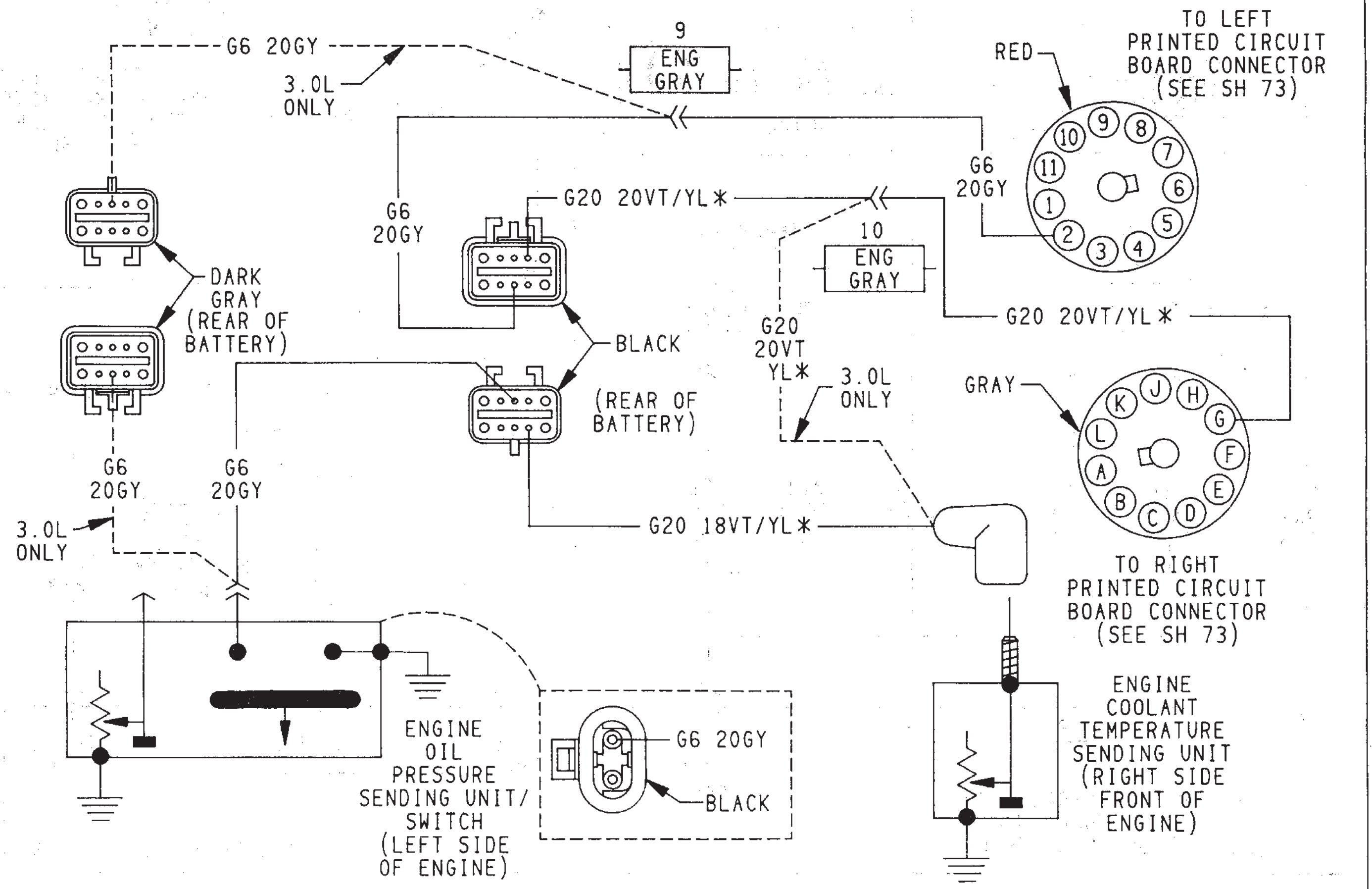
AP-PD 11

IGNITION SWITCH

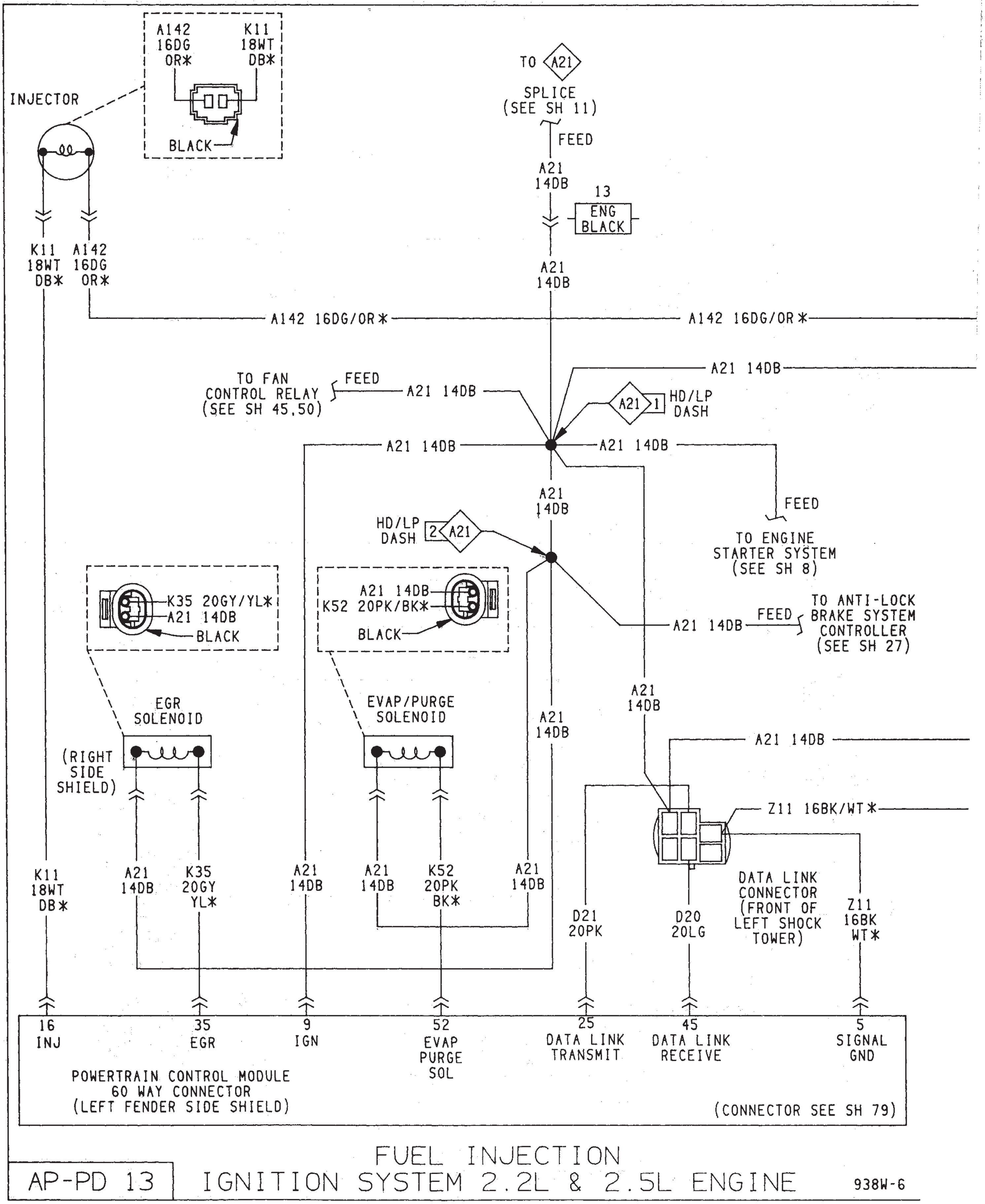
938W-6

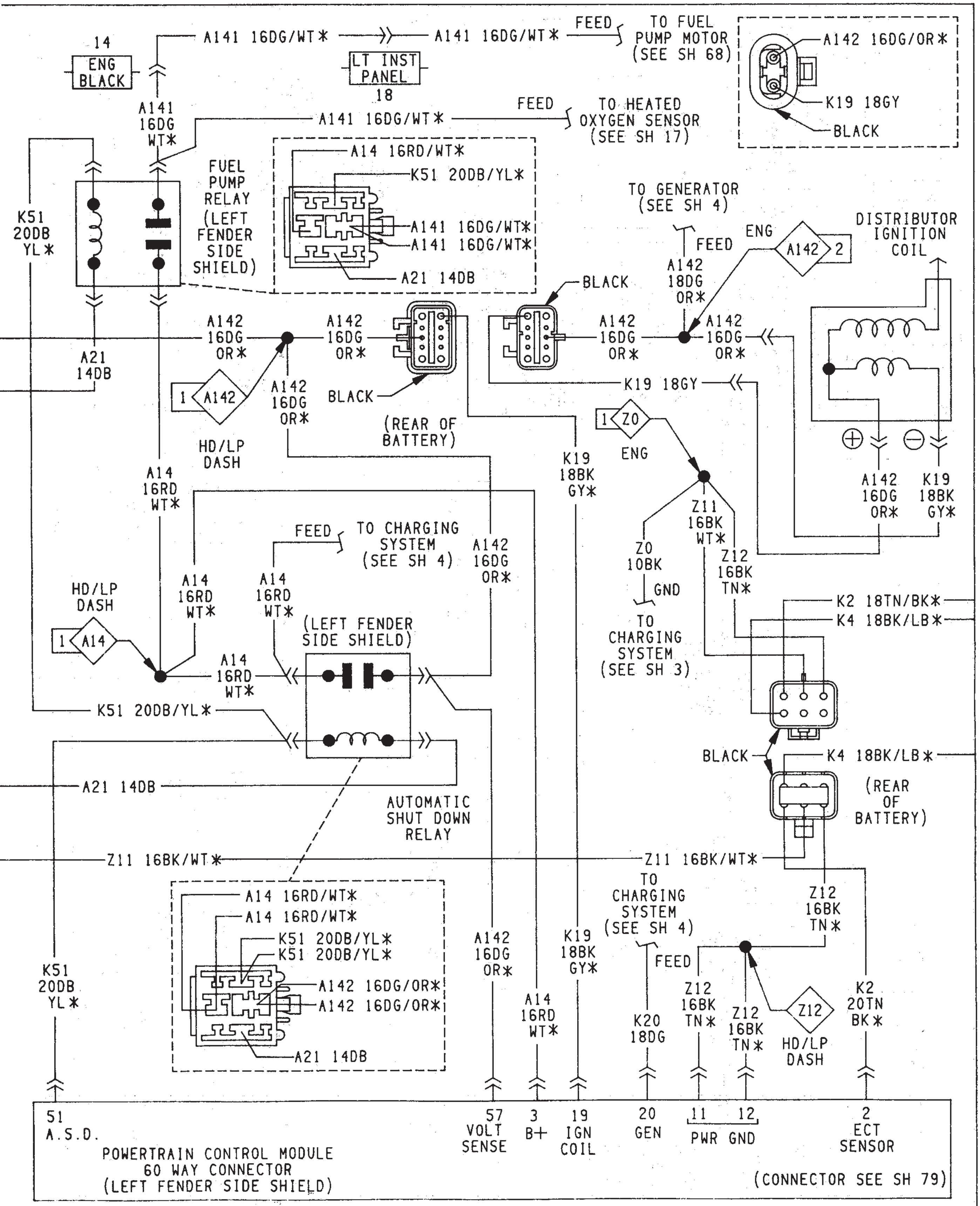


UNDERHOOD LAMP



ENGINE OIL PRESSURE AND TEMPERATURE SYSTEM

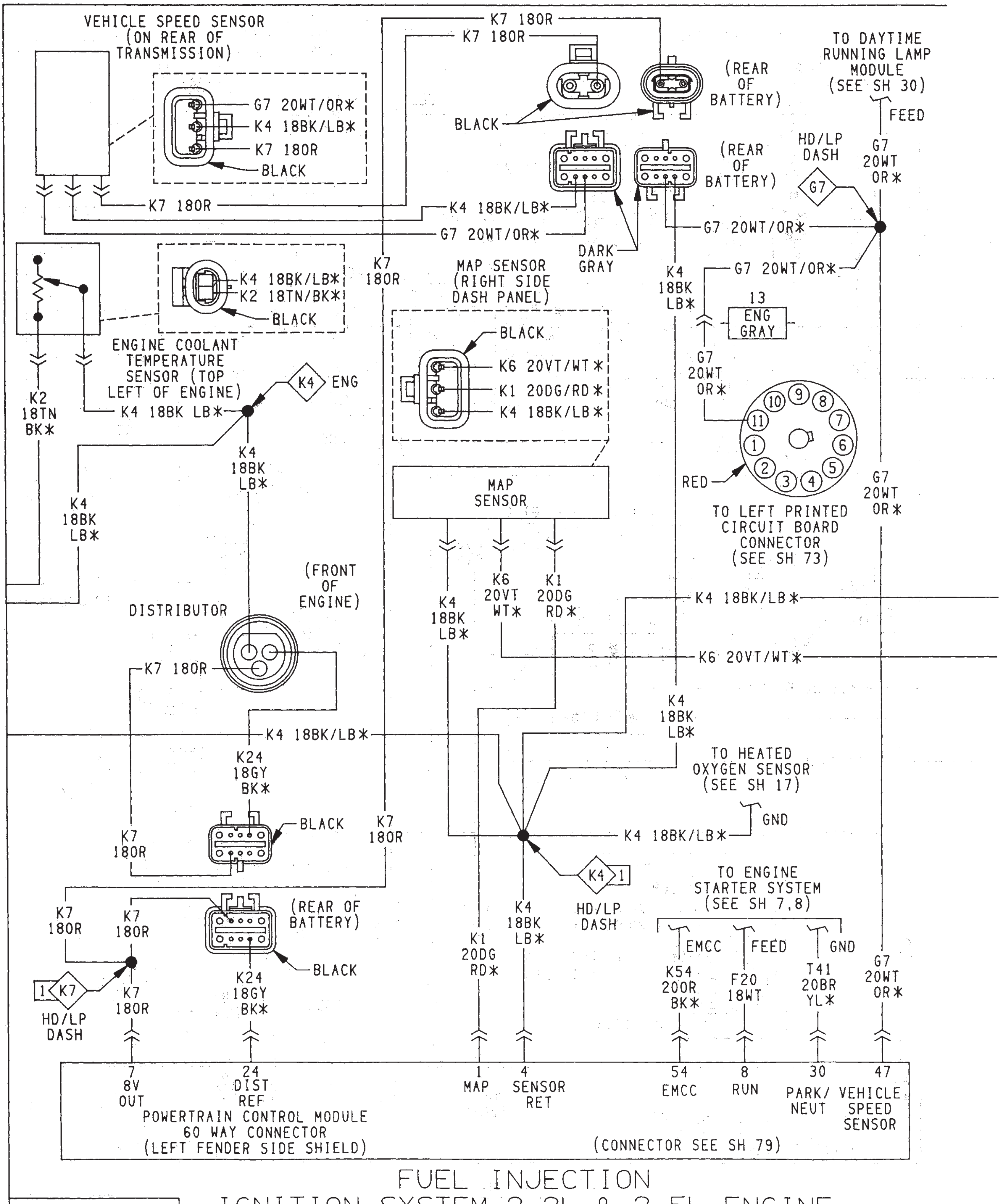

A142 16DG OR*
K11 18WT DB*
INJECTOR
BLACK
TO A21 SPLICE (SEE SH 11)
FEED
A21 14DB
13 ENG BLACK
A21 14DB
K11 18WT DB*
A142 16DG OR*
A142 16DG/OR*
A142 16DG/OR*
A21 14DB
TO FAN CONTROL RELAY (SEE SH 45,50)
FEED
A21 14DB
A21 1 HD/LP DASH
A21 14DB
A21 14DB
FEED
TO ENGINE STARTER SYSTEM (SEE SH 8)
A21 14DB
HD/LP DASH 2 A21
K35 20GY/YL*
A21 14DB
BLACK
A21 14DB
K52 20PK/BK*
BLACK
A21 14DB
FEED
TO ANTI-LOCK BRAKE SYSTEM CONTROLLER (SEE SH 27)
EGR SOLENOID
(RIGHT SIDE SHIELD)
EVAP/PURGE SOLENOID
A21 14DB
A21 14DB
A21 14DB
Z11 16BK/WT*
K11 18WT DB*
A21 14DB
K35 20GY YL*
A21 14DB
A21 14DB
K52 20PK BK*
A21 14DB
D21 20PK
D20 20LG
DATA LINK CONNECTOR (FRONT OF LEFT SHOCK TOWER)
Z11 16BK WT*
16 INJ
35 EGR
9 IGN
52 EVAP PURGE SOL
25 DATA LINK TRANSMIT
45 DATA LINK RECEIVE
5 SIGNAL GND
POWERTRAIN CONTROL MODULE 60 WAY CONNECTOR (LEFT FENDER SIDE SHIELD)
(CONNECTOR SEE SH 79)
FUEL INJECTION
AP-PD 13
IGNITION SYSTEM 2.2L & 2.5L ENGINE
938W-6



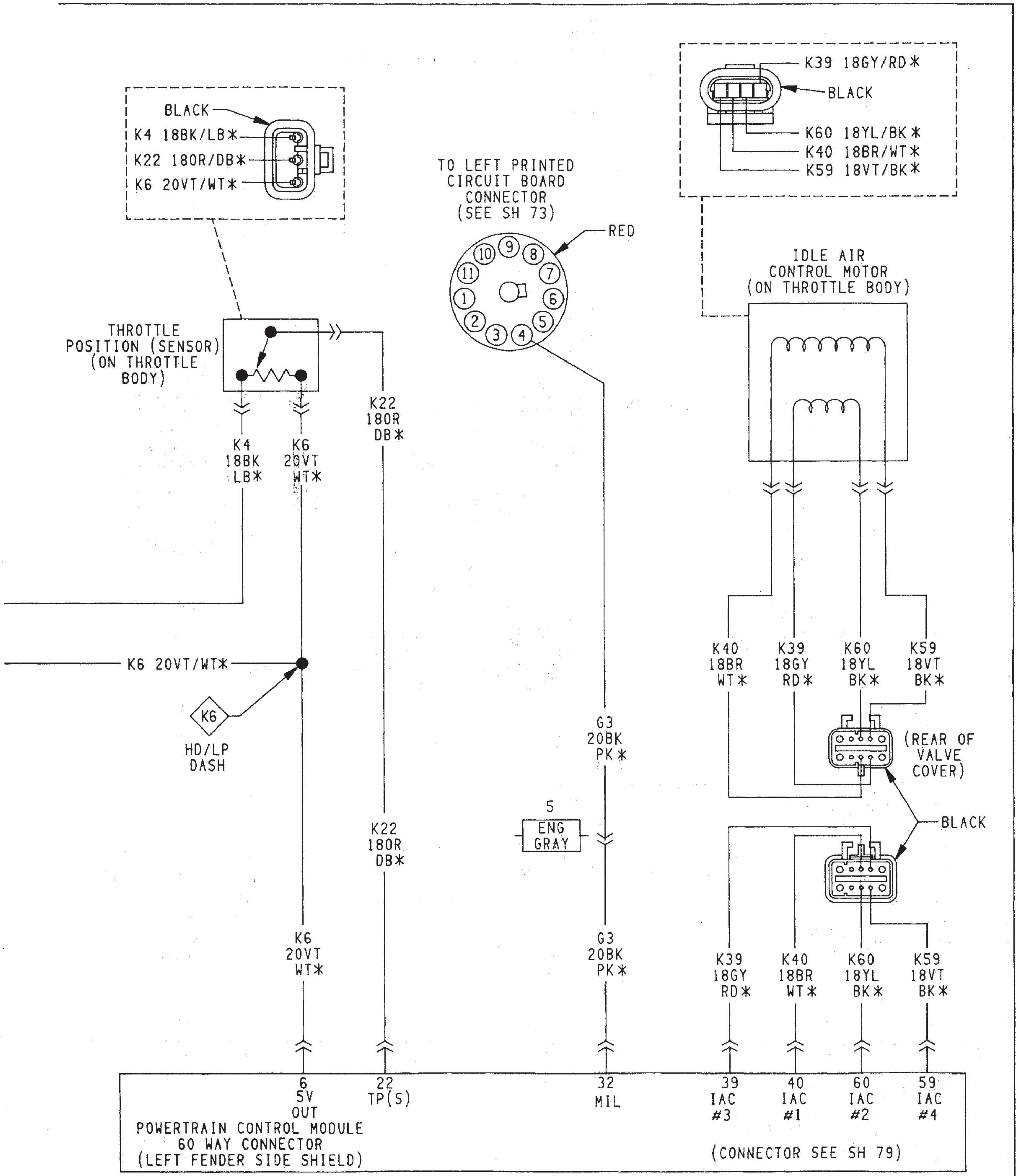
FUEL INJECTION

938W-6 IGNITION SYSTEM 2.2L & 2.5L ENGINE

AP-PD 14



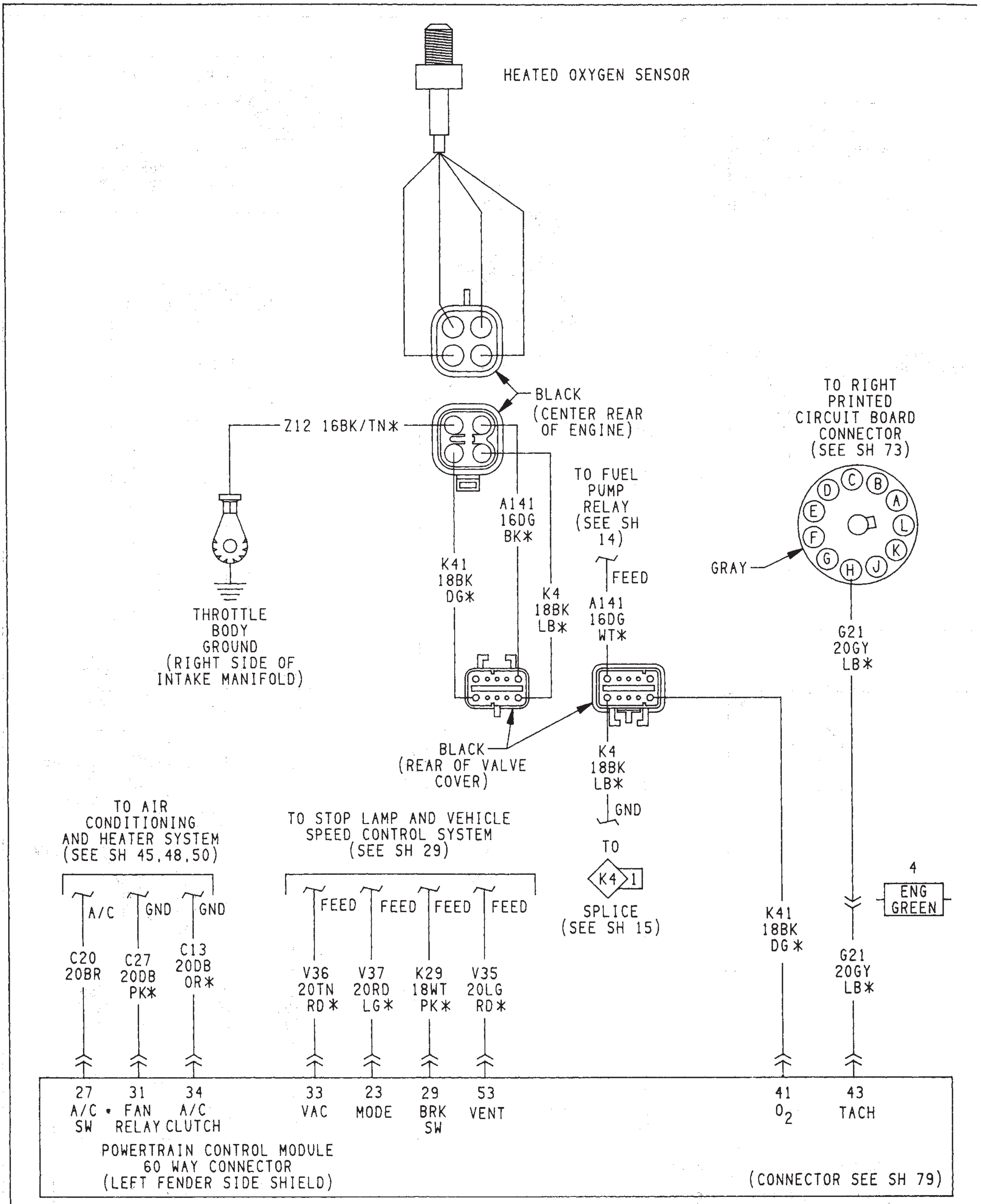
FUEL INJECTION
IGNITION SYSTEM 2.2L & 2.5L ENGINE



FUEL INJECTION
IGNITION SYSTEM 2.2L & 2.5L ENGINE

938W-6

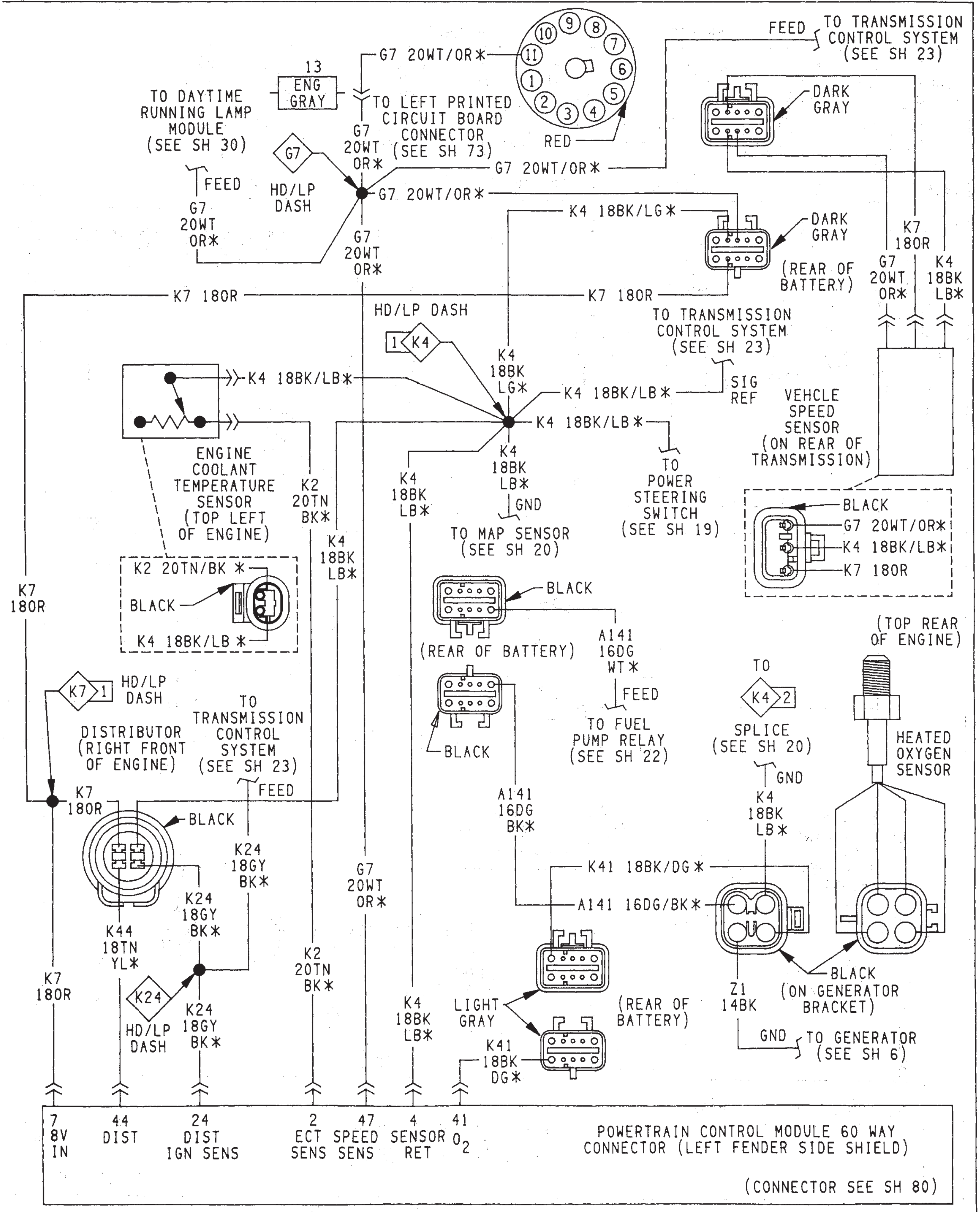
AP-PD 16



AP-PD 17

FUEL INJECTION
IGNITION SYSTEM 2.2L & 2.5L ENGINE

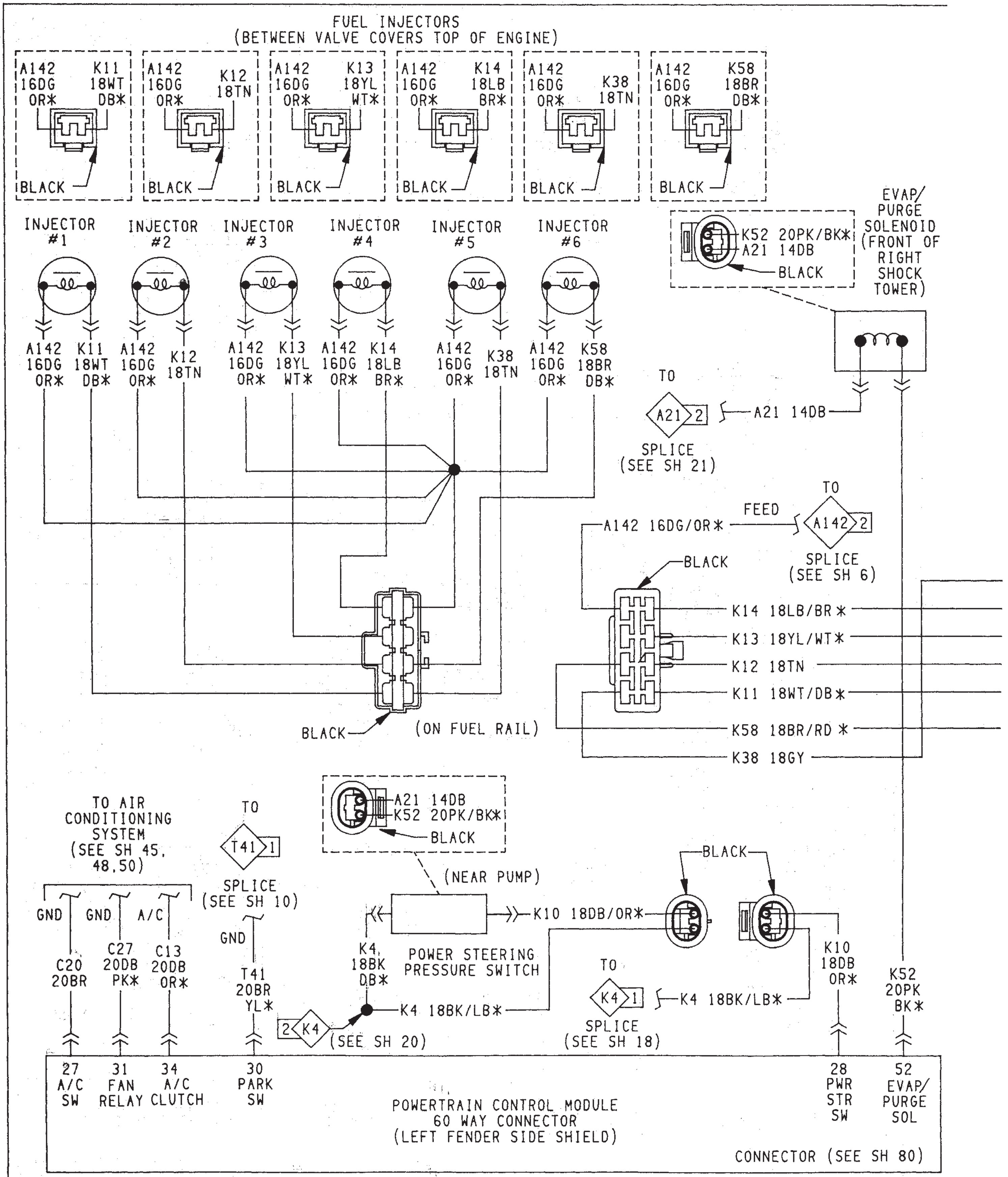
938W-6



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-6

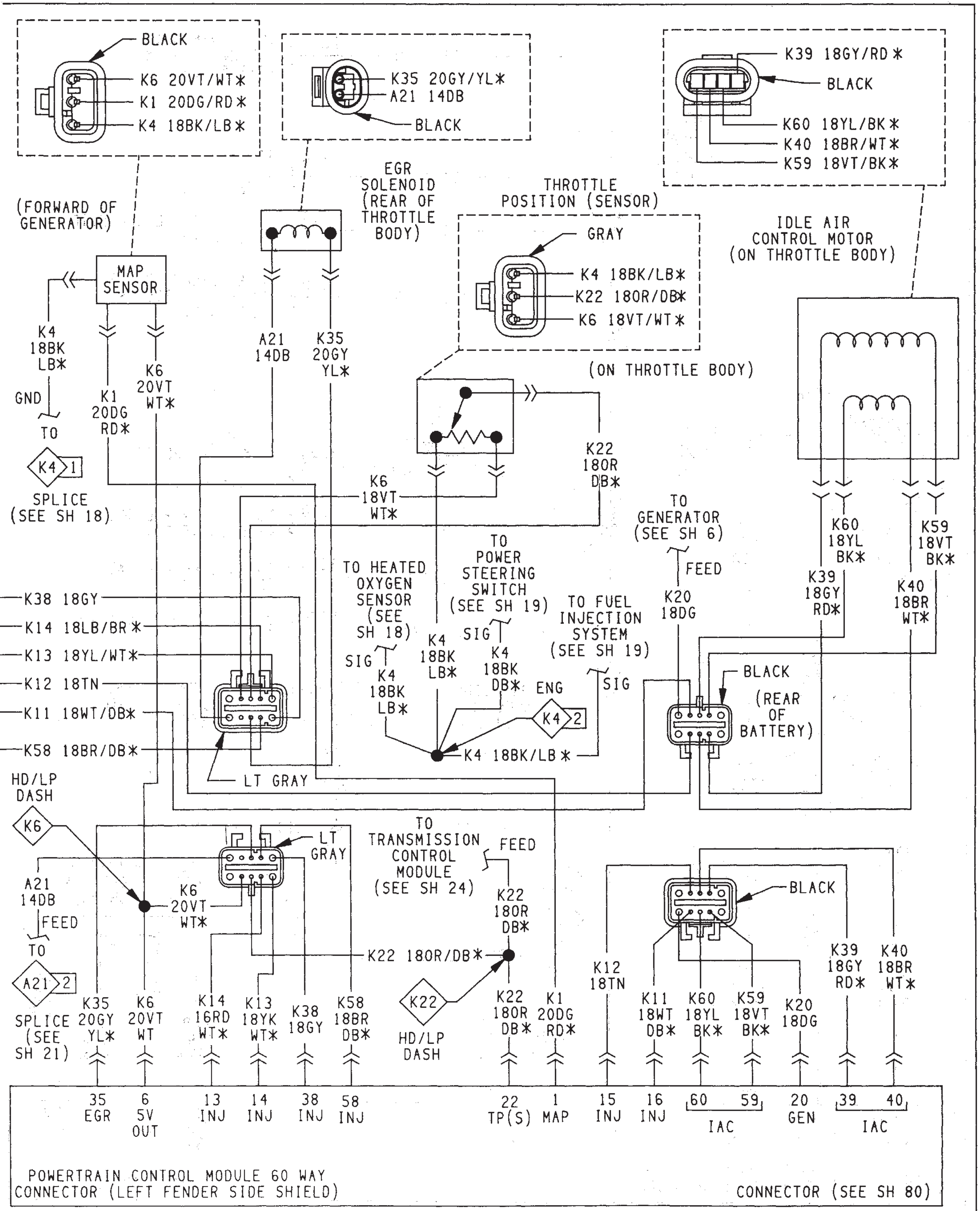
AP-PD 18



AP-PD 19

FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

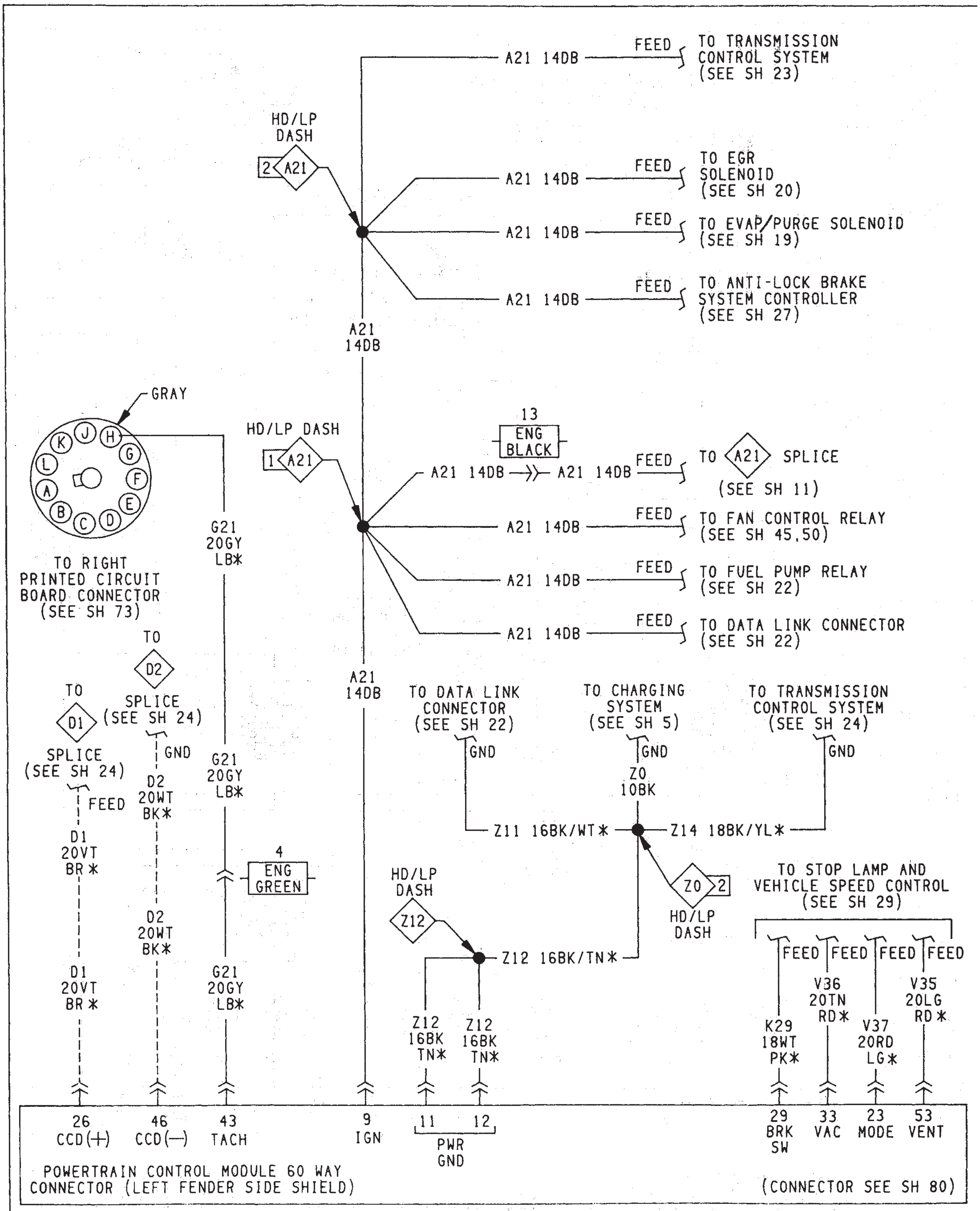
938W-6



FUEL INJECTION
IGNITION SYSTEM (3.0L ENGINE)

938W-6

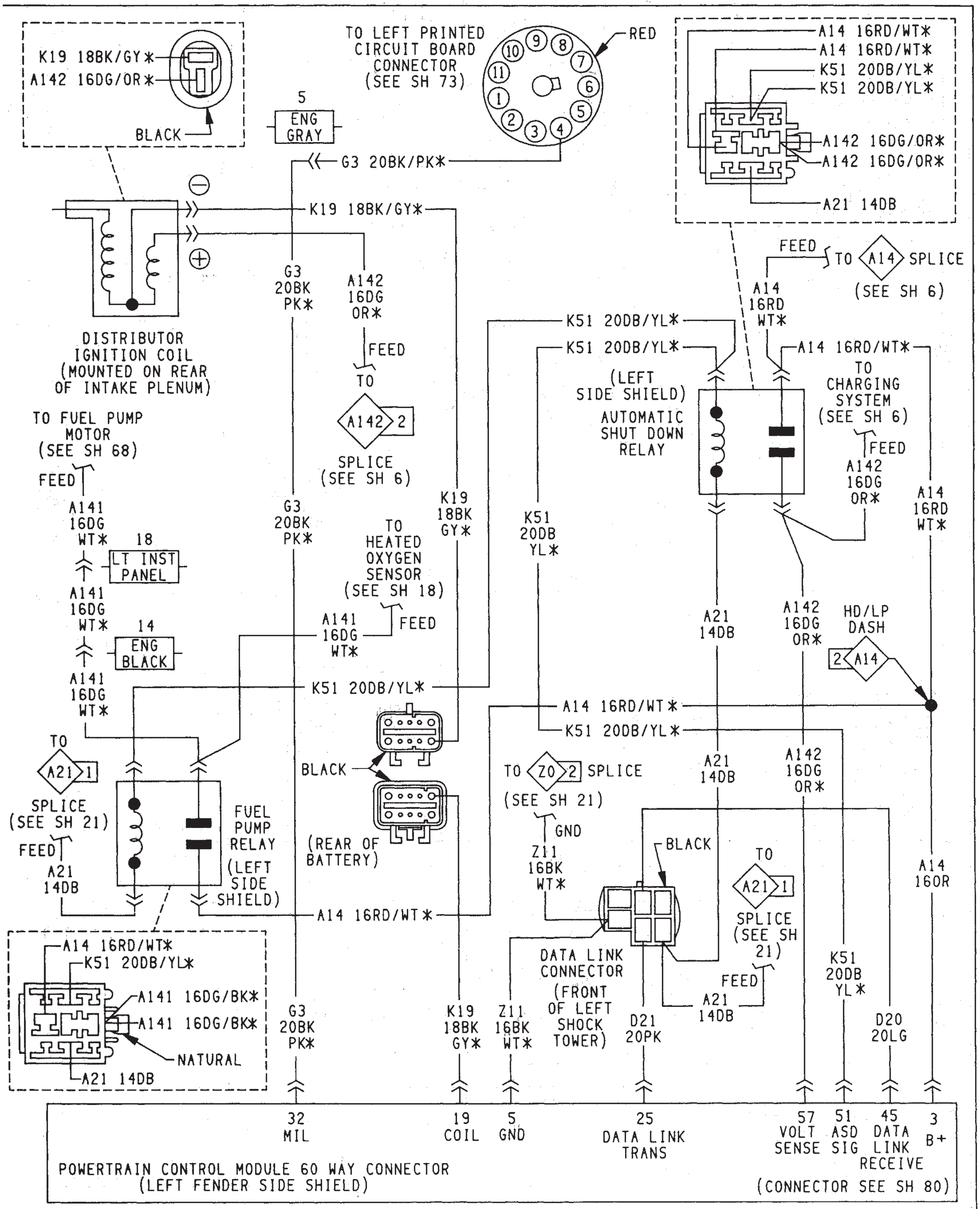
AP-PD 20



AP-PD 21

FUEL INJECTION
IGNITION SYSTEM (3.0 L ENGINE)

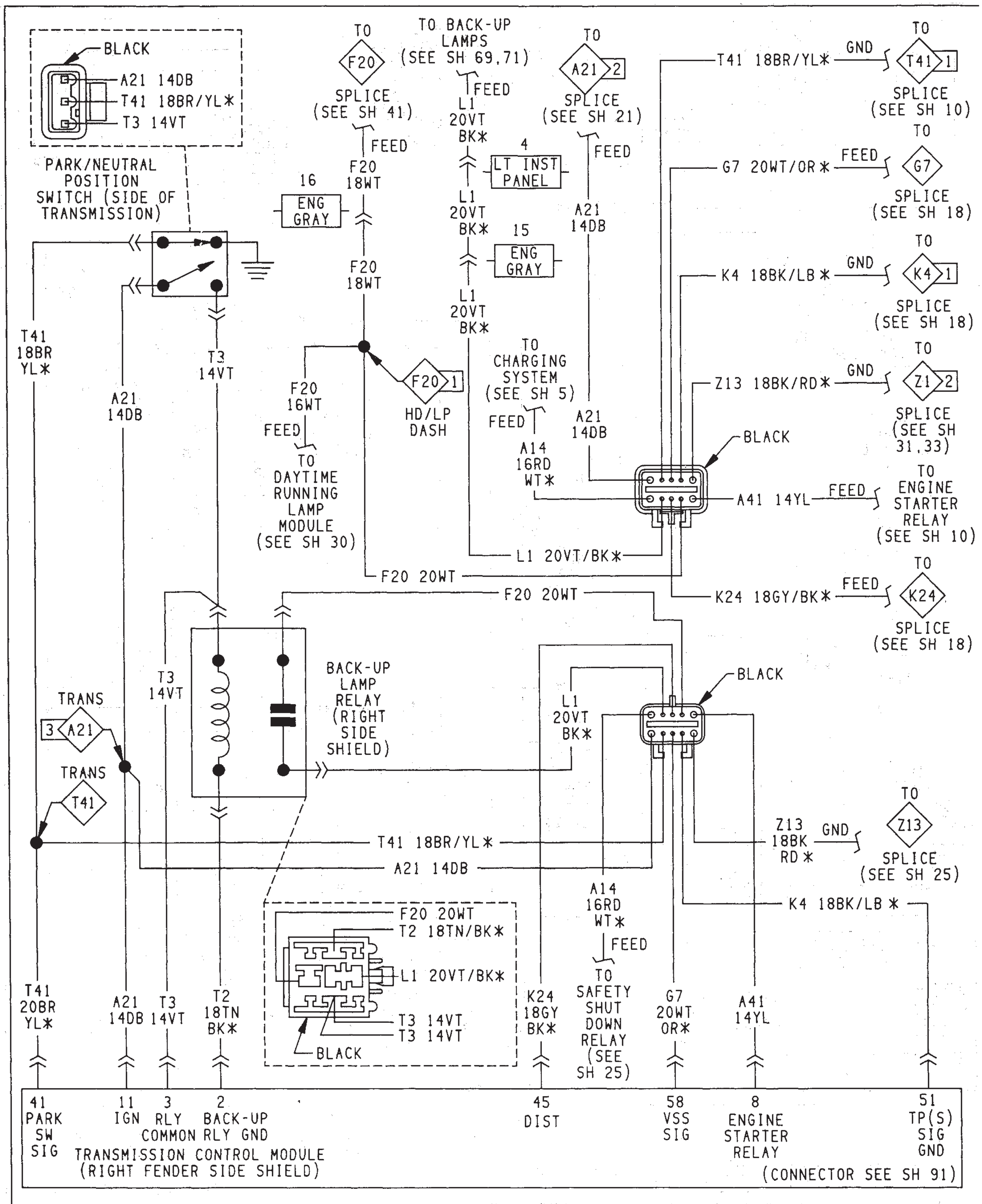
938W-6



FUEL INJECTION
IGNITION SYSTEM (3.0 L ENGINE)

938W-6

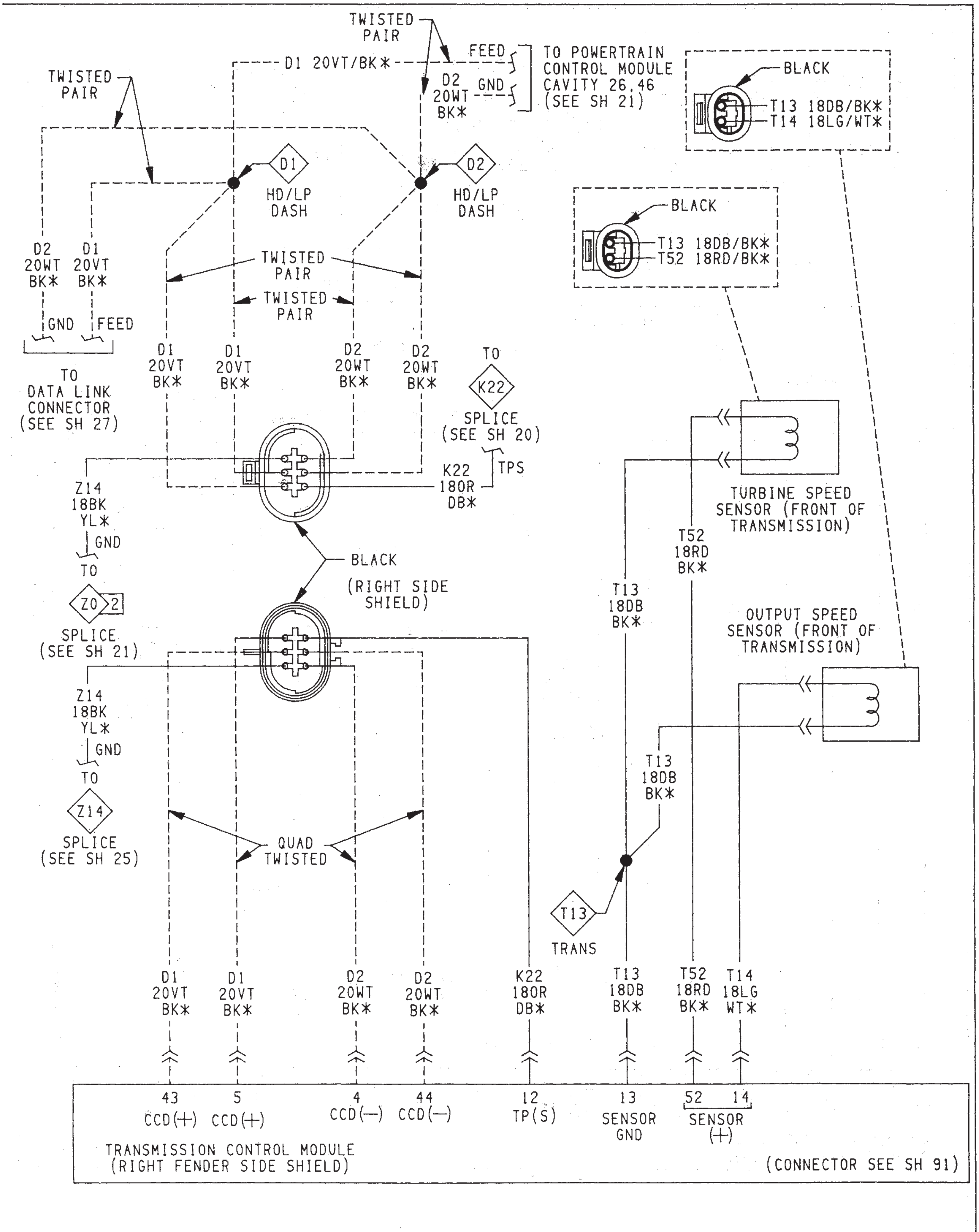
AP-PD 22



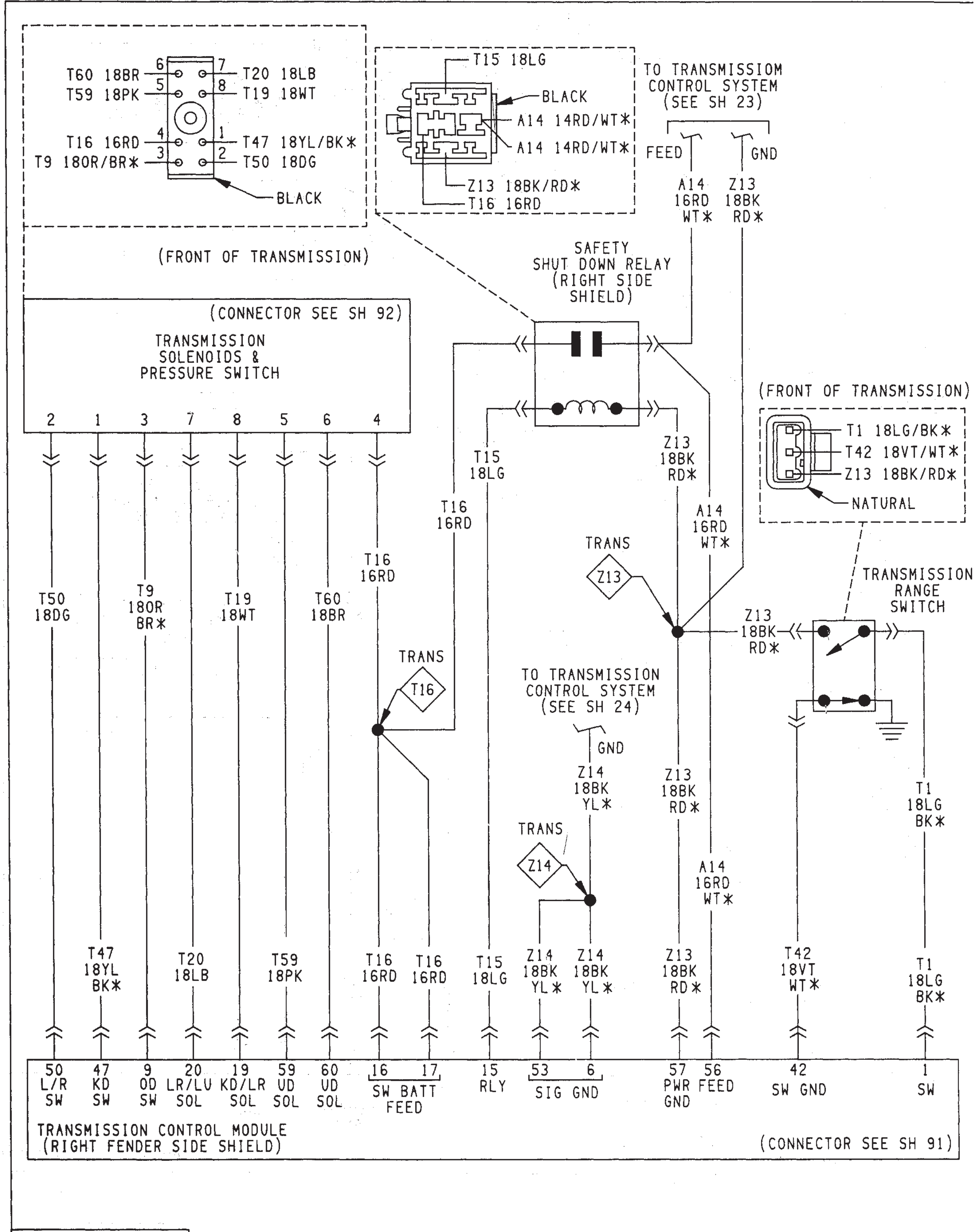
AP-PD 23

TRANSMISSION CONTROL SYSTEM

938W-6



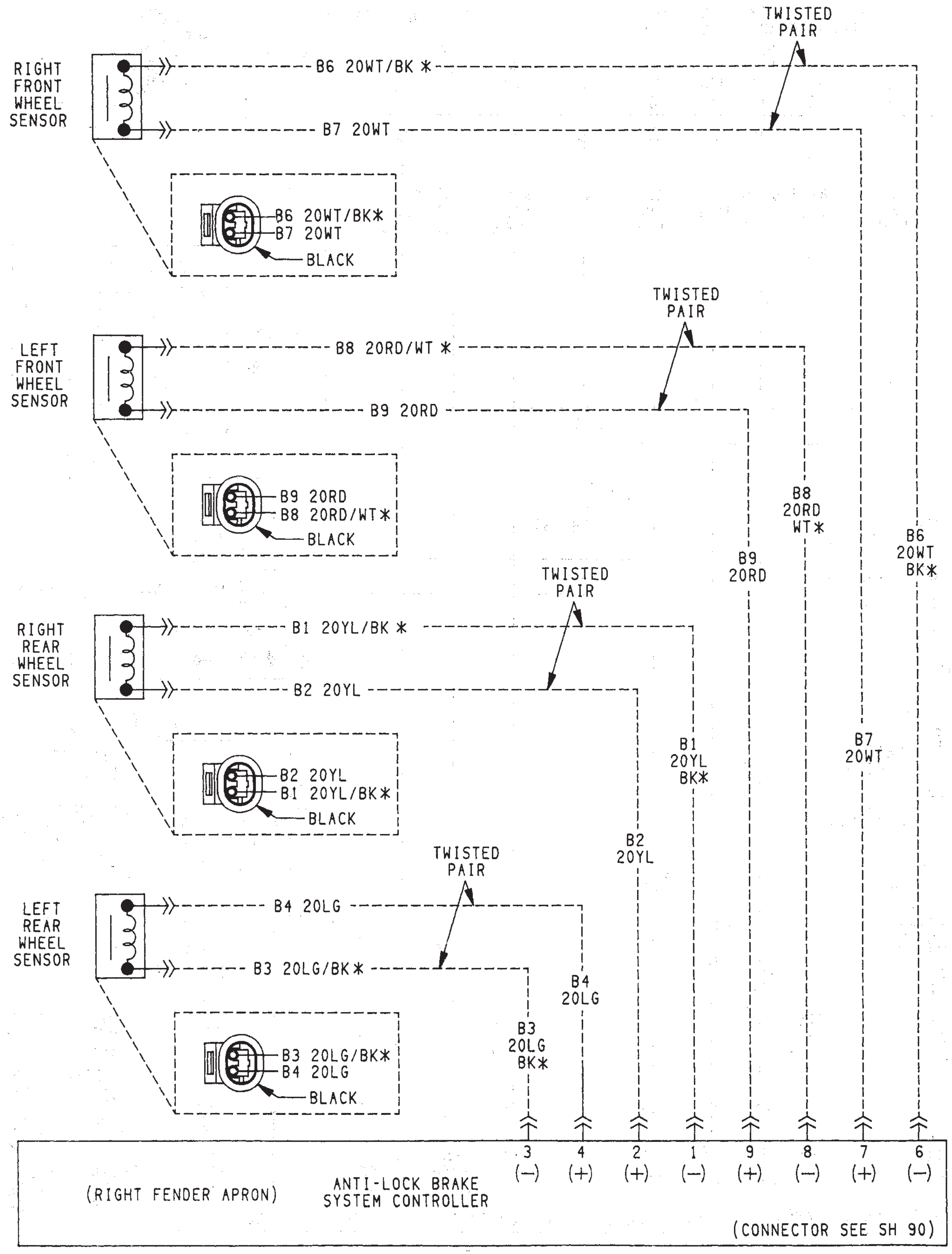
938W-6 TRANSMISSION CONTROL SYSTEM



AP-PD 25

TRANSMISSION CONTROL SYSTEM

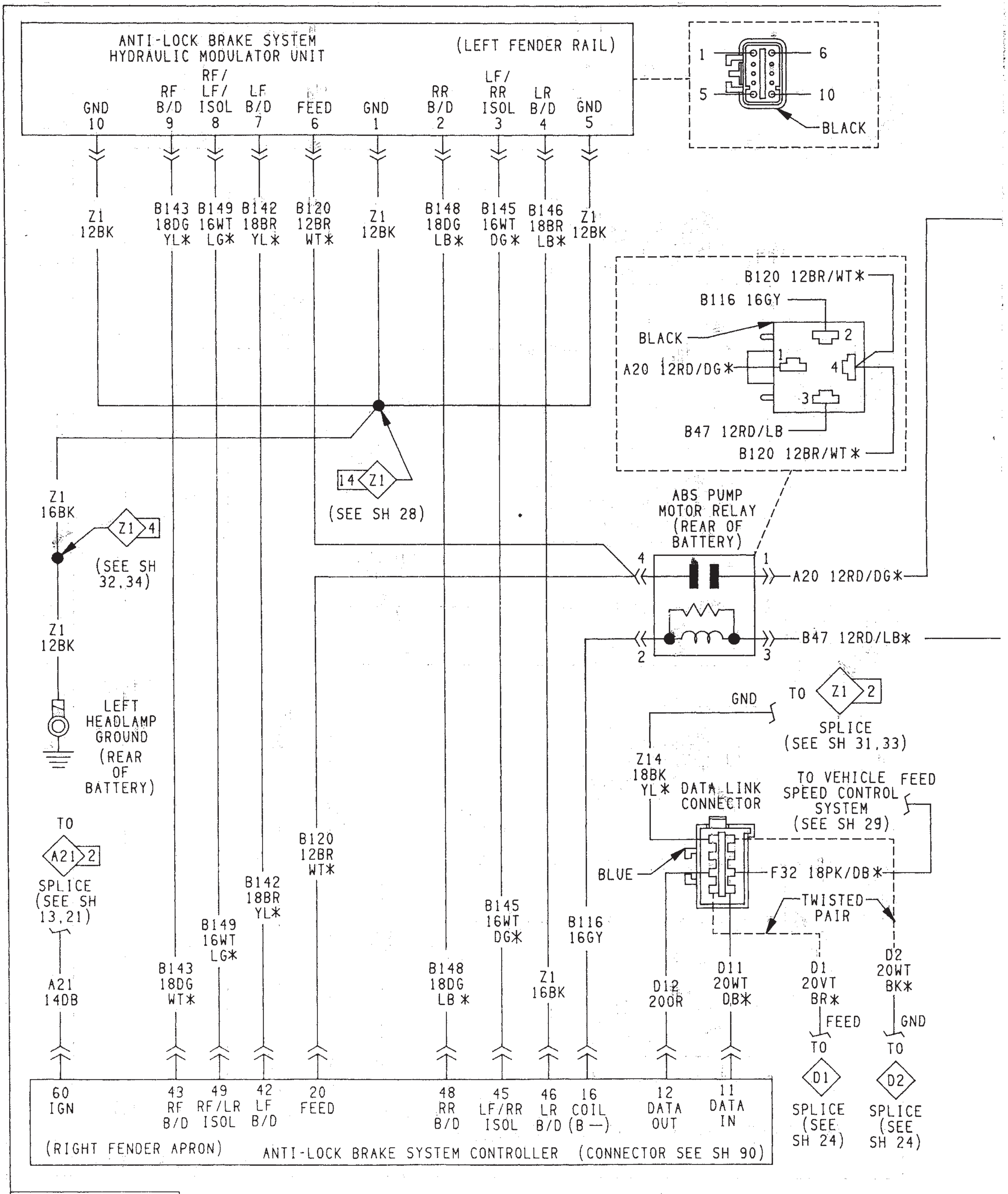
938W-6



938W-6

ANTI-LOCK BRAKING SYSTEM

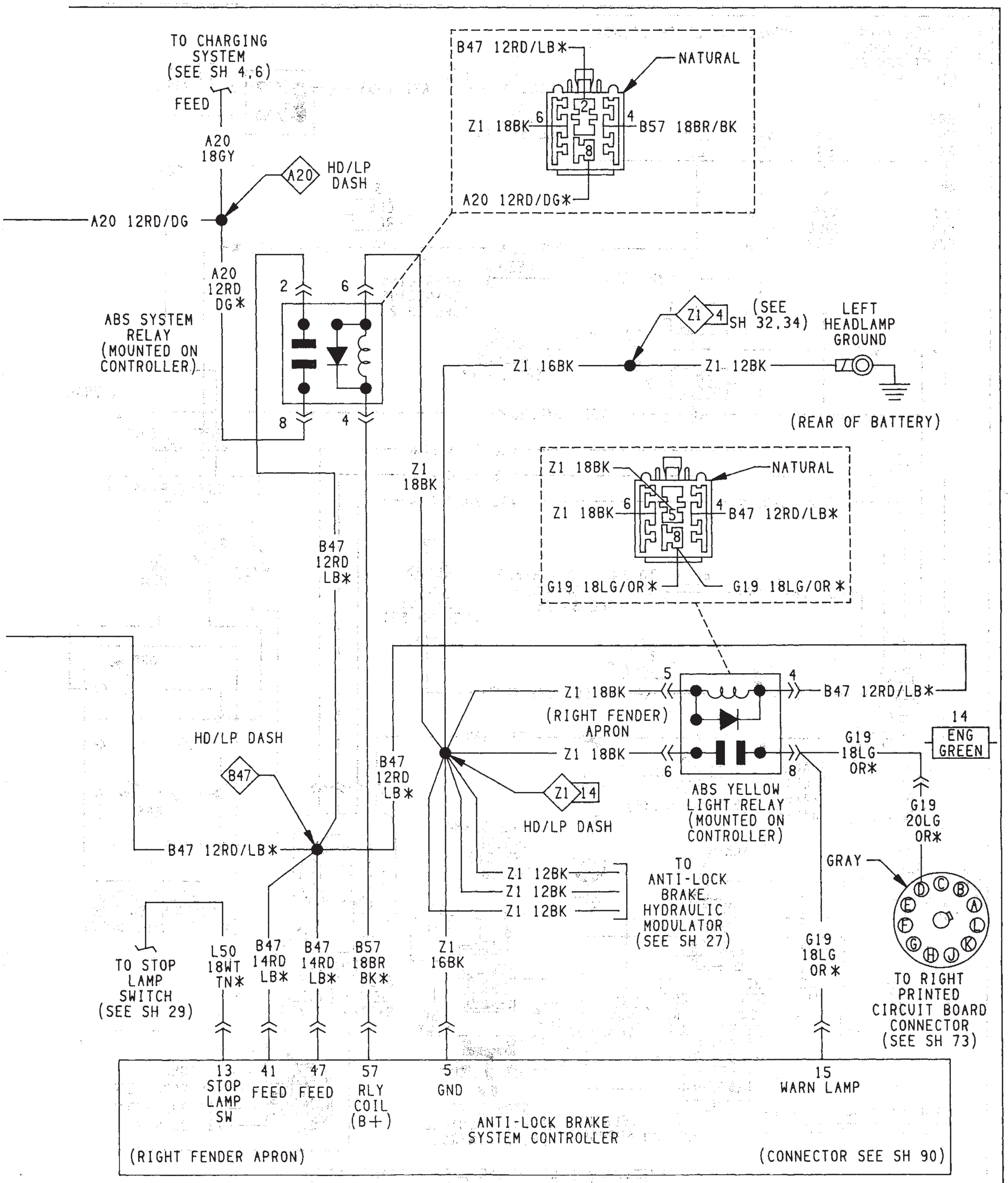
AP-PD 26



AP-PD 27

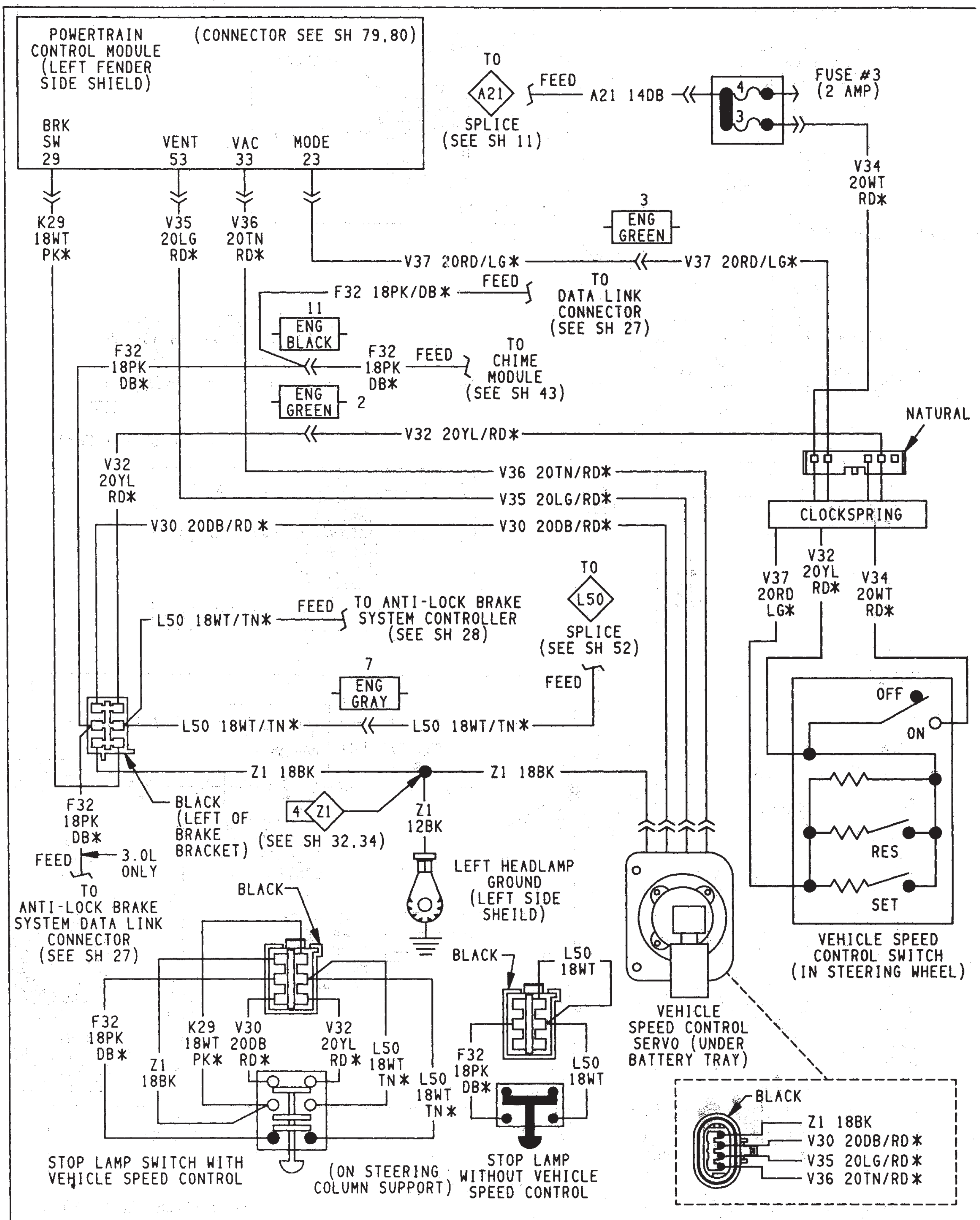
ANTI-LOCK BRAKING SYSTEM

938W-6



938W-6

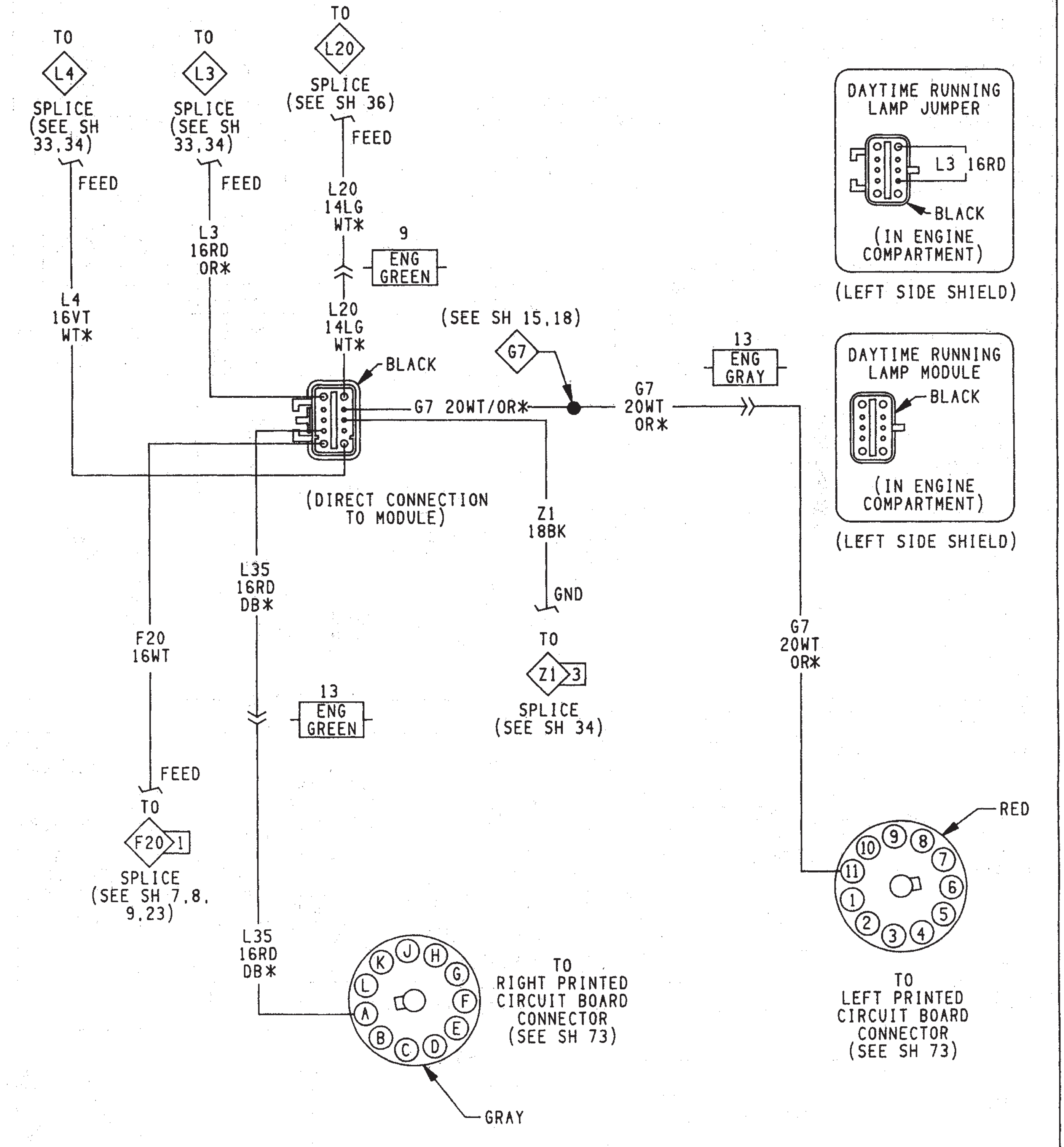
ANTI-LOCK BRAKING SYSTEM



VEHICLE SPEED CONTROL
& STOP LAMP SYSTEM

AP-PD 29

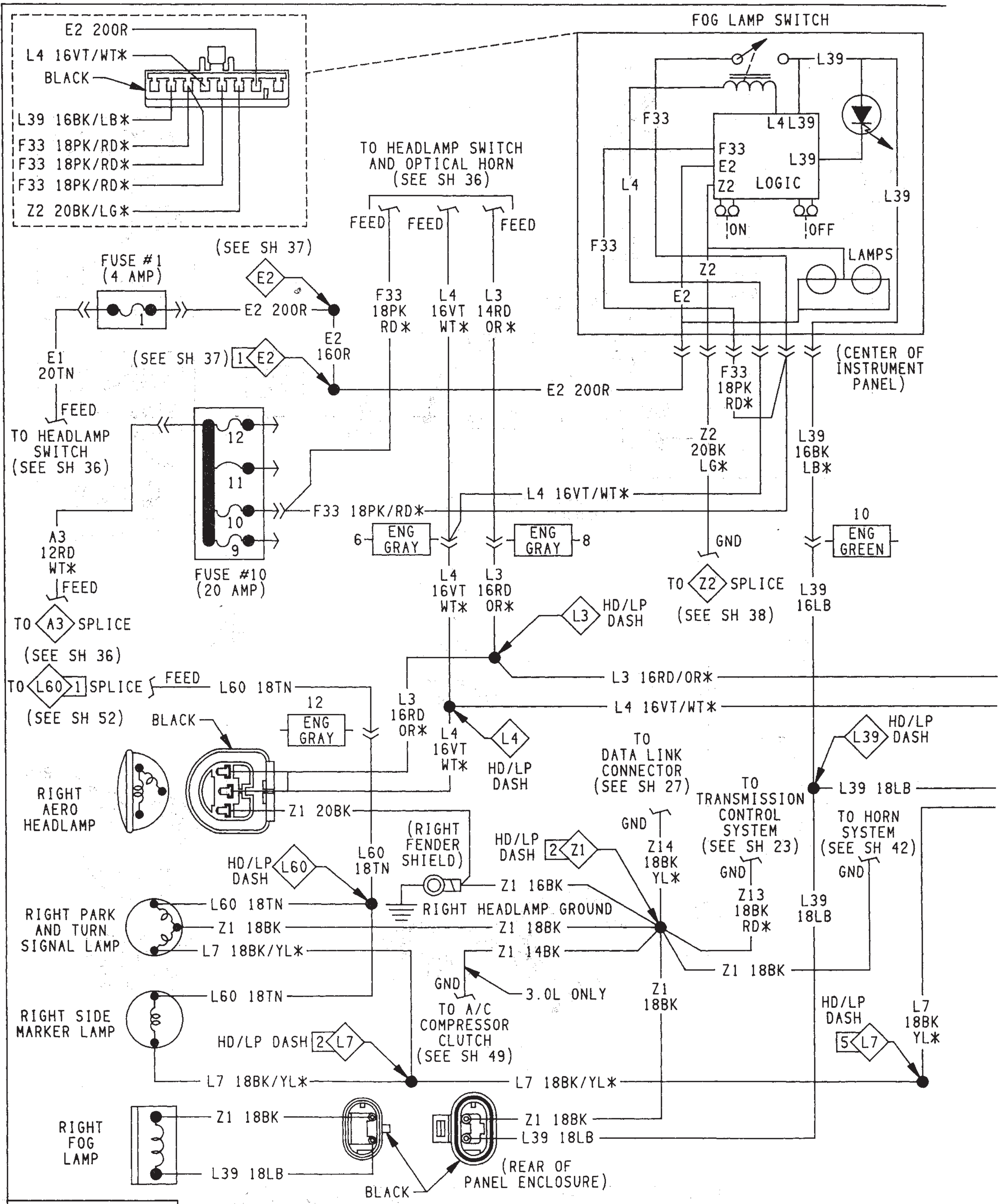
938W-6



DAYTIME RUNNING LAMP MODULE
(CANADIAN ONLY)

938W-6

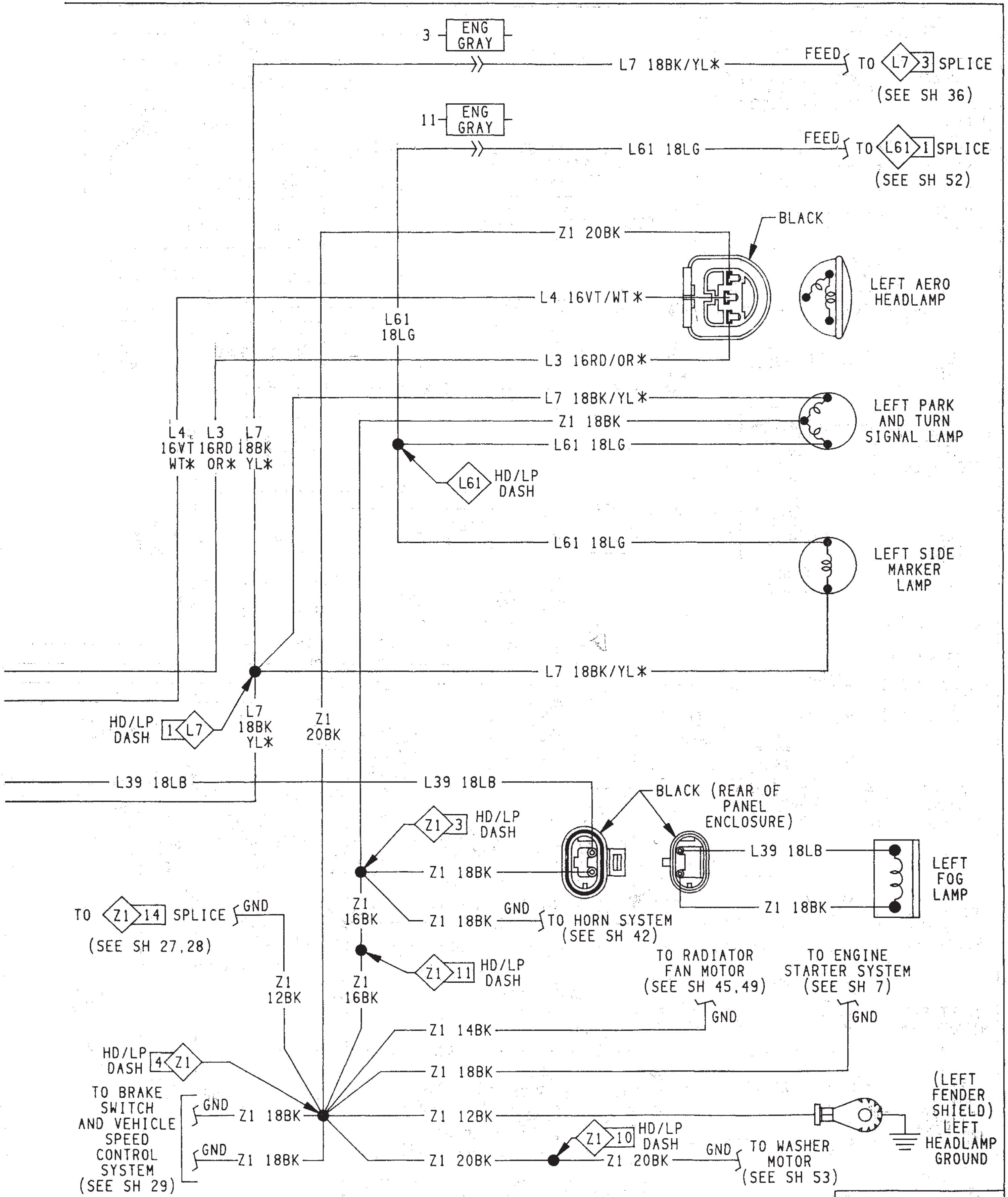
AP-PD 30



AP-PD 31

FRONT END LIGHTING

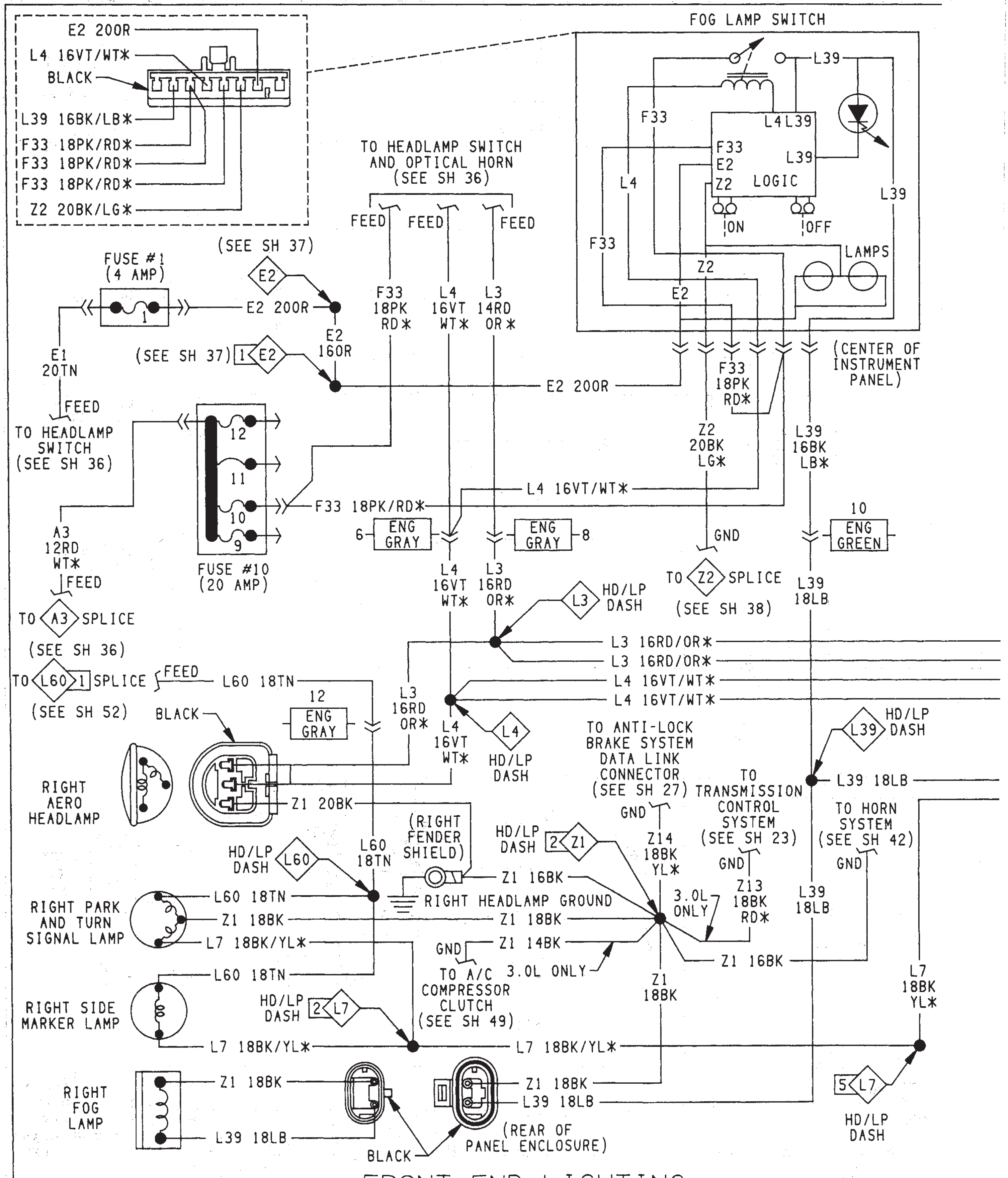
938W-6



938W-6

FRONT END LIGHTING

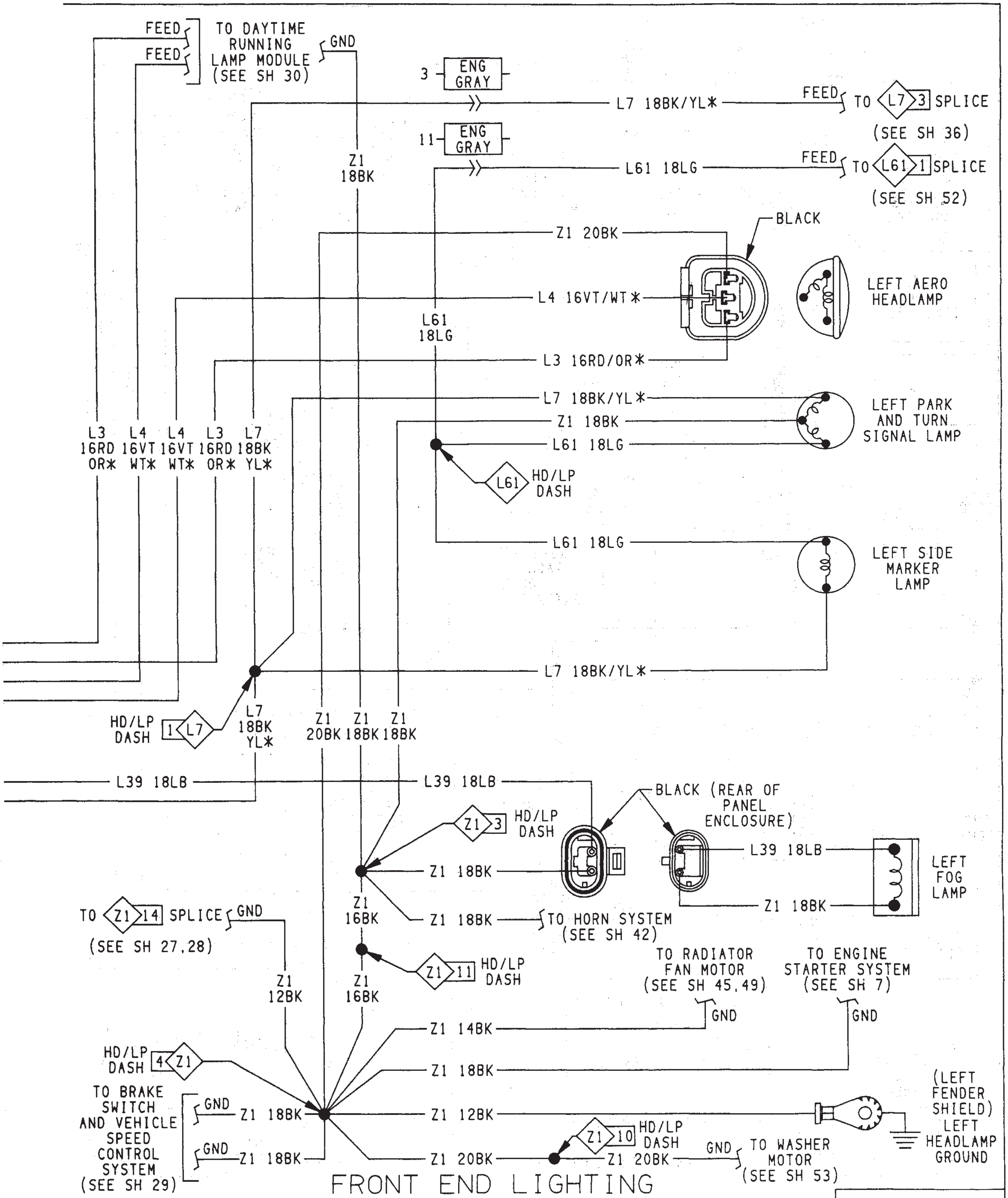
AP-PD 32



AP-PD 33

FRONT END LIGHTING
WITH DAYTIME RUNNING LIGHTS

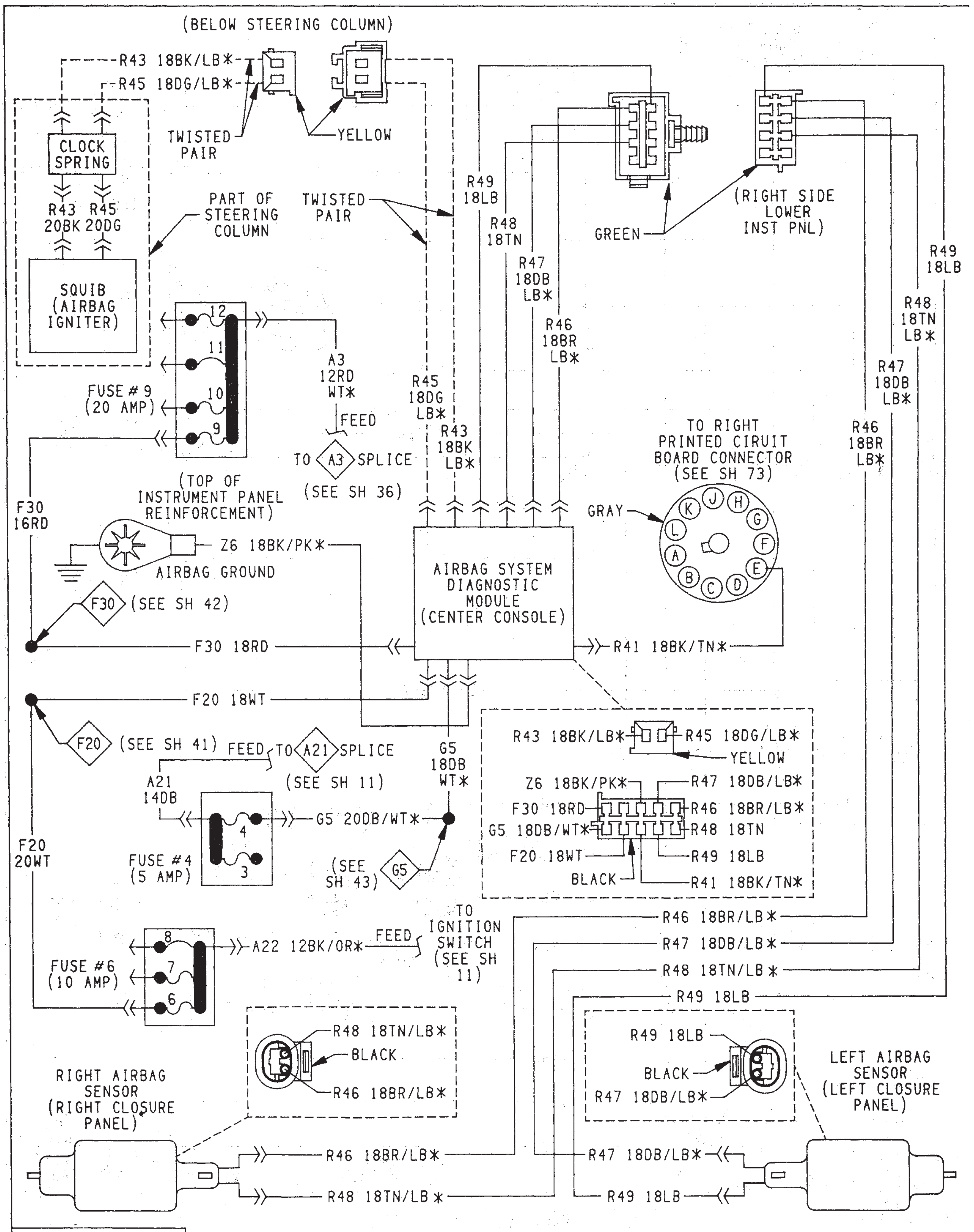
938W-6



FRONT END LIGHTING
WITH DAYTIME RUNNING LIGHTS

938W-6

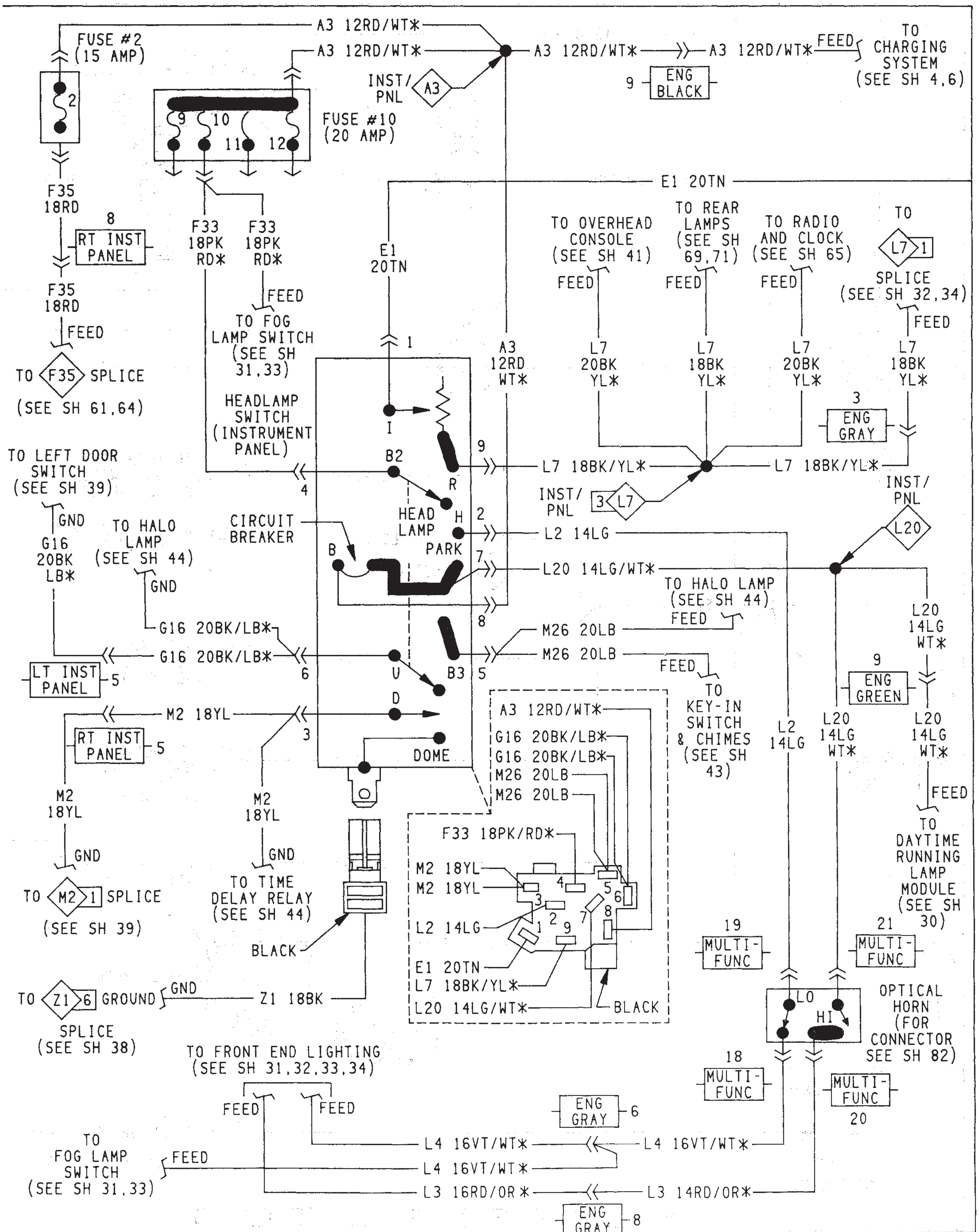
AP-PD 34



AP-PD 35

AIRBAG SYSTEM

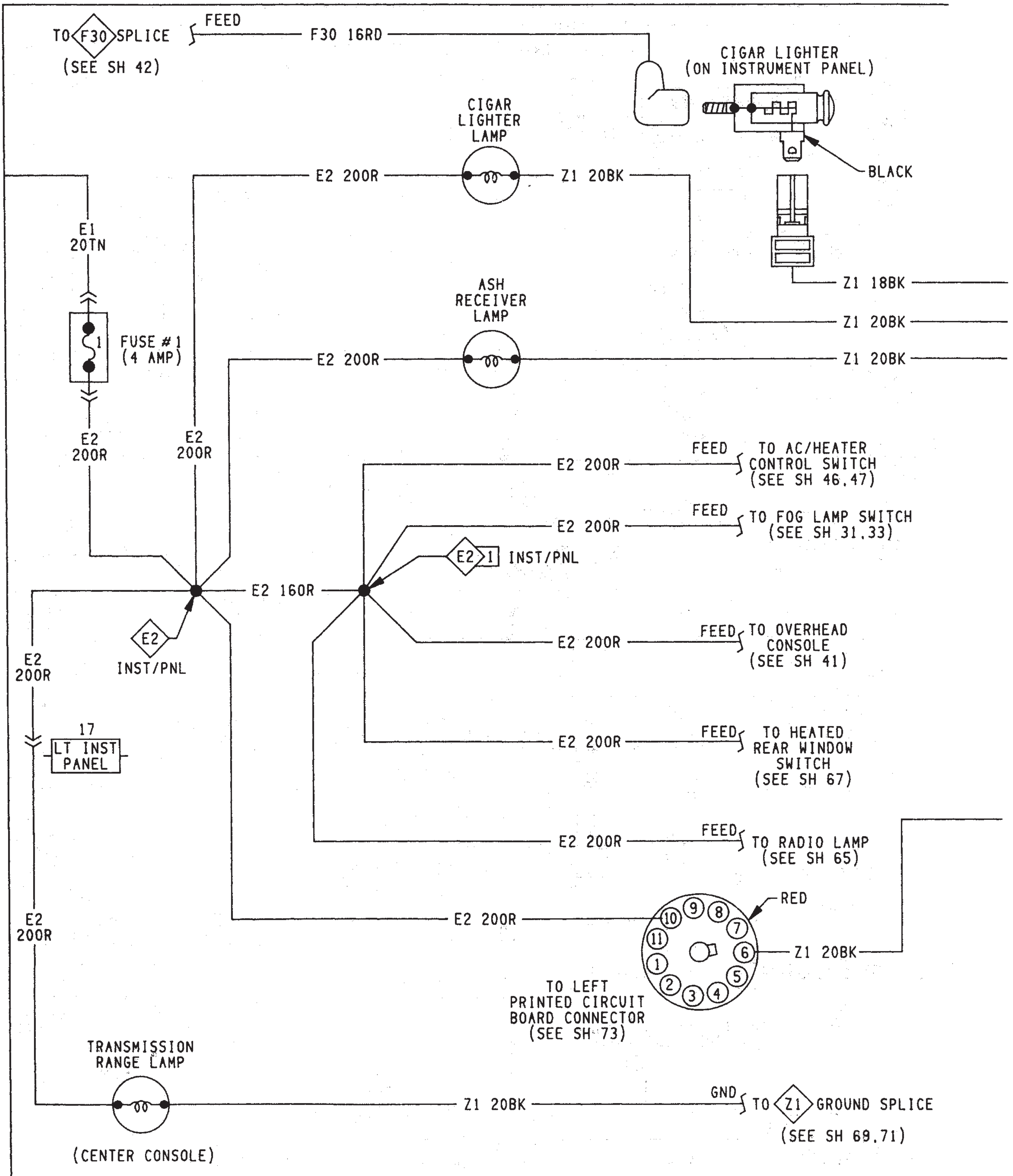
938W-6



938W-6

HEADLAMP SWITCH

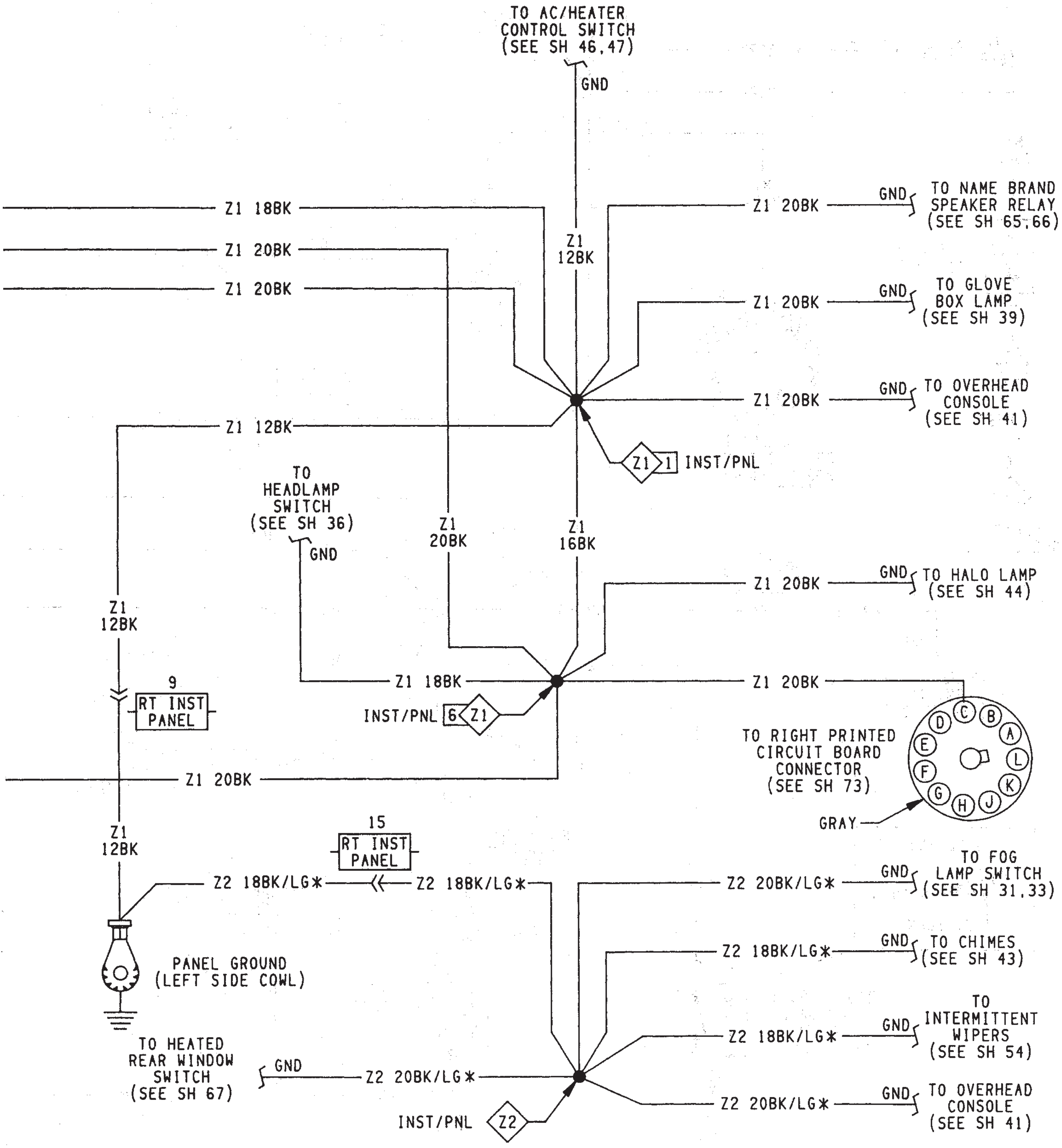
AP-PD 36



HEADLAMP SWITCH CONTROLLED
INTERIOR LIGHTING

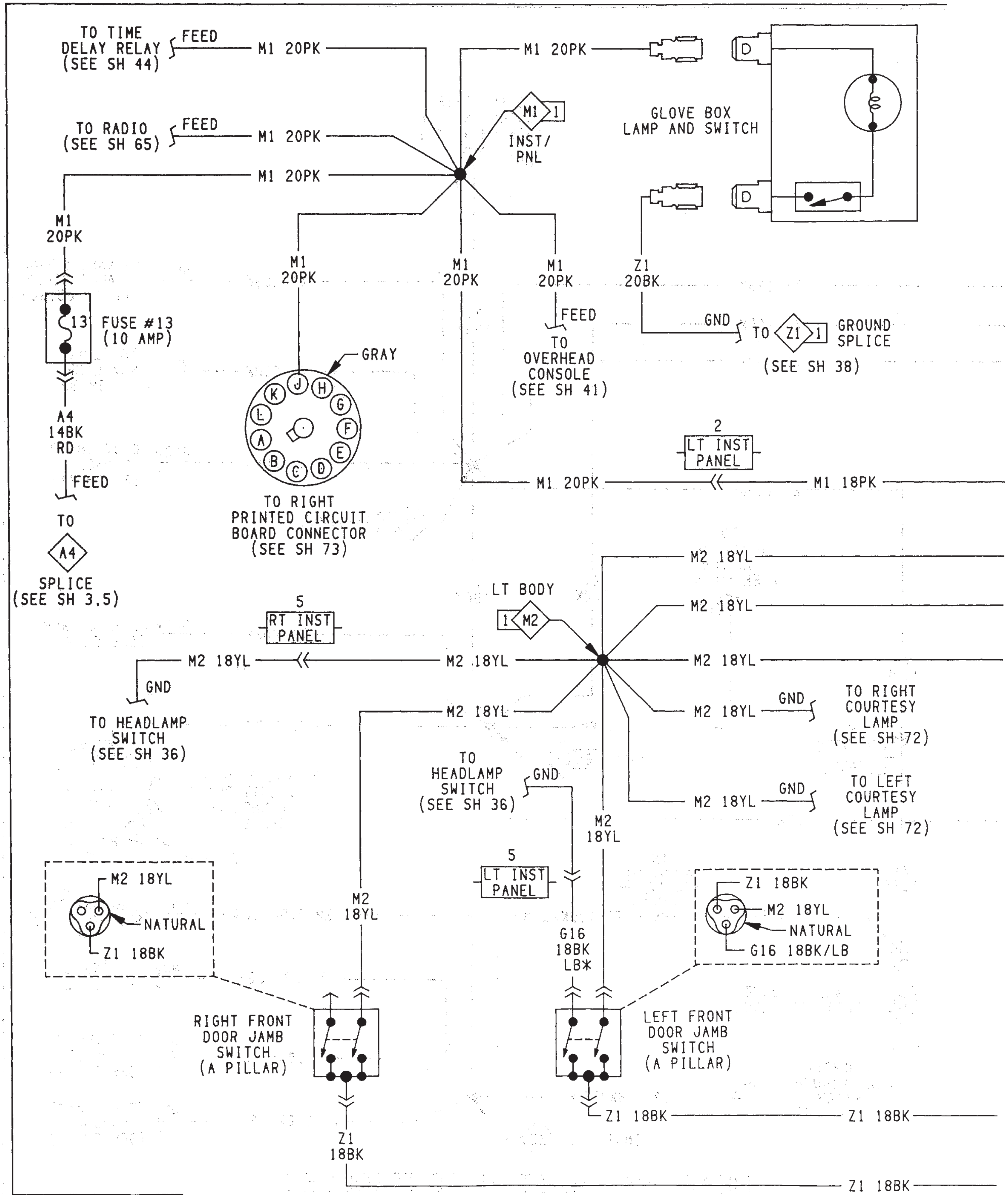
AP-PD 37

938W-6



HEADLAMP SWITCH CONTROLLED INTERIOR LIGHTING

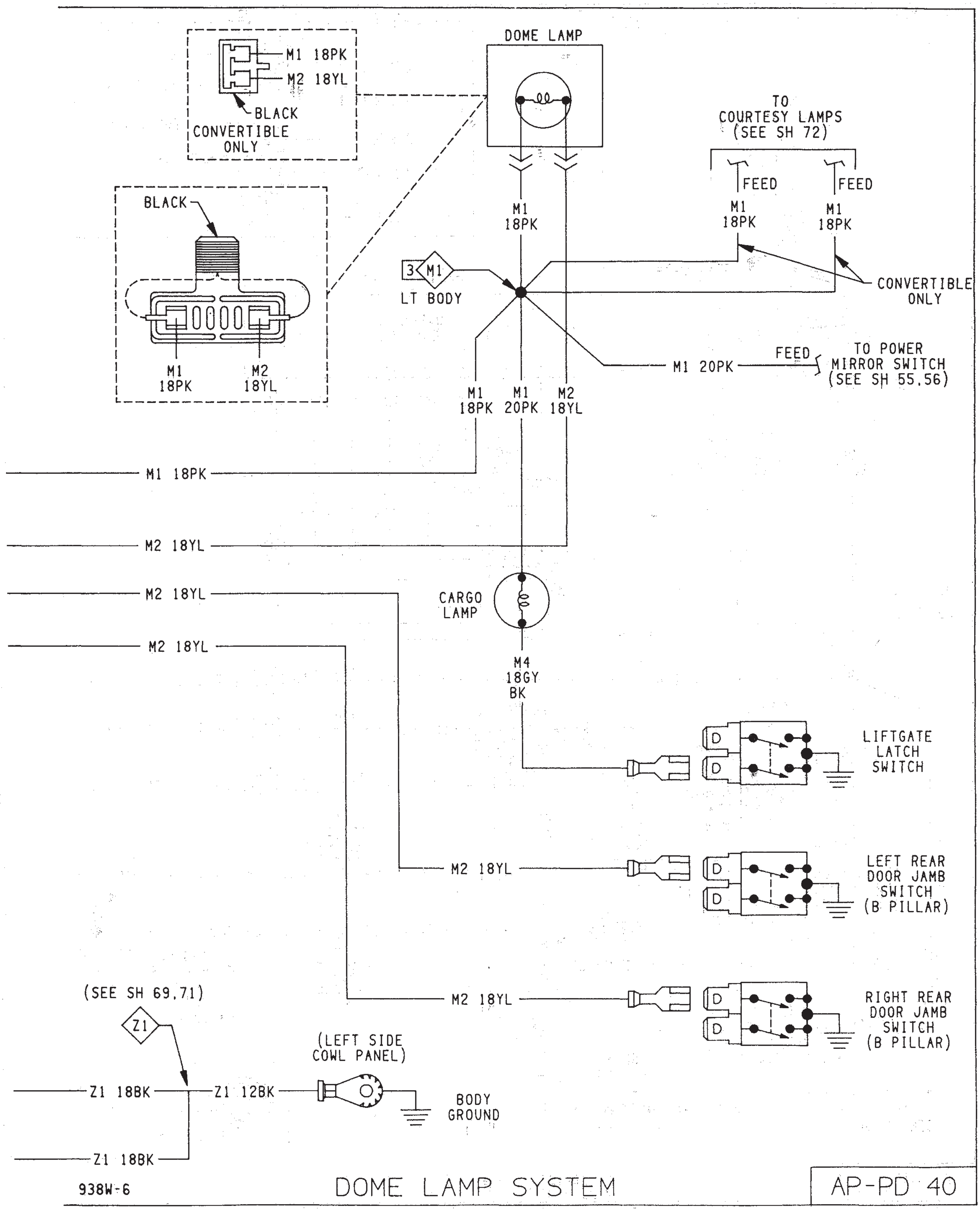
938W-6



AP-PD 39

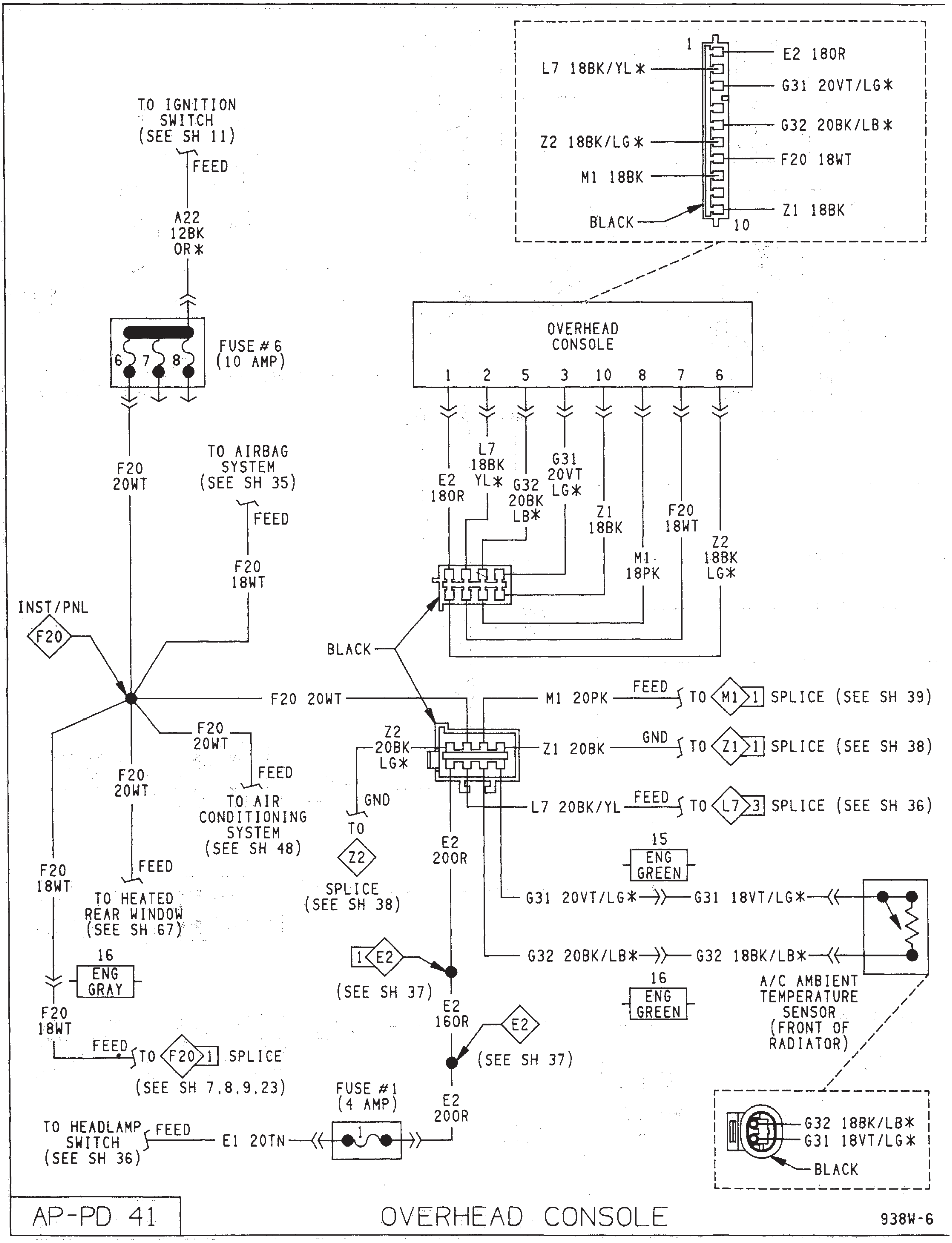
DOME LAMP SYSTEM

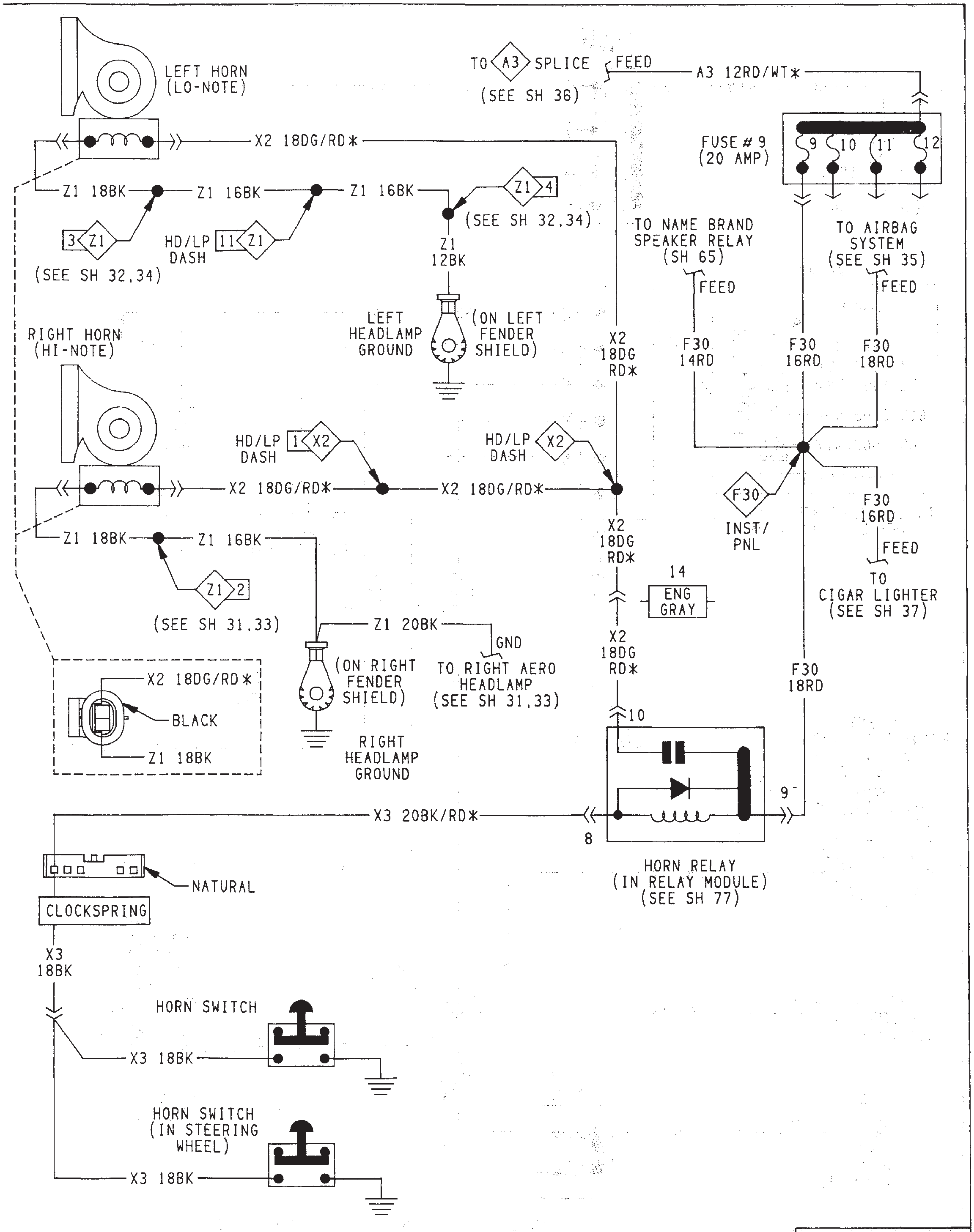
938W-6



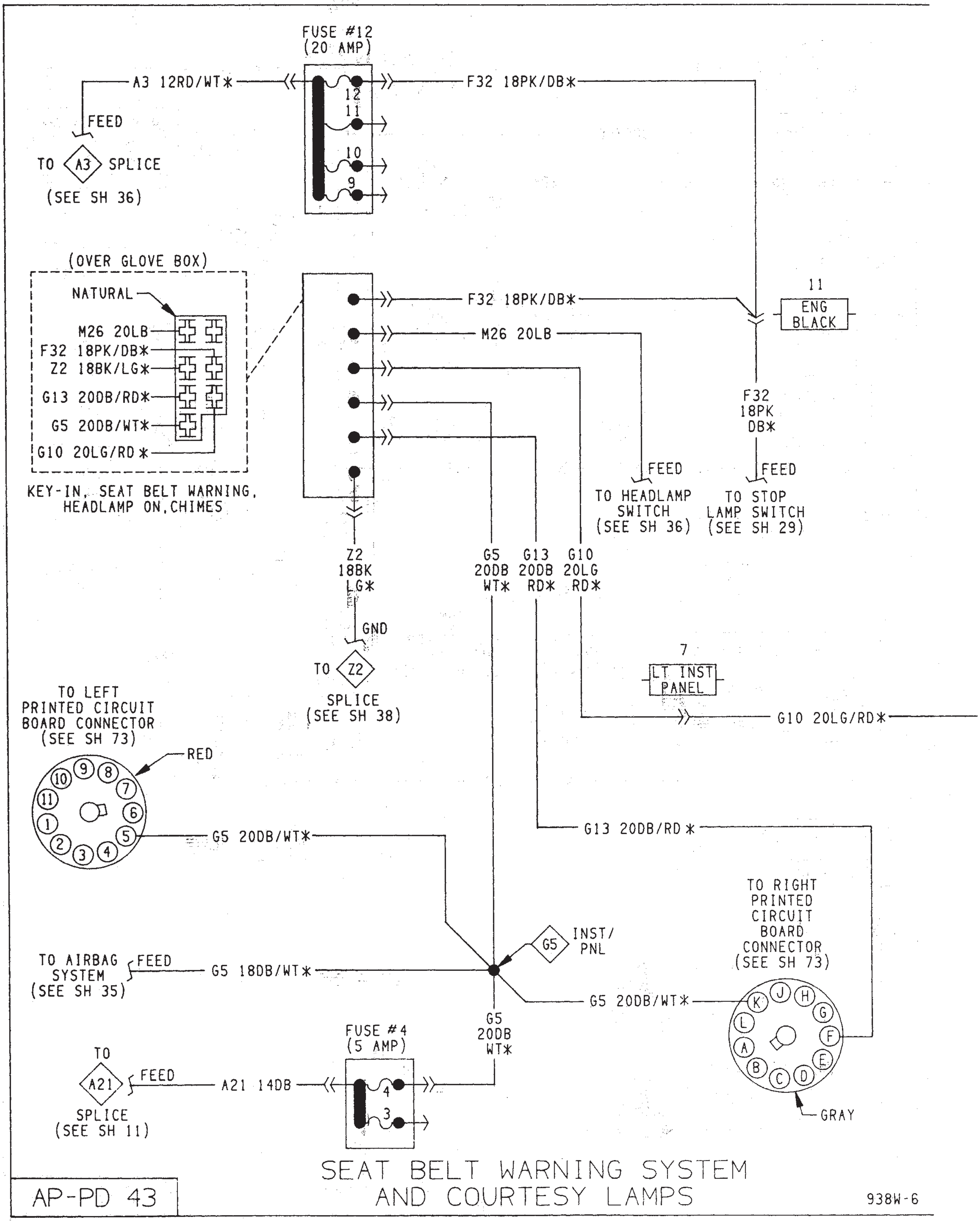
938W-6

DOME LAMP SYSTEM

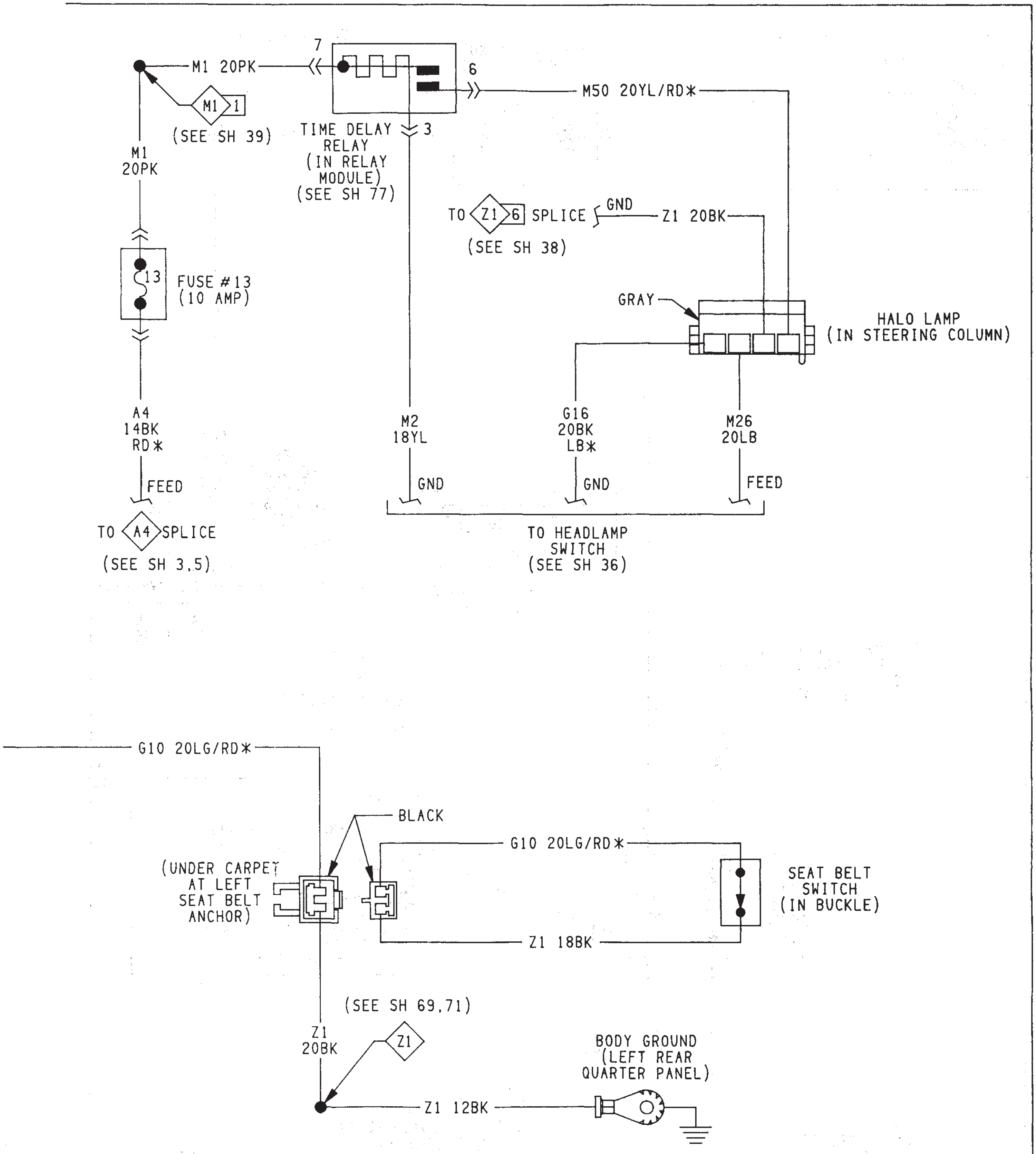

1
L7 18BK/YL*
E2 18OR
G31 20VT/LG*
G32 20BK/LB*
Z2 18BK/LG*
F20 18WT
M1 18BK
BLACK
Z1 18BK
10
TO IGNITION SWITCH (SEE SH 11)
FEED
A22 12BK OR*
FUSE #6 (10 AMP)
6 7 8
OVERHEAD CONSOLE
1 2 5 3 10 8 7 6
E2 18OR
L7 18BK YL*
G32 20BK LB*
G31 20VT LG*
Z1 18BK
M1 18PK
F20 18WT
Z2 18BK LG*
F20 20WT
TO AIRBAG SYSTEM (SEE SH 35)
FEED
F20 18WT
INST/PNL
F20
BLACK
F20 20WT
M1 20PK
FEED
TO M1 1 SPLICE (SEE SH 39)
Z2 20BK LG*
Z1 20BK
GND
TO Z1 1 SPLICE (SEE SH 38)
F20 20WT
FEED
TO AIR CONDITIONING SYSTEM (SEE SH 48)
F20 20WT
GND
TO
Z2
SPLICE (SEE SH 38)
L7 20BK/YL
FEED
TO L7 3 SPLICE (SEE SH 36)
E2 20OR
15 ENG GREEN
FEED
TO HEATED REAR WINDOW (SEE SH 67)
F20 18WT
G31 20VT/LG*
G31 18VT/LG*
G32 20BK/LB*
G32 18BK/LB*
16 ENG GRAY
1 E2
(SEE SH 37)
16 ENG GREEN
A/C AMBIENT TEMPERATURE SENSOR (FRONT OF RADIATOR)
E2 16OR
E2
(SEE SH 37)
F20 18WT
FEED
TO F20 1 SPLICE
(SEE SH 7,8,9,23)
FUSE #1 (4 AMP)
1
E2 20OR
TO HEADLAMP SWITCH (SEE SH 36)
FEED
E1 20TN
G32 18BK/LB*
G31 18VT/LG*
BLACK
AP-PD 41
OVERHEAD CONSOLE
938W-6


LEFT HORN
(LO-NOTE)
TO A3 SPLICE
(SEE SH 36)
FEED
A3 12RD/WT*
FUSE # 9
(20 AMP)
9
10
11
12
X2 18DG/RD*
Z1 18BK
Z1 16BK
Z1 16BK
Z1 4
(SEE SH 32,34)
3 Z1
(SEE SH 32,34)
HD/LP
DASH
11 Z1
Z1
12BK
TO NAME BRAND
SPEAKER RELAY
(SH 65)
FEED
TO AIRBAG
SYSTEM
(SEE SH 35)
FEED
LEFT
HEADLAMP
GROUND
(ON LEFT
FENDER
SHIELD)
RIGHT HORN
(HI-NOTE)
X2
18DG
RD*
F30
14RD
F30
16RD
F30
18RD
HD/LP
DASH
1 X2
HD/LP
DASH
X2
X2 18DG/RD*
X2 18DG/RD*
F30
INST/
PNL
F30
16RD
FEED
Z1 18BK
Z1 16BK
X2
18DG
RD*
14
ENG
GRAY
TO
CIGAR LIGHTER
(SEE SH 37)
Z1 2
(SEE SH 31,33)
Z1 20BK
GND
X2
18DG
RD*
X2 18DG/RD*
BLACK
Z1 18BK
(ON RIGHT
FENDER
SHIELD)
TO RIGHT AERO
HEADLAMP
(SEE SH 31,33)
F30
18RD
10
RIGHT
HEADLAMP
GROUND
9
X3 20BK/RD*
8
NATURAL
HORN RELAY
(IN RELAY MODULE)
(SEE SH 77)
CLOCKSPRING
X3
18BK
HORN SWITCH
X3 18BK
HORN SWITCH
(IN STEERING
WHEEL)
X3 18BK

HORN SYSTEM

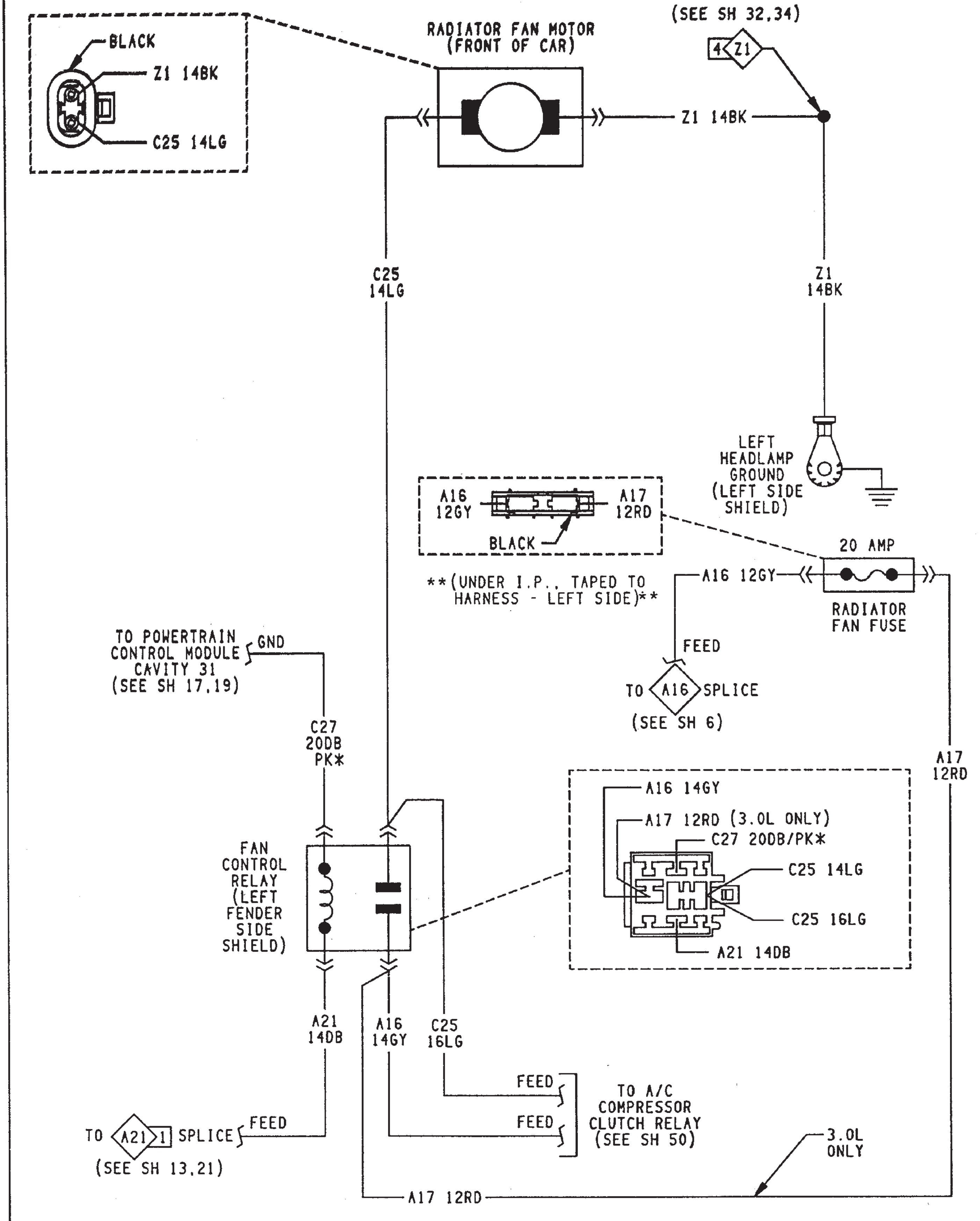


SEAT BELT WARNING SYSTEM AND COURTESY LAMPS



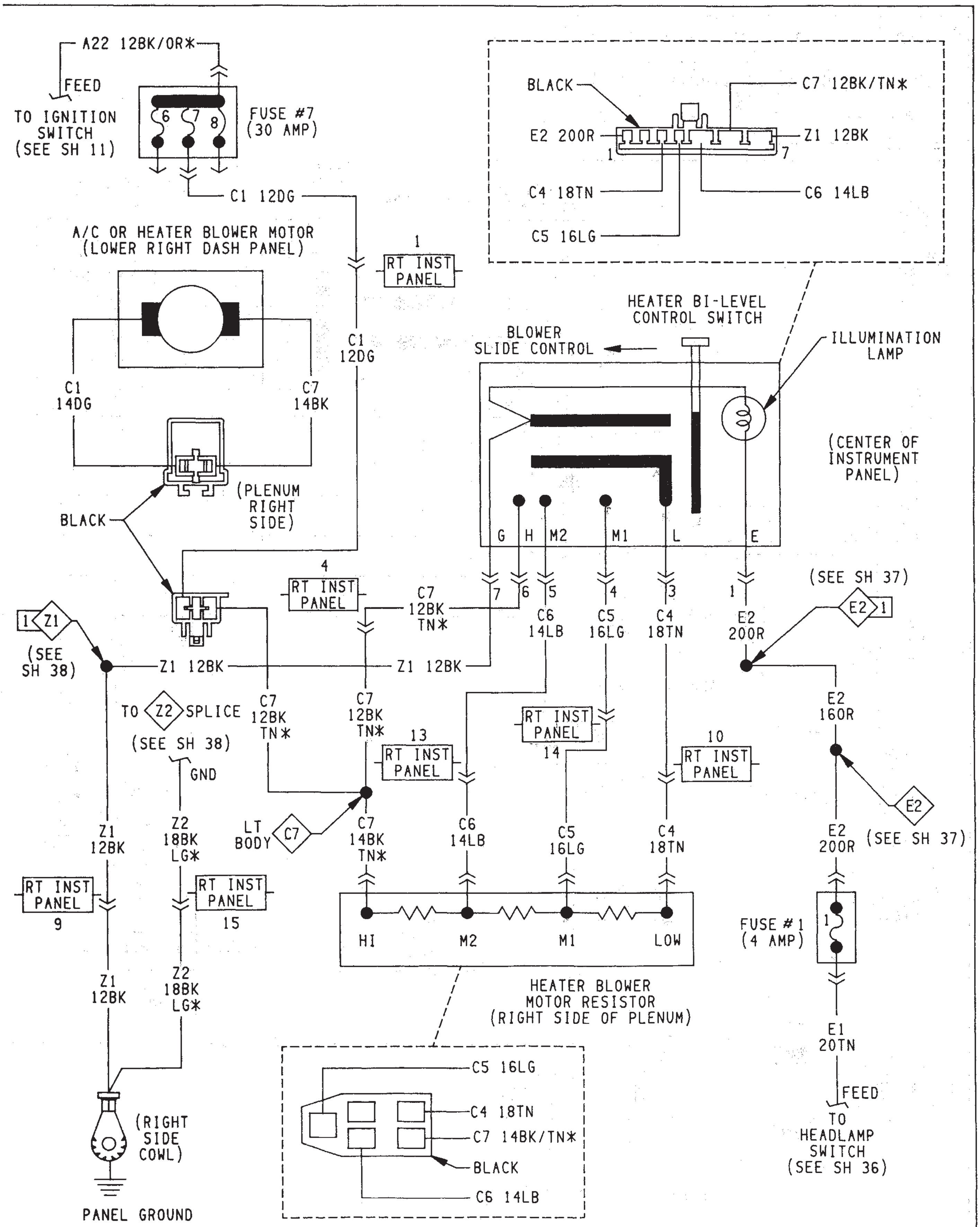
SEAT BELT WARNING SYSTEM
AND COURTESY LAMPS

1993 Front Wheel Drive Car
Publication No. 81-270-3103
TSB 08-56-93 November 12, 1993



FAN CONTROL SYSTEM WITH HEATER

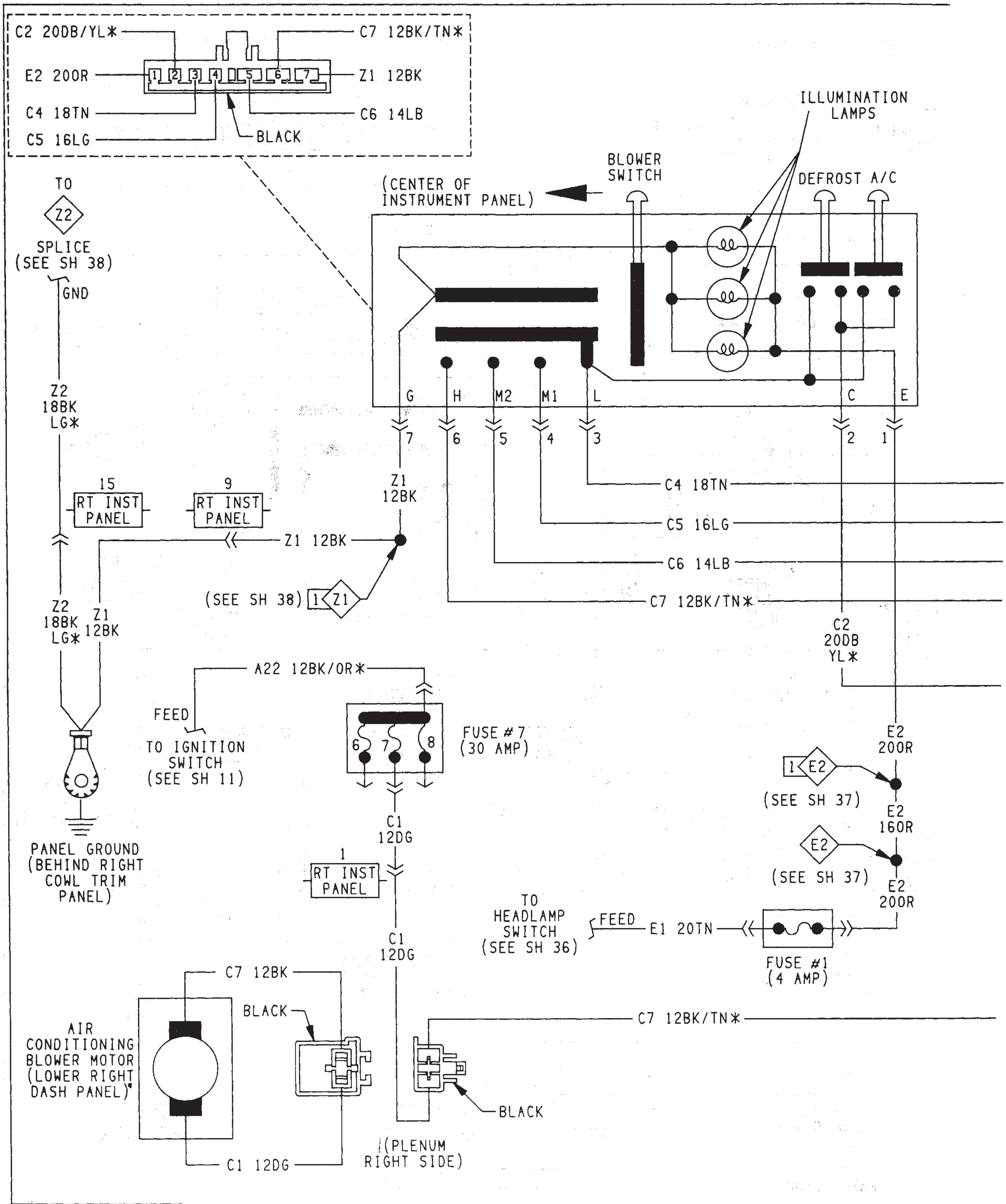
938W-6



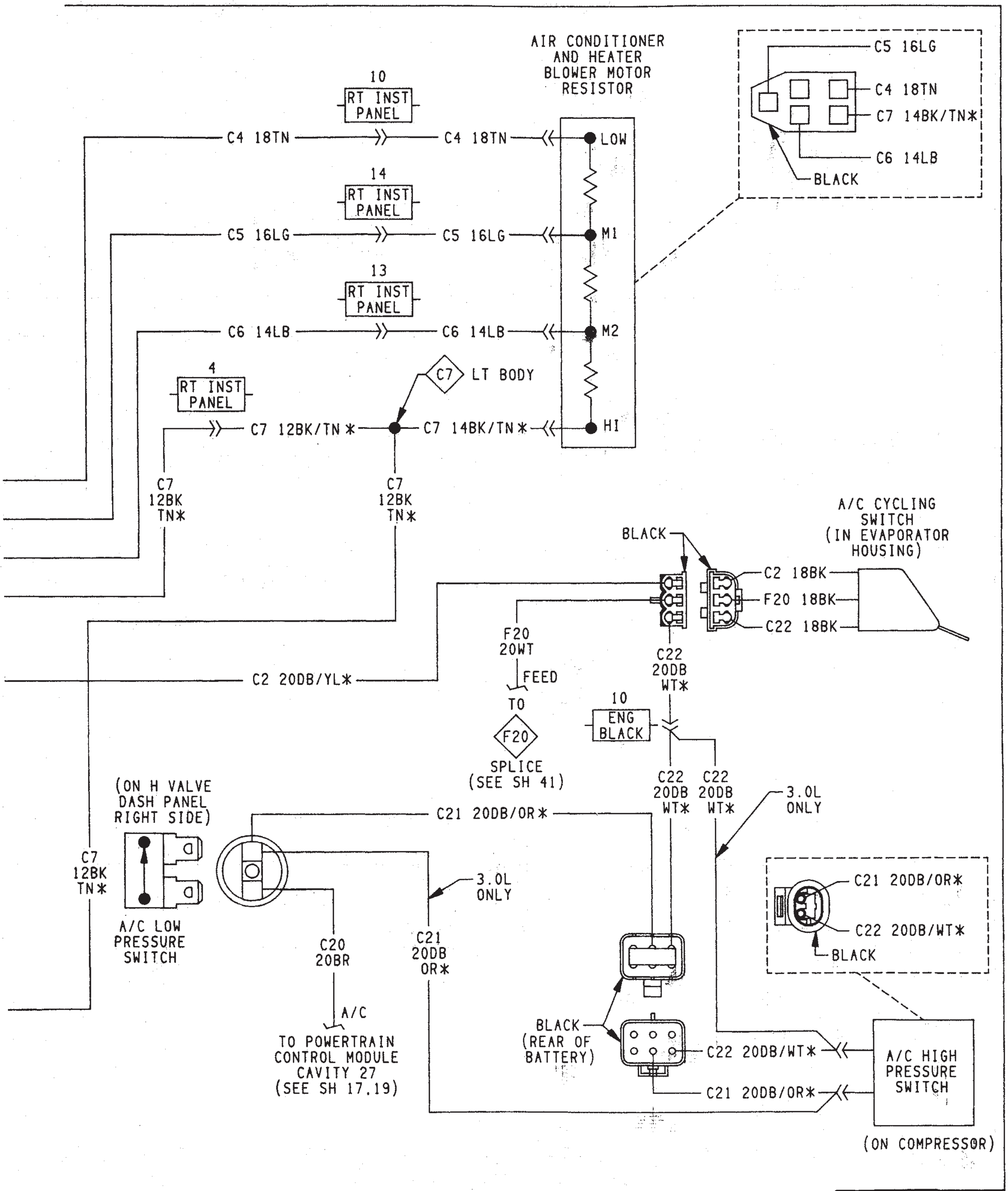
938W-6

HEATER SYSTEM

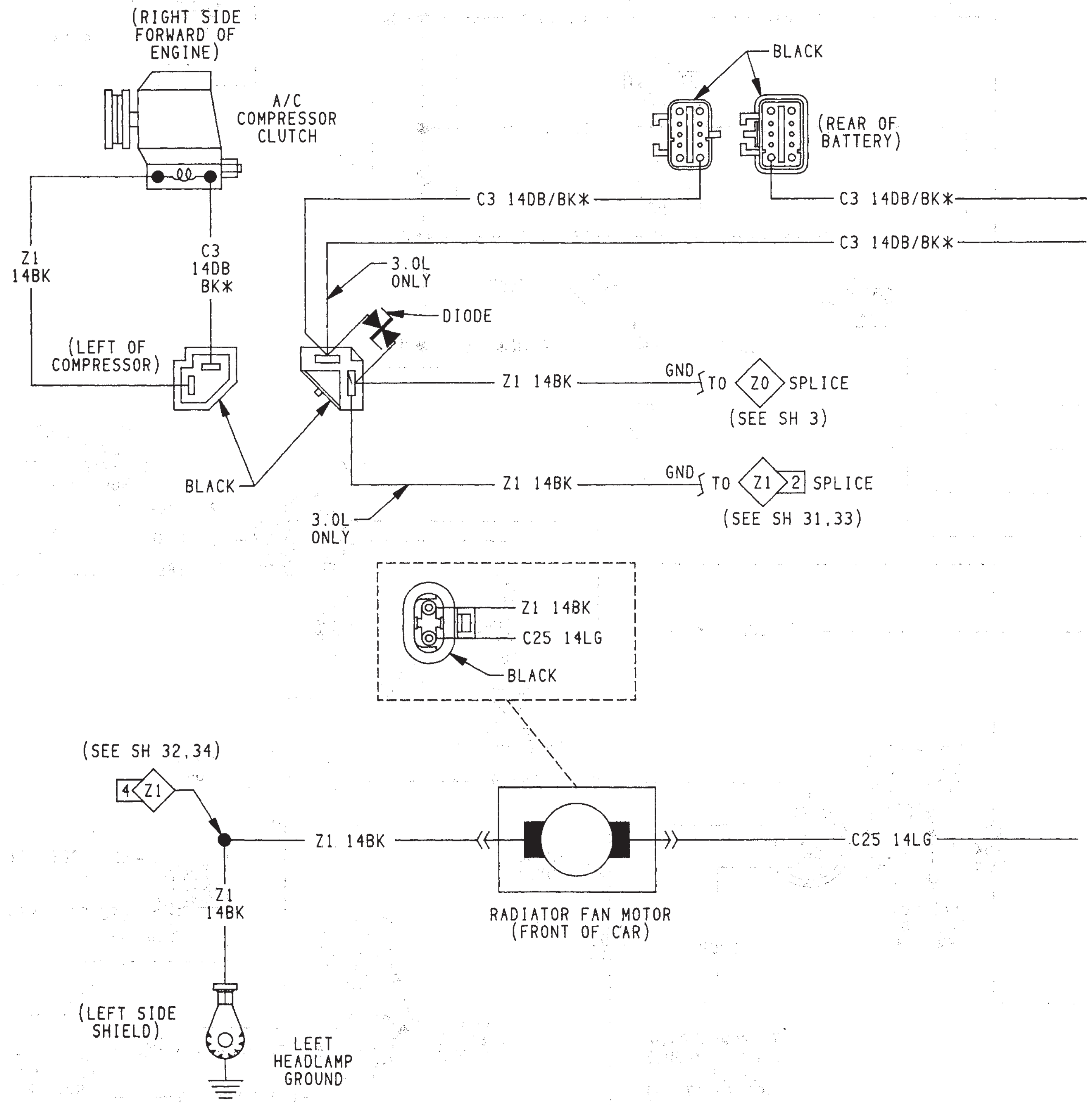
AP-PD 46



AP-PD 47 AIR CONDITIONING AND HEATER SYSTEM 938W-6



938W-6 AIR CONDITIONING AND HEATER SYSTEM AP-PD 48

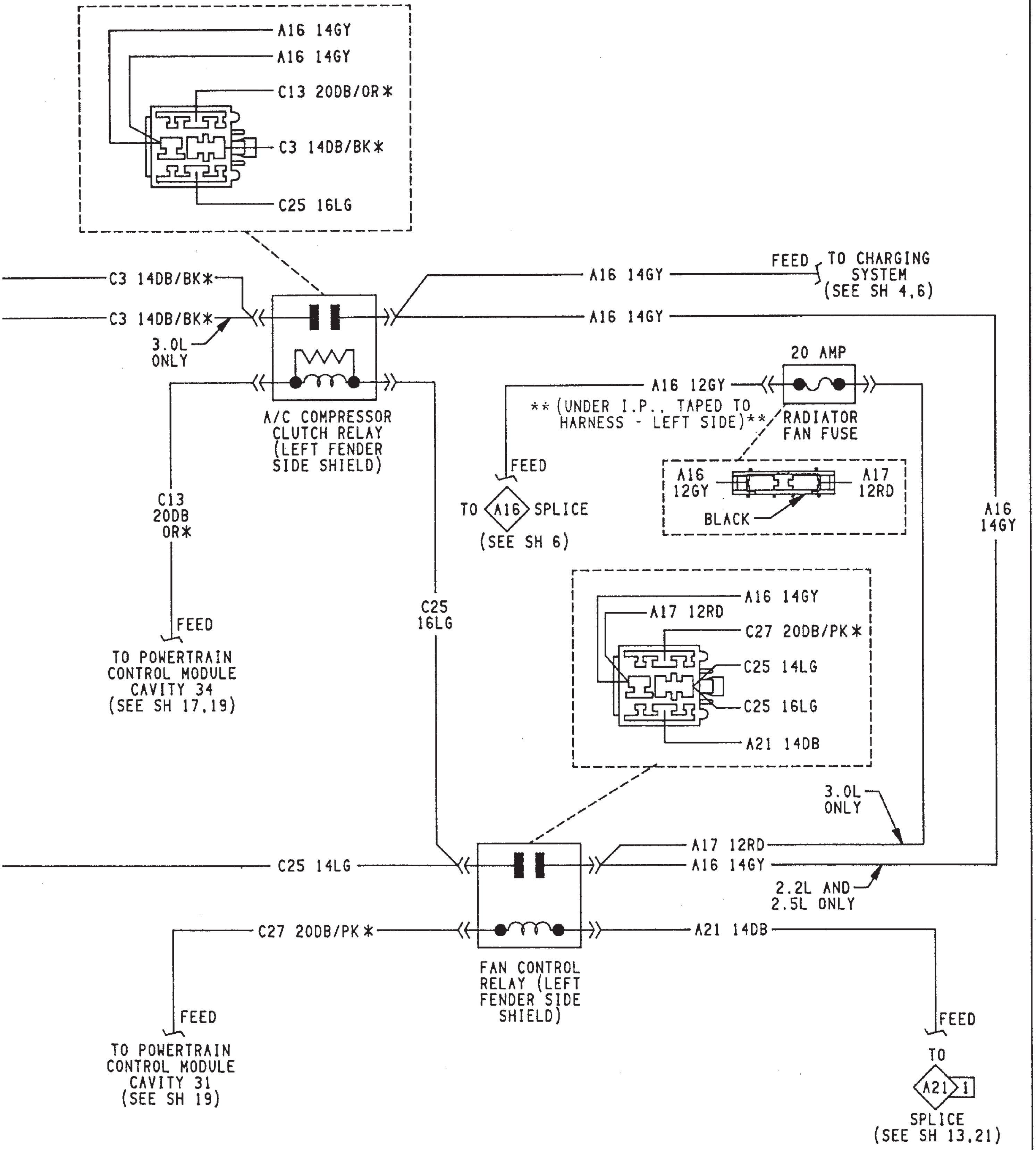


FAN CONTROL SYSTEM WITH AIR CONDITIONING AND HEATER SYSTEM

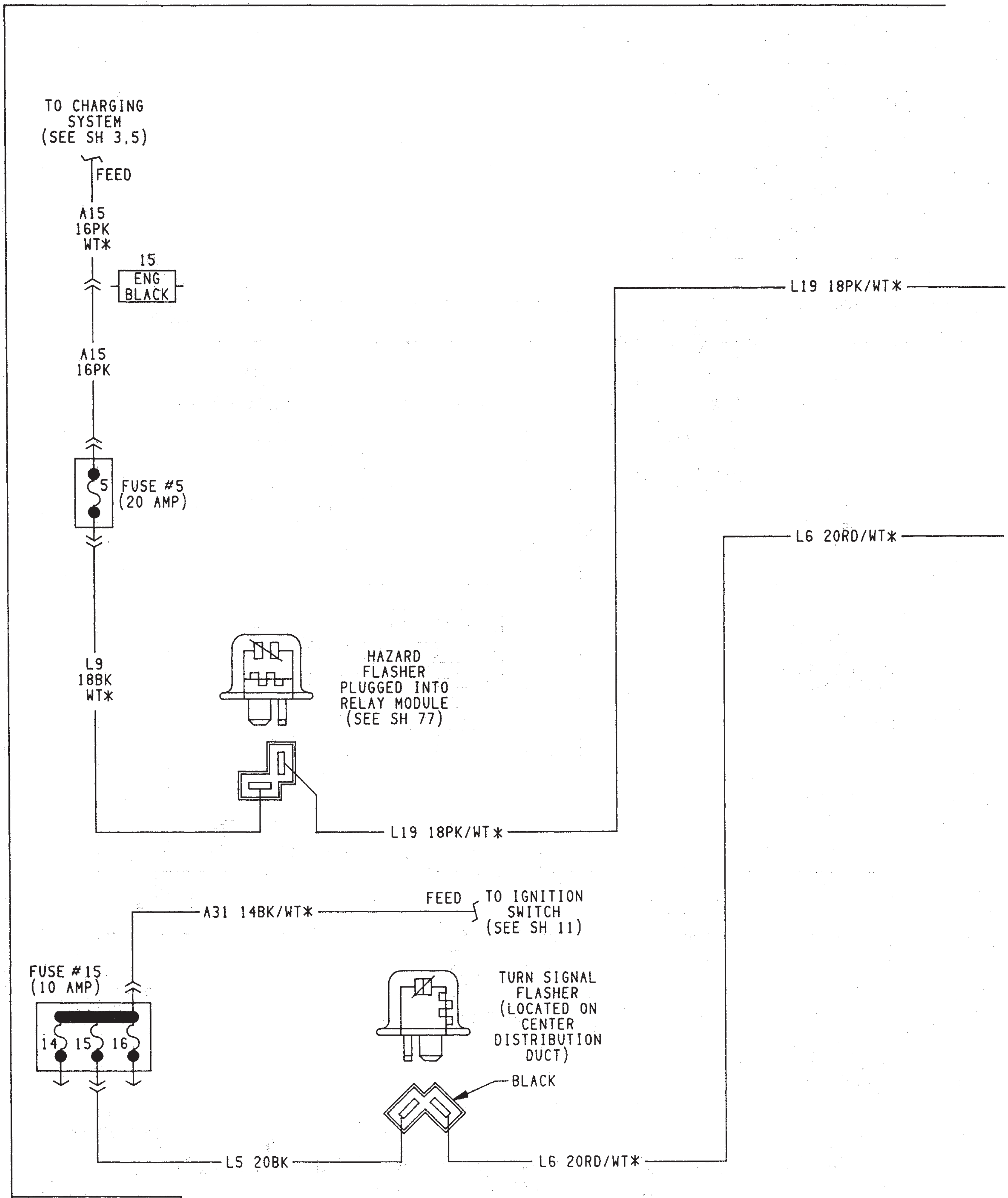
AP-PD 49

938W-6

1993 Front Wheel Drive Car
Publication No. 81-270-3103
TSB 08-56-93 November 12, 1993



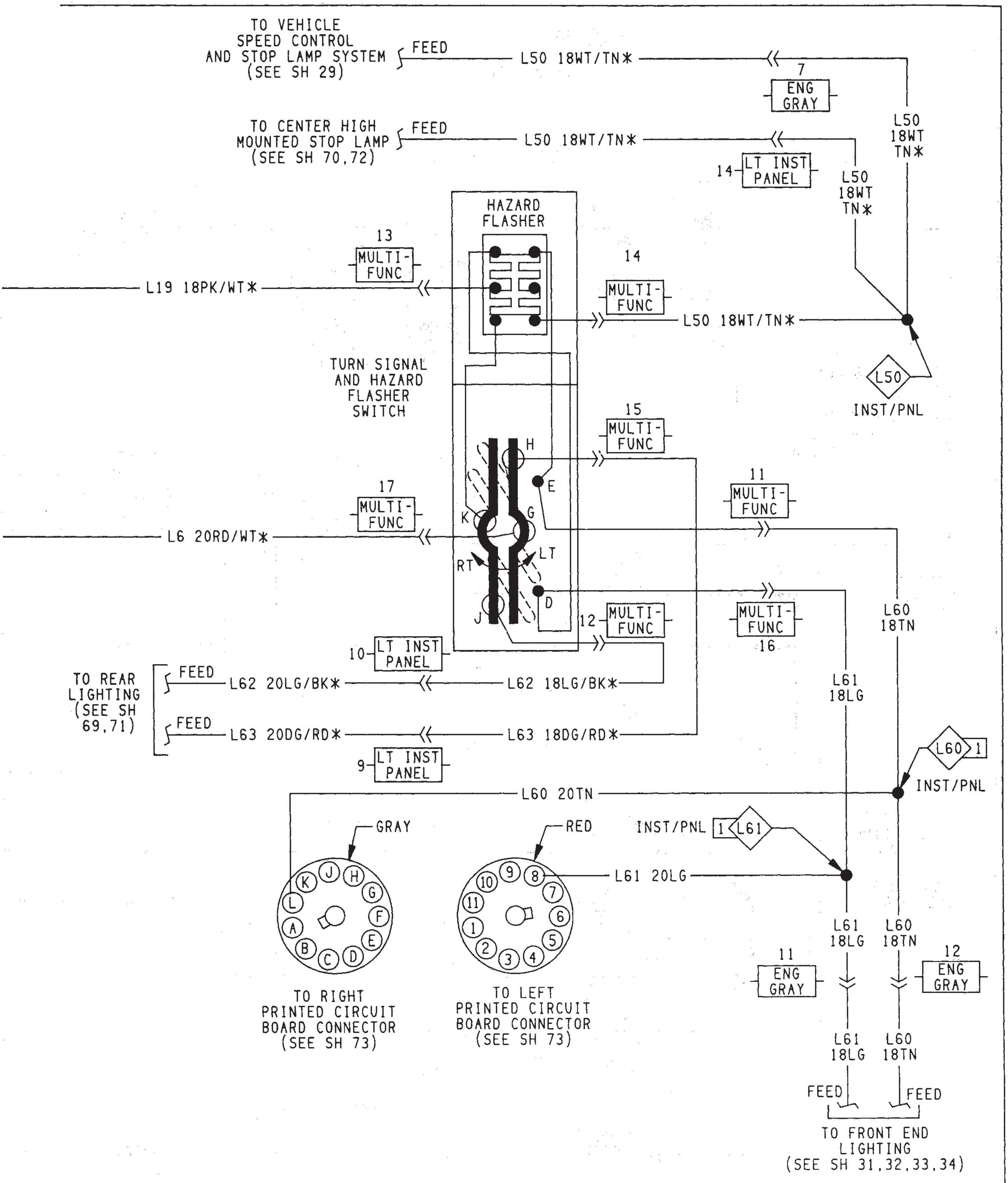
FAN CONTROL SYSTEM WITH AIR CONDITIONING
AND HEATER SYSTEM



AP-PD 51

TURN AND HAZARD FLASHER SYSTEMS

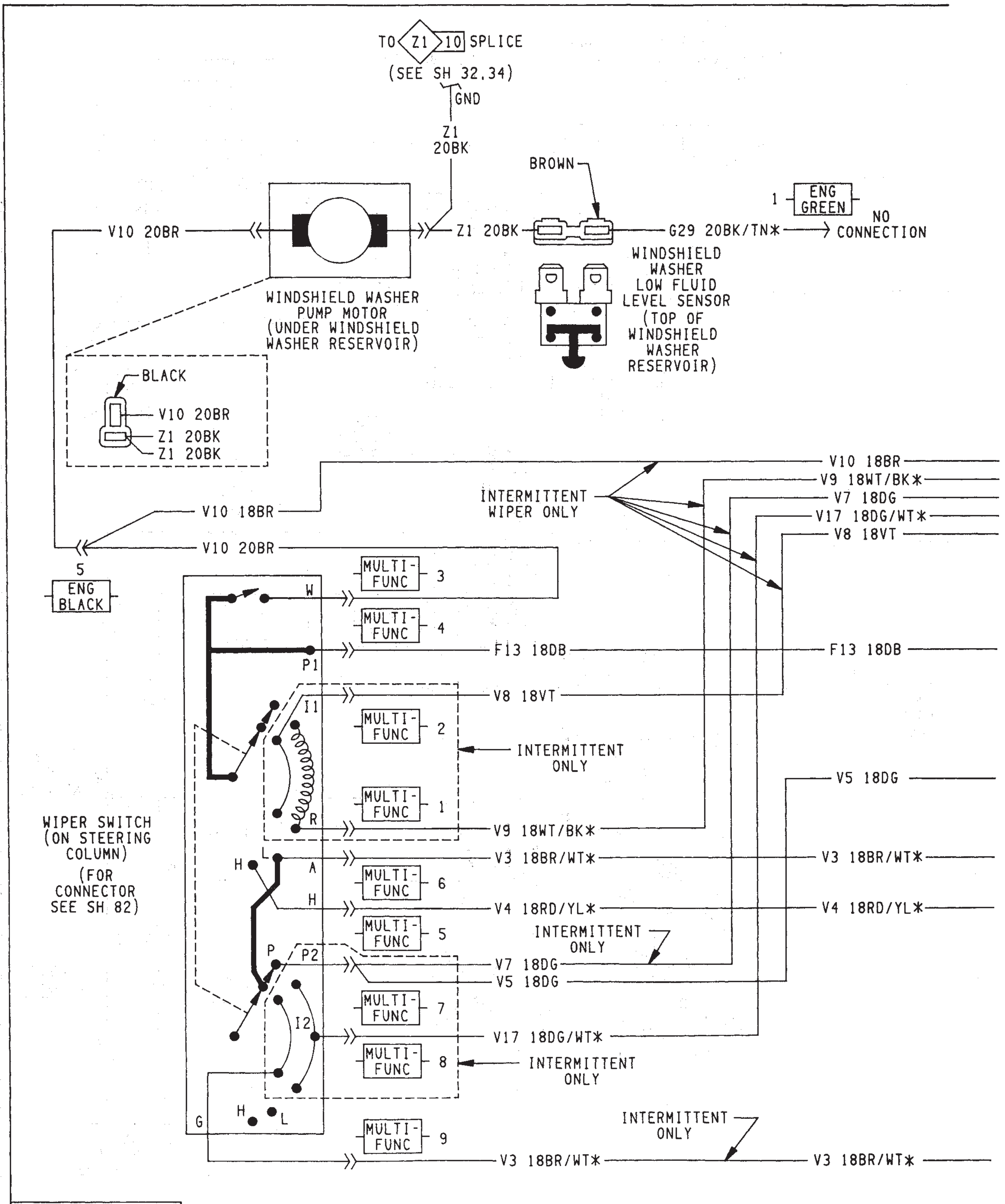
938W-6



938W-6

TURN AND HAZARD FLASHER SYSTEMS

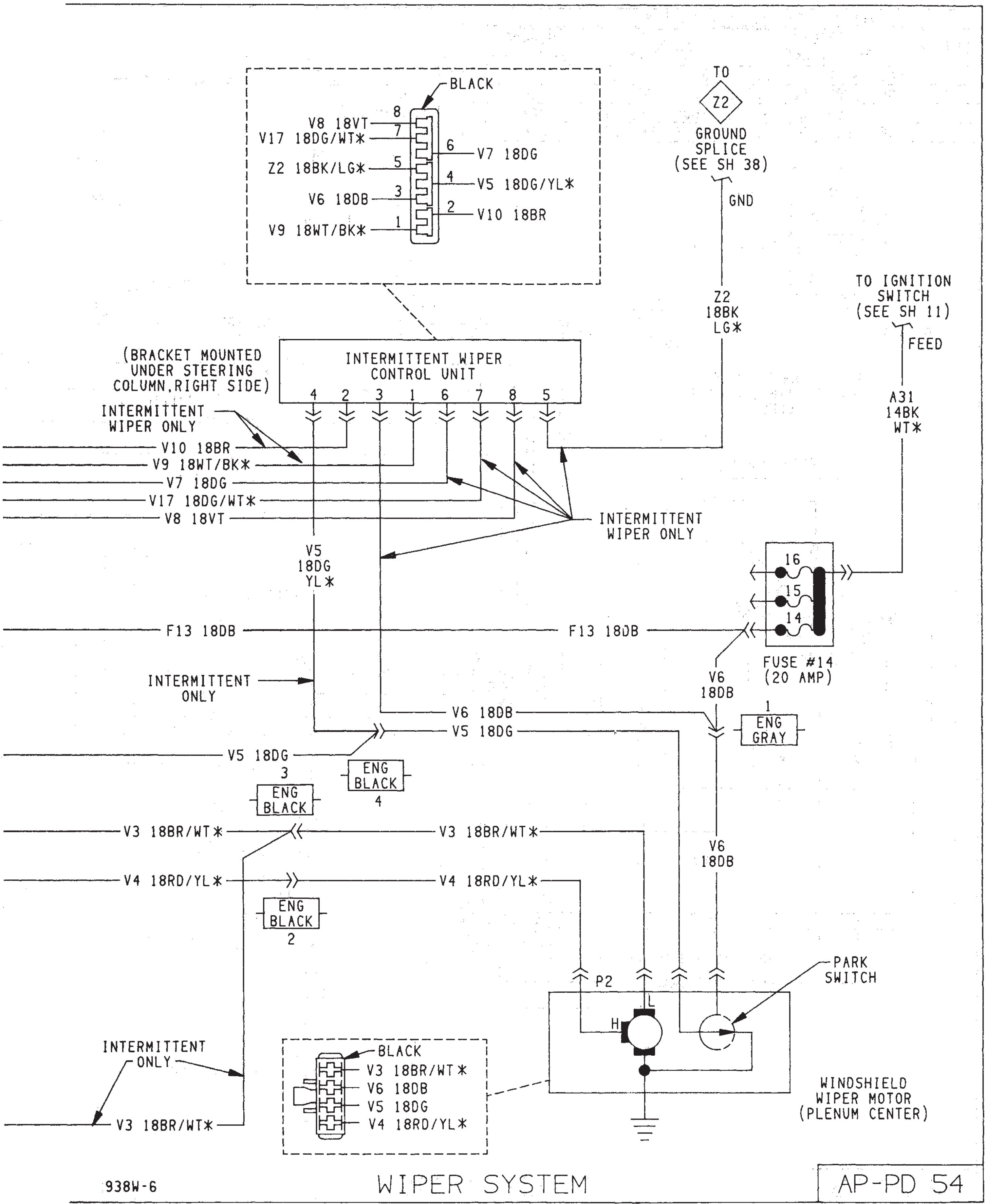
AP-PD 52



AP-PD 53

WIPER SYSTEM

938W-6

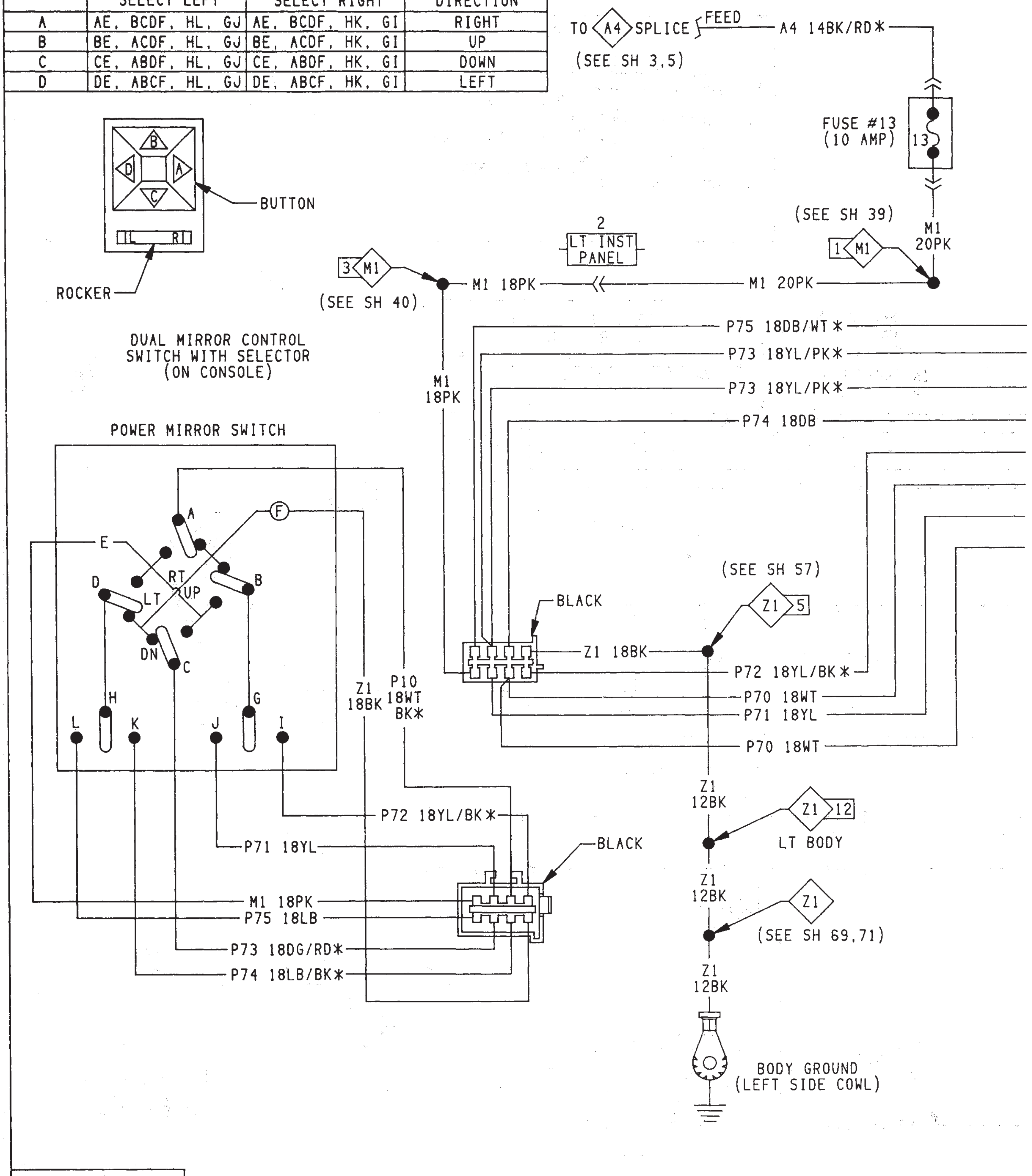


938W-6

WIPER SYSTEM

AP-PD 54

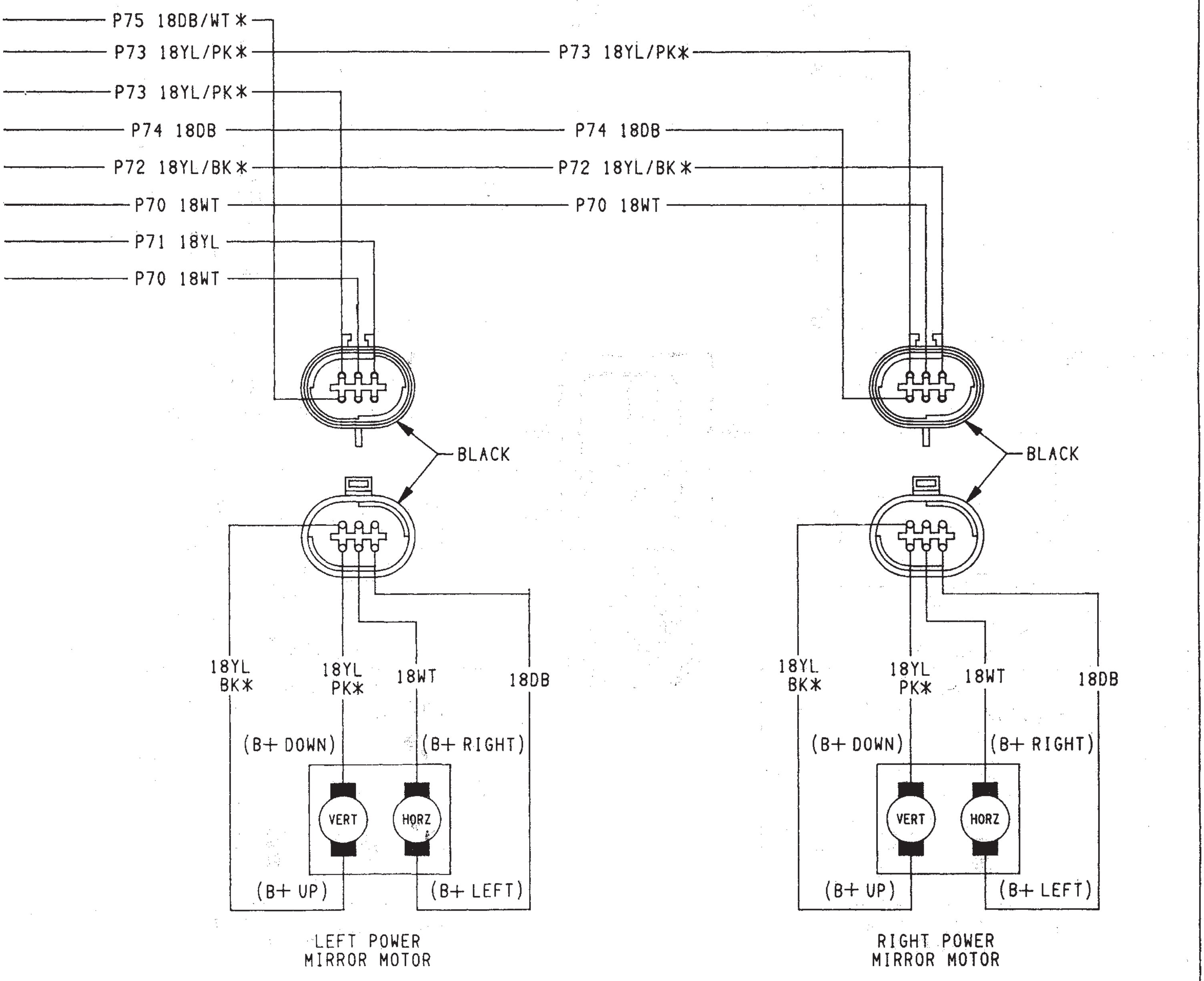
POWER MIRROR SWITCH FUNCTION			
BUTTON	CIRCUIT SELECT LEFT	CIRCUIT SELECT RIGHT	MIRROR DIRECTION
A	AE, BCDF, HL, GJ	AE, BCDF, HK, GI	RIGHT
B	BE, ACDF, HL, GJ	BE, ACDF, HK, GI	UP
C	CE, ABDF, HL, GJ	CE, ABDF, HK, GI	DOWN
D	DE, ABCF, HL, GJ	DE, ABCF, HK, GI	LEFT



AP-PD 55

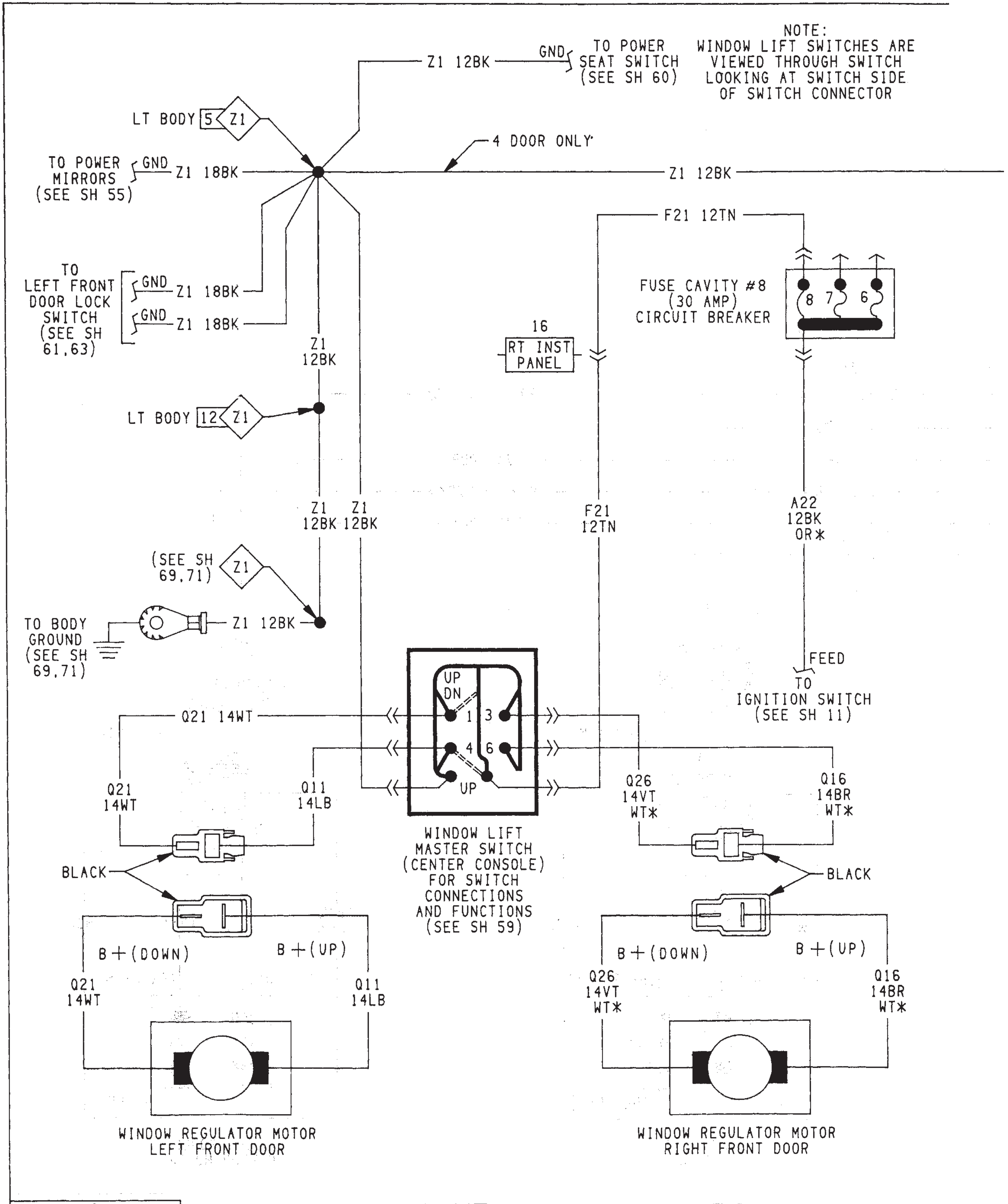
POWER MIRRORS

938W-6



938W-6

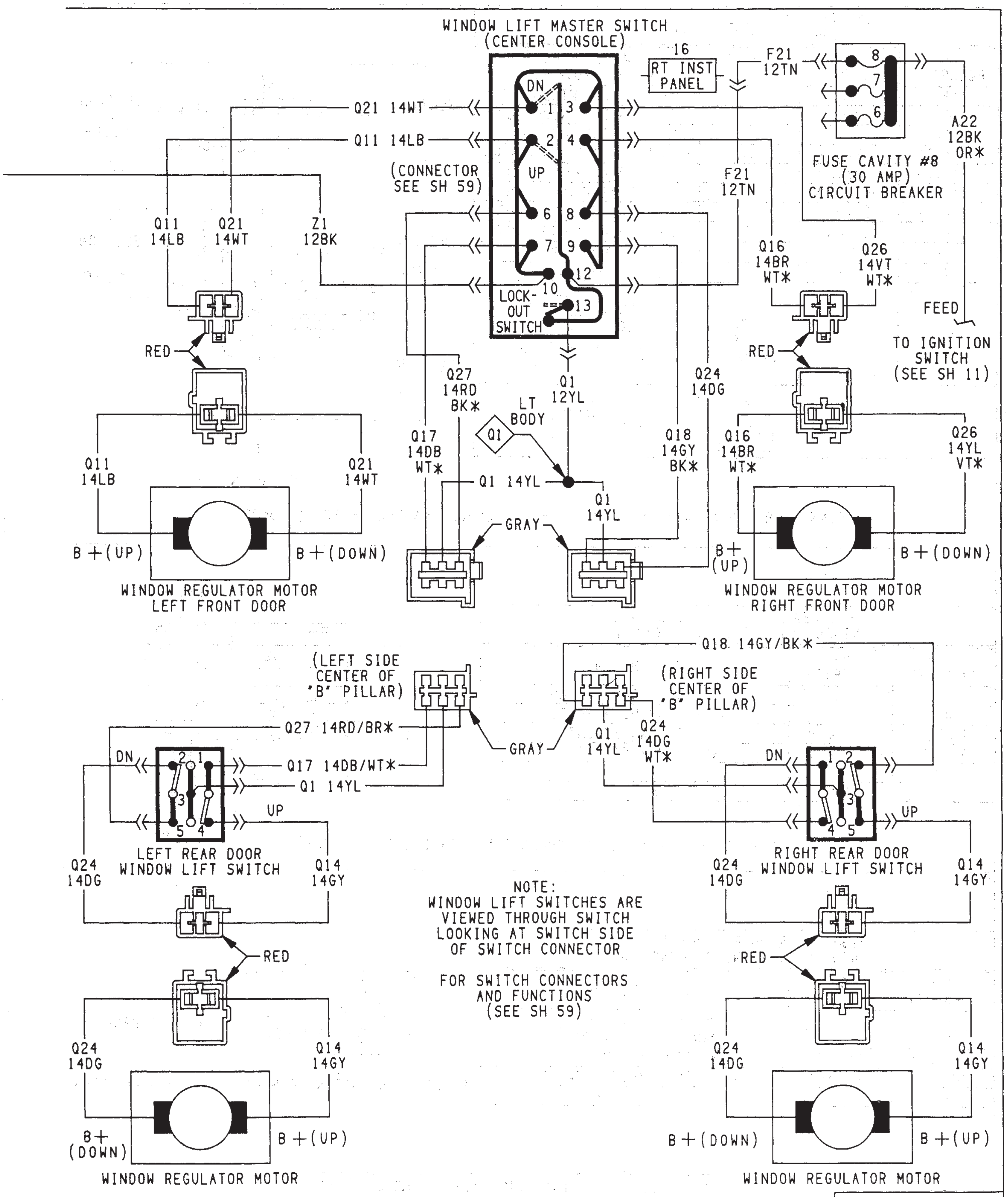
POWER MIRRORS



AP-PD 57

2 DOOR POWER WINDOW SYSTEM

938W-6



NOTE:
WINDOW LIFT SWITCHES ARE VIEWED THROUGH SWITCH LOOKING AT SWITCH SIDE OF SWITCH CONNECTOR

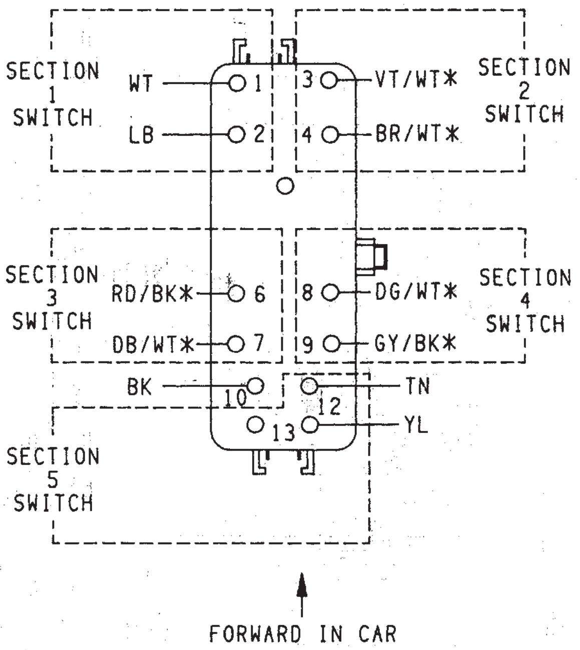
FOR SWITCH CONNECTORS AND FUNCTIONS (SEE SH 59)

938W-6

4 DOOR-POWER WINDOW SYSTEM

CENTER CONSOLE CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

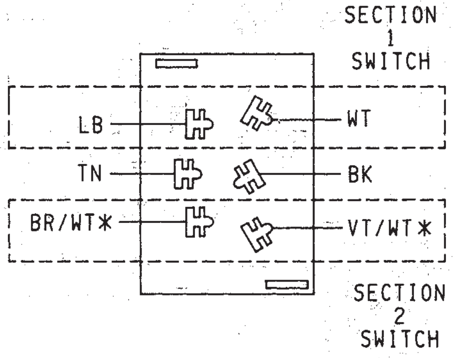
B+ POLARITY	B− POLARITY	SWITCH SECTION	WINDOW AND WINDOW MOVEMENT
LB	WT	1	LEFT FRONT WINDOW UP
WT	LB	1	LEFT FRONT WINDOW DOWN
BR/WT*	VT/WT*	2	RIGHT FRONT WINDOW UP
VT/WT*	BR/WT*	2	RIGHT FRONT WINDOW DOWN
DB/WT*	RD/BK*	3	LEFT REAR WINDOW UP
RD/BK*	DB/WT*	3	LEFT REAR WINDOW DOWN
GY/BK*	DG/WT*	4	RIGHT REAR WINDOW UP
DG/WT*	GY/BK*	4	RIGHT REAR WINDOW DOWN
---	BK	N/A	GROUND B−
TN	---	5	FEED B+
OPEN	---	5 SWITCH ROCKER INBOARD	RIGHT FRONT AND BOTH REAR WINDOW LIFT SWITCHES LOCKED OUT OF SYSTEM
YL	---	5 SWITCH ROCKER CENTERED	ALL WINDOW LIFT SWITCHES IN SYSTEM



CONNECTOR-5 GANG WITH LOCK-OUT CENTER CONSOLE MASTER SWITCH (4 DOOR)

LEFT REAR DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

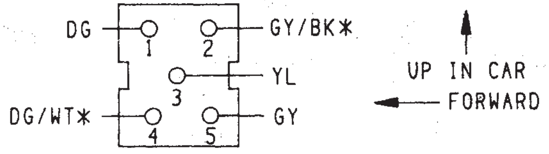
B+ POLARITY	B− POLARITY	WINDOW MOVEMENT
LB	WT	UP FROM DOOR SWITCH
WT	LB	DOWN FROM DOOR SWITCH
BR/WT*	VT/WT*	UP FROM MASTER SWITCH
VT/WT*	BR/WT*	DOWN FROM MASTER SWITCH
TN	---	FEED B+
---	BK	GROUND B−



CONNECTOR-2 GANG CENTER CONSOLE MASTER SWITCH (2 DOOR)

RIGHT REAR DOOR CONNECTOR AND WINDOW LIFT SWITCH FUNCTION

B+ POLARITY	B− POLARITY	WINDOW MOVEMENT
GY	DG	UP FROM DOOR SWITCH
DG	GY	DOWN FROM DOOR SWITCH
GY/BK*	DG/WT*	UP FROM MASTER SWITCH
DG/WT*	GY/BK*	DOWN FROM MASTER SWITCH
YL	---	FEED B+



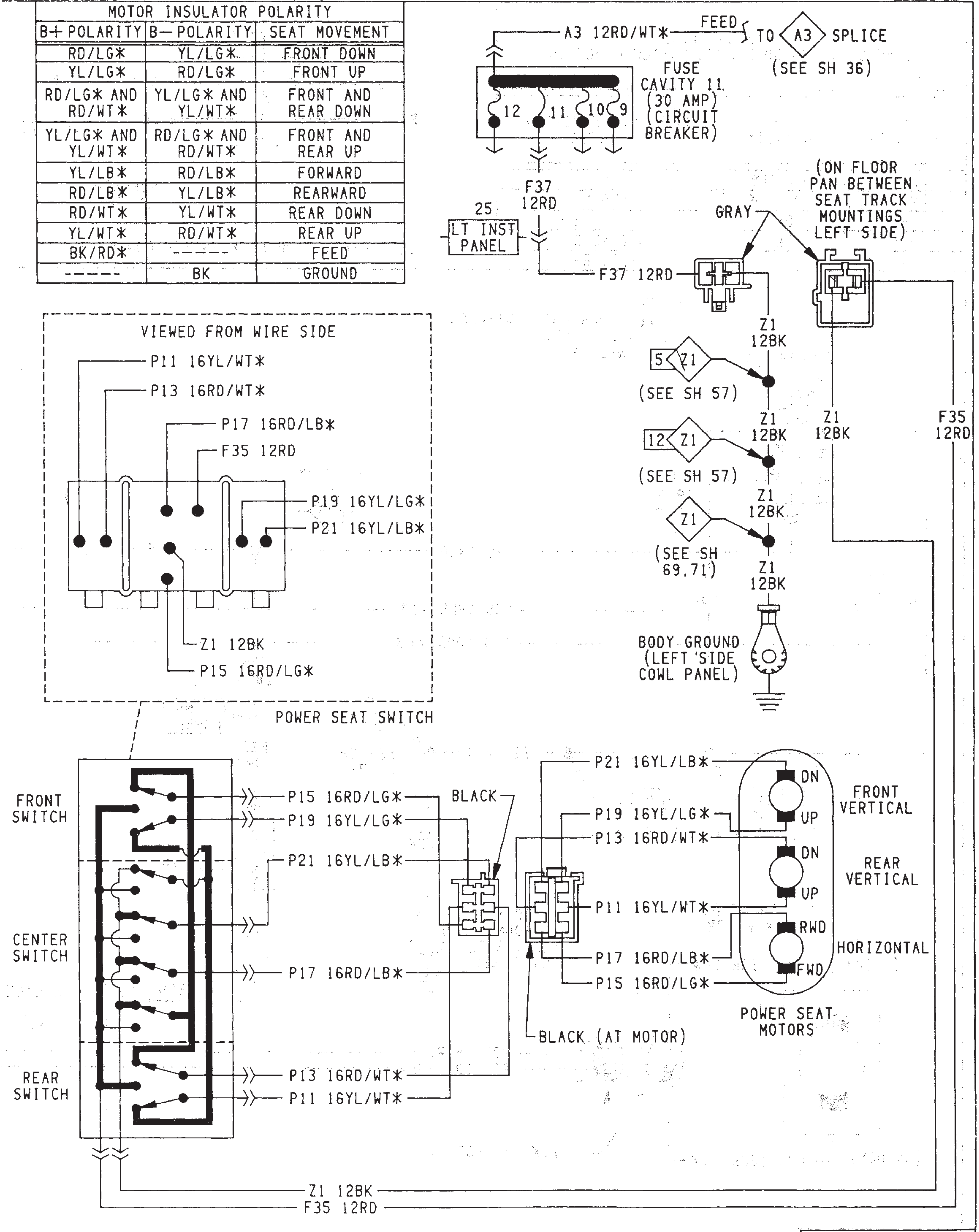
RIGHT REAR DOOR WINDOW LIFT SWITCH CONNECTOR

POWER WINDOW CONNECTOR AND SWITCH FUNCTION

AP-PD 59

938W-6

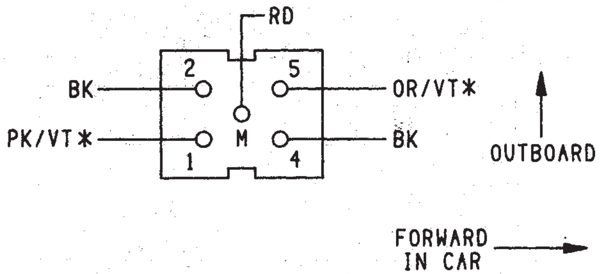
MOTOR INSULATOR POLARITY		
B+ POLARITY	B− POLARITY	SEAT MOVEMENT
RD/LG*	YL/LG*	FRONT DOWN
YL/LG*	RD/LG*	FRONT UP
RD/LG* AND RD/WT*	YL/LG* AND YL/WT*	FRONT AND REAR DOWN
YL/LG* AND YL/WT*	RD/LG* AND RD/WT*	FRONT AND REAR UP
YL/LB*	RD/LB*	FORWARD
RD/LB*	YL/LB*	REARWARD
RD/WT*	YL/WT*	REAR DOWN
YL/WT*	RD/WT*	REAR UP
BK/RD*	-----	FEED
-----	BK	GROUND



LEFT BUCKET POWER SEAT SYSTEM

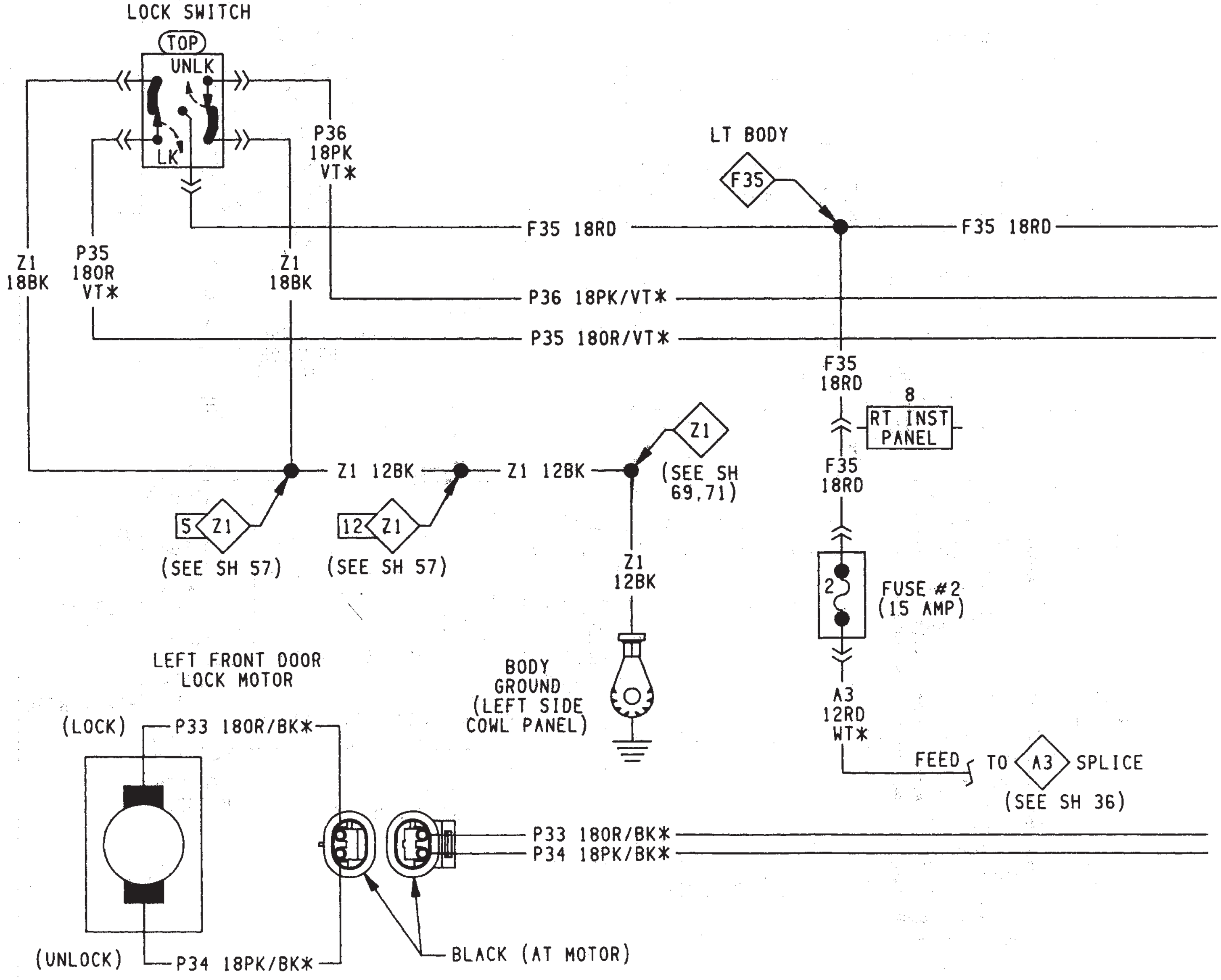
LEFT FRONT DOOR
CONNECTOR AND DOOR LOCK SWITCH FUNCTION

B+ POLARITY	B− POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR/VT*	PK/VT*	LOCK
PK/VT*	OR/VT*	UNLOCK
—	BK	GROUND B−
—	BK	GROUND B−
RD	—	FEED B+



LEFT FRONT DOOR LOCK SWITCH CONNECTOR

*NOTE
POWER DOOR LOCK SWITCHES
ARE VIEWED FROM
TERMINAL END



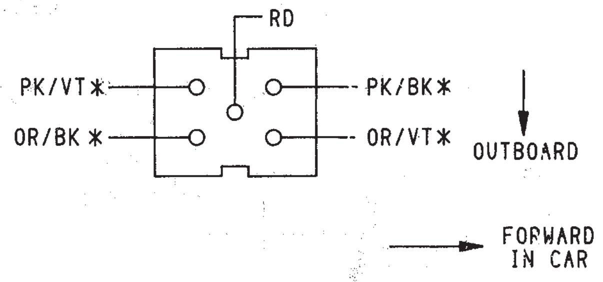
AP-PD 61

2 DOOR POWER LOCK SYSTEM

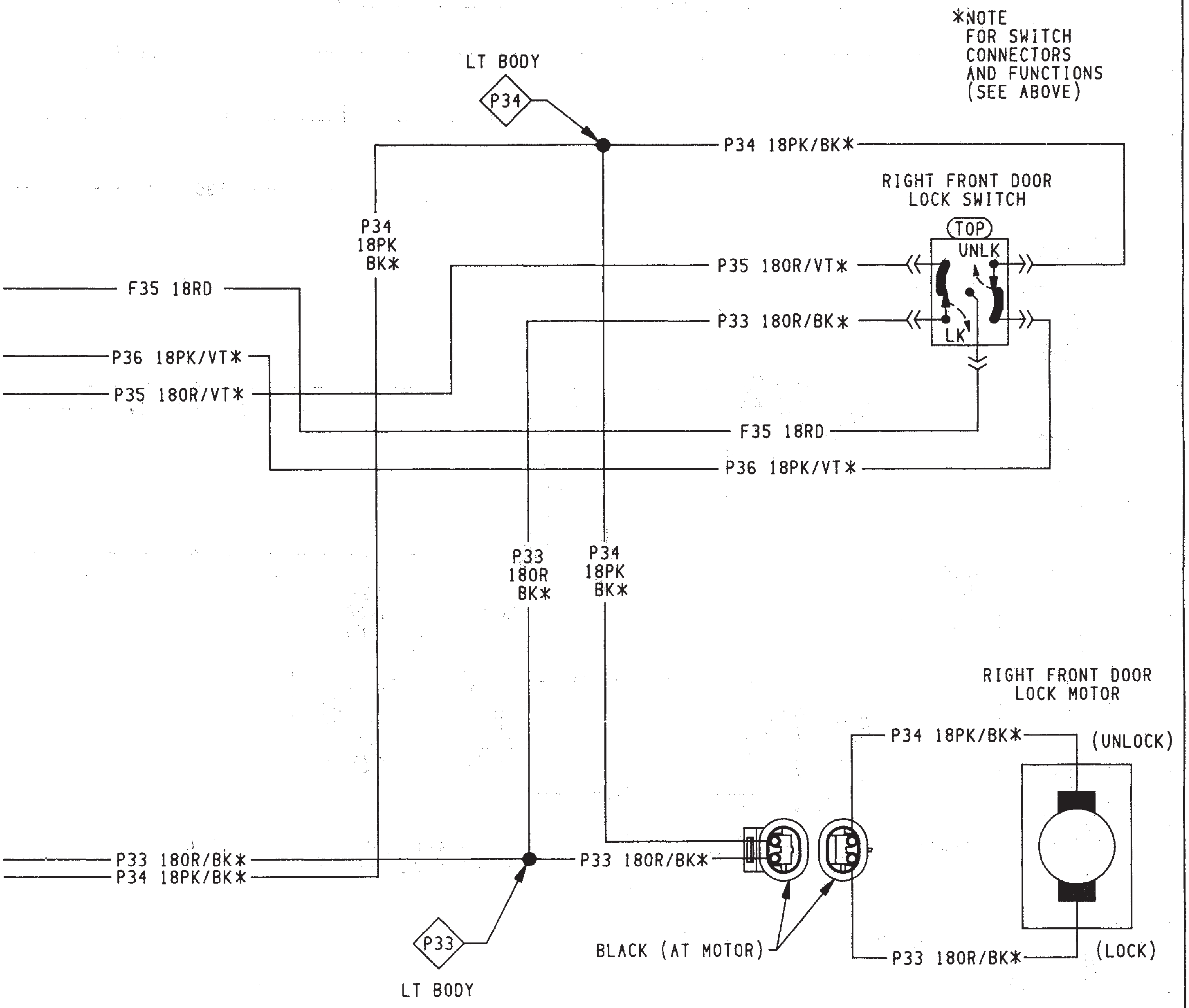
938W-6

RIGHT FRONT DOOR CONNECTOR AND DOOR LOCK SWITCH FUNCTION

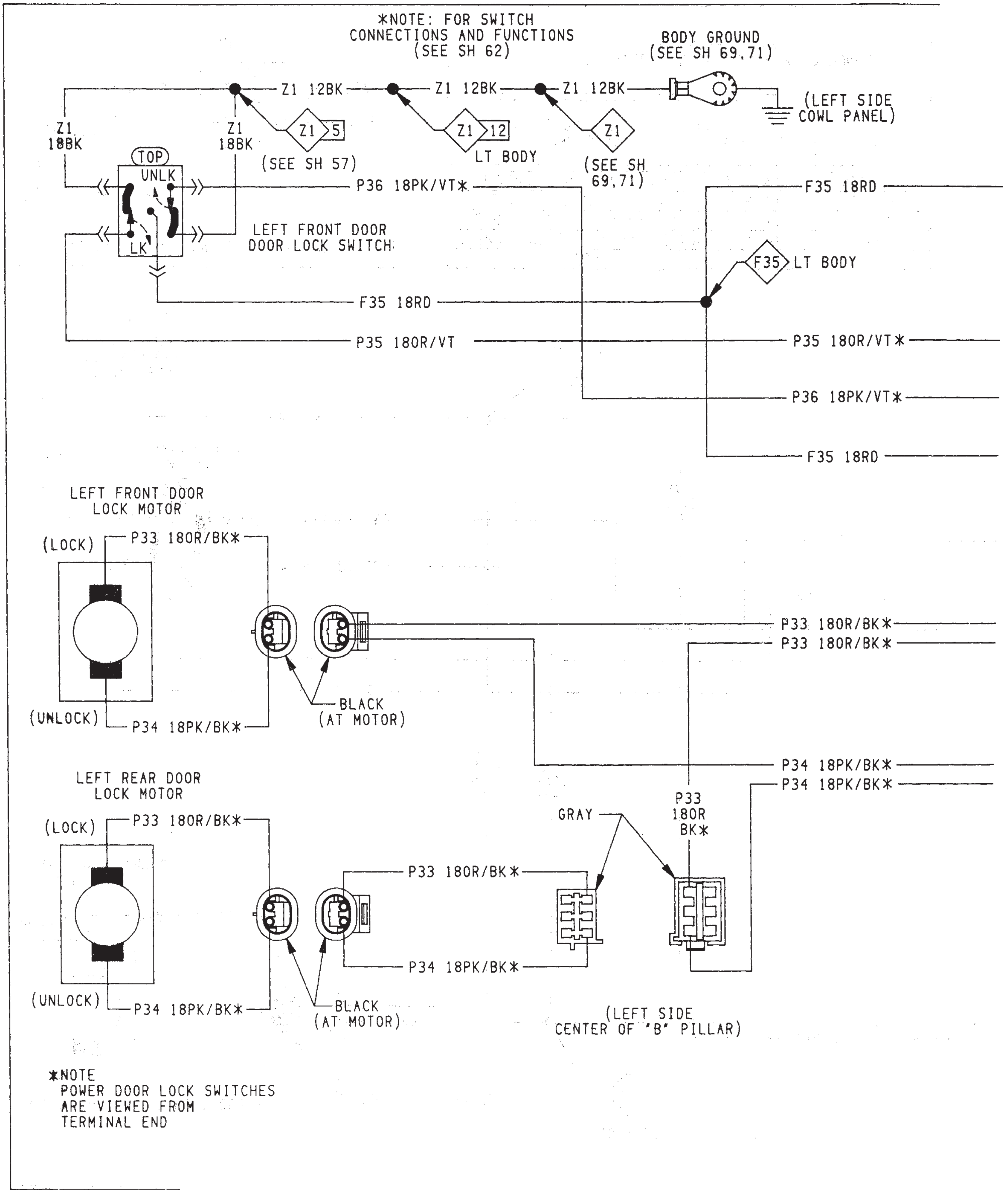
B+ POLARITY	B− POLARITY	DOOR LOCK FUNCTION ALL DOORS
OR/BK*	PK/VT*	LOCK FROM DOOR SWITCH
PK/VT*	OR/BK*	UNLOCK FROM DOOR SWITCH
OR/VT*	PK/VT*	LOCK FROM LEFT DOOR SWITCH
PK	OR/VT*	UNLOCK FROM LEFT DOOR SWITCH
RD	—	FEED B+



RIGHT FRONT DOOR LOCK SWITCH CONNECTOR



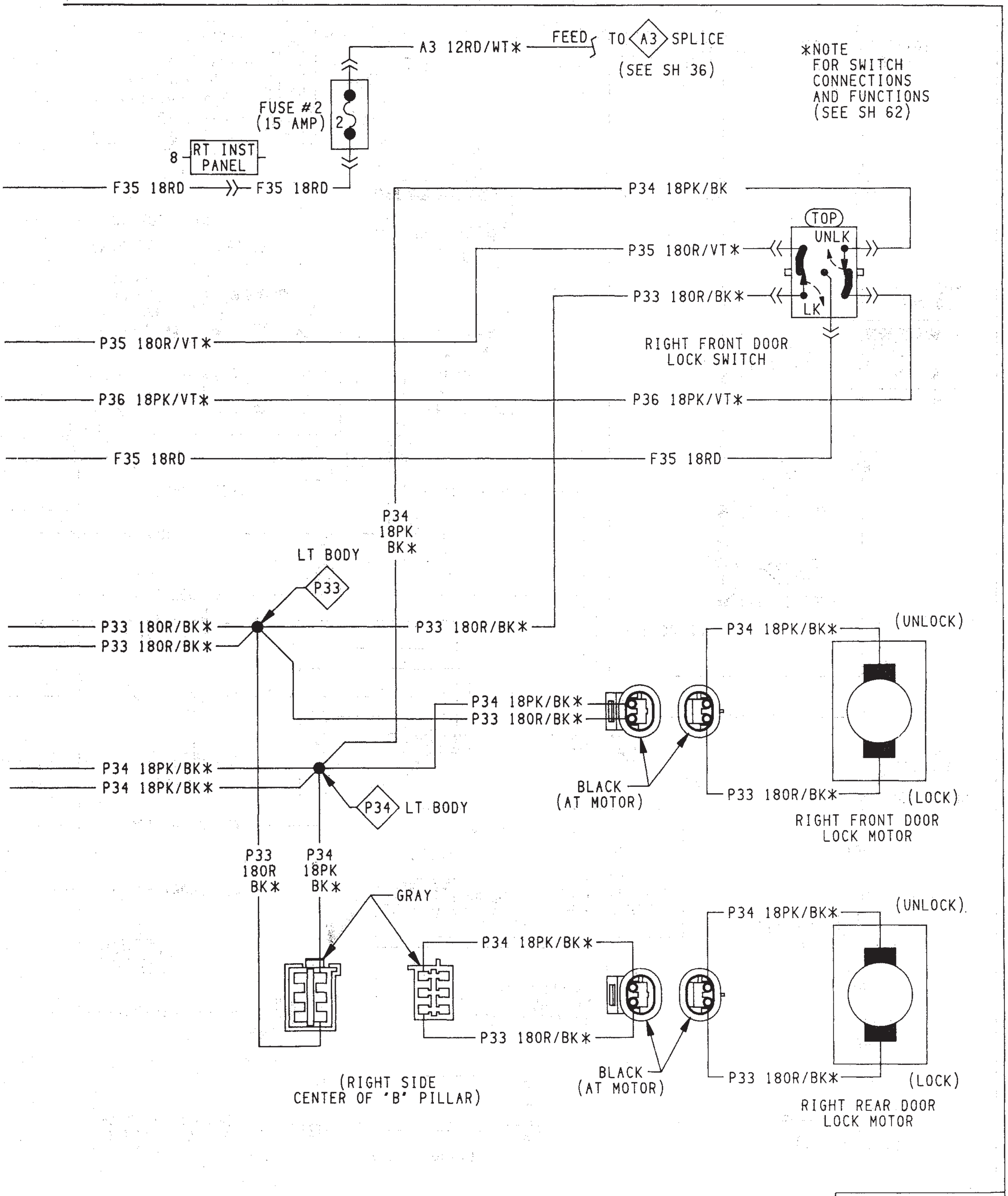
2 DOOR POWER LOCK SYSTEM



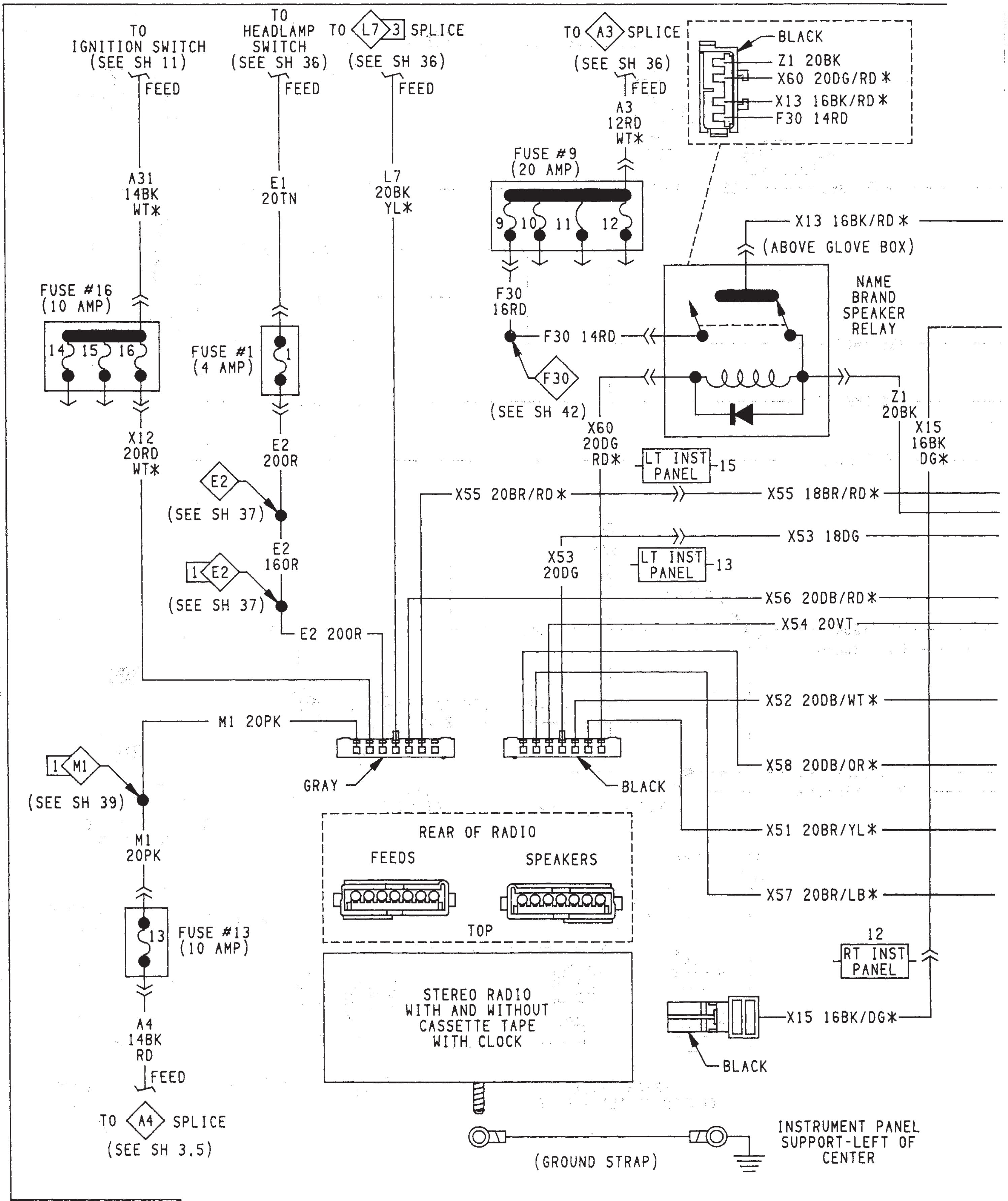
AP-PD 63

4 DOOR POWER LOCK SYSTEM

938W-6



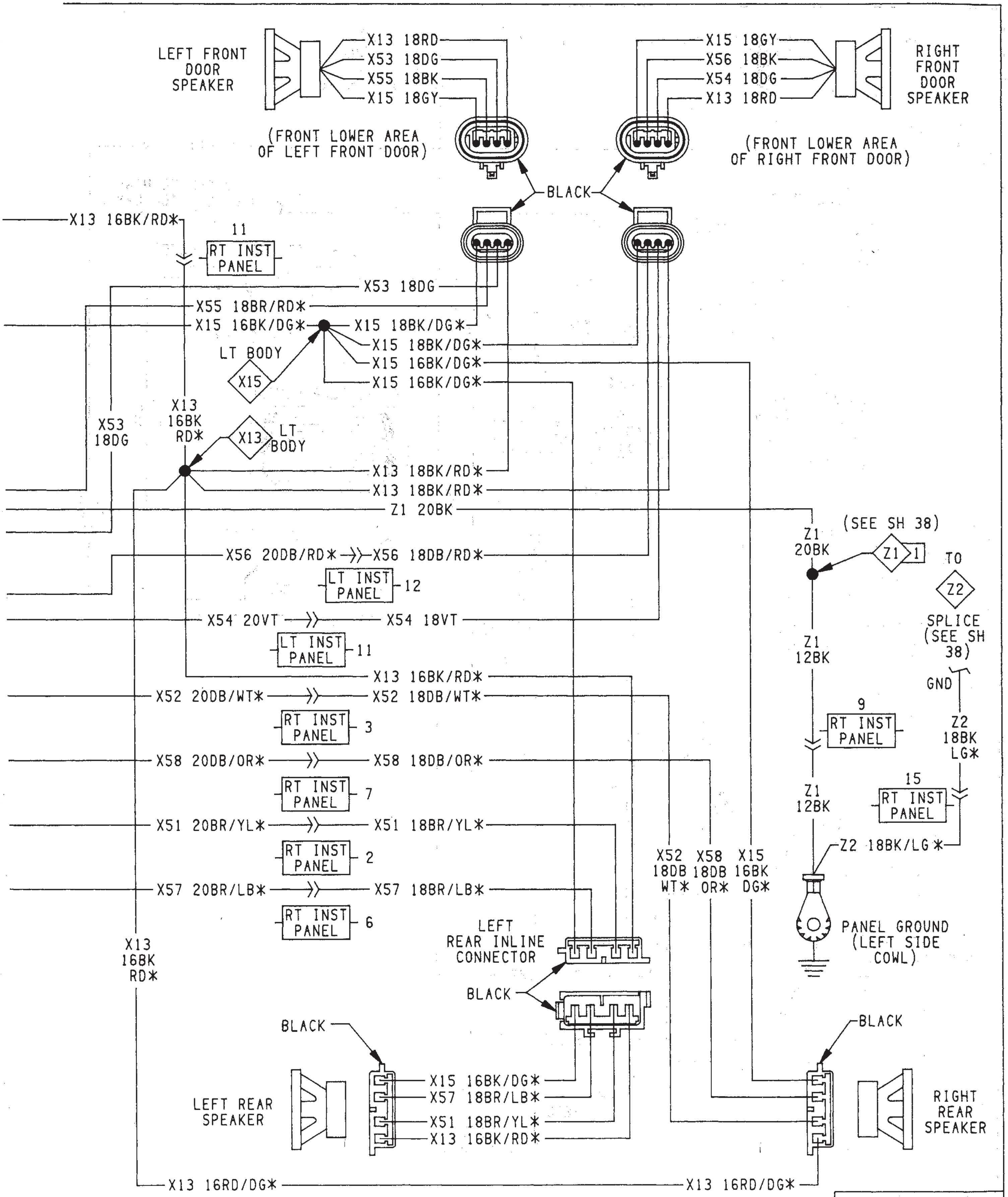
4 DOOR POWER LOCK SYSTEM



AP-PD 65

STEREO RADIO

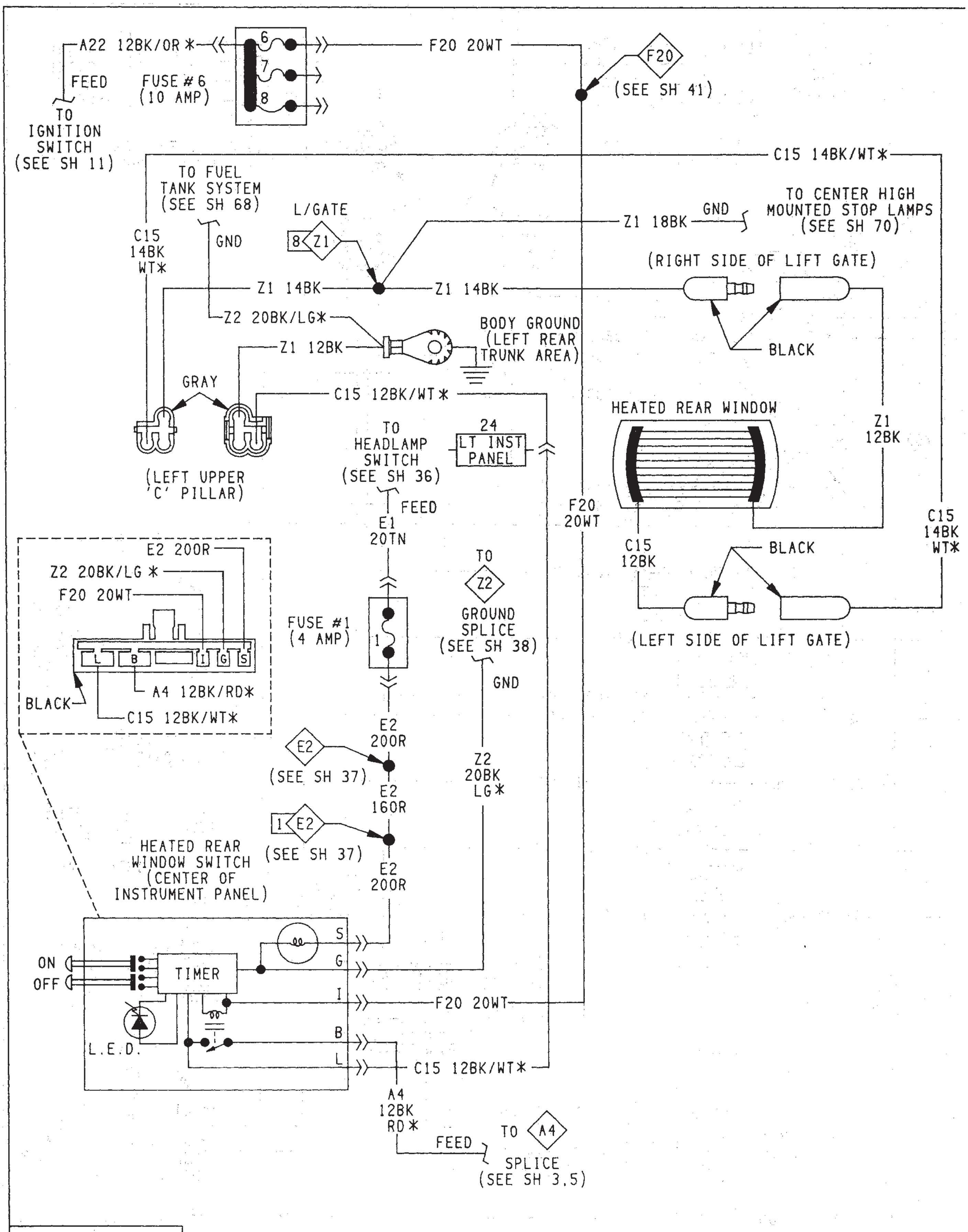
938W-6



938W-6

DOOR AND REAR SPEAKERS

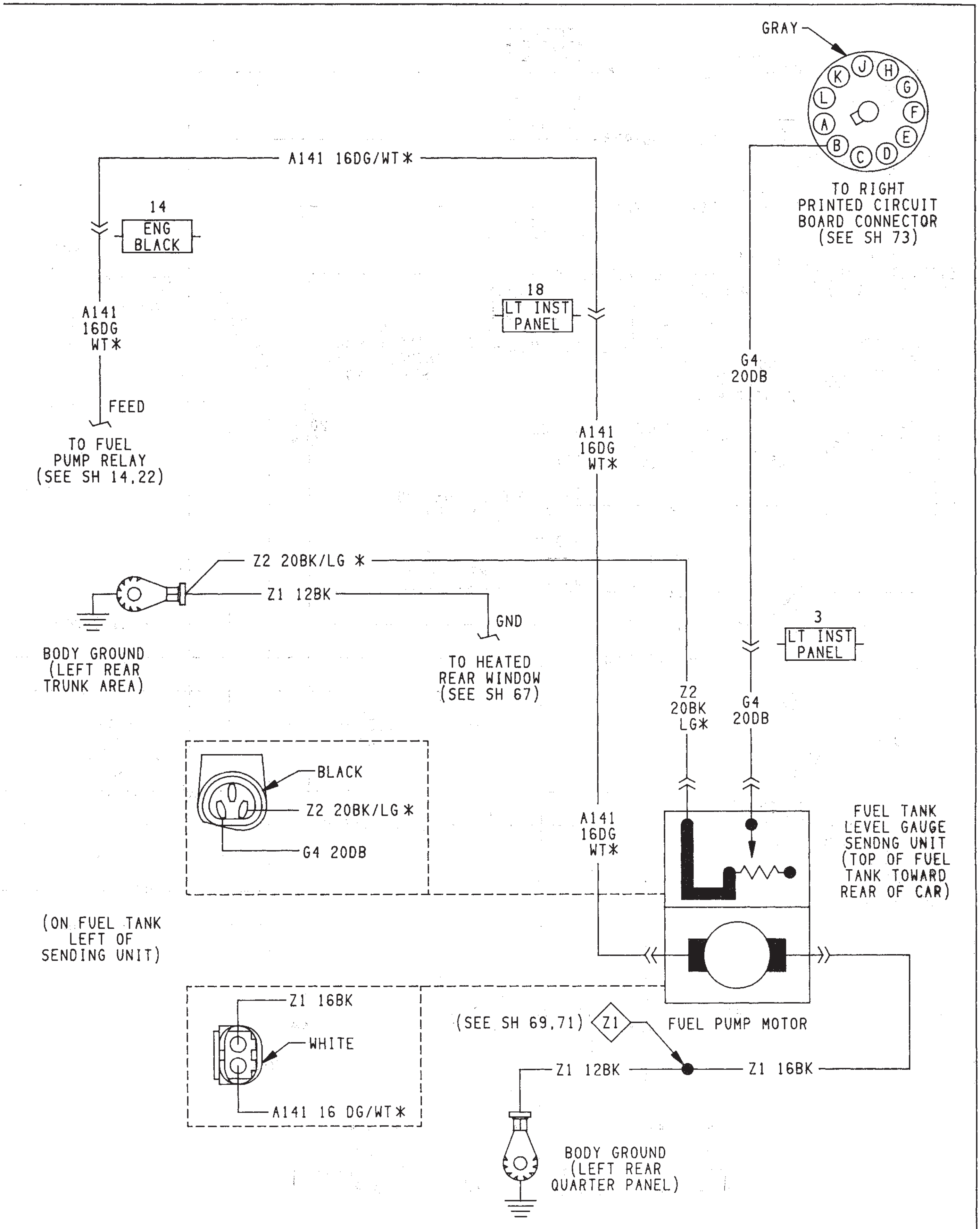
AP-PD 66



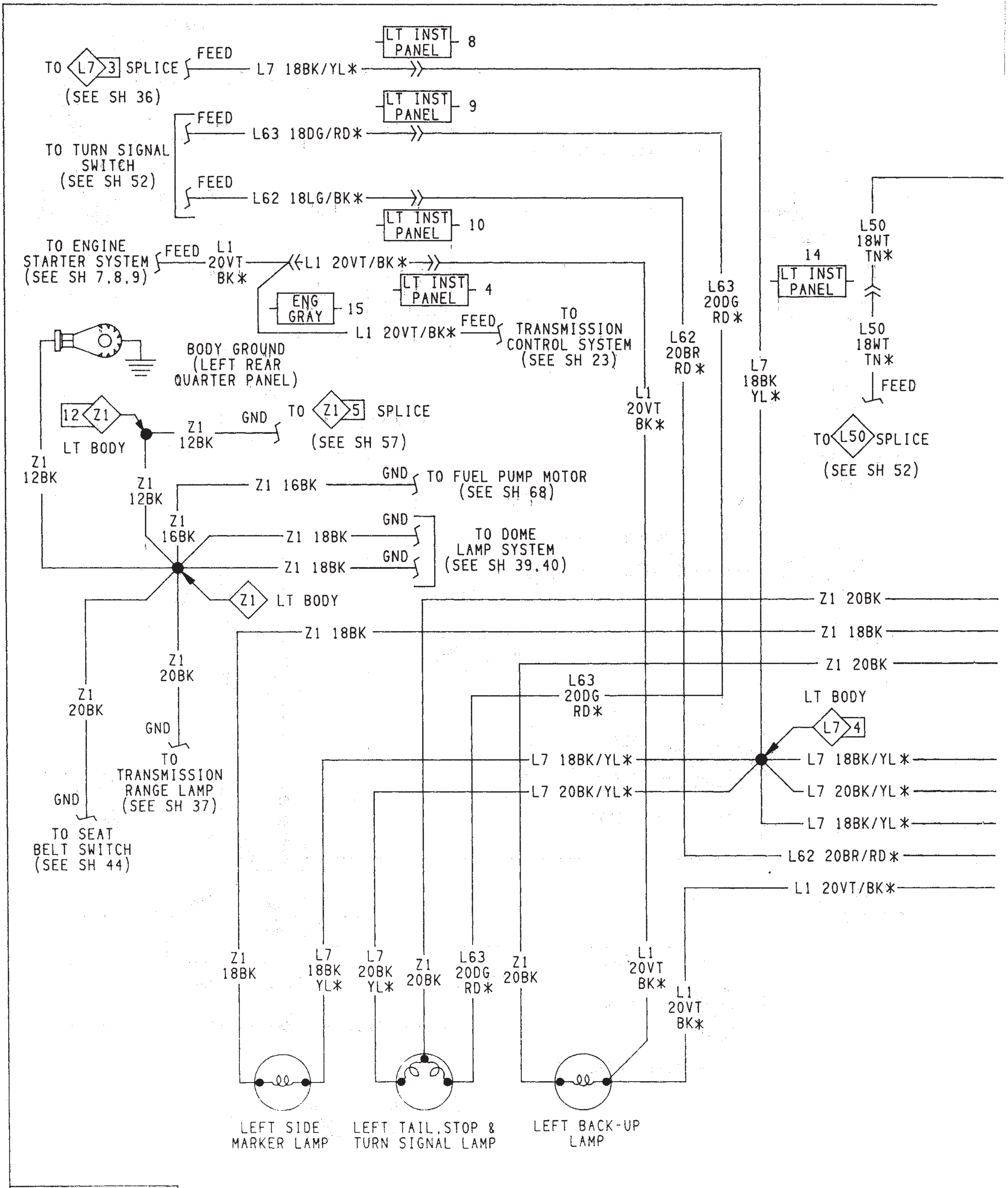
AP-PD 67

HEATED REAR WINDOW

938W-6



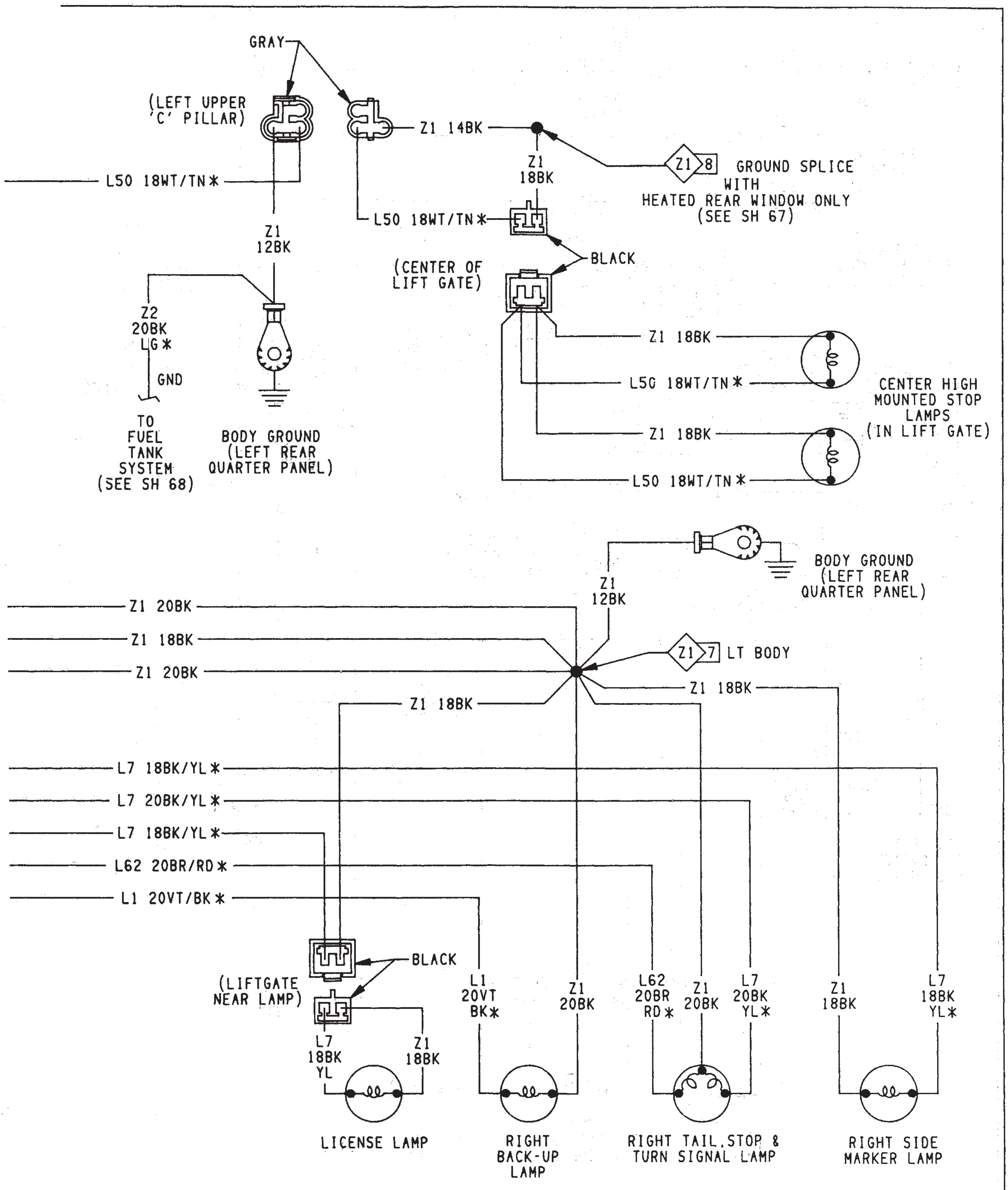
FUEL TANK SYSTEM



AP-PD 69

REAR LIGHTING

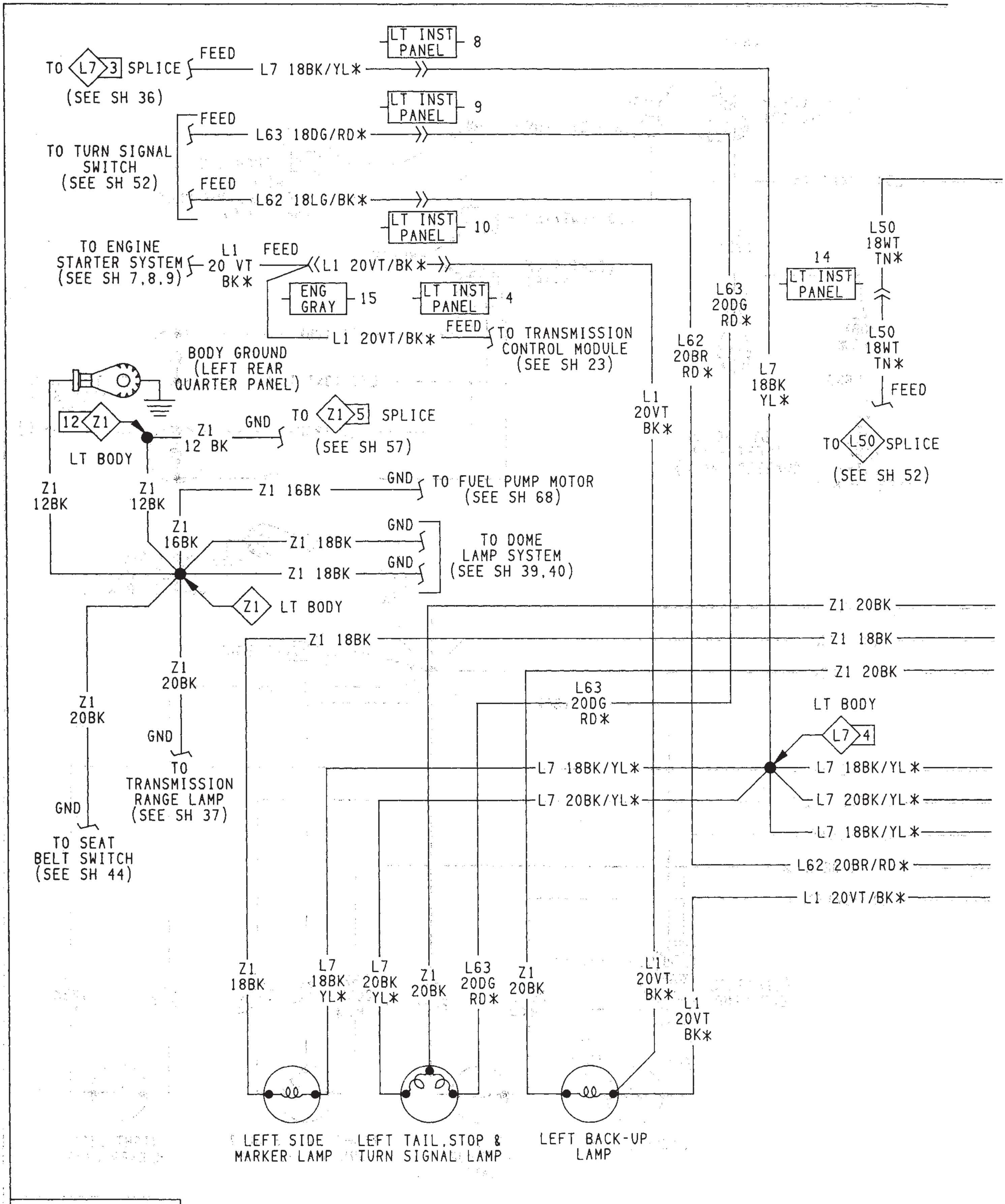
938W-6



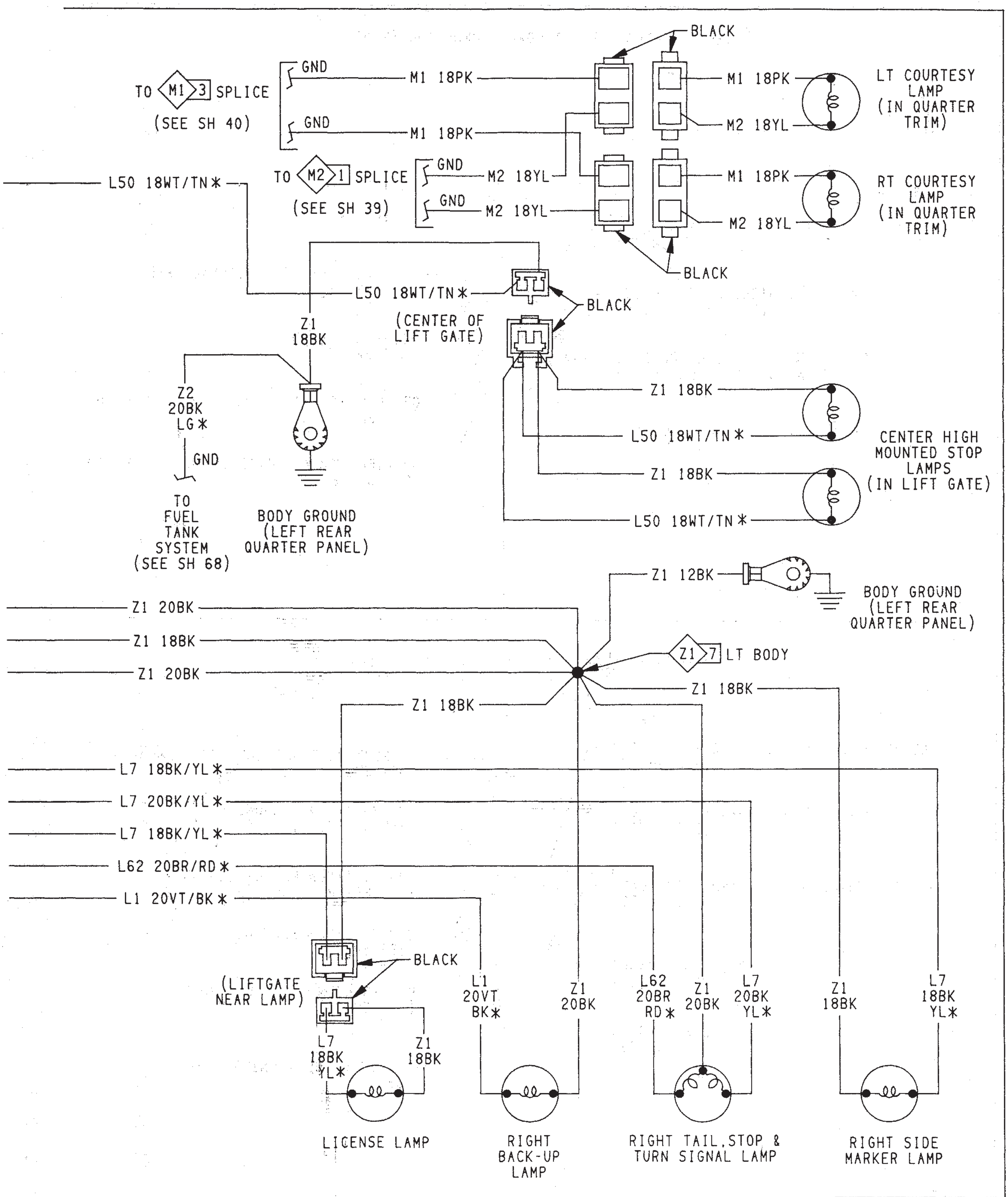
938W-6

REAR LIGHTING

AP-PD 70

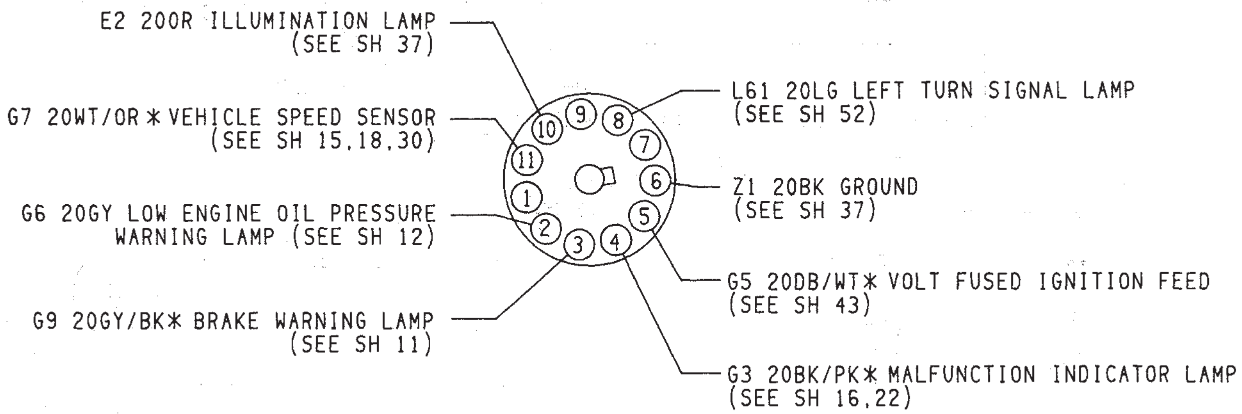


AP-PD 71 REAR LIGHTING (CONVERTIBLE ONLY) 938W-6

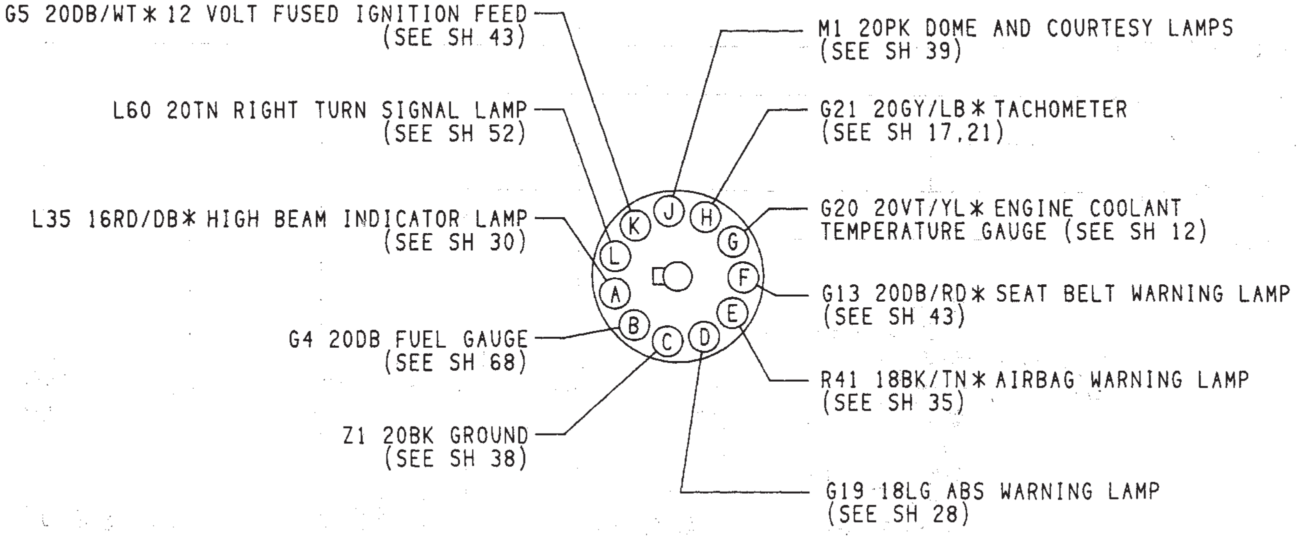


938W-6 REAR LIGHTING (CONVERTIBLE ONLY) AP-PD 72

LEFT PRINTED CIRCUIT BOARD CONNECTOR (RED)



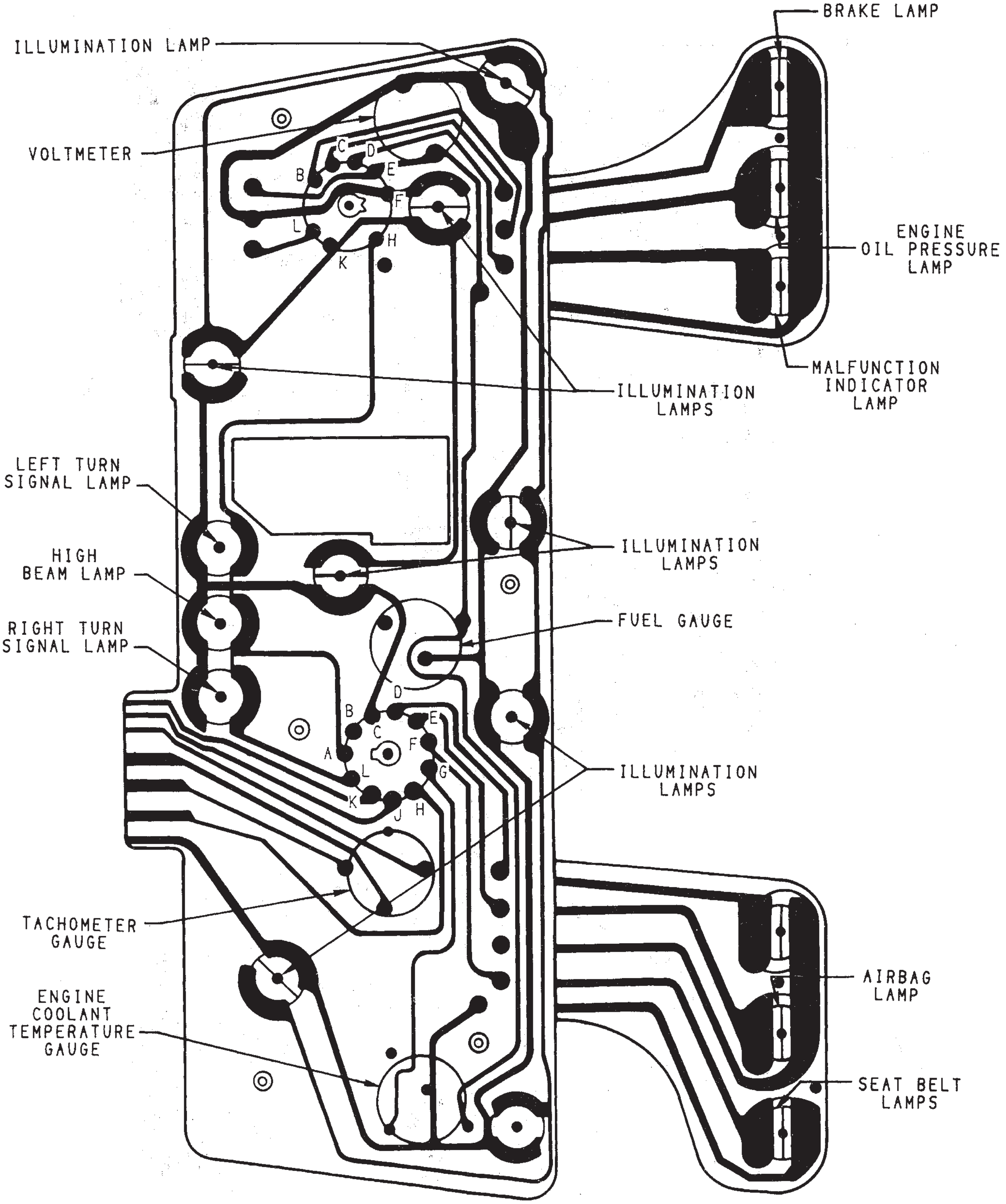
RIGHT PRINTED CIRCUIT BOARD CONNECTOR (GRAY)



AP-PD 73

PRINTED CIRCUIT BOARD CONNECTORS

938W-6

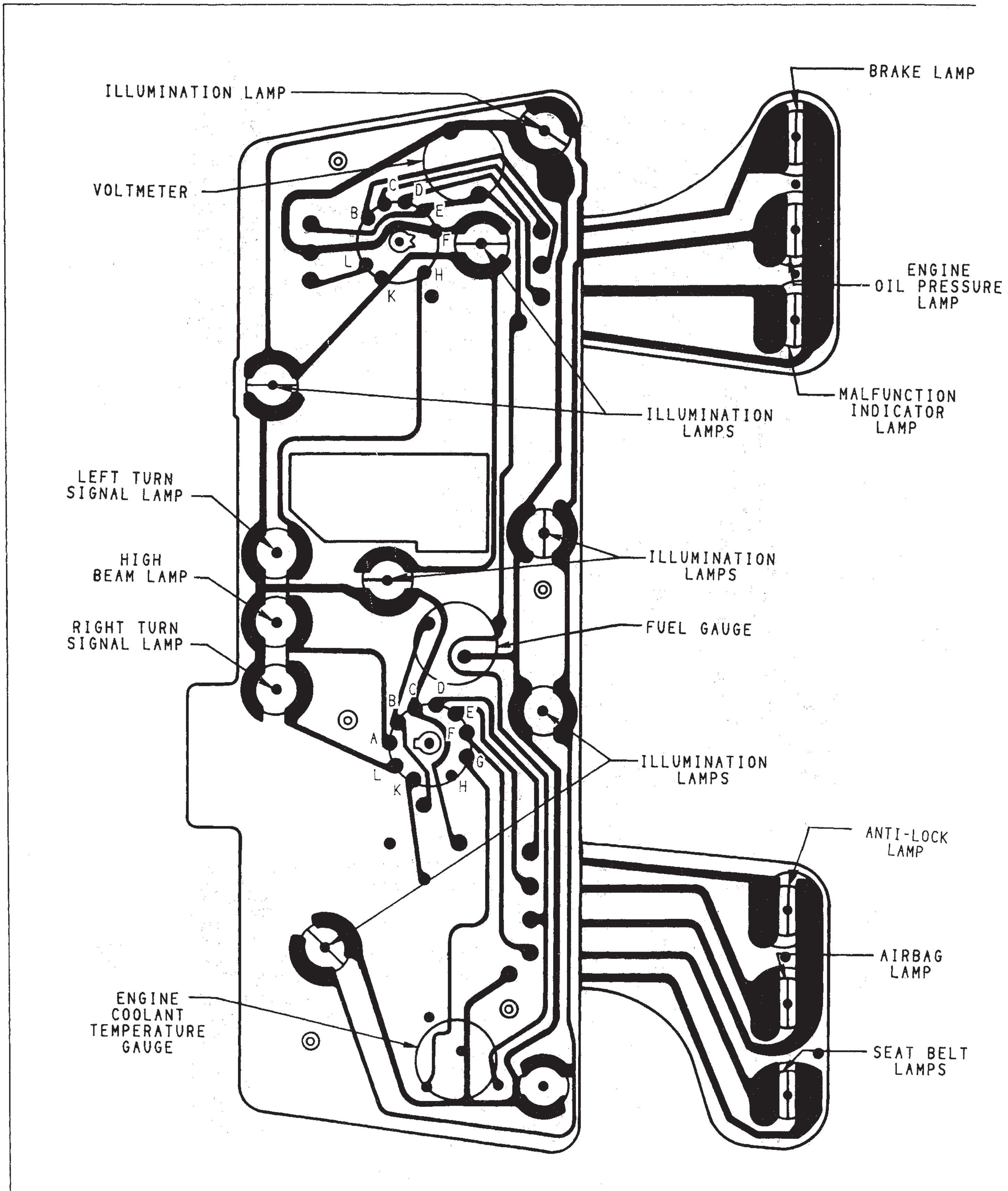


WITHOUT TACHOMETER

938W-6

PRINTED CIRCUIT BOARD

AP-PD 74

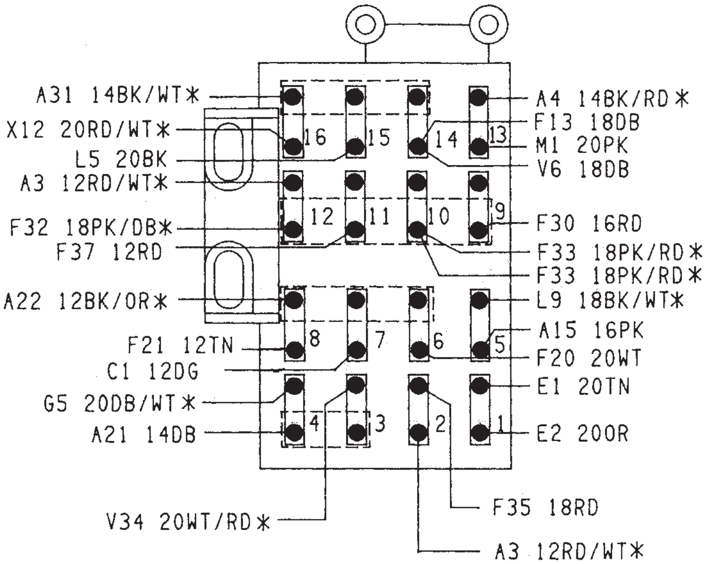


WITH TACHOMETER

PRINTED CIRCUIT BOARD

AP-PD 75

938W-6

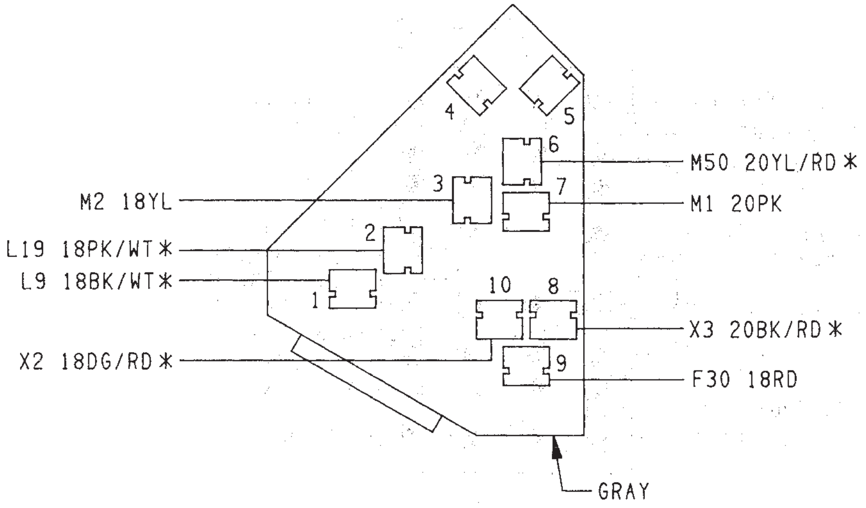


FRONT OF FUSE BLOCK

FUSEBLOCK MOUNTED
LEFT LOWER INSTRUMENT
PANEL

FUSE #	AMPS	COLOR	SHEET
1	4	PINK	1,31,33,37,41,46,47,65,67
2	15	LIGHT BLUE	1,36,61,64
3	2	GRAY	2,11,29
4	5	TAN	2,11,35,43
5	20	YELLOW	1,3,5,51
6	10	RED	2,11,35,41,67
7	30	LIGHT GREEN	2,11,46,47
8	30	CIRCUIT BREAKER (POWER WINDOW OPTION)	2,11,57,58
9	20	YELLOW	1,35,42,65
10	20	YELLOW	1,31,33,36
11	30	CIRCUIT BREAKER (POWER SEAT OPTION)	1,60
12	20	YELLOW	1,43
13	10	RED	2,3,5,39,44,55,65
14	20	YELLOW	2,11,54
15	10	RED	2,11,51
16	10	RED	2,11,65

FUSE BLOCK MODULE

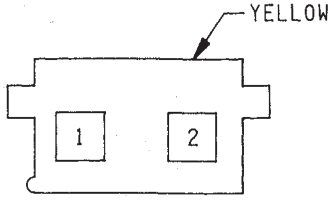


VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	L9 18BK/WT ✱	HAZARD FLASHER FEED	51
2	L19 18PK/WT ✱	HAZARD FLASHER FEED	51
3	M2 18YL	DOOR/LIFT SWITCHED GROUND	44
4	———	———	———
5	———	———	———
6	M50 20YL/RD ✱	TIME DELAY RELAY FEED	44
7	M1 20PK	RADIO FEED	44
8	X3 20BK/RD ✱	HORN SWITCH FEED	42
9	F30 18RD	HORN RELAY FEED	42
10	X2 18DG/RD ✱	HORN RELAY FEED	42

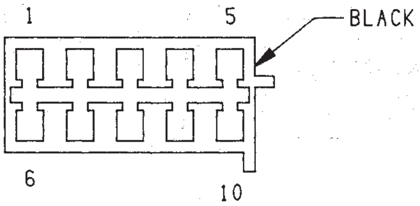
AP-PD 77

RELAY MODULE



VIEWED FROM TERMINAL END

	CAV	CIRCUIT	FUNCTION	SHEET
*	1	R43 18BK/LB*	AIRBAG SQUIB	35
*	2	R45 18DG/LB*	AIRBAG SQUIB	35

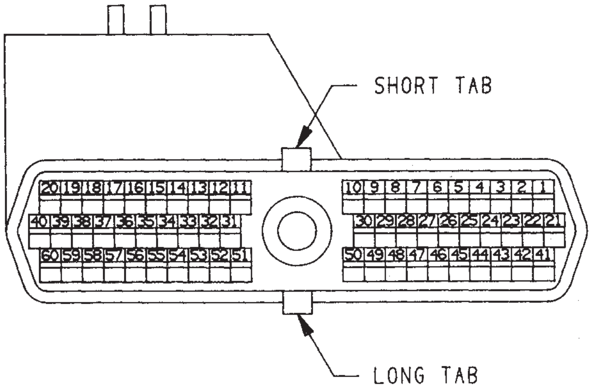


VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	R48 18TN	RIGHT AIRBAG SENSOR	35
2	R49 18LB	LEFT AIRBAG SENSOR	35
3	R41 18BK/TN*	AIRBAG WARNING LAMP	35
4	F20 18WT	A/C CYCLING SWITCH	35
5	G5 18DB/WT*	AIRBAG MODULE	35
6	R46 18BR/LB*	RIGHT AIRBAG SENSOR	35
7	R47 18DB/LB*	LEFT AIRBAG SENSOR	35
8	Z6 18BK/PK*	AIRBAG MODULE GROUND	35
9	————	————————————	————
10	F30 18RD	AIRBAG MODULE FEED	35

* -INDICATES TWISTED PAIR

AIRBAG DIAGNOSTIC MODULE CONNECTORS



VIEWED FROM WIRE END

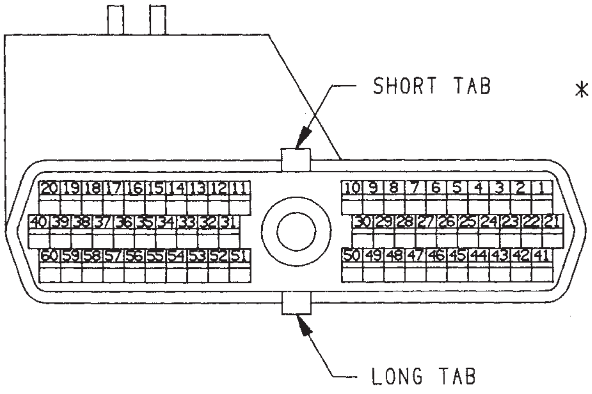
CAV	CIRCUIT	FUNCTION	SHEET
1	K1 20DG/RD*	MAP SENSOR SIGNAL	15
2	K2 20TN/BK*	ENGINE COOLANT TEMPERATURE SENSOR	14
3	A14 16RD/WT*	BATTERY VOLTAGE	14
4	K4 18BK/LB*	SENSOR RETURN	15
5	Z11 16BK/WT*	SIGNAL GROUND	13
6	K6 20VT/WT*	5 VOLT OUTPUT	16
7	K7 18OR	8 VOLT OUTPUT	15
8	F20 18WT	RUN ONLY INPUT	15
9	A21 14DB	IGNITION VOLTAGE SUPPLY	13
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	14
12	Z12 16BK/TN*	POWER GROUND	14
13	—	—	—
14	—	—	—
15	—	—	—
16	K11 18WT/DB*	INJECTOR CONTROL SIGNAL	13
17	—	—	—
18	—	—	—
19	K19 18BK/GY*	DISTRIBUTOR IGNITION COIL	14
20	K20 18DG	GENERATOR FIELD CONTROL	14
21	—	—	—
22	K22 18OR/DB*	THROTTLE POSITION (SENSOR)	16
23	V37 20RD/LG*	VEHICLE SPEED CONTROL (SET)	17,29
24	K24 18GY/BK*	DISTRIBUTOR IGNITION SENSOR	15
25	D21 20PK	DATA LINK TRANSMIT	13
26	—	—	—
27	C20 20BR	A/C LOW PRESSURE SWITCH	17
28	—	—	—
29	K29 18WT/PK*	BRAKE SWITCH SIGNAL	17,29
30	T41 20BR/YL*	PARK/NEUTRAL POSITION SW SIGNAL	15
31	C27 20DB/PK*	FAN CONTROL RELAY	17
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	16
33	V36 20TN/RD*	VEHICLE SPEED CONTROL (VACUUM)	17,29
34	C13 20DB/OR*	A/C COMPRESSOR CLUTCH RELAY	17
35	K35 20GY/YL*	EGR DIAGNOSTIC SOLENOID	13
36	—	—	—
37	—	—	—
38	—	—	—
39	K39 18GY/RD*	IDLE AIR CONTROL MOTOR	16
40	K40 18BR/WT*	IDLE AIR CONTROL MOTOR	16
41	K41 18BK/DG*	HEATED OXYGEN SENSOR SIGNAL	17
42	—	—	—
43	G21 20GY/LB*	TACHOMETER SIGNAL	17
44	—	—	—
45	D20 20LG	DATA LINK RECEIVE	13
46	—	—	—
47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	15
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN RELAY	14
52	K52 20PK/BK*	EVAP/PURGE SOLENOID	13
53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	17,29
54	K54 20OR/BK*	EMCC SOLENOID	15
55	—	—	—
56	—	—	—
57	A142 16DG/OR*	VOLTAGE SENSE	14
58	—	—	—
59	K59 18VT/BK*	IDLE AIR CONTROL MOTOR	16
60	K60 18YL/BK*	IDLE AIR CONTROL MOTOR	16

POWERTRAIN CONTROL MODULE CONNECTOR (2.2L AND 2.5L ENGINE)

AP-PD 79

938W-6

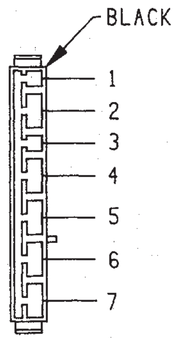
CAV	CIRCUIT	FUNCTION	SHEET
1	K1 20DG/RD*	MAP SENSOR SIGNAL	20
2	K2 20TN/BK*	ENGINE COOLANT TEMP SENSOR	18
3	A14 16OR	BATTERY VOLTAGE	22
4	K4 18BK/LB*	SENSOR RETURN	18
5	Z11 16BK/WT*	SIGNAL GROUND (LOGIC MODULE)	22
6	K6 20VT/WT*	5 VOLT OUTPUT	20
7	K7 18OR	8 VOLT OUTPUT	18
8	—	—	—
9	A21 14DB	IGNITION VOLTAGE SUPPLY	21
10	—	—	—
11	Z12 16BK/TN*	POWER GROUND	21
12	Z12 16BK/TN*	POWER GROUND	21
13	K14 18LB/BR*	INJECTOR #4	20
14	K13 18YL/WT*	INJECTOR #3	20
15	K12 18TN	INJECTOR #2	20
16	K11 18WT/DB*	INJECTOR #1	20
17	—	—	—
18	—	—	—
19	K19 18BK/GY*	DISTRIBUTOR IGNITION COIL	22
20	K20 18DG	GENERATOR FIELD CONTROL	20
21	—	—	—
22	K22 18OR/DB*	THROTTLE POSITION (SENSOR)	20
23	V37 20RD/LG*	VEHICLE SPEED CONTROL (SET)	21,29
24	K24 18GY/BK*	DISTRIBUTOR IGNITION SENSOR	18
25	D1 20VT/BK	DATA LINK TRANSMIT	22
* 26	D1 20VT/BR*	CCD BUSS (B+)	21
27	C20 20BR	A/C LOW PRESSURE SWITCH	19
28	K10 18DB/OR*	POWER STEERING SWITCH	19
29	K29 18WT/PK*	BRAKE SWITCH SIGNAL	21,29
30	T41 20BR/YL*	PARK/NEUTRAL POSITION SW SIGNAL	19
31	C27 20DB/PK*	FAN CONTROL RELAY	19
32	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	22
33	V36 20TN/RD*	VEHICLE SPEED CONTROL (VACUUM)	21,29
34	C13 20DB/OR*	A/C COMPRESSOR CLUTCH RELAY	19
35	K35 20GY/YL*	EGR DIAGNOSTIC SOLENOID	20
36	—	—	—
37	—	—	—
38	K38 18GY	INJECTOR #5	20
39	K39 18GY/RD*	IDLE AIR CONTROL MOTOR	20
40	K40 18BR/WT*	IDLE AIR CONTROL MOTOR	20
41	K41 18BK/DG*	HEATED OXYGEN SENSOR SIGNAL	18
42	—	—	—
43	G21 20GY/LB*	TACHOMETER SIGNAL	21
44	K44 18TN/YL*	DISTRIBUTOR IGNITION SENSOR	18
45	D20 20LG	DATA LINK RECEIVE	22
* 46	D2 20WT/BK*	CCD BUSS (B−)	21
47	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	18
48	—	—	—
49	—	—	—
50	—	—	—
51	K51 20DB/YL*	AUTOMATIC SHUT DOWN RELAY	22
52	K52 20PK/BK*	EVAP PURGE SOLENOID	19
53	V35 20LG/RD*	VEHICLE SPEED CONTROL (VENT)	21,29
54	—	—	—
55	—	—	—
56	—	—	—
57	A142 16DG/OR*	VOLTAGE SENSE	22
58	K58 18BR/DB*	INJECTOR #6	20
59	K59 18VT/BK*	IDLE AIR CONTROL MOTOR	20
60	K60 18YL/BK*	IDLE AIR CONTROL MOTOR	20



VIEWED FROM WIRE END

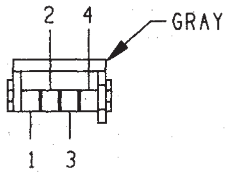
* - INDICATES TWISTED PAIR

POWERTRAIN CONTROL MODULE CONNECTOR (3.0L ENGINE)



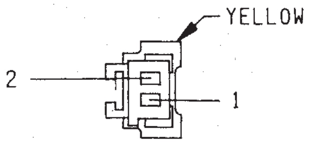
VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	A41 14YL	ENGINE STARTER RELAY	11
2	A21 14DB	IGNITION FEED (RUN & START)	11
3	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH FEED	11
3	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH FEED	11
4	A2 12PK/BK*	IGNITION FEED	11
5	A22 12BK/OR*	IGNITION FEED (RUN ONLY)	11
6	A31 14BK/WT*	IGNITION FEED (RUN & ACC)	11
7	A1 12RD	IGNITION FEED	11



VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	G16 20BK/LB*	LEFT DOOR JAMB SWITCH	44
2	M26 20LB	KEY-IN BUZZER	44
3	Z1 20BK	GROUND	44
4	M50 20YL/RD*	HALO LAMP FEED	44



VIEWED FROM TERMINAL END

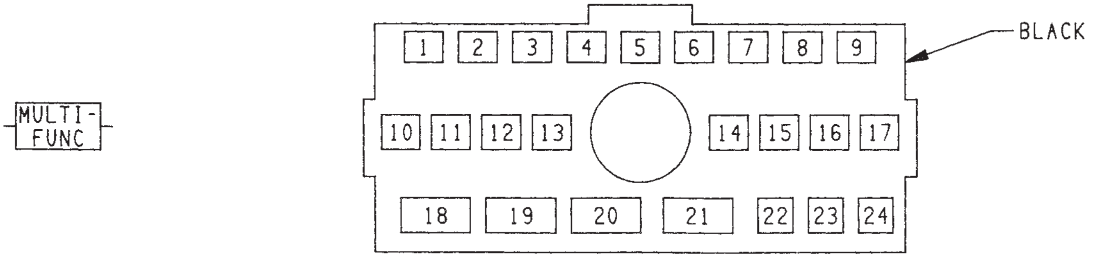
	CAV	CIRCUIT	FUNCTION	SHEET
*	1	R45 18DG/LB*	LEFT AIRBAG SQUIB IGNITER	35
*	2	R43 18BK/LB*	LEFT AIRBAG SQUIB IGNITER	35

* -INDICATES TWISTED PAIR

AP-PD 81

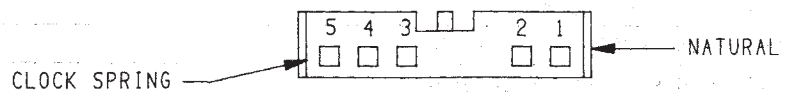
STEERING COLUMN CONNECTORS

938W-6



VIEWED FROM WIRE END

CAV	CIRCUIT	FUNCTION	SHEET
1	V9 18WT/BK*	INTERMITTENT WIPER MODULE (DELAY)	53
2	V8 18VT	INTERMITTENT WIPER MODULE (POTENTIOMETER)	53
3	V10 20BR	WINDSHIELD WASHER PUMP MOTOR FEED	53
4	F13 18DB	FEED	53
5	V4 18RD/YL*	(HIGH SPEED)	53
6	V3 18BR/WT *	(LOW SPEED)	53
7	V7 18DG	INTERMITTENT WIPER MODULE (PARK/DWELL)	53
	V5 18DG	STANDARD WIPER PARK	
8	V17 18DG/WT*	INTERMITTENT WIPER MODULE (PULSE)	53
9	V3 18BR/WT *	(LOW SPEED)	53
10	————	————————————	————
11	L60 18TN	RIGHT FRONT TURN SIGNAL	52
12	L62 18LG/BK*	RIGHT REAR TURN/STOP SIGNAL	52
13	L19 18PK/WT*	HAZARD FLASHER FEED	52
14	L50 18WT/TN *	STOP LAMP SWITCH FEED	52
15	L63 18DG/RD *	LEFT REAR TURN/STOP SIGNAL	52
16	L61 18LG	LEFT FRONT TURN SIGNAL	52
17	L6 20RD/WT *	TURN SIGNAL FLASHER FEED	52
18	L4 16VT/WT *	HEADLAMP (LOW BEAM)	36
19	L2 14LG	OPTICAL HORN FEED (LOW BEAM)	36
20	L3 14RD/OR*	HEADLAMP (HIGH BEAM)	36
21	L20 14LG/WT*	OPTICAL HORN FEED	36
22	————	————————————	————
23	————	————————————	————
24	————	————————————	————



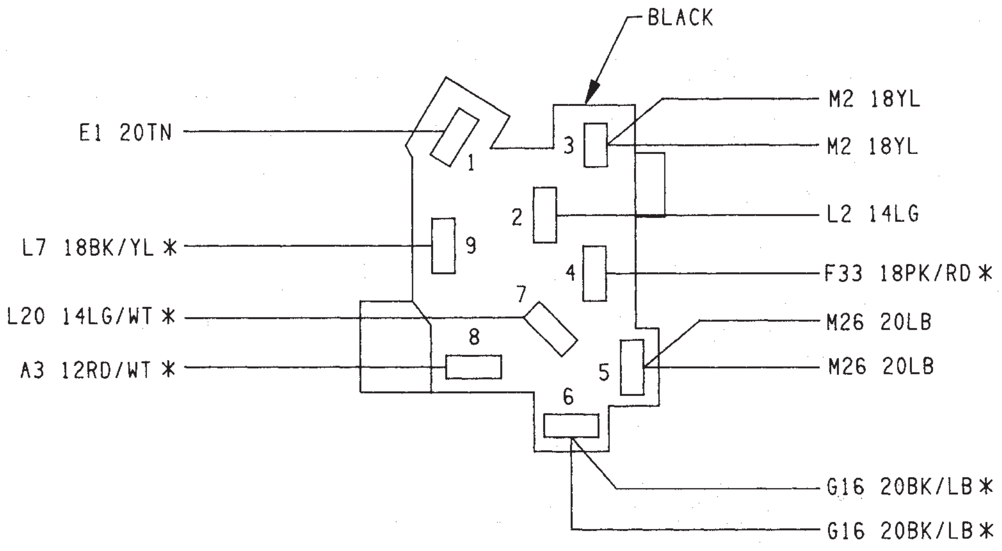
VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	V34 20WT/RD *	VEHICLE SPEED CONTROL (ON/OFF)	29
2	V37 20RD/LG *	VEHICLE SPEED CONTROL (SET)	29
3	—	—	—
4	V32 20YL/RD *	VEHICLE SPEED CONTROL (RESUME)	29
5	X3 20BK/RD *	HORN SWITCH FEED	42

STEERING MULTI-FUNCTION SWITCH COLUMN CONNECTORS

938W-6

AP-PD 82



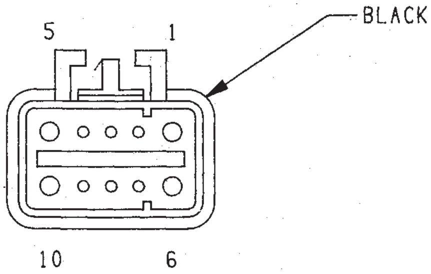
VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	E1 20TN	HEADLAMP SWITCH FEED	36
2	L2 14LG	OPTICAL HORN FEED (LOW-BEAM)	36
3	M2 18YL	DOOR/LIFT SWITCHED GROUND	36
3	M2 18YL	DOOR/LIFT SWITCHED GROUND	36
4	F33 18PK/RD *	HEADLAMP SWITCH FEED	36
5	M26 20LB	HALO LAMP FEED	36
5	M26 20LB	CHIME FEED	36
6	G16 20BK/LB *	LEFT FRONT DOOR JAMB SWITCH	36
6	G16 20BK/LB *	LEFT FRONT DOOR JAMB SWITCH	36
7	L20 14LG/WT *	OPTICAL HORN FEED (HIGH-BEAM)	36
8	A3 12RD/WT *	HEADLAMP SWITCH FEED	36
9	L7 18BK/YL *	HEADLAMP SWITCH FEED	36

AP-PD 83

HEADLAMP SWITCH CONNECTOR

938W-6

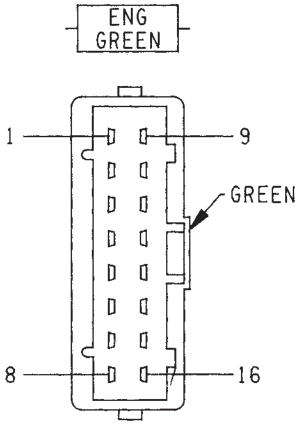


VIEWED FROM TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	L3 16RD/OR *	HEADLAMP (HIGH-BEAM)	30
2	————	————————————	————
3	————	————————————	————
4	L35 16RD/DB *	INDICATOR LAMP (HIGH-BEAM)	30
5	F20 16WT	BACK-UP LAMP SWITCH FEED	30
6	L20 14LG/WT *	OPTICAL HORN FEED (HIGH-BEAM)	30
7	G7 20WT/OR *	VEHICLE SPEED SENSOR SIGNAL	30
8	Z1 18BK	GROUND	30
9	————	————————————	————
10	L4 16VT/WT *	HEADLAMP (LOW-BEAM)	30

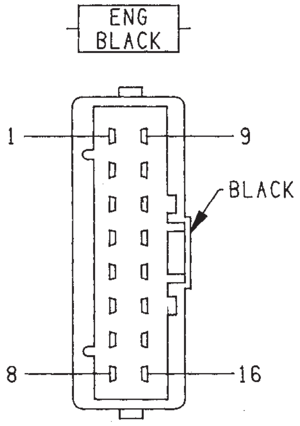
DAYTIME RUNNING LIGHTS MODULE CONNECTOR

CAVITY	CIRCUIT	FUNCTION	SHEET
1	—	—	—
2	V32 20YL/RD*	VEHICLE SPEED CONTROL (RESUME)	29
3	V37 20RD/LG*	VEHICLE SPEED CONTROL (SET)	29
4	G21 20GY/LB*	TACHOMETER SIGNAL	17,21
5	—	—	—
6	—	—	—
7	—	—	—
8	—	—	—
9	L20 14LG/WT*	OPTICAL HORN FEED (HIGH BEAM)	30,36
10	L39 16BK/LB*	FOG LAMP FEED	31,33
11	—	—	—
12	—	—	—
13	L35 16RD/DB*	INDICATOR LAMP (HIGH-BEAM)	30
14	G19 18LG	ABS WARNING LAMP (AMBER)	28
15	G31 20VT/LG*	A/C AMBIENT TEMPERATURE SENSOR	41
16	G32 20BK/LB*	A/C AMBIENT TEMPERATURE SENSOR RETURN	41



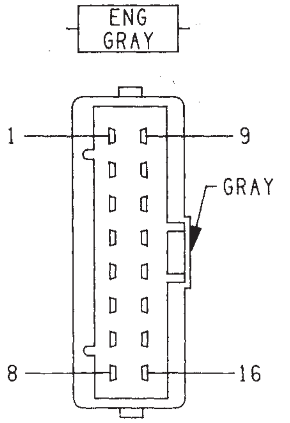
VIEWED FROM
TERMINAL END

CAVITY	CIRCUIT	FUNCTION	SHEET
1	A1 12RD	IGNITION FEED	4,6,11
2	V4 18RD/YL*	INTERMITTENT WIPER MODULE (HIGH SPEED)	54
3	V3 18BR/WT*	INTERMITTENT WIPER MODULE (LOW SPEED)	54
3	V3 18BR/WT*	INTERMITTENT WIPER MODULE (LOW SPEED)	54
4	V5 18DG/YL*	WINDSHIELD WIPER MOTOR (PARK)	54
5	V10 18BR	WINDSHIELD WASHER PUMP MOTOR FEED	53
5	V10 20BR	WINDSHIELD WASHER PUMP MOTOR FEED	53
6	—	—	—
7	—	—	—
8	A2 12PK/BK*	IGNITION FEED	4,6,11
9	A3 12RD/WT*	HEADLAMP SWITCH FEED	4,6,36
10	C22 20DB/WT*	A/C HIGH PRESSURE SWITCH	48
11	F32 18PK/DB*	STOP LAMP SWITCH FEED	29,43
11	F32 18PK/DB*	STOP LAMP SWITCH FEED	29,43
12	—	—	—
13	A21 14DB	IGNITION FEED (RUN & START)	11,13,21
14	A141 16DG/WT*	FUEL PUMP MOTOR FEED	14,22,68
15	A15 16PK	HAZARD FLASHER FEED	3,5,51
16	A4 12BK/RD*	HEATED REAR WINDOW FEED	3,5



VIEWED FROM
TERMINAL END

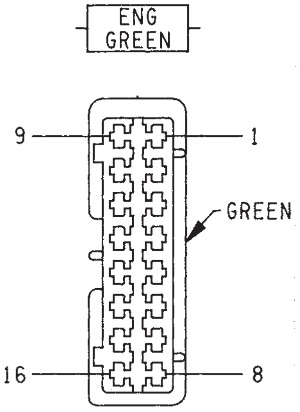
CAVITY	CIRCUIT	FUNCTION	SHEET
1	V6 18DB	WINDSHIELD WIPER MOTOR FEED	54
1	V6 18DB	WINDSHIELD WIPER MOTOR FEED	54
2	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11
3	L7 18BK/YL*	HEADLAMP SWITCH FEED	32,34,36
4	—	—	—
5	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	16,22
6	L4 16VT/WT*	HEADLAMP (LOW-BEAM)	31,33,36
6	L4 16VT/WT*	HEADLAMP (LOW-BEAM)	31,33,36
7	L50 18WT/TN*	STOP LAMP SWITCH FEED	29,52
8	L3 14RD/OR*	HEADLAMP (HIGH-BEAM)	31,33,36
9	G6 20GY	LOW ENGINE OIL PRESSURE WARNING LAMP	12
10	G20 20VT/YL*	ENGINE COOLANT TEMPERATURE SENDING UNIT	12
11	L61 18LG	LEFT FRONT TURN SIGNAL	32,34,52
12	L60 18TN	RIGHT FRONT TURN SIGNAL	31,33,52
13	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	15,18,30
14	X2 18DG/RD*	HORN RELAY FEED	42
15	L1 20VT/BK*	BACK-UP LAMP FEED	7,8,9,23,69,71
16	F20 18WT	BACK-UP LAMP SWITCH FEED	7,8,9,23,41



VIEWED FROM
TERMINAL END

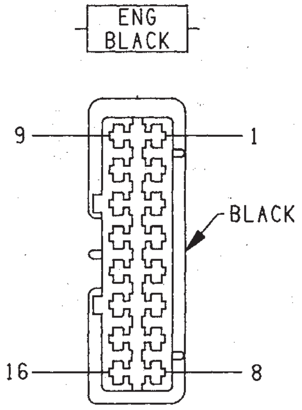
AP-PD 85 INSTRUMENT PANEL TO ENGINE WIRING 938W-6

CAVITY	CIRCUIT	FUNCTION	SHEET
1	G29 20BK/TN*	LOW WASHER FLUID SENSOR	53
2	V32 20YL/RD*	VEHICLE SPEED CONTROL (RESUME)	29
3	V37 20RD/LG*	VEHICLE SPEED CONTROL (SET)	29
4	G21 20GY/LB*	TACHOMETER SIGNAL	17,21
5	—	—	—
6	—	—	—
7	—	—	—
8	—	—	—
9	L20 14LG/WT*	OPTICAL HORN FEED (HIGH-BEAM)	30,36
10	L39 18LB	FOG LAMP FEED	31,33
11	—	—	—
12	—	—	—
13	L35 16RD/DB*	INDICATOR LAMP (HIGH-BEAM)	30
14	G19 18LG/OR*	ABS WARNING LAMP (AMBER)	28
15	G31 18VT/LG*	A/C AMBIENT TEMPERATURE SENSOR	41
16	G32 18BK/LB*	A/C AMBIENT TEMPERATURE SENSOR RETURN	41



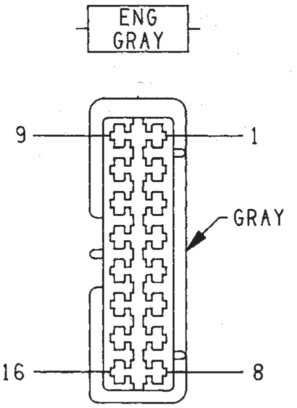
VIEWED FROM TERMINAL END

CAVITY	CIRCUIT	FUNCTION	SHEET
1	A1 12RD	IGNITION FEED	4,6,11
2	V4 18RD/YL*	INTERMITTENT WIPER MODULE (HIGH SPEED)	54
3	V3 18BR/WT*	INTERMITTENT WIPER MODULE (LOW SPEED)	54
4	V5 18DG	WINDSHIELD WIPER MOTOR (PARK)	54
5	V10 20BR	WINDSHIELD WASHER PUMP MOTOR FEED	53
6	—	—	—
7	—	—	—
8	A2 12PK/BK*	IGNITION FEED	4,6,11
9	A3 12RD/WT*	HEADLAMP SWITCH FEED	4,6,36
10	C22 20DB/WT*	A/C HIGH PRESSURE SWITCH	48
11	F32 18PK/DB*	STOP LAMP SWITCH FEED	29,43
11	F32 18PK/DB*	STOP LAMP SWITCH FEED	29,43
12	—	—	—
13	A21 14DB	IGNITION FEED (RUN & START)	11,13,21
14	A141 16DG/WT*	FUEL PUMP MOTOR FEED	14,22,68
15	A15 16PK/WT*	HAZARD FLASHER FEED	3,5,51
16	A4 12BK/RD*	HEATED REAR WINDOW FEED	3,5



VIEWED FROM TERMINAL END

CAVITY	CIRCUIT	FUNCTION	SHEET
1	V6 18DB	WINDSHIELD WIPER MOTOR FEED	54
2	G9 20GY/BK*	BRAKE WARNING LAMP SWITCH	11
3	L7 18BK/YL*	HEADLAMP SWITCH FEED	32,34,36
4	—	—	—
5	G3 20BK/PK*	MALFUNCTION INDICATOR LAMP	16,22
6	L4 16VT/WT*	HEADLAMP (LOW-BEAM)	31,33,36
7	L50 18WT/TN*	STOP LAMP SWITCH FEED	28,29,52
8	L3 16RD/OR*	HEADLAMP (HIGH-BEAM)	31,33,36
9	G6 20GY	LOW ENGINE OIL PRESSURE WARNING LAMP	12
10	G20 20VT/YL*	ENGINE COOLANT TEMPERATURE SENDING UNIT	12
11	L61 18LG	LEFT FRONT TURN SIGNAL	32,34,52
12	L60 18TN	RIGHT FRONT TURN SIGNAL	31,33,52
13	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	15,18,30
14	X2 18DG/RD*	HORN RELAY FEED	42
15	L1 20VT/BK*	BACK-UP LAMP FEED	7,8,9,23,69,71
15	L1 20VT/BK*	BACK-UP LAMP FEED	7,8,9,23,69,71
16	F20 18WT	BACK-UP LAMP SWITCH FEED	7,8,9,23,41

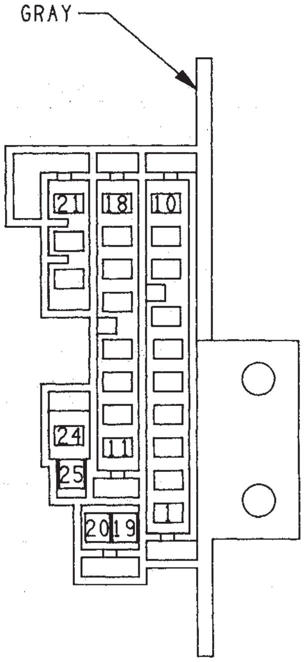


VIEWED FROM TERMINAL END

938W-6 ENGINE TO INSTRUMENT PANEL WIRING AP-PD 86

LT INST
PANEL

CAVITY	CIRCUIT	FUNCTION	SHEET
1	—	—	—
2	M1 18PK	DOME AND COURTESY LAMP FEED	39,55
3	G4 20DB	FUEL GAUGE	68
4	L1 20VT/BK*	BACK-UP LAMP FEED	7,8,23,69,71
5	G16 18BK/LB*	LEFT FRONT DOOR JAMB SWITCH	36,39
6	—	—	—
7	G10 20LG/RD*	SEAT BELT WARNING LAMP FEED	43
8	L7 18BK/YL*	TAIL, LICENSE & SIDE MARKER LAMPS	69,71
9	L63 20DG/RD*	LEFT REAR TURN SIGNAL LAMP	52,69,71
10	L62 20BR/RD*	RIGHT REAR TURN SIGNAL LAMP	52,69,71
11	X54 18VT	RIGHT FRONT DOOR SPEAKER (B+)	66
12	X56 18DB/RD*	RIGHT FRONT DOOR SPEAKER (B—)	66
13	X53 18DG	LEFT FRONT DOOR SPEAKER (B+)	65
14	L50 18WT/TN*	CENTER HIGH MOUNTED STOP LAMP FEED	52,69,71
15	X55 18BR/RD*	LEFT FRONT DOOR SPEAKER (B—)	65
16	—	—	—
17	E2 20OR	ILLUMINATION LAMP FEED	37
18	A141 16DG/WT*	FUEL PUMP MOTOR FEED	14,22,68
19	—	—	—
20	—	—	—
21	—	—	—
22	—	—	—
23	—	—	—
24	C15 12BK/WT*	HEATED REAR WINDOW FEED	67
25	F37 12RD	POWER SEAT FEED	60

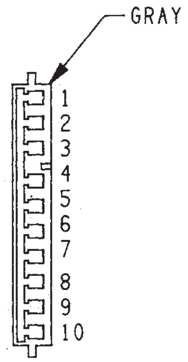


VIEWED FROM
TERMINAL END

LEFT BODY TO INSTRUMENT
PANEL WIRING

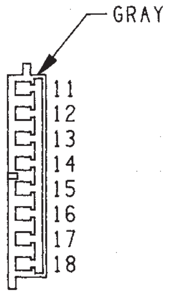
LT INST PANEL

CAVITY	CIRCUIT	FUNCTION	SHEET
1	L62 18LG/BK*	RIGHT REAR TURN SIGNAL LAMP	52,69,71
2	L63 18DG/RD*	LEFT REAR TURN SIGNAL LAMP	52,69,71
3	L7 18BK/YL*	TAIL, LICENSE & SIDE MARKER LAMPS	69,71
4	G10 20LG/RD*	SEAT BELT WARNING LAMP FEED	43
5	—	—	—
6	G16 20BK/LB*	LEFT FRONT DOOR JAMB SWITCH	36,39
7	L1 20VT/BKD*	BACK-UP LAMP FEED	7,8,23,69,71
8	G4 20DB	FUEL GUAGE	68
9	M1 20PK	DOME AND COURTESY LAMP FEED	39,55
10	—	—	—



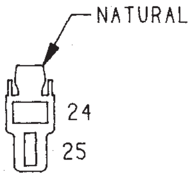
VIEWED FROM TERMINAL END

CAVITY	CIRCUIT	FUNCTION	SHEET
11	X54 20VT	RIGHT FRONT DOOR SPEAKER (B+)	66
12	X56 20DB/RD*	RIGHT FRONT DOOR SPEAKER (B−)	66
13	X53 20DG	LEFT FRONT DOOR SPEAKER (B+)	65
14	L50 18WT/TN*	CENTER HIGH MOUNTED STOP LAMP FEED	52,69,71
15	X55 20BR/RD*	LEFT FRONT DOOR SPEAKER (B−)	65
16	—	—	—
17	E2 20OR	ILLUMINATION LAMP FEED	37
18	A141 16DG/WT*	FUEL PUMP MOTOR FEED	14,22,68



VIEWED FROM TERMINAL END

CAVITY	CIRCUIT	FUNCTION	SHEET
24	C15 12BK/WT*	HEATED REAR WINDOW FEED	67
25	F37 12RD	POWER SEAT FEED	60



VIEWED FROM TERMINAL END

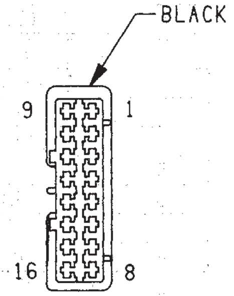
INSTRUMENT PANEL TO LEFT BODY WIRING

938W-6

AP-PD 88

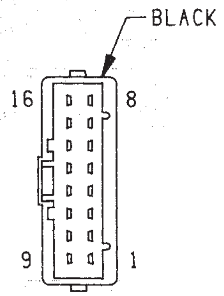
RT INST
PANEL

CAVITY	CIRCUIT	FUNCTION	SHEET
1	C1 12DG	BLOWER MOTOR FEED	46,47
2	X51 18BR/YL*	LEFT REAR SPEAKER (B+)	66
3	X52 18DB/WT*	RIGHT REAR SPEAKER (B+)	66
4	C7 12BK/TN*	BLOWER MOTOR (HIGH SPEED)	46,48
5	M2 18YL	DOOR/LIFT SWITCHED GROUND	36,39
6	X57 18BR/LB*	LEFT REAR SPEAKER (B−)	66
7	X58 18DB/OR*	RIGHT REAR SPEAKER (B−)	66
8	F35 18RD	POWER DOOR LOCK SWITCH FEED	36,61,64
9	Z1 12BK	GROUND	38,46,47,66
10	C4 18TN	BLOWER MOTOR (LOW SPEED)	46,48
11	X13 16BK/RD*	SPEAKER AMPLIFIER (B+)	66
12	X15 16BK/DG*	SPEAKER AMPLIFIER (B−)	65
13	C6 14LB	BLOWER MOTOR (M2 SPEED)	46,48
14	C5 16LG	BLOWER MOTOR (M1 SPEED)	46,48
15	Z2 18BK/LG*	PANEL GROUND	38,46,47,66
16	F21 12TN	POWER WINDOW LIFT FEED	57,58



VIEWED FROM
TERMINAL END

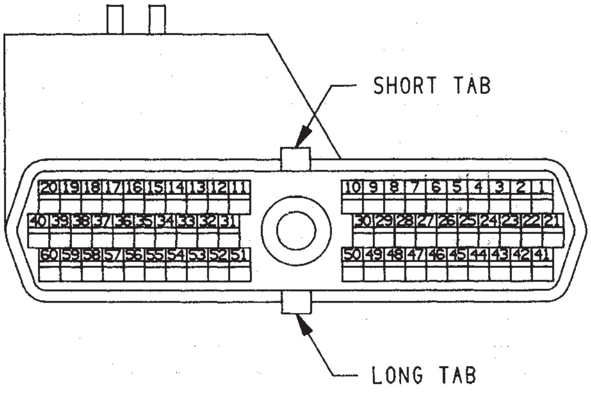
CAVITY	CIRCUIT	FUNCTION	SHEET
1	C1 12DG	BLOWER MOTOR FEED	46,47
2	X51 20BR/YL*	LEFT REAR SPEAKER (B+)	66
3	X52 20DB/WT*	RIGHT REAR SPEAKER (B+)	66
4	C7 12BK/TN*	BLOWER MOTOR (HIGH SPEED)	46,48
5	M2 18YL	DOOR/LIFT SWITCHED GROUND	36,39
6	X57 20BR/LB*	LEFT REAR SPEAKER (B−)	66
7	X58 20DB/OR*	RIGHT REAR SPEAKER (B−)	66
8	F35 18RD	POWER DOOR LOCK SWITCH FEED	36,61,64
9	Z1 12BK	GROUND	38,46,47,66
10	C4 18TN	BLOWER MOTOR (LOW SPEED)	46,48
11	X13 16BK/RD*	SPEAKER AMPLIFIER (B+)	66
12	X15 16BK/DG*	SPEAKER AMPLIFIER (B−)	65
13	C6 14LB	BLOWER MOTOR (M2 SPEED)	46,48
14	C5 16LG	BLOWER MOTOR (M1 SPEED)	46,48
15	Z2 18BK/LG*	PANEL GROUND	38,46,47,66
16	F21 12TN	POWER WINDOW LIFT FEED	57,58



VIEWED FROM
TERMINAL END

AP-PD 89 RIGHT INSTRUMENT PANEL INTERFACE 938W-6

	CAV	CIRCUIT	FUNCTION	SHEET
*	1	B1 20YL/BK*	ABS RIGHT REAR WHEEL SENSOR (—)	26
*	2	B2 20YL	ABS RIGHT REAR WHEEL SENSOR (+)	26
*	3	B3 20LG/BK*	ABS LEFT REAR WHEEL SENSOR (—)	26
*	4	B4 20LG	ABS LEFT REAR WHEEL SENSOR (+)	26
	5	Z1 16BK	GROUND	28
*	6	B6 20WT/BK*	ABS RIGHT FRONT WHEEL SENSOR (—)	26
*	7	B7 20WT	ABS RIGHT FRONT WHEEL SENSOR (+)	26
*	8	B8 20RD/WT*	ABS LEFT FRONT WHEEL SENSOR (—)	26
*	9	B9 20RD	ABS LEFT FRONT WHEEL SENSOR (+)	26
	10	—	—	—
	11	D11 20WT/DB*	ABS DIAGNOSTIC (DATA IN)	27
	12	D12 20OR	ABS DIAGNOSTIC (DATA OUT)	27
	13	L50 18WT/TN*	STOP LAMP SWITCH	28
	14	—	—	—
	15	G19 18LG/OR*	ABS WARNING LAMP	28
	16	B116 16GY	ABS PUMP RELAY COIL	27
	17	—	—	—
	18	—	—	—
	19	—	—	—
	20	B120 12BR/WT*	ABS PUMP MOTOR FEED	27
	21	—	—	—
	22	—	—	—
	23	—	—	—
	24	—	—	—
	25	—	—	—
	26	—	—	—
	27	—	—	—
	28	—	—	—
	29	—	—	—
	30	—	—	—
	31	—	—	—
	32	—	—	—
	33	—	—	—
	34	—	—	—
	35	—	—	—
	36	—	—	—
	37	—	—	—
	38	—	—	—
	39	—	—	—
	40	—	—	—
	41	B47 14RD/LB*	ABS SOLENOID FEED	28
	42	B142 18BR/YL*	ABS LEFT FRONT BUILD/DECAY	27
	43	B143 18DG/YL*	ABS RIGHT FRONT BUILD/DECAY	27
	44	—	—	—
	45	B145 16WT/DG	LEFT FRONT/RIGHT REAR ISOLATE	27
	46	B146 18BR/LB*	ABS LEFT REAR BUILD/DECAY	27
	47	B47 14RD/LB*	ABS SOLENOID FEED	28
	48	B148 18DG/LB*	ABS RIGHT REAR BUILD/DECAY	27
	49	B149 16WT/LG	RIGHT FRONT/LEFT REAR ISOLATE	27
	50	—	—	—
	51	—	—	—
	52	—	—	—
	53	—	—	—
	54	—	—	—
	55	—	—	—
	56	—	—	—
	57	B57 18BR/BK*	ABS SYSTEM RELAY COIL	28
	58	—	—	—
	59	—	—	—
	60	A21 14DB	IGNITION START/RUN	27



VIEWED FROM WIRE END

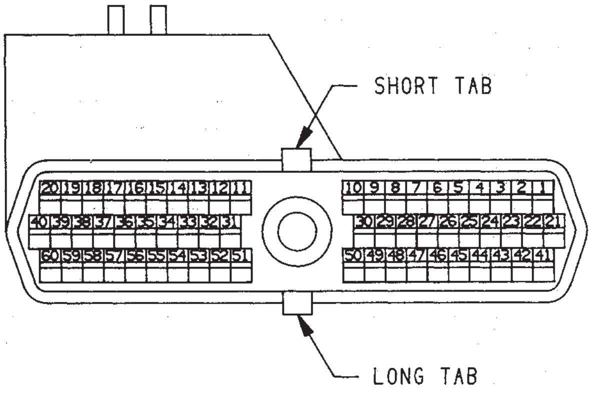
*-INDICATES TWISTED PAIRS B1 & B2,
B3 & B4, B6 & B7, AND B8 & B9

ANTI-LOCK BRAKE SYSTEM CONTROLLER CONNECTOR

938W-6

AP-PD 90

CAV	CIRCUIT	FUNCTION	SHEET
1	T1 18LG/BK*	TRANSMISSION RANGE SWITCH	25
2	T2 18TN/BK*	BACK-UP RELAY GROUND (−)	23
3	T3 14VT	RELAY COMMON	23
* 4	D2 20WT/BK*	CCD BUSS (B−)	24
* 5	D1 20VT/BK*	CCD BUSS (B+)	24
6	Z14 18BK/YL*	SIGNAL GROUND	25
7	—	—	—
8	A41 14YL	ENGINE STARTER RELAY	23
9	T9 18OR/BR*	OVERDRIVE PRESSURE SWITCH	25
10	—	—	—
11	A21 14DB	IGNITION VOLTAGE SUPPLY	23
12	K22 18OR/DB*	THROTTLE POSITION (SENSOR)	24
13	T13 18DB/BK*	VEHICLE SPEED SENSOR (B−)	24
14	T14 18LG/WT*	OUTPUT SPEED SENSOR (B+)	24
15	T15 18LG	SHUT DOWN RELAY POWER	25
16	T16 16RD	SWITCHED BATTERY FEED	25
17	T16 16RD	SWITCHED BATTERY FEED	25
18	—	—	—
19	T19 18WT	KICK-DOWN/LOW AND REVERSE	25
20	T20 18LB	LR/LU SOLENOID	25
21	—	—	—
22	—	—	—
23	—	—	—
24	—	—	—
25	—	—	—
26	—	—	—
27	—	—	—
28	—	—	—
29	—	—	—
30	—	—	—
31	—	—	—
32	—	—	—
33	—	—	—
34	—	—	—
35	—	—	—
36	—	—	—
37	—	—	—
38	—	—	—
39	—	—	—
40	—	—	—
41	T41 20BR/YL*	PARK/NEUTRAL POSITION SW SIGNAL	23
42	T42 18VT/WT*	TRANSMISSION RANGE SWITCH GND	25
* 43	D1 20VT/BK*	CCD BUSS (B+)	24
* 44	D2 20WT/BK*	CCD BUSS (B−)	24
45	K24 18GY/BK*	DISTRIBUTOR IGNITION SENSOR	23
46	—	—	—
47	T47 18YL/BK*	KICK-DOWN PRESSURE SWITCH	25
48	—	—	—
49	—	—	—
50	T50 18DG	LOW REVERSE PRESSURE SWITCH	25
51	K4 18BK/LB*	SENSOR RETURN	23
52	T52 18RD/BK*	INPUT SPEED SENSOR (B+)	24
53	Z14 18BK/YL*	SIGNAL GROUND	25
54	—	—	—
55	—	—	—
56	A14 16RD/WT*	BATTERY VOLTAGE	25
57	Z13 18BK/RD*	POWER GROUND	25
58	G7 20WT/OR*	VEHICLE SPEED SENSOR SIGNAL	23
59	T59 18PK	UD SOLENOID	25
60	T60 18BR	OD SOLENOID	25



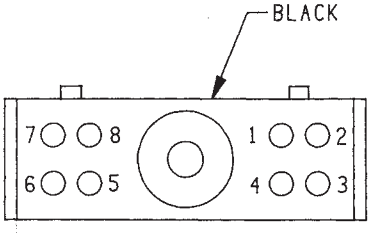
VIEWED FROM WIRE END

* - INDICATES QUAD TWISTED

AP-PD 91

TRANSMISSION CONTROL MODULE CONNECTOR

938W-6



VIEWED FROM
TERMINAL END

CAV	CIRCUIT	FUNCTION	SHEET
1	T47 18YL/BK*	KICK-DOWN PRESSURE SWITCH	25
2	T50 18DG	LOW REVERSE PRESSURE SWITCH	25
3	T9 18OR/BR*	OVERDRIVE PRESSURE SWITCH	25
4	T16 16RD	SWITCHED BATTERY FEED	25
5	T59 18PK	UD SOLENOID	25
6	T60 18BR	OD SOLENOID	25
7	T20 18LB	LR/LU SOLENOID	25
8	T19 18WT	KICK-DOWN/LOW AND REVERSE	25

938W-6

TRANSMISSION SOLENOID CONNECTOR

AP-PD 92

CHRYSLER CORPORATION

SERVICE MANUAL SUPPLEMENT BENDIX ANTILOCK 4 BRAKE SYSTEM

1993 FRONT WHEEL DRIVE CAR

This manual supplements the 1993 Front-Wheel-Drive Car Service Manual 81-270-3101, and contains the service information on the new Bendix Antilock 4 brake system. The Bendix Antilock 4 brake system only affects the LeBaron Landau, Spirit, Acclaim and LeBaron Coupe and Convertible built at the Newark Assembly Plant after April 19, 1993. Any of these model vehicles built at other assembly plants, will continue to use carryover antilock brake systems for the remainder of the 1993 model year.

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

CHRYSLER
CORPORATION
SERVICE & PARTS DIVISION

NEXT PAGE ▶

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 components.

The Component and System Index of this manual identifies the correct group for the component or system to be serviced. 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.

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

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

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

NOTE: The acronyms, terminology and nomenclature used to identify emissions related components in this manual may have changed from prior publications. These new terms are in compliance with S.A.E. recommended practice J1930. This terminology standard (J1930) is required to comply with the California Air Research Board (CARB) requirements.

NEXT PAGE ▶

GROUP TAB LOCATOR

5	**Brakes**
8W	**Wiring Diagrams**
	Component and System Index

Service Manual Comment Forms (Rear of Manual)

BRAKES

CONTENTS

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the break down of these designations is included in the Introduction Section at the front of this service manual.

Standard brake equipment consists of:

- Double pin floating caliper disc front brakes.
- Rear automatic adjusting drum brakes.
- Differential valve with a brake warning switch.
- Master cylinder.
- Vacuum power booster.
- Double pin floating caliper rear disc brakes are available on some models.

The Bendix Antilock 4 Brake System, uses the following standard brake system components. Master cylinder, power booster, caliper assemblies, braking discs, pedal assembly, brake lines and hoses. The unique parts of the Bendix Antilock 4 Brake System consists of the following components, modulator assembly, unique proportioning valves, unique junction block, wheel speed sensors, tone wheels, and electronic control unit. These components will be described in detail in the Bendix Antilock 4 Brake System section in this service manual supplement.

The hydraulic system, (Fig. 1) on the Bendix Antilock 4 brake system is diagonally split. Diagonally split hydraulic brake systems, have the left front and right rear brakes on one hydraulic system and the right front and left rear on the other. A diagonally split hydraulic brake system, will maintain half of the vehicles braking capability if there is a failure in either half of the hydraulic system.

The Bendix Antilock 4 Brake System uses two types of brake line fittings and tubing flares on the modulator assembly (Fig. 1). The different types are the ISO style and double wall style with their corresponding fittings at different joint locations. See (Fig. 2) for specific joint locations and type of tubing flares.

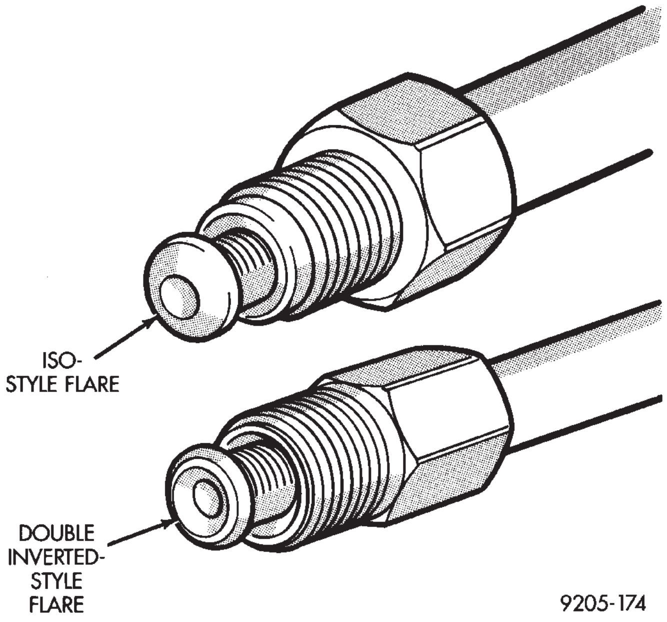


Fig. 1 Identifying Hydraulic Brake Tubing Flares

CAUTION: When servicing a vehicle, sheet metal screws, bolts or other metal fastener cannot be installed in a shock tower to take the place of any original plastic clip. Also, NO holes can be drilled into the front shock tower in the area shown in (Fig. 3), for installation of any metal fasteners into the shock tower.

Because of minimum clearance in this area, (Fig. 3) 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, lost or broken during servicing a vehicle, replace only with the equivalent part listed in the Mopar parts catalog.

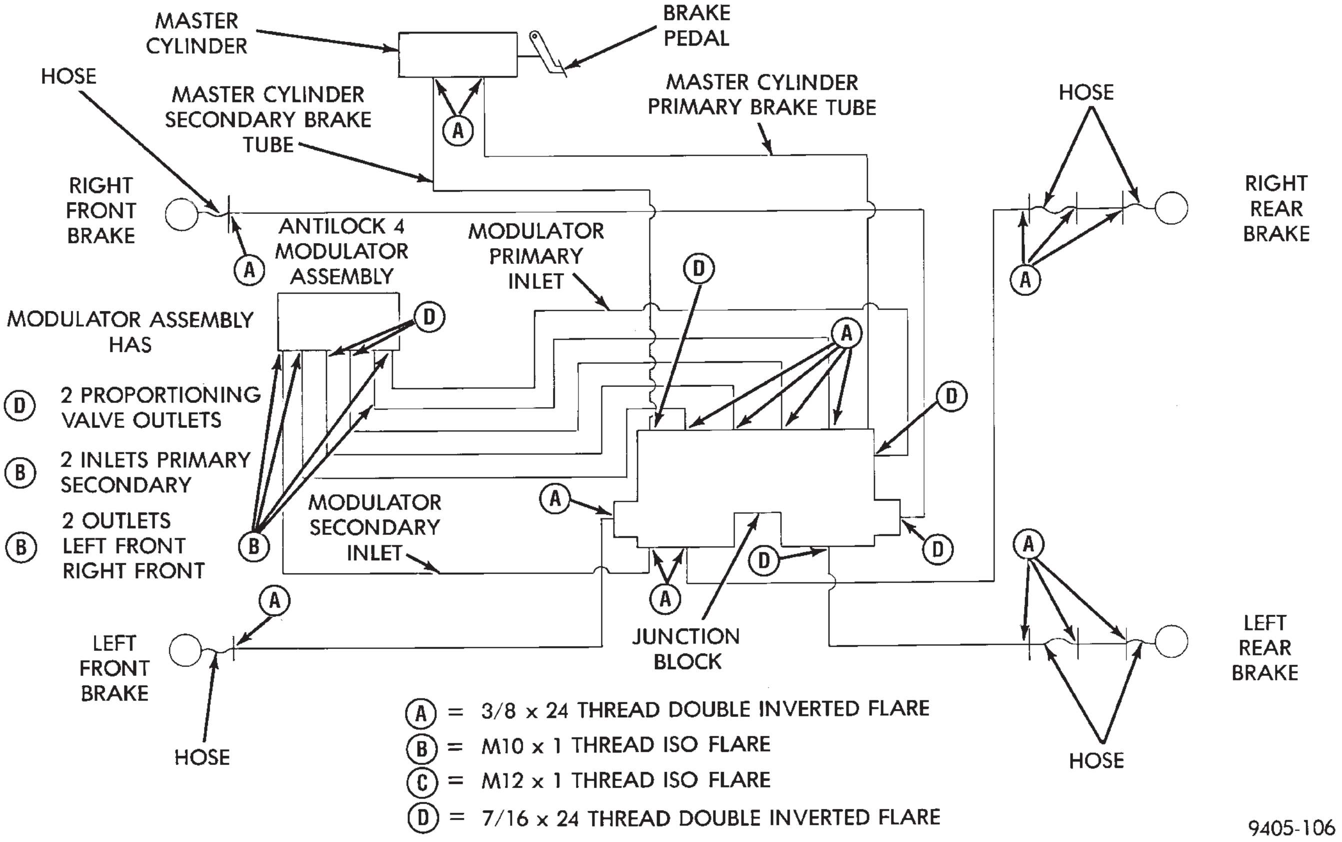


Fig. 2 Bendix Antilock 4 Brake Tube Routing And Fitting Locations

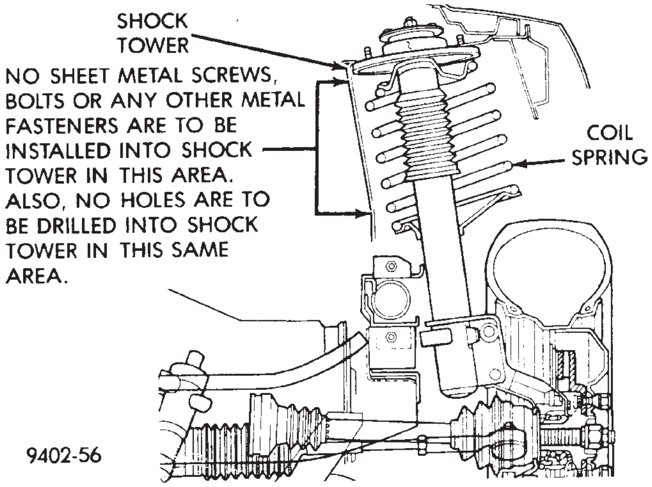


Fig. 3 Shock Tower To Spring Minimum Clearance Area

SERVICE ADJUSTMENTS

INDEX

MASTER CYLINDER FLUID LEVEL

Check master cylinder reservoir brake fluid level a minimum of two times a year.

Master cylinder reservoirs are marked with the words fill to bottom of rings indicating proper fluid level (Fig. 4).

Use only Mopar® brake fluid or an equivalent from a sealed container. Brake fluid must conform to DOT 3, specifications.

Use only brake fluid that was stored in a tightly-sealed container.

CAUTION: DO NOT use petroleum-based fluid because seal damage in the brake system will result.

CAUTION: DO NOT use brake fluid with a lower boiling point, as brake failure could result during prolonged hard braking.

If necessary add only an approved brake fluid to master cylinder fluid reservoir until filled to the proper level. Correct master cylinder fluid reservoir fill level is to the bottom of the primary reservoir split ring.

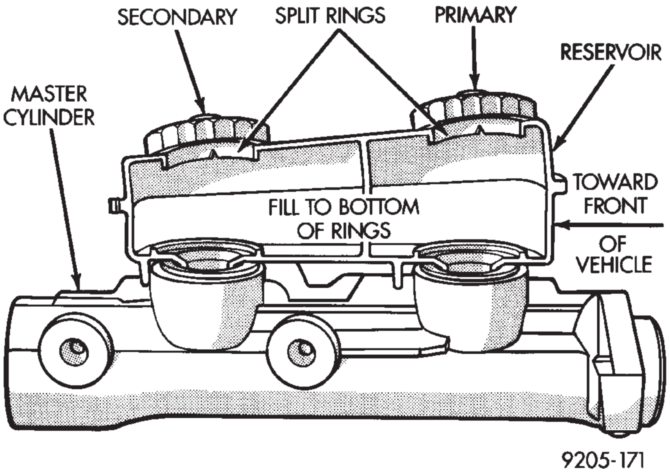


Fig. 4 Master Cylinder Fluid Level

BLEEDING BENDIX ANTILOCK 4 BRAKE SYSTEM

CAUTION: When bleeding the Bendix Antilock 4 Brake System hydraulic circuits, refer to the Bendix Antilock 4 Brake System bleeding procedure in this service manual supplement.

BASE BRAKE SYSTEM BLEEDING PROCEDURE

CAUTION: The base brakes hydraulic system, on a vehicle equipped with a Bendix Antilock 4 Brake System, can NOT be bled using a brake hydraulic system pressure bleeder. This type of pressure bleeding equipment, does not develop the pressure required in the brake hydraulic system, to adequately bleed all trapped air. The only approved method of bleeding the base brakes hydraulic system, on vehicles equipped with a Bendix Antilock 4 Brake System, is the manual procedure of pressurizing the hydraulic system using constant moderate to heavy foot pressure on the brake pedal.

When bleeding brake hydraulic systems, some air may be trapped in brake lines or valves as far as ten feet from the bleeder screw (Fig. 5). Therefore, it is essential to have a fast flow of a large volume of brake fluid when bleeding the brakes. This will ensure all trapped air is completely bled out of the brakes hydraulic system.

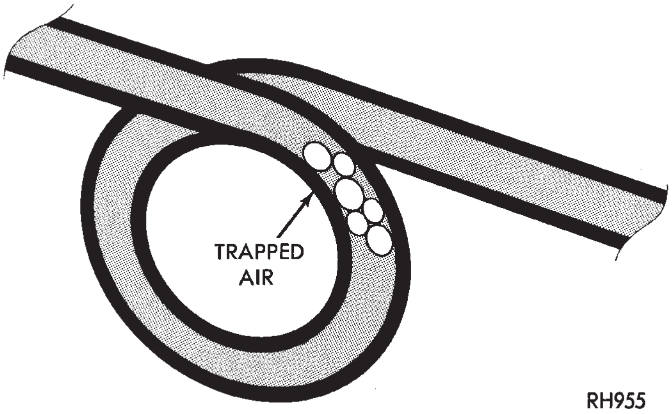


Fig. 5 Trapped Air in Brake Line

To bleed the base brake hydraulic system. Attach a clear plastic hose to the bleeder screw starting at the right rear wheel and feed the hose into a clear jar containing fresh brake fluid (Fig. 6).

The following wheel sequence when bleeding the base brakes hydraulic system should be used. This sequence will ensure adequate removal of all trapped air from the hydraulic system.

- Right rear wheel
- Left front wheel

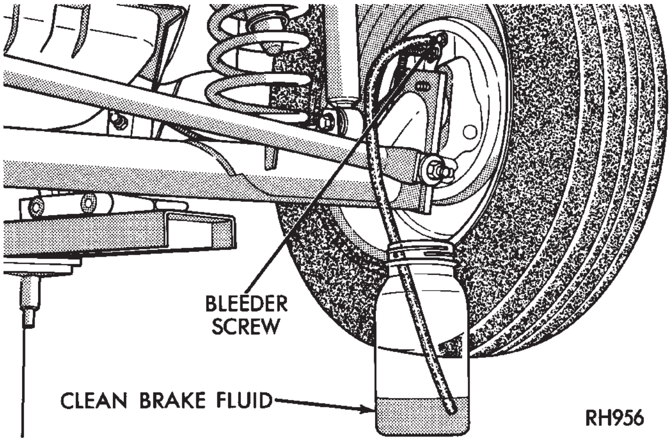


Fig. 6 Proper Method for Purging Air From Brake System

- Left rear wheel
- Right front wheel

(1) Pump brake pedal three or four times, then hold a constant moderate to heavy foot pressure on the brake pedal.

CAUTION: Just cracking the bleeder screw often restricts fluid flow, and a slow, weak fluid discharge will NOT get all the air out.

(2) Open bleeder screw (Fig. 7) at least 1 full turn. When bleeder screw opens, brake pedal will drop to the floor.

(3) Close bleeder screw. Release brake pedal off floor only **after** bleeder screw is completely closed.

(4) Repeat steps 1 through 3, four or five times, at each bleeder screw. This should pass a sufficient amount of brake hydraulic fluid to expel all trapped air. Be sure to monitor brake fluid level in master cylinder fluid reservoir. It must stay at a level that will not allow air to re-enter the hydraulic system through the master cylinder.

After 4 to 8 ounces of hydraulic fluid has been bled from the bleeder screw at this wheel, and an air-free flow has been maintained, a good bleed is indicated.

Repeat above procedure at all other remaining bleeder screws, while checking brake pedal for travel. If brake pedal travel is still excessive or has not improved, enough brake fluid has not passed through the hydraulic system to expel all trapped air. Be sure to monitor brake fluid level in the master cylinder brake fluid reservoir. It must stay at the proper level so air will not be allowed to re-enter the brake system through the master cylinder.

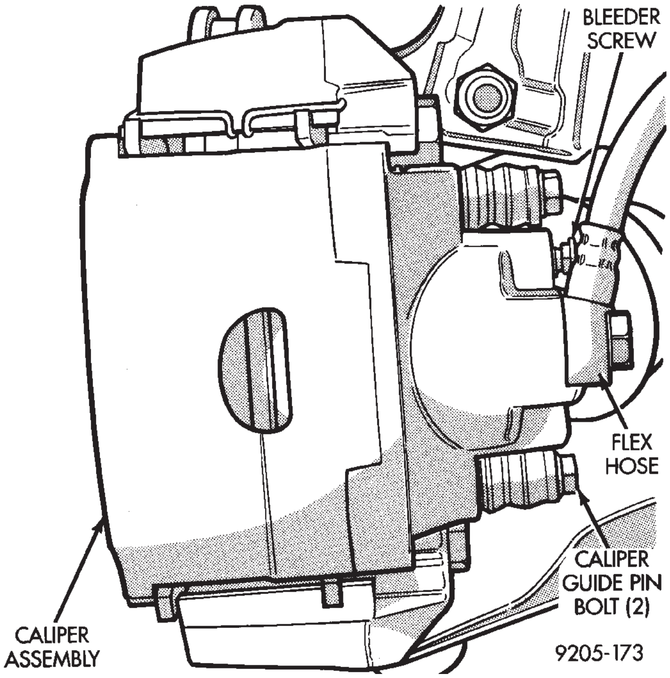


Fig. 7 Open Bleeder Screw at Least One Full Turn (Typical)

Test drive vehicle to be sure brakes are operating correctly and that pedal is not spongy.

TESTING FOR FLUID CONTAMINATION

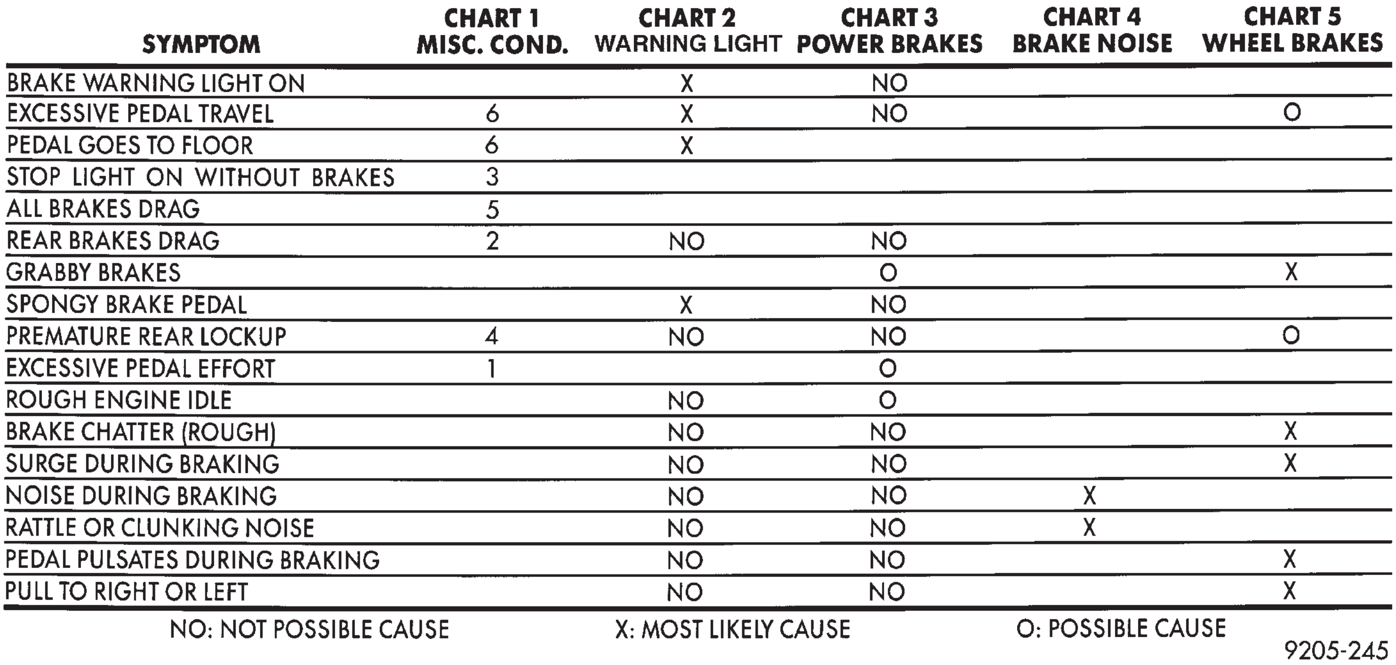
Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil contamination.

If contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals and all hoses.

BASIC DIAGNOSIS GUIDE



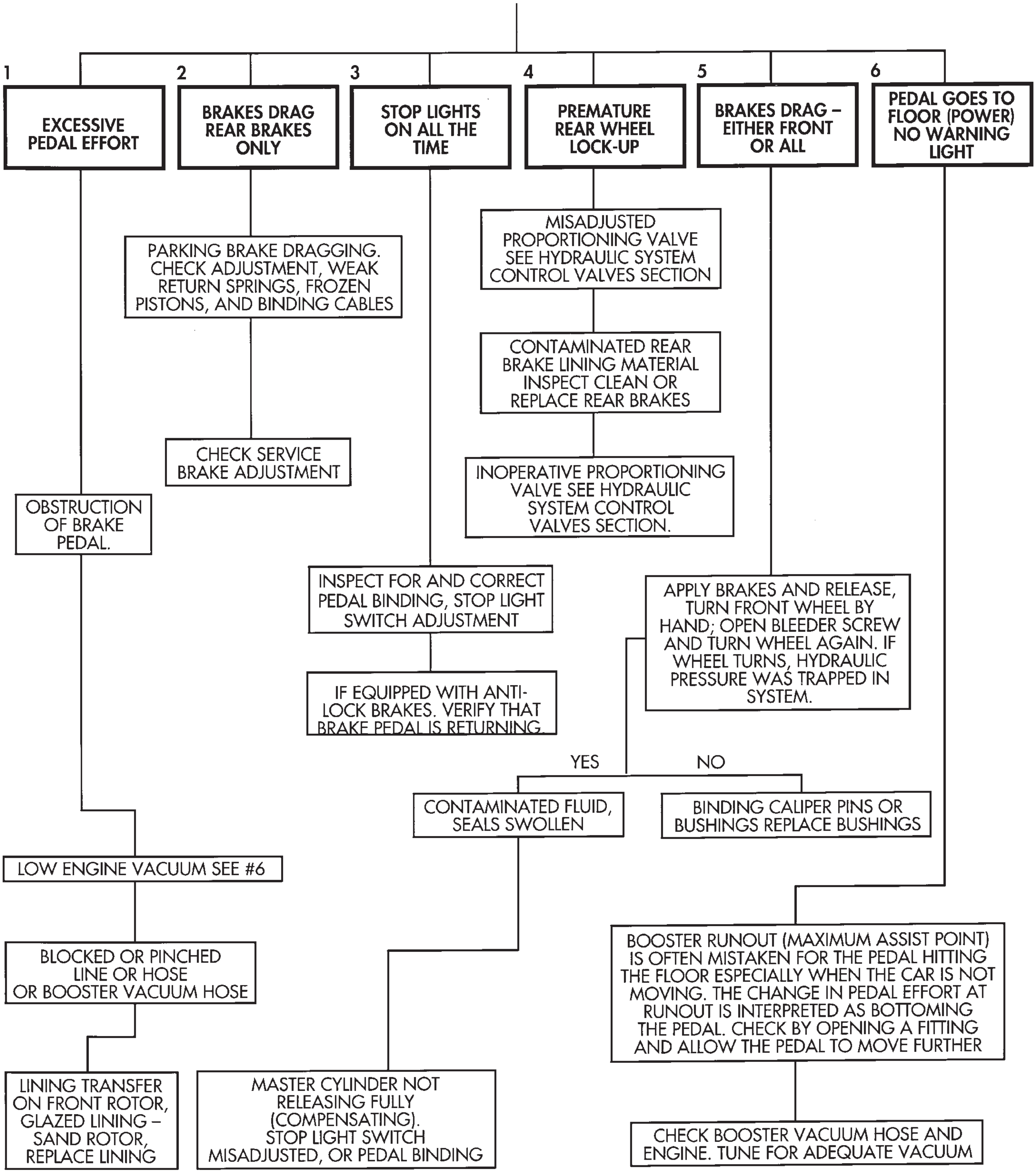
SYMPTOM	CHART 1 MISC. COND.	CHART 2 WARNING LIGHT	CHART 3 POWER BRAKES	CHART 4 BRAKE NOISE	CHART 5 WHEEL BRAKES
BRAKE WARNING LIGHT ON		X	NO		
EXCESSIVE PEDAL TRAVEL	6	X	NO		O
PEDAL GOES TO FLOOR	6	X			
STOP LIGHT ON WITHOUT BRAKES	3				
ALL BRAKES DRAG	5				
REAR BRAKES DRAG	2	NO	NO		
GRABBY BRAKES			O		X
SPONGY BRAKE PEDAL		X	NO		
PREMATURE REAR 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 POSSIBLE CAUSE X: MOST LIKELY CAUSE O: POSSIBLE CAUSE

9205-245

BRAKE SYSTEM DIAGNOSTICS

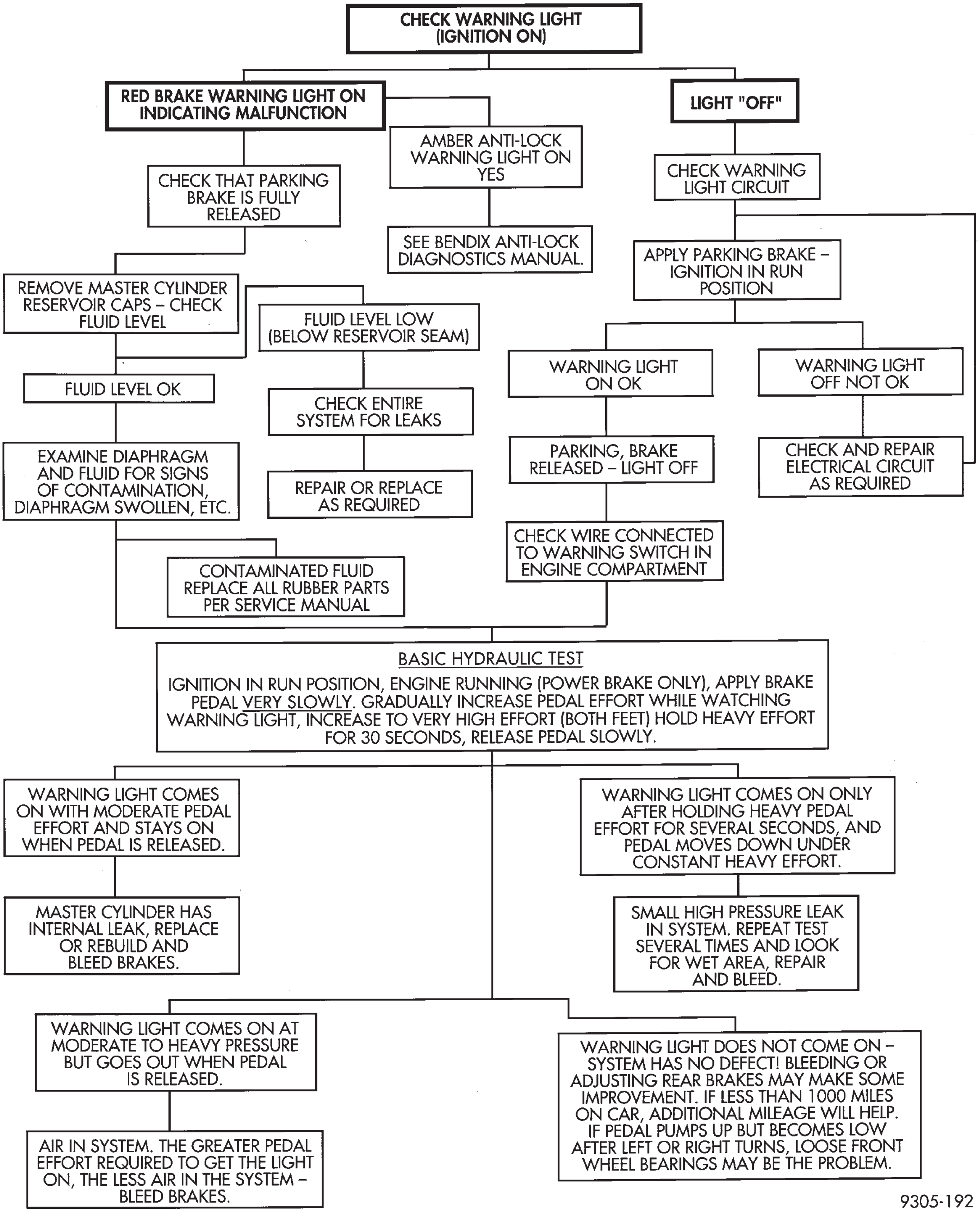
CHART 1 MISCELLANEOUS CONDITIONS



9305-191

BRAKE SYSTEM DIAGNOSTICS

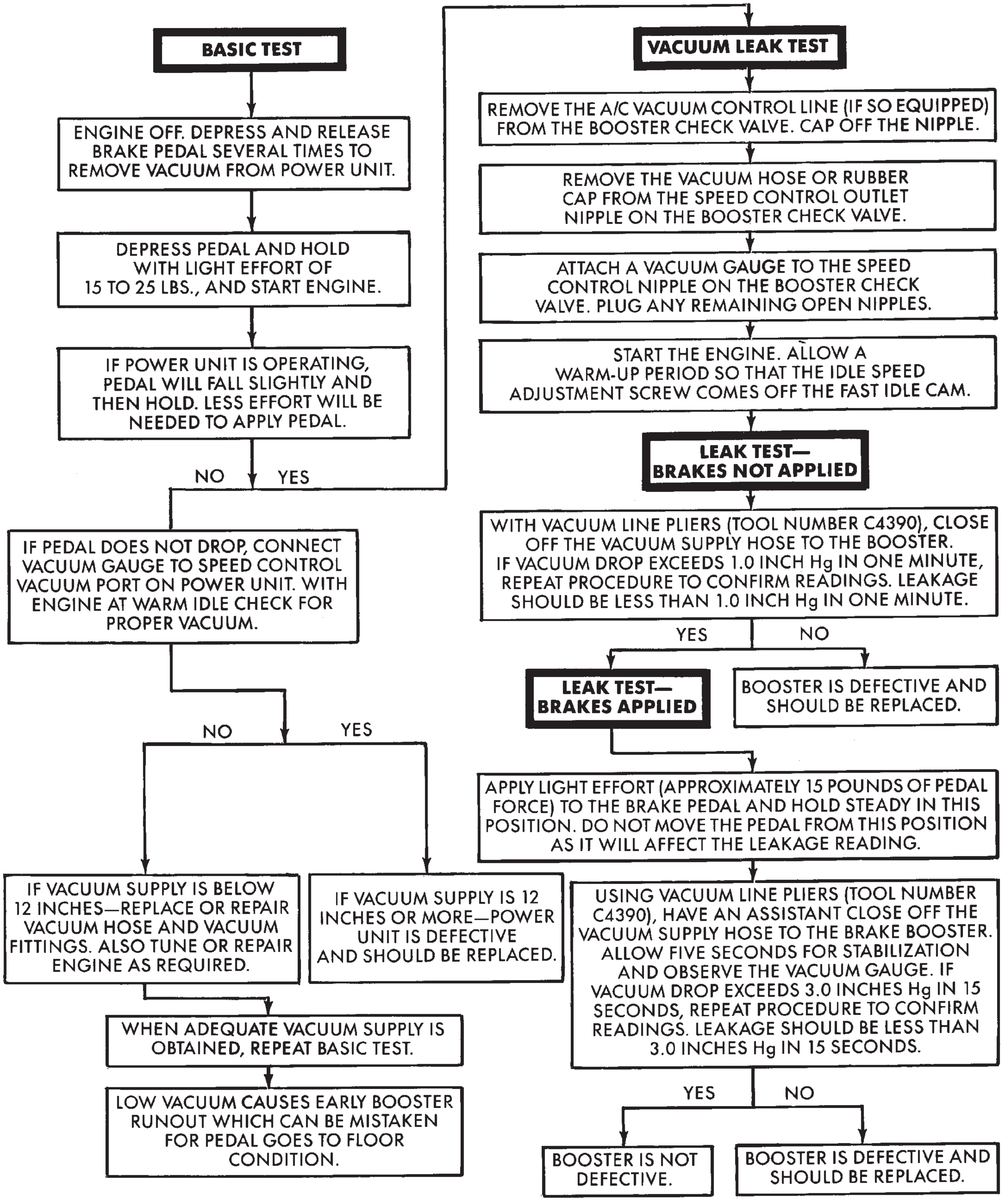
CHART 2 ACTUATION



9305-192

BRAKE SYSTEM DIAGNOSTICS

CHART 3 POWER BRAKES



BASIC TEST

ENGINE OFF. DEPRESS AND RELEASE BRAKE PEDAL SEVERAL TIMES TO REMOVE VACUUM FROM POWER UNIT.

DEPRESS PEDAL AND HOLD WITH LIGHT EFFORT OF 15 TO 25 LBS., AND START ENGINE.

IF POWER UNIT IS OPERATING, PEDAL WILL FALL SLIGHTLY AND THEN HOLD. LESS EFFORT WILL BE NEEDED TO APPLY PEDAL.

IF PEDAL DOES NOT DROP, CONNECT VACUUM GAUGE TO SPEED CONTROL VACUUM PORT ON POWER UNIT. WITH ENGINE AT WARM IDLE CHECK FOR PROPER VACUUM.

IF VACUUM SUPPLY IS BELOW 12 INCHES—REPLACE OR REPAIR VACUUM HOSE AND VACUUM FITTINGS. ALSO TUNE OR REPAIR ENGINE AS REQUIRED.

IF VACUUM SUPPLY IS 12 INCHES OR MORE—POWER UNIT IS DEFECTIVE AND SHOULD BE REPLACED.

WHEN ADEQUATE VACUUM SUPPLY IS OBTAINED, REPEAT BASIC TEST.

LOW VACUUM CAUSES EARLY BOOSTER RUNOUT WHICH CAN BE MISTAKEN FOR PEDAL GOES TO FLOOR CONDITION.

VACUUM LEAK TEST

REMOVE THE A/C VACUUM CONTROL LINE (IF SO EQUIPPED) FROM THE BOOSTER CHECK VALVE. CAP OFF THE NIPPLE.

REMOVE THE VACUUM HOSE OR RUBBER CAP FROM THE SPEED CONTROL OUTLET NIPPLE ON THE BOOSTER CHECK VALVE.

ATTACH A VACUUM GAUGE TO THE SPEED CONTROL NIPPLE ON THE BOOSTER CHECK VALVE. PLUG ANY REMAINING OPEN NIPPLES.

START THE ENGINE. ALLOW A WARM-UP PERIOD SO THAT THE IDLE SPEED ADJUSTMENT SCREW COMES OFF THE FAST IDLE CAM.

LEAK TEST—BRAKES NOT APPLIED

WITH VACUUM LINE PLIERS (TOOL NUMBER C4390), CLOSE OFF THE VACUUM SUPPLY HOSE TO THE BOOSTER. IF VACUUM DROP EXCEEDS 1.0 INCH Hg IN ONE MINUTE, REPEAT PROCEDURE TO CONFIRM READINGS. LEAKAGE SHOULD BE LESS THAN 1.0 INCH Hg IN ONE MINUTE.

LEAK TEST—BRAKES APPLIED

BOOSTER IS DEFECTIVE AND SHOULD BE REPLACED.

APPLY LIGHT EFFORT (APPROXIMATELY 15 POUNDS OF PEDAL FORCE) TO THE BRAKE PEDAL AND HOLD STEADY IN THIS POSITION. DO NOT MOVE THE PEDAL FROM THIS POSITION AS IT WILL AFFECT THE LEAKAGE READING.

USING VACUUM LINE PLIERS (TOOL NUMBER C4390), HAVE AN ASSISTANT CLOSE OFF THE VACUUM SUPPLY HOSE TO THE BRAKE BOOSTER. ALLOW FIVE SECONDS FOR STABILIZATION AND OBSERVE THE VACUUM GAUGE. IF VACUUM DROP EXCEEDS 3.0 INCHES Hg IN 15 SECONDS, REPEAT PROCEDURE TO CONFIRM READINGS. LEAKAGE SHOULD BE LESS THAN 3.0 INCHES Hg IN 15 SECONDS.

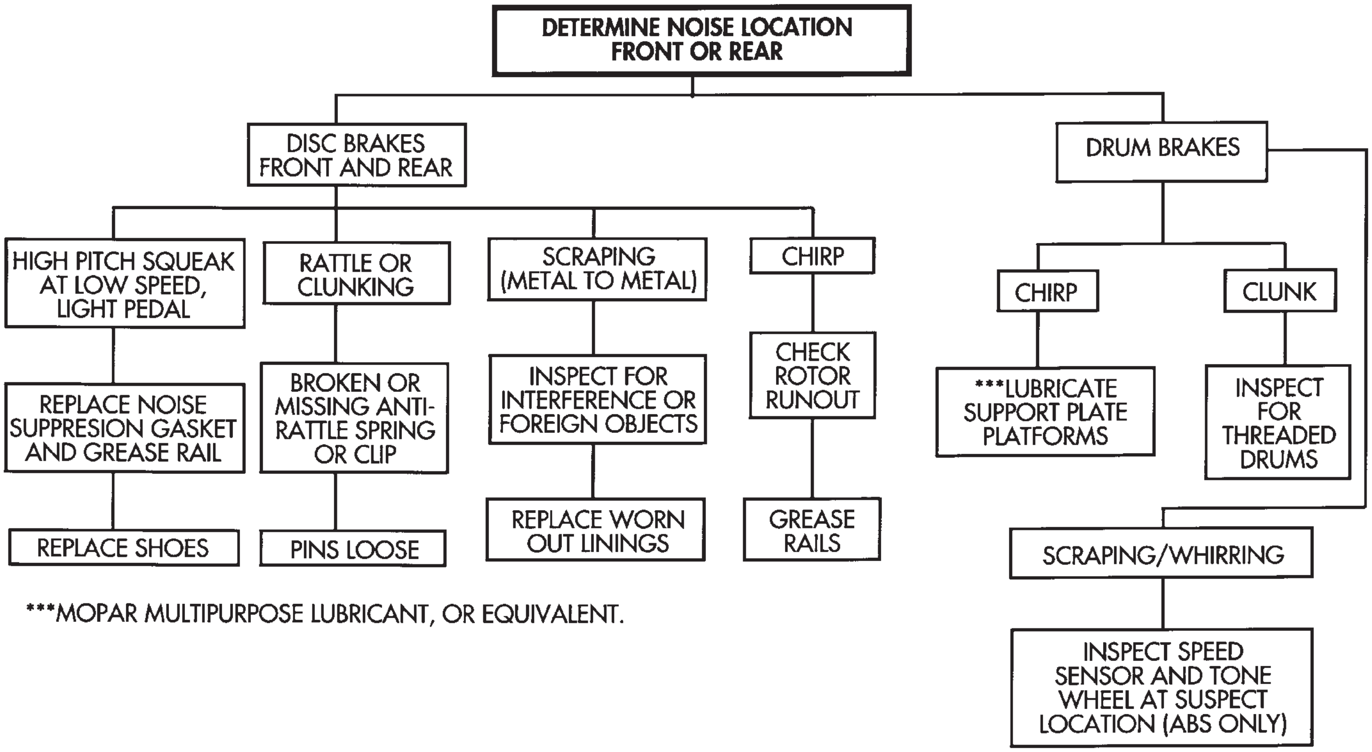
BOOSTER IS NOT DEFECTIVE.

BOOSTER IS DEFECTIVE AND SHOULD BE REPLACED.

9105-36

BRAKE SYSTEM DIAGNOSTICS

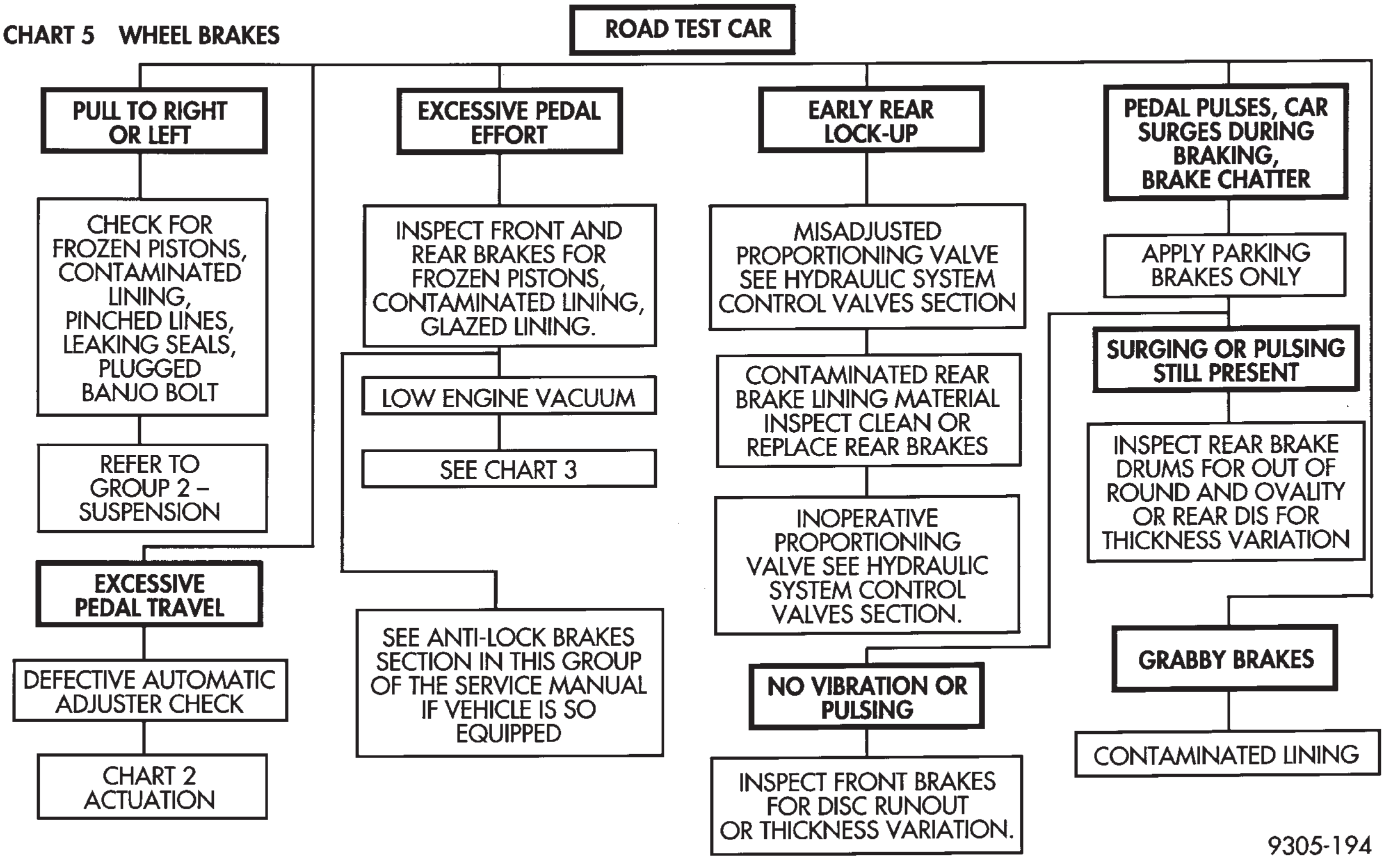
CHART 4 BRAKE NOISE



9305-193

BRAKE SYSTEM DIAGNOSTICS

CHART 5 WHEEL BRAKES



9305-194

HYDRAULIC SYSTEM CONTROL VALVES

INDEX

GENERAL INFORMATION

All models equipped with a Bendix Antilock 4 Brake System have 2 screw-in type proportioning valves. There is 1 valve for each individual rear wheel hydraulic brake line. The proportioning valves are mounted directly into the rear brake outlet ports of the modulator assembly (Fig. 1).

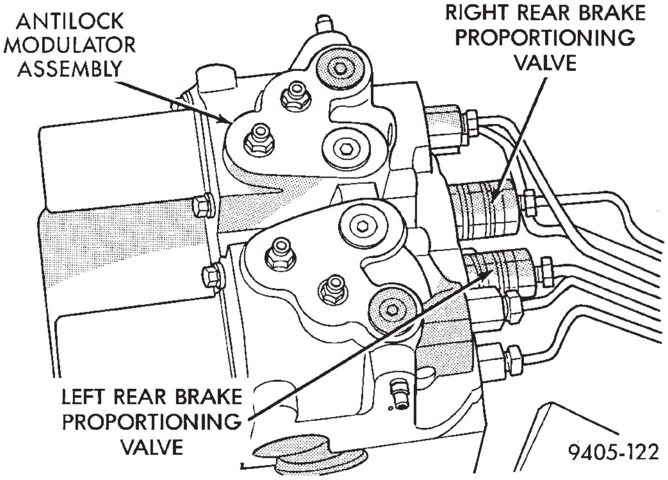


Fig. 1 Rear Brake Proportioning Valve Location On Modulator Assembly

The proportioning valves limit brake pressure to the rear brakes after a certain pressure (split point) is reached. This improves front to rear brake balance during normal braking.

Screw-in proportioning valves can be identified by numbers stamped on the body of the valve. The first digit represents the slope, the second digit represents the split (cut-in) point, and the arrow represents the flow direction of the valve. **Be sure numbers listed on a replacement valve are the same as on the valve that is being removed.** See (Fig. 2) for detail of the valve identification.

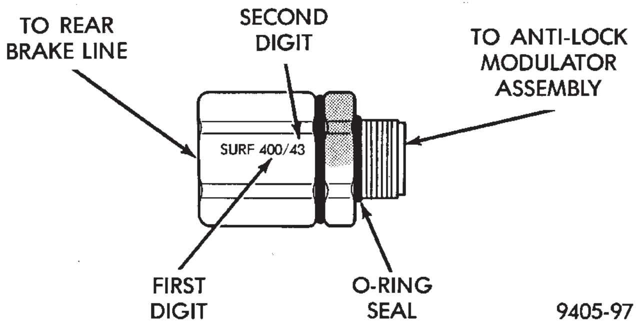


Fig. 2 ABS PROPORTIONING VALVE IDENTIFICATION

PRESSURE DIFFERENTIAL WARNING LIGHT SWITCH

The hydraulic brake system, on vehicles equipped with the Bendix Antilock 4 Brake System is split diagonally. The left front and right rear brakes are on one hydraulic system, and the right front and left rear are on another. Both systems are routed through, and hydraulically separated by the Pressure Differential Switch (Fig. 3) mounted in the hydraulic brake tube junction block. The function of the Pressure Differential Switch is to alert the driver of a malfunction in the brake hydraulic system.

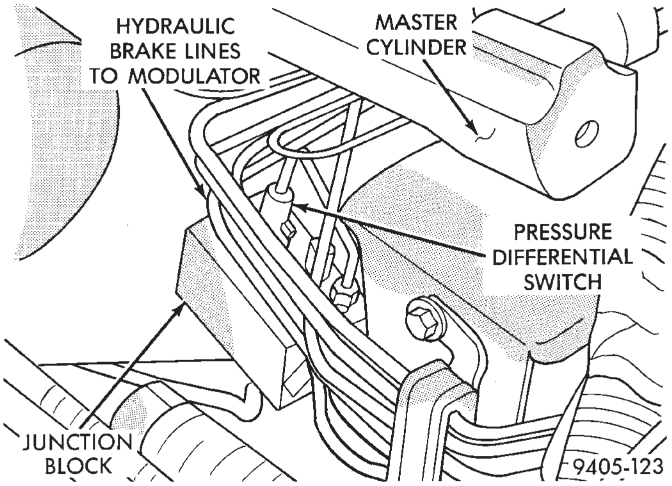


Fig. 3 Pressure Differential Warning Light Switch In Junction Block.

If hydraulic pressure is lost in one system, the warning light switch will activate the RED brake warning light on the instrument panel, when the brake pedal is depressed. At this point the brakes hydraulic system requires immediate service. However, since the brake systems are split diagonally the vehicle will retain 50% of its stopping capability in the event of a failure in either half.

The warning light switch is the latching type. It will automatically center itself after the repair is made and the brake pedal is depressed.

BENDIX ANTILOCK 4 PROPORTIONING VALVE APPLICATIONS

VEH FAM	VALVE FUNCTION	MATERIAL	PROPORTIONING		IDENTIFICATION (COLOR BAND)
			SPLIT	SLOPE	
AA-AJ ALL	14" DISC-DISC SCREW IN PROPORTIONING VALVE	ALUMINUM	435 P.S.I.	.43	NONE

9405-107

The instrument panel bulb can be checked each time the ignition switch is turned to the start position or the parking brake is set.

HYDRAULIC SYSTEM SERVICE PROCEDURES

BRAKE WARNING SYSTEM

CHECKING BRAKE WARNING SWITCH UNIT

The Red Brake Warning light will come on when the parking brake is applied with the ignition key turned ON. The same light will also illuminate should one of the two service brake hydraulic systems fail.

CAUTION:Make sure air does not enter the hydraulic system during this test procedure. See bleeding without a pressure bleeder at the beginning of this section for master cylinder fluid level checking procedures.

To test the service brake warning system lamp. Raise vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light.

If light fails to come on, inspect for a burned out bulb, disconnected socket, or a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is not interrupted. Check the service brake warning switch operation with a test lamp between the switch terminal and a known good ground. Be sure to fill master cylinder and bleed brake system after correction has been made, if necessary.

TESTING ANTILOCK PROPORTIONING VALVES

(1) Install one gauge and (TEE) between modulator assembly and male end (Inlet) of proportioning valve (Fig. 4).

(2) Install second gauge at female end (Outlet) of proportioning valve (Fig. 4).

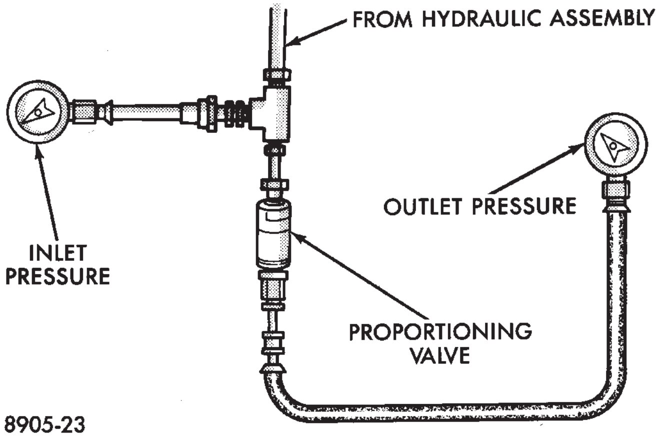


Fig. 4 Tube Connections for ABS

(3) Have a helper exert pressure on brake pedal to obtain and hold required pressure reading on the valve inlet gauge.

(4) Check reading on outlet gauge. If inlet and outlet pressures do not agree with the following chart, replace the valve. See (Fig. 3) for proportioning valve identification.

BENDIX ANTILOCK 4 PROPORTIONING VALVE PRESSURES

ABS PROPORTIONING VALVE SPLIT POINT	SLOPE	INLET PRESSURE PSI	OUTLET PRESSURE PSI
435 PSI	.43	1000	764–877

9405-110

BENDIX ANTILOCK 4 BRAKE SYSTEM

INDEX

GENERAL INFORMATION

The purpose of an Anti-Lock Brake System is to prevent wheel lock-up under heavy braking conditions on virtually any type of road surface. Antilock Braking is desirable because a vehicle which is stopped without locking its wheels will retain directional stability and some steering capability. This allows a driver to retain greater control of the vehicle during heavy braking.

This service manual supplement covers the description, diagnostics, and on car service procedures covering the Bendix Antilock 4 Brake System. If service is required on the non Antilock related components of the brake system, refer to the appropriate section in Group 5 of the Front Wheel Drive Car Engine, Chassis And Body service manual.

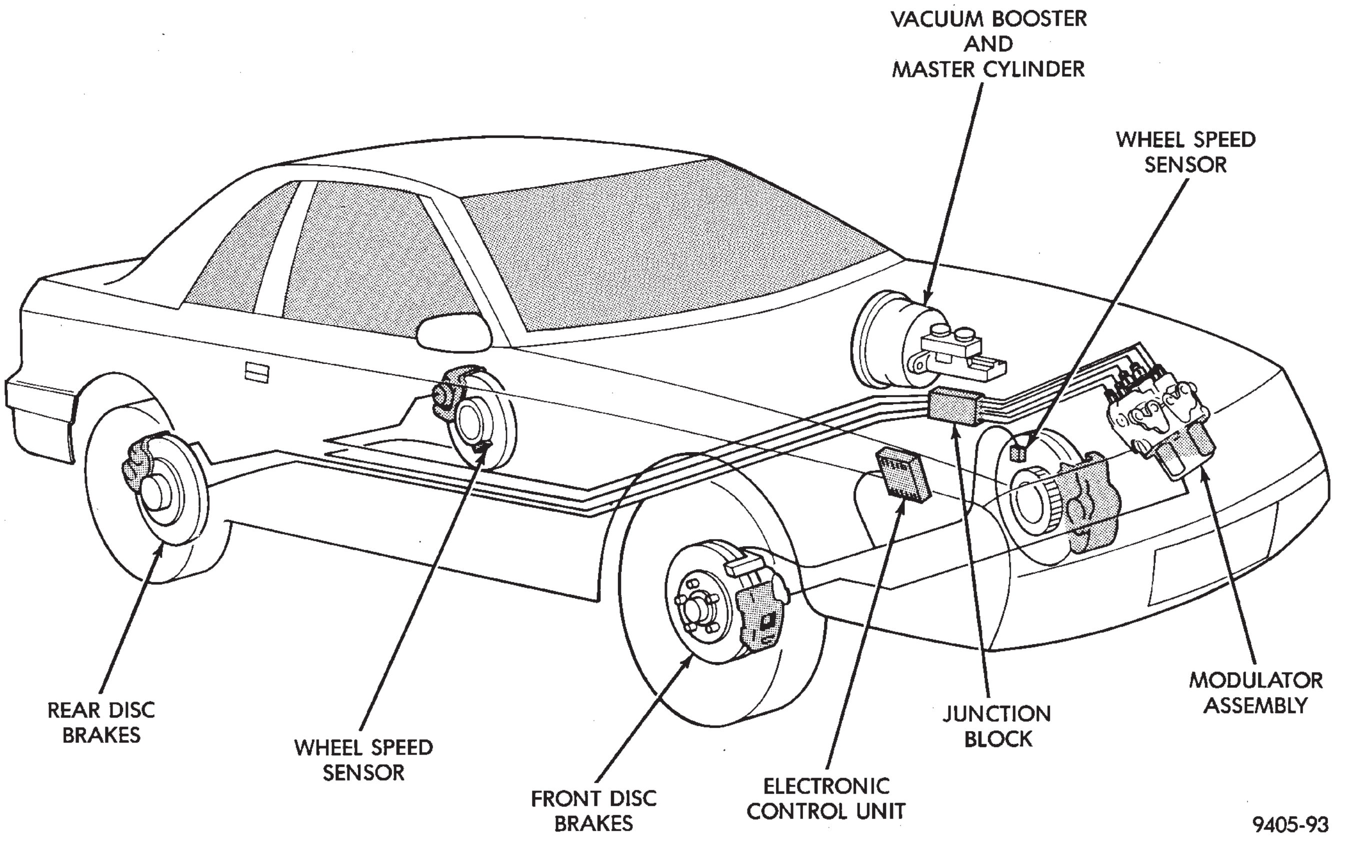
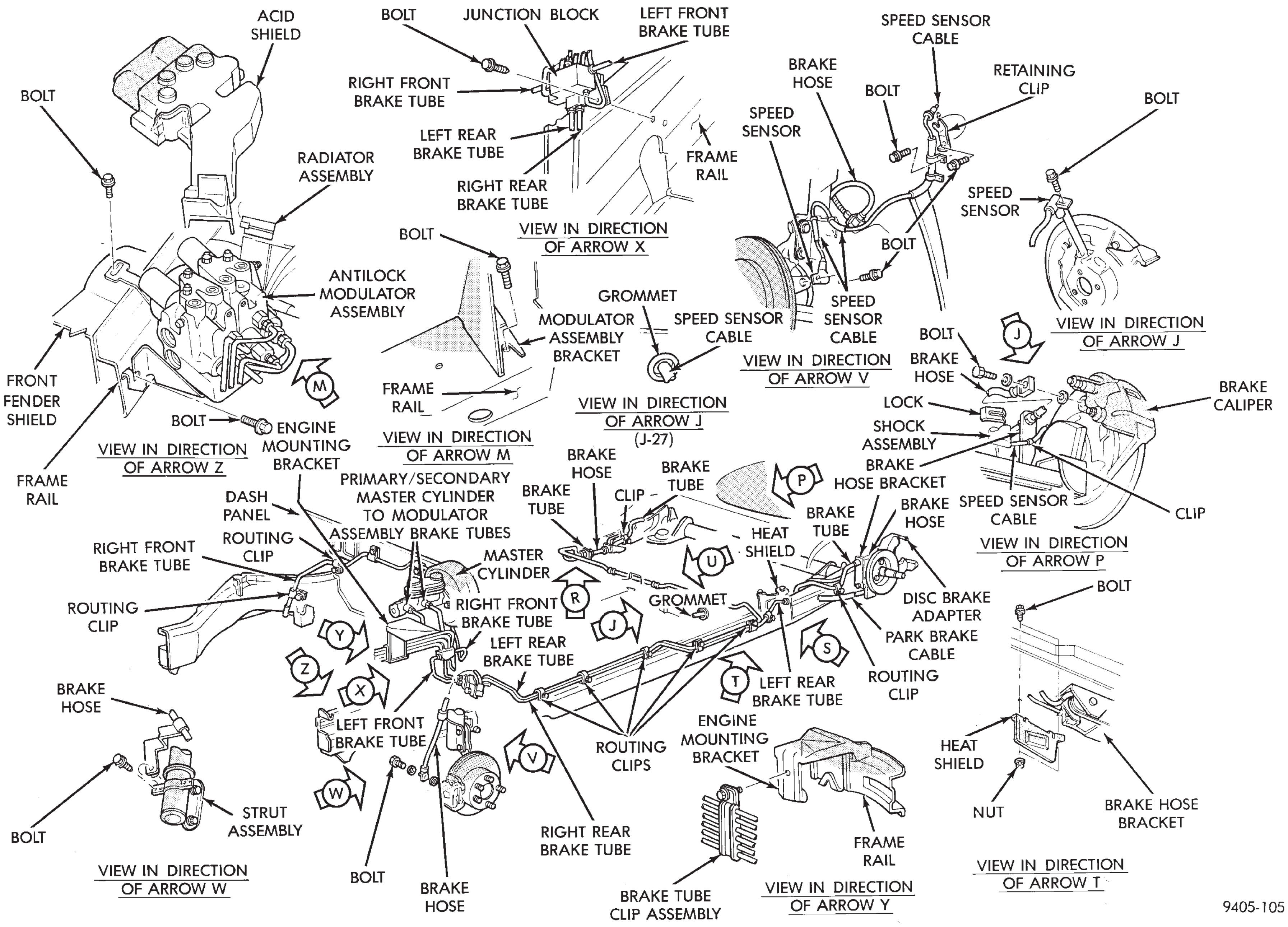


Fig. 1 Bendix Antilock 4 Brake System Components



HYDRAULIC BRAKE LINE ROUTING WITH BENDIX ANTILOCK 4 BRAKE SYSTEM

ANTILOCK BRAKE SYSTEM DEFINITIONS

In this section of the manual several abbreviations are used for the components that are in the Bendix Antilock 4 Brake System, they are listed below for your reference.

- CAB—Controller Antilock Brake
- ABS—Antilock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor
- AC—Alternating Current

NORMAL BRAKE SYSTEM FUNCTION

Under normal braking conditions, the Bendix Antilock 4 Brake System functions the same as a standard non-Antilock brake system.

When a wheel locking tendency is detected during a brake application, the vehicle brake system will enter the Antilock mode. During Antilock Braking, hydraulic pressure in the four wheel circuits is modulated to prevent wheels from locking. Each wheel circuit is designed with a set of electrical valves and hydraulic line to provide modulation, although for vehicle stability, both rear wheel valves receive the same electrical signal. The system can modulate pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) and received at the CAB.

MAJOR COMPONENTS

The following is a list of major system components. Details of all components can be found later in this section. See (Fig. 1) for the general location of the components in the vehicle.

MASTER CYLINDER AND VACUUM BOOSTER

The Bendix Antilock 4 Brake System uses a vehicles standard Master Cylinder/Reservoir and Vacuum Booster (Fig. 2). The master cylinder primary and secondary outputs (Fig. 2) go to the frame rail mounted junction block and then directly to the modulator assembly inlet ports.

MODULATOR AND PUMP MOTOR/ASSEMBLY

The Modulator Assembly (Fig. 3) contains the electronic valves used for brake pressure modulation, and the Pump/Motor assembly.

The Pump/Motor function, as part of the modulator assembly, is to pump low pressure brake fluid from the modulator sump into the ABS accumulator, as required.

WHEEL SPEED SENSORS

A Wheel Speed Sensor (Fig. 4) is located at each wheel to transmit wheel speed information to the CAB.

CONTROLLER ANTILOCK BRAKE CAB

The CAB (Fig. 5) is a small computer which receives wheel speed information, controls Antilock operation and monitors system operation.

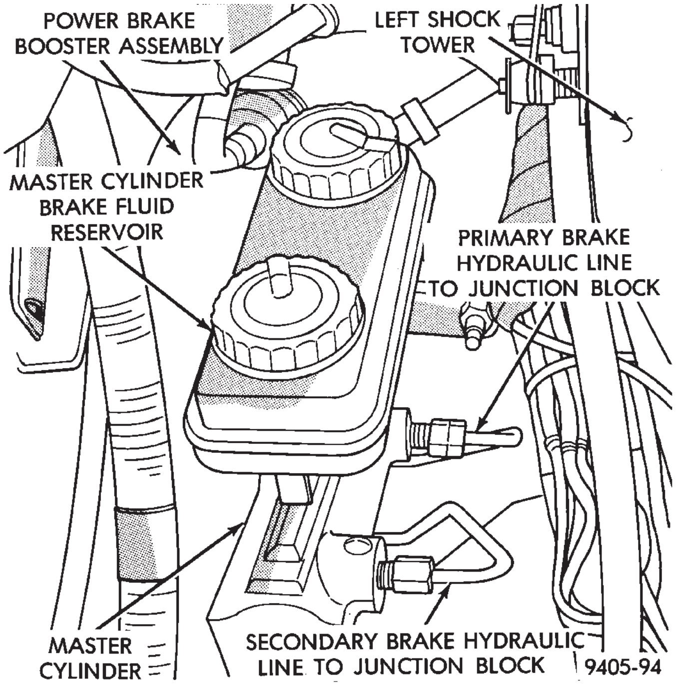


Fig. 2 Master Cylinder And Brake Booster Assembly

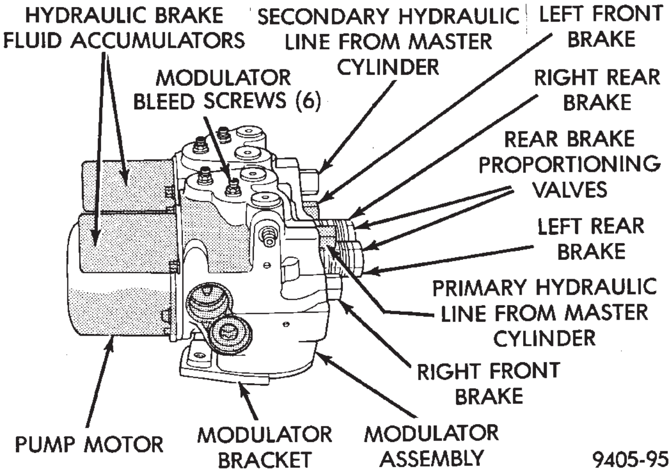


Fig. 3 Modulator And Pump/Motor Assembly

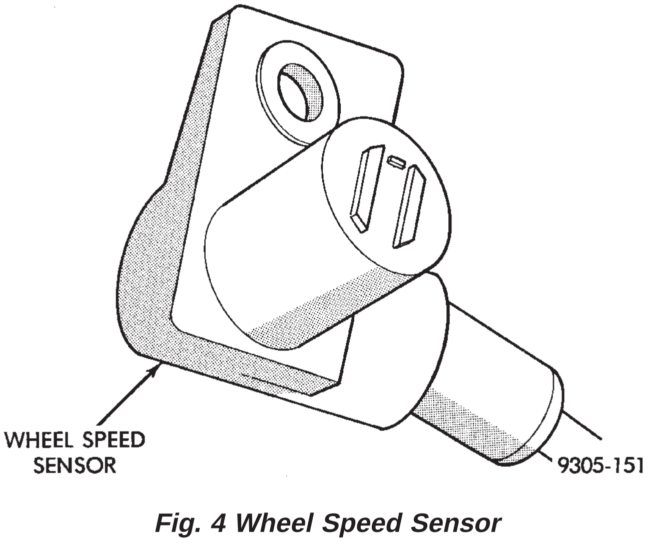


Fig. 4 Wheel Speed Sensor

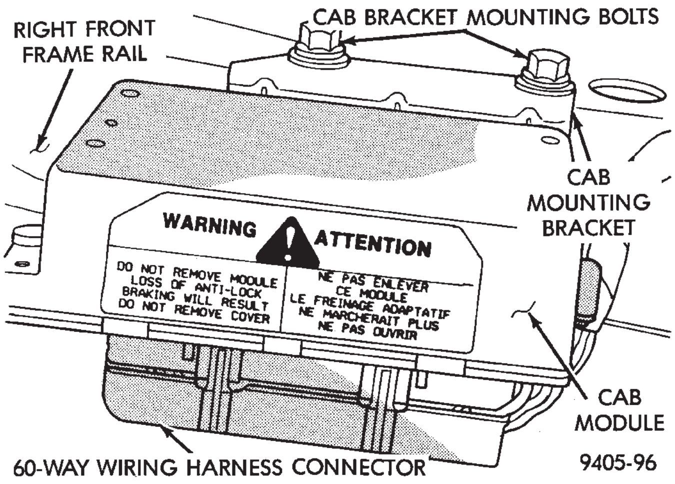


Fig. 5 Controller Antilock Brake CAB

ANTILOCK BRAKES OPERATION AND PERFORMANCE

The Bendix Antilock 4 Brake System represents the current state-of-the-art in vehicle brake 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. More technical details are discussed further in this section.

PEDAL FEEL

Since the Bendix Antilock 4 Brake System uses the vehicle's conventional brake system power booster and master cylinder. The brake pedal feel during normal braking is the same as on a conventional Non ABS equipped vehicle.

When the Antilock system becomes activated during hard braking due to a wheel lockup tendency. The brake pedal effort will increase do to the master cylinder pressure being isolated from the brake system. Some brake pedal movement and associated noises may be felt and heard by the driver. This is normal operation of the Bendix Antilock 4 Brake System due to pressurized brake fluid being transferred to and from the wheel brakes.

ANTILOCK BRAKE SYSTEM OPERATION

During Antilock Brake system operation, brake pressures are modulated by cycling electric solenoid valves. The cycling of these valves can be heard as a series of popping or ticking noises. In addition, the cycling may be felt as a pulsation in the brake pedal. If Antilock operation occurs during a hard application of the brakes, some pulsation may be felt in the vehicle body due to fore and aft movement of vehicle suspension components.

Although ABS operation is available at virtually all vehicle speeds, it will automatically turn off at speeds below 3 to 5 mph. Wheel lockup may be perceived at the very end of an anti lock stop and is considered normal.

TIRE NOISE & MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired in order to achieve optimum vehicle braking performance.

During brake fluid pressure modulation, as the brake fluid pressure is increased, wheel slip is allowed to reach up to 30%. This means that wheel rolling speed is 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 Antilock Brake System will not leave dark black tire marks since the wheel never reaches a locked condition. Tire marks may however be noticeable as light patched marks.

VEHICLE PERFORMANCE

Antilock Brakes provide the driver with some steering control during hard braking, however there are conditions 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.

SYSTEM SELF-DIAGNOSTICS

The Bendix Antilock 4 Brake System has been designed with the following self diagnostic capabilities.

The self diagnostic ABS startup cycle begins when the ignition switch is turned to the on position. At this time an electrical check is completed on the ABS components such as Wheel Speed Sensor Continuity and System and other Relay continuity. During this check the Amber Antilock Light is on for approximately 1-2 seconds.

Further Antilock Brake System functional testing is accomplished once the vehicle is set in motion, known as drive-off.

(1) The solenoid valves and the pump/motor are activated briefly to verify function.

(2) The voltage output from each of the wheel speed sensors is verified to be within the correct operating range.

If a vehicle is not set in motion within 3 minutes from the time the ignition switch is turned to the on position. The solenoid valve test is bypassed but the pump/motor is activated briefly to verify that it is operating correctly.

WARNING SYSTEMS OPERATION

The ABS system uses an Amber Antilock Warning Lamp, located in the instrument cluster. The purpose of the warning lamp is discussed in detail below.

The Amber Antilock Warning Light will turn on whenever the CAB detects a condition which results in a shutdown of the Antilock brake system. The Amber Antilock Warning Lamp is normally on until the CAB completes its self tests and turns the lamp off (approximately 1-2 seconds). When the Amber Antilock Warning Light is on, only the Antilock brake function of the brake system if affected. The standard brake system and the ability to stop the car will not be affected when only the Amber Antilock Warning Light is on.

NORMAL OPERATION OF WARNING LAMP

With ignition key turned to the Crank position, the Red Brake Warning Lamp and Amber Antilock Warning Lamp will turn on as a bulb check. The Amber Antilock Warning Lamp will stay on for 1-2 seconds then turn off, once verification of Antilock Brake System self diagnosis is completed.

ANTILOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the Bendix Antilock 4 Brake System components. For information on servicing the Four Wheel Disc Brake System, see the standard Brake section in the Front Wheel Drive Car, chassis service manual.

MODULATOR ASSEMBLY

WARNING: THE ONLY COMPONENTS OF THE MODULATOR ASSSEMBLY THAT ARE SERVICEABLE, ARE THE 2 PROPORTIONING VALVES, BLEED SCREWS AND THREAD SAVERS. THE REMAINING COMPONENTS OF THE MODULATOR ASSEMBLY ARE NOT INTENDED TO BE SERVICEABLE ITEMS. NO ATTEMPT SHOULD BE MADE TO REMOVE OR SERVICE ANY OTHER COMPONENTS OF THE MODEULATOR ASSEMBLY.

The Modulator Assembly (Fig. 1) is located under the battery tray and is covered with an acid shield. The Modulator Assembly contains the following components for controlling the Antilock brake system. 4 Build/Decay Valves, 4 Shuttle Orifices, 2 Fluid Sumps, 2 Accumulators, and a Pump/Motor assembly. Also attached to the Modulator Assembly are 6 brake tubes which are connected to a 12 way junction block. The junction block (Fig. 2) is mounted to the left frame rail below the master cylinder in the same location as the non ABS equipped combination valve. The wheel brake lines are attached to the system via the connector block.

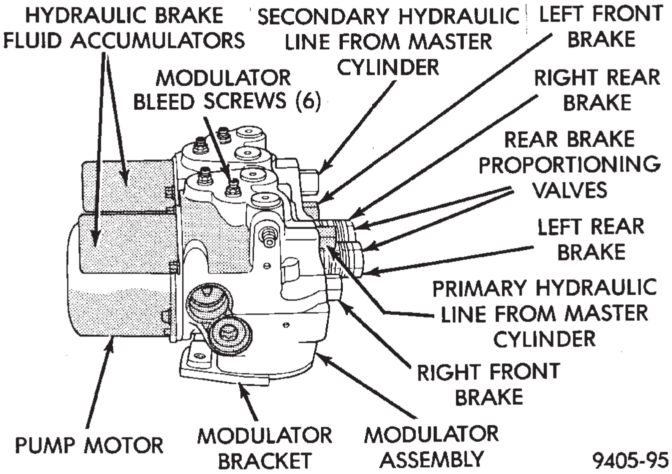


Fig. 1 Modulator Assembly

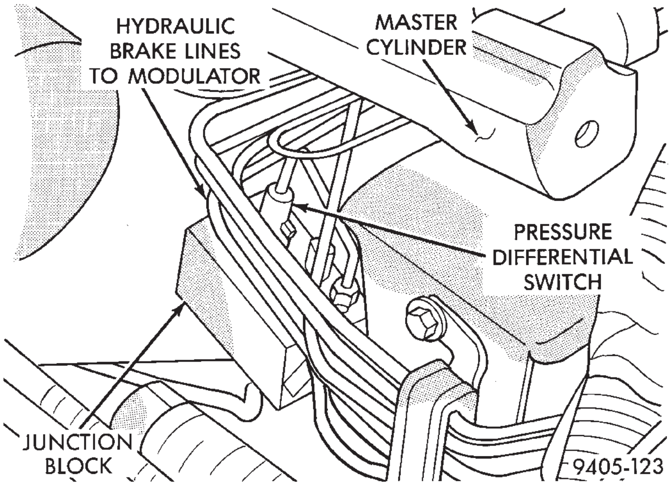


Fig. 2 Antilock Brake Junction Block

BUILD/DECAY VALVES

There are 4 Build/Decay valves, one for each wheel. In the released position they provide a fluid path direct to the wheel brakes. In the actuated (decay) position, they provide a fluid path from the wheel brakes to the sump. The Build/Decay valves are spring loaded in the released (build) position.

SHUTTLE ORIFICE

There are 4 Shuttle Orifice Valves, one for each wheel. The Shuttle Orifice Valve is a hydraulically actuated valve which shuttles when the Build/Decay valve is actuated. Actuating of the Build/Decay valve causes a pressure differential to be created across the Shuttle Orifice Valve. This acts like placing an orifice (restriction) in the line between the wheel and the Build/Decay Valve. This restriction provides a controlled build rate to each wheel brake during an Antilock stop. The Shuttle Orifice Valve will remain in the orificed position until the ABS cycle is complete. When the ABS cycle has been completed the Build/Decay valves will return to their released position which will equalize the pressure across the Shuttle Orifice Valves. When the pressure equalizes, the spring loaded Shuttle Orifice valves will return to the unrestricted position.

FLUID SUMPS

There are two Fluid Sumps in the Hydraulic Assembly, one for the primary and secondary hydraulic circuits. The Fluid Sumps store the brake fluid that is decayed from the wheel brakes during an ABS cycle. This fluid is then pumped to an accumulator and/or the hydraulic system in order to provide build pressure. The typical pressure in the sumps is 50 psi, during ABS operation only.

HYDRAULIC SPRING ACCUMULATOR

The Hydraulic Spring Accumulators (Fig. 3) (one on each circuit) are used to store pressurized hydraulic brake fluid during ABS operation only. This fluid is used during hard braking when the ABS system is activated, to supplement brake pressure when required. During normal Non ABS brake operation there is NO pressurized brake fluid stored in the accumulators. The Hydraulic Spring Accumulators are not a serviceable part of the Modulator Assembly and should never be removed from the assembly.

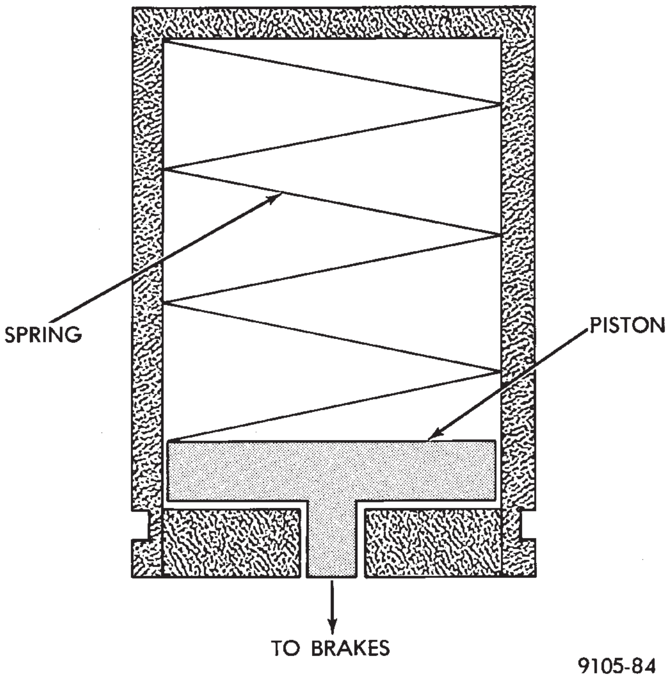


Fig. 3 Hydraulic Spring Accumulator

PRESSURE DIFFERENTIAL SWITCH

The Pressure Differential Switch on the Bendix Antilock 4 Brake System is located on the frame rail mounted brake hydraulic tube junction block. This switch functions the same as the Pressure Differential Switch located in the combination valve on standard non ABS brake system. The pressure differential switch monitors the primary and secondary hydraulic brake circuits for a difference in pressure. A pressure difference greater than 225 psi., will move and latch the switch, grounding the Red Brake Warning Light circuit. This will in turn, turn on the Red Brake Warning Light in the instrument panel to warn the driver of a pressure loss in one of the brake hydraulic systems. This pressure differential switch is a replaceable item of the junction block assembly. **The Red Brake Warning Light only indicates a problem with the foundation brake hydraulic system and not the Antilock system.**

PUMP/MOTOR ASSEMBLY

The Modulator Assembly contains 2 Pump Assemblies, one each for the primary and secondary hydraulic circuits. Both pumps are driven by a common electric motor which is part of the Modulator Assembly. The pumps take brake fluid from the sumps to supply pressure to the accumulators or hydraulic system via the shuttle orifice during an Antilock stop. The motor only runs during an ABS stop and is controlled by the CAB via the Pump/Motor Relay. The Pump/Motor Assembly is not a serviceable item. If it requires service the Modulator Assembly must be replaced.

PROPORTIONING VALVES

Two Proportioning Valves (Fig. 4) are used in the Bendix Antilock 4 Brake System, one for each of the rear wheel brake hydraulic circuits. The Proportioning Valves function the same as in a standard brake system. The Proportioning Valves are located on the side of the modulator assembly (Fig. 1). Each rear wheel hydraulic brake line, is connected to an individual proportioning valve.

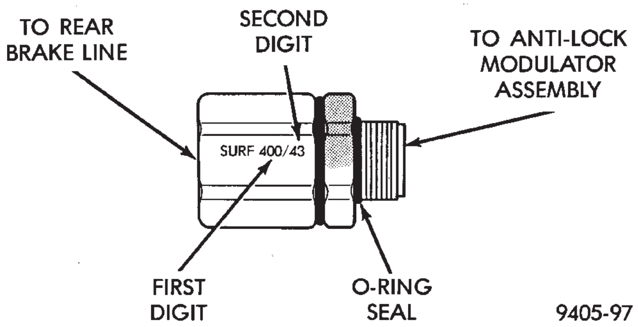


Fig. 4 Proportioning Valve Identification

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS), is located at each wheel (Fig. 5 and 6), and sends a small AC signal to the control module CAB. This signal is generated by magnetic induction. The magnetic induction is created, when a toothed sensor ring (Tone Wheel) (Fig. 7) passes a 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, the CAB will then modulate hydraulic pressure to prevent the wheel or wheels from locking.

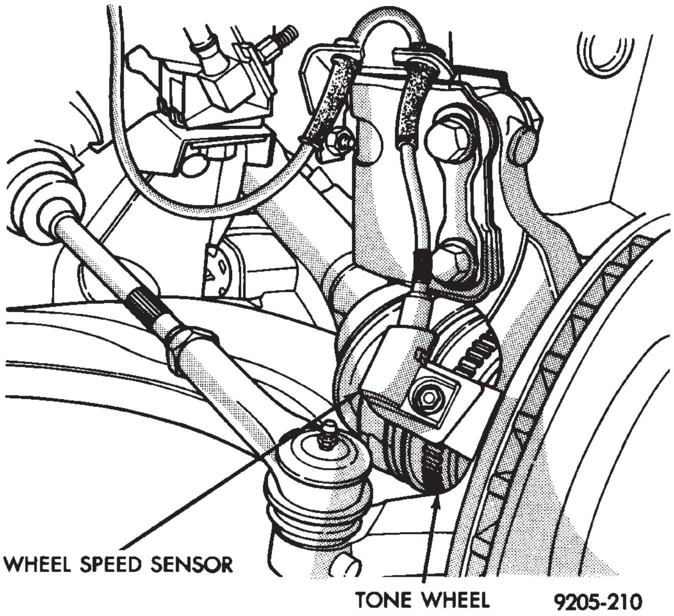


Fig. 5 Front Wheel Speed Sensor

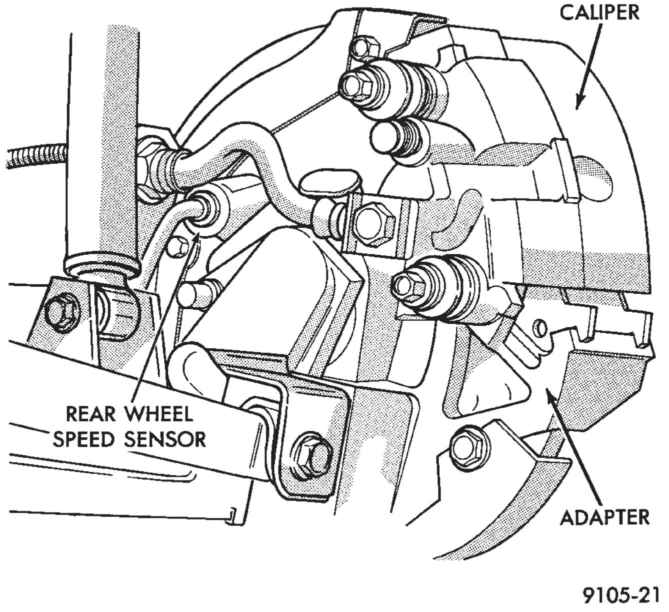


Fig. 6 Rear Wheel Speed Sensor

The front Wheel Speed Sensor is attached to a boss in the steering knuckle (Fig. 5). The tone wheel is part of the outboard constant velocity joint (Fig. 5).

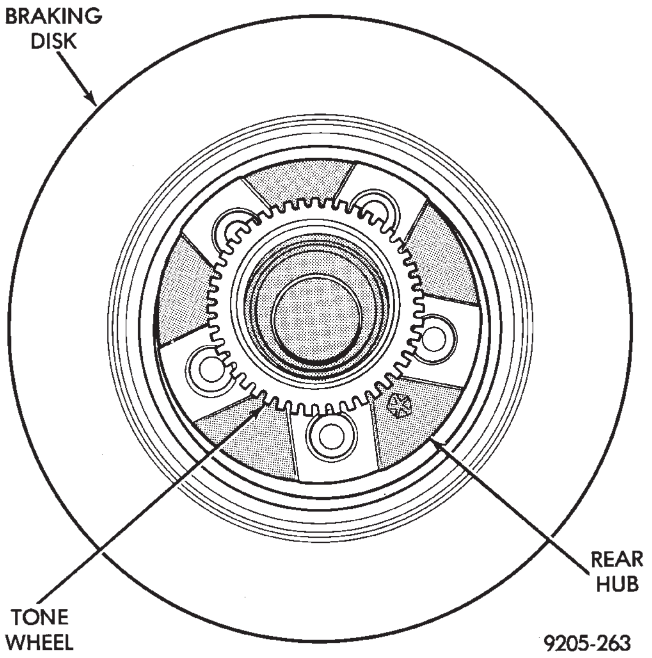


Fig. 7 Rear Tone Wheel (Typical)

The rear Wheel Speed Sensor is mounted to the caliper adapter (Fig. 6) and the rear tone wheel is an integral part of the rear wheel hub (Fig. 7). The speed sensor air gap is NOT adjustable.

The four Wheel Speed Sensors are serviced individually. The front Tone Wheels are serviced as an assembly with the outboard constant velocity joint. The rear Tone Wheels are serviced as an assembly with the rear brake hub.

Correct Antilock system operation is dependent on the vehicle's wheel speed signals, that are generated by the Wheel Speed Sensors. The vehicle's wheels and tires must all be the same size and type to generate accurate signals. In addition, the tires must be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals.

CONTROLLER ANTILOCK BRAKE CAB

The Antilock Brake Controller is a small microprocessor based device which monitors the brake system and controls the system while it functions in the Antilock mode. The CAB is mounted on the top of the right front frame rail and uses a 60-way system connector (Fig. 8). The power source for the CAB is through the ignition switch in the Run or On position. **THE CONTROLLER ANTILOCK BRAKE CAB IS NOT ON THE CCD BUS**

The primary functions of the CAB are:

(1) Detect wheel locking tendencies.

(2) Control fluid modulation to the brakes while in Antilock mode.

(3) Monitor the system for proper operation.

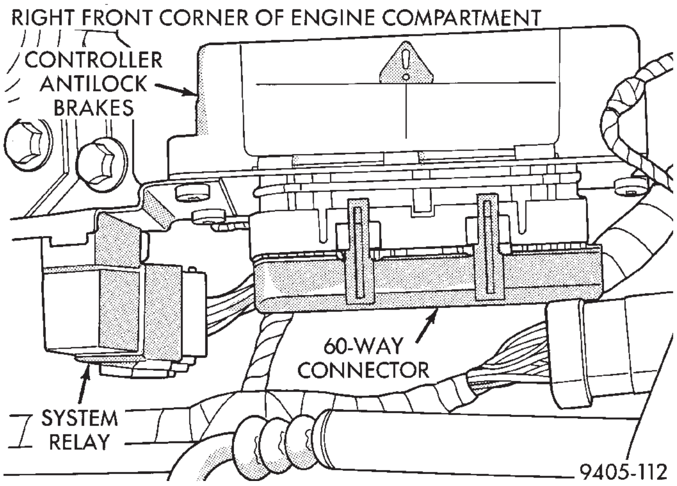


Fig. 8 CAB Location

(4) Provide communication to the DRB II while in the Antilock brakes diagnostic mode.

The CAB continuously monitors the speed of each wheel, through the signals generated at the Wheel Speed Sensors. This is used to determine if any wheel of the vehicle is beginning to lock-up (skid) when the brakes are applied. When a wheel locking tendency is detected during brake apply. The CAB commands the appropriate Build/Decay valves to 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 Antilock Warning Lamp and disable the ABS brake system. The normal Non ABS brake system will remain operational.

The CAB contains a self-diagnostic program which will turn on the Amber Antilock Warning Lamp when a system fault is detected. Faults are stored in a diagnostic program memory. There are 16 fault codes which may be stored in the CAB and displayed through the DRB II. These fault codes will remain in the CAB memory even after the ignition has been turned off. The fault codes can be cleared by using the DRB II diagnostics tester, or they will be automatically cleared from the memory after (50) ignition switch on/off cycles.

CONTROLLER ANTILOCK BRAKE (INPUTS)

- Four wheel speed sensors.
- Stop lamp switch.
- Ignition switch.
- System relay voltage.
- Ground.
- Pump/Motor Relay Monitor
- Diagnostics Communications

CONTROLLER ANTILOCK BRAKE (OUTPUTS)

- 4 Build/Decay valves.
- Antilock warning lamp.
- System relay actuation.
- Diagnostic communication.
- Pump/Motor relay actuation

DIAGNOSTIC CONNECTOR

The Bendix Antilock 4 Brake System diagnostic connector is located under the fuse panel access cover. The access cover is located on the lower section of the instrument panel to the left side of the steering column. The diagnostics connector is a blue 6 way connector see (Fig. 9).

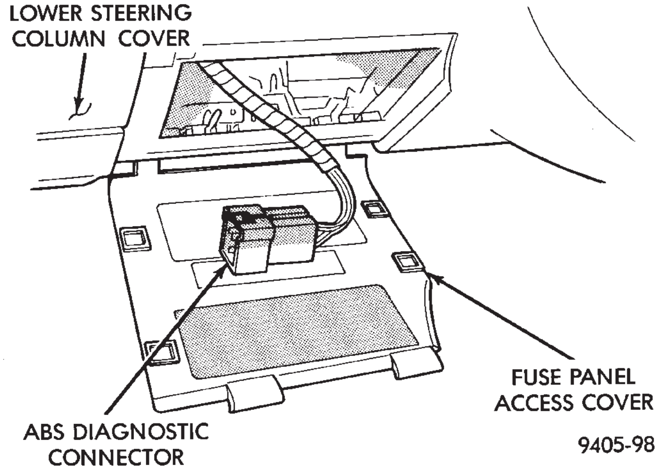


Fig. 9 Antilock Diagnostic Connector Location

ANTILOCK SYSTEM RELAYS AND WARNING LAMPS

SYSTEM RELAY

The ABS Modulator Valves are powered through the System Relay which is located on a bracket mounted to the CAB (Fig. 10). The System Relay provides power to the CAB for modulator valve operation (pins 47 and 41) after the startup cycle when the ignition is turned on.

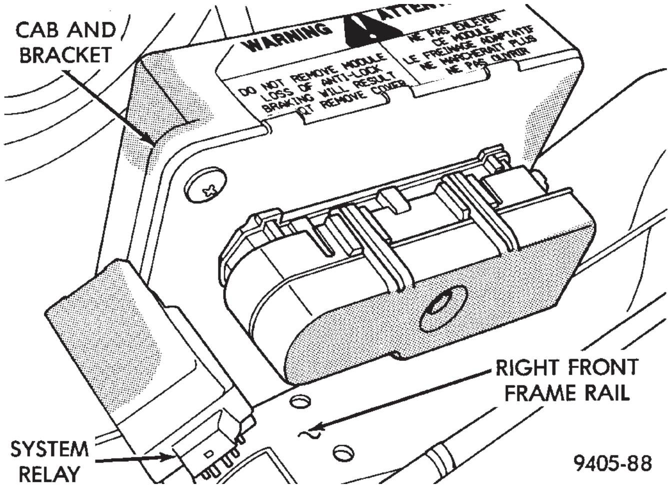


Fig. 10 System Relay Location On The CAB

ANTILOCK WARNING LAMP DIODE

The Warning Lamp Relay on the Bendix Antilock 4 Brake System has been replaced with a diode. The diode is used to control the function of the warning lamp and is located inside the CAB module wiring harness. The diode is a replaceable component of the wiring harness, and will not require replacement of the entire wiring harness if only the diode is diagnosed to have failed.

When the system relay is de-energized, the Antilock warning lamp will be lit. This will occur because a ground path exists for the Antilock warning lamp through the Antilock warning lamp diode and the system relay armature. When the system relay is energized by the CAB, the system relay armature will no longer provide a ground and the lamp will turn off. Thus, the lamp will be lit if either the CAB is disconnected or a system fault causes the Antilock to be turned off.

PUMP/MOTOR RELAY

Pump/Motor power is supplied by the Pump/Motor Relay. The Pump/Motor Relay is either mounted on the left front inner fender shield, or the front of the left shock tower. The mounting location is dependent on whether the vehicle is or is not equipped with a power distribution center. See (Fig. 11 and 12) for specific mounting locations.

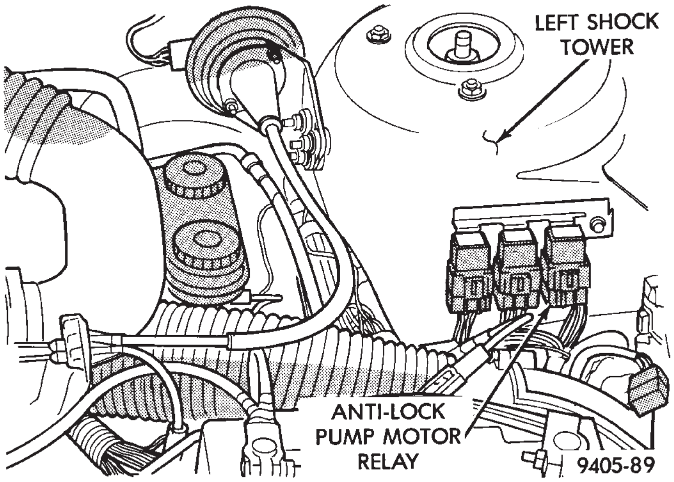


Fig. 11 Pump Motor Relay Location On AA Body W/O Power Distribution Center

ANTILOCK WARNING LAMP OFF

System Relay Energized

From pin 57, the CAB energizes the Antilock system relay coil, thus the electrical current flow in the coil closes the system relay. Then electrical current is provided to pins 47 and 41 of the CAB to provide power to the modulator valves.

The CAB turns off the Amber Antilock Warning Lamp by breaking the ground path through pin 15 of the CAB.

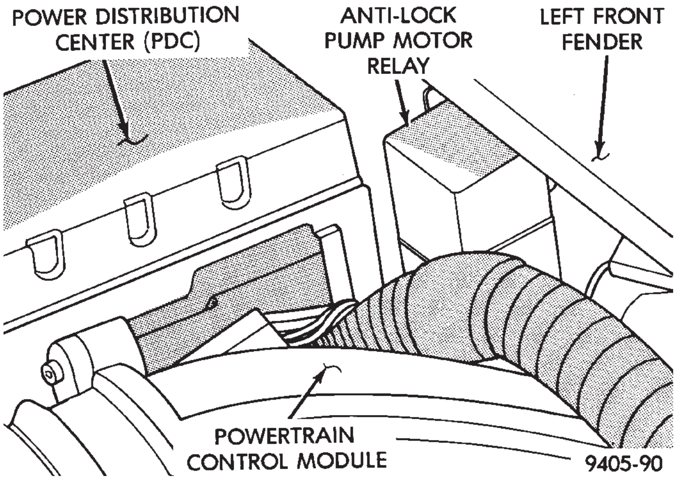


Fig. 12 Pump Motor Relay Location On AJ Body With Power Distribution Center

ANTILOCK WARNING LAMP ON

System Relay De-Energized.

When the Amber Antilock Warning Lamp is on, there is no electrical current flow from the CAB at pin 57 and the System Relay coil is NOT energized. No electrical current flows to pin 47 and 41 (modulator valve power), or to the Antilock Warning Lamp diode. Thus, the Amber Antilock Warning Lamp is not energized. The Amber Antilock Warning Lamp is now grounded through the Antilock Warning Lamp diode and pin 15 of the CAB turning on the Amber Antilock Warning Lamp.

HYDRAULIC CIRCUITS AND VALVE OPERATION

Through the following operation descriptions and diagrams. The function of the various hydraulic control valves in the ABS system 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 Antilock braking.

For explanation purposes we will assume all speed sensors are sending the same wheel speed information, requiring the same hydraulic fluid modulation at the same rate.

NORMAL BRAKING

BUILD/DECAY VALVES

Closed (Fig. 1)

The brake pedal is applied. The travel of the brake pedal closes primary and secondary circuits from the master cylinder fluid supply. Brake fluid from the master cylinder primary and secondary circuits flows through the build/decay valves to the wheel brakes.

ABS BRAKING-BUILD PRESSURE

BUILD/DECAY VALVES

Open (Fig. 2)

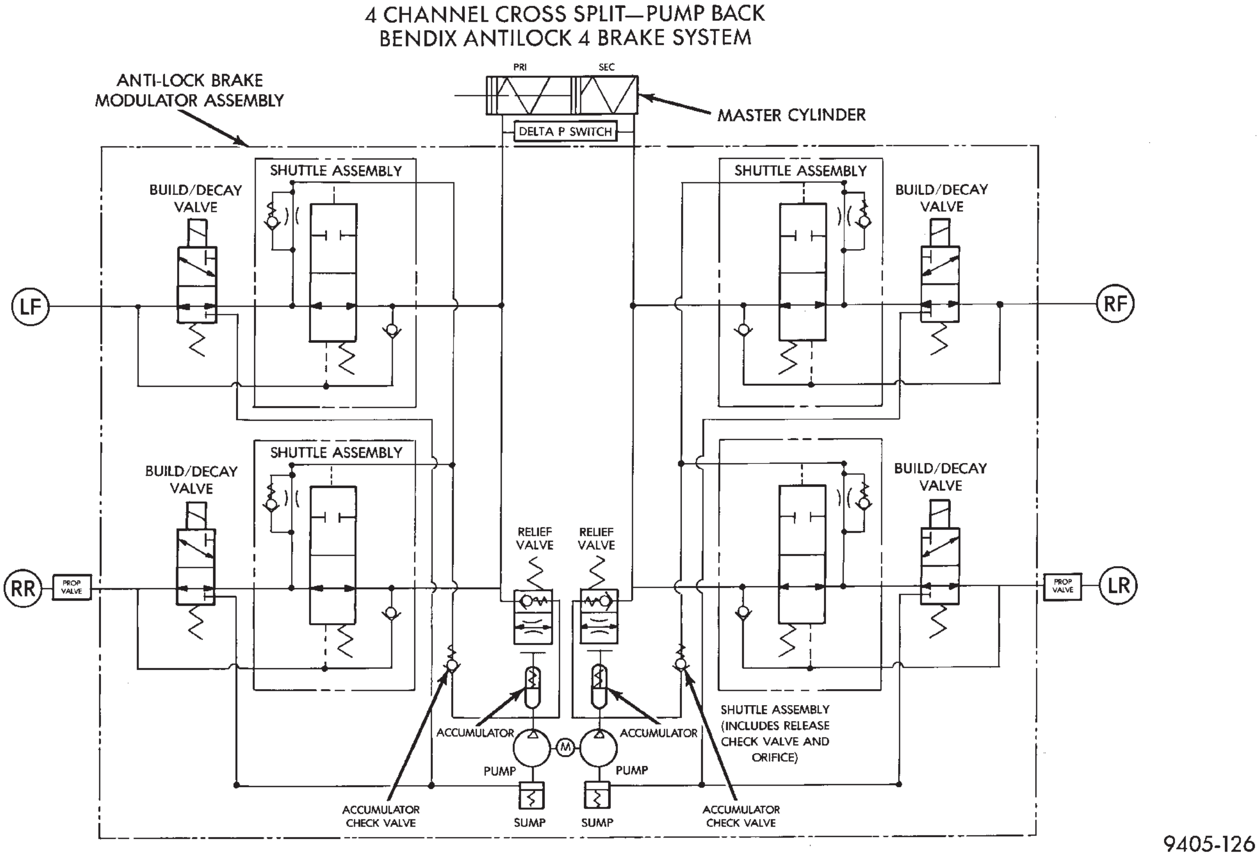


Fig. 1 Normal Braking - Hydraulic Control

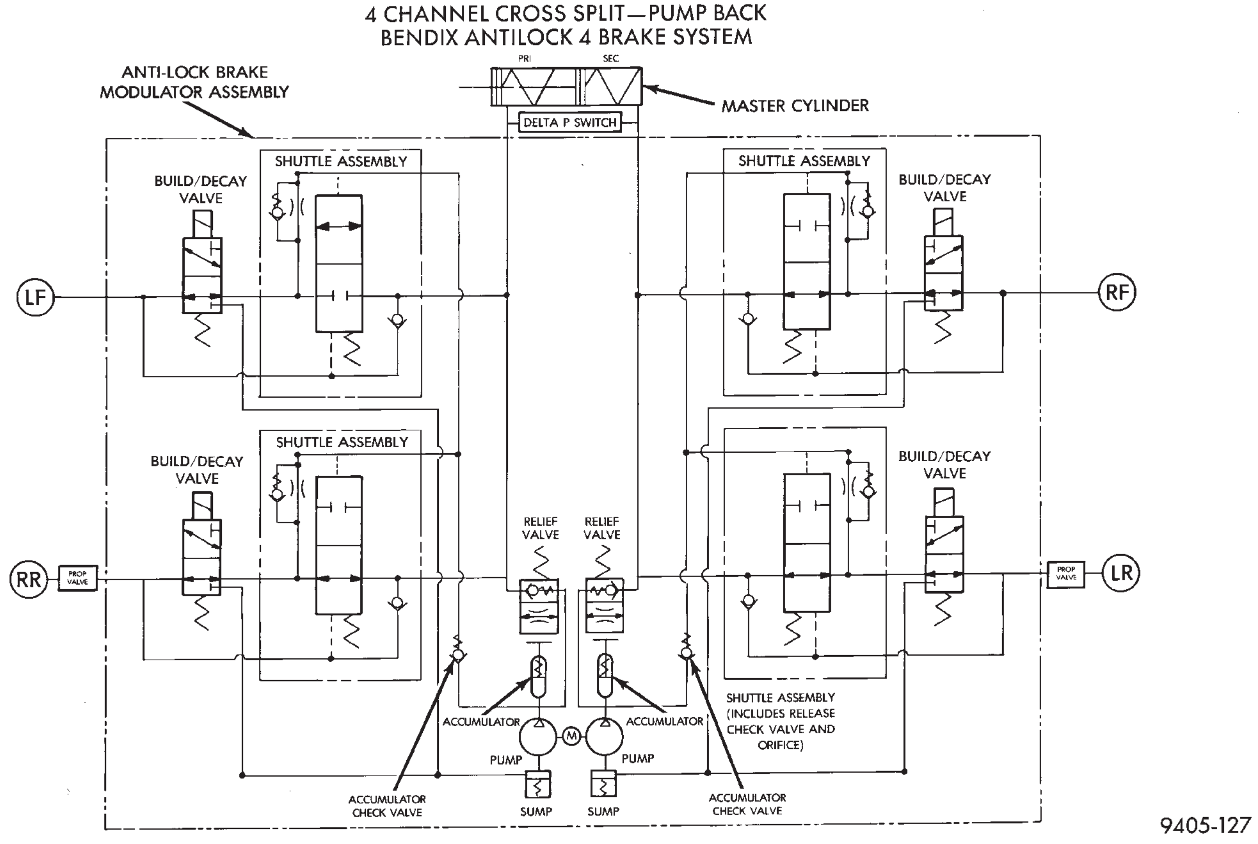


Fig. 2 Build Pressure - Hydraulic Control (Left Front Wheel Shown)

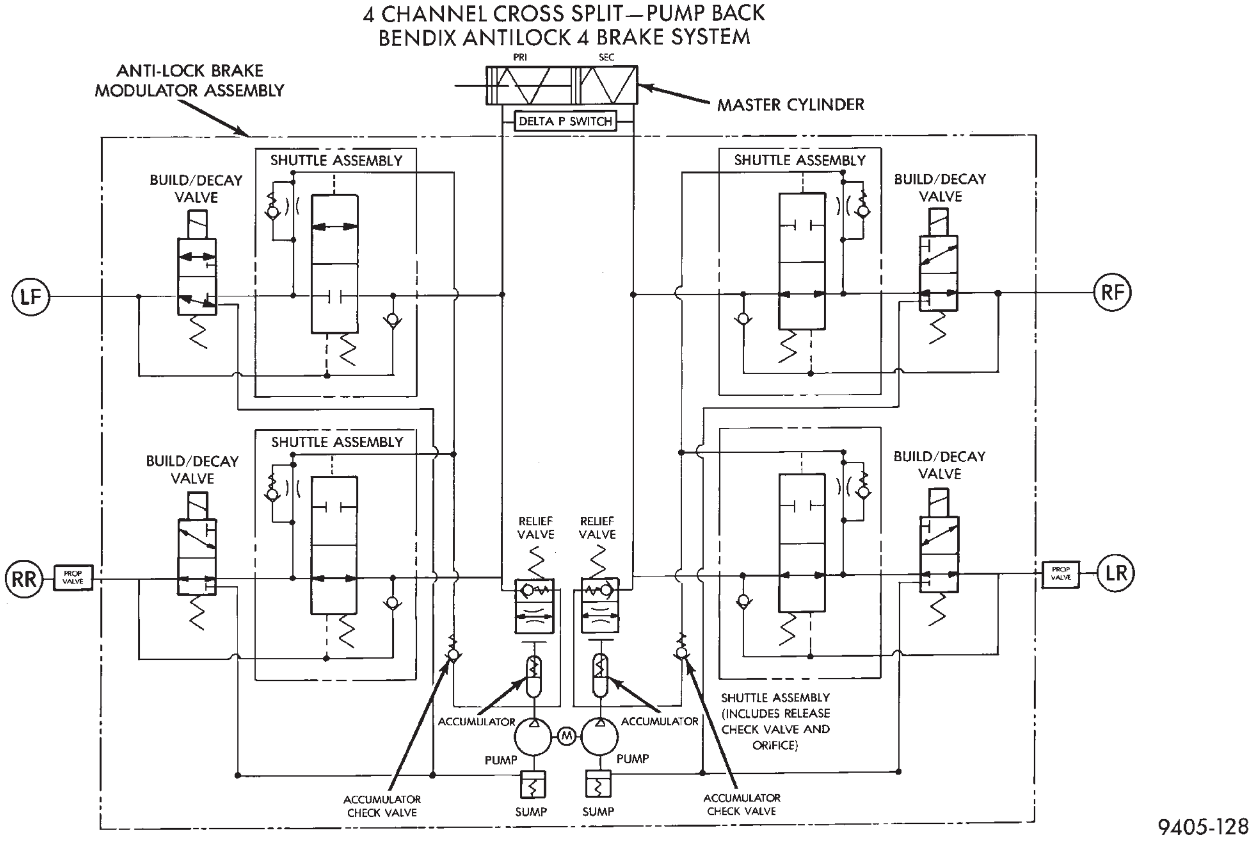


Fig. 3 Decay Pressure - Hydraulic Control (Left Front Wheel Shown)

ABS BRAKING-DECAY PRESSURE

BUILD/DECAY VALVES

Open, allowing release of brake fluid pressure through the decay valve to the modulator sump. This brake fluid then gets pumped into the accumulator for the build pressure cycle (Fig. 3).

BENDIX ANTILOCK 4 BRAKE SYSTEM DIAGNOSTICS

GENERAL INFORMATION

WARNING: SOME OPERATIONS IN THIS SECTION REQUIRE THAT HYDRAULIC TUBES, HOSES AND FITTINGS BE DISCONNECTED FOR INSPECTION OR TESTING PURPOSES.

CAUTION: REVIEW THIS ENTIRE SECTION PRIOR TO PERFORMING ANY MECHANICAL WORK ON A VEHICLE EQUIPPED WITH THE BENDIX ANTILOCK 4 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: Certain components of ABS brake system are not intended to be serviced individually. Attempting to remove or disconnect certain system components, may result in personal injury and/or improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

This section contains information necessary to diagnosis mechanical conditions which can affect operation of the Bendix Antilock 4 Brake System. Specifically, this section should be used to help diagnose mechanical conditions which result in any of the following:

(1) Anti-Lock Warning Lamp turned on.

(2) Brakes Lock on Hard Application

Vehicle conditions which are obviously mechanical in nature, such as noise, pulsation, no power assist, turning on of the Red Brake Warning Lamp or vibration during normal braking. Should be directed to Group 5 Brakes in the Front Wheel Drive, Chassis service manual.

To effectively diagnose and repair conditions affecting the Bendix Antilock 4 Brake System, it is important to read and understand the Antilock Brake System Functional Description. The Bendix Antilock 4 Brake System Functional Description is explained earlier in this service manual supplement. Then follow the diagnostic procedures outlined in this section.

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 system.

DEFINITIONS

Several abbreviations are used in this manual. They are presented here for reference.

- CAB—Controller Antilock Brake
- ABS—Antilock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor
- AC—Alternating Current

ABS COMPUTER SYSTEM SERVICE PRECAUTIONS

The ABS system uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. However 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 by the appropriate diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter, special tools or the DRB II 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.

ABS GENERAL SERVICE PRECAUTIONS

TEST DRIVING ABS COMPLAINT VEHICLES

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.

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.

Before test driving a brake complaint vehicle, note whether the Red or Amber Brake Warning Lamp is turned on. If the Red Brake Warning Lamp, is turned on, refer to the base brake Control Valves Section in the Front Wheel Drive, chassis service manual. If the Amber Antilock Warning light was or is on, read record and erase the faults. While the Amber ABS Warning Lamp is on the ABS system is not functional. The standard brake system and ability to stop the car is not affected, if only the Amber Antilock Warning Lamp is on.

(1) Turn ignition key to the off position and then back to the on position. Note whether the Amber ABS Warning Lamp continues to stay on. If it does refer to the 1994 Bendix Antilock 4 Brake System Diagnostic Manual for the required diagnostic test procedures.

(2) If the Amber ABS Warning Lamp goes out, shift vehicle into gear and drive car to a speed of 5 mph to complete the ABS drive-off cycle. If at this time, the Amber ABS Warning Lamp goes on refer to the 1994 Bendix Antilock 4 Brake System Diagnostic Manual.

(3) If the Amber ABS Warning Lamp remains OUT, continue to drive the vehicle a short distance. During this test drive be sure that the vehicle achieves at least 25 mph. Brake to at least one complete stop 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 Bendix Antilock 4 Brake System Diagnostics Manual for required diagnostic test procedures and proper use of the DRB II tester.

ABS BRAKE SYSTEM ON VEHICLE SERVICE

The following are general precautions which should be observed whenever servicing and or diagnosing the ABS system and other vehicle electronic systems. Failure to observe these precautions may result in ABS system damage.

(1) If welding work is to be performed on a vehicle using an arc welder. The wiring harness connector should be disconnected from the CAB before beginning any welding operation.

(2) The CAB 60 way connector and modulator assembly 10 way connector, should never be connected or disconnected with the ignition in the on position.

(3) Some components of Bendix Antilock 4 Brake System assemblies can not be serviced separately from the assembly and will require replacement of the complete assembly for servicing. Do not disassemble any component which is designated as non-serviceable.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

WHEEL SPEED SENSOR CABLES

Proper installation and routing of the Wheel Speed Sensor Cables is critical to continued system operation. Be sure that cables are installed, routed and clipped properly. Failure to install speed sensor cables as shown in the on car service section of this manual. May result in contact with moving parts or over extension of cables, resulting in component failure and an open circuit.

MECHANICAL DIAGNOSTICS AND SERVICE PROCEDURES

SPECIAL SERVICE TOOL

Some diagnostic procedures in this section require the use of the DRB diagnostics tester. The proper application and procedures for the use of this tool are described below.

DRB DIAGNOSTIC TESTER

Some of the diagnostic procedures that are explained in this section require the use of the DRB Diagnostics Tester to insure that proper diagnostics are performed. Refer to those sections for proper testing procedures and the DRB operators manual for its proper operational information.

INTERMITTENT FAULTS

As with virtually any electronic system, intermittent faults in the ABS system may be difficult to accurately diagnose.

Most intermittent faults are caused by faulty electrical connections or wiring. When an intermittent fault is encountered, check suspect circuits for:

(1) Poor mating of wiring harness connector halves or terminals not fully seated in the connector body.

(2) Improperly formed or damaged terminals. All connector terminals in a suspect circuit should be checked and carefully reformed to increase contact tension with its mating terminal.

(3) Poor terminal to wire connection. This requires removing the terminal from the connector body to inspect.

(4) Pin presence in the connector assembly

(5) Connector push-in, spread, and corrosion.

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 set Fault code.

Most failures of the ABS system will disable the Antilock 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 it occurred, if the failure condition is no longer present. The following conditions may result in intermittent illumination of the Amber Antilock Warning Lamp. All other failures will cause the lamp to remain on until the ignition switch is turned off. Circuits involving these inputs to the CAB should be investigated if a complaint of intermittent warning system operation is encountered.

(1) Low system voltage: If Low System Voltage is detected by the CAB, the CAB will turn on the Amber Antilock Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

(2) Antilock system and pump/motor relay. If the relays fail to make the ground circuit connection or has an intermittent ground. The CAB will turn on the Amber Antilock Warning Light.

(3) Excess decay, an extended pressure decay period, will turn on the Amber Antilock Warning Light until the vehicle comes to a complete stop.

Additionally, any condition which results in interruption of electrical current to the CAB or modulator assembly, may cause the Amber Antilock Warning Lamp to turn on intermittently.

ABS BRAKE SYSTEM DIAGNOSTIC FEATURES

ABS SYSTEM SELF DIAGNOSIS

The ABS system is equipped with a self diagnostic capability which may be used to assist in isolation of ABS faults. The features of the self diagnostics system are described below.

START-UP CYCLE

The self diagnostic ABS start up cycle begins when the ignition switch is turned to the on position. An electrical check is completed on the ABS components. Such as Wheel Speed Sensor Continuity and System and other Relay continuity. During this check the Amber Antilock Light is turned on for approximately 1- 2 seconds.

Further Functional testing is accomplished once the vehicle is set in motion, known as drive-off.

- The solenoid valves and the pump/motor are activated briefly to verify function.
- The voltage output from the wheel speed sensors is verified to be within the correct operating range.

If the vehicle is not set in motion within 3 minutes from the time the ignition switch is set in the on position. The solenoid test is bypassed but the pump/motor is activated briefly to verify that it is operating correctly.

CONTROLLER ANTILOCK BRAKE CAB

Fault codes are kept in a Non-Volatile memory until either erased by the technician using the DRB or erased automatically after 50 ignition cycles (key ON-OFF cycles). The only fault that will not be erased after 50 (KEY CYCLES) is the CAB fault. A CAB fault can only be erased by the technician using the DRB diagnostic tester. More than one fault can be stored at a time. The number of key cycles since the most recent fault was stored is also displayed. Most functions of the CAB and ABS system can be accessed by the technician for testing and diagnostic purposes by using the DRB.

LATCHING VERSUS NON-LATCHING ABS FAULTS

Some faults detected by the CAB are latching; the fault is latched and ABS is disabled until the ignition switch is reset. Thus ABS is disabled even if the original fault has disappeared. Other faults are non-latching; any warning lights that are turned on, are only turned on as long as the fault condition exists. As soon as the condition goes away, the Antilock Warning Light is turned off. Although a fault code will be set in most cases.

BENDIX ANTILOCK 4 BRAKE SYSTEM DIAGNOSTICS

Bendix Antilock 4 Brake System Diagnostics, beyond basic mechanical diagnostics, covered earlier in this section, are accomplished by using the DRB scan tool. See testing procedures outlined in the 1994 Bendix Antilock 4 Diagnostics Manual.

Please refer to the above mentioned manual for any further electronic diagnostics and service procedures that are required on the Bendix Antilock 4 Brake System.

ON-CAR ABS BRAKE SYSTEM SERVICE

GENERAL SERVICE PRECAUTIONS

The following are general cautions which should be observed when servicing the Bendix Antilock 4 Brake System and other vehicle electronic systems. Failure to observe these precautions may result in Antilock Brake System component damage.

If welding work is to be performed on a vehicle using an electric arc welder, disconnect the 60 way wiring harness connector from the CAB, prior to performing the welding operation.

The wiring harness connector should never be connected or disconnected from the CAB with the ignition key in the ON or Run position.

(3) Most components making up the assemblies of the Bendix Antilock 4 Brake System can not be serviced separately from those assemblies. This will require replacement of the complete assembly for the servicing of these components. Do not disassemble any component from an assembly which is designated as non-serviceable.

CHECKING BRAKE FLUID LEVEL

CAUTION: Only use brake fluid conforming to DOT 3 specifications, such as Mopar or Equivalent. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluids will cause swelling and distortion of rubber parts in the hydraulic brake system. Water will mix with brake fluid, lowering the boiling point of the brake fluid, possibly causing brake fluid to boil resulting in brake fade. Keep all brake fluid containers capped to prevent contamination. Remove the front cap of the master cylinder reservoir and fill to the bottom of the split ring.

For the specific procedure for the inspection of brake fluid level and adding of brake to the reservoir. Refer to the Service Adjustments Section in this group of the service manual.

BLEEDING BENDIX ANTILOCK 4 BRAKE SYSTEM

The base brakes and Antilock Brake System must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake lines, hoses or components.

If the Antilock Modulator Assembly is removed from the vehicle, both the Base Brake System and the Antilock Brake System must be bled using the appropriate procedure. It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During brake bleeding operations, ensure that brake fluid level remains close to the FULL level in the reservoir. Check brake fluid level periodically during bleeding procedure, adding DOT 3 brake fluid as required.

CAUTION: The base brake and Antilock brake hydraulic systems, on the Bendix Antilock 4 Brake System, can NOT be bled using any type of brake pressure bleeding equipment. This type of bleeding equipment does not develop the pressure required in the brake hydraulic system, to adequately bleed all trapped air. The only approved method for bleeding air out of the hydraulic system on vehicles equipped with the Bendix Antilock 4 Brake System, is the manual procedure of pressurizing the hydraulic system using constant, moderate to heavy foot pressure on the brake pedal.

The Bendix Antilock 4 Brake System must be bled as two independent brake 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. The Bendix Antilock 4 Brake System can only be bled using a manual method of pressurizing the brakes hydraulic system.

The Antilock portion of brake system MUST be bled separately. This bleeding procedure requires the use of the DRB Diagnostic tester and the bleeding sequence procedure outlined below.

BENDIX ANTILOCK 4 MODULATOR ASSEMBLY BLEEDING PROCEDURE

(1) Assemble and install all brake system components on the vehicle, making sure all hydraulic fluid lines are installed and properly torqued.

(2) Bleed the base brake system, using **ONLY** the bleeding procedure outlined in the Service Adjustments section of this service manual supplement.

To perform the bleeding procedure on the ABS modulator assembly, the battery, battery tray and acid shield must be removed from vehicle. Then reconnect the vehicle's battery to vehicle's battery cables, using ONLY approved battery jumper cables.

(3) Connect the DRB Diagnostics Tester to the vehicle's diagnostics connector. The vehicle diagnostic connector is located behind the fuse panel access cover on the lower section of the dash panel left of the steering column. The diagnostic connector is a blue 6 way connector.

(4) Using the DRB check to make sure the CAB does not have any stored fault codes. If it does, remove them using the DRB.

WARNING: WHEN BLEEDING THE MODULATOR ASSEMBLY WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE MODULATOR BLEED SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH FRESH 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.

When bleeding Antilock modulator assembly, the following bleeding sequence **MUST** be followed to insure a complete bleeding of all air from the Antilock brake, and base brake hydraulic systems. **The modulator assembly can ONLY be bled using a manual bleeding procedure to pressurize the hydraulic system.**

MODULATOR ASSEMBLY CIRCUIT BLEEDING PROCEDURE AND SEQUENCE

1 MODULATOR PRIMARY CHECK VALVE CIRCUIT

Note: To bleed hydraulic circuits of the Bendix Antilock 4 Brake System modulator assembly, the aid of a second mechanic or helper will be required to pump the brake pedal.

(1) Install a clear bleed tube (such as Tygon) on primary check valve circuit bleed screw (Fig. 1). Then install bleed tube into a clear container partially filled with fresh clean brake fluid (Fig. 1).

(2) Pump brake pedal several times, then apply and hold a constant medium to heavy force on brake pedal.

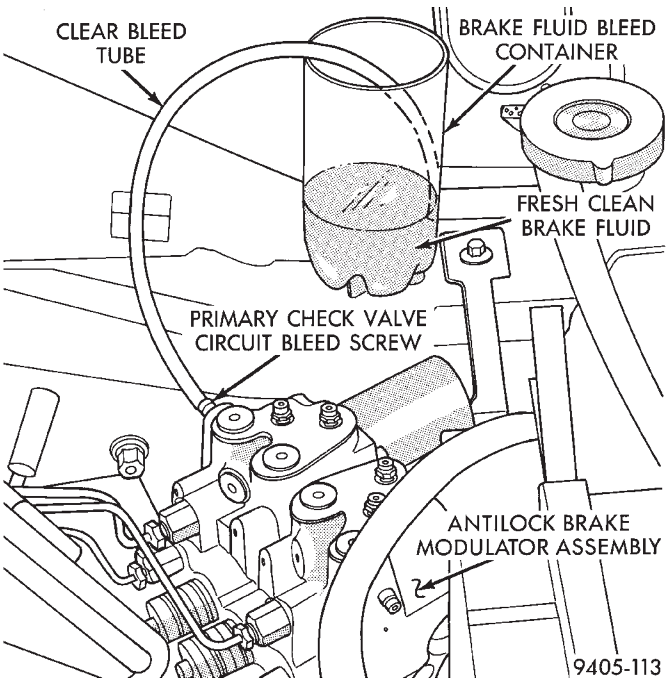


Fig. 1 Bleeding Modulator Assembly Primary Check Valve Circuit

(3) Open primary check valve circuit bleed screw (Fig. 1) at least 1 full turn to ensure an adequate flow of brake fluid. Continue bleeding primary check valve circuit until brake pedal bottoms.

(4) After brake pedal bottoms, close and tighten bleed screw. Then release brake pedal. **Do not release brake pedal prior to closing and tightening bleed screw.**

(5) Continue bleeding modulator assembly, repeating steps 2 through 4 until a clear, bubble free flow of brake fluid is evident.

(6) When all air is bled from primary check valve circuit, tighten bleed screw and remove bleed hose from bleed screw. **Do not remove bleed hose before tightening bleed screw, air may re-enter modulator.**

(7) Torque modulator assembly primary bleed screw to 9 N●m (80 in. lbs.).

2 MODULATOR SECONDARY CHECK VALVE CIRCUIT

(1) Move clear bleed tube to secondary check valve circuit bleed screw (Fig. 2). Then install bleed tube into a container partially filled with fresh clean brake fluid (Fig. 2).

(2) Pump brake pedal several times, then apply and hold a constant medium to heavy force on brake pedal.

(3) Open secondary check valve circuit bleeder screw (Fig. 2), at least 1 full turn to ensure an adequate flow of brake fluid. Continue to bleed secondary check valve circuit until the brake pedal bottoms.

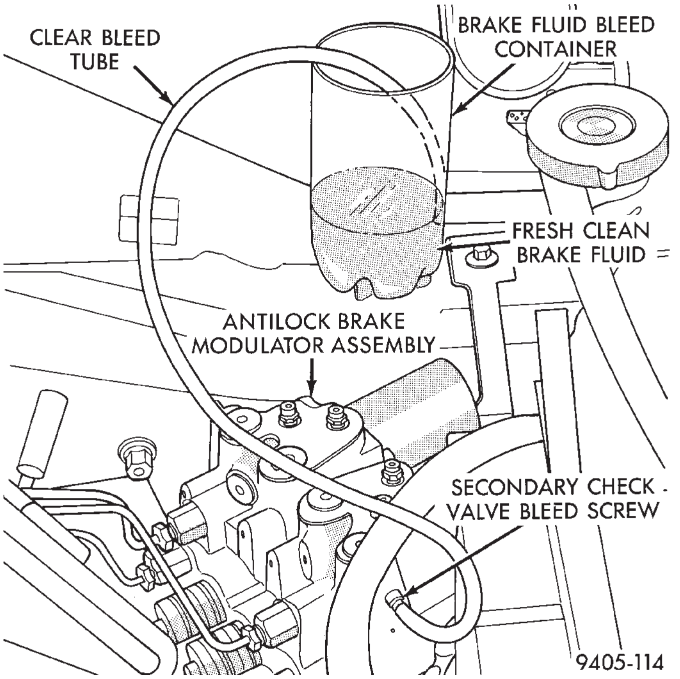


Fig. 2 Bleeding Modulator Assembly Secondary Check Valve Circuit

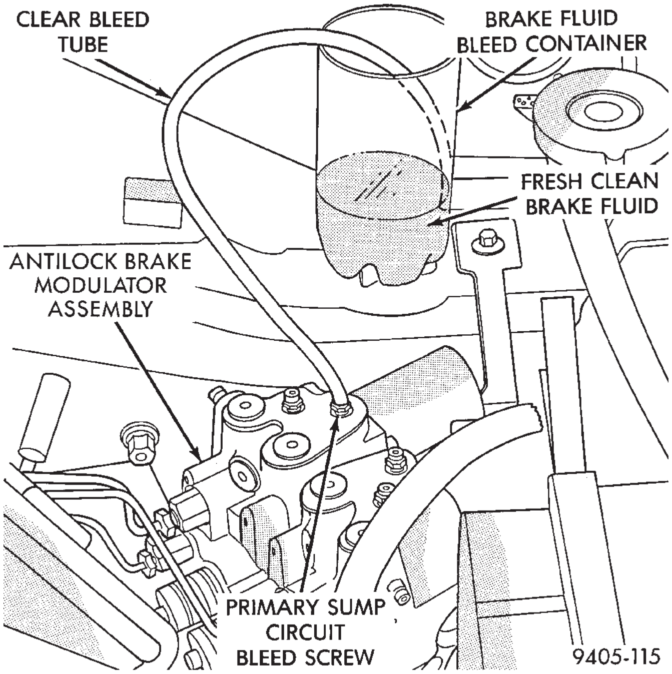


Fig. 3 Bleeding Modulator Assembly Primary Sump Circuit

(4) After brake pedal bottoms, close and tighten bleed screw and release brake pedal. **Do not release brake pedal prior to closing and tightening bleed screw.**

(5) Continue bleeding secondary check valve circuit, repeating steps 2 through 4, until a clear, bubble free flow of brake fluid is evident.

(6) When air is bled from primary check valve circuit, tighten bleed screw and remove bleed hose from bleed screw. **Do not remove bleed hose before tightening bleed screw, air may re-enter modulator.**

(7) Torque modulator assembly primary bleed screw to 9 N●m (80 in. lbs.).

3 MODULATOR ASSEMBLY PRIMARY SUMP CIRCUIT

(1) Move clear bleed tube to primary sump bleed screw (Fig. 3). Then install bleed tube into a container partially filled with fresh clean brake fluid (Fig. 3).

(2) Pump brake pedal several times, then apply and hold a constant medium to heavy force on brake pedal.

(3) Open modulator assembly primary sump circuit bleed screw (Fig. 3) at least 1 full turn. This will ensure an adequate flow of brake fluid from the primary sump circuit.

(4) Using the DRB, select the bleed ABS hydraulic unit mode. Then select the primary circuit. (The RF and LR solenoids will alternately fire for five seconds). Using the DRB, continue to select the primary circuit until an air-free flow of brake fluid from primary sump bleed screw is maintained or brake pedal bottoms. If an air-free flow of brake fluid is not maintained before brake pedal bottoms, close bleed screw and repeat steps 2 through 4, until an air free flow is maintained.

(5) After an air-free flow of brake fluid is maintained from primary sump bleed screw, close and lightly tighten bleeder screw. Then release brake pedal. **Do not release brake pedal prior to closing and tightening bleeder screw.**

(6) After primary sump bleed screw is closed, remove bleed hose from primary sump bleed screw.

(7) Torque modulator assembly primary sump bleed screw to 9 N●m (18 in. lbs.).

4 MODULATOR ASSEMBLY PRIMARY ACCUMULATOR CIRCUIT

(8) Transfer clear bleed tube to primary accumulator bleed screw (Fig. 4). Then install bleed tube into a container partially filled with fresh clean brake fluid (Fig. 4).

(9) Pump brake pedal several times, then apply a constant medium to heavy force on the brake pedal. Using the DRB, select the bleed ABS hydraulic unit mode. Then select the primary circuit valves. (The RF and LR modulator assembly solenoids will fire for 5 seconds).

(10) Open the modulator assembly primary accumulator circuit bleed screw (Fig. 4) at least one full turn. This will ensure an adequate flow of brake fluid from the primary accumulator circuit. Continue bleeding primary accumulator circuit until an air-free flow of brake fluid from bleed screw is maintained or the brake pedal bottoms. If an air-free flow

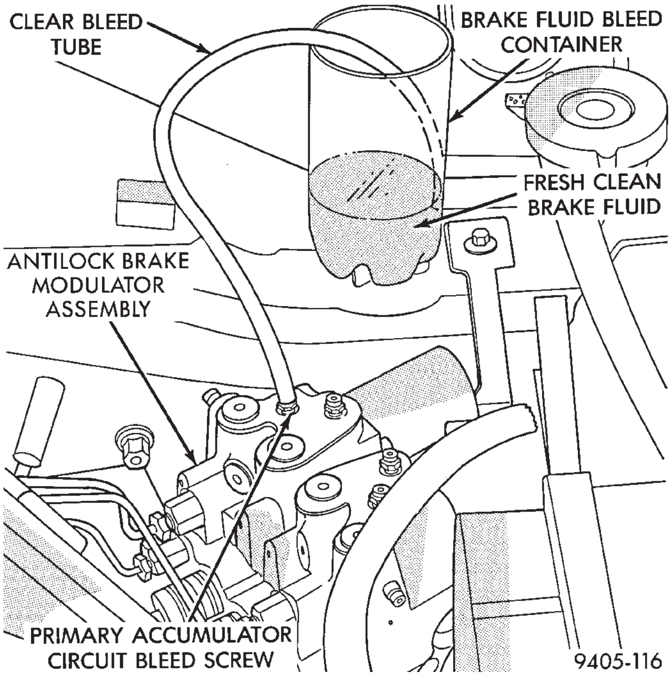


Fig. 4 Bleeding Modulator Assembly Primary Accumulator Circuit

of brake fluid is not maintained before brake pedal bottoms, close bleed screw and repeat steps 8 and 9 until an air free flow is maintained.

(11) After an air-free flow of brake fluid is maintained from the primary accumulator bleed screw, close and lightly tighten bleed screw. Then release pressure from brake pedal. **Do not release force from brake pedal prior to closing and tightening bleed screw.**

Note: For the next modulator assembly bleeding procedure, use of the DRB is not required. This step of the bleed procedure does not require modulator solenoids to be operated for bleeding to be performed.

(12) Pump brake pedal several times, then apply and hold a constant medium to heavy force on the brake pedal.

(13) Again without firing modulator solenoids, open primary accumulator circuit bleed screw (Fig. 4) 1 full turn. This will ensure an adequate flow of brake fluid from the primary accumulator circuit.

(14) Bleed primary accumulator circuit until a clear, air-free flow of brake fluid is maintained from the accumulator bleed screw or the brake pedal bottoms. If an air-free flow of brake fluid is not maintained from the bleed screw before the brake pedal bottoms. First, close bleed screw and then repeat steps 11 and 12 of this bleeding procedure until an air-free flow is maintained.

(15) After an air-free flow of brake fluid is maintained from the primary accumulator circuit bleed screw, close and lightly tighten bleed screw. Then release force from brake pedal. **Do not release force from brake pedal prior to closing and tightening bleeder screw.**

(16) After primary accumulator bleed screw is closed, remove bleed hose from bleed screw.

(17) Torque secondary accumulator bleed screw to 9 N●m (80 in. lbs.).

5 MODULATOR ASSEMBLY SECONDARY SUMP CIRCUIT

(1) Transfer clear bleed tube to secondary sump bleed screw on modulator assembly (Fig. 5). Then install bleed tube into a container partially filled with fresh clean brake fluid (Fig. 5).

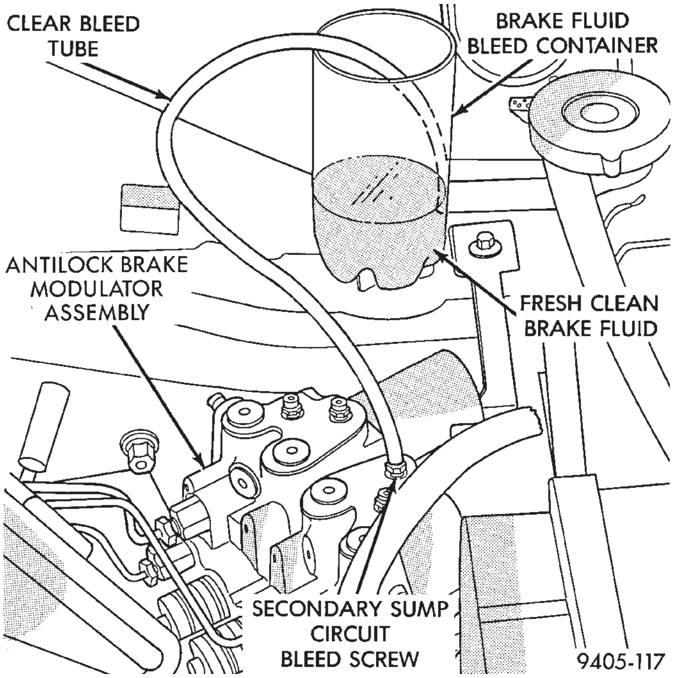


Fig. 5 Bleeding Modulator Assembly Secondary Sump Circuit

(2) Pump brake pedal several times, then apply and hold a constant medium to heavy force on brake pedal.

(3) Open the secondary sump circuit bleed screw (Fig. 5) at least 1 full turn. This will ensure an adequate flow of brake fluid is expelled from the secondary sump circuit.

(4) Using the DRB, select the bleed ABS hydraulic unit mode. Then select the secondary circuit valves. (The LF and RR solenoids will alternately fire for five seconds). Continue bleeding secondary sump circuit until an air-free flow of brake fluid from secondary sump bleed screw is maintained or brake pedal bottoms. If an air-free flow of brake fluid is not maintained before brake pedal bottoms, close bleed screw and repeat steps 2 through 4 until an air-free flow is maintained.

(5) After an air-free flow of brake fluid is maintained from secondary sump bleed screw, close and lightly tighten bleed screw. Then release force from

brake pedal. **Do not release brake pedal prior to closing and tightening bleeder screw.**

(6) After secondary sump bleed screw is closed, remove bleed hose from bleed screw.

(7) Torque secondary sump bleed screw to 9 N●m (80 in. lbs.).

6 MODULATOR ASSEMBLY SECONDARY ACCUMULATOR CIRCUIT

(8) Transfer bleed tube to secondary accumulator bleed screw (Fig. 6). Then install bleed tube into a container partially filled with fresh clean brake fluid (Fig. 6).

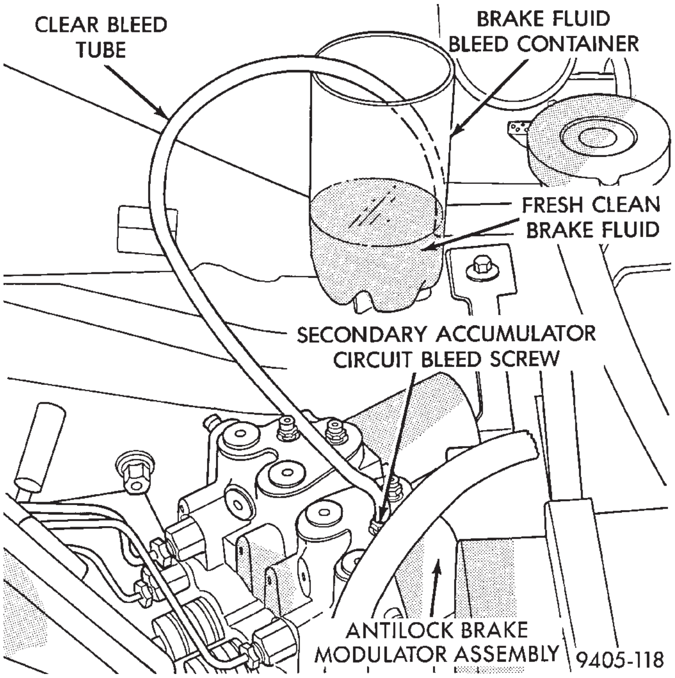


Fig. 6 Bleeding Modulator Assembly Secondary Accumulator Circuit

(9) Apply constant, medium to heavy force on brake pedal. Then using the DRB, select the bleed ABS hydraulic unit mode, and then select the secondary circuit valves. (The LF and RR modulator assembly solenoids will fire for 5 seconds).

(10) Open the secondary accumulator circuit bleed screw (Fig. 6) at least one full turn. This will ensure an adequate flow of brake fluid is expelled from the secondary accumulator circuit. Continue to bleed primary accumulator circuit, until an air-free flow of brake fluid from the bleed screw is maintained or brake pedal bottoms. If an air-free flow of brake fluid is not maintained from bleed screw before brake pedal bottoms, close bleed screw and then repeat steps 8 and 9 until an air free flow is maintained.

(11) After an air-free flow of brake fluid is maintained from the bleed screw, close and lightly tighten the bleed screw. Then release force from brake pedal. **Do not release force from brake pedal prior to closing and tightening bleeder screw.**

Note: For the next modulator assembly bleeding procedure, use of the DRB is not required. This step of the bleeding procedure does not require the modulator solenoids to be operated for bleeding to be performed.

(12) Pump brake pedal several times, then apply and hold constant medium to heavy force on brake pedal.

(13) Again without firing modulator assembly solenoids, open secondary accumulator circuit bleed screw (Fig. 6) at least 1 full turn. This will ensure an adequate flow of brake fluid is expelled from the secondary accumulator circuit.

(14) Bleed secondary accumulator circuit until a clear, air-free flow of brake fluid is maintained from the secondary accumulator bleed screw or the brake pedal bottoms. If an air- free flow of brake fluid is not maintained from secondary accumulator bleed screw before brake pedal bottoms, repeat steps 12 and 13 of this bleeding procedure until an air-free flow is maintained.

(15) After an air free flow of brake fluid is maintained from secondary accumulator circuit bleed screw, close and lightly tighten bleed screw. Then release force from brake pedal. **Do not release force from brake pedal prior to closing and tightening bleed screw.**

(16) After secondary accumulator bleed screw is closed, remove bleed hose from bleed screw.

(17) Torque secondary accumulator bleed screw to 9 N●m (80 in. lbs.).

PUMP/MOTOR SERVICE

On the Bendix Antilock 4 Brake System the Pump/Motor assembly can only be serviced as part of Modulator Assembly.

MODULATOR ASSEMBLY (FIG. 1)

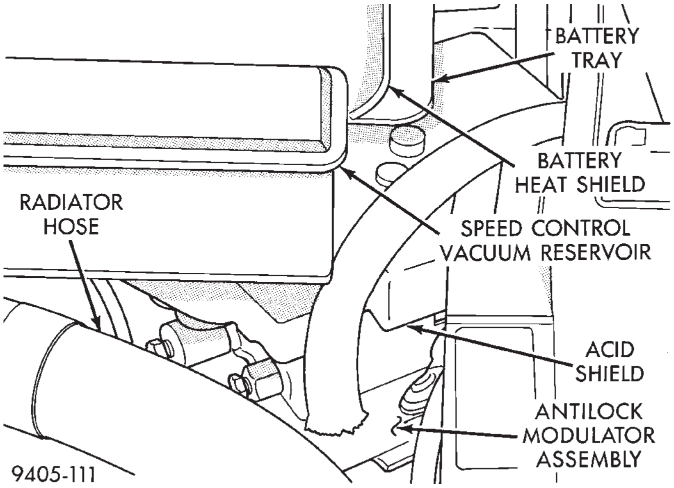


Fig. 1 Antilock Modulator Assembly Location In Vehicle

REMOVE

(1) Raise vehicle on jackstands or position vehicle centered on a frame contact hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Disconnect and remove both battery cables from battery.

(3) Remove heat shield (Fig. 2) from battery. Then remove battery hold down clamp (Fig. 2) and battery from battery tray.

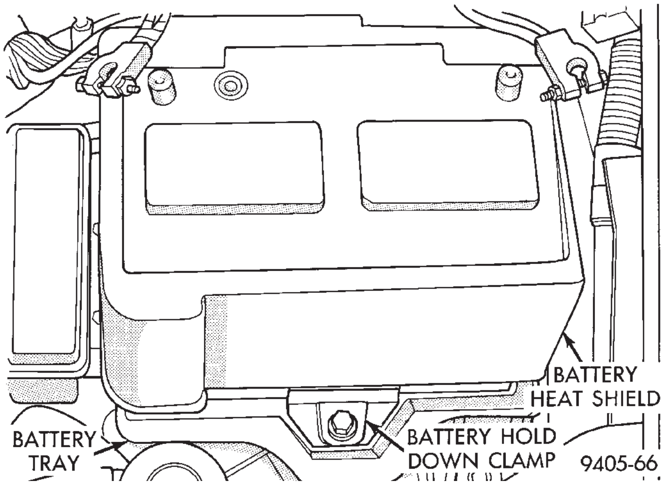


Fig. 2 Battery Heat Shield And Hold Down Clamp

(4) Remove battery tray access cover (Fig. 3) from battery tray. **Do not discard, access cover MUST be put back on battery tray, when battery is reinstalled.**

(5) If equipped, remove the 2 bolts (Fig. 4) attaching speed control vacuum reservoir to battery tray. Then remove speed control system vacuum reservoir (Fig. 4) from battery tray. **Vacuum lines (Fig. 4) do not need to be removed from vacuum reservoir.**

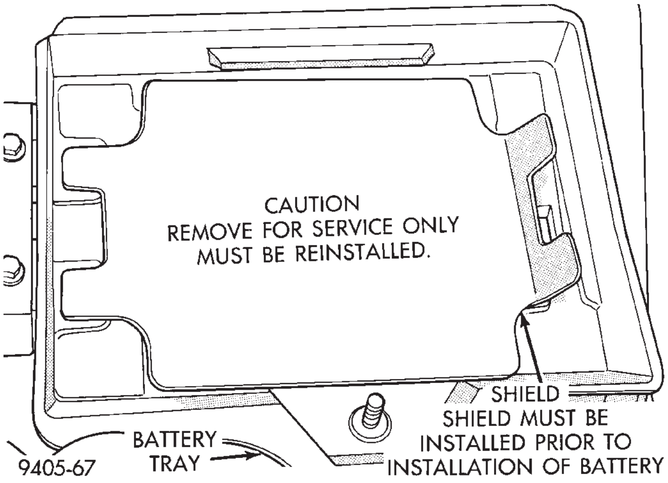


Fig. 3 Battery Tray Shield

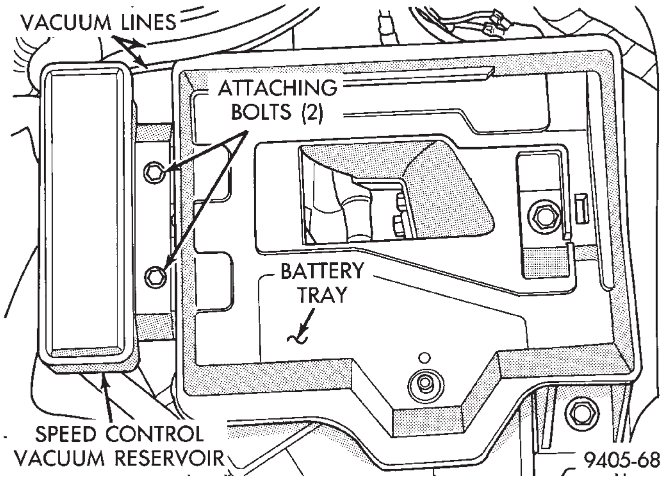


Fig. 4 Speed Control System Vacuum Reservoir

(6) Remove the 4 bolts attaching battery tray (Fig. 5) to the frame rail and fender shield of vehicle. Then remove battery tray from vehicle.

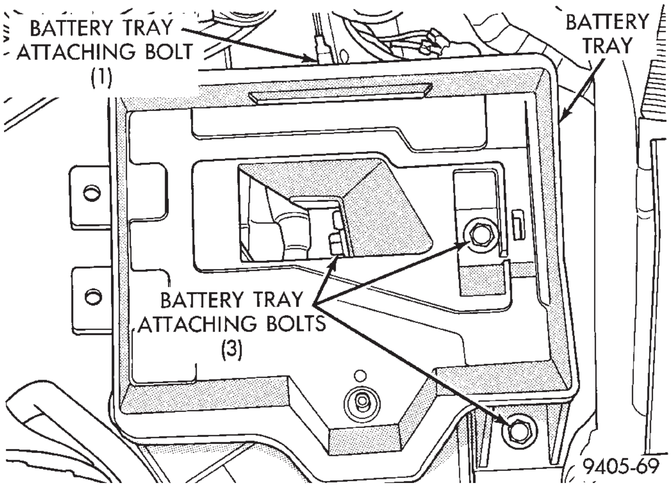


Fig. 5 Battery Tray And Attaching Bolts

(7) Remove battery acid shield, (Fig. 6) from the ABS modulator assembly.

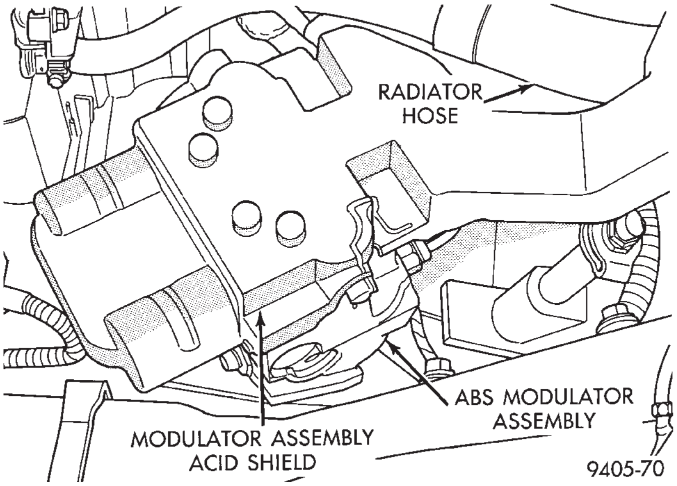


Fig. 6 ABS Modulator Assembly Acid Shield

(8) Remove the 6 tube nuts (Fig. 7), attaching hydraulic brake line tube bundle to modulator assembly, thread savers and proportioning valves. Then remove the hydraulic brake lines as an assembly, from the modulator assembly. **Brake lines do not need to be loosened at junction block.**

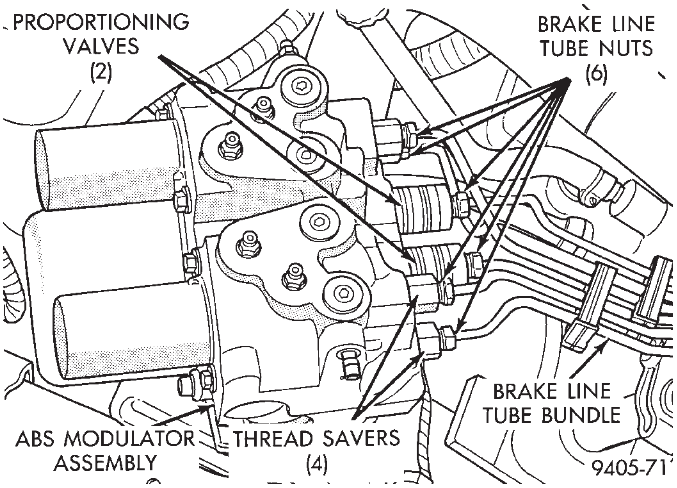


Fig. 7 Hydraulic Brake Line Connections To Modulator Assembly

(9) Raise vehicle.

(10) Remove the vehicle's wiring harness 10 way connector, from the modulator assembly (Fig. 8).

(11) Remove 2 bolts (Fig. 9) attaching bottom of modulator assembly to its mounting bracket.

(12) Lower vehicle.

(13) Remove bolt (Fig. 10) attaching front of modulator assembly to mounting bracket.

(14) Remove modulator assembly from mounting bracket and remove from vehicle.

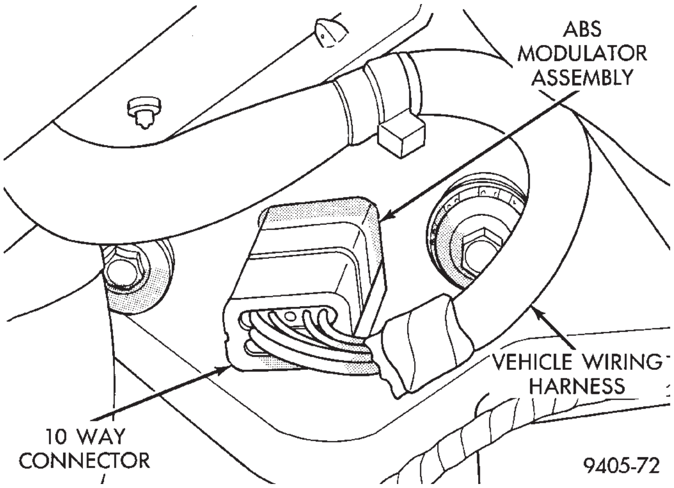


Fig. 8 Vehicle Wiring Harness Connection To Modulator Assembly

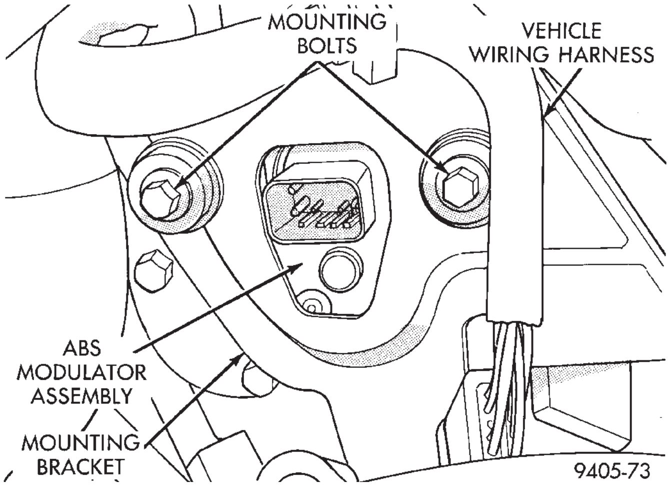


Fig. 9 Modulator Assembly To Mounting Bracket Attaching Bolts

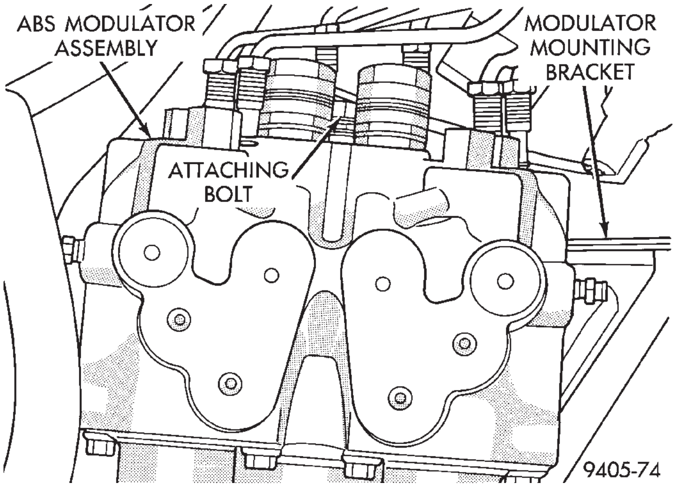


Fig. 10 Front Modulator Assembly To Bracket Bolt

INSTALL

NOTE: Before installing modulator assembly back on mounting bracket, inspect the 3 modulator assembly to bracket isolators (Fig. 11) for any signs of deterioration or damage. Replace all 3 isolators if any show signs of damaged or deterioration, before mounting modulator assembly on bracket.

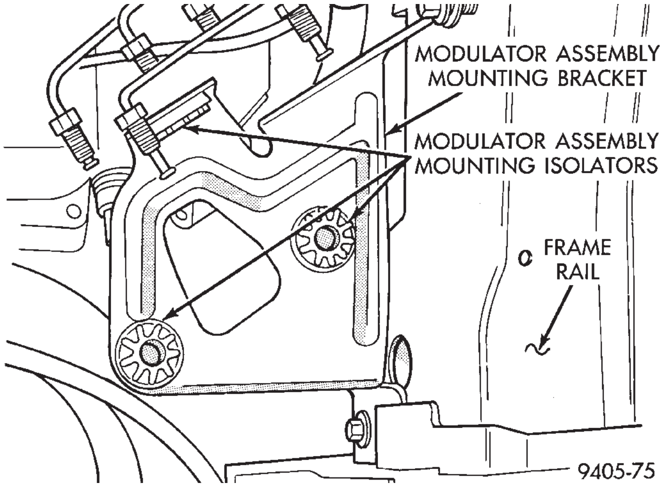


Fig. 11 Modulator Assembly Mounting Isolators

(1) Install modulator assembly on mounting bracket.

(2) Install bolt (Fig. 12) attaching side of modulator assembly to mounting bracket. **Only loosely install bolt at this time, do not tighten or torque.**

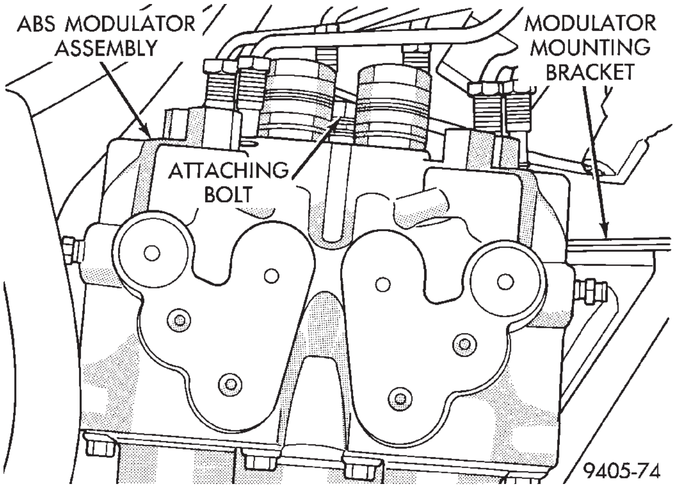


Fig. 12 Front Modulator Assembly To Bracket Bolt

(3) Raise vehicle.

CAUTION: Be sure mounting isolators are correctly positioned on mounting bracket and modulator assembly, before installing and torquing modulator mounting bolts.

(4) Install the 2 modulator assembly to mounting bracket attaching bolts (Fig. 13). Torque the 2 mounting bolts to 28 N●m (21 ft. lbs.).

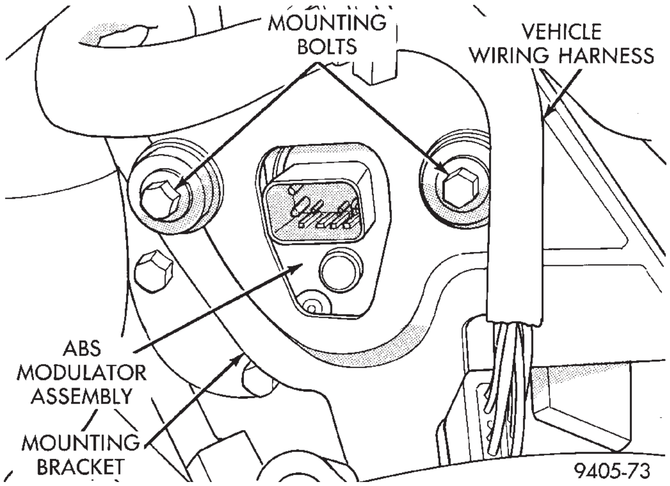


Fig. 13 Modulator Assembly To Bracket Attaching Bolts.

(5) Install vehicle's wiring harness 10 way connector onto the modulator assembly (Fig. 14). **Be sure lock on vehicle wiring harness connector is fully engaged with tab on modulator assembly electrical connector.**

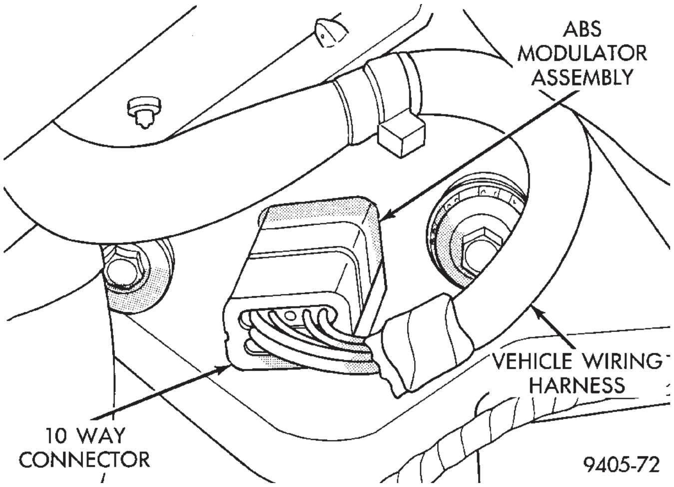


Fig. 14 Electrical Connection To Modulator Assembly

(6) Lower vehicle.

(7) Torque front modulator assembly to mounting bracket attaching bolt (Fig. 12) to 28 N●m (21 ft. lbs.)

(8) Align the 6 disconnected hydraulic brake lines with their appropriate fitting locations on modulator assembly (Fig. 15). Then thread the 6 brake line tube nuts **by hand** into the proportioning valves and thread savers on modulator assembly.

(9) Using a crow foot and torque wrench (Fig. 16), torque the 6 hydraulic brake line tube nuts to 18 N●m (159 in. lbs.).

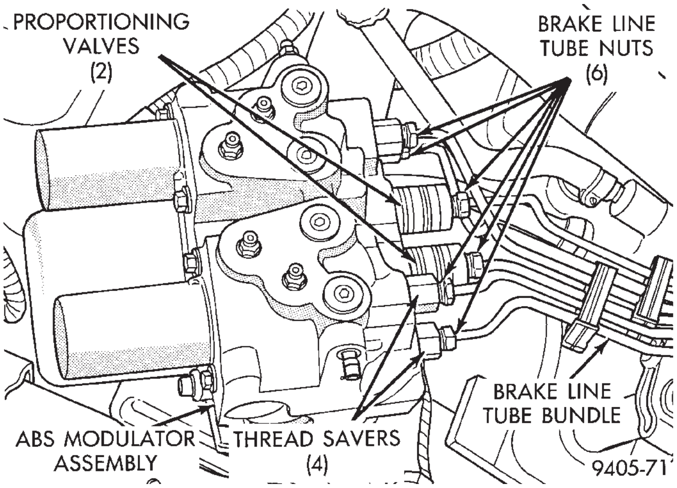


Fig. 15 Hydraulic Brake Line Connections at Modulator Assembly

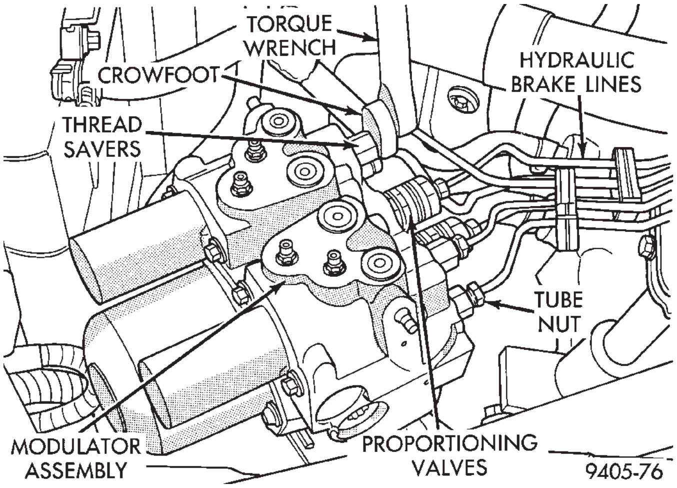


Fig. 16 Torquing Brake Line Connections To Modulator Assembly

(10) Using approved battery jumper cables, attach battery, to the vehicles negative and positive battery cables (Fig. 17).

(11) Bleed the vehicles base brake and Antilock brake hydraulic systems. Refer to Bleeding Bendix Antilock 4 Brake System in this service manual supplement for required bleeding procedure.

(12) Install the battery acid shield (Fig. 18) onto modulator assembly. **Be sure acid shield is securely attached to modulator assembly before installing battery tray.**

(13) Install battery tray in vehicle. Then install the 4 bolts (Fig. 19) attaching battery tray to inner fender and frame rail. Torque the 4 attaching bolts to 20 N●m (175 in.lbs.).

(14) If equipped, install speed control vacuum reservoir on battery tray. Then install the 2 speed control vacuum reservoir attaching bolts (Fig. 20). Torque the vacuum reservoir to attaching bolts to 4 N●m (30 in. lbs.).

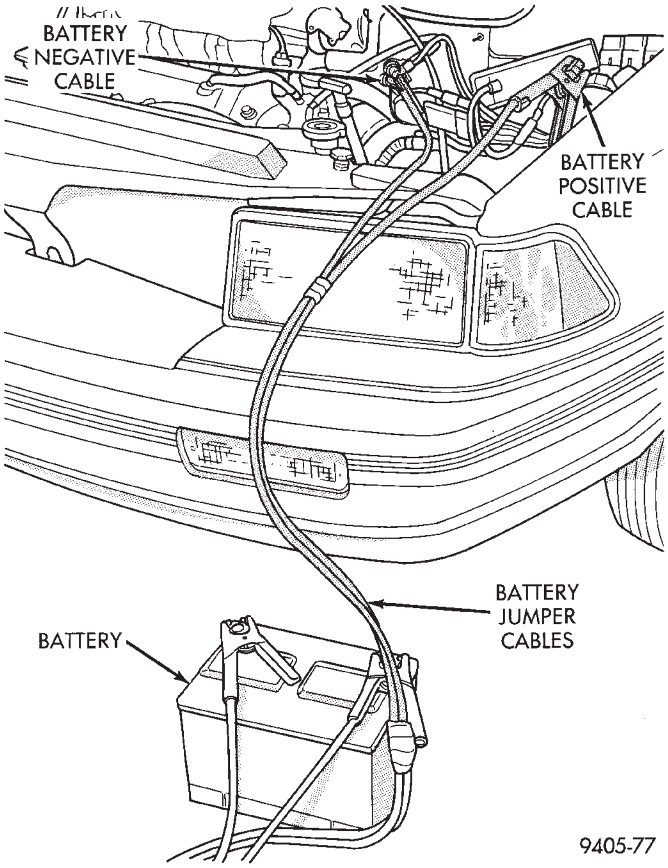


Fig. 17 Battery Connected To Vehicle For Bleeding Modulator Assembly

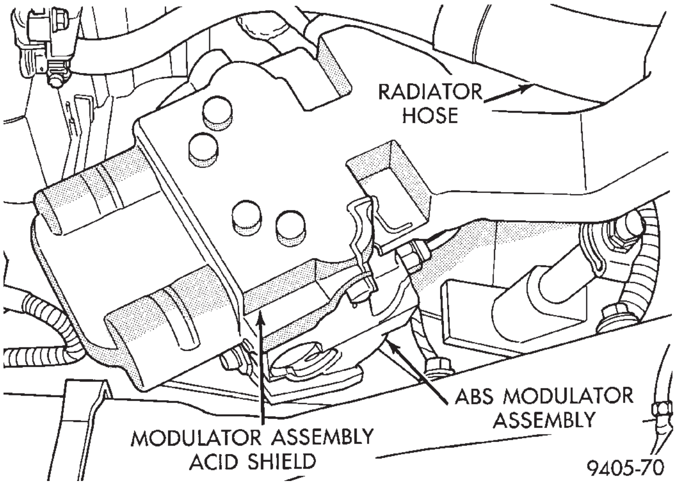


Fig. 18 Modulator Assembly Acid Shield Installed

(15) Install battery tray access cover (Fig. 21) on battery tray. **The access cover MUST be back on battery tray, before battery is installed in battery tray.**

(16) Install battery on battery tray. Then install and securely tighten battery hold down clamp (Fig. 22). Then install battery heat shield, on battery (Fig. 22).

(17) Install battery cables on battery. Securely tighten clamping bolts on battery cable terminals.

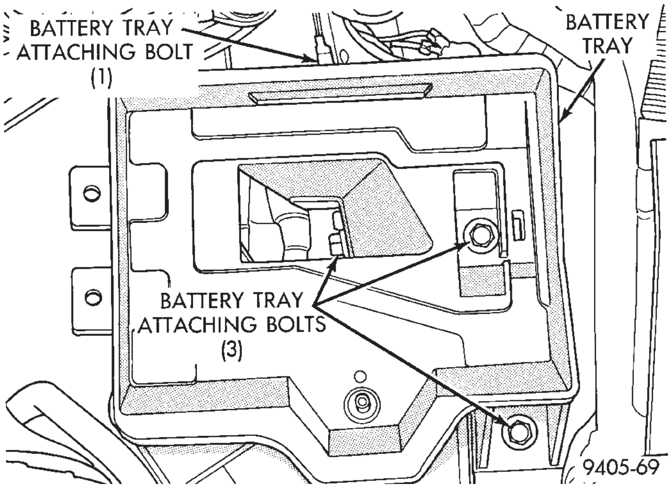


Fig. 19 Battery Tray Installation And Attaching Bolts

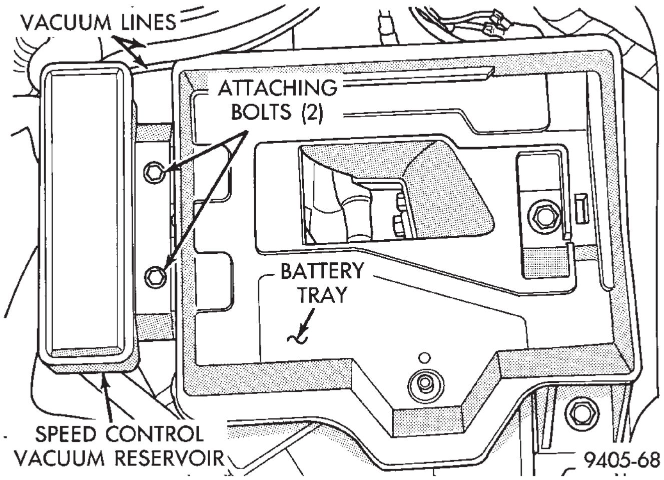


Fig. 20 Vacuum Reservoir Installation And Attaching Bolts

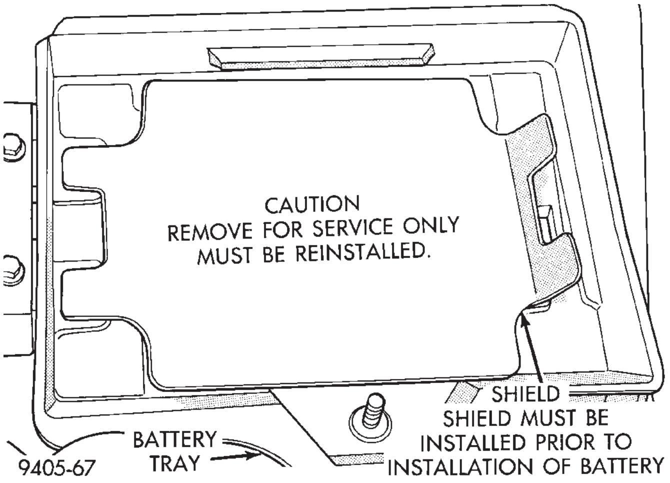


Fig. 21 Battery Tray Access Shield Installed

(18) Reset any electrical components of the vehicle which were affected by the removal of the battery.

(19) Road test vehicle to verify correct operation of the vehicles's base and Antilock brake systems.

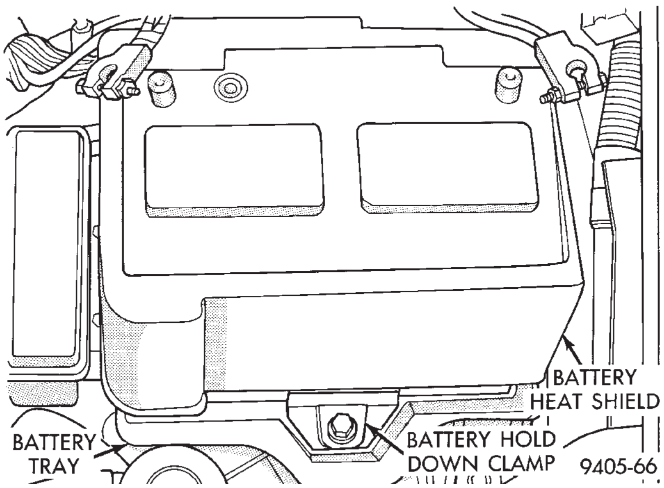


Fig. 22 Battery Hold Down Clamp And Heat Shield Installed

HYDRAULIC BRAKE TUBE ASSEMBLY (JUNCTION BLOCK TO MODULATOR ASSEMBLY)

The hydraulic brake tubes from the Antilock modulator assembly to the junction block (Fig. 1) are serviced as the complete assembly shown. No hydraulic brake tube from modulator assembly to junction block should be replaced as a single brake tube.

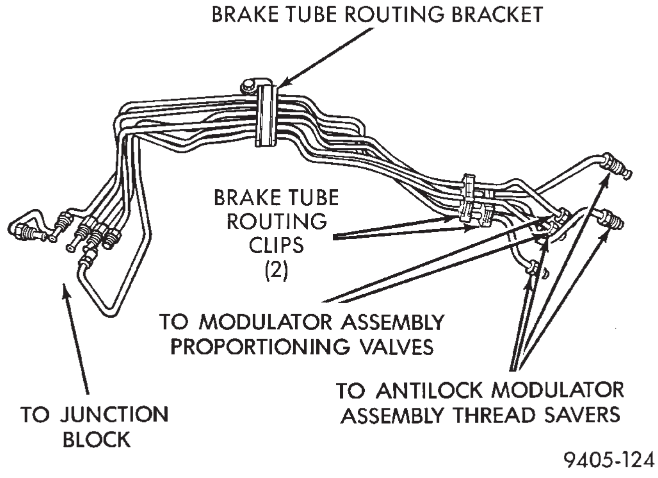


Fig. 1 Hydraulic Brake Tube Bundle Assembly

REMOVE

(1) Disconnect and remove both battery cables from battery.

(2) Remove heat shield (Fig. 2) from battery. Then remove battery hold down clamp (Fig. 2) and battery from battery tray.

(3) Remove battery tray access cover (Fig. 3) from battery tray. **Do not discard, access cover MUST be put back on battery tray, when battery is reinstalled.**

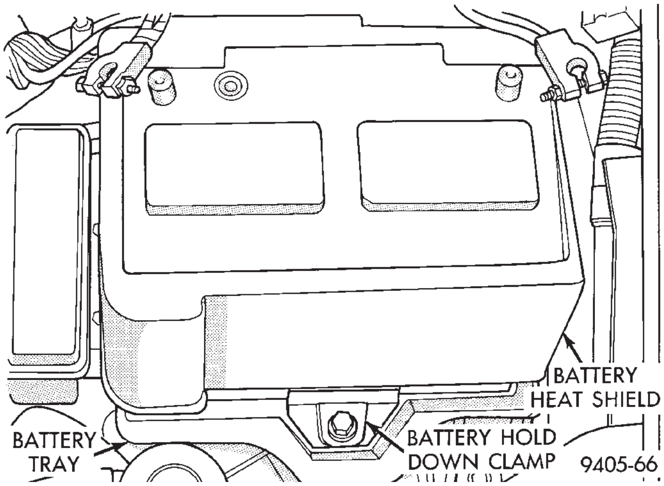


Fig. 2 Battery Heat Shield And Hold Down Clamp

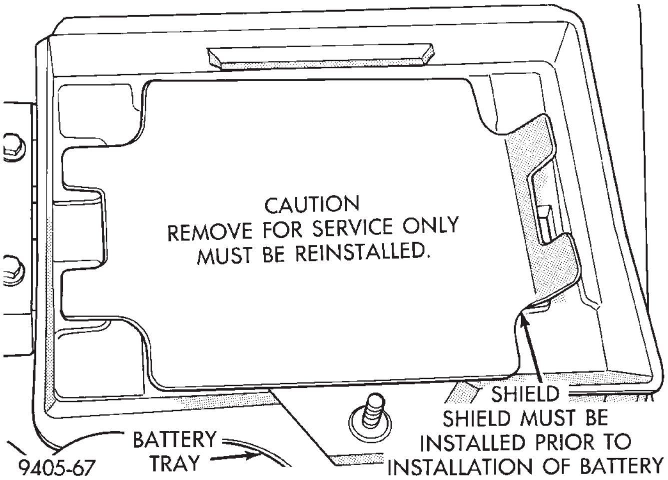


Fig. 3 Battery Tray Shield

(4) If equipped, remove the 2 bolts (Fig. 4) attaching speed control vacuum reservoir to battery tray. Then remove vacuum reservoir (Fig. 4) from the battery tray. **Vacuum lines (Fig. 4) do not need to be removed from vacuum reservoir.**

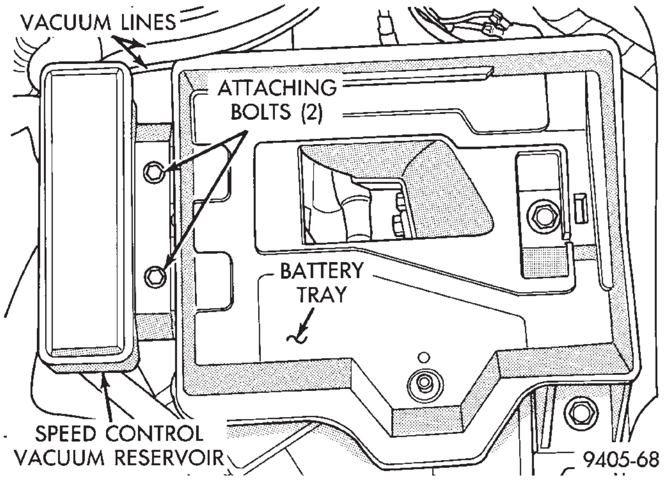


Fig. 4 Speed Control System Vacuum Reservoir

(5) Remove the 4 bolts attaching battery tray (Fig. 5) to frame rail and fender shield of the vehicle. Then remove battery tray.

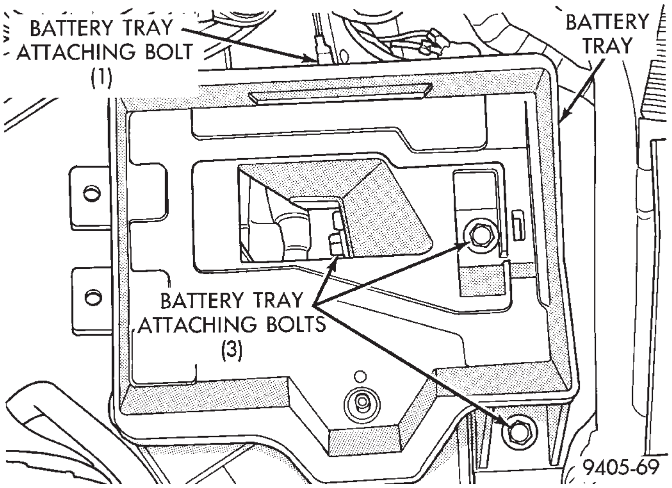


Fig. 5 Battery Tray And Attaching Bolts

(6) Remove battery acid shield, (Fig. 6) from the ABS modulator assembly.

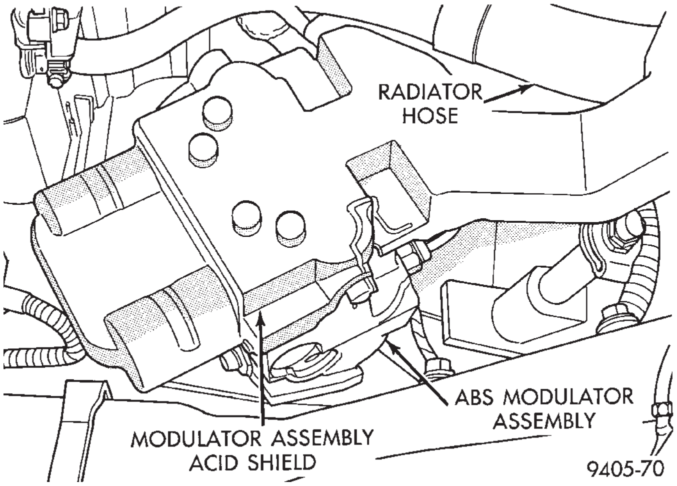


Fig. 6 ABS Modulator Assembly Acid Shield

(7) Remove the 6 tube nuts (Fig. 7), attaching hydraulic brake line tube bundle to modulator assembly, thread savers and proportioning valves. Then remove the 6 hydraulic brake lines as an assembly, from the modulator assembly.

(8) Remove electrical connector from the brake pressure differential warning switch on hydraulic junction block (Fig. 8).

(9) Remove the primary and secondary hydraulic brake tubes (Fig. 9) going from the master cylinder to the junction block, from both master cylinder and junction block.

(10) Remove the brake hydraulic tube going to the vehicle’s left front wheel from the junction block.

(11) Remove the 6 hydraulic brake tubes at the hydraulic junction block, coming from the antilock modulator assembly.

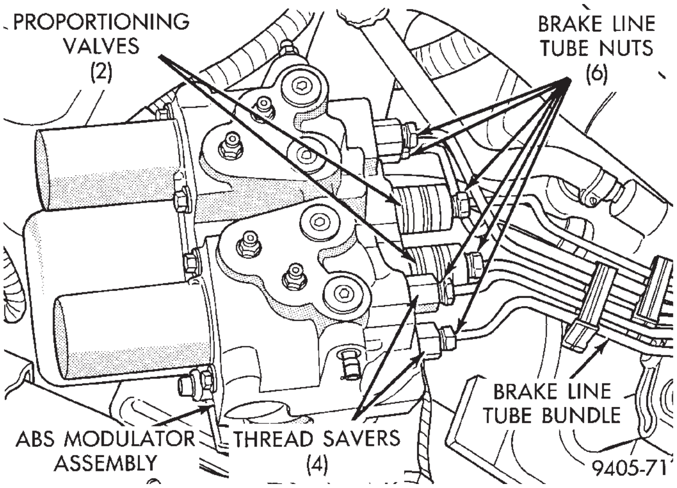


Fig. 7 Hydraulic Brake Line Connections To Modulator Assembly

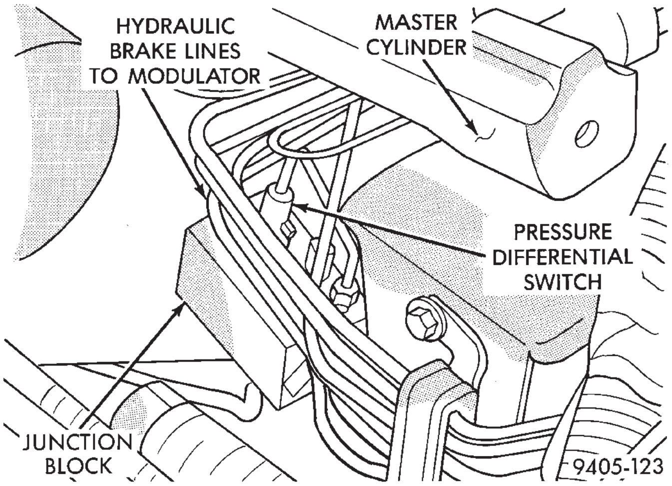


Fig. 8 Pressure Differential Switch Assembly

(12) Remove hydraulic brake tube assembly routing bracket, from the engine mounting bracket (Fig. 10).

(13) Remove the 6 hydraulic brake tubes and routing bracket as an assembly from the vehicle.

INSTALL

(1) Install the 6 hydraulic brake tubes, clips and routing bracket as an assembly into the vehicle.

(2) Align the 6 hydraulic brake tubes with their correct locations on the junction block. Thread the 6 brake line tube nuts **by hand** into the junction block tube ports. Then torque all 6 brake tube nuts to 18 N●m (159 in.lbs.).

(3) Install the primary and secondary hydraulic brake tubes, from master cylinder to junction block (Fig. 9). Then torque the brake line tube nuts at both the master cylinder and junction block to 18 N●m (159 in. lbs.).

(4) Install the hydraulic brake tube assembly routing bracket onto the engine mounting bracket (Fig. 10). Torque the brake tube routing bracket attaching bolt to 11 N●m (95 in. lbs.).

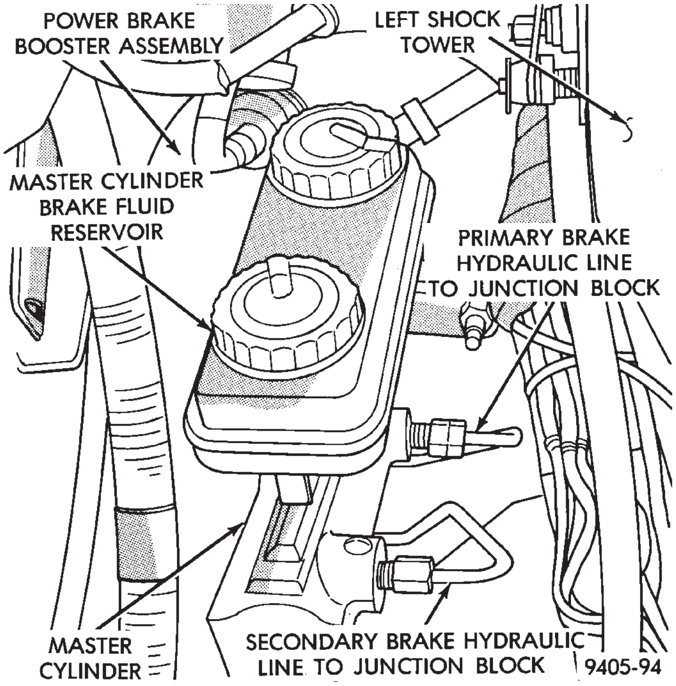


Fig. 9 Brake Tubes From Master Cylinder To Junction Block

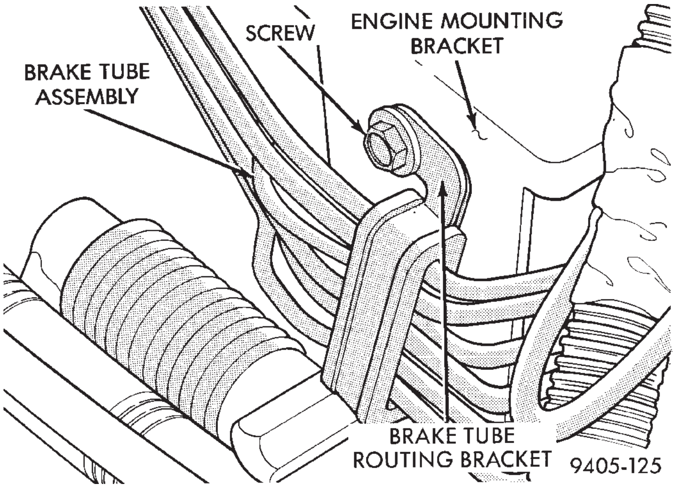


Fig. 10 Brake Tube Routing Bracket

(5) Align the 6 hydraulic brake lines with their appropriate fitting locations on the modulator assembly (Fig. 11). Thread the 6 brake line tube nuts **by hand** into proportioning valves and thread savers on modulator assembly.

(6) Using a crow foot and torque wrench (Fig. 12), torque the 6 hydraulic brake line tube nuts to 18 N●m (159 in. lbs.).

(7) Using approved battery jumper cables, attach battery, to the vehicles negative and positive battery cables (Fig. 13).

(8) Bleed the vehicles base brake and Antilock brake hydraulic systems. Refer to Bleeding Bendix

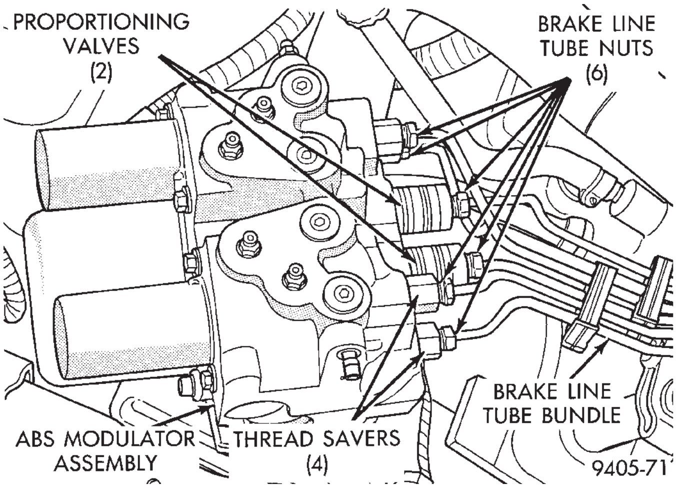


Fig. 11 Hydraulic Brake Line Connections at Modulator Assembly

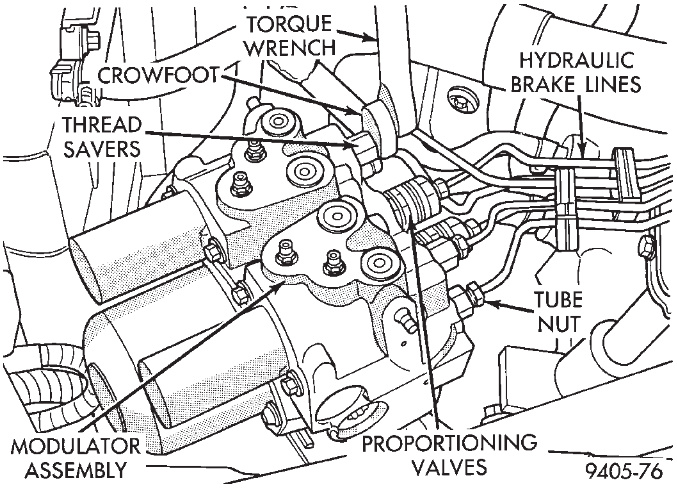


Fig. 12 Torquing Brake Line Connections To Modulator Assembly

Antilock 4 Brake System in this service manual supplement for required bleeding procedure.

(9) Install battery acid shield (Fig. 14) onto the ABS modulator assembly. **Be sure acid shield is securely attached to modulator assembly before installing battery tray.**

(10) Install battery tray into vehicle. Then install the 4 bolts (Fig. 15) attaching battery tray to inner fender and frame rail. Torque the 4 battery tray attaching bolts to 20 N●m (175 in.lbs.).

(11) If equipped, install speed control vacuum reservoir on battery tray. Install the 2 speed control vacuum reservoir attaching bolts (Fig. 16). Torque the 2 vacuum reservoir attaching bolts to 4 N●m (30 in. lbs.).

(12) Install battery tray access cover (Fig. 17) on bottom of battery tray. **The access cover MUST be on battery tray, before battery is installed.**

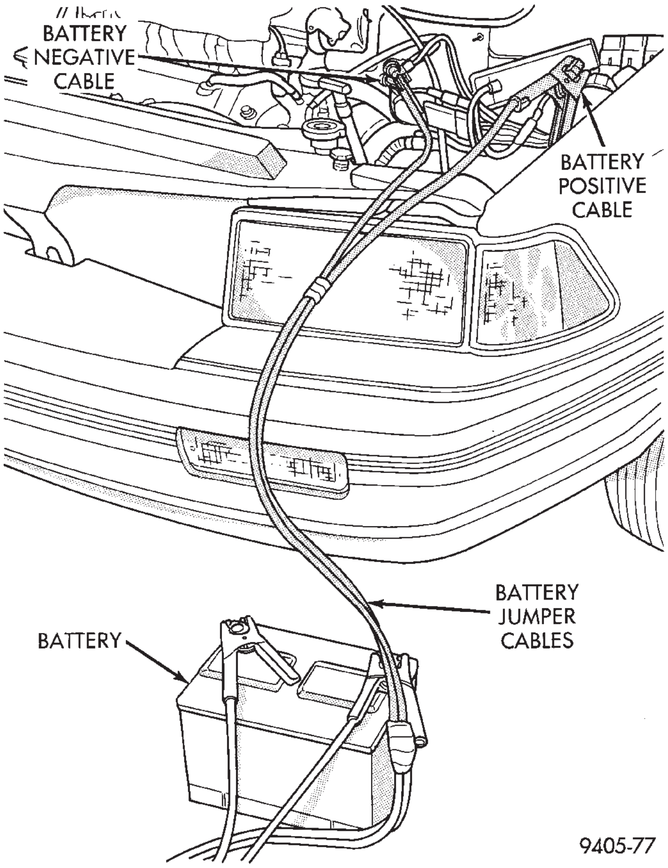


Fig. 13 Battery Connected To Vehicle For Bleeding Modulator Assembly

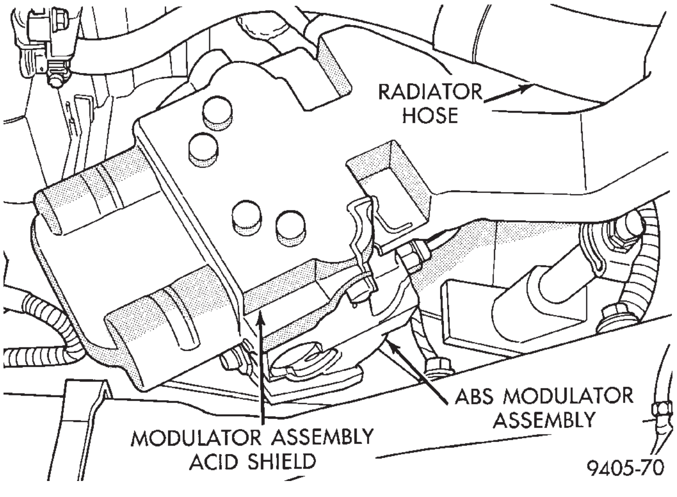


Fig. 14 Modulator Assembly Acid Shield Installed

(13) Install battery on battery tray. Then install and securely tighten the battery hold down clamp (Fig. 18). Then install battery heat shield, on battery (Fig. 18).

(14) Install battery cables on battery. Securely tighten clamping bolts on battery cable terminals.

(15) Reset any electrical components of the vehicle which were affected by the removal of the battery.

(16) Road test vehicle to verify correct operation of the vehicles's base and Antilock brake systems.

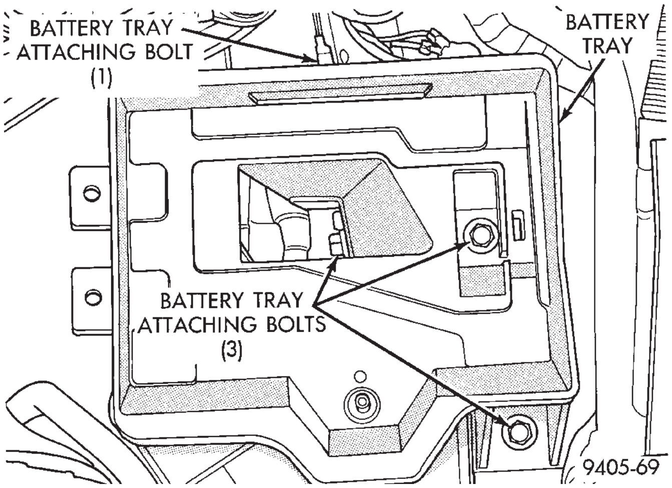


Fig. 15 Battery Tray Installation And Attaching Bolts

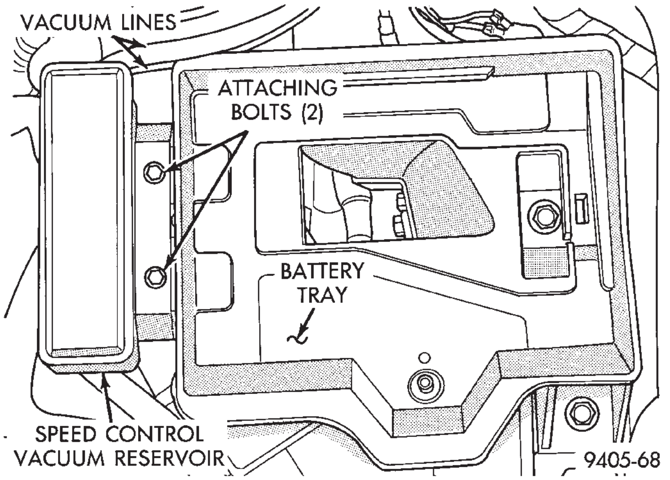


Fig. 16 Vacuum Reservoir Installation And Attaching Bolts

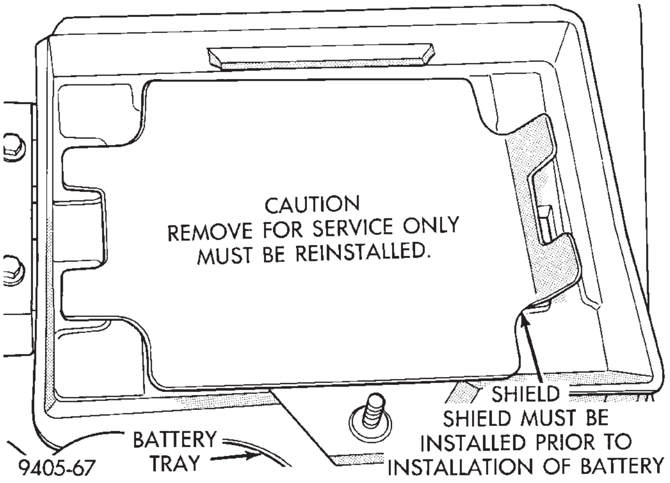


Fig. 17 Battery Tray Access Shield Installed

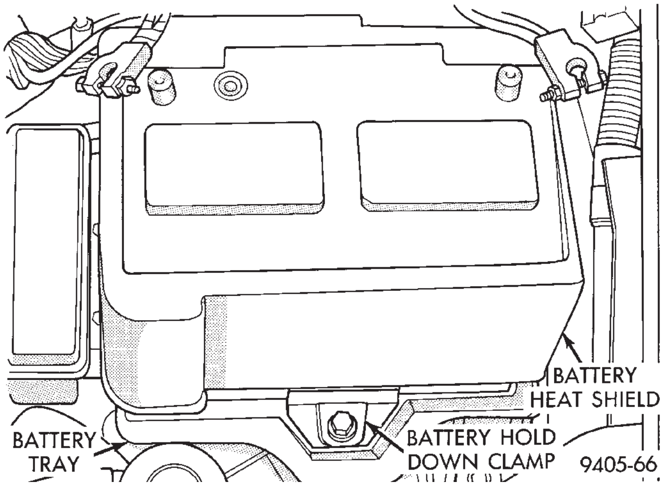


Fig. 18 Battery Hold Down Clamp And Heat Shield Installed

MASTER CYLINDER AND POWER BOOSTER

REMOVAL AND INSTALLATION

If the Master Cylinder or Power Booster need to be removed for replacement or servicing of other vehicle components. Refer to Master Cylinder or Power Brake Service section in group 5 of the 1993 M.Y. Front Wheel Drive Car service manual.

After servicing master cylinder, refer back to this service manual supplement for the appropriate procedure and sequence used to bleed the base and Antilock portion of the brake system.

PROPORTIONING VALVES (FIG. 1)

CAUTION: Proportioning valves should never be disassembled.

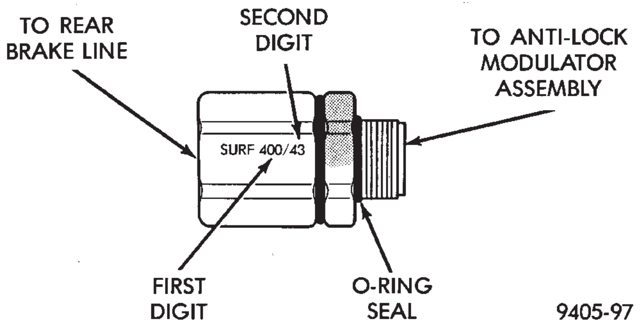


Fig. 1 ABS Proportioning Valve Identification

REMOVAL

(1) Disconnect and remove both battery cables from battery.

(2) Remove heat shield (Fig. 2) from the battery. Then remove battery hold down clamp (Fig. 2) and battery from battery tray.

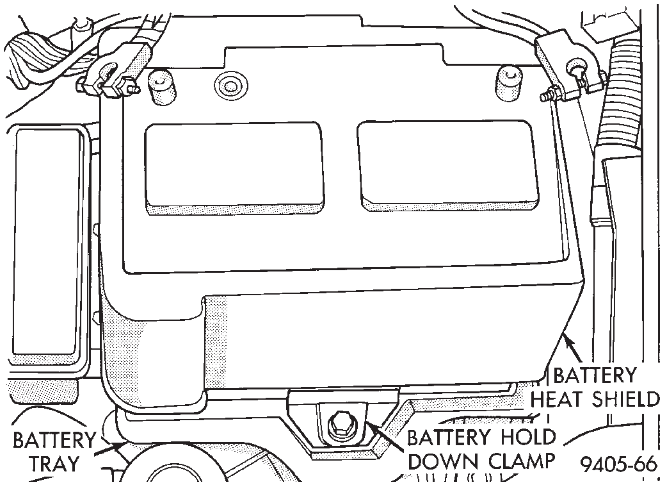


Fig. 2 Battery Heat Shield And Hold Down Clamp

(3) Remove battery tray access cover (Fig. 3) from battery tray. **Do not discard, access cover MUST be put back on battery tray, when battery is reinstalled.**

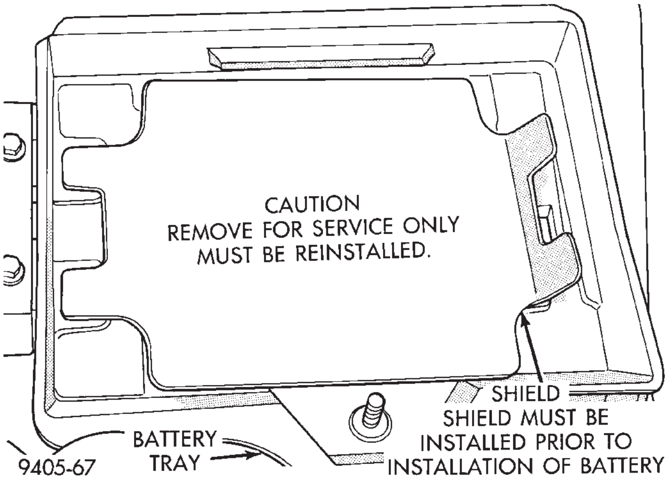


Fig. 3 Battery Tray Shield

(4) If equipped, remove the 2 bolts (Fig. 4) attaching speed control vacuum reservoir to battery tray. Then remove speed control vacuum reservoir (Fig. 4) from the battery tray. **Vacuum lines (Fig. 4) do not need to be removed from vacuum reservoir.**

(5) Remove the 4 bolts attaching battery tray (Fig. 5) to frame rail and fender shield of vehicle. Then remove battery tray from vehicle.

(6) Remove battery acid shield, (Fig. 6) from the ABS modulator assembly.

(7) Remove brake tube from the proportioning valve, requiring removal from modulator assembly (Fig. 7).

(8) Remove proportioning valve (Fig. 7) requiring replacement from the modulator assembly.

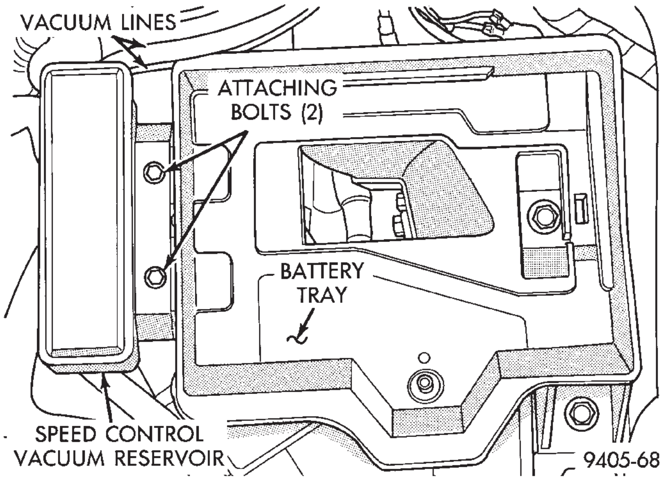


Fig. 4 Speed Control System Vacuum Reservoir

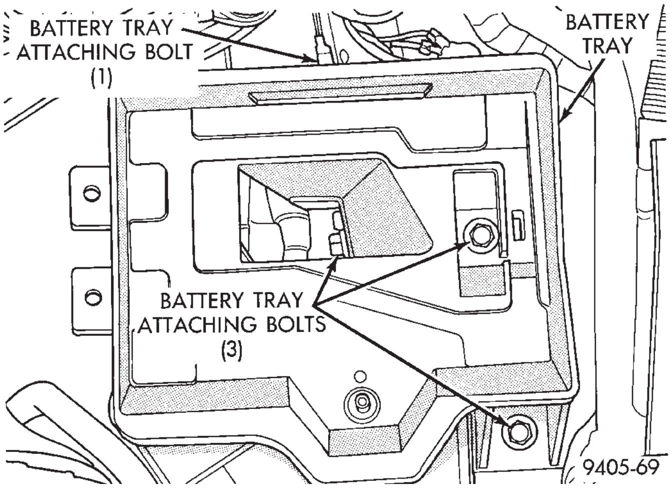


Fig. 5 Battery Tray And Attaching Bolts

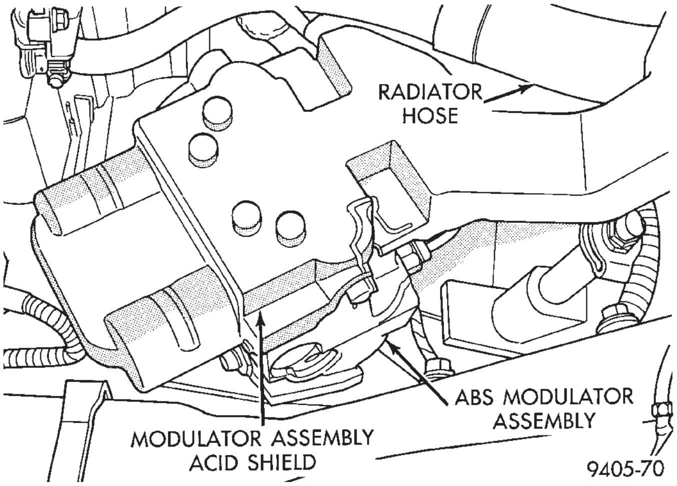


Fig. 6 ABS Modulator Assembly Acid Shield

INSTALL

(1) Slightly moisten proportioning valve to modulator assembly sealing O-Ring with fresh clean brake fluid.

(2) Install proportioning valve into modulator assembly by hand, until O-Ring seal is fully seated

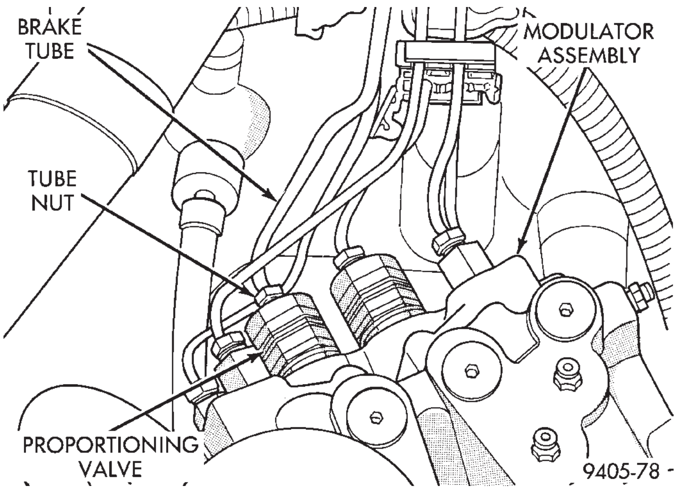


Fig. 7 Proportioning Valve Removal From Modulator Assembly

against modulator assembly. Then torque proportioning valve to 35 N●m (26 ft. lbs.) torque.

(3) Install hydraulic brake line on proportioning valve and hand start tube nut into proportioning valve. Torque tube nut to 18 N●m (159 in. lbs.) torque.

(4) Using approved battery jumper cables, attach battery, to the vehicles negative and positive battery cables (Fig. 8).

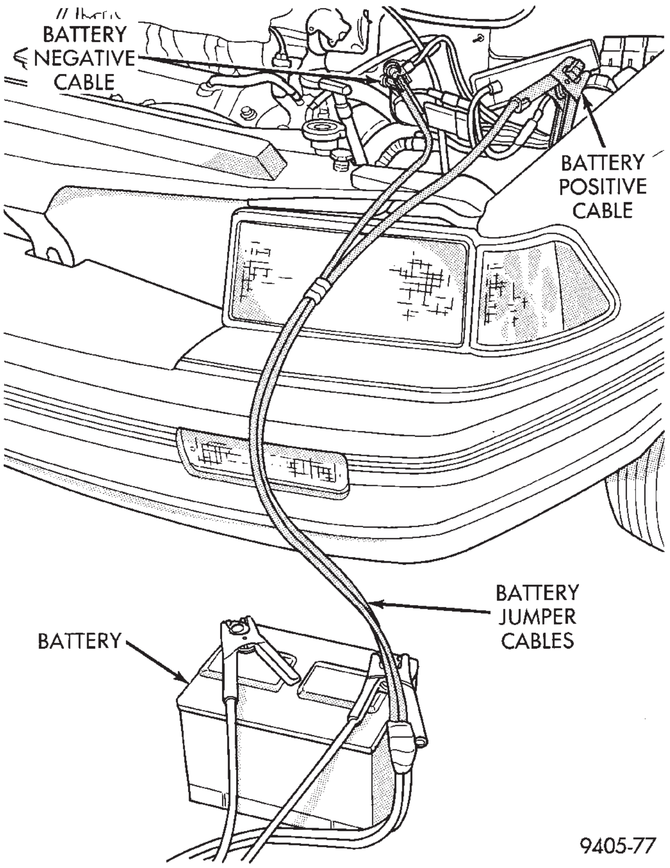


Fig. 8 Battery Connected To Vehicle For Bleeding Modulator Assembly

(5) Bleed the vehicles base brake and Antilock brake hydraulic systems. Refer to Bleeding Bendix Antilock 4 Brake System in this service manual supplement for required bleeding procedure.

(6) Install battery acid shield (Fig. 9) onto the ABS modulator assembly. **Be sure acid shield is securely attached to modulator assembly before installing battery tray.**

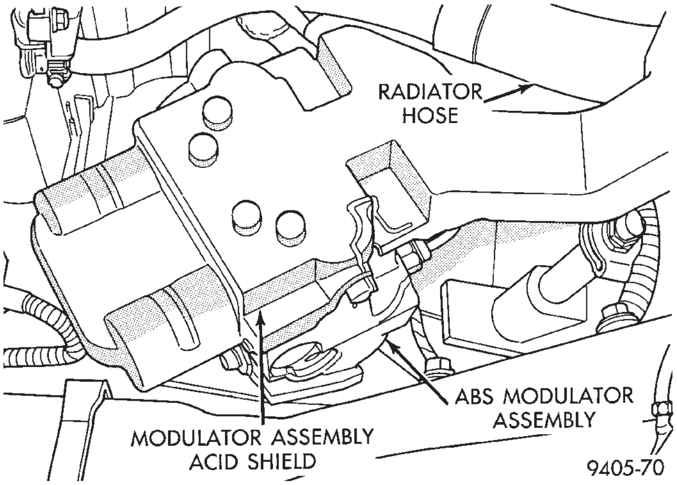


Fig. 9 Modulator Assembly Acid Shield Installed

(7) Install battery tray in vehicle. Then install the 4 bolts (Fig. 10) attaching battery tray to inner fender and frame rail. Torque the 4 battery tray attaching bolts to 20 N●m (175 in.lbs.).

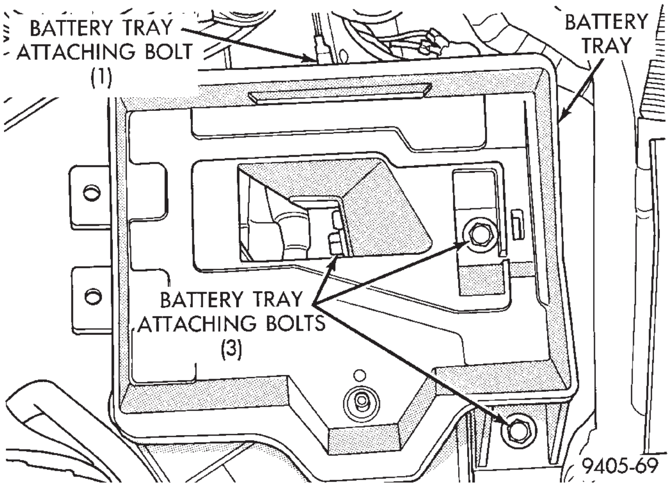


Fig. 10 Battery Tray Installation And Attaching Bolts

(8) If equipped, install speed control vacuum reservoir on battery tray. Install the 2 speed control vacuum reservoir attaching bolts (Fig. 11). Torque the 2 vacuum reservoir attaching bolts to 4 N●m (30 in. lbs.).

(9) Install battery tray access cover (Fig. 12) on bottom of battery tray. **The access cover MUST be on battery tray, before battery is installed in battery tray.**

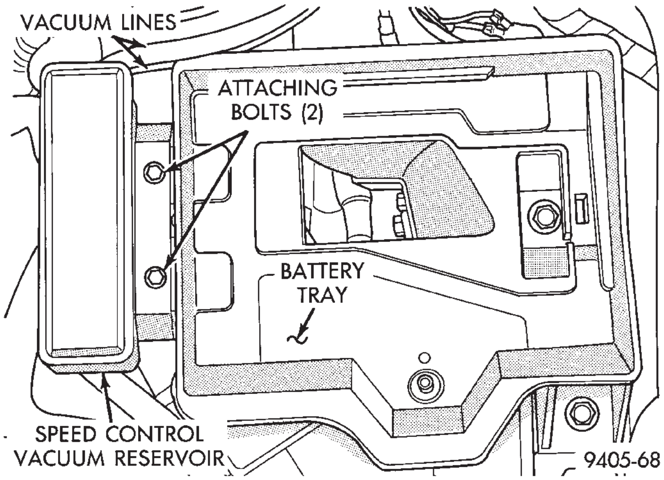


Fig. 11 Vacuum Reservoir Installation And Attaching Bolts

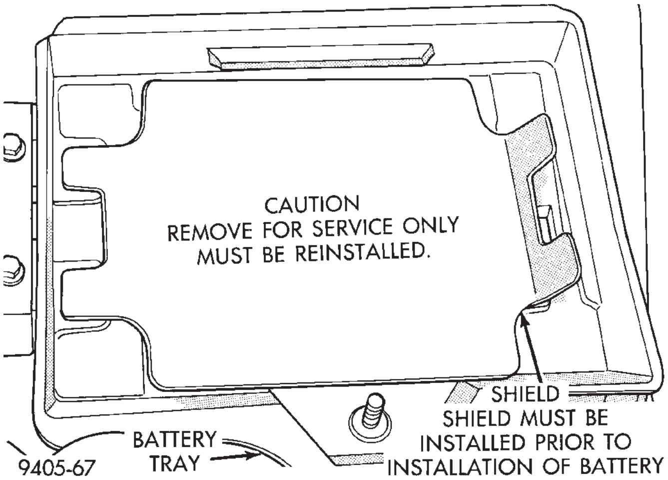


Fig. 12 Battery Tray Access Shield Installed

(10) Install battery on battery tray and install and securely tighten the battery hold down clamp (Fig. 13). Then install heat shield, on battery (Fig. 13).

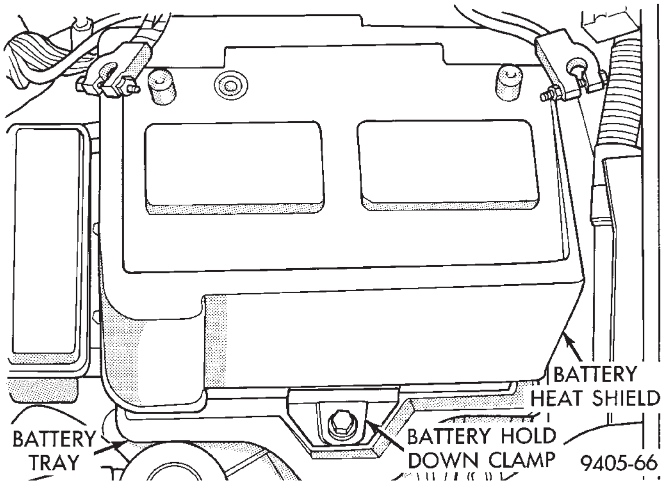


Fig. 13 Battery Hold Down Clamp And Heat Shield Installed

(11) Install battery cables on battery. Securely tighten clamping bolts on battery cable terminals.

(12) Reset any electrical components of the vehicle which were affected by the removal of the battery.

(13) Road test vehicle to verify correct operation of the vehicles's base and Antilock brake systems.

ELECTRONIC COMPONENTS

CONTROLLER ANTILOCK BRAKE CAB

REMOVE

(1) Turn vehicle ignition off.

(2) Disconnect the wiring harness connector from the Antilock system relay (Fig. 1). Relay will be removed as part of the CAB bracket.

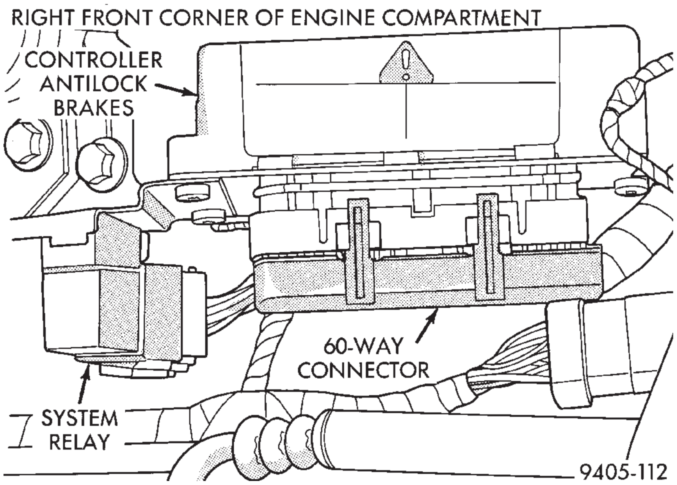


Fig. 1 CAB Location

CAUTION: BEFORE REMOVING 60 WAY CONNECTOR FROM THE CAB VERIFY THAT THE VEHICLE'S IGNITION IS IN THE OFF OR LOCK POSITION. IF IGNITION IS ON WHEN 60 WAY CONNECTOR IS REMOVED FROM THE CAB DAMAGE TO THE CONTROLLER COULD OCCUR.

(3) Loosen bolt (Fig. 2) retaining the wiring harness 60 way connector to the CAB. Then disconnect the 60 way connector (Fig. 2) from the CAB by pulling it straight out, do not twist connector when removing.

(4) Remove the 2 bolts (Fig. 3) attaching the CAB module mounting bracket, to the frame rail of the vehicle.

(5) Remove the CAB and its mounting bracket as an assembly from the vehicle from the vehicle.

(6) Remove the 3 screws (Fig. 4) attaching the CAB to the CAB mounting bracket. Then separate CAB from mounting bracket.

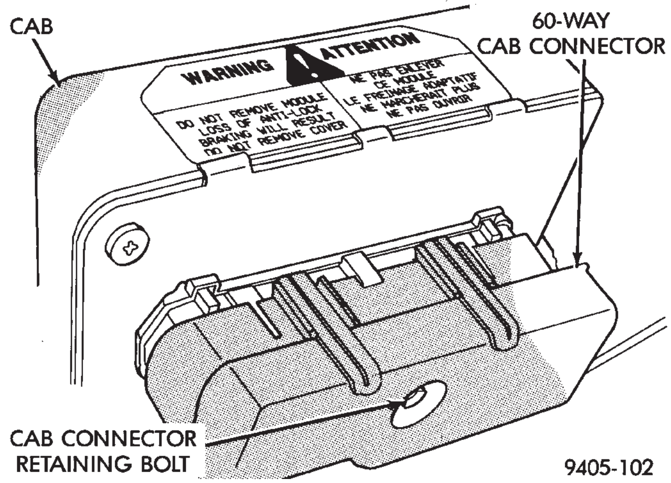


Fig. 2 CAB 60 Way Connector And Retaining Bolt

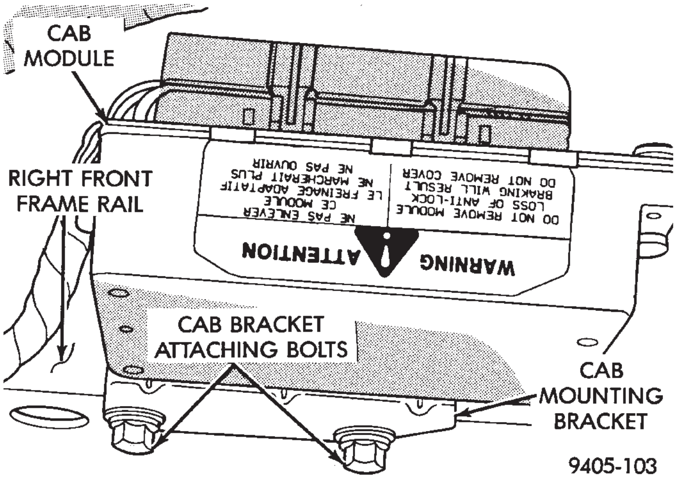


Fig. 3 CAB Bracket To Frame Rail Mounting Bolts

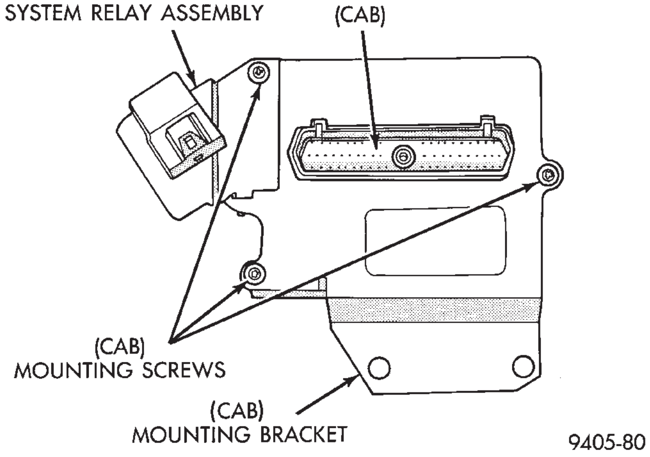


Fig. 4 CAB Removal From Mounting Bracket

INSTALL

(1) Install CAB and system relay/bracket assembly on CAB mounting bracket (Fig. 4). Install the 3 CAB to CAB mounting bracket attaching screws (Fig. 4). Torque the 3 CAB to mounting bracket attaching screws to 12 N●m (106 in. lbs.).

(2) Install the CAB, system relay and mounting bracket on the frame rail of the vehicle. Install the 2 bolts (Fig. 3) attaching the CAB mounting bracket to the frame rail of the vehicle. Torque the 2 CAB mounting bracket attaching bolts (Fig. 3) to 28 N●m (250 in. lbs.).

CAUTION: BEFORE INSTALLING 60 WAY CONNECTOR ON THE CAB VERIFY THAT THE VEHICLE'S IGNITION IS IN THE OFF OR LOCK POSITION. IF IGNITION IS ON WHEN 60 WAY CONNECTOR IS INSTALLED ON THE CAB, DAMAGE TO THE CONTROLLER COULD OCCUR.

(3) Install the wiring harness 60 way connector (Fig. 2) into the CAB electrical connector as far as possible by hand. After 60 way connector is installed as far as possible by hand, use the 60 way connector retaining bolt (Fig. 2) to fully seat connector into the CAB. Then torque the wiring harness 60 way CAB connector retaining bolt to 4 N●m (38 in. lbs.).

(4) Install the wiring harness connector onto the Antilock system relay (Fig. 1). **Be sure locking tab on wiring harness connector is fully engaged with lock on system relay.**

(5) Road test vehicle to verify correct operation of the vehicles's Antilock brake system.

REMOVAL/INSTALLATION OF SYSTEM RELAY

The antilock brake system, system relay is serviced as an assembly, with the mounting bracket. The system relay is mounted to a separate bracket which is attached to the CAB and mounting bracket assembly (Fig. 5).

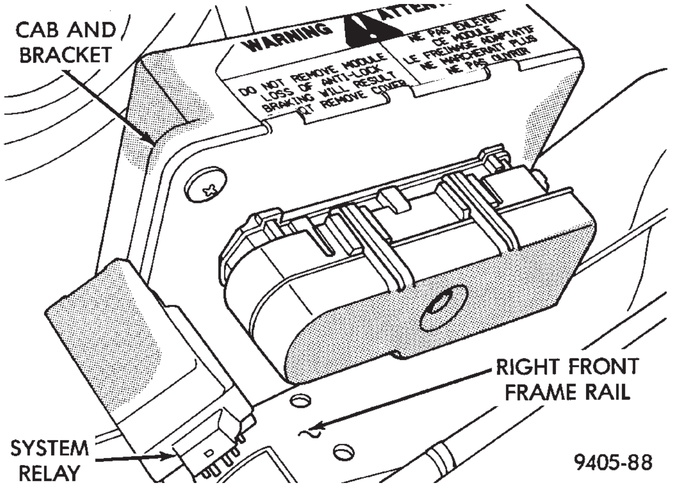


Fig. 5 Antilock Brakes System Relay Location

REMOVE

(1) Hold system relay with one hand, while pulling strait down on the wiring harness connector. Until connector is free from the relay **(do not twist the connector).**

(2) Remove screw (Fig. 6) holding the system relay and bracket to the CAB bracket. Then remove the system relay and mounting bracket assembly from the CAB bracket.

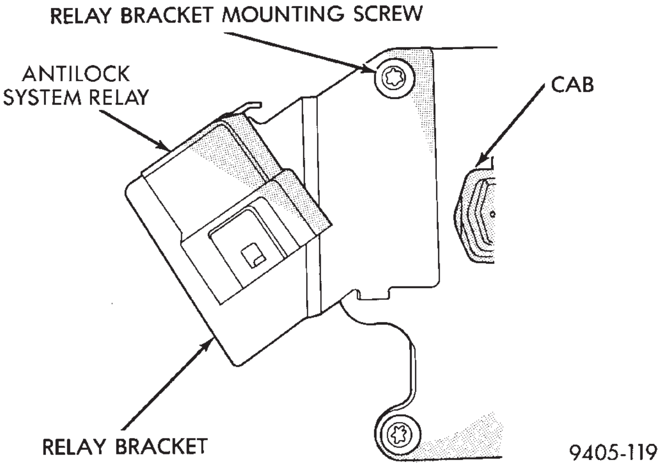


Fig. 6 System Relay And Bracket Removal

INSTALL

(1) Mount the system relay and its mounting bracket assembly to the CAB mounting bracket, with the mounting screw (Fig. 6).

(2) Holding the system relay with one hand, pushing the wiring harness connector strait onto the terminals of the relay. Make sure connector is fully seated onto terminals of the system relay and the lock on the wiring harness connector is fully engaged with the relay.

(3) Road test vehicle to verify correct operation of the vehicles's Antilock brake system.

REMOVE/INSTALL PUMP MOTOR RELAY

Find location of Antilock Pump Motor Relay (Fig. 7 & 8), depending on whether the vehicle being serviced has or does not have a power distribution center PDC.

(1) Hold the Antilock pump motor relay with one hand, while pulling wiring harness relay connector strait off the relay terminals.

(2) Remove the pump motor relay assembly from the vehicle.

(3) Installation is done in the reverse order off removal. Be sure that the wiring harness connector is fully seated onto the terminals of the Pump Motor Relay.

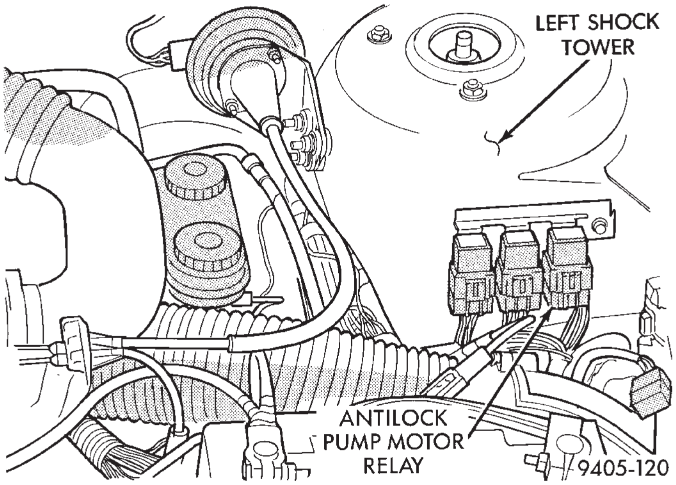


Fig. 7 Pump Motor Relay Location On AA Body W/O Power Distribution Center

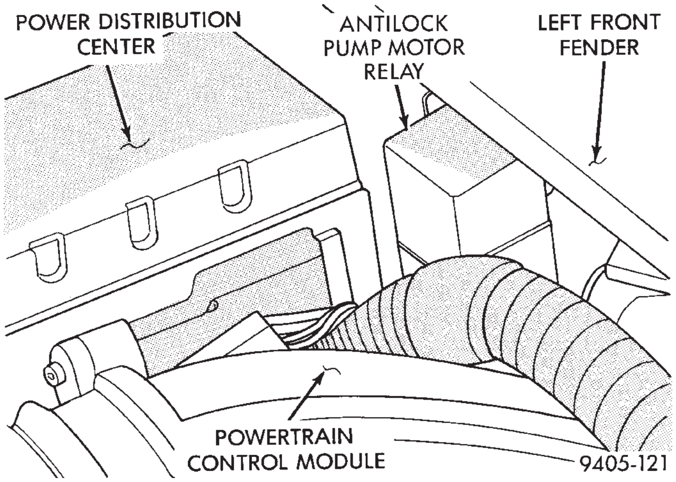


Fig. 8 Pump Motor Relay Location On AJ Body With Power Distribution Center

WHEEL SPEED SENSORS

INSPECTION

Inspect tonewheel for missing or broken teeth, this can cause erratic sensor signals.

Tonewheel should show no evidence of contact with the wheel speed sensor. If contact was made, determine cause and correct.

Excessive runout of the tonewheel can cause erratic wheel speed sensor. Replace assembly if runout exceeds approximately 0.25 mm (0.010 inch).

FRONT WHEEL SPEED SENSOR (FIG. 9)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove screw from grommet retainer clip that holds the grommet into fender shield (Fig. 9).

(3) Remove the 2 screws that fasten the sensor routing tube to the frame rail.

(4) Carefully, pull sensor assembly grommet from fender shield.

(5) Unplug speed sensor connector from vehicle wiring harness.

(6) Remove the sensor assembly grommets from the retainer brackets.

(7) Remove sensor head screw.

(8) Carefully, 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.

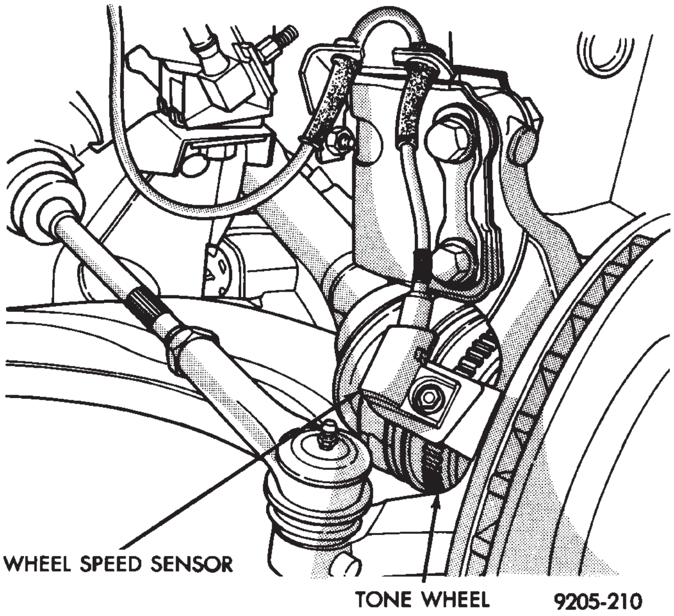


Fig. 9 Front Wheel Speed Sensor Routing

INSTALLATION

(1) Connect the wheel speed sensor connector to the wiring harness.

(2) Push sensor assembly grommet into hole in fender shield. Install clip and screw.

(3) Install the 2 screws that fasten the speed sensor routing tube to the frame rail.

(4) Install sensor grommets in brackets on fender shield and strut damper.

(5) Coat the speed sensor with High Temperature Multi-purpose E.P. Grease before installing into the steering knuckle. Install screw tighten to 7 N●m (60 in. lbs.)

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.

REAR WHEEL SPEED SENSOR (FIGS. 10 AND 11)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove sensor assembly grommet from underbody and pull harness through hole in underbody.

(3) Unplug connector from harness.

(4) Remove sensor assembly grommets from bracket which is screwed into the body hose bracket, just forward of trailing arm bushing (batwing bracket.)

(5) Remove sensor and brake tube assembly clip, located on the inboard side of trailing arm.

(6) Remove sensor wire fastener from rear brake hose bracket.

(7) Remove outboard sensor assembly retainer nut. This nut also is used to capture the brake tube clip.

(8) Remove sensor head screw.

(9) Carefully, remove sensor head from adapter assembly. 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.

INSTALLATION

Installation is reverse order of removal. Be sure to coat sensor with High Temperature Multi-purpose E.P. Grease before installing into adapter assembly. Tighten screw to 7 N●m (60 in. lbs.) torque.

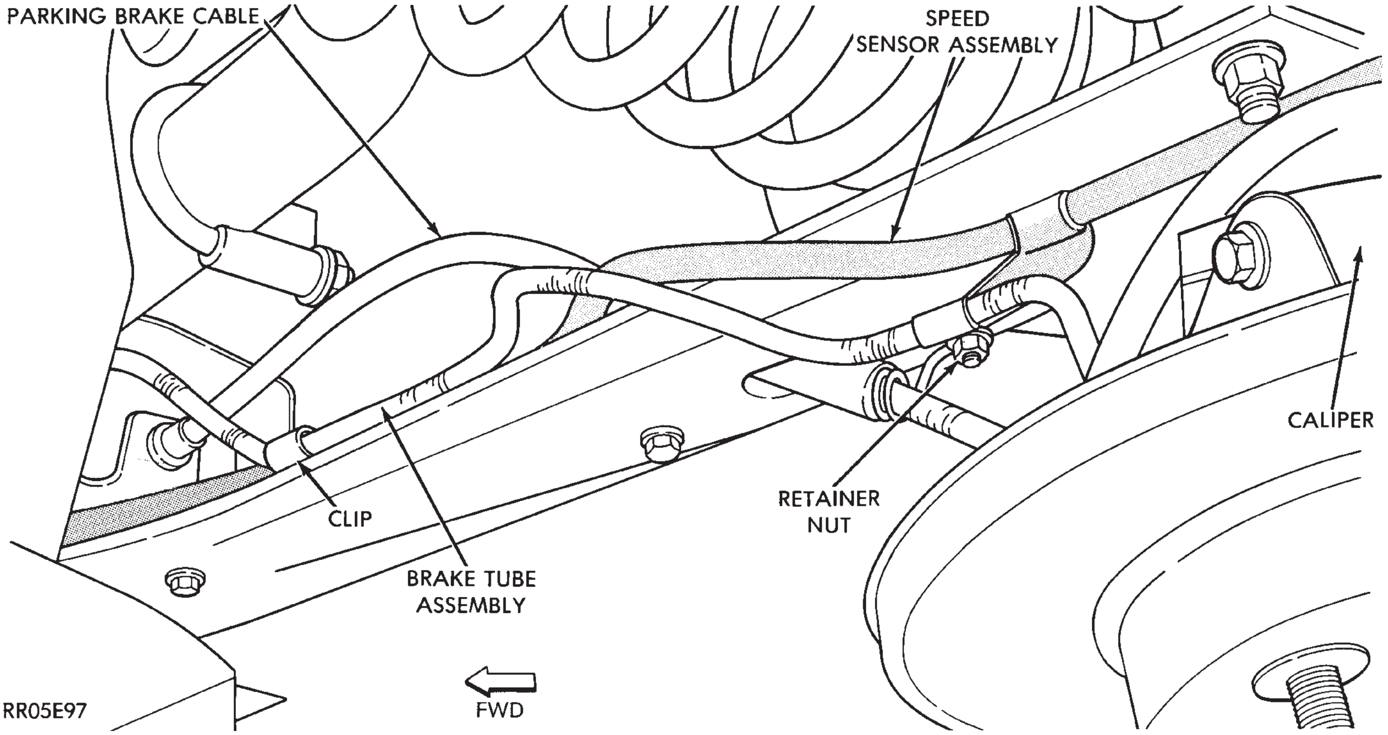


Fig. 10 Rear Wheel Speed Sensor Routing at Trailing Arm

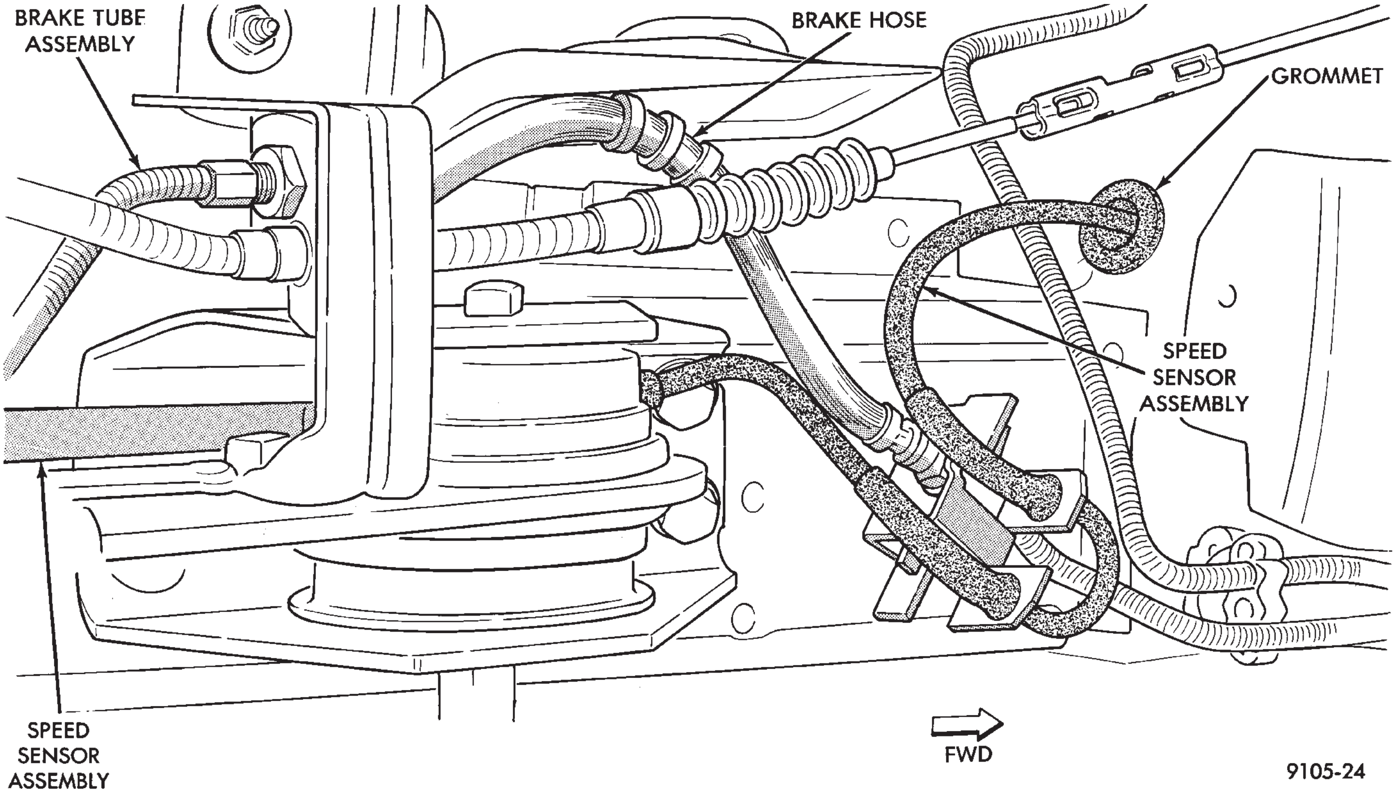


Fig. 11 Body Routing of Rear Speed Sensor Wiring

SPECIFICATIONS

SPECIFICATIONS METRIC

FRONT BRAKES—DISC

Type	Single Piston-Dual Pin Slider
Caliper Bore Diameter	54 mm AA, AG, AJ, AP 60 mm AC, AG, AY
Adjustment	Automatic
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press In EPDM Rubber
Disc Type All Bodies	Vented
Disc Diameter—Outside AA, AC, AG, AJ, AP, AY	240 mm std.
AG	260 mm opt.
Runout — Maximum Allowable T.I.R.*	.10 mm (.004 in.)
Parallelism—Total Variation in Thickness in 360 of Rotation	.013 mm (.0005 in.)
Brake Shoes And Linings	Rivited

*Measured On The Vehicle

REAR BRAKES—DISC WITH SEPARATE PARKING BRAKE

Type	Single Piston With Internal Park Brake (Drum In Hat)
Caliper Bore Diameter AA, AJ, AP	34 mm 14 in. Wheel
AG	36 mm 15 in. Wheel
AC, AY	36 mm 14 in. Wheel
Adjustment	Disc Brake—Automatic Parking Brake—Manual
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press in EPDM Rubber
Disk Type	Solid-14 in. Wheel Vented-15 in. Wheel
Disc Diameter—Outside	270 mm 14 in. Wheel 286 mm-15 in. Wheel
Diameter—Parking Brake Drum	171.9mm to 172.15mm

REAR BRAKES—DRUM

Type	Leading Trailing
Adjustment	Automatic
Drum Diameter AP Body	220 mm (8 in.) Standard
AA, AG, AJ Body	220 mm (8.5 in.) Standard
AC, AY Body	220 mm (8.5 in.) Heavy Duty And C-45 Ribbed And Flared
Wheel Cylinder Diameter AA, AC, AG, AP, AY	15.9 mm
Brake Shoes And Linings	Rivited

9305-166

BRAKE ACTUATION SYSTEM

ACTUATION:	Power Brakes Standard
Hydraulic System	Dual-Diagonally Split
MASTER CYLINDER:	
Type	Dual-Tandem-Chrysler
Body Material	Anodized Aluminum
Reservoir Material	Glass Reinforced Nylon
Bore and Stroke	21 mm x 33.4 mm 23.8 mm x 39.5 mm .875 in. x 33.4 mm
Displacement Split	50/50
Outlet Port Threads	ABS M-12 Pri. and Sec. W/O ABS M-12 Sec. M-10 Pri.
Outlet Fitting Type	ISO Flare
ABS Hydraulic Assembly Fitting Type	ISO Style Flare
Pedal Ratio AY & AY W/ABS	5.10
AA, AC, AG, AJ, AP, AY W/O ABS	3.28
BOOSTER:	
Make	Bendix Vacuum/Hyd. W/O ABS Teves Vacuum/Hyd. W/ABS
Mounting Studs	M8 x 1.25
Type	230 mm Single 205 mm Tandem
Boost @ 20" HG	2675 N All Vehicles
COMBINATION HYDRAULIC VALVE:	
Material	Brass
Function	Proportioning Valve And Warning Light Switch (Latching)

9305-167

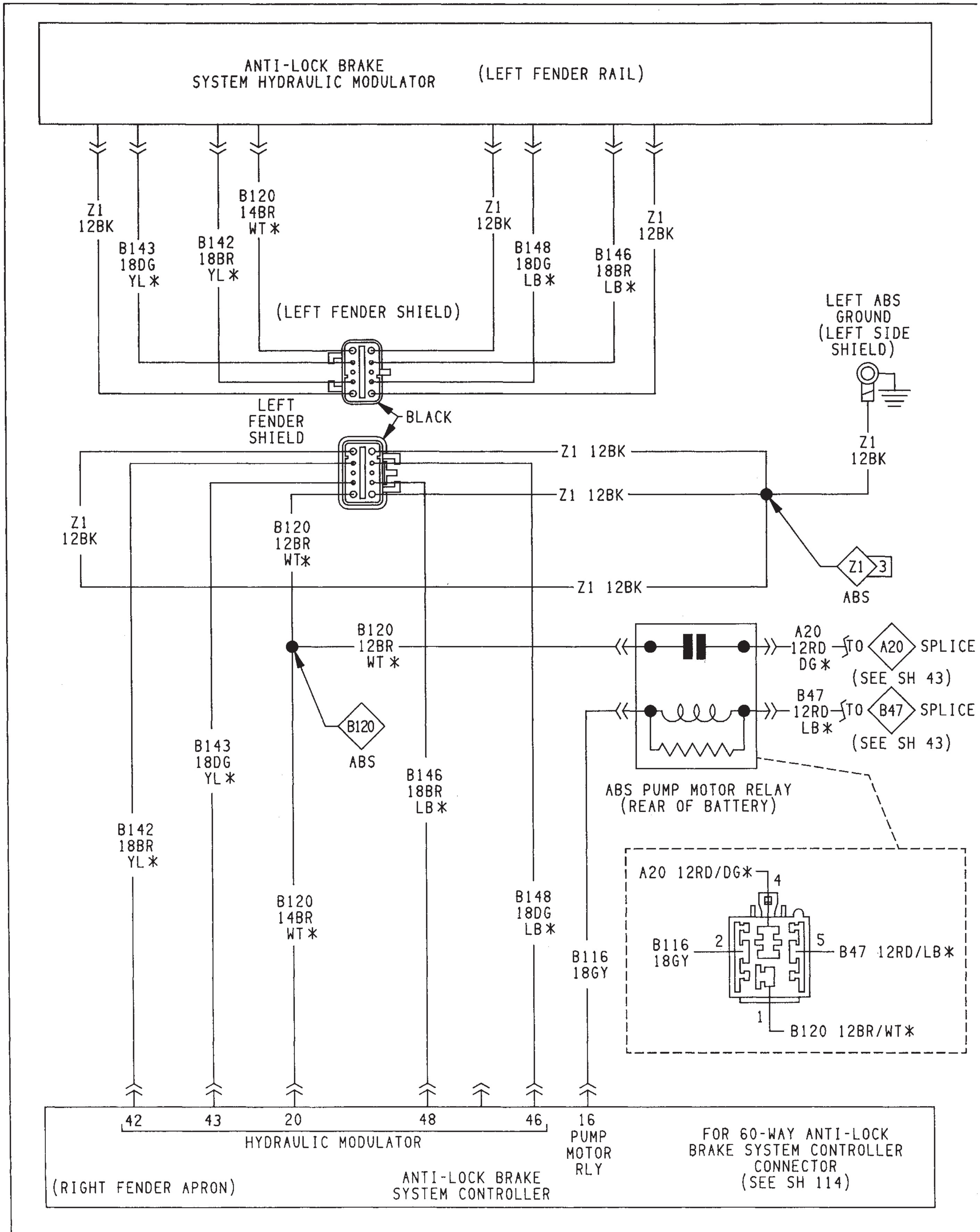
TIGHTENING REFERENCE

DESCRIPTION	TORQUE
Hydraulic Brake Tubes To All Fittings (If Not Specified)	17 N•m (145 in. lbs.)
Brake Hoses To Calipers (Banjo Bolts)	48 N•m (35 ft. lbs.)
Brake Hose Intermediate Bracket	12 N•m (105 in. lbs.)
Master Cylinder To Brake Booster Mounting Nuts	28 N•m (250 in. lbs.)
Brake Booster Assembly To Dash Panel	28 N•m (250 in. lbs.)
Wheel Cylinder to Rear Brake Support Plate	8 N•m (75 in. lbs.)
Wheel Cylinder Bleed Screw	10 N•m (80 in. lbs.)
Brake Support Plate To Rear Axle Mounting Bolts (All Except AG, AJ, AP Body)	109 N•m (80 ft. lbs.)
Brake Support Plate To Rear Axle Mounting Bolts (AG, AJ, AP Body	72 N•m (53 ft. lbs.)
Wheel Stud Lug Nuts	109 - 150 N•m (80 - 110 ft. lbs.)
Caliper Adapter To Steering Knuckle Mounting Bolts	224 N•m (165 ft. lbs.)
Caliper Guide Pin Bolts	31 N•m (23 ft. lbs.)
Bearing Retainer Mounting Bolt	168 N•m (124 ft. lbs.)
Caliper Bleed Screw	15 N•m (125 in. lbs.)
Brake Light Switch Mounting Bracket Screw	8 N•m (75 in. lbs.)
Parking Brake Assembly Mounting	28 N•m (250 in. lbs.)

9305-168

WIRING DIAGRAMS AA-BODY

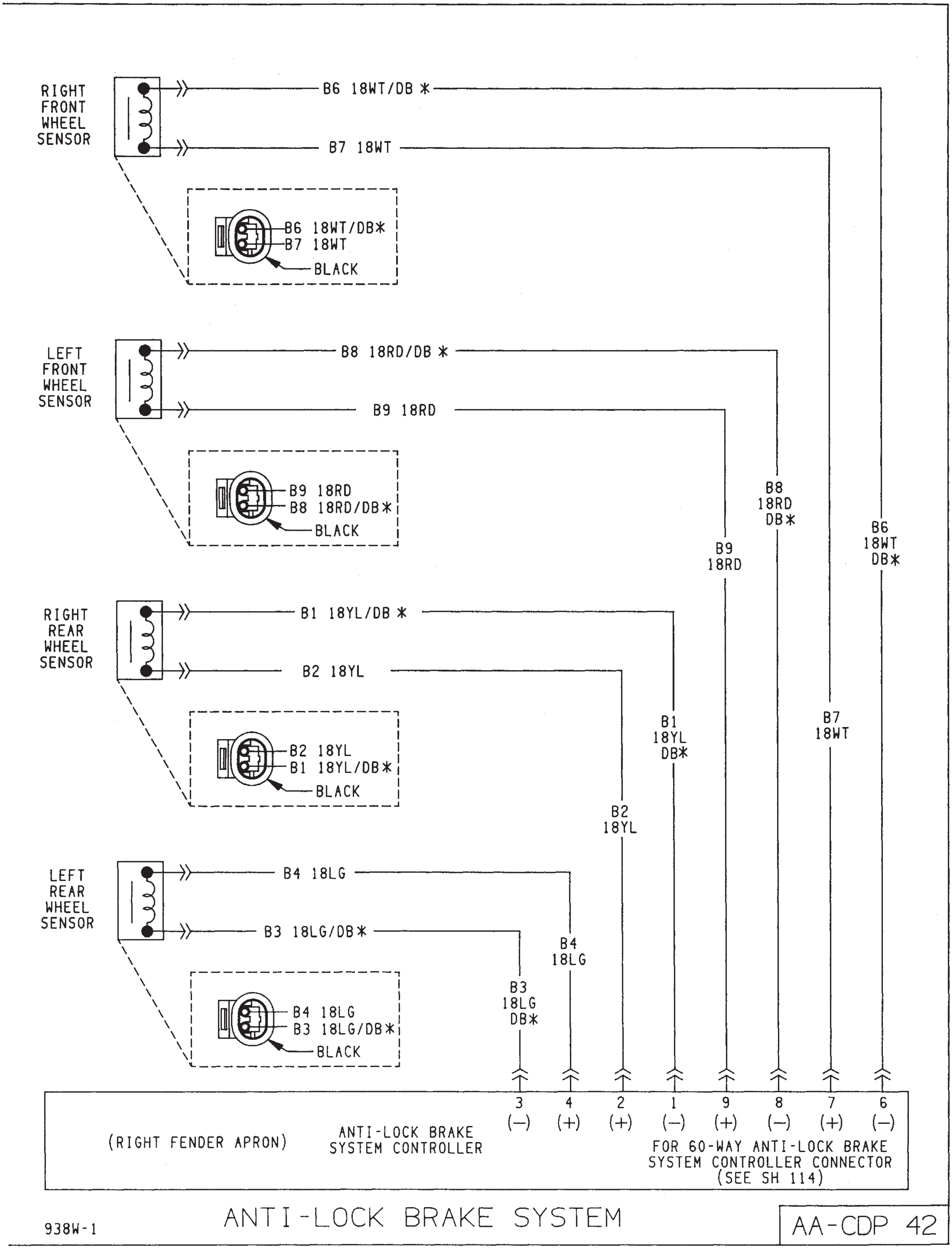
INDEX



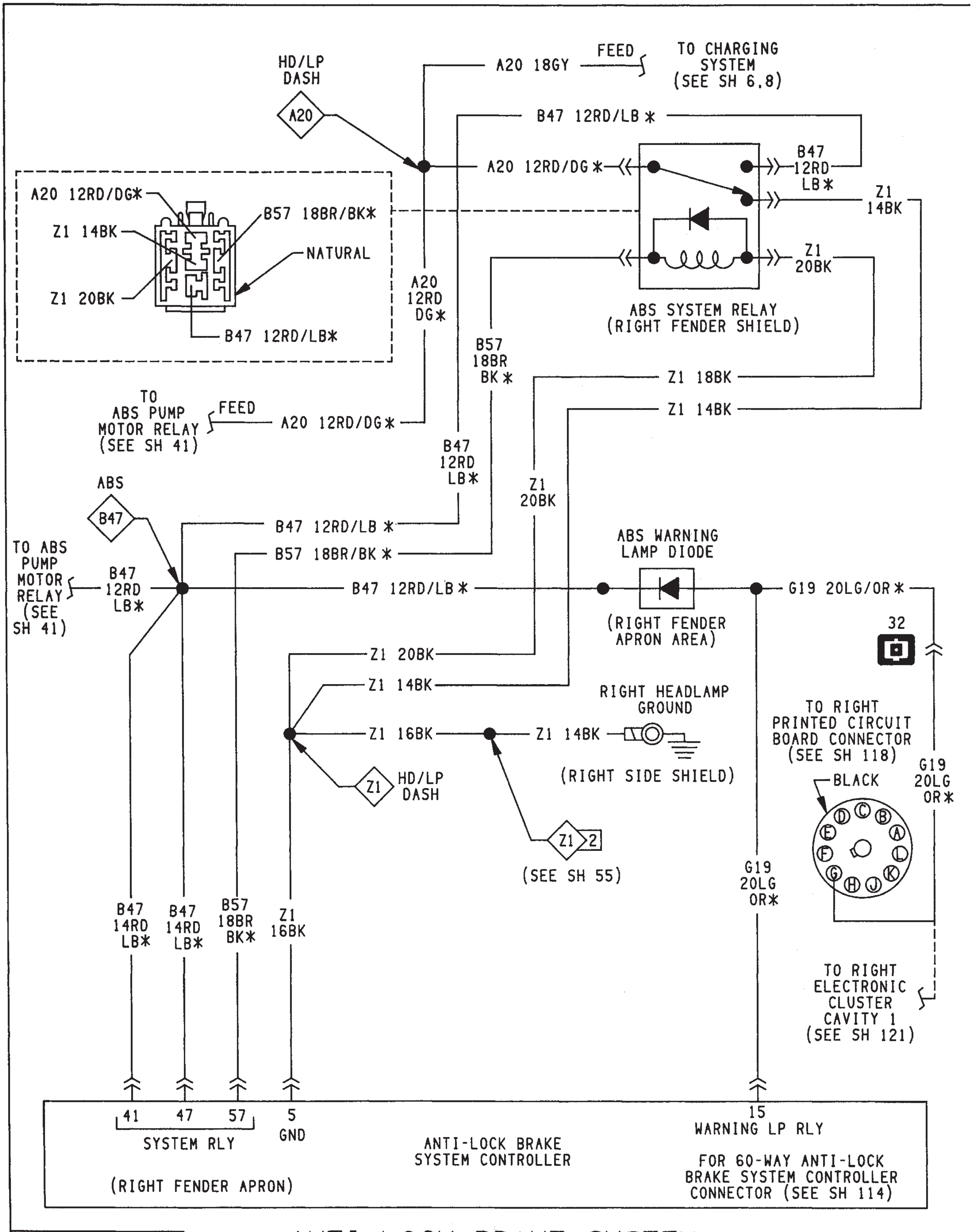
AA-CDP 41

ANTI-LOCK BRAKE SYSTEM

938W-1



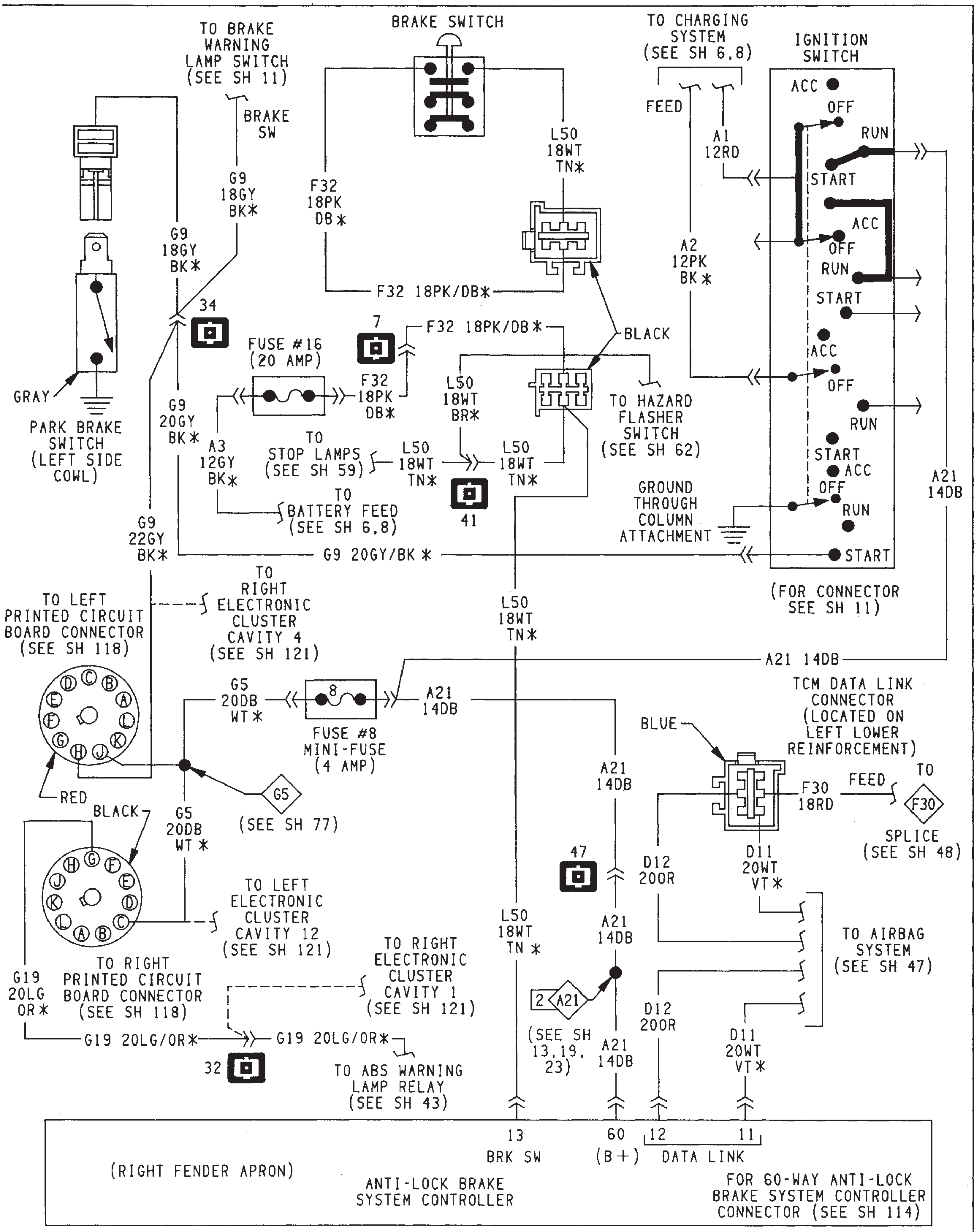
ANTI-LOCK BRAKE SYSTEM



AA-CDP 43

ANTI-LOCK BRAKE SYSTEM

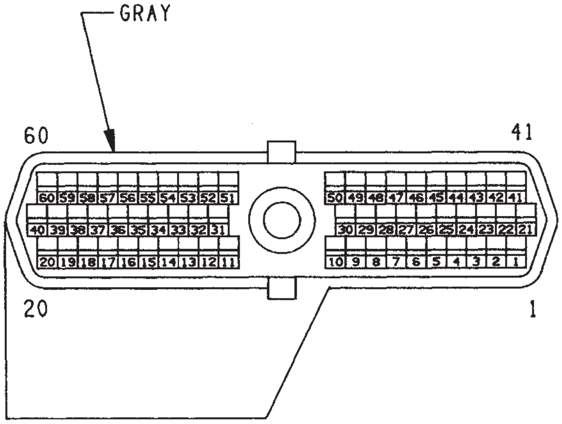
938W-1



938W-1

ANTI-LOCK BRAKE SYSTEM

AA-CDP 44



CAV	WIRE CODE	IGNITION SYSTEM CIRCUITS	SHEET
1	B1 18YL/DB *	RIGHT REAR WHEEL SENSOR	42
2	B2 18YL	RIGHT REAR WHEEL SENSOR	42
3	B3 18LG/DB *	LEFT REAR SHEEL SENSOR	42
4	B4 18LG	LEFT REAR SHEEL SENSOR	42
5	Z1 16BK	ABS GROUND	43
6	B6 18WT/DB *	RIGHT FRONT WHEEL SENSOR	42
7	B7 18WT	RIGHT FRONT WHEEL SENSOR	42
8	B8 18RD/DB *	LEFT FRONT WHEEL SENSOR	42
9	B9 18RD	LEFT FRONT WHEEL SENSOR	42
10	—	—	—
11	D11 20WT/VT *	DATA LINK CONNECTOR	44
12	D12 20OR	DATA LINK CONNECTOR	44
13	L50 18WT/TN *	STOP LAMP	44
14	—	—	—
15	G19 20LG/OR *	ABS WARNING LAMP RELAY	43
16	B116 18GY	ABS PUMP MOTOR RELAY	41
17	—	—	—
18	—	—	—
19	—	—	—
20	B120 14BR/WT *	ABS SYSTEM HYDRAULIC MODULATOR	41
21	—	—	—
22	—	—	—
23	—	—	—
24	—	—	—
25	—	—	—
26	—	—	—
27	—	—	—
28	—	—	—
29	—	—	—
30	—	—	—
31	—	—	—
32	—	—	—
33	—	—	—
34	—	—	—
35	—	—	—
36	—	—	—
37	—	—	—
38	—	—	—
39	—	—	—
40	—	—	—
41	B47 14RD/LB *	ABS SYSTEM RELAY	43
42	B142 18BR/YL *	ABS SYSTEM HYDRAULIC MODULATOR	41
43	B143 18DG/YL *	ABS SYSTEM HYDRAULIC MODULATOR	41
44	—	—	—
45	—	—	—
46	B146 18BR/LB *	ABS SYSTEM HYDRAULIC MODULATOR	41
47	B47 14RD/LB *	ABS SYSTEM RELAY	43
48	B148 18DG/LB *	ABS SYSTEM HYDRAULIC MODULATOR	41
49	—	—	—
50	—	—	—
51	—	—	—
52	—	—	—
53	—	—	—
54	—	—	—
55	—	—	—
56	—	—	—
57	B57 18BR/BK *	ABS SYSTEM RELAY	43
58	—	—	—
59	—	—	—
60	A21 14DB	IGNITION SWITCH	44

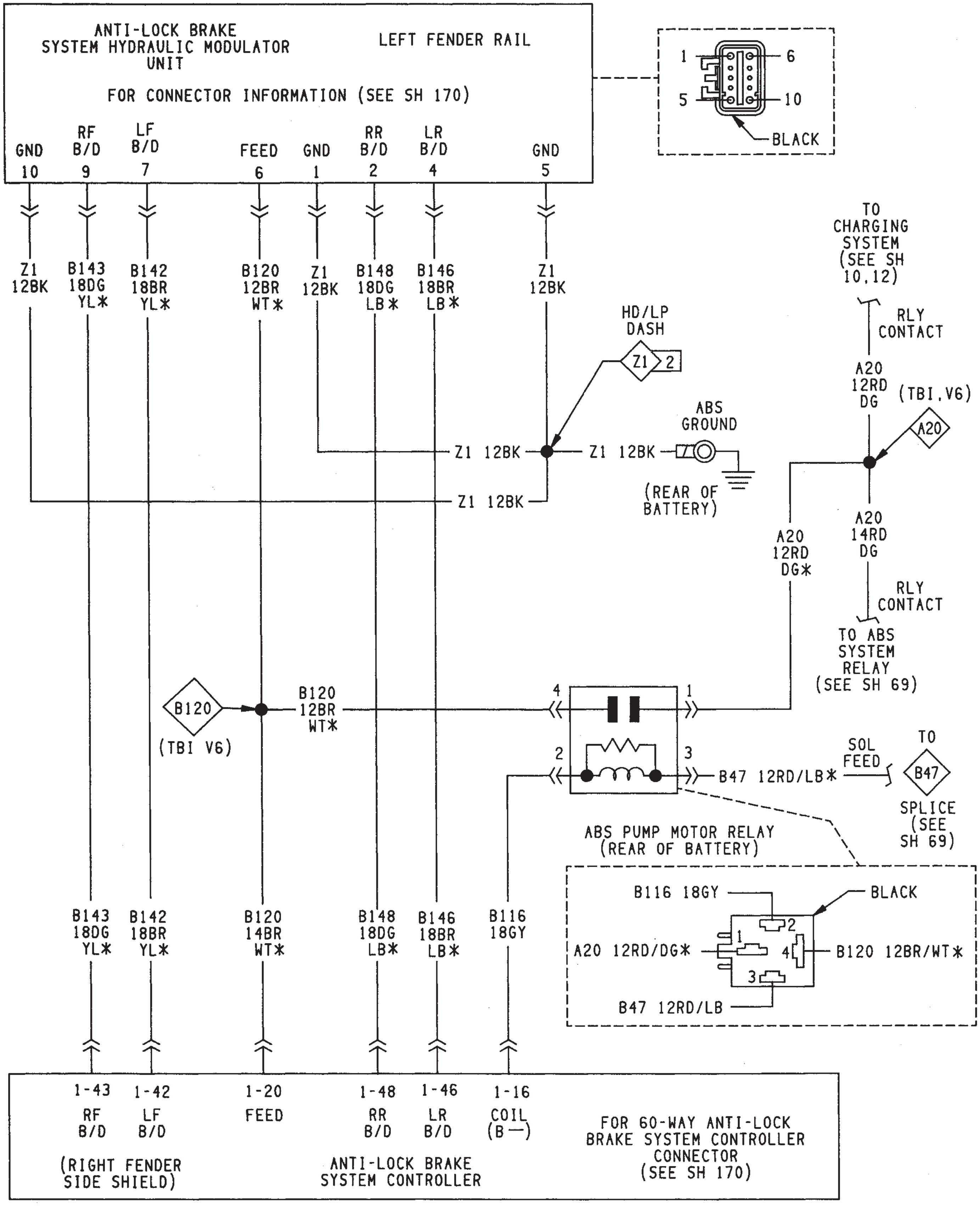
ANTI-LOCK BRAKE SYSTEM
CONTROLLER CONNECTOR-LC4

938W-1

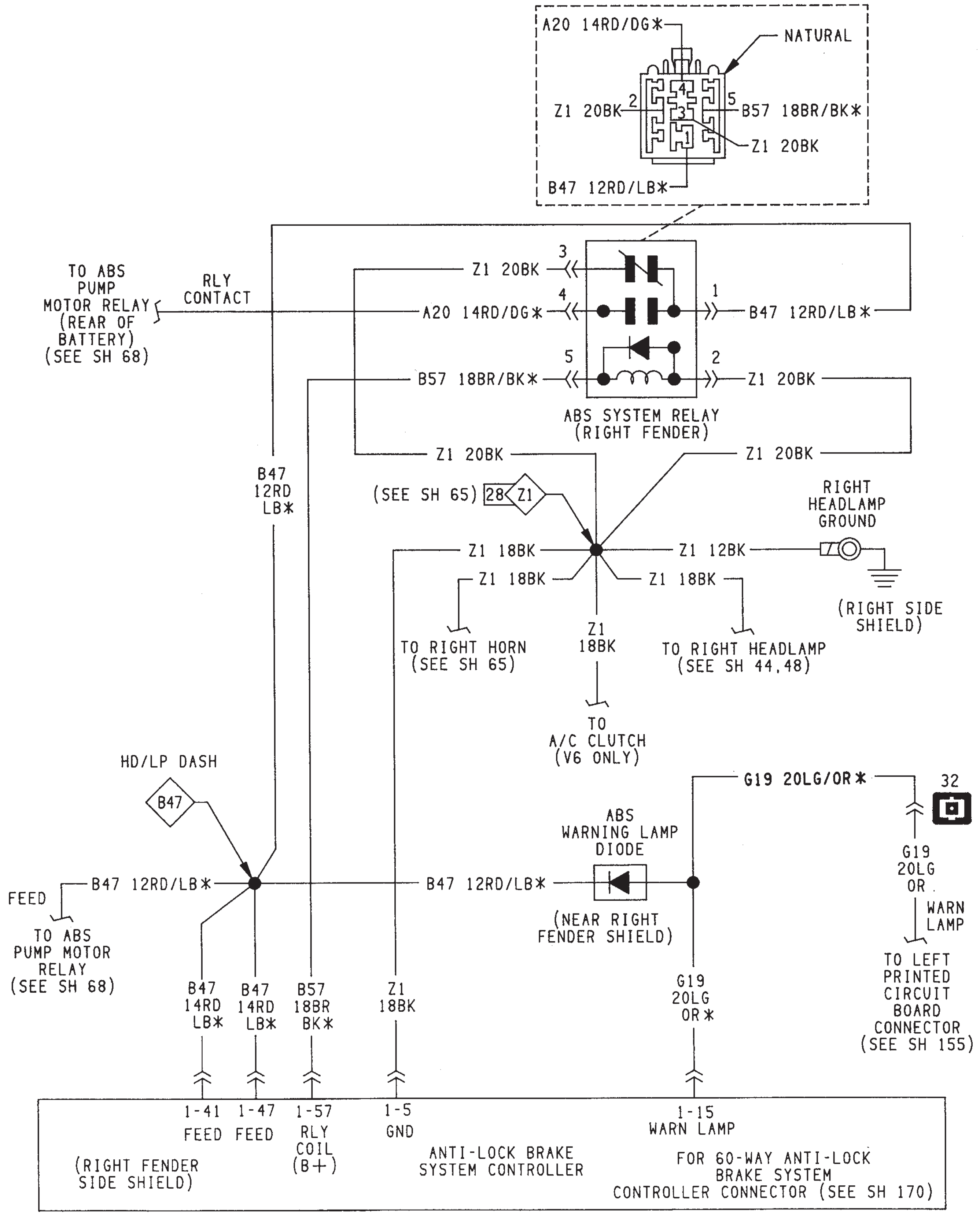
AA-CDP 114

WIRING DIAGRAMS AJ BODY

ALPHABETICAL INDEX



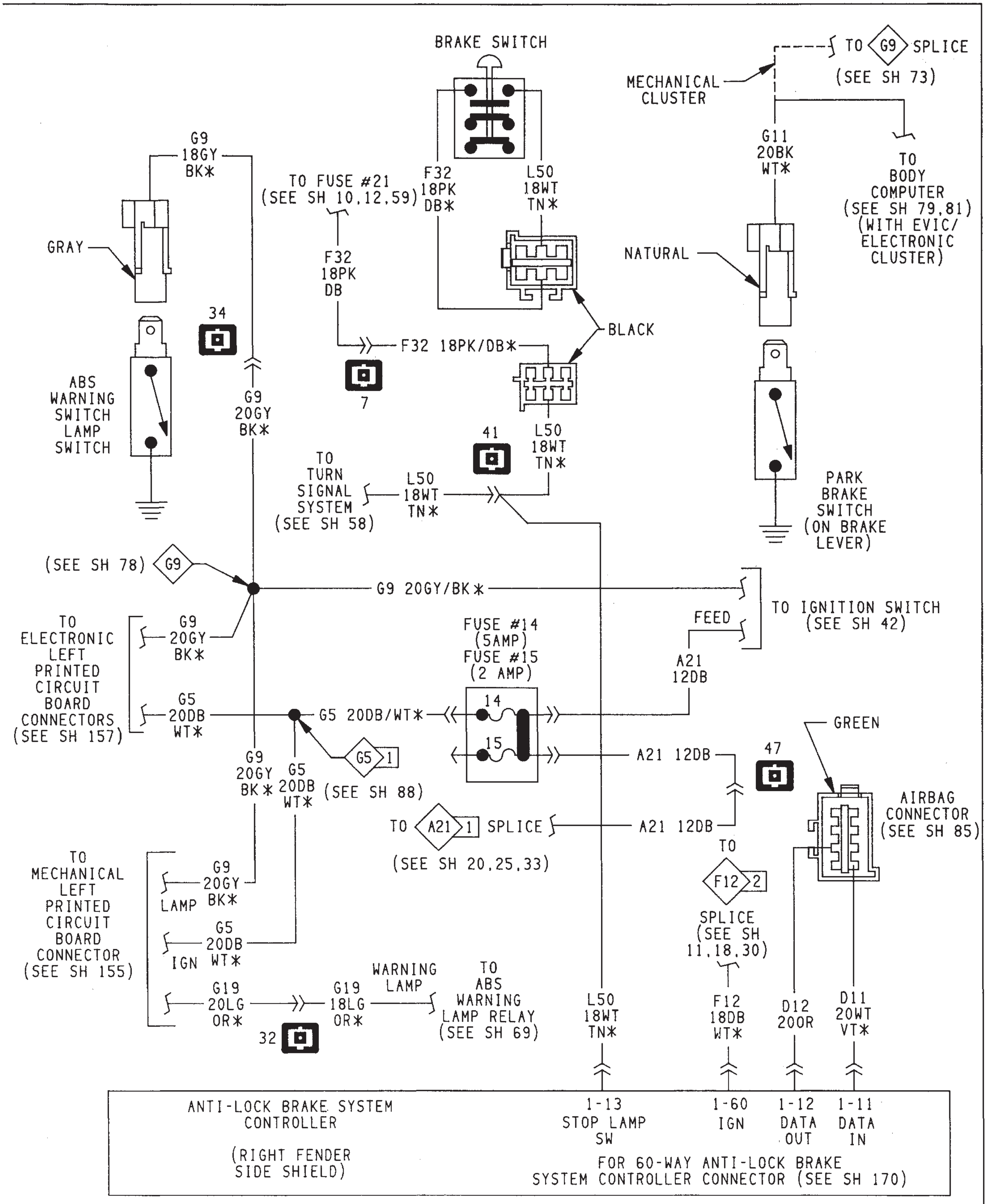
ANTI-LOCK BRAKE SYSTEM
2.5L TBI AND 3.0L V6



ANTI-LOCK BRAKE SYSTEM
2.5L TBI AND 3.0L V6

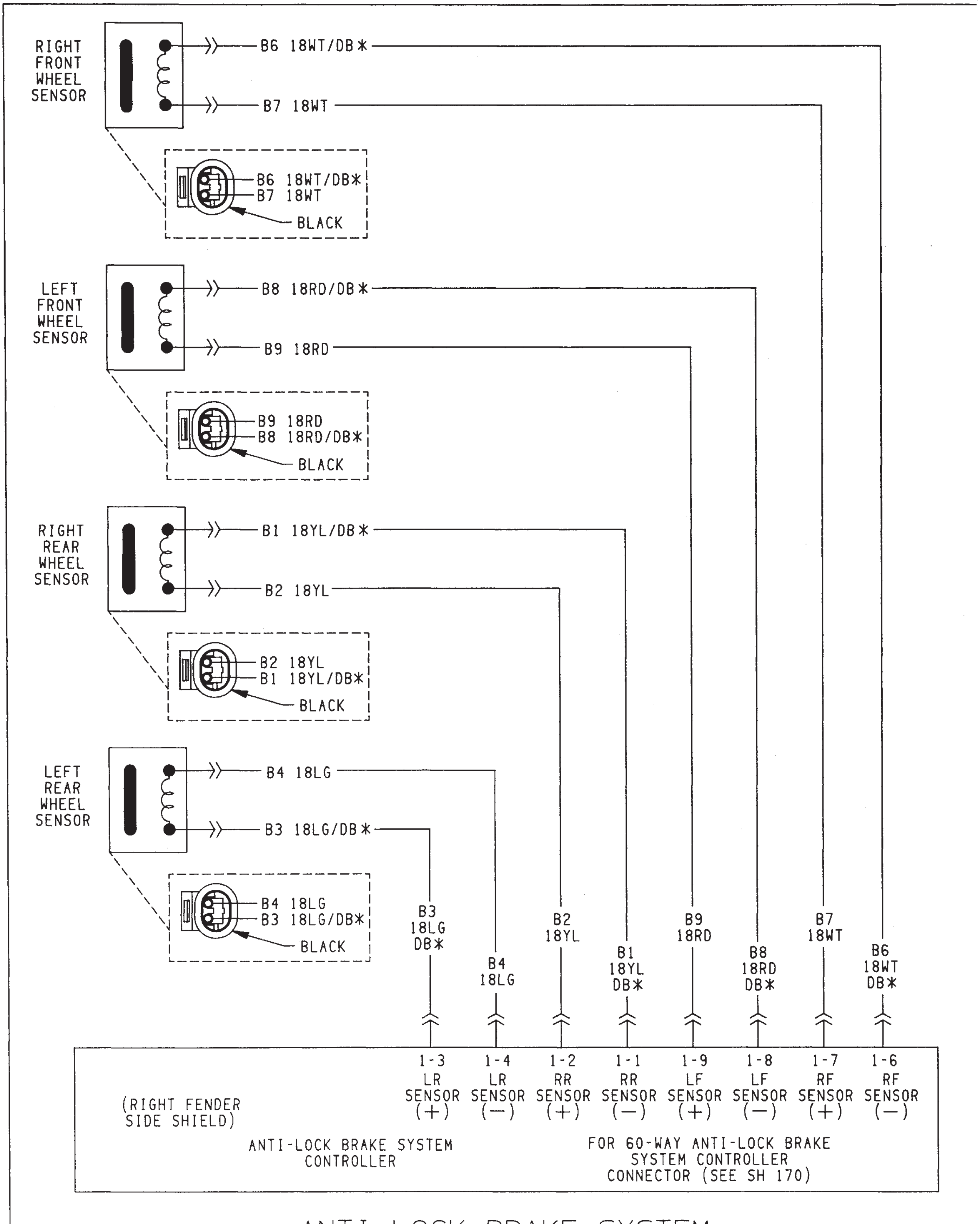
AJ 69

938W-5



ANTI-LOCK BRAKE SYSTEM
2.5L TBI AND 3.0L V6

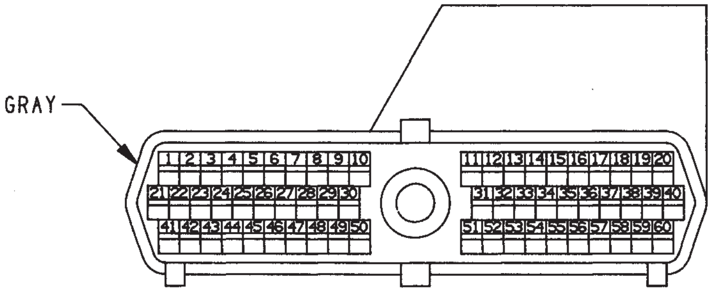
938W-5



ANTI-LOCK BRAKE SYSTEM
2.5L TBI AND 3.0L V6

AJ 71

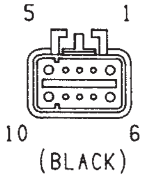
938W-5



VIEWED FROM TERMINAL
END OF CONNECTOR

ABS CONT			
CAV	CIRCUIT INFO	MS CIRCUIT FUNCTION	SHEET
1	B1 18YL/DB*	(ABS) RT REAR WHEEL SENSOR (−)	71
2	B2 18YL	(ABS) RT REAR WHEEL SENSOR (+)	71
3	B3 18LG/DB*	(ABS) LT REAR WHEEL SENSOR (−)	71
4	B4 18LG	(ABS) LT REAR WHEEL SENSOR (+)	71
5	Z1 18BK	BODY GROUND	69
6	B6 18WT/DB*	(ABS) RT FRONT WHEEL SENSOR (−)	71
7	B7 18WT	(ABS) RT FRONT WHEEL SENSOR (+)	71
8	B8 18RD/DB*	(ABS) LT FRONT WHEEL SENSOR (−)	71
9	B9 18RD	(ABS) LT FRONT WHEEL SENSOR (+)	71
11	D11 20WT/VT*	DIAGNOSTIC A.B.S. (SIGNAL DATA IN)	70
12	D12 20OR	DIAGNOSTIC A.B.S. (SIGNAL DATA OUT)	70
13	L50 18WT/TN*	STOP LAMP SWITCH	70
15	G19 20LG/OR*	A.B.S. WARNING LAMP (AMBER)	69
16	B116 18GY	(ABS) PUMP RELAY COIL (B−) 'LCI'	68
20	B120 14BR/WT*	(ABS) PUMP MOTOR FEED/MONITOR 'LCI'	68
41	B47 14RD/LB*	(ABS) SOLENOID FEED	69
42	B142 18BR/YL*	(ABS) LT FRONT BUILD/DECAY 'LCI'	68
43	B143 18DG/YL*	(ABS) RT FRONT BUILD/DECAY 'LCI'	68
46	B146 18BR/LB*	(ABS) LT REAR BUILD/DECAY 'LCI'	68
47	B47 14RD/LB*	(ABS) SOLENOID FEED	69
48	B148 18DG/LB*	(ABS) RT REAR BUILD/DECAY 'LCI'	68
57	B57 18BR/BK*	(ABS) SYSTEM RELAY COIL (+)	69
60	F12 18DB/WT*	FUSED IGNITION RUN/START	70

ABS HYDRAULICS UNIT



ABS HYD			
CAV	CIRCUIT INFO		SHEET
1	Z1 12BK	ABS GROUND	68
2	B148 18DG/LB*	(ABS) RIGHT REAR BUILD/DECAY/	68
4	B146 18BR/LB*	(ABS) LEFT REAR BUILD/DECAY/	68
5	Z1 12BK	ABS GROUND	68
6	B120 12BR/WT*	(ABS) PUMP MONITOR/MOTOR FEED	68
7	B142 18BR/YL*	(ABS) LEFT FRONT BUILD/DECAY	68
9	B143 18DG/YL*	(ABS) RIGHT FRONT BUILD/DECAY	68
10	Z1 12BK	ABS GROUND	68

ANTI-LOCK BRAKE SYSTEM
2.5L TBI AND 3.0L V6

COMPONENT AND SYSTEM INDEX