LUBRICATION AND MAINTENANCE

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GENERAL INFORMATION

INTRODUCTION

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

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

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

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

Use the schedule that best describes your driving conditions.

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

PARTS AND LUBRICANT RECOMMENDATIONS

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

INTERNATIONAL SYMBOLS

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

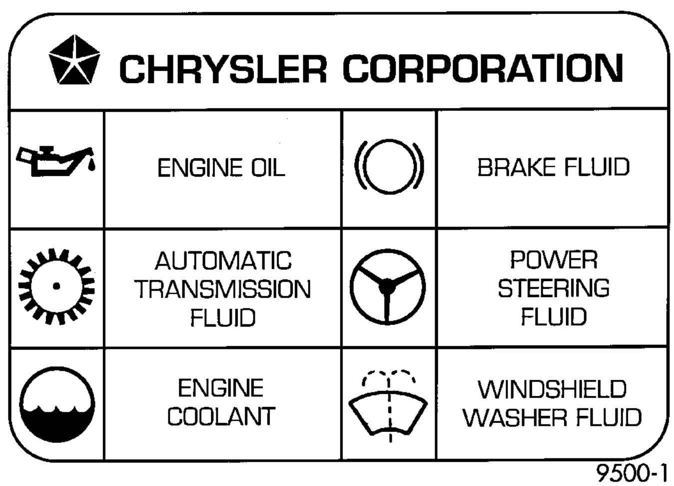


Fig. 1 International Symbols

GENERAL INFORMATION (Continued)

CLASSIFICATION OF LUBRICANTS

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

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

9400-9

Fig. 2 API Symbol

ENGINE OIL

SAE GRADE RATING INDICATES ENGINE OIL VISCOSITY

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

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

API QUALITY CLASSIFICATION

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

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

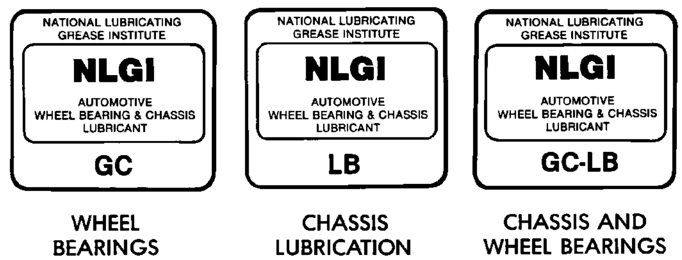
Refer to Group 9, Engine for engine oil specification.

GEAR LUBRICANTS

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

LUBRICANTS AND GREASES

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



9200-7

Fig. 3 NLGI Symbol

FLUID CAPACITIES

FUEL TANK

All . . . . 47.3 L (12.5 gal.)

ENGINE OIL W/FILTER CHANGE

All . . . . 4.25 L (4.5 qts.)

ENGINE OIL W/OUT FILTER CHANGE

All . . . . 3.8 L (4.0 qts.)

COOLING SYSTEM

All* . . . . 6 L (6.5 qts.)

*Includes heater and coolant recovery bottle

AUTOMATIC TRANSAXLE

NOTE: Overhaul Fill Capacity with Torque Converter Empty

31 TH . . . . 8.4 L (8.9 qts.)
31 TH (Fleet Vehicles) . . . . 8.7 L (9.2 qts.)

MANUAL TRANSAXLE

NV T350 . . . . 1.9-2.2 L (4.0-4.6 pts.)

POWER STEERING

All . . . . 0.95 L (2.0 pts.)

MAINTENANCE SCHEDULES

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GENERAL INFORMATION

INTRODUCTION

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

There are two maintenance schedules that show proper service based on the conditions that the vehicle is subjected to. Use the schedule that best describes these conditions.

Schedule— **A** , lists maintenance recommended for vehicles used for general transportation.

Schedule— **B** , lists maintenance recommended for vehicles used under the following conditions:

- Frequent short trip driving less than 5 miles (8 km)
- Frequent driving in dusty conditions
- Frequent trailer towing
- Extensive idling
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C)

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

EMISSION CONTROL SYSTEM MAINTENANCE

The scheduled emission maintenance listed in **bold type** on the Maintenance Schedules, must be done at the mileage specified to assure the continued proper functioning of the emission control system. These, and all other maintenance services included in this manual, should be done to provide the best vehicle performance and reliability. More frequent maintenance may be needed for vehicles in severe operating conditions such as dusty areas and very short trip driving.

UNSCHEDULED INSPECTION

At Each Stop For Fuel

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

Once A Month

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

At Each Oil Change

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

SCHEDULE—A

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

- Change engine oil.

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

- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.

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

- Change engine oil.
- Inspect the front brake pads and rear brake linings.

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

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints.
- Adjust drive belt tension.

GENERAL INFORMATION (Continued)

- **Replace air cleaner element.**
- **Replace spark plugs.**

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

- Change engine oil.

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

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads and rear brake linings.
- Adjust drive belt tension.
- Flush and replace engine coolant at 36 months, regardless of mileage.

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

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

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

- Change engine oil.
- Replace engine oil filter.
- **Check and replace, if necessary***, the PCV valve.****
- Lubricate front suspension upper ball joints.
- Replace drive belts.
- **Replace air cleaner element.**
- **Replace ignition cables.**
- **Replace spark plugs.**

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

- Change engine oil.
- Inspect front brake pads and rear brake linings.

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

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

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

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

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

- Change engine oil.
- Replace engine oil filter.
- **Check and replace, if necessary***, the PCV valve.****
- Lubricate front suspension upper ball joints.
- Inspect front brake pads and rear brake linings.
- Adjust drive belt tension.
- **Replace air cleaner air cleaner element.**
- **Replace spark plugs.**

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

- Change engine oil.

105,000 Miles (168 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine timing belt**
- Adjust drive belt tension.

SCHEDULE—B

3,000 Miles (5 000 km)

- Change engine oil

6,000 Miles (10 000 km)

- Change engine oil
- Replace engine oil filter.

9,000 Miles (14 000 km)

- Change engine oil
- Inspect front brake pads and rear brake lining.

12,000 Miles (19 000 km)

- Change engine oil
- Replace engine oil filter.

15,000 Miles (24 000 km)

- Change engine oil
- Adjust drive belt tension.
- **Inspect and replace, if required, the air cleaner element.**
- Change automatic transaxle fluid and filter. Adjust the bands.*

18,000 Miles (29 000 km)

- Change engine oil
- Replace engine oil filter.
- Inspect front brake pads and rear brake linings.

21,000 Miles (34 000 km)

- Change engine oil

24,000 Miles (38 000 km)

- Change engine oil
- Replace engine oil filter.

27,000 Miles (43 000 km)

- Change engine oil
- Inspect front brake pads and rear brake linings.

30,000 Miles (48 000 km)

- Change engine oil
- Replace engine oil filter.
- **Check and replace, if necessary, the PCV valve.****

GENERAL INFORMATION (Continued)

- Lubricate front suspension upper ball joints.
- Adjust drive belt tension.
- **Replace air cleaner element.**
- **Replace spark plugs.**
- Change automatic transmission fluid and filter. Adjust the bands.*

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

36,000 Miles (58 000 km)
- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.
- Inspect front brake pads and rear brake linings.

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

42,000 Miles (67 000 km)
- Change engine oil.
- Replace engine oil filter.

45,000 Miles (72 000 km)
- Change engine oil.
- Inspect front brake pads and rear brake linings.
- **Inspect and replace, if necessary, the air cleaner element.**
- Adjust drive belt tension.
- Change automatic transaxle fluid and filter. Adjust the bands.*

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

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

54,000 Miles (86 000 km)
- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads and rear brake linings.

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

60,000 Miles (96 000 km)
- Change engine oil.
- Replace engine oil filter.
- **Check and replace, if necessary***, the PCV valve.****
- Lubricate front suspension upper ball joints.
- Replace drive belts.
- **Replace air cleaner element.**
- **Replace ignition cables.**
- **Replace spark plugs.**
- Change automatic transaxle fluid and filter. Adjust the bands.*

63,000 Miles (101 000 km)
- Change engine oil.
- Inspect front brake pads and rear brake linings.

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

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

72,000 Miles (115 000 km)
- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads and rear brake linings.

75,000 Miles (120 000 km)
- Change engine oil.
- Adjust drive belt tension.
- **Inspect and replace, if necessary, the air cleaner element.**
- Change automatic transaxle fluid and filter. Adjust the bands.*

78,000 Miles (125 000 km)
- Change engine oil.
- Replace engine oil filter.

81,000 Miles (130 000 km)
- Change engine oil.
- Flush and replace the engine coolant.
- Inspect front brake pads and rear brake linings.

84,000 Miles (134 000 km)
- Change engine oil.
- Replace engine oil filter.

87,000 Miles (139 000 km)
- Change engine oil.

90,000 Miles (144 000 km)
- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads and rear brake linings.
- **Check and replace, if necessary***, the PCV valve.****
- Lubricate front suspension upper ball joints.
- Adjust drive belt tension.
- **Replace air cleaner element.**
- **Replace spark plugs.**
- Change automatic transaxle fluid and filter. Adjust the bands.*

GENERAL INFORMATION (Continued)

93,000 Miles (149 000 km)

- Change engine oil.

96,000 Miles (154 000 km)

- Change engine oil.
- Replace engine oil filter.

99,000 Miles (158 000 km)

- Change engine oil.
- Inspect front brake pads and rear brake linings.

102,000 Miles (163 000km)

- Change engine oil.
- Replace engine oil filter.

105,000 Miles (168 000km)

- **Replace the engine timing belt**
- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.
- **Inspect and replace, if necessary, the air cleaner element.**

*Police, taxi, or delivery service usage and trailer towing require the more frequent transaxle service indicated with a * in schedule—B. Perform these services if the vehicle is usually operated under these conditions.

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

NOTE: ***This maintenance is not required if the PCV valve was previously replaced.

JUMP STARTING, TOWING AND HOISTING

INDEX

SERVICE PROCEDURES

JUMP STARTING PROCEDURE

WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN GROUP 8A, BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS. DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT. DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR. DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS BELOW THE TOP OF LEAD PLATES. DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE. DO NOT USE OPEN FLAME NEAR BATTERY. REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT. WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.

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

TO JUMP START A DISABLED VEHICLE:

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

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

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

(2) When using another vehicle as a booster source, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.

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

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

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

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

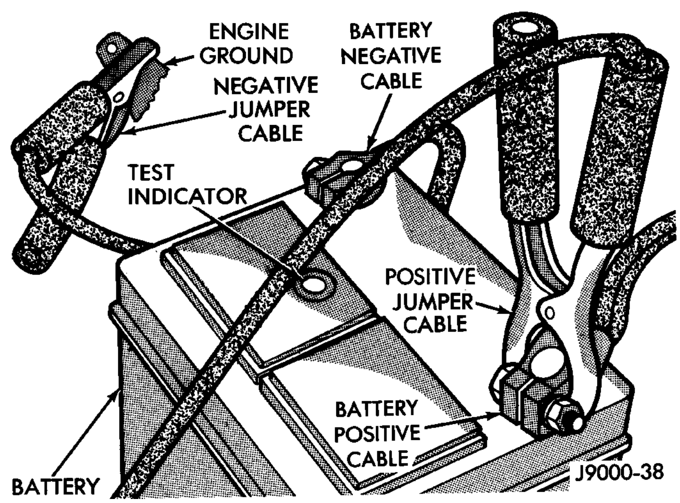


Fig. 1 Jumper Cable Clamp Connections

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

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

SERVICE PROCEDURES (Continued)

DISCONNECT CABLE CLAMPS AS FOLLOWS:

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

TOWING RECOMMENDATIONS

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. Do not attach towing device to front or rear suspension components. Do not secure vehicle to towing device by the use of front or rear suspension or steering components. Remove or secure loose or protruding objects from a damaged vehicle before towing. Refer to state and local rules and regulations before towing a vehicle. Do not allow weight of towed vehicle to bear on lower fascia, air dams, or spoilers.

RECOMMENDED TOWING EQUIPMENT

To avoid damage to bumper fascia and air dams use of a wheel lift or flat bed towing device (Fig. 2) 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.

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.

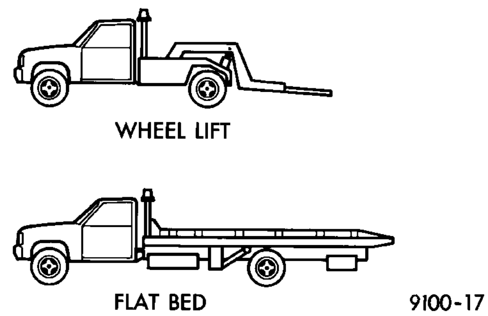


Fig. 2 Recommended Towing Devices

LOCKED VEHICLE TOWING

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

FLAT TOWING WITH TOW BAR

- 3-speed automatic transaxle vehicles can be flat towed at speeds not to exceed 40 km/h (25 mph) for not more than 25 km (15 miles). The steering column must be unlocked and gear selector in neutral.
- 5-speed manual transaxle vehicles can be flat towed at any legal highway speed for extended distances. The gear selector must be in the neutral position.

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 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.
- 5-speed manual transaxle vehicles can be towed at any legal highway speed for extended distances. The gear selector must be in the neutral position.
- 3-speed automatic transaxle vehicles can be towed at speeds not to exceed 40 km/h (25 mph) for

SERVICE PROCEDURES (Continued)

not more than 25 km (15 miles). The gear selector must be in the neutral position.

HOISTING RECOMMENDATIONS

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

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

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

Do not attempt to raise one entire side of the vehicle by placing a floor jack midway between the front and rear wheels. This practice may result in permanent damage to the body.

FLOOR JACK

When properly positioned, a floor jack can be used to lift a PL vehicle (Fig. 3). Support the vehicle in the raised position with jack stands.

A floor jack must never be used on any part of the underbody.

HOIST

A vehicle can be lifted with:

- A single-post, frame-contact hoist.

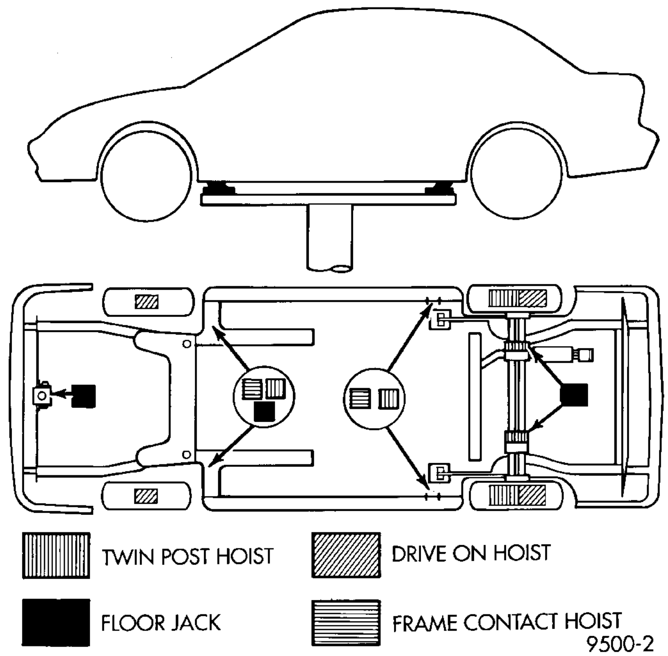


Fig. 3 Hoisting and Jacking Points

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

NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly (Fig. 3).

SUSPENSION

CONTENTS

WHEEL ALIGNMENT

INDEX

DESCRIPTION AND OPERATION

WHEEL ALIGNMENT GENERAL INFORMATION

Proper vehicle wheel alignment is the proper adjustment of all interrelated front and rear suspension angles (Fig. 1). These angles are what affects the handling and steering of the vehicle when it is in motion.

The method of checking a vehicle's front and rear wheel alignment will vary depending on the type and manufacturer of the equipment being used. Instructions furnished by the manufacturer of the equipment being used should always be followed to ensure accuracy of the alignment, except alignment specifications recommended by Chrysler Corporation **MUST ALWAYS** be used.

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

Wheel alignment adjustments should be made in the following sequence, to ensure that an accurate alignment is performed.

(1) Rear Wheel Toe Adjustment within specifications for both total toe and thrust angle.

(2) Front Wheel Toe Adjustment within specifications for total toe.

DESCRIPTION AND OPERATION (Continued)

(3) **Toe** is measured in degrees or inches and is the distance that the front edges of the tires are closer (or farther apart) than the rear edges (Fig. 1). See Front Wheel Drive Specifications for correct front and rear wheel Toe specifications.

(4) **Thrust Angle** is defined as the average of the Toe settings on each rear wheel. If this measurement is out of specification, re-adjust rear wheel Toe so that each wheel has 1/2 of the total Toe measurement. When re-adjusting, do not exceed the total Toe specification.

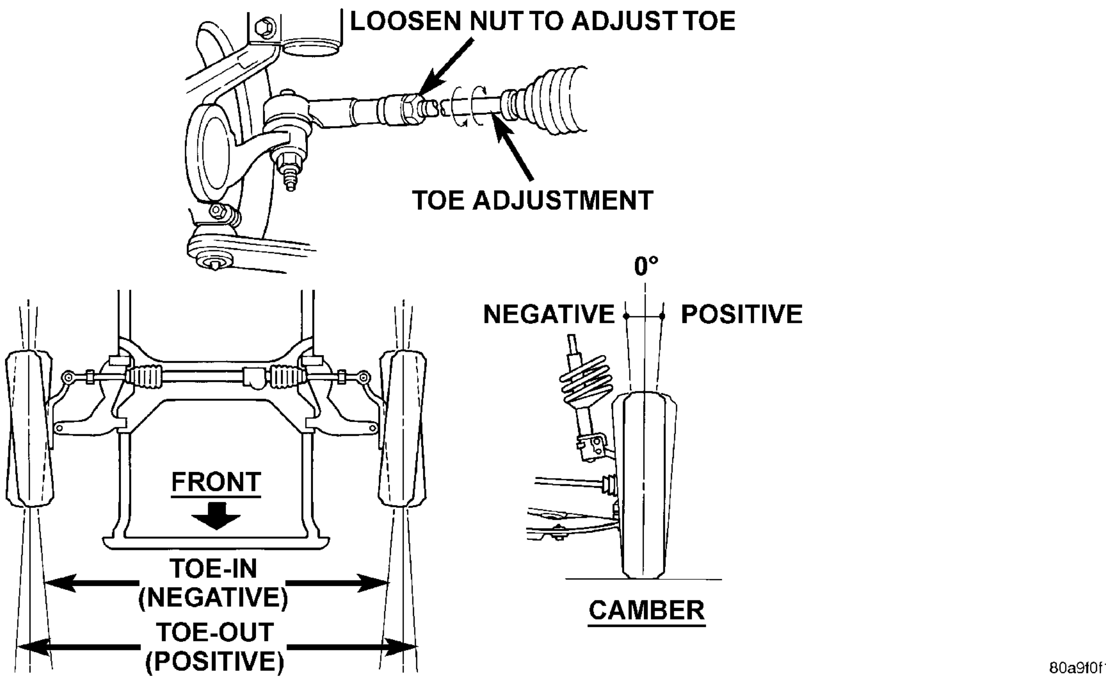


Fig. 1 Alignment Camber/Toe

DIAGNOSIS AND TESTING

SUSPENSION AND STEERING DIAGNOSIS

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
Front End Whine On Turns	1. Defective Wheel Bearing 2. Incorrect Wheel Alignment 3. Worn Tires	1. Replace Wheel Bearing 2. Check And Reset Wheel Alignment 3. Replace Tires
Front End Growl Or Grinding On Turns	1. Defective Wheel Bearing 2. Engine Mount Grounding Against Frame Or Body Of Vehicle. 3. Worn Or Broken C/V Joint 4. Loose Wheel Lug Nuts 5. Incorrect Wheel Alignment 6. Worn Tires	1. Replace Wheel Bearing 2. Check For Motor Mount Hitting Frame Rail And Reposition Engine As Required 3. Replace C/V Joint 4. Verify Wheel Lug Nut Torque 5. Check And Reset Wheel Alignment 6. Replace Tires
Front End Clunk Or Snap On Turns	1. Loose Wheel Lug Nuts 2. Worn Or Broken C/V Joint 3. Worn Or Loose Tie Rod Or Ball Joint 4. Worn Control Arm Bushing 5. Loose Sway Bar Or Upper Strut Attachment	1. Verify Wheel Lug Nut Torque 2. Replace C/V Joint 3. Tighten Or Replace Tie Rod End Or Ball Joint 4. Replace Control Arm Bushing 5. Tighten Sway Bar Or Upper Strut Attachment To Specified Torque
Front End Whine With Vehicle Going Straight At A Constant Speed	1. Defective Wheel Bearing 2. Incorrect Wheel Alignment 3. Worn Tires	1. Replace Wheel Bearing 2. Check And Reset Wheel Alignment 3. Replace Tires
Front End Growl Or Grinding With Vehicle Going Straight At A Constant Speed	1. Engine Mount Grounding 2. Worn Or Broken C/V Joint	1. Reposition Engine As Required 2. Replace C/V Joint
Front End Whine When Accelerating Or Decelerating	1. Worn Or Defective Transaxle Gears Or Bearings	1. Replace Transaxle Gears Or Bearings
Front End Clunk When Accelerating Or Decelerating	1. Worn Or Broken Engine Mount 2. Worn Or Defective Transaxle Gears Or Bearings 3. Loose Wheel Lug Nuts 4. Worn Or Broken C/V Joint 5. Worn Or Loose Ball Joint 6. Worn Or Loose Control Arm Bushing 7. Loose Crossmember Bolts	1. Replace Engine Mount 2. Replace Transaxle Gears Or Bearings 3. Verify Wheel Lug Nut Torque 4. Replace C/V Joint 5. Tighten Or Replace Ball Joint 6. Tighten To Specified Torque Or Replace Control Arm Bushing 7. Tighten Crossmember Bolts To Specified Torque

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
Road Wander	1. Incorrect Tire Pressure	1. Inflate Tires To Rcommended Pressure
	2. Incorrect Front Or Rear Wheel Toe	2. Check And Reset Front Wheel Toe
	3. Worn Wheel Bearings	3. Replace Wheel Bearing
	4. Worn Control Arm Bushings	4. Replace Control Arm Bushing
	5. Excessive Friction In Steering Gear	5. Replace Steering Gear
	6. Excessive Friction In Steering Shaft Coupling	6. Replace Steering Coupler
	7. Excessive Friction In Strut Upper Bearing	7. Replace Strut Bearing
Lateral Pull	1. Unequal Tire Pressure	1. Inflate All Tires To Recommended Pressure
	2. Radial Tire Lead	2. Perform Lead Correction Procedure
	3. Incorrect Front Wheel Camber	3. Check And Reset Front Wheel Camber
	4. Power Steering Gear Imbalance	4. Replace Power Steering Gear
	5. Wheel Braking	5. Correct Braking Condition Causing Lateral Pull
Excessive Steering Free Play	1. Incorrect Steering Gear Adjustment	1. Adjust Or Replace Steering Gear
	2. Worn Or Loose Tie Rod Ends	2. Replace Or Tighten Tie Rod Ends
	3. Loose Steering Gear Mounting Bolts	3. Tighten Steering Gear Bolts To The Specified Torque
	4. Loose Or Worn Steering Shaft Coupler	5. Replace Steering Shaft Coupler
Excessive Steering Effort	1. Low Tire Pressure	1. Inflate All Tires To Recommended Pressure
	2. Lack Of Lubricant In Steering Gear	2. Replace Steering Gear
	3. Low Power Steering Fluid Level	3. Fill Power Steering Fluid Reservoir To Correct Level
	4. Loose Power Steering Pump Belt	4. Correctly Adjust Power Steering Pump Drive Belt
	5. Lack Of Lubricant In Steering Ball Joints	5. Lubricate Or Replace Steering Ball Joints
	6. Steering Gear Malfunction	6. Replace Steering Gear
	7. Lack Of Lubricant In Steering Coupler	7. Replace Steering Coupler

PRE-ALIGNMENT VEHICLE INSPECTION

CAUTION: If the front suspension crossmember shows any sign of impact damage, the steering column to steering gear coupling must be inspected. Refer to Group 19 Steering in this service manual for the inspection procedure.

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) Be sure the fuel tank is full when the wheel alignment specifications are checked and or adjusted. A full tank of fuel weighs approximately 75 pounds, if the fuel tank is not full this reduction in weight will affect the curb height of the vehicle and the alignment specifications.

(2) Alignment specifications of a vehicle can be the most accurately checked and set when the passenger

DIAGNOSIS AND TESTING (Continued)

compartment and trunk of the vehicle are vacant with the exception of the spare tire. People, luggage, and any other appreciable weight will adversely affect the checking and setting of the camber specification.

(3) Check and if required, inflate all of the tires to the recommended air pressure. All tires must be of the same size and in good condition and have approximately the same tread wear. **Note the type of tread wear on the tire, this will aid in diagnosing problems. Refer to Group 22 Tires And Wheels in this service manual for the tire wear diagnosis.**

(4) Check the front tire and wheel assemblies for radial runout.

(5) Before beginning the alignment process, inspect all suspension component fasteners for looseness and/or loss of specified torque.

(6) Inspect the lower front ball joints and all steering linkage for looseness and any signs of wear and or damage.

(7) Inspect the tie rod ends for looseness and any signs of wear and or damage.

(8) Inspect the rubber bushings on all suspension components for signs of wear or deterioration. If any bushings show signs of wear or deterioration they should be replaced prior to aligning the vehicle.

SERVICE PROCEDURES

WHEEL ALIGNMENT CHECK AND ADJUSTMENT PROCEDURE

CASTER CAMBER

Front and rear Caster and Camber settings on this vehicle are determined at the time the vehicle is designed, by the location of the vehicle's suspension components. This is called a Net Build vehicle and results in no required adjustment of Caster and Camber after vehicle is built or when servicing the suspension components. Thus Caster and Camber are not normally considered an adjustable specification when performing an alignment on this vehicle. Though Caster and Camber are not adjustable they must be checked to ensure they meet vehicle specifications.

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

If a vehicles caster is not within manufacturers alignment specifications, check for damaged suspension components or body parts. This type of damage can cause component locations to move affecting vehicle alignment. **No adjustment can be made for the Caster setting on this vehicle.**

CAUTION: Do not attempt to adjust the vehicles Caster or Camber by heating, bending or any other modification of the suspension components.

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

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

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

(3) Correctly jounce vehicle and read front and rear alignment settings and compare to vehicle specifications for Camber, Caster and Toe. See Alignment Specifications in this group of the service manual for required specifications. **If front and rear camber readings are within required specifications proceed to step Step 3 in the Front And Rear Toe Setting procedure. If Camber readings are not within specifications refer to step Step 1 in the following camber adjustment bolt package installation procedure, for the front and rear Camber adjustment procedure.**

CAMBER ADJUSTMENT BOLT PACKAGE INSTALLATION PROCEDURE

(1) If front and or rear camber readings obtained are not within the required specification range, a Mopar Service Kit is available to provide the required adjustment. The kit contains new bolts and nuts for the strut clevis bracket to steering knuckle attachment. The bolts contained in the service kit, are slightly undersize allowing for movement between the strut clevis bracket and steering knuckle. The movement allowed by the undersize bolts will provide approximately 2 degrees of camber adjustment per side of vehicle. To install new bolts in service kit follow the procedure below.

SERVICE PROCEDURES (Continued)

CAUTION: The Mopar Service Kit for allowing adjustment of front and rear camber are different for the front and rear of the vehicle. When using the service kits be sure that the front and rear strut attaching bolts are always used in the right location on the vehicle.

(2) Raise front and or rear of vehicle until tires are not supporting the weight of the vehicle.

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

(3) Remove original upper bolt attaching the front or rear strut clevis bracket to the steering knuckle or rear knuckle (Fig. 2) or (Fig. 3).

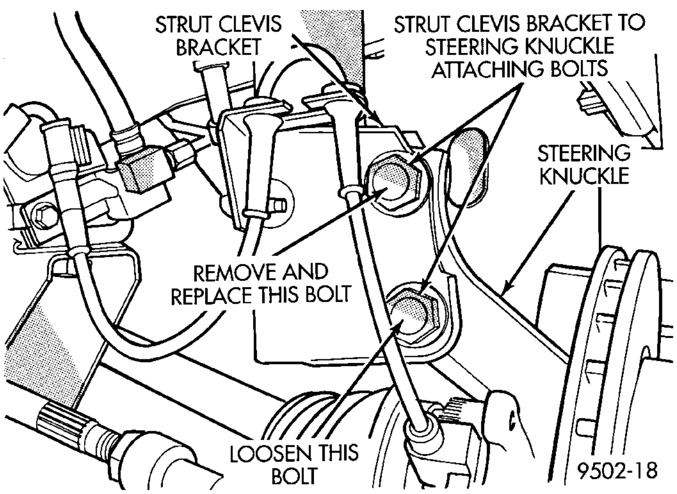


Fig. 2 Front Strut Clevis Bracket To Steering Knuckle Attaching Bolts

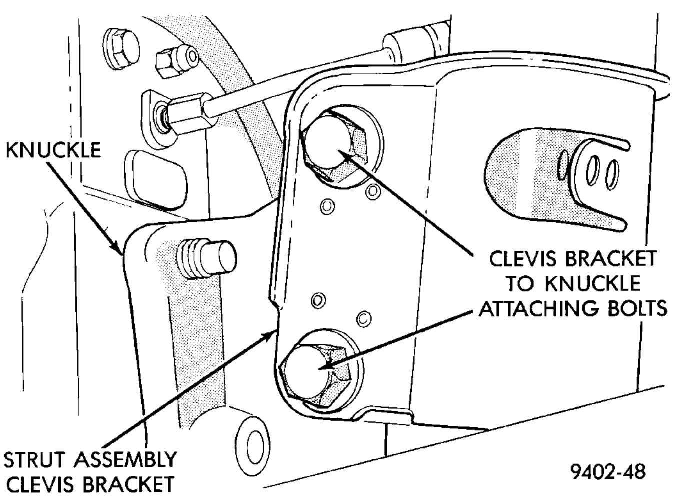


Fig. 3 Rear Strut Clevis Bracket Attaching Bolts

(4) Loosen lower bolt attaching strut clevis bracket to steering knuckle or rear knuckle **ONLY** enough to allow knuckle to move in clevis bracket.

(5) Install bolt from service kit into the upper strut clevis bracket to steering knuckle or rear knuckle mounting hole.

CAUTION: Only the nuts supplied in the service kits MUST be used with the service kit replacement bolts. The original nuts will not properly secure the strut clevis bracket to steering knuckle or rear knuckle.

(6) Install nut provided in service kit on the replacement bolt.

(7) Tighten upper bolt and nut from service kit until snug, but still allowing movement between strut clevis bracket and knuckle.

(8) Remove original lower bolt. Install bolt from service kit into the bottom hole of the strut clevis bracket. Install nut and snug.

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

(10) Adjust front and or rear camber to the preferred setting by pushing or pulling on the top of the front or rear tire. When camber is correctly set tighten upper and lower strut clevis bracket bolts. Again jounce front and rear of vehicle an equal amount of times and verify front and rear camber setting. See Alignment Specifications in this group of the service manual for required specifications.

(11) When vehicle is at correct camber setting torque both front strut clevis bracket to steering knuckle attaching bolts to 53 N·m (40 ft. lbs.) plus an additional 1/4 turn after required torque is met. Torque rear strut clevis bracket to rear knuckle attaching bolts to 95 N·m (70 ft. lbs.).

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

FRONT AND REAR TOE SETTING PROCEDURE

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

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

(3) When performing the Toe setting procedure, set rear wheel Toe to preferred specification first, then set front wheel Toe to the preferred specification.

(4) Loosen nuts on attaching bolts, for the left and right rear lateral links to rear crossmember (Fig. 4).

(5) Rotate lateral link adjustment cams (Fig. 5) until the preferred rear Toe specification is obtained. See Alignment Specifications in this group of the service manual for preferred specification.

SERVICE PROCEDURES (Continued)

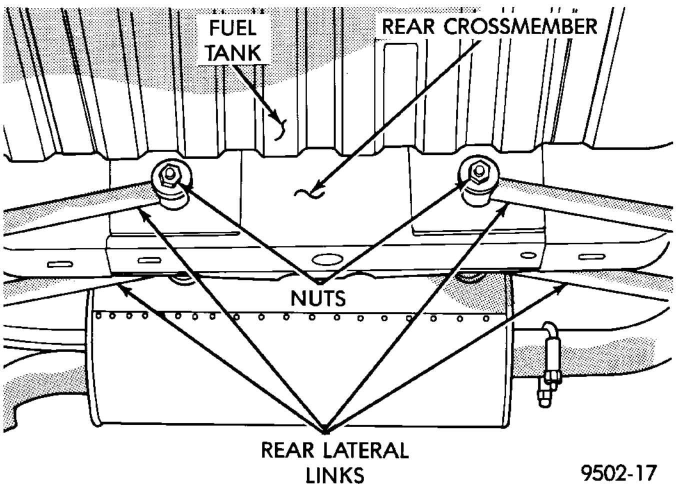


Fig. 4 Rear Lateral Link To Crossmember Attaching Bolts

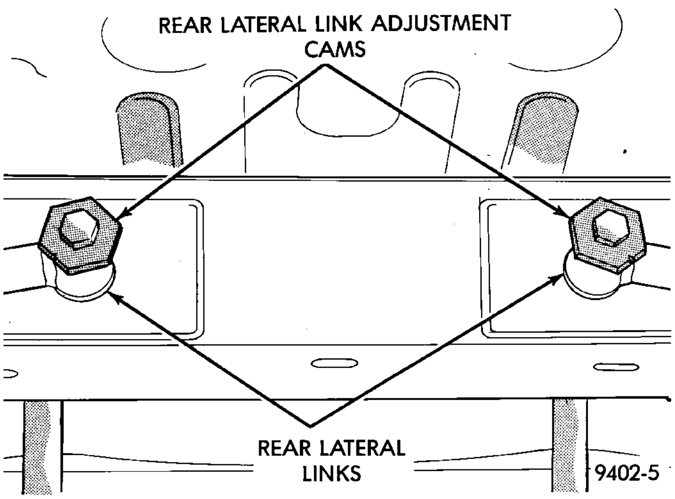


Fig. 5 Rear Wheel Toe Adjustment Cams

(6) While holding Toe adjustment cams from turning, tighten left and right lateral links to rear crossmember attaching bolt nuts. This will securely hold adjustment cams in position. Then while holding lateral link attaching bolt and adjustment cam from turning, torque nut of lateral link attaching bolt to 95 N·m (70 ft. lbs.) (Fig. 6).

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

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

(8) Tighten tie rod locknuts to 54 N·m (40 ft.lbs.) torque.

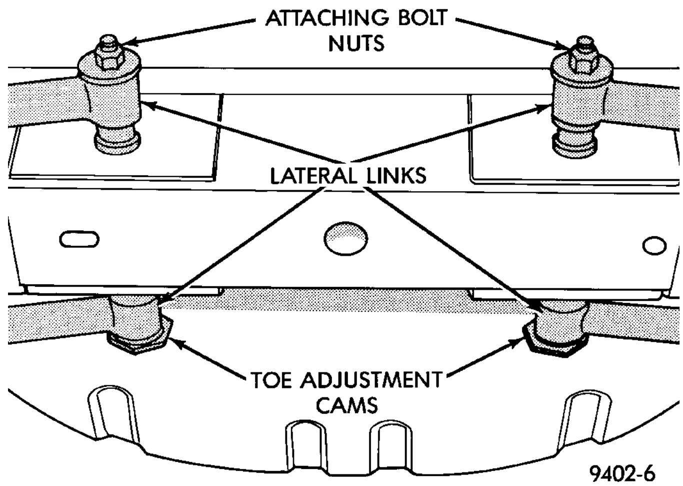


Fig. 6 Torquing Rear Lateral Link Attaching Bolts

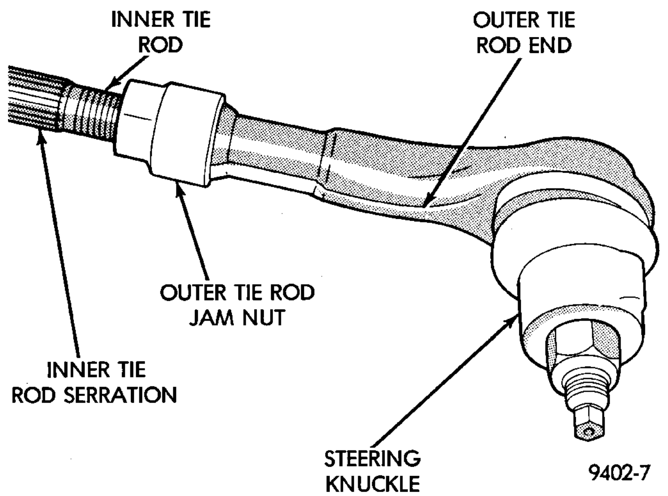


Fig. 7 Front Wheel Toe Adjustment

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

(10) Remove steering wheel clamp.

SPECIFICATIONS

VEHICLE ALIGNMENT SPECIFICATIONS AT CURB HEIGHT

FRONT WHEEL ALIGNMENT	ACCEPTABLE ALIGNMENT RANGE AT CURB HEIGHT	PREFERRE SETTING
CAMBER	-0.4° to +0.4°	+0.0°
TOTAL TOE . . . . Specified In Degrees (See Note)	0.3°in to 0.1°out	0.1° in
CASTER* . . . . *Side To Side Caster Difference Not To Exceed	+1.8° to +3.8° 1.0° or less	+2.8°
REAR WHEEL ALIGNMENT	ACCEPTABLE ALIGNMENT RANGE AT CURB HEIGHT	PREFERRE SETTING
CAMBER	-.75° to +0.25°	-0.25°
TOTAL TOE . . . . Specified In Degrees (See Note) TOE OUT: When Backed On Alignment Rack Is TOE In When Driving	0.3° in to 0.1° out	0.1° in
THRUST ANGLE	-0.10° to +0.10°	
Note: Total Toe is the arithmetic sum of the left and right wheel Toe settings. Positive is Toe-in, negative is Toe-out. Total Toe must be equally split between each front wheel to ensure the steering wheel is centered after setting Toe. Left and Right Toe must be equal to within 0.02 degrees.		

FRONT SUSPENSION

INDEX

GENERAL INFORMATION

GENERAL INFORMATION

CAUTION: ONLY FRAME CONTACT HOISTING EQUIPMENT CAN BE USED ON THIS VEHICLE. All vehicles have a fully independent rear suspension. The vehicles can not be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used, damage to rear suspension components will occur.

CAUTION: At no time when servicing a vehicle, can a sheet metal screw, bolt or other metal fastener be installed in the shock tower to take the place of an original plastic clip. Also, NO holes can be drilled into the front shock tower in the area shown in (Fig. 1), for the installation of any metal fasteners into the shock tower.

Because of the minimum clearance in this area (Fig. 1) installation of metal fasteners could damage the coil spring coating and lead to a corrosion failure of the spring. If a plastic clip is missing, or is lost or broken during servicing a vehicle, replace only with the equivalent part listed in the Mopar parts catalog.

DESCRIPTION AND OPERATION

FRONT SUSPENSION

This vehicle has a gas pressurized MacPherson strut front suspension design (Fig. 2).

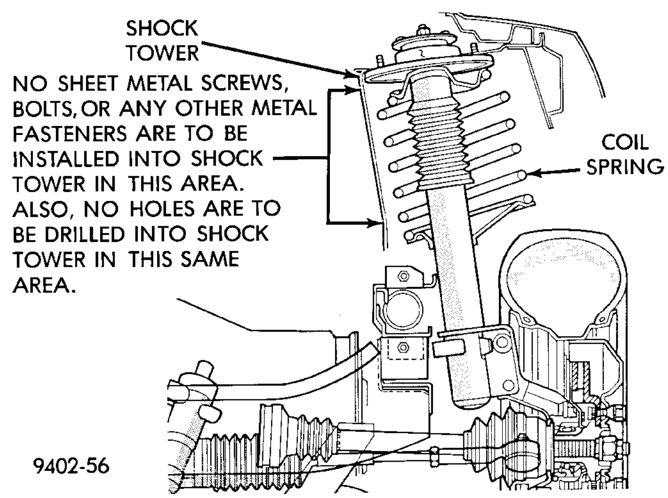


Fig. 1 Shock Tower To Spring Minimum Clearance Area

A MacPherson strut assembly is used in place of the front suspension upper control arm and upper ball joint. The bottom of the MacPherson strut, mounts directly to the steering knuckle using 2 attaching bolts and nuts going through the clevis

DESCRIPTION AND OPERATION (Continued)

bracket and steering knuckle (Fig. 2). The top of the strut is mounted directly to the strut tower of the vehicle by the strut mount assembly's 3 studs and attaching nuts (Fig. 2). During steering maneuvers, the strut assembly (through a pivot bearing in the upper strut mount assembly) and steering knuckle (through the lower ball joint) turn as an assembly (Fig. 2).

The MacPherson strut assembly includes the following components: A rubber isolated top mount, an upper spring seat/bearing assembly, jounce bumper, dust shield, coil spring with plastic noise insulator and the strut dampener.

A cast lower control arm assembly (Fig. 2) is attached to the front suspension crossmember using 2 rubber isolator bushings and to the steering knuckle by means of a ball joint.

A sealed for life front hub and bearing assembly is attached to the front steering knuckle. The outer C/V joint assembly is splined to the front hub and bearing assembly and is retained by a prevailing torque nut.

DESCRIPTION AND OPERATION (Continued)

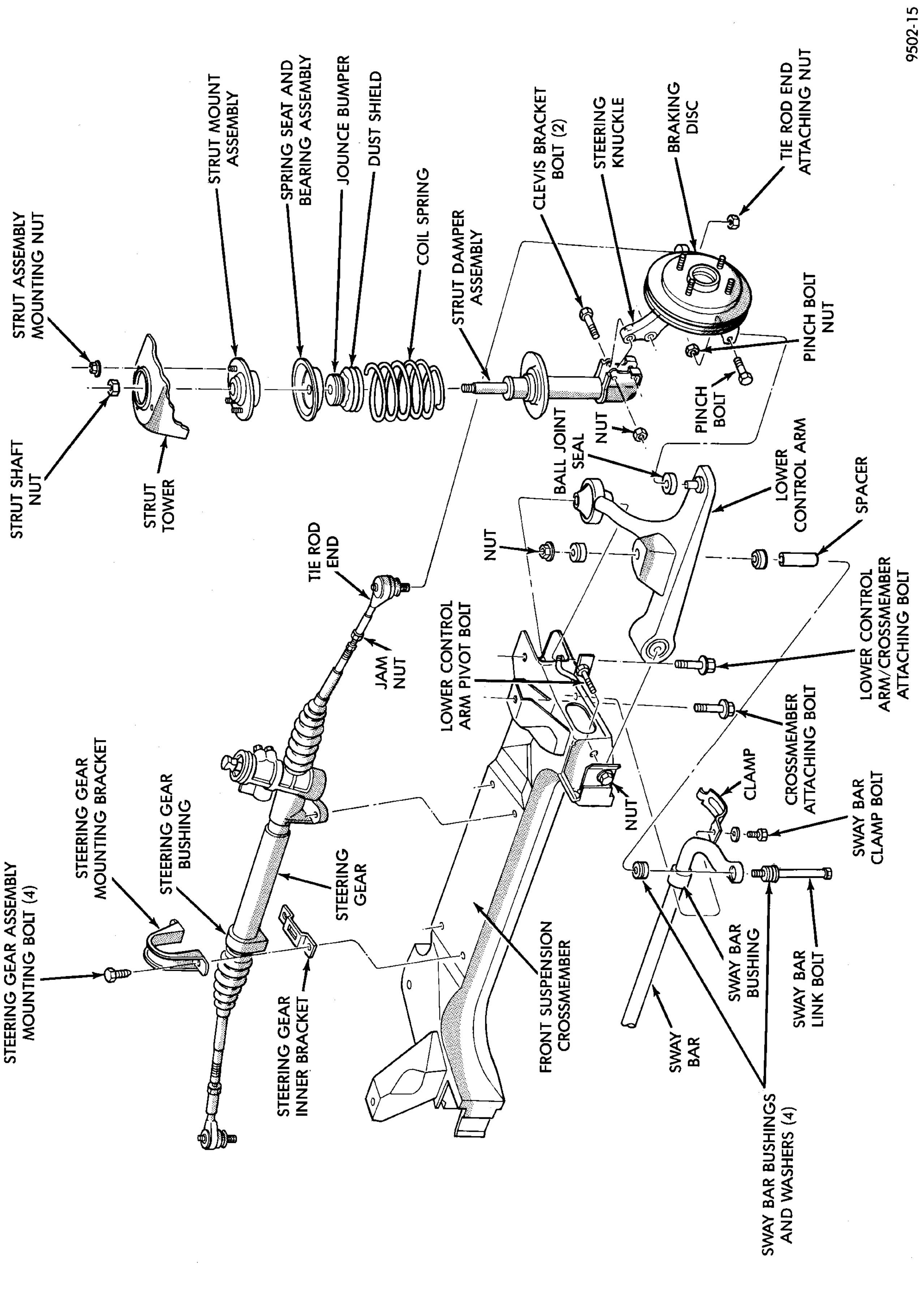


Fig. 2 Front Suspension (Typical)

DESCRIPTION AND OPERATION (Continued)

McPHERSON STRUT ASSEMBLY

The front strut and suspension of the vehicle is supported by coil springs positioned around the struts. The springs are contained between an upper seat, located just below the top strut mount assembly 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 of the strut assembly attaches to the top of the steering knuckle using 2 thru-bolts and prevailing torque nuts. Caster and camber is a fixed setting (net build) on all vehicles and is not required to be adjusted.

STEERING KNUCKLE

The steering knuckle (Fig. 3) is a single casting with legs machined for attachment to the front strut assembly and lower control arm ball joint. The steering knuckle also has machined abutments on the casting to support and align the front brake caliper assembly. The knuckle also holds the front drive shaft outer C/V joint hub and bearing assembly. The hub is positioned through the bearing and knuckle, with the constant velocity stub shaft splined through the hub. The outer C/V joint is retained to the hub/bearing using a hub nut. The hub nut is held on the stub shaft using a nut retainer and cotter pin.

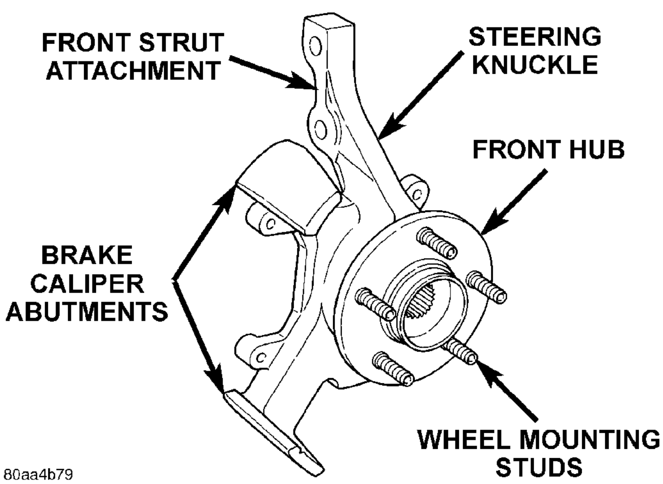


Fig. 3 Steering Knuckle Assembly

LOWER CONTROL ARM

The lower control arm (Fig. 4) is a ductile iron casting using 2 rubber bushings to isolate it from the front suspension crossmember and frame of the vehicle. The isolator bushings consist of 2 metal encased rubber isolated pivot bushings. The front of the lower control arm is bolted to the front crossmember using a bolt through the center of the rubber pivot bushing (Fig. 4). The rear of the lower control arm is mounted to both the front crossmember and the frame rail of the vehicle using a thru-bolt. The thru-bolt goes through both the crossmember and rear lower control arm bushing, threading directly into the frame rail of the vehicle. The lower control arms are inter-connected through a linked rubber isolated stabilizer bar.

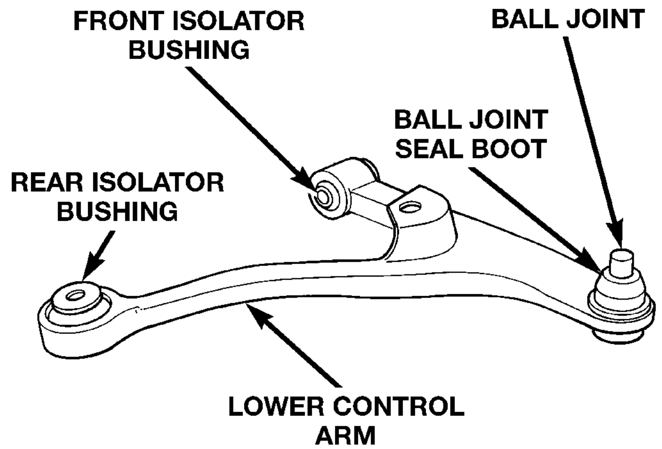


Fig. 4 Lower Control Arm Assembly

STABILIZER BAR

The stabilizer bar (Fig. 5) interconnects both front lower control arms of the vehicle and is attached to the front suspension cradle.

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

Attachment of the stabilizer bar to the front suspension cradle is through 2 rubber-isolator bushings and bushing retainers (Fig. 5). The stabilizer bar to lower control arm attachment is done utilizing a rubber isolated stabilizer bar attaching link (Fig. 5). All parts of the stabilizer bar are serviceable, and the stabilizer bar to crossmember bushings are split for easy removal and installation. The split in the stabilizer bar to crossmember bushing must be positioned toward the front of the vehicle, when the stabilizer bar is installed on the vehicle.

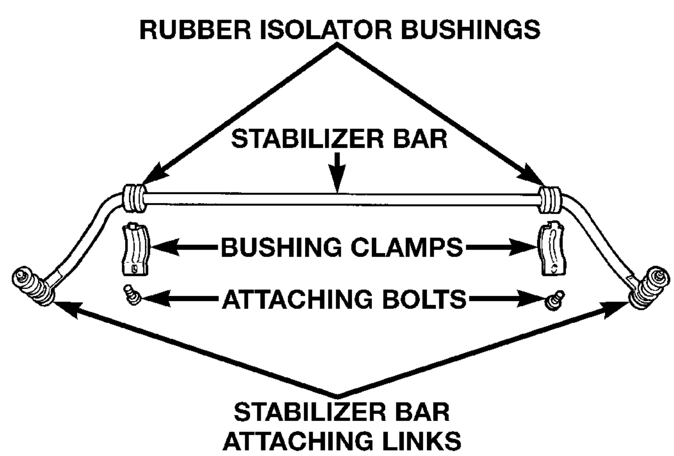


Fig. 5 Stabilizer Bar And Components

DESCRIPTION AND OPERATION (Continued)

FRONT WHEEL HUB BEARING

The front wheel hub bearing used on the Neon is a Unit 1 type cartridge bearing (Fig. 6).

The wheel bearing is serviced separately from the front steering knuckle and front hub assembly. Installation and retention of the front wheel bearing into the steering knuckle, is by means of an interference press fit using a retaining compound and a retaining snap ring (Fig. 6). Installation of the front hub into the front wheel bearing, must be done after wheel bearing and retaining snap ring is installed in steering knuckle.

The unit 1 wheel bearing is serviced only as a complete assembly less the wheel hub. If the front wheel bearing requires replacement, the hub must be removed from the original wheel bearing and transferred to the replacement bearing.

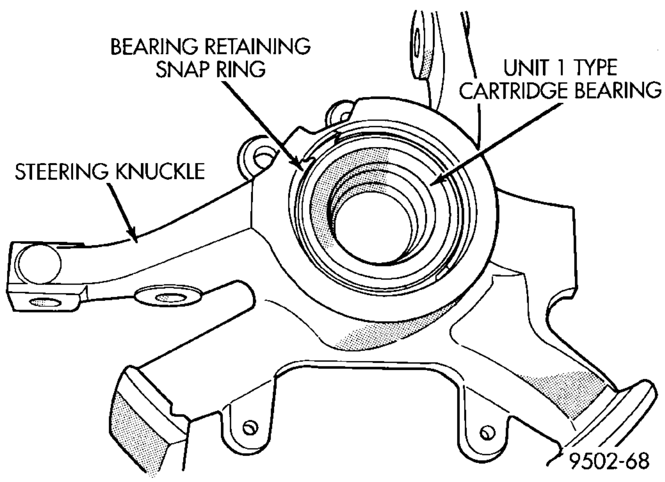


Fig. 6 Front Wheel Hub Bearing

COIL SPRING

Coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. During service procedures when both springs are removed, mark springs to ensure installation in original position. Each coil spring comes with a plastic sleeve on the second coil of the spring. This plastic sleeve is a noise insulator for the coil spring. **If coil springs require replacement, be sure that the springs needing replacement, are replaced with springs meeting the correct load rating for the vehicle and its specific options.**

BALL JOINT

The ball joint (Fig. 7) is pressed into the lower control arm and has a non-tapered stud with a notch for steering knuckle clamp bolt clearance. The ball joint stud is clamped and locked into the steering knuckle leg using a pinch bolt. The ball joint used on this vehicle is replaceable and if found defective can be serviced as a separate component of the lower control arm assembly.

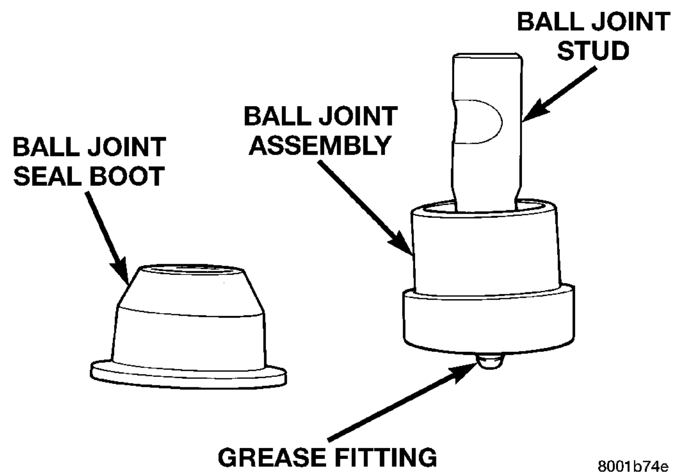


Fig. 7 Ball Joint Assembly

WHEEL MOUNTING STUDS

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

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

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

DIAGNOSIS AND TESTING

MCPHERSON STRUT ASSEMBLY

(1) Inspect for damaged or broken coil springs (Fig. 8).

(2) Inspect for torn or damaged strut assembly dust boots (Fig. 8).

(3) Lift dust boot (Fig. 9) and inspect strut assembly for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off lower end of unit). A slight amount of seepage between the strut rod and strut shaft seal is not unusual and does not affect performance of the strut assembly. Also inspect jounce bumpers for signs of damage or deterioration.

STEERING KNUCKLE

The front suspension steering knuckle is not a repairable component of the front suspension. **IT MUST BE REPLACED IF FOUND TO BE DAM-**

DIAGNOSIS AND TESTING (Continued)

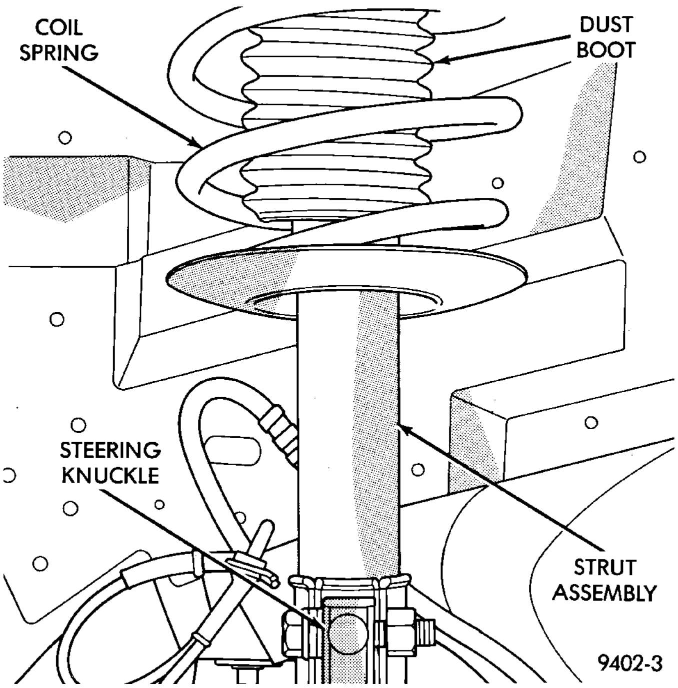


Fig. 8 McPherson Strut Assembly Inspection

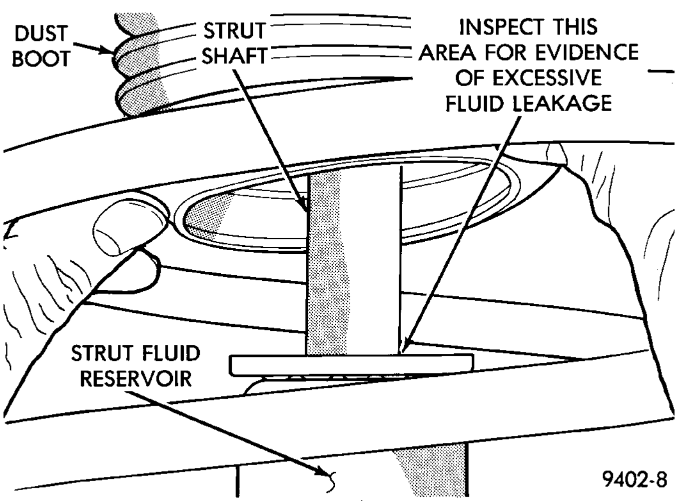


Fig. 9 Strut Assembly Leakage Inspection

AGED IN ANY WAY. If it is determined that the steering knuckle is bent when servicing the vehicle, no attempt is to be made to straighten the steering knuckle.

On this vehicle the steering knuckle must be removed from the vehicle when servicing the front hub bearing.

LOWER CONTROL ARM

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

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

BALL JOINT ASSEMBLY

With the weight of the vehicle resting on the road wheels. Grasp the grease fitting as shown in (Fig. 10) and with no mechanical assistance or added force attempt to move the grease fitting.

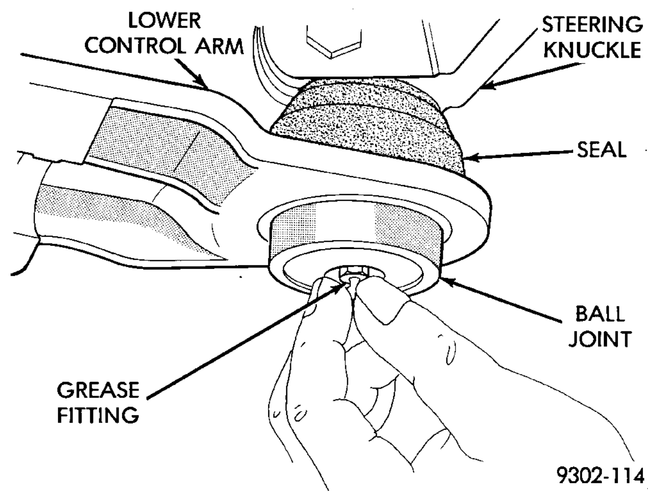


Fig. 10 Checking Ball Joint Wear

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

STABILIZER BAR

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

HUB/BEARING

The hub bearing is designed for the life of the vehicle and requires no type of periodic maintenance. The following procedure may be used for diagnosing the condition of the hub bearing.

With the wheel, disc brake caliper, and brake rotor removed, rotate the wheel hub. Any roughness or resistance to rotation may indicate dirt intrusion or a

DIAGNOSIS AND TESTING (Continued)

failed hub bearing. If the hub bearing exhibits any of these conditions during diagnosis, the hub bearing will require replacement, the bearing is not serviceable.

Damaged bearing seals and the resulting excessive grease loss may also require bearing replacement. Moderate grease weapage from the hub bearing is considered normal and should not require replacement of the hub bearing.

REMOVAL AND INSTALLATION

MCPHERSON STRUT

REMOVE

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

(1) Loosen wheel nuts.

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

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

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

(5) Remove hydraulic brake hose routing bracket and attaching screw from strut damper bracket. If vehicle is equipped with Anti-Lock brakes, hydraulic hose routing bracket is combined with speed sensor cable routing bracket (Fig. 11).

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

(6) Remove the 2 bolts (Fig. 12) attaching the strut to the steering knuckle.

(7) Remove the 3 nuts attaching the upper mount of the strut (Fig. 13) to the strut tower of the vehicle .

INSTALL

(1) Install strut assembly into strut tower, aligning the 3 studs on the upper strut mount into the holes in shock tower. Install the 3 upper strut mount retaining nut and washer assemblies (Fig. 13). Torque the 3 nuts to 31 N·m (23 ft. lbs.).

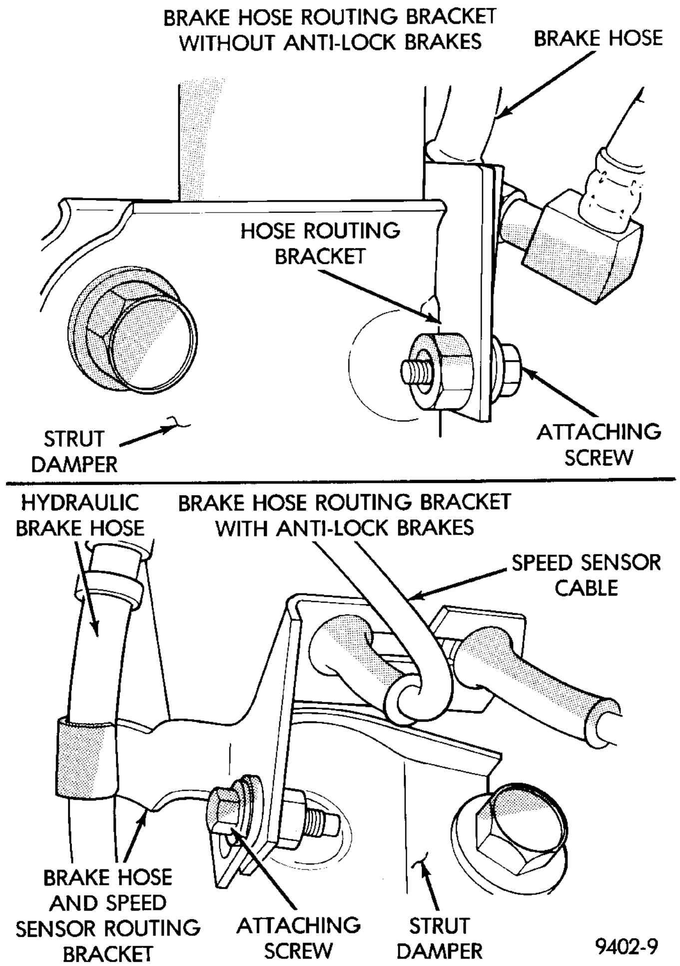


Fig. 11 Brake Hose And Speed Sensor Cable Routing Brackets

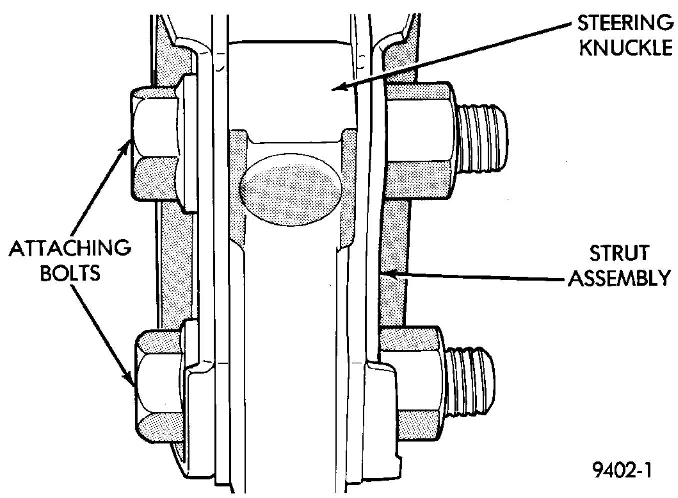


Fig. 12 Strut To Steering Knuckle Attaching Bolts

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

REMOVAL AND INSTALLATION (Continued)

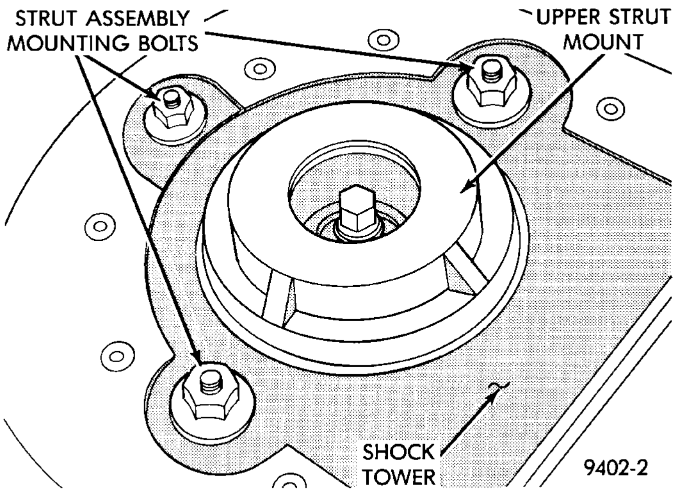


Fig. 13 Strut To Shock Tower Mounting

(2) Align strut assembly with steering knuckle. Position arm of steering knuckle into strut assembly, aligning the strut assembly to steering knuckle mounting holes. Install the 2 strut assembly to steering knuckle attaching bolts (Fig. 12). Attaching bolts should be installed with the nuts facing the front of the vehicle. Torque both attaching bolts to 53 N·m (40 ft. lbs.) plus an additional 1/4 turn after specified torque is met.

(3) Install hydraulic brake hose routing bracket and attaching screw onto strut damper bracket. If vehicle is equipped with Anti-Lock brakes, hydraulic hose routing bracket is combined with speed sensor cable routing bracket (Fig. 11). Torque bracket attaching bolts (Fig. 11) to 13 N·m (10 ft. lbs.).

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

STEERING KNUCKLE

REMOVE

(1) Remove cotter pin, nut lock, and spring washer (Fig. 14).

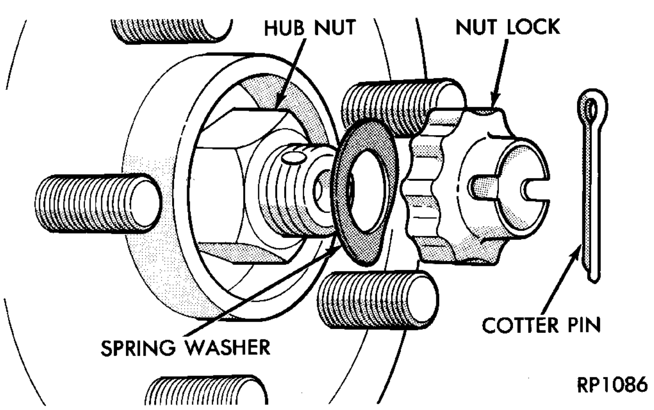


Fig. 14 Cotter Pin, Nut Lock, And Spring Washer

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

(2) Loosen hub nut while vehicle is on the floor with the brakes applied (Fig. 15). **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

(3) Raise vehicle on jack stands or centered on a

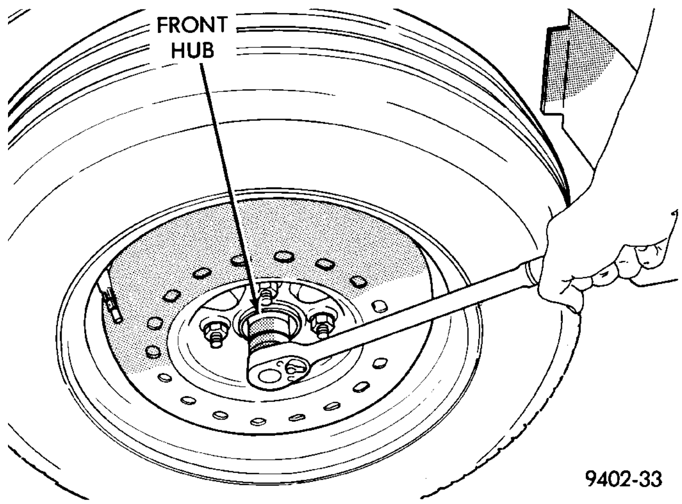


Fig. 15 Loosening Front Hub Retaining Nut

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.

(4) Remove the front tire and wheel.

(5) Remove front disc brake caliper to steering knuckle attaching bolts (Fig. 16).

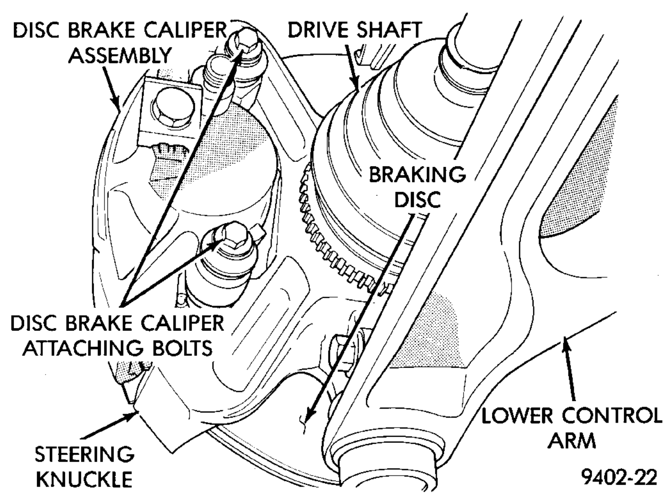


Fig. 16 Disc Brake Caliper Attaching Bolts

(6) Remove the disc brake caliper from the steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then

REMOVAL AND INSTALLATION (Continued)

removing top of caliper out from under steering knuckle (Fig. 17).

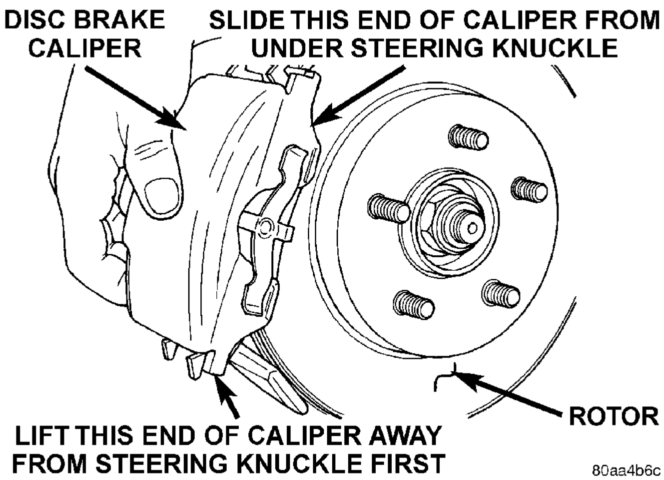


Fig. 17 Brake Caliper Removal

(7) Support brake disc brake caliper assembly using a wire hook and not by hydraulic hose (Fig. 18).

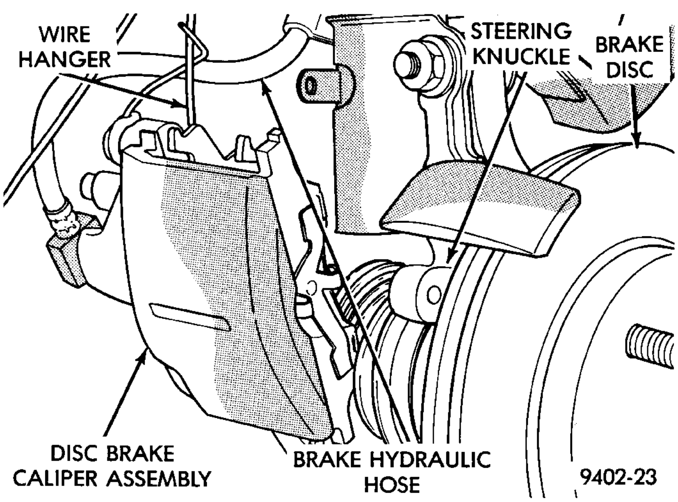


Fig. 18 Supporting Brake Caliper

(8) Remove the rotor from the front hub/bearing (Fig. 19).

(9) Remove the nut attaching outer tie rod end to the steering knuckle (Fig. 20). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench.**

(10) Remove the tie rod end stud from steering knuckle arm, using Remover, Special Tool MB-990635 (Fig. 21).

(11) Remove nut and bolt (Fig. 22), clamping ball joint stud, from steering knuckle.

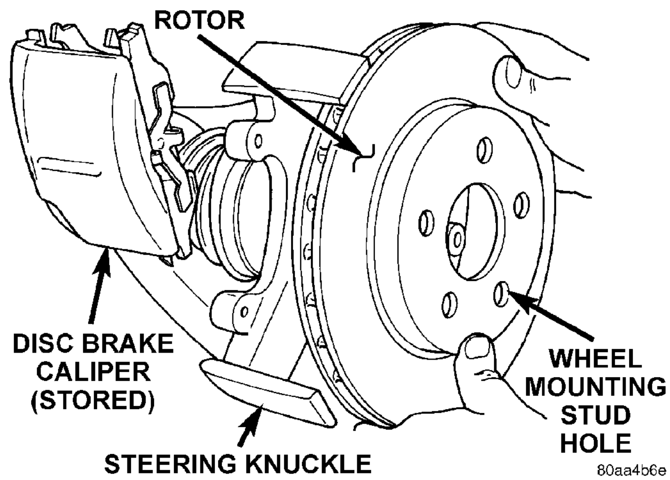


Fig. 19 Remove /Install Rotor

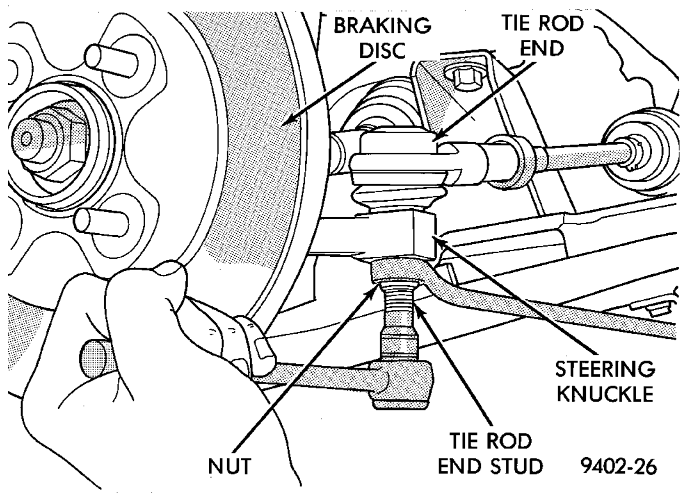


Fig. 20 Tie Rod End Attaching Nut

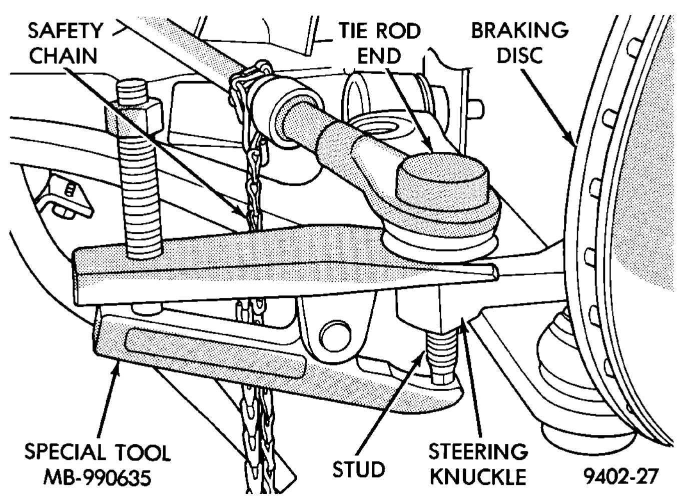


Fig. 21 Tie Rod End Removal From Steering Knuckle

(12) Separate ball joint stud from steering knuckle by prying down on lower control arm (Fig. 23). **Note: Use caution when separating ball joint stud**

REMOVAL AND INSTALLATION (Continued)

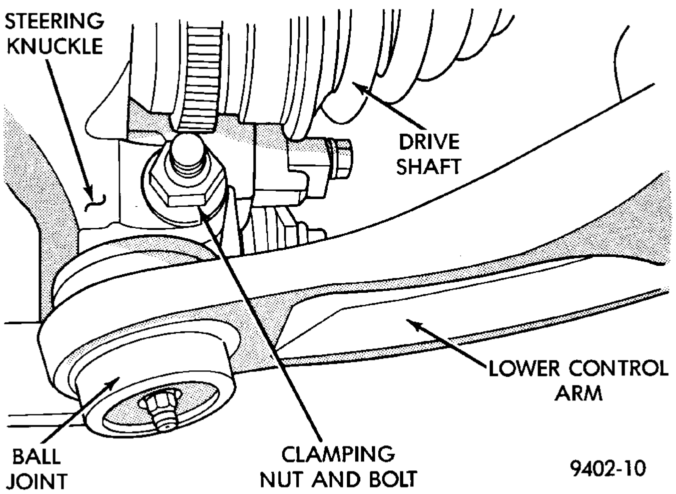


Fig. 22 Steering Knuckle To Ball Joint Clamp Bolt

from steering knuckle, so ball joint seal does not get cut.

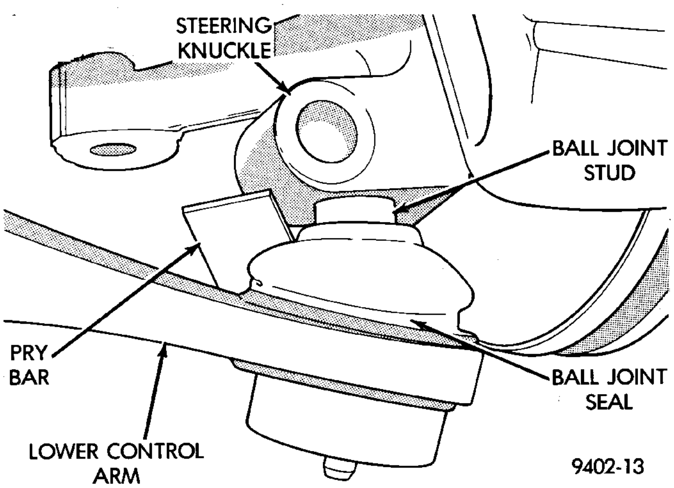


Fig. 23 Separate Ball Joint Stud from Knuckle Assembly

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(13) Pull steering knuckle assembly out and away from outer C/V joint of the driveshaft assembly (Fig. 24).

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

(14) Remove the 2 steering knuckle to strut damper clevis bracket attaching bolts (Fig. 25).

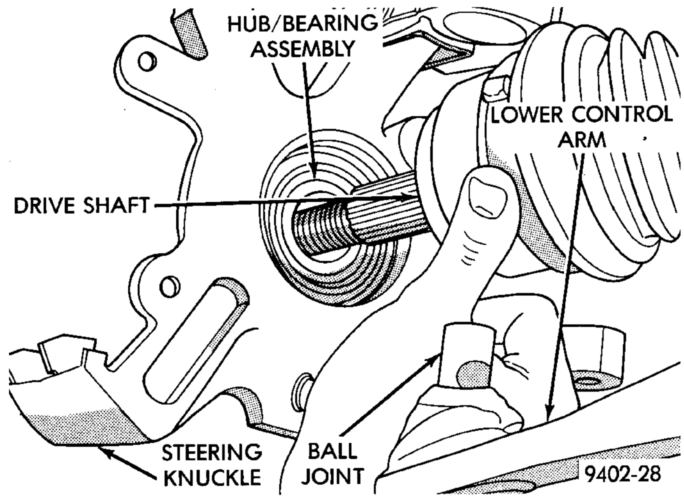


Fig. 24 Steering Knuckle Separation From Driveshaft

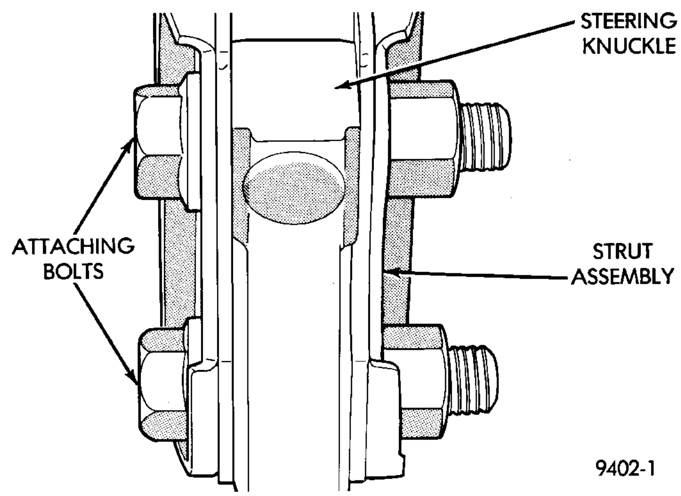


Fig. 25 Remove Steering Knuckle To Strut Attaching Bolts

(15) **The cartridge type front wheel bearing used on this vehicle is not transferable to the replacement steering knuckle. If the replacement steering knuckle does not come with a hub and bearing assembly, a new bearing must be installed in the steering knuckle. Installation of the new wheel bearing must be done before installing steering knuckle on vehicle.** Refer to Hub and Bearing Service in this section of the service manual for proper wheel bearing removal and installation procedure.

INSTALL

(1) Install a new cartridge hub and bearing assembly into the steering knuckle. Refer to Hub And Bearing Service in this section of the service manual for proper wheel bearing removal and installation procedure.

REMOVAL AND INSTALLATION (Continued)

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

(2) Install steering knuckle back in clevis bracket of strut damper assembly (Fig. 25). Install the strut damper to steering knuckle attaching bolts. **Note: The steering knuckle to strut assembly attaching bolts are serrated and must not be turned in steering knuckle during installation.** Torque attaching nuts to 54 N·m (40 ft. lbs.) plus an additional 1/4 turn after specified torque is met.

(3) Slide drive shaft back into front hub and bearing assembly. Then install steering knuckle onto the ball joint stud (Fig. 24).

(4) Install a **NEW** steering knuckle to ball joint stud, clamp bolt and nut (Fig. 22). Torque the clamp bolt to 100 N·m (75 ft. lbs.).

(5) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 20). Then using a crowfoot and 11/32 socket (Fig. 26), torque tie rod end attaching nut to 55 N·m (40 ft. lbs.).

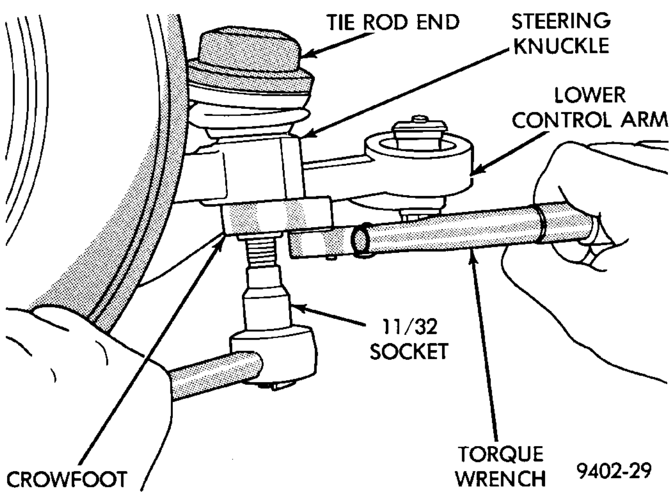


Fig. 26 Torquing Tie Rod End Attaching Nut

(6) Install the rotor on the hub/bearing (Fig. 19).

(7) Install the disc brake caliper on the steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 27).

(8) Install the disc brake caliper to steering knuckle attaching bolts (Fig. 16). Tighten the caliper attaching bolts to a torque of 31 N·m (23 ft. lbs.).

(9) Clean all foreign matter from the threads of the outer C/V joint stub axle (Fig. 28). Install hub nut onto threads of stub axle and tighten nut.

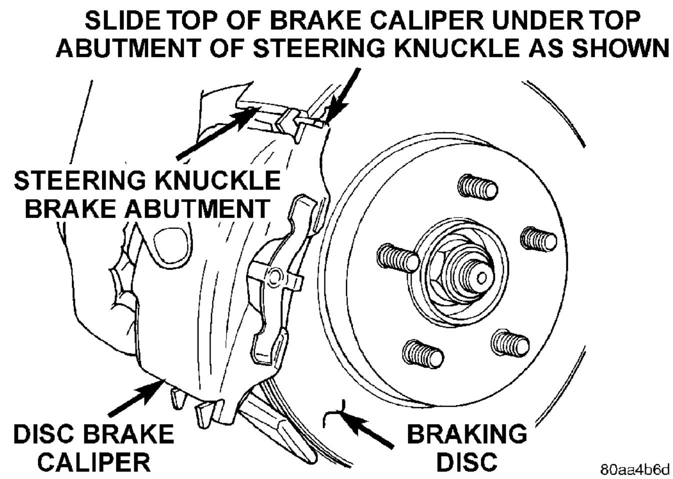


Fig. 27 Brake Caliper Installation

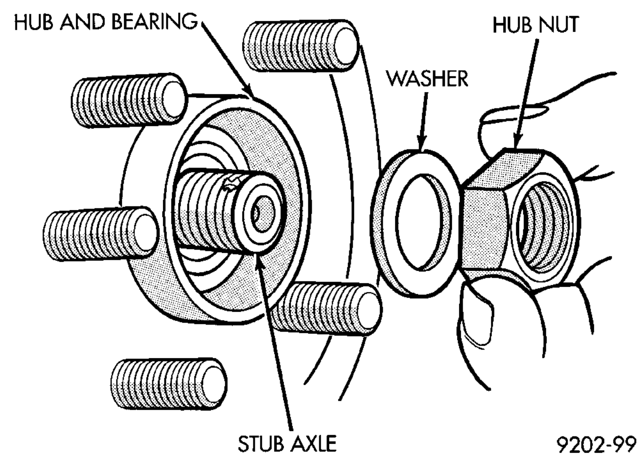


Fig. 28 Front Hub To Stub Shaft Nut

(10) With vehicle brakes applied to keep braking disc from turning, tighten hub nut to a torque of 183 N·m (135 ft. lbs.) (Fig. 29).

(11) Install front wheel and tire assembly. Install front wheel lug nuts and torque to 135 N·m (100 ft. lbs.).

(12) Lower vehicle.

(13) Install the spring washer, hub nut lock, and new cotter pin (Fig. 30). Wrap cotter pin prongs tightly around the hub nut lock (Fig. 31).

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

REMOVAL AND INSTALLATION (Continued)

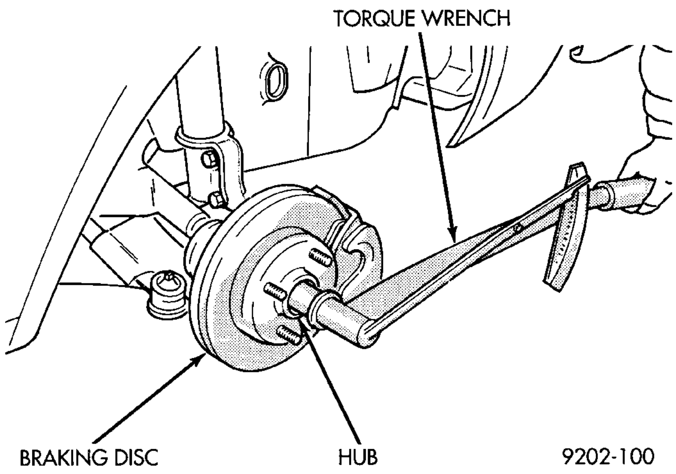


Fig. 29 Torquing Front Hub Nut

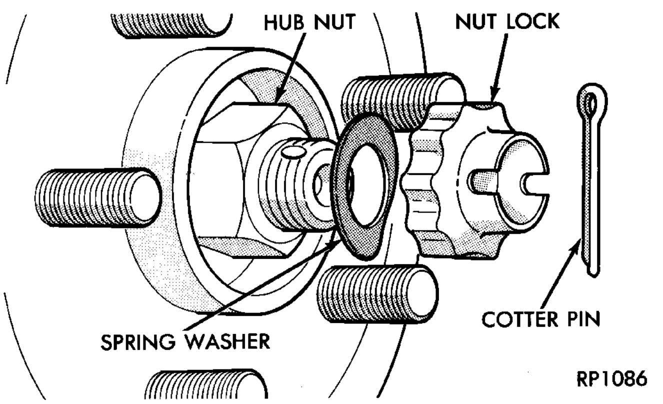


Fig. 30 Spring Washer, Nut Lock, And New Cotter Pin

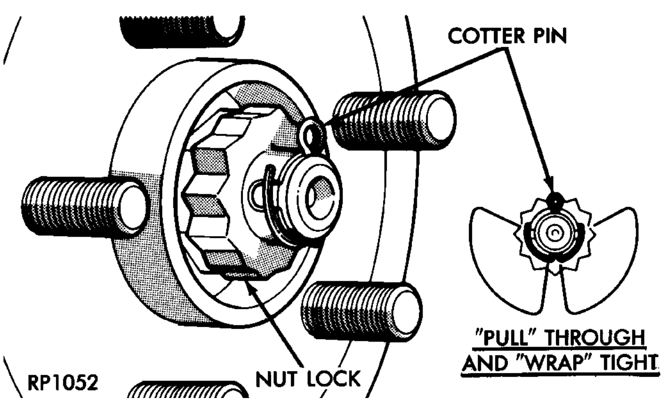


Fig. 31 Cotter Pin Correctly Installed

LOWER CONTROL ARM

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used. Remove wheel and tire assembly from side of vehicle requiring service to lower control arm.

(2) Remove the steering knuckle to ball joint ball stud, clamping nut and bolt (Fig. 32).

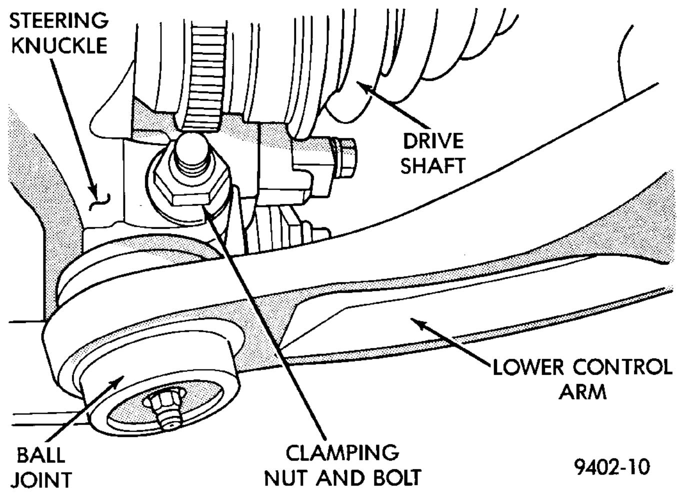


Fig. 32 Control Arm To Steering Knuckle Attachment

(3) Remove the 2 attaching links connecting the stabilizer bar to the lower control arms (Fig. 33).

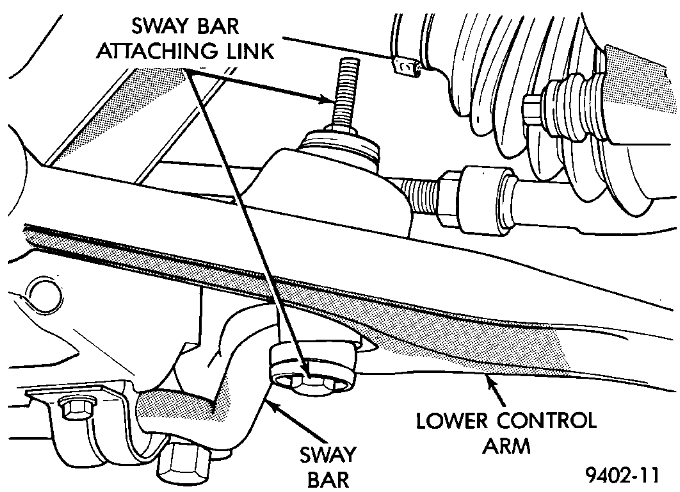


Fig. 33 Stabilizer Bar Link To Lower Control Arm Attachment

(4) Loosen but do not remove bolts attaching stabilizer bar retainers to front suspension crossmember (Fig. 34). Then rotate stabilizer bar and attaching links away from lower control arms

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

(5) Using a pry bar, separate steering knuckle from ball joint stud (Fig. 35). **Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.**

REMOVAL AND INSTALLATION (Continued)

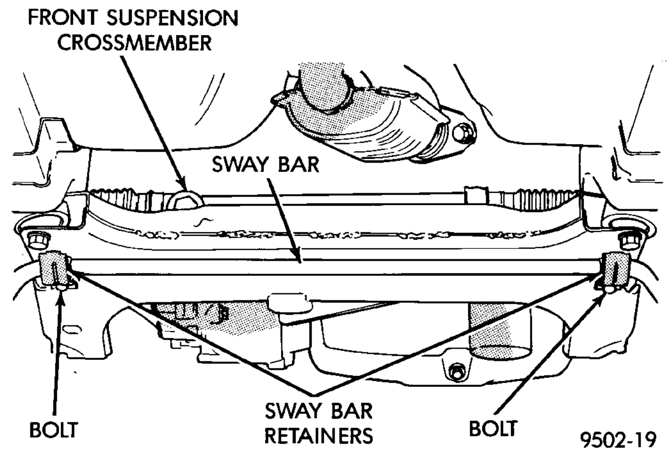


Fig. 34 Stabilizer Bar To Crossmember Retainers

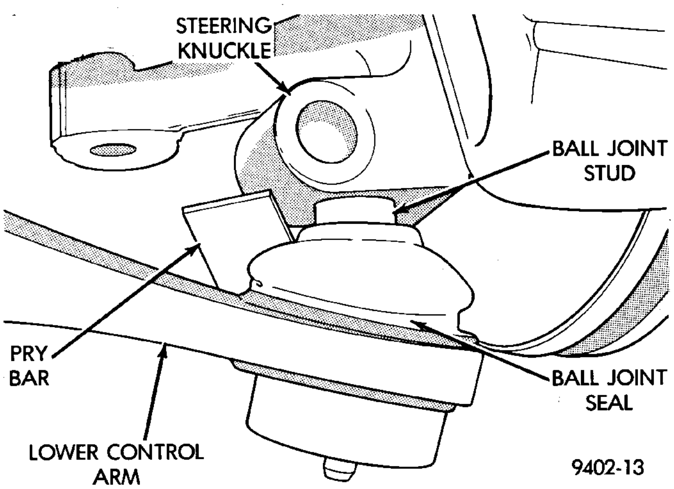


Fig. 35 Ball Joint Separation From Steering Knuckle

(6) Remove front lower control arm bushing to crossmember attaching nut and bolt (Fig. 36). Remove rear lower control arm to crossmember and frame rail attaching bolt (Fig. 36). Then remove lower control arm from crossmember.

INSTALL

(1) Position lower control arm into front crossmember. Then install rear lower control arm to crossmember and frame rail attaching bolt (Fig. 36). **Do not tighten rear attaching bolt at this time** . Then install front lower control arm to crossmember nut and bolt (Fig. 36).

(2) Torque front lower control arm nut and bolt to 163 N·m (120 ft. lbs.), first and then torque rear lower control arm attaching bolt to same torque specification.

(3) Install ball joint stud into steering knuckle. Then install steering knuckle to ball joint stud clamping bolt and nut (Fig. 32). Torque clamping bolt to 95 N·m (70 ft. lbs.).

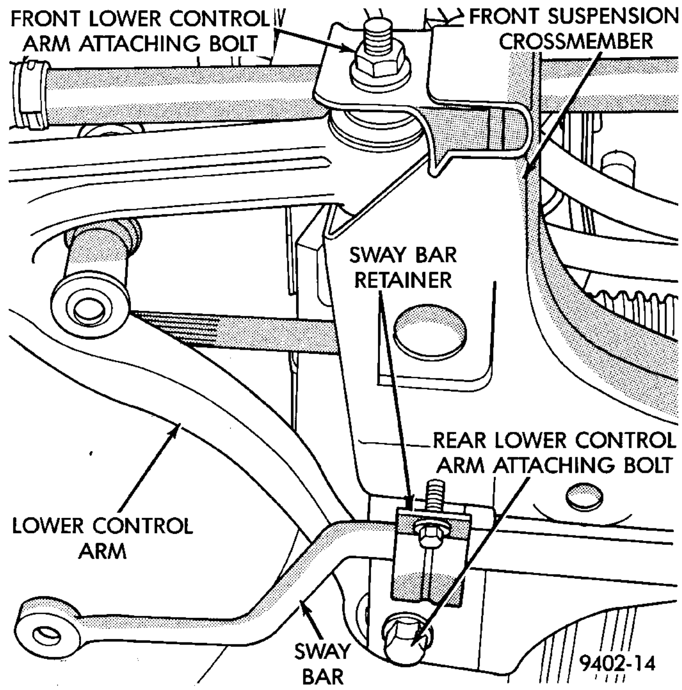


Fig. 36 Lower Control Arm Attaching Bolts

(4) Assemble stabilizer bar to lower control arm link assemblies and bushings as shown in (Fig. 37).

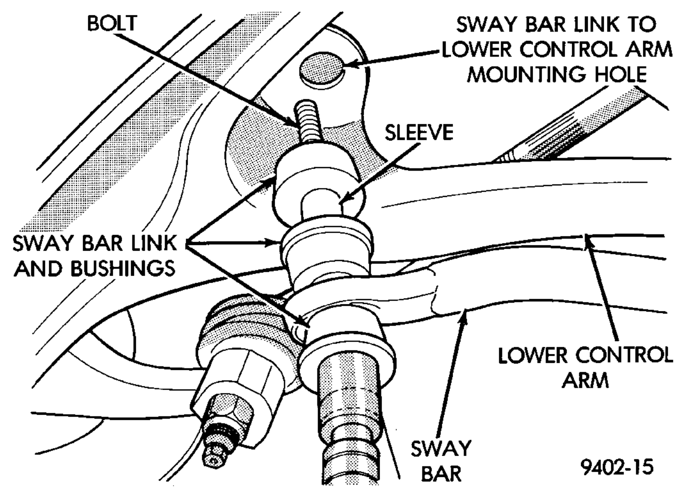


Fig. 37 Assembled Stabilizer Bar Link And Bushings

(5) Rotate stabilizer bar into position, installing the stabilizer bar link assemblies into the lower control arms. Then install the top stabilizer bar link bushings and nuts (Fig. 38). **DO NOT TIGHTEN LINK ASSEMBLIES AT THIS TIME**

(6) Lower vehicle so suspension is supporting the total weight of the vehicle.

(7) Torque the stabilizer bar to lower control arm link assemblies (Fig. 38) to 28 N·m (21 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

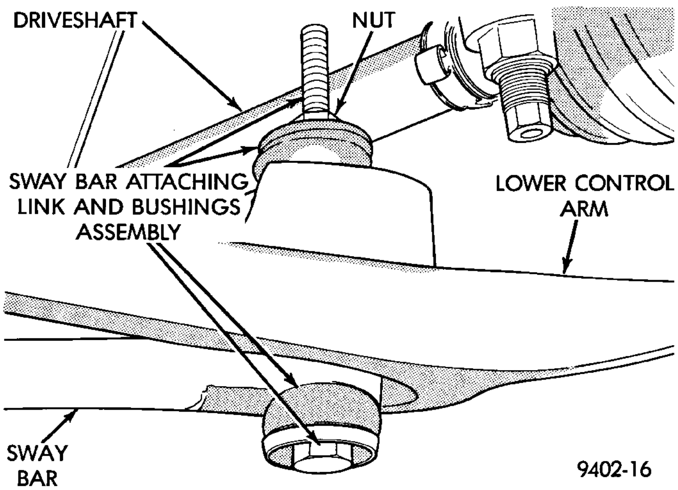


Fig. 38 Installed Stabilizer Bar To Lower Control Arm Attaching Link

(8) Torque the 2 stabilizer bar bushing retainer, to crossmember attaching bolts (Fig. 34) to 28 N·m (21 ft. lbs.).

STABILIZER BAR

REMOVE

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

(2) Remove nuts and stabilizer bar attaching link assemblies from the front lower control arms (Fig. 39).

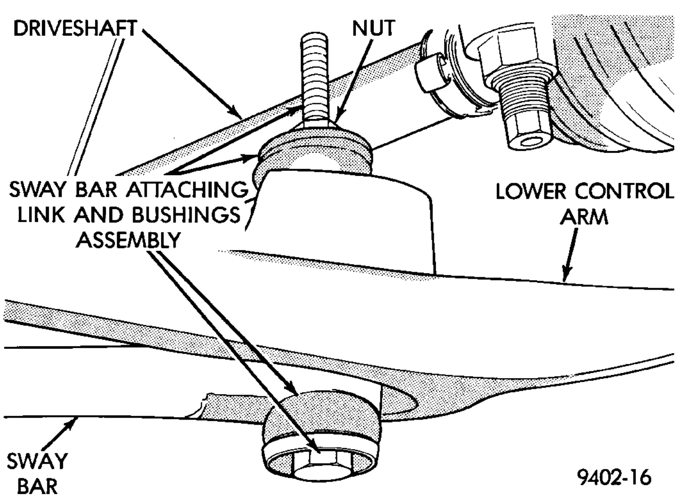


Fig. 39 Sabilizer Bar To Lower Control Arm Attaching Links

(3) Remove bolts at front crossmember to stabilizer bar bushing retainers (Fig. 40). Then remove bushing retainers, stabilizer bar, and bushings from front crossmember.

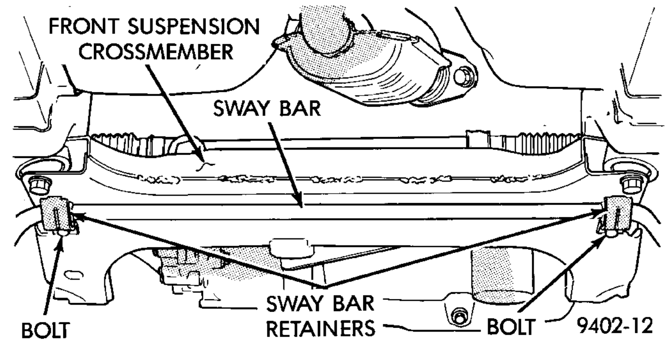


Fig. 40 Front Stabilizer Bar Bushing Retainers

INSTALL

(1) If inspection determines replacement of stabilizer bar to lower control arm attachment link bushings is required, replace bushings before installing stabilizer bar. Refer to (Fig. 41) for proper orientation of attaching link bushing components.

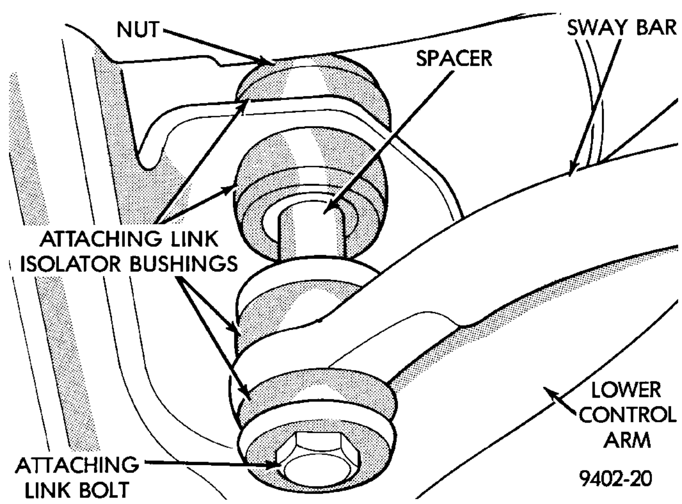


Fig. 41 Stabilizer Bar Attaching Link Assembly Bushing Orientation

(2) If stabilizer bar to front crossmember bushings require replacement at time of inspection, install new bushings before installing stabilizer bar. Bushings are replaced by opening slit on bushings and peeling them off stabilizer bar. Install new bushings on stabilizer bar, by spreading bushing at slit and forcing them on stabilizer bar. **Bushings must be installed on stabilizer bar with slit in bushing facing front of vehicle when stabilizer bar is installed (Fig. 42).**

(3) Position stabilizer bar into front crossmember, so cutouts in stabilizer bar bushings are aligned with raised bead in crossmember. Install stabilizer bar bushing retainers onto crossmember aligning raised bead on retainer with cutouts in bushings (Fig. 43).

REMOVAL AND INSTALLATION (Continued)

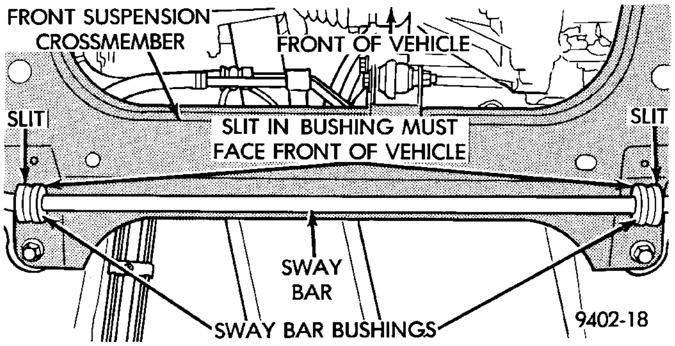


Fig. 42 Correct Stabilizer Bar To Crossmember Bushing Installation

Do not tighten stabilizer bar bushing retainers at this time.

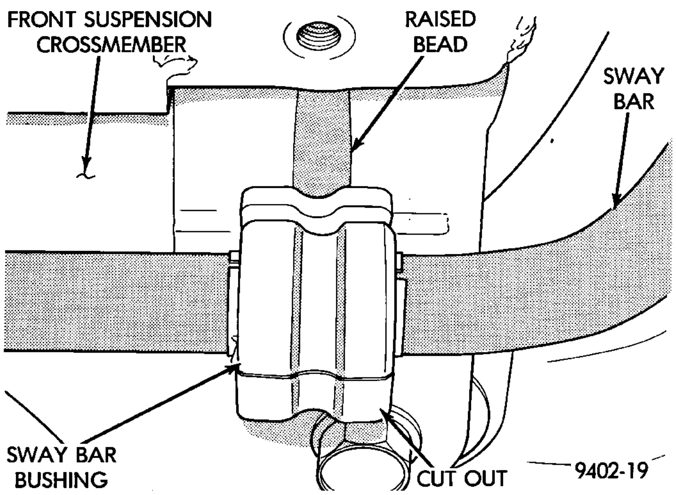


Fig. 43 Stabilizer Bar To Crossmember Bushing Position

(4) Align stabilizer bar attaching link and bushing assemblies with attaching link mounting holes in the lower control arms (Fig. 44). Install stabilizer bar attaching links into both lower control arms. Install the attaching link to stabilizer bar bushing and retaining nut. Torque the stabilizer bar attaching link nut (Fig. 44) to 28 N·m (21 ft. lbs.).

(5) Lower vehicle so the suspension is supporting the total weight of the vehicle.

(6) With lower control arms of the vehicle at curb height, tighten stabilizer bar bushing to crossmember retainer attaching bolts to 28 N·m (21 ft. lbs.) torque.

HUB BEARING

REMOVE

(1) Remove the steering knuckle, hub and the hub bearing as an assembly from the vehicle. Refer to Steering Knuckle in the Removal And Installation section in this group of the service manual for the required steering knuckle removal procedure.

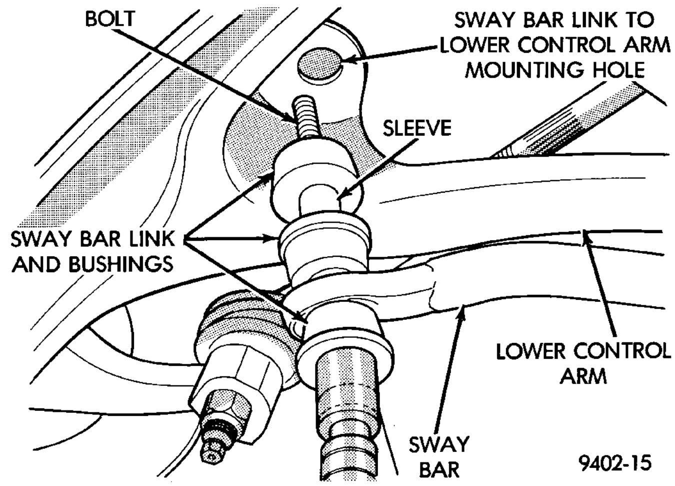


Fig. 44 Stabilizer Bar Link To Control Arm Attachment

The removal and installation of the steering knuckle hub bearing is to ONLY be done with the steering knuckle removed from the vehicle. Removal of the hub bearing from the steering knuckle MUST be done using an arbor press and the following procedure.

(2) Install Bearing Splitter, Special Tool P334 on the steering knuckle and hub/bearing assembly as shown in (Fig. 45) to support steering knuckle when pressing out hub.

(3) Position steering knuckle and hub and bearing in an arbor press supported by Bearing Splitter, Special Tool P334 as shown in (Fig. 45).

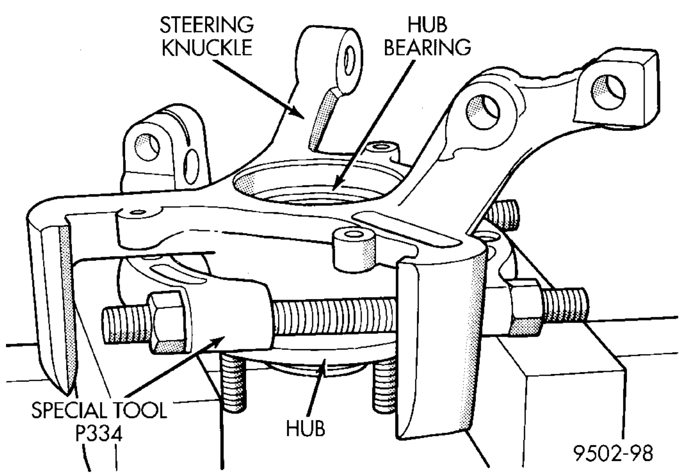


Fig. 45 Supporting Steering Knuckle For Hub Removal

(4) Position Driver, Special Tool 6644-2 on the small end of the hub to drive hub out of bearing. Using arbor press remove hub from bearing. The one bearing race will come out with hub when hub is removed from bearing.

REMOVAL AND INSTALLATION (Continued)

(5) Remove Bearing Splitter, Special Tool P334 from the steering knuckle.

CAUTION: Safety goggles and or face protection should always be worn when removing the snap ring (Fig. 46) retaining the hub/bearing in the steering knuckle. When the snap ring is removed from the steering knuckle it could fly out of the steering knuckle with great force possibly causing personal injury.

(6) Using a screw driver, (Fig. 46) remove the snap ring retaining the hub bearing in the steering knuckle.

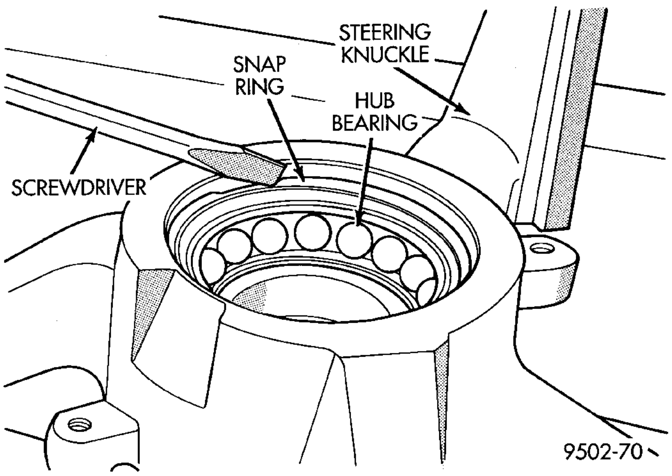


Fig. 46 Hub Bearing Retaining Snap Ring Removal

(7) Place steering knuckle in an arbor press (Fig. 47) supported by press blocks as shown. Press blocks must not obstruct hub bearing bore in steering knuckle so bearing can be pressed out of knuckle. Place Bearing Driver, Special Tool MB-990799 on outer race of hub bearing (Fig. 47). Press hub bearing completely out of the steering knuckle.

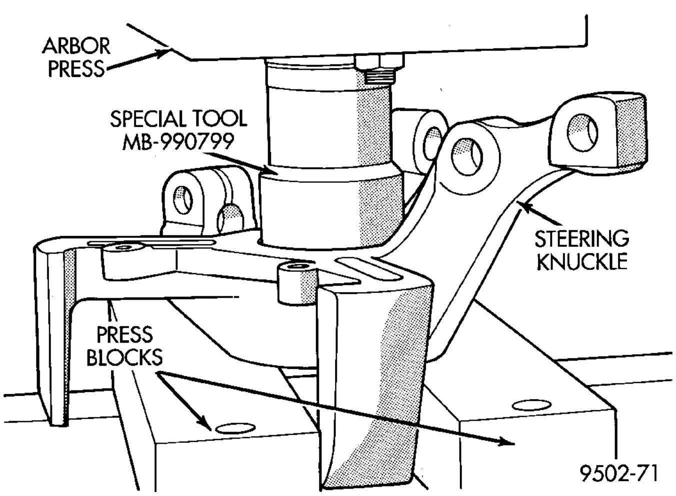


Fig. 47 Hub Bearing Removal From Steering Knuckle

(8) Install Bearing Splitter, Special Tool P334 on hub so it is between the flange of the hub and the bearing race remaining on the hub (Fig. 48). Place hub, bearing race and the bearing splitter in an arbor press as shown in (Fig. 48). Place Driver, Special Tool 6644-2 on end of hub (Fig. 48). Press the hub out of the bearing race.

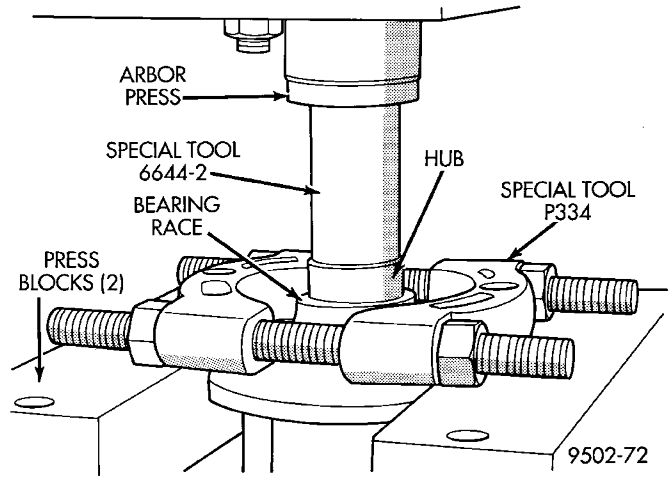


Fig. 48 Removing Bearing Race From Hub

INSTALL

(1) Wipe bore of steering knuckle clean of any grease or dirt with a **clean dry** shop towel.

CAUTION: Do not use any type of solvent on the hub bearing when cleaning it.

CAUTION: The hub bearing must be wiped as clean as possible. Any remaining rust preventative on the bearing can effect the bonding action of the adhesive to the bearing.

(2) Clean the rust preventative from the replacement hub bearing using a **clean dry** shop towel.

CAUTION: When applying adhesive to bore of steering knuckle, do not allow adhesive to get into the snap ring in bore or on the seal of the hub bearing

(3) Apply Loctite Adhesive # 640 or an equivalent, to the bore of the steering knuckle. The adhesive is to be applied to the entire bore wall suface, from the shoulder at the bottom to just below the snap ring groove.

(4) Place new hub bearing into bore of steering knuckle. Be sure the bearing is square with the bore. Place the steering knuckle in an arbor press with Receiver, Special Tool C-4698-2 supporting steering knuckle (Fig. 49). Place Diver, Special Tool 5052 (Fig. 49) on the outer race of the hub bearing. Press the

REMOVAL AND INSTALLATION (Continued)

hub bearing into the steering knuckle until it is fully bottomed in the bore of the steering knuckle.

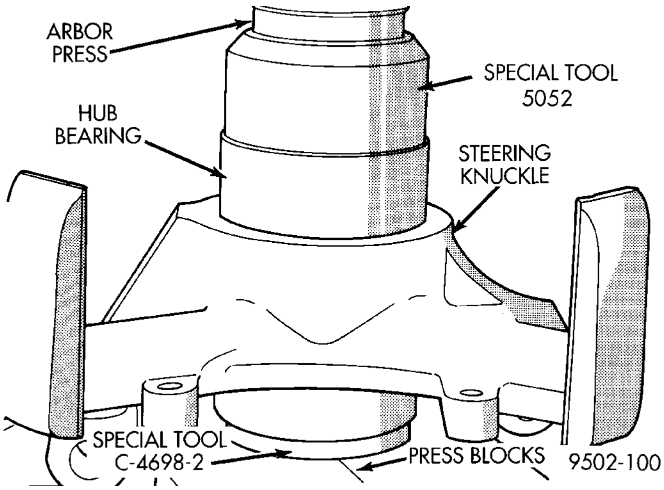


Fig. 49 Pressing Hub Bearing Into Steering Knuckle

CAUTION: When installing the retaining snap ring for the hub bearing care must be taken not to damage seal on new hub bearing.

(5) Install hub bearing retaining snap ring into snap ring groove in hub bearing bore of steering knuckle (Fig. 50). Be sure snap ring is fully seated in snap ring groove.

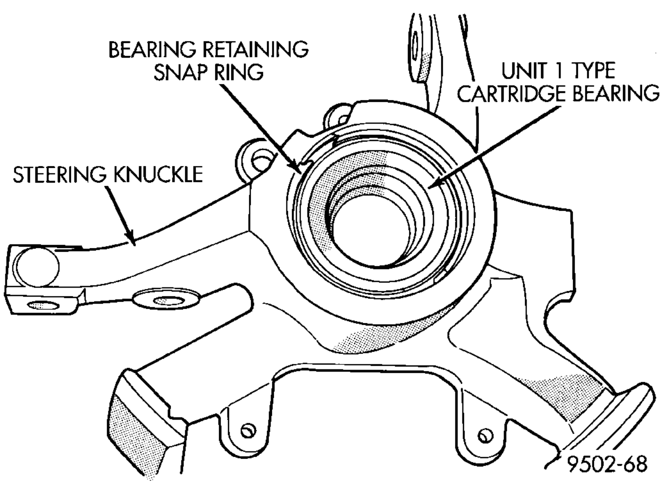


Fig. 50 Hub Bearing Retaining Snap Ring Installed

(6) Place steering knuckle with hub bearing installed in an arbor press with Receiver, Special Tool MB-990799 supporting inner race of the hub bearing (Fig. 51). Place hub in nub bearing making sure it is square with bearing. Place Driver, Special Tool 6522 on front face of hub (Fig. 51). Press the hub into the hub bearing until hub is fully bottomed in hub bearing.

(7) Install the steering knuckle, hub and the hub bearing as an assembly on the vehicle. Refer to Steering Knuckle in the Removal And Installation

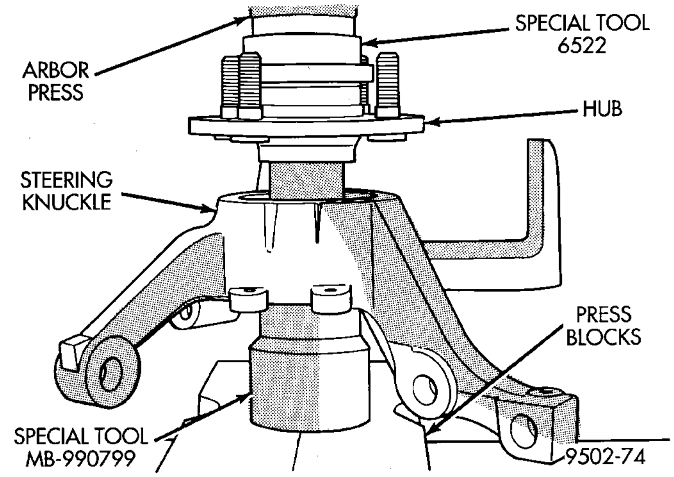


Fig. 51 Pressing Hub Into Hub Bearing

section in this group of the service manual for the required steering knuckle installation procedure.

(8) Install the wheel and tire on the vehicle.

(9) Lower the vehicle.

(10) Set the front wheel Toe to the required specification. Refer to Wheel Alignment Check And Adjustment Procedure in the Service Procedures Section in this group of the service manual.

CAUTION: After the vehicle is aligned it can only be moved a short distance and then parked. Do not move the vehicle any further until the adhesive has cured for a minimum of two hours. Driving the vehicle before the adhesive is allowed to cure properly, will affect the retention of the bearing in the bore of the steering knuckle.

FRONT WHEEL MOUNTING STUDS

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

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

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

REMOVE

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

REMOVAL AND INSTALLATION (Continued)

(2) Remove the front wheel and tire.

(3) Remove the 2 bolts (Fig. 52) attaching the disc brake caliper to the steering knuckle .

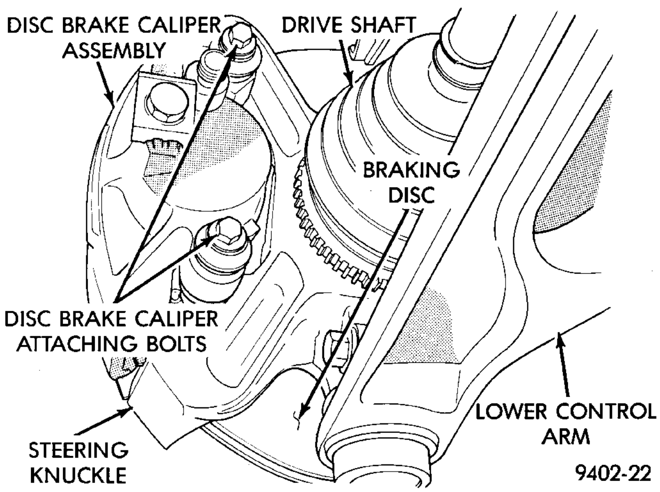


Fig. 52 Caliper Attaching Bolts

(4) Remove the disc brake caliper from the steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 53).

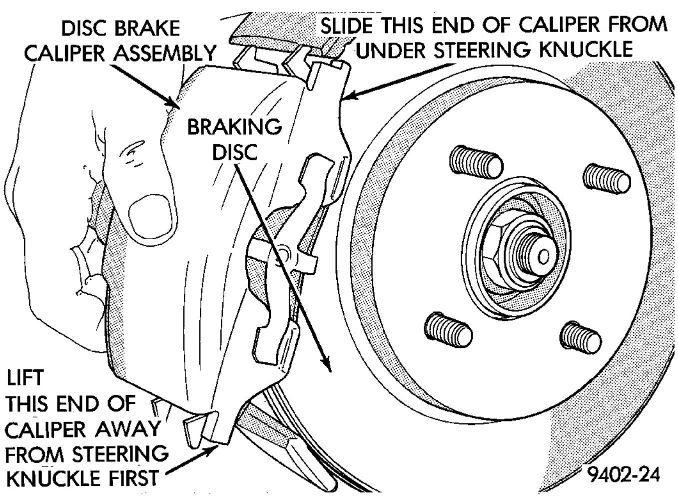


Fig. 53 Brake Caliper Removal

(5) Support the disc brake caliper using a wire hook, (Fig. 54) not by the hydraulic flex hose.

(6) Remove the rotor from the front hub (Fig. 55).

(7) Install a lug nut on the wheel stud being removed from the hub/bearing, so threads on stud are even with end of lug nut (Fig. 56). Rotate hub so stud requiring removal is aligned with notch cast into front of steering knuckle. Install Remover, Special Tool C-4150 on hub/bearing flange and wheel stud (Fig. 56).

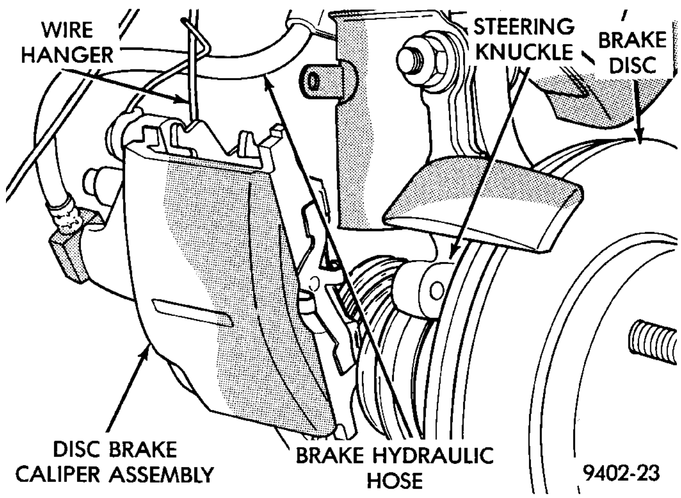


Fig. 54 Correctly Supported Brake Caliper

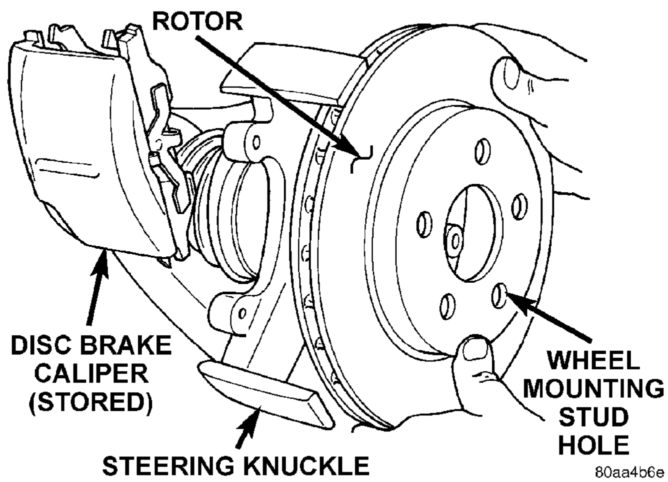


Fig. 55 Remove/Install Rotor

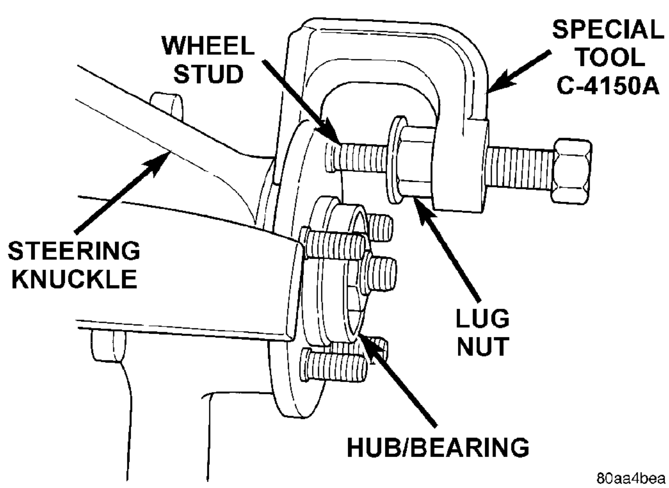


Fig. 56 Removing Wheel Stud From Hub/Bearing

REMOVAL AND INSTALLATION (Continued)

(8) Tighten Special Tool C-4150, pushing the wheel stud out of the hub and bearing flange. When shoulder of wheel stud is past flange remove special tool from hub/bearing. Remove lug nut from stud and remove stud from flange.

INSTALL

(1) Install replacement stud in flange of hub/bearing. Install washers and wheel lug nut on stud (Fig. 57). Lug nut **MUST** be installed with the flat side of the lug nut against the washers (Fig. 57).

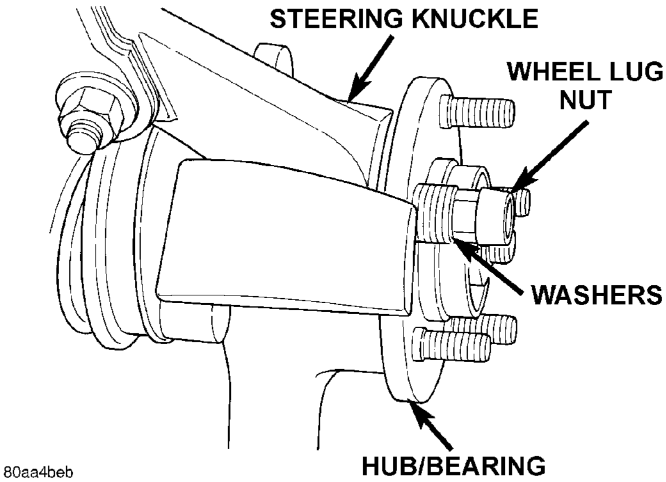


Fig. 57 Installing Wheel Stud

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

(3) Install rotor on front hub (Fig. 55).

(4) Install disc brake caliper on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then install bottom of caliper against bottom abutment on steering knuckle (Fig. 58).

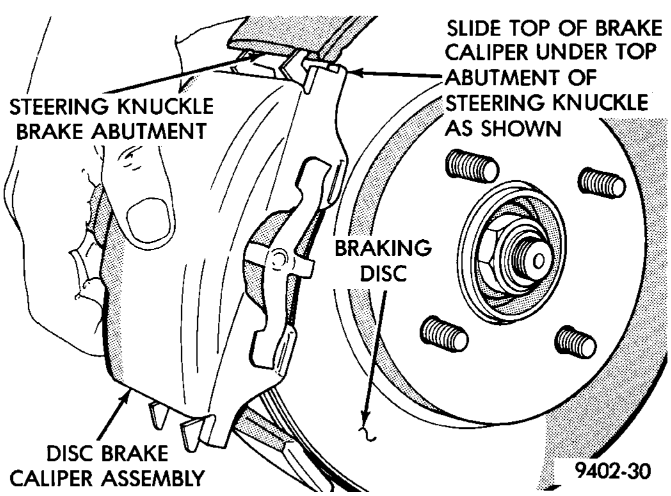


Fig. 58 Disc Brake Caliper Installation

(5) Install the disc brake caliper to steering knuckle attaching bolts (Fig. 53). Tighten the attaching bolts to a torque of 31 N·m (23 ft. lbs.).

(6) Install front wheel and tire. Install front wheel lug nuts and torque to 135 N·m

(7) (100 ft. lbs.).

(8) Lower vehicle.

DISASSEMBLY AND ASSEMBLY

McPHERSON STRUT

DISASSEMBLY

(1) Clamp the strut assembly in a vise, with the strut in a vertical position. **When clamping the strut assembly in the vise, do not clamp strut using the body of the strut only by strut clevis bracket (Fig. 59).**

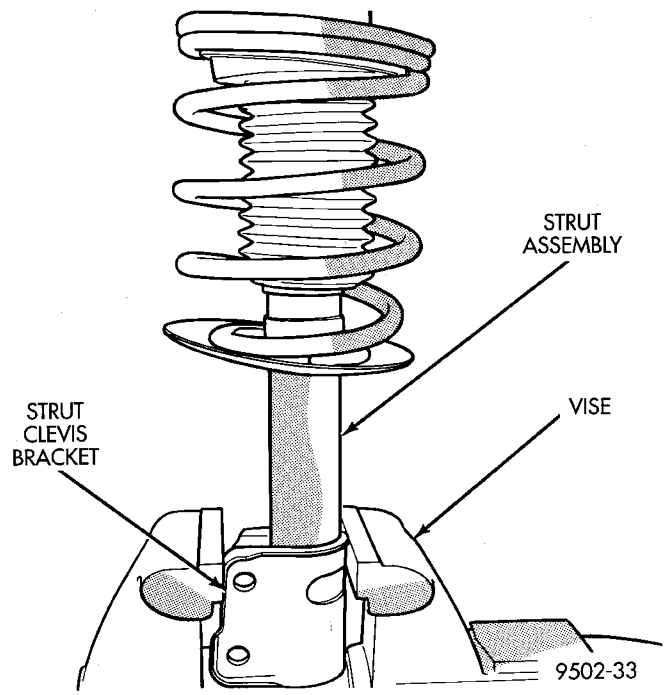


Fig. 59 Strut Assembly Correctly Clamped In Vise

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

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

DISASSEMBLY AND ASSEMBLY (Continued)

WARNING: WHEN COMPRESSING COIL SPRING FOR REMOVAL FROM STRUT ASSEMBLY, THE FIRST FULL TOP AND BOTTOM COIL OF THE COIL SPRING MUST BE CAPTURED BY THE JAWS OF THE COIL SPRING COMPRESSOR (Fig. 60).

(3) Compress the strut assembly coil spring, using Spring Compressor, Special Tool C-4838 (Fig. 60).

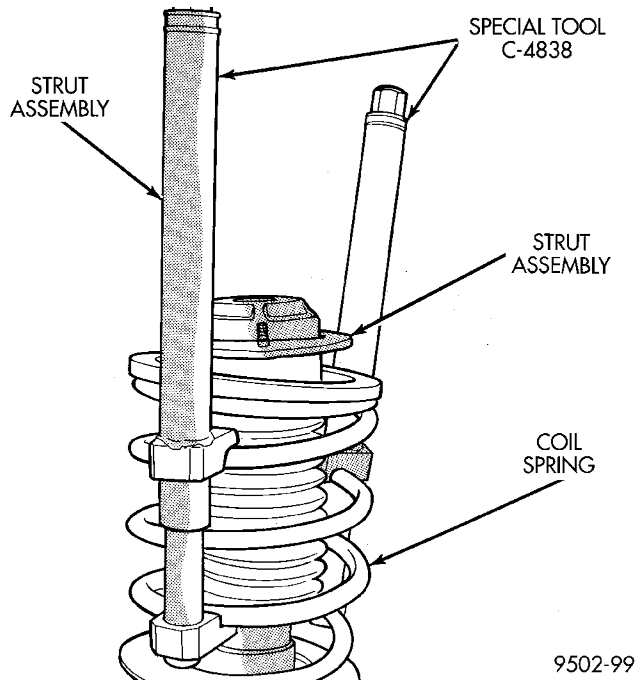


Fig. 60 Compressing Strut Assembly Coil Spring

(4) Install Socket, Strut Nut, Special Tool L-4558A (or L-4558) on the strut shaft retaining nut (Fig. 61). Then install a 10 mm socket on the hex of the strut damper shaft (Fig. 61). While holding strut shaft from turning, remove the strut shaft retaining nut.

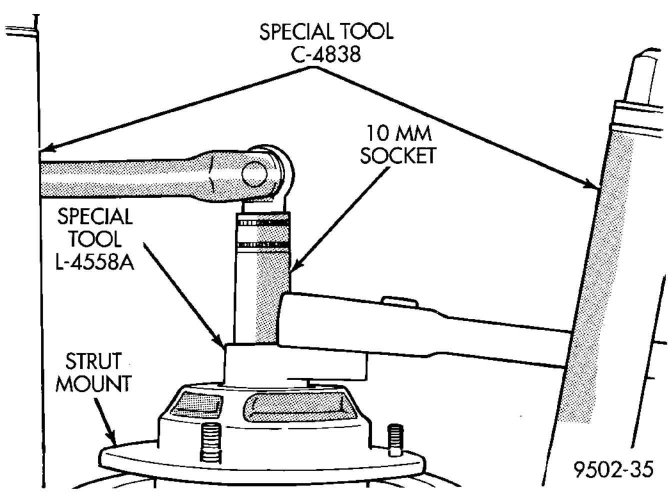


Fig. 61 Strut Shaft Retaining Nut Removal Tools

(5) Remove the strut assembly mount/isolator (Fig. 62) from the strut.

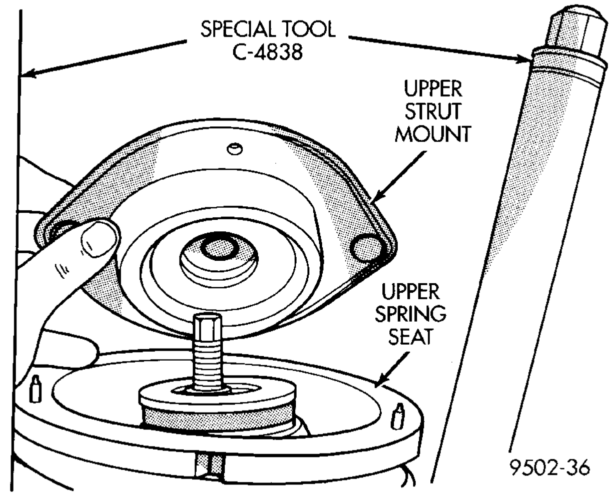


Fig. 62 Strut Mount

(6) Remove the upper spring seat, pivot bearing and dust shield as an assembly (Fig. 63) from the strut.

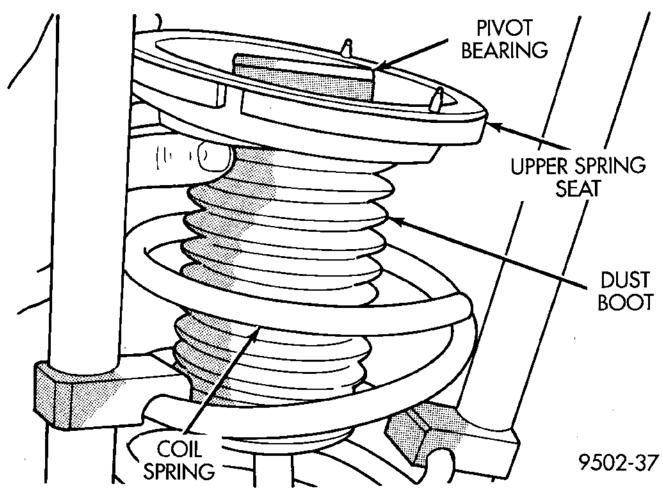


Fig. 63 Upper Spring Seat Assembly

(7) Remove the jounce bumper (Fig. 64) from the shaft of the strut assembly.

(8) Remove the coil spring from the strut assembly (Fig. 65). **Mark left and right on the coil springs for their installation back on the correct side of the vehicle.**

WARNING: IF A REPLACEMENT COIL SPRING IS TO BE INSTALLED ON THE STRUT ASSEMBLY, THE FIRST FULL TOP AND BOTTOM COIL OF THE SPRING MUST BE CAPTURED BY THE JAWS OF THE COIL SPRING COMPRESSOR.

(9) Inspect the strut for any binding of the strut shaft over the full stroke of the shaft.

DISASSEMBLY AND ASSEMBLY (Continued)

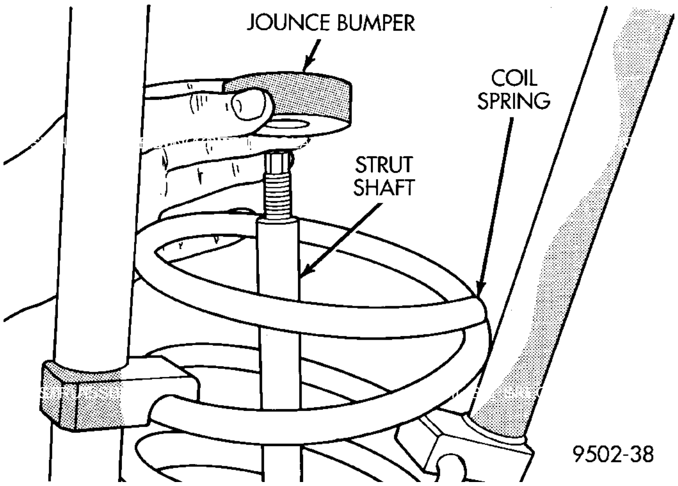


Fig. 64 Jounce Bumper Removal

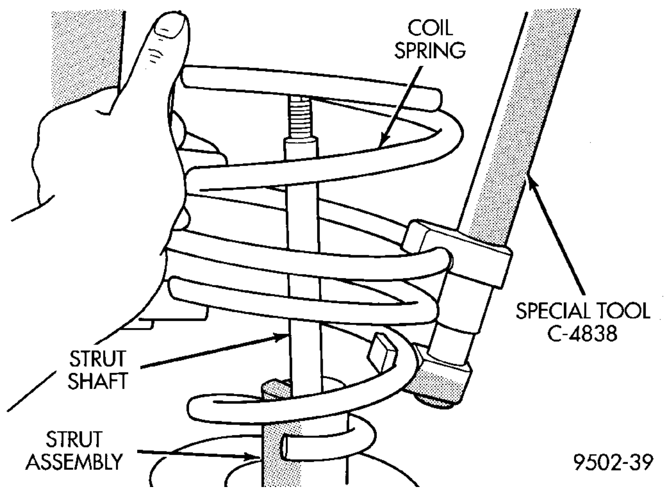


Fig. 65 Strut Assembly Coil Spring

(10) Inspect the strut mount and the upper spring seat assembly (Fig. 66) for any of the following conditions:

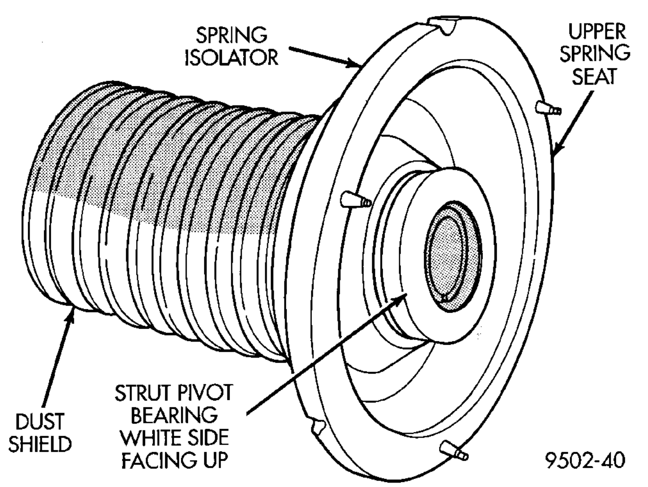


Fig. 66 Upper Spring Mount And Isolator Assembly Components

- Mount for cracks and distortion and retaining studs for any sign of damage.
- Severe deterioration of rubber isolator,
- Binding strut assembly pivot bearing. If pivot bearing is replaced it is to be installed with the white side of bearing facing up (Fig. 66).
- Inspect dust shield for rips and/or deterioration.
- Inspect jounce bumper for cracks and signs of deterioration.

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

ASSEMBLE

(1) Clamp the strut assembly in a vise, with the strut in a vertical position. **When clamping the strut assembly in the vise, do not clamp strut using the body of the strut only by strut clevis bracket (Fig. 59).**

(2) Install the compressed coil spring onto the strut. Coil spring is to be installed with smaller coil down, so spring correctly seats on strut assembly (Fig. 65).

(3) Install jounce bumper on the strut shaft (Fig. 64).

(4) Install dust shield, pivot bearing and upper spring seat as an assembly on the strut (Fig. 63).

(5) Position upper spring seat alignment notch with clevis bracket on strut assembly.

(6) Install strut mount on strut assembly (Fig. 62) and the strut mount retaining nut on the shaft of the strut assembly.

WARNING: THE FOLLOWING 2 STEPS MUST BE COMPLETELY DONE BEFORE SPRING COMPRESSOR, SPECIAL TOOL C-4838 IS RELEASED FROM THE COIL SPRING.

(7) Install Socket, Strut Nut, Special Tool L-4558A (or L-4558) on the strut shaft retaining nut (Fig. 61). Then install a 10 mm socket through the center of the socket and on the hex of the strut shaft (Fig. 61). While holding strut shaft from turning, torque strut shaft retaining nut to 75 N·m (55 ft. lbs.).

(8) Equally loosen both Spring Compressors, Special Tool C-4838 until top coil of spring is fully seated against upper spring seat and strut mount. Then relieve all tension from spring compressors and remove spring compressors from strut assembly spring.

BALL JOINT

DISASSEMBLE

(1) Using a screw driver or other suitable tool, pry seal boot off of ball joint assembly (Fig. 67).

DISASSEMBLY AND ASSEMBLY (Continued)

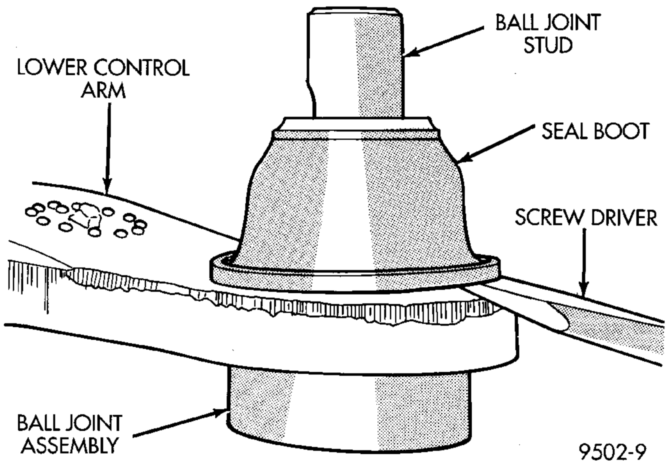


Fig. 67 Ball Joint Seal Boot Removal

(2) Position Receiving Cup, Special Tool 6758 to support lower control arm while receiving ball joint assembly (Fig. 68). Install Remover/Installer, Special Tool 6804 in top of ball joint assembly (Fig. 68).

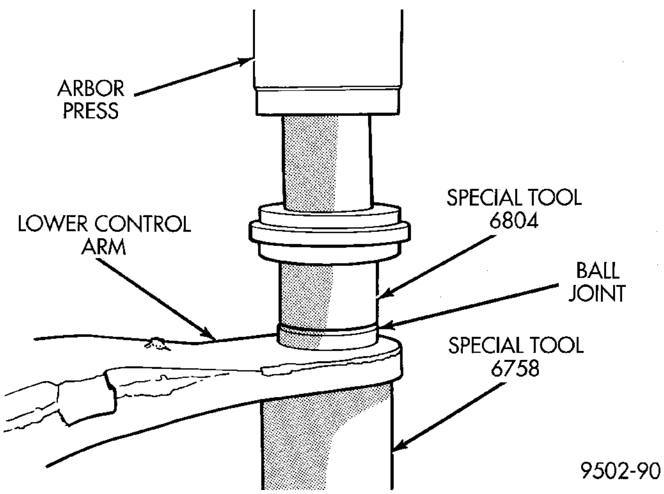


Fig. 68 Removing Ball Joint From Lower Control Arm

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

ASSEMBLE

CAUTION: When installing ball joint in its mounting hole in lower control arm, position ball joint so notch in ball joint stud is facing the front lower control arm bushing. This will ease assembly of ball joint to steering knuckle when attempting to install pinch bolt.

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

(2) Position assembly in an arbor press with Receiving Cup, Special Tool 6758 supporting lower control arm (Fig. 69). Then install Remover/Installer, Special Tool 6804 on the bottom of the ball joint assembly (Fig. 69).

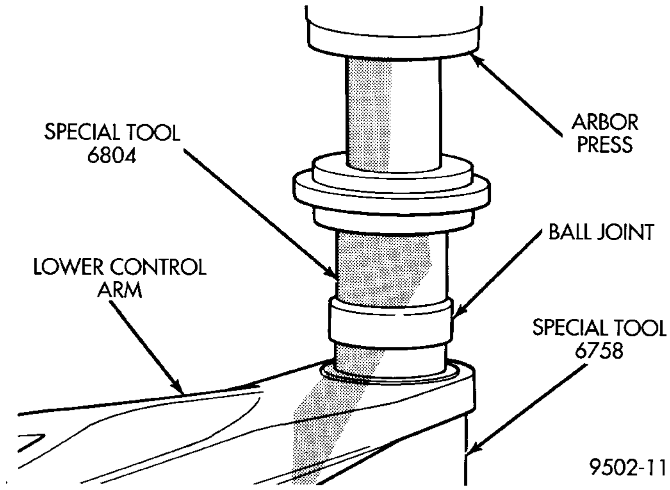


Fig. 69 Installing Ball Joint In Lower Control Arm

(3) Carefully align all pieces. Using the arbor press apply pressure against ball joint assembly (Fig. 69), until ball joint is fully seated against bottom surface of lower control arm. Do not apply excessive pressure against ball joint and lower control arm.

(4) Install a **NEW** ball joint assembly sealing boot on ball joint assembly. Install sealing boot as far as possible on ball joint assembly.

CAUTION: Do not use an arbor press to install the sealing boot on the lower control arm ball joint assembly. Damage to the sealing boot can occur do to excessive pressure applied to sealing boot when being installed.

(5) Position Receiving Cup, Special Tool 6758 over sealing boot so it is aligned properly with bottom edge of sealing boot (Fig. 70). Apply pressure **BY HAND** to special tool 6758, until sealing boot is pressed squarely against top surface of lower control arm.

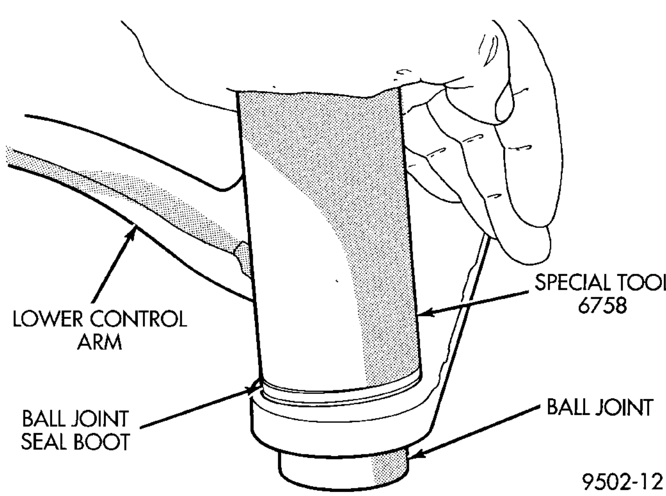


Fig. 70 Ball Joint Seal Boot Installation

DISASSEMBLY AND ASSEMBLY (Continued)

LOWER CONTROL ARM FRONT ISOLATOR BUSHING

DISASSEMBLY

To perform the removal and replacement of the lower control arm front isolator bushing, the lower control arm must be removed from the vehicle.

(1) Remove the lower control arm assembly from the vehicle. See Lower Control Arm in the Removal And Installation Section in this group of the service manual for the required removal procedure.

(2) Mount Remover/Installer, Special Tool C-4212-F in a vise (Fig. 71). Install Bushing Remover, Special Tool 6804 and Bushing Receiver, Special Tool 6758 on Special Tool C-4212-F (Fig. 71).

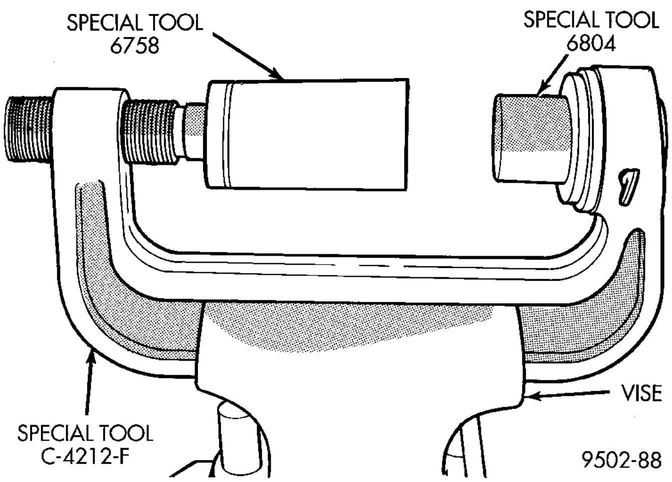


Fig. 71 Special Tools Assembled For Removing Front Bushing

(3) Install lower control arm on Special Tools assembled for removal of the front isolator bushing as shown in (Fig. 72). Be sure Special Tool 6758 is square on lower control arm and Special Tool 6804 is positioned correctly on isolator bushing.

(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press front bushing out of lower control arm.

ASSEMBLY

(1) Mount Installer Cup, Special Tool C-4212-F on Remover/Installer, Special Tool C-4212-F (Fig. 73). Then mount Bushing Installer, Special Tool 6810 on screw portion of Remover/Installer Special Tool C-4212-F (Fig. 73).

(2) Start front bushing into lower control arm **by hand, making sure it is square with its mounting hole in the lower control arm.** Bushing is to be installed in lower control arm from the machined surface side of lower control arm bushing hole (Fig. 74).

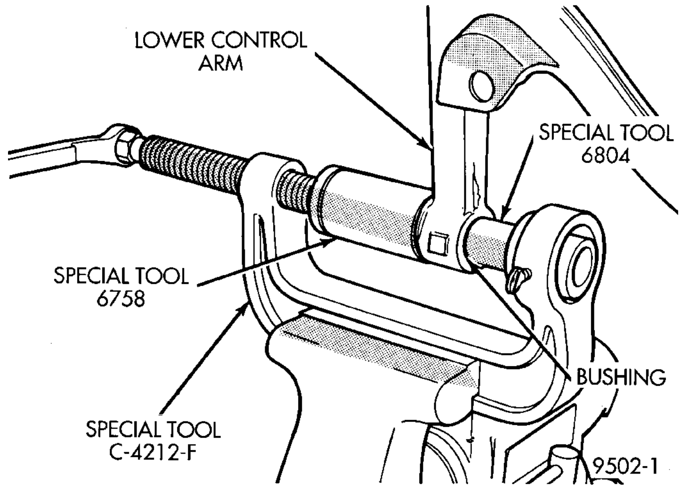


Fig. 72 Removing Front Bushing From Lower Control Arm

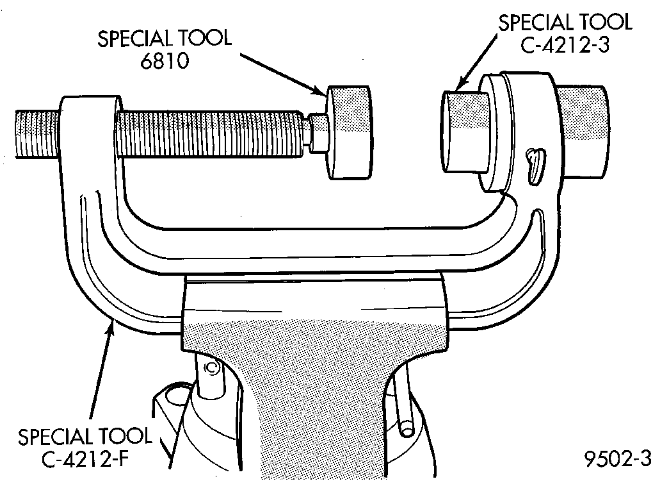


Fig. 73 Special Tools Assembled For Installing Front Bushing

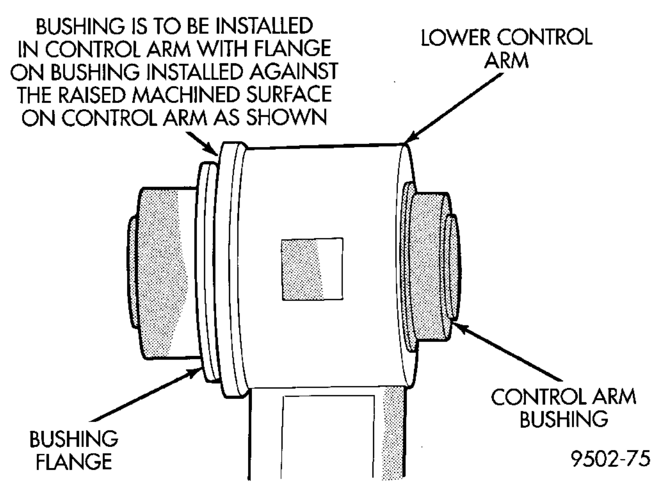


Fig. 74 Installation Direction Of Lower Control Arm Front Bushing

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Install lower control arm as shown in (Fig. 75) on Special Tools assembled for installing front isolator bushing into lower control arm. Be sure Special Tool C-4212-F is square on lower control arm and Special Tool 6810 is positioned correctly on isolator bushing.

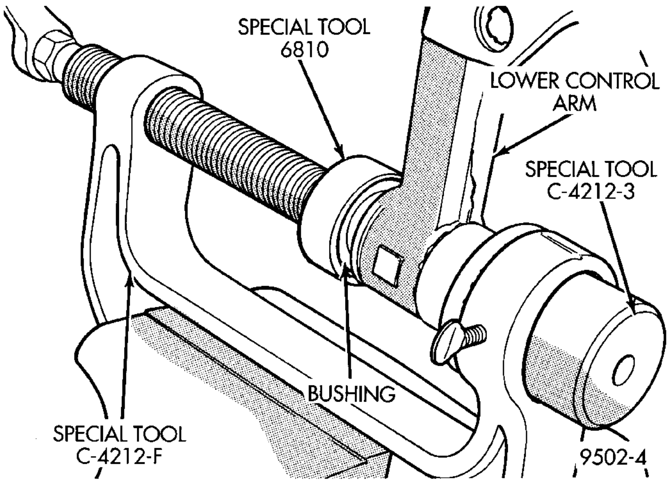


Fig. 75 Front Bushing Installation

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing front bushing into lower control arm. Continue pressing front bushing into lower control arm until special tool 6810 is sitting flush on the machined surface of the lower control arm (Fig. 76). This will correctly position front bushing in lower control arm.

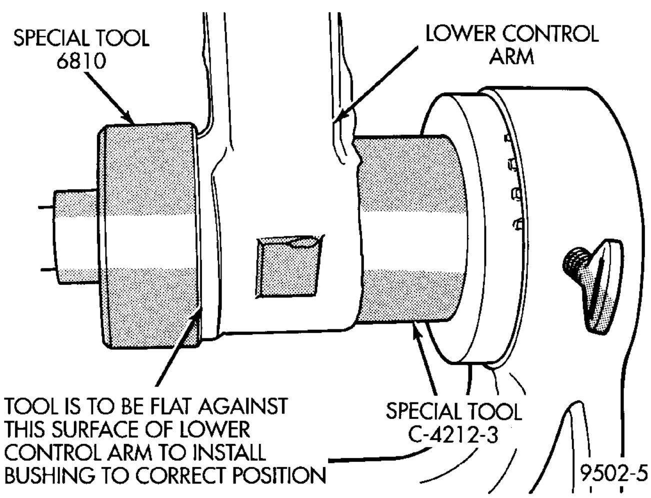


Fig. 76 Installation Position Of Front Lower Control Arm Bushing

(5) Install the lower control arm assembly back on the vehicle. See Lower Control Arm in the Removal And Installation Section in this group of the service manual for the required installation procedure.

LOWER CONTROL ARM REAR ISOLATOR BUSHING

DISASSEMBLY

Removal and installation of the lower control arm rear isolator bushing is done using an arbor press. Do not attempt to use a different procedure from that below for the removal and replacement of rear lower control arm bushing.

(1) Remove the lower control arm assembly from the vehicle. See Lower Control Arm in the Removal And Installation Section in this group of the service manual for the required removal procedure.

(2) Position lower control arm in an arbor press supported at rear bushing using Receiver Cup, Special Tool 6556 (Fig. 77). Position Remover/Installer, Special Tool 6758 on top of rear control arm bushing (Fig. 77).

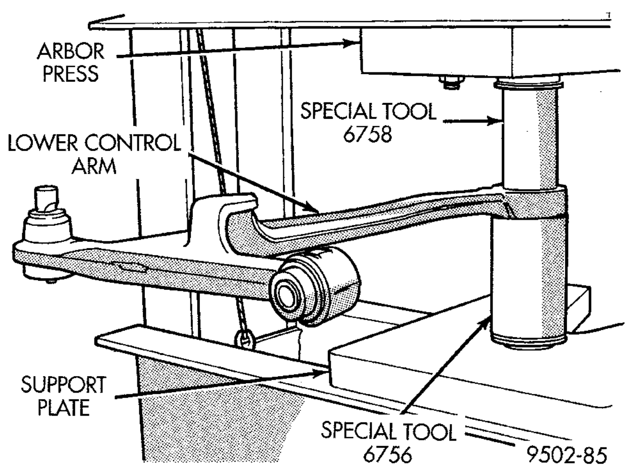


Fig. 77 Special Tools Assembled For Removing Rear Bushing

(3) Press isolator bushing out of the lower control arm.

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

(1) Install the rear bushing into the lower control arm in the direction indicated in (Fig. 78). **Rear bushing must be positioned in lower control arm with the void in the bushing pointing toward the compression strut of the lower control arm as shown in (Fig. 78).**

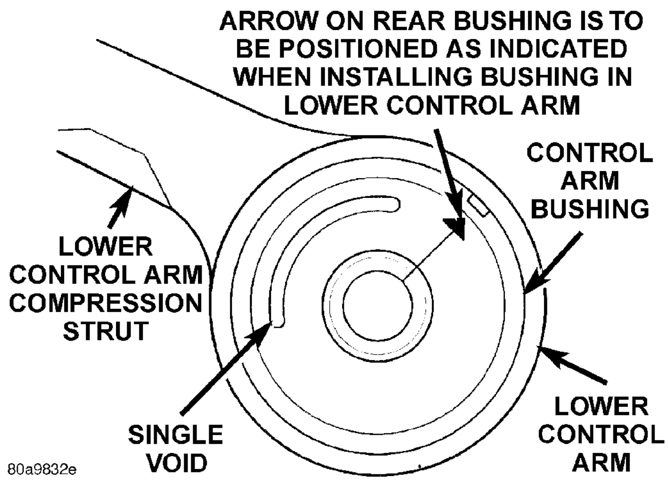


Fig. 78 Correct Installation Of Bushing In Lower Control Arm

(2) Place lower control arm in an arbor press supported at rear bushing hole using Receiver Cup, Special Tool 6556 (Fig. 79). Correctly position Remover/Installer, Special Tool 6760 on top of rear control arm bushing (Fig. 79).

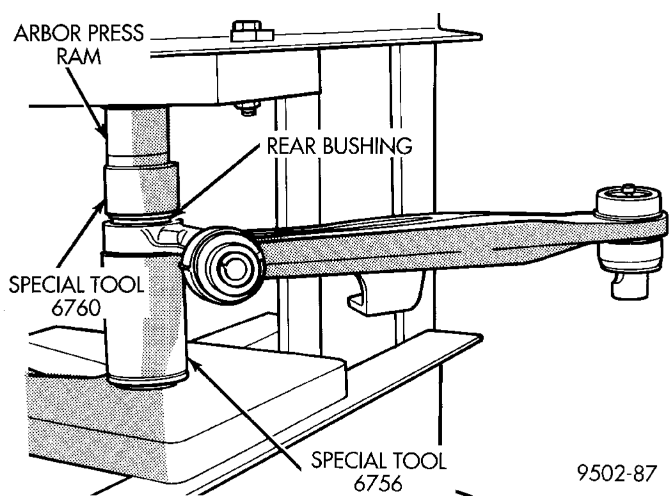


Fig. 79 Rear Bushing Installation

(3) Press rear bushing into lower control arm, until flange on bushing is flush with machined surface of lower control arm (Fig. 80).

(4) Install the lower control arm assembly back on the vehicle. See Lower Control Arm in the Removal And Installation Section in this group of the service manual for the required installation procedure.

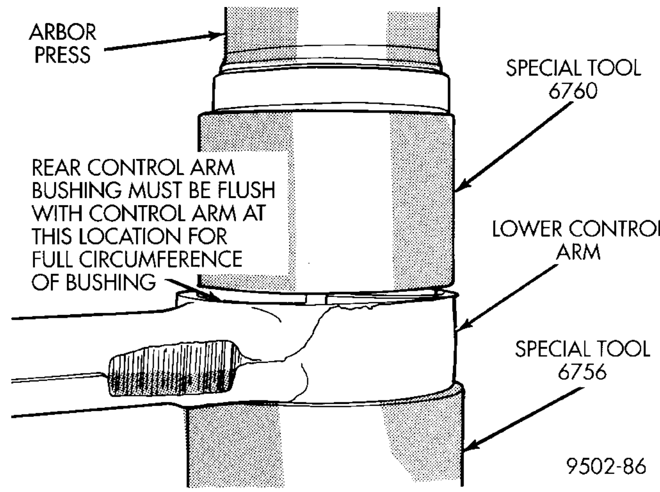


Fig. 80 Correctly Installed Rear Bushing

SPECIFICATIONS

FRONT SUSPENSION FASTENER TORQUES

DESCRIPTION **TORQUE**

McPHERSON STRUT:
To Shock Tower
Attaching Nuts . . . . 34 N·m (300 in. lbs.)
Clevis Bracket To
Steering Knuckle . 54 N·m (40 ft. lbs.) + 90° Turn
Strut Shaft Nut . . . . 74 N·m (55 ft. lbs.)

STEERING KNUCKLE:
Ball Joint Stud To Steering
Knuckle Nut/Bolt . . . . 95 N·m (70 ft. lbs.)
Disc Brake Caliper Bolts . . . . . . 22 N·m (16 ft. lbs.)

STEERING GEAR:
To Crossmember Attaching
Bolts . . . . 68 N·m (50 ft. lbs.)
Tie Rod End Adjusting
Sleeve Nut . . . . 75 N·m (55 ft. lbs.)
Tie Rod End To Steering
Knuckle Nut . . . . 54 N·m (40 ft. lbs.)

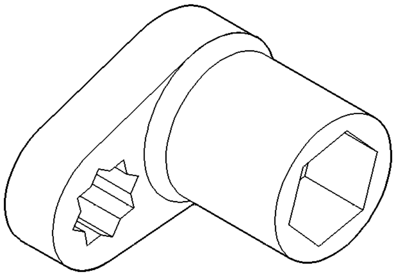
FRONT SUSPENSION CROSSMEMBER:
To Body Attaching Bolts . . . . . 163 N·m (120 ft. lbs.)
Lower Control Arm Pivot
Bolt . . . . 163 N·m (120 ft. lbs.)

STABILIZER BAR:
Bushing Retainer To Crossmember
Bolts . . . . 28 N·m (21 ft. lbs.)
To Control Arm Attaching
Link Nut . . . . 28 N·m (21 ft. lbs.)

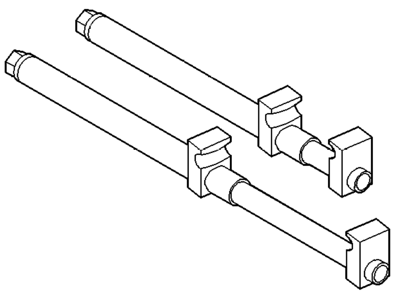
HUB AND BEARING:
Front Stub Axle To Hub
Bearing Nut . . . . 183 N·m (135 ft. lbs.)
Wheel Mounting
Lug Nut . . . . 109-150 N·m (80-110 ft. lbs.)

SPECIAL TOOLS

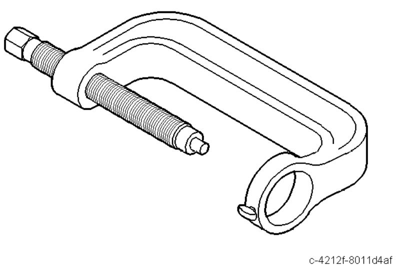
FRONT SUSPENSION



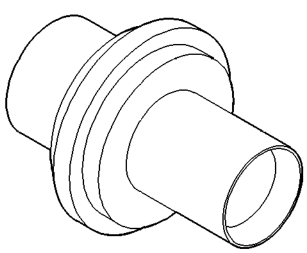
Socket/Holder Front Strut Nut L-4558A



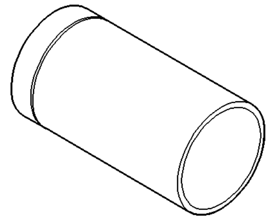
Compressor Strut Coil Spring C-4838



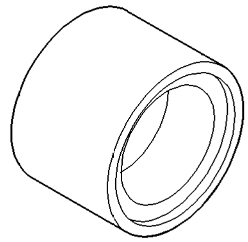
Press Remover/Installer C-4212-F



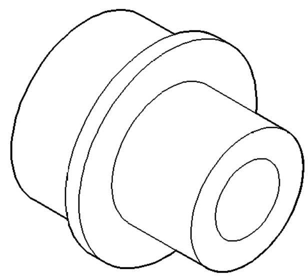
Remover Lower Control Arm Small Bushing And Ball Joint 6804



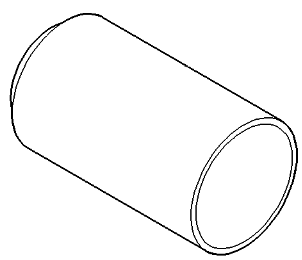
Installer Ball Joint 6758



Installer Lower Control Arm Small Bushing 6810

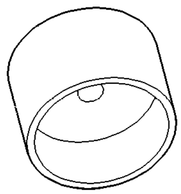


Adapter Ball Joint Remover/Installer C-4212-3

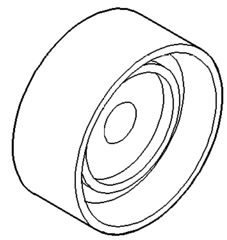


Receiver Ball Joint 6756

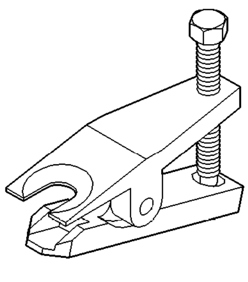
SPECIAL TOOLS (Continued)



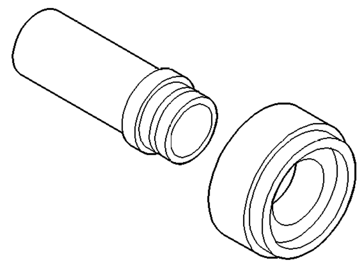
Installer Ball Joint 6760



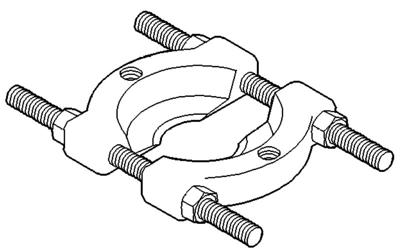
Installer Bearing 5052



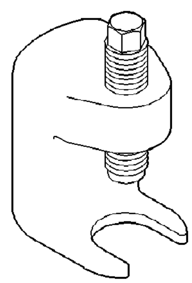
Remover Tie Rod End MB-990635



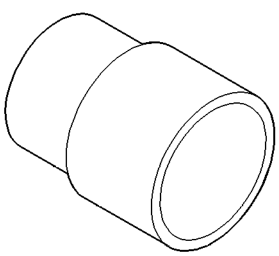
Installer Adapter C-4698-2



Puller Bearing P-334



Remover Lower Ball Joint C-4150A



Remover Ball Joint MB-990799

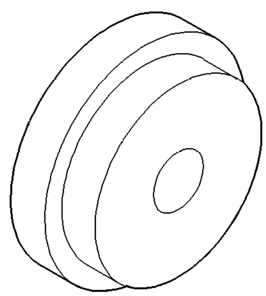
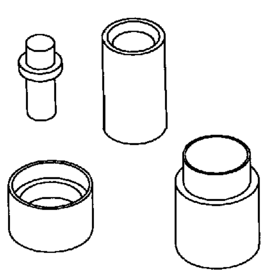


Fig. 81 Installer Bearing Cup 6522



Remover/Installer Lower Control Arm Bushing 6644-2

REAR SUSPENSION

INDEX

GENERAL INFORMATION

GENERAL INFORMATION

CAUTION: Only frame contact or wheel lift hoisting equipment can be used on vehicles having a fully independent rear suspension. Vehicles with independent rear suspension can not be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used damage to rear suspension components will occur.

NOTE: If a rear suspension component becomes bent, damaged or fails, no attempt should be made to straighten or repair it. Always replace with a new component.

DESCRIPTION AND OPERATION

REAR SUSPENSION

The rear suspension system used on this vehicle is a fully independent type rear suspension system (Fig. 1).

DESCRIPTION AND OPERATION (Continued)

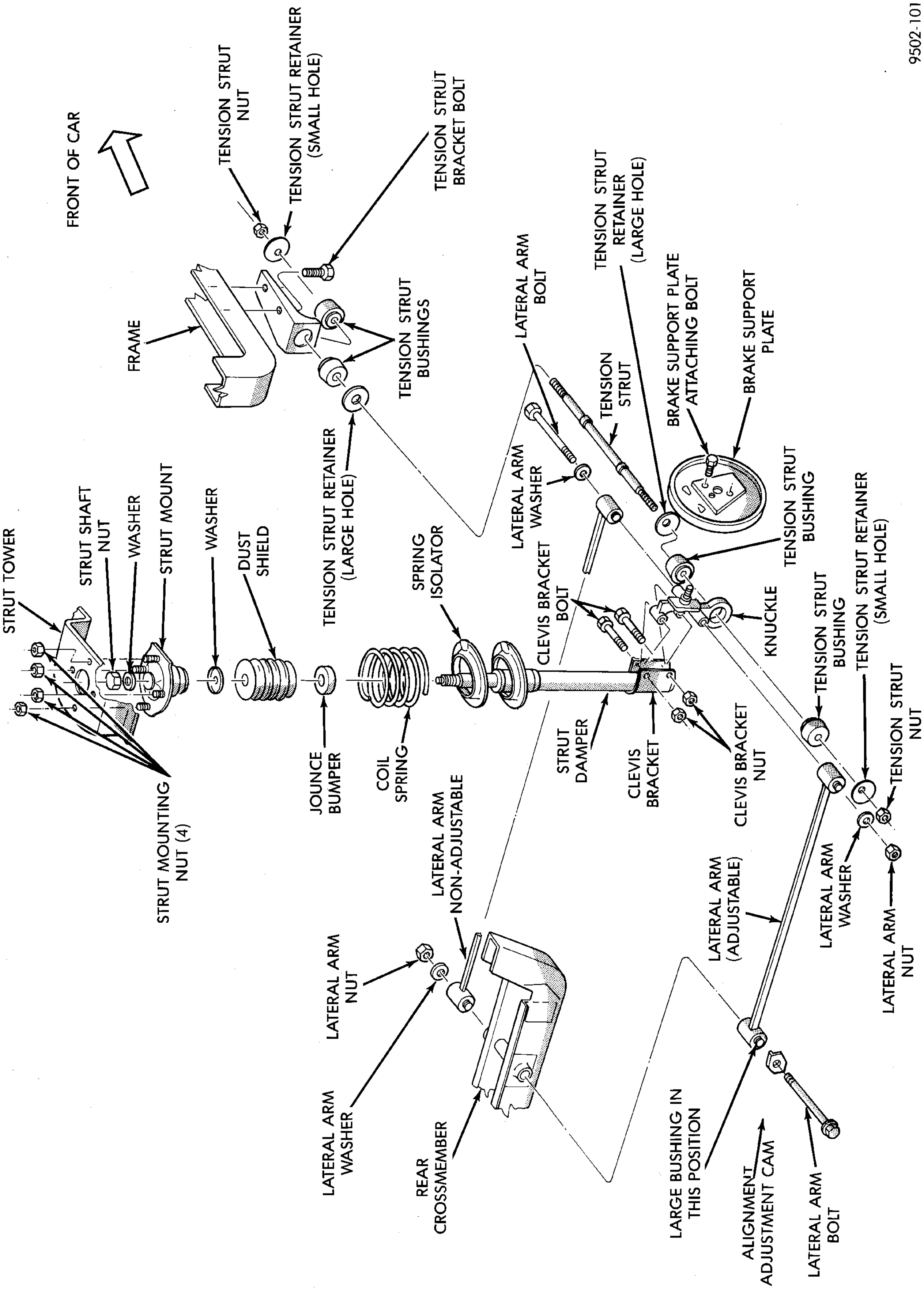


Fig. 1 Neon Fully Independent Rear Suspension

DESCRIPTION AND OPERATION (Continued)

STRUT ASSEMBLY

The rear strut assemblies support the weight of the vehicle using coil springs positioned around the struts. The coil springs are contained between the upper mount of the strut assembly and a lower spring seat on the body of the strut assembly.

The top of each strut assembly is bolted to the top of the inner fender through a rubber isolated mount.

The bottom of the strut assembly attaches to the rear knuckle using 2 thru-bolts and prevailing torque nuts. Rear Caster and camber on this vehicle is a fixed setting (net build) and is not required to be adjusfted as a normal procedure when performing an alignment on this vehicle.

COIL SPRING

Rear coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. During service procedures when both rear coil springs are removed, mark the coil springs to ensure installation of the springs in their original position. **If coil springs require replacement, be sure the springs needing replacement, are replaced with springs meeting the correct load rating for the vehicle and its specific options.**

STABILIZER BAR

The stabilizer bar interconnects both rear strut assemblies and is attached to the rear frame rails of the vehicle.

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

Attachment of the stabilizer bar to the rear frame rails of the vehicle is through 2 rubber-isolator bushings and bushing retainers. The stabilizer bar to strut assembly attachment is done utilizing a rubber isolated stabilizer bar attaching link. All parts of the stabilizer bar are serviceable, and the stabilizer bar to frame rail isolator bushings are split for easy removal and installation. The split in the stabilizer bar to crossmember bushing must be positioned toward the rear of the vehicle, when the stabilizer bar is installed on the vehicle.

KNUCKLE

A forged rear knuckle bolts to each rear strut assembly. The movement of the rear knuckle is controlled laterally using two lateral arms attached to the knuckle. The outboard ends of the two lateral arms are mounted forward and rearward of the spindle centerline, and inboard ends are mounted to the rear crossmember. Fore and aft movement of the knuckle is controlled by using a tension strut.

LATERAL LINKS AND TENSION STRUTS

The lateral arms and tension strut have rubber isolator bushings at each end. The lateral arms are attached to the rear crossmember and knuckle, using a unique bolt and nut assembly at each end. The lateral arm to rear crossmember attaching bolts are longer than the lateral arm to knuckle attaching bolts. Each lateral arm to knuckle attaching bolt and nut assembly uses 2 flat washers. Each lateral arm to rear crossmember attaching bolt uses 1 flat washer and 1 adjustment cam to provide a means for rear wheel Toe adjustment. The tension strut assembly attaches to a bracket on the frame rail and to the bottom of the knuckle.

Lateral arms, tension struts and knuckles are normally replaced only when the part has been damaged or when the vehicle has been involved in an accident. If a suspension part has been damaged, be sure to check the underbody dimensions of the car. If underbody dimensions of the vehicle are not correct, the frame must be straightened before replacement suspension components are installed.

DIAGNOSIS AND TESTING

STRUT INSPECTION (ON VEHICLE)

(1) Inspect for damaged or broken coil springs (Fig. 2).

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

(3) Inspect for damaged lower spring isolator (Fig. 2).

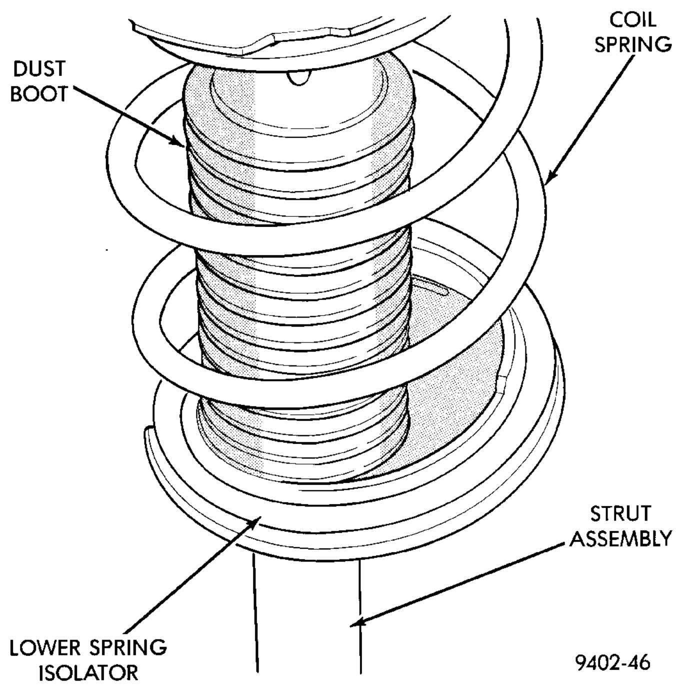


Fig. 2 On Vehicle Strut Assembly Inspection

DIAGNOSIS AND TESTING (Continued)

(4) Lift dust boot and inspect strut assembly for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off lower end of unit). A slight amount of seepage between the strut rod and strut shaft seal is not unusual and does not affect performance of the strut assembly (Fig. 3). Also inspect jounce bumpers for signs of damage or deterioration.

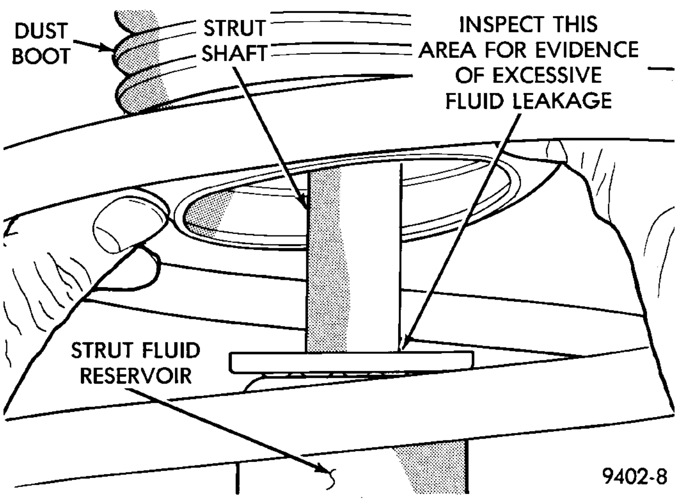


Fig. 3 Strut Assembly Leakage Inspection

SUSPENSION KNUCKLE

The rear suspension knuckle is not a repairable component of the rear suspension. If it is determined that the knuckle is broken or bent when servicing the vehicle, no attempt is to be made to repair or to straighten the knuckle. **THE KNUCKLE MUST BE REPLACED IF FOUND TO BE DAMAGED IN ANY WAY.**

LATERAL LINKS

Inspect the lateral link isolator bushings and sleeves for signs of damage or deterioration. If the lateral link isolator bushings or sleeves are damaged or are deteriorated, replacement of the lateral link assembly will be required. The isolator bushings are not serviceable as a separate component of the lateral link assembly.

Inspect the lateral links for signs of contact with the ground or road debris which has bent or caused other damage to the lateral link assembly. If the lateral link is bent or damaged, the lateral link will require replacement. **Do not attempt to repair or straighten a lateral link.**

TENSION STRUT

Inspect the tension strut bushings and retainers for signs of deterioration or damage. If the tension strut bushings are deteriorated or the retainers are damaged, replacement of the tension strut bushings and or the retainers will be required. The bushings and retainers are serviceable as separate components of the tension strut.

Inspect the tension strut for signs of contact with the ground or road debris which has bent or caused other damage to the tension strut. If the tension strut is bent or damaged the tension strut will require replacement. **Do not attempt to repair or straighten a tension strut.**

STABILIZER BAR AND BUSHINGS

Inspect the stabilizer bar for damage or bending. Inspect for broken or distorted stabilizer bar bushings, bushing retainers, and worn or damaged stabilizer bar to strut attaching links. If stabiizer bar to rear frame rail bushing replacement is required, bushings can be removed from sway bar by opening slit and peeling bushing off sway bar.

STABILIZER BAR ATTACHING LINKS

Inspect the bushings and sleeves in the stabilizer bar attaching links for damage or deterioration. Inspect the stabilizer bar attaching link to ensure it is not bent or broken. If any of these conditions are present when inspecting the attaching links, replacement of the attaching link is required.

SERVICE PROCEDURES

REAR WHEEL ALIGNMENT

Refer to Front And Rear Wheel Toe Setting Procedures in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required rear wheel Toe setting procedure.

REMOVAL AND INSTALLATION

STRUT ASSEMBLY

REMOVE

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

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

(3) Remove hydraulic flex hose bracket, from bracket on rear strut assembly (Fig. 4). If vehicle is equipped with Anti-Lock brakes, the wheel speed sensor cable routing clip is also attached to the strut assembly bracket.

(4) Support rear knuckle, suspension and brake components of vehicle before removing clevis bracket to knuckle attaching bolts. **Do not let weight of**

REMOVAL AND INSTALLATION (Continued)

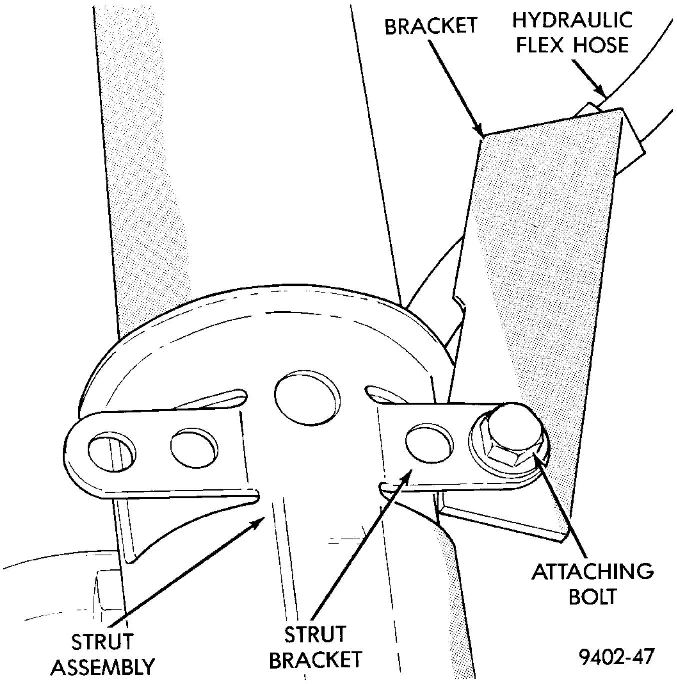


Fig. 4 Hydraulic Flex Hose Bracket Attachment To Strut

rear knuckle and assembled components hang unsupported when strut is removed.

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

(5) Remove the 2 clevis bracket bolts (Fig. 5) attaching strut assembly to rear knuckle.

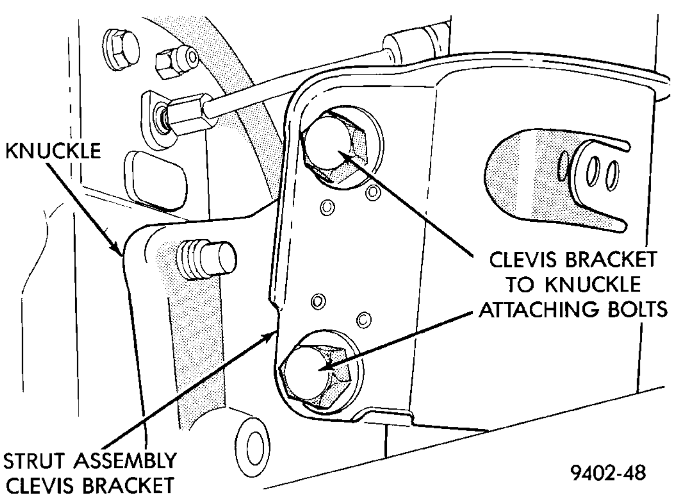


Fig. 5 Knuckle To Clevis Bracket Bolts

(6) Lower vehicle. Access to rear upper strut mount to strut tower attaching bolts, is through the trunk of the vehicle.

(7) Remove carpet (if required) from top of strut tower. Then remove rubber dust shield (Fig. 6) from top of strut tower, this will allow easier access to upper strut mount attaching nuts.

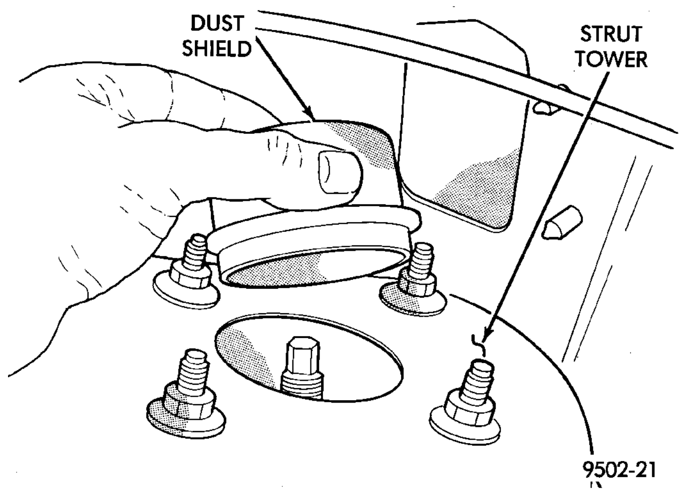


Fig. 6 Dust Shield Removal From Strut Tower

(8) Loosen but do not remove the 4 upper strut mount to strut tower attaching nuts (Fig. 7). Then while supporting the strut assembly fully remove the 4 strut mount attaching nuts.

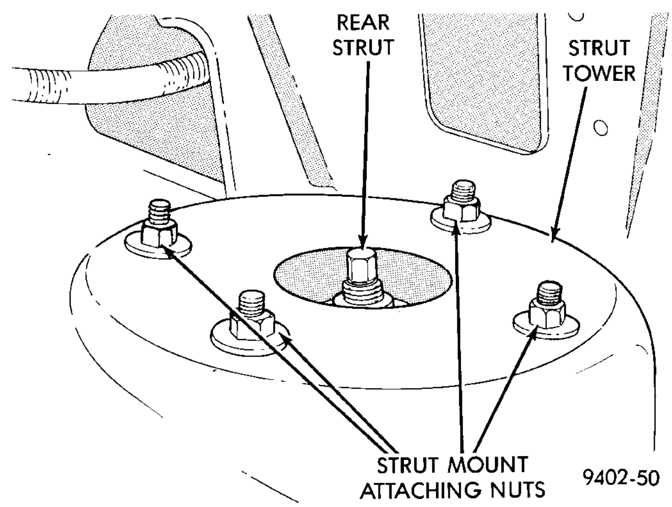


Fig. 7 Strut Mount Attaching Nuts

(9) Remove strut assembly from knuckle, by sliding knuckle out of clevis bracket on strut assembly. Then remove strut assembly from vehicle.

INSTALL

(1) Position strut assembly back into vehicle with the 4 studs on strut mount assembly through holes in strut tower of vehicle. Install the 4 strut mount to body attaching nuts (Fig. 7) onto mount studs. Torque the 4 strut mount to body attaching nuts to 34 N·m (300 in. lbs).

REMOVAL AND INSTALLATION (Continued)

(2) Install dust shield into hole on top of strut tower (Fig. 6). Install carpeting back on top of rear strut tower.

(3) Raise vehicle.

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

(4) Install knuckle assembly into clevis bracket on strut assembly. Install the 2 clevis bracket to knuckle assembly attaching bolts and nuts (Fig. 5). Torque both clevis bracket to knuckle assembly attaching nuts to 95 N·m (70 ft. lbs.).

(5) Install hydraulic flex hose bracket, on strut assembly bracket (Fig. 4). Install and securely tighten bolt attaching hose bracket to strut bracket. If vehicle is equipped with Anti-Lock brakes, the wheel speed sensor cable routing clip is also attached to the strut assembly bracket.

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

(7) Lower vehicle to the ground.

(8) Check and reset rear wheel TOE to specifications if required. Refer to Front And Rear Toe Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required Toe setting procedure.

COIL SPRING

Coil 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. 8) 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 and spring rate for the vehicle.**

NOTE: During service procedures requiring removal or installation of a coil spring with Spring Compressor, Special Tool C-4838. It is required that the first full top and bottom coil of the coil spring be captured by the jaws of spring compressor (Fig. 8).

Replacement of the coil spring requires removal of the strut assembly from the vehicle, and the disassembly of the strut. Refer to strut assembly in the removal and installation section in this group of the service manual for the required removal and replacement procedure for the strut assembly. Then refer to

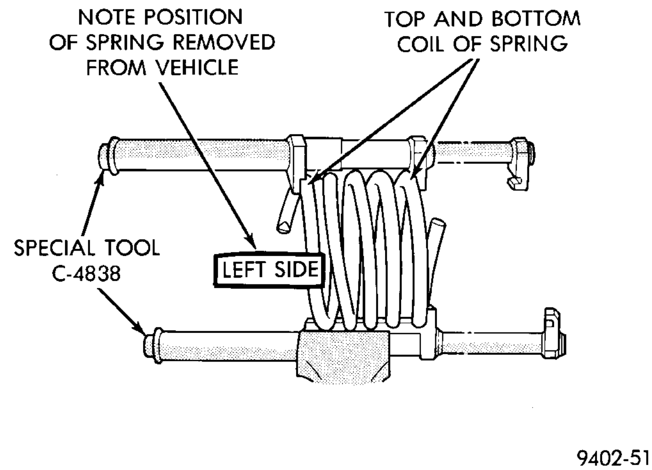


Fig. 8 Identifying Coil Springs

strut assembly in the disassembly and assembly section in this group of the service manual for the required procedure to disassemble and assemble the strut assembly for the removal of the coil spring.

STABILIZER BAR

REMOVE

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

(2) Remove both rear wheel and tire assemblies from the vehicle.

(3) Remove rear stabilizer bar from the 2 stabilizer bar to strut attaching links (Fig. 9).

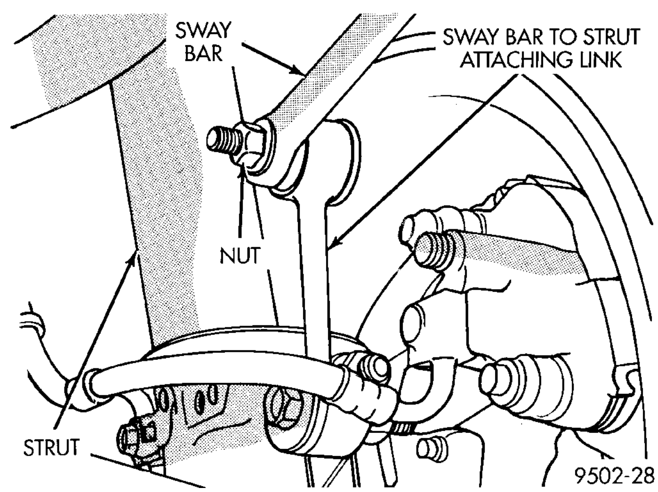


Fig. 9 Sway Bar To Strut Attaching Link

(4) Rotate stabilizer bar down slightly to clear attaching links.

(5) Remove the 2 stabilizer bar to rear frame rail retainers (Fig. 10).

REMOVAL AND INSTALLATION (Continued)

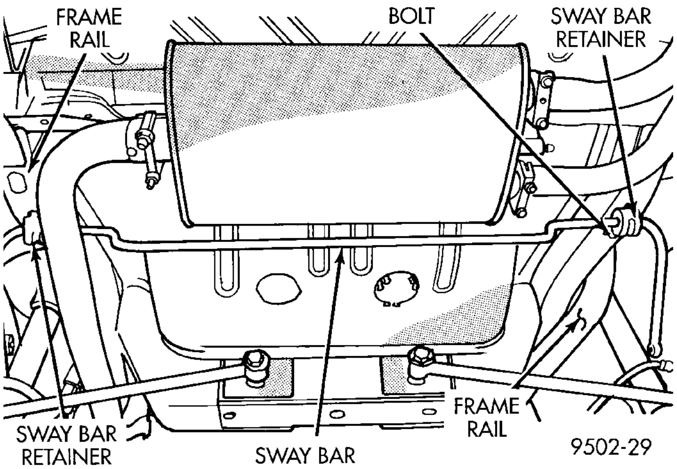


Fig. 10 Sway Bar To Frame Rail Retainers

(6) Remove stabilizer bar from vehicle.

STABILIZER BAR AND BUSHING INSPECTION

Inspect for broken or distorted retainers and bushings. If bushing replacement is required, bushing can be removed by opening slit in bushing and removing bushing from around stabilizer bar. When bushings are installed on stabilizer bar, bushings must be installed with slit positioned on stabilizer bar so slit will face rear of vehicle when stabilizer bar is installed (Fig. 11).

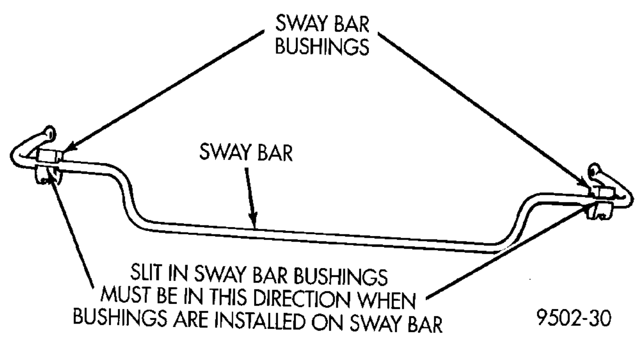


Fig. 11 Bushings Correctly Installed On Stabilizer Bar

INSTALL

(1) Install stabilizer bar and isolator bushings back into the vehicle as an assembly. Position stabilizer bar so it is centered in the vehicle and does not contact other suspension components or vehicle body.

(2) Install the 2 stabilizer bar to frame rail retainers into frame rail and loosely install both retainer attaching bolts (Fig. 10).

(3) Position both stabilizer bar to strut assembly attaching links on stabilizer bar. Install and securely tighten the stabilizer bar attaching link to stabilizer bar attaching nuts (Fig. 9).

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

(5) Lower the vehicle to the ground.

(6) With suspension supporting the full weight of the vehicle, securely tighten the stabilizer bar retainer to frame rail attaching bolts (Fig. 9).

KNUCKLE

REMOVE

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

(2) Remove the rear wheel and tire.

(3) If vehicle is equipped with rear disc brakes, remove the rear caliper from the adapter. Refer to Rear Disk Brakes in Group 5 Brakes of this Service manual for required caliper removal procedure. After removing the caliper, store the caliper by hanging it from frame of the vehicle (Fig. 12). Do not let weight of rear caliper hang from flexible brake hose.

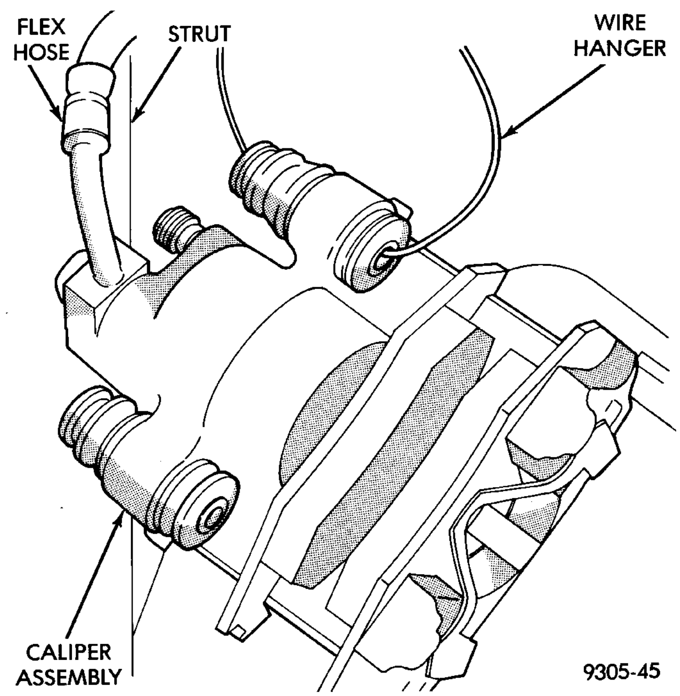


Fig. 12 Storing Rear Caliper

(4) If vehicle is equipped with rear disc brakes, remove rotor from hub. If vehicle is equipped with rear drum brakes, remove brake drum from hub.

(5) If vehicle is equipped with ABS brakes, remove the speed sensor head from the rear disc brake adapter (Fig. 13).

REMOVAL AND INSTALLATION (Continued)

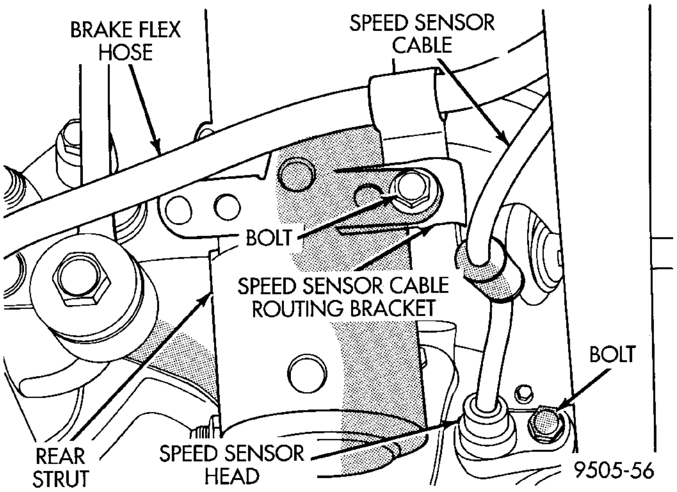


Fig. 13 Speed Sensor Head Attachment To Disc Brake Adapter

(6) Remove rear hub/bearing retaining nut (Fig. 14). Then remove the hub/bearing from the knuckle.

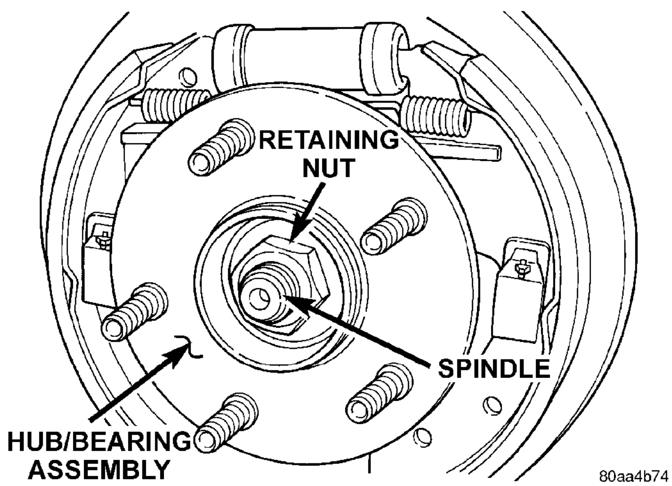


Fig. 14 Hub/ Bearing Retaining Nut

(7) If vehicle is equipped with rear drum brakes remove the 4 bolts (Fig. 15) attaching rear brake support plate to knuckle. Then remove brake support plate, brake shoes and wheel cylinder as an assembly from rear knuckle (Fig. 15). **It is not necessary to remove brake flex hose from wheel cylinder when removing support plate.** Brake support plate when removed, must be supported in same manner as caliper assembly.

(8) On vehicles equipped with rear disc brakes, remove the 4 bolts attaching disc brake adapter to rear knuckle (Fig. 16). Then remove the adapter, rotor shield, park brake shoes and park brake cable as an assembly from knuckle.

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

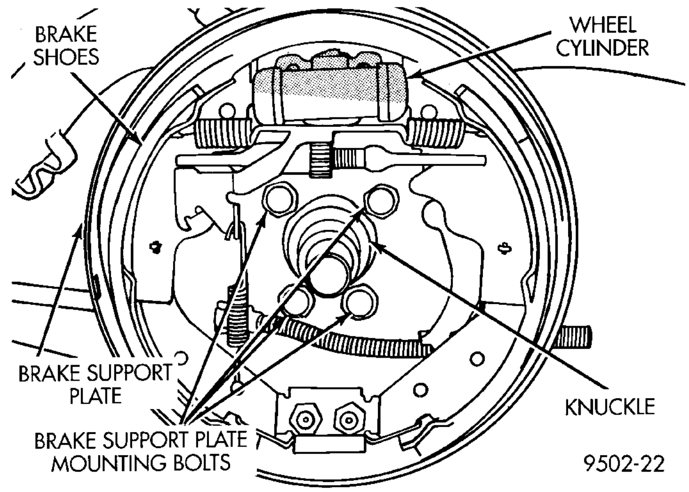


Fig. 15 Drum Brake Support Plate Mounting Bolts

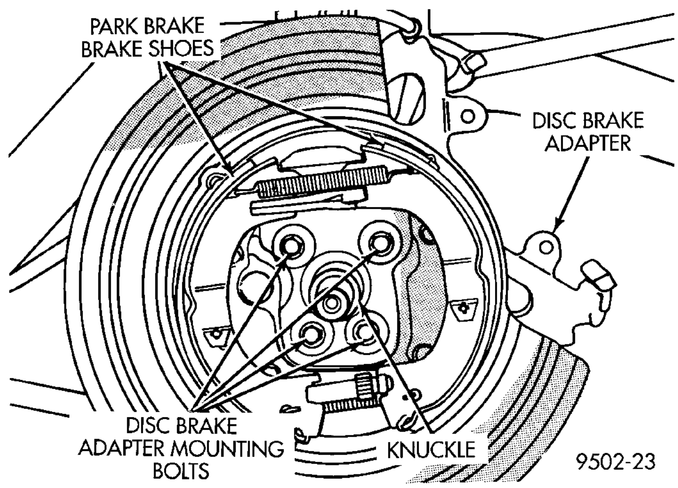


Fig. 16 Disc Brake Adapter Mounting

(9) Loosen but do not remove at this time, the 2 strut assembly to knuckle attaching bolts (Fig. 17). Then remove the lateral links to knuckle attaching bolt (Fig. 17).

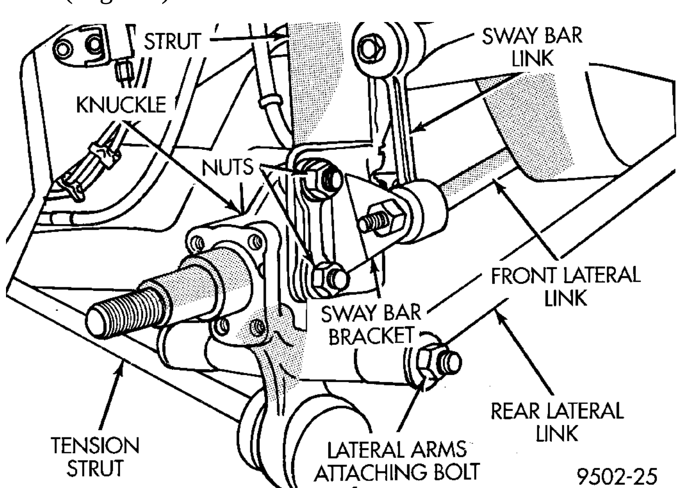


Fig. 17 Knuckle To Strut And Lateral Arm Mounting Bolts

REMOVAL AND INSTALLATION (Continued)

(10) Hold tension strut from turning by using a large adjustable wrench on flat of tension strut (Fig. 18) and remove tension strut nut. Then remove nut, tension strut retainer and rear tension strut bushing from tension strut at rear knuckle (Fig. 18).

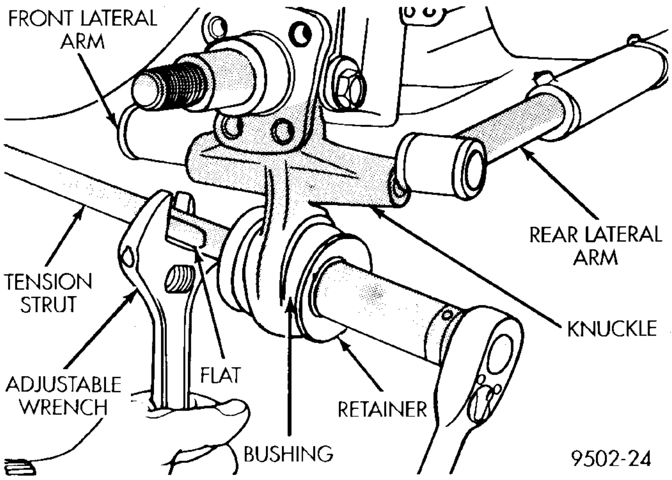


Fig. 18 Tension Strut To Rear Knuckle Attachment

(11) Remove both rear knuckle to strut assembly clevis bracket attaching bolts (Fig. 17). If vehicle is equipped with a rear sway bar also remove the sway bar link to strut mounting bracket (Fig. 17).

(12) Remove knuckle assembly from strut, by sliding knuckle straight out of clevis bracket on strut assembly. Then remove knuckle from tension strut.

INSTALL

(1) Insert tension strut, tension strut bushing and tension strut retainer into knuckle. Then install knuckle into clevis bracket on rear strut assembly. **Be sure stepped area of bushing is squarely seated into hole in knuckle.**

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

(2) Install the 2 strut assembly clevis bracket to knuckle attaching bolts and nuts (Fig. 17). Torque the attaching bolts to 95 N·m (70 ft. lbs.).

(3) Install the lateral arms to knuckle attaching bolt, washers and nut as shown in (Fig. 17). **Do not tighten the lateral link bolt at this time. The vehicle must be at curb height when tightening the lateral link bolts.**

(4) Install tension strut bushing, tension strut retainer and nut on tension strut (Fig. 19). **When installing tension strut retainers, the retainers must be installed on tension strut, with cupped side of retainer facing away from bushing and knuckle (Fig. 19).**

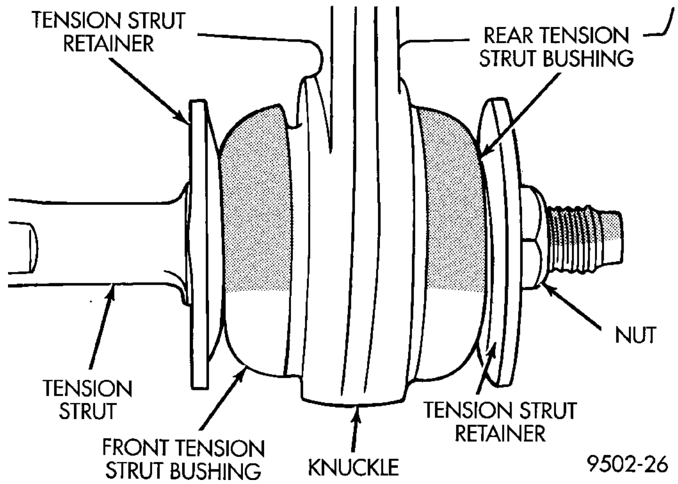


Fig. 19 Tension Strut Bushings Installed On Tension Strut

(5) Position a large adjustable wrench on flat of tension strut to keep it from turning, (Fig. 20) and then torque tension strut nut to 95 N·m (70 ft. lbs.).

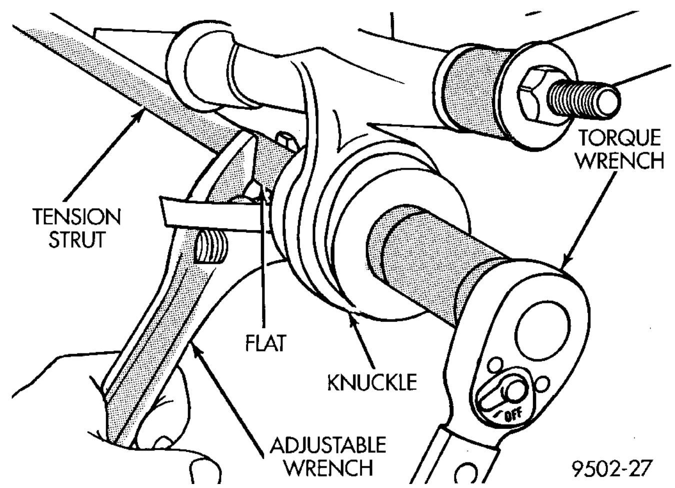


Fig. 20 Torquing Tension Strut Nut

(6) On vehicles equipped with rear drum brakes, install rear brake support plate assembly onto the knuckle (Fig. 15). Install the 4 bolts (Fig. 15) attaching rear brake support plate to rear knuckle. Torque attaching bolts to 68 N·m (50 ft. lbs.).

(7) On vehicles equipped with rear disc brakes, install the disc brake adapter on knuckle (Fig. 16) Install the 4 bolts attaching the disc brake adapter to knuckle (Fig. 16). Torque attaching bolts to 68 N·m (50 ft. lbs.).

(8) If vehicle is equipped with ABS brakes, install speed sensor head into rear brake support plate or disc brake adapter or (Fig. 13). Torque speed sensor head mounting bolt to 7 N·m (60 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

CAUTION: The hub/bearing retaining nut must be tightened to but must not exceed its required torque specification. The proper torque specification of the retaining nut is critical to the life of the hub bearing.

(9) Install rear hub and bearing assembly on knuckle. Install hub and bearing assembly retaining nut (Fig. 14), and torque to 217 N·m (160 ft. lbs).

(10) If vehicle is equipped with rear disc brakes, install rear braking disc on hub. If vehicle is equipped with rear drum brakes, install the brake drum on hub.

(11) If vehicle is equipped with rear disc brakes, install rear braking disc on hub. Carefully install rear brake caliper over braking disc and install on adapter. Tighten the caliper assembly to adapter mounting bolts to 22 N·m (192 in. lbs.). Refer to Rear Disc Brakes in Group 5 Brakes in this service manual for required caliper installation procedure.

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

(13) Lower vehicle.

(14) With suspension supporting total weight of vehicle, and lateral links at correct curb height, torque both lateral link attaching bolts to 95 N·m (70 ft. lbs.).

(15) Check and reset rear wheel TOE to specifications if required. Refer to Front And Rear Toe Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required Toe setting procedure.

LATERAL LINKS

The rear suspension lateral links (Fig. 21) are only serviced as complete assemblies. The isolator bushings used in the lateral links are not serviced as separate components. The rear lateral link assemblies are unique, having different size bushings to accommodate the rear Toe adjustment cams. The rearward lateral links, must be installed with small bushing sleeve at knuckle and large bushing sleeve at rear crossmember. This is required to accommodate the rear Toe adjustment cam.

REMOVE

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

(2) Remove the rear wheel and tire assembly from the side of the vehicle requiring lateral link removal.

(3) Remove the nut, bolt and washers attaching the lateral links to the knuckle (Fig. 22).

(4) Remove nut, bolt, washer and Toe adjustment cam, attaching lateral links requiring removal, from rear crossmember (Fig. 23). Then remove lateral links from vehicle.

INSTALL

Rear lateral links when being installed, must be specifically positioned and orientated on the vehicle.

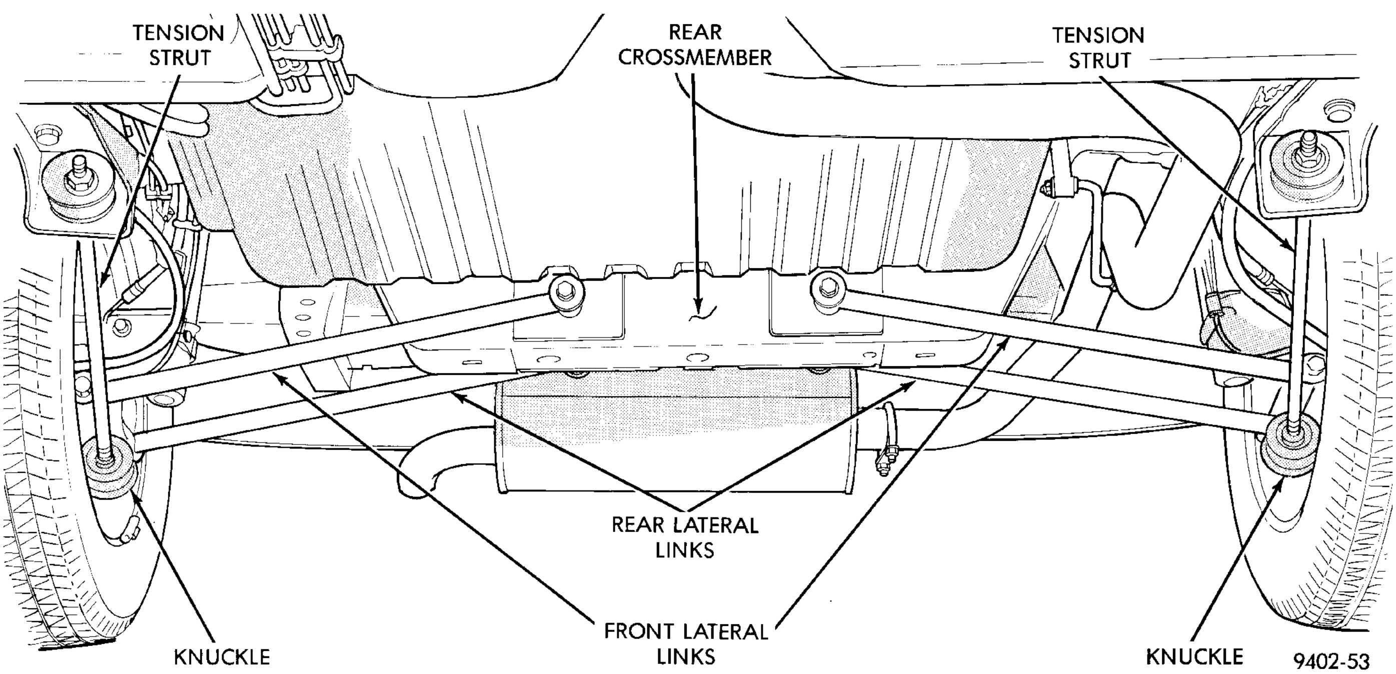


Fig. 21 Rear Suspension Lateral Links

REMOVAL AND INSTALLATION (Continued)

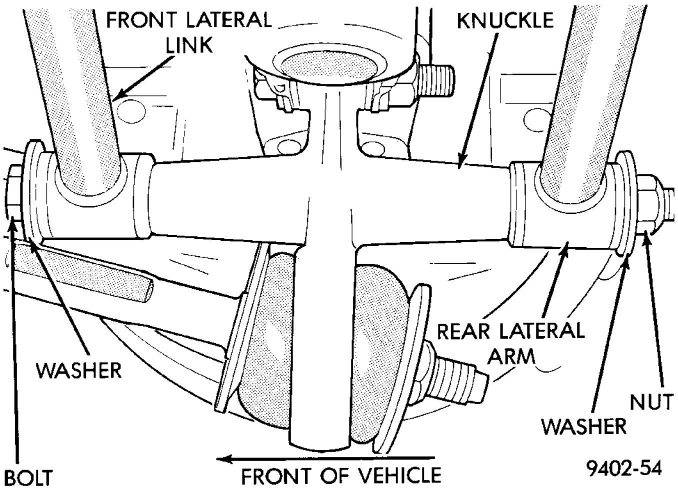


Fig. 22 Lateral Link Attachment To Knuckle

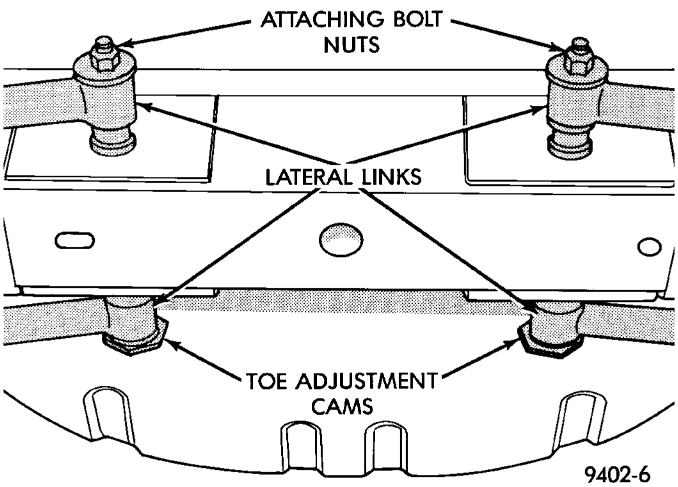


Fig. 23 Lateral Link Attachment To Crossmember

The lateral link having same size bushing sleeves, must be mounted to the crossmember and knuckle toward front of vehicle. The lateral link with different size bushing sleeves, must be mounted to the crossmember and knuckle toward rear of vehicle. The lateral link with small and large bushing sleeves, must be installed with small bushing sleeve at knuckle and large bushing sleeve at rear crossmember. This is required to accommodate the rear Toe adjustment cam at rear crossmember.

The lateral link mounting bolts are different lengths, and need to be installed in specific locations and direction on vehicle. **The lateral link mounting bolt at knuckle MUST be installed, with head of bolt facing front of vehicle. The lateral link mounting bolt at crossmember MUST be installed, with head of bolt facing rear of vehicle. The long attaching bolt must be used at rear crossmember and short bolt used at knuckle.**

(1) Install washer on short lateral link attaching bolt. Then install short lateral link attaching bolt, into lateral link having the same size bushing sleeves. Then install lateral link, bolt and washer onto knuckle as an assembly, with head of bolt facing to front of vehicle (Fig. 22).

(2) Install lateral link with small and large bushing sleeve, on lateral link attaching bolt in rear knuckle (Fig. 22). **Small bushing sleeve must be installed on bolt in rear knuckle with large bushing sleeve at crossmember of vehicle.**

(3) Install washer and nut onto lateral link attaching bolt at rear knuckle (Fig. 22). **Do not tighten the lateral link to rear knuckle attaching bolt at this time.**

(4) Install Toe adjustment cam on long lateral link attaching bolt. Install long lateral link attaching bolt and adjustment cam, into lateral link toward rear of vehicle, having the large bushing sleeve. Then pass lateral link attaching bolt into rear crossmember (Fig. 24). **Head of long lateral link to crossmember attaching bolt must face to rear of vehicle when installed.**

(5) Position forward rear lateral link against rear crossmember (Fig. 24). Then pass the lateral link attaching bolt through front lateral link bushing sleeve.

(6) Install washer and nut onto lateral link attaching bolt at rear crossmember (Fig. 24). **Do not tighten the lateral link to rear crossmember attaching bolt at this time.**

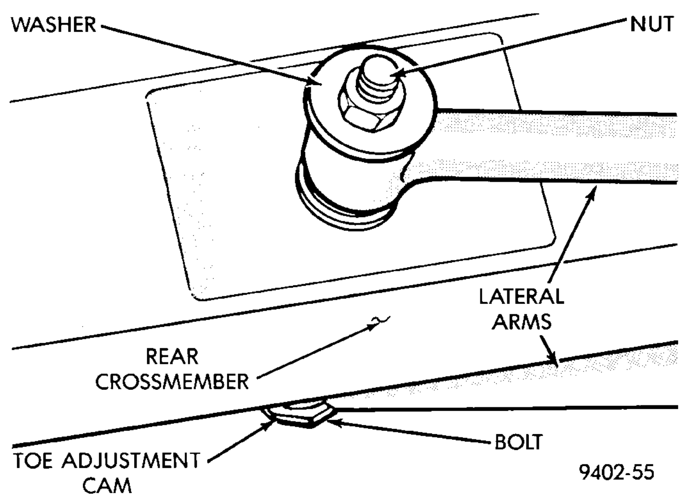


Fig. 24 Lateral Link Attachment To Crossmember

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

(8) Lower vehicle to the ground.

REMOVAL AND INSTALLATION (Continued)

(9) With suspension supporting total weight of vehicle, and lateral links at correct curb height, torque both lateral link attaching bolts to 95 N·m (70 ft. lbs.).

(10) Check and reset rear wheel TOE to specifications if required. Refer to Front And Rear Toe Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required Toe setting procedure.

DISASSEMBLY AND ASSEMBLY

STRUT ASSEMBLY

DISASSEMBLY

The rear strut unit is not serviced and must be replaced as an assembly if found to be defective. The strut is available with 2 calibrations, be sure strut is replaced with an assembly of the same calibration.

The components of the strut assembly listed below are replaceable if found to be defective.

- Coil spring (Coil springs come in a standard rate of 120 lb./in. be sure spring is replaced with a spring of the same rate.)
- Dust shield
- Mount assembly
- Jounce Bumper
- Lower Spring Isolator
- Shaft Nut

(1) Remove strut assembly requiring service from the vehicle. Refer to Strut Assembly Removal in Servicing Rear Struts, in this section of the service manual.

(2) Position strut assembly in a vise (Fig. 25). Using paint or equivalent, mark the strut unit, lower spring isolator, spring and upper strut mount for indexing of the parts at assembly.

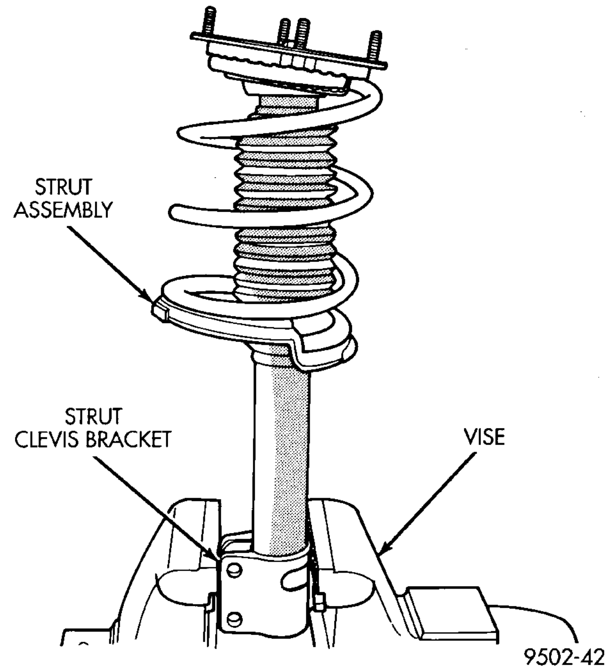


Fig. 25 Strut Assembly Mounted In Vise

(3) Position Spring Compressors, Special Tool C-4838 on the strut assembly spring (Fig. 26). Compress coil spring until all load is removed from upper strut mount assembly.

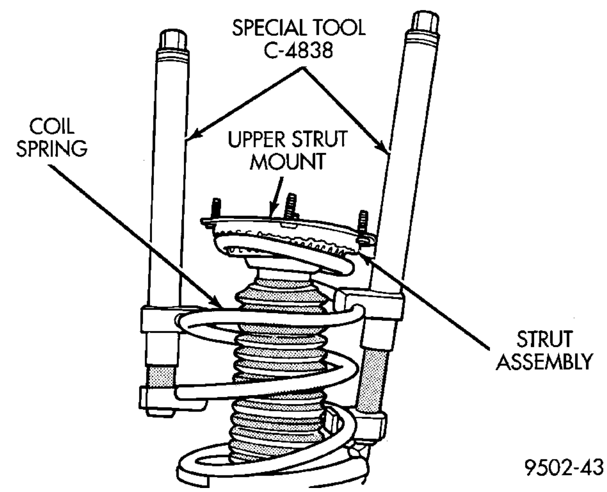


Fig. 26 Compressing Strut Assembly Coil Spring

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Install Strut Rod Socket, Special Tool, L-4558A or L-4558 on strut shaft nut (Fig. 27). Inserted a 10 mm socket through special tool and onto end of strut shaft (Fig. 27) to keep strut shaft from turning. Remove strut shaft nut from strut shaft.

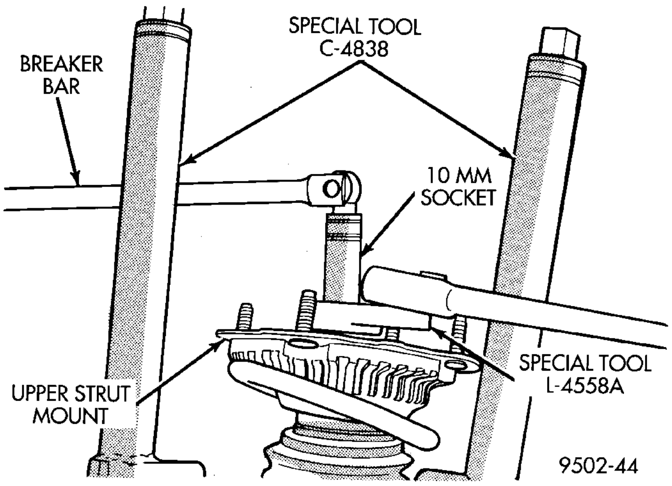


Fig. 27 Removing/Installing Strut Shaft Nut

(5) Remove washer (Fig. 28) between strut shaft nut and upper strut mount and isolator.

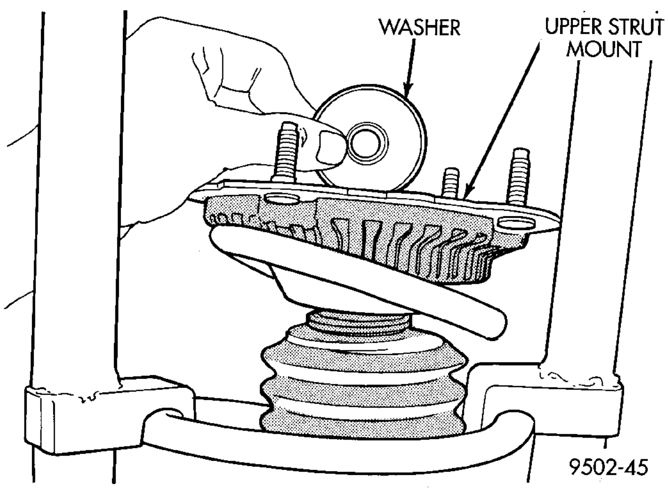


Fig. 28 Strut Mount Washer

(6) Remove upper strut mount assembly from strut shaft and spring (Fig. 29).

(7) Remove the washer from strut shaft, that is between the strut upper mount assembly and dust shield (Fig. 30).

(8) Remove the coil spring and spring compressor as an assembly from the strut (Fig. 31).

(9) Remove the dust shield from the strut assembly (Fig. 32).

(10) Remove the jounce bumper (Fig. 33) from the shaft of the strut assembly.

(11) Remove the coil spring lower isolator from the strut assembly spring seat (Fig. 34).

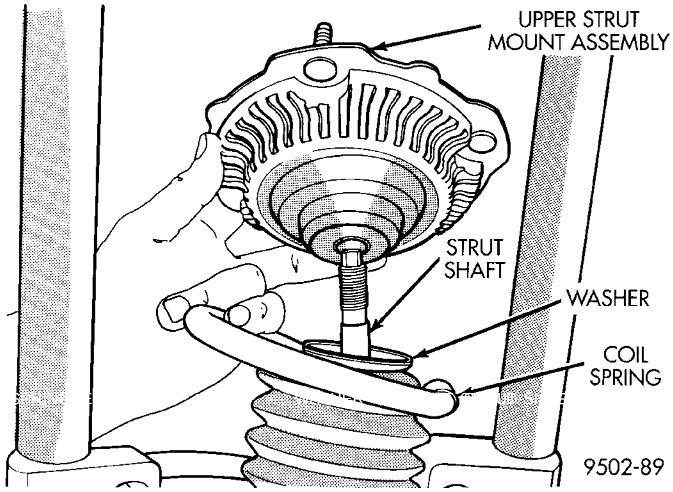


Fig. 29 Upper Strut Mount

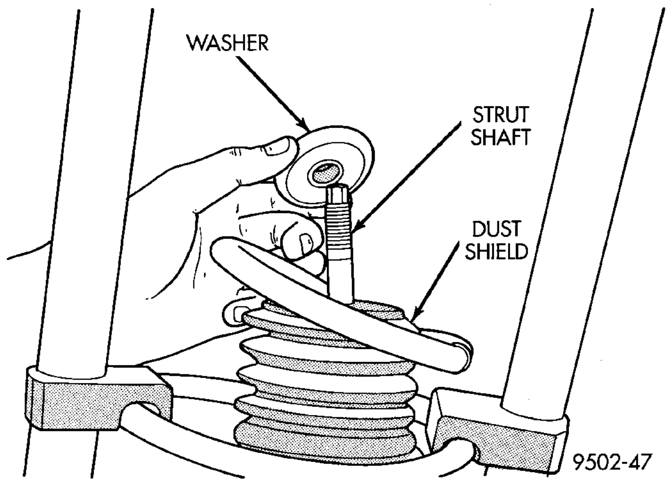


Fig. 30 Washer

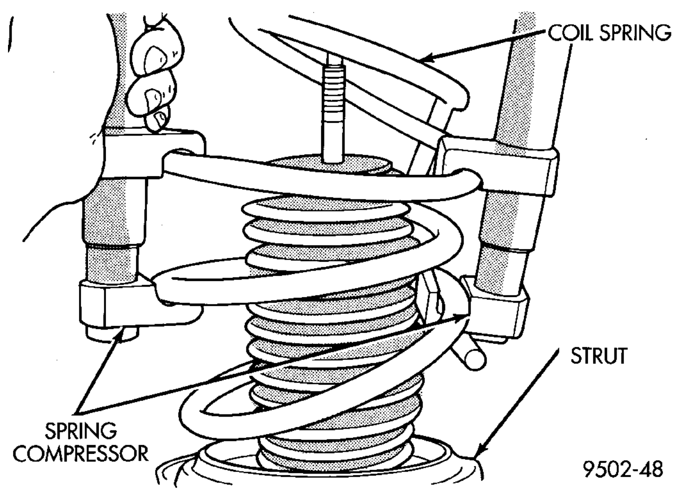


Fig. 31 Coil Spring And Compressor

(12) Inspect all disassembled components for signs of abnormal wear or failure replacing any components as required. Inspect strut unit for signs of abnormal oil leakage and for loss of gas charge. To

DISASSEMBLY AND ASSEMBLY (Continued)

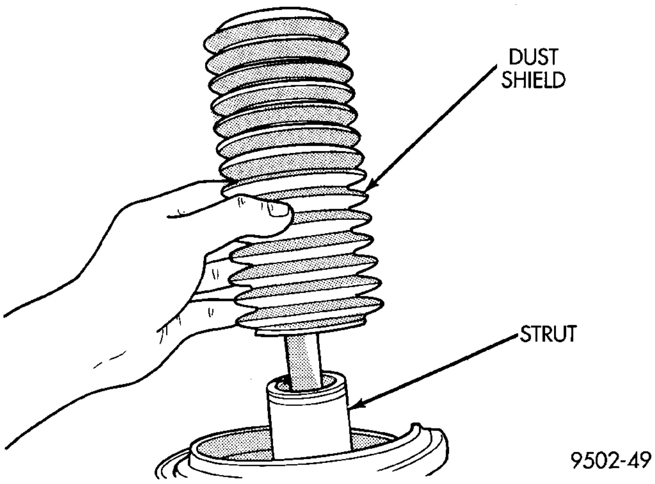


Fig. 32 Dust Shield

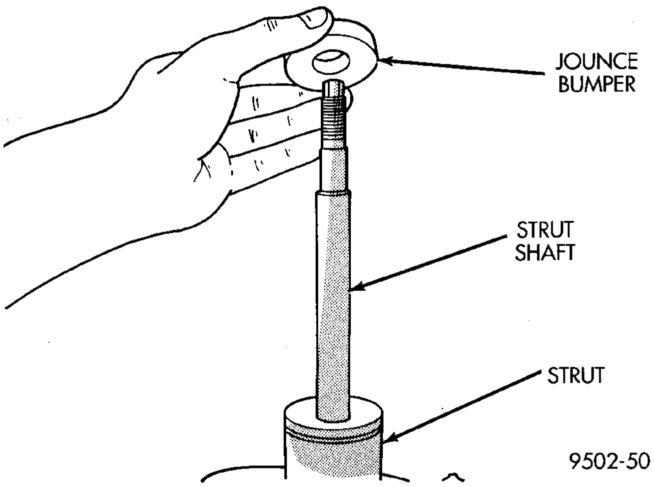


Fig. 33 Jounce Bumper

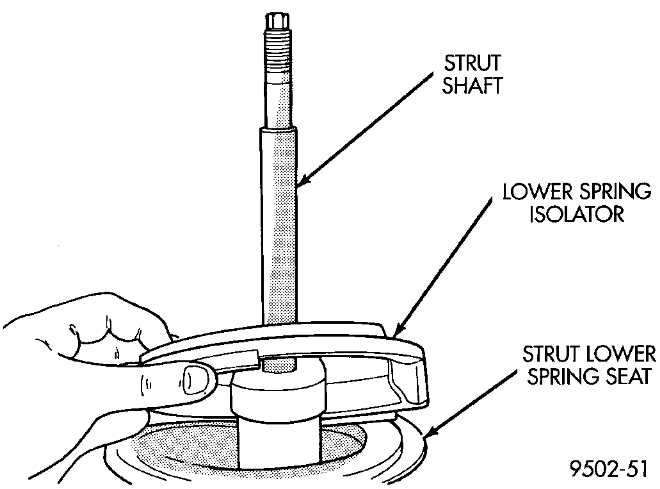


Fig. 34 Coil Spring Lower Isolator

check for loss of gas charge in strut unit. Push strut shaft into body of strut and release, strut shaft should return to its fully extended position. If strut shaft does not return to its fully extended position replace strut unit.

ASSEMBLY

(1) Install the original or a new isolator on lower spring seat of strut (Fig. 34).

(2) Install jounce bumper on strut shaft (Fig. 33).

(3) Install the dust shield on the strut assembly (Fig. 32).

(4) Lower the coil spring onto the strut unit (Fig. 31). Position end of coil spring against edge of spring isolator on lower spring seat of strut assembly.

(5) Install washer on strut shaft with raised edge of washer facing upward (Fig. 30).

(6) Install the strut assembly upper mount onto the strut shaft (Fig. 29).

(7) Install the washer on the strut assembly upper mount (Fig. 28). Washer must be installed with the raised edge of the washer facing down.

(8) Install the upper strut mount to strut shaft retaining nut.

(9) Using Strut Rod Socket, Special Tool, L-4558A and a 10 mm socket (Fig. 27) to keep strut shaft from turning, torque the strut shaft nut to 61 N·m (45 ft. lbs.).

(10) Equally loosen the Spring Compressors, Special Tool C-4838 until spring is seated on upper strut mount and all tension is relieved from the spring compressors.

(11) Install the strut assembly back into the vehicle. Refer to Strut Assembly Removal in Servicing Rear Struts in this section of the service manual.

(12) Check and reset rear wheel TOE to specifications if required.

STABILIZER BAR BUSHINGS

(1) If stabilizer bar to frame rail bushings require replacement at time of inspection, install new bushings before installing stabilizer bar. Bushings are replaced by opening slit on bushings and peeling them off stabilizer bar. Install new bushings on stabilizer bar, by spreading bushing at slit and forcing them on stabilizer bar. **Bushings must be installed on stabilizer bar with slit in bushing facing rear of vehicle when stabilizer bar is installed (Fig. 35).**

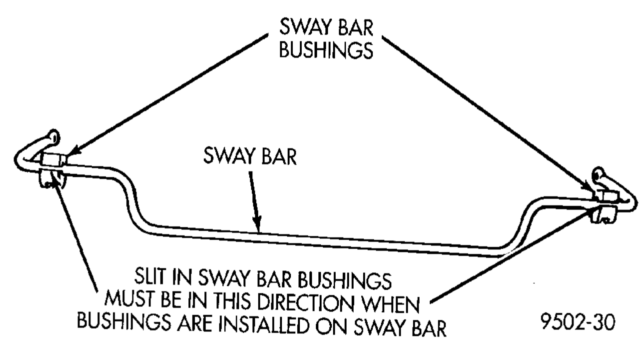


Fig. 35 Correct Stabilizer Bushing Installation

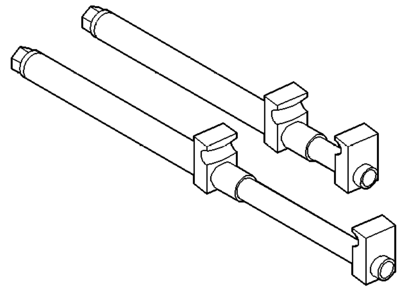
SPECIFICATIONS

REAR SUSPENSION FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
STRUT ASSEMBLY:	
To Body Attaching Nuts	34 N·m (300 in. lbs.)
Clevis Bracket To Knuckle Nut/Bolt	95 N·m (70 ft. lbs.)
Strut Assembly Shaft Nut	75 N·m (55 ft. lbs.)
BRAKE SUPPORT PLATE:	
To Knuckle Bolts	68 N·m (50 ft. lbs.)
STABILIZER BAR:	
Bushing Retainer To Frame Bolt	34 N·m (300 in. lbs.)
To Strut Attaching Link Nut	34 N·m (300 in. lbs.)
TENSION STRUT:	
Shaft Nut	95 N·m (70 ft. lbs.)
Bracket To Body Attaching Bolts	95 N·m (70 ft. lbs.)
LATERAL LINK:	
Attaching Nut	95 N·m (70 ft. lbs.)
DISC BRAKE CALIPER:	
To Adapter Mounting Bolt	22 N·m (16 ft. lbs.)
Brake Hose To Caliper Mounting Bolt	45 N·m (35 ft. lbs.)
Adapter To Knuckle Mounting Bolt	68 N·m (50 ft. lbs.)
BRAKE HOSE:	
Bracket Mounting Bolt	23 N·m (17 ft. lbs.)
HUB AND BEARING:	
To Knuckle Retaining Nut	216 N·m (160 ft. lbs.)
Wheel Stud Lug Nuts (All Wheel Types)	109-150 N·m (80-110 ft. lbs.)

SPECIAL TOOLS

REAR SUSPENSION



Compressor Strut Coil Spring C-4838

DIFFERENTIAL AND DRIVELINE

CONTENTS

GENERAL INFORMATION

FRONT DRIVESHAFTS

Vehicles equipped with either an automatic or manual transmission use the unequal–length driveshaft system.

Vehicles equipped with automatic transaxles use a solid short interconnecting shaft on the left side. The right side of the vehicle uses a longer solid interconnecting shaft (Fig. 1).

Vehicles equipped with manual transaxles use a larger diameter (32 mm) short interconnecting shaft on the left side. The right side uses a longer interconnecting damper (Fig. 1).

Driveshafts used on both the right and left sides of the vehicle use a tuned rubber damper weight. The damper weight applications vary by which side of the vehicle the driveshaft is located on and the transmission application of the vehicle. When replacing a driveshaft, be sure the replacement driveshaft has the same damper weight as the original.

Both driveshaft assemblies use the same type of inner and outer joints. The inner joint of both driveshaft assemblies is a tripod joint, and the outer joint of both driveshaft assemblies is a Rzeppa joint. Both tripod joints and Rzeppa joints are true constant velocity (C/V) joint assemblies. The inner tripod joint allows for the changes in driveshaft length through

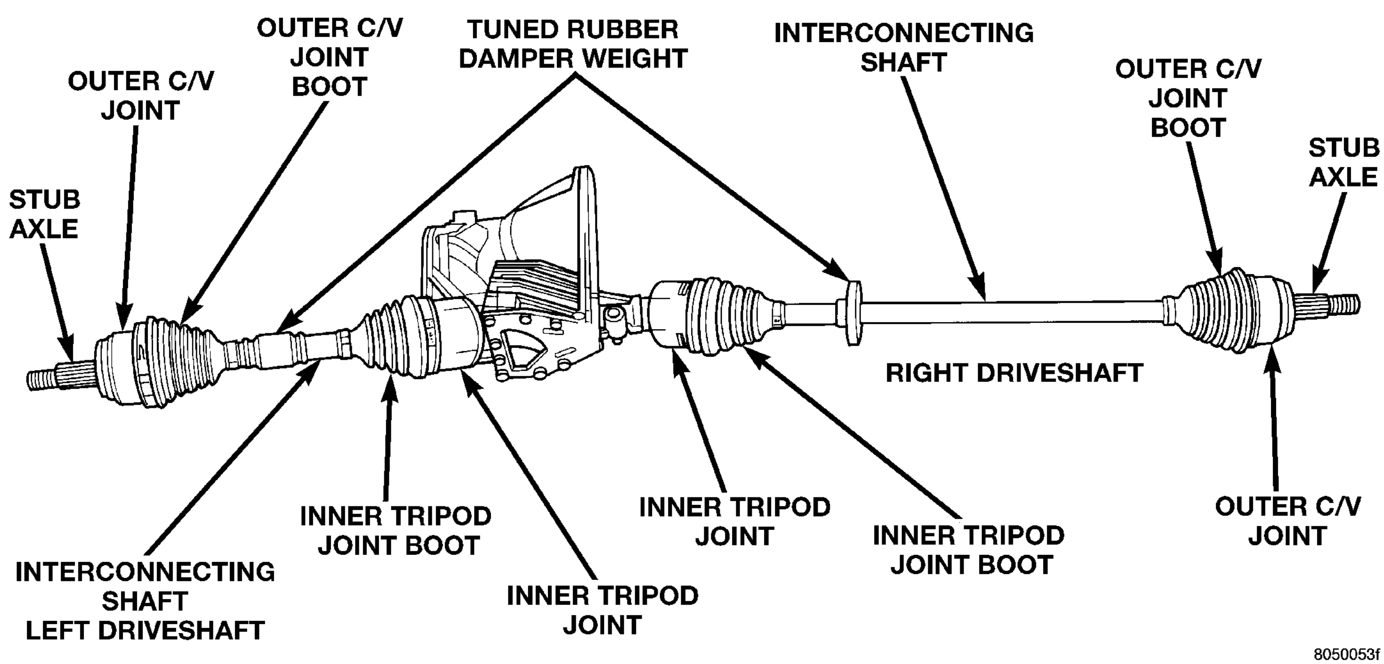


Fig. 1 Unequal Length Driveshaft System

GENERAL INFORMATION (Continued)

the jounce and rebound travel of the front suspension.

On vehicles equipped with ABS brakes, the outer C/V joint is equipped with a tone wheel used to determine vehicle speed for ABS brake operation.

The inner tripod joint of both driveshafts is splined into the transaxle side gears. The inner tripod joints are retained in the side gears of the transaxle using a snap ring located in the stub shaft of the tripod joint. The outer C/V joint has a stub shaft that is splined into the wheel hub and retained by a hub nut using a nut lock and cotter pin.

NOTE: This vehicle does not use a rubber–lip bearing seal as on previous front–wheel–drive cars to prevent contamination of the front wheel bearing. On these vehicles, the face of the outer C/V joint fits deeply into the steering knuckle, using a close outer C/V joint–to–steering knuckle fit. This design deters direct water splash on bearing seal while allowing any water that gets in, to run out the bottom of the steering knuckle bearing bore. It is important to thoroughly clean the outer C/V joint and the wheel bearing area in the steering knuckle before it is assembled after servicing.

FRONT DRIVESHAFT IDENTIFICATION

Driveshafts and driveshaft inner and outer boots can be identified as shown in (Fig. 2). Driveshaft boot location on the driveshaft assemblies is determined by the number of convolutions on the driveshaft boot. Refer to (Fig. 2) for the correct location of the sealing boots.

DIAGNOSIS AND TESTING

DRIVESHAFT DIAGNOSIS

VEHICLE INSPECTION

(1) Check for grease in the vicinity of the inboard tripod joint and outboard C/V joint; this is a sign of inner or outer joint seal boot or seal boot clamp damage.

(2) A light film of grease may appear on the right inner tripod joint seal boot; this is considered normal and should not require replacement of the seal boot. The right inner tripod joint seal boot is made of silicone rubber; which will allow the weeping (sweating) of the joint lubricant to pass through it while in operation.

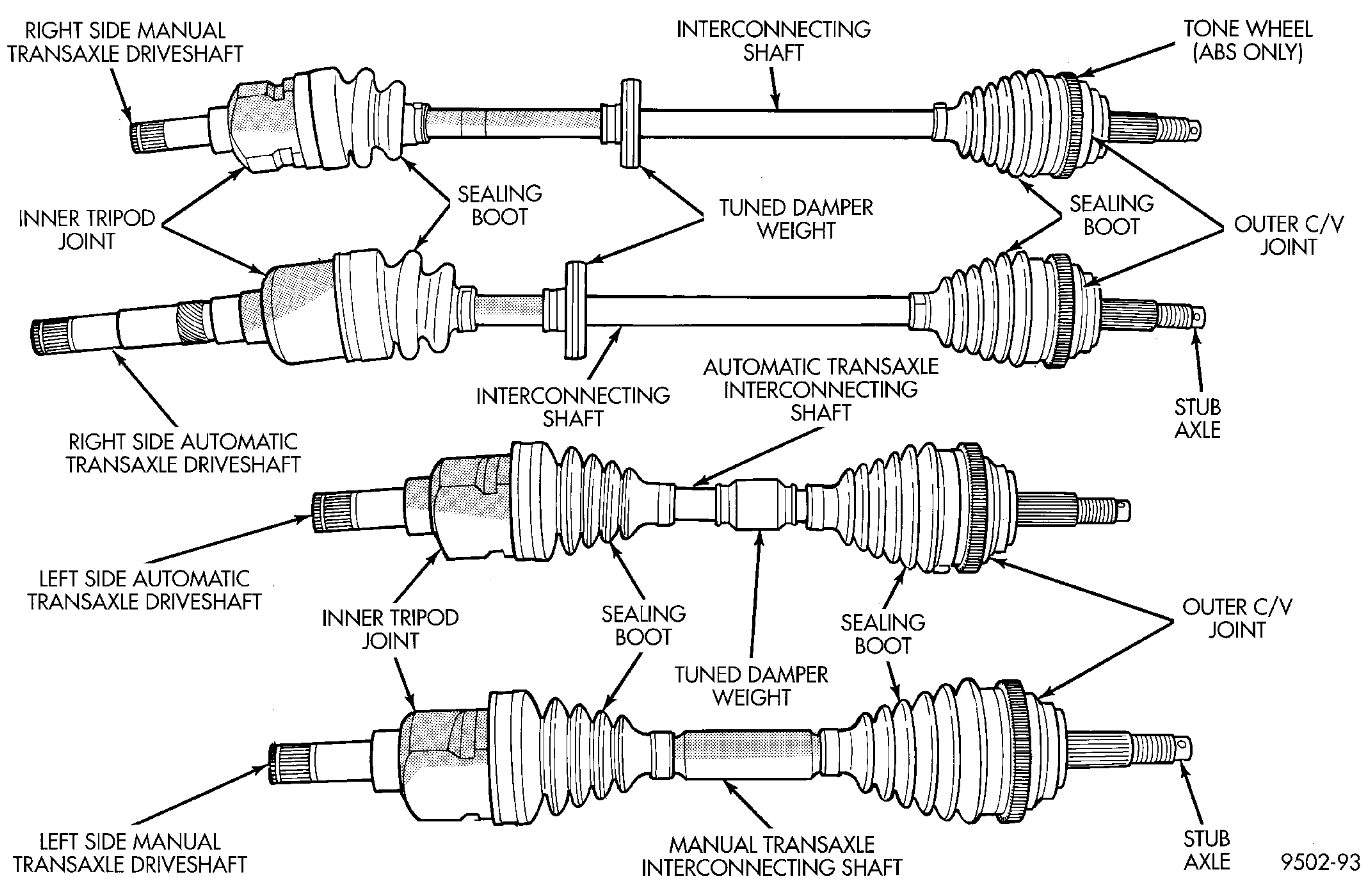


Fig. 2 Driveshaft Identification

DIAGNOSIS AND TESTING (Continued)

NOISE AND/OR VIBRATION IN TURNS

A clicking noise and/or a vibration in turns could be caused by one of the following conditions.

(1) Damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss and/or contamination of the joint grease, resulting in inadequate lubrication of the joint.

(2) Noise may also be caused by another component of the vehicle coming in contact with the driveshafts.

CLUNKING NOISE DURING ACCELERATION

This noise may be a result of one of the following conditions:

(1) A torn seal boot on the inner or outer joint of the driveshaft assembly.

(2) A loose or missing clamp on the inner or outer joint of the driveshaft assembly.

(3) A damaged or worn driveshaft C/V joint.

SHUDDER OR VIBRATION DURING ACCELERATION

(1) A worn or damaged driveshaft inner tripod joint.

(2) A sticking tripod joint spider assembly (inner tripod joint only).

(3) Improper wheel alignment. See Wheel Alignment in this group for alignment checking and setting procedures and specifications.

VIBRATION AT HIGHWAY SPEEDS

(1) Foreign material (mud, etc.) packed on the backside of the wheel(s).

(2) Out of balance front tires or wheels. See Group 22, Wheels And Tires for the required balancing procedure.

(3) Improper tire and/or wheel runout. See Group 22, Wheels And Tires for the required runout checking procedure.

REMOVAL AND INSTALLATION

FRONT DRIVESHAFTS

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, or 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.

REMOVAL

CAUTION: The driveshaft, when installed, acts as a bolt and secures the front hub/bearing assembly. If vehicle is to be supported or moved on its wheels with a driveshaft removed, install a PROPER–SIZED BOLT AND NUT through front hub. Tighten bolt and nut to 183 N·m (135 ft. lbs.). This will ensure that the hub bearing cannot loosen.

(1) Remove cotter pin, nut lock, and spring washer (Fig. 3) from the end of the outer C/V joint stub axle.

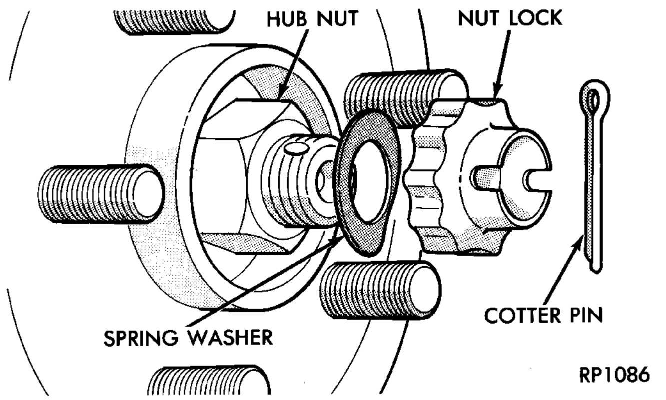


Fig. 3 Cotter Pin, Nut Lock and Spring Washer

(2) Loosen (but do not remove) stub axle–to–hub/bearing retaining nut (Fig. 4). Loosen hub nut while vehicle is on the floor with the brakes applied. The front hub and driveshaft are splined together and retained by the hub nut.

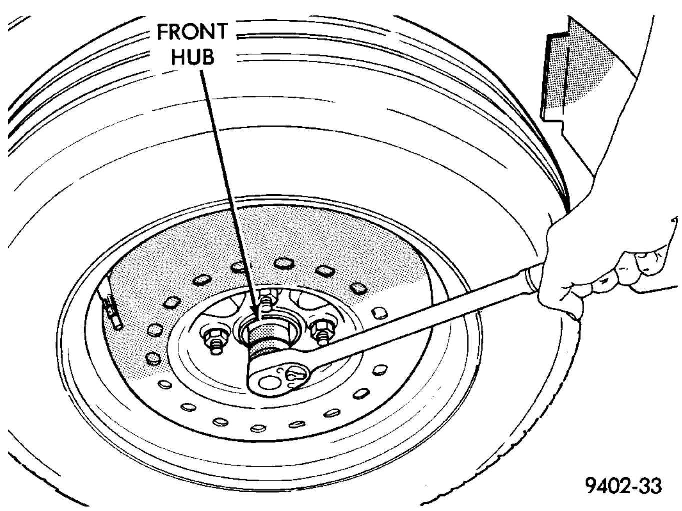


Fig. 4 Loosening Front Hub Retaining Nut

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

(4) Remove front tire and wheel assembly from the hub.

REMOVAL AND INSTALLATION (Continued)

(5) Remove front disc brake caliper assembly to steering knuckle bolts (Fig. 5).

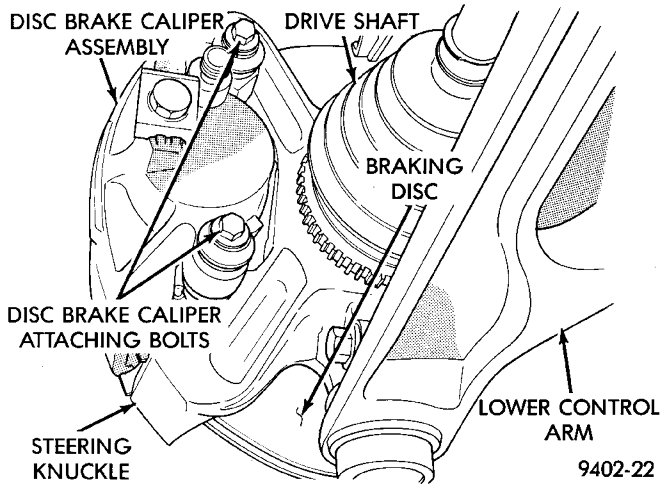


Fig. 5 Front Disc Brake Caliper Assembly Bolts

(6) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 6).

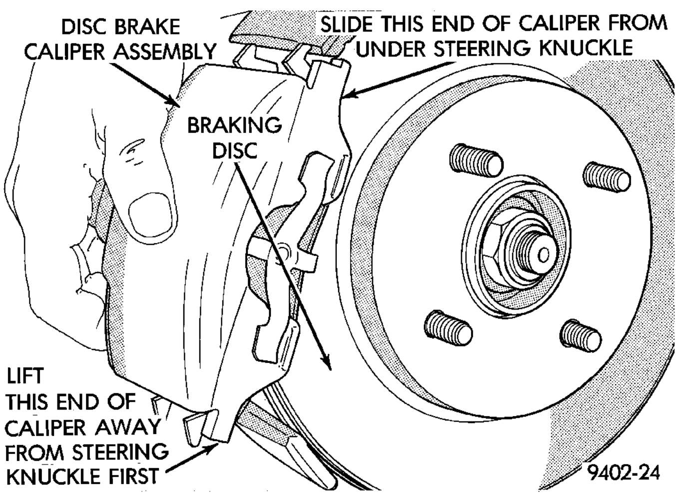


Fig. 6 Brake Caliper Assembly Removal

(7) Support brake caliper/adapter assembly using a wire hook, **not by the brake flex hose** (Fig. 7).

(8) Remove braking disc from front hub (Fig. 8).

(9) Remove nut attaching outer tie rod end to steering knuckle. **Nut is to be removed from tie rod end using the following procedure: Hold tie rod end stud with a 11/32 socket while loosening and removing nut.**

(10) Remove the tie rod end stud from steering knuckle arm using Special Tool MB-990635 (Fig. 9).

(11) Remove nut and bolt (Fig. 10) retaining ball joint stud into steering knuckle.

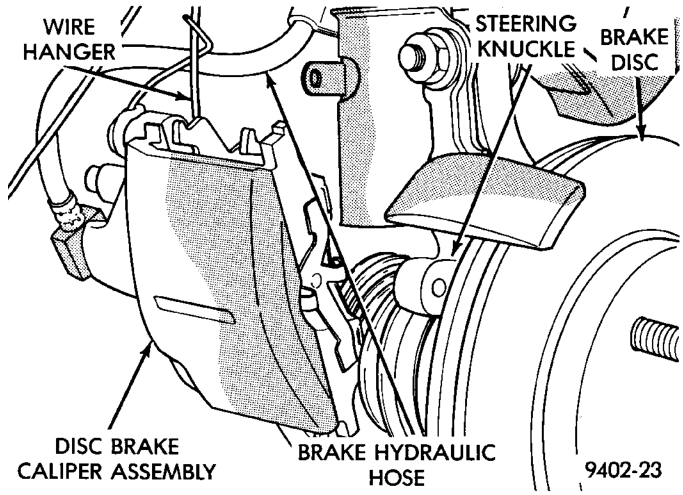


Fig. 7 Supporting Brake Caliper

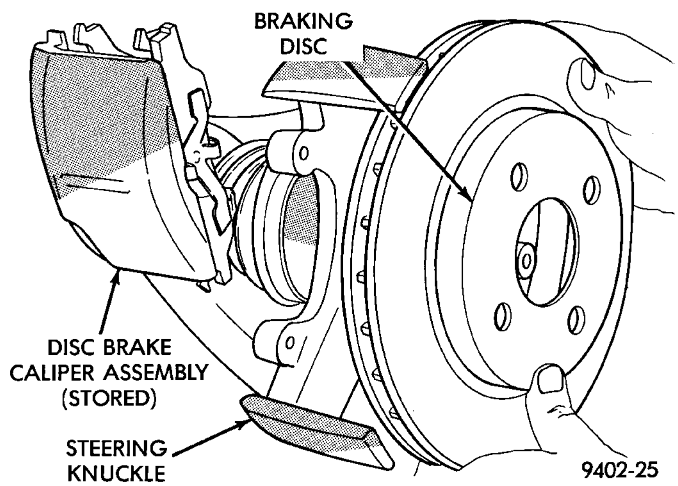


Fig. 8 Removing Front Braking Disc

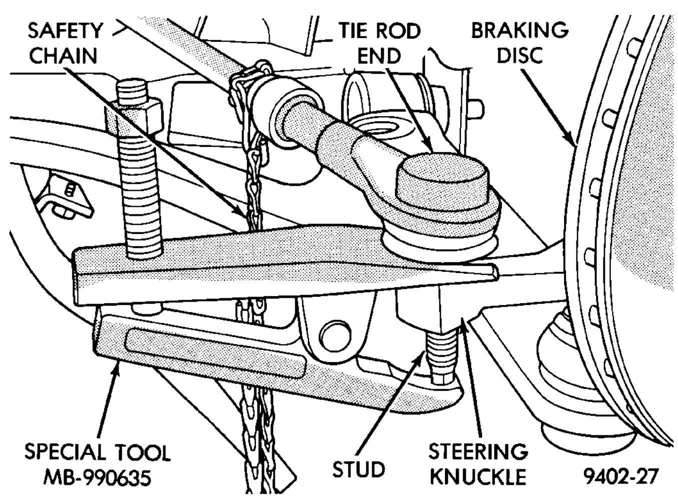


Fig. 9 Tie Rod End Removal from Steering Knuckle

NOTE: Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get damaged.

REMOVAL AND INSTALLATION (Continued)

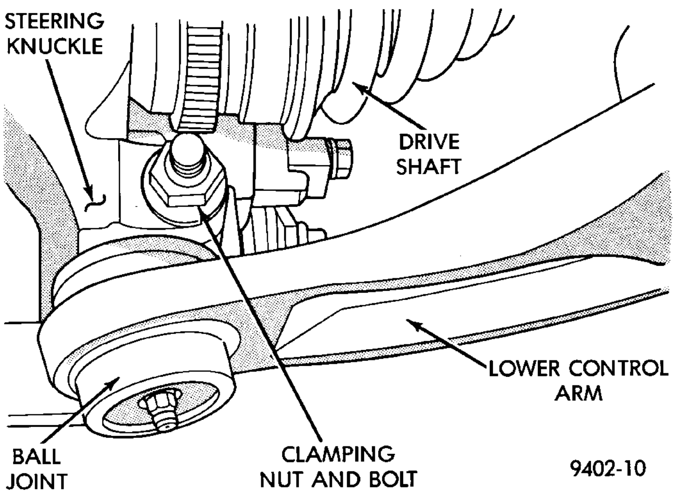


Fig. 10 Removing Steering Knuckle Clamp Bolt

(12) Separate ball joint stud from steering knuckle by prying down on lower control arm (Fig. 11).

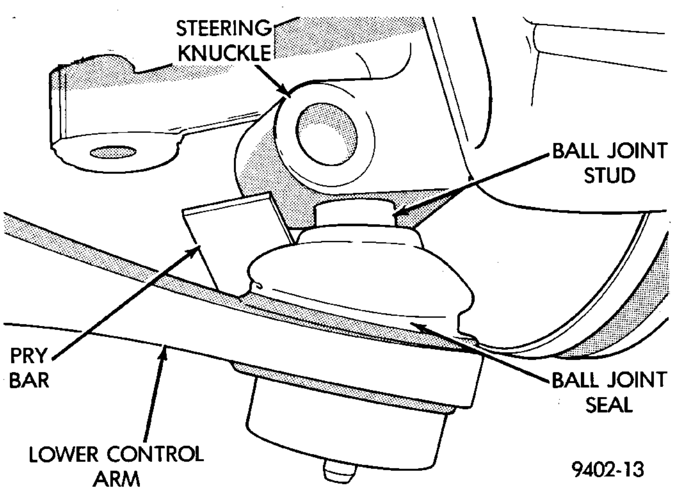


Fig. 11 Separate Ball Joint Stud from Steering Knuckle

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(13) Pull steering knuckle assembly out and away from outer C/V joint of the driveshaft assembly (Fig. 12).

(14) Support outer end of the driveshaft assembly.

NOTE: Removal of the inner tripod joints is made easier if you apply outward pressure on the joint as you strike the punch with a hammer.

(15) Remove the inner tripod joints from the side gears of the transaxle using a punch to dislodge the inner tripod joint retaining ring from the transaxle side gear. If removing the right side inner tripod

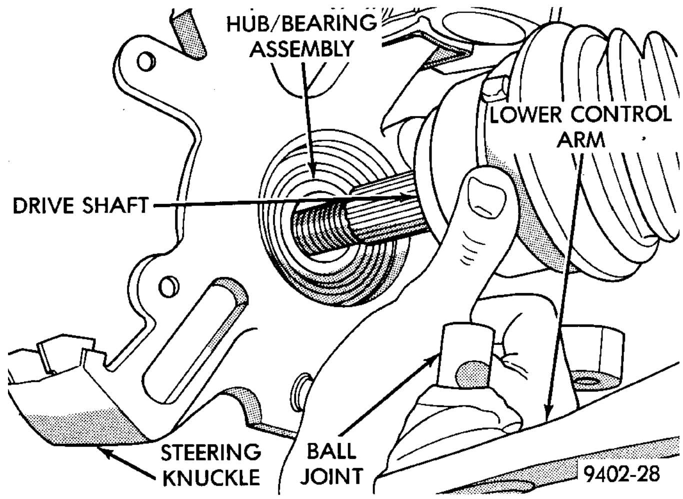


Fig. 12 Steering Knuckle Separation from Driveshaft

joint, position the punch against the inner tripod joint (Fig. 13). Strike the punch sharply with a hammer to dislodge the right inner joint from the side gear. If removing the left side inner tripod joint, position the punch in the groove of the inner tripod joint (Fig. 14). Strike the punch sharply with a hammer to dislodge the left inner tripod joint from the side gear.

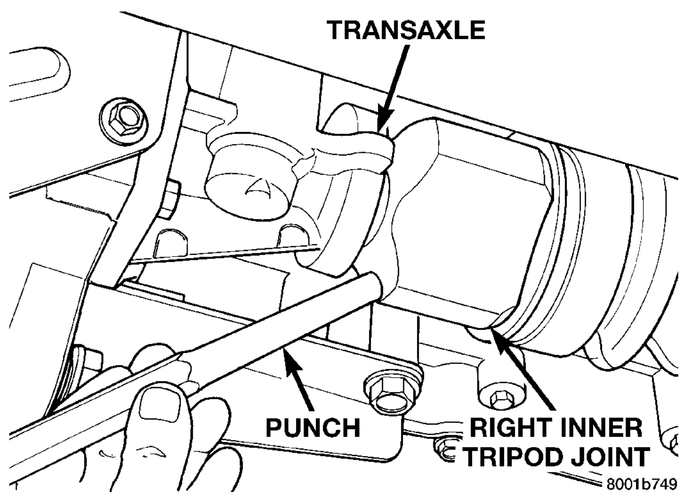


Fig. 13 Disengaging Right Inner Tripod Joint from Transaxle

(16) Hold inner tripod joint and interconnecting shaft of driveshaft assembly (Fig. 15). Remove inner tripod joint from transaxle by pulling it straight out of transaxle side gear and transaxle oil seal. **When removing tripod joint, do not let spline or snap ring drag across sealing lip of the transaxle to tripod joint oil seal.**

REMOVAL AND INSTALLATION (Continued)

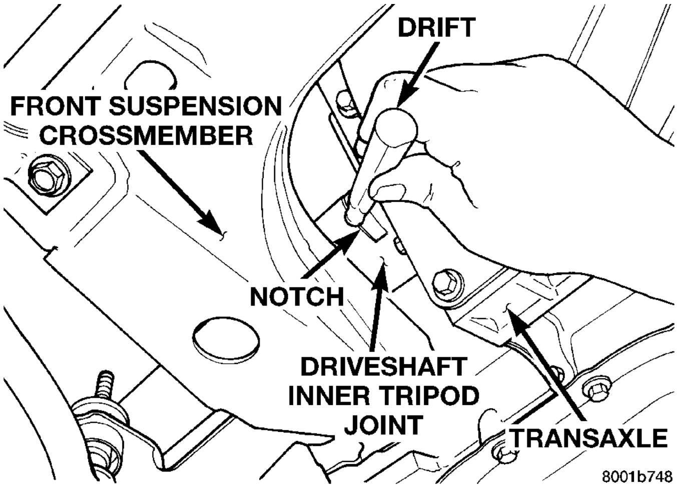


Fig. 14 Disengaging Left Inner Tripod Joint from Transaxle

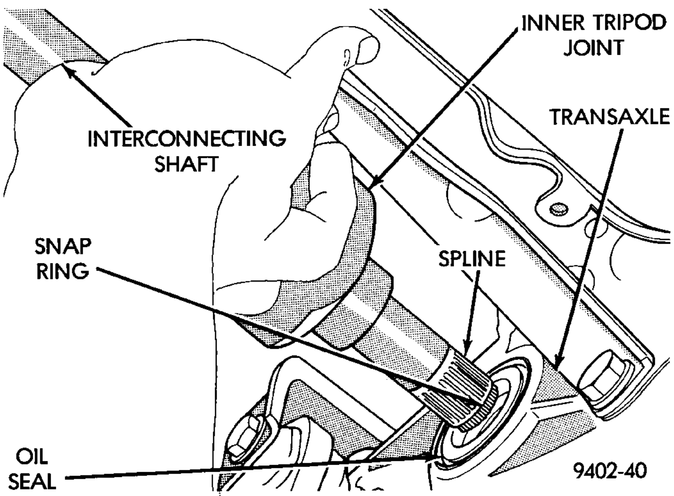


Fig. 15 Tripod Joint Removal from Transaxle

CAUTION: The driveshaft, when installed, acts as a bolt and secures the front hub/bearing assembly. If vehicle is to be supported or moved on its wheels with a driveshaft removed, install a PROPER–SIZED BOLT AND NUT through front hub. Tighten bolt and nut to 183 N·m (135 ft. lbs.). This will ensure that the hub bearing cannot loosen.

INSTALLATION

(1) Thoroughly clean spline and oil seal sealing surface, on tripod joint. Lightly lubricate oil seal sealing surface on tripod joint with fresh clean transmission lubricant.

(2) Holding driveshaft assembly by tripod joint and interconnecting shaft, install tripod joint into transaxle side gear as far as possible by hand.

(3) Carefully align tripod joint with transaxle side gears. Then grasp driveshaft interconnecting shaft and push tripod joint into transaxle side gear until fully seated. **Test that snap ring is fully engaged with side gear by attempting to remove tripod joint from transaxle by hand. If snap ring is fully engaged with side gear, tripod joint will not be removable by hand.**

(4) Clean all debris and moisture out of steering knuckle (Fig. 16).

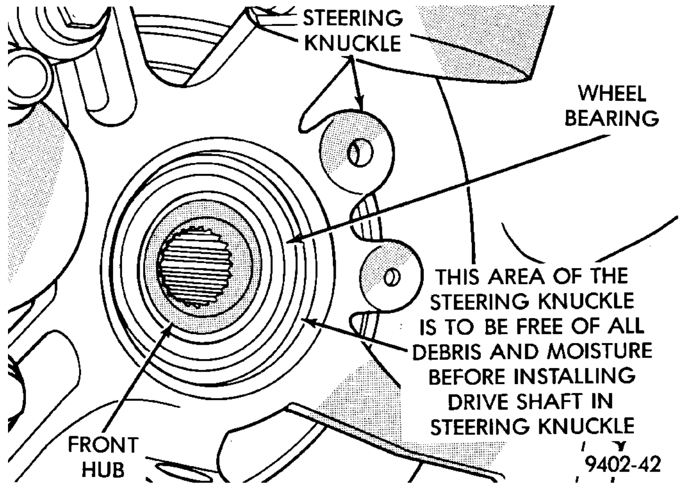


Fig. 16 Steering Knuckle to C/V Joint Sealing Area

(5) Ensure that front of outer C/V joint, which fits into steering knuckle (Fig. 17), is free of debris and moisture before assembling into steering knuckle.

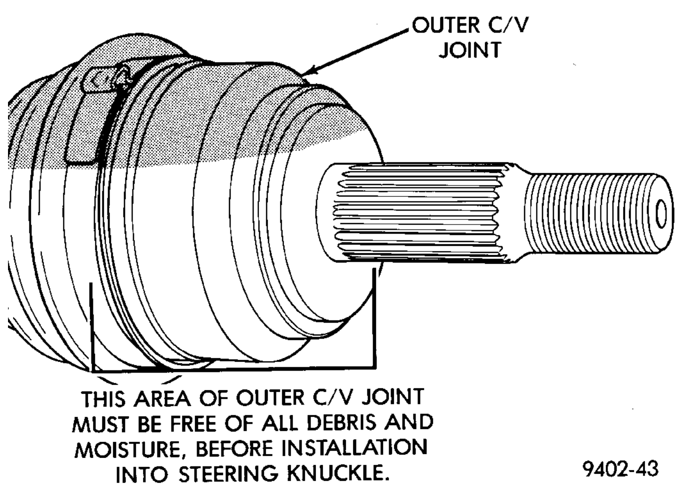


Fig. 17 Outer C/V Joint Inspection

(6) Slide driveshaft back into front hub. Install steering knuckle onto the ball joint stud (Fig. 18).

(7) Install a **NEW** steering knuckle to ball joint stud bolt and nut (Fig. 19). Tighten the nut and bolt to 95 N·m (70 ft. lbs.).

(8) Install tie rod end into steering knuckle. Start tie rod end to steering knuckle nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle nut. Then,

REMOVAL AND INSTALLATION (Continued)

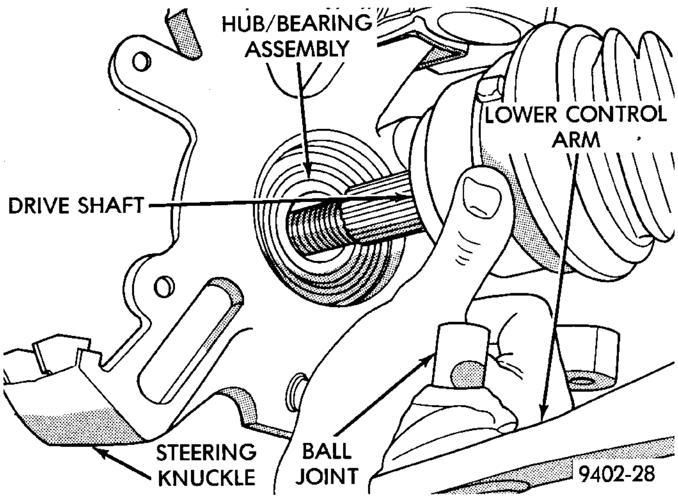


Fig. 18 Driveshaft Installation Into Hub And Steering Knuckle

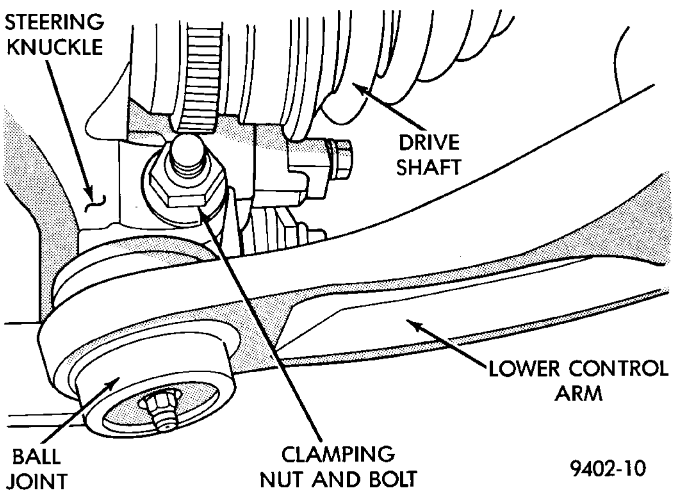


Fig. 19 Tighten Steering Knuckle Clamp Bolt

using a crowfoot and 11/32 socket, tighten tie rod end nut to 61 N·m (45 ft. lbs.).

(9) Install braking disc back on hub and bearing assembly (Fig. 20).

(10) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 21).

(11) Install caliper assembly to steering knuckle bolts (Fig. 22). Tighten to 31 N·m (23 ft. lbs.).

(12) Clean all foreign matter from threads of outer C/V joint stub axle. Install hub nut and washer onto the threads of the stub axle and tighten nut (Fig. 23).

(13) With vehicle brakes applied to keep axle shaft from turning, tighten hub nut to 183 N·m (135 ft. lbs.).

(14) Install spring washer, nut lock, and cotter pin on outer C/V joint stub axle (Fig. 24).

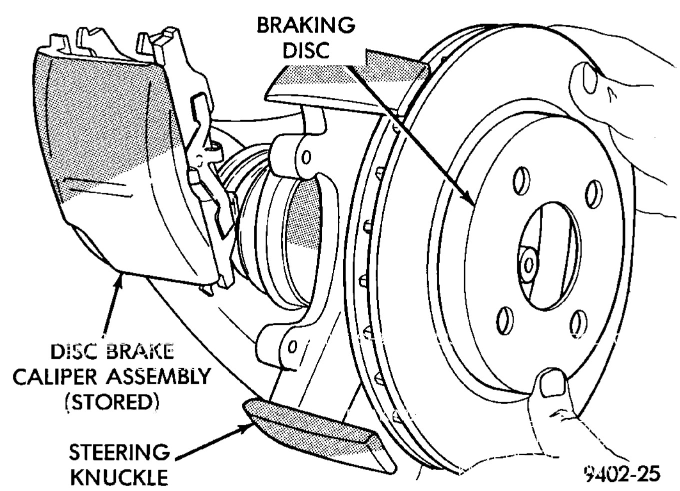


Fig. 20 Installing Braking Disc

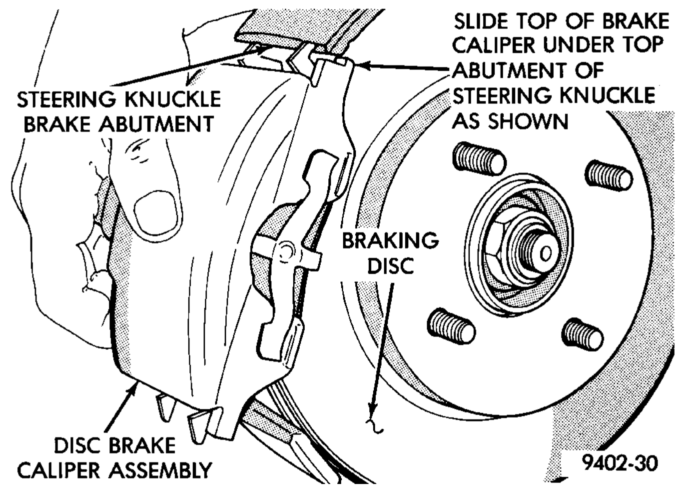


Fig. 21 Disc Brake Caliper Assembly Installation

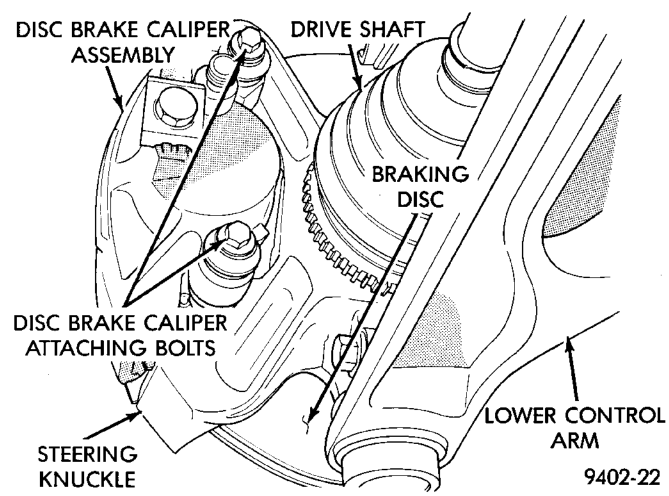


Fig. 22 Front Disc Brake Caliper Assembly Bolts

(15) Install front wheel and tire assembly. Install front wheel lug nuts and tighten to 135 N·m (100 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

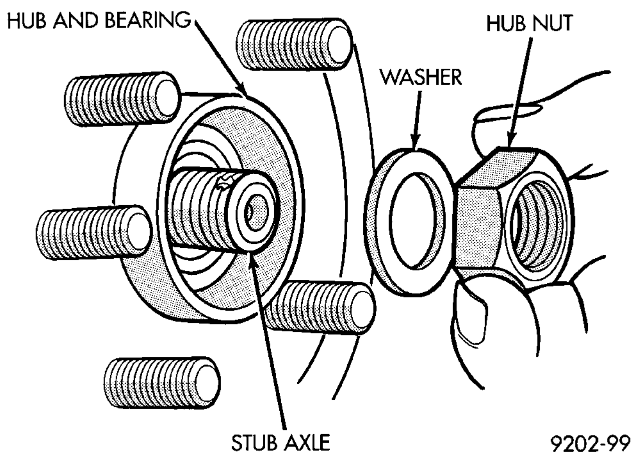


Fig. 23 Front Hub To Stub Shaft Nut Installed

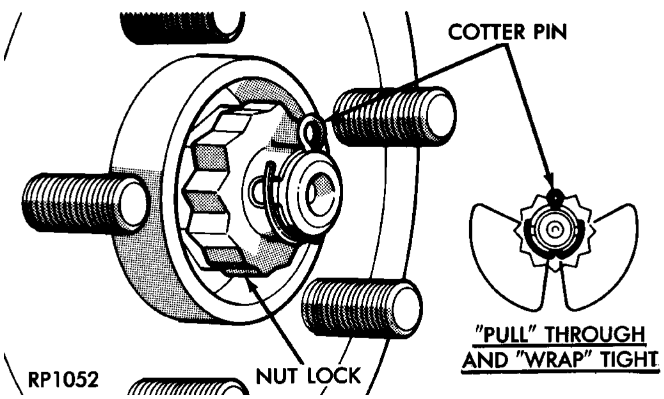


Fig. 24 Spring Washer, Nut Lock And Cotter Pin Installation

(16) Check for correct fluid level in transaxle assembly. Refer to Group 21 Transaxle, for the correct fluid level checking procedure for the type of transaxle being checked.

(17) Lower vehicle.

DISASSEMBLY AND ASSEMBLY

DRIVESHAFT RECONDITION

NOTE: The only service that is to be performed on the driveshaft assemblies is the replacement of the driveshaft seal boots.

If any failure of internal driveshaft components is diagnosed during a vehicle road test or disassembly of the driveshaft, the driveshaft will need to be replaced as an assembly.

NOTE: Lubricant requirements and quantities are different for inner joints than for outer joints. Use only the recommended lubricants in the required quantities when servicing driveshaft assemblies.

See (Fig. 25) for the exploded view of the front driveshaft components.

INNER TRIPOD JOINT SEAL BOOT

REMOVAL

To remove sealing boot from driveshaft for replacement, the driveshaft assembly must be removed from the vehicle. See Servicing Driveshaft in this section for the required driveshaft removal and replacement procedure.

The inner tripod joints use no internal retention in the tripod housing to keep the spider assembly in the housing. Therefore, do not pull on the interconnecting shaft to disengage tripod housing from transmission stub shaft. Removal in this manner will cause damage to the inboard joint sealing boots.

(1) Remove the driveshaft requiring boot replacement from the vehicle. See Servicing Driveshaft in this section for the required driveshaft removal procedure.

(2) Remove large boot clamp that retains inner tripod joint sealing boot to tripod joint housing (Fig. 26) and discard. Then remove small clamp that retains inner tripod joint sealing boot to interconnecting shaft and discard. Remove the sealing boot from the tripod housing and slide it down the interconnecting shaft.

CAUTION: When removing the spider joint from the tripod joint housing, hold the rollers in place on the spider trunions to prevent the rollers and needle bearings from falling away.

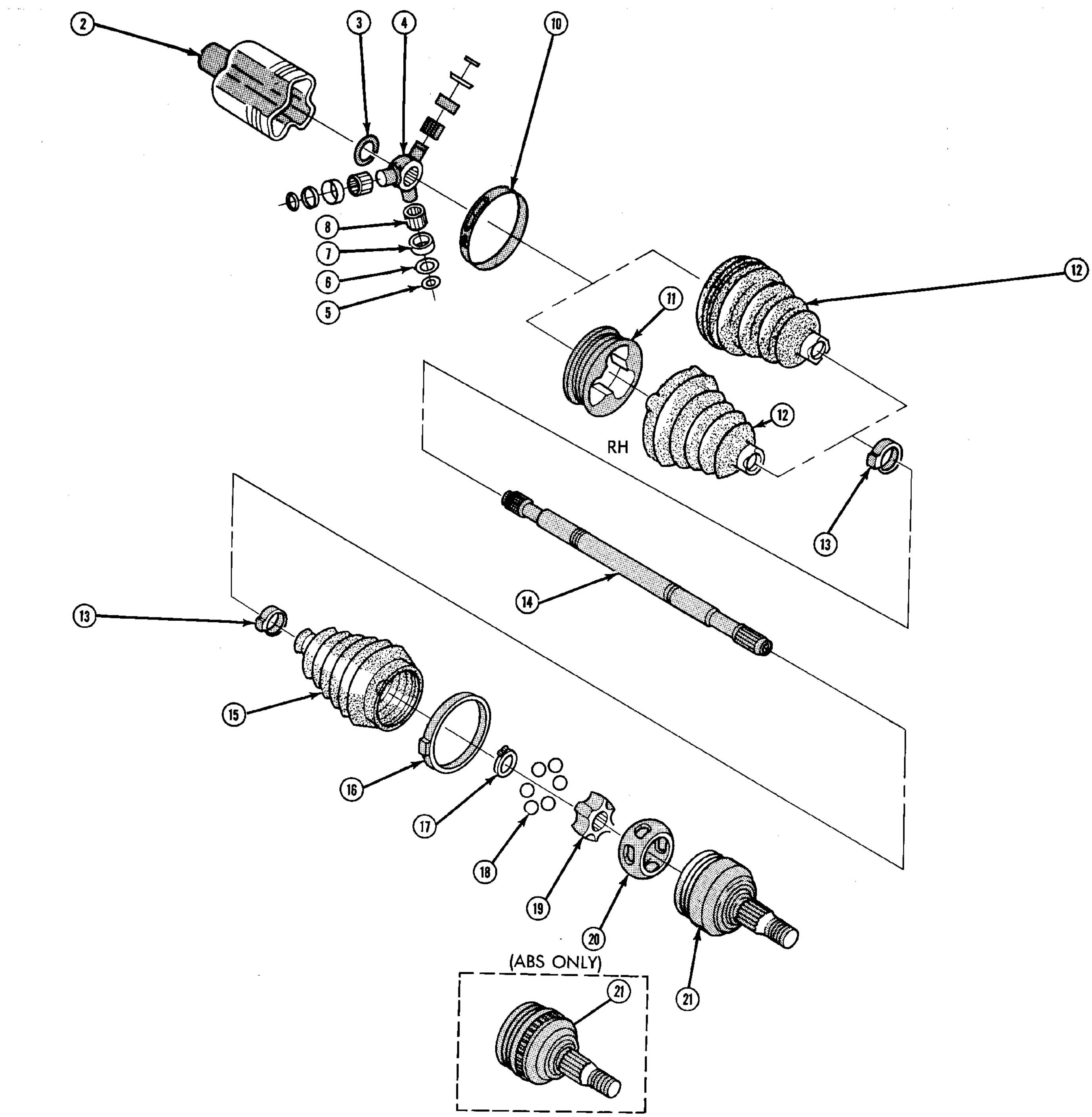
(3) Slide the interconnecting shaft and spider assembly out of the tripod joint housing (Fig. 27).

(4) Remove snap ring that retains spider assembly to interconnecting shaft (Fig. 28). Remove the spider assembly from interconnecting shaft. If spider assembly will not come off interconnecting shaft by hand, it can be removed by tapping spider assembly with a brass drift (Fig. 29). **Do not hit the outer tripod bearings in an attempt to remove spider assembly from interconnecting shaft.**

(5) Slide sealing boot off interconnecting shaft.

(6) Thoroughly clean and inspect spider assembly, tripod joint housing, and interconnecting shaft for any signs of excessive wear. **If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.**

DISASSEMBLY AND ASSEMBLY (Continued)



2. – HOUSING ASM, RETAINER &
3. – RING, SPACER
4. – SPIDER, TRIPOT JOINT
5. – RING, RETAINING
6. – RETAINER, BALL & ROLLER
7. – BALL, TRIPOT JOINT
8. – ROLLER, NEEDLE
10. – CLAMP, SEAL RETAINING
11. – BUSHING, TRILOBAL TRIPOT
12. – SEAL, DRIVE AXLE INBOARD
13. – CLAMP, SEAL RETAINING
14. – SHAFT, AXLE (RH SHOWN, LH SIMILAR)
15. – SEAL, DRIVE AXLE OUTBOARD
16. – CLAMP, SEAL RETAINING
17. – RING, RACE RETAINING
18. – BALL, CHROME ALLOY
19. – RACE, C/V JOINT INNER
20. – CAGE, C/V JOINT
21. – RACE, C/V JOINT OUTER

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Fig. 25 Driveshaft Assembly Components (Exploded View)

DISASSEMBLY AND ASSEMBLY (Continued)

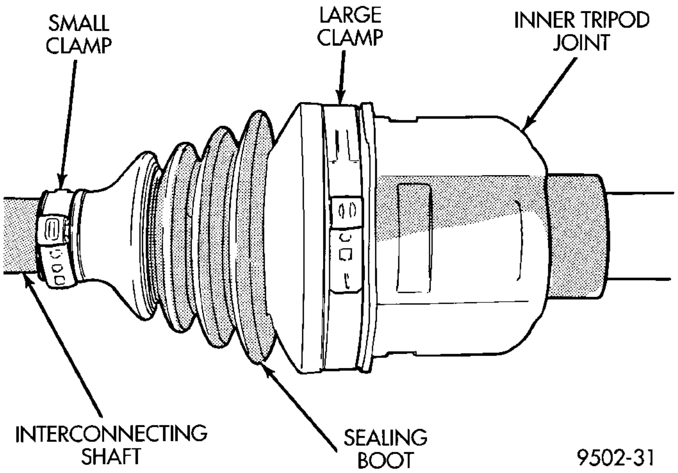


Fig. 26 Inner Tripod Joint Sealing Boot Clamps

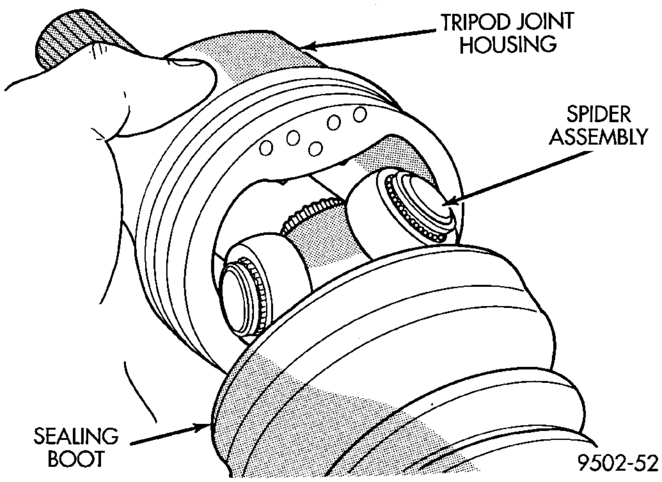


Fig. 27 Spider Assembly Joint Removal from Housing

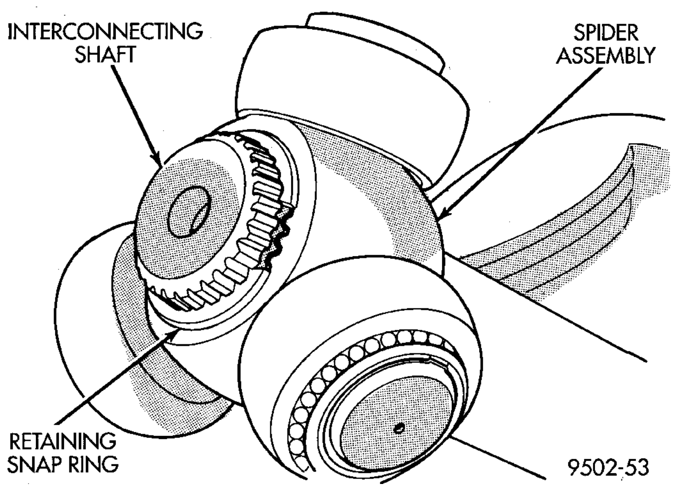


Fig. 28 Spider Assembly Retaining Snap Ring

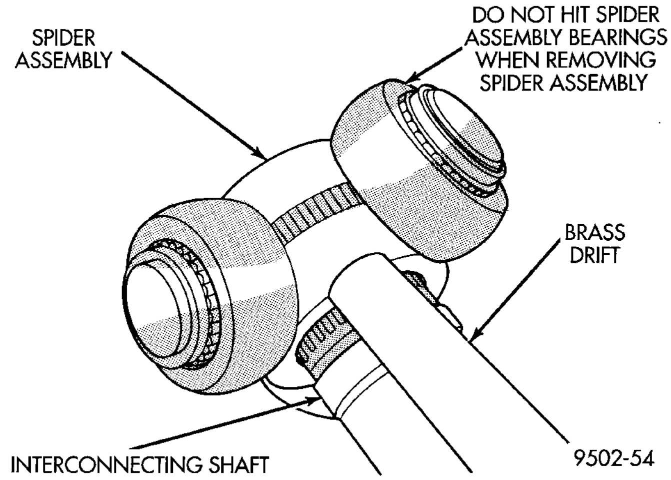


Fig. 29 Spider Assembly Removal from Interconnecting Shaft

INSTALLATION

NOTE: The inner tripod joint sealing boots are made from two different types of material. High–temperature applications use silicone rubber whereas standard temperature applications use Hytrel plastic. The silicone sealing boots are soft and pliable. The Hytrel sealing boots are stiff and rigid. The replacement sealing boot MUST BE the same type of material as the sealing boot that was removed.

(1) Slide inner tripod joint seal boot retaining clamp, onto interconnecting shaft. Then slide the replacement inner tripod joint sealing boot onto interconnecting shaft. **Inner tripod joint seal boot MUST be positioned on interconnecting shaft, so the raised bead on the inside of the seal boot is in groove on interconnecting shaft (Fig. 30).**

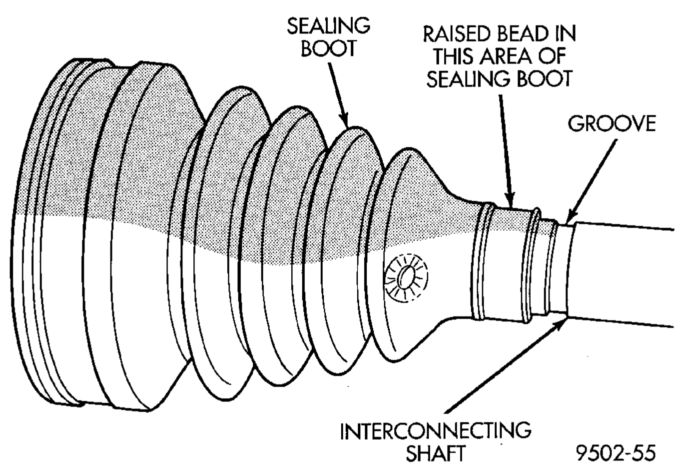


Fig. 30 Sealing Boot Installation on Interconnecting Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Install spider assembly onto interconnecting shaft with chamfer on spider assembly toward interconnecting shaft (Fig. 31). Spider assembly must be installed on interconnecting shaft far enough to fully install spider retaining snap ring. If spider assembly will not fully install on interconnecting shaft by hand, it can be installed by tapping the spider body with a brass drift (Fig. 32). **Do not hit the outer tripod bearings in an attempt to install spider assembly on interconnecting shaft.**

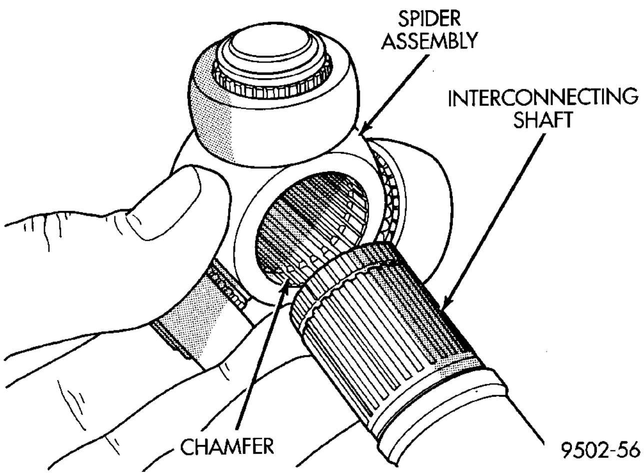


Fig. 31 Spider Assembly Installation on Interconnecting Shaft

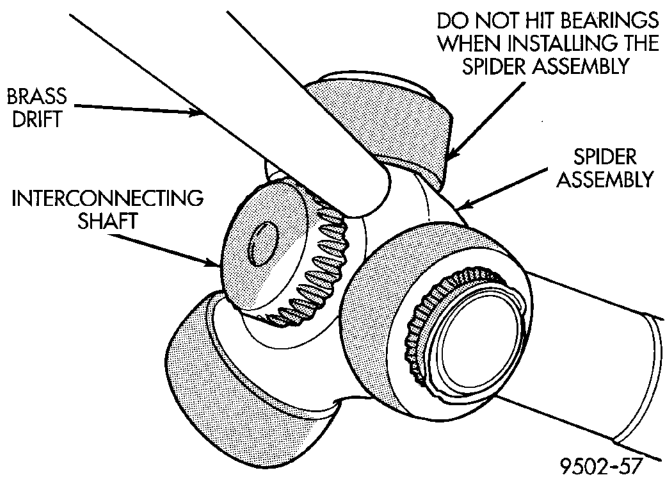


Fig. 32 Installing Spider Assembly On Interconnecting Shaft

(3) Install the spider assembly to interconnecting shaft retaining snap ring into groove on end of interconnecting shaft (Fig. 33). Be sure the snap ring is fully seated into groove on interconnecting shaft.

(4) Distribute 1/2 the amount of grease provided in the seal boot service package (DO NOT USE ANY OTHER TYPE OF GREASE) into tripod housing. Put the remaining amount into the sealing boot.

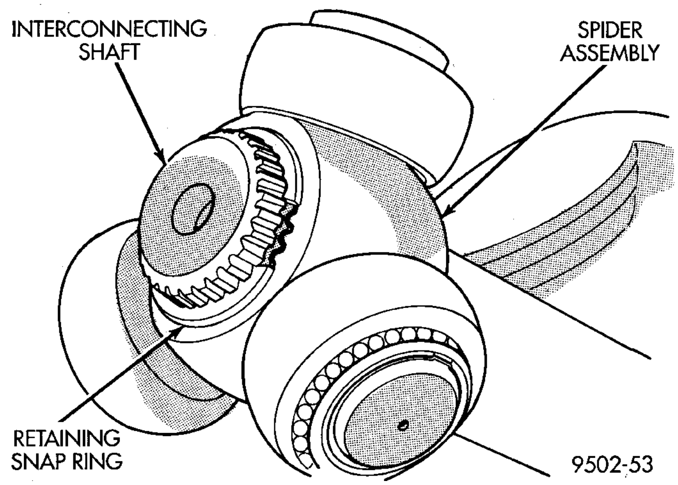


Fig. 33 Spider Assembly Retaining Snap Ring Installed

(5) Align tripod housing with spider assembly and then slide tripod housing over spider assembly and interconnecting shaft (Fig. 34).

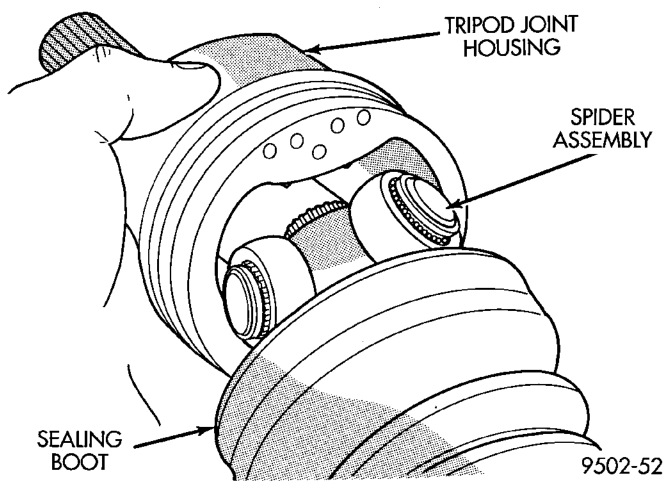


Fig. 34 Installing Tripod Housing on Spider Assembly

(6) Install inner tripod joint seal boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C- 4975-A over bridge of clamp (Fig. 35). Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 36).

CAUTION: Seal must not be dimpled, stretched, or out–of–shape in any way. If seal is NOT shaped correctly, equalize pressure in seal and shape it by hand.

(8) Position sealing boot into the tripod housing retaining groove. Install seal boot retaining clamp evenly on sealing boot.

DISASSEMBLY AND ASSEMBLY (Continued)

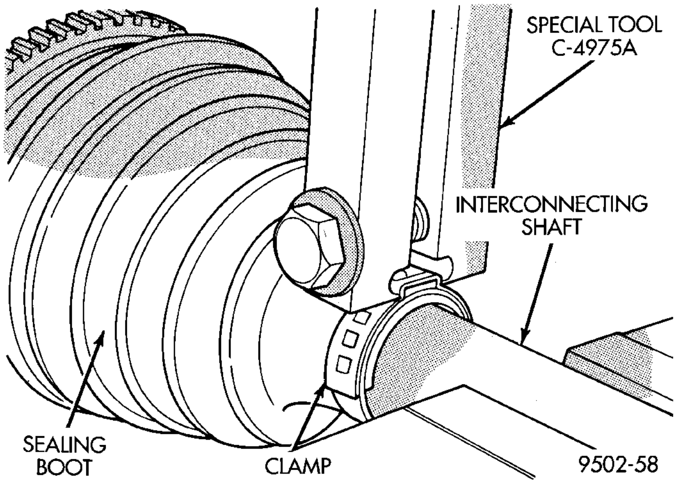


Fig. 35 Crimping Tool Installed on Sealing Boot Clamp

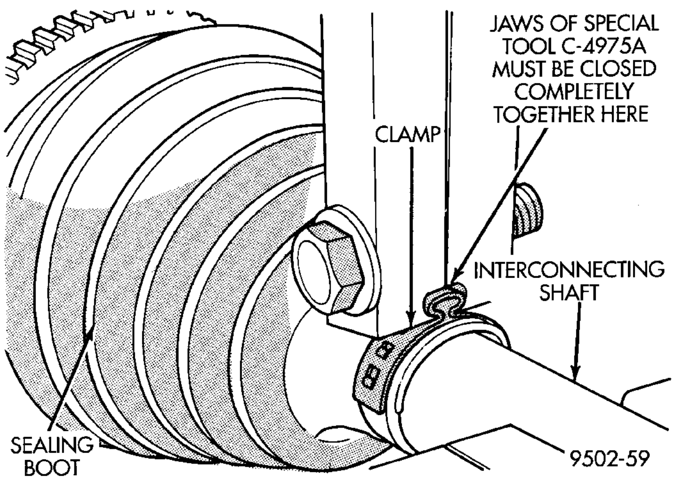


Fig. 36 Sealing Boot Retaining Clamp Installed

CAUTION: The following positioning procedure determines the correct air pressure inside the inner tripod joint assembly prior to clamping the sealing boot to inner tripod joint housing. If this procedure is not done prior to clamping sealing boot to tripod joint housing, boot durability can be adversely affected.

CAUTION: When venting the inner tripod joint assembly, use care so inner tripod sealing boot does not get punctured or, in any other way, damaged. If sealing boot is punctured or damaged while being vented, the sealing boot can not be used.

(9) Insert a trim stick between the tripod joint and the sealing boot to vent inner tripod joint assembly (Fig. 37). **When inserting trim stick between tripod housing and sealing boot, ensure trim stick is held flat and firmly against the tripod housing. If this is not done, damage to the sealing boot can occur.** If inner tripod joint has a Hytrel (hard plastic) sealing boot, be sure trim stick is inserted between soft rubber insert and tripod housing, and not the hard plastic sealing boot and soft rubber insert.

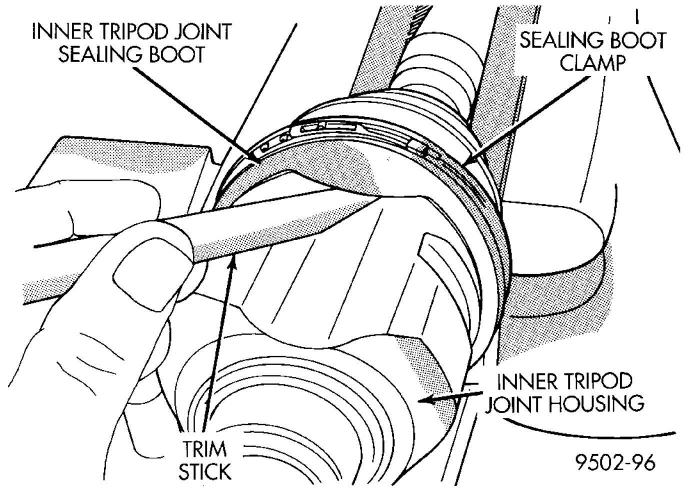


Fig. 37 Trim Stick Inserted for Venting Tripod Joint

(10) With trim stick inserted between sealing boot and tripod joint housing, position inner tripod joint on driveshaft until correct sealing boot edge to edge length is obtained for type of sealing boot material being used (Fig. 38) (Fig. 39). Then remove the trim stick.

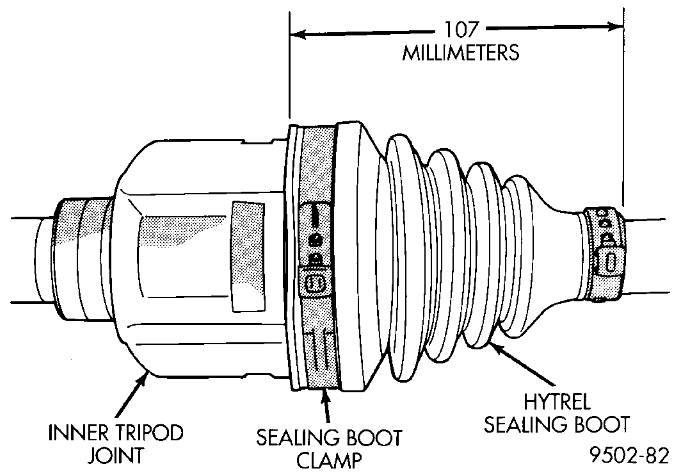


Fig. 38 Sealing Boot End to End Length with Hytrel Boot

(11) Clamp tripod joint sealing boot to tripod joint using required procedure for type of boot clamp application. If seal boot uses crimp type boot clamp, clamp sealing boot onto tripod housing using crimper, Special Tool C-4975-A. Place crimping tool C- 4975-A over bridge of clamp (Fig. 40). Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face–to–face (Fig. 41).

DISASSEMBLY AND ASSEMBLY (Continued)

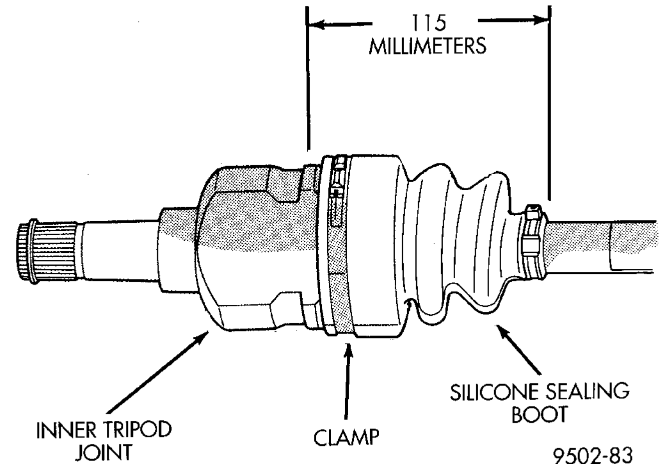


Fig. 39 Sealing Boot End to End Length with Silicone Boot

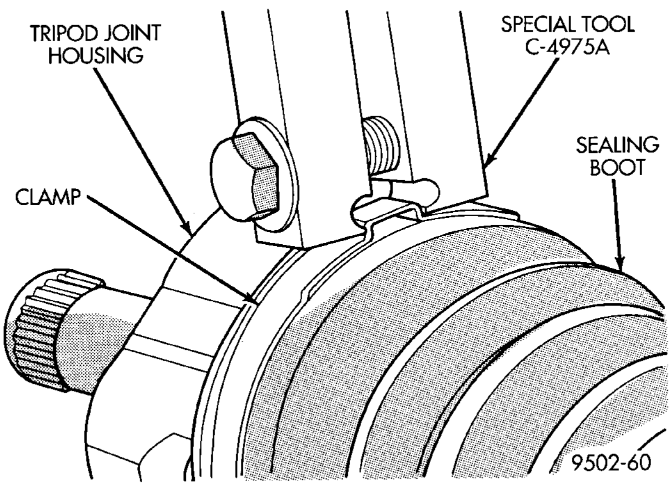


Fig. 40 Crimping Tool Installed on Sealing Boot Clamp

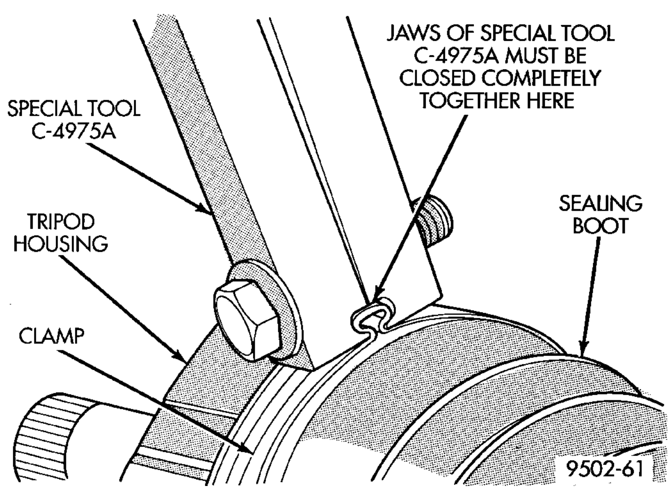


Fig. 41 Sealing Boot Retaining Clamp Installed

(12) If seal boot uses low profile latching type boot clamp, clamp sealing boot onto tripod housing using clamp locking tool, Snap-On® YA3050 (or an equivalent). Place prongs of clamp locking tool in the holes of the clamp (Fig. 42). Squeeze tool together until top band of clamp is latched behind the two tabs on lower band of clamp (Fig. 43).

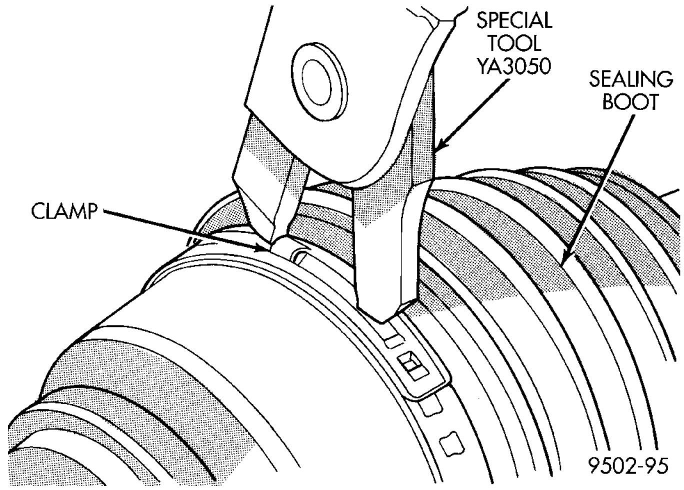


Fig. 42 Clamping Tool Installed on Sealing Boot Clamp

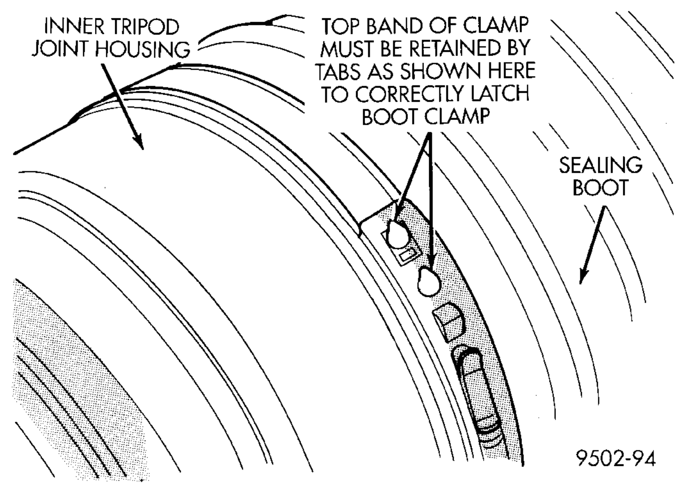


Fig. 43 Sealing Boot Clamp Correctly Installed

(13) Install the driveshaft requiring boot replacement back on the vehicle. See Servicing Driveshaft in this section for the required driveshaft installation procedure.

OUTER C/V JOINT SEAL BOOT

REMOVAL

To remove outer C/V joint sealing boot from a driveshaft for replacement, the driveshaft assembly must be removed from the vehicle. See Servicing Driveshaft in this section for the required driveshaft removal and replacement procedure.

(1) Remove driveshaft assembly requiring boot replacement from vehicle. See Servicing Driveshaft in

DISASSEMBLY AND ASSEMBLY (Continued)

this section for the required driveshaft removal procedure.

(2) Remove large boot clamp retaining C/V joint sealing boot to C/V joint housing (Fig. 44) and discard. Remove small clamp that retains outer C/V joint sealing boot to interconnecting shaft and discard. Remove sealing boot from outer C/V joint housing and slide it down interconnecting shaft.

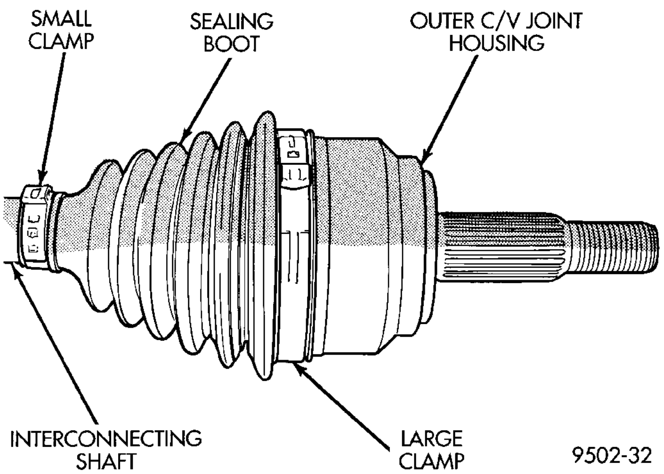


Fig. 44 Outer C/V Joint Seal Boot Clamps

(3) Wipe away grease to expose outer C/V joint and interconnecting shaft.

(4) Remove outer C/V joint from interconnecting shaft using the following procedure: Support interconnecting shaft in a vise **equipped with protective caps on jaws of vise to prevent damage to interconnecting shaft.** Then, using a **soft–faced hammer,** sharply hit the end of the C/V joint housing to dislodge housing from internal circlip on interconnecting shaft (Fig. 45). Then slide outer C/V joint off end of interconnecting shaft, joint may have to be tapped off shaft using a **soft–faced** hammer.

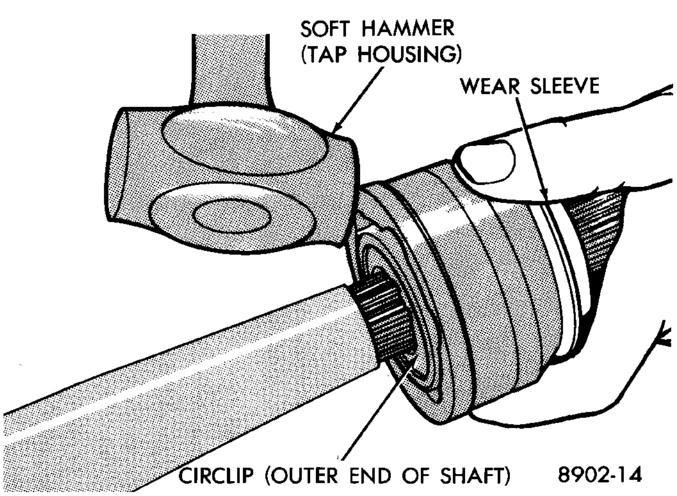


Fig. 45 Outer C/V Joint Removal from Interconnecting Shaft

(5) Remove large circlip (Fig. 46) from the interconnecting shaft before attempting to remove outer C/V joint sealing boot.

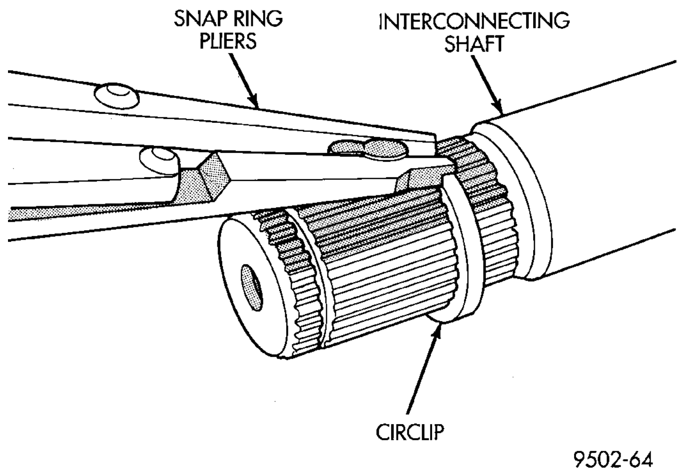


Fig. 46 Circlip Removal from Interconnecting Shaft

(6) Slide failed sealing boot off interconnecting shaft.

(7) Thoroughly clean and inspect outer C/V joint assembly and interconnecting joint for any signs of excessive wear. **If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.**

INSTALLATION

(1) Slide new sealing boot to interconnecting shaft retaining clamp onto interconnecting shaft. Slide the outer C/V joint assembly sealing boot onto the interconnecting shaft (Fig. 47). **Seal boot MUST be positioned on interconnecting shaft so the raised bead on the inside of the seal boot is in groove on interconnecting shaft.**

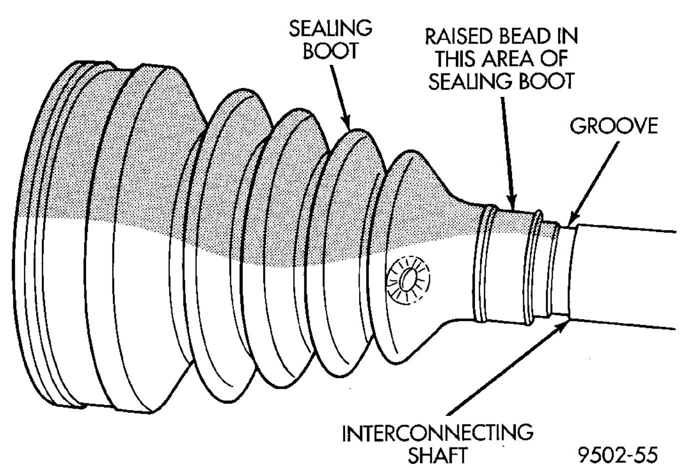


Fig. 47 Sealing Boot Installation on Interconnecting Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Align splines on interconnecting shaft with splines on cross of outer C/V joint assembly and start outer C/V joint onto interconnecting shaft.

(3) Install outer C/V joint assembly onto interconnecting shaft by using a **soft–faced** hammer and tapping end of stub axle (with nut installed) until outer C/V joint is fully seated on interconnecting shaft (Fig. 48).

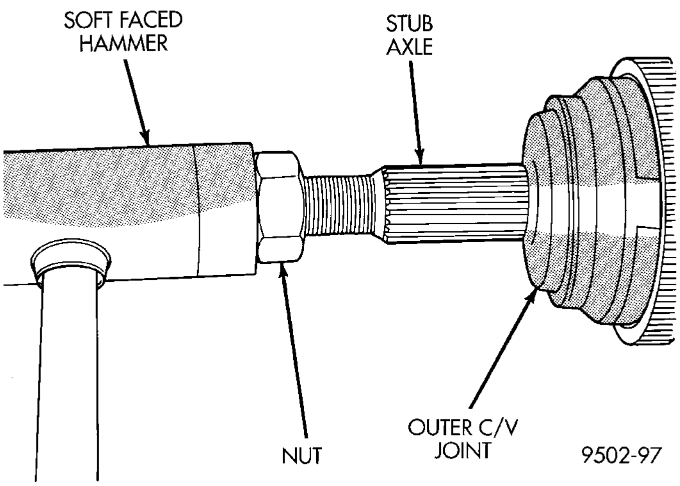


Fig. 48 Outer C/V Joint Installation on Interconnecting Shaft

(4) Outer C/V joint assembly must be installed on interconnecting shaft until cross of outer C/V joint assembly is seated against circlip on interconnecting shaft (Fig. 49).

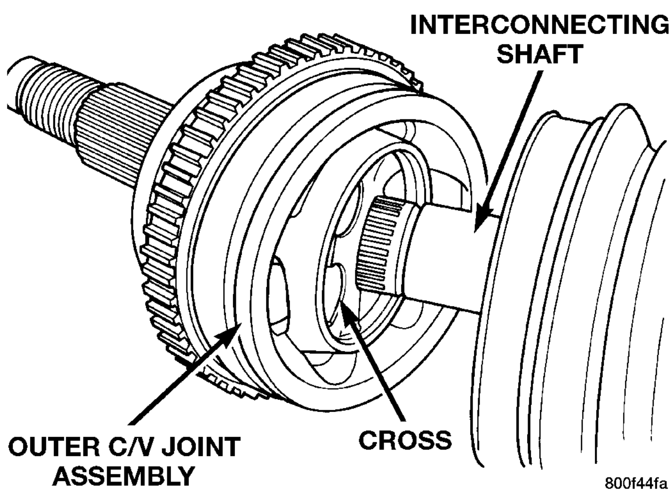


Fig. 49 Outer C/V Joint Correctly Installed on Interconnecting Shaft

(5) Distribute 1/2 the amount of grease provided in seal boot service package (DO NOT USE ANY OTHER TYPE OF GREASE) into outer C/V joint assembly housing. Put the remaining amount into the sealing boot.

(6) Install outer C/V joint sealing boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C- 4975-A over bridge of clamp (Fig. 50). Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 51).

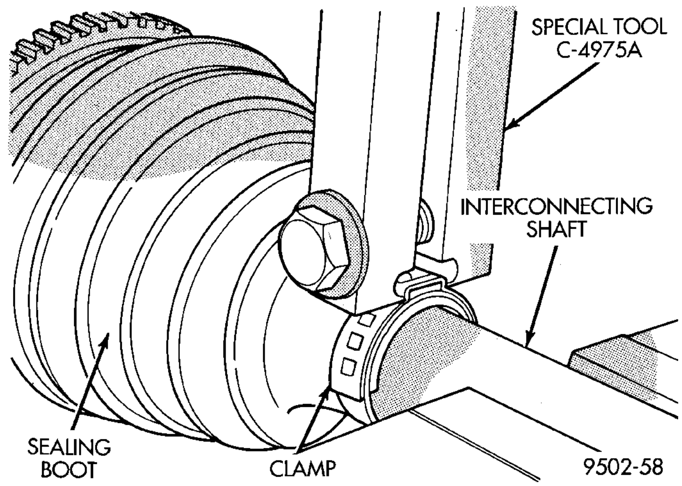


Fig. 50 Crimping Tool Installed on Sealing Boot Clamp

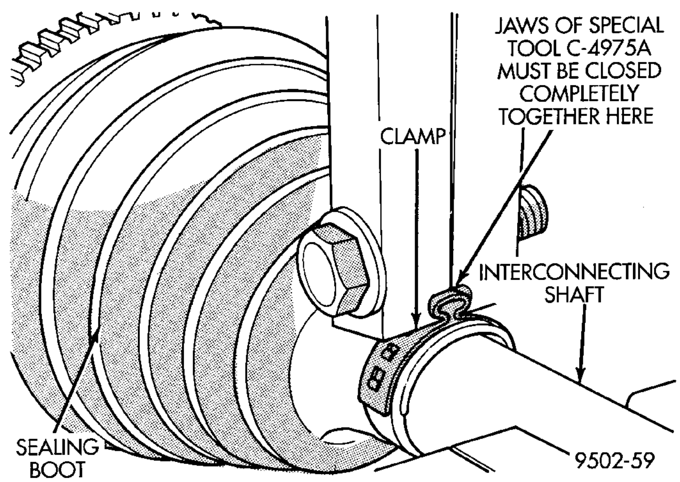


Fig. 51 Sealing Boot Retaining Clamp Installed

CAUTION: Seal must not be dimpled, stretched, or out–of–shape in any way. If seal is NOT shaped correctly, equalize pressure in seal and shape it by hand.

(8) Position outer C/V joint sealing boot into its retaining groove on outer C/V joint housing. Install sealing boot to outer C/V joint retaining clamp evenly on sealing boot.

(9) Clamp sealing boot onto outer C/V joint housing using Crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C- 4975-A over bridge of clamp (Fig. 52). Tighten nut on crimping

DISASSEMBLY AND ASSEMBLY (Continued)

tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 53).

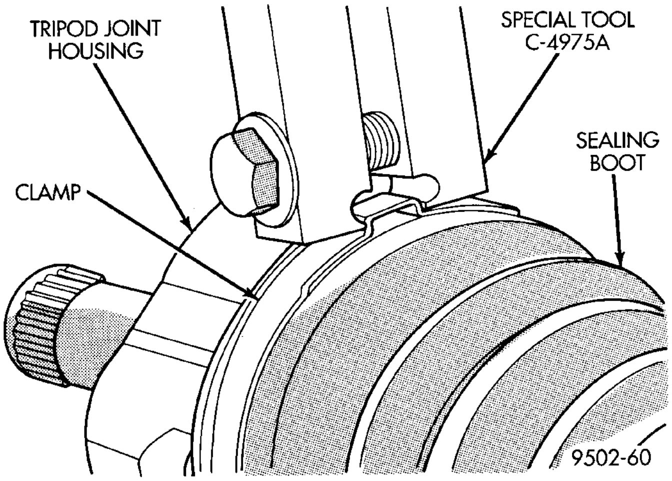


Fig. 52 Crimping Tool Installed on Sealing Boot Clamp

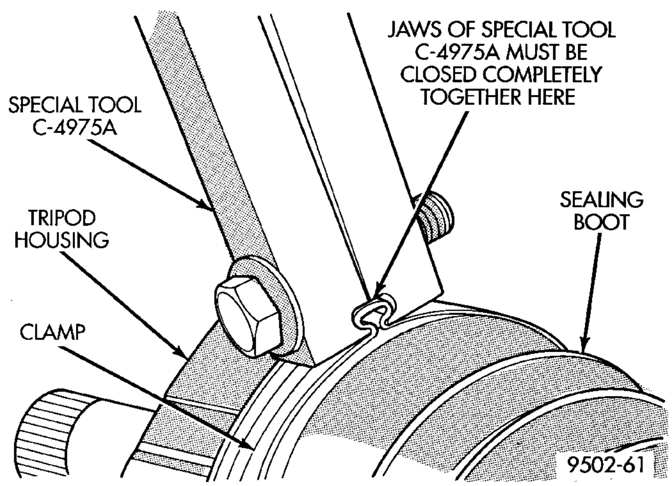


Fig. 53 Sealing Boot Retaining Clamp Installed

(10) Install the driveshaft requiring boot replacement back on the vehicle. See Servicing Driveshaft in this section for the required driveshaft installation procedure.

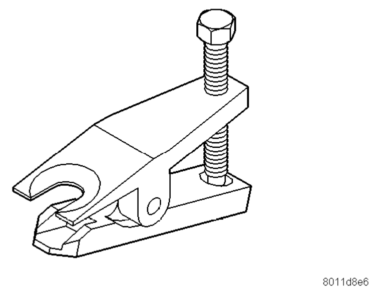
SPECIFICATIONS

TORQUE

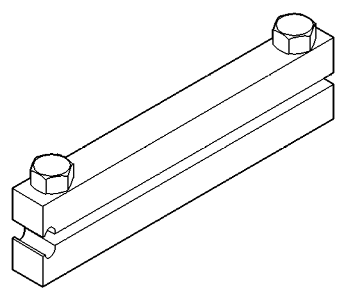
DESCRIPTION	TORQUE
Caliper To Knuckle Bolt	31 N·m (23 ft. lbs.)
Driveshaft Nut	183 N·m (135 ft. lbs.)
Front Wheel Lug Nuts	135 N·m (100 ft. lbs.)
Knuckle To Ball Joint Bolt	95 N·m (70 ft. lbs.)
Tie Rod End To Knuckle	61 N·m (45 ft. lbs.)

SPECIAL TOOLS

DRIVESHAFT



Tie Rod Remover MB-990635



Boot Clamp Installer C-4975A

BRAKES

CONTENTS

GENERAL INFORMATION

INDEX

GENERAL INFORMATION

BASE BRAKE SYSTEM DESCRIPTION

Typical brake equipment consists of:

- Double pin floating caliper disc front brakes.
- Rear automatic adjusting drum brakes.
- Brake Fluid Level Switch.
- Master cylinder.
- Vacuum power booster.
- Double pin floating caliper rear disc brakes are available on some models.
- Hand operated auto adjust park brake lever.
- Front disc brake pads are semi-metallic.

Vehicles equipped with an Antilock Brake System (ABS) use a system designated ABX-4 and is supplied by Bendix. This system shares the base brake hardware with vehicles not equipped with ABS. A vehicle equipped with ABS does however use a different vacuum booster, master cylinder and brake tubes. Also included in the ABS system is a hydraulic control unit (HCU), four wheel speed sensors, and an electronic controller (CAB). These components will be described in detail in the Bendix ABX 4 brake section in this group of the service manual.

The hydraulic brake system 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 master cylinder is anodized, lightweight aluminum. On vehicles equipped with front disc brakes and rear drum brakes, the master cylinder bore is 21.0 mm. On vehicles equipped with four wheel disc brakes, the master cylinder bore is 7/8”.

BASE BRAKE SYSTEM

INDEX

DESCRIPTION AND OPERATION

FRONT DISC BRAKES

The front disc brakes (Fig. 1) and (Fig. 2) consists of the following components:

- The driving hub
- Braking disc (rotor)
- Caliper assembly - single piston, floating type
- Brake shoes and linings

The double pin Kelsey-Hayes Calipers are mounted directly to the steering knuckles and use no adapter. The caliper is mounted to the steering knuckle using bushings, sleeves and 2 guide pin bolts which thread directly into bosses on the steering knuckle (Fig. 2) and (Fig. 3).

Two machined abutments on the steering knuckle position the caliper. The guide pin bolts, sleeves and bushings control the 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

DESCRIPTION AND OPERATION (Continued)

pedal is released. This maintains the proper brake shoe to rotor clearance (Fig. 4).

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

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

The front disc brake caliper piston (Fig. 2), is manufactured from a phenolic compound. The outside diameter of the caliper piston is 54 mm.

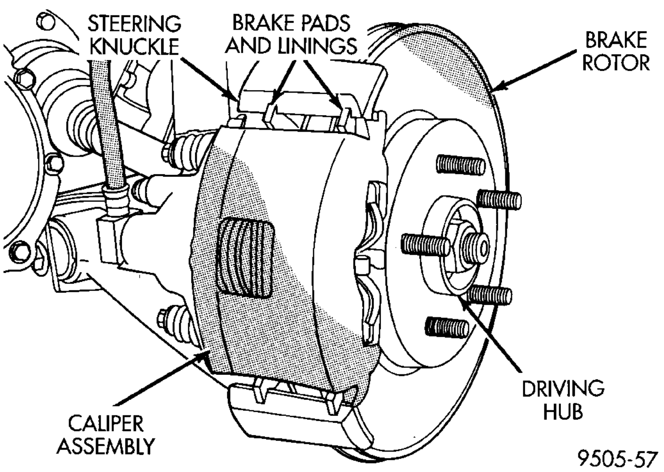


Fig. 1 Front Disc Brake Caliper Assembly

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

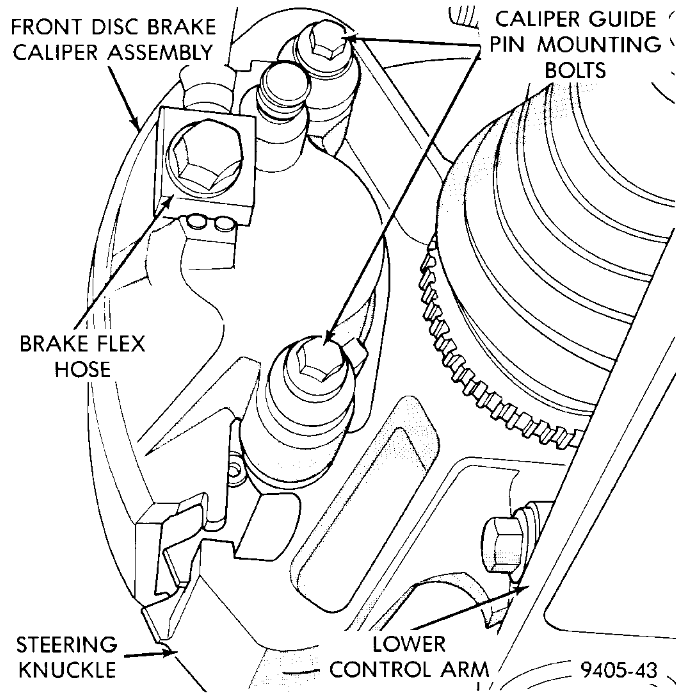


Fig. 3 Front Disc Brake Caliper Mounting

A rubber dust boot is installed in the cylinder bore opening and in a groove in the piston (Fig. 4). This prevents contamination in the bore area.

As front disc brake linings wear, master cylinder reservoir brake fluid level will drop. Fluid level should be checked after replacing linings.

Front disc brakes are equipped with an audible wear indicator (Fig. 2) on the outboard brake pad.

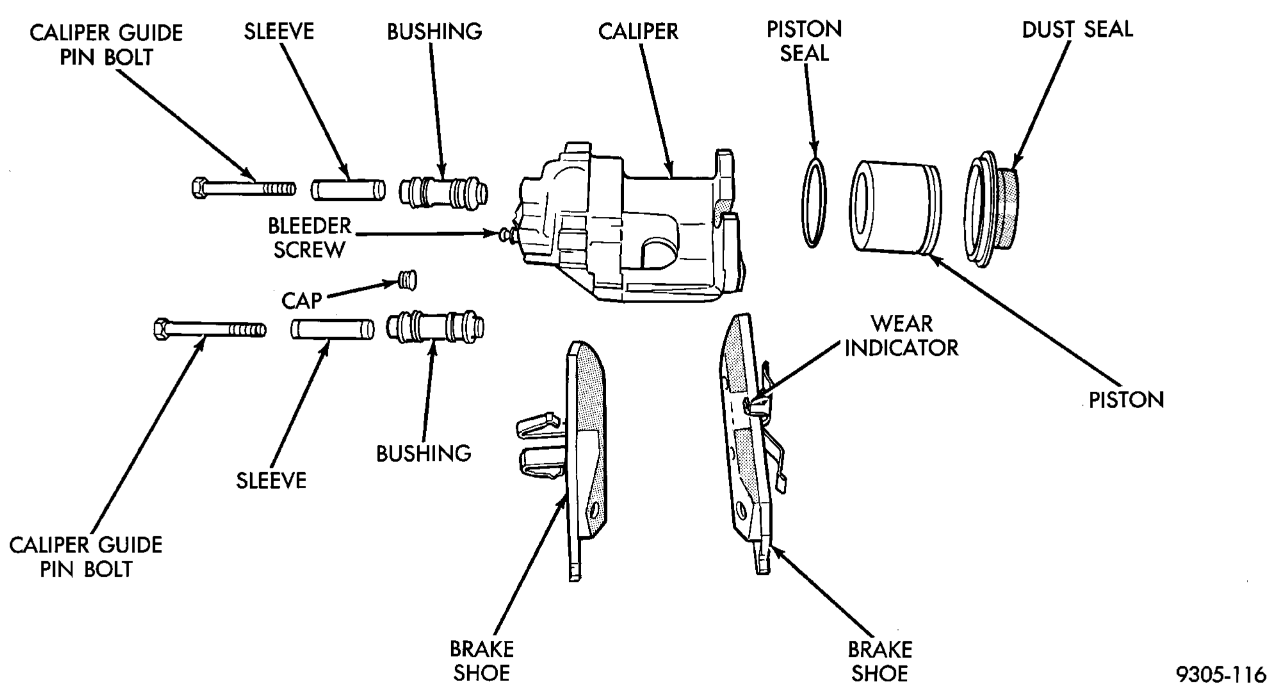


Fig. 2 Front Disc Brake Caliper (Exploded View)

DESCRIPTION AND OPERATION (Continued)

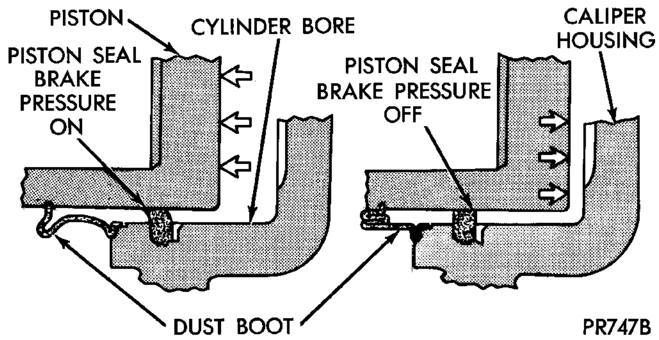


Fig. 4 Piston Seal Function for Automatic Adjustment

This sensor emits a sound when the brake lining may need inspection and/or replacement.

REAR DISC BRAKES

The rear disc brakes are similar to the front disc brakes, however, there are several distinctive features that require different service procedures. The single piston, floating caliper rear disc brake assembly includes a hub and bearing assembly, adapter, brake rotor, caliper, brake pads/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 rotor.

Vehicles are equipped with a caliper assembly that has a 34 mm (1.43 in.) piston and uses a solid non-vented rotor.

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 and rotor shield are mounted to the rear suspension knuckles of vehicle. The adapter 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 pads for movement inboard and outboard (Fig. 5).

REAR DRUM BRAKES

The rear wheel drum brakes are a two shoe, internal expanding type with an automatic adjuster screw (Fig. 6). The automatic adjuster screw is actuated each time the brakes are applied. The automatic adjuster screw is located directly below the rear brake wheel cylinder.

PARKING BRAKES

All vehicles are equipped with a center mounted, hand operated park brake lever. This lever is an

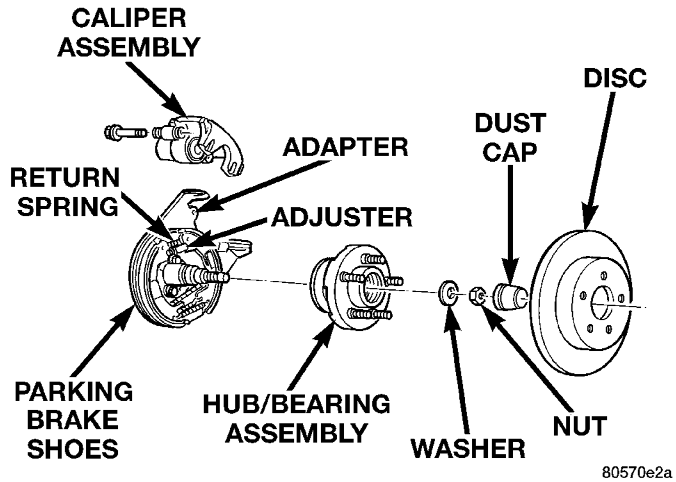


Fig. 5 Rear Disc Brake Assembly Exploded View

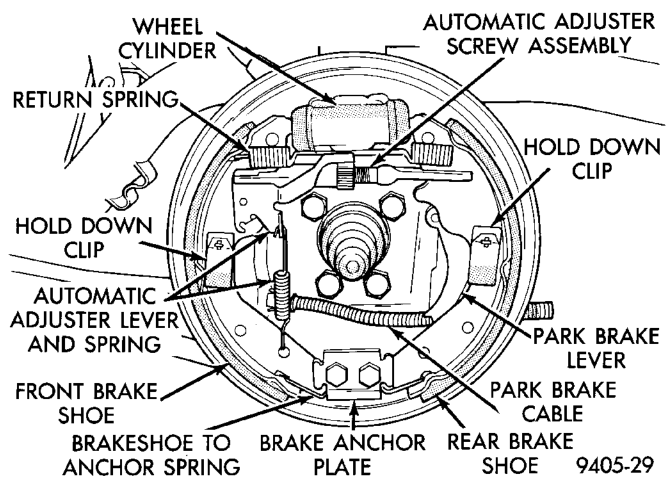


Fig. 6 Kelsey Hayes Rear Wheel Brake Assembly (Left Side Shown)

auto-adjust type which continuously applies minimal tension to the parking brake cables to keep them in adjustment at all times. Due to this feature, the park brake cable system does not require adjustment. Proper parking brake system adjustment is obtained by proper drum brake or drum-in-hat brake shoe adjustment.

On vehicles equipped with rear drum brakes, the rear wheel service brakes also act as the vehicle's parking brakes. The rear drum brake shoes, when acting as parking brakes, are mechanically operated using an internal actuating lever and strut which is connected to a flexible steel cable. There is an individual park brake cable for each rear wheel, which are joined using a park cable equalizer before terminating at the floor mounted, hand operated park brake lever.

The parking brakes on vehicles equipped with rear disc brakes consist of a small duo-servo brake assembly mounted to the disc brake caliper adapter (Fig. 7). The hat (center) section (Fig. 8) of the rear rotor

DESCRIPTION AND OPERATION (Continued)

serves as the braking surface (drum) for the parking brakes. This park brake application uses the same operating cable configuration as the drum brake equipped vehicles, but different cables.

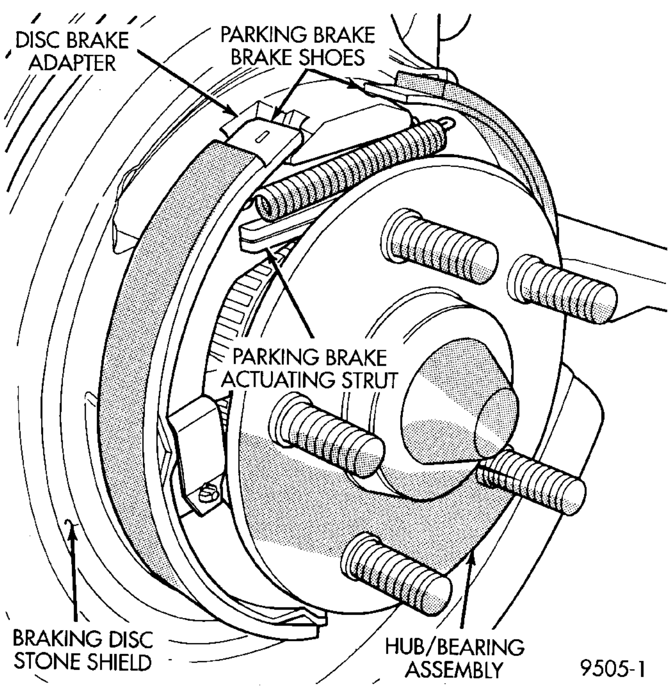


Fig. 7 Park Brake Assembly With Rear Disc Brakes

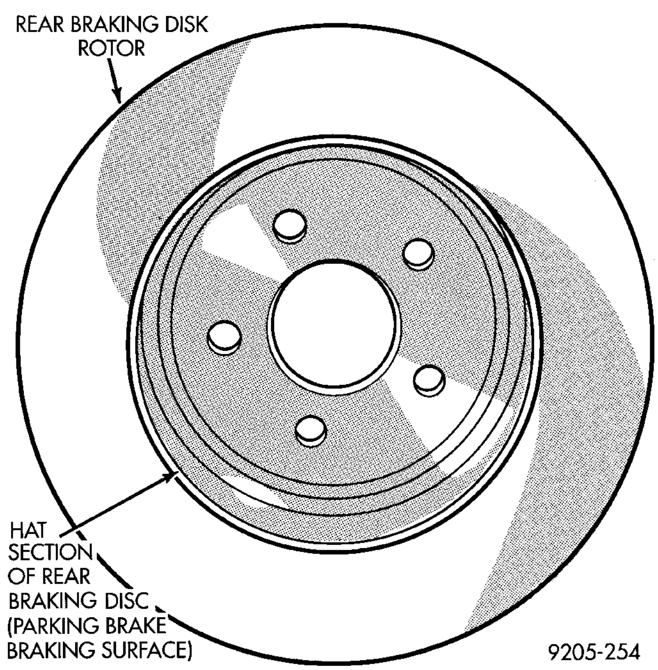


Fig. 8 Drum In Hat Rotor

PROPORTIONING VALVES

This vehicle uses screw-in proportioning valves at the master cylinder or Hydraulic Control Unit instead of the combination valve used in prior designs. With this new design, the chassis brake tubes connect directly from the master cylinder (or HCU) to the brake flex hose.

The non-ABS master cylinders are a four outlet design with two screw-in proportioning valves attached directly to the inboard side of the master cylinder housing (Fig. 9).

The ABS master cylinders are a two outlet design with the screw-in proportioning valves attached directly to the Hydraulic Control Unit (HCU) (Fig. 10).

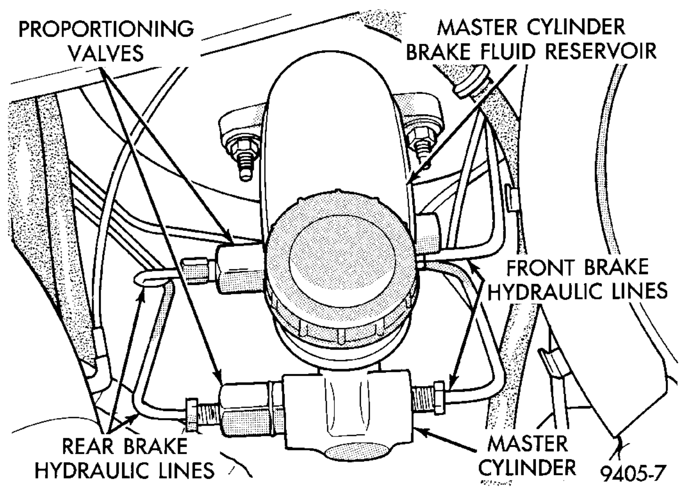


Fig. 9 Master Cylinder And Proportioning Valves For Non ABS Equipped Vehicles

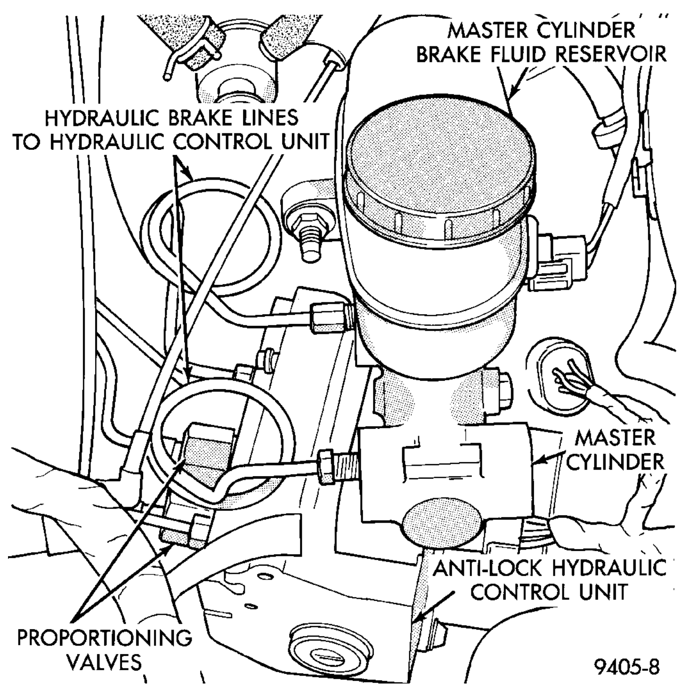


Fig. 10 Master Cylinder And Proportioning Valves For Antilock Brake Equipped Vehicles

Proportioning valves balance front to rear braking by controlling at a given ratio, the increase in rear brake system hydraulic pressure above a preset level

DESCRIPTION AND OPERATION (Continued)

(split point). Under light pedal application, the proportioning valve allows full hydraulic pressure to be applied to the rear brakes.

There are two proportioning valve assemblies used in each vehicle. Due to differences in thread sizes, each prop valve has a different part number. During any service procedures identify valve assemblies by supplier part number and or the color identification band (Fig. 11).

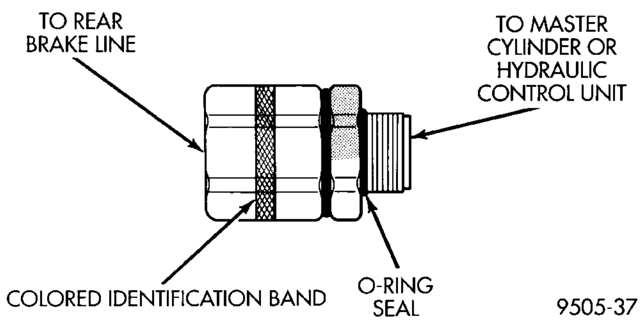


Fig. 11 Proportioning Valve Identification

CHASSIS TUBES AND HOSES

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

MASTER CYLINDER

This vehicle is available with three different master cylinders. The vehicle uses screw-in proportioning valves at the master cylinder or Hydraulic Control Unit instead of the combination valve used in prior designs. With this new design, the chassis brake tubes connect directly from the master cylinder (or HCU) to the brake flex hose.

Vehicles not equipped with ABS use a standard compensating port design, while vehicles equipped with ABS use a center valve design master cylinder. In addition, the non-ABS master cylinders are a four outlet design with two screw-in proportioning valves attached directly to the inboard side of the master cylinder housing (Fig. 12). The ABS master cylinders are a two outlet design with the screw-in proportioning valves attached directly to the Hydraulic Control Unit (HCU) (Fig. 13). Vehicles equipped with rear drum brakes use a master cylinder with a 21 mm bore diameter, while vehicles equipped with rear disc brake use a 7/8” bore master cylinder.

The brake system master cylinder assembly (Fig. 12) consists of the following components. The body of the master cylinder is an anodized aluminum casting. It has a machined bore to accept the master cylinder piston and threaded ports with seats for hydraulic brake line connections. The brake fluid reservoir of the master cylinder assembly is made of a see through polypropelene type plastic.

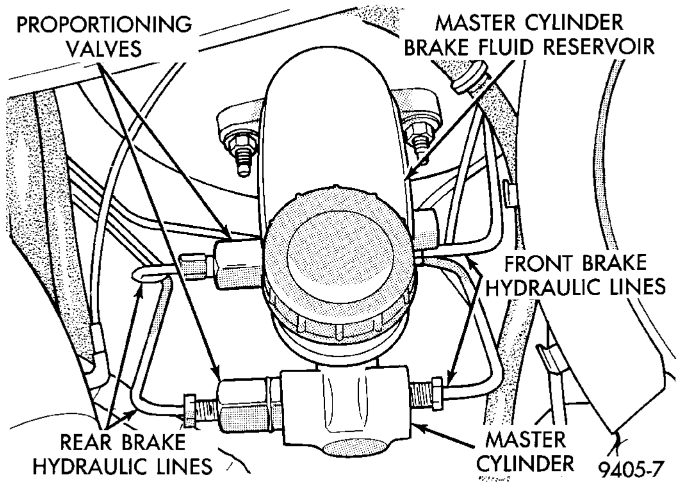


Fig. 12 Master Cylinder For Non Anti-Lock Brake Equipped Vehicles

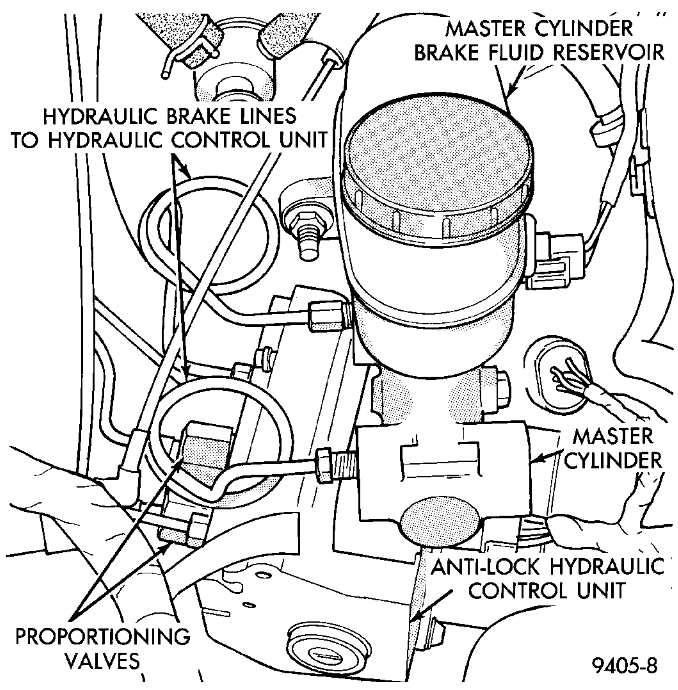


Fig. 13 Master Cylinder For Anti-Lock Brake Equipped Vehicles

On Non-ABS master cylinders, the primary outlet ports (Fig. 14) supply hydraulic pressure to the left front and right rear brakes. The secondary outlet ports (Fig. 14) supply hydraulic pressure to the right front and left rear brakes.

On ABS master cylinders, the primary outlet port (Fig. 15) supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port

DESCRIPTION AND OPERATION (Continued)

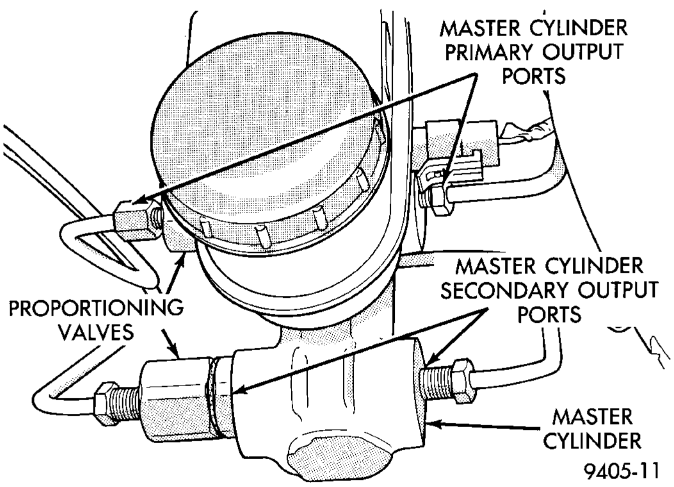


Fig. 14 Non-ABS Master Cylinder Primary And Secondary Ports

(Fig. 15) supplies hydraulic pressure to the left front and right rear brakes.

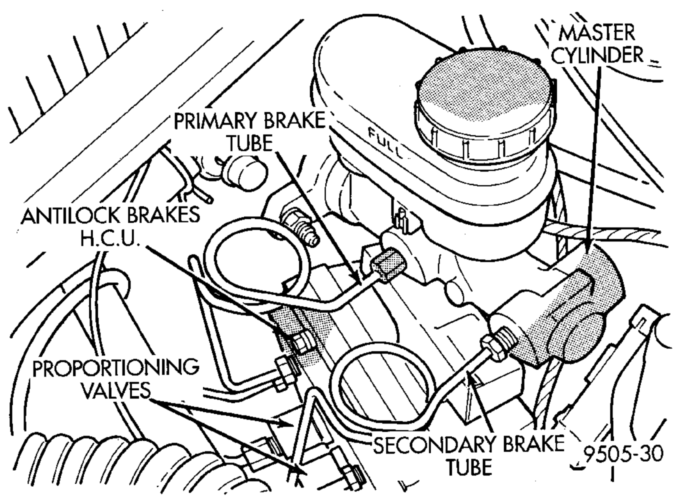


Fig. 15 ABS Master Cylinder Primary And Secondary Ports

VACUUM BOOSTER

All vehicles use a 230 mm single diaphragm power brake vacuum booster. There are however two different booster designs; one for vehicles equipped with ABS and one for vehicles without ABS. These two boosters differ at the interface to the master cylinder. If the power brake booster requires replacement be sure it is replaced with the correct part.

The power brake booster can be identified by the tag attached to the body of the booster assembly (Fig. 16). This tag contains the following information: The production part number of the power booster assembly, the date it was built, who manufactured it, and brake sales code.

NOTE: 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 replaced as an assembly.

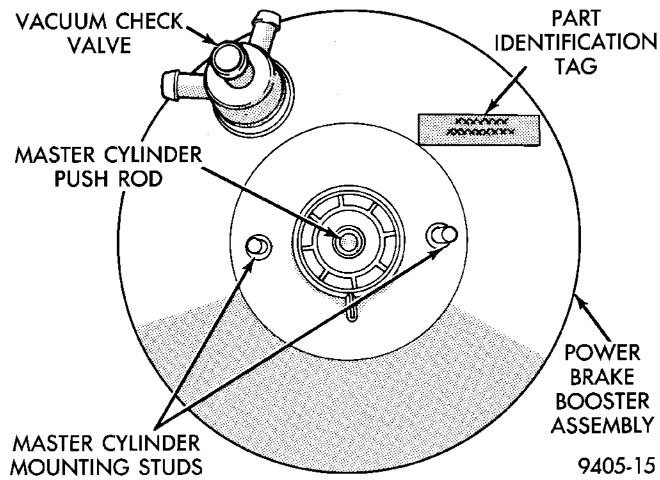


Fig. 16 Power Brake Booster Identification

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

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 16).

As the brake pedal is depressed, the power booster input rod moves forward (Fig. 17). This opens and closes valves in the power booster, allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the power booster (Fig. 17) 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.

Different engine options available for this vehicle require that different vacuum hose routings be used.

The power brake vacuum booster assembly mounts on the engine side of the dash panel. It is connected to the brake pedal by the input push rod (Fig. 17). A vacuum line connects the power booster to the intake manifold. The master cylinder is bolted to the front of the power brake vacuum booster assembly.

RED BRAKE WARNING LAMP

The red Brake warning lamp is located in the instrument panel cluster and is used to indicate a low brake fluid condition or that the parking brake is applied. In addition, the brake warning lamp is turned on as a bulb check by the ignition switch when the ignition switch is placed in the crank position. Problems with this system will generally be of the type where the warning lamp fails to turn on when it should, or remains on when it should not.

DESCRIPTION AND OPERATION (Continued)

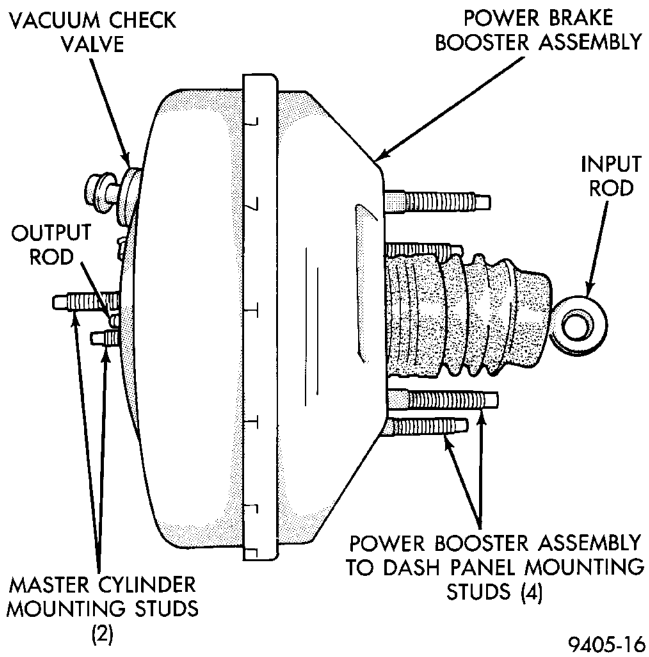


Fig. 17 Power Brake Booster Assembly

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

The Brake Fluid Level sensor is located in the brake fluid reservoir of the master cylinder assembly (Fig. 18). The purpose of the sensor is to provide the driver with an early warning that the brake fluid level in the master cylinder reservoir has dropped to below normal. This may indicate an abnormal loss of brake fluid in the master cylinder fluid reservoir resulting from a leak in the hydraulic system.

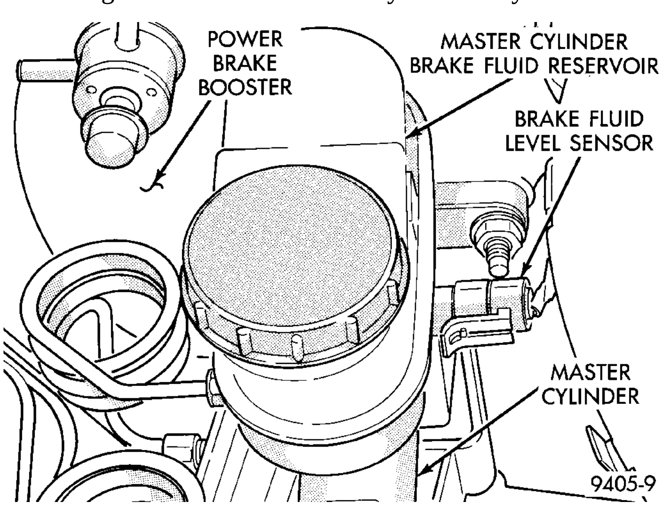


Fig. 18 Master Cylinder Fluid Level Sensor

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

STOP LAMP SWITCH

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

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

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

REAR WHEEL HUB AND BEARING ASSEMBLY

All vehicles are equipped with permanently lubricated and sealed for life rear wheel bearings. There is no periodic lubrication or maintenance recommended for these units. However, if servicing of a rear wheel bearing is required, refer to procedures in the diagnosis and testing section and the removal and installation section in this group of the service manual for the inspection and replacement of the rear wheel bearing.

DIAGNOSIS AND TESTING

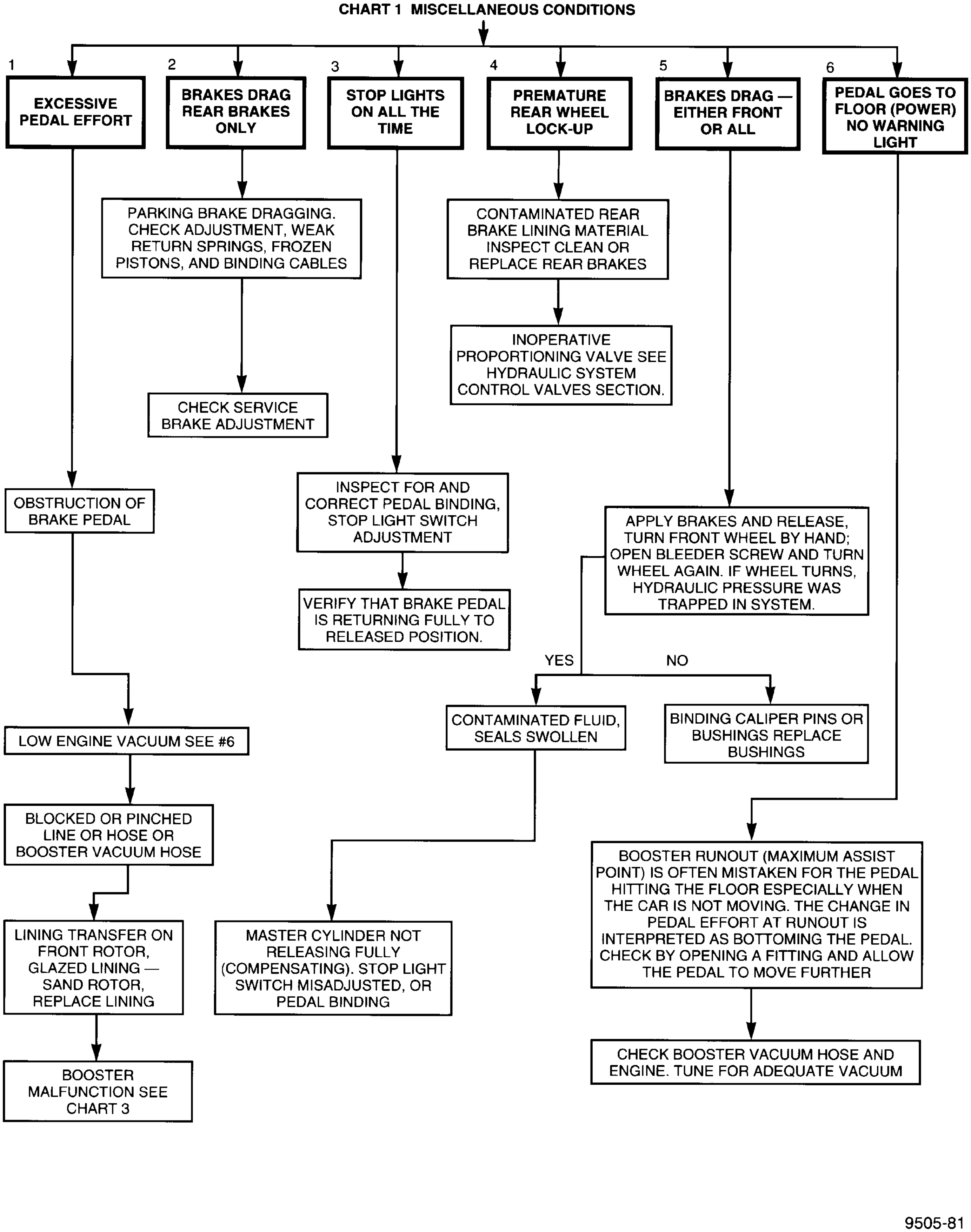
BRAKE SYSTEM BASIC DIAGNOSIS GUIDE

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

DIAGNOSIS AND TESTING (Continued)

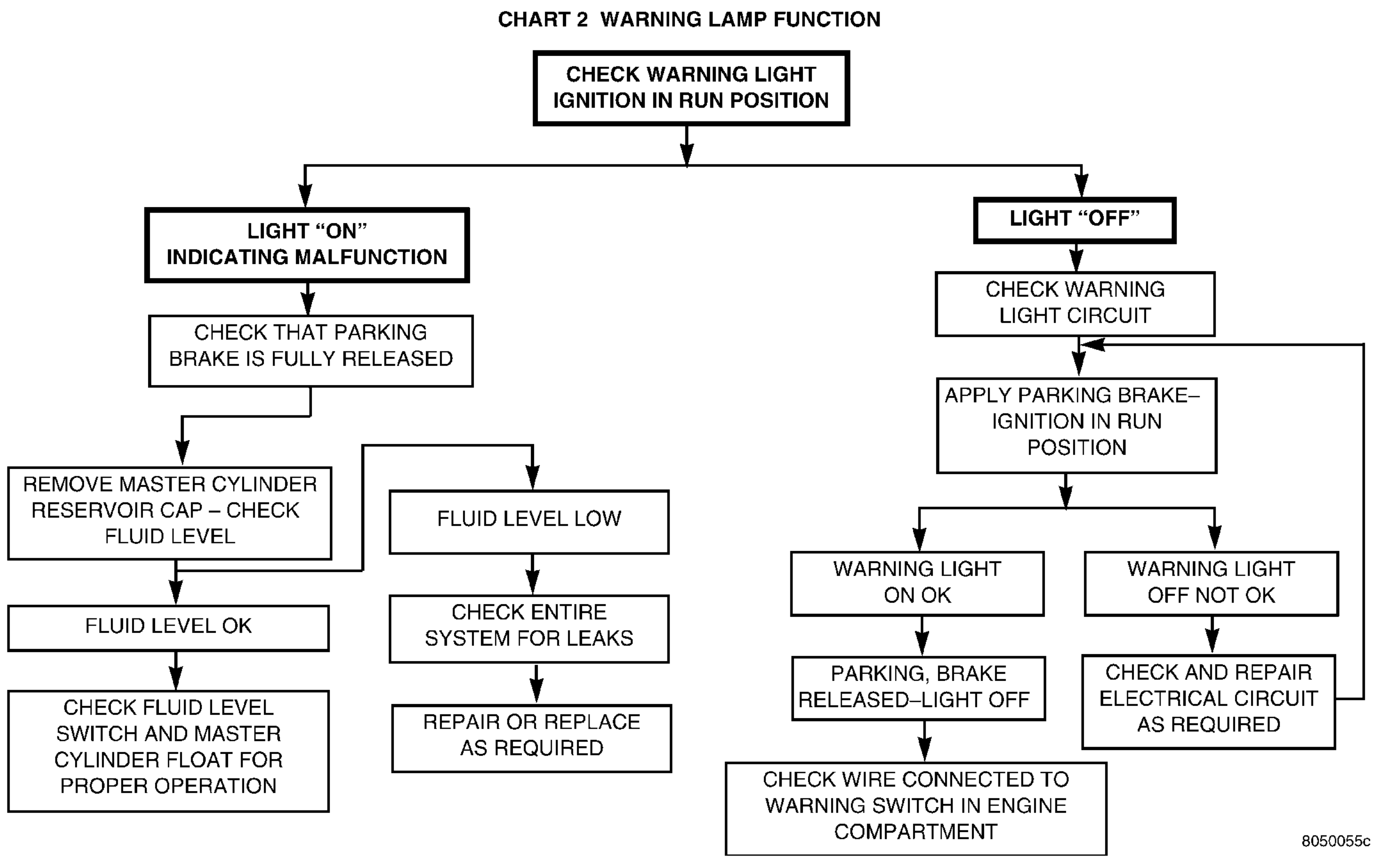
BRAKE SYSTEM DIAGNOSIS CHARTS

MISCELLANEOUS BRAKE SYSTEM CONDITIONS



DIAGNOSIS AND TESTING (Continued)

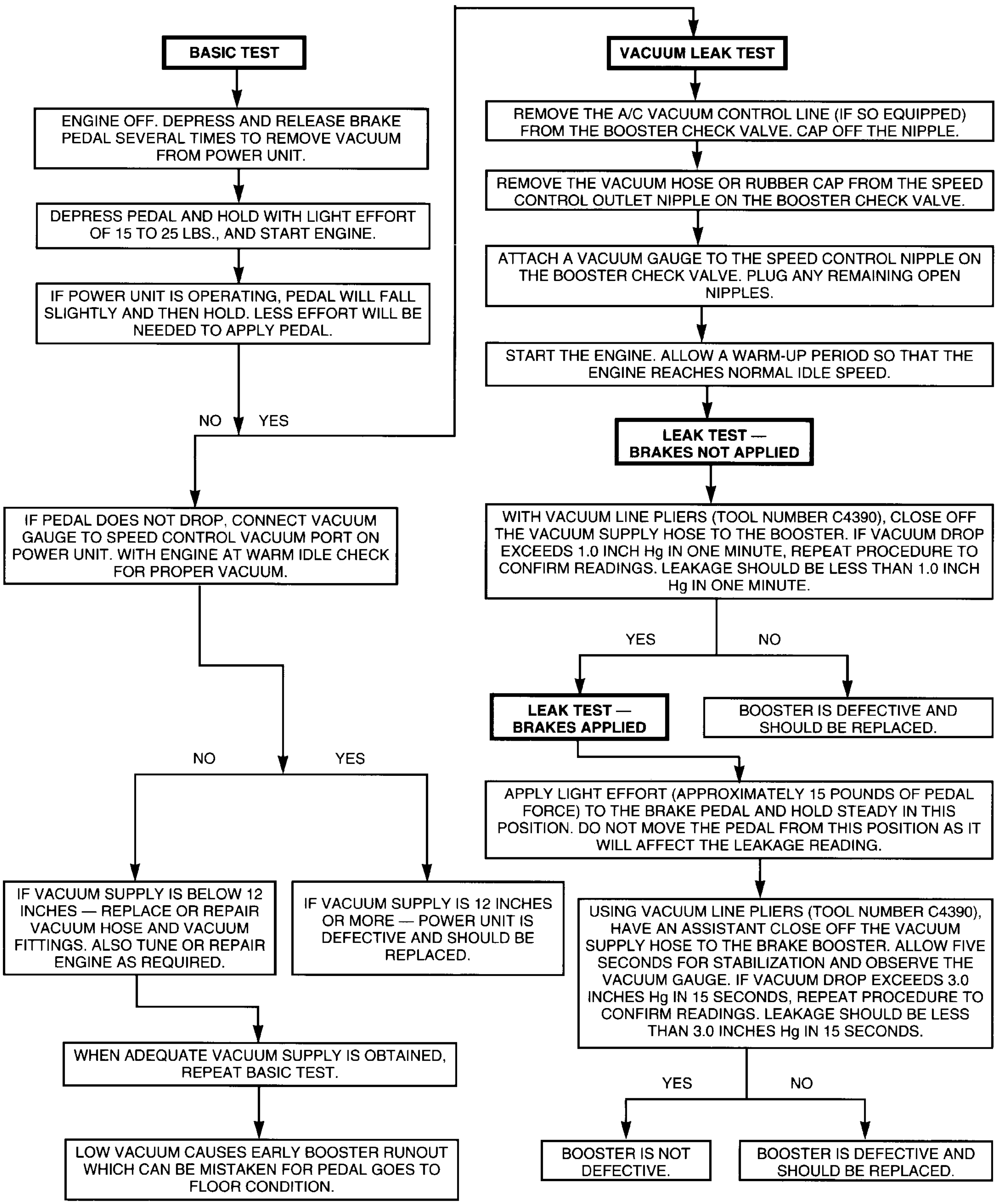
RED BRAKE WARNING LAMP FUNCTION



DIAGNOSIS AND TESTING (Continued)

POWER BRAKE SYSTEM DIAGNOSTICS

CHART 3 POWER BRAKES



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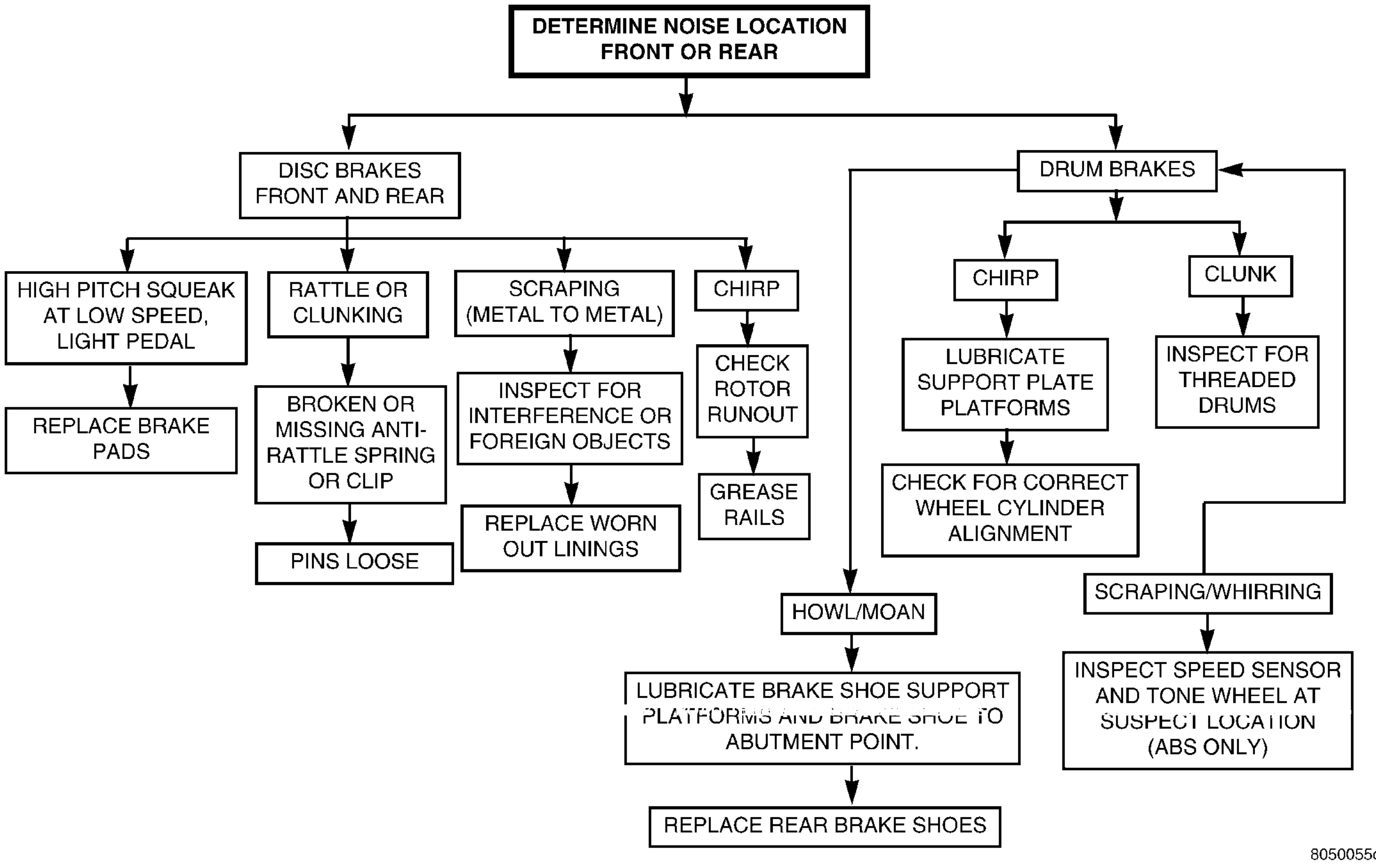
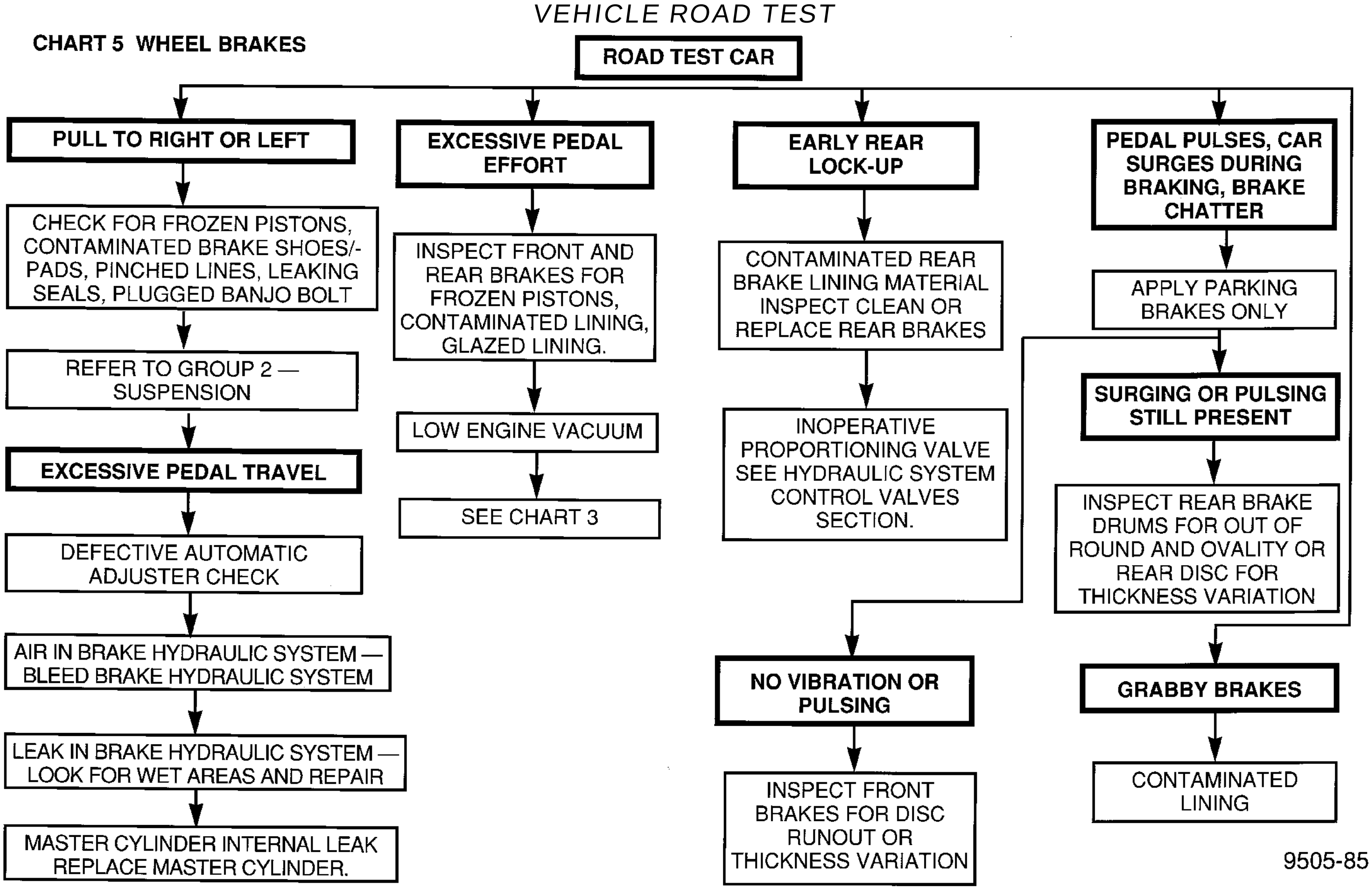
DIAGNOSIS AND TESTING (Continued)

BRAKE NOISE



VEHICLE ROAD TEST

CHART 5 WHEEL BRAKES



DIAGNOSIS AND TESTING (Continued)

DRUM BRAKE AUTOMATIC ADJUSTER

Place the vehicle on a hoist with a helper in the driver's seat to apply the brakes. Remove the access plug from the rear adjustment slot in each brake support plate to provide access to the adjuster star wheel. Then, to eliminate the possibility of maximum adjustment, back the star wheel off approximately 10 notches. It will be necessary to hold the adjuster lever away from the star wheel to permit this adjustment.

Apply the brake pedal. This application of force will cause the brake shoes to leave the anchor. Upon application of the brake pedal, the lever should move downward, 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.

ROTOR THICKNESS AND RUNOUT

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

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

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

Excessive lateral runout or wobble.

Thickness variation (Parallelism).

Dishing or distortion (Flatness).

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

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

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

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

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

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

ROTOR RUNOUT AND THICKNESS VARIATION

On vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable). To measure runout on the vehicle, remove the wheel and reinstall the lug nuts tightening the rotor to the hub. Mount Dial Indicator, Special Tool C-3339 with Mounting Adaptor, Special Tool SP- 1910 on steering arm. Dial indicator plunger should contact braking surface of rotor approximately one inch from edge of rotor (Fig. 19). Check lateral runout (both sides of rotor) runout should not exceed 0.13 mm (0.005 inch).

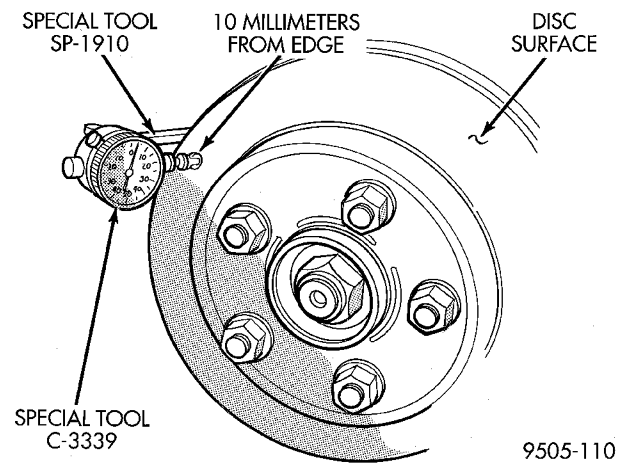


Fig. 19 Checking Rotor For Runout

If runout is in excess of the specification, check the lateral runout of the hub face. Before removing rotor from hub, make a chalk mark across both the rotor and one wheel stud on the high side of runout so you'll know exactly how the rotor and hub was originally mounted (Fig. 20). Remove rotor from hub.

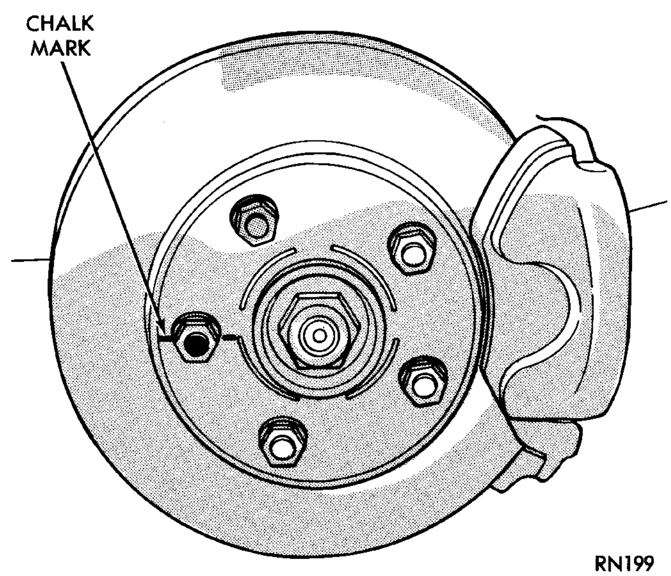


Fig. 20 Marking Rotor and Wheel Stud

Install Dial Indicator, Special Tool C-3339 and Mounting Adaptor, Special Tool SP-1910 on steering knuckle. Position stem so it contacts hub face near

DIAGNOSIS AND TESTING (Continued)

outer diameter. Care must be taken to position stem outside the stud circle but inside the chamfer on the hub rim (Fig. 21). **Clean hub surface before checking.**

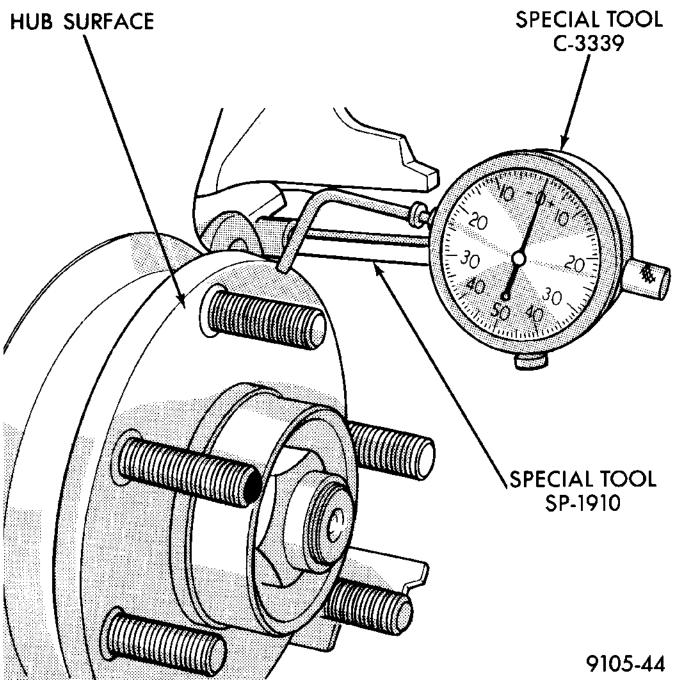


Fig. 21 Checking Hub for Runout

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 rotor on hub with chalk marks two wheel studs apart (Fig. 22). Tighten nuts in the proper sequence and torque to specifications. Finally, check runout of rotor to see if runout is now within specifications.

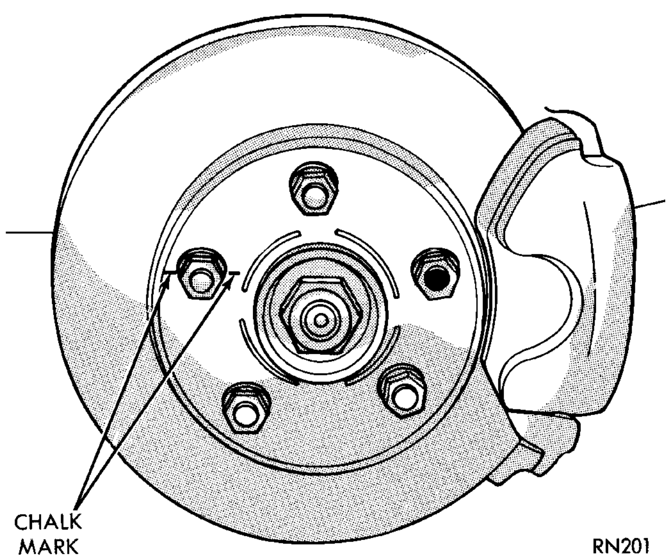


Fig. 22 Index Rotor And Wheel Stud

If runout is not within specifications. Install a new rotor or reface rotor, being careful to remove as little as possible from each side of rotor. Remove equal amounts from each side of rotor. Do not reduce thickness below minimum thickness cast into the un-machined surface of the rotor.

Thickness variation measurements of rotor should be made in conjunction with runout. Measure thickness of rotor at 12 equal points with a micrometer at a radius approximately 25 mm (1 inch) from edge of rotor (Fig. 23). If thickness measurements vary by more than 0.013 mm (0.0005 inch) rotor should be removed and resurfaced, or a new rotor installed. If cracks or burned spots are evident, rotor must be replaced.

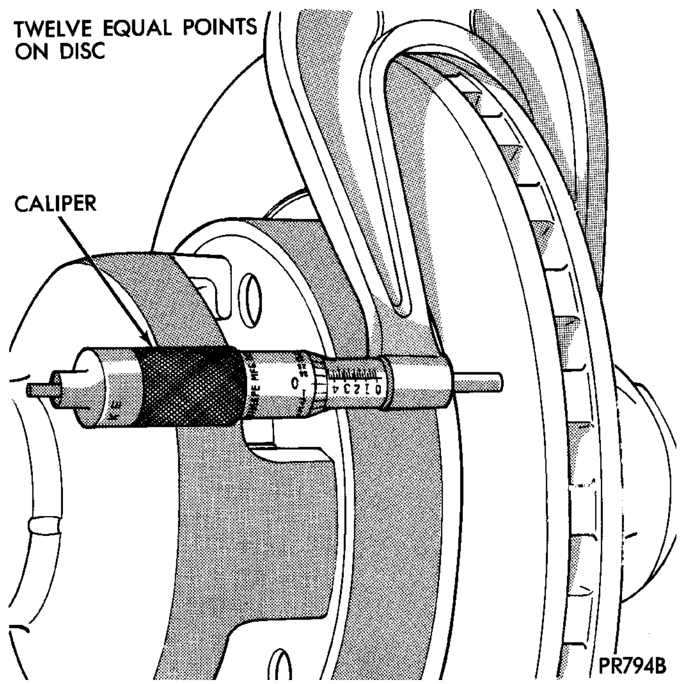


Fig. 23 Checking Rotor For Thickness

Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the rotor must be machined or replaced. See Brake Rotor Machining in the Service Procedures Section in this group of the service manual. Refer to front or rear brake rotor in the Removal And Installation section in this group of the service manual for the required brake rotor replacement procedure.

PROPORTIONING VALVES

PROPORTIONING VALVE TESTING SPECIAL TOOLS

The in-line proportioning valves used on this vehicle require special pressure fittings to test the proportioning valves for proper proportioning valve function. The pressure fittings are installed before and after the proportioning valve being tested to ver-

DIAGNOSIS AND TESTING (Continued)

ify proportioning valve is maintaining the required hydraulic pressure to the rear wheel brake which it controls.

If a condition of premature rear wheel skid occurs on a vehicle, the proportioning valve should always be tested prior to it being replaced. This is due to the fact that there are conditions other then a faulty proportioning valve which can cause a premature rear wheel skid.

Testing proportioning valve pressures on a vehicle with or without ABS requires using the same special tools.

There are 4 Pressure Fittings, Special Tool 6805 (Fig. 24) which are to be used for testing both rear proportioning valves if mounted at the master cylinder or the HCU.

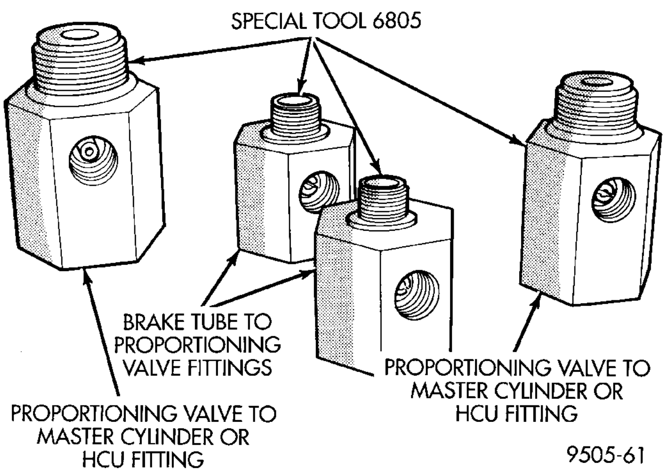


Fig. 24 Proportioning Valve Pressure Test Fittings

The pressure gauges used for testing the new inline proportioning valves on both non-ABS and ABS brakes, is Pressure Gauge Set, Special Tool C-4007-A currently used for testing the combination valve (Fig. 25).

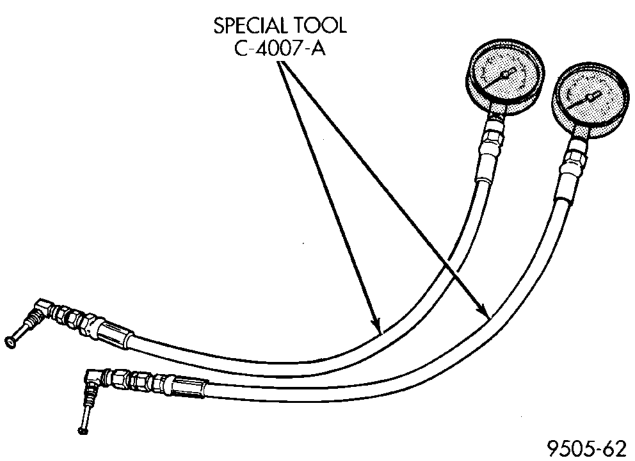


Fig. 25 Proportioning Valve Pressure Test Gauge Set

PROPORTIONING VALVE TESTING NON ABS BRAKE

If premature rear wheel skid occurs on hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 26). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which slides first is determined, use the following procedure to diagnose the proportioning valve.

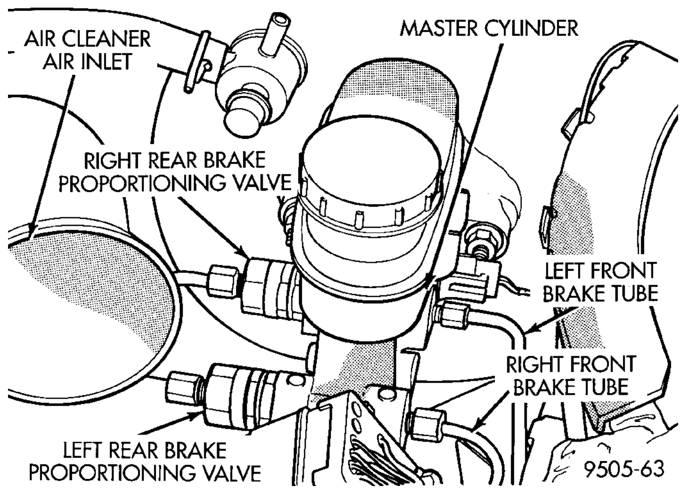


Fig. 26 Non-ABS Brakes Proportioning Valve Location On Master Cylinder

The test procedure for a premature rear wheel skid is the same for both rear wheel proportioning valves. The pressure test fittings used for each proportioning valve though are different due to proportioning valve and brake tube nut thread sizes being unique for each rear wheel. After road testing vehicle to determine which wheel skids first, the proper test fittings required will have to be determined. Then follow the procedure below for testing the required proportioning valve.

(1) After road testing vehicle to determine which rear wheel exhibits premature rear wheel skid, refer to (Fig. 26) to determine which proportioning valve needs to be tested.

(2) Remove hydraulic brake tube (Fig. 26) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(3) Remove proportioning valve from that outlet port of the master cylinder.

CAUTION: Be sure the pressure test fitting being installed into master cylinder, has the correct thread sizes for installation into the master cylinder and the installation of the proportioning valve.

DIAGNOSIS AND TESTING (Continued)

(4) Install Pressure Test Fitting, Special Tool 6805-1 or 6805-2 (Fig. 27) into the outlet port of the master cylinder, which the proportioning valve was removed from.

(5) Install proportioning valve into pressure test fitting installed in master cylinder outlet port (Fig. 27).

CAUTION: Be sure the pressure test fitting being installed into proportioning valve, has the correct thread sizes for installation into the proportioning valve and installation of brake tube fitting.

(6) Install Pressure Test Fitting, Special Tool 6805-3 or 6805-4 (Fig. 27) into the outlet port of the proportioning valve.

(7) Connect brake hydraulic tube onto the pressure test fitting that was installed in proportioning valve (Fig. 27).

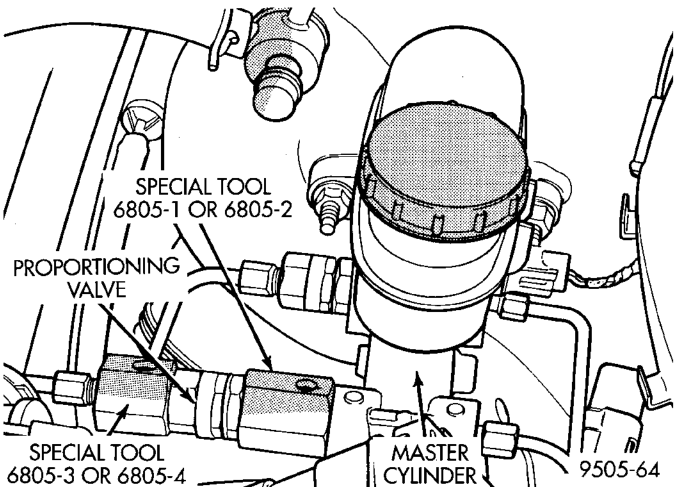


Fig. 27 Proportioning Valve Installation For Pressure Testing

(8) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 28). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air. hose.

(9) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(10) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

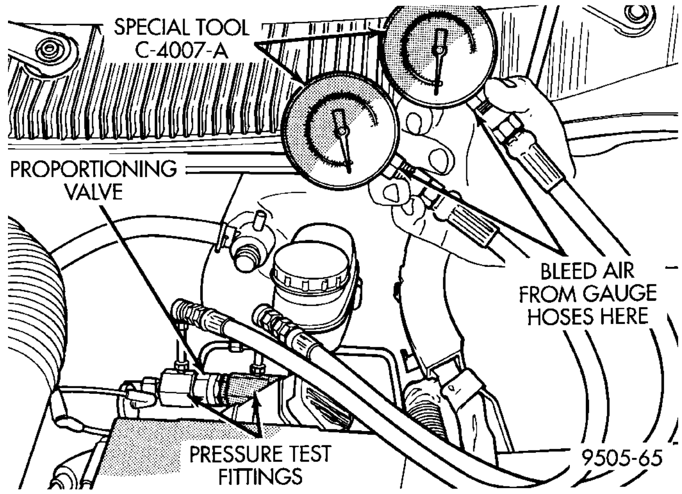


Fig. 28 Pressure Gauges Installed On Pressure Test Fittings

(11) Install proportioning valve in master cylinder and hand tighten until proportioning is fully installed and O-ring seal is seated into master cylinder. Then torque proportioning valve to 40 N·m (30 ft. lbs.).

(12) Install brake tube on proportioning valve. Torque tube nut to 17 N·m (145 in. lbs.) torque.

(13) Bleed the affected brake line. See Bleeding Brake System in the Service Adjustments section of the manual for proper bleeding procedure

PROPORTIONING VALVE TEST WITH ABS BRAKES

If premature rear wheel ABS cycling occurs on a hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 29). Since ABS cycles both rear brakes together, both valves must be tested to isolate the suspect proportioning valve.

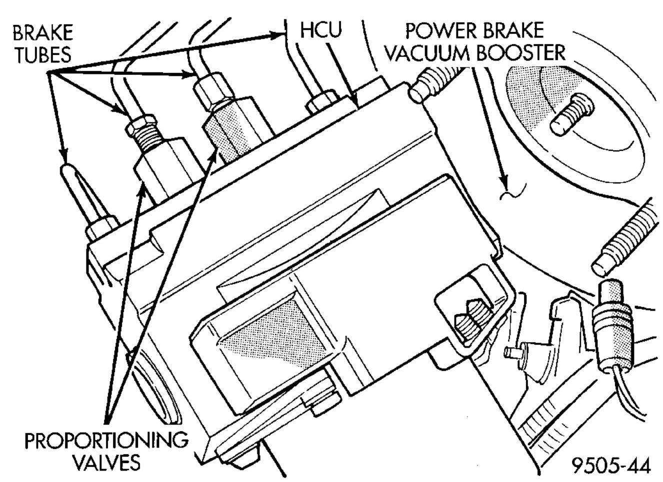


Fig. 29 Proportioning Valve Locations On HCU

DIAGNOSIS AND TESTING (Continued)

The test procedure is the same for both rear wheel proportioning valves. The pressure test fittings used for each proportioning valve though are different due to proportioning valve and brake tube nut thread sizes being unique for each rear wheel. Follow the procedure below for testing the required proportioning valve.

(1) Road test vehicle to verify premature rear wheel ABS cycling, refer to (Fig. 29) to determine which proportioning valve needs to be tested.

(2) Remove hydraulic brake tube (Fig. 29) from one of the proportioning valves.

(3) Then remove proportioning valve from that outlet port of the HCU.

CAUTION: Be sure the pressure test fitting being installed into the HCU, has the correct thread sizes for installation into the HCU and installation of the proportioning valve.

(4) Install Pressure Test Fitting, Special Tool 6805-1 or 6805-2 (Fig. 30) into the outlet port of the HCU.

(5) Install proportioning valve (Fig. 30) into pressure test fitting installed in the HCU outlet port.

CAUTION: Be sure the pressure test fitting being installed into proportioning valve, has the correct thread sizes for installation into the proportioning valve and installation of brake tube fitting into proportioning valve.

(6) Install Pressure Test Fitting, Special Tool 6805-3 or 6805-4 (Fig. 30) into the outlet of the proportioning valve.

(7) Connect brake tube onto pressure test fitting installed in proportioning valve (Fig. 30).

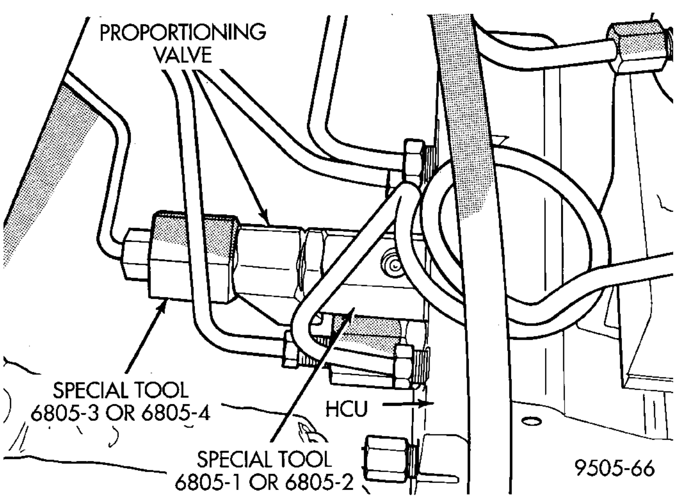


Fig. 30 Proportioning Valve Installation For Pressure Testing

(8) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 31). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air.

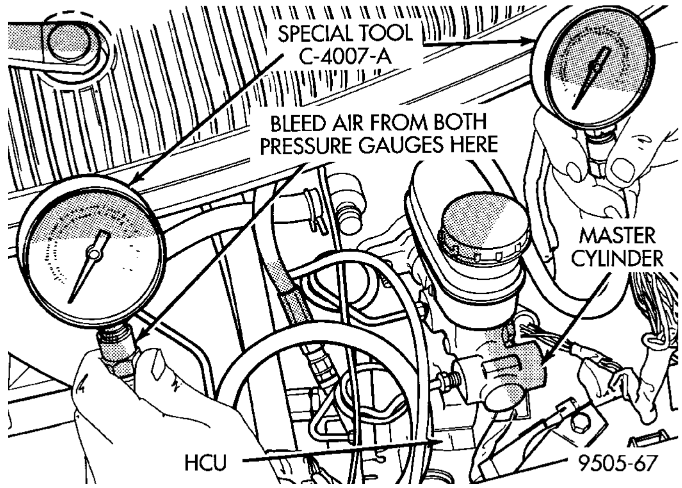


Fig. 31 Pressure Gauges Installed On Pressure Test Fittings At HCU

(9) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(10) Install proportioning valve in HCU and hand tighten until proportioning is fully installed and O-ring seal is seated into HCU. Then torque proportioning valve to 40 N·m (30 ft. lbs.).

(11) Install brake tube on proportioning valve. Torque tube nut to 17 N·m (145 in. lbs.) torque.

(12) Bleed the affected brake line. See Bleeding Brake System in the Service Adjustments section of the manual for proper bleeding procedure.

(13) Repeat steps 2 thru 12 for the second proportioning valve.

(14) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

DIAGNOSIS AND TESTING (Continued)

BRAKE PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS

SALES CODE	BRAKE SYSTEM TYPE	SPLIT POINT	SLOPE	IDENTIFICATION	INLET PRESSURE	OUTLET PRESSURE
BRA	14” Disc/Drum	400 psi	0.43	Black Band	1000 psi	600-700 psi
BRD	14” Disc/Disc	400 psi	0.34	Bar Code Band	1000 psi	550-650 psi
BRF	14” Disc/Disc W/ABS	400 psi	0.34	Bar Code Band	1000 psi	550-650 psi

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

RED BRAKE WARNING LAMP TEST

For diagnosis of specific problems with the red brake warning lamp system, refer to Brake System Diagnostics Chart 2, located in the Diagnosis And Testing section in this group of the service manual.

STOP LAMP SWITCH TEST PROCEDURE

The required procedure for testing the stop lamp switch is covered in Group 8H, Vehicle Speed Control System in this service manual. The electrical circuit tests for stop lamps is covered in Group 8W Rear Lighting in this service manual.

SERVICE PROCEDURES

BRAKE FLUID LEVEL CHECK

Check master cylinder reservoir brake fluid level a minimum of twice a year.

Master cylinder reservoirs are marked with the words **FULL AND MIN** indicating proper range of the master cylinder fluid level (Fig. 32).

CAUTION: Use only Mopar® brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

If necessary, add specified brake fluid bringing level to the **FULL** mark on the side of the master cylinder brake fluid reservoir (Fig. 32).

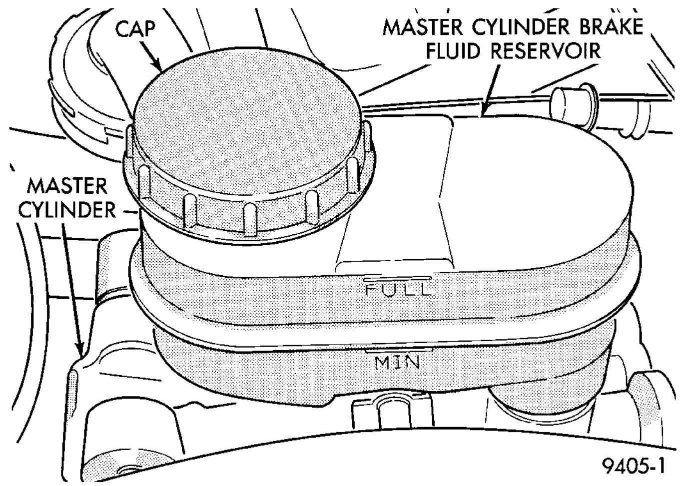


Fig. 32 Master Cylinder Fluid Level

BRAKE BLEEDING

NOTE: For bleeding the ABS hydraulic system, see Bleeding ABX-4 Brake System in the Service Procedures Section of the ABS Brake Section in this group of the service manual.

CAUTION: Before removing the master cylinder cover, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder.

PRESSURE BLEEDING

CAUTION: Use bleeder tank Special Tool C-3496-B with required adapter for the master cylinder reservoir to pressurize the hydraulic system for bleeding.

NOTE: 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. 33). 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.

The following wheel sequence for bleeding the brake hydraulic system should be used to ensure

SERVICE PROCEDURES (Continued)

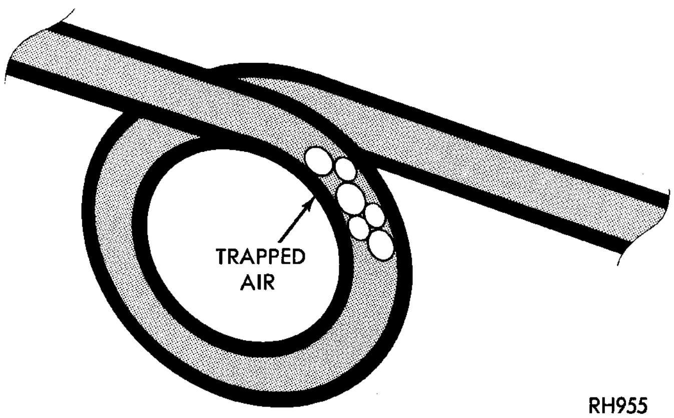


Fig. 33 Trapped Air in Brake Line

adequate removal of all trapped air from the hydraulic system.

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

(1) Attach a clear plastic hose to the bleeder screw starting at the right rear wheel and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 34).

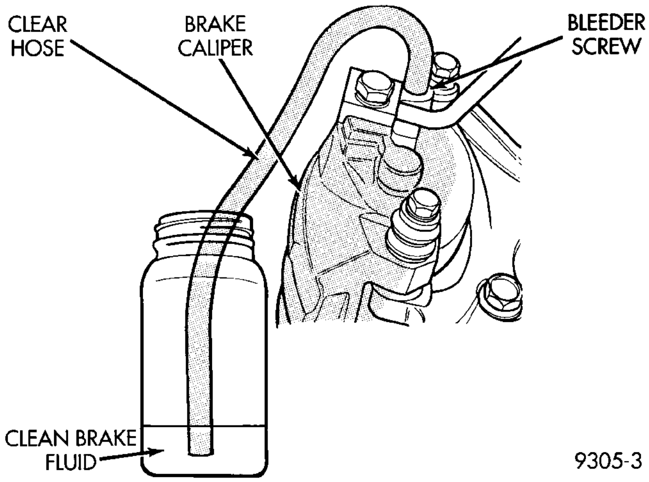


Fig. 34 Proper Method for Purging Air From Brake System (Typical)

(2) Open the bleeder screw at least **one full turn** or more to obtain an steady stream of brake fluid (Fig. 35).

(3) After 4 to 8 ounces of fluid has been bled through the brake and an air-free flow is maintained in the clear plastic hose and jar, close the bleeder screw.

(4) Repeat the procedure at all the other remaining bleeder screws. Then check the pedal for travel. If pedal travel is excessive or has not been improved, enough fluid has not passed through the system to expel all the trapped air. Be sure to monitor the fluid

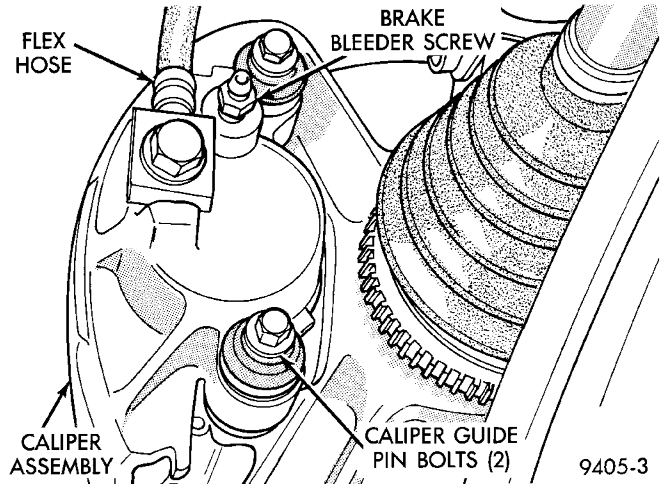


Fig. 35 Open Bleeder Screw at Least One Full Turn

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 reservoir.

BLEEDING WITHOUT A PRESSURE BLEEDER

NOTE: Correct bleeding of the brakes hydraulic system without the use of pressure bleeding equipment will require the aid of a helper.

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.

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

(1) Attach a clear plastic hose to the bleeder screw starting at the right rear wheel and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 34).

(2) Pump the brake pedal three or four times and hold it down before the bleeder screw is opened.

(3) Open the bleeder screw at least 1 full turn. When the bleeder screw opens the brake pedal will drop.

(4) Close the bleeder screw. Release the brake pedal only **after** the bleeder screw is closed.

(5) Repeat steps 1 through 3, four or five times at each bleeder screw. Then check the pedal for travel. If pedal travel is excessive or has not been improved, enough fluid has not passed through the system to expel all the trapped air. Be sure to monitor the fluid level in the master cylinder reservoir. It must stay at the proper level so air will not be allowed to re-enter the brake system.

(6) Test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

SERVICE PROCEDURES (Continued)

MASTER CYLINDER BLEEDING

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder (Fig. 36) and (Fig. 37). Position so outlets of Bleeding Tubes will be below surface of brake fluid when reservoir is filled to its proper level.

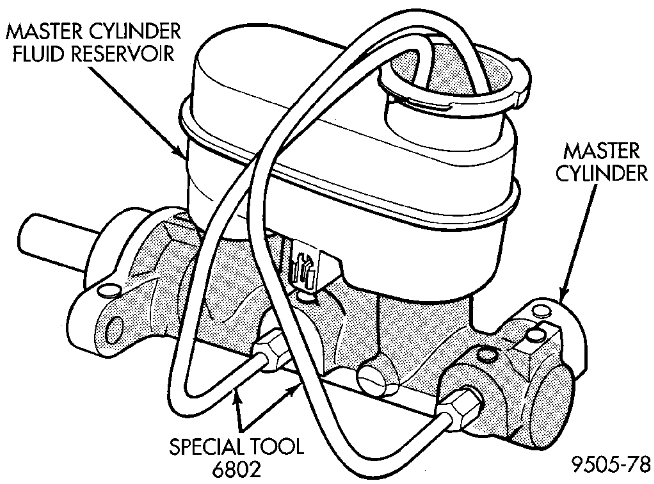


Fig. 36 Bleeding Tubes Attached to ABS Master Cylinder

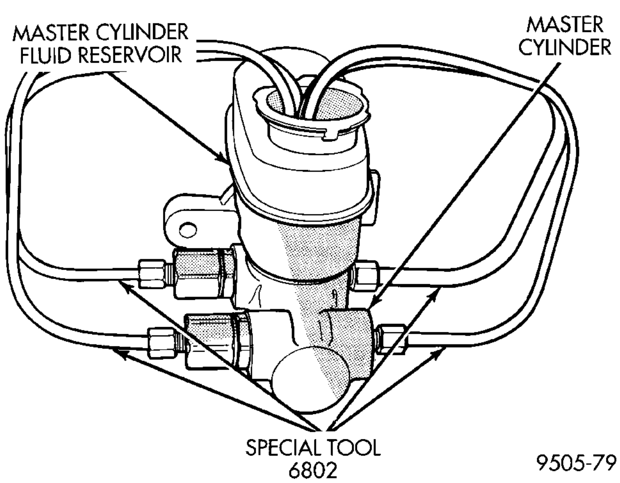


Fig. 37 Bleeding Tubes Attached To Non-ABS Master Cylinder

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 38). Depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled.

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

NOTE: Note: 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.

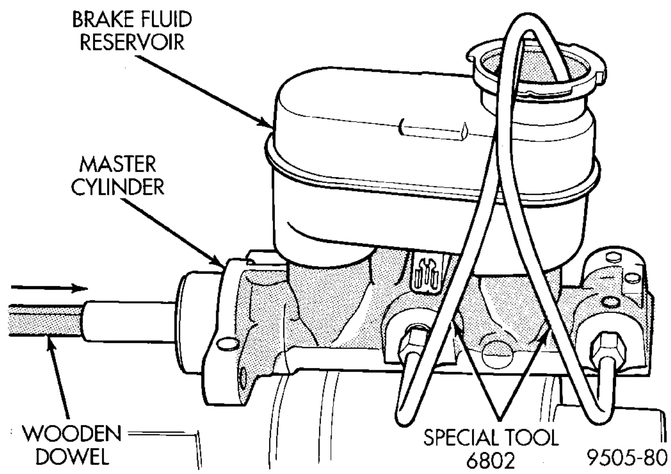


Fig. 38 Bleeding Master Cylinder

BRAKE ROTOR MACHINING

BRAKE ROTOR MACHINING PROCEDURES

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

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or pulsation, the rotor should be resurfaced, refaced (Fig. 39) or (Fig. 40) or replaced.

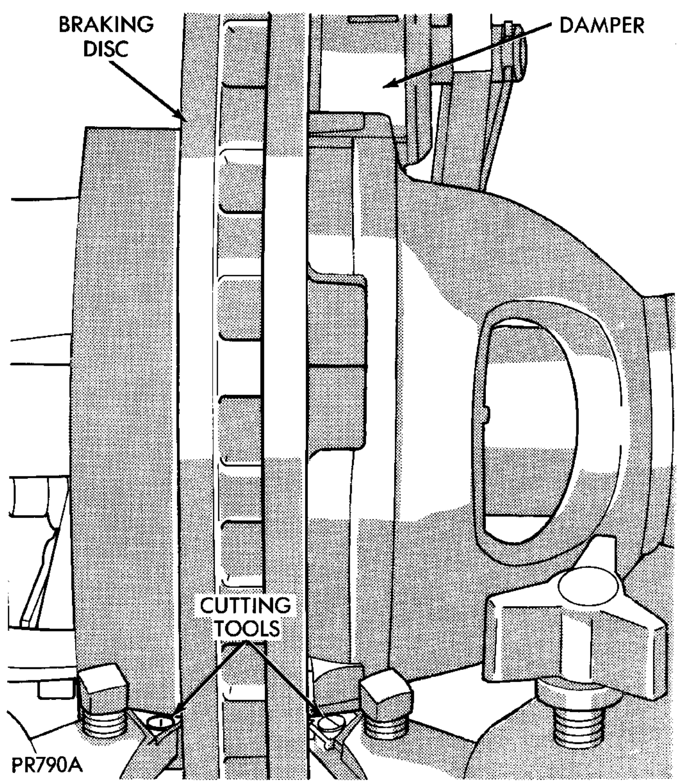


Fig. 39 Refacing Brake Rotor

SERVICE PROCEDURES (Continued)

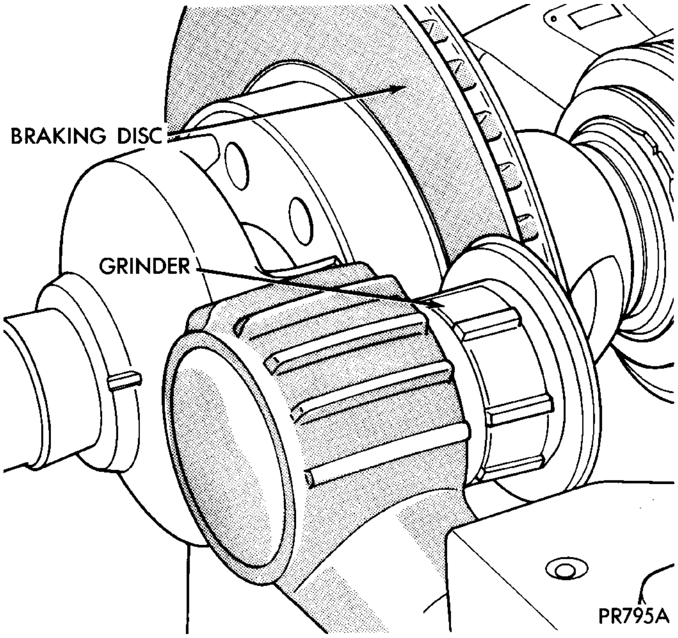


Fig. 40 Resurfacing Brake Rotor (Final Finish)

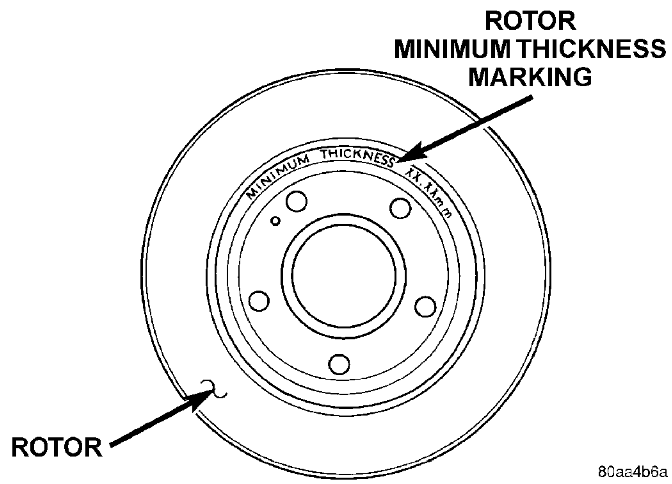


Fig. 41 Minimum Brake Rotor Thickness Markings (Typical)

The following chart shows the location of measurements and specifications when servicing the rotor.

NOTE: All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 41).

This marking includes 0.76 mm (0.030 inch) allowable rotor wear beyond the recommended 0.76 mm (0.030 inch) of rotor refacing.

The collets, shafts and adapters used on the brake lathe and the bearing cups in the rotor MUST be clean and free from any chips or contamination.

When mounting the rotor on the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

If the rotor is not mounted properly, the lateral runout will be worse after refacing or resurfacing than before.

REFACING BRAKE ROTOR

Refacing of the rotor is not required each time the brake pads are replaced.

When refacing a rotor the required 0.8 mm (0.003 inch) TIR (Total Indicator Reading) and 0.013 mm (0.0005 inch) thickness variation limits MUST BE MAINTAINED. **Extreme care** in the operation of rotor turning equipment is required.

The use of a double straddle cutter (Fig. 39) that machines both sides of the rotor at the same time is highly recommended.

RESURFACNG BRAKE ROTOR

This operation can be used when rotor surface is rusty, has lining deposits or excessive lateral runout or thickness variation is evident.

A sanding rotor attachment will remove surface contamination without removing much rotor material.

It will generally follow variations in thickness that are in the rotor.

BRAKE ROTOR REFINISHING LIMITS

BRAKING ROTOR	ROTOR THICKNESS	MINIMUM ROTOR THICKNESS	ROTOR THICKNESS VARIATION	ROTOR RUN OUT*	ROTOR MICRO FINISH
All Front Disc Brakes	20.13-19.87 mm .792 -.782 in.	18.4 mm .724 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

SERVICE PROCEDURES (Continued)

BRAKE DRUM MACHINING

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 brake drums are marked with the maximum allowable brake drum diameter (Fig. 42).

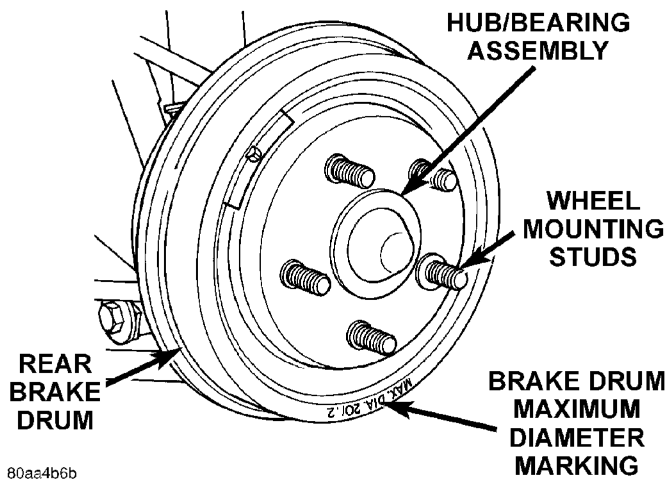


Fig. 42 Brake Drum Maximum Diameter Identification

PARK BRAKE LEVER AUTO ADJUSTER MECHANISM

WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE AUTO ADJUSTER LOCK-OUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF AUTO ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

WARNING: WHEN REPAIRS TO THE PARK BRAKE LEVER OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(1) Remove screws attaching rear of center console assembly to console bracket (Fig. 43) or (Fig. 44).

(2) Remove the 2 screws located in cup holders (Fig. 45), attaching front of center console assembly to console bracket.

(3) Raise park brake hand lever assembly as high as it will go for required clearance to remove center console.

(4) Remove center console assembly from vehicle.

(5) Lower park brake lever handle.

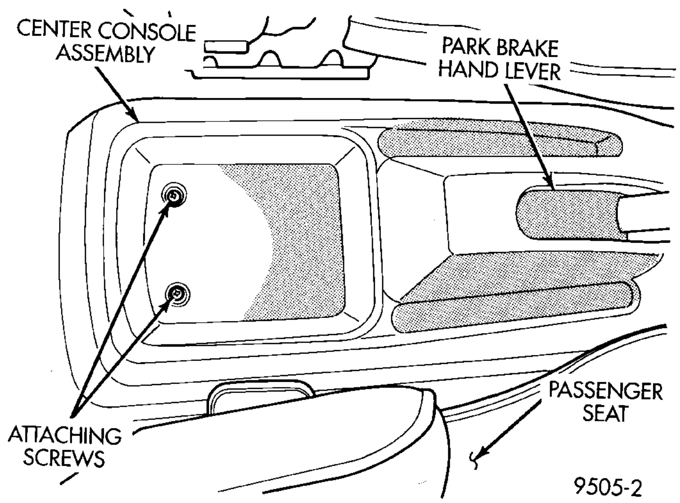


Fig. 43 Attaching Screws At Rear Of Center Console W/O Arm Rest

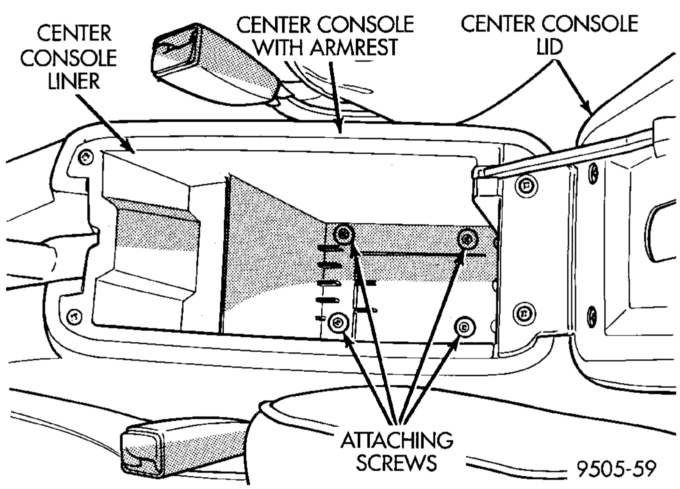


Fig. 44 Attaching Screws At Rear Of Center Console With Arm Rest

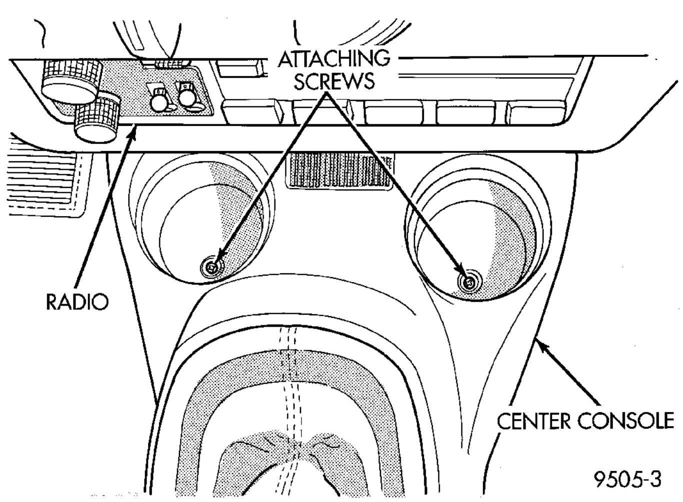


Fig. 45 Attaching Screws At Front Of Center Console

SERVICE PROCEDURES (Continued)

(6) Grasp park brake lever output cable by hand and pull upward (Fig. 46). Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 46). This will lock the park brake mechanism and take tension off park brake cables.

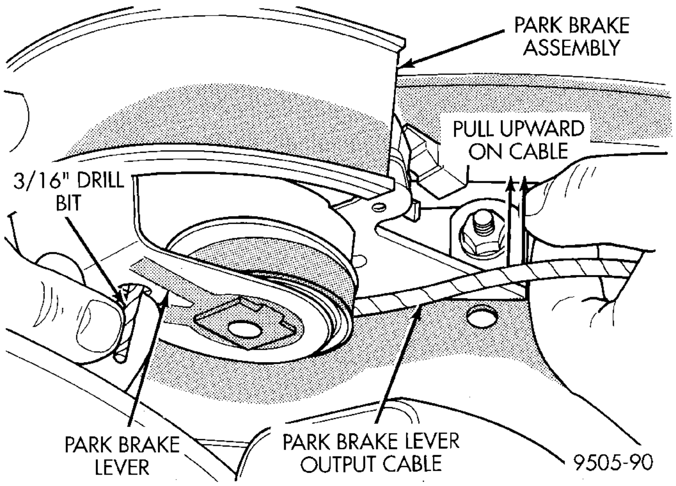


Fig. 46 Locking Pin Installed In Park Brake Mechanism

RELEASING PARK BRAKE AUTO ADJUSTER

NOTE: The park brake lever can be in any position when releasing the auto adjuster. To ease installation of center console, it is advisable to pull park brake lever handle all the way up before removing lockout pin

(1) Be sure rear park brake cables are properly installed in the equalizer (Fig. 47).

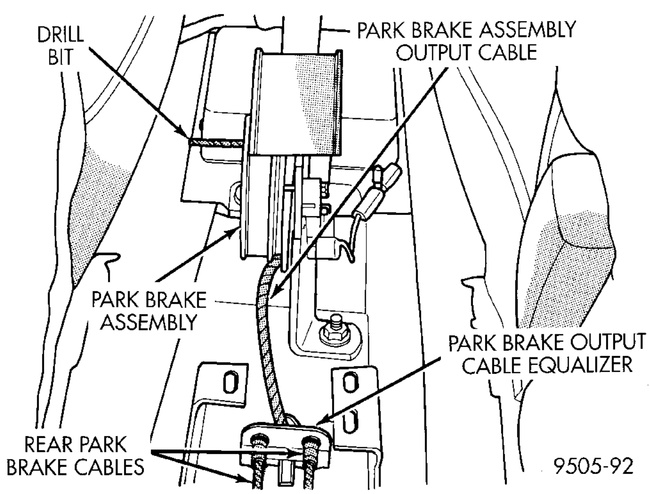


Fig. 47 Park Brake Cables Properly Installed In Equalizer

(2) Pull park brake lever handle all the way up.

(3) Firmly grasp park brake lever locking pin (Fig. 48), and quickly remove it from the park brake lever mechanism. This will allow the park brake lever mechanism to correctly adjust the park brake cables.

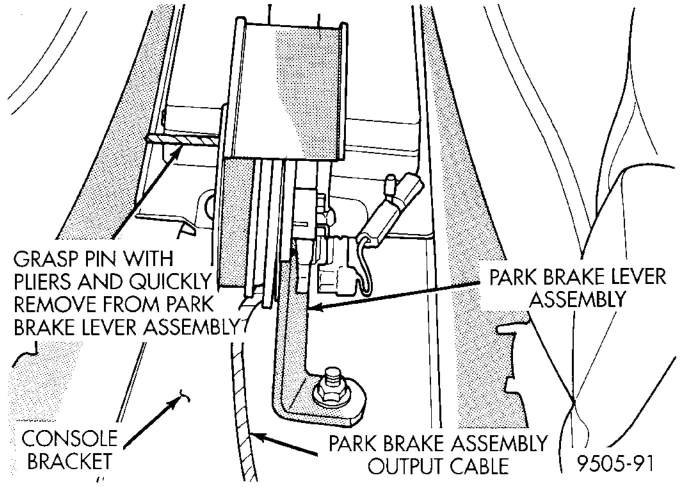


Fig. 48 Removing Lockout Pin From Park Brake Lever

(4) Install center console.

(5) Install the 4 console assembly attaching screws (Fig. 43) or (Fig. 44).

(6) Cycle park brake lever once to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle, they should rotate freely without dragging.

BRAKE TUBE REPAIR

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZN-AL alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

Care should be taken when repairing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 49). Ream out any burrs or rough edges showing on inside of tubing (Fig. 50). This will make the ends of tubing square (Fig. 50) 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. 51) and (Fig. 52). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

SERVICE PROCEDURES (Continued)

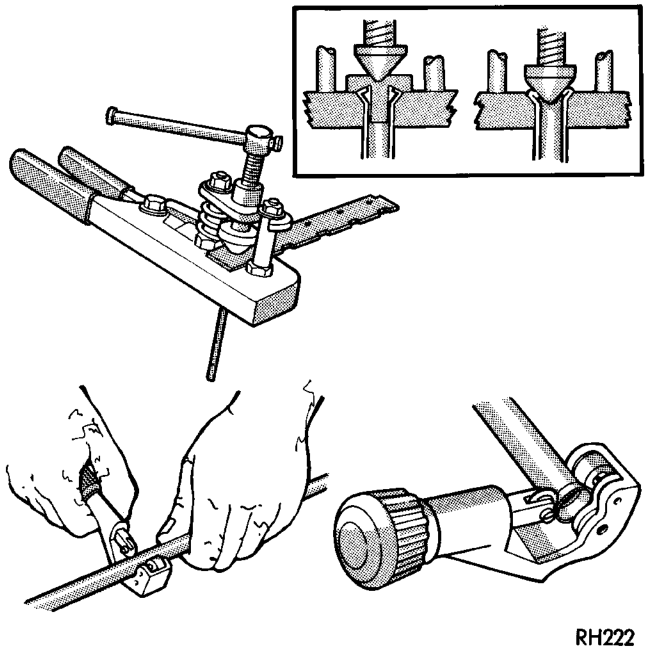


Fig. 49 Cutting And Flaring Of Brake Fluid Tubing

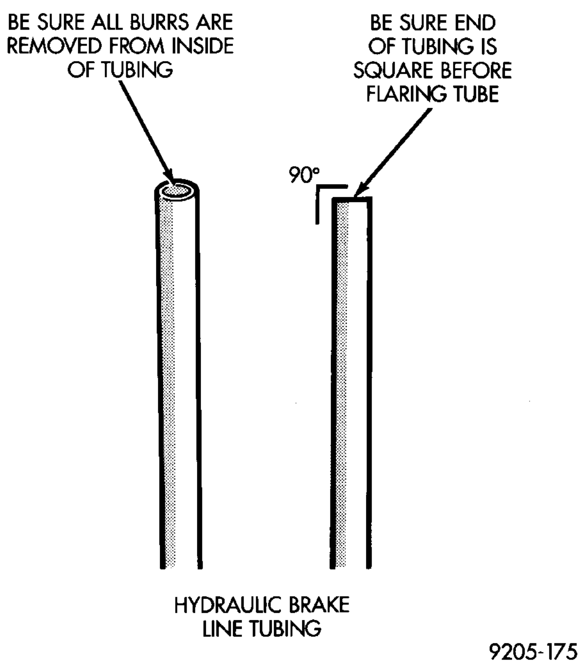


Fig. 50 Brake Fluid Tube Preparation For Flaring

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the tubing size. Squeeze handles of flaring tool and lock tubing in place. Place 3/16 inch plug of gauge (A) down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.

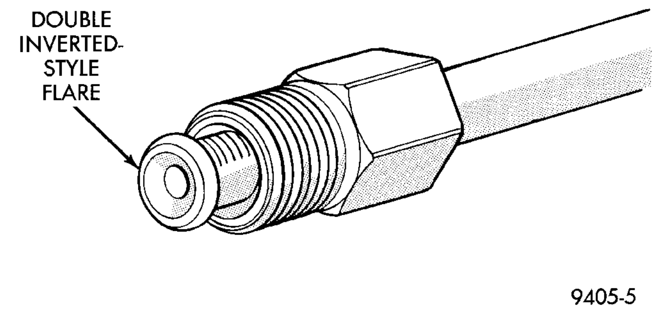


Fig. 51 Double Inverted Brake Line Tubing Flare

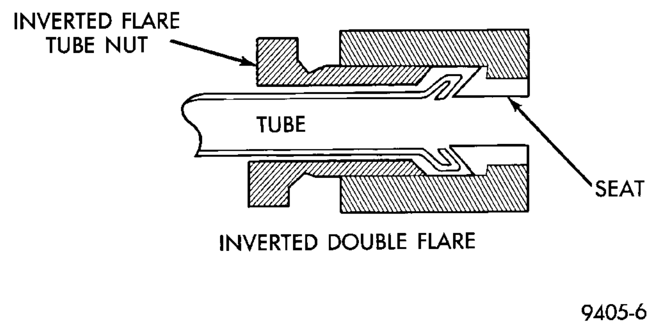


Fig. 52 Double Wall Inverted Flare Connection

REMOVAL AND INSTALLATION

WHEEL AND TIRE ASSEMBLY

To install the wheel and tire assembly, first position it properly on the mounting surface using the hub pilot as a guide. Then progressively tighten the lug nuts in the proper sequence (Fig. 53) to half of the required torque. Finally tighten the lug nuts in the proper sequence (Fig. 53) to 129 N·m (95 ft. lbs.). Never use oil or grease on studs or nuts.

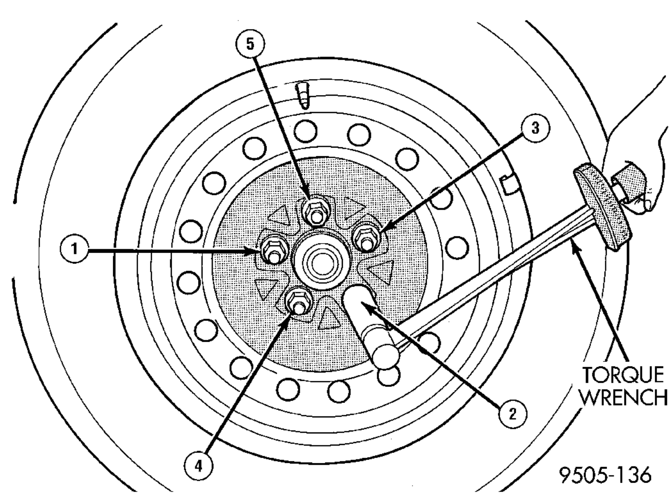


Fig. 53 Wheel Nut Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

FRONT DISC BRAKE CALIPER

REMOVE

During service procedures, grease or any other foreign material must be kept off caliper assembly, surfaces of braking rotor and external surfaces of hub.

Handling of the braking rotor and caliper should be done in such a way as to avoid deformation of the rotor and scratching or nicking of the brake linings.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this service manual for the required lifting procedure for this vehicle.

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

(3) Remove the 2 brake caliper to steering knuckle guide pin bolts (Fig. 54).

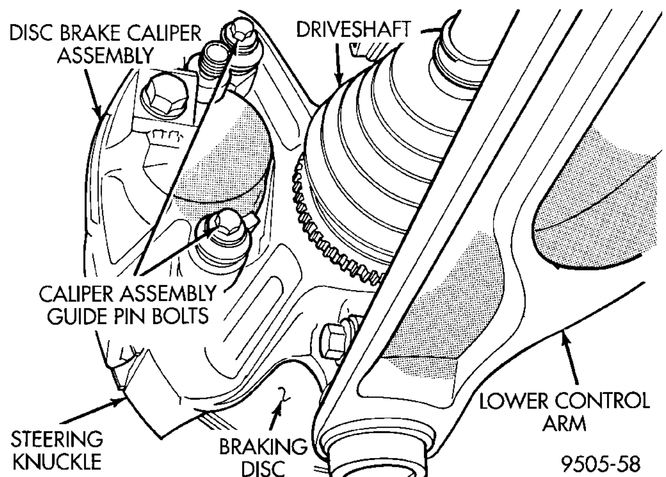


Fig. 54 Caliper Guide Pin Bolts

(4) Remove caliper from steering knuckle, by first rotating free end of caliper away from steering knuckle. Then slide opposite end of caliper out from under machined abutment on steering knuckle (Fig. 55).

(5) Support the disc brake caliper firmly using a wire hanger (Fig. 56). This is required to prevent the weight of the caliper from damaging the flexible brake hose .

INSTALL

NOTE: Step 1 below is only required when installing a caliper after new brake shoes have been installed.

(1) Completely retract the caliper piston back into the bore of the caliper.

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the front rotor on the hub, making sure it is squarely seated on face of hub.

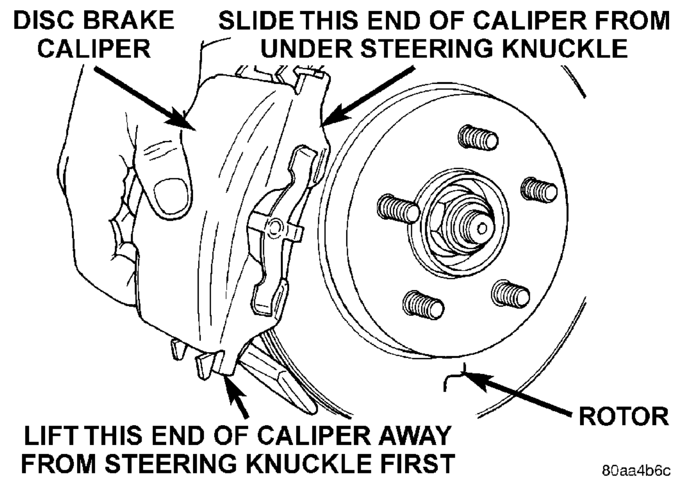


Fig. 55 Removing Caliper Assembly From Steering Knuckle

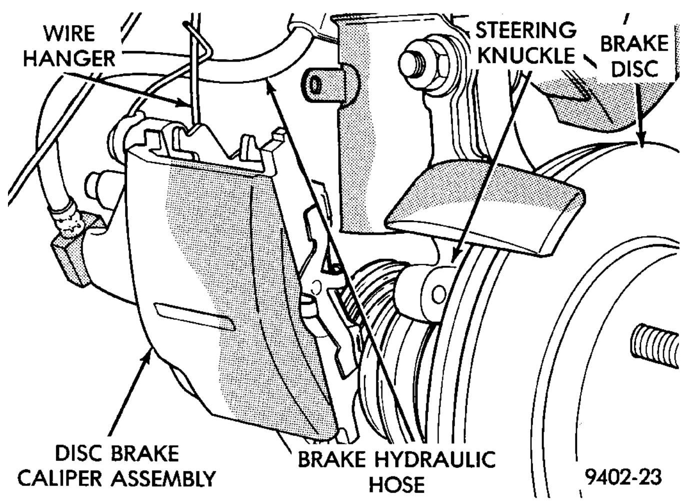


Fig. 56 Storing Disc Brake Caliper

CAUTION: Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(4) Carefully position the brake caliper and brake shoes on the steering knuckle by first hooking the end of the caliper under the edge of the steering knuckle as shown in (Fig. 57). Then rotate caliper into position on the steering knuckle.

(5) Install the caliper guide pin bolts and tighten to 18 to 20 N·m (192 in. lbs.) (Fig. 54). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

(6) Install the wheel and tire assembly.

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

(8) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.**

REMOVAL AND INSTALLATION (Continued)

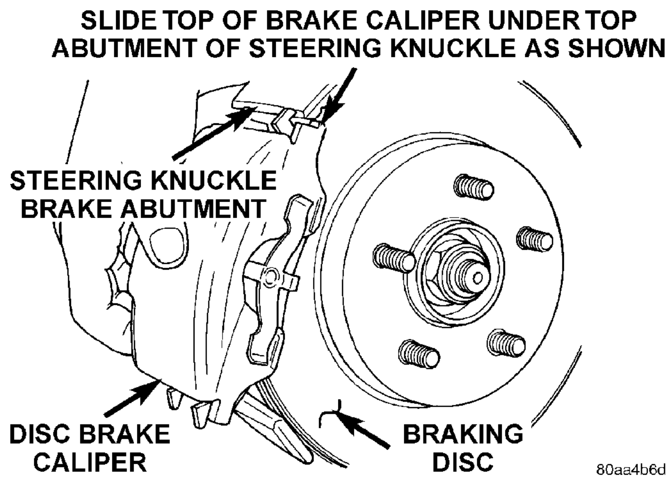


Fig. 57 Installing Caliper Assembly On Steering Knuckle

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

FRONT DISC BRAKE SHOES

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKELININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

During service procedures, grease or any other foreign material must be kept off caliper assembly, surfaces of braking rotor and external surfaces of hub.

Handling of the braking rotor and caliper should be done in such a way as to avoid deformation of the rotor 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.

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

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

(3) Remove the 2 guide pin bolts (Fig. 58) mounting the caliper to the steering knuckle .

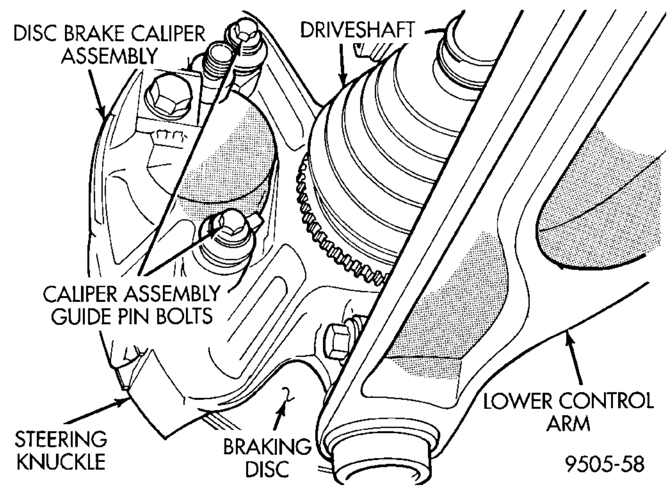


Fig. 58 Caliper Guide Pin Bolts

(4) Remove brake caliper from steering knuckle, by first rotating free end of caliper away from steering knuckle. Then slide opposite end of caliper out from under machined abutment on steering knuckle (Fig. 59).

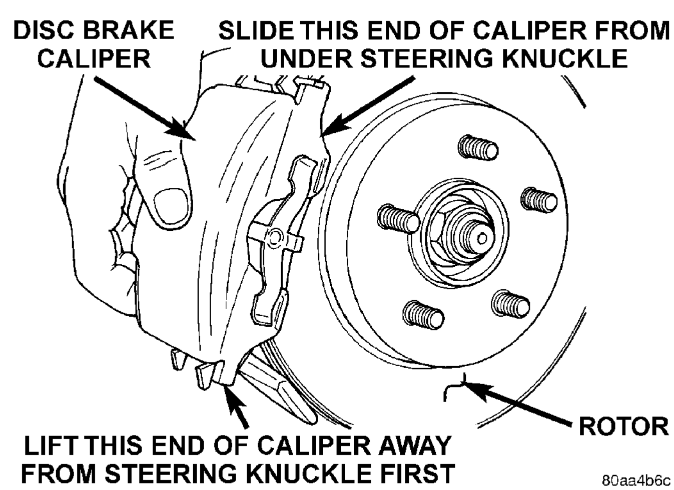


Fig. 59 Removing Caliper From Steering Knuckle

REMOVAL AND INSTALLATION (Continued)

(5) Support caliper firmly to prevent weight of caliper from damaging the flexible brake hose (Fig. 60).

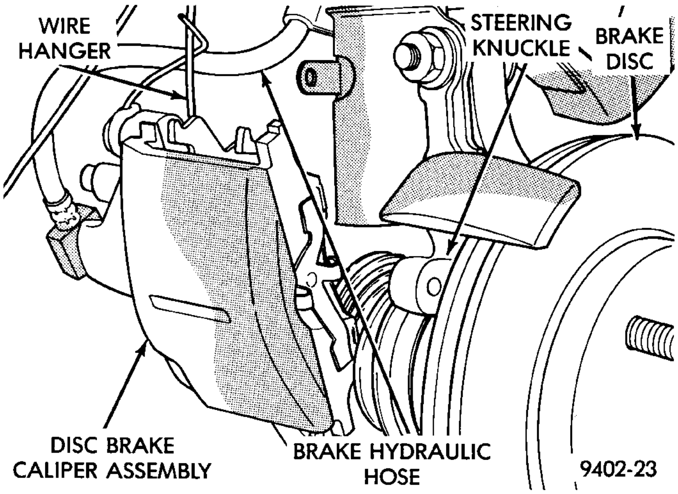


Fig. 60 Storing Caliper

(6) Remove brake rotor from hub by pulling it straight off the wheel mounting studs (Fig. 61).

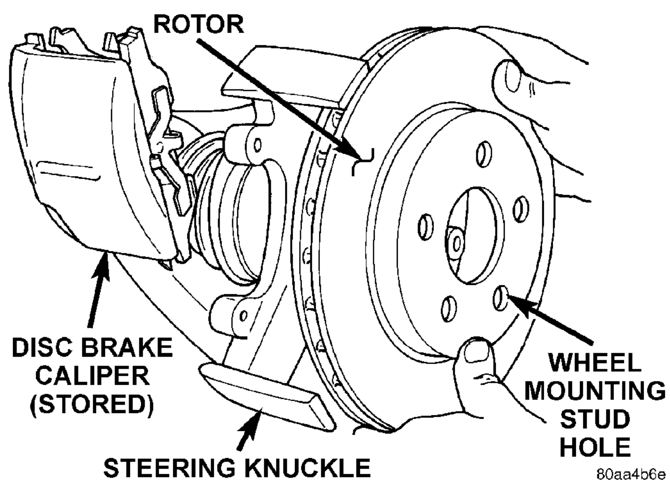


Fig. 61 Removing/Installing Brake Rotor

(7) Remove outboard brake shoe by prying the shoe retaining clip over raised area on caliper. Then slide the brake shoe down and off the caliper (Fig. 62).

(8) Pull the inboard brake shoe away from the caliper piston until the retaining clip is out of the cavity in the piston. (Fig. 63).

CALIPER INSPECTION

Check caliper 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 and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

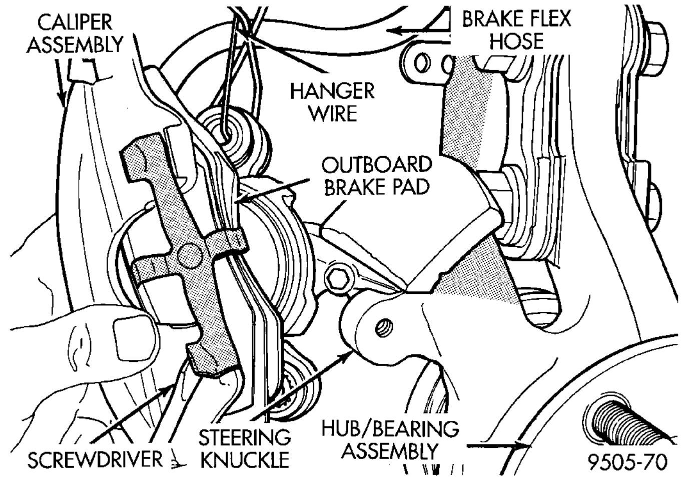


Fig. 62 Removing Outboard Brake Shoe

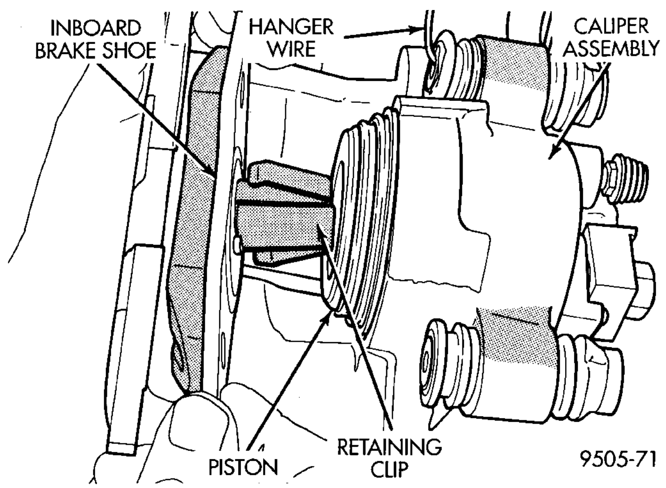


Fig. 63 Removing Inboard Brake Shoe

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 Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

INSTALL

(1) Completely retract caliper piston back into piston bore of caliper. This is required for caliper installation with new brake shoe assemblies.

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install the front rotor on the hub, making sure it is squarely seated on face of hub (Fig. 61).

(4) Remove the protective paper from the noise suppression gasket on both the inner and outer brake shoes (if equipped).

NOTE: Note: The inboard and outboard brake shoes are not common (Fig. 64).

REMOVAL AND INSTALLATION (Continued)

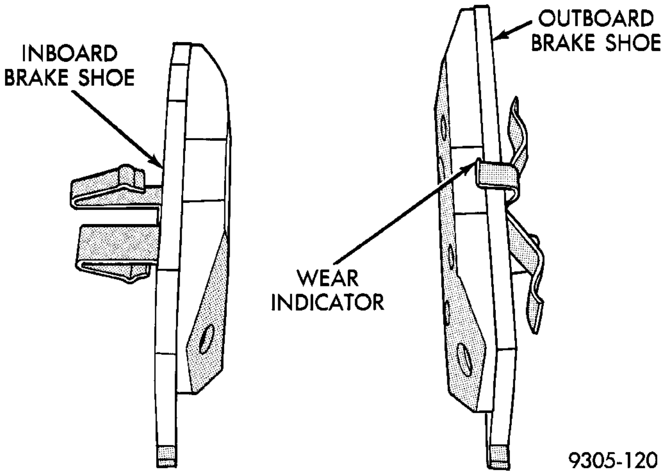


Fig. 64 Front Brake Shoe Identification

(5) Install the new inboard brake shoe into the caliper piston by firmly pressing into piston bore with thumbs (Fig. 65). Be sure inboard brake shoe is positioned squarely against the face of the caliper piston.

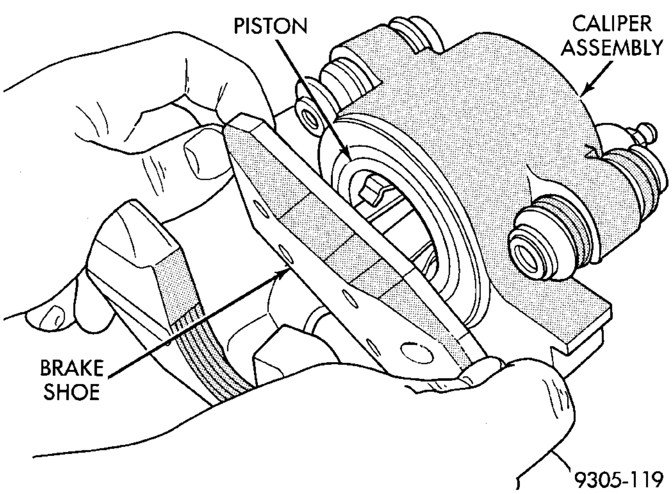


Fig. 65 Installing Inboard Brake Shoe

(6) Slide the new outboard brake shoe onto the caliper (Fig. 66).

CAUTION: Use care when installing the caliper onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(7) Carefully position the brake caliper and brake shoes over the rotor by hooking the end of the caliper under the steering knuckle (Fig. 67). Then rotate caliper into position on steering knuckle.

(8) Install the caliper guide pin bolts (Fig. 58) and tighten to 18 to 20 N·m (192 in. lbs.). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

(9) Install the wheel and tire assembly.

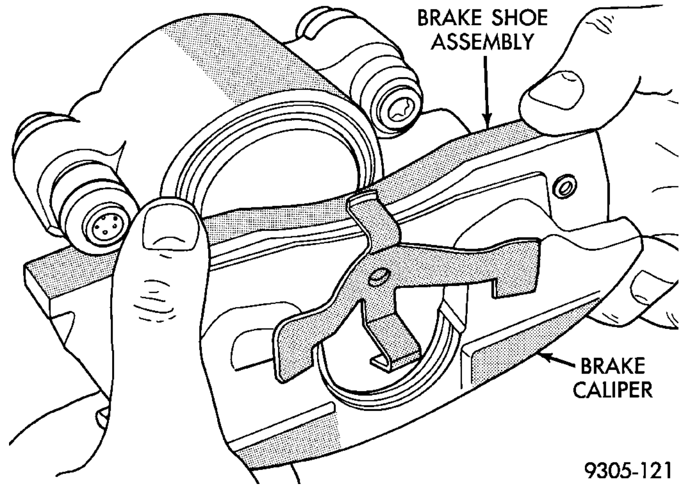


Fig. 66 Installing Outboard Brake Shoe

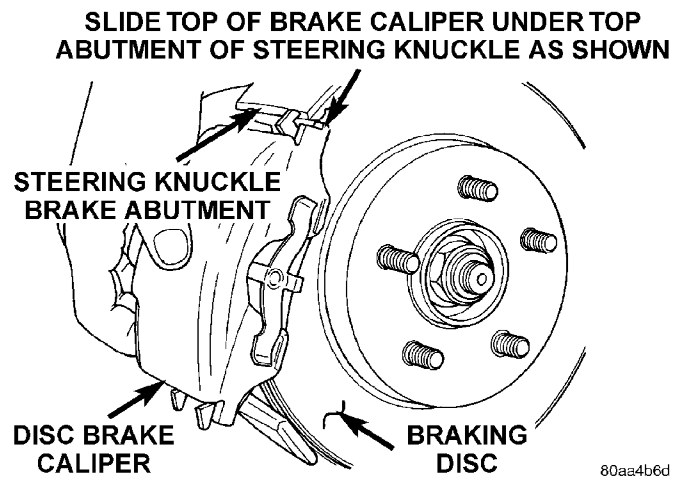


Fig. 67 Installing Caliper On Steering Knuckle

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

(11) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.**

(12) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

REAR DISC BRAKE CALIPER

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheel and tire assemblies from vehicle.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the 2 caliper assembly to adapter guide pin bolts (Fig. 68).

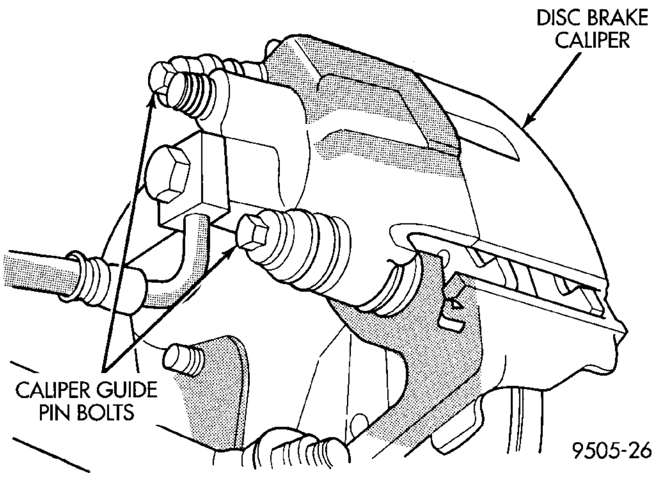


Fig. 68 Caliper Assembly Guide Pin Bolts

(4) Remove caliper assembly from adapter and rotor by first rotating top of caliper assembly away from adapter, and then lifting caliper assembly off lower machined abutment on adapter (Fig. 69).

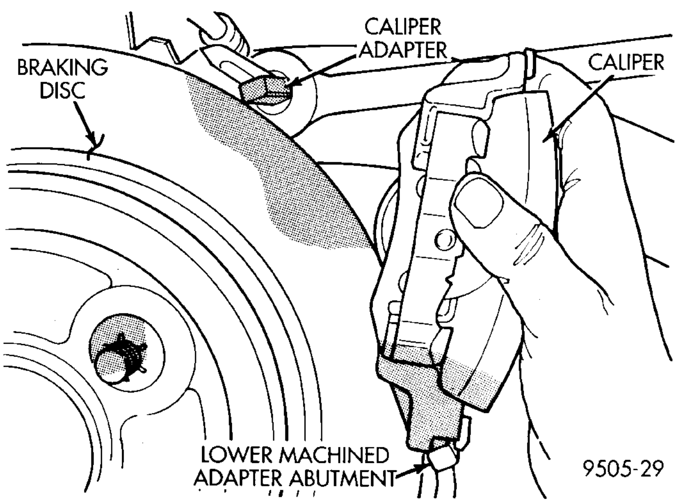


Fig. 69 Removing Caliper Assembly From Adapter

(5) Support caliper assembly firmly from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 70).

INSTALL

NOTE: Step 1 below is only required when installing the disc brake caliper, after new brake shoes have been installed.

(1) Completely retract caliper piston back into piston bore of caliper assembly.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

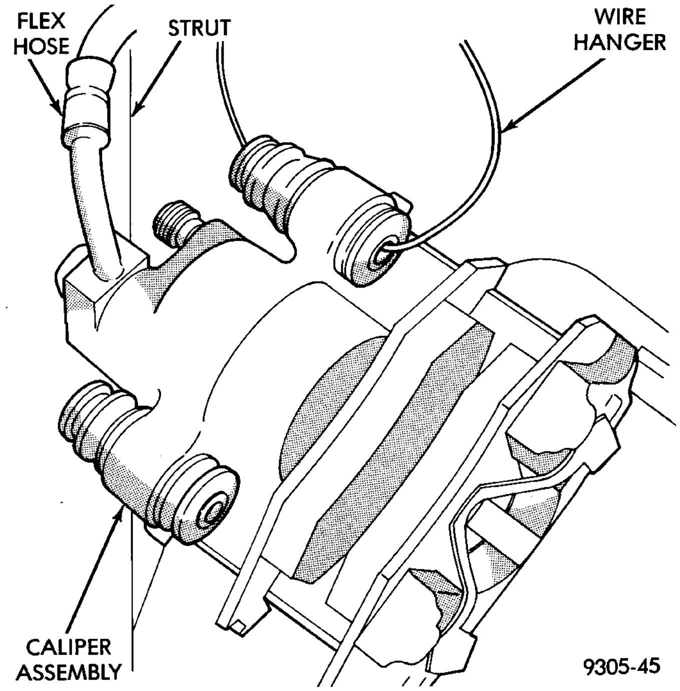


Fig. 70 Storing Caliper

(3) If removed, install the rear rotor on the hub making sure it is squarely seated on the face of the hub (Fig. 71).

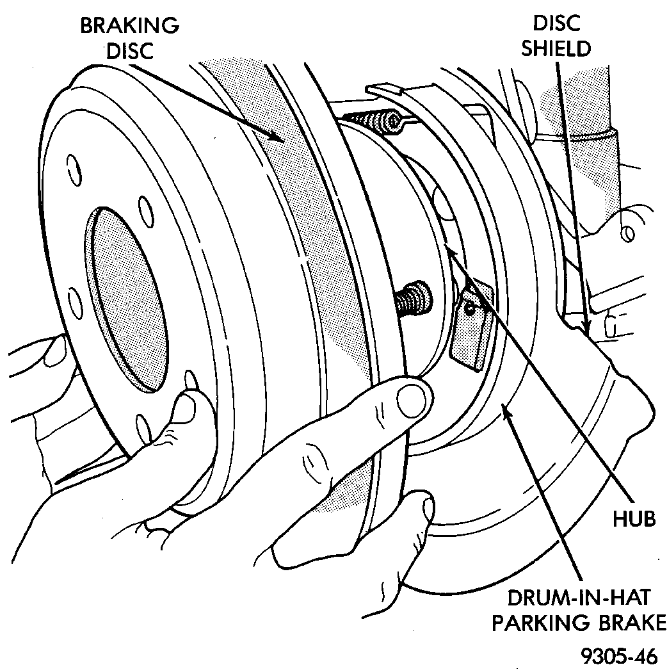


Fig. 71 Installing Rear Rotor

CAUTION: Use care when installing caliper assembly onto adapter so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(4) Carefully lower caliper and brake shoe assemblies over braking disc (rotor) reversing the required

REMOVAL AND INSTALLATION (Continued)

removal procedure (Fig. 69). Make sure that the caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(5) Install caliper assembly guide pin bolts into adapter and tighten (Fig. 68). Then torque both guide pin bolts to 22 N·m (192 in. lbs.).

(6) Install the wheel and tire assembly.

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

(8) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.** .

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

REAR DISC BRAKE SHOES

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKELININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

During service procedures, grease or any other foreign material must be kept off caliper assembly, surfaces of braking rotor and external surfaces of hub.

Handling of the braking rotor and caliper should be done in such a way as to avoid deformation of the rotor 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.

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheel and tire assemblies from vehicle.

(3) Remove the 2 caliper assembly to adapter guide pin bolts (Fig. 72).

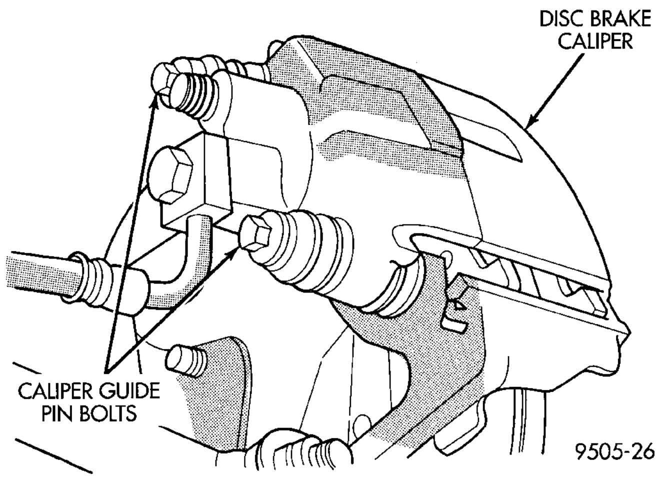


Fig. 72 Caliper Assembly Guide Pin Bolts

(4) Remove caliper assembly from adapter and rotor by first rotating top of caliper assembly away from adapter, and then lifting caliper assembly off lower machined abutment on adapter (Fig. 73).

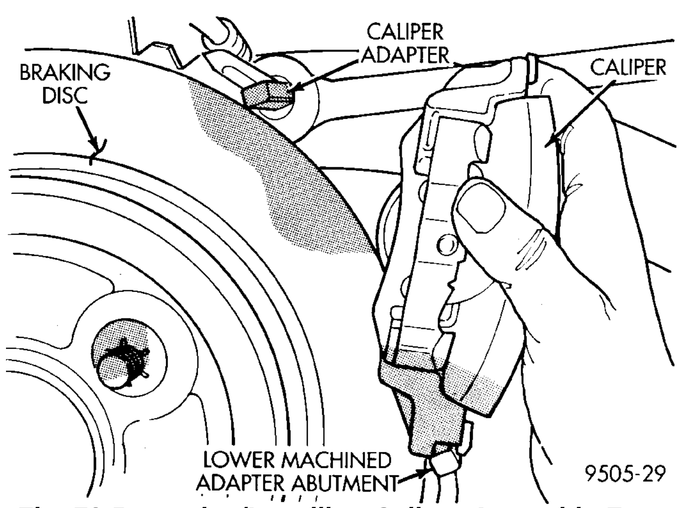


Fig. 73 Removing/Installing Caliper Assembly From Adapter

REMOVAL AND INSTALLATION (Continued)

(5) Support caliper assembly firmly from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 74).

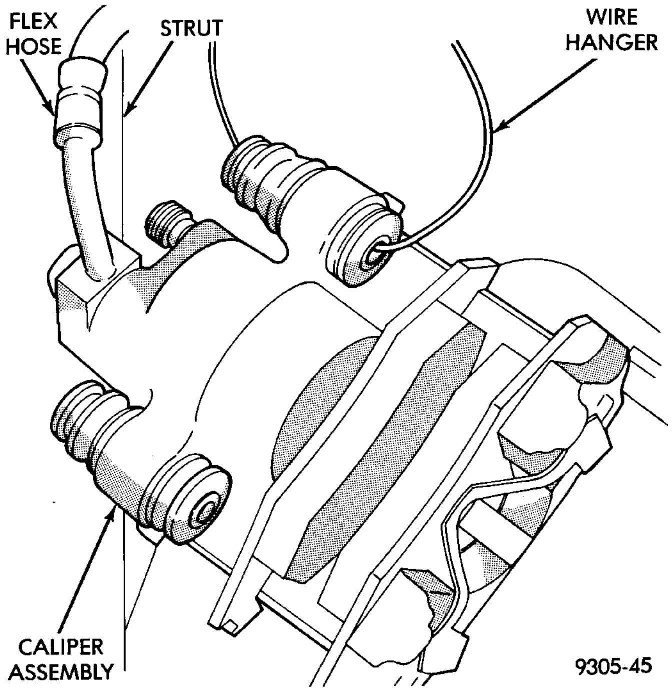


Fig. 74 Storing Caliper

(6) Remove rear rotor from hub/bearing assembly (Fig. 75). Then inspect drum-in-hat parking brake shoes and parking brake braking surface on rotor for any signs of excessive wear or damage. Replace parking brake shoes if required.

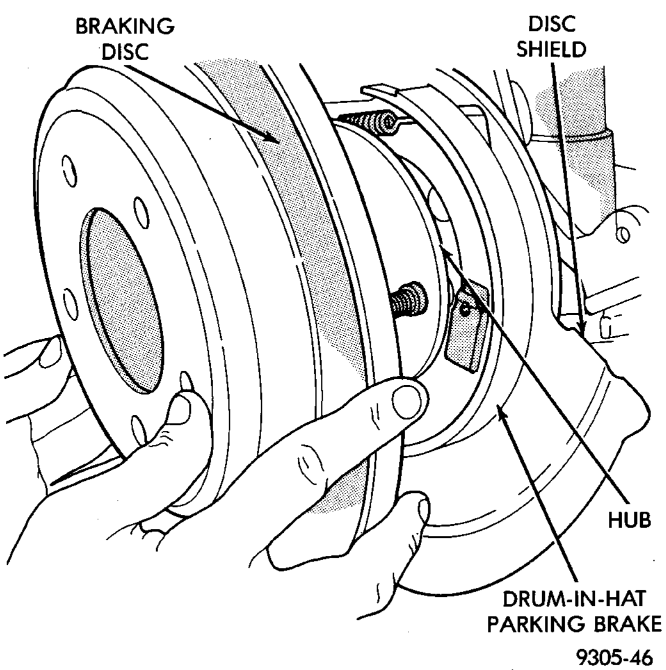


Fig. 75 Rear Brake Rotor

(7) Remove outboard brake pad from caliper by prying brake pad retaining clip over raised area on caliper. Then slide brake pad down and off the caliper (Fig. 76).

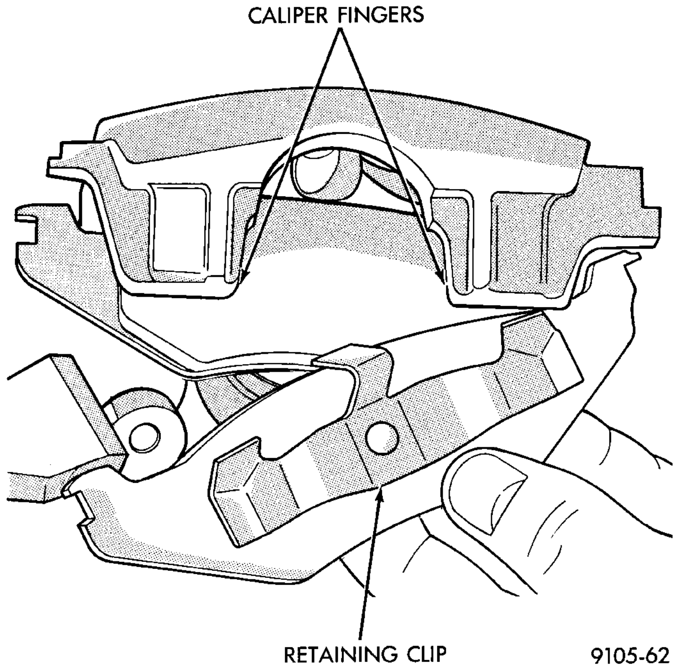


Fig. 76 Outboard Brake Shoe

(8) Pull inboard brake pad away from caliper piston, until retaining clip is free from cavity in piston. (Fig. 77).

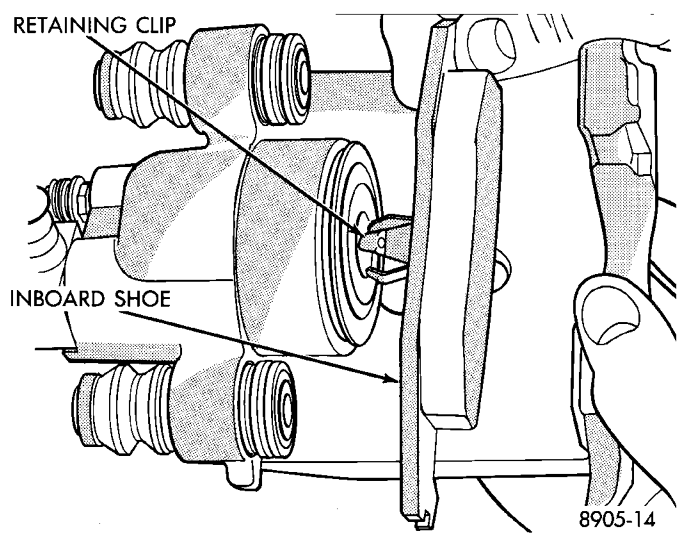


Fig. 77 Removing Inboard Brake Shoe

CALIPER INSPECTION

Check caliper 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 and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Pro-

REMOVAL AND INSTALLATION (Continued)

cedures in Disc Brake Caliper Service in this section of the service manual.

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 Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

INSTALL

(1) Completely retract the caliper piston back into the piston bore of the caliper assembly. This is required for caliper installation when new brake pad assemblies are installed on caliper.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install rear rotor on the hub making sure it is squarely seated on face of hub (Fig. 75).

(4) Remove protective paper from noise suppression gasket on both inner and outer brake pad assemblies (if equipped).

(5) Install new inboard brake shoe assembly into caliper piston by firmly pressing into piston bore with thumbs (Fig. 77). **Be sure inboard brake shoe assembly is positioned squarely against face of caliper piston.**

(6) Slide new outboard brake pad assembly onto the caliper assembly (Fig. 76). Be sure retaining clip is squarely seated in the depressed areas on the caliper.

CAUTION: Use care when installing caliper assembly onto adapter, so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(7) Carefully lower caliper and brake shoe assemblies over braking disc (rotor) reversing the required removal procedure (Fig. 73). Make sure that caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(8) Install caliper assembly guide pin bolts into adapter and tighten (Fig. 72). Then torque both guide pin bolts to 22 N·m (192 in. lbs.).

(9) Install the wheel and tire assembly.

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

(11) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.** .

(12) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

REAR BRAKE DRUM

REMOVE

Further clearance can be obtained by backing off the brake automatic adjuster screw. Remove rubber plug from top of brake support plate. Rotate automatic adjuster screw assembly with an upward motion, using a medium size screwdriver.

See adjusting rear service brakes in the Service Adjustments section in this group of the service manual for the specific adjustment procedure.

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove rear brake drum to hub retaining clips (if equipped).

(4) Remove rear brake drum from rear hub/bearing assembly (Fig. 78).

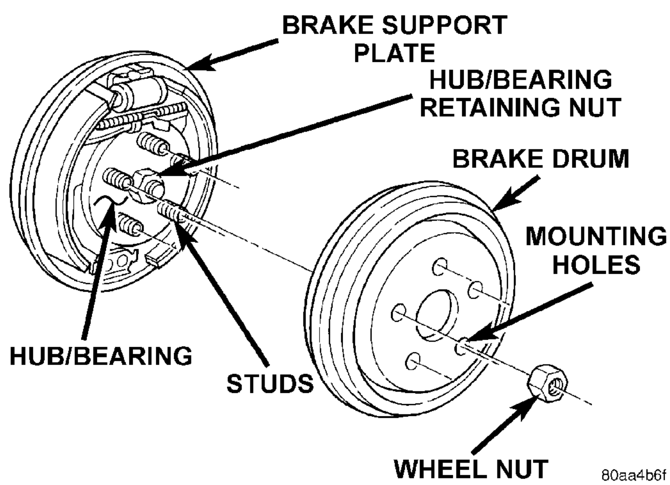


Fig. 78 Brake Drum And Hub/Bearing

(5) Inspect brake linings for wear, shoe alignment and contamination.

INSTALL

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

(2) Install the wheel and tire assembly.

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

REMOVAL AND INSTALLATION (Continued)

REAR BRAKE SHOES

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove the brake drum to hub/bearing retaining clips (if equipped) (Fig. 79).

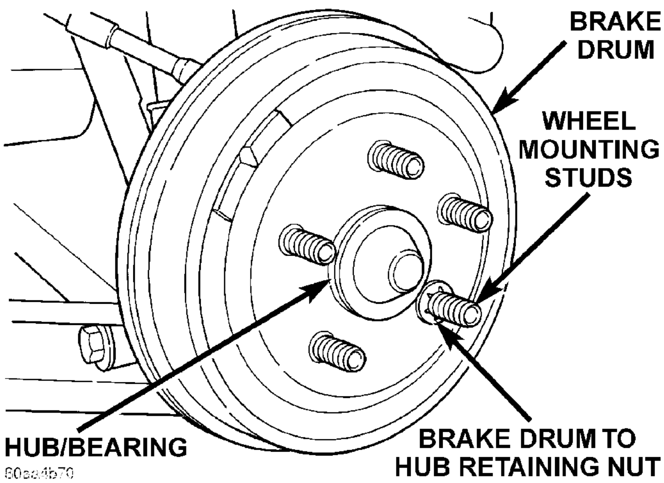


Fig. 79 Rear Brake Drum

(4) Remove the brake drum from the hub/bearing (Fig. 80).

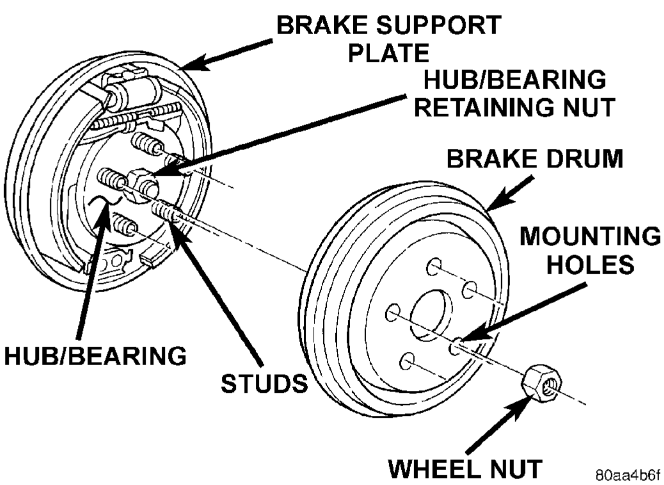


Fig. 80 Brake Drum Remove/Install

(5) Remove the adjustment lever to leading brake shoe spring (Fig. 81).

(6) Remove the automatic adjustment lever (Fig. 82) from the brake shoe.

(7) Remove hold down clips and pins attaching the leading and trailing brake shoes to the brake support plate (Fig. 83).

(8) Remove lower brake shoe to anchor plate return spring (Fig. 84).

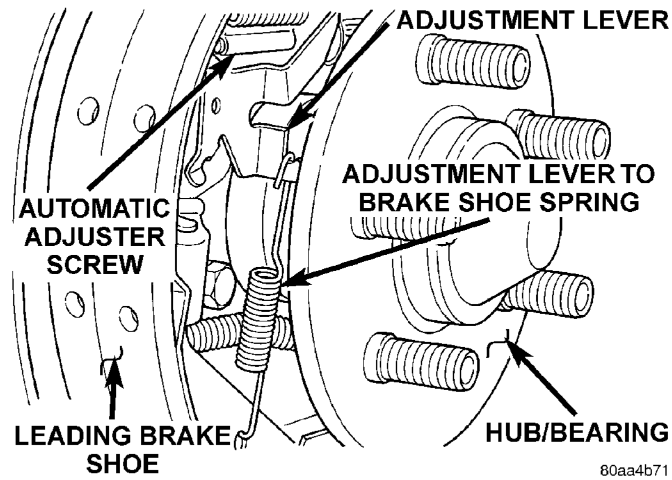


Fig. 81 Automatic Adjustment Lever Spring

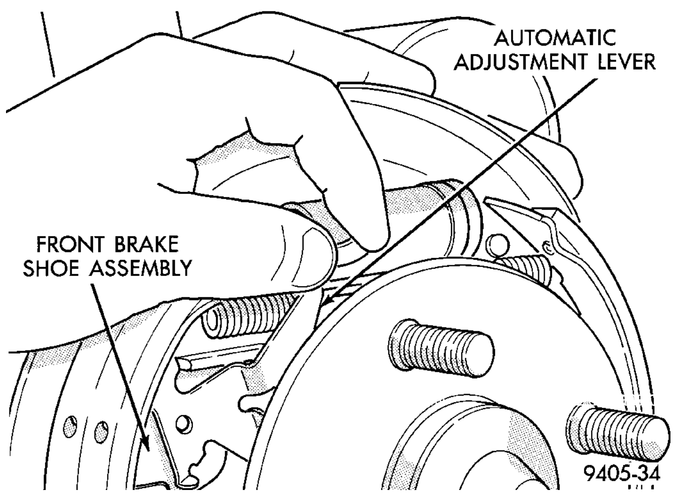


Fig. 82 Automatic Adjustment Lever

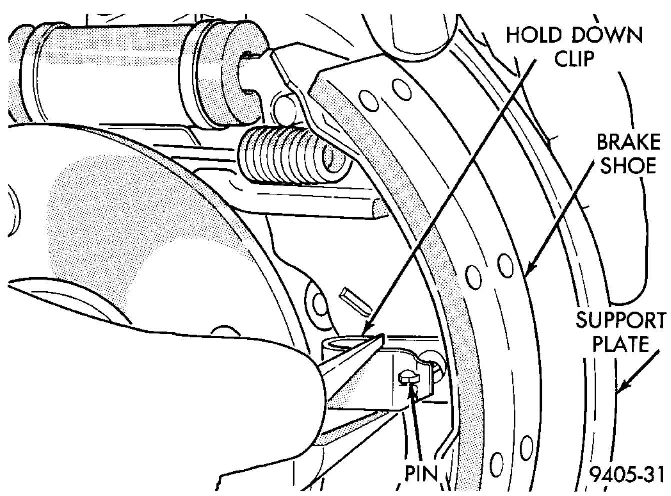


Fig. 83 Brake Shoe Hold Down Clips And Pins

(9) Remove the park brake lever pin to rear brake shoe retaining clip (Fig. 85).

(10) Remove the leading and trailing brake shoe, upper return spring and automatic adjuster screw

REMOVAL AND INSTALLATION (Continued)

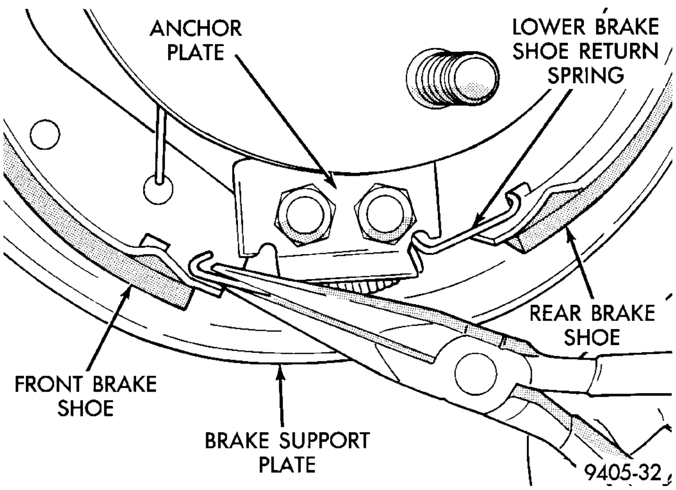


Fig. 84 Brake Shoe To Anchor Plate Return Spring

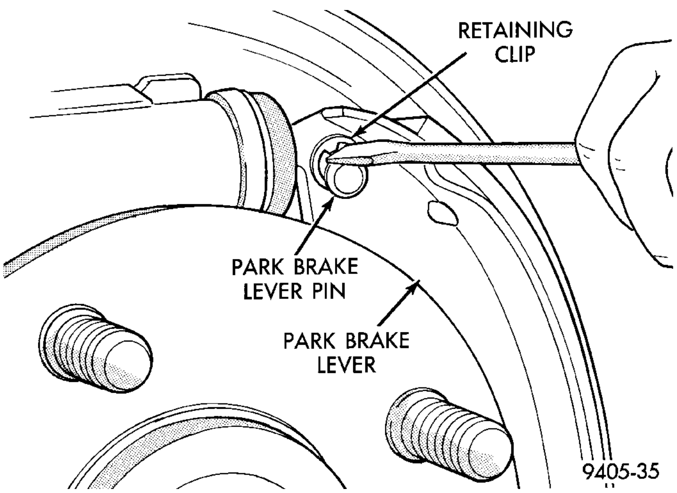


Fig. 85 Park Brake Lever Pin To Brake Shoe Retaining Clip

from the brake support plate as an assembly (Fig. 86).

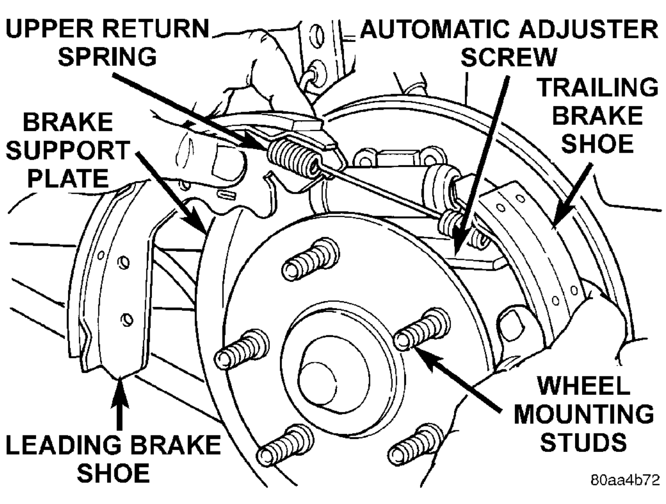


Fig. 86 Remove /Install Brake Shoes

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 may be 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. 87). Replace adjusting screw if corroded.

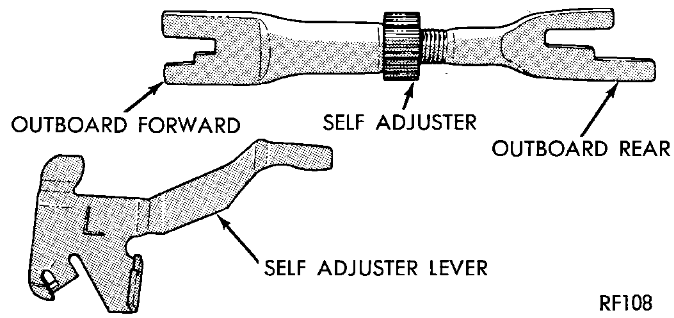


Fig. 87 Adjuster Screw and Lever (Typical)

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

INSTALL

(1) Lubricate the eight shoe contact areas on the support plate and anchor using Mopar Multi-Purpose Lubricant or equivalent (Fig. 88).

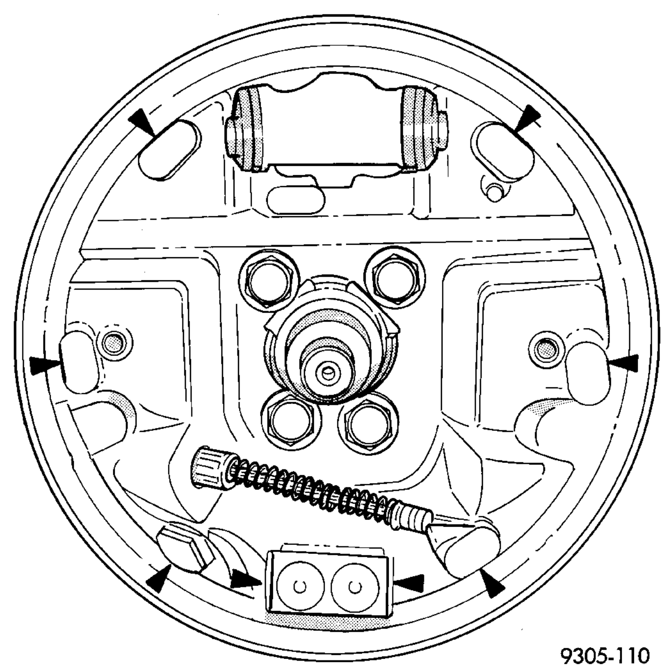


Fig. 88 Shoe Contact Areas on Support Plate

REMOVAL AND INSTALLATION (Continued)

(2) Assemble front and rear brake shoe assembly, automatic adjuster screw and upper return spring before installation on brake support plate.

(3) Install the pre-assembled brake shoes, automatic adjuster screw and upper return spring on the brake support plate (Fig. 86).

(4) Install the wave washer on the pin of park brake lever.

(5) Install pin on park brake lever into hole in rear brake shoe assembly (Fig. 89).

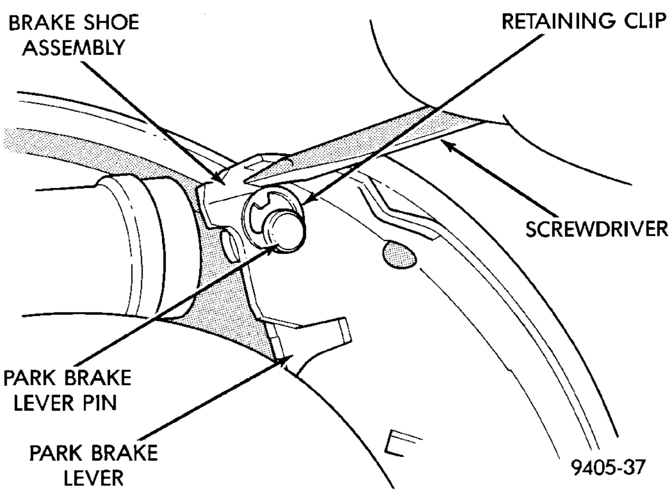


Fig. 89 Park Brake Lever Pin Retaining Clip Installation

(6) Install both brake shoe, to brake support plate, hold down pins and clips (Fig. 83).

(7) Install the lower brake shoe to anchor plate return spring (Fig. 84).

(8) Install the automatic adjustment lever, on the front brake shoe of the rear wheel brake assembly (Fig. 82).

(9) Install the automatic adjustment lever to front brake shoe assembly spring (Fig. 81).

(10) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(11) Install the rear brake drums on the hubs.

(12) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.

(13) Install the wheel and tire assembly.

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

(15) Road test vehicle. The automatic adjuster will continue the brake adjustment during the road test of the vehicle.

REAR BRAKE SHOE SUPPORT PLATE

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear tire and wheel assembly from vehicle.

(3) Remove the dust cap (Fig. 90) from the rear hub/ bearing.

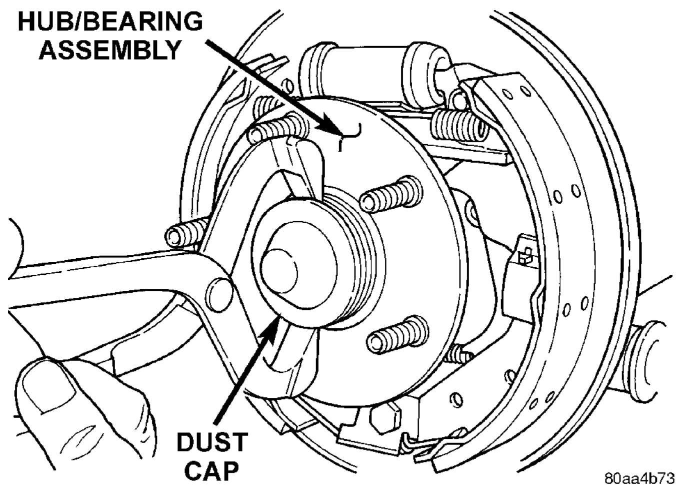


Fig. 90 Hub/ Bearing Dust Cap

(4) Remove the retaining nut (Fig. 91) holding the rear hub/bearing to the spindle. Remove the hub/ bearing from the spindle.

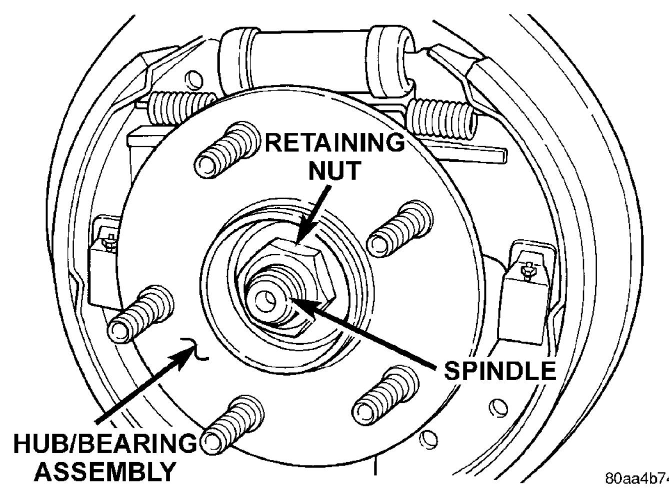


Fig. 91 Rear Hub/ Bearing Retaining Nut

REMOVAL AND INSTALLATION (Continued)

(5) Remove the rear brake shoes from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly removal procedure.

(6) Disconnect the rear brake flex hose tube from the wheel cylinder (Fig. 92).

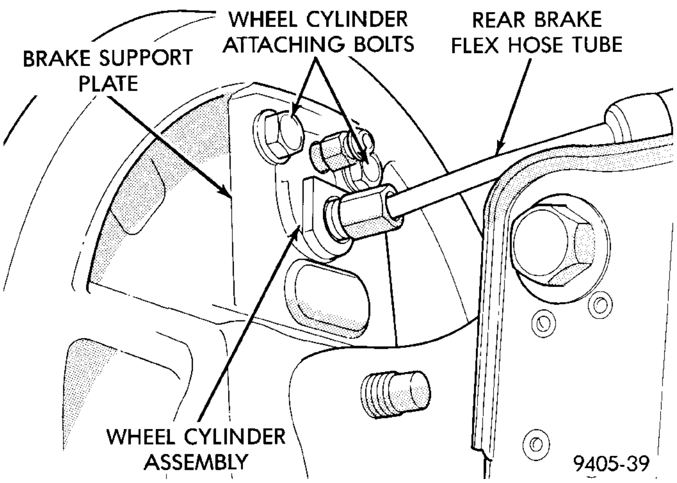


Fig. 92 Brake Flex Hose Tube At Wheel Cylinder

(7) Remove park brake actuator lever from the park brake cable.

(8) Position a 1/2 wrench over the retainer fingers on the end of the parking brake cable (Fig. 93). Compress cable housing retaining fingers and start cable housing out of support plate (Fig. 93). Remove wrench when retainer is free from the park brake cable mounting hole in the rear brake support plate. Alternate method is to use a aircraft type hose clamp over cable housing end fitting compressing the three fingers.

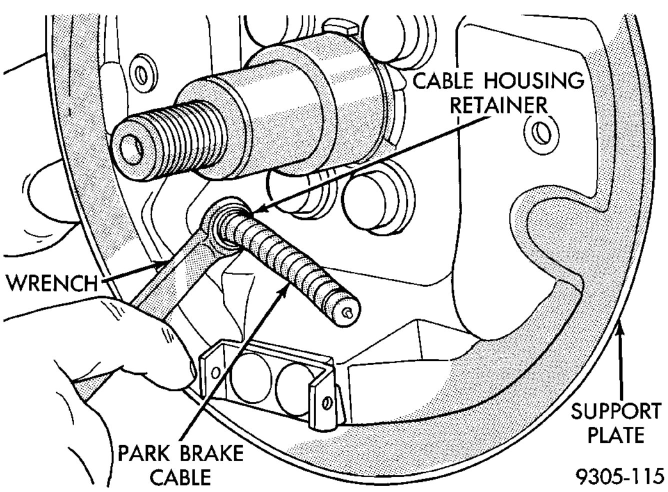


Fig. 93 Removing Park Brake Cable From Support Plate

(9) Remove the 4 brake support plate to knuckle attaching bolt and washer assemblies. Separate brake support plate from rear suspension knuckle.

INSTALL

(1) Install brake support plate and gasket on rear suspension knuckle casting. Torque support plate to knuckle casting attaching bolts to 75 N·m (55 ft. lbs.).

(2) Insert parking brake cable end fitting into brake support plate.

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder. Torque tube nut to wheel cylinder fitting to 17 N·m (145 in. lbs.).

(4) Attach parking brake cable to the parking brake actuator.

(5) Install rear brake shoe assemblies on the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly installation procedure.

(6) Install rear hub and bearing assembly on rear spindle. Install a **NEW** hub and bearing assembly retaining nut (Fig. 91). Torque hub and bearing assembly retaining nut to 217 N·m (160 ft. lbs.). Install dust cap.

(7) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(8) Install brake drum. Adjust and bleed service brakes.

(9) After brake drums are installed, pump brake pedal several times to do final adjustment of the brake shoe assemblies.

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

REAR BRAKE WHEEL CYLINDER

REMOVE

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

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

(3) Remove rear brake drum.

(4) Remove rear brake shoe assemblies from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly removal procedure.

(5) If brake shoes are wet with grease or brake fluid, remove and replace.

REMOVAL AND INSTALLATION (Continued)

(6) Disconnect the rear brake flex hose from the wheel cylinder (Fig. 94).

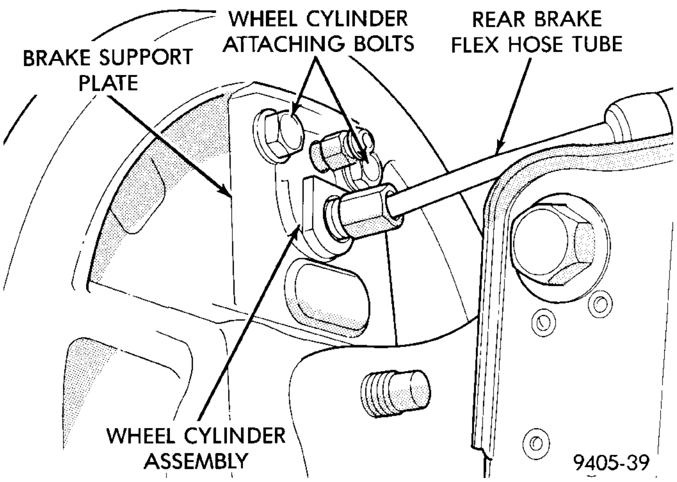


Fig. 94 Brake Flex Hose At Wheel Cylinder

(7) Remove rear wheel cylinder attaching bolts (Fig. 94).

(8) Remove rear wheel cylinder assembly from brake support plate (Fig. 95).

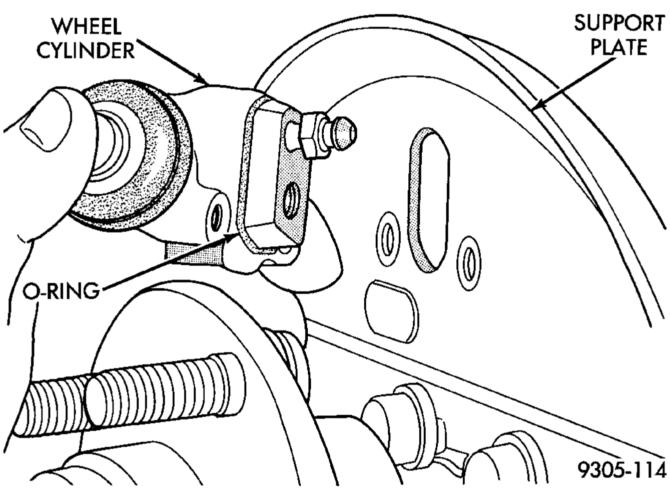


Fig. 95 Remove/Install Wheel Cylinder

INSTALL

(1) Apply a small bead of silicone sealer around the mating surface of the wheel cylinder to brake support plate.

NOTE: When installing wheel cylinder on brake support plate, be sure it is positioned squarely (horizontal) to the brake shoe assemblies.

(2) Install wheel cylinder onto brake support plate. Tighten the attaching bolts to 13 N·m (115 in. lbs.).

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder. Torque tube nut to 17 N·m (145 in. lbs.).

(4) Install rear brake shoe assemblies on the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly installation procedure.

(5) Install rear brake drum onto rear hub.

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

(7) Adjust the rear brakes. See Rear Drum Brake Shoe Adjustment in the Adjustments section in this group of the service manual.

(8) Bleed the entire brake system. See Bleeding Brake System in Service Adjustments section in this group of the service manual.

REAR HUB/BEARING

REMOVE

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

(2) Remove rear wheel and tire assembly.

(3) On vehicles equipped with rear drum brakes, remove brake drum (Fig. 96) from rear hub/bearing assembly. On vehicles equipped with rear disc brakes, remove disc brake caliper from disc brake adapter, and then remove rotor (Fig. 97) from hub/bearing assembly.

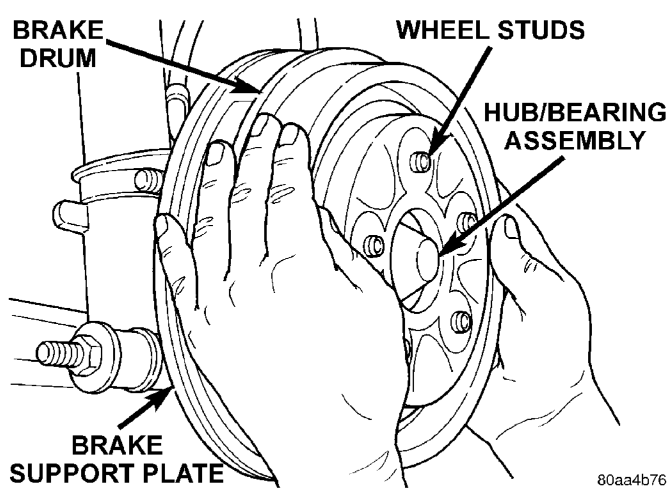


Fig. 96 Brake Drum Removal

REMOVAL AND INSTALLATION (Continued)

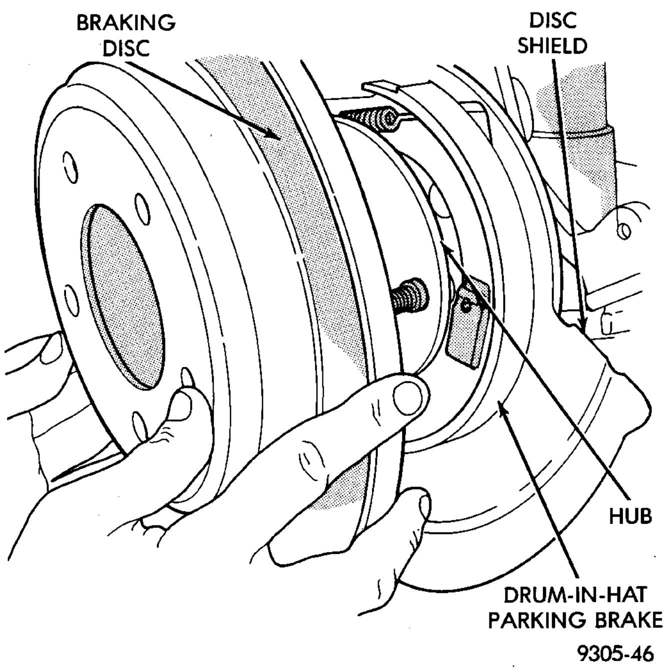


Fig. 97 Rear Rotor Removal

(4) Remove the dust cap (Fig. 98) from the rear hub/bearing.

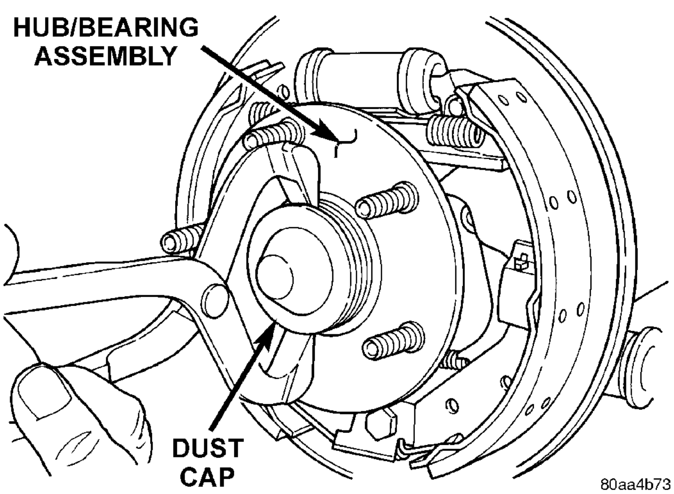


Fig. 98 Rear Hub/Bearing Dust Cap

(5) Remove the retaining nut (Fig. 99) mounting the hub/bearing to the rear spindle.

(6) Remove the hub/bearing from the rear spindle by pulling it off the end of spindle by hand.

INSTALL

CAUTION: The hub/bearing retaining nut must be tightened to but must not exceed its required torque specification. The proper torque specification of the retaining nut is critical to the life of the hub bearing.

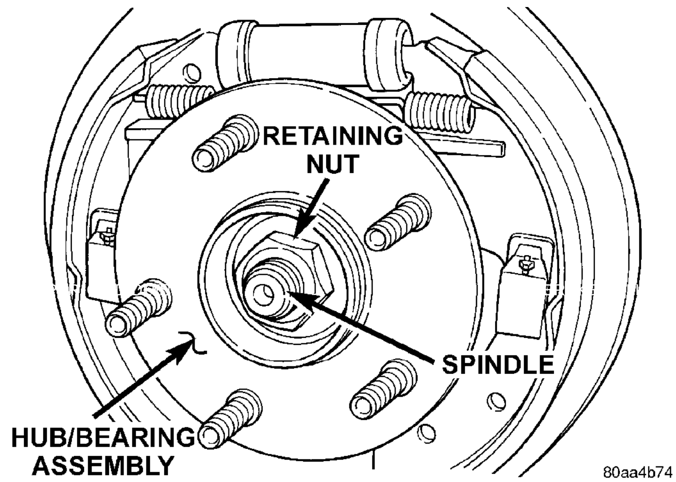


Fig. 99 Hub/Bearing Assembly Retaining Nut

(1) Position hub/bearing assembly on rear spindle.

(2) Install **a new hub nut** (Fig. 99) and tighten to a torque of 217 N·m (160 ft. lbs.).

(3) Install the dust cap, on the hub/bearing using a soft faced hammer.

(4) On drum brake equipped vehicles, install the brake drum on the hub/bearing. On vehicles equipped with rear disc brakes, install the rotor on the hub/bearing.

(5) On disc brake equipped vehicles install the disc brake caliper on the adapter. Install the 2 guide pin bolts (Fig. 100) mounting the disc brake caliper to the adapter. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.). Refer To Rear Disc Brake Service in this group of the service manual for the required caliper installation procedure.

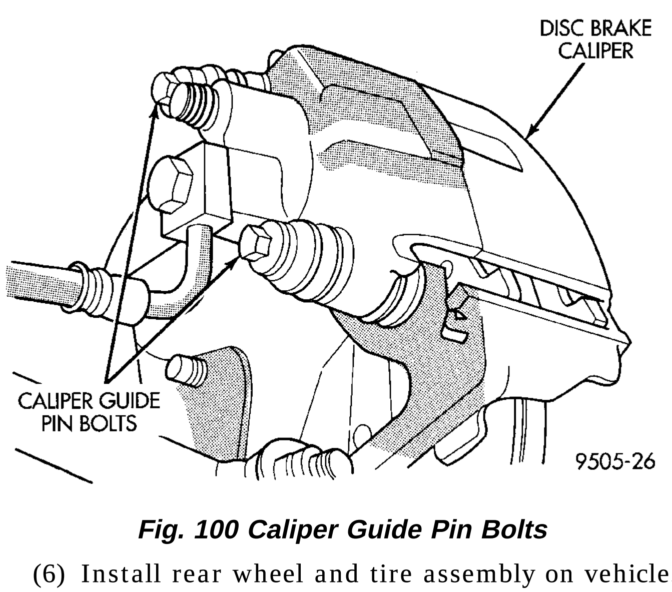


Fig. 100 Caliper Guide Pin Bolts

(6) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half specified torque. Then repeat pattern, fully tightening stud nuts to 135 N·m (100 ft. lbs.).

(7) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

MASTER CYLINDER

REMOVE

CAUTION: On ABS equipped vehicles, vacuum in power booster must be pumped down before removing master cylinder to prevent booster from sucking in any contamination. This can be done simply by pumping the brake pedal until a firm pedal is achieved, with the ignition off.

(1) On ABS equipped vehicles, be sure engine is not running, and pump the brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove vehicle wiring harness connector, from brake fluid level sensor, in master cylinder brake fluid reservoir (Fig. 101).

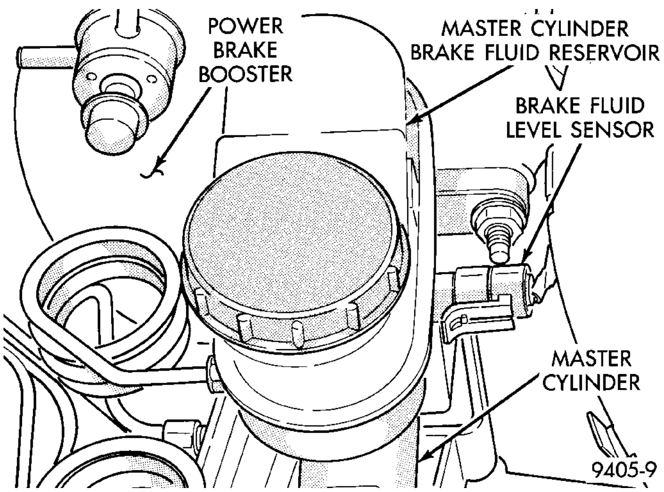


Fig. 101 Master Cylinder Fluid Level Sensor

(3) Disconnect the primary and secondary brake tubes from the master cylinder (Fig. 102) and (Fig. 103). Install plugs at all open brake tube outlets on master cylinder assembly.

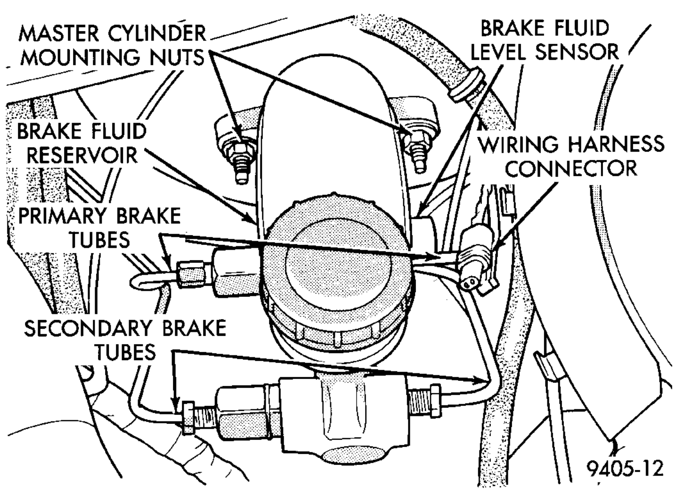


Fig. 102 Primary And Secondary Brake Tubes W/O ABS Brakes

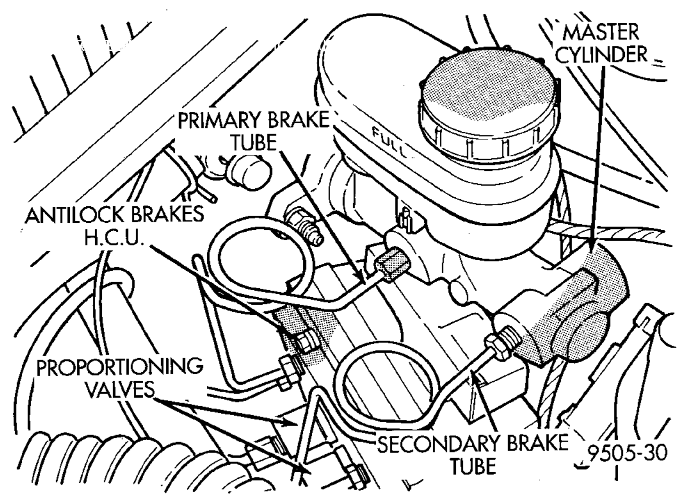


Fig. 103 Primary And Secondary Brake Tubes With ABS Brakes

(4) On vehicles equipped with ABS, clean area where master cylinder attaches to booster using a suitable brake cleaner product such as Mopar Brake Parts Cleaner or an equivalent.

(5) Remove the 2 nuts (Fig. 104) attaching master cylinder housing to power brake vacuum booster.

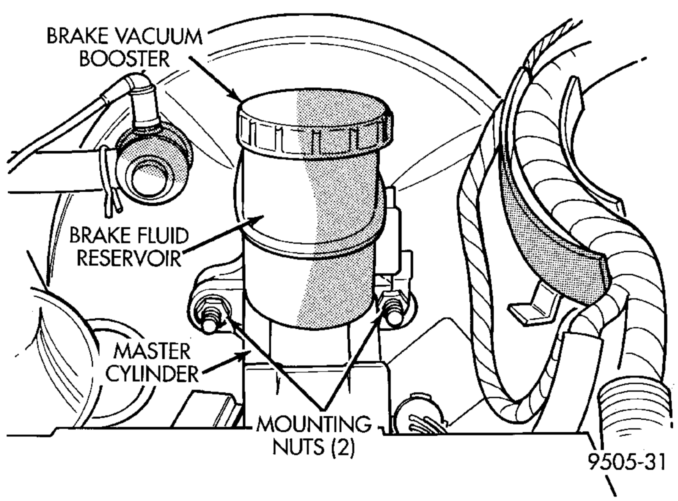


Fig. 104 Master Cylinder Mounting To Vacuum Booster

(6) Slide master cylinder assembly straight out of the power brake vacuum booster.

CAUTION: On vehicles equipped with ABS, the master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal in the front of the power brake vacuum booster (Fig. 105) MUST be replaced whenever the master cylinder is removed from the power brake vacuum booster.

(7) If vehicle is equipped with ABS, remove vacuum seal (Fig. 105) located in the front of the power

REMOVAL AND INSTALLATION (Continued)

brake vacuum booster. Vacuum seal is removed by **carefully** inserting a small screw driver between the push rod of the power brake vacuum booster and vacuum seal (Fig. 105) and pry seal out of power brake vacuum booster. **Do not attempt to pry seal out of master cylinder by inserting a tool between seal and power brake vacuum booster.**

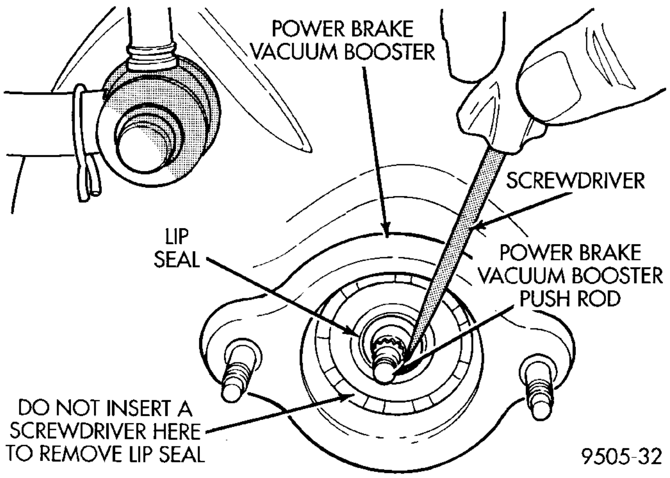


Fig. 105 Removing Seal From Vacuum Booster

BLEEDING MASTER CYLINDER

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder (Fig. 106) and (Fig. 107). Position tubes so outlets of Bleeding Tubes will be below surface of brake fluid when reservoir is filled to proper level.

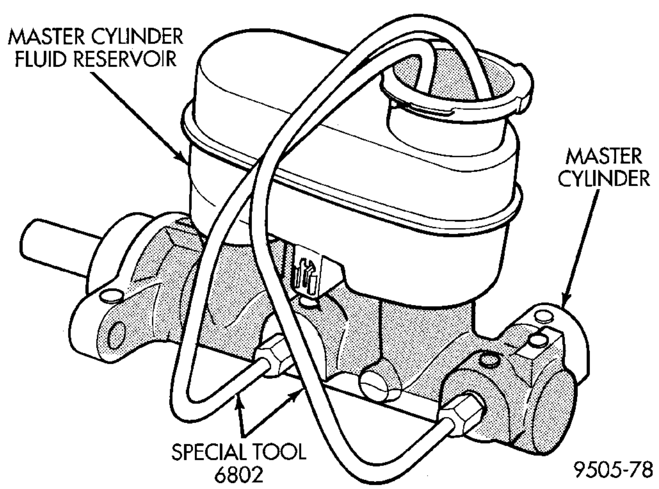


Fig. 106 Bleeding Tubes Attached to ABS Master Cylinder

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 108), depress push rod slowly and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled.

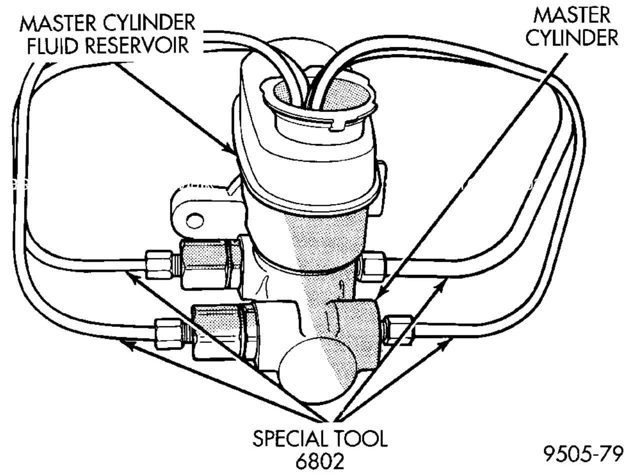


Fig. 107 Bleeding Tubes Attached To Non-ABS Master Cylinder

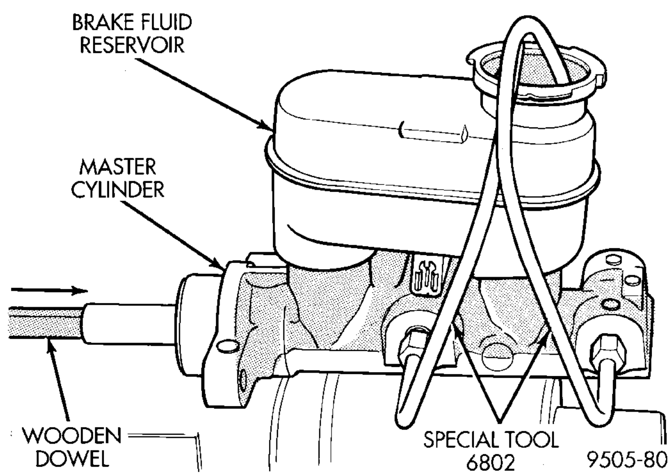


Fig. 108 Bleeding Master Cylinder

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

NOTE: Note: 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.

INSTALL

CAUTION: When replacing the master cylinder on a vehicle equipped with ABS, a NEW vacuum seal MUST be installed in the power brake vacuum booster. Use only the procedure detailed below for installing vacuum seal into power brake vacuum booster. Be sure old vacuum seal is removed from power brake vacuum booster before attempting to install new seal.

REMOVAL AND INSTALLATION (Continued)

CAUTION: When lubricating master cylinder push rod, use only Mopar Silicone Dielectric Compound. Using any other type of grease or lubricant on the push rod, will not provide adequate long term lubrication of the push rod.

(1) Lubricate master cylinder push rod as indicated in (Fig. 109) only using **Mopar Dielectric Grease—And No Substitutes.** Refer to the Mopar Chemicals Catalog to obtain the required lubricant.

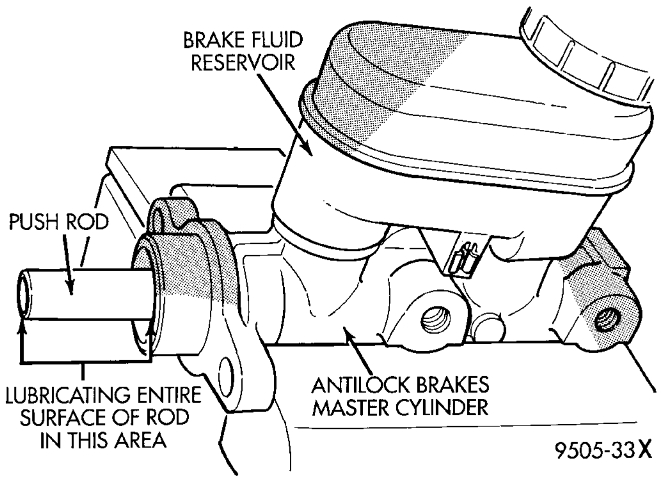


Fig. 109 Lubricating Master Cylinder Push Rod

(2) Install vacuum seal on master cylinder push rod as shown in (Fig. 110) with notches on vacuum seal pointing toward master cylinder housing. Then slide vacuum seal onto master push rod until seal is seated against master cylinder housing (Fig. 111) before installing master cylinder on power brake vacuum booster.

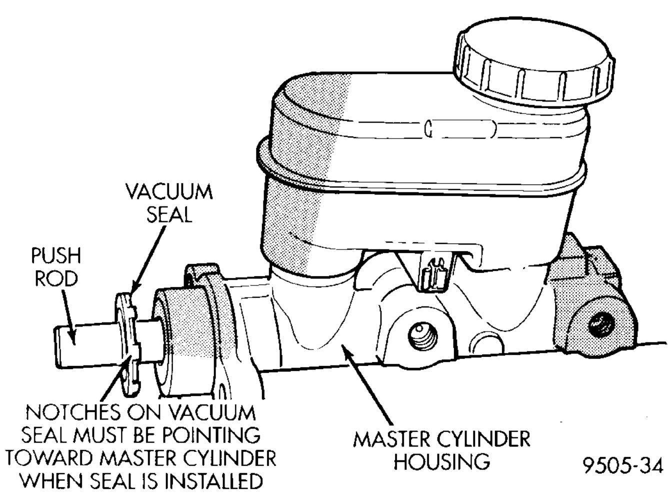


Fig. 110 Installing Vacuum Seal On Master Cylinder Push Rod

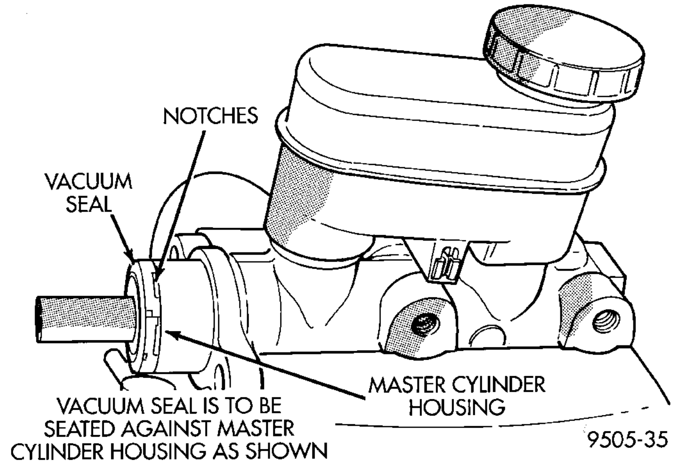


Fig. 111 Vacuum Seal Positioned For Installing Master Cinder

CAUTION: If vehicle is equipped with ABS, be sure old vacuum seal is removed from power brake vacuum booster before attempting to install master cylinder and NEW vacuum seal. If vacuum seal is not removed, refer to Master Cylinder Removal in this section of the service manual for required vacuum seal removal procedure.

(3) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

(4) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 104) and torque to 28 N·m (250 in. lbs.) torque.

(5) Connect brake tubes to master cylinder primary and secondary ports (Fig. 102) and (Fig. 103). Torque all tube nuts to 17 N·m (145 in. lbs.) torque.

VACUUM BOOSTER

REMOVE

CAUTION: On ABS equipped vehicles, vacuum in power booster must be pumped down before removing master cylinder to prevent booster from sucking in any contamination. This can be done simply by pumping the brake pedal until a firm pedal is achieved, with the ignition off.

(1) On ABS equipped vehicles, with engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

REMOVAL AND INSTALLATION (Continued)

(2) Remove vehicle wiring harness connector from brake fluid level sensor located in master cylinder brake fluid reservoir (Fig. 112).

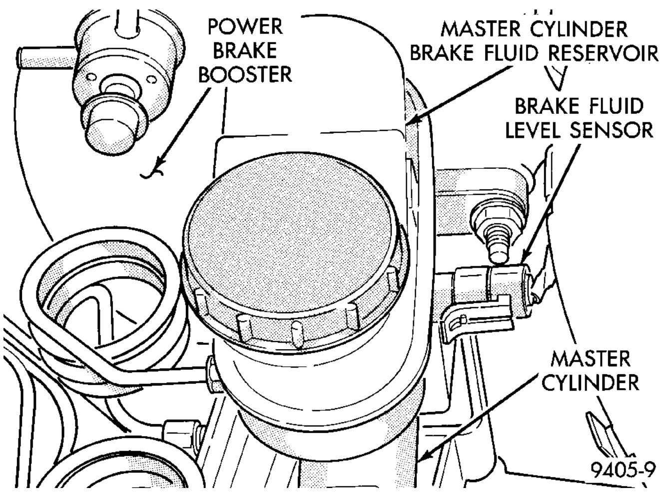


Fig. 112 Master Cylinder Fluid Level Sensor

(3) Disconnect the primary and secondary brake tubes from the master cylinder (Fig. 113) and (Fig. 114). Install plugs at all open brake tube outlets on master cylinder assembly.

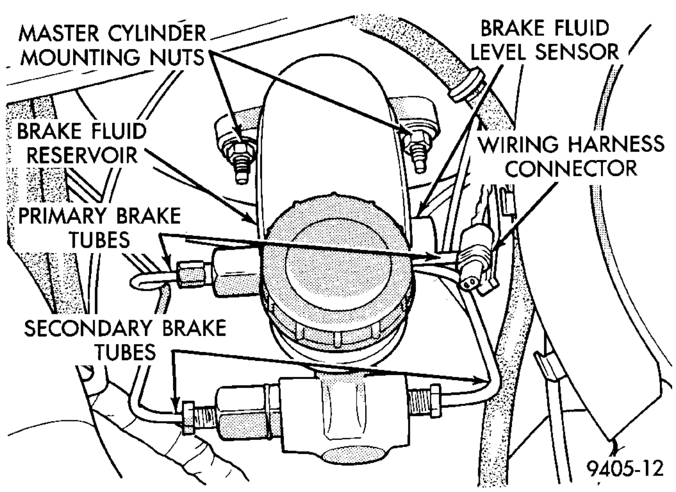


Fig. 113 Primary And Secondary Brake Tubes W/O ABS Brakes

(4) On vehicles equipped with ABS, clean area where master cylinder attaches to booster using a suitable brake cleaner such as Mopar Brake Parts Cleaner or an equivalent.

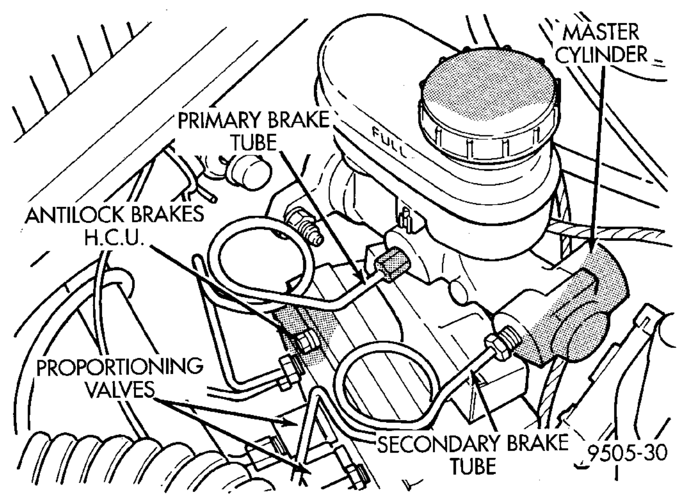


Fig. 114 Primary And Secondary Brake Tubes With ABS Brakes

(5) Remove the 2 nuts (Fig. 115) attaching master cylinder housing to power brake vacuum booster.

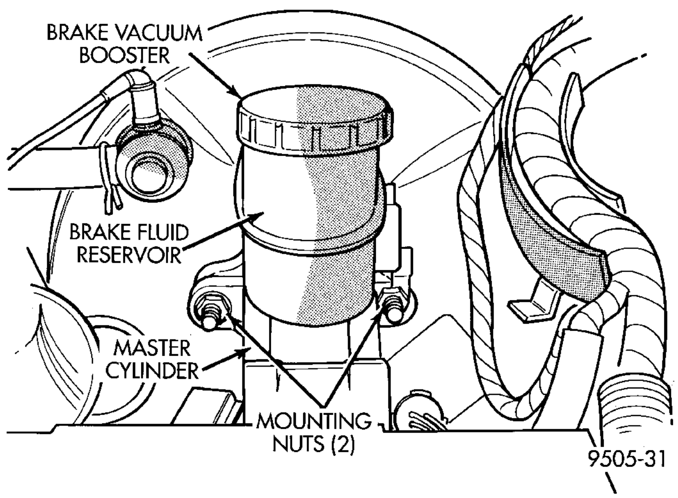


Fig. 115 Master Cylinder Mounting To Vacuum Booster

(6) Slide master cylinder assembly straight out of the power brake vacuum booster.

CAUTION: On vehicles equipped with ABS, the master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal in the front of the power brake vacuum booster (Fig. 116) MUST be replaced whenever the master cylinder is removed from the power brake vacuum booster.

(7) If vehicle is equipped with ABS, remove vacuum seal (Fig. 116) located in the front of the power brake vacuum booster. Vacuum seal is removed by **carefully** inserting a small screw driver between the push rod of the power brake vacuum booster and vacuum seal (Fig. 116) and prying seal out of power

REMOVAL AND INSTALLATION (Continued)

brake vacuum booster. **Do not attempt to pry seal out of master cylinder by inserting a tool between seal and power brake vacuum booster.**

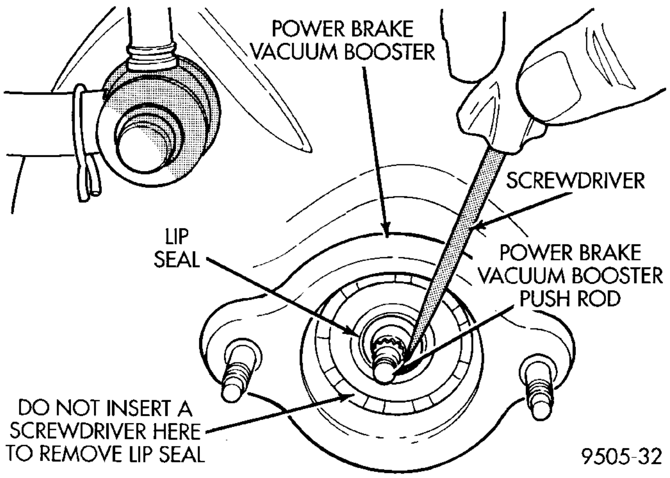


Fig. 116 Vacuum Seal Removal From Power Brake Booster

(8) Disconnect vacuum hoses from check valve on power brake vacuum booster (Fig. 117). **Do not remove check valve from power brake vacuum booster.**

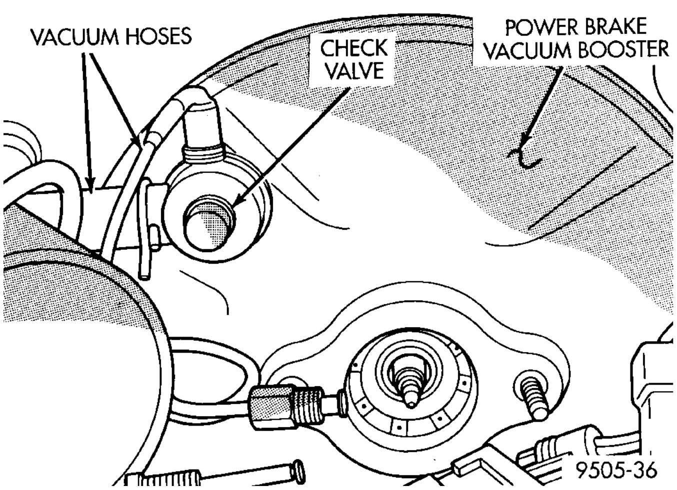


Fig. 117 Power Brake Vacuum Booster Check Valve

NOTE: If vehicle is equipped with antilock brakes, the hydraulic control unit (HCU) needs to be removed from the vehicle to allow removal of the power brake vacuum booster. Refer to Antilock Brake System Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section of this service manual for the required procedure.

(9) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver (Fig. 118) under the center tang of the retaining clip.

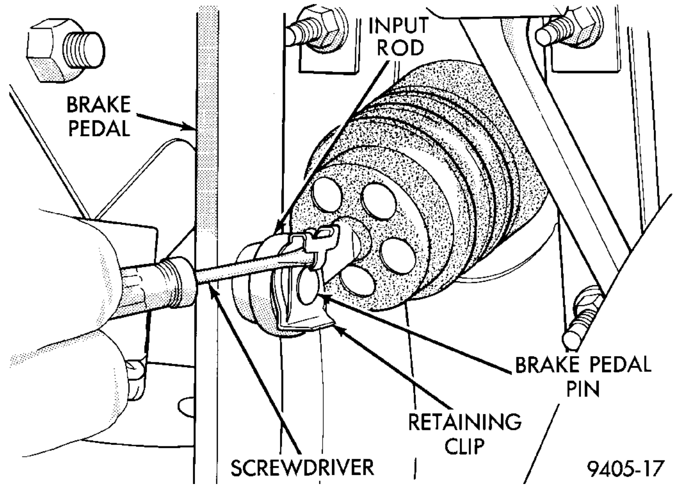


Fig. 118 Input Rod Retaining Pin

CAUTION: Discard retaining clip when removed, it is not to be reused. Replace only with a new retaining clip when assembled.

(10) Rotate screwdriver (Fig. 118) enough to allow retaining clip tang to pass over the end of the brake pedal pin.

(11) Remove the 4 nuts attaching the power brake vacuum booster to the dash panel (Fig. 119). The nuts are accessible from under the instrument panel in the area of the steering column and brake pedal bracket.

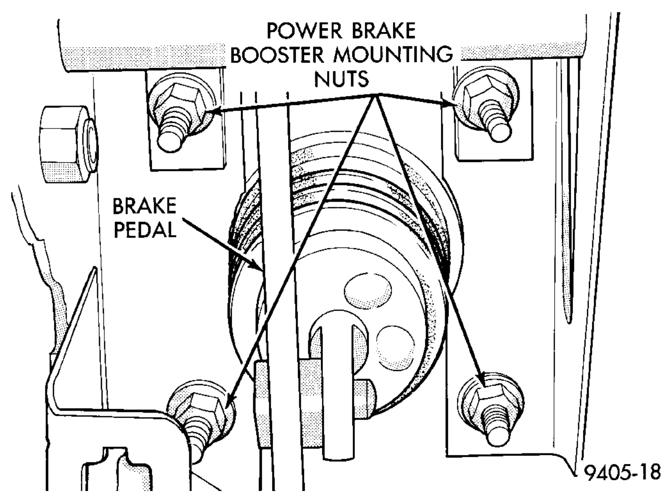


Fig. 119 Power Brake Booster Mounting

(12) Slide power brake vacuum booster forward until mounting studs clear dash panel, then tilt the booster up and to the center of the vehicle to remove.

INSTALL

(1) Position power brake booster onto dash panel.

(2) Install and torque the 4 power brake vacuum booster mounting nuts (Fig. 119) to 29 N·m (250 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

(3) Using lubriplate, or equivalent, coat the surface of the brake pedal pin where it contacts the brake vacuum booster input rod.

(4) Connect power brake vacuum booster input rod to brake pedal pin and install a NEW retaining clip. **Use only a new retainer clip DO NOT USE the old clip.**

(5) Connect all previously removed vacuum hoses onto power brake vacuum booster check valve (Fig. 117).

(6) If vehicle is equipped with ABS, install HCU. Refer to Antilock Brake System Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section of this service manual for the required procedure.

CAUTION: When replacing the power brake vacuum booster on a vehicle equipped with ABS, a NEW vacuum seal MUST be installed in the power brake vacuum booster. Use only the procedure detailed below for installing vacuum seal into power brake vacuum booster. If old vacuum seal came out with master cylinder when it was removed from power brake vacuum booster, be sure it is removed from master cylinder before attempting to install master cylinder into power brake vacuum booster.

CAUTION: When lubricating master cylinder push rod, use only Mopar Silicone Dielectric Compound. Using any other type of grease or lubricant on the push rod, will not provide adequate long term lubrication of the push rod.

(7) Lubricate master cylinder push rod as indicated in (Fig. 120) only using **Mopar Dielectric Grease—And No Substitutes.** Refer to the Mopar Chemicals Catalog to obtain the required lubricant.

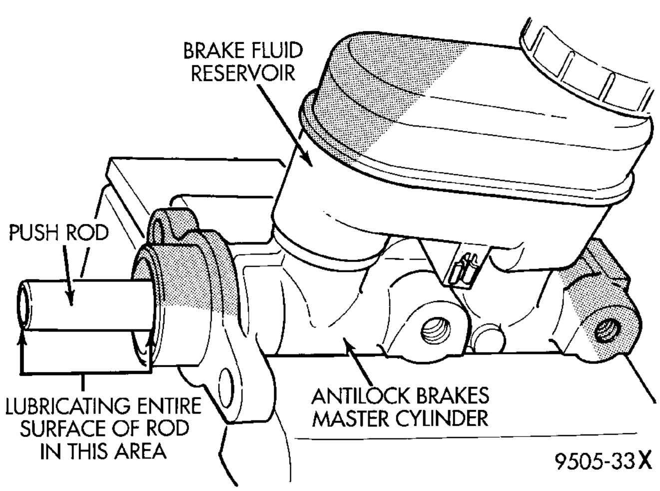


Fig. 120 Lubricating Master Cylinder Push Rod

(8) Install vacuum seal on master cylinder push rod as shown with notches on vacuum seal pointing toward master cylinder housing (Fig. 121). Then slide vacuum seal onto master push rod until seal is seated against master cylinder housing (Fig. 122) before installing master cylinder on power brake vacuum booster.

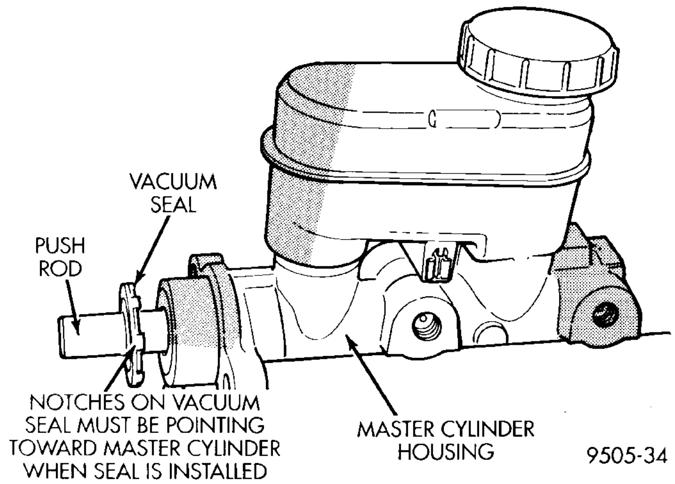


Fig. 121 Installing Vacuum Seal On Master Cylinder Push Rod

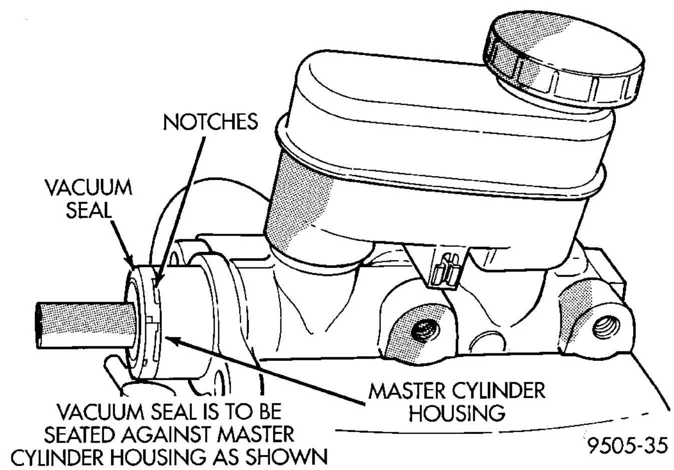


Fig. 122 Vacuum Seal Positioned For Installing Master Cylinder

CAUTION: If vehicle is equipped with ABS, be sure the old vacuum seal is removed from power brake vacuum booster before attempting to install master cylinder and NEW vacuum seal. If vacuum seal is not removed, refer to Master Cylinder Removal in this section of the service manual for required vacuum seal removal procedure.

(9) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

REMOVAL AND INSTALLATION (Continued)

(10) Install the 2 master cylinder mounting nuts (Fig. 115) and torque to 28 N·m (250 in. lbs.) torque.

(11) Connect brake tubes to master cylinder primary and secondary ports (Fig. 113) and (Fig. 114). Torque all tube nuts to 17 N·m (145 in. lbs.) torque.

(12) Reconnect wiring connector to fluid level sensor.

(13) Adjust stop lamp switch as necessary.

(14) Bleed brake system.

CHASSIS TUBES AND HOSES

Always use Mopar replacement brake hose assemblies 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. **Hose assemblies for each brake are unique and not interchangeable.**

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 brake tubing, before attaching to front frame rail. Then tighten all brake line fittings to specified torque.

On vehicles equipped with rear drum brakes, install rear brake hoses first to wheel cylinders and rear struts and then attach hose bracket to body. On vehicles equipped with rear disc brakes, attach brake hoses to calipers and struts first and then attach brake hose bracket to body. Following this procedure will reduce potential for twisting brake during installation procedure.

Only double wall 4.75mm (3/16 in.) steel brake line tubing, with Al- Rich/ZN-AL alloy coating should be used for replacement. Care must 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.

PROPORTIONING VALVE (BASE BRAKES)

CAUTION: Proportioning valves (Fig. 123) should never be disassembled.

There are two proportioning valve assemblies used in each vehicle. Due to different thread sizes, each proportioning valve has a different part number. During any service procedures identify the proportioning valve assemblies by supplier part number and or the color identification band (Fig. 123).

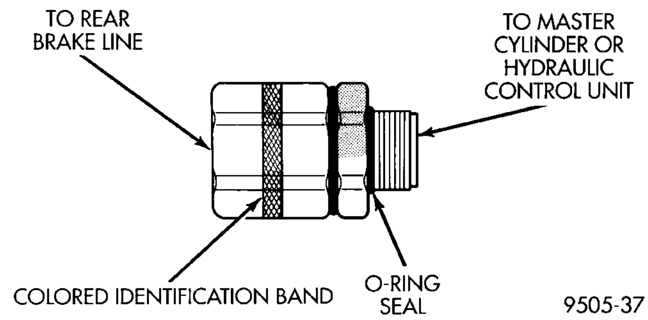


Fig. 123 Proportioning Valve

If premature rear wheel skid occurs on hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 124). Therefore, a road test to determine which rear brake slides first is essential.

If a malfunctioning proportioning valve is suspected on a vehicle. Refer to Brake Hydraulic System Control Valves in the Diagnosis And Testing Section in this group of the service manual for the required test procedure.

REMOVE

Use the proportioning valve test procedure stated above to determine which proportioning valve requires replacement, then replace it using procedure below.

(1) Disconnect brake tube from proportioning valve requiring removal from the master cylinder (Fig. 124).

(2) Remove proportioning valve (Fig. 124) from the master cylinder requiring replacement.

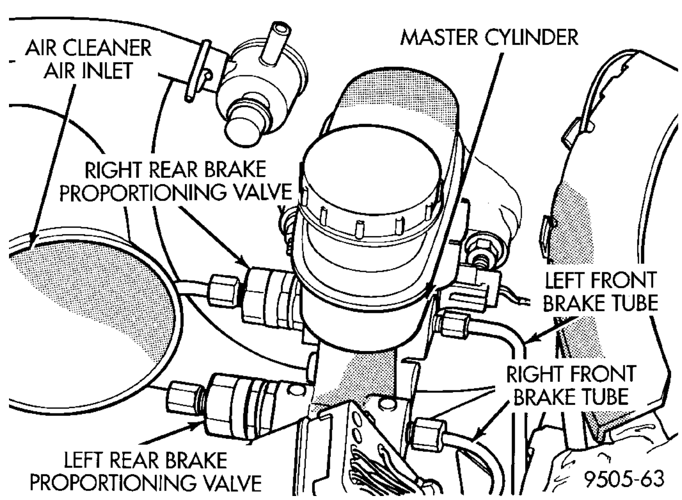


Fig. 124 Non-ABS Proportioning Valve Locations On Master Cylinder

REMOVAL AND INSTALLATION (Continued)

INSTALL

(1) Wet O-ring seal on new proportioning valve using clean fresh brake fluid.

(2) Install proportioning valve in master cylinder and hand tighten until proportioning valve and O-ring seal is fully seated in master cylinder. Torque proportioning valve to 40 N·m (30 ft. lbs.).

(3) Install brake tube on proportioning valve. Tighten tube nut to 17 N·m (145 in lbs.) torque.

(4) Bleed the affected brake line. See Bleeding Base Brake Hydraulic System in the Service Procedures Section in this group of the service manual for the proper bleeding procedure.

PARK BRAKE LEVER ASSEMBLY

WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER ASSEMBLY CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE AUTO ADJUSTER LOCKOUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF AUTO ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

REMOVE

(1) Remove the screws attaching the rear of the center console assembly to console bracket (Fig. 125) or (Fig. 126).

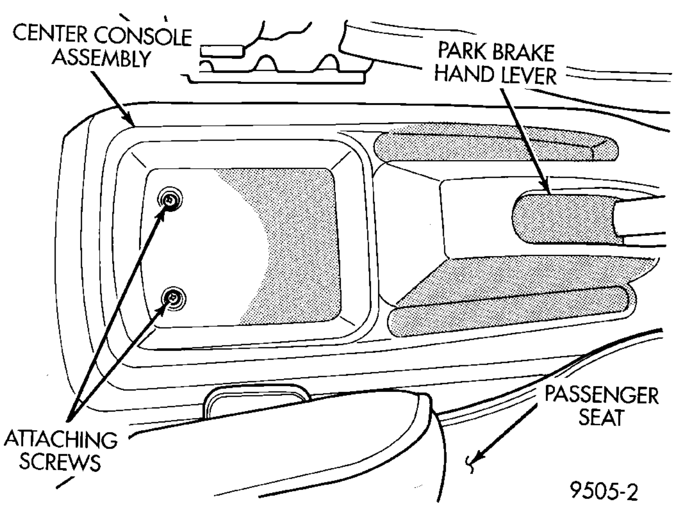


Fig. 125 Center Console Rear Attaching Screws W/O Arm Rest

(2) Remove the 2 screws located in cup holders (Fig. 127), attaching front of center console assembly to console bracket.

(3) Raise park brake hand lever as high as it will go to get the required clearance to remove the center console.

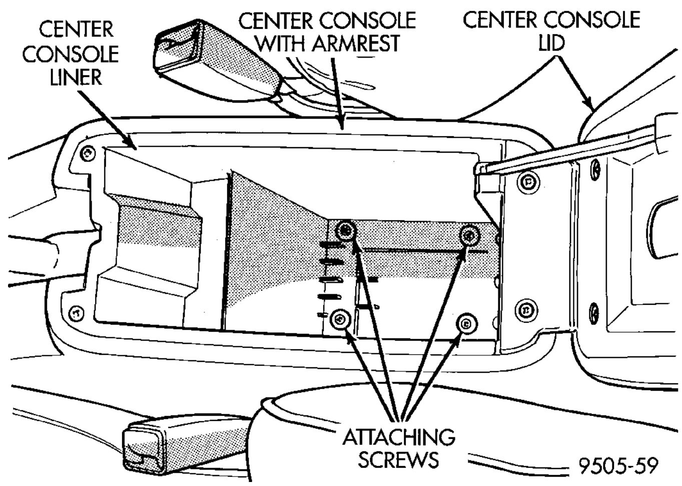


Fig. 126 Center Console Rear Attaching Screws With Arm Rest

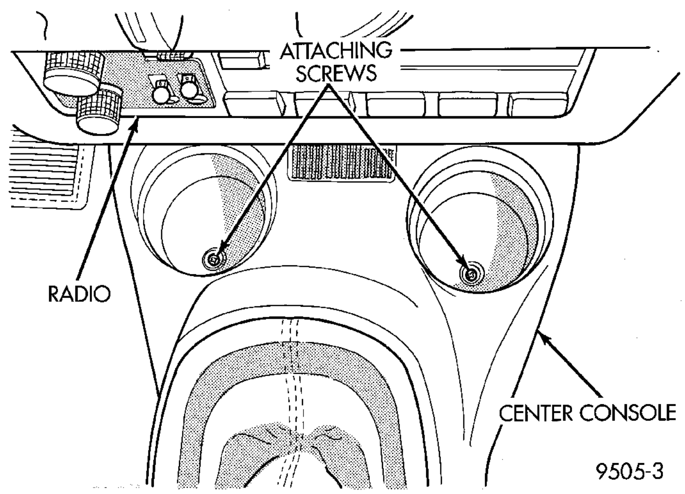


Fig. 127 Attaching Screws At Front Of Center Console

(4) Remove center console assembly.

WARNING: WHEN REPAIRS TO THE PARK BRAKE HAND LEVER ASSEMBLY OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(5) Lower park brake lever handle.

(6) Grasp park brake lever output cable by hand and pull rearward (Fig. 128). Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 128). This will lock the park brake mechanism and take tension off park brake cables.

(7) Remove both rear park brake cables from the park brake cable equalizer (Fig. 129).

(8) Remove wiring harness electrical connector for brake warning light ground from the park brake lever (Fig. 130).

REMOVAL AND INSTALLATION (Continued)

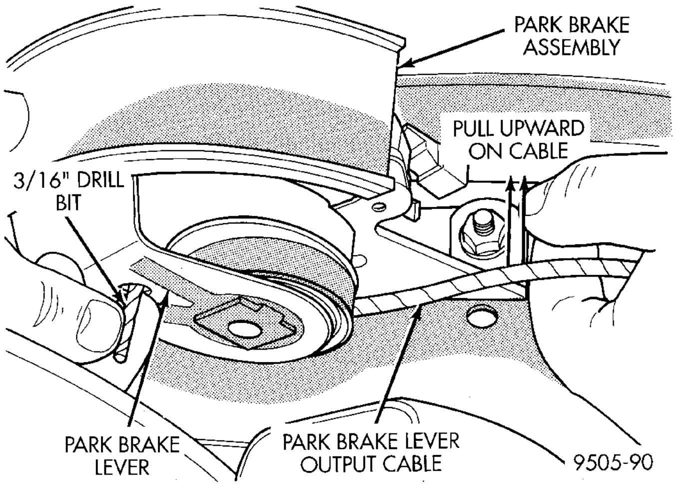


Fig. 128 Locking Pin Installed In Park Brake Mechanism

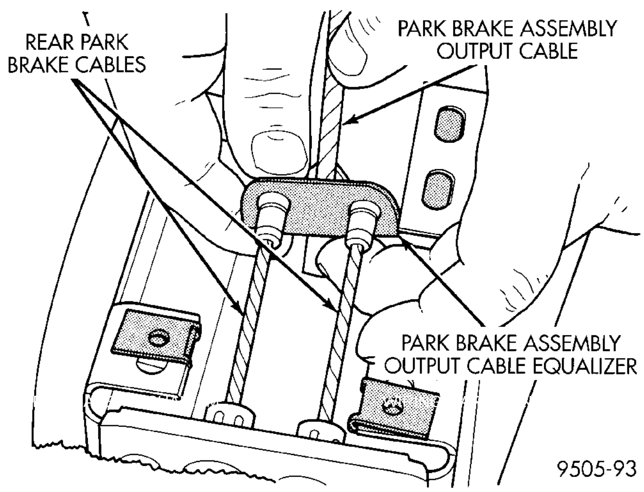


Fig. 129 Park Brake Cables At Equalizer

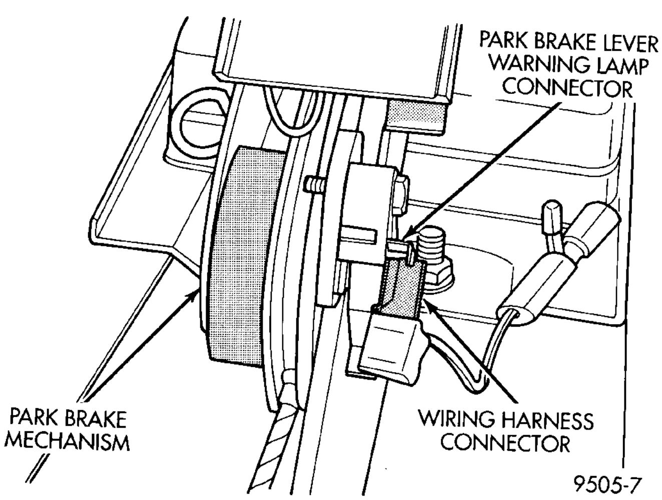


Fig. 130 Brake Warning Lamp Connection To Park Brake Lever

(9) Remove the 2 nuts (Fig. 131) attaching the park brake lever to the console bracket. Remove park brake lever mechanism from vehicle.

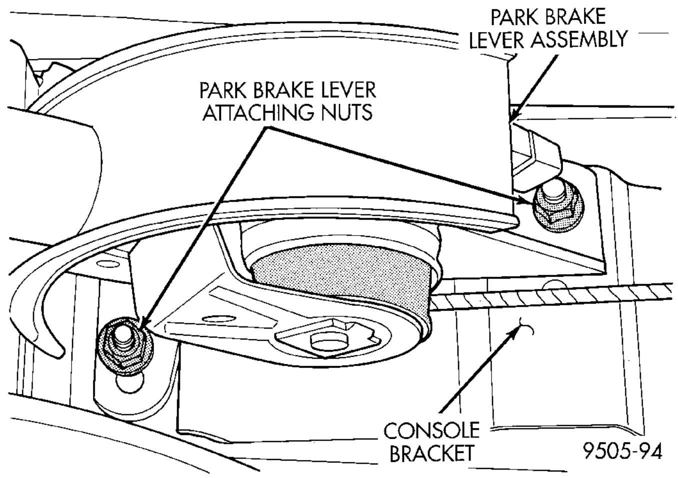


Fig. 131 Park Brake Lever Attachment To Console Bracket

INSTALL

(1) Place park brake lever on console bracket. Install and securely tighten the 2 attaching nuts (Fig. 131).

(2) Install both rear park brake cables into equalizer on park brake lever output cable (Fig. 129).

(3) Ensure that park brake cable is correctly installed and aligned with cable track on park brake lever.

(4) Firmly grasp park brake lever locking pin (Fig. 132) and quickly remove it from the park brake lever mechanism. This will allow the park brake lever mechanism to correctly adjust the park brake cables.

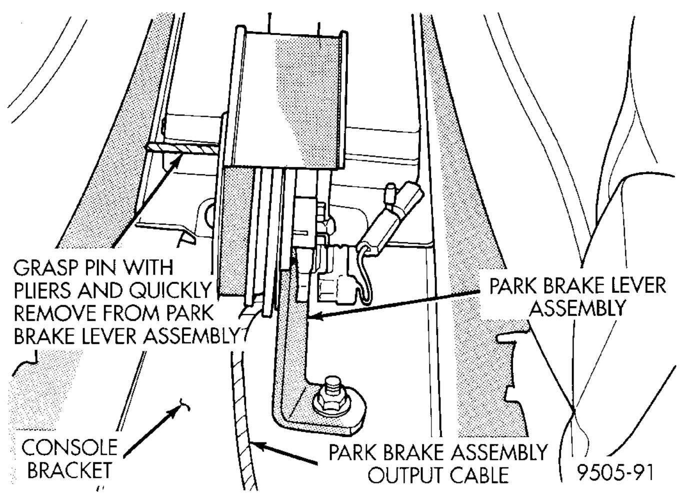


Fig. 132 Removing Lockout Pin From Park Brake Lever Assembly

(5) Connect electrical connector for brake warning lamp onto terminal on park brake lever assembly (Fig. 130).

REMOVAL AND INSTALLATION (Continued)

(6) Cycle park brake lever once to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle. They should rotate freely without dragging.

(7) Raise park brake lever to its fully engaged position. This is necessary to allow installation of the center console.

(8) Install center console assembly.

(9) Install the 4 center console assembly attaching screws (Fig. 125), (Fig. 126) and (Fig. 127).

PARK BRAKE LEVER OUTPUT CABLE

On this vehicle, the park brake lever output cable (Fig. 133), is not replaceable as a separate component of the park brake lever. The park brake lever output cable (Fig. 133) should never be attempted to be repaired in any manner. Follow the require procedures under park brake lever removal and replacement when servicing a park brake lever output cable.

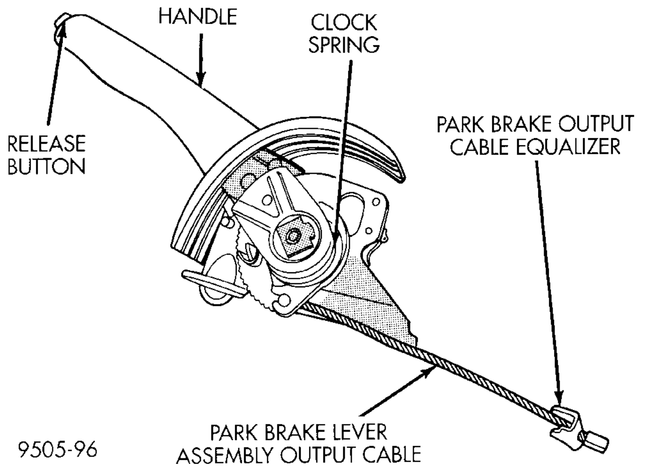


Fig. 133 Brake Lever Assembly And Output Cable

PARK BRAKE CABLES

NOTE: Note: Remove only one rear park brake cable from rear brakes at a time. Failure to do so will result in high efforts required to connect park brake cables to equalizer or park brake lever at rear wheel brakes.

For installation of the rear park brake cables follow the procedure as listed below.

REMOVE

(1) Remove screws attaching rear of center console assembly to floor pan of vehicle (Fig. 134) or (Fig. 135).

(2) Remove the 2 screws located in cup holders (Fig. 136) attaching front of center console to console bracket.

(3) Raise park brake lever as high as it will go for the clearance required to remove the center console.

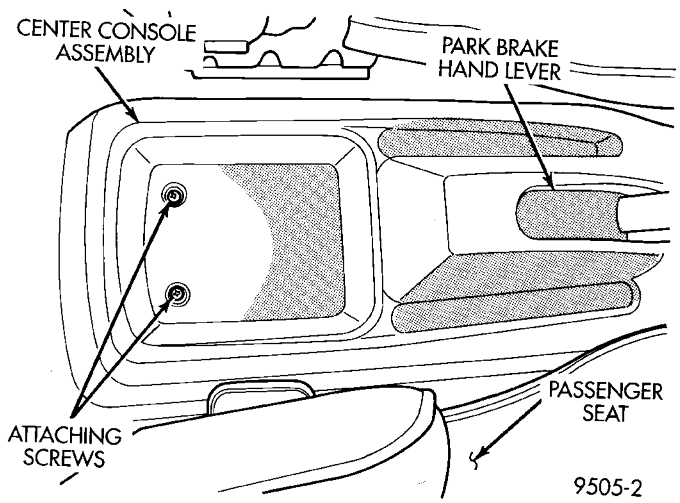


Fig. 134 Center Console W/O Arm Rest Rear Attaching Screws

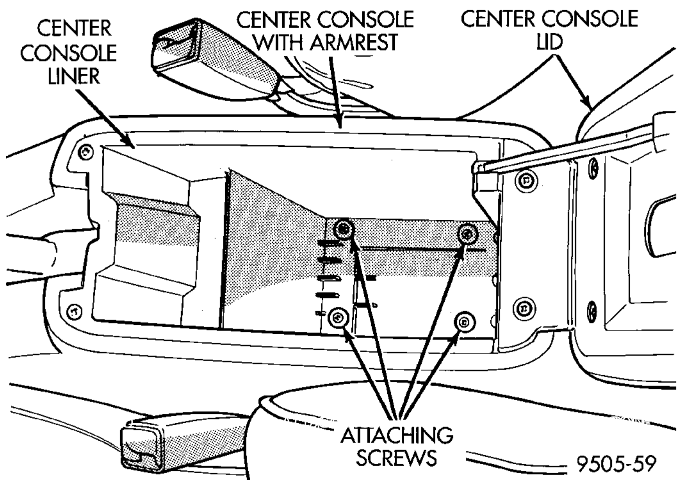


Fig. 135 Center Console With Arm Rest Rear Attaching Screws

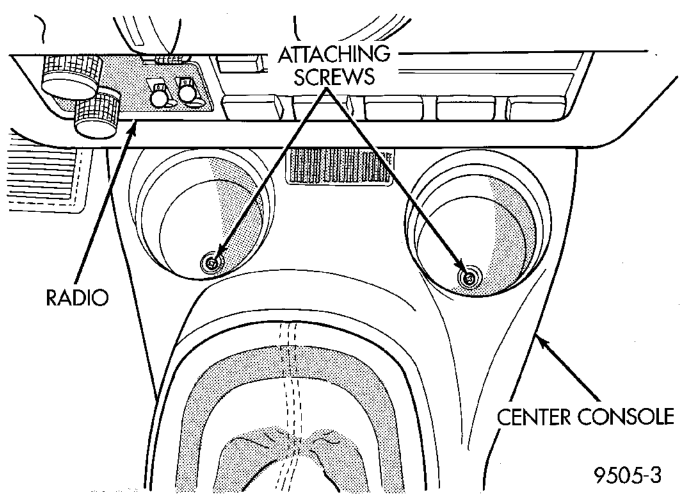


Fig. 136 Center Console Front Attaching Screws

(4) Remove center console assembly from vehicle.

REMOVAL AND INSTALLATION (Continued)

WARNING: WHEN REPAIRS TO THE PARK BRAKE HAND LEVER ASSEMBLY OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(5) Lower park brake lever handle.

(6) Grasp park lever output cable by hand and pull rearward (Fig. 137). Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 137). This will lock the park brake mechanism and take tension off park brake cables.

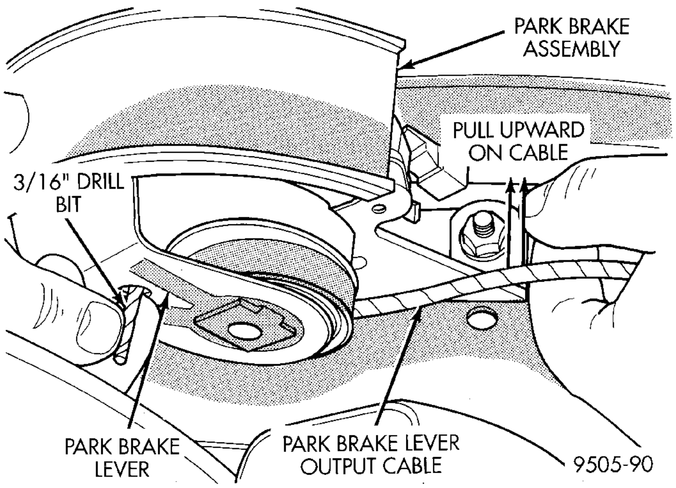


Fig. 137 Locking Pin Installed In Park Brake Mechanism

(7) Remove rear park brake cables from the park brake cable equalizer (Fig. 138).

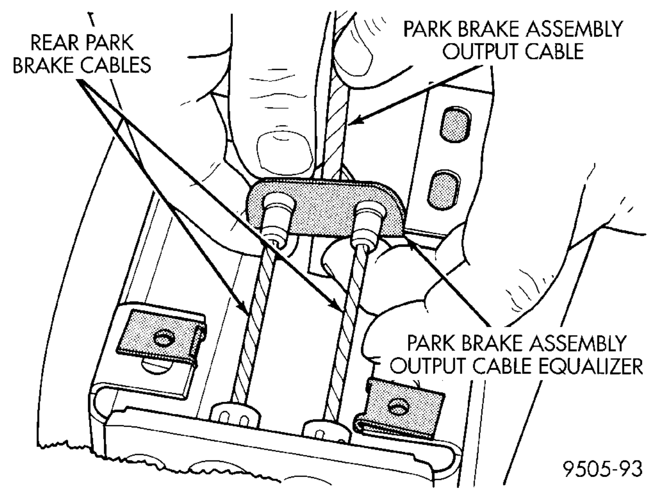


Fig. 138 Park Brake Cables Attachment To Equalizer

(8) Remove rear seat cushion from vehicle.

(9) Remove scuff plates (Fig. 139) from right and left rear door sills. Scuff plates are attached to door sills using clips on bottom of scuff plates. Remove by **carefully** prying scuff plate retaining clips out of door sills.

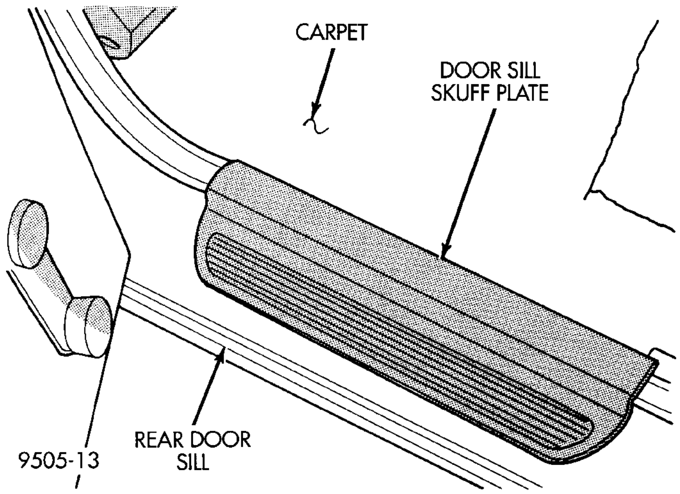


Fig. 139 Rear Door Sill Scuff Plates

(10) Fold rear carpeting forward to expose park brake cables.

(11) Install the box end of a 1/2 in. wrench over the park brake cable retainer as indicated in (Fig. 140). This will compress tabs on park brake cable retainer, allowing cable to be removed from console bracket. From under carpet, grasp park brake cable housing and pull cable straight out of console bracket.

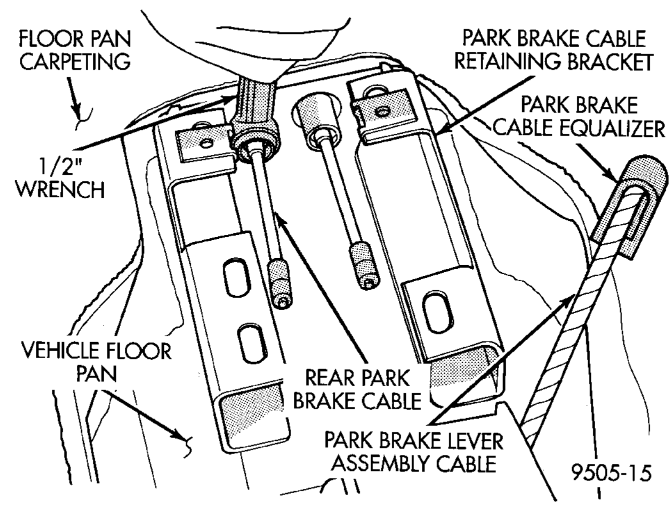


Fig. 140 Compressing Park Brake Cable Retaining Tabs

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

(13) Remove rear wheel and tire assembly.

(14) On vehicles equipped with rear drum brakes, remove brake drum (Fig. 141) from rear hub/bearing assembly. On vehicles equipped with rear disc brakes, remove disc brake caliper from disc brake

REMOVAL AND INSTALLATION (Continued)

adapter, and then remove rotor (Fig. 142) from hub/bearing assembly.

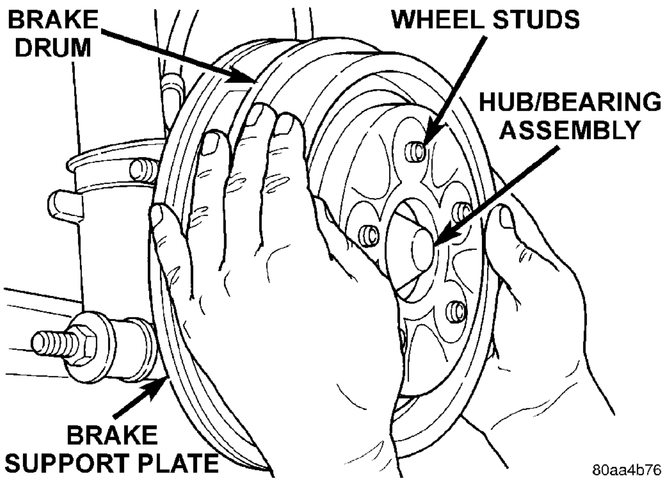


Fig. 141 Brake Drum Removal

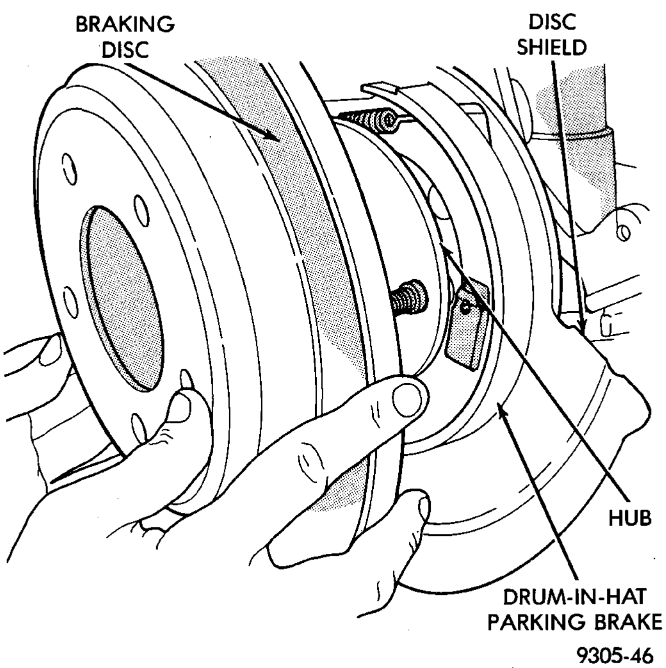


Fig. 142 Rear Brake Rotor

(15) Remove the dust dust cap (Fig. 143) from the rear hub/bearing.

(16) Remove the retaining nut (Fig. 144) for the hub/bearing from the spindle.

(17) Remove thehub/bearing (Fig. 145) from the rear spindle.

(18) **On vehicles equipped with rear drum brakes,** remove park brake cable from park brake actuating lever (Fig. 146). Then remove the actuating spring (Fig. 147) between brake shoe adjustment lever and brake shoe assembly.

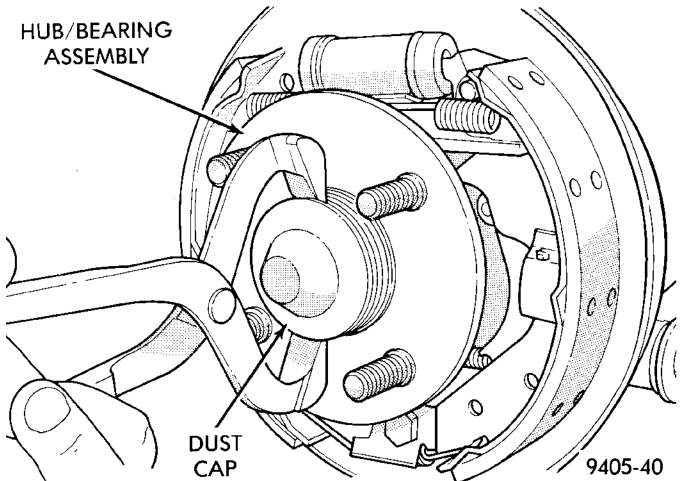


Fig. 143 Dust Cap Removal

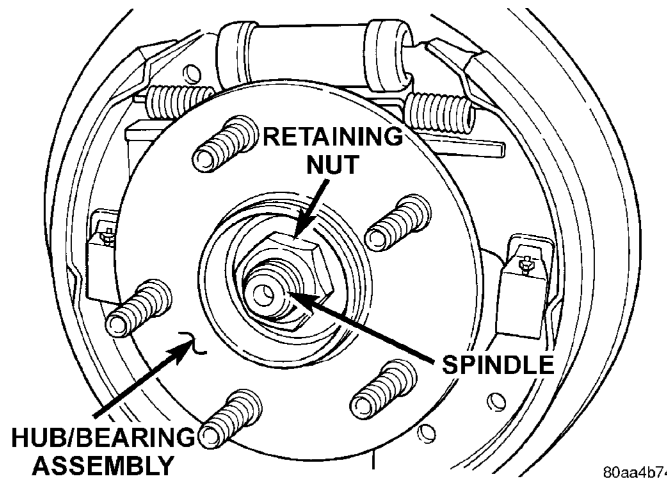


Fig. 144 Hub/Bearing Retaining Nut

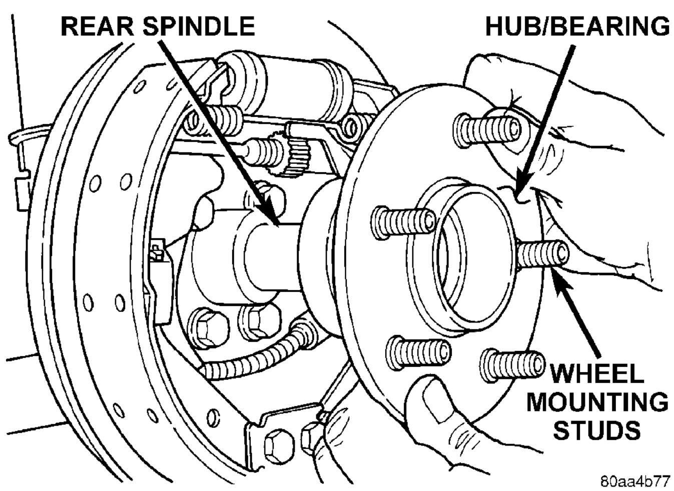


Fig. 145 Hub/Bearing Removal From Spindle (Drum Brakes Shown)

(19) **On vehicles equipped with rear disc brakes,** remove brake shoe assemblies (Fig. 148) from rear disc brake adapter. Then remove parking brake actuating lever (Fig. 149) from the park brake cable.

REMOVAL AND INSTALLATION (Continued)

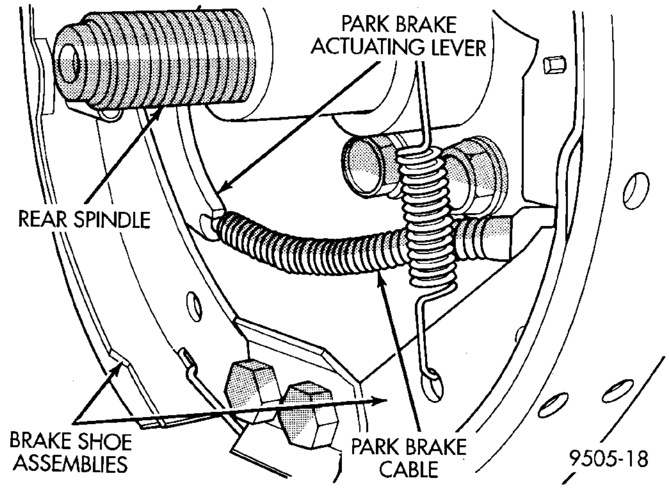


Fig. 146 Park Brake Cable Attachment To Actuating Lever

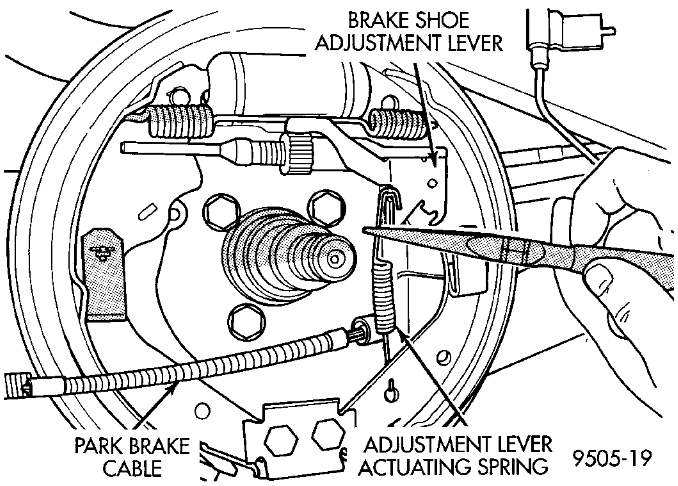


Fig. 147 Brake Adjustment Lever Actuating Spring

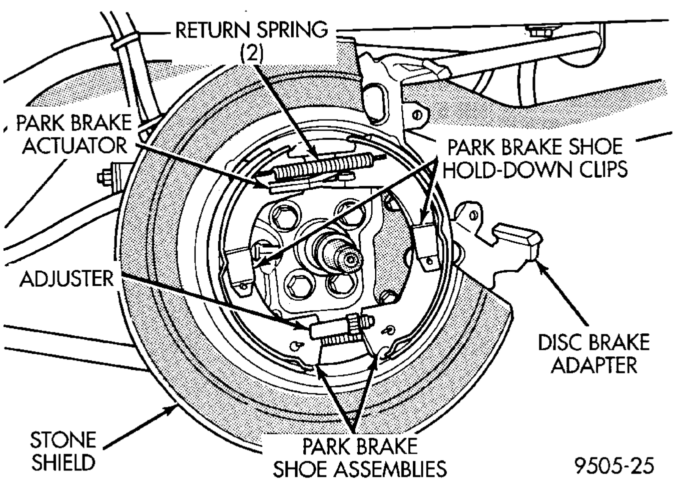


Fig. 148 Parking Brake Shoe Assemblies

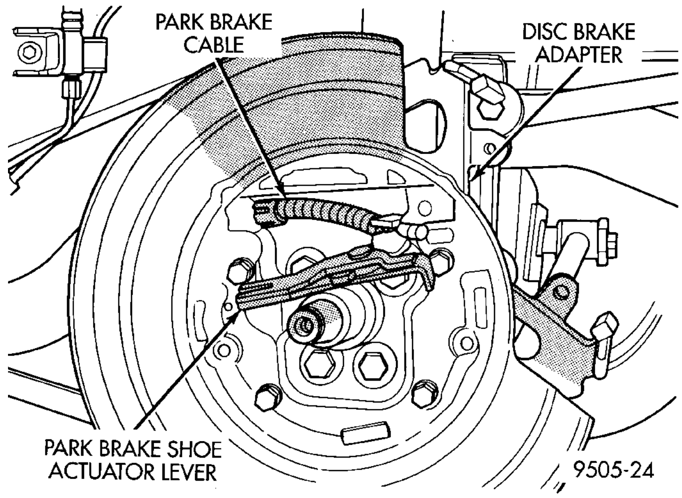


Fig. 149 Parking Brake Actuator Lever

(20) On vehicles equipped with rear drum brakes, remove park brake cable (Fig. 150) from rear brake support plate. Park brake cable is removed from brake support plate using a 1/2 in. wrench as shown in (Fig. 150) to compress locking tabs on park brake cable retainer.

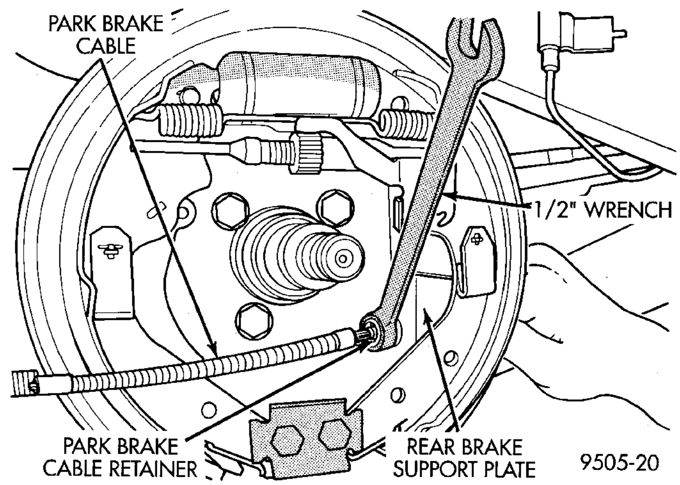


Fig. 150 Park Brake Cable Removal From Brake Support Plate

REMOVAL AND INSTALLATION (Continued)

(21) On vehicles equipped with rear disc brakes, remove park brake cable (Fig. 151) from rear disc brake adapter. Park brake cable is removed from disc brake adapter using a screwdriver as shown in (Fig. 151) to compress locking tabs on park brake cable retainer.

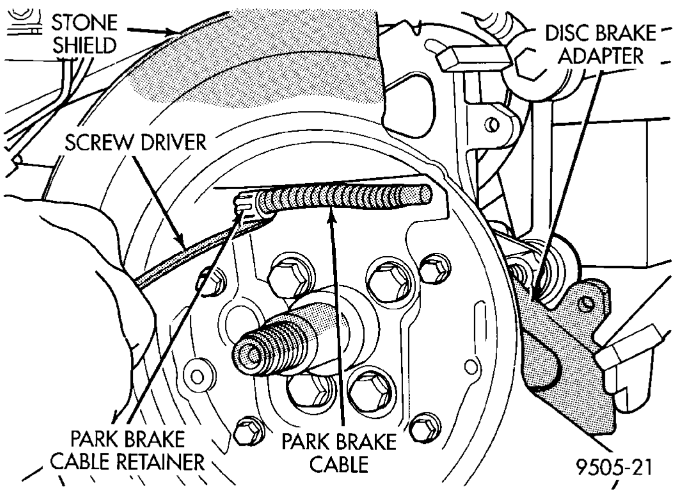


Fig. 151 Park Brake Cable Removal From Disc Brake Adapter

(22) Remove park brake cable routing bracket (Fig. 152) from vehicle frame rail.

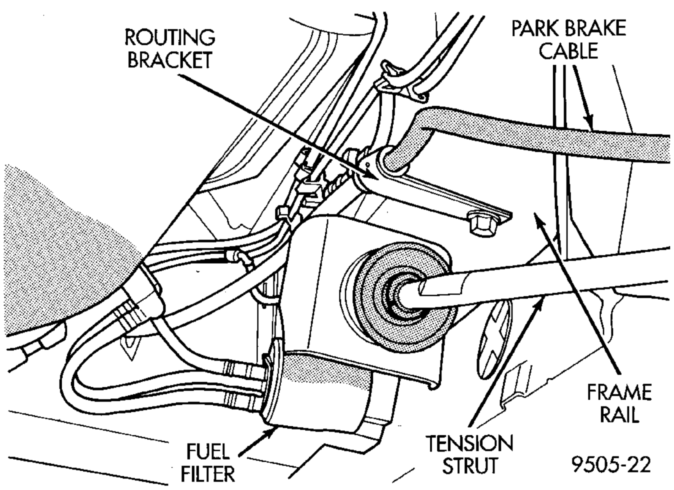


Fig. 152 Park Brake Cable Routing Bracket

(23) Remove park brake cable and sealing grommet (Fig. 153) from floor pan of vehicle.

INSTALL

(1) Install park brake cable into floor pan of vehicle making sure sealing grommet is installed in floor pan as far as possible to insure proper seal.

(2) Install park brake cable into brake support plate or rear disc brake adapter. Be sure locking tabs on cable retainer are expanded to ensure park brake cable is securely held in support plate or adapter.

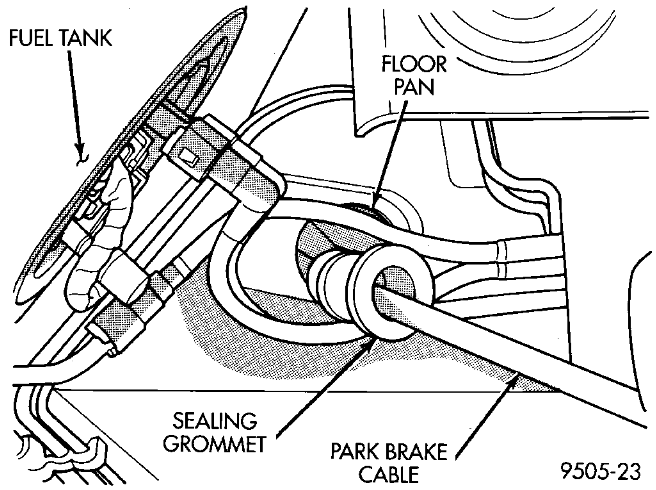


Fig. 153 Park Brake Cable Seal At Floor Pan

(3) Install park brake cable routing bracket (Fig. 152) on frame rail. Install and securely tighten routing bracket attaching bolt.

(4) **On vehicles equipped with rear drum brakes,** install park brake cable on park brake cable actuating lever (Fig. 146). Then install actuating spring between brake shoe assembly and brake adjustment lever (Fig. 147).

(5) **On vehicles equipped with rear disc brakes,** install park brake shoes actuator lever (Fig. 149) on park brake cable. Then install park brake shoe assemblies on disc brake adapter (Fig. 148).

(6) Install the hub/bearing assembly on the rear spindle. Then install **A NEW** rear hub/bearing assembly retaining nut. Torque hub/bearing assembly retaining nut to 217 N·m (160 ft. lbs.).

(7) Install hub/bearing assembly dust cap, using a soft faced hammer.

(8) On drum brake equipped vehicles, install rear brake drum on hub/bearing assembly. On vehicles equipped with rear disc brakes, install rotor on hub/bearing assembly.

(9) On disc brake equipped vehicles install disc brake caliper on disc brake adapter. Install the 2 caliper guide pin bolts (Fig. 154) and torque to 22 N·m (192 in. lbs.). Refer To Rear Disc Brake Service in this group of the service manual for the required caliper installation procedure.

(10) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half specified torque. Then repeat pattern, fully tightening stud nuts to 135 N·m (100 ft. lbs.).

(11) Lower vehicle.

(12) Grasp park brake cable to floor pan seal grommet (Fig. 155) by hand, and pull it into floor pan to ensure seal grommet is fully seated into floor pan.

(13) Route park brake cable under carpeting and up to park brake cable retaining bracket on floor

REMOVAL AND INSTALLATION (Continued)

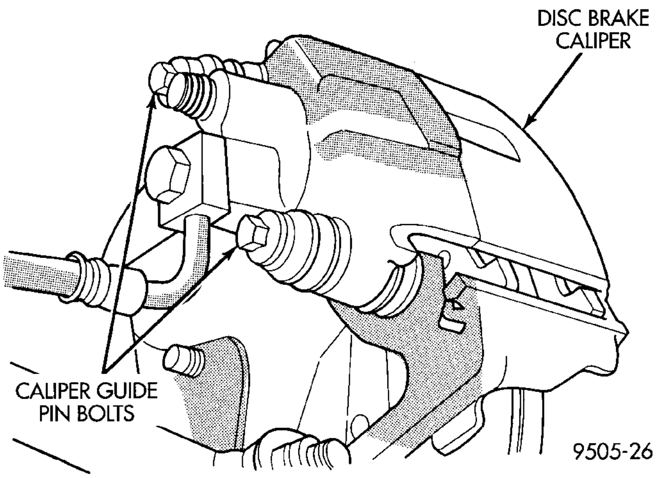


Fig. 154 Rear Caliper Guide Pin Bolts

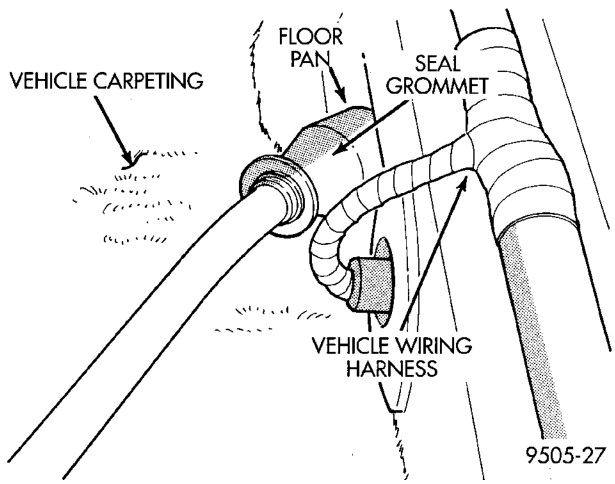


Fig. 155 Seal Grommet Installation In Floor Pan

pan. Then install park brake cable into retaining bracket (Fig. 156). Be sure tabs (Fig. 156) on park brake cable retainer, have expanded out to hold park brake cable in retaining bracket.

(14) Install rear park brake cables into equalizer (Fig. 138) on park brake lever cable.

(15) Reposition rear carpeting.

(16) Install both rear door sill plate scuff moldings, by snapping them onto rear door sills.

(17) Install lower rear seat cushion. Be sure lower seat cushion is fully installed in retainers on floor pan of vehicle.

(18) Firmly grasp park brake lever locking pin (3/16 in. drill bit) (Fig. 157) and quickly remove it from the park brake lever mechanism. This will allow the park brake lever mechanism to correctly adjust the park brake cables.

(19) Cycle park brake lever ounce to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle, they should rotate freely without dragging.

(20) Apply park brake to full engagement.

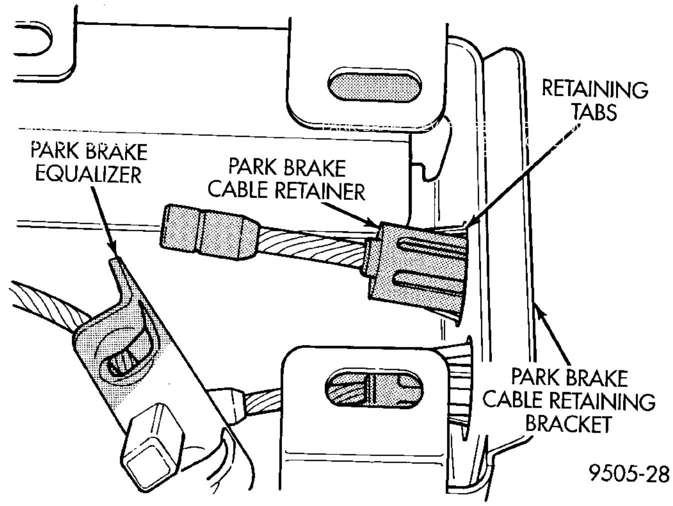


Fig. 156 Park Brake Cable Installed In Retaining Bracket

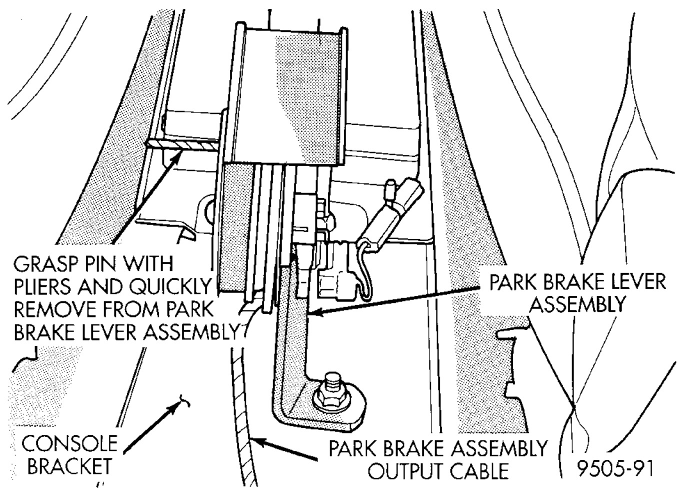


Fig. 157 Removing Lockout Pin From Park Brake Lever

(21) Install center console assembly.

(22) Install the center console assembly attaching screws.

PARK BRAKE SHOES WITH REAR DISC BRAKES

REMOVE

(1) Remove rear disc brake caliper assembly from adapter and rotor (See Disc Brake Shoe Removal).

(2) Remove rear rotor from rear hub.

(3) Remove dust cap from rear hub.

(4) Remove rear hub and bearing assembly retaining nut and washer.

(5) Remove rear hub and bearing assembly from rear spindle.

(6) Remove rear brake shoe assembly hold down clip (Fig. 158).

(7) Turn brake shoe adjuster wheel until adjuster is at shortest length.

REMOVAL AND INSTALLATION (Continued)

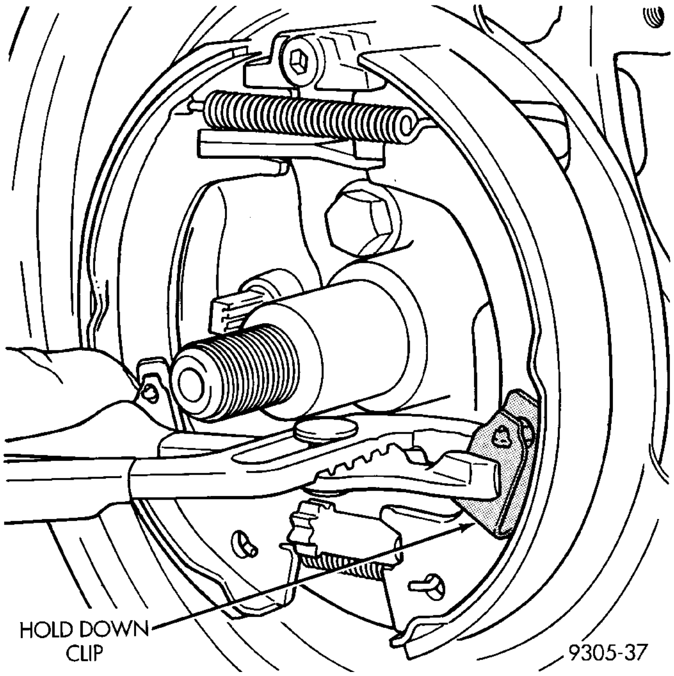


Fig. 158 Rear Brake Shoe Hold-Down Clip

(8) Remove adjuster assembly from the parking brake shoe assemblies (Fig. 159).

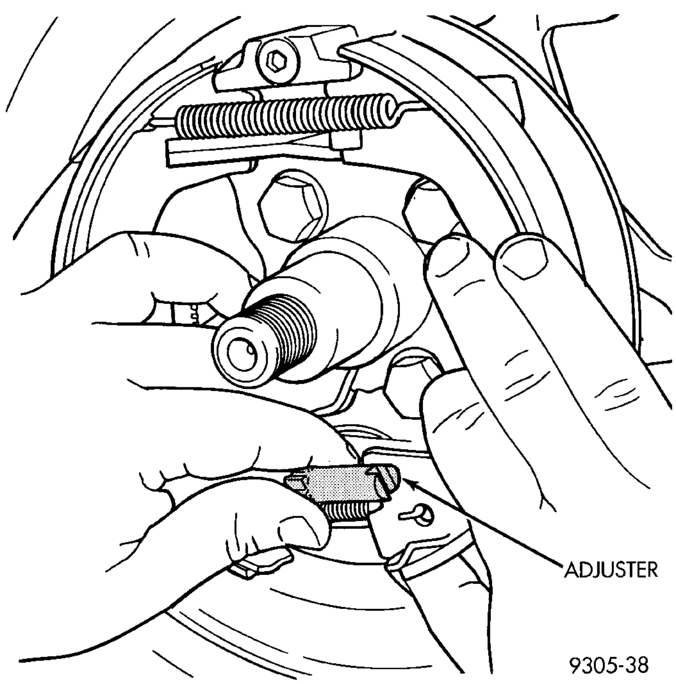


Fig. 159 Park Brake Shoe Adjuster Assembly

(9) Remove lower shoe to shoe spring (Fig. 160).

(10) Pull rear brake shoe assembly away from anchor. Then remove rear brake shoe and upper spring (Fig. 161).

(11) Remove front brake shoe hold-down clip (Fig. 162). Then remove front brake shoe assembly.

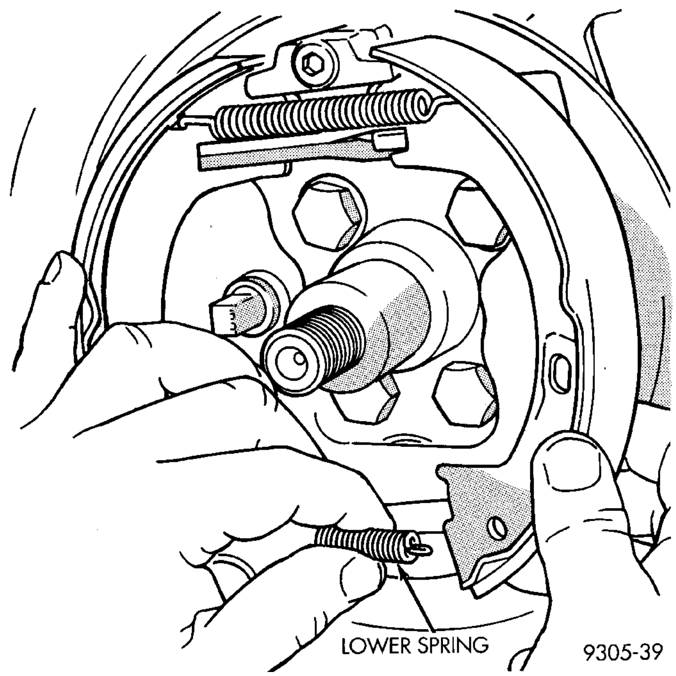


Fig. 160 Brake Shoe Lower Return Spring

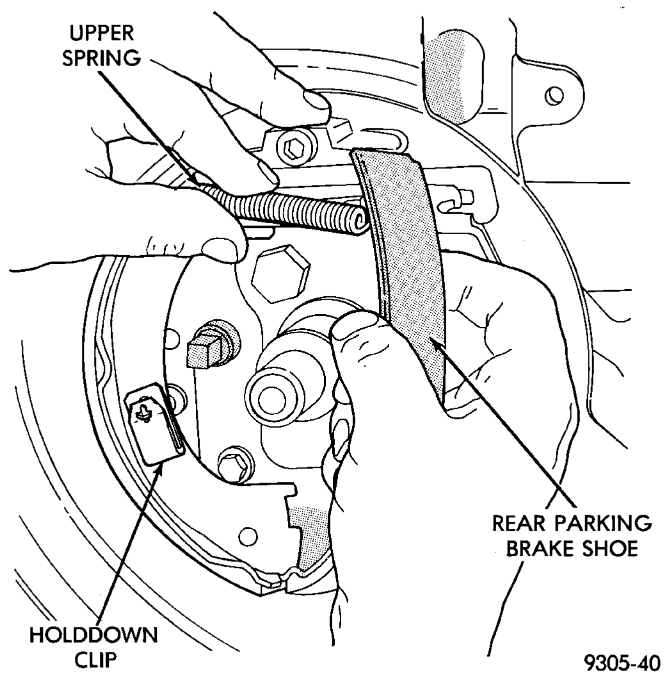


Fig. 161 Brake Shoe and Upper Spring

INSTALL

(1) Install front brake shoe and hold down clip (Fig. 162).

(2) Install rear brake shoe and the upper brake shoe to shoe return spring (Fig. 161).

(3) Pull rear brake shoe over anchor block until properly located on adapter.

(4) Install the lower shoe to shoe return spring (Fig. 160).

REMOVAL AND INSTALLATION (Continued)

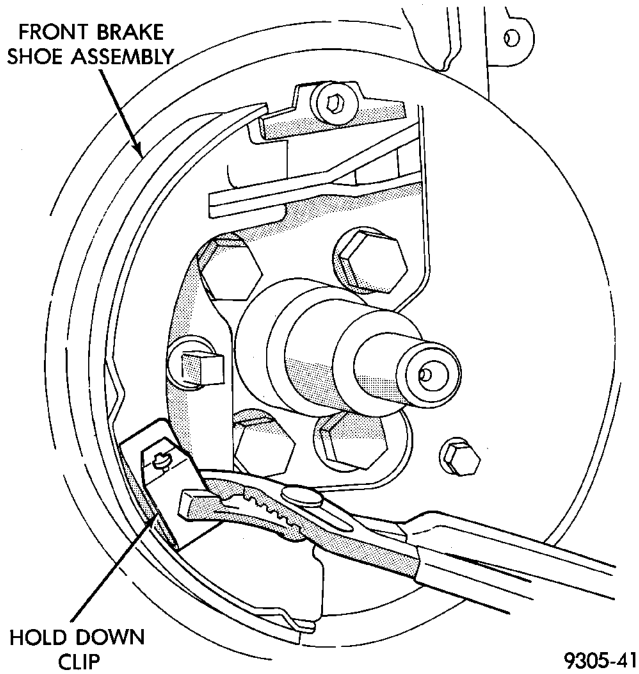


Fig. 162 Front Hold Down Clip And Brake Shoe

(5) Install brake shoe adjuster assembly with star wheel rearward (Fig. 159).

(6) Install rear brake shoe hold down clip (Fig. 158).

(7) Adjust brake shoes to a diameter to 171 mm (6.75 inch).

(8) Install rear hub and bearing assembly on spindle.

(9) Install **A NEW** hub and bearing assembly retaining nut. Torque the hub and bearing assembly retaining nut to 168 N·m (124 ft. lbs.).

(10) Install hub and bearing assembly dust cap.

(11) Install rear rotor.

(12) Install rear disc brake caliper on the adapter (See Brake Shoe Removal).

(13) Install wheel and tire assemblies.

(14) Tighten wheel stud nuts to 129 N·m (95 ft.lbs.).

STOP LAMP SWITCH

REMOVE

(1) Depress and hold the brake pedal while rotating stop lamp switch (Fig. 163) in a counter-clockwise direction approximately 30 degrees.

(2) Pull the switch rearward and remove from its mounting bracket.

(3) Disconnect wiring harness connector from stop lamp switch.

INSTALL

NOTE: Prior to installing stop lamp switch into bracket, the plunger must be moved to its fully extended position using procedure in Step 1.

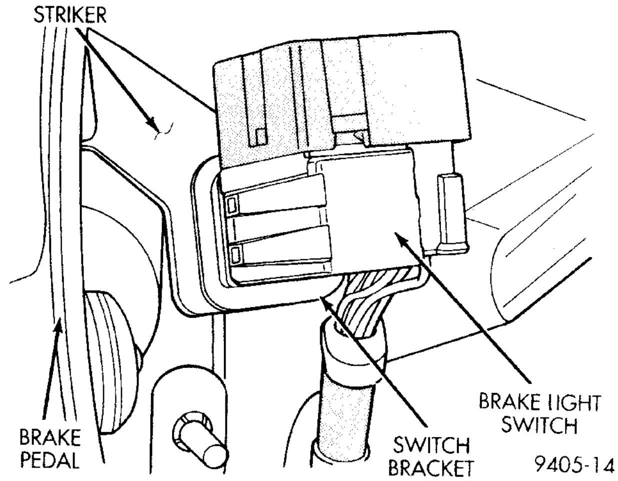


Fig. 163 Stop Lamp Switch

(1) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(2) Connect the wiring harness connector to the stop lamp switch.

(3) Mount the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then install switch in bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in bracket, rotate switch clockwise approximately 30° to lock switch into bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If to much force is used, damage to the stop lamp switch or striker (Fig. 163) can result.

(4) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger to ratchet backward to the correct position.

DISASSEMBLY AND ASSEMBLY

BRAKE FLUID RESERVOIR

NOTE: The master cylinder does not need to be removed from the power brake vacuum booster for replacement of the brake fluid reservoir.

(1) Clean master cylinder housing and brake fluid reservoir.

(2) Remove the brake fluid reservoir cap. Using a **CLEAN** syringe or equivalent type tool, empty as much brake fluid as possible from the reservoir.

NOTE: Do not pry off using a tool, damage to reservoir may result.

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Rock brake fluid reservoir from side to side while pulling up to remove the reservoir from the master cylinder housing (Fig. 164).

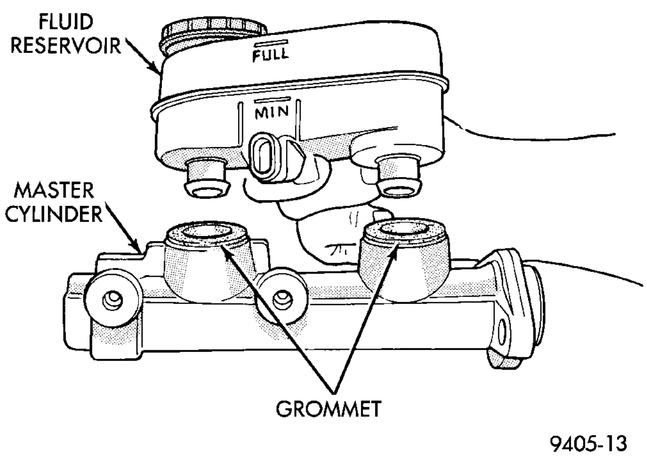


Fig. 164 Removing Fluid Reservoir From Master Cylinder

(4) Remove master cylinder housing to brake fluid reservoir grommets.

(5) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 164) in master cylinder housing.

(6) Lubricate reservoir mounting area with fresh clean brake fluid. Place reservoir in position over grommets. Seat reservoir into grommets using a rocking motion while firmly pressing down on fluid reservoir.

(7) Be sure reservoir is positioned properly.

(8) Make sure bottom of reservoir touches top of grommet.

BRAKE FLUID LEVEL SWITCH

The master cylinder or brake fluid reservoir does not have to be removed from vehicle for replacement of the brake fluid level sensor.

(1) Remove wiring harness connector from brake fluid reservoir level sensor (Fig. 165).

(2) Compress retaining tabs (Fig. 166) on end of brake fluid level switch.

(3) While compressing retaining tabs, grasp opposite end of brake fluid level switch and pull it out of master cylinder brake fluid reservoir (Fig. 167).

(4) Correctly align the replacement level switch with its mounting hole in the brake fluid reservoir. Push switch into fluid reservoir until retaining tabs are fully expanded on opposite side of fluid reservoir (Fig. 166).

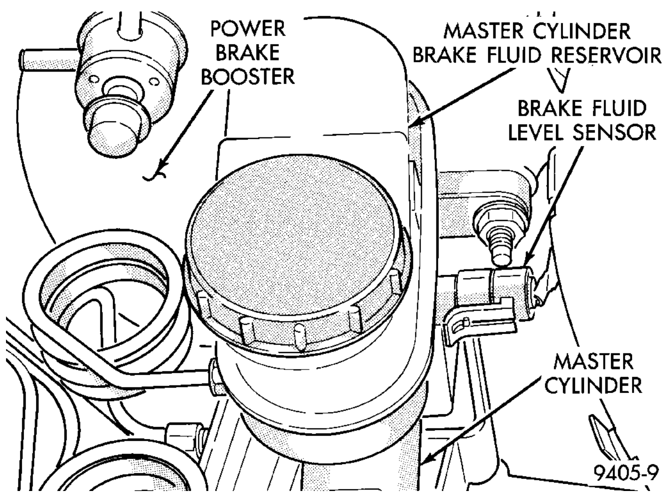


Fig. 165 Master Cylinder Fluid Level Sensor

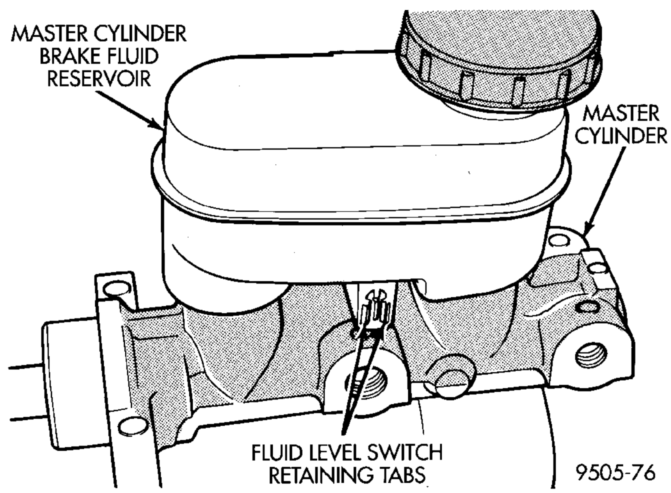


Fig. 166 Brake Fluid Level Switch Retaining Tabs

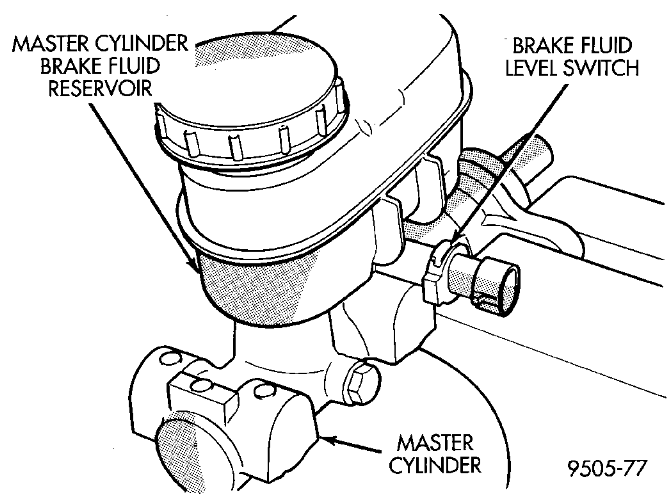


Fig. 167 Removing/Installing Fluid Reservoir Level Switch

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Install the wiring harness connector onto the brake fluid level switch.

FRONT AND REAR DISC BRAKE CALIPER

CLEANING AND INSPECTION

Check for brake fluid leaks in and around dust boot area and inboard brake pad, and for any ruptures, brittleness or damage to the piston dust boot. If the dust boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new piston seal and dust boot, and piston if scored. Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

CALIPER GUIDE PIN BUSHING SERVICE

The double pin caliper uses a sealed for life bushing and sleeve assembly. If required this assembly can be serviced using the following procedure.

REMOVING CALIPER GUIDE PIN BUSHINGS

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang caliper assembly on a wire hook away from the brake rotor.

(2) Push out and then pull the steel sleeve from the inside of the bushing using your fingers as shown in (Fig. 168).

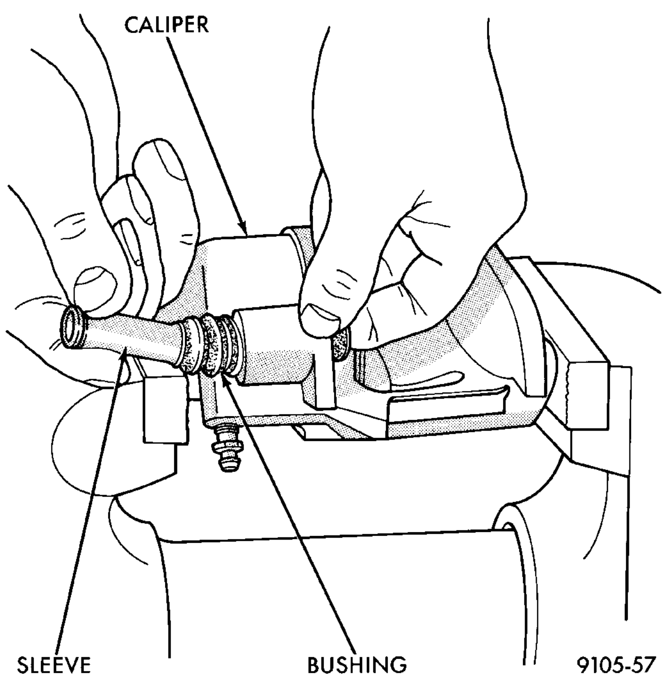


Fig. 168 Removing Inner Sleeve From Bushing

(3) Using your fingers, collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the brake caliper housing (Fig. 169).

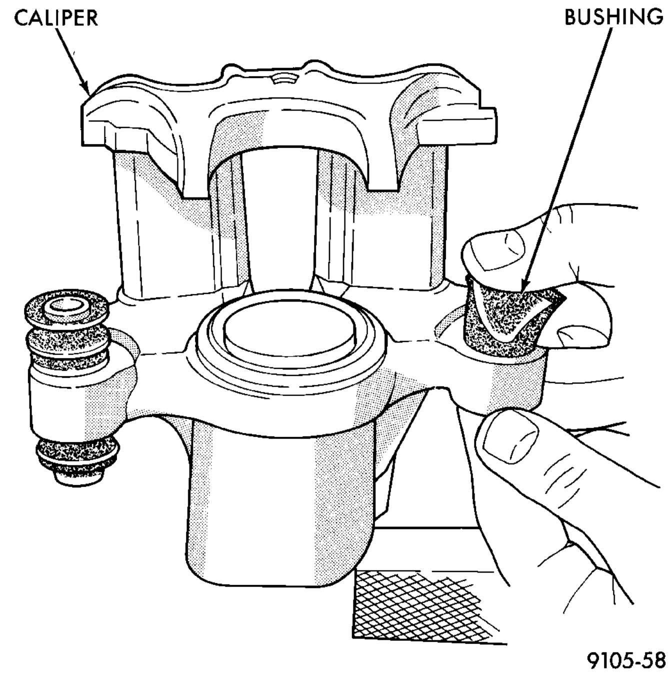


Fig. 169 Removing Bushing From Caliper

INSTALLING CALIPER GUIDE PIN BUSHINGS

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 170).

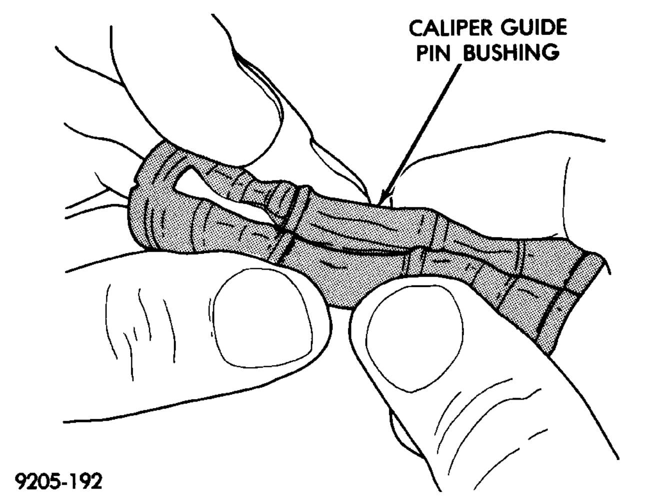


Fig. 170 Folded Caliper Guide Pin Bushing

(2) Insert the folded bushing into the caliper housing (Fig. 171). **Do not use a sharp object to perform this step due to possible damage to the bushing.**

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper housing. Flanges should be seated evenly on both sides of the bushing hole (Fig. 172).

DISASSEMBLY AND ASSEMBLY (Continued)

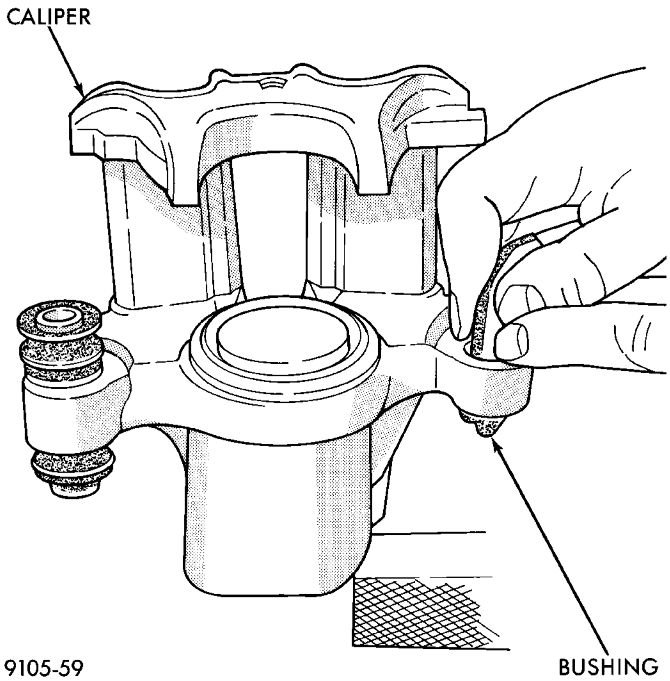


Fig. 171 Installing Caliper Guide Pin Bushing

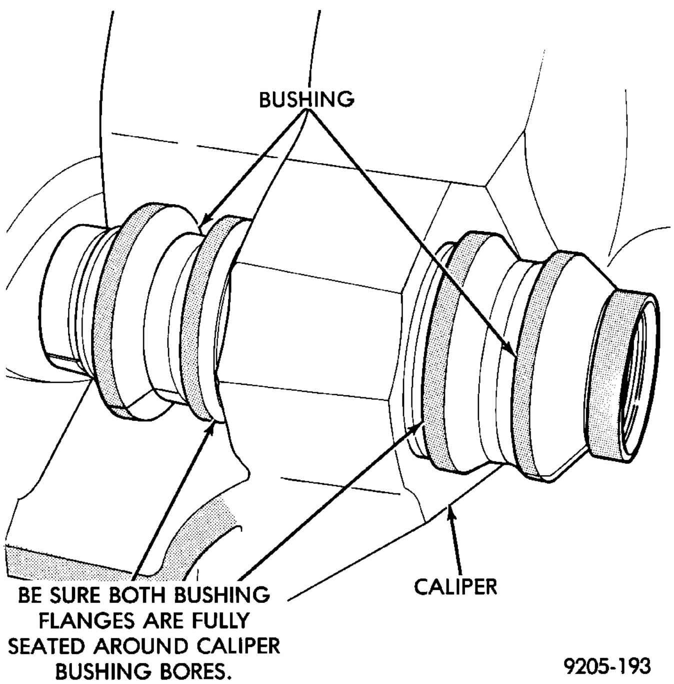


Fig. 172 Bushing Correctly Installed In Caliper

(4) Lubricate the inside surfaces of the bushing using Mopar, Silicone Dielectric Compound or an equivalent.

(5) Install guide pin sleeve into one end of bushing until seal area of bushing is past seal groove in sleeve (Fig. 173).

(6) Holding convoluted boot end of bushing with one hand, push steel sleeve bushing through boot

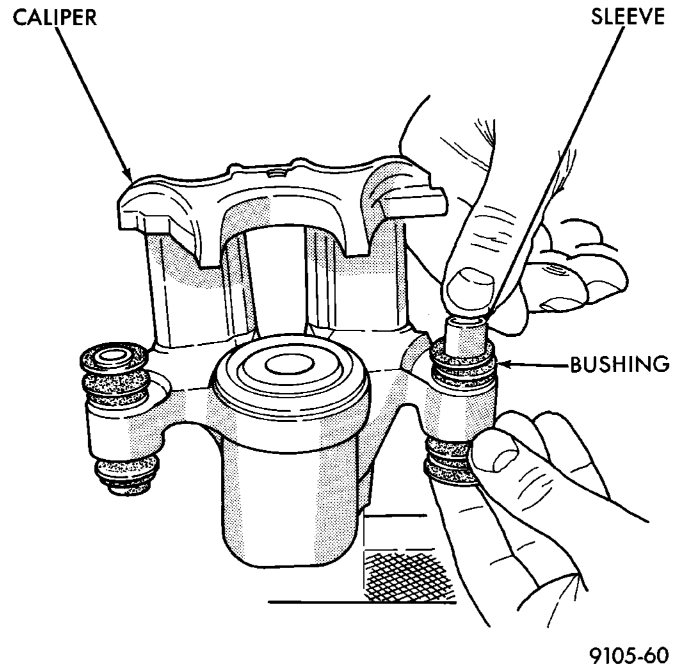


Fig. 173 Installing Sleeve In Bushing

until one end of bushing is fully seated into seal groove on one end of sleeve (Fig. 173).

(7) Holding sleeve in place, work other end of bushing over end of sleeve and into the seal grove on sleeve (Fig. 174). Be sure other end of bushing did not come out of seal grove in sleeve.

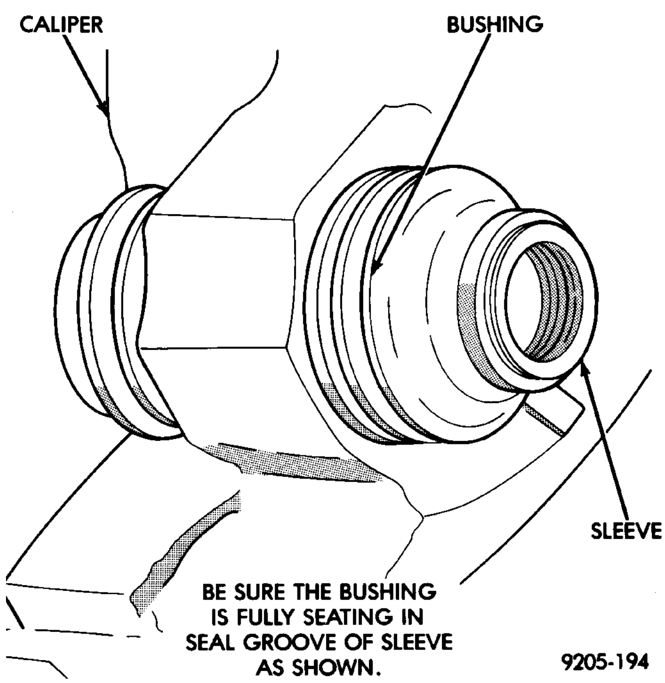


Fig. 174 Correctly Installed Caliper Sleeve And Bushing

(8) When the sleeve is seated properly into the bushing, the sealed for life sleeve/bushing can be

DISASSEMBLY AND ASSEMBLY (Continued)

held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

CALIPER DISASSEMBLY

WARNING: UNDER NO CONDITION SHOULD AIR PRESSURE EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang assembly on a wire hook away from rotor, so hydraulic fluid cannot get on rotor. Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. Then apply and hold down the brake pedal to any position beyond the first inch of pedal travel. This will prevent loss of brake fluid from the master cylinder.

(3) If both front caliper pistons are to be removed, disconnect brake tube at flexible brake hose at frame rail. Plug brake tube and remove piston from opposite caliper using the same process as above for the first piston removal.

(4) Disconnect the brake fluid flex hose from the caliper assembly.

CAUTION: Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion and binding of piston.

(5) To disassemble caliper, mount in a vise equipped with protective jaws.

(6) Remove guide pin sleeves and guide pin bushings. See Removing Guide Pin Bushings in the caliper disassembly section of this manual.

(7) Remove the piston dust boot from the caliper and discard (Fig. 175).

(8) Using a soft tool, such as a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 176). Discard old seal. **Do not use a screw driver or other metal tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.**

(9) Clean all parts using alcohol or a suitable solvent and wipe dry **using only a lint free cloth.** No lint residue can remain in caliper bore. Clean out all drilled passages and bores. **Whenever a caliper has been disassembled, a new boot and seal must be installed at assembly.**

(10) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095, or equivalent providing the diameter of the bore is not increased more than 0.0254 mm (0.001 inch) (Fig. 177).

(11) If the bore does not clean up within this specification, a new caliper housing should be installed. Install a new piston if the old one is pitted or scored.

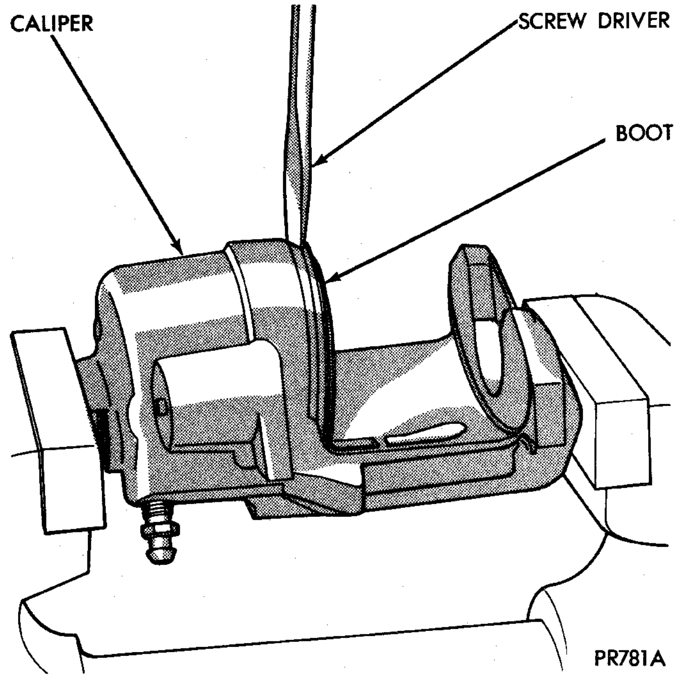


Fig. 175 Removing Caliper/Piston Dust Boot

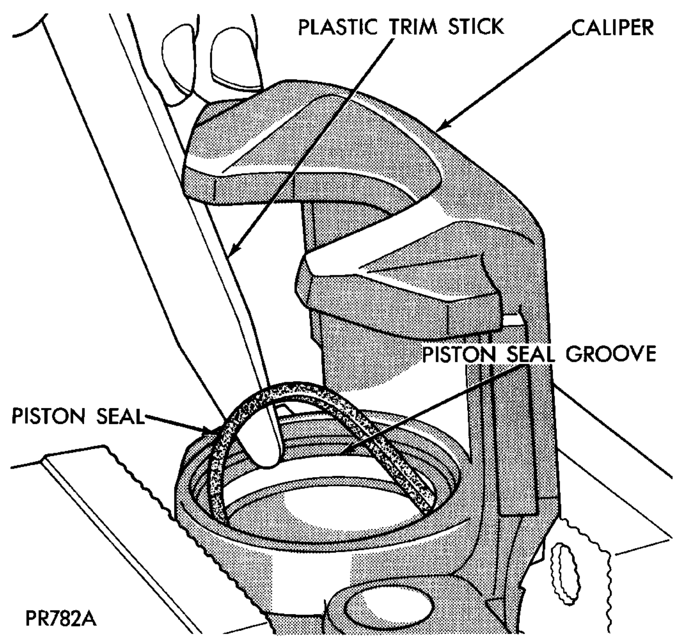


Fig. 176 Removing Piston Seal From Caliper

NOTE: When using Caliper Honing Tool, Special Tool C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush.

DISASSEMBLY AND ASSEMBLY (Continued)

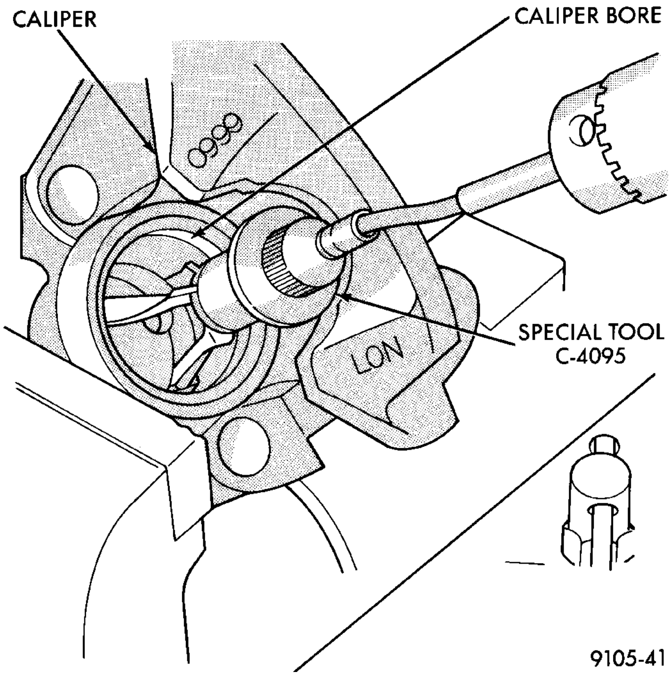


Fig. 177 Honing Brake Caliper Piston Bore

NOTE: Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lint free cloth and then clean a second time.

CAUTION: When inspecting caliper piston, do not use anything but solvents to clean piston surface. If surface of piston cannot be cleaned using only solvents, piston must be replaced.

(12) Inspect caliper piston for pitting, scratches, or any physical damage. Replace piston if there is evidence of scratches, pitting or physical damage.

CALIPER ASSEMBLY

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(1) Clamp caliper in a vise (with protective caps installed on jaws of vise).

(2) Dip new piston seal in clean brake fluid and install in the groove of the caliper bore. Seal should be positioned at one area in groove and gently worked around the groove (Fig. 178), 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. 178).

(3) Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

(4) Position dust boot over piston after coating with brake fluid.

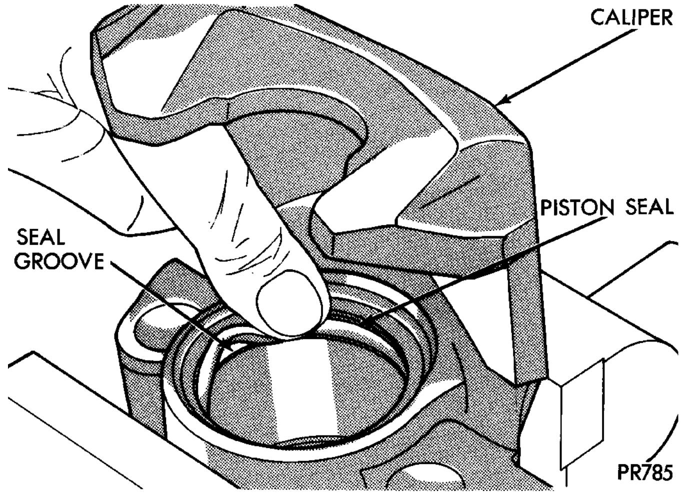


Fig. 178 Installing New Piston Seal In Caliper

CAUTION: Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

(5) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 179).

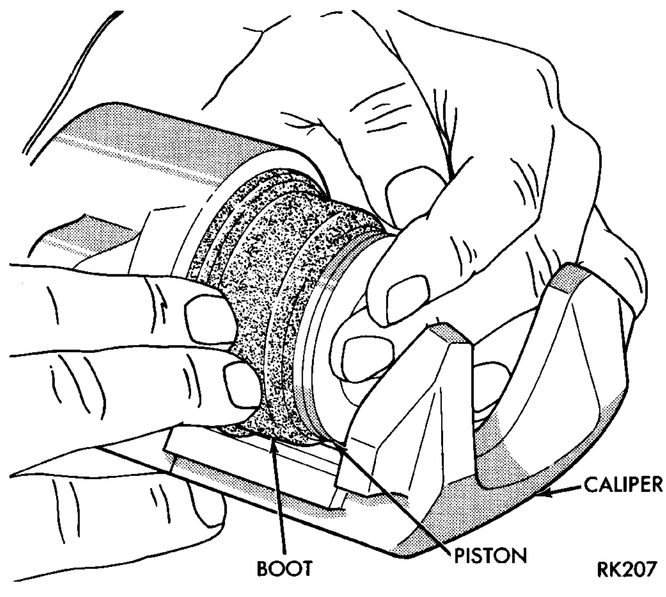


Fig. 179 Installing Piston Into Caliper Bore

(6) Position dust boot into the counterbore of the caliper assembly piston bore.

(7) Using a hammer and Installer Piston Caliper Boot, Special Tool C-4689 and Handle, Special Tool C-4171, drive boot into counterbore of the caliper (Fig. 180).

(8) Install guide pin sleeves and bushings. See Install Guide Pin Bushings section in the caliper disassembly section of this manual.

DISASSEMBLY AND ASSEMBLY (Continued)

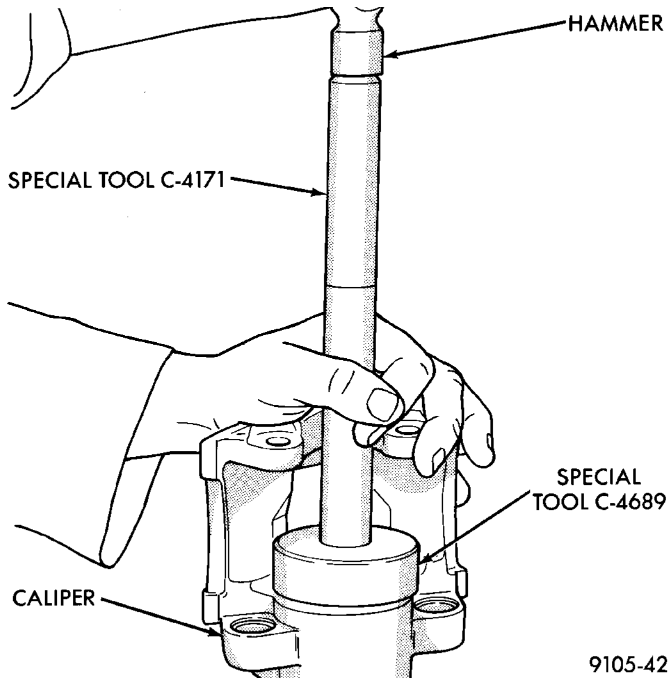


Fig. 180 Installing Dust Boot In Caliper Counterbore

(9) Install brake pads. See Installing Brake Pads in the Brake Pad Service Procedures section of this manual.

(10) Before installing caliper assembly on vehicle, inspect brake rotor. If any conditions as described in Checking Brake Rotor for Runout and Thickness are present the rotor, must be replaced or refaced. If the rotor does not require any servicing, install caliper assembly.

(11) Install brake hose onto caliper using banjo bolt. Torque the brake hose to caliper assembly banjo bolt to 33 N·m (24 ft. lbs.). **New seal washers MUST always be used when installing brake hose to caliper.**

(12) Bleed the brake system (see Bleeding Brake System).

WHEEL CYLINDER (REAR DRUM BRAKE)

DISASSEMBLE

To disassemble the wheel cylinders, proceed as follows:

(1) Pry boots away from cylinders and remove (Fig. 181).

(2) Press **IN** on one piston to force out opposite piston, cup and spring (Fig. 181). Then using a soft tool such as a dowel rod, press out the cup and piston that remain in the wheel cylinder.

(3) Wash wheel cylinder, pistons, and spring (Fig. 181) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

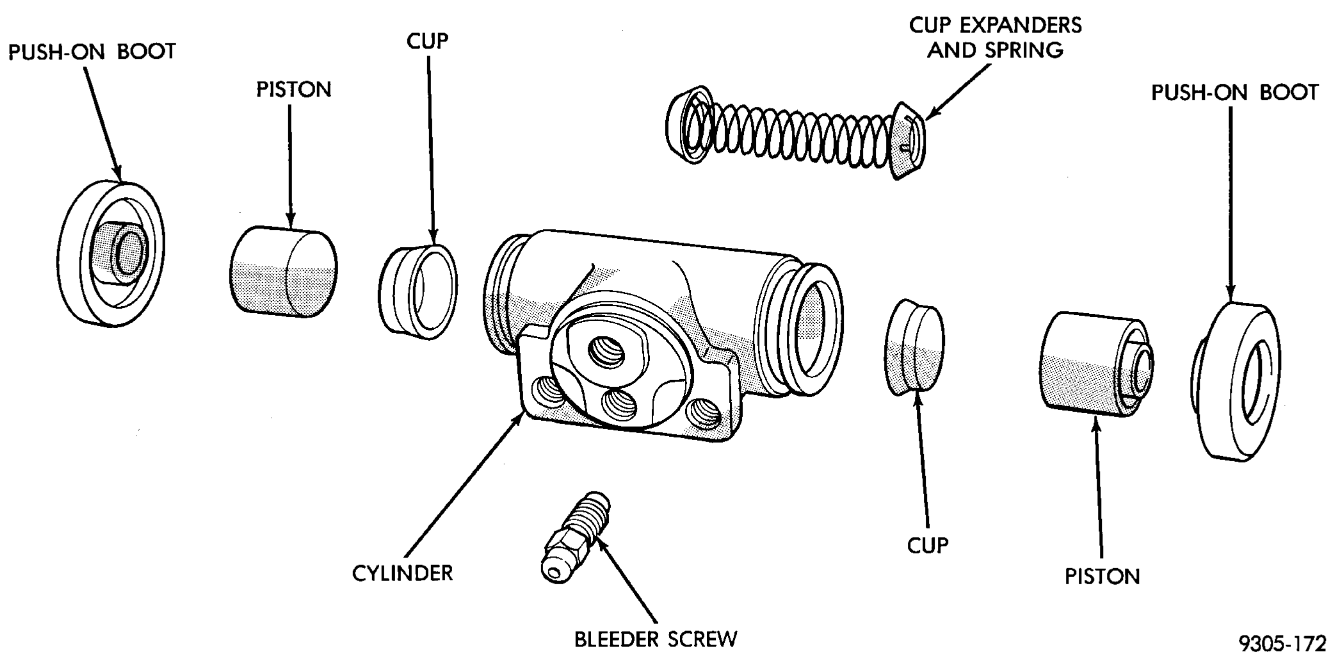


Fig. 181 Rear Wheel Cylinder (Exploded View)

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLE

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with Mopar Protect-A-Cup Lubricant.

(3) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 181).

(4) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 181).

(5) Coat the interior surfaces of the push on boots (Fig. 181) with the Mopar Protect-A-Cup Lubricant

(6) Install a boot over each end of cylinder (Fig. 181). **Be careful not to damage boot during installation.**

CLEANING AND INSPECTION

FRONT DISC BRAKES

BRAKE PAD LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the front disc brake shoes. Refer to Front Disc Brake Shoe Removal in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.95 mm (5/16 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** front wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Front Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Front Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Front Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

REAR DISC BRAKES

BRAKE PAD LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the rear disc brake shoes. Refer to Rear Disc Brake Shoe Removal in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.0 mm (9/32 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** rear wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Rear Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

CLEANING AND INSPECTION (Continued)

REAR DRUM BRAKES

Rear brake shoe lining should show contact across entire width of the lining and also from the heel to the toe of the lining, otherwise replace.

Brake shoes with lack of contact at the toe or heel of the brake shoe linng may be improperly ground.

Clean and inspect the brake support plate and adjusting screws. Apply a thin coat of Mopar Multi-Purpose Lubricant or equivalent to the threads of the self adjuster (Fig. 182). Replace adjusting screw if corroded.

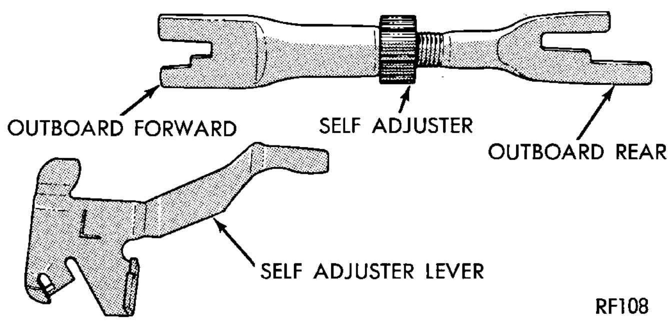


Fig. 182 Adjuster Screw And Lever (Typical)

If old brake shoe return or hold down springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

REAR DRUM BRAKE WHEEL CYLINDER

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

CHASSIS TUBES AND HOSES

Flexible rubber hose is used at both front and rear brakes. 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, worn spots or physical damage. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

The steel brake tubing should be inspected periodically for evidence of corrosion, physical damage or contact with moving or hot components of the vehicle.

REAR WHEEL HUB AND BEARING ASSEMBLY

The rear hub and bearing assembly is designed for the life of the vehicle and should require no maintenance. The following procedure may be used for evaluation of bearing condition.

With wheel and brake drum removed, rotate flanged outer ring of hub. Excessive roughness, lateral play or resistance to rotation may indicate dirt intrusion or bearing failure. If the rear wheel bearings exhibit these conditions during inspection, the hub and bearing assembly should be replaced.

Damaged bearing seals and resulting excessive grease loss may also require bearing replacement. Moderate grease loss from bearing is considered normal and should not require replacement of the hub and bearing assembly.

ADJUSTMENTS

STOP LAMP SWITCH

(1) Remove stop lamp switch from its bracket by rotating it approximately 30° in a counter-clockwise direction.

(2) Disconnect wiring harness connector from stop lamp switch.

(3) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(4) Install the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then while keeping the brake pedal depressed, install the stop lamp switch into the bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in the square hole of the bracket, rotate switch clockwise approximately 30° to lock the switch into the bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If too much force is used, damage to the vacuum booster, stop lamp switch or striker (Fig. 183) can result.

(5) Connect the wiring harness connector to the stop lamp switch.

(6) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger (Fig. 183) to ratchet backward to the correct position.

ADJUSTMENTS (Continued)

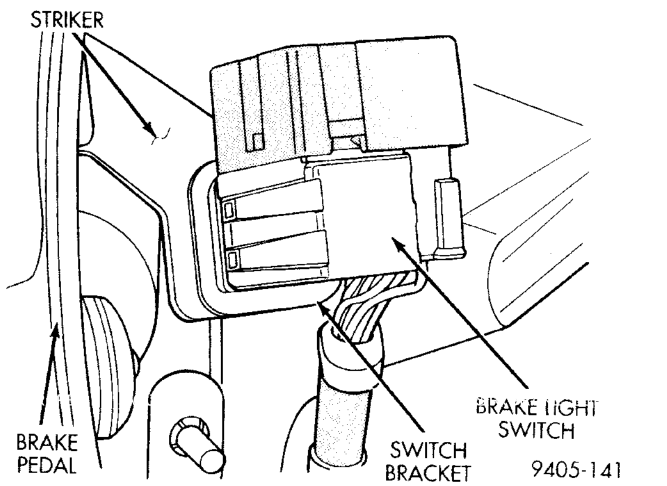


Fig. 183 Stop Light Switch Location In Vehicle

REAR DRUM BRAKE SHOE ADJUSTMENT

NOTE: Normally, self adjusting drum brakes will not require manual brake shoe adjustment. Although in the event of a brake reline it is advisable to make the initial adjustment manually to speed up the adjusting time.

(1) Raise the vehicle so 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. 184) from the rear brake shoe support plate.

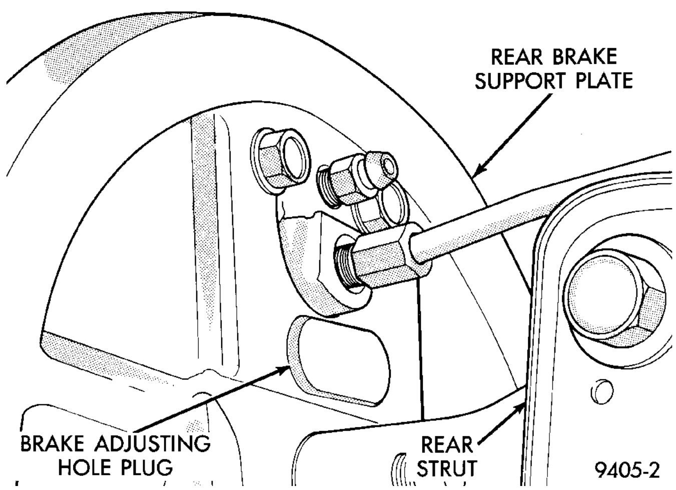


Fig. 184 Rear Brake Adjusting Hole Plug

(3) **Be sure parking brake lever is fully released.**

(4) Insert Brake Adjuster, Special Tool C-3784, (Fig. 185) or equivalent, through the adjusting hole in support plate and against star wheel of adjusting screw. Move handle of tool downward until a slight drag is felt when the road wheel is rotated.

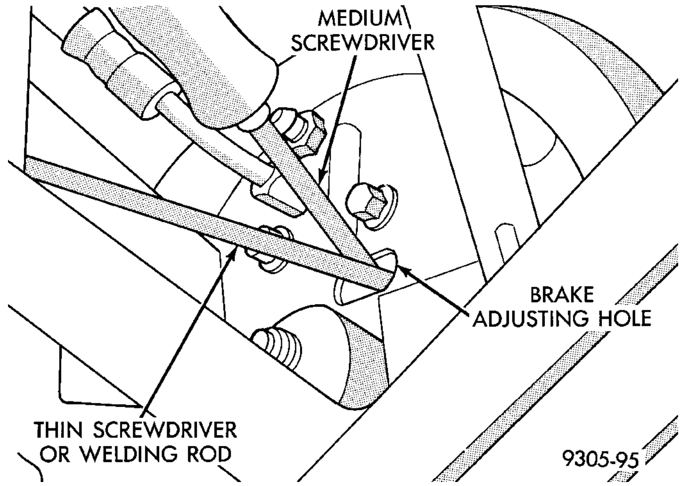


Fig. 185 Brake Drum Adjustment With Tool C-3784

(5) Insert a thin screwdriver or piece of welding rod into brake adjusting hole (Fig. 185). Push adjusting lever out of engagement with star wheel. **Care should be taken so as not to bend adjusting lever or distort lever spring.** While holding adjusting lever out of engagement 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. 184) in rear brake supports.

(7) Apply and release the park brake lever one time **after** wheel brake adjustment.

PARKING BRAKE ADJUSTMENT

VEHICLE EQUIPPED REAR DRUM BRAKES

Due to the auto adjust feature of the parking brake lever, adjustment of the parking brake system on vehicles equipped with rear drum brakes relies on proper drum brake shoe adjustment. See Rear Brake Adjustment in the Service Adjustments Section in this group of the service manual.

VEHICLE EQUIPPED REAR DISC BRAKES

Due to the auto adjust feature of the parking brake lever, adjustment of the parking brake system on vehicles equipped with rear disc brakes relies on proper drum-in-hat brake shoe adjustment. See Rear Park Brake Adjustment in the Parking Brakes Section in this group of the service manual.

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use

SPECIFICATIONS (Continued)

only Mopar brake fluid or an equivalent from a tightly sealed container.

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

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

BRAKE ACTUATION SYSTEM

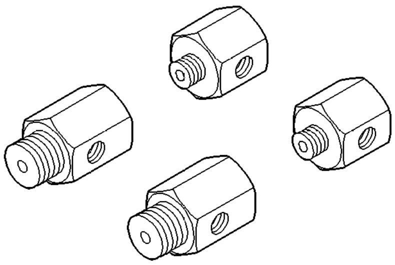
ACTUATION:
Vacuum Operated Power Brakes . . . . Standard
Hydraulic System . . . . Dual-Diagonally Split
MASTER CYLINDER ASSEMBLY:
Type . . . . Dual Tandem
Body Material . . . . Anodized Aluminum
Reservoir Material . . . . Polypropelene
MASTER CYLINDER BORE / STROKE AND SPLIT:
Non ABS . . . . 21 mm x 32.6 mm (.875 in. x 1.28 in.)
ABS . . . . 21 mm x 32.7 mm (.874 in. x 1.29 in.)
Displacement Split . . . . 50 / 50
MASTER CYLINDER FLUID OUTLET PORTS:
ABS . . . . Primary 3/8–24 Secondary 7/16–24
Non ABS . . . . Primary Inboard And Outboard 7/16–24
Non ABS . . . . Secondary Inboard And Outboard 3/8–23
Outlet Fitting Type . . . . . . SAE 45 ° Inverted Flare
ABS HYDRAULIC CONTROL UNIT:
Hydraulic Tube Fitting
Type . . . . SAE 45 ° Inverted Flare
BOOSTER:
Make/Type . . . . Bendix Vacuum W/&W/O ABS
Mounting Studs . . . . M8 x 1.25
Type . . . . 230 mm Single
Boost At 20 inches Of
Manifold Vacuum . . . . 4690 All
SCREW IN PROPORTIONING VALVE:
Material . . . . Aluminum
Function . . . . Hydraulic Pressure Proportioning
BRAKE PEDAL
Pedal Ratio 3.28

BRAKE FASTENER TORQUE SPECIFICATIONS

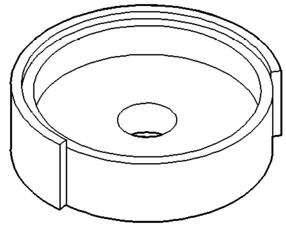
DESCRIPTION TORQUE
BRAKE TUBES:
Tube Nuts To Fittings And
Components Except HCU. . . . . 17 N·m (145 in. lbs.)
From Master Cylinder To
HCU At HCU Ports . . . . 21 N·m (185 in. lbs.)
BRAKE HOSE:
To Caliper Banjo Bolt . . . . 48 N·m (35 ft. lbs.)
Intermediate Bracket . . . . 12 N·m (105 in. lbs.)
MASTER CYLINDER:
To Vacuum Booster
Mounting Nut . . . . 28 N·m (250 in. lbs.)
BRAKE BOOSTER:
To Dash Panel
Mounting Nuts . . . . 28 N·m (250 in. lbs.)
REAR WHEEL CYLINDER:
To Support Plate
Mounting Bolts . . . . 13 N·m (115 in. lbs.)
Bleeder Screw . . . . 10 N·m (80 in. lbs.)
BRAKE SUPPORT PLATE:
To Axle Mounting Bolts . . . . 75 N·m (55 ft. lbs.)
REAR DISC BRAKE ADAPTER:
To Axle Mounting Bolts . . . . 75 N·m (55 ft. lbs.)
DISC BRAKE CALIPER:
Guide Pin Bolts . . . . 22 N·m (192 in. lbs.)
Bleeder Screw . . . . 15 N·m (125 in. lbs.)
ABS HYDRAULIC CONTROL UNIT:
To Mounting Bracket Bolts . . . 28 N·m (250 in. lbs.)
Bracket To Frame Rail
Mounting Bolt (Top) . . . . 18 N·m (160 in. lbs.)
Bracket To Frame Rail
Mounting Bolts (Side) . . . . . 22 N·m (200 in. lbs.)
PARKING BRAKE:
Lever Mounting Nuts . . . . 28 N·m (250 in. lbs.)
REAR HUB AND BEARING:
To Knuckle Retaining Nut . . . 217 N·m (160 ft. lbs.)
WHEEL:
Stud Lug Nut . . . . 109–150 N·m (80–110 ft. lbs.)

SPECIAL TOOLS

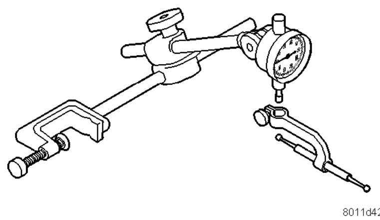
BASE BRAKE SYSTEM



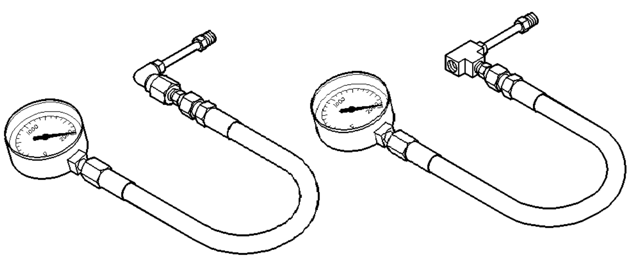
Adapters, Brake Pressure Test 6805



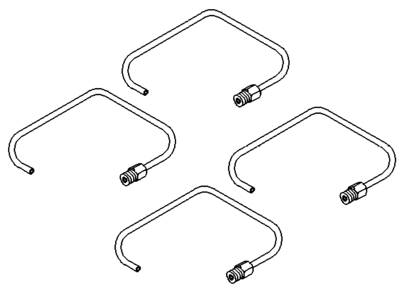
Installer, Dust Boot C-4689



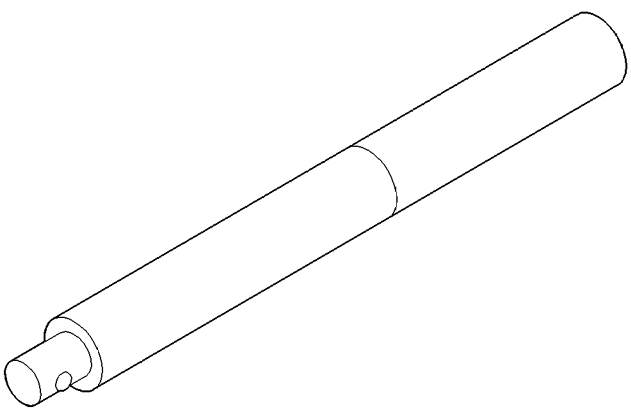
Dial Indicator C-3339



Gauge Set C-4007-A



Tubes, Master Cylinder Bleeding 6802



Handle, Universal C-4171

ANTILOCK BRAKE SYSTEM–BENDIX ABX-4

INDEX

DESCRIPTION AND OPERATION

ANTILOCK BRAKES OPERATION DESCRIPTION

The purpose of the Antilock Brake System (ABS) 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 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 and on car service for the Bendix ABX-4 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.

ABS COMPONENT ABBREVIATION LIST

In this section of the service manual several abbreviations are used for the components that are in the Bendix ABX-4 Brake System. These components are listed below for your reference.

- CAB—Controller Antilock Brake
- HCU—Hydraulic Control Unit
- ABS—Antilock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor
- FWD—Front Wheel Drive
- DTC—Diagnostic Trouble Code

DESCRIPTION AND OPERATION (Continued)

ABS OPERATION AND VEHICLE PERFORMANCE

This ABS System represents the current state-of-the-art in vehicle braking systems and offers the driver increased safety and control during braking. This is accomplished by a sophisticated system of electrical and hydraulic components. As a result, there are a few performance characteristics that may at first seem different but should be considered normal. These characteristics are discussed below.

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions the same as a standard brake system with a diagonally split master cylinder and conventional vacuum assist.

ABS SYSTEM OPERATION

If a wheel locking tendency is detected during a brake application, the brake system will enter the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal.

During an ABS stop, the brakes hydraulic system is still a diagonally split. However, the brake system pressure is further split into three control channels. During antilock operation of the vehicle brake system, the front wheels are controlled independently and are on two separate control channels. The rear wheels of the vehicle however, are controlled together through one control channel.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller Antilock Brake (CAB).

ABS operation is available at all vehicle speeds above 3 to 5 mph. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

VEHICLE HANDLING PERFORMANCE DURING ABS BRAKING

It is important to remember that an antilock brake system does not shorten a vehicle's stopping distance under all driving conditions, but does provide improved control of the vehicle while stopping. Vehicle stopping distance is still dependent on vehicle speed, weight, tires, road surfaces and other factors.

Though ABS provides the driver with some steering control during hard braking, there are conditions however, where the system does not provide any benefit. In particular, hydroplaning is still possible when the tires ride on a film of water. This results in the vehicles tires leaving the road surface rendering the vehicle virtually uncontrollable. In addition, extreme steering maneuvers at high speed or high speed cornering beyond the limits of tire adhesion to the road surface may cause vehicle skidding, independent of vehicle braking. For this reason, the ABS system is termed Antilock instead of Anti-Skid.

NOISE AND BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping and/or groaning noises heard by the driver. This is normal due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS will be turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less then 3 mph or during an ABS stop where ABS is no longer required. These conditions will exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel or sand on it. Also stopping a vehicle on a bumpy road surface may activate the ABS because of the wheel hop caused by the bumps.

TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows, 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25 to30%. This means that the wheel rolling velocity is 25 to 30% less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lock-up.

Complete wheel lock up normally leaves black tire marks on dry pavement. The ABS System will not leave dark black tire marks since the wheel never reaches a fully locked condition. Tire marks may however be noticeable as light patched marks.

ABS COMPONENTS

The following is a detailed description of the Allied Signal ABX-4 ABS brake system components. For information on servicing the base brake system components, see the Base Brake section of this Service Manual.

DESCRIPTION AND OPERATION (Continued)

MASTER CYLINDER AND POWER BRAKE BOOSTER

The Bendix ABX-4 ABS System uses a modified master cylinder and power brake booster assembly (Fig. 1). The master cylinder primary and secondary outputs go directly to the hydraulic control unit (HCU). Refer to the appropriate base brake section in this group of the service manual for further information on the individual components.

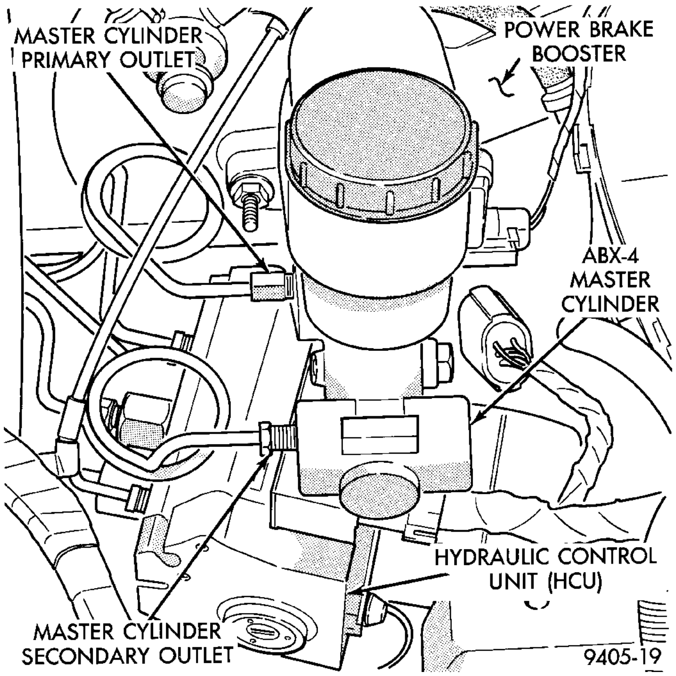


Fig. 1 ABX-4 Master Cylinder And Brake Booster Assembly

ABS HYDRAULIC CONTROL UNIT (HCU)

WARNING: THE ONLY PARTS OF THE HYDRAULIC CONTROL UNIT (HCU) THAT ARE SERVICEABLE, ARE THE RELAY BOX, THE PROPORTIONING VALVES, AND THE HCU MOUNTING BRACKET. THE REMAINING COMPONENTS OF THE HYDRAULIC CONTROL UNIT (HCU) ARE NOT SERVICEABLE ITEMS. NO ATTEMPT SHOULD EVER BE MADE TO REMOVE OR SERVICE ANY OTHER PARTS OF THE HYDRAULIC CONTROL UNIT (HCU).

The hydraulic control unit (HCU) is located under the master cylinder and power brake booster and is mounted to the left frame rail (Fig. 2). The HCU contains the following components for controlling the vehicle's braking system during ABS braking: 4 Decay Valves, 4 Shuttle Valves, 2 Fluid Sumps, a Pump/Motor and a relay box. Also attached to the hydraulic control unit are the rear brake proportioning valves and the vehicles 6 hydraulic brake tubes (Fig. 2).

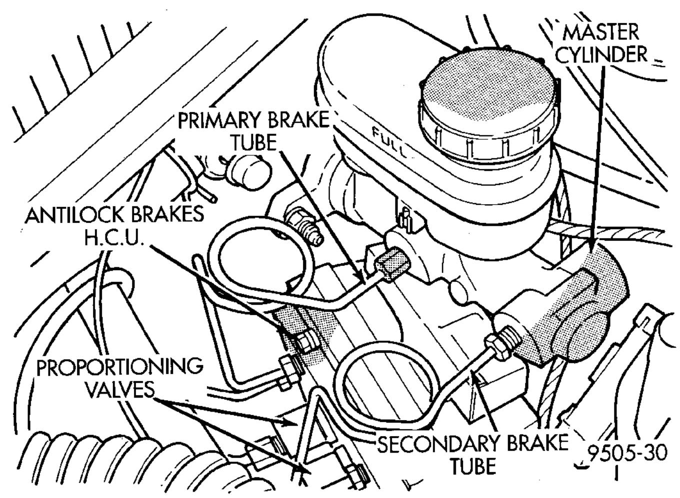


Fig. 2 Hydraulic Control Unit Location In Vehicle

HYDRAULIC CONTROL UNIT DECAY SOLENOIDS

There are 4 decay solenoids, one for each wheel. In the released position they provide a fluid path from the master cylinder to the wheel brakes of the vehicle. In the actuated (decay) position, they provide a fluid path from wheel brakes of the vehicle to the sumps. The Decay solenoids are spring loaded in the released (build) position during normal braking.

HYDRAULIC CONTROL UNIT SHUTTLE VALVES

There are 4 Shuttle Valves, one for each wheel. The Shuttle Valve is a hydraulically actuated valve which shuttles when the decay solenoid and pump are energized. This places an orifice (restriction) in the line between the pump and the decay solenoid. This restriction provides a controlled build rate to each wheel brake during an ABS stop. The Shuttle Valve will remain in the orificed position until the ABS cycle is complete. When the ABS cycle has been completed the decay solenoids will return to their released position which will equalize the pressure across the Shuttle Valves. When the pressure equalizes, the spring loaded Shuttle Orifice valves will return to the unrestricted position.

HYDRAULIC CONTROL UNIT FLUID SUMPS

There are two fluid sumps in the hydraulic control unit (HCU), one each for the primary and secondary hydraulic circuits. The fluid sumps temporarily store brake fluid that is decayed from the wheel brakes during an ABS cycle. This fluid is then delivered to the pump to provide build pressure. The typical pressure in the sumps is 50 psi, during ABS operation only.

DESCRIPTION AND OPERATION (Continued)

HYDRAULIC CONTROL UNIT PUMP MOTOR ASSEMBLY

The HCU 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 HCU. The pumps pick up fluid from the sumps to supply build pressure to the brakes during an ABS 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 HCU must be replaced.

RELAY BOX

ABX-4 utilizes two relays contained in a relay box mounted to the HCU. The relay box contains a system relay and a pump/motor relay. A single 10-way connector provides the electrical interface. The relay box is serviceable as an assembly.

PUMP/MOTOR RELAY OPERATION

Pump/Motor power is supplied by the Pump/Motor Relay. The pump motor relay is also part of the relay box (Fig. 3) mounted to the HCU. If pump/motor relay replacement is required, it is also only serviced by the replacement of the relay box assembly (Fig. 3).

Voltage for the 12 volt side of the relay coil is provided by the system relay. The ground path through the relay coil is completed by the CAB during ABS braking. The relay contacts are closed when the relay is energized. This provides 12 volts to the pump/motor as needed during ABS braking.

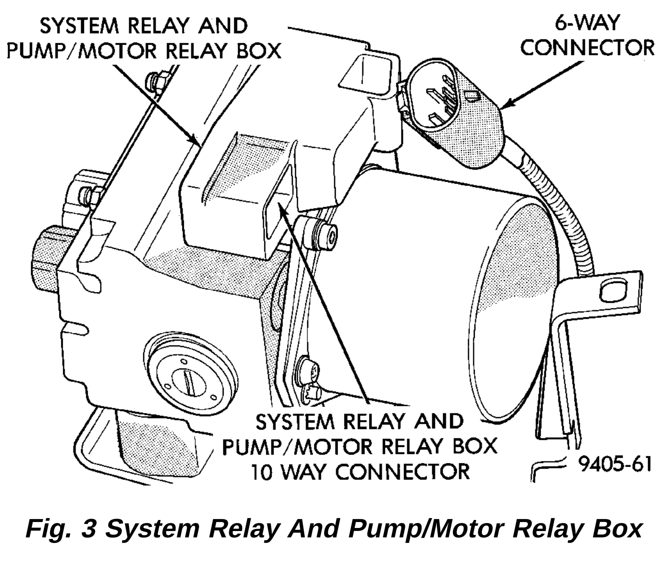


Fig. 3 System Relay And Pump/Motor Relay Box

SYSTEM RELAY OPERATION

The main purpose of the system relay is to put the ABS system into a stand-by mode for ABS operation. The system relay is energized by the CAB shortly after the ignition switch is turned on.

When energized by the CAB, the system relay turns off the ABS warning lamp and provides 12 volts to the CAB. This voltage can then be used by the CAB to energize the decay solenoids during ABS braking. When energized, the system relay also provides the pump/motor relay coil with 12 volts. The ground path to the pump/motor relay is completed by the CAB during ABS braking.

Conversely, when the system relay is de-energized, the ABS warning lamp is illuminated, voltage to the decay solenoids is cut off, and the pump/motor relay is prevented from energizing. Typically, the system relay is de-energized by the controller when a fault is detected that requires turning ABS off.

PROPORTIONING VALVES

Two Proportioning Valves 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 side of the HCU. The proportioning valve application is identified by the colored band on the proportioning valve (Fig. 4).

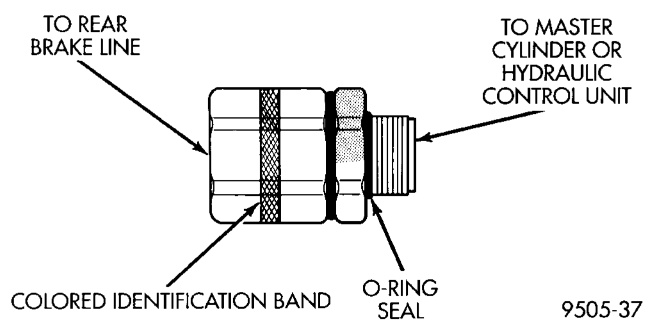


Fig. 4 Proportioning Valve Identification

DESCRIPTION AND OPERATION (Continued)

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS) is located at each wheel (Fig. 5), (Fig. 6) and (Fig. 7), and sends a small AC signal to the control module (CAB). This signal is generated by magnetic induction created when a toothed sensor ring (tone wheel) (Fig. 5) passes the stationary magnetic Wheel Speed Sensor. The (CAB) converts the AC signal generated at each wheel into a digital signal. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

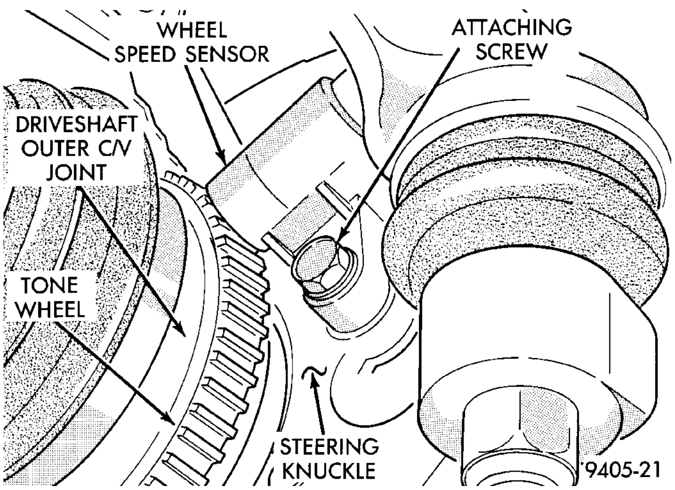


Fig. 5 Front Wheel Speed Sensor

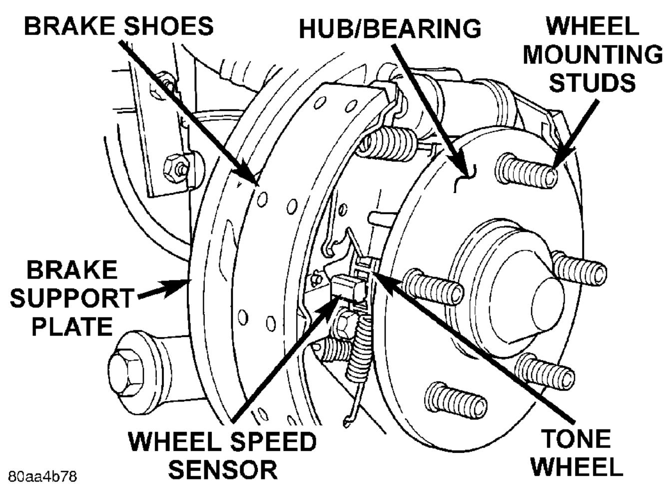


Fig. 6 Wheel Speed Sensor With Drum Brakes

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). The rear Wheel Speed Sensor on rear drum brake applications is mounted to the rear brake support plate (Fig. 6) and the rear tone wheel is an integral part of the rear wheel hub and bearing assembly. The rear Wheel Speed Sensor on rear disc brake applications is mounted to the rear disc brake adapter (Fig.

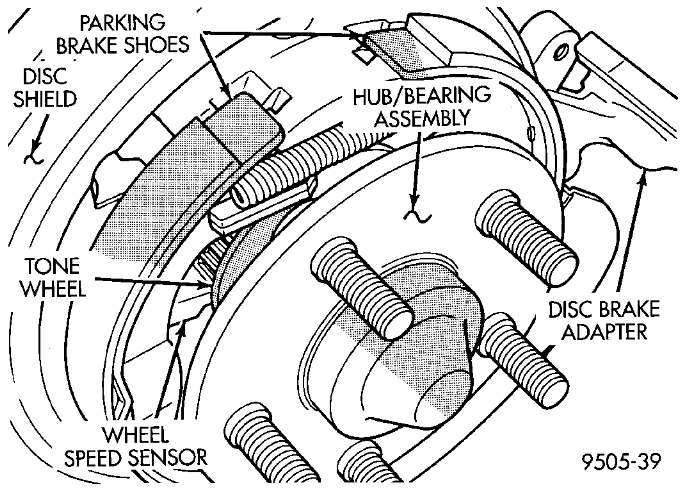


Fig. 7 Wheel Speed Sensor With Disc Brakes

7) and the rear tone wheel is also an integral part of the rear wheel hub and bearing assembly. The speed sensor air gap on both applications 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 hub and bearing assembly.

Correct ABS system operation is dependent on accurate wheel speed signals. The vehicle's wheels and tires must all be the same size and type to generate accurate signals. Variations in wheel and tire size can produce inaccurate wheel speed signals.

CONTROLLER ANTILOCK BRAKE (CAB)

The Antilock Brake Controller (CAB) is a microprocessor based device which monitors the ABS system during normal braking and controls it when in an ABS stop. The CAB is mounted under the instrument panel on the drivers side kick panel (Fig. 8). The CAB uses a 60 way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the Run or On position. **THE 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 ABS mode.

(3) Monitor the system for proper operation.

(4) Provide communication to the DRB 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 commands the HCU to modulate brake fluid pressure in some or all of the hydraulic circuits. The

DESCRIPTION AND OPERATION (Continued)

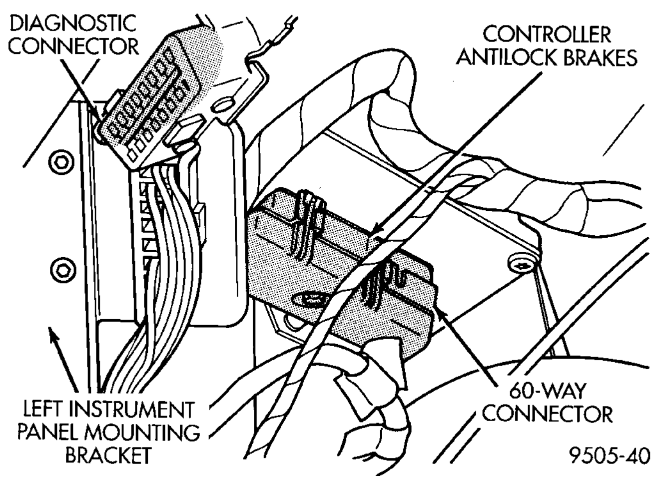


Fig. 8 Location Of Controller Antilock Brake (CAB)

CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The ABS system is constantly monitored by the CAB for proper operation. If the CAB detects a fault, it will turn on the Amber ABS Warning Lamp and disable the ABS braking system. The normal Non ABS braking system will remain operational.

The CAB contains a self-diagnostic program which will turn on the Amber ABS Warning Lamp when a ABS system fault is detected. Faults are then stored in a diagnostic program memory. There are multiple fault messages which may be stored in the CAB and displayed through the DRB. These fault messages will remain in the CAB memory even after the ignition has been turned off. The fault messages can be cleared by using the DRB diagnostics tester, or they will be automatically cleared from the memory after the vehicle is driven approximately 3500 miles.

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 Decay Solenoids
- ABS warning lamp.
- System relay actuation.
- Diagnostic communication.
- Pump motor relay actuation

ABS WARNING LAMP FUNCTION AND LOCATION

The ABS system uses an Amber ABS Warning Lamp, located in the instrument cluster. The purpose of the warning lamp is discussed in detail below.

The ABS warning lamp will turn on when the CAB detects a condition which results in a shutdown of ABS function. The ABS Warning Lamp is normally on until the CAB completes its self tests and turns the lamp off (approximately 5 seconds after the ignition switch is turned on). When the ABS warning lamp is on, only the ABS 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 ABS warning lamp is on.

ABS BRAKING MODE HYDRAULIC CIRCUIT SOLENOID AND VALVE FUNCTION

Through the following operation descriptions 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 ABS 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 VALVE FUNCTION

BUILD/DECAY VALVES OPEN

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 build/decay valves to the wheel brakes.

ABS BRAKING-DECAY MODE-DECAY SOLENOID FUNCTION

DECAY SOLENOID ENERGIZED

This will allow brake hydraulic pressure to be dumped to the HCU sump. At the HCU sump, the brake hydraulic fluid is picked up by the pump and restored to high pressure for the next build cycle.

ABS BRAKING-BUILD MODE-DECAY SOLENOID FUNCTION

DECAY SOLENOID DE-ENERGIZED

Decayed brake fluid, is picked up by the pump in the HCU and restored to high pressure. This high pressure brake fluid causes the shuttle valve in the HCU to actuate, routing high pressure brake fluid through the build orifice. Routing the high pressure brake fluid through the build orifice allows for a controlled build pressure in the brakes hydraulic system. High pressure brake fluid from the build orifice then

DESCRIPTION AND OPERATION (Continued)

passes through the de-energized decay solenoid and to the wheel brakes to restore braking pressure.

DIAGNOSIS AND TESTING

ABS GENERAL DIAGNOSTICS INFORMATION

This section contains information necessary to diagnose and test the Bendix ABX-4 Brake System. Specifically, this section should be used to help diagnose conditions which result in any of the following:

- ABS Warning Lamp turned on.
- Brakes Lock on Hard Application

Diagnosis of base brake conditions which are obviously mechanical in nature should be directed to Group 5 Brakes in this service manual. This includes brake noise, brake pulsation, lack of power assist, parking brake, Red BRAKE Warning Lamp lighting, or vehicle vibration during normal braking.

Many conditions that generate customer complaints may be normal operating conditions, but are judged to be a problem due to not being familiar with the ABS system. These conditions can be recognized without performing extensive diagnostic work, given adequate understanding of the operating principles and performance characteristics of the ABS system. See the ABS System Operation section in this group of the service manual to familiarize yourself with the operating principles of the ABS system.

DIAGNOSTICS MANUAL INFORMATION

Detailed procedures for diagnosing specific ABS conditions are covered in the Bendix ABX-4 diagnostics manual. The following information is presented to give the technician a general background on the diagnostic capabilities of the ABX-4 ABS system. Please refer to the above mentioned manual for any further electronic diagnostics and service procedures that are required on the Bendix ABX-4 Brake System.

DIAGNOSTIC TESTER (DRB)

The Allied Signal ABX-4 Antilock Brake System diagnostics are performed using the DRB scan tool. Refer to the Allied Signal ABX-4 diagnostic manual for the proper testing procedures and the DRB operators manual for its proper operational information when diagnosing this brake system.

DRB DIAGNOSTIC CONNECTOR

On this vehicle, the ABX-4 brake system (DRB) diagnostic connector is located under the steering column cover, directly below the steering column (Fig. 9). The ABX-4 system uses the ISO 9141-K connector which is shared by other vehicle diagnostic systems such as the powertrain control module and air bag.

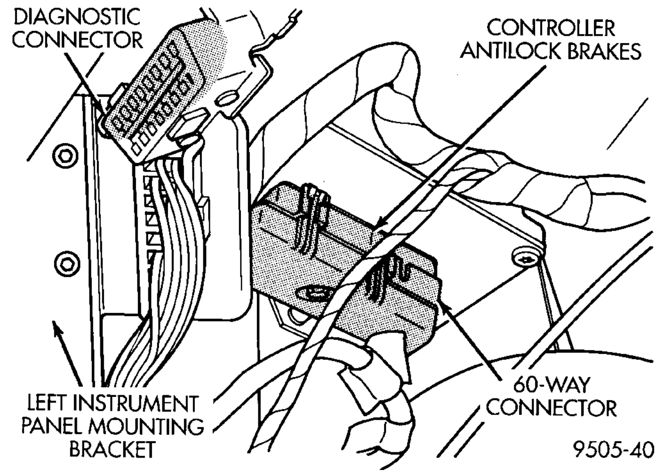


Fig. 9 ABS System Diagnostic Connector Location

SELF DIAGNOSTICS INFORMATION

The ABX-4 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. Electrical checks are completed on ABS components, such as the Controller, decay solenoid continuity, and the system relay operation. During this check the Amber ABS Warning Light is turned on for approximately 5 seconds.

DRIVE-OFF CYCLE

Further Functional testing is accomplished once the vehicle is set in motion and reaches a speed of about 7 mph. This cycle is performed only once after each ignition on/off cycle.

- The solenoid valves and the pump/motor are activated briefly to verify function. If the brake pedal is applied at this time, the test is bypassed.
- The wheel speed sensor output is verified to be within the correct operating range.

ONGOING TESTS

Other tests are performed on a continuous basis. These include checks for decay solenoid continuity, wheel speed sensor continuity and wheel speed sensor output.

DIAGNOSTIC TROUBLE CODE INFORMATION

Fault codes are kept in the controller's memory until either erased by the technician using the DRB or erased automatically after the vehicle has been driven 3500 miles. Fault codes are retained by the controller even if the ignition is turned off or the battery is disconnected. The only fault that will not be

DIAGNOSIS AND TESTING (Continued)

erased automatically 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 miles the vehicle has been driven 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 braking is disabled until the ignition switch is reset. Thus ABS braking is non operational 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 ABS Warning Light is turned off, although a fault code will be set in most cases.

INTERMITTENT DIAGNOSTIC TROUBLE CODES

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

(5) Proper ground connections. Check all ground connections for signs of corrosion, tight fasteners, or other potential defects. Refer to wiring diagram manual for ground locations.

(6) 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.

(7) Most failures of the ABS system will disable ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, which will allow ABS operation to resume during the ignition cycle in which a failure occurred if the failure conditions are no longer present. The following conditions may result in intermittent illumination of the ABS Warning Lamp. All other failures will cause the lamp to remain on until the ignition switch is turned off. Circuits involving these inputs to the (CAB) should be investigated if a complaint of intermittent warning system operation is encountered.

(8) Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

(9) Additionally, any condition which results in interruption of electrical current to the CAB or modulator assembly may cause the ABS Warning Lamp to turn on intermittently.

TONEWHEEL INSPECTION

Carefully inspect tonewheel at the suspected faulty wheel speed sensor for missing, chipped or broken teeth, this can cause erratic speed sensor signals.

Tonewheels should show no evidence of contact with the wheel speed sensors. If contact was made, determine cause and correct before replacing the wheel speed sensor.

Excessive runout of the tonewheel can cause erratic wheel speed sensor signals. Refer to Tonewheel Runout in the Specification Section in this section of the service manual for the tonewheel runout specification. Replace drive shaft assembly or rear hub/bearing assembly if tonewheel runout exceeds the specification.

Inspect tonewheels for looseness on their mounting surfaces. Tonewheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface.

Check the wheel speed sensor head alignment to the tone wheel. Also check the gap between the speed sensor head and the tone wheel to ensure it is at specification. Refer to Wheel Speed Sensor Clearance in the Specification Section in this section of the service manual.

PROPORTIONING VALVES

CAUTION: Proportioning valves (Fig. 10) should never be disassembled.

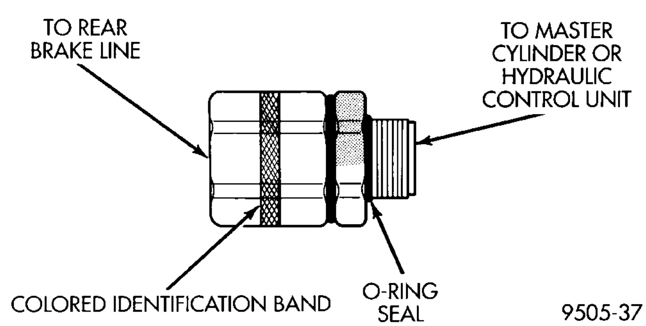


Fig. 10 Proportioning Valve

If premature rear wheel ABS cycling occurs on a hard brake application, it could be an indication that

DIAGNOSIS AND TESTING (Continued)

a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake.

If a malfunctioning proportioning valve is suspected on a vehicle equipped with the Bendix ABX-4 ABS Brake System, refer to Proportioning Valve Test With ABS Brakes in the Base Brake Diagnosis And Testing Section in this group of the service manual.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

VEHICLE TEST DRIVE INFORMATION AND PROCEDURE

Most ABS complaints will require a test drive as a part of the diagnostic procedure. The purpose of the test drive is to duplicate the condition.

NOTE: Remember conditions that result in the turning on of the Red BRAKE Warning Lamp may indicate reduced braking ability. The following procedure should be used to test drive an ABS complaint vehicle.

Before test driving a brake complaint vehicle, note whether the Red Brake Warning Lamp or Amber ABS Warning Lamp is turned on. If it is the Red Brake Warning Lamp, refer to the hydraulic system section in the brake group of this manual. If the ABS Warning lamp was/is on, test drive the vehicle as described below, to verify the complaint. While the ABS Warning Lamp is on, the ABS system is not functional. The standard brake system and the ability to stop the car is not be affected if only the ABS Warning Lamp is on.

(1) Turn the key to the off position and then back to the on position. Note whether the ABS Warning Lamp continues to stay on. If it does, refer to the ABX-4 Diagnostic Manual for the required test procedures.

(2) If the 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 ABS Warning Lamp goes on refer to the ABX-4 Diagnostic Manual.

(3) If the ABS Warning Lamp remains OUT, drive the vehicle a short distance. During this test drive be sure that the vehicle achieves at least 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 ABX-4 Diagnostics Manual for required test procedures and proper use of the DRB tester.

ABS SERVICE PRECAUTIONS

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits. **In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter or the DRB tester as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, ect.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

SERVICE PROCEDURES

BRAKE FLUID LEVEL INSPECTION

CAUTION: Use only Mopar brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

For the specific procedure covering the inspection of the brake fluid level and adding brake fluid to the reservoir, refer to the Service Adjustments Section in this group of the service manual.

BLEEDING PROCEDURE INFORMATION

The base brake system must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake tubes, hoses or components. The

SERVICE PROCEDURES (Continued)

ABS system, particularly the HCU, should only be bled when the HCU is replaced or removed from the vehicle, or if there is reason to believe the HCU has ingested air. Under most circumstances that would require brake bleeding, only the base brake system needs to be bled.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During bleeding operations, be sure that the brake fluid level remains close to the FULL level in the reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The Bendix ABX-4 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 ABS 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.

ABS BLEEDING PROCEDURE

When bleeding the ABS system, the following bleeding sequence **MUST** be followed to insure complete and adequate bleeding. The ABS system can be bled using a manual bleeding procedure or standard pressure bleeding equipment.

If the brake system is to be bled using pressure bleeding equipment, refer to Bleeding Brake System in the Service Procedure section in the Base Brake Section in this group of the service manual for proper equipment usage and procedures.

(1) Assemble and install all brake system components on vehicle making sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB Diagnostics Tester to the diagnostics connector. Located under the steering column cover, directly below the steering column (Fig. 11).

(3) Using the DRB, check to make sure the CAB does not have any fault codes stored. If it does, remove them using the DRB.

WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.

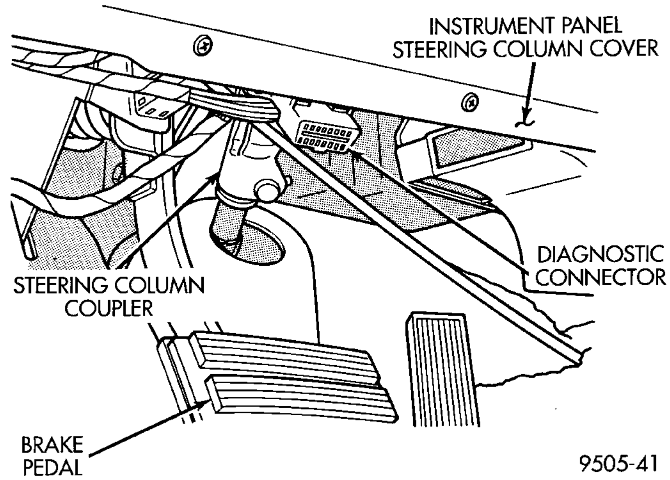


Fig. 11 ABS System Diagnostic Connector Location

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in the Service Adjustments section of this service manual.

(5) Using the DRB, go to the “Bleed ABS” routine. Apply the brake pedal firmly and initiate the “Bleed ABS” cycle one time. Release the brake pedal.

(6) Bleed the base brake system again, as in step Step 4 above.

(7) Repeat steps Step 5 and Step 6 above until brake fluid flows clear and free of bubbles. Check brake fluid level in reservoir periodically to prevent reservoir from running low on brake fluid.

(8) Test drive the vehicle to be sure brake are operating correctly and that pedal is solid.

REMOVAL AND INSTALLATION

GENERAL SERVICE CAUTIONS

CAUTION: Review this entire section prior to performing any mechanical work on a vehicle equipped with the Allied Signal ABX- 4 Antilock 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 ABS System are not intended to be serviced individually. Attempting to remove or disconnect certain system components may result in improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

The following are general cautions which should be observed when servicing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS System component damage.

If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

The CAB 60 way connector or the HCU 10 and 6 way connectors should never be connected or disconnected with the ignition switch in the ON position.

ABS HYDRAULIC CONTROL UNIT

REMOVE

(1) Disconnect negative (ground) cable from the battery and isolate cable.

(2) Disconnect vehicle wiring harness connector from brake fluid level sensor at base of master cylinder brake fluid reservoir (Fig. 12).

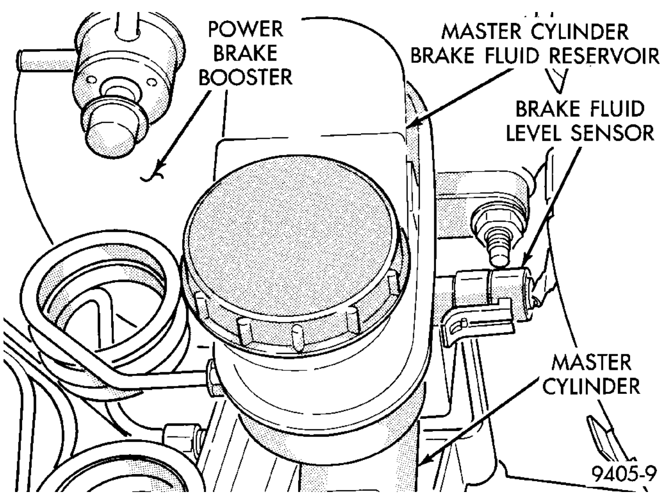


Fig. 12 Master Cylinder Brake Fluid Level Sensor

(3) Disconnect primary and secondary brake tubes from master cylinder housing (Fig. 13). Install plugs at brake tube outlets of master cylinder assembly.

(4) Clean area where master cylinder attaches to booster using a suitable brake cleaner.

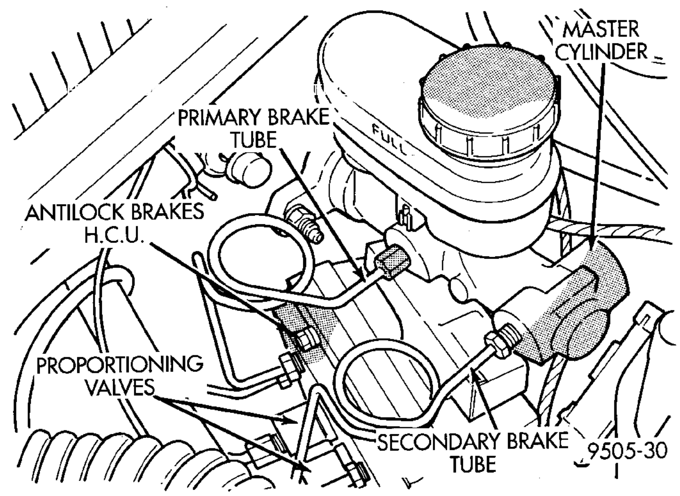


Fig. 13 Primary And Secondary Brake Tubes With ABS Brakes

CAUTION: On ABS equipped vehicles, vacuum in power booster must be pumped down before removing master cylinder to prevent the booster from sucking in any contamination. This can be done simply by pumping the brake pedal, with the engine not running, until a firm brake pedal is achieved.

(5) Remove the 2 nuts (Fig. 14) attaching master cylinder to power brake booster unit.

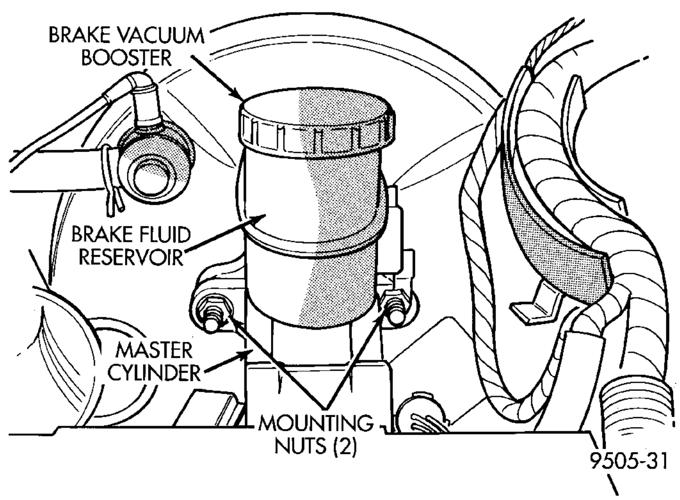


Fig. 14 Master Cylinder Mounting

(6) Slide master cylinder assembly straight out, and away from power brake booster unit.

REMOVAL AND INSTALLATION (Continued)

(7) Disconnect the 6 way connector from the HCU wiring harness and 10 way connector from the relay box located on the HCU (Fig. 15).

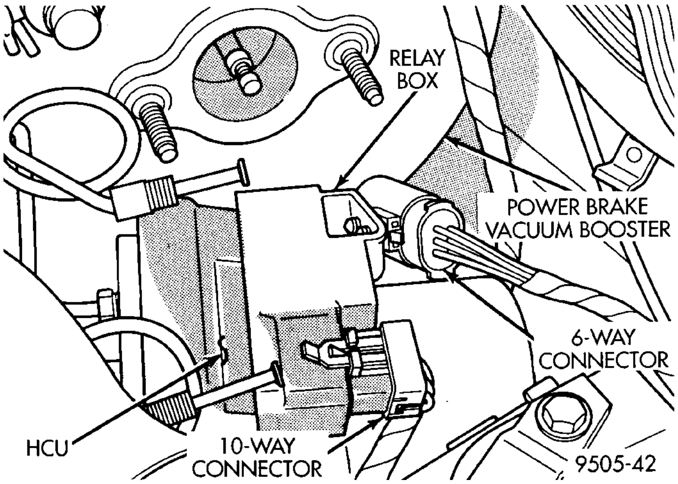


Fig. 15 Electrical Connections To HCU And Relay Box

(8) Remove the primary and secondary master cylinder brake tubes (Fig. 16) from the HCU.

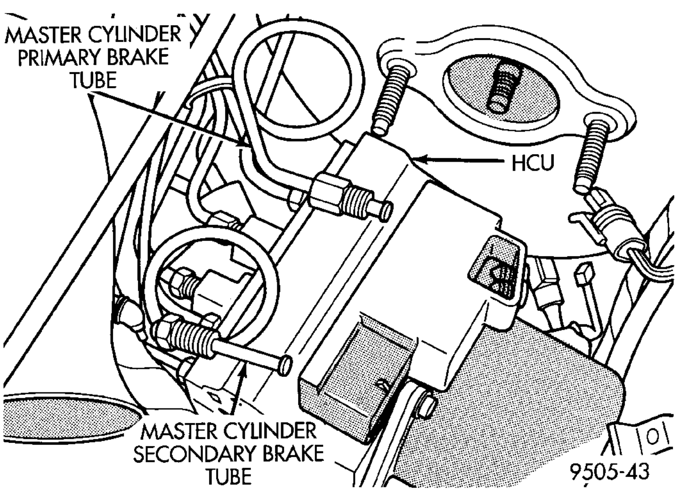


Fig. 16 Primary And Secondary Brake Tubes From Master Cylinder To HCU

(9) Remove the chassis brake tubes from the proportioning valves and outlet ports of the (HCU) (Fig. 17).

(10) Raise vehicle.

(11) Loosen and remove the 2 bolts attaching the HCU mounting bracket to the side of the front frame rail (Fig. 18).

(12) Lower vehicle.

(13) Loosen and remove the bolts attaching the HCU mounting bracket to the top of the frame rail (Fig. 18).

(14) Remove HCU and its mounting bracket as an assembly from the vehicle.

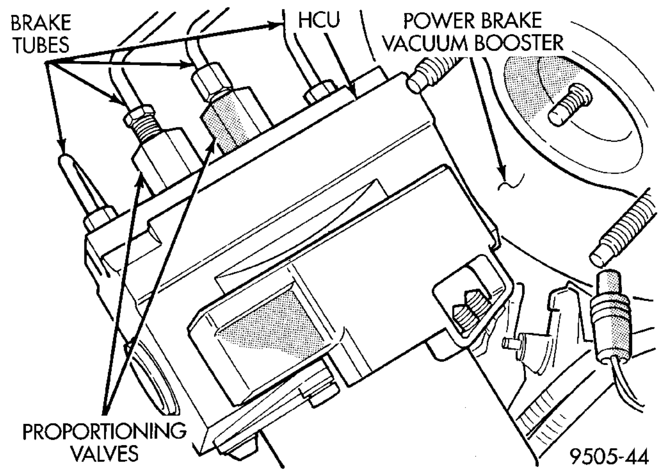


Fig. 17 Chassis Brake Tube Connections To HCU

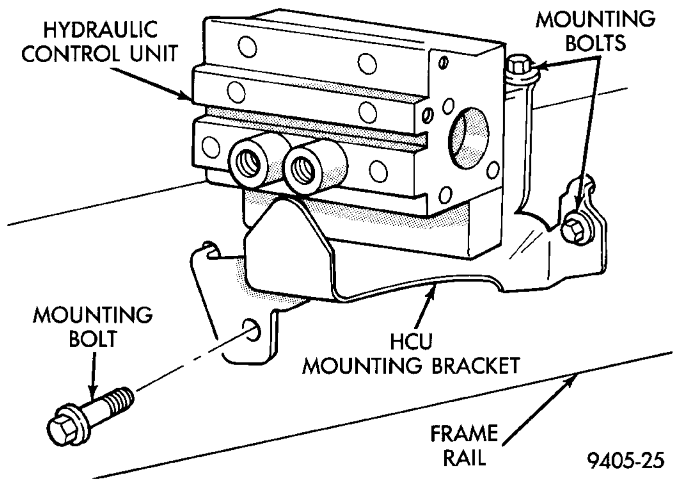


Fig. 18 Hydraulic Control Unit Mounting Bracket

INSTALL

(1) Install the HCU and mounting bracket as an assembly, on left front frame rail of the vehicle, aligning tabs on mounting bracket with holes in frame rail. (Fig. 18).

(2) Install and loosely tighten the bolt attaching the HCU mounting bracket to the top of the frame rail.

(3) Raise vehicle.

(4) Install the 2 bolts attaching the HCU mounting bracket to the side of the front frame rail (Fig. 18). Then torque both mounting bolts to 28 N·m (200 in. lbs.).

(5) Lower vehicle.

(6) Torque bolt attaching HCU mounting bracket to top of frame rail to 20 N·m (180 in. lbs.).

(7) Install the 4 chassis brake tubes (Fig. 17) onto the proportioning valves and outlet ports of the HCU. Torque the 4 chassis brake tube nuts to 17 N·m (145 in.lbs.).

REMOVAL AND INSTALLATION (Continued)

(8) Install primary and secondary brake tubes (Fig. 16) from the master cylinder onto the HCU, **with tube nuts only hand tightened.**

(9) Install vehicle wiring harness connectors onto the 10 way, and 6 way connectors, located on the relay box of the HCU (Fig. 15).

(10) Remove vacuum seal (Fig. 19) located in the front of the power brake vacuum booster. Vacuum seal is removed by **carefully** inserting a small screw driver between the push rod of the power brake vacuum booster and vacuum seal (Fig. 19) and pry seal out of power brake vacuum booster. **Do not attempt to pry seal out of master cylinder by inserting a tool between seal and power brake vacuum booster.**

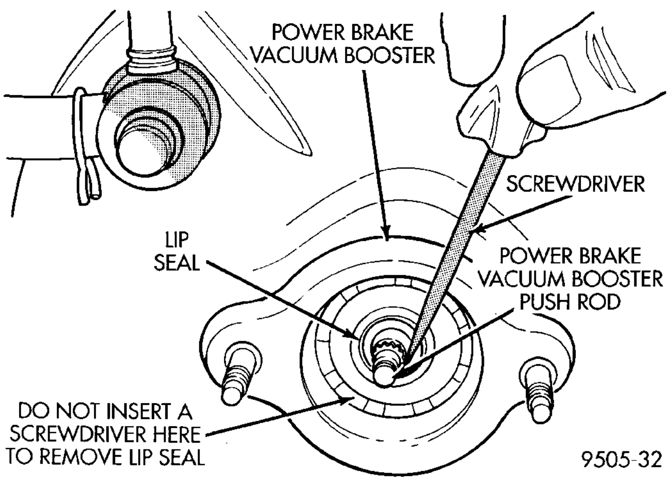


Fig. 19 Removing Vacuum Seal From Vacuum Booster

(11) Remove old vacuum seal from master cylinder, if the vacuum seal came out of power brake vacuum booster when master cylinder was removed.

CAUTION: When replacing the master cylinder on a vehicle equipped with ABS, a NEW vacuum seal MUST be installed in the power brake vacuum booster. Use only the procedure detailed below for installing vacuum seal into power brake vacuum booster. Be sure old vacuum seal is removed from power brake vacuum booster before attempting to install new seal.

CAUTION: When lubricating master cylinder push rod, use only Mopar Silicone Dielectric Compound. Using any other type of grease or lubricant on the push rod, will not provide adequate long term lubrication of the push rod.

(12) Lubricate master cylinder push rod as indicated in (Fig. 20) only using **Mopar Dielectric Grease—And No Substitutes.** Refer to the Mopar Chemicals Catalog to obtain the required lubricant.

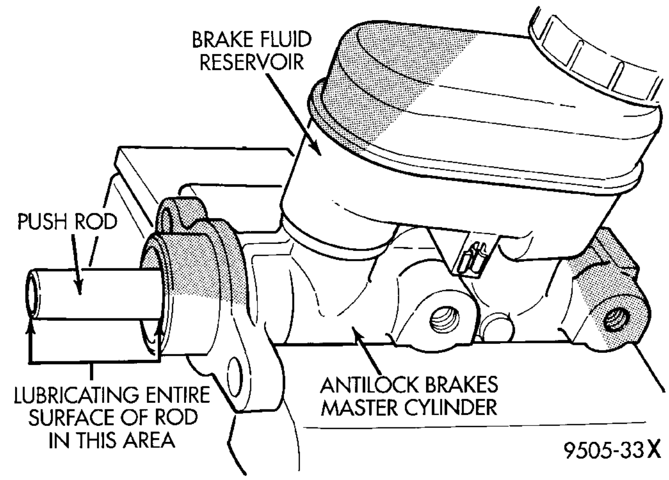


Fig. 20 Lubricating Master Cylinder Push Rod

(13) Install vacuum seal on master cylinder push rod as shown in (Fig. 21) with notches on vacuum seal pointing toward master cylinder housing. Then slide vacuum seal onto master push rod until seal is seated against master cylinder housing (Fig. 22) before installing master cylinder on power brake vacuum booster.

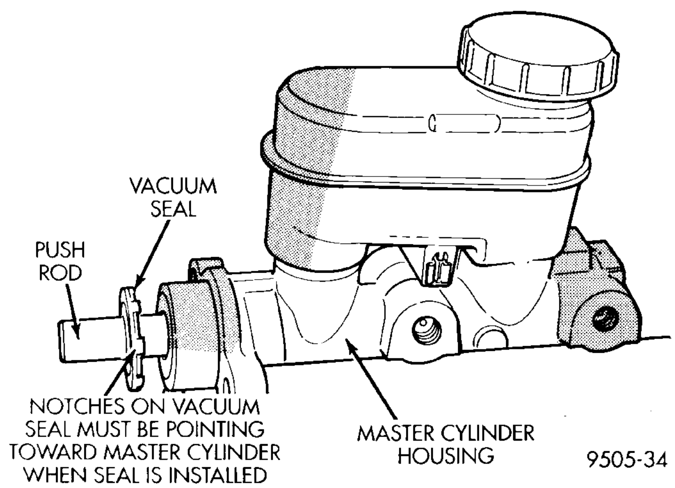


Fig. 21 Installing Vacuum Seal On Master Cylinder Push Rod

CAUTION: If vehicle is equipped with ABS, be sure old vacuum seal is removed from power brake vacuum booster before attempting to install master cylinder and NEW vacuum seal. If vacuum seal is not removed, refer to Master Cylinder Removal in this section of the service manual for required vacuum seal removal procedure.

(14) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

REMOVAL AND INSTALLATION (Continued)

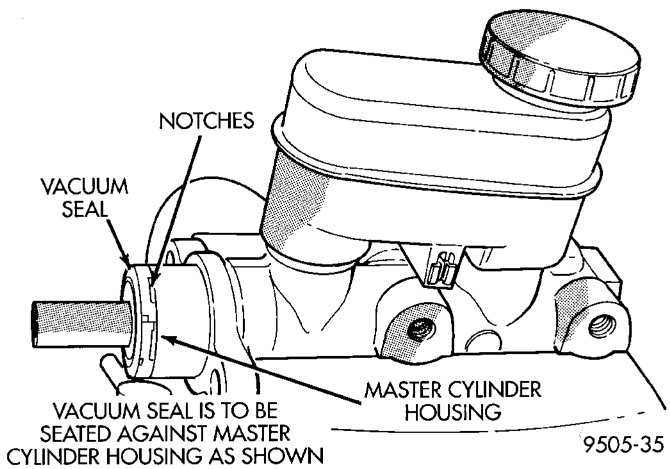


Fig. 22 Vacuum Seal Positioned For Installing Master Cylinder

(15) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 14) and torque to 28 N·m (250 in. lbs.) torque.

(16) Connect brake tubes to master cylinder primary and secondary ports (Fig. 13). Torque all tube nuts to 17 N·m (145 in. lbs.) torque.

(17) Install the wiring harness connector on the master cylinder reservoir brake fluid level switch (Fig. 12).

(18) Bleed the base brakes and the ABS brakes hydraulic systems. Refer to Bleeding Base Brake Hydraulic System in Service Procedures of the Base Brake Section and Antilock Brakes Hydraulic System Bleeding Procedure in Service Procedures of the Antilock Brake Section for the required procedures.

(19) Road test vehicle to ensure proper operation of the base and ABS brake systems.

PROPORTIONING VALVES

The HCU does not require removal from the vehicle for the replacement of the proportioning valves. Use the proportioning valve test procedure in the Diagnosis And Testing Section in this group of the service manual to determine which proportioning valve requires replacement, then replace it using procedure below.

REMOVE

(1) Disconnect the brake tube fitting from the proportioning valve requiring removal from the HCU (Fig. 23).

(2) Remove proportioning valve (Fig. 23) requiring replacement, from the HCU.

INSTALL

(1) Wet O-ring seal on new proportioning valve using clean fresh brake fluid.

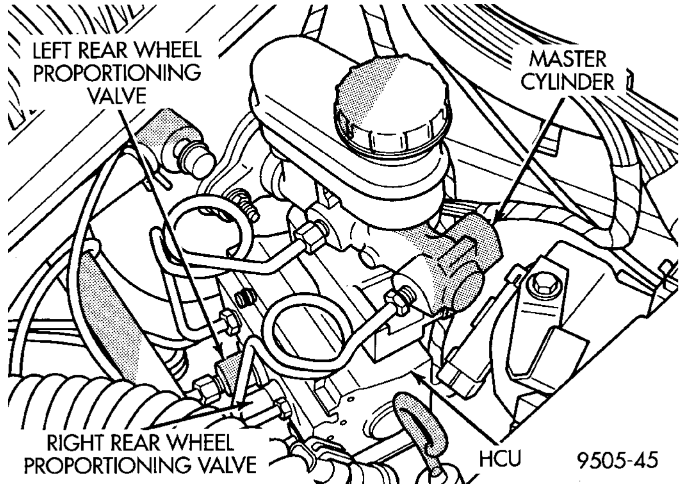


Fig. 23 Rear Wheel Proportioning Valve Location On HCU

(2) Install proportioning valve in HCU and hand tighten until proportioning is fully installed and O-ring seal is seated into HCU. Then torque proportioning valve to 40 N·m (30 ft. lbs.).

(3) Install brake tube on proportioning valve. Tighten tube nut to 17 N·m (145 in. lbs.) torque.

(4) Bleed the base brakes hydraulic system. Refer to Bleeding Base Brake Hydraulic System in Service Procedures of the Base Brake Section.

MASTER CYLINDER AND POWER BRAKE BOOSTER

If the Master Cylinder or the Power Booster need to be serviced or replaced, refer to Master Cylinder or Power Brake Booster in the Removal And Installation Section in the Base Brake Section of this service manual.

RELAY BOX

The system relay and pump/motor relay are both serviced together as an assembly with the relay box. The relay box is mounted directly to the HCU.

To remove the relay box from the HCU, the HCU requires removal from the vehicle. This is to allow visual access of the relay box to HCU electrical connection. Visual access to this connection is necessary to be sure connection is correctly made when installing relay box on the HCU.

REMOVE

(1) Disconnect negative (ground) cable from the battery and isolate the cable.

(2) Remove the HCU from the vehicle. See Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section, in this group of the service manual, for the required HCU removal procedure.

(3) Unclip the 6 way wiring harness connector (Fig. 24) from the relay box.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the 2 screws (Fig. 24) attaching the relay box assembly to the HCU. **Remove only the 2 screws mounting the relay box to the HCU do not remove the pump motor mounting screws (Fig. 24).**

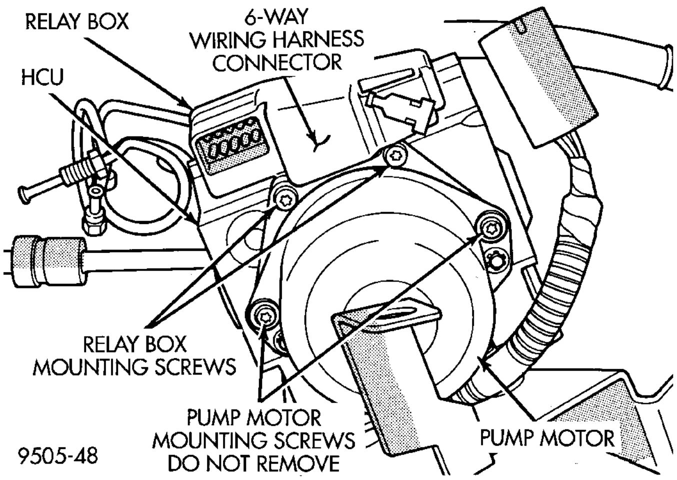


Fig. 24 Relay Box To HCU Mounting Screws

(5) Grasp relay box. Without twisting or rocking, pull relay box away from pump motor housing until connector on relay box unplugs from the pump motor terminal (Fig. 25). **This is a tight connection, relay box will require a good amount of force to unplug from pump motor.**

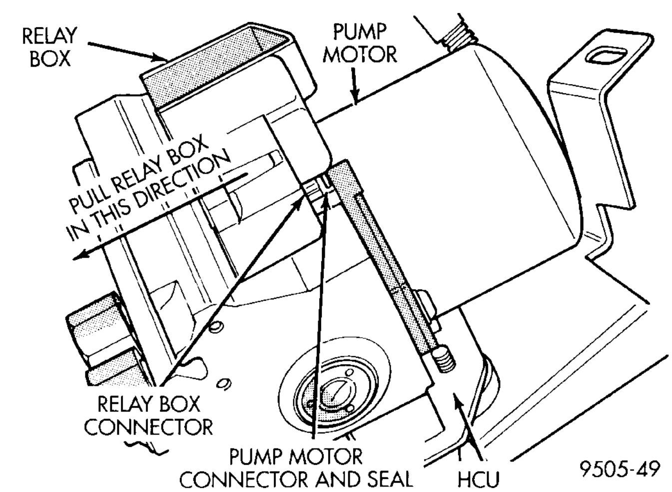


Fig. 25 Relay Box To HCU Electrical Connection

(6) Remove relay box from HCU.

INSTALL

(1) Be sure electrical connector seal (Fig. 26) is installed in pump motor housing before installing relay box. If electrical connector seal is cracked, brittle or in any way damaged it must be replaced before installing relay box.

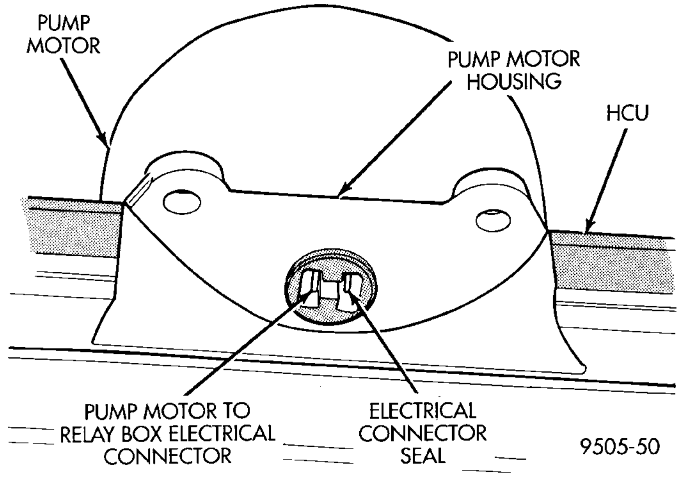


Fig. 26 Pump Motor To Relay Box Electrical Connection Seal

(2) Position relay box on HCU and carefully align the terminals on the relay box with the terminals on the pump motor.

(3) Grasp relay box with both hands. Then without twisting or rocking, push relay box onto the pump motor electrical connector as far as possible by hand.

(4) Install and securely tighten the 2 screws (Fig. 24) attaching the relay box assembly to the HCU.

(5) Reconnect the 6 way connector onto the relay box.

(6) Install the HCU back in the vehicle. See Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section, in this group of the service manual, for the required HCU installation procedure.

(7) Connect the negative (-) ground cable back on the negative post of the battery.

(8) Bleed the base brakes and the ABS brakes hydraulic systems. Refer to Bleeding Base Brake Hydraulic System in Service Procedures of the Base Brake Section and Antilock Brakes Hydraulic System Bleeding Procedure in Service Procedures of the Antilock Brake Section for the required procedures.

(9) Road test vehicle to ensure proper operation of the base and ABS systems.

REMOVAL AND INSTALLATION (Continued)

CONTROLLER ANTILOCK BRAKES (CAB)

The CAB is mounted under the instrument panel on the drivers side kick panel of the vehicle (Fig. 27).

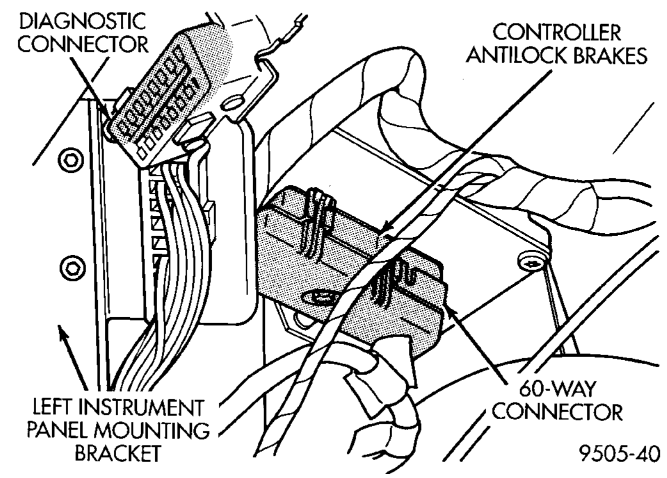


Fig. 27 Location Of Controller Antilock Brake (CAB)

REMOVE

(1) Turn vehicle ignition off.

(2) Disconnect the wiring harness 60 way connector (Fig. 28) from the Controller Antilock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

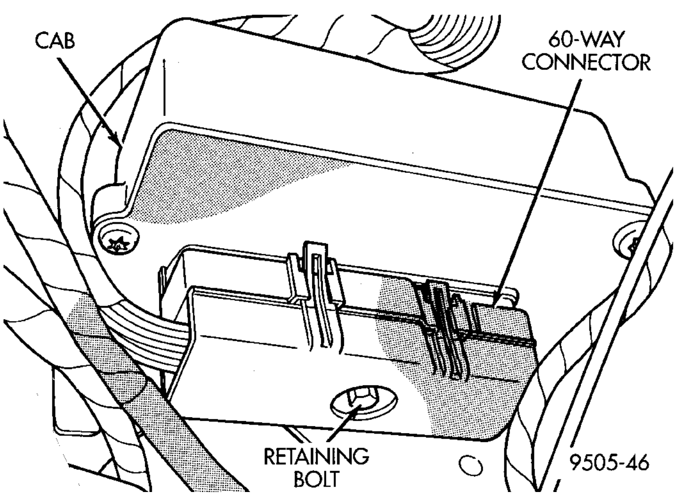


Fig. 28 CAB 60-Way Wiring Harness Connector

(3) Remove the 2 controller bracket to drivers side cowl mounting nuts (Fig. 29).

(4) Remove the CAB from the vehicle.

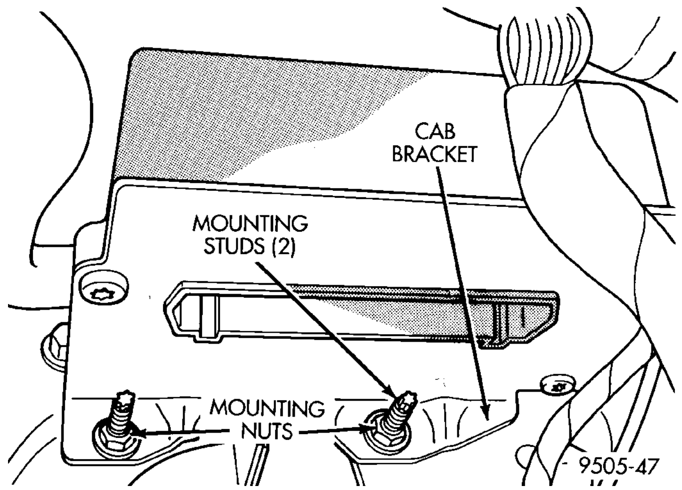


Fig. 29 CAB Bracket To Kick Panel Mounting

INSTALL

(1) Install CAB and mounting bracket on mounting studs located on passenger side kick panel (Fig. 29).

(2) Install the 2 CAB bracket mounting nuts (Fig. 29) and securely tighten.

(3) Install the 60-way wiring harness connector (Fig. 28) by hand into the 60-way CAB connector, as far as possible. Then use the CAB connector retaining bolt (Fig. 28) to fully seat wiring harness connector into the CAB.

(4) Torque the 60-way connector retaining bolt (Fig. 28) to 4 N·m (38 in. lbs.).

(5) **If a new CAB is being installed, it must be initiallized prior to the vehicle being driven. The CAB is initialized using the DRB Scan Tool and the initializing procedure described upon selecting Bendix ABX-4 Diagnostics. New controllers are programmed to flash the ABS warning lamp until initilized by the installing technician.**

FRONT WHEEL SPEED SENSOR

NOTE: 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 an open circuit.

REMOVAL AND INSTALLATION (Continued)

REMOVE

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

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

(3) Unplug speed sensor cable connector (Fig. 30) from vehicle wiring harness. Remove clip (Fig. 30) attaching speed sensor cable connector to vehicle body.

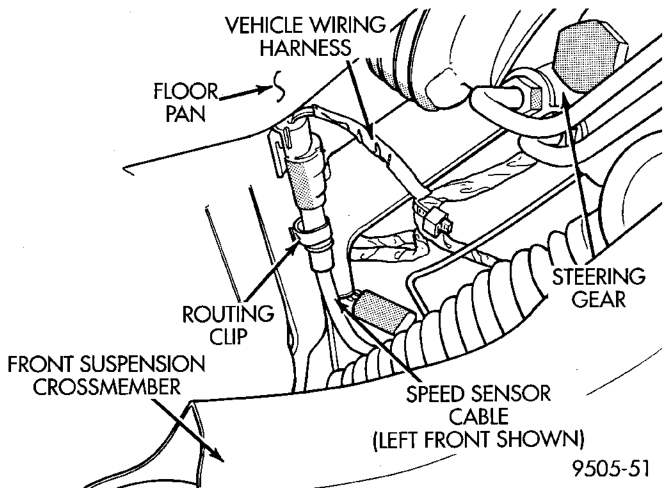


Fig. 30 Speed Sensor Cable To Wiring Harness Connection

(4) Remove wheel speed sensor head to steering knuckle attaching bolt (Fig. 31).

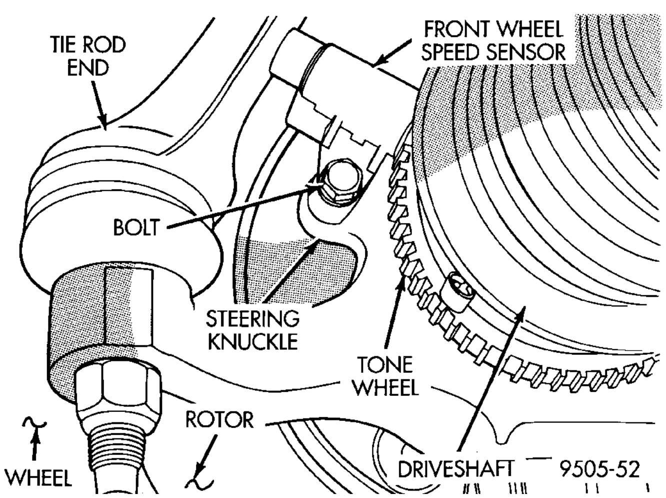


Fig. 31 Front Wheel Speed Sensor Attaching Bolt

(5) 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.

(6) Remove the speed sensor cable assembly grommets from the retaining bracket (Fig. 32). Remove speed sensor cable routing clip from the frame of the vehicle (Fig. 32).

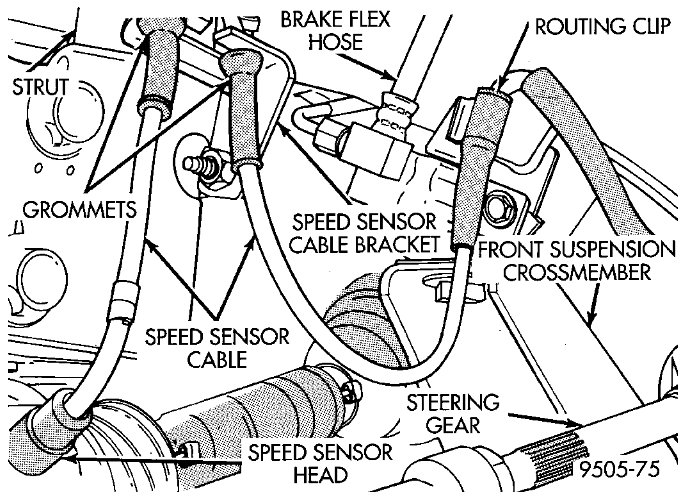


Fig. 32 Front Wheel Speed Sensor Cable Routing

INSTALL

(1) Connect the wheel speed sensor cable connector to the vehicle wiring harness (Fig. 30).

(2) Install the speed sensor cable assembly grommets into the retaining bracket (Fig. 32). Install speed sensor cable routing clip onto the frame of the vehicle (Fig. 32).

(3) Install wheel speed sensor to steering knuckle attaching screw (Fig. 31). Torque the attaching screw to 7 N·m (60 in. lbs.)

(4) Install the wheel and tire assembly on vehicle.

(5) Road test vehicle to ensure proper operation of the base and ABS systems.

REAR WHEEL SPEED SENSOR

NOTE: 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 an open circuit.

REMOVE

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

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

REMOVAL AND INSTALLATION (Continued)

(3) Unplug speed sensor cable connector from vehicle wiring harness (Fig. 33). Remove clip (Fig. 33) attaching speed sensor cable connector to vehicle body.

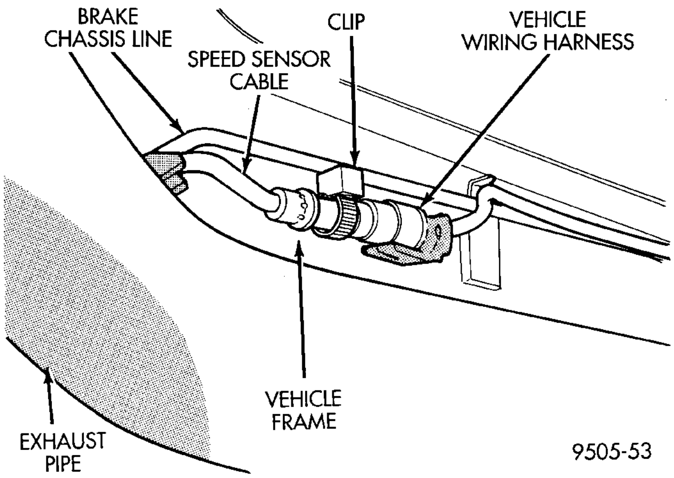


Fig. 33 Rear Speed Sensor Connection To Vehicle Wiring Harness

(4) Remove the speed sensor cable routing bracket from under rear brake flex hose mounting bracket. Then remove the speed sensor cable from the routing clips on the rear brake flex hose and chassis brake tube.

(5) Remove bolt (Fig. 34) attaching the rear wheel speed sensor to the disc brake adapter. Then remove bolt attaching speed sensor cable routing bracket to rear strut assembly (Fig. 34).

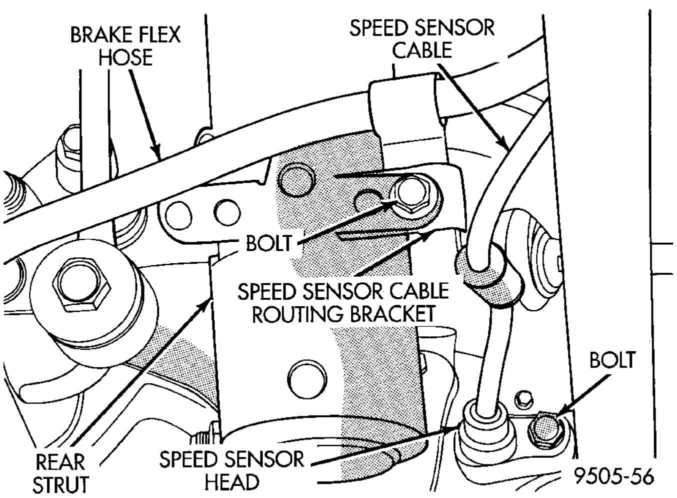


Fig. 34 Speed Sensor Head Mounting And Cable Routing

(6) Remove speed sensor head from the disc brake adapter. If the speed sensor head has seized in the adapter, DO NOT USE PLIERS ON SENSOR HEAD.

INSTALL

(1) Install wheel speed sensor head into disc brake adapter (Fig. 34).

(2) Install wheel speed sensor attaching bolt (Fig. 34). Tighten the attaching bolt to a torque of 7 N·m (60 in. lbs.)

(3) Install the brake flex hose and wheel speed sensor cable routing bracket on the rear strut bracket (Fig. 34).

(4) Install wheel speed sensor cable into the routing clips on the rear brake flex hose and chassis brake tube.

(5) Plug speed sensor cable connector into vehicle wiring harness (Fig. 33). Install clip (Fig. 33) attaching speed sensor cable connector to vehicle body.

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

(7) Road test vehicle to ensure proper operation of the base and ABS systems.

SPECIFICATIONS

SPEED SENSOR TONE WHEEL RUNOUT

The total indicator runout allowed for both the front and rear tone wheel measured using a dial indicator is 0.25 mm (.009 in.).

WHEEL SPEED SENSOR TO TONE WHEEL CLEARANCE

FRONT WHEEL

Minimum Clearance .35mm (.014 in.)
Maxamum Clearance 1.2 mm (.047 in.)

REAR WHEEL

Minimum Clearance .40mm (.016 in.)
Maxamum Clearance 1.2 mm (.047 in.)

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
BRAKE TUBES:	
Tube Nuts To Fittings And Components Except HCU. . .	17 N·m (145 in. lbs.)
From Master Cylinder To HCU At HCU Ports	21 N·m (185 in. lbs.)
BRAKE HOSE:	
To Caliper Banjo Bolt	48 N·m (35 ft. lbs.)
Intermediate Bracket	12 N·m (105 in. lbs.)
MASTER CYLINDER:	
To Vacuum Booster Mounting Nut	28 N·m (250 in. lbs.)
BRAKE BOOSTER:	
To Dash Panel Mounting Nuts	28 N·m (250 in. lbs.)

SPECIFICATIONS (Continued)

DESCRIPTION	TORQUE
REAR WHEEL CYLINDER:	
To Support Plate Mounting Bolts	13 N·m (115 in. lbs.)
Bleeder Screw	10 N·m (80 in. lbs.)
BRAKE SUPPORT PLATE:	
To Axle Mounting Bolts	75 N·m (55 ft. lbs.)
REAR DISC BRAKE ADAPTER:	
To Axle Mounting Bolts	75 N·m (55 ft. lbs.)
DISC BRAKE CALIPER:	
Guide Pin Bolts	22 N·m (192 in. lbs.)
Bleeder Screw	15 N·m (125 in. lbs.)
ABS HYDRAULIC CONTROL UNIT:	
To Mounting Bracket Bolts	28 N·m (250 in. lbs.)
Bracket To Frame Rail Mounting Bolt (Top)	18 N·m (160 in. lbs.)
Bracket To Frame Rail Mounting Bolts (Side)	22 N·m (200 in. lbs.)
PARKING BRAKE:	
Lever Mounting Nuts	28 N·m (250 in. lbs.)
REAR HUB AND BEARING:	
To Knuckle Retaining Nut	217 N·m (160 ft. lbs.)
WHEEL:	
Stud Lug Nut	109–150 N·m (80–110 ft. lbs.)

CLUTCH

CONTENTS

GENERAL INFORMATION

CLUTCH COMPONENTS

NOTE: Neon vehicles produced at the Toluca assembly plant, in Mexico, have conventional clutch and flywheel assemblies. Vehicles produced at Belvidere assembly plant have modular clutch assemblies.

Before beginning clutch service, check the 11th character of the V.I.N. to determine where it was produced. The 11th character is "D" for vehicles produced at Belvidere, or "T" for vehicles produced at Toluca.

For a vehicle produced at Belvidere assembly, refer to this manual for service information on the modular clutch assembly. For a vehicle produced at Toluca assembly, refer to the following information to determine proper service procedures.

Service parts stock only a Conventional Clutch Disc Assembly or a Modular Clutch Service Package to service Toluca built vehicles. The Modular Clutch Service Package contains the following parts:

- **One modular clutch assembly**
- **One drive plate assembly**
- **One backing plate assembly**
- **Four drive plate to clutch bolts**
- **Eight drive plate to crankshaft bolts**

If only the clutch disc requires replacement, obtain the clutch disc. Replace the clutch disc using the information in the Removal And Installation section of this manual.

If the clutch pressure plate or flywheel requires replacement, obtain the Modular Clutch Service Package. Refer to this manual for service information on the modular clutch assembly.

The clutch assembly used in this vehicle consists of a single, dry-type clutch disc and a diaphragm style clutch cover.

The clutch disc has cushion springs riveted to the disc hub assembly. The clutch disc facings are riveted to the cushion springs. The facings are made from a non-asbestos material.

The clutch cover pressure plate assembly is a diaphragm type unit with a one-piece diaphragm spring with multiple release fingers. The pressure plate release fingers are preset during manufacture and are not adjustable.

A sleeve-type release bearing is used to engage and disengage the clutch cover pressure plate. The bearing is prelubed during manufacture and is a sealed unit.

The release bearing is operated by a pivoting release fork in the clutch housing. The fork pivots on a ball stud within the housing. The release fork is actuated by a self-adjusting clutch cable.

The clutch cable has a unique self-adjuster mechanism built into the cable which compensates for clutch disc wear. The cable requires no maintenance or lubrication. There are no serviceable components on the cable assembly.

GENERAL INFORMATION (Continued)

The clutch pedal is connected to the cable through a plastic spacer. The upper end of the clutch pedal pivots in the pedal bracket on two nylon bushings and a shaft (Fig. 1). These bushings are greased at assembly and do not require periodic lubrication.

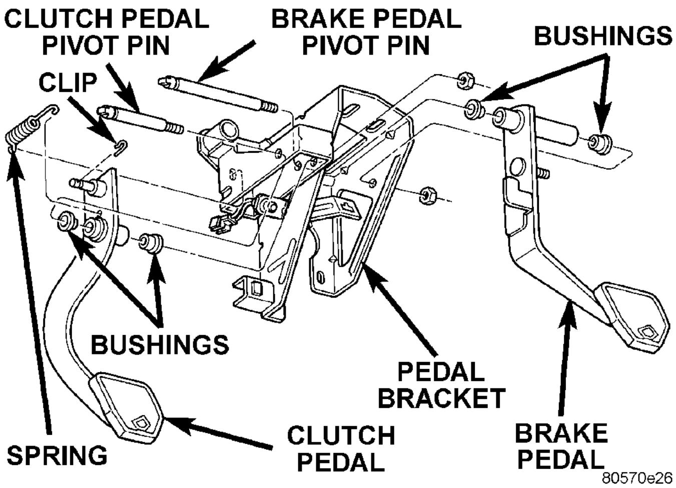


Fig. 1 Clutch Pedal Components

CLUTCH DISC AND COVER APPLICATION

The 2.0 single overhead cam engine uses a 216 mm (8.5 in.) clutch disc. The manual transaxle is available only with the 2.0 liter engine.

CLUTCH REPLACEMENT

The transaxle must be removed to service the clutch disc, pressure plate, flywheel/drive plate, and/or clutch release bearing and lever.

DESCRIPTION AND OPERATION

CLUTCH CABLE

The manual transaxle clutch release system has a unique self-adjusting mechanism to compensate for clutch disc wear (Fig. 2). This adjuster mechanism is located within the clutch cable assembly. The preload spring maintains tension on the cable. This tension keeps the clutch release bearing continuously loaded against the fingers of the clutch cover assembly.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch functions as a safety interlock device. It prevents possible engine cranking with the clutch engaged.

The clutch pedal position switch is wired in series between the starter relay coil and the ignition switch.

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

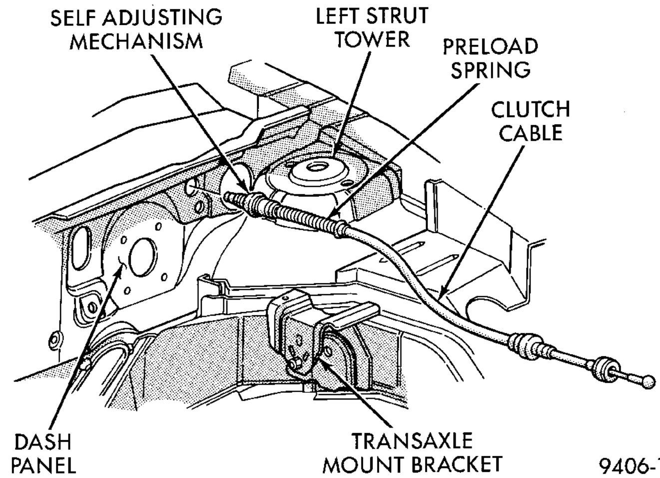


Fig. 2 Clutch Cable Routing

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 3).

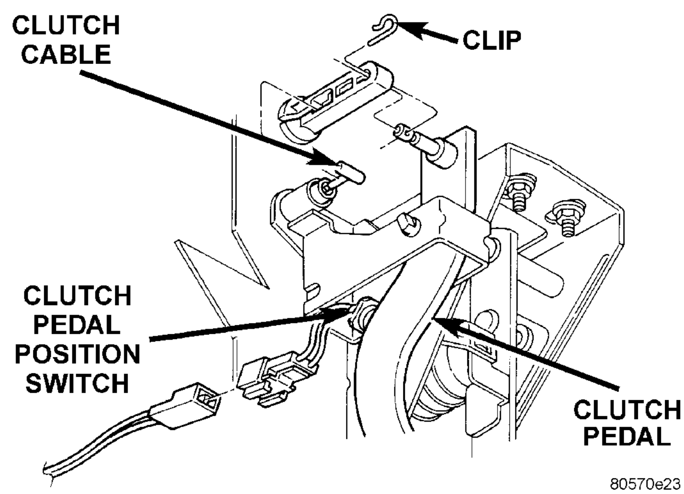


Fig. 3 Clutch Pedal Position Switch and Components

DIAGNOSIS AND TESTING

CLUTCH PEDAL POSITION SWITCH

CLUTCH PEDAL POSITION SWITCH–ELECTRICAL TEST

Disconnect clutch pedal position switch harness from instrument panel wiring harness. Using an ohmmeter, check for continuity between the two terminals in the connector on the switch harness. There should be no continuity between the terminals when the switch is in its normal (fully extended) position. When the switch is depressed more than 1.25 mm (0.050), the ohmmeter should show continuity (zero ohms).

If ohmmeter readings do not fall within these ranges, the switch is defective, and must be replaced.

DIAGNOSIS AND TESTING (Continued)

CLUTCH PEDAL POSITION SWITCH–MECHANICAL TEST

With the park brake set and the vehicle **IN NEUTRAL,** turn the key to the start position. The vehicle should not crank. If the vehicle cranks, the switch is defective (shorted out) and must be replaced. If the vehicle does not crank, proceed to the next step.

WARNING: BEFORE PERFORMING THIS STEP, BE SURE THAT THE AREA IN FRONT OF THE VEHICLE IS CLEAR OF OBSTRUCTIONS AND PEOPLE. VEHICLE MAY MOVE WHEN PERFORMING THIS TEST.

With the park brake set and the vehicle **IN GEAR,** turn the key to the start position and hold it there. Slowly depress the clutch pedal and feel for any vehicle motion when the starter is energized. If there is no motion, the switch is working properly.

If motion is felt, check to see if the switch is making contact when the pedal is between 25 mm (1.0 in.) and 6 mm (0.25 in.) from the floor. If this condition is met, then the problem is either the clutch or the self-adjusting cable (See “Clutch Will Not Disengage Properly”). If this condition is not met, then the switch mounting tab on the brake bracket is bent, and the brake bracket must be replaced.

If vehicle will not crank, even with clutch pedal pressed to the floor, refer to “Service Diagnosis-Clutch Pedal Position Switch” chart in this section.

SERVICE DIAGNOSIS–CLUTCH PEDAL POSITION SWITCH

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WON’T CRANK WHEN CLUTCH PEDAL IS PRESSED TO THE FLOOR	Switch does not have continuity when plunger is depressed 1.25 mm	Defective switch. Replace switch.
	Switch plunger is not depressed when clutch pedal is pushed to the floor	Floor mat interferes with clutch pedal movement. Move floor mat out of the way.
	Problem is related to other components in the starting circuit	Check other components in the starting circuit. Refer to Section 8A, Battery/Starting/Charging System.

DIAGNOSIS AND TESTING (Continued)

CLUTCH DIAGNOSIS

Problem diagnosis will generally require a road test to determine the type of fault. Component inspection will then determine the problem after road testing.

Drive the vehicle at normal speeds during road test. Shift the transaxle through all gear ranges and observe clutch action. If chatter, grab, slip, or improper release is experienced, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed. The transaxle or other driveline components may actually be at fault.

SERVICE DIAGNOSIS—CLUTCH GRAB/CHATTER

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC FACING COVERED WITH OIL OR GREASE	Oil leak at engine rear main or transaxle input shaft seal	Correct leak and replace w/modular clutch assembly
	Too much grease applied to splines of disc and input shaft	Apply lighter coating of grease to splines
NO FAULT FOUND WITH CLUTCH COMPONENTS	Problem actually related to suspension or driveline component	Further diagnosis required. Check engine/transmission mounts, suspension attaching parts and other driveline components as needed.
	Engine related problems	Check EFI and ignition systems
PARTIAL ENGAGEMENT OF CLUTCH DISC	Clutch cover, spring, or release fingers bent, distorted (rough handling, improper assembly)	Replace w/modular clutch assembly
	Clutch disc damaged or distorted	Replace w/modular clutch assembly
	Clutch misalignment	Check alignment and runout of flywheel, disc, or cover. Check clutch housing to engine dowels and dowel holes for damage. Correct as necessary.

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—CLUTCH SLIPS

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC FACING WORN OUT	Normal wear.	Replace w/modular clutch assembly.
	Driver frequently rides (slips) clutch, results in rapid wear overheating.	Replace w/modular clutch assembly
	Insufficient clutch cover diaphragm spring tension	Replace w/modular clutch assembly
CLUTCH DISC FACING CONTAMINATED WITH OIL OR GREASE	Leak at rear main oil seal or transaxle input shaft seal	Replace leaking seals. Replace w/modular clutch assembly.
	Excessive amount of grease applied to input shaft splines	Apply less grease to input shaft. Replace w/modular clutch assembly
	Road splash, water entering housing	Seal housing. Inspect clutch assembly.
CLUTCH IS RUNNING PARTIALLY DISENGAGED	Release bearing sticking or binding, does not return to normal running position.	Verify that bearing is actually binding. Then, replace bearing and transmission front bearing retainer if sleeve surface is damaged.
	Cable self-adjuster mechanism sticking or binding causing high preload	Verify that self-adjuster is free to move
CLUTCH DISC FACINGS HAVE FRACTURED INTO SMALL PIECES	Driver performs a 5-1 downshift at vehicle speed in excess of 60 miles per hour	Alert driver to problem cause. Replace w/modular clutch assembly.
	Leak at rear main or transaxle input shaft seal	Replace w/modular clutch assembly. Replace seal.
	Excessive heat from slippage	Replace w/modular clutch assembly

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—IMPROPER CLUTCH RELEASE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC BINDS ON INPUT SHAFT SPLINES	Clutch disc hub splines damaged during installation	Clean, smooth, and lubricate disc and shaft splines. Replace w/modular clutch assembly and/or input shaft if splines are severely damaged.
	Input shaft splines rough, damaged.	Clean input shaft splines. Then lube.
	Corrosion or rust formations on splines of input shaft and disc	Clean input shaft splines and disc splines, then lube
CLUTCH DISC RUSTED TO FLYWHEEL AND/OR PRESSURE PLATE	Occurs in vehicles stored or not driven for extended period of time. Also occurs after steam cleaning if vehicle is not used for extended period.	Replace w/modular clutch assembly
CLUTCH WILL NOT DISENGAGE PROPERLY	Disc bent, distorted during transaxle installation	Replace w/modular clutch assembly
	Clutch cover diaphragm spring damaged during transaxle installation	Replace w/modular clutch assembly
	Release fork bent, loose, or damaged	Replace fork if worn or damaged
	Clutch cable binding or routed incorrectly	Check and correct cable routing
	Self-adjuster in cable not functioning properly, resulting in excess cable slack	Pull on cable conduit at transaxle (as if disconnecting cable) to check adjuster operation

SERVICE DIAGNOSIS–CLUTCH PEDAL NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH PEDAL MAKES REPEATED “POP” NOISE IN THE FIRST INCH OF TRAVEL	Self-adjusting mechanism in cable defective	Replace clutch cable
CLUTCH PEDAL SQUEAKS WHEN DEPRESSED TO FLOOR	Pedal bushings worn out or inadequate lubrication	Replace or lubricate bushings
	Clutch pedal return spring worn out	Replace return spring

DIAGNOSIS AND TESTING (Continued)

DRIVE PLATE MISALIGNMENT

Common causes of misalignment are:

- Heat warping
- Mounting drive plate on a dirty crankshaft flange
- Incorrect bolt tightening
- Improper seating on the crankshaft shoulder
- Loose crankshaft bolts

Clean the crankshaft flange before mounting the drive plate. Dirt and grease on the flange surface may misalign the flywheel, causing excessive runout. Use new bolts when mounting drive plate to crankshaft. Tighten drive plate bolts to specified torque only. Over-tightening can distort the drive plate hub causing excessive runout.

CLUTCH COVER AND DISC RUNOUT

Check condition of the clutch cover before installation. A warped cover or diaphragm spring will cause grab and/or incomplete release or engagement. Use care when handling the clutch assembly. Impact can distort the cover, diaphragm spring, and release fingers.

CLUTCH CHATTER COMPLAINTS

For all clutch chatter complaints, do the following:

(1) Check for loose, misaligned, or broken engine and transmission mounts. If present, they should be corrected at this time. Test vehicle for chatter. If chatter is gone, there is no need to go any further. If chatter persists:

(2) Check to see if clutch cable routing is correct and operates smoothly.

(3) Check for loose connections in drive train. Correct any problems and determine if clutch chatter complaints have been satisfied. If not:

(4) Remove transaxle. See Group 21, Manual Transaxle for procedure.

(5) Check to see if the release bearing is sticky or binding. Replace bearing, if needed.

(6) Check linkage for excessive wear on the pivot stud and fork fingers. Replace all worn parts.

(7) Check clutch assembly for contamination (dirt, oil). Replace clutch assembly, if required.

(8) Check to see if the clutch disc hub splines are damaged. Replace with new clutch assembly, if necessary.

(9) Check input shaft splines for damage. Replace, if necessary.

(10) Check for uneven wear on clutch fingers.

(11) Check for broken clutch cover diaphragm spring fingers. Replace with new clutch assembly, if necessary.

CLASH–INTO–REVERSE COMPLAINTS

Certain NV T350 (A-578) manual transaxles are equipped with a reverse brake. It prevents clash when shifting into reverse, but only if the vehicle is not moving. See Group 21, Transaxle for further diagnosis.

(1) Depress clutch pedal to floor and hold. After three seconds, shift to reverse. If clash is present, clutch has excessive spin time, and the reverse brake may not be functioning.

(2) Remove transaxle. See Group 21, Manual Transaxle for procedure.

(3) Check the input shaft spline, clutch disc splines, and release bearing for dry rust. If present, clean rust off and apply a light coat of bearing grease to the input shaft splines. Apply grease on the input shaft splines only where the clutch disc slides. Verify that the clutch disc slides freely along the input shaft spline.

(4) Check to see if the clutch disc hub splines are damaged, and replace with new clutch assembly if required.

(5) Check the input shaft for damaged splines. Replace as necessary.

(6) Check for broken clutch cover diaphragm spring fingers.

(7) Install clutch assembly and transaxle.

REMOVAL AND INSTALLATION

CLUTCH CABLE

REMOVAL

(1) Pull up and remove Power Distribution Center.

(2) Remove clutch cable inspection cover.

(3) Pull back on clutch cable housing and disengage cable from housing (Fig. 4).

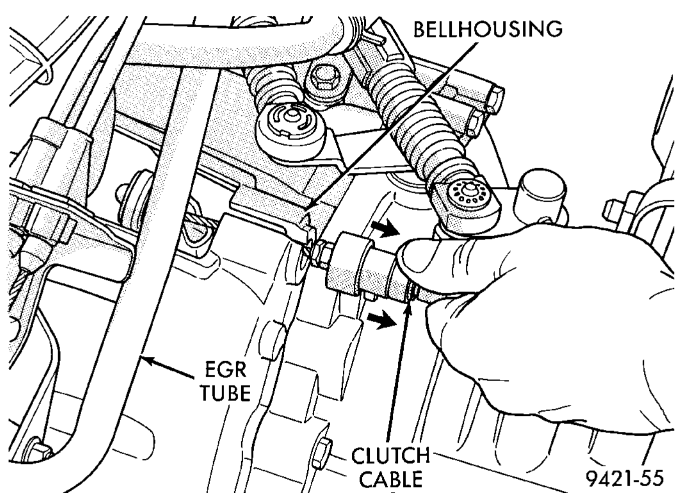


Fig. 4 Cable at Transaxle

REMOVAL AND INSTALLATION (Continued)

(4) Guide cable through slot in transaxle and disconnect cable from release lever.

(5) Disconnect clutch cable up-stop/spacer with cable strand from clutch pedal (Fig. 5).

NOTE: Depressing the clutch pedal provides access to the clutch cable strand. Disconnect the cable up-stop/spacer from the pedal pivot pin by removing the retaining clip at the top of the clutch pedal. Wedge a flat–blade pry tool between the pin and the retaining tab. While holding the tab slightly separated from the pin, pull the upstop/spacer off the pedal. Now remove the cable end from the upstop/spacer.

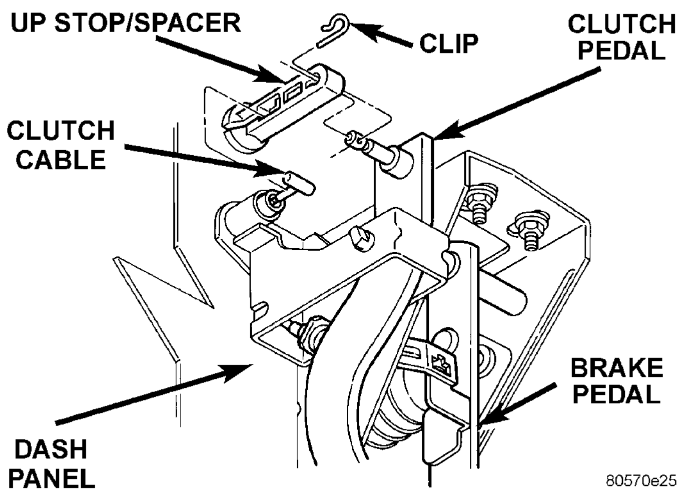


Fig. 5 Cable End Removal

CAUTION: Do not pull on the clutch cable to remove it from the dash panel. Damage to the cable self-adjuster may occur.

(6) Use a slight twisting motion while grasping the grommet and body to remove the cable from the dash panel and clutch bracket.

(7) A screwdriver may be required to dislodge the cable grommet from the dash panel. Use caution to avoid damage to the cable grommet.

INSTALLATION

(1) Using a slight twisting motion, insert the self–adjuster mechanism end of the clutch cable through the dash panel hole and into the bracket.

(2) Seat the cylindrical part of the cable grommet in the dash panel. Be sure the self–adjuster is firmly seated against the clutch bracket to ensure proper adjuster mechanism function.

(3) Connect the clutch cable to the up-stop/spacer.

(4) Connect the up-stop/spacer to the clutch pedal.

(5) Perform the Adjuster Mechanism Function Check before finishing installation.

ADJUSTER MECHANISM FUNCTION CHECK

(1) With slight pressure, pull the clutch release lever end of the cable to draw the cable taut. Push the clutch cable housing toward the dash panel (With less than 25 lbs. of effort, the cable housing should move 30-50mm.). This indicates proper adjuster mechanism function. If the cable does not adjust, determine if the mechanism is properly seated on the bracket.

(2) If the adjust mechanism functions properly, guide the cable through the slot in the transaxle housing. Connect cable to release lever, seating the cupped washer securely on lever tangs.

(3) Pull back on clutch cable housing and insert into transaxle housing (Fig. 4).

(4) Reinstall cable inspection cover and PDC. Check clutch pedal position switch operation.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 6).

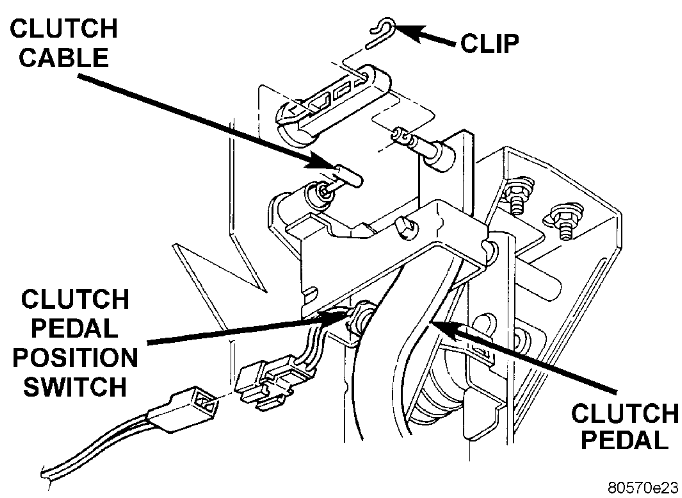


Fig. 6 Clutch Pedal Position Switch and Components

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

REMOVAL AND INSTALLATION (Continued)

switch wires to seat switch into bracket, switch damage may occur.

(3) Attach switch wiring harness to vehicle wiring harness.

(4) After installation, the switch must be checked for proper operation. Refer to Diagnosis and Testing section for proper testing procedures.

CLUTCH ASSEMBLY

Neon vehicles produced at the Toluca assembly plant, in Mexico, have conventional clutch and flywheel assemblies. Vehicles produced at Belvidere assembly plant have modular clutch assemblies.

TOLUCA BUILT VEHICLES

The transaxle must be removed to service the clutch disc, flywheel, clutch cover and/or the release bearing and lever.

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.

(3) Insert Clutch Disc Aligning Tool 6724 through the clutch disc hub to prevent the clutch disc from falling and damaging the facings (Fig. 7).

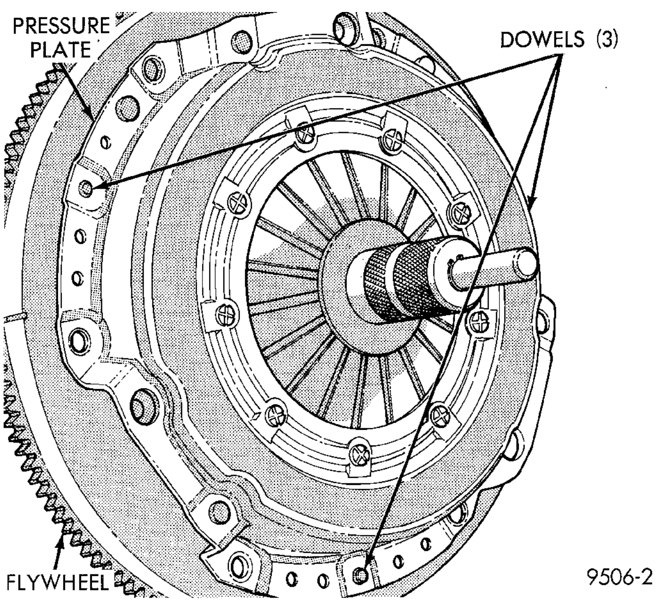


Fig. 7 Clutch Disc Aligning Tool

(4) Loosen clutch cover attaching bolts, one or two turns at a time, in a crisscross pattern. This will 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.

(2) The friction faces of the flywheel and pressure plate should not have excessive discoloration, burned areas, cracks, deep grooves, or ridges. Replace parts as required.

(3) Clean the flywheel face with medium sandpaper (80-180 grade), then wipe the surface with mineral spirits. If the surface is severely scored, heat checked, cracked 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:

• 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.

• Rotate the flywheel and crankshaft until the daub of white paint (heavy side) is at the 12 o'clock position.

• 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 .20 mm (.008 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, clean, and not 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 pressure plate for flatness. The pressure plate friction area should be FLAT TO SLIGHTLY CONCAVE, with the inner diameter 0.000 mm to 0.1 mm (0.000 in. to 0.0039 in.) below the outer diameter. It should also be free

REMOVAL AND INSTALLATION (Continued)

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 with disc centered with tool 6724, 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 orange cover balance spot as close as possible to orange flywheel balance 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 (Fig. 8).

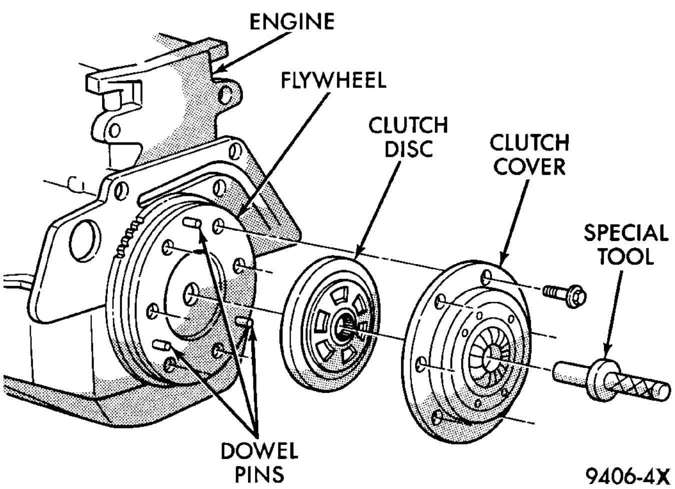


Fig. 8 Clutch Installation

(2) To avoid distortion of the clutch cover, bolts should be tightened a few turns at a time. Use a crisscross pattern, until all bolts are 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.

BELVIDERE BUILT VEHICLES

The transaxle must be removed to service the modular clutch disc assembly and lever.

REMOVAL

(1) Remove the starter wiring. Remove the starter assembly.

(2) Remove the rear transaxle support bracket.

(3) Remove the front transaxle support bracket.

(4) Remove modular clutch retaining bolts.

(5) Remove transaxle. See Group 21, Manual Transaxle, for procedure.

(6) The transaxle and modular clutch come out as an assembly.

(7) Remove the modular clutch assembly from the transaxle input shaft (Fig. 9). Handle carefully to avoid contaminating the friction surfaces.

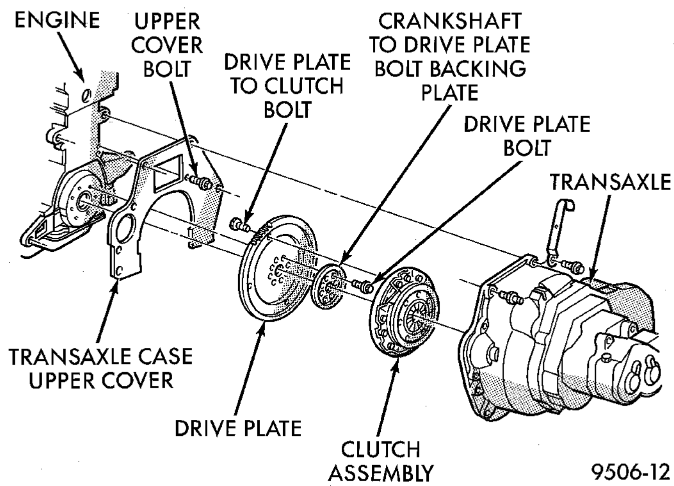


Fig. 9 Clutch Components

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.

INSTALLATION

(1) Mount modular clutch assembly onto input shaft.

(2) Install transaxle. See Group 21, Manual Transaxle, for procedure.

NOTE: Use new bolts when mounting modular clutch assembly to drive plate.

(3) To avoid distortion of the drive plate, bolts should be tightened a few turns at a time. Use a crisscross pattern, until all bolts are seated. Tighten bolts to 75 N·m (55 ft. lbs.) following a crisscross pattern sequence.

(4) Install clutch inspection cover.

(5) Install transaxle lower support brackets.

(6) Install starter assembly.

RELEASE BEARING AND FORK

Remove the transaxle from the vehicle. See Group 21, Transaxle for removal and installation procedures.

REMOVAL

(1) Move the lever and bearing assembly to a vertical in-line position. Grasp the release lever with

REMOVAL AND INSTALLATION (Continued)

two hands in the pivot stud socket area. Pull with even pressure and the lever will pop off the pivot–stud. Do not use a screwdriver or pry bar to pop off the lever. This may damage the spring clip on the lever.

(2) As a unit, remove the fork from the bearing thrust plate. Be careful not to damage retention tabs on bearing.

(3) Examine the condition of the bearing. **It is pre-lubricated and sealed and should not be immersed in oil or solvent.**

(4) 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.

(5) Check the condition of the pivot stud spring clips on back side of clutch fork. If the clips are broken or distorted, replace the clutch fork.

INSTALLATION

(1) The pivot ball pocket in the fork is Teflon coated and should be installed WITHOUT any lubricant such as grease. Using grease will break down the Teflon coating. Be sure the ball stud and fork pocket are clean of contamination and dirt.

(2) Assemble the fork to the bearing. The small pegs on the bearing must go over the fork arms.

(3) Slide the bearing and fork assembly onto the input shaft bearing retainer, as a unit.

(4) Snap the clutch fork onto the pivot ball.

(5) Reinstall transaxle assembly. Refer to Group 21, Transaxle for further information.

CLEANING AND INSPECTION

CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, grease, water, or other fluids on the clutch contact surfaces will cause faulty operation.

During inspection, note if any components are contaminated. Look for evidence of oil, grease, or water/road splash on clutch components.

OIL CONTAMINATION

Oil contamination indicates a leak at the rear main seal and/or transaxle input shaft. Oil leaks produce a residue of oil on the transaxle housing interior, clutch cover and flywheel. Heat buildup caused by slippage can bake the oil residue onto the components. This glaze-like residue ranges in color from amber to black.

GREASE CONTAMINATION

Grease contamination is usually a product of overlubrication. During clutch service, apply only a small amount of grease to the input shaft splines. Excess grease may be thrown off during operation, contaminating the disc.

ROAD SPLASH/WATER CONTAMINATION

Road splash contamination is usually caused by driving the vehicle through deep water puddles. Water can be forced into the clutch housing, causing clutch components to become contaminated. Facing of disc will absorb moisture and bond to the flywheel and/or, pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, replacement of clutch assembly may be required. Drive the vehicle until normal clutch operating temperature has been obtained. This will dry off disc assembly, pressure plate, and flywheel.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. Facing of disc will absorb moisture and will bond to flywheel and/or pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, it may require replacement of clutch assembly. After cleaning, drive the vehicle to its normal clutch operating temperature. This will dry off disc assembly, pressure plate, and flywheel.

ADJUSTMENTS

CLUTCH CABLE

The manual transaxle clutch release system has a unique self-adjusting mechanism to compensate for clutch disc wear (Fig. 10). This adjuster mechanism is located within the clutch cable assembly. The preload spring maintains tension on the cable. This tension keeps the clutch release bearing continuously loaded against the fingers of the clutch cover assembly.

ADJUSTER MECHANISM FUNCTION CHECK

(1) With slight pressure, pull the clutch release lever end of the cable to draw the cable taut. Push the clutch cable housing toward the dash panel. With less than 25 lbs. of effort the cable housing should move 30-50mm. This indicates proper adjuster mechanism function. If the cable does not adjust, determine if the mechanism is properly seated on the bracket.

(2) If the adjust mechanism functions properly, guide the cable through the slot in the transaxle

ADJUSTMENTS (Continued)

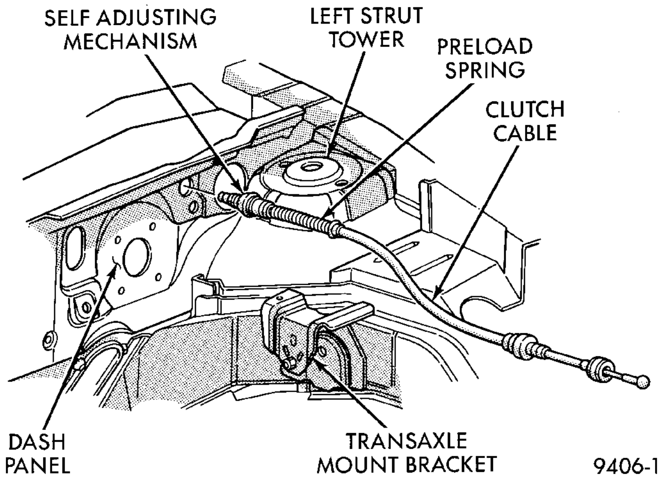


Fig. 10 Clutch Cable Routing

housing. Connect cable to release lever, seating the cupped washer securely on lever tangs.

(3) Pull back on clutch cable housing and insert into transaxle housing (Fig. 11).

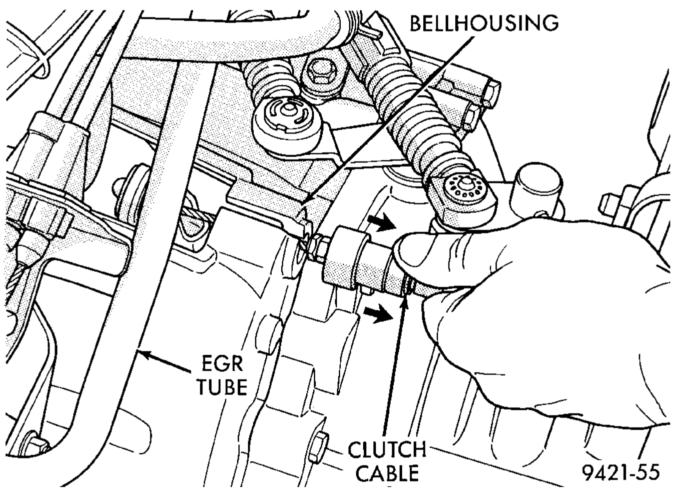


Fig. 11 Cable at Transaxle

(4) Reinstall cable inspection cover and air cleaner assembly. Check clutch pedal position switch operation.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 12).

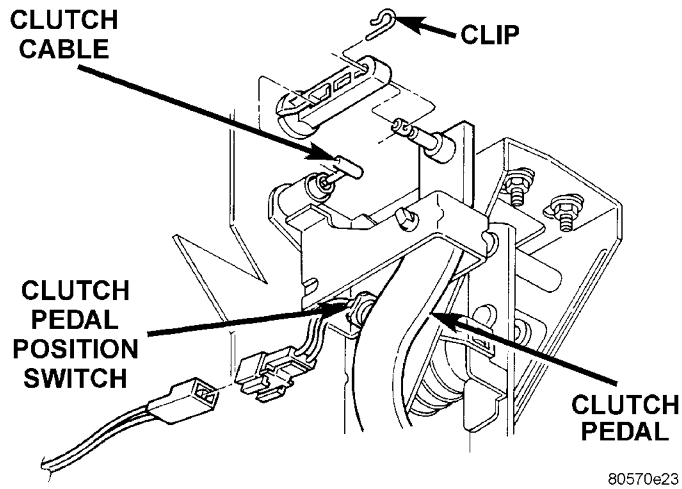


Fig. 12 Clutch Pedal Position Switch and Components

SPECIFICATIONS

TORQUE

MODULAR CLUTCH

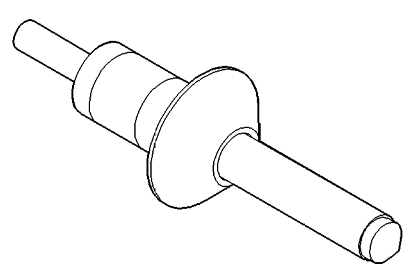
DESCRIPTION	TORQUE
Drive Plate To Clutch Bolts	75 N·m (55 ft. lbs.)
Drive Plate To Crankshaft Bolts	95 N·m (70 ft. lbs.)
Clutch Pedal Pivot Shaft Nut	41 N·m (30 ft. lbs.)

CONVENTIONAL CLUTCH

DESCRIPTION	TORQUE
Clutch Cover Bolts	28 N·m (250 in. lbs.)
Flywheel to Crankshaft Bolts	95 N·m (70 ft. lbs.)
Clutch Pedal Pivot Shaft Nut	41 N·m (30 ft. lbs.)

SPECIAL TOOLS

CLUTCH



Clutch Disc Aligner-6724

COOLING

CONTENTS

GENERAL INFORMATION

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, fan, shroud, coolant reserve system, transmission oil cooler, hoses, clamps, air condition condenser and transmission oil lines.

- When the Engine is cold: The thermostat is closed; the cooling system has no flow through the radiator. The coolant flows through the engine, heater system and bypass.
- When the Engine is warm: Thermostat is open; the cooling system has flow through radiator, engine, heater system and bypass.

GENERAL INFORMATION (Continued)

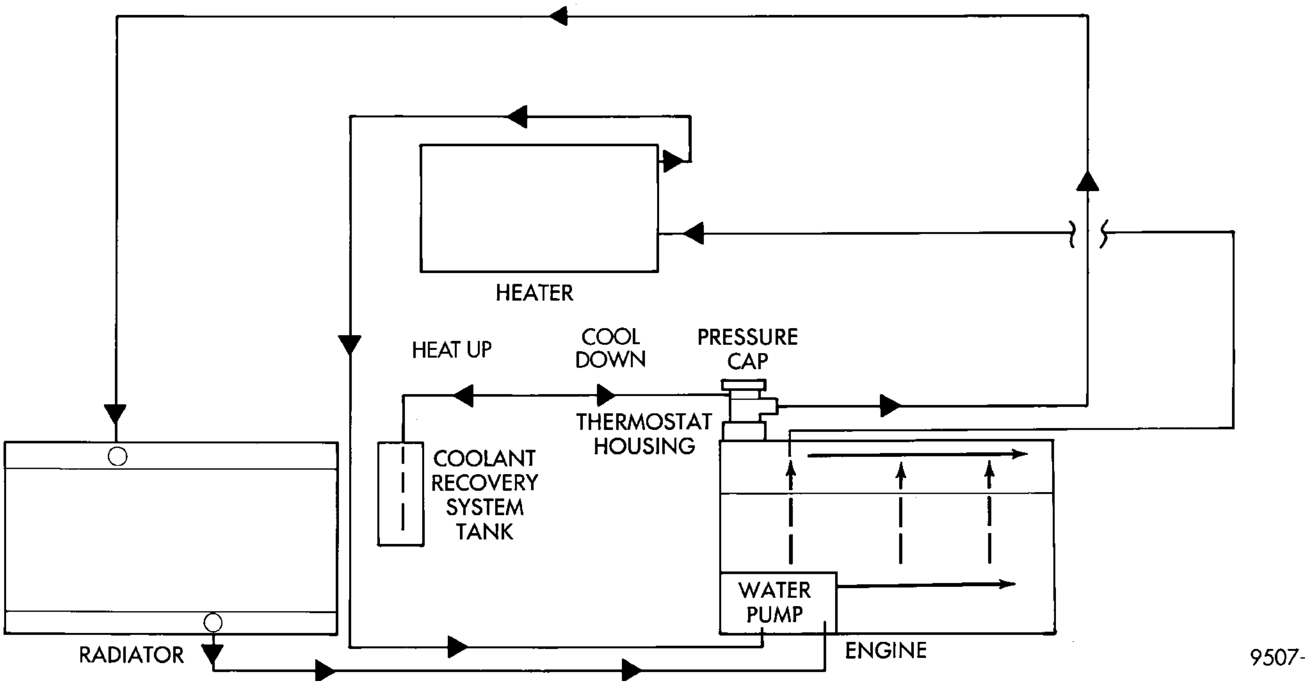


Fig. 1 Cooling System Operation

Coolant flow circuit for the 2.0L engine is shown in (Fig. 1).

During any reassembly procedures all pipe fittings in water jacket, and waterbox require cleaning and application of thread sealant for entire length of threads.

ACCESSORY DRIVE BELTS

If the engine is equipped with power steering or air conditioning, it will have 2 drive belts. One belt drives the generator, the other drives the Power Steering and Air Conditioning. (Fig. 2)

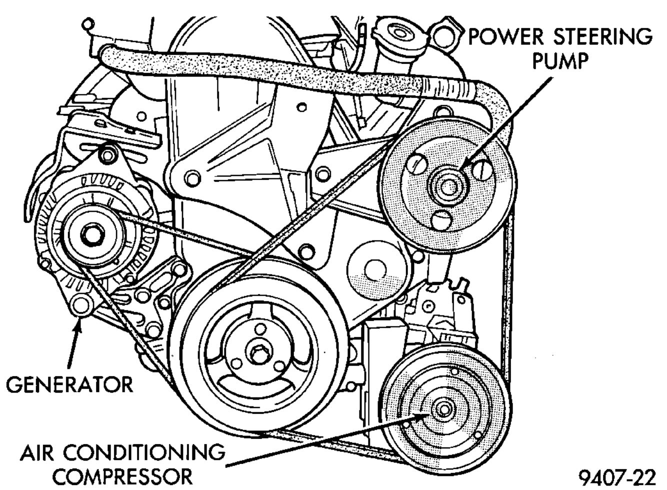


Fig. 2 Drive Belts

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. The system provides space for expansion and contraction, and a convenient safe method for checking and adjusting the coolant level and at atmospheric pressure without removing the pressure cap. It also provides some reserve coolant to compensate for minor leaks and evaporation or boiling losses. All vehicles are equipped with this system (Fig. 3).

See Coolant Level Check, Service Procedures. Deaeration and Pressure Cap sections for operation and service.

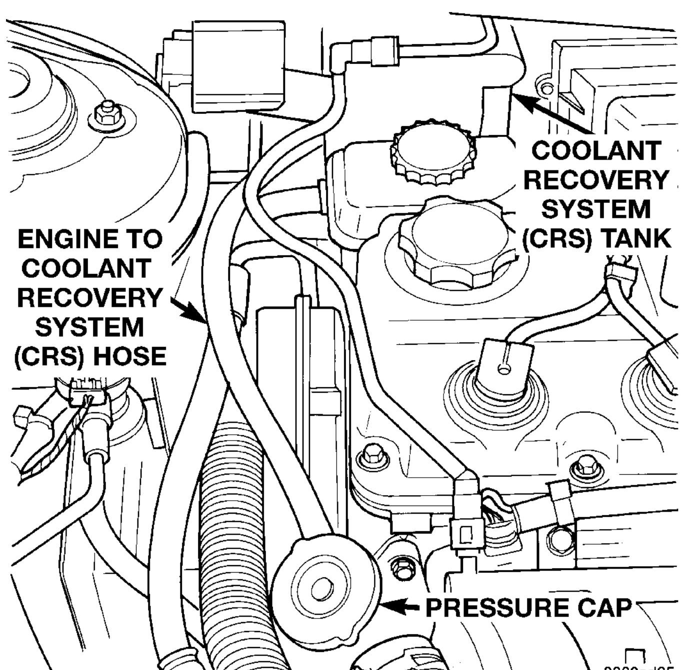


Fig. 3 Coolant Recovery System

GENERAL INFORMATION (Continued)

ENGINE THERMOSTAT

The engine thermostat is located on the front of the engine (radiator side) in the thermostat housing/ engine outlet connector. The thermostat has an air bleed (vent) located in the flange and a O-ring for sealing incorporate on it. There is a relief in the thermostat housing/outlet connector for the O-ring.

WATER PUMP

The water pump has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block (Fig. 4). Cylinder block to water pump sealing is provided by a rubber O-ring. The water pump is driven by the timing belt. Refer to Group 9, Engine section for component removal to access the water pump.

NOTE: The water pump on all models can be replaced without discharging the air conditioning system.

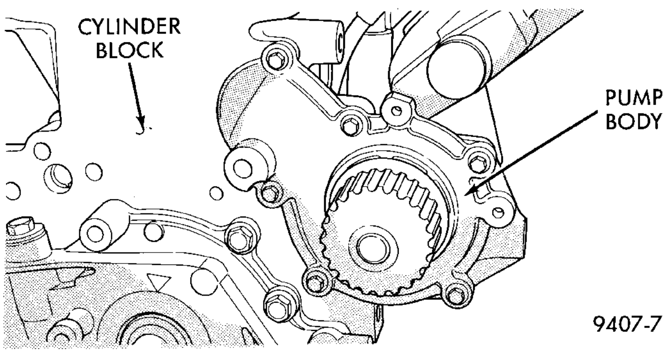


Fig. 4 Water Pump

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 off the heat to the air.

COOLANT REPLACEMENT

Refer to Group 0, Lubrication and Maintenance for schedule.

COOLING SYSTEM PRESSURE CAP

The cooling system is equipped with a pressure cap that releases pressure at some point within a range of 97-124 kPa (14-18 psi) (Fig. 5).

The system will operate at higher than atmospheric pressure, which raises the coolant boiling point, allowing increased radiator cooling capacity.

AUTOMATIC TRANSMISSION OIL COOLER

Oil coolers are internal oil to coolant type, mounted in the radiator lower tank (Fig. 6). Rubber oil lines

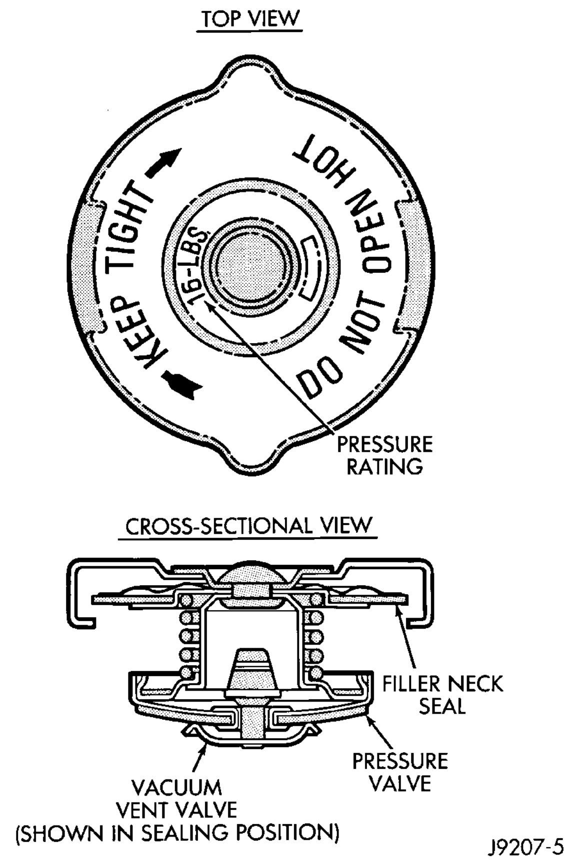


Fig. 5 Cooling System Pressure Cap

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 2 N·m (18 in. lbs.).

RADIATOR

The radiator is a down-flow type (vertical tubes) with design features that provide greater strength, as well as sufficient heat transfer capabilities to keep the engine satisfactorily cooled (Fig. 6).

ENGINE BLOCK HEATER

The 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.

DESCRIPTION AND OPERATION

ENGINE THERMOSTAT

The engine cooling thermostats are wax pellet driven, reverse poppet choke type. They are designed

DESCRIPTION AND OPERATION (Continued)

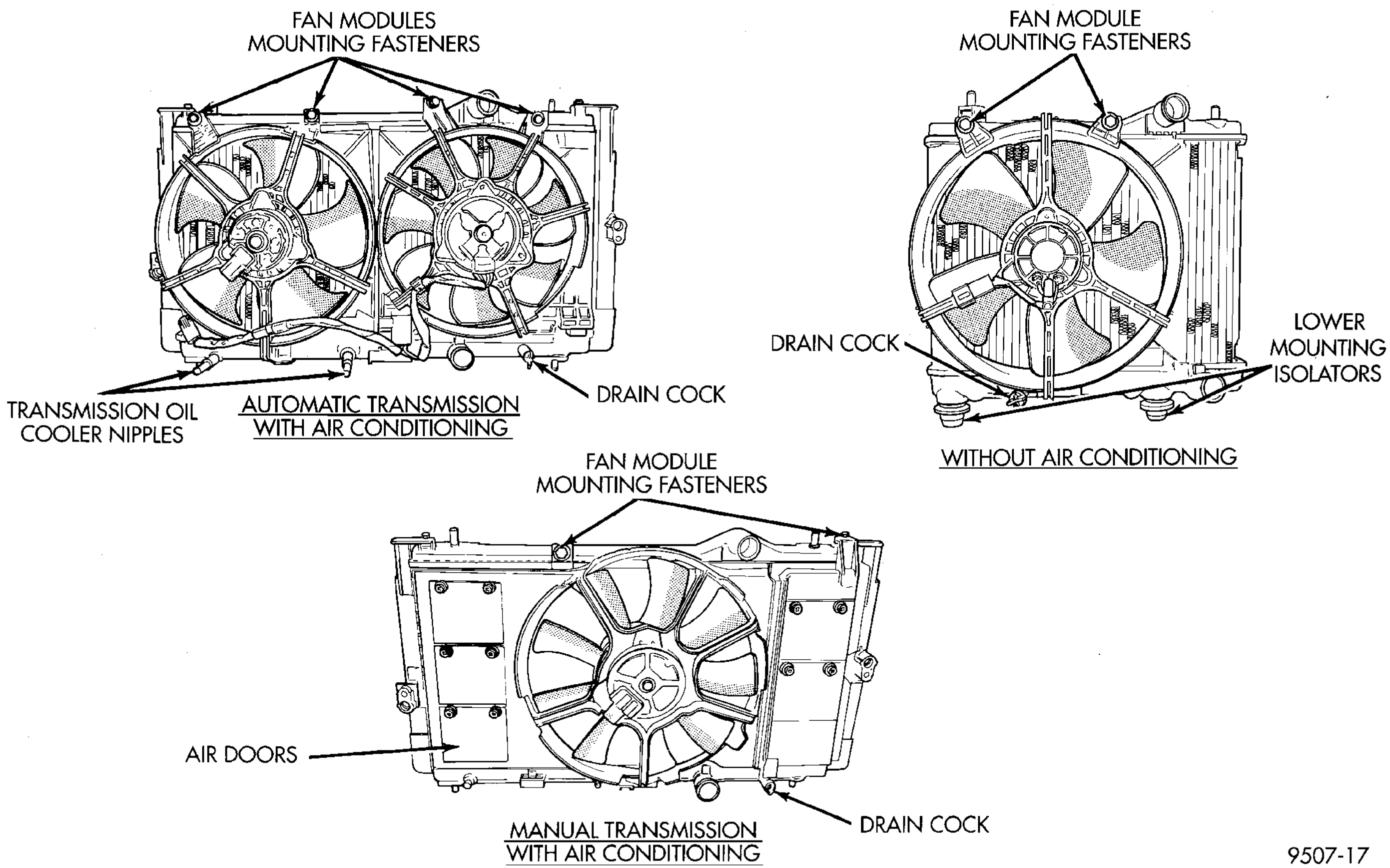


Fig. 6 Cooling Modules

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.

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. It does this by transferring heat from engine metal and automatic transmission oil cooler (if equipped) to coolant, moving this heated coolant to the heater core and radiator, and then transferring this heat to the ambient air.

COOLANT PERFORMANCE

Performance is measurable. For heat transfer pure water excels (Formula = 1 btu per minute for each degree of temperature rise for each pound of water). This formula is altered when necessary additives to control boiling, freezing, and corrosion are added as follows:

- Pure Water (1 btu) boils at 100°C (212°F) and freezes at 0°C (32°F).
- 100 Percent Glycol (.7 btu) can cause a hot engine and detonation and will 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 DOHC, and water pumps requires special corrosion protection. Mopar Antifreeze 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

DESCRIPTION AND OPERATION (Continued)

contaminated, drain, flush, and replace with fresh properly mixed solution.

COOLING SYSTEM PRESSURE CAP

The cooling system is equipped with a pressure cap that releases built up pressure, maintaining a range of 97-124 kPa (14-18 psi).

The cooling system will operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point thus, allowing increased radiator cooling capacity.

There is a vent valve in the center of the cap that allows a small coolant flow from the coolant reserve system (CRS) tank. This valve is spring loaded in the closed position. However it must be free to open during system cool-down. **If the valve is stuck shut, the radiator hoses will collapse on cool-down. Clean the vent valve (Fig. 7) to ensure proper sealing function.**

There is a gasket in the cap that seals to the top of the filler neck so that vacuum is maintained to draw coolant back into the system from the coolant reserve system (CRS) tank.

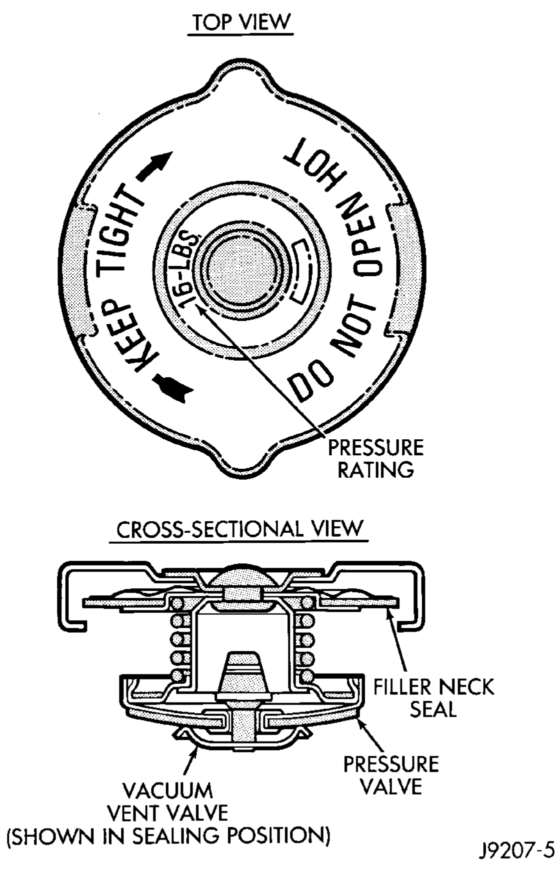


Fig. 7 Cooling System Pressure Cap

RADIATOR HOSES AND CLAMPS

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE WORKING ON VEHICLE. RELIEVE PRESSURE BY PLACING A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE IT COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING OUT COOLANT AND STEAM AND THE PRESSURE DROPS CONTINUE SERVICE.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAM. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter.

The hose clamps are removed by using Special Tool 6094 or equivalent constant tension clamp pliers (Fig. 8) 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 Mopar equipment spring type clamp.

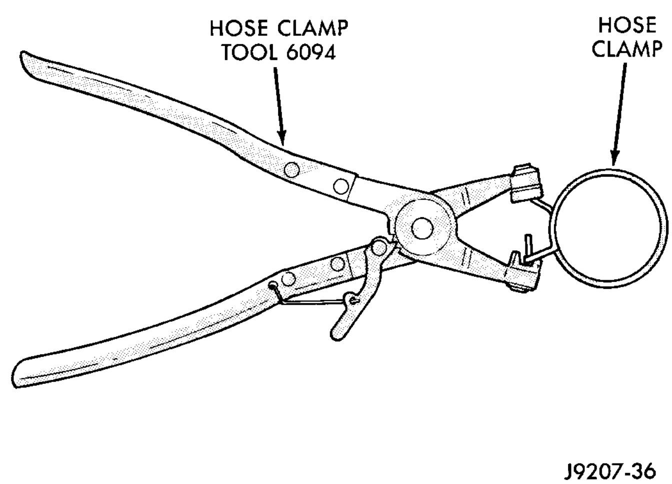


Fig. 8 Hose Clamp Tool

ENGINE BLOCK HEATER

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. **The power cord**

DESCRIPTION AND OPERATION (Continued)

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.

WATER PUMP

The water pump body is made of aluminum with a steel impeller. The water pump is bolted to the front of the block, and driven by the timing belt. The water pump is the heart of the cooling system, pumping the coolant through the engine block, cylinder head, heater core, and radiator.

NOTE: The water pump on all models can be replaced without discharging the air conditioning system.

DIAGNOSIS AND TESTING

COOLING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) number 17 been set indicating a stuck open engine thermostat?	1. Refer to On Board Diagnostic in Group 25. Replace thermostat if necessary. if the (DTC) number 17 has not been set, the problem may be with the temperature gauge.
	2. Is the temperature gauge (if equipped) connected to the temperature gauge coolant sensor on the engine?	2. Check the connector at the engine coolant sensor. Refer to Group 8E. Repair as necessary.
	3. Is the temperature gauge (if equipped) operating OK?	3. Check Gauge operation. Refer to Group 8E. Repair as necessary.
	4. Coolant level low during cold ambient temperature, accompanied by poor heater performance.	4. Check coolant level in the coolant overflow/reserve tank and the radiator. Inspect the system for leaks. Repair as necessary. Refer to WARNINGS outlined in this section before removing pressure cap.
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	1. Trailer being towed, a steep hill being climbed, vehicle being operated in slow moving traffic, or engine idling during high ambient (outside) temperatures with air conditioning on. High altitudes Could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and drive the vehicle without any of the previous conditions. Observe the temperature gauge the gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause of the overheating and repair. Refer to POSSIBLE CAUSES in this section.
	2. Is temperature gauge (if equipped) reading correctly?	2. Check gauge. Refer to Group 8E. Repair as necessary.
	3. Is temperature warning lamp (if equipped) illuminating unnecessarily?	3. Check warning lamp operation. Refer to Group 8E. Repair as necessary.
	4. Coolant low in overflow/reserve tank and radiator?	4. Check for coolant leaks and repair as necessary. Refer to checking cooling system for leaks in this group.
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 6.	5. Tighten cap.
	6. Poor seals at radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator cap Inspection. Replace cap if necessary.
		6. (b) Check condition of filler neck. If neck is bent or damaged, replace neck.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	7. Coolant level low in radiator but not in coolant overflow/reserve tank. This means the radiator is not drawing coolant from the coolant overflow/reserve tank as the engine cools. As the engine cools, a vacuum is formed inside the cooling system. If the radiator cap seals are defective, or the cooling system has a leak, a vacuum can not be formed.	7. (a) Check condition of radiator cap and cap seals. Replace cap if necessary. (b) Check condition of filler neck. If neck is damaged, replace filler neck. (c) Check condition of hoses from filler neck to coolant tank. It should be tight at both ends without any kinks or tears. Replace hose if necessary. (d) Check coolant overflow/reserve tank and tank hoses for blockage. Repair as necessary.
	8. Freeze point of coolant not correct. Mixture may be to rich.	8. Check coolant. Refer to coolant section in this group. Adjust glycol to water ratio as required.
	9. Coolant not flowing through system.	9. Check for coolant flow at filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through filler neck. If flow is not observed determine reason for lack of flow and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Clean insects or debris.
	11. Radiator core is plugged or corroded.	11. Replace or re-core radiator.
	12. Fuel or ignition system problems.	12. Refer to Fuel and Ignition System group for diagnosis. Also refer to the appropriate Powertrain Diagnosis Procedures manual for operation of the DRB scan tool.
	13. Dragging brakes.	13. Inspect brake system and repair as necessary. Refer to Group 5, Brakes for diagnosis.
	14. Bug screen is being used causing reduced air flow.	14. Remove bug screen.
	15. Thermostat partially or completely shut. This is more prevalent on high mileage vehicles.	15. Check thermostat operation and replace as necessary. Refer to thermostats in this group.
	16. Electric cooling fan not operating properly.	16. Check electric fan operation and repair as necessary.
	17. Cylinder head gasket leaking.	17. Check cylinder head gasket for leaks. Refer to testing cooling system for leaks. For repairs, refer to group 9, Engines.
	18. Heater core leaking.	18. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERAUTRE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. The gauge may cycle up and down. This is due to the cycling of the electric radiator fan.	1. A normal condition. No correction is necessary. If gauge cycling is going into the hot zone, check electric fan operation and repair as necessary. Refer to procedure outlined in this section.
	2. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly.	2. A normal condition. No correction is necessary.
	3. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	3. Check operation of gauge and repair if necessary. Refer to Group 8E, Instrument Panel and Gauges
	4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine is still running).	4. A normal condition. No correction is necessary. Gauge reading should return to normal range after vehicle is driven.
	5. Gauge reading high after re-starting a warmed-up (hot) engine.	5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	6. Check and correct coolant leaks. Refer to Testing Cooling System for Leaks in this group.
	7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing thermostat to open late.	7. (a) Check for cylinder head gasket leaks with a commercially available Block Leak Tester. Repair as necessary. (b) Check for coolant in the engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary.
	8. Water pump impeller loose on shaft.	8. Check water pump and replace as necessary. Refer to Water Pumps in this group.
	9. Loose accessory drive belt (water pump slipping).	9. Refer to Engine Accessory Drive Belts in this group. Check and correct as necessary.
	10. Air leak on suction side of water pump allows air to build up in cooling system causing thermostat to open late.	10. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/ OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. Refer to Radiator Caps in this group. Replace cap as necessary.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. Refer to Testing Cooling System for Leaks in this group.
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating. 2. Freeze point of coolant not correct. Mixture is too rich or too lean.	1. Check reason for overheating and repair as necessary. 2. Check the freeze point of the coolant. Refer to Coolant in the group for test procedure. Adjust the glycol to water ratio as required.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this group. Replace if necessary. (b) Hose between coolant resrve overflow tank and radiator is kinked. Repair as necessary. (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
ELECTRIC RADIATOR FAN RUNS ALL THE TIME	1. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective. 2. Check for low coolant level.	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 2. Repair as necessary.
ELECTRIC RADIATOR FAN WILL NOT RUN. GAUGE READING HIGH OR HOT	1. Fan motor defective. 2. Fan relay, powertrain control modue (PCM) or engine coolant temperature sensor defective. 3. Blown fuse in power distribution center (PDC).	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 3. Determine reason for blown fuse and repair as necessary.
NOISY FAN	1. Fan blades loose. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Electric fan motor defective.	1. Replace fan blade assembly. Refer to Cooling System Fans in this group. 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. 4. Refer to procedure outlined in this section.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or air conditioning condenser is restricted, obstructed or dirty.	1. Remove restriction and/or clean as necessary.
	2. Electric radiator fan not operating when a/c is on.	2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. repair as necessary.
	3. Engine is overheating (heat may be transferred from radiator to A/C condenser. High underhood temperature due to engine overheating may also transfer heat to A/C components).	3. Correct overheating condition. Refer to Group 7, Cooling.
INADEQUATE HEATER PERFORMANCE.	1. Has a diagnostic trouble code (DTC) number 17 been set?	1. Refer to On-Board Diagnostic in Group 25, and replace thermostat if necessary.
	2. Coolant level low.	2. Refer to testing cooling system for leaks in this section. Repair as necessary.
	3. Obstructions in heater hose fittings at engine.	3. Remove heater hoses at both ends and check for obstructions. Repair as necessary.
	4. Heater hose kinked.	4. Locate kinked area and repair as necessary.
	5. Water pump is not pumping coolant to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. The accessory drive belt may be slipping causing poor water pump operation.	5. Refer to water pump in this group. Repair as necessary. If slipping belt is detected, refer to accessory drive belts in this group. Repair as necessary.
HEAT ODOR	6. Various heat shields are used at certain drive line components. One or more of these shields may be missing.	6. Locate missing shields and replace or repair as necessary.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
HEAT ODOR - CONT.	2. Is temperature gauge reading above the normal range?	2. Refer to the previous Temperature Gauge Reads High in these Diagnosis Charts. Repair as necessary.
	3. Is cooling fan operating correctly?	3. Refer to Cooling System Fan in this group for diagnosis. Repair as necessary.
	4. Has undercoating been applied to any unnecessary component?	4. Clean undercoating as necessary.
	5. Engine may be running rich causing the catalytic converter to overheat.	5. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
POOR DIRVEABILITY (THERMOSTAT POSSIBLY STUCK OPEN). GAUGE MAY BE READING LOW	1. For proper driveability, good vehicle emissions and for preventing build-up of engine oil sludge, the thermostat must be operating properly. Has a diagnostic trouble code (DTC) number 17 been set?	1. Refer to On-Board Diagnostics in Group 25. DTC's may also be checked using the DRB scan tool. Refer to the proper Powertrain Diagnostics Procedures manual for checking the thermostat using the DRB scan tool. Replace thermostat if necessary.
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This ususally occurs in cold weather with no fan or airflow to blow it away.	1. Occasional stem emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Check the freeze point of the coolant. Refer to Coolant in the group for test procedure. Adjust the glycol to water ratio as required.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

DIAGNOSIS AND TESTING (Continued)

ENGINE THERMOSTAT 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 thermostat that opens too soon type failure mode is included in the on-board 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 heater performance or temperature gage position, unless code 17 is present. See diagnosis for other probable causes. Thermostat 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.

ACCESSORY DRIVE BELT 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 CHIRP 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 grooves or eccentric pulley.	(a) Replace belt. (b) Adjust belt tension. (c) Align accessories. (d) Replace pulley.

DIAGNOSIS AND TESTING (Continued)

WATER PUMP DIAGNOSIS

A quick flow 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.

Another flow test to help determine pump operation.

WARNING: DO NOT remove radiator cap if the cooling system is hot or under pressure.

(1) Remove radiator cap.

(2) Remove a small amount of coolant from the system, start the engine and warm up until thermostat opens. With the thermostat open and coolant level low you will see if the water pump is pumping coolant through the system.

COOLING SYSTEM FLOW CHECK

To determine whether coolant is flowing through the cooling system, use the following procedures:

(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 THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Remove pressure cap when engine is cold, remove small amount of coolant Idle engine until thermostat opens, you should observe coolant flow while looking down the filler neck. Once flow is detected install the pressure cap.

RADIATOR FAN CONTROL

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 Powertrain Control Module (PCM). The (PCM) turns on the fan through the Pulse Width Module (PWM). See Wiring Diagrams Manual for circuity and diagnostics provided.

Switching through the (PCM) 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.
- 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 next fan operation is to help prevent steaming. The fan will run only below 16°C (61°F) ambient. Between 38°C (100°F) to 97°C (207°F) coolant temperature, at idle and then only for three minutes.

Refer to Radiator Fan Control Module Group 14, Fuel Injection for more information.

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

TESTING COOLING SYSTEM FOR LEAKS

The system should be full. With the engine not running, wipe the filler neck sealing seat clean.

Attach a radiator pressure tester to the filler neck, as shown in (Fig. 9) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 2 psi in 2 minutes, inspect the system for external leaks.

Move all hoses at the radiator and heater while system is pressurize at 15 psi, since some leaks occur due to engine rock while driving.

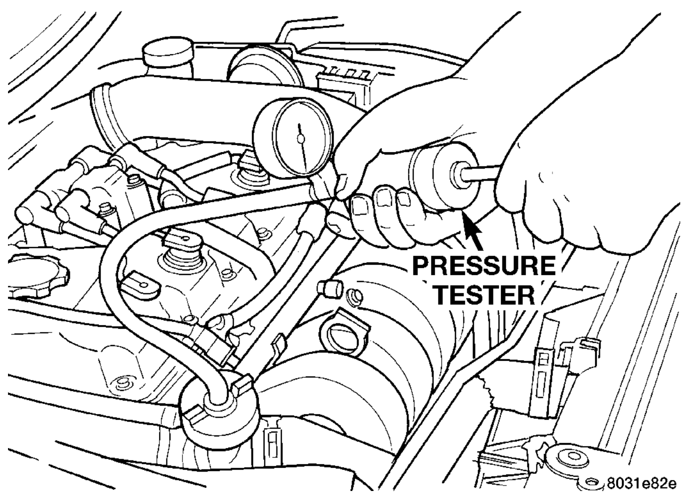


Fig. 9 Pressure Testing Cooling System—Typical

If there are no external leaks after the gauge dial shows a drop in pressure, detach the tester. Start the engine, and run the engine to normal operating temperature in order to open the thermostat and allow the coolant to expand. Reattach the tester. If the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

WARNING: WITH THE PRESSURE TESTER IN PLACE PRESSURE BUILDS UP QUICKLY. ANY EXCESSIVE PRESSURE BUILD-UP DUE TO CONTINUOUS ENGINE OPERATION MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

DIAGNOSIS AND TESTING (Continued)

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 cracked cylinder head.

There may be internal leaks, which can be determined by removing the oil dipstick. If water globules appear intermixed with the oil, it indicates an internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

PRESSURE 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. 10). Attach the radiator pressure tester to the **filler neck nipple,** and pump air into the system. The pressure cap upper gasket should relieve pressure 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 PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, THE COOLING SYSTEM BUILDS UP PRESSURE. TO PREVENT SCALDING OR OTHER INJURY, THE PRESSURE CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT AND/OR UNDER PRESSURE.

There is no need to remove the pressure cap at any time **except** for the following purposes:

- Check and adjust coolant freeze point
- Refill system with new coolant
- Conducting service procedures
- Checking for leaks

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. 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. WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS, PUSH DOWN ON THE CAP AND REMOVE IT 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 COOLING SYSTEM PRESSURE CAP

Dip the pressure cap in water; clean off any deposits on the vent valve or its seat, and apply the cap to end of radiator pressure tester (Fig. 11). Working the

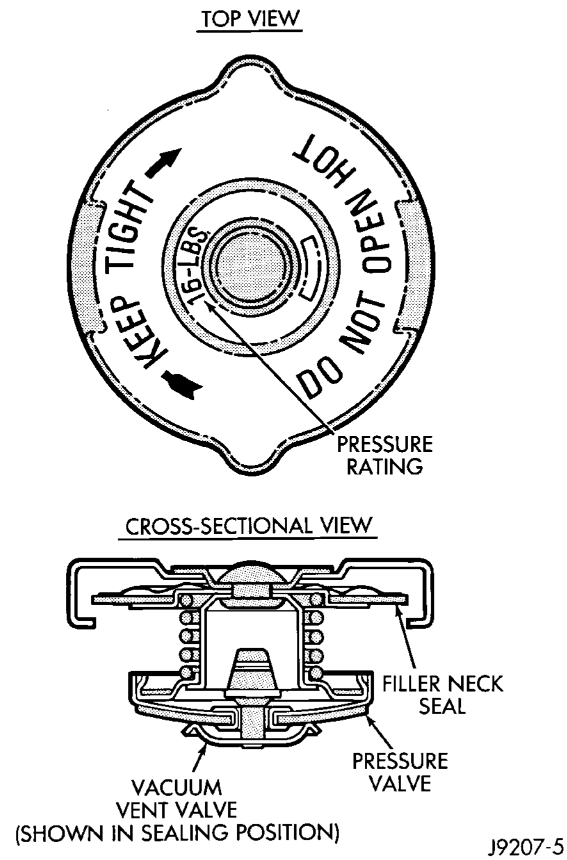


Fig. 10 Cooling System Pressure Cap

plunger, increase 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 the cap.

CAUTION: The radiator pressure tester is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn the tool upside down, and recheck the pressure cap to confirm that the cap is faulty.

If the pressure cap tests properly while positioned the on radiator pressure tester, but will not hold pressure or vacuum when positioned on the filler neck, inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

LOW COOLANT LEVEL AERATION

- Will cause corrosion in the system.
- 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 above problems.

DIAGNOSIS AND TESTING (Continued)

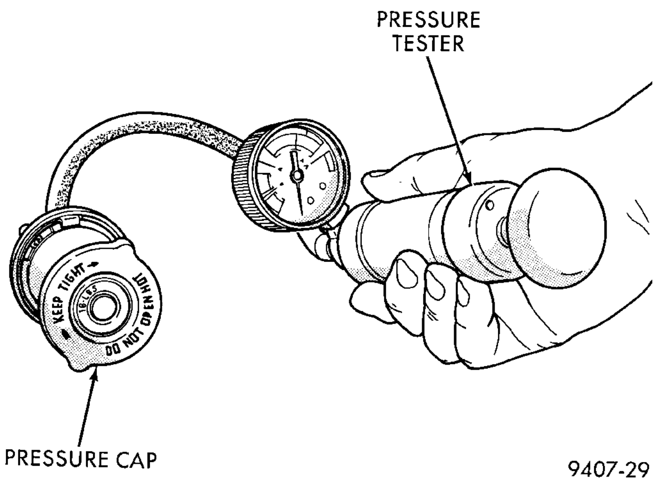


Fig. 11 Pressure Testing Radiator Cap

DEAERATION

Air can only be removed from the system by gathering under the pressure cap. On the next heat up it will be pushed past the pressure cap into the CRS tank by thermal expansion of the coolant. It then escapes to the atmosphere in the CRS tank and is replaced with solid coolant on cool down.

TEMPERATURE GAUGE INDICATION

At idle the temperature gauge could rise slowly to about 1/2 gauge travel. The fan will come on and the gauge could drop to about 1/3 gauge travel, this is normal.

SERVICE PROCEDURES

ROUTINE COOLANT LEVEL CHECK

NOTE: 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 (Fig. 12) is between the add and full marks.

ADDING ADDITIONAL COOLANT

NOTE: The radiator cap should not be removed.

When additional coolant is needed, it should be added to the coolant reserve tank. Use only 50/50 concentration of ethylene glycol type antifreeze and water

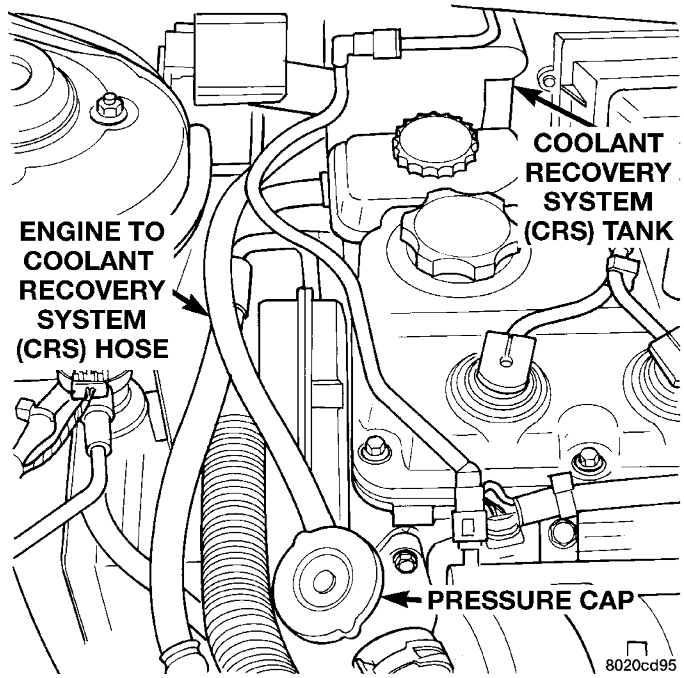


Fig. 12 Coolant Recovery System

SERVICING COOLANT LEVEL

NOTE: 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 ADD 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.

DRAINING COOLANT

NOTE: 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.

Without removing radiator pressure cap and with system not under pressure,

SERVICE PROCEDURES (Continued)

(1) Shut engine off and turn draincock counterclockwise to open (Fig. 13).

(2) The coolant reserve tank should empty first, then remove the pressure cap. (if not, Refer to Testing Cooling System for leaks).

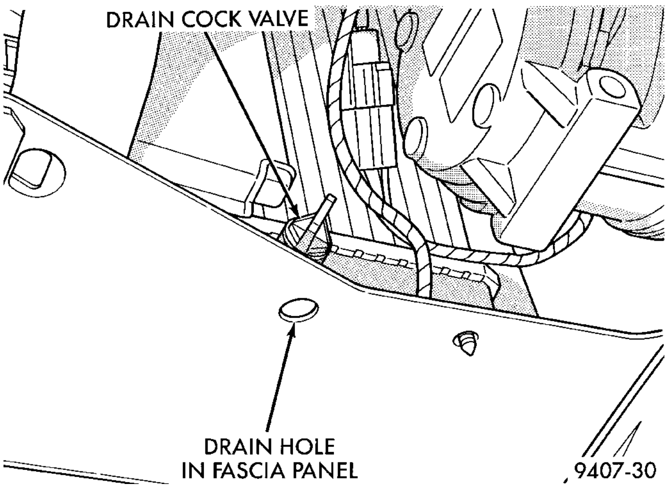


Fig. 13 Draining Cooling System

REFILLING COOLING SYSTEM

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.

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 FULL mark with 50/50 solution. It may be necessary to add coolant to the reserve tank to maintain coolant level between the FULL and ADD mark after three or four warm-up, cool down cycles and trapped air has been removed.

REMOVAL AND INSTALLATION

WATER PUMP

REMOVAL

(1) Raise vehicle on a hoist. Remove right inner splash shield.

(2) Remove accessory drive belts and power steering pump. Refer to Accessory Drive Belt service of this section.

(3) Drain cooling system. Refer to Draining Cooling System in this group.

(4) Support engine from the bottom and remove right engine mount.

(5) Remove power steering pump bracket bolts and set pump and bracket assembly aside. Power steering lines do not need to be disconnected.

(6) Remove right engine mount bracket.

(7) Remove timing belt. Refer to Group 9, Engine for procedure.

(8) Remove inner timing belt cover.

(9) Remove water pump attaching screws to engine (Fig. 14).

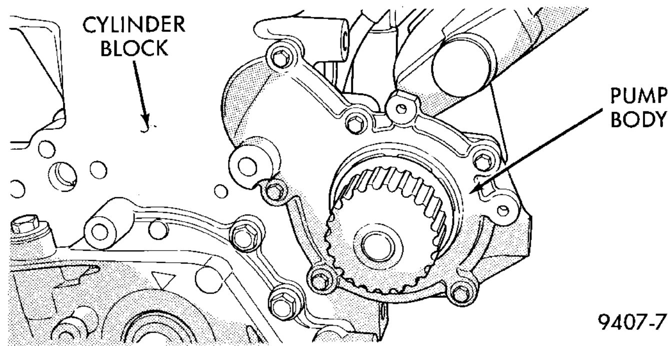


Fig. 14 Water Pump

INSTALLATION

(1) Install new O-ring gasket in water pump body O-ring groove (Fig. 15). Use small dabs of Mopar Silicone Rubber Adhesive Sealant around the water pump body to secure O-ring in place during installation.

CAUTION: Make sure O-ring gasket is properly seated in water pump groove before tightening screws. An improperly located O-ring may cause damage to the O-ring and cause a coolant leak.

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.). Pressurize cooling system to 15 psi with pressure tester and check water pump shaft seal and O-ring for leaks.

(3) Rotate pump by hand to check for freedom of movement.

(4) Install inner timing belt cover.

(5) Install timing belt. Refer to Group 9, Engine, and Reassemble engine.

(6) Install right engine mount bracket and engine mount. Refer to Group 9, Engine for procedure.

(7) Fill cooling system. See **Filling Cooling System.**

(8) Install power steering pump and accessory drive belts, Refer to Accessory Drive Belts, in this Group.

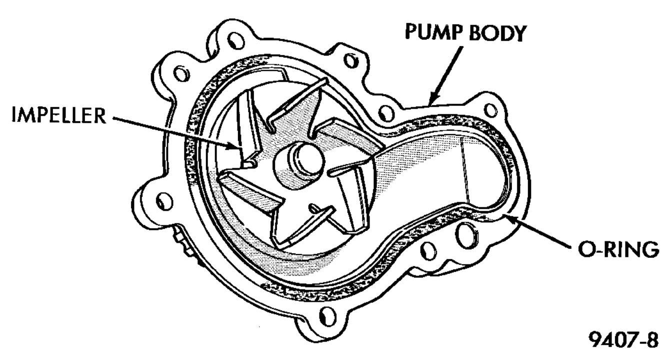


Fig. 15 Water Pump Body

REMOVAL AND INSTALLATION (Continued)

WATER PUMP INLET TUBE

The inlet tube connects the water pump to the radiator and heater core. This tube is sealed by a O-ring and held in place by fasteners to the block.

REMOVAL

CAUTION: Do not use any sharp tools to remove hoses from inlet tube. This may cause the tube to leak.

(1) Drain cooling system. Refer to procedure outlined in this section.

(2) Remove upper radiator hose to access the hose connections at the inlet tube.

(3) Remove lower radiator hose and heater hose from the inlet tube (Fig. 16).

(4) Remove the two fasteners that hold the inlet tube to the block and one fastener that holds the intake manifold to inlet tube.

(5) Rotate tube while removing the tube from the engine block (Fig. 17).

INSTALLATION

(1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 17).

(2) Lube O-ring with coolant and install into the cylinder block opening.

(3) Install two fasteners to the engine block and the one fastener to the intake manifold. Tighten fasteners to 12 N·m (105 in. lbs.).

(4) Connect lower radiator hose and heater hose to inlet tube.

(5) Install upper radiator hose.

(6) Fill cooling system. Refer to procedure outlined in this section.

(7) Pressure system to 104 kPa (15 psi) to check for leaks.

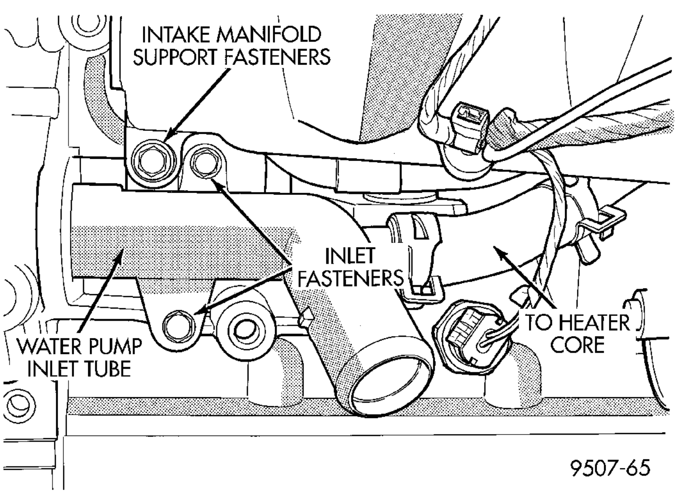


Fig. 16 Water Pump Inlet Tube Hose Connections

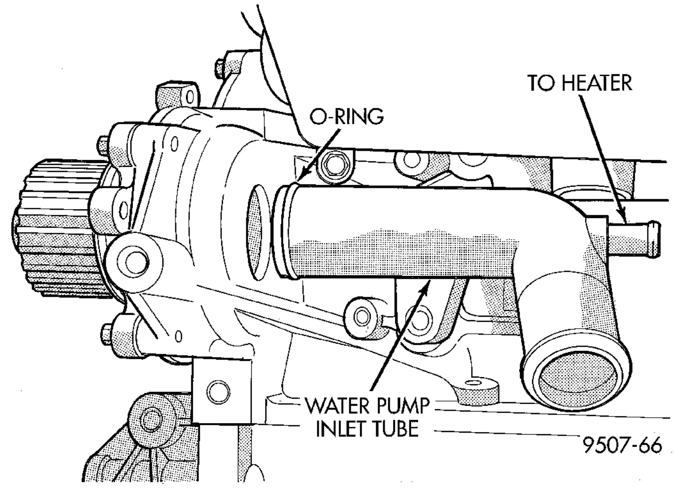


Fig. 17 Water Pump Inlet Tube

ENGINE THERMOSTAT

REMOVAL

(1) Drain cooling system to the thermostat level or below.

(2) Remove coolant recovery system (CRS) hose and thermostat/engine outlet connector bolts (Fig. 18) or (Fig. 19).

(3) Remove thermostat an O-ring assembly, and clean sealing surfaces.

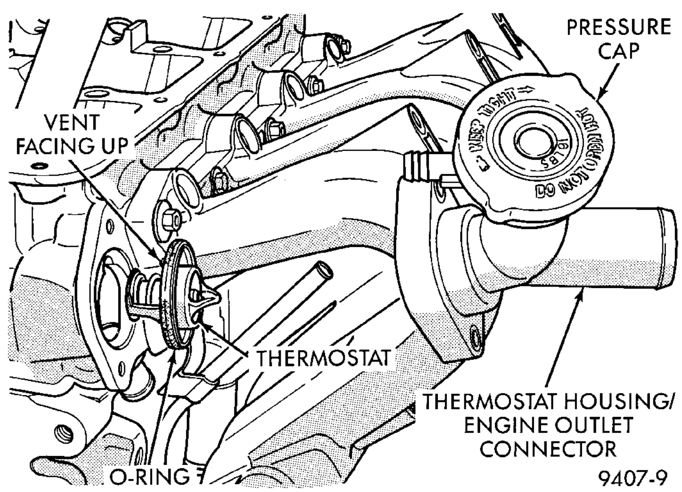


Fig. 18 Thermostat/Engine Outlet Connector—SOHC

INSTALLATION

(1) Place the new thermostat assembly into the thermostat housing/outlet connector. Align vent with notch in cylinder head.

(2) Install thermostat housing/outlet connector onto cylinder head and tighten bolts to 12.5 N·m (110 in. lbs.). Connect the coolant recovery system (CRS) hose.

(3) Refill cooling system (see **Refilling System**).

REMOVAL AND INSTALLATION (Continued)

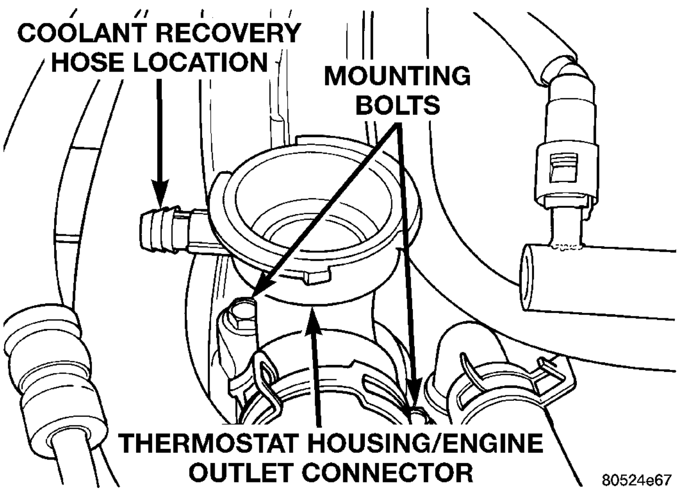


Fig. 19 Thermostat/Engine Outlet Connector—DOHC

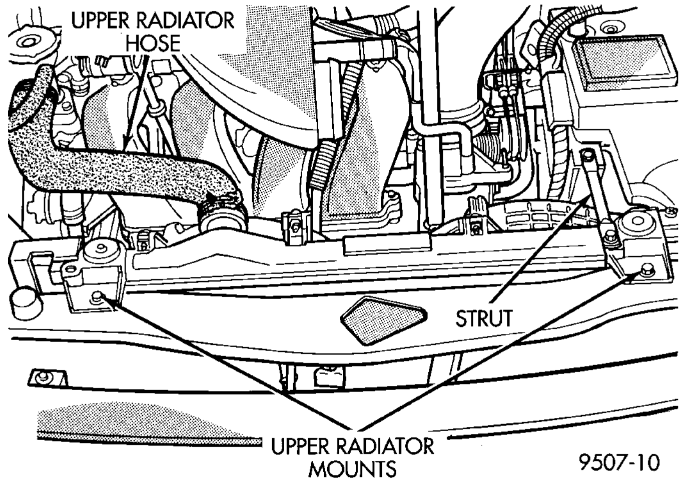


Fig. 20 Radiator Mounting

RADIATOR

REMOVAL

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.

(1) Disconnect negative battery cable from battery.

(2) Drain cooling system. Refer to Draining Cooling System of this section.

(3) Remove hose clamps and hoses from the radiator.

(4) Disconnect automatic transmission hoses and plug off, if equipped.

(5) Remove radiator to battery strut (Fig. 20). Remove fan module assembly by disconnecting fan motor electrical connector. Remove fan shroud retaining screws, located on the top of the shroud (Fig. 21). Lift shroud up and out of bottom shroud attachment clips separating shroud from radiator. For dual fan applications the left fan module may be removed first, then the right side module last. Fan damage should always be avoided.

(6) Remove upper radiator isolator bracket mounting screws. Disconnect the engine block heater wire if equipped.

(7) Remove the air conditioning condenser attaching screws located at the front of the radiator, if equipped (Fig. 22). Lean condenser forward, it is not necessary to discharge the air conditioning system to remove radiator.

(8) Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

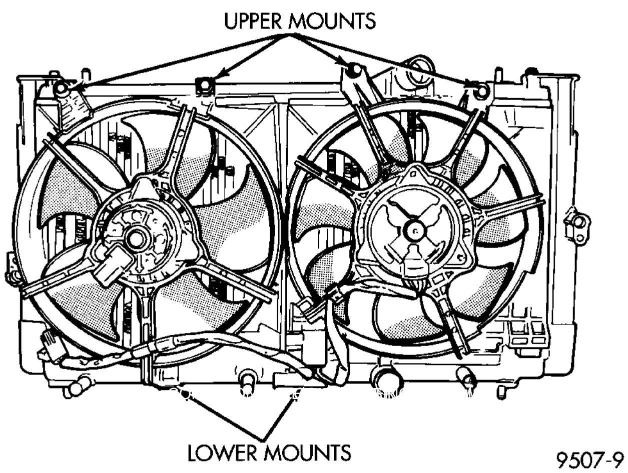


Fig. 21 Servicing Fan Module

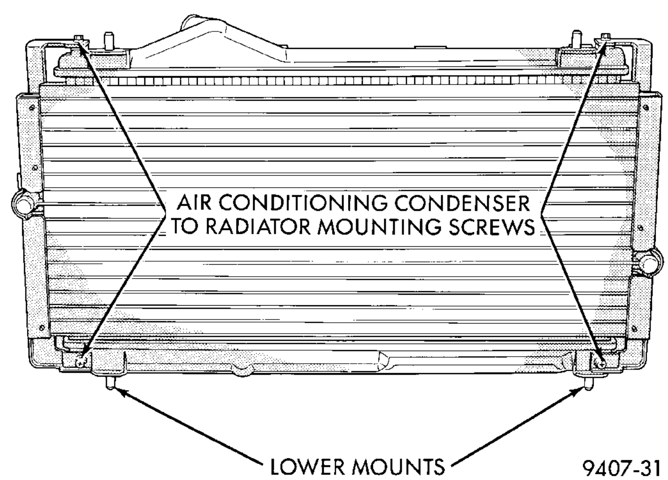


Fig. 22 A/C Condenser to Radiator Mounting Screws

INSTALLATION

(1) Slide radiator down into position behind radiator support (yoke).

(2) Attach air conditioning condenser to radiator if equipped (Fig. 22), with four mounting screws and

REMOVAL AND INSTALLATION (Continued)

tighten to 5.4 N·m (50 in. lbs.). Then seat the assembly lower rubber isolators into the mounting holes provided in the lower crossmember.

(3) Tighten radiator isolator mounting bracket screws to 7.4 N·m (65 in. lbs.). The radiator should have clearance to move up approximately 5 to 8 mm (0.25 in.) after assembled.

(4) Connect automatic transmission hoses, if equipped. Tighten hose clamps to 4 N·m (35 in. lbs.).

(5) Slide fan module down into clip(s) on lower radiator flange (Fig. 21). For dual fan application install the right fan module first and then the left fan module. Install retaining screws and tighten to 5.4 N·m (50 in. lbs.).

(6) Install radiator hoses and coolant reserve hose align hoses and position hose clamps so they will not interfere with the engine or hood.

(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.

RADIATOR DRAINCOCK

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. 23) from the radiator tank.

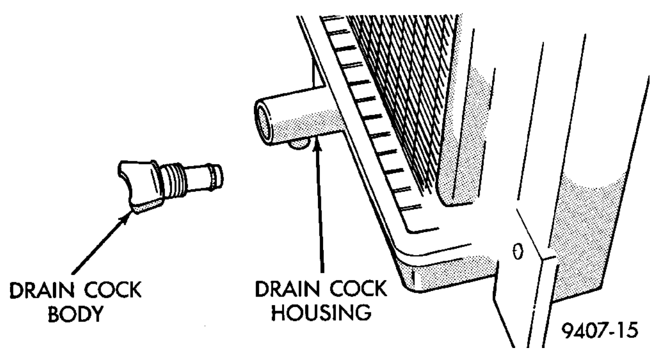


Fig. 23 Draincock

INSTALLATION

(1) Push the draincock assembly body into the tank opening.

(2) Tighten the draincock stem by turning clockwise to 2.0-2.7 N·m (18-25 in. lbs.).

RADIATOR FANS AND MOTOR

All models use a single speed electric motor driven cooling system fans. The fan modules includes a motor, fan blade, and support shroud. The module is fastened to the radiator by screws.

REMOVAL FAN MODULE

(1) Disconnect fan motor leads from module.

(2) Remove fan module fasteners from radiator (Fig. 24).

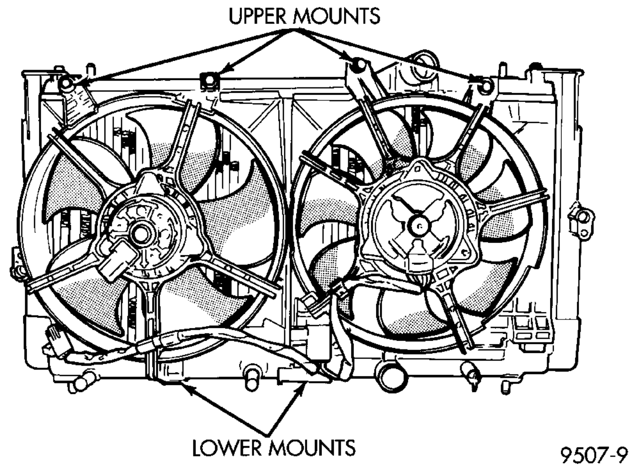


Fig. 24 Servicing Fan Module

FAN BLADE

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.

(1) 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 burr removal may be required to remove fan from motor shaft (Fig. 25).** Do not permit the fan blades to touch the bench.

(2) To install fan on motor shaft, slide the fan over shaft. Support motor and shaft as above while installing fan retaining clip.

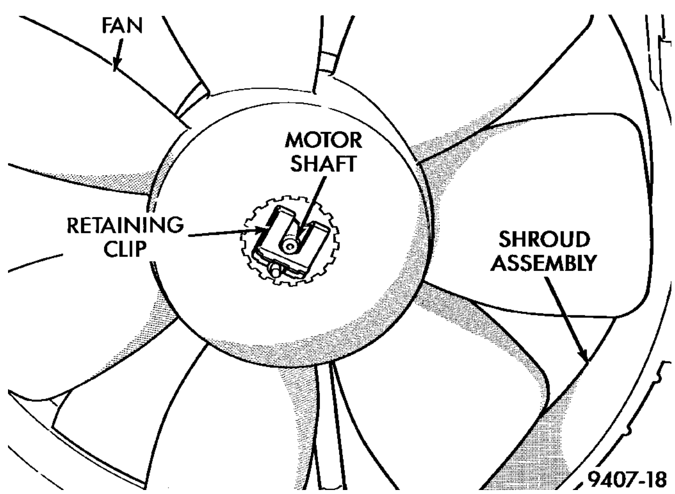


Fig. 25 Servicing Radiator Fan

REMOVAL AND INSTALLATION (Continued)

INSTALLATION FAN MODULE

(1) Install module to radiator. Torque shroud to radiator fasteners to 7.5 N·m (65 in. lbs.).

(2) Connect fan motor lead. **For wiring diagrams of fan motor systems Refer to 8W Wiring Diagrams** .

ELECTRIC FAN MOTOR—SERVICE

WARNING: Do not disassemble the fan motor from the support bracket.

Electric fan motor is serviced as an assembly with the fan module.

FAN SHROUD

Some fan shrouds are equipped with flapped doors to prevent the shroud from restricting air flow at high speeds.

All vehicles have fan shrouds to improve fan air flow efficiency.

The shroud supports the electric fan motor and fan. For removal and installation procedures, refer to radiator removal in this Section.

ENGINE BLOCK HEATER

REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Drain, Clean, Flush and Refill of this section for procedure.

(2) 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.

ACCESSORY DRIVE BELTS

AIR CONDITIONING COMPRESSOR AND POWER STEERING PUMP

(1) Loosen the power steering pump locking bolts A and B and pivot bolt C (Fig. 26) to remove and install belt and/or adjust belt tension.

(2) Using a 1/2” breaker bar, adjust belt tension by applying torque to the square D hole on the power steering pivot bracket. Adjust tension to specification given in Belt Tension Chart.

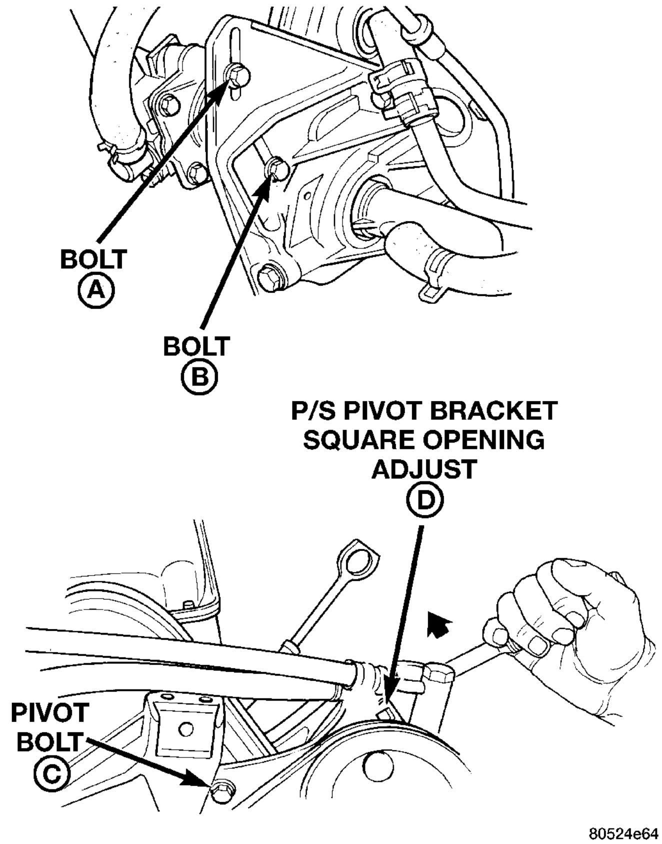


Fig. 26 Power Steering Pump Adjustment

(3) Tighten in order, first tighten locking bolt A to 27 N·m (20 ft. lbs.) then, bolt B to 27 N·m (20 ft. lbs.) Then pivot bolt C to 54 N·m (40 ft. lbs.).

Accessory Drive Belt	Gauge	Torque
Power Steering Pump and Air Conditioning Compressor	New 135 lb.	121 N·m (90 ft. lbs.)
	Used 100 lb.	81 N·m (60 ft. lbs.)
Generator	New 135 lb.	121 N·m (90 ft. lbs.)
	Used 100 lb.	81 N·m (60 ft. lbs.)

GENERATOR BELT

(1) Loosen pivot bolt E then locking nut F and adjusting bolt G (Fig. 27) to remove and install belt and/or adjust belt tension.

(2) Tighten adjusting bolt G, adjust belt tension to specification shown in Belt Tension Chart.

(3) Tighten pivot bolt E to 54 N·m (40 ft. lbs.). Locking nut F to 54 N·m (40 ft. lbs.).

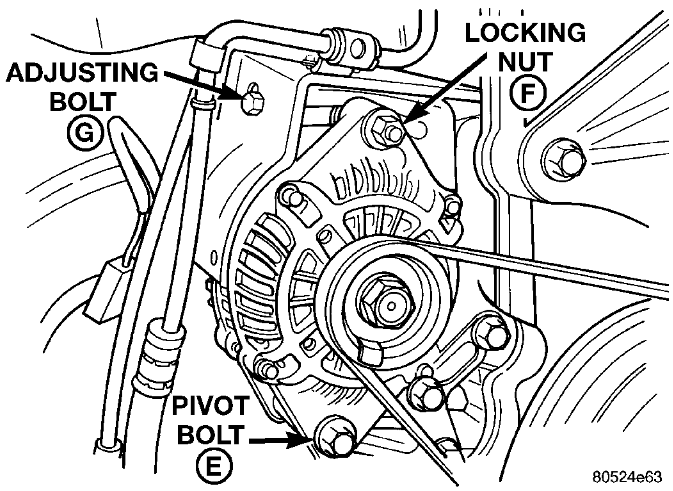


Fig. 27 Generator Adjustment

CLEANING AND INSPECTION

WATER PUMP

Replace water pump body assembly if it has any of these defects:

(1) Cracks or damage on the body.

(2) Coolant leaks from the shaft seal, evident by coolant traces on the pump body.

(3) Loose or rough turning bearing.

(4) Impeller rubs either the pump body or the engine block.

(5) Impeller loose or damaged.

(6) Sprocket or sprocket flange loose or damaged.

ACCESSORY DRIVE BELT INSPECTION

Belt replacement under any or all of the following conditions is required, excessive wear, frayed cords or severe glazing.

Poly-V-Belt system with back drive pulley may develop minor cracks across the ribbed side (due to reverse bending). These minor cracks are considered normal and acceptable. Cracks parallel are not (Fig. 28).

NOTE: Do not use any type of belt dressing or restorer on Poly-V-Belt and V-Belt

COOLING SYSTEM CAP

Hold the cap in your hand, **right side up** (Fig. 29). The vent valve at the bottom of the cap should open with a slight pull. If the rubber gasket has swollen, preventing the valve from opening, replace the cap.

If any light can be seen between vent valve and the rubber gasket, replace the cap. **Use only a replacement cap that has a spring to hold the vent shut.**

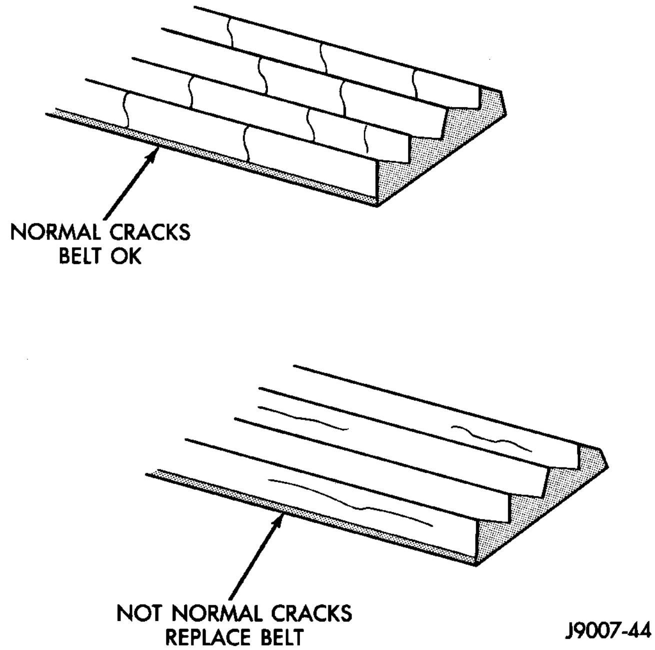


Fig. 28 Drive Belt Wear Pattern

A replacement cap must be of the type designed for coolant reserve systems. This design ensures system pressurization.

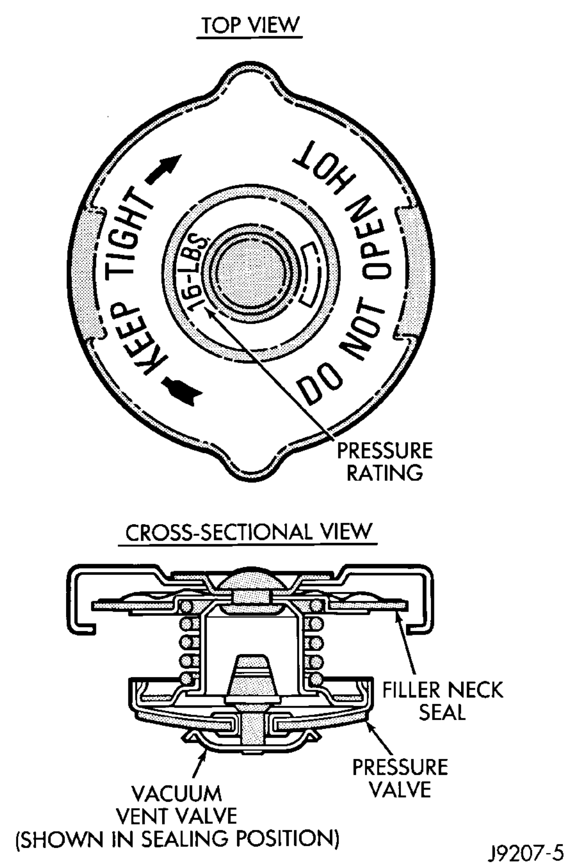


Fig. 29 Cooling System Pressure Cap

CLEANING AND INSPECTION (Continued)

CLEANING COOLING SYSTEM

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.

RADIATOR FLUSHING

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 FLUSHING

Drain radiator (see: **Draining Cooling System**) and remove hoses from radiator. Remove engine thermostat and reinstall thermostat housing. A gasket may be needed to seal the housing to cylinder head because the seal is part of thermostat. 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 and fill cooling system. Refer to **Refilling Cooling System**) for procedure.

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.

CHEMICAL CLEANING

One type of corrosion encountered with aluminum cylinder heads is aluminum hydroxide deposits. Corrosion products are carried to the radiator and deposited when cooled off. They appear as dark grey when wet and white when dry. This corrosion can be removed with a two part cleaner (oxalic acid and neutralizer) available in auto parts outlets. Follow manufacturers directions for use.

ADJUSTMENTS

PROPER BELT TENSION

Satisfactory performance of the belt driven accessories depends on belt condition and proper belt tension. Refer to Accessory Drive Belt Inspection in this section. There are two belt tensioning methods given in order of preference:

- Belt tension gauge method.
- Torque equivalent method.

The belt tension gauge method usually requires the vehicle to be raised on a hoist and the splash shield removed.

TORQUE EQUIVALENT METHOD

Adjustable accessory brackets provided with a 13 mm (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 in the Belt Tension Chart.

BELT TENSION CHART

ACCESSORY DRIVE BELT	GAUGE	TORQUE
Power Steering Pump and A/C Compressor	New 135 lb.	121 N·m (90 ft. lbs.)
	Used 100 lb.	81 N·m 60 ft. lbs.)
Generator	New 135 lb.	121 N·m (90 ft. lbs.)
	Used 100 lb.	81 N·m 60 ft. lbs.)

BELT TENSION GAUGE METHOD

NOTE: 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 Gauge.

BELT TENSION CHART GAUGE

ACCESSORY DRIVE BELT	GAUGE
Power Steering Pump and A/C Compressor	New 135 lb.
	Used 100 lb.
Generator	New 135 lb.
	Used 100 lb.

SPECIFICATIONS

COOLING SYSTEM CAPACITY

7.00 LITERS	7.40 QTS.
CAPACITY, Includes Heater and Coolant Reserve System	

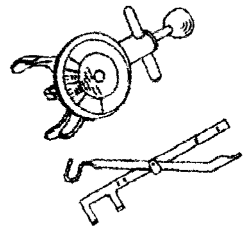
TORQUE

DESCRIPTION **TORQUE**

A/C Condenser to Radiator . . . . 7.2 N·m (65 in. lbs.)
Fan Module to Radiator . . . . . . 7.2 N·m (65 in. lbs.)
Fan Motor to Shroud
Retaining Screws (A/C equipped) . . . . 3.8 N·m (34 in. lbs.)
Fan Motor to Shroud
Retaining Screws (Non A/C equipped) . . . 2.3 N·m (20 in. lbs.)
Radiator (Cooling Module)
to Body Screws . . . . 7.2 N·m (65 in. lbs.)
Thermostat Housing/Engine
Outlet Connector Screws . . . 12 N·m (105 in. lbs.)
Upper Radiator Crossmember
Bolts . . . . 28 N·m (250 in. lbs.)
Water Pump to Engine Block
Mounting Bolts . . . . 12 N·m (105 in. lbs.)
Water Pump Inlet Tube to
Engine Block Mounting
Screws . . . . 12 N·m (105 in. lbs.)

SPECIAL TOOLS

COOLING



Accessory Drive Belt Tension Gauge C-4162

BATTERY

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The battery stores, stabilizes, and delivers electrical current to operate various electrical systems in the vehicle. The determination of whether a battery is good or bad is made by its ability to accept a charge. It also must supply high-amperage current for a long enough period to be able to start the vehicle. The capability of the battery to store electrical current comes from a chemical reaction. This reaction takes place between the sulfuric acid solution (electrolyte) and the lead +/- plates in each cell of the battery. As the battery discharges, the plates react with the acid from the electrolyte. When the charging system charges the battery, the water is converted to sulfuric acid in the battery. The concentration of acid in the electrolyte is measured as specific gravity using a hydrometer. The original equipment (OE) battery is equipped with a hydrometer (test indicator) built into the battery cover. The specific gravity indicates the battery's state-of-charge. The OE battery is sealed and water cannot be added.

The battery is vented to release gases that are created when the battery is being charged and discharged. The battery top, posts, and terminals should be cleaned when other under hood maintenance is performed.

When the electrolyte level is below the top of the plates, Yellow/Clear in the test Indicator, the battery must be replaced. The battery must be completely charged, and the battery top, posts, and cable clamps must be cleaned before diagnostic procedures are performed.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DESCRIPTION AND OPERATION

BATTERY IGNITION OFF DRAW (IOD)

A completely normal vehicle will have a small amount of current drain on the battery with the key out of the ignition. It can range from 4 to 10 milliamperes after all the modules time out. If a vehicle will not be operated for approximately a 20 days, the IOD fuse should be disconnected to minimize the vehicle electrical drain on the battery. The IOD fuse is located in the Power Distribution Center (PDC). Refer to the PDC to locate the cover proper fuse.

DESCRIPTION AND OPERATION (Continued)

CHARGING TIME REQUIRED

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD -1°C (30°F) BATTERY. PERSONAL INJURY MAY RESULT.

The time required to charge a battery will vary depending upon the following factors.

SIZE OF BATTERY

A completely discharged large heavy-duty battery may require more recharging time than a completely discharged small capacity battery, refer to (Fig. 1) for charging times.

CHARGING AMPERAGE	5 AMPS	10 AMPS	15 AMPS	20 AMPS
OPEN CIRCUIT VOLTAGE	HOUR CHARGING AT 21°C (77°F)			
12.34 TO 12.52	4.6 HRS.	2.3 HRS.	1.5 HRS.	1.1 HRS.
12.16 TO 12.33	6.9 HRS.	3.4 HRS.	2.3 HRS.	1.8 HRS.
11.97 TO 12.15	9.2 HRS.	4.6 HRS.	3.0 HRS.	2.3 HRS.
10.00 TO 11.96	11.5 HRS.	5.8 HRS.	3.8 HRS.	2.9 HRS.
10.00 TO 0	SEE CHARGING COMPLETELY DISCHARGE BATTERY			

948A-48

Fig. 1 Battery Charging Time

TEMPERATURE

A longer time will be needed to charge a battery at -18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, current accepted by battery will be very low at first. In time, the battery will accept a higher rate as battery temperature warms.

CHARGER CAPACITY

A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 20 amperes or more.

STATE OF CHARGE

A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current amperage will be low. As water is converted back to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise, bringing the green ball (Fig. 2) into view at approximately 75 percent state-of-charge.

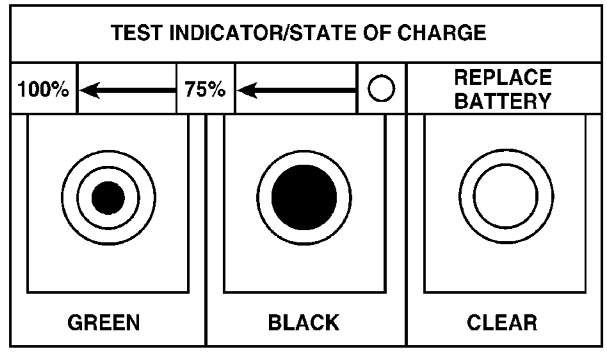


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Fig. 2 Reading Test Indicator

DIAGNOSIS AND TESTING

BATTERY BUILT-IN TEST INDICATOR

USING TEST INDICATOR

The Test Indicator (Fig. 2), (Fig. 3) and (Fig. 4) measures the specific gravity of the electrolyte. Specific Gravity (SG) of the electrolyte will show state-of-charge (voltage). The test indicator WILL NOT show cranking capacity of the battery. Refer to Battery Load Test for more information. Look into the sight glass (Fig. 2), (Fig. 4) and note the color of the indicator. Refer to the following description of colors:

NOTE: GREEN = 75 to 100% state-of-charge

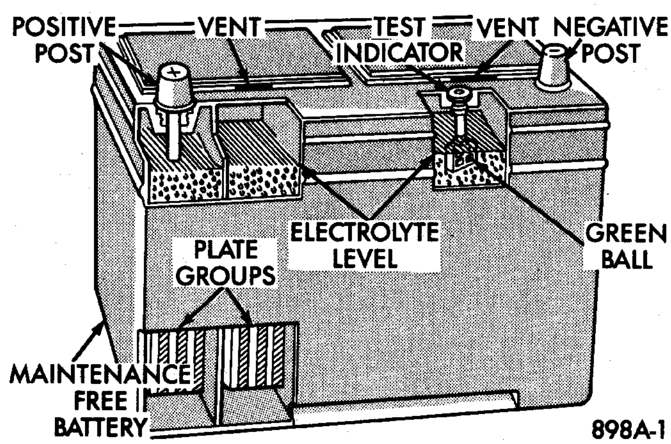

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Fig. 3 Battery Construction and Test Indicator

The battery is adequately charged for further testing and may be returned to use. If the vehicle will not crank for a maximum 15 seconds, refer to BATTERY LOAD TEST in this Group for more information.

NOTE: BLACK OR DARK = 0 to 75% state-of-charge

The battery is INADEQUATELY charged and must be charged until green dot is visible, (12.4 volts or greater) before the battery is tested or returned to

DIAGNOSIS AND TESTING (Continued)

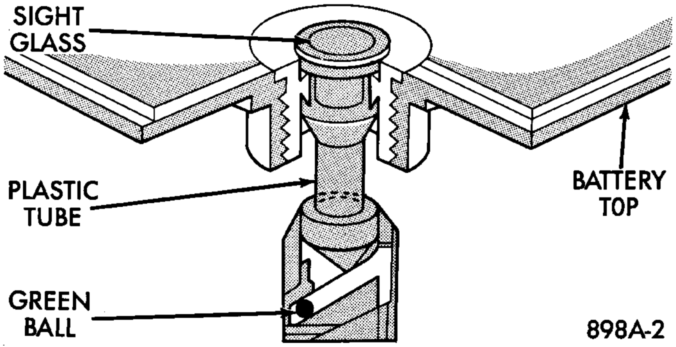

Fig. 4 Test Indicator

use. Refer to Causes of Battery Discharging in this Group for more information.

NOTE: CLEAR COLOR = Replace Battery

WARNING: DO NOT CHARGE, ASSIST BOOST, LOAD TEST, OR ADD WATER TO THE BATTERY WHEN CLEAR COLOR DOT IS VISIBLE. PERSONAL INJURY MAY OCCUR.

A clear color dot shows electrolyte level in battery is below the test indicator (Fig. 2). Water cannot be added to a maintenance free battery. The battery must be replaced. A low electrolyte level may be caused by an over charging condition. Refer to Generator Test Procedures on Vehicle.

CAUSES OF BATTERY DISCHARGING

It is normal to have a small 5 to 25 milliamperes continuous electrical draw from the battery. This draw will take place with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accessories that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period of approximately 20 days the IOD fuse should be pulled. The fuse is located in the power distribution center. Disconnection of this fuse will reduce the level of battery discharge. Refer to Battery Diagnosis and Testing Chart and to the proper procedures.

BATTERY DIAGNOSIS AND TESTING

STEPS	POSSIBLE CAUSE	CORRECTION
VISUAL INSPECTION Check for possible damage to battery and clean battery.	(1) Loose battery post, Cracked battery cover or case, Leaks or Any other physical (2) Battery OK.	(1) Replace Battery (2) Check state of charge. Refer to Test Indicator.
TEST INDICATOR Check Charge Eye Color	(1) GREEN (2) BLACK (3) CLEAR	(1) Battery is charged. Perform Battery 0pen Circuit Voltage Test (2) Perform Battery Charging procedure. (3) Replace Battery.
BATTERY OPEN CIRCUIT VOLTAGE TEST	(1) Battery is above 12.40 Volts (2) Battery is below 12.40 Volts.	(1) Perform the Battery Load Test. (2) Perform Battery Charging procedure.
BATTERY CHARGING	(1) Battery accepted Charge. (2) Battery will not accept charge	(1) Ensure that the indicator eye is GREEN and perform Battery 0pen Circuit Voltage Test (2) Perform Charging a Completely Discharged Battery.
BATTERY LOAD TEST	(1) Acceptable minimum voltage. (2) Unacceptable minimum voltage	(1) Battery is OK to put in use, perform Battery Ignition Off Draw Test. (2) Replace Battery and perform Battery Ignition Off Draw Test.
CHARGING A COMPLETELY DISCHARGED BATTERY	(1) Battery accepted charge. (2) Battery will not accept charge.	(1) Ensure that the indicator eye is GREEN and perform Battery 0pen Circuit Voltage Test. (2) Replace Battery.
IGNITION OFF DRAW TEST	(1) IOD is 5-25 Milliamperes. (2) IOD Exceeds 25 Milliamperes.	(1) Vehicle is normal. (2) Eliminate excess IOD draw.

DIAGNOSIS AND TESTING (Continued)

ABNORMAL BATTERY DISCHARGING

- Corroded battery posts, cables or terminals.
- Loose or worn generator drive belt.
- Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.
- Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.
- Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Battery Ignition Off Draw (IOD).
- Defective charging system.
- Defective battery.

BATTERY IGNITION OFF DRAW (IOD)

High current draw on the battery with the ignition OFF will discharge a battery. After a dead battery is recharged, the vehicle ignition off draw (IOD) should be checked. To determine if a high current draw condition exists first check the vehicle with a test lamp.

(1) Verify that all electrical accessories are OFF.

- Remove key from ignition switch
- Turn off all lights
- Trunk lid is closed
- Engine compartment hood lamp is disconnected or lamp removed
- Glove box door is closed
- Sun visor vanity lights are OFF
- All doors are closed
- Allow the ignition key lamp system to time out in approximately 30 seconds, if equipped.

(2) Disconnect battery negative cable (Fig. 5).

(3) Connect a 12 Volt test lamp, with a cold resistance of 5-7 ohms, between the battery negative cable clamp and the negative post (Fig. 6). If test lamp goes out system is OK. If test lamp lights and stays ON, go to Test Lamp Stays ON procedure.

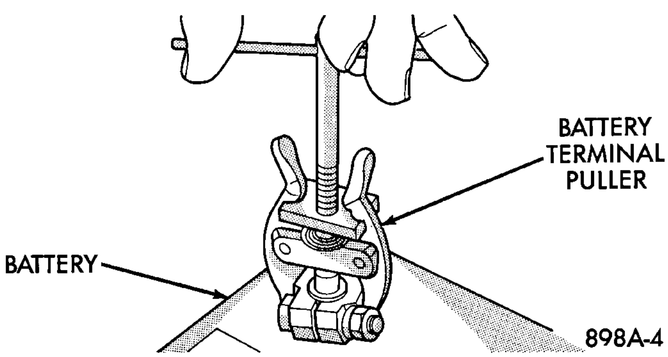

Fig. 5 Disconnect Battery Negative Cable

TEST LAMP STAYS ON

There is either a short circuit or a fault in an electronic module. Two fuses in the Power Distribution Center (PDC) feed the modules with ignition off draw.

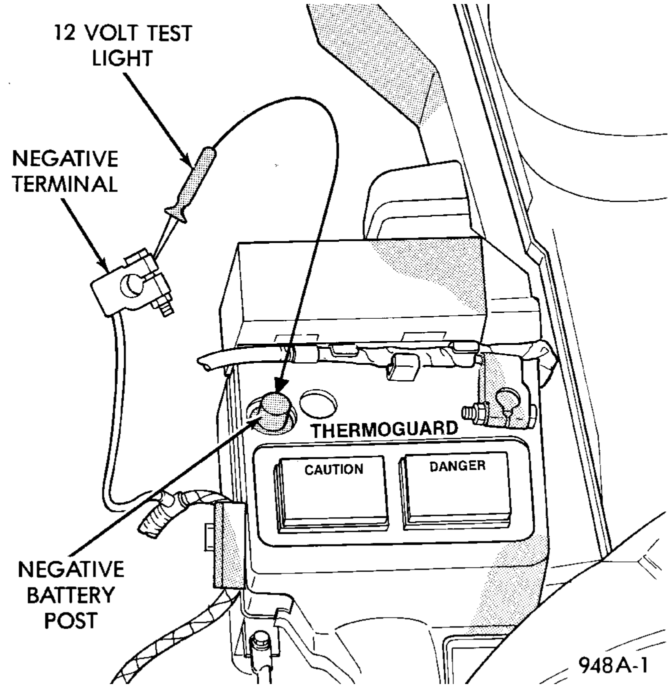

Fig. 6 Ignition OFF (IOD) Test

- Interior lamps fuse (10 Amp) (IOD) PDC.
- Fuel pump fuse (20 Amp) in PDC

(1) Remove interior lamp and fuel pump fuses. By removing these fuses all ignition off draw from the vehicle electronics will be disconnected. The test lamp should go out. If test lamp goes out go to Step 2. If test lamp does not go out there is a current draw or short circuit. Refer to Group 8W, Wiring Diagrams.

(2) Install the fuel pump fuse. If test lamp lights, there is a current draw or short circuit in the A14 wiring circuit feed.

(a) Disconnect Powertrain Control Module.

(b) If test lamp goes out, replace Powertrain Control Module.

(c) If test lamp does not go out, there is a current draw or short circuit in the A14 circuit feed. Refer to Group 8W, Wiring Diagrams.

(3) Install the interior lamp fuse. If test lamp lights, there is a current draw or short circuit in the M01 circuit. Refer to Group 8W, Wiring Diagrams. If test lamp stays out, go to Step 4

(4) Use a multi-meter that has at least a range of 200 milliamperes. Install meter between the battery negative cable and battery negative post (Fig. 7). Carefully remove the test lamp without disconnecting the meter. After all modules time-out the total vehicle IOD should be less than 10 milliamperes. If ignition off draw is more than 10 milliamperes go to Step 5.

(5) Remove both fuses from the Power Distribution Center:

- Fuel pump fuse (20 Amp)

DIAGNOSIS AND TESTING (Continued)

- Interior lamps fuse (10 Amp)

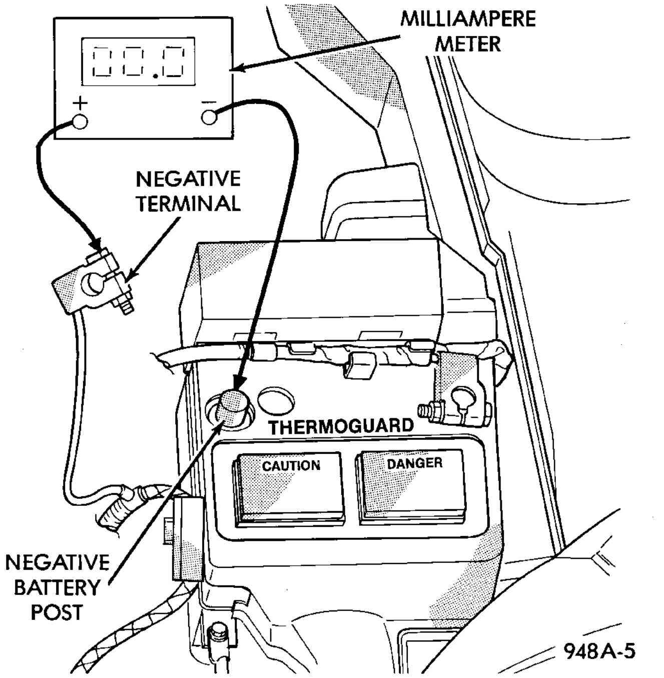

Fig. 7 Milliampere Meter Connection

(6) If there is any reading with fuses removed there is a current draw or short circuit in the wiring. Refer to Group 8W, Wiring Diagrams. If OK go to Step 7.

(7) Install interior lamp fuse. After installing fuse, the current can reach 250 milliamperes. After time-out the reading should not exceed 8 milliamperes. If NOT OK go to Step 8. If OK go to Step 9.

- Ignition key lamp system
- Radio
- Remote keyless entry module, if equipped

(8) Disconnect radio and ignition switch key lamp one component at time, to see if any component is at fault. If the high reading is not eliminated there is a short circuit in the wiring. Refer to Group 8W, Wiring Diagrams.

CAUTION: Always disconnect the meter before opening a door.

(9) Remove interior lamps fuse and install the fuel pump fuse. The reading should be between 1-3 milliamperes. If reading is higher than 3 milliamperes:

(a) Disconnect Powertrain Control Module.

(b) If reading drops to zero, replace Powertrain Control Module.

(c) If reading remains the same there is a current draw or short circuit in the A14 circuit. Refer to Group 8W, Wiring Diagrams.

BATTERY LOAD TEST

A fully charged battery must have cranking capacity, to provide the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking capability of the battery.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.

(1) Remove both battery cables, negative cable first. The battery top, cables and posts should be clean. If green dot is not visible in indicator, charge the battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 8). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 9).

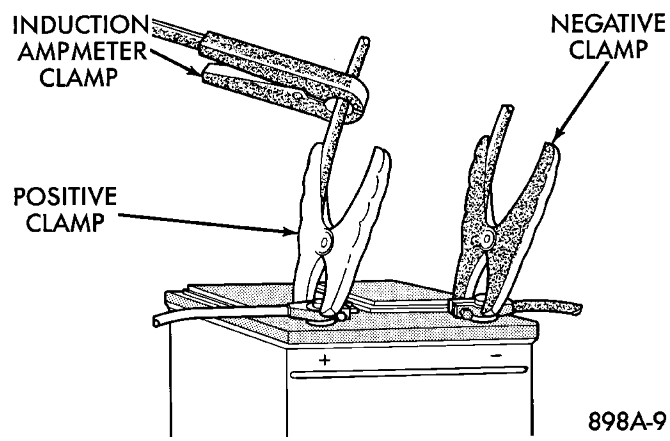

Fig. 8 Volt-Ammeter Load Tester Connections

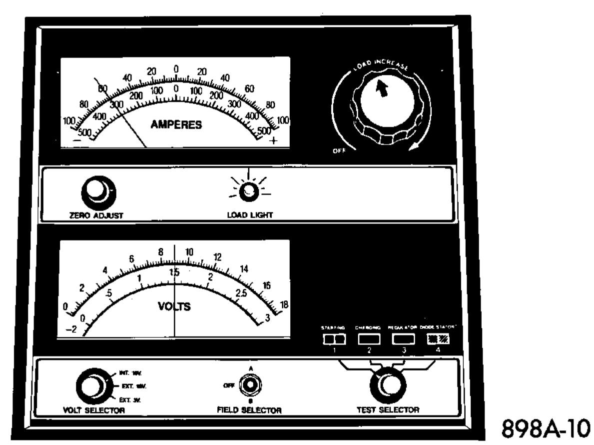

Fig. 9 Remove Surface Charge From Battery

DIAGNOSIS AND TESTING (Continued)

(3) Allow the battery to stabilize for 2 minutes, and then verify open circuit voltage.

(4) Rotate the load control knob on the tester to maintain 50% of the battery cold crank rating for 15 seconds (Fig. 10). Record the loaded voltage reading and return the load control to off. Refer to the Battery Specifications at the rear of this Group.

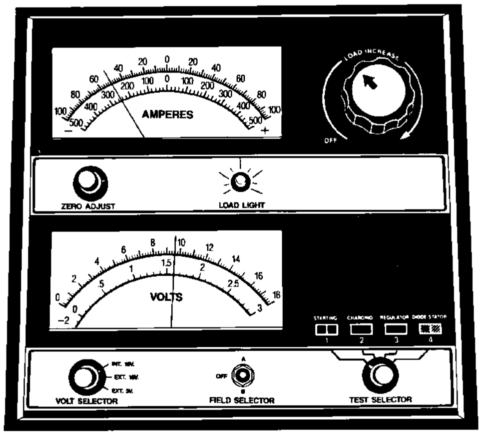

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Fig. 10 Load 50% Cold Crank Rating

(5) Voltage drop will vary according to battery temperature at the time of the load test. Battery temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged or boosted a few minutes prior to the test, the battery would be slightly warmer. Refer to Load Test Voltage Chart for proper loaded voltage reading:

Load Test Temperature		
Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(6) If battery passes load test, it is in good condition and further tests are not necessary. If it fails load test, it should be replaced.

BATTERY OPEN CIRCUIT VOLTAGE TEST

An open circuit voltage no load test shows the state of charge of a battery and whether it is ready for a load test at 50 percent of the battery's cold crank rating. Refer to Battery Load Test. If a battery has open circuit voltage reading of 12.4 volts or greater, and will not pass the load test, replace the battery because it is defective. To test open circuit voltage, perform the following operation.

(1) Remove both battery cables, negative cable first. Battery top, cables and posts should be clean. If green dot is not visible in indicator, charge the battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 8). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 9).

(3) Allow the battery to stabilize for 2 minutes, and then verify the open circuit voltage (Fig. 11).

(4) This voltage reading will approximate the state of charge of the battery. It will not reveal battery cranking capacity (Fig. 12).

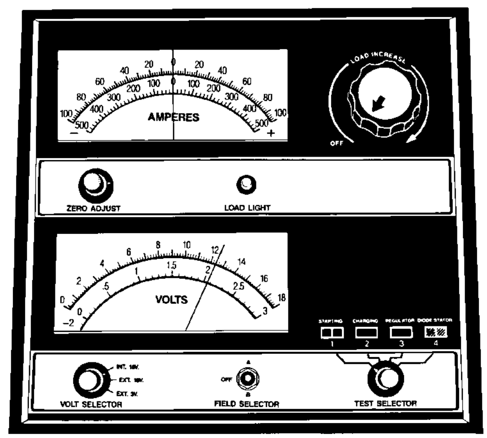

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Fig. 11 Testing Open Circuit Voltage

Open Circuit Volts	Percent Charge
11.7 volts or less	0%
12.0	25%
12.2	50%
12.4	75%
12.6 or more	100%

928A-3

Fig. 12 Battery Open Circuit Voltage

BATTERY TEMPERATURE SENSOR

For Battery Temperature Sensor refer to Group 8C Generator.

SERVICE PROCEDURES

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. 12).
- It passes the 15 second load test. Refer to Battery Load Test.
- The built in test indicator dot is GREEN (Fig. 2).

NOTE: 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. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN.

CAUTION: Disconnect the battery NEGATIVE cable first, before charging battery to avoid damage to electrical systems. Lift the red battery boot cover from the positive cable clamp. Do not exceed 16.0 volts while charging battery. Refer to the instructions supplied with charging equipment

Battery electrolyte may bubble inside of battery case while being charged properly. If the electrolyte boils violently, or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger. Evaluate battery condition. Battery damage may occur if charging is excessive.

Some battery chargers are equipped with polarity sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

CAUTION: Charge battery until test indicator appears green. Do not overcharge.

It may be necessary to jiggle the battery or vehicle to bring the green dot in the test indicator into view.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. Refer to Battery Load Test in this Group. If the battery passes the load test, the battery is OK to use. If battery will not pass the load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service.

CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced (Fig. 13).

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.

Fig. 13 Charging Rate

(1) Measure the voltage at battery posts with a voltmeter accurate to 1/10 volt (Fig. 14). 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.

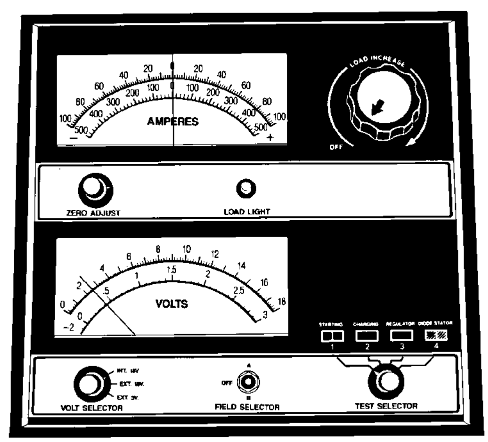

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Fig. 14 Voltmeter Accurate to 1/10 Volt (Connected)

(2) Connect charger leads. Some chargers feature polarity protection circuitry that prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry. This may happen even though the leads are connected properly.

(3) Battery chargers vary in the amount of voltage and current they provide. For the time required for the battery to accept measurable charger current at various voltages, refer to (Fig. 13). If charge current is still not measurable after charging times, the battery should be replaced. If charge current is measur-

SERVICE PROCEDURES (Continued)

able during charging time, the battery may be good, and charging should be completed in the normal manner.

VISUAL INSPECTION

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(1) Clean top of battery with a solution of warm water and baking soda.

(2) Apply soda solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 15).

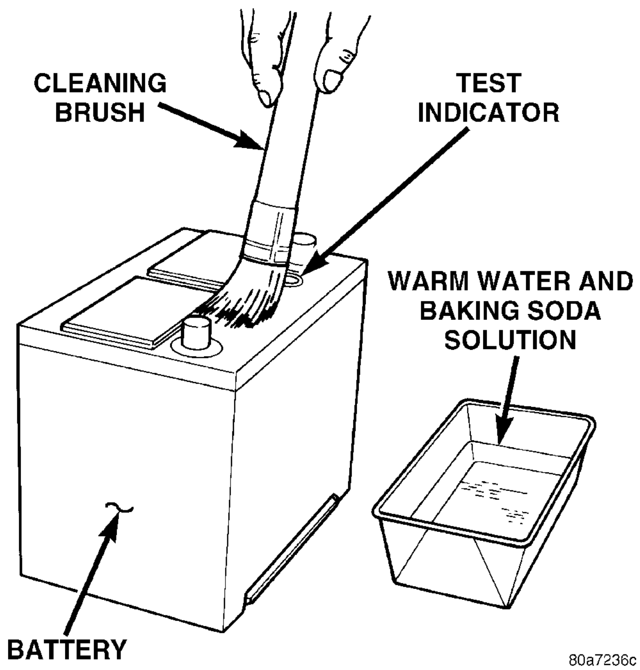


Fig. 15 Cleaning Battery

(3) Rinse soda solution from battery with clear water and blot battery dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.

(4) Inspect battery case and cover for cracks, leakage or damaged hold down ledge. If battery is damaged replace it.

(5) Inspect battery tray for damage caused by acid from battery. If acid is present, clean area with baking soda solution.

(6) Clean battery posts with a battery post cleaning tool (Fig. 16).

(7) Clean battery cable clamps with a battery terminal cleaning tool (Fig. 17). Replace cables that are frayed or have broken clamps.

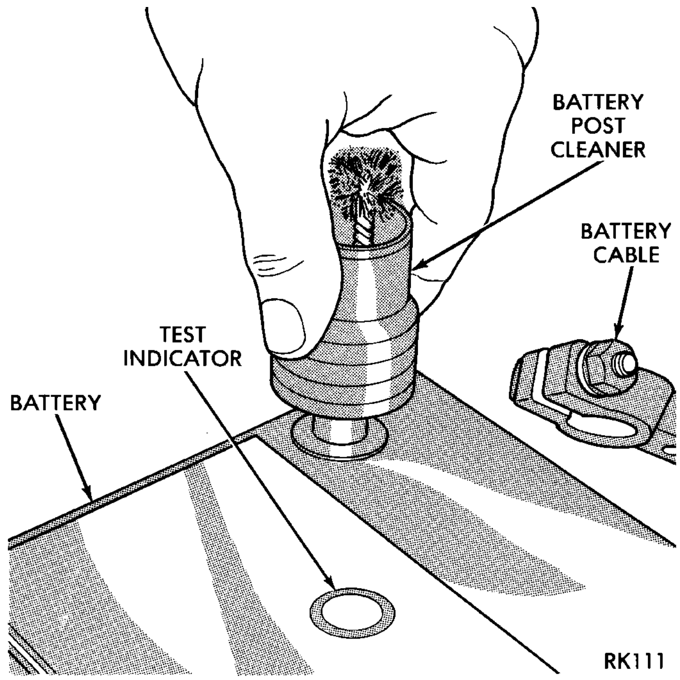


Fig. 16 Cleaning Battery Post

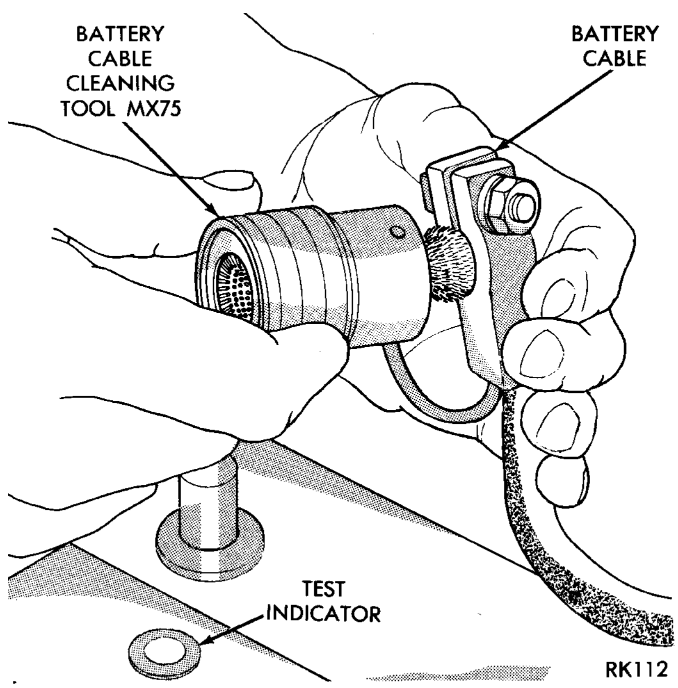


Fig. 17 Cleaning Battery Cable Terminal

REMOVAL AND INSTALLATION

BATTERY

REMOVAL

(1) Make sure ignition switch is in OFF position and all accessories are OFF.

(2) Remove battery negative cable then the positive cable (Fig. 5).

(3) Remove battery thermoguard cover (Fig. 18).

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.

(4) Remove battery hold down clamp (Fig. 19) and battery from vehicle.

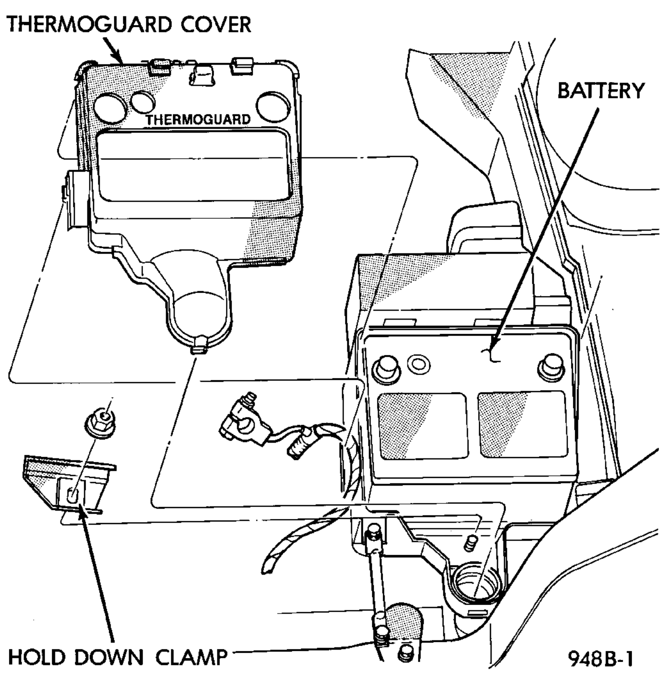


Fig. 18 Battery Thermoguard

INSTALLATION

(1) Install battery in vehicle making sure that it is properly positioned on battery tray.

(2) Install battery hold down clamp, making sure that it is properly positioned on battery.

(3) Place thermoguard cover over the battery and snap it together with battery tray (Fig. 20). The battery tray pencil strut may have to be loosened on one end to install the thermoguard cover. After the thermoguard cover is in place, tighten pencil strut as necessary.

(4) Connect battery cable clamps to battery posts and making sure top of clamp is flush or below with

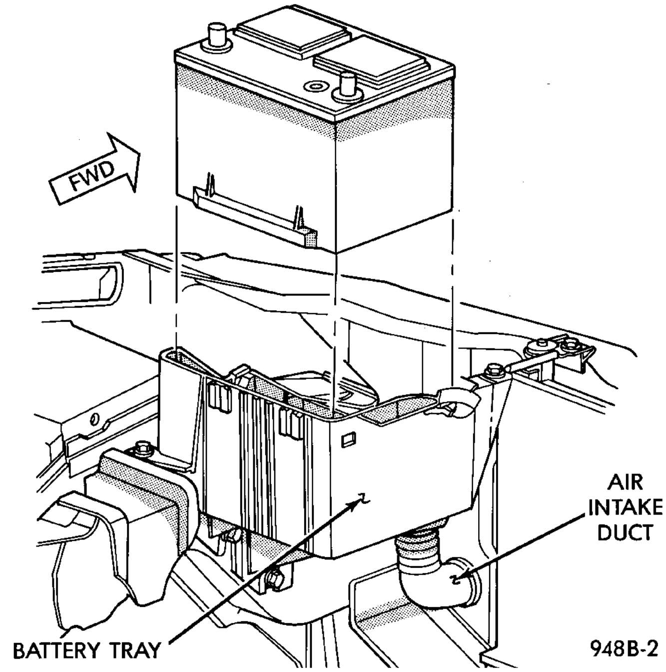


Fig. 19 Battery Hold-Down

top of post (Fig. 21). Install battery positive cable first.

(5) Tighten clamp nuts securely.

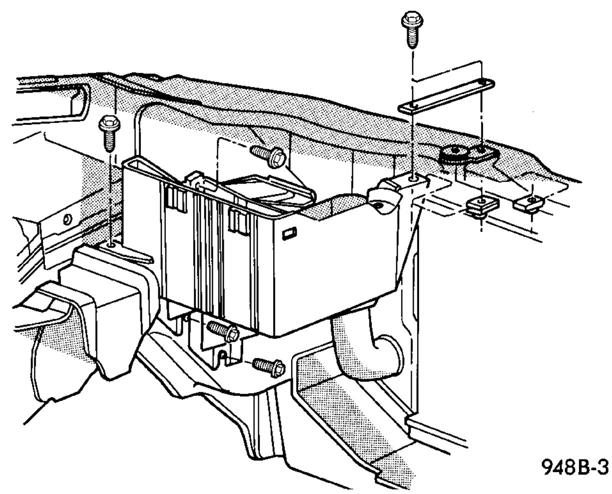


Fig. 20 Battery Tray Removal

BATTERY TRAY

REMOVAL

(1) Remove battery, refer to Battery Removal.

(2) Remove battery tray pencil strut. Remove battery tray, refer to (Fig. 20).

INSTALLATION

For installation reverse above procedures.

REMOVAL AND INSTALLATION (Continued)

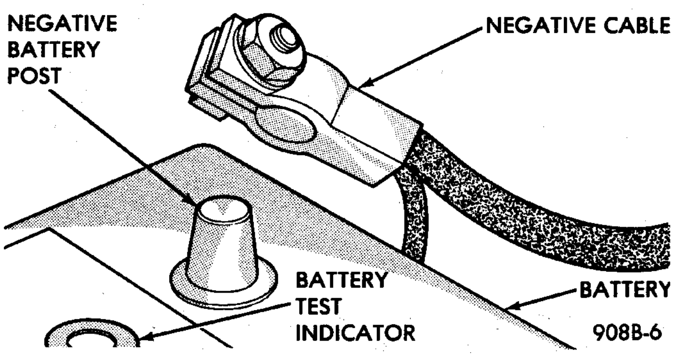


Fig. 21 Remove and Install Battery Cables

FRESH AIR INLET TUBE REMOVAL

REMOVAL

(1) Ensure that the ignition switch and all accessories are OFF

(2) Remove battery negative cable first then the positive cable (Fig. 5).

(3) Remove battery thermoguard cover (Fig. 18).

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.

(4) Squeeze the sides of the tube at the pull strap lock tabs and push down through the hole in the battery tray (Fig. 22). DO NOT push directly down on the pull strap itself.

(5) Remove the tube from the radiator closure panel by squeezing the lock tabs and pushing from the front side (Fig. 19).

INSTALLATION

For installation reverse above procedures. Ensure that the lock tabs are properly seated in the radiator panel and to the bottom of battery tray (Fig. 22). Ensure that the tube opening is properly aligned with hole before pulling on strap.

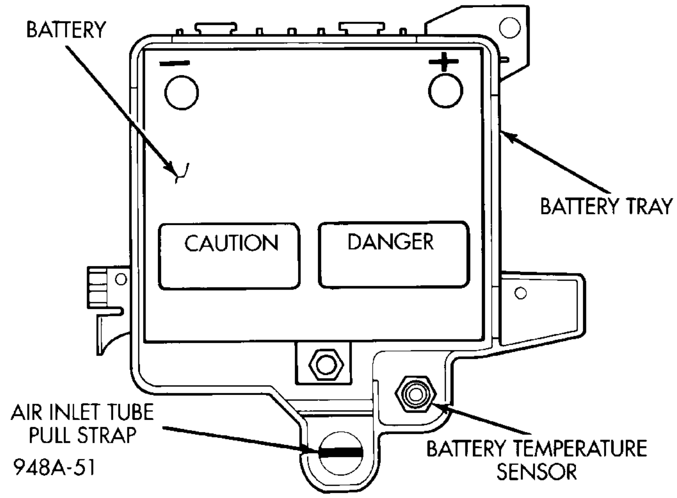


Fig. 22 Air Inlet Tube Pull Strap

SPECIFICATIONS

BATTERY SPECIFICATIONS

Load Test (Amps)	Cold Cranking Rating @ -18°C (0°F)	Reserve Capacity
225 Amp	450 Amp	85 Minutes

COLD CRANK RATING

The current battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at –18° C (0° F).

RESERVE CAPACITY RATING

The length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27°C (80°F).

TORQUE

DESCRIPTION	TORQUE
Battery Hold Down Bolt Clamp Bolt	9 N·m (75 in. lbs.)

STARTING

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The starting system (Fig. 1) has:
- Ignition switch
- Starter relay
- Neutral starting and back up switch
- Clutch pedal position switch
- Wiring harness
- Battery
- Starter motor with an integral solenoid

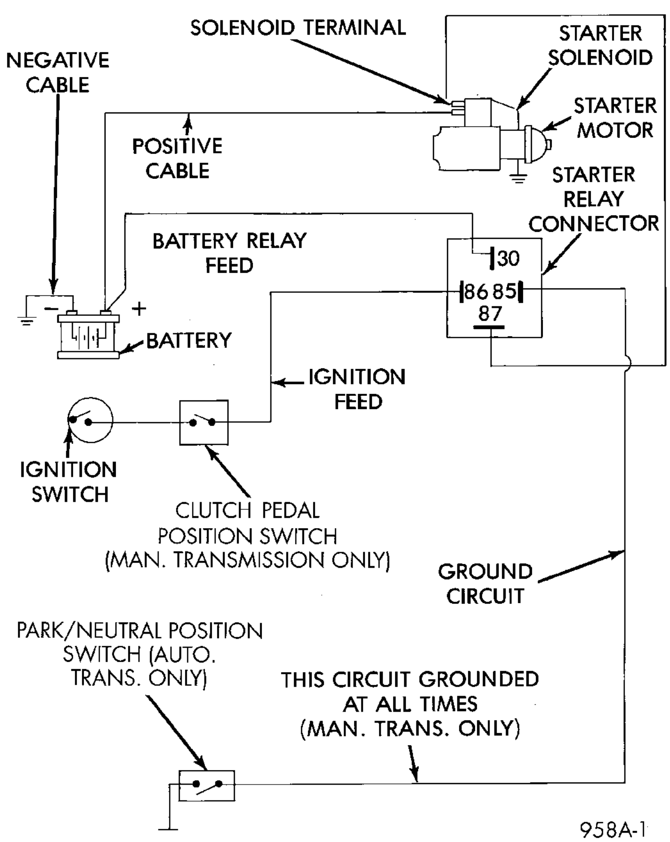


Fig. 1 Starting System

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

BOSCH STARTER

The Bosch is a permanent magnet starter motor. A planetary gear train transmits power between starter motor and pinion shaft. The fields have six permanent magnets. The starter system consists of two separate circuits:
- A high amperage supply to feed the starter motor.
- A low amperage circuit to control the starter solenoid.

SUPPLY CIRCUIT AND CONTROL CIRCUIT

The starter system consists of two separate circuits:
- A high amperage supply to feed the starter motor.
- A low amperage circuit to control the starter solenoid.

DIAGNOSIS AND TESTING

CONTROL CIRCUIT TEST

The starter control circuit has:

- Starter solenoid
- Starter relay
- Transmission range sensor, or Park/Neutral Position switch with automatic transmissions
- Clutch Pedal Position Switch with manual transmissions
- Ignition switch
- Battery
- All related wiring and connections

CAUTION: Before performing any starter tests, the ignition and fuel systems must be disabled.

- To disable ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the in the Power Distribution Center (PDC). Refer to the PDC cover for the proper relay location.

STARTER SOLENOID

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION WITH THE PARKING BRAKE APPLIED

(1) Verify battery condition. Battery must be in good condition with a full charge before performing any starter tests. Refer to Battery Tests.

(2) Perform Starter Solenoid test BEFORE performing the starter relay test.

(3) Raise the vehicle.

(4) Perform a visual inspection of the starter/starter solenoid for corrosion, loose connections or faulty wiring.

(5) Lower the vehicle.

(6) Locate and remove the starter relay from the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location.

(7) Connect a remote starter switch or a jumper wire between the remote battery positive post and terminal 87 of the starter relay connector.

(a) If engine cranks, starter/starter solenoid is good. Go to the Starter Relay Test.

(b) If engine does not or solenoid chatters, check wiring and connectors from starter relay to starter solenoid for loose or corroded connections. Particularly at starter terminals.

(c) Repeat test. If engine still fails to crank properly, trouble is within starter or starter mounted solenoid, and replace starter.

STARTER RELAY

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION/NEUTRAL WITH THE PARKING BRAKE APPLIED

RELAY TEST

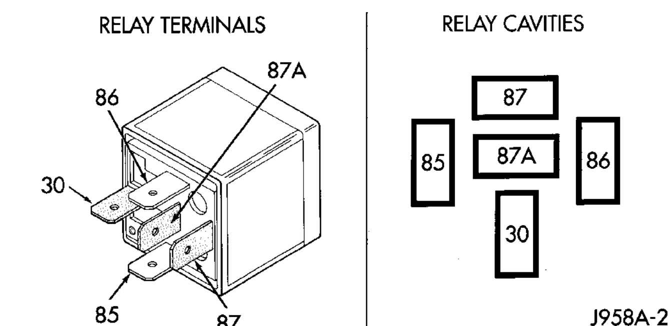
The starter relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

Remove the starter relay from the PDC as described in this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ±5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery B+ lead to terminals 86 and a ground lead to terminal 85 to energize the relay. The relay should click. Also test for continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to Relay Circuit Test procedure. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Starter Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the PDC fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coils. There should be

DIAGNOSIS AND TESTING (Continued)

continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open circuit to the starter solenoid as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. On vehicles with a manual transmission, the clutch pedal must be fully depressed for this test. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If not OK with an automatic transmission, check for an open or short circuit to the ignition switch and repair, if required. If the circuit to the ignition switch is OK, see the Ignition Switch Test procedure in this group. If not OK with a manual transmission, check the circuit between the relay and the clutch pedal position switch for an open or a short. If the circuit is OK, see the Clutch Pedal Position Switch Test procedure in this group.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. On vehicles with an automatic transmission, it is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. On vehicles with a manual transmission, it is grounded at all times. Check for continuity to ground at the cavity for relay terminal 85. If not OK with an automatic transmission, check for an open or short circuit to the park/neutral position switch and repair, if required. If the circuit is OK, see the Park/Neutral Position Switch Test procedure in this group. If not OK with a manual transmission, repair the circuit to ground as required.

SAFETY SWITCHES

For diagnostics,

- Clutch Pedal Position Switch, refer to Group 6, Clutch.
- Park/Neutral Position Switch, refer to Group 21, Transaxle

IGNITION SWITCH

After testing starter solenoid and relay, test ignition switch and wiring. Refer to Group 8D, Ignition Systems or Group 8W, Wiring Diagrams. Check all wiring for opens or shorts, and all connectors for being loose or corroded.

BATTERY

Refer to Group 8A, Battery for proper procedures.

ALL RELATED WIRING AND CONNECTORS

Refer to Group 8W, Wiring Diagrams,

FEED CIRCUIT RESISTANCE TEST

Before proceeding with this operation, review Diagnostic Preparation and Starter Feed Circuit Tests. The following operation will require a voltmeter, accurate to 1/10 of a volt.

CAUTION: Ignition system also must be disabled to prevent engine start while performing the following tests.

(1) To disable the ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for proper relay location.

(2) With all wiring harnesses and components properly connected, perform the following:

(a) Connect the negative lead of the voltmeter to the battery negative post, and positive lead to the battery negative cable clamp (Fig. 2). Rotate and hold the ignition switch in the START position. Observe the voltmeter. If voltage is detected, correct poor contact between cable clamp and post.

(b) Connect positive lead of the voltmeter to the battery positive post, and negative lead to the battery positive cable clamp (Fig. 2). Rotate and hold the ignition switch key in the START position. Observe the voltmeter. If voltage is detected, correct poor contact between the cable clamp and post.

(c) Connect negative lead of voltmeter to battery negative terminal, and positive lead to engine block near the battery cable attaching point (Fig. 3). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, correct poor contact at ground cable attaching point. If voltage reading is still above 0.2 volt after correcting poor contacts, replace ground cable.

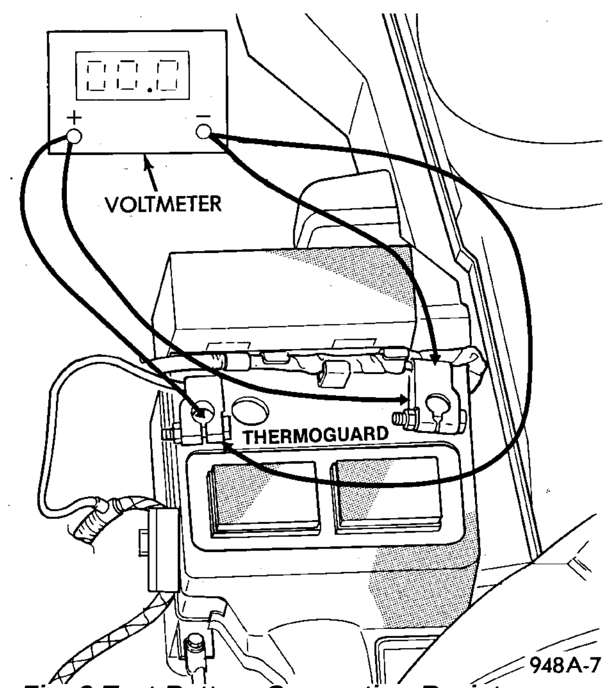


Fig. 2 Test Battery Connection Resistance

DIAGNOSIS AND TESTING (Continued)

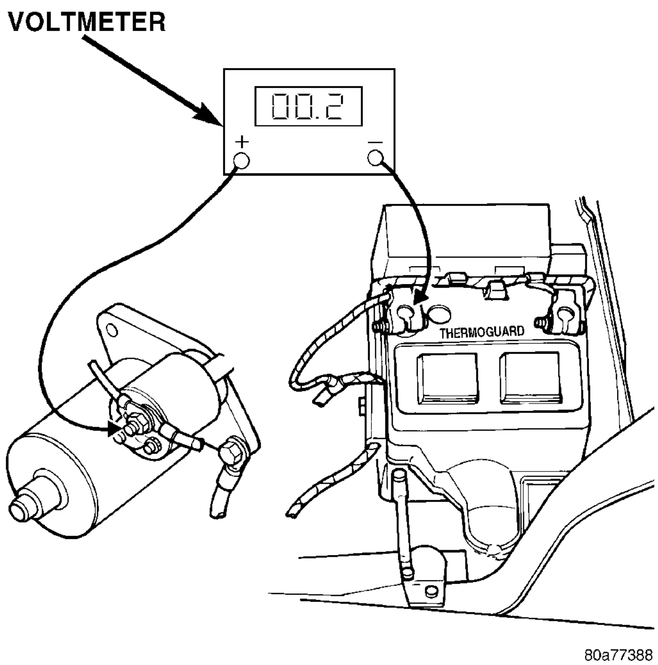


Fig. 3 Test Ground Circuit Resistance

(3) Connect positive voltmeter lead to the starter motor housing and the negative lead to the battery negative terminal (Fig. 4). Hold the ignition switch key in the START position. If voltage reads above 0.2 volt, correct poor starter to engine ground.

(a) Connect the positive voltmeter lead to the battery positive terminal, and negative lead to battery cable terminal on starter solenoid (Fig. 5). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, correct poor contact at battery cable to solenoid connection. If reading is still above 0.2 volt after correcting poor contacts, replace battery positive cable.

(b) If resistance tests do not detect feed circuit failures, replace the starter motor.

FEED CIRCUIT TEST

The following procedure will require a suitable volt-ampere tester (Fig. 6).

CAUTION: Before performing any starter tests, the ignition and fuel systems must be disabled.

(1) Connect a volt-ampere tester to the battery terminals (Fig. 7). Refer to the operating instructions provided with the tester being used.

(2) To disable the ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for proper relay location. The 2.5L Diesel Engine, to disable the engine from starting, disconnect wire connector from the Fuel Solenoid.

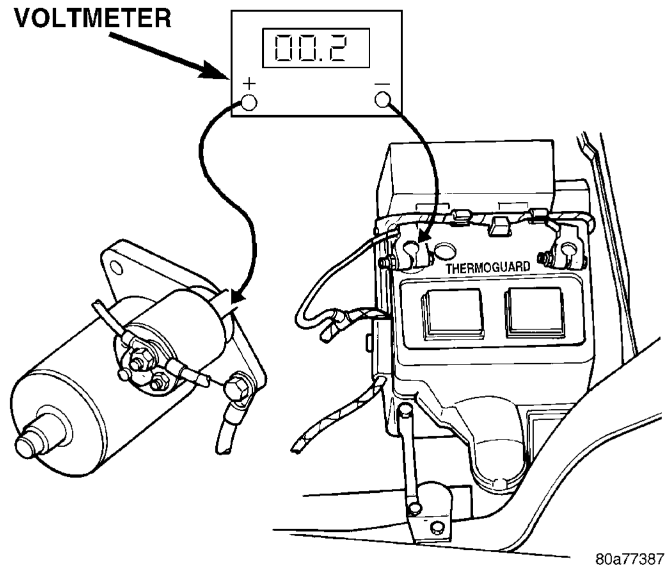


Fig. 4 Test Starter Motor Ground

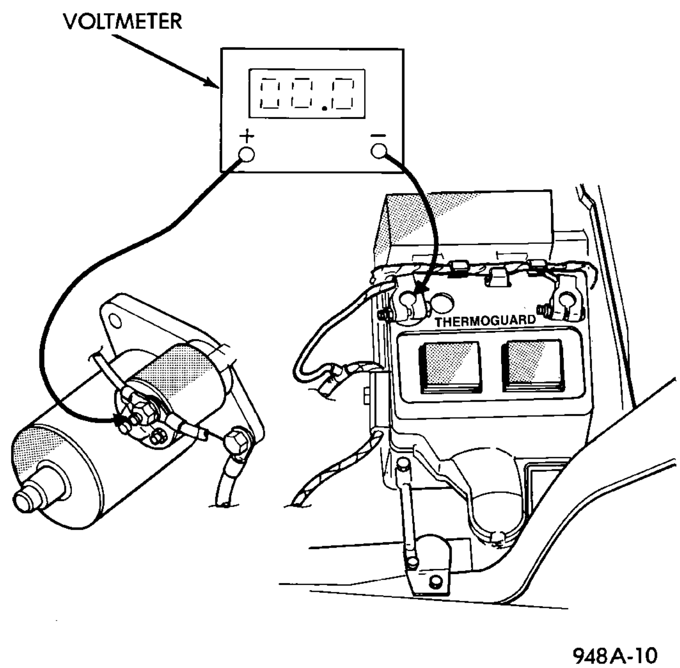


Fig. 5 Test Battery Positive Cable Resistance

(3) Verify that all lights and accessories are OFF, and the transmission shift selector is in the PARK position or with the clutch pedal depressed and SET parking brake.

CAUTION: Do not overheat the starter motor or draw the battery voltage below 9.6 volts during cranking operations.

(4) Rotate and hold the ignition switch in the START position. Observe the volt-ampere tester (Fig. 6).

DIAGNOSIS AND TESTING (Continued)

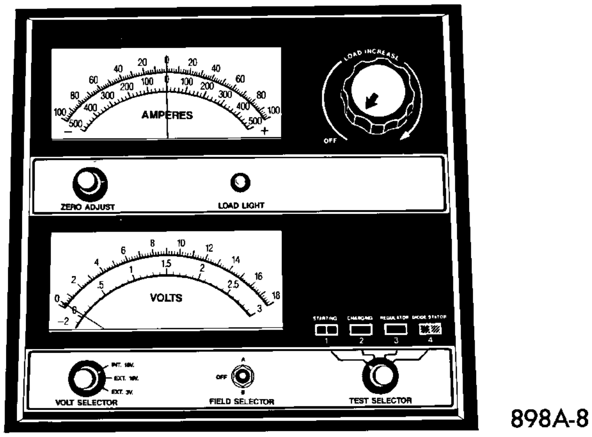


Fig. 6 Volt Ampere Tester

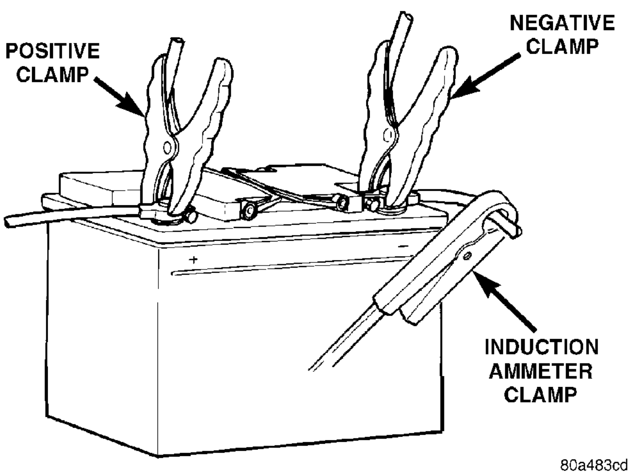


Fig. 7 Volt-Ampere Tester Connections

- If voltage reads above 9.6 volts, and amperage draw reads above 280 amps or the Diesel engine above 450 amps, check for engine seizing or faulty starter.
- If voltage reads 12.4 volts or greater and amperage reads 0 to 10 amps, check for corroded cables and/or bad connections.
- Voltage below 9.6 volts and amperage draw above 300 amps or Diesel engine above 500 amps, the problem is the starter. Replace the starter refer to starter removal.

(5) After the starting system problems have been corrected, verify the battery state-of-charge and charge battery if necessary. Disconnect all testing equipment and connect ASD relay or the Fuel Solenoid. Start the vehicle several times to assure the problem has been corrected.

STARTING SYSTEM TEST

For circuit descriptions and diagrams, refer to 8W-21, Starting System in Group 8W, Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

INSPECTION

Before removing any unit from the starting system for repair or diagnosis, perform the following inspections:

- **Battery** - Visually inspect the battery for indications of physical damage and loose or corroded cable connections. Determine the state-of-charge and cranking capacity of the battery. Charge or replace the battery, if required. Refer to Group 8A, Battery for more information.
- **Ignition Switch** - Visually inspect the ignition switch for indications of physical damage and loose or corroded wire harness connections.
- **Clutch Pedal Position Switch** - Visually inspect the clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections.
- **Park/Neutral Position Switch** - Visually inspect the park/neutral position switch for indications of physical damage and loose or corroded wire harness connections.
- **Starter Relay** - Visually inspect the starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter** - Visually inspect the starter for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect the starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect the wire harness for damage. Repair or replace any faulty wiring, as required.

DIAGNOSIS AND TESTING (Continued)

STARTING SYSTEM DIAGNOSIS		
CONDITION	**POSSIBLE CAUSE**	**CORRECTION**
STARTER FAILS TO ENGAGE.	1. Battery discharged or faulty. 2. Starting circuit wiring faulty. 3. Starter relay faulty. 4. Ignition switch faulty. 5. Park/Neutral position switch (auto trans) faulty or mis-adjusted. 6. Clutch pedal position switch (man trans) faulty. 7. Starter solenoid faulty. 8. Starter assembly faulty.	1. Refer to Group 8A, Battery. Charge or replace battery, if required. 2. Refer to Feed Circuit Resistance Test and Feed Circuit Test in this section. 3. Refer to Relay Test, in this section. Replace relay, if necessary. 4. Refer to Ignition Switch Test, in Group 8D Ignition System or Group 8W, Wiring Diagrams. Replace switch, if necessary. 5. Refer Park/Neutral Position Switch Test, in Group 21, Transaxle. Replace switch, if necessary. 6. Refer to Clutch Pedal Position Switch Test, in Group 6, Clutch. Replace switch, if necessary. 7. Refer to Solenoid Test, in this section. Replace starter assembly, if necessary. 8. If all other starting system components and circuits check OK, replace starter assembly.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty. 2. Starting circuit wiring faulty. 3. Starter assembly faulty. 4. Engine seized.	1. Refer to Group 8A, Battery. Charge or replace battery as necessary. 2. Refer to the Feed Circuit Resistance Test and the Feed Circuit Test in this section. Repair as necessary. 3. If all other starting system components and circuits check OK, replace starter assembly. 4. Refer to Group 9 Engine, for diagnostic and service procedures.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Broken teeth on starter ring gear. 2. Starter assembly faulty.	1. Remove starter. Inspect ring gear and replace if necessary. 2. If all other starting system components and circuits check OK, replace starter assembly.
STARTER DOES NOT DISENGAGE.	1. Starter improperly installed. 2. Starter relay faulty. 3. Ignition switch faulty. 4. Starter assembly faulty.	1. Install starter. Tighten starter mounting hardware to correct torque specifications. 2. Refer to Relay Test, in this section. Replace relay, if necessary. 3. Refer to Ignition Switch Test, in Group 8D, Ignition System. Replace switch, if necessary. 4. If all other starting system components and circuits check OK, replace starter assembly.

REMOVAL AND INSTALLATION

SAFETY SWITCHES

For Removal and Installation of the:

• Clutch Position Switch, refer to Group 6, Clutch.

• Park/Neutral Switch, refer to Group 21, Transaxle.

STARTER

REMOVAL

(1) Disconnect battery negative cable (Fig. 8).

(2) Raise vehicle.

(3) Vehicles equipped with A/C:

(a) Using a floor jack or jack stand, support the engine and transmission assembly so they will not rotate.

(b) Remove the front engine mount bolt from the insulator and front crossmember mounting bracket (Fig. 9).

(c) Lower the front of the engine, rotate the engine forward, allowing easier removal of starter motor.

(4) For easier servicing, do not remove the wiring from starter at this time.

(5) Remove two bolts attaching starter to transmission housing (Fig. 10).

(6) Remove starter/starter solenoid assembly from transmission housing. Position the starter to gain access to the wiring connectors.

(7) Remove the battery positive cable nut and remove the battery positive and generator output wire from the starter (Fig. 11).

(8) Disconnect push-on solenoid connector.

(9) Position the starter vertically such that the pinion end faces downward.

(10) Remove the starter through the bottom of the vehicle. Move aside A/C plumbing as necessary.

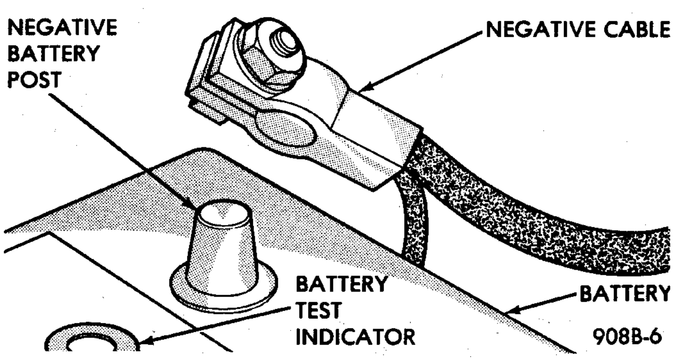


Fig. 8 Battery Cable Removal and Installation

INSTALLATION

(1) Clean corrosion/dirt from the cable and wire terminals before installing wiring to the solenoid.

(2) Connect the battery positive and generator output wire to the starter solenoid post (Fig. 11).

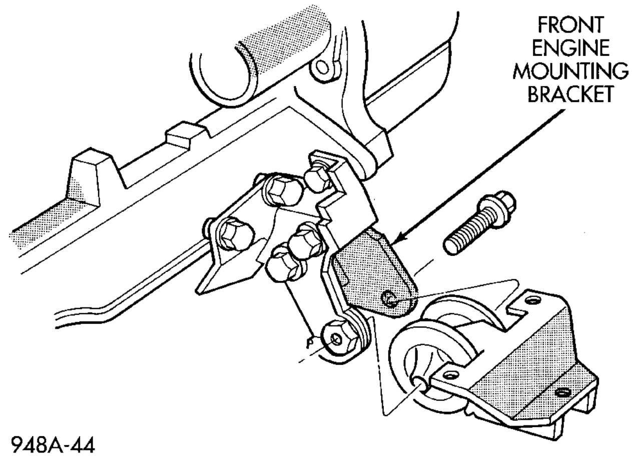


Fig. 9 Front Engine Mount Bolt Removal

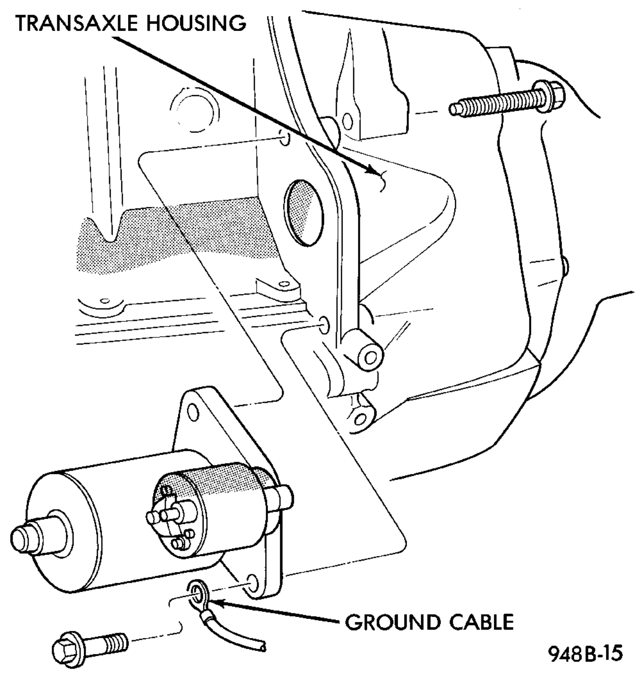


Fig. 10 Starter Removal

CAUTION: It is critical that the generator output terminal be connected to the battery positive terminal of the starter solenoid, for proper operation of the charging and cranking systems.

(3) Connect the push-on solenoid connector.

(4) Position the starter face into transmission housing. Support starter in pilot and start the top bolt (Fig. 10).

(5) Attach ground cable to lower mounting bolt and start bolt.

(6) Ensure the proper starter alignment before tightening the starter mounting bolts to 54 N·m (40 ft. lbs.) torque.

(7) Vehicles equipped with A/C:

REMOVAL AND INSTALLATION (Continued)

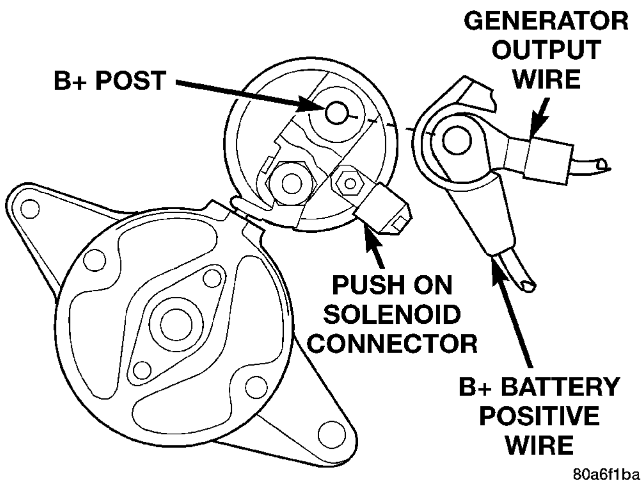


Fig. 11 Wire Connection

(a) Using a floor jack or jack stand, raise the engine and transmission assembly to the original position.

(b) Install the front engine mount bolt through the insulator and front crossmember mounting bracket (Fig. 9).

(c) Tighten bolt to 54 N·m (40 ft. lbs.) torque.

(8) Lower vehicle and connect battery cables.

STARTER RELAY

The relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for relay location.

SPECIFICATIONS

STARTER

Manufacturer	BOSCH
Engine Application	2.0L OHC - DOHC
Power rating	0 .95 Kw
Voltage	12 VOLTS
No. of Fields	6
No. of Poles	6
Brushes	4
Drive	Planetary Gear Train
Cranking Amperage Draw test	150 - 280 Amps.

Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

TORQUE

DESCRIPTION	TORQUE
Starter Mounting Bolts	54 N·m (40 ft. lbs.)
Starter Solenoid Battery Nut	10 N·m (90 in. lbs.)

CHARGING SYSTEM

CONTENTS

GENERAL INFORMATION

OVERVIEW

The battery, starting, and charging systems operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components involved in these systems must perform within specifications.

Group 8A covers the battery, Group 8B covers the starting system, and Group 8C covers the charging system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in these groups include the most basic conventional diagnostic methods to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. See the On-Board Diagnostics Test in Group 8C - Charging System for more information.

DESCRIPTION AND OPERATION

CHARGING SYSTEM OPERATION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to Group 8D, Ignition System for information)
- Battery (refer to Group 8A, Battery for information)
- Battery temperature sensor
- Voltmeter (refer to Group 8E, Instrument Panel and Gauges for information)
- Wiring harness and connections (refer to Group 8W, Wiring for information)

The charging system is turned on and off with the ignition switch. When the ignition switch is turned to the ON position, battery voltage is applied to the generator rotor through one of the two field terminals to produce a magnetic field. The generator is driven by the engine through a serpentine belt and pulley arrangement.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry, contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor located on the front bumper beam is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly and to maintain

DESCRIPTION AND OPERATION (Continued)

the proper voltage depending on battery temperature.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including the EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. See On-Board Diagnostic System Test in this group for more information.

GENERATOR

The generator is belt-driven by the engine. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicle electrical system through the generator, battery, and ground terminals.

Noise emitting from the generator may be caused by:

- Worn, loose or defective bearings
- Loose or defective drive pulley
- Incorrect, worn, damaged or misadjusted drive belt
- Loose mounting bolts
- Misaligned drive pulley
- Defective stator or diode

BATTERY TEMPERATURE SENSOR

The battery temperature sensor is used to determine the battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The sensor is located forward of the vehicle battery, and is attached to the battery tray (Fig. 1).

ELECTRONIC VOLTAGE REGULATOR

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

Operation: The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

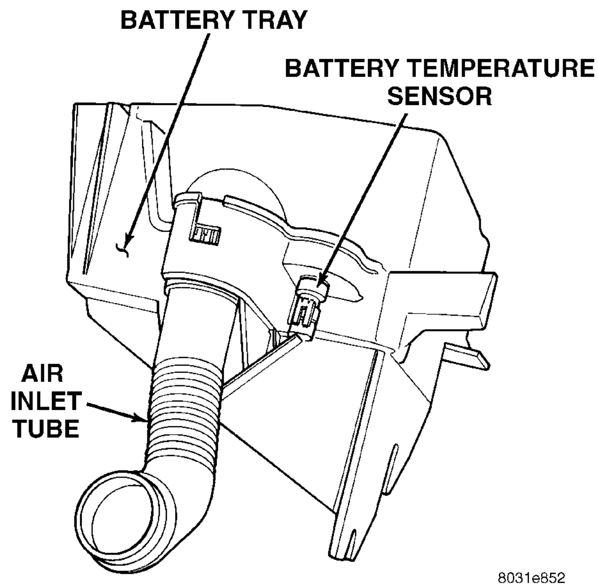


Fig. 1 Battery Temperature Sensor

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage and battery temperature (refer to Battery Temperature Sensor for more information). It then compensates and regulates generator current output accordingly. Also see Charging System Operation for additional information.

DIAGNOSIS AND TESTING

CHARGING SYSTEM

When the ignition switch is turned to the ON position, battery potential will register on the voltmeter. During engine cranking a lower voltage will appear on the meter. With the engine running, a voltage reading higher than the first reading (ignition in ON) should register.

The following are possible symptoms of a charging system fault:

- The voltmeter does not operate properly
- An undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- Accessories being left on with the engine not running
- A faulty or improperly adjusted switch that allows a lamp to stay on. See Ignition-Off Draw Test in Group 8A, Battery for more information.

DIAGNOSIS AND TESTING (Continued)

The following procedures may be used to correct a problem diagnosed as a charging system fault.

INSPECTION

(1) Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.

(2) Inspect all fuses in the fuseblock module and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(3) Inspect the electrolyte level in the battery. Replace battery if electrolyte level is low.

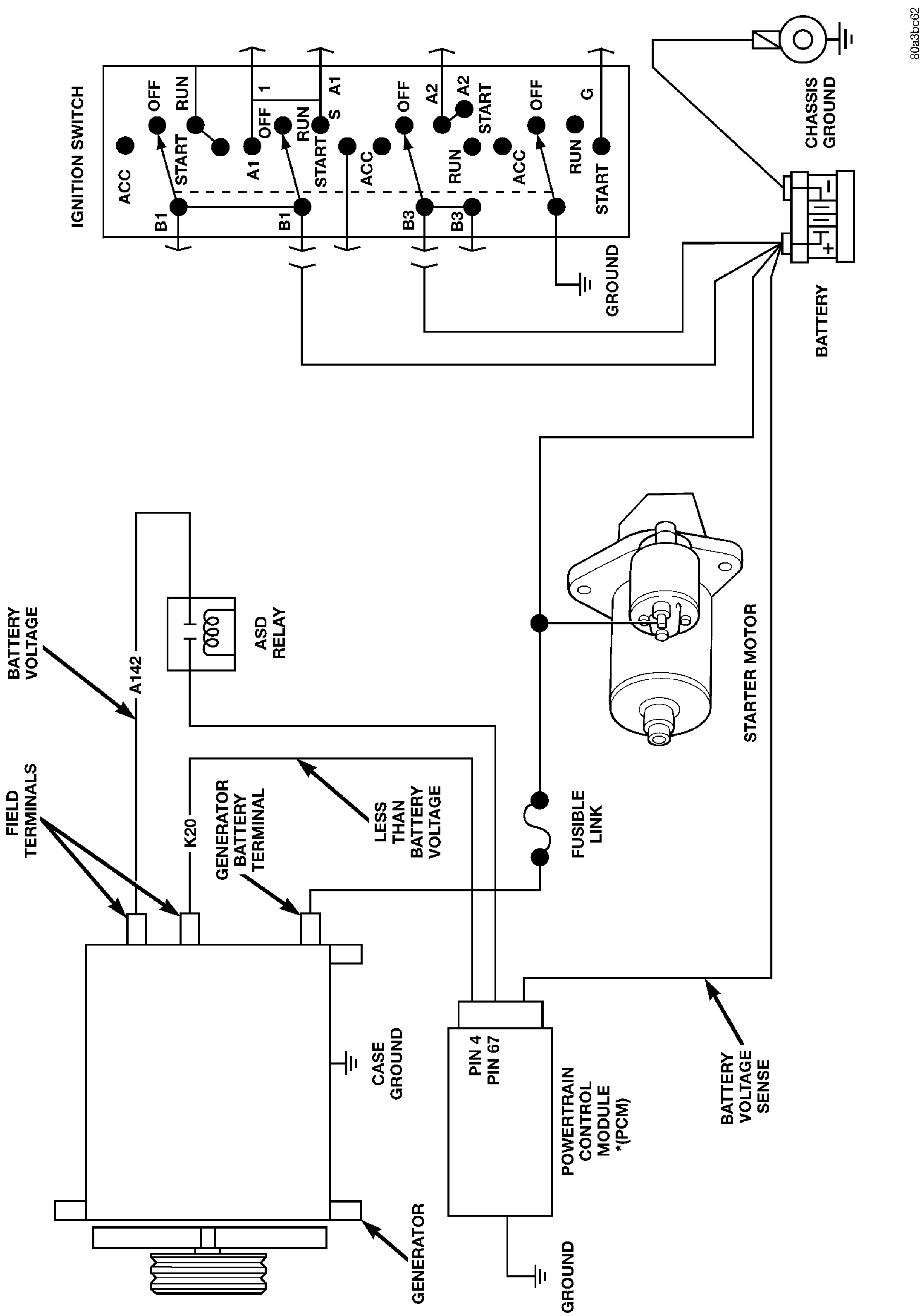
(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in Group 7, Cooling System.

(6) Inspect automatic belt tensioner (if equipped). Refer to Group 7, Cooling System for information.

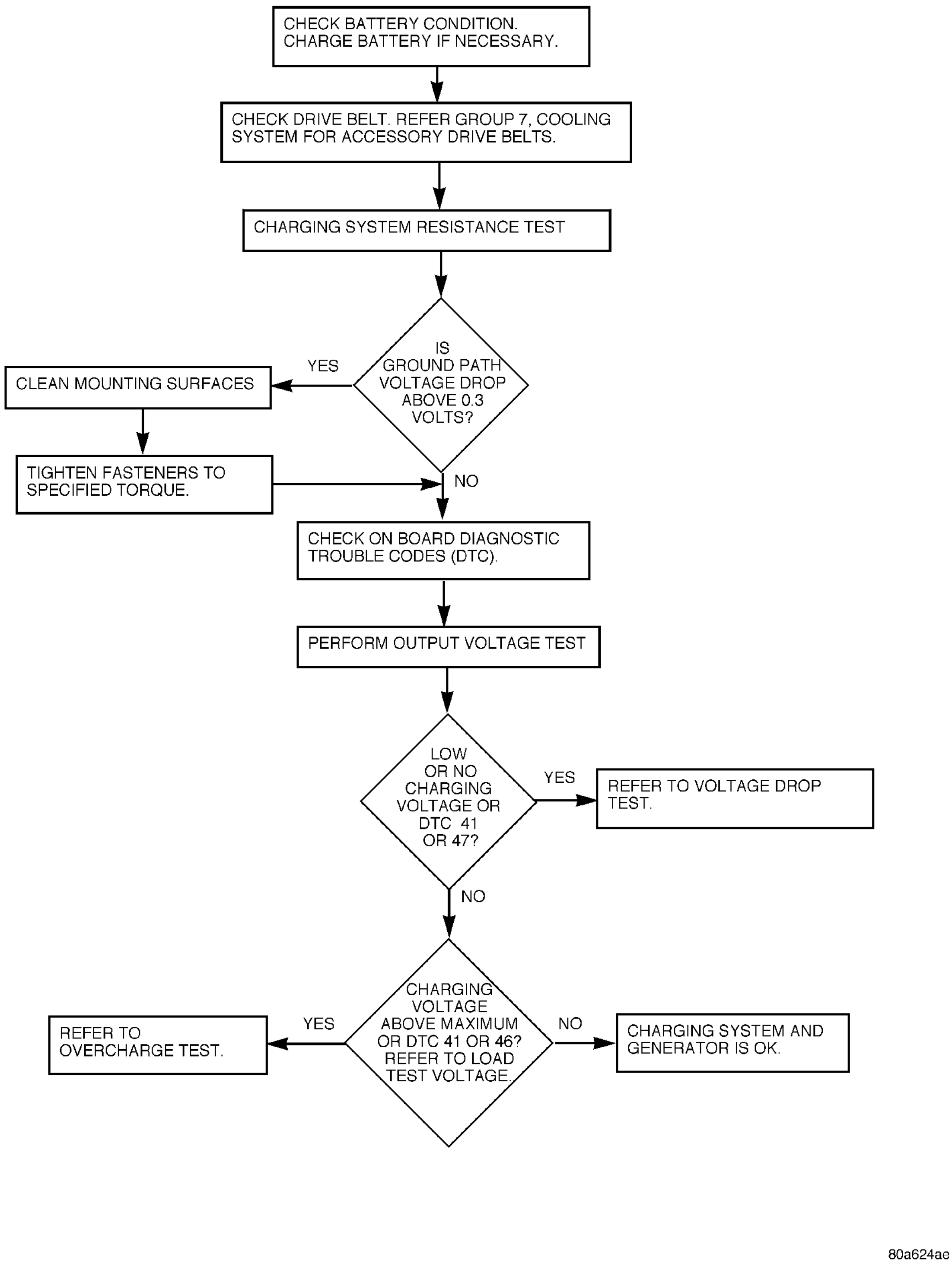
(7) Inspect connections at generator field, battery output, and ground terminals. Also check ground connection at engine. They should all be clean and tight. Repair as required.

DIAGNOSIS AND TESTING (Continued)



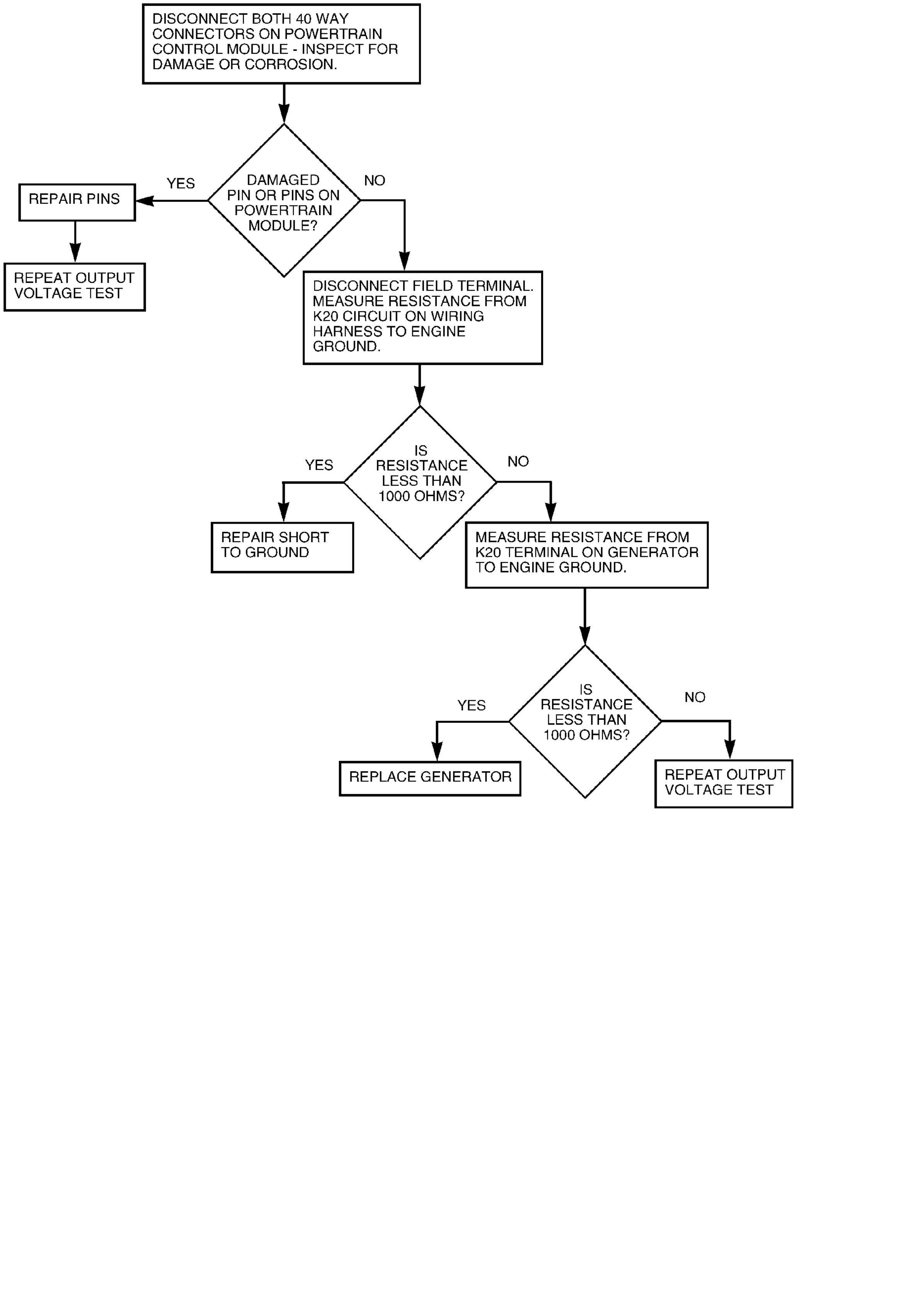
Charging System Schematic—Typical

DIAGNOSIS AND TESTING (Continued)



Charging System Test

DIAGNOSIS AND TESTING (Continued)



Overcharge Test

DIAGNOSIS AND TESTING (Continued)

CHARGING SYSTEM RESISTANCE TESTS

These tests will show the amount of voltage drop across the generator output wire from the generator output (B+) terminal to the battery positive post. They will also show the amount of voltage drop from the ground (-) terminal on the generator (Fig. 2) to the battery negative post.

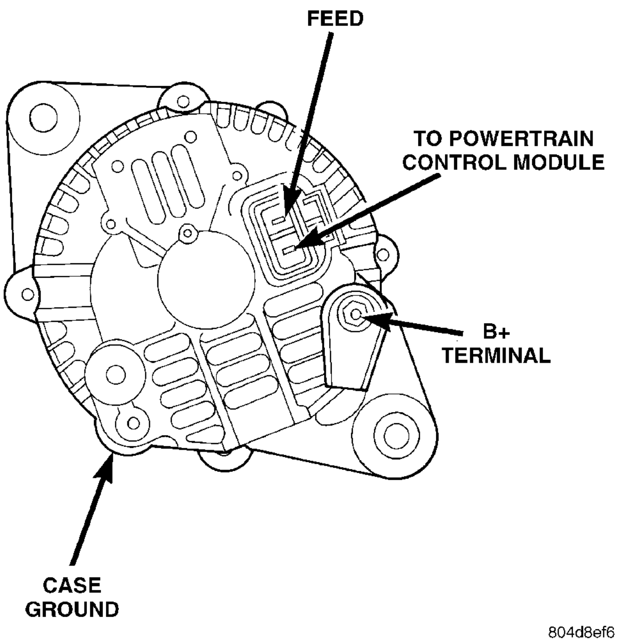


Fig. 2 Generator Terminals

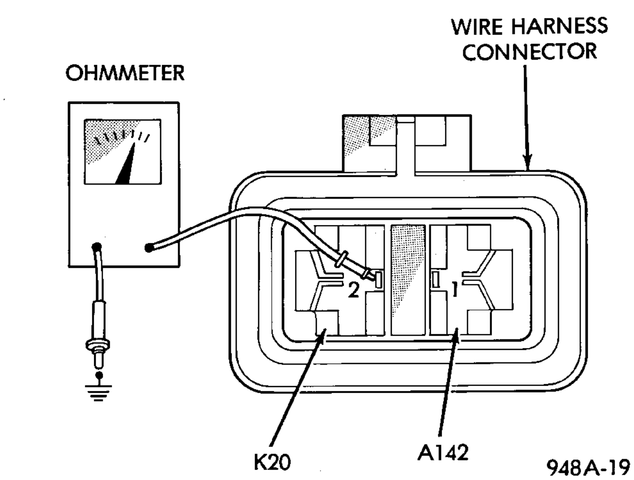


Fig. 3 Electrical Resistance Test

A voltmeter with a 0–18 volt DC scale should be used for these tests. By repositioning the voltmeter test leads, the point of high resistance (voltage drop) can easily be found.

Test points on the generator may be reached by either removing the air cleaner housing or below by raising the vehicle on a hoist.

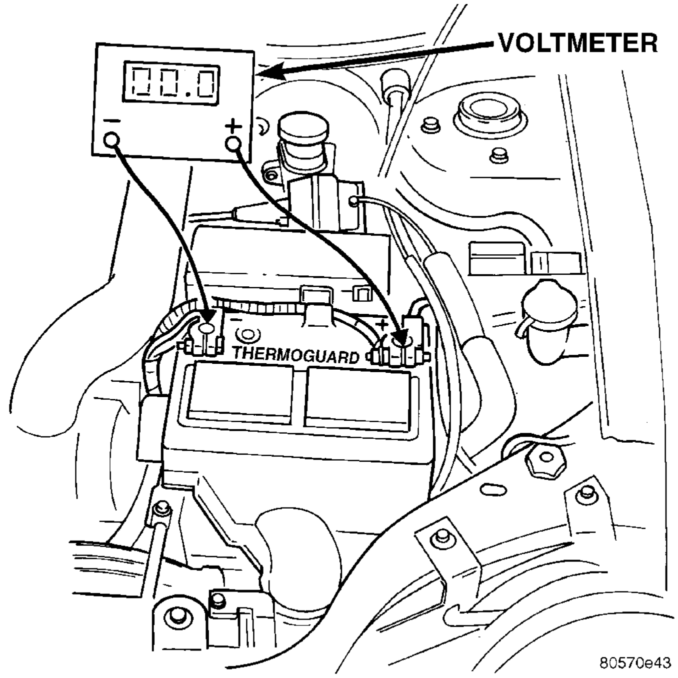


Fig. 4 Battery Voltage Test

PREPARATION

(1) Before starting test, make sure battery is in good condition and is fully-charged. See Group 8A, Battery for more information.

(2) Check condition of battery cables at battery. Clean if necessary.

(3) Start the engine and allow it to reach normal operating temperature.

(4) Shut engine off.

(5) Connect an engine tachometer.

(6) Fully engage the parking brake.

TEST

(1) Start engine.

(2) Place heater blower in high position.

(3) Turn on headlamps and place in high-beam position.

(4) Turn vehicle interior lamps on.

(5) Start engine. Bring engine speed up to 2400 rpm and hold.

(6) Testing (- ground) circuitry:

(a) Touch the negative lead of voltmeter directly to battery positive **POST** (Fig. 4).

(b) Touch the positive lead of voltmeter to the B+ output terminal stud on the generator (not the terminal mounting nut). Voltage should be no higher than 0.6 volts. If voltage is higher than 0.6 volts, touch test lead to terminal mounting stud nut and then to the wiring connector. If voltage is now below 0.6 volts, look for dirty, loose or poor connection at this point. Refer to Group 8, Wiring for connector location. A voltage drop test may be

DIAGNOSIS AND TESTING (Continued)

performed at each (- ground) connection in this circuit to locate the excessive resistance.

(7) Testing (+ positive) circuitry:

(a) Touch the positive lead of voltmeter directly to battery negative **POST** .

(b) Touch the negative lead of voltmeter to the ground terminal stud on the generator case (not the terminal mounting nut). Voltage should be no higher than 0.3 volts. If voltage is higher than 0.3 volts, touch test lead to terminal mounting stud nut and then to the wiring connector. If voltage is now below 0.3 volts, look for dirty, loose or poor connection at this point. A voltage drop test may be performed at each (+ positive) connection in this circuit to locate the excessive resistance. This test can also be performed between the generator case and the engine. If test voltage is higher than 0.3 volts, check for corrosion at generator mounting points or loose generator mounting.

CURRENT OUTPUT TEST

The current output test will determine if the charging system can deliver its minimum test current (amperage) output. Refer to the Specifications section at the end of this group for minimum test current (amperage) requirements.

The first part of this test will determine the combined amperage output of both the generator and the Electronic Voltage Regulator (EVR) circuitry.

PREPARATION

(1) Determine if any Diagnostic Trouble Codes (DTC) exist. To determine a DTC, refer to On-Board Diagnostics in this group. For repair, refer to the appropriate Powertrain Diagnostic Procedures manual.

(2) Before starting test, make sure battery is in good condition and is fully-charged. See Group 8A, Battery for more information.

(3) Check condition of battery cables at battery. Clean if necessary.

(4) Perform the previous Output Wire Resistance Test (voltage drop test) (Fig. 5). This will ensure clean and tight generator/battery electrical connections.

(5) Be sure the generator drive belt is properly tensioned. Refer to Group 7, Cooling System for information.

(6) A volt/amp tester equipped with both a battery load control (carbon pile rheostat) and an inductive-type pickup clamp (ammeter probe) will be used for this test. Refer to operating instructions supplied with tester. When using a tester equipped with an inductive-type clamp, removal of wiring at the generator will not be necessary.

(7) Start the engine and allow it to reach operating temperature.

(8) Shut engine off.

(9) Turn off all electrical accessories and all vehicle lighting.

(10) Connect the volt/amp tester leads to the battery. Be sure the carbon pile rheostat control is in the OPEN or OFF position before connecting leads. See Load Test in Group 8A, Battery for more information. Also refer to the operating instructions supplied with test equipment.

(11) Connect the inductive clamp (ammeter probe). Refer to the operating instructions supplied with test equipment.

(12) If volt/amp tester is not equipped with an engine tachometer, connect a separate tachometer to the engine.

TEST

(1) Perform the previous test Preparation.

(2) Fully engage the parking brake.

(3) Start engine.

(4) Bring engine speed to 2500 rpm.

(5) With engine speed held at 2500 rpm, slowly adjust the rheostat control (load) on the tester to obtain the highest amperage reading. Do not allow voltage to drop below 12 volts. Record the reading. **This load test must be performed within 15 seconds to prevent damage to test equipment.** On certain brands of test equipment, this load will be applied automatically. Refer to the operating manual supplied with test equipment.

(6) The ammeter reading must meet the Minimum Test Amps specifications as displayed in the Generator Ratings chart. This can be found in the Specifications section at the end of this group. A label stating a part reference number is attached to the generator case. On some engines this label may be located on the bottom of the case. Compare this reference number to the Generator Ratings chart.

(7) Rotate the load control to the OFF position.

(8) Continue holding engine speed at 2500. If EVR circuitry is OK, amperage should drop below 15–20 amps. With all electrical accessories and vehicle lighting off, this could take several minutes of engine operation. If amperage did not drop, refer to the appropriate Powertrain Diagnostic Procedures manual for testing.

(9) Remove volt/amp tester.

If minimum amperage could not be met, refer to the appropriate Powertrain Diagnostic Procedures manual for testing.

DIAGNOSIS AND TESTING (Continued)

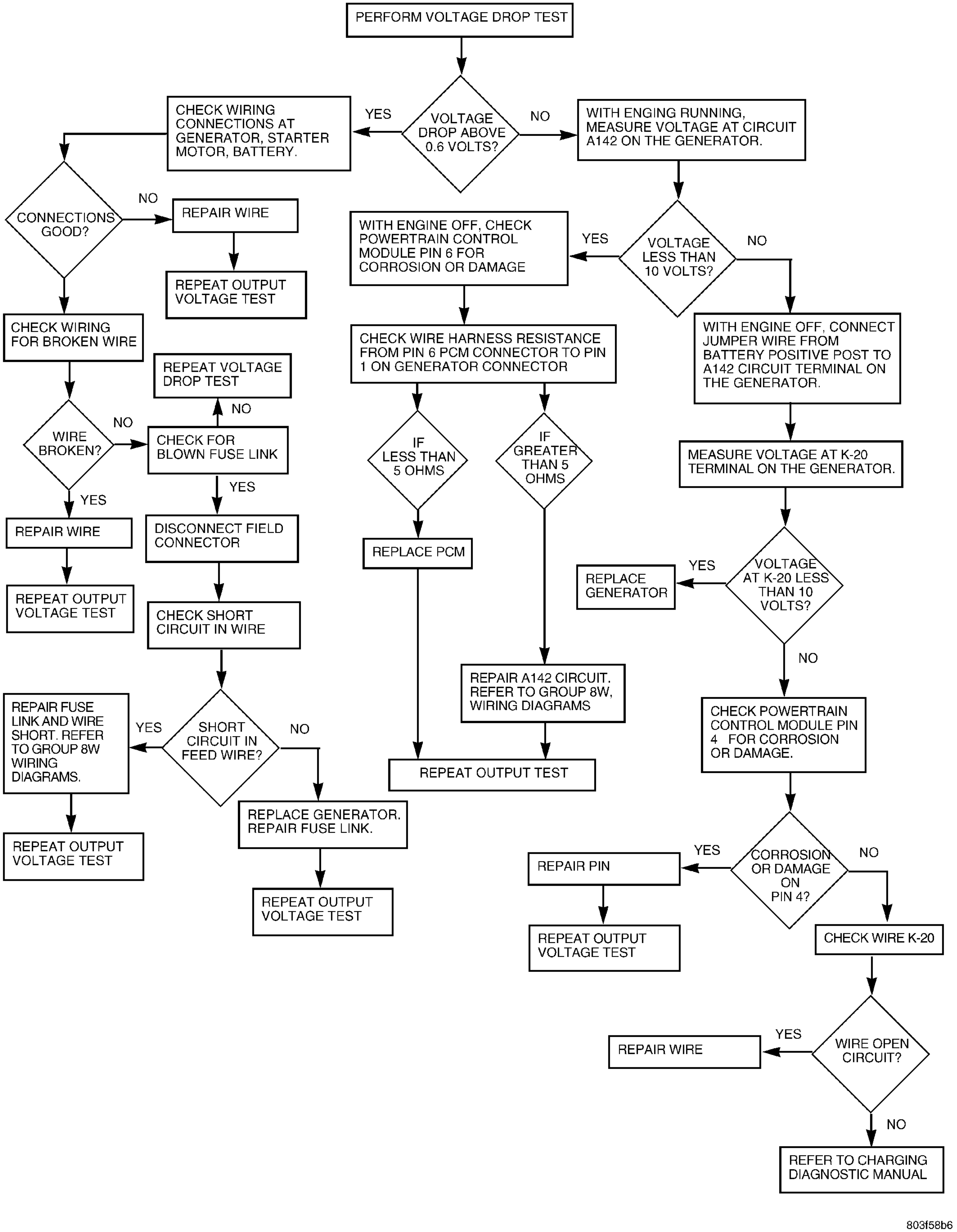


Fig. 5 Voltage Drop Test

DIAGNOSIS AND TESTING (Continued)

BATTERY TEMPERATURE SENSOR

To perform a complete test of this sensor and its circuitry, refer to the appropriate Powertrain Diagnostic Procedures manual. To test the sensor only, refer to the following:

(1) The sensor is located under the battery and is attached to the battery tray (Fig. 6). A two-wire pigtail harness is attached directly to the sensor. The opposite end of this harness connects the sensor to the engine wiring harness.

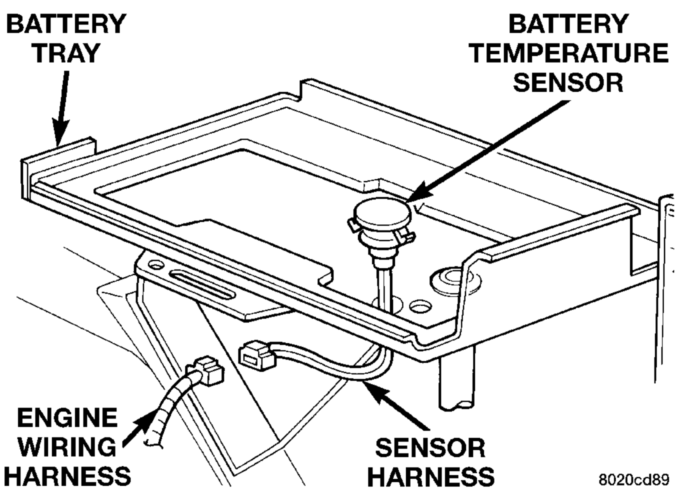


Fig. 6 Battery Temperature Sensor

(2) Disconnect the two-wire pigtail harness from the engine harness.

(3) Attach ohmmeter leads to the wire terminals of the pigtail harness.

(4) At room temperature of 25° C (75–80° F), an ohmmeter reading of 9,000 (9K) to 11,000 (11K) ohms should be observed.

(5) If reading is above or below the specification, replace the sensor.

(6) Refer to the Removal and Installation section for procedures.

ON-BOARD DIAGNOSTIC SYSTEM TEST

GENERAL INFORMATION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the OBD system. Some circuits are checked continuously and some are checked only under certain conditions.

If the OBD system senses that a monitored circuit is bad, it will put a DTC into electronic memory. The DTC will stay in electronic memory as long as the circuit continues to be bad. The PCM is programmed to clear the memory after 50 engine starts if the problem does not occur again.

DIAGNOSTIC TROUBLE CODES

Diagnostic Trouble Codes (DTC) are two-digit numbers flashed on the malfunction indicator (Check Engine) lamp that identify which circuit is bad. Refer to Group 25, On Board Diagnostic for more information. A DTC description can also be read using the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for information.

A DTC does not identify which component in a circuit is bad. Thus, a DTC should be treated as a

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
12*	Battery Disconnect	Direct battery input to PCM was disconnected within the last 50 key-on cycles.
41**	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control 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.
55*	N/A	Completion of fault code display on Check Engine lamp.

* Check Engine lamp will not illuminate at all times if this Diagnostic Trouble Code was recorded. Cycle ignition key as described in manual and observe code flashed by Check Engine lamp.

** Check Engine lamp will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

J958A-7

Fig. 7 Generator Diagnostic Trouble Code

DIAGNOSIS AND TESTING (Continued)

symptom, not as the cause for the problem. In some cases, because of the design of the diagnostic test procedure, a DTC can be the reason for another DTC to be set. Therefore, it is important that the test procedures be followed in sequence, to understand what caused a DTC to be set.

See the Generator Diagnostic Trouble Code chart (Fig. 7) for DTC's which apply to the charging system. Refer to the Powertrain Diagnostic Procedures manual to diagnose an on-board diagnostic system trouble code.

RETRIEVING DIAGNOSTIC TROUBLE CODES

To start this function, cycle the ignition switch ON-OFF-ON-OFF-ON within 5 seconds. This will cause any DTC stored in the PCM memory to be displayed. The malfunction indicator (Check Engine) lamp will display a DTC by flashing on and off. There is a short pause between flashes and a longer pause between digits. All DTC's displayed are two-digit numbers, with a four-second pause between codes.

An example of a DTC is as follows:

(1) Lamp on for 2 seconds, then turns off.

(2) Lamp flashes 4 times pauses and then flashes 1 time.

(3) Lamp pauses for 4 seconds, flashes 4 times, pauses, then flashes 7 times.

(4) The two DTC's are 41 and 47. Any number of DTC's can be displayed, as long as they are in memory. The lamp will flash until all stored DTC's are displayed, then it will flash a DTC 55 to indicate the test is complete.

ERASING DIAGNOSTIC TROUBLE CODES

The DRB Scan Tool must be used to erase a DTC.

REMOVAL AND INSTALLATION

GENERATOR

REMOVAL

(1) Disconnect battery negative cable (Fig. 8).

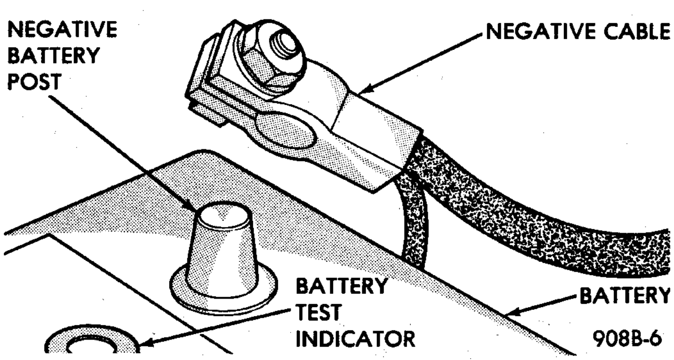


Fig. 8 Removal/Installation of Battery Cables

(2) Loosen but DO NOT remove the generator adjustment nut.

(3) Raise vehicle with front wheels turned fully to the right.

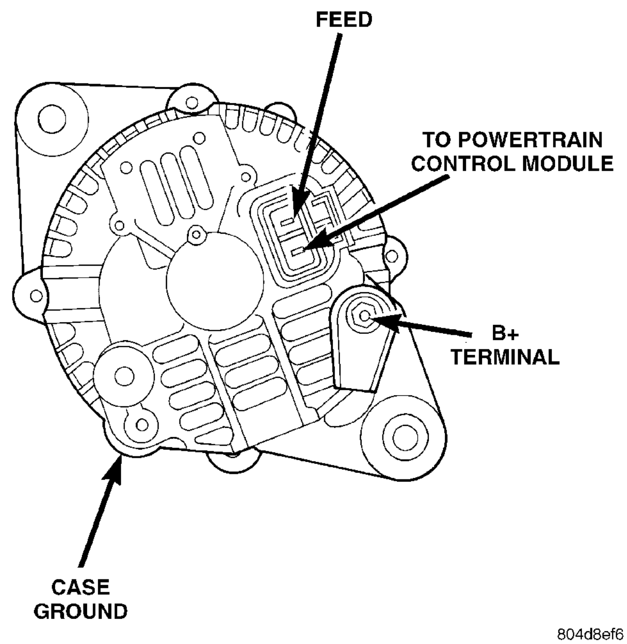


Fig. 9 Wire Terminal Connection

(4) Remove the plastic lower splash shield.

(5) Disconnect the generator field circuit wiring connector (Fig. 11). Squeeze locking tab to release.

(6) Remove the B+ terminal nut and wire.

(7) Loosen pivot bolt, but do not remove (Fig. 10) and (Fig. 11).

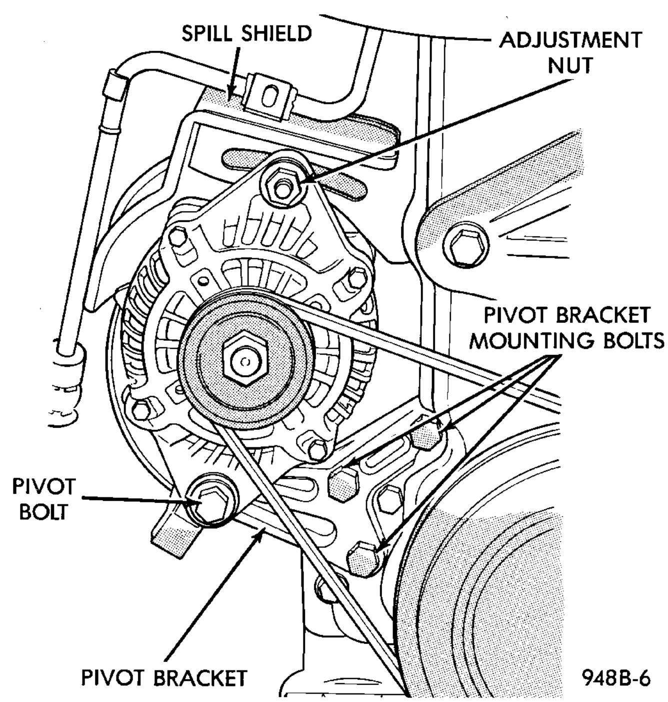


Fig. 10 Generator Front View

REMOVAL AND INSTALLATION (Continued)

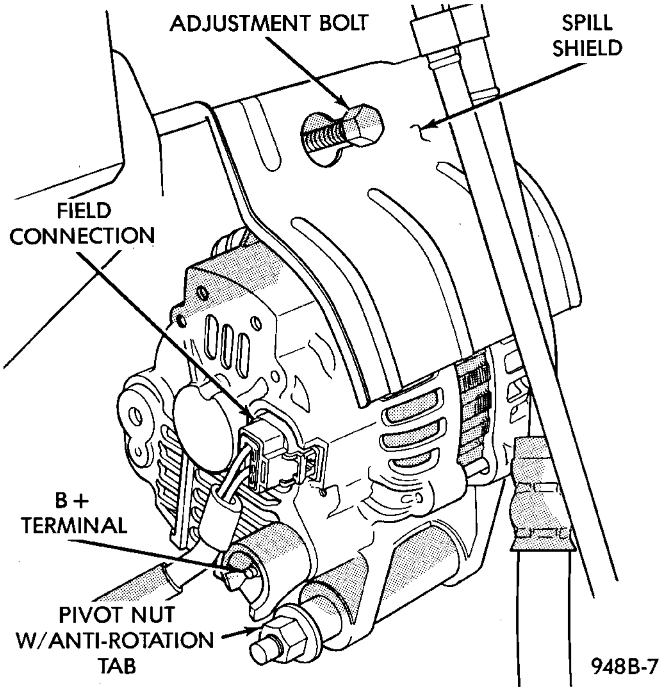


Fig. 11 Generator Rear View

(8) Remove the generator drive belt. The generator spill shield does not need to be removed.

(9) Remove three mounting pivot bracket bolts.

(10) Remove pivot bolt and bracket.

(11) Holding the generator in one hand, remove adjustment nut and slide the generator off the T-bolt. The T-bolt does not need to be removed.

(12) Lower the generator and remove through the wheel well.

INSTALLATION

(1) For installation, reverse above procedures. The generator field connector has a locking tab and will snap when fully installed. Refer to group 7 Cooling System, Belt Removal/Install Adjust. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart in Group 8A, Battery/Starter/Charging Systems Diagnostics.

BATTERY TEMPERATURE SENSOR

REMOVAL

(1) Make sure ignition switch is in OFF position and all accessories are OFF.

(2) Remove battery negative cable first then the positive cable (Fig. 12).

(3) Remove battery thermoguard (Fig. 13).

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.

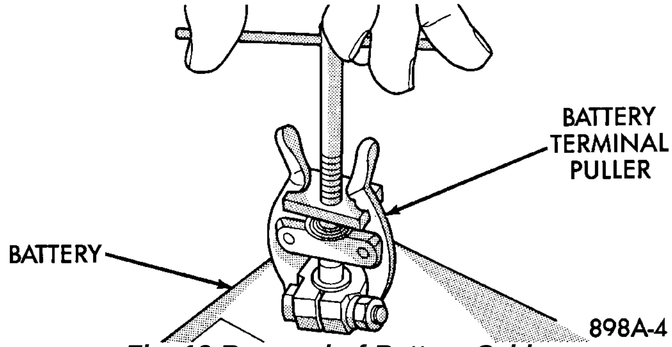


Fig. 12 Removal of Battery Cables

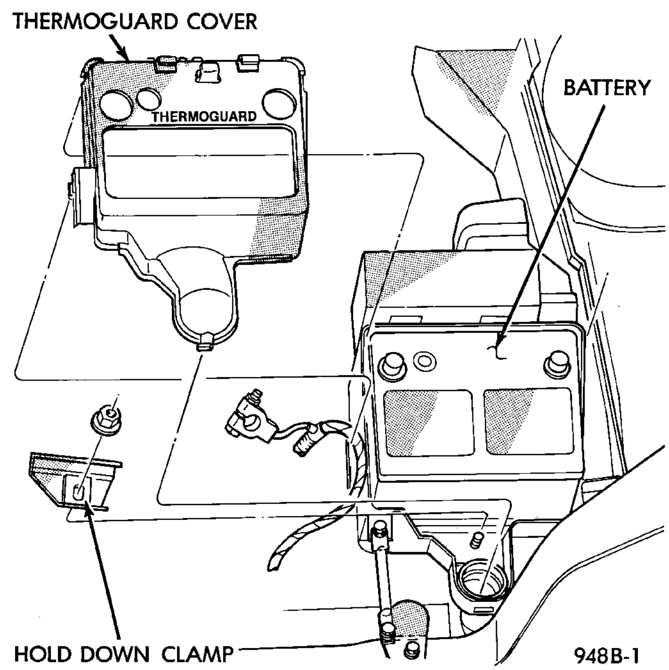


Fig. 13 Battery Thermoguard

(4) Remove temperature sensor mounting nut from battery tray (Fig. 14).

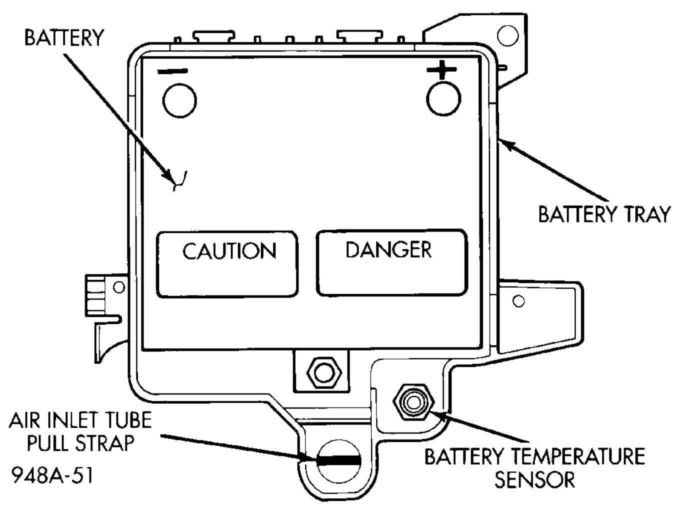


Fig. 14 Battery Temperature Sensor Location

REMOVAL AND INSTALLATION (Continued)

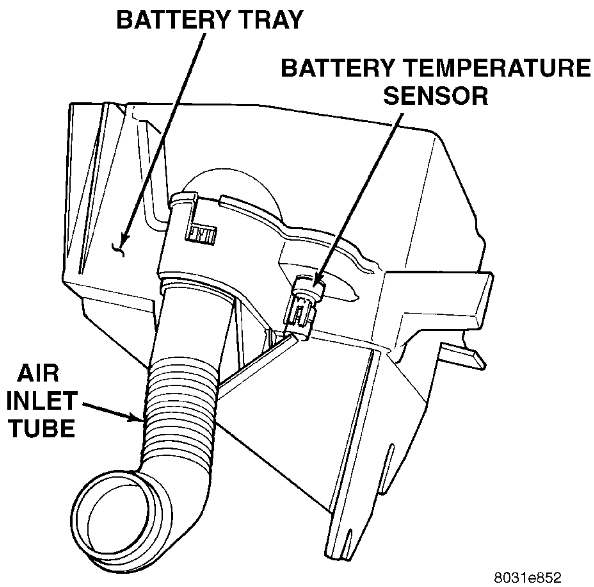


Fig. 15 Battery Temperature Sensor Connector

(5) Disconnect sensor wire connector (Fig. 15).

INSTALLATION

For installation reverse above procedures.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	PART NUMBER	RATED SAE AMPS	ENGINES	MINIMUM TEST AMPS
MELCO	4793190	83 AMPS	2.0L SOHC/DOHC	75 AMPS

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Battery Terminal Nut	9 N·m (75 in. lbs.)
Battery Hold Down Clamp Bolt . .	9 N·m (75 in. lbs.)
Generator Mounting Bolt	54 N·m (40 ft. lbs.)
Generator Pivot Bolt	54 N·m (40 ft. lbs.)

IGNITION SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

This section describes the electronic ignition system for the 2.0L engines used in Neon vehicles.

The On-Board Diagnostics Section in Group 25 describes diagnostic trouble codes.

Group 0, Lubrication and Maintenance, contains general maintenance information for ignition related items. The Owner's Manual also contains maintenance information.

DESCRIPTION AND OPERATION

IGNITION SYSTEM

Ignition system operation and diagnostics, are identical for 2.0L Single Overhead Cam (SOHC) and 2.0L Duel Overhead Cam (DOHC) engines.

The major difference between the two engines is component location which affects the ignition system service procedures. There are various sensors that are in different locations due to a different cylinder head and intake manifold.

DESCRIPTION AND OPERATION (Continued)

The 2.0L engines use a fixed ignition timing system. The distributorless electronic ignition system is referred to as the Direct Ignition System (DIS).

Basic ignition timing is not adjustable. The Powertrain Control Module (PCM) determines spark advance. The system's three main components are the coil pack, crankshaft position sensor, and camshaft position sensor.

POWERTRAIN CONTROL MODULE

The Powertrain Control Module (PCM) regulates the ignition system (Fig. 1). 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 maintains spark advance at 9° BTDC. During engine operation the following inputs determine the amount of spark advance provided by the PCM.

- Intake air temperature
- Coolant temperature
- Engine RPM
- Intake manifold vacuum
- Knock sensor

The PCM also regulates the fuel injection system. Refer to the Fuel Injection sections of Group 14.

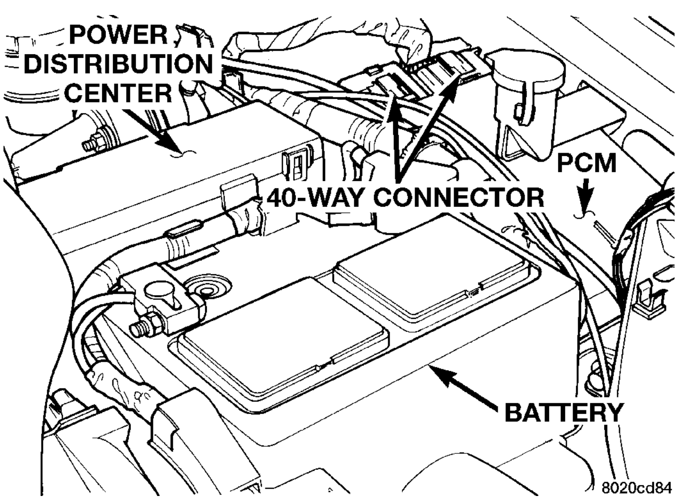


Fig. 1 Powertrain Control Module

SPARK PLUGS

The 2.0L engines uses resistor spark plugs. For spark plug identification and specifications, Refer to the Specifications section at the end of this group.

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 0.

Spark plugs that have low mileage 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. 2) to the dimensions specified in the chart at the end of this section.

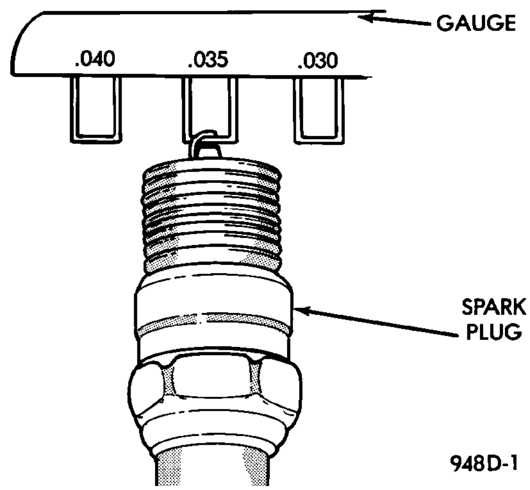


Fig. 2 Setting Spark Plug Electrode Gap

Always tighten spark plugs to the specified torque. Over tightening can cause distortion and change the spark plug gap. Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

SPARK PLUG CABLES

Spark plug cables are sometimes referred to as secondary ignition wires. The wires transfer electrical current from the coil pack to individual spark plugs at each cylinder. The resistor type, nonmetallic spark plug cables provide suppression of radio frequency emissions from the ignition system.

Check the spark plug cable connections for good contact at the coil and 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. Spark plug boot should completely cover the spark plug hole in the cylinder head cover. Install the boot until the terminal snaps over the spark plug. A snap must be felt to ensure the spark plug cable terminal engaged the spark plug.

Loose cable connections will corrode, increase resistance and permit water to enter the coil towers. These conditions can cause ignition malfunction. Plastic clips in various locations protect the cables from damage. When the cables are replaced the clips must be used to prevent damage to the cables. The

DESCRIPTION AND OPERATION (Continued)

#1 cable must be routed under the PCV hose and clipped to the #2 cable.

ELECTRONIC IGNITION COILS

WARNING: THE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The coil pack consists of 2 coils molded together. The coil pack is mounted on the valve cover (Fig. 3) or (Fig. 4). 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. Coil number one fires cylinders 1 and 4. Coil number two fires cylinders 2 and 3. The PCM determines which of the coils to charge and fire at the correct time.

The Auto Shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs. Refer to Auto Shutdown (ASD) Relay—PCM Output, in this section for relay operation.

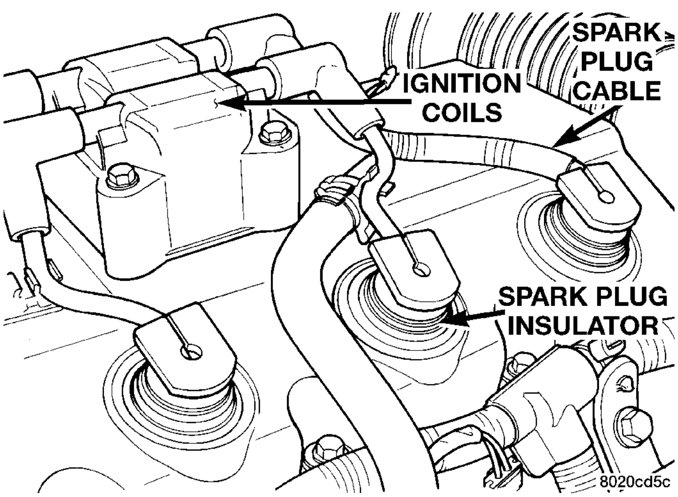


Fig. 3 Ignition Coil Pack—SOHC

AUTOMATIC SHUTDOWN RELAY

The Automatic Shutdown (ASD) relay supplies battery voltage to the fuel injectors, electronic ignition coil and the heating elements in the oxygen sensors.

A buss bar in the Power Distribution Center (PDC) supplies voltage to the solenoid side and contact side of the relay. The ASD relay power circuit contains a 20 amp fuse between the buss bar in the PDC and the relay. The fuse also protects the power circuit for

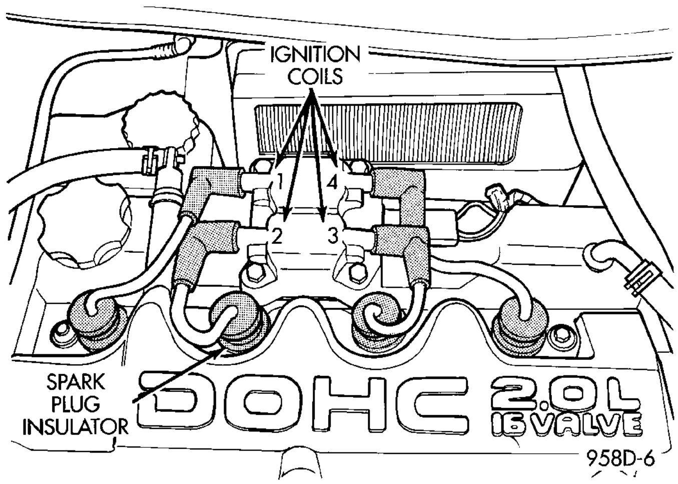


Fig. 4 Ignition Coil Pack—DOHC

the fuel pump relay and pump. The fuse is located in the PDC. Refer to Group 8W, Wiring Diagrams for circuit information.

The PCM controls the ASD relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position. When the ignition switch is in On or Start, the PCM monitors the crankshaft and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive crankshaft and camshaft position sensor signals when the ignition switch is in the Run position, it will de-energize the ASD relay.

The ASD relay is located in the PDC (Fig. 5). The inside top of the PDC cover has label showing relay and fuse identification.

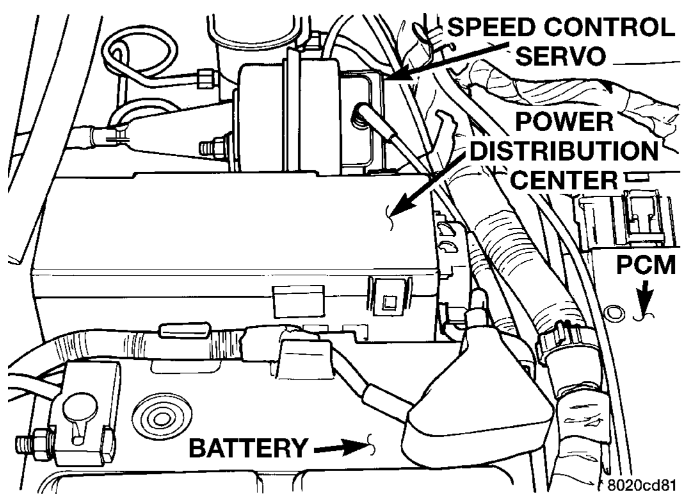


Fig. 5 Power Distribution Center (PDC)

CRANKSHAFT POSITION SENSOR

The PCM determines what cylinder to fire from the crankshaft position sensor input and the camshaft position sensor input. The second crankshaft counter-

DESCRIPTION AND OPERATION (Continued)

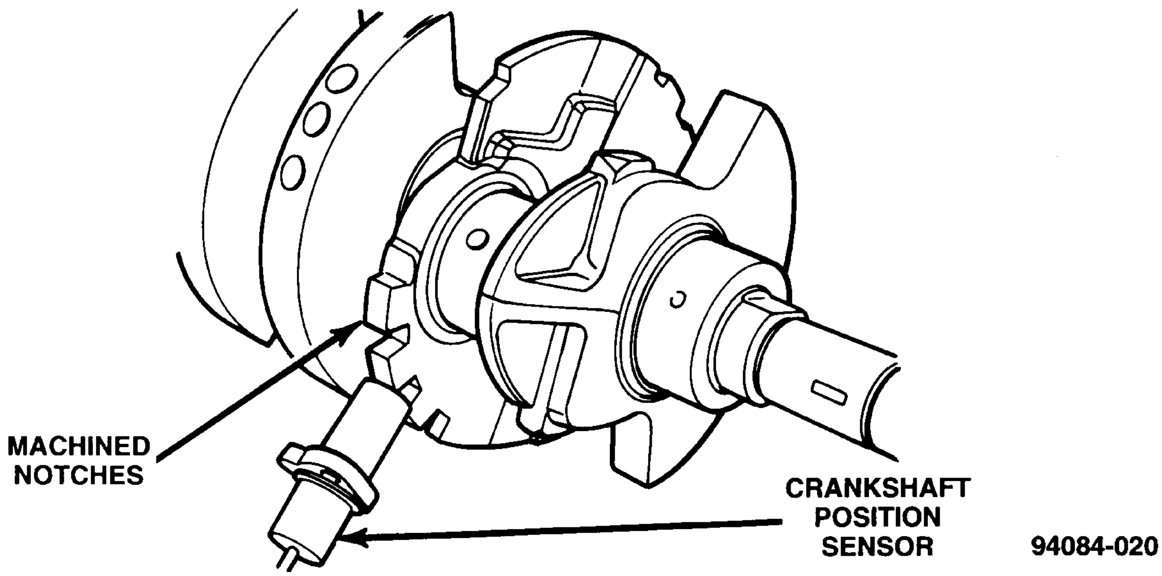


Fig. 6 Timing Reference Notches

weight has machined into it two sets of four timing reference notches including a 60 degree signature notch (Fig. 6). From the crankshaft position sensor input the PCM determines engine speed and crankshaft angle (position).

The notches generate pulses from high to low in the crankshaft position sensor output voltage. When a metal portion of the counterweight aligns with the crankshaft position sensor, the sensor output voltage goes low (less than 0.5 volts). When a notch aligns with the sensor, voltage goes high (5.0 volts). As a group of notches pass under the sensor, the output voltage switches from low (metal) to high (notch) then back to low.

If available, an oscilloscope can display the square wave patterns of each voltage pulse. From the frequency of the output voltage pulses, the PCM calculates engine speed. The width of the pulses represent the amount of time the output voltage stays high before switching back to low. The period of time the sensor output voltage stays high before switching back to low is referred to as pulse-width. The faster the engine is operating, the smaller the pulse-width on the oscilloscope.

By counting the pulses and referencing the pulse from the 60 degree signature notch, the PCM calculates crankshaft angle (position). In each group of timing reference notches, the first notch represents 69 degrees before top dead center (BTDC). The second notch represents 49 degrees BTDC. The third notch represents 29 degrees. The last notch in each set represents 9 degrees before top dead center BTDC.

The timing reference notches are machined at 20° increments. From the voltage pulse-width the PCM tells the difference between the timing reference notches and the 60 degree signature notch. The 60 degree signature notch produces a longer pulse-width than the smaller timing reference notches. If the camshaft position sensor input switches from high to low when the 60 degree signature notch passes under the crankshaft position sensor, the PCM knows cylinder number one is the next cylinder at TDC.

The crankshaft position sensor mounts to the engine block behind the generator, just above the oil filter (Fig. 7).

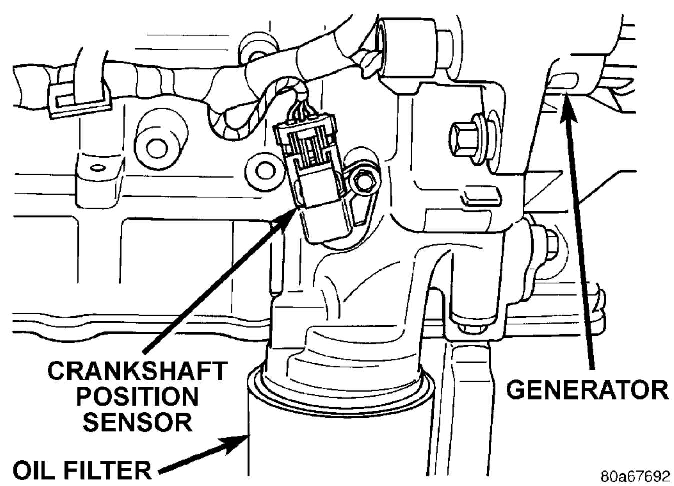


Fig. 7 Crankshaft Position Sensor

CAMSHAFT POSITION SENSOR

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor (Fig. 8) or (Fig. 9) and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

The camshaft position sensor attaches to the rear of the cylinder head (Fig. 10). A target magnet

DESCRIPTION AND OPERATION (Continued)

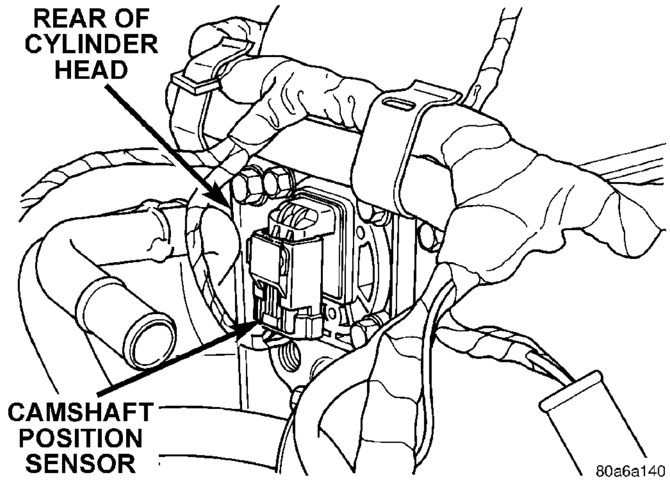


Fig. 8 Camshaft Position Sensor—SOHC

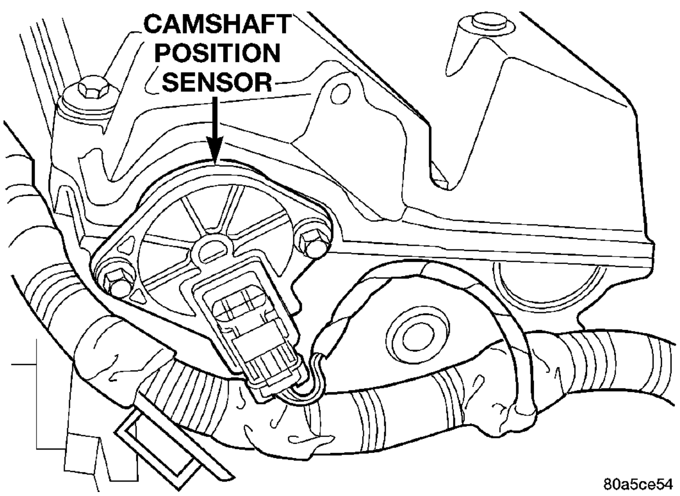


Fig. 9 Camshaft Position Sensor—DOHC

attaches to the rear of the camshaft and indexes to the correct position. The target magnet has four different poles arranged in an asymmetrical pattern. As the target magnet rotates, the camshaft position sensor senses the change in polarity (Fig. 11). The sensor input switches from high (5 volts) to low (0.30 volts) as the target magnet rotates. When the north pole of the target magnet passes under the sensor, the output switches high. The sensor output switches low when the south pole of the target magnet passes underneath.

The camshaft position sensor is mounted to the rear of the cylinder head. The sensor also acts as a thrust plate to control camshaft endplay on SOHC engines.

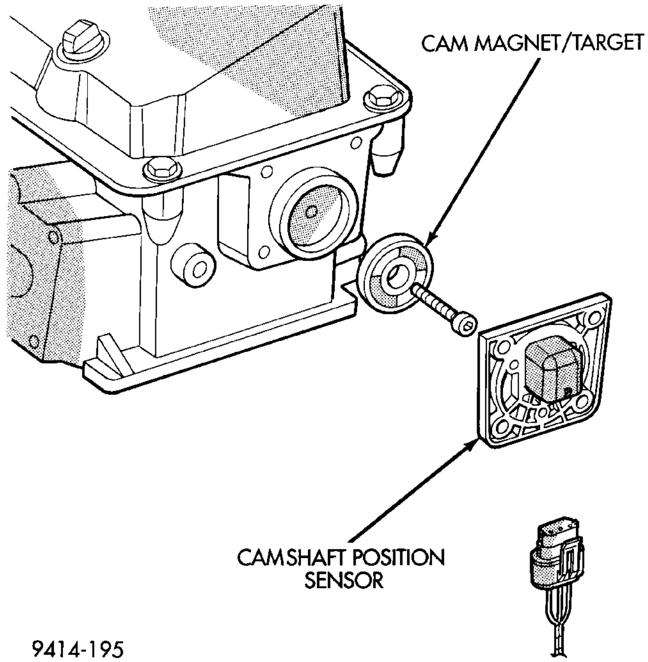


Fig. 10 Target Magnet —Typical

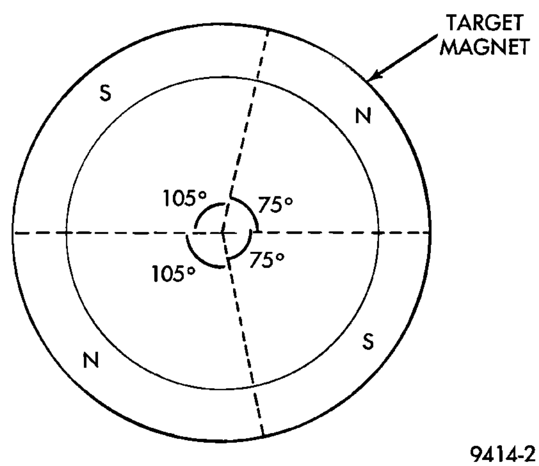


Fig. 11 Target Magnet Polarity

COMBINATION ENGINE COOLANT TEMPERATURE SENSOR

The coolant temperature sensor provides an input voltage to the PCM and a separate input voltage to the temperature gauge on the instrument panel. The PCM determines engine coolant temperature from the coolant temperature sensor. As coolant temperature varies, the coolant temperature sensor resistance changes resulting in a different input voltage to the PCM.

DESCRIPTION AND OPERATION (Continued)

When the engine is cold, the PCM will demand slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached.

SOHC

The coolant sensor threads into the end of the cylinder head, next to the camshaft position sensor (Fig. 12). New sensors have sealant applied to the threads.

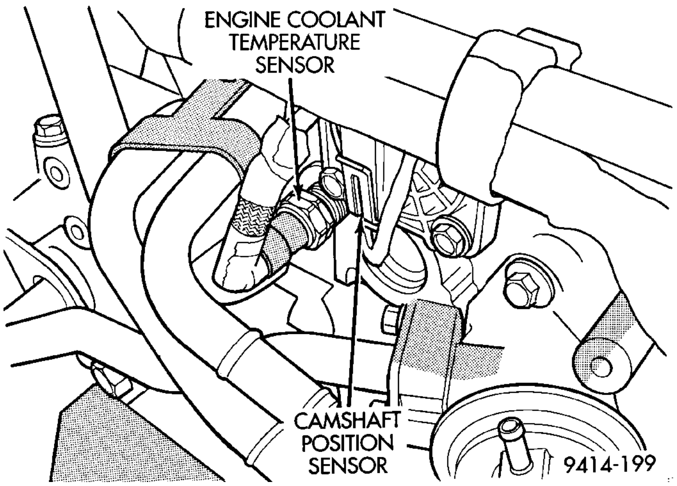


Fig. 12 Engine Coolant Temperature Sensor—SOHC

DOHC

The coolant sensor threads into the intake manifold next to the thermostat housing (Fig. 13). New sensors have sealant applied to the threads.

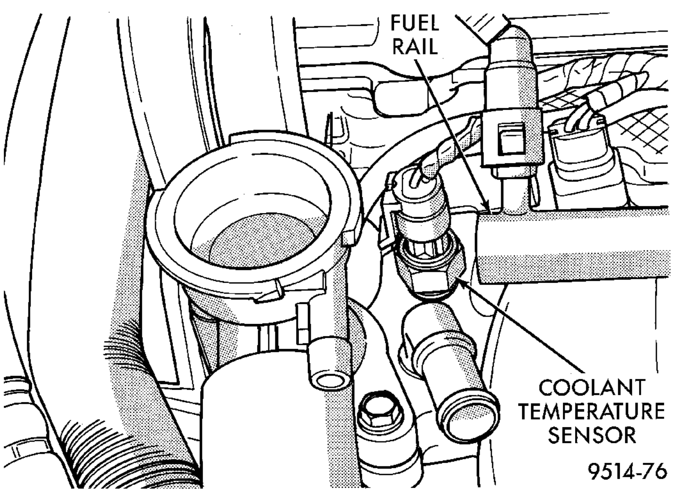


Fig. 13 Engine Coolant Temperature Sensor—DOHC

INTAKE AIR TEMPERATURE SENSOR

The intake air temperature sensor measures the temperature of the air as it enters the engine. The sensor supplies one of the inputs the PCM uses to determine injector pulse-width.

The MAP/Intake Air Temperature (IAT) sensor, located on the intake manifold, combines the MAP and Intake Air Temperature (IAT) functions into one sensor (Fig. 14) or (Fig. 15).

KNOCK SENSOR

The knock sensor threads into the side of the cylinder block in front of the starter motor. When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increase, the knock sensor output voltage also increases.

NOTE: Over or under tightening effects knock sensor performance, possibly causing improper spark control.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)

The PCM supplies 5 volts to the MAP sensor. The MAP sensor function 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/IAT sensor mounts to the intake manifold (Fig. 14) or (Fig. 15).

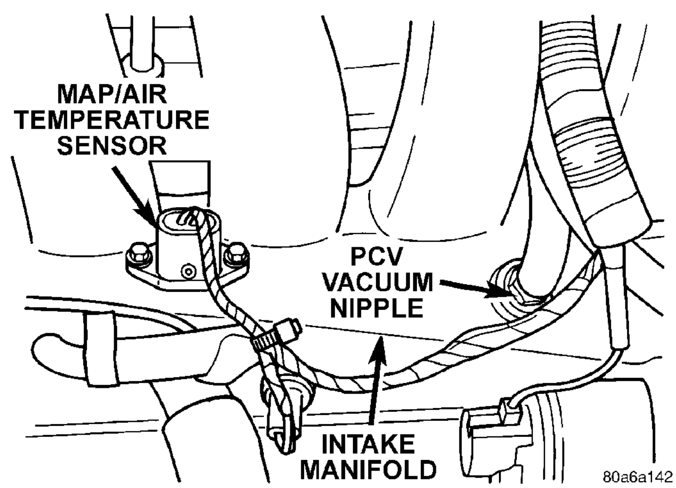


Fig. 14 MAP/IAT sensor—SOHC

DESCRIPTION AND OPERATION (Continued)

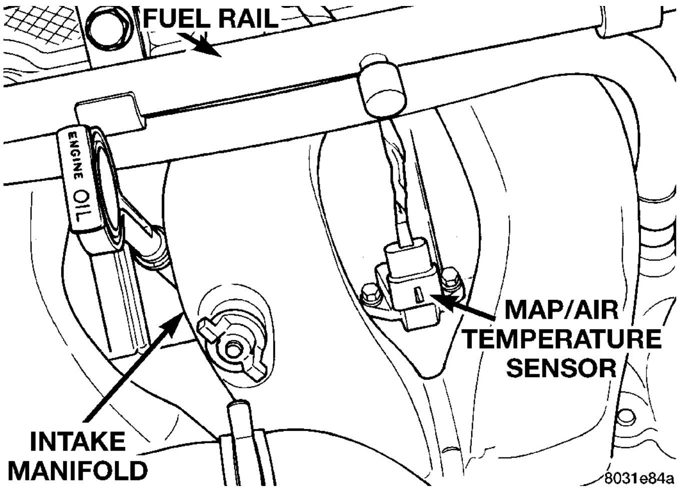


Fig. 15 MAP/IAT sensor—DOHC

THROTTLE POSITION SENSOR (TPS)

The TPS mounts to the side of the throttle body. The TPS connects to the throttle blade shaft. The TPS is a variable resistor that provides the Powertrain Control Module (PCM) with an input signal (voltage). The signal represents throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the powertrain control module) represents throttle blade position. The TPS output voltage to the PCM varies from approximately 0.38 volts to 1.2 volts at minimum throttle opening (idle) to a maximum of 3.1 volts to 4.4 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 also adjusts fuel injector pulse width and ignition timing based on these inputs.

IGNITION SWITCH

In the RUN position, the ignition switch connects power from the Power Distribution Center (PDC) to a 30 amp fuse in the fuse block, back to a bus bar in the PDC. The bus bar feeds circuits for the Powertrain Control Module (PCM), duty cycle purge solenoid, EGR solenoid, and ABS system. The bus bar in the PDC feeds the coil side of the radiator fan relay, A/C compressor clutch relay, and the fuel pump relay. It also feeds the Airbag Control Module (ACM)

LOCK KEY CYLINDER

The lock cylinder is inserted in the end of the housing opposite the ignition switch. The ignition key rotates the cylinder to 5 different detents (Fig. 16):

- Accessory
- Off (lock)
- Unlock
- On/Run
- Start

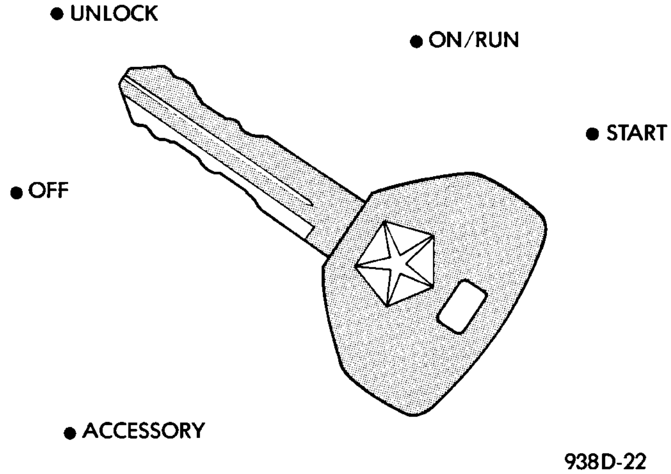


Fig. 16 Ignition Lock Cylinder Detents

IGNITION INTERLOCK

All vehicles equipped with automatic transaxles have an interlock system. The system prevents shifting the vehicle out of Park unless the ignition lock cylinder is in the Off, Run or Start position. In addition, the operator cannot rotate the key to the lock position unless the shifter is in the park position. On vehicles equipped with floor shift refer to Group 21 - Transaxle for Automatic Transmission Shifter/Ignition Interlock.

DIAGNOSIS AND TESTING

TESTING FOR SPARK AT COIL—2.0/2.4L

WARNING: THE DIRECT IGNITION SYSTEMS GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The coil pack contains independent coils. Each coil must be checked individually.

CAUTION: Spark plug wire damage may occur if the spark plug is moved more than 1/4 inch away from the engine ground.

CAUTION: Do not leave any one spark plug cable disconnected any longer than 30 seconds or possible heat damage to catalytic converter will occur.

CAUTION: Test must be performed at idle and in park only with the parking brake on.

DIAGNOSIS AND TESTING (Continued)

NOTE: New isolated engine valve cover may not provide adequate ground. Use engine block as engine ground.

Use a new spark plug and spark plug cable for the following test.

(1) Insert a new spark plug into the new spark plug boot. Ground the plug to the engine (Fig. 17). Do not hold with your hand.

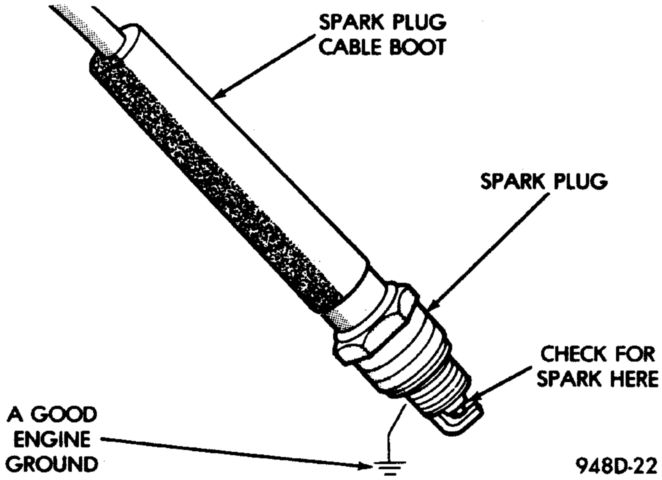


Fig. 17 Testing For Spark

(2) Starting with coil insulator #1, remove it from the DIS coil.

(3) Plug the test spark plug cable onto #1 coil tower. Make sure a good connection is made; there should be a click sound.

(4) Crank the engine and look for spark across the electrodes of the spark plug.

CAUTION: Always install the cable back on the coil tower after testing to avoid damage to the coil and catalytic converter.

(5) Repeat the above test for the remaining coils. If there is no spark during all cylinder tests, proceed to the Failure To Start Test.

(6) If one or more tests indicate irregular, weak, or no spark, proceed to Check Coil Test.

CHECK COIL TEST

NOTE: Coil one fires cylinders 1 and 4, coil two fires cylinders 2 and 3. Each coil tower is labeled with the number of the corresponding cylinder.

(1) Remove the ignition cables and measure the resistance of the cables. Resistance must be between ranges shown in chart in specifcation section in this group. Replace any cable not within tolerance.

(2) Disconnect the electrical connector from the coil pack.

(3) Measure the primary resistance of each coil. At the coil, connect an ohmmeter between the B+ pin and the pin corresponding to the cylinders in question (Fig. 18). Resistance on the primary side of each coil should be 0.45 - 0.65 ohm. Replace the coil if resistance is not within tolerance.

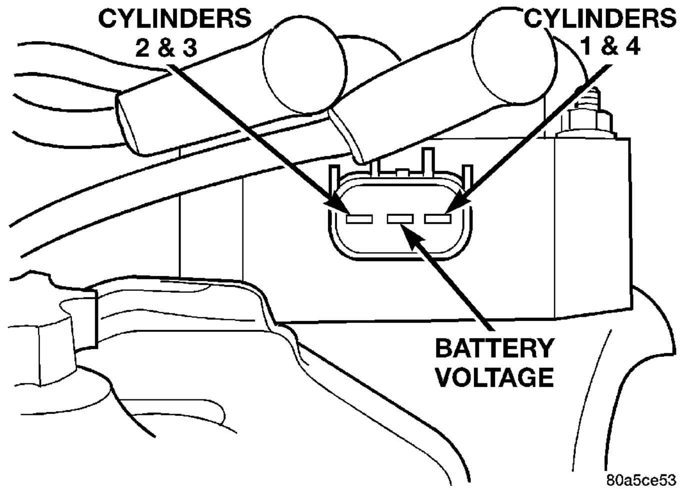


Fig. 18 Terminal Identification

(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. 19). Secondary resistance should be 11,000 to 14,000 ohms. Replace the coil if resistance is not within tolerance.

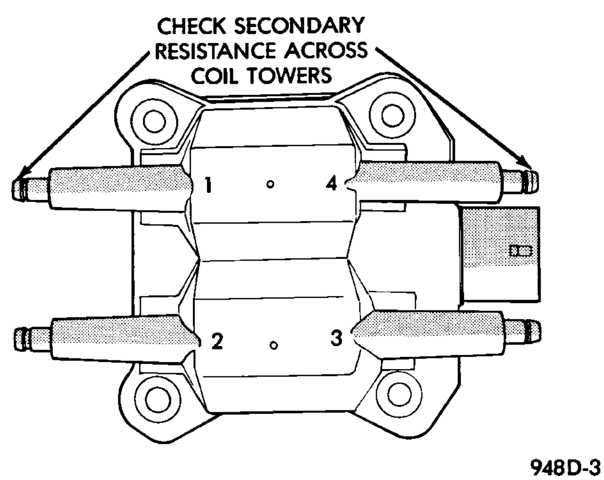


Fig. 19 Checking Ignition Coil Secondary Resistance

FAILURE TO START TEST—2.0/2.4L

This no-start test checks the camshaft position sensor and crankshaft position sensor.

Use the DRB scan tool to test the camshaft position sensor and the sensor circuits. Refer to the appropriate Powertrain Diagnostics Procedure Man-

DIAGNOSIS AND TESTING (Continued)

ual. Refer to the wiring diagrams section for circuit information.

The Powertrain Control Module (PCM) supplies 8 volts to the camshaft position sensor and crankshaft position sensor through one circuit. If the 8 volt supply circuit shorts to ground, neither sensor will produce a signal (output voltage to the PCM).

When the ignition key is turned and left in the On position, the PCM automatically energizes the Auto Shutdown (ASD) relay. However, the controller de-energizes the relay within one second because it has not received a camshaft position sensor signal indicating engine rotation.

During cranking, the ASD relay will not energize until the PCM receives a camshaft position sensor signal. Secondly, the ASD relay remains energized only if the controller senses a crankshaft position sensor signal immediately after detecting the camshaft position sensor signal.

(1) Check battery voltage. Voltage should approximately 12.66 volts or higher to perform failure to start test.

(2) Disconnect the harness connector from the coil pack (Fig. 20).

(3) Connect a test light to the B+ (battery voltage) terminal of the coil electrical connector and ground. The B+ wire for the DIS coil is the center terminal. **Do not spread the terminal with the test light probe.**

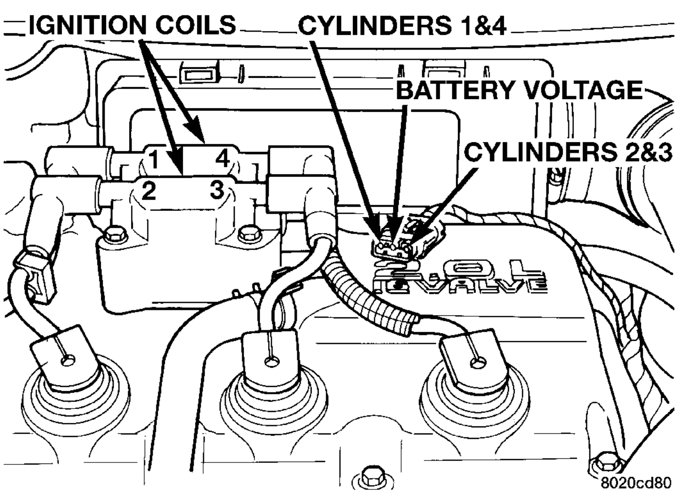


Fig. 20 Ignition Coil Engine Harness Connector

(4) Turn the ignition key to the **ON position.** The test light should flash On and then Off. **Do not turn the Key to off position, leave it in the On position** .

(a) If the test light flashes momentarily, the PCM grounded the ASD relay. Proceed to step 5.

(b) If the test light did not flash, the ASD relay did not energize. The cause is either the relay or one of the relay circuits. Use the DRB scan tool to test the ASD relay and circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

(5) Crank the engine. (If the key was placed in the off position after step 4, place the key in the On position before cranking. Wait for the test light to flash once, then crank the engine.)

(6) If the test light momentarily flashes during cranking, the PCM is not receiving a crankshaft position sensor signal.

(7) If the test light did not flash during cranking, unplug the crankshaft position sensor connector. Turn the ignition key to the off position. Turn the key to the On position, wait for the test light to momentarily flash once, then crank the engine. If the test light momentarily flashes, the crankshaft position sensor is shorted and must be replaced. If the light did not flash, the cause of the no-start is in either the crankshaft position sensor/camshaft position sensor 8 volt supply circuit, or the camshaft position sensor output or ground circuits.

IGNITION TIMING PROCEDURE

The engines for this vehicle, use a fixed ignition system. The PCM regulates ignition timing. Basic ignition timing is not adjustable.

CAMSHAFT POSITION SENSOR AND CRANKSHAFT POSITION SENSOR

The output voltage of a properly operating camshaft position sensor or crankshaft position sensor switches from high (5.0 volts) to low (0.3 volts). By connecting an Moper Diagonostic System (MDS) and engine analyzer to the vehicle, technicians can view the square wave pattern.

ENGINE COOLANT TEMPERATURE SENSOR

Refer to Group 14, Fuel System for Diagnosis and Testing.

INTAKE AIR TEMPERATURE SENSOR

Refer to Group 14, Fuel System, for Diagnosis and Testing.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

Refer to Group 14, Fuel System for Diagnosis and Testing.

THROTTLE POSITION SENSOR

To perform a complete test of the this sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the throttle position sensor only, refer to the following:

The Throttle Position Sensor (TPS) can be tested with a digital voltmeter (DVM). The center terminal of the sensor is the output terminal. One of the other

DIAGNOSIS AND TESTING (Continued)

terminals is a 5 volt supply and the remaining terminal is ground.

Connect the DVM between the center and sensor ground terminal. Refer to Group 8W - Wiring Diagrams for correct pinout.

With the ignition switch in the ON position, check the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at Wide-Open-Throttle (WOT). At idle, TPS output voltage should be approximately 0.38 volts to 1.2 volts. At wide open throttle, TPS output voltage should be approximately 3.1 volts to 4.4 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

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. 21). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 1600 km (1000 miles) of operation for non platinum spark plugs. Non-platnium spark plugs that have normal wear can usually be cleaned, have the electrodes filed and regapped, and then reinstalled.

CAUTION: Never attempt to file the electrodes or use a wire brush for cleaning platinum spark plugs. This would damage the platinum pads which would shorten spark plug life.

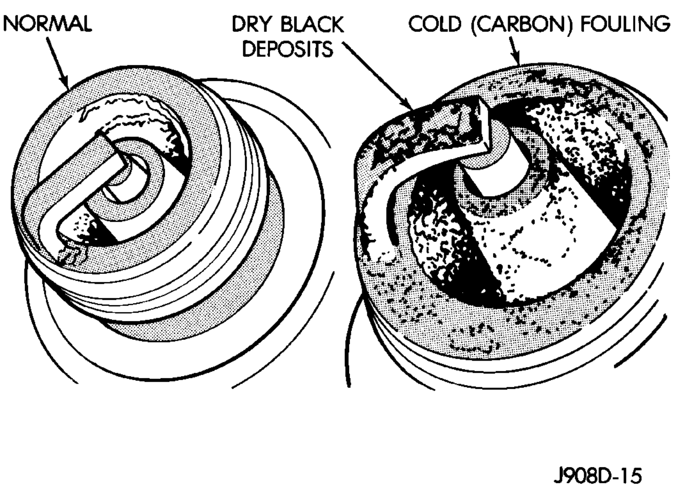


Fig. 21 Normal Operation and Cold (Carbon) Fouling

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. 21). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or misfire conditions. Cold (carbon) fouling of the entire set may be caused by a clogged air cleaner.

Cold fouling is normal after short operating periods. The spark plugs do not reach a high enough operating temperature during short operating periods. **Replace carbon fouled plugs with new spark plugs.**

FUEL FOULING

A spark plug that is coated with excessive wet fuel is called fuel fouled. This condition is normally observed during hard start periods. **Clean fuel fouled spark plugs with compressed air and reinstall them in the engine.**

OIL FOULING

A spark plug that is coated with excessive wet oil is oil fouled. In older engines, wet fouling can be caused by worn rings or excessive cylinder wear. Break-in fouling of new engines may occur before normal oil control is achieved. **Replace oil fouled spark plugs with new ones.**

OIL OR ASH ENCRUSTED

If one or more plugs are oil or ash encrusted, evaluate the engine for the cause of oil entering the combustion chambers (Fig. 22). Sometimes fuel additives can cause ash encrustation on an entire set of spark plugs. **Ash encrusted spark plugs can be cleaned and reused.**

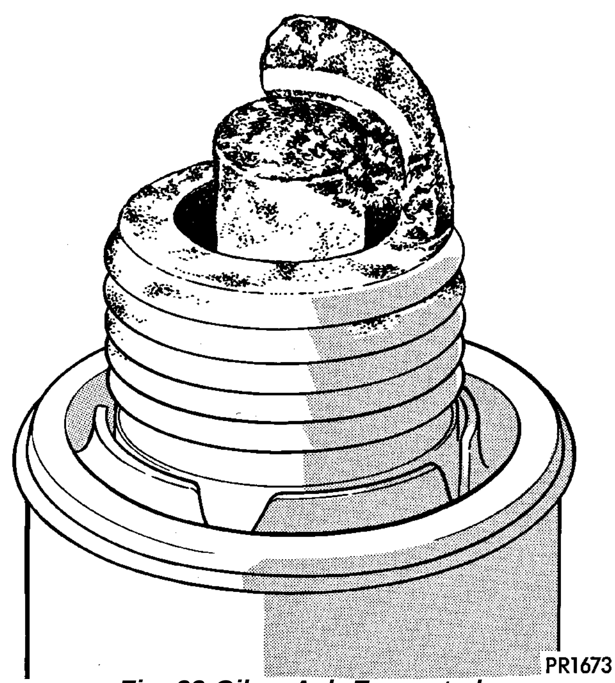


Fig. 22 Oil or Ash Encrusted

DIAGNOSIS AND TESTING (Continued)

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. 23). This short circuits the electrodes. **Spark plugs with electrode gap bridging can be cleaned and reused.**

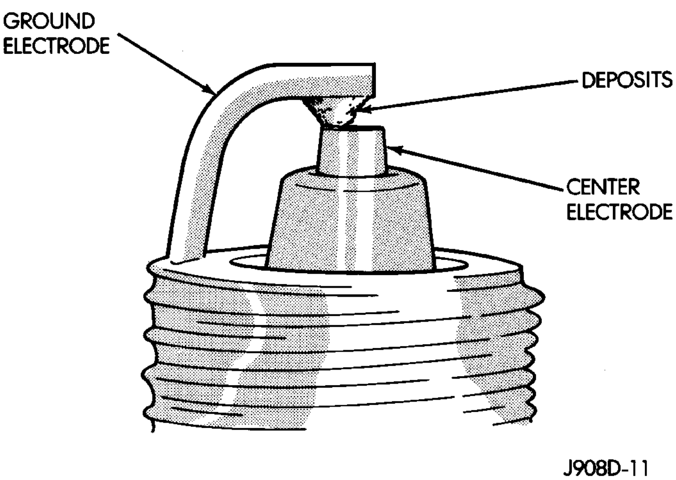


Fig. 23 Electrode Gap Bridging

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 24). They may appear to be harmful, but are a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy but the deposits are easily removed. **Spark plugs with scavenger deposits can be considered normal in condition, cleaned and reused.**

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. 25). **Spark plugs with chipped electrode insulators must be replaced.**

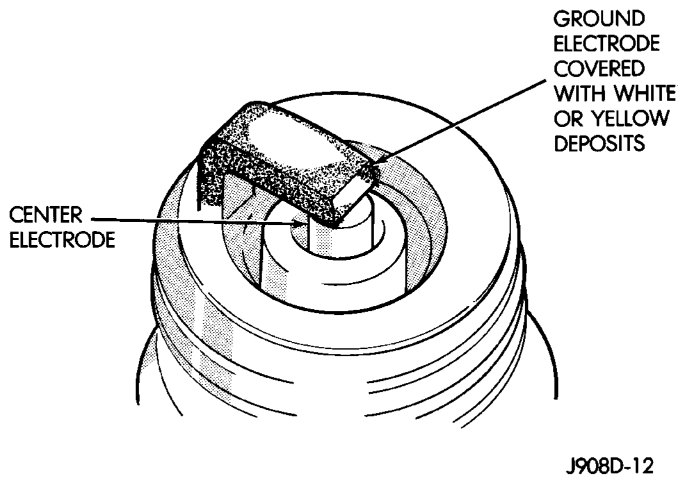


Fig. 24 Scavenger Deposits

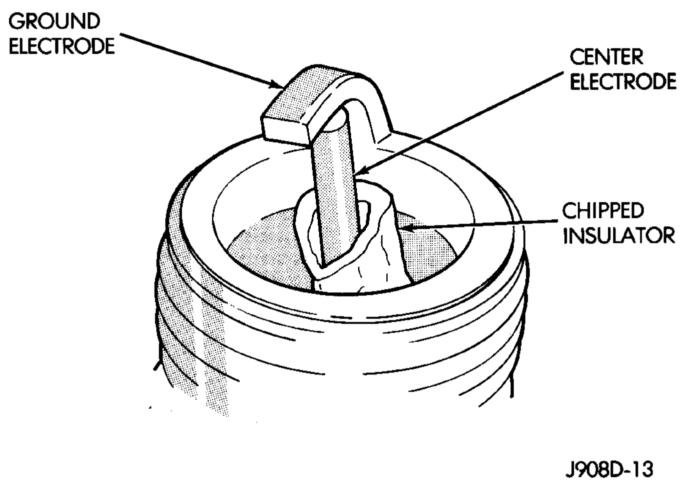


Fig. 25 Chipped Electrode Insulator

PREIGNITION DAMAGE

Excessive combustion chamber temperature can cause preignition damage. First, the center electrode dissolves and the ground electrode dissolves somewhat later (Fig. 26). Insulators appear relatively deposit free. Determine if the spark plugs are the correct type, as specified on the VECI label, or if other operating conditions are causing engine overheating.

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 27). 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.

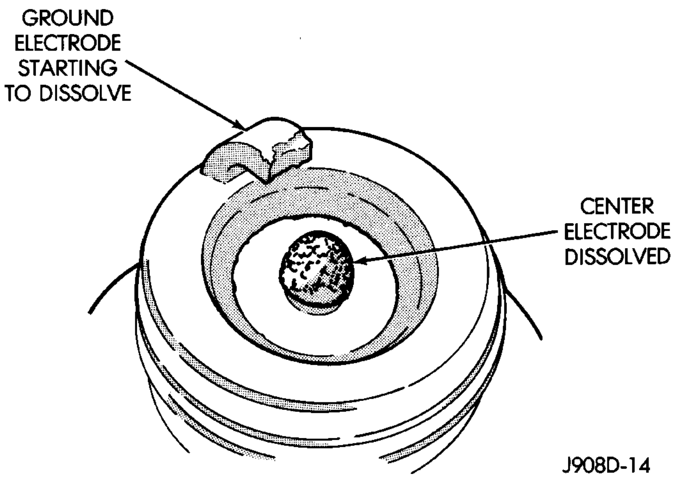


Fig. 26 Preignition Damage

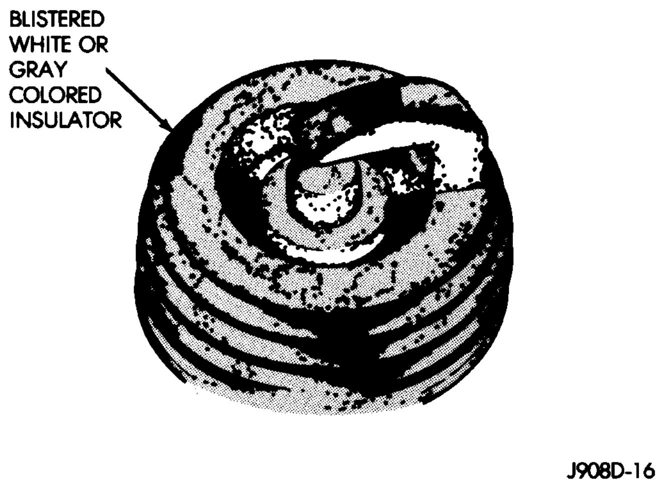


Fig. 27 Spark Plug Overheating

REMOVAL AND INSTALLATION

POWERTRAIN CONTROL MODULE (PCM)

The PCM attaches to the inner fender panel next to the washer fluid bottle on the driver's side (Fig. 28).

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove positive cable from battery.
(3) Remove the washer bottle neck from the rubber grommet.
(4) Remove screws attaching PCM to body.
(5) Lift PCM up and disconnect two 40-way connectors.

INSTALLATION

(1) Attach two 40-way connectors to PCM.
(2) Install PCM. Tighten mounting screws to 6.75 N·m±1 N·m (60 in. lbs.± 10 in. lbs.) torque.
(3) Install washer bottle neck into the rubber grommet.

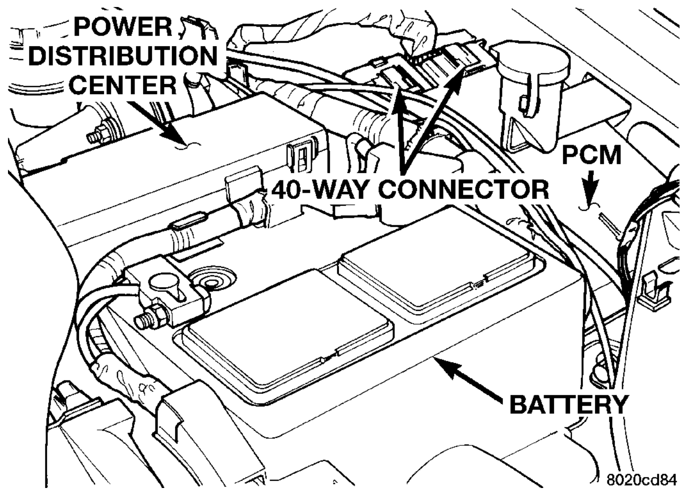


Fig. 28 Powertrain Control Module

(4) Connect positive cable to battery.
(5) Connect negative cable to battery.

SPARK PLUG SERVICE

Failure to route the cables properly could cause the radio to reproduce ignition noise, cross ignition of the spark plugs or short circuit the cables to ground.

REMOVAL

REMOVE CABLES FROM COIL FIRST.

Always remove the spark plug cable by grasping the top of the spark plug insulator, turning the boot 1/2 turn and pulling straight up in a steady motion.

(1) Remove the spark plug using a quality socket with a rubber or foam insert.
(2) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

INSTALLATION

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.
(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.
(3) Install spark plug insulators over spark plugs. Ensure the top of the spark plug insulator covers the upper end of the spark plug tube.

Reconnect to coil.

SPARK PLUG CABLE SERVICE

Failure to route the cables properly could cause the radio to reproduce ignition noise, cross ignition of the spark plugs or short circuit the cables to ground.

REMOVAL

Remove spark plug cable from coil frist.

Always remove the spark plug cable by grasping the top of the spark plug insulator, turning the boot 1/2 turn and pulling straight up in a steady motion.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

Install spark plug insulators over spark plugs. Ensure the top of the spark plug insulator covers the upper end of the spark plug tube.The connect the other end to coil pack. On **SOHC** engines, be sure that dual plastic clip holds #1,#2 cables off of valve cover and that PCV hose plastic clip holds #3 cable away from metal PCV clamp and edge of air duct. On **DOHC** , be sure that the plastic clip on PCV hose is positioned so that cable clip is beneath hose, and that #1 cable is snapped into this clip to protect it from metal PCV clamp.

SPARK PLUG TUBES

The spark plugs tubes are pressed into the cylinder head. Sealant is applied to the end of the tube before installation. For engine information, refer to Group 9, Engines.

IGNITION COIL

SOHC/DOHC

The electronic ignition coil pack attaches directly to the valve cover (Fig. 29) or (Fig. 30).

REMOVAL

(1) Disconnect electrical connector from coil pack.
(2) Remove coil pack mounting nuts.
(3) Remove coil pack.

INSTALLATION

(1) Install coil pack on valve cover.
(2) Transfer spark plug cables to new coil pack. The coil pack towers are numbered with the cylinder identification. Be sure the ignition cables snap onto the towers.

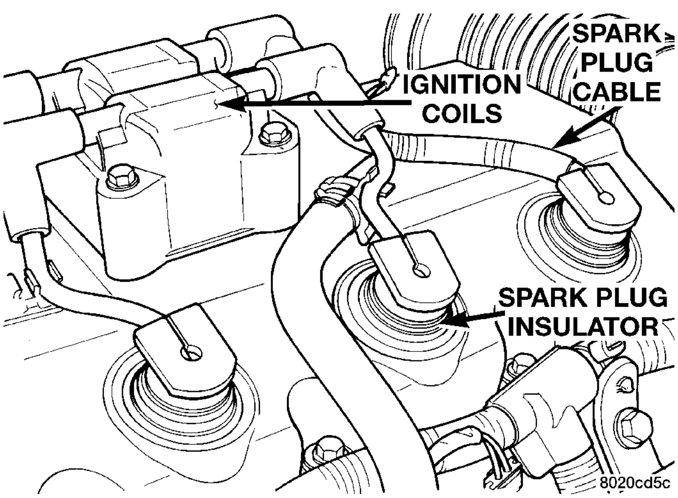


Fig. 29 Electronic Ignition Coil Pack—SOHC

AUTOMATIC SHUTDOWN RELAY

The relay is located in the Power Distribution Center (PDC) (Fig. 31). The PDC is located next to the battery in the engine compartment. For the location

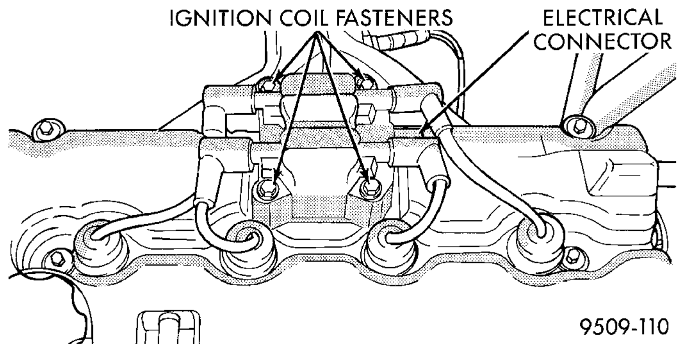


Fig. 30 Electronic Ignition Coil Pack—DOHC

of the relay within the PDC, refer to the PDC cover for location. Check electrical terminals for corrosion and repair as necessary.

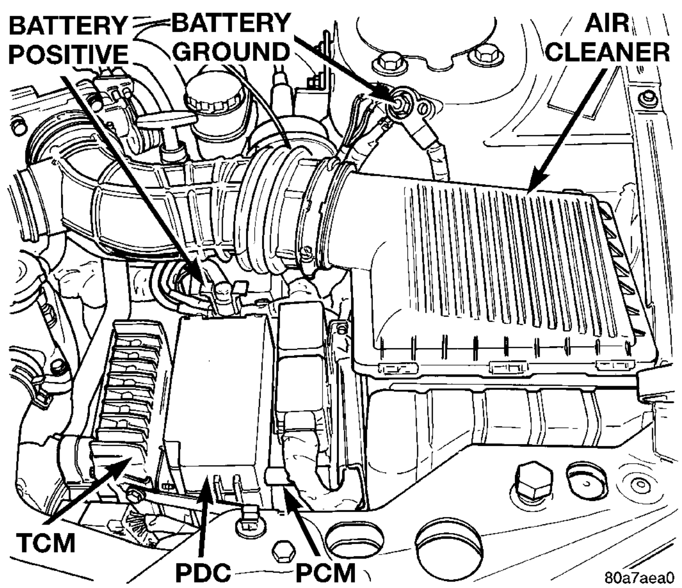


Fig. 31 Power Distribution Center (PDC)

CAMSHAFT POSITION SENSOR—SOHC

The camshaft position sensor is mounted to the rear of the cylinder head (Fig. 32).

REMOVAL

(1) Disconnect the filtered air tube from the throttle body and air cleaner housing. Remove filtered air tube.
(2) Remove the air cleaner inlet tube.
(3) Disconnect electrical connectors from engine coolant sensor and camshaft position sensor.
(4) Remove brake booster hose and electrical connector from holders on end of cylinder head cover.
(5) Remove camshaft position sensor mounting screws. Remove sensor.
(6) Loosen screw attaching target magnet to rear of camshaft (Fig. 33).

REMOVAL AND INSTALLATION (Continued)

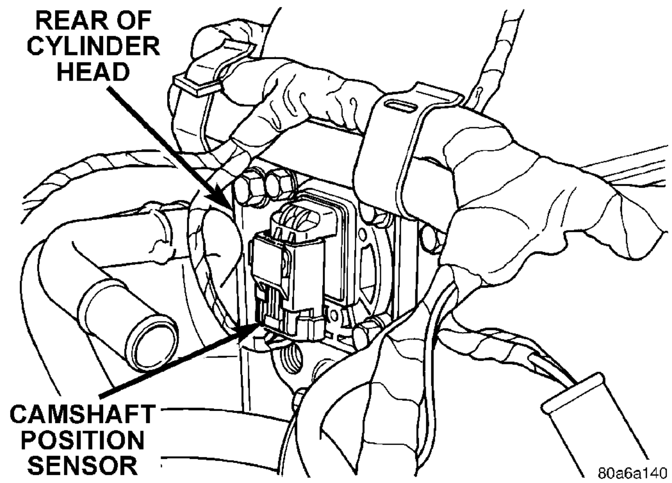


Fig. 32 Camshaft Position Sensor Location—SOHC

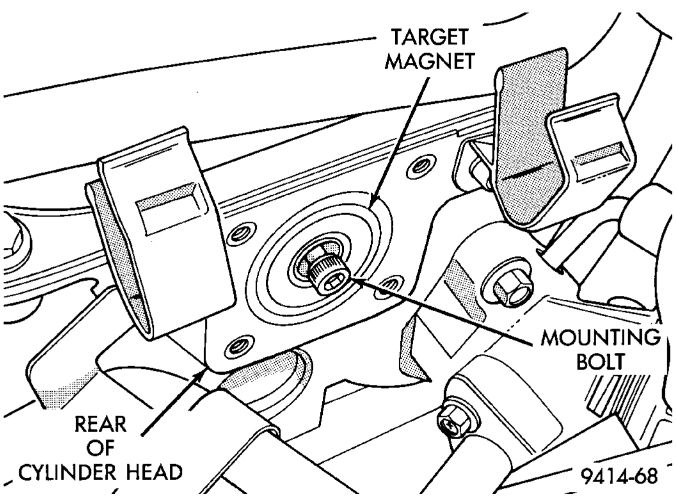


Fig. 33 Target Magnet Removal/Installation

INSTALLATION

The target magnet has two locating dowels that fit into machined locating holes in end of the camshaft.

(1) Install target magnet in end of camshaft. Tighten mounting screw to 3.4 N·m (30 in. lbs.) torque.

(2) Install camshaft position sensor. Tighten sensor mounting screws to 9 N·m (80 in. lbs.) torque.

(3) Place brake booster hose and electrical harness in holders on end of valve cover.

(4) Attach electrical connectors to coolant temperature sensor and camshaft position sensor.

(5) Install air cleaner inlet tube and filtered air tube.

CAMSHAFT POSITION SENSOR—DOHC

The camshaft position sensor is mounted to the rear of the cylinder head (Fig. 34).

REMOVAL

(1) Remove filtered air tube from the throttle body and air cleaner housing.

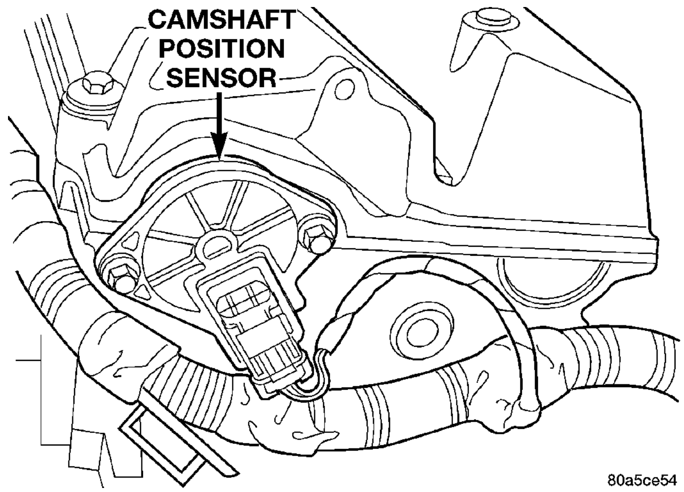


Fig. 34 Camshaft Position Sensor Location—DOHC

(2) Disconnect electrical connector from camshaft position sensor.

(3) Remove camshaft position sensor mounting screws. Remove sensor.

(4) Loosen screw attaching target magnet to rear of camshaft (Fig. 35).

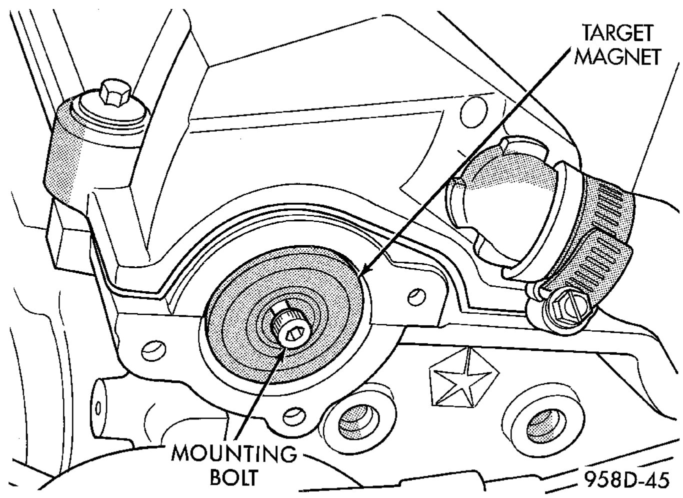


Fig. 35 Target Magnet Removal/Installation

INSTALLATION

The target magnet has locating dowels that fit into machined locating holes in the end of the camshaft (Fig. 36).

(1) Install target magnet in end of camshaft. Tighten mounting screw to 3 N·m (30 in. lbs.) torque.

(2) Install camshaft position sensor. Tighten sensor mounting screws to 9 N·m (80 in. lbs.) torque.

(3) Carefully attach electrical connector to camshaft position sensor. Installation at an angle may damage the sensor pins.

(4) Install filtered air tube. Tighten clamps to 3 N·m ±1 (25 in. lbs. ±5) torque.

REMOVAL AND INSTALLATION (Continued)

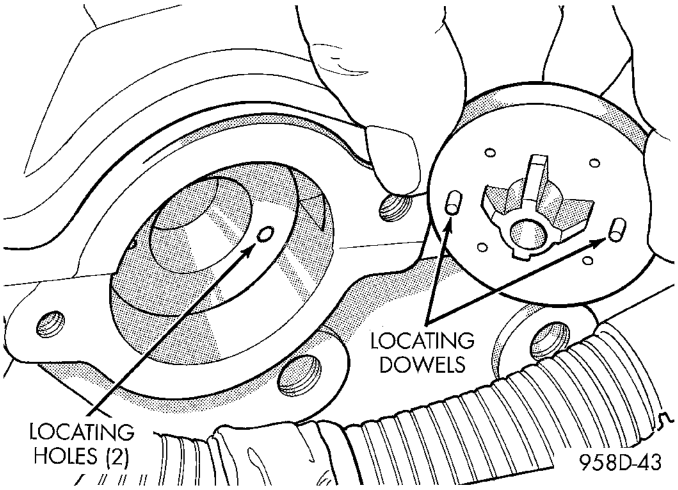


Fig. 36 Target Magnet Installation

CRANKSHAFT POSITION SENSOR

The crankshaft position sensor mounts to the engine block behind the generator, just above the oil filter (Fig. 37).

REMOVAL

(1) Disconnect electrical connector from crankshaft position sensor.

(2) Remove sensor mounting screw. Remove sensor.

INSTALLATION

Reverse procedure for installation.

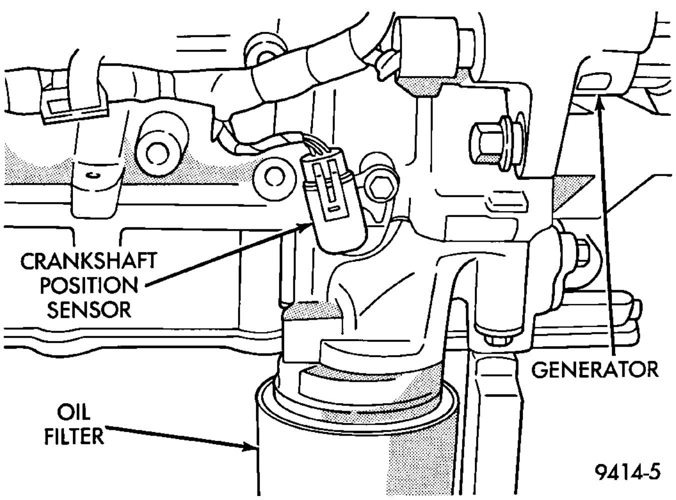


Fig. 37 Crankshaft Position Sensor

COMBINATION ENGINE COOLANT TEMPERATURE SENSOR—SOHC

The combination engine coolant sensor is located at the rear of the cylinder head next to the camshaft position sensor (Fig. 38). New sensors have sealant applied to the threads.

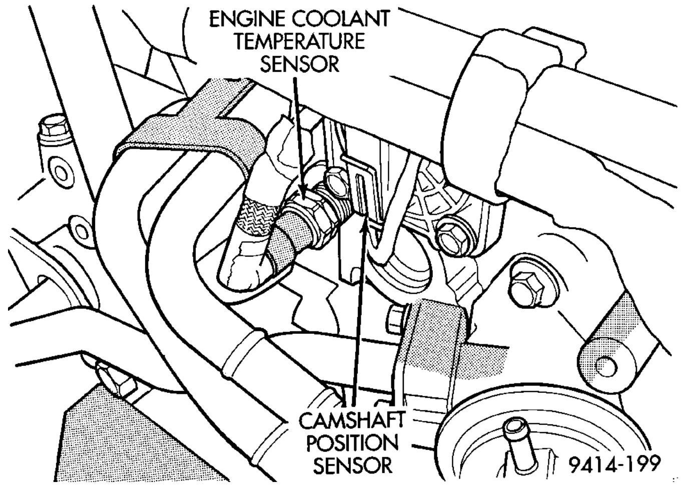


Fig. 38 Engine Coolant Temperature Sensor

REMOVAL

(1) With the engine cold, drain the cooling system until coolant level drops below sensor. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 18.6 N·m (165 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

COMBINATION ENGINE COOLANT TEMPERATURE SENSOR—DOHC

The coolant sensor threads into the intake manifold next to the thermostat housing (Fig. 39). New sensors have sealant applied to the threads.

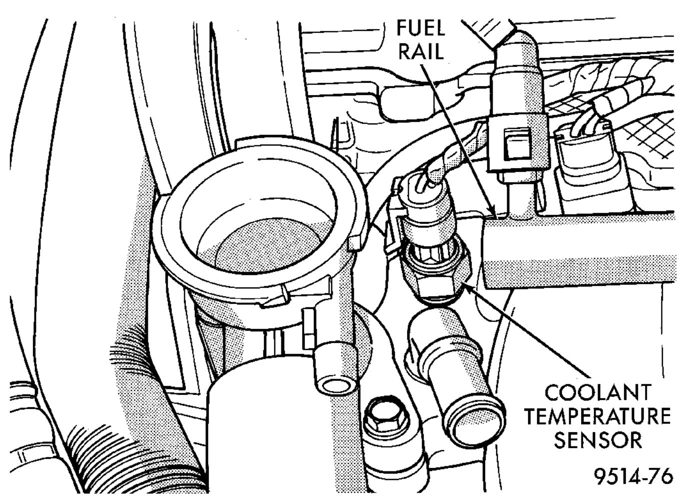


Fig. 39 Engine Coolant Temperature Sensor—DOHC

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 18.6 N·m (165 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

MAP/IAT SENSOR—SOHC

Refer to Group 14, Fuel Injection Section for Removal/Installation.

MAP/IAT SENSOR—DOHC

Refer to Group 14, Fuel Injection Section for Removal/Installation..

THROTTLE POSITION SENSOR

Refer to Group 14, Fuel Injection Section, for Removal/Installation.

IGNITION SWITCH

The ignition switch attaches to the lock cylinder housing on the end opposite the lock cylinder (Fig. 40). For ignition switch terminal and circuit identification, refer to Group 8W, Wiring Diagrams.

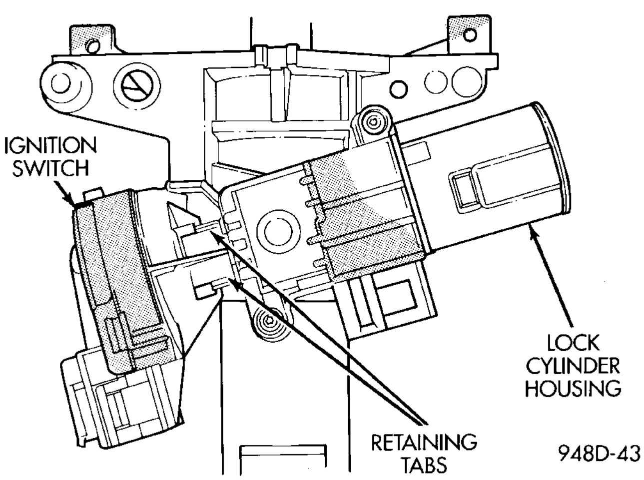


Fig. 40 Ignition Switch—Viewed From Below Column

REMOVAL

(1) Disconnect negative cable from battery.

(2) Place key cylinder in RUN position. Through the hole in the lower shroud, depress lock cylinder retaining tab and remove key cylinder (Fig. 41).

(3) Remove upper and lower shrouds from steering column.

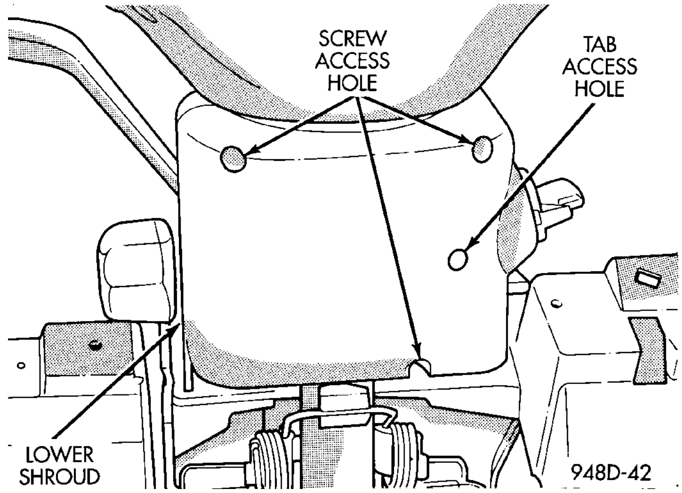


Fig. 41 Steering Column Shrouds

(4) Disconnect electrical connectors from ignition switch.

(5) Remove ignition switch mounting screw (Fig. 42) with a #10 Torx® bit.

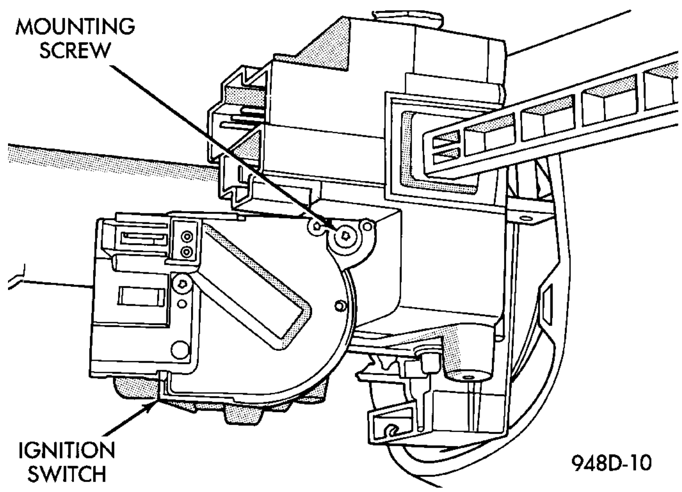


Fig. 42 Ignition Switch Mounting Screw

(6) Depress retaining tabs (Fig. 43) and pull ignition switch from steering column.

INSTALLATION

(1) Ensure the ignition switch is in the RUN position and the actuator shaft in the lock housing is in the RUN position.

(2) Carefully install the ignition switch. The switch will snap over the retaining tabs (Fig. 44). Install mounting screw (Fig. 42).

(3) Install electrical connectors to ignition switch.

(4) Install upper and lower shrouds.

(5) Install key cylinder (cylinder retaining tab will depress only in the RUN position).

(6) Connect negative cable to battery.

(7) Check for proper operation of ignition switch and key-in warning switch.

REMOVAL AND INSTALLATION (Continued)

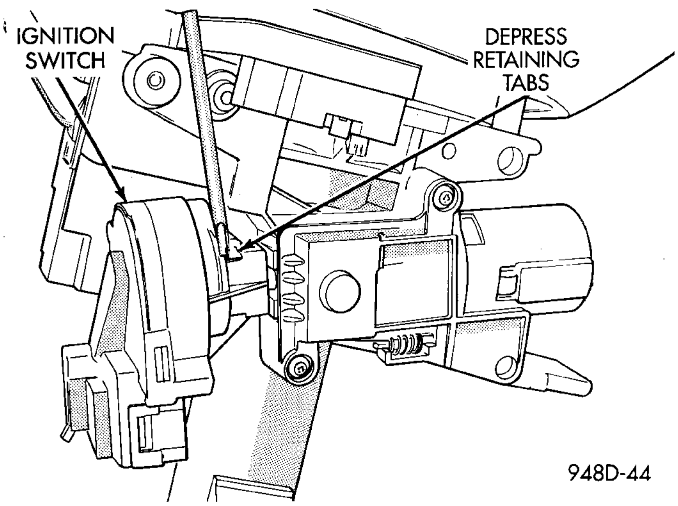


Fig. 43 Removing Ignition Switch

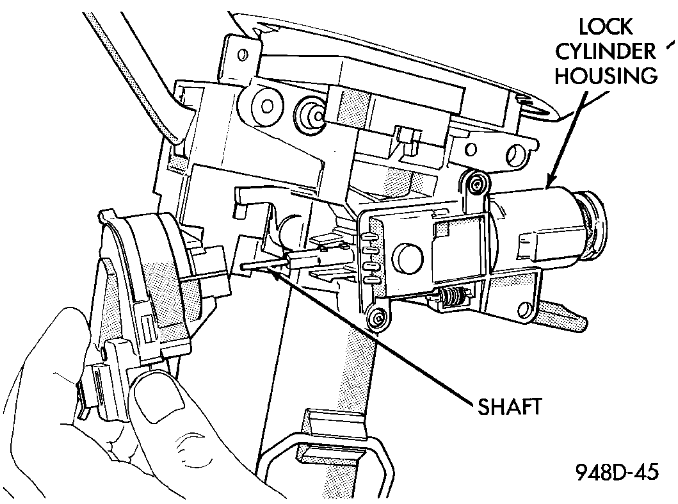


Fig. 44 Ignition Switch Installation

LOCK KEY CYLINDER

The lock cylinder is inserted in the end of the housing opposite the ignition switch. The ignition key rotates the cylinder to 5 different detentes (Fig. 45):

- Accessory
- Off (lock)
- Unlock
- On/Run
- Start

REMOVAL

(1) Disconnect negative cable from battery.

(2) Place key cylinder in RUN position. Through the hole in the lower shroud, depress lock cylinder retaining tab and remove key cylinder.

INSTALLATION

(1) Install key in lock cylinder. Turn key to run position (retaining tab on lock cylinder can be depressed).

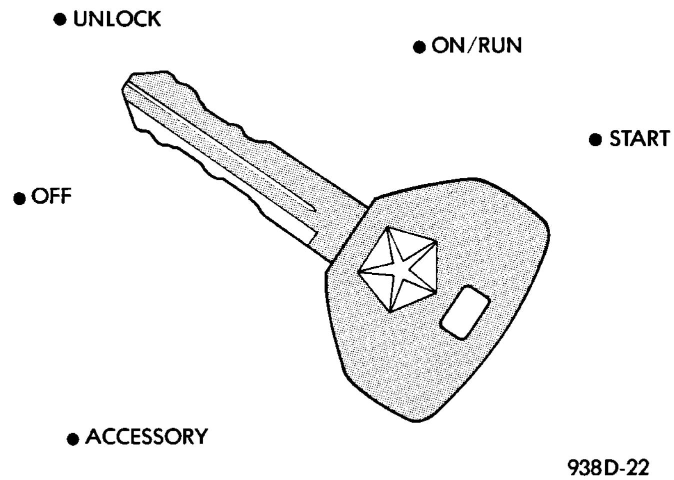


Fig. 45 Ignition Lock Cylinder Detentes

(2) The shaft at the end of the lock cylinder aligns with the socket in the end of the housing. To align the socket with the lock cylinder, ensure the socket is in the Run position (Fig. 46).

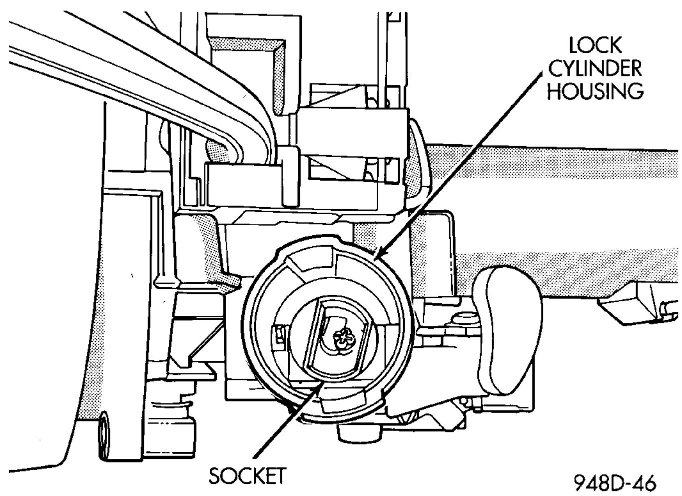


Fig. 46 Socket in Lock Cylinder Housing

(3) Align the lock cylinder with the grooves in the housing. Slide the lock cylinder into the housing until the tab sticks through the opening in the housing.

(4) Turn the key to the Off position. Remove the key.

(5) Connect negative cable to battery.

IGNITION INTERLOCK

Refer to Group 21, Transaxle for Shifter/Ignition Interlock Service.

LOCK CYLINDER HOUSING

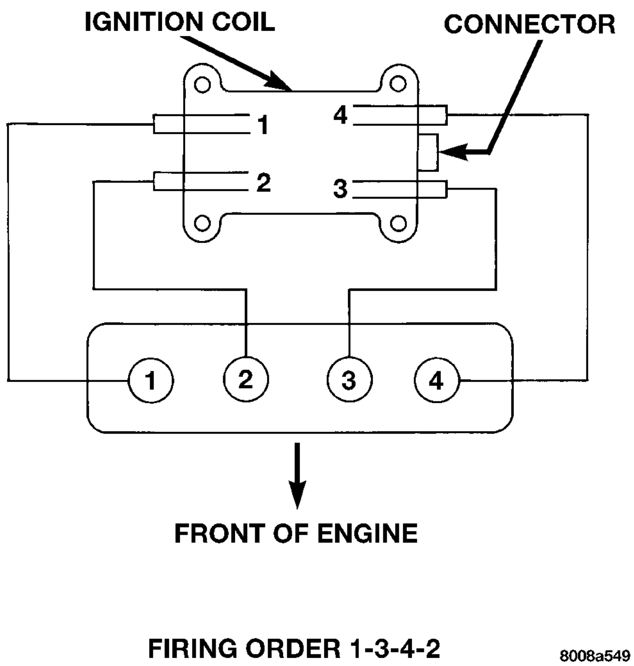
Refer to Steering Column in Group 19, Steering, for Lock Cylinder Housing Service.

SPECIFICATIONS

VECI LABEL

If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label. The VECI label is located in the engine compartment.

FIRING ORDER—2.0L



TORQUE SPECIFICATION

DESCRIPTION	TORQUE
Camshaft Position Sensor Screw	9 N·m (80 in. lbs.)
SOHC Cam Magnet/Target	3.4 N·m (30 in. lbs.)
DOHC Cam Magnet/Target	3 N·m (30 in. lbs.)
Crankshaft Position Sensor Screw	9 N·m (80 in. lbs.)
Coolant Temp. Sensor	18.6 N·m (165 in. lbs.)
Ignition Coil to Cyl. Head	22 N·m (200 in. lbs.)
Ignition Coil Bracket Nuts	22 N·m (200 in. lbs.)
Knock Sensor	10 N·m (90 in. lbs.)
MAP/IAT Sensor Plastic Manifold	2 N·m (20 in. lbs.)
MAP/IAT Sensor Aluminum Manifold	3 N·m (30 in. lbs.)
Spark Plugs	28 N·m (20 ft. lbs.)

SPARK PLUG CABLE RESISTANCE—SOHC

CABLE	RESISTANCE
#1,#4	3500 ohms—4900 ohms
#2,#3	2950 ohms—4100 ohms

SPARK PLUG CABLE RESISTANCE—DOHC

CABLE	RESISTANCE
#1,#4	3050 ohms—4250 ohms
#2,#3	2300 ohms—3300 ohms

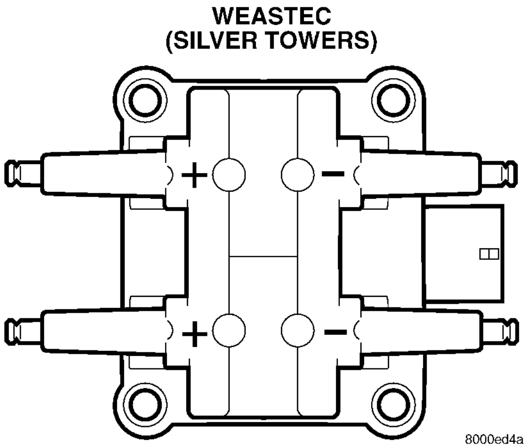
SPARK PLUG

Engine	Spark Plug	Gap	Thread Size
2.0L	RC9YC	0.033 TO 0.038	14mm (3/4 in.) reach

IGNITION COIL

Coil Manufacture	Primary Resistance at 21°C-27°C (70°F-80°F)	Secondary Resistance at 21°C-27°C (70°F-80°F)
Weastec (Steel Towers)	0.45 to 0.65 Ohms	7,000 to 15,800 Ohms

SPECIFICATIONS (Continued)



Coil Polarity

INSTRUMENT PANEL AND SYSTEMS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The purpose of the dash gauges and indicator lamps is to keep the driver informed about the operating condition of the vehicle. If an abnormal condition occurs, the driver is informed by indicator lamp. The driver can seek service before damage occurs.

Indicator lamps use ON/OFF switch functions for operation, while gauges use a sending unit or sensor.

GENERAL INFORMATION (Continued)

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DESCRIPTION AND OPERATION

DOME LAMP

The Dome Lamp operates when a door is open or when the headlamp switch is placed in courtesy position.

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 in the individual radio operating instructions. Refer to the Owner's Manual supplied with the vehicle.

INSTRUMENT CLUSTER

There are two conventional instrument cluster assemblies available. The clusters electronically drive the speedometer, odometer, and gauges (Fig. 1) and (Fig. 2).

GAUGES

All gauges in the electronic clusters are the analog type gauges. When the ignition switch is moved to the OFF position, the cluster drives each gauge to its lowest position.

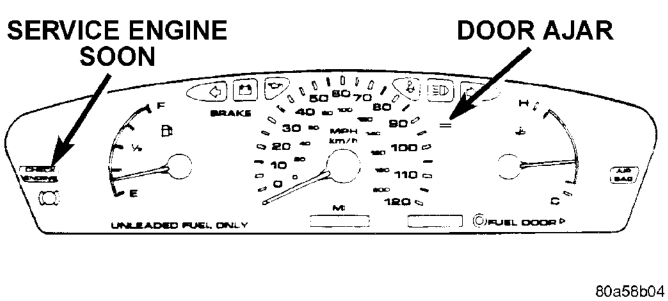


Fig. 1 Instrument Cluster With Tachometer

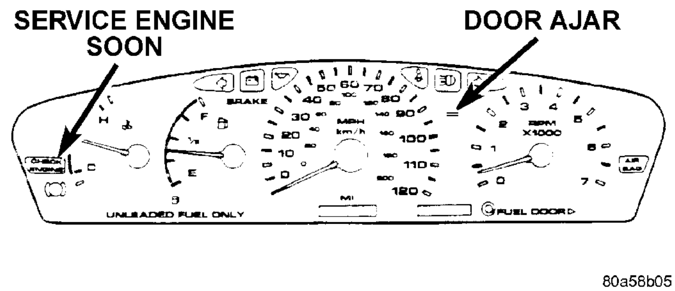


Fig. 2 Instrument Cluster Without Tachometer

WARNING AND INDICATOR LAMPS

The instrument cluster has warning lamps and indicators for the following systems:

- Airbag
- Anti-lock Brakes (ABS) if equipped
- Brake warning
- Charging System
- Door Ajar
- High beam indicator
- Low oil pressure
- Malfunction indicator (check engine) lamp
- Right and left turn signals.
- Seat belt warning

DIAGNOSIS AND TESTING

AIRBAG WARNING SYSTEM

For testing of this system refer to Group 8M, Restraint Systems.

BRAKE SYSTEM WARNING LAMP TEST

The brake warning lamp illuminates when the parking brake is applied with ignition switch turned to the ON position. The same lamp will also illuminate if one of the two service brake systems fail the when brake pedal is applied.

To test the system:

- As the ignition switch is turned to the start position the lamp should light.
- Turn ignition switch to the ON position and apply the parking brake. The lamp should light.

If lamp fails to light inspect for:

- A burned out lamp
- Loose, corroded or damaged socket
- A damaged circuit board
- A broken or disconnected wire at the switch
- Defective switch

To test the service brake warning system, refer to Group 5, Brakes, Hydraulic System Control Valves.

DIAGNOSIS AND TESTING (Continued)

FOG LAMP SWITCH TEST

(1) Remove the fog lamp switch. Refer to the Rear Window Defogger and/or Fog Lamp Switch Removal.

(2) Using two jumper wires, connect Pin 2 and Pin 4 of the switch to battery voltage.

(3) Using a test lamp, connect the test lamp to Pin 3 as shown in (Fig. 3). Refer to (Fig. 4) for fog lamp switch circuit.

(4) Push the fog lamp switch button. The test lamp and the LED indicator on the front of the switch should illuminate.

(5) If either the LED or the test lamp fails to illuminate, replace the switch.

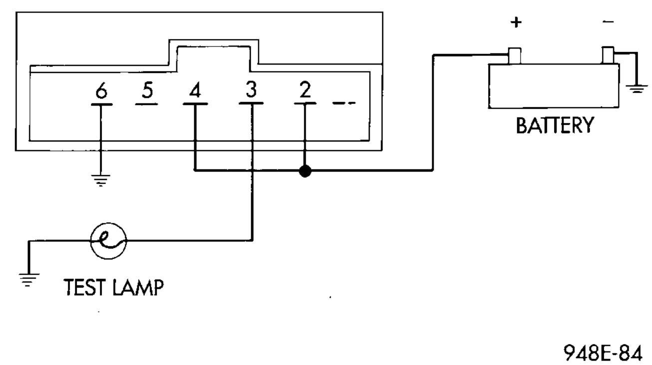


Fig. 3 Fog Lamp Switch Test

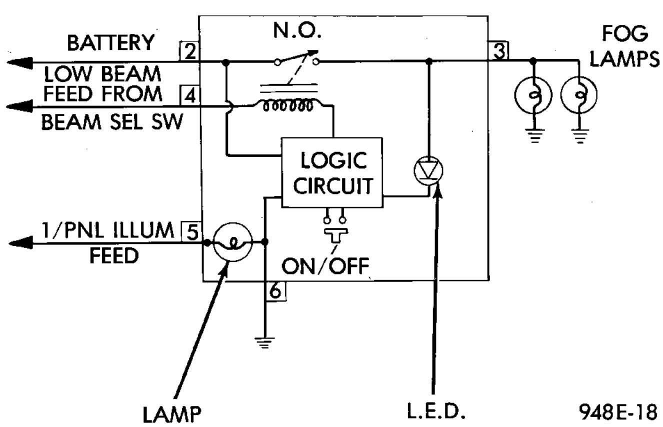


Fig. 4 Fog Lamp Switch Circuit

FOG LAMP SWITCH TEST EXPORT

Refer to Group 8W, Wiring Diagrams for wiring or circuit information.

FRONT EXPORT

(1) Remove the fog lamp switch and disconnect the connector at the center stack.

(2) Using two jumper wires connect Pin L7 to battery voltage, and connect Pin Z03 to ground (Fig. 5).

(3) Push the fog lamp switch button. The LED indicator on the front of the switch should illuminate. Check Pin L35 with a test lamp for battery voltage.

(4) If either the LED or the test lamp fails to illuminate, replace the switch.

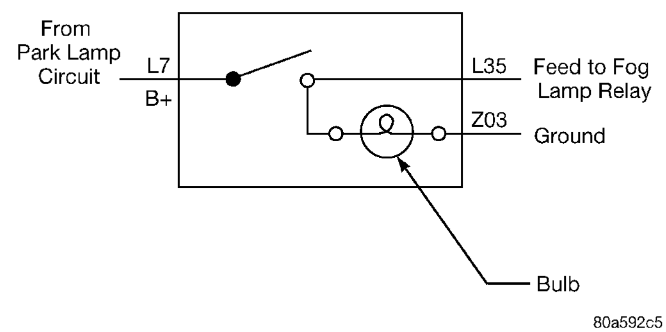


Fig. 5 Front Fog Lamp Switch Circuit Diagram

REAR EXPORT

(1) Remove the fog lamp switch. Refer to Rear Window Defogger and/or Fog Lamp Switch Removal.

(2) Using two jumper wires connect Pin 2 and Pin 4 of the switch to battery voltage.

(3) Using a test lamp, connect the test lamp to Pin 3 as shown in (Fig. 6). Refer to Group 8W, Wiring Diagrams for fog lamp switch circuit.

(4) Push the fog lamp switch button. The test lamp should illuminate, and the LED indicator on the front of the switch.

(5) If either the LED, or the test lamp fails to illuminate, replace the switch.

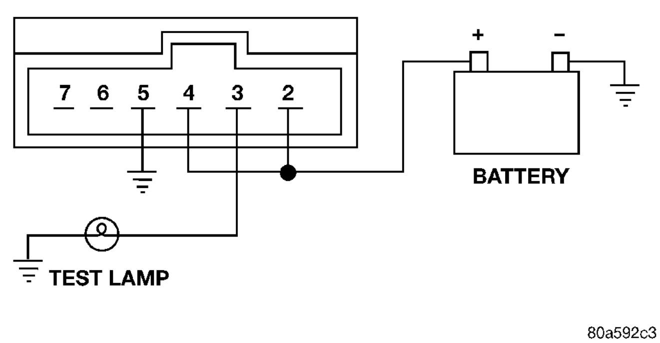


Fig. 6 Rear Fog Lamp Switch Test

FUEL TANK SENDING UNIT TEST

Refer to Group 14, Fuel for test procedures.

HEADLAMP LEVELING SWITCH

(1) Remove the headlamp leveling switch from the instrument panel and disconnect the wire harness connector from the switch. Refer to Wiring Diagrams for the proper wire circuits and the wire connector connections.

DIAGNOSIS AND TESTING (Continued)

(2) If the L.E.D. is not illuminated, using a voltmeter, connect B+ lead to Pin 4 of the Wire harness connector. Connect the negative lead to Pin 3. Turn ON the headlamp switch to the low beam position and ensure the instrument panel dimmer switch is on day light driving position. If voltage is present, replace switch. If no voltage, connect the ground lead to a good ground, if voltage, repair Pin 3 ground circuit as necessary, and if no voltage, refer to Wiring Diagrams and test circuit back to headlamp switch.

(3) Using a voltmeter, connect B+ lead to Pin 2 of the Wire harness connector. Connect the negative lead to Pin 3. Turn ON the headlamp switch to the low beam position. If battery voltage, go to Step 5. If not OK, go to Step 4.

(4) Connect the ground lead to a good ground, if no voltage, refer to Wiring Diagrams and test circuit back to headlamp switch. If battery voltage, repair Pin 3 ground circuit as necessary.

(5) Turn headlamps OFF. Connect the wire harness connector to the headlamp leveling switch. Turn ON the headlamp switch to the low beam position. Check voltage at Pin 5, while rotating the headlamp leveling switch knob through the four positions. The voltage reading should change as the switch is rotated to each position. If the voltage does not vary replace switch. If OK, test the headlamp leveling motors and/or circuit to the motors.

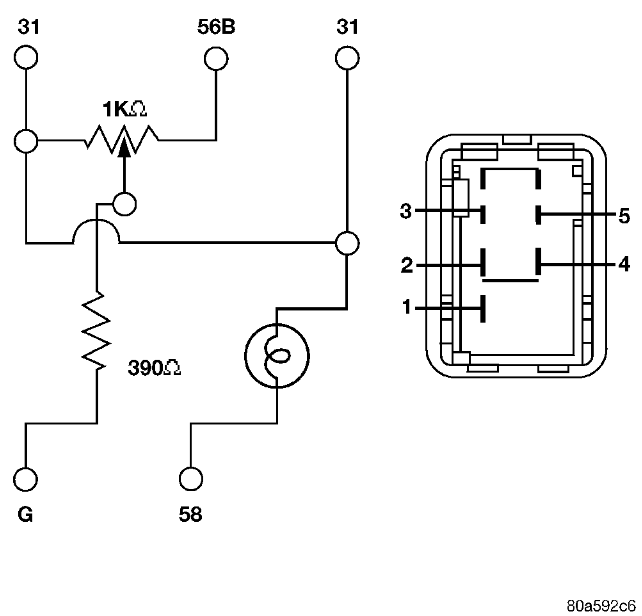
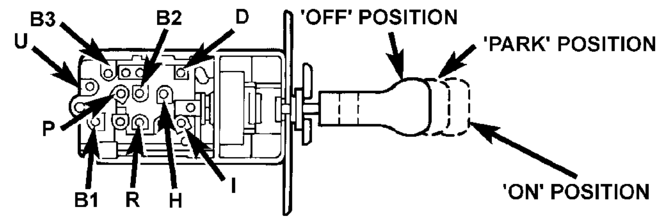


Fig. 7 Headlamp Leveling Switch Circuit Diagram

HEADLAMP SWITCH TEST

(1) Remove the headlamp switch. Refer to Headlamp Switch Removal.

(2) Use a ohmmeter, and check continuity between the terminals of the switch as shown in the Headlamp Switch Test (Fig. 8).



SWITCH POSITIONS	CONTINUITY BETWEEN
OFF	B1 to P OPTICAL HORN
PARK	B1 to P OPTICAL HORN B2 to R PARK LAMPS B3 to U HEADLAMPS ON WARNING CIRCUIT
ON	B1 to P OPTICAL HORN B1 to H HEADLAMPS B2 to R PARK LAMPS B3 to U HEADLAMPS ON WARNING CIRCUIT
TURN SWITCH FULL RIGHT/LEFT FOR TEST	
	1-7 OHMS
ON	B2 to I DIMMER SWITCH FOR ILLUMINATION LAMPS

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Fig. 8 Headlamp Switch Test

HEATER A/C BLOWER SWITCH TEST

(1) Remove Heater A/C control module. Refer to Heater A/C Control Removal procedures.

(2) Use a ohmmeter, and check continuity between the terminals of the switch as shown in the Blower Switch Test (Fig. 9).

(3) If the switch fails any part of the continuity test, other then Pin 1 to Pin 7, replace Heater A/C Control. If no continuity between Pin 1 to Pin 7 check the lamps, replace if necessary.

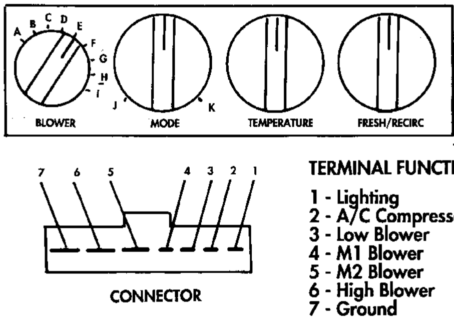
HEATER BLOWER SWITCH TEST

(1) Remove heater control, refer to A/C Heater Control Removal.

(2) Use a ohmmeter, and check continuity between the terminals of the switch as shown in the Heater Blower Test (Fig. 10).

(3) If switch fails any part of the continuity test, other then Pin 1 to Pin 7, replace heater control. If no continuity between Pin 1 to Pin 7 check the lamps, replace if necessary.

DIAGNOSIS AND TESTING (Continued)



TERMINAL FUNCTION

1 - Lighting
2 - A/C Compressor Clutch
3 - Low Blower
4 - M1 Blower
5 - M2 Blower
6 - High Blower
7 - Ground

BLOWER POSITION	MODE POSITION	CONTINUITY BETWEEN
A	J	PIN 1 TO PIN 7 PIN 2 TO PIN 7 PIN 6 TO PIN 7
B	J	PIN 1 TO PIN 7 PIN 2 TO PIN 7 PIN 5 TO PIN 7
C	J	PIN 1 TO PIN 7 PIN 2 TO PIN 7 PIN 4 TO PIN 7
D	J	PIN 1 TO PIN 7 PIN 2 TO PIN 7 PIN 3 TO PIN 7
E	J	PIN 1 TO PIN 7
F	J	PIN 1 TO PIN 7 PIN 3 TO PIN 7
G	J	PIN 1 TO PIN 7 PIN 4 TO PIN 7
H	J	PIN 1 TO PIN 7 PIN 5 TO PIN 7
I	J	PIN 1 TO PIN 7 PIN 6 TO PIN 7
I	K	PIN 1 TO PIN 7 PIN 2 TO PIN 7 PIN 6 TO PIN 7

*Continuity between terminals 1 and 7 is through lamps

948E-15

Fig. 9 Blower Switch Test

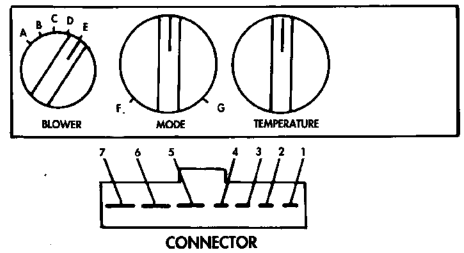
INSTRUMENT PANEL AND COMPONENTS

CAUTION: Disconnect the battery negative cable before servicing the instrument panel or components. When power is required for test purposes, connect battery cable for test only. Disconnect the battery negative cable after test and before continuing service procedures.

LOW OIL PRESSURE WARNING LAMP TEST

The low oil pressure warning lamp will illuminate when the ignition switch is turned to the ON position without engine running. The lamp also illuminates if the engine oil pressure drops below a safe oil pressure level.

To test the system, turn the ignition switch to the ON position. If the lamp fails to light, inspect for a broken or disconnected wire at the oil pressure switch, located at the front of the engine (Fig. 11). If the wire at the connector checks good, pull the connector loose from the switch and with a jumper wire, ground the connector to the engine. With the ignition switch turned to the ON position, check the warning lamp. If the lamp still fails to light, inspect for a burned out lamp or disconnected socket in the cluster.



TERMINAL FUNCTION

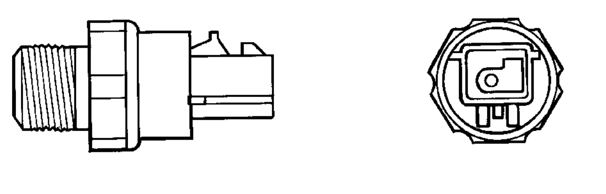
1 - Lighting
2 - Not used for Heater
3 - Low Blower
4 - M1 Blower
5 - M2 Blower
6 - High Blower
7 - Ground

BLOWER POSITION	MODE POSITION	CONTINUITY BETWEEN
A	F	PIN 1 TO PIN 7
B	F	PIN 1 TO PIN 7 PIN 3 TO PIN 7
C	F	PIN 1 TO PIN 7 PIN 4 TO PIN 7
D	F	PIN 1 TO PIN 7 PIN 5 TO PIN 7
E	F	PIN 1 TO PIN 7 PIN 6 TO PIN 7

*Continuity between terminals 1 and 7 is through lamps

948E-16

Fig. 10 Heater Blower Switch Test



80570e09

Fig. 11 Oil Pressure Switch

MULTIPLE GAUGE INOPERATIVE TEST

Test speedometer, tachometer and other gauges for malfunction:

(1) Remove the cluster. Refer to Cluster Removal and Installation.

(2) Check for ignition voltage at Pin J1-5 of the cluster wire harness connector (Fig. 12) and (Fig. 13).

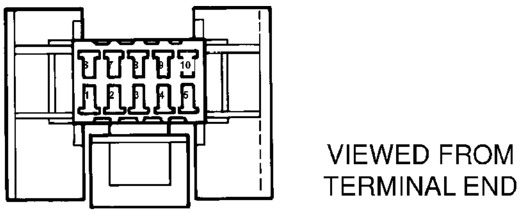
DIAGNOSIS AND TESTING (Continued)

Check for battery voltage at Pin J1-6 of the connector. If no voltage, repair as necessary.

(3) Check Pin J1-8 of the connector for continuity to ground. If no ground, repair as necessary.

(4) If the voltage and ground are OK, and the pins or the connectors are not distorted, replace the printed circuit board.

(5) Install cluster.

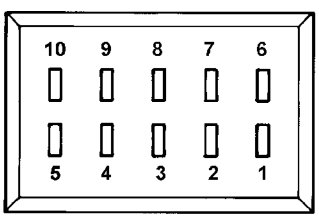


CLUSTER WIRING HARNESS CONNECTORS			
J1 CONNECTOR		J2 CONNECTOR	
PIN	DESCRIPTION	PIN	DESCRIPTION
1	DOOR AJAR	1	OIL PRESSURE
2	HI BEAM	2	ABS
3	RIGHT TURN	3	MIL* (CHECK ENGINE)
4	SEAT BELT	4	ENGINE TEMPERATURE
5	IGNITION FEED	5	KEY IN HEADLAMPS ON
6	BATTERY	6	BRAKE
7	TACHOMETER SIGNAL	7	CHARGING SYSTEM
8	GROUND	8	LEFT TURN
9	AIRBAG	9	ILLUMINATION
10	SPEED SIGNAL	10	FUEL LEVEL

*MALFUNCTION INDICATOR LAMP

80a58b06

Fig. 12 Cluster Wire Harness Connector



CLUSTER WIRING HARNESS CONNECTORS			
J1 CONNECTOR		J2 CONNECTOR	
PIN	DESCRIPTION	PIN	DESCRIPTION
1	DOOR AJAR	1	OIL PRESSURE
2	HI BEAM	2	ABS
3	RIGHT TURN	3	MIL* (CHECK ENGINE)
4	SEAT BELT	4	ENGINE TEMPERATURE
5	IGNITION FEED	5	KEY IN HEADLAMPS ON
6	BATTERY	6	BRAKE
7	TACHOMETER SIGNAL	7	CHARGING SYSTEM
8	GROUND	8	LEFT TURN
9	AIRBAG	9	ILLUMINATION
10	SPEED SIGNAL	10	FUEL LEVEL

*MALFUNCTION INDICATOR LAMP

80a58b07

Fig. 13 Cluster Connector

INDIVIDUAL GAUGE INOPERATIVE

FUEL GAUGE

(1) Disconnect the fuel gauge sending unit.

(2) Turn the ignition switch to the ON position. The fuel gauge should be at its lowest position. Turn the ignition switch OFF.

(3) Ground fuel gauge sending unit connector Pin 3. Refer to Group 8W, Wiring Diagrams. Turn ignition switch to the ON position. The fuel gauge should be at its highest position. Turn ignition switch OFF then ON, after a sending unit signal change to disable the cluster electronic gauge dampening mechanism.

(a) If OK, check the fuel gauge sending unit connector for proper connection. If the connections are OK, refer to Group 14 Fuel System for Fuel Level Sensor Diagnosis.

(b) If not OK, connect the sending unit. Remove the cluster and check for an open or short in the sending unit wiring. The sending unit will be less than 1080 ohms and greater than 50 ohms depending upon fuel level. If the sending unit wiring is open or a short circuit, repair as necessary.

(c) If the sending unit wiring is OK, replace the gauge assembly. If the condition persists, replace the cluster printed circuit board.

FUEL GAUGE INCORRECTLY INDICATES EMPTY

The fuel system uses both the instrument cluster and the Powertrain Control Module (PCM) to monitor the fuel level sending unit. If the PCM fuel monitoring circuits senses an open circuit, the increased circuit resistance will causes a false fuel gauge empty reading. Check for continuity between cluster wire harness connector Pin J2-10 and Pin 23 of the PCM (Fig. 12) and (Fig. 14). If there is no continuity, repair as necessary. If there is continuity, refer to Fuel Gauge test.

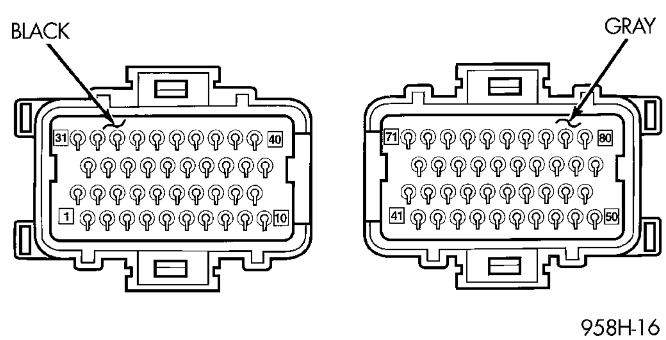


Fig. 14 Powertrain Control Module Pin Location

LOW FUEL WARNING CIRCUIT

The low fuel warning lamp receives its signal from the fuel gauge drive circuit. Due to production varia-

DIAGNOSIS AND TESTING (Continued)

tions, the point where the lamp illuminates, may vary from 1/16 to 3/16 mark on the fuel gauge. There is a built in time delay before the lamp illuminates. This prevents the lamp from going on and off under various road conditions.

(1) Verify that the fuel gauge is operating properly.

(2) Check the low fuel warning lamp assembly.

(3) If the lamp still does not function under a low fuel condition replace the printed circuit board.

TACHOMETER CIRCUIT

(1) Remove the cluster. Refer to Cluster Removal.

(2) Check for battery voltage at Pin J1-6 of the cluster wire harness connector (Fig. 12).

(3) With the ignition switch in the ON position, check for battery voltage at Pin J1-5 connector.

(4) Check Pin J1-8 of the connector for continuity to ground.

(5) Check for tachometer signal from the Powertrain Control Module by connecting an AC DIGITAL VOLTMETER to Pin J1-7 of the connector and ground. A reading of at least 1.0 volt should be present with the engine running.

(a) If the voltage is NOT within specification, go to Step 6.

(b) If the voltage is within specification, go to Step 7.

(6) If there is less than 1.0 volt at Pin J1-7 of the connector, check for continuity between Pin J1-7 and Pin 73 of the Powertrain Control Module connector (Fig. 14). Also, check the connector at the Powertrain Control Module for damaged pins or terminal push outs.

(7) If the voltage is less than 1.0 volt at Pin J1-7 of the connector and there is continuity between Pin J1-7 and Pin 73 of the PCM connector, replace the Powertrain Control Module.

(8) If all tests performed test good, replace the dial and gauge assembly.

(9) If the tachometer continues to be inoperative, replace the print circuit board.

TEMPERATURE GAUGE

(1) Disconnect the coolant temperature sensor (Fig. 15).

(2) Turn ignition switch ON. The temperature gauge should be at its lowest position. Turn ignition switch OFF.

(3) Ground temperature gauge sending unit connector Pin 3. Refer to Group 8W, wiring Diagrams. Turn ignition switch ON. The temperature gauge should be at its highest position. After the seat belt lamp goes out, the cluster should chime for about eight seconds.

(a) If OK, check temperature sending unit connector for proper connection. If connections are OK, replace the sending unit.

(b) If not OK, and the high temperature chime sounds but the gauge shows cold, replace the gauge assembly. If gauge is still not working, replace the printed circuit board.

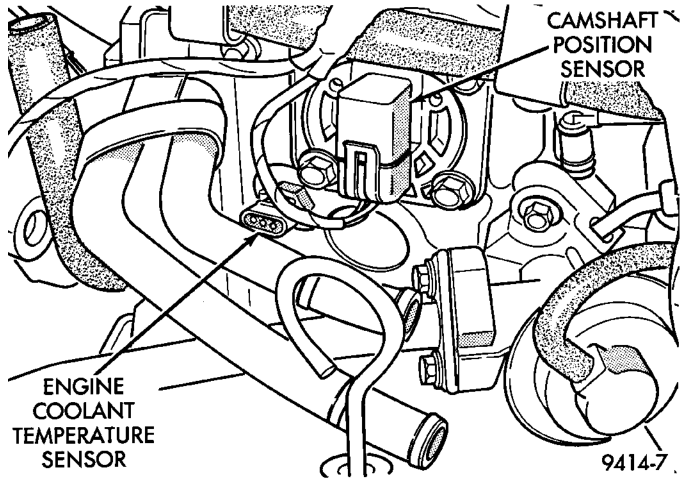


Fig. 15 Engine Coolant Temperature Sensor

SPEEDOMETER SYSTEM

The vehicle is equipped with a electronically driven speedometer and odometer assemblies. A signal is sent from a transmission-mounted vehicle speed sensor to the speedometer circuitry through the wiring harness.

SEAT BELT REMINDER SYSTEM TEST

For testing of this system refer to Group 8U, Chime Warning/Reminder Systems.

SENDING UNIT

When a problem occurs with a cluster gauge check for a defective sending unit or wiring. 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.

SERVICE ENGINE SOON INDICATOR

Refer to Group 25, Emission Control Systems for procedures.

VEHICLE SPEED SENSOR TEST

To test the vehicle speed sensor and related components use a scan tool (DRB), and refer to the appropriate Powertrain Diagnostics Test Procedure Manual.

REMOVAL AND INSTALLATION

ASH RECEIVER RETAINER AND LAMP

REMOVAL

(1) Remove the ash receiver receptacle.

(2) Remove the center bezel.

(3) Remove the two ash receiver retainer attaching screws from the upper-rearward face and remove retainer.

(4) For lamp replacement, remove the clamp and lamp hood from the top of the retainer. Remove the wiring clip at the forward edge of the retainer and remove the lamp socket from the hood and replace lamp.

INSTALLATION

For installation reverse the above procedures. When installing the retainer ensure that the forward tabs are inserted properly into the slots in the instrument panel.

CENTER BEZEL

REMOVAL

(1) Open the ash receiver receptacle.

(2) Grasp the bezel and pull rearward disengaging the clips.

INSTALLATION

For installation, reverse the above procedures.

CIGAR LIGHTER RECEPTACLE

REMOVAL

(1) Remove the cigar lighter element.

(2) Reach underneath the instrument panel through the bottom access hole and disconnect the cigar lighter receptacle wiring connectors.

(3) Unscrew the cigar lighter receptacle shell from the receptacle and remove from the base instrument panel.

INSTALLATION

For installation, reverse the above procedures.

CLUSTER

CAUTION: Cluster MUST be stored in a face up position or damage will occur to the gauge operation.

REMOVAL

(1) Disconnect the battery to ensure no DTCs are generated.

(2) Remove the instrument panel top cover and cluster bezel.

(3) Remove the four screws attaching cluster housing to the base panel.

(4) Pull the cluster rearward to disconnect from base panel.

(5) Remove the cluster assembly.

INSTALLATION

For installation, reverse the above procedures.

CLUSTER LAMP

The Instrument Cluster illumination Lamps location are shown in (Fig. 16). The cluster is viewed from the rear. To replace lamp(s), the cluster must be removed. Refer to Cluster Removal and Installation procedure.

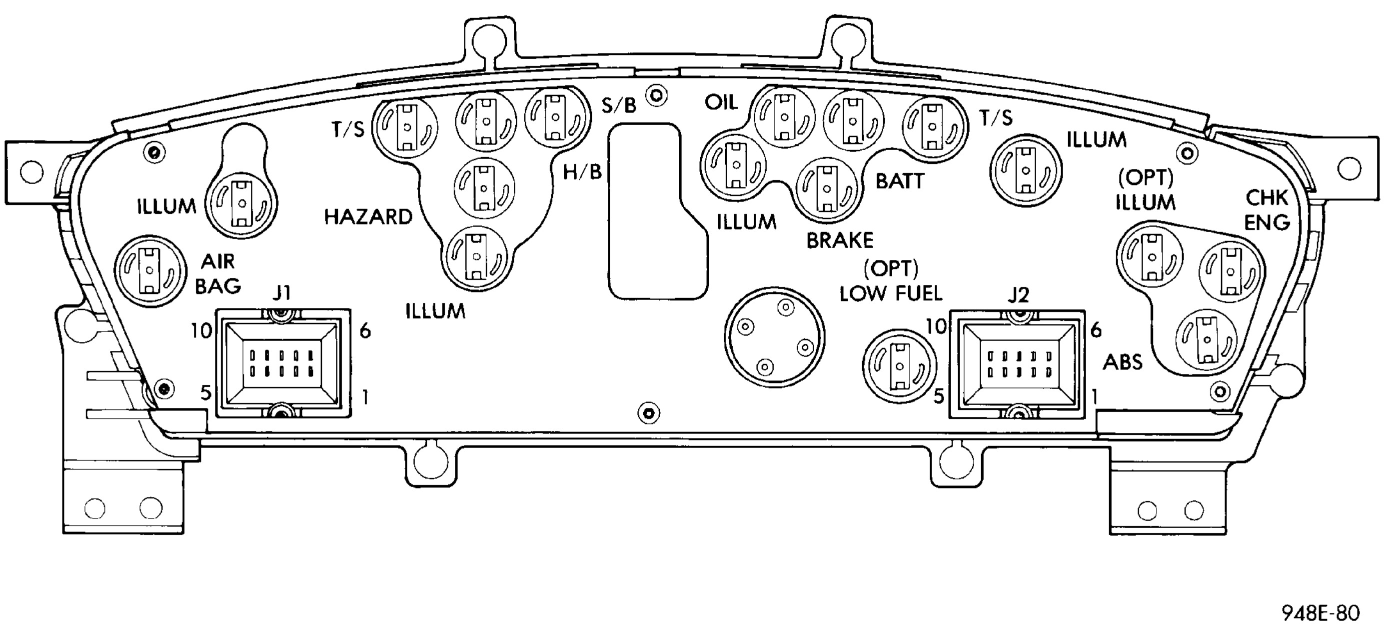


Fig. 16 Instrument Cluster Illumination Lamps

REMOVAL AND INSTALLATION (Continued)

CLUSTER PRINTED CIRCUIT BOARD

REMOVAL

(1) Remove the cluster, refer to Cluster Removal.

(2) Remove the attaching screws and rear cover (Fig. 17). The bottom screws attaching lens to housing can be accessed without removing foam pad.

(3) Disconnect the odometer connector and remove eight attaching screws that attach the printed circuit board and housing (Fig. 18).

(4) Carefully remove printed circuit board from the cluster.

INSTALLATION

For installation, reverse the above procedures. Carefully place board on the cluster and ensure that the odometer connector is placed through the board. Gently press board on cluster with a slight rocking motion to ensure pins on gauges line up.

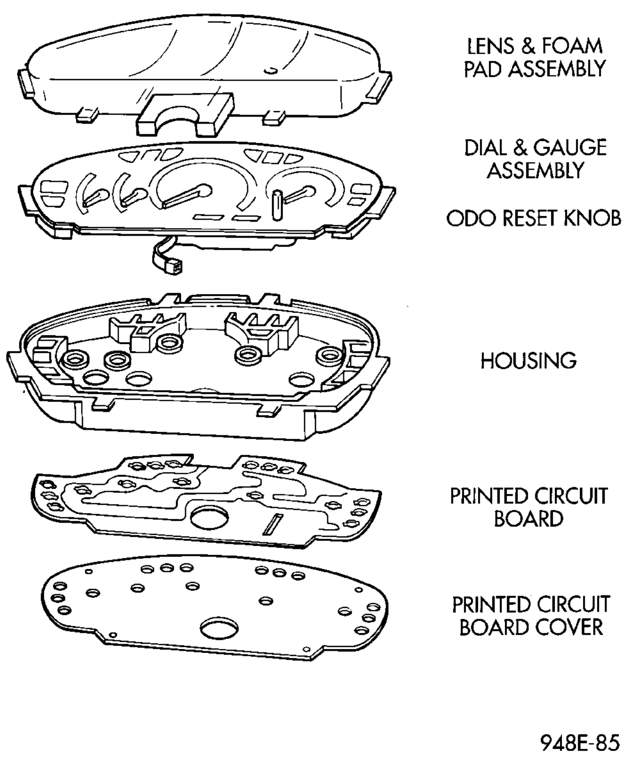


Fig. 17 Cluster Assembly

DOME LENS/LAMP

REMOVAL

Pry either the forward or rearward edge of the lens away from the retainer and replace the lamp.

INSTALLATION

For installation, snap lens into retainer.

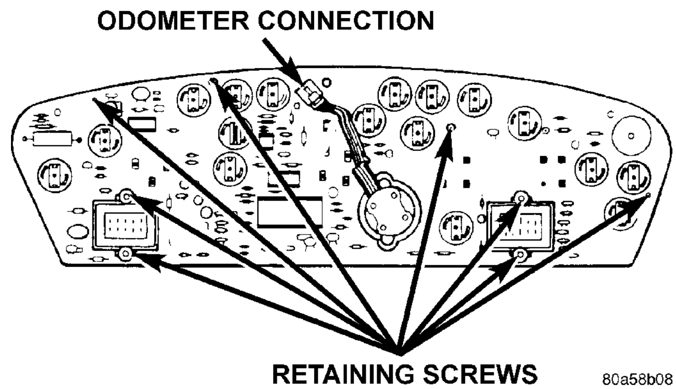


Fig. 18 Printed Circuit Board

END CAP RHD

Removal

(1) Unlatch the glove box door and lower is to the full open position.

(2) Remove the left trim panel as necessary to remove the end cap attaching screws.

(3) Remove the end cap

Installation

For installation, reverse the above procedures.

FLOOR CONSOLE

REMOVAL

(1) Remove the MTX shifter knob only.

(2) Remove the attaching screws from each side of the cup holder.

(a) Non-armrest console. Remove the two screws from the rear of the console (Fig. 19).

(b) Armrest console. Remove the four screws in the console bin.

(3) Pull the parking brake lever up all the way.

(4) Lift the console at the rear and guide it out from under the instrument panel.

INSTALLATION

For installation, reverse the above procedures.

FRONT FOG LAMP SWITCH EXPORT

REMOVAL

(1) Disconnect the wire connector in the center stack, BUX left side and RHD right side.

(2) Remove the floor console and disconnect the two clips attaching the wire harness from the underside of the floor console.

(3) Remove the switch bezel from the floor console.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

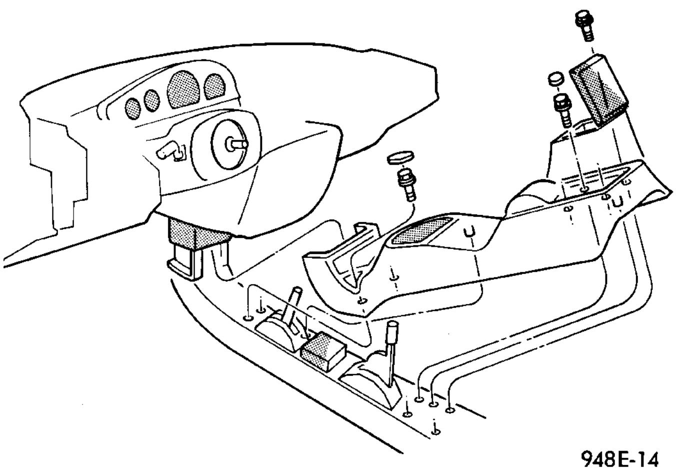


Fig. 19 Floor Console with Transmission Range Indicator

GAUGE

REMOVAL

(1) Remove the cluster. Refer to Cluster Removal.

(2) Remove the attaching screws PC board cover (Fig. 18). The bottom screws attaching lens to housing can be accessed without removing the foam pad.

(3) Disconnect the odometer connector.

(4) Remove the lens attaching screws and remove the lens.

(5) Carefully pry out the dial and gauge assembly.

INSTALLATION

For installation, reverse the above procedures.

(1) When handling or storing the cluster ensure that overlays are not damaged. Set the cluster in the face up position or the gauge operation will be damaged.

(2) The gauges are replaced as an dial and gauge assembly.

GLOVE BOX DOOR/BIN

REMOVAL

(1) Disconnect battery negative cable and isolate it or remove fuse 12 prior to removing the switch, or the wires may short to ground.

(2) Remove the screws along the bottom of glove box door.

(3) Open the glove box and push the glove box sides inward allowing the door bumpers to clear and box to tip forward.

(4) Pull the glove box door/bin rearward and remove from vehicle.

installation

For installation, reverse the above procedures.

GLOVE BOX SWITCH/LAMP

REMOVAL

(1) Disconnect battery negative cable and isolate it or remove fuse 12 prior to removing the switch, or wires may short to ground.

(2) Open the glove box and push the glove box sides inward allowing the door bumpers to clear and the box to tip forward.

(3) Reach inside the opening and squeeze the lamp/switch retainers until they are disengage.

(4) Pull the switch/lamp rearward and remove it. Replace the lamp. To replace the switch disconnect wire and replace the switch.

INSTALLATION

For installation, reverse the above procedures.

HEADLAMP LEVELING SWITCH EXPORT

REMOVAL

(1) Remove the top cover and cluster bezel assembly.

(2) Disengage the headlamp leveling switch bezel from instrument panel (Fig. 20).

(3) Pull the switch and bezel rearward from the opening and disconnect the wire connector.

INSTALLATION

For installation, reverse the above procedures.

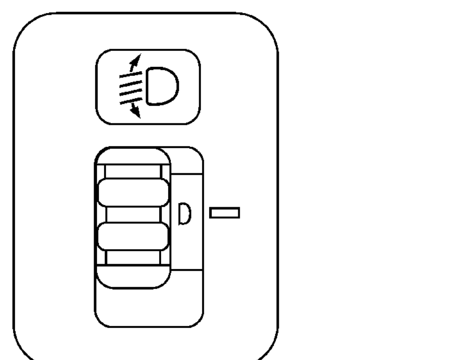


Fig. 20 Headlamp Leveling Switch

HEADLAMP SWITCH

REMOVAL

(1) Remove the steering column cover and liner.

(2) Remove the three screws securing headlamp switch mounting plate to the instrument panel (Fig. 21).

(3) Pull the headlamp switch and mounting plate rearward from the instrument panel opening.

(4) Disconnect both the nine way and the ground wiring connectors from the switch.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the switch knob by depressing the release button on the bottom on the switch and pulling out knob from switch.

(6) Snap headlamp switch bezel out of mounting plate to gain access to the mounting plate retaining nut.

(7) Remove the headlamp switch, mounting plate retaining nut and separate switch from mounting plate.

INSTALLATION

For installation, reverse the above procedures.

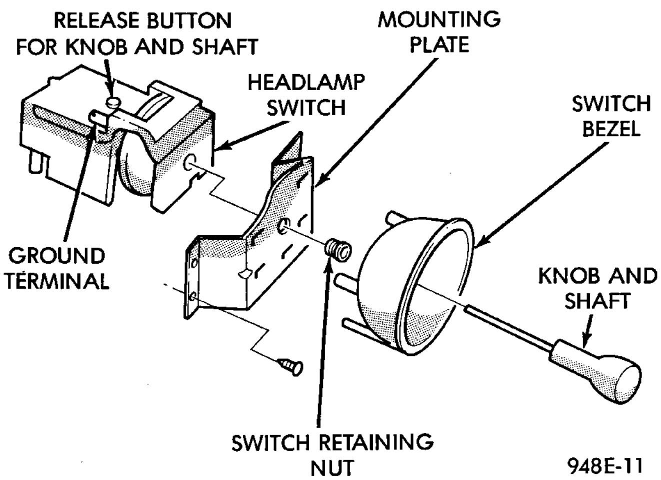


Fig. 21 Headlamp Switch

HEATER A/C CONTROL

REMOVAL

(1) Remove the top cover and cluster bezel.

(2) Reach in and disconnect the wiring connector(s) for the rear window defogger and/or fog lamp switch(s) as required.

(3) Remove the six attaching screws across the forward portion of the trim panel. Then lift the flange forward to disengage the three locator pins.

(4) Pull panel rearward disengaging the clips along the bottom.

(5) Open the ash receiver.

(6) Remove the center bezel.

(7) Remove three attaching screws at corners of the control (Fig. 22).

(8) Pull the control rearward and disconnect the wiring connector.

(9) Using a screwdriver, disengage the cable attachment clips.

INSTALLATION

For installation, reverse the above procedures.

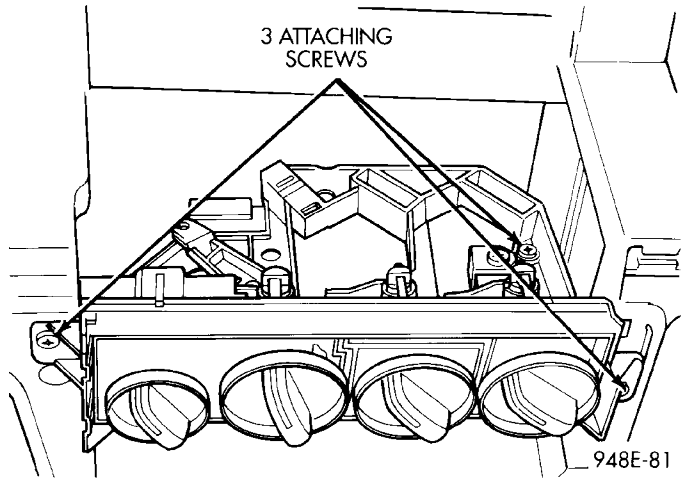


Fig. 22 HEATER A/C CONTROL

HEATER A/C CONTROL BLOWER SWITCH

The switch is not serviced, replace heater A/C control. Refer to the Heater A/C Control Removal and Installation.

HEATER A/C CONTROL LAMP

REMOVAL

(1) Remove the Heater A/C Control. Refer to the Heater A/C Control Removal.

(2) Remove the two center knobs by pulling the knob rearward.

(3) Replace the lamp.

INSTALLATION

For installation, reverse the above procedures.

HEATER CONTROL BLOWER SWITCH

The switch is not serviced, replace the heater control. Refer to the A/C Heater Control Removal and Installation.

IGNITION KEY LAMP

REMOVAL

(1) Remove the steering column cover. Refer to Steering Column Cover Removal.

(2) Disconnect the lamp hood from the base panel.

(3) Remove the lamp socket from hood and replace the lamp.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

INSTRUMENT PANEL

REMOVAL

CAUTION: Disconnect battery negative cable, in engine compartment, before servicing instrument panel.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the floor console. Refer to Floor Console Removal.

(3) Remove the right and left cowl side trim panels (Fig. 23).

(4) Remove the steering column cover and liner.

(5) Remove the top cover and cluster bezel assembly.

(6) Remove the right and left trim panel.

(7) Remove the defroster upper duct by lifting it up.

(8) Remove the center outlet duct by pulling rearward.

(9) Disconnect the Heater A/C Control, by removing the control cables clips with a screwdriver and remove the wire connector.

CAUTION: Lock the steering wheel in the straight ahead position. This will prevent clockspring damage when the steering wheel rotates freely.

(10) Disconnect the steering column at the bottom slap together joint.

(11) Disconnect the ATX shifter interlock cable at the shifter, if equipped.

(12) Disconnect the instrument panel wiring as required.

(13) Remove the four attaching screws at the center floor pan bracket (Fig. 24).

(14) Remove the four attaching screws at steering column.

(15) Remove the four cowl top nuts.

(16) Remove the attaching screws from the left and right lower cowl side bracket (Fig. 25).

(17) Remove the two attaching screws from the left upper cowl side and one from the right upper cowl side.

(18) Pull the instrument panel rearward away from the dash/plenum.

(19) Remove the instrument panel from vehicle.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

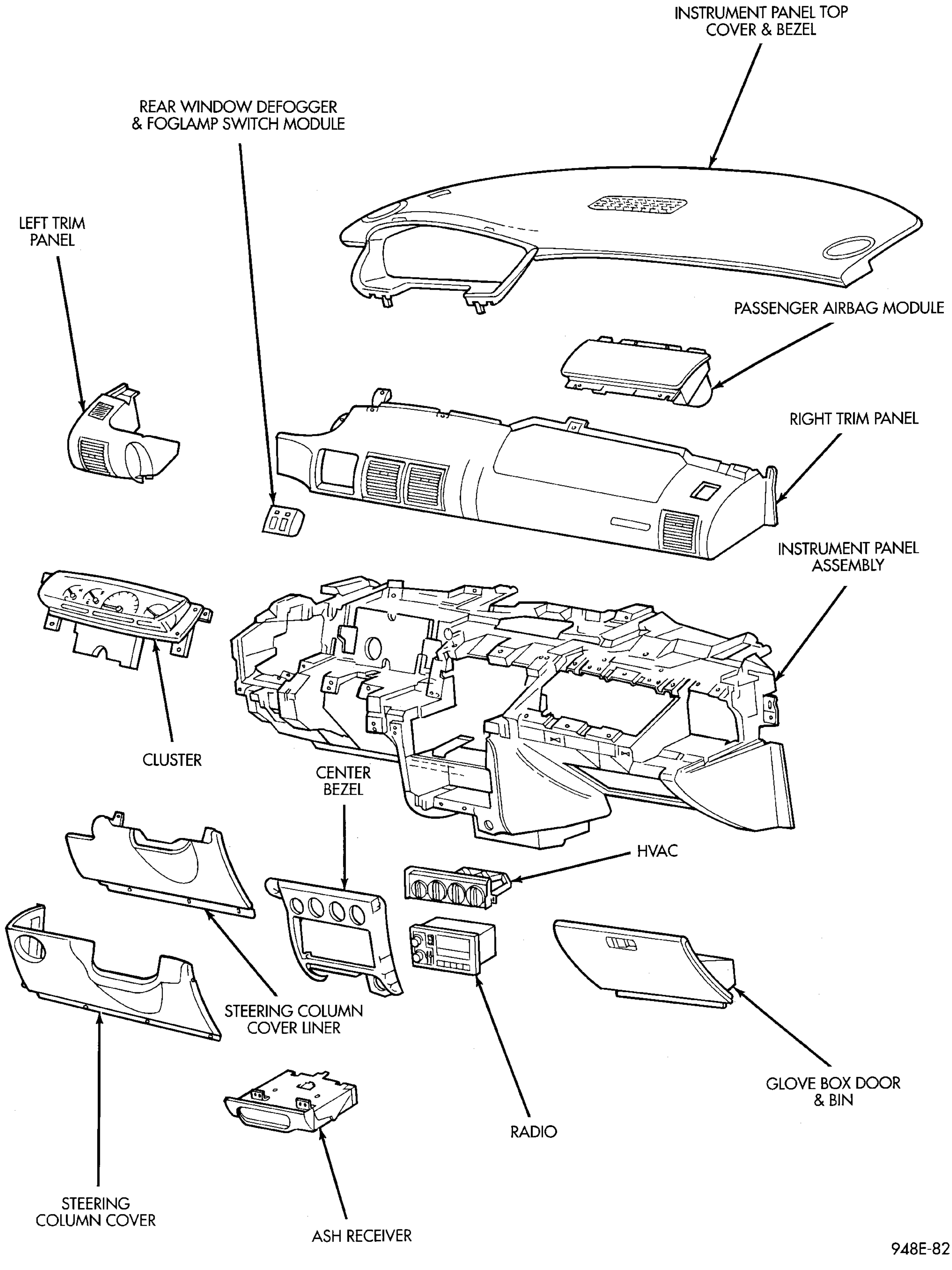


Fig. 23 Instrument Panel Assembly

REMOVAL AND INSTALLATION (Continued)

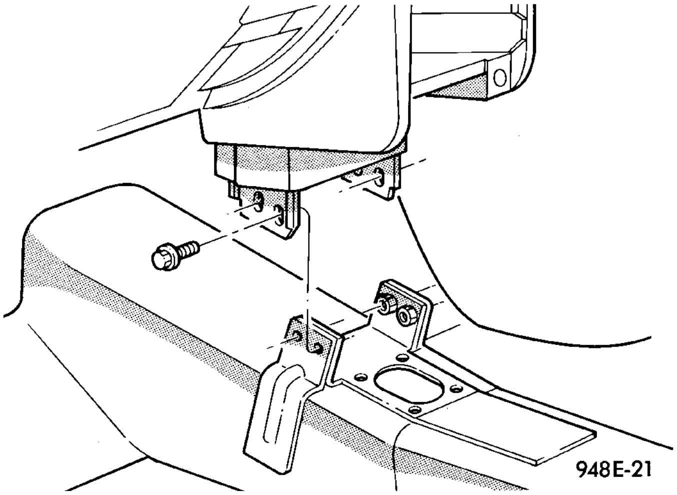


Fig. 24 Center Floor Pan Bracket

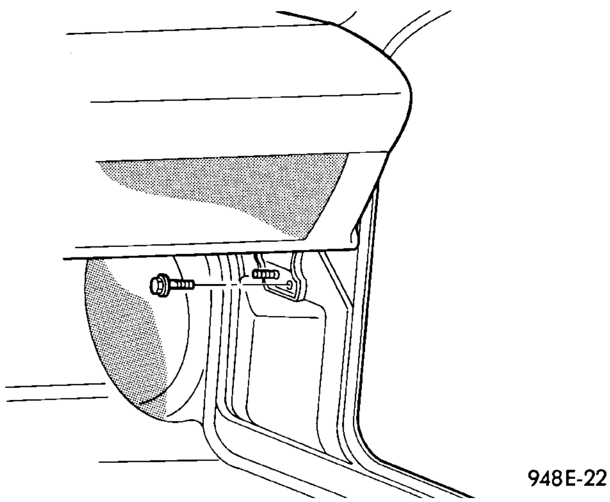


Fig. 25 Side Bracket

LEFT TRIM PANEL

REMOVAL

(1) Remove the top cover and cluster bezel (Fig. 23).

(2) Remove the steering column cover.

(3) Remove the two attaching screws along the bottom and the one at the top of the trim panel and pull rearward to remove.

INSTALLATION

For installation, reverse the above procedures.

ODOMETER

REMOVAL

(1) Remove the instrument panel top cover and cluster bezel.

(2) Remove the four screws attaching cluster to instrument panel (Fig. 26).

(3) Remove the cluster.

(4) Remove the screws attaching PC board cover to cluster.

(5) Disconnect the odometer connector from the printed circuit board.

(6) Remove the screws attaching lens, dial and gauge assembly to the housing. The bottom screws attaching lens to the housing can be accessed without removing the foam pad.

(7) Remove the lens, dial and gauge assembly from housing.

(8) Remove the two screws holding the odometer to dial and gauge assembly. When setting the dial/gauge and/or cluster assembly down, it must be face up or the gauge operation will be damaged.

INSTALLATION

For installation, reverse the above procedures. Carefully place the dial and gauge assembly on the cluster and ensure that the odometer connector is placed through the board. Install with a slight rocking motion to ensure the pins on gauges line up.

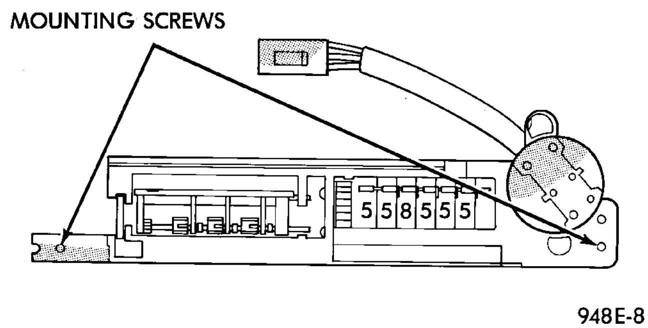


Fig. 26 Odometer

RADIO

For Radio removal procedures, Refer to Group 8F, Audio Systems.

REAR WINDOW DEFOGGER AND/OR FOG LAMP SWITCH

REMOVAL

(1) Remove the top cover and cluster bezel assembly. Refer to the Top Cover and Cluster Bezel Removal above.

(2) Reach in and disengage the left bezel latch and remove assembly (Fig. 27).

(3) Pull the bezel and switch(s) rearward from the opening and disconnect the wire connector(s).

(4) Remove the switch from the bezel.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

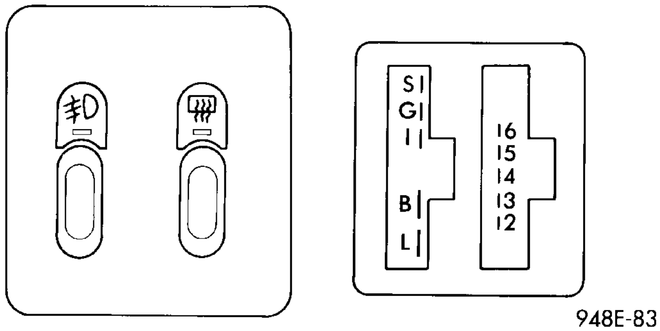


Fig. 27 Rear Window Defogger and Fog Lamp Switch

REAR WINDOW DEFOGGER AND/OR REAR FOG LAMP SWITCH EXPORT

REMOVAL

(1) Remove the top cover and cluster bezel assembly. Refer to Top Cover and Cluster Bezel Removal above.

(2) Reach in and disengage the left bezel latch and remove the assembly (Fig. 28).

(3) Pull the bezel and switch(s) rearward from the opening and disconnect the wire connector(s).

(4) Remove the switch from the bezel.

INSTALLATION

For installation, reverse the above procedures.

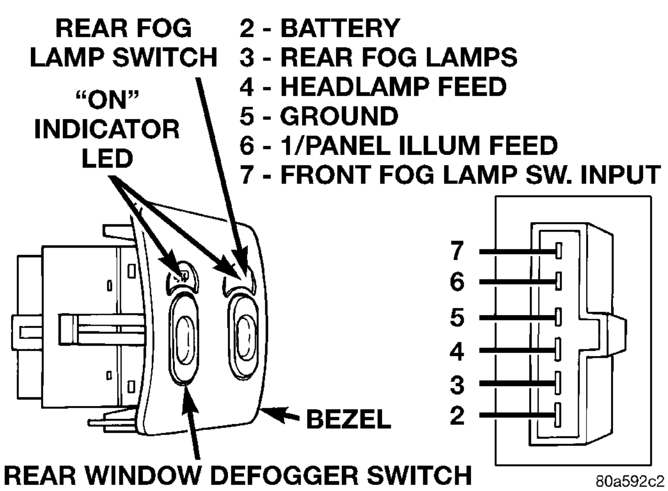


Fig. 28 Rear Window Defogger and Rear Fog Lamp Switch

RIGHT TRIM PANEL

REMOVAL

(1) Remove the top cover and cluster bezel (Fig. 23).

(2) Reach in and disconnect the wiring connector(s) for the rear window defogger and/or fog lamp switch(s) as required.

(3) Remove the six attaching screws across the forward portion of the trim panel. Then lift flange forward to disengage the three locator pins.

(4) Pull the panel rearward until the clips along the bottom disengage.

INSTALLATION

For installation, reverse the above procedures.

SHIFTER KNOB

ATX SHIFTER

REMOVAL

(1) Loosen the set screw at the left side under the button area.

(2) Pull up until the knob slides off the shifter shaft.

INSTALLATION

For installation, reverse the above procedures.

MTX SHIFTER

REMOVAL

(1) Pull the top part of the boot down until the two tabs at the bottom of the knob are exposed.

(2) Release the locking tabs from the pins on the shifter shaft.

(3) Pull up until the knob slides off the shifter shaft.

INSTALLATION

For installation, reverse the above procedures.

STEERING COLUMN COVER

REMOVAL

(1) Remove the three attachment screws along the bottom of the cover and screw on the left outward face of cover (Fig. 29).

(2) Grasp the cover and pull rearward until the clips disengage.

INSTALLATION

For installation, reverse the above procedures.

STEERING COLUMN COVER LINER

REMOVAL

(1) Remove the steering column cover (Fig. 23).

(2) Remove the two attachment screws at the upper area of the liner and the lower left corner.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

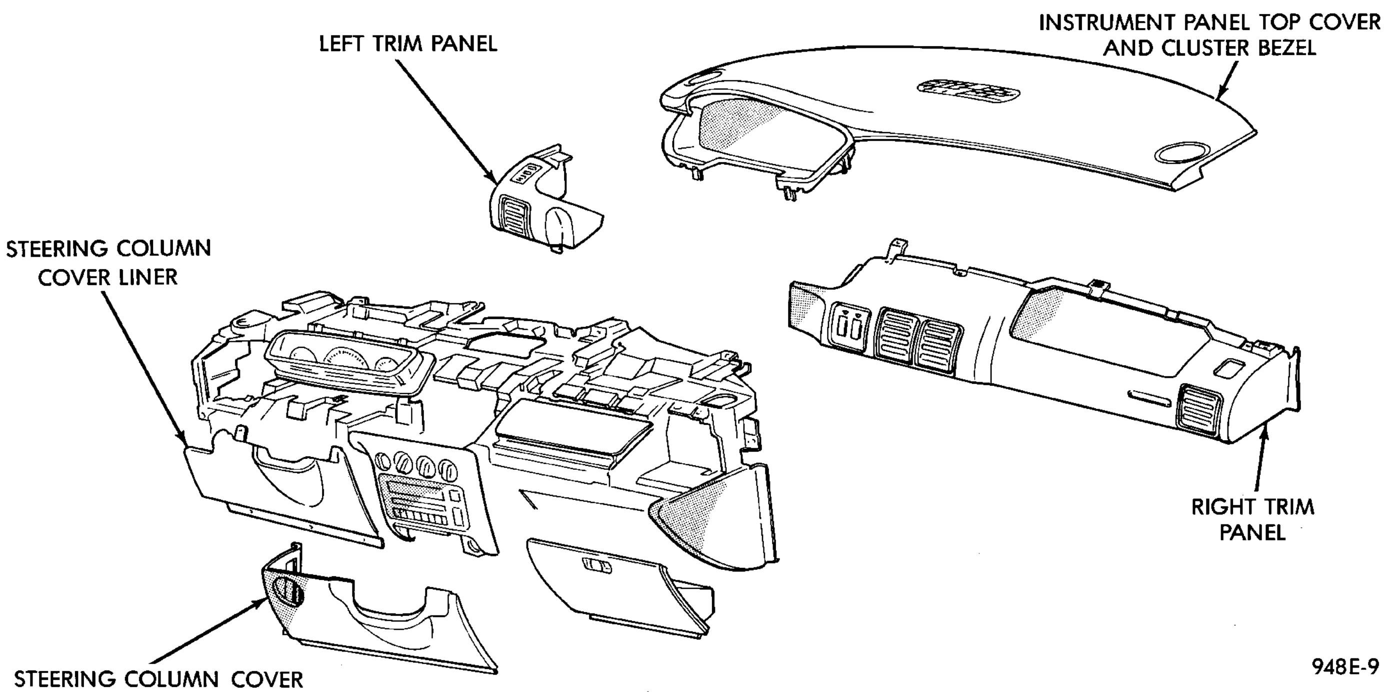


Fig. 29 Instrument Panel and Top Cover

STEERING COLUMN SHROUDS

(1) Remove the steering column cover and steering column cover liner.

(2) Lift up the top cover and cluster bezel until the clips disengage and separate to provide clearance (Fig. 30).

(3) Rotate the ignition key cylinder to run/on position. Insert a screw driver into the access hole at the bottom of lower shroud to release the ignition key cylinder.

(4) Pull out the ignition key cylinder.

(5) Remove the three lower to upper shroud attaching screws through the bottom of the lower shroud.

(6) Separate the upper and lower shrouds.

INSTALLATION

For installation, reverse the above procedures.

TOP COVER AND CLUSTER BEZEL REMOVAL

REMOVAL

(1) Use care not to scratch the panel. Lift up on the bottom outer areas of the cluster bezel and along the rearward edge of the top cover to disengage the clips (Fig. 29).

(2) Pull the top cover and cluster bezel rearward until the forward pins disengage from the instrument panel.

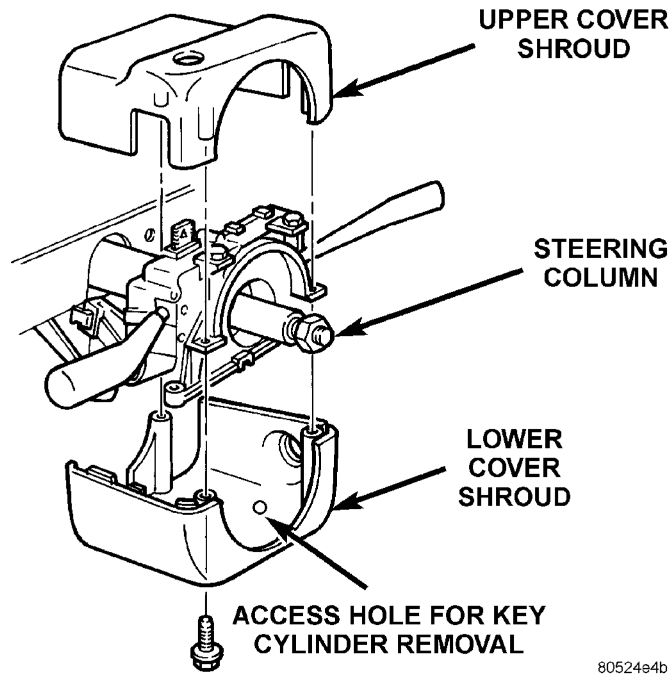


Fig. 30 Upper/Lower Shroud

INSTALLATION

For installation, reverse the above procedures. Position spring clips to instrument panel and push firmly until seated.

TRANSMISSION RANGE INDICATOR LAMP

REMOVAL

(1) Raise the floor console (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

(2) Remove the attaching screw from each of the two forward cup holders of the floor console. Remove the screws at the rear of the console or inside of the armrest console bin.

(3) Pull the parking brake lever all the way up.

(4) Lift the floor console at the rear high enough to gain access to the lamp and socket.

(5) Remove the indicator lamp socket from bezel to replace the lamp.

INSTALLATION

For installation, reverse the above procedures.

TRUNK LAMP/LENS

REMOVAL

The trunk lamp snaps into the rear shelf panel reinforcement under/below the package shelf.

(1) Remove the socket assembly by reaching up above the sheet metal. Push the snap inward and downward and remove the assembly.

(2) Remove the lamp from socket and pull the socket from the lens. Replace as necessary.

INSTALLATION

For installation, reverse the above procedures.

VEHICLE SPEED SENSOR

REMOVAL

(1) Remove the harness connector from the sensor and make sure the weather seal is on the harness connector.

(2) Remove the sensor retaining bolt.

(3) Pull the sensor and pinion gear assembly out of transaxle. If necessary, carefully pry it loose with a flat blade tool (Fig. 31) and (Fig. 32).

INSTALLATION

For installation, reverse the above procedures. Seat the sensor assembly by hand to ensure proper gear engagement. Tighten retaining bolt to 7 N·m (60 in. lbs.) torque.

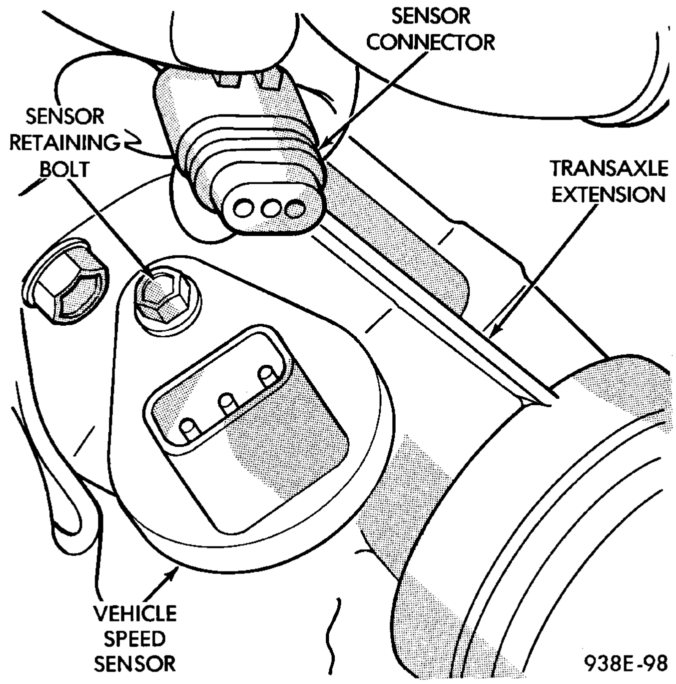


Fig. 31 Vehicle Speed Sensor and Connector

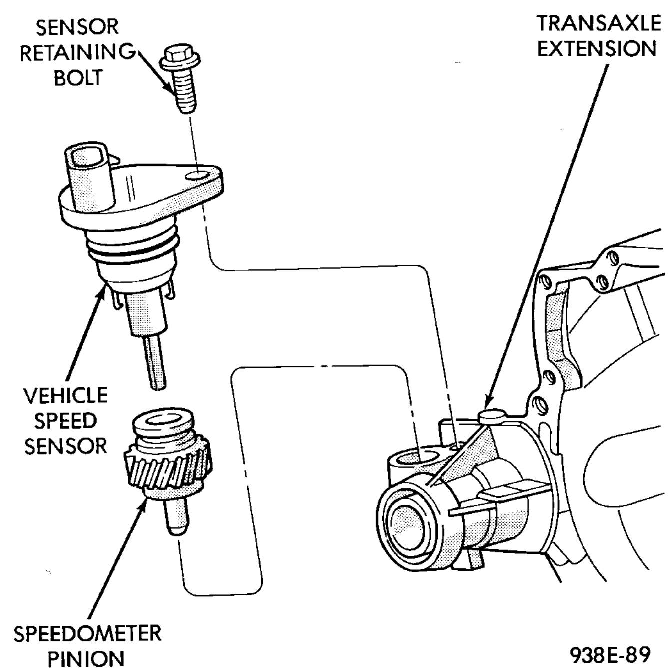


Fig. 32 Vehicle Speed Sensor and Speedometer Pinion

REMOVAL AND INSTALLATION (Continued)

AUDIO SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

Operating instructions for the factory installed audio systems can be found in the Owner's Manual provided with the vehicle.

The vehicles are equipped with an Interior (Ignition Off Draw) fuse in the Power Distribution Center located in the engine compartment. After the Interior (IOD) fuse or battery has been disconnected the clock will require resetting.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DESCRIPTION AND OPERATION

INTERFERENCE ELIMINATION

The radio utilizes a ground wire plugged on to a blade terminal and is bolted to the radio chassis. Both connector and terminal should be securely attached. The engine has two separate ground straps to suppress ignition noise which may interfere with radio reception.

- Left engine mount clip on strap
- Engine to shock tower reinforcement

Inductive type spark plug cables in the high tension circuit of the ignition system complete the interference suppression. Faulty or deteriorated spark plug wires should be replaced.

DIAGNOSIS AND TESTING

AUDIO DIAGNOSTIC TEST PROCEDURES

CAUTION: The CD player will only operate between approximate temperatures of -23°C and +65°C (-10°F and +145°F).

Whenever a radio malfunction occurs;

(1) First check FUSES:

(a) Power Distribution Center (PDC), Interior lamp fuse, M1 - Radio Memory Feed

(b) Fuse Block:

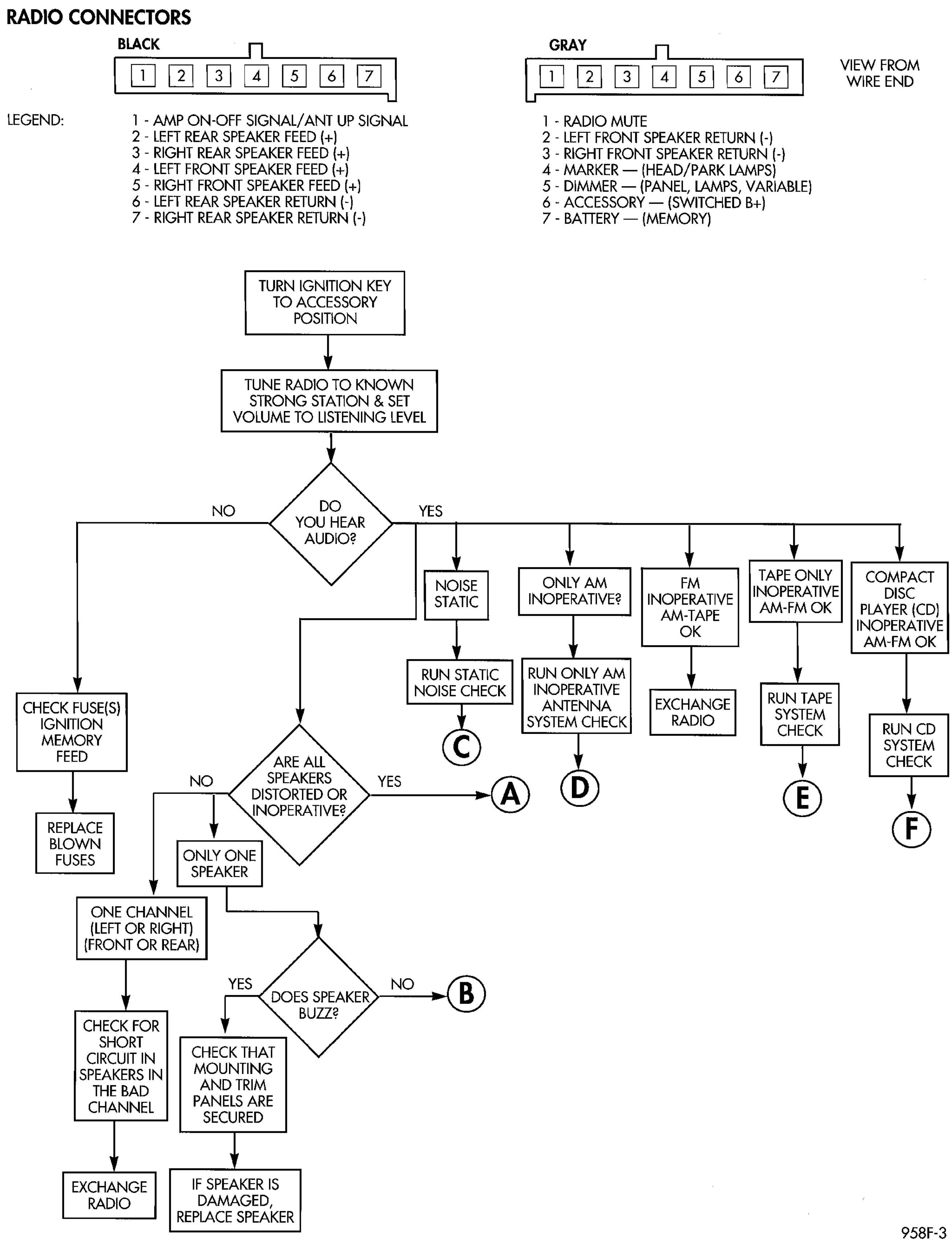
(I) Fuse 12, Illumination in the fuse block

(II) Fuse 16, Ignition feed in the fuse block

NOTE: The vehicles are shipped with the INTERIOR LAMP fuse disconnected.

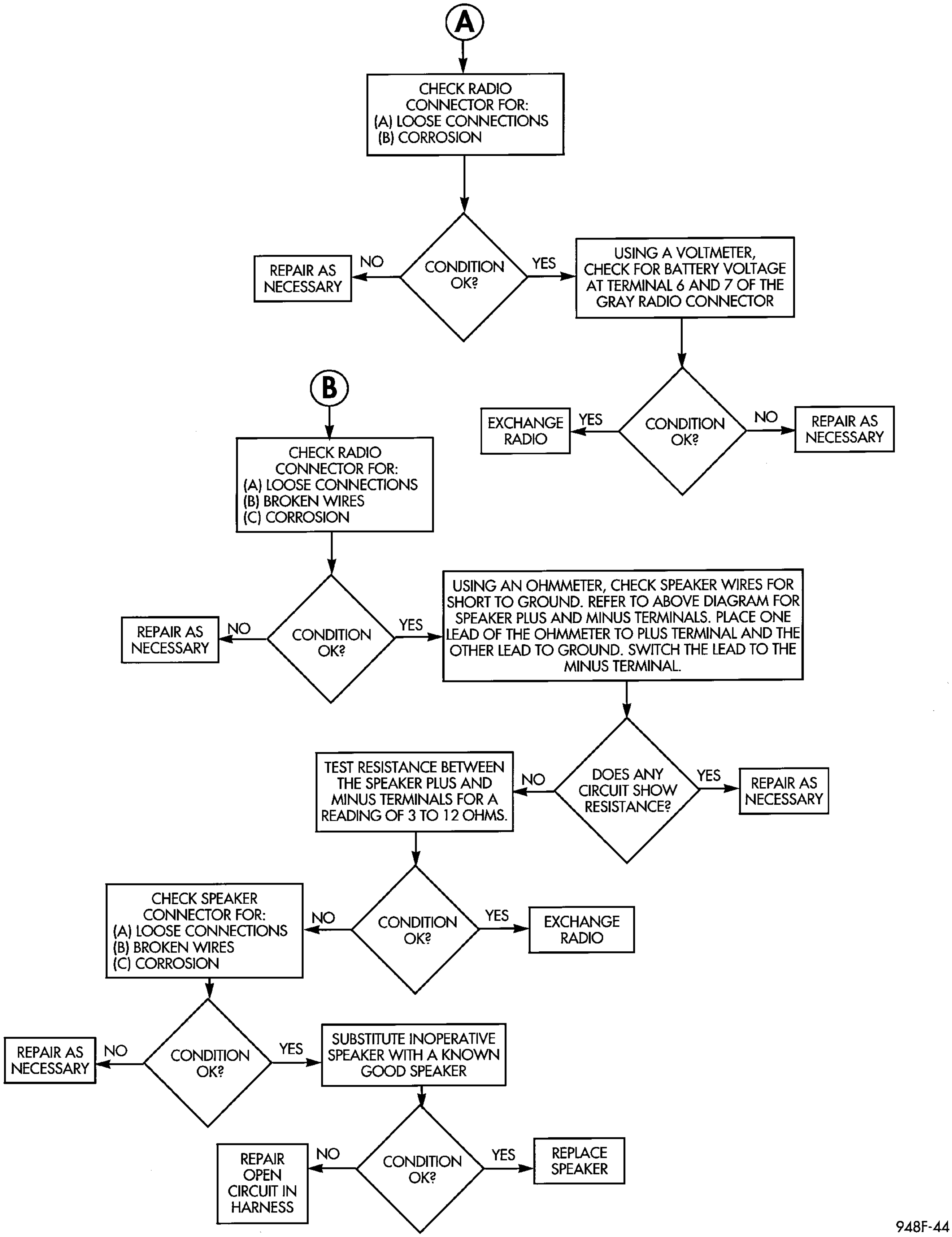
(2) Verify, the radio wire harness are properly connected before starting normal diagnosis and repair procedures. Refer to Audio Diagnostic Charts and/or Group 8W, Wiring Diagrams, Radio Section.

DIAGNOSIS AND TESTING (Continued)



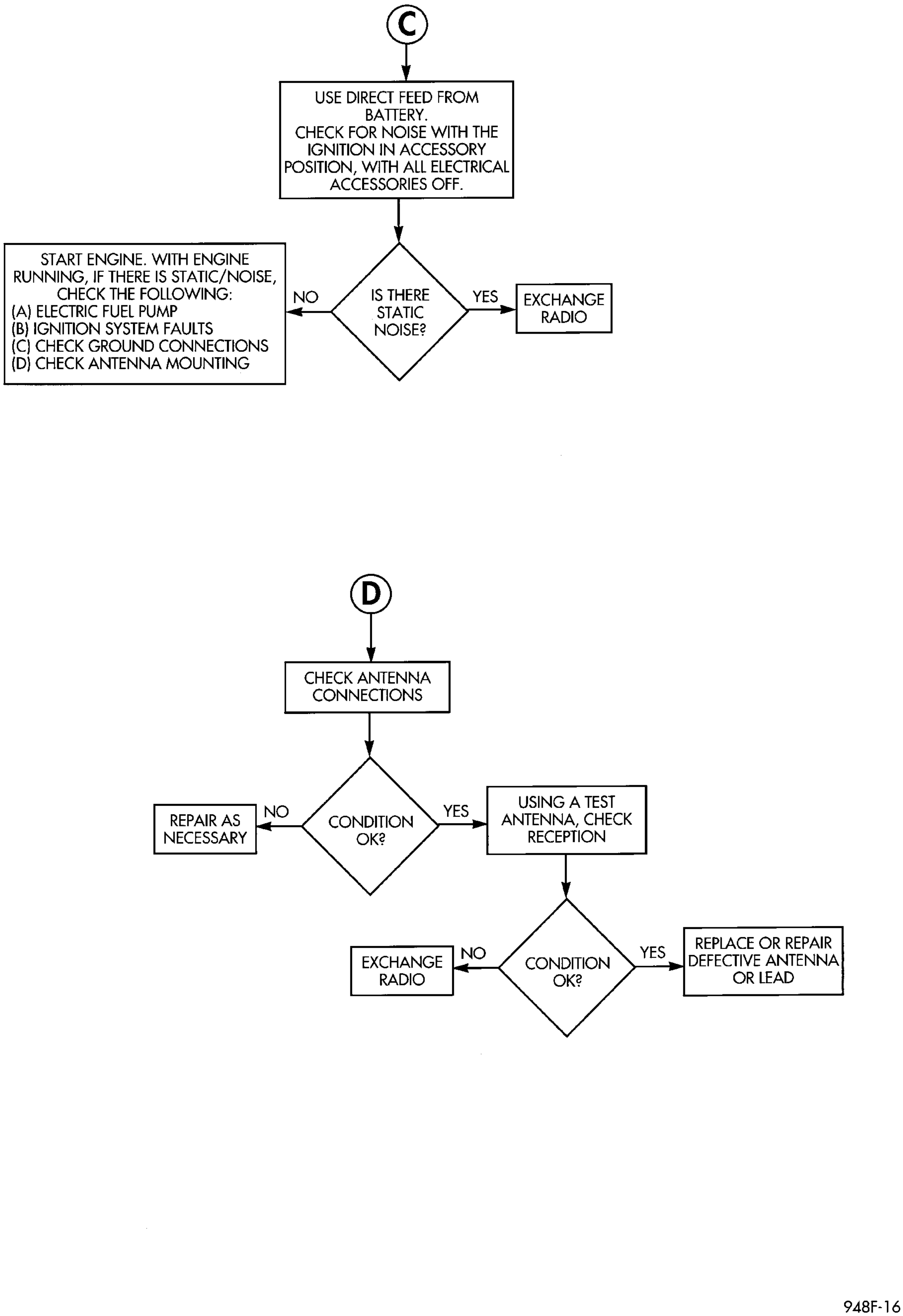
AM/FM STEREO – CD – CASSETTE TAPE

DIAGNOSIS AND TESTING (Continued)



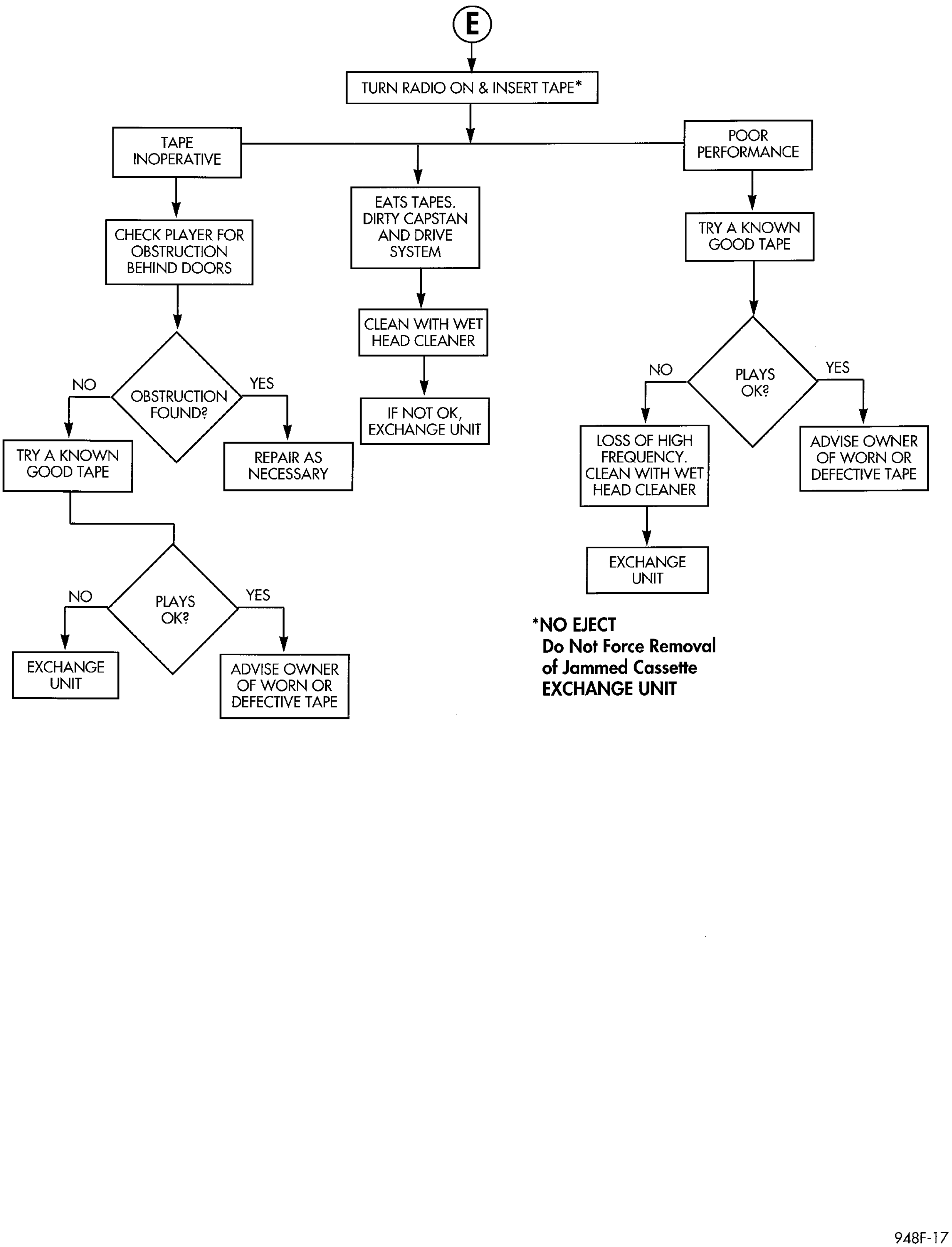
AM/FM STEREO CONTINUED

DIAGNOSIS AND TESTING (Continued)



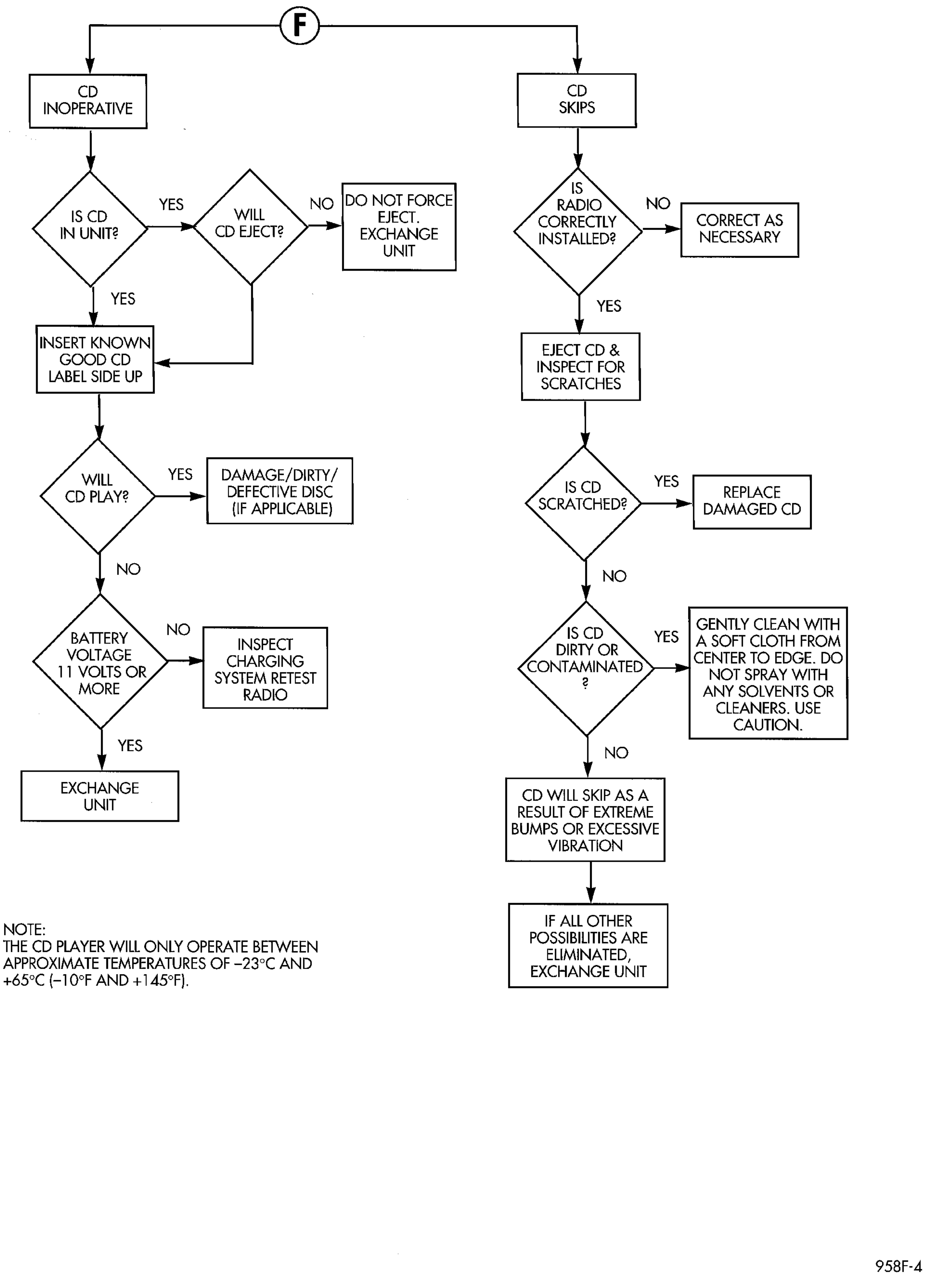
AM/FM STEREO CONTINUED

DIAGNOSIS AND TESTING (Continued)



AM/FM STEREO CONTINUED

DIAGNOSIS AND TESTING (Continued)



AM/FM STEREO CONTINUED

DIAGNOSIS AND TESTING (Continued)

TESTING

The antenna has a short cable which connects into the instrument panel harness. The connection is made on the right side of the instrument panel.

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. 1).

(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 antenna. The wheel well splash shield must be removed for access to the antenna that is mounted on load beam.

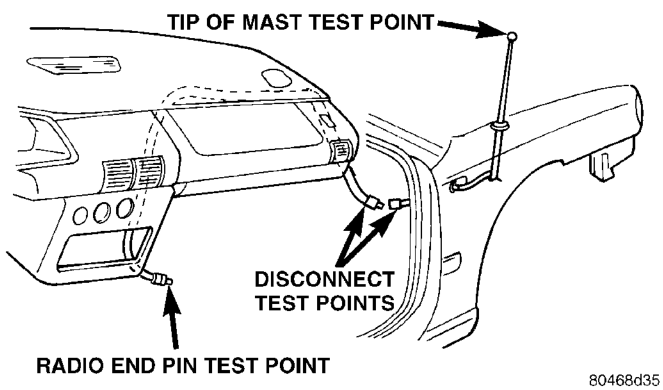


Fig. 1 Antenna Test Points

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.

(1) Continuity should be present between the tip of the mast and radio lead in (Fig. 2).

(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 bracket. **Wiggle cable over its entire length to reveal intermittent short or open circuits during step 1, 2 and 3.**

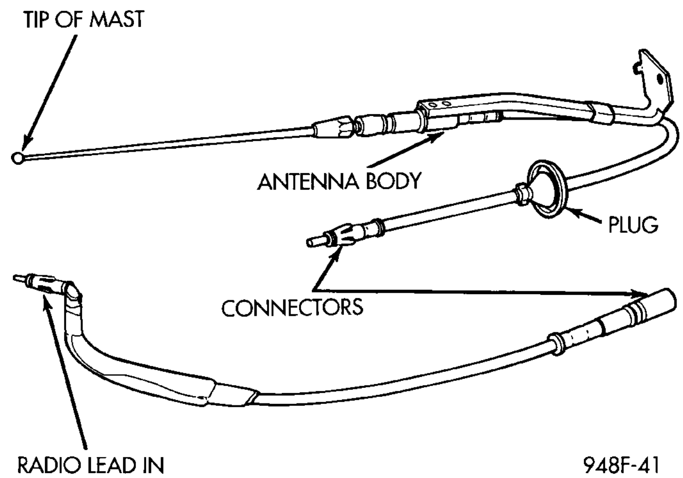


Fig. 2 Antenna Bench Test Points

REMOVAL AND INSTALLATION

ANTENNA

REMOVAL

(1) Remove antenna mast by unscrewing mast from antenna body (Fig. 3), or (Fig. 4).

(2) Locate the antenna lead disconnect in the instrument panel wire harness above the right kick panel. Disconnect the antenna cable from cable lead.

(3) Unfasten push pins from the rear of the plastic inner fender shield and move shield to gain access to mounting screws (Fig. 5).

(4) Remove mounting screw and remove antenna base and cable assembly from under the fender.

INSTALLATION

(1) Align antenna adapter tongue with grove in the fender hole and push adapter into fender.

(2) From under the fender, push the antenna base and cable assembly through the adapter in the fender. Tighten mounting screw to 7 N·m (75 in. lbs.).

(3) Seat the grommet in the side panel and connect the cable to the instrument panel harness connector.

(4) Install the plastic inner fender shield.

REMOVAL AND INSTALLATION (Continued)

(5) Connect the antenna cable to the cable lead.

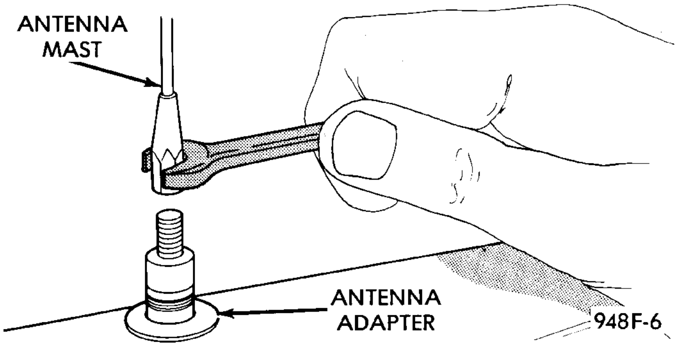


Fig. 3 Antenna Mast Removal

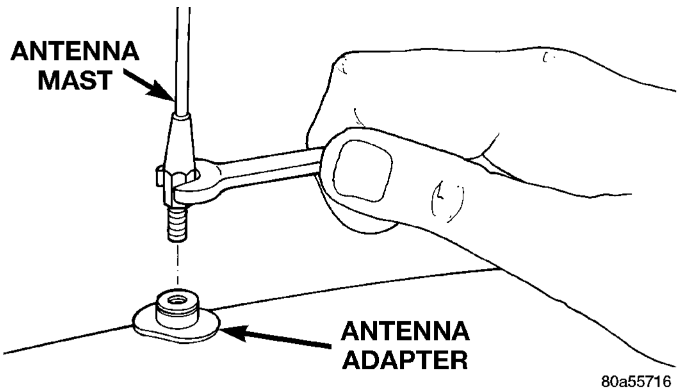


Fig. 4 Antenna Mast Removal - Export

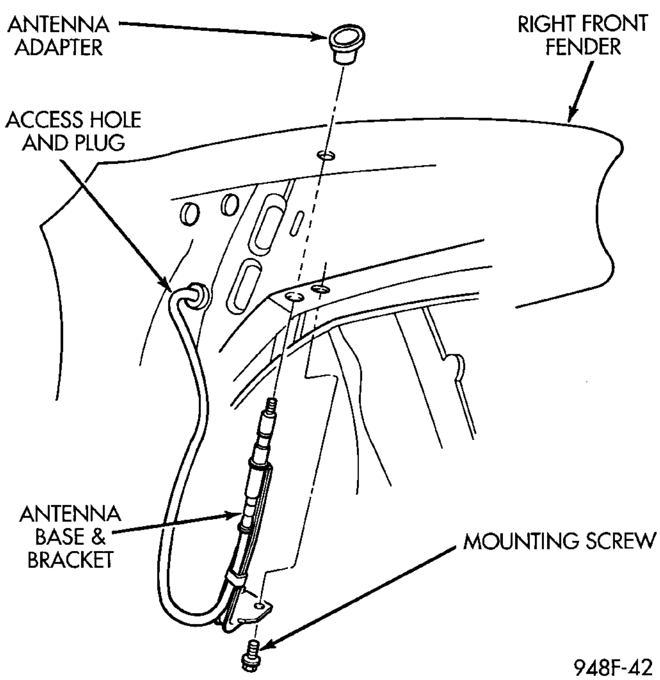


Fig. 5 Antenna Mounting

RADIO

REMOVAL

(1) Remove center module bezel (Fig. 6).

(2) Remove two mounting screws on the radio and pull out of instrument panel (Fig. 7).

(3) Disconnect wiring and antenna cable and remove ground wire from radio.

INSTALLATION

For installation reverse the above procedures.

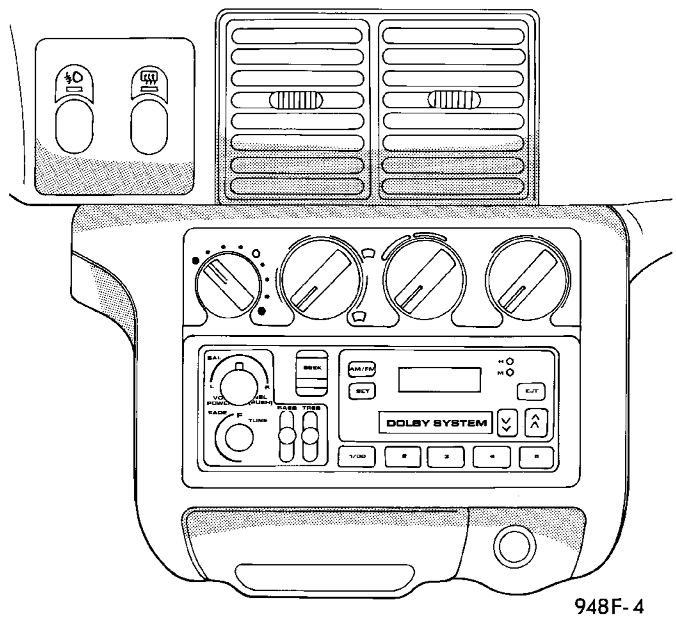


Fig. 6 Center Module Bezel

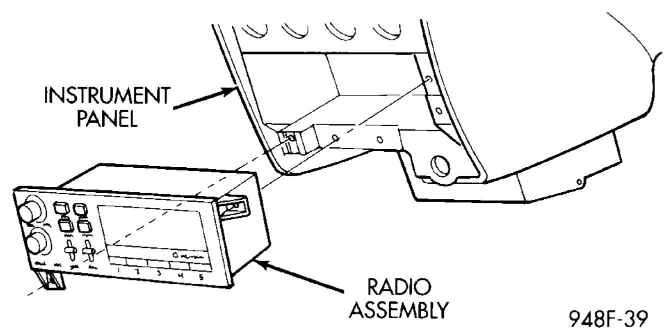


Fig. 7 Radio Assembly

INSTRUMENT PANEL SPEAKER

REMOVAL

(1) Remove instrument panel top cover and cluster bezel (Fig. 8). Refer to Group 8E, Instrument Panel and Systems, for removal procedures.

(2) Remove speaker retaining screws.

(3) Remove speaker and disconnect wire connector.

INSTALLATION

For installation reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

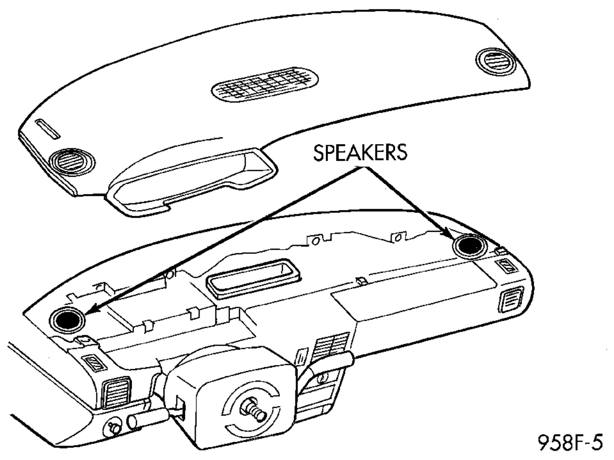


Fig. 8 Instrument Panel Speakers

FRONT DOOR SPEAKER

REMOVAL

(1) Remove door trim panel, refer to Group 23, Body.

(2) Remove three speaker retaining screws (Fig. 9).

(3) Remove speaker assembly and disconnect wire connector.

INSTALLATION

For installation reverse the above procedures.

REAR SHELF SPEAKER(S)

REMOVAL

(1) Remove rear seat and seat back, refer to Group 23, Body for seat removal procedures. Remove seat cushion, seat back and seat belt anchor bolts.

(2) Pry out the seat belt trim bezel along the rearward edge.

(3) Partially remove the shelf trim panel slipping it down to the seat back position.

(4) Remove four speaker retaining screws (Fig. 10).

(5) Remove speaker and disconnect wire connector.

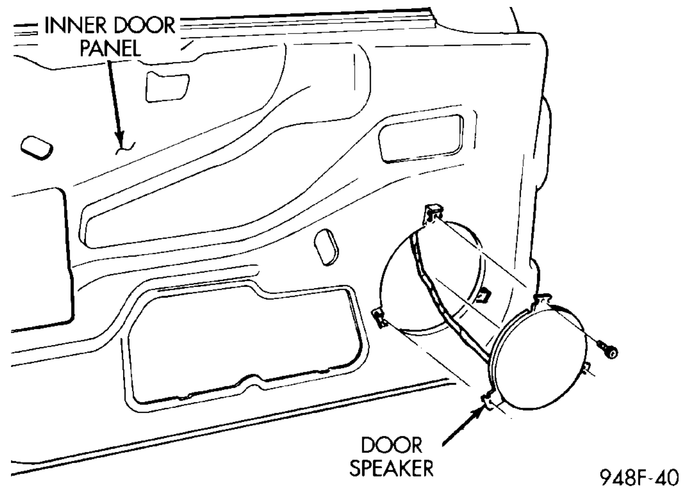


Fig. 9 Front Door Speaker

INSTALLATION

For installation reverse the above procedures. Position speakers so that the wire connectors are pointing to the drivers side of car. Tighten the seat belt anchor bolts to the proper torque refer to Group 23, Body.

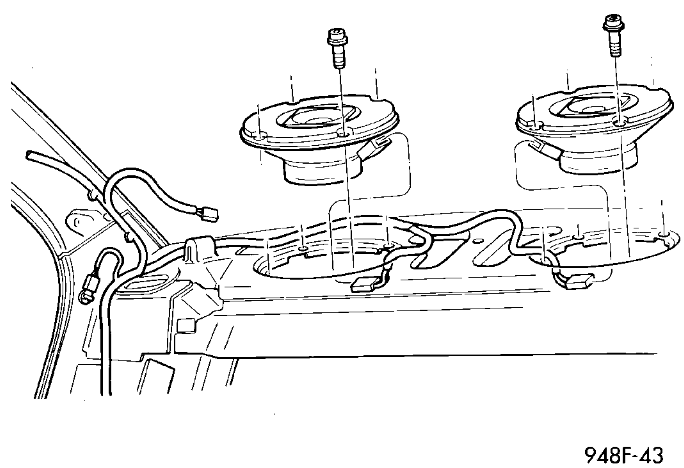


Fig. 10 Rear Shelf Speakers

HORNS

CONTENTS

DESCRIPTION AND OPERATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

The horn circuit consists of a horn switch, horn relay, and horn. The horn circuit feed is from the fuse to the horn relay in the Power Distribution Center (PDC). The PDC is mounted on the battery tray. When the horn switch is depressed, it completes the ground circuit. The horn relay coil closes contacts and allows current to flow to the horn. The horn is grounded to the headlamp ground connection (Fig. 1).

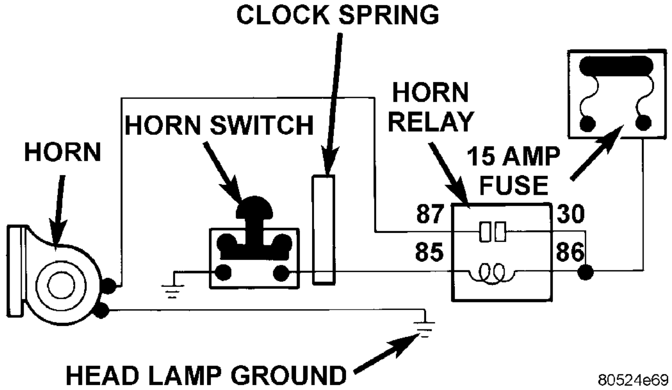


Fig. 1 Horn System

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

HORN SWITCH

The horn switch is mounted between the outer and inner cover of the Driver Airbag Module (Fig. 2). When the Driver Airbag is pressed the horn switch makes contact to ground. The ground signal is carried to the horn relay and the horn sounds.

(1) The horn switch grounds to the airbag housing.

(2) If horn does not sound check for corrosion:

- Horn wire
- Horn switch ground connected to airbag metal housing
- Airbag to steering wheel
- Ensure horn wire is properly connected and insulator is in place on wire

(3) Refer to Group 8W, Wiring Diagrams if wire circuit needs to be repaired.

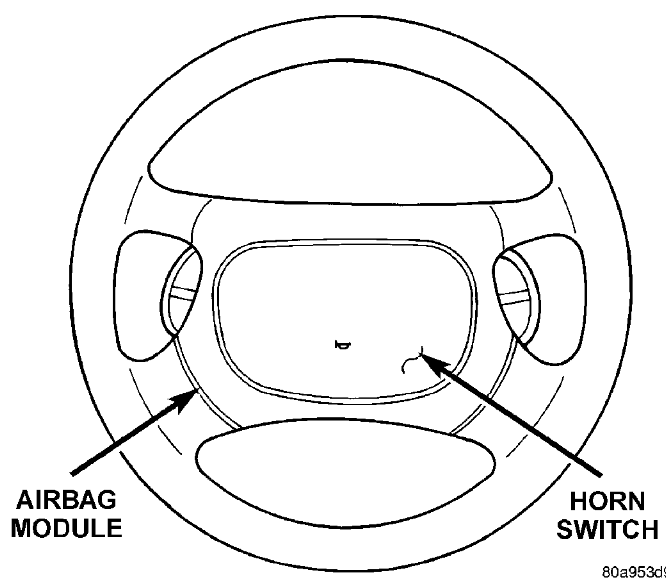


Fig. 2 Horn Switch

DIAGNOSIS AND TESTING

HORN

(1) Disconnect wire connector at horn.

(2) Using a voltmeter, connect one lead to ground terminal and the other lead to the positive wire terminal (Fig. 3).

(3) Depress the horn switch, battery voltage should be present.

(4) If no voltage, refer to Horn System Test. If voltage is OK, go to Step 5.

(5) Using ohmmeter, test ground wire for continuity to ground.

(6) If no ground repair as necessary.

(7) If wires test OK and horn does not sound, replace horn.

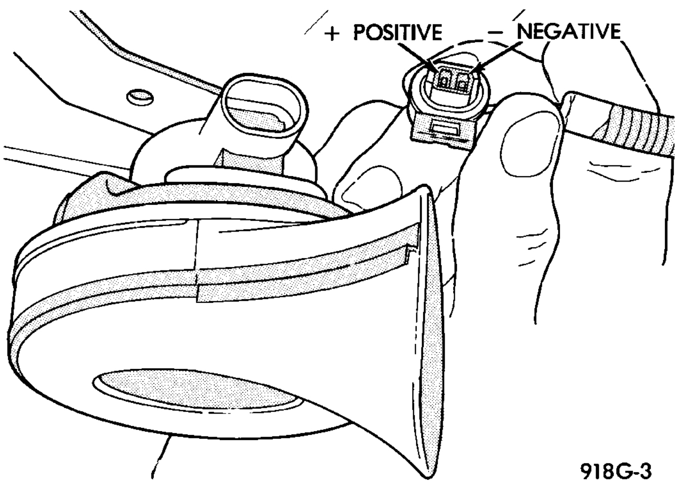


Fig. 3 Horn and Connector

HORN RELAY

(1) Remove horn relay.

(2) Using ohmmeter, test for continuity between ground and circuit 65 of horn relay.

(a) When the horn switch is not depressed, no continuity should be present.

(b) Continuity to ground when horn switch is depressed.

(c) If continuity is not correct repair horn switch or wiring as necessary, refer to Group 8W, Wiring Diagrams.

(3) Insert a jumper wire between circuit 63 and 66 of the Power Distribution Center.

(a) If horn sounds replace relay.

(b) If the horn does not sound, install horn relay and refer to Horn Test.

(4) Using voltmeter, test voltage at:

(a) Circuit 62 and 66 test for battery voltage from fuse C to body ground.

(b) If voltage is incorrect repair as necessary. Refer to Group 8W, Wiring Diagrams.

(5) Check relay for 70 to 75 ohms resistance from terminal 85 to 86 (Fig. 4). If resistance not OK, replace relay.

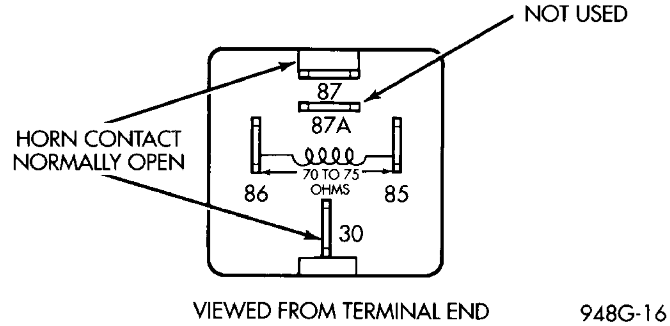


Fig. 4 Horn and Connector

HORN SWITCH

(1) Remove horn relay from the Power Distribution Center.

(2) Using ohmmeter, connect one lead to ground and the other lead to cavity 65 of the power distribution center (Fig. 5).

(3) Depress horn switch, should have continuity. If no continuity go to Step 4.

(4) Test continuity at horn switch, remove the Driver Airbag Module. Refer to Driver Airbag Module Removal and Installation procedures.

(5) Using ohmmeter, connect one lead to the airbag module ground and the other lead to B+ wire (Fig. 6).

(6) Depress horn switch, and the meter should show continuity. If no continuity, replace the Driver Airbag Module. If OK, repair as necessary.

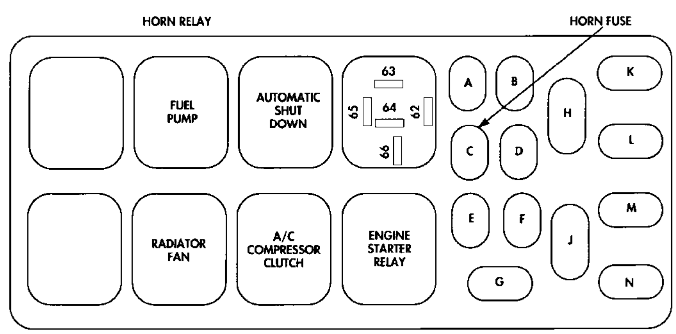


Fig. 5 Power Distribution Center

DIAGNOSIS AND TESTING (Continued)

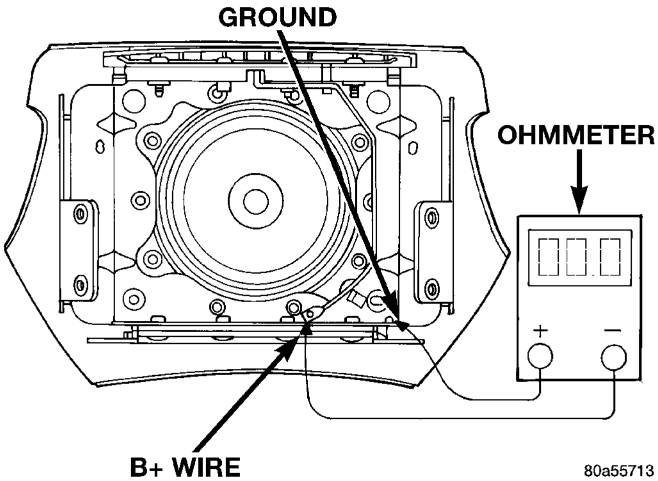


Fig. 6 Test Horn Switch - Driver Airbag Module

SYSTEM TEST

Refer to Horn System Test below. If the horn does not sound, check horn fuse located in the Power Distribution Center. If the fuse is blown, replace with the correct fuse. If the horn fail to sound and the new fuse blows when depressing the horn switch, a short circuit in the horn or the horn wiring between the fuse terminal and the horn is responsible, or a defective horn switch allowed the horn to burn out is responsible.

If the fuse is OK, test horn relay refer to Horn Relay Test.

If the relay is OK, test horn refer to Horn Test.

CAUTION: Continuous sounding of horn may cause horn relay to fail.

Should the horn sound continuously:

- Unplug the horn relay from Power Distribution Center.
- Refer to Horn Relay Test.

Refer to Group 8W, wiring Disgrams for circuit and wiring information.

REMOVAL AND INSTALLATION (Continued)

HORN SYSTEM TEST		
CONDITION	**POSSIBLE CAUSE**	**CORRECTION**
Horn sounds continuously. NOTE: Immediately unplug horn relay in the Power Distribution Center (PDC)	(1) Faulty horn relay. (2) Horn control circuit to relay shorted to ground. (3) Pinched horn switch wire under Driver Airbag Module. (4) Defective horn switch	(1) Refer to horn relay test. (2) Check terminal 65 in PDC for continuity to ground. If continuity to ground indicates: (a) Steering Wheel horn switch/lead shorted to ground. (b) Wiring harness shorted to ground. Find the short and repair as necessary. (3) Replace Driver Airbag Module. (4) Replace Driver Airbag Module.
Horn sound intermittently as the steering wheel is turned.	(1) Horn relay control circuit X3 is shorted to ground inside steering wheel. (2) Pinched horn switch wire under Driver Airbag Module (3) Defective horn switch	(1) Remove Driver Airbag Module and/or steering wheel. Check for rubbing or loose wire/connector, repair as necessary. (2) Replace Driver Airbag Module. (3) Replace Driver Airbag Module.
Horn does not sound	(1) Check fuse 23 in PDC (2) No Voltage at horn RELAY TERMINALS 62 & 66, and fuse is OK. (3) Open circuit from terminal 65 of the horn relay to horn switch X3 circuit. (4) Defective or damaged horn. (5) Defective horn switch	(1) Replace fuse if blown repair as necessary. (2) No voltage, repair PDC as necessary. (3) Repair circuit as necessary. (4) Voltage at horn when horn switch is pressed, replace horn. (5) Replace Driver Airbag Module.
Fuse blows when horn sounds	(1) Short circuit in horn or horn wiring	(1) Remove horn relay, check for shorted horn or horn wiring. Disconnect horn wire harness to isolate short and repair as necessary.
Fuse blows without blowing horn NOTE: For wiring repairs refer to Group 8W, Wire Diagrams.	(1) Short circuit	(1) Remove relay, install new fuse, if fuse does not blow replace horn relay. If fuse blows with relay removed, check for short to ground with ohmmeter on circuit between terminals 62 & 66 and the fuse terminal. Repair as necessary.

REMOVAL AND INSTALLATION

HORN

REMOVAL

Disconnect connector and remove horn attaching nuts from the bumper support bracket (Fig. 7).

INSTALLATION

For installation, reverse the above procedures. Insure that the horn projector does not touch bumper reinforcement or the sound output may be altered.

HORN RELAY

REMOVAL

(1) Remove the Power Distribution Center cover and locate the horn relay.

(2) Remove the horn relay (Fig. 5).

INSTALLATION

For installation, reverse the above procedures.

HORN SWITCHES

The Horn Switch is part of the Driver Airbag Module. Refer to Driver Airbag Module Removal and Installation procedures in Group 8M.

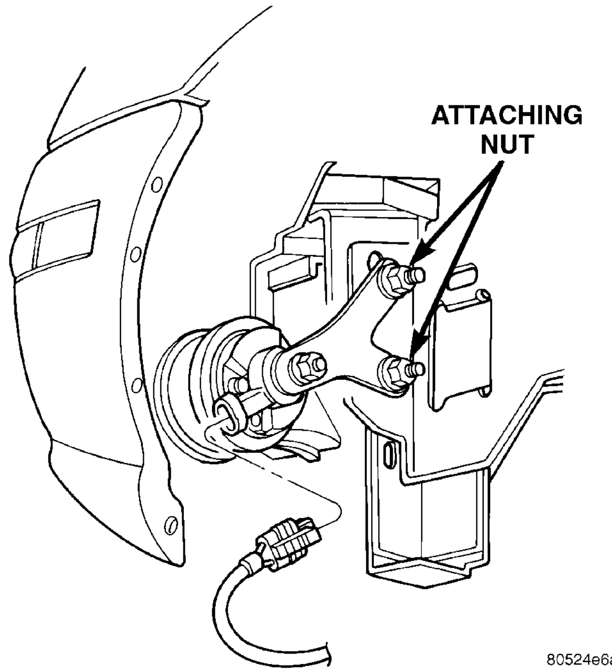


Fig. 7 Horn Location

VEHICLE SPEED CONTROL SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The speed control system is electronically controlled and vacuum operated. The electronic control is integrated into the powertrain control module which is located in the engine compartment. The controls are located on the steering wheel and consist of five switches. The ON and OFF buttons are located on the left side of the airbag module. The RESUME/ ACCEL, SET/COAST and CANCEL buttons are located on the right side of the airbag module (Fig. 1). For identification and location of the major components (Fig. 2) and (Fig. 3).

The system is designed to operate at speeds above 30 mph (50 km/h).

WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

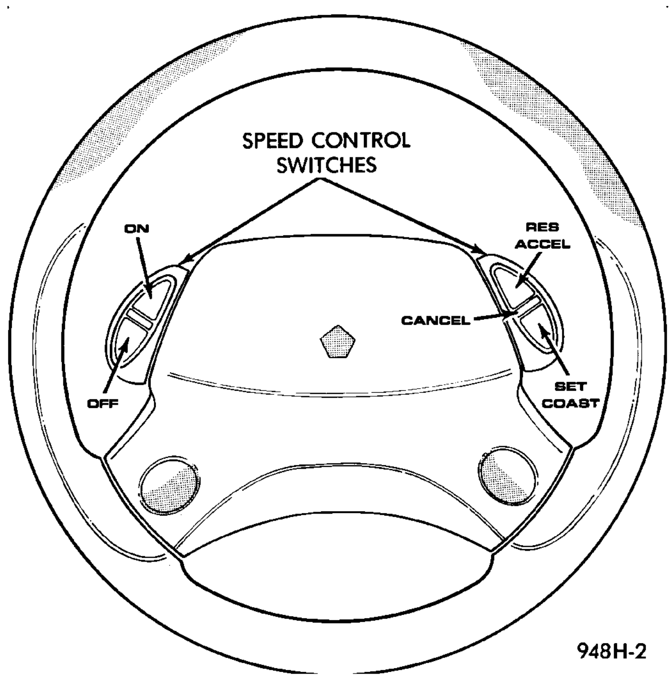


Fig. 1 Speed Control Switch

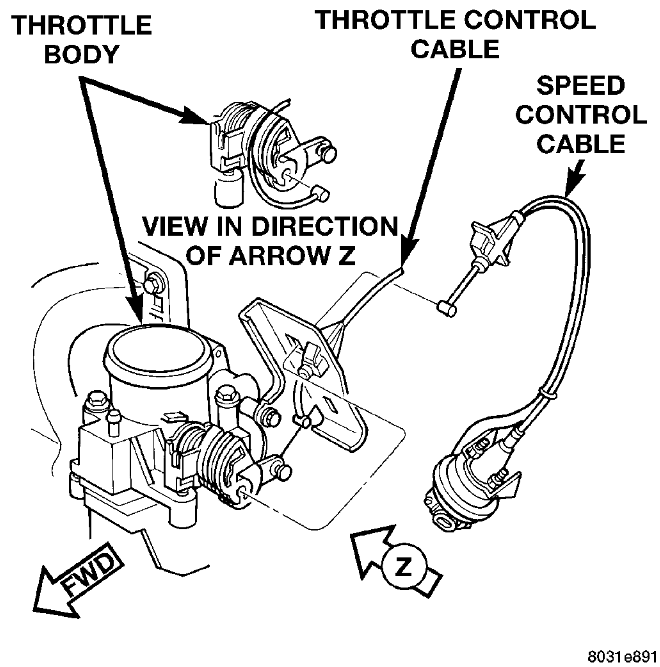


Fig. 2 MTX Speed Control System

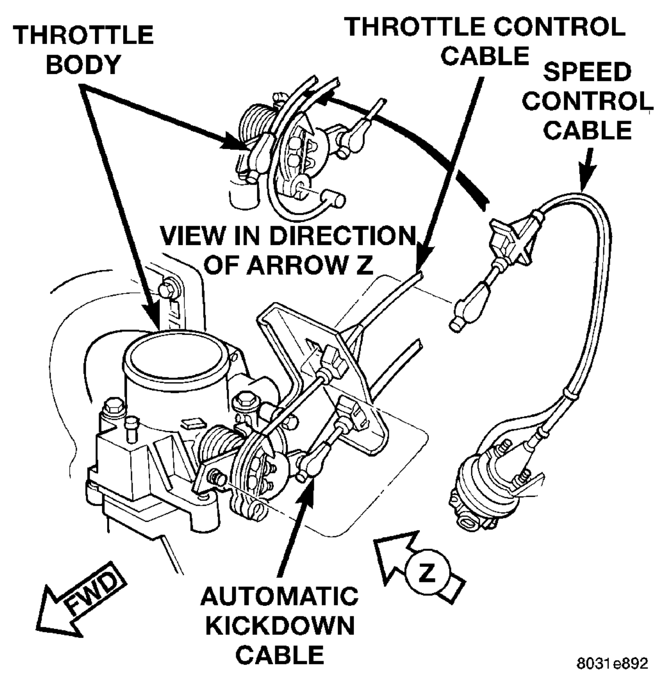


Fig. 3 ATX Speed Control System

DESCRIPTION AND OPERATION

SPEED CONTROL SERVO

The servo unit consists of a solenoid valve body, and a vacuum chamber. The PCM controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

SPEED CONTROL SWITCHES

There are two separate switch pods that operate the speed control system. The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME/ACCELERATE, SET/COAST and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in RAM for speed control. To store a set speed, depress the COAST/SET switch while the vehicle is moving at a speed between 30 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral
- The VSS signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- An rpm increase without a VSS signal increase (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)
- If the actual speed is not within 20 mph of the set speed

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the RES/ACCEL switch restores the vehicle to the target speed that was stored in the PCM's RAM.

NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.

If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the RES/ACCEL switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the RAM when the RES/ACCEL switch is released. The PCM also has a "tap-up" feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an

DESCRIPTION AND OPERATION (Continued)

existing recorded target speed, depress and hold the SET/COAST switch until the desired speed is reached. Then release the switch. The ON and OFF switches operates two components: the PCM's ON/OFF input, and the battery voltage to the brake switch, which powers the speed control servo.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

STOP LAMP SWITCH

Vehicles equipped with the speed control option use a dual function stop lamp switch. The switch is mounted in the same location as the conventional stop lamp switch, on the brake pedal mounting bracket under the instrument panel. The PCM monitors the state of the dual function stop lamp switch. Refer to Group 5, Brakes for more information on stop lamp switch service and adjustment procedures.

SERVO CABLE

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage. This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

POWERTRAIN CONTROL MODULE

The speed control electronic control circuitry is integrated into the Powertrain Control Module (PCM). The PCM is located in the engine compartment. The PCM speed control functions are monitored by the On-Board Diagnostics (OBD). All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. See On-Board Diagnostic Tests in this group for more information. The PCM cannot be repaired and must be replaced if faulty.

VACUUM RESERVOIR

The reservoir contains a one-way check valve to trap engine vacuum in the reservoir. When engine vacuum drops, as in climbing a grade while driving, the reservoir supplies the vacuum needed to maintain proper speed control operation. The vacuum reservoir cannot be repaired and must be replaced if faulty.

VEHICLE SPEED SENSOR

The Vehicle Speed Sensor (VSS) is a pulse generator mounted to an adapter near the transmission output shaft. The sensor is driven through the adapter by a speedometer pinion gear. The VSS pulse signal to the speedometer/odometer is monitored by the PCM speed control circuitry to determine vehicle speed and to maintain speed control set speed. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnosis and testing of this component. Refer to Group 14, Fuel System for removal/installation procedures.

DIAGNOSIS AND TESTING

ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Group 8E, Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies an inoperative system, and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a flash lamp code 15, 34 or 77 exists at the Check Engine Lamp (MIL), conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Loose or leaking vacuum hoses or connections.
- Secure attachment at both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Failed speed control servo. Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

CHECKING FOR DIAGNOSTIC CODES

When trying to verify a speed control system electronic malfunction: Connect a DRB scan tool if available to the data link connector (Fig. 4). The connector is located at left side of the steering column, and at lower edge of the panel.

DIAGNOSIS AND TESTING (Continued)

If a scan tool is not available, use the following procedure:

(1) With key inserted in ignition switch, cycle switch to ON position three times. On third cycle, leave switch in ON position.

(2) After switch has been cycled three times, observe MALFUNCTION INDICATOR LAMP (check engine) indicator on instrument cluster. If a diagnostic code is present, indicator will flash (blink) in a series which will show which diagnostic code is the problem. EXAMPLE: A series of three flashes in rapid succession, a slight pause, then four flashes in rapid succession would indicate diagnostic code 34.

(3) A speed control malfunction may occur without either diagnostic code being indicated. If no diagnostic code appears conduct test in the following paragraphs depending on failure mode. If code 15 or 34 is observed, refer to the appropriate Powertrain Diagnostic Manual for the electrical circuit diagnostic..

Refer to Group 25, for further information and useage of the DRB scan tool and a more complete list of Diagnostic Trouble Code.

SPEED CONTROL ACCELERATES OR TAPS UP BY ITSELF

Check for diagnostic trouble codes. If code 15 refer to the Powertrain Diagnostic Manual, if code 34 perform the following test:

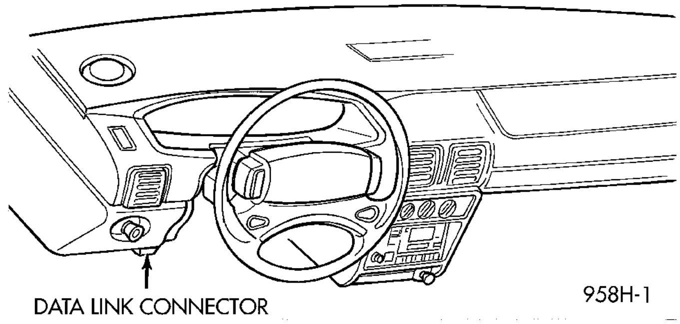


Fig. 4 Data Link Connector Location

(1) Conduct the speed control switch test on the resume ACCEL/SWITCH.

(2) If it failes, replace switch.

(3) If it passes, disconnect the 4 way connector at servo. Test continuity of pin 1 to ground to test for intermittent short. Wiggle wires while preforming test.

(4) If continuity to ground, repair wiring.

(5) If no continuity to ground, replace PCM.

SPEED CONTROL SLOWS DOWN BY ITSELF

Test vehicle speed sensor, refer to group 8E. If sensor fails replace sensor, if it passes perform the following test:

(1) Perform the speed control switch test on the SET/COAST switch, if it fails replace switch.

SPEED CONTROL DIAGNOSTIC TROUBLE CODES

Diagnostic Trouble Code	Hex Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
15**		No Vehicle Speed Sensor Signal	No vehicle distance (speed) sensor signal detected during road load conditions.
34*	OF	Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
	or		
	56	MUX S/C Switch High	Speed control switch input above the maximum acceptable voltage.
	or		
	57	MUX S/C Switch Low	Speed control switch input below the minimum acceptable voltage.
55*		N/A	Completion of fault code display on Check Engine Lamp.
77	52	S/C Power Relay Circuit	Malfunction detected with power feed to speed control servo soleniods.
* Check Engine Lamp will not illuminate at all times if this Diagnostic Trouble Code was recorded. Cycle ignition key as described in manual and observe code flashed by Check Engine Lamp.			
** Check Engine Lamp will illuminate during engine operation if this Diagnostic Trouble Code was recorded.			

DIAGNOSIS AND TESTING (Continued)

(2) If the switch passes, conduct the vacuum supply test.

(3) If it passes, conduct the servo vacuum test. If it fails replace servo.

(4) If it passes, test continuity of pin 2 of harness connector to PCM pin 80 for intermittent open. Wiggle wires while performing this test. If no continuity to pin 80, repair harness for open.

(5) If no continuity, replace the PCM.

SPEED CONTROL WILL NOT RESUME-SETS OK

Perform the speed control switch test on the RESUME/ACCEL switch. If the switch fails replace switch.

(1) If switch passes, check continuity from RESUME/ACCEL switch connector pin 1 to pin 41 of 40 way connector at PCM. Check for intermittent open circuit, wiggle wires while performing test.

(2) If intermittent open, repair circuit.

(3) If continuity is ok, perform continuity test from pin 1 of RESUME/ACCEL switch connector to ground. Check for intermittent short, wiggle wires while performing this test.

(4) If shorted, repair harness for short.

SPEED CONTROL WILL NOT SLOW DOWN

Check for diagnostic trouble codes. If code 34 or no code perform the following test:

(1) Conduct the speed control switch test on the resume SET/COAST.

(2) If it fails, replace switch.

(3) If it passes use an ohmeter to test continuity between pin 1 of SET/COAST switch connector and ground. Wiggle wires while preforming test. If no continuity, repair circuit.

(4) If continuity, test continuity between pin 2 of SET/COAST switch connector and pin 41 of the PCM 40 way connector. Wiggle wires while preforming test. If no continuity, repair circuit.

(5) If continuity, disconnect the servo connector. Test continuity from pin 2 of connector and ground to test for intermittent short. Wiggle wires while preforming test. If continuity repair circuit.

(6) If no continuity, conduct the servo vacuum test. If it fails, replace servo.

(7) If it passes, replace PCM.

SPEED CONTROL ELECTRICAL TEST

Electronic speed control systems may be tested using two different methods. One involves use of a DRB. If this test method is desired, refer to the Powertrain Diagnostic Test Procedures for charging and speed control system manual.

The other test method uses a volt/ohm meter. The volt/ohm meter method is described in the following tests.

If any information is needed concerning wiring, refer to Group 8W, Wiring Diagrams (Fig. 5).

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals, or seals. If these components are damaged, intermittent or complete system failure may occur.

When electrical connections are removed, corrosion should be removed from electrical terminals and a light coating of Mopar Multi-Purpose Grease, or equivalent, applied. Inspect connectors for damage terminals.

A poor connection can cause a complete or intermittent malfunction and is also the only connection in the circuit, that can not be tested. For this reason, a loose connection may be misdiagnosed as a component malfunction.

DIAGNOSIS AND TESTING (Continued)

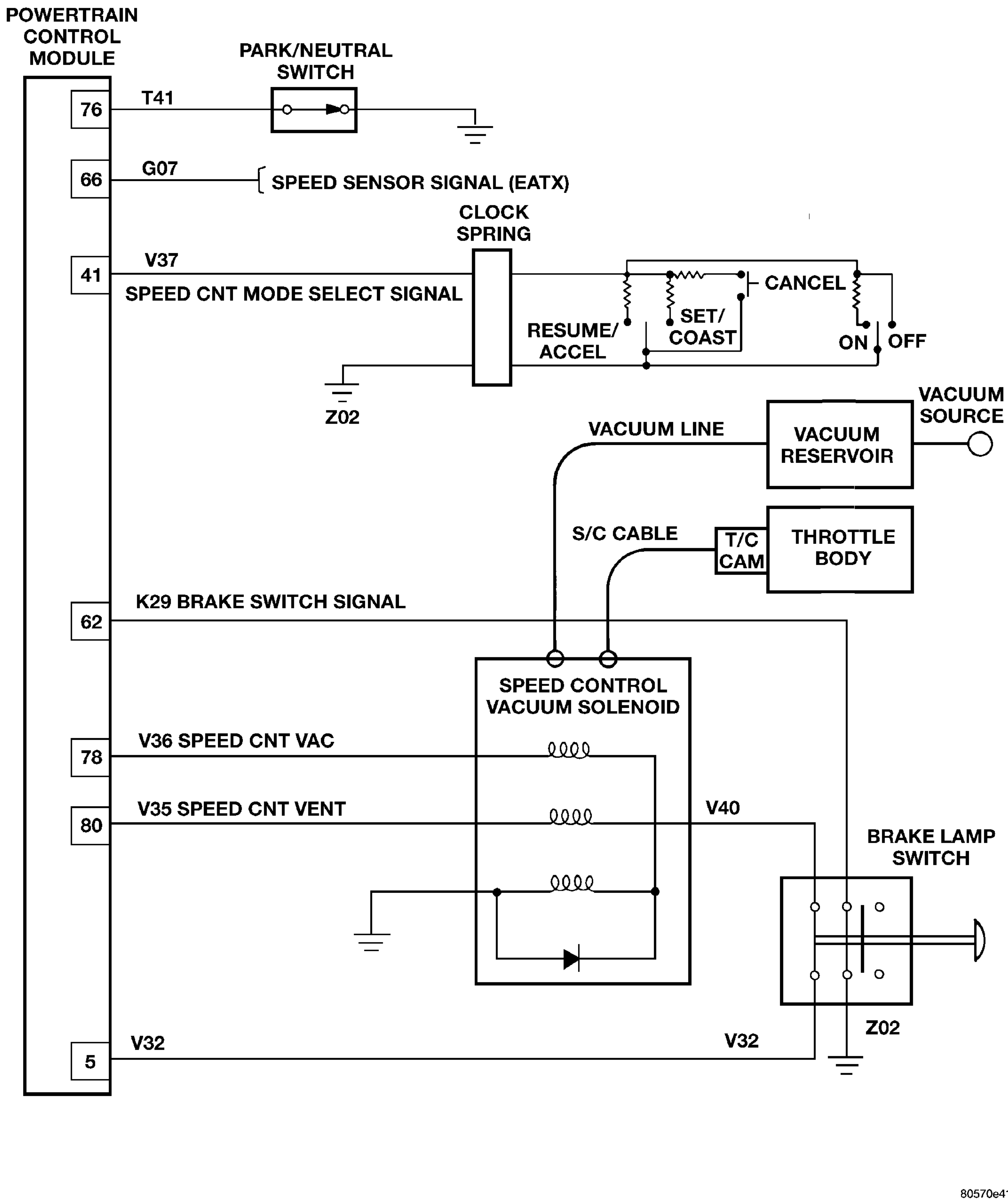


Fig. 5 Speed Control Circuit

DIAGNOSIS AND TESTING (Continued)

OVERSHOOT/UNDERSHOOT ON SPEED CONTROL SET

If the operator repeatedly presses and releases the set button with their foot off of the accelerator (a “lift foot set” to begin speed control operation), the vehicle may accelerate and exceed the desired set speed by up to 5 MPH (8 km/h) and then decelerate to less than the desired set speed before finally achieving the desired set speed.

The Speed Control has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. When the speed control is set with the vehicle operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts. If the lift foot sets are continually used, the speed control overshoot/undershoot condition will develop.

To “unlearn” the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed with the accelerator pedal (not decelerating or accelerating), and then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. This procedure must be performed approximately 10–15 times to completely unlearn the overshoot/undershoot condition.

SERVO VACUUM TEST

(1) Turn ignition switch to the ON position without starting engine. Activate speed control ON switch.

(2) Disconnect the four-way electrical connector and the vacuum harness at the servo (Fig. 6).

(3) Connect a jumper wire from Pin 3 of the servo to Pin 3 of the wire connector.

(4) Ground Pins 2 and 4 in the servo. Do not connect pin 1.

(5) Connect a hand held vacuum pump to the vacuum nipple and apply 10 - 15 inches of vacuum.

(6) If servo pulls cables, replace servo.

(7) Ground Pin 1 on servo.

(8) Check that the throttle cable pulls in and holds as long as the vacuum pump is connected. After one minute, check if cable is still holding. If cable does not hold replace the servo.

(9) Disconnect jumper from pin 3. Cable should return to rest position. If not, replace servo.

(10) Connect 4 way electrical connector and vacuum harness to servo.

SPEED CONTROL SWITCH TEST

The speed control switches mounted on the steering wheel contain five switches and four resistors. The PCM sends 5 volts through pin 41 to the speed control switches. The input on pin 41 is responsible

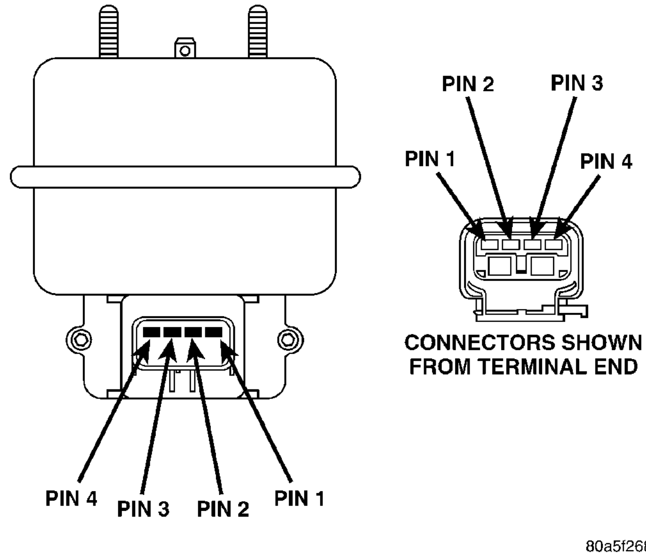


Fig. 6 Servo Harness Connector

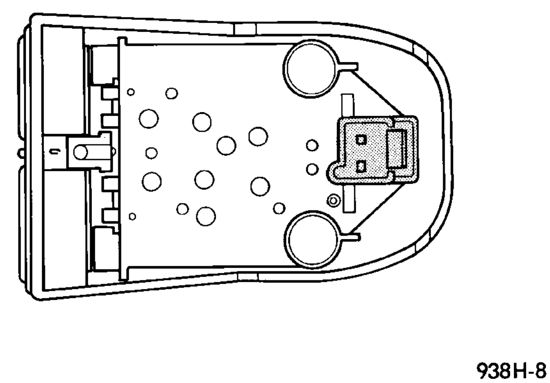


Fig. 7 Speed Control Switch

for identifying the following: Resume/Accelerate, Set/Coast, On, Off and Cancel. This is accomplished by multiplexing. Multiplexing allows the PCM to identify more than one signal from a single wire. To accomplish this, the speed control switch uses resistors that cause different voltage signals at pin 41.

The 5-volt signal at pin 41 has no path to ground when no buttons are depressed, allowing the PCM to recognize the open circuit. When the ON, OFF switch contacts are closed, the 5 volt signal is pulled through a 15400 ohm resistor to ground providing a voltage of 4.14 to 4.73 volts at pin 41. Once the PCM recognizes the ON signal, the PCM provieds a battery voltage signal to the speed control servo through pin 5 of the 80–way connector.

When the SET/COAST switch is depressed, a momentary contact closes a path to ground through a 2,940 ohm resistor. This causes a voltage of approximately 1.99 to 3.20 volts at pin 41, indicating that the SET/COAST switch has been depressed. When the RES/ACCEL switch is depressed, a momentary

DIAGNOSIS AND TESTING (Continued)

contact closes to ground through a 6,650 ohm resistor. The 5-volt signal then passes through a higher resistance than that of the SET/COAST switch, causing the voltage to be approximately 3.30 to 4.14 volts. When the OFF switch is depressed, the contacts close directly to ground, causing the 5-volt signal to drop to 0 volts. When the CANCEL is pressed the contact closes to ground through a 920 ohm resister, causing voltage at pin 41 of 0.61 to 1.94 volts.

OHMMETER CHECK OF SWITCH

(1) Remove the ON, OFF speed control switch assembly and disconnect the two-way connector (Fig. 7).

(2) Using an ohmmeter, touch one lead to one Pin and the second lead to the other Pin. The meter should read no continuity. Press the OFF button, the ohmmeter should read 0 to 0.5 ohms. Press the ON button, the ohmmeter should read 15,245 to 15,555 ohms. If the resistance does not fall within these values replace switch.

(3) Remove the RESUME/SET/CANCEL speed control switch assembly and disconnect the two-way connector.

(4) Using an ohmmeter, touch one lead to one Pin and the second lead to the other Pin. The meter should read no continuity. Press the SET button, the ohmmeter should read 2,910 to 2,970 ohms. Press the RESUME button, the ohmmeter should read 6,580 to 6,720 ohms. Press the CANCEL button, the ohmmeter should read 900 to 920 ohms. If the resistance values do not fall within these specification replace the switch.

STOP LAMP SWITCH TEST

(1) Remove the stop lamp switch refer to Stop Switch Removal/Installation in this section. Disconnect connector from stop lamp switch (Fig. 8). Using an ohmmeter, switch continuity may be checked as follows:

(2) With switch plunger released, there should be continuity between Pin 5 and Pin 6.

(3) With switch plunger depressed, there should be continuity:

- Between Pin 1 and Pin 2.
- Between Pin 3 and Pin 4.

(4) If the above results are not obtained, the stop lamp switch is defective or out of adjustment.

(5) Stop lamp switch adjustment is detailed in Group 5, Brakes.

ELECTRICAL TESTS AT POWERTRAIN CONTROL MODULE

(1) Unplug 2 40-way connectors from the Powertrain Control Module (PCM), located (Fig. 9).

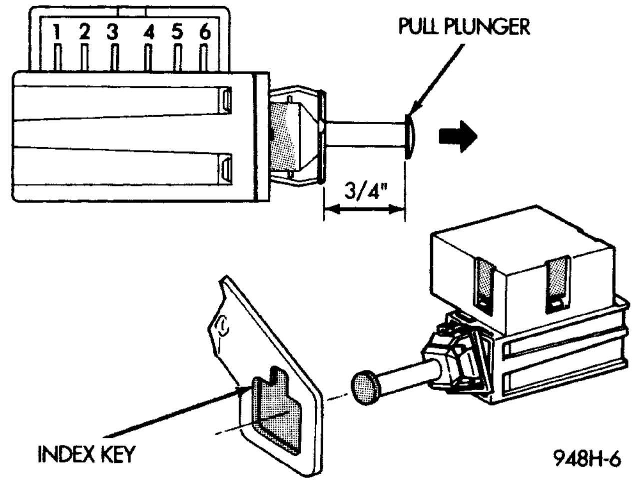


Fig. 8 Stop Lamp Wiring

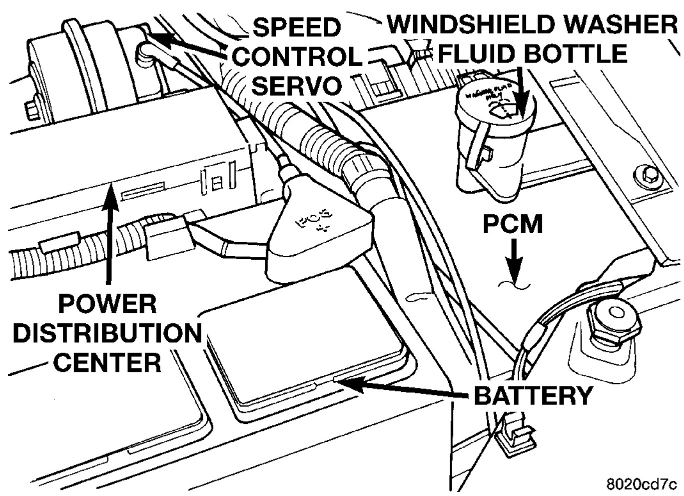


Fig. 9 Powertrain Control Module Location

(2) Remove both steering wheel speed control switches and disconnect the wire connectors.

(a) Using an ohmmeter, check for continuity between pin 41 of the PCM connector and pin 1 of each speed control switch connector (Fig. 10).

(b) If no continuity, repair as necessary.

(c) Using an ohmeter, check for continuity between pin 41 of the PCM connector and ground.

(d) If no continuity, repair as necessary.

(e) If continuity, perform the Switch Test.

(3) Place ignition switch in the ON position for the following tests.

(a) Connect wire connectors to both switches.

(b) Using a voltmeter, connect the ground lead to ground.

(c) Touch the positive lead of the voltmeter to pin 5 on the PCM. Depress the ON switch, the voltmeter should read battery voltage. Depress OFF switch, the voltmeter should read 0 volts. If no voltage, repair wire between pin 80 and pin 2 of the servo. If OK, go to step 4.

DIAGNOSIS AND TESTING (Continued)

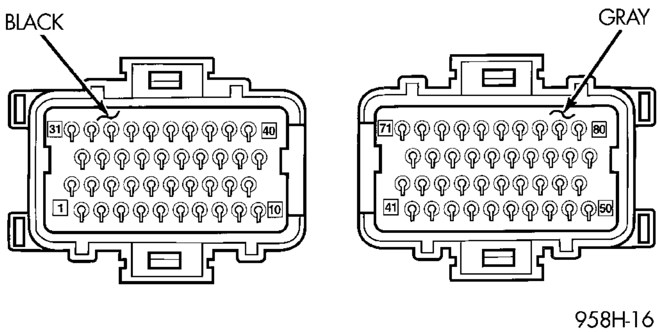


Fig. 10 PCM 40—Way Connectors

(d) Reconnect the BLACK connector (with pins 1–40) to PCM.

(e) Touch the positive lead of the voltmeter to the harness connector pin 80. Depress OFF switch, the voltmeter should read 0 volts. Depress ON switch, the voltmeter should read battery voltage. If no voltage, go to step 5. Repair the wire between pin 78 and 1 of the speed control servo. If OK, go to step 5.

(4) Disconnect the 4 way connector at the servo. Depress the ON switch. The voltmeter should read battery volts at pin 3. If no voltage go to step 7. If voltage is OK, repair wire between pin 80 and pin 2 of the servo.

(5) Reconnect the 4 way connector to servo.

(6) Touch the positive lead of the voltmeter to the harness connector pin 80. Depress OFF switch, the voltmeter should read 0 volts. Depress ON switch, the voltmeter should read battery voltage. If no voltage, go to step 5. Repair the wire between pin 80 and pin 1 of the speed control servo. If OK, go to step 5.

(7) **Turn key off.**

(8) Using an ohmmeter, connect one lead to ground and touch the other lead to pin 62. With the brake pedal released, the meter should show continuity. If no continuity, perform the following test:

(a) Check for continuity between pin 62 and pin 3 of the stop lamp switch connector. If no continuity, repair as necessary.

(b) If continuity, perform Stop Lamp Switch Test.

(9) If the Stop Lamp Switch Test is OK, check for continuity between pin 6 of the stop lamp switch and ground. When the pedal is depressed, the meter should show open circuit. If no continuity repair as necessary. If OK, go to step 8.

(10) Using an ohmmeter, touch one lead to a ground and touch the other lead to pin 76. 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 scan tool.

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at the servo and install a vacuum gauge in the hose (Fig. 11).

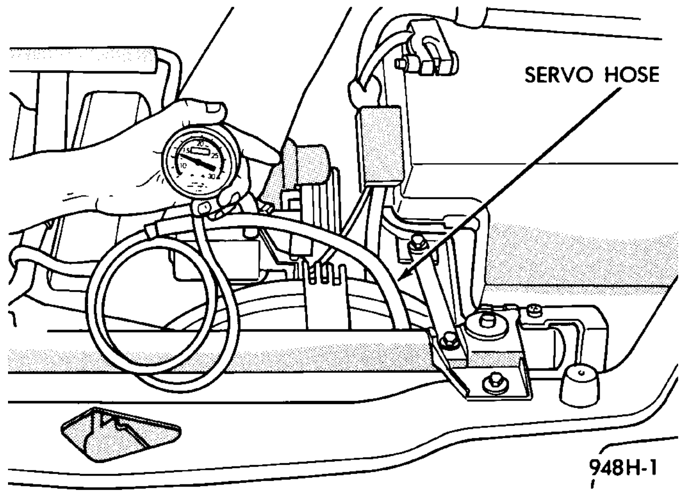


Fig. 11 Vacuum Gauge Test—Typical

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury. Shut off engine, the vacuum should continue to hold 10 inches of mercury.

(3) If vacuum does not meet this requirement, check and correct the following vacuum leaks in the vacuum lines, check valve, vacuum reservoir or poor engine performance.

VEHICLE SPEED SENSOR

For diagnosis and testing of the Vehicle Speed Sensor (VSS), refer to the appropriate Powertrain Diagnostic Procedures service manual. Also refer to the DRB scan tool.

REMOVAL AND INSTALLATION

SPEED CONTROL SERVO

REMOVAL

(1) Disconnect electrical connector from servo.

(2) Disconnect vacuum hoses from servo

(3) Remove 2 nuts retaining cable to servo.

(4) Remove hair pin holding cable to servo.

INSTALLATION

(1) Install hairpin to cable at servo.

(2) Install 2 nuts at cable to servo and servo bracket, tighten to 7 N·m (60 ins. lbs.).

(3) Connect electrical connector to servo.

(4) Connect vacuum hose to servo

REMOVAL AND INSTALLATION (Continued)

SPEED CONTROL SWITCH

The speed control switches are mounted in the steering wheel and wired through the clock spring device under the airbag module (Fig. 1).

WARNING: IF REMOVAL OF AIRBAG MODULE IS NECESSARY, REFER TO GROUP 8M, RESTRAINT SYSTEMS.

REMOVAL

(1) Turn off ignition.

(2) Remove two screws from side of each switch.

(3) Rock switch away from airbag and steering wheel.

(4) Disconnect two-way electrical connector.

(5) Repeat for the other switch.

INSTALLATION

For installation reverse above procedures.

STOP LAMP SWITCH

REMOVAL

Remove the switch from the bracket by depressing the brake pedal and rotating the switch in a counter-clockwise direction approximately 30 degrees. Pull the switch rearward and remove from bracket. Disconnect wiring harness connector.

INSTALLATION

Before installing the switch, reset the adjustable switch plunger by pulling on the plunger head until the plunger reaches the end of its travel. A ratcheting sound will be heard during this procedure.

Connect the wiring harness to the switch. Mount the switch into the bracket by holding the switch with the plunger facing forward in car. There is an index key on the switch that mates with the bracket slot at the top of the square hole. Align key and push switch into square hole in bracket while depressing the brake pedal. Once the switch is seated in the hole, rotate clockwise approximately 30 degrees to lock into place. The switch will automatically adjust when the pedal is released. Pull back on the pedal to assure correct adjustment.

SPEED CONTROL SERVO CABLE

REMOVAL

(1) Remove throttle control shield.

(2) Remove throttle clasp from the throttle body lever.

(3) Remove speed control cable from throttle lever by sliding clasp out hole used for throttle cable.

(4) Compress the retaining tabs on the cable and slide cable out of bracket.

(5) Disconnect electrical connector from servo.

(6) Disconnect vacuum hose from servo

(7) Remove 2 nuts retaining bracket to servo.

(8) Remove push nuts holding cable housing to servo.

(9) Remove retaining clip holding cable to servo.

INSTALLATION

(1) Install retaining clip to cable at servo.

(2) Slide cable bell housing over servo mounting studs.

(3) Install servo mounting studs into bracket.

(4) Install 2 nuts at cable to servo and servo bracket, tighten to 7 N·m (60 ins. lbs.).

(5) Connect electrical connector to servo.

(6) Connect vacuum hose to servo

(7) Slide cable into throttle cable bracket and engage retaining tabs.

(8) Rotate the throttle lever forward to the wide open position and install speed control cable clasp.

(9) Rotate the throttle lever forward to the wide open position and install throttle cable clasp.

(10) Install throttle control shield. Tighten bolt to 5.6 N·m (50 in. lbs.).

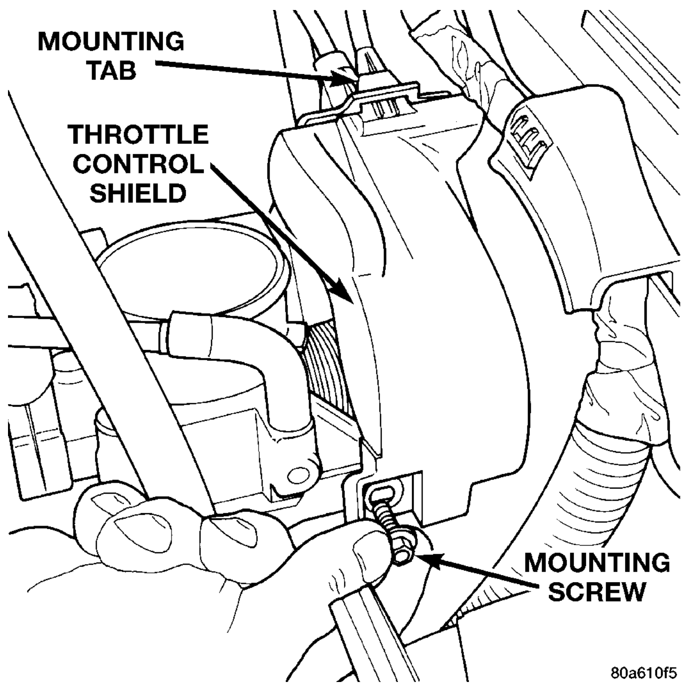


Fig. 12 Throttle Control Shield

REMOVAL AND INSTALLATION (Continued)

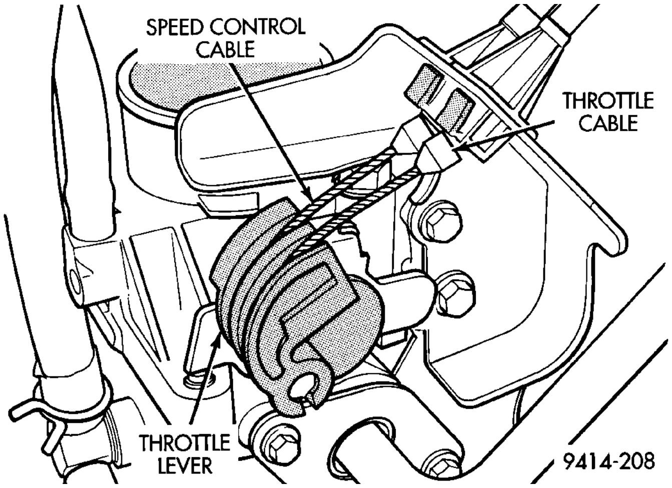


Fig. 13 Throttle Cable Attachment to Throttle Body—Manual Transmission

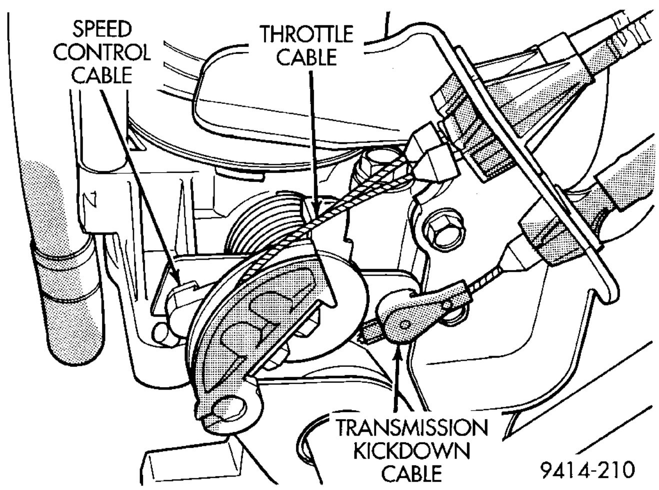


Fig. 14 Throttle Cable Attachment to Throttle Body—Automatic Transmission

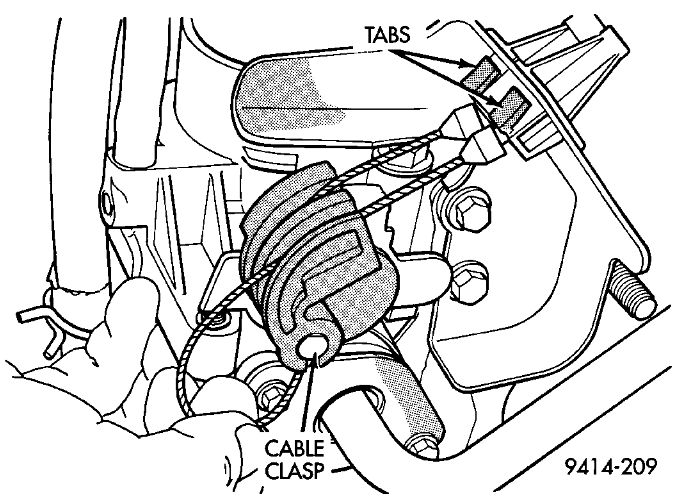


Fig. 15 Disconnecting Throttle Cable

POWERTRAIN CONTROL MODULE

For Removal/Installation refer to Powertrain Control Module in Group 14, Fuel Injection System.

VACUUM RESERVOIR

REMOVAL

(1) Raise and support vehicle.
(2) Remove bolt on top of vacuum reservoir.
(3) Remove vacuum hoses.
(4) Remove vacuum reservoir.

INSTALLATION

(1) Install vacuum reservoir, install push pin and tighten screw to 5 N.m (44 in. lbs.)..
(2) Install vacuum hoses.
(3) Lower vehicle.

VEHICLE SPEED SENSOR

For Removal/Installation, refer to Vehicle Speed Sensor in Group 21, Transaxle.

TURN SIGNAL AND FLASHERS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR AIRBAG REMOVAL PROCEDURES.

The turn signals are part of the multi-function switch. Which contains:

- Electrical circuitry for turn signals
- Hazard warning switch
- Headlamp beam select switch
- Headlamp optical horn

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 molded to the clockspring mechanism comes in contact with the cancel actuator on the turn signal multi-function switch assembly. The 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, one of two indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DESCRIPTION AND OPERATION

HAZARD WARNING SYSTEM

The hazard warning system is actuated by a slide 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 front of the button.

COMBINATION FLASHER

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 cause the flasher rate to double.

The combo-flasher is located on the fuse block. The combo-flasher is black in color for ease of identification (Fig. 1).

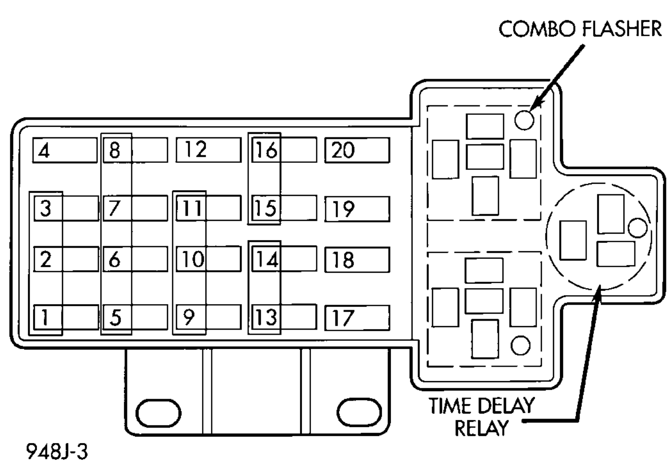


Fig. 1 Combo-Flasher

DIAGNOSIS AND TESTING

MULTI-FUNCTION SWITCH

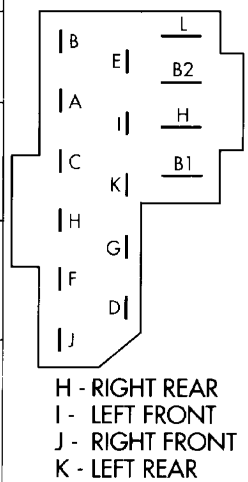
The multi-function switch contains electrical circuitry for turn signal, hazard warning, headlamp beam select, headlamp optical horn. This integrated switch assembly is mounted to the left hand side of the steering column. Should any function of the switch fail, the entire switch assembly must be replaced. Refer to Turn Signal and Hazard Warning Flasher Diagnosis Chart for diagnosis.

MULTI-FUNCTION SWITCH TEST		
CONDITION	**POSSIBLE CAUSES**	**CORRECTION**
Turn signal flashes at twice the normal rate.	(1) Faulty external lamp. (2) Poor ground at lamp. (3) Open circuit in wiring to external lamp. (4) Faulty contact in switch.	(1) Replace lamp. (2) Check and/or repair wiring (3) Repair wiring harness. Check connectors. (4) Replace multi function switch.
Indicator lamp illuminated brightly, external lamp glows dimly at a rapid rate.	(1) Loose or corroded external lamp connection. (2) Poor ground circuit at external lamp.	(1) Replace socket connection. (2) Repair wiring harness. Check connectors.
Hazard warming system does not flash.	(1) Faulty fuse. (2) Faulty flasher. (3) Open circuit in feed wire to switch. (4) faulty contact in switch. (5) Open or grounded circuit in wiring to external lamps.	(1) Replace fuse. (2) Replace flasher. (3) Repair wiring harness, Check connectors. (4) Replace multi function switch. (5) Repair wiring harness.
Indicator lamp illuminates brightly, external lamp does not light.	(1) Open circuit in wire to external lamp. (2) Burned out lamp.	(1) Repair wiring harness. (2) Replace lamp.
System does not flash on either side.	(1) Faulty fuse. (2) Faulty flasher unit. (3) Loose bulkhead connector. (4) Loose or faulty rear wiring harness or terminals. (5) Open circuit to flasher unit. (6) Open circuit in feed wire to turn signal switch. (7) Faulty switch connection in switch. (8) Open or grounded circuit in wiring to external lamps.	(1) Replace fuse. (2) Replace flasher. (3) Tighten connector. (4) Repair wiring harness (5) Check connectors, repair wiring harness. (6) Check connectors, repair wiring harness. (7) Replace multi function switch. (8) Repair wiring harness.
System does not cancel after completion of the turn.	(1) Broken cancelling finger on switch. (2) Broken or missing cancelling cam on clockspring.	(1) Replace multi function switch. (2) Replace clockspring.
External lamps operate properly, no indicator lamp operation.	(1) Faulty indicator lamp in instrument cluster.	(1) Replace lamp.

DIAGNOSIS AND TESTING (Continued)

To test the switch, first disconnect the negative battery cable, then remove the upper and lower column shrouds 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) and (Fig. 3).

SWITCH POSITION		CONTINUITY BETWEEN
TURN SIGNAL	HAZARD WARNING	
NEUTRAL	OFF	F and H F and K A and E
LEFT	OFF	F and H C and K C and I A and E
RIGHT	OFF	F and K C and H C and J A and E
NEUTRAL	ON	B and E C and H C and K C and I C and J



948J-12

Fig. 2 Turn Signal and Hazard Switch Continuity

REMOVAL AND INSTALLATION

MULTI-FUNCTION SWITCH

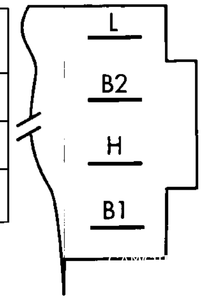
REMOVAL

(1) Disconnect battery negative cable.

(2) Remove both upper and lower steering column shrouds.

(3) Remove multi-function switch mounting screws (Fig. 4).

SWITCH POSITION	CONTINUITY BETWEEN
LOW BEAM	B2 and L
HIGH BEAM	B2 and H
OPTICAL HORN	B1 and H



948J-2

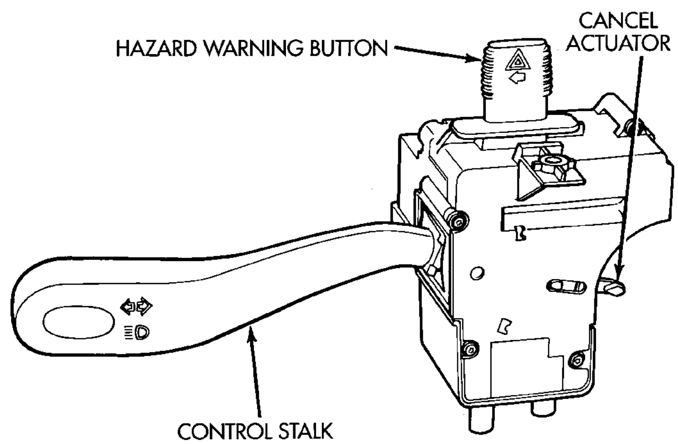
Fig. 3 Beam Select Switch Continuity

INSTALLATION

For installation, reverse the above procedures.

• Tighten multi-function switch to column retaining screws to 2 N·m (17 in. lbs.) torque.

• Tighten steering column cover retaining screws to 2 N·m (17 in. lbs.) torque.



948J-15

Fig. 4 Multi-Function Switch

WINDSHIELD WIPERS AND WASHERS

CONTENTS

WINDSHIELD WIPERS

INDEX

GENERAL INFORMATION

INTRODUCTION

WARNING: VEHICLES ARE EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN SERVICE PROCEDURES.

The windshield wipers will only operate with the ignition switch in the ACCESSORY or IGNITION RUN position. The wiper circuit is protect against over loads by a fuse in the fuse block and a circuit breaker within the wiper motor. This protects the circuitry of the wiper system and the vehicle.

The wiper motor has permanent magnet fields.

The intermittent wiper system, in addition to low and high speed, has a delay mode and a pulse wipe mode. The delay mode has a range of 1 to 15 seconds. Pulse wipe is accomplished by momentarily moving the stalk lever into the WASH position while the wiper switch is in either OFF or DELAY position. The wiper blades then sweep once or twice and return to the previous wiper switch mode, OFF or DELAY.

The intermittent wiper function is integral to the wiper switch. All electronics and relay are inside the switch assembly.

The wiper system completes the wipe cycle when the switch is turned OFF. The blades park in the lowest portion of the wipe pattern.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DESCRIPTION AND OPERATION

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

DESCRIPTION AND OPERATION (Continued)

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. The right and left wipers are different blade lengths. The driver side length is 525 mm and the passenger side length is 450 mm. The blades should not be interchanged.

DIAGNOSIS AND TESTING

WINDSHIELD WIPER CONDITION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

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.

Whatever the problem, disconnect motor wire harness and clean the terminals, then connect motor wire harness and test.

MOTOR WILL NOT OPERATE IN SOME OR ALL SWITCH POSITIONS

(1) Check fuse 15, in the fuse block (Fig. 1).

(a) If fuse is OK, go 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, go to Step 2.

(d) If replacement fuse blows, go to Step 6.

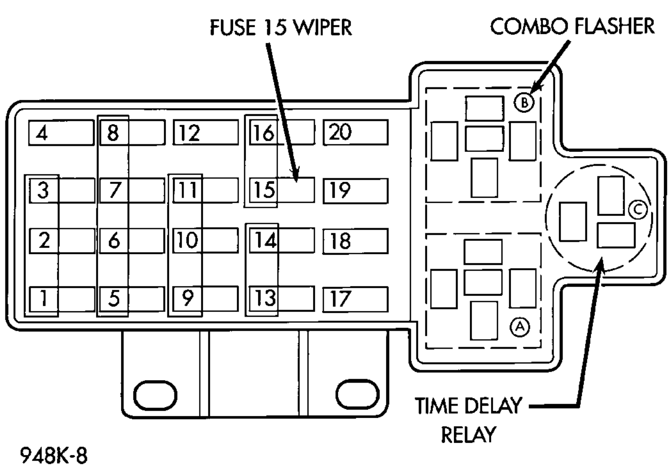


Fig. 1 Fuse Block

(2) Disconnect motor wire connector.

(3) Check motor low speed. Using two jumper wires, connect one jumper wire between the battery positive terminal and terminal 2 of the motor connector. Connect the other jumper wire to the battery negative terminal and the motor ground strap (Fig. 2). Check motor high speed, connect the positive jumper wire to terminal 1 of the motor connector. Connect the negative jumper wire to the motor ground strap.

(a) If motor does not run, high or low speed go to Step 4.

(b) If motor runs, go to Step 5.

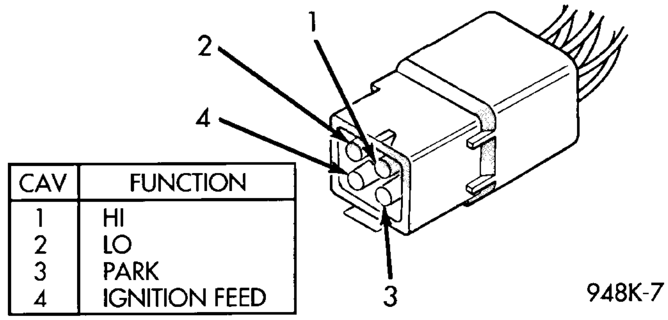


Fig. 2 Motor Connector

(4) Using an ohmmeter, check for good ground at the motor ground strap. If OK, replace motor. If not repair the ground circuit as necessary.

(5) Check terminal E of wiper switch connector for continuity to ground. If OK, go to Step 6. If not OK, repair the ground circuit as necessary.

(6) Using a voltmeter, with wiper switch connected, connect negative lead to motor ground strap. Connect the positive lead to terminal P1 of the wiper switch connector (Fig. 3) and (Fig. 5).

(a) If no voltage, repair wiring as necessary. If OK, go to Step 2.

(b) Check wiper switch low speed, connect voltmeter positive lead to terminal L of the wiper switch connector. Move wiper stalk to LOW position. If no voltage, replace switch.

(c) Check wiper switch high speed, connect voltmeter positive lead to terminal H of the wiper switch connector. Move wiper stalk to HIGH position. If no voltage, replace switch.

(7) Disconnect motor connector and replace fuse 15 in fuse block.

(a) If fuse does not blow, replace motor.

(b) If fuse blows, disconnect wiper switch and replace fuse.

(c) If fuse does not blow, replace switch.

(d) If fuse blows, repair wiring as necessary.

MOTOR OPERATES SLOWLY AT ALL SPEEDS

(1) Remove wiper arms and cowl screen. Disconnect motor linkage from motor. Connect an ammeter between battery positive terminal and terminal 4 of

DIAGNOSIS AND TESTING (Continued)

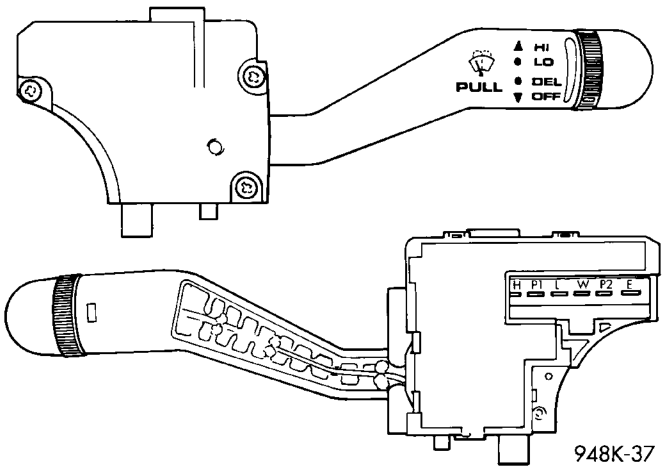


Fig. 3 Wiper Switch and Terminals

the motor connector (Fig. 4). Turn wiper motor on and check ampere reading.

If motor runs and ammeter reading is more than 6 amps, go to Step 2. If less than 6 amps, go to Step 3. When replacing drive link nut tighten to 11 to 12 N·m (98 to 106 in. lbs.) torque.

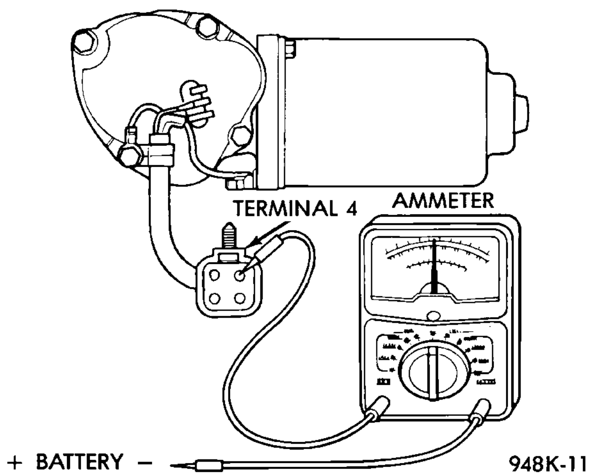


Fig. 4 Ammeter Test

(2) Using an ohmmeter, check the high and low circuits for a short to ground. Refer to Group 8W, Wiring Diagrams.

(3) Check to see if wiper linkage or pivots are binding or caught.

WIPERS RUN AT HIGH SPEED WITH SWITCH IN LOW SPEED POSITION OR WIPERS RUN AT LOW SPEED WITH SWITCH IN HIGH SPEED POSITION.

(1) Check for crossed wires in the motor pigtail wire connector. Refer to Group 8W, Wiring Diagrams.

(2) Check for crossed wires in harness connector from wiper switch to motor.

(3) If OK, replace wiper switch.

WIPERS WILL OPERATE CONTINUOUSLY WITH SWITCH IN THE INTERMITTENT POSITION—WHEN WIPER SWITCH IS TURNED OFF, WIPERS STOP WHEREVER THEY ARE, WITHOUT RETURNING TO PARK POSITION.

(1) Check at motor ground strap for a good ground.

(2) Turn ignition switch OFF. Using an ohmmeter, with the motor in the park position, check for continuity between terminal 3 and ground strap. If continuity, replace wiper switch. If no continuity, repair wiring as necessary.

WIPERS DO NOT OPERATE WHEN WASHER MOTOR IS ENGAGED (PULSE WIPE) OR WIPERS DO OPERATE IN INTERMITTENT POSITION.

Check for a good ground at motor ground strap and at wiper switch terminal E. If OK, replace wiper switch. If not OK, repair wiring as necessary.

WIPER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

Whenever a wiper motor malfunction occurs, verify that the wire harness is properly connected start normal diagnosis and repair procedures. Refer to Wiper Motor Test.

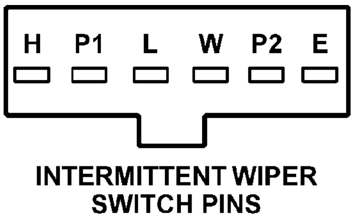
DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Wiper blades do not park properly.	(1) Wiper arms improperly parked. (2) Wiper arms are loose on pivot shaft. (3) Motor crank loose at output shaft.	(1) Remove wiper arms and repark. Refer to Wiper Arm Removal and Installation. (2) Remove wiper arm and repark. Refer to Wiper Arm Removal and Installation. (3) Remove wiper arm, run wiper motor to park position and remove the module. Without rotating the motor output shaft, remove the crank and clean any foreign matter from the motor shaft. Install the motor crank in its original position.
Motor stops in any position when the switch is turned off.	(1) Open park circuit.	(1) Check park switch by disconnecting the wire connector and apply battery voltage to Pin 4. Place a jumper wire from Pin 2 to Pin 3 and then to an external ground. Replace motor if it does not park.
Motor will not stop when the switch is turned off.	(1) Faulty switch. (2) Lock of dynamic brake on wet glass.	(1) check switch in low, high and intermittent position. (2) Ensure park switch has clean ground.
Wiper blades slap against cowl screen or window moldings.	(1) Wiper arms are parked incorrectly.	(1) Park wiper arms. Refer to Wiper Arm Adjustment.
Blades chatter.	(1) Foreign substance such as polish on glass or blades. (2) Arms twisted, blade at wrong angle on glass. (3) Blade structure bent. (4) Blade element has permanent set.	(1) Clean glass and blade element with non-abrasive cleaner. (2) Replace arm. (3) Replace blade. (4) Replace blade element.
Wiper knock at reversal.	(1) Linkage bushings worn. (2) Armature endplay in motor.	(1) Replace worn link. Refer to Wiper Linkage Removal and Installation. (2) Replace wiper motor. Refer to Wiper Motor Removal and Installation.
Wiper motor will not run.	(1) Blown fuse. (2) New fuse blows. (3) New fuse blows. (4) No Voltage at motor. (5) Poor ground.	(1) Replace fuse, and run system. (2) Check for short in wiring or switch. (3) Replace fuse, remove motor connector, turn switch ON, fuse does not blow, replace motor. (4) Check switch and wiring harness. Refer to Group 8W, Wiring Diagrams. (5) Repair ground wire connection as necessary.

DIAGNOSIS AND TESTING (Continued)

WIPER SWITCH

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 (Fig. 5).



SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN P2 and PIN L
LOW	PIN P1 and PIN L
HIGH	PIN P1 and PIN H
WASH	PIN P1 and PIN W
INTERMITTENT	CANNOT BE CHECKED

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Fig. 5 Wiper Switch Test

REMOVAL AND INSTALLATION

WIPER ARM

REMOVAL

(1) Place the wiper arm/blades in the PARK position and turn ignition OFF.

(2) Remove arm cap and wiper arm nut.

(3) Remove the arm from the pivot using a rocking motion.

(4) Clean metal splinters OFF the pivot shafts.

INSTALLATION

For installation reverse above procedures. Before installation activate wiper system to ensure the wiper module is in the PARK position. Position wiper arms so that the heel of the blade(s) is on the park line on the windshield.

WIPER BLADE

REMOVAL

(1) Lift wiper arm to over center position.

(2) Remove blade assembly from arm by pushing release tab under arm tip and slide blade away from arm tip (Fig. 6) and (Fig. 7).

(3) Gently place wiper arm tip on glass surface.

INSTALLATION

For installation reverse above procedures.

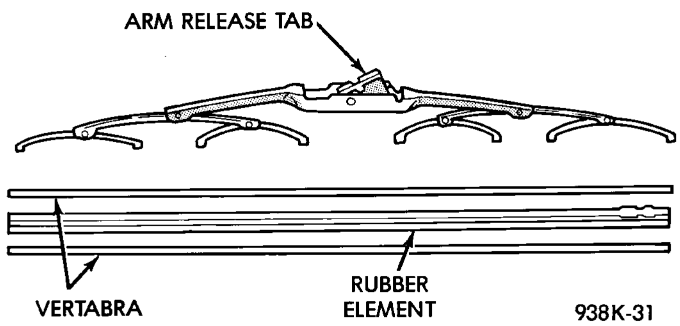

Fig. 6 Wiper Blade and Element

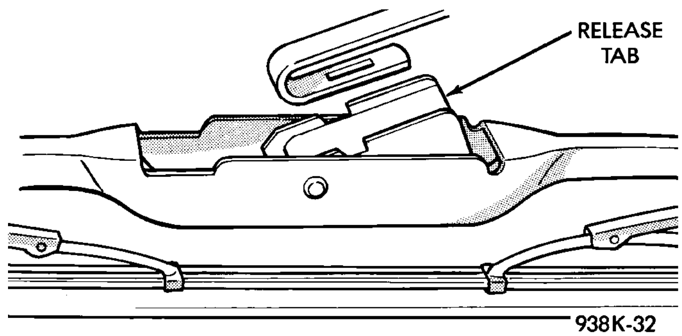

Fig. 7 Remove Blade from Arm

WIPER BLADE ELEMENT

REMOVAL

(1) Lift wiper arm to raise blade off glass.

(2) Remove blade assembly from arm by pushing release tab under arm tip and slide blade away from arm tip (Fig. 6) and (Fig. 7). Gently place wiper arm tip on glass surface.

(3) Remove wiping element from blade assembly. Pull stopper, of the rubber element, out of the end claw together with vertibra (metal rails) (Fig. 8).

INSTALLATION

For installation reverse the above procedures. Check that the element and vertibra are through all claws and the final claw is locked in the stopper.

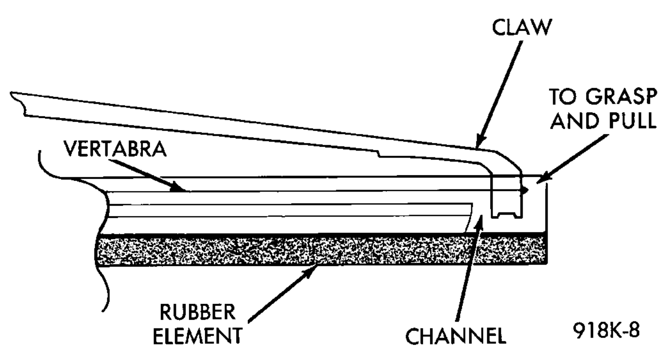

Fig. 8 Wiper Blade and Element

REMOVAL AND INSTALLATION (Continued)

WIPER LINKAGE

REMOVAL

(1) Remove wiper module refer above (Fig. 9).

(2) Disconnect wiper arm linkage, by insert screwdriver between ball cap and linkage, then twist the screwdriver and lift straight up on linkage.

INSTALLATION

For installation reverse the above procedures. Using pliers or hand press the ball cap straight on to the ball stud.

WIPER MODULE

REMOVAL

(1) Remove wiper arms and blades (Fig. 9).

(2) Remove the rear hood seal with the cowl top plastic screen.

(3) Disconnect motor wire connector at front plenum wall.

(4) Remove wiper module mounting screws and remove module.

INSTALLATION

For installation reverse the above procedures. Tighten the mounting screws to 7 to 9 N·m (60 to 80 in. lbs.) torque.

WIPER MOTOR

REMOVAL

(1) Remove wiper module refer above.

(2) Remove linkage from motor crank. Insert screwdriver between crank and linkage then twist the screwdriver and lift straight up on linkage.

(3) Remove motor mounting screws and remove motor.

INSTALLATION

For installation add unilube grease to socket and reverse the above procedures. Tighten the motor mounting screws to 5 to 6 N·m (45 to 55 in. lbs.) torque. Tighten drive link nut to 11 to 12 N·m (98 to 106 in. lbs.) torque.

WIPER SWITCH

REMOVAL

(1) Remove three screws holding steering column shroud and remove upper half of shroud (Fig. 10).

(2) Remove mounting screw on switch and remove switch.

(3) Disconnect wire harness connector from switch.

INSTALLATION

For installation, reverse the above procedures.

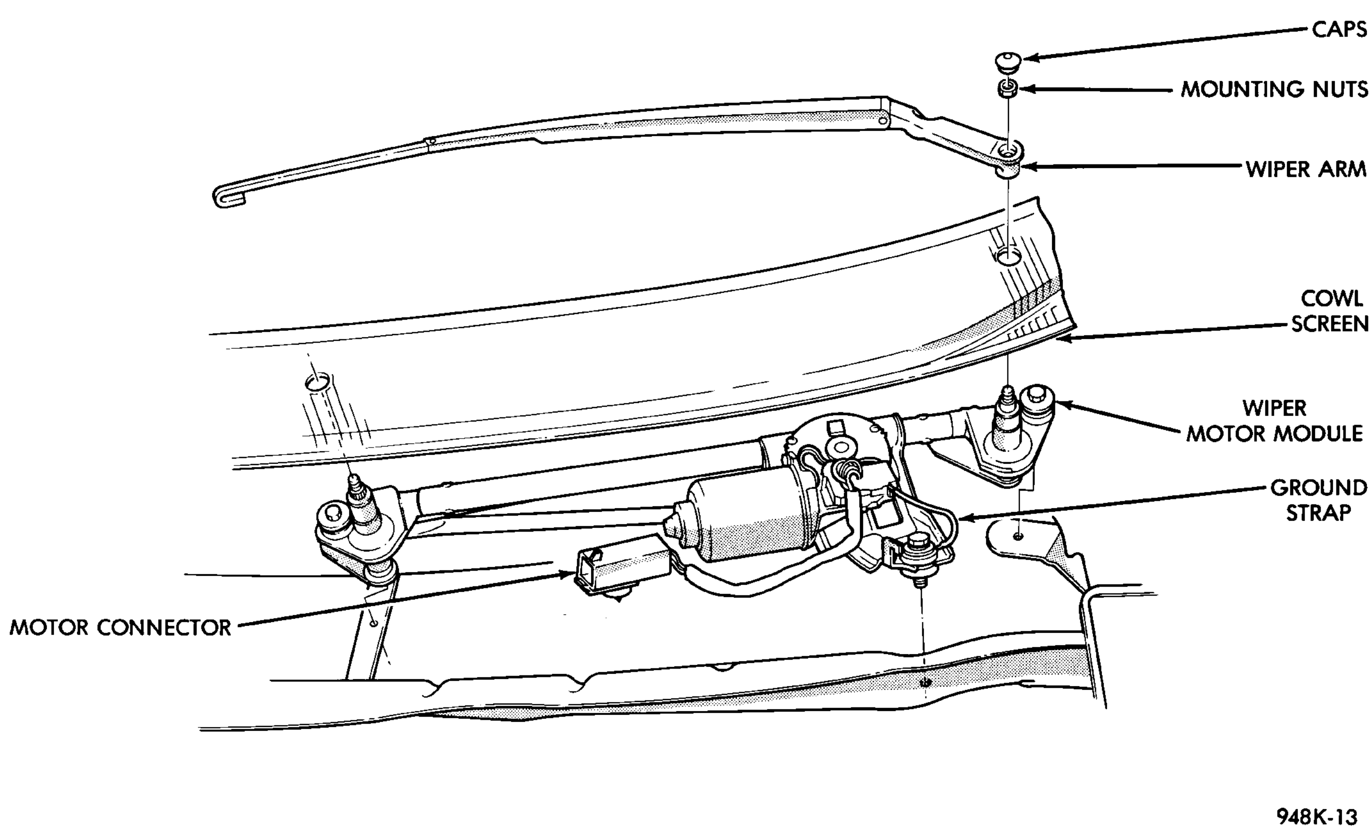

Fig. 9 Wiper Motor and Linkage Module

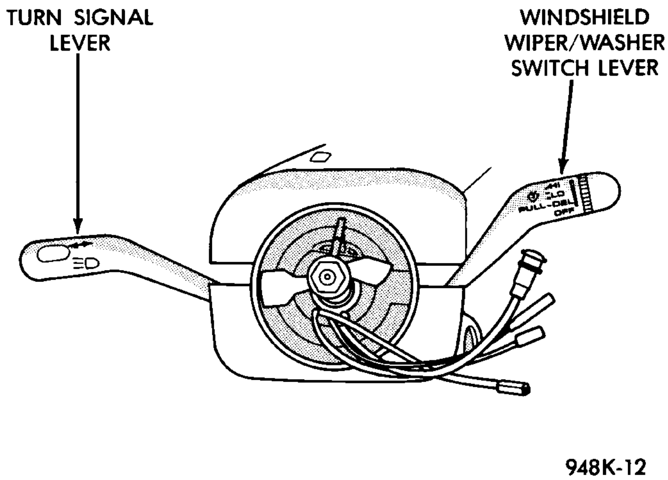

Fig. 10 Upper Shroud Removal

CLEANING AND INSPECTION

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 recommended to remove the accumulation of salt and road grime. The wiper blades, arms and windshield should be cleaned with a sponge or cloth and a mild detergent or nonabrasive cleaner. If the wiper blades continue to streak or smear, they should be replaced. The wiper blade should run smoothly across the windshield in both directions. The wiper blade should slightly roll over center when the blade reverses direction. A wiper blade insert that has lost flexibility or a wiper arm that has lost spring tension, will cause the blade to skip or chatter across the windshield. If the wiper blades are new and the wiper arm spring tension is OK and a chattering sound is emitted from the wiper(s), the wiper blade is not rolling over center. If this condition exists, refer to the Wiper Arm Alignment paragraph of this group.

ADJUSTMENTS

WIPER ARM ADJUSTMENT

(1) Cycle the wiper motor into the PARK position.

(2) Lift the wiper blade off the windshield and release it.

(3) The wiper blade heel should be parked within 5 mm of the park line. The park line is mark on the windshield (Fig. 11).

(4) In the event that the wiper blade tip excessively strikes the cowl screen due to long term normal wear, reposition the wiper blade heel slightly above the park line. Make sure that the wipers are in the PARK position.

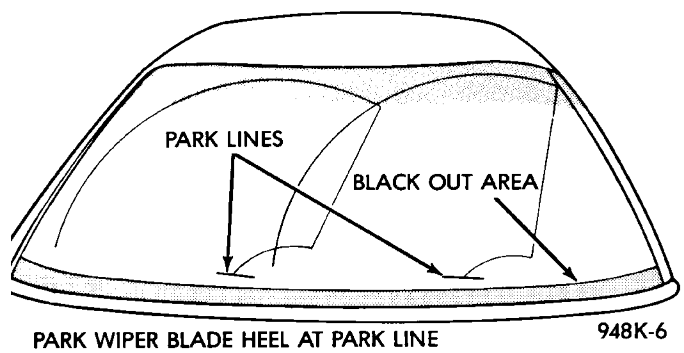

Fig. 11 Arm Adjustment

WINDSHIELD WASHER SYSTEM

INDEX

DESCRIPTION AND OPERATION

WASHER NOZZLE

This model is equipped with two hood mounted washer nozzles. Each nozzle emits two streams into the wiper pattern (Fig. 1). If the nozzle performance is unsatisfactory they can be adjusted. To adjust insert a pin into the nozzle ball and move to proper pattern (Fig. 2). The right and left nozzles are identical.

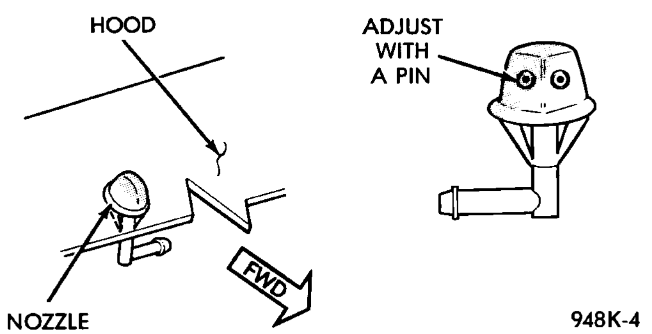

Fig. 1 Windshield Washer Nozzle

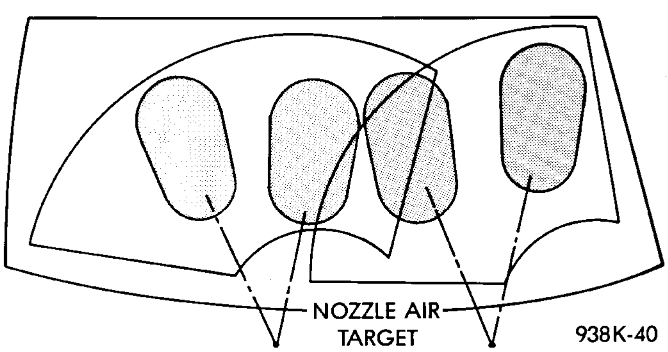

Fig. 2 Windshield Washer Pattern

DIAGNOSIS AND TESTING

WINDSHIELD WASHERS

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. 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 Test (Fig. 3).

The electric pump assembly is mounted directly to the reservoir. A permanently lubricated motor is coupled to a rotor type pump. Fluid, gravity fed from the reservoir, is forced by the pump through rubber hoses to the hood mounted nozzles which direct the fluid streams to the windshield.

The pump and reservoir are serviced as separate assemblies (Fig. 4).

Condition	Possible Cause	Correction
Pump runs no fluid flowing.	(1) No fluid in the reservoir.	(1) Fill reservoir.
	(2) Nozzle plugged or frozen.	(2) Thaw and check flow if blocked replace as necessary.
	(3) Broken, loose or pinched hose.	(3) Check flow through hose connections.
	(4) Faulty pump.	(4) Apply battery voltage to motor terminals, replace if pump does not run.
System operates intermittently.	(1) Loose wire connection.	(1) Check wire connections.
	(2) Faulty switch.	(2) Disconnect wire harness use voltmeter to check switch.
System output is low.	(1) Pinched hose.	(1) Check flow through hose connection.
	(2) Hose blocked.	(2) Disconnect hose at nozzle and Y connector check for flow. Replace as necessary.

948K-35

Fig. 3 Windshield Washer Test

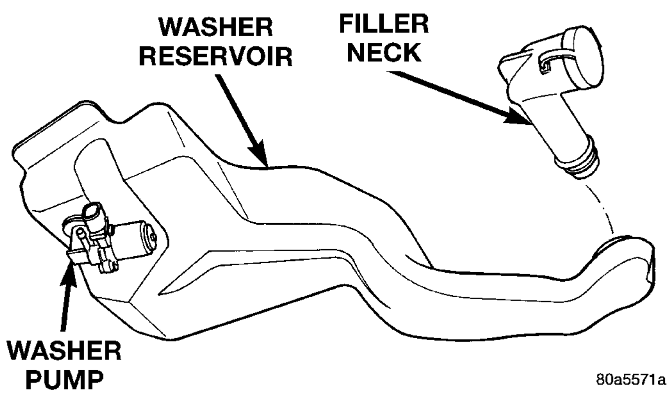

Fig. 4 Washer Fluid Reservoir

REMOVAL AND INSTALLATION

WASHER NOZZLE

REMOVAL

(1) Disconnect washer fluid hose at the nozzle.

(2) Using a needle nose pliers, squeeze together the locking tabs on the nozzle (Fig. 1).

(3) Remove nozzle.

INSTALLATION

(1) Place the nozzle in position and push downward till locking tabs are securely snapped into position.

(2) Connect the washer hose and ensure that the hose is not kinked.

WASHER RESERVOIR

REMOVAL

(1) Remove filler neck (Fig. 5).

(2) Raise vehicle on hoist.

(3) Disconnect the wire connector from the reservoir pump (Fig. 6).

(4) Disconnect the washer hose at the pump and drain the reservoir.

(5) Remove fastener from reservoir.

(6) Remove the reservoir through fender opening.

INSTALLATION

For installation, reverse the above procedures. Tighten the reservoir screw to 2.2 to 3.3 N·m (20 to 29 in. lbs.) torque.

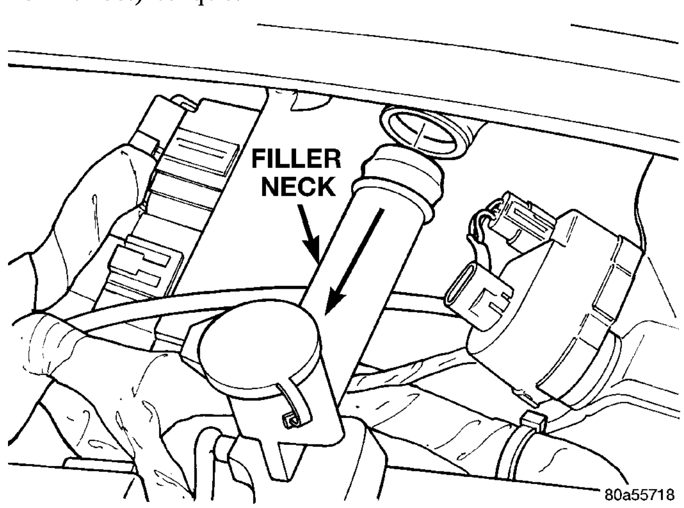

Fig. 5 Filler Neck Removal

REMOVAL AND INSTALLATION (Continued)

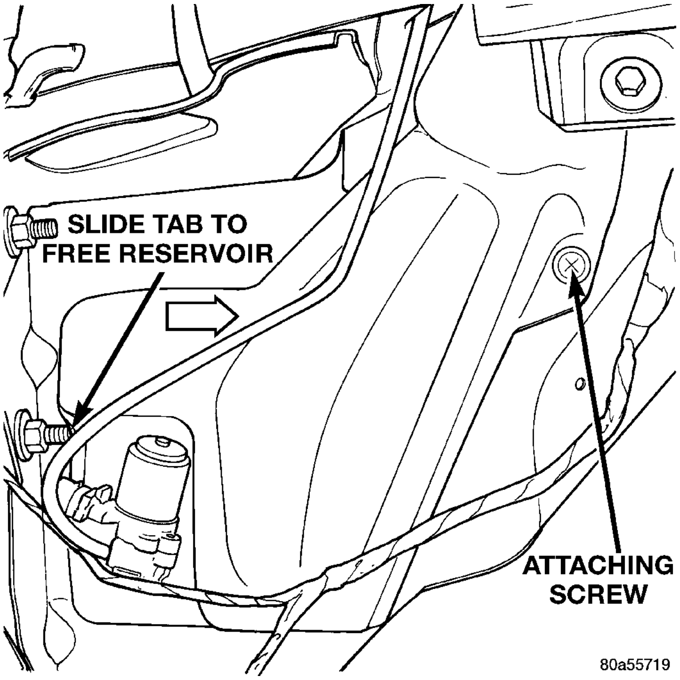

Fig. 6 Reservoir Removal

WASHER RESERVOIR PUMP

REMOVAL

(1) Raise vehicle on hoist.

(2) Disconnect the wire connector from the reservoir pump.

(3) Disconnect the washer hose at the pump and drain the reservoir.

(4) Gently pry pump away from reservoir and out of grommet. Care must be taken not to puncture reservoir (Fig. 7).

(5) Remover rubber grommet from reservoir and throw away.

INSTALLATION

For installation, reverse the above procedures.

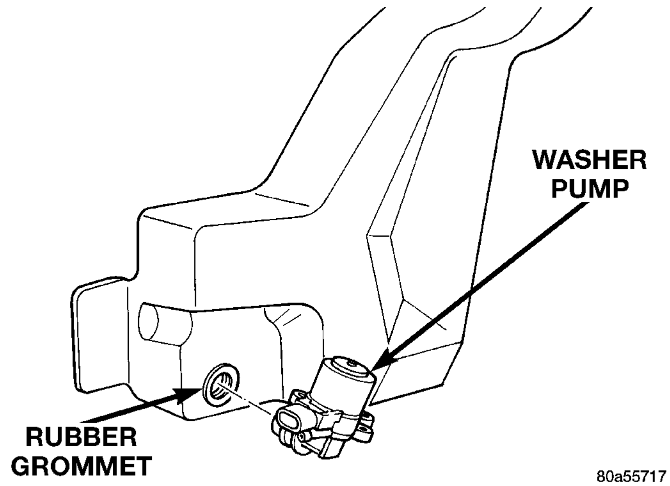

Fig. 7 Washer Pump

LAMPS

CONTENTS

LAMP DIAGNOSIS

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GENERAL INFORMATION

GENERAL INFORMATION

Each vehicle is equipped with various lamp assemblies. A good ground is necessary for proper lighting operation. Grounding is provided by the lamp socket when it comes in contact with the metal body, or through a separate ground wire.

When changing lamp bulbs check the socket for corrosion. If corrosion is present, clean it with a wire brush and coat the inside of the socket lightly with Mopar Multi-Purpose Grease or equivalent.

SAFETY PRECAUTIONS

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

Do not use bulbs with higher candle power than indicated in the Bulb Application table at the end of this group. Damage to lamp can result.

Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges are not holding the component in place.

DAYTIME RUNNING LAMP MODULE

PL vehicles built for use in Canada are equipped with a Daytime Running Lamp (DRL) system. The DRL system operates the headlamps at 50% illumination with the headlamp switch OFF, park brake released and the ignition ON. The DRL system is controlled by the Daytime Running Lamp Module. The DRL module overrides the headlamp switch when the headlamps are turned OFF. The headlamps operate normally when the headlamps are turned ON.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

When a vehicle experiences problems with the headlamp system, verify the condition of the battery connections, charging system, headlamp bulbs, wire connectors, relay, high beam dimmer switch and headlamp switch. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

DIAGNOSIS AND TESTING (Continued)

HEADLAMP DIAGNOSIS

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to Group 8W, Wiring Diagrams.

Conventional and halogen headlamps are interchangeable. It is recommended that they not be intermixed on a given vehicle.

DIAGNOSIS AND TESTING (Continued)

.

HEADLAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables. 2. Loose or worn generator drive belt. 3. Charging system out too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground. 7. Both headlamp bulbs defective.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace generator drive belt. 3. Test and repair charging system, refer to Group 8A. 4. Test battery state-of-charge, refer to Group 8A. 5. Load test battery, refer to Group 8A. 6. Test for voltage drop across Z1-ground locations, refer to Group 8W. 7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT FREQUENTLY.	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system, refer to Group 8A. 2. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE.*	1. Charging system output too low. 2. Poor headlamp circuit ground. 3. High resistance in headlamp circuit. 4. Both headlamp bulbs defective.	1. Test and repair charging system, refer to Group 8A. 2. Test voltage drop across Z1-ground, refer to Group 8W. 3. Test amperage draw of headlamp circuit. 4. Replace both headlamp bulbs.
HEADLAMPS FLASH RANDOMLY.	1. Poor headlamp circuit ground. 2. High resistance in headlamp circuit. 3. Faulty headlamp switch circuit breaker. 4. Loose or corroded terminals or splices in circuit.	1. Repair circuit ground, refer to Group 8W. 2. Test amperage draw of headlamp circuit. 3. Replace headlamp switch. 4. Repair connector terminals or splices, refer to Group 8W.
HEADLAMPS DO NOT ILLUMINATE.	1. No voltage to headlamps. 2. No ground at headlamps. 3. Faulty headlamp switch. 4. Faulty headlamp dimmer switch. 5. Broken connector terminal or wire splice in headlamp circuit.	1. Replace fuse, refer to Group 8W. 2. Repair circuit ground, refer to Group 8W. 3. Replace headlamp switch. 4. Replace headlamp dimmer switch. 5. Repair connector terminal or wire splices.
* Canada vehicles must have lamps ON.		

DIAGNOSIS AND TESTING (Continued)

FOG LAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables. 2. Loose or worn generator drive belt. 3. Charging system output too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground. 7. Both fog lamp bulbs defective.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace generator drive belt. 3. Test and repair charging system, refer to Group 8A. Test battery state-of-charge, refer to Group 8A. 5. Load test battery, refer to Group 8A. 6. Test for voltage drop across Z1-ground locations, refer to Group 8W. 7. Replace both lamp bulbs.
FOG LAMP BULBS BURN OUT FREQUENTLY.	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system, refer to Group 8A. 2. Inspect and repair all connectors and splices, refer to Group 8W.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE.	1. Charging system output too low. 2. Poor fog lamp circuit ground. 3. High resistance in fog lamp circuit. 4. Both fog lamp bulbs defective.	1. Test and repair charging system, refer to Group 8A. 2. Test voltage drop across Z1-ground, refer to Group 8W. 3. Test amperage draw of fog lamp circuit. 4. Replace both fog lamp bulbs.
FOG LAMPS FLASH RANDOMLY.	1. Poor fog lamp circuit ground. 2. High resistance in fog lamp circuit. 3. Faulty fog lamp switch circuit breaker. 4. Loose or corroded terminals or splices in circuit.	1. Repair circuit ground, refer to Group 8W. 2. Test amperage draw of fog lamp circuit. 3. Replace fog lamp switch. 4. Repair connector terminals or splices, refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE.	1. Blown fuse for log lamps. 2. No ground at fog lamps. 3. Faulty fog lamp switch. 4. Broken connector terminal or wire splice in fog lamp circuit.	1. Replace fuse, refer to Group 8W. 2. Repair circuit ground, refer to Group 8W. 3. Replace fog lamp switch. 4. Repair connector terminal or wire splices.

HEADLAMP ALIGNMENT

INDEX

GENERAL INFORMATION

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.**

SERVICE PROCEDURES

HEADLAMP ALIGNMENT PREPARATION

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Inspect and correct damaged or defective components that could interfere with proper headlamp alignment.

(3) Verify proper tire inflation.

(4) Clean headlamp lenses.

(5) Verify that luggage area is 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.

ADJUSTMENTS

HEADLAMP ADJUSTMENT USING ALIGNMENT SCREEN

ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft) away from front of headlamp lens (Fig. 1).

(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

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.

FOG LAMP ALIGNMENT

Prepare an alignment screen. Refer to Alignment Screen Preparation paragraph in this section. Disengage the wire connectors from the back of the headlamp bulbs to disable the headlamps. This will allow a more accurate projection reading of the fog lamps. Turn on the headlamp switch and actuate the fog lamp switch. 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. 2).

SPECIAL TOOLS (Continued)

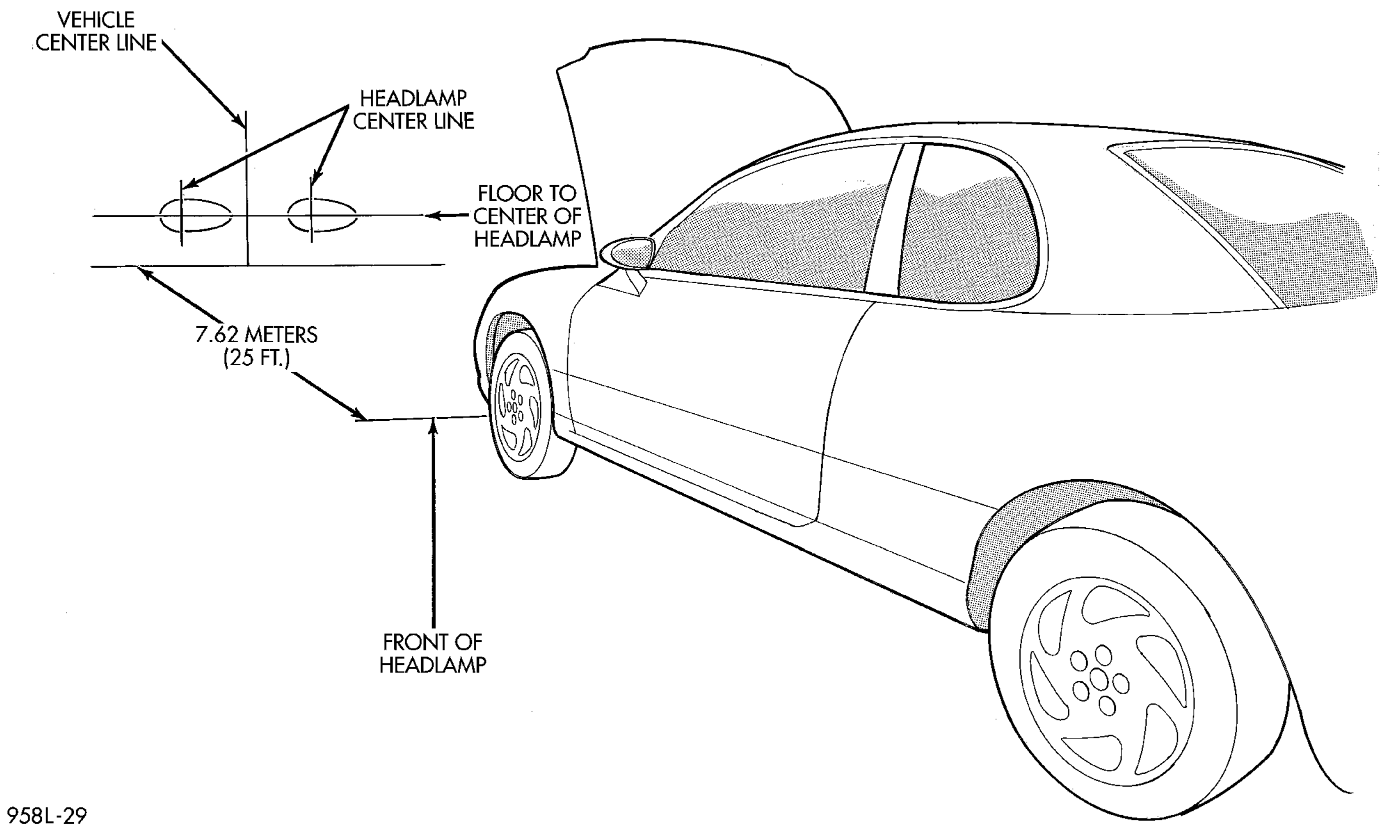


Fig. 1 Headlamp Alignment Screen—Typical

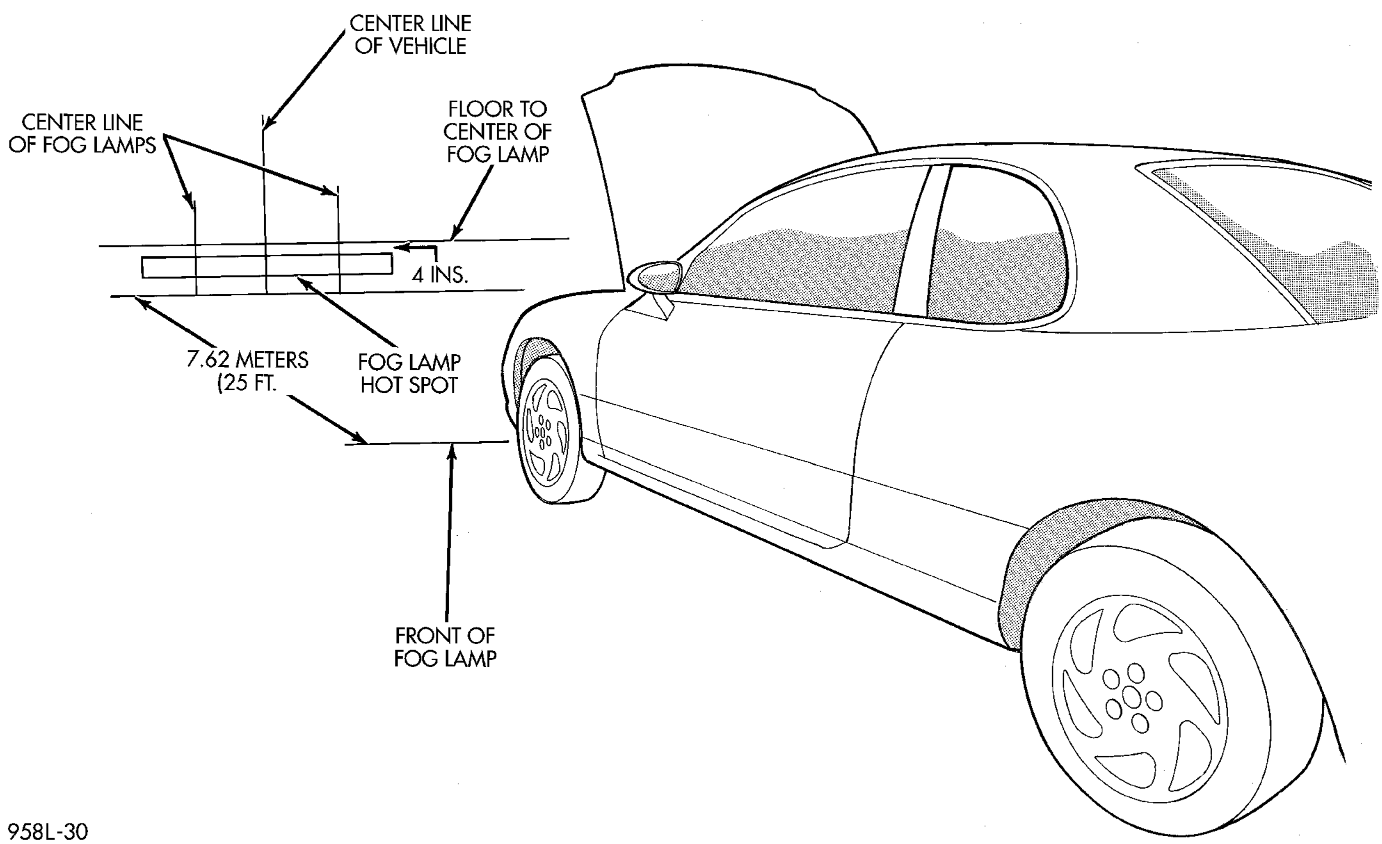
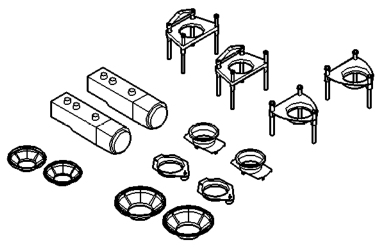


Fig. 2 Lamp Alignment Screen

SPECIAL TOOLS

SPECIAL TOOLS—HEADLAMP ALIGNMENT



Headlamp Aiming Kit C-4466–A

LAMP BULB SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

(1) Release hood latch and open hood.

(2) Disengage wire connector from headlamp bulb connector.

(3) Remove retaining ring holding bulb to back of headlamp module.

(4) Pull bulb from back of headlamp module (Fig. 1).

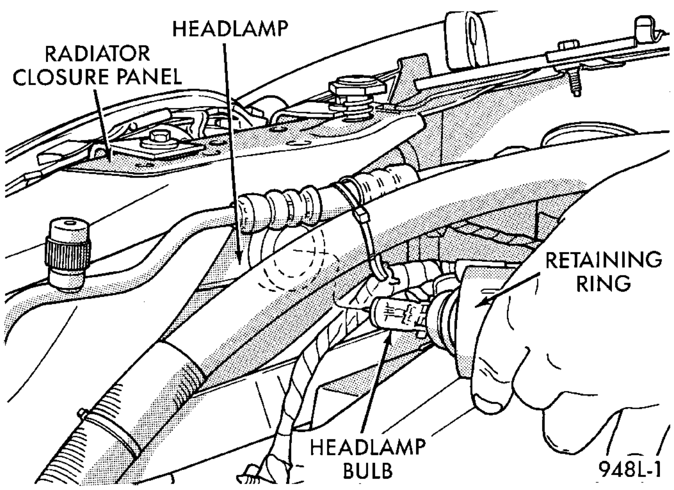


Fig. 1 Headlamp Bulb

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

Reverse the preceding operation.

FOG LAMP BULB

REMOVAL

(1) Remove fog lamp from behind fascia.

(2) Disengage wire connector from fog lamp bulb base.

(3) Remove bulb from lamp (Fig. 2).

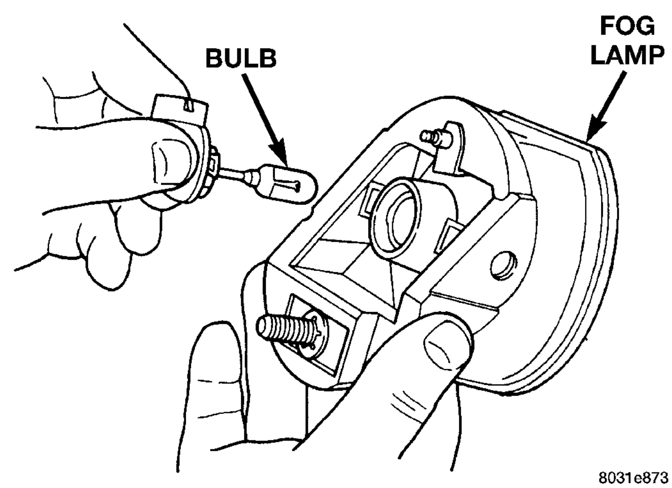


Fig. 2 Fog Lamp Bulb

INSTALLATION

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

Reverse the preceding operation.

PARK AND TURN SIGNAL LAMP BULB

REMOVAL

(1) Release hood latch and open hood.

(2) Remove screws holding park and turn signal lamp to headlamp module.

(3) Separate lamp from module.

(4) Remove bulb socket from back of lamp.

(5) Pull bulb from socket (Fig. 3).

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

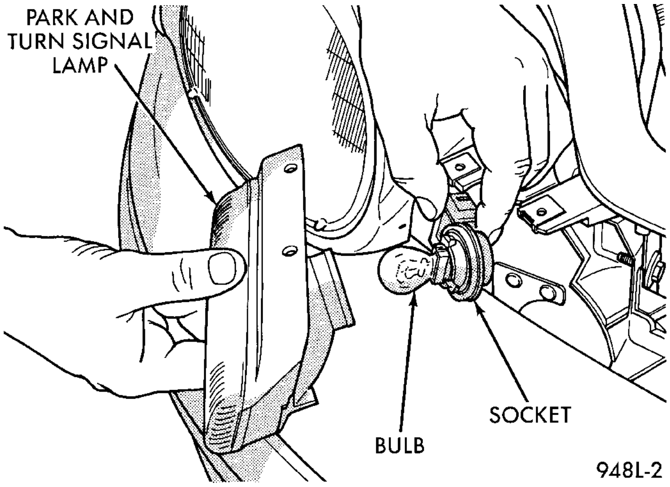


Fig. 3 Park and Turn Signal Lamp Bulb

FRONT SIDE MARKER LAMP BULB

REMOVAL

(1) Reach behind front bumper fascia forward of front wheel.

(2) Remove socket from side marker lamp.

(3) Pull bulb from socket (Fig. 4).

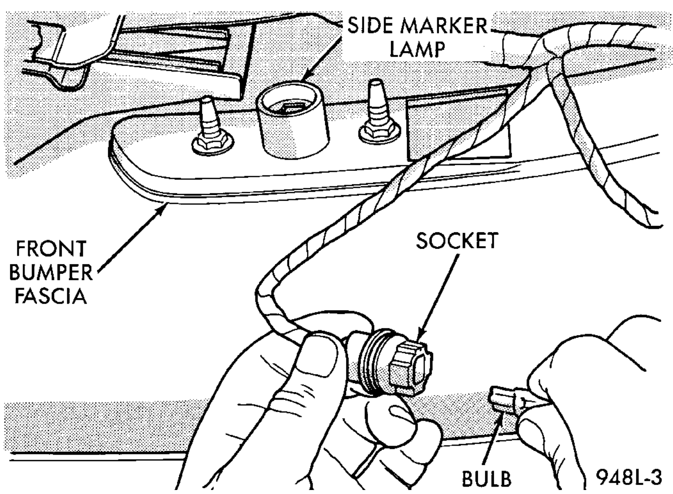


Fig. 4 Front Side Marker

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP BULB

REMOVAL

(1) Release trunk latch and open trunk lid.

(2) Remove bulb socket from center high mounted stop lamp (Fig. 5).

(3) Pull bulb from socket.

INSTALLATION

Reverse the preceding operation.

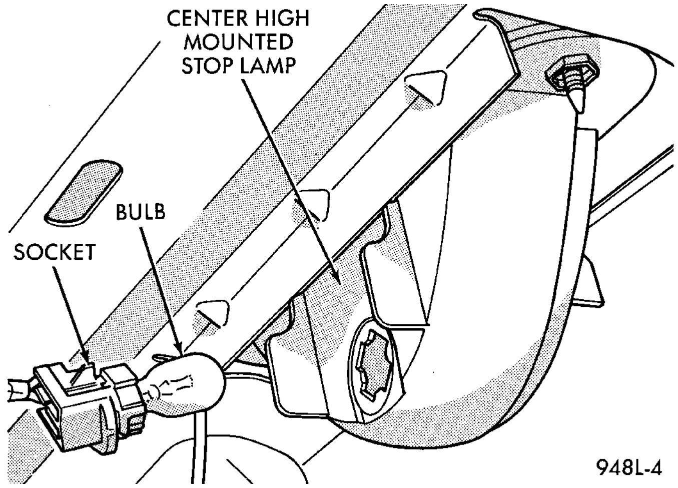


Fig. 5 CHMSL Bulb

TAIL, STOP, BACK-UP AND TURN SIGNAL LAMP BULB

REMOVAL

(1) Release trunk latch and open trunk lid.

(2) Separate trunk lining from rear closure panel to gain access to back of tail lamp.

(3) Rotate and remove bulb socket from tail lamp through openings in rear closure panel (Fig. 6).

(4) Pull bulb from socket.

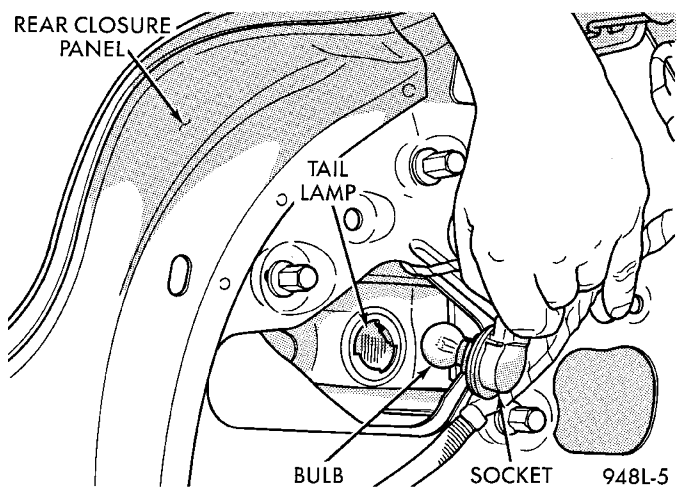


Fig. 6 Tail and Stop Lamp Bulb

INSTALLATION

(1) Push bulb into socket.

(2) Rotate and install bulb socket into tail lamp through openings in rear closure panel.

(3) Install trunk lining to rear closure panel.

(4) Close and secure trunk lid.

REMOVAL AND INSTALLATION (Continued)

LICENSE PLATE LAMP BULB

REMOVAL

(1) Remove screws holding license plate lamp to rear bumper (Fig. 7).

(2) Separate lamp from bumper.

(3) Remove bulb socket from lamp.

(4) Pull bulb from socket.

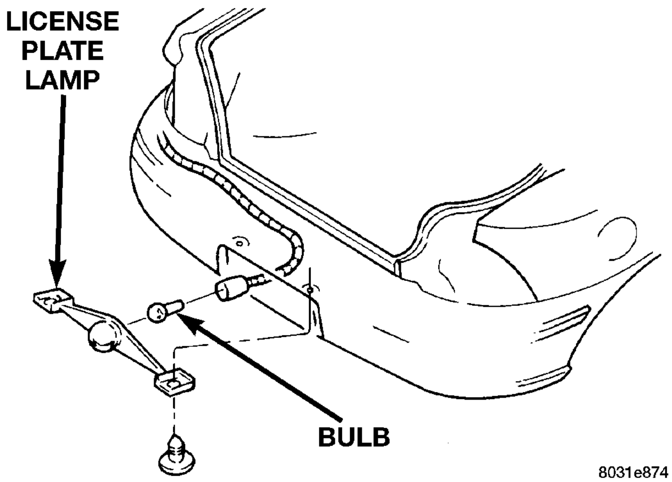


Fig. 7 License Plate Lamp

INSTALLATION

Reverse the preceding operation.

UNDERHOOD LAMP BULB

REMOVAL

(1) Disconnect the wire harness connector from the underhood lamp.

(2) Rotate the bulb counter-clockwise. Remove it from the lamp socket.

INSTALLATION

(1) Insert the replacement bulb in the lamp base socket and rotate it clockwise.

(2) Connect the wire harness connector.

DOME LAMP BULB

REMOVAL

(1) Insert a trim stick between the headliner and dome lamp lens.

(2) Carefully pry downward on the four corners of the lamp lens.

(3) Separate lamp lens from lamp.

(4) Grasp bulb and pull from lamp socket.

INSTALLATION

(1) Position bulb in socket and snap into place.

(2) Position lens on lamp and snap into place.

VISOR VANITY LAMP BULB

REMOVAL

(1) Lower visor.

(2) Insert a small flat bladed tool between the lamp lens and lamp.

(3) Carefully pry lens outward.

(4) Remove bulb from socket.

INSTALLATION

(1) Position bulb in socket and snap into place.

(2) Position lens on lamp and snap into place.

REAR CARGO LAMP BULB

The trunk lamp snaps into the rear shelf panel reinforcement under/below the package shelf.

REMOVAL

(1) Insert a trim stick or small flat blade between the lamp lens and rear shelf reinforcement panel.

(2) Pry the lamp lens downward.

(3) Pull bulb from socket

INSTALLATION

(1) Push bulb into socket.

(2) Position the lamp in the rear shelf reinforcement panel and snap into place.

LAMP SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP MODULE

REMOVAL

(1) Release hood latch and open hood.

(2) From behind bumper fascia, remove bolt holding outboard end of module to fender.

(3) Loosen bolts holding inboard end of module to radiator closure panel.

(4) Remove bolt holding grille to headlamp module.

(5) Remove bolts holding top of module to upper crossmember (Fig. 1).

(6) Disengage wire connector from headlamp and parking lamp sockets.

(7) Separate headlamp module from vehicle.

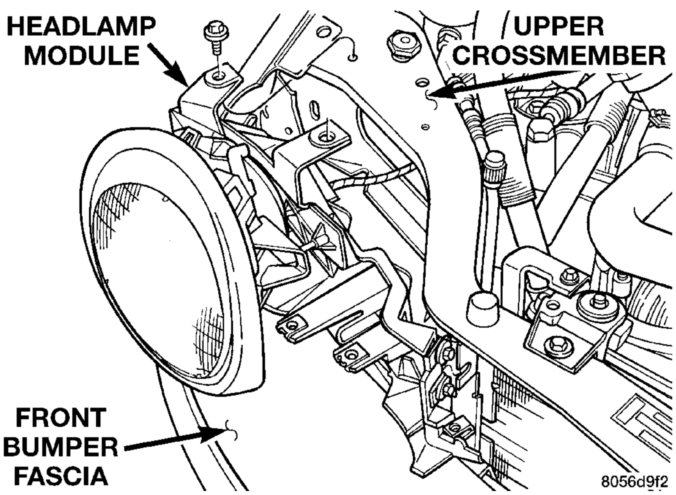


Fig. 1 Headlamp Module

INSTALLATION

Reverse the preceding operation.

FOG LAMP

REMOVAL

(1) Remove bolt holding fog lamp to radiator closure panel (Fig. 2).

(2) Separate fog lamp from radiator closure panel.

(3) Pull fog lamp through opening in fascia.

(4) Disengage wire connector from fog lamp bulb base.

(5) Separate fog lamp from vehicle.

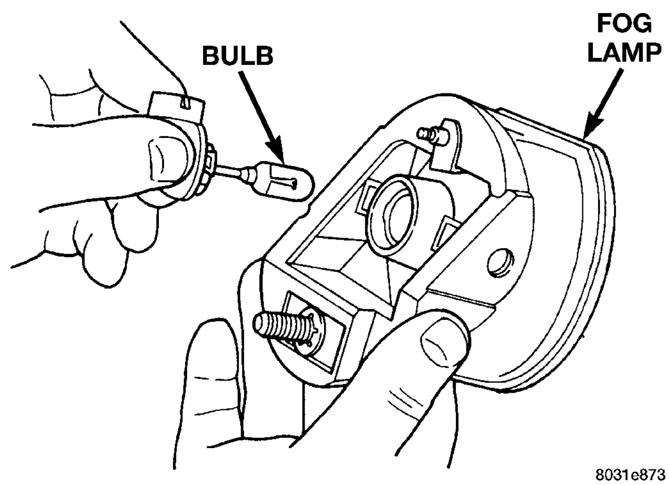


Fig. 2 Fog Lamp

INSTALLATION

Reverse the preceding operation.

PARK AND TURN SIGNAL LAMP

REMOVAL

(1) Release hood latch and open hood.

(2) Remove screws holding lamp to headlamp module (Fig. 3).

(3) Separate park and turn signal lamp from vehicle.

(4) Disengage wire connector from back of lamp socket.

REMOVAL AND INSTALLATION (Continued)

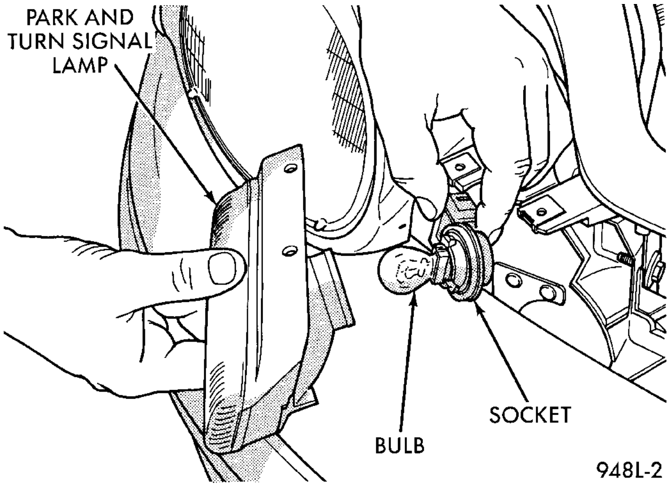


Fig. 3 Park and Turn Signal Lamp

INSTALLATION

Reverse the preceding operation.

FRONT SIDE MARKER LAMP

REMOVAL

(1) Remove socket and bulb from side marker lamp.

(2) Remove nuts holding side marker lamp to front bumper fascia (Fig. 4).

(3) Separate side marker lamp from vehicle.

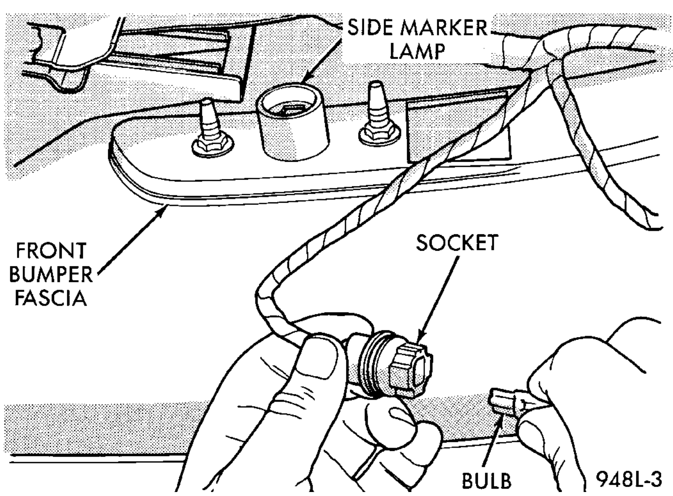


Fig. 4 Front Side Marker Lamp

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Release trunk latch and open trunk lid.

(2) Remove socket and bulb from lamp.

(3) Remove nuts holding center high mounted stop lamp to trunk lid (Fig. 5).

(4) Pull CHMSL from trunk lid.

(5) Separate CHMSL bezel from trunk lid.

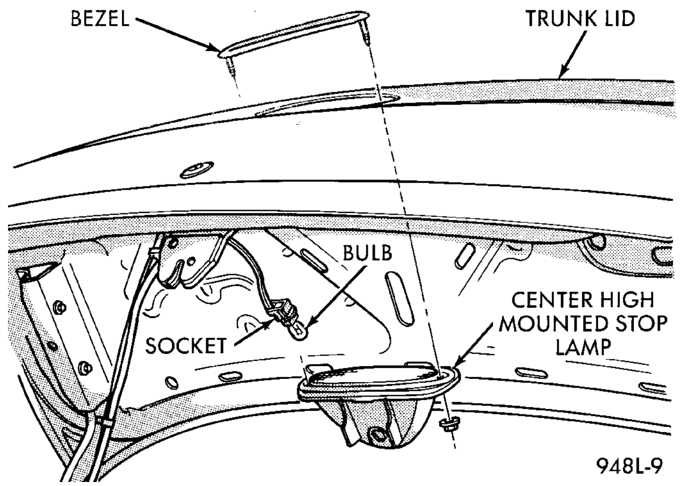


Fig. 5 Center High Mounted Stop Lamp

INSTALLATION

Reverse the preceding operation.

TAIL, STOP AND TURN SIGNAL LAMP

REMOVAL

(1) Release trunk latch and open trunk lid.

(2) Remove trunk trim panel from tail lamp area, if equipped.

(3) Remove sockets and bulbs from lamp.

(4) Remove nuts holding tail lamp to rear closure panel (Fig. 6).

(5) Separate tail lamp from vehicle.

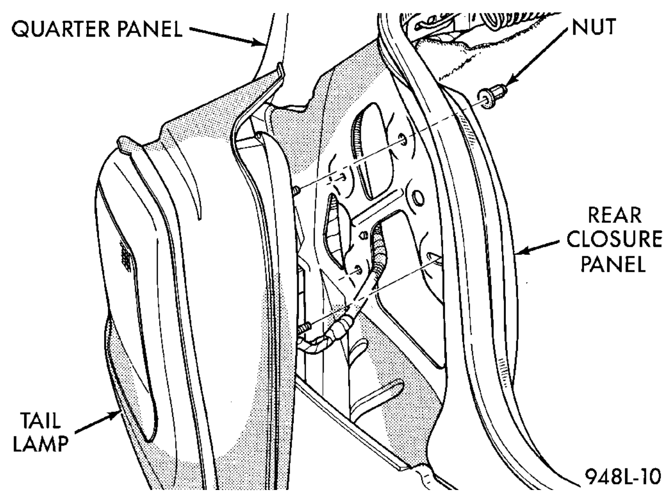


Fig. 6 Tail, Stop and Turn Signal Lamp

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

LICENSE PLATE LAMP

REMOVAL

(1) Remove screws holding license plate lamp to rear bumper fascia (Fig. 7).

(2) Separate license plate lamp from bumper.

(3) Remove socket and bulb from lamp.

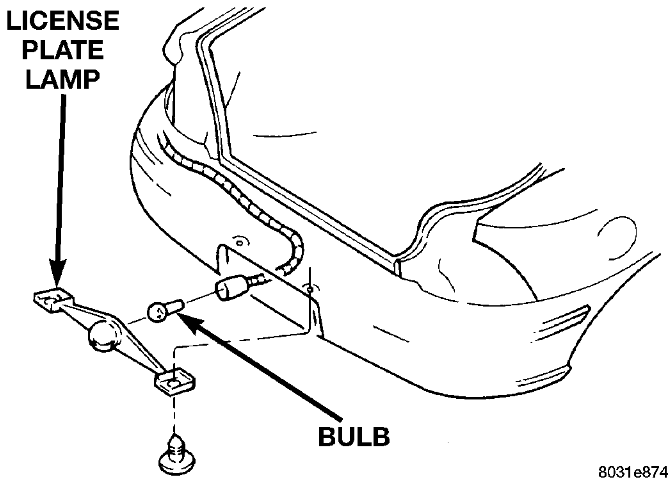


Fig. 7 License Plate Lamp

INSTALLATION

Reverse the preceding operation.

UNDERHOOD LAMP

REMOVAL

(1) Open and support hood.

(2) Remove lamp bulb.

(3) Disengage lamp wire connector.

(4) Remove the screw attaching lamp to hood.

(5) Separate lamp from vehicle.

INSTALLATION

(1) Position lamp on hood and install screw.

(2) Route lamp wire through hood silencer pad and connect lamp wire connector.

(3) Install lamp bulb.

(4) Remove hood support and close hood.

DOME LAMP

REMOVAL

(1) Insert a trim stick between the headliner and dome lamp lens.

(2) Carefully pry downward on the four corners of the lamp lens.

(3) Separate lamp lens from lamp.

(4) Disengage wire connector and remove from vehicle.

INSTALLATION

Reverse the removal procedure.

VISOR VANITY LAMP

The visor vanity lamp is incorporated in the visor assembly. Replace the visor if the lamp has failed.

REAR CARGO LAMP

REMOVAL

(1) Insert a trim stick or small flat blade between the lamp lens and rear shelf reinforcement panel.

(2) Pry the lamp lens downward.

(3) Disengage wire connectors.

(4) Separate lamp from vehicle.

INSTALLATION

Reverse the removal procedure.

LAMP SYSTEMS

INDEX

REMOVAL AND INSTALLATION

DAYTIME RUNNING LAMP (CANADA)

The Daytime Running Lamp module is attached to a support brace on the underside of the instrument panel (Fig. 1).

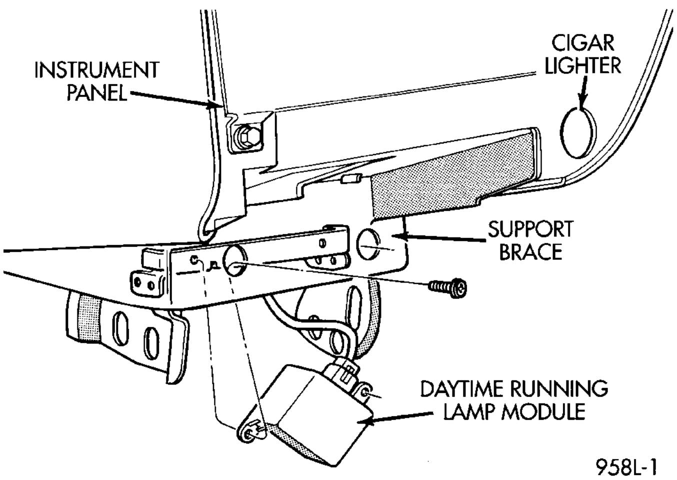


Fig. 1 DRL Module

REMOVAL

(1) Remove screw attaching DRL module to I/P support brace.
(2) Disengage wire connector.
(3) Separate module from vehicle.

INSTALLATION

(1) Engage DRL module wire connector.
(2) Position module on I/P support brace and install screw.

BULB APPLICATION

INDEX

SPECIFICATIONS

GENERAL INFORMATION

The following Bulb Application Tables lists the lamp title on the left side of the column and trade number or part number on the right.

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result. Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

EXTERIOR LAMPS

LAMP	BULB
Back-up	3157
Center High Mounted Stop	921
Fog	GE 881
Headlamp	9007
License Plate	168
Park/Turn Signal	3157NA
Tail/Stop/Turn Signal	3157
Front Side Marker	168

INTERIOR 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.

LAMP	BULB
A/C and Heater Control	203
Ash Receiver	161
Cigar Lighter	203
Dome Lamp	578
Gear Selector Console W/Auto	161
Glove Compartment	194
Ignition Lock	161
Instrument Panel and Cluster	PC194
Rear Cargo	912
Underhood	105

RESTRAINT SYSTEM

CONTENTS

GENERAL INFORMATION

WARNINGS AND PRECAUTIONS

WARNING: THIS SYSTEM IS A SENSITIVE, COMPLEX ELECTRO–MECHANICAL UNIT. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A SOLID SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED AND COULD RESULT IN PERSONAL INJURY. WHEN CARRYING OR HANDLING AN UNDEPLOYED AIRBAG MODULE, THE TRIM SIDE OF THE AIRBAG SHOULD BE POINTING AWAY FROM THE BODY TO MINIMIZE POSSIBILITY OF INJURY IF ACCIDENTAL DEPLOYMENT OCCURS.

REPLACE AIRBAG SYSTEM COMPONENTS WITH MOPAR® REPLACEMENT PARTS. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WEAR SAFETY GLASSES, RUBBER GLOVES, AND LONG SLEEVES CLOTHING WHEN CLEANING POWDER RESIDUE FROM VEHICLE AFTER AIRBAG DEPLOYMENT. SODIUM HYDROXIDE POWDER RESIDUE EMITTED FROM A DEPLOYED AIRBAG CAN CAUSE SKIN IRRITATION. FLUSH AFFECTED AREA WITH COOL WATER IF IRRITATION IS EXPERIENCED. IF NASAL OR THROAT IRRITATION IS EXPERIENCED, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

DO NOT USE A REPLACEMENT AIRBAG THAT IS NOT IN THE ORIGINAL PACKAGING, IMPROPER DEPLOYMENT AND PERSONAL INJURY CAN RESULT.

THE FACTORY INSTALLED FASTENERS, SCREWS AND BOLTS USED TO FASTEN AIRBAG COMPONENTS HAVE A SPECIAL COATING AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. DO NOT USE SUBSTITUTE FASTENERS, USE ONLY ORIGINAL EQUIPMENT FASTENERS LISTED IN THE PARTS CATALOG WHEN FASTENER REPLACEMENT IS REQUIRED.

NOTE: Airbags should be stored in a cool dry location away from excessive heat and static electrical activity with the fabric airbag facing UP, or a premature deployment can result.

If the Driver/Passenger Airbag Module is defective and not deployed, refer to Chrysler Corporation current return list for proper handling procedures.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DESCRIPTION AND OPERATION

AIRBAG CONTROL MODULE

The Airbag Control Module (ACM) contains the safing sensor and energy reserve capacitor. The safing sensor is located inside the ACM. The module is mounted on the tunnel/floor pan between the gear shift lever and the park brake lever (Fig. 1). The safing sensor provides confirmation of a crash, but does not discriminate severity. The ACM monitors the system to determine the system readiness. The ACM will store sufficient energy to deploy the airbags for at least one second after the battery is disconnected. The ACM contains on-board diagnostics, and will illuminate the AIRBAG warning lamp in the cluster when a fault occurs. The warning equipment is tested for six to eight seconds every time the vehicle is started.

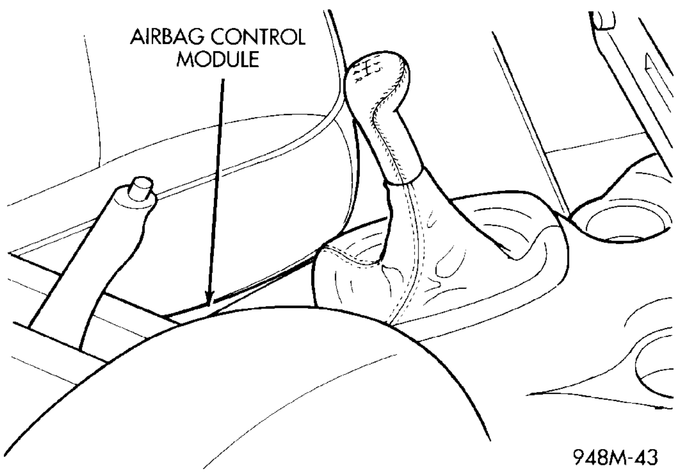


Fig. 1 Airbag Control Module Location

CLOCKSPRING

The clockspring is mounted to the steering column behind the steering wheel. The clockspring is used to maintain a continuous electrical circuit between the wiring harness and the:

- Driver's airbag module
- Speed control switches
- Horn switch

The clockspring consists of a flat, ribbon like, electrically conductive tape which winds and unwinds with the steering wheel rotation.

DRIVER AND PASSENGER AIRBAG MODULE

WARNING: NEVER DISASSEMBLE THE DRIVER OR PASSENGER AIRBAG MODULE, THERE ARE NO SERVICEABLE PARTS WITH IN THE MODULES.

The Driver Airbag Module located on the steering wheel is the most visible part of the system (Fig. 2). The airbag module contains a housing to which the cushion, inflator and cover are attached to.

The driver side inflator assembly is mounted from the back of the module housing. When supplied with the proper electrical signal the inflator assembly will produce a gas and discharge it directly into the cushion. A protective cover is fitted to the front of the Driver Airbag Module and forms a decorative cover in the center of the steering wheel. The Driver Airbag Module is mounted directly to the steering wheel.

The Passenger Airbag Module is located beneath the decorative cover of the instrument panel, facing the passenger seat (Fig. 3).

The passenger inflator assembly is within the module housing. The module is mounted to the instrument panel retainer and support structure. When supplied with the proper electrical signal the inflator will produce a gas and discharge it directly into the cushion. A protective cover is fitted into the instrument panel over the airbag module and forms a decorative cover.

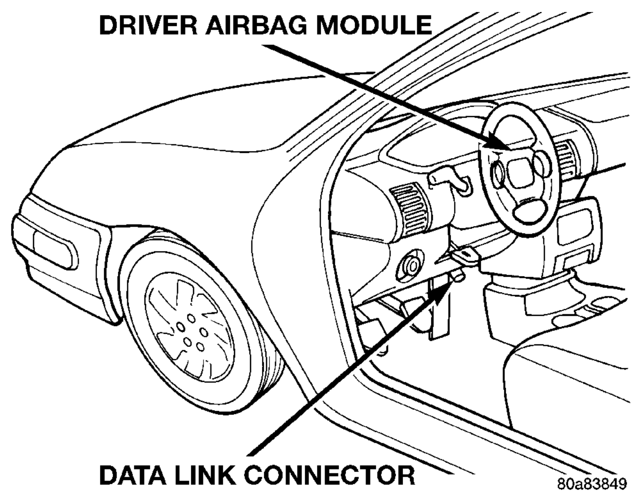


Fig. 2 Driver Airbag

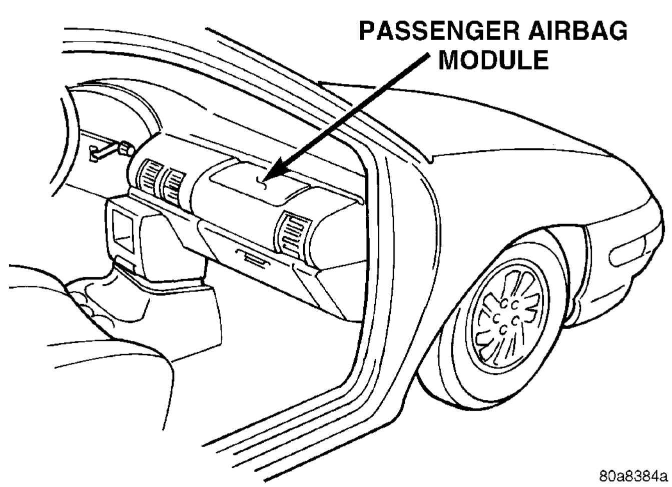


Fig. 3 Passenger Airbag

DIAGNOSIS AND TESTING

AIRBAG SYSTEM TEST

(1) Connect scan tool (DRB) to Data Link connector, located at right side of the steering column and at the lower edge of the lower instrument panel.

(2) Turn the ignition key to ON position. Exit vehicle with scan tool. Use the latest version of the proper cartridge.

(3) After checking that no one is inside the vehicle, connect the battery negative terminal.

(4) Using the scan tool, read and record active diagnostic code data.

(5) Read and record any stored diagnostic codes.

(6) Refer to the Passive Restraint Diagnostic Test Manual if any diagnostic codes are found in Step 4 or Step 5.

(7) Erase stored diagnostic codes if there are no active diagnostic codes. If problems remain, diagnostic codes will not erase. Refer to the Passive Restraint Diagnostic Test Manual to diagnose the problem. **If airbag warning lamp either fails to light, or goes on and stays on, there is a system malfunction. Refer to the Passive Restraint Diagnostic Test Manual to diagnose the problem.**

SERVICE PROCEDURES

CLEANUP PROCEDURE

Roll or fold the passenger airbag towards the instrument panel surface and close the door over the folded bag. Then tape the door shut.

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Work from the outside in to avoid kneeling or sitting in a contaminated area. Vacuum the heater and A/C outlets as well (Fig. 4). If the heater or air conditioner was in RECIRC mode at time of airbag deployment, operate blower motor on low speed and vacuum powder residue expelled from the heater and A/C outlets. Multiple vacuum cleaning may to necessary to decontaminate the interior of the vehicle.

NOTE: Dispose deployed airbag properly, contact dealer or government agency for disposal recommendations.

SERVICE OF DEPLOYED AIRBAG MODULE

DRIVER AIRBAG

After a Driver Airbag Module has been deployed:

- Driver Airbag Module
- Clockspring assembly

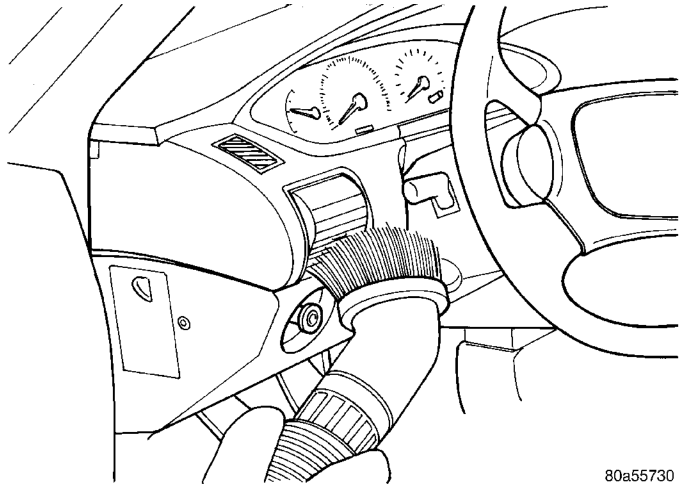


Fig. 4 Vacuum Heater and A/C Outlets

The component above must be replaced because they cannot be reused. Other driver airbag system components are replaced if damaged.

PASSENGER AIRBAG

After a Passenger Airbag Module has been deployed:

- Passenger Airbag Module
- Right trim panel

The lower instrument panel knee blocker, top cover, and any other components should be replaced if damaged.

HANDLING AIRBAG MODULE

DEPLOYED MODULE

The vehicle interior may contain a very small amount of sodium hydroxide powder, a by-product of airbag deployment. Sodium hydroxide powder can irritate the skin, eyes, nose and throat. Wear safety glasses, rubber gloves, and long sleeved clothing when cleaning any of the powder residue from the vehicle.

If you find that the cleanup is irritating your skin, run cool water over the affected area. Also, if you experience nasal or throat irritation, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

UNDEPLOYED

The airbag modules must be stored in its original special container until used for service. At no time should a source of electricity be permitted near the inflator on the back of an airbag module. When carrying or handling an undeployed airbag module, the trim side of the airbag should be pointing away from the body to minimize possibility of injury if accidental deployment occurs. Do not place undeployed air-

SERVICE PROCEDURES (Continued)

bag face down on a solid surface, the airbag will propel into the air if accidentally deployment occurs.

MAINTENANCE INSPECTION

(1) Check that both front impact sensors are properly installed to the closure panel with three fasteners each. Repair as required.

(2) Check the airbag warning lamp for proper operation as follows:

(a) Turn ignition switch to the ON position, the airbag warning lamp should light. If not, test the system using a scan tool and Passive Restraint System Diagnostic Procedures Manual. Repair as required.

(b) The airbag warning lamp lights, but fails to go out after eight seconds. Test the system using a scan tool and Passive Restraint System Diagnostic Procedures Manual. Repair as required.

(c) After correcting active malfunction erase stored diagnostic codes.

REMOVAL AND INSTALLATION

AIRBAG CONTROL MODULE (ACM)

REMOVAL

WARNING: THE ACM CONTAINS A SAFING SENSOR WHICH ENABLES THE SYSTEM TO DEPLOY THE AIRBAGS. TO AVOID ACCIDENTAL DEPLOYMENT, NEVER CONNECT ACM ELECTRICALLY TO THE SYSTEM WHILE VEHICLE BATTERY IS CONNECTED.

DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.

CAUTION: Failure to follow the parking brake service procedures can result in damage to the parking brake mechanism.

(1) Disconnect and isolate the battery negative cable.

(2) Manual transaxle only, remove shifter knob fastener and remove shifter knob.

(3) Remove screws attaching rear of center console assembly to console bracket (Fig. 5) or (Fig. 6).

(4) Remove the two screws located in cup holders (Fig. 7), attaching front of center console assembly to console bracket.

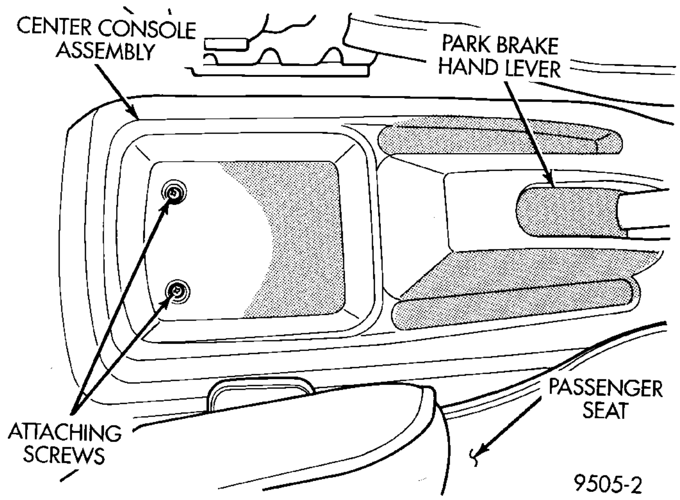


Fig. 5 Attaching Screws At Rear Of Center Console With/Without Arm Rest

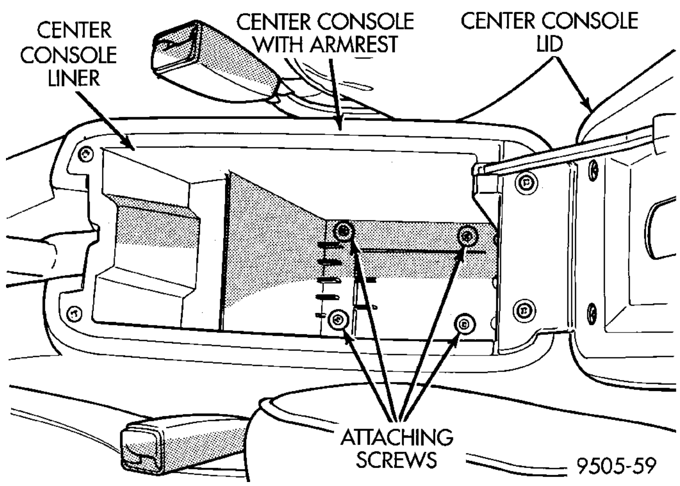


Fig. 6 Attaching Screws At Rear Of Center Console With Arm Rest

(5) Raise park brake hand lever assembly as high as it will go for required clearance to remove center console.

(6) Remove center console assembly from vehicle.

REMOVAL AND INSTALLATION (Continued)

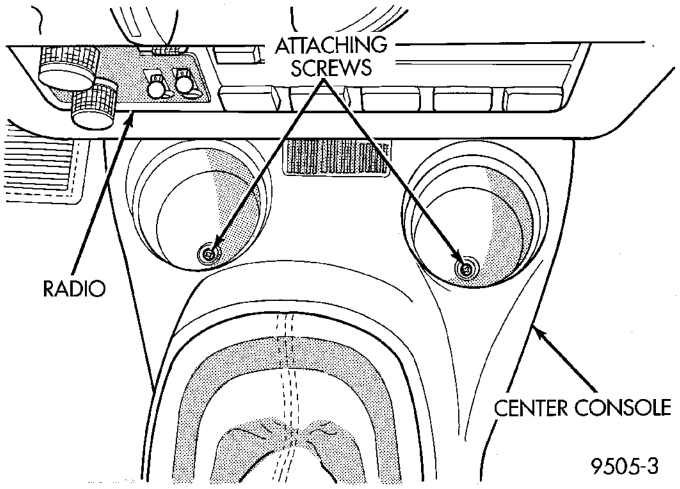


Fig. 7 Attaching Screws At Front Of Center Console

WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER ASSEMBLY CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE AUTO ADJUSTER LOCKOUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF AUTO ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

WHEN REPAIRS TO THE PARK BRAKE HAND LEVER ASSEMBLY OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(7) Lower park brake lever handle.

(8) Grasp park brake lever output cable by hand and pull upward. Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 8). This will lock the park brake mechanism and take tension off park brake cables.

(9) Remove both rear park brake cables from the park brake cable equalizer (Fig. 9).

(10) Remove wiring harness electrical connector for brake warning light from park brake lever (Fig. 10).

(11) Remove the two nuts (Fig. 11) attaching park brake lever to console bracket. Remove park brake lever mechanism from vehicle.

(12) Remove module mounting nuts and remove module (Fig. 12).

(13) Disconnect ACM 4-way and 13-way connectors (Fig. 13).

(14) Remove Airbag Control Module.

INSTALLATION

(1) Connect both ACM connectors and ensure both connectors and all locking tabs are engaged.

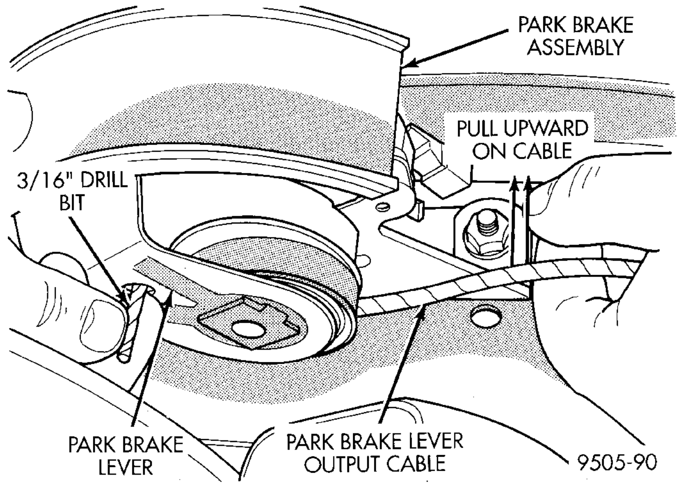


Fig. 8 Locking Pin Installed In Park Brake Mechanism

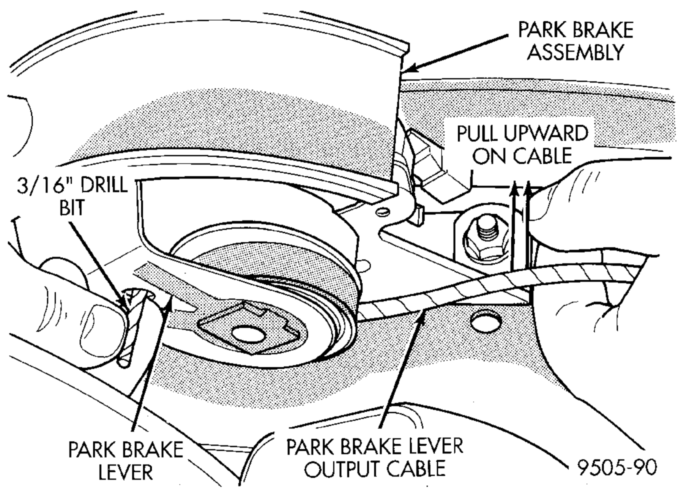


Fig. 9 Removing Park Brake Cables From Equalizer

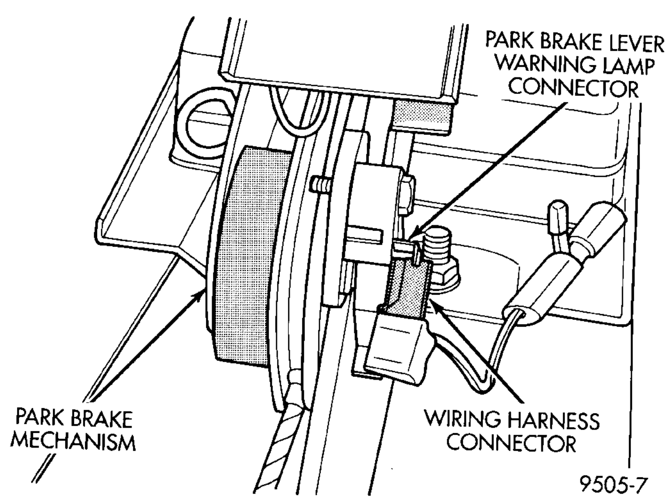


Fig. 10 Brake Warning Lamp Connection To Park Brake Lever

REMOVAL AND INSTALLATION (Continued)

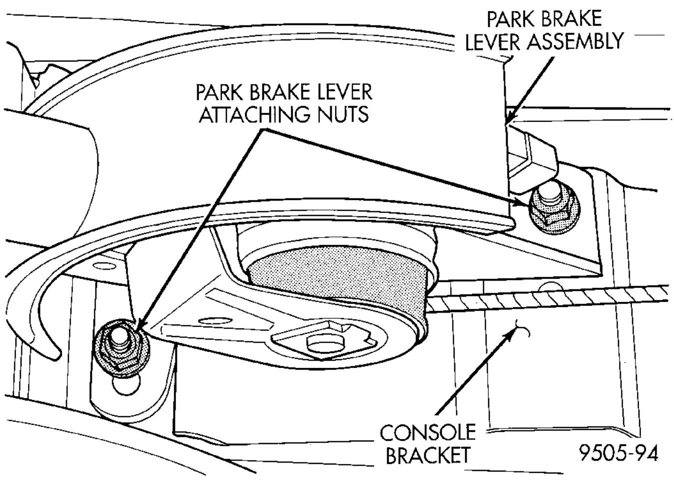


Fig. 11 Park Brake Lever Attachment To Console Bracket

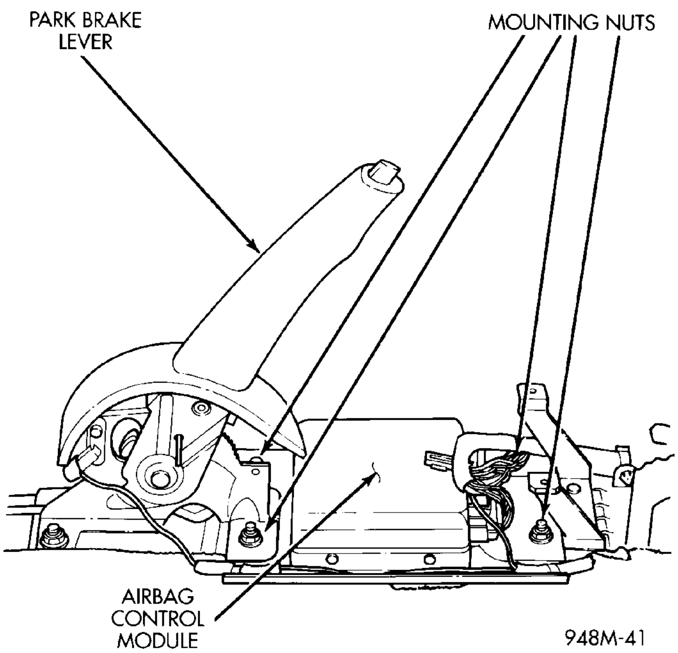


Fig. 12 Airbag Control Module

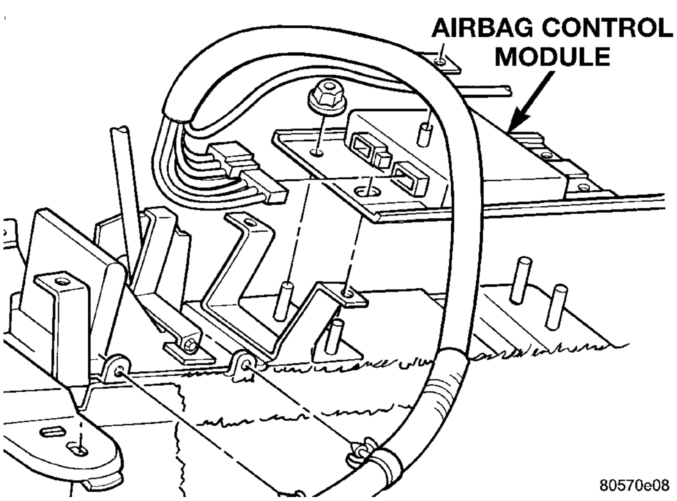


Fig. 13 ACM Connectors

CAUTION: USE SUPPLIED SCREWS ONLY

(2) Position ACM (arrow pointing forward) in the console floor bracket, attach the nuts and tighten to 11 to 14 N·m (105 to 125 in. lbs.) torque.

NOTE: The park brake lever can be in any position when releasing the auto adjuster. To ease installation of center console, it is advisable to pull park brake lever handle all the way up before removing lockout pin.

(3) Place park brake lever on console bracket. Install and securely tighten the 2 attaching nuts.

(4) Install both rear park brake cables into equalizer on park brake lever output cable (Fig. 14) and (Fig. 15).

(5) Ensure that park brake cable is correctly installed and aligned with cable track on park brake lever.

(6) Pull park brake lever handle all the way up.

(7) Firmly grasp park brake lever locking pin and quickly remove it from the park brake lever mechanism (Fig. 16) This will allow the park brake lever mechanism to correctly adjust the park brake cables.

(8) Connect electrical connector for brake warning lamp onto terminal on park brake lever assembly (Fig. 17).

(9) Cycle park brake lever once to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle. They should rotate freely without dragging.

(10) Raise park brake lever to its fully engaged position. This is necessary to allow installation of the center console.

(11) Install center console assembly.

(12) Install the four center console assembly attaching screws (Fig. 18), (Fig. 19) and (Fig. 20).

(13) Replace shifter knob and fastener.

(14) Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test for the proper procedures.

REMOVAL AND INSTALLATION (Continued)

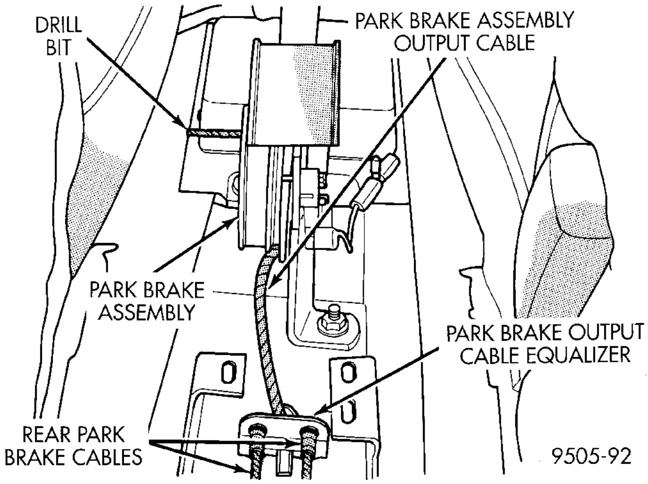


Fig. 14 Park Brake Cables Properly Installed In Equalizer

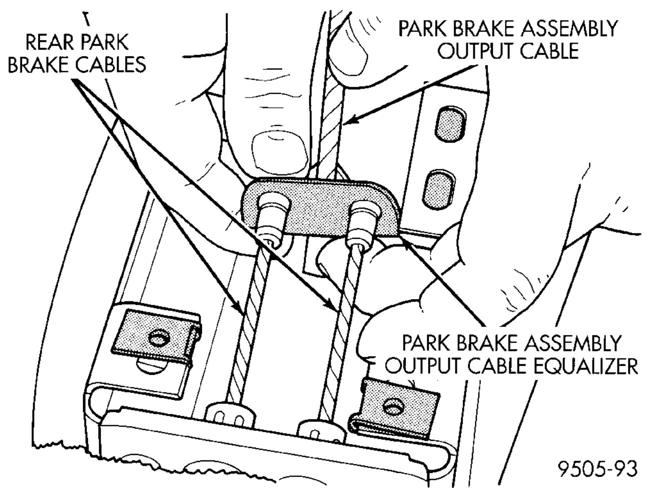


Fig. 15 Rear Park Brake Cable Installation On Equalizer

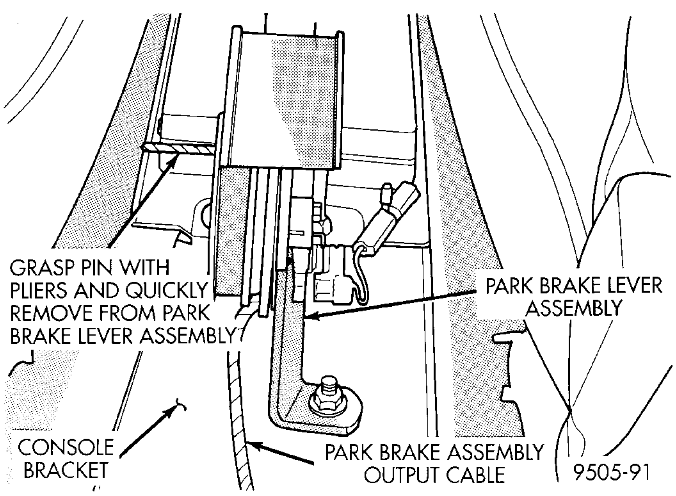


Fig. 16 Removing Lockout Pin From Park Brake Lever Assembly

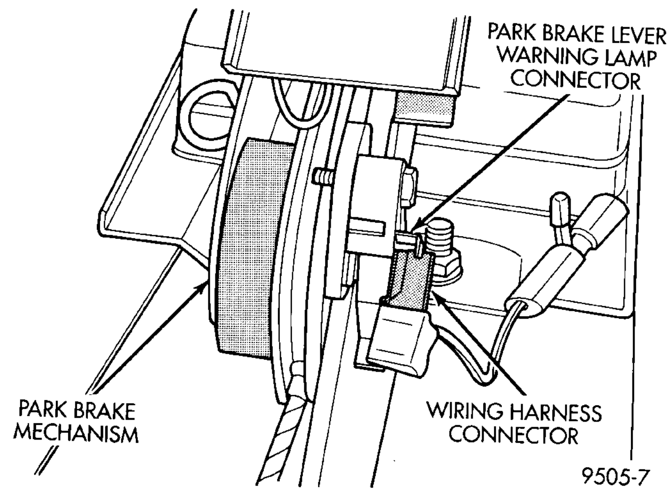


Fig. 17 Brake Warning Lamp Connection To Park Brake Lever

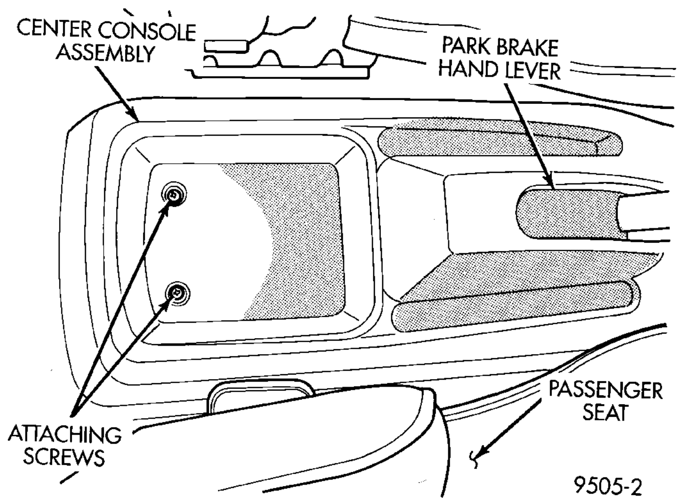


Fig. 18 Attaching Screws At Rear Of Center Console With/Without Arm Rest

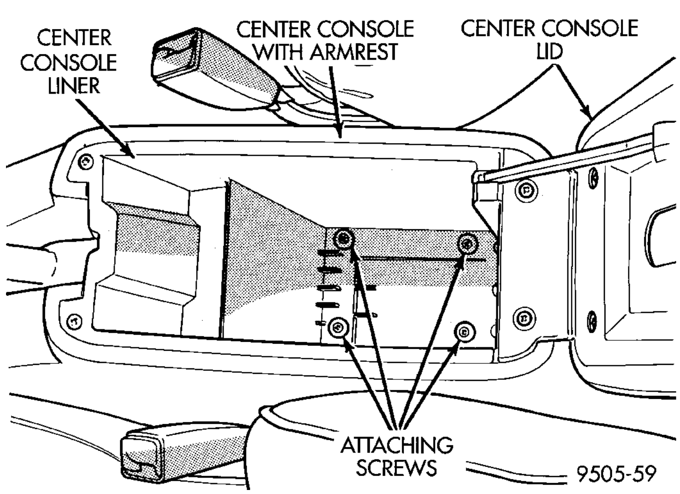


Fig. 19 Attaching Screws At Rear Of Center Console With Arm Rest

REMOVAL AND INSTALLATION (Continued)

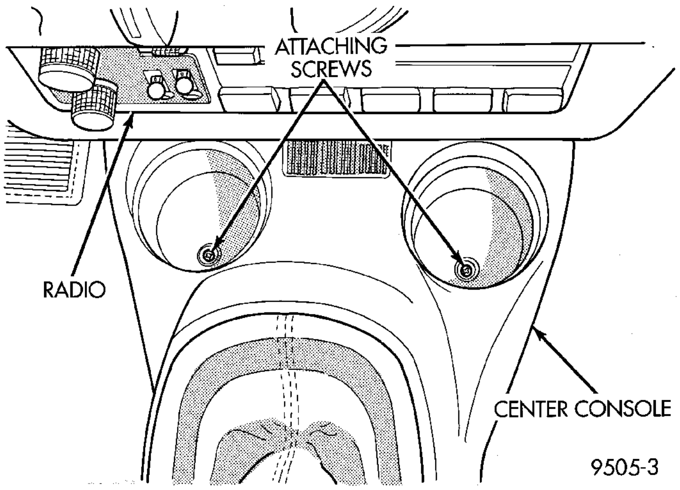


Fig. 20 Attaching Screws At Front Of Center Console

CLOCKSPRING

REMOVAL

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.

(1) Place the front road wheels in the straight ahead position then:

• Rotate the steering wheel half turn (180 degrees) to the right (clockwise)

• Lock column with ignition lock cylinder.

(2) Disconnect and isolate the battery negative cable.

(3) Wait two minutes for the reserve capacitor to discharge before removing non-deployed module.

(4) Remove speed control switch mounting screws, switches and disconnect the wire connectors or remove covers.

(5) Remove the Driver Airbag Module attaching bolts from under the speed control switches or covers.

(6) Lift module and disconnect the airbag and horn wire connectors.

(7) Remove the steering wheel, refer to Steering Wheel removal procedures.

(8) Remove upper and lower steering column shrouds to gain access to clockspring wiring.

(9) Disconnect the 2-way and 4-way connectors between the clockspring and the instrument panel wiring harness at the base of the clockspring (Fig. 21).

(10) Unlatch and remove clockspring assembly from steering shaft. The clockspring cannot be repaired, and must be replaced if faulty.

(11) Rotate clockspring rotor a half turn (180 degrees) to the left (counter clockwise).

(12) Lock the clockspring rotor in the center position as follows: Insert a paper clip wire through the hole in the rotor at the 10 O'clock position and bend to prevent it from falling out.

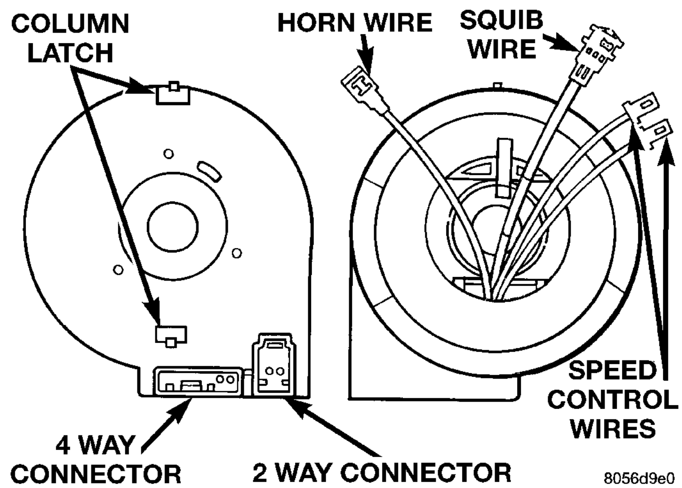


Fig. 21 Clockspring

INSTALLATION

(1) Confirm that:

• The steering wheel position is a half turn (180 degrees) to the right (clockwise)

• The column is locked with the ignition cylinder lock.

• Check that the turn signal stalk is in the neutral position

• When reusing the clockspring, remove locking wire and rotate clockspring rotor one half turn (180 degrees) to the right (clockwise). Locate the clockspring on the steering shaft and push down on the rotor until the clockspring is fully seated on the steering column.

• When installing a new clockspring, position the front wheels straight a head. Remove grenade pin. Rotate clockspring rotor one half turn (180 degrees) to the right (clockwise).

(2) Connect the clockspring to the instrument panel harness, ensure wiring is properly routed. Then check that the connectors, locking tabs are properly engaged and the halo lamp wire is in position.

(3) Install steering column shrouds. Be sure all wires are inside of shrouds.

(4) Install steering wheel ensuring the flats on hub align with the clockspring. Pull the horn, airbag and

REMOVAL AND INSTALLATION (Continued)

speed control leads through the larger slot. Ensure leads do not get pinched under the steering wheel.

(5) Route speed control wires under and behind the airbag module mounting tabs.

(6) Connect the horn lead wire and the airbag lead wire to the airbag module.

(7) Install the airbag module and tighten bolts to 12 to 14 N·m (105 to 125 in. lbs.) torque.

(8) Connect the speed control wires to the switches and install switches. Tighten screws to 2 N·m (20 in. lbs.) torque.

(9) Do not connect the battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

DRIVER AIRBAG MODULE

REMOVAL

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.

When removing a deployed module, rubber gloves, eye protection and long sleeved shirt should be worn, as there may be deposits on the surface which could irritate the skin and eyes.

(1) Disconnect and isolate the battery negative cable.

(2) Remove speed control switches or covers from steering wheel armature and disconnect the wires.

(3) Remove two bolts attaching Driver Airbag Module from the sides of steering wheel (Fig. 22).

(4) Lift module and disconnect airbag squib wire connector and horn wire.

(5) Remove Driver Airbag Module.

(6) When replacing a deployed driver airbag module, the clockspring must also be replaced. Refer to Clockspring Removal and Installation for proper procedure.

INSTALLATION

For installation, reverse the above procedures.

(1) Connect the squib wire to the module. Make airbag connection by pressing straight in on the connector. The connector should be fully seated feel for positive snap to assure positive connection.

(2) Connect the horn wire.

(3) Install two bolts and tighten to 10 to 11 N·m (90 to 100 in. lbs.) torque.

(4) Install covers to the steering wheel armature or connect the wire connectors to the speed control switches and install switches. Tighten fastener to 2 N·m (20 in. lbs.) TORQUE.

(5) Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

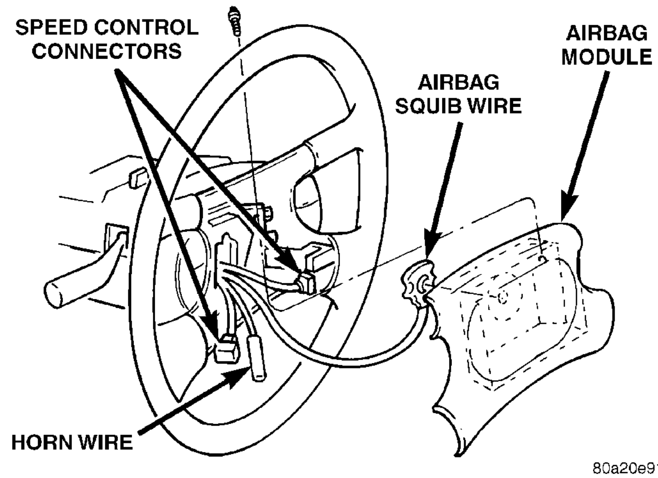


Fig. 22 Driver Airbag Module

PASSENGER AIRBAG MODULE

NON-DEPLOYED MODULE

REMOVAL

When removing a module for any reason other than DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable.

(2) Remove instrument panel top cover (Fig. 23).

(3) Remove instrument panel right trim bezel.

(4) Open glove box and push the sides inward allowing the door bumper to pass and box to open.

(5) Remove the four trim screws which attach the Passenger Airbag Module to the top instrument panel (Fig. 24).

(6) Remove two module attaching nuts from the support structure.

(7) Lift module up until the wire connector is visible and disconnect the 4-way wire connector from module. Unlock the red locking tab and compress lock to release the connector (Fig. 25).

INSTALLATION

For installation, reverse the above procedures. Ensure that the red locking tab is in the lock position after installing the connector. Tighten trim screws to 2 N·m (20 in. lbs.) torque. Tighten the module nuts to 22 to 34 N·m (200 to 300 in. lbs.) torque. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

REMOVAL AND INSTALLATION (Continued)

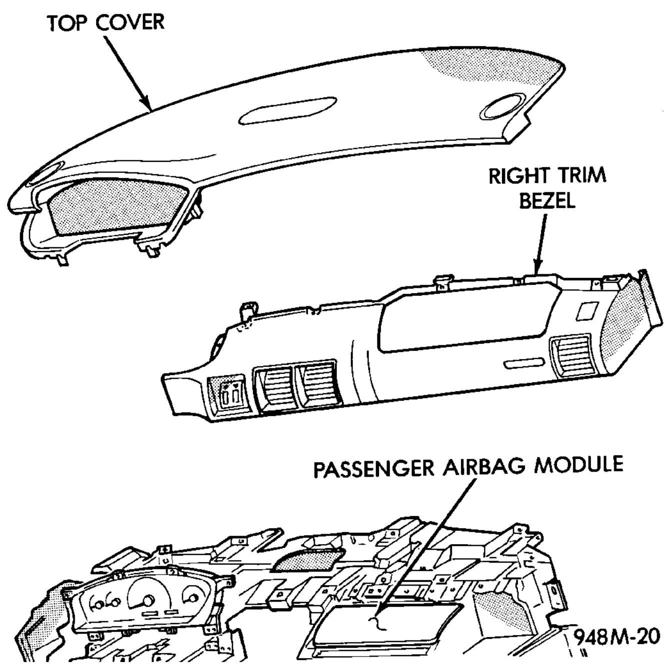


Fig. 23 Instrument Panel

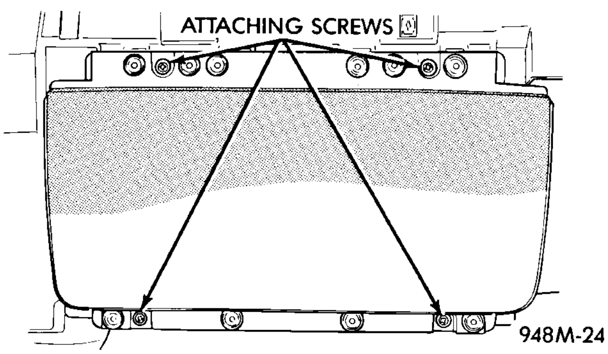


Fig. 24 Passenger Airbag Module

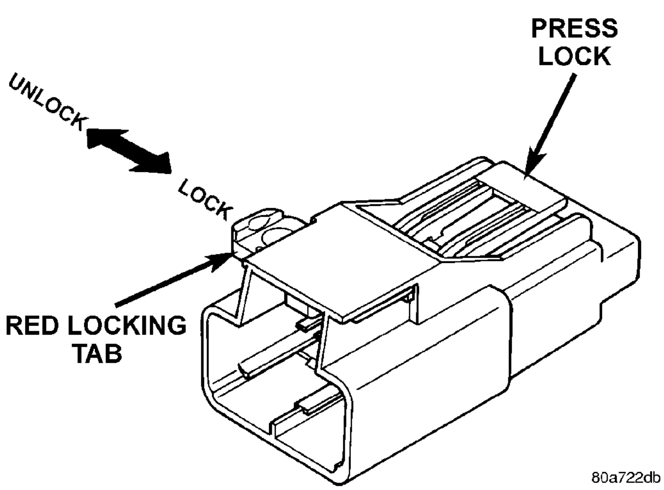


Fig. 25 Airbag Module Connector

DEPLOYED MODULE

REMOVAL

When removing a deployed module, rubber gloves, eye protection, and a long-sleeved shirt should be worn, as there may be deposits on the surface which could irritate the skin and eyes.

(1) Disconnect and isolate the battery negative cable.

(2) Roll/fold airbag towards instrument panel.

(3) Close door over folded airbag and tape door closed.

(4) Remove instrument panel top cover (Fig. 23).

(5) Remove instrument panel right trim panel.

(6) Open glove box and push the sides inward allowing the door bumper to pass and box to open.

(7) Remove the four trim screws which attach the module to the top instrument panel (Fig. 24).

(8) Remove two module attaching nuts from the support structure.

(9) Lift module up until the wire connector is visible and disconnect the 4-way wire connector from module. Unlock the red locking tab and compress lock to release the connector.

INSTALLATION

For installation, reverse the above procedures. Ensure that the red locking tab is in the lock position after installing the connector. Tighten trim screws to 2 N·m (20 in. lbs.) torque. Tighten the module nuts to 22 to 34 N·m (200 to 300 in. lbs.) torque. Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

STEERING WHEEL

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.

REMOVAL

(1) Adjust the steering wheel so that the tires are in the straight ahead position then:

- Rotate the steering wheel half turn (180 degrees) to the right (clockwise)
- Lock column with the ignition cylinder lock

(2) Disconnect and isolate the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the speed control switches and disconnect the wire connectors or covers.

(4) Remove the Driver Airbag Module attaching bolts from the back of steering wheel.

(5) Lift module and disconnect the airbag and horn wire connectors.

(6) Remove steering wheel retaining nut.

(7) Remove the steering wheel with a steering wheel puller. While removing the steering wheel take care to feed the wires gently through the holes in the clockspring armature.

INSTALLATION

(1) Confirm that:

- The steering wheel position is a half turn (180 degrees) to the right (clockwise)
- The column is locked with the ignition cylinder lock.
- Check that the turn signal stalk is in the neutral position

(2) Install the steering wheel ensuring the flats on hub align with the clockspring. Pull the horn lead, airbag and speed control leads through the larger slot. Ensure leads do not get pinched under the steering wheel.

(3) Install the steering wheel retaining nut, and tighten it to 61 N·m (45 ft. lbs.) torque.

(4) Install the airbag module. Refer to Driver Airbag Module Removal and Installation for proper procedures.

(5) Do not connect the battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

ADJUSTMENTS

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:

- The clockspring is not known to be properly positioned
- The front wheels were moved
- The steering wheel was moved from the half turn (180 degrees) to the right (clockwise) position.

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.

(1) Remove clockspring, refer to Clockspring Removal.

(2) Rotate the clockspring rotor in the CLOCKWISE DIRECTION to the end of travel. Do not apply excessive torque.

(3) From the end of travel, rotate the rotor two full turns and a half in the counterclockwise direction. The horn wire and the squib wire should end up at the bottom. If not, rotate the rotor counter clockwise until the wires are properly orientated, but not more than half turn (180 degrees). Engage clockspring locking mechanism.

(4) For installation, refer to Clockspring Installation

(5) Do not connect battery negative cable. Refer to Diagnosis and Testing for Airbag System Test procedures.

ELECTRICALLY HEATED SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

INTRODUCTION

For proper operation of the Rear Window Defogger system refer to the Owner's Manual.

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).

Circuit protection is provided by a maxi fuse, located in the Power Distribution Center, 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.

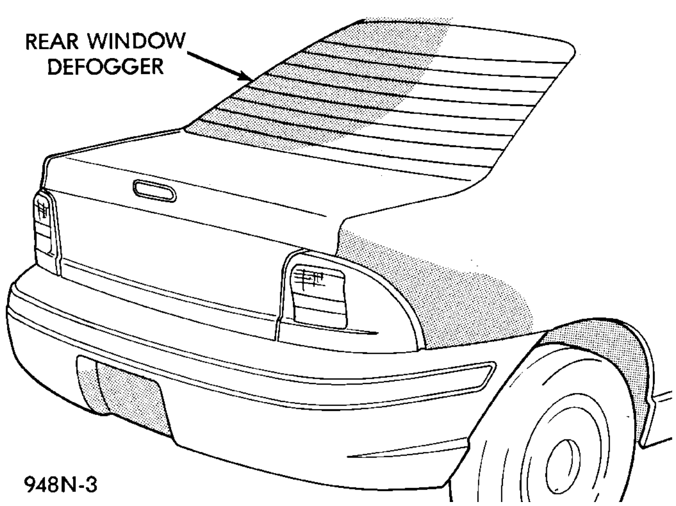


Fig. 1 Rear Window Defogger

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

REAR WINDOW DEFOGGER SWITCH

The rear window defogger switch is a control switch and timer relay integrated into a single panel mounted assembly. Actuating the switch energizes the circuit which allows current to flow through the grid lines. Upon initial actuation for approximately eight to ten minutes, or until either the switch or ignition is turned off. An indicating lamp illuminates a lens inlaid in the control switch.

DIAGNOSIS AND TESTING

DEFOGGER SYSTEM

Electrically heated rear window defogger operation can be checked in vehicle in the following manner:

(1) Turn ignition switch to the ON position.

(2) Connect an ammeter in series with the battery. Push the defogger control switch to the ON position. A distinct increase in amperage draw should be noted.

(3) 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.

(4) Using a DC voltmeter, connect negative lead to Point B, and the positive lead to Point A (Fig. 2). The voltmeter should read 10-14 volts.

DIAGNOSIS AND TESTING (Continued)

(5) Step 2, Step 3 or Step 4 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.

(6) 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 maxi-fuse and control circuit fuse are OK and all electrical connections are secure.

(7) 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.

(8) If turning the switch ON produces severe voltmeter deflection, the circuit should be closely checked for a shorting condition.

(9) If the system operation has been verified but indicator lamp does not light, replace the switch.

(10) For detailed wiring information, refer to group 8W, Wiring Diagrams.

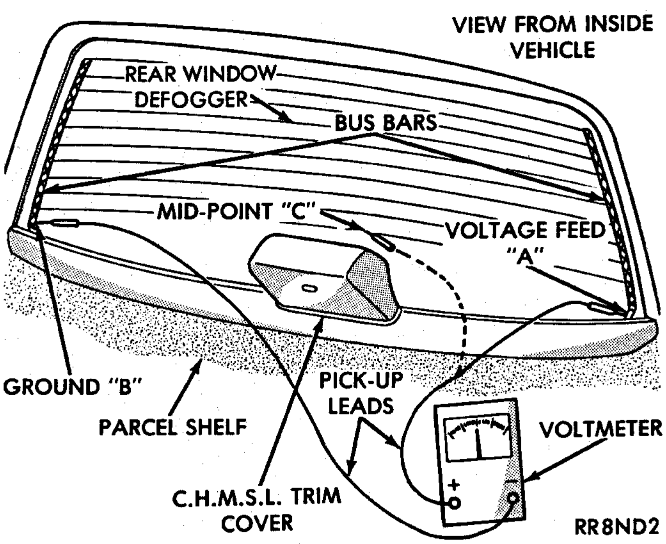


Fig. 2 Rear Glass Grid Line Test

GRID LINES

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 connection in the feed or the ground circuit.

(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 the line is OK
- 0 volts indicates a break in line between Mid-Point C and terminal A
- 10-14 volts indicates a break between Mid-Point C and terminal B

Move the lead toward the break and voltage will change as soon as break is crossed. Refer to (Fig. 2) and (Fig. 3).

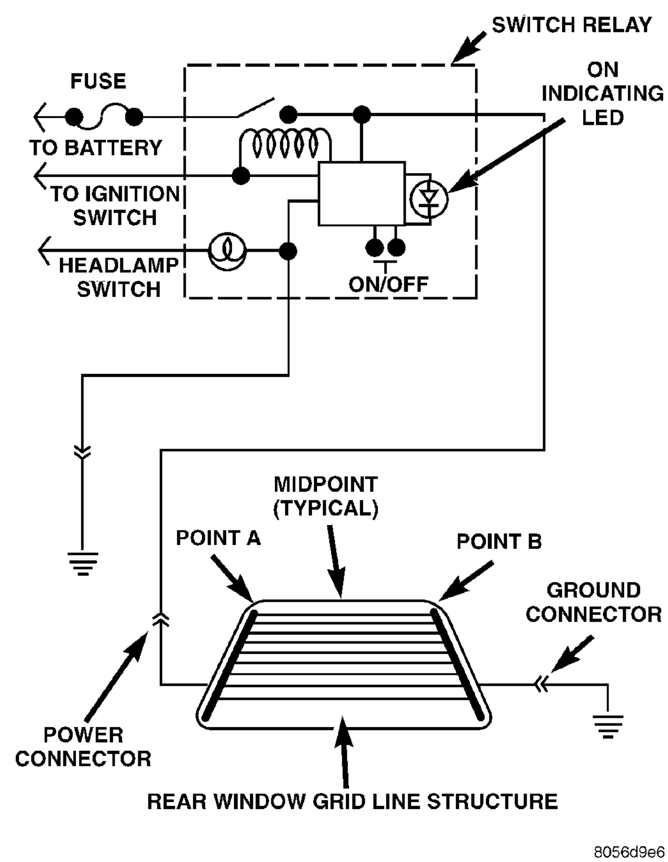


Fig. 3 Systems Electrical Circuit

DIAGNOSIS AND TESTING (Continued)

REAR WINDOW DEFOGGER SWITCH

The rear window defogger switch may be tested in-vehicle or bench tested. In vehicle testing is accomplished in the following manner:

(1) Remove the switch from the instrument panel but leave the switch connected, refer to Group 8E, Instrument Panel and Systems for removal procedures.

(2) Turn the ignition switch ON.

(3) Using a voltmeter, check for battery voltage at Pin 3 and Pin 4 (Fig. 3), (Fig. 4) and (Fig. 5).

(a) If OK, go to Step 4.

(b) If NOT OK, check fuse 8 in fuse block and the 30 Amp maxi fuse in the Power Distribution Center (PDC). If fuses are OK, check wiring circuit. Refer to Group 8W, Wiring Diagrams.

(4) Check Pin 5, with switch in the ON position there should be battery voltage and no voltage in the OFF position.

(a) If OK, go to Step 5.

(b) If NOT OK, no voltage in the ON position or voltage in the OFF position. Replace the switch/relay module.

(5) Press switch to ON position. The indicator lamp should come on and remain on for approximately 10 minutes. If the indicator lamp fails to light or no voltage is present for approximately 10 minutes. Replace Rear Window Defogger Switch.

(6) To bench test relay:

(a) Using a jumper wire connect a 12 volt batter supply, apply voltage to Pin 3 and 4. Ground Pin 2.

(b) Follow the above procedures except Step 2

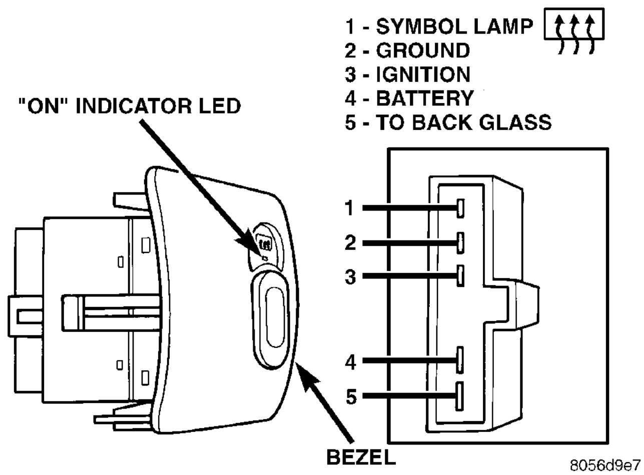


Fig. 4 Rear Window Defogger Switch

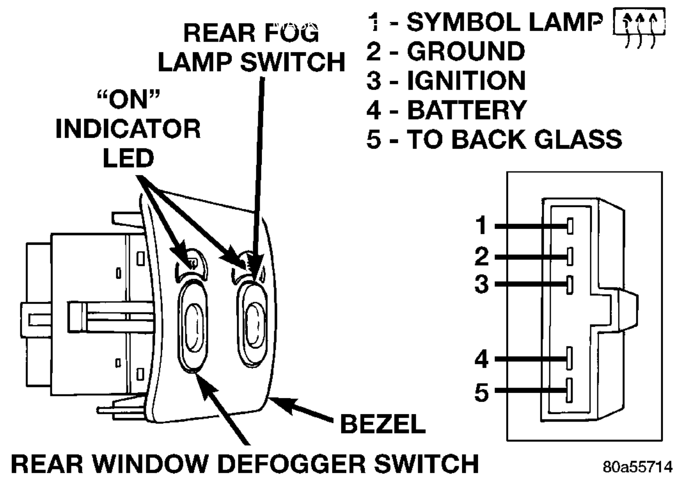


Fig. 5 Rear Window Defogger Switch - Export

SERVICE PROCEDURES

GRID LINE AND TERMINAL REPAIR

WARNING: REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION. CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, HARMFUL IF SWALLOWED. AVOID CONTACT WITH SKIN AND EYES. FOR SKIN, WASH AFFECTED AREAS WITH SOAP AND WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING; CALL A PHYSICIAN IMMEDIATELY. IF IN CONTACT WITH EYES, FLUSH WITH PLENTY OF WATER. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTENTS CONTAIN 3 PERCENT FLAMMABLE SOLVENTS.

KEEP OUT OF REACH OF CHILDREN.

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. 6).

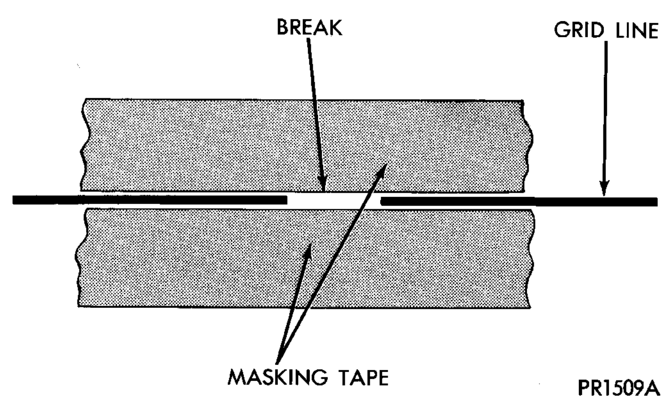


Fig. 6 Grid Line Repair

SERVICE PROCEDURES (Continued)

(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. 6).

(5) Apply conductive epoxy through slit in masking tape. Overlap both ends of the break by 19 mm (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°to 371°C (500° to 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.

POWER DOOR LOCKS

CONTENTS

POWER DOOR LOCKS

INDEX

DESCRIPTION AND OPERATION

INTRODUCTION

All doors can be locked or unlocked electrically by operating the switch on either front door panels.

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 can be locked or unlocked mechanically from the outside with the key or electrically as described above.

CHILD PROTECTION LOCK

The child protection lock is on the rear door only. The lock will disable the inside door handle from opening the door when engaged. The lock is part of the latch/lock assembly. The lock is engaged by moving a lever that is located on the rearward inside edge of the door.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DIAGNOSIS AND TESTING

DOOR LOCK MOTOR

Make certain battery is in normal 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.

To test an individual door lock motor, disconnect the electrical connector from the motor. To lock the door, connect a 12 volt power source to the positive pin of the lock motor and a ground wire to the other pin (Fig. 1) To unlock the door reverse the wire connections at the motor pin terminals. If these results are NOT obtained, replace the door latch assembly.

DOOR LOCK SWITCH

Remove the switch from its mounting location. Using an ohmmeter, refer to (Fig. 2) to determine if

DIAGNOSIS AND TESTING (Continued)

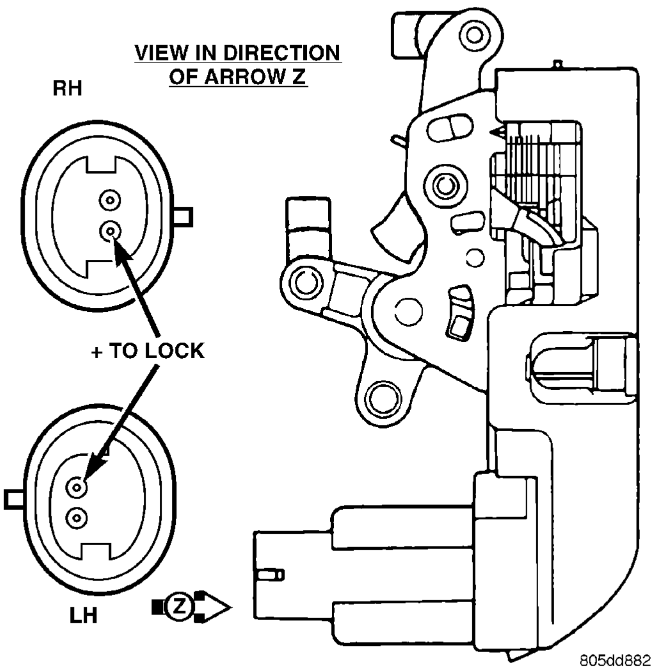
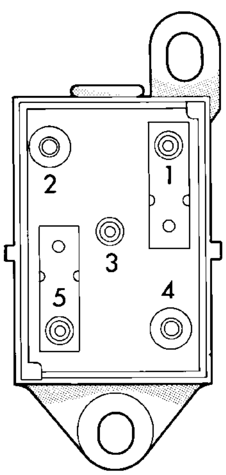


Fig. 1 Door Latch Assembly

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
UNLOCK	PINS 3 & 5 PINS 1 & 4
LOCK	PINS 1 & 3 PINS 2 & 5

948P-1

Fig. 2 Door Lock Switch Continuity Test

WIRING

The following wiring test sequence determines whether or not voltage is continuous through the body harness to switch.

(1) Remove left side switch from door 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. Touch other test light lead to Red Wire terminal.

(a) If test light comes on, the wiring circuit between the battery and switch is functional.

(b) If test light does not come on, check fuse 3 in the fuse block or for a open circuit.

(4) If test light comes on, the wiring circuit between the battery and switch is functional.

REMOVAL AND INSTALLATION

DOOR LOCK MOTOR

REMOVAL

(1) Remove door trim panel, refer to Group 23, Body for removal procedures.

(2) Disconnect all door linkages at the latch/lock assembly (Fig. 1).

(3) Disconnect motor wire connector.

(4) Remove latch/lock assembly attaching screws and remove assembly.

INSTALLATION

For installation, reverse the above procedures.

DOOR LOCK SWITCH

REMOVAL

(1) Remove front door trim, refer to Group 23, Body for proper procedures.

(2) Disconnect wire connector.

(3) Remove attaching screws.

(4) Remove the switch.

INSTALLATION

For installation, reverse the above procedures.

REMOTE KEYLESS ENTRY

INDEX

GENERAL INFORMATION

INTRODUCTION

The key fob transmitter has three buttons to actuate and program the Remote Keyless Entry (RKE) system (Fig. 1).

- UNLOCK: Actuating the UNLOCK button once will unlock the driver door and activate the illuminated entry system. Actuating the UNLOCK button twice within five seconds will unlock all doors.
- LOCK: Actuating the LOCK button locks all doors and sounds horn (chirp). The chirp verifies the door lock operation.
- PANIC: Actuating the PANIC button sounds the horns and alternately flashes the headlamps and parking lamps. The panic alarm will remain on for one minute, until the PANIC button is actuated again or the ignition is switched to the RUN position.
- The Remote Keyless Entry Module is capable of retaining the transmitter Vehicle Access Code (VAC) in memory even after vehicle power has been interrupted.

DESCRIPTION AND OPERATION

VEHICLE ACCESS CODE (VAC) PROGRAMMING

The system allows locking and unlocking of vehicle door(s) by remote control using a hand held radio frequency transmitter. The ignition switch must be OFF before the panic function can be activated with the transmitter.

The receiver may receive VAC signals from two transmitters. Each transmitter has its own Vehicle Access Code and the code is programmed and stored into receiver memory. If the transmitter is replaced or a second transmitter is added, the codes of both units have to be reprogrammed into the receiver memory. If a receiver module is replaced, both the transmitter codes must be stored in the new receiver memory.

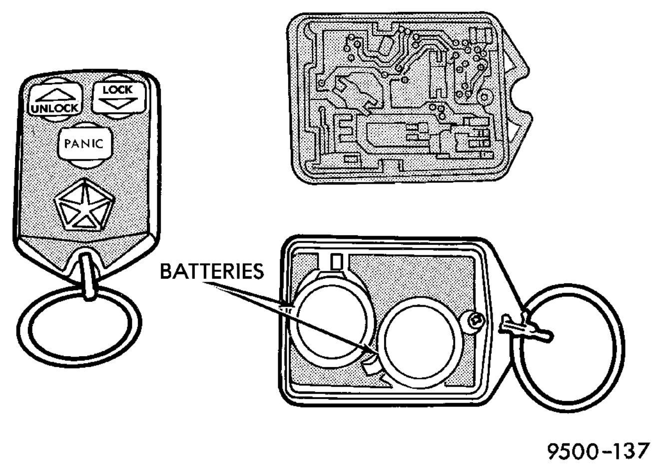


Fig. 1 Key Fob Transmitter

OPERATION

The transmitter has three buttons for operation (Fig. 1). They are LOCK, UNLOCK and PANIC.

The receiver is capable of retaining all Vehicle Access Codes (VAC) even when power is removed.

Each remote keyless entry module (RKE) must have at least one and no more than two transmitters.

DIAGNOSIS AND TESTING

REMOTE KEYLESS ENTRY CONDITION

Use an analog voltmeter for the following test.

DIAGNOSIS AND TESTING (Continued)

REMOTE KEYLESS ENTRY GENERAL CHECKS BEFORE OTHER CHECKS.

(1) Check if door locks operate properly. If not OK, repair as necessary.

(2) Disconnect the wire connectors at the RKE module Using a ohmmeter check for continuity between the Pins of the wire connectors (Fig. 2):

• Pin 1 to Pin 4 of the gray connector.
• Pin 2 to Pin 3 of the gray connector.
• Pin 1 of the black connector to Pin 3 of the gray connector.

If no continuity repair as necessary. Refer to Group 8W, Wiring Diagrams.

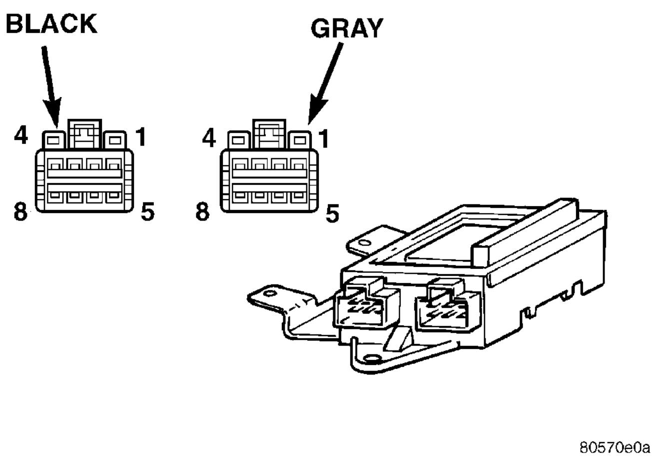


Fig. 2 Remote Keyless Entry Module

(3) Using a voltmeter, check the wire connectors for battery feed and ignition feed (Fig. 2):

• Check Pin 2 of the black connector for battery feed.
• Check Pin 8 of the black connector for ignition feed with the ignition key in the ON position.

If not OK, check and repair as necessary.

(4) Using a ohmmeter, check the Pin 8 of the black connector for continuity to ground. If not OK, check and repair as necessary (Fig. 2).

(5) Test transmitter batteries for at least six volts. If not OK, replace batteries as necessary.

(6) Check if module is programmed properly. Refer to Program Remote Keyless Entry Module. If module will not program check for continuity between Pin 4 of the black connector to the programming line connector (Fig. 2). If no continuity repair as necessary, refer to Group 8W, Wiring Diagrams.

(7) Check if horn operates properly. If not OK, repair as necessary.

DRIVER DOOR WILL NOT UNLOCK WITH THE TRANSMITTER

(1) Using an analog voltmeter, connect the meter to Pin 1 of the black connector and to ground. Press the unlock button once and check for a voltage pulse (Fig. 2).

(2) If no voltage pulse is measured, replace the receiver. If voltage pulse is measured, check the wiring to the driver door and repair as necessary.

DRIVER DOOR WILL UNLOCK WITH THE TRANSMITTER, BUT ALL OTHER DOORS WILL NOT UNLOCK

(1) Using an analog voltmeter, connect the meter to Pin 3 of the gray connector and to ground (Fig. 2). Press the unlock button twice within five seconds and check for a voltage pulse.

(2) If no voltage pulse is measured, replace the receiver. If voltage pulse is measured, check the wiring to the passenger door lock motors and repair as necessary.

ALL DOORS WILL NOT LOCK WITH THE TRANSMITTER

(1) Using an analog voltmeter, connect the meter to Pin 1 of the gray connector and to ground. Press the lock button and check for a voltage pulse (Fig. 2).

(2) If no voltage pulse is measured, replace the receiver. If voltage pulse is measured, check the wiring to the door lock motors and repair as necessary.

DOORS WILL LOCK USING THE TRANSMITTER BUT THERE IS NO HORN CHIRP

(1) Using an analog voltmeter, connect the meter to Pin 6 of the gray connector and to ground. Press the lock button and check for a voltage pulse decrease (Fig. 2).

(2) If no voltage pulse decrease is measured, replace the receiver. If voltage OK, repair circuit to the horn relay as necessary.

ILLUMINATED ENTRY FAILS TO WORK IN INITIAL UNLOCKING WITH TRANSMITTER

(1) Using an analog voltmeter, connect the meter to Pin 6 of the black connector and to ground. Press the lock button and check for a voltage pulse decrease (Fig. 2).

(2) If no voltage pulse decrease is measured, replace the receiver. If voltage OK, repair circuit to the dome as necessary.

PARKING LAMPS AND/OR HEAD LAMPS FAIL TO FLASH WITH PANIC BUTTON

(1) Using an analog voltmeter, connect the meter to Pin 5 of the gray connector and to ground to test parking lamps out put. Press the panic button and check for a voltage pulse (Fig. 2).

(2) If no voltage pulse is measured, replace the receiver. If voltage OK, repair circuit to the parking lamps as necessary.

DIAGNOSIS AND TESTING (Continued)

(3) Connect the meter to Pin 5 of the black connector and to ground to test head lamps out put. Press the panic button and check for a voltage pulse (Fig. 2).

(4) If no voltage pulse is measured, replace the receiver. If voltage OK, repair circuit to the head lamps as necessary.

REMOTE KEYLESS ENTRY SYSTEM

When trouble shooting problems with the Remote Keyless Entry System, always verify that the power door lock/unlock switches are functional. If the doors do not lock/unlock refer to Group 8W, Wiring Diagram for Pin and wiring locations.

If the following items do not work:

- Remote keyless entry system
- Radio/clock
- Door lock switches

A blown fuse is the probable cause. Check fuses 2, 3 and 11 in the fuse block. To check for a blown fuse, pull the fuse out slightly, but maintain contact between the fuse terminals and the terminals in fuse block. Using the voltmeter probe, check both terminals for 12 volts. If only one terminal measures battery voltage, the circuit breaker is defective and must be replaced. If neither terminal measures battery voltage, check the high current fuses 3 and 11 in the Power Distribution Center (PDC). The PDC is located in the engine compartment. If fuse(s) are NOT OK, replace fuse(s) or repair as necessary. If fuses are OK, check for an open or shorted circuit to the Power Distribution Center, repair as needed.

SERVICE PROCEDURES

HORN CHIRP CANCELLATION

During the programming operation the horn chirp can be disabled or enable using the following procedure. One or both transmitters can be program to be disabled or enable.

(1) Retrieve the programming line from the upper edge of the passenger side cowl trim panel upper edge. The RKE Programming Line is a green wire with a red bullet connector.

(2) Using a jumper wire, ground the RKE programming line.

(3) Turn ignition switch to the ON position.

(4) Press any button on the transmitter. The locks will cycle to confirm programming,

(5) To disable or enable horn chirp press the lock button on the transmitter four times and the horn will sound to confirm programming. Press the lock button on the second transmitter four times and the horn will sound to confirm programming.

(6) Disconnect the programming line from ground. This returns the system to its normal operation mode.

(7) Replace any removed components. Return programming line chirpto its original position. Check for system operation.

PANIC FUNCTION CANCELLATION

During the programming operation the panic function can be disabled or enable using the following procedure. One or both transmitters can be program to be disabled or enable.

(1) Retrieve the programming line from the upper edge of the passenger side cowl trim panel. The RKE Program Line is a green wire with a red bullet connector.

(2) Using a jumper wire, ground the RKE Programming Line.

(3) Turn ignition switch to the ON position.

(4) Press any button on the transmitter. The locks will cycle to confirm programming,

(5) To disable or enable panic function press the panic button on the transmitter four times and the horn will sound to confirm programming. Press the panic button on the second transmitter four times and the horn will sound to confirm programming.

(6) Disconnect the programming line from ground. This returns the system to its normal operation mode.

(7) Replace any removed components. Return the programming line to its original position. Check for system operation.

PROGRAM REMOTE KEYLESS ENTRY MODULE

(1) Retrieve the programming line from the upper edge of the passenger side cowl trim panel. The RKE Programming Line is a green wire with a red bullet connector.

(2) Using a jumper wire, ground the RKE programming line.

(3) Turn ignition switch to the ON position.

(4) Press any button on the transmitter to set code. The locks will cycle to confirm programming. If there is a second transmitter it must be set at this time. Press any button on the second transmitter and wait for the locks to cycle to confirm programming.

(5) Disconnect the programming line from ground. This returns the system to its normal operation mode.

(6) Replace all removed components. Return programming line to its original position. Check for system operation.

REMOVAL AND INSTALLATION

REMOTE KEYLESS ENTRY MODULE

REMOVAL

(1) Remove the right trim panel, refer to Group 8E, Instrument Panel and Systems for proper removal procedures.

(2) Disconnect wire connector from RKE module.

(3) Remove screws holding RKE module to instrument panel assembly (Fig. 3).

(4) Remove module.

INSTALLATION

For installation, reverse above procedures.

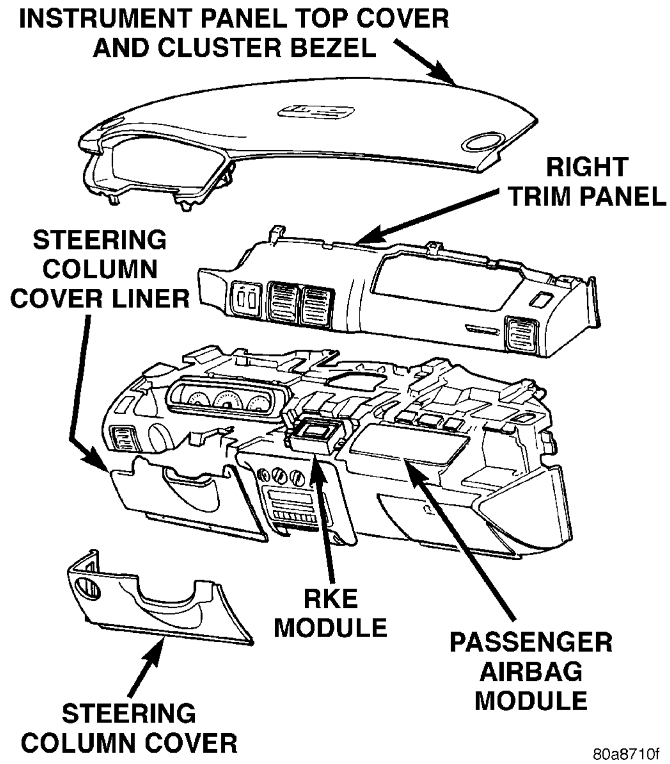


Fig. 3 RKE Module Location

SPECIFICATIONS

RKE TRANSMITTER BATTERY

The batteries can be removed without special tools and are readily available at local retail stores. The recommended battery is Duracell DL 2016 or equivalent. Battery life is about one to two years.

CAUTION: Do not touch the battery terminals or handle the batteries any more than necessary. Hands must be clean and dry.

RKE TRANSMITTER RANGE

Normal operation range is up to about a distance of 7 meters (23 ft.) of the vehicle. Range may be better or worse depending on the environment around the vehicle. Closeness to a radio frequency transmitter such as a radio station tower may degrade operational range, while range in an open field will be enhanced.

POWER WINDOWS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The window lift motors are of the permanent magnet type. A battery positive and negative connection to either of the two motor terminals will cause the motor to rotate in one direction. Reversing current through these same two connections will cause the motor to rotate in the opposite direction.

Each individual motor is grounded through the master switch.

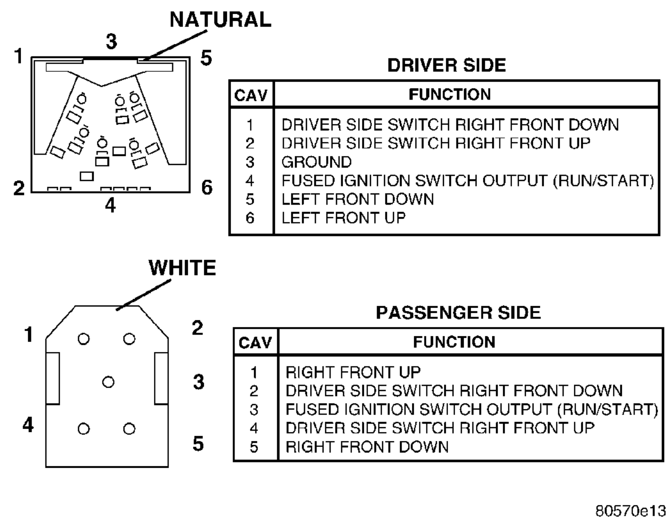
NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DIAGNOSIS AND TESTING

WIRING TEST

The following wiring test determines whether or not voltage is continuous through the body harness to switch.

Remove switch for testing. Connect a voltmeter positive lead to Pin 4 and negative lead to Pin 3 of the switch connector (Fig. 1). Turn ignition switch to the ON position. Voltmeter should read battery voltage. If OK, go to Window Switch Test. If not OK, check the 30 amp circuit breaker behind the fuse block or for a broken wire. For wiring, specific connector type and location, refer to Group 8W, Wiring Diagrams.



DRIVER SIDE

CAV	FUNCTION
1	DRIVER SIDE SWITCH RIGHT FRONT DOWN
2	DRIVER SIDE SWITCH RIGHT FRONT UP
3	GROUND
4	FUSED IGNITION SWITCH OUTPUT (RUN/START)
5	LEFT FRONT DOWN
6	LEFT FRONT UP

PASSENGER SIDE

CAV	FUNCTION
1	RIGHT FRONT UP
2	DRIVER SIDE SWITCH RIGHT FRONT DOWN
3	FUSED IGNITION SWITCH OUTPUT (RUN/START)
4	DRIVER SIDE SWITCH RIGHT FRONT UP
5	RIGHT FRONT DOWN

Fig. 1 Window Switch Connectors

WINDOW SWITCH TEST

Remove the switch from its mounting, refer to the Window Switch Removal and Installation procedures.. Using an ohmmeter, refer to the test procedures below, Driver Side or Passenger Side Window Switch Continuity Test to determine if continuity is correct (Fig. 2) and (Fig. 3). If the results are not obtained, replace the switch.

WINDOW MOTOR TEST

(1) Remove door trim panel, refer to Group 23 Body for removal procedures.

(2) Connect positive (+) lead from a test battery to either of the two motor terminals.

(3) Connect negative (-) lead from test battery to remaining motor terminal.

(4) 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 move it in UP direction no movement will be observed.

DIAGNOSIS AND TESTING (Continued)

SWITCH POSITION	CONTINUITY BETWEEN TERMINALS
OFF	PIN 1 TO 2 PIN 1 TO 4 PIN 1 TO 5 PIN 1 TO 6 PIN 2 TO 4 PIN 2 TO 5 PIN 2 TO 6 PIN 4 TO 5 PIN 4 TO 6 PIN 5 TO 6
DRIVER SIDE UP	PIN 1 TO 3 PIN 2 TO 4
DRIVER SIDE DOWN	PIN 1 TO 4 PIN 2 TO 3
PASSENGER SIDE UP	PIN 3 TO 5 PIN 4 TO 6
PASSENGER SIDE DOWN	PIN 3 TO 6 PIN 4 TO 5

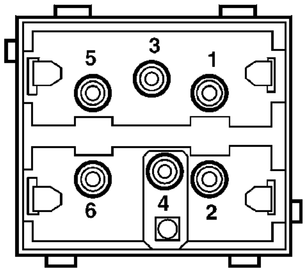


Fig. 2 Driver Side Window Switch Continuity Test

SWITCH POSITION	CONTINUITY BETWEEN TERMINALS
OFF	PIN 2 TO 5 PIN 1 TO 4
UP	PIN 1 TO 4 PIN 3 TO 5
DOWN	PIN 1 TO 3 PIN 2 TO 5

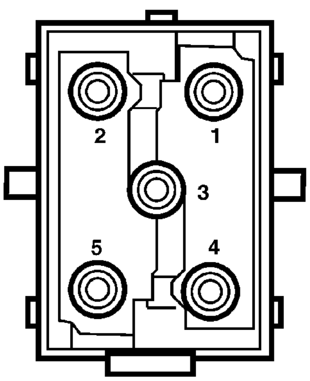


Fig. 3 Passenger Side Window Switch Continuity Test

(b) Likewise, motor connected to move window in DOWN direction no movement will be observed if window is already in full DOWN position.

(c) Reverse battery leads in Step 2 and Step 3 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, the test leads should be reversed one more time to complete a full window travel inspection.

(6) If window does not move, check to make sure that it is free.

(7) It is necessary that the window be free to slide up and down in the glass channels. If the window is not free to move up and down, the window lift motor will not be able to move the glass.

(8) To determine if the glass is free, disconnect the regulator from the glass lift plate. Remove the two attaching nuts, and slide the window up and down by hand. This check can not be made on a four door vehicle.

REMOVAL AND INSTALLATION

WINDOW SWITCH

REMOVAL

(1) Using a flat tool, insert tool in the slot on the bottom of the switch bezel (Fig. 4).

(2) Pry the bezel from the door trim panel.

(3) Disconnect wire connector from switch.

(4) Remove switch by releasing the tabs from bezel.

INSTALLATION

For installation, reverse above procedures.

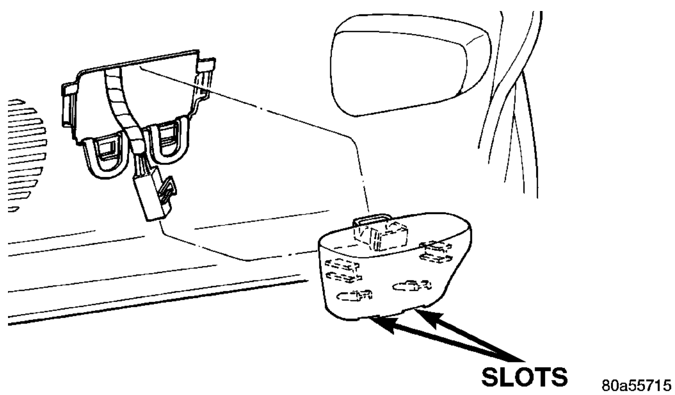


Fig. 4 Switch Removal

2 DOOR WINDOW MOTOR

WARNING: DO NOT HAVE ANY HANDS OR FINGERS IN SECTOR GEAR AREA WHERE THEY CAN BE PINCHED BY SMALL MOVEMENTS OF REGULATOR LINKAGE.

REMOVAL

(1) Move the window to the full-up position, if possible.

(2) Remove door trim panel and window regulator, refer to Group 23 Body for removal procedures.

REMOVAL AND INSTALLATION (Continued)

WARNING: FAILURE TO CLAMP THE SECTOR GEAR TO THE MOUNTING PLATE WHEN REMOVING THE MOTOR CAN RESULT IN INJURY.

(3) Secure the sector gear and mounting plate with a C clamp or similar clamping tool. This will prevent a sudden and forceful movement of the regulator when the motor is removed.

(4) Remove three mounting screws that hold motor gearbox to regulator (Fig. 5).

(5) Remove motor from regulator.

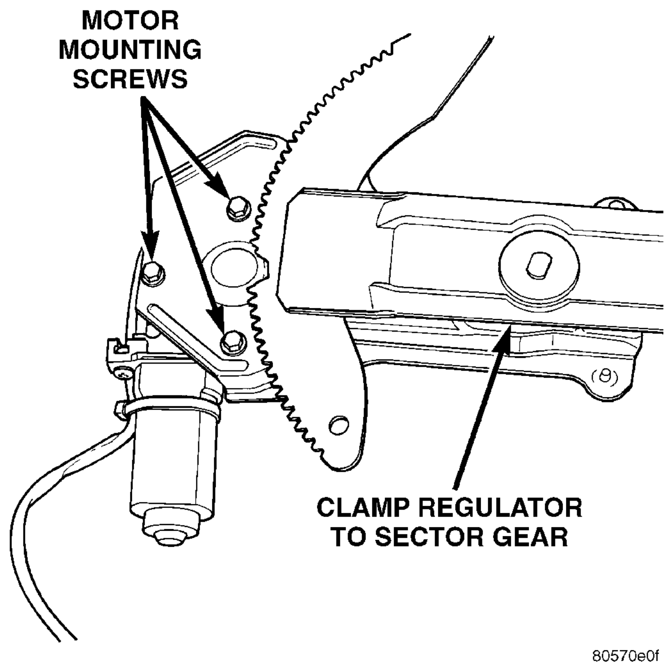


Fig. 5 2 Door Motor Removal

INSTALLATION

(1) Install new motor on regulator by positioning motor gearbox so that it engages regulator sector teeth.

(2) 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 5.6 to 8 N·m (50 to 70 in. lbs.) torque.

(4) Install regulator, using the switch, test operation of motor.

4 DOOR WINDOW MOTOR

REMOVAL

(1) Move the window so it is not in the full up or down position, if possible.

(2) Remove door trim panel, refer to Group 23 Body for removal procedures.

(3) Disconnect wiring connector from motor.

(4) Remove the three nuts attaching the window regulator motor/housing to the door inner panel. This will allow the motor/housing to be moved to the lower door inner panel opening since the cables will flex (Fig. 6).

(5) Turn the motor/housing to gain access to the three nuts attaching the motor to the housing.

(6) Remove the three nuts attaching the motor to the housing.

(7) Remove the motor from the housing. Be careful not to pull the cable drum from the housing, as the motor shaft will tend to pull the drum with it.

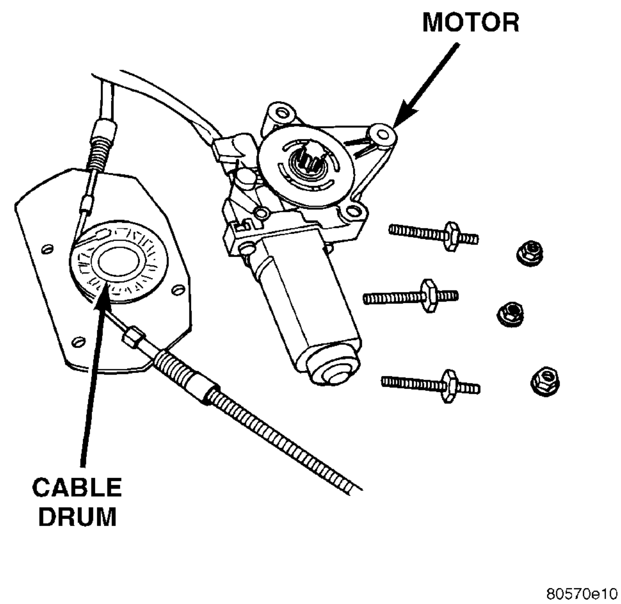


Fig. 6 4 Door Motor Removal

INSTALLATION

For installation, reverse above procedures.

POWER MIRRORS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

Electrically operated power mirrors are available on all car lines. The mirrors are controlled by a single switch assembly located on the driver's door trim panel. The push button rocker switch uses L (left) and R (right) for mirror selection and a button to push for the desired direction of mirror movement (Fig. 1).

The motors which operate the mirrors are part of the mirror assembly and cannot be replaced separately.

Right Hand Drive (RHD) vehicles may be equipped with Power Fold Away Mirrors. The mirror is controlled the same way as the Left Hand Drive (LHD) vehicle. The RHD vehicle has an additional switch in the switch pod that controls the folding function of the mirror assembly (Fig. 2).

All vehicles are equipped with a Ignition-Off Draw Fuse, and they are disconnected when the vehicles are originally shipped from the factory. Disconnecting this fuse will help prevent the battery from discharge during storage. The fuse is located in Power Distribution Center (PDC) refer to the cover for proper location.

This fuse is included in the power mirror circuity and should be checked if the mirrors are inoperative.

The RHD vehicle mirror circuitry is powered from the accessory feed circuit and protected by a 15 amp circuit breaker and power mirror relay. The relay provides for the switching of the mirror. The circuit breaker and mirror relay are located in the inner door panel wire harness.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

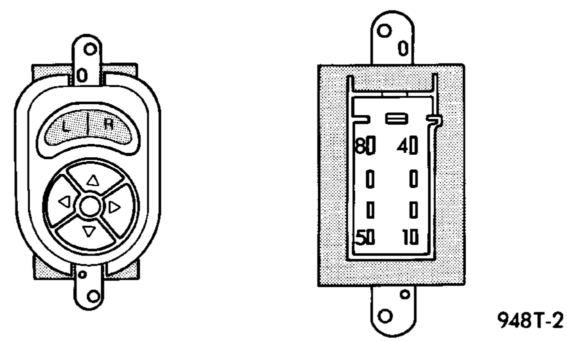


Fig. 1 Power Mirror Switch

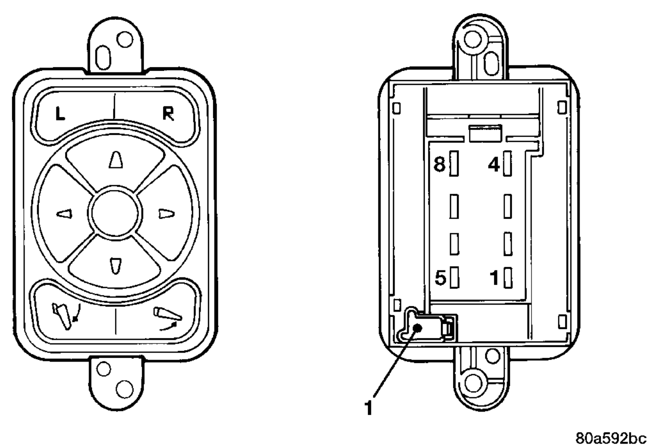


Fig. 2 Power Fold Away Mirror Switch

DIAGNOSIS AND TESTING

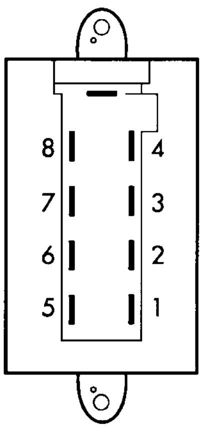
MIRROR SWITCH TEST

(1) Remove power mirror switch from mounting position.

(2) Disconnect wiring harness at switch connector.

(3) Using an ohmmeter, test for continuity between the terminals of the switch as shown in the Mirror Switch Test (Fig. 3) and RHD Power Fold Away Mirror Switch Test (Fig. 4)

(4) If test results are not obtained as shown in the (Fig. 3) or (Fig. 4), replace the switch.



MIRROR SWITCH CONTINUITY	
Mirror Selector Knob in "L" Position	
MOVE LEVER	**CONTINUITY BETWEEN**
▲	PINS 2 AND 8 PINS 1 AND 5
▶	PINS 2 AND 6 PINS 1 AND 7
▼	PINS 2 AND 5 PINS 1 AND 8
◀	PINS 2 AND 7 PINS 1 AND 6
Mirror Selector Knob in "R" Position	
MOVE LEVER	**CONTINUITY BETWEEN**
▲	PINS 2 AND 4 PINS 1 AND 5
▶	PINS 2 AND 6 PINS 1 AND 3
▼	PINS 2 AND 5 PINS 1 AND 4
◀	PINS 2 AND 3 PINS 1 AND 6

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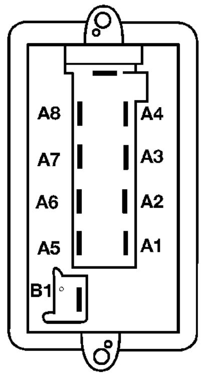
Fig. 3 Mirror Switch Test

MIRROR MOTOR

(1) Remove door trim panel, refer to Group 23 Front Door Trim.

(2) Remove switch mounting screws from back side of trim panel and remove switch.



MIRROR SWITCH CONTINUITY	
Mirror Selector Knob in "L" Position	
MOVE LEVER	**CONTINUITY BETWEEN**
▲	PINS A-2 AND A-8 PINS A-1 AND B-1 PINS A-1 AND A-5
▶	PINS A-2 AND A-6 PINS A-1 AND A-7
▼	PINS A-2 AND A-5 PINS A-1 AND A-8 PINS A-1 AND B-1
◀	PINS A-2 AND A-7 PINS A-1 AND A-6
Mirror Selector Knob in "R" Position	
MOVE LEVER	**CONTINUITY BETWEEN**
▲	PINS A-2 AND A-4 PINS A-1 AND B-1 PINS A-1 AND A-5
▶	PINS A-2 AND A 6 PINS A-1 AND A-3
▼	PINS A-2 AND A-5 PINS A-1 AND B-1 PINS A-1 AND A-4
◀	PINS A-1 AND A-6 PINS A-2 AND A-5
Mirror Folding Position	
OUT	PINS A- 1 AND A-5 PINS A- 2 AND B-1
IN	PINS A- 1 AND B-1 PINS A- 2 AND A-5

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Fig. 4 Power Fold Away Mirror Switch Test

DIAGNOSIS AND TESTING (Continued)

(3) Disconnect wire connector.

(4) Using two jumper wires, one connected to a 12 volt source, and 2 the other connected to a good body ground. Refer to the Mirror Test (Fig. 5) for appropriate mirror response. RHD vehicle with Power Fold Away Mirror refer to (Fig. 6)

(5) If test results are not obtained as shown in the (Fig. 5), check for open or shorted circuit (Fig. 7), or replace mirror assembly as necessary.

MIRROR TEST			
MIRROR SWITCH CONNECTOR			
		Mirror Reaction	
12 volt	Ground	Left	Right
PIN 4	PIN 5		UP
PIN 8	PIN 5	UP	
PIN 5	PIN 4		DOWN
PIN 5	PIN 8	DOWN	
PIN 6	PIN 3		RIGHT
PIN 6	PIN 7	RIGHT	
PIN 3	PIN 6		LEFT
PIN 7	PIN 6	LEFT	
DOOR CONNECTOR			
PIN 3	PIN 1	UP	
PIN 1	PIN 3	DOWN	
PIN 6	PIN 4	RIGHT	
PIN 4	PIN 6	LEFT	

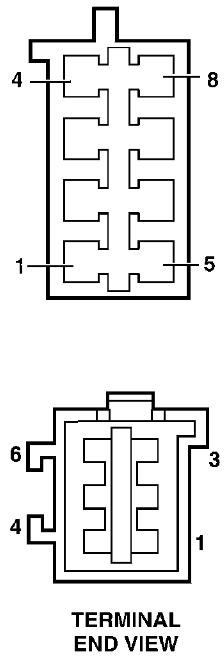

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Fig. 5 Mirror Test

MIRROR TEST			
MIRROR SWITCH AND RELAY CONNECTORS			
12 volts	Ground	Mirror Reaction	
Mirror Relay Removed		Left	Right
PIN A-4	PIN C-8		UP
PIN A-8	PIN C-8	UP	
PIN C-8	PIN A-4		DOWN
PIN C-8	PIN A-8	DOWN	
PIN A-6	PIN A-3		RIGHT
PIN A-6	PIN A-7	RIGHT	
PIN A-3	PIN A-6		LEFT
PIN A-7	PIN A-6	LEFT	
PIN C-8	PIN B-1	RETRACT (IN)	RETRACT (IN)
PIN B-1	PIN C-8	EXTEND (OUT)	EXTEND (OUT)
MIRROR RELAY INSTALLED			
PIN A-4	——		UP
PIN A-8	——	UP	
PIN A-5	PIN A-4		DOWN
PIN A-5	PIN A-8	DOWN	
PIN A-6	PIN A-3		RIGHT
PIN A-6	PIN A-7	RIGHT	
PIN A-3	PIN A-6		LEFT
PIN A-7	PIN A-6	LEFT	
PIN A-5	PIN B-1	RETRACT (IN)	RETRACT (IN)
PIN B-1	——	EXTEND (OUT)	EXTEND (OUT)
MIRROR CONNECTOR IN LEFT OR RIGHT DOOR			
PIN D-3	PIN D-1	UP	
PIN D-1	PIN D-3	DOWN	
PIN D-6	PIN D-4	RIGHT	
PIN D-4	PIN D-6	LEFT	
PIN D-5	PIN D-1	EXTEND (OUT)	
PIN D-1	PIN D-5	RETRACT (IN)	

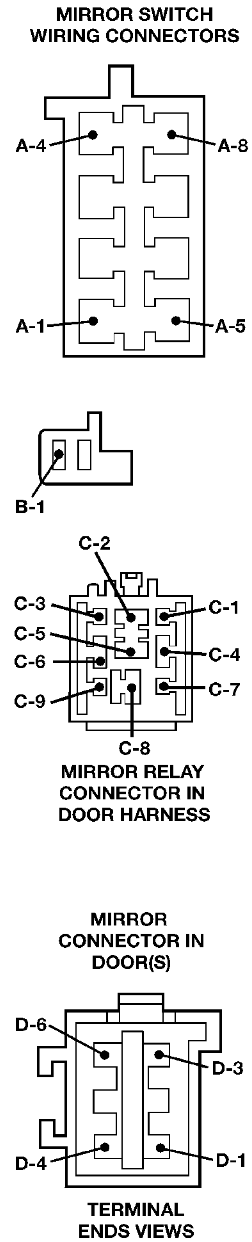

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Fig. 6 Power Fold Away Mirror Test

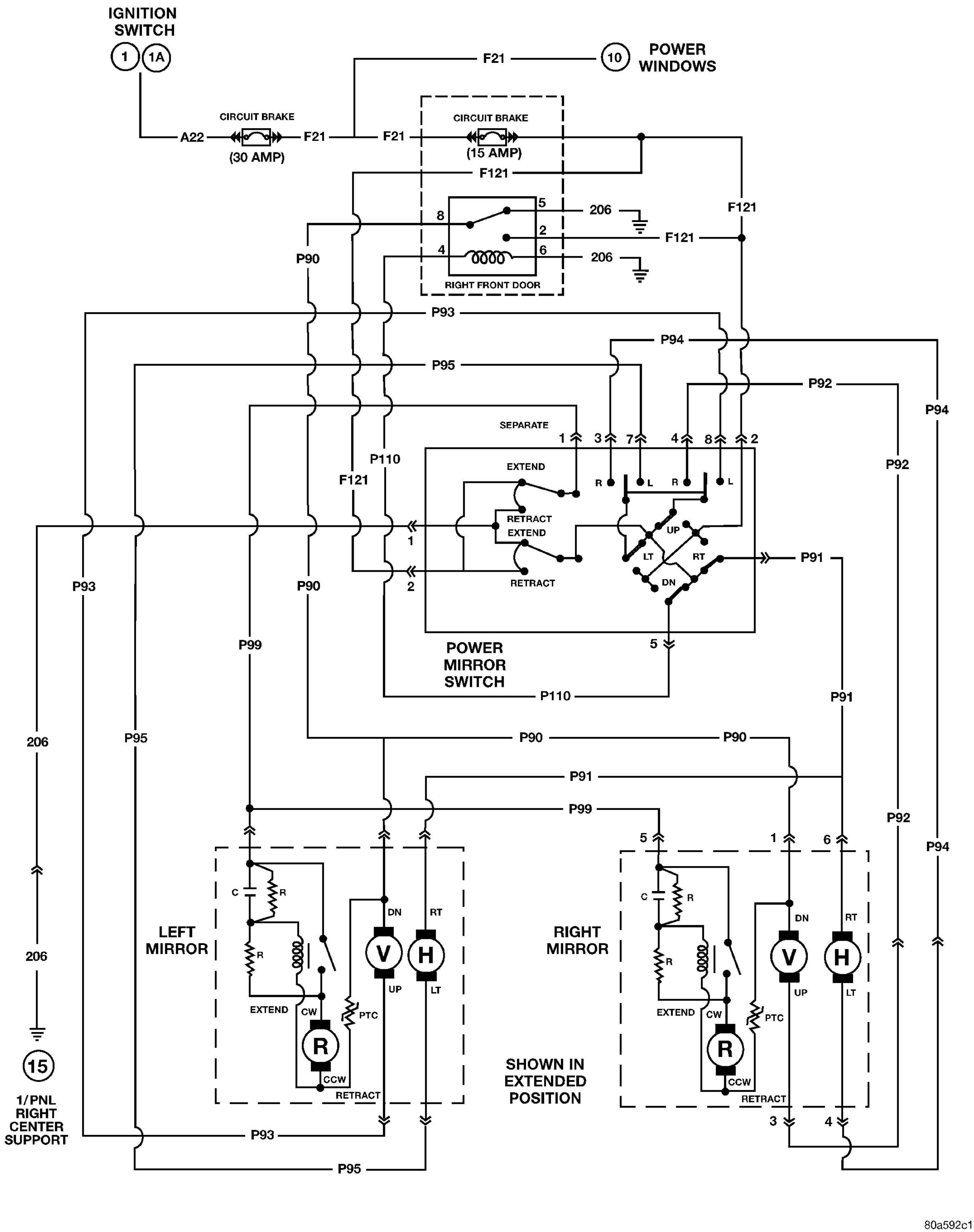


Fig. 7 Power Fold Away Mirrors Wiring Schematic

REMOVAL AND INSTALLATION

INSIDE MIRROR/READING LAMPS ASSEMBLY

REMOVAL

(1) Disconnect wiring connector.
(2) Loosen mirror set screw (Fig. 8).
(3) Lift mirror from mounting button.

INSTALLATION

For installation, reverse the above procedure. Ensure the mirror is fully locked into place.

INSIDE MIRROR/READING LAMPS BULB/LENS

REMOVAL

(1) Using a small thin blade tool, pry at the center of the lens nearest the mirror to remove lens (Fig. 8).
(2) Remove cartridge lamp and replace if necessary.

INSTALLATION

Install lens by setting lens into position and applying pressure until it is locked into position.

MIRROR SWITCH

REMOVAL

(1) Remove door trim panel, refer to Group 23 Front Door Trim.
(2) Remove switch mounting screws from back side of trim panel and remove switch.
(3) Disconnect wire connector.

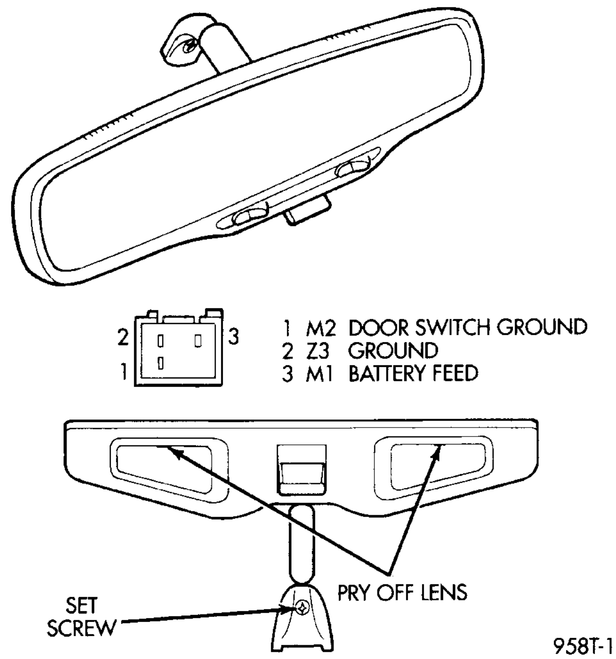


Fig. 8 Mirror/Reading Lamps

INSTALLATION

For installation, reverse the above procedures.

MIRROR ASSEMBLY

For door trim panel and mirror removal and installation, refer to Group 23 Body. Test operation of mirror before installing door trim panel.

CHIME WARNING/REMINDER SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO THE AIRBAG PORTION OF THIS SECTION FOR STEERING WHEEL OR SWITCH REMOVAL AND INSTALLATION PROCEDURES.

The seat belt reminder system uses both visual and audible signals. A combined seat belt and key reminder chime with a red light on the instrument panel.

The system will always illuminate the seat belt reminder lamp for four to eight seconds when the ignition switch is turned to the ON position. The CHIME will sound during the same time interval if the driver's seat belt is not fastened. Passenger belts are not connected to the system. The chime will activate if the drivers door is opened and:

- The key is in the ignition switch, with the ignition switch in either the OFF or accessory (ACC) position
- The head lamps are ON.

The chime is part of the instrument cluster.

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

DIAGNOSIS AND TESTING

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 and fully retracted. The seat belt warning lamp should light for four to eight seconds and the tone should sound three to five times.

HEADLAMPS LEFT ON

To test the headlamps left on function:

- Turn headlamps
- Driver's door open
- Key removed from the ignition switch

Chime should sound until headlamps are turned off or driver's door is closed.

KEY LEFT IN IGNITION SWITCH

To test the key left in ignition function, insert key into the ignition and open driver's door. Chime should sound until key is removed from ignition or driver's door is closed.

CHIME SYSTEM CONDITIONS

The cluster harness connector, J1 is car right and the J2 is car left.

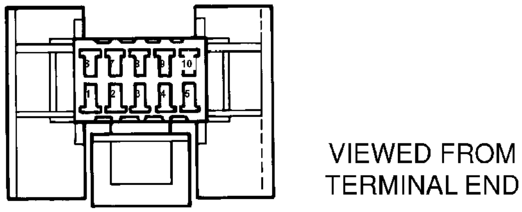
NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVERS SEAT BELT IS UNBUCKLED

(1) Using an ohmmeter, with the seat belt fully retracted, check for continuity to ground at Pin 4 of the J1 wire harness connector (Fig. 1). If OK, go to step 2. If not OK, repair as necessary.

(2) Check for continuity to ground at Pin 8 of the J1 wire harness connector. If OK, go to Step 3. If not OK, repair as necessary.

(3) Using voltmeter, check for battery feed at Pin 6 of the J1 wire harness connector. Check for ignition feed at Pin 5 of the J1 wire harness connector. If not OK, repair as necessary.

DIAGNOSIS AND TESTING (Continued)



CLUSTER WIRING HARNESS CONNECTORS			
J1 CONNECTOR		J2 CONNECTOR	
PIN	DESCRIPTION	PIN	DESCRIPTION
1	DOOR AJAR	1	OIL PRESSURE
2	HI BEAM	2	ABS
3	RIGHT TURN	3	MIL* (CHECK ENGINE)
4	SEAT BELT	4	ENGINE TEMPERATURE
5	IGNITION FEED	5	KEY IN HEADLAMPS ON
6	BATTERY	6	BRAKE
7	TACHOMETER SIGNAL	7	CHARGING SYSTEM
8	GROUND	8	LEFT TURN
9	AIRBAG	9	ILLUMINATION
10	SPEED SIGNAL	10	FUEL LEVEL

*MALFUNCTION INDICATOR LAMP

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Fig. 1 Cluster Wire Harness Connectors

NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS ON.

(1) Check for burned out lamp.

(2) Check for battery feed at cluster wire harness connector terminal J1-6 (Fig. 1).

(3) Check for ignition feed at cluster wire harness connector terminal J1-5. Repair as necessary.

NO TONE WHEN HEADLAMPS ARE ON AND DRIVERS DOOR IS OPEN

(1) Check left door jamb switch for good ground when drivers door is open.

(2) Check for ground at J2-5.

(3) Check for battery feed at cluster wire harness connector terminal J1-6 (Fig. 1).

(4) Check for NO voltage at J1-5. Ignition voltage must not be present for the chime to work.

(5) Check headlamp switch.

NO TONE WHEN KEY IS LEFT IN IGNITION AND DRIVERS DOOR IS OPEN

(1) Check for continuity to ground at Pin 8 of the J1 wire harness connector. If OK, go to Step 3. If not OK, repair as necessary.

(2) Using voltmeter, check for battery feed at Pin 6 of the J1 wire harness connector. Check for NO ignition feed at Pin 5 of the J1 wire harness connector. If OK, go to Step 3. If not OK, repair as necessary.

(3) Open driver's door and ensure the ignition key is in the OFF or ACC position. Check for continuity to ground at Pin 5 of the J2 wire harness connector. If ground OK, replace cluster printed circuit board. If no ground, check key-in switch or door switch wiring and repair as necessary.

CHIMES CONTINUE WHEN HEADLAMPS ARE TURNED OFF AND/OR KEY IS REMOVED FROM IGNITION

Check for ground at J2-5. If grounded the chime should activate. Make sure the door is closed, key is in ignition and parking lamps are OFF. If ground is still present check door switch, key in switch, headlamp switch and repair as necessary.

REMOVAL AND INSTALLATION

CHIME

The chime is built into the instrument cluster print circuit board. Refer to Group 8E, Instrument Panel and Gauges.

SEAT BELT BUCKLE

Refer to Group 23, Body of this service manual.

HEADLAMP SWITCH

Refer to Group 8E, Instrument Panel and Systems.

KEY-IN SWITCH

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.

WIRING DIAGRAMS

CONTENTS

8W-01 GENERAL INFORMATION

INDEX

DESCRIPTION AND OPERATION

HOW TO USE THIS GROUP

The purpose of this group is to show the electrical circuits in a clear, simple fashion and to make troubleshooting easier. Components that work together are shown together. All electrical components used in a specific system are shown on one diagram. The feed for a system is shown at the top of the page. All wires, connectors, splices, and components are shown in the flow of current to the bottom of the page. Wiring which is not part of the circuit represented is referenced to another page/section, where the complete circuit is shown. In addition, all switches, components, and modules are shown in the **at rest position with the doors closed and the key removed from the ignition.**

If a component is part of several different circuits, it is shown in the diagram for each. For example, the headlamp switch is the main part of the exterior lighting, but it also affects the interior lighting and the chime warning system. **It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.**

SECTION IDENTIFICATION

Sections in Group 8W are organized by sub-systems. The sections contain circuit operation descriptions, helpful information, and system diagrams. The intention is to organize information by system, consistently from year to year.

CONNECTOR/GROUND LOCATIONS

Section 8W-90 contains connector/ground location illustrations. The illustrations contain the connector name (or number)/ground number and component identification. Connector/ground location charts in Section 8W-90 reference the illustration number for components and connectors.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the Diagram pages.

SPLICE LOCATIONS

Splice Location charts in Section 8W-70 show the entire splice, and provide references to other sections the splice serves.

Section 8W-95 contains illustrations that show the general location of the splices in each harness. The illustrations show the splice by number, and provide a written location.

DESCRIPTION AND OPERATION (Continued)

NOTES, CAUTIONS, and WARNINGS

Throughout this group additional important information is presented in three ways; Notes, Cautions, and Warnings.

NOTES are used to help describe how switches or components operate to complete a particular circuit. They are also used to indicate different conditions that may appear on the vehicle. For example, an up-to and after condition.

CAUTIONS are used to indicate information that could prevent making an error that may damage the vehicle.

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER, AND MUFFLER.

WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING.

WIRE CODE IDENTIFICATION

Each wire shown in the diagrams contains a code (Fig. 1) 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. 2)

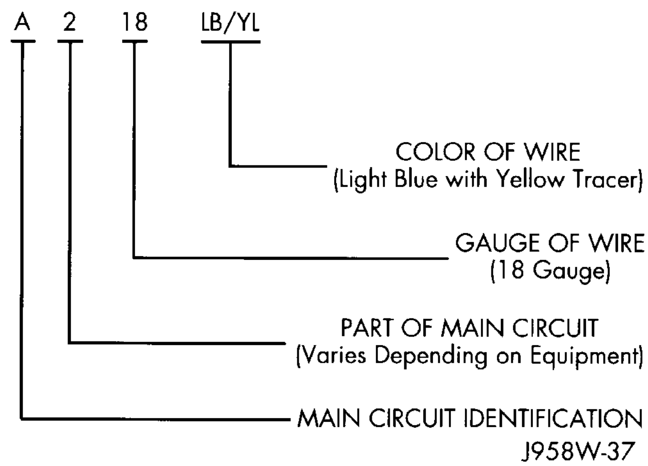

Fig. 1 Wire Code Identification

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	

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Fig. 2 Wire Color Code Chart

DESCRIPTION AND OPERATION (Continued)

CIRCUIT IDENTIFICATION

All circuits in the diagrams use an alpha/numeric code to identify the wire and its function (Fig. 3). To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT	FUNCTION
A	Battery Feed
B	Brake Controls
C	Climate Controls
D	Diagnostic Circuits
E	Dimming Illumination Circuits
F	Fused Circuits (Secondary Feed)
G	Monitoring Circuits (Gauges)
H	Open
I	Not Used
J	Open
K	Powertrain Control Module
L	Exterior Lighting
M	Interior Lighting
N	ESA Module
O	Not Used
P	Power Option (Battery Feed)
Q	Power Options (Battery Feed)
R	Passive Restraint
S	Suspension/Steering
T	Transmission/Transaxle/Transfer Case
U	Open
V	Speed Control, Washer/Wiper
W	Open
X	Audio Systems
Y	Open
Z	Grounds

948W-190

Fig. 3 Circuit Identification

CONNECTORS

Connectors shown in the diagrams are identified using the international standard arrows for male and female terminals (Fig. 4). A connector identifier is placed next to the arrows to indicate the connector number (Fig. 4).

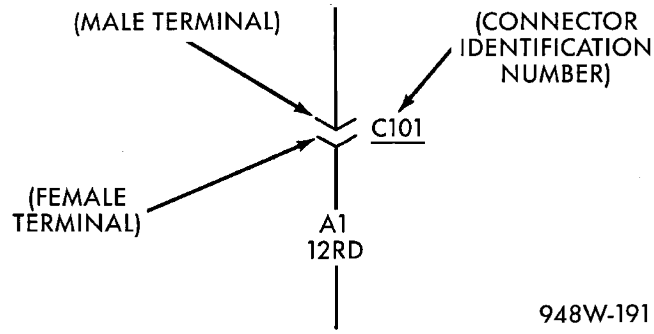


Fig. 4 Connector Identification

For viewing connector pin outs, with two terminals or greater, refer to section 8W-80. This section identifies in-line connectors by number, and component connectors by name. If a component has two or more connectors they will be identified as C1, C2, C3...etc. This sections also provides terminal numbering, circuit identification, wire colors, and functions.

All connectors are viewed from the terminal end unless otherwise specified. To find the connector location in the vehicle refer to section 8W-90. This section uses the connector identification number from the wiring diagrams to provide a figure number reference.

TAKE OUTS

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component.

SYMBOLS

Various symbols are used throughout the Wiring Diagrams. These symbols can be identified by referring to the symbol identification chart (Fig. 5).

DESCRIPTION AND OPERATION (Continued)

LEGEND OF SYMBOLS USED ON WIRING DIAGRAMS			
+	POSITIVE		BY-DIRECTIONAL ZENER DIODE
−	NEGATIVE		MOTOR
	GROUND		ARMATURE AND BRUSHES
	FUSE	C100	CONNECTOR IDENTIFICATION
	GANG FUSES WITH BUSS BAR		MALE CONNECTOR
	CIRCUIT BREAKER		FEMALE CONNECTOR
	CAPACITOR		DENOTES WIRE CONTINUES ELSEWHERE
Ω	OHMS		DENOTES WIRE GOES TO ONE OF TWO CIRCUITS
	RESISTOR		SPLICE
	VARIABLE RESISTOR	S100	SPLICE IDENTIFICATION
	SERIES RESISTOR		THERMAL ELEMENT
	COIL	TIMER	TIMER
	STEP UP COIL		MULTIPLE CONNECTOR
	OPEN CONTACT		OPTIONAL ◆ WIRING WITH ◇ WIRING WITHOUT
	CLOSED CONTACT		"Y" WINDINGS
	CLOSED SWITCH	88:88	DIGITAL READOUT
	OPEN SWITCH		SINGLE FILAMENT LAMP
	CLOSED GANGED SWITCH		DUAL FILAMENT LAMP
	OPEN GANGED SWITCH		L.E.D. — LIGHT EMITTING DIODE
	TWO POLE SINGLE THROW SWITCH		THERMISTOR
	PRESSURE SWITCH		GAUGE
	SOLENOID SWITCH		SENSOR
	MERCURY SWITCH		FUEL INJECTOR
	DIODE OR RECTIFIER		948W-192

Fig. 5 Symbol Identification

DESCRIPTION AND OPERATION (Continued)

ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 6) is used to indicate this. When handling any component with this symbol comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.

(3) When using a voltmeter, be sure to connect the ground lead first.

(4) Do not remove the part from its protective packing until it is time to install the part.

(5) Before removing the part from its package, ground the package to a known good ground on the vehicle.

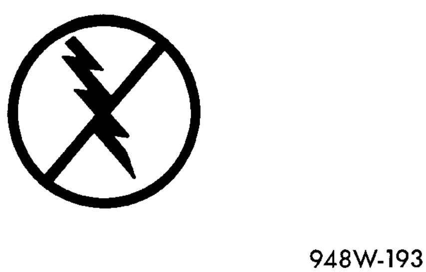


Fig. 6 Electrostatic Discharge Symbol

FASTENERS

CAUTION: At no time when servicing a vehicle, can a sheet metal screw, bolt, or other metal fastener be installed in the strut tower to take the place of an original plastic clip. Also, NO holes can be drilled into the front strut tower in the area shown in (Fig. 7) for the installation of any metal fasteners into the strut tower. Because of the minimum clearance in this area (Fig. 7) installation of metal fasteners could damage the coil spring coating and lead to a corrosion failure of the spring. If a plastic clip is missing, or is lost or broken during servicing a vehicle, replace only with the equivalent part listed in the parts catalog.

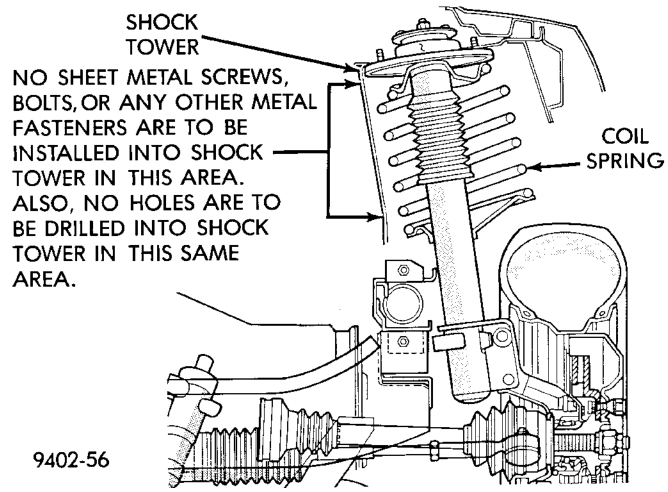


Fig. 7 Shock Tower to Spring Minimum Clearance Area

POSITIVE TEMPERATURE COEFFICIENT

Positive Temperature Coefficient (PTC) devices are being used for circuit protection. These PTC's act like a solid state fuse. They are located in the junction block, and are used to protect such items as: power door lock motors, power windows, and various engine solenoids.

A special symbol is used to identify these in the wiring diagrams (Fig. 8).

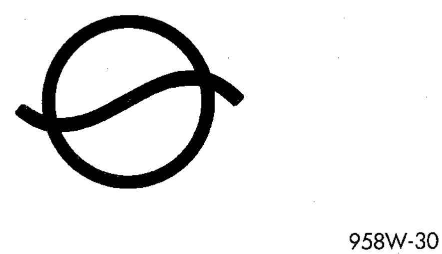


Fig. 8 Positive Temperature Coefficient Symbol

DIAGNOSIS AND TESTING

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

• Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.

DIAGNOSIS AND TESTING (Continued)

• Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicle are solid state. When checking voltages in these circuits use a meter with a 10-megohm or greater impedance.

• Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: - Most of the electrical components used in today's vehicle are Solid State. When checking resistance in these circuits use a meter with a 10-megohm or greater impedance. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle electrical system can cause damage to the equipment and provide false readings.

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 9). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.

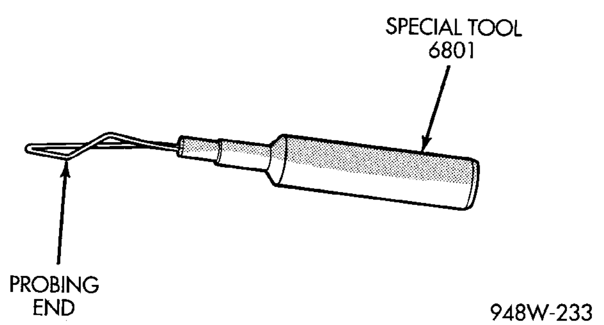


Fig. 9 Probing Tool

INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly check the following items.

• Connectors are fully seated
• Spread terminals, or terminal push out
• Terminals in the wiring assembly are fully seated into the connector/component and locked in position
• Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
• Damaged connector/component casing exposing the item to dirt and moisture
• Wire insulation that has rubbed through causing a short to ground
• Wiring broke inside of the insulation

CHECKING FOR TERMINAL SPREADING

When an intermittent or open circuit is suspected it is important to check for a spread terminal. To accomplish this remove the suspect female terminal from its connector.

Check the female terminal for drag when mated with the appropriate male terminal. If the terminal is spread (no or little drag felt) replace the terminal using the procedures covered in this section of the wiring diagrams.

TROUBLESHOOTING TESTS

Before beginning any tests on a vehicles electrical system use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems section in this section.

TESTING FOR VOLTAGE

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 10).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

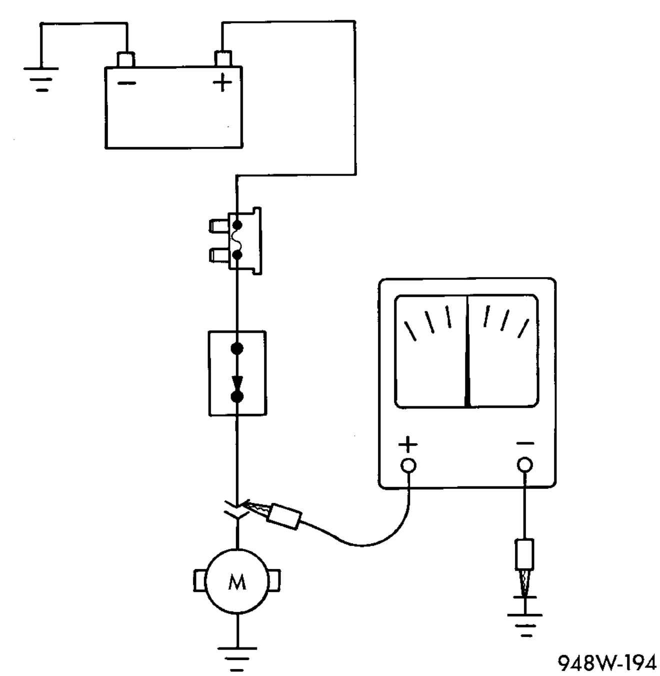


Fig. 10 Testing for Voltage

TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 11).

DIAGNOSIS AND TESTING (Continued)

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

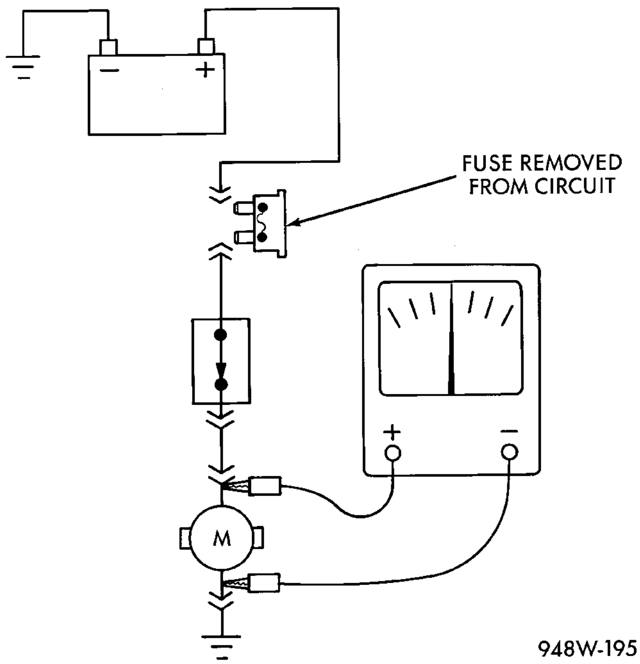


Fig. 11 Testing for Continuity

TESTING FOR A SHORT TO GROUND

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

(1) Refer to the wiring diagrams and disconnect or isolate all items on the fused circuit.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

TESTING FOR A VOLTAGE DROP

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 12).

(2) Connect the other lead of the voltmeter to the other side of the switch or component.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

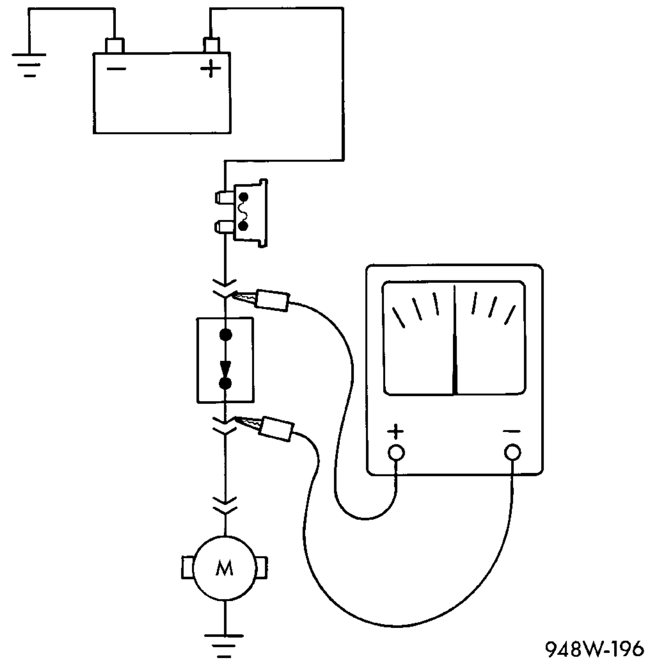


Fig. 12 Testing for Voltage Drop

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.

(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.

(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.

(4) Isolate the problem area.

(5) Repair the problem.

(6) Verify proper operation. For this step check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

SERVICE PROCEDURES

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct 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

SERVICE PROCEDURES (Continued)

(2) Remove 1 inch of insulation from each end of the wire.

(3) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(4) Spread the strands of the wire apart on each part of the exposed wire (example 1). (Fig. 13)

(5) Push the two ends of wire together until the strands of wire are close to the insulation (example 2) (Fig. 13)

(6) Twist the wires together (example 3) (Fig. 13)

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(8) Center the heat shrink tubing over the joint, and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(9) Secure the wire to the existing ones to prevent chafing or damage to the insulation

(10) Connect battery and test all affected systems.

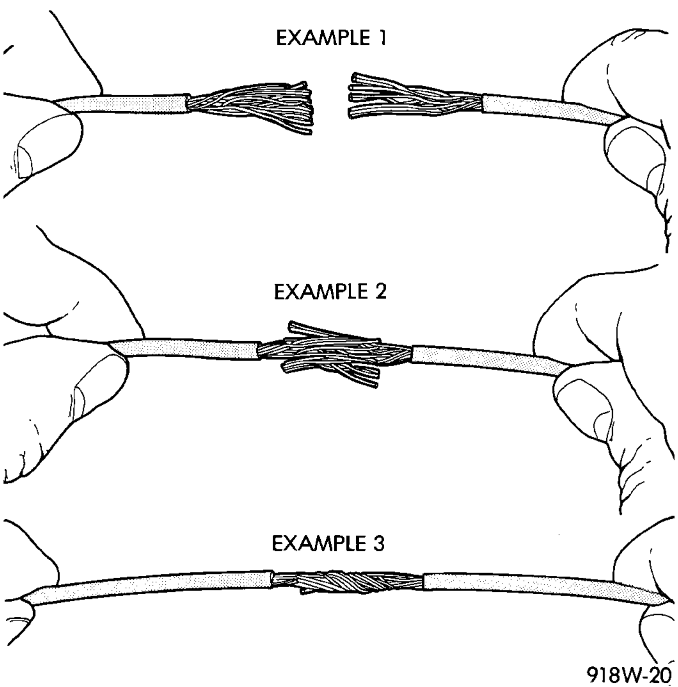


Fig. 13 Wire Repair

FUSIBLE LINK REPLACEMENT

On PL vehicles there is a fusible link placed between the output terminal of the generator and the engine starter motor terminal. A service part is available if this fusible link requires replacement.

This service part has the eyelet that attaches to the starter motor. If the fusible link requires replacement this indicates a problem in the charging/starting system that needs to be corrected.

Replacement of the fusible link is the same as repairing a wire. Refer to the wiring repair information in this section for soldering information.

TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

(3) Insert the terminal releasing special tool 6742 into the terminal end of the connector (Fig. 14).

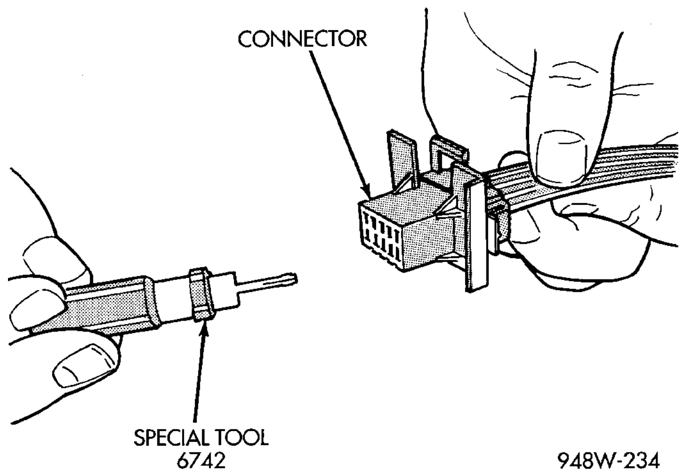


Fig. 14 Molex Connector Repair

(4) Using special tool 6742 release the locking fingers on the terminal (Fig. 15).

(5) Pull on the wire to remove it from the connector.

(6) Repair or replace the connector or terminal, as necessary.

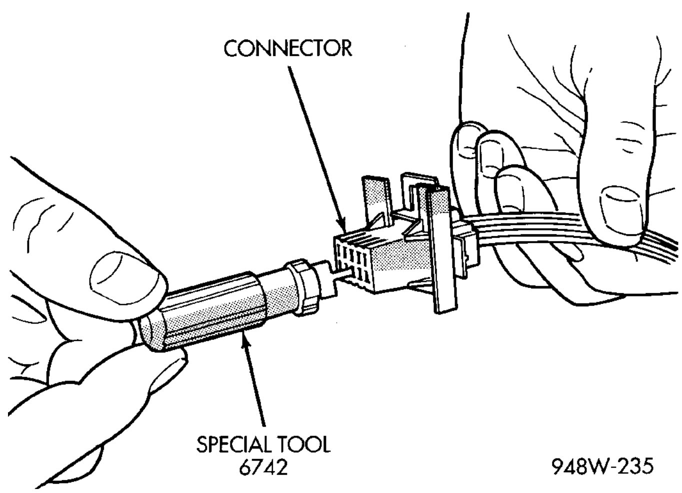


Fig. 15 Using Special Tool 6742

SERVICE PROCEDURES (Continued)

CONNECTOR REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector that is to be repaired from its mating half/component

(3) Remove the connector locking wedge, if required (Fig. 16)

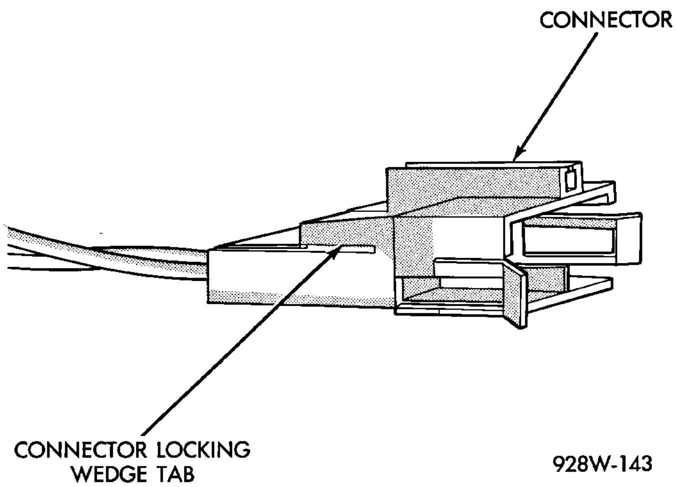


Fig. 16 Connector Locking Wedge

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 17) (Fig. 18).

(5) Reset the terminal locking tang, if it has one.

(6) Insert the removed wire in the same cavity on the repair connector.

(7) Repeat steps four through six for each wire in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.

(8) Insert the connector locking wedge into the repaired connector, if required.

(9) Connect connector to its mating half/component.

(10) Connect battery and test all affected systems.

CONNECTOR AND TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector (that is to be repaired) from its mating half/component.

(3) Cut off the existing wire connector directly behind the insulator. Remove six inches of tape from the harness.

(4) Stagger cut all wires on the harness side at 1/2 inch intervals (Fig. 19).

(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

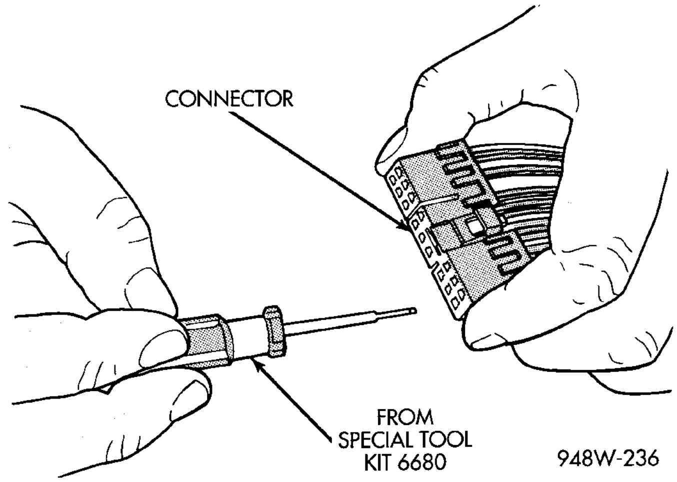


Fig. 17 Terminal Removal

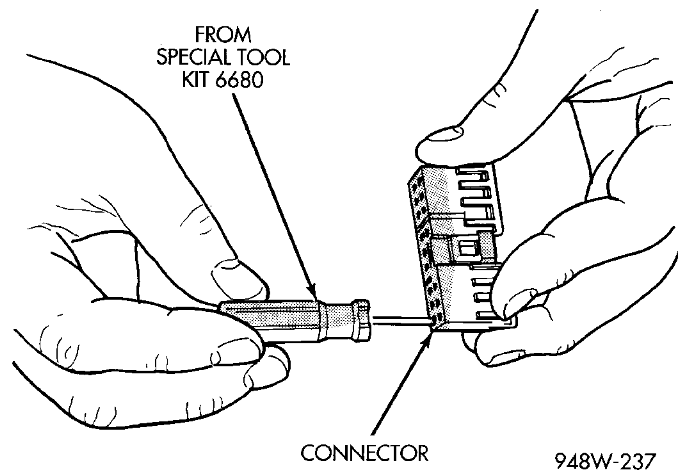


Fig. 18 Terminal Removal Using Special Tool

for soldered connections. Check that the overall length is the same as the original (Fig. 19).

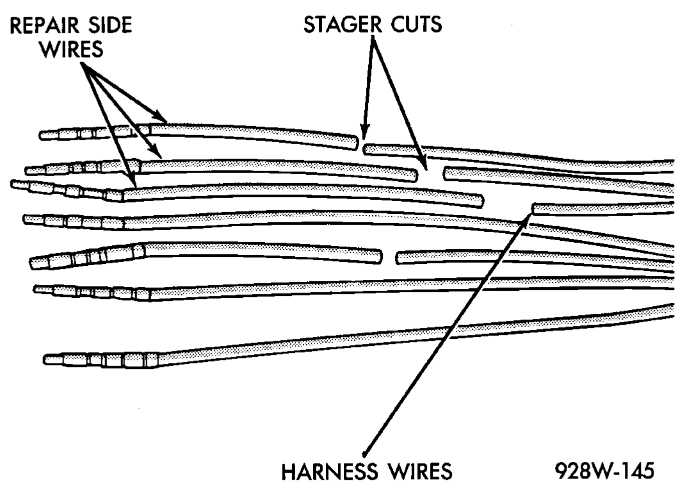


Fig. 19 Stagger Cutting Wires

(7) Remove 1 inch of insulation from each wire.

SERVICE PROCEDURES (Continued)

(8) Place a piece of heat shrink tubing over one side of the wire. Be sure the tubing will be long enough to cover and seal the entire repair area.

(9) Spread the strands of the wire apart on each part of the exposed wires.

(10) Push the two ends of wire together until the strands of wire are close to the insulation.

(11) Twist the wires together.

(12) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(13) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing

(14) Repeat steps 8 through 13 for each wire.

(15) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(16) Re-connect the repaired connector.

(17) Connect the battery, and test all affected systems.

TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector being repaired from its mating half. Remove connector locking wedge, if required (Fig. 20).

(3) Remove connector locking wedge, if required (Fig. 20).

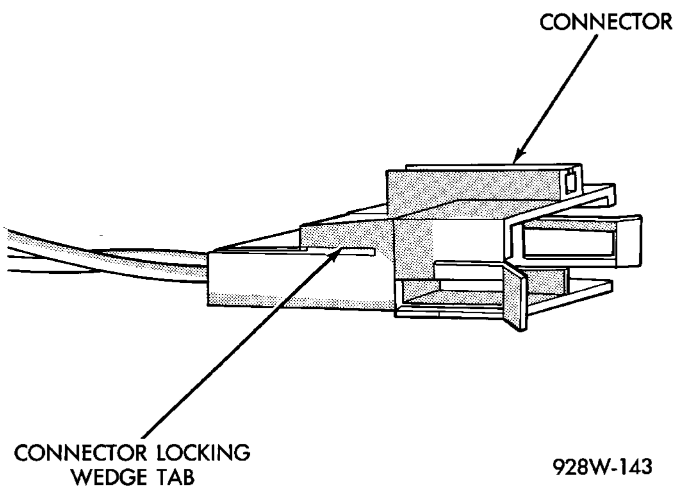


Fig. 20 Connector Locking Wedge Tab (Typical)

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 21) (Fig. 22).

(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.

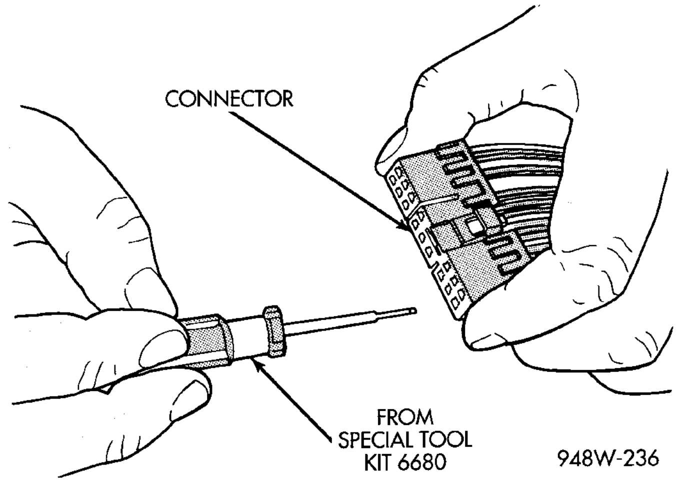


Fig. 21 Terminal Removal

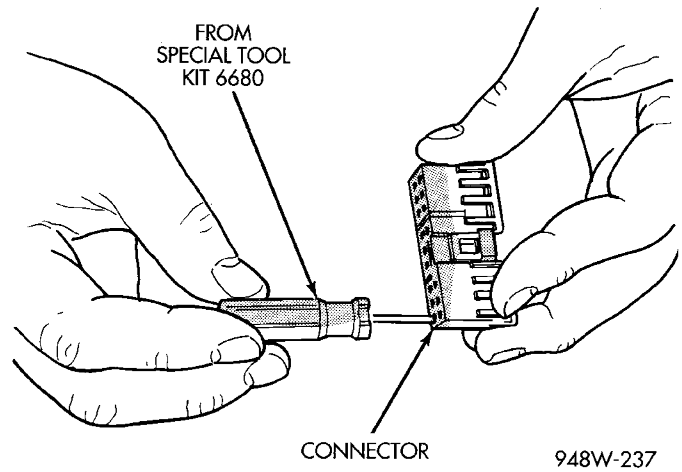


Fig. 22 Terminal Removal Using Special Tool

(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.

(11) Push the two ends of wire together until the strands of wire are close to the insulation.

(12) Twist the wires together.

(13) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(14) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(15) Insert the repaired wire into the connector.

(16) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(17) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(18) Connect battery, and test all affected systems.

SERVICE PROCEDURES (Continued)

DIODE REPLACEMENT

(1) Disconnect the battery.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 23).

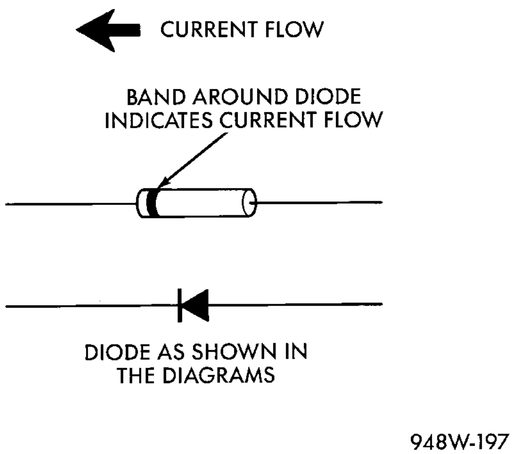


Fig. 23 Diode Identification

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

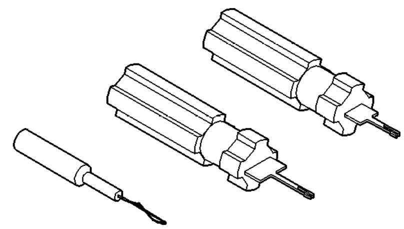
(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

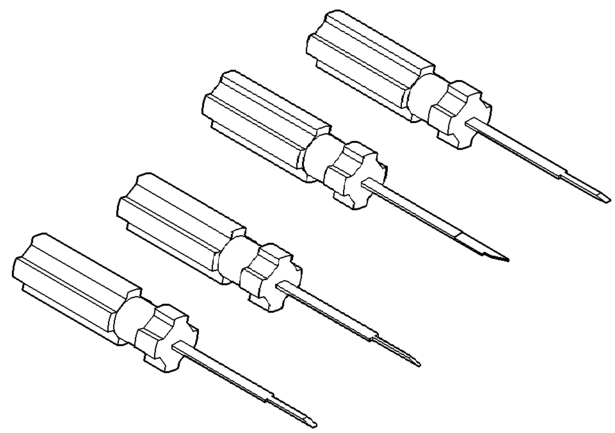
(8) Re-connect the battery, and test affected systems.

SPECIAL TOOLS

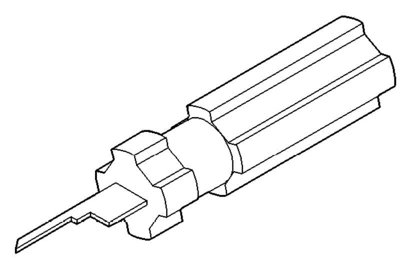
WIRING/TERMINAL



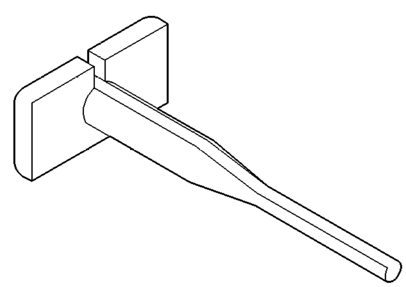
Probing Tool Package 6807



Terminal Pick 6680



Terminal Removing Tool 6932



Terminal Removing Tool 6934

8W-02 COMPONENT INDEX

INDEX

8W-02 COMPONENT INDEX

GENERAL INFORMATION

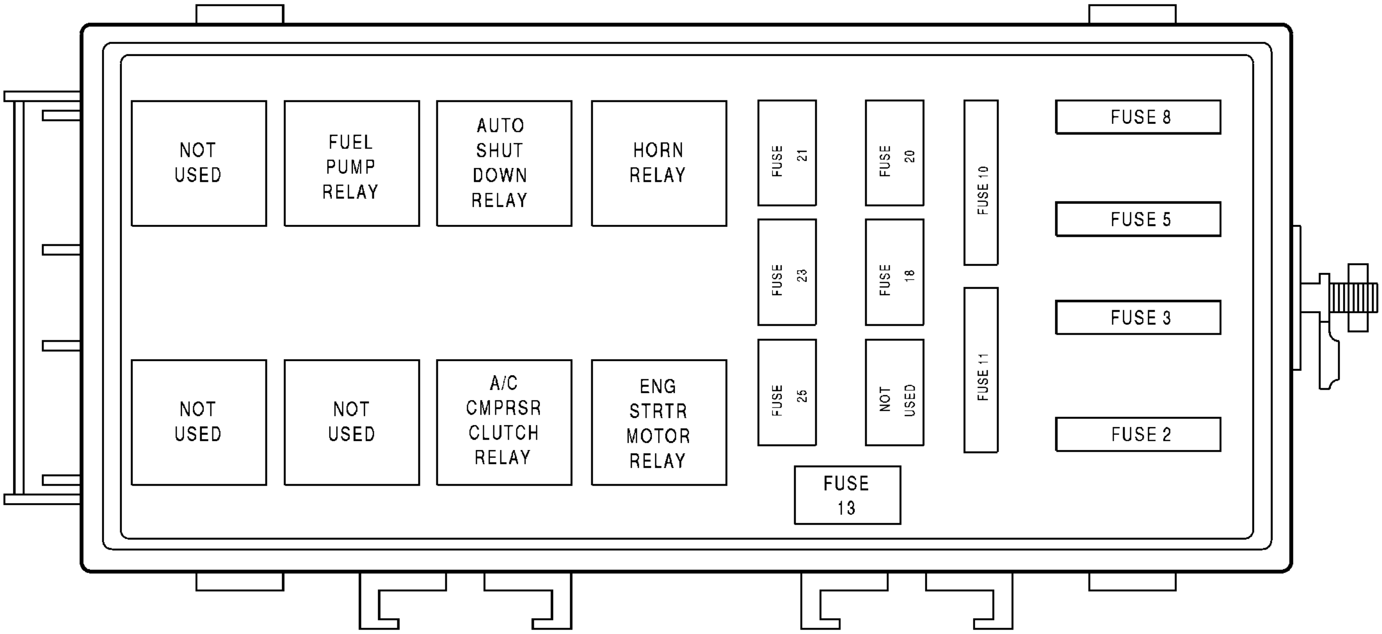
INTRODUCTION

This section provides an alphabetical listing of all the components covered in group 8W. For information on system operation, refer to the appropriate section of the wiring diagrams.

8W-10 POWER DISTRIBUTION

INDEX

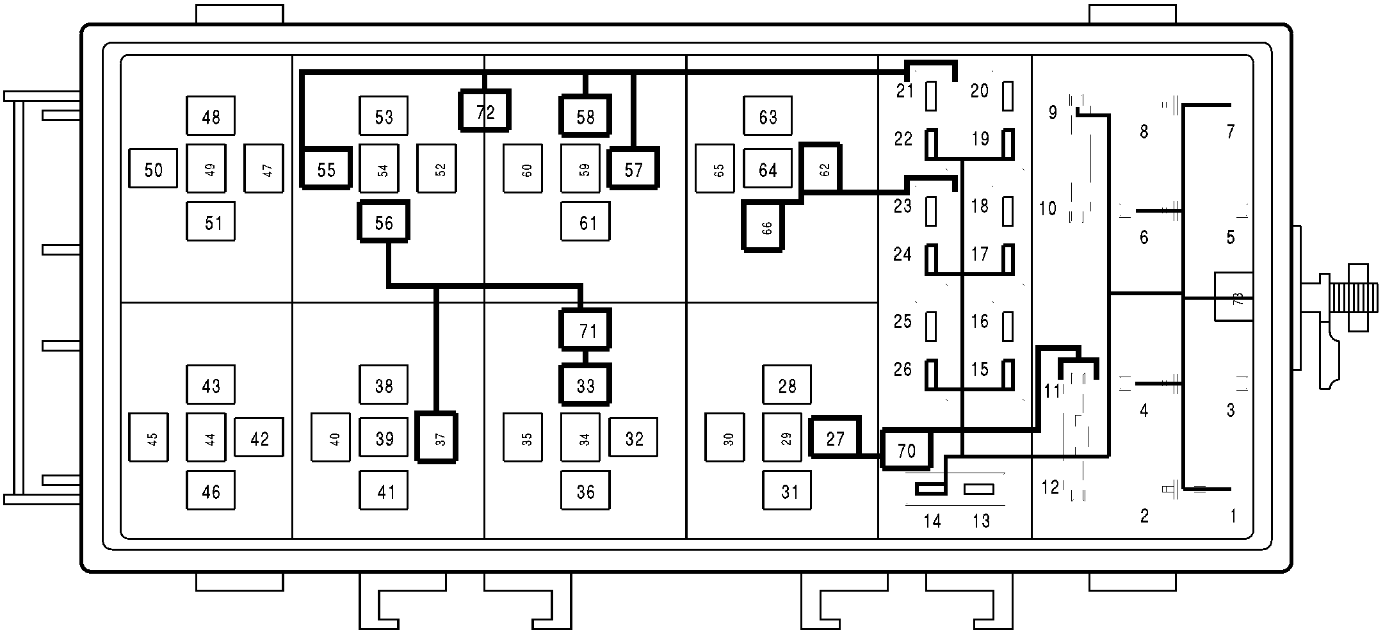
TOP OF
POWER DISTRIBUTION CENTER



PDC FUSE APPLICATION CHART

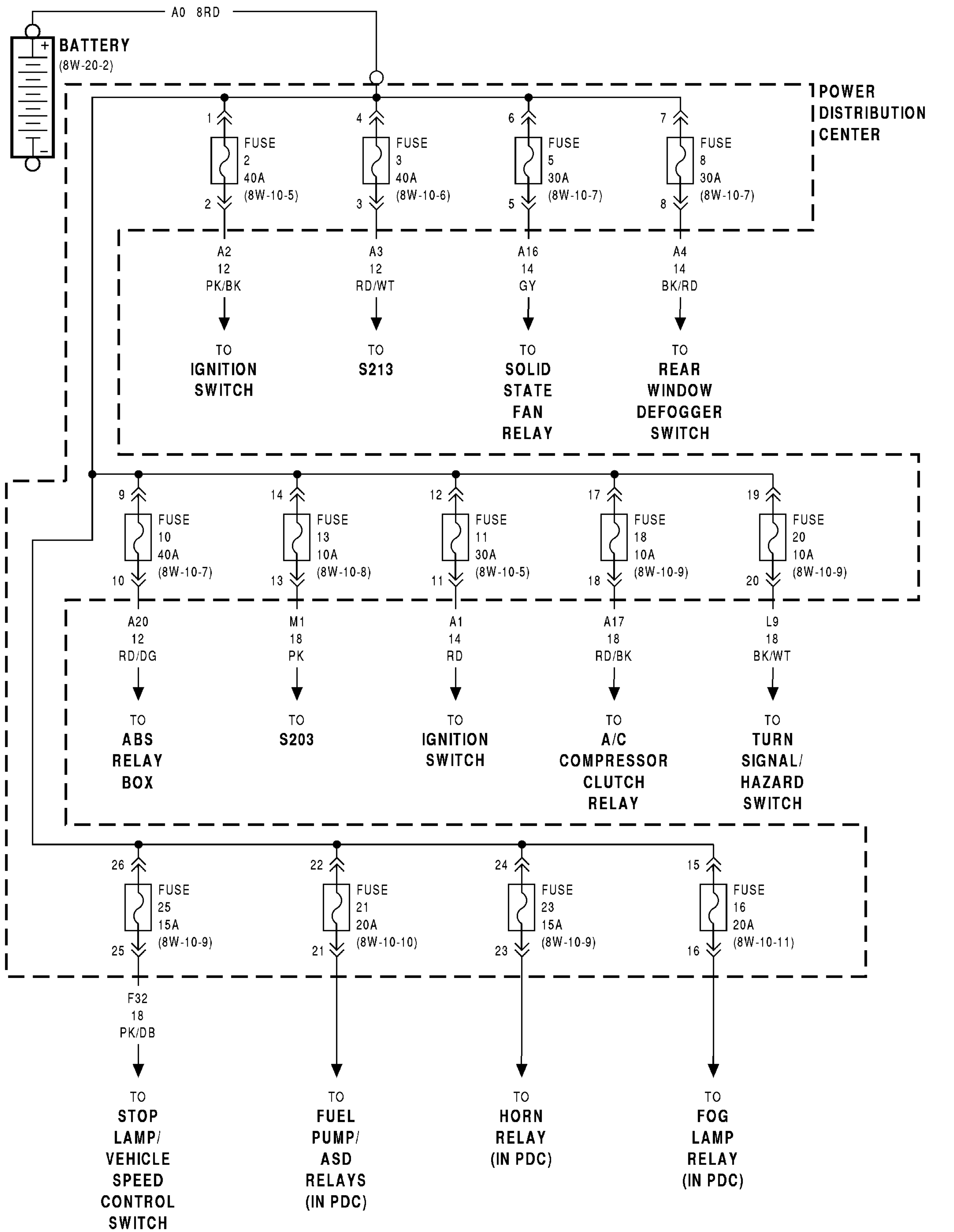
FUSE NO.	AMPS	CIRCUIT	FUNCTION
2	40A	A2 12PK/BK	FUSED B+
3	40A	A3 12RD/WT	FUSED B+
5	30A	A16 14GY	FUSED B+
8	30A	A4 14BK/RD	FUSED B+
10	40A	A20 12RD/DG	FUSED B+
11	30A	A1 14RD	FUSED B+
13	10A	M1 18PK	FUSED B+
		M1 18PK	FUSED B+
16	20A	F61 18WT/OR	FUSED B+
		F61 18WT/OR	FUSED B+
18	10A	A17 18RD/BK	FUSED B+
20	10A	L9 18BK/WT	FUSED B+
21	20A	A14 16RD/WT	FUSED B+
23	15A	F32 18PK/DB	FUSED B+
25	15A	F32 18PK/DB	FUSED B+

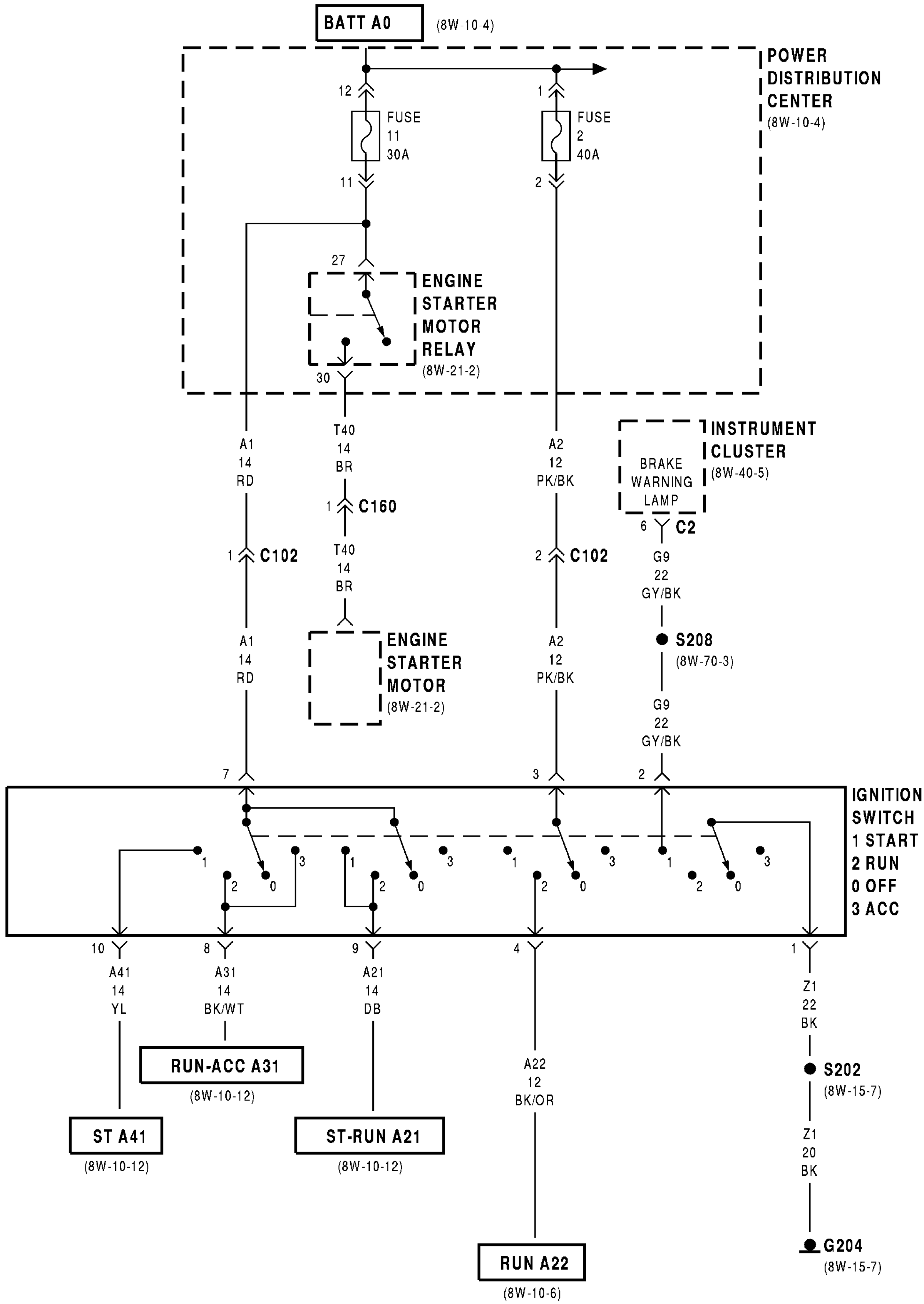
BOTTOM OF
POWER DISTRIBUTION CENTER

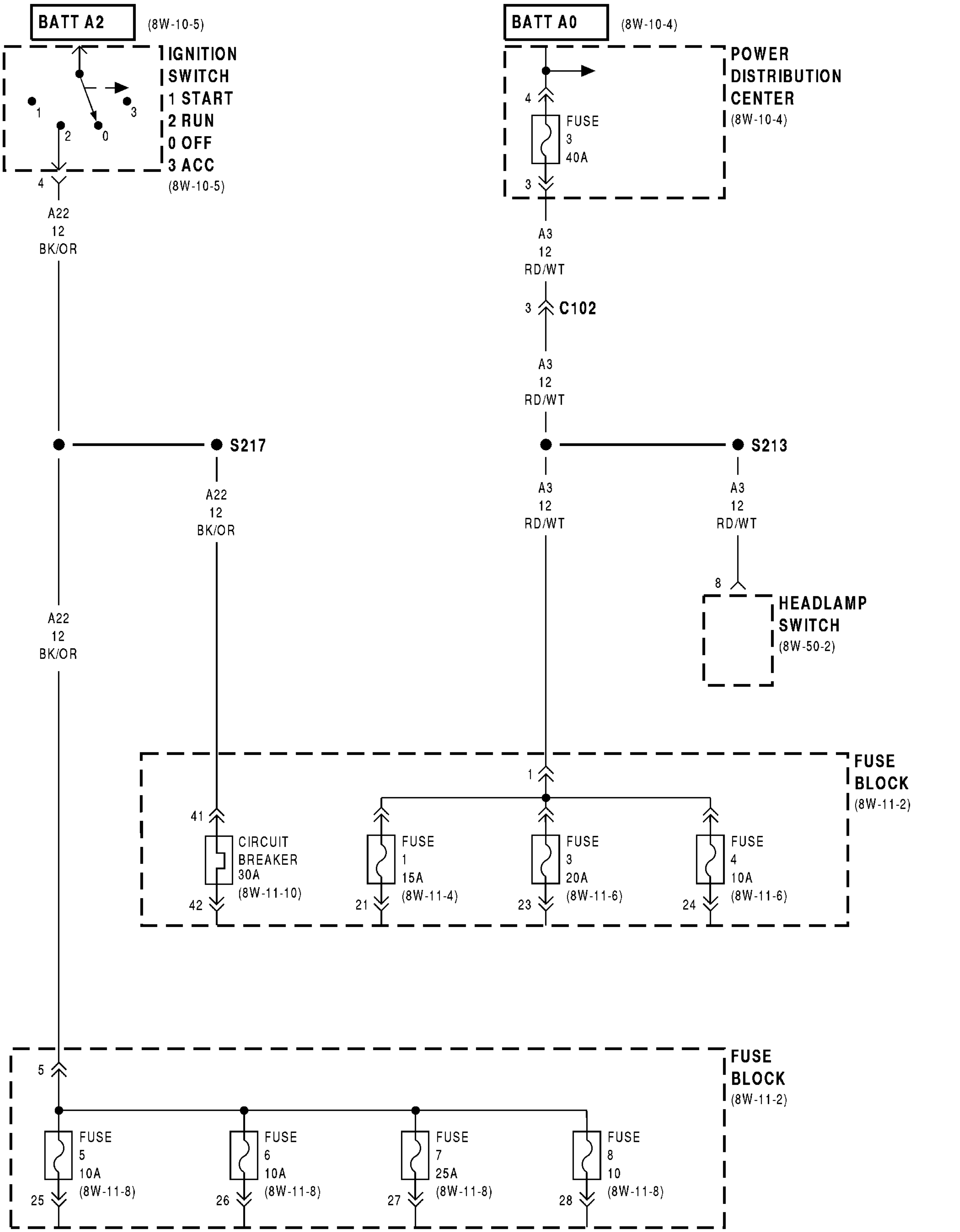


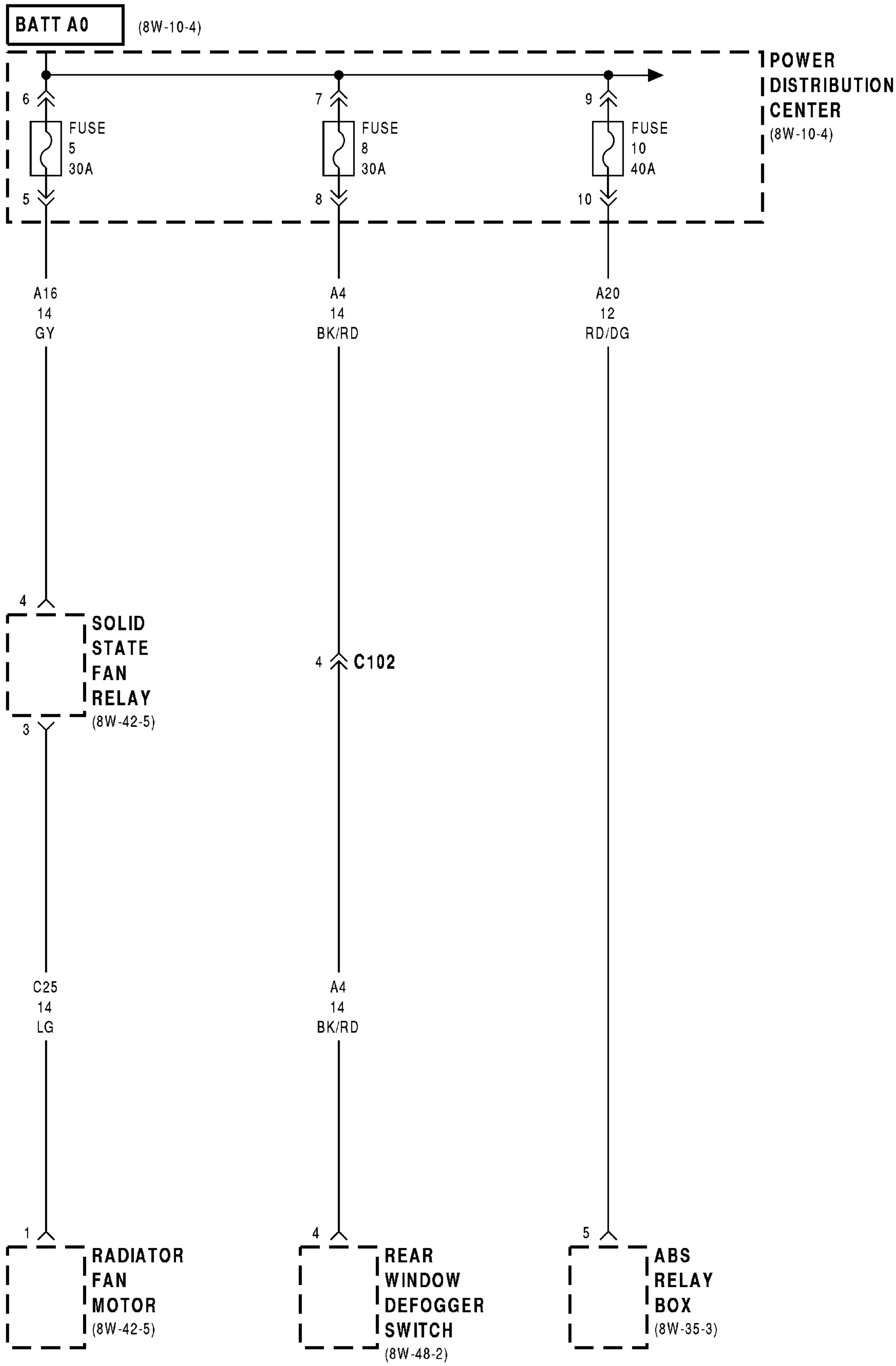
CAV	CIRCUIT	FUNCTION
2	A2 12PK/BK	FUSED B+
3	A3 12RD/WT	FUSED B+
5	A16 14GY	FUSED B+
8	A4 14BK/RD	FUSED B+
10	A20 12RD/DG	FUSED B+
13	M1 18PK	FUSED B+
	M1 18PK	FUSED B+
18	A17 18RD/BK	FUSED B+
20	L9 18BK/WT	FUSED B+
25	F32 18PK/DB	FUSED B+
28 A/T	A41 14YL	FUSED IGNITION (START)
28 M/T	T141 14YL/RD	FUSED IGNITION (START)
30	T40 14BR	ENGINE STARTER MOTOR RELAY OUTPUT
31 A/T	T41 18BR/YL	PARK/NEUTRAL POSITION SWITCH SENSE
31 M/T	Z1 18BK	GROUND
32	A17 18RD/BK	FUSED B+
35	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
36	C28 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
38	C25 14LG	FAN CONTROL RELAY OUTPUT
40	C27 18DB/PK	FAN CONTROL RELAY CONTROL
41	A16 14GY	FUSED B+
52	A141 16DG/WT	FUEL PUMP RELAY OUTPUT
53	K31 18BR	FUEL PUMP RELAY CONTROL
60	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
61	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
63	X2 18DG/RD	HORN RELAY OUTPUT
65	X3 18BK/RD	HORN RELAY CONTROL
70	A1 14RD	FUSED B+
71	F12 18LG/BK	FUSED IGNITION (START-RUN)
72	A14 16RD/WT	FUSED B+
73	A0 8RD	B+

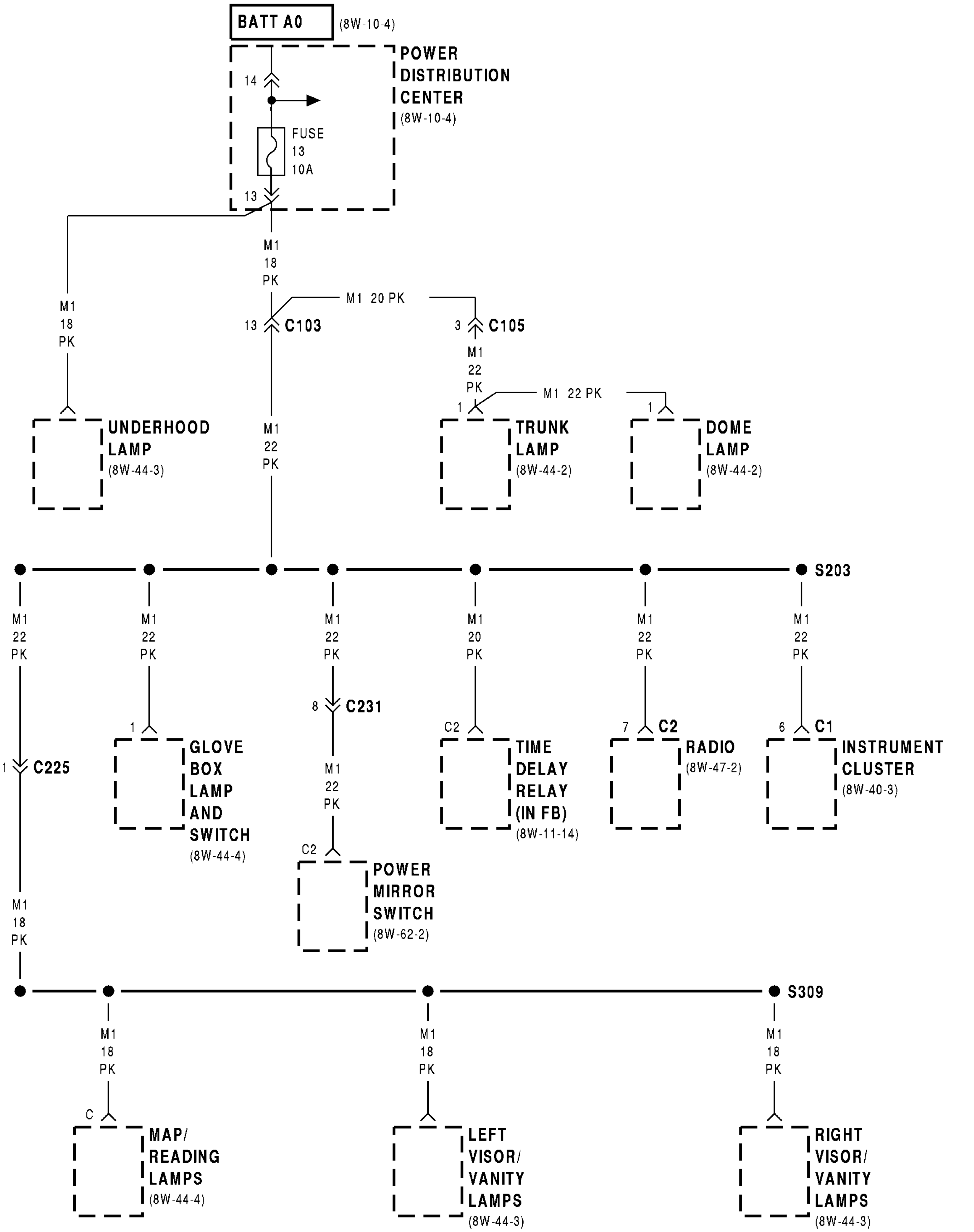
PLL01002 978W-1

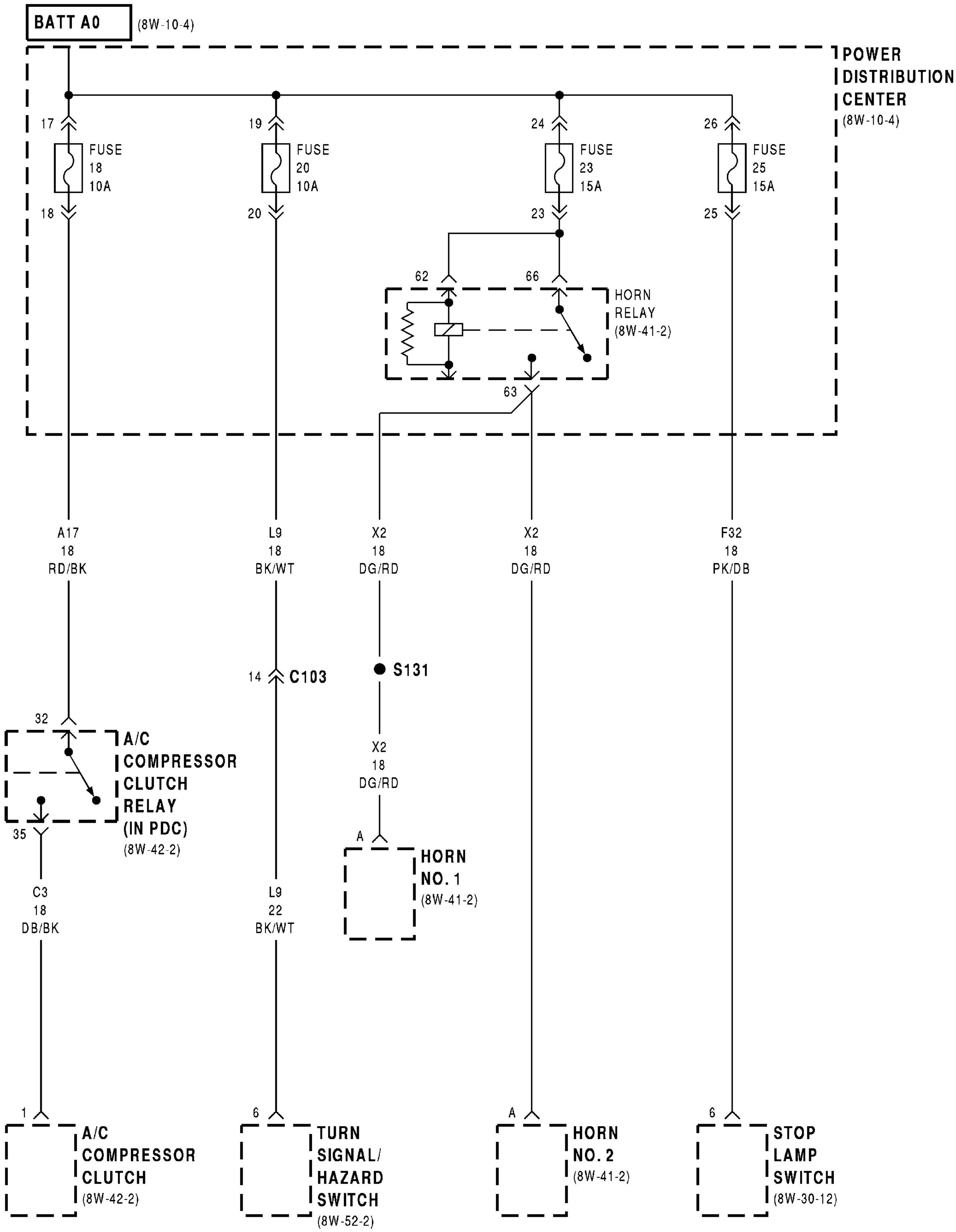

A0 8RD
BATTERY
(8W-20-2)
POWER
DISTRIBUTION
CENTER
FUSE 2 40A (8W-10-5)
FUSE 3 40A (8W-10-6)
FUSE 5 30A (8W-10-7)
FUSE 8 30A (8W-10-7)
A2 12 PK/BK
TO IGNITION SWITCH
A3 12 RD/WT
TO S213
A16 14 GY
TO SOLID STATE FAN RELAY
A4 14 BK/RD
TO REAR WINDOW DEFOGGER SWITCH
FUSE 10 40A (8W-10-7)
FUSE 13 10A (8W-10-8)
FUSE 11 30A (8W-10-5)
FUSE 18 10A (8W-10-9)
FUSE 20 10A (8W-10-9)
A20 12 RD/DG
TO ABS RELAY BOX
M1 18 PK
TO S203
A1 14 RD
TO IGNITION SWITCH
A17 18 RD/BK
TO A/C COMPRESSOR CLUTCH RELAY
L9 18 BK/WT
TO TURN SIGNAL/ HAZARD SWITCH
FUSE 25 15A (8W-10-9)
FUSE 21 20A (8W-10-10)
FUSE 23 15A (8W-10-9)
FUSE 16 20A (8W-10-11)
F32 18 PK/DB
TO STOP LAMP/ VEHICLE SPEED CONTROL SWITCH
TO FUEL PUMP/ ASD RELAYS (IN PDC)
TO HORN RELAY (IN PDC)
TO FOG LAMP RELAY (IN PDC)

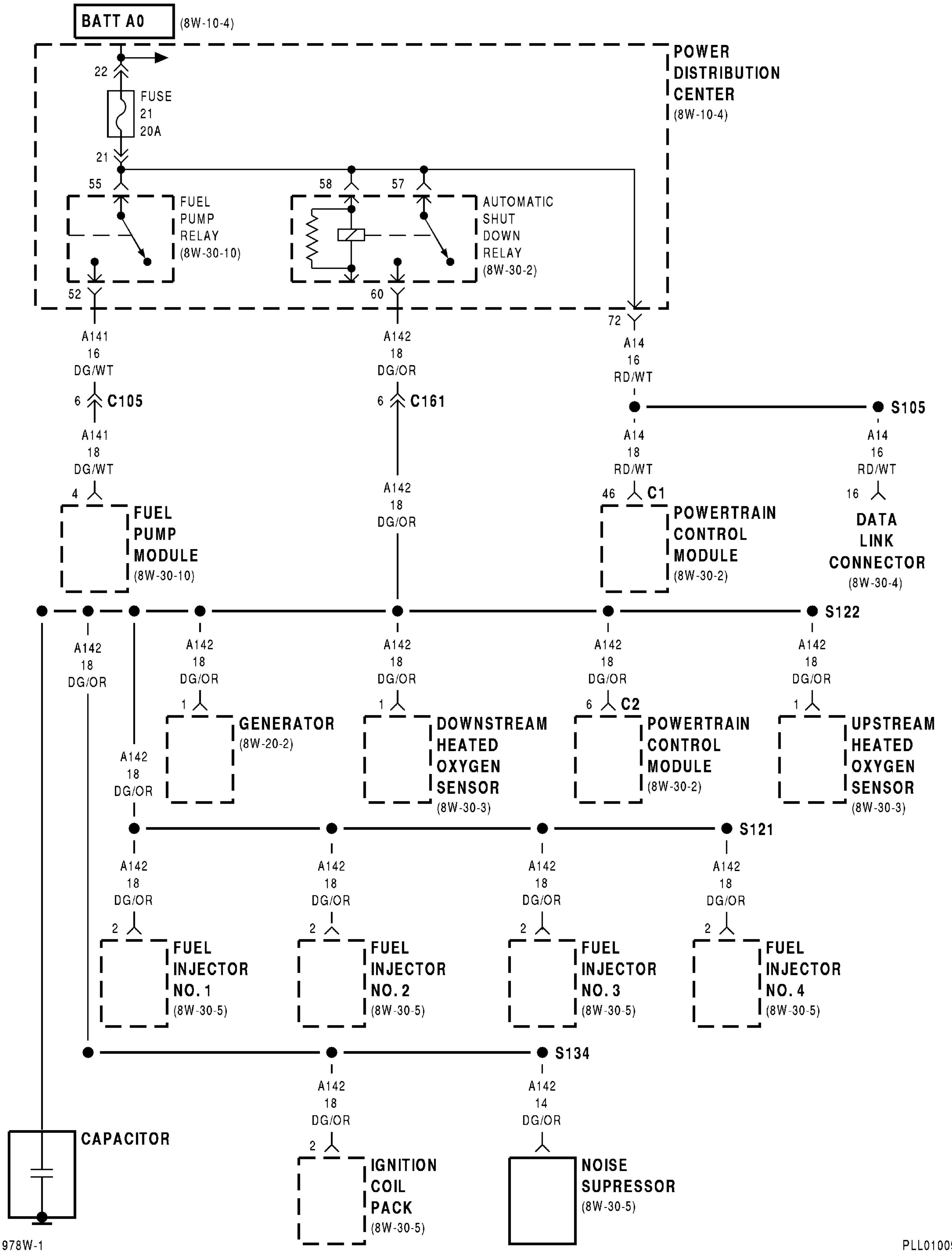

BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
12
FUSE 11 30A
11
1
FUSE 2 40A
2
27
ENGINE STARTER MOTOR RELAY
(8W-21-2)
30
INSTRUMENT CLUSTER
(8W-40-5)
BRAKE WARNING LAMP
6 C2
A1 14 RD
T40 14 BR
1 C160
T40 14 BR
A2 12 PK/BK
1 C102
2 C102
G9 22 GY/BK
S208
(8W-70-3)
G9 22 GY/BK
ENGINE STARTER MOTOR
(8W-21-2)
A1 14 RD
A2 12 PK/BK
7
3
2
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 ACC
10
8
9
4
1
A41 14 YL
A31 14 BK/WT
A21 14 DB
Z1 22 BK
RUN-ACC A31
(8W-10-12)
A22 12 BK/OR
S202
(8W-15-7)
Z1 20 BK
ST A41
(8W-10-12)
ST-RUN A21
(8W-10-12)
G204
(8W-15-7)
RUN A22
(8W-10-6)


BATT A2
(8W-10-5)
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 ACC
(8W-10-5)
1
2
0
3
4
A22
12
BK/OR
BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
4
FUSE
3
40A
3
A3
12
RD/WT
3
C102
A3
12
RD/WT
S217
A22
12
BK/OR
S213
A3
12
RD/WT
A3
12
RD/WT
8
HEADLAMP SWITCH
(8W-50-2)
A22
12
BK/OR
FUSE BLOCK
(8W-11-2)
1
41
CIRCUIT BREAKER
30A
(8W-11-10)
42
FUSE
1
15A
(8W-11-4)
21
FUSE
3
20A
(8W-11-6)
23
FUSE
4
10A
(8W-11-6)
24
FUSE BLOCK
(8W-11-2)
5
FUSE
5
10A
(8W-11-8)
25
FUSE
6
10A
(8W-11-8)
26
FUSE
7
25A
(8W-11-8)
27
FUSE
8
10
(8W-11-8)
28

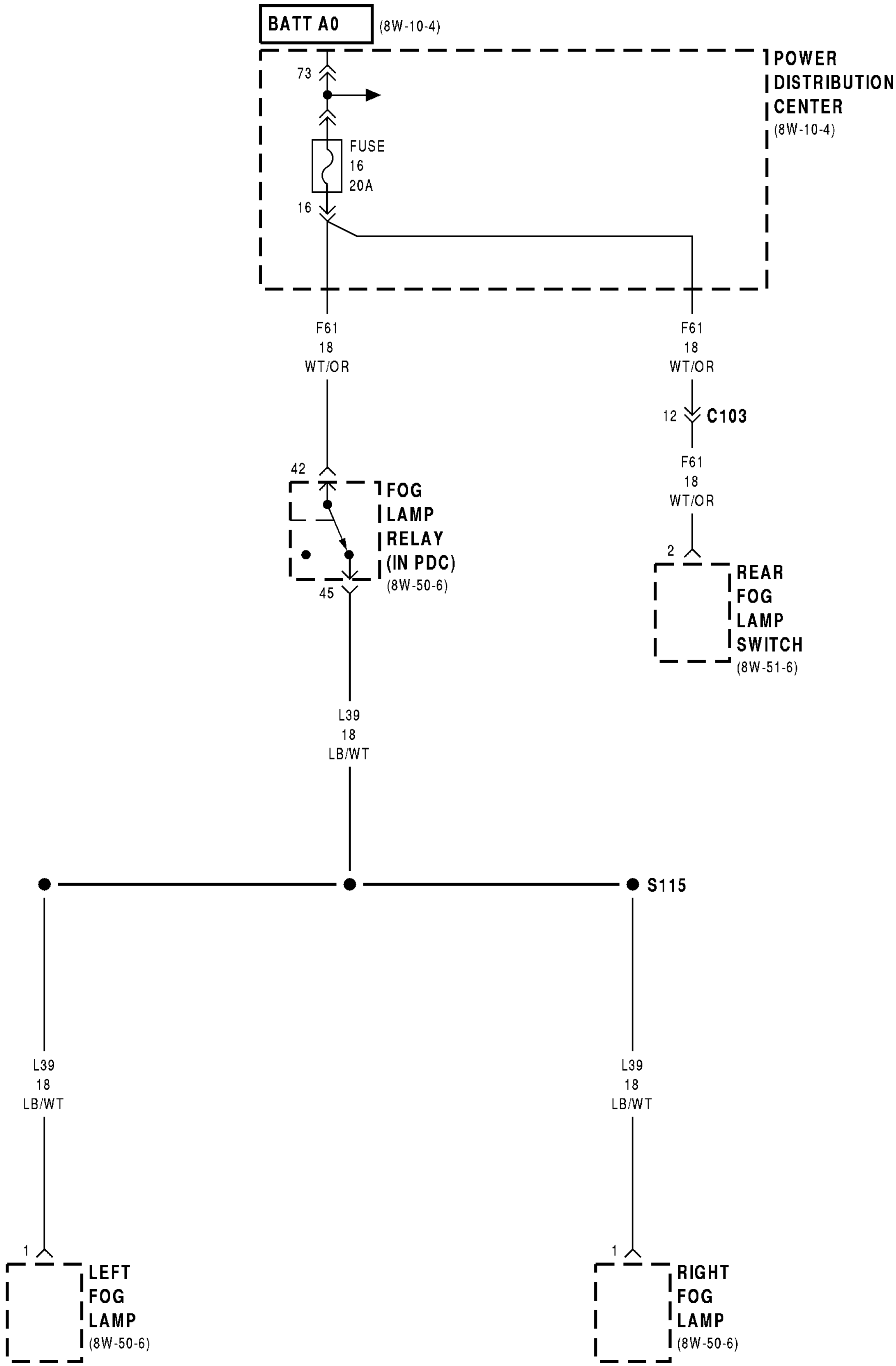

BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
6
FUSE
5
30A
5
7
FUSE
8
30A
8
9
FUSE
10
40A
10
A16
14
GY
A4
14
BK/RD
A20
12
RD/DG
4
SOLID
STATE
FAN
RELAY
(8W-42-5)
3
4
C102
C25
14
LG
A4
14
BK/RD
1
RADIATOR
FAN
MOTOR
(8W-42-5)
4
REAR
WINDOW
DEFOGGER
SWITCH
(8W-48-2)
5
ABS
RELAY
BOX
(8W-35-3)

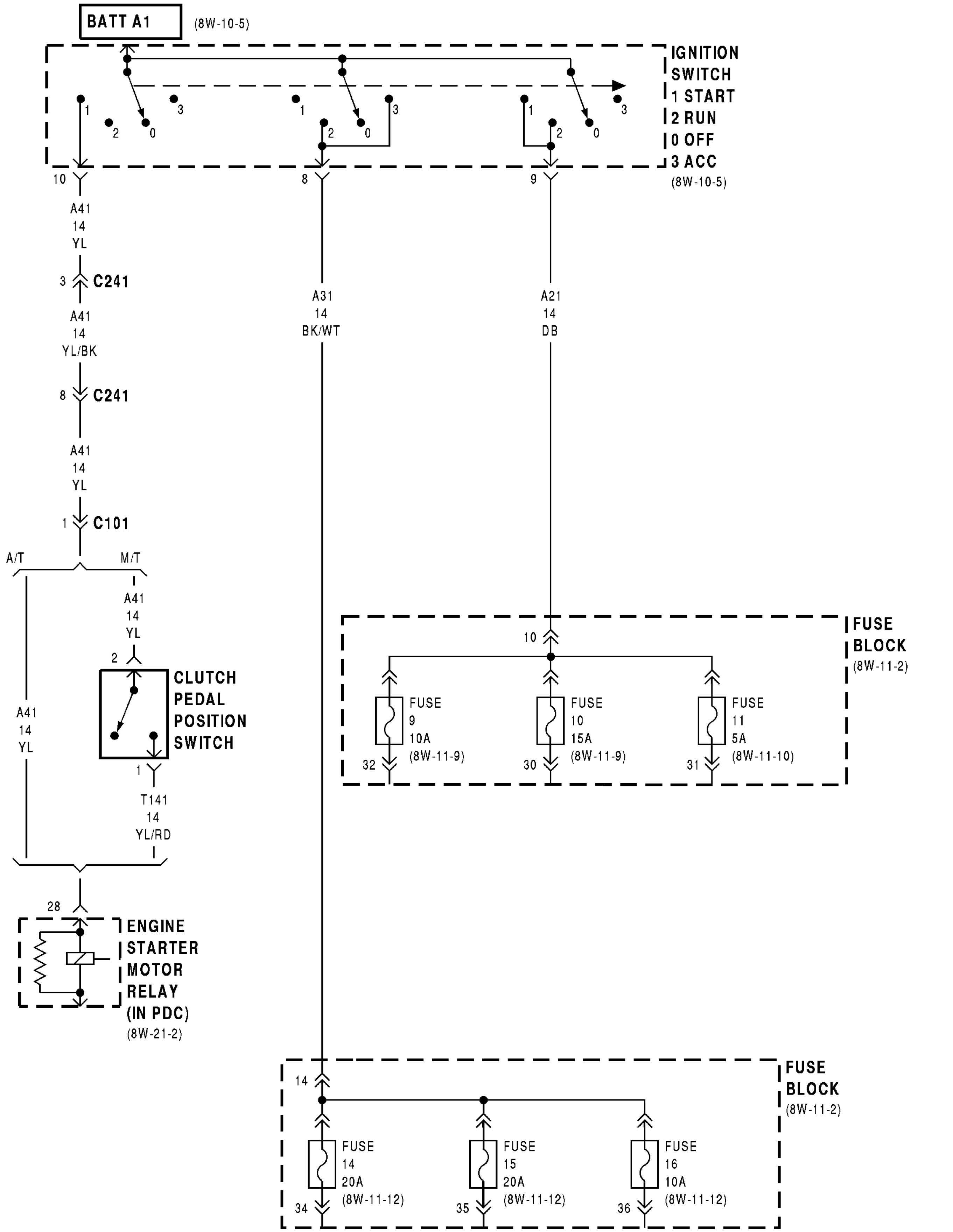

BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
14
FUSE
13
10A
13
M1
18
PK
M1 20 PK
13
C103
3
C105
M1
22
PK
M1 22 PK
1
1
M1
18
PK
UNDERHOOD
LAMP
(8W-44-3)
M1
22
PK
TRUNK
LAMP
(8W-44-2)
DOME
LAMP
(8W-44-2)
S203
M1
22
PK
M1
22
PK
M1
22
PK
M1
20
PK
M1
22
PK
M1
22
PK
8
C231
C2
7
C2
6
C1
1
GLOVE
BOX
LAMP
AND
SWITCH
(8W-44-4)
TIME
DELAY
RELAY
(IN FB)
(8W-11-14)
RADIO
(8W-47-2)
INSTRUMENT
CLUSTER
(8W-40-3)
1
C225
M1
22
PK
C2
POWER
MIRROR
SWITCH
(8W-62-2)
M1
18
PK
S309
M1
18
PK
M1
18
PK
M1
18
PK
C
MAP/
READING
LAMPS
(8W-44-4)
LEFT
VISOR/
VANITY
LAMPS
(8W-44-3)
RIGHT
VISOR/
VANITY
LAMPS
(8W-44-3)


BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
17
FUSE
18
10A
18
19
FUSE
20
10A
20
24
FUSE
23
15A
23
26
FUSE
25
15A
25
62
66
HORN
RELAY
(8W-41-2)
63
A17
18
RD/BK
L9
18
BK/WT
X2
18
DG/RD
X2
18
DG/RD
F32
18
PK/DB
14
C103
S131
X2
18
DG/RD
32
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-42-2)
35
A
HORN
NO. 1
(8W-41-2)
C3
18
DB/BK
L9
22
BK/WT
1
A/C
COMPRESSOR
CLUTCH
(8W-42-2)
6
TURN
SIGNAL/
HAZARD
SWITCH
(8W-52-2)
A
HORN
NO. 2
(8W-41-2)
6
STOP
LAMP
SWITCH
(8W-30-12)



BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
22
FUSE 21 20A
21
55
58
57
FUEL PUMP RELAY
(8W-30-10)
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
52
60
72
A141 16 DG/WT
A142 18 DG/OR
A14 16 RD/WT
6 C105
6 C161
S105
A141 18 DG/WT
A14 18 RD/WT
A14 16 RD/WT
4
46 C1
16
FUEL PUMP MODULE
(8W-30-10)
A142 18 DG/OR
POWERTRAIN CONTROL MODULE
(8W-30-2)
DATA LINK CONNECTOR
(8W-30-4)
S122
A142 18 DG/OR
1
GENERATOR
(8W-20-2)
DOWNSTREAM HEATED OXYGEN SENSOR
(8W-30-3)
6 C2
POWERTRAIN CONTROL MODULE
(8W-30-2)
UPSTREAM HEATED OXYGEN SENSOR
(8W-30-3)
S121
2
FUEL INJECTOR NO. 1
(8W-30-5)
FUEL INJECTOR NO. 2
(8W-30-5)
FUEL INJECTOR NO. 3
(8W-30-5)
FUEL INJECTOR NO. 4
(8W-30-5)
S134
A142 14 DG/OR
CAPACITOR
IGNITION COIL PACK
(8W-30-5)
NOISE SUPRESSOR
(8W-30-5)


BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
73
FUSE
16
20A
16
F61
18
WT/OR
F61
18
WT/OR
12
C103
F61
18
WT/OR
42
FOG
LAMP
RELAY
(IN PDC)
(8W-50-6)
45
2
REAR
FOG
LAMP
SWITCH
(8W-51-6)
L39
18
LB/WT
S115
L39
18
LB/WT
L39
18
LB/WT
1
LEFT
FOG
LAMP
(8W-50-6)
1
RIGHT
FOG
LAMP
(8W-50-6)



BATT A1
(8W-10-5)
IGNITION
SWITCH
1 START
2 RUN
0 OFF
3 ACC
(8W-10-5)
1
2
0
3
10
8
9
A41
14
YL
3
C241
A41
14
YL/BK
8
C241
A41
14
YL
1
C101
A/T
M/T
A41
14
YL
2
CLUTCH
PEDAL
POSITION
SWITCH
1
T141
14
YL/RD
A41
14
YL
28
ENGINE
STARTER
MOTOR
RELAY
(IN PDC)
(8W-21-2)
A31
14
BK/WT
A21
14
DB
FUSE
BLOCK
(8W-11-2)
10
FUSE
9
10A
(8W-11-9)
32
FUSE
10
15A
(8W-11-9)
30
FUSE
11
5A
(8W-11-10)
31
FUSE
BLOCK
(8W-11-2)
14
FUSE
14
20A
(8W-11-12)
34
FUSE
15
20A
(8W-11-12)
35
FUSE
16
10A
(8W-11-12)
36

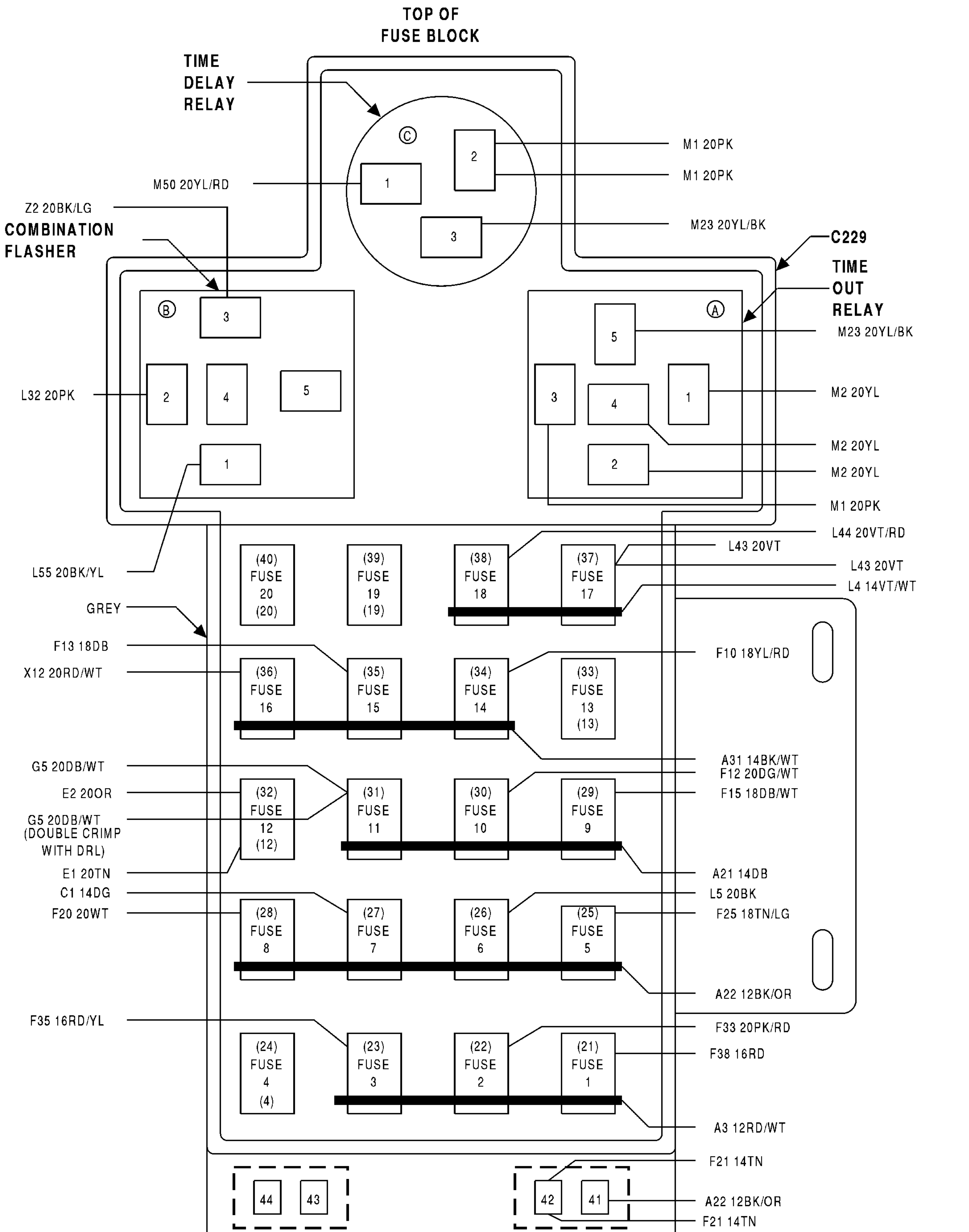
8W-10 POWER DISTRIBUTION

DESCRIPTION AND OPERATION

This section covers the power distribution center and all circuits involved with it. For additional information on system operation, refer to the appropriate wiring diagrams.

8W-11 FUSE/FUSE BLOCK

INDEX


TOP OF FUSE BLOCK
TIME DELAY RELAY
C
M1 20PK
M1 20PK
M50 20YL/RD
M23 20YL/BK
Z2 20BK/LG
COMBINATION FLASHER
C229
TIME OUT RELAY
B
A
M23 20YL/BK
L32 20PK
M2 20YL
M2 20YL
M2 20YL
M1 20PK
L44 20VT/RD
L43 20VT
L43 20VT
L4 14VT/WT
L55 20BK/YL
GREY
(40) FUSE 20 (20)
(39) FUSE 19 (19)
(38) FUSE 18
(37) FUSE 17
F13 18DB
X12 20RD/WT
F10 18YL/RD
(36) FUSE 16
(35) FUSE 15
(34) FUSE 14
(33) FUSE 13 (13)
A31 14BK/WT
F12 20DG/WT
G5 20DB/WT
E2 20OR
G5 20DB/WT (DOUBLE CRIMP WITH DRL)
F15 18DB/WT
(32) FUSE 12 (12)
(31) FUSE 11
(30) FUSE 10
(29) FUSE 9
E1 20TN
A21 14DB
C1 14DG
L5 20BK
F20 20WT
F25 18TN/LG
(28) FUSE 8
(27) FUSE 7
(26) FUSE 6
(25) FUSE 5
A22 12BK/OR
F35 16RD/YL
F33 20PK/RD
F38 16RD
(24) FUSE 4 (4)
(23) FUSE 3
(22) FUSE 2
(21) FUSE 1
A3 12RD/WT
F21 14TN
44
43
42
41
A22 12BK/OR
F21 14TN

FUSES

FUSE NO.	AMPS	FEED CIRCUIT	FUSED CIRCUIT
1	15A	A3 12RD/WT	F38 16RD
2	15A	A3 12RD/WT	F33 20PK/RD
3	20A	A3 12RD/WT	F35 16RD/YL
4	-		-
5	10A	A22 12BK/OR	F25 18TN/LG
6	10A	A22 12BK/OR	L5 20BK
7	25A	A22 12BK/OR	C1 14DG
8	10A	A22 12BK/OR	F20 20WT
9	10A	A21 14DB	F15 18DB/WT
10	15A	A21 14DB	F12 20DG/WT
11	5A	A21 14DB	G5 20DB/WT
			G5 20DB/WT
12	4A	E1 20TN	E2 20OR
13	-		-
14	20A	A31 14BK/WT	F10 18YL/RD
15	20A	A31 14BK/WT	F13 18DB
16	10A	A31 14BK/WT	X12 20RD/WT
17	10A	L4 14VT/WT	L43 20VT
17	10A	L4 14VT/WT	L43 20VT
18	10A	L4 14VT/WT	L44 20VT/RD
19	-		-
20	-		-

TIME OUT RELAY (A)

CAVITY	CIRCUIT	FUNCTION
A1	M2 20YL	DOOR LATCH SWITCH SENSE
	M2 20YL	DOOR LATCH SWITCH SENSE
A2	M2 20YL	DOOR LATCH SWITCH SENSE
	M2 20YL	DOOR LATCH SWITCH SENSE
A3	M2 20PK*	FUSED B+
	M2 20PK**	FUSED B+
A4	M2 20YL	DOOR LATCH SWITCH SENSE
	M2 20YL	DOOR LATCH SWITCH SENSE
A5	M23 20YL/BK	GROUND

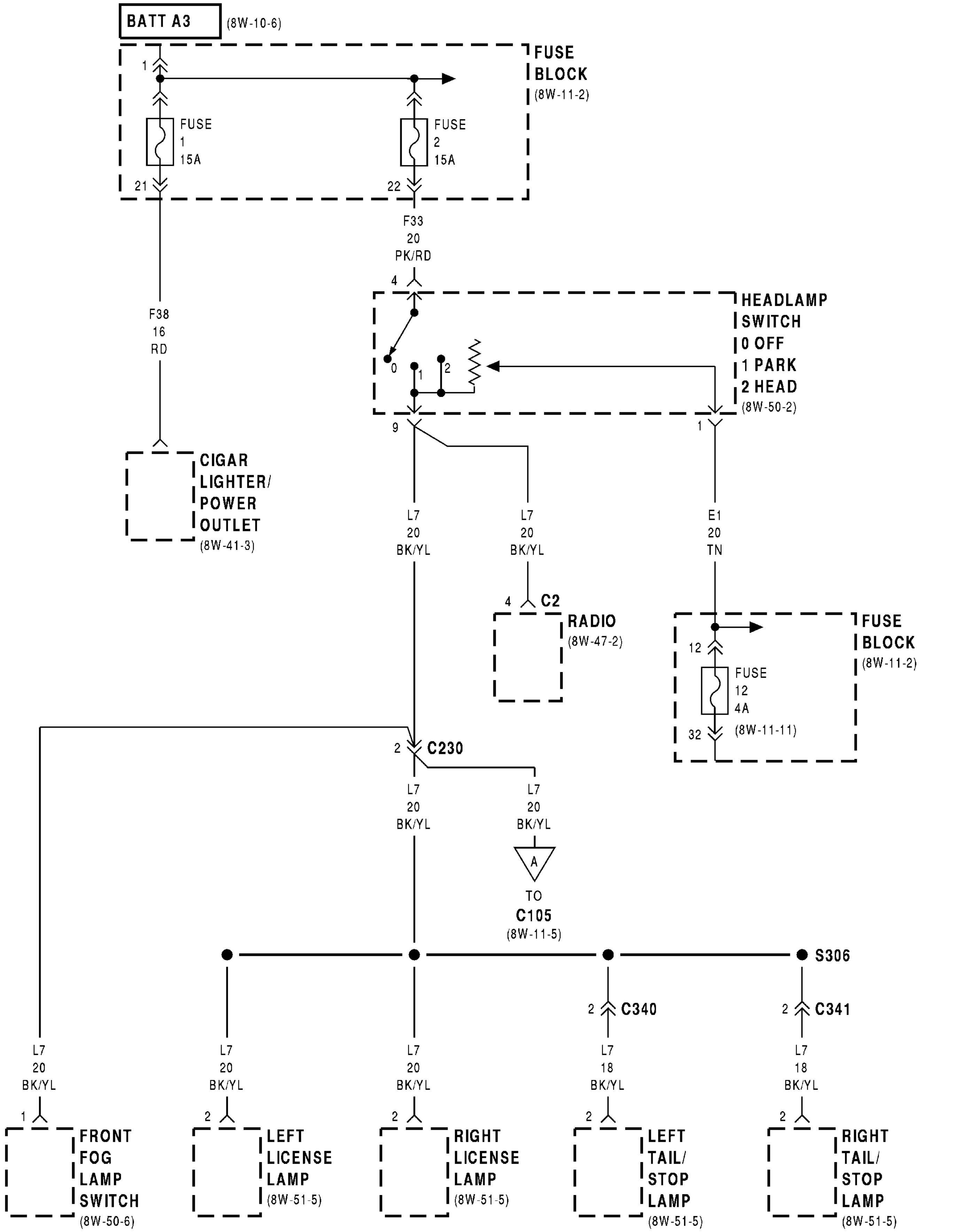
COMBINATION FLASHER (B)

CAVITY	CIRCUIT	FUNCTION
B1	L55 20BK/YL	COMBINATION FLASHER INPUT
B2	L32 20PK	COMBINATION FLASHER OUTPUT
B3	Z2 20BK/LG	GROUND
B4	-	-
B5	-	-

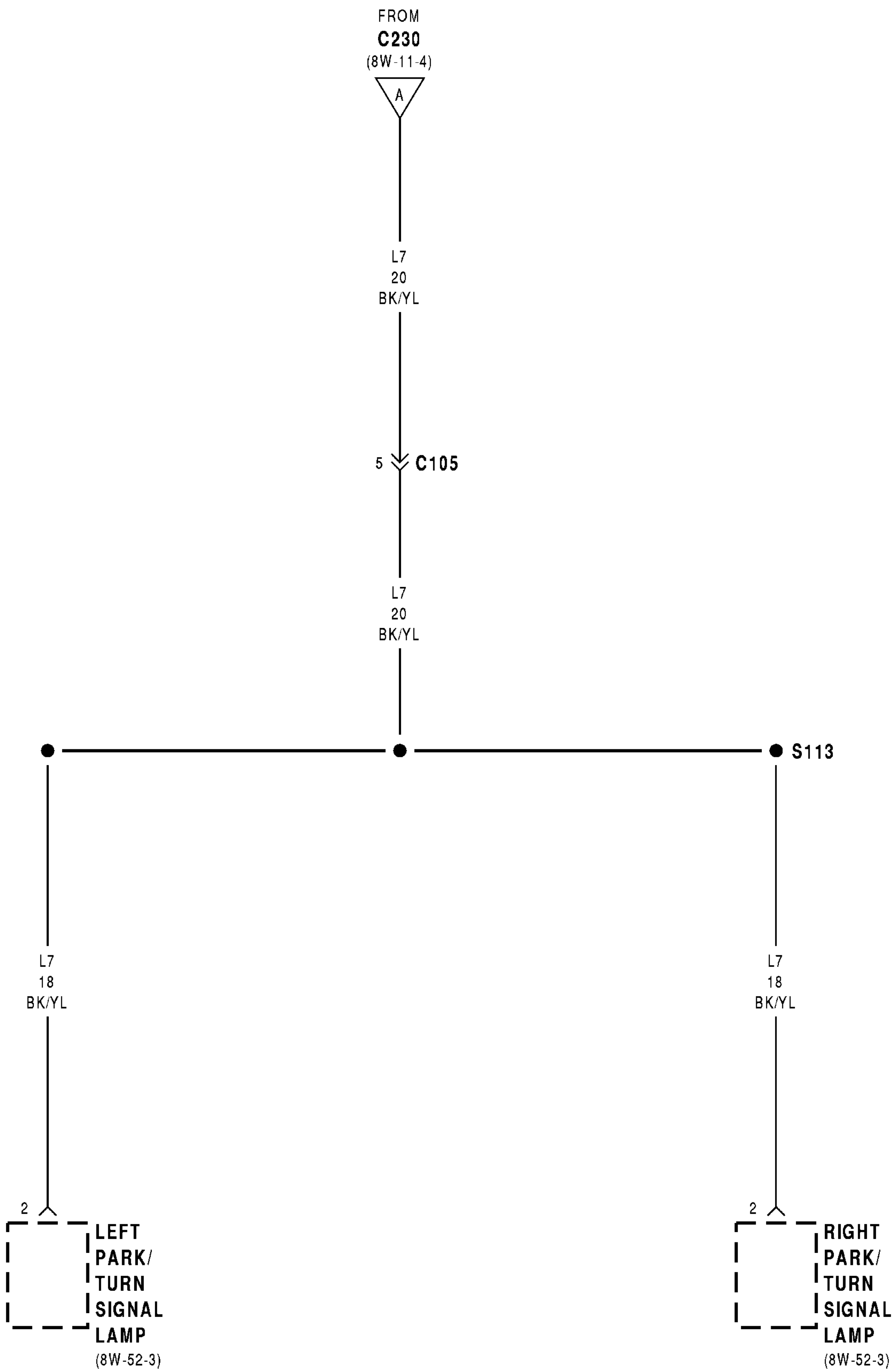
TIME DELAY RELAY (C)

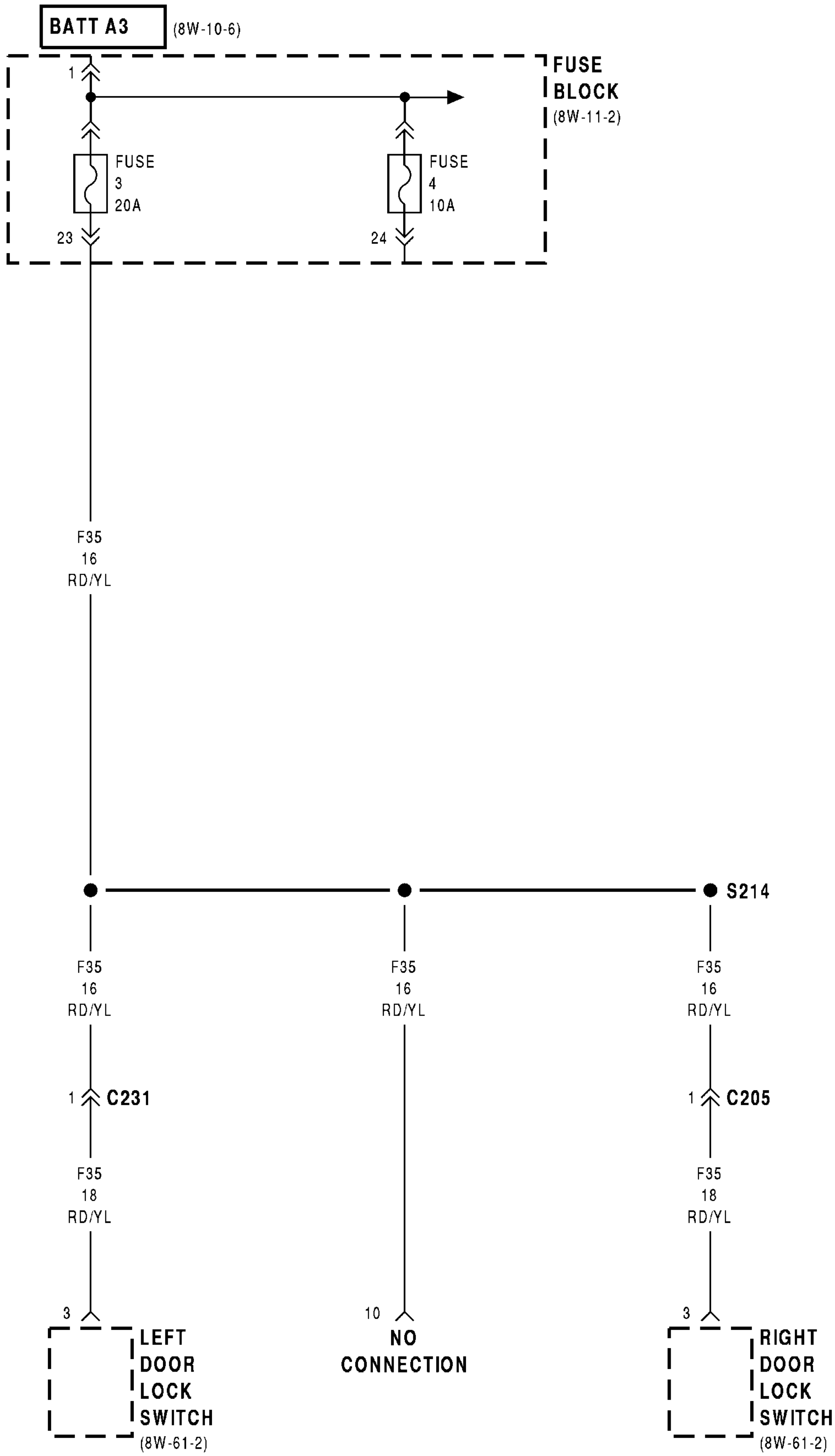
CAVITY	CIRCUIT	FUNCTION
C1	M50 20YL/RD*	KEY-IN LAMP DRIVER
C2	M1 20PK*	FUSED B+
	M1 20PK*	FUSED B+
C3	M23 20YL/BK*	TIME OUT RELAY

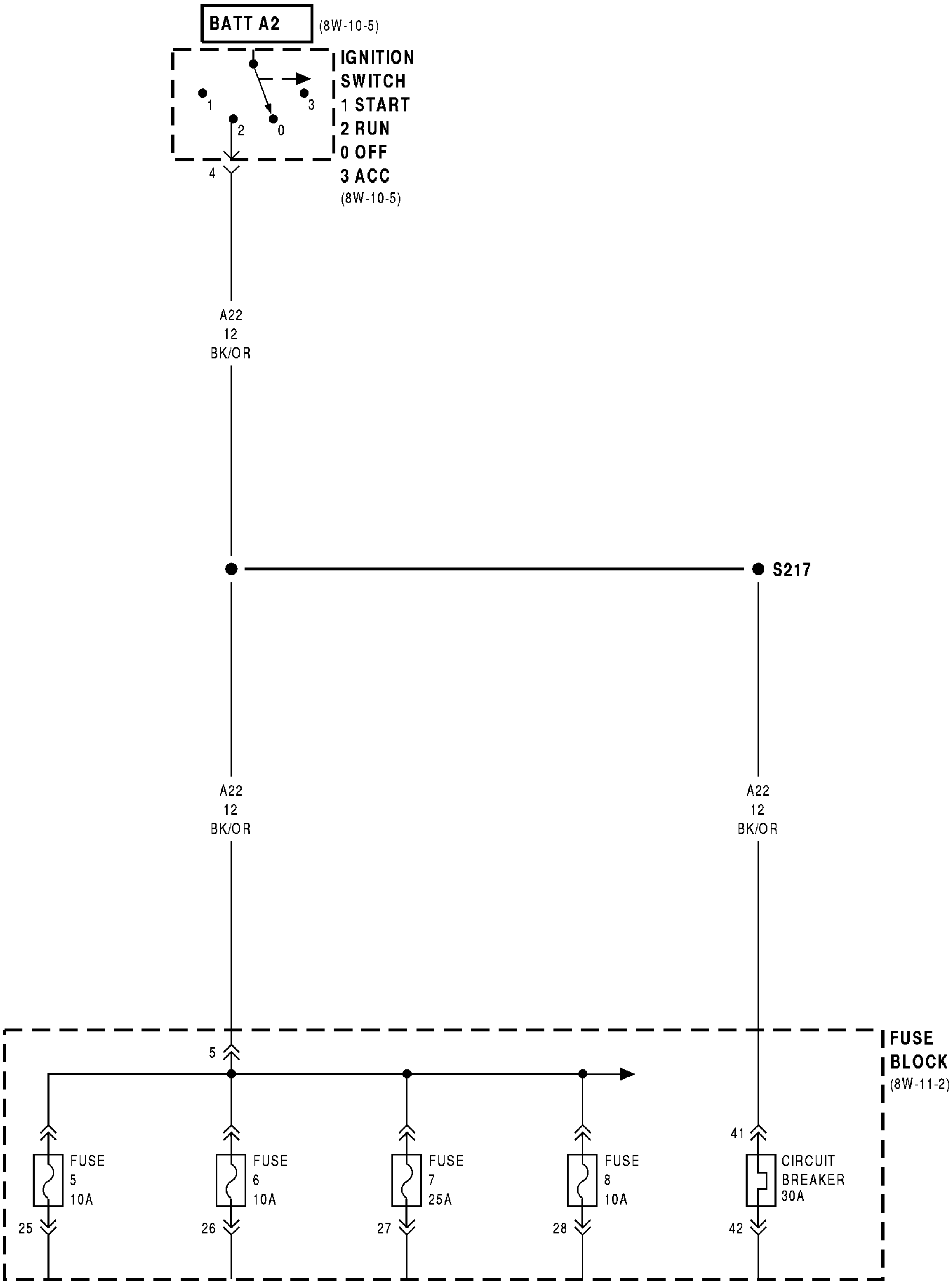
* MAX-SPORT
** MID-SPORT

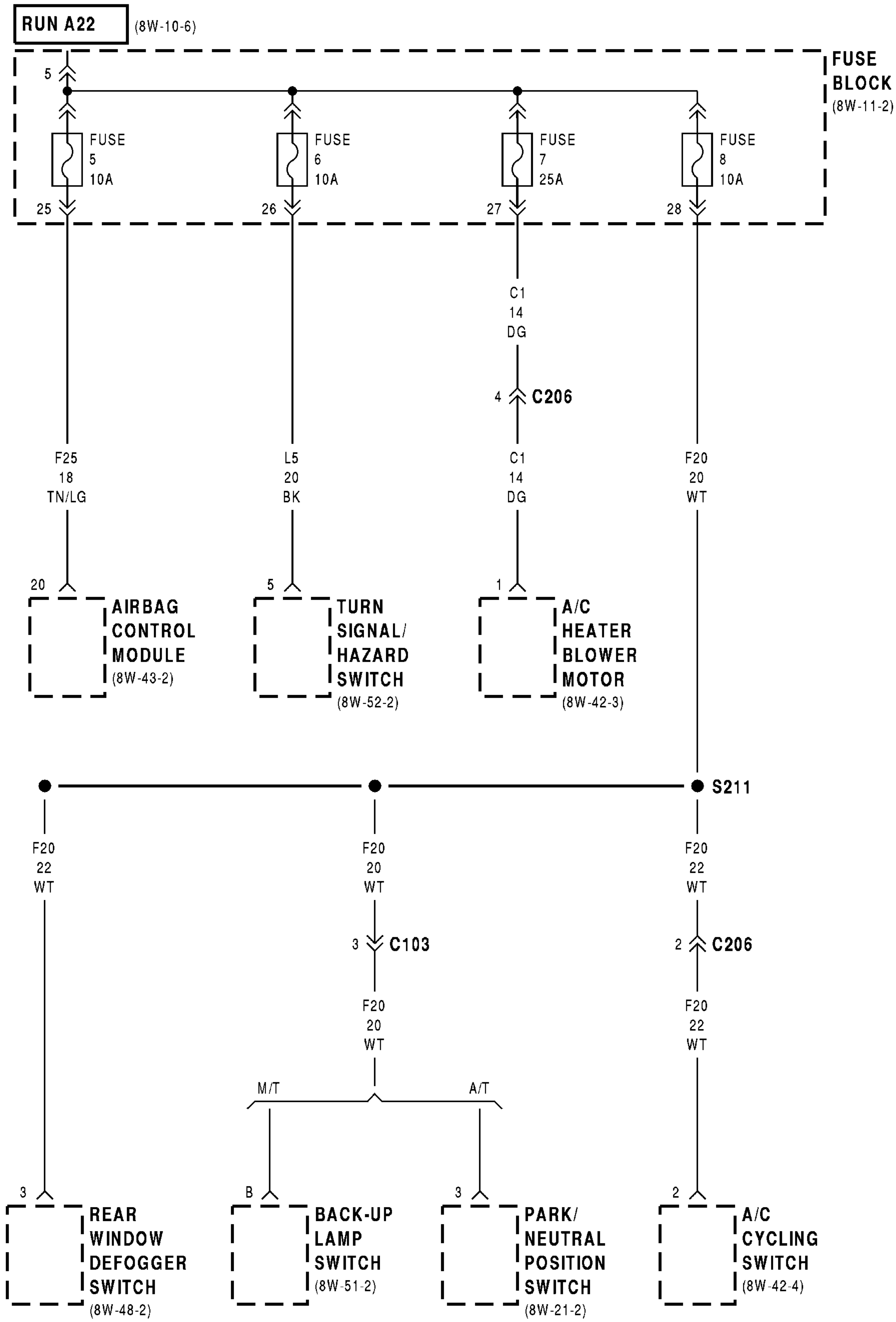


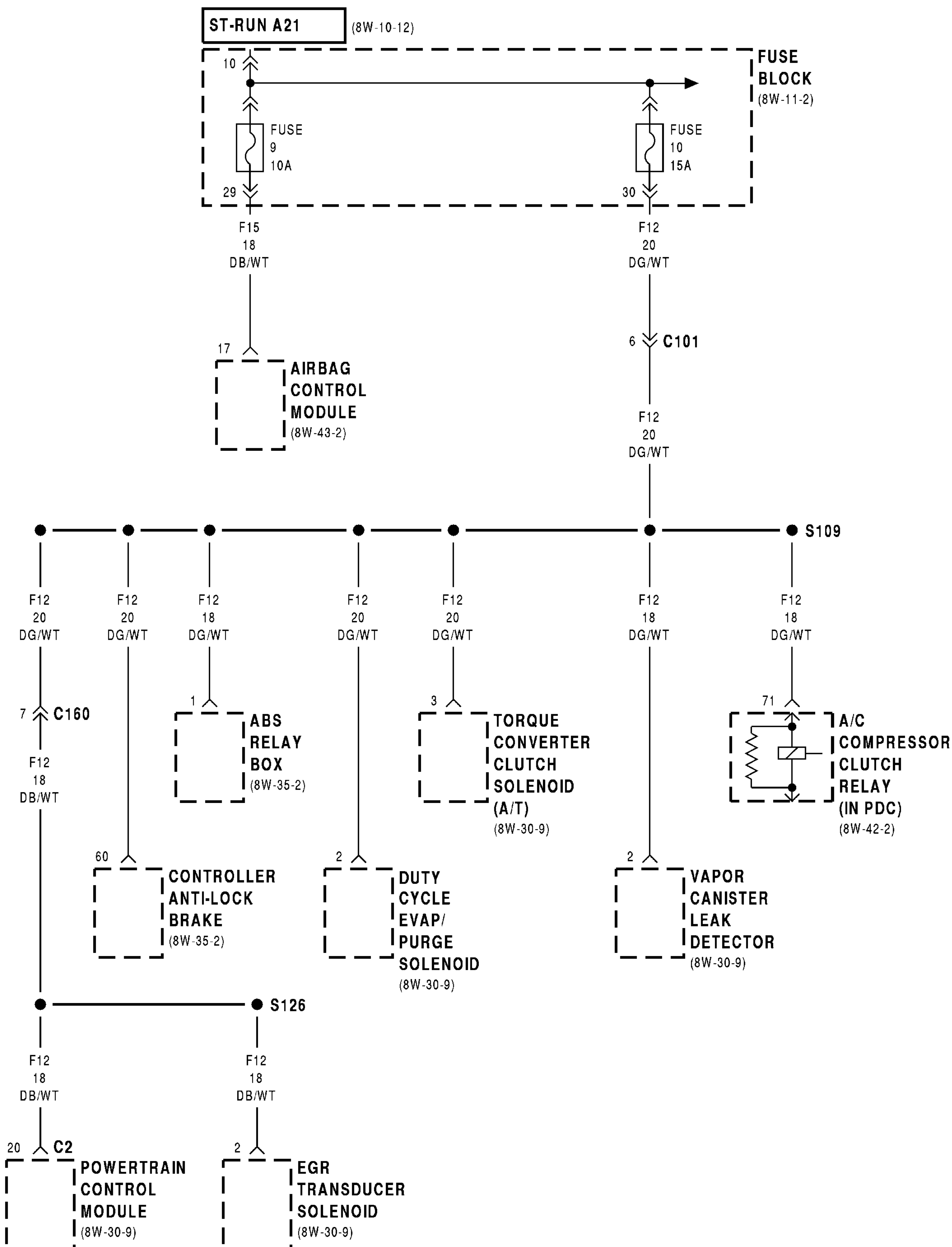
BATT A3
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
1
FUSE
1
15A
FUSE
2
15A
21
22
F33
20
PK/RD
F38
16
RD
4
HEADLAMP
SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
0
1
2
9
1
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-3)
L7
20
BK/YL
L7
20
BK/YL
E1
20
TN
4
C2
RADIO
(8W-47-2)
FUSE
BLOCK
(8W-11-2)
12
FUSE
12
4A
32
(8W-11-11)
2
C230
L7
20
BK/YL
L7
20
BK/YL
A
TO
C105
(8W-11-5)
S306
2
C340
2
C341
L7
20
BK/YL
L7
20
BK/YL
L7
20
BK/YL
L7
18
BK/YL
L7
18
BK/YL
1
2
2
2
2
FRONT
FOG
LAMP
SWITCH
(8W-50-6)
LEFT
LICENSE
LAMP
(8W-51-5)
RIGHT
LICENSE
LAMP
(8W-51-5)
LEFT
TAIL/
STOP
LAMP
(8W-51-5)
RIGHT
TAIL/
STOP
LAMP
(8W-51-5)

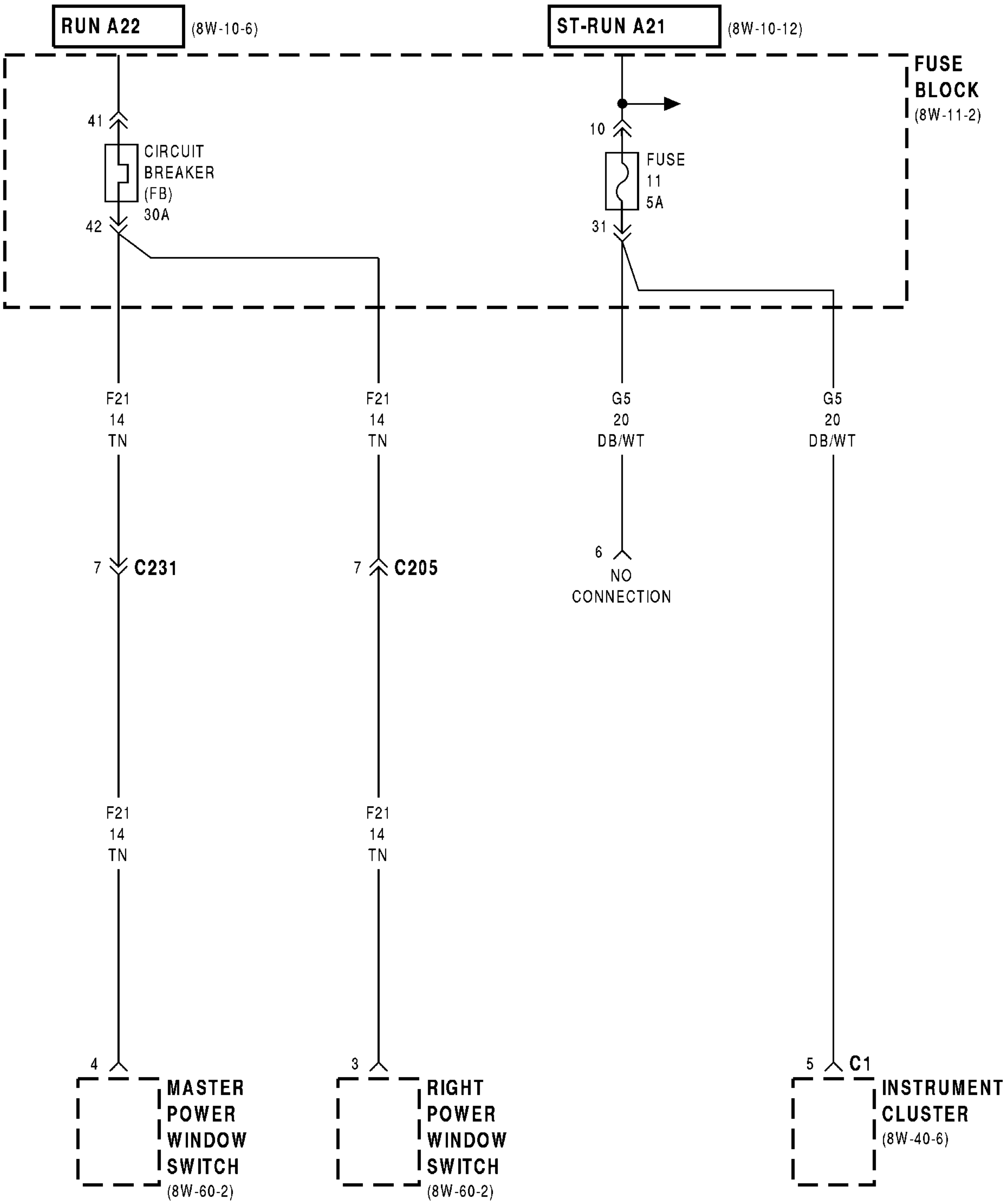

FROM
C230
(8W-11-4)
A
L7
20
BK/YL
5
C105
L7
20
BK/YL
S113
L7
18
BK/YL
L7
18
BK/YL
2
LEFT
PARK/
TURN
SIGNAL
LAMP
(8W-52-3)
2
RIGHT
PARK/
TURN
SIGNAL
LAMP
(8W-52-3)

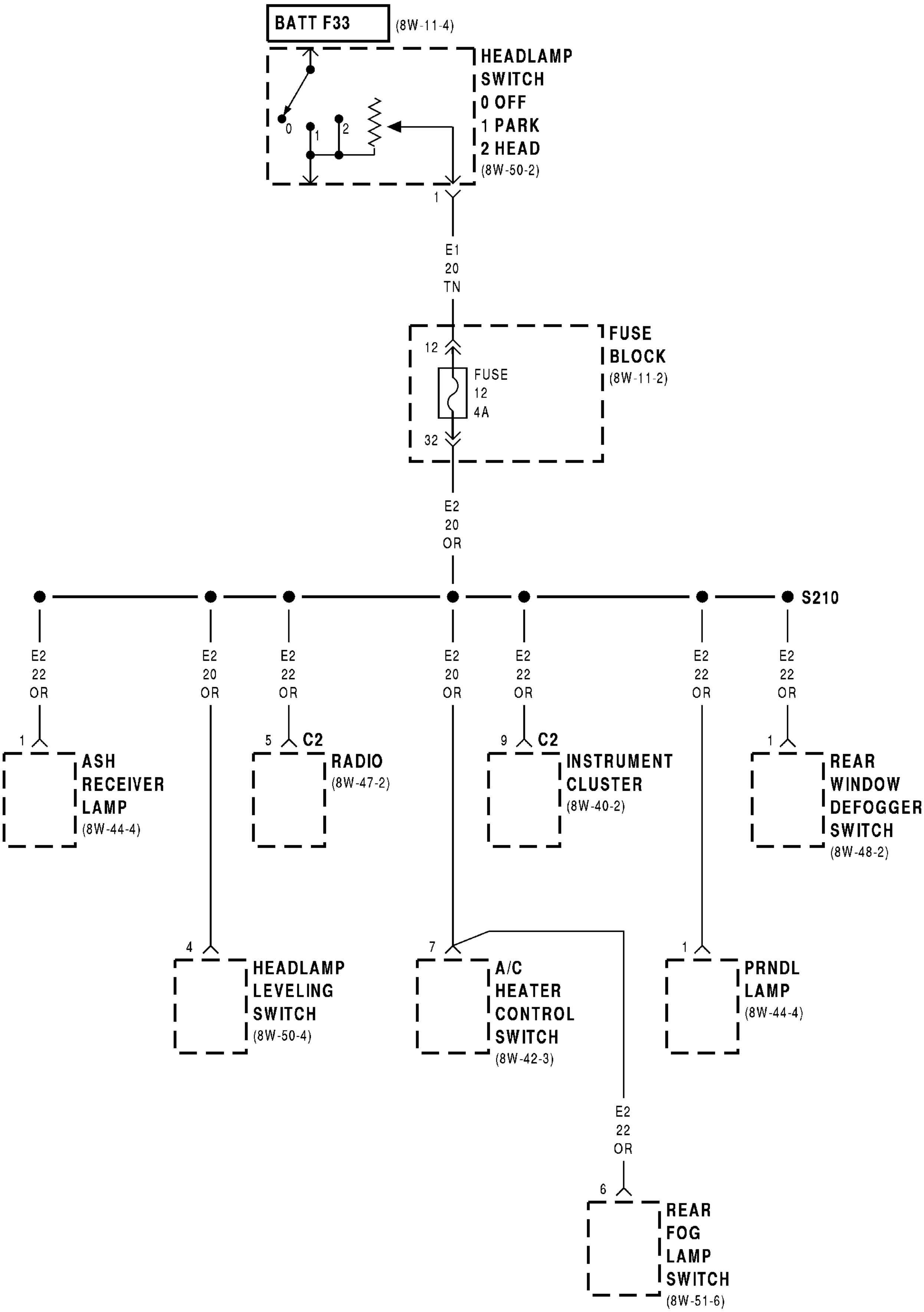

BATT A3
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
1
FUSE
3
20A
FUSE
4
10A
23
24
F35
16
RD/YL
S214
F35
16
RD/YL
F35
16
RD/YL
F35
16
RD/YL
1
C231
1
C205
F35
18
RD/YL
F35
18
RD/YL
3
LEFT
DOOR
LOCK
SWITCH
(8W-61-2)
10
NO
CONNECTION
3
RIGHT
DOOR
LOCK
SWITCH
(8W-61-2)

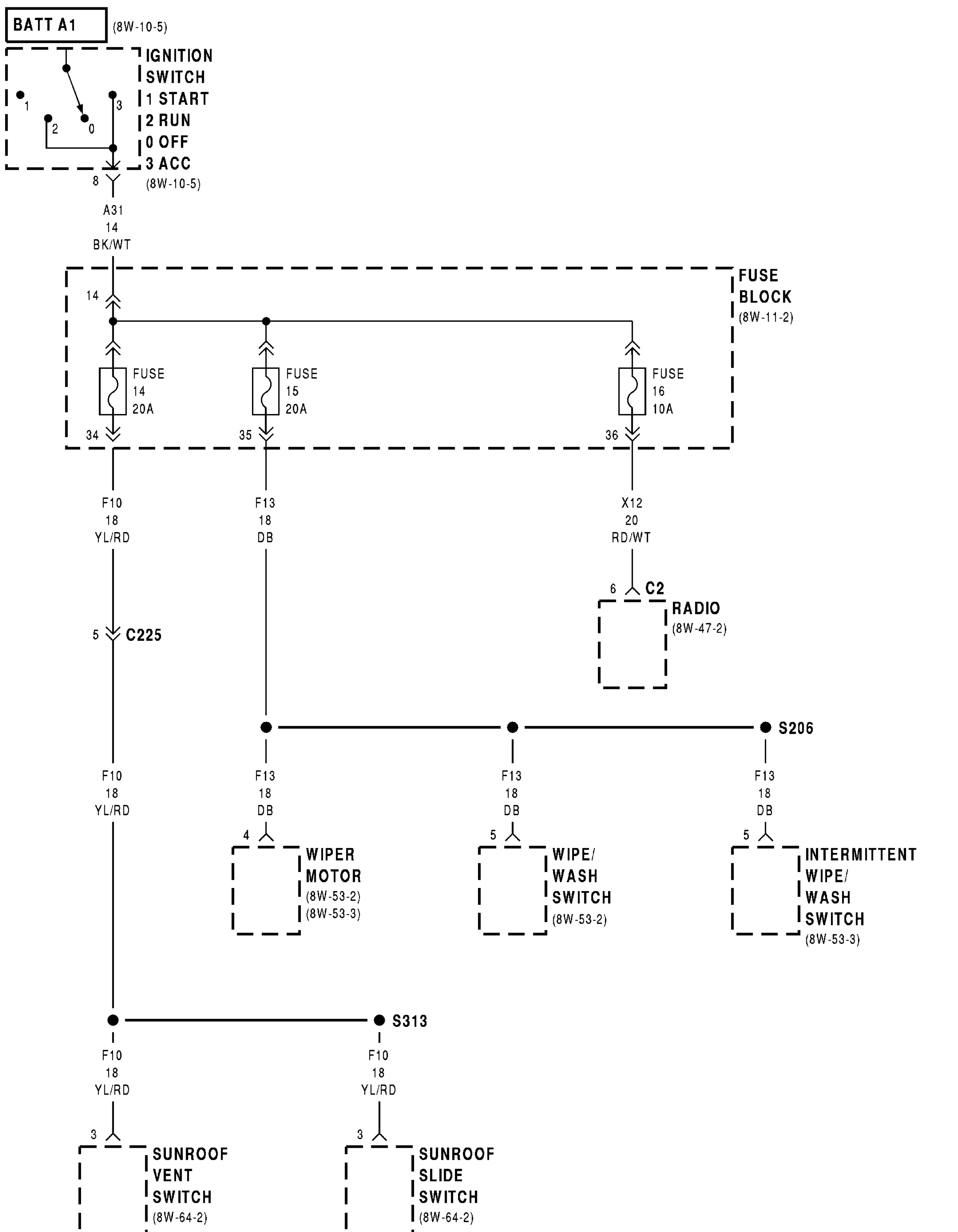

BATT A2
(8W-10-5)
IGNITION
SWITCH
1 START
2 RUN
0 OFF
3 ACC
(8W-10-5)
1
2
0
3
4
A22
12
BK/OR
S217
A22
12
BK/OR
A22
12
BK/OR
5
FUSE
BLOCK
(8W-11-2)
FUSE
5
10A
FUSE
6
10A
FUSE
7
25A
FUSE
8
10A
41
CIRCUIT
BREAKER
30A
25
26
27
28
42

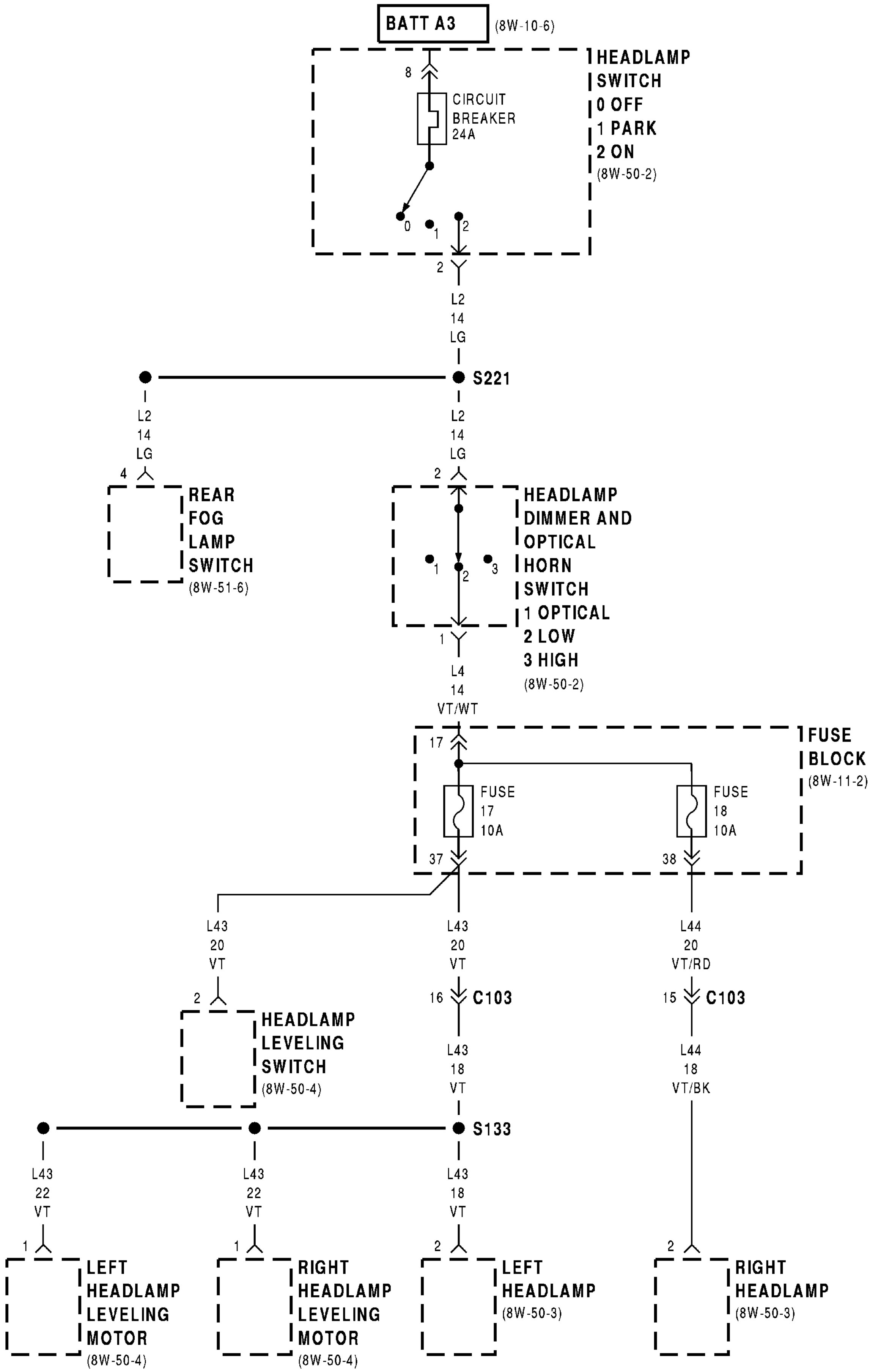

RUN A22
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
5
FUSE
5
10A
FUSE
6
10A
FUSE
7
25A
FUSE
8
10A
25
26
27
28
C1
14
DG
4
C206
F25
18
TN/LG
L5
20
BK
C1
14
DG
F20
20
WT
20
AIRBAG
CONTROL
MODULE
(8W-43-2)
5
TURN
SIGNAL/
HAZARD
SWITCH
(8W-52-2)
1
A/C
HEATER
BLOWER
MOTOR
(8W-42-3)
S211
F20
22
WT
F20
20
WT
3
C103
F20
22
WT
2
C206
F20
20
WT
F20
22
WT
M/T
A/T
3
REAR
WINDOW
DEFOGGER
SWITCH
(8W-48-2)
B
BACK-UP
LAMP
SWITCH
(8W-51-2)
3
PARK/
NEUTRAL
POSITION
SWITCH
(8W-21-2)
2
A/C
CYCLING
SWITCH
(8W-42-4)

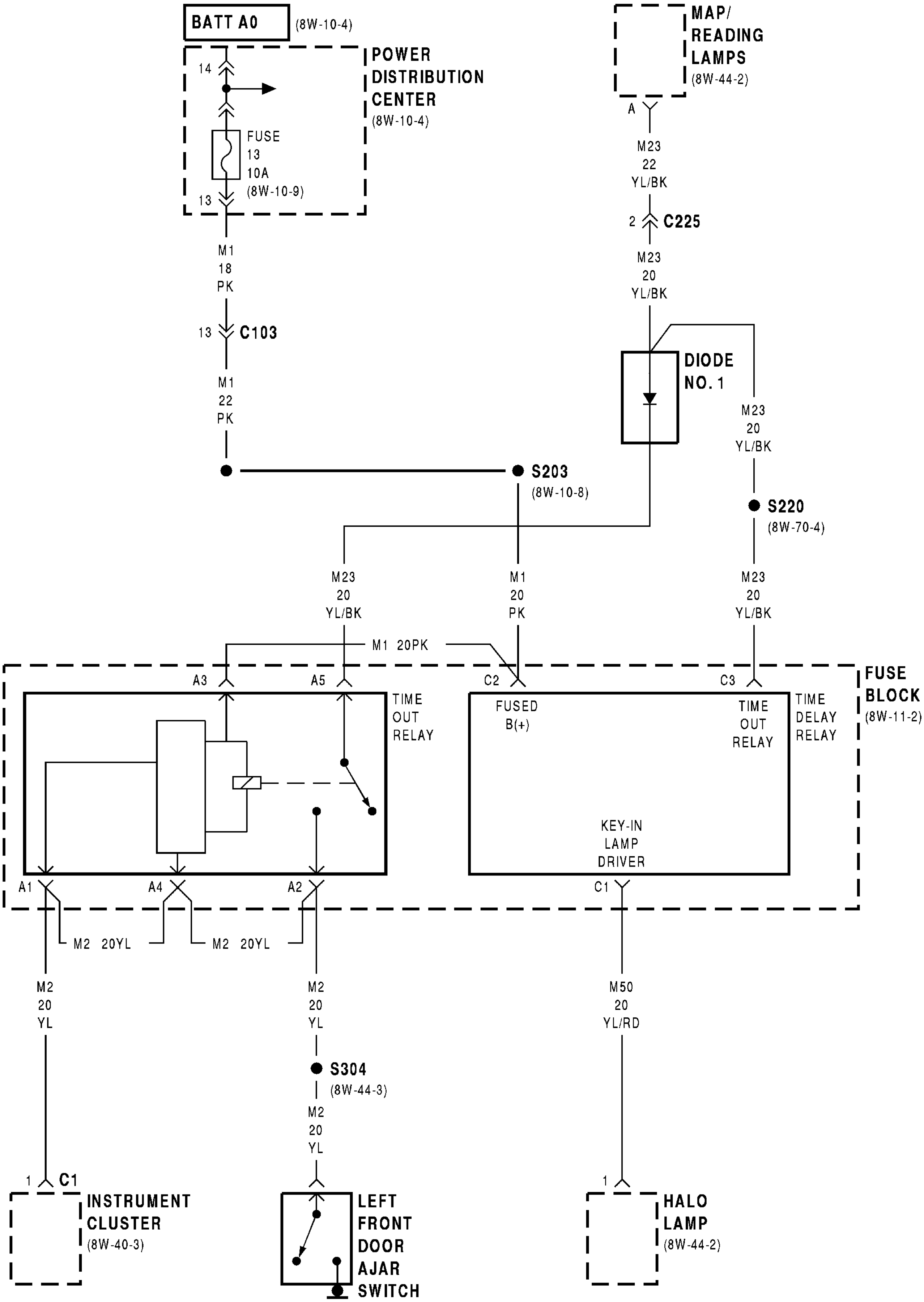

ST-RUN A21
(8W-10-12)
FUSE BLOCK
(8W-11-2)
10
FUSE
9
10A
29
FUSE
10
15A
30
F15
18
DB/WT
17
AIRBAG CONTROL MODULE
(8W-43-2)
F12
20
DG/WT
6
C101
F12
20
DG/WT
S109
F12
20
DG/WT
7
C160
F12
18
DB/WT
F12
20
DG/WT
60
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
F12
18
DG/WT
1
ABS RELAY BOX
(8W-35-2)
F12
20
DG/WT
2
DUTY CYCLE EVAP/ PURGE SOLENOID
(8W-30-9)
F12
20
DG/WT
3
TORQUE CONVERTER CLUTCH SOLENOID (A/T)
(8W-30-9)
F12
18
DG/WT
2
VAPOR CANISTER LEAK DETECTOR
(8W-30-9)
F12
18
DG/WT
71
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-2)
S126
F12
18
DB/WT
20
C2
POWERTRAIN CONTROL MODULE
(8W-30-9)
F12
18
DB/WT
2
EGR TRANSDUCER SOLENOID
(8W-30-9)


RUN A22
(8W-10-6)
ST-RUN A21
(8W-10-12)
FUSE
BLOCK
(8W-11-2)
41
CIRCUIT
BREAKER
(FB)
30A
42
10
FUSE
11
5A
31
F21
14
TN
F21
14
TN
G5
20
DB/WT
G5
20
DB/WT
7
C231
7
C205
6
NO
CONNECTION
F21
14
TN
F21
14
TN
4
MASTER
POWER
WINDOW
SWITCH
(8W-60-2)
3
RIGHT
POWER
WINDOW
SWITCH
(8W-60-2)
5
C1
INSTRUMENT
CLUSTER
(8W-40-6)


BATT F33
(8W-11-4)
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
0
1
2
1
E1
20
TN
FUSE BLOCK
(8W-11-2)
12
FUSE
12
4A
32
E2
20
OR
S210
E2
22
OR
E2
20
OR
E2
22
OR
E2
20
OR
E2
22
OR
E2
22
OR
E2
22
OR
1
ASH RECEIVER LAMP
(8W-44-4)
5 C2
RADIO
(8W-47-2)
9 C2
INSTRUMENT CLUSTER
(8W-40-2)
1
REAR WINDOW DEFOGGER SWITCH
(8W-48-2)
4
HEADLAMP LEVELING SWITCH
(8W-50-4)
7
A/C HEATER CONTROL SWITCH
(8W-42-3)
1
PRNDL LAMP
(8W-44-4)
E2
22
OR
6
REAR FOG LAMP SWITCH
(8W-51-6)


BATT A1
(8W-10-5)
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 ACC
(8W-10-5)
1
2
0
3
8
A31
14
BK/WT
FUSE BLOCK
(8W-11-2)
14
FUSE 14 20A
FUSE 15 20A
FUSE 16 10A
34
35
36
F10
18
YL/RD
F13
18
DB
X12
20
RD/WT
6
C2
RADIO
(8W-47-2)
5
C225
S206
4
WIPER MOTOR
(8W-53-2)
(8W-53-3)
WIPE/ WASH SWITCH
(8W-53-2)
INTERMITTENT WIPE/ WASH SWITCH
(8W-53-3)
S313
3
SUNROOF VENT SWITCH
(8W-64-2)
SUNROOF SLIDE SWITCH
(8W-64-2)


BATT A3
(8W-10-6)
HEADLAMP SWITCH
0 OFF
1 PARK
2 ON
(8W-50-2)
CIRCUIT BREAKER 24A
8
0
1
2
2
L2 14 LG
S221
L2 14 LG
L2 14 LG
4
REAR FOG LAMP SWITCH
(8W-51-6)
2
HEADLAMP DIMMER AND OPTICAL HORN SWITCH
1 OPTICAL
2 LOW
3 HIGH
(8W-50-2)
1
L4 14 VT/WT
FUSE BLOCK
(8W-11-2)
17
FUSE 17 10A
FUSE 18 10A
37
38
L43 20 VT
L43 20 VT
L44 20 VT/RD
16 C103
15 C103
2
HEADLAMP LEVELING SWITCH
(8W-50-4)
L43 18 VT
L44 18 VT/BK
S133
L43 22 VT
L43 22 VT
L43 18 VT
1
1
2
2
LEFT HEADLAMP LEVELING MOTOR
(8W-50-4)
RIGHT HEADLAMP LEVELING MOTOR
(8W-50-4)
LEFT HEADLAMP
(8W-50-3)
RIGHT HEADLAMP
(8W-50-3)


BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
14
FUSE 13 10A (8W-10-9)
13
M1 18 PK
13 C103
M1 22 PK
S203
(8W-10-8)
MAP/ READING LAMPS
(8W-44-2)
A
M23 22 YL/BK
2 C225
M23 20 YL/BK
DIODE NO. 1
M23 20 YL/BK
S220
(8W-70-4)
M23 20 YL/BK
M1 20 PK
M23 20 YL/BK
M1 20PK
A3
A5
C2
C3
TIME OUT RELAY
FUSED B(+)
TIME OUT RELAY
TIME DELAY RELAY
FUSE BLOCK
(8W-11-2)
KEY-IN LAMP DRIVER
A1
A4
A2
C1
M2 20YL
M2 20YL
M2 20 YL
M2 20 YL
M50 20 YL/RD
S304
(8W-44-3)
M2 20 YL
1 C1
INSTRUMENT CLUSTER
(8W-40-3)
LEFT FRONT DOOR AJAR SWITCH
1
HALO LAMP
(8W-44-2)

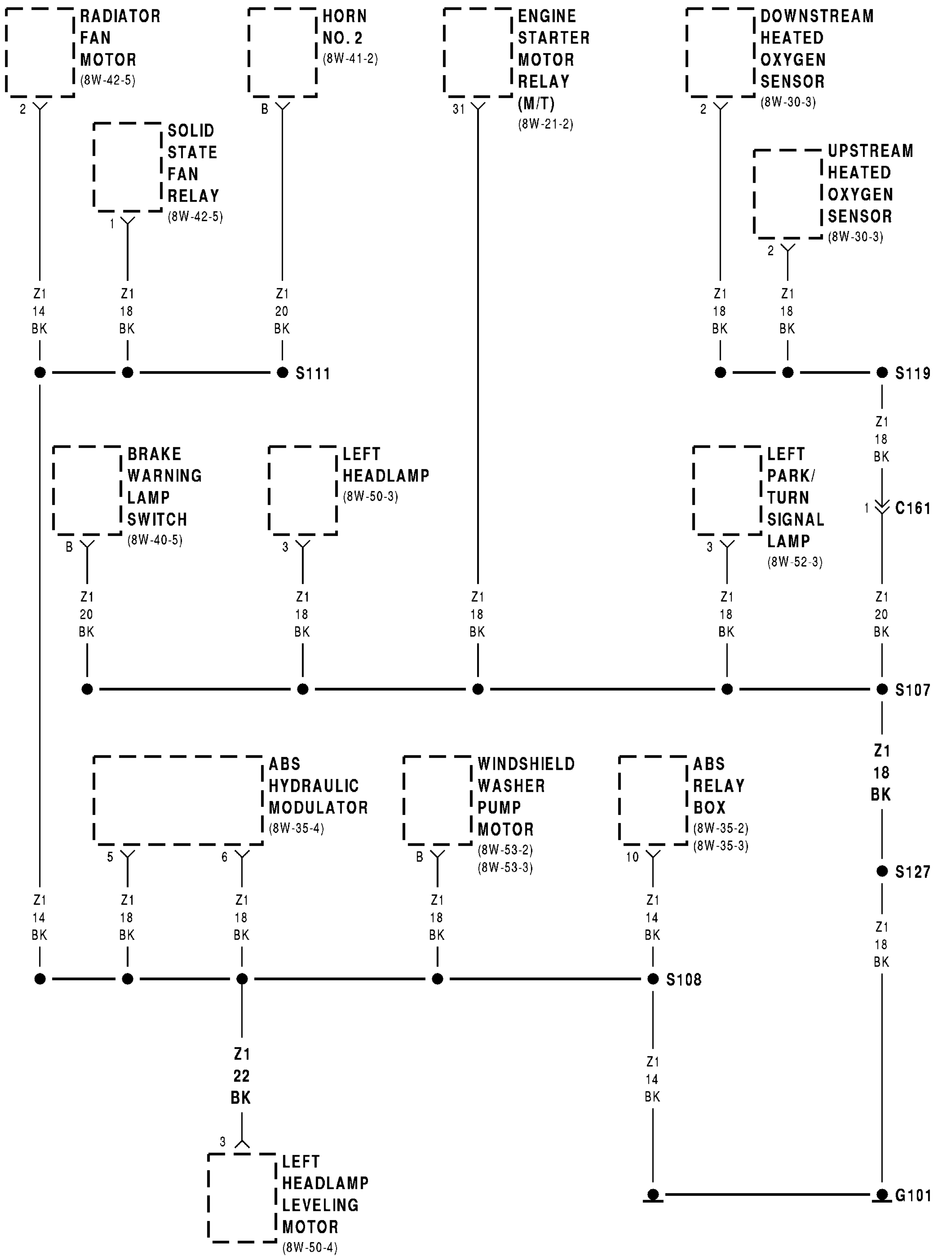
8W-11 FUSE/FUSE BLOCK

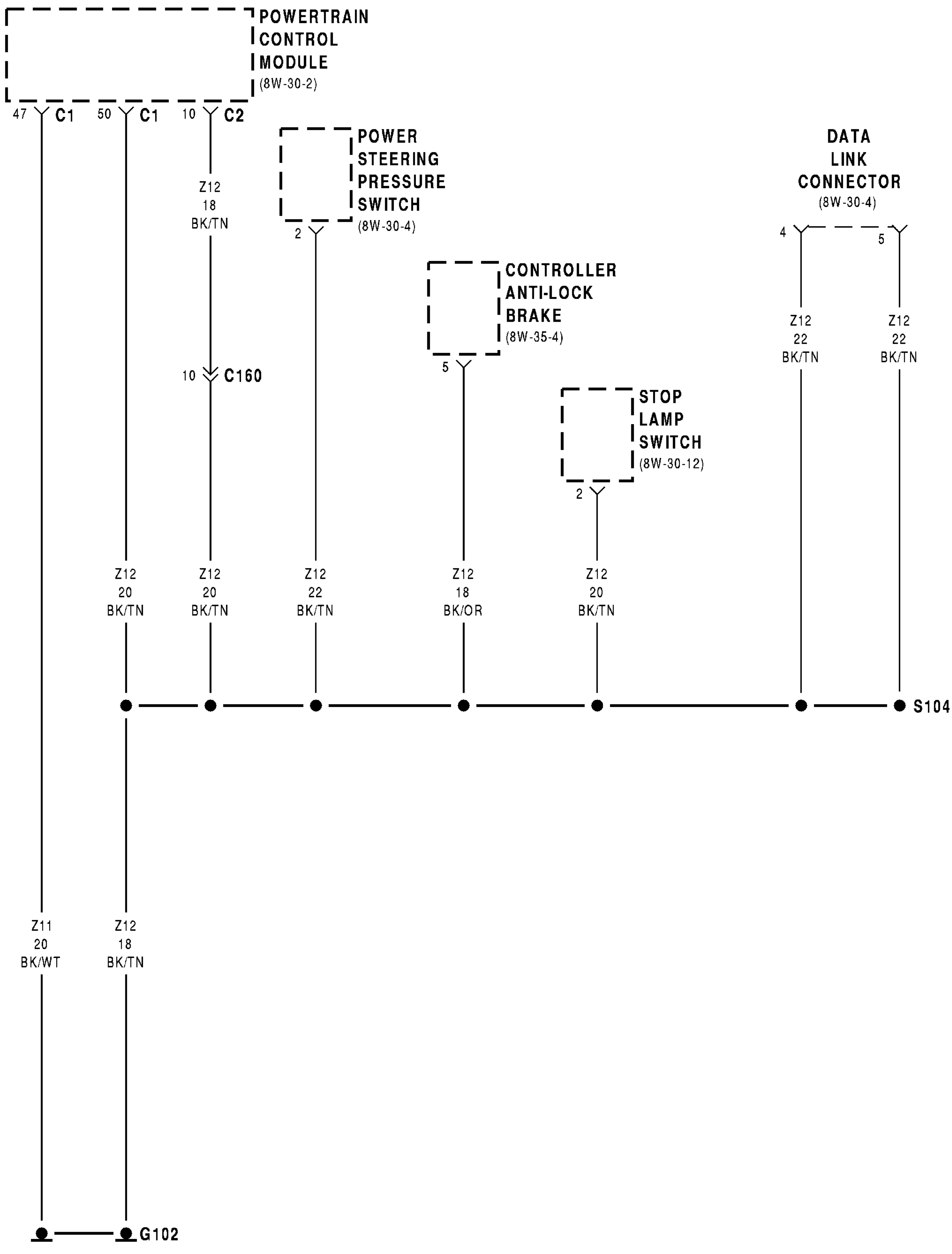
DESCRIPTION AND OPERATION

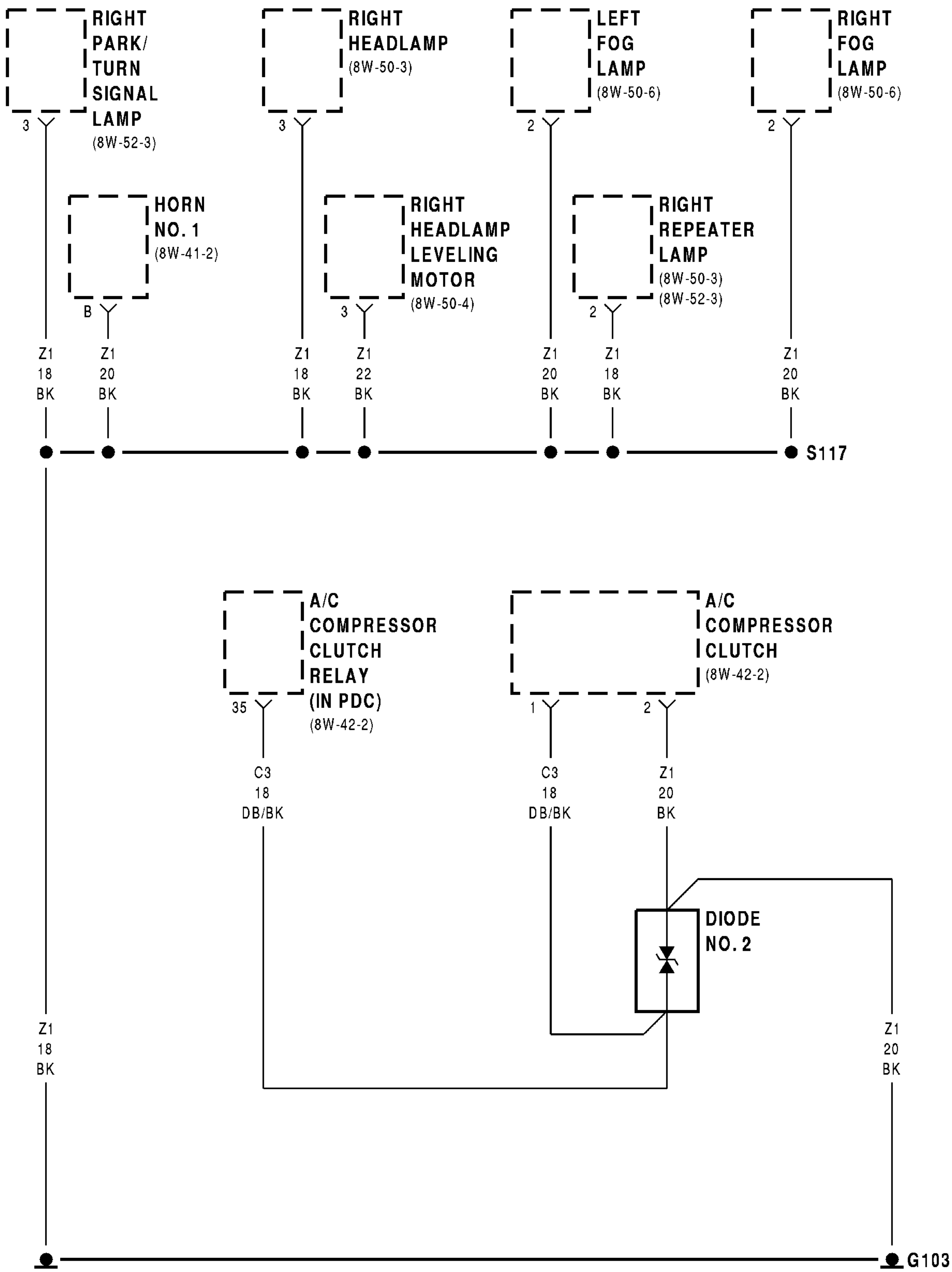
This section covers the fuse block and all circuits involved with it. For additional information on system operation, please refer to the appropriate section of the wiring diagrams.

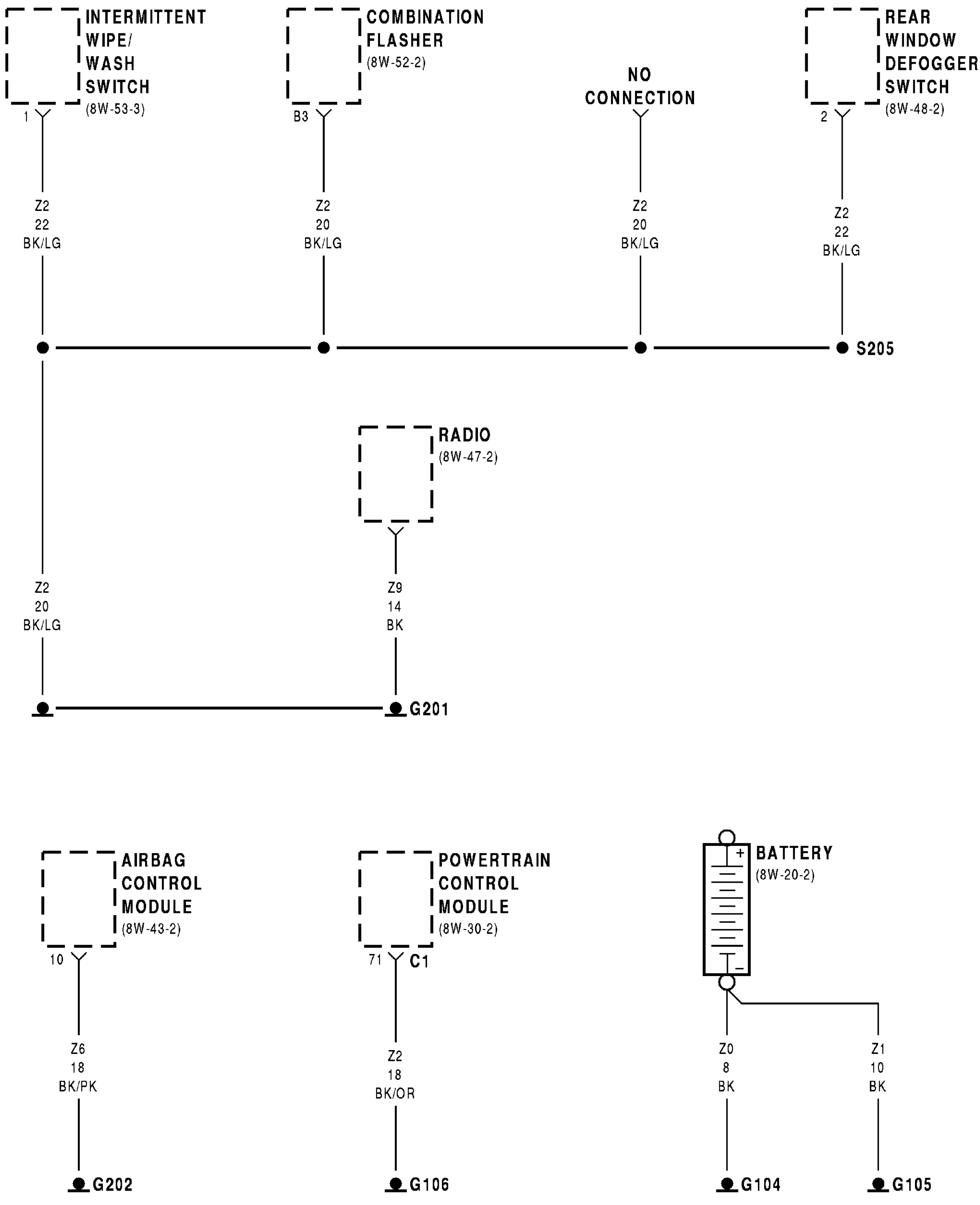
8W-15 GROUND DISTRIBUTION

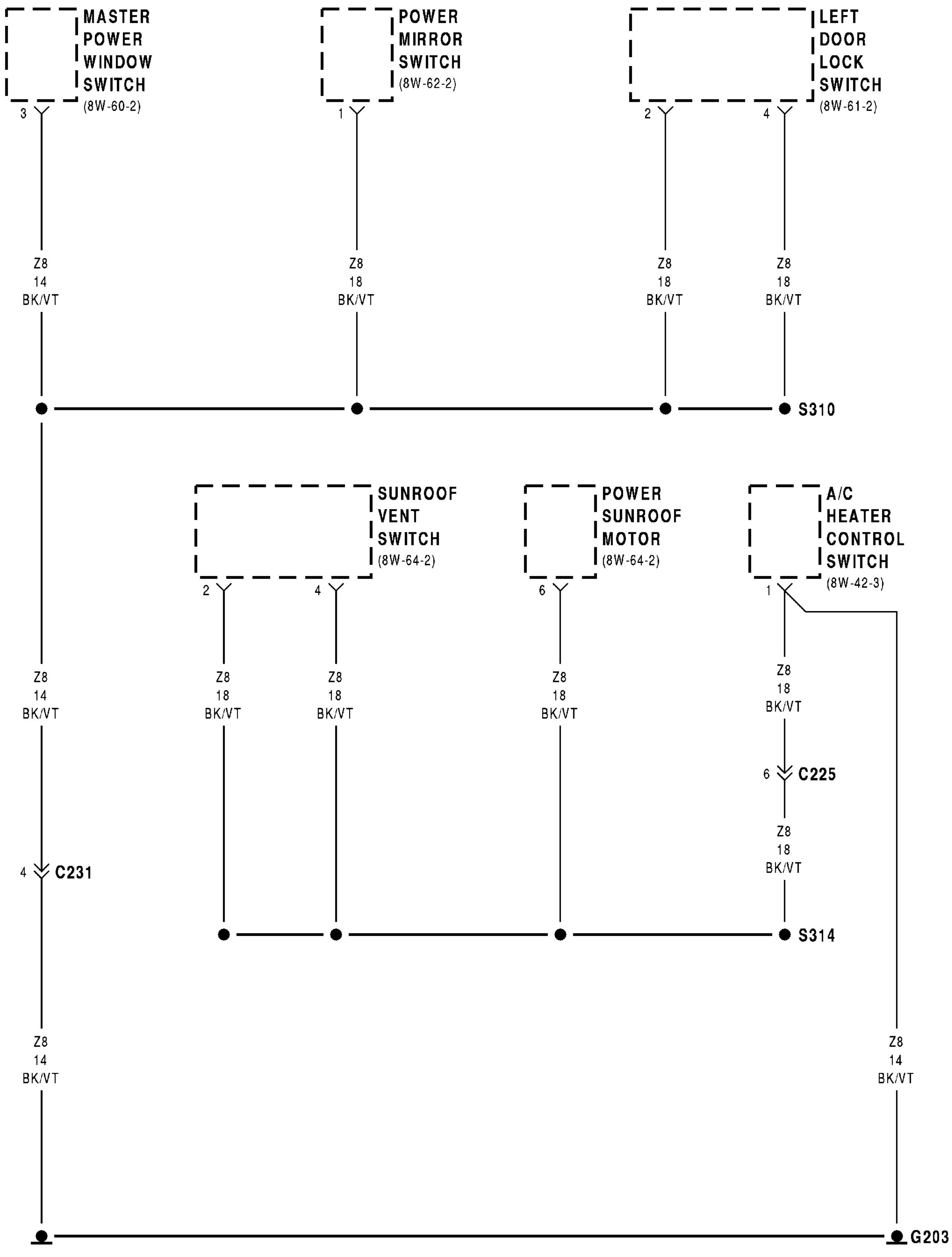
INDEX

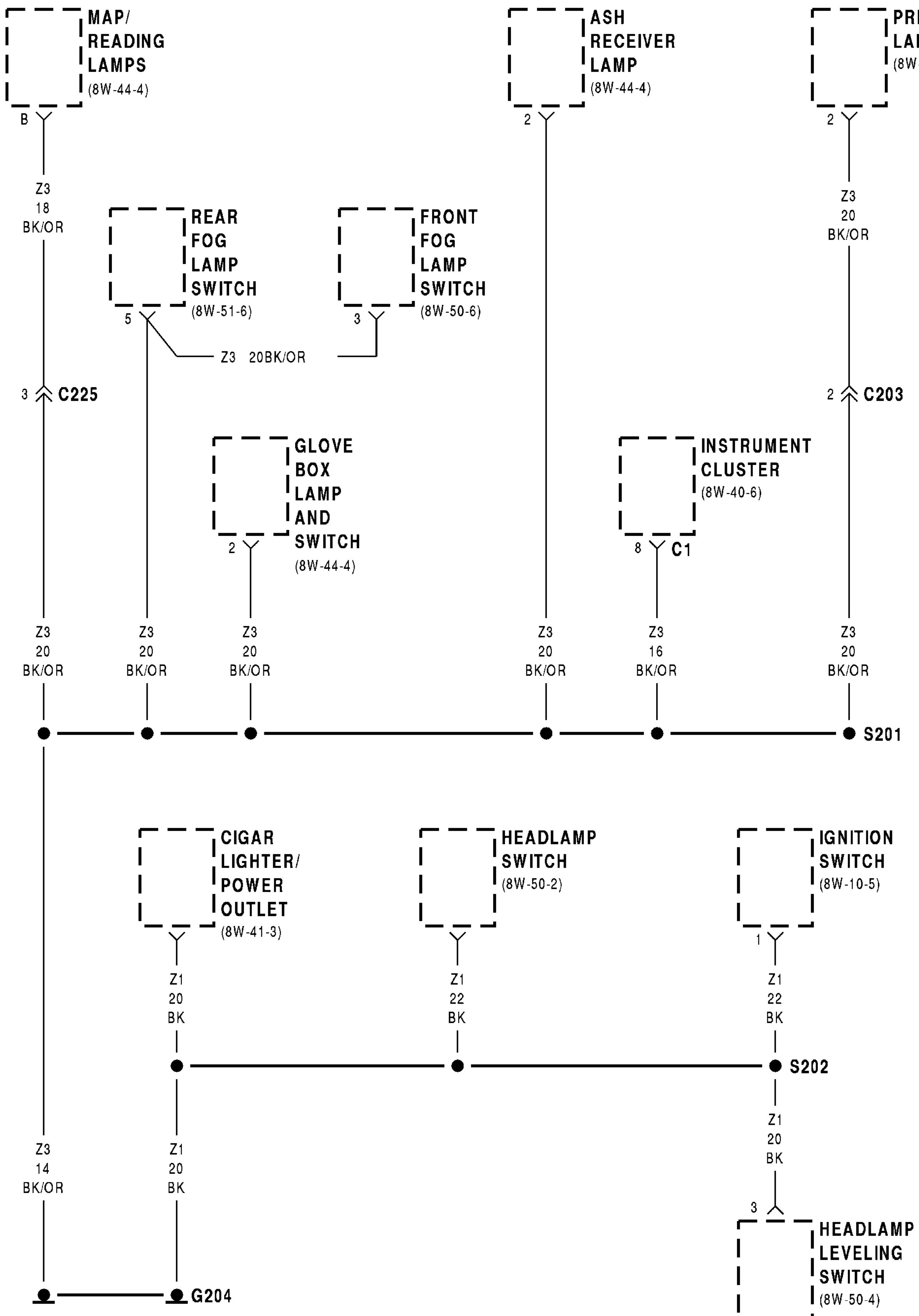

RADIATOR FAN MOTOR (8W-42-5)
2
SOLID STATE FAN RELAY (8W-42-5)
1
HORN NO. 2 (8W-41-2)
B
ENGINE STARTER MOTOR RELAY (M/T) (8W-21-2)
31
DOWNSTREAM HEATED OXYGEN SENSOR (8W-30-3)
2
UPSTREAM HEATED OXYGEN SENSOR (8W-30-3)
2
Z1 14 BK
Z1 18 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
S111
S119
Z1 18 BK
C161
1
BRAKE WARNING LAMP SWITCH (8W-40-5)
B
LEFT HEADLAMP (8W-50-3)
3
LEFT PARK/ TURN SIGNAL LAMP (8W-52-3)
3
Z1 20 BK
Z1 18 BK
Z1 18 BK
Z1 18 BK
Z1 20 BK
S107
Z1 18 BK
ABS HYDRAULIC MODULATOR (8W-35-4)
5
6
WINDSHIELD WASHER PUMP MOTOR (8W-53-2) (8W-53-3)
B
ABS RELAY BOX (8W-35-2) (8W-35-3)
10
S127
Z1 14 BK
Z1 18 BK
Z1 18 BK
Z1 18 BK
Z1 14 BK
Z1 18 BK
S108
Z1 22 BK
Z1 14 BK
3
LEFT HEADLAMP LEVELING MOTOR (8W-50-4)
G101

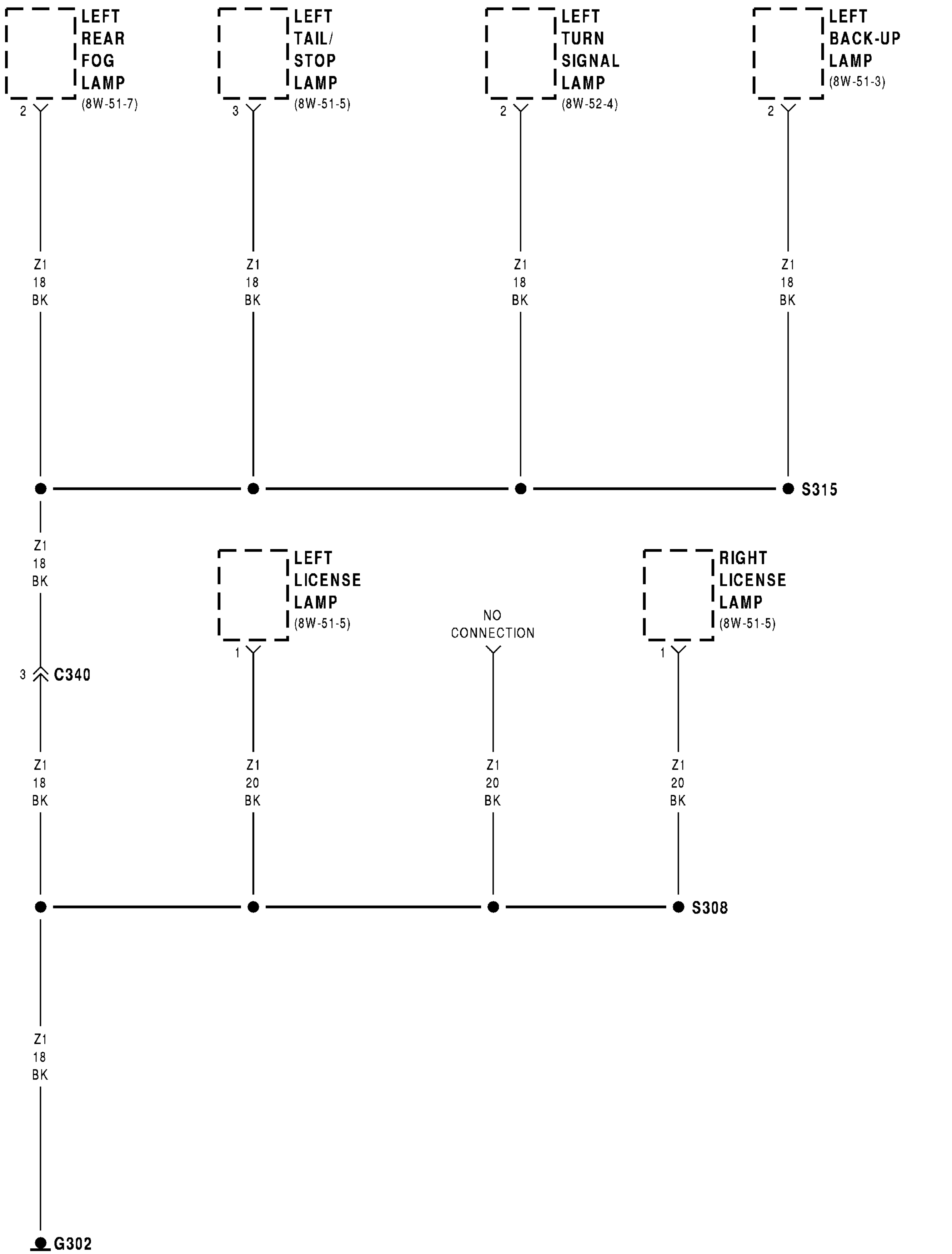

POWERTRAIN CONTROL MODULE
(8W-30-2)
47 C1
50 C1
10 C2
Z12 18 BK/TN
10 C160
POWER STEERING PRESSURE SWITCH
(8W-30-4)
2
CONTROLLER ANTI-LOCK BRAKE
(8W-35-4)
5
STOP LAMP SWITCH
(8W-30-12)
2
DATA LINK CONNECTOR
(8W-30-4)
4
5
Z12 22 BK/TN
Z12 22 BK/TN
Z12 20 BK/TN
Z12 20 BK/TN
Z12 22 BK/TN
Z12 18 BK/OR
Z12 20 BK/TN
S104
Z11 20 BK/WT
Z12 18 BK/TN
G102


RIGHT PARK/ TURN SIGNAL LAMP
(8W-52-3)
3
RIGHT HEADLAMP
(8W-50-3)
3
LEFT FOG LAMP
(8W-50-6)
2
RIGHT FOG LAMP
(8W-50-6)
2
HORN NO. 1
(8W-41-2)
B
RIGHT HEADLAMP LEVELING MOTOR
(8W-50-4)
3
RIGHT REPEATER LAMP
(8W-50-3)
(8W-52-3)
2
Z1 18 BK
Z1 20 BK
Z1 18 BK
Z1 22 BK
Z1 20 BK
Z1 18 BK
Z1 20 BK
S117
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-2)
35
A/C COMPRESSOR CLUTCH
(8W-42-2)
1
2
C3 18 DB/BK
C3 18 DB/BK
Z1 20 BK
DIODE NO. 2
Z1 18 BK
Z1 20 BK
G103


INTERMITTENT WIPE/ WASH SWITCH
(8W-53-3)
1
COMBINATION FLASHER
(8W-52-2)
B3
NO CONNECTION
REAR WINDOW DEFOGGER SWITCH
(8W-48-2)
2
Z2
22
BK/LG
Z2
20
BK/LG
Z2
20
BK/LG
Z2
22
BK/LG
S205
RADIO
(8W-47-2)
Z2
20
BK/LG
Z9
14
BK
G201
AIRBAG CONTROL MODULE
(8W-43-2)
10
POWERTRAIN CONTROL MODULE
(8W-30-2)
71
C1
BATTERY
(8W-20-2)
+
-
Z6
18
BK/PK
Z2
18
BK/OR
Z0
8
BK
Z1
10
BK
G202
G106
G104
G105


MASTER POWER WINDOW SWITCH
(8W-60-2)
3
POWER MIRROR SWITCH
(8W-62-2)
1
LEFT DOOR LOCK SWITCH
(8W-61-2)
2
4
Z8 14 BK/VT
Z8 18 BK/VT
Z8 18 BK/VT
Z8 18 BK/VT
S310
SUNROOF VENT SWITCH
(8W-64-2)
2
4
POWER SUNROOF MOTOR
(8W-64-2)
6
A/C HEATER CONTROL SWITCH
(8W-42-3)
1
Z8 14 BK/VT
Z8 18 BK/VT
Z8 18 BK/VT
Z8 18 BK/VT
Z8 18 BK/VT
6
C225
Z8 18 BK/VT
4
C231
S314
Z8 14 BK/VT
Z8 14 BK/VT
G203


MAP/
READING
LAMPS
(8W-44-4)
B
Z3
18
BK/OR
ASH
RECEIVER
LAMP
(8W-44-4)
2
PRNDL
LAMP
(8W-44-4)
2
Z3
20
BK/OR
REAR
FOG
LAMP
SWITCH
(8W-51-6)
5
FRONT
FOG
LAMP
SWITCH
(8W-50-6)
3
Z3 20BK/OR
3 C225
2 C203
GLOVE
BOX
LAMP
AND
SWITCH
(8W-44-4)
2
INSTRUMENT
CLUSTER
(8W-40-6)
8 C1
Z3
20
BK/OR
Z3
20
BK/OR
Z3
20
BK/OR
Z3
20
BK/OR
Z3
16
BK/OR
Z3
20
BK/OR
S201
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-3)
HEADLAMP
SWITCH
(8W-50-2)
IGNITION
SWITCH
(8W-10-5)
1
Z1
20
BK
Z1
22
BK
Z1
22
BK
S202
Z1
20
BK
Z3
14
BK/OR
Z1
20
BK
3
HEADLAMP
LEVELING
SWITCH
(8W-50-4)
G204



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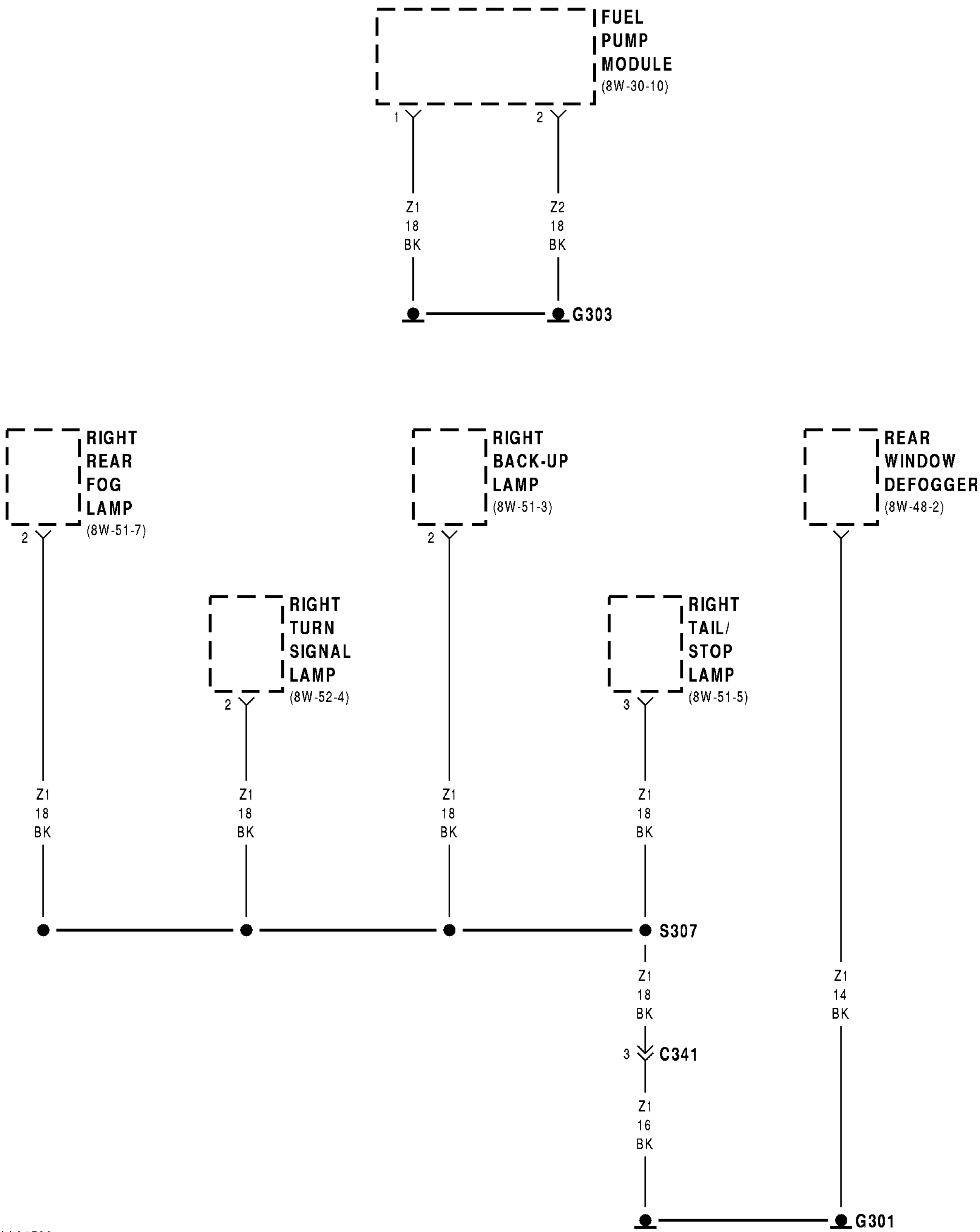

FUEL PUMP MODULE
(8W-30-10)
1
2
Z1
18
BK
Z2
18
BK
G303
RIGHT REAR FOG LAMP
(8W-51-7)
RIGHT TURN SIGNAL LAMP
(8W-52-4)
RIGHT BACK-UP LAMP
(8W-51-3)
RIGHT TAIL/ STOP LAMP
(8W-51-5)
REAR WINDOW DEFOGGER
(8W-48-2)
S307
C341
Z1
14
BK
Z1
16
BK
G301

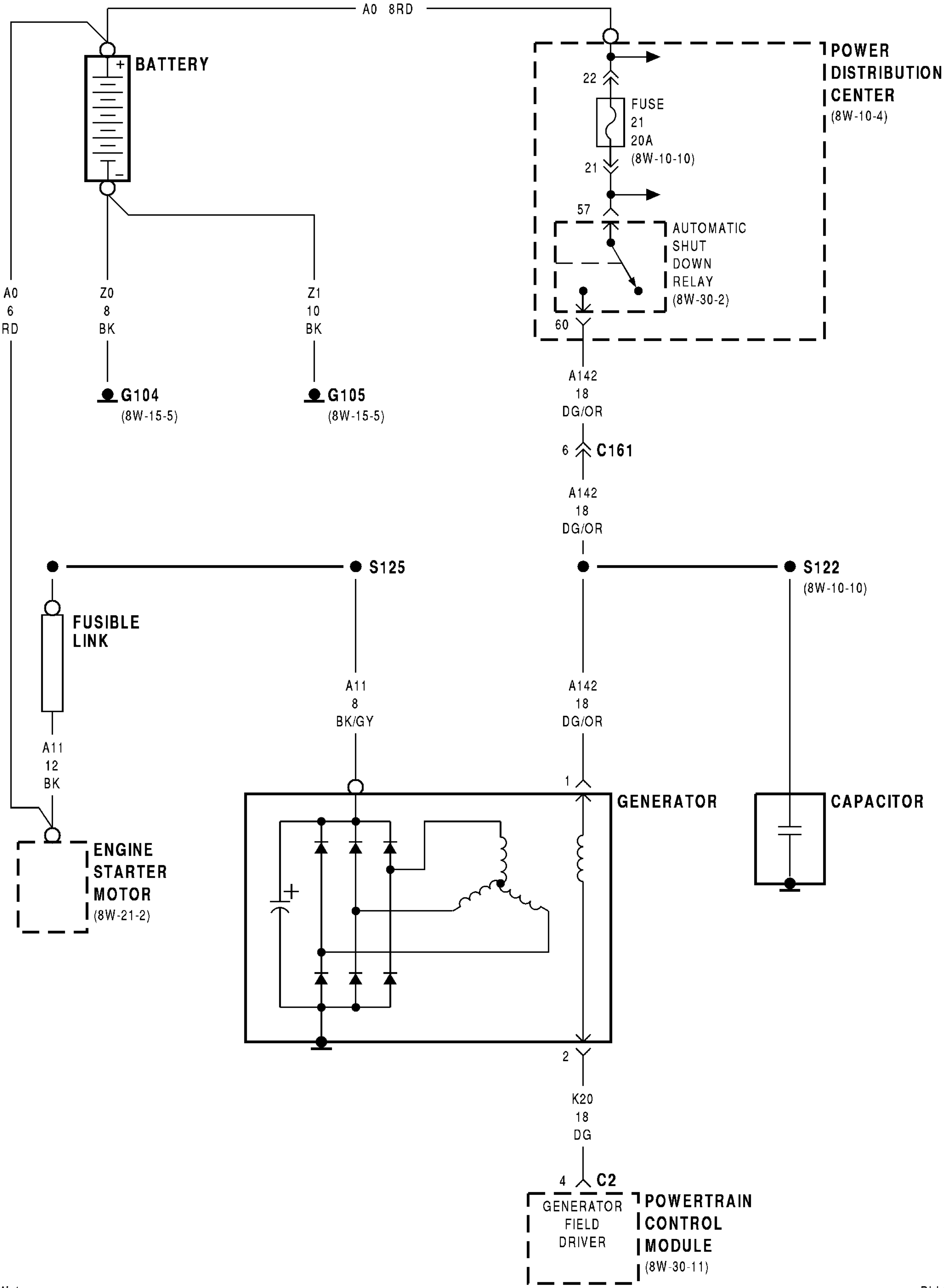
8W-15 GROUND DISTRIBUTION

GENERAL INFORMATION

This section identifies the grounds, splices that connect to those grounds, and the components that connect those grounds. For additional information on system operation, refer to the appropriate section of the wiring diagrams. For an illustration of the physical location of each ground, refer to group 8W-90.

8W-20 CHARGING SYSTEM

INDEX


A0 8RD
BATTERY
POWER DISTRIBUTION CENTER
(8W-10-4)
22
FUSE
21
20A
(8W-10-10)
21
57
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
60
A0
6
RD
Z0
8
BK
Z1
10
BK
G104
(8W-15-5)
G105
(8W-15-5)
A142
18
DG/OR
6
C161
A142
18
DG/OR
S125
S122
(8W-10-10)
FUSIBLE LINK
A11
8
BK/GY
A142
18
DG/OR
A11
12
BK
1
GENERATOR
CAPACITOR
ENGINE STARTER MOTOR
(8W-21-2)
2
K20
18
DG
4
C2
GENERATOR FIELD DRIVER
POWERTRAIN CONTROL MODULE
(8W-30-11)

8W-20 CHARGING SYSTEM

DESCRIPTION AND OPERATION

CHARGING SYSTEM

The charging system is an integral part of the battery and starter systems. Since all of these systems work together, any diagnosis and testing should be done in conjunction.

The charging system is protected by a 12 gauge fusible link located in the A11 circuit. This fusible link is between the generator and the starter.

The generator ground is provided through a case ground in the generator to its attaching bracket. This generator uses a voltage regulator internal to the Powertrain Control Module (PCM).

When the vehicle is running, battery voltage is applied to the generator field terminal through the A142 circuit. This circuit is the output from the contact side of the Automatic Shut Down (ASD) relay. The ground, or voltage regulated side, of the generator field is controlled by the K20 circuit which connects to cavity 4 of the PCM connector.

When there is current present in the field, and the rotor is turning, the stator in the generator produces a B+ voltage that is supplied to the battery through the A11 and A0 circuits. The A11 circuit is connected to the output terminal of the generator and connects to the engine starter motor battery feed terminal. The A0 circuit is a direct feed line from the battery and connects to the engine starter motor.

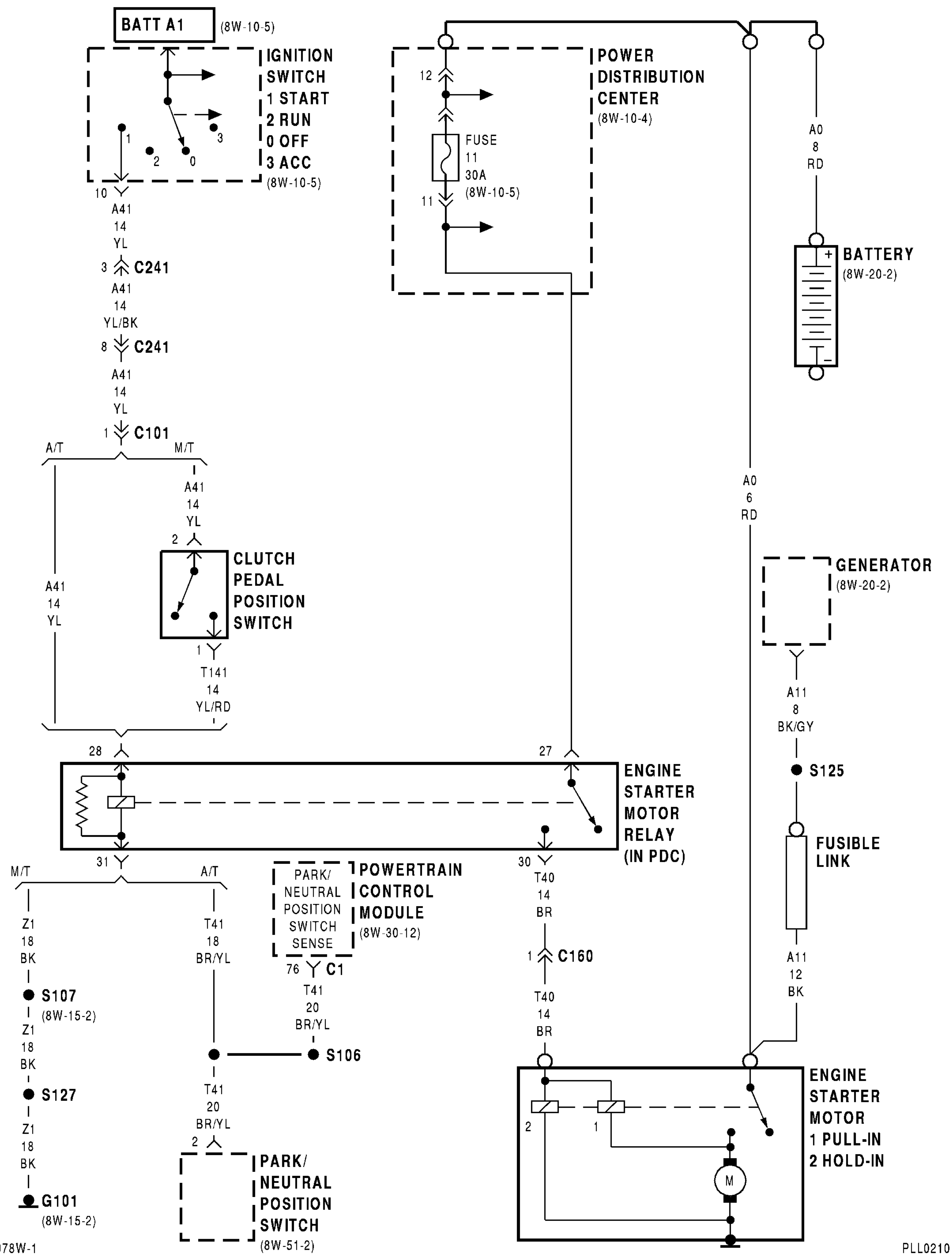
Grounding for the system is accomplished at the battery negative terminal. These grounds connect to the engine and body.

HELPFUL INFORMATION

- Inspect for a blown fusible link in the A11 circuit between the generator and the starter motor.
- For additional information on charging system diagnosis, refer to the appropriate section of the service manual.

8W-21 STARTING SYSTEM

INDEX



978W-1 PLL02101

8W-21 STARTING SYSTEM

DESCRIPTION AND OPERATION

STARTING SYSTEM- MANUAL TRANSMISSION

The Power Distribution Center (PDC) supplies battery voltage to the engine starter motor solenoid through circuit T40 when the coil side of the engine starter motor relay energizes. Circut A1 supplies the battery voltage for the contact side of the relay. Circuit A1 and circuit T40 are protected by a 30 amp fuse and feeds the contact side of the engine starter motor relay. Both the 30 amp fuse and the engine starter motor relay are located in the PDC.

The ignition switch supplies battery voltage to the coil side of the engine starter motor relay on circuit A41 when the key is moved to the START position and the operator has pressed the clutch pedal to CLOSE the clutch pedal position switch. Circuit Z1 supplies the ground for the coil side of the engine starter motor relay. When the coil side of the relay energizes, the contacts CLOSE, supplying battery voltage to the engine starter motor solenoid.

Circuit A0 (battery positive cable) supplies battery voltage to the motor of the starter when the solenoid energizes.

HELPFUL INFORMATION

- Check for blown engine starter motor fuse in the PDC.
- Move ignition key to the START position and with the clutch pedal pressed, listen for starter motor relay to click. The engine starter motor relay is located in the PDC.
- Check for a good ground at starter motor.
- The left headlamp ground is the end point for the starter relay coil ground circuit and is located at the left side of the radiator closure panel.

STARTING SYSTEM (AUTOMATIC TRANSMISSION)

The Power Distribution Center (PDC) supplies battery voltage to the engine starter motor solenoid through circuit T40 when the coil side of the engine starter motor relay energizes. Circuit A1 supplies battery voltage to the contact side of the relay. Circuit A1 and circuit T40 are protected by a 30 amp fuse and feeds the contact side of the engine starter motor relay. Both the 30 amp fuse and the engine starter motor relay are located in the PDC.

The ignition switch supplies battery voltage to the coil side of the engine starter motor relay on circuit A41 when the key is moved to the START position and the park/neutral portion of the park/neutral position switch (3 speed transmission) is CLOSED. Ground for the coil side of the engine starter motor relay is supplied by circuit T41.

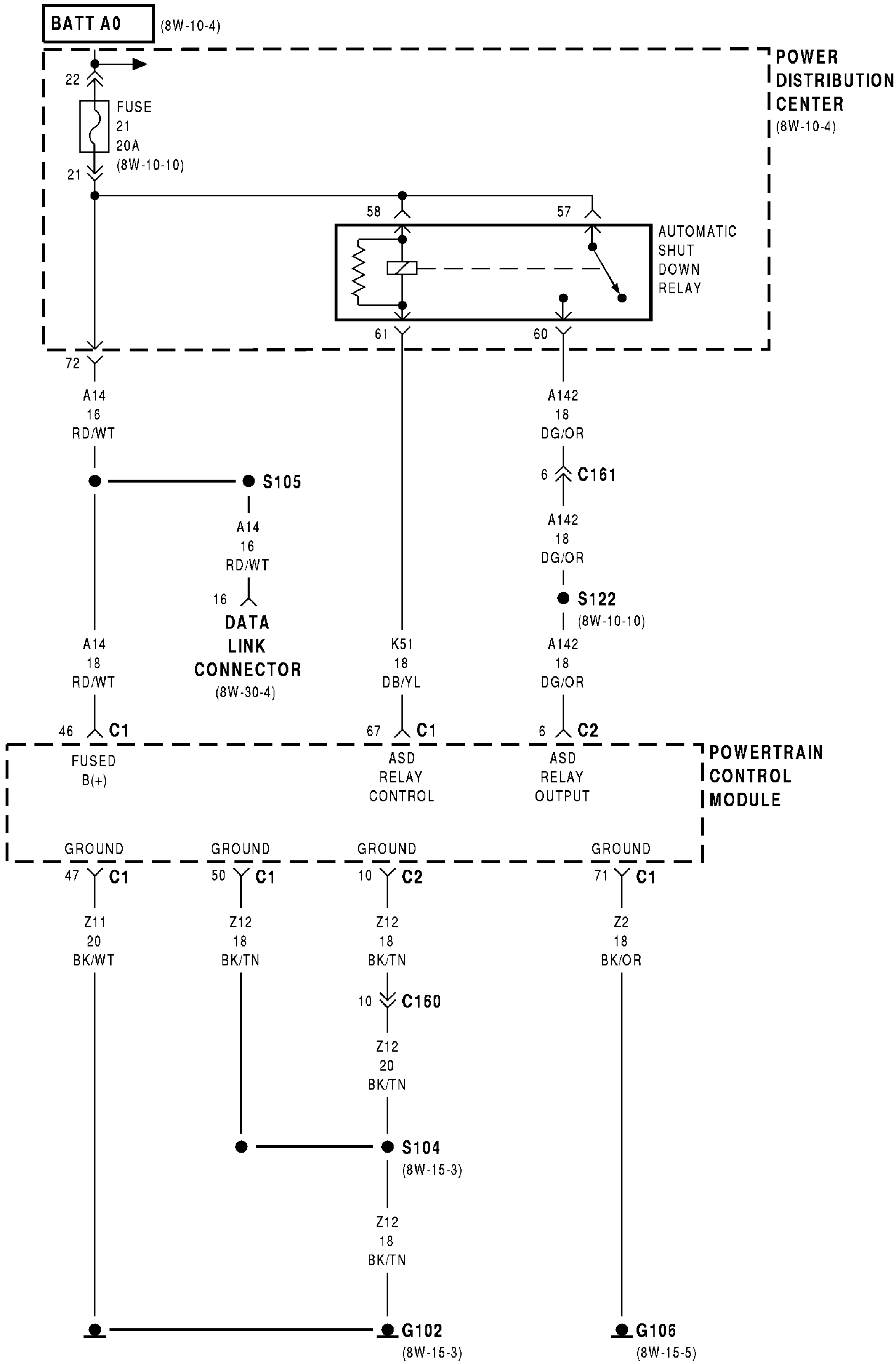
Circuit A0 (battery positive cable) supplies battery voltage to the motor of the engine starter when the solenoid energizes.

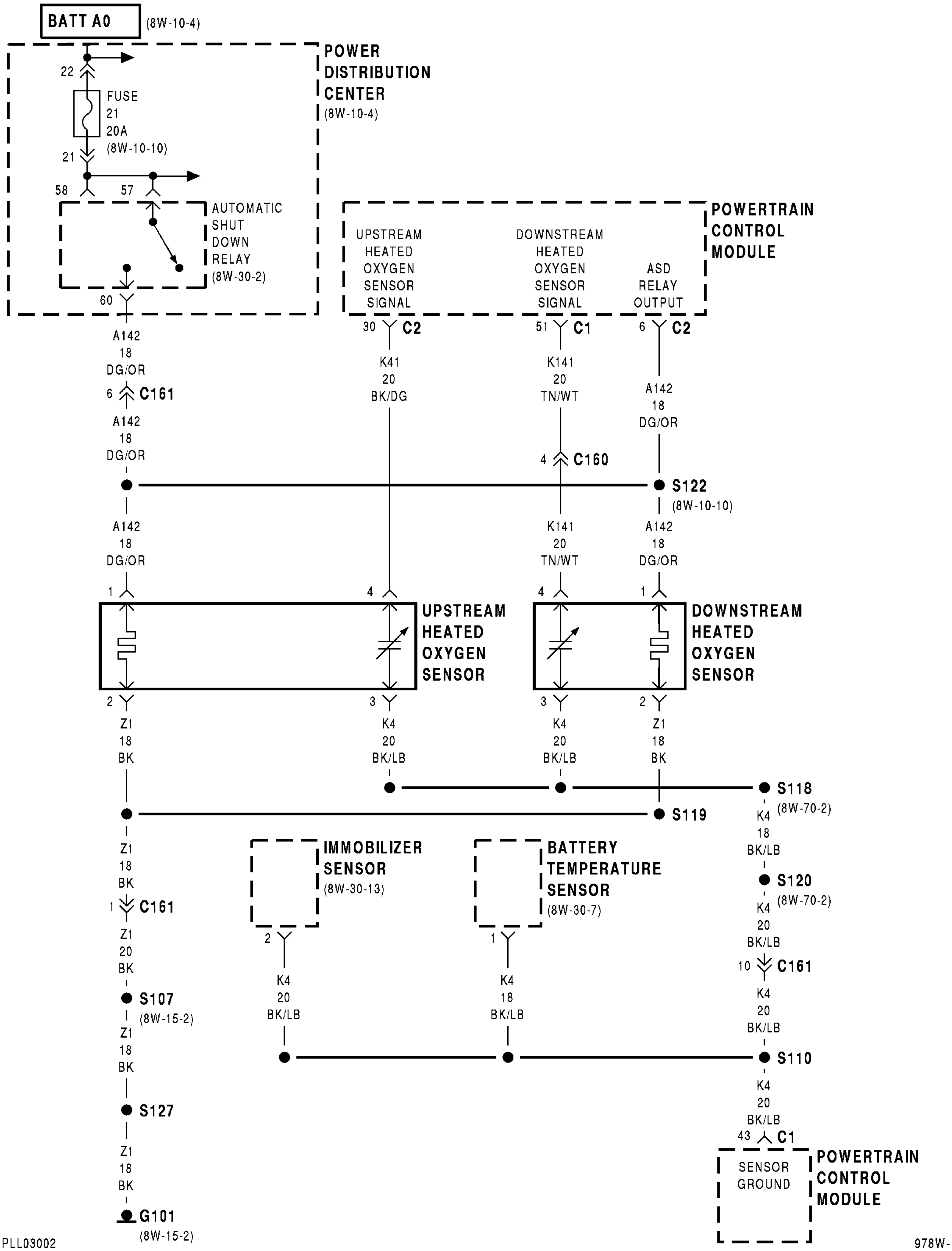
HELPFUL INFORMATION

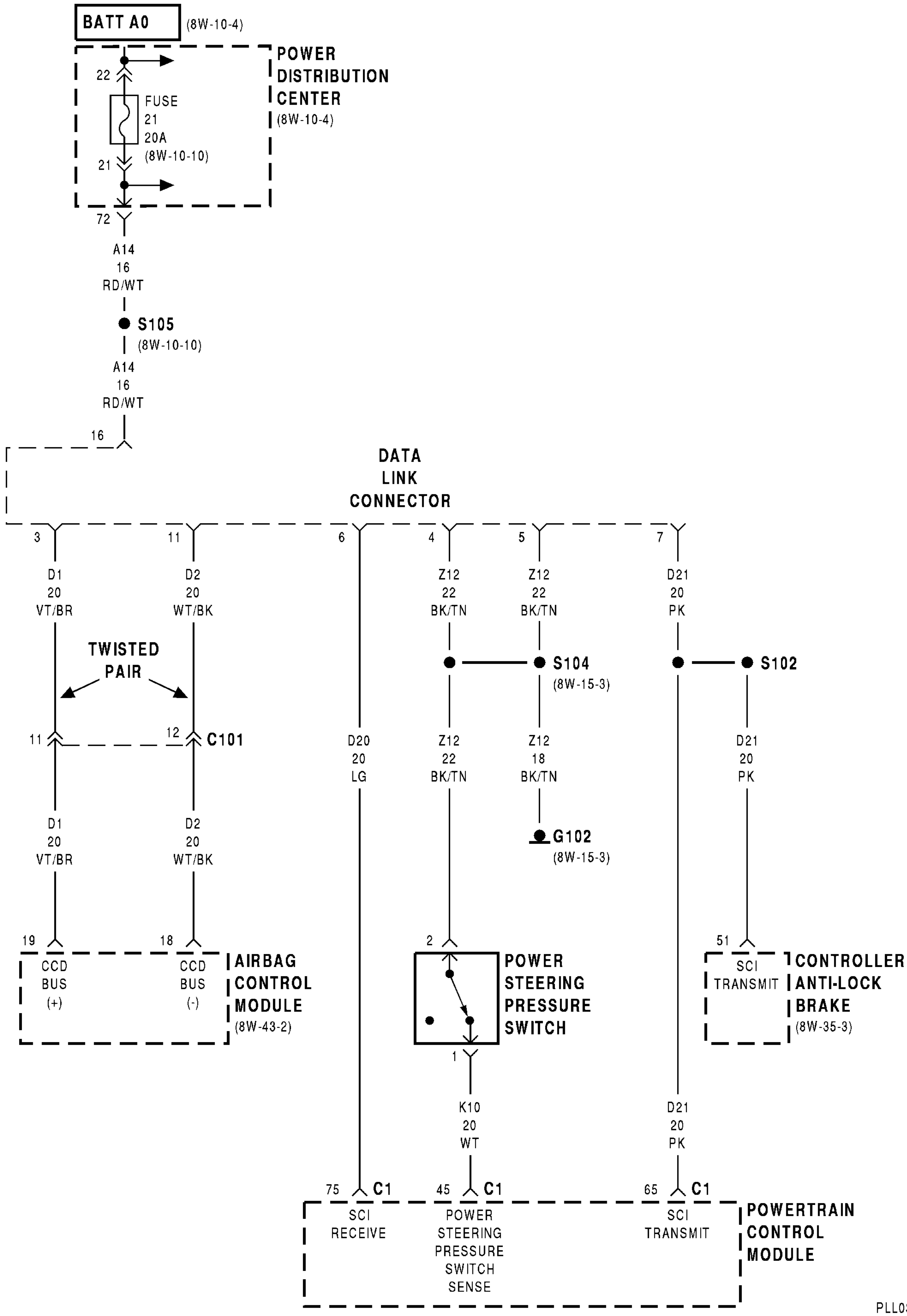
- Check for blown engine starter motor fuse in the PDC.
- With the gear selector in the Park or Neutral position, move ignition key to the START position and listen for engine starter motor relay to click. The engine starter motor relay is located in the PDC.
- Check for a good ground at engine starter motor.

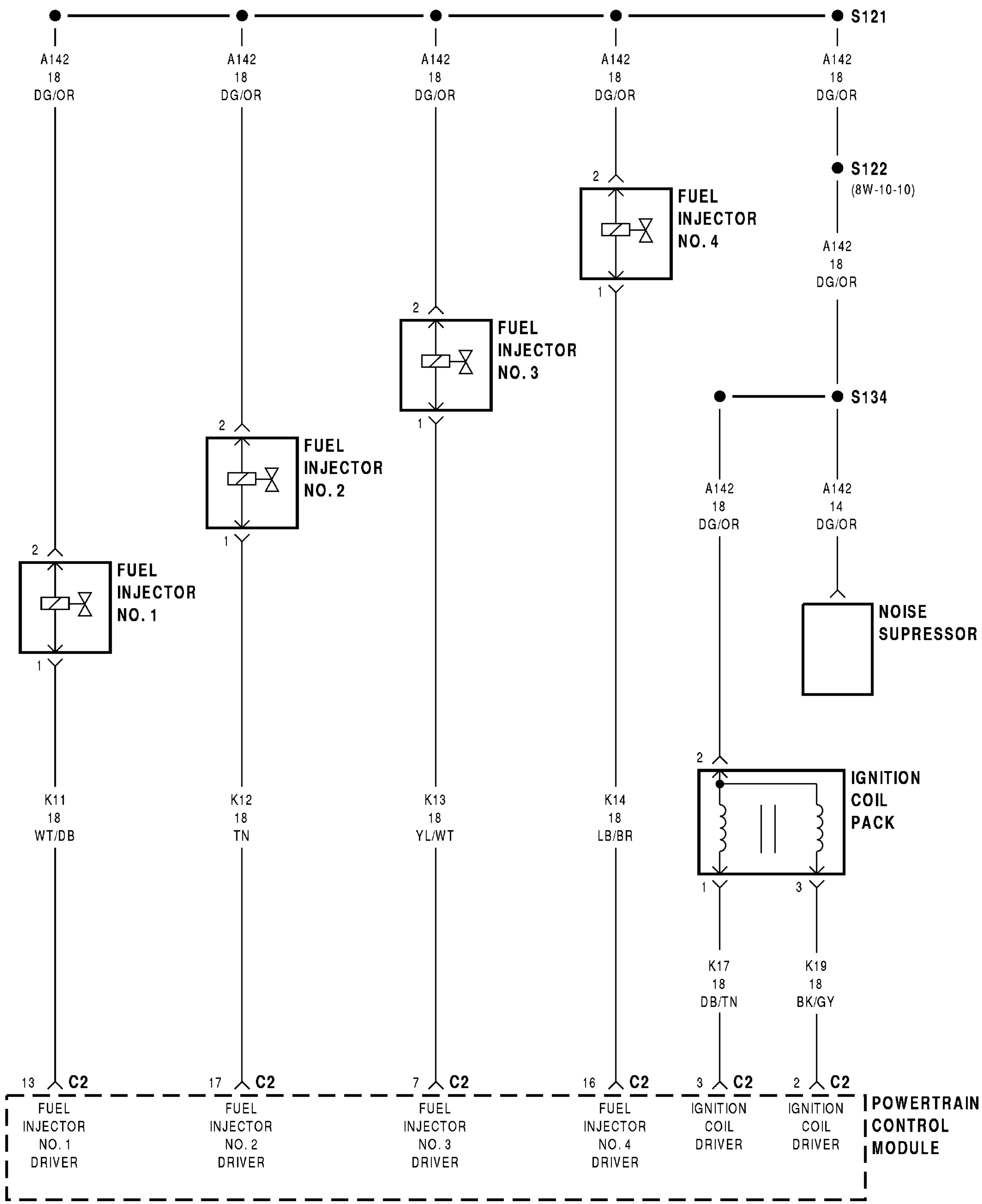
8W-30 FUEL/IGNITION SYSTEMS

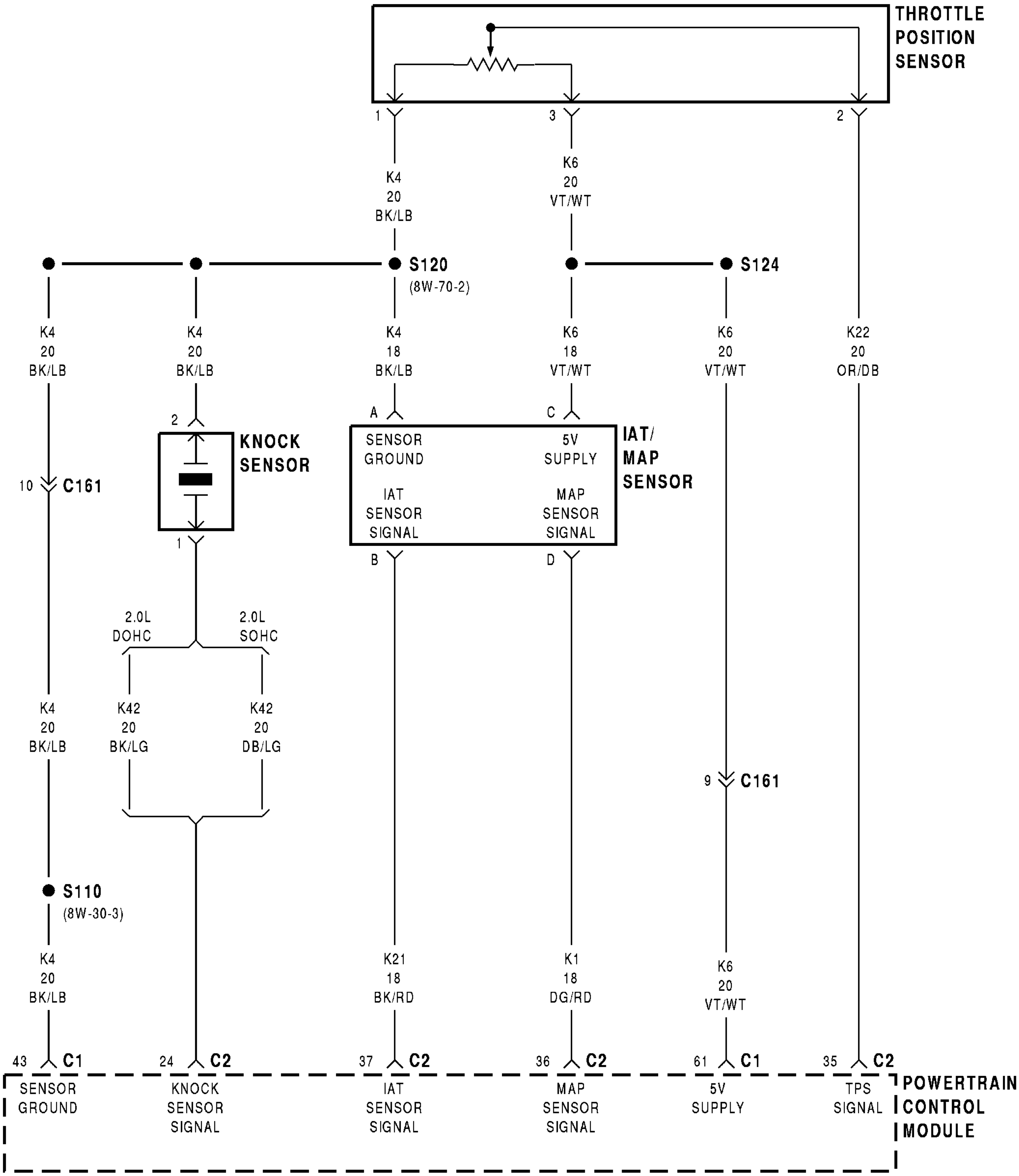
INDEX

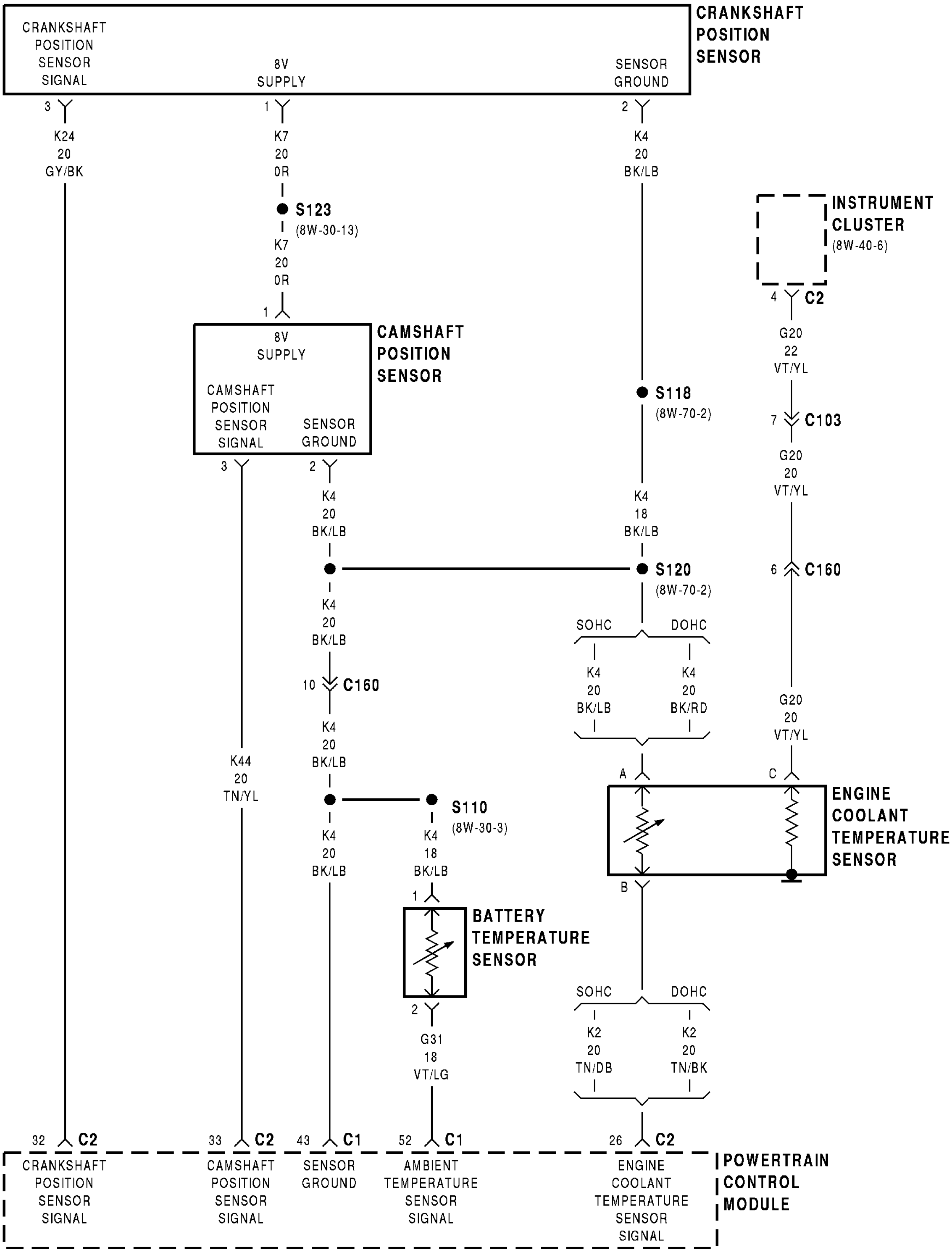

BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
22
FUSE
21
20A
(8W-10-10)
21
58
57
AUTOMATIC SHUT DOWN RELAY
61
60
72
A14
16
RD/WT
S105
A14
16
RD/WT
16
DATA LINK CONNECTOR
(8W-30-4)
A142
18
DG/OR
6
C161
A142
18
DG/OR
S122
(8W-10-10)
A142
18
DG/OR
A14
18
RD/WT
K51
18
DB/YL
46
C1
67
C1
6
C2
FUSED B(+)
ASD RELAY CONTROL
ASD RELAY OUTPUT
POWERTRAIN CONTROL MODULE
GROUND
GROUND
GROUND
GROUND
47
C1
50
C1
10
C2
71
C1
Z11
20
BK/WT
Z12
18
BK/TN
Z12
18
BK/TN
Z2
18
BK/OR
10
C160
Z12
20
BK/TN
S104
(8W-15-3)
Z12
18
BK/TN
G102
(8W-15-3)
G106
(8W-15-5)

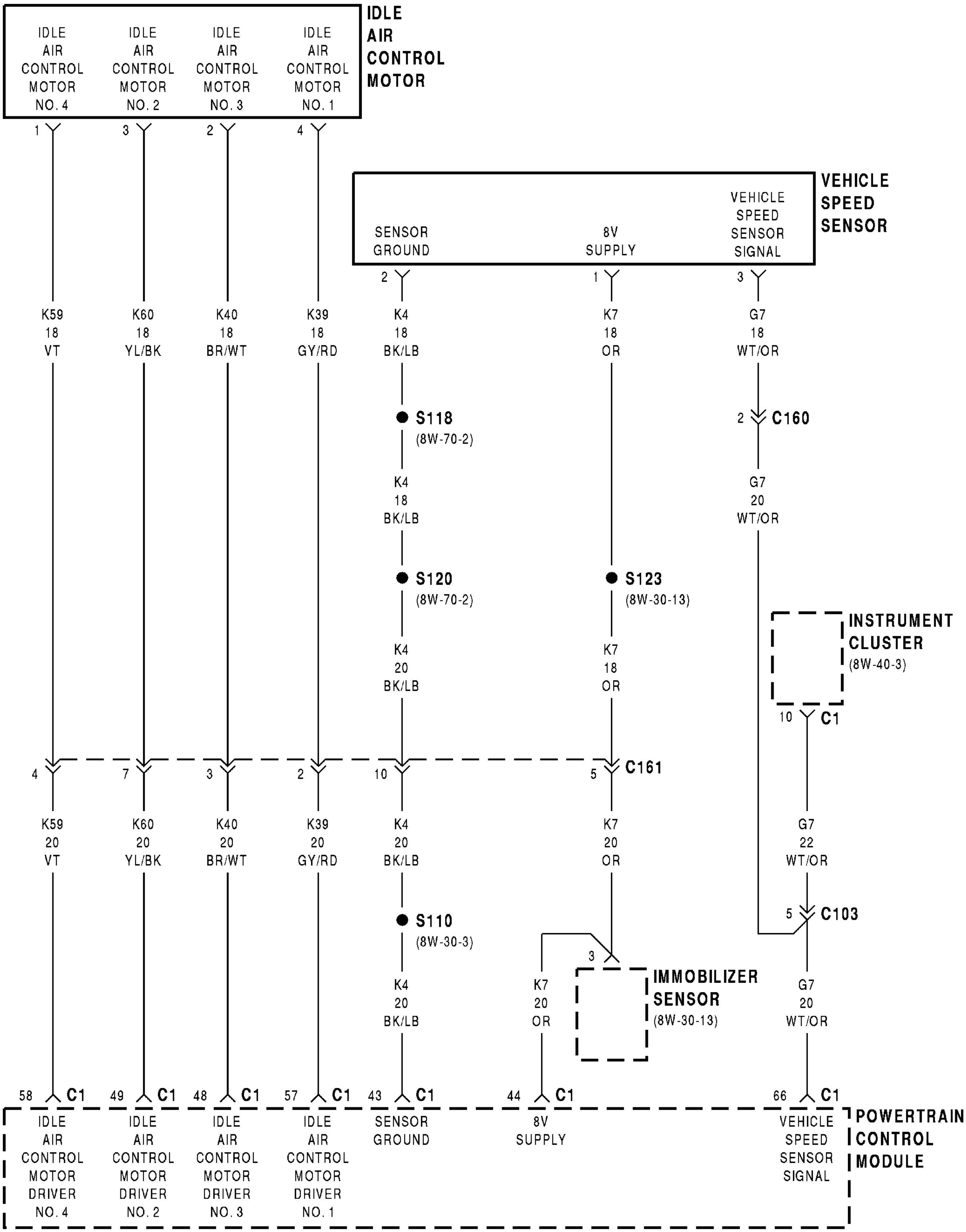

BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
22
FUSE
21
20A
(8W-10-10)
21
58
57
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
60
A142
18
DG/OR
6 C161
POWERTRAIN
CONTROL
MODULE
UPSTREAM
HEATED
OXYGEN
SENSOR
SIGNAL
DOWNSTREAM
HEATED
OXYGEN
SENSOR
SIGNAL
ASD
RELAY
OUTPUT
30 C2
51 C1
6 C2
K41
20
BK/DG
K141
20
TN/WT
4 C160
S122
(8W-10-10)
UPSTREAM
HEATED
OXYGEN
SENSOR
DOWNSTREAM
HEATED
OXYGEN
SENSOR
Z1
18
BK
K4
20
BK/LB
S118
(8W-70-2)
S119
K4
18
BK/LB
S120
(8W-70-2)
IMMOBILIZER
SENSOR
(8W-30-13)
BATTERY
TEMPERATURE
SENSOR
(8W-30-7)
1 C161
Z1
20
BK
S107
(8W-15-2)
10 C161
S110
S127
43 C1
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE
G101
(8W-15-2)
PLL03002
978W-1

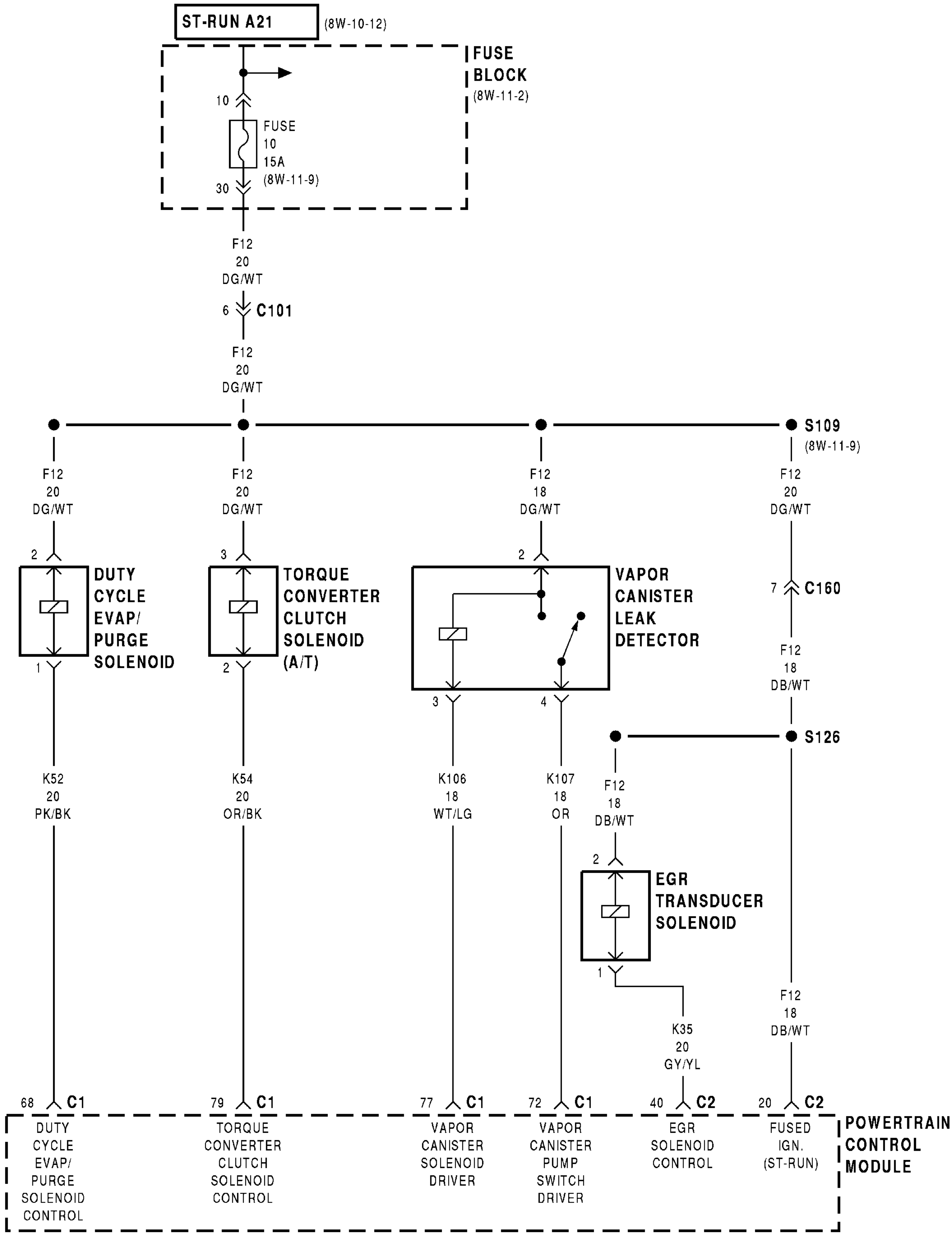

BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
22
FUSE 21 20A
(8W-10-10)
21
72
A14 16 RD/WT
S105
(8W-10-10)
A14 16 RD/WT
16
DATA LINK CONNECTOR
3
11
6
4
5
7
D1 20 VT/BR
D2 20 WT/BK
Z12 22 BK/TN
Z12 22 BK/TN
D21 20 PK
TWISTED PAIR
S104
(8W-15-3)
S102
11
12
C101
D20 20 LG
Z12 22 BK/TN
Z12 18 BK/TN
D21 20 PK
G102
(8W-15-3)
D1 20 VT/BR
D2 20 WT/BK
19
18
CCD BUS (+)
CCD BUS (-)
AIRBAG CONTROL MODULE
(8W-43-2)
2
POWER STEERING PRESSURE SWITCH
1
51
SCI TRANSMIT
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
K10 20 WT
D21 20 PK
75 C1
45 C1
65 C1
SCI RECEIVE
POWER STEERING PRESSURE SWITCH SENSE
SCI TRANSMIT
POWERTRAIN CONTROL MODULE

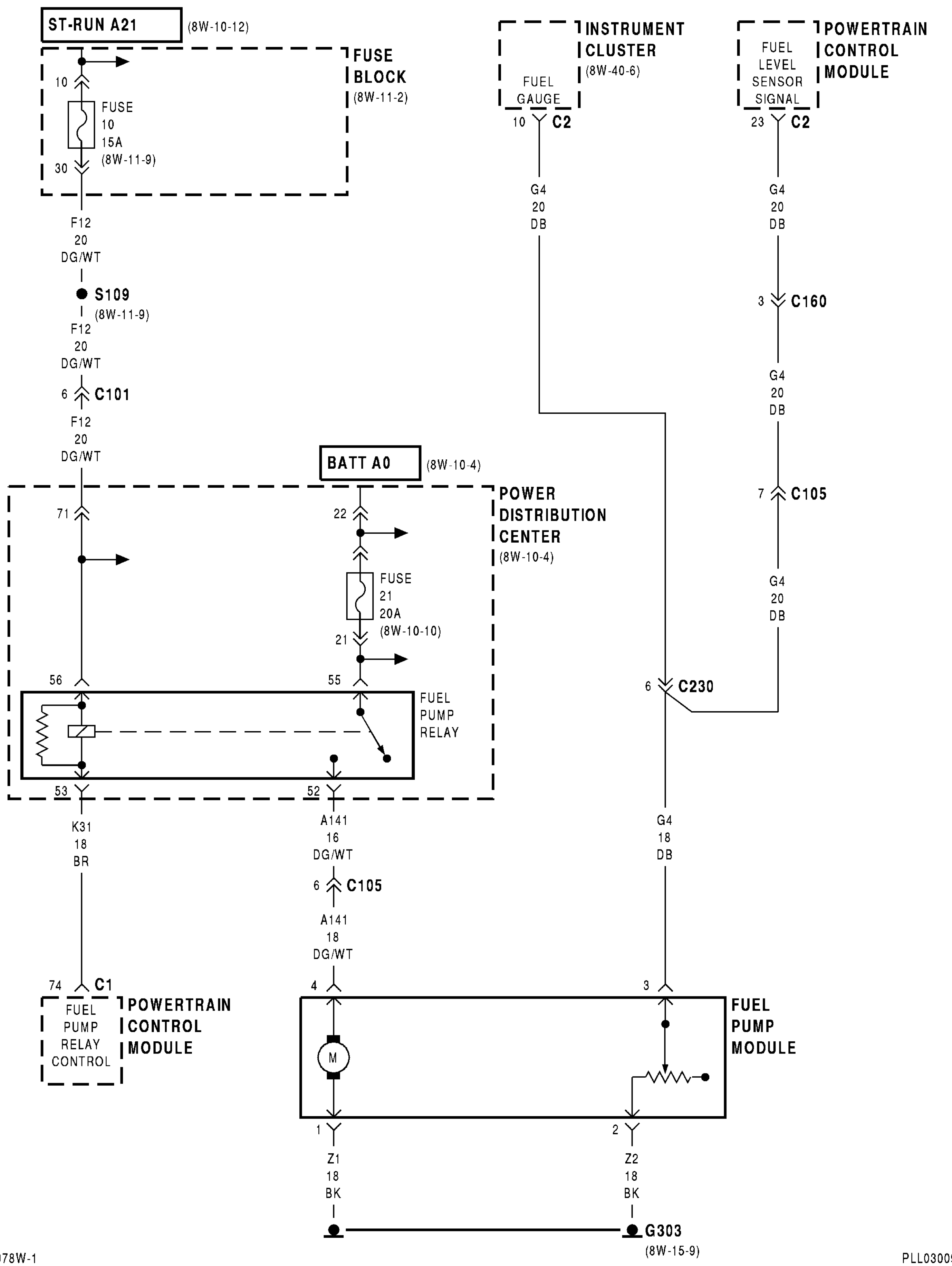

S121
A142
18
DG/OR
S122
(8W-10-10)
S134
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 4
A142
14
DG/OR
NOISE
SUPRESSOR
IGNITION
COIL
PACK
K11
18
WT/DB
K12
18
TN
K13
18
YL/WT
K14
18
LB/BR
K17
18
DB/TN
K19
18
BK/GY
13 C2
17 C2
7 C2
16 C2
3 C2
2 C2
FUEL INJECTOR NO. 1 DRIVER
FUEL INJECTOR NO. 2 DRIVER
FUEL INJECTOR NO. 3 DRIVER
FUEL INJECTOR NO. 4 DRIVER
IGNITION COIL DRIVER
IGNITION COIL DRIVER
POWERTRAIN
CONTROL
MODULE

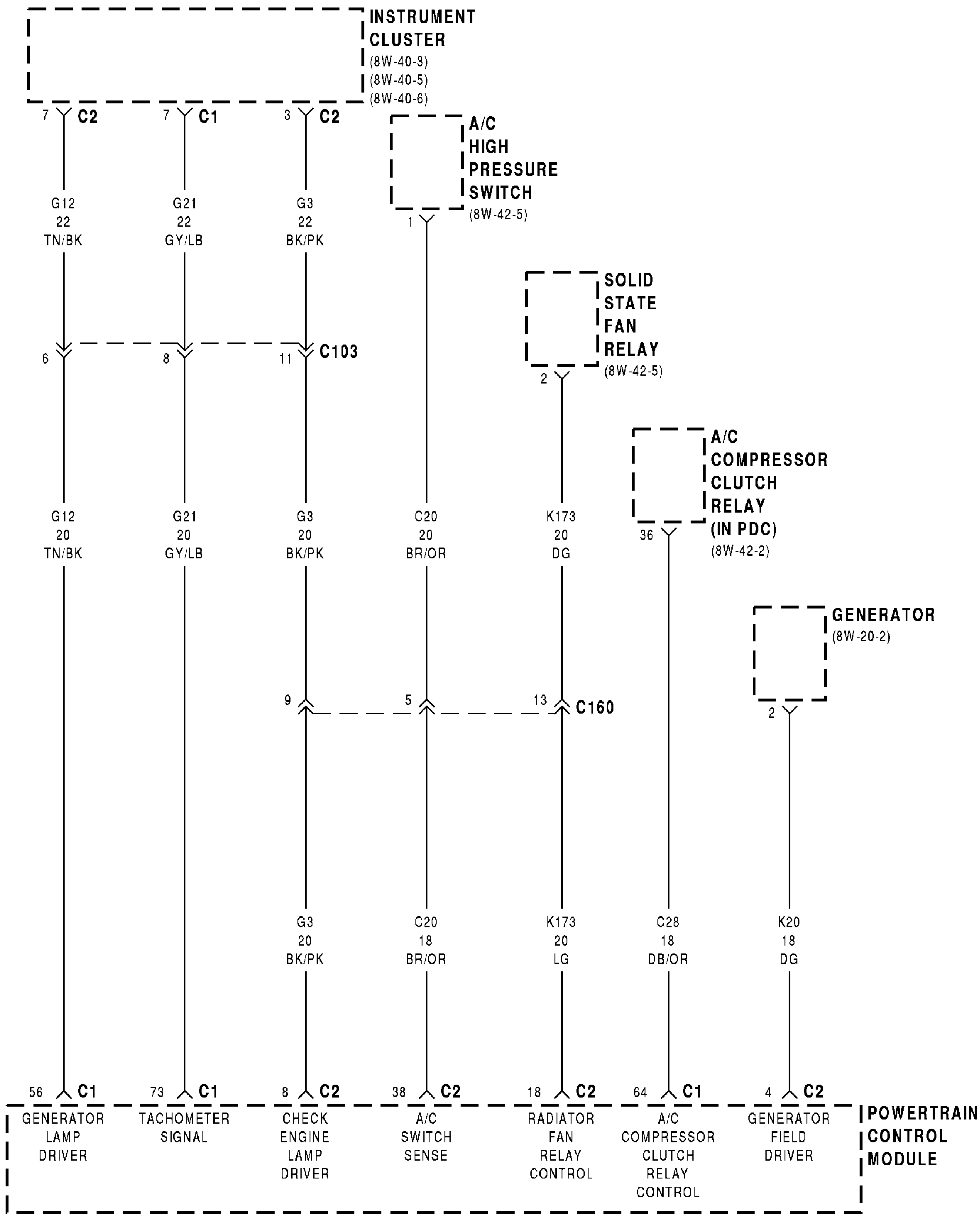

THROTTLE
POSITION
SENSOR
1
3
2
K4
20
BK/LB
K6
20
VT/WT
S120
(8W-70-2)
S124
K4
20
BK/LB
K4
20
BK/LB
K4
18
BK/LB
K6
18
VT/WT
K6
20
VT/WT
K22
20
OR/DB
A
C
2
KNOCK
SENSOR
10
C161
SENSOR
GROUND
5V
SUPPLY
IAT
SENSOR
SIGNAL
MAP
SENSOR
SIGNAL
IAT/
MAP
SENSOR
1
B
D
2.0L
DOHC
2.0L
SOHC
K4
20
BK/LB
K42
20
BK/LG
K42
20
DB/LG
9
C161
S110
(8W-30-3)
K4
20
BK/LB
K21
18
BK/RD
K1
18
DG/RD
K6
20
VT/WT
43
C1
24
C2
37
C2
36
C2
61
C1
35
C2
SENSOR
GROUND
KNOCK
SENSOR
SIGNAL
IAT
SENSOR
SIGNAL
MAP
SENSOR
SIGNAL
5V
SUPPLY
TPS
SIGNAL
POWERTRAIN
CONTROL
MODULE

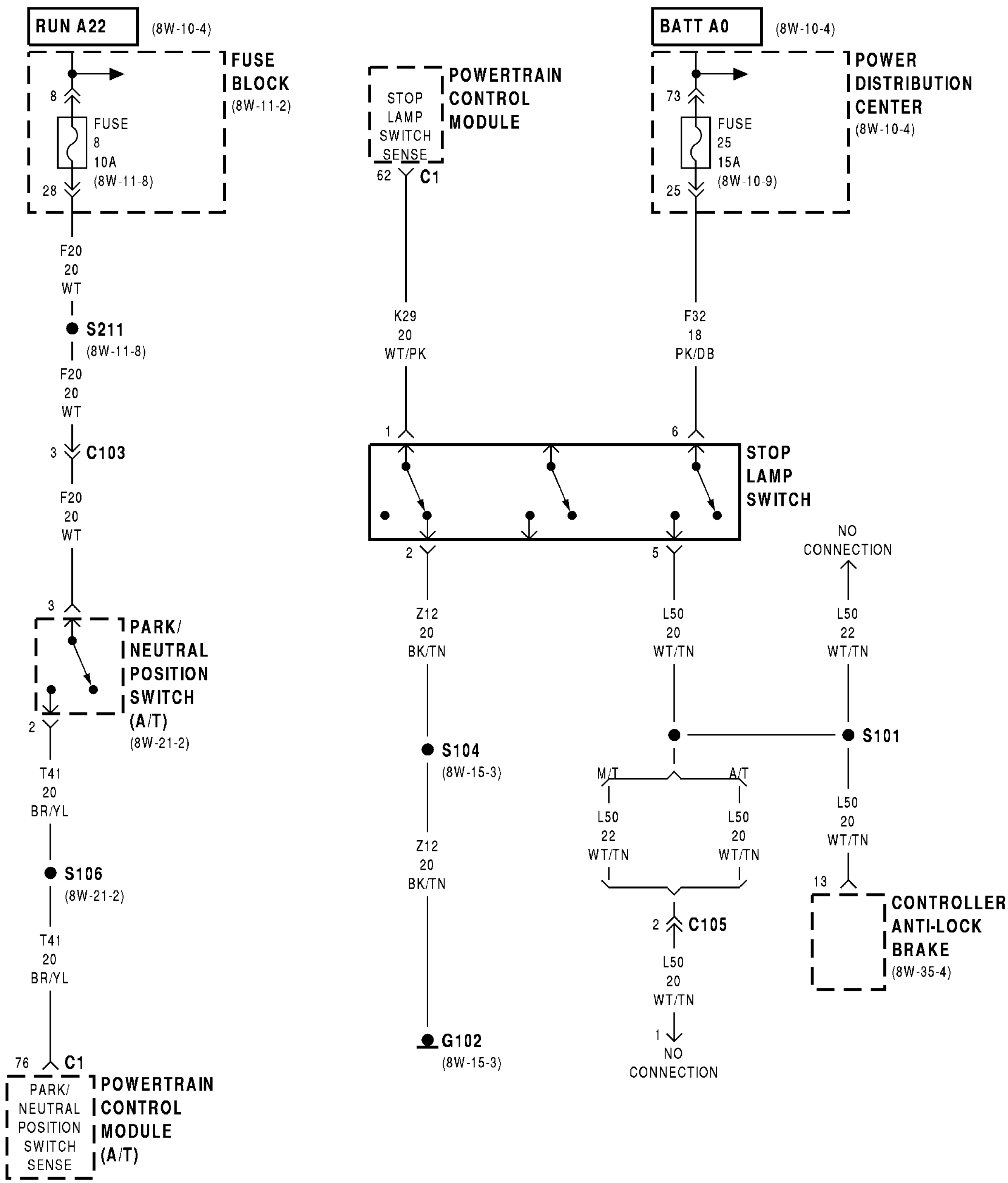

CRANKSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR SIGNAL
8V SUPPLY
SENSOR GROUND
3
1
2
K24 20 GY/BK
K7 20 OR
K4 20 BK/LB
S123 (8W-30-13)
K7 20 OR
1
CAMSHAFT POSITION SENSOR
8V SUPPLY
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
3
2
K4 20 BK/LB
S118 (8W-70-2)
K4 18 BK/LB
S120 (8W-70-2)
K4 20 BK/LB
10 C160
K4 20 BK/LB
K44 20 TN/YL
S110 (8W-30-3)
K4 20 BK/LB
K4 18 BK/LB
1
BATTERY TEMPERATURE SENSOR
2
G31 18 VT/LG
INSTRUMENT CLUSTER (8W-40-6)
4 C2
G20 22 VT/YL
7 C103
G20 20 VT/YL
6 C160
G20 20 VT/YL
SOHC DOHC
K4 20 BK/LB
K4 20 BK/RD
A
C
ENGINE COOLANT TEMPERATURE SENSOR
B
SOHC DOHC
K2 20 TN/DB
K2 20 TN/BK
32 C2
33 C2
43 C1
52 C1
26 C2
CRANKSHAFT POSITION SENSOR SIGNAL
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
AMBIENT TEMPERATURE SENSOR SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

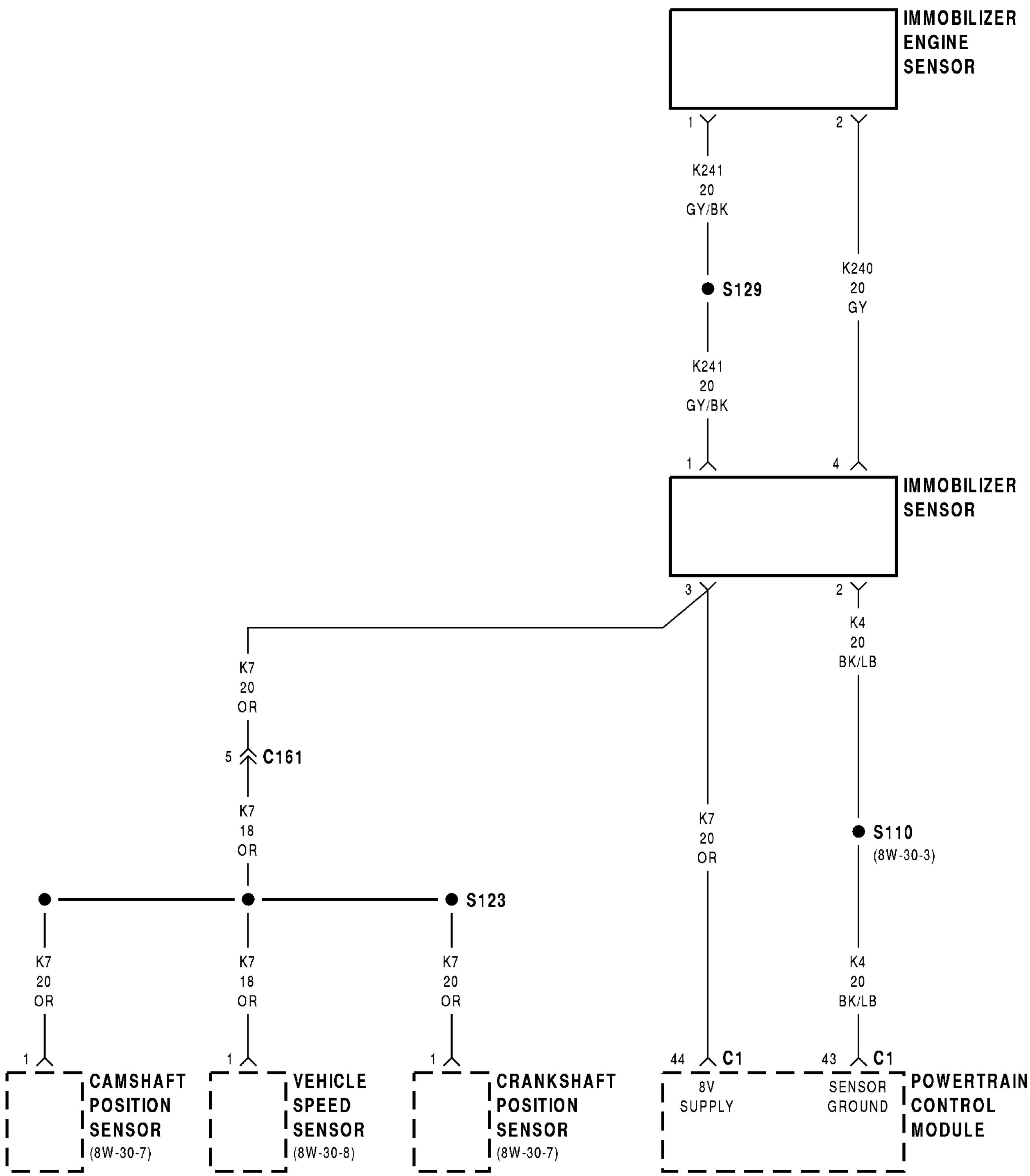

IDLE AIR CONTROL MOTOR
IDLE AIR CONTROL MOTOR NO. 4
IDLE AIR CONTROL MOTOR NO. 2
IDLE AIR CONTROL MOTOR NO. 3
IDLE AIR CONTROL MOTOR NO. 1
VEHICLE SPEED SENSOR
SENSOR GROUND
8V SUPPLY
VEHICLE SPEED SENSOR SIGNAL
K59 18 VT
K60 18 YL/BK
K40 18 BR/WT
K39 18 GY/RD
K4 18 BK/LB
K7 18 OR
G7 18 WT/OR
S118 (8W-70-2)
C160
G7 20 WT/OR
S120 (8W-70-2)
S123 (8W-30-13)
K4 20 BK/LB
K7 18 OR
INSTRUMENT CLUSTER (8W-40-3)
C1
C161
K59 20 VT
K60 20 YL/BK
K40 20 BR/WT
K39 20 GY/RD
K4 20 BK/LB
K7 20 OR
G7 22 WT/OR
C103
S110 (8W-30-3)
IMMOBILIZER SENSOR (8W-30-13)
K7 20 OR
G7 20 WT/OR
POWERTRAIN CONTROL MODULE
IDLE AIR CONTROL MOTOR DRIVER NO. 4
IDLE AIR CONTROL MOTOR DRIVER NO. 2
IDLE AIR CONTROL MOTOR DRIVER NO. 3
IDLE AIR CONTROL MOTOR DRIVER NO. 1
SENSOR GROUND
8V SUPPLY
VEHICLE SPEED SENSOR SIGNAL


ST-RUN A21
(8W-10-12)
FUSE BLOCK
(8W-11-2)
10
FUSE 10 15A
(8W-11-9)
30
F12 20 DG/WT
6 C101
F12 20 DG/WT
S109
(8W-11-9)
F12 20 DG/WT
F12 20 DG/WT
F12 18 DG/WT
F12 20 DG/WT
2
DUTY CYCLE EVAP/ PURGE SOLENOID
1
3
TORQUE CONVERTER CLUTCH SOLENOID (A/T)
2
2
VAPOR CANISTER LEAK DETECTOR
3
4
7 C160
F12 18 DB/WT
S126
K52 20 PK/BK
K54 20 OR/BK
K106 18 WT/LG
K107 18 OR
F12 18 DB/WT
2
EGR TRANSDUCER SOLENOID
1
K35 20 GY/YL
F12 18 DB/WT
68 C1
79 C1
77 C1
72 C1
40 C2
20 C2
DUTY CYCLE EVAP/ PURGE SOLENOID CONTROL
TORQUE CONVERTER CLUTCH SOLENOID CONTROL
VAPOR CANISTER SOLENOID DRIVER
VAPOR CANISTER PUMP SWITCH DRIVER
EGR SOLENOID CONTROL
FUSED IGN. (ST-RUN)
POWERTRAIN CONTROL MODULE


ST-RUN A21
(8W-10-12)
FUSE BLOCK
(8W-11-2)
10
FUSE
10
15A
(8W-11-9)
30
F12
20
DG/WT
S109
(8W-11-9)
F12
20
DG/WT
6
C101
F12
20
DG/WT
BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
71
22
FUSE
21
20A
(8W-10-10)
21
56
55
FUEL PUMP RELAY
53
52
K31
18
BR
A141
16
DG/WT
6
C105
A141
18
DG/WT
74
C1
FUEL PUMP RELAY CONTROL
POWERTRAIN CONTROL MODULE
4
3
FUEL PUMP MODULE
M
1
2
Z1
18
BK
Z2
18
BK
G303
(8W-15-9)
INSTRUMENT CLUSTER
(8W-40-6)
FUEL GAUGE
10
C2
G4
20
DB
POWERTRAIN CONTROL MODULE
FUEL LEVEL SENSOR SIGNAL
23
C2
G4
20
DB
3
C160
G4
20
DB
7
C105
G4
20
DB
6
C230
G4
18
DB


INSTRUMENT CLUSTER
(8W-40-3)
(8W-40-5)
(8W-40-6)
7 C2
7 C1
3 C2
G12 22 TN/BK
G21 22 GY/LB
G3 22 BK/PK
A/C HIGH PRESSURE SWITCH
(8W-42-5)
1
6
8
11 C103
SOLID STATE FAN RELAY
(8W-42-5)
2
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-2)
36
G12 20 TN/BK
G21 20 GY/LB
G3 20 BK/PK
C20 20 BR/OR
K173 20 DG
GENERATOR
(8W-20-2)
2
9
5
13 C160
G3 20 BK/PK
C20 18 BR/OR
K173 20 LG
C28 18 DB/OR
K20 18 DG
56 C1
73 C1
8 C2
38 C2
18 C2
64 C1
4 C2
GENERATOR LAMP DRIVER
TACHOMETER SIGNAL
CHECK ENGINE LAMP DRIVER
A/C SWITCH SENSE
RADIATOR FAN RELAY CONTROL
A/C COMPRESSOR CLUTCH RELAY CONTROL
GENERATOR FIELD DRIVER
POWERTRAIN CONTROL MODULE


RUN A22
(8W-10-4)
FUSE BLOCK
(8W-11-2)
8
FUSE
8
10A
(8W-11-8)
28
F20
20
WT
S211
(8W-11-8)
F20
20
WT
3
C103
F20
20
WT
3
PARK/ NEUTRAL POSITION SWITCH (A/T)
(8W-21-2)
2
T41
20
BR/YL
S106
(8W-21-2)
T41
20
BR/YL
76
C1
PARK/ NEUTRAL POSITION SWITCH SENSE
POWERTRAIN CONTROL MODULE (A/T)
STOP LAMP SWITCH SENSE
POWERTRAIN CONTROL MODULE
62
C1
K29
20
WT/PK
1
2
Z12
20
BK/TN
S104
(8W-15-3)
Z12
20
BK/TN
G102
(8W-15-3)
BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
73
FUSE
25
15A
(8W-10-9)
25
F32
18
PK/DB
6
STOP LAMP SWITCH
5
L50
20
WT/TN
NO CONNECTION
L50
22
WT/TN
S101
M/T
A/T
L50
22
WT/TN
L50
20
WT/TN
2
C105
L50
20
WT/TN
1
NO CONNECTION
L50
20
WT/TN
13
CONTROLLER ANTI-LOCK BRAKE
(8W-35-4)


IMMOBILIZER
ENGINE
SENSOR
1
2
K241
20
GY/BK
S129
K240
20
GY
K241
20
GY/BK
1
4
IMMOBILIZER
SENSOR
3
2
K4
20
BK/LB
K7
20
OR
5
C161
K7
18
OR
K7
20
OR
S110
(8W-30-3)
S123
K7
20
OR
K7
18
OR
K7
20
OR
K4
20
BK/LB
1
1
1
44
C1
43
C1
CAMSHAFT
POSITION
SENSOR
(8W-30-7)
VEHICLE
SPEED
SENSOR
(8W-30-8)
CRANKSHAFT
POSITION
SENSOR
(8W-30-7)
8V
SUPPLY
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE

8W-30 FUEL/IGNITION SYSTEMS

INDEX

DESCRIPTION AND OPERATION

IGNITION SWITCH

In the RUN position, the ignition switch connects circuit A1 from the Power Distribution Center (PDC) to circuit A21. A 30 amp fuse in the PDC protects circuits A1 and A21. Circuit A21 feeds a bus bar in the fuse block. The bus bar feeds circuits G5, F12, and F15.

- Circuit G5 powers the gauge cluster warning lamps and the daytime running lamp (DRL) module. Fuse cavity 11 (5 amp) in the fuse block protects circuit G5.
- Circuit F12 splices to the Powertrain Control Module (PCM), duty cycle purge solenoid, EGR solenoid, ABS system, and a bus bar in the PDC. The bus bar in the PDC feeds the coil side of the radiator fan relay, A/C compressor clutch relay, and the fuel pump relay. A 15 amp fuse in the fuse block, cavity 10, protects circuit F12.
- Circuit F15 feeds the Airbag Control Module (ACM). A 10 amp fuse in the fuse block, cavity 9, protects circuit F15.

BATTERY FEED

Circuit A14 from the Power Distribution Center (PDC) supplies battery voltage to cavity 46 of the Powertrain Control Module (PCM). A 20 amp fuse in the PDC protects circuit A14.

HELPFUL INFORMATION

Circuit A14 connects to a bus bar in the PDC that the battery feeds. Circuit A14 powers the Automatic Shut Down (ASD) relay and fuel pump relay. The A14 circuit also splices to the data link connector.

POWER (DEVICE) GROUND

Circuit Z12 connects to cavities 10 and 50 of the Powertrain Control Module (PCM). The Z12 circuit provides ground for PCM internal drivers that operate high current devices like the injectors and ignition coils.

Internal to the PCM, the power (device) ground circuit connects to the PCM sensor return circuit (from circuit K4) and the signal ground circuit (Z11).

HELPFUL INFORMATION

Circuit Z12 which supplies ground for the PCM high current drivers, has the same termination point as circuit Z11. The termination point is the left side of the radiator closure panel.

If the system loses ground for the ganged circuits, at the left side of the radiator closure panel, the vehicle will not operate. Check the connection at the ganged ground circuit eyelet.

SIGNAL GROUND

The signal ground circuit Z11 connects to cavity 47 of the PCM. The Z11 circuit provides ground for the sensors that provide inputs to the PCM. Internal to the PCM, the signal ground circuit connects to the PCM sensor return circuit (from circuit K4) and the power (device) ground circuit (Z12).

The termination point for circuit Z11 is an eyelet attached to the left side of the radiator closure panel.

HELPFUL INFORMATION

Circuit Z12 which supplies ground for the PCM high current drivers, has the same termination point

DESCRIPTION AND OPERATION (Continued)

as circuit Z11. The termination point is the left side of the radiator closure panel.

If the system loses ground for the ganged circuits, at the left side of the radiator closure panel, the vehicle will not operate. Check the connection at the ganged ground circuit eyelet.

DATA LINK CONNECTOR

Circuit A14 supplies battery voltage to the universal data link connector. Circuit A14 originates in the Power Distribution Center (PDC) and connects to a battery fed bus bar. A 20 amp fuse protects circuit A14.

A twisted pair of wires, circuits D1 and D2, from the Airbag Control Module (ACM) connect to the universal data link connector.

Ground circuit Z12 splices to two cavities of the data link connector. The Z12 circuit also connects to cavities 10 and 50 of the PCM connector.

Circuit D20 connects to cavity 75 of the PCM and to the universal data link connector. Circuit D20 is the SCI receive circuit for the PCM.

Circuit D21 connects to cavity 65 of the PCM and to the universal data link connector. Circuit D21 is the SCI transmit circuit for the PCM. The D21 circuit splices to the ABS module.

HELPFUL INFORMATION

The grounding point for circuit Z12 is the left side of the radiator closure panel.

Circuit Z12 also supplies ground for the PCM high current drivers and has the same termination point as circuit Z11.

If the system loses ground for the ganged circuits at the left side radiator closure panel the vehicle will not operate. Check the connection at the ganged ground circuit eyelet.

AUTOMATIC SHUT DOWN RELAY

The Automatic Shut Down (ASD) relay is located in the Power Distribution Center (PDC). Power for the coil and contact side of the relay is supplied on circuit A14. This circuit is HOT at all times and protected by a 20 amp fuse located in the PDC.

The Powertrain Control Module (PCM) controls the ground path for the coil side of the relay on circuit K51. This circuit connects to cavity 67 of the PCM.

When the PCM supplies the ground path on circuit K51 the contacts in the relay CLOSE connecting circuits A14 and A142. The A142 circuit is spliced and supplies power to the generator, fuel injectors, PCM, ignition coil, and heated oxygen sensors.

HELPFUL INFORMATION

- Refer to group 14 Fuel System, for additional information.
- Check the 20 amp fuse located in the PDC.

FUEL PUMP MOTOR

Circuit A14 is a bus bar in the Power Distribution Center (PDC) and connects to battery voltage. The contact side of the fuel pump relay connects circuit A14 and circuit A141. A 20 amp fuse in the PDC protects circuits A14 and A142.

Circuit A141 supplies voltage for the fuel pump motor. Circuit Z1 provides ground for the fuel pump motor. The grounding point for circuit Z1 is the right rear wheel house.

Circuit F12 supplies voltage to the coil side of the fuel pump relay. The Powertrain Control Module (PCM) controls the ground path circuit for the coil side of the fuel pump relay on circuit K31. Circuit K31 connects to cavity 74 of the PCM.

HELPFUL INFORMATION

Circuit F12 originates in the fuse block where it connects to a bus bar fed by circuit A21. In the START and RUN position, the ignition switch connects circuit A1 from the PDC to circuit A21. A 30 amp fuse in the PDC protects circuits A1 and A21.

Circuit F12 splices to feed the ABS control module, EGR solenoid, Torque Converter Clutch (TCC) solenoid, leak detection pump, and the EVAP/Purge solenoid.

Circuit F12 also connects to a bus bar in the PDC. The bus bar supplies voltage to the coil side of radiator fan relay and A/C clutch relay, as well as the fuel pump relay.

VEHICLE SPEED SENSOR

Circuit K7 supplies 8 volts from the Powertrain Control Module (PCM) to the Vehicle Speed Sensor (VSS). The K7 circuit connects to cavity 44 of the PCM connector.

Circuit G7 from the VSS provides an input signal to the PCM. The G7 circuit connects to cavity 66 of the PCM connector.

The PCM provides ground for the VSS signal (circuit G7) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Circuit G7 splices to the speedometer and odometer in the instrument cluster.

Circuit K7 splices to supply 8 volts to the camshaft position sensor and crankshaft position sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Crankshaft position sensor
- Camshaft position sensor
- Battery temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor

DESCRIPTION AND OPERATION (Continued)

- Engine coolant temperature sensor
- Knock sensor
- Intake air temperature sensor

HEATED OXYGEN SENSORS

Circuit A14 is a bus bar in the Power Distribution Center (PDC), and connects to battery voltage. The contact side of the Automatic Shut Down (ASD) relay connects circuit A14 and circuit A142. A 20 amp fuse in the PDC protects circuits A14 and A142.

Circuit A14 also supplies voltage to the coil side of the ASD relay. The Powertrain Control Module (PCM) controls the ground path circuit for the coil side of the ASD relay on circuit K51. Circuit K51 connects to cavity 67 of the PCM connector.

Circuit A142 splices to supply voltage for the upstream and downstream heated oxygen sensors.

The A142 circuit also splices to cavity 6 of the PCM. The input provided by circuit A142 at cavity 6 tells the PCM that the ASD relay energized.

Circuit K41 delivers the signal from the upstream heated oxygen sensor to the PCM. Circuit K41 connects to cavity 30 of the PCM connector.

Circuit K141 delivers the signal from the downstream heated oxygen sensor to the PCM. Circuit K141 connects to cavity 51 of the PCM connector.

The PCM provides a ground for the upstream and downstream heated oxygen sensor signals (circuit K41 and K141) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

Circuit Z1 provides ground for the heater circuits in each sensor. Circuit Z1 terminates at the left side of the radiator closure panel.

HELPFUL INFORMATION

Circuit A142 splices to supply voltage to the fuel injectors, ignition coil, ASD relay, generator, and the upstream and downstream heated oxygen sensors. The PCM controls the ground circuit for each of the components powered by circuit A142.

CRANKSHAFT POSITION SENSOR

Circuit K7 supplies 8 volts from the Powertrain Control Module (PCM) to the crankshaft position sensor. The K7 circuit connects to cavity 44 of the PCM connector.

Circuit K24 from the sensor provides an input signal to the PCM. The K24 circuit connects to cavity 32 of the PCM connector.

The PCM provides ground for the crankshaft position sensor signal (circuit K24) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Circuit K7 splices to supply 8 volts to the camshaft position sensor and vehicle speed sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Camshaft position sensor
- Battery temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Knock sensor
- Intake air temperature sensor
- Vehicle speed sensor

CAMSHAFT POSITION SENSOR

Circuit K7 supplies 8 volts from the Powertrain Control Module (PCM) to the camshaft position sensor. The K7 circuit connects to cavity 44 of the PCM connector.

Circuit K44 from the sensor provides an input signal to the PCM. The K44 circuit connects to cavity 33 of the PCM connector.

The PCM provides ground for the camshaft position sensor signal (circuit K44) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Circuit K7 splices to supply 8 volts to the camshaft position sensor and vehicle speed sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Crankshaft position sensor
- Battery temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Knock sensor
- Intake air temperature sensor
- Vehicle speed sensor

ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature sensor provides an input to the Powertrain Control Module (PCM) on circuit K2. The sensor also operates the engine coolant temperature gauge in the instrument cluster on circuit G20. Refer to Section 8W-40 for coolant temperature gauge circuit description.

From circuit K2 the engine coolant temperature sensor draws up to 5 volts from the PCM. The sensor is a variable resistor. As coolant temperature changes, the resistance in the sensor changes causing a change in current draw. The K2 circuit connects to cavity 26 of the PCM connector.

The PCM provides ground for the engine coolant temperature sensor signal (circuit K2) through circuit

DESCRIPTION AND OPERATION (Continued)

K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

The engine coolant temperature sensor is case grounded. The case ground provides the ground for the coolant temperature gauge circuit G20.

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Battery temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Knock sensor
- Intake air temperature sensor
- Vehicle speed sensor

THROTTLE POSITION SENSOR

From the Powertrain Control Module (PCM), circuit K6 supplies 5 volts to the Throttle Position Sensor (TPS). Circuit K6 connects to cavity 61 of the PCM connector.

Circuit K22 delivers the TPS signal to the PCM. Circuit K22 connects to cavity 35 of the PCM connector.

The PCM provides ground for the TPS signal (circuit K22) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Refer to Group 14 for TPS operation.

Circuit K6 splices to supply 5 volts to the Manifold Absolute Pressure (MAP) sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Battery temperature sensor
- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Manifold absolute pressure sensor
- Knock sensor
- Intake air temperature sensor
- Vehicle speed sensor

MANIFOLD ABSOLUTE PRESSURE SENSOR

From the Powertrain Control Module (PCM), circuit K6 supplies 5 volts to the Manifold Absolute Pressure (MAP) sensor. Circuit K6 connects to cavity 61 of the PCM connector.

Circuit K1 delivers the MAP signal to the PCM. Circuit K1 connects to cavity 36 of the PCM connector.

The PCM provides ground for the MAP sensor signal (circuit K1) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Refer to Group 14 for MAP sensor operation.

Circuit K6 splices to supply 5 volts to the Throttle Position Sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Battery temperature sensor
- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Knock sensor
- Intake air temperature sensor
- Vehicle speed sensor

INTAKE AIR TEMPERATURE SENSOR

The intake air temperature sensor provides an input to the Powertrain Control Module (PCM) on circuit K21. Circuit K21 connects to cavity 37 of the PCM connector.

From circuit K21 the intake air temperature sensor draws voltage from the PCM. The sensor is a variable resistor. As intake air temperature changes, the resistance in the sensor changes causing a change in current draw.

The PCM provides ground for the intake air temperature sensor signal (circuit K21) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Battery temperature sensor
- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Knock sensor
- Manifold absolute pressure sensor
- Vehicle speed sensor

KNOCK SENSOR

The knock sensor provides an input to the Powertrain Control Module (PCM) on circuit K42. Circuit K42 connects to cavity 24 of the PCM connector.

The PCM provides ground for the knock sensor signal (circuit K42) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

DESCRIPTION AND OPERATION (Continued)

HELPFUL INFORMATION

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Battery temperature sensor
- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Intake air temperature sensor
- Manifold absolute pressure sensor
- Vehicle speed sensor

BATTERY TEMPERATURE SENSOR

From circuit G31 the battery temperature sensor draws voltage from the Powertrain Control Module (PCM). The sensor is a variable resistor. As battery temperature changes, the resistance in the sensor changes causing a change in current draw. Circuit G31 connects to cavity 52 of the PCM connector.

The PCM provides ground for the battery temperature sensor signal (circuit G31) through circuit K4. Circuit K4 connects to cavity 43 of the PCM connector.

HELPFUL INFORMATION

Circuit K4 splices to supply ground for the signals from the following:

- Upstream heated oxygen sensor
- Downstream heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Knock sensor
- Intake air temperature sensor
- Vehicle speed sensor

FUEL INJECTORS

Circuit A14 is a bus bar in the Power Distribution Center (PDC), and connects to battery voltage. The contact side of the Automatic Shut Down (ASD) relay connects circuit A14 and circuit A142. A 20 amp fuse in the PDC protects circuits A14 and A142.

Circuit A14 also supplies voltage to the coil side of the ASD relay. The Powertrain Control Module (PCM) controls the ground circuit for the coil side of the ASD relay on circuit K51. Circuit K51 connects to cavity 67 of the PCM connector.

Circuit A142 supplies voltage for the fuel injectors. The PCM controls the ground circuit of each injector.

- Circuit K11 is the ground circuit for Injector #1. Circuit K11 connects to cavity 13 of the PCM.
- Circuit K12 is the ground circuit for Injector #2. Circuit K12 connects to cavity 17 of the PCM.
- Circuit K13 is the ground circuit for Injector #3. Circuit K13 connects to cavity 7 of the PCM.
- Circuit K14 is the ground circuit for Injector #4. Circuit K14 connects to cavity 16 of the PCM.

HELPFUL INFORMATION

Circuit A142 splices to supply voltage to the fuel injectors, ignition coil, ASD relay, generator, and the upstream and downstream heated oxygen sensors. The PCM controls the ground circuit for each of the components powered by circuit A142.

The injectors operate in sequence. Refer to Group 14 for system operation.

IGNITION COIL PACK

Circuit A14 is a bus bar in the Power Distribution Center (PDC), and connects to battery voltage. The contact side of the Automatic Shut Down (ASD) relay connects circuit A14 and circuit A142. A 20 amp fuse in the PDC protects circuits A14 and A142.

Circuit A14 also supplies voltage to the coil side of the ASD relay. The Powertrain Control Module (PCM) controls the ground path circuit for the coil side of the ASD relay on circuit K51. Circuit K51 connects to cavity 67 of the PCM connector.

Circuit A142 supplies voltage for the ignition coil pack. The coil pack consists of two individual coils molded together. The PCM controls the ground circuit of each coil.

- Circuit K19 is the ground circuit for the ignition coil that fires spark plugs # 1 and # 4. Circuit K19 connects to cavity 2 of the PCM.
- Circuit K17 is the ground circuit for the ignition coil that fires spark plugs #2 and # 3. Circuit K17 connects to cavity 3 of the PCM.

HELPFUL INFORMATION

Circuit A142 splices to supply voltage to the fuel injectors, ignition coil, ASD relay, generator, upstream heated oxygen sensor and downstream heated oxygen sensor. The PCM controls the ground circuit for each of the components powered by circuit A142.

IDLE AIR CONTROL MOTOR

The Powertrain Control Module (PCM) operates the Idle Air Control (IAC) motor through 4 circuits - K39, K40, K59, and K60. Each circuit connects to separate cavities in the PCM connector.

- Circuit K39 connects to cavity 57 of the PCM connector.
- Circuit K40 connects to cavity 48 of the PCM connector.
- Circuit K59 connects to cavity 58 of the PCM connector.
- Circuit K60 connects to cavity 49 of the PCM connector.

DESCRIPTION AND OPERATION (Continued)

POWER STEERING PRESSURE SWITCH

The power steering pressure switch opens and closes circuit K10 between the Powertrain Control Module (PCM) and ground. Circuit K10 connects to cavity 45 of the PCM connector.

Circuit Z12 provides ground for the power steering pressure switch. The grounding point for circuit Z12 is the left side of the radiator closure panel.

TORQUE CONVERTER CLUTCH SOLENOID (TCC)

The Powertrain Control Module (PCM) operates the TCC solenoid by providing a ground path on circuit K54. Circuit K54 connects to PCM cavity 79.

Circuit F12 supplies battery voltage to the TCC solenoid. Circuit F12 connects to a bus bar in the fuse block fed by circuit A21. A 15 amp fuse in the fuse block, cavity 10, protects circuit F12. Circuit F12 connects to cavity 20 of the PCM connector.

HELPFUL INFORMATION

Circuit F12 splices to feed the ABS control module, PCM, EGR solenoid, leak detection pump, and the duty cycle EVAP/Purge solenoid. The F12 circuit also connects to a bus bar in the PDC that supplies voltage to the coil side of radiator fan relay, A/C clutch relay, and fuel pump relay.

In the RUN or START position, the ignition switch connects circuit A1 from the fuse block and circuit A21. Circuit A1 connects to battery voltage and is protected by a 30 amp fuse in the PDC.

DUTY CYCLE EVAP/PURGE SOLENOID

Circuit F12 supplies battery voltage to the Duty Cycle EVAP/Purge solenoid. The Powertrain Control Module (PCM) switches ground path for the solenoid ON and OFF through circuit K52.

Circuit F12 connects to a bus bar in the fuse block fed by circuit A21. A 15 amp fuse in the fuse block, cavity 10, protects circuit F12. Circuit F12 also connects to cavity 20 of the PCM connector.

Circuit K52 connects to cavity 68 of the PCM, and cavity 1 of the solenoid connector.

HELPFUL INFORMATION

Circuit F12 splices to feed the ABS control module, PCM, EET solenoid, leak detection pump, and the TCC solenoid. The F12 circuit also connects to a bus bar in the PDC that supplies voltage to the coil side of radiator fan relays, A/C clutch relay, and fuel pump relay.

In the START or RUN position, the ignition switch connects circuit A1 from the fuse block and circuit A21. Circuit A1 connects to battery voltage and is protected by a 30 amp fuse in the PDC.

EGR TRANSDUCER (EET) SOLENOID

Circuit F12 supplies battery voltage to the EET solenoid. The Powertrain Control Module (PCM) switches ground path for the solenoid ON and OFF through circuit K35.

Circuit F12 connects to a bus bar in the fuse block fed by circuit A21. A 15 amp fuse in the fuse block, cavity 10, protects circuit F12. Circuit F12 also connects to cavity 20 of the PCM.

Circuit K35 connects to cavity 40 of the PCM connector.

HELPFUL INFORMATION

Circuit F12 splices to feed the ABS control module, PCM, Duty Cycle EVAP/Purge solenoid, leak detection pump, and the TCC solenoid. The F12 circuit also connects to a bus bar in the PDC that supplies voltage to the coil side of radiator fan relays, A/C clutch relay, and fuel pump relay.

In the START or RUN position, the ignition switch connects circuit A1 from the fuse block and circuit A21. Circuit A1 connects to battery voltage and is protected by a 30 amp fuse in the PDC.

LOW FUEL DETECT INPUT

Circuit G4 provides an input to the Powertrain Control Module (PCM) indicating fuel tank level. This circuit connects to cavity 23 of the PCM connector.

The G4 circuit is also used for the fuel gauge located in the instrument cluster. For operation of the fuel gauge, refer to section 8W-40.

PARK/NEUTRAL POSITION SWITCH INPUT (3–SPD TRANSMISSION)

On vehicles equipped with the 3–spd automatic transmission the park/neutral switch provides an input to the Powertrain Control Module (PCM).

When CLOSED, the park/neutral position switch provides a ground path on circuit T41 for the coil side of the engine starter motor relay. The case grounded switch provides ground for circuit T41.

Circuit A41 from the ignition switch provides battery voltage to the coil side of the relay.

Circuit T41 splices to cavity 76 of the PCM. The park/neutral position switch provides an input to the Powertrain Control Module (PCM).

HELPFUL INFORMATION

In the START position, the ignition switch connects circuit A1 from the Power Distribution Center (PDC) to circuit A41. A 30 amp fuse protects circuits A1 and A41.

8W-35 ANTI-LOCK BRAKES

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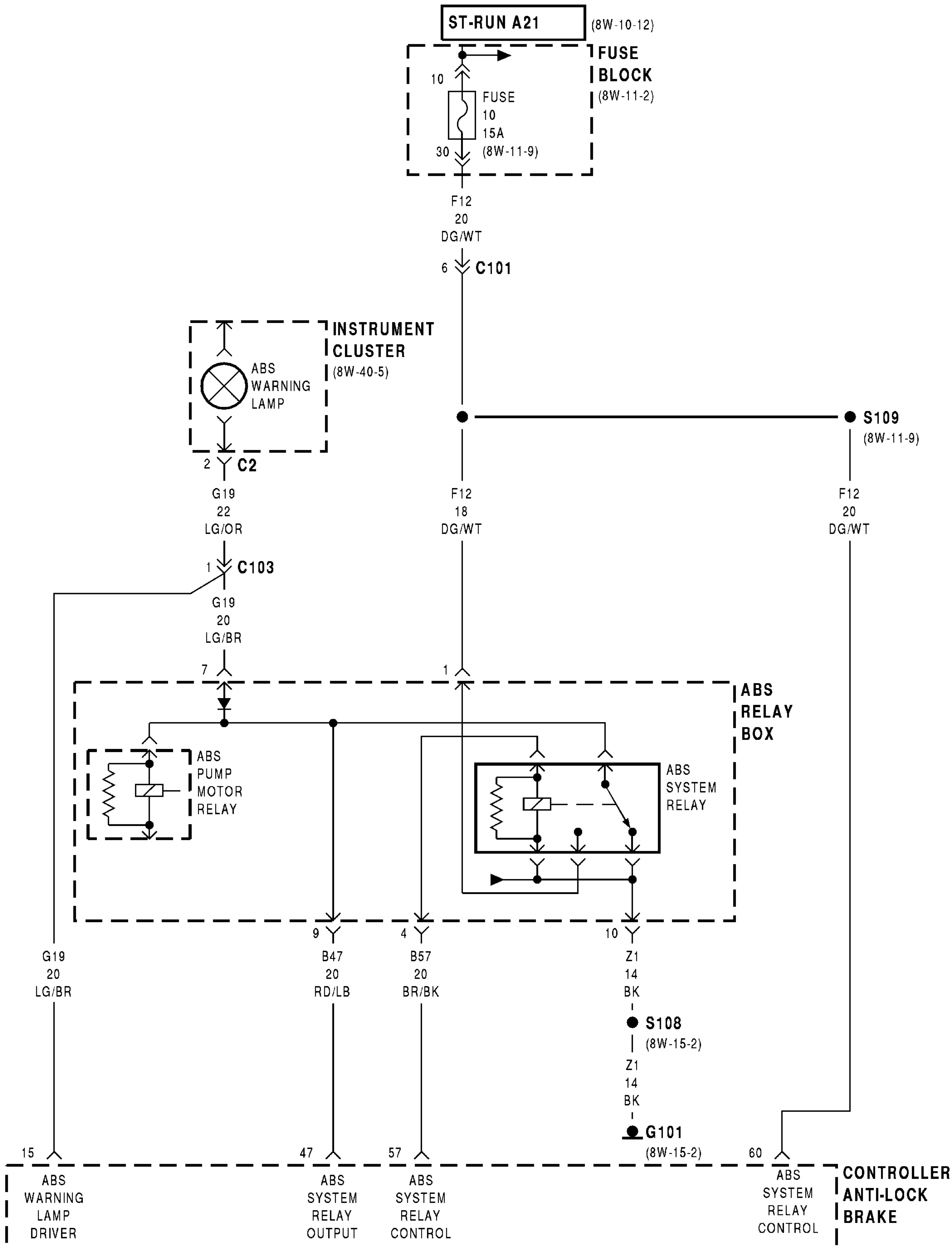
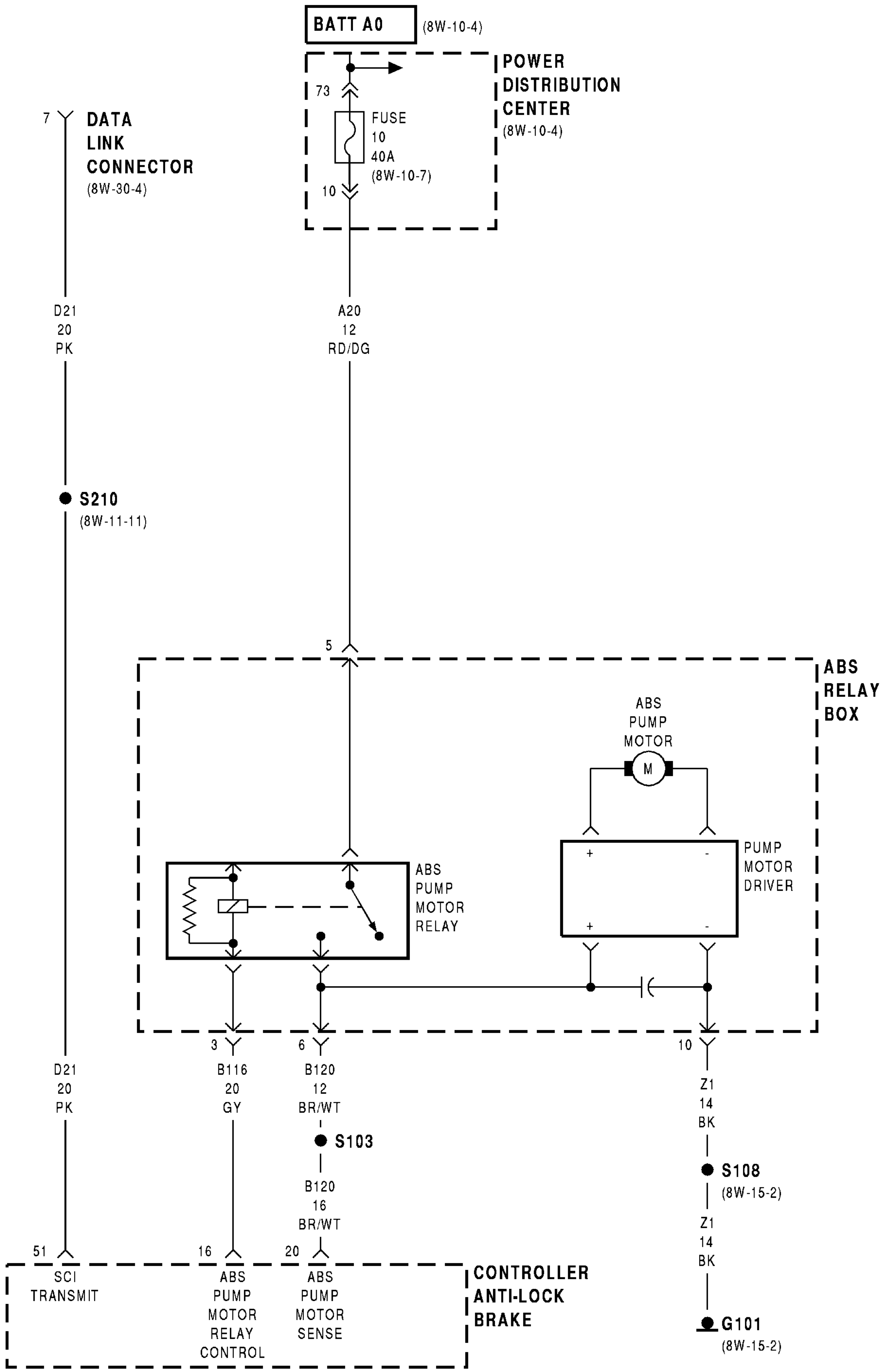
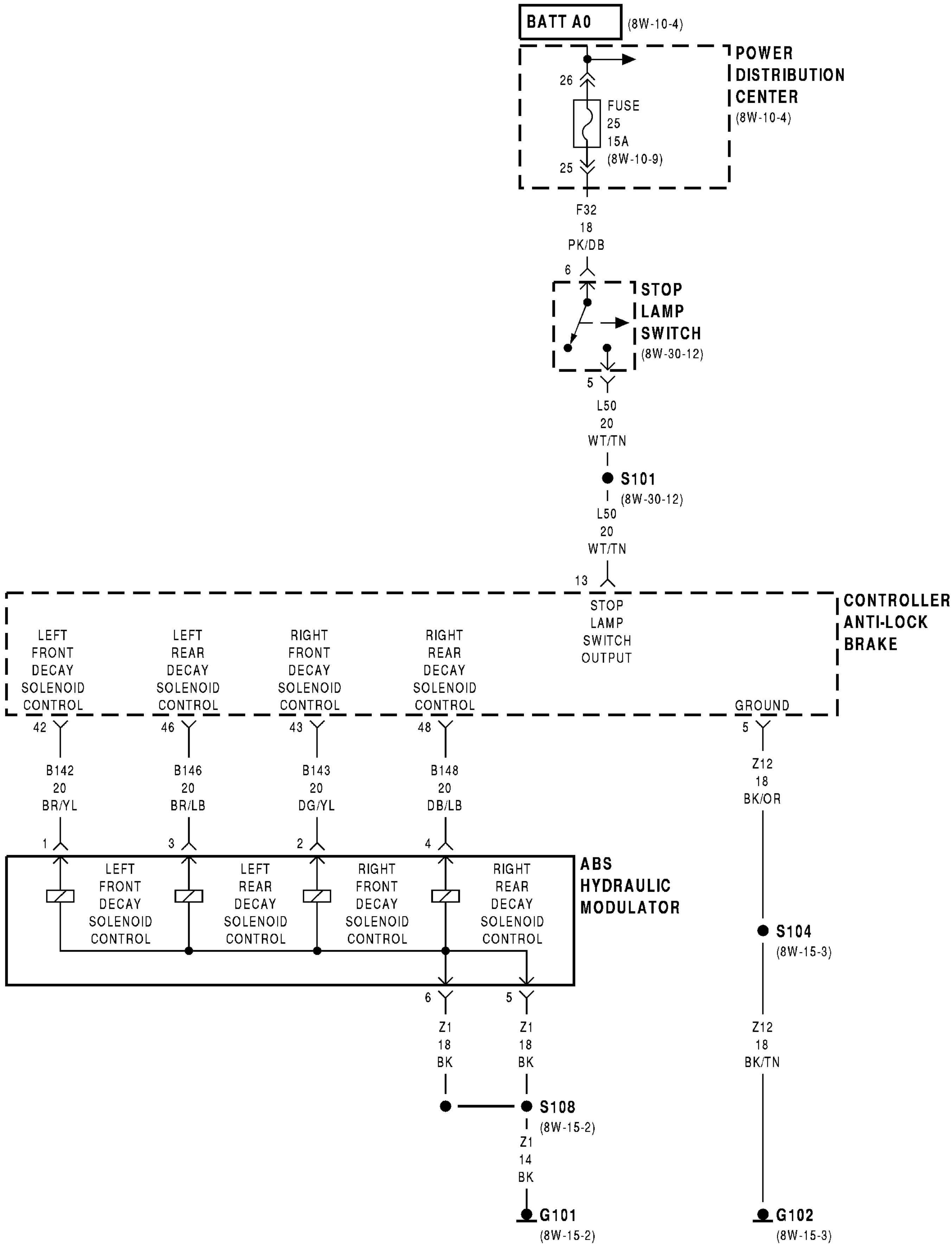
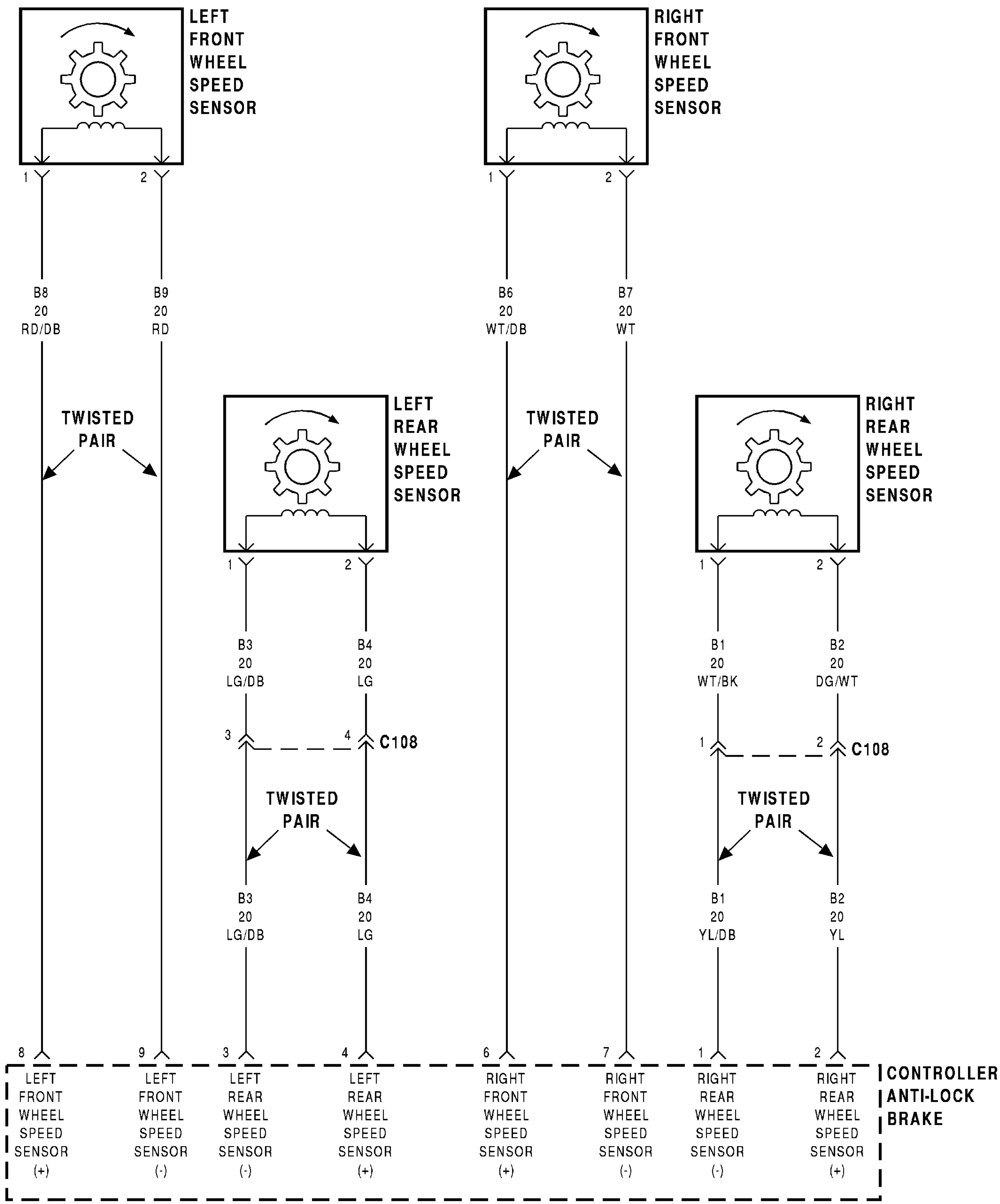

ST-RUN A21
(8W-10-12)
FUSE
BLOCK
(8W-11-2)
10
FUSE
10
15A
30
(8W-11-9)
F12
20
DG/WT
6
C101
INSTRUMENT
CLUSTER
(8W-40-5)
ABS
WARNING
LAMP
2
C2
S109
(8W-11-9)
G19
22
LG/OR
F12
18
DG/WT
F12
20
DG/WT
1
C103
G19
20
LG/BR
7
1
ABS
RELAY
BOX
ABS
PUMP
MOTOR
RELAY
ABS
SYSTEM
RELAY
9
4
10
G19
20
LG/BR
B47
20
RD/LB
B57
20
BR/BK
Z1
14
BK
S108
(8W-15-2)
Z1
14
BK
G101
(8W-15-2)
15
47
57
60
ABS
WARNING
LAMP
DRIVER
ABS
SYSTEM
RELAY
OUTPUT
ABS
SYSTEM
RELAY
CONTROL
ABS
SYSTEM
RELAY
CONTROL
CONTROLLER
ANTI-LOCK
BRAKE


BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
73
FUSE
10
40A
(8W-10-7)
10
7
DATA
LINK
CONNECTOR
(8W-30-4)
D21
20
PK
A20
12
RD/DG
S210
(8W-11-11)
5
ABS
RELAY
BOX
ABS
PUMP
MOTOR
M
PUMP
MOTOR
DRIVER
ABS
PUMP
MOTOR
RELAY
3
6
10
D21
20
PK
B116
20
GY
B120
12
BR/WT
S103
B120
16
BR/WT
Z1
14
BK
S108
(8W-15-2)
Z1
14
BK
G101
(8W-15-2)
51
16
20
SCI
TRANSMIT
ABS
PUMP
MOTOR
RELAY
CONTROL
ABS
PUMP
MOTOR
SENSE
CONTROLLER
ANTI-LOCK
BRAKE


BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
26
FUSE
25
15A
(8W-10-9)
25
F32
18
PK/DB
6
STOP LAMP SWITCH
(8W-30-12)
5
L50
20
WT/TN
S101
(8W-30-12)
L50
20
WT/TN
13
CONTROLLER ANTI-LOCK BRAKE
STOP LAMP SWITCH OUTPUT
LEFT FRONT DECAY SOLENOID CONTROL
LEFT REAR DECAY SOLENOID CONTROL
RIGHT FRONT DECAY SOLENOID CONTROL
RIGHT REAR DECAY SOLENOID CONTROL
GROUND
42
46
43
48
5
B142
20
BR/YL
B146
20
BR/LB
B143
20
DG/YL
B148
20
DB/LB
Z12
18
BK/OR
1
3
2
4
ABS HYDRAULIC MODULATOR
LEFT FRONT DECAY SOLENOID CONTROL
LEFT REAR DECAY SOLENOID CONTROL
RIGHT FRONT DECAY SOLENOID CONTROL
RIGHT REAR DECAY SOLENOID CONTROL
S104
(8W-15-3)
6
5
Z1
18
BK
Z1
18
BK
Z12
18
BK/TN
S108
(8W-15-2)
Z1
14
BK
G101
(8W-15-2)
G102
(8W-15-3)


LEFT FRONT WHEEL SPEED SENSOR
RIGHT FRONT WHEEL SPEED SENSOR
LEFT REAR WHEEL SPEED SENSOR
RIGHT REAR WHEEL SPEED SENSOR
TWISTED PAIR
B8 20 RD/DB
B9 20 RD
B6 20 WT/DB
B7 20 WT
B3 20 LG/DB
B4 20 LG
B1 20 WT/BK
B2 20 DG/WT
C108
B1 20 YL/DB
B2 20 YL
CONTROLLER ANTI-LOCK BRAKE
LEFT FRONT WHEEL SPEED SENSOR (+)
LEFT FRONT WHEEL SPEED SENSOR (-)
LEFT REAR WHEEL SPEED SENSOR (-)
LEFT REAR WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (+)

8W-35 ANTI-LOCK BRAKES

INDEX

DESCRIPTION AND OPERATION

ANTI-LOCK BRAKES

Power for the Anti-Lock brake system is supplied by two fuses. There is a 15 amp fuse located in the fuse block cavity 10. This fuse supplies power to the Controller Anti Lock Brake (CAB), and the ABS system relay on the F12 circuit. The F12 circuit also supplies power to the Powertrain Control Module (PCM). Power for the fuse is supplied on the A21 circuit from the ignition switch. This fuse is HOT in the START/RUN position.

The second fuse is located in the Power Distribution Center (PDC). It is a 40 amp fuse. This fuse is HOT at all times and supplies power to the contact side of the ABS pump motor relay.

There are three grounding points used in the ABS system. One is a case ground on the CAB. The second is the Z12 circuit at the CAB connector cavity 5. This ground is spliced, and terminates at the left side of the radiator closure panel.

The third ground is on the Z1 circuit. This ground is used for the ABS hydraulic modulator, ABS system relay, and the ABS pump motor. This ground, like the Z12 ground splices and terminates at the left headlamp ground.

Additional information on the circuit function of the ABS system is listed below. For diagnostic and testing procedures, refer to the appropriate section of the Service Manual or the Diagnostic Test Procedures Manual.

ABS WARNING LAMP

The ABS warning lamp is an output from the Controller Anti Lock Brake (CAB) and the ABS relay box. It is used to alert the operator of a problem in the ABS system. The G19 circuit from the CAB and the ABS system relay is used to detect a problem. If a problem is detected, the CAB grounds the G19 circuit and illuminates the lamp in the instrument cluster.

Circuit G19 is also an output of the CAB to the ABS system relay contact side.

ABS SYSTEM RELAY

The system relay is used for the operation of the ABS system. Power for the relay is supplied on the B57 circuit from cavity 57 of the Controller Anti Lock Brake (CAB).

Ground for the relay is on the Z1 circuit. This ground is spliced in with the pump motor and terminates at the left headlamp ground.

When the system is operating normally power for the contact side of the relay is supplied from the CAB on the B57 circuit. It passes through the relay to the Z1 ground and terminates at the left headlamp ground. If a problem is detected in the system, the contact side of the relay switches from the Z1 to the F12 circuit. This causes the ABS warning lamp in the instrument cluster to illuminate.

ABS PUMP MOTOR RELAY

The ABS pump motor relay controls when the pump motor runs. Power for the coil side of the relay is supplied from cavity 47 of the Controller Anti Lock Brake (CAB) on the B47 circuit. This circuit also supplies voltage for the contact side of the system relay. The ground side of the coil is controlled by the B116 circuit. Circuit B116 connects to cavity 16 of the CAB connector.

Circuit B120 from cavity 20 of the CAB connector powers the ABS pump motor. This circuit is also used as an input to the CAB for pump motor monitoring.

HYDRAULIC MODULATOR

The hydraulic modulator is used for the controlling of the brake system pressure to the wheels. The modulator is made up of four solenoids.

Circuits involved are, B142 for the left front wheel, B143 for the right front wheel, B146 for the left rear wheel, and B148 for the right rear wheel.

The solenoids use a common ground on the Z1 circuit. There are two Z1 circuits from the modulator. Both of these grounds terminate at the left headlamp ground, and are spliced in with the ABS pump motor and the ABS system relay.

DESCRIPTION AND OPERATION (Continued)

WHEEL SPEED SENSORS

There are four wheel speed sensors, one at each wheel. The sensors use a tone wheel to determine wheel speed. Input to the Controller Anti Lock Brake (CAB) is done on the following circuits. All of these circuits are a twisted pair.

B8 and B9 for the left front wheel (cavity 8 and cavity 9).

B6 and B7 for the right front wheel (cavity 6 and cavity 7).

B3 and B4 for the left rear wheel (cavity 3 and cavity 4).

B1 and B2 for the right rear wheel (cavity 1 and cavity 2).

BRAKE SWITCH INPUT

Circuit L50 is an input to the Controller Anti Lock Brake (CAB). The L50 connects to cavity 13 of the CAB connector. Circuit L50 is spliced in with the stop lamps and is used to provide the CAB with information on when the brakes are being applied.

DATA LINK CONNECTOR

Circuit D21 is used for diagnostics of a fault with the ABS system. It is spliced in with the Powertrain Control Module (PCM) circuits and used as an output from the Controller Anti Lock Brake (CAB). Circuit D21 connects to cavity 51 of the CAB connector.

HELPFUL INFORMATION

- Check the 15 amp fuse located in cavity 10 of the fuse block.
- Check the 40 amp fuse located in the PDC.
- Check for a good ground at the left headlamp ground.
- Check the case ground on the CAB
- Refer to the appropriate section of the service manual, or the Diagnostic Test Procedures Manual.

8W-40 INSTRUMENT CLUSTER

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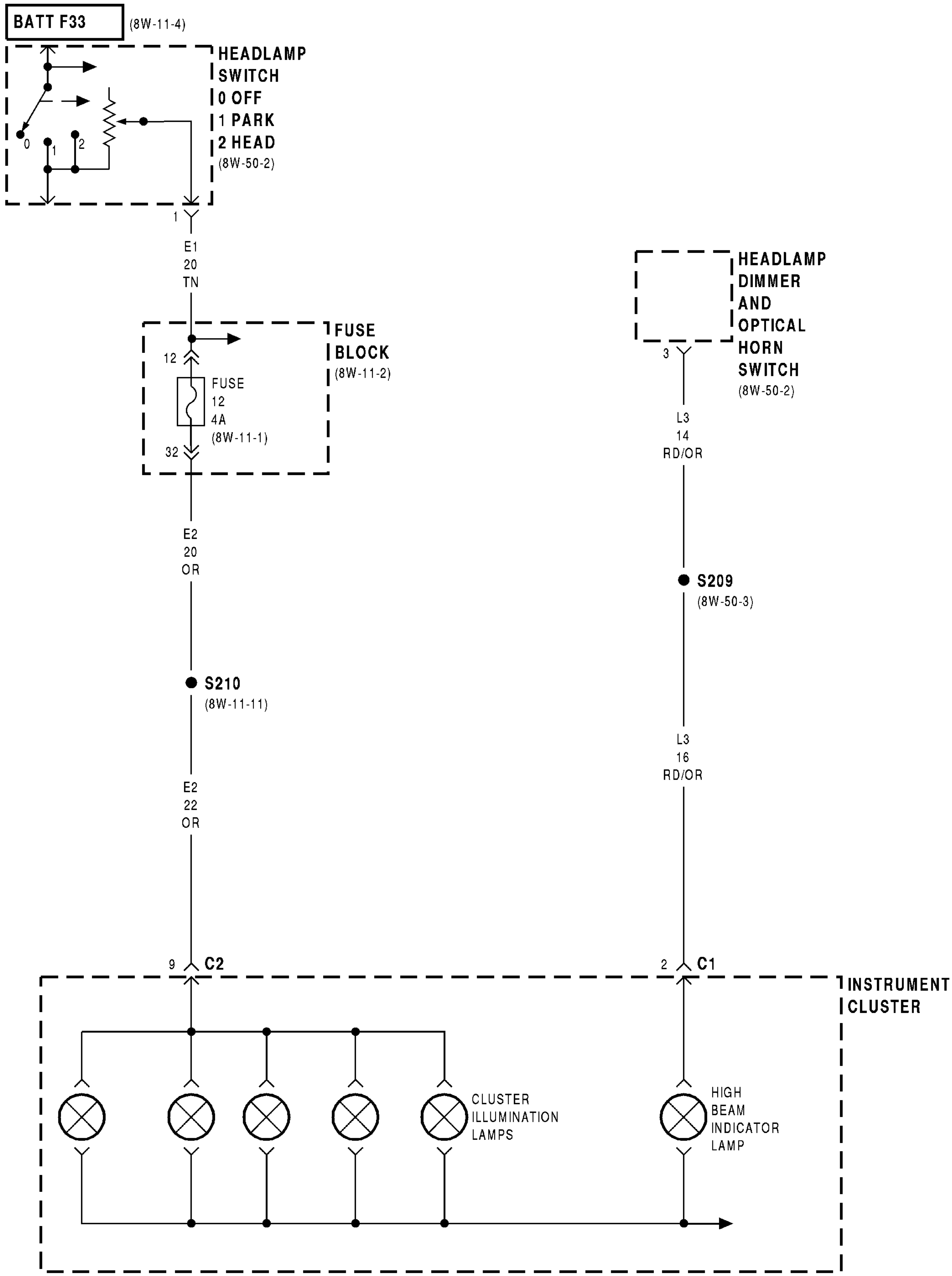
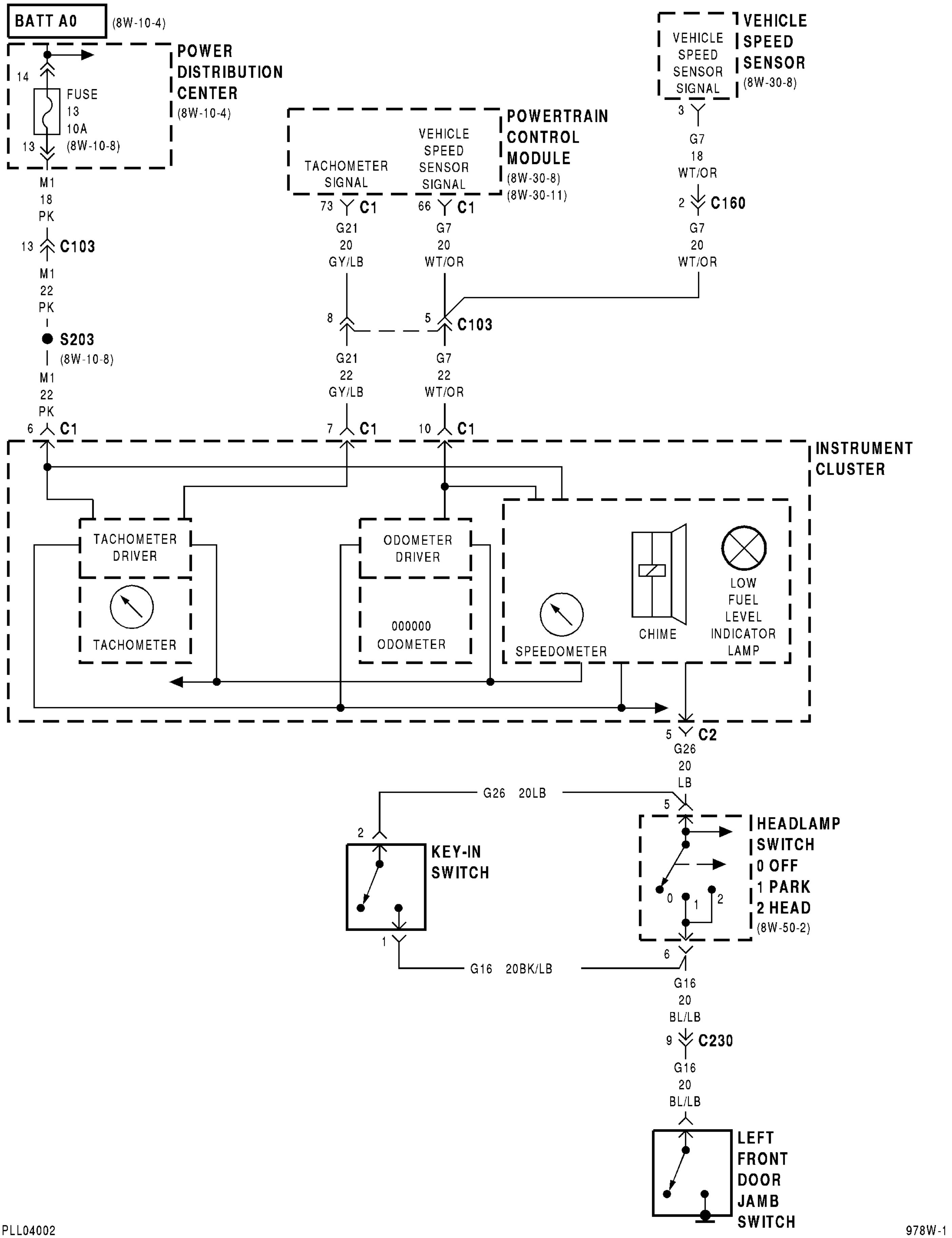
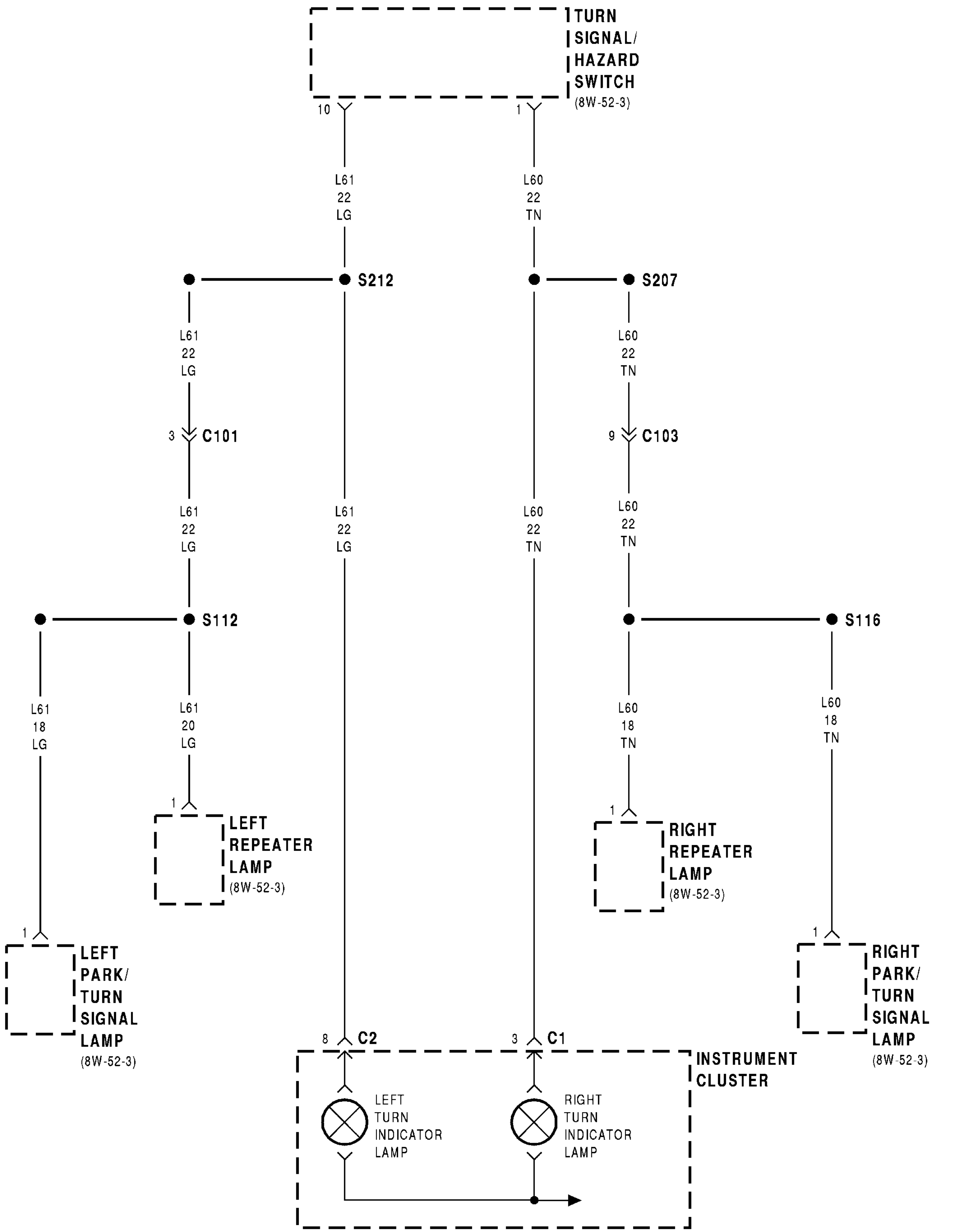
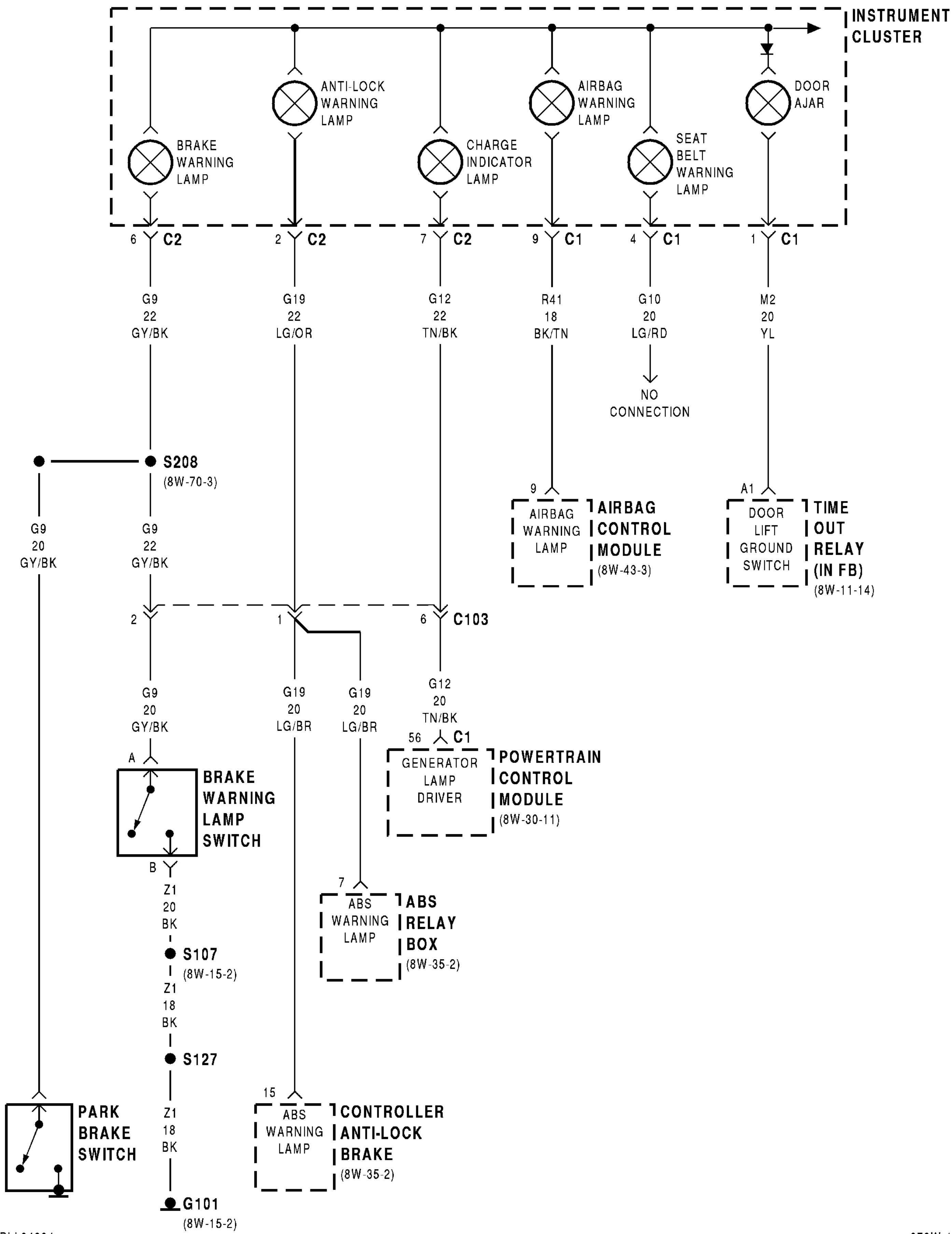
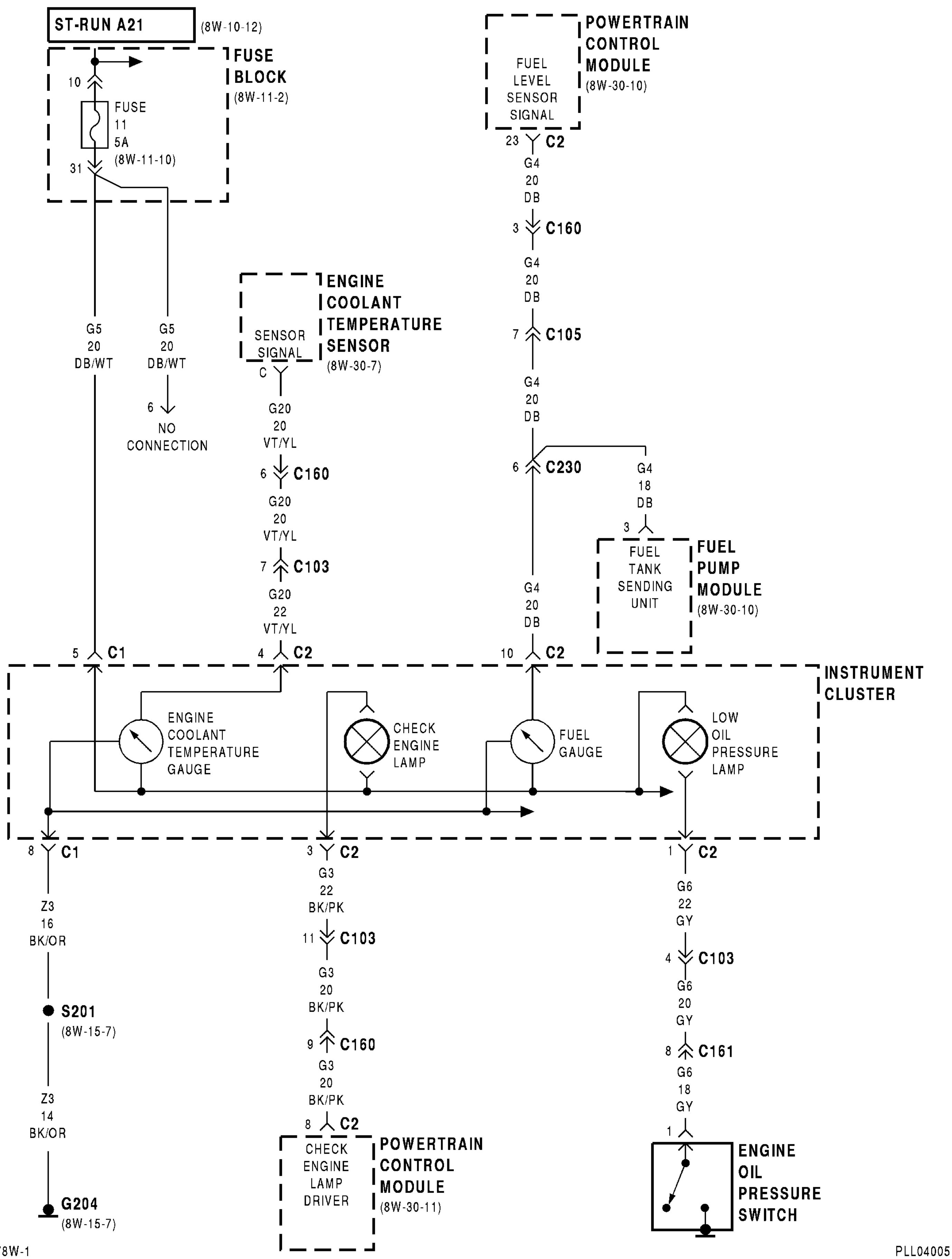

BATT F33
(8W-11-4)
HEADLAMP
SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
0
1
2
1
E1
20
TN
FUSE
BLOCK
(8W-11-2)
12
FUSE
12
4A
(8W-11-1)
32
E2
20
OR
S210
(8W-11-11)
E2
22
OR
HEADLAMP
DIMMER
AND
OPTICAL
HORN
SWITCH
(8W-50-2)
3
L3
14
RD/OR
S209
(8W-50-3)
L3
16
RD/OR
9
C2
2
C1
INSTRUMENT
CLUSTER
CLUSTER
ILLUMINATION
LAMPS
HIGH
BEAM
INDICATOR
LAMP



BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
14
FUSE 13 10A (8W-10-8)
13
M1 18 PK
13 C103
M1 22 PK
S203
(8W-10-8)
M1 22 PK
6 C1
POWERTRAIN CONTROL MODULE
(8W-30-8)
(8W-30-11)
TACHOMETER SIGNAL
VEHICLE SPEED SENSOR SIGNAL
73 C1
66 C1
G21 20 GY/LB
G7 20 WT/OR
8
5 C103
G21 22 GY/LB
G7 22 WT/OR
7 C1
10 C1
VEHICLE SPEED SENSOR
VEHICLE SPEED SENSOR SIGNAL
(8W-30-8)
3
G7 18 WT/OR
2 C160
G7 20 WT/OR
INSTRUMENT CLUSTER
TACHOMETER DRIVER
TACHOMETER
ODOMETER DRIVER
000000
ODOMETER
SPEEDOMETER
CHIME
LOW FUEL LEVEL INDICATOR LAMP
5 C2
G26 20 LB
G26 20LB
5
2
KEY-IN SWITCH
1
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
0
1
2
6
G16 20BK/LB
G16 20 BL/LB
9 C230
G16 20 BL/LB
LEFT FRONT DOOR JAMB SWITCH


TURN SIGNAL/ HAZARD SWITCH
(8W-52-3)
10
1
L61
22
LG
L60
22
TN
S212
S207
C101
C103
3
9
S112
S116
L61
18
LG
L61
20
LG
L60
18
TN
LEFT REPEATER LAMP
(8W-52-3)
RIGHT REPEATER LAMP
(8W-52-3)
LEFT PARK/ TURN SIGNAL LAMP
(8W-52-3)
RIGHT PARK/ TURN SIGNAL LAMP
(8W-52-3)
8
C2
3
C1
INSTRUMENT CLUSTER
LEFT TURN INDICATOR LAMP
RIGHT TURN INDICATOR LAMP


INSTRUMENT CLUSTER
BRAKE WARNING LAMP
ANTI-LOCK WARNING LAMP
CHARGE INDICATOR LAMP
AIRBAG WARNING LAMP
SEAT BELT WARNING LAMP
DOOR AJAR
6 C2
2 C2
7 C2
9 C1
4 C1
1 C1
G9 22 GY/BK
G19 22 LG/OR
G12 22 TN/BK
R41 18 BK/TN
G10 20 LG/RD
M2 20 YL
NO CONNECTION
S208 (8W-70-3)
G9 20 GY/BK
G9 22 GY/BK
9
AIRBAG WARNING LAMP
AIRBAG CONTROL MODULE (8W-43-3)
A1
DOOR LIFT GROUND SWITCH
TIME OUT RELAY (IN FB) (8W-11-14)
2
1
6 C103
G9 20 GY/BK
G19 20 LG/BR
G19 20 LG/BR
G12 20 TN/BK
56 C1
GENERATOR LAMP DRIVER
POWERTRAIN CONTROL MODULE (8W-30-11)
A
BRAKE WARNING LAMP SWITCH
B
Z1 20 BK
S107 (8W-15-2)
Z1 18 BK
S127
Z1 18 BK
G101 (8W-15-2)
7
ABS WARNING LAMP
ABS RELAY BOX (8W-35-2)
15
ABS WARNING LAMP
CONTROLLER ANTI-LOCK BRAKE (8W-35-2)
PARK BRAKE SWITCH



ST-RUN A21
(8W-10-12)
FUSE
BLOCK
(8W-11-2)
10
FUSE
11
5A
(8W-11-10)
31
G5
20
DB/WT
G5
20
DB/WT
6
NO
CONNECTION
POWERTRAIN
CONTROL
MODULE
(8W-30-10)
FUEL
LEVEL
SENSOR
SIGNAL
23
C2
G4
20
DB
3
C160
G4
20
DB
7
C105
G4
20
DB
6
C230
G4
18
DB
3
FUEL
TANK
SENDING
UNIT
FUEL
PUMP
MODULE
(8W-30-10)
G4
20
DB
ENGINE
COOLANT
TEMPERATURE
SENSOR
(8W-30-7)
SENSOR
SIGNAL
C
G20
20
VT/YL
6
C160
G20
20
VT/YL
7
C103
G20
22
VT/YL
5
C1
4
C2
10
C2
INSTRUMENT
CLUSTER
ENGINE
COOLANT
TEMPERATURE
GAUGE
CHECK
ENGINE
LAMP
FUEL
GAUGE
LOW
OIL
PRESSURE
LAMP
8
C1
3
C2
1
C2
Z3
16
BK/OR
S201
(8W-15-7)
Z3
14
BK/OR
G204
(8W-15-7)
G3
22
BK/PK
11
C103
G3
20
BK/PK
9
C160
G3
20
BK/PK
8
C2
CHECK
ENGINE
LAMP
DRIVER
POWERTRAIN
CONTROL
MODULE
(8W-30-11)
G6
22
GY
4
C103
G6
20
GY
8
C161
G6
18
GY
1
ENGINE
OIL
PRESSURE
SWITCH

8W-40 INSTRUMENT CLUSTER

INDEX

DESCRIPTION AND OPERATION

INSTRUMENT CLUSTER

The Instrument Cluster, located on the right side of the instrument panel, provides the operator with gauges and warning lamps relating to vehicle operation. All gauges in the standard and optional cluster are magnetic type and logic driven.

Battery voltage for the clusters warning lamps and gauges is provided on the G5 circuit. This circuit connects from the fuse block and is protected by a 5 amp fuse located in cavity 11. The cluster is powered only when the ignition switch is in the START or RUN position. The cluster is also powered on initial driver's door opening.

Illumination lamps, internal to the cluster, receive battery voltage on the E2 circuit from the 4 amp fuse located in cavity 12 of the fuse block. This circuit is HOT only when the headlamp switch is in the ON position. Grounding for the cluster is provided on the Z3 circuit and terminates at the instrument panel left center support.

The M1 circuit also feeds the cluster through a 10 amp fuse in the Power Distribution Center (PDC). This fuse is HOT at all times and also used to power the underhood lamp, and the interior lamps. The fuse is also lifted OPEN during vehicle shipping to reduce battery draw.

SPEEDOMETER

The speedometer and odometer receive their information on the G7 circuit from the Vehicle Speed Sensor (VSS) on manual and 3–spd automatic transmission applications. The G7 circuit also provides a signal to the Powertrain Control Module (PCM).

Logic internal to the instrument cluster adjusts the position of the gauge pointer to the correct vehicle speed using the signal on the G7 circuit.

HIGH SPEED WARNING MODULE

Power for the high speed warning module is supplied from two circuits. One is the M1 circuit, which is the Ignition-Off Draw (IOD) circuit. This circuit is protected by a 10 amp fuse located in the Power Distribution Center (PDC).

Power is also supplied to the module on circuit F20. This circuit is HOT in the RUN position only and protected by a 10 amp fuse located in the fuse block.

Ground for the module is supplied on circuit Z1 which terminates at the instrument panel left center support.

Vehicle speed input is provided on circuit G7.

TACHOMETER

The tachometer is connected to the Powertrain Control Module (PCM) on the G21 circuit. It uses solid state circuity to decode the ignition pulses received from the PCM to adjust the gauge pointer to the proper position.

ENGINE COOLANT TEMPERATURE GAUGE

The temperature gauge is connected to the engine coolant temperature sensor on the G20 circuit. The engine coolant temperature sensor for the gauge is a combination unit. One side of the unit is used for the Powertrain Control Module (PCM) and the other side for the cluster. The sending unit is case grounded to the engine.

The logic driven gauge moves in response to the measured resistance of the engine coolant temperature sending unit.

DESCRIPTION AND OPERATION (Continued)

FUEL GAUGE

The fuel level gauge is connected to the fuel pump module on the G4 circuit. The fuel pump module contains the fuel pump and a variable resistor for the gauge. Grounding for the fuel pump module is provided on the Z2 circuit and terminates at the left rear wheel house.

The logic driven gauge moves in response to the measured resistance of the fuel tank sending unit.

The fuel level sensor contains a variable resistor. As the position of the float arm on the level sensor changes, the resistor changes the current flow through the fuel gauge circuit. A change in current flow alters the magnetic field in the fuel gauge which changes the pointer position.

ODOMETER

The speedometer and odometer receive their information on the G7 circuit from the Vehicle Speed Sensor (VSS) on vehicles equipped with the manual or 3–spd automatic transmission. This circuit also provides a signal to the Powertrain Control Module (PCM).

Logic internal to the cluster steps the odometer at a high rate to indicate the proper mileage.

SERVICE ENGINE SOON LAMP

The Service Engine Soon lamp illuminates when the ignition switch is in the ON position and prior to starting the vehicle. The lamp will turn off after the vehicle is started.

If while the vehicle is running a problem is detected in the engine control system the lamp is illuminated. This is accomplished by the Powertrain Control Module (PCM) grounding the G3 circuit.

SEAT BELT WARNING INDICATOR

The fasten seat belt indicator is used with the warning chime to indicate to the operator to fasten the seat belt. There is a switch located in the drivers side B-pillar that is normally OPEN with the seat belt buckled.

If the seat belt is not buckled the switch CLOSES and a ground path is completed from the G10 circuit to the Z1 circuit. This will illuminate the lamp in the instrument cluster.

When the ignition switch is moved to the START position the lamp will illuminate. Logic internal to the instrument cluster determines the length of time.

LOW FUEL LAMP

The low fuel lamp is used to indicate to the operator that the fuel level is below a predetermined level. This lamp is logic driven by the instrument cluster.

When the instrument cluster determines a low fuel condition based on an input from the fuel tank gauge level sending unit (circuit G4) it illuminates the lamp.

HEADLAMP ON CHIME

The headlamp ON chime is used to indicate to the operator that the headlamps or parking lamps are ON when the drivers door is OPEN. If the lamps are ON and the drivers door is opened, a ground path is completed from the G26 circuit at the cluster, through the headlamp switch, to the G16 circuit and ending at the door ajar switch. The door ajar switch is case grounded.

KEY-IN CHIME

The key-in chime is used to indicate to the operator that the key is in the ignition with the drivers door OPEN. If the key is in the ignition and the drivers door is OPEN, a ground path is completed from the G26 circuit at the cluster, through the CLOSED key-in switch, to the G16 circuit and terminating at the door ajar switch which is case grounded.

CHARGE INDICATOR LAMP

The Charge Indicator lamp is used to alert the operator that the charging system voltage has fallen below the normal operating range. This circuit is controlled by the Powertrain Control Module (PCM). When the PCM determines a problem, it grounds the G12 circuit.

AIRBAG WARNING LAMP

The Airbag Warning lamp is used to alert the operator of a problem with the Airbag system. The lamp is illuminated when the Airbag Control Module (ACM) grounds the R41 circuit. Refer to the appropriate section of the Service Manual or Diagnostic Test Procedures Manual to diagnosis this system.

LOW OIL PRESSURE LAMP

The low oil pressure lamp is used to indicate to the operator that the engine oil pressure has dropped below a predetermined pressure. Power for the lamp is provided on the G5 circuit which also powers the other warning lamps.

When the oil pressure is low the normally OPEN oil pressure switch CLOSES completing a path to ground on circuit G6. The oil pressure switch is case grounded to the engine block.

HIGH BEAM INDICATOR LAMP

The High Beam Indicator Lamp is used to indicate to the operator that the high beam headlamps are ON. Power is supplied to the cluster on the L3 circuit. Ground is provided on the Z3 circuit.

Circuit L3 connects from the headlamp dimmer switch to the instrument cluster.

DESCRIPTION AND OPERATION (Continued)

RIGHT AND LEFT TURN SIGNAL INDICATORS

These lamps are used to indicate to the operator which turn signal is ON. Power for the lamps comes from the turn signal switch. The L60 circuit is for the right turn indicator, and the L61 circuit is used for the left turn signal indicator. Ground for the circuits is provided on the Z3 circuit.

BRAKE WARNING INDICATOR LAMP

The Brake Warning Indicator lamp is used to alert the operator of a problem with the vehicles braking system. The lamp illuminates when the ignition switch is turned to START position to perform a self check.

There are two switches used in this system and they are wired in parallel form. A parking brake switch located on the parking brake mechanism will illuminate the lamp if the normally OPEN switch is CLOSED. This switch is case grounded.

The other switch used is the brake warning lamp switch. This switch is normally OPEN. When the brake system pressure is below a predetermined level the switch CLOSES and completes a path to ground from the G9 circuit at the cluster, through the switch, to the left headlamp ground.

ANTI-LOCK WARNING LAMP

The Anti-Lock warning lamp is used to alert the driver of a problem in the ABS system. When the ABS controller determines a problem in the system it grounds the G19 circuit and illuminates the lamp.

HELPFUL INFORMATION

- Check the 5 amp fuse in cavity 11 of the fuse block.
- Check the 4 amp fuse in cavity 12 of the fuse block.
- Check the Ignition-Off Draw fuse in the PDC.
- Check for a good ground at the instrument panel left center support.
- For additional diagnostic tests refer to the appropriate section of the Service Manual.

8W-41 HORNS/CIGAR LIGHTER

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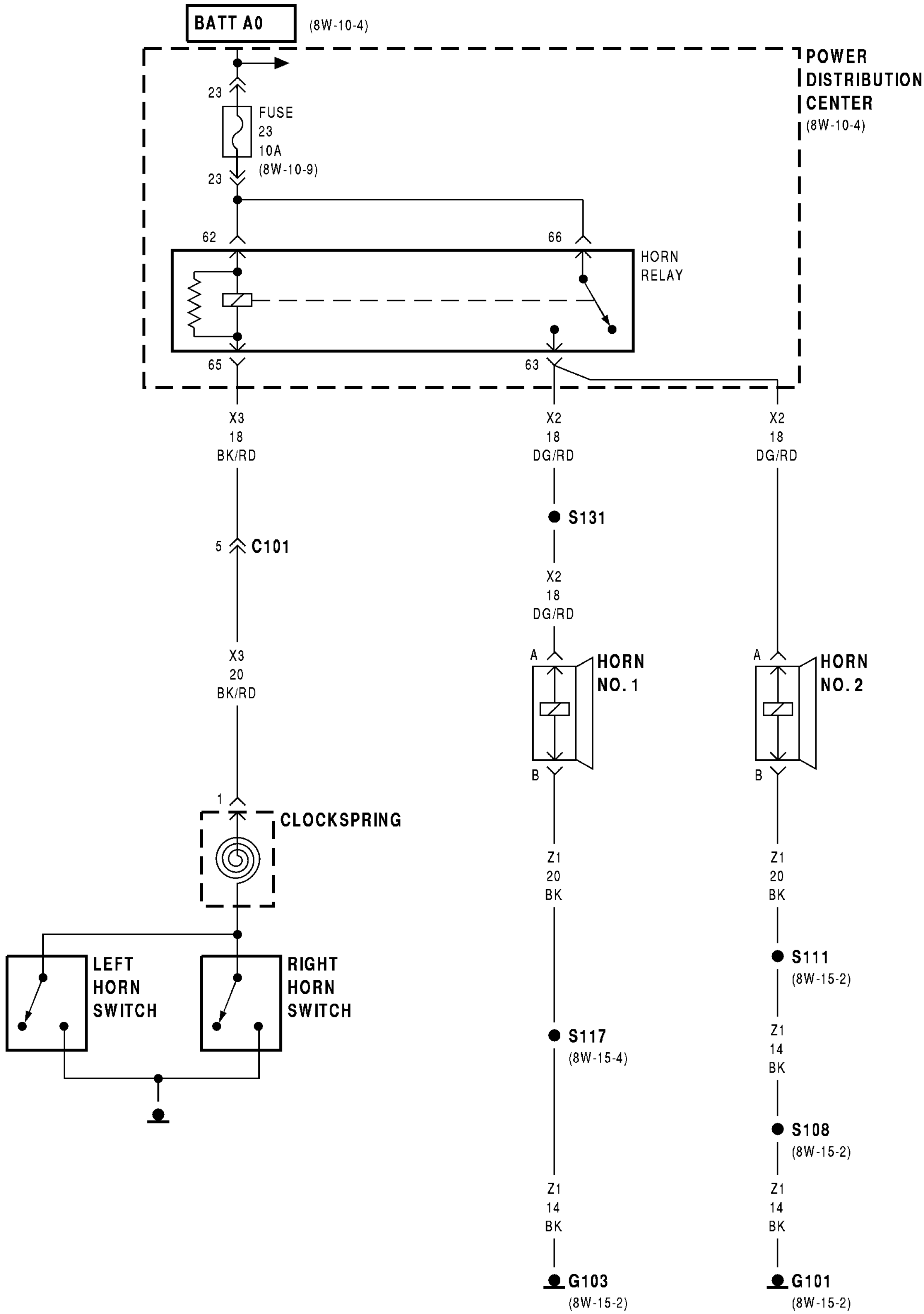
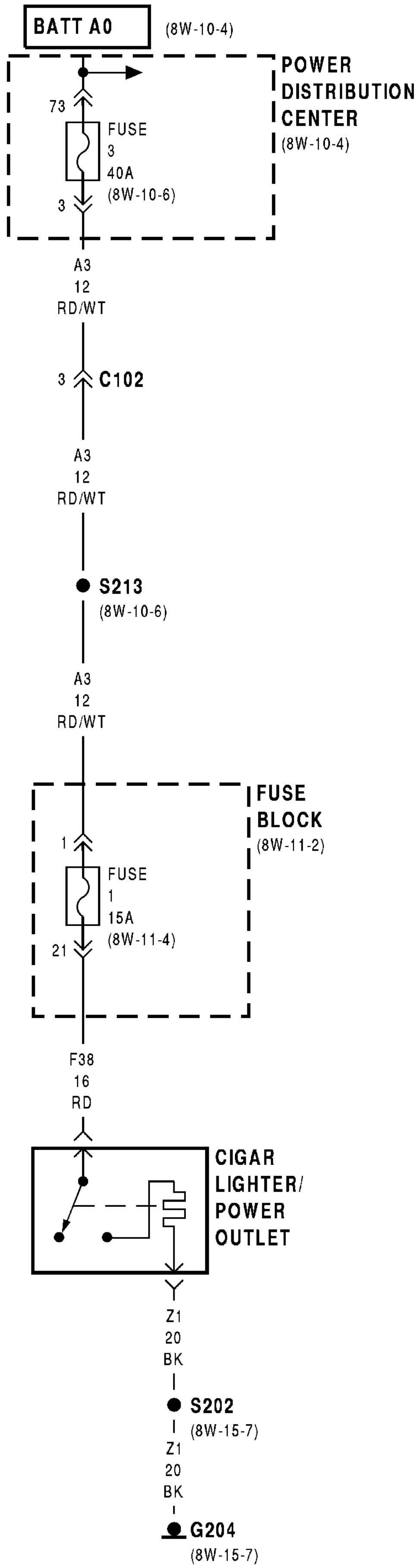

BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
23
FUSE
23
10A
(8W-10-9)
23
62
66
HORN
RELAY
65
63
X3
18
BK/RD
X2
18
DG/RD
X2
18
DG/RD
S131
5
C101
X2
18
DG/RD
X3
20
BK/RD
A
HORN
NO. 1
A
HORN
NO. 2
B
B
1
CLOCKSPRING
Z1
20
BK
Z1
20
BK
S111
(8W-15-2)
LEFT
HORN
SWITCH
RIGHT
HORN
SWITCH
S117
(8W-15-4)
Z1
14
BK
S108
(8W-15-2)
Z1
14
BK
Z1
14
BK
G103
(8W-15-2)
G101
(8W-15-2)


BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
73
FUSE
3
40A
(8W-10-6)
3
A3
12
RD/WT
3
C102
A3
12
RD/WT
S213
(8W-10-6)
A3
12
RD/WT
FUSE
BLOCK
(8W-11-2)
1
FUSE
1
15A
(8W-11-4)
21
F38
16
RD
CIGAR
LIGHTER/
POWER
OUTLET
Z1
20
BK
S202
(8W-15-7)
Z1
20
BK
G204
(8W-15-7)

8W-41 HORNS/CIGAR LIGHTER

DESCRIPTION AND OPERATION

HORNS

The horn system is powered by a 15 amp fuse located in the Power Distribution Center (PDC) which is HOT at all times on circuit F31. This circuit supplies voltage to the coil and contact side of the horn relay.

When the operator presses the horn switch, a ground path is completed on the coil side of the horn relay through the switch. The horn relay, located in the PDC, then CLOSES the relay contacts. Voltage is passed through the CLOSED relay contacts on circuit X2 to the horn. Grounding for the horn is on the Z1 circuit to the left headlamp ground which is located on the left side of the radiator closure panel.

HELPFUL INFORMATION

- Check the 15 amp fuse in the PDC.
- Press the horn switch and listen for the horn relay to click. A clicking relay indicates voltage is present up to the switch.
- Check for a good ground at the left headlamp ground.

CIGAR LIGHTER

The cigar lighter in this vehicle uses a cigar lighter relay and a cigar lighter element. Power for the cigar lighter relay is supplied by two sources.

Power for the coil side of the relay is supplied by circuit F13. This circuit is protected by a 20 amp fuse located in the fuse block. Power for the contact side of the relay is supplied on circuit F38. The F38 circuit is protected by a 15 amp fuse.

Ground for the cigar lighter element and relay is supplied on circuit Z1.

8W-42 AIR CONDITIONING-HEATER

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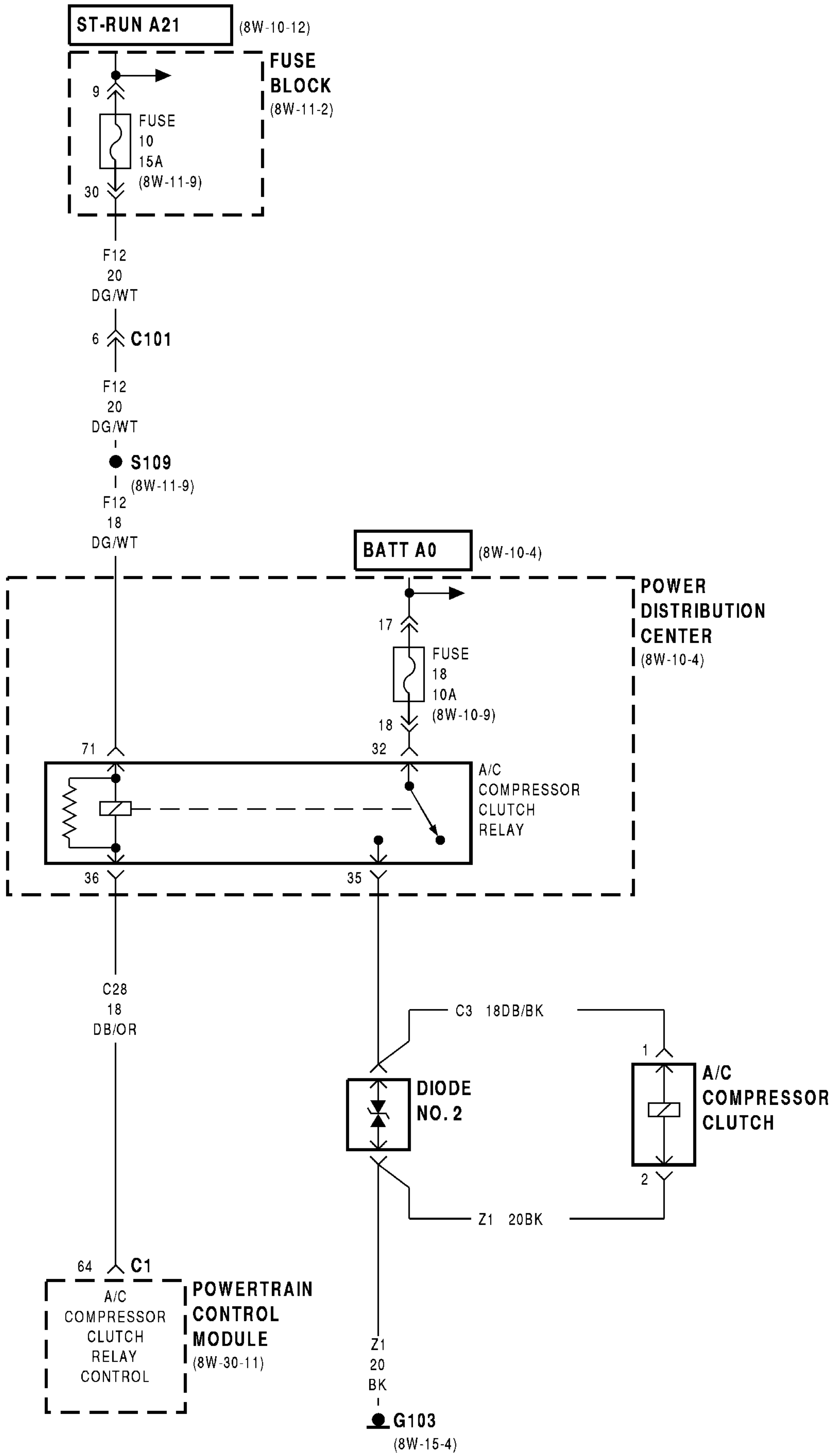
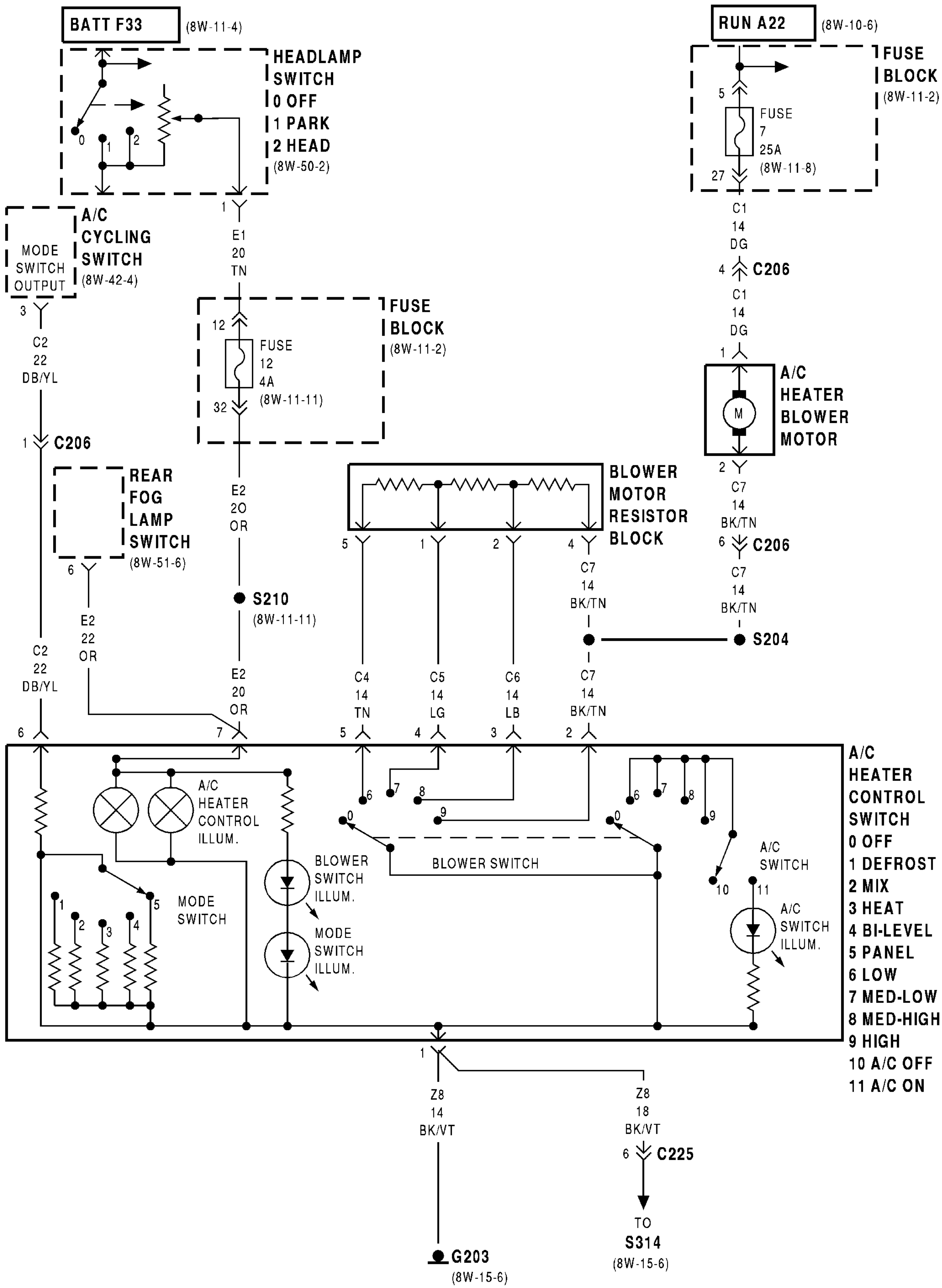
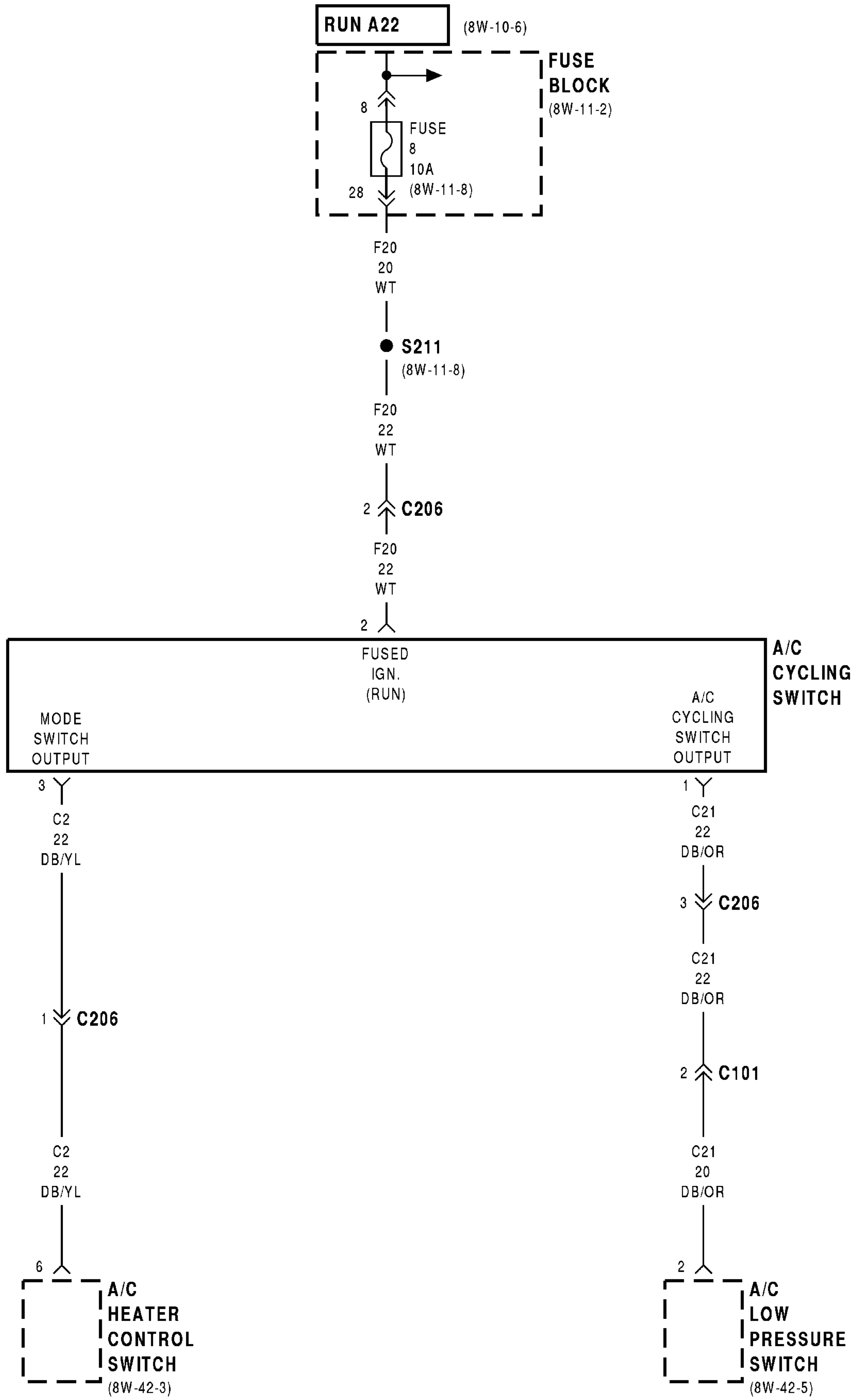
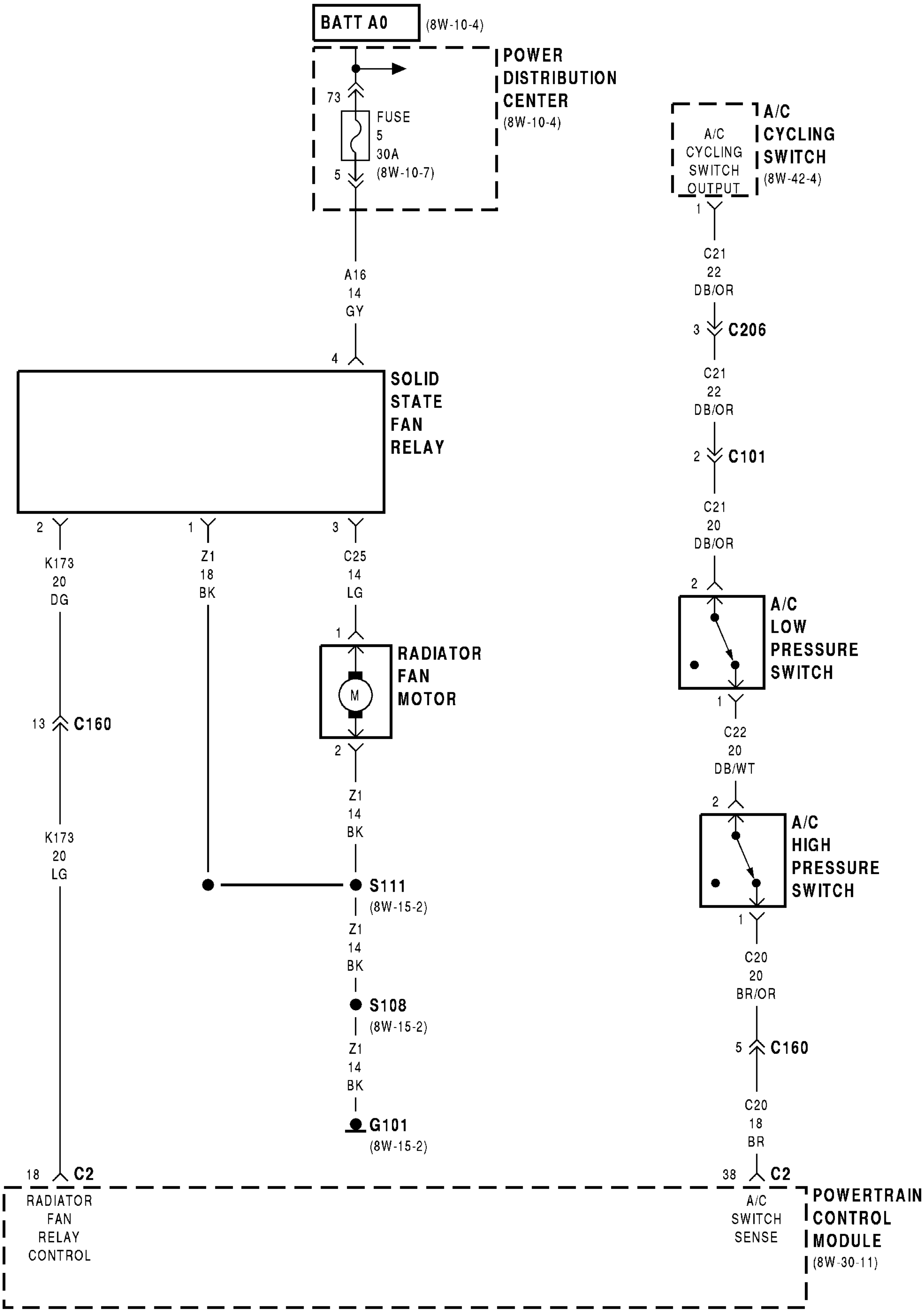

ST-RUN A21
(8W-10-12)
FUSE BLOCK
(8W-11-2)
9
FUSE 10 15A
(8W-11-9)
30
F12 20 DG/WT
6 C101
F12 20 DG/WT
S109
(8W-11-9)
F12 18 DG/WT
BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
17
FUSE 18 10A
(8W-10-9)
18
71
32
A/C COMPRESSOR CLUTCH RELAY
36
35
C28 18 DB/OR
C3 18DB/BK
1
DIODE NO. 2
A/C COMPRESSOR CLUTCH
2
Z1 20BK
64 C1
A/C COMPRESSOR CLUTCH RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-11)
Z1 20 BK
G103
(8W-15-4)


BATT F33
(8W-11-4)
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
RUN A22
(8W-10-6)
FUSE BLOCK
(8W-11-2)
FUSE 7 25A
(8W-11-8)
A/C CYCLING SWITCH
MODE SWITCH OUTPUT
(8W-42-4)
E1 20 TN
C1 14 DG
C206
FUSE BLOCK
(8W-11-2)
FUSE 12 4A
(8W-11-11)
C2 22 DB/YL
A/C HEATER BLOWER MOTOR
M
REAR FOG LAMP SWITCH
(8W-51-6)
E2 20 OR
BLOWER MOTOR RESISTOR BLOCK
C7 14 BK/TN
S210
(8W-11-11)
E2 22 OR
S204
C4 14 TN
C5 14 LG
C6 14 LB
A/C HEATER CONTROL ILLUM.
BLOWER SWITCH
BLOWER SWITCH ILLUM.
MODE SWITCH
MODE SWITCH ILLUM.
A/C SWITCH
A/C SWITCH ILLUM.
A/C HEATER CONTROL SWITCH
0 OFF
1 DEFROST
2 MIX
3 HEAT
4 BI-LEVEL
5 PANEL
6 LOW
7 MED-LOW
8 MED-HIGH
9 HIGH
10 A/C OFF
11 A/C ON
Z8 14 BK/VT
Z8 18 BK/VT
C225
TO S314
(8W-15-6)
G203
(8W-15-6)


RUN A22
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
8
FUSE
8
10A
(8W-11-8)
28
F20
20
WT
S211
(8W-11-8)
F20
22
WT
2
C206
F20
22
WT
2
FUSED
IGN.
(RUN)
A/C
CYCLING
SWITCH
MODE
SWITCH
OUTPUT
A/C
CYCLING
SWITCH
OUTPUT
3
C2
22
DB/YL
1
C206
C2
22
DB/YL
6
A/C
HEATER
CONTROL
SWITCH
(8W-42-3)
1
C21
22
DB/OR
3
C206
C21
22
DB/OR
2
C101
C21
20
DB/OR
2
A/C
LOW
PRESSURE
SWITCH
(8W-42-5)


BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
73
FUSE
5
30A
(8W-10-7)
5
A16
14
GY
4
SOLID STATE FAN RELAY
2
1
3
K173
20
DG
Z1
18
BK
C25
14
LG
1
RADIATOR FAN MOTOR
M
2
Z1
14
BK
13
C160
K173
20
LG
S111
(8W-15-2)
Z1
14
BK
S108
(8W-15-2)
Z1
14
BK
G101
(8W-15-2)
A/C CYCLING SWITCH OUTPUT
A/C CYCLING SWITCH
(8W-42-4)
1
C21
22
DB/OR
3
C206
C21
22
DB/OR
2
C101
C21
20
DB/OR
2
A/C LOW PRESSURE SWITCH
1
C22
20
DB/WT
2
A/C HIGH PRESSURE SWITCH
1
C20
20
BR/OR
5
C160
C20
18
BR
18
C2
38
C2
RADIATOR FAN RELAY CONTROL
A/C SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-11)

8W-42 AIR CONDITIONING-HEATER

INDEX

DESCRIPTION AND OPERATION

AIR CONDITIONING-HEATER SYSTEM

The A/C-Heater System is powered by a by several fuses. Fuse 10, a 15 amp fuse located in the fuse block, is HOT in the RUN position. This fuse powers the coil side of the A/C compressor clutch relay located in the Power Distribution Center (PDC).

A 30 amp fuse, on circuit A16 located in the PDC, powers the solid state radiator fan relay. This fuse is HOT at all times. The 10 amp fuse on circuit A17 located in the PDC powers the contact side of the A/C compressor clutch relay.

The A/C-Heater blower motor is protected by a 25 amp fuse located in cavity 7 of the fuse block. This fuse in HOT in the RUN position only. When the ignition switch is in the RUN position, power is supplied to the fuse on circuit A22. The power leaves the fuse on circuit C1 and goes directly to the blower motor.

There is a 4 amp fuse located in cavity 12 of the fuse block used for the illumination lamps in the A/C-Heater control. The fuse is HOT at all times.

A/C OPERATION

When the A/C or the defrost switch is put in the ON position, and the A/C cycling switch, low pressure cut-out switch, and the high pressure switch are CLOSED, the Powertrain Control Module (PCM) receives a request for A/C.

After receiving this input, the PCM activates the A/C compressor by grounding the C28 circuit on the coil side of the A/C Compressor Clutch relay. Power for the coil side of the relay is supplied on the bus bar located in the Power Distribution Center (PDC). With the coil energized, current flows from the 10 amp fuse in the PDC on circuit A17 through the CLOSED contacts in the relay, on the C3 circuit to the A/C compressor clutch.

The A/C compressor clutch receives this voltage and creates a magnetic field energizing the clutch. Ground for the coil is provided at the right headlamp ground.

The connector at the A/C compressor has a diode located in it. This diode is used to control the induced voltage resulting from the magnetic field collapsing when the clutch is disengaged. The diode provides a path for the voltage to protect other components and systems.

The A/C compressor clutch relay is also used by the PCM to disengage the compressor in a Wide Open Throttle (W.O.T.) condition.

RADIATOR FAN OPERATION

The radiator fan system used in this vehicle uses a solid state relay that controls the speed of the radiator fan.

Power for the relay is supplied on circuit A16 This circuit is HOT at all times and protected by a 30 amp fuse located in the Power Distribution Center (PDC).

Ground for the coil side of the relay is controlled by the Powertrain Control Module (PCM). When the PCM determines the need for fan operation the PCM supplies the ground path for circuit K173. This circuit connects to cavity 18 of the PCM connector.

From the relay circuit C25 connects to the radiator fan motor(s). On vehicles equipped with the manual transmission only one radiator fan is used. For vehicles equipped with an automatic transmission there are two radiator fans used.

Ground for the radiator fans is supplied on circuit Z1.

BLOWER MOTOR OPERATION

With the ignition switch in the RUN position, power flows from the 25 amp fuse, in cavity 7 of the fuse block, to the blower motor. Blower motor speed is controlled by the fan control switch located in the instrument panel, and the resistor block.

Blower motor LOW speed operation is accomplished on the C4 circuit. When the control switch is moved to the LOW speed position, current is passed on the C7 circuit through the blower motor resistor to the C4 circuit. It then flows through the blower motor switch to the Z8 circuit. The Z8 circuit terminates at a grounding point on the instrument panel left center support.

The operation of the blower motor M1 and M2 speed operations is the same as the LOW speed

DESCRIPTION AND OPERATION (Continued)

except, the C5 circuit is used for the M1 speed and circuit C6 is used for M2 speed operation.

Blower motor HIGH speed operation is accomplished on the C7 circuit which supplies battery voltage directly to the blower motor. There are no resistors used in the HIGH speed mode.

HELPFUL INFORMATION

- Check the 30 amp fuse located in the PDC for the radiator fan motor
- Check the 15 amp fuse located in cavity 10 of the fuse block for the A/C compressor clutch relay
- Check the 10 amp fuse located in the PDC for the A/C compressor clutch relay.
- Check the 25 amp fuse located in cavity 7 of the fuse block for the blower motor.
- Check the right headlamp ground located at the right fender side shield.
- Check the left headlamp ground located on the left side of the radiator closure panel.
- On vehicles equipped with A/C check the refrigerant level. The system will not operate with a low level of refrigerant.

8W-43 AIRBAG SYSTEM

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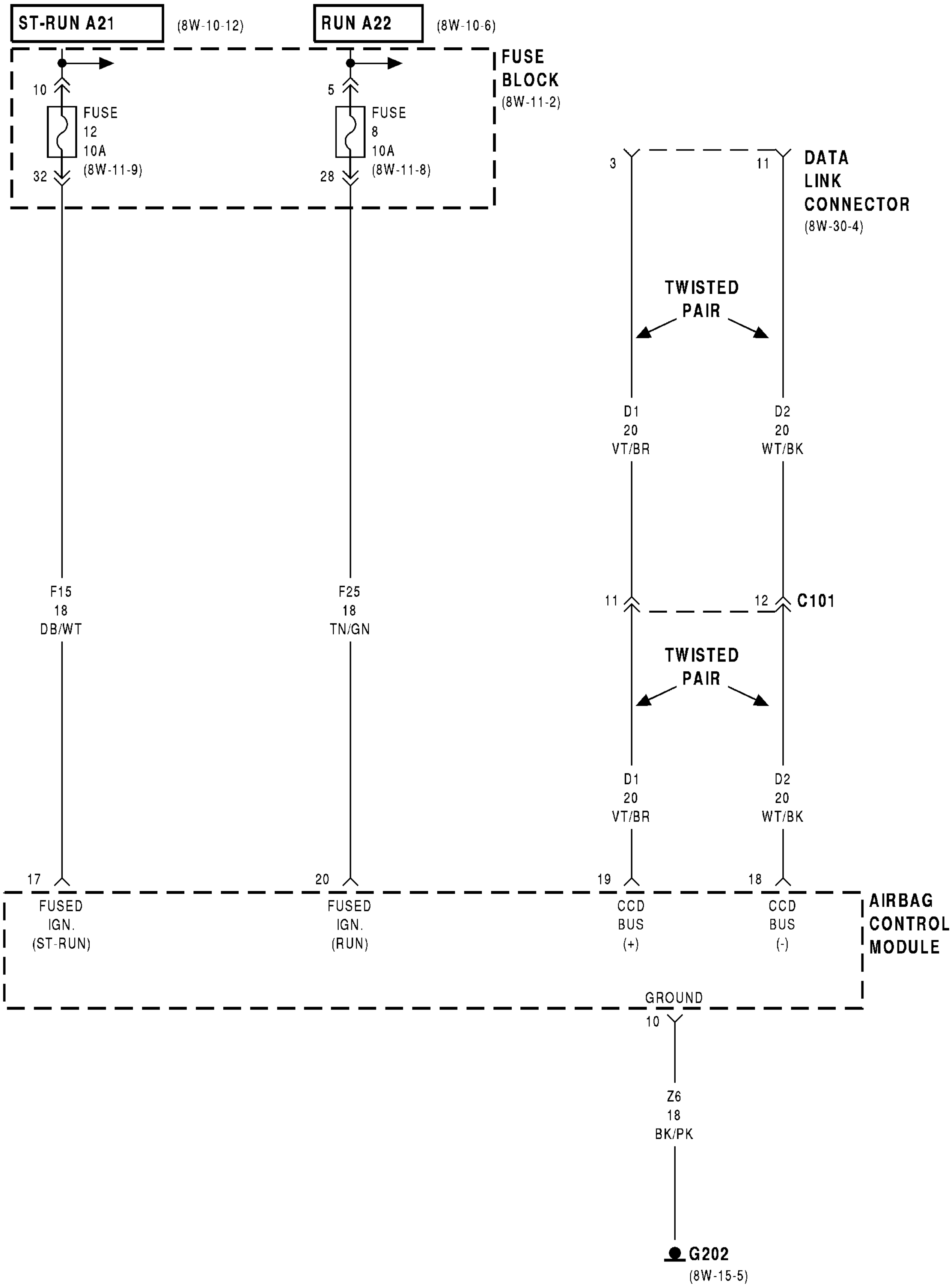
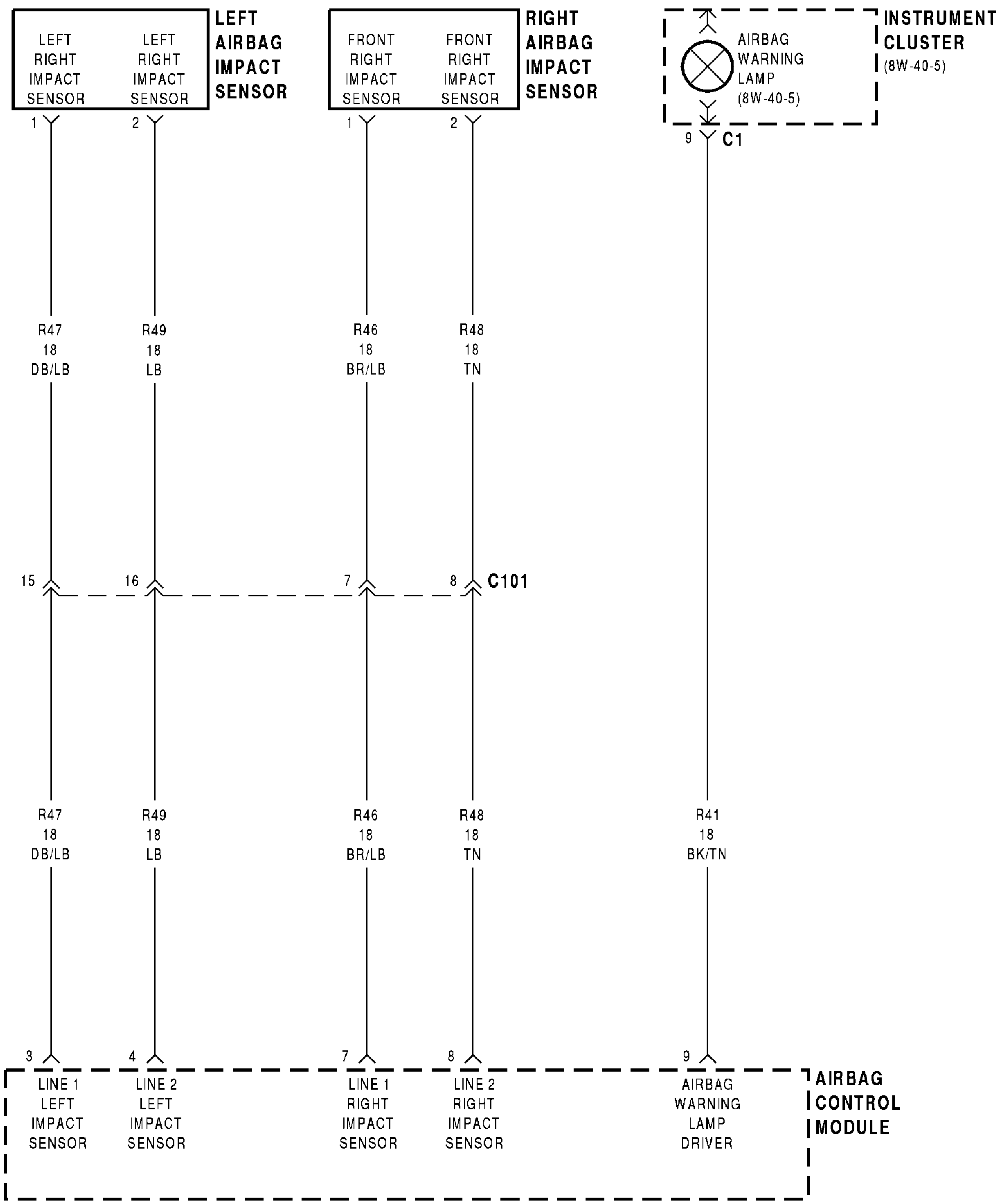
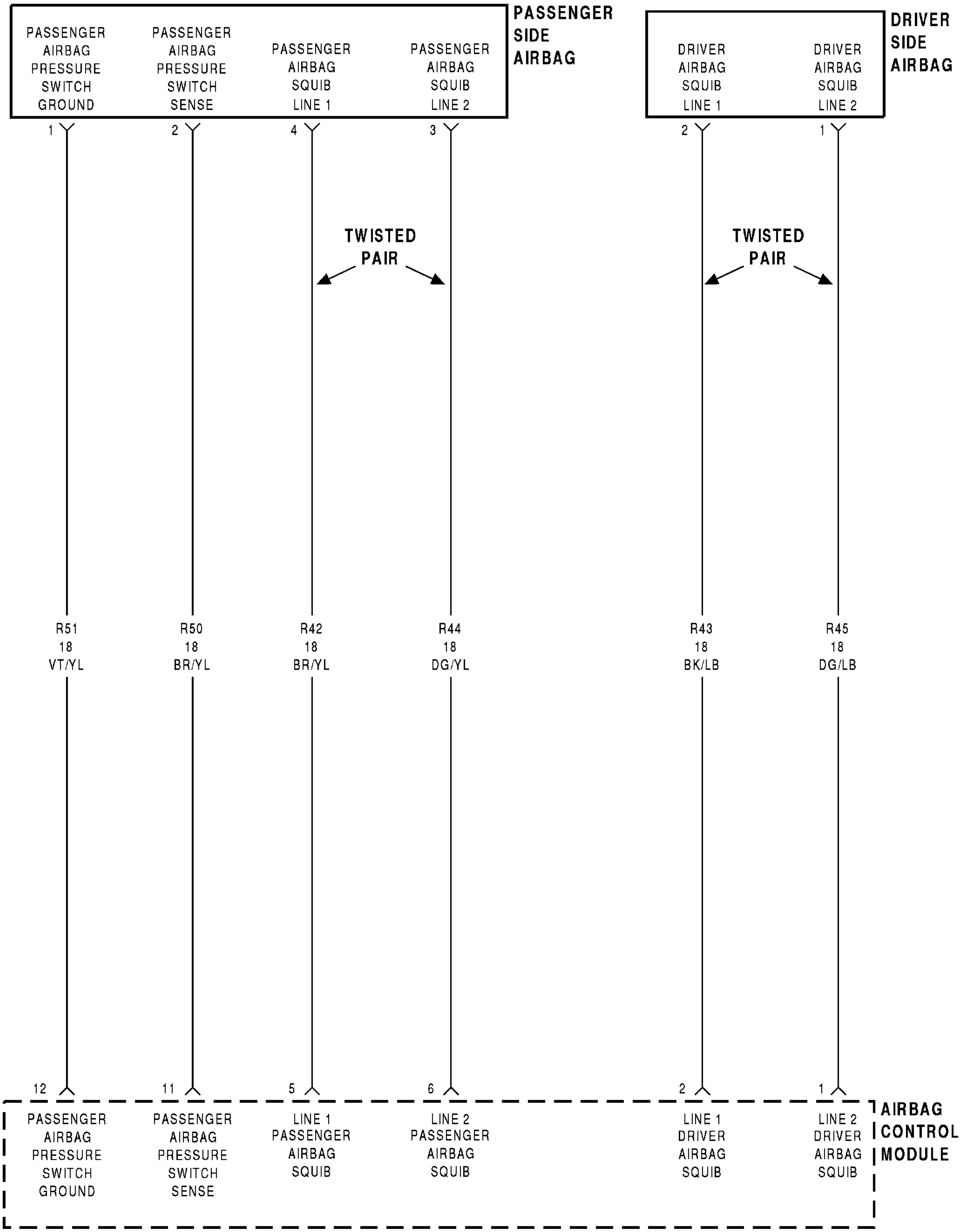

ST-RUN A21
(8W-10-12)
RUN A22
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
10
FUSE
12
10A
(8W-11-9)
32
5
FUSE
8
10A
(8W-11-8)
28
3
11
DATA
LINK
CONNECTOR
(8W-30-4)
TWISTED
PAIR
D1
20
VT/BR
D2
20
WT/BK
F15
18
DB/WT
F25
18
TN/GN
11
12
C101
TWISTED
PAIR
D1
20
VT/BR
D2
20
WT/BK
17
20
19
18
FUSED
IGN.
(ST-RUN)
FUSED
IGN.
(RUN)
CCD
BUS
(+)
CCD
BUS
(-)
AIRBAG
CONTROL
MODULE
GROUND
10
Z6
18
BK/PK
G202
(8W-15-5)


LEFT AIRBAG IMPACT SENSOR
LEFT RIGHT IMPACT SENSOR
LEFT RIGHT IMPACT SENSOR
RIGHT AIRBAG IMPACT SENSOR
FRONT RIGHT IMPACT SENSOR
FRONT RIGHT IMPACT SENSOR
INSTRUMENT CLUSTER
(8W-40-5)
AIRBAG WARNING LAMP
(8W-40-5)
C1
R47 18 DB/LB
R49 18 LB
R46 18 BR/LB
R48 18 TN
C101
R41 18 BK/TN
AIRBAG CONTROL MODULE
LINE 1 LEFT IMPACT SENSOR
LINE 2 LEFT IMPACT SENSOR
LINE 1 RIGHT IMPACT SENSOR
LINE 2 RIGHT IMPACT SENSOR
AIRBAG WARNING LAMP DRIVER


PASSENGER SIDE AIRBAG
PASSENGER AIRBAG PRESSURE SWITCH GROUND
PASSENGER AIRBAG PRESSURE SWITCH SENSE
PASSENGER AIRBAG SQUIB LINE 1
PASSENGER AIRBAG SQUIB LINE 2
1
2
4
3
DRIVER SIDE AIRBAG
DRIVER AIRBAG SQUIB LINE 1
DRIVER AIRBAG SQUIB LINE 2
2
1
TWISTED PAIR
TWISTED PAIR
R51 18 VT/YL
R50 18 BR/YL
R42 18 BR/YL
R44 18 DG/YL
R43 18 BK/LB
R45 18 DG/LB
12
11
5
6
2
1
PASSENGER AIRBAG PRESSURE SWITCH GROUND
PASSENGER AIRBAG PRESSURE SWITCH SENSE
LINE 1 PASSENGER AIRBAG SQUIB
LINE 2 PASSENGER AIRBAG SQUIB
LINE 1 DRIVER AIRBAG SQUIB
LINE 2 DRIVER AIRBAG SQUIB
AIRBAG CONTROL MODULE

8W-43 AIRBAG SYSTEM

DESCRIPTION AND OPERATION

AIRBAG CONTROL MODULE (ACM)

Two different circuits supply battery voltage from the fuse block to the Airbag Control Module (ACM), F15 and F25. The F15 and F25 circuits are connected to separate bus bars internal to the fuse block. Different circuits from the Power Distribution Center (PDC) and ignition switch supply battery voltage to the fuse block bus bars.

The F25 circuit supplies battery voltage to the ACM only when the ignition switch is in the RUN position. The F15 circuit powers the ACM when the ignition switch is in either the START or RUN position.

An internal bus bar in the ignition switch connects the A1 circuit from the PDC to the A21 circuit when the switch is either the START or RUN position. The A21 circuit supplies battery voltage to the bus bar in the fuse block that feeds the F15 circuit. A 30 amp fuse in the PDC protects the A1 and A21 circuits. A 10 amp fuse in the fuse block, cavity 9, protects the F15 circuit.

When the ignition switch is in the RUN position, it connects the A2 circuit from the PDC to the A22 circuit. The A22 circuit supplies battery voltage to the fuse block bus bar that feeds the F25 circuit. A 40 amp fuse in the PDC protects the A2 and A22 circuits. A 10 amp fuse in the fuse block, cavity 5, protects the F25 circuit.

Circuits D1 and D2 are connected to the CCD Bus and the ACM. The CCD bus is used to provide communications between modules and the universal data link connector.

The ACM has a case ground and an external dedicated ground, circuit Z6. The dedicated ground connects to the instrument panel right center support.

AIRBAG IMPACT SENSOR

The Airbag system uses a sensor internal to the Airbag Control Module (ACM) to detect impact. For information regarding operation of this sensor, refer to the appropriate group of the Service Manual.

AIRBAG SQUIB (AIRBAG IGNITER)

DRIVERS SIDE AIRBAG

Two circuits, R43 and R45, connect the ACM to the drivers side airbag module squib (igniter) after passing through the clock spring connector. Circuit R43 from cavity 3 of the ACM 4-way connector connects to the squib. Circuit R45 from cavity 4 of the ACM 4-way connector connects to the squib. R43 and R45 are a twisted pair of wires.

PASSENGERS SIDE AIRBAG

Two circuits, R42 and R44, connect the ACM to the passengers side airbag module squib (igniter). Circuit R42 from cavity 1 of the ACM 4-way connector connects to the squib. Circuit R44 from cavity 2 of the ACM 4- way connector connects to the squib. R42 and R44 are a twisted pair of wires.

Circuits R50 and R51 are connected from the ACM to the passangers airbag. These circuits are used to monitor the pressure switch.

AIRBAG WARNING LAMP

The Airbag Warning lamp is used to alert the operator of a problem with the Airbag system. The lamp is illuminated when the Airbag Control Module (ACM) grounds the R41 circuit. Refer to the appropriate section of the Service Manual or Diagnostic Test Procedures Manual to diagnosis this system.

HELPFUL INFORMATION

- Check for blown fuses in the circuit that connect to the ignition switch and those that connect to the ACM.
- While the bus bars in the fuse block power the ACM, they also feed additional components on separate fuse protected circuits.
- The ACM has a case ground and an external dedicated ground. The dedicated ground connects to the instrument panel right center support.

8W-44 INTERIOR LIGHTING

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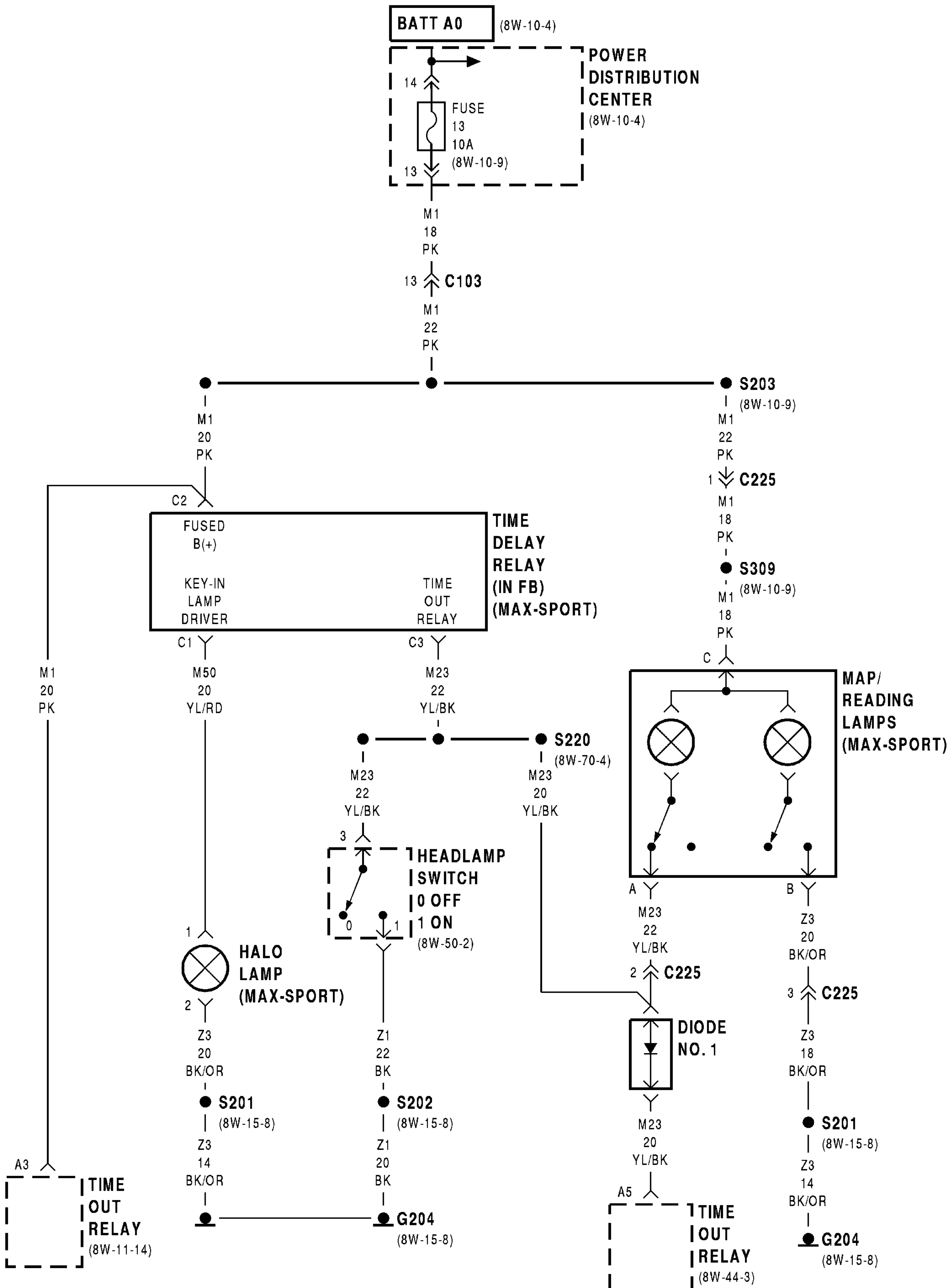
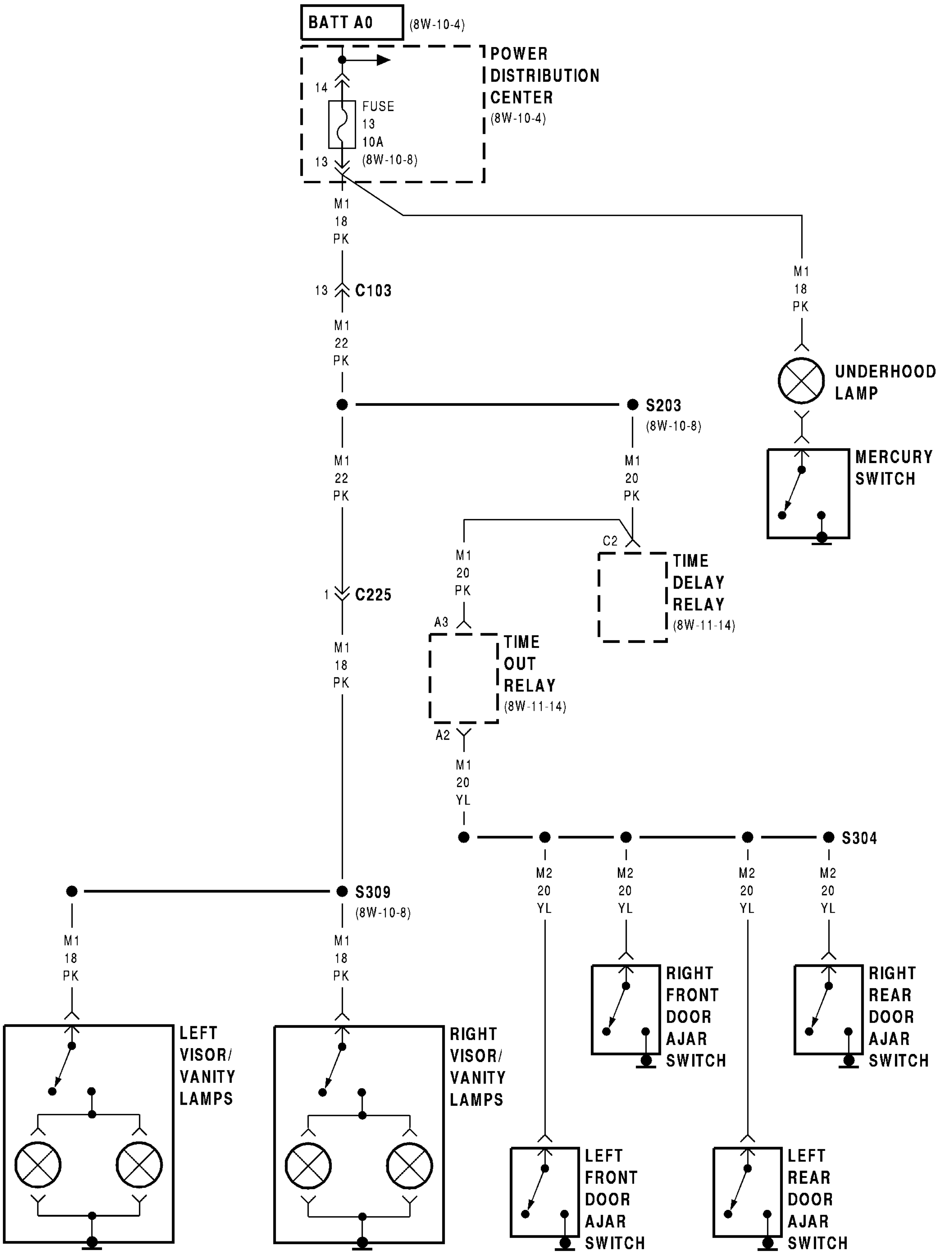
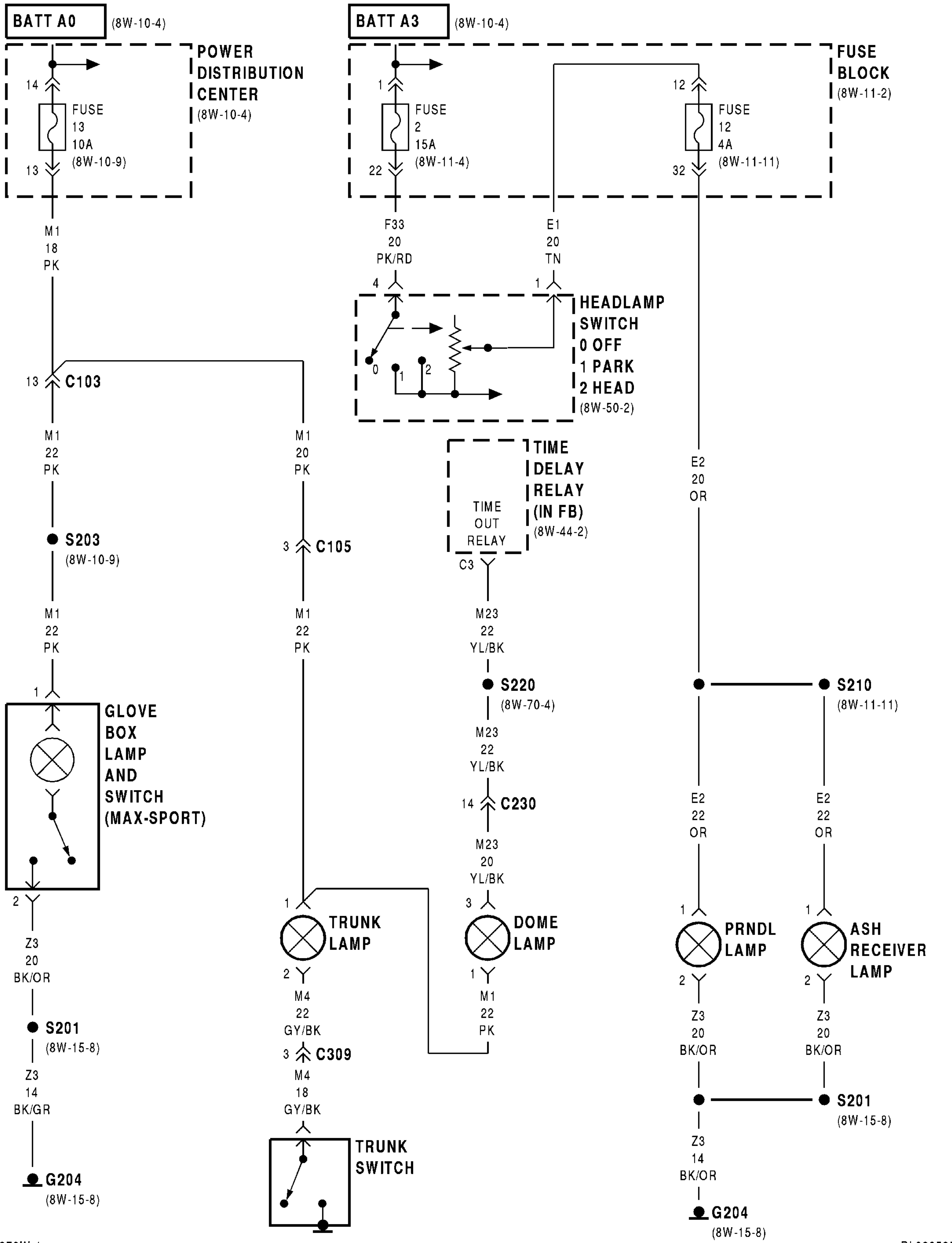

BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
14
FUSE
13
10A
(8W-10-9)
13
M1
18
PK
13
C103
M1
22
PK
S203
(8W-10-9)
M1
20
PK
M1
22
PK
1
C225
M1
18
PK
C2
FUSED
B(+)
KEY-IN
LAMP
DRIVER
TIME
OUT
RELAY
TIME DELAY RELAY (IN FB) (MAX-SPORT)
S309
(8W-10-9)
M1
18
PK
C1
C3
C
M1
20
PK
M50
20
YL/RD
M23
22
YL/BK
MAP/ READING LAMPS (MAX-SPORT)
S220
(8W-70-4)
M23
22
YL/BK
M23
20
YL/BK
3
HEADLAMP SWITCH
0 OFF
1 ON
(8W-50-2)
0
1
A
B
M23
22
YL/BK
Z3
20
BK/OR
1
HALO LAMP (MAX-SPORT)
2
C225
3
C225
DIODE NO. 1
2
Z3
20
BK/OR
Z1
22
BK
Z3
18
BK/OR
S201
(8W-15-8)
S202
(8W-15-8)
M23
20
YL/BK
S201
(8W-15-8)
Z3
14
BK/OR
Z1
20
BK
Z3
14
BK/OR
A3
TIME OUT RELAY
(8W-11-14)
G204
(8W-15-8)
A5
TIME OUT RELAY
(8W-44-3)
G204
(8W-15-8)



PLL04402

978W-1


BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
14
FUSE 13 10A (8W-10-9)
13
M1 18 PK
13 C103
M1 22 PK
S203 (8W-10-9)
M1 22 PK
1
GLOVE BOX LAMP AND SWITCH (MAX-SPORT)
2
Z3 20 BK/OR
S201 (8W-15-8)
Z3 14 BK/GR
G204 (8W-15-8)
M1 20 PK
3 C105
M1 22 PK
1
TRUNK LAMP
2
M4 22 GY/BK
3 C309
M4 18 GY/BK
TRUNK SWITCH
BATT A3
(8W-10-4)
FUSE BLOCK
(8W-11-2)
1
FUSE 2 15A (8W-11-4)
22
12
FUSE 12 4A (8W-11-11)
32
F33 20 PK/RD
E1 20 TN
4
1
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
0
1
2
TIME DELAY RELAY (IN FB)
(8W-44-2)
TIME OUT RELAY
C3
M23 22 YL/BK
S220 (8W-70-4)
M23 22 YL/BK
14 C230
M23 20 YL/BK
3
DOME LAMP
1
M1 22 PK
E2 20 OR
S210 (8W-11-11)
E2 22 OR
E2 22 OR
1
PRNDL LAMP
2
1
ASH RECEIVER LAMP
2
Z3 20 BK/OR
Z3 20 BK/OR
S201 (8W-15-8)
Z3 14 BK/OR
G204 (8W-15-8)

8W-44 INTERIOR LIGHTING

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DESCRIPTION AND OPERATION

INTRODUCTION

The courtesy lamp system is powered at all times by the 10 amp fuse located in the Power Distribution Center (PDC). The M1 circuit feeds the courtesy lamps, which include the trunk lamp, underhood lamp, visor/vanity lamps, dome lamp, time delay relay, and the glove box lamp.

HALO LAMP/TIME DELAY RELAY

The time delay relay is used to allow a time-ON function for the ignition switch halo lamp. Power for the relay is received on the M1 circuit from the 10 amp fuse located in the Power Distribution Center (PDC). This is the Ignition-Off Draw (IOD) fuse and HOT at all times.

When a door is OPENED, or the headlamp switch is moved to the dome lamp position, a ground path is provided for the relay on the M23 circuit. This energizes the relay, CLOSING the contacts. When the relay contacts are CLOSED, power is provided through the relay to the M50 circuit.

The M50 circuit supplies current to the ignition switch lamp in the steering column. Ground for the lamp is provided on the Z3 circuit. This circuit splices with the glove box lamp, the ash receiver lamp, and the PRNDL lamp. The Z3 circuit terminates at the instrument panel left center support.

Circuit M23 is also spliced with the Remote Keyless Entry (RKE) module and the time out relay located in the fuse block.

TIME OUT RELAY

The time out relay is located in the fuse block and is used to control the ground path for various interior lamps. It will also turn the lamps OFF after a specified period of time, and works with the Remote Keyless Entry (RKE) system for illuminated entry.

Cirucit M2 connects to the relay and supplied a ground path through the door ajar switches.

Circuit M1 is used to supply battery voltage to the relay. This circuit is proteced by a 10 amp fuse located in cavity 13 of the Power Distribution Center (PDC).

Circuit M32 is connected from the relay to the various interior lamps and RKE module.

PRNDL (TRANSMISSION RANGE INDICATOR) LAMP

The PRNDL lamp receives power on the E2 circuit from the 4 amp fuse located in the fuse block in cavity 12. The fuse receives power from the headlamp switch. Circuit E2 also powers the ash receiver lamp.

When the headlamp switch is moved to the PARK or ON position, current flows through the fuse to the PRNDL lamp. The ground for the lamp is supplied on the Z3 circuit, and terminates at the instrument panel left center support. This circuit is also spliced in with the ash receiver lamp, the ignition switch lamp, and the glove box lamp.

VISOR/VANITY LAMPS

The visor/vanity lamps are case-grounded, and are operated by a switch internal to the assembly. Power for the lamps is on the M1 circuit from the Power Distribution Center (PDC). When the operator opens the cover, the switch CLOSES, completing a path to ground illuminating the lamp.

DOME LAMP

The dome lamp receives power from the 10 amp fuse located in the Power Distribution Center on the M1 circuit. This circuit is HOT at all times and the Ignition-Off Draw (IOD) fuse. The ground path for the lamp is provided in two different ways.

One way is through the door ajar switches and the time out relay. Circuit M2 connects to all the door ajar switches from the time out relay. The switches are case-grounded to the body. When a door is OPENED, the plunger in the switch CLOSES, completing a path to ground.

DESCRIPTION AND OPERATION (Continued)

The second ground path is through the headlamp switch. Circuit M23 is spliced in with the time out relay. When the operator turns the headlamp switch to the dome lamp ON position, a ground path is provided through the switch on the Z1 circuit. This ground terminates at the instrument panel left center support.

On vehicles equipped with Remote Keyless Entry (RKE) the M23 circuit is spliced to the RKE module. This allows the lamp to be turned ON when a valid signal is reveived by the RKE module from the transmitter.

MAP/READING LAMPS

The map/reading lamps are powered by the M1 circuit from the Power Distribution Center (PDC). This circuit is the Ignition-Off Draw circuit and protected by a 10 amp fuse. The M1 circuit is spliced and provides power for the visor/vanity lamps, radio, power mirrors, dome lamp, time delay relay, and other interior lamps.

Ground for the lamps is provided from two sources. One is the Z3 circuit which is spliced in with the glove box lamp and terminates at the instrument panel left center support. The second ground is provided on circuit M23. This circuit is spliced in with the time out relay so the lamps will turn ON when any door is OPENED.

On vehicles equipped with Remote Keyless Entry (RKE) the M23 circuit, which is the ground circuit when a door is OPENED, is connected to the RKE module. The module will provide a ground path for the lamps with a valid signal from the transmitter.

GLOVE BOX LAMP

The glove box lamp receives power on the M1 circuit from the 10 amp fuse located in the Power Distribution Center (PDC). A switch, wired in series after the lamp, CLOSES when the glove box door is opened, and completes a path to ground on the Z3 circuit.

The Z3 circuit is spliced in with the ash receiver lamp, PRNDL lamp, and the time delay relay. The Z3 circuit terminates at the instrument panel left center support.

ASH RECEIVER LAMP

The ash receiver lamp receives power on the E2 circuit from the 4 amp fuse located in the fuse block in cavity 12. The fuse receives power from the headlamp switch. Circuit E2, which is HOT at all times, also powers the Transmission Range Indicator (PRNDL) lamp.

When the headlamp switch is moved to the PARK or ON position, current flows through the fuse to the ash receiver lamp. The ground for the lamp is supplied on the Z3 circuit, and terminates at the instrument panel left center support. This circuit is also spliced in with the PRNDL lamp, the ignition switch lamp, and the glove box lamp.

UNDERHOOD LAMP

Power for the underhood lamp is supplied on circuit M1. This is the Ignition-Off Draw (IOD) circuit and is protected by a 10 amp fuse located in the Power Distribution Center (PDC).

When the hood is raised a ground path is completed through the mercury switch to a case ground illuminating the lamp.

TRUNK LAMP

The trunk lamp uses a case-grounded switch located on the trunk latch. The switch is normally OPEN. When the deck lid is opened, the switch CLOSES, completing a path to ground on circuit M4. The M1 circuit provides power to the lamp, and is HOT at all times.

HELPFUL INFORMATION

- Check the 10 amp fuse located in the Power Distribution Center (PDC) for the trunk lamp, underhood lamp, visor/vanity lamps, dome lamp, time delay relay, and the glove box lamp.
- Check for a good ground at the instrument panel left center support.
- Check the door switches for a good ground.
- Check the 4 amp fuse in the fuse block, cavity 12.

8W-47 AUDIO SYSTEMS

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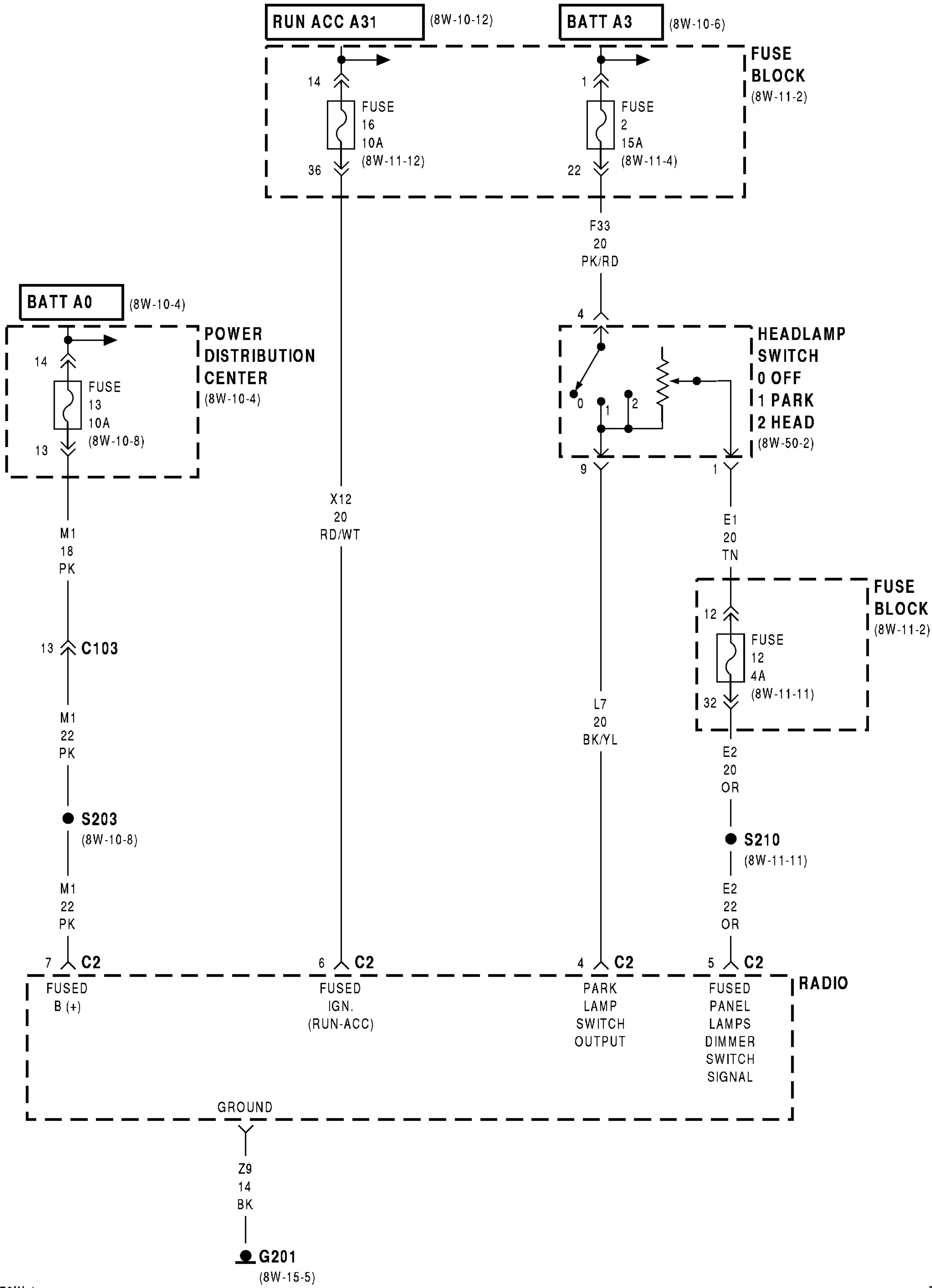
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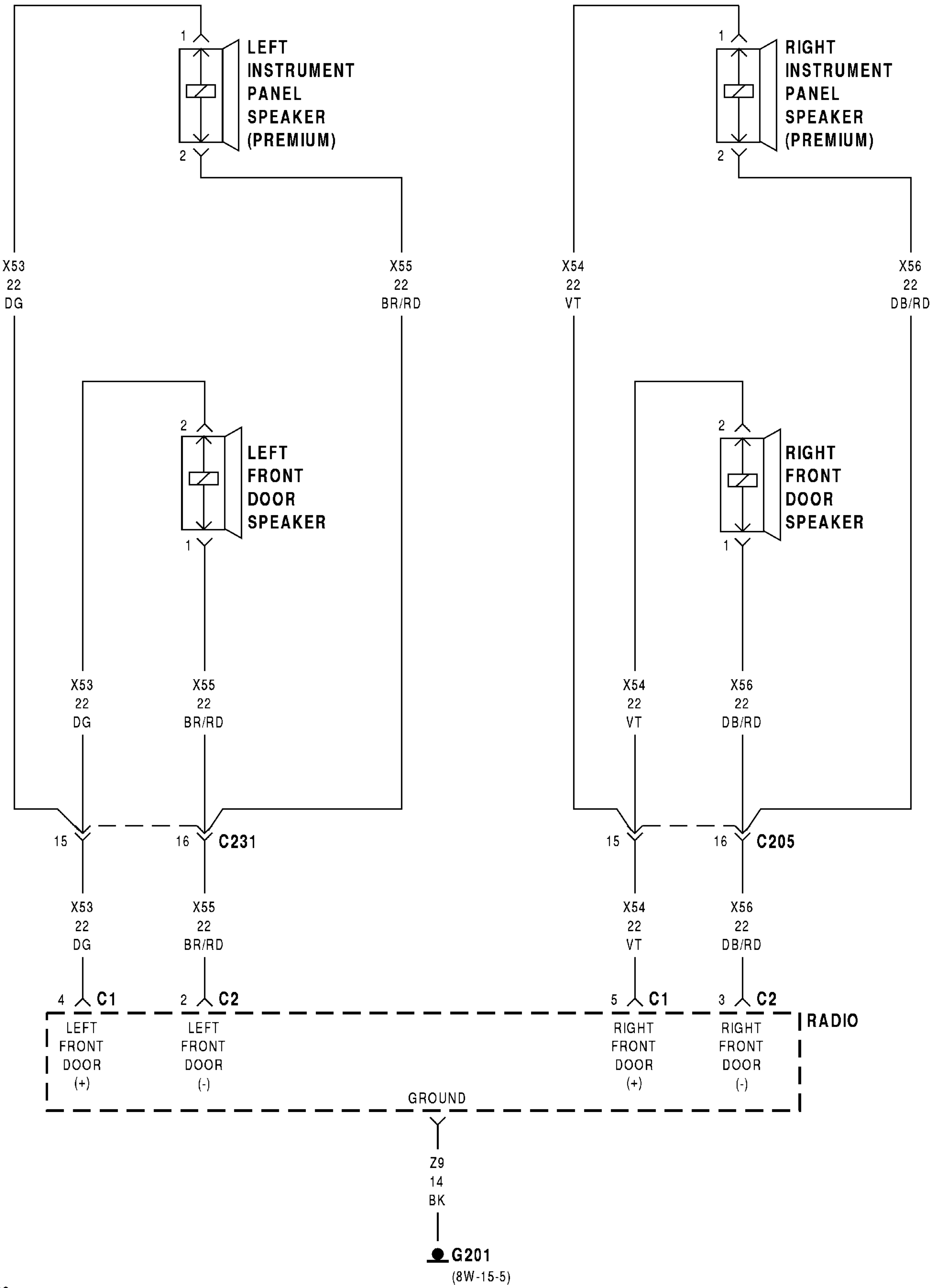
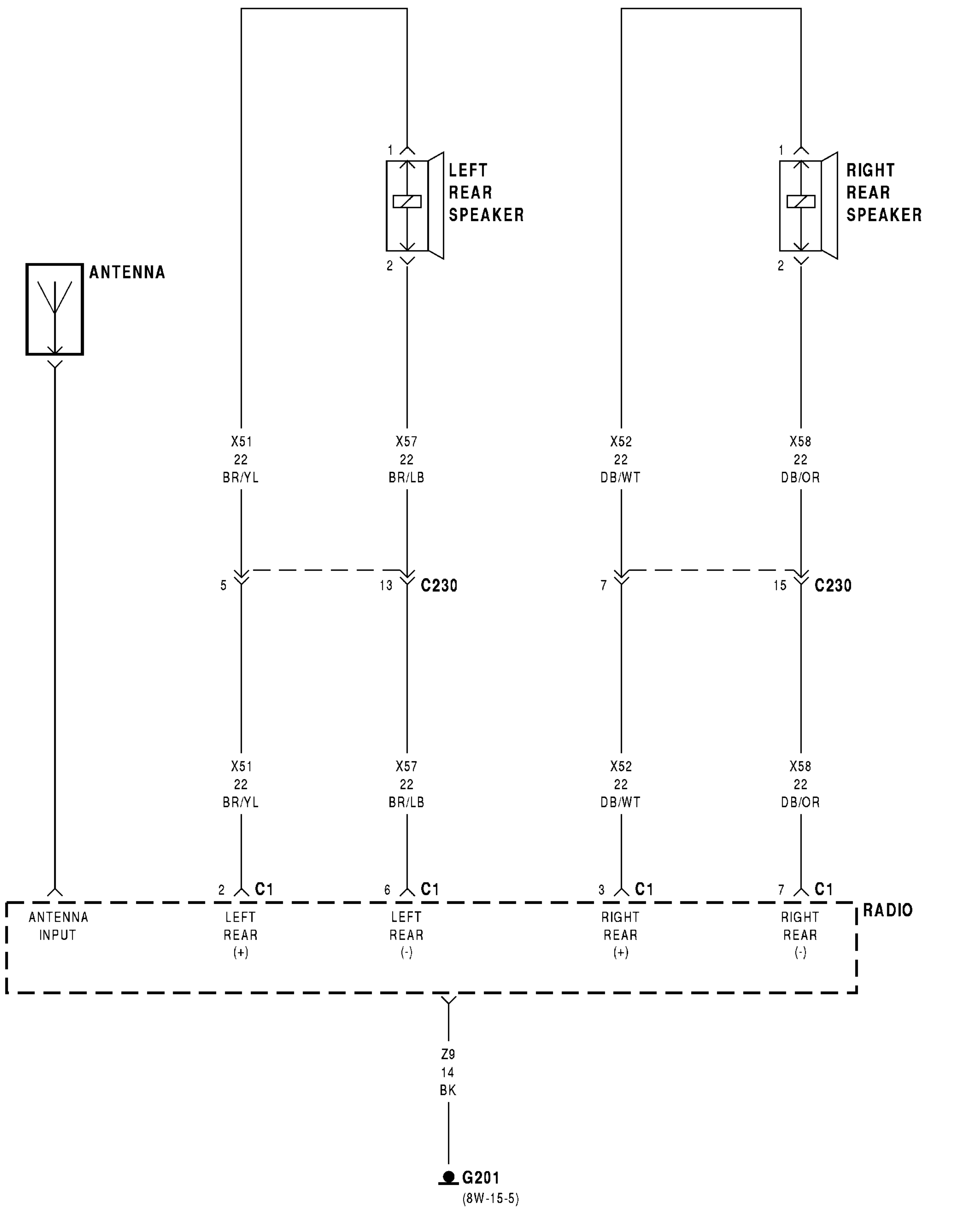
(8W-10-12)
BATT A3
(8W-10-6)
FUSE BLOCK
(8W-11-2)
14
FUSE 16 10A (8W-11-12)
36
1
FUSE 2 15A (8W-11-4)
22
F33 20 PK/RD
BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
14
FUSE 13 10A (8W-10-8)
13
4
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
0
1
2
9
1
X12 20 RD/WT
M1 18 PK
E1 20 TN
FUSE BLOCK
(8W-11-2)
12
FUSE 12 4A (8W-11-11)
32
13 C103
M1 22 PK
L7 20 BK/YL
E2 20 OR
S203
(8W-10-8)
S210
(8W-11-11)
M1 22 PK
E2 22 OR
7 C2
6 C2
4 C2
5 C2
RADIO
FUSED B (+)
FUSED IGN. (RUN-ACC)
PARK LAMP SWITCH OUTPUT
FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
GROUND
Z9 14 BK
G201
(8W-15-5)


LEFT INSTRUMENT PANEL SPEAKER (PREMIUM)
RIGHT INSTRUMENT PANEL SPEAKER (PREMIUM)
X53 22 DG
X55 22 BR/RD
X54 22 VT
X56 22 DB/RD
LEFT FRONT DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
C231
C205
C1
C2
RADIO
LEFT FRONT DOOR (+)
LEFT FRONT DOOR (-)
RIGHT FRONT DOOR (+)
RIGHT FRONT DOOR (-)
GROUND
Z9 14 BK
G201
(8W-15-5)


1
LEFT REAR SPEAKER
2
1
RIGHT REAR SPEAKER
2
ANTENNA
X51 22 BR/YL
X57 22 BR/LB
X52 22 DB/WT
X58 22 DB/OR
5
13
C230
7
15
C230
X51 22 BR/YL
X57 22 BR/LB
X52 22 DB/WT
X58 22 DB/OR
2 C1
6 C1
3 C1
7 C1
RADIO
ANTENNA INPUT
LEFT REAR (+)
LEFT REAR (-)
RIGHT REAR (+)
RIGHT REAR (-)
Z9 14 BK
G201
(8W-15-5)

8W-47 AUDIO SYSTEMS

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DESCRIPTION AND OPERATION

RADIO OPERATION

When the ignition switch is in either the ACCESSORY or RUN position, it connects circuit A1 from the Power Distribution Center (PDC) to circuit A31. Circuit A31 powers a bus bar in the fuse block. The bus bar feeds two circuits, one of which is circuit X12. Circuit X12 powers the radio. A 10 amp fuse, in cavity 16 of the fuse block, protects circuit X12.

Circuit Z9 supplies the ground path for the radio. The grounding point for circuit Z9 is the instrument panel right center support.

RADIO MEMORY

Circuit M1 from the Power Distribution Center (PDC) supplies power for the radio memory. The circuit contains the Ignition Off Draw (IOD) fuse. The IOD fuse is removed during vehicle shipping to prevent excessive battery draw.

RADIO ILLUMINATION

When the parking lamps or headlamps are ON, circuits E2 and L7 power the radio illumination lamps and park lamps. Circuit E2 feeds the illumination lamp. Circuit L7 feeds the park lamps of the radio. Circuit F33 feeds circuit L7.

A 4 amp fuse, in cavity 12 of the fuse block, protects circuit E2. A 15 amp fuse, in cavity 2 of the fuse block, protects circuits L7 and F33.

SPEAKERS

Circuit X53 feeds the speaker in the left front door. Circuit X55 is the return from the speaker to the radio. On the premium system the X53 and X55 circuits are connected in with the instrument panel speaker.

Circuit X54 feeds the speaker in the right front door. Circuit X56 is the return from the speaker to the radio. On the premium system the X54 and X56 circuits are connected in with the instrument panel speaker.

Circuit X51 feeds the left rear speaker. Circuit X57 is the return from the speaker to the radio.

Circuit X52 feeds the right rear speaker. Circuit X58 is the return from the speaker to the radio.

HELPFUL INFORMATION

- Circuit M1 also powers the vanity lamps, glove box lamp, time delay relay, dome lamps, underhood lamp, cargo lamp, and power mirrors.
- If the radio does not operate, check for blown fuses in circuits A1 and X12.
- Circuits A3, and F33 feed the L7 circuit.
- If the radio illumination lamps do not operate, check for blown fuses in circuits E2, F33, and A3.

8W-48 REAR WINDOW DEFOGGER

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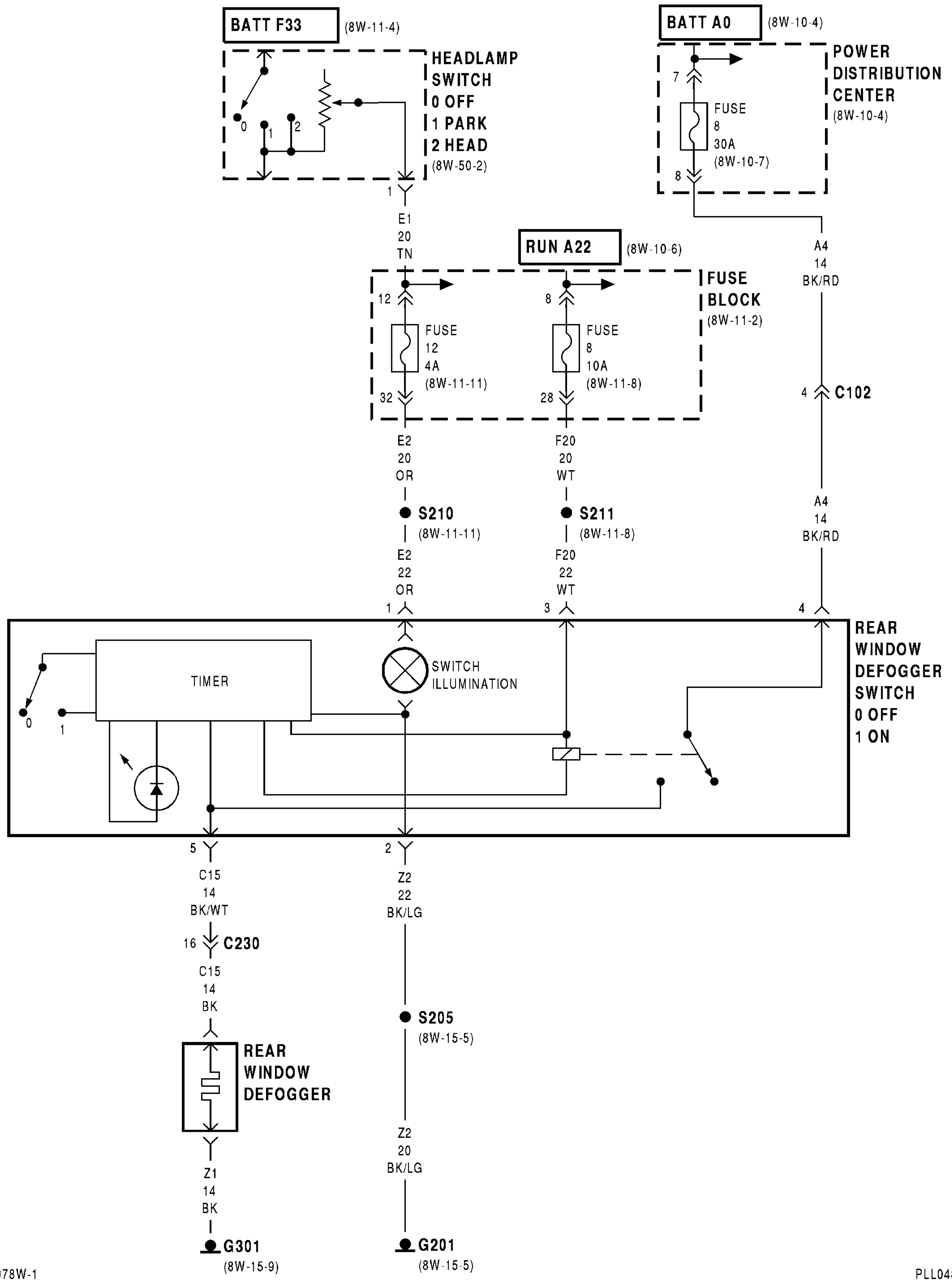
BATT F33
(8W-11-4)
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
(8W-50-2)
BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
FUSE
8
30A
(8W-10-7)
E1
20
TN
RUN A22
(8W-10-6)
A4
14
BK/RD
FUSE BLOCK
(8W-11-2)
FUSE
12
4A
(8W-11-11)
FUSE
8
10A
(8W-11-8)
C102
E2
20
OR
F20
20
WT
S210
(8W-11-11)
S211
(8W-11-8)
E2
22
OR
F20
22
WT
TIMER
SWITCH ILLUMINATION
REAR WINDOW DEFOGGER SWITCH
0 OFF
1 ON
C15
14
BK/WT
C230
C15
14
BK
Z2
22
BK/LG
S205
(8W-15-5)
REAR WINDOW DEFOGGER
Z1
14
BK
Z2
20
BK/LG
G301
(8W-15-9)
G201
(8W-15-5)

8W-48 REAR WINDOW DEFOGGER

DESCRIPTION AND OPERATION

REAR WINDOW DEFOGGER

The Rear Window Defogger system is powered by a 40 amp fuse located in the Power Distribution Center (PDC) on circuit A4. This circuit is HOT at all times. The system is also powered by a 10 amp fuse located in cavity 8 of the fuse block, this fuse is HOT in the RUN position only.

When the operator presses the rear window defogger switch the contacts internal to the switch CLOSE and the timer starts. When the switch is released the timer circuity keeps the relay energized for the specified time.

Voltage is passed through the switch on the A4 circuit to the C15 circuit and then to the rear window defogger grid. The grid consists of two bus bars and grid lines that form a parallel circuit. When voltage is passed through the grid, the grid lines heat up and heat the rear window.

Grounding for the rear window defogger switch is provided on the Z2 circuit and terminates at the instrument panel right center support. The grid uses the grounding point at the rear body in the right wheel house.

When the system is in operation, a L.E.D. located in the switch, indicates to the operator the system is functioning. The switch is also illuminated when the headlamp switch is in the PARK or ON position. Power for the illumination circuit comes from the 4 amp fuse, located in cavity 12 of the fuse block, on the E2 circuit.

HELPFUL INFORMATION

- Check the 40 amp fuse in the Power Distribution Center (PDC).
- Check the 10 amp fuse in cavity 8 of the fuse block.
- Check for broken gird lines on the window.
- Check for a broken buss bar or disconnected leads at the rear window.
- Check for a good ground at the rear body ground located in the right rear wheel house.

8W-50 FRONT LIGHTING

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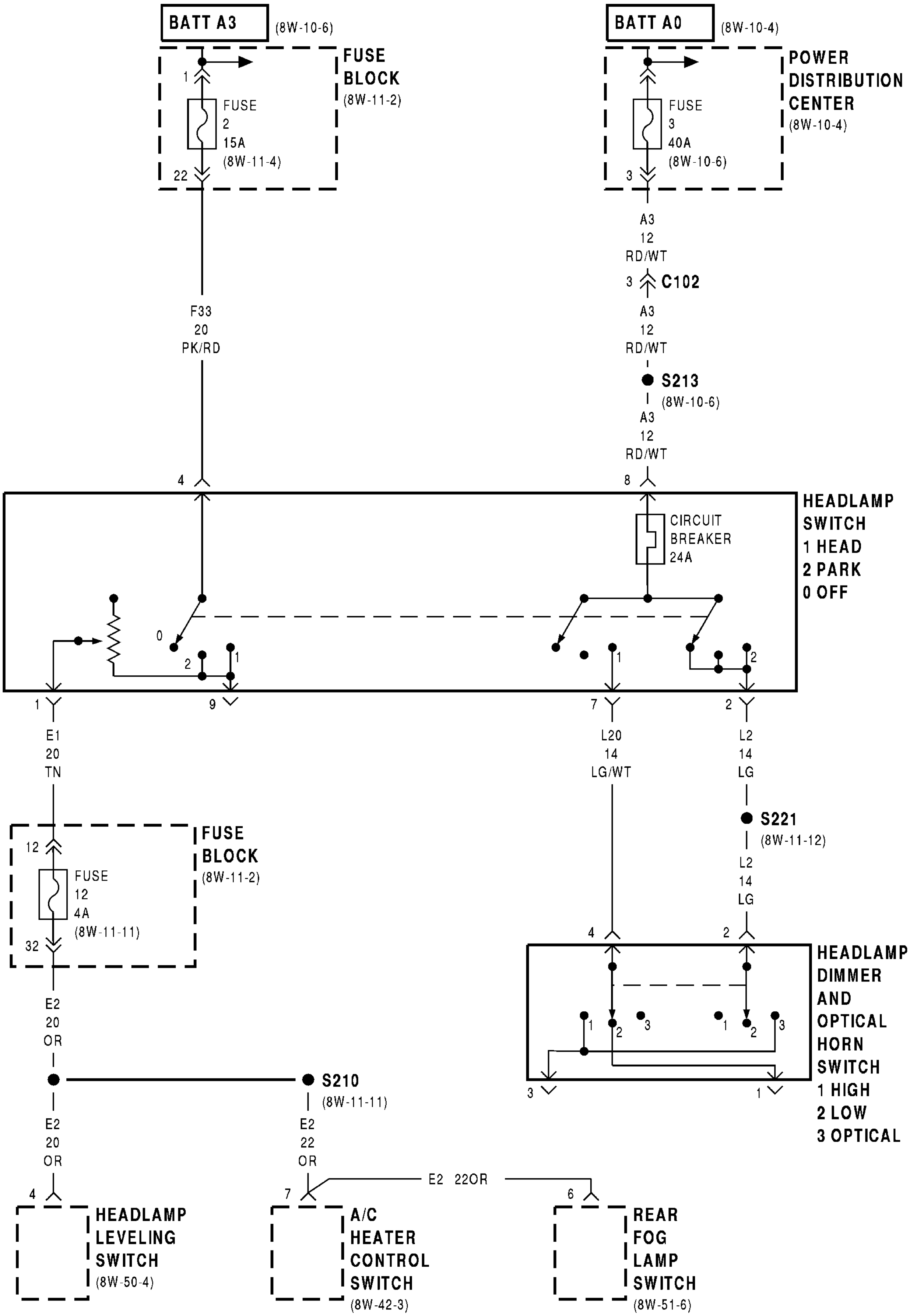
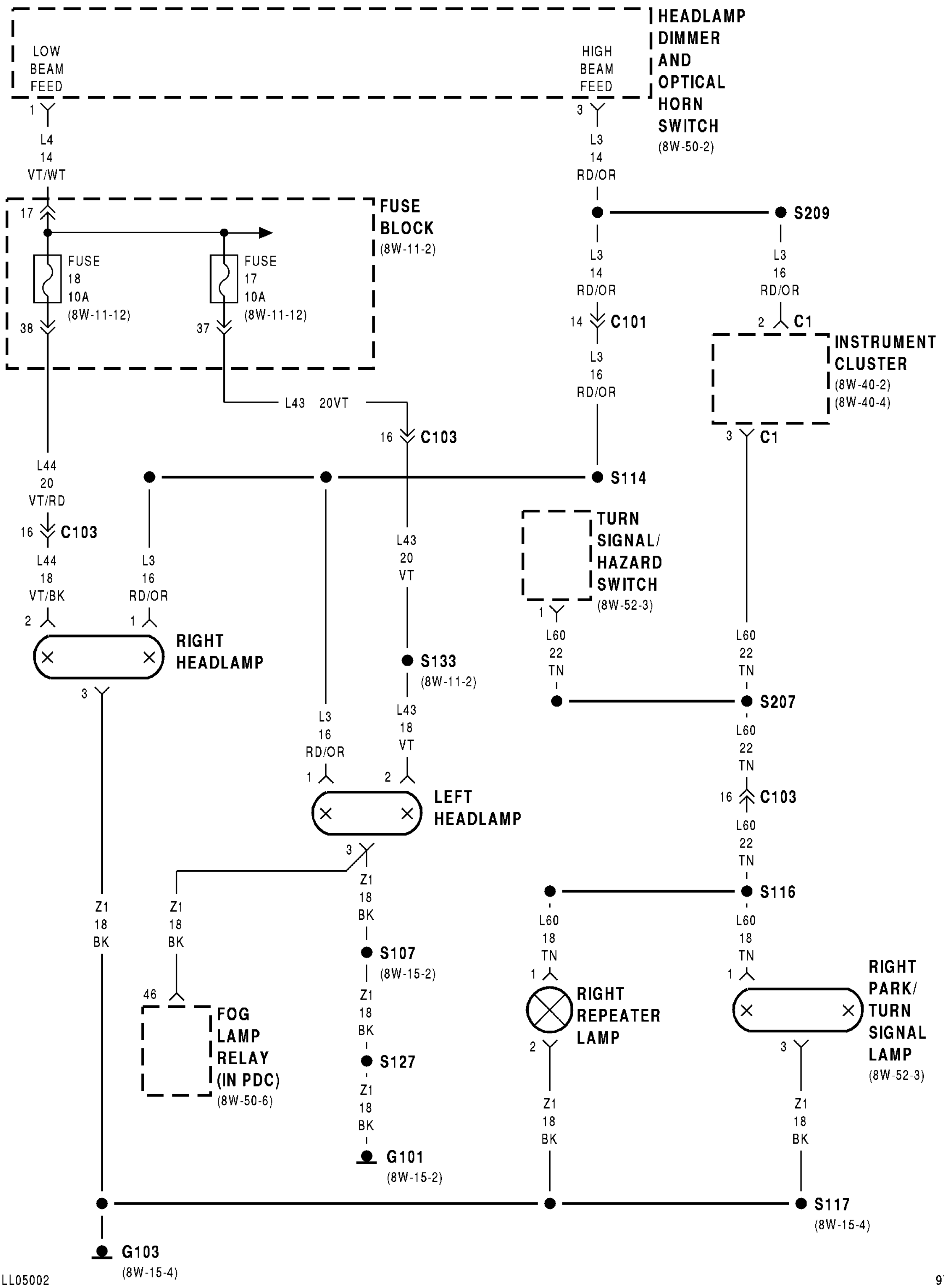
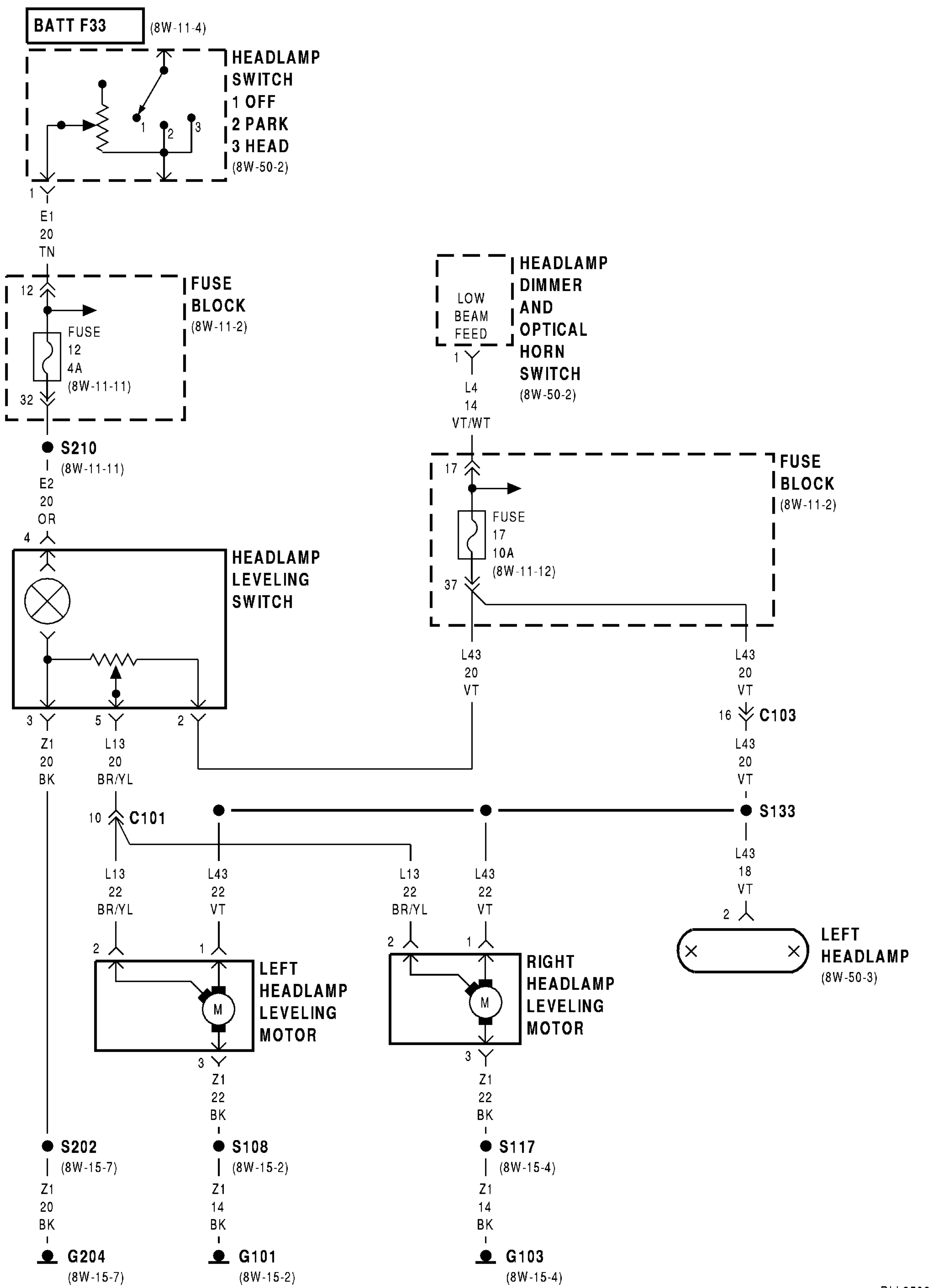
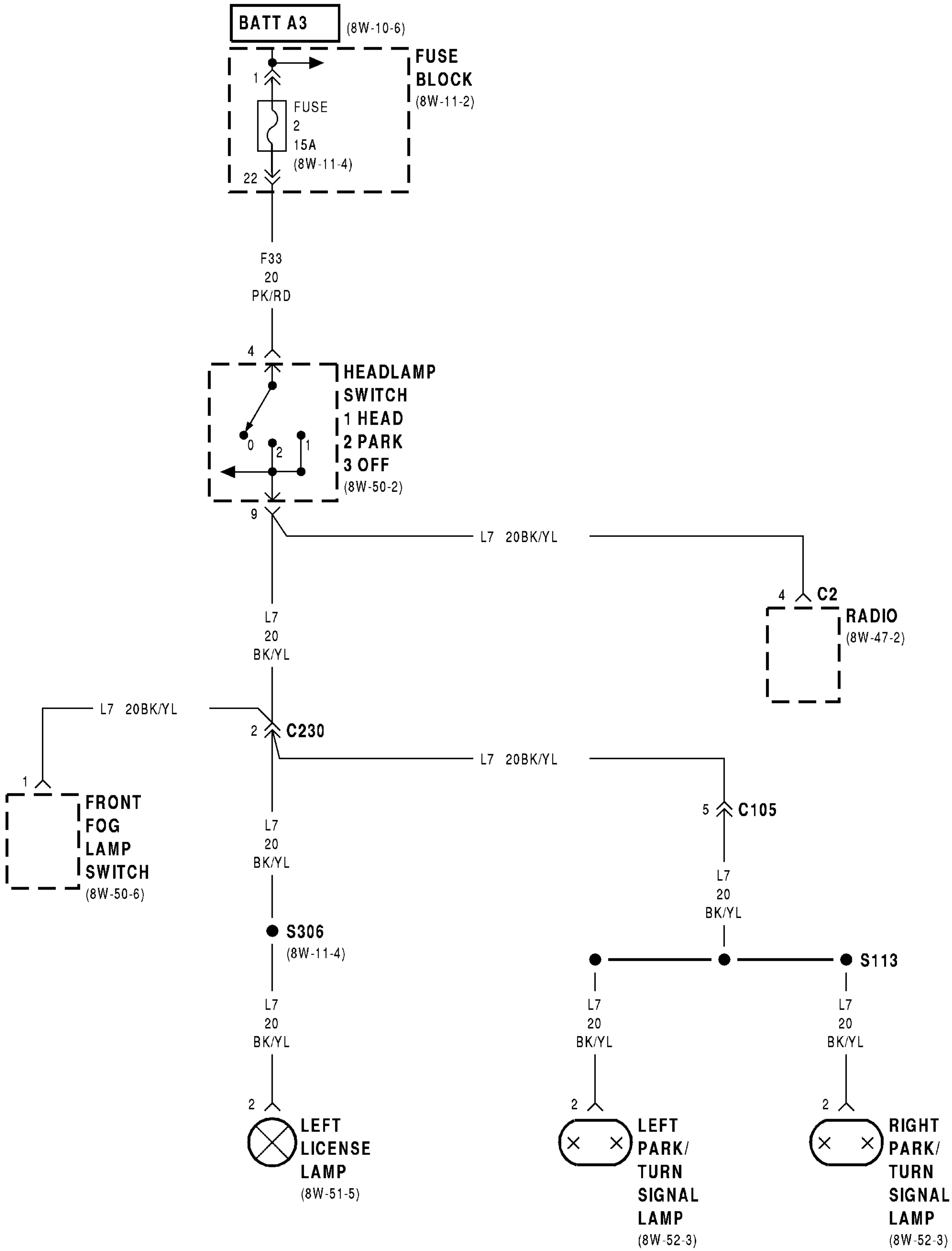
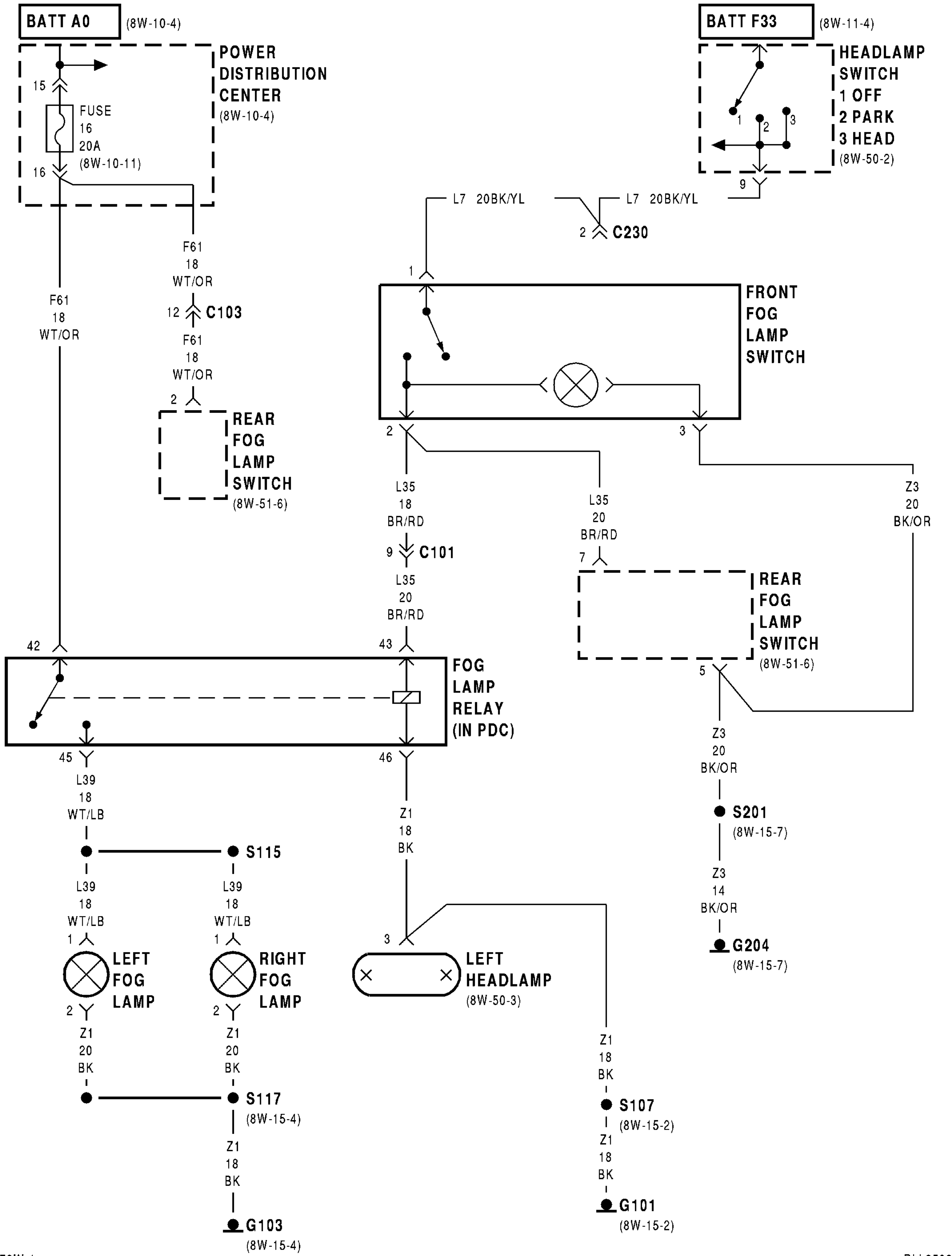

BATT A3
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
FUSE
2
15A
(8W-11-4)
BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
FUSE
3
40A
(8W-10-6)
A3
12
RD/WT
C102
F33
20
PK/RD
S213
(8W-10-6)
CIRCUIT
BREAKER
24A
HEADLAMP
SWITCH
1 HEAD
2 PARK
0 OFF
E1
20
TN
L20
14
LG/WT
L2
14
LG
S221
(8W-11-12)
FUSE
BLOCK
(8W-11-2)
FUSE
12
4A
(8W-11-11)
HEADLAMP
DIMMER
AND
OPTICAL
HORN
SWITCH
1 HIGH
2 LOW
3 OPTICAL
E2
20
OR
S210
(8W-11-11)
E2
22
OR
E2 22OR
HEADLAMP
LEVELING
SWITCH
(8W-50-4)
A/C
HEATER
CONTROL
SWITCH
(8W-42-3)
REAR
FOG
LAMP
SWITCH
(8W-51-6)


HEADLAMP DIMMER AND OPTICAL HORN SWITCH
(8W-50-2)
LOW BEAM FEED
HIGH BEAM FEED
L4 14 VT/WT
L3 14 RD/OR
FUSE BLOCK
(8W-11-2)
FUSE 18 10A (8W-11-12)
FUSE 17 10A (8W-11-12)
S209
L3 16 RD/OR
C101
C1
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-4)
L43 20VT
C103
L44 20 VT/RD
S114
TURN SIGNAL/ HAZARD SWITCH
(8W-52-3)
L44 18 VT/BK
L3 16 RD/OR
L43 20 VT
RIGHT HEADLAMP
S133
(8W-11-2)
L60 22 TN
S207
L43 18 VT
LEFT HEADLAMP
Z1 18 BK
S116
L60 18 TN
S107
(8W-15-2)
FOG LAMP RELAY (IN PDC)
(8W-50-6)
RIGHT REPEATER LAMP
RIGHT PARK/ TURN SIGNAL LAMP
(8W-52-3)
S127
G101
(8W-15-2)
S117
(8W-15-4)
G103
(8W-15-4)



978W-1 PLL05003


BATT A3
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
1
FUSE
2
15A
(8W-11-4)
22
F33
20
PK/RD
4
HEADLAMP
SWITCH
1 HEAD
2 PARK
3 OFF
(8W-50-2)
0
2
1
9
L7 20BK/YL
4
C2
RADIO
(8W-47-2)
L7
20
BK/YL
L7 20BK/YL
2
C230
L7 20BK/YL
1
FRONT
FOG
LAMP
SWITCH
(8W-50-6)
L7
20
BK/YL
5
C105
L7
20
BK/YL
S306
(8W-11-4)
S113
L7
20
BK/YL
L7
20
BK/YL
L7
20
BK/YL
2
LEFT
LICENSE
LAMP
(8W-51-5)
2
LEFT
PARK/
TURN
SIGNAL
LAMP
(8W-52-3)
2
RIGHT
PARK/
TURN
SIGNAL
LAMP
(8W-52-3)


BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
15
FUSE
16
20A
(8W-10-11)
16
BATT F33
(8W-11-4)
HEADLAMP
SWITCH
1 OFF
2 PARK
3 HEAD
(8W-50-2)
1
2
3
9
L7 20BK/YL
L7 20BK/YL
2
C230
F61
18
WT/OR
12
C103
F61
18
WT/OR
2
REAR
FOG
LAMP
SWITCH
(8W-51-6)
F61
18
WT/OR
1
FRONT
FOG
LAMP
SWITCH
2
3
L35
18
BR/RD
9
C101
L35
20
BR/RD
L35
20
BR/RD
7
REAR
FOG
LAMP
SWITCH
(8W-51-6)
Z3
20
BK/OR
5
42
43
FOG
LAMP
RELAY
(IN PDC)
45
46
L39
18
WT/LB
Z1
18
BK
Z3
20
BK/OR
S201
(8W-15-7)
S115
L39
18
WT/LB
L39
18
WT/LB
Z3
14
BK/OR
1
1
3
LEFT
FOG
LAMP
RIGHT
FOG
LAMP
LEFT
HEADLAMP
(8W-50-3)
G204
(8W-15-7)
2
2
Z1
20
BK
Z1
20
BK
Z1
18
BK
S117
(8W-15-4)
S107
(8W-15-2)
Z1
18
BK
Z1
18
BK
G103
(8W-15-4)
G101
(8W-15-2)

8W-50 FRONT LIGHTING

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GENERAL INFORMATION

INTRODUCTION

The headlamp switch has 3 positions, ON, PARK (parking lights) and OFF. Two circuits, L2 and L20 connect the headlamp switch to the headlamp dimmer/optical horn switch located in the multi-function switch. The multi-function switch feeds the low and high beams of the headlamps.

DESCRIPTION AND OPERATION

PARKING LAMPS

Circuit A3 in the Power Distribution Center (PDC) connects to a bus bar in the fuse block. One of the four circuits powered by the bus bar is circuit F33. Circuit F33 connects to the headlamp switch. A 40 amp fuse in the PDC protects the A3 circuit. A 15 amp fuse, in cavity 2 of the fuse block, protects the F33 circuit.

The headlamp switch has 3 positions, ON, PARK (tail lamps) and OFF, plus a dimmer switch. When the headlamp switch is in the PARK or ON position, the switch connects circuit F33 to circuit L7. From the headlamp switch, circuit L7 branches to power the front parking lamps and rear tail lamps, lavalier lamps, side marker lamps, and rear license plate lamp.

GROUND CIRCUIT

Circuit Z1 provides ground for the parking lamps, headlamps, lavalier lamps, tail lamps, side marker lamps and rear license plate lamp although different grounding points are used. Circuit Z1 also provides the ground path for the headlamps and turn signals.

HELPFUL INFORMATION

- Check for a blown 40 amp fuse in the PDC.
- Check for a blown fuse in cavity 2 of the fuse block.
- For the left front parking lamp, turn signal, side marker lamp and left headlamp, the Z1 circuit grounding point is the left side of the radiator closure panel.
- For the right front parking lamp, turn signal, side marker lamp and right headlamp, the Z1 circuit grounding point is in the right fender side shield.
- Circuit L7 also feeds the radio, if equipped.
- When the headlamp switch is in the PARK or ON position, the dimmer circuit, F33, also connects to circuit E1. Circuit E1 powers the ash receiver lamp, transmission range indicator lamp, instrument panel cluster illumination lamps, HVAC control lamp, heated rear window lamp, and radio lamp. A 4 amp fuse, in cavity 12 of the fuse block, protects circuit E1.

HEADLAMPS

The headlamp switch has 3 positions, ON, PARK (parking lights) and OFF. Two circuits, L2 and L20 connect the headlamp switch to the headlamp dimmer/optical horn switch located in the multi-function switch. The multi-function switch feeds the low and high beams of the headlamps.

HEADLAMP SWITCH IN OFF OR PARKING LAMP POSITION

Circuit A3 originates in the Power Distribution Center (PDC) and supplies battery voltage for the headlamp switch. A 40 amp fuse protects the A3 circuit. The headlamp switch has an internal 24 amp circuit breaker that connects circuit A3 to either the L2 or L20 circuits, depending on switch position.

In the OFF and PARK positions the headlamp switch feeds the L20 circuit that connects to the multi-function switch. Circuit L20 powers the high beam circuit when the operator flashes the headlamps with the turn signal stalk of the multi-function switch. When the operator flashes the headlamps with the stalk, the multi-function switch connects the L20 circuit to the L3 circuit. The L3 circuit feeds the high beam of the headlamps.

HEADLAMP SWITCH IN ON POSITION

When the headlamp switch is in the ON position, it connects the A3 circuit from the PDC to circuit L2.

DESCRIPTION AND OPERATION (Continued)

Circuit L2 connects to the multi- function switch and feeds the L4 circuit (for low beam operation). The L4 circuit connects to a bus bar in the fuse block. Circuits L43 and L44 connect to the bus bar in fuse block and power the low beam headlamps. Circuit L43 supplies voltage to the left headlamp. Circuit L44 supplies voltage to the right headlamp. Both the L43 and L44 circuits have separate 10 amp fuses located in fuse block. Fuse 17 protects circuit L43, and fuse 18 protects circuit L44.

When the operator selects high beam operation with the turn signal stalk of the multi-function switch, circuit L2 connects to the L3 Circuit L3 powers high beam operation.

HEADLAMP GROUND

Although circuit Z1 provides ground for the right and left headlamps it has different termination points for both. For the right headlamp the Z1 circuit terminates at the right inner fender shield. For the left headlamp the Z1 circuit terminates at the left side of the radiator closure panel.

HELPFUL INFORMATION

- Check for a blown fuse in cavity 17 for L43 and cavity 18 for L44.
- Check the 40 amp fuse located in the PDC.
- The headlamp switch has a 24 amp internal circuit breaker.
- For the left front parking lamp, turn signal, side marker lamp and left headlamp, the Z1 circuit grounding point is the left side of the radiator closure panel.
- For the right front parking lamp, turn signal, side marker lamp and right headlamp, the Z1 circuit grounding point is in the right fender side shield.

HEADLAMP LEVELING MOTORS

The headlamp leveling system used in this vehicle uses a variable position switch located in the instrument panel along with headlamp leveling motors located at the headlamps.

Power for the switch and the leveling motors is supplied on circuit L43. This circuit is HOT when the headlamp switch is in the ON position and the operator has selected LOW beam operation. In addition, circuit L43 is protected by a 10 amp fuse located in the fuse block and is the feed for the left LOW beam headlamp.

Ground for the switch is supplied on circuit Z1. When the operator moves the switch, power is supplied on circuit L13 from the switch to the headlamp leveling motors. Ground for the leveling motors is supplied on circuit Z1 and has the same termination point as the respective headlamps.

The headlamp leveling switch also has a lamp located in it for night illumination. Power for the lamp is supplied on circuit E2. The E2 circuit is HOT when the operator has turned the headlamp switch to the PARK or ON position. The E2 circuit is protected by a 4 amp fuse located in the fuse block.

FOG LAMPS (FRONT)

The fog lamp system in this vehicle uses a switch located in the instrument panel along with a relay located in the Power Distribution Center (PDC).

Power for the switch is supplied on circuit L7. This circuit is the feed for the front and rear parking lamps and is HOT when the headlamp switch is in the PARK position.

Power for the contact side of the relay is supplied on circuit F61. This circuit is HOT at all times and protected by a 20 amp fuse in the PDC. Ground for the coil side of the relay is supplied in circuit Z1.

When the operator turns the lamps ON by closing the switch, power flows on circuit L7 through the switch to circuit L35. Circuit L35 connects from the switch to the coil side of the fog lamp relay. With this input the contacts in the fog lamp relay CLOSE connecting circuits F61 and L39.

Circuit L39 connects from the relay to the fog lamps. Ground for the lamps is supplied on circuit Z1.

HELPFUL INFORMATION

- Check the 20 amp fuse located in the PDC for the fog lamps
- Check the lamp filament
- Check the grounding points for the lamps, switch and relay

8W-51 REAR LIGHTING

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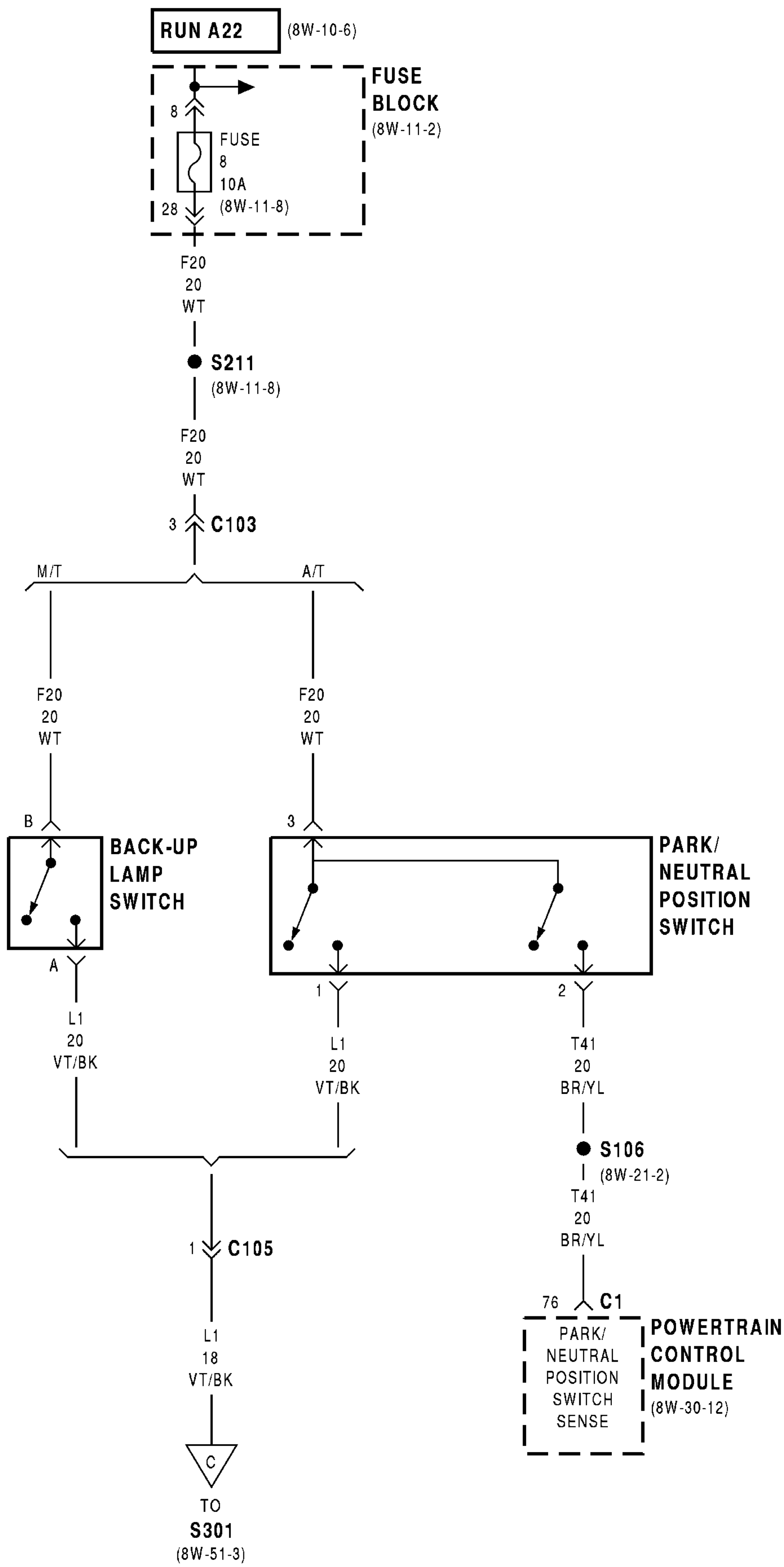
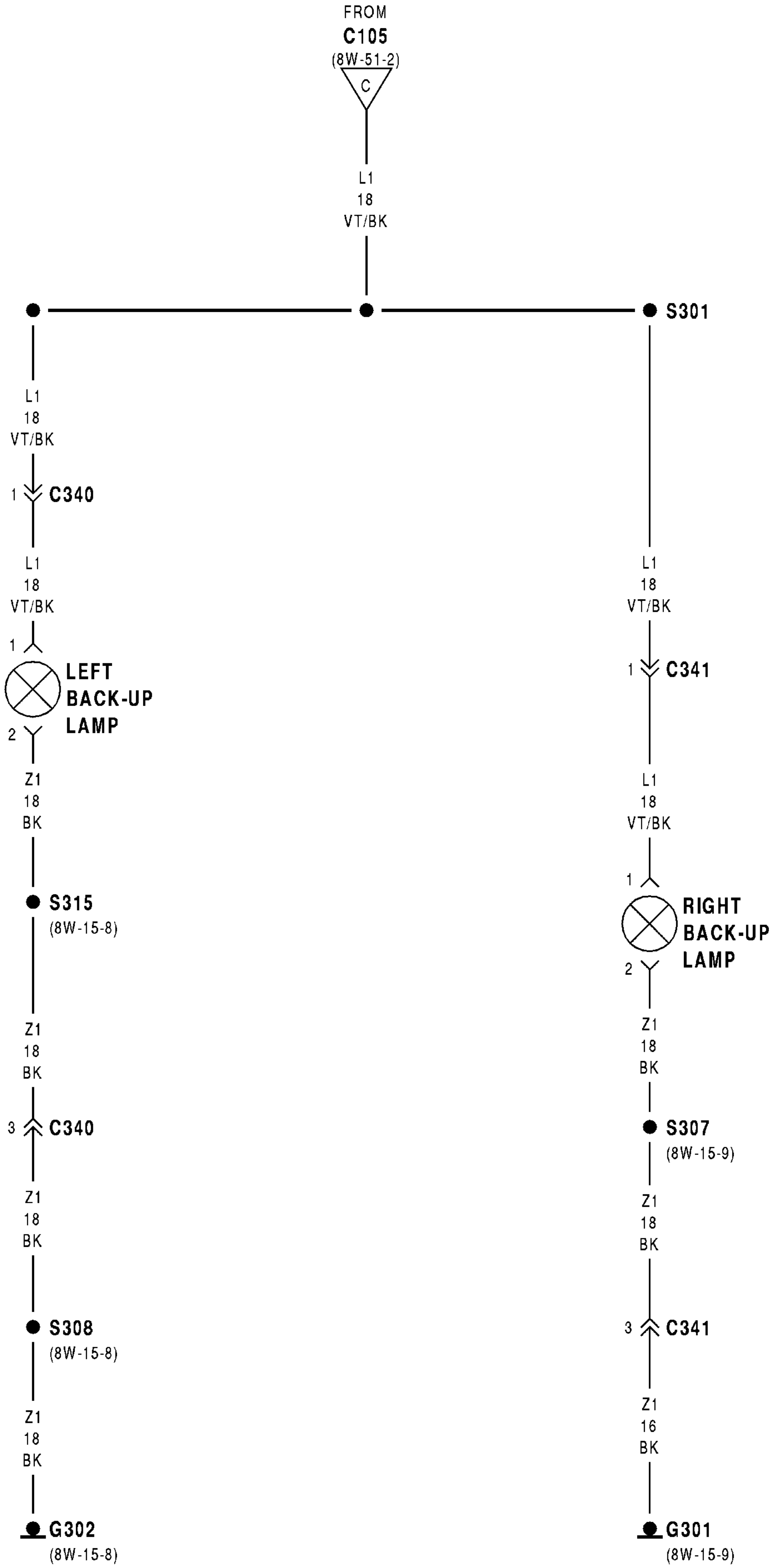
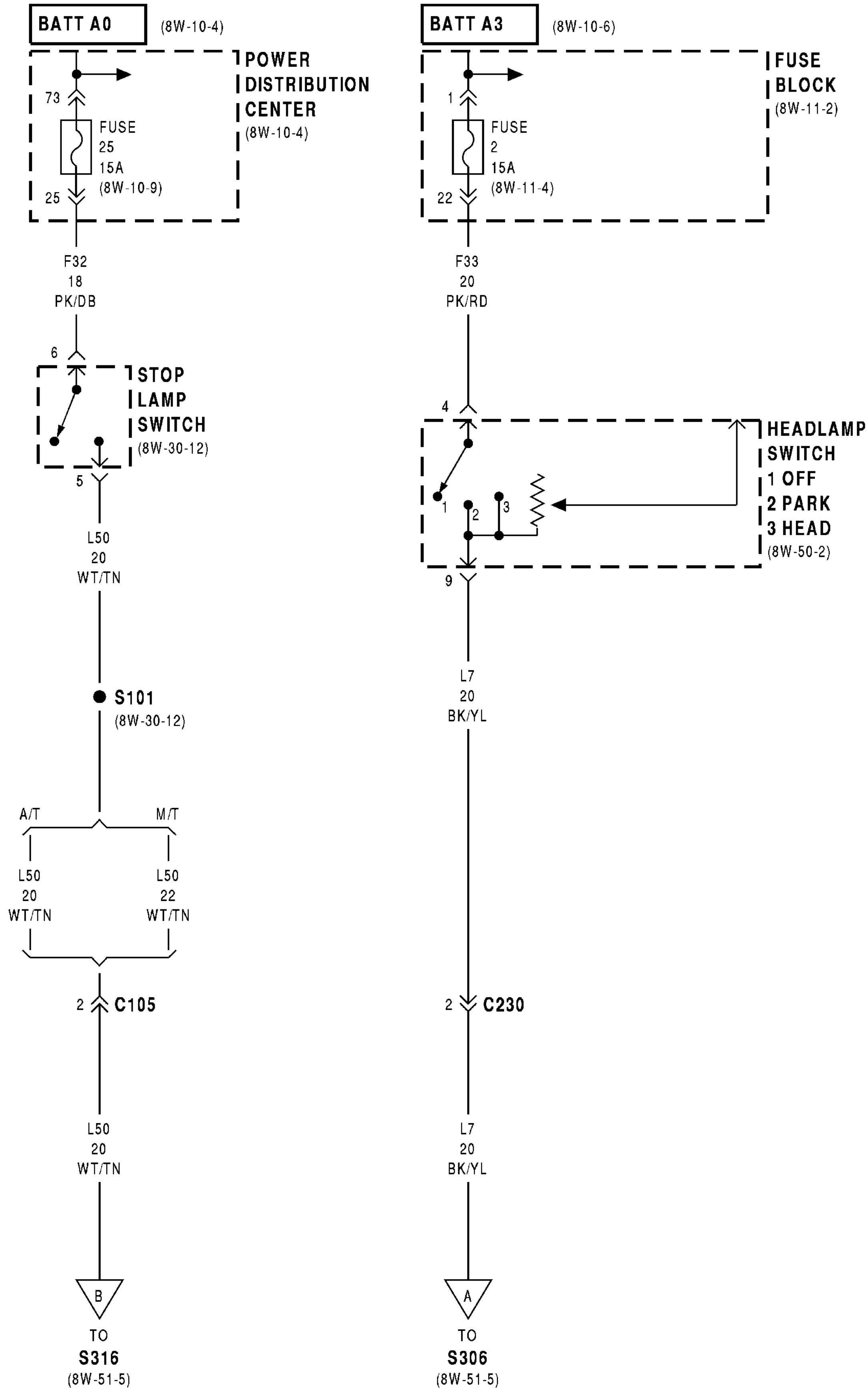
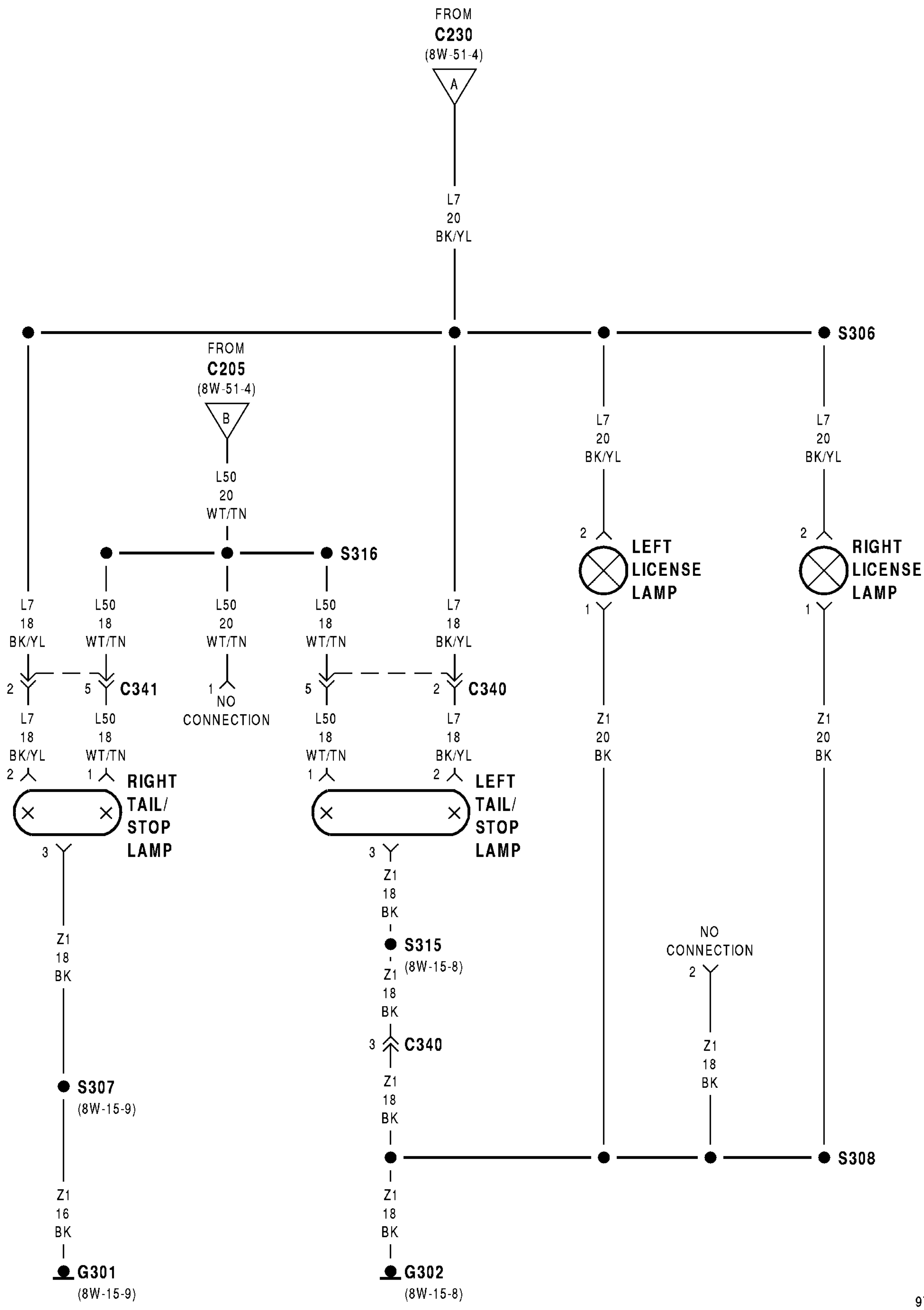
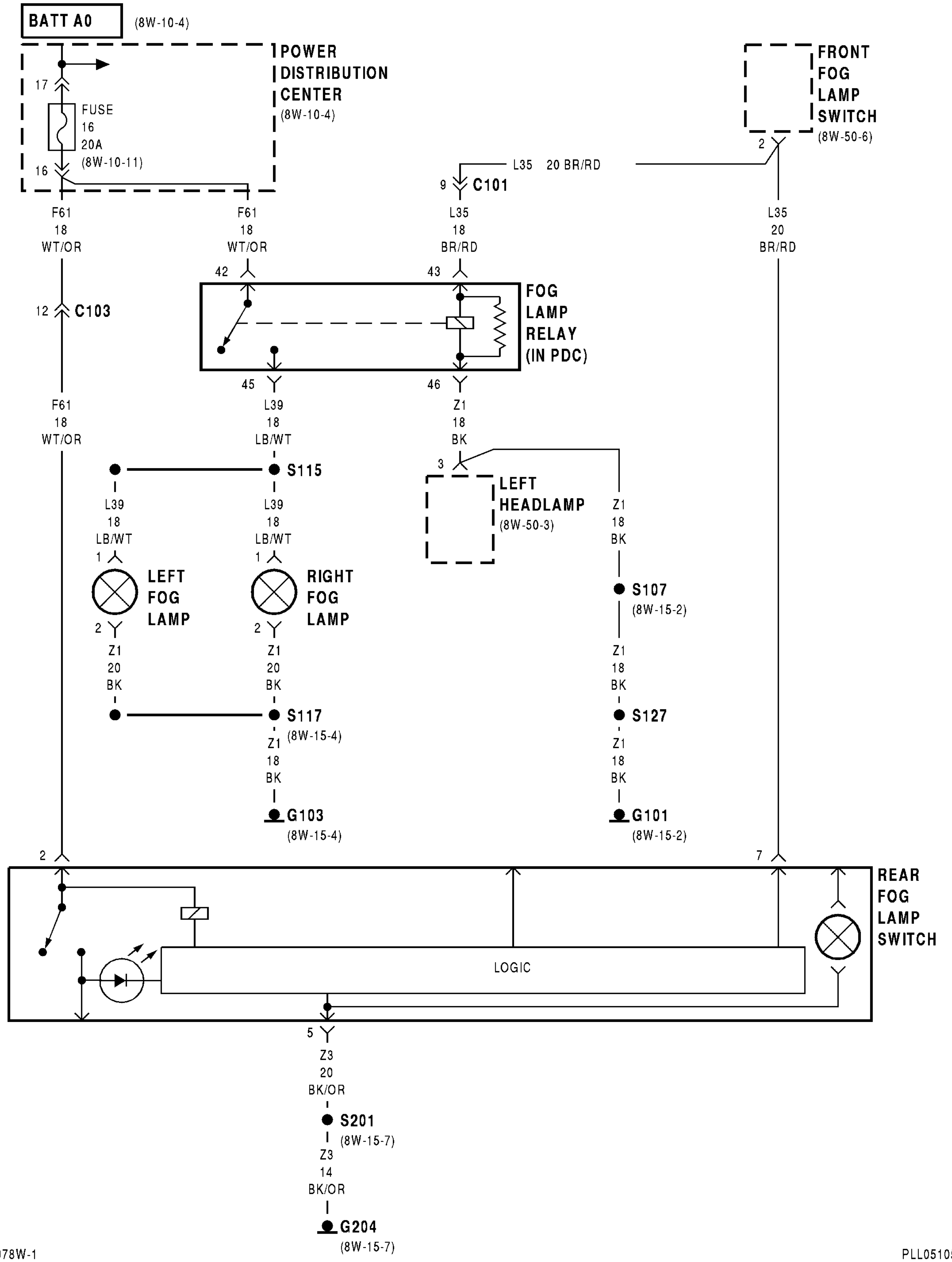

RUN A22
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
8
FUSE
8
10A
(8W-11-8)
28
F20
20
WT
S211
(8W-11-8)
F20
20
WT
3
C103
M/T
A/T
F20
20
WT
F20
20
WT
B
BACK-UP
LAMP
SWITCH
A
3
PARK/
NEUTRAL
POSITION
SWITCH
1
2
L1
20
VT/BK
L1
20
VT/BK
T41
20
BR/YL
S106
(8W-21-2)
T41
20
BR/YL
1
C105
76
C1
PARK/
NEUTRAL
POSITION
SWITCH
SENSE
POWERTRAIN
CONTROL
MODULE
(8W-30-12)
L1
18
VT/BK
C
TO
S301
(8W-51-3)

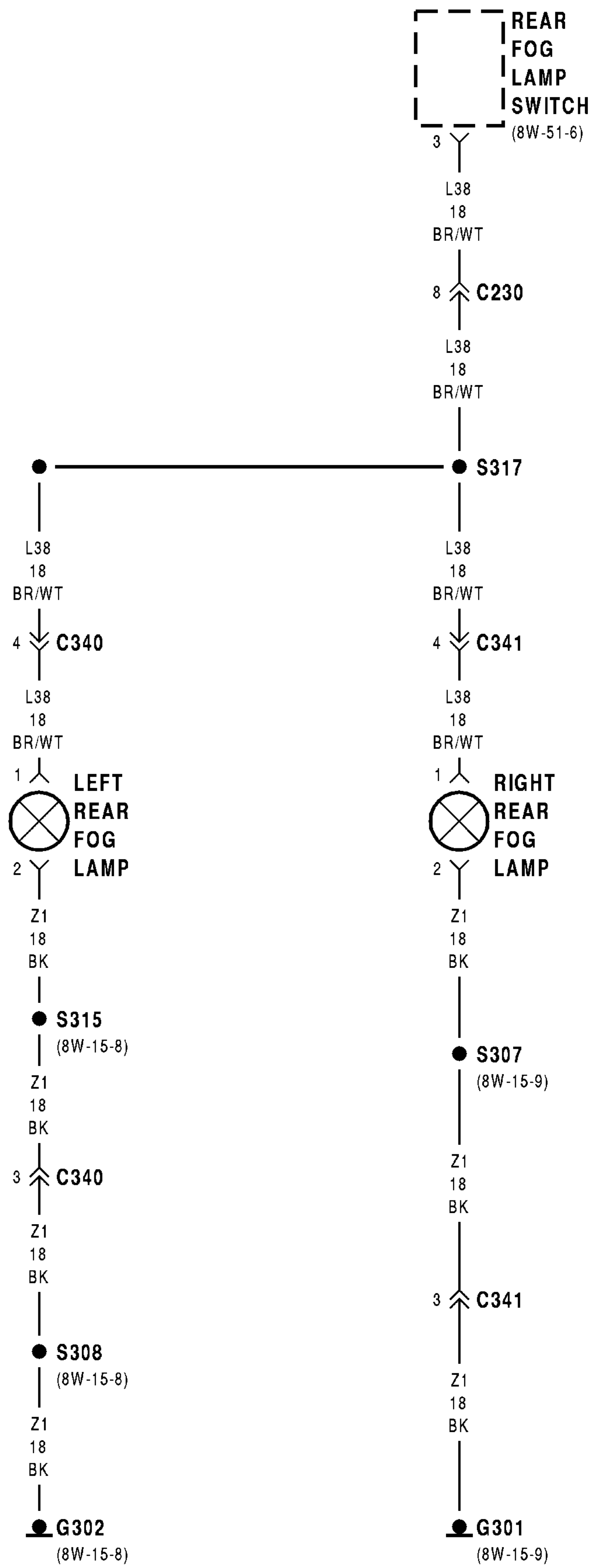

FROM
C105
(8W-51-2)
C
L1
18
VT/BK
S301
L1
18
VT/BK
1
C340
L1
18
VT/BK
1
LEFT
BACK-UP
LAMP
2
Z1
18
BK
S315
(8W-15-8)
Z1
18
BK
3
C340
Z1
18
BK
S308
(8W-15-8)
Z1
18
BK
G302
(8W-15-8)
L1
18
VT/BK
1
C341
L1
18
VT/BK
1
RIGHT
BACK-UP
LAMP
2
Z1
18
BK
S307
(8W-15-9)
Z1
18
BK
3
C341
Z1
16
BK
G301
(8W-15-9)

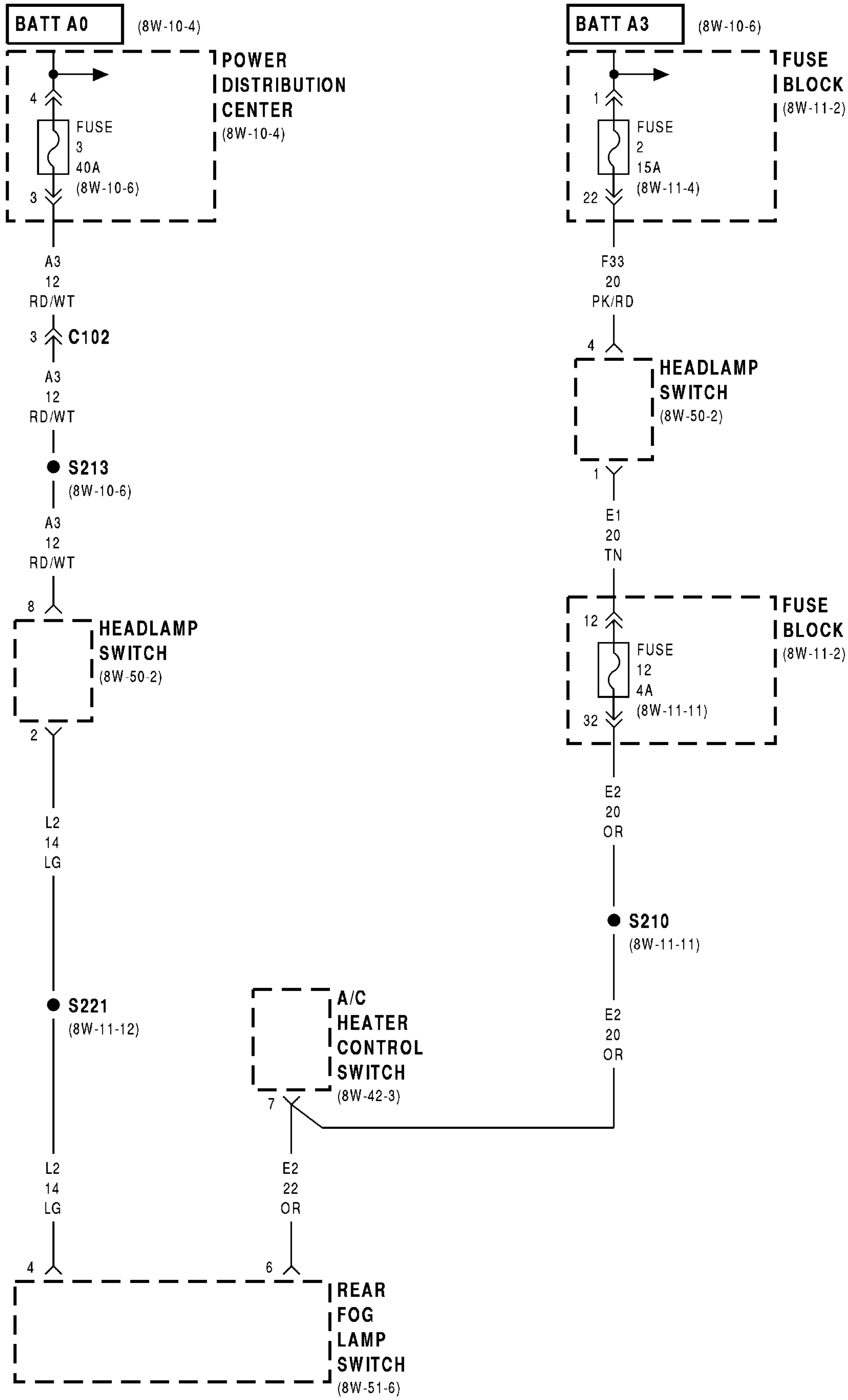

BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
73
FUSE
25
15A
(8W-10-9)
25
F32
18
PK/DB
6
STOP
LAMP
SWITCH
(8W-30-12)
5
L50
20
WT/TN
S101
(8W-30-12)
A/T
M/T
L50
20
WT/TN
L50
22
WT/TN
2
C105
L50
20
WT/TN
B
TO
S316
(8W-51-5)
BATT A3
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
1
FUSE
2
15A
(8W-11-4)
22
F33
20
PK/RD
4
HEADLAMP
SWITCH
1 OFF
2 PARK
3 HEAD
(8W-50-2)
1
2
3
9
L7
20
BK/YL
2
C230
L7
20
BK/YL
A
TO
S306
(8W-51-5)


FROM
C230
(8W-51-4)
A
L7
20
BK/YL
S306
FROM
C205
(8W-51-4)
B
L50
20
WT/TN
S316
L7
18
BK/YL
L50
18
WT/TN
L50
20
WT/TN
L50
18
WT/TN
L7
18
BK/YL
C341
1
NO
CONNECTION
C340
RIGHT
TAIL/
STOP
LAMP
LEFT
TAIL/
STOP
LAMP
LEFT
LICENSE
LAMP
RIGHT
LICENSE
LAMP
Z1
20
BK
Z1
18
BK
S315
(8W-15-8)
C340
S307
(8W-15-9)
NO
CONNECTION
S308
Z1
16
BK
G301
(8W-15-9)
G302
(8W-15-8)



BATT A0
(8W-10-4)
POWER DISTRIBUTION CENTER
(8W-10-4)
17
FUSE
16
20A
(8W-10-11)
16
FRONT FOG LAMP SWITCH
(8W-50-6)
2
L35 20 BR/RD
9
C101
F61
18
WT/OR
F61
18
WT/OR
L35
18
BR/RD
L35
20
BR/RD
42
43
12
C103
FOG LAMP RELAY (IN PDC)
45
46
F61
18
WT/OR
L39
18
LB/WT
Z1
18
BK
S115
3
LEFT HEADLAMP
(8W-50-3)
L39
18
LB/WT
L39
18
LB/WT
Z1
18
BK
1
1
LEFT FOG LAMP
RIGHT FOG LAMP
S107
(8W-15-2)
2
2
Z1
20
BK
Z1
20
BK
Z1
18
BK
S117
(8W-15-4)
S127
Z1
18
BK
Z1
18
BK
G103
(8W-15-4)
G101
(8W-15-2)
2
7
REAR FOG LAMP SWITCH
LOGIC
5
Z3
20
BK/OR
S201
(8W-15-7)
Z3
14
BK/OR
G204
(8W-15-7)


REAR
FOG
LAMP
SWITCH
(8W-51-6)
3
L38
18
BR/WT
8
C230
L38
18
BR/WT
S317
L38
18
BR/WT
4
C340
L38
18
BR/WT
1
LEFT
REAR
FOG
LAMP
2
Z1
18
BK
S315
(8W-15-8)
Z1
18
BK
3
C340
Z1
18
BK
S308
(8W-15-8)
Z1
18
BK
G302
(8W-15-8)
L38
18
BR/WT
4
C341
L38
18
BR/WT
1
RIGHT
REAR
FOG
LAMP
2
Z1
18
BK
S307
(8W-15-9)
Z1
18
BK
3
C341
Z1
18
BK
G301
(8W-15-9)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POWER DISTRIBUTION CENTER
(8W-10-4)
4
FUSE
3
40A
(8W-10-6)
3
A3
12
RD/WT
3
C102
A3
12
RD/WT
S213
(8W-10-6)
A3
12
RD/WT
8
HEADLAMP SWITCH
(8W-50-2)
2
L2
14
LG
S221
(8W-11-12)
L2
14
LG
4
BATT A3
(8W-10-6)
FUSE BLOCK
(8W-11-2)
1
FUSE
2
15A
(8W-11-4)
22
F33
20
PK/RD
4
HEADLAMP SWITCH
(8W-50-2)
1
E1
20
TN
12
FUSE BLOCK
(8W-11-2)
FUSE
12
4A
(8W-11-11)
32
E2
20
OR
S210
(8W-11-11)
E2
20
OR
A/C HEATER CONTROL SWITCH
(8W-42-3)
7
E2
22
OR
6
REAR FOG LAMP SWITCH
(8W-51-6)

8W-51 REAR LIGHTING

INDEX

DESCRIPTION AND OPERATION

TAIL LAMPS AND LICENSE LAMPS

Circuit A3 in the Power Distribution Center (PDC) connects to a bus bar in the fuse block. One of the four circuits powered by the bus bar is circuit F33. A 40 amp fuse in the PDC protects the A3 circuit. A 15 amp fuse, in cavity number 2 of the fuse block, protects the F33 circuit.

The headlamp switch has 3 positions, ON, PARK (tail lamps) and OFF, plus a dimmer switch. When the headlamp switch is in the PARK or ON position, it connects circuit F33 to circuit L7. From the headlamp switch, circuit L7 branches to power the front parking lamps, rear tail lamps, side marker lamps, and rear license plate lamp.

GROUND CIRCUIT

Circuit Z1 provides ground for the tail lamps, parking lamps, headlamps, side marker lamps, lamps and rear license plate lamps although different grounding points are used. Circuit Z1 also provides the ground path for the headlamps, stop lamps and turn signals.

HELPFUL INFORMATION

- Check for a blown 40 amp fuse in the PDC.
- Check for a blown fuse in cavity 2 of the fuse block
- For the left rear parking lamp, turn signal, side marker lamp, and the rear license plate the Z1 circuit grounding point is in the left rear wheel well.
- For the right rear parking lamp, turn signal and side marker lamp, the Z1 circuit grounding point is in the right rear wheel well.
- Circuit L7 also feeds the radio, if equipped.
- When the headlamp switch is in the PARK or ON position, the dimmer circuit, F33, connects to circuit E1. Circuit E1 powers the ash receiver lamp, transmission range indicator lamp, instrument panel cluster illumination lamps, HVAC control lamp, heated rear window lamp, and radio lamp. A 4 amp fuse, in cavity 12 of the fuse block, protects circuit E1.

FOG LAMPS (REAR)

The rear fog lamps will operate only when the headlamp switch is in the ON position.

Circuit A3 from the Power Distribution Center supplies (PDC) voltage to a bus bar in the fuse block. Circuit F61 is one of four circuits that the bus bar feeds and is protected by a 20 amp fuse in cavity 4. Circuit F61 connects to the rear fog lamp switch and the front fog lamp relay.

The fog lamp switch contains a relay that supplies voltage to the fog lamps. Circuit L2 from the multifunction switch supplies voltage to the coil side of the relay (only when the headlamps operate on LOW beam). Circuit F61 supplies voltage to the contact side of the relay. During LOW beam headlamp operation when the fog lamp switch contacts CLOSE, circuit F61 connects to circuit L38.

Circuit L38 feeds right and left fog lamp. Circuit L38 also feeds the green L.E.D. in the switch that illuminates during fog lamps operation.

When the headlamp switch is in the PARK or ON position, circuit E1 from the headlamp switch supplies voltage for circuit E2. Circuit E2 contains a 4 amp fuse in cavity 12 of the fuse block, and powers the bulb in the fog lamp switch.

GROUND CIRCUIT

Although circuit Z1 provides the ground path for the fog lamps, the circuit has different grounding points for each lamp.

Circuit Z3 supplies the ground path for the fog lamp switch. The grounding point for the headlamp switch is the instrument panel left center support.

HELPFUL INFORMATION

- Circuit Z1 also supplies ground for side marker lamps, turn signals, parking lamps and headlamps.
- Circuit A3 from the PDC supplies voltage to the headlamp switch for circuit L2.
- Circuit F33 from the fuse block supplies voltage to the headlamp switch for circuit E1. Circuit A3 from the PDC supplies voltage to a bus bar in the fuse block that feeds the F33 circuit. Fuse 2, in the fuse block, protects the F33 circuit.

DESCRIPTION AND OPERATION (Continued)

STOP LAMPS

Circuit F32 in the Power Distribution Center (PDC) feeds the stop lamps. Circuit F32 connects to the stop lamp switch. A 15 amp fuse in the PDC protects circuit F32.

When the operator presses the brake pedal, the stop lamp switch CLOSES and connects circuit F32 to circuit L50. Circuit L50 connects to the stop lamps. Circuit L50 also splices to power the CHMSL lamp.

GROUND CIRCUIT

Circuit Z1 provides ground for the stop lamps, CHMSL lamp, and the stop lamp switch. The Z1 circuit has more than one grounding point. It also supplies ground path for the tail lamps, parking lamps, headlamps, side marker lamps, rear license plate lamp, back-up lamps and turn signals.

HELPFUL INFORMATION

- Check for blown fuses in circuit F32 (in PDC).
- Check for continuity across the stop lamp switch when it is CLOSED.
- For rear lighting on the left side of the vehicle, the Z1 circuit grounding point is in the left rear wheel well.
- For rear lighting on the right side of the vehicle, the Z1 circuit grounding point is in the right rear wheel well.
- For the stop lamp switch, the Z1 circuit grounding point is in the left front inner fender shield.

BACK-UP LAMPS

In the RUN position, the ignition switch connects circuit A2 from the Power Distribution Center (PDC) to circuit A22. Circuit A22 feeds a bus bar in the fuse block. A 40 amp fuse in the PDC protects the A2 and A22 circuits.

Circuit F20 is one of four circuits that connects to the fuse block bus bar fed by circuit A22. Circuit F20 supplies power to the back-up lamp switch. On 3–spd automatic transaxle vehicles, the back-up lamp switch is part of an assembly that includes the park/neutral position switch.

When the operator puts the transmission in REVERSE, the back-up lamp switch connects circuit F20 to circuit L1. Circuit L1 feeds the back-up lamps. A 10 amp fuse, in cavity 8 of the fuse block, protects F20 and L1 circuits.

GROUND CIRCUIT

Circuit Z1 provides ground for the back-up lamps. The Z1 circuit has more than one grounding point. It also supplies ground path for the tail lamps, parking lamps, headlamps, side marker lamps, rear license plate lamp, stop lamps and turn signals.

HELPFUL INFORMATION

- Check for blown fuses in circuits A2 and F20.
- Check for continuity across the stop lamp switch when it is CLOSED.
- For rear lighting on the left side of the vehicle, the Z1 circuit grounding point is in the left rear wheel well.
- For rear lighting on the right side of the vehicle, the Z1 circuit grounding point is in the right rear wheel well.
- Circuit F20 feeds the heated rear window switch and A/C clutch cycling switch.

8W-52 TURN SIGNALS

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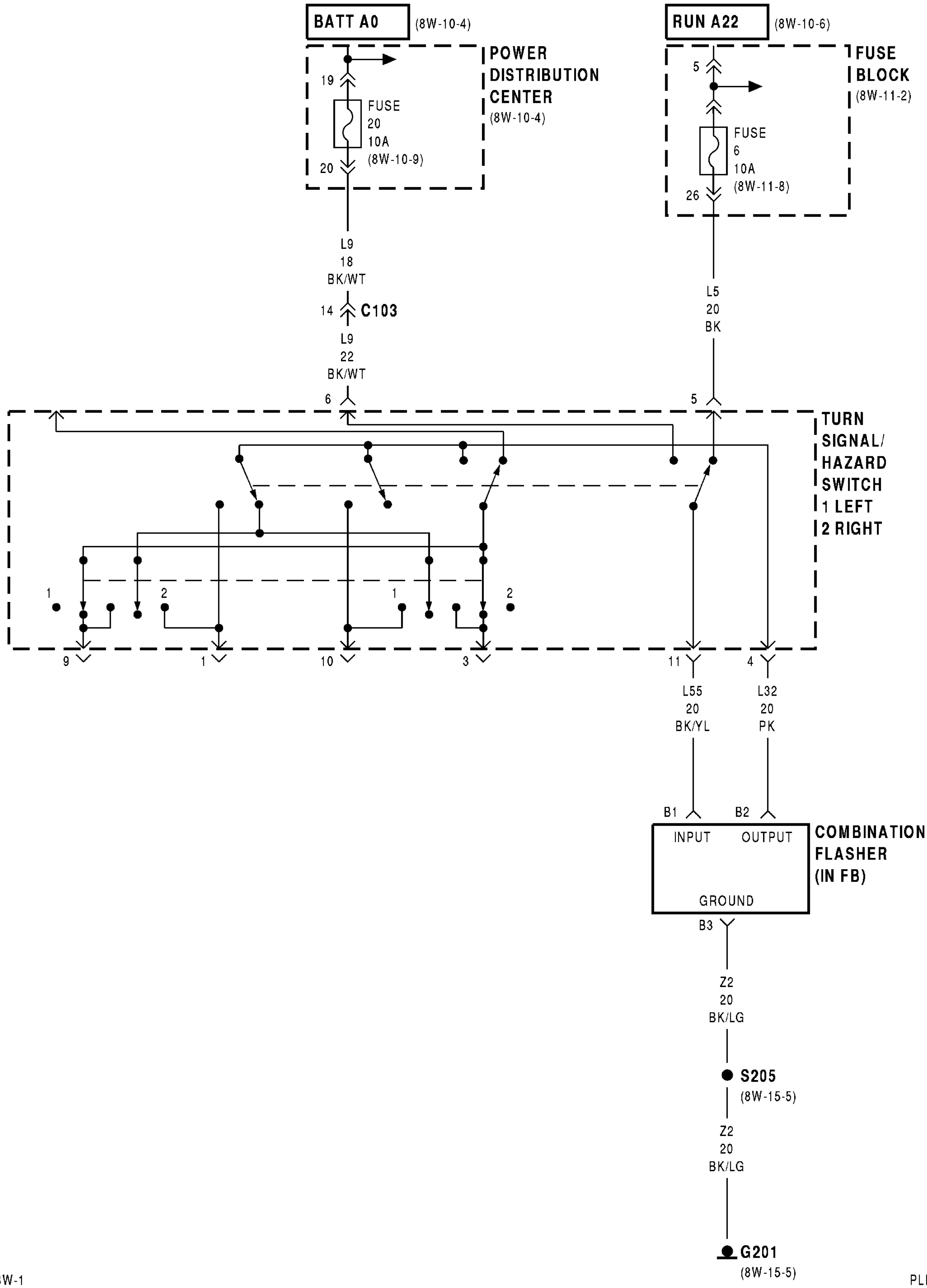
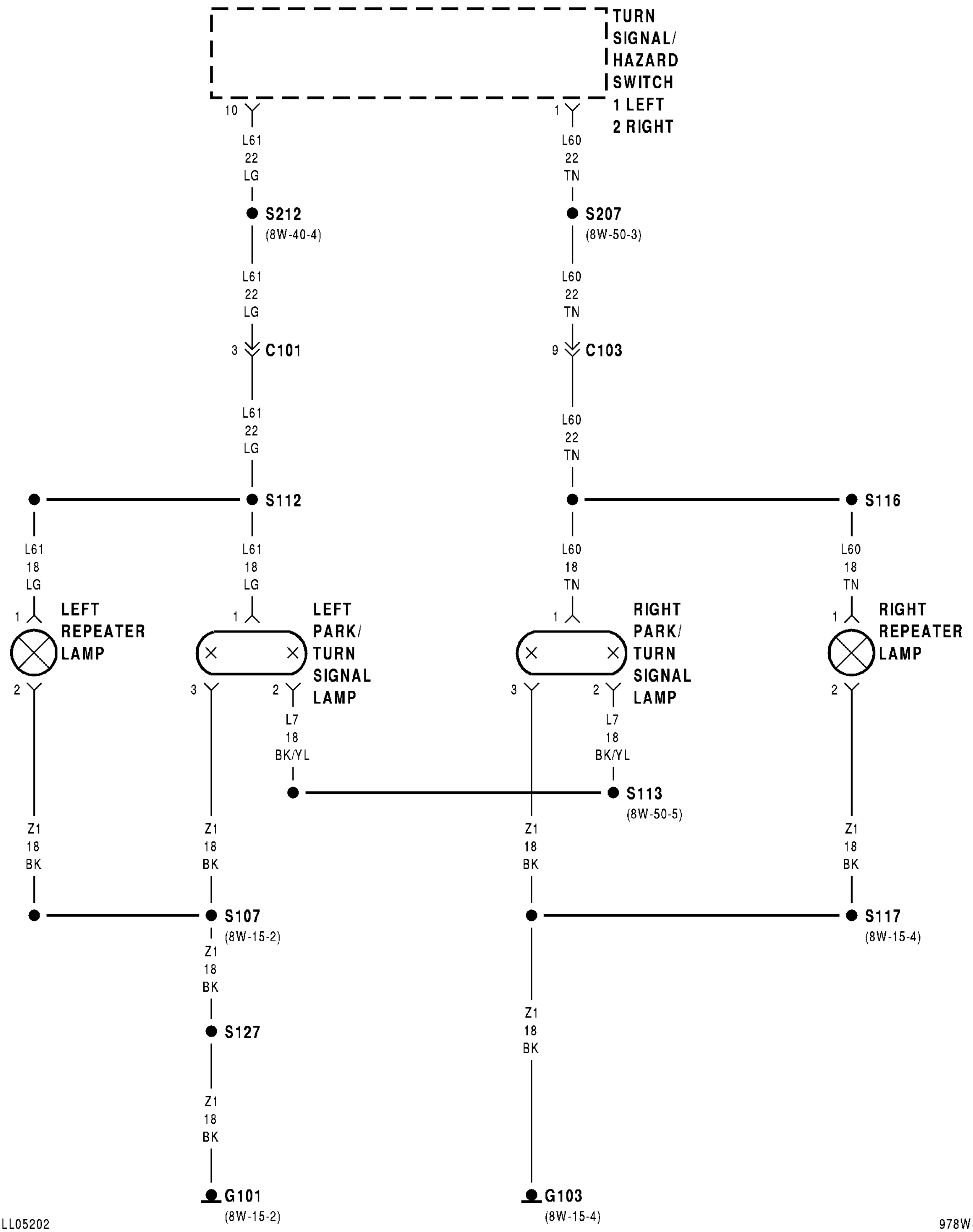
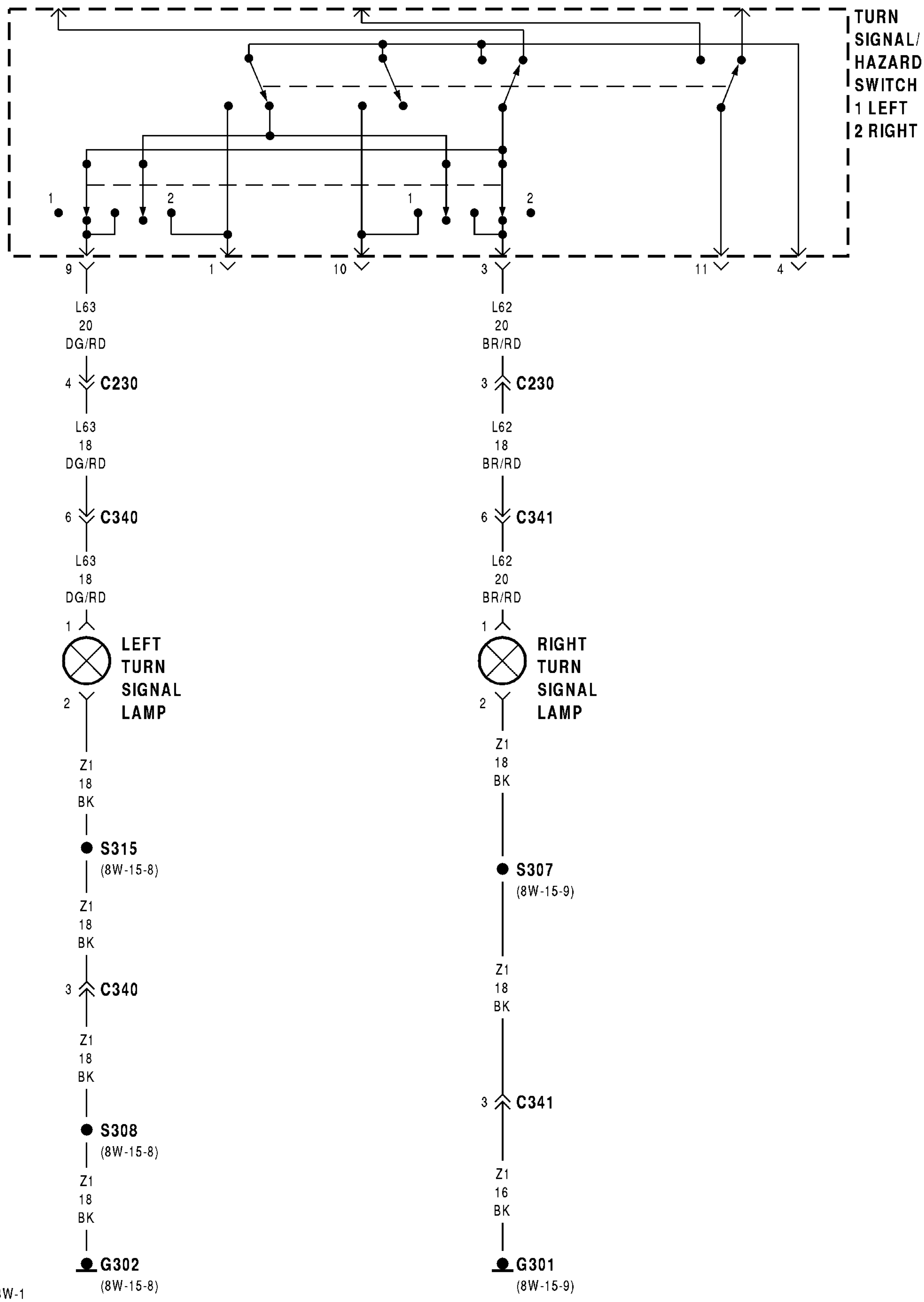


BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
19
FUSE
20
10A
(8W-10-9)
20
L9
18
BK/WT
14
C103
L9
22
BK/WT
6
RUN A22
(8W-10-6)
FUSE
BLOCK
(8W-11-2)
5
FUSE
6
10A
(8W-11-8)
26
L5
20
BK
5
TURN
SIGNAL/
HAZARD
SWITCH
1 LEFT
2 RIGHT
1
2
1
2
9
1
10
3
11
4
L55
20
BK/YL
L32
20
PK
B1
B2
INPUT
OUTPUT
COMBINATION
FLASHER
(IN FB)
GROUND
B3
Z2
20
BK/LG
S205
(8W-15-5)
Z2
20
BK/LG
G201
(8W-15-5)


TURN SIGNAL/ HAZARD SWITCH 1 LEFT 2 RIGHT
10
L61 22 LG
1
L60 22 TN
S212
(8W-40-4)
S207
(8W-50-3)
L61 22 LG
L60 22 TN
3
C101
9
C103
L61 22 LG
L60 22 TN
S112
S116
L61 18 LG
L61 18 LG
L60 18 TN
L60 18 TN
LEFT REPEATER LAMP
LEFT PARK/ TURN SIGNAL LAMP
RIGHT PARK/ TURN SIGNAL LAMP
RIGHT REPEATER LAMP
L7 18 BK/YL
L7 18 BK/YL
S113
(8W-50-5)
Z1 18 BK
S107
(8W-15-2)
S117
(8W-15-4)
S127
G101
(8W-15-2)
G103
(8W-15-4)


TURN SIGNAL/ HAZARD SWITCH
1 LEFT
2 RIGHT
1
2
1
2
9
1
10
3
11
4
L63
20
DG/RD
4
C230
L63
18
DG/RD
6
C340
L63
18
DG/RD
1
LEFT TURN SIGNAL LAMP
2
Z1
18
BK
S315
(8W-15-8)
Z1
18
BK
3
C340
Z1
18
BK
S308
(8W-15-8)
Z1
18
BK
G302
(8W-15-8)
L62
20
BR/RD
3
C230
L62
18
BR/RD
6
C341
L62
20
BR/RD
1
RIGHT TURN SIGNAL LAMP
2
Z1
18
BK
S307
(8W-15-9)
Z1
18
BK
3
C341
Z1
16
BK
G301
(8W-15-9)

8W-52 TURN SIGNALS

INDEX

DESCRIPTION AND OPERATION

TURN SIGNALS

Voltage for the turn signals flows from the Power Distribution Center (PDC) to the ignition switch on circuit A2. With the key in the RUN position, the ignition switch connects voltage from the A2 circuit to the A22 circuit. A 40 amp fuse in the PDC protects the A2 and A22 circuits.

Circuit A22 connects to a bus bar in the fuse block. L5 is one of the circuits fed by the bus bar. Circuit L5 contains a 10 amp fuse and supplies voltage to the multi-function switch. The multi- function switch supplies voltage to the combination flashing unit on circuit L55. Voltage leaves the combination flashing unit on circuit L32 and flows to the multi-function switch connector.

RIGHT TURN SIGNAL

When the operator selects the right turn signal, the multi-function connects power from circuit L32 to circuits L60 and L62. Circuit L62 connects to the multi-function switch and feeds the right rear turn signal/hazard flasher/stop lamp.

Circuit L60 connects to the multi-function switch and feeds the right front turn signal/hazard flasher lamp and side marker lamp. Circuit L60 also splices to power the turn signal indicator lamp on the instrument cluster.

LEFT TURN SIGNAL

When the operator selects the left turn signal, the multi-function connects power from circuit L32 to circuits L61 and L63. Circuit L63 connects to the multi-function switch and feeds the left rear turn signal/hazard flasher/stop lamp.

Circuit L61 connects to the multi-function switch and feeds the left right front turn signal/hazard flasher lamp and side marker lamp. Circuit L61 also splices to power the turn signal indicator lamp on the instrument cluster.

GROUND CIRCUIT

Circuit Z1 provides ground for all the turn signal lamps, although the it has different grounding points for each turn signal circuit. Circuit Z2 provides the ground path for the combination flashing unit.

HELPFUL INFORMATION

- For the left front turn signal/hazard flasher lamp, the Z1 circuit grounding point is the left side of the radiator closure panel.
- For the right front turn signal/hazard flasher lamp, the Z1 circuit grounding point is in the right fender side shield.
- For the left rear turn signal/hazard flasher/stop lamp, the Z1 circuit grounding point is in the left rear wheel well.
- For the right rear turn signal/hazard flasher/stop lamp, the Z1 circuit grounding point is in the right rear wheel well.
- Circuit Z1 also supplies ground for the headlamps, parking lamps, rear license plate lamp, back-up lamps and side marker lamps.
- The grounding point for circuit Z2 is the instrument panel right center support. Circuit Z2 supplies ground for the combination flashing unit.
- A 10 amp fuse, in cavity 6 of the fuse block, protects circuit L5.
- A 40 amp fuse in the PDC protects the A2 and A22 circuits.
- The bus bar in the fuse block that connects to circuit A22 and feeds circuit L5 for the turn signals also powers three other fuse protected circuits. The other circuits are C1, F20 and F25.

HAZARD FLASHERS

Circuit L9 from the Power Distribution Center (PDC) supplies battery voltage for the hazard flashers. A 10 amp fuse in the PDC protects circuit L9.

Circuit L9 connects to the multi-function switch. With the hazard flashers ON, the multi-function switch connects circuits L9 and L55.

Circuit L55 feeds the combination flashing unit. Circuit Z2 provides ground for the flashing unit.

From the flashing unit, circuit L32 connects to the multi-function switch. With the hazard flashers ON, the multi-function switch connects circuit L32 to circuits L60, L61, L62, and L63.

DESCRIPTION AND OPERATION (Continued)

Circuit L60 supplies voltage to the right front turn signal/hazard lamp. The L60 circuit splices to the instrument cluster to power the right indicator lamp.

Circuit L61 supplies voltage to the left front turn signal/hazard lamp. The L61 circuit splices to the instrument cluster to power the left indicator lamp.

Circuit L62 supplies voltage to the right rear turn signal/hazard flasher/stop lamp.

Circuit L63 supplies voltage to the left rear turn signal/hazard/flasher/stop lamp.

GROUND CIRCUITS

Circuit Z3 provides ground for the instrument cluster indicator lamps. The termination point for circuit Z3 is the instrument panel left center support.

Circuit Z1 provides ground for all the turn signal/hazard lamps, although the it has different grounding points for each circuit. Circuit Z2 provides the ground path for the combination flashing unit.

HELPFUL INFORMATION

- For the left front turn signal/hazard flasher lamp the Z1 circuit grounding point is the left side of the radiator closure panel.
- For the right front turn signal/hazard flasher lamp the Z1 circuit grounding point is in the right fender side shield.
- For the left rear turn signal/hazard flasher/stop lamp the Z1 circuit grounding point is in the left rear wheel well.
- For the right rear turn signal/hazard flasher/stop lamp the Z1 circuit grounding point is in the right rear wheel well.
- Circuit Z1 also supplies ground for the headlamps, parking lamps, rear license plate lamp, back-up lamps and side marker lamps.
- The grounding point for circuit Z2 is the instrument panel right center support. Circuit Z2 supplies ground for the combination flashing unit.

8W-53 WIPERS

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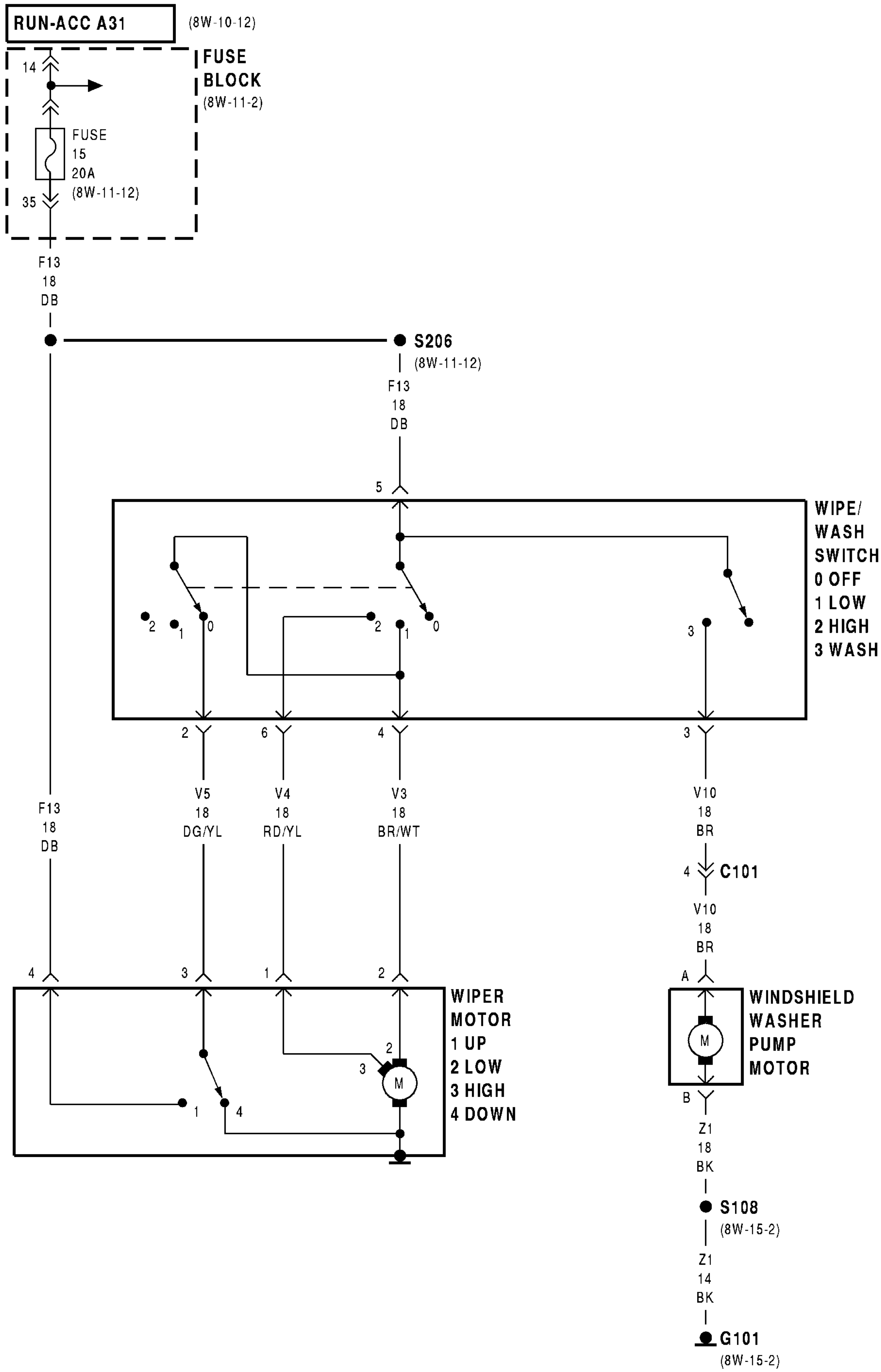
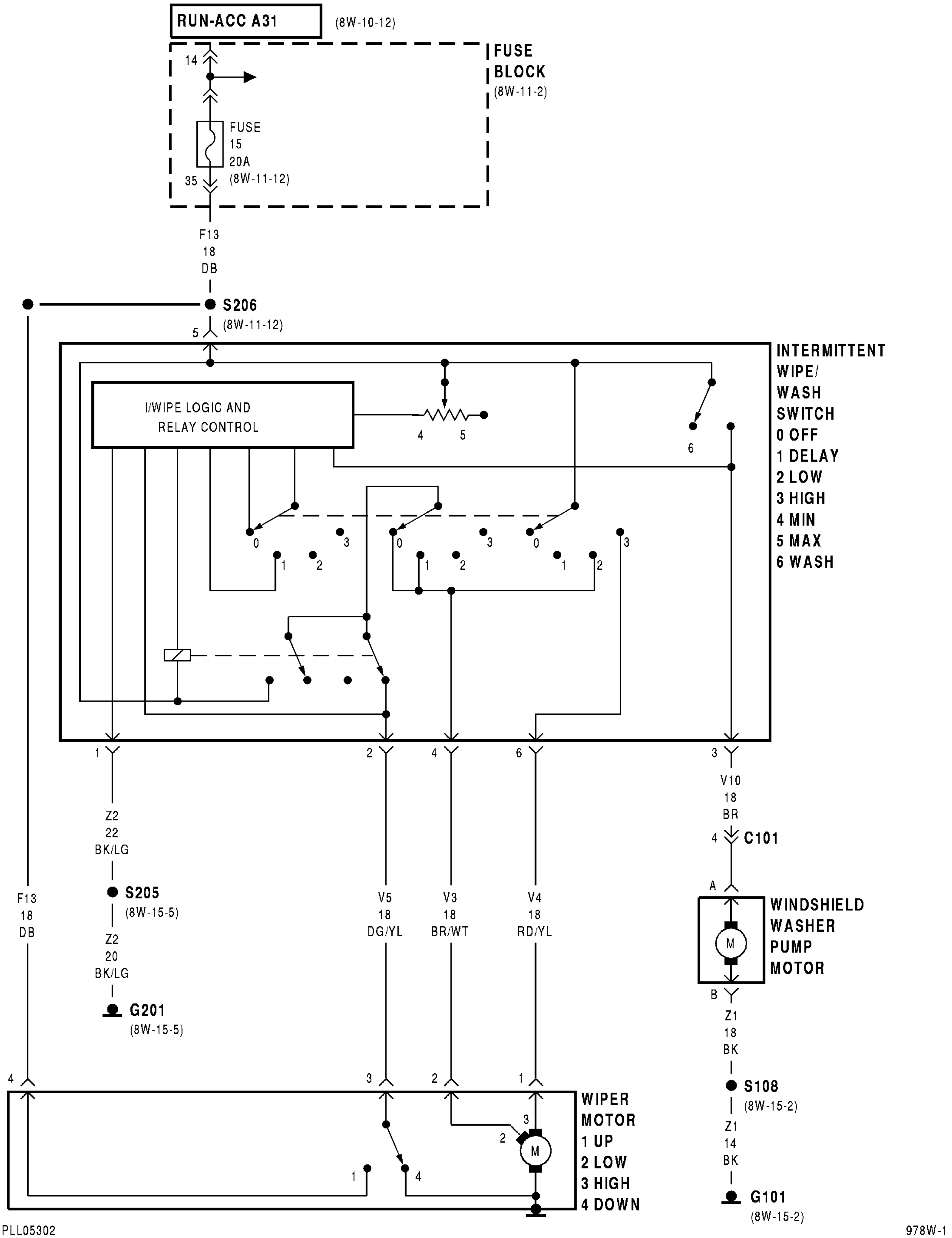

RUN-ACC A31
(8W-10-12)
FUSE BLOCK
(8W-11-2)
14
FUSE
15
20A
(8W-11-12)
35
F13
18
DB
S206
(8W-11-12)
5
WIPE/ WASH SWITCH
0 OFF
1 LOW
2 HIGH
3 WASH
2 6 4 3
V5 18 DG/YL
V4 18 RD/YL
V3 18 BR/WT
V10 18 BR
4 C101
A
WINDSHIELD WASHER PUMP MOTOR
B
Z1 18 BK
S108
(8W-15-2)
Z1 14 BK
G101
(8W-15-2)
4 3 1 2
WIPER MOTOR
1 UP
2 LOW
3 HIGH
4 DOWN
M


RUN-ACC A31
(8W-10-12)
FUSE BLOCK
(8W-11-2)
14
FUSE
15
20A
(8W-11-12)
35
F13
18
DB
S206
(8W-11-12)
5
INTERMITTENT WIPE/ WASH SWITCH
0 OFF
1 DELAY
2 LOW
3 HIGH
4 MIN
5 MAX
6 WASH
I/WIPE LOGIC AND RELAY CONTROL
4
5
6
0
1
2
3
1
2
4
6
3
Z2
22
BK/LG
S205
(8W-15-5)
Z2
20
BK/LG
G201
(8W-15-5)
V5
18
DG/YL
V3
18
BR/WT
V4
18
RD/YL
V10
18
BR
4
C101
A
WINDSHIELD WASHER PUMP MOTOR
M
B
Z1
18
BK
S108
(8W-15-2)
Z1
14
BK
G101
(8W-15-2)
F13
18
DB
4
3
2
1
WIPER MOTOR
1 UP
2 LOW
3 HIGH
4 DOWN
M
PLL05302
978W-1

8W-53 WIPERS

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DESCRIPTION AND OPERATION

WIPERS—INTERMITTENT

The intermittent windshield wiper system is powered by a 20 amp fuse located in the fuse block. This fuse is HOT in the RUN and ACCESORY position. This system has three modes of operation, INTERMITTENT, LOW, and HIGH.

When the ignition switch is in the RUN or ACCESORY position, power is supplied on the F13 circuit to the windshield wiper switch and wiper motor. The wiper motor is case grounded and the switch logic and relay control uses its own ground on the Z2 circuit to the right instrument panel center support.

When the operator moves the switch to LOW speed position, battery voltage is passed through the switch to circuit V3, which connects to the LOW speed brushes of the wiper motor. If the switch is moved to the HIGH speed mode of operation, power is switched to the V4 circuit and to the HIGH speed brushes of the motor.

When the delay mode of operation is selected circuits internal to the switch power up the logic and relay control. The internal control supplies power to the LOW speed area of the switch (V3 circuit) and cycles the wipers. The amount of delay between wiper cycles is dependent on switch position. All relays and internal logic in the switch are not serviceable and should be replaced as an assembly.

As the windshield wiper motor turns, the park switch internal to the motor moves from its grounded position to the powered RUN position. When the wiper switch is turned OFF, the V5 circuit is used to prevent the wipers from stopping in any position but park.

The intermittent windshield wiper system is also equipped with a pulse wipe feature. To activate this feature the operator presses the washer switch momentarily. When the washer switch CLOSES, a voltage signal is sent to the internal logic and relay control. The control will cycle the wipers. In addition, the wipers are placed in the maximum delay position.

The windshield washer uses a pump motor inside of the windshield washer fluid reservoir. When the washer switch is pressed, power is supplied on the V10 circuit to the pump motor. Ground for the pump motor is the Z1 circuit and terminates at the left headlamp ground.

HELPFUL INFORMATION

- Check the 20 amp fuse in cavity 15 of the fuse block.
- Check the ground strap on the windshield wiper motor.
- For the intermittent wiper system a ground is dedicated to the wiper switch.

8W-60 POWER WINDOWS

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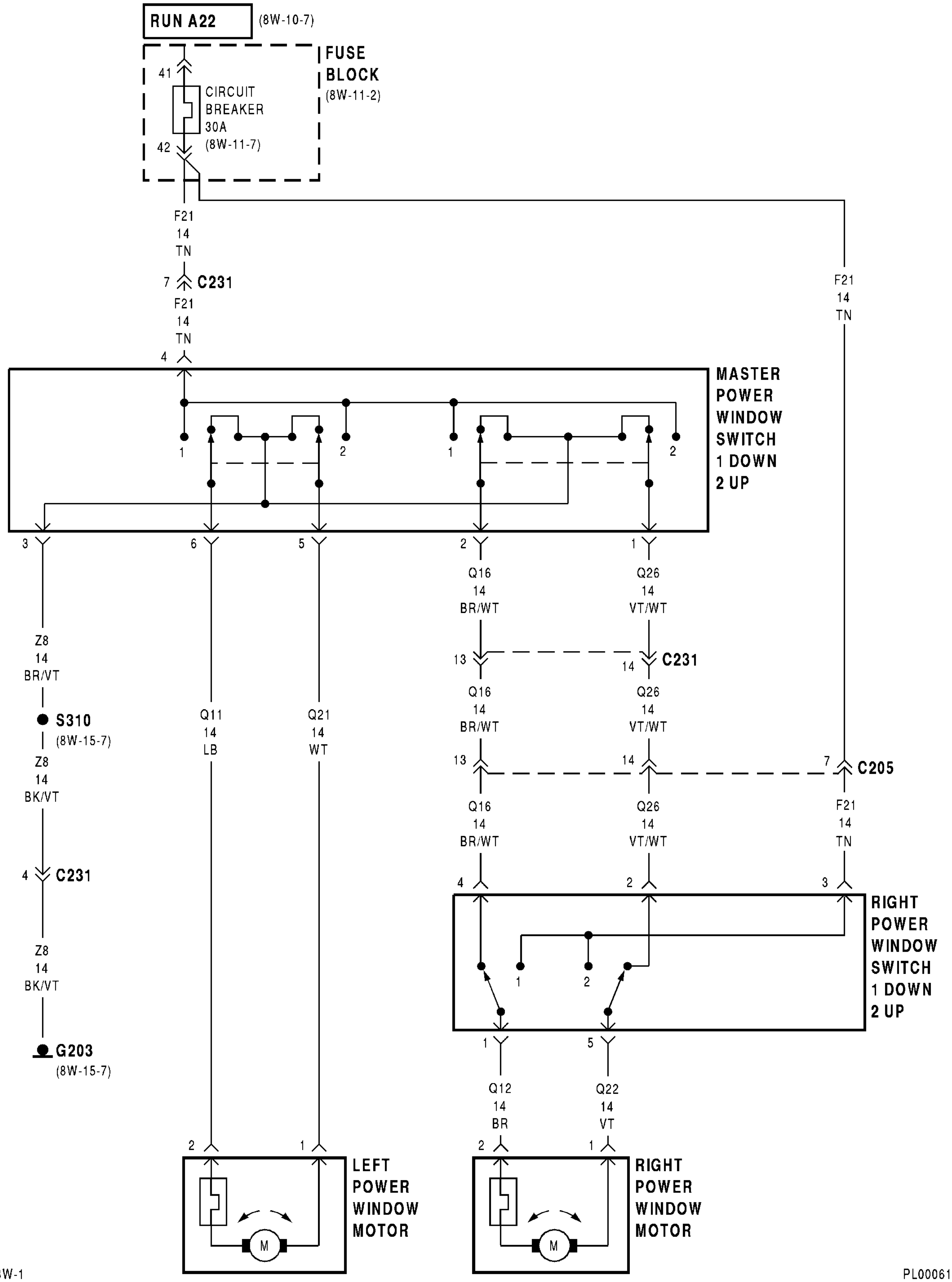
RUN A22
(8W-10-7)
FUSE
BLOCK
(8W-11-2)
41
CIRCUIT
BREAKER
30A
(8W-11-7)
42
F21
14
TN
7
C231
F21
14
TN
4
MASTER
POWER
WINDOW
SWITCH
1 DOWN
2 UP
1
2
1
2
3
6
5
2
1
Q16
14
BR/WT
Q26
14
VT/WT
13
14
C231
Q16
14
BR/WT
Q26
14
VT/WT
13
14
7
C205
Q16
14
BR/WT
Q26
14
VT/WT
F21
14
TN
F21
14
TN
4
2
3
RIGHT
POWER
WINDOW
SWITCH
1 DOWN
2 UP
1
2
1
5
Q12
14
BR
Q22
14
VT
Z8
14
BR/VT
S310
(8W-15-7)
Z8
14
BK/VT
4
C231
Z8
14
BK/VT
G203
(8W-15-7)
Q11
14
LB
Q21
14
WT
2
1
LEFT
POWER
WINDOW
MOTOR
M
2
1
RIGHT
POWER
WINDOW
MOTOR
M

8W-60 POWER WINDOWS

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DESCRIPTION AND OPERATION

POWER WINDOWS

The power window system is supplied power from the 30 amp circuit breaker located behind the fuse block. Power for the circuit breaker is supplied on circuit A22 from the ignition switch. This circuit is HOT when the ignition switch is in the RUN position.

Power for the A22 circuit is supplied by the A2 circuit which is HOT at all times and protected by a 40-amp fuse located in the Power Distribution Center (PDC). The A22 is spliced and supplies power for the fuses that protect the Airbag, A/C-Heater blower motor, turn signals, and the heated rear window.

Circuit F21 connects, from the circuit breaker, to both window switches. This is the feed for the switches. Both switches use a BUS bar to provide power for the different functions of the switch.

The ground path for the system is through master window switch on the Z8 circuit. The grounding point is located at the instrument panel left center support brace.

MASTER WINDOW SWITCH (LEFT WINDOW OPERATION)

When the window switch is moved to the window DOWN position, voltage is supplied on the F21 circuit through the CLOSED contacts in the switch to the Q21 circuit. The Q21 circuit connects from the switch to the left front window motor. Grounding is provided on circuit Q11 from the motor back to the switch. The ground is passed through the switch to the Z8 circuit. The Z8 circuit goes to its grounding point.

When window UP operation is selected, the power and ground circuits are reversed. Circuit Q11 is the feed and circuit Q21 is the ground.

MASTER WINDOW SWITCH (RIGHT WINDOW OPERATION)

When the window switch is moved to the window DOWN position, voltage is supplied on the F21 circuit through the CLOSED contacts in the switch to the Q26 circuit. The Q26 circuit connects from the master switch to the right window switch. A BUS bar internal to the right switch passes the voltage through the switch to circuit Q22. Circuit Q22 connects from the switch to the right window motor. Grounding is provided on circuit Q12 from the motor back to the right switch.

The ground is passed through the switch on a BUS bar to circuit Q16. Circuit Q16 then goes to the master switch. The ground is passed through the switch to the Z8 circuit. The Z8 circuit attaches to its grounding point.

When window UP operation is selected, the power and ground circuits are reversed. Circuits Q12 and Q16 are the feeds and circuits Q22 and Q26 are the grounds.

RIGHT WINDOW SWITCH OPERATION

When the window switch is moved to the window DOWN position, voltage is supplied on the F21 circuit through the CLOSED contacts in the switch to the Q22 circuit. The Q22 circuit connects from the switch to the right front window motor. Grounding is provided on circuit Q12 from the motor back to the switch. The ground is passed through the switch to the Q16 circuit. The Q16 circuit connects from the right switch to the master switch. Ground is passed through the master switch to the Z8 circuit. The Z8 circuit goes to its grounding point.

When window UP operation is selected, the power and ground circuits are reversed. Circuit Q12 is the feed and circuit Q22 is the ground.

HELPFUL INFORMATION

- Check the 40 amp fuse located in the PDC.
- Check the 30 amp circuit breaker located behind the fuse block.
- Check the ground at the instrument panel left center support.

8W-61 POWER DOOR LOCKS

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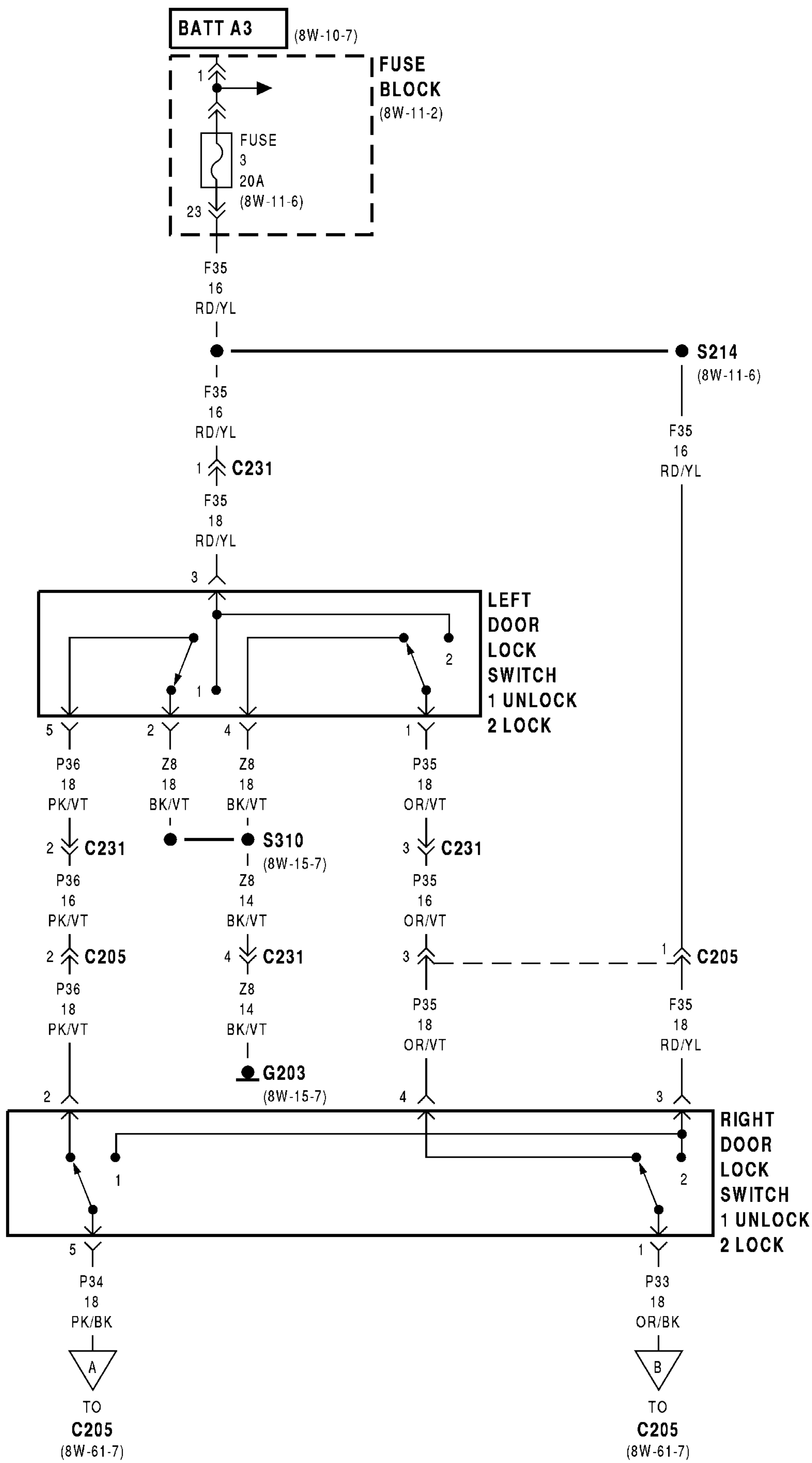
BATT A3
(8W-10-7)
FUSE BLOCK
(8W-11-2)
FUSE
3
20A
(8W-11-6)
F35
16
RD/YL
S214
(8W-11-6)
C231
F35
18
RD/YL
LEFT DOOR LOCK SWITCH
1 UNLOCK
2 LOCK
P36
18
PK/VT
Z8
18
BK/VT
P35
18
OR/VT
C231
S310
(8W-15-7)
Z8
14
BK/VT
P36
16
PK/VT
P35
16
OR/VT
C205
G203
(8W-15-7)
RIGHT DOOR LOCK SWITCH
1 UNLOCK
2 LOCK
P34
18
PK/BK
P33
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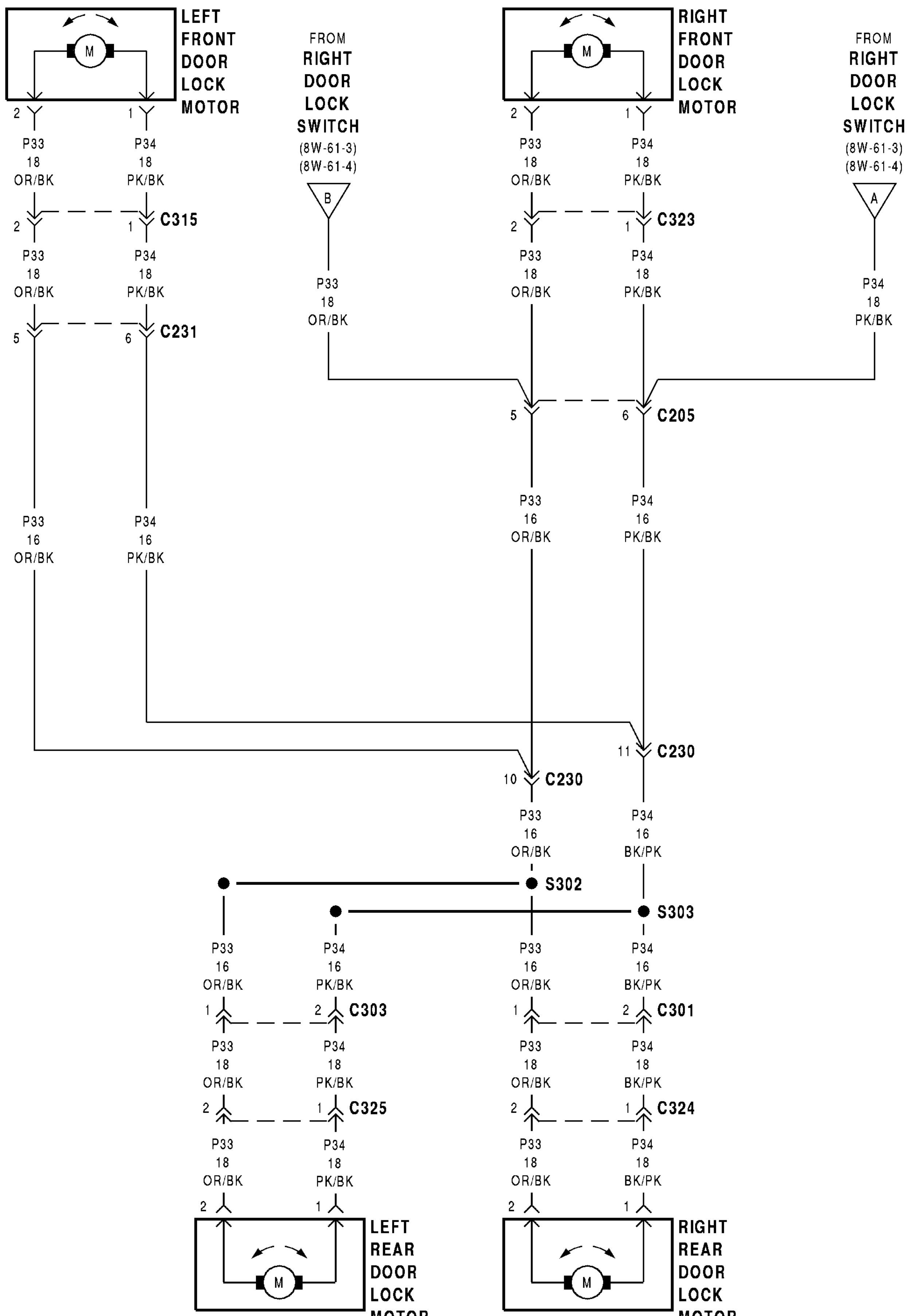
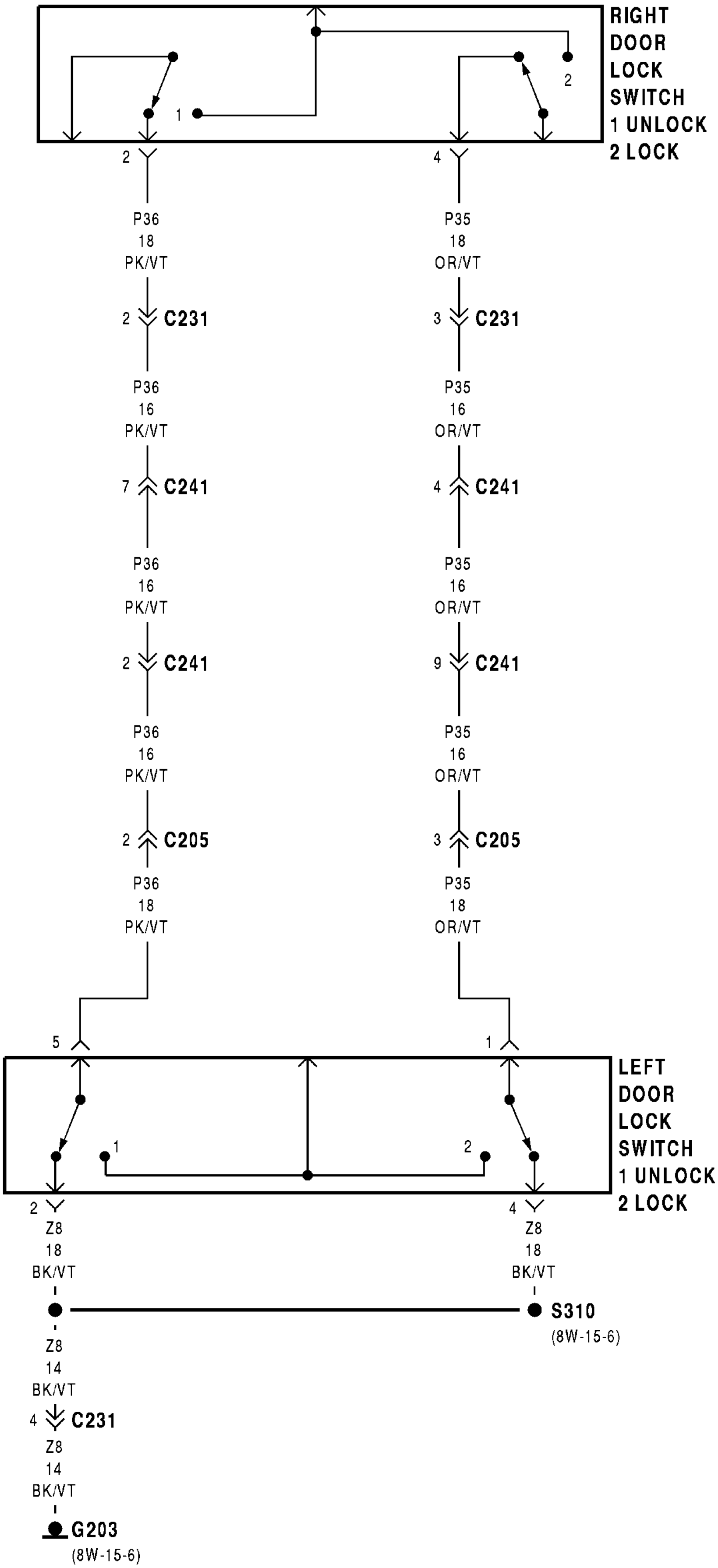
OR/BK
TO
C205
(8W-61-7)
TO
C205
(8W-61-7)


LEFT FRONT DOOR LOCK MOTOR
FROM RIGHT DOOR LOCK SWITCH (8W-61-3) (8W-61-4)
B
RIGHT FRONT DOOR LOCK MOTOR
FROM RIGHT DOOR LOCK SWITCH (8W-61-3) (8W-61-4)
A
P33 18 OR/BK
P34 18 PK/BK
C315
C231
C323
C205
P33 16 OR/BK
P34 16 PK/BK
C230
P34 16 BK/PK
S302
S303
C303
C301
C325
C324
P34 18 BK/PK
LEFT REAR DOOR LOCK MOTOR
RIGHT REAR DOOR LOCK MOTOR
M


RIGHT
DOOR
LOCK
SWITCH
1 UNLOCK
2 LOCK
P36
18
PK/VT
P35
18
OR/VT
C231
P36
16
PK/VT
P35
16
OR/VT
C241
C241
C205
LEFT
DOOR
LOCK
SWITCH
1 UNLOCK
2 LOCK
Z8
18
BK/VT
S310
(8W-15-6)
Z8
14
BK/VT
C231
G203
(8W-15-6)

8W-61 POWER DOOR LOCKS

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DESCRIPTION AND OPERATION

POWER DOOR LOCKS

The Power Distribution Center (PDC) supplies voltage to the fuse block from the 40 amp HEADLAMPS fuse on circuit A3. Fuse 3, a 20 amp located in the fuse block, supplies battery voltage on the F35 circuit to both door lock switches.

The ground path for the system is through the left door lock switch on the Z8 circuit. The grounding point is located at the instrument panel left center support brace.

LEFT DOOR SWITCH OPERATION (LOCK)

When the door lock switch is moved to the LOCK position, voltage is supplied on the P35 circuit to the bus bar located inside the right door switch, lock side. Battery voltage is passed through the switch to the P33 circuit to the door motors. Grounding is provided through the P34 circuit for all door motors back to the right door switch. The ground is passed through the bus bar internal to the switch, UNLOCK side, to the P36 circuit. The P36 circuit connects to the left front switch to a bus bar, internal to the switch, and then to the Z8 circuit. The Z8 circuit connects to its grounding point.

LEFT DOOR SWITCH OPERATION (UNLOCK)

When the switch is moved to the UNLOCK position, voltage is supplied on the P36 circuit to the right door switch, unlock side. The battery voltage is passed through the switch internal bus bar to the P34 circuit. The P34 circuit then connects to the door motors on the unlock side. Grounding for the UNLOCK function is provided by the P33 circuit.

The P33 circuit conects back to the right door switch, LOCK side, and passes through the internal bus bar to the P35 circuit. The P35 circuit conects back to the left door switch, and passes through the switch to the Z8 circuit. The Z8 circuit goes to it's grounding point.

RIGHT DOOR SWITCH OPERATION (LOCK)

When the switch is moved to the LOCK position, voltage is supplied to the P33 circuit, and then to the door lock motors. The ground path is provided on the P34 circuit back to the right door switch. The ground is passed through the switch internal bus bar to the P36 circuit. The P36 circuit connects to the left door switch and through to the Z8 circuit. The Z8 circuit then connects to the grounding point at the left center instrument panel support.

RIGHT DOOR SWITCH OPERATION (UNLOCK)

When the switch is moved to the UNLOCK position voltage is supplied to the P34 circuit from the switch to the door UNLOCK side of the motors. The grounding path is through the LOCK side of the motors, circuit P33, back to the switch. The ground continues through the internal bus bar of the switch on circuit P35 to the left door switch. At the left door switch, the ground passes through that switches internal bus bar to the Z8 grounding point.

POWER DOOR LOCKS W/ REMOTE KEYLESS ENTRY

Power for the Remote Keyless Entry (RKE) module is supplied from three sources.

Power is supplied to the RKE module on circuit G5. This circuit is protected by a 5 amp fuse located in cavity 11 of the fuse block. Power for the fuse is supplied from the ignition switch on circuit A21. This circuit is HOT in the START and RUN position.

Power for the A21 circuit is supplied by circuit A1. This circuit is HOT at all times and is protected by a 30 amp fuse located in the PDC.

Circuit F35 supplies battery voltage to the RKE module. This circuit is HOT at all times and is proteced by a 20 amp fuse located in cavity 3 of the fuse block. Power for the fuse is supplied on circuit A3. The A3 circuit is proteced by a 40 amp fuse located in the PDC.

The F35 circuit is used to supply power for the contact side of several relays internal to the RKE module.

Power is also supplied by circuit M1. This is the Ignition-Off Draw (IOD) circuit and is protected by a 10 amp fuse located in cavity 13 of the Power Distribution Center (PDC).

DESCRIPTION AND OPERATION (Continued)

LEFT DOOR UNLOCK (USING RKE TRANSMITTER)

When the operator selects left front UNLOCK the RKE module energizes the left front unlock realy connecting circuits F35 and P34. Circuit P34 connects from the module to the door lock motor.

Ground for the motor is supplied on circuit P33 through a bus bar in the right switch to circuit P35. The P35 circuit connects from the switch to the LOCK-ALL relay in the RKE module. Ground is passed through the normally CLOSED contacts in the relay to the left door switch.

Ground is passed through a bus bar in the switch to circuit Z8. This circuit terminates at the instrument panel left center support.

UNLOCK- ALL (USING RKE TRANSMITTER)

When the operator selects UNLOCK ALL the RKE module energizes the unlock all relay connecting circuits F35 and P36. Circuit P36 connects from the module to the passangers and drivers door switch, unlock side.

Power is passed through the bus bar in the passangers switch to circuit P34. This circuit connects to the UNLOCK side of the motors.

Ground for the motors is supplied on circuit P33 through a bus bar in the right switch to circuit P35. The P35 circuit connects from the switch to the LOCK-ALL relay in the RKE module. Ground is passed through the normally CLOSED contacts in the relay to the left door switch.

Ground is passed through a bus bar in the switch to circuit Z8. This circuit terminates at the instrument panel left center support.

LOCK- ALL (USING RKE TRANSMITTER)

When the operator selects LOCK ALL the RKE module energizes the lock all relay connecting circuits F35 and P35. Circuit P35 connects from the module to the passangers and drivers door switch, lock side.

Power is passed through the bus bar in the passangers switch to circuit P33. This circuit connects to the LOCK side of the motors.

Ground for the motors is supplied on circuit P34 through a bus bar in the right switch to circuit P36. The P36 circuit connects from the switch to the UNLOCK-ALL relay in the RKE module. Ground is passed through the normally CLOSED contacts in the relay to the left door switch.

Ground is passed through a bus bar in the switch to circuit Z8. This circuit terminates at the instrument panel left center support.

LOCK/ UNLOCK (USING DOOR SWITCHES)

Operation of the lock and unlock functions is the same as systems without RKE. The only change between the systems is all of the lock and unlock circuits pass through the RKE module. Refer to the standard door lock circuit descriptions.

PANIC FUNCTION

When the operator activates the panic function of the system the RKE module grounds the appropriate relays connecting circuits F35 and L4 to feed the headlamps, and F35 to L7 to feed the parking lamps.

For additional information on system operation, refer to the Owner's Manual.

ILLUMINATED ENTRY

When the RKE module determines a need for the interior lamps to be turned ON, the module energizes the relay connecting circuits M23 and Z2. The M23 circuit is the ground side for many of the vehicles interior lamps.

The Z2 circuit connects to the instrument panel left center support.

HELPFUL INFORMATION

- Check the 40 amp fuse in the PDC.
- Check the 15 amp fuse in cavity 3 of the fuse block.
- Check the grounding point on the instrument panel left center support brace.

8W-62 POWER MIRRORS

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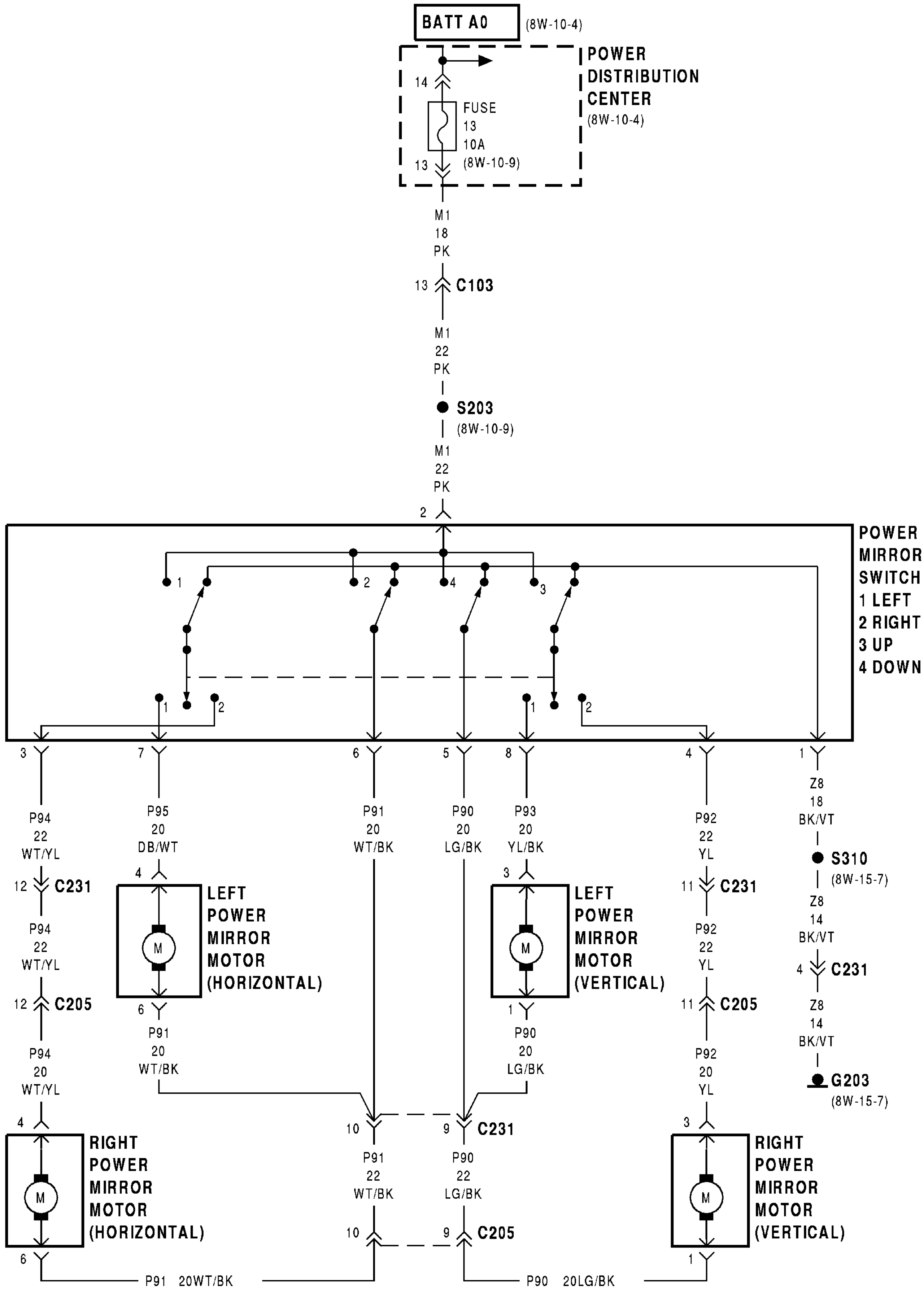
BATT A0
(8W-10-4)
POWER
DISTRIBUTION
CENTER
(8W-10-4)
14
FUSE
13
10A
(8W-10-9)
13
M1
18
PK
13
C103
M1
22
PK
S203
(8W-10-9)
M1
22
PK
2
POWER
MIRROR
SWITCH
1 LEFT
2 RIGHT
3 UP
4 DOWN
3
7
6
5
8
4
1
P94
22
WT/YL
P95
20
DB/WT
P91
20
WT/BK
P90
20
LG/BK
P93
20
YL/BK
P92
22
YL
Z8
18
BK/VT
S310
(8W-15-7)
12
C231
LEFT
POWER
MIRROR
MOTOR
(HORIZONTAL)
LEFT
POWER
MIRROR
MOTOR
(VERTICAL)
11
C231
Z8
14
BK/VT
C231
12
C205
11
C205
G203
(8W-15-7)
P94
20
WT/YL
P91
20
WT/BK
P90
20
LG/BK
P92
20
YL
10
9
C231
RIGHT
POWER
MIRROR
MOTOR
(HORIZONTAL)
P91
22
WT/BK
P90
22
LG/BK
RIGHT
POWER
MIRROR
MOTOR
(VERTICAL)
10
9
C205
P91 20WT/BK
P90 20LG/BK

8W-62 POWER MIRRORS

INDEX

DESCRIPTION AND OPERATION

POWER MIRRORS

Power for the power mirror switch is supplied on circuit F121. This circuit is protected by a 15 amp circuit breaker located in the right front door. Power for the circuit breaker is supplied by circuit F21.

The F21 circuit is protected by a 30 amp circuit breaker. This circuit breaker also supplies power to the power windows.

The power mirror switch has a right and left position. Moving the switch to either of these positions changes the voltage path internal to the switch (ie. changes polarity at the motors).

When the switch is moved to the RIGHT position and mirror movement UP is selected, voltage is supplied to the mirror on circuit P92 and the ground path is supplied on circuit P90. The P90 circuit connects from the mirror to the normally CLOSED contacts in the mirror relay located in the right door.

When the right mirror DOWN movement is selected voltage is supplied through the switch to circuit P110. The P110 circuit connects from the switch to the power mirror relay located in the door, coil side. Power on the coil side causes the contacts in the relay to CLOSE connecting circuits F121 and P90. The P90 circuit then supplies power to the DOWN side of the motor. Ground for the motor is supplied on circuit P92 back to the switch and then connects to circuit Z8. The Z8 circuit connects from the switch to its grounding point on the right instrument panel center support.

If right door mirror movement LEFT is selected voltage is supplied through the P94 circuit and the ground is passed through circuit P91. When left mirror RIGHT movement is selected the power and ground are reversed.

When the switch is moved to the LEFT position and mirror movement UP is selected, voltage is supplied to the mirror on circuit P93 and the ground path is supplied on circuit P90. The P90 circuit connects from the mirror to the normally CLOSED contacts in the mirror relay located in the right door.

When the left mirror DOWN movement is selected voltage is supplied through the switch to circuit P110. The P110 circuit connects from the switch to the power mirror relay located in the door, coil side. Power on the coil side causes the contacts in the relay to CLOSE connecting circuits F121 and P90. The P90 circuit then supplies power to the DOWN side of the motor. Ground for the motor is supplied on circuit P93 back to the switch and then connects to circuit Z8. The Z8 circuit connects from the switch to its grounding point on the right instrument panel center support.

If left door mirror movement LEFT is selected voltage is supplied through the P95 circuit and the ground is passed through circuit P91. When left mirror RIGHT movement is selected the power and ground are reversed.

HELPFUL INFORMATION

- Check the 30 amp circuit breaker located behind the fuse block
- Check the 15 amp circuit breaker located in the right door
- Check the grounding point at the instrument panel right center support

8W-64 POWER SUNROOF

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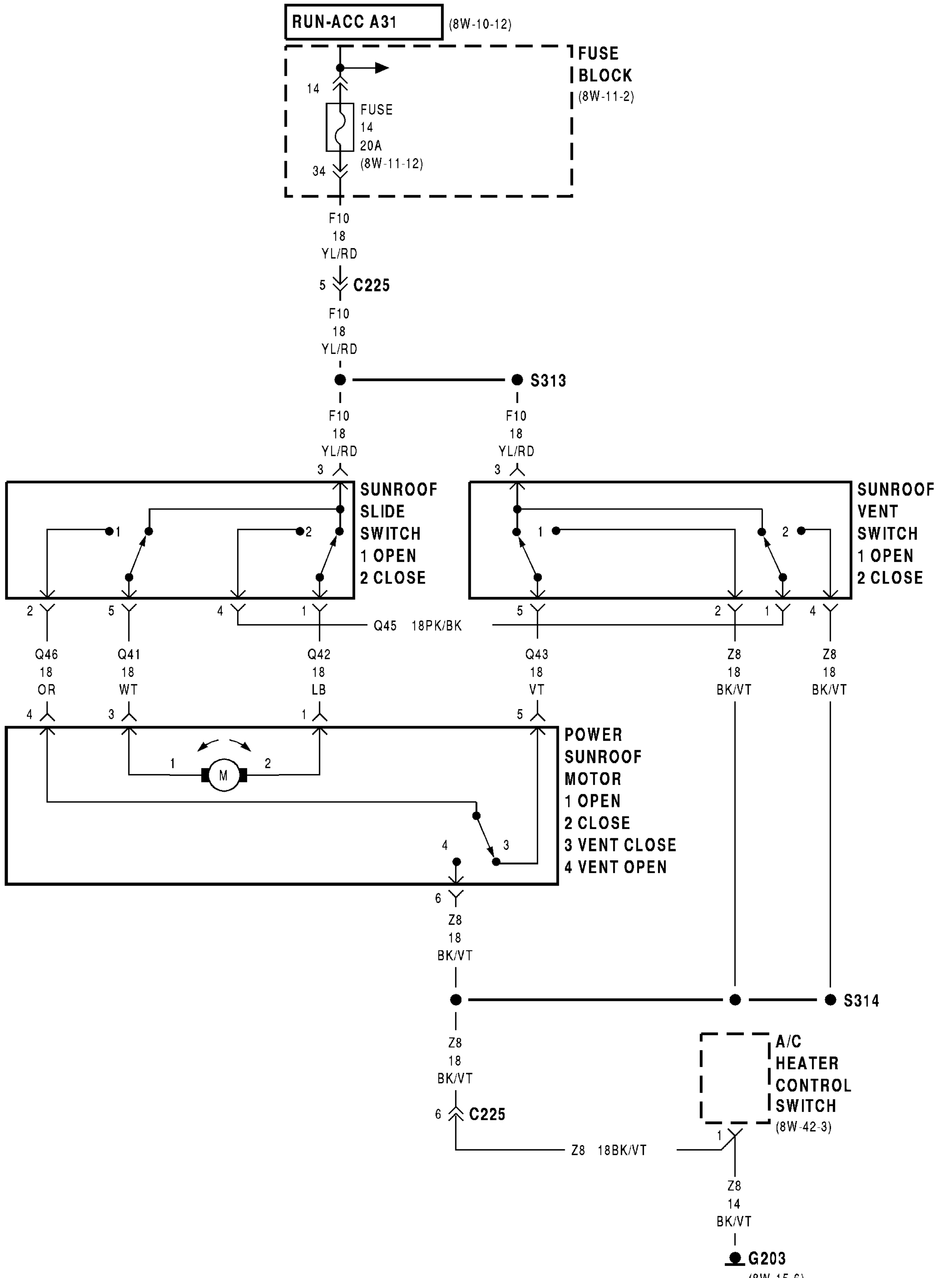

RUN-ACC A31
(8W-10-12)
FUSE
BLOCK
(8W-11-2)
14
FUSE
14
20A
(8W-11-12)
34
F10
18
YL/RD
5
C225
F10
18
YL/RD
S313
F10
18
YL/RD
F10
18
YL/RD
3
3
SUNROOF
SLIDE
SWITCH
1 OPEN
2 CLOSE
1
2
SUNROOF
VENT
SWITCH
1 OPEN
2 CLOSE
2
5
4
1
Q45 18PK/BK
5
2
1
4
Q46
18
OR
Q41
18
WT
Q42
18
LB
Q43
18
VT
Z8
18
BK/VT
Z8
18
BK/VT
4
3
1
5
POWER
SUNROOF
MOTOR
1 OPEN
2 CLOSE
3 VENT CLOSE
4 VENT OPEN
M
6
Z8
18
BK/VT
S314
Z8
18
BK/VT
6
C225
A/C
HEATER
CONTROL
SWITCH
(8W-42-3)
Z8 18BK/VT
Z8
14
BK/VT
G203
(8W-15-6)

8W-64 POWER SUNROOF

DESCRIPTION AND OPERATION

POWER SUNROOF

Power for the tilt and slide switches is supplied on circuit F10. This circuit is HOT in the ACCESSORY and RUN position only, and protected by a 20 amp fuse located in the fuse block, cavity 14.

Power for the fuse is supplied by circuit A31. This circuit connects from the ignition switch to the fuse block.

Feed for the A31 circuit is supplied on circuit A1. This circuit is protected by a 30 amp fuse located in the Power Distribution Center (PDC).

SUNROOF OPEN/CLOSE

When the operator selects sunroof OPEN the switch connects the feed circuit F10 to circuit Q41. The Q41 circuit connects from the switch to the OPEN side of the motor.

Ground for the motor is supplied on circuit Q42 from the motor back to the CLOSE side of the open/close switch. The ground is passed through the bus bar in the switch to circuit Q45. Circuit Q45 connects from the open/close switch to the tilt switch.

The ground is passed through the switch to circuit Z8 and finally to ground.

When the operator selects the CLOSE function, power and ground are reversed.

TILT OPEN/CLOSE

When the operator selects tilt OPEN circuit F10 is connected to circuit Q43. Circuit Q43 connects from the switch to the CLOSED vent limit switch in the sunroof module.

The voltage is passed through the switch to circuit Q46. The Q46 circuit connects from the limit switch to the slide switch OPEN side.

Power is passed through the switch to the Q41 circuit, then to the power sunroof motor.

Ground is provided on circuit Q42 from the motor to the slide switch CLOSE side. The ground is passed through the bus bar in the switch to circuit Q45. The Q45 circuit connects from the slide switch to the tilt switch CLOSE side.

Ground is passed through the switch to the Z8 circuit and to ground.

When the operator selects the VENT CLOSE function, power and ground are reversed.

8W-70 SPLICE INFORMATION

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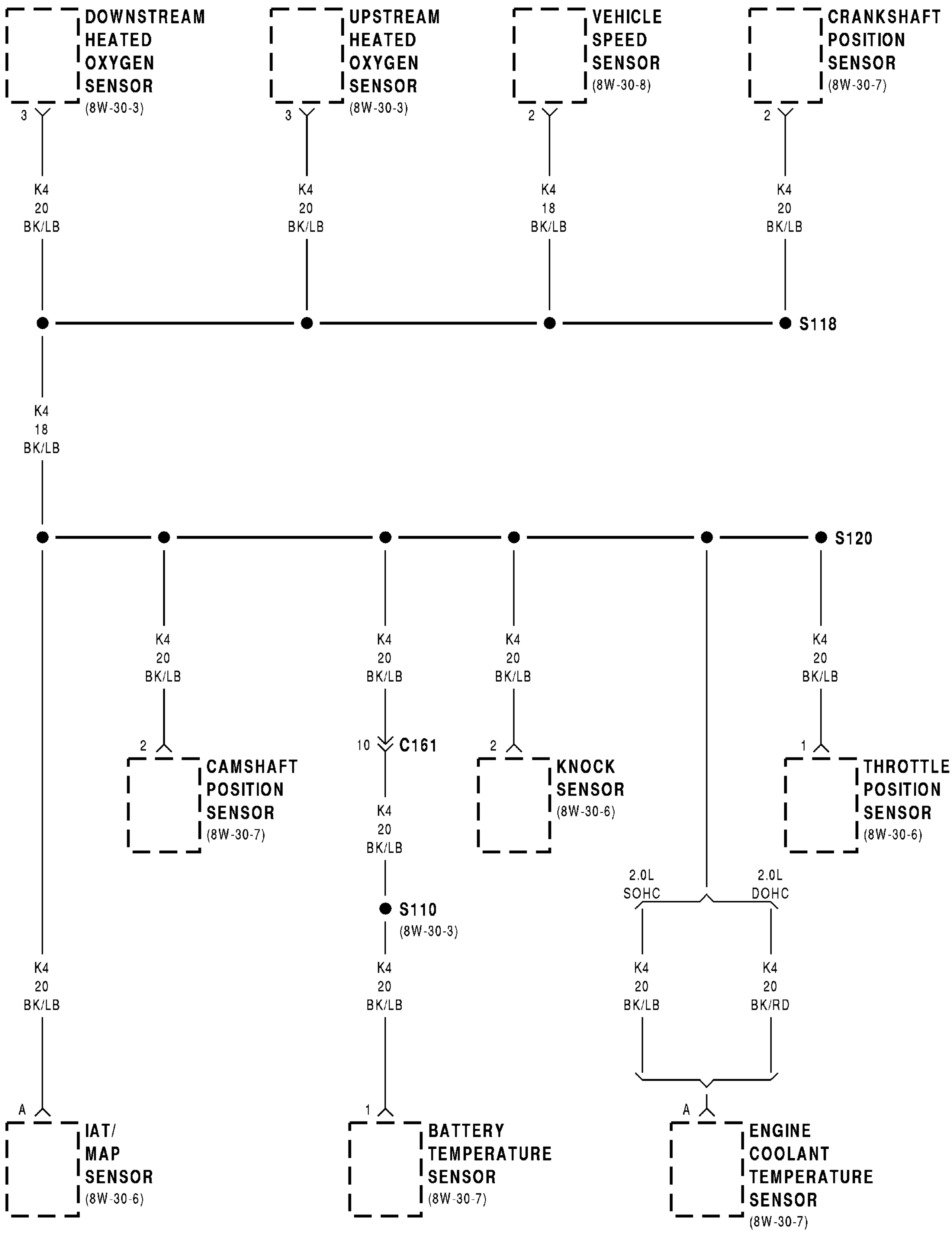
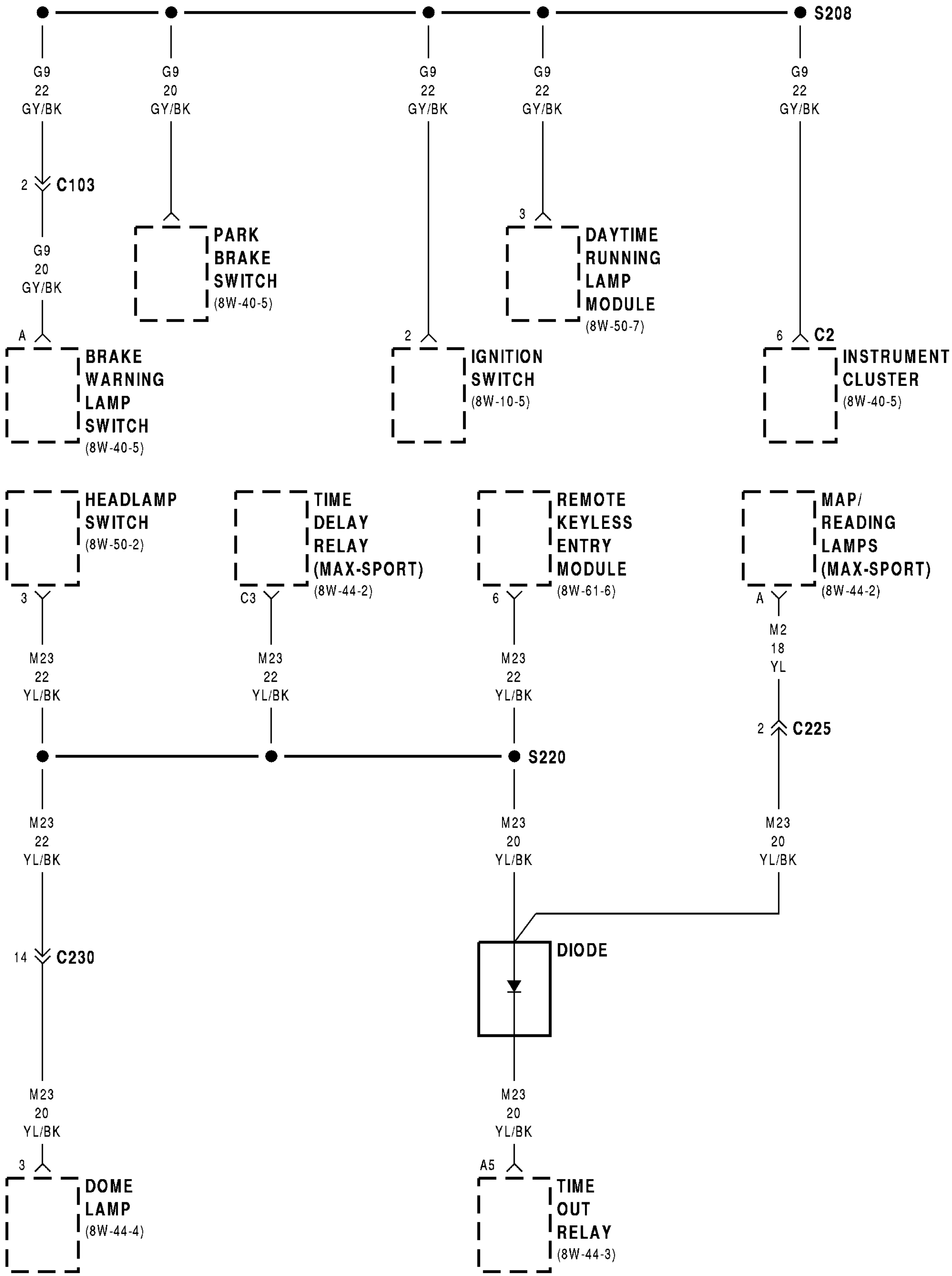


DOWNSTREAM HEATED OXYGEN SENSOR
(8W-30-3)
3
K4
20
BK/LB
UPSTREAM HEATED OXYGEN SENSOR
(8W-30-3)
3
K4
20
BK/LB
VEHICLE SPEED SENSOR
(8W-30-8)
2
K4
18
BK/LB
CRANKSHAFT POSITION SENSOR
(8W-30-7)
2
K4
20
BK/LB
S118
K4
18
BK/LB
S120
K4
20
BK/LB
2
CAMSHAFT POSITION SENSOR
(8W-30-7)
K4
20
BK/LB
10
C161
K4
20
BK/LB
S110
(8W-30-3)
K4
20
BK/LB
K4
20
BK/LB
2
KNOCK SENSOR
(8W-30-6)
K4
20
BK/LB
1
THROTTLE POSITION SENSOR
(8W-30-6)
2.0L SOHC
2.0L DOHC
K4
20
BK/LB
K4
20
BK/RD
K4
20
BK/LB
A
IAT/ MAP SENSOR
(8W-30-6)
1
BATTERY TEMPERATURE SENSOR
(8W-30-7)
A
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-7)


S208
G9
22
GY/BK
G9
20
GY/BK
2
C103
PARK
BRAKE
SWITCH
(8W-40-5)
3
DAYTIME
RUNNING
LAMP
MODULE
(8W-50-7)
A
BRAKE
WARNING
LAMP
SWITCH
(8W-40-5)
2
IGNITION
SWITCH
(8W-10-5)
6
C2
INSTRUMENT
CLUSTER
(8W-40-5)
HEADLAMP
SWITCH
(8W-50-2)
TIME
DELAY
RELAY
(MAX-SPORT)
(8W-44-2)
REMOTE
KEYLESS
ENTRY
MODULE
(8W-61-6)
MAP/
READING
LAMPS
(MAX-SPORT)
(8W-44-2)
3
C3
6
A
M2
18
YL
2
C225
M23
22
YL/BK
S220
M23
20
YL/BK
14
C230
DIODE
3
DOME
LAMP
(8W-44-4)
A5
TIME
OUT
RELAY
(8W-44-3)

8W-80 CONNECTOR PIN-OUTS

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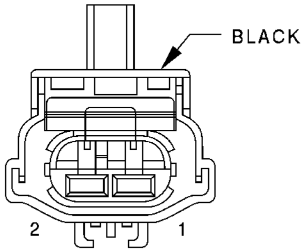
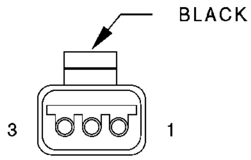


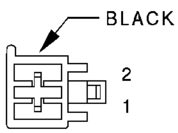
A/C COMPRESSOR CLUTCH

CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z1 20BK	GROUND



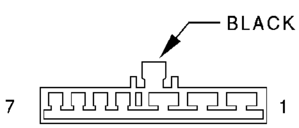
A/C CYCLING SWITCH

CAV	CIRCUIT	FUNCTION
1	C21 22DB/OR	A/C CYCLING SWITCH OUTPUT
2	F20 22WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	C2 22DB/YL	MODE SWITCH OUTPUT



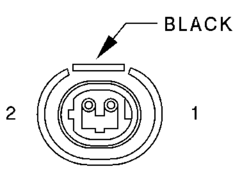
A/C-HEATER BLOWER MOTOR (WITH A/C)

CAV	CIRCUIT	FUNCTION
1	C1 14DG	FUSED IGNITION SWITCH OUTPUT (RUN)
2	C7 14BK/TN	HIGH BLOWER MOTOR DRIVER



A/C-HEATER CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	Z8 14BK/VT	GROUND
	Z8 18BK/VT	GROUND
2	C7 14BK/TN	HIGH BLOWER MOTOR DRIVER
3	C6 14LB	M2 BLOWER MOTOR DRIVER
4	C5 14LG	M1 BLOWER MOTOR DRIVER
5	C4 14TN	LOW BLOWER MOTOR DRIVER
6	C2 22DB/YL*	MODE SWITCH OUTPUT
7	E2 22OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
7	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL



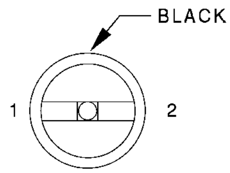
A/C HIGH PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	C20 20BR/OR	A/C SWITCH SENSE
2	C22 20DB/WT	LOW PRESSURE SWITCH OUTPUT

* WITH A/C

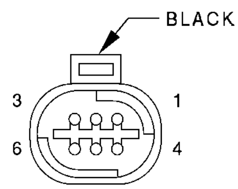
PLL08004

978W-1



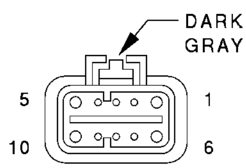
A/C LOW PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	C22 20DB/WT	LOW PRESSURE SWITCH OUTPUT
2	C21 20DB/OR	A/C CYCLING SWITCH OUTPUT



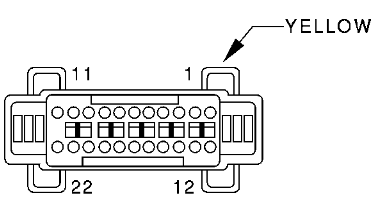
ABS HYDRAULIC MODULATOR

CAV	CIRCUIT	FUNCTION
1	B142 20BR/YL	LEFT FRONT DUMP SOLENOID CONTROL
2	B143 20DG/YL	RIGHT FRONT DUMP SOLENOID CONTROL
3	B146 20BR/LB	LEFT REAR DUMP SOLENOID CONTROL
4	B148 20DB/LB	RIGHT REAR DUMP SOLENOID CONTROL
5	Z1 18BK	GROUND
6	Z1 18BK	GROUND



ABS RELAY BOX

CAV	CIRCUIT	FUNCTION
1	F12 18DG/WT	ABS RELAY FEED
2	–	–
3	B116 20GY	ABS PUMP MOTOR RELAY CONTROL
4	B57 20BR/BK	ABS SYSTEM RELAY CONTROL
5	A20 12RD/DG	FUSED B(+)
6	B120 12BR/WT	ABS PUMP MOTOR RELAY OUTPUT
7	G19 20LG/BR	ABS WARNING LAMP DRIVER
8	–	–
9	B47 20RD/LB	ABS SYSTEM RELAY OUTPUT
10	Z1 14BK	GROUND

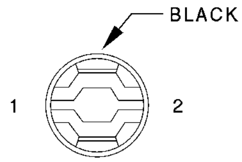


AIRBAG CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER AIRBAG SQUIB LINE 2
2	R43 18BK/LB	DRIVER AIRBAG SQUIB LINE 1
3	R47 18DB/LB	LEFT IMPACT SENSOR LINE 1
4	R49 18LB	LEFT IMPACT SENSOR LINE 2
5	R42 18BK/YL	PASSENGER AIRBAG SQUIB LINE 1
6	R44 18DG/YL	PASSENGER AIRBAG SQUIB LINE 2
7	R46 18BR/LB	RIGHT IMPACT SENSOR LINE 1
8	R48 18TN	RIGHT IMPACT SENSOR LINE 2
9	R41 18BK/TN	AIRBAG WARNING LAMP DRIVER
10	Z6 18BK/PK	GROUND
11	R50 18BR/YL	PASSENGER AIRBAG PRESSURE SWTICH SENSE
12	R51 18VT/YL	PASSENGER AIRBAG PRESSURE SWITCH GROUND
17	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)
18	D2 20WT/BK	CCD BUS (–)
19	D1 20VT/BR	CCD BUS (+)
20	F25 18TN/LG	FUSED IGNITION SWITCH OUTPUT (RUN)

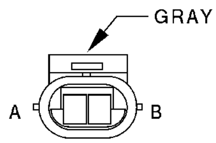
PLL08005

978W-1



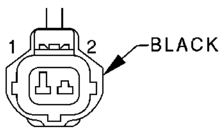
ASH RECEIVER LAMP

CAV	CIRCUIT	FUNCTION
1	E2 22OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	Z3 20BK/OR	GROUND



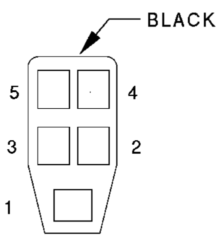
BACK-UP LAMP SWITCH (MTX)

CAV	CIRCUIT	FUNCTION
A	L1 20VT/BK	REVERSE LAMP SENSE
B	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)



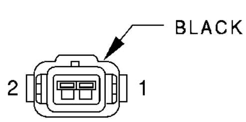
BATTERY TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	G31 18VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL



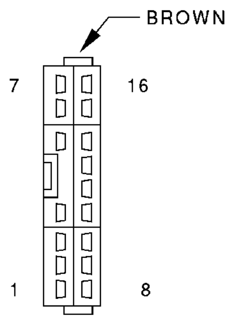
BLOWER MOTOR RESISTOR BLOCK

CAV	CIRCUIT	FUNCTION
1	C5 14LG	M1 BLOWER MOTOR DRIVER
2	C6 14LB	M2 BLOWER MOTOR DRIVER
3	–	–
4	C7 14BK/TN	HIGH BLOWER MOTOR DRIVER
5	C4 14TN	LOW BLOWER MOTOR DRIVER



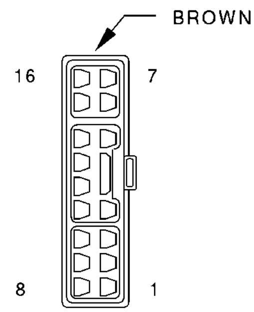
BRAKE WARNING LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
2	Z1 20BK	GROUND



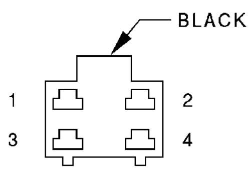
C101

CAV	CIRCUIT
1	A41 14YL
2	C21 20DB/OR
3	L61 22LG
4	V10 18BR
5	X3 18BK/RD
6	F12 20DG/WT
7	R46 18BR/LB
8	R48 18TN
9	L35 18BR/RD
10	L13 22BR/YL
	L13 22BR/YL
11	D1 20VT/BR
12	D2 20WT/BK
13	L50 22WT/TN
14	L3 16RD/OR
15	R47 18DB/LB
16	R49 18LB



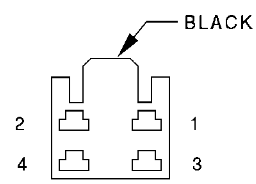
C101

CAV	CIRCUIT
1	A41 14YL
2	C21 22DB/OR
3	L61 22LG
4	V10 18BR
5	X3 20BK/RD
6	F12 20DG/WT
7	R46 18BR/LB
8	R48 18TN
9	L35 20BR/RD
10	L13 20BR/YL
11	D1 20VT/BR
12	D2 20WT/BK
13	–
14	L3 14RD/OR
15	R47 18DB/LB
16	R49 18LB



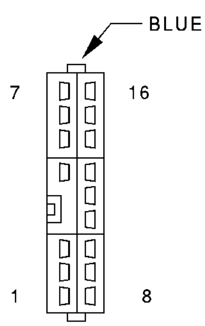
C102

CAV	CIRCUIT
1	A1 14RD
2	A2 12PK/BK
3	A3 12RD/WT
4	A4 14BK/RD



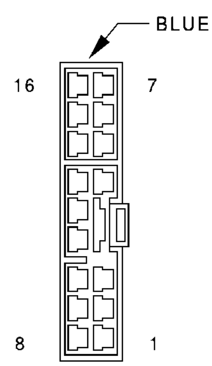
C102

CAV	CIRCUIT
1	A1 14RD
2	A2 12PK/BK
3	A3 12RD/WT
4	A4 14BK/RD



C103

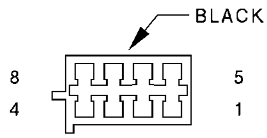
CAV	CIRCUIT
1	G19 20LG/BR
	G19 20LG/BR
2	G9 20GY/BK
3	F20 20WT
4	G6 20GY
5	G7 20WT/OR
	G7 20WT/OR
6	G12 20TN/BK
7	G20 20VT/YL
8	G21 20GY/LB
9	L60 22TN
10	–
11	G3 20BK/PK
12	F61 18WT/OR
13	M1 18PK
	M1 20PK
14	L9 18BK/WT
15	L44 18VT/BK
16	L43 18VT



C103

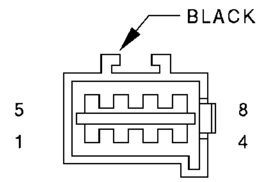
CAV	CIRCUIT
1	G19 22LG/OR
2	G9 22GY/BK
3	F20 20WT
4	G6 22GY
5	G7 22WT/OR
6	G12 22TN/BK
7	G20 22VT/YL
8	G21 22GY/LB
9	L60 22TN
10	–
11	G3 22BK/PK
12	F61 18WT/OR
13	M1 22PK
14	L9 22BK/WT
15	L44 20VT/RD
16	L43 20VT

• DOUBLE CRIMP WITH RKE



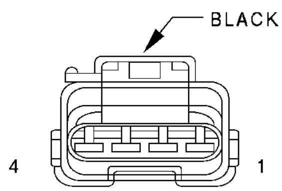
C105

CAV	CIRCUIT
1	L1 20VT/BK
2	L50 22WT/TN
2	L50 20WT/TN*
3	M1 20PK
4	–
5	L7 20BK/YL
6	A141 16DG/WT
7	G4 20DB
8	–



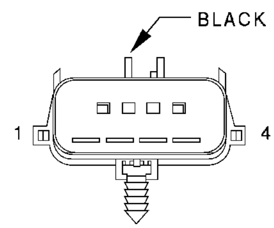
C105

CAV	CIRCUIT
1	L1 18VT/BK
2	L50 20WT/TN
3	M1 22PK
4	–
5	L7 20BK/YL
6	A141 18DG/WT
7	G4 20DB
8	–



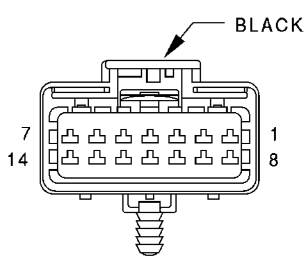
C108

CAV	CIRCUIT
1	B1 20WT/BK
2	B2 20DG/WT
3	B3 20LG/DB
4	B4 20LG



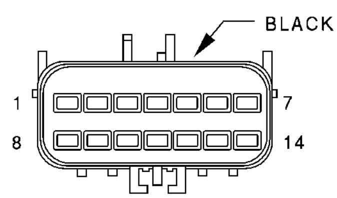
C108

CAV	CIRCUIT
1	B1 20YL/DB
2	B2 20YL
3	B3 20LG/DB
4	B4 20LG



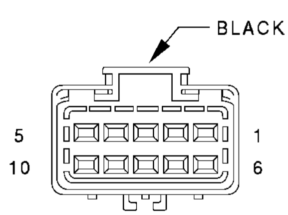
C160

CAV	CIRCUIT
1	T40 14BR
2	G7 20WT/OR
3	G4 20DB
4	K141 20TN/WT
5	C20 20BR/OR
6	G20 20VT/YL
7	F12 20DG/WT
8	–
9	G3 20BK/PK
10	Z12 20BK/TN
11	–
12	–
13	K173 20DG
14	–



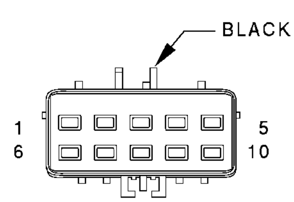
C160

CAV	CIRCUIT
1	T40 14BR
2	G7 18WT/OR
3	G4 20DB
4	K141 20TN/WT
5	C20 18BR
6	G20 20VT/YL
7	F12 18DB/WT
8	–
9	G3 20BK/PK
10	Z12 18BK/TN
11	–
12	–
13	K173 20LG
14	–



C161

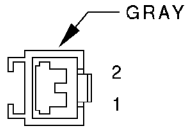
CAV	CIRCUIT
1	Z1 20BK
2	K39 20GY/RD
3	K40 20BR/WT
4	K59 20VT
5	K7 20OR
6	A142 18DG/OR
7	K60 20YL/BK
8	G6 20GY
9	K6 20VT/WT
10	K4 20BK/LB



C161

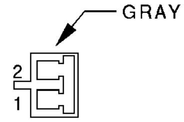
CAV	CIRCUIT
1	Z1 18BK
2	K39 18GY/RD
3	K40 18BR/WT
4	K59 18VT
5	K7 18OR
6	A142 18DG/OR
7	K60 18YL/BK
8	G6 18GY
9	K6 20VT/WT
10	K4 20BK/LB

* WITH A/T



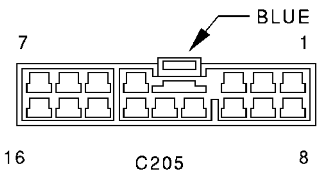
C203

CAV	CIRCUIT
1	E2 22OR
2	Z3 20BK/OR



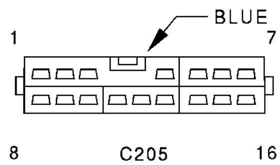
C203

CAV	CIRCUIT
1	E2 22OR
2	Z3 20BK/OR



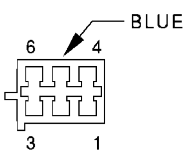
C205

CAV	CIRCUIT
1	F35 16RD/YL
2	P36 16PK/VT
3	P35 16OR/VT
4	–
5	P33 16OR/BK
6	P34 16PK/BK
7	F21 14TN
8	–
9	P90 22LG/BK
10	P91 22WT/BK
11	P92 22YL
12	P94 22WT/YL
13	Q16 14BR/WT
14	Q26 14VT/WT
15	X54 22VT
15	X54 22VT
16	X56 22DB/RD
16	X56 22DB/RD



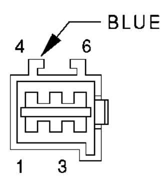
C205

CAV	CIRCUIT
1	F35 18RD/YL
2	P36 18PK/VT
3	P35 18OR/VT
4	–
5	P33 18OR/BK
5	P33 18OR/BK
6	P34 18PK/BK
6	P34 18PK/BK
7	F21 14TN
8	–
9	P90 20LG/BK
10	P91 20WT/BK
11	P92 20YL
12	P94 20WT/YL
13	Q16 14BR/WT
14	Q26 14VT/WT
15	X54 22VT
16	X56 22DB/RD



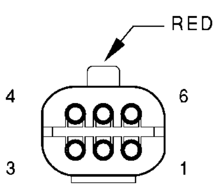
C206

CAV	CIRCUIT
1	C2 22DB/YL●●
2	F20 22WT●●
3	C21 22DB/OR●●
4	C1 14DG
5	–
6	C7 14BK/TN



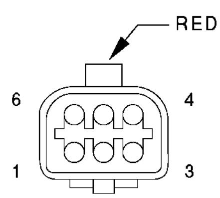
C206

CAV	CIRCUIT
1	C2 22DB/YL●●
2	F20 22WT●●
3	C21 22DB/OR●●
4	C1 14DG
5	–
6	C7 14BK/TN



C225

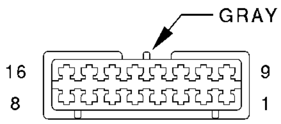
CAV	CIRCUIT
1	M1 18PK
2	M23 22YL/BK
3	Z3 18BK/OR
4	–
5	F10 18YL/RD
6	Z8 18BK/VT



C225

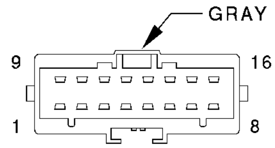
CAV	CIRCUIT
1	M1 22PK
2	M23 20YL/BK
3	Z3 20BK/OR
4	–
5	F10 18YL/RD
6	Z8 18BK/VT

●● WITH A/C



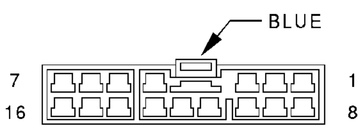
C230

CAV	CIRCUIT
1	G10 20LG/RD
2	L7 20BK/YL
	L7 20BK/YL
3	L62 18BR/RD
4	L63 18DG/RD
5	X51 22BR/YL
6	G4 18DB
	G4 20DB
7	X52 22DB/WT
8	L38 18BR/WT
9	G16 20BK/LB
10	P33 16OR/BK
11	P34 16PK/BK
12	M2 20YL
13	X57 22BR/LB
14	M23 20YL/BK
15	X58 22DB/OR
16	C15 14BK



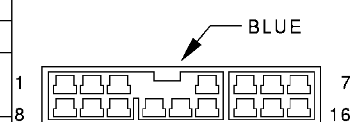
C230

CAV	CIRCUIT
1	G10 20LG/RD
2	L7 20BK/YL
	L7 20BK/YL
3	L62 20BR/RD
4	L63 20DG/RD
5	X51 22BR/YL
6	G4 20DB
7	X52 22DB/WT
8	L38 18BR/WT
9	G16 20BK/LB
10	P33 16OR/BK
	P33 16OR/BK
11	P34 16PK/BK
	P34 16PK/BK
12	M2 20YL
13	X57 22BR/LB
14	M23 22YL/BK
15	X58 22DB/OR
16	C15 14BK/WT



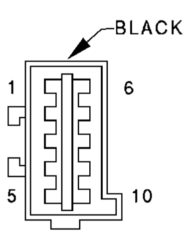
C231

CAV	CIRCUIT
1	F35 16RD/YL
2	P36 16PK/VT
3	P35 16OR/VT
4	Z8 14BK/VT
5	P33 16OR/BK
6	P34 16PK/BK
7	F21 14TN
8	M1 22PK
9	P90 22LG/BK
10	P91 22WT/BK
11	P92 22YL
12	P94 22WT/YL
13	Q16 14BR/WT
14	Q26 14VT/WT
15	X53 22DG
	X53 22DG
16	X55 22BR/RD
	X55 22BR/RD



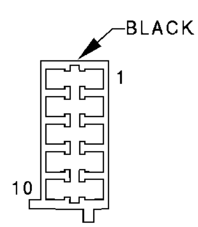
C231

CAV	CIRCUIT
1	F35 18RD/YL
2	P36 18PK/VT
3	P35 18OR/VT
4	Z8 14BK/VT
5	P33 18OR/BK
6	P34 18PK/BK
7	F21 14TN
8	M1 22PK
9	P90 20LG/BK
	P90 20LG/BK
10	P91 20WT/BK
	P91 20WT/BK
11	P92 22YL
12	P94 22WT/YL
13	Q16 14BR/WT
14	Q26 14VT/WT
15	X53 22DG
16	X55 22BR/RD



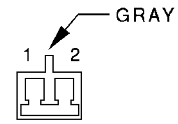
C241

CAV	CIRCUIT
1	M23 22YL/BK
2	P36 16PK/VT
3	A41 14YL
4	P35 16OR/VT
5	Z2 20BK/LG
6	G5 20DB/WT
7	P36 16PK/VT
8	A41 14YL
9	P35 16OR/VT
10	F35 16RD/YL



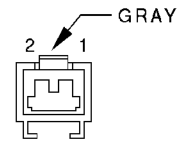
C241

CAV	CIRCUIT
1	–
2	P36 16PK/VT
3	A41 14YL/BK
4	P35 16OR/VT
5	–
6	–
7	P36 16PK/VT
8	A41 14YL/BK
9	P35 16OR/VT
10	–



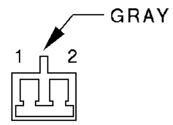
C301

CAV	CIRCUIT
1	P33 16OR/BK
2	P34 16PK/BK



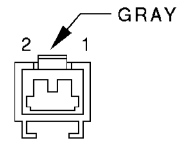
C301

CAV	CIRCUIT
1	P33 18OR/BK
2	P34 18PK/BK



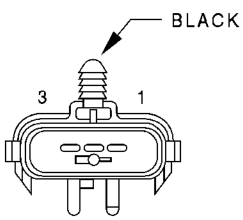
C303

CAV	CIRCUIT
1	P33 16OR/BK
2	P34 16PK/BK



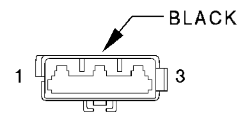
C303

CAV	CIRCUIT
1	P33 18OR/BK
2	P34 18PK/BK



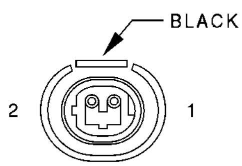
C309

CAV	CIRCUIT
1	L50 20WT/TN
2	Z1 20BK
3	M4 22GY/BK



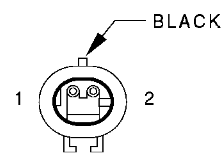
C309

CAV	CIRCUIT
1	–
2	–
3	M4 18GY/BK



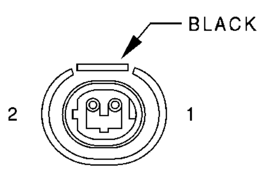
C315

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



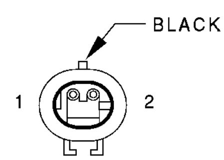
C315

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



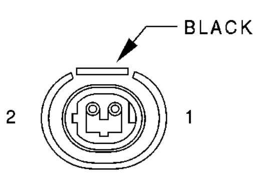
C323

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



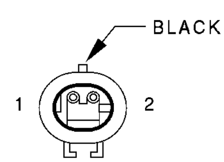
C323

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



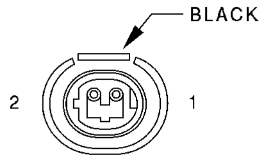
C324

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



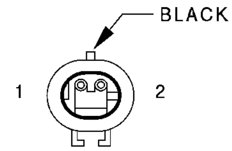
C324

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



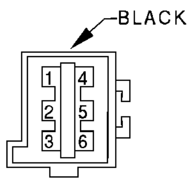
C325

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



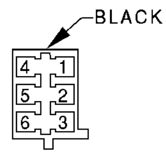
C325

CAV	CIRCUIT
1	P34 18PK/BK
2	P33 18OR/BK



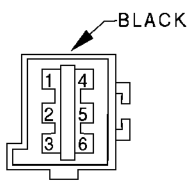
C340

CAV	CIRCUIT
1	L1 18VT/BK
2	L7 18BK/YL
3	Z1 18BK
4	L38 18BR/WT
5	L50 18WT/TN
6	L63 18DG/RD



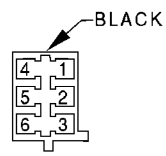
C340

CAV	CIRCUIT
1	L1 18VT/BK
2	L7 18BK/YL
3	Z1 18BK
4	L38 18BR/WT
5	L5018WT/TN
6	L63 18DG/RD



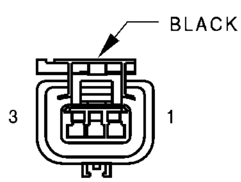
C341

CAV	CIRCUIT
1	L1 18VT/BK
2	L7 18BK/YL
3	Z1 16BK
4	L38 18BR/WT
5	L50 18WT/TN
6	L62 18BR/RD



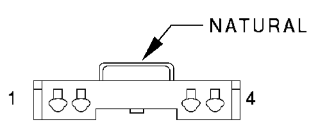
C341

CAV	CIRCUIT
1	L1 18VT/BK
2	L7 18BK/YL
3	Z1 18BK
4	L38 18BR/WT
5	L50 18WT/TN
6	L63 18DG/RD



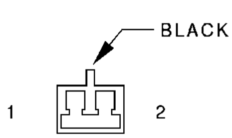
CAMSHAFT
POSITION SENSOR

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8 VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K44 20TN/YL	CAMSHAFT POSITION SENSOR SIGNAL



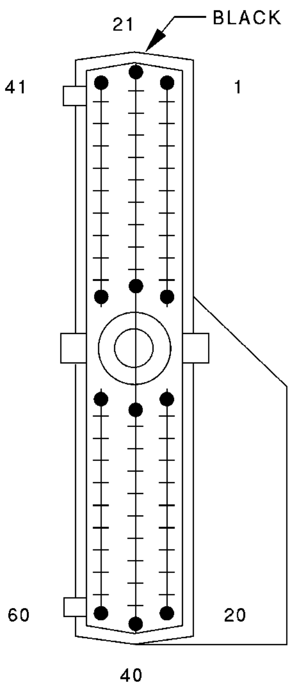
CLOCKSPRING

CAV	CIRCUIT	FUNCTION
1	X3 20BK/RD	HORN RELAY CONTROL
2	–	–
3	–	–
4	–	–



CLUTCH PEDAL
POSITION SWITCH (MTX)

CAV	CIRCUIT	FUNCTION
1	T141 14YL/RD	CLUTCH PEDAL POSITION SWITCH SIGNAL
2	A41 14YL	IGNITION SWITCH FEED



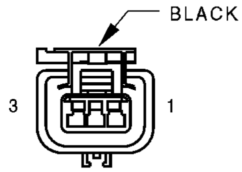
CONTROLLER
ANTI-LOCK
BRAKE

CAV	CIRCUIT	FUNCTION
1	B1 20YL/DB	RIGHT REAR WHEEL SPEED SENSOR (–)
2	B2 20YL	RIGHT REAR WHEEL SPEED SENSOR (+)
3	B3 20LG/DB	LEFT REAR WHEEL SPEED SENSOR (–)
4	B4 20LG	LEFT REAR WHEEL SPEED SENSOR (+)
5	Z12 18BK/OR	GROUND
6	B6 20WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (+)
7	B7 20WT	RIGHT FRONT WHEEL SPEED SENSOR (–)
8	B8 20RD/DB	LEFT FRONT WHEEL SPEED SENSOR (+)
9	B9 20RD	LEFT FRONT WHEEL SPEED SENSOR (–)
10	–	–
11	–	–
12	–	–
13	L50 20WT/TN	STOP LAMP SWITCH OUTPUT
14	–	–
15	G19 20LG/BR	ABS WARNING LAMP DRIVER
16	B116 20GY	ABS PUMP MOTOR RELAY CONTROL
17	–	–
18	–	–
19	–	–
20	B120 16BR/WT	ABS PUMP MOTOR RELAY OUTPUT
21	–	–
22	–	–
23	–	–
24	–	–
25	–	–
26	–	–
27	–	–
28	–	–
29	–	–
30	–	–
31	–	–
32	–	–
33	–	–
34	–	–
35	–	–
36	–	–
37	–	–
38	–	–
39	–	–
40	–	–
41	–	–
42	B142 20BR/YL	LEFT FRONT DUMP SOLENOID CONTROL
43	B143 20DG/YL	RIGHT FRONT DUMP SOLENOID CONTROL
44	–	–
45	–	–
46	B146 20BR/LB	LEFT REAR DUMP SOLENOID CONTROL
47	B47 20RD/LB	ABS SYSTEM RELAY OUTPUT
48	B148 20DB/LB	RIGHT REAR DUMP SOLENOID CONTROL
49	–	–
50	–	–

(CONTINUED ON NEXT PAGE)

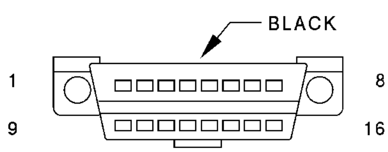
(CONTINUED)

CAV	CIRCUIT	FUNCTION
51	D21 20PK	SCI TRANSMIT
52	–	–
53	–	–
54	–	–
55	–	–
56	–	–
57	B57 20BR/BK	ABS SYSTEM RELAY CONTROL
58	–	–
59	–	–
60	F12 20DG/WT	ABS MODULE FEED



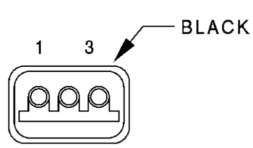
CRANKSHAFT
POSITION
(CKP) SENSOR

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8 VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K24 20GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL



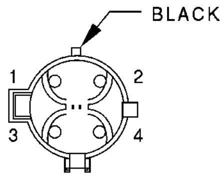
DATA LINK
CONNECTOR

CAV	CIRCUIT	FUNCTION
1	–	–
2	–	–
3	D1 20VT/BR	CCD BUS (+)
4	Z12 22BK/TN	GROUND
5	Z12 22BK/TN	GROUND
6	D20 20LG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	–	–
9	–	–
10	–	–
11	D2 20WT/BK	CCD BUS (–)
12	–	–
13	–	–
14	–	–
15	–	–
16	A14 16RD/WT	FUSED B(+)



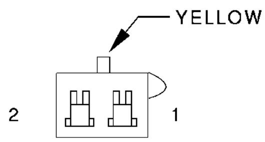
DOME LAMP

CAV	CIRCUIT	FUNCTION
1	M1 22PK	FUSED B(+)
2	–	–
3	M2 20YL	DOME LAMP FEED



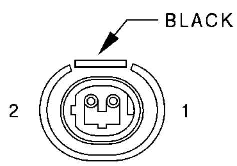
DOWNSTREAM HEATED
OXYGEN SENSOR

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 20BK/LB	SENSOR GROUND
4	K141 20TN/WT	DOWNSTREAM HEATED OXYGEN SENSOR SIGNAL



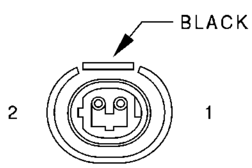
DRIVER SIDE
AIRBAG

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER AIRBAG SQUIB LINE 2
2	R43 18BK/LB	DRIVER AIRBAG SQUIB LINE 1



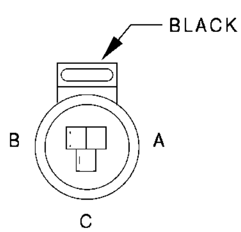
DUTY CYCLE
EVAP/PURGE
SOLENOID

CAV	CIRCUIT	FUNCTION
1	K52 20PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
2	F12 20DG/WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)



(EGR)
TRANSDUCER
SOLENOID

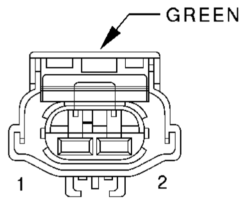
CAV	CIRCUIT	FUNCTION
1	K35 20GY/YL	EXHAUST GAS RECIRCULATION SOLENOID CONTROL
2	F12 18DB/WT	FUSED IGNITION SWITCH RELAY OUTPUT



ENGINE COOLANT
TEMPERATURE (ECT)
SENSOR

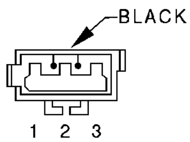
CAV	CIRCUIT	FUNCTION
A	K4 20BK/LB*	SENSOR GROUND
A	K4 20BK/RD●	SENSOR GROUND
B	K2 20TN/DB*	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
B	K2 20TN/BK●	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
C	G20 20VT/YL	ENGINE COOLANT TEMPERATURE GAUGE SIGNAL

* 2.0L SOHC ENGINE
● 2.0L DOHC ENGINE



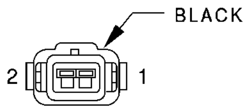
ENGINE OIL
PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	G6 18GY	OIL PRESSURE SWITCH SENSOR
2	–	–



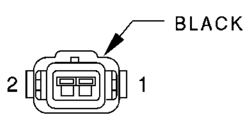
FRONT FOG LAMP
SWITCH

CAV	CIRCUIT	FUNCTION
1	L7 20BK/YL	HEADLAMP SWITCH FEED TO FRONT FOG LAMP SWITCH
2	L35 20BR/RD	FRONT FOG LAMP SWITCH TO RELAY
2	L35 20BR/RD	FRONT FOG LAMP SWITCH TO REAR FOG LAMP SWITCH
3	Z3 20BK/OR	GROUND



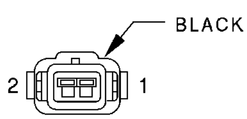
FUEL INJECTOR NO. 1

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	INJECTOR NO. 1 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT



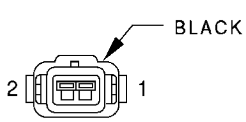
FUEL INJECTOR NO. 2

CAV	CIRCUIT	FUNCTION
1	K12 18TN	INJECTOR NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT



FUEL INJECTOR NO. 3

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	INJECTOR NO. 3 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT



FUEL INJECTOR NO. 4

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	INJECTOR NO. 4 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT

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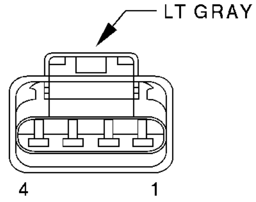
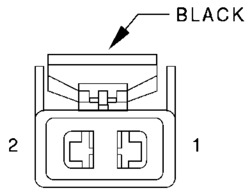


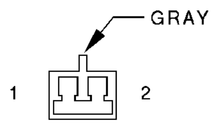
FUEL PUMP MODULE

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	Z2 18BK	GROUND
3	G4 18DB	FUEL LEVEL SENSOR SIGNAL
4	A141 18DG/WT	FUEL PUMP RELAY OUTPUT



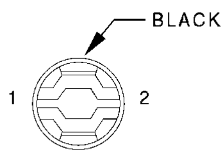
GENERATOR

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	K20 18DG	GENERATOR FIELD DRIVER



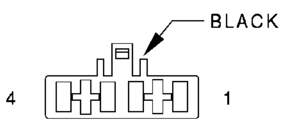
GLOVE BOX LAMP AND SWITCH

CAV	CIRCUIT	FUNCTION
1	M1 22PK	FUSED B(+)
2	Z3 20BK/OR	GROUND



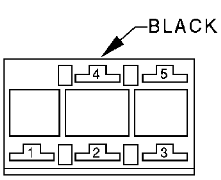
HALO LAMP

CAV	CIRCUIT	FUNCTION
1	M50 20YL/RD	TIME DELAY RELAY FEED
2	Z3 20BK/OR	GROUND



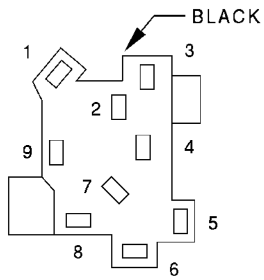
HEADLAMP DIMMER AND OPTICAL HORN SWITCH

CAV	CIRCUIT	FUNCTION
1	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
2	L2 14LG	HEADLAMP SWITCH OUTPUT
3	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
4	L20 14LG/WT	FUSED B(+)



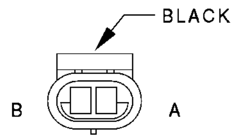
HEADLAMP LEVELING SWITCH

CAV	CIRCUIT	FUNCTION
1	–	–
2	L43 20VT	LEFT HEADLAMP FEED
3	Z1 20BK	GROUND
4	E2 20OR	ILLUMINATION FEED
5	L13 20BR/YL	HEADLAMP LEVELING SIGNAL TO MOTORS



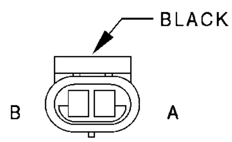
HEADLAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	E1 20TN	PANEL LAMPS DIMMER SWITCH SIGNAL
2	L2 14LG	HEADLAMP SWITCH OUTPUT
3	M23 22YL/BK	TIME OUT RELAY
4	F33 20PK/RD	FUSED B(+)
5	G26 20LB	KEY-IN IGNITION SWITCH SENSE
	G26 20LB	KEY-IN IGNITION SWITCH SENSE
6	G16 20BK/LB	LEFT FRONT DOOR JAMB SWITCH SENSE
	G16 20BK/LB	LEFT FRONT DOOR JAMB SWITCH SENSE
7	L20 14LG/WT	FUSED B(+)
8	A3 12RD/WT	FUSED B(+)
9	L7 20BK/YL	PARK LAMP SWITCH OUTPUT
	L7 20BK/YL	PARK LAMP SWITCH OUTPUT



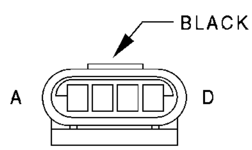
HORN NO. 1

CAV	CIRCUIT	FUNCTION
A	X2 18DG/RD	HORN RELAY OUTPUT
B	Z1 20BK	GROUND



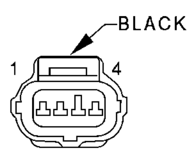
HORN NO.2

CAV	CIRCUIT	FUNCTION
A	X2 18DG/RD	HORN RELAY OUTPUT
B	Z1 20BK	GROUND



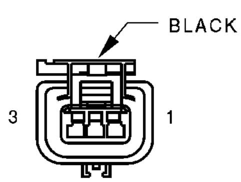
(IAT/MAP) SENSOR

CAV	CIRCUIT	FUNCTION
A	K4 18BK/LB	SENSOR GROUND
B	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
C	K6 18VT/WT	5 VOLT SUPPLY
D	K1 18DG/RD	MAP SENSOR SIGNAL



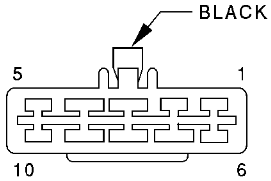
IDLE AIR CONTROL (IAC) MOTOR

CAV	CIRCUIT	FUNCTION
1	K59 18VT	IDLE AIR CONTROL MOTOR NO. 4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL MOTOR NO. 1 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
4	K39 18GY/RD	IDLE AIR CONTROL MOTOR NO. 3 DRIVER



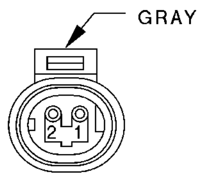
IGNITION COIL PACK

CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
3	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER



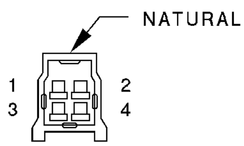
IGNITION SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 22BK	GROUND
2	G9 22GY/BK	RED BRAKE WARNING LAMP DRIVER
3	A2 12PK/BK	FUSED B(+)
4	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
5	–	–
6	–	–
7	A1 14RD	FUSED (B+)
8	A31 14BK/WT	IGNITION SWITCH OUTPUT (ACC/RUN)
9	A21 14DB	IGNITION SWITCH OUTPUT (RUN/START)
10	A41 14YL	IGNITION SWITCH OUTPUT (START)



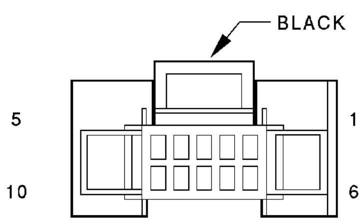
IMMOBILIZER ENGINE SENSOR

CAV	CIRCUIT	FUNCTION
1	K241 20GY/BK	IMMOBILIZER SENSOR
2	K240 20GY	IMMOBILIZER SENSOR



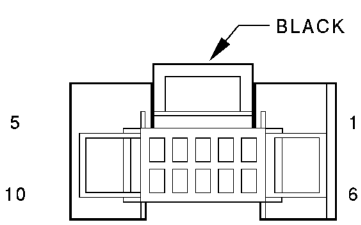
IMMOBILIZER SENSOR

CAV	CIRCUIT	FUNCTION
1	K241 20GY/BK	IMMOBILIZER ENGINE SENSOR
2	K4 20BK/LB	SENSOR GROUND
3	K7 20OR	8 VOLT SUPPLY
	K7 20OR	8 VOLT SUPPLY
4	K240 GY	IMMOBILIZER ENGINE SENSOR



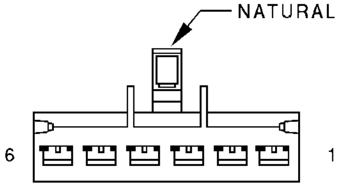
INSTRUMENT CLUSTER – C1

CAV	CIRCUIT	FUNCTION
1	M2 20YL	DOOR/LIFT GROUND SWITCH
2	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
3	L60 22TN	RIGHT TURN SIGNAL
4	G10 20LG/RD	SEAT BELT SWITCH SENSE
5	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)
6	M1 22PK	FUSED B(+)
7	G21 22GY/LB	TACHOMETER SIGNAL
8	Z3 16BK/OR	GROUND
9	R41 18BK/TN	AIRBAG WARNING LAMP DRIVER
10	G7 22WT/OR	VEHICLE SPEED SENSOR SIGNAL



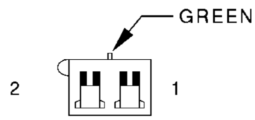
INSTRUMENT CLUSTER – C2

CAV	CIRCUIT	FUNCTION
1	G6 22GY	OIL PRESSURE SWITCH SENSE
2	G19 22LG/OR	ABS WARNING LAMP DRIVER
3	G3 22BK/PK	CHECK ENGINE LAMP DRIVER
4	G20 22VT/YL	ECT GAUGE SENSOR SIGNAL
5	G26 20LB	KEY-IN IGNITION SWITCH SENSE
6	G9 22GY/BK	RED BRAKE WARNING LAMP DRIVER
7	G12 22TN/BK	GENERATOR LAMP DRIVER
8	L61 22LG	LEFT TURN SIGNAL
9	E2 22OR	PANEL LAMPS DRIVER
10	G4 20DB	FUEL LEVEL SENSOR SIGNAL



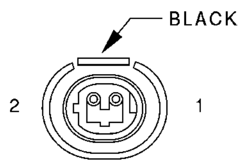
INTERMITTENT WIPE/WASH SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 22BK/LG**	GROUND
2	V5 18DG/YL	WIPER RELAY COMMON
3	V10 18BR	WINDSHIELD WASHER RELAY OUTPUT
4	V3 18BR/WT	WIPER SWITCH LOW SPEED OUTPUT
5	F13 18DB	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
6	V4 18RD/YL	WIPER SWITCH HIGH SPEED OUTPUT



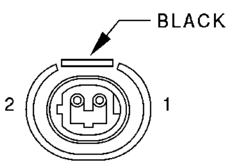
KEY-IN SWITCH

CAV	CIRCUIT	FUNCTION
1	G16 20BK/LB	LEFT FRONT DOOR JAMB SWITCH SENSE
2	G26 20LB	KEY-IN IGNITION SWITCH SENSE



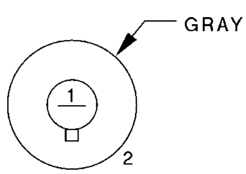
KNOCK SENSOR

CAV	CIRCUIT	FUNCTION
1	K42 20DB/LG*	KNOCK SENSOR SIGNAL
1	K42 20BK/LG•	KNOCK SENSOR SIGNAL
2	K4 20BK/LB	SENSOR GROUND



LEFT AIRBAG IMPACT SENSOR

CAV	CIRCUIT	FUNCTION
1	R47 18DB/LB	LEFT IMPACT SENSOR LINE 1
2	R49 18LB	LEFT IMPACT SENSOR LINE 2



LEFT BACK-UP LAMP

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP SENSE
2	Z1 18BK	GROUND

* 2.0L SOHC ENGINE
• 2.0L DOHC ENGINE
** WITH INTERMITTENT WIPERS

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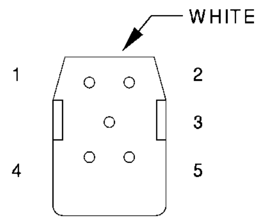
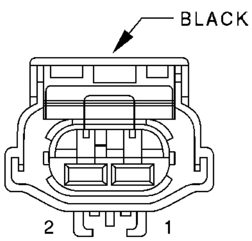


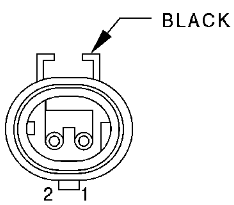
LEFT DOOR
LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	P35 18OR/VT	LEFT DOOR LOCK SWITCH OUTPUT
2	Z8 18BK/VT	GROUND
3	F35 18RD/YL	FUSED B(+)
4	Z8 18BK/VT	GROUND
5	P36 18PK/VT	LEFT DOOR UNLOCK SWITCH OUTPUT



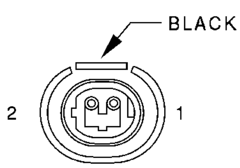
LEFT DOOR
WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q21 14WT	LEFT FRONT DOWN
2	Q11 14LB	LEFT FRONT UP



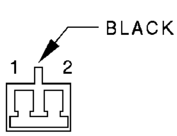
LEFT FOG
LAMP

CAV	CIRCUIT	FUNCTION
1	L39 20LB/WT	FRONT FOG LAMPS SWITCH OUTPUT
2	Z1 20BK	GROUND



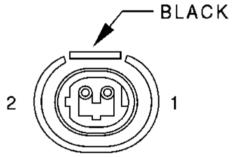
LEFT FRONT
DOOR LOCK
MOTOR

CAV	CIRCUIT	FUNCTION
1	P34 18PK/BK	DOOR UNLOCK DRIVER
2	P33 18OR/BK	DOOR LOCK DRIVER



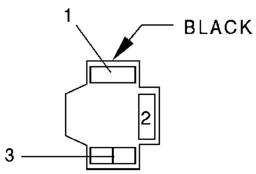
LEFT FRONT
DOOR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X55 22BR/RD	LEFT FRONT SPEAKER (–)
2	X53 22DG	LEFT FRONT SPEAKER (+)



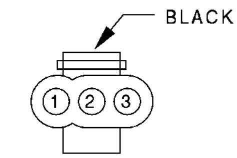
LEFT FRONT
WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B8 20RD/DB	LEFT FRONT WHEEL SPEED SENSOR (+)
2	B9 20RD	LEFT FRONT WHEEL SPEED SENSOR (-)



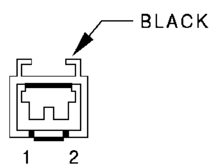
LEFT HEADLAMP

CAV	CIRCUIT	FUNCTION
1	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
2	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
3	Z1 18BK	GROUND
	Z1 18BK	GROUND



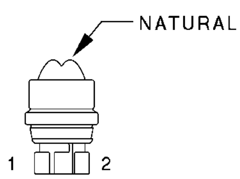
LEFT HEADLAMP
LEVELING MOTOR

CAV	CIRCUIT	FUNCTION
1	L43 22VT	LEFT HEADLAMP FEED
2	L13 22BR/YL	HEADLAMP LEVELING SIGNAL FROM SWITCH
3	Z1 22BK	GROUND



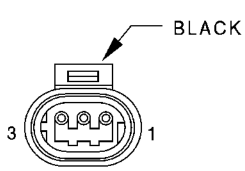
LEFT INSTRUMENT
PANEL SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X53 22DG	LEFT FRONT SPEAKER (+)
2	X55 22BR/RD	LEFT FRONT SPEAKER (–)



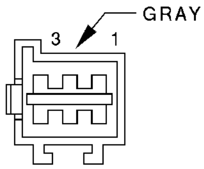
LEFT
LICENSE LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L7 20BK/YL	PARK LAMP SWITCH OUTPUT



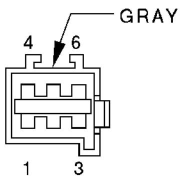
LEFT PARK/TURN
SIGNAL LAMP

CAV	CIRCUIT	FUNCTION
1	L61 18LG	LEFT TURN SIGNAL
2	L7 18BK/YL	PARK LAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



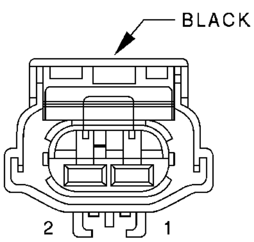
LEFT POWER MIRROR

CAV	CIRCUIT	FUNCTION
1	P90 20LG/BK	LEFT/RIGHT POWER MIRROR VERTICAL SUPPLY
2	–	–
3	P93 20YL/BK	LEFT POWER MIRROR (VERTICAL)
4	P95 20DB/WT	LEFT POWER MIRROR (HORIZONTAL)
5	–	–
6	P91 20WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY



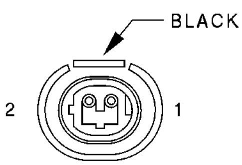
LEFT POWER MIRROR MOTOR

CAV	CIRCUIT	FUNCTION
1	P90 20LG/BK	MIRROR MOTOR B+(DOWN) B–(UP)
2	–	–
3	P93 20YL/BK	MIRROR MOTOR B+(UP) B–(DOWN)
4	P95 20DB/WT	MIRROR MOTOR B+(LEFT) B–(RIGHT)
5	–	–
6	P91 20WT/BK	MIRROR MOTOR B+(RIGHT) B–(LEFT)



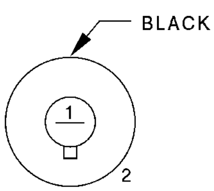
LEFT POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q21 14WT	LEFT FRONT DOWN
2	Q11 14LB	LEFT FRONT UP



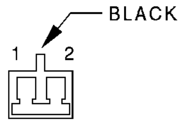
LEFT REAR DOOR LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P34 18PK/BK	DOOR UNLOCK DRIVER
2	P33 18OR/BK	DOOR LOCK DRIVER



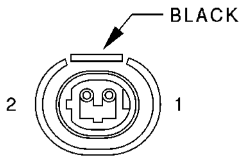
LEFT REAR FOG LAMP

CAV	CIRCUIT	FUNCTION
1	L38 18BR/WT	REAR FOG LAMP FEED
2	Z1 18BK	GROUND



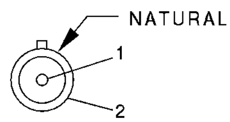
LEFT REAR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X51 22BR/YL	LEFT REAR SPEAKER (+)
2	X57 22BR/LB	LEFT REAR SPEAKER (−)



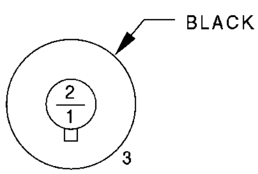
LEFT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B3 20LG/DB	LEFT REAR WHEEL SPEED SENSOR (−)
2	B4 20LG	LEFT REAR WHEEL SPEED SENSOR (+)



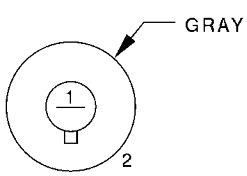
LEFT REPEATER LAMP

CAV	CIRCUIT	FUNCTION
1	L61 18LG	LEFT TURN SIGNAL
2	Z1 18BK	GROUND



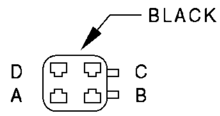
LEFT TAIL/STOP LAMP

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	TAIL/STOP
2	L7 18BK/YL	TAIL/STOP
3	Z1 18BK	GROUND



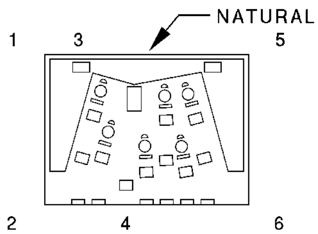
LEFT TURN SIGNAL LAMP

CAV	CIRCUIT	FUNCTION
1	L63 18DG/RD	LEFT TURN SIGNAL LAMP FEED
2	Z1 18BK	GROUND



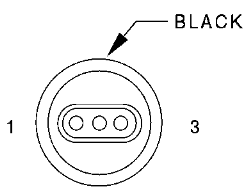
MAP/READING LAMPS

CAV	CIRCUIT	FUNCTION
A	M23 22YL/BK	TIME OUT RELAY
B	Z3 18BK/OR	GROUND
C	M1 18PK	FUSED B(+)
D	–	–



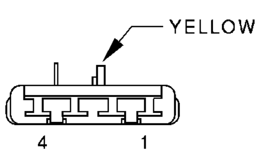
MASTER POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q26 14VT/WT	MASTER SWITCH RIGHT FRONT DOWN
2	Q16 14BR/WT	MASTER SWITCH RIGHT FRONT UP
3	Z8 14BK/VT	GROUND
4	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN/START)
5	Q21 14WT	LEFT FRONT DOWN
6	Q11 14LB	LEFT FRONT UP



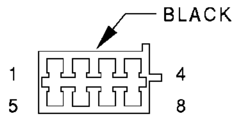
PARK/NEUTRAL POSITION SWITCH (ATX)

CAV	CIRCUIT	FUNCTION
1	L1 20VT/BK	REVERSE LAMP SENSE
2	T41 20BR/YL	PARK/NEUTRAL POSITION SWITCH SENSE
3	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)



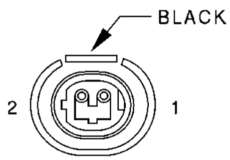
PASSENGER SIDE AIRBAG

CAV	CIRCUIT	FUNCTION
1	R51 18VT/YL	PASSENGER AIRBAG PRESSURE SWITCH GROUND
2	R50 18BR/YL	PASSENGER AIRBAG PRESSURE SWITCH SENSE
3	R44 18DG/YL	PASSENGER AIRBAG SQUIB LINE 2
4	R42 18BK/YL	PASSENGER AIRBAG SQUIB LINE 1



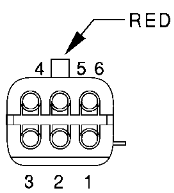
POWER MIRROR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z8 18BK/VT	GROUND
2	M1 22PK	FUSED B(+)
3	P94 22WT/YL	RIGHT POWER MIRROR (HORIZONTAL)
4	P92 22YL	RIGHT POWER MIRROR (VERTICAL)
5	P90 20LG/BK	LEFT/RIGHT POWER MIRROR VERTICAL SUPPLY
6	P91 20WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY
7	P95 20DB/WT	LEFT POWER MIRROR (HORIZONTAL)
8	P93 20YL/BK	LEFT POWER MIRROR (VERTICAL)



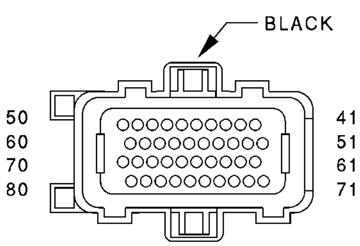
POWER STEERING PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	K10 20WT	POWER STEERING PRESSURE SWITCH SENSE
2	Z12 22BK/TN	GROUND



POWER SUNROOF MOTOR

CAV	CIRCUIT	FUNCTION
1	Q42 18LB	POWER SUNROOF CLOSE
2	–	–
3	Q41 18WT	POWER SUNROOF OPEN
4	Q46 18OR	POWER SUNROOF VENT OPEN/CLOSE LIMIT
5	Q43 18VT	POWER SUNROOF VENT
6	Z8 18BK/VT	GROUND



POWERTRAIN CONTROL MODULE – C1

CAV	CIRCUIT	FUNCTION
41	–	–
42	–	–
43	K4 20BK/LB	SENSOR GROUND
44	K7 20OR	8 VOLT SUPPLY
45	K10 20WT	POWER STEERING PRESSURE SWITCH SENSE
46	A14 18RD/WT	FUSED B(+)
47	Z11 20BK/WT	GROUND
48	K40 20BR/WT	IDLE AIR CONTROL MOTOR NO. 3 DRIVER
49	K60 20YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
50	Z12 20BK/TN	GROUND
51	K141 20TN/WT	DOWNSTREAM HEATED OXYGEN SENSOR SIGNAL
52	G31 18VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
53	–	–
54	–	–
55	–	–
56	G12 20TN/BK	GENERATOR LAMP DRIVER
57	K39 20GY/RD	IDLE AIR CONTROL MOTOR NO. 1 DRIVER
58	K59 20VT	IDLE AIR CONTROL MOTOR NO. 4 DRIVER
59	–	–
60	–	–

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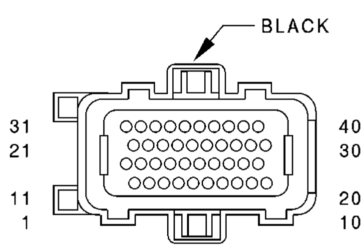
CAV	CIRCUIT	FUNCTION
61	K6 20VT/WT	5 VOLT SUPPLY
62	K29 20WT/PK	STOP LAMP SWITCH SENSE
63	–	–
64	C28 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
65	D21 20PK	SCI TRANSMIT
66	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
67	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
68	K52 20PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
69	–	–
70	–	–
71	Z2 18BK/OR	–
72	K107 18OR	VAPOR CANISTER PUMP SWITCH DRIVER
73	G21 20GY/LB	TACHOMETER SIGNAL
74	K31 18BR	FUEL PUMP RELAY CONTROL
75	D20 20LG	SCI RECEIVE
76	– **	–
76	T41 20BR/YL●●	PARK/NEUTRAL POSITION SWITCH SENSE
77	K106 18WT/LG	VAPOR CANISTER SOLENOID DRIVER
78	–	–
79	– **	–
79	K54 20OR/BK●●	TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
80	–	–



POWERTRAIN CONTROL MODULE – C2

CAV	CIRCUIT	FUNCTION
1	–	–
2	K19 18BK/GY	IGNITION COIL NO. 1, 3 DRIVER
3	K17 18DB/TN	IGNITION COIL NO. 2, 4 DRIVER
4	K20 18DG	GENERATOR FIELD DRIVER
5	V32 20YL/RD	SPEED CONTROL FEED
6	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
7	K13 18YL/WT	INJECTOR NO. 3 DRIVER
8	G3 20BK/PK	CHECK ENGINE LAMP DRIVER
9	–	–
10	Z12 18BK/TN	GROUND
11	–	–
12	–	–
13	K11 18WT/DB	INJECTOR NO. 1 DRIVER
14	–	–
15	–	–
16	K14 18LB/BR	INJECTOR NO. 4 DRIVER
17	K12 18TN	INJECTOR NO. 2 DRIVER
18	K173 20LG	RAD FAN PULSE CONTROL
19	–	–
20	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)
21	–	–
22	–	–
23	G4 20DB	FUEL LEVEL SENSOR SIGNAL
24	K42 20BK/LG●	KNOCK SENSOR SIGNAL
24	K42 20DB/LG*	KNOCK SENSOR SIGNAL

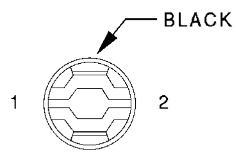
(CONTINUED ON NEXT PAGE)

* 2.0L (SOHC) ENGINE
● 2.0L (DOHC) ENGINE
** MTX
●● ATX

PLL08027 978W-1

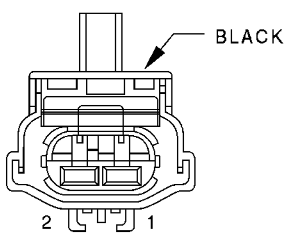
(CONTINUED)

CAV	CIRCUIT	FUNCTION
25	–	–
26	K2 20TN/DB*	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
26	K2 20TN/BK●	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
27	–	–
28	–	–
29	–	–
30	K41 20BK/DG	UPSTREAM HEATED OXYGEN SENSOR SIGNAL
31	–	–
32	K24 20GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
33	K44 20TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
34	–	–
35	K22 20OR/DB	THROTTLE POSITION SENSOR SIGNAL
36	K1 18DG/RD	MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
37	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
38	C20 18BR	A/C SWITCH SENSE
39	–	–
40	K35 20GY/YL	EXHAUST GAS RECIRCULATION SOLENOID CONTROL



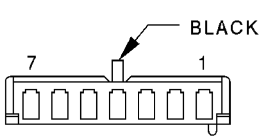
PRNDL LAMP

CAV	CIRCUIT	FUNCTION
1	E2 22OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	Z3 20BK/OR	GROUND



RADIATOR FAN MOTOR

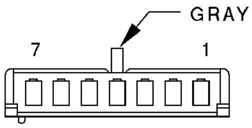
CAV	CIRCUIT	FUNCTION
1	C25 14LG	RADIATOR FAN RELAY OUTPUT
2	Z1 14BK	GROUND



RADIO - C1

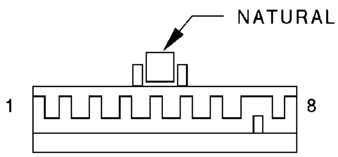
CAV	CIRCUIT	FUNCTION
1	–	–
2	X51 22BR/YL	LEFT REAR SPEAKER (–)
3	X52 22DB/WT	RIGHT REAR SPEAKER (+)
4	X53 22DG	LEFT FRONT SPEAKER (+)
5	X54 22VT	RIGHT FRONT SPEAKER (+)
6	X57 22BR/LB	LEFT REAR SPEAKER (–)
7	X58 22DB/OR	RIGHT REAR SPEAKER (–)

* 2.0L (SOHC) ENGINE
● 2.0L (DOHC) ENGINE



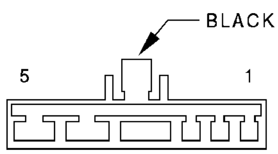
RADIO - C2

CAV	CIRCUIT	FUNCTION
1	–	–
2	X55 22BR/RD	LEFT FRONT SPEAKER (–)
3	X56 22DB/RD	RIGHT FRONT SPEAKER (–)
4	L7 20BK/YL	PARK LAMP SWITCH OUTPUT
5	E2 22OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
6	X12 20RD/WT	FUSED IGNITION SWITCH OUTPUT (ACC/RUN)
7	M1 22 PK	FUSED B(+)



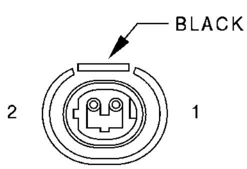
REAR FOG
LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	–	–
2	F61 18WT/OR	FOG LAMP FEED
3	L38 18BR/WT	REAR FOG LAMP FEED
4	L2 14LG	HEADLAMP SWITCH FEED
5	Z3 20BK/OR	GROUND
5	Z3 20BK/OR	GROUND
6	E2 22OR	FUSED ILLUMINATION FEED
7	L35 20BR/RD	FRONT FOG LAMP FEED
8	–	–



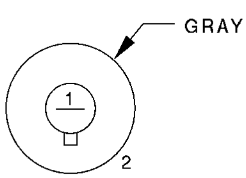
REAR WINDOW
DEFOGGER SWITCH

CAV	CIRCUIT	FUNCTION
1	E2 220R	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	Z2 22BK/LG	GROUND
3	F20 22WT	FUSED IGNITION SWITCH OUTPUT (RUN)
4	A4 14BK/RD	FUSED B(+)
5	C15 14BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT



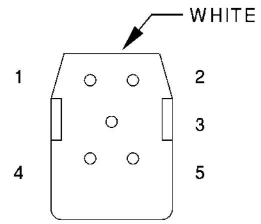
RIGHT
AIRBAG IMPACT SENSOR

CAV	CIRCUIT	FUNCTION
1	R46 18BR/LB	RIGHT IMPACT SENSOR LINE 1
2	R48 18TN	RIGHT IMPACT SENSOR LINE 2



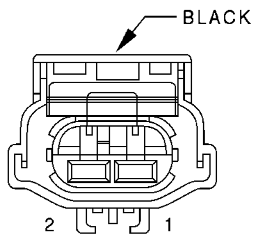
RIGHT BACK-UP
LAMP

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP SENSE
2	Z1 18BK	GROUND



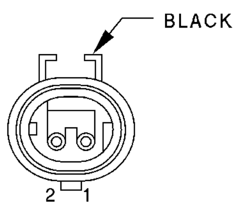
RIGHT DOOR
LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	P33 18OR/BK	DOOR LOCK DRIVER
2	P36 18PK/VT	DOOR UNLOCK SWITCH OUTPUT
3	F35 18RD/YL	FUSED B(+)
4	P35 18OR/VT	LEFT DOOR LOCK SWITCH OUTPUT
5	P34 18PK/BK	DOOR UNLOCK DRIVER



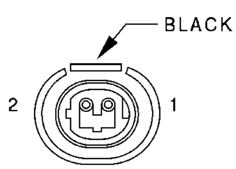
RIGHT DOOR
WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q22 14VT	RIGHT FRONT DOWN
2	Q12 14BR	RIGHT FRONT UP



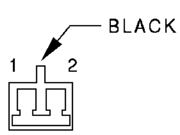
RIGHT FOG
LAMP

CAV	CIRCUIT	FUNCTION
1	L39 18LB/WT	FRONT FOG LAMPS SWITCH OUTPUT
2	Z1 20BK	GROUND



RIGHT FRONT
DOOR LOCK
MOTOR

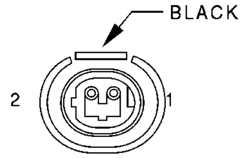
CAV	CIRCUIT	FUNCTION
1	P34 18PK/BK	DOOR UNLOCK DRIVER
2	P33 18OR/BK	DOOR LOCK DRIVER



RIGHT FRONT
DOOR SPEAKER

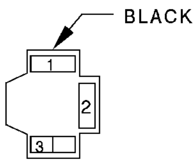
CAV	CIRCUIT	FUNCTION
1	X56 22DB/RD	RIGHT FRONT SPEAKER (–)
2	X54 22VT	RIGHT FRONT SPEAKER (+)

PLL08030 978W-1



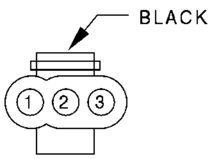
RIGHT FRONT
WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B6 20WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (+)
2	B7 20WT	RIGHT FRONT WHEEL SPEED SENSOR (–)



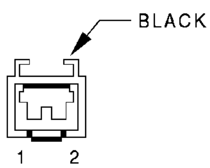
RIGHT
HEADLAMP

CAV	CIRCUIT	FUNCTION
1	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
2	L44 18VT/BK	FUSED RIGHT LOW BEAM OUTPUT
3	Z1 18BK	GROUND



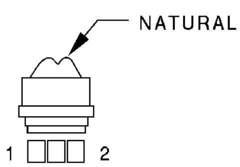
RIGHT HEADLAMP
LEVELING MOTOR

CAV	CIRCUIT	FUNCTION
1	L43 22VT	RIGHT HEADLAMP FEED
2	L13 22BR/YL	HEADLAMP LEVELING SIGNAL FROM SWITCH
3	Z1 22BK	GROUND



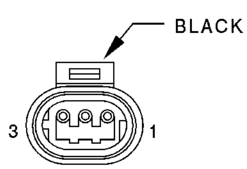
RIGHT INSTRUMENT
PANEL SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X54 22VT	RIGHT FRONT SPEAKER (+)
2	X56 22DB/RD	RIGHT FRONT SPEAKER (–)



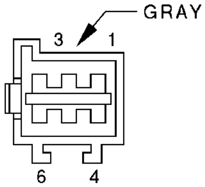
RIGHT LICENSE
LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L7 20BK/YL	LICENSE LAMP FEED



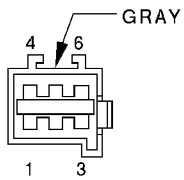
RIGHT PARK/TURN
SIGNAL LAMP

CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	L7 18BK/YL	PARK LAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



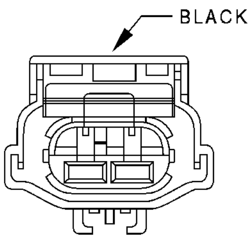
RIGHT
POWER MIRROR

CAV	CIRCUIT	FUNCTION
1	P90 20LG/BK	LEFT/RIGHT POWER MIRROR VERTICAL SUPPLY
2	–	
3	P92 20YL	LEFT POWER MIRROR (VERTICAL)
4	P94 20WT/YL	LEFT POWER MIRROR (HORIZONTAL)
5	–	–
6	P91 20WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY



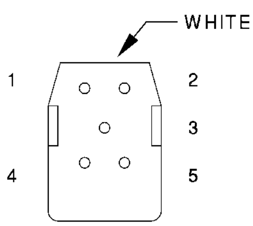
RIGHT POWER
MIRROR MOTOR

CAV	CIRCUIT	FUNCTION
1	P90 20LG/BK	MIRROR MOTOR B+(DOWN) B–(UP)
2	–	–
3	P92 20YL	MIRROR MOTOR B+(UP) B–(DOWN)
4	P94 20WT/YL	MIRROR MOTOR B+(LEFT) B–(RIGHT)
5	–	–
6	P91 20WT/BK	MIRROR MOTOR B+(RIGHT) B–(LEFT)



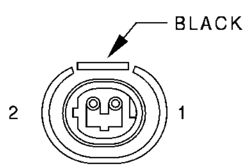
RIGHT POWER
WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q22 14VT	RIGHT FRONT DOWN
2	Q12 14BR	RIGHT FRONT UP



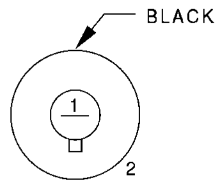
RIGHT POWER
WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q12 14BR	RIGHT FRONT UP
2	Q26 14VT/WT	MASTER SWITCH RIGHT FRONT DOWN
3	F21 14TN	FUSED IGNITIOIN SWITCH OUTPUT (RUN/START)
4	Q16 14BR/WT	MASTER SWITCH RIGHT FRONT UP
5	Q22 14VT	RIGHT FRONT DOWN



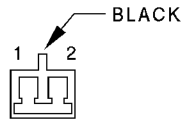
RIGHT REAR
DOOR LOCK
MOTOR

CAV	CIRCUIT	FUNCTION
1	P34 18PK/BK	DOOR UNLOCK DRIVER
2	P33 18OR/BK	DOOR LOCK DRIVER



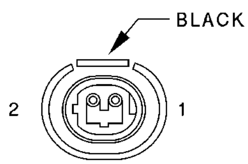
RIGHT REAR
FOG LAMP

CAV	CIRCUIT	FUNCTION
1	L38 18BR/WT	REAR FOG LAMP FEED
2	Z1 18BK	GROUND



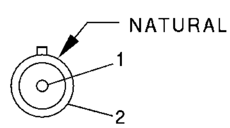
RIGHT REAR
SPEAKER

CAV	CIRCUIT	FUNCTION
1	X52 22DB/WT	RIGHT REAR SPEAKER (+)
2	X58 22DB/OR	RIGHT REAR SPEAKER (–)



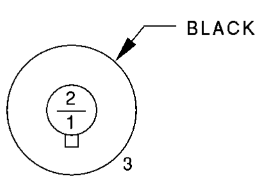
RIGHT REAR
WHEEL SPEED
SENSOR

CAV	CIRCUIT	FUNCTION
1	B1 20WT/BK	RIGHT REAR WHEEL SPEED SENSOR (–)
2	B2 20DG/WT	RIGHT REAR WHEEL SPEED SENSOR (+)



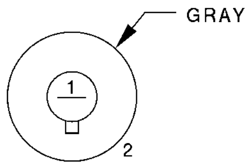
RIGHT REPEATER
LAMP

CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	Z1 18BK	GROUND



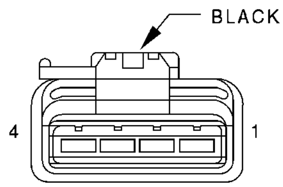
RIGHT TAIL/STOP LAMP

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	TAIL/STOP
2	L7 18BK/YL	TAIL/STOP
3	Z1 18BK	GROUND



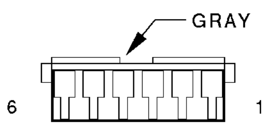
RIGHT TURN SIGNAL LAMP

CAV	CIRCUIT	FUNCTION
1	L63 18DG/RD	RIGHT TURN SIGNAL LAMP FEED
2	Z1 18BK	GROUND



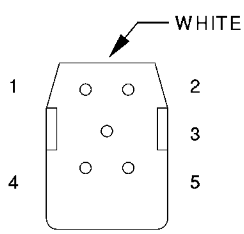
SOLID STATE FAN RELAY

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	K173 20DG	RADIATOR FAN RELAY CONTROL
3	C25 14LG	ENGINE FAN FEED
4	A16 14GY	RADIATOR FAN RELAY FEED



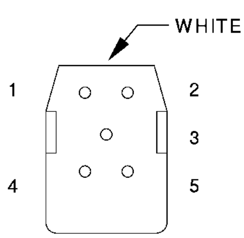
STOP LAMP
SWITCH

CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	STOP LAMP SWITCH SENSE
2	Z12 20BK/TN	GROUND
3	–	–
4	–	–
5	L50 20WT/TN	STOP LAMP SWITCH OUTPUT
6	F32 18PK/DB	FUSED B(+)



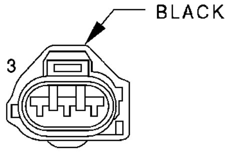
SUNROOF
SLIDE SWITCH

CAV	CIRCUIT	FUNCTION
1	Q42 18LB	POWER SUNROOF CLOSE
2	Q46 18OR	POWER SUNROOF VENT OPEN/CLOSE LIMIT
3	F10 18YL/RD	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
4	Q45 18PK/BK	POWER SUNROOF VENT CLOSE
5	Q41 18WT	POWER SUNROOF OPEN



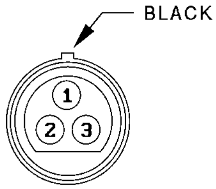
SUNROOF
VENT SWITCH

CAV	CIRCUIT	FUNCTION
1	Q45 18PK/BK	POWER SUNROOF VENT CLOSE
2	Z8 18BK/VT	GROUND
3	F10 18YL/RD	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
4	Z8 18BK/VT	GROUND
5	Q43 18VT	POWER SUNROOF VENT



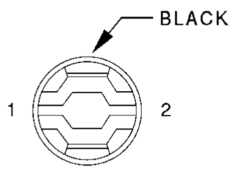
THROTTLE POSITION (TPS) SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K22 20OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K6 20VT/WT	5 VOLT SUPPLY



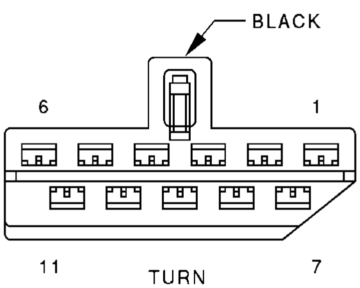
TORQUE CONVERTOR CLUTCH (TCC) SOLENOID – (ATX)

CAV	CIRCUIT	FUNCTION
1	–	–
2	K54 20OR/BK	TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
3	F12 20DG/WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)



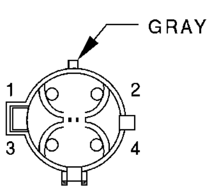
TRUNK LAMP

CAV	CIRCUIT	FUNCTION
1	M1 22PK	FUSED B(+)
	M1 22PK	FUSED B(+)
2	M4 22GY/BK	TRUNK LAMP SWITCH OUTPUT



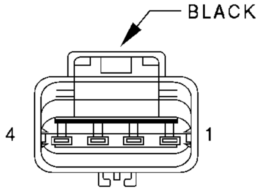
TURN SIGNAL/HAZARD SWITCH

CAV	CIRCUIT	FUNCTION
1	L60 22TN	RIGHT TURN SIGNAL
2	–	–
3	L62 20BR/RD	RIGHT REAR STOP/TURN SIGNAL LAMP OUTPUT
4	L32 20PK	COMBINATION FLASHER OUTPUT
5	L5 20BK	FUSED IGNITION SWITCH OUTPUT (RUN)
6	L9 22BK/WT	FUSED B(+)
7	–	–
8	–	–
9	L63 20DG/RD	LEFT REAR STOP/TURN SIGNAL LAMP OUTPUT
10	L61 22LG	LEFT TURN SIGNAL
11	L55 20BK/YL	COMBINATION FLASHER INPUT



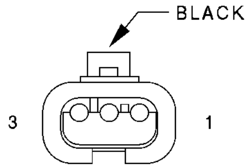
UPSTREAM HEATED OXYGEN SENSOR

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 20BK/LB	SENSOR GROUND
4	K41 20BK/DG	UPSTREAM HEATED OXYGEN SENSOR SIGNAL



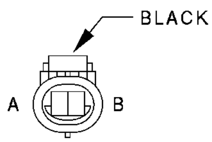
VAPOR CANISTER LEAK DETECTOR

CAV	CIRCUIT	FUNCTION
1	–	–
2	F12 18DG/WT	FUSED IGNITION SWITCH OUTPUT (RUN/START)
3	K106 18WT/LG	VAPOR CANISTER SOLENOID DRIVER
4	K107 18OR	VAPOR CANISTER PUMP SWITCH DRIVER



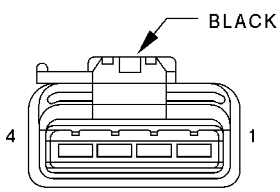
VEHICLE SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	K7 18OR	8 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL



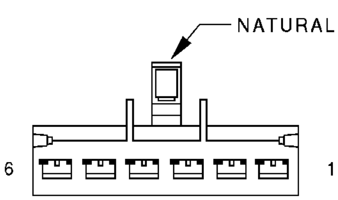
WINDSHIELD WASHER PUMP MOTOR

CAV	CIRCUIT	FUNCTION
A	V10 18BR	WASHER PUMP CONTROL SWITCH OUTPUT
B	Z1 18BK	GROUND



WIPER MOTOR

CAV	CIRCUIT	FUNCTION
1	V4 18RD/YL	WIPER SWITCH HIGH SPEED OUTPUT
2	V3 18BR/WT	WIPER SWITCH LOW SPEED OUTPUT
3	V5 18DG/YL	WIPER RELAY COMMON
4	F13 18DB	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)



WIPE/WASH SWITCH

CAV	CIRCUIT	FUNCTION
1	–	–
2	V5 18DG/YL	WIPER RELAY COMMON
3	V10 18BR	WINDSHIELD WASHER RELAY OUTPUT
4	V3 18BR/WT	WIPER SWITCH LOW SPEED OUTPUT
5	F13 18DB	FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
6	V4 18RD/YL	WIPER SWITCH HIGH SPEED OUTPUT

8W-90 CONNECTOR/GROUND LOCATIONS

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of components, grounds, and connectors in the vehicle. A index is provided. Use the wiring diagrams in each section for connector/ground number identification. Refer to the index for the proper figure number.

CONNECTOR/GROUND LOCATIONS

For items not shown in this section a N/S is placed in the Fig. column.

Connector Name/Number	Color	Location	Fig.
A/C Compressor Clutch	BK	Top of A/C Compressor	9
A/C Cycling Switch	BK	Center of HVAC Housing	N/S
A/C-Heater Blower Motor	BK	RT Side of HVAC Housing	N/S
A/C-Heater Control Switch	BK	Rear of HVAC Control	15
A/C Hi-Pressure Switch	GY	Top of A/C Compressor	9
A/C Low Pressure Switch	BK	RT Rear Cowl Panel	5
ABS Relay Box	DK/ GY	On ABS Hydraulic Unit	3
Airbag Control Module C1	YL	Rear of Gearshift	13
Ash Receiver Lamp	BK	At Lamp	N/S
Back-Up Lamp Switch	GY	Top of Transmission	4
Battery Temp Sensor	BK	Front Lower of Battery Tray	7
Blower Motor Resistor Block	NAT	RT Side Cowl Panel	10
Brake Warning Lamp Switch	BK	LT Frame Rail	6
C101	BR	Top Center of I.P.	15
C102	BK	Top Center of I.P.	15
C103	BL	Top Center of I.P.	15
C105	BK	LT Kick Panel	N/S
C108	BK	Rear of ABS Hydraulic Unit	3

Connector Name/Number	Color	Location	Fig.
C160	LT/ GY	Near PDC	6
C161	BK	Near PDC	6
C205	BL	LT Kick Panel	16
C206	BL	Top Right of I.P.	15
C225	RD	Top of I.P.	15
C230	GY	LT Side of I.P.	14
C231	BL	LT Side of I.P.	14
C301	GY	RT B-Pillar	19
C303	GY	LT B-Pillar	19
C309	BK	LT Rear Wheel Well	22
Camshaft Position Sensor	BK	LT Rear of Cyl Head	8
CHMSL	BK	Rear of Lamp	22
Clockspring	NAT	Rear of Steering Wheel	12
Clutch Pedal Position Switch	BK	Top of Clutch Pedal	2
Controller Anti-Lock Brake	BK	LT Kick Panel	3
Crankshaft Position Sensor	BK	Rear of Engine	8
Data Link Connector	BK	LT Side of Steering Column	14
Daytime Running Lamp Module	BK	Rear of Radio	15
Dome Lamp	BK	LT C-Pillar	20
Downstream Heated Oxygen Sensor	GY	RT Rear of Engine	5
Driver Side Airbag Squib	YL	Rear of Clockspring	12

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Duty Cycle Evap/Purge Solenoid	GY	RT Strut Tower	5
Engine Coolant Temp Sensor	BK	LT Side of Cylinder Head	8
EGR Solenoid Transducer	GY	LT Rear of Cylinder Head	8
Fog Lamp Switch	NAT	Rear of Switch	16
Fuel Injector #1	BK	At Injector	9
Fuel Injector #2	BK	At Injector	9
Fuel Injector #3	BK	At injector	9
Fuel Injector #4	BK	At Injector	9
Fuel Tank Module	LT/ GY	At Module	23
G101		Top LT of Radiator Closure Panel	6
G102		Top LT of Radiator Closure Panel	6
G103		RT Radiator Closure Panel	5
G104		Front Lower of Engine	N/S
G105		Front of Battery	6
G106		LT Frame Rail	6
G201		RT Side of I.P. Center Stack	15
G202		RT Side of I.P. Center Stack	15
G203		LT Side of I.P. Center Stack	15
G204		LT Side of I.P. Center Stack	15
G301		RT Rear Quarter Panel	24
G302		LT Rear Quarter Panel	24
G303		LT Rear Quarter Panel	24
Generator	GY	Rear of Generator	8
Glove Box Lamp and Switch	GY	Rear of Switch	16

Connector Name/Number	Color	Location	Fig.
Headlamp Dimmer/Optical Horn Switch	BK	Rear of Switch	12
Headlamp Switch	BK	Bottom of Switch	14
Heater Blower Motor	BK	RT Side of HVAC Housing	N/S
Horn	BK	LT Inner Fender	7
Idle Air Control Motor	BK	On Throttle Body	9
Ignition Coil Pack	BK	Top of Valve Cover	8
Ignition Switch	BK	Rear of Switch	12
Ignition Switch Lamp	BK	At Lamp	N/S
Instrument Cluster C1	BK	LT Side of Cluster	17
Instrument Cluster C2	BK	RT Side of Cluster	15
Intake Air Temp/MAP Sensor	BK	RT Side of Intake	9
Key-In Switch	GN	Rear of Switch	12
Knock Sensor	GY	Front of Engine	9
Left Airbag impact Sensor	GY	LT Side of Radiator Closure Panel	1
Left Back-Up Lamp	GY	At Lamp	24
Left Door Lock Switch	WT	At Switch	18
Left Door Speaker	BK	At Speaker	18
Left Door Window Lift Motor	BK	At Motor	18
Left Fog Lamp	BK	At Lamp	5
Left Front Power Door Lock Motor	GY	At Motor	18
Left Front Side Marker Lamp	BK	At Lamp	7
Left Front Wheel Speed Sensor	GY	LT Fender Side Shield	3
Left Headlamp	BK	At Lamp	7
Left Instrument Panel Speaker	BK	At Speaker	15
Left Park/Turn Signal Lamp	BK	At Lamp	7
Left Power Mirror	GY	At Mirror	18
	BK	At Motor	19

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Left Rear Shelf Speaker	BK	At Speaker	18
Left Rear Wheel Speed Sensor	GY	LT Rear Frame Rail	N/S
Left Tail/Stop/Turn Signal Lamp	BK	At Lamp	24
License Plate Lamp	NAT	Rear of Lamp	22
Map/Reading Lamps	BK	Front of Windshield Header	11
Master Power Window Switch	BK	At Switch	18
Oil Pressure Switch	GN	Rear of Engine	8
Park/Neutral Position Switch	BK	Front of Transmission	4
Passenger Side Airbag Squib	YL	Rear of PAB	16
Power Mirror Switch	BK	At Switch	18
Power Sunroof Motor	RD	At Motor	11
Power Steering Pressure Switch	GY	LT Side of Steering Gear	6
Powertrain Control Module C1	BK	LT Fender Side Shield	6
Powertrain Control Module C2	BK	LT Fender Side Shield	6
PRNDL Illumination LED	BK	Base of Gearshift	13
Radiator Fan Motor Assy	BK	Rear of Motor	7
Radio C1	BK	Rear of Radio	15
Radio C2	GY	Rear of Radio	15
Rear Window Defogger Switch	BK	Rear of Switch	16
Remote Keyless Entry Module C1	BK	At Module	N/S
Remote Keyless Entry Module C2	LT/GY	At Module	N/S
Right Airbag Impact Sensor	GY	RT Side of Radiator Closure Panel	1
Right Back-Up Lamp	GY	At Lamp	24
RIght Door Lock Switch	WT	At Switch	18

Connector Name/Number	Color	Location	Fig.
Right Door Power Window Switch	WT	At Switch	18
Right Door Window Lift Motor	BK	At Motor	18
RIght Fog Lamp	BK	At Lamp	5
Right Front Door Speaker	BK	At Speaker	18
Right Front Power Door Lock Motor	GY	At Motor	18
Right Front Side Marker Lamp	BK	At Lamp	5
Right Front Wheel Speed Sensor	GY	RT Fender Side Shield	5
Right Headlamp	BK	At Lamp	5
Right Instrument Panel Speaker	BK	At Speaker	N/S
Right Park/Turn Signal Lamp	BK	At Lamp	5
Right Power Mirror	GY	At Mirror	18
Right Rear Power Door Lock Motor	BK	At Motor	18
Right Rear Shelf Speaker	BK	At Speaker	N/S
Right Rear Wheel Speed Sensor	GY	RT Rear Frame Rail	N/S
Right Tail/Stop Turn Signal Lamp	BK	At Lamp	24
Seat Belt Switch	BK	LT B-Pillar	N/S
Stop Lamp/Vehicle Speed Control Switch	GY	Top of Brake Pedal	2
Sunroof Slide Switch	BL	Front of Windshield Header	11
Sunroof Vent Switch	YL	Front of Windshield Header	11
Throttle Position Sensor	BK	On Throttle Body	9
Torque Converter Clutch Solenoid	BK	Front of Transmission	4
Trunk Lamp	BK	At Lamp	12
Turn Signal/Hazard Switch	BK	Rear of Switch	12
Upstream Heated Oxygen Sensor	GY	Rear of Engine	8

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Vapor Canister Leak Detector	BK	RT Front Fender	5
Vehicle Speed Control Servo	BK	Side of Battery Tray	7
Vehicle Speed Control Switch	NAT	Rear of Clockspring	12
Vehicle Speed Sensor	BK	Rear of Transmisison	4
Washer Fluid Level Switch	BK	Bottom of Reservior	N/S

Connector Name/Number	Color	Location	Fig.
Wiper/Washer Switch	NAT	Rear of Switch	12
WIndshield Washer Pump Motor	BK	Bottom of Reservior	7
Windshield Wiper Motor	BK	Center of Cowl Panel	10

DESCRIPTION AND OPERATION (Continued)

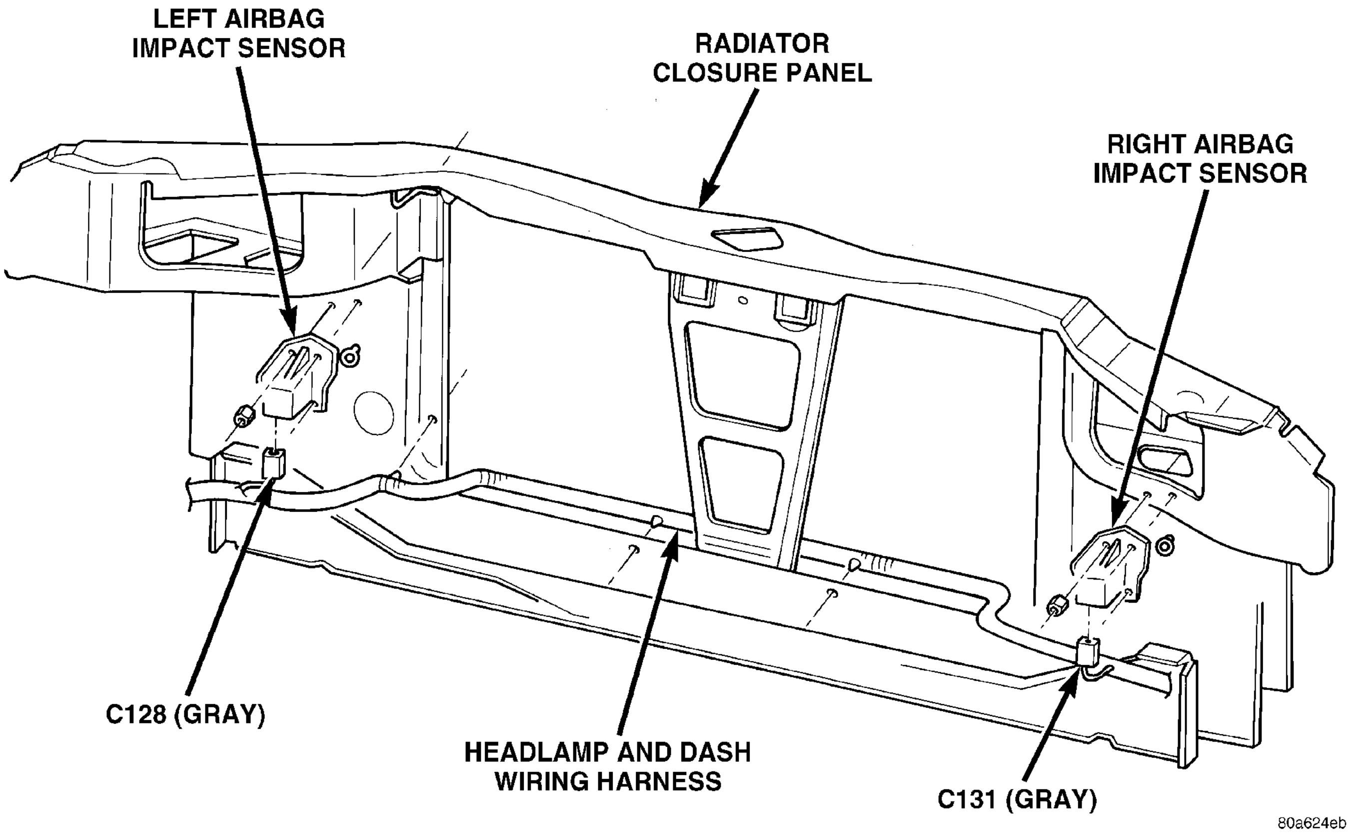


Fig. 1 Airbag Impact Sensors

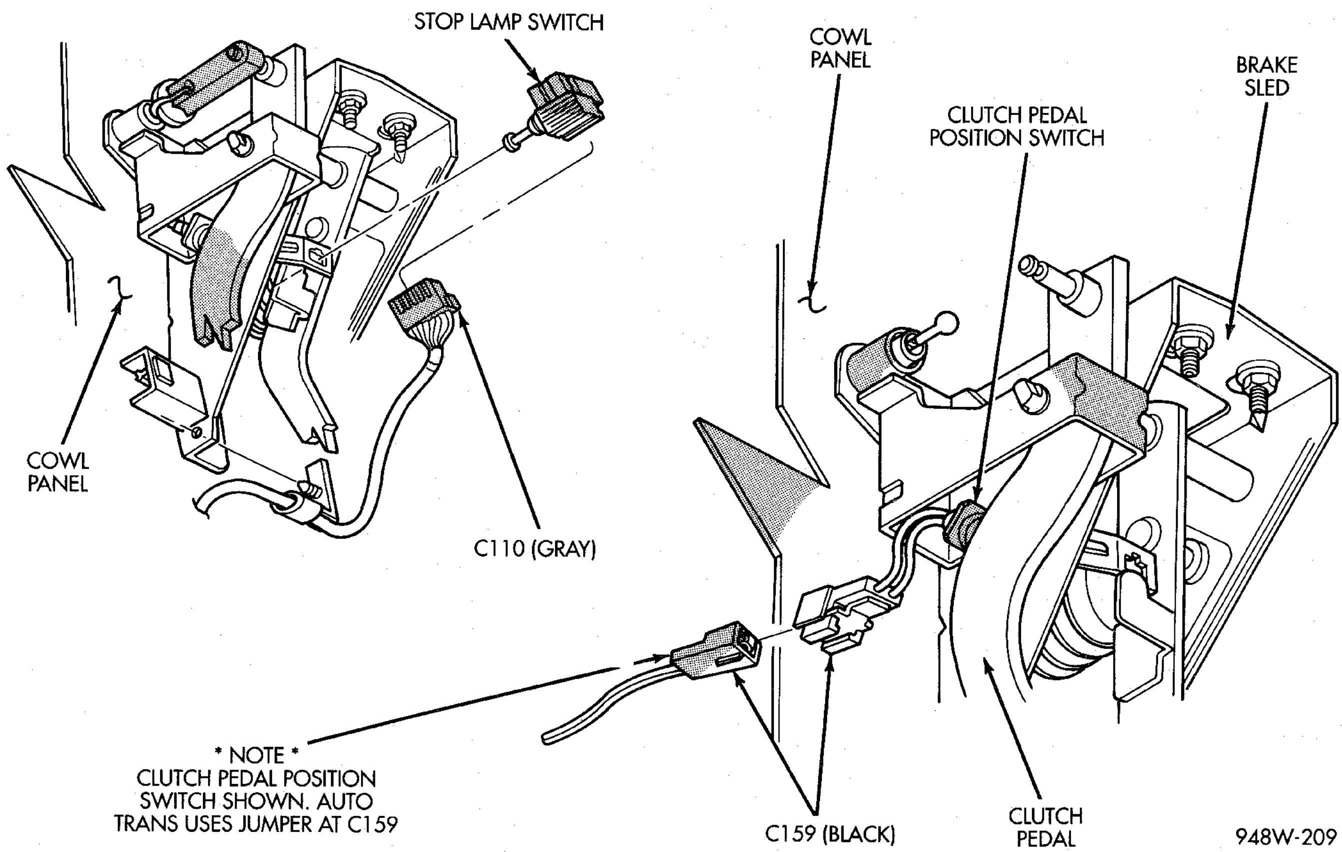


Fig. 2 Brake Support Bracket Connections

DESCRIPTION AND OPERATION (Continued)

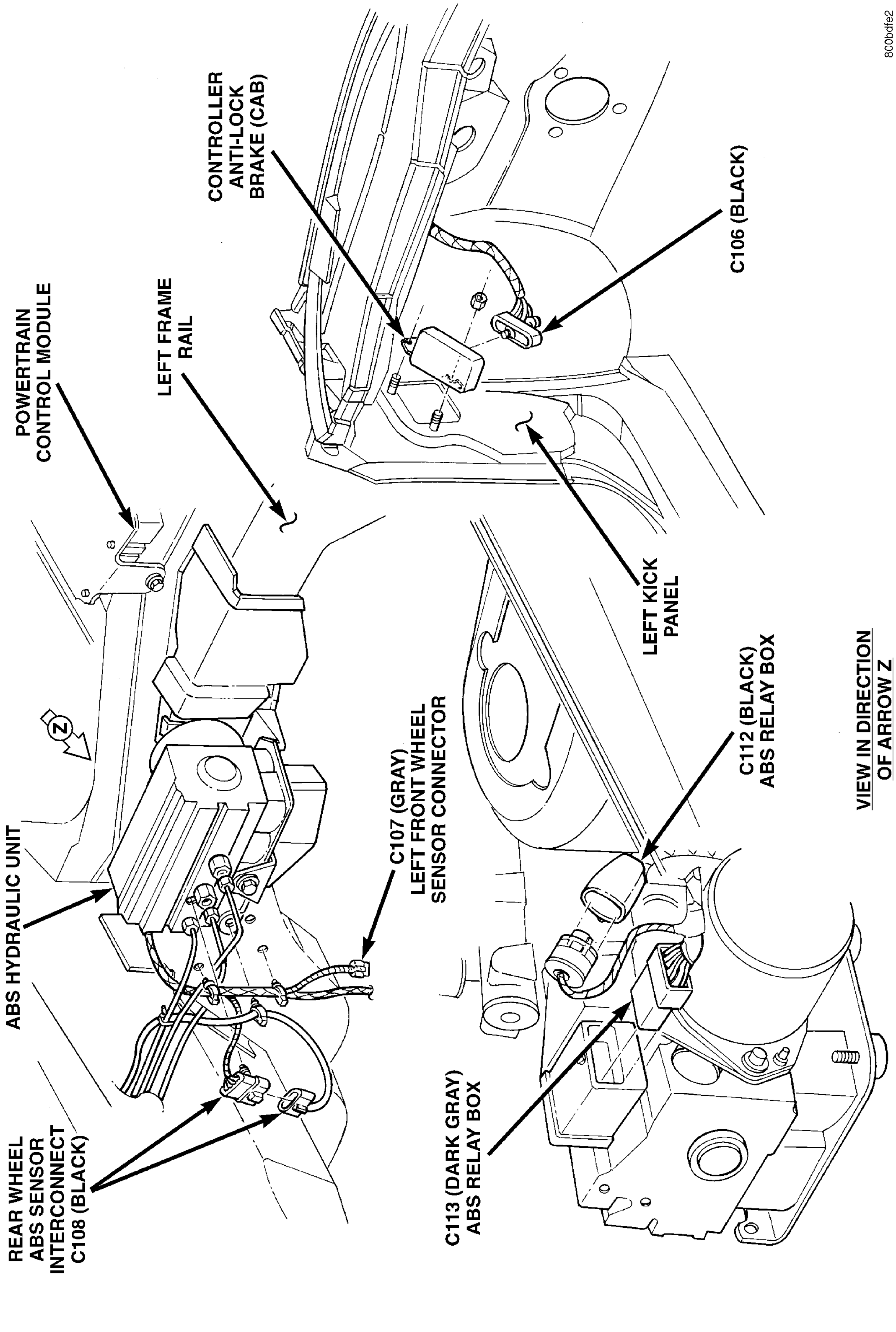


Fig. 3 ABS Connections

DESCRIPTION AND OPERATION (Continued)

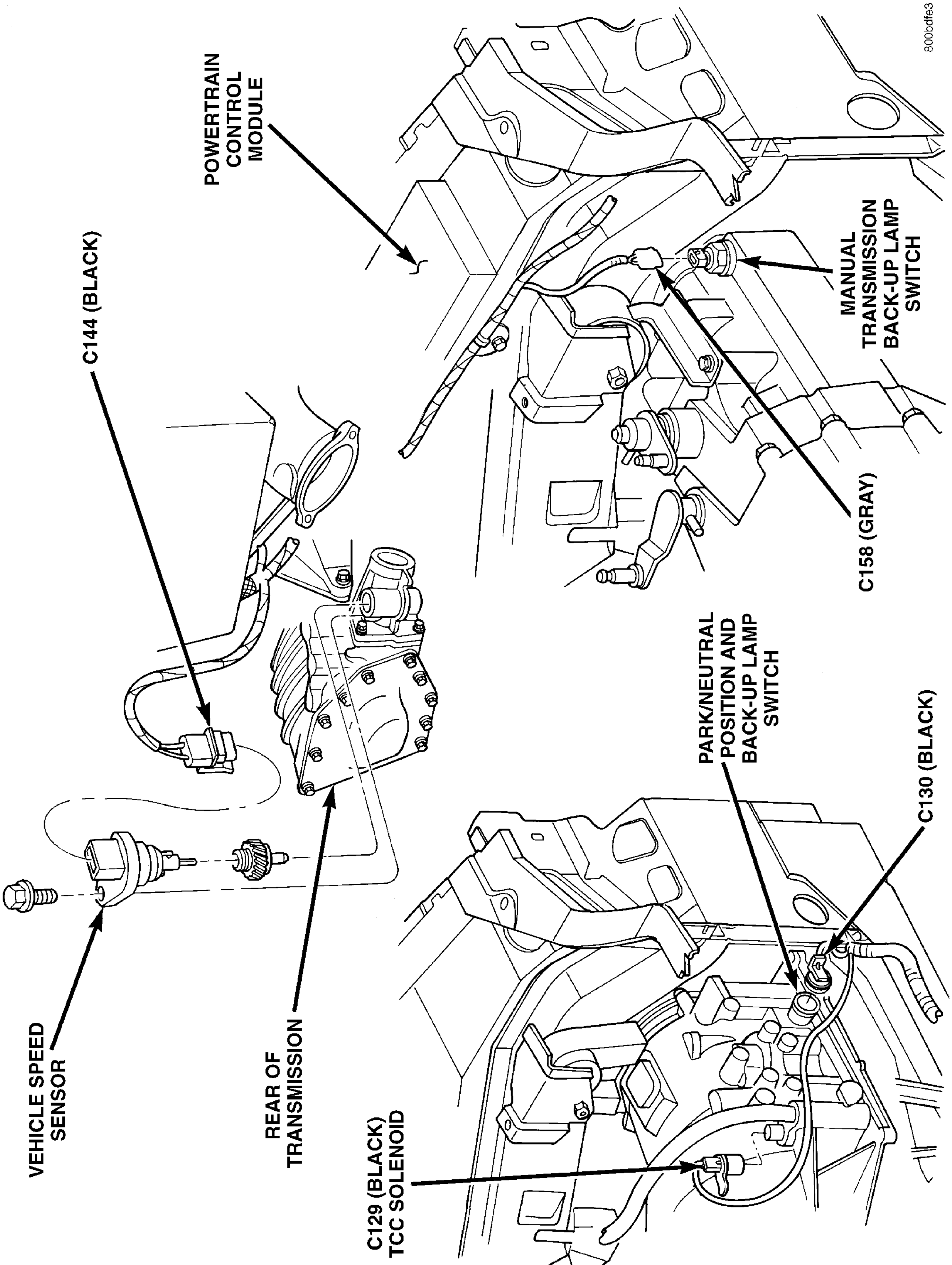


Fig. 4 Transmission Connections

DESCRIPTION AND OPERATION (Continued)

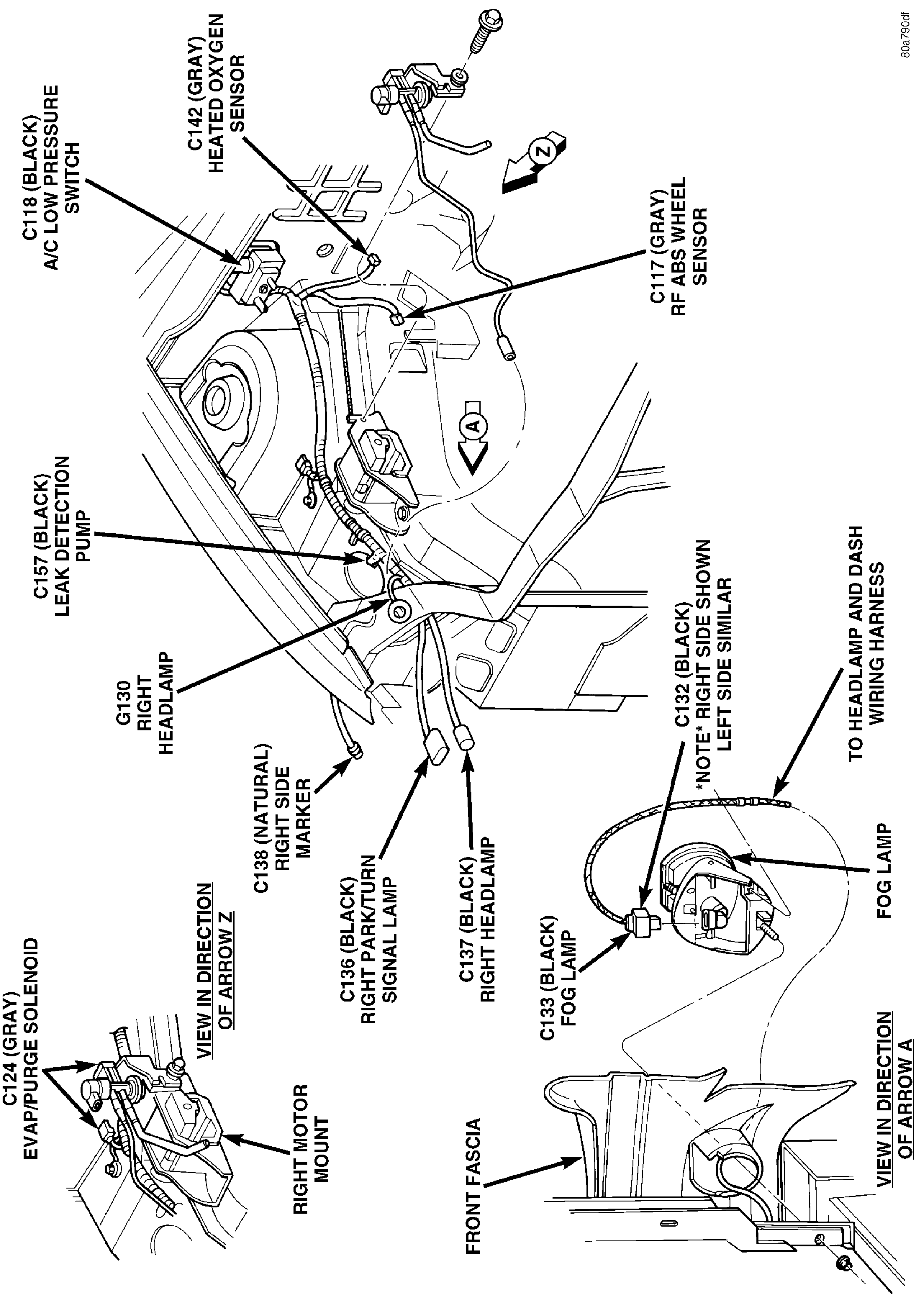


Fig. 5 Engine Compartment Connections (Right Side)

DESCRIPTION AND OPERATION (Continued)

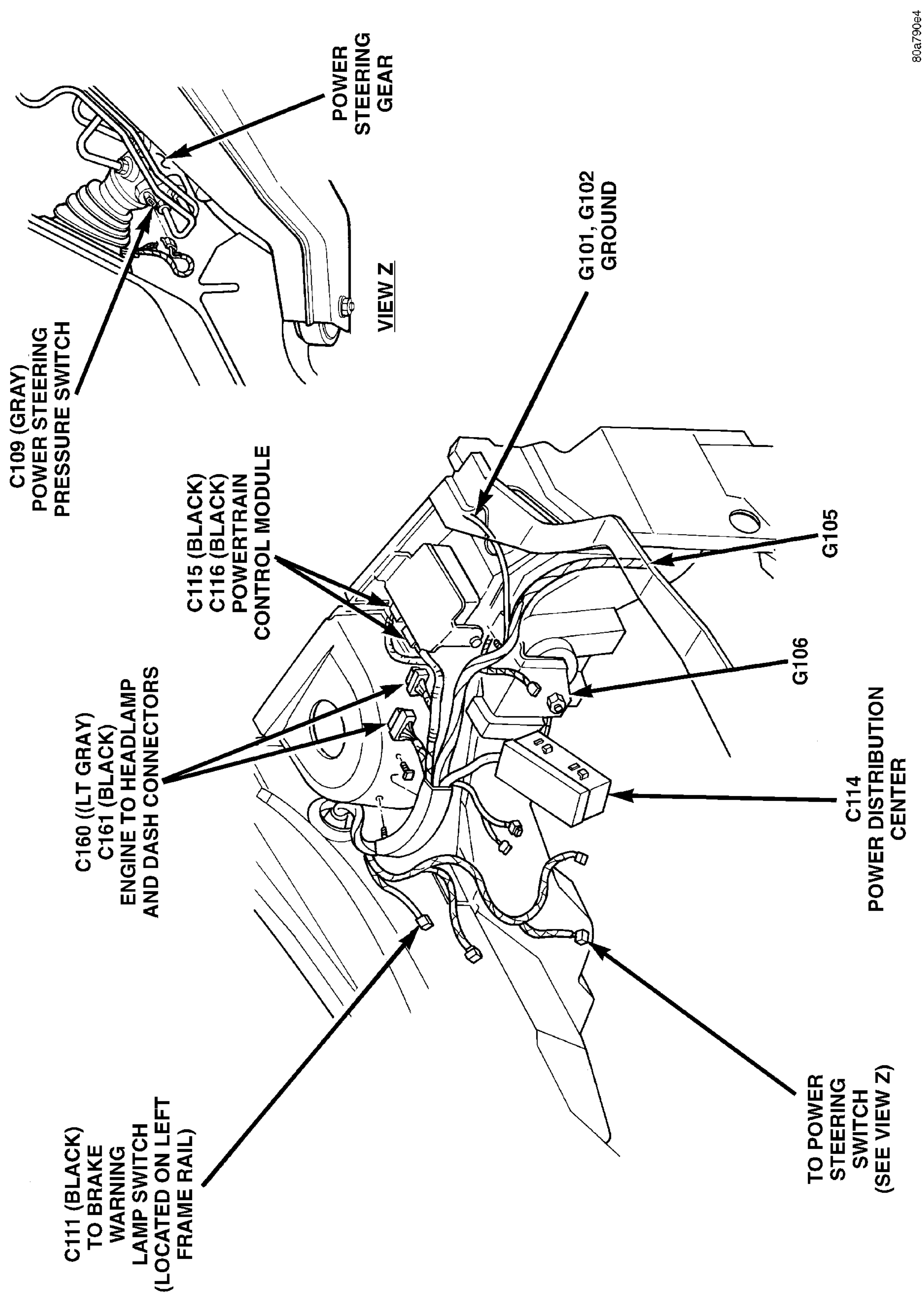


Fig. 6 Engine Compartment Connections (Left Side)

DESCRIPTION AND OPERATION (Continued)

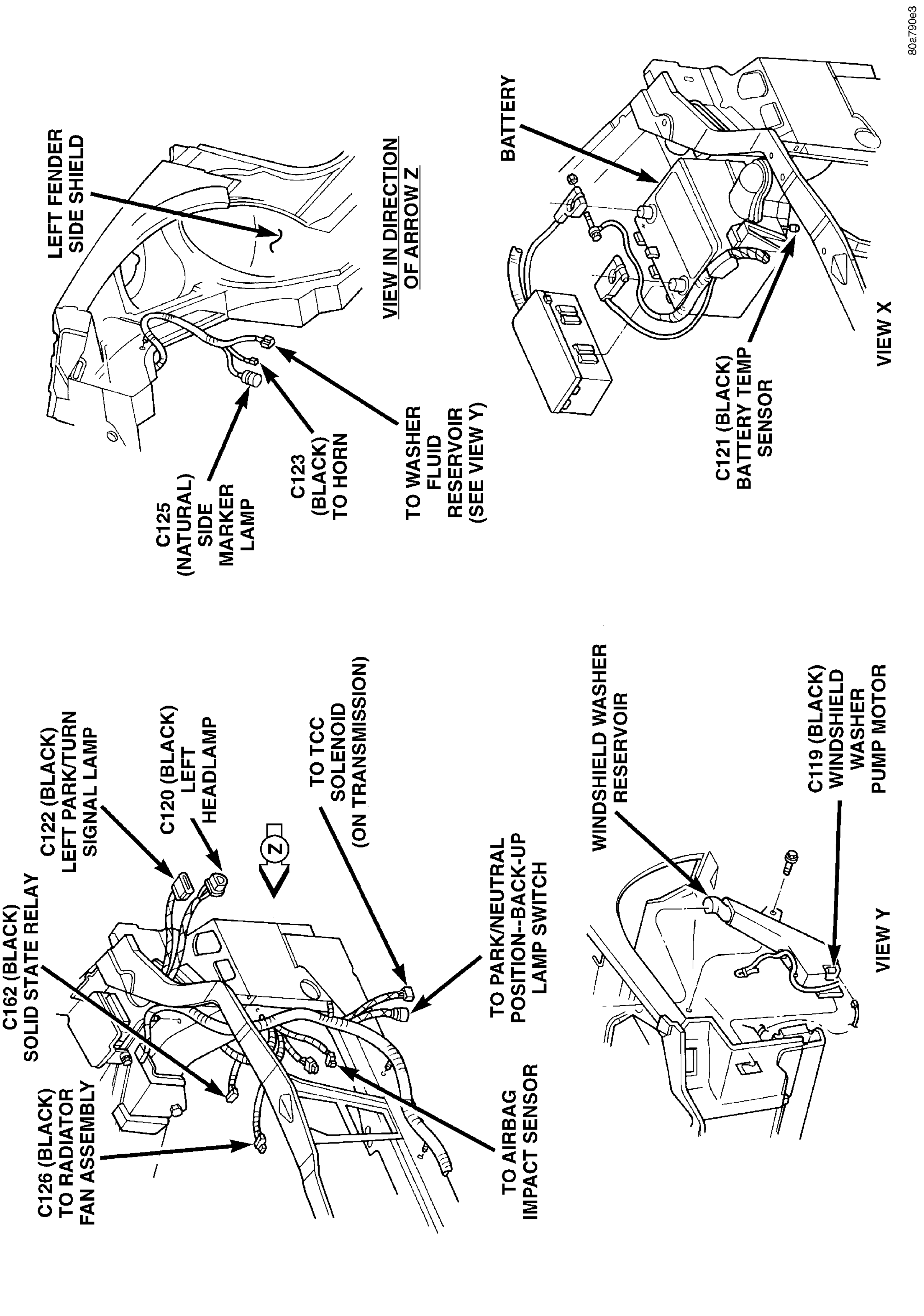


Fig. 7 Engine Compartment Connections (Left Side)

DESCRIPTION AND OPERATION (Continued)

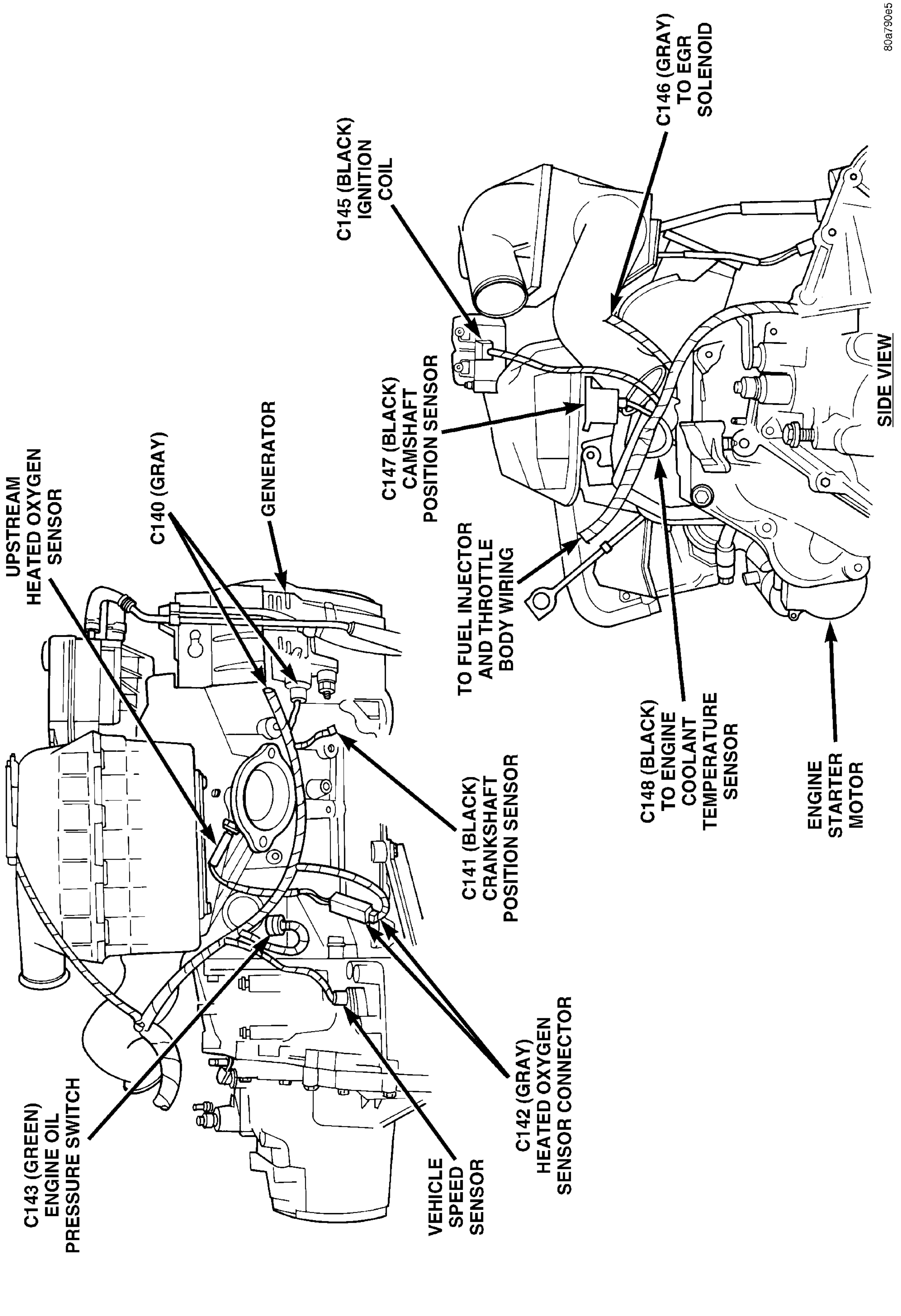


Fig. 8 Engine Connections

DESCRIPTION AND OPERATION (Continued)

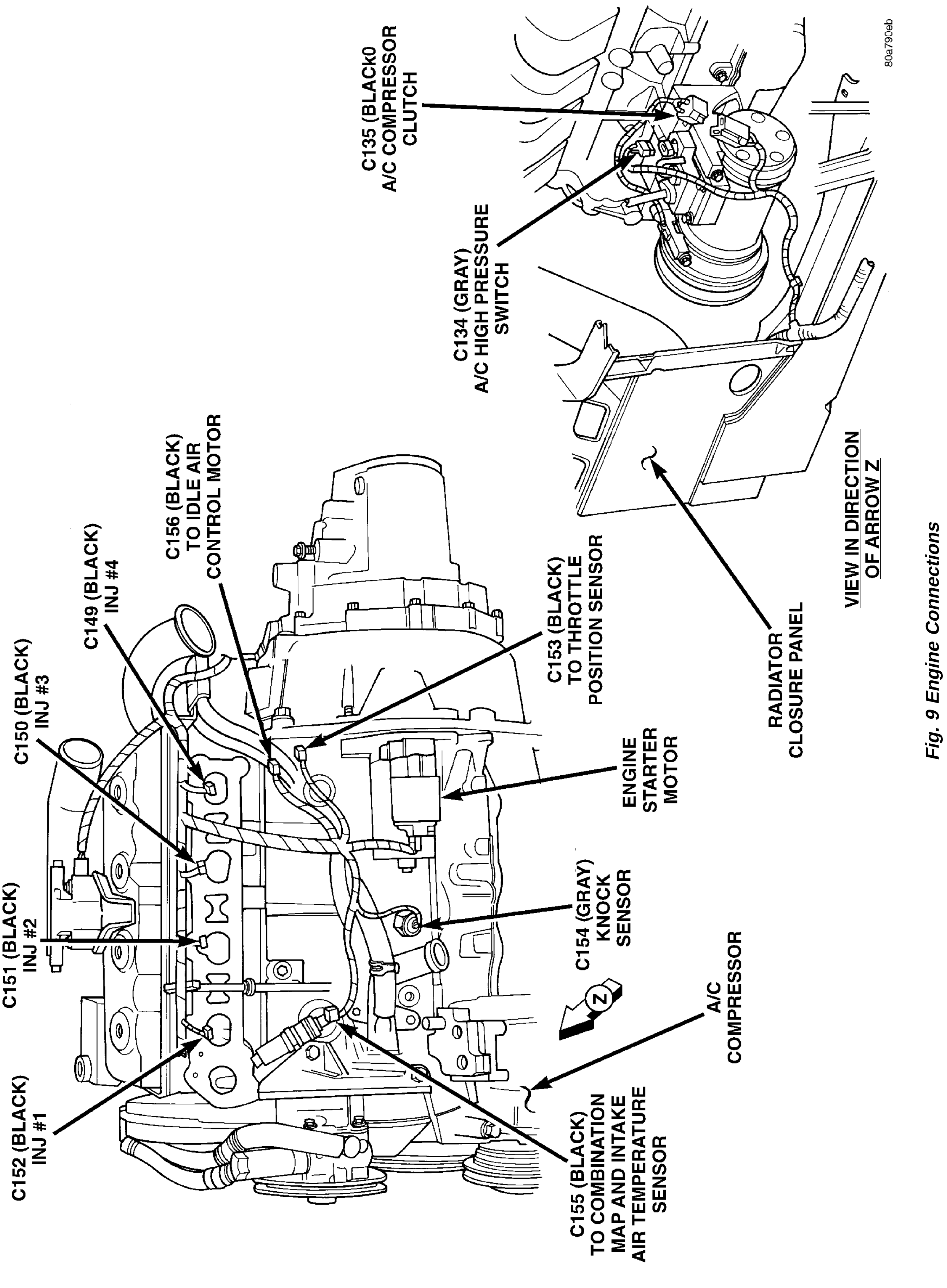


Fig. 9 Engine Connections

DESCRIPTION AND OPERATION (Continued)

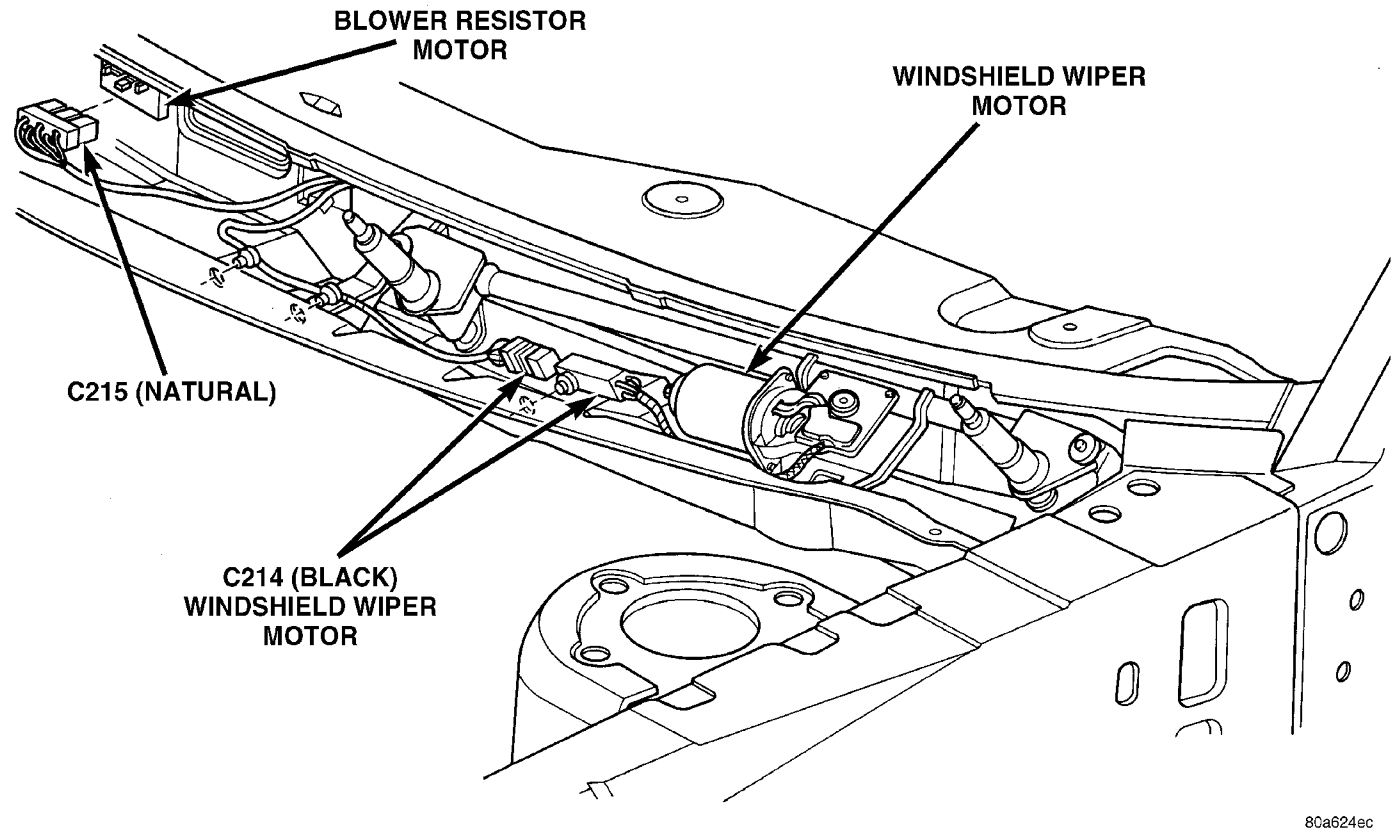


Fig. 10 Cowl Panel Connections

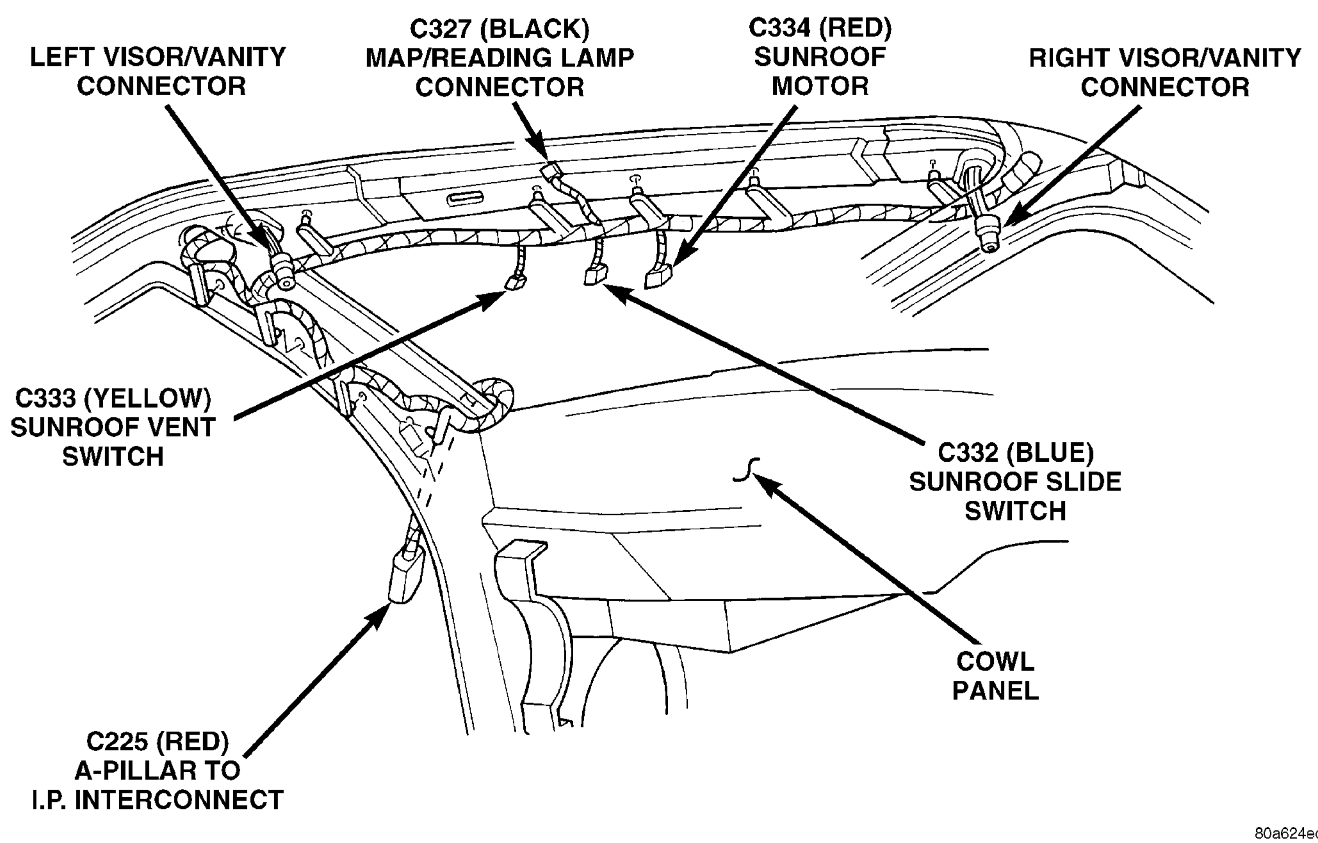


Fig. 11 Visor/Vanity Connections

DESCRIPTION AND OPERATION (Continued)

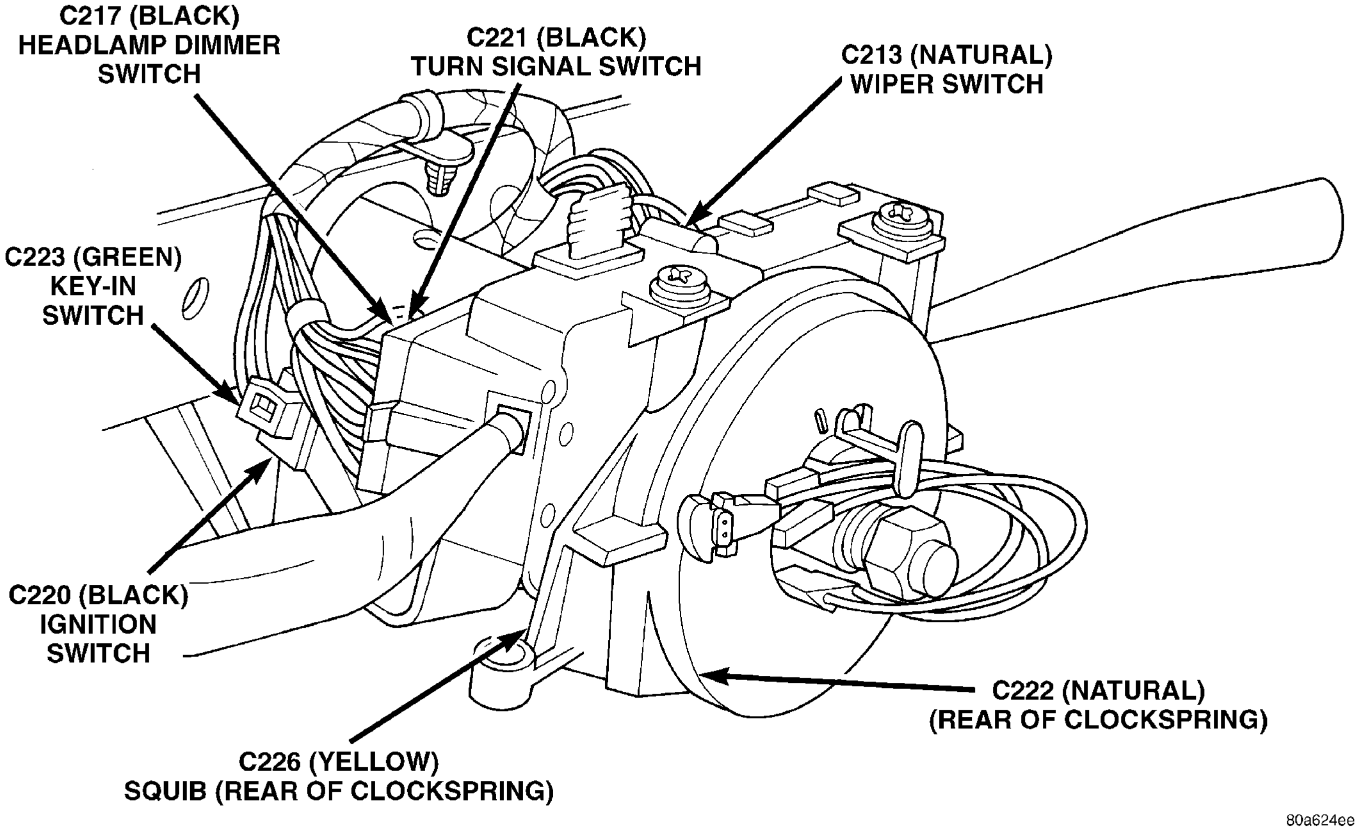


Fig. 12 Steering Column Connections

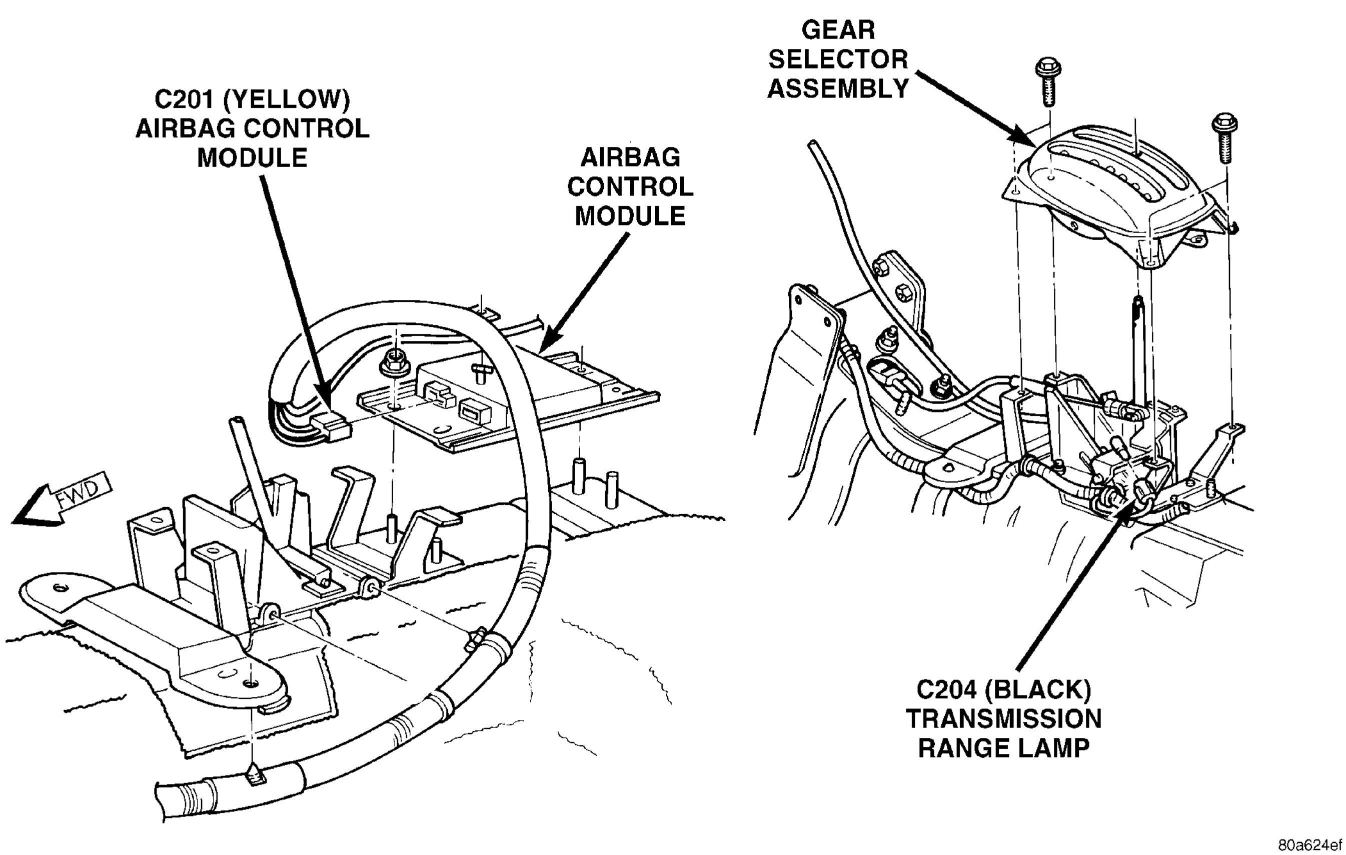


Fig. 13 Console Connections

DESCRIPTION AND OPERATION (Continued)

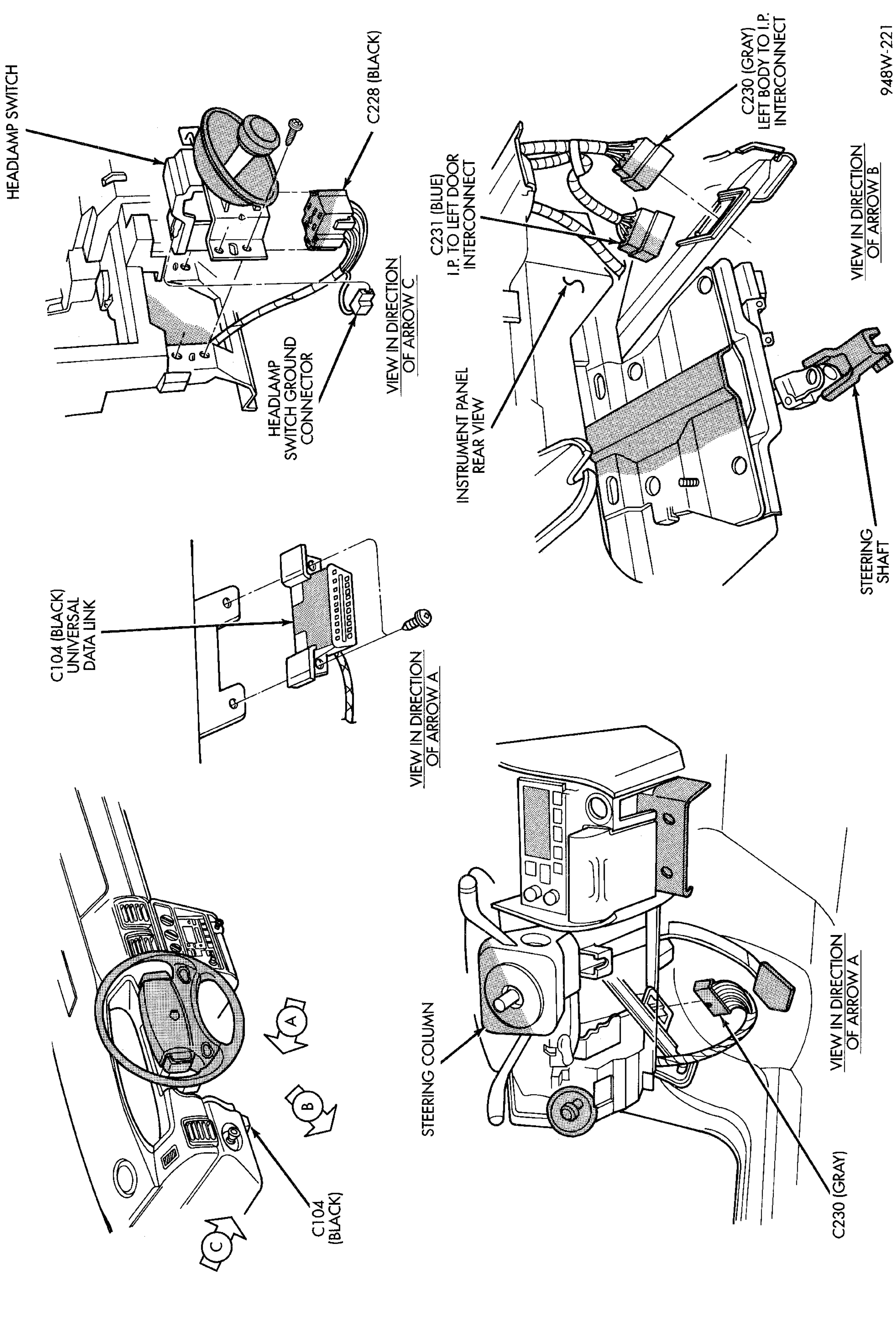


Fig. 14 Instrument Panel Connections (Left Side)

DESCRIPTION AND OPERATION (Continued)

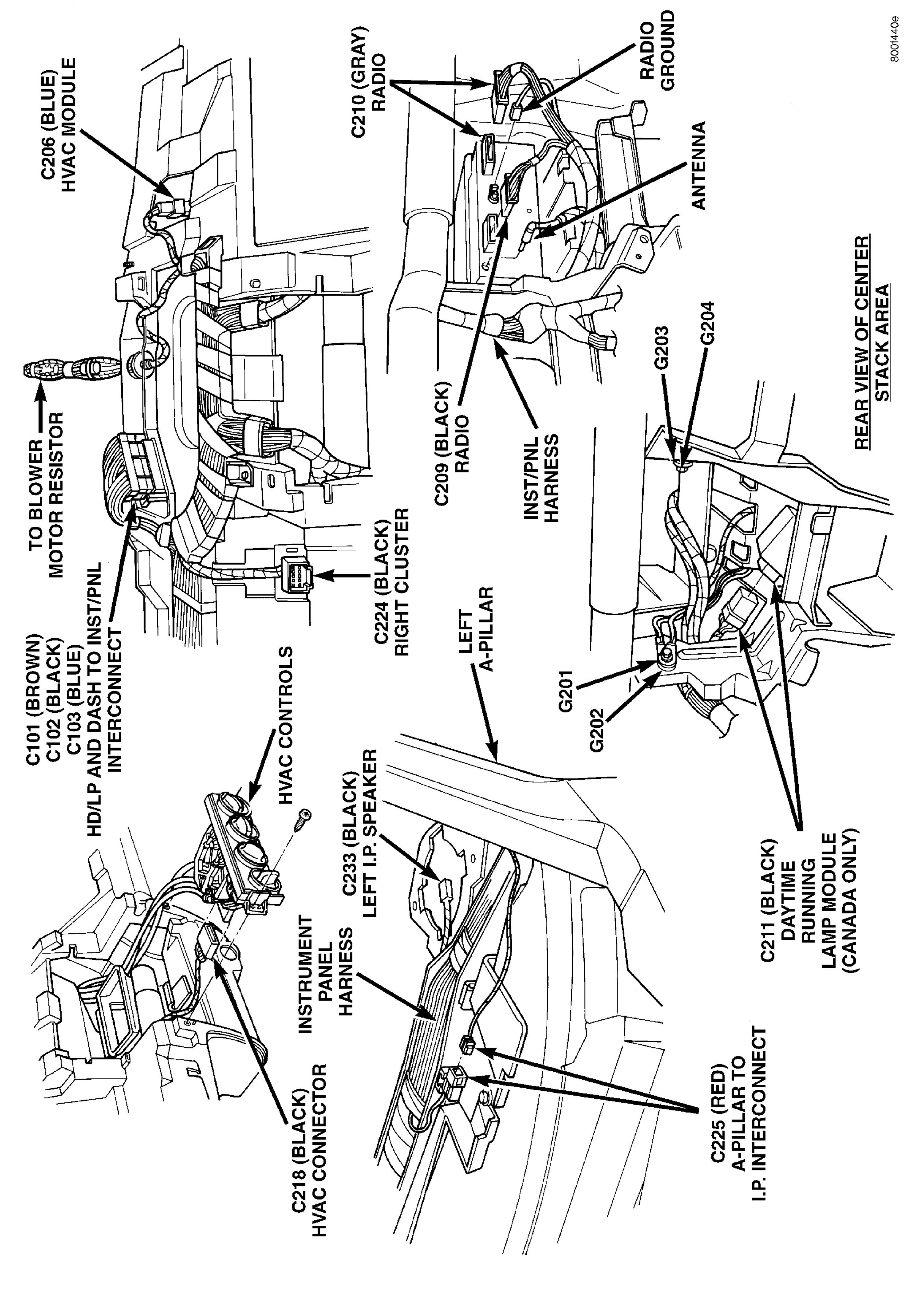


Fig. 15 Instrument Panel Connections (Center Stack)

DESCRIPTION AND OPERATION (Continued)

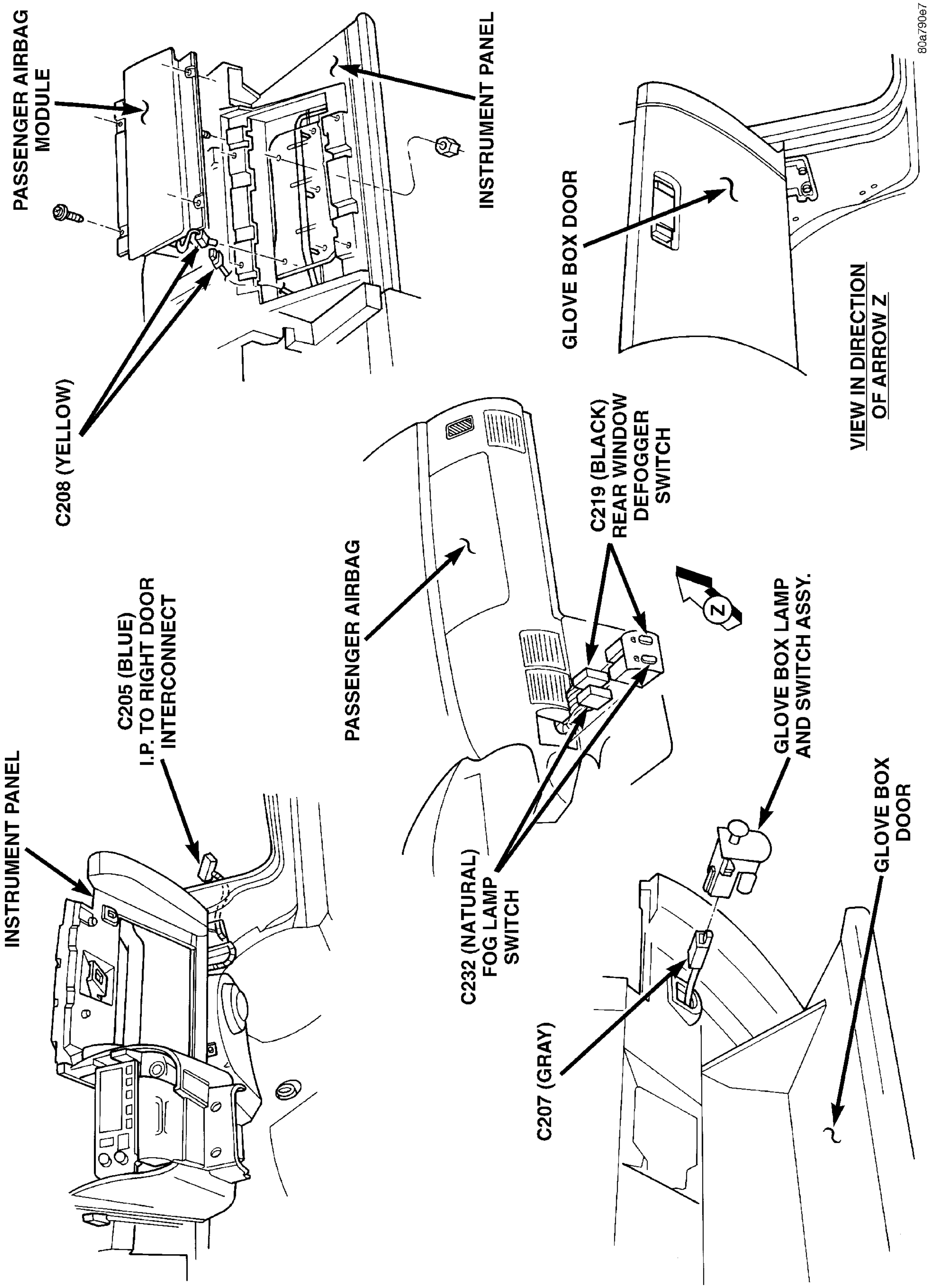


Fig. 16 Instrument Panel Connections (Right Side)

DESCRIPTION AND OPERATION (Continued)

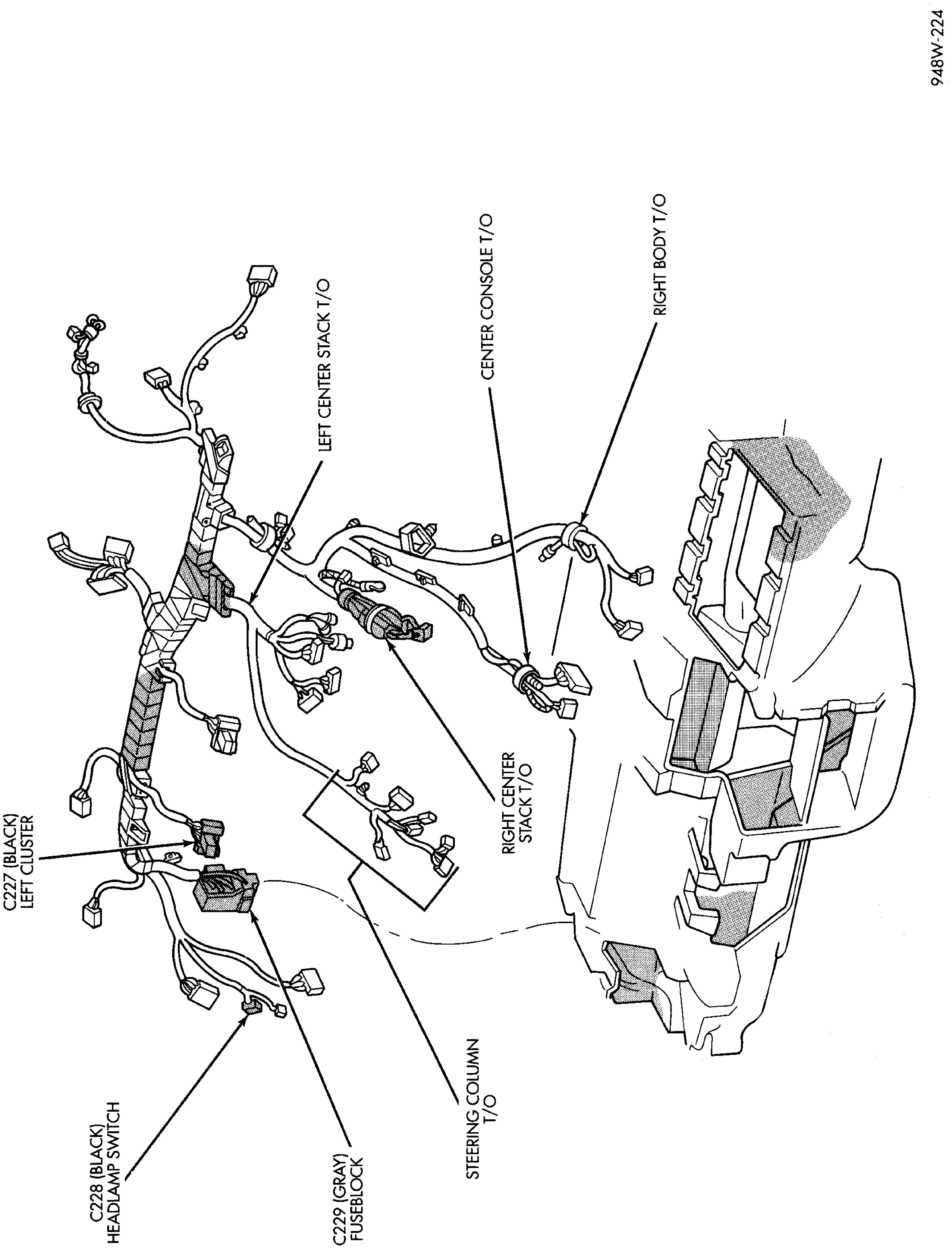


Fig. 17 Instrument Panel Connections (Left Side)

DESCRIPTION AND OPERATION (Continued)

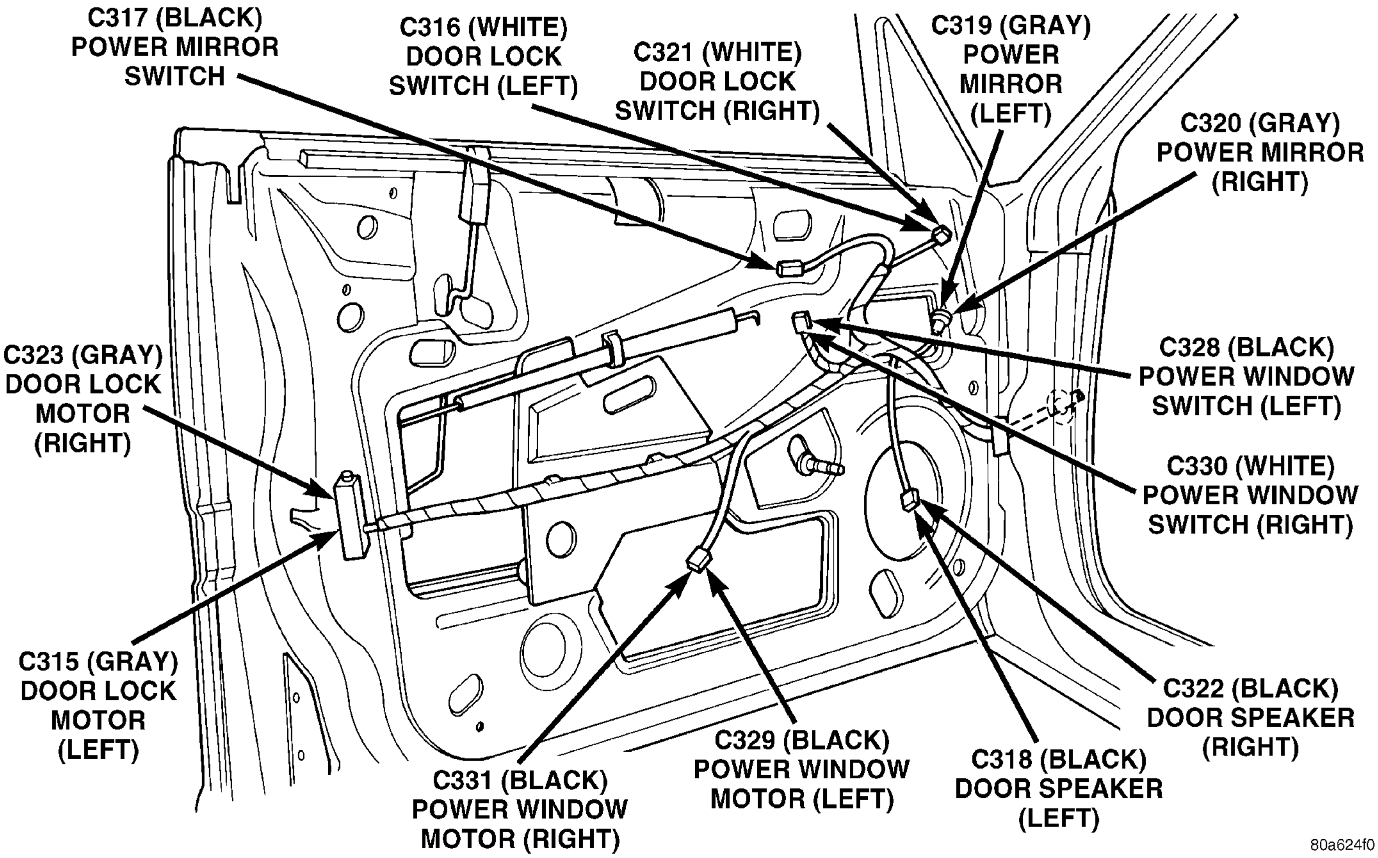


Fig. 18 Door Connections (Front)

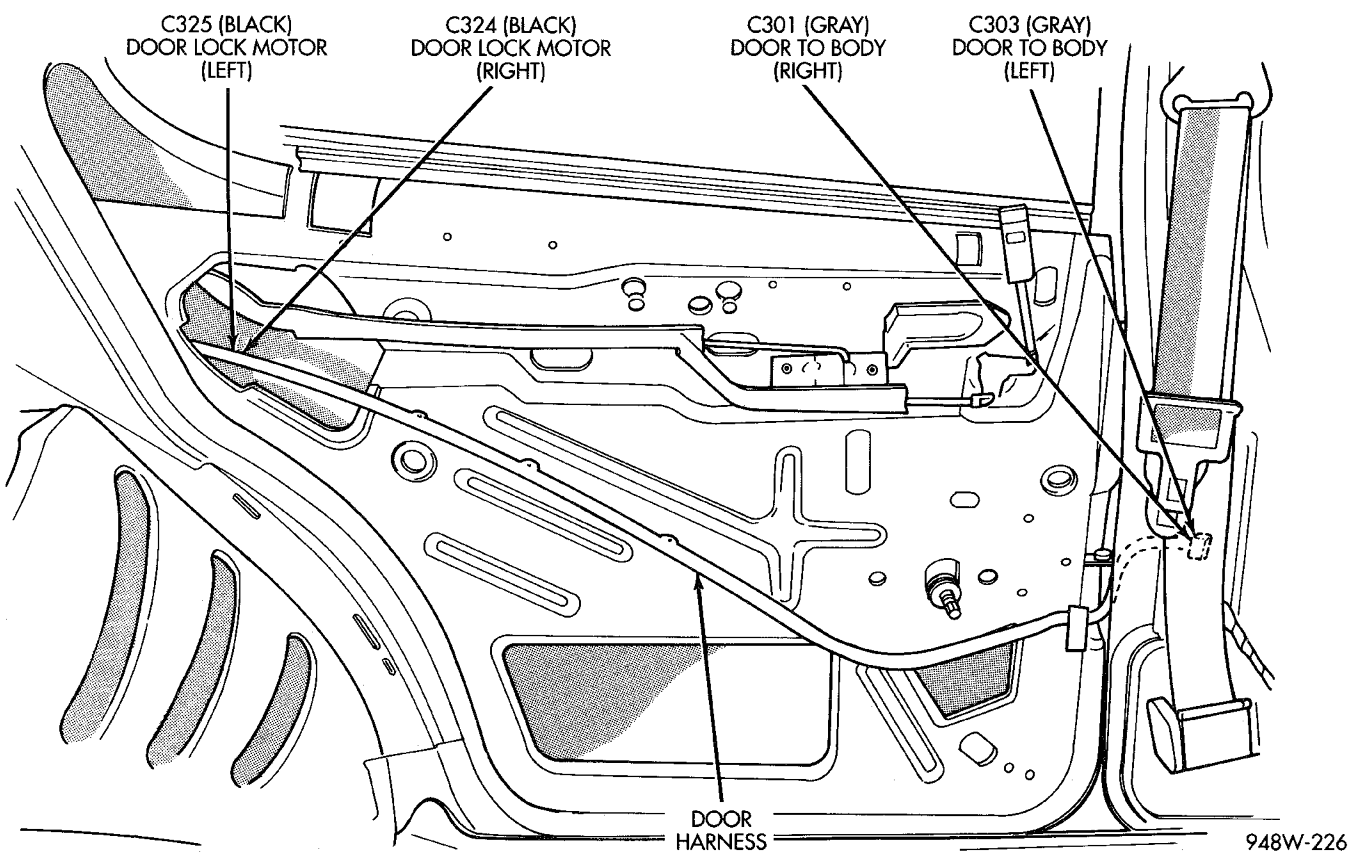


Fig. 19 Door Connections (Rear)

DESCRIPTION AND OPERATION (Continued)

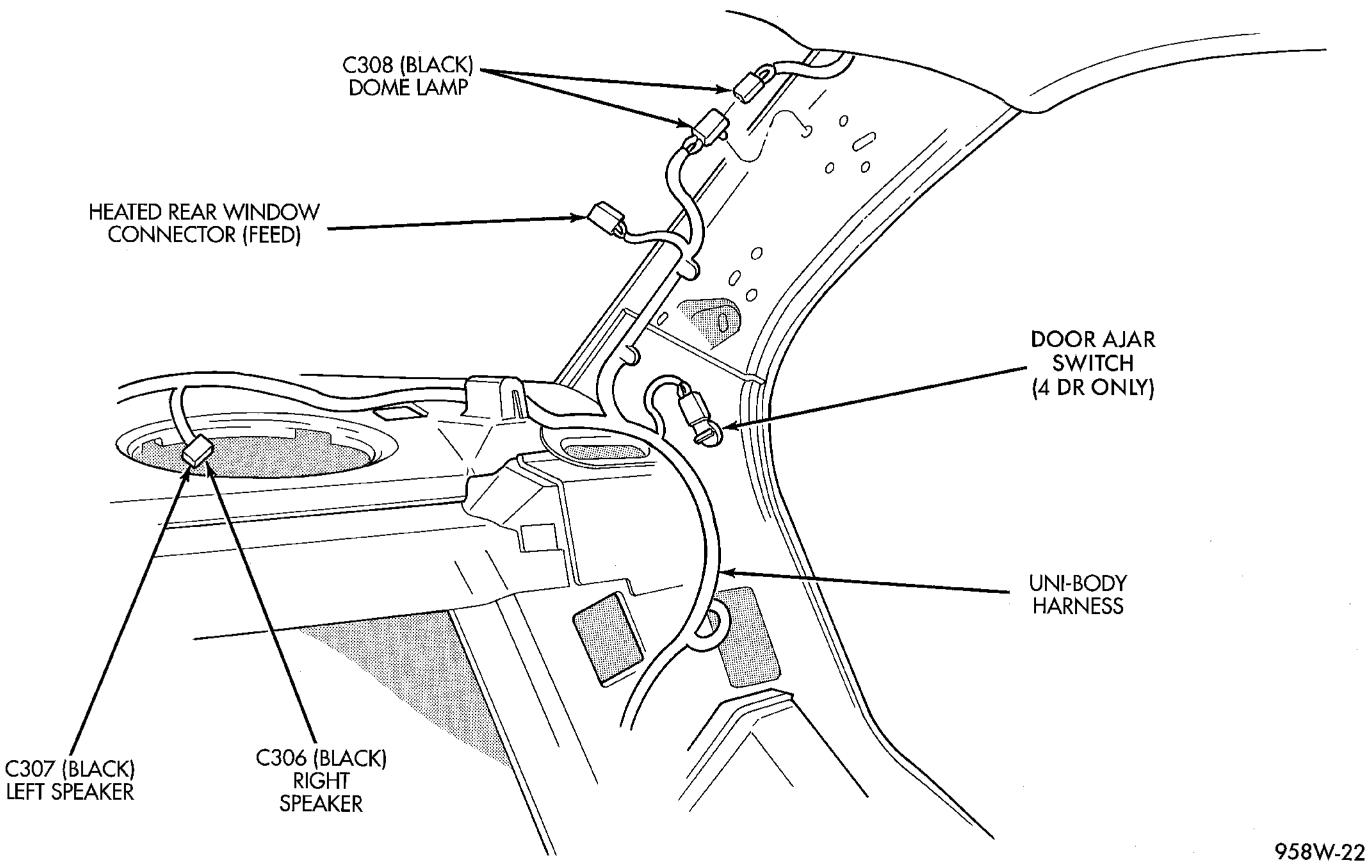


Fig. 20 Body Connections (Left Rear)

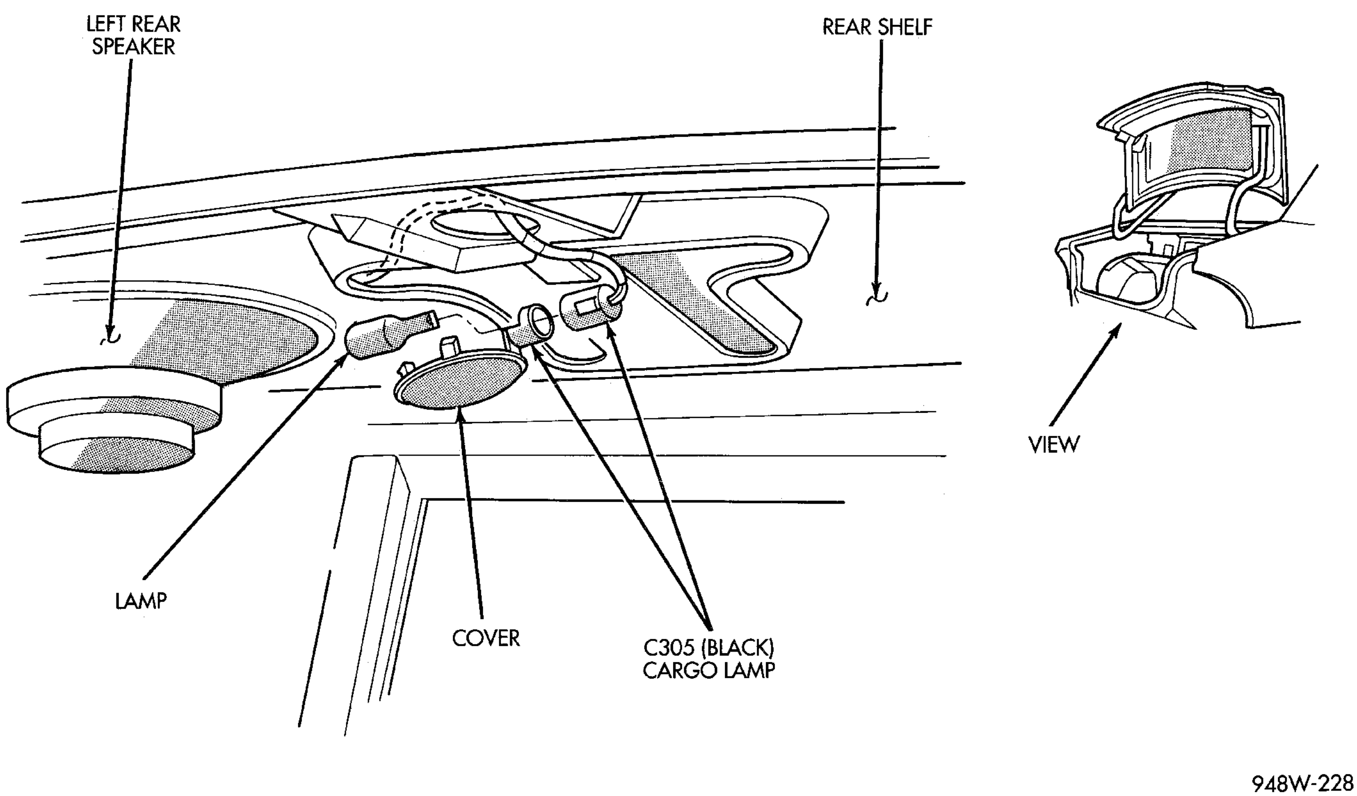


Fig. 21 Trunk Connections

DESCRIPTION AND OPERATION (Continued)

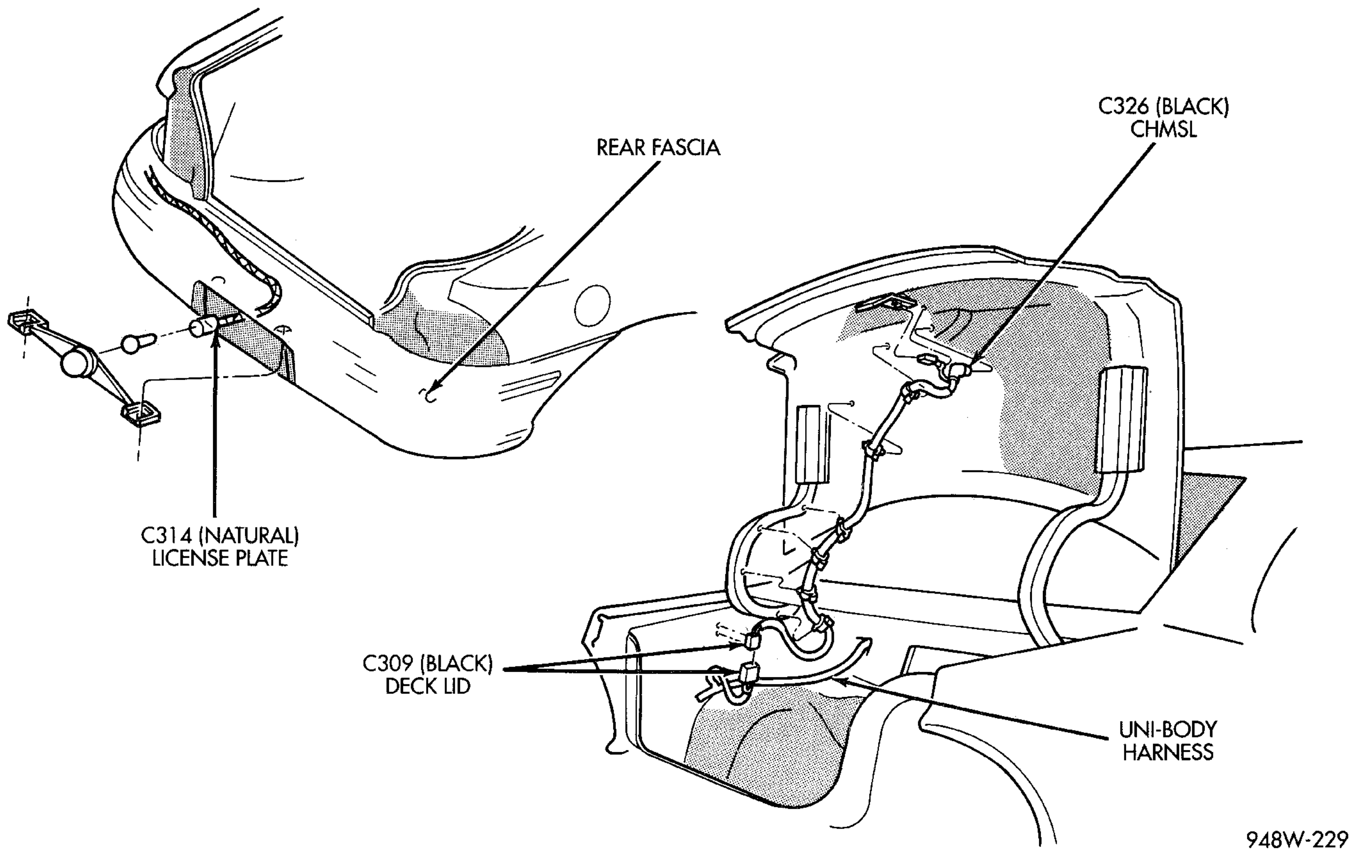


Fig. 22 Decklid/Rear Bumper Connections

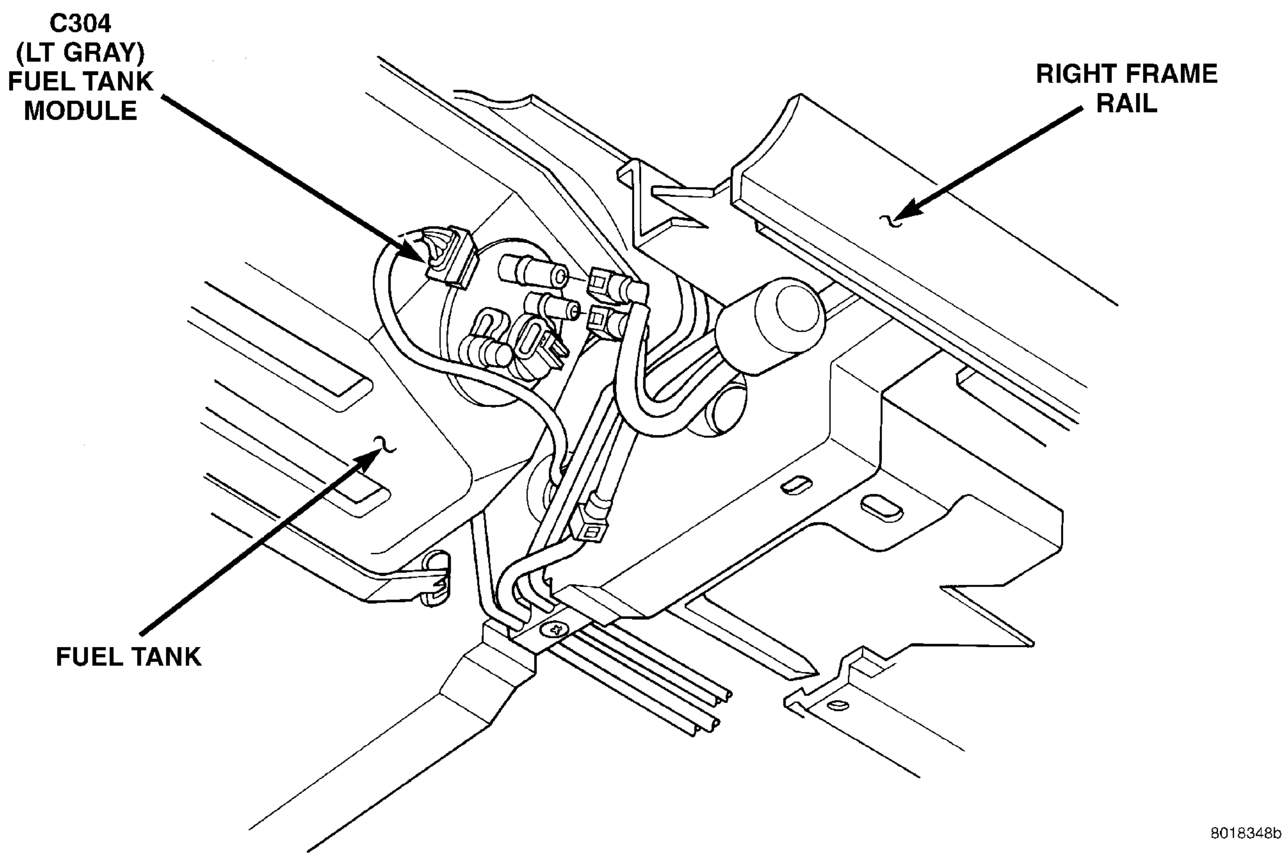


Fig. 23 Fuel Tank Connections

DESCRIPTION AND OPERATION (Continued)

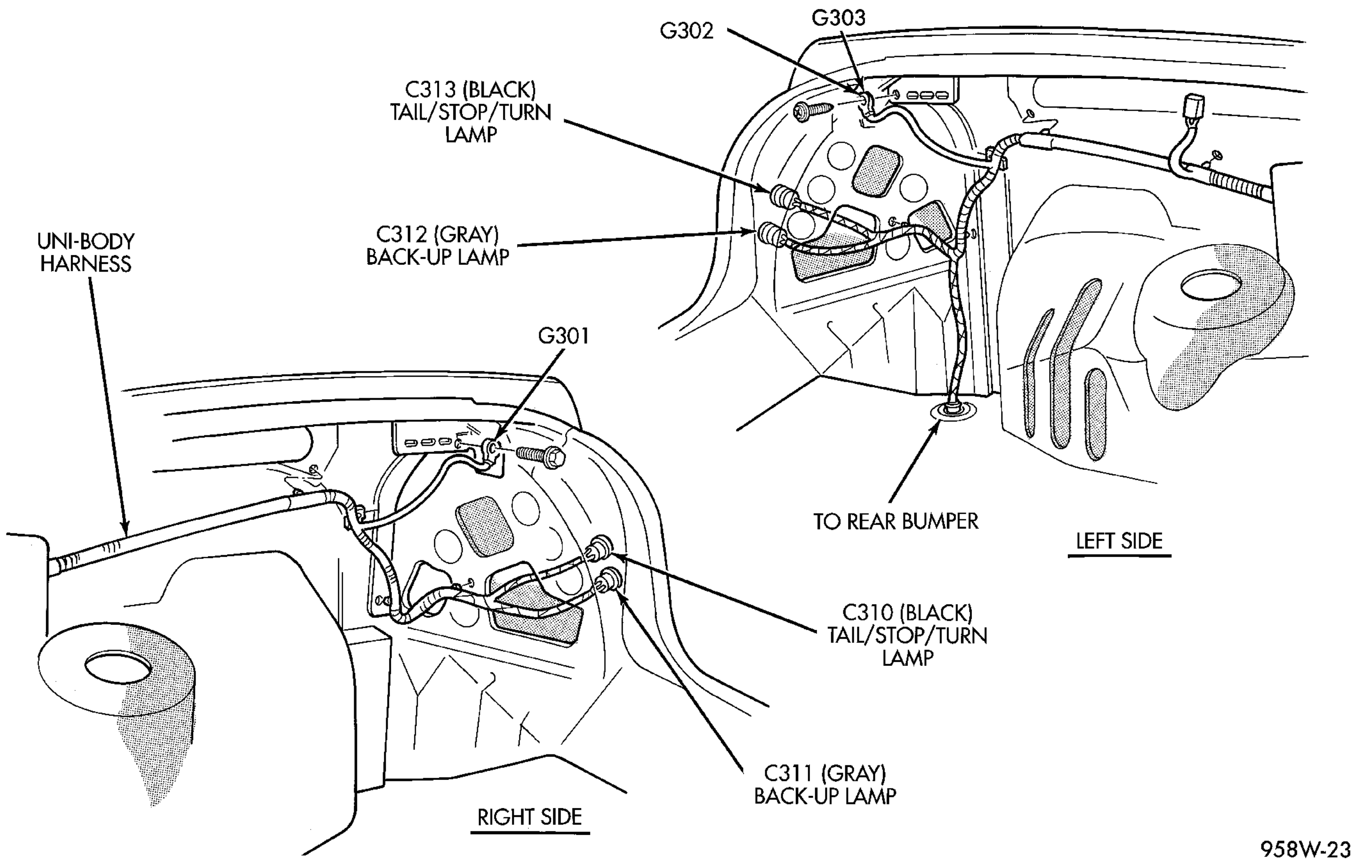


Fig. 24 Rear Lighting Connections

8W-95 SPLICE LOCATIONS

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of the splices in this vehicle. A splice index is provided. Use the wiring diagrams in each section for splice number identification. Refer to the index for the proper splice number.

SPLICE LOCATIONS

The following index covers all splices shown in the wiring diagrams. If a splice is not shown in this section, a N/S will be in the Fig. column.

Splice	Location	Fig.
S101	Near Dat Link T/O	1
S102	In CAB T/O	1
S103	Near CAB Connector	1
S104	Left Strut Tower	1
S105	Left Strut Tower	1
S106	Near PCM T/O	1
S107	Before T/O for Left Headlamp	2
S108	Before T/O for Left Headlamp	2
S109	Before T/O for Left Headlamp	2
S110	In PCM T/O	1
S111	In PCM T/O	1
S112	Near T/O for Left Headlamp	2
S113	Near T/O for Left Headlamp	2
S114	Near T/O for Left Headlamp	2
S115	Neat T/O for Radiator Fan Motor	2
S116	Near T/O for Left Fog Lamp	2
S117	Near EVAP/Purge Sol T/O	2
S118	Between O2S and Crank Sensor T/O	3
S119	Between O2S and VSS T/O	3
S120	Between INJ #3 and #4 T/O	3
S121	Between INJ #1 and #2 T/O	3
S122	Near T/O for EGR Sol	3
S123	Near HD/LP and Dash Connector	3
S124	Between Cam Sensor and Coil T/O's	3
S125	Near Starter	3
S126	Near PCM T/O	1
S127	Near Ignition Coil	3
S201	Near T/O for Center Console	5
S202	Near T/O for PAB	4
S203	Near T/O for HVAC	4
S204	Near HVAC Connector	4
S205	Near Center Stack T/O	4
S206	Near Center Stack T/O	4
S207	Top Center of I.P.	5
S208	Top Center of I.P.	5
S209	Top Center of I.P.	5
S210	Top Center of I.P.	5
S211	Between RT and LT Cluster T/O's	5
S211	Between RT and LT Cluster T/O's	5
S212	Between RT and LT Cluster T/O's	5
S213	Near T/O for Fuseblock	4
S214	Near T/O for Fuseblock	4
S215	In T/O for Door/Body Wiring	4
S216	Near STRG Column T/O	4
S217	In T/O for C/BRKR	4
S218	Between RT and LT Cluster T/O's	4
S219	Between RT and LT Cluster T/O's	4
S220	Near Fuseblock T/O	N/S
S301	Near LT B-Pillar T/O	6
S302	Near LT B-Pillar T/O	6
S303	Near LT B-Pillar T/O	6
S304	Near Fuel Tank T/O	6
S305	Near Right Rear Body Ground T/O	7
S306	Near Fuel Tank T/O	7
S307	Between LR Body Ground and LT Tail Lamp T/O	6
S308	Near LR Body Ground	6
S309	Near Top of A-Pillar, Left Side	8
S310	Near DR/LK SW and PWR Mirro T/O	8
S311	Near LR Wheel House T/O	6
S312	On RR Wheel House	7
S313	Near T/O for Sunroof Slide SW	8
S314	Near T/O for Sunroof Slide Switch	N/S

DESCRIPTION AND OPERATION (Continued)

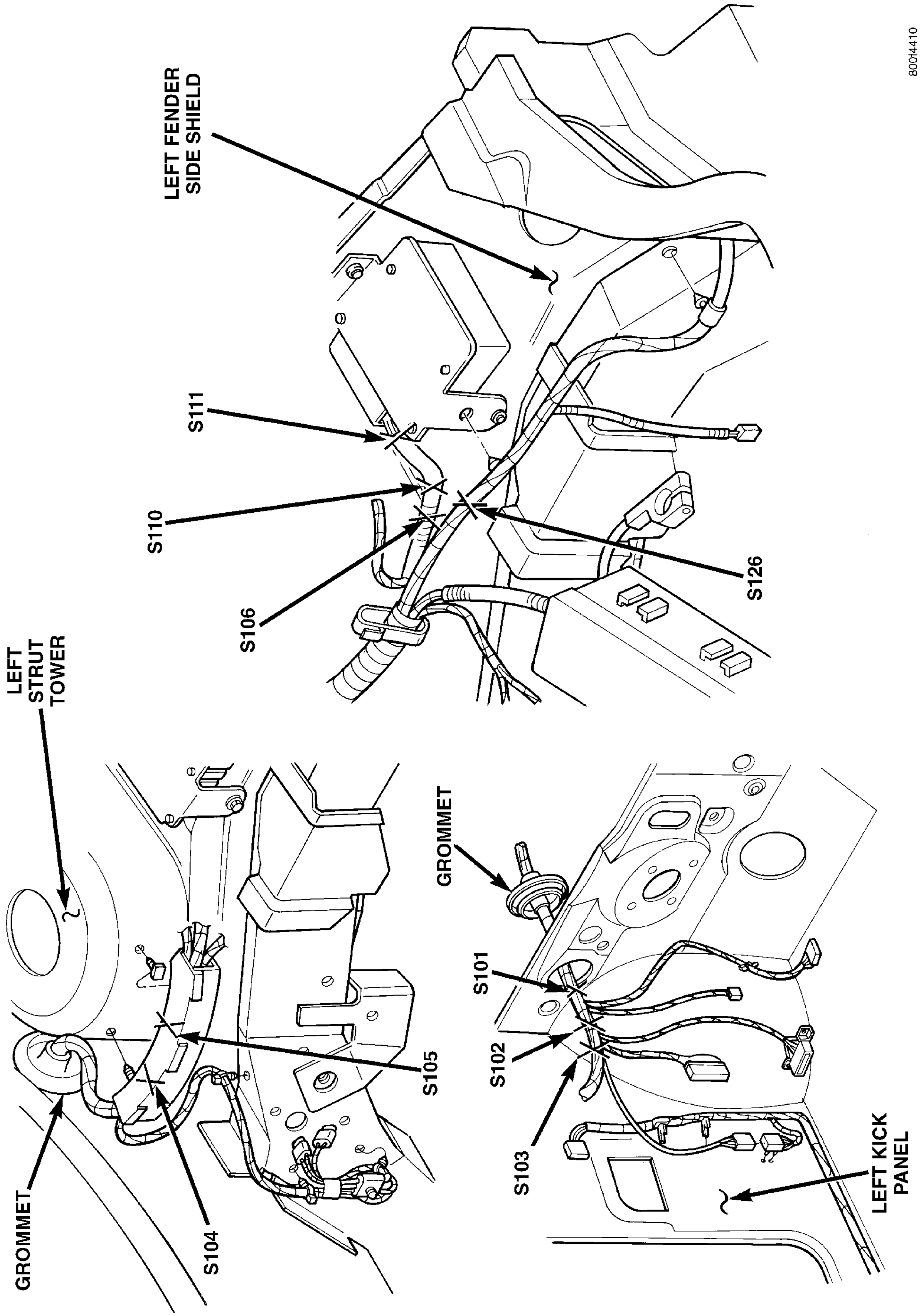


Fig. 1 Engine Compartment Splices

DESCRIPTION AND OPERATION (Continued)

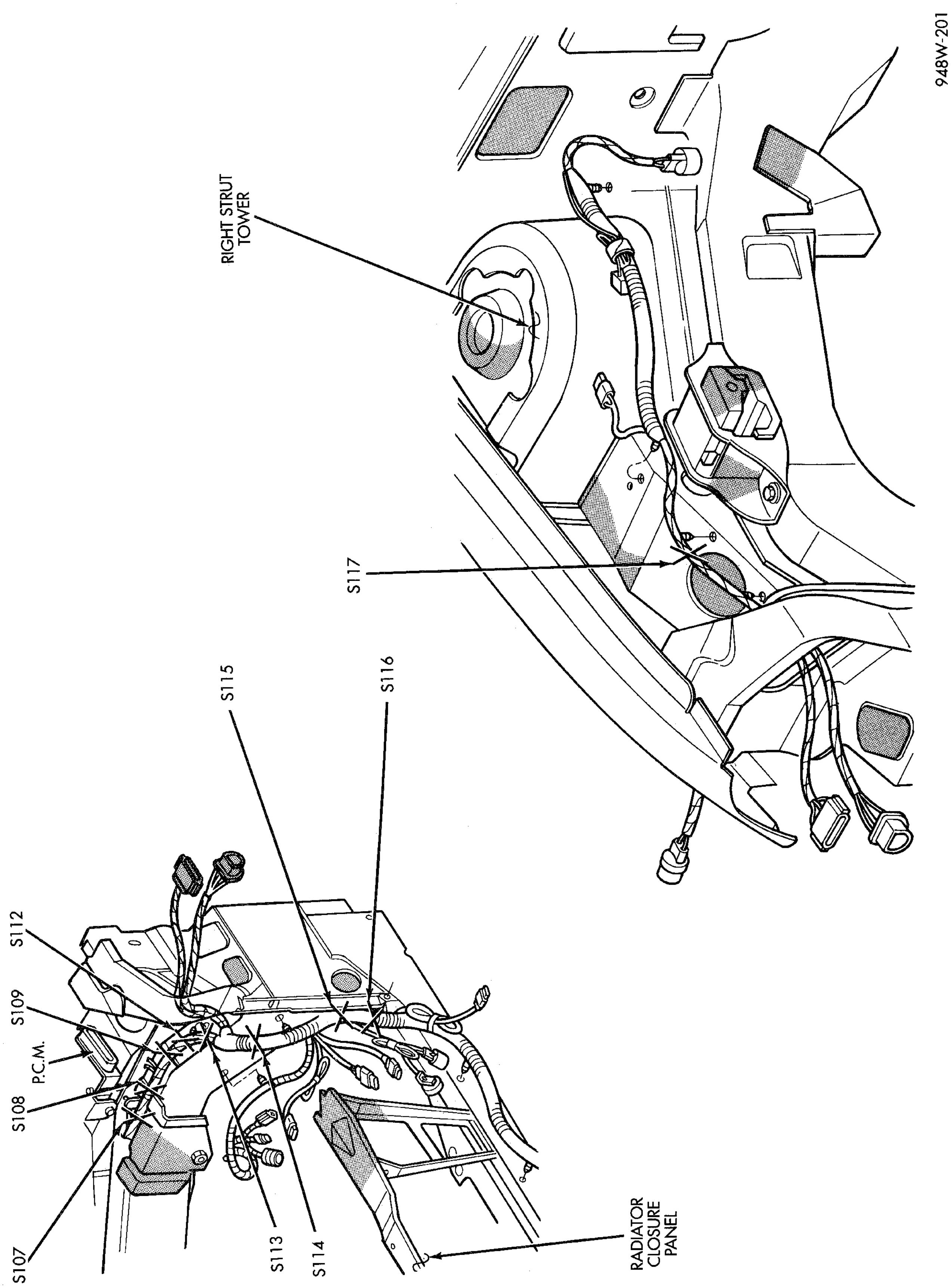


Fig. 2 Engine Compartment Splices

DESCRIPTION AND OPERATION (Continued)

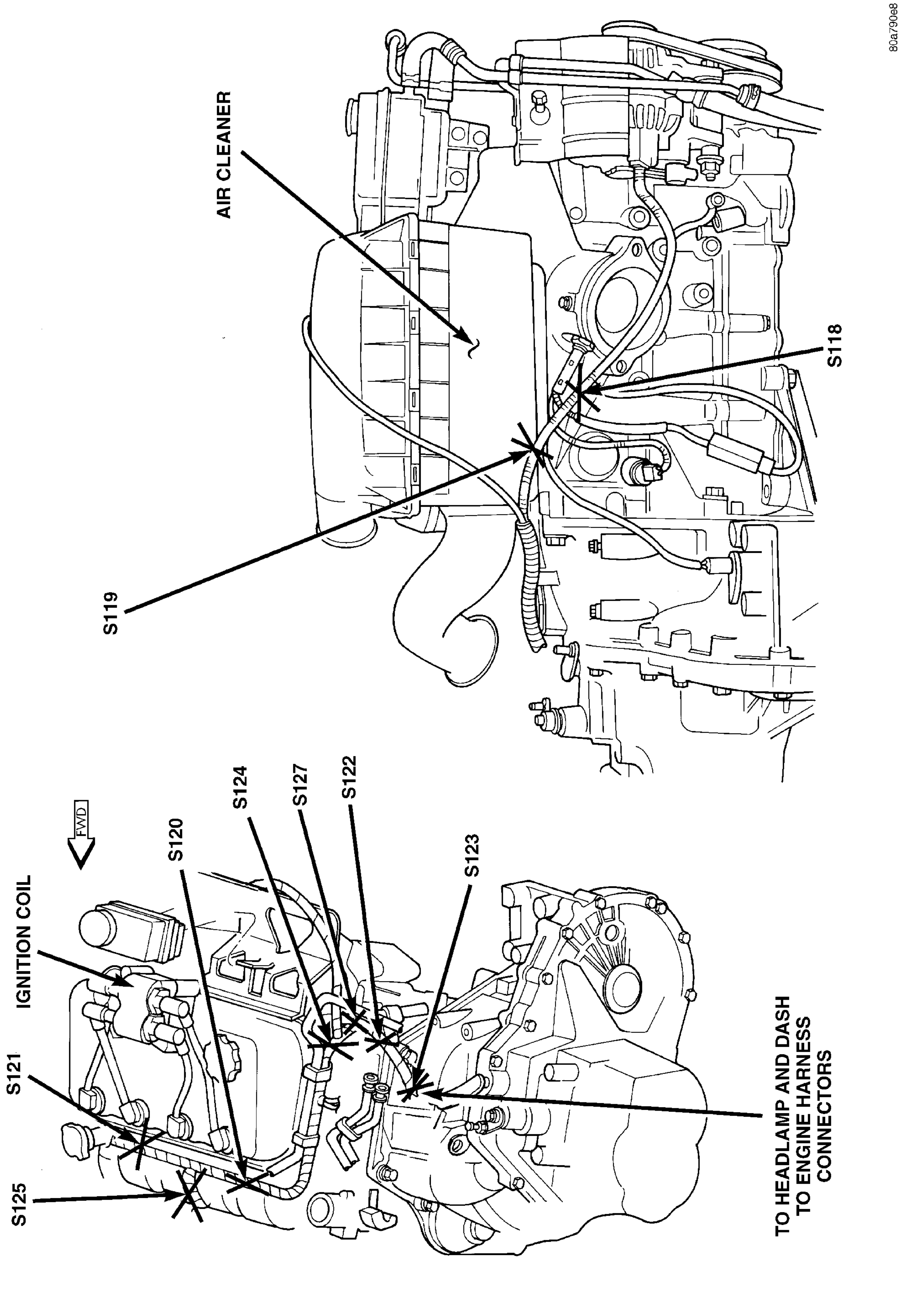


Fig. 3 Engine Splices

DESCRIPTION AND OPERATION (Continued)

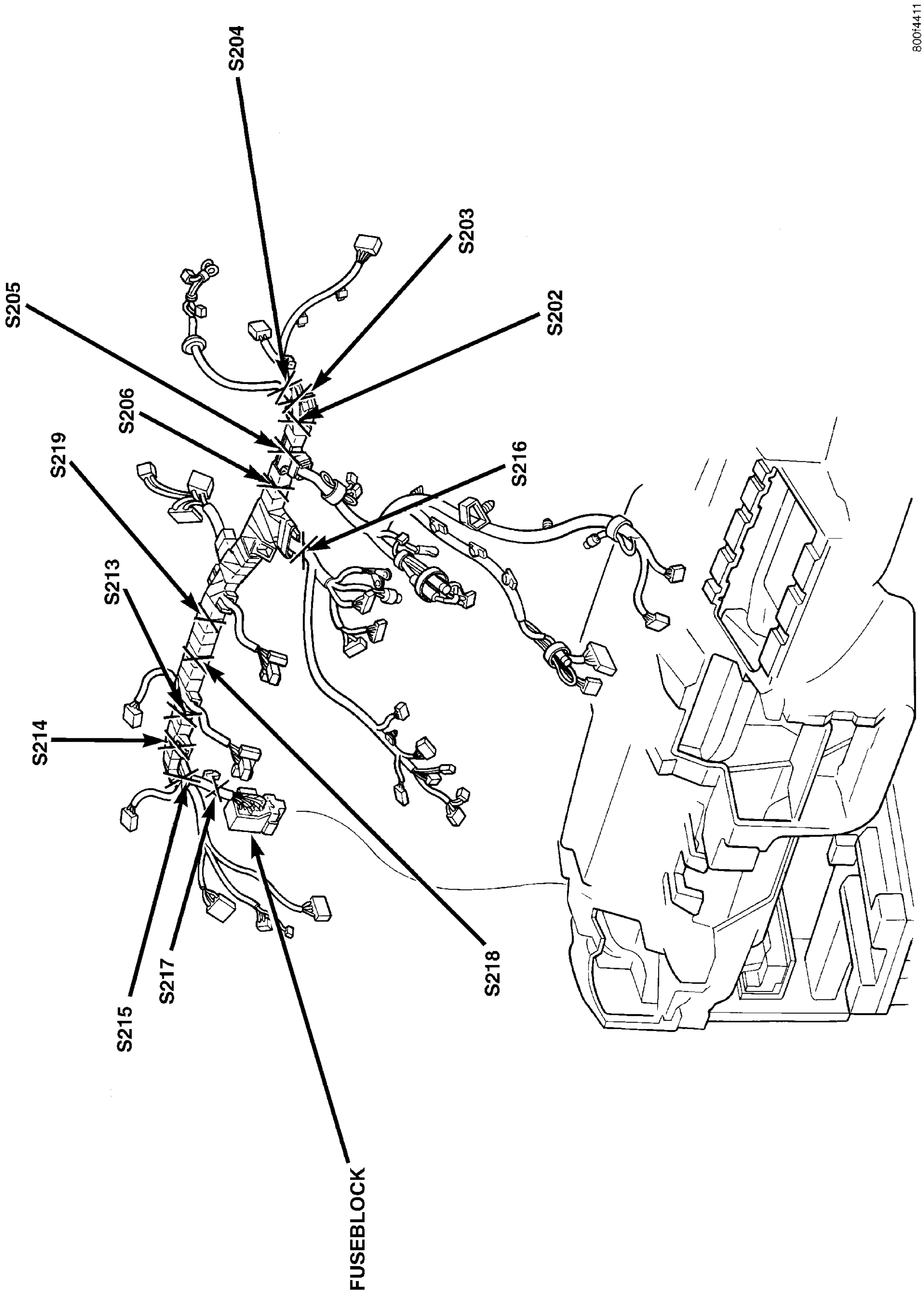


Fig. 4 Instrument Panel Splices

DESCRIPTION AND OPERATION (Continued)

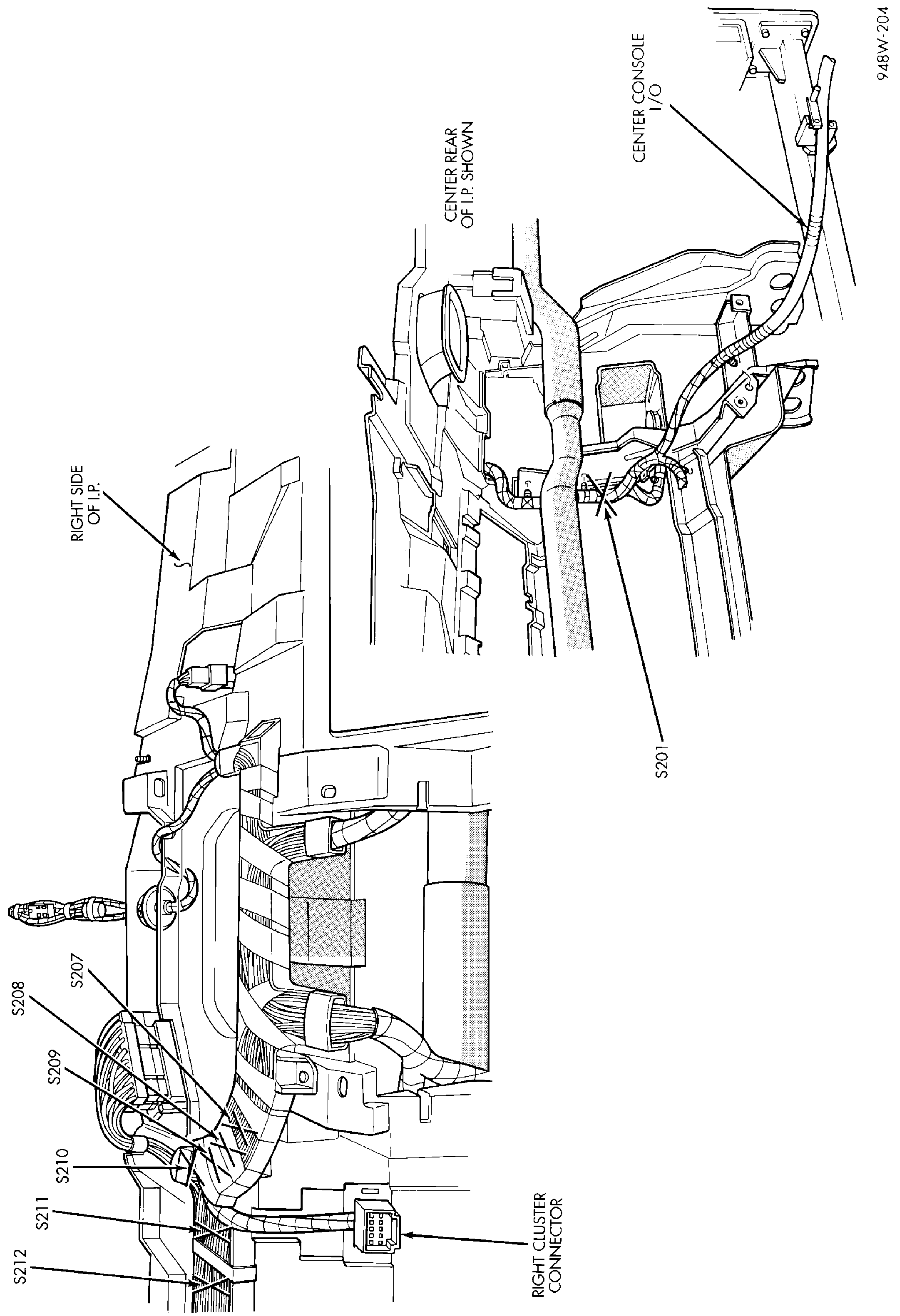


Fig. 5 Instrument Panel Splices

DESCRIPTION AND OPERATION (Continued)

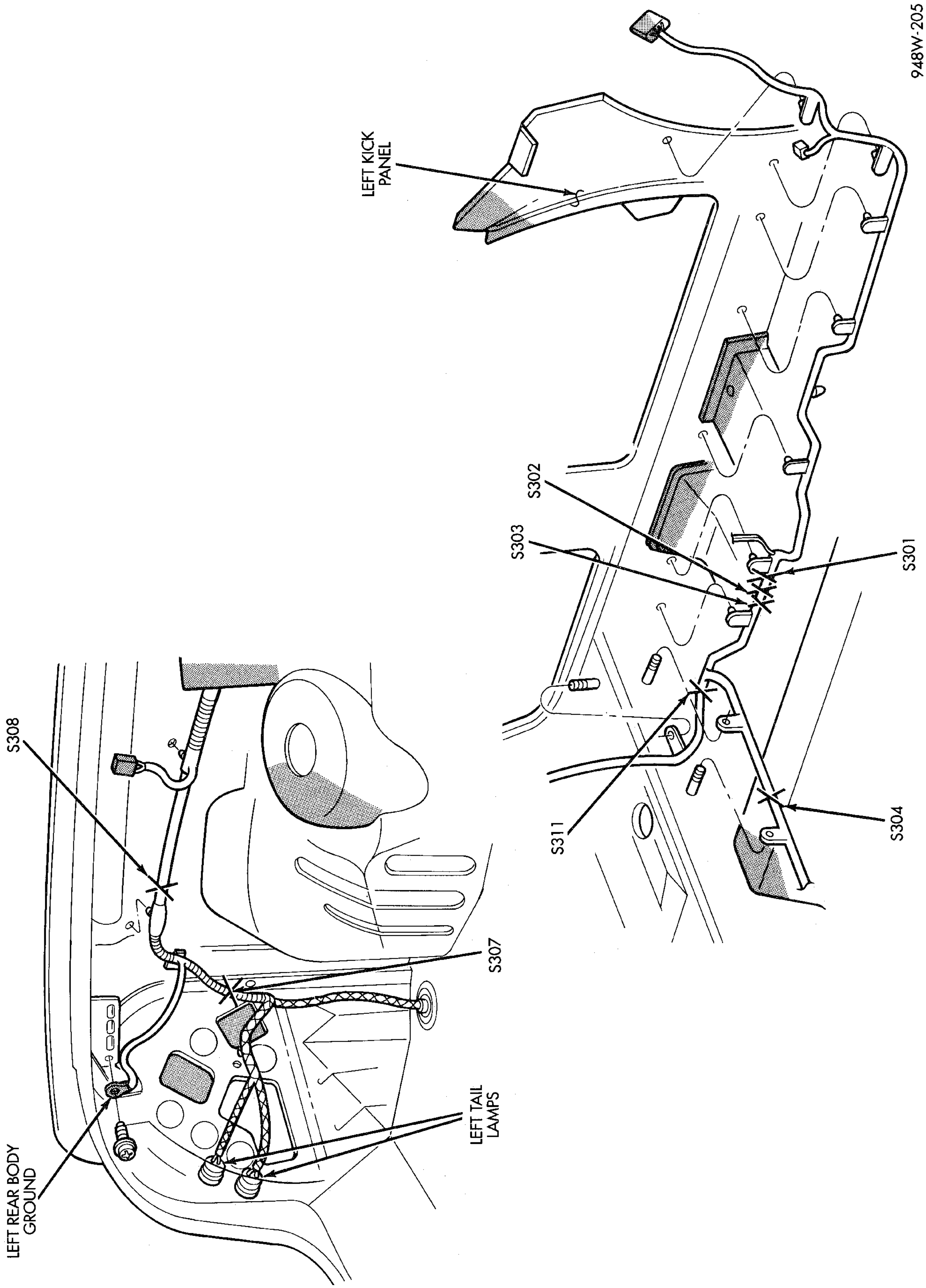


Fig. 6 Body Splices (Left Side)

DESCRIPTION AND OPERATION (Continued)

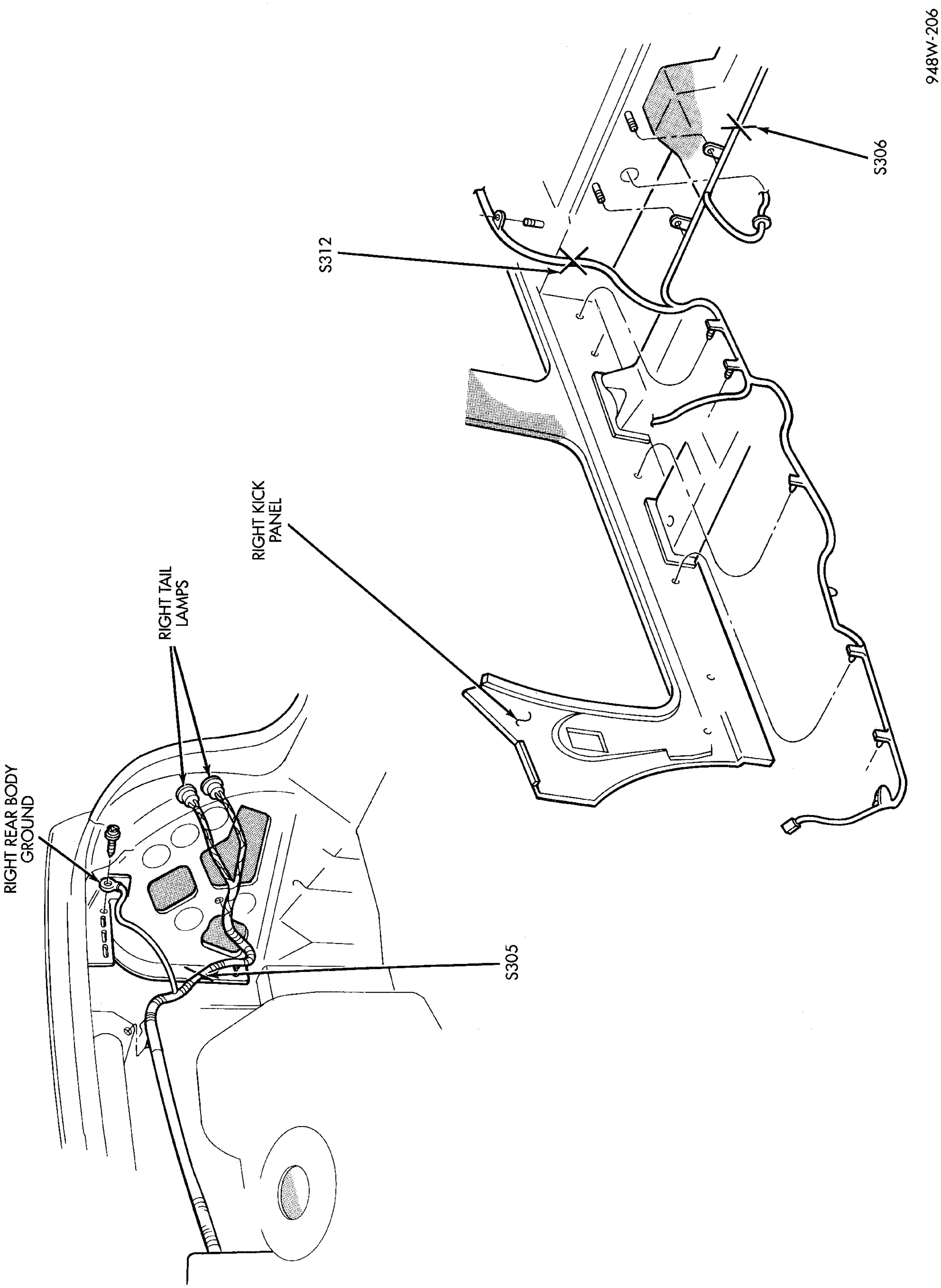


Fig. 7 Body Splices (Right Side)

DESCRIPTION AND OPERATION (Continued)

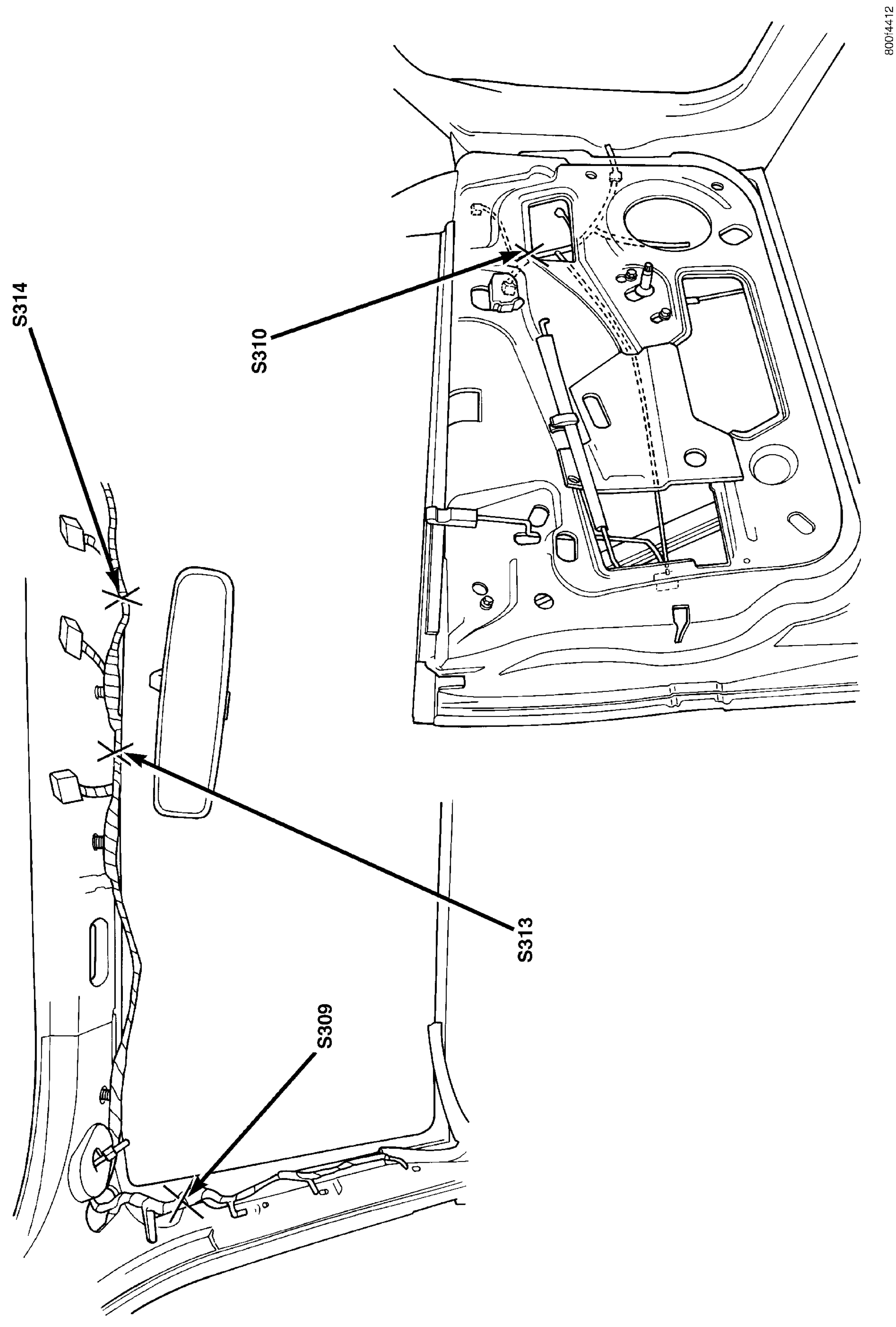


Fig. 8 Door and Windshield Header Splices

ENGINE

CONTENTS

STANDARD SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

FORM-IN-PLACE GASKETS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar Silicone Rubber Adhesive Sealant and Mopar Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

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. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR TORQUE CURE GASKET MAKER

Mopar Torque Cure Gasket Maker is a unique anaerobic type gasket material to be used **ONLY** between the bedplate and engine block. The material cures in the absence of air when torqued between two metallic surfaces. It will not cure if left in the uncovered tube. This anaerobic material is specially made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components.

GASKET DISASSEMBLY

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

SURFACE PREPARATION

Scrape clean or wire brush all gasket surfaces removing all loose material. Inspect stamped parts to

GENERAL INFORMATION (Continued)

assure gasket rails are flat. Flatten rails with a hammer on a heavy steel 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 1 mm(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 material off the location.

The Mopar Silicone Rubber Adhesive Sealant gasket material or equivalent should be applied in a continuous bead approximately 3 mm (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 towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

CRANKSHAFT SPROCKET BOLT ACCESS PLUG

An Access plug is located in the right inner fender shield. Remove the plug and insert the proper size socket, extension and ratchet, when crankshaft rotation is necessary.

ENGINE CORE PLUGS

REMOVAL

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 1). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 1).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

INSTALLATION

Thoroughly remove all rust and clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with sealer. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 inch.) inside the lead in chamfer (Fig. 1).

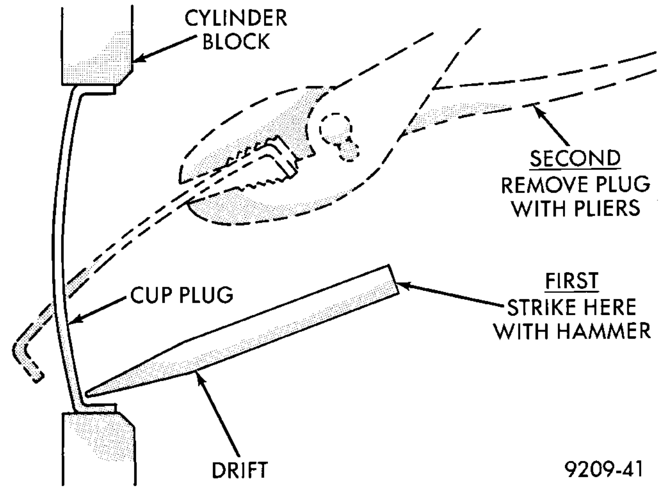


Fig. 1 Core Hole Plug Removal

It is in not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

ENGINE PERFORMANCE

If a loss of performance is noticed, ignition timing should be checked. timing belt or chain may have skipped one or two teeth. Camshaft and crankshaft timing should also be checked. Refer to Group 9, Engine Timing belt or chain installation.

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) Check intake manifold for vacuum leaks.

PERFORM CYLINDER COMPRESSION TEST

(1) Check engine oil level and add oil if necessary.

(2) Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

(3) Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.

(4) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire (Conventional Ignition System). For Direct Ignition System DIS disconnect the coil connector.

(5) Be sure throttle blade is fully open during the compression check.

GENERAL INFORMATION (Continued)

(6) Insert compression gage adaptor into the #1 spark plug hole in cylinder head. Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(7) Repeat the previous step for all remaining cylinders.

(8) Compression should not be less than (689kPa) 100 psi and not vary more than 25 percent from cylinder to cylinder.

(9) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(10) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

(11) Clean or replace spark plugs as necessary and adjust gap as specified in Group 8, Electrical. Tighten to specifications.

(1) Test resistance of spark plug cables. Refer to Group 8, Electrical Ignition System Secondary Circuit Inspection.

(2) Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to Group 8, Electrical Ignition System.

(3) Check fuel pump pressure at idle and different RPM ranges. Refer to Group 14, Fuel System for Specifications.

(4) The air filter elements should be replaced as specified in Group 0, Lubrication and Maintenance,.

(5) Inspect crankcase ventilation system as out lined in Group 0, Lubrication and Maintenance. For emission controls see Group 25, Emission Controls for service procedures.

(6) Inspect and adjust accessory belt drives referring to Group 7, Cooling System, Accessory Drive Belts for proper adjustments.

(7) Road test vehicle as a final test.

HONING CYLINDER BORES

(1) Used carefully, the cylinder bore resizing hone C-823 equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, Tool C-3501, equipped with 280 grit stones, if the cylinder bore is straight and round. 20-60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Inspect cylinder walls after each 20 strokes, using a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.**

(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 50-60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 2).

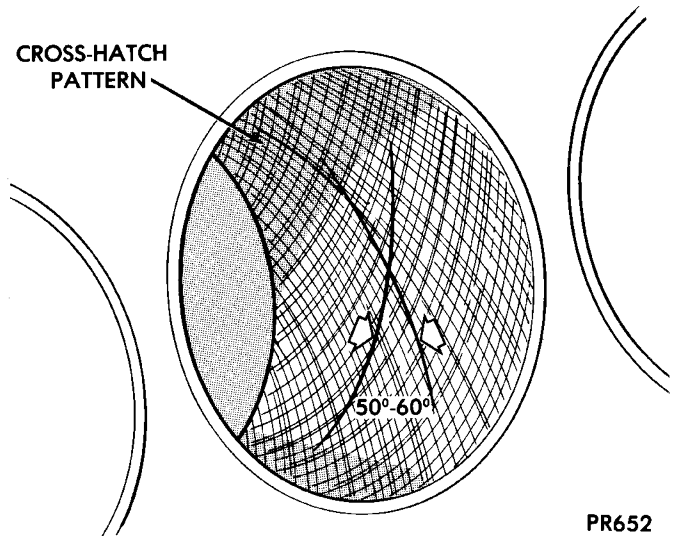


Fig. 2 Cylinder Bore Cross-Hatch Pattern

(4) A controlled hone motor speed between 200-300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 50-60 degree angle. Faster up and down strokes increase the cross-hatch angle.

(5) After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

CAUTION: Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

MEASURING MAIN BEARING AND CONNECTING ROD BEARING CLEARANCES

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:

GENERAL INFORMATION (Continued)

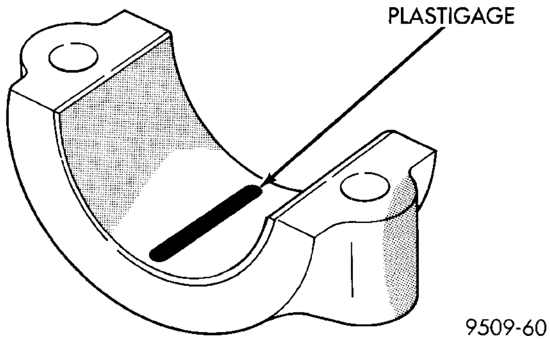


Fig. 3 Plastigage Placed in Lower Shell

NOTE: The total clearance of the main bearings can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

PREFERRED METHOD

Shimming the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (0.010 in.) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tightening bolts to 14-20 N·m (10-15 ft. lbs.). The number of main bearing will vary from engine to engine.

ENGINE WITH 5 MAIN BEARINGS

- When checking #1 main bearing shim #2 main bearing.
- When checking #2 main bearing shim #1 & 3 main bearing.
- When checking #3 main bearing shim #2 & 4 main bearing.
- When checking #4 main bearing shim #3 & 5 main bearing.
- When checking #5 main bearing shim #4 main bearing.

ENGINE WITH 4 MAIN BEARING

- When checking #1 main bearing shim # 2 main bearing.
- When checking #2 main bearing shim #1 & #3 main bearing.
- When checking #3 main bearing shim #2 & #4 main bearing.
- When checking #4 main bearing shim #3 main bearing.

NOTE: REMOVE ALL SHIMS BEFORE REASSEMBLING ENGINE

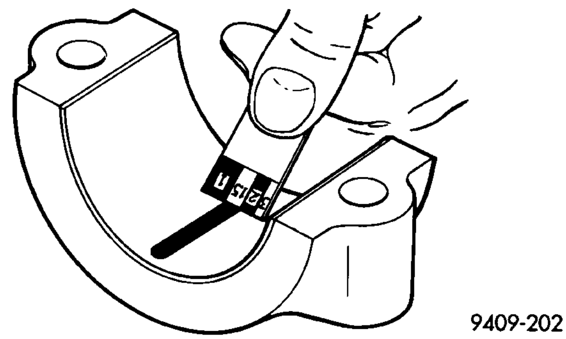


Fig. 4 Clearance Measurement

ALTERNATIVE METHOD

The weight of the crankshaft can be supported by a jack under the counterweight adjacent to the bearing being checked.

PLASTIGAGE PROCEDURE

(1) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(2) Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes (Fig. 3). (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.

(3) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 4) with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

CONNECTING ROD BEARING CLEARANCE

Engine connecting rod bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.

(2) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from

GENERAL INFORMATION (Continued)

the oil hole (Fig. 3). In addition, suspect areas can be checked by placing plastigage in the suspect area.

(4) Assemble the rod cap with Plastigage in place. Tighten the rod cap to the specified torque. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

(5) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 4) with the scale provided on the package. Locate the band closest to the same width. This band indicates the amount of oil clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. If the bearing clearance exceeds 0.076 mm (0.003 in.) replace bearing.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (including aluminum head spark plug threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

CAUTION: Be sure that the tapped holes maintain the original centerline.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, these steps should be used.

CAUTION: Do Not Use Starter Motor To Rotate Engine, severe damage may occur.

(1) Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.

(2) Remove negative battery cable.

(3) Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.

(4) With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.

(5) Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).

(6) Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., Connecting Rods, Pistons, Valves etc.)

(7) Repair engine or components as necessary to prevent this problem from occurring again.

CAUTION: Squirt approximately 1 teaspoon of oil into cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.

(8) Install new spark plugs.

(9) Drain engine oil and remove oil filter.

(10) Fill engine with specified amount of approved oil and install new oil filter.

(11) Connect negative battery cable.

(12) Start engine and check for any leaks.

CHECKING ENGINE OIL LEVEL

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Add only when the level is at or below the ADD mark (Fig. 5).

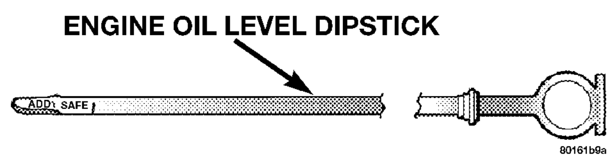


Fig. 5 Oil Level

ENGINE OIL SERVICE

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

GENERAL INFORMATION (Continued)

ENGINE OIL SPECIFICATION

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

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified or an oil that conforms to the API Service Grade SH or SH/CD. MOPAR provides engine oils that conform to all of these service grades.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 30 specifies a single viscosity engine oil. Engine oils also have multiple viscosities. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 6).

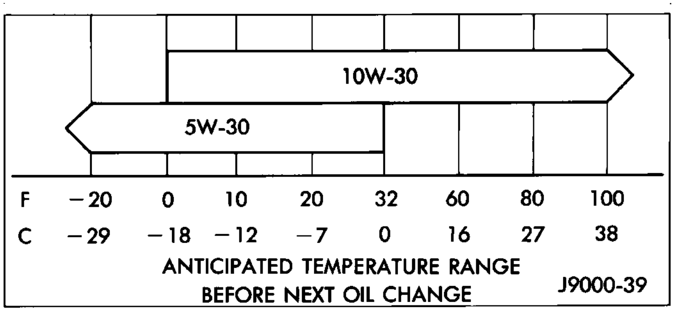


Fig. 6 Temperature/Engine Oil Viscosity

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. They are designated as either ENERGY CONSERVING or ENERGY CONSERVING II.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 7).

Fig. 7 Engine Oil Container Standard Notations

ENGINE OIL ADDITIVES

In some instances, such as infrequent operation, short trip driving, and during break-in after a major overhaul, addition of special materials containing anti-rust and anti-scuff additives are beneficial. A suitable product for this purpose is MOPAR Engine Oil Supplement.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule.

TO CHANGE ENGINE OIL

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE DIAGNOSIS

INDEX

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine tune-ups.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer to Group 14, Fuel System, for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.

(2) Spray a small stream of water (Spray Bottle) at the suspected leak area.

(3) If a change in RPM'S, the area of the suspected leak has been found.

(4) Repair as required.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Check engine oil level and add oil if necessary.

(2) Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

(3) Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.

(4) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire (Conventional Ignition System). For Direct Ignition System DIS disconnect the coil connector.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gage adaptor into the #1 spark plug hole in cylinder head. Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(7) Repeat the previous step for all remaining cylinders.

(8) Compression should not be less than (689kPa) 100 psi and not vary more than 25 percent from cylinder to cylinder.

(9) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(10) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the**

DIAGNOSIS AND TESTING (Continued)

cause of low compression unless some malfunction is present.

(11) Clean or replace spark plugs as necessary and adjust gap as specified in Group 8, Electrical. Tighten to specifications.

(12) Test resistance of spark plug cables. Refer to Group 8, Electrical Ignition System Secondary Circuit Inspection.

(13) Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to Group 8, Electrical Ignition System.

(14) Check fuel pump pressure at idle and different RPM ranges. Refer to Group 14, Fuel System for Specifications.

(15) The air filter elements should be replaced as specified in Group 0, Lubrication and Maintenance,.

(16) Inspect crankcase ventilation system as out lined in Group 0, Lubrication and Maintenance. For emission controls see Group 25, Emission Controls for service procedures.

(17) Inspect and adjust accessory belt drives referring to Group 7, Cooling System, Accessory Drive Belts for proper adjustments.

(18) Road test vehicle as a final test.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE RADIATOR CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1 379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

(3) During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor pressed into the vertical oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected rocker arms (sohc) or lash adjuster (dohc) and replace.

INSPECTION (ENGINE OIL LEAKS IN GENERAL)

Begin with a through visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

DIAGNOSIS AND TESTING (Continued)

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat inspection.

(5) **If the oil leak source is not positively identified at this time** , proceed with the air leak detection test method as follows:

(6) Disconnect the fresh air hose (makeup air) at the cylinder head cover and plug or cap the nipple on the cover.

(7) Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.

(8) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(9) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

(10) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(11) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose. Proceed to next step.

(12) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area remove transmission for further inspection.

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, oil galley cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

(7) After the oil leak root cause and appropriate corrective action have been identified. Refer to Rear Crankshaft Seals, for proper replacement procedures.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery specific gravity. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. Refer to Group 8A, Battery/Starter/Charging System Diagnostics.
	4. Moisture on ignition wires.	4. Wipe wires clean and dry.
	5. Faulty ignition cables.	5. Replace any cracked or shorted cables.
	6. Faulty coil or control unit.	6. Test and replace, if necessary (refer to Group 8D, Ignition system).
	7. Incorrect spark plug gap.	7. Set gap (refer to Group 8D, Ignition System).
	8. Dirt or water in fuel system.	8. Clean system and replace fuel filter.
	9. Faulty fuel pump.	9. Install new fuel pump (refer to Group 14, Fuel System).
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set too low.	1. Refer to Group 14, Fuel System.
	2. Idle mixture too lean or too rich.	2. Refer to Group 14, Fuel System.
	3. Leak in intake manifold.	3. Inspect intake manifold gasket and vacuum hoses. Replace, if necessary (refer to Group 11, Exhaust System & Intake Manifold).
	4. Incorrect ignition wiring.	4. Install correct wiring.
	5. Faulty coil.	5. Test and replace, if necessary (refer to Group 8D, Ignition System).
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. Clean plugs and set gap (refer to Group 8D, Ignition System).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Install new fuel pump.
	4. Incorrect valve timing.	4. Correct valve timing.
	5. Blown cylinder head gasket.	5. Install new cylinder head gasket.
	6. Low compression.	6. Test compression of each cylinder.
	7. Burned, warped or pitted valves.	7. Install new valves.
	8. Plugged or restricted exhaust system.	8. Install new parts, as necessary.
	9. Faulty ignition cables.	9. Replace any cracked or shorted cables.
	10. Faulty coil.	10. Test and replace, as necessary (refer to Group 8D, Ignition System).
ENGINE MISSES ON ACCELERATION	1. Dirty or gap set too wide in spark plug.	1. Clean spark plugs and set gap (refer to Group 8D, Ignition System).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Install new valves.
	4. Faulty coil.	4. Test and replace, if necessary, (refer to Group 8D, Ignition System).
ENGINE MISSES AT HIGH SPEED	1. Dirty or gap set too wide in spark plug.	1. Clean spark plugs and set gap (refer to Group 8D, Ignition System).
	2. Faulty coil.	2. Test and replace, as necessary (refer to Group 8D, Ignition System).
	3. Dirty injector.	3. Clean injectors.
	4. Dirt or water in fuel system.	4. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check for correct oil level (refer to Group 0, Lubrication and Maintenance).
	2. Thin or diluted oil.	2. Change oil (refer to Group 0, Lubrication and Maintenance).
	3. Low oil pressure.	3. Check engine oil level.
	4. Dirt in tappets/lash adjusters.	4. Replace rocker arm/hydraulic lash adjuster assembly.
	5. Worn rocker arms.	5. Inspect oil supply to rocker arms.
	6. Worn tappets/lash adjusters.	6. Install new rocker arm/hydraulic lash adjuster assembly.
	7. Worn valve guides.	7. Ream and install new valves with oversize stems.
	8. Excessive runout of valve seats on valve faces.	8. Grind valve seats and valves.
	9. Missing adjuster pivot.	9. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level (refer to Group 0, Lubrication and Maintenance).
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thin or diluted oil.	3. Change oil to correct viscosity.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Connecting rod journal out-of-round.	5. Replace crankshaft or grind journals.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level (refer to Group 0, Lubrication and Maintenance).
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thin or diluted oil.	3. Change oil to correct viscosity.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Excessive end play.	5. Check thrust bearing for wear on flanges.
	6. Crankshaft journal out-of-round, worn.	6. Grind journals or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque.
OIL PRESSURE DROP	1. Low oil level.	1. Check engine oil level.
	2. Faulty oil pressure sending unit.	2. Install new sending unit.
	3. Low oil pressure.	3. Check sending unit and check main bearing oil clearance.
	4. Clogged oil filter.	4. Install new oil filter.
	5. Worn parts in oil pump.	5. Replace worn parts or pump.
	6. Thin or diluted oil.	6. Change oil to correct viscosity.
	7. Excessive bearing clearance.	7. Measure bearings for correct clearance.
	8. Oil pump relief valve stuck.	8. Remove valve and inspect, clean and install.
	9. Oil pump suction tube loose, bent cracked, or blocked.	9. Remove oil pan and install new tube, or clean if necessary.
	10. Oil pump cover warped or cracked.	10. Install new oil pump.
OIL LEAKS	1. Misaligned or deteriorated gaskets.	1. Replace the gasket.
	2. Loose fastener, broken or porous metal part.	2. Tighten, repair or replace the part.
	3. Misaligned or deteriorated cup or threaded plug.	3. Replace.
OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. PCV system malfunction.	1. Check system. Clean and repair, as necessary (refer to Group 25, Emissions Control System).
	2. Worn, scuffed or broken rings.	2. Hone cylinder bores. Install new rings.
	3. Carbon in oil ring slot.	3. Install new rings.
	4. Rings fitted too tightly in grooves.	4. Remove the rings. Check grooves. If groove is not proper width, replace piston.
	5. Worn valve guides.	5. Ream guides and replace valves with oversize valves and seals.
	6. Valve stem seal unseated or defective.	6. Repair or replace seal.

2.0L SOHC ENGINE

INDEX

DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION

The engine identification number is located on the left rear of the cylinder block behind starter (Fig. 1).

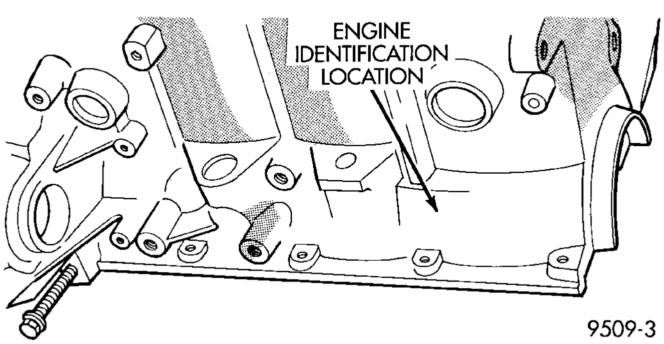


Fig. 1 Engine Identification SOHC

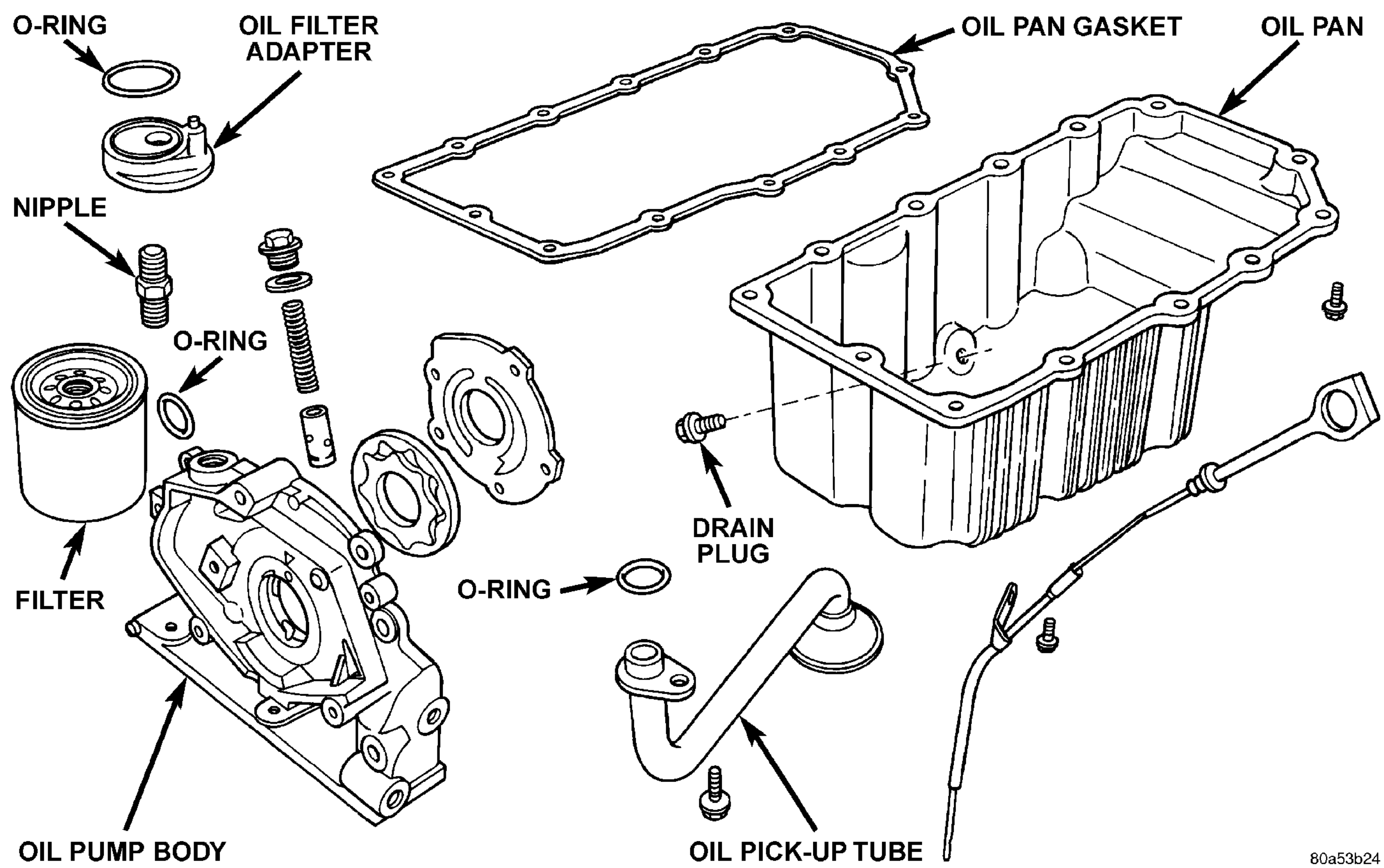
GENERAL SPECIFICATION

Type . . . . In-Line OHV, DOHC & SOHC
Bore . . . . 87.5mm (3.445 Inch)
Stroke . . . . 83.0mm (3.268 inch)
Compression Ratio . . . . DOHC - 9.6:1 SOHC - 9.8:1
Displacement . . . . 2.0 Liters (122 Cubic Inch)
Firing Order 1, 3, 4, 2
Compression Pressure . . . . 1172 - 1551 kPa (170 - 225 psi)
Maximum Variation Between Cylinders 25%
Lubrication . . . . Pressure Feed - Full Flow Filtration (Crankshaft Driven Pump)

Engine Oil Capacity

With Oil Filter Change . . . . 4.25 Liter (4.5 Qts.)
Without Oil Filter Change . . . . . 3.8 Liter (4.0 Qts.)

DESCRIPTION AND OPERATION (Continued)



Engine Lubrication Components

ENGINE LUBRICATION SYSTEM

ENGINE LUBRICATION

Refer to Group 0, Lubrication and Maintenance for recommended oil to be used in various engine application. System is full flow filtration, pressure feed type. The oil pump is mounted in the front engine cover and driven by the crankshaft. Pressurized oil is then routed through the main oil gallery, running the length of the cylinder block, supplying main and rod bearings with further routing. Rod bearing oil throw-off lubricates the pistons from directed slots on the side of the connecting rod assemblies. Camshaft and valve mechanisms are lubricated from a full-length cylinder head oil gallery supplied from the crankcase main oil gallery.

PRESSURE LUBRICATION

Oil drawn up through the pickup tube is pressurized by the pump and routed through the full flow filter to the main oil gallery running the length of the cylinder block. A cylinder head restrictor, located in the block, provides increased oil flow to the main oil gallery (Fig. 2).

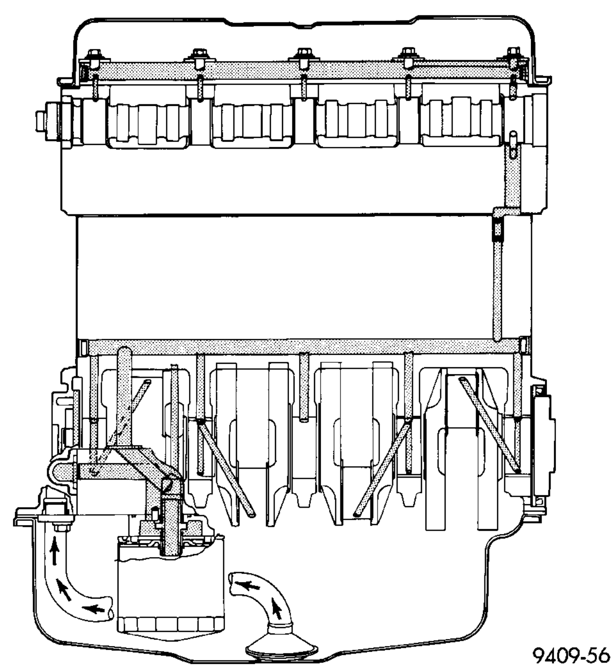


Fig. 2 Engine Lubrication System— SOHC

MAIN/ROD BEARINGS

A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft

DESCRIPTION AND OPERATION (Continued)

route oil from main bearing journals to connecting rod journals.

CAMSHAFT/HYDRAULIC LASH ADJUSTERS

A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up into the cylinder head. The rocker shafts route oil to the rocker arms/hydraulic lash adjuster assemblies.

SPLASH LUBRICATION

Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

ENGINE COMPONENTS

CYLINDER BLOCK AND BEDPLATE ASSEMBLY A partial open deck is used for cooling and weight reduction with water pump molded into the block. Nominal wall thickness is 4 mm. The bedplate incorporates main bearing caps. Rear seal retainer is integral with the block.

CRANKSHAFT A nodular cast iron crankshaft is used. The engine has 5 main bearings, with number 3 flanged to control thrust. The 52 mm diameter main and 48 mm diameter crank pin journals (all) have undercut fillet radiuses that are deep rolled for added strength. To optimize bearing loading 8 counterweights are used. Hydrodynamic seals provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for parting line sealing. A sintered iron timing belt sprocket is mounted on the crankshaft nose. This sprocket transmits crankshaft movement, via timing belt to the camshaft sprocket providing timed valve actuation.

PISTONS The SOHC Engine **DOES NOT** have provision for a free wheeling valve train. Non free wheeling valve train means, in the event of a broken timing belt Pistons will contact the Valves. All engines use pressed-in piston pins to attach forged powdered metal connecting rods. The connecting rods are a cracked cap design and are not repairable. Hex head cap screw are used to provide alignment and durability in the assembly. Pistons And Connecting rods are serviced as an assembly.

PISTON RINGS The piston rings include a molybdenum faced top ring for reliable compression sealing and a taper faced intermediate ring for additional cylinder pressure control. Oil Control Ring Package consist of 2 steel rails and a expander spacer.

CYLINDER HEAD — SOHC It features a Single Over Head Camshaft, four-valves per cylinder cross flow design. The valves are arranged in two inline banks, with the two intake per cylinder facing toward the radiator. The exhaust valves facing toward the dash panel. Rocker arm shafts mount directly to the cylinder head. It incorporates powder metal valve guides and seats. The hollow rocker arm shafts supplies oil to the hydraulic lash adjusters, camshaft and valve mechanisms.

CAMSHAFT — SOHC The nodular iron camshaft has five bearing journals and 3 cam lobes per cylinder. Provision for cam position sensor on the cam at the rear of cylinder head which also acts as thrust plate. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

VALVES — SOHC Four valves per cylinder are actuated by roller rocker arms/hydraulic lash adjusters assemblies which pivot on rocker arm shafts. All valves have 6 mm diameter chrome plated valve stems. The valve train has 33 mm (1.299 inch) diameter intake valves and 28 mm (1.10 inch) diameter exhaust valves. Viton rubber valve stem seals are integral with spring seats. Valve springs, spring retainers, and locks are conventional design.

INTAKE MANIFOLD The intake manifold is a molded plastic composition, attached to the cylinder head with ten fasteners. This long branch design enhances low and midrange torque.

EXHAUST MANIFOLD The exhaust manifold is made of nodular cast iron for strength and high temperatures. Exhaust gasses exit through a machined, articulated joint connection to the exhaust pipe.

PARTS REPLACED

If any of the following parts have been changed or replaced:

- Camshaft
- Camshaft Position Sensor
- Camshaft Position Sensor Target Magnet
- Cylinder Block
- Cylinder Head
- Water Pump
- Powertrain Control Module (PCM)
- Timing belt and tensioner.

The camshaft and crankshaft timing relearn procedure must be performed. Refer to Group 25, for procedure.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure switch and install gauge assembly C-3292 with adaptor.

(2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not perform the 3000 RPM test in the next step.

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170-550 kPa (25-80 psi).

(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open, a clogged

DIAGNOSIS AND TESTING (Continued)

oil pick-up screen or a damaged oil pick-up tube O-ring.

SERVICE PROCEDURES

CYLINDER BORE AND PISTON SIZING

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 3). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 3). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Cylinder Bore and Piston Specifications Table.

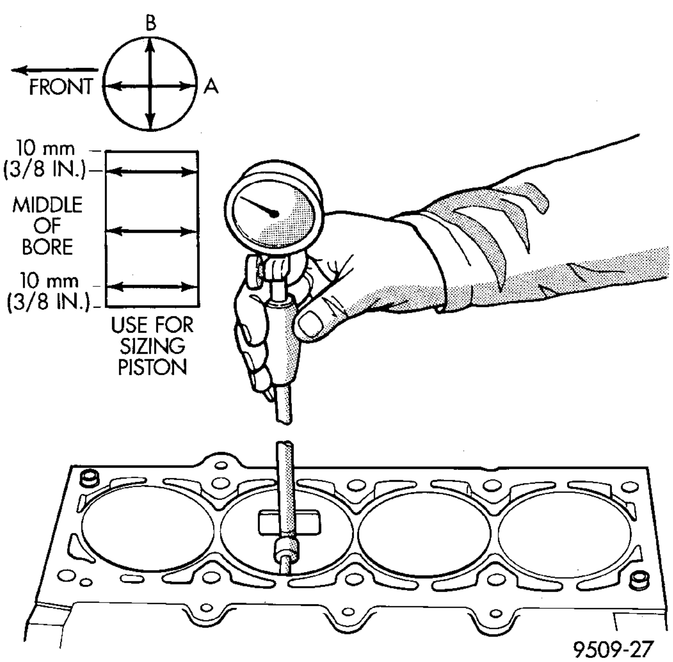


Fig. 3 Checking Cylinder Bore Size

SIZING PISTONS

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 17.5 mm (11/16 inch) from the bottom of the skirt as shown in (Fig. 4). Cylinder bores should be measured halfway down the cylinder bore

CYLINDER BORE AND PISTON SPECIFICATIONS TABLE

Standard Bore	Maximum Out-of-Round	Maximum Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
87.463 - 87.481 mm (3.4434 - 3.4441 in.)		
Piston to Bore Clearance		
0.012 - 0.044 mm (0.0004 - 0.0017 in.)		
Measurements Taken at Piston Size Location		

and transverse to the engine crankshaft center line shown in (Fig. 3). Refer to Cylinder Bore and Specifications Table. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

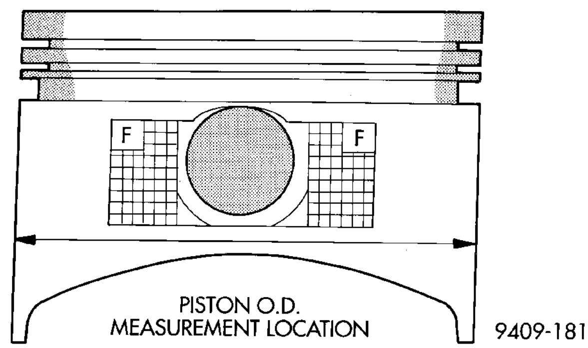


Fig. 4 Piston Measurements

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

FITTING PISTON RINGS

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 5). Refer to specifications (Fig. 7).

(2) Check piston ring to groove side clearance (Fig. 6). Refer to specification (Fig. 7).

FITTING CONNECTING RODS

(1) Follow the procedure specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 8). Refer to specifications.

SERVICE PROCEDURES (Continued)

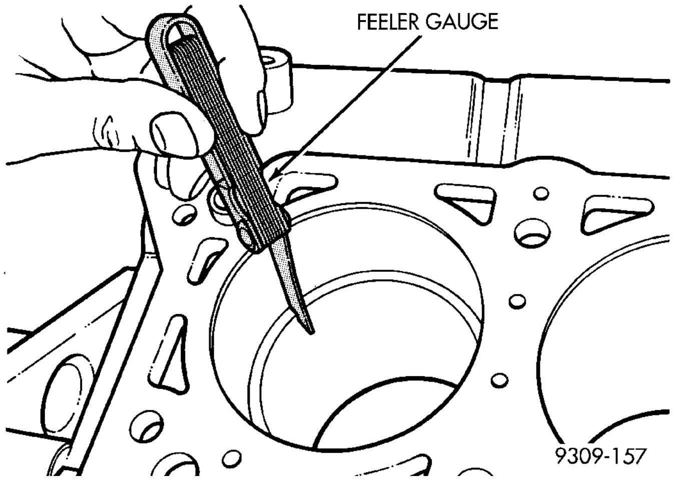


Fig. 5 Piston Ring Gap

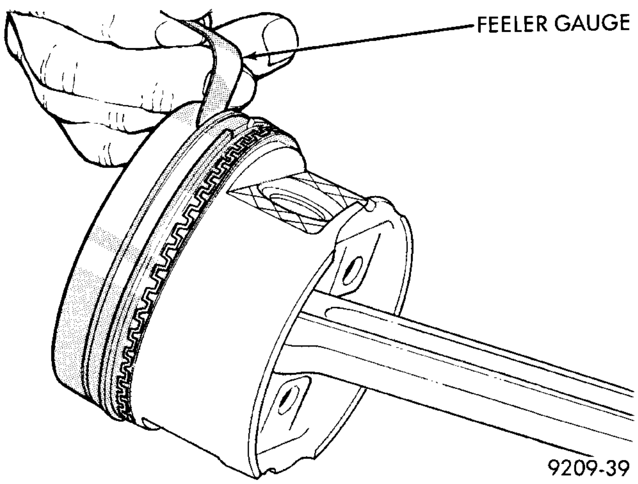


Fig. 6 Piston Ring Side Clearance

Ring Position	Ring Gap	Wear Limit
Upper Ring	0.23 to 0.52 mm (0.009 to 0.020 in.)	0.8 mm (0.031 in.)
Intermediate Ring	0.49 to 0.78 mm (0.019 to 0.031 in.)	1.0 mm (0.039 in.)
Oil Control Ring	0.23 to 0.66 mm (0.009 to 0.026 in.)	1.0 mm (0.039 in.)
Ring Position	**Groove Clearance**	**Maximum Clearance**
Upper Ring	0.025 to 0.065 mm (0.0010 to 0.0026 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.025 to 0.065 mm (0.0010 to 0.0026 in.)	0.10 mm (0.004 in.)
OIL CONTROL RING - THREE PIECE. OIL RING SIDE RAILS MUST BE FREE TO ROTATE AFTER ASSEMBLY.		

Fig. 7 Piston Ring Specifications

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

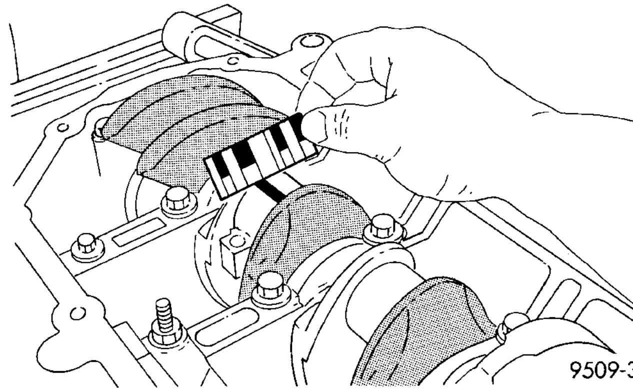


Fig. 8 Checking Connecting Rod Bearing Clearance

NOTE: The rod bearing bolts should not be reused.

(2) Before installing the **NEW** bolts the threads should be oiled with clean engine oil.

(3) Install each bolt finger tight than alternately torque each bolt to assemble the cap properly.

(4) Tighten the bolts to 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn) **Do not use a torque wrench for last step.**

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 9). Refer to connecting rod specifications (Fig. 10).

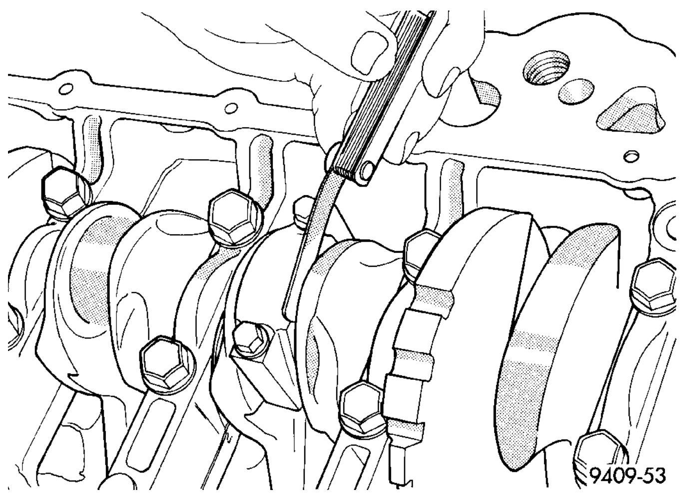


Fig. 9 Checking Connecting Rod Side Clearance

SERVICE PROCEDURES (Continued)

CONNECTING ROD BEARING OIL CLEARANCE	
New Part:	0.026 to 0.059 mm (0.001 to 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
CONNECTING ROD SIDE CLEARANCE	
New Part:	0.13 to 0.38 mm (0.005 to 0.015 in.)
Wear Limit:	0.40 mm (0.016 in.)

Fig. 10 Connecting Rod Specifications

FITTING CRANKSHAFT BEARINGS

Refer to Measuring Main Bearing Clearance in Standard Service Procedures. Refer to (Fig. 11) for specifications.

Crankshaft End-Play	
New Part:	0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Wear Limit:	0.37 mm (0.015 in.)
Main Bearing Clearance	
New Part:	.022 - .062 mm (0.0008 - 0.0024 in.)
Connecting Rod Bearing Clearance	
New Part:	0.026 - .059 mm (0.001 - 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
Crankshaft Journal Sizes	
Main Bearing Journal Diameter	
Standard	52.000 ± 0.008 mm (2.0472 ± 0.0003 in.)
1st Undersize	51.983 ± 0.008 mm (2.0466 ± 0.0003 in.)
Connecting Rod Journal	
Standard	48.000 ± 0.008 mm (1.8897 ± 0.0003 in.)
1st Undersize	47.983 ± 0.008 mm (1.8891 ± 0.0003 in.)

Fig. 11 Crankshaft Specifications

CRANKSHAFT END PLAY

DIAL INDICATOR METHOD

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 12).

(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. 11) for specifications.

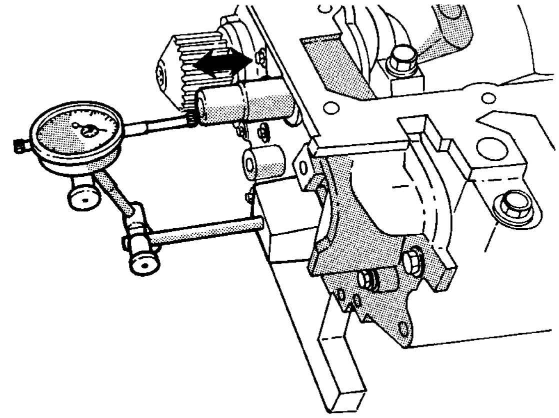


Fig. 12 Checking Crankshaft End Play— Dial Indicator

FEELER GAGE METHOD

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. Do **not** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

REMOVAL AND INSTALLATION

FRONT MOUNT

(1) Raise vehicle on hoist.

(2) Support the engine and transmission assembly with a floor jack so it will not rotate.

(3) Remove the front engine mount thru-bolt from the insulator and engine mount bracket (Fig. 13).

(4) Remove the mass damper. Remove the front mount nuts and remove insulator assembly.

(5) Remove the engine mount bracket, if necessary.

(6) Reverse removal procedure for installation and tighten fasteners in this order.

a. If engine mount bracket was removed, tighten bolt 1 to 3 N·m (20 in. lbs.) and bolts 2, 3 and 4 to 108 N·m (80 ft. lbs.) (Fig. 13).

b. If engine mount bracket was removed, tighten bolts 5 and 1 to 54 N·m (40 ft. lbs.).

c. Tighten engine mount bracket to insulator assembly thru-bolt to 54 N·m (40 ft. lbs.).

d. Tighten insulator assembly nuts to the lower radiator crossmember torque to 54 N·m (40 ft. lbs.).

e. Install mass damper and tighten to 54 N·m (40 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

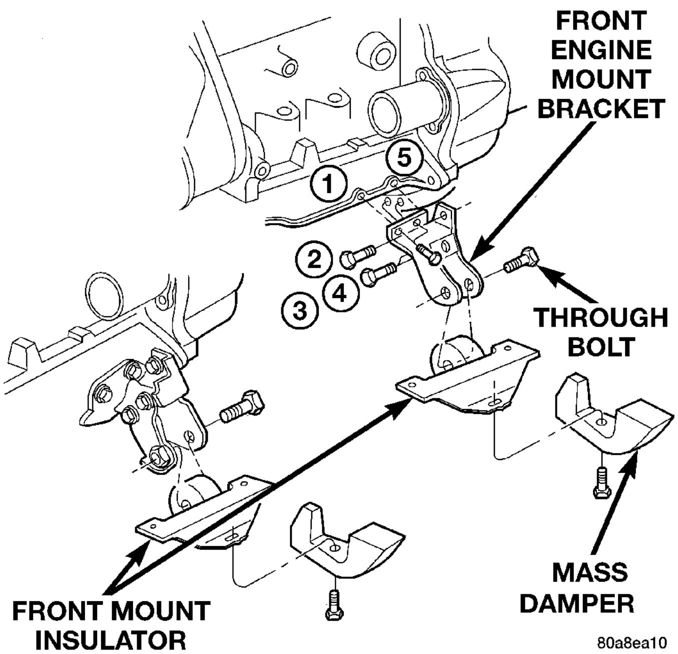


Fig. 13 Engine Mounting—Front

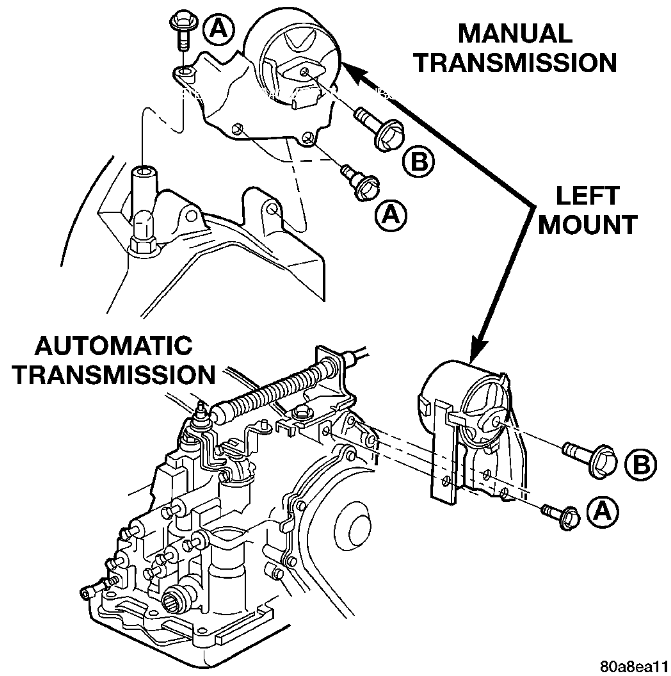


Fig. 14 Engine Mounting—Left

LEFT MOUNT

(1) Raise vehicle on hoist and remove left front wheel.

(2) Remove the Power Distribution Center (PDC) on manual transaxle model, from battery tray mount and lay aside.

(3) Support the transmission with a transmission jack.

(4) Remove the thru-bolt access hole cover. Remove the insulator thru-bolt from the mount (Fig. 14).

(5) Remove the transmission mount fasteners and remove mount.

(6) Reverse removal procedure for installation. Tighten fasteners in this order (Fig. 14):

A. 55 N·m (40 ft. lbs.)

B. 108 N·m (80 ft. lbs.)

RIGHT MOUNT

(1) Remove the purge duty solenoid from engine mount bracket.

(2) Remove the right engine mount insulator vertical fasteners from frame rail (Fig. 15).

(3) Remove the load on the engine mounts by carefully supporting the engine and transmission assembly with a floor jack.

(4) Remove the thru-bolt access hole cover. Remove the thru-bolt from the insulator assembly (Fig. 15). Remove insulator.

(5) Reverse removal procedure for installation. Tighten engine mount to rail fasteners to 54 N·m (40 ft. lbs.), then tighten engine mount to engine bracket thru-bolt to 108 N·m (80 ft. lbs.).

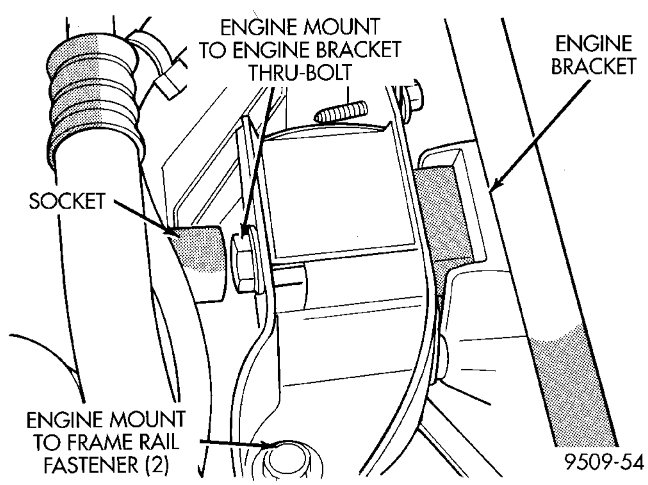


Fig. 15 Engine Mounting—Right

POWER HOP DAMPER

NOTE: Power hop damper is used on manual transmission vehicle only.

(1) Remove the thru-bolt and nut from the front suspension crossmember (Fig. 16).

(2) Remove the damper nut and grommets. Remove the damper.

(3) Remove the power hop damper bracket, if necessary.

(4) Reverse removal procedure for installation. Tighten all bolts and nuts to 54 N·m (40 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

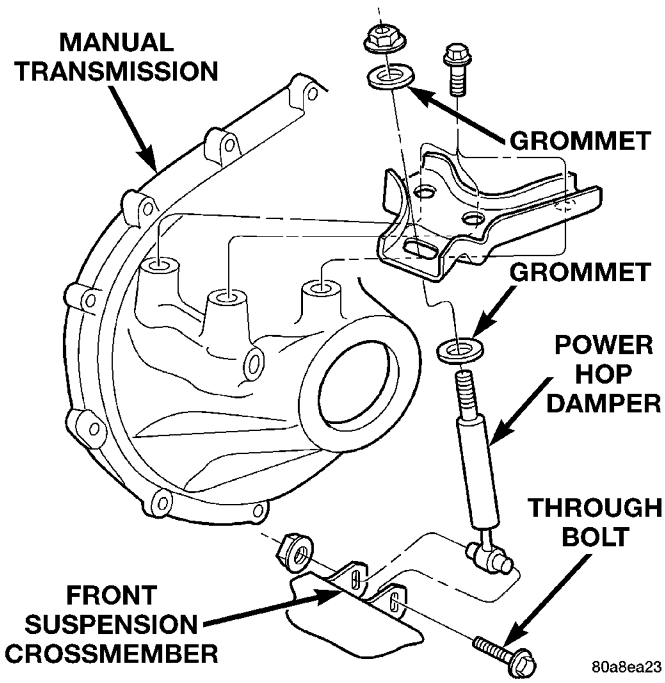


Fig. 16 Power Hop Damper

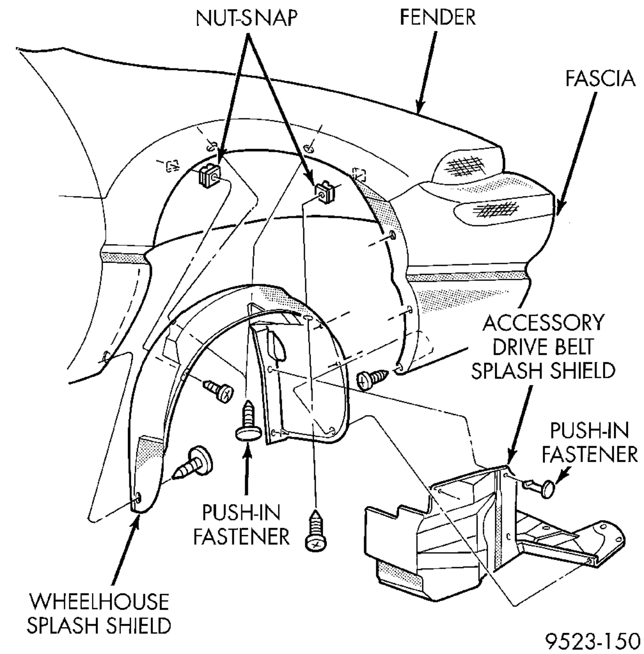


Fig. 17 Right Inner Splash Shield

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect and remove battery and tray. Set Powertrain Control Module (PCM) aside.

(3) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(4) Remove upper radiator hose, radiator and fan module. Refer to Group 7, Cooling System for procedure.

(5) Remove lower radiator hose.

(6) Disconnect automatic transmission cooler lines and plug. If equipped.

(7) Disconnect clutch cable (Manual) and transmission shift linkage.

(8) Disconnect throttle body linkage.

(9) Disconnect engine wiring harness.

(10) Disconnect heater hoses.

(11) Discharge Air Conditioning System. Refer to Group 24, Air Conditioning for procedure.

(12) Hoist vehicle and remove right inner splash shield (Fig. 17).

(13) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(14) Remove axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(15) Disconnect exhaust pipe from manifold.

(16) Remove front engine mount.

(17) Manual transmission: Remove power hop damper.

(18) Lower vehicle. Remove air cleaner assembly.

(19) Remove power steering pump and reservoir, Set them aside.

(20) Remove A/C compressor.

(21) Remove ground straps to body.

(22) Raise vehicle enough to allow engine dolly and cradle Special Tools 6135 and 6710 to be installed under vehicle.

(23) Loosen engine support posts to allow movement for positioning onto engine locating holes and flange on the engine bedplate. Lower vehicle and position cradle until the engine is resting on support posts (Fig. 18). Tighten mounts to cradle frame. This will keep support posts from moving when removing or installing engine and transmission.

(24) Install safety straps around the engine to cradle tighten; straps and lock them into position.

(25) Raise vehicle enough to see if straps are tight enough to hold cradle assembly to engine.

(26) Lower vehicle so weight of the engine and transmission ONLY is on the cradle assembly.

(27) Remove engine and transmission mount thru-bolts.

(28) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly with the cradle to allow for removal around body flanges.

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right

REMOVAL AND INSTALLATION (Continued)

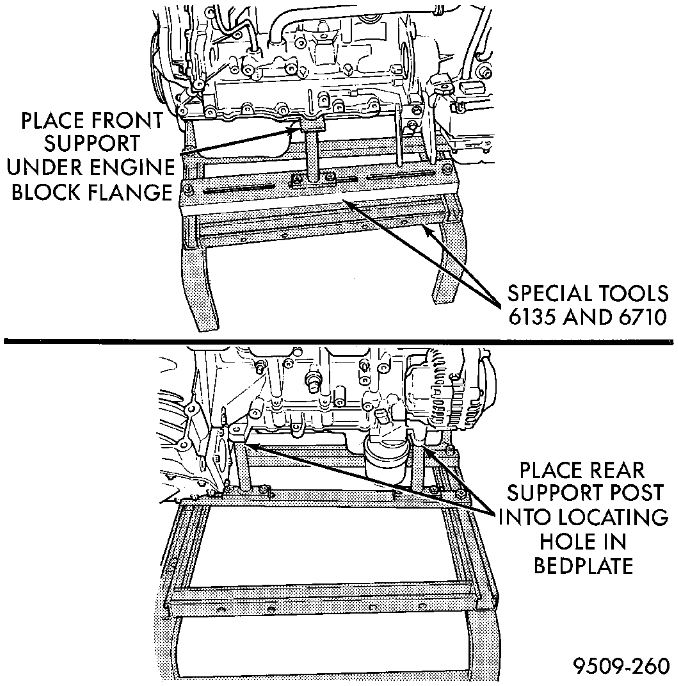


Fig. 18 Positioning Engine Cradle Support Post Mounts

engine and left transmission mounts. Refer to procedures outlined in this section.

(3) Remove safety straps from engine and transmission assembly. Slowly raise vehicle enough to remove the engine dolly and cradle.

(4) Install axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(5) Install transmission and engine braces and splash shields.

(6) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(7) Install power steering pump and reservoir. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(8) Install A/C compressor and hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(9) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(10) Install front engine mount. Refer to this section for procedure.

(11) Manual transmission: Install power hop damper.

(12) Install inner splash shield. Install wheels and tires.

(13) **Manual Transmission:** Connect clutch cable and linkages. Refer to Group 6, Manual Transaxle Clutch.

(14) **Automatic Transmission:** Connect shifter and kickdown linkage. Refer to Group 21, Transaxle for procedures.

(15) Connect fuel line and heater hoses.

(16) Install ground straps. Connect engine and throttle body connections and harnesses. Refer to Group 8, Electrical for procedure.

(17) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(18) Install radiator and shroud assembly. Install radiator hoses. Fill cooling system. Refer to Group 7, Cooling System for filling procedure.

(19) Install battery tray and battery. Set Powertrain Control Module (PCM) into place.

(20) Install air cleaner and hoses.

(21) Install oil filter. Fill engine crankcase with proper oil to correct level.

(22) Start engine and run until operating temperature is reached.

(23) Adjust transmission linkage, if necessary.

CYLINDER HEAD COVER

REMOVAL

(1) Remove air cleaner inlet duct (Fig. 19)

(2) Remove ignition coil pack (Fig. 20).

(3) Remove the cylinder head cover bolts.

(4) Remove cylinder head cover from cylinder head.

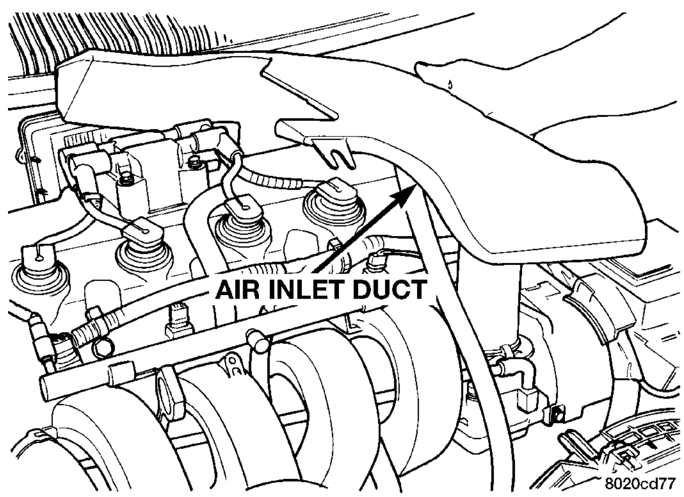


Fig. 19 Inlet Duct Removal

INSTALLATION

Before installation, clean cylinder head and cover mating surfaces. Make certain the cylinder head cover mating surface is flat.

(1) Install new valve cover gasket.

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(2) Install cover assembly to head and tighten fasteners to 12 N·m (105 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

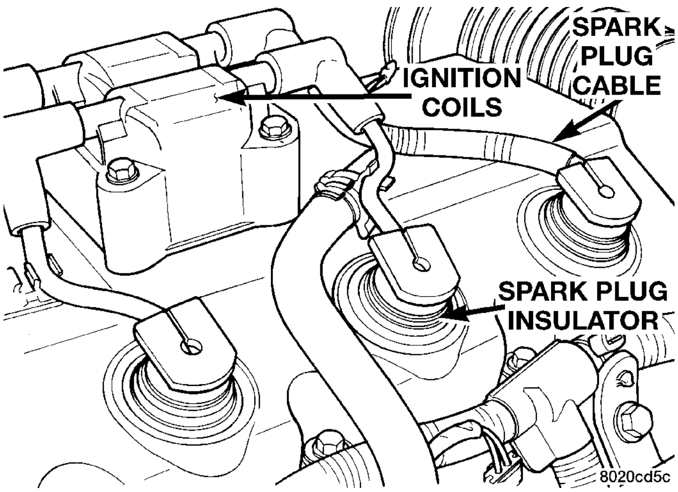


Fig. 20 Ingition Coil Pack

(3) Install ignition coil pack. Tighten fasteners to 23 N·m (200 in. lbs.).

SPARK PLUG TUBE

(1) Remove valve cover. Refer to procedure outlined in this section.

(2) Using locking pliers remove the tube from the cylinder head (Fig. 21). Discard old tube.

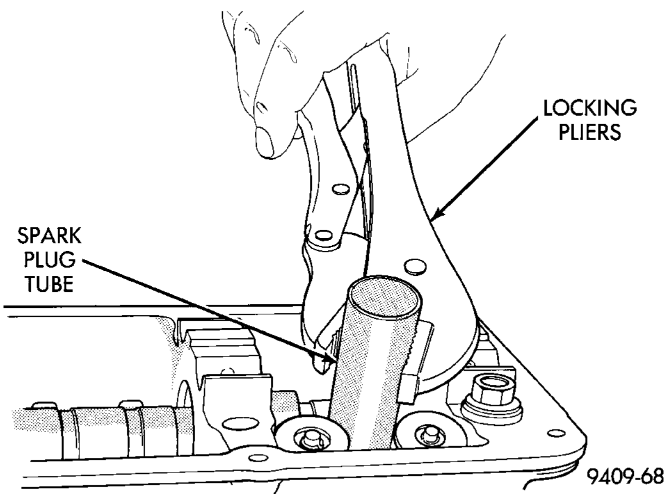


Fig. 21 Servicing Spark Plug Tubes

(3) Clean area around spark plug with MOPAR parts cleaner or equivalent.

(4) Apply Loctite sealer 271 or Mopar Stud and Bearing Mount or equivalent to a new tube approximately 1 mm from the end in a 3 mm wide area.

(5) Install sealer end of tube into the cylinder head. Then carefully install the tube using a hardwood block and mallet until the tube is seated into the bottom of the bore.

(6) Install valve cover. Refer to procedure outlined in this section.

SPARK PLUG TUBE SEALS

The spark plug tube seals are located in the cylinder head cover (Fig. 22). These seals are pressed into the cylinder head cover to seal the end of the spark plug tubes. If these seals show signs of hardness and/or cracking they should be replaced.

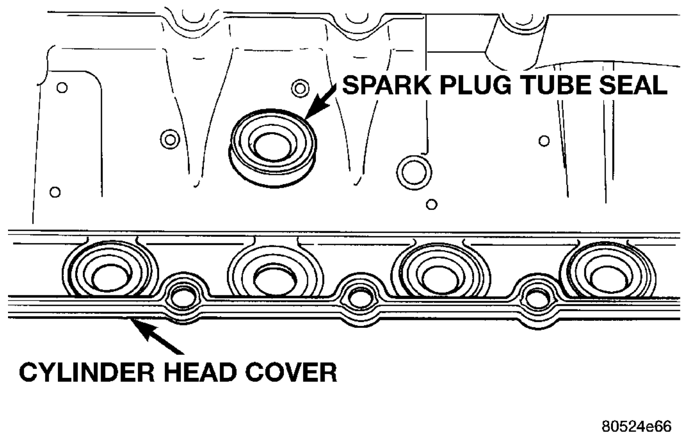


Fig. 22 Spark Plug Tube Seals

CAMSHAFT

NOTE: TO REMOVE CAMSHAFT CYLINDER HEAD MUST BE REMOVED.

REMOVAL

(1) Refer to Timing Belt Removal for timing belt and camshaft sprocket removal and installation.

(2) Remove the cylinder head cover.

(3) Mark rocker arm shaft assemblies for installation.

(4) Remove rocker arm shaft bolts. Refer to procedure outlined in this section.

(5) Remove the timing belt and camshaft sprocket. Refer to timing belt service outlined in this section.

(6) Remove cylinder head. Refer to procedure outlined in this section.

(7) Remove camshaft sensor and remove camshaft from the rear of the head.

REMOVAL AND INSTALLATION (Continued)

NOTE: Check oil feed holes for blockage.

Inspect cylinder head journals for wear, Refer to Cylinder Head, Inspect and Cleaning.

Check camshaft bearing journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft without rocker arm assemblies. Install cam sensor and tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 23).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.13 - 0.33 mm (0.005 - 0.013 in.).

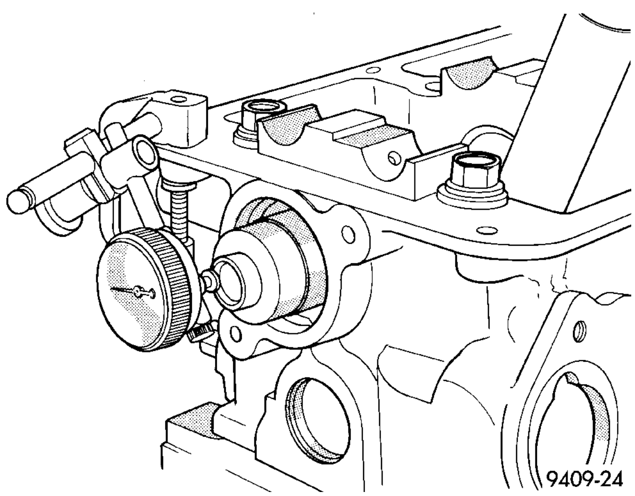


Fig. 23 Camshaft End Play

INSTALLATION

(1) Lubricate camshaft journals. Install camshaft into the cylinder head carefully.

(2) Install cam sensor and tighten fasteners to 9.5 N·m (85 in. lbs.).

(3) Install camshaft seal. Camshaft must be installed before the camshaft seal is installed. Refer to procedure outlined in this section.

(4) Install camshaft sprocket and tighten to 115 N·m (85 ft. lbs.).

(5) Install timing belt. (Refer to procedure outlined in this section).

(6) Install rocker arm assemblies in correct order as removed. Tighten the rocker arm assemblies in sequence shown in (Fig. 24) to 23 N·m (200 in. lbs.).

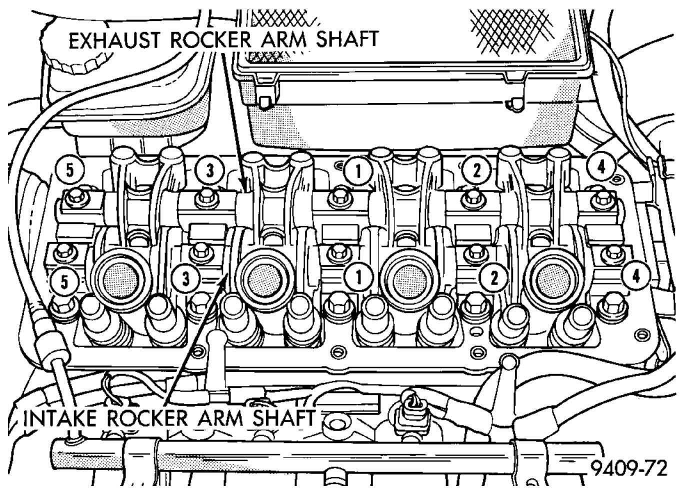


Fig. 24 Rocker Arm Shaft Tightening Sequence

ROCKER ARM/HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove valve cover using procedure outlined in this section.

(2) Identify the rocker arm shaft assemblies before removal.

(3) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.

(4) Identify the rocker arms spacers and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts from the shaft (Fig. 25).

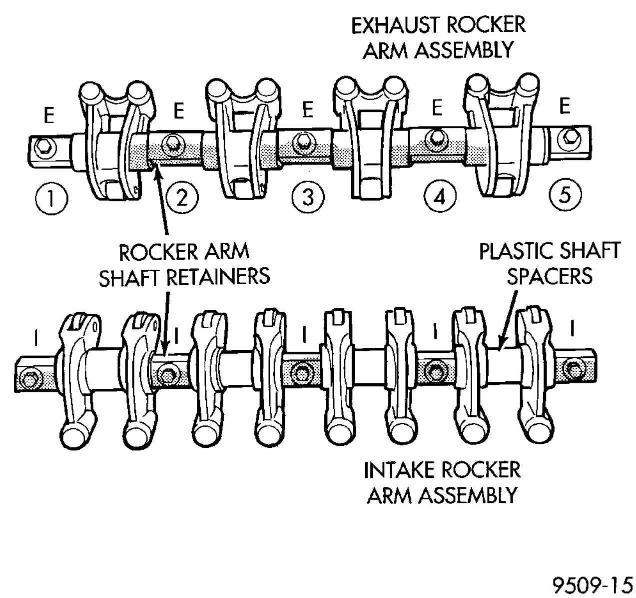


Fig. 25 Rocker Arm Shaft Assemblies

REMOVAL AND INSTALLATION (Continued)

(5) Slide the rocker arms and spacers off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

NOTE: Inspect the rocker arm for scoring, wear on the roller or damage to the rocker arm (Fig. 26) Replace if necessary. Check the location where the rocker arms mount to the shafts for wear or damage. Replace if damaged or worn. The rocker arm shaft is hollow and is used as a lubrication oil duct. Check oil holes for clogging with small wire, clean as required. Lubricate the rocker arms and spacers. Install onto shafts in their original position (Fig. 25).

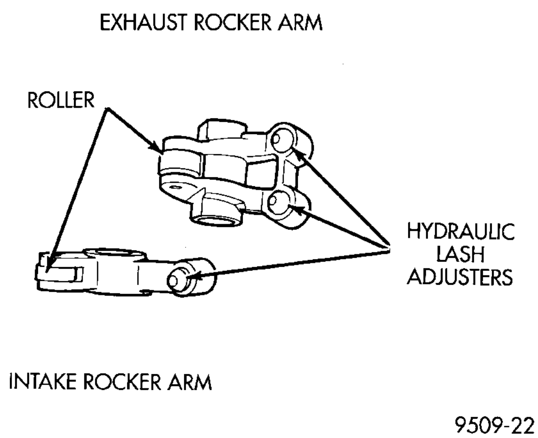


Fig. 26 Rocker Arm Assemblies

INSTALLATION

CAUTION: Set crankshaft to 3 notches before TDC before installing rocker arm shafts. Refer to Timing Belt System and Camshaft Seal Service of this section for procedure.

(1) Install rocker arm/hydraulic lash adjuster assembly making sure that adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed. If there is excessive plunger travel. Place the rocker arm assembly into clean engine oil and pump the plunger until the lash adjuster travel is taken up. If travel is not reduced, replace the assembly. Hydraulic lash adjuster and rocker arm are serviced as an assembly.

(2) Install rocker arm and shaft assemblies with NOTCH in the rocker arm shafts pointing up and toward the timing belt side of the engine (Fig. 27). Install the retainers in their original positions on the exhaust and intake shafts (Fig. 25).

CAUTION: When installing the intake rocker arm shaft assembly be sure that the plastic spacers do not interfere with the spark plug tubes. If the spacers do interfere rotate until they are at the proper angle. To avoid damaging the spark plug tubes, do not attempt rotating the spacers by forcing down the shaft assembly.

(3) Tighten bolts to 23 N·m (200 in. lbs.) in sequence shown in (Fig. 28).

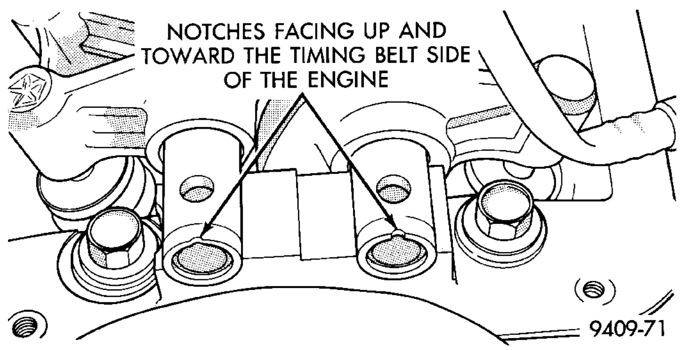


Fig. 27 Rocker Arm Shaft Notches

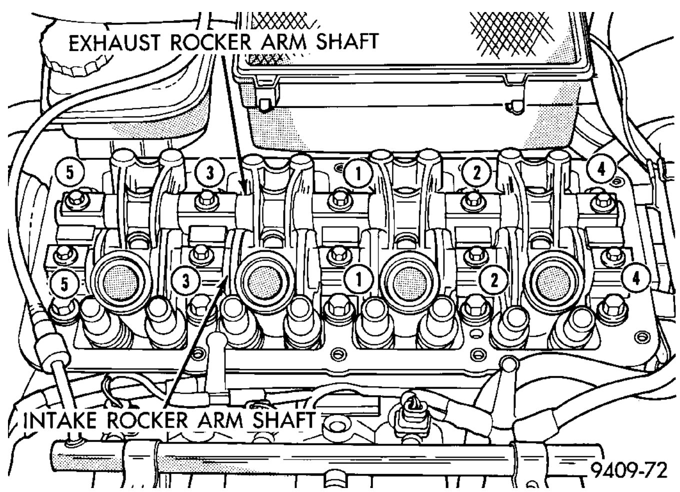


Fig. 28 Rocker Arm Shaft Tightening Sequence

HYDRAULIC LASH ADJUSTER NOISE

A tappet-like noise may be produced from several items. Refer to Lash Adjuster Noise - Diagnosis in Standard Service Procedures, outlined in this Group. **Lash adjusters are replaced with the rocker arm as an assembly.**

VALVE SEALS AND SPRINGS IN VEHICLE

REMOVAL

(1) Remove rocker arm shafts assemblies as previously outlined in this section.

(2) Rotate crankshaft until piston is at TDC on compression.

(3) With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.

(4) Using Special Tool MD-998772A with adapter 6779 (Fig. 29) compress valve springs and remove valve locks.

(5) Remove valve spring.

REMOVAL AND INSTALLATION (Continued)

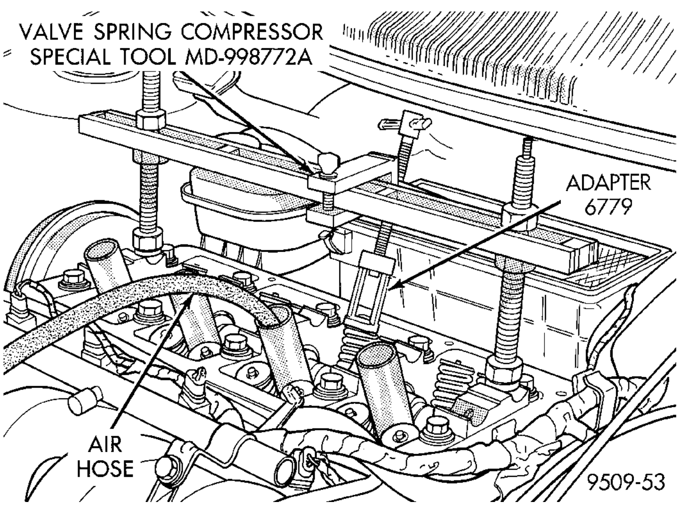


Fig. 29 Removing and Installing Valve Spring

(6) Remove valve stem seal by using a valve stem seal tool (Fig. 30).

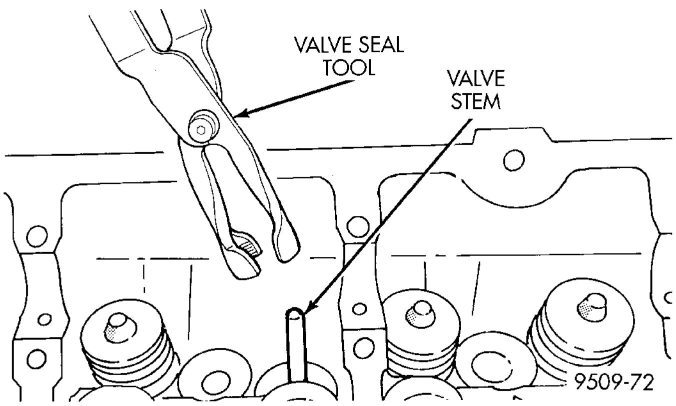


Fig. 30 Valve Stem Oil Seal Tool

INSTALLATION

(1) Install valve seal/valve spring seat assembly as outlined in the Valve Installation procedure in this section.

(2) Using Special Tool MD-998772A compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems (air pressure required), piston at TDC.

(3) Install rocker arm shaft assemblies as previously outlined in this section.

(4) Install valve cover as previously outlined in this section.

CYLINDER HEAD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System

(2) Disconnect negative battery cable. Drain cooling system. Refer to Group 7, Cooling System.

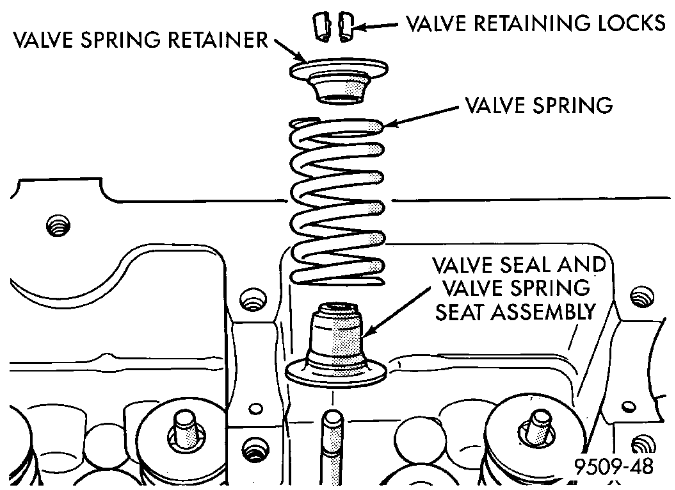


Fig. 31 Valve Spring Assembly

(3) Remove air cleaner inlet duct and air cleaner (Fig. 32), disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.

(4) Remove throttle linkage.

(5) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(6) Remove power brake vacuum hose from intake manifold.

(7) Raise vehicle and remove exhaust pipe from manifold.

(8) Remove power steering pump assembly and set aside.

(9) Disconnect coil pack wiring connector and remove coil pack and bracket from engine.

(10) Remove cylinder head cover.

(11) Remove cam sensor and fuel injectors wiring connectors.

(12) Remove intake manifold **SOHC ONLY** . Removal procedure outline in Group 11.

(13) Remove timing belt and camshaft sprocket. Refer to procedure outlined in this section.

(14) Remove rocker arm shaft assemblies.

(15) Remove cylinder head bolts.

NOTE: Inspect camshaft bearing journals for scoring. Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 33).

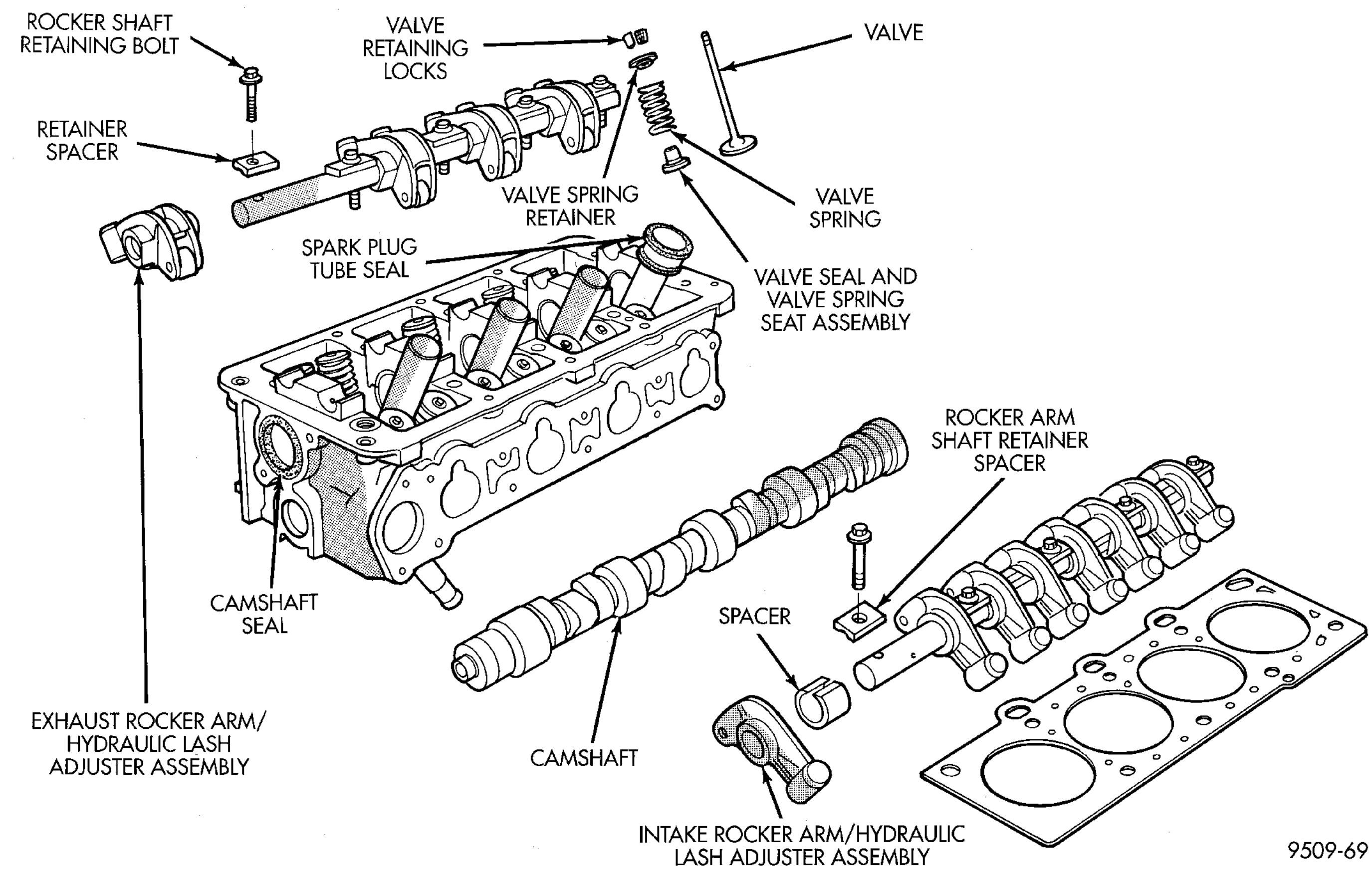
INSTALLATION

(1) Before installing the bolts the threads should be oiled with engine oil. The 4 short bolts 110 mm (4.330 in.) are to be installed in positions 7, 8, 9, and 10 (Fig. 34).

(2) Tighten the cylinder head bolts in the sequence shown in (Fig. 34). Using the 4 step torque method, tighten according to the following values:

- First All to 34 N·m (25 ft. lbs.)
- Second All to 68 N·m (50 ft. lbs.)
- Third All to 68 N·m (50 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)



Cylinder Head and Valve Assembly

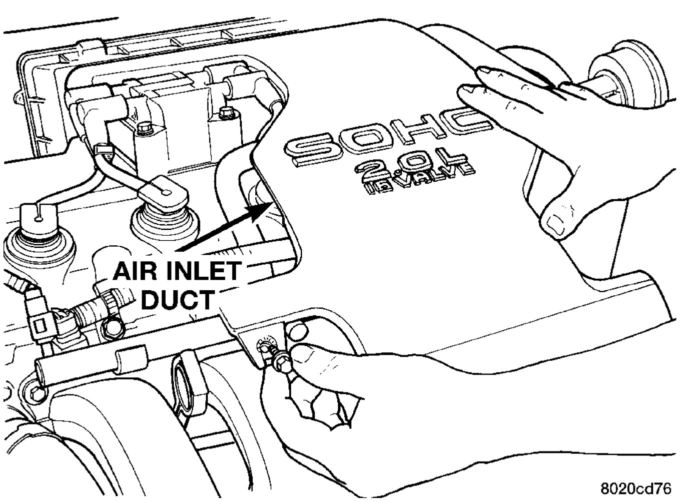


Fig. 32 Air Cleaner Inlet Duct

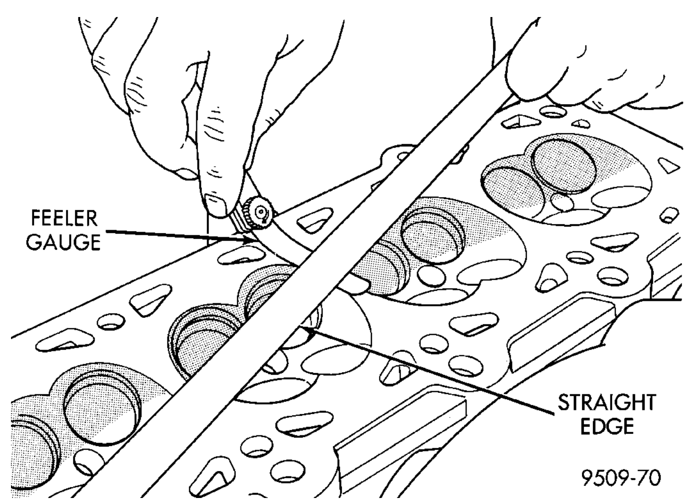


Fig. 33 Checking Cylinder Head Flatness

• Fourth Turn an additional 1/4 Turn, **Do not use a torque wrench for this step.**

For the rest of installation, reverse removal procedure.

TIMING BELT COVER

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 35).

(3) Remove crankshaft vibration damper. Refer to procedure outlined in this section for removal.

REMOVAL AND INSTALLATION (Continued)

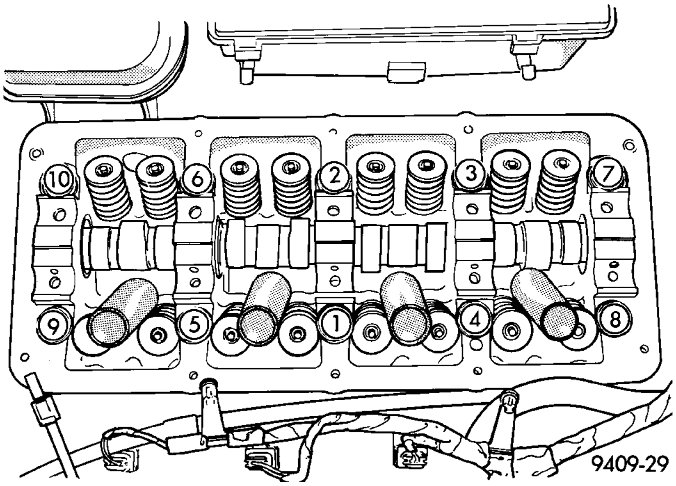


Fig. 34 Cylinder Head Tightening Sequence

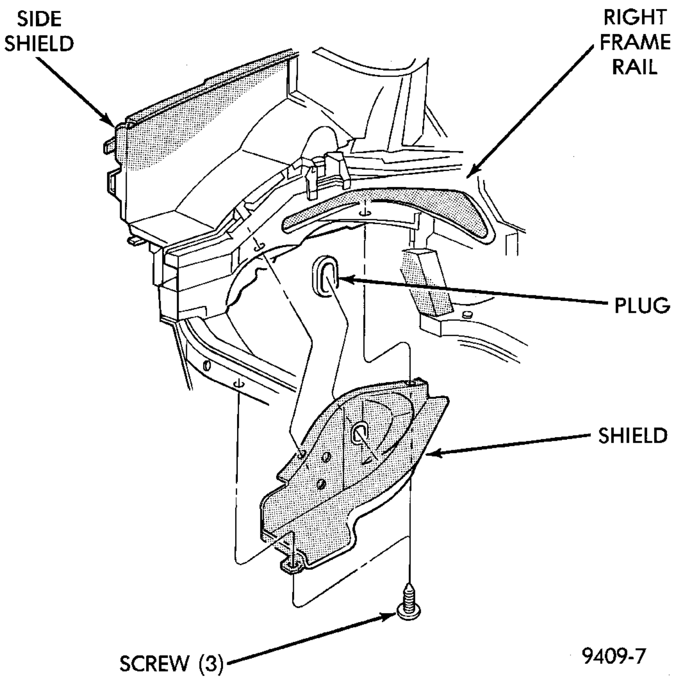


Fig. 35 Right Inner Splash Shield

(4) Lower vehicle and place a jack under engine.

(5) Remove right engine mount. Refer to procedure outlined in this section.

(6) Remove right engine mount bracket (Fig. 36).

(7) Remove front timing belt cover (Fig. 37).

INSTALLATION

(1) Install front timing cover.

(2) Install engine mount bracket.

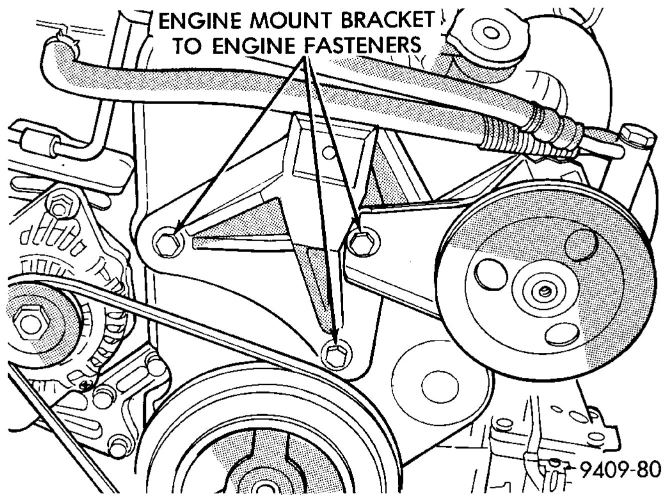


Fig. 36 Right Engine Mount Bracket

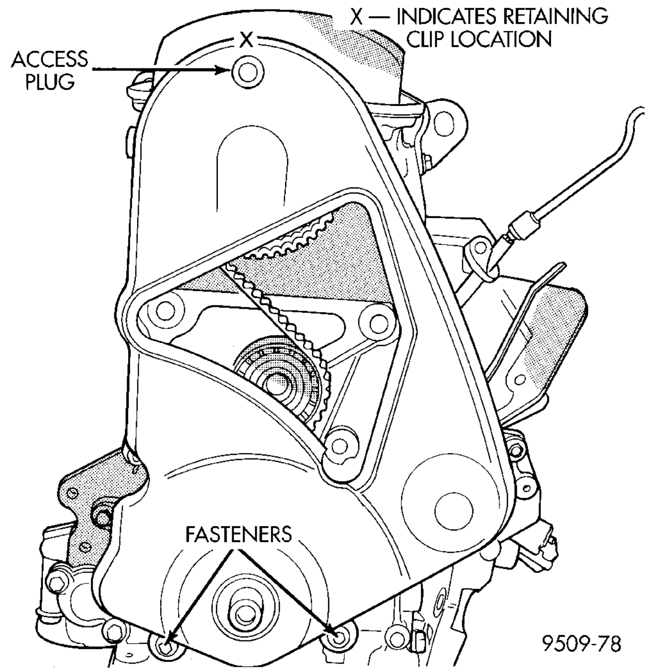


Fig. 37 Timing Belt Cover

(3) Install Right engine mount. Refer to procedure outlined in this section for installation.

(4) Remove jack from under engine.

(5) Install crankshaft vibration damper Refer to procedure outlined in this section for installation.

(6) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(7) Raise vehicle on hoist and install right inner splash shield.

REMOVAL AND INSTALLATION (Continued)

CAMSHAFT OIL SEAL

REMOVAL

CAUTION: Do Not Rotate the camshaft or crankshaft when timing belt is removed damage to the engine may occur.

(1) Remove timing belt cover and belt. Removal procedure is outlined in this section. Remove camshaft sprocket bolt, with the Modified Special Tool C-4687-1 as shown in (Fig. 38).

(2) Hold camshaft sprocket with modified tool while removing bolt. Remove sprocket from camshaft.

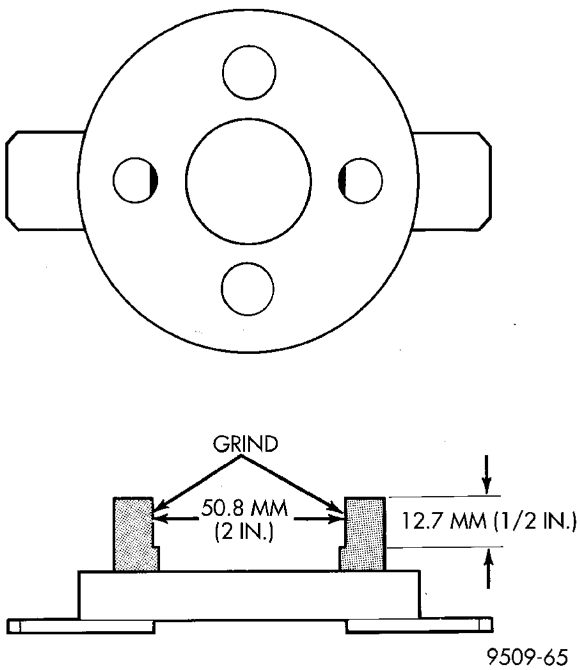


Fig. 38 Modification to Special Tool

(3) Remove camshaft seal using Special Tool C-4679–A (Fig. 39).

CAUTION: Do not nick shaft seal surface or seal bore.

(4) Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

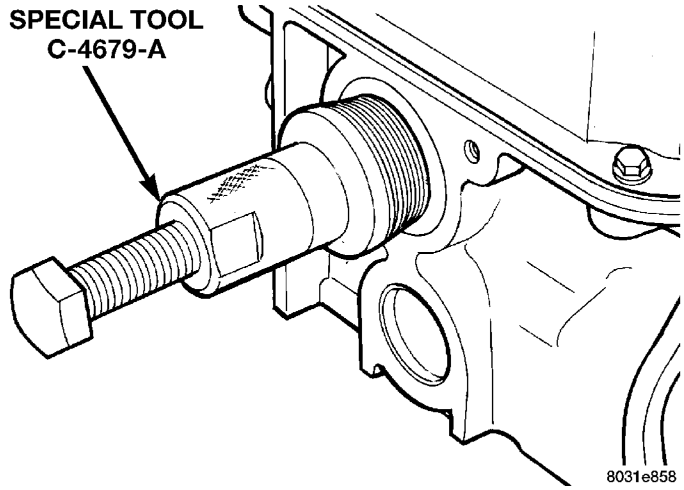


Fig. 39 Removing Camshaft Oil Seal

INSTALLATION

(1) Install camshaft seal flush with cylinder head using Special Tool MD 998306 (Fig. 40).

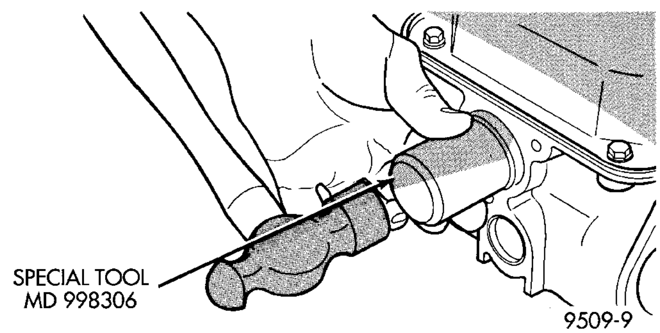


Fig. 40 Installing Camshaft Seal

(2) Install camshaft sprocket retaining bolt. Hold camshaft sprocket with Special Tool C-4687-1 (Fig. 38) and tighten bolt to 115 N·m (85 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

TIMING BELT SYSTEM

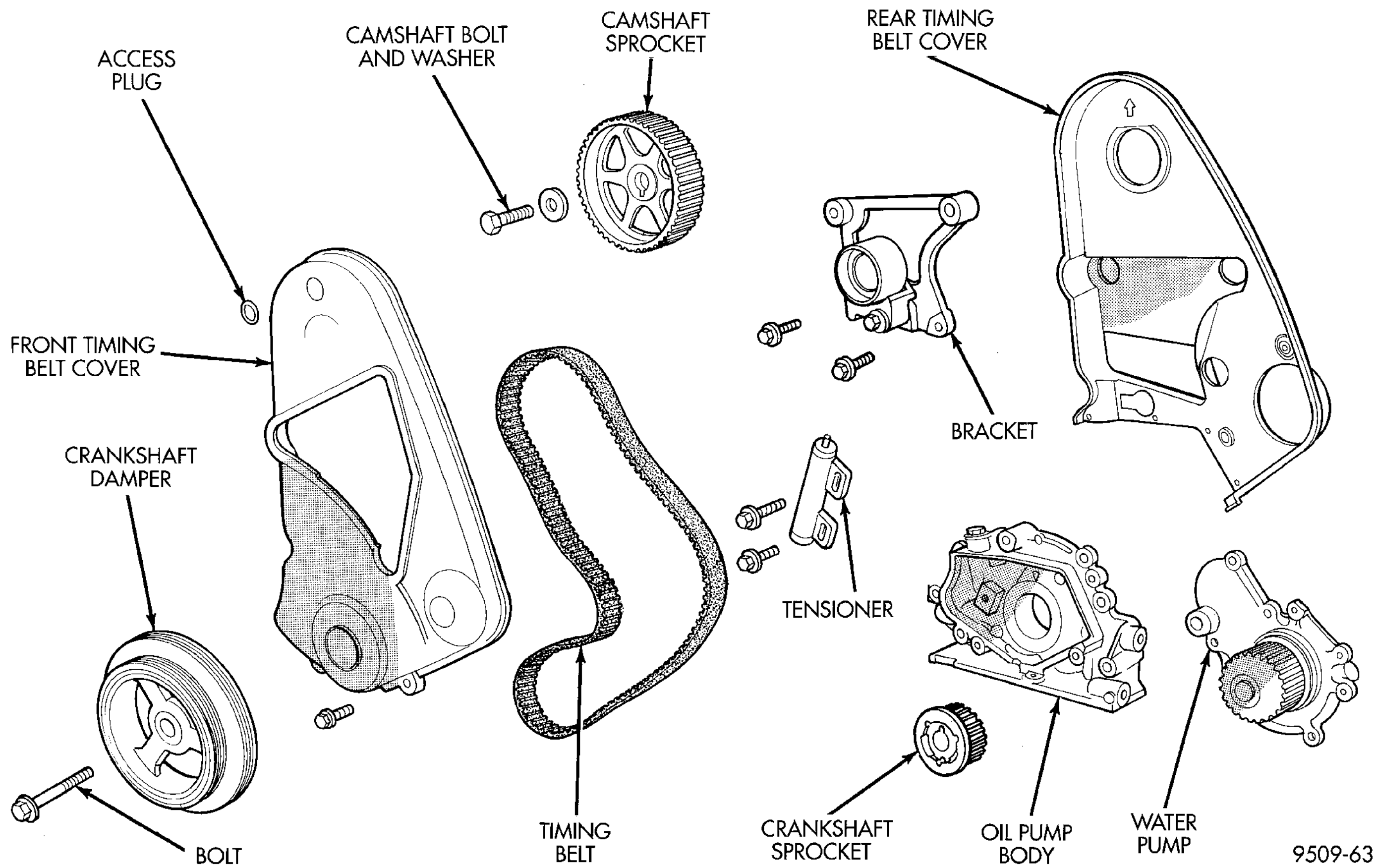


Fig. 41 Timing Belt System

CHECKING BELT TIMING—COVER INSTALLED

- Remove number one spark plug.
- Using a dial indicator, set number one cylinder to TDC on the compression stroke.
- Remove the access plug from the outer timing belt cover (Fig. 41).
- Check the timing mark on the camshaft sprocket, it should align with the arrow on the rear belt cover (Fig. 42).

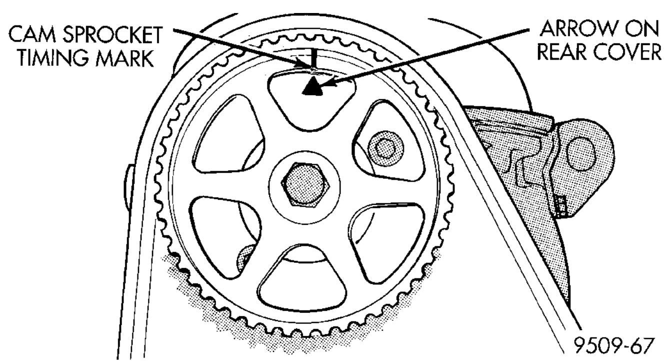


Fig. 42 Camshaft Timing Marks

REMOVAL—TIMING BELT

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 43).

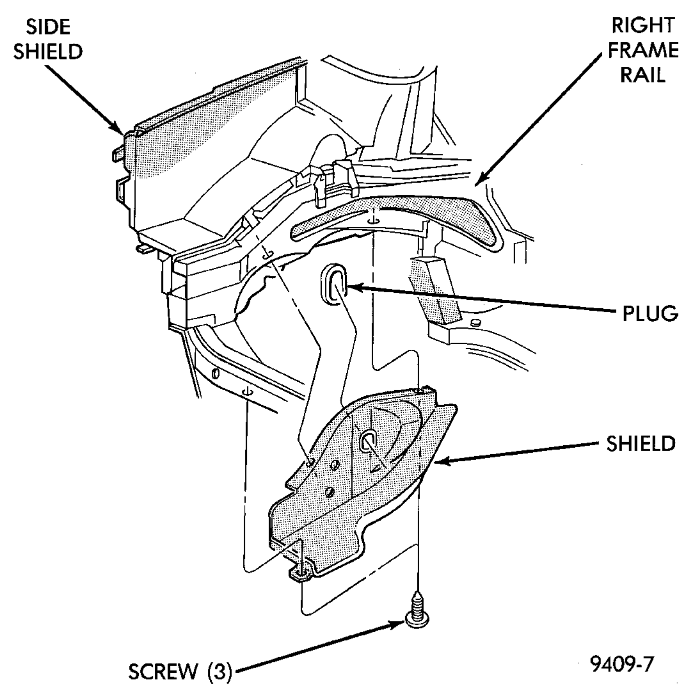


Fig. 43 Right Inner Splash Shield

REMOVAL AND INSTALLATION (Continued)

(3) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 44).

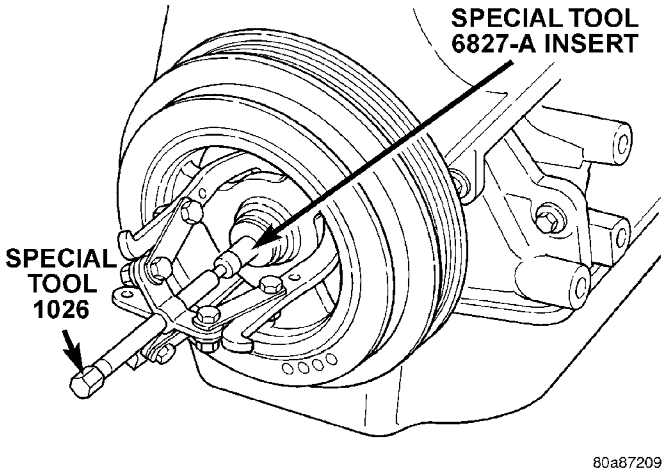


Fig. 44 Crankshaft Damper—Removal

(4) Lower vehicle and place a jack under engine.

(5) Remove right engine mount. Refer to procedure outlined in this section.

(6) Remove right engine mount bracket (Fig. 45).

(7) Remove front timing belt cover (Fig. 46).

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt.

(8) Loosen timing belt tensioner fasteners (Fig. 48) and remove timing belt and tensioner.

CAUTION: Do not loosen, tighten, or remove the tensioner pivot bolt (Fig. 47).

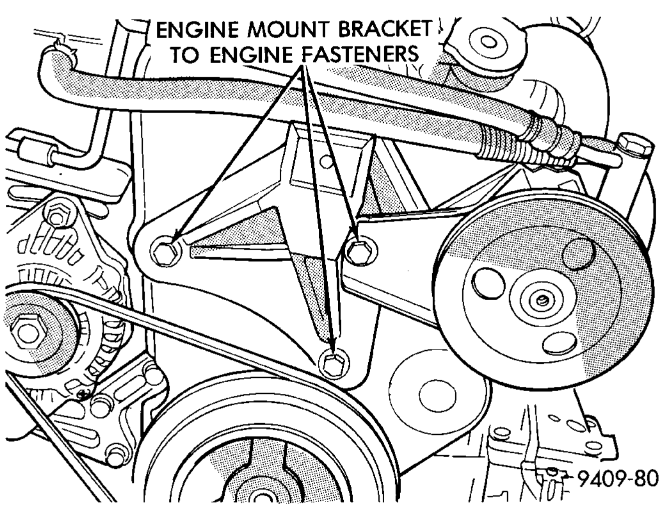


Fig. 45 Right Engine Mount Bracket

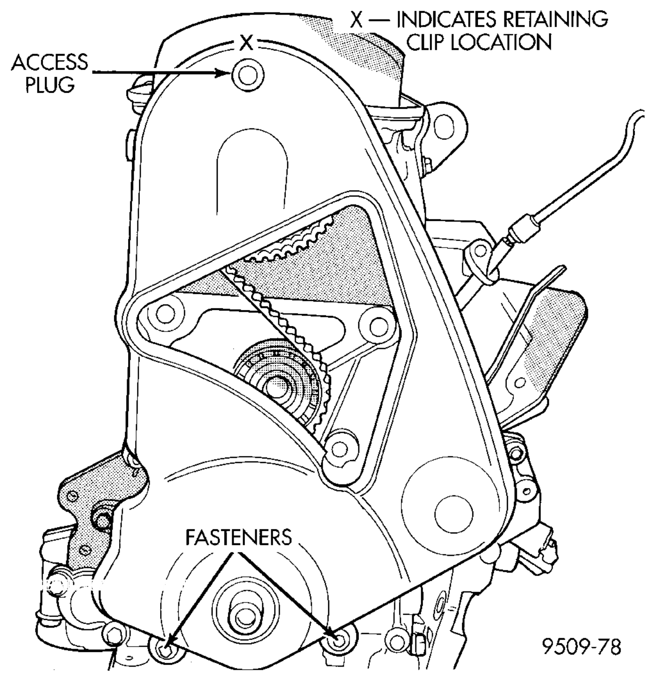


Fig. 46 Timing Belt Cover

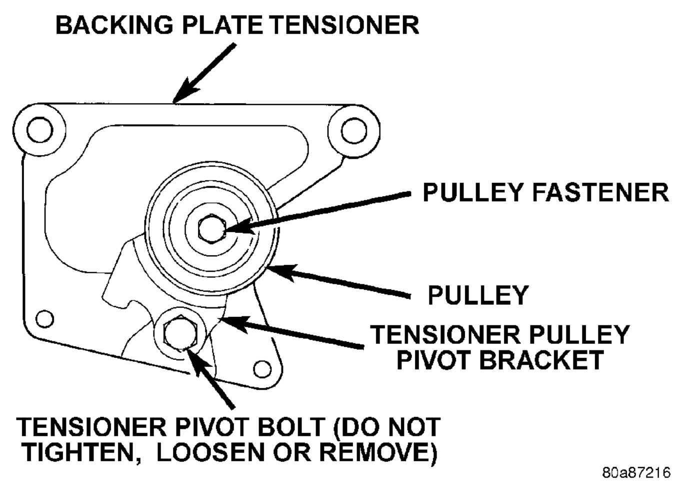


Fig. 47 Tensioner Pulley Assembly

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE AND BELT INSTALLATION —SOHC ENGINE

(1) When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

(2) Place the tensioner into a vise equipped with soft jaws and slowly compress the plunger (Fig. 49).

CAUTION: Index the tensioner in the vise the same way it is installed on the engine. This is to ensure proper pin orientation when tensioner is installed on the engine.

(3) When plunger is compressed into the tensioner body install a 1.9 mm (5/64) allen wrench or pin

REMOVAL AND INSTALLATION (Continued)

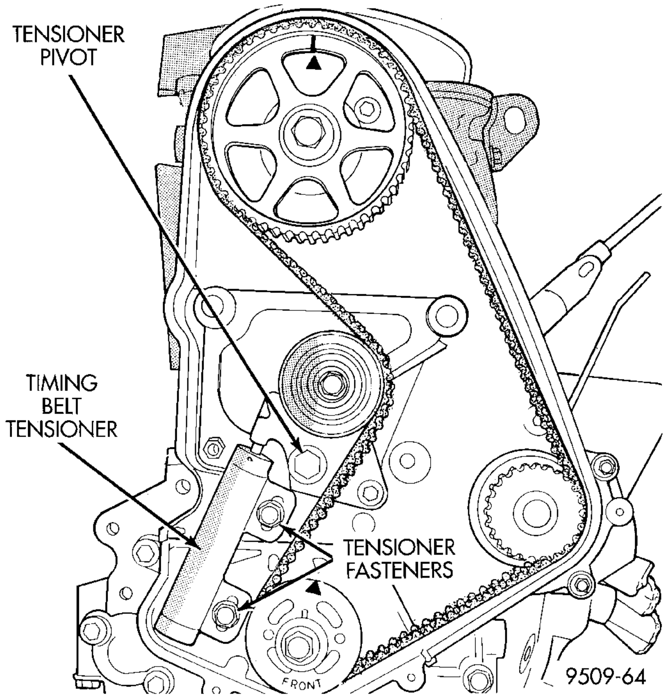


Fig. 48 Remove Timing Belt

through the body and plunger to retain plunger in place until tensioner is installed.

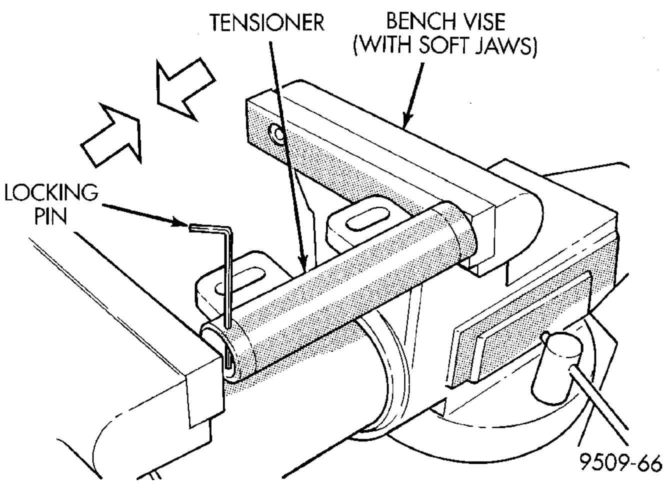


Fig. 49 Compressing Timing Belt Tensioner

(4) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 50).

(5) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear of timing belt cover (Fig. 51).

(6) Move crankshaft to 1/2 mark before TDC (Fig. 52) for belt installation.

(7) Install timing belt. Starting at the crankshaft, go around the water pump sprocket and then around the camshaft sprocket.

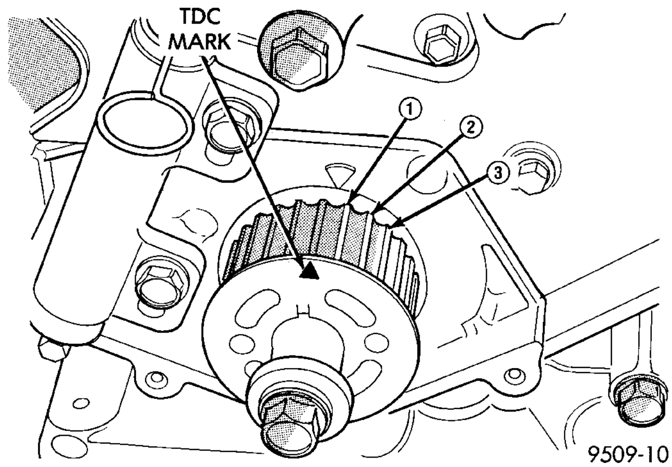


Fig. 50 Crankshaft Sprocket Timing

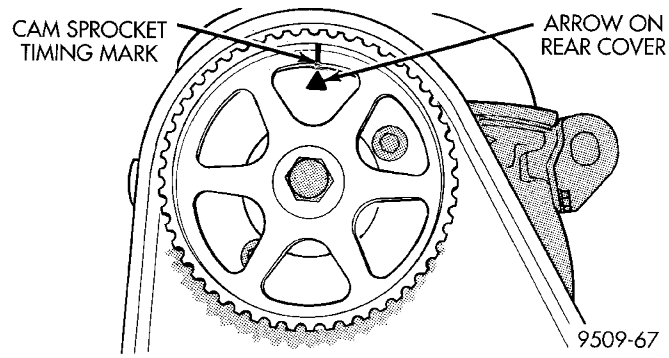


Fig. 51 Camshaft Timing Mark

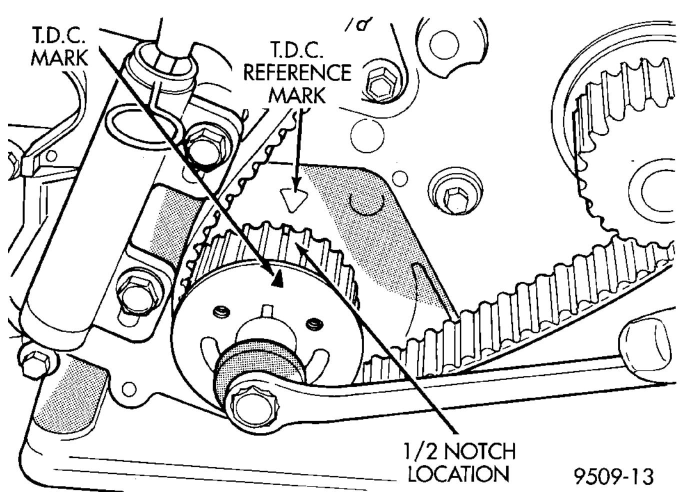


Fig. 52 Adjusting Crankshaft Sprocket for Timing Belt Installation

(8) Move crankshaft sprocket to TDC to take up belt slack. Install tensioner to block but do not tighten fasteners.

(9) Using a torque wrench on the tensioner pulley apply 28 N·m (250 in. lbs.) of torque (Fig. 53).

(10) With torque being applied to the tensioner pulley move the tensioner up against the tensioner

REMOVAL AND INSTALLATION (Continued)

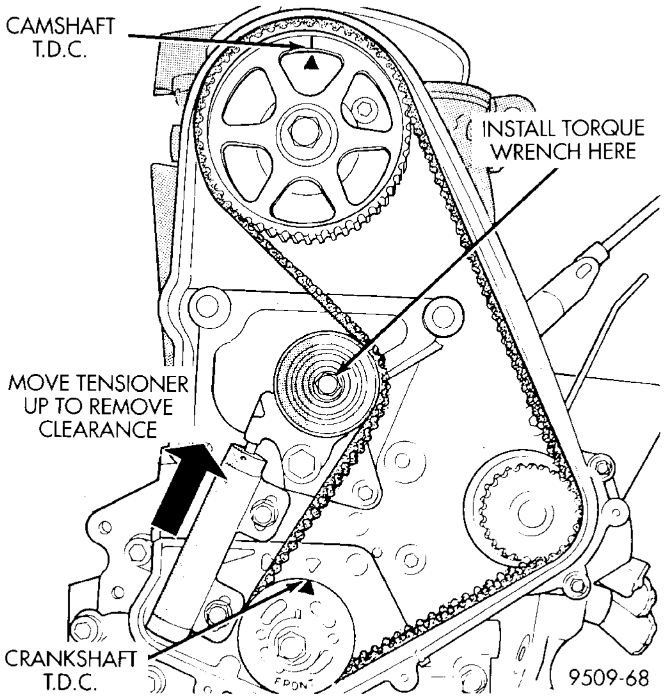


Fig. 53 Adjusting Timing Belt Tension

pulley bracket and tighten fasteners to 31 N·m (275 in. lbs.) (Fig. 53).

(11) Pull tensioner plunger pin. Pretension is correct when pin can be removed and installed.

(12) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 53).

(13) Install front half of timing cover.

(14) Install engine mount bracket.

(15) Install Right engine mount. Refer to procedure outlined in this section.

(16) Remove jack from under engine.

(17) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 54).

(18) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(19) Raise vehicle on hoist and install right inner splash shield.

(20) Perform camshaft and crankshaft timing relearn. Refer to Group 25, Emission Control Systems for procedure.

OIL PAN

REMOVAL

(1) Drain engine oil.

(2) Remove transmission bending bracket. Refer to Engine Support Module Removal and Installation in this section.

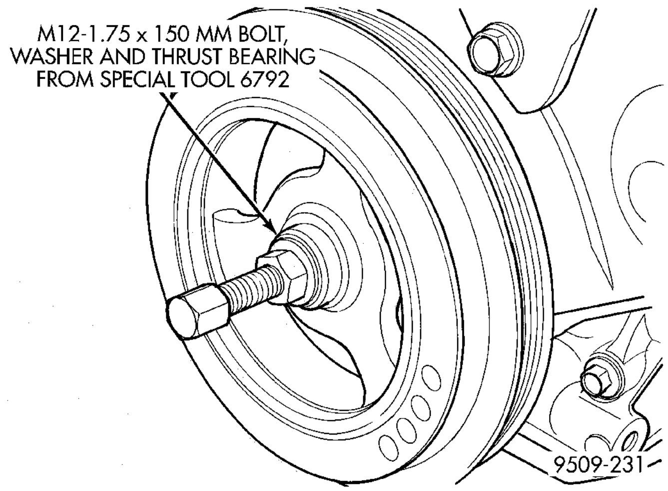


Fig. 54 Crankshaft Damper—Installation

(3) Remove front engine mount and bracket. Refer to Engine Support Module Removal and Installation in this section.

(4) Remove transmission inspection cover.

(5) If equipped with air conditioning remove oil filter and adaptor. Refer to Oil Filter Adapter Removal and Installation in this section.

(6) Remove oil pan.

(7) Clean oil pan and all gasket surfaces.

INSTALLATION

(1) Apply Mopar Silicone Rubber Adhesive Sealant or equivalent at the oil pump to engine block parting line (Fig. 55).

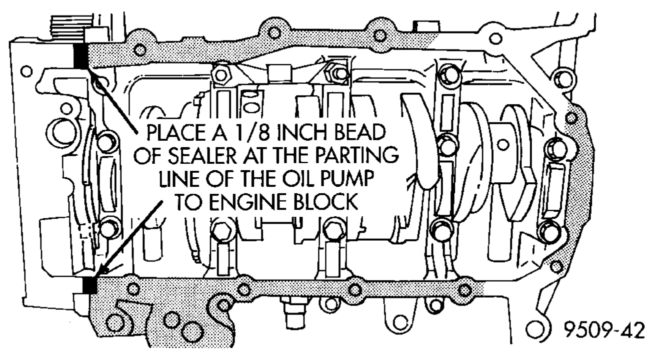


Fig. 55 Oil Pan Sealing

(2) Install a new oil pan gasket to pan.

(3) Install pan and tighten screws to 12 N·m (105 in. lbs.).

(4) Install oil filter and adaptor.

(5) Install transmission inspection cover.

(6) install front engine mount and bracket.

(7) Install transmission bending bracket.

(8) Install proper amount of oil. With oil filter 4.25 Liters (4.5 Qts.). Without oil filter 3.8 Liters (4.0 Qts.)

REMOVAL AND INSTALLATION (Continued)

FRONT CRANKSHAFT OIL SEAL

REMOVAL

(1) Using Special Tool 1026 and Insert 6827–A, remove crankshaft damper (Fig. 56).

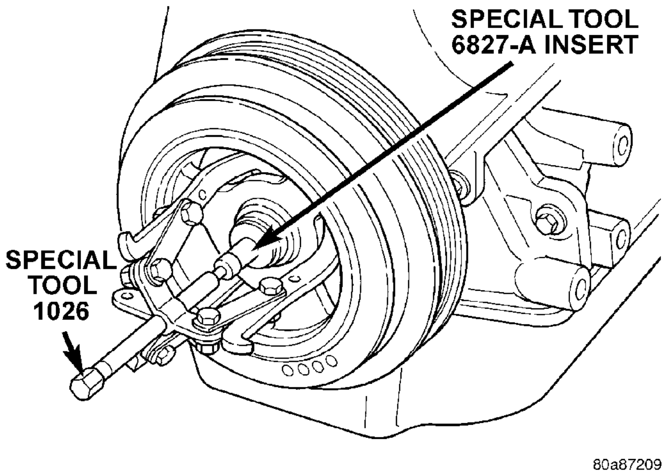


Fig. 56 Crankshaft Damper—Removal

(2) Remove outer timing belt cover and timing belt. Refer to Timing Belt System outlined in this section.

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C- 4685-C2 (Fig. 57).

CAUTION: Do not nick shaft seal surface or seal bore.

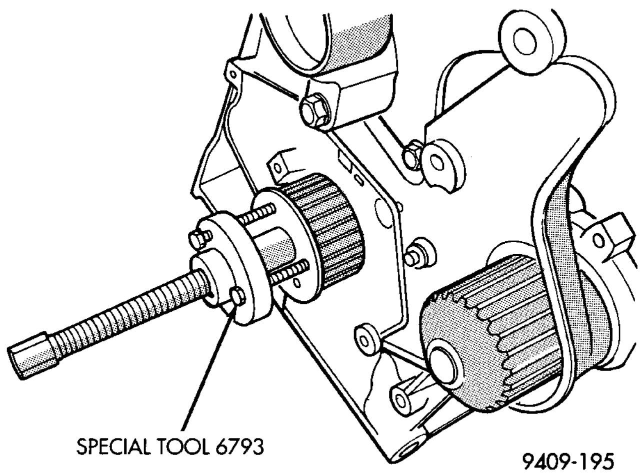


Fig. 57 Crankshaft Sprocket—Removal

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 58). Do not damage the seal contact area on the crankshaft.

INSTALLATION

(1) Install new seal by using Tool 6780–1 (Fig. 59).

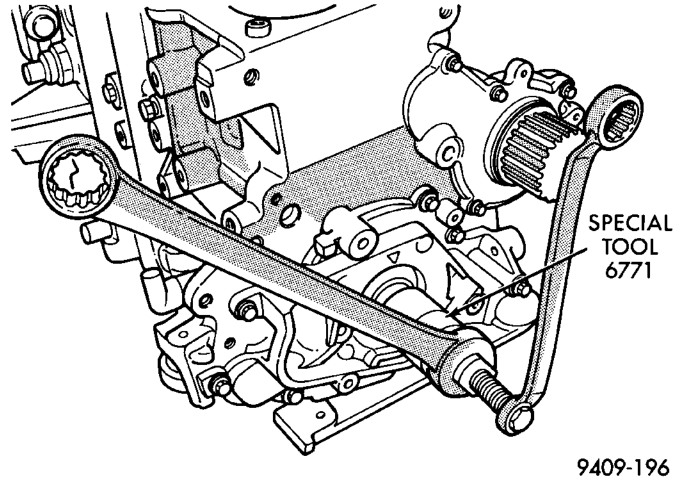


Fig. 58 Front Crankshaft Oil Seal—Removal

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

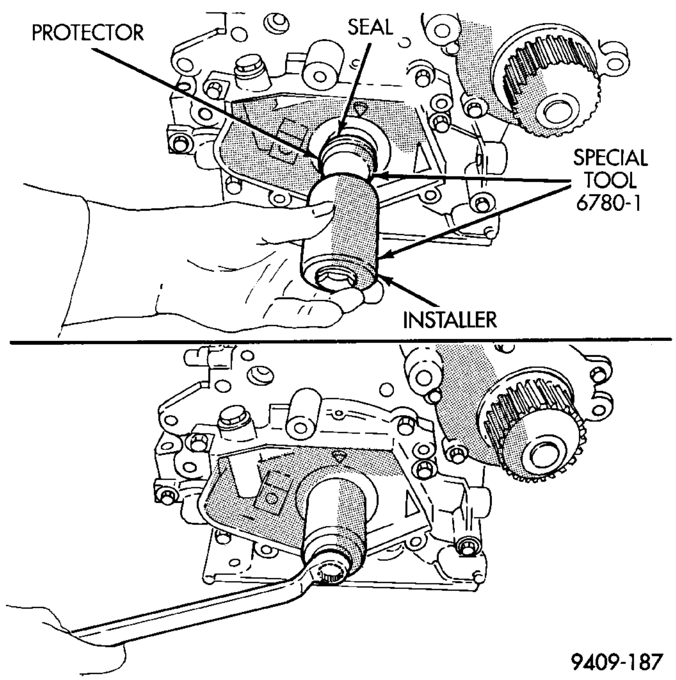


Fig. 59 Front Crankshaft Oil Seal—Installation

(3) Install crankshaft sprocket (Fig. 60). Using Special Tool 6792.

NOTE: Make sure the word “front” on the sprocket is facing you.

(4) Install timing belt and covers. Refer to Timing Belt System in this section for installation.

(5) Install crankshaft damper (Fig. 61). Use thrust bearing/washer and 12M-1.75 x 150 mm bolt from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

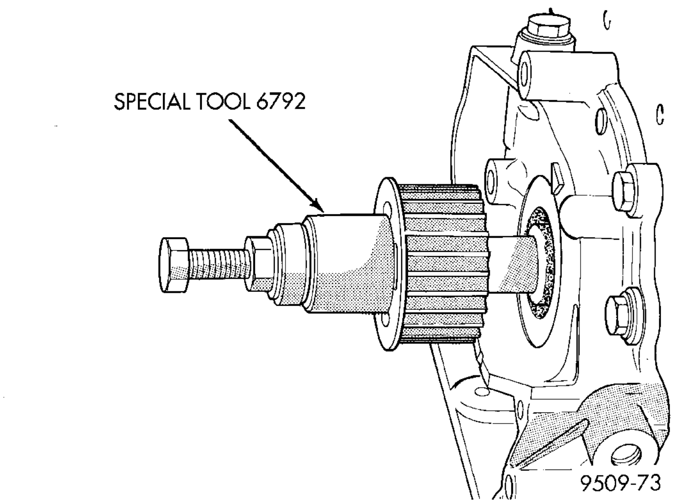


Fig. 60 Crankshaft Sprocket—Installation

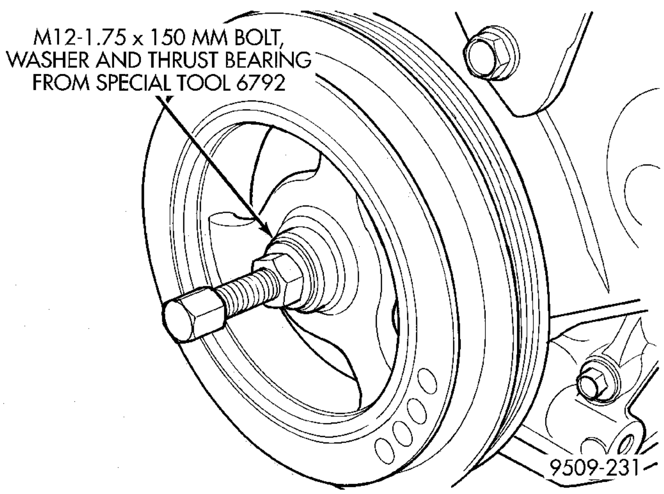


Fig. 61 Crankshaft Damper—Installation

REAR CRANKSHAFT SEAL

REMOVAL

(1) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 62) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.

INSTALLATION

CAUTION: If burr or scratch is present on the crankshaft edge (chamfer), cleanup with 400 grit sand paper to prevent seal damage during installation of new seal.

NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 63).

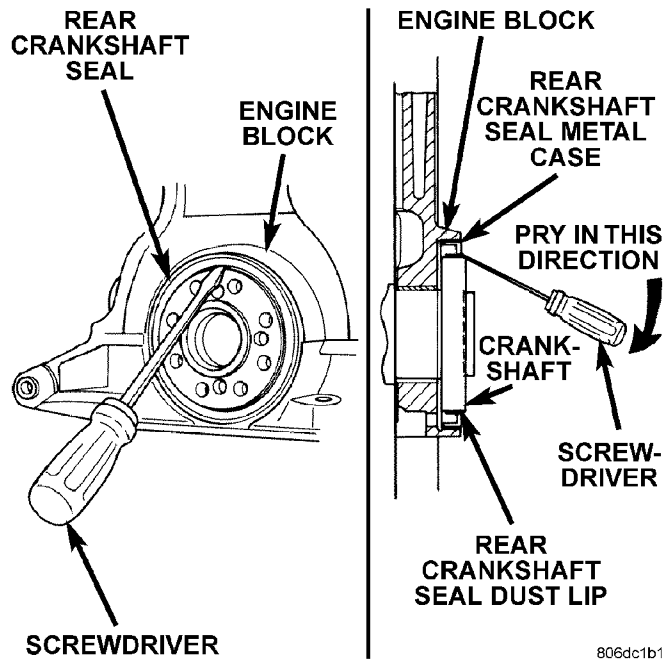


Fig. 62 Rear Crankshaft Oil Seal—Removal

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 63). Pilot tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 64) until the tool bottoms out against the block (Fig. 65).

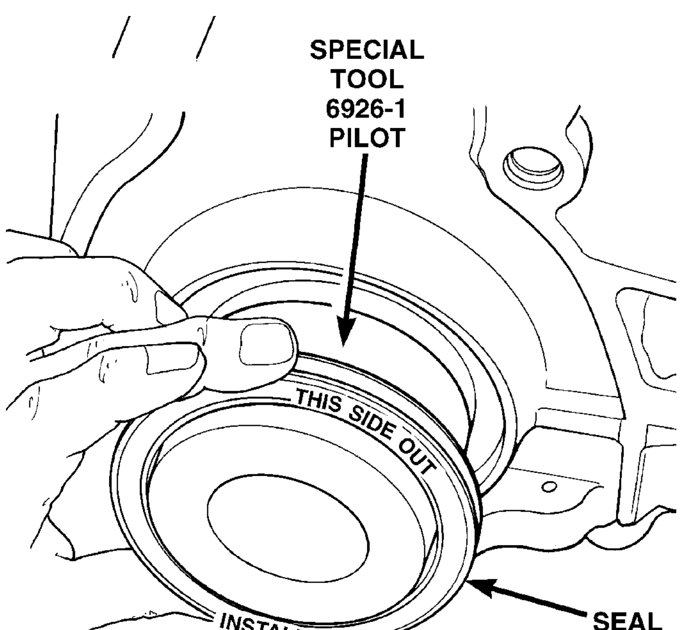


Fig. 63 Rear Crankshaft Seal and Special Tool 6926-1

REMOVAL AND INSTALLATION (Continued)

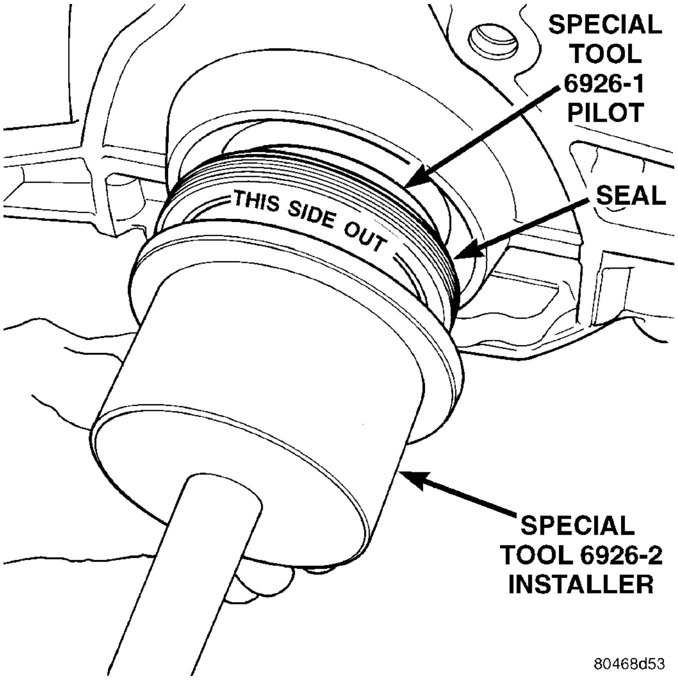


Fig. 64 Crankshaft Seal Special Tool 6926-2

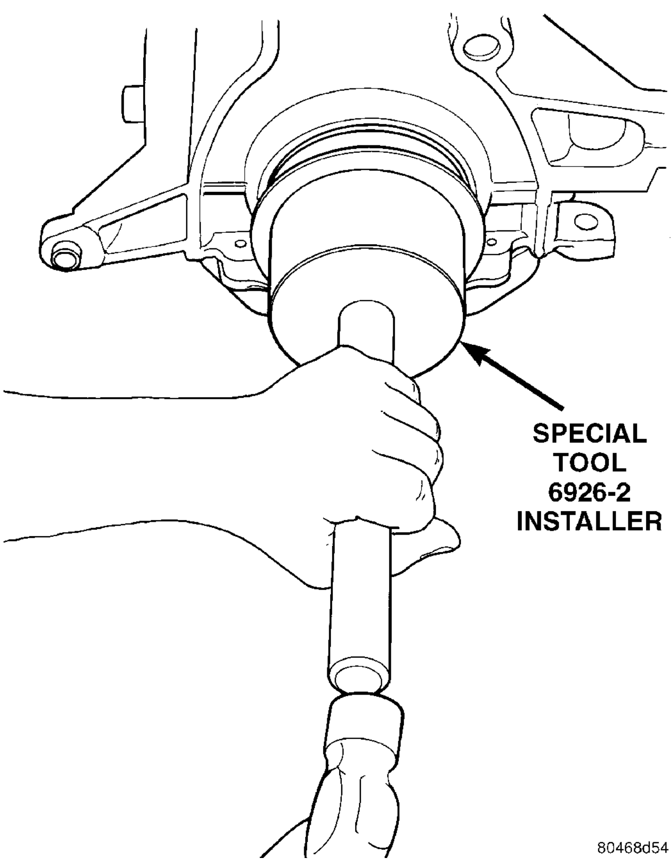


Fig. 65 Rear Crankshaft Seal—Installation

CRANKSHAFT

REMOVAL

(1) Remove oil filter and adapter from bedplate.

(2) Remove oil pan.

(3) Remove crankshaft sprocket and oil pump both procedures outlined in this section.

(4) Remove all main bearing cap and bedplate bolts from the engine block (Fig. 66).

(5) Using a mallet tap the bedplate loose from the engine block dowel pins.

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block and bedplate alignment.

(6) Bedplate should be removed evenly from the cylinder block dowel pins.

(7) Lift out crankshaft from cylinder block. Be sure not to damage the main bearings or journals when removing the crankshaft.

CRANKSHAFT MAIN BEARINGS LOCATION

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells installed in the (bedplate) main bearing cap are plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 67).

NOTE: The upper and lower main Bearing shells are Not interchangeable. The lower shells have a revised tab to prevent improper installation.

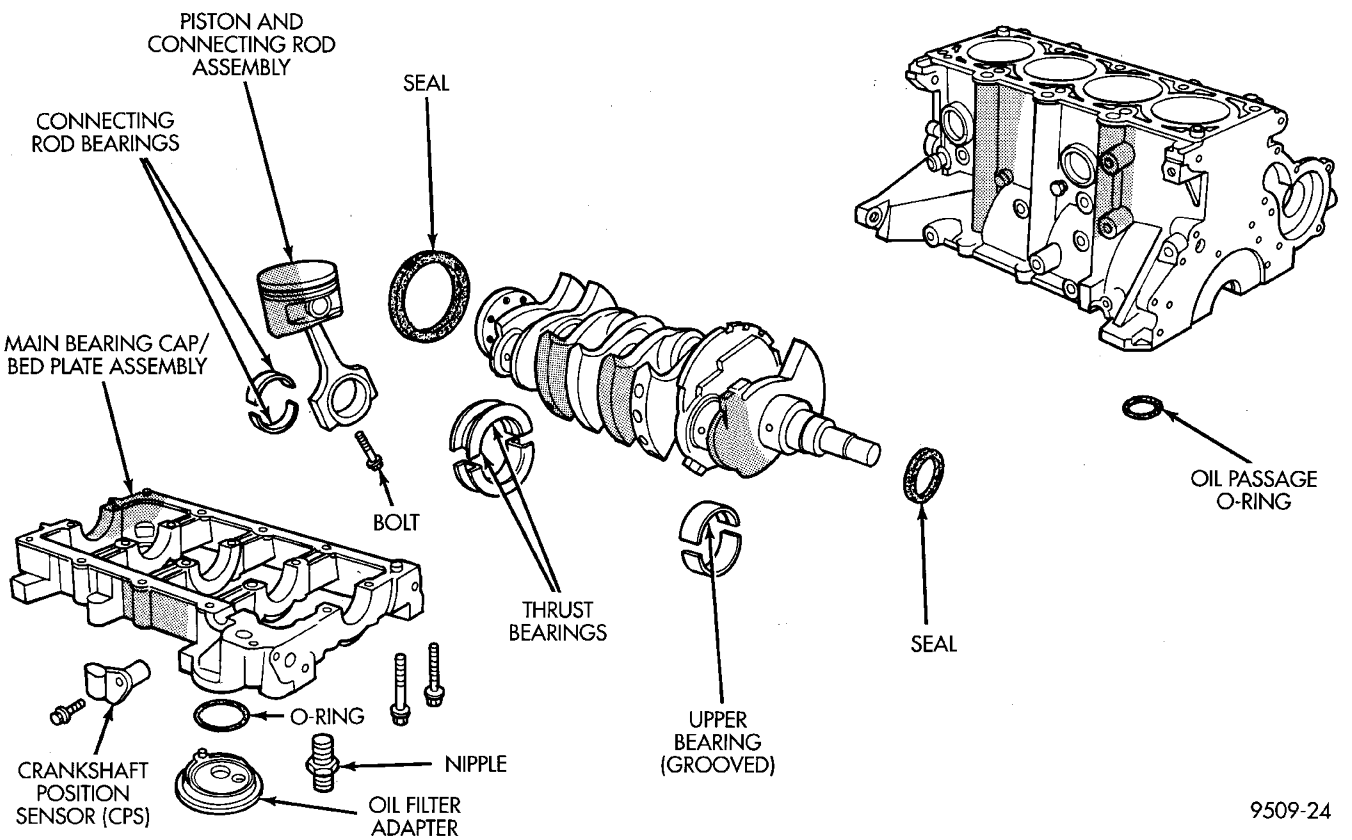
CRANKSHAFT MAIN JOURNALS INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. DO NOT grind thrust faces of Number 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the nodular cast iron crankshafts used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine (Fig. 67). All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersized: 0.016 mm

REMOVAL AND INSTALLATION (Continued)



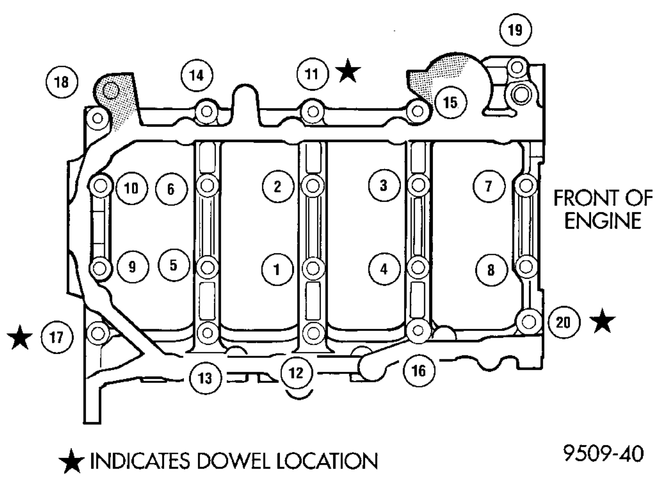


Fig. 66 Bedplate Bolts

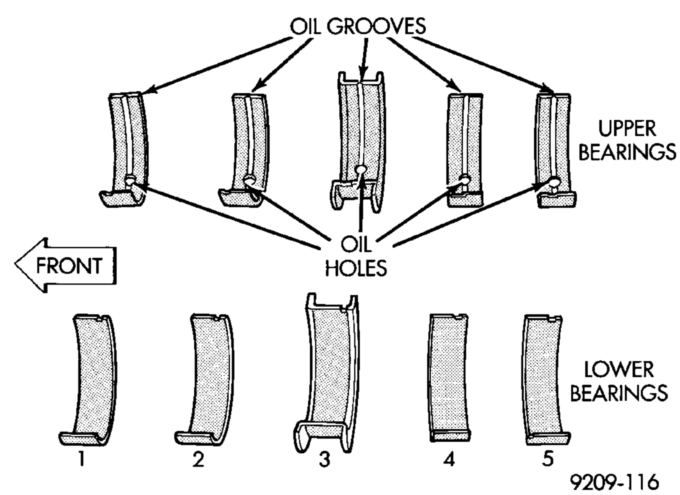


Fig. 67 Main Bearing Identification

(.0006 inch), .032 mm (.0012 inch), .250 mm (.010 inch). Never install an undersize bearing that will reduce clearance below specifications.

INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block. Install O-ring into recess in the block (Fig. 68).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

CAUTION: Do Not get oil on the bedplate mating surface. It will affect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals and install crankshaft and O-ring in cylinder block.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

REMOVAL AND INSTALLATION (Continued)

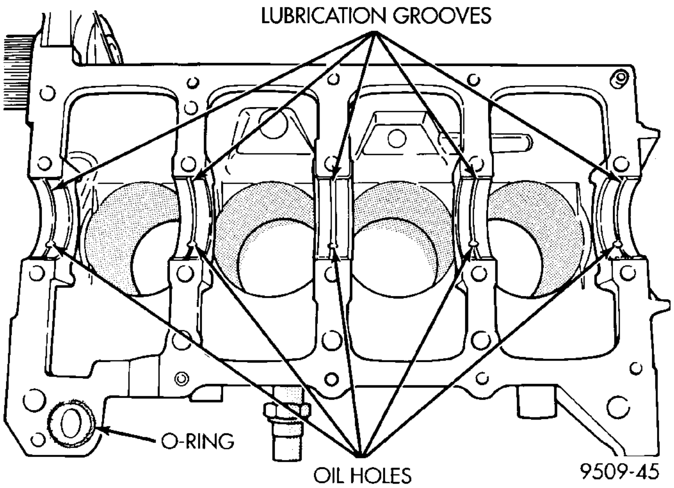


Fig. 68 Installing Main Bearing Upper Shell

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar Torque Cure Gasket Maker to cylinder block as shown in (Fig. 69).

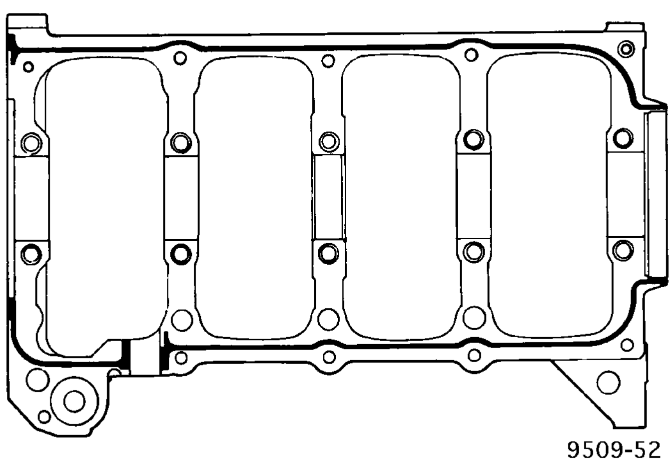


Fig. 69 Main Bearing Caps/Bedplate Sealing

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(6) Before installing the bolts the threads should be oiled with clean engine oil, wipe off any excess oil.

(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten this bolts down together until the bedplate contacts the cylinder block. Torque bolts to 30 N·m (22 ft. lbs.) (Fig. 70).

(8) Install main bearing bedplate to engine block bolts (1 thru 10) and torque each bolt to 81 N·m (60 ft. lbs.) in sequence shown in (Fig. 70).

(9) Install main bearing bedplate to engine block bolts (11 thru 20), with baffle studs in positions 12, 13 and 16 and torque each bolt to 30 N·m (22 ft. lbs.) in sequence shown in (Fig. 70).

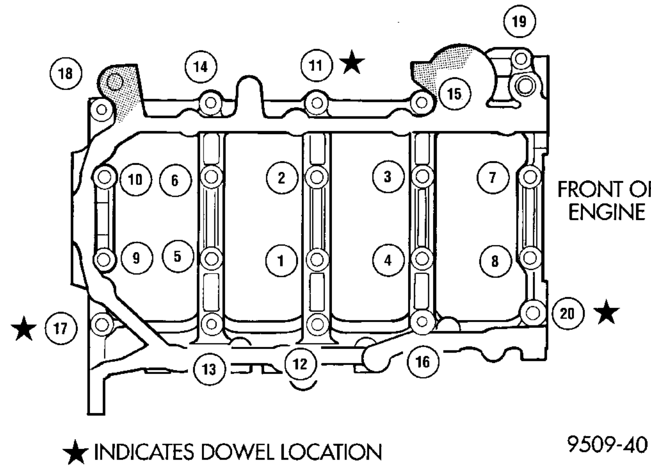


Fig. 70 Main Bearing Caps/Bedplate Torque Sequence

(10) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

(11) Install oil pump. If crankshaft end play is to be checked refer to service procedures in this section.

(12) Install crankshaft sprocket.

(13) Install oil filter adapter and filter. Refer to procedure outlined in this section.

OIL FILTER ADAPTER

REMOVE AND INSTALL

Ensure O-ring is in the groove on adapter. Align roll pin into engine block and tighten assembly to 80 N·m (60 ft. lbs.) (Fig. 71).

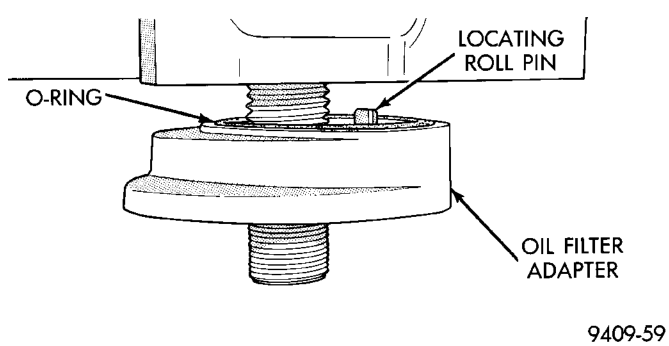


Fig. 71 Engine Oil Filter Adapter to Engine Block

OIL FILTER

REMOVE AND INSTALL

CAUTION: When servicing the oil filter (Fig. 72) avoid deforming the filter, install tool band strap against the seam at the base of the filter. The seam, joining the can to the base is reinforced by the base plate.

REMOVAL AND INSTALLATION (Continued)

(1) Turn counterclockwise to remove.

(2) To install, lubricate new filter gasket. Check filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber. Screw filter on until gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

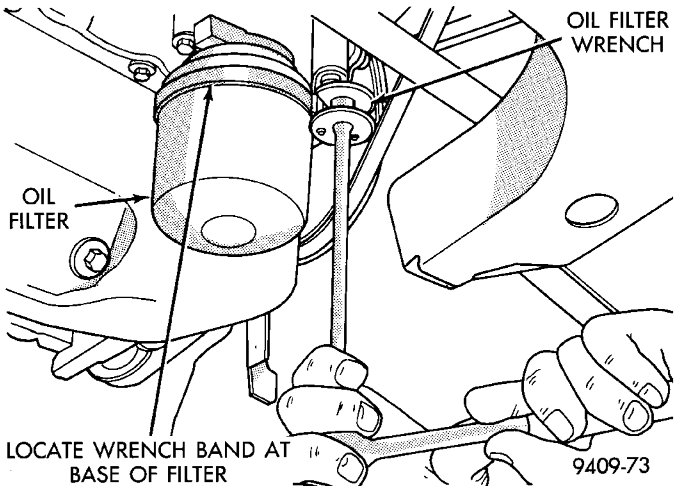


Fig. 72 Engine Oil Filter

OIL PUMP

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove Timing Belt. Refer to Timing Belt System, in this section.

(3) Remove Oil Pan. Refer to Oil Pan Removal in this section.

(4) Remove Crankshaft Sprocket using Special Tool 6793 and insert C4685–C2 (Fig. 73).

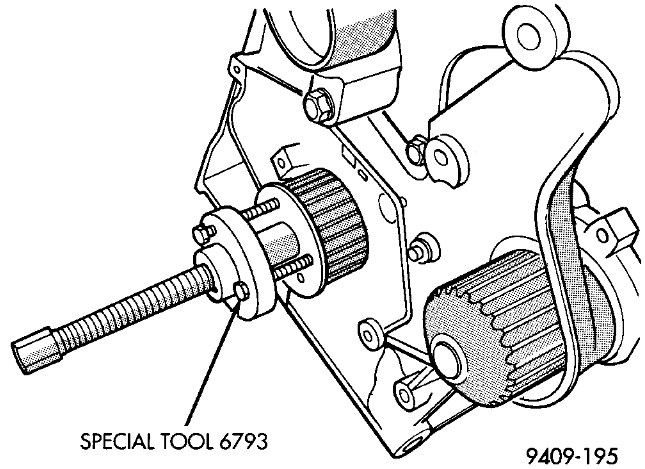


Fig. 73 Crankshaft Sprocket—Removal

(5) Remove oil pick-up tube.

(6) Remove oil pump, (Fig. 74) and front crankshaft seal.

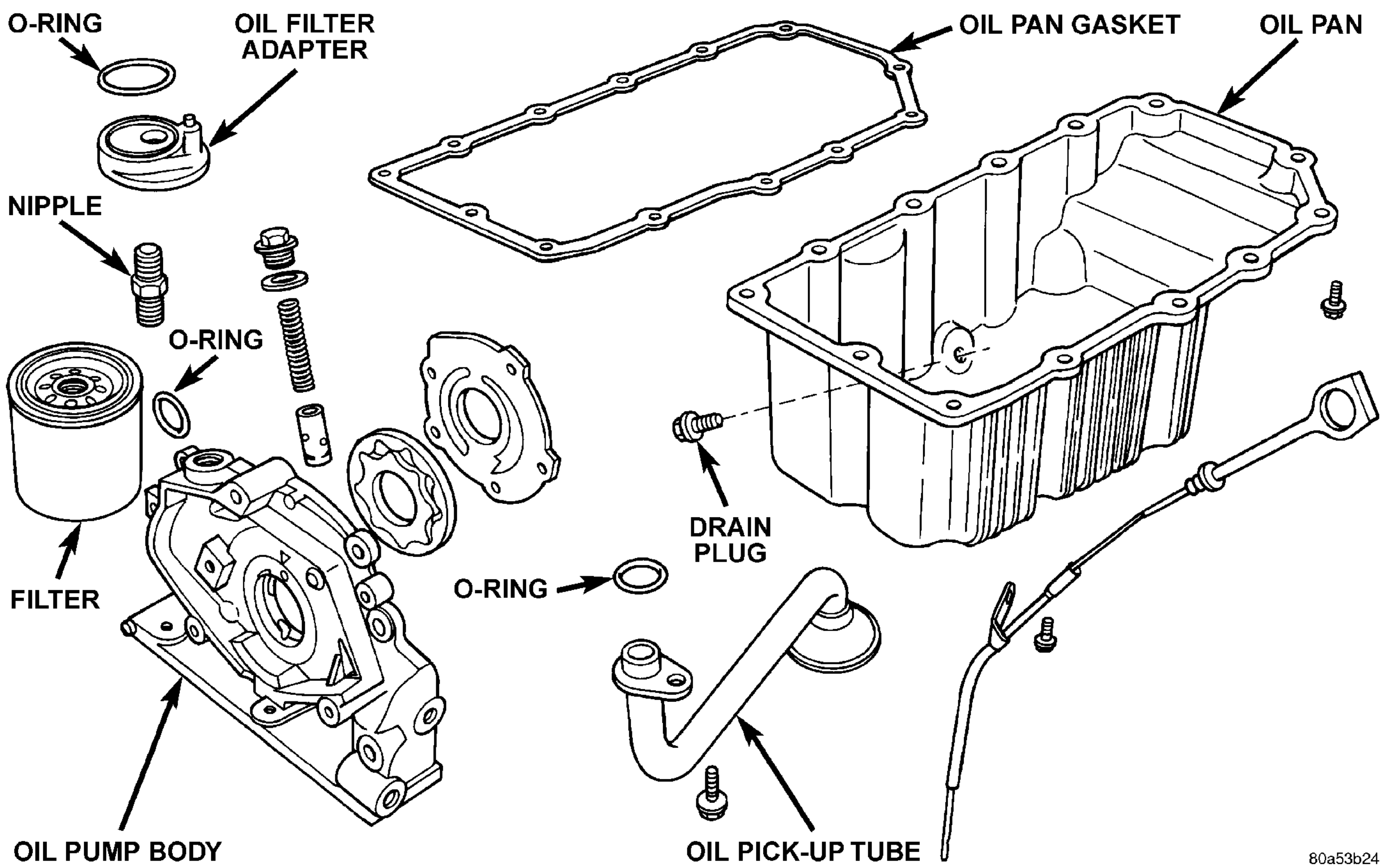


Fig. 74 Oil Pump and Tube

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

(2) Apply Mopar Gasket Maker to oil pump as shown in (Fig. 75). Install oil ring into oil pump body discharge passage.

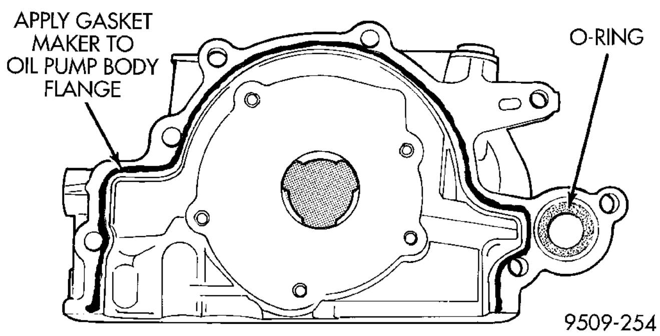


Fig. 75 Oil Pump Sealing

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

(5) Torque all oil pump attaching bolts to 28 N·m (250 in. lbs.)

(6) Install new front crankshaft seal using Special Tool 6780 (Fig. 76).

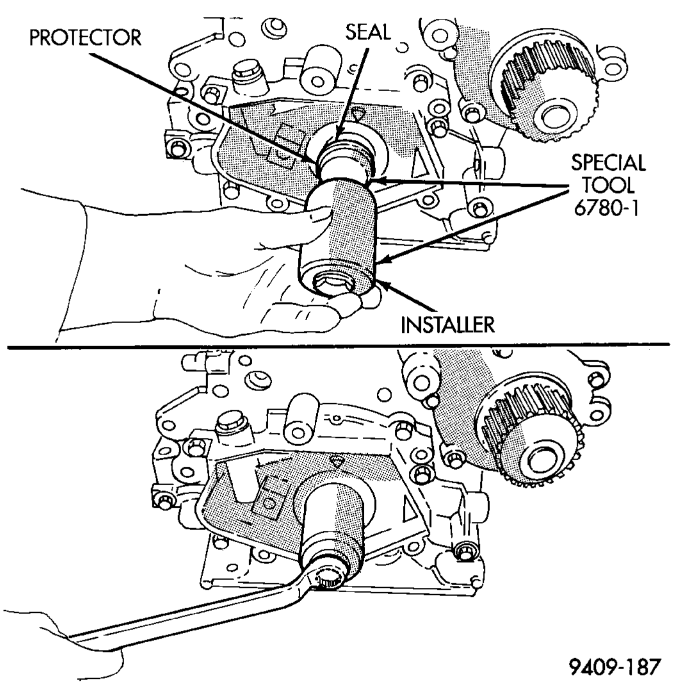


Fig. 76 Front Crankshaft Seal—Installation

(7) Install crankshaft sprocket, using Special Tool 6792 (Fig. 77).

(8) Install oil pump pick-up tube and oil pan.

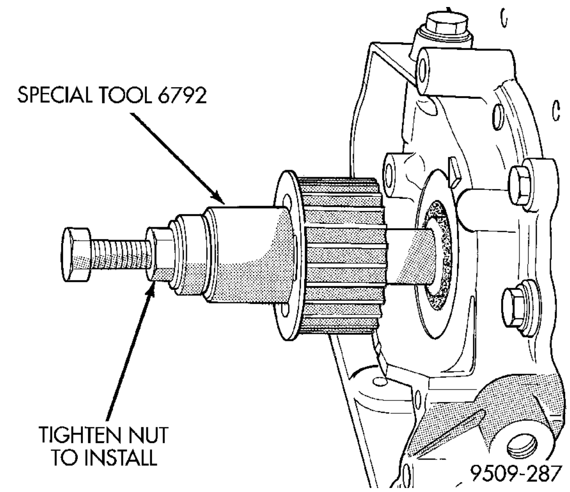


Fig. 77 Crankshaft Sprocket—Installation

(9) Install Timing Belt. Refer to Timing Belt Installation in this section.

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. 78).

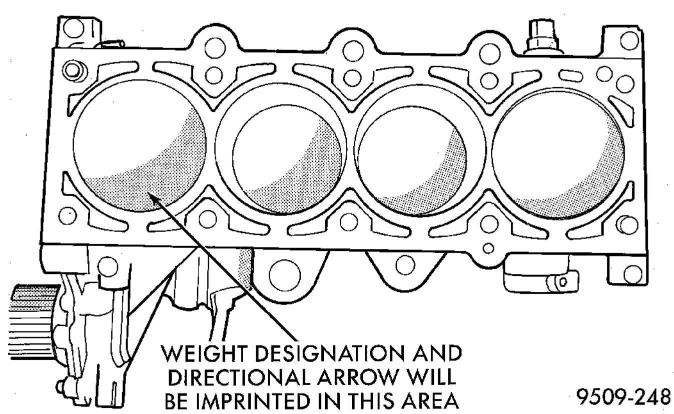


Fig. 78 Piston Markings

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 79) for identification.

(3) Pistons will have a stamping in the approximate location shown in (Fig. 78). These stamps will be either a directional arrow or a weight identification for the assembly. L is for light and H is for heavy. These assemblies should all be the same weight class. Service piston assemblies are marked with a S and can be used with either L or H production assemblies. The weight designation stamps should face toward the timing belt side of the engine.

REMOVAL AND INSTALLATION (Continued)

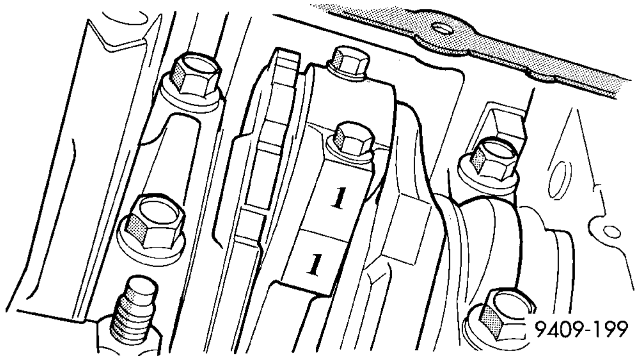


Fig. 79 Identify Connecting Rod to Cylinder

(4) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(5) Remove connecting rod cap bolts **Do not use old bolts if reinstalling connecting rod.** Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(6) After removal, install bearing cap on the mating rod.

(7) Piston and Rods are serviced as an assembly.

PISTON RING—REMOVAL

(1) ID mark on face of upper and intermediate piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 80).

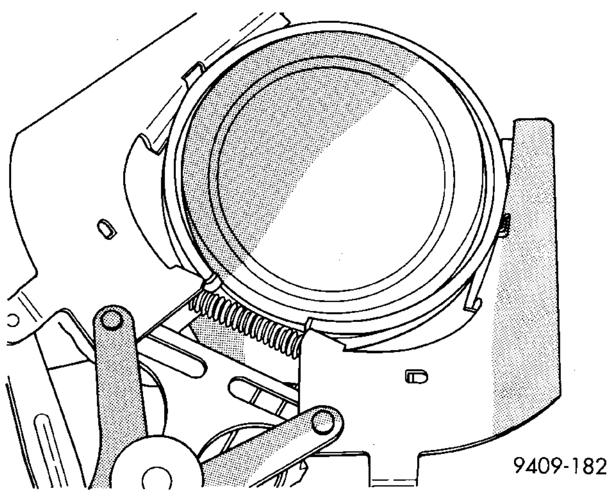


Fig. 80 Piston Rings—Removing and Installing

(3) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

(4) Clean ring grooves of any carbon deposits.

PISTON RINGS—INSTALLATION

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 81).

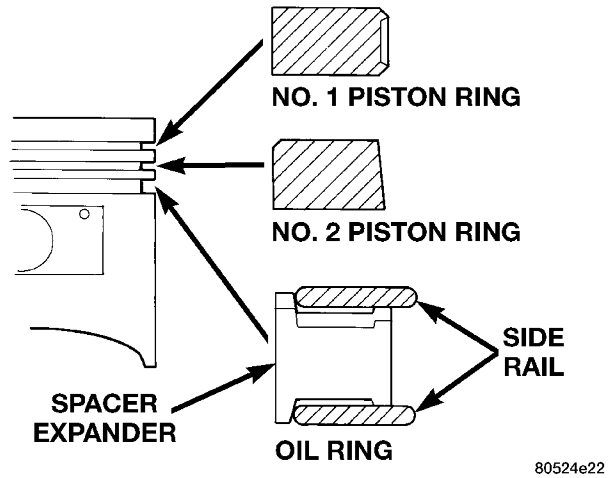


Fig. 81 Piston Ring Installation

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.

f. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander (Fig. 82).**

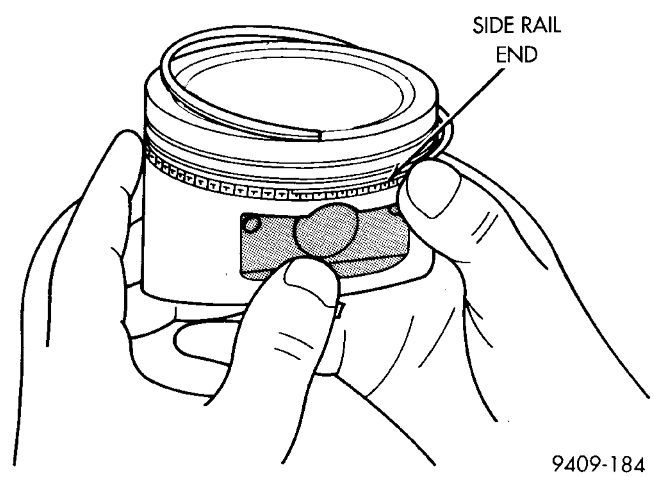


Fig. 82 Installing Side Rail

(2) Install upper side rail first and then the lower side rail.

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 81).

(4) Position piston ring end gaps as shown in (Fig. 83).

(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or

REMOVAL AND INSTALLATION (Continued)

on the thrust direction. Staggering ring gap is important for oil control.

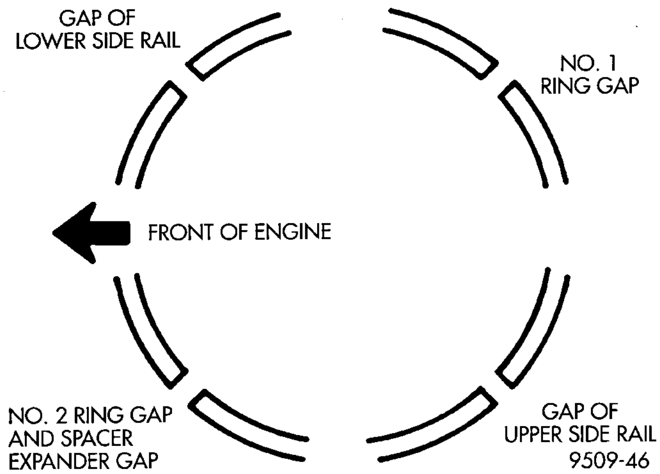


Fig. 83 Piston Ring End Gap Position

PISTON AND ROD —INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 83).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 84). **Be sure position of rings does not change during this operation** .

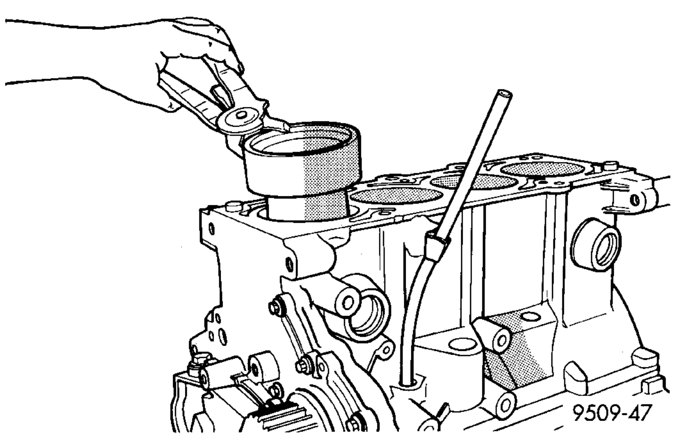


Fig. 84 Installing Piston

(4) The weight stamp designation L or H will be in the front half of the piston should face toward the front of the engine for SOHC engine. The arrow should face toward the front of the engine for DOHC engine (Fig. 78).

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston assembly into cylinder bore and guide rod over the crankshaft journal.

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

(7) Install rod caps. Install **New** bolts and tighten to 27 N·m (20 ft.lb.) Plus 1/4 turn.

VIBRATION DAMPER

NOTE: If a gap is found in the crankshaft damper, in the area where the Poly-V Generator belt rides this is normal and is acceptable (Fig. 85).

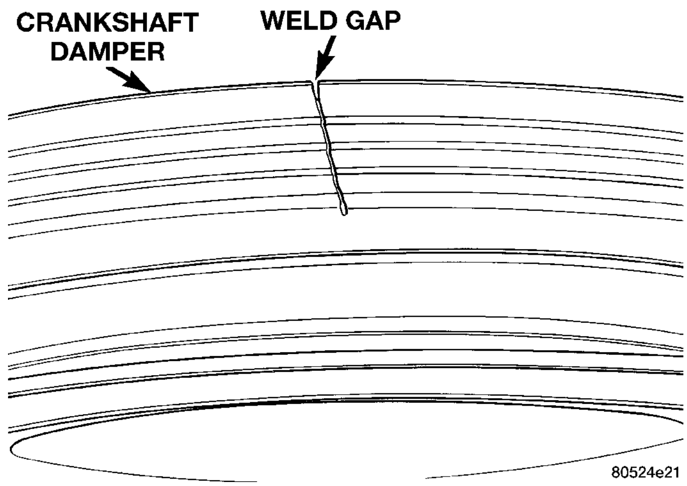


Fig. 85 Weld Gap

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 86).

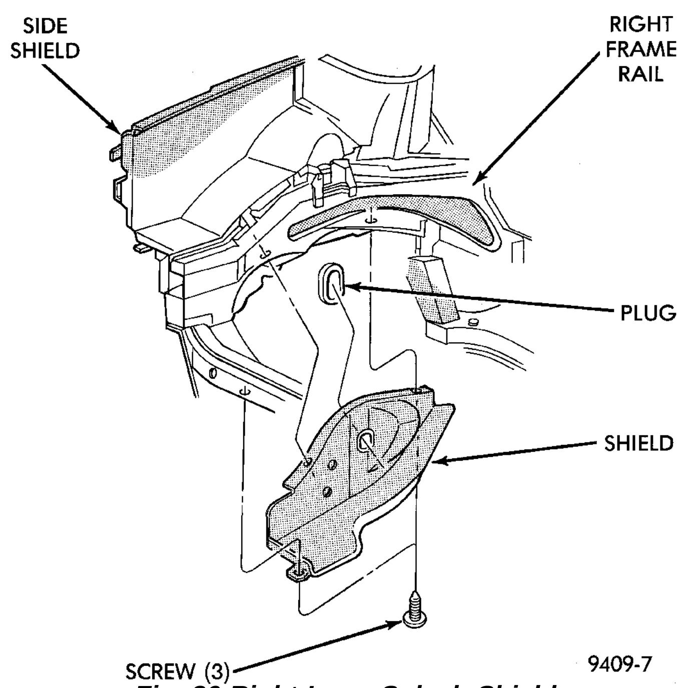


Fig. 86 Right Inner Splash Shield

REMOVAL AND INSTALLATION (Continued)

(3) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827–A (Fig. 87).

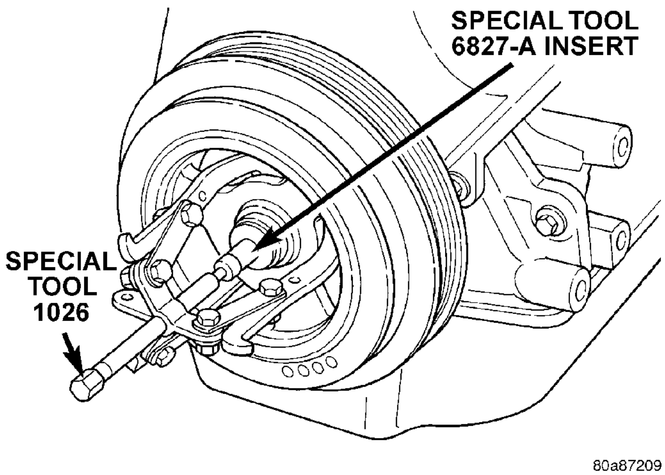


Fig. 87 Crankshaft Damper—Removal

INSTALLATION

(1) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 88).

(2) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(3) Raise vehicle on hoist and install right inner splash shield.

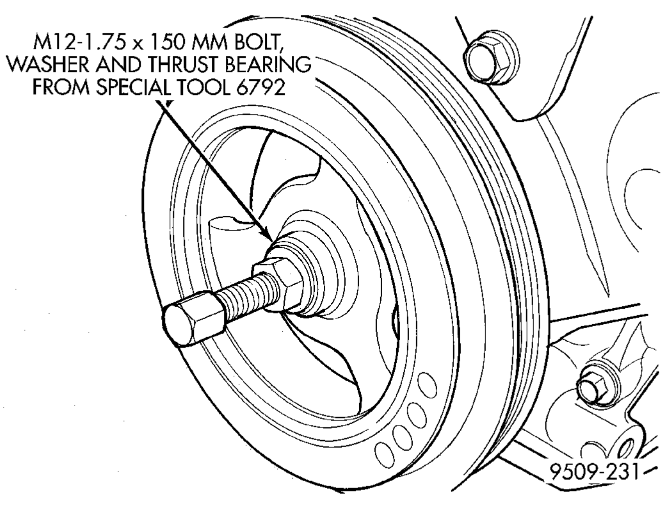


Fig. 88 Crankshaft Damper—Installation

DISASSEMBLY AND ASSEMBLY

OIL PUMP

(1) To remove the relief valve, proceed as follows:

(2) Remove the threaded plug and gasket from the oil pump (Fig. 89).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 89) or serious damage may occur.

(3) Remove spring and relief valve (Fig. 89).

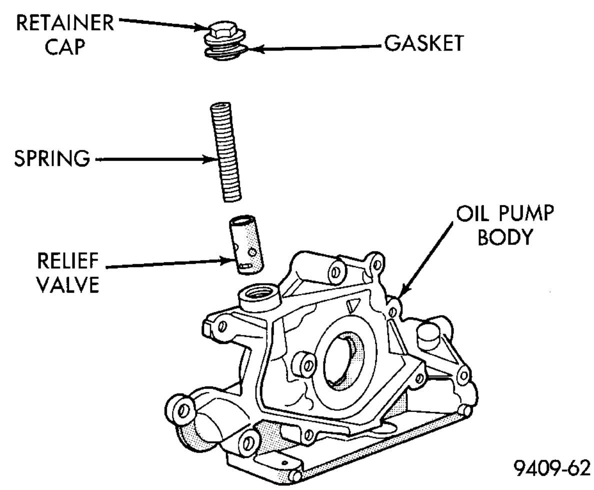


Fig. 89 Oil Pressure Relief Valve

(4) Remove oil pump cover screws, and lift off cover.

(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 90).

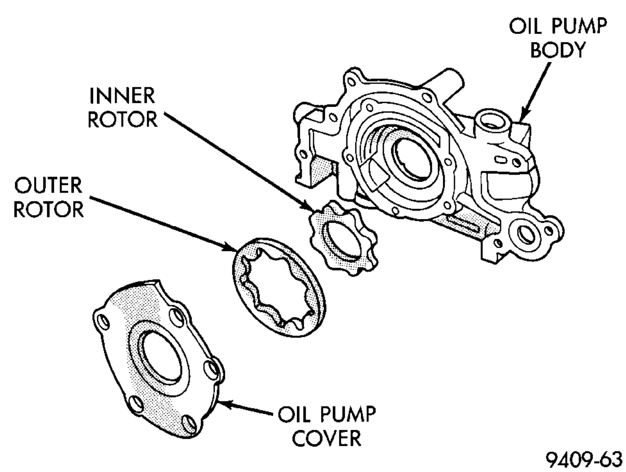


Fig. 90 Oil Pump

DISASSEMBLY AND ASSEMBLY (Continued)

VALVE SERVICE WITH THE CYLINDER HEAD REMOVED

REMOVAL

(1) With cylinder head removed, compress valve springs using Special Tool C-3422–B or equivalent.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

(3) Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

(3) If valve stems are worn more than 0.05 mm (.002 in.), replace valve.

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 91). Refer to (Fig. 92) for specifications. Replace guides if they are not within specification.

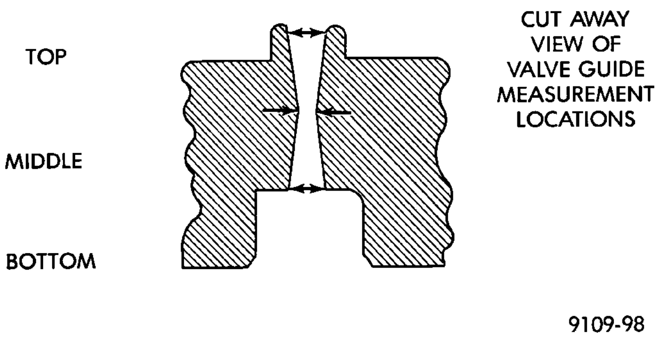


Fig. 91 Checking Wear on Valve Guide—Typical

Valve Guide Diameter	Intake Valve	Exhaust Valve
	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	5.975 - 6.000 mm (0.2352 - 0.2362 in.)
Clearance	**New**	**Service Limit**
Intake	0.023 - 0.066 mm (0.001 - 0.0025 in.)	0.25 mm (0.010 in.)
Exhaust	0.051 - 0.094 mm (0.002 - 0.0037 in.)	
		9509-244

Fig. 92 Valve Guide Specifications

(3) Check valve guide height (Fig. 93).

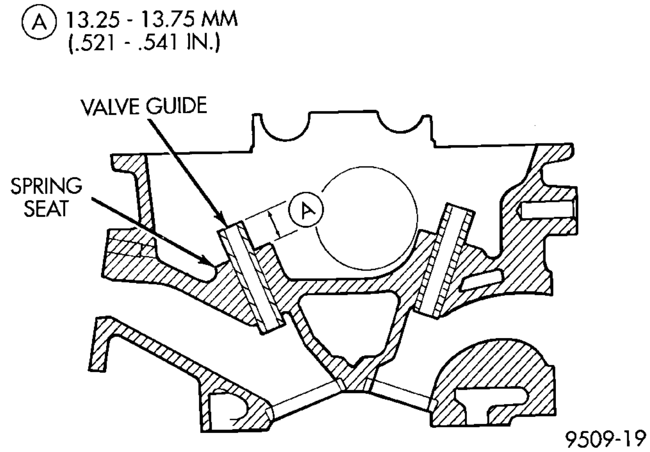


Fig. 93 Valve Guide Height

TESTING VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested Special Tool C-647. As an example, the compression length of the spring to be tested is 33.34 mm (1-5/16 inches). Turn tool table until surface is in line with the 33.34 mm (1-5/16 inch) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device (Fig. 94). Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Discard the springs that do not meet specifications. The Following specifications apply to both intake and exhaust valve springs.

- Valve Closed Nominal Force— 67 lbs. @ 39.8 mm (1.57 in.)
- Valve Open Nominal Force— 160 lbs. @ 32.6 mm (1.28 in.)

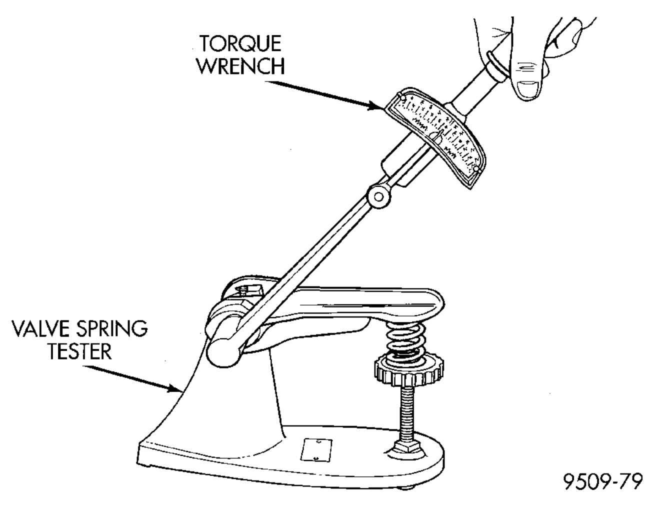


Fig. 94 Testing a Valve Spring

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Verify springs are not distorted with a steel square and surface plate, check springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and valve face have a 45 degree angle.

(2) Inspect the remaining margin after the valves are refaced (Fig. 95). Intake valves with less than 0.95 mm (1/32 inch.) margin and Exhaust valves with less than 1.05 mm (3/64 inch) margin should be discarded.

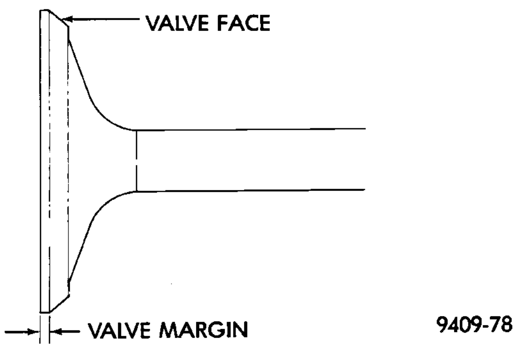


Fig. 95 Refacing Intake and Exhaust Valves

(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 See (Fig. 96) for valve specification.

Face Angle	
Intake and Exhaust	45 - 45-1/2°
Head Diameter	
Intake	33.12 - 33.37 mm (1.303 - 1.313 in.)
Exhaust	28.57 - 28.83 mm (1.124 - 1.135 in.)
Length (Overall)	
Intake	114.69 - 115.19 mm (4.515 - 4.535 in.)
Exhaust	116.94 - 117.44 mm (4.603 - 4.623 in.)
Stem Diameter	
Intake	5.934 - 5.952 mm (0.234 - 0.234 in.)
Exhaust	5.906 - 5.924 mm (0.233 - 0.233 in.)
Valve Margin	
Intake	1.15 - 1.48 mm (0.0452 - 0.0582 in.)
Exhaust	1.475 - 1.805 mm (0.0580 - 0.0710 in.)

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Fig. 96 Valve Specifications

(4) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator. Total runout should not exceed. 0.051 mm (0.002 inch.) (total indicator reading).

(5) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

- Intake valve seat diameter is 33 mm (1.299 in.)
- Exhaust valve seat diameter is 28 mm (1.102 in.)

(6) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. The intake valve seat must be serviced when the valve seat width is 2.0 mm (0.079 in.) or greater. The exhaust valve seat must be serviced when the valve seat width is 2.5 mm (0.098 in.) or greater. Otherwise the cylinder head must be replaced.

(7) When seat is properly positioned the width of intake and exhaust seats should be 0.75 to 1.25 mm (0.030 to 0.049 in.) (Fig. 97).

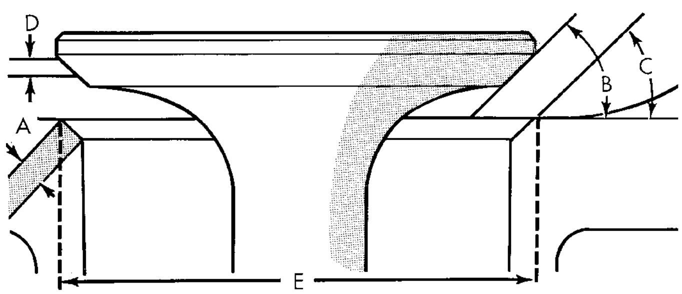

Fig. 97 Refacing Valve Seats

(8) Check valve tip to spring seat dimensions A after grinding the valve seats or faces. Grind valve tip to 43.51 - 44.57 mm (1.71 - 1.75 in.) for exhaust valve and 45.01 - 46.07 mm (1.77 - 1.81 in.) for intake valve over spring seat when installed in the head (Fig. 98). The valve tip chamfer may need to be reground to prevent seal damage when the valve is installed.

CLEANING

Clean all valve guides, valves and valve spring assemblies thoroughly with suitable cleaning solution before reassembling.

DISASSEMBLY AND ASSEMBLY (Continued)

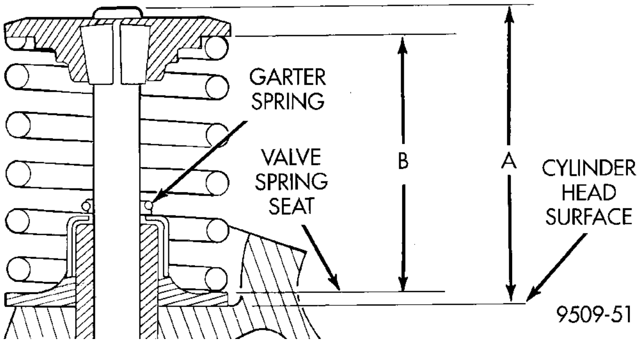

Fig. 98 Checking Spring Installed Height and Valve Tip to Spring Seat Dimensions

VALVE INSTALLATION

(1) Coat valve stems with clean engine oil and insert in cylinder head.

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 99). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: If oversize valves are used, there is only one oversize valve available. The same stem seal is used on both the standard and oversize valve.

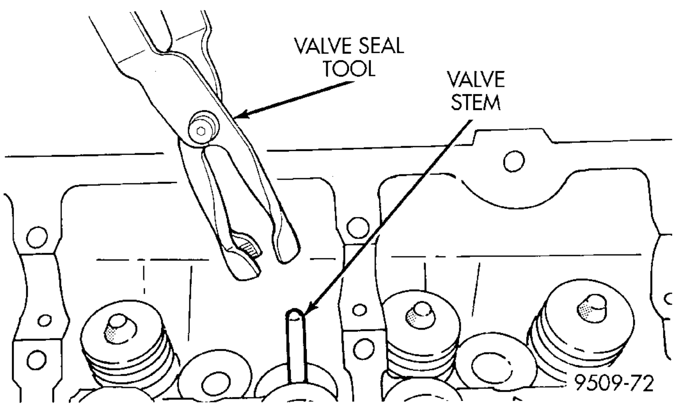

Fig. 99 Valve Stem Oil Seal Tool

(3) Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 98). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 40.18 mm (1.58 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

(5) Install rocker arm shafts as previously described in this section.

(6) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.17 mm (0.046 in.) for intake and 1.28 mm (0.050 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster/s to bleed down before rotating cam.

CLEANING AND INSPECTION

CYLINDER HEAD AND CAMSHAFT JOURNALS

INSPECTING CYLINDER HEAD

Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 100).

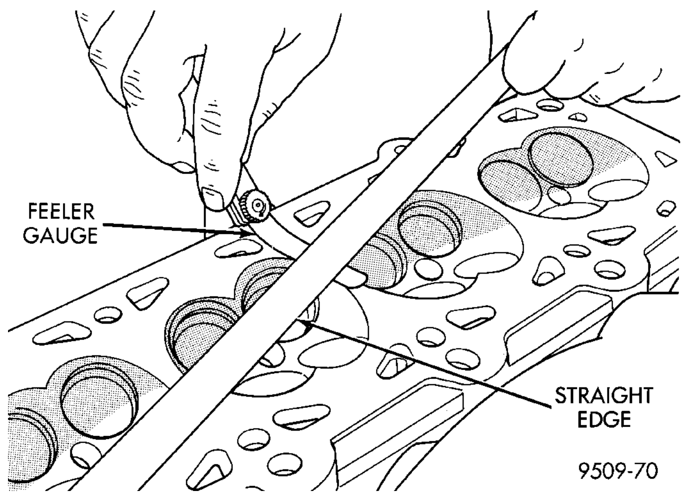

Fig. 100 Checking Cylinder Head Flatness

Inspect cylinder head journals for wear.

Check camshaft journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CLEANING

Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

CLEANING AND INSPECTION (Continued)

OIL PUMP

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 101). If a 0.076 mm (0.003 inch.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

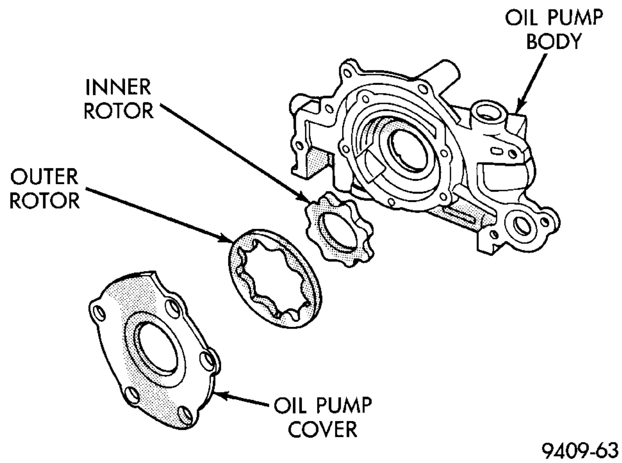

Fig. 101 Checking Oil Pump Cover Flatness

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 inch.) or less (Fig. 102), or if the diameter is 79.95 mm (3.148 inches) or less, replace outer rotor.

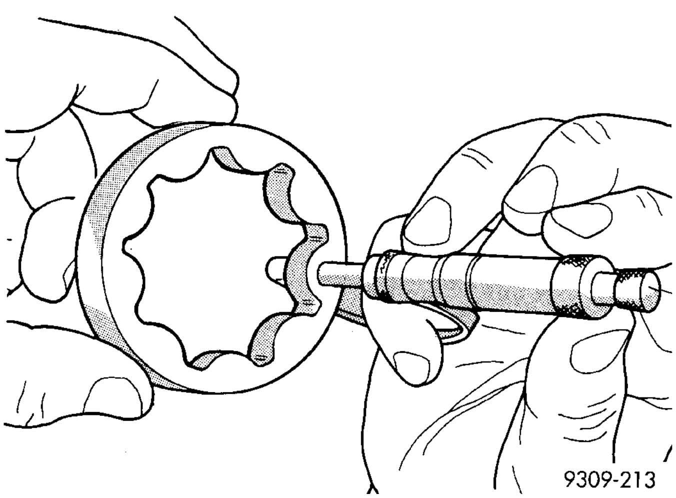

Fig. 102 Measuring Outer Rotor Thickness

(4) If inner rotor measures 7.64 mm (.301 inch) or less replace inner rotor (Fig. 103).

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 104). If measurement is 0.39 mm (0.015 inch.) or more, replace housing only if outer rotor is in specification.

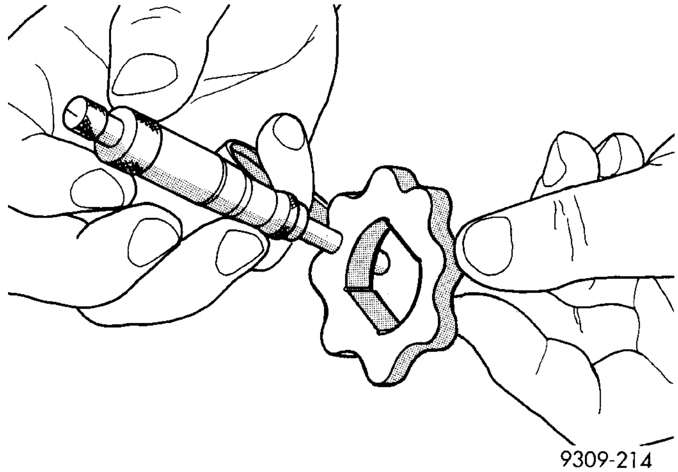

Fig. 103 Measuring Inner Rotor Thickness

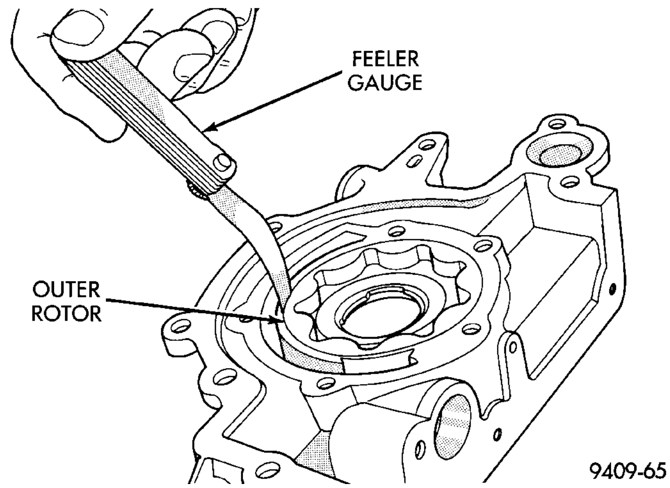

Fig. 104 Measuring Outer Rotor Clearance in Housing

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 105) is .203 mm (.008 inch) or more, replace both rotors.

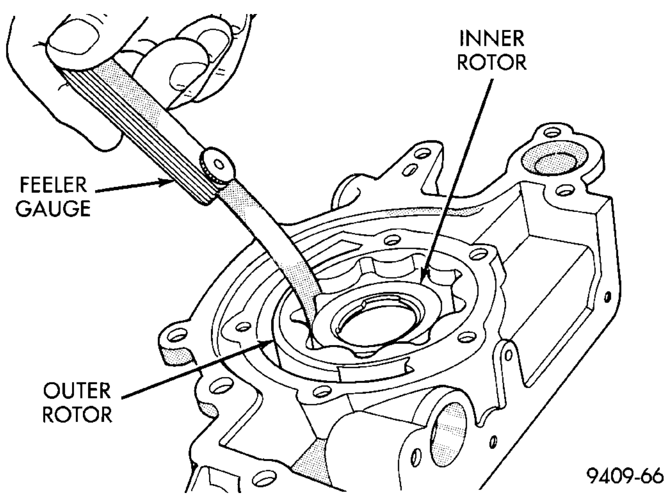

Fig. 105 Measuring Clearance Between Rotors

CLEANING AND INSPECTION (Continued)

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of .102 mm (.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 106). **ONLY** if rotors are in specs.

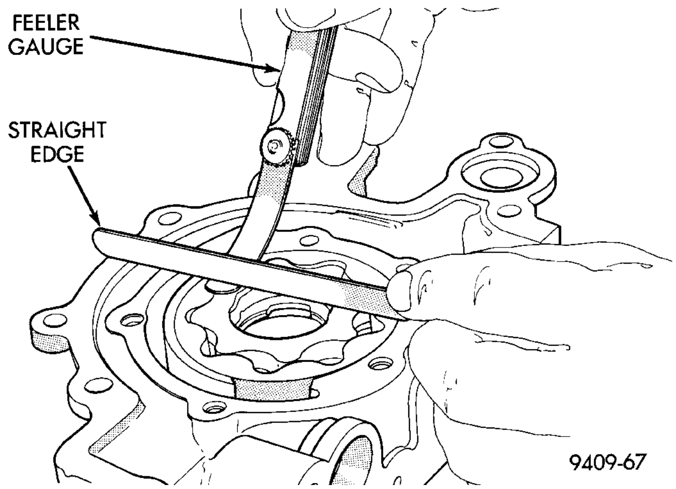

Fig. 106 Measuring Clearance Over Rotors

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings, damaged or missing oil pick-up tube o-ring, clogged oil pick-up tube screen, clogged oil filter and stuck open pressure relief valve or other reasons for oil pressure loss.

CYLINDER BLOCK AND BORE

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, Refer to Engine Core Plugs outlined in this section.

(3) Examine block and cylinder bores for cracks or fractures.

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 107). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 107). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to (Fig. 108) for specifications.

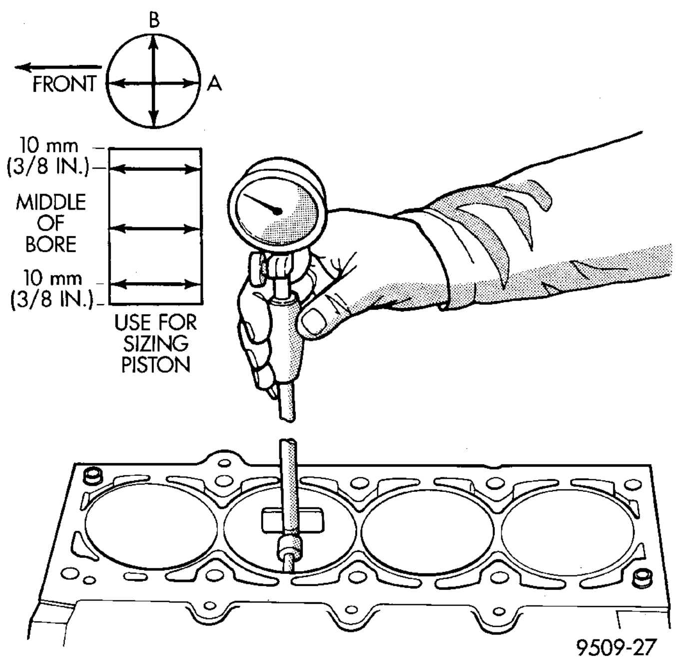

Fig. 107 Checking Cylinder Bore Size

Standard Bore	Maximum Out-of-Round	Maximum Taper
87.5 mm (3.445 inch.)	0.051 mm (0.002 inch.)	0.051 mm (0.002 inch.)
Standard Piston Size 87.463 - 87.481 mm (3.4434 - 3.4441 inch.)		
Piston to Bore Clearance: 0.012 - 0.044 mm (.0005 to .0017 inches.) Measurements taken at Piston Size location.		

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Fig. 108 Cylinder Bore and Piston Specifications

SPECIFICATIONS

ENGINE 2.0L SOHC

Cylinder Block

Cylinder Bore Diameter . . . . . 87.4924 - 87.5076 mm (3.4446 - 3.4452.in.)

Out-of-Round (Max.) . . . . 0.051 mm (0.002 in.)

Taper (Max.) . . . . 0.051 mm (0.002 in.)

Pistons

Clearance 17.5 mm (11/16 in.) from bottom of skirt . . . . 0.012 - 0.044 mm (0.0004 - 0.0017 in.)

Weight . . . . 325 - 335 grams (11.47 - 11.82 oz.)

Land Clearance (Diametrical) . . . . 0.734 - 0.797 mm (0.029 - 0.031 in.)

Piston Length . . . . 64 mm (2.520 in.)

Piston Ring Groove Depth No. 1 . . . . 3.989 - 4.188 mm (0.157 - 0.165 in.)

Piston Ring Groove Depth No. 2 . . . . 4.462 - 4.661 mm (0.176 - 0.184 in.)

Piston Ring Groove Depth No. 3 . . . . 3.847 - 4.131 mm (0.151 - 0.163 in.)

Piston Pins

Clearance in Piston . . . . 0.008 - 0.020 mm (0.0003 - 0.0008 in.)

In Rod (Interference) . . . . 0.018 - 0.043 mm (0.0007 - 0.0017 in.)

Diameter . . . . 20.998 - 21.003 mm (0.8267 - 0.8269 in.)

End Play . . . . None

Length . . . . 74.75 - 75.25 mm (2.943 - 2.963 in.)

Piston Rings

Ring Gap Top Compression Ring . . . . 0.23 - 0.52 mm (0.009 - 0.020 in.)

Ring Gap 2nd Compression Ring . . . . 0.49 - 0.78 mm (0.019 - 0.031 in.)

Ring Gap Oil Control (Steel Rails) . . . . 0.23 - 0.66 mm (0.009 - 0.026 in.)

Ring Side Clearance Both Compression Rings . . . . 0.025 - 0.065 mm (0.0010 - 0.0026 in.)

Oil Ring (Pack) . . . . 0.004 - 0.178 mm (0.0002 - 0.0070 in.)

Ring Width Compression Rings . . . . . 1.17 - 1.19 mm (0.046 - 0.047 in.)

Oil Ring (Pack) . . . . 2.854 - 3.008 mm (0.1124 - 0.1184 in.)

Connecting Rod

Bearing Clearance . . . . 0.026 - 0.059 mm (0.001 - 0.0023 in.)

Piston Pin Bore Diameter . . . . 20.96 - 20.98 mm (0.8252 - 0.8260 in.)

Large End Bore Diameter . . . . . 50.991 - 51.005 mm (2.0075 - 2.0081 in.)

Side Clearance . . . . 0.13 - 0.38 mm (0.005 - 0.015 in.)

Total Weight (Less Bearing) . . . . 543 grams (1.20 lbs.)

Crankshaft

Connecting Rod Journal Diameter . . . . 47.9924 - 48.0076 mm (1.8894 - 1.8900 in.)

Out-of-Round (Max.) . . . . 0.0035 mm (0.0001 in.)

Taper (Max.) . . . . 0.0038 mm (0.0001 in.)

Main Bearing Diametrical Clearance No. 1 - 5 . . . . 0.022 - 0.062 mm (0.0008 - 0.0024 in.)

End Play . . . . 0.09 - 0.24 mm (0.0035 - 0.0094 in.)

Main Bearing Journals

Diameter . . . . 51.9924 - 52.0076 mm (2.0469 - 2.0475 in.)

Out-of-Round (Max.) . . . . 0.0035 mm (0.0001 in.)

Taper (Max.) . . . . 0.0038 mm (0.0001 in.)

ENGINE 2.0L SOHC

Rocker Arm Shaft

Rocker Arm Shaft Diameter . . . . 19.996 – 19.984mm (0.786 – 0.7867 in.)

Rocker Arm Shaft Retainers (Width)

Intake (All) . . . . 28.46 mm (1.12 in.)

Exhaust . . . . 1 & 5 29.20 mm (1.14in.) 2, 3, and 4 - 40.45 mm (1.59 in.)

Rocker Arm/Hydraulic Lash Adjuster *

Rocker Arm Inside Diameter . . . . 20.00 – 20.02 mm (0.787 – 0.788 in.)

Rocker Arm Shaft Clearance . . . . . 0.016 – 0.054 mm (0.0006 – 0.0021 in.)

Body Diameter . . . . 22.949 – 22.962 mm (0.9035 – 0.9040 in.)

Plunger Travel Minimum (Dry) . . . . 2.2 mm (0.087 in.)

Rocker Arm Ratio . . . . 1.4 to 1

Camshaft

No. 1 . . . . . . 41.20 – 41.221 mm (1.622 – 1.6228 in.)

No. 2 . . . . 41.6 – 41.621 mm (1.637 – 1.638 in.)

No. 3 . . . . 42.0 – 42.021 mm (1.653 – 1.654 in.)

No. 4 . . . . 42.4 – 42.421 mm (1.669 – 1.670 in.)

No. 5 . . . . 42.8 – 42.821 mm (1.685 – 1.6858 in.)

Bearing Journal Diameter

No. 1 . . . . . 41.128 – 41.147 mm (1.619 – 1.6199 in.)

No. 2 . . . . . . 41.528 – 41.547 mm (1.634 – 1.635 in.)

No. 3 . . . . . . 41.928 – 41.947 mm (1.650 – 1.651 in.)

No. 4 . . . . . . 42.328 – 42.374 mm (1.666 – 1.668 in.)

No. 5 . . . . . 42.728 – 42.747 mm (1.682 – 1.6829 in.)

Diametrical Bearing Clearance . . . . 0.053 – 0.093 mm (0.0027 – 0.003 in.)

Max. Allowable . . . . 0.12 mm (0.0047 in.)

End Play . . . . 0.05 – 0.39 mm (0.0059 in.)

Lift (Zero Lash)

Intake . . . . 7.8 mm (0.307 in.)

Exhaust . . . . 7.03 mm (0.277 in.)

SPECIFICATIONS (Continued)

Valve Timing Exhaust Valve
Closes (ATDC) . . . . 5.4°
Opens (BBDC) . . . . 43.7°
Duration . . . . 229.1°

Valve Timing Intake Valve **
Closes (ABDC) . . . . 41.1°
Opens (ATDC) . . . . 13.9°
Duration . . . . 207.2°
Valve Overlap . . . . 0°

Cylinder Head
Material . . . . Cast Aluminum
Gasket Thickness (Compressed) . . . . 1.15 mm (0.045 in.)

Valve Seat
Angle . . . . 45°
Runout (Max.) . . . . 0.050 mm (0.002)
Width (Finish) Intake and Exhaust . . . . 0.75 – 1.25 mm (0.030 – 0.049 in.)

Valve Guide Finished
Diameter I.D. . . . . 5.975 – 6.000 mm (.235 – .236 in.)
Guide Bore Diameter (Std.) . . . . . . 11.0 – 11.02 mm (0.4330 – 0.4338 in.)

Valves
Face Angle Intake and Exhaust . . . . 45 – 45-1/2°
Head Diameter Intake . . . . 32.12 – 33.37 mm (1.303 – 1.313 in.)
Head Diameter Exhaust . . . . 28.57 – 28.83 mm (1.124 – 1.135 in.)

Valve Margin
Intake . . . . 1.15 – 1.48 mm (0.0452 – 0.0582 in.)
Exhaust . . . . 1.475 – 1.805 mm (0.058 – 0.071 in.)

Valve Length (Overall)
Intake . . . . 114.69 – 115.19 mm (4.515 – 4.535 in.)
Exhaust . . . . 109.59 – 110.09 mm (4.603 – 4.623 in.)

Valve Stem Tip Height
Intake . . . . 45.01 – 46.07 mm (1.77 – 1.81 in.)
Exhaust . . . . 43.51 – 44.57 mm (1.71 – 1.75 in.)

Stem Diameter
Intake . . . . 5.934 – 5.952 mm (0.234 – 0.234 in.)
Exhaust . . . . 5.906 – 5.924 mm (0.233 – 0.233 in.)

Stem to Guide Clearance
Intake . . . . 0.048 – 0.066 mm (0.0018 – 0.0025 in.)
Exhaust . . . . 0.0736 – 0.094 mm (0.0029 – 0.0037 in.)
Max. Allowable Intake . . . . 0.076 mm (0.003 in.)
Max. Allowable Exhaust . . . . . . 0.101 mm (0.004 in.)

Valve Springs
Free Length (Approx.) . . . . 44.4 mm (1.747 in.)
Nominal Force (Valve closed) . . . . 91 N·m @ 39.8 mm (67 ft. lbs. @ 1.57 in.)
Nominal Force (Valve open) . . . . 239 N·m @ 32.6 mm (176 lbs. @ 1.28 in.)
Installed Height . . . . 40.18 mm (1.580 in.)

* SERVICE AS AN ASSEMBLY WITH ROCKER ARM.

** ALL READINGS IN CRANKSHAFT DEGREES, AT 0.5 mm (0.019 in.) OF VALVE LIFT.

TORQUE CHART 2.0L SOHC

DESCRIPTION . . . . TORQUE

Camshaft Sensor Pick Up
Bolts . . . . 9.6 N·m (85 in. lbs.)

Timing Belt Cover
Bolts M6 . . . . 12 N·m (105 in. lbs.)

Camshaft Sprocket
Bolt . . . . 115 N·m (85 ft. lbs.)

Connecting Rod Cap
Bolts . . . . 27 N·m (20 ft. lbs.) Plus 1/4 Turn

Crankshaft Main Bearing Cap/Bedplate
M8 Bedplate Bolts . . . . 30 N·m (22 ft. lbs.)
M11 Main Cap Bolts . . . . 81 N·m (60 ft. lbs.)

Crankshaft Damper
Bolt . . . . 142 N·m (105 ft. lbs.)

Cylinder Head
Bolts . . . . Refer To Cylinder Head Installation

Cylinder Head Cover
Bolts . . . . 12 N·m (105 in. lbs.)

Engine Mount Bracket
Bolts . . . . 41 N·m (30 ft. lbs.)

Exhaust Manifold to Cylinder Head
Bolts . . . . 23 N·m (200 in. lbs.)

Exhaust Manifold Heat Shield
Bolts . . . . 12 N·m (105 in. lbs.)

Front Torque Bracket—2.0/2.4L Engine
Bolts . . . . 33 N·m (24 ft. lbs.)

Front Torque Bracket Strut—2.0/2.4L Engine
Long Bolts . . . . 110 N·m (80 ft. lbs.)
Short Bolt . . . . 61 N·m (45 ft. lbs.)

Intake Manifold
Bolts . . . . 12 N·m (105 in. lbs.)

Oil Filter Adapter
Fastener . . . . 80 N·m (60 ft. lbs.)
Oil Filter . . . . 20 N·m (15 ft. lbs.)

Oil Pan
Bolts . . . . 12 N·m (105 in. lbs.)
Drain Plug . . . . 27 N·m (20 ft. lbs.)

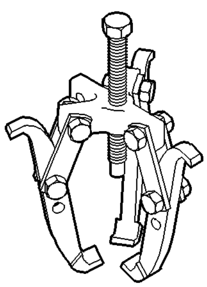
Oil Pump Attaching
Bolts . . . . 28 N·m (250 in. lbs.)

SPECIFICATIONS (Continued)

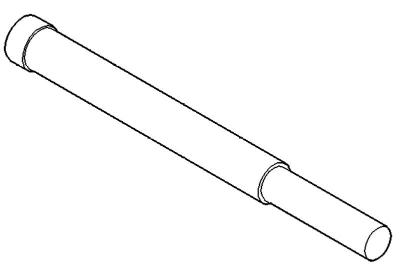
DESCRIPTION . . . . TORQUE
Oil Pump Cover Fastener . . . 12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Bolt . 28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap . . . 41 N·m (30 ft. lbs.)
Rear Torque Bracket
Bolts . . . . 110 N·m (80 ft. lbs.)
Rocker Arm Shaft
Bolts . . . . 28 N·m (250 in. lbs.)
Spark Plugs . . . . 28 N·m (20 ft. lbs.)
Support Module—Front and Rear
Thru Bolt . . . . 61 N·m (45 ft. lbs.)
Thermostat Housing
Bolts . . . . 23 N·m (200 in lbs.)
Timing Belt
Tensioner . . . . 31 N·m (275 in. lbs.)
Timing Belt Tensioner Pivot Bracket
Bolt . . . . 31 N·m (275 in. lbs.)
Timing Belt Tensioner Pulley
Bolt . . . . 68 N·m (50 ft. lbs.)
Water Pump Mounting
Bolts . . . . 12 N·m (105 in. lbs.)

SPECIAL TOOLS

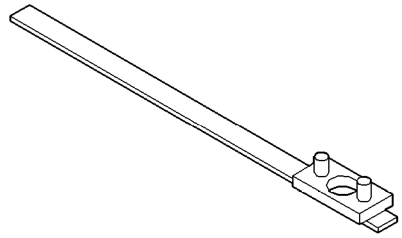
ENGINE 2.0L SOHC



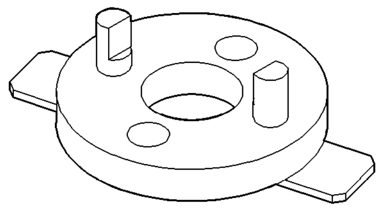
Puller 1026



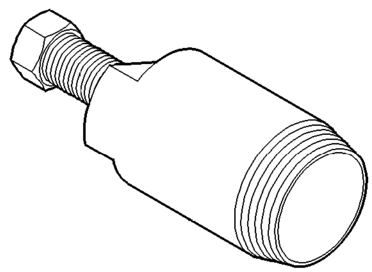
Crankshaft Damper Removal Insert 6827-A



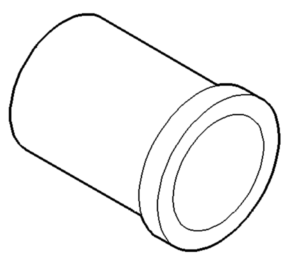
Camshaft Sprocket Remover/Installer C-4687



Camshaft Sprocket Remover/Installer Adapter C-4687-1

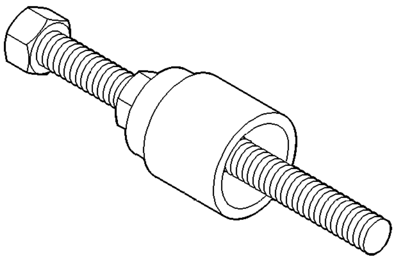


Camshaft Seal Remover C-4679-A

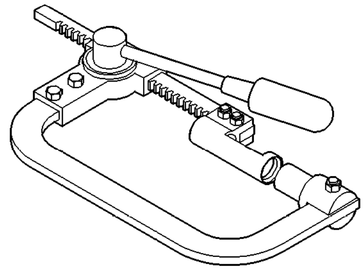


Camshaft Seal Installer MD-998306

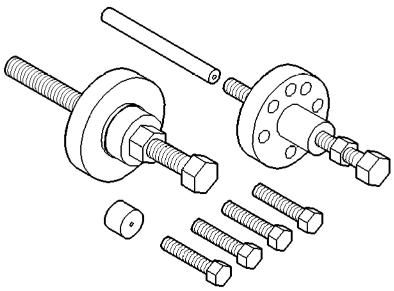
SPECIAL TOOLS (Continued)



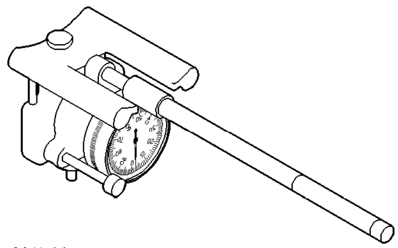
Crankshaft Damper Installer 6792



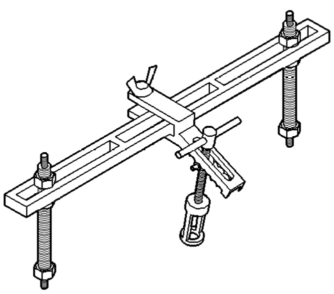
Valve Spring Compressor C-3575-A



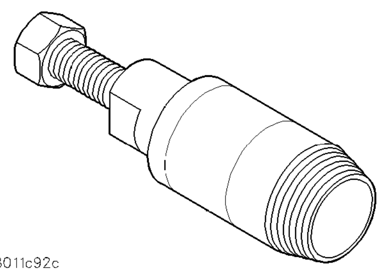
Crankshaft Damper Installer C-4685-C



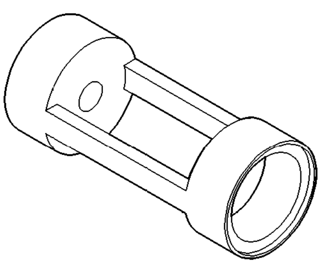
Cylinder Bore Indicator C-119



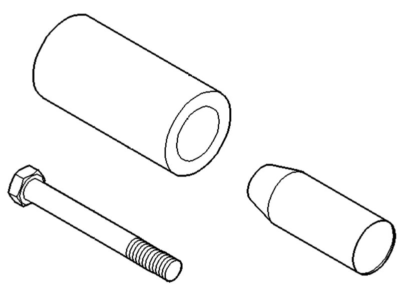
Valve Spring Compressor MD-998772-A



Front Crankshaft Seal Remover 6771

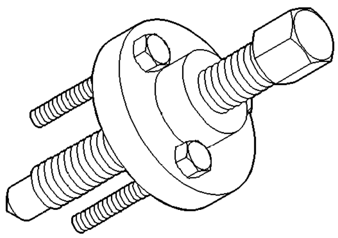


Spring Compressor Adapter 6779

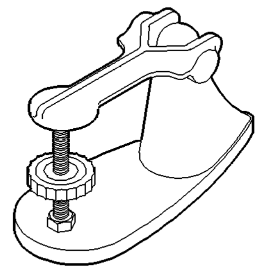


Front Crankshaft Seal Installer 6780

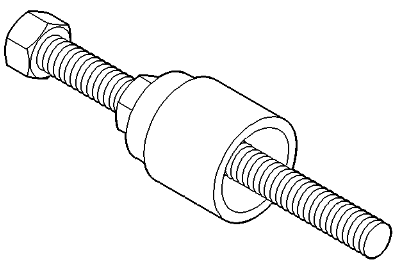
SPECIAL TOOLS (Continued)



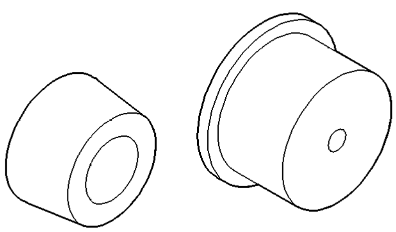
Crankshaft Sprocket Remover 6793



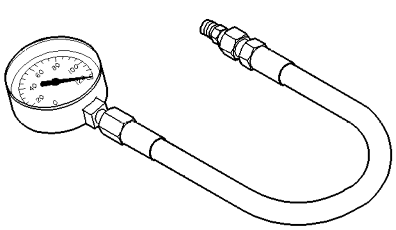
Valve Spring Tester C-647



Crankshaft Sprocket Installer 6792



Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



Pressure Gage C-32932

2.0L DOHC ENGINE

INDEX

DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION NUMBER

The engine identification number is located on the rear of the cylinder block (Fig. 1).

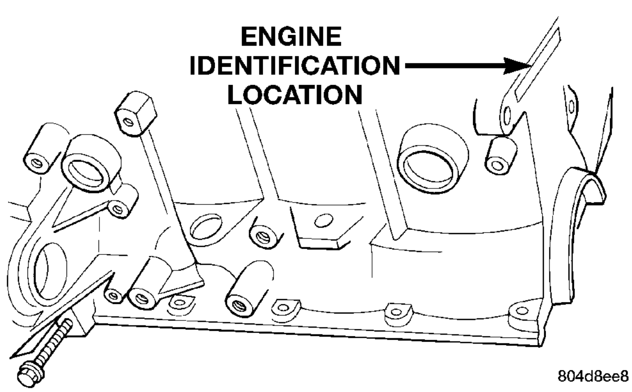


Fig. 1 Engine Identification DOHC

GENERAL SPECIFICATION

Type . . . . In-Line OHV, DOHC & SOHC
Bore . . . . 87.5mm (3.445 Inch)
Stroke . . . . 83.0mm (3.268 inch)
Compression Ratio . . . . DOHC - 9.6:1 SOHC - 9.8:1
Displacement . . . . 2.0 Liters (122 Cubic Inch)
Firing Order 1, 3, 4, 2
Compression Pressure . . . . 1172 - 1551 kPa (170 - 225 psi)
Maximum Variation Between Cylinders 25%
Lubrication . . . . Pressure Feed - Full Flow Filtration (Crankshaft Driven Pump)

Engine Oil Capacity
With Oil Filter Change . . . . 4.25 Liter (4.5 Qts.)
Without Oil Filter Change . . . . . 3.8 Liter (4.0 Qts.)

DESCRIPTION AND OPERATION (Continued)

ENGINE LUBRICATION SYSTEM

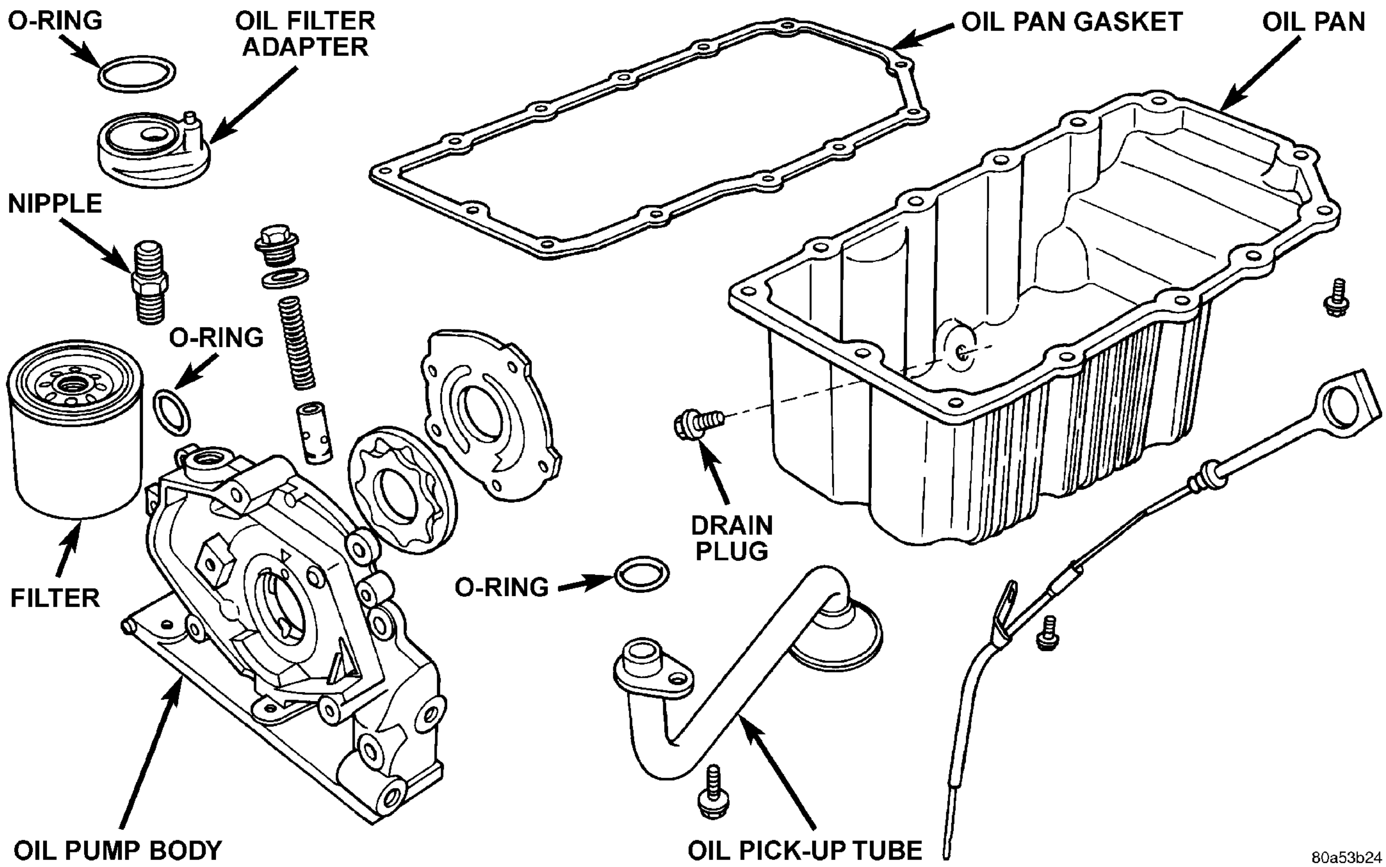


Fig. 2 Engine Lubrication Components

PRESSURE LUBRICATION

Oil drawn up through the pickup tube is pressurized by the pump and routed through the full flow filter (Fig. 2) to the main oil gallery running the length of the cylinder block. A cylinder head restrictor, located in the block, provides increased oil flow to the main oil gallery (Fig. 3).

MAIN/ROD BEARINGS

A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from main bearing journals to connecting rod journals.

CAMSHAFT/HYDRAULIC LASH ADJUSTERS

A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up past a cylinder head bolt to an oil gallery running the length of the cylinder head. The camshaft journals are partially slotted to allow a predetermined amount of pressurized oil to pass into the bearing cap cavities with small holes directed to spray lubricate the camshaft lobes.

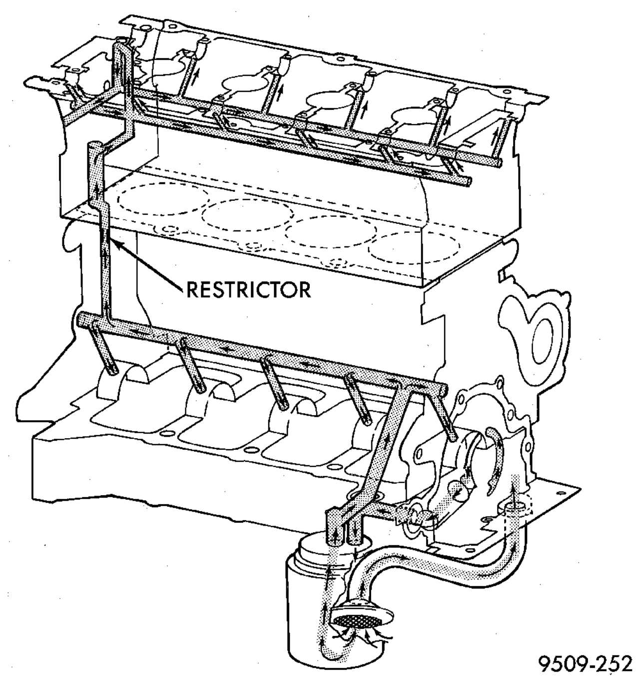


Fig. 3 Engine Lubrication System —DOHC Engine

DESCRIPTION AND OPERATION (Continued)

SPLASH LUBRICATION

Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

ENGINE COMPONENTS

CYLINDER BLOCK AND BEDPLATE ASSEMBLY A partial open deck is used for cooling and weight reduction with water pump molded into the block. Nominal wall thickness is 4 mm. The bedplate incorporates main bearing caps. Rear seal retainer is integral with the block.

CRANKSHAFT A nodular cast iron crankshaft is used. The engine has 5 main bearings, with number 3 flanged to control thrust. The 52 mm diameter main and 48 mm diameter crank pin journals (all) have undercut fillet radiuses that are deep rolled for added strength. To optimize bearing loading 8 counterweights are used. Hydrodynamic seals provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for parting line sealing. A sintered iron timing belt sprocket is mounted on the crankshaft nose. This sprocket provides motive power; via timing belt to the camshaft sprocket providing timed valve actuation.

PISTONS The DOHC Engine **DO NOT** have provision for a free wheeling valve train. Non free wheeling valve train means, in the event of a broken timing belt Pistons will contact the Valves. All engines use pressed-in piston pins to attach forged powdered metal connecting rods. The connecting rods are a cracked cap design and are not repairable. Hex head cap screw are used to provide alignment and durability in the assembly.

PISTON RINGS The piston rings include a molybdenum faced top ring for reliable compression sealing and a taper faced intermediate ring for additional cylinder pressure control. Oil Control Ring Package contains of 2 steel rails and a expander spacer.

CYLINDER HEAD Features a Dual Over Head Camshaft (DOHC), 4 valves per cylinder cross flow design. The valves are arranged in two inline banks, with the ports of the bank of two intake valves per cylinder facing toward the radiator side of engine and ports of the bank of two exhaust valves per cylinder facing toward the dash panel. Incorporates powder metal valve guides and seats. Integral oil galleys within the cylinder head supplies oil to the hydraulic lash adjusters, camshaft and valve mechanisms.

CAMSHAFTS The nodular iron camshafts have six bearing journals and 2 cam lobes per cylinder. Flanges at the rear journals control camshaft end play. Provision for cam position sensor is located on the intake camshaft at the rear of cylinder head. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

VALVES Four valves per cylinder are actuated by roller cam followers which pivot on stationary hydraulic lash adjusters. All valves have 6 mm diameter chrome plated valve stems. The valve sizes are 34.8 mm (1.370 inch.) diameter intake valves and 30.5 mm (1.20 inch.) diameter exhaust valves. Viton rubber valve stem seals are integral with the spring seats. Valve springs, spring retainers, and locks are conventional.

INTAKE MANIFOLD The intake manifold is a two piece aluminum casting, attached to the cylinder head with ten fasteners. This long branch fan design enhances low and midspeed torque.

EXHAUST MANIFOLD The exhaust manifold is made of nodular cast iron for strength and high temperatures. Exhaust gasses exit through a machined, articulated joint connection to the exhaust pipe.

PARTS REPLACED

If any of the following parts have been changed or replaced:

- Camshaft
- Camshaft Position Sensor
- Camshaft Position Sensor Target Magnet
- Cylinder Block
- Cylinder Head
- Water Pump
- Powertrain Control Module (PCM)

The camshaft and crankshaft timing relearn procedure must be performed. Refer to Group 25, Emission Control Systems for procedure.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure switch and install gauge assembly C-3292 with adaptor.

(2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not perform the 3000 RPM test in the next step.

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170-550 kPa (25-80 psi).

(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open, a clogged oil pick-up screen or a damaged oil pick-up tube O-ring.

SERVICE PROCEDURES

CYLINDER BORE AND PISTON SIZING

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 4). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 4). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Cylinder Bore and Piston Specifications Table.

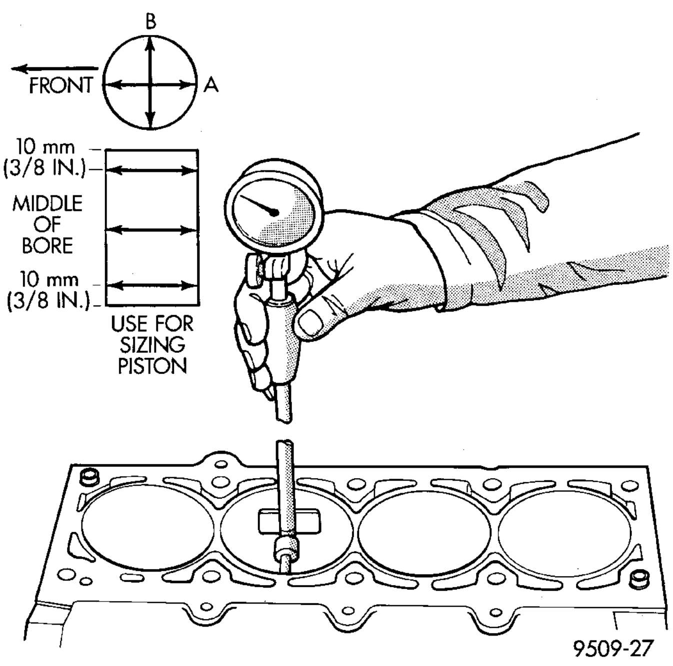


Fig. 4 Checking Cylinder Bore Size

CYLINDER BORE AND PISTON SPECIFICATIONS TABLE

Standard Bore	**Maximum Out-of-Round**	**Maximum Taper**
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
87.457 - 87.475 mm (3.4432 - 3.4439 in.)		
Piston to Bore Clearance		
0.018 - 0.050 mm (0.0007 - 0.0020 in.)		
Measurements Taken at Piston Size Location		

SIZING PISTONS

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 17.5 mm (11/16 inch) from the bottom of the skirt as shown in (Fig. 5). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 4). Refer to Cylinder Bore and Piston Specifications Table. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

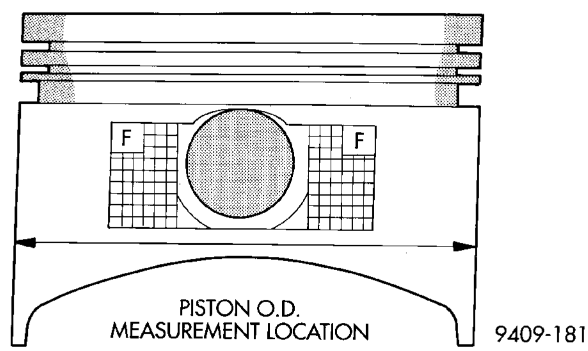


Fig. 5 Piston Measurements

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

SERVICE PROCEDURES (Continued)

FITTING PISTON RINGS

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 5). Refer to specifications (Fig. 7).

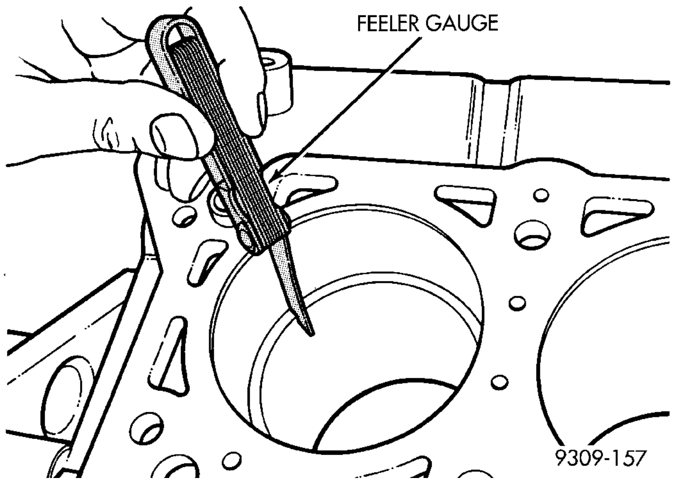


Fig. 6 Piston Ring Gap

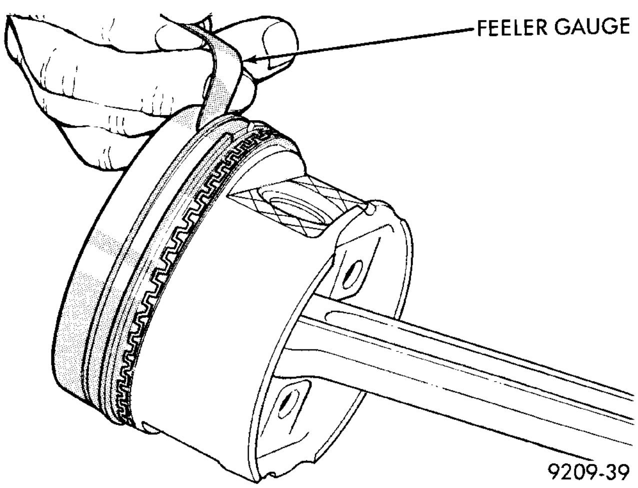


Fig. 7 Piston Ring Side Clearance

(2) Check piston ring to groove side clearance (Fig. 6). Refer to specification (Fig. 7).

FITTING CONNECTING RODS

(1) Follow the procedure specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 8). Refer to specifications.

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

NOTE: The rod bearing bolts should not be reused.

Ring Position	Ring Gap	Wear Limit
Upper Ring	0.23 to 0.52 mm (0.009 to 0.020 in.)	0.8 mm (0.031 in.)
Intermediate Ring	0.49 to 0.78 mm (0.019 to 0.031 in.)	1.0 mm (0.039 in.)
Oil Control Ring	0.23 to 0.66 mm (0.009 to 0.026 in.)	1.0 mm (0.039 in.)
Ring Position	**Groove Clearance**	**Maximum Clearance**
Upper Ring	0.025 to 0.065 mm (0.0010 to 0.0026 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.025 to 0.065 mm (0.0010 to 0.0026 in.)	0.10 mm (0.004 in.)
OIL CONTROL RING - THREE PIECE. OIL RING SIDE RAILS MUST BE FREE TO ROTATE AFTER ASSEMBLY.		

Fig. 8 Piston Ring Specifications

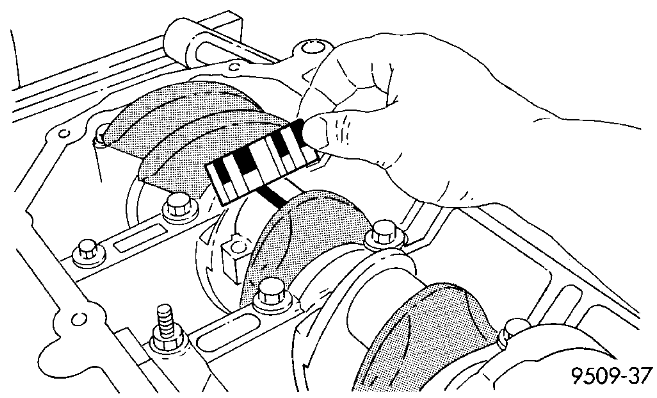


Fig. 9 Checking Connecting Rod Bearing Clearance

(2) Before installing the **NEW** bolts the threads should be oiled with clean engine oil.

(3) Install each bolt finger tight than alternately torque each bolt to assemble the cap properly.

(4) Tighten the bolts to 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn) **Do not use a torque wrench for last step.**

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 9). Refer to connecting rod specifications (Fig. 10).

FITTING CRANKSHAFT BEARINGS

Refer to Measuring Main Bearing Clearance in Standard Service Procedures. Refer to (Fig. 11) for specifications.

CRANKSHAFT END PLAY

DIAL INDICATOR METHOD

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 12).

(2) Move crankshaft all the way to the rear of its travel.

SERVICE PROCEDURES (Continued)

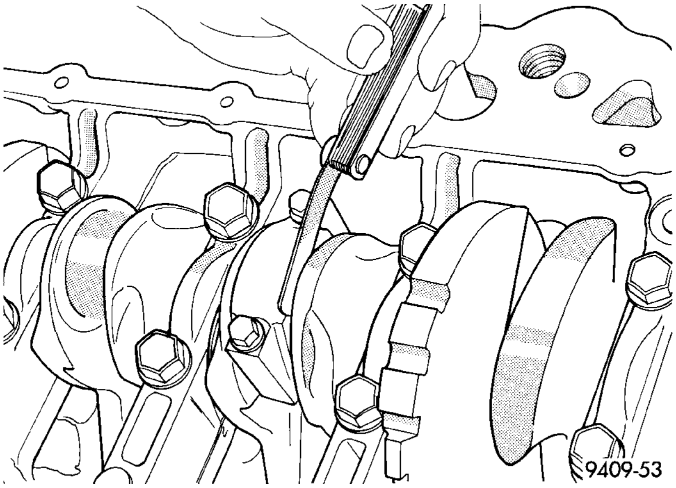


Fig. 10 Checking Connecting Rod Side Clearance

CONNECTING ROD BEARING OIL CLEARANCE	
New Part:	0.026 to 0.059 mm (0.001 to 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
CONNECTING ROD SIDE CLEARANCE	
New Part:	0.13 to 0.38 mm (0.005 to 0.015 in.)
Wear Limit:	0.40 mm (0.016 in.)

Fig. 11 Connecting Rod Specifications

Crankshaft End-Play	
New Part:	0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Wear Limit:	0.37 mm (0.015 in.)
Main Bearing Clearance	
New Part:	.022 - .062 mm (0.0008 - 0.0024 in.)
Connecting Rod Bearing Clearance	
New Part:	0.026 - .059 mm (0.001 - 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
Crankshaft Journal Sizes	
Main Bearing Journal Diameter	
Standard	52.000 ± 0.008 mm (2.0472 ± 0.0003 in.)
1st Undersize	51.983 ± 0.008 mm (2.0466 ± 0.0003 in.)
Connecting Rod Journal	
Standard	48.000 ± 0.008 mm (1.8897 ± 0.0003 in.)
1st Undersize	47.983 ± 0.008 mm (1.8891 ± 0.0003 in.)

Fig. 12 Crankshaft Specifications

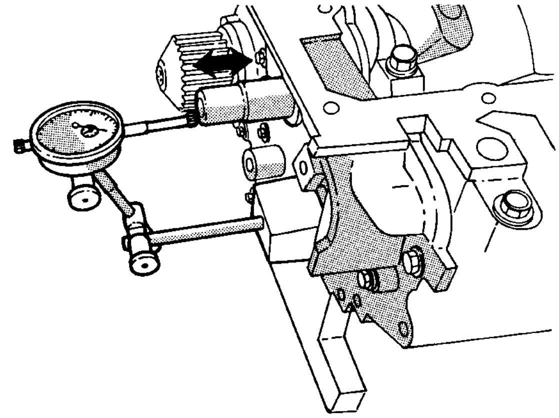


Fig. 13 Checking Crankshaft End Play— Dial Indicator

(3) Zero the dial indicator.

(4) Move crankshaft all the way to the front and read the dial indicator. Refer to (Fig. 11) for specifications.

FEELER GAGE METHOD

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. Do **not** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

REMOVAL AND INSTALLATION

FRONT MOUNT

(1) Raise vehicle on hoist.

(2) Support the engine and transmission assembly with a floor jack so it will not rotate.

(3) Remove the front engine mount thru-bolt from the insulator and engine mount bracket (Fig. 14).

(4) Remove the mass damper. Remove the front mount nuts and remove insulator assembly.

(5) Remove the engine mount bracket, if necessary.

(6) Reverse removal procedure for installation and tighten fasteners in this order.

a. If engine mount bracket was removed, tighten bolt 1 to 3 N·m (20 in. lbs.) and bolts 2, 3 and 4 to 108 N·m (80 ft. lbs.) (Fig. 14).

b. If engine mount bracket was removed, tighten bolts 5 and 1 to 54 N·m (40 ft. lbs.).

c. Tighten engine mount bracket to insulator assembly thru-bolt to 54 N·m (40 ft. lbs.).

d. Tighten insulator assembly nuts to the lower radiator crossmember torque to 54 N·m (40 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

e. Install mass damper and tighten to 54 N·m (40 ft. lbs.)

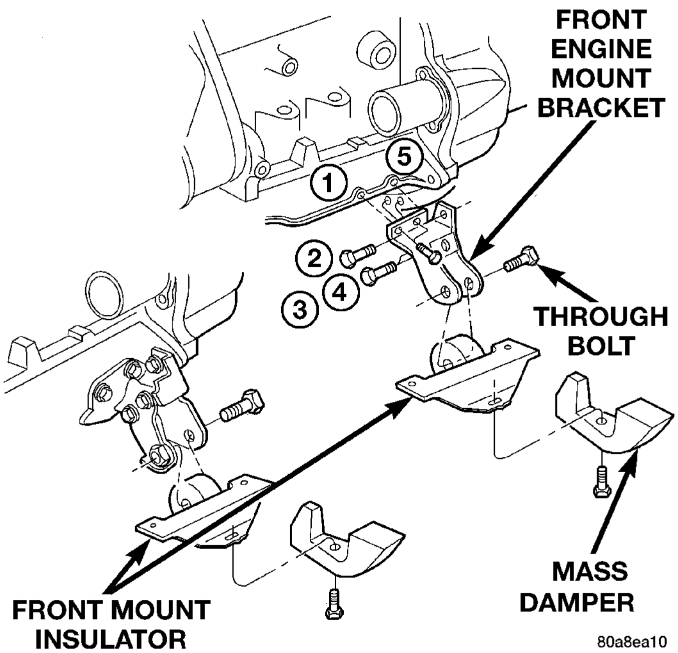


Fig. 14 Engine Mounting—Front

LEFT MOUNT

(1) Raise vehicle on hoist and remove left front wheel.

(2) Remove the Power Distribution Center (PDC) on manual transaxle model, from battery tray mount and lay aside.

(3) Support the transmission with a transmission jack.

(4) Remove the thru-bolt access hole cover. Remove the insulator thru-bolt from the mount (Fig. 15).

(5) Remove the transmission mount fasteners and remove mount.

(6) Reverse removal procedure for installation. Tighten fasteners in this order (Fig. 15):

A. 55 N·m (40 ft. lbs.)

B. 108 N·m (80 ft. lbs.)

RIGHT MOUNT

(1) Remove the purge duty solenoid from engine mount bracket.

(2) Remove the right engine mount insulator vertical fasteners from frame rail (Fig. 16).

(3) Remove the load on the engine mounts by carefully supporting the engine and transmission assembly with a floor jack.

(4) Remove the thru-bolt access hole cover. Remove the thru-bolt from the insulator assembly (Fig. 16). Remove insulator.

(5) Reverse removal procedure for installation. Tighten engine mount to rail fasteners to 54 N·m (40

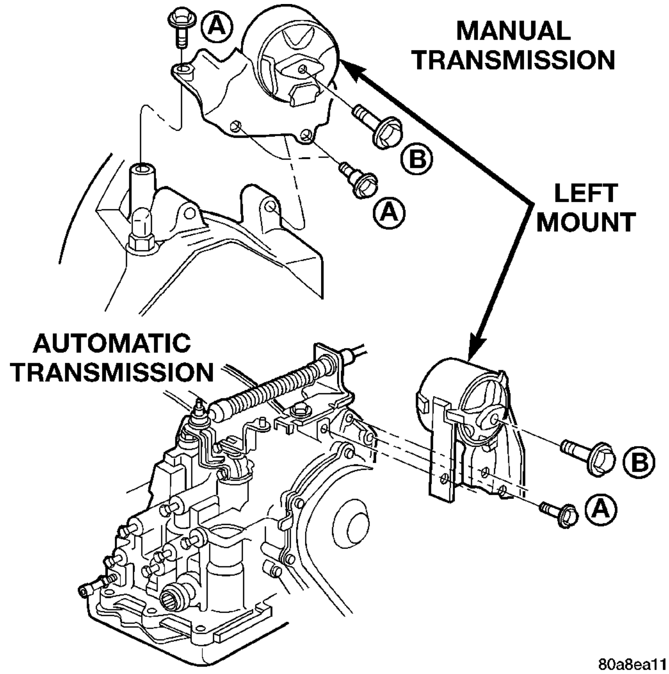


Fig. 15 Engine Mounting—Left

ft. lbs.), then tighten engine mount to engine bracket thru-bolt to 108 N·m (80 ft. lbs.).

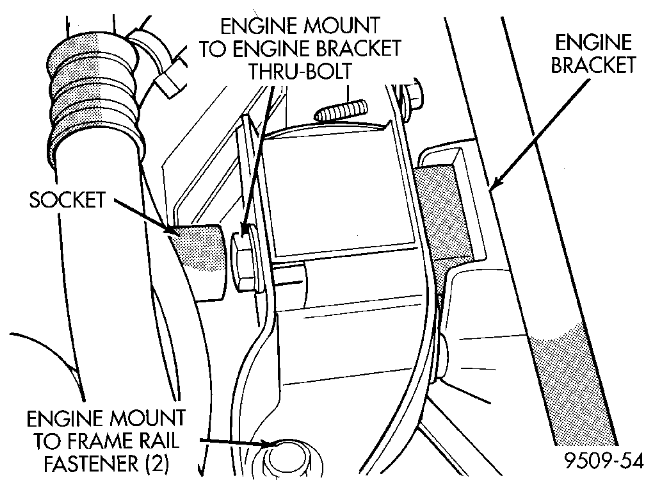


Fig. 16 Engine Mounting—Right

POWER HOP DAMPER

NOTE: Power hop damper is used on manual transmission vehicle only.

(1) Remove the thru-bolt and nut from the front suspension crossmember (Fig. 17).

(2) Remove the damper nut and grommets. Remove the damper.

(3) Remove the power hop damper bracket, if necessary.

(4) Reverse removal procedure for installation. Tighten all bolts and nuts to 54 N·m (40 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

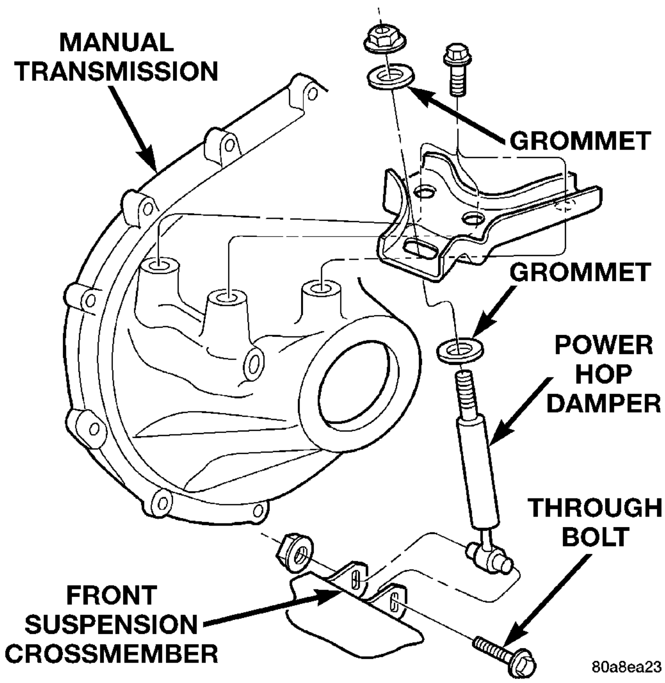


Fig. 17 Power Hop Damper

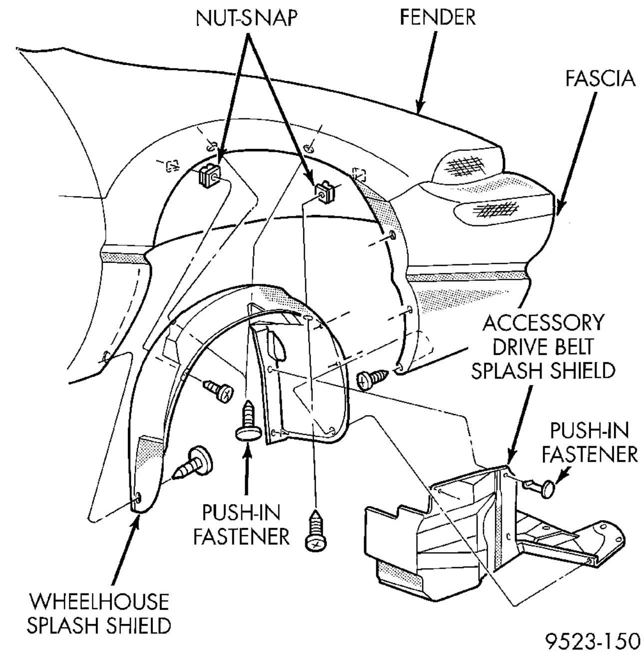


Fig. 18 Right Inner Splash Shield

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect and remove battery and tray. Set Powertrain Control Module (PCM) aside.

(3) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(4) Remove upper radiator hose, radiator and fan module. Refer to Group 7, Cooling System for procedure.

(5) Remove lower radiator hose.

(6) Disconnect automatic transmission cooler lines and plug. If equipped.

(7) Disconnect clutch cable (Manual) and transmission shift linkage.

(8) Disconnect throttle body linkage.

(9) Disconnect engine wiring harness.

(10) Disconnect heater hoses.

(11) Discharge Air Conditioning System. Refer to Group 24, Air Conditioning for procedure.

(12) Hoist vehicle and remove right inner splash shield (Fig. 17).

(13) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(14) Remove axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(15) Disconnect exhaust pipe from manifold.

(16) Remove front engine mount.

(17) Manual transmission: Remove power hop damper.

(18) Lower vehicle. Remove air cleaner assembly.

(19) Remove power steering pump and reservoir, Set them aside.

(20) Remove A/C compressor.

(21) Remove ground straps to body.

(22) Raise vehicle enough to allow engine dolly and cradle Special Tools 6135 and 6710 to be installed under vehicle.

(23) Loosen engine support posts to allow movement for positioning onto engine locating holes and flange on the engine bedplate. Lower vehicle and position cradle until the engine is resting on support posts (Fig. 18). Tighten mounts to cradle frame. This will keep support posts from moving when removing or installing engine and transmission.

(24) Install safety straps around the engine to cradle tighten; straps and lock them into position.

(25) Raise vehicle enough to see if straps are tight enough to hold cradle assembly to engine.

(26) Lower vehicle so weight of the engine and transmission ONLY is on the cradle assembly.

(27) Remove engine and transmission mount thru-bolts.

(28) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly with the cradle to allow for removal around body flanges.

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right

REMOVAL AND INSTALLATION (Continued)

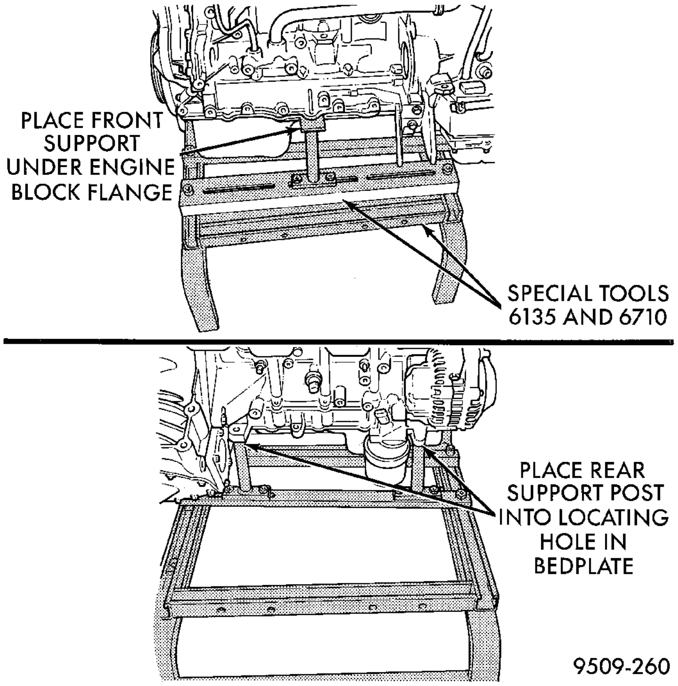


Fig. 19 Positioning Engine Cradle Support Post Mounts

engine and left transmission mounts. Refer to procedures outlined in this section.

(3) Remove safety straps from engine and transmission assembly. Slowly raise vehicle enough to remove the engine dolly and cradle.

(4) Install axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(5) Install transmission and engine braces and splash shields.

(6) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(7) Install power steering pump and reservoir. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(8) Install A/C compressor and hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(9) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(10) Install front engine mount. Refer to this section for procedure.

(11) Manual transmission: Install power hop damper.

(12) Install inner splash shield. Install wheels and tires.

(13) **Manual Transmission:** Connect clutch cable and linkages. Refer to Group 6, Manual Transaxle Clutch.

(14) **Automatic Transmission:** Connect shifter and kickdown linkage. Refer to Group 21, Transaxle for procedures.

(15) Connect fuel line and heater hoses.

(16) Install ground straps. Connect engine and throttle body connections and harnesses. Refer to Group 8, Electrical for procedure.

(17) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(18) Install radiator and shroud assembly. Install radiator hoses. Fill cooling system. Refer to Group 7, Cooling System for filling procedure.

(19) Install battery tray and battery. Set Powertrain Control Module (PCM) into place.

(20) Install air cleaner and hoses.

(21) Install oil filter. Fill engine crankcase with proper oil to correct level.

(22) Start engine and run until operating temperature is reached.

(23) Adjust transmission linkage, if necessary.

CYLINDER HEAD COVER

REMOVAL

(1) Remove ignition coil pack (Fig. 20).

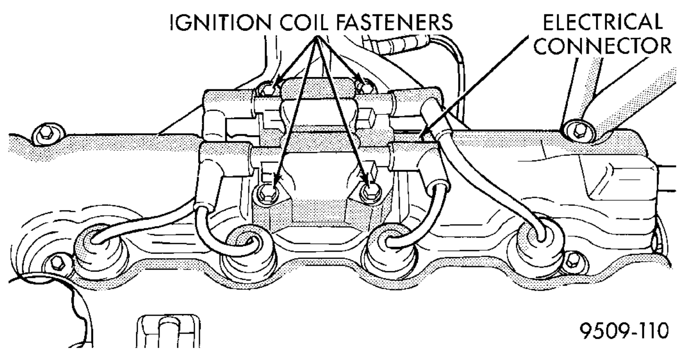


Fig. 20 Ignition Coil Pack

(2) Remove the cylinder head cover fasteners (Fig. 21).

(3) Remove cylinder head cover from cylinder head.

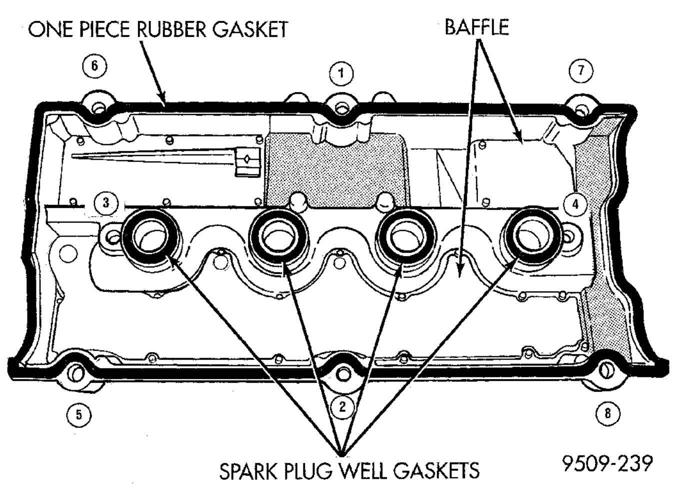


Fig. 21 Cylinder Head Cover and Gasket

REMOVAL AND INSTALLATION (Continued)

COVER INSTALLATION

NOTE: Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

(1) Install new cylinder head cover gaskets.

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(2) Apply Mopar Silicone Rubber Adhesive Sealant at the camshaft cap corners and at the top edges of the 1/2 round seal.

(3) Install cylinder head cover assembly to head and tighten fasteners in sequence shown in (Fig. 21). Using the 3 step torque method:

- Step 1 Tighten all fasteners to 4.5 N·m (40 in. lbs.)
- Step 2 Tighten all fasteners to 9.0 N·m (80 in. lbs.)
- Step 3 Tighten all fasteners to 12 N·m (105 in. lbs.)

(4) Install ignition coil pack. Tighten fasteners to 12 N·m (105 in. lbs.).

CAMSHAFT

REMOVAL

(1) Remove valve cover using procedure outlined in this section.

(2) Remove timing belt, sprockets and covers. Refer to Timing Belt Service outlined in this section.

(3) Bearing caps are identified for location. Remove the outside bearing caps first (Fig. 22).

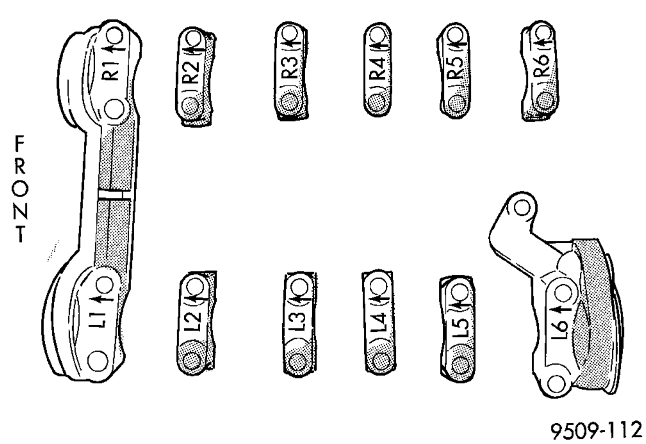


Fig. 22 Camshaft Bearing Cap Identification

(4) Loosen the camshaft bearing cap attaching fasteners in sequence shown in (Fig. 23) one camshaft at a time.

CAUTION: Camshafts are not interchangeable. The intake cam number 6 thrust bearing face spacing is wider.

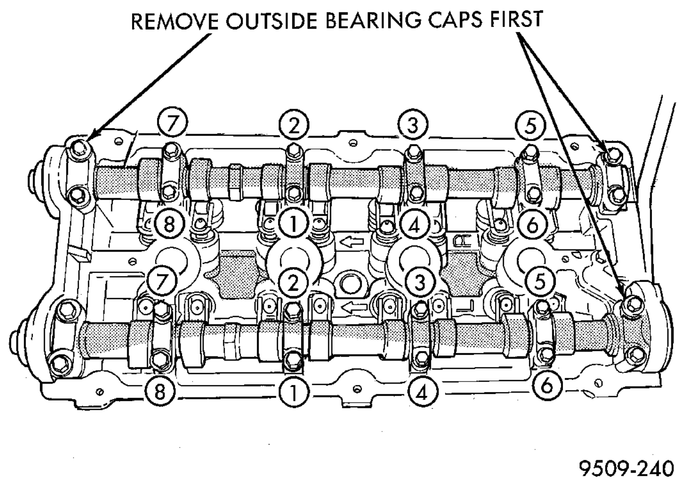


Fig. 23 Camshaft Bearing Cap— Removal

(5) Identify the camshafts before removing from the head. The camshafts are not interchangeable.

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft **WITHOUT** cam follower assemblies. Install rear cam caps and tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 24).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.05– 0.15 mm (0.002– 0.06 in.).

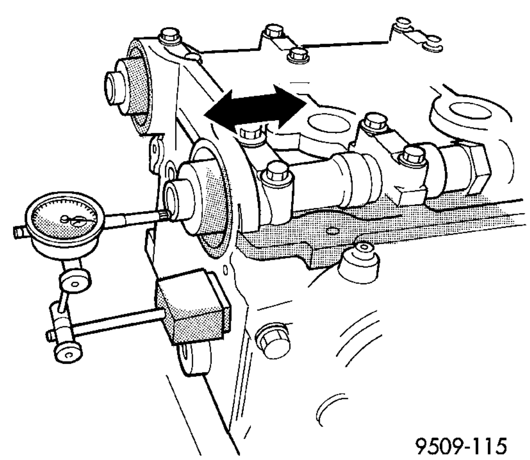


Fig. 24 Camshaft End Play

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

NOTE: Check camshaft for binding in cylinder head. Inspect camshaft bearing journals for damage. If camshafts are binding, also check the cylinder head bearing surface for damage, and check the camshaft bearing oil feed holes in the cylinder head for clogging.

Check the cam surface for abnormal wear and damage, replace if defective. A visible worn groove in the roller follower or on the cam lobes is cause for replacement.

CAUTION: Ensure that NONE of the pistons are at top dead center when installing the camshafts.

(1) Lubricate bearing journals and cam followers with clean oil and install the camshafts. Install right and left camshaft bearing caps #2 thru #5 and right #6. Tighten M6 fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 25).

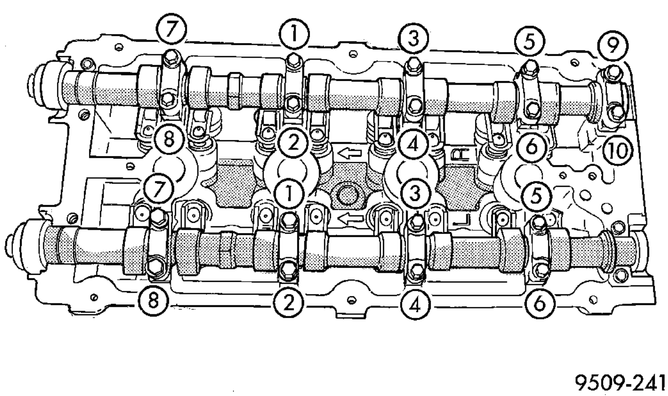


Fig. 25 Camshaft Bearing Cap—Tightening Sequence

(2) Apply Mopar Gasket Maker to No. 1 and No. 6 bearing caps (Fig. 26). Install bearing caps and tighten M8 fasteners to 24 N·m (215 in. lbs.).

(3) Bearing cap number 1, must be installed before the camshaft seals can be installed.

(4) Install timing belt, sprockets and covers. Refer to timing belt service outlined in this section.

(5) Install valve cover using procedure outlined in this section.

CAM FOLLOWER AND HYDRAULIC LASH ADJUSTER ASSEMBLY

REMOVAL

(1) Remove valve cover using procedure outlined in this section.

(2) Remove timing belt, sprockets and covers using procedure outlined in this section.

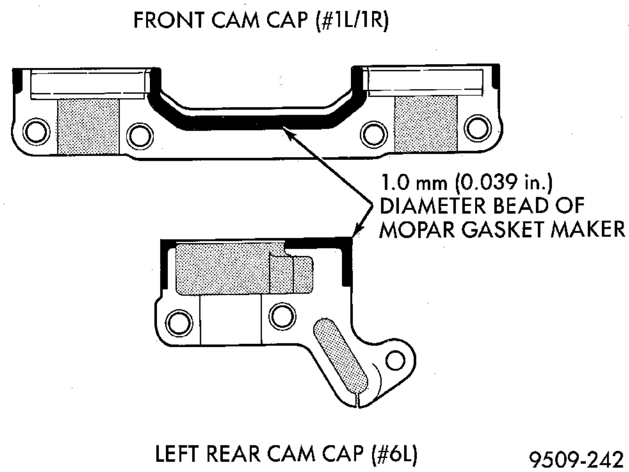


Fig. 26 Camshaft Bearing Cap Sealing

(3) Remove camshaft. Refer to procedure previously outline this section.

(4) Remove cam follower assemblies from cylinder head. Keep the cam followers in the order they have been removed from the head for reassembly.Mark hydraulic lash adjusters for reassembly in their original position. Lash adjusters are serviced as a assembly.

NOTE: Inspect the cam follower assembly for wear or damage (Fig. 27). Replace as necessary.

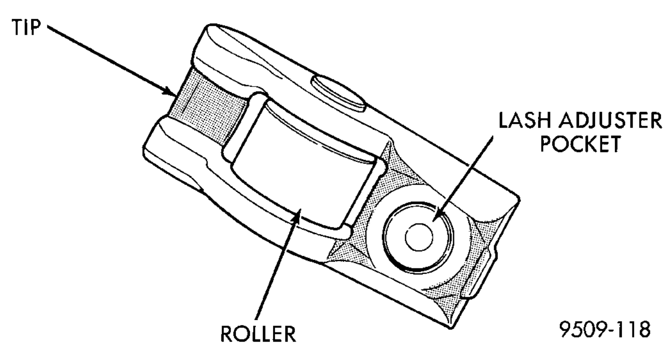


Fig. 27 Cam Follower Assembly

INSTALLATION

(1) Install hydraulic lash adjuster assembly making sure that adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is Lubricate with clean oil and install cam follower assemblies in their original position on the hydraulic adjuster and valve stem (Fig. 28).

(2) Install the camshafts. Refer to procedure previously outlined in this section.

HYDRAULIC LASH ADJUSTER NOISE

A tappet like noise may be produced from several items. Refer to Lash Adjuster Noise Diagnosis in Standard Service Procedures, outlined in this Group.

REMOVAL AND INSTALLATION (Continued)

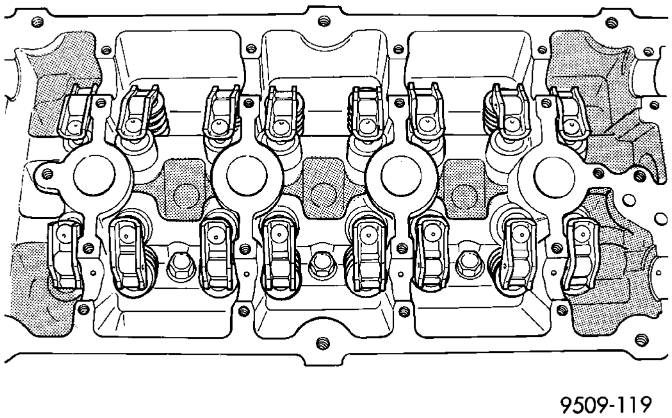


Fig. 28 Cam Follower Assemblies—Installation

Hydraulic Lash adjusters are replaced as an assembly and are not repaired.

VALVE SPRING AND SEALS—CYLINDER HEAD NOT REMOVED

REMOVAL

(1) Remove camshafts as previously outlined in this section.

(2) Rotate crankshaft until piston is at TDC on compression.

(3) With air hose attached to adapter tool installed in spark plug hole, apply 90 - 120 psi air pressure.

(4) Using Special Tool MD998772A with adapter 6779 (Fig. 29) compress valve springs and remove valve locks.

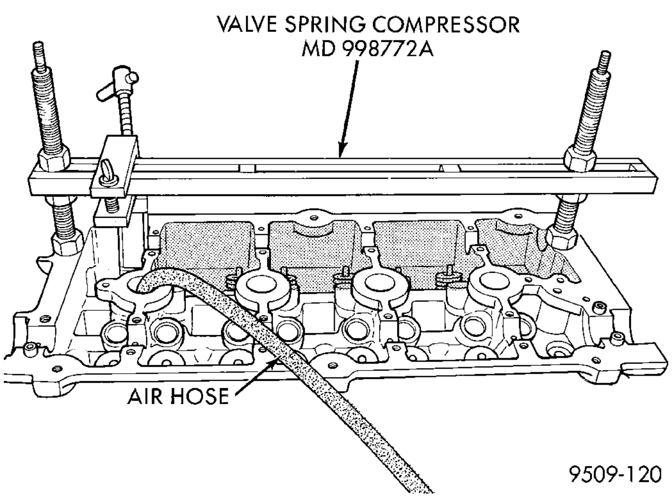


Fig. 29 Removing and Installing Valve Spring

(5) Remove valve spring.

(6) Remove valve stem seal by using a valve stem seal tool (Fig. 30).

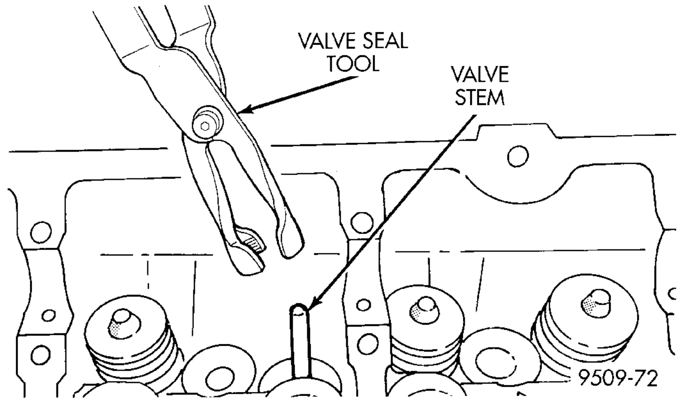


Fig. 30 Valve Stem Oil Seal Tool

INSTALLATION

(1) Install valve seal/valve spring seat assembly (Fig. 31) as outlined in the valve installation procedure in this section.

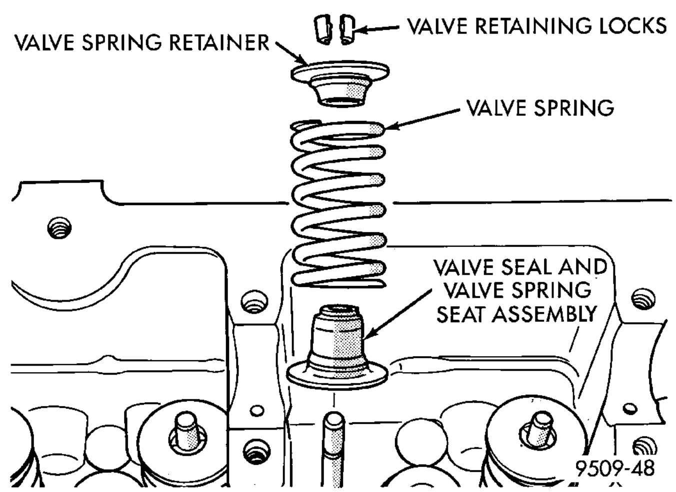


Fig. 31 Valve Stem Seal and Valve Spring Seat Assemblies

(2) Install valve spring and retainer. Using Special Tool MD998772A 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) Remove air hose and install spark plugs.

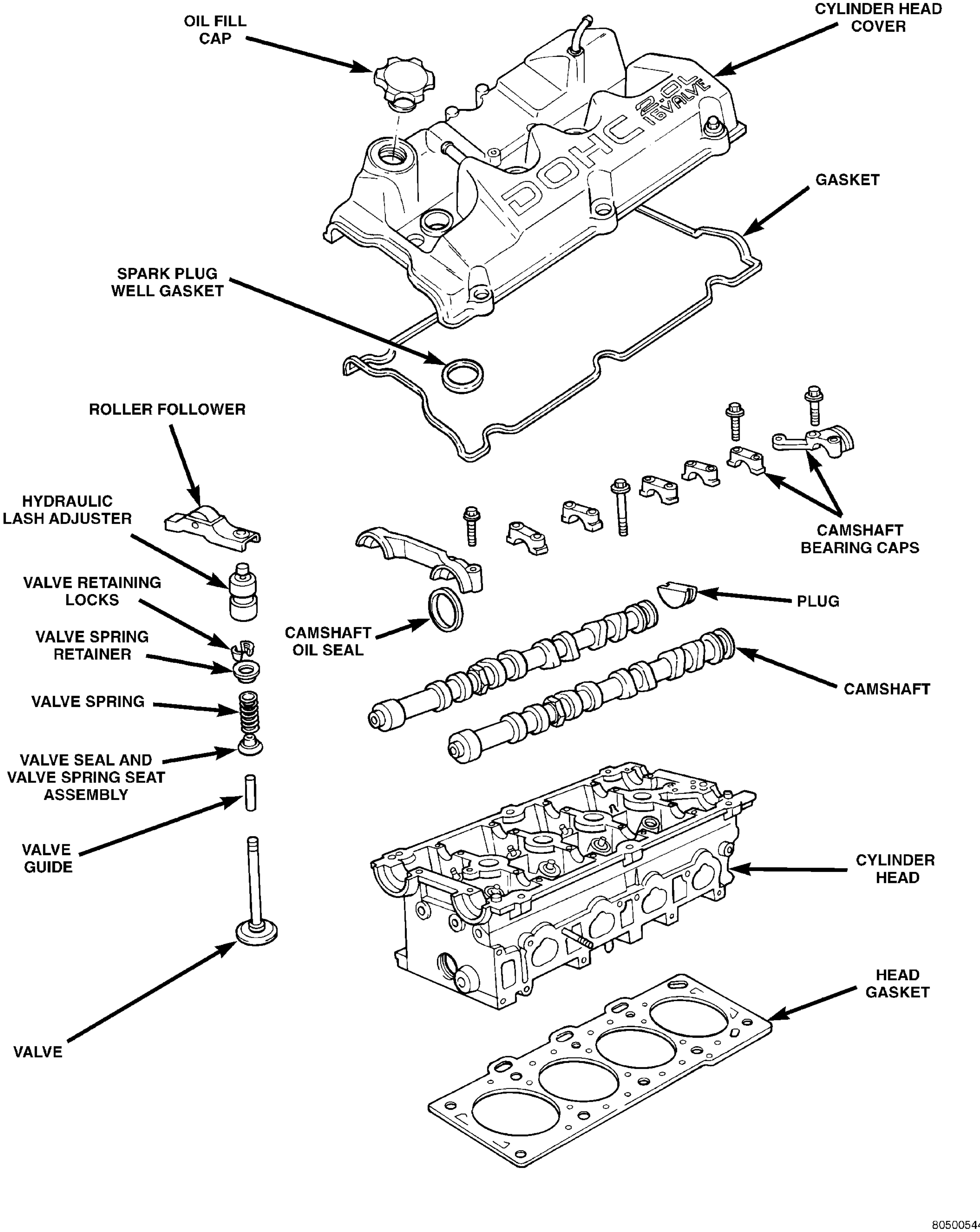
(4) Install camshafts as previously outlined in this section.

(5) Install valve cover as previously outlined in this section.

CYLINDER HEAD

Cylinder Head and Valve Assembly

REMOVAL AND INSTALLATION (Continued)



REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System.

(2) Disconnect negative battery cable. Drain cooling system. Refer to Group 7, Cooling System.

(3) Remove air cleaner duct and air cleaner, disconnect all vacuum lines, electrical wiring and fuel line from fuel rail and throttle body.

(4) Remove throttle linkage.

(5) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(6) Remove power brake vacuum hose from intake manifold.

(7) Raise vehicle and remove exhaust pipe from manifold.

(8) Remove power steering pump assembly and set aside.

(9) Disconnect coil pack wiring connector and remove coil pack from engine.

(10) Remove cam sensor and fuel injectors wiring connectors.

(11) Remove timing belt and camshaft sprocket. Refer to procedure outlined in this section.

(12) Remove cylinder head cover.

(13) Remove camshaft and cam follower assemblies. Refer to Camshaft Service for removal procedure outlined in this section.

(14) Remove cylinder head bolts.

NOTE: Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

CYLINDER HEAD FLATNESS

(1) Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 32).

NOTE: Inspect camshaft bearing journals for scoring.

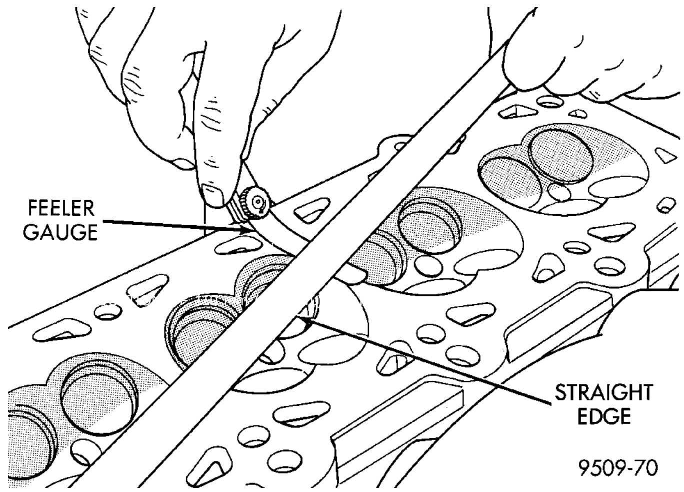


Fig. 32 Checking Cylinder Head Flatness

INSTALLATION

(1) Before installing the bolts the threads should be oiled with engine oil. The 4 short bolts 110 mm (4.330 in.) are to be installed in positions 7, 8, 9, and 10 (Fig. 33).

(2) Tighten the cylinder head bolts in this sequence shown in (Fig. 33). Follow the four step procedure listed below.

- First Bolts 1 thru 6 to 34 N·m (25 ft. lbs.) and Bolts 7 thru 10 to 28 N·m (20 ft. lbs.)
- Second Bolts 1 thru 6 to 68 N·m (50 ft. lbs.) and Bolts 7 thru 10 to 28 N·m (20 ft. lbs.)
- Third Bolts 1 thru 6 to 68 N·m (50 ft. lbs.) and Bolts 7 thru 10 to 28 N·m (20 ft. lbs.)
- Fourth Turn an additional 1/4 Turn, **Do not use a torque wrench for this step.**

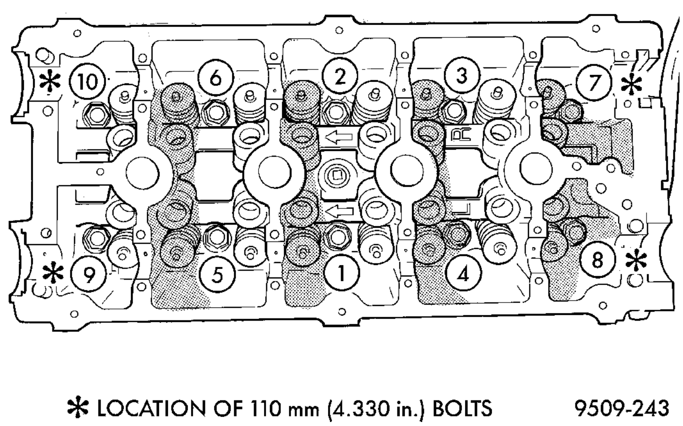


Fig. 33 Cylinder Head Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

(3) Reverse removal procedure, for rest of installation.

VIBRATION DAMPER

NOTE: If a gap is found in the crankshaft damper, in the area where the Poly-V Generator belt rides this is normal and is acceptable (Fig. 85).

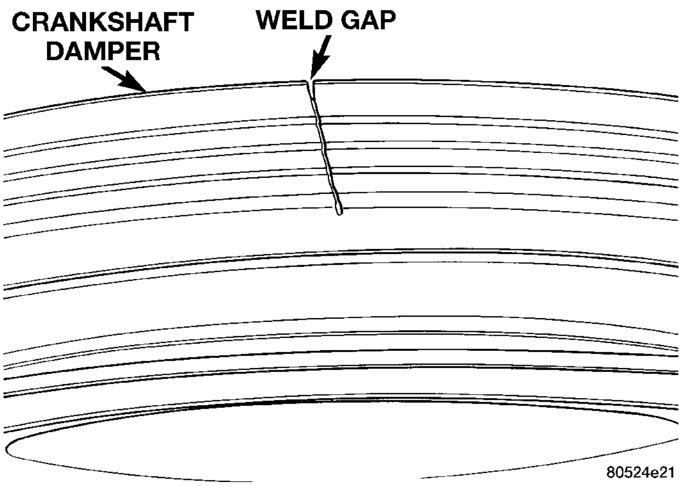


Fig. 34 Weld Gap

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 86).

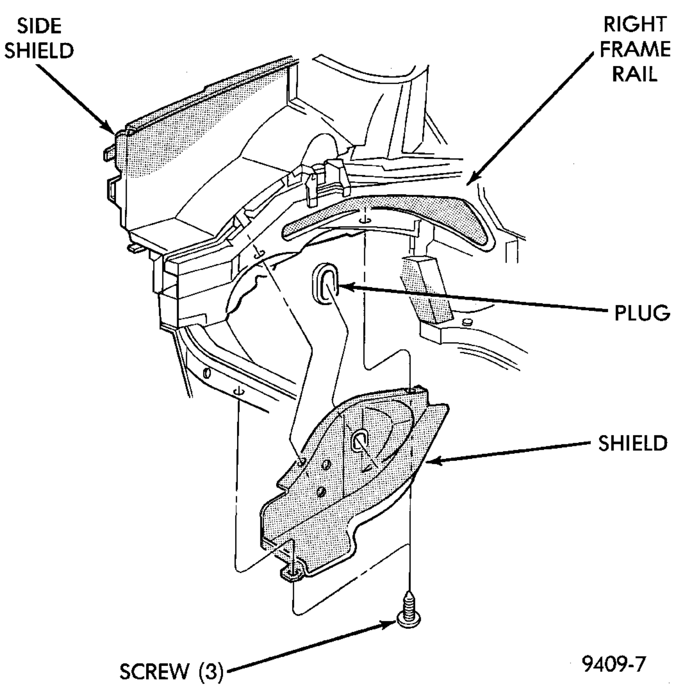


Fig. 35 Right Inner Splash Shield

(3) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827–A (Fig. 87).

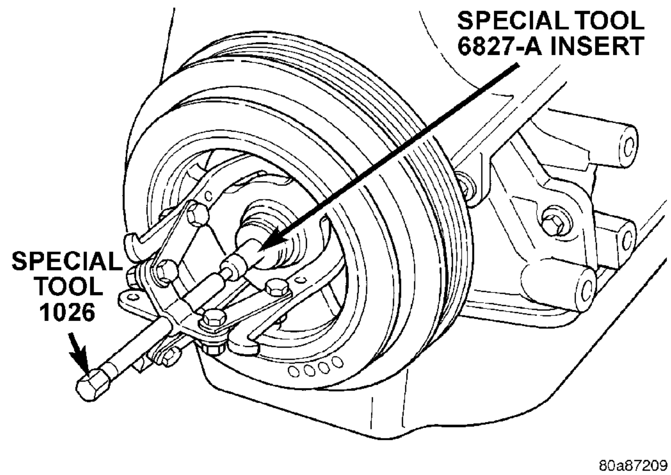


Fig. 36 Crankshaft Damper—Removal

INSTALLATION

(1) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 88).

(2) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(3) Raise vehicle on hoist and install right inner splash shield.

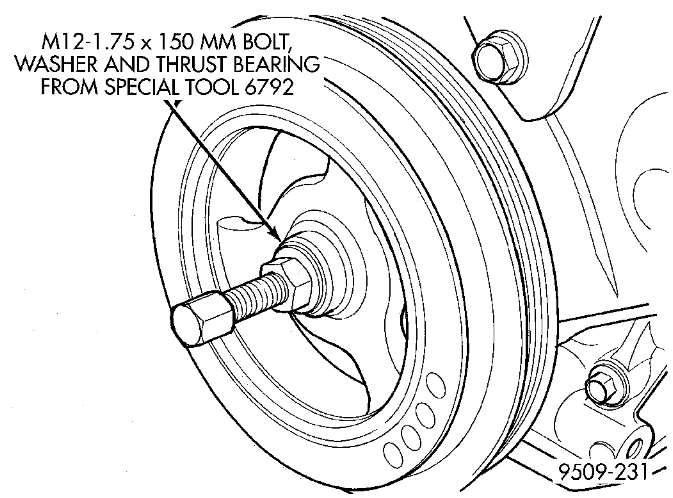


Fig. 37 Crankshaft Damper—Installation

REMOVAL AND INSTALLATION (Continued)

TIMING BELT COVER

REMOVAL

CAUTION: Camshaft or crankshaft should not be rotated after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 38).

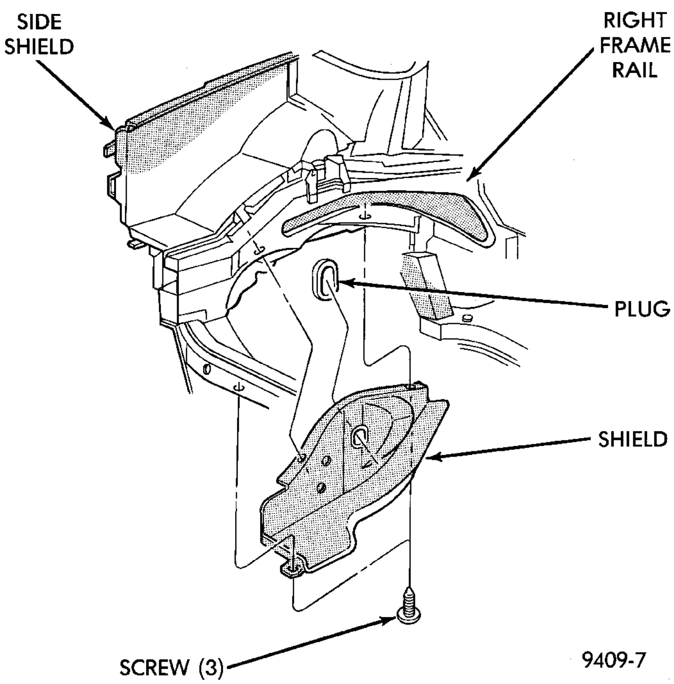


Fig. 38 Right Inner Splash Shield

(3) Remove crankshaft damper bolt. Remove damper using Special Tool 1026 and Insert 6827–A or equivalent (Fig. 39).

(4) Lower vehicle and place a jack under engine

(5) Remove right engine mount. Refer to procedure outlined in this section

(6) Remove right engine mount bracket (Fig. 40)

(7) Remove timing belt cover fasteners, remove cover (Fig. 40).

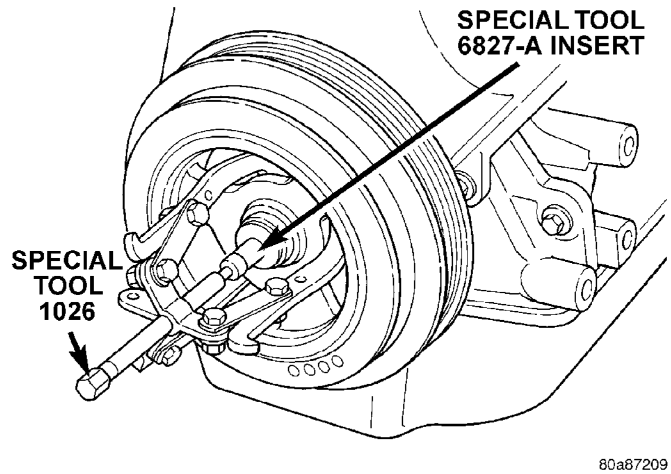


Fig. 39 Crankshaft Damper—Removal

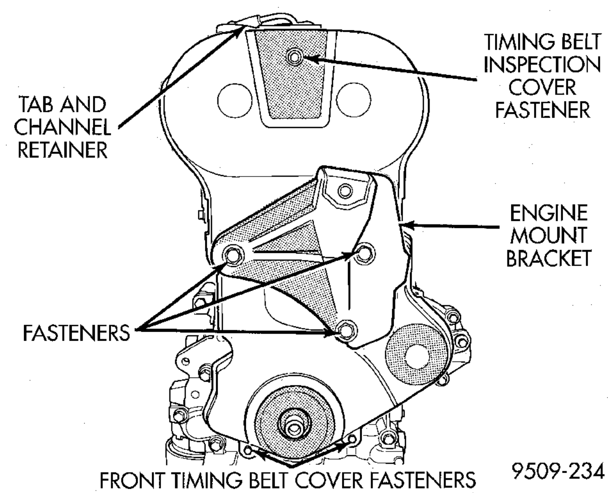


Fig. 40 Front Timing Belt Cover

INSTALLATION

(1) Install front timing cover.

(2) Install engine mount bracket.

(3) Install Right engine mount. Refer to procedure outlined in this section for installation.

(4) Remove jack from under engine.

(5) Install crankshaft vibration damper Refer to procedure outlined in this section for installation.

(6) Install accessory drive belts. Refer to Group 7, Cooling System, Accessory Drive section for procedure.

(7) Raise vehicle on hoist and install right inner splash shield.

REMOVAL AND INSTALLATION (Continued)

TIMING BELT

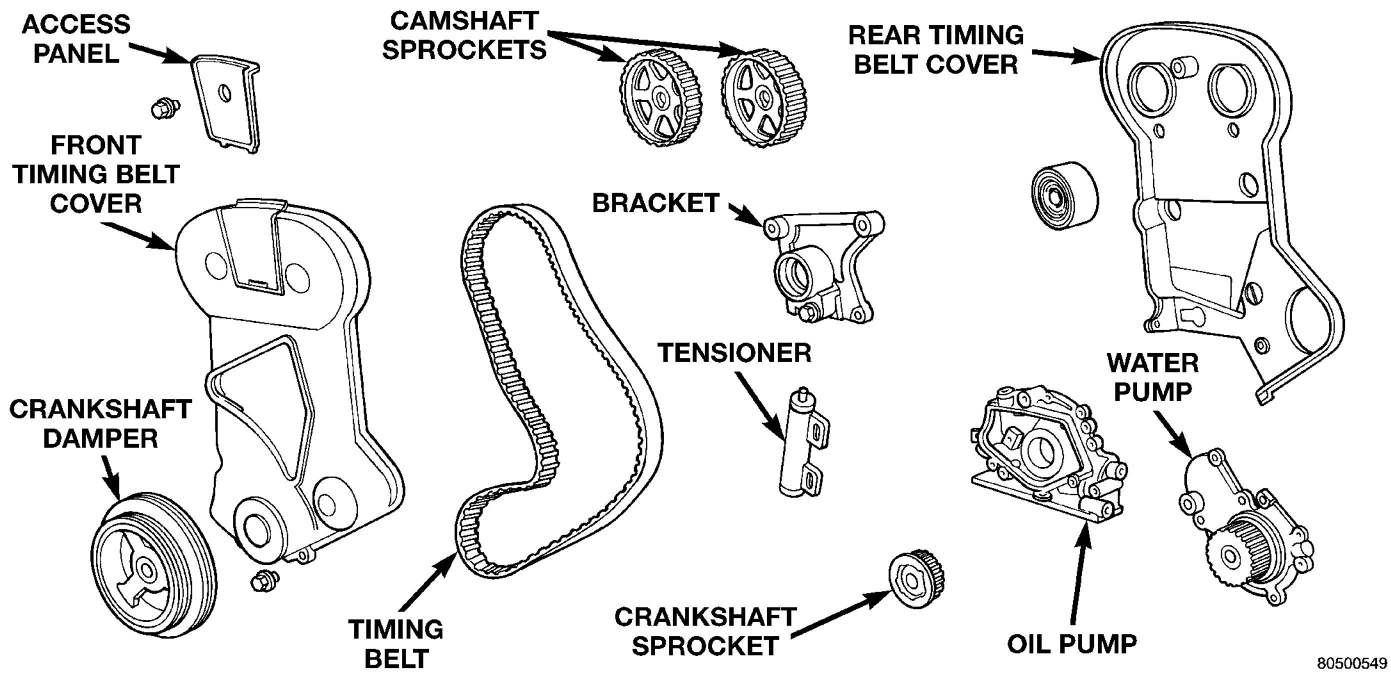


Fig. 41 Typical Timing Belt System—DOHC

CHECKING BELT TIMING —COVER INSTALLED

(1) Remove number one spark plug.

(2) Using a dial indicator, set number one cylinder to TDC on the compression stroke.

(3) Remove the timing belt access cover from the engine (Fig. 41).

(4) Check the timing marks on the camshaft sprockets, they should align with each other (Fig. 42).

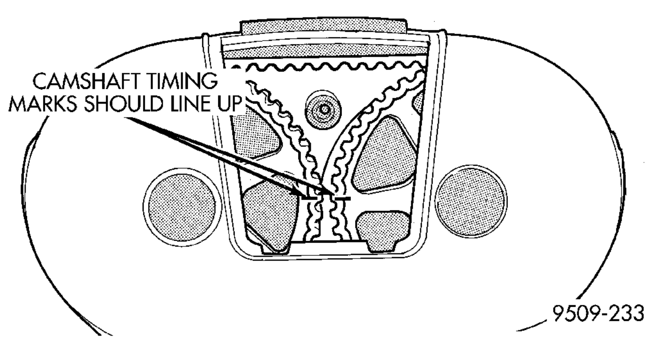


Fig. 42 Camshaft Timing Check

REMOVAL

CAUTION: Camshaft or crankshaft should not be rotate after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

(1) Remove crankshaft damper bolt. Remove damper procedure outlined in this section.

(2) Remove engine mount bracket and timing belt cover fasteners, remove cover.

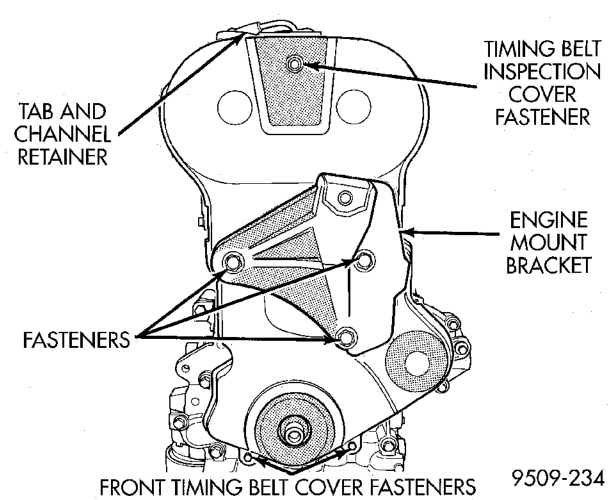


Fig. 43 Front Timing Belt Cover

REMOVAL AND INSTALLATION (Continued)

(3) Align camshaft timing marks. Loosen timing belt tensioner fasteners and remove timing belt.

CAUTION: Do not loosen, tighten, or remove the tensioner pivot bolt (Fig. 44).

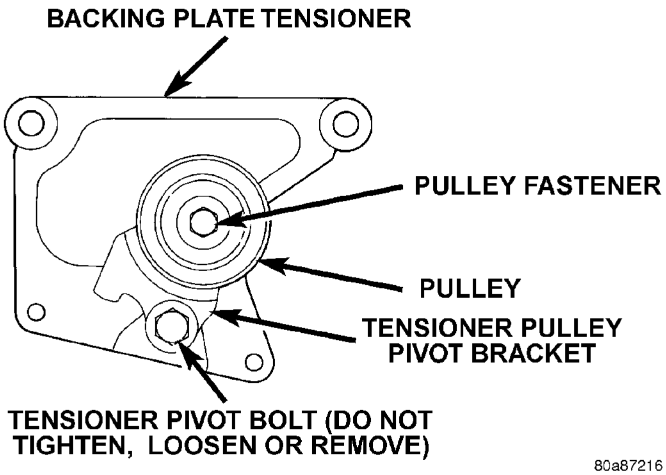


Fig. 44 Tensioner Pulley Assembly

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE AND BELT INSTALLATION —DOHC ENGINE

(1) When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

(2) Place the tensioner into a vise and slowly compress the plunger (Fig. 45).

CAUTION: Index the tensioner in the vise the same way it is installed on the engine. This is to ensure proper pin orientation when tensioner is installed on the engine.

(3) When plunger is compressed into the tensioner body install a pin through the body and plunger to retain plunger in place until tensioner is installed.

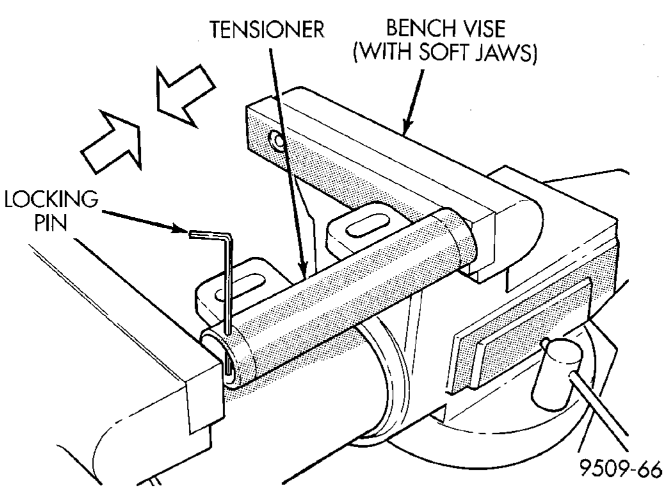


Fig. 45 Compressing Timing Belt Tensioner

(4) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 46).

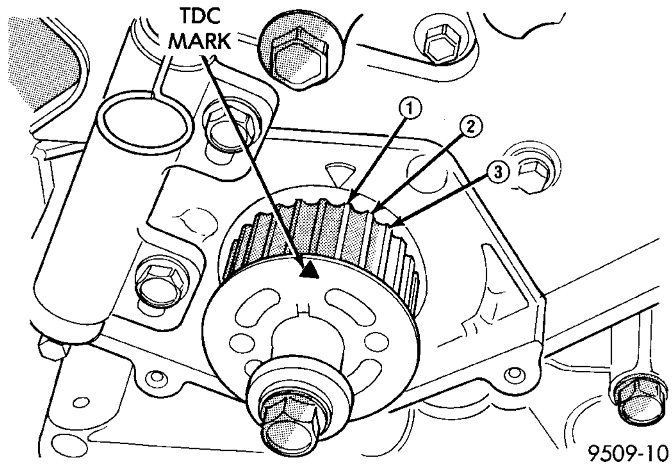


Fig. 46 Crankshaft Sprocket Timing

(5) Set camshafts timing marks together by aligning notches on sprockets (Fig. 47).

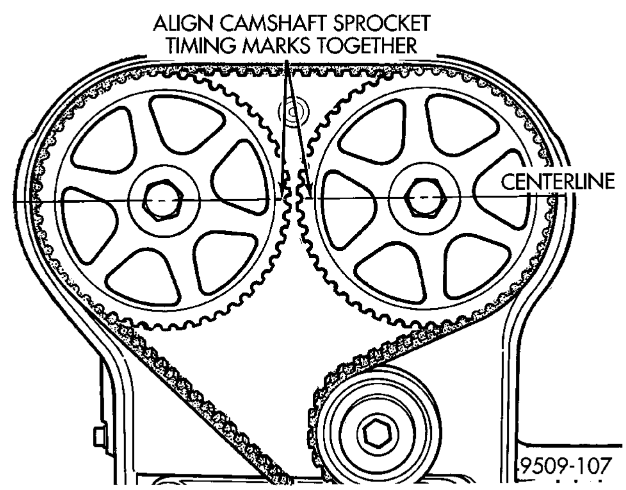


Fig. 47 Camshaft Timing Marks

(6) Rotate crankshaft 1/2 tooth counterclockwise from TDC (Fig. 48).

(7) Install timing belt in this direction. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner pulley (Fig. 49).

(8) Move crankshaft sprocket to TDC to take up belt slack. Install tensioner to block but do not tighten fasteners.

(9) Using a torque wrench on the tensioner pulley apply 28 N·m (250 in. lbs.) of torque to tensioner (Fig. 49).

(10) With torque being applied to the tensioner pulley move the tensioner up against the tensioner pulley bracket and tighten fasteners to 31 N·m (275 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

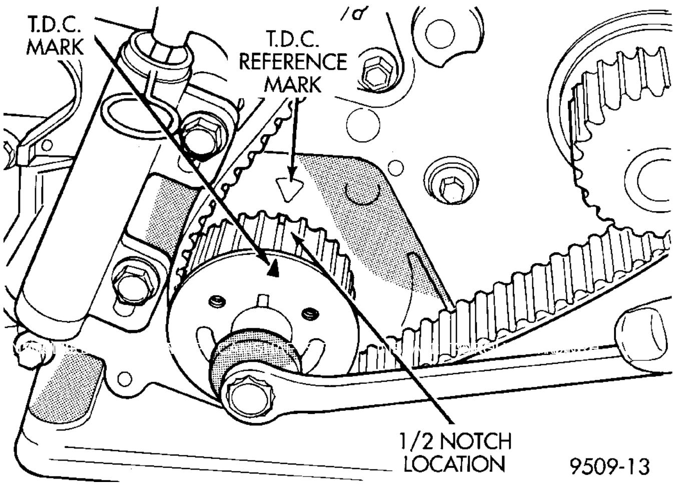


Fig. 48 Adjusting Crankshaft Sprocket for Timing Belt Installation

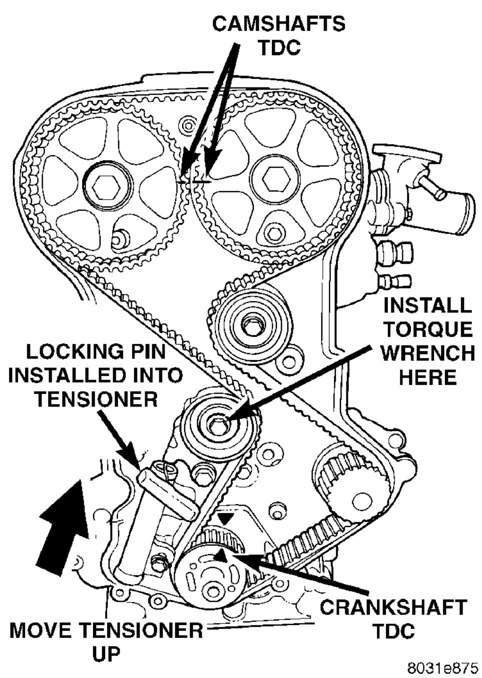


Fig. 49 Adjusting Timing Belt Tension

(11) Pull tensioner plunger pin. Pretension is correct when pin can be removed and installed freely.

(12) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 49).

(13) Install front half of timing cover.

(14) Install engine mount bracket.

(15) Install right engine mount. Refer to procedure outlined in this section.

(16) Remove jack from under engine.

(17) Install crankshaft damper using M12 1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 50).

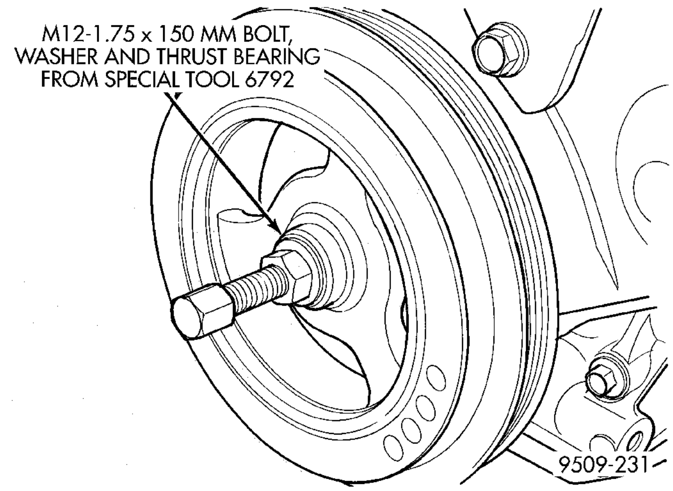


Fig. 50 Crankshaft Damper—Installation

(18) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(19) Raise vehicle on hoist and install right inner splash shield.

(20) Perform camshaft and crankshaft timing relearn. Refer to Group 25, Emission Control Systems for procedure.

OIL PAN

REMOVAL

(1) Drain engine oil.

(2) Remove transmission bending bracket. Refer to Engine Support Module Removal and Installation in this section.

(3) Remove front engine mount and bracket. Refer to Engine Support Module Removal and Installation in this section.

(4) Remove transmission inspection cover.

(5) If equipped with air conditioning remove oil filter and adaptor. Refer to Oil Filter Adapter Removal and Installation in this section.

(6) Remove oil pan.

(7) Clean oil pan and all gasket surfaces.

INSTALLATION

(1) Apply Mopar Silicone Rubber Adhesive Sealant or equivalent at the oil pump to engine block parting line (Fig. 55).

(2) Install a new oil pan gasket to pan.

(3) Install pan and tighten screws to 12 N·m (105 in. lbs.).

(4) Install oil filter and adaptor.

(5) Install transmission inspection cover.

(6) install front engine mount and bracket.

(7) Install transmission bending bracket.

REMOVAL AND INSTALLATION (Continued)

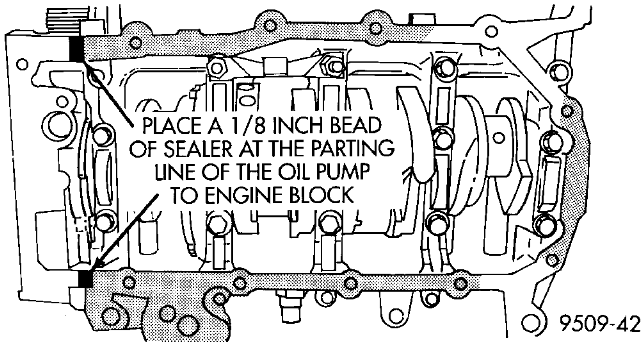


Fig. 51 Oil Pan Sealing

(8) Install proper amount of oil. With oil filter 4.25 Liters (4.5 Qts.). Without oil filter 3.8 Liters (4.0 Qts.)

CAMSHAFT OIL SEALS

REMOVAL

(1) Remove front timing belt cover and timing belt. Refer to procedure outlined in this section.

CAUTION: Before removing timing belt set crankshaft sprocket 3 notches before TDC, this will prevent possible engine damage (Fig. 52).

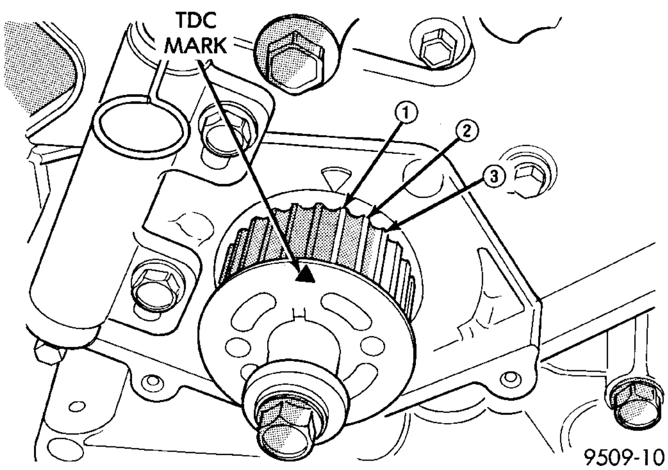


Fig. 52 Crankshaft Sprocket 3 Notches Before TDC

(2) Hold camshaft sprocket with Special Tool C-4687 with adaptor C4687–1 while removing / installing bolts (Fig. 53).

(3) Remove camshaft seal using a pry bar. Be careful not to nick or damage the camshaft seal surface or cylinder head seal retaining bore (Fig. 54).

CAUTION: Do not nick shaft seal surface or seal bore.

(4) Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

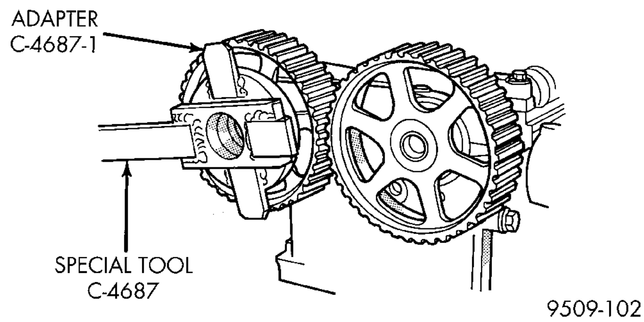


Fig. 53 Removing / Installing Camshaft Sprocket Bolt

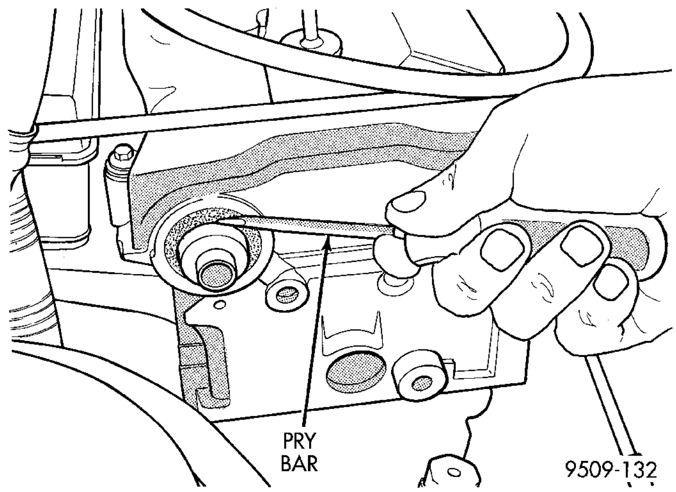


Fig. 54 Removing Camshaft Oil Seals

INSTALLATION

(1) Install camshaft seal into cylinder head using Special Tool MD 998713 until flush with the head (Fig. 55).

(2) Install camshaft sprockets and tighten attaching bolts to 101 N·m (75 ft. lbs.).

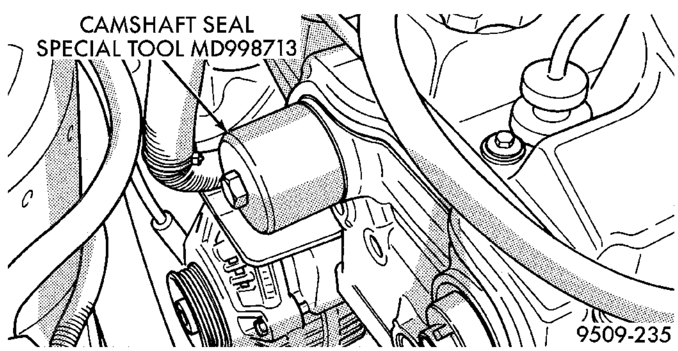


Fig. 55 Installing Camshaft Seals

REMOVAL AND INSTALLATION (Continued)

FRONT CRANKSHAFT OIL SEAL

REMOVAL

(1) Using Special Tool 1026 and Insert 6827–A, remove crankshaft damper (Fig. 56).

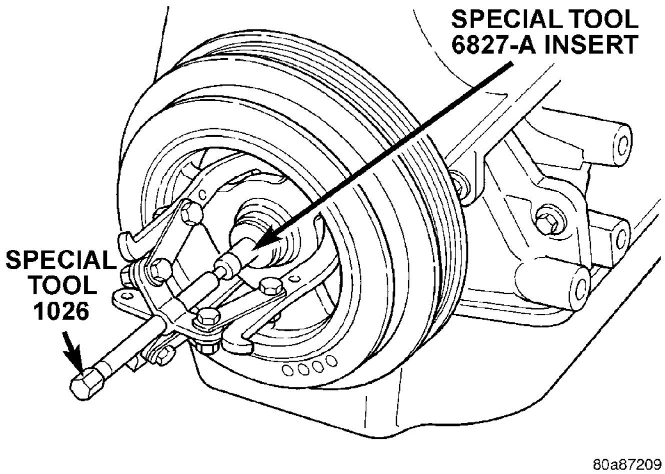


Fig. 56 Crankshaft Damper—Removal

(2) Remove outer timing belt cover and timing belt. Refer to Timing Belt System outlined in this section.

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C- 4685-C2 (Fig. 57).

CAUTION: Do not nick shaft seal surface or seal bore.

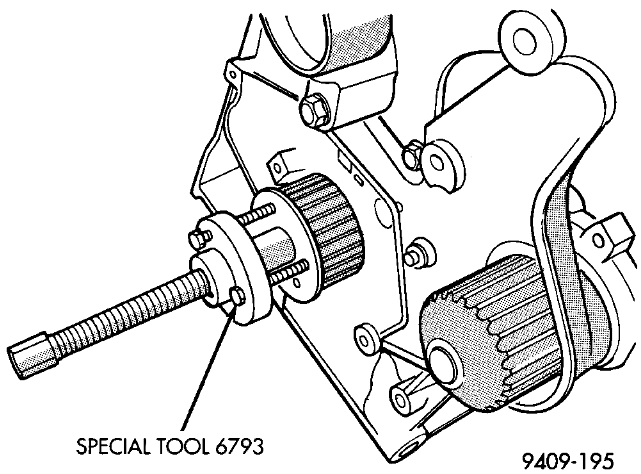


Fig. 57 Crankshaft Sprocket—Removal

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 58). Do not damage the seal contact area on the crankshaft.

INSTALLATION

(1) Install new seal by using Tool 6780–1 (Fig. 59).

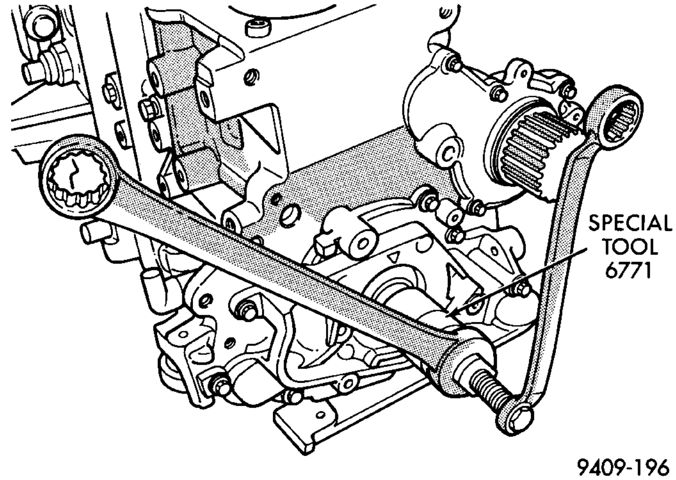


Fig. 58 Front Crankshaft Oil Seal—Removal

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

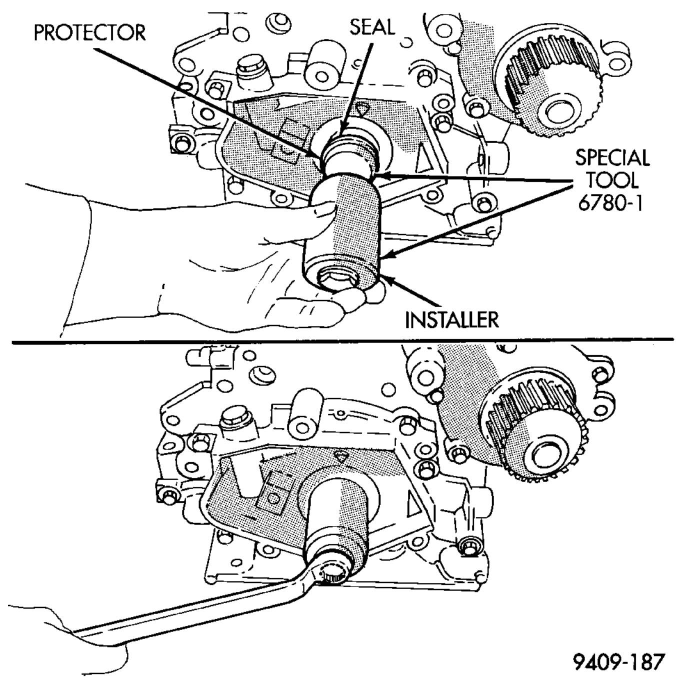


Fig. 59 Front Crankshaft Oil Seal—Installation

(3) Install crankshaft sprocket (Fig. 60). Using Special Tool 6792.

NOTE: Make sure the word "front" on the sprocket is facing you.

(4) Install timing belt and covers. Refer to Timing Belt System in this section for installation.

(5) Install crankshaft damper (Fig. 61). Use thrust bearing/washer and 12M-1.75 x 150 mm bolt from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

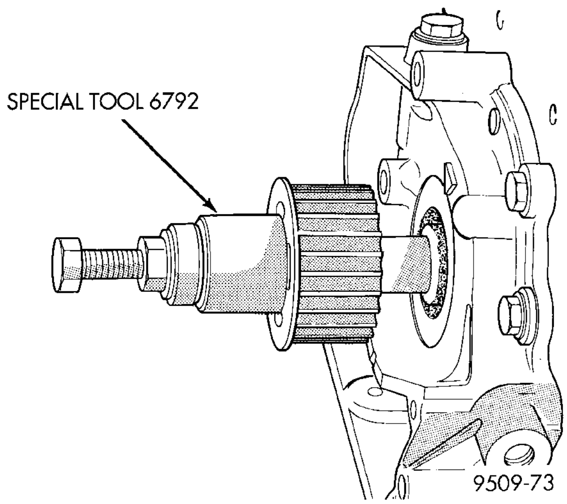


Fig. 60 Crankshaft Sprocket—Installation

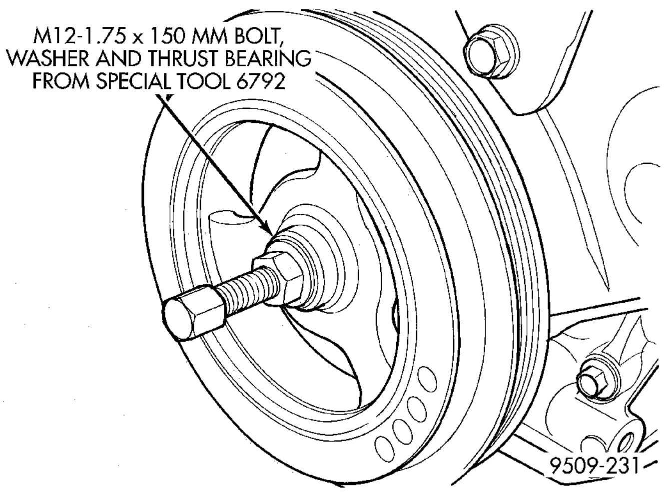


Fig. 61 Crankshaft Damper—Installation

REAR CRANKSHAFT SEAL

REMOVAL

(1) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 62) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.

INSTALLATION

CAUTION: If burr or scratch is present on the crankshaft edge (chamfer), cleanup with 400 grit sand paper to prevent seal damage during installation of new seal.

NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 63).

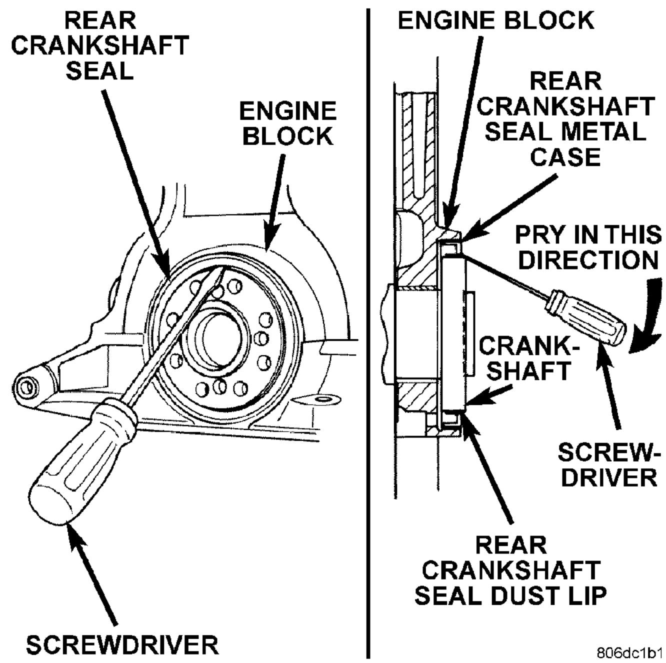


Fig. 62 Rear Crankshaft Oil Seal—Removal

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 63). Pilot tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 64) until the tool bottoms out against the block (Fig. 65).

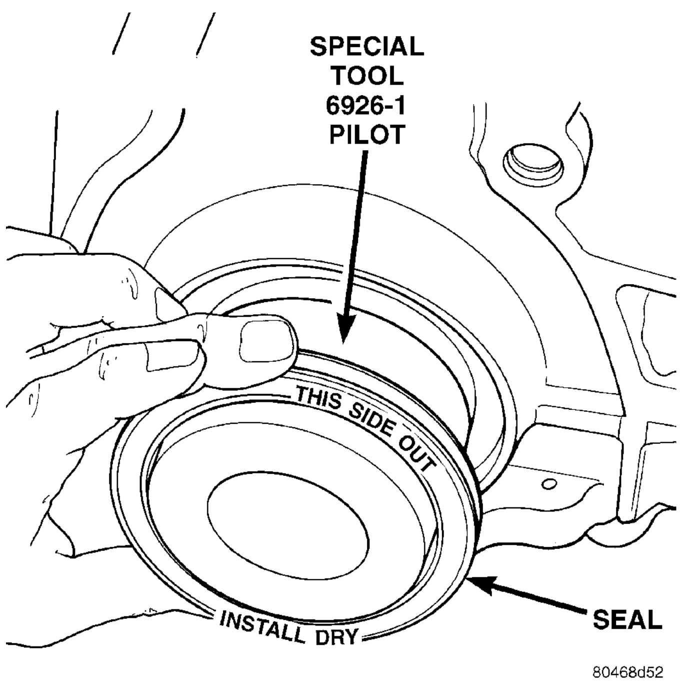


Fig. 63 Rear Crankshaft Seal and Special Tool 6926-1

REMOVAL AND INSTALLATION (Continued)

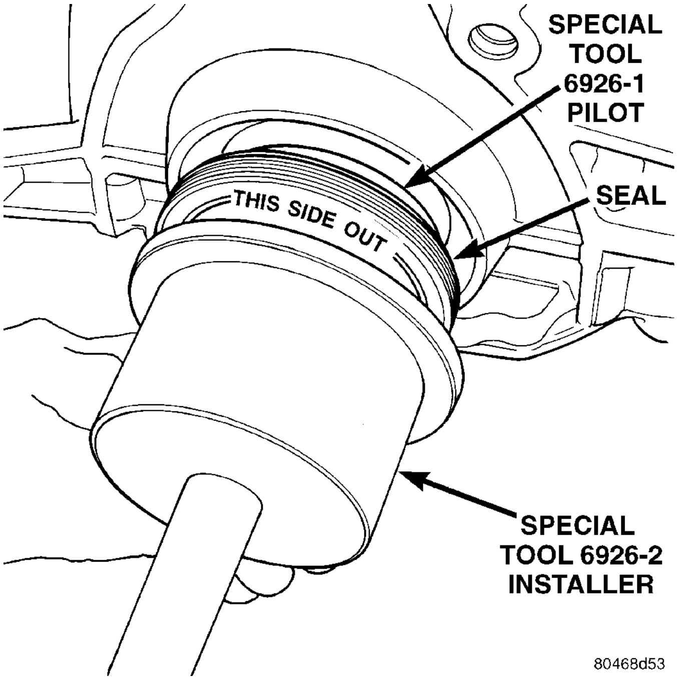


Fig. 64 Crankshaft Seal Special Tool 6926-2

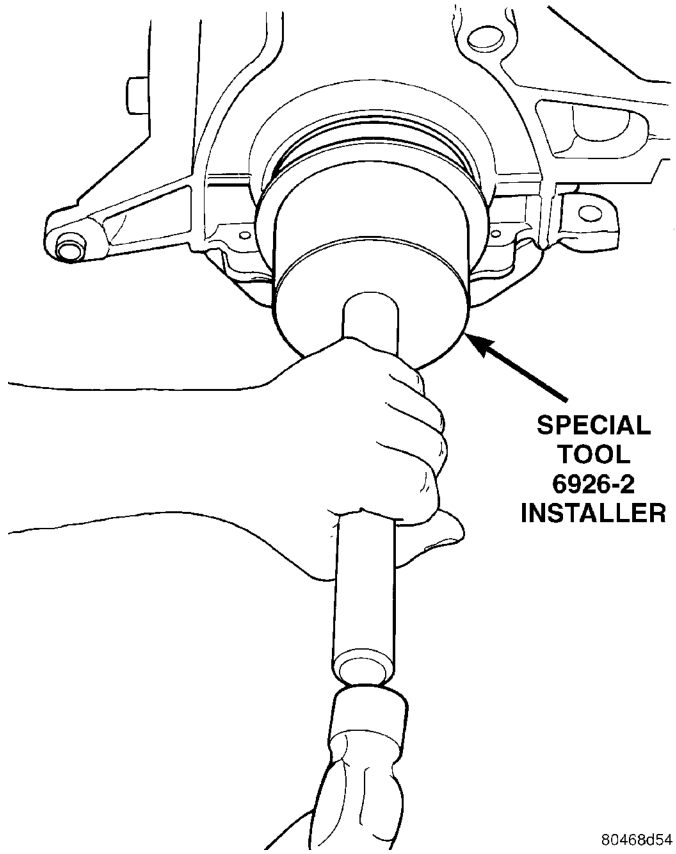
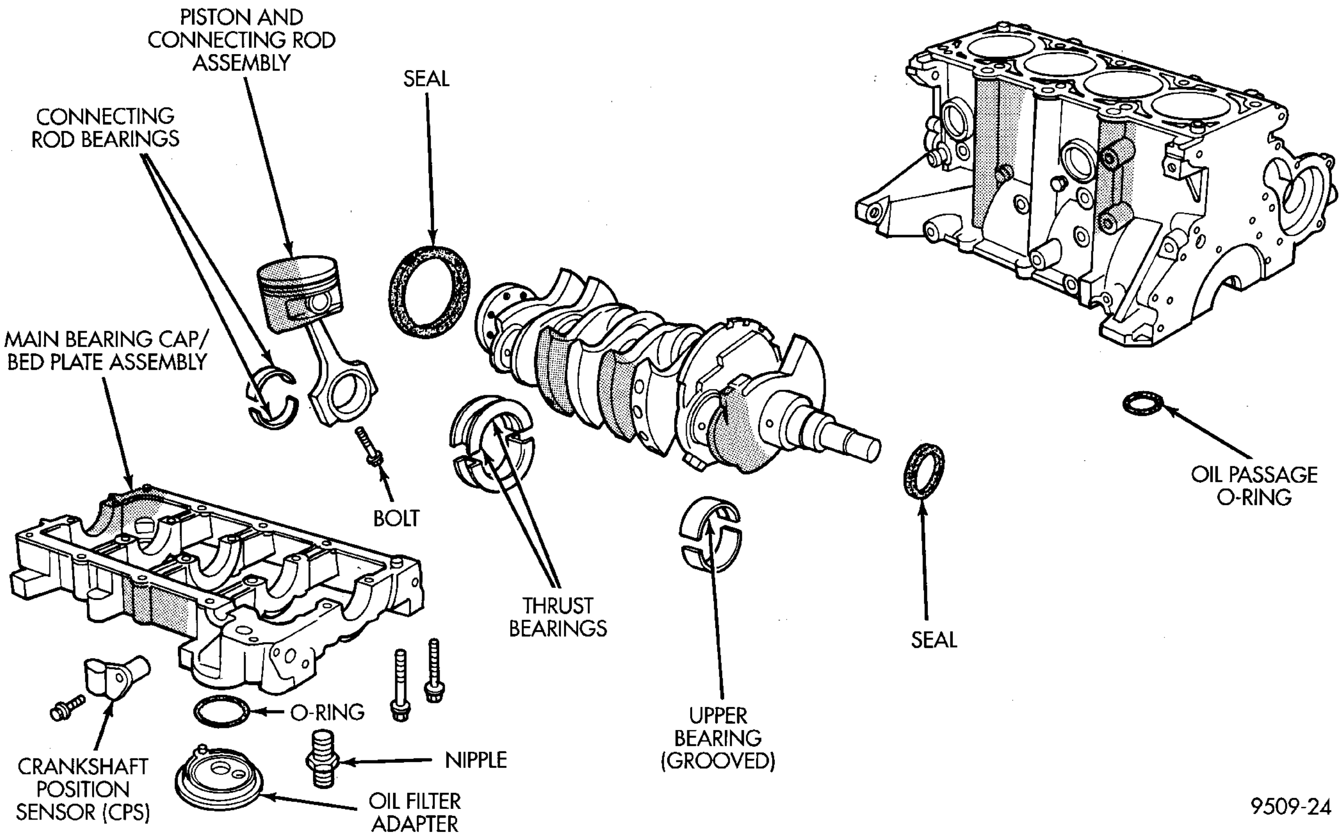


Fig. 65 Rear Crankshaft Seal—Installation

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT



REMOVAL

(1) Remove oil filter and adapter from bedplate.

(2) Remove oil pan.

(3) Remove crankshaft sprocket and oil pump both procedures outlined in this section.

(4) Remove all main bearing cap and bedplate bolts from the engine block (Fig. 66).

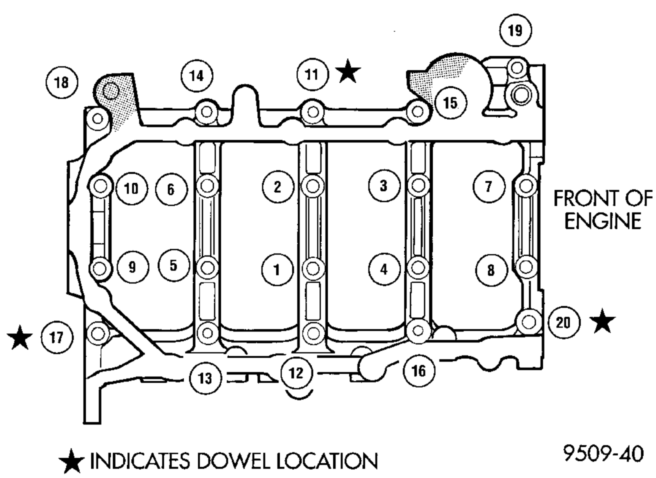


Fig. 66 Bedplate Bolts

(5) Using a mallet tap the bedplate loose from the engine block dowel pins.

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block and bedplate alignment.

(6) Bedplate should be removed evenly from the cylinder block dowel pins.

(7) Lift out crankshaft from cylinder block. Be sure not to damage the main bearings or journals when removing the crankshaft.

CRANKSHAFT MAIN BEARINGS LOCATION

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells installed in the (bedplate) main bearing cap are plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 67).

NOTE: The upper and lower main Bearing shells are Not interchangeable. The lower shells have a revised tab to prevent improper installation.

CRANKSHAFT MAIN JOURNALS INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be

REMOVAL AND INSTALLATION (Continued)

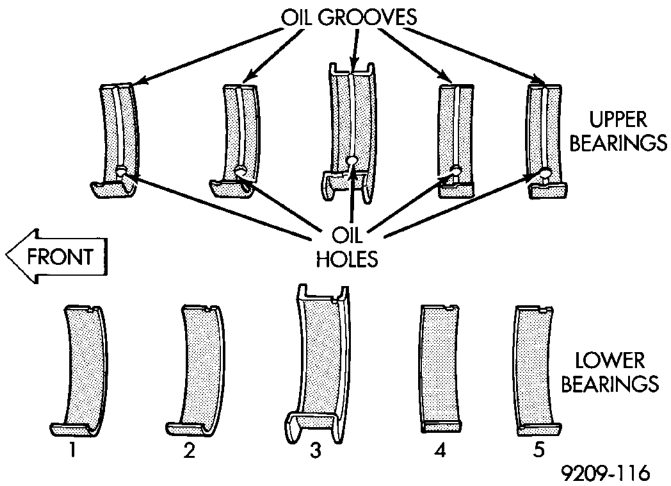


Fig. 67 Main Bearing Identification

held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. DO NOT grind thrust faces of Number 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the nodular cast iron crankshafts used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine (Fig. 67). All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersized: 0.016 mm (.0006 inch), .032 mm (.0012 inch), .250 mm (.010 inch). Never install an undersize bearing that will reduce clearance below specifications.

INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block. Install O-ring into recess in the block (Fig. 68).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

CAUTION: Do Not get oil on the bedplate mating surface. It will affect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals and install crankshaft and O-ring in cylinder block.

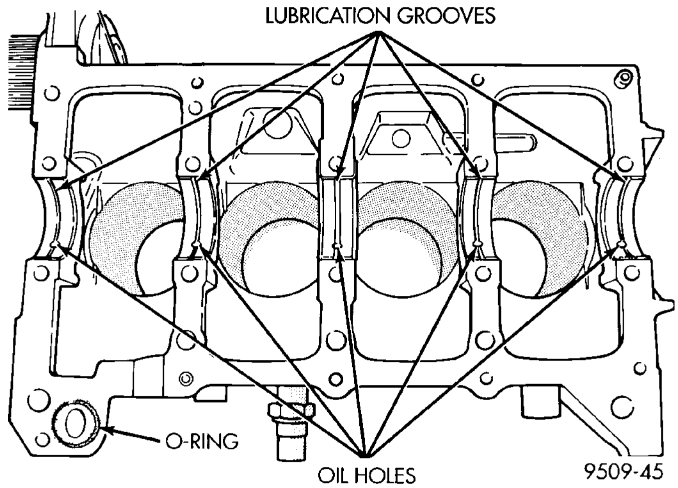


Fig. 68 Installing Main Bearing Upper Shell

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar Torque Cure Gasket Maker to cylinder block as shown in (Fig. 69).

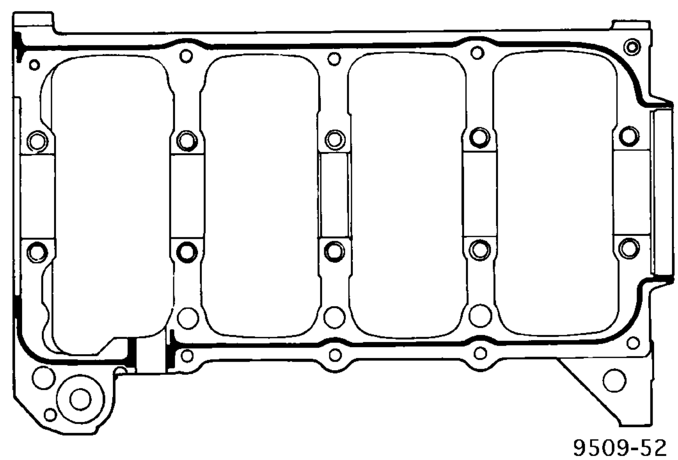


Fig. 69 Main Bearing Caps/Bedplate Sealing

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(6) Before installing the bolts the threads should be oiled with clean engine oil, wipe off any excess oil.

(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten this bolts down together until the bedplate contacts the cylinder block. Torque bolts to 30 N·m (22 ft. lbs.) (Fig. 70).

(8) Install main bearing bedplate to engine block bolts (1 thru 10) and torque each bolt to 81 N·m (60 ft. lbs.) in sequence shown in (Fig. 70).

REMOVAL AND INSTALLATION (Continued)

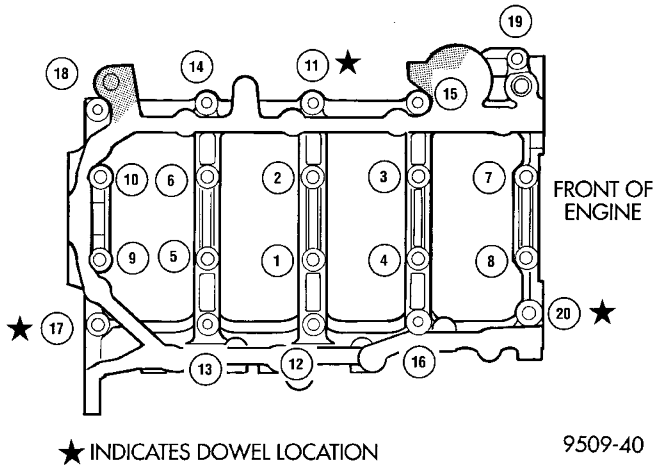


Fig. 70 Main Bearing Caps/Bedplate Torque Sequence

(9) Install main bearing bedplate to engine block bolts (11 thru 20), with baffle studs in positions 12, 13 and 16 and torque each bolt to 30 N·m (22 ft. lbs.) in sequence shown in (Fig. 70).

(10) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

(11) Install oil pump. If crankshaft end play is to be checked refer to service procedures in this section.

(12) Install crankshaft sprocket.

(13) Install oil filter adapter and filter. Refer to procedure outlined in this section.

OIL FILTER ADAPTER

REMOVE AND INSTALL

Ensure O-ring is in the groove on adapter. Align roll pin into engine block and tighten assembly to 80 N·m (60 ft. lbs.) (Fig. 71).

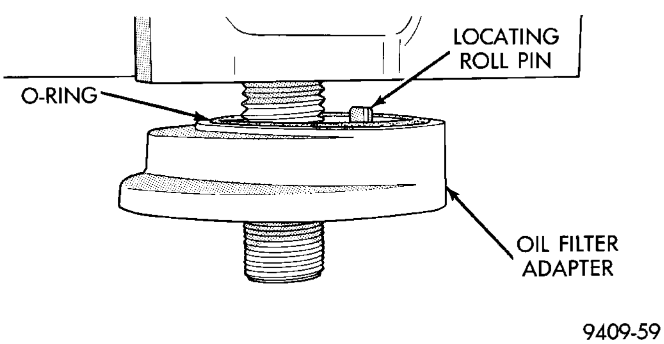


Fig. 71 Engine Oil Filter Adapter to Engine Block

OIL FILTER

REMOVE AND INSTALL

CAUTION: When servicing the oil filter (Fig. 72) avoid deforming the filter, install tool band strap against the seam at the base of the filter. The seam, joining the can to the base is reinforced by the base plate.

(1) Turn counterclockwise to remove.

(2) To install, lubricate new filter gasket. Check filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber. Screw filter on until gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

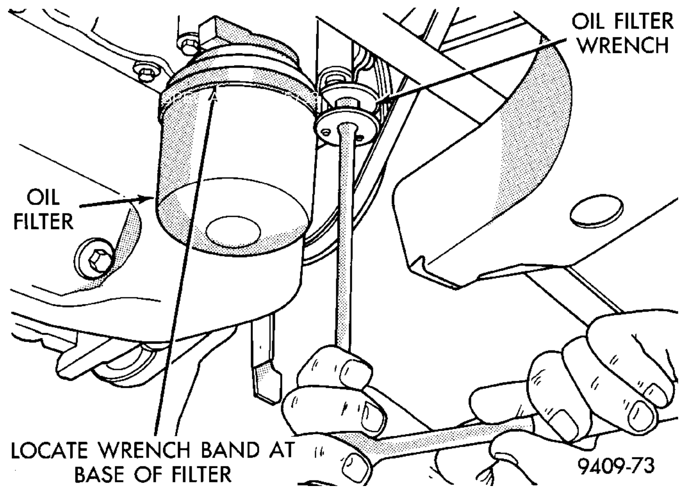


Fig. 72 Engine Oil Filter

OIL PUMP

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove Timing Belt. Refer to Timing Belt System, in this section.

(3) Remove Oil Pan. Refer to Oil Pan Removal in this section.

(4) Remove Crankshaft Sprocket using Special Tool 6793 and insert C4685–C2 (Fig. 73).

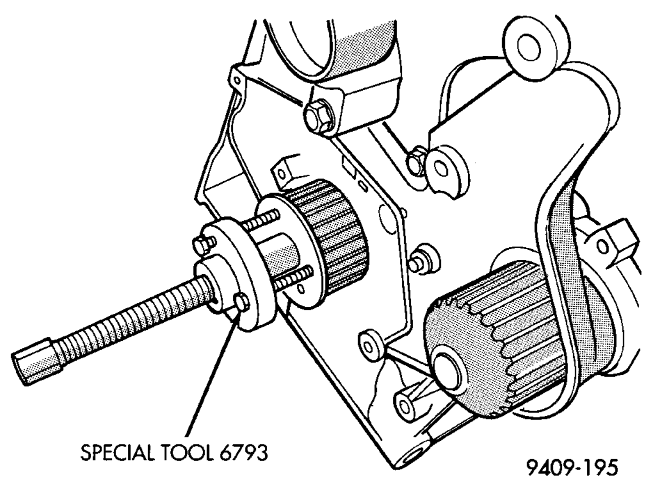


Fig. 73 Crankshaft Sprocket—Removal

(5) Remove oil pick-up tube.

REMOVAL AND INSTALLATION (Continued)

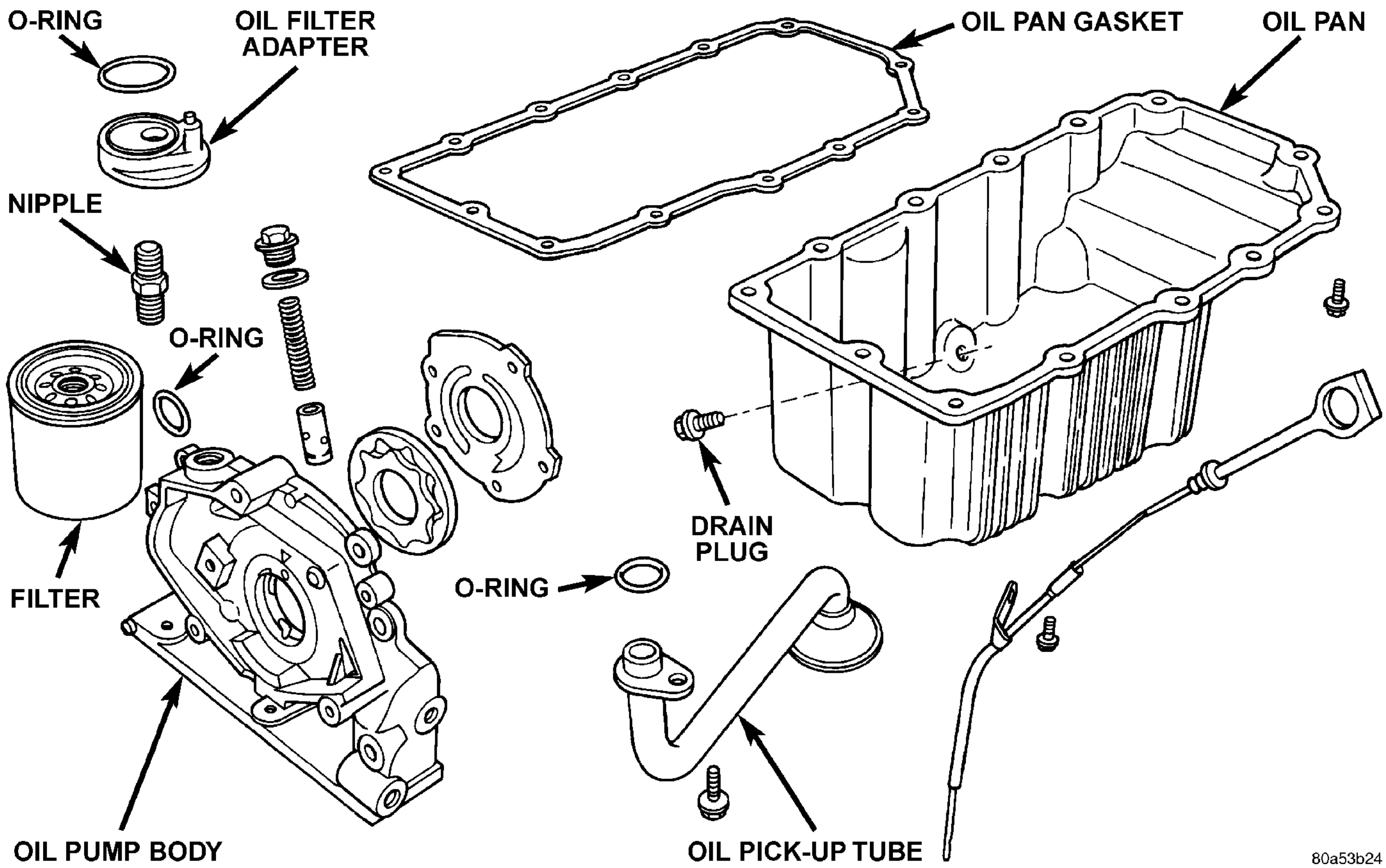


Fig. 74 Oil Pump and Tube

(6) Remove oil pump, (Fig. 74) and front crankshaft seal.

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

(2) Apply Mopar Gasket Maker to oil pump as shown in (Fig. 75). Install oil ring into oil pump body discharge passage.

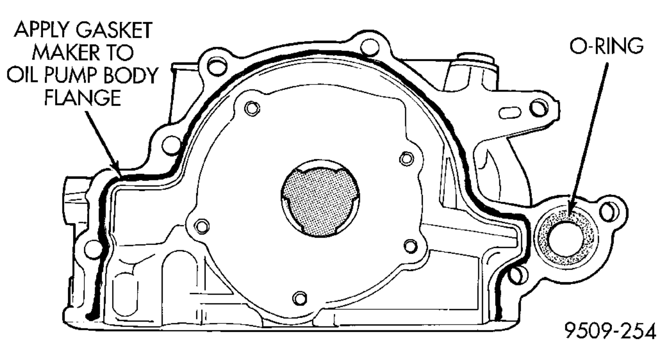


Fig. 75 Oil Pump Sealing

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

(5) Torque all oil pump attaching bolts to 28 N·m (250 in. lbs.)

(6) Install new front crankshaft seal using Special Tool 6780 (Fig. 76).

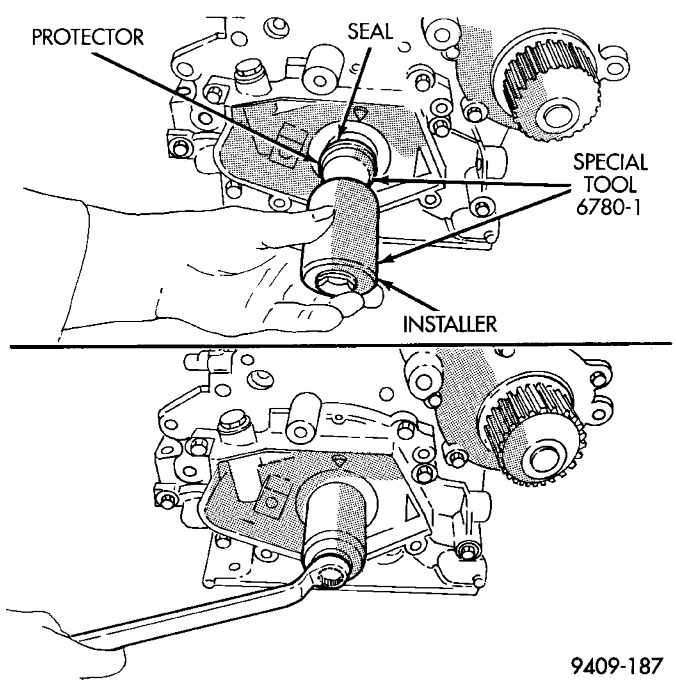


Fig. 76 Front Crankshaft Seal—Installation

REMOVAL AND INSTALLATION (Continued)

(7) Install crankshaft sprocket, using Special Tool 6792 (Fig. 77).

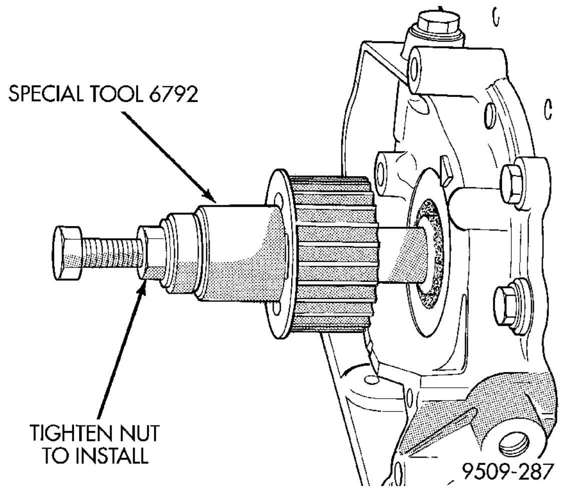


Fig. 77 Crankshaft Sprocket—Installation

(8) Install oil pump pick-up tube and oil pan.

(9) Install Timing Belt. Refer to Timing Belt Installation in this section.

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. 78).

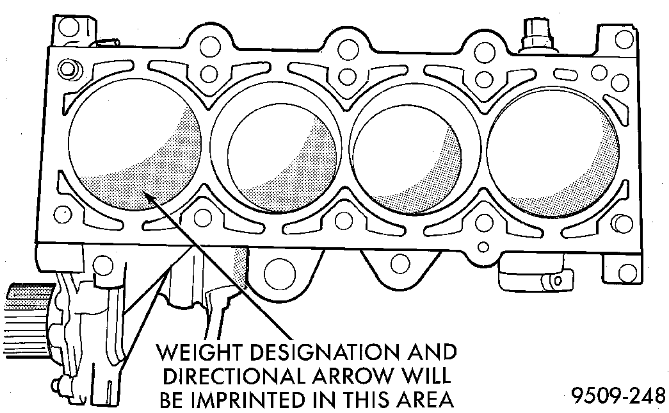


Fig. 78 Piston Markings

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 79) for identification.

(3) Pistons will have a stamping in the approximate location shown in (Fig. 78). These stamps will be either a directional arrow or a weight identification for the assembly. L is for light and H is for heavy. These assemblies should all be the same weight class. Service piston assemblies are marked with a S and can be used with either L or H production assemblies. The weight designation stamps should face toward the timing belt side of the engine.

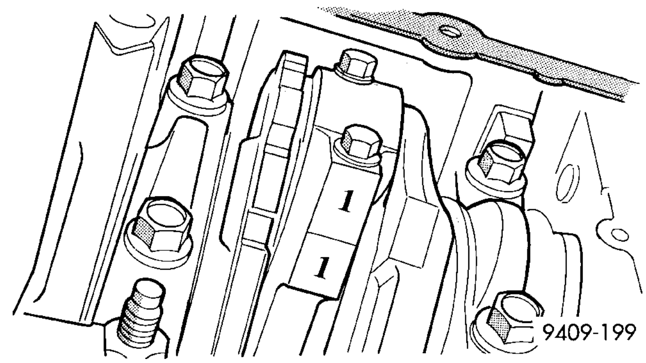


Fig. 79 Identify Connecting Rod to Cylinder

(4) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(5) Remove connecting rod cap bolts **Do not use old bolts if reinstalling connecting rod.** Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(6) After removal, install bearing cap on the mating rod.

(7) Piston and Rods are serviced as an assembly.

PISTON RING—REMOVAL

(1) ID mark on face of upper and intermediate piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 80).

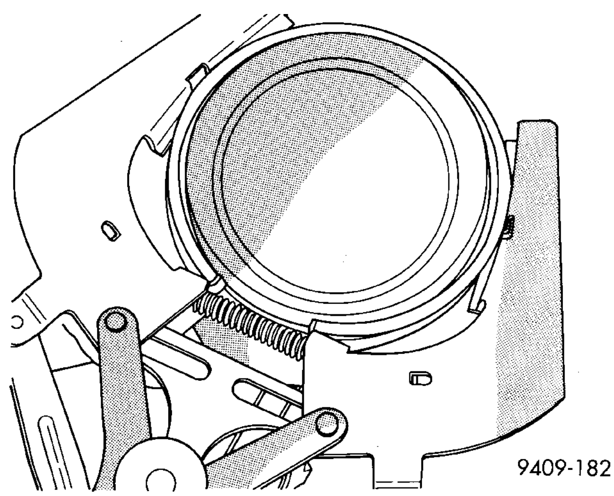


Fig. 80 Piston Rings—Removing and Installing

(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.

REMOVAL AND INSTALLATION (Continued)

PISTON RINGS—INSTALLATION

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 81).

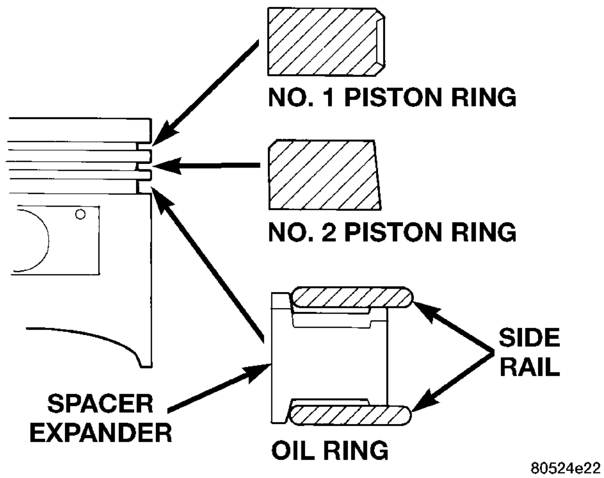


Fig. 81 Piston Ring Installation

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.
f. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander (Fig. 82).**

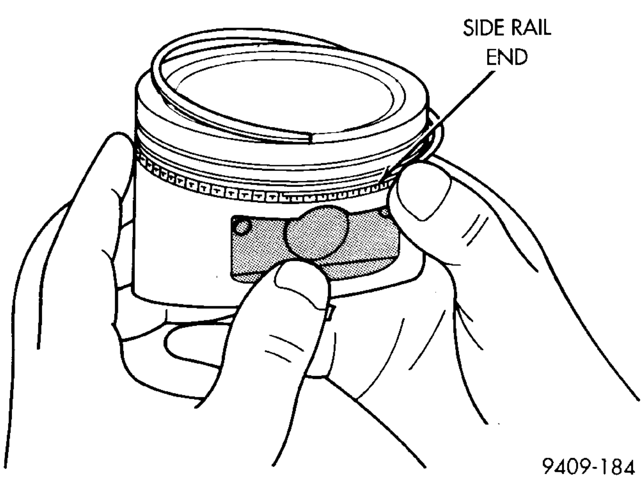


Fig. 82 Installing Side Rail

(2) Install upper side rail first and then the lower side rail.

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 81).

(4) Position piston ring end gaps as shown in (Fig. 83).

(5) 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.

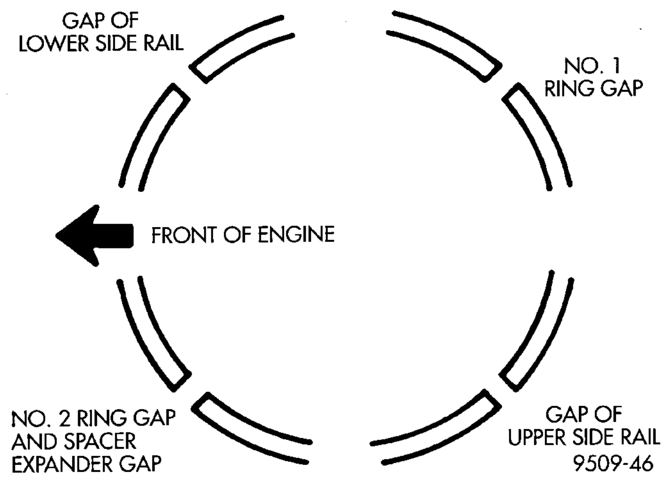


Fig. 83 Piston Ring End Gap Position

PISTON AND ROD —INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 83).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 84). **Be sure position of rings does not change during this operation** .

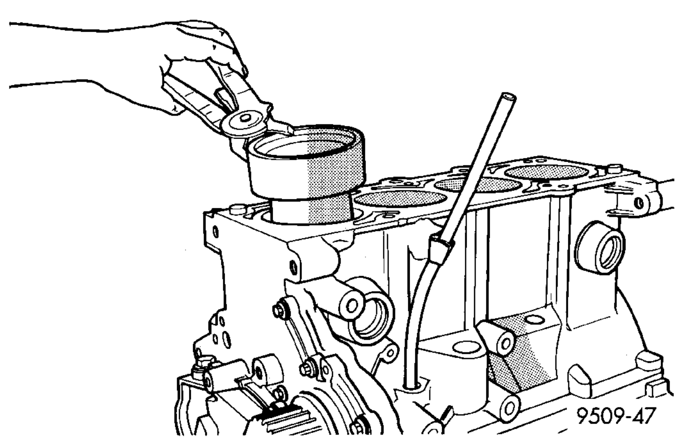


Fig. 84 Installing Piston

(4) The weight stamp designation L or H will be in the front half of the piston should face toward the front of the engine for SOHC engine. The arrow

REMOVAL AND INSTALLATION (Continued)

should face toward the front of the engine for DOHC engine (Fig. 78).

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston assembly into cylinder bore and guide rod over the crankshaft journal.

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

(7) Install rod caps. Install **New** bolts and tighten to 27 N·m (20 ft.lb.) Plus 1/4 turn.

DISASSEMBLY AND ASSEMBLY

OIL PUMP

(1) To remove the relief valve, proceed as follows:

(2) Remove the threaded plug and gasket from the oil pump (Fig. 89).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 89) or serious damage may occur.

(3) Remove spring and relief valve (Fig. 89).

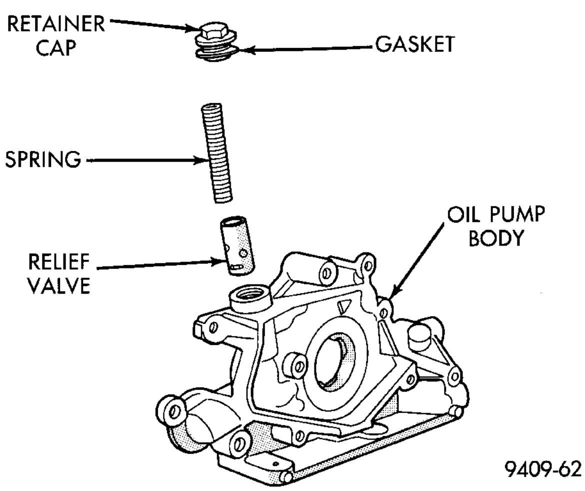


Fig. 85 Oil Pressure Relief Valve

(4) Remove oil pump cover screws, and lift off cover.

(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 90).

VALVE SERVICE WITH CYLINDER HEAD REMOVED

REMOVAL

(1) With cylinder head removed, compress valve springs using Special Tool MD 998735 or equivalent.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

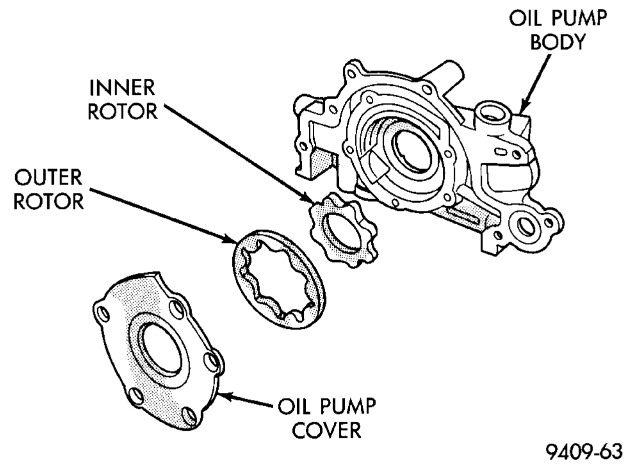


Fig. 86 Oil Pump

(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 GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 87). Refer to (Fig. 88) for specifications. Replace guides if they are not within specification.

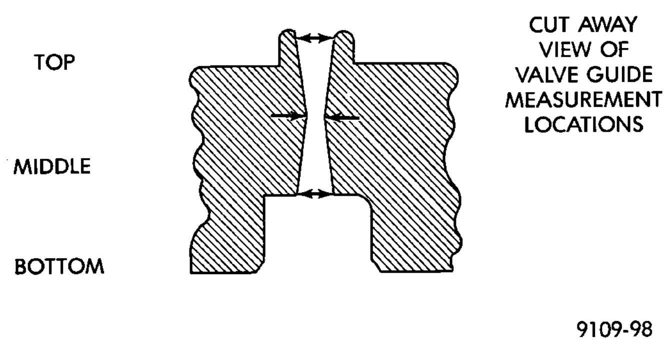


Fig. 87 Checking Wear on Valve Guide—Typical

Valve Guide Diameter	Intake Valve	Exhaust Valve
	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	5.975 - 6.000 mm (0.2352 - 0.2362 in.)
Clearance	**New**	**Service Limit**
Intake	0.023 - 0.066 mm (0.001 - 0.0025 in.)	0.25 mm (0.010 in.)
Exhaust	0.051 - 0.094 mm (0.002 - 0.0037 in.)	

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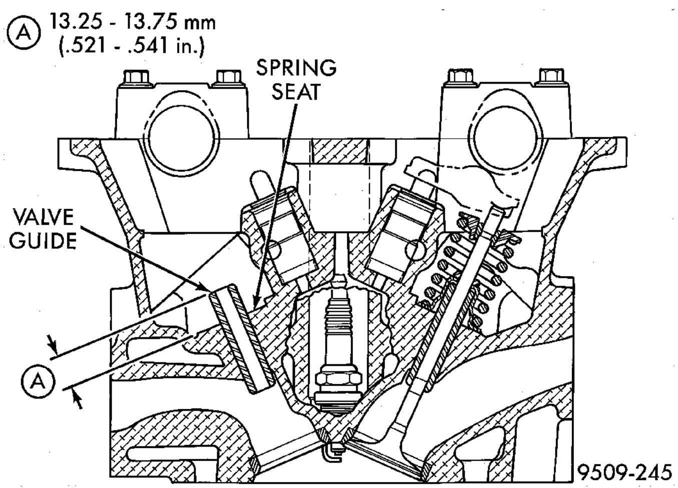
Fig. 88 Valve Guide Specification

DISASSEMBLY AND ASSEMBLY (Continued)

CHECK VALVE GUIDE HEIGTH



Valve Guide Heigth

TESTING VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested Special Tool C-647. As an example, the compression length of the spring to be tested is 33.34 mm (1-5/16 inches). Turn tool table until surface is in line with the 33.34 mm (1-5/16 inch) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device (Fig. 89). Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Discard the springs that do not meet specifications. The Following specifications apply to both intake and exhaust valve springs;

- Valve Closed Nominal Tension— 58 ft. lbs. @ 38.0 mm (1.50 in.)
- Valve Open Nominal Tension— 130 ft. lbs. @ 29.25 mm (1.17 in.)

(2) Verify springs are not distorted with a steel square and surface plate, check springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and valve face have a 45 and a 45 1/2 degree angles.

(2) Inspect the remaining margin after the valves are refaced (Fig. 91). Intake valves with less than 1.2 mm (3/64 inch.) margin and Exhaust valves with less than 0.9 mm (1/32 inch.) margin should be discarded.

(3) When refacing valve seats, it is important that the correct size valve guide pilot be used for the reseating stones. A true and complete surface must be obtained.

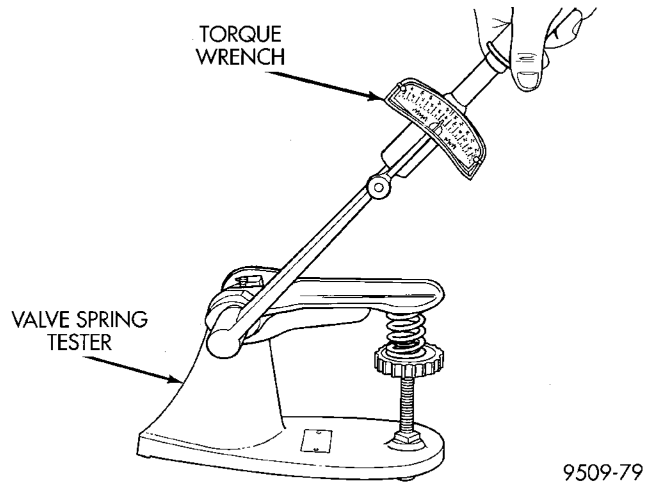


Fig. 89 Testing Valve Spring

(4) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator. Total runout should not exceed. 0.051 mm (0.002 inch.) (total indicator reading).

(5) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

- Intake valve seat diameter is 34.37 - 34.63 mm (1.353 - 1.363 inch.)
- Exhaust valve seat diameter is 29.37 29.63 mm (1.156 1.166 inch.)

(6) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. The intake valve seat must be serviced when the valve seat width is 2.0 mm (0.079 in.) or greater. The exhaust valve seat must be serviced when the valve seat width is 2.5 mm (0.098 in.) or greater. Otherwise the cylinder head must be replaced. Refer to (Fig. 90) for valve specifications.

(7) When seat is properly positioned the width of intake and exhaust seats should be 0.90 to 1.30 mm (0.035 to 0.051 inch.) (Fig. 92).

(8) Check valve tip height dimensions A after grinding the valve seats or faces (Fig. 93). Grind valve tip to 47.99 mm (1.889 in.) for exhaust valve and 48.04 mm (1.891 in.) for intake valve when installed in the head (Fig. 93). The valve tip chamfer may need to be reground to prevent seal damage when the valve is installed.

DISASSEMBLY AND ASSEMBLY (Continued)

Face Angle	
Intake and Exhaust	45 - 44 1/2°
Head Diameter	
Intake	34.67 - 34.93 mm (1.364 - 1.375 in.)
Exhaust	30.37 - 30.63 mm (1.195 - 1.205 in.)
Length (Overall)	
Intake	111.49 - 111.99 mm (4.389 - 4.409 in.)
Exhaust	109.59 - 110.09 mm (4.314 - 4.334 in.)
Stem Diameter	
Intake	5.934 - 5.952 mm (0.233 - 0.234 in.)
Exhaust	5.906 - 5.924 mm (0.233 - 0.233 in.)
Valve Margin	
Intake	1.285 - 1.615 mm (0.050 - 0.063 in.)
Exhaust	0.985 - 1.315 mm (0.038 - 0.051 in.)

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Fig. 90 Valve Specifications

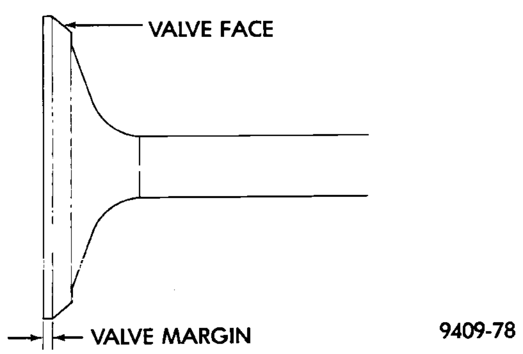

Fig. 91 Refacing Intake and Exhaust Valves

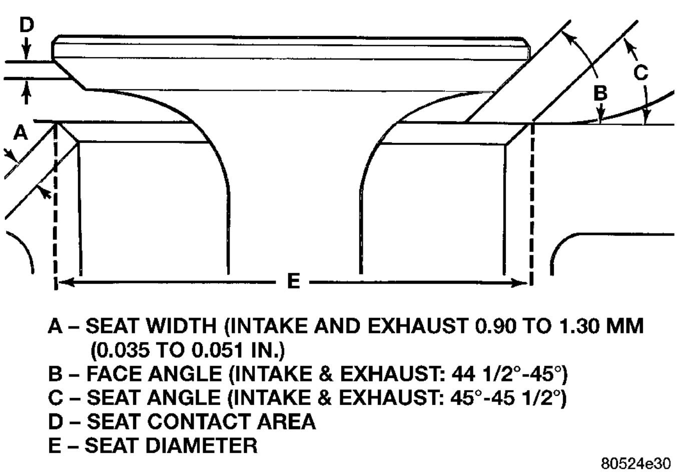

Fig. 92 Refacing Valve Seats

VALVE INSTALLATION

(1) Coat valve stems with clean engine oil and insert in cylinder head.

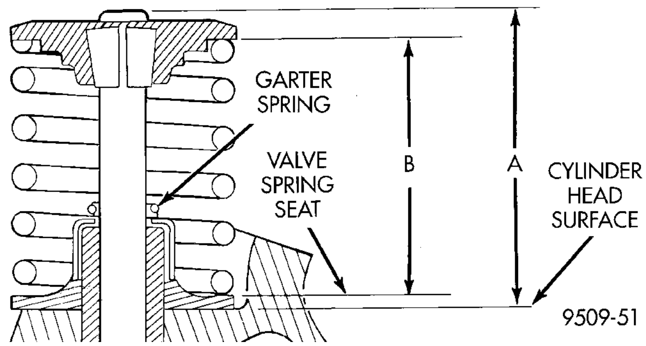

Fig. 93 Checking Spring Installed Height and Valve Tip Height Dimensions

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 94). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: If oversize valves are used, there is only one oversize valve available. The same stem seal is used on both the standard and oversize valve.

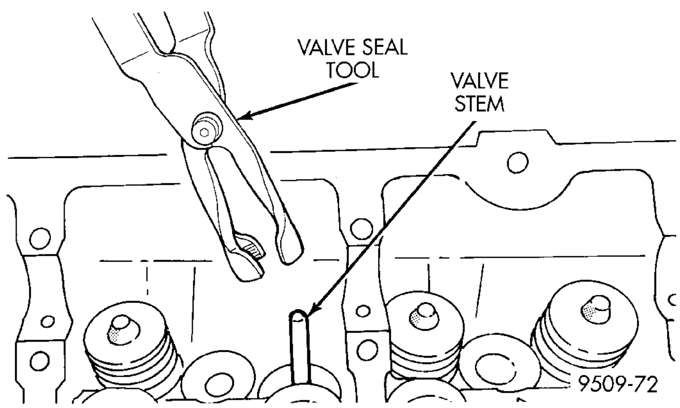

Fig. 94 Valve Stem Oil Seal Tool

(3) Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 93). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 38.75 mm (1.525 in.), install a 7.620 mm (0.030 inch.) spacer under the valve spring seat to bring spring height back within specification.

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Install cam followers and camshaft as previously described in this section.

(6) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.17 mm (0.046 in.) for intake and 1.28 mm (0.050 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster or adjusters to bleed down before rotating cam.

CLEANING AND INSPECTION

CYLINDER HEAD AND CAMSHAFT JOURNALS

INSPECTING CYLINDER HEAD

Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 100).

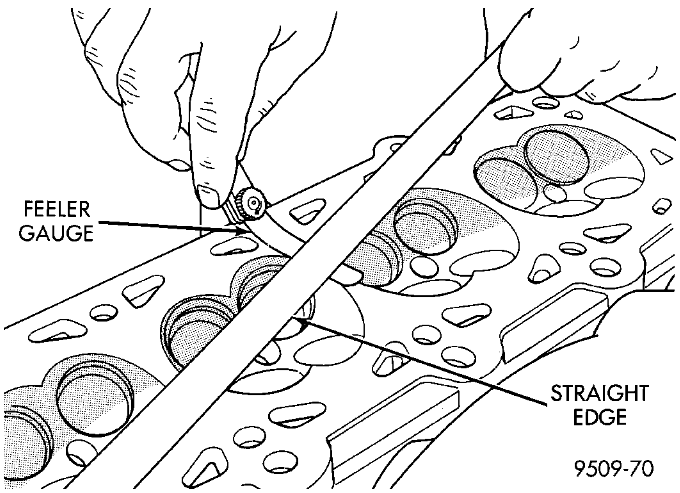

Fig. 95 Checking Cylinder Head Flatness

Inspect cylinder head journals for wear.

Check camshaft journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CLEANING

Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

OIL PUMP

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 101). If a 0.076 mm (0.003 inch.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

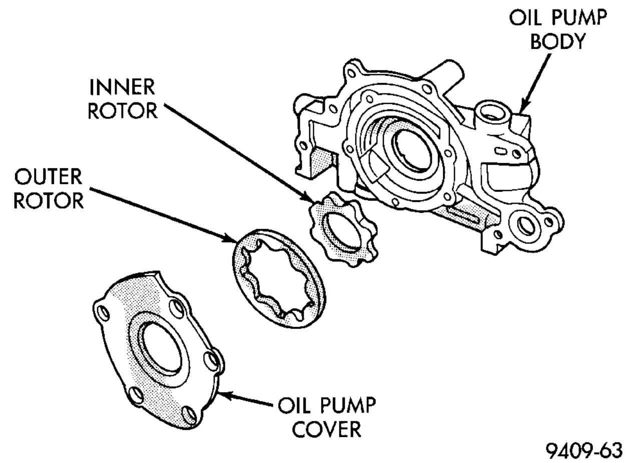

Fig. 96 Checking Oil Pump Cover Flatness

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 inch.) or less (Fig. 102), or if the diameter is 79.95 mm (3.148 inches) or less, replace outer rotor.

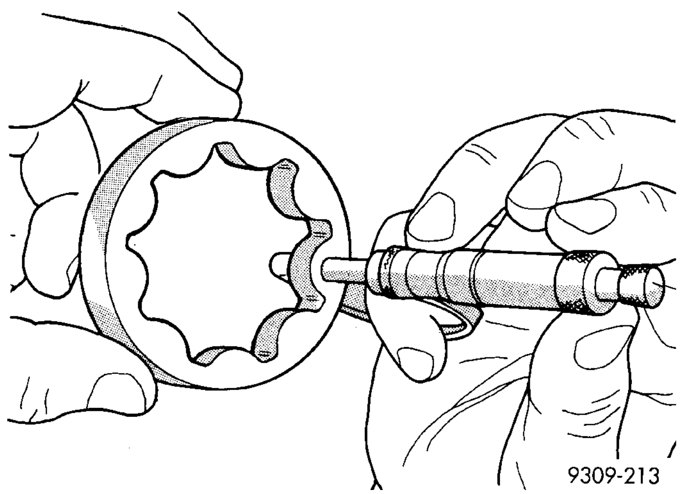

Fig. 97 Measuring Outer Rotor Thickness

(4) If inner rotor measures 7.64 mm (.301 inch) or less replace inner rotor (Fig. 103).

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 104). If measurement is 0.39 mm (0.015 inch.) or more, replace housing only if outer rotor is in specification.

CLEANING AND INSPECTION (Continued)

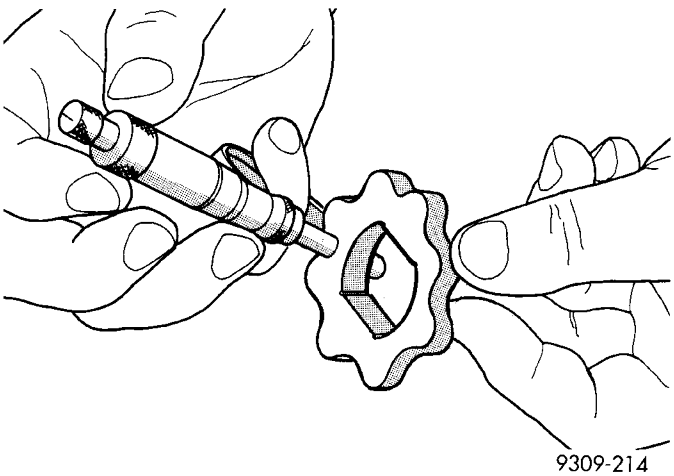

Fig. 98 Measuring Inner Rotor Thickness

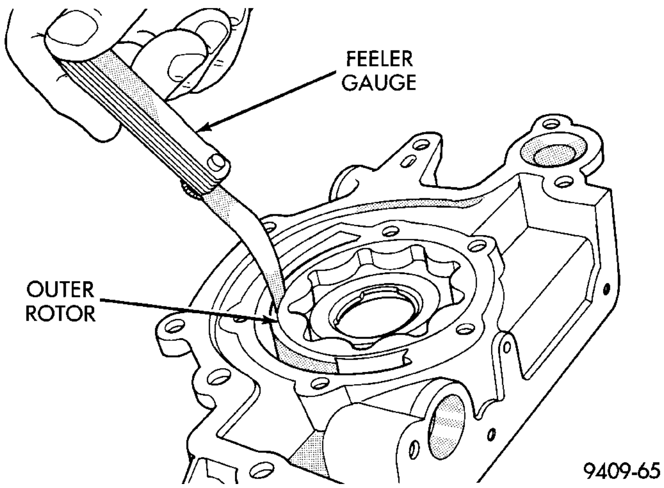

Fig. 99 Measuring Outer Rotor Clearance in Housing

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 105) is .203 mm (.008 inch) or more, replace both rotors.

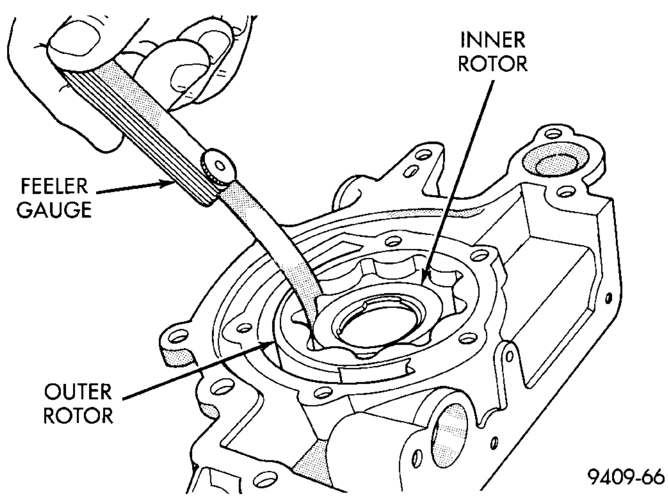

Fig. 100 Measuring Clearance Between Rotors

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of .102 mm (.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 106). **ONLY** if rotors are in specs.

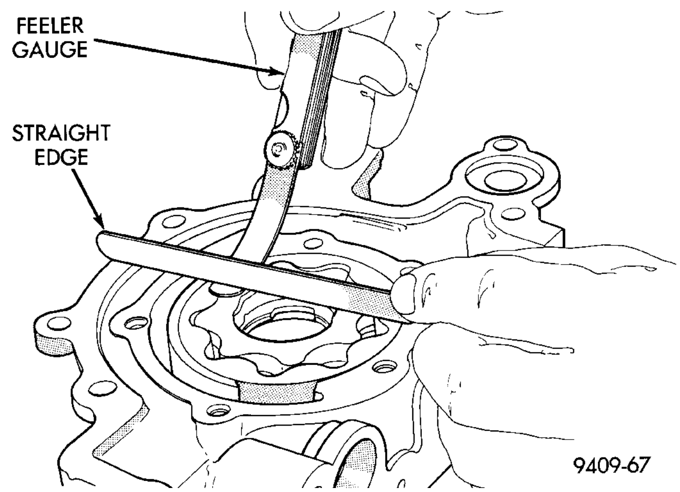

Fig. 101 Measuring Clearance Over Rotors

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings, damaged or missing oil pick-up tube o-ring, clogged oil pick-up tube screen, clogged oil filter and stuck open pressure relief valve or other reasons for oil pressure loss.

CYLINDER BLOCK AND BORE

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, Refer to Engine Core Plugs outlined in this section.

(3) Examine block and cylinder bores for cracks or fractures.

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 107). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that

CLEANING AND INSPECTION (Continued)

specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 107). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to (Fig. 108) for specifications.

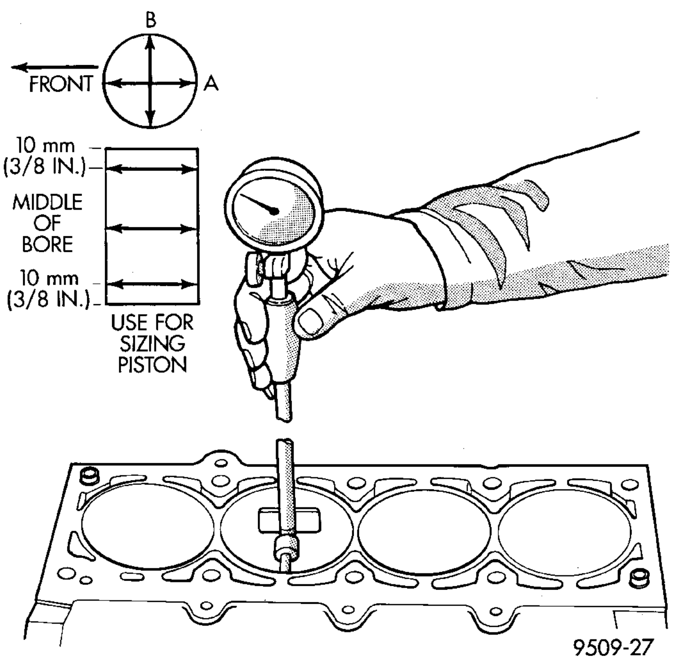

Fig. 102 Checking Cylinder Bore Size

Standard Bore	Maximum Out-of-Round	Maximum Taper
87.5 mm (3.445 inch.)	0.051 mm (0.002 inch.)	0.051 mm (0.002 inch.)
Standard Piston Size 87.463 - 87.481 mm (3.4434 - 3.4441 inch.)		
Piston to Bore Clearance: 0.012 - 0.044 mm (.0005 to .0017 inches.) Measurements taken at Piston Size location.		

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Fig. 103 Cylinder Bore and Piston Specifications

SPECIFICATIONS

ENGINE 2.0L DOHC

Cylinder Block

Cylinder Bore Diameter . . . 87.4924 - 87.5076 mm (3.4446 - 3.4452 in.)
Out-of-Round (Max.) . . . . 0.051 mm (0.002 in.)
Taper (Max.) . . . . 0.051 mm (0.002 in.)

Pistons

Clearance 17.5 mm (11/16 in.) from bottom of skirt . . . . 0.018 - 0.050 mm (0.0007 - 0.0020 in.)
Weight . . . . . . 340 - 350 grams (11.99 - 12.34 oz.)
Head Land Clearance (Diametrical) . . . . 0.740 - 0.803 mm (0.029 - 0.031 in.)
Piston Length . . . . 64.8 mm (2.551 in.)
Piston Ring Groove Depth No. 1 . . . . 3.983 - 4.132 mm (0.157 - 0.163 in.)
Piston Ring Groove Depth No. 2 . . . . 4.456 - 4.605 mm (0.175 - 0.181 in.)
Piston Ring Groove Depth No. 3 . . . . 3.841 - 4.075 mm (0.151 - 0.160 in.)

Piston Pins

Clearance in Piston . . . . 0.008 - 0.020 mm (0.0003 - 0.0008 in.)
In Rod (Interference) . . . . 0.018 - 0.043 mm (0.0007 - 0.0017 in.)
Diameter . . . . 20.998 - 21.003 mm (0.8267 - 0.8269 in.)
End Play . . . . None
Length . . . . 74.75 - 75.25 mm (2.943 - 2.963 in.)

Piston Rings

Ring Gap Top Compression Ring . . . . 0.23 - 0.52 mm (0.009 - 0.020 in.)
Ring Gap 2nd Compression Ring . . . . 0.49 - 0.78 mm (0.019 - 0.031 in.)
Ring Gap Oil Control (Steel Rails) . . . . 0.23 - 0.66 mm (0.009 - 0.026 in.)
Ring Side Clearance Both Compression Rings . . . . 0.025 - 0.065 mm (0.0010 - 0.0026 in.)
Oil Ring (Pack) . . . . 0.004 - 0.178 mm (0.0002 - 0.0070 in.)
Ring Width Compression Rings . . . . . . 1.17 - 1.19 mm (0.046 - 0.047 in.)
Oil Ring (Pack) . . . . 2.854 - 3.008 mm (0.1124 - 0.1184 in.)

SPECIFICATIONS (Continued)

Connecting Rod

Bearing Clearance . . . . 0.026 - 0.059 mm (0.001 - 0.0023 in.)
Piston Pin Bore Diameter . . . . . 20.96 - 20.98 mm (0.8252 - 0.8260 in.)
Large End Bore Diameter . . . 50.991 - 51.005 mm (2.0075 - 2.0081 in.)
Side Clearance . . . . 0.13 - 0.38 mm (0.005 - 0.015 in.)
Total Weight (Less Bearing) . . . . 543 grams (1.20 lbs.)

Crankshaft

Connecting Rod Journal Diameter . . . . 47.9924 - 48.0076 mm (1.8894 - 1.8900 in.)
Out-of-Round (Max.) . . . . . 0.0035 mm (0.0001 in.)
Taper (Max.) . . . . 0.0038 mm (0.0001 in.)
Main Bearing Diametrical Clearance No. 1 - 5 . . . . 0.022 - 0.062 mm (0.0008 - 0.0024 in.)
End Play . . . . 0.09 - 0.24 mm (0.0035 - 0.0094 in.)

Main Bearing Journals

Diameter . . . . 51.9924 - 52.0076 mm (2.0469 - 2.0475 in.)
Out-of-Round (Max.) . . . . . 0.0035 mm (0.0001 in.)
Taper (Max.) . . . . 0.0038 mm (0.0001 in.)

Camshaft

Bearing Bore Diameter No. 1 - 6 . . . . 26.020 mm - 26.041 mm (1.024 - 1.025 in.)
Diametrical Bearing Clearance . . . . 0.069 - 0.071 mm (0.0027 - 0.003 in.)
End Play . . . . 0.05 - 0.15 mm (0.002 - 0.006 in.)
Bearing Journal Diameter No. 1 - 6 . . . . 25.951 - 25.970 mm (1.021 - 1.022 in.)
Lift (Zero Lash) Intake . . . . . . 8.75 mm (0.344 in.)
Lift (Zero Lash) Exhaust . . . . 8.00 mm (0.314 in.)

Valve Timing @ .5 mm Lift

Intake Valve Closes (ABDC) . . . . 38°
Intake Valve Opens (BTDC) . . . . 1.2°
Intake Valve Duration . . . . 219.2°
Exhaust Valve Closes (BTDC) . . . . 3°
Exhaust Valve Opens (BBDC) . . . . 42°
Exhaust Valve Duration . . . . 219°
Valve Overlap . . . . 0°

Cylinder Head

Material . . . . Cast Aluminum
Gasket Thickness (Compressed) . . . . 1.15 mm (0.045 in.)
Valve Seat Angle . . . . 44.5 - 45°
Runout (Max.) . . . . 0.050 mm (0.002 in.)
Width (Finished) Intake and Exhaust . . . 0.9 - 1.3 mm (0.035 - 0.051 in.)
Valve Guide Finished Diameter ID . . . . 5.975 - 6.000 mm (0.235 - 0.236 in.)
Guide Bore Diameter (Standard) . . . . 11.0 - 11.02 mm (0.4330 - 0.4338 in.)

Valves

Head Diameter Intake . . . . 34.67 - 34.93 mm (1.365 - 1.375 in.)
Head Diameter Exhaust . . . . . . 30.37 - 30.36 mm (1.195 - 1.195 in.)
Valve Margin Intake . . . . 1.15 - 1.48 mm (0.0452 - 0.0582 in.)
Valve Margin Exhaust . . . . 1.475 - 1.805 mm (0.058 - 0.071 in.)
Length Intake . . . . 111.49 -111.99 mm (4.389 - 4.409 in.)
Length Exhaust . . . . 109.59 - 110.09 mm (4.314 - 4.334 in.)
Valve Stem Tip Heigth Intake . . . . 48.04 mm (1.891 in.)
Valve Stem Tip Heigth Exhaust . . . . 47.99 mm (1.889 in.)
Stem Diameter Intake . . . . 5.9034 - 5.952 mm (0.234 - 0.234 in.)
Stem Diameter Exhaust . . . . . . 5.906 - 5.924 mm (0.233 - 0.233 in.)
Stem-to-Guide Clearance Intake . . . . 0.023 - 0.066 mm (0.0009 - 0.0025 in.)
Stem-to-Guide Clearance Exhaust . . . . 0.051 - 0.094 mm (0.002 - 0.0037 in.)
Maximum Allowable Intake . . . . 0.076 mm (0.003 in.)
Maximum Allowable Exhaust . . . . 0.101 mm (0.004 in.)

Valve Spring

Free Length (Approx.) . . . . 46 mm (1.811 in.)
Spring Tension (Valve Closed) . . . . 246 - 270 N @ 38.0 mm (55 - 60 lbs. @ 1.496 in.)
Spring Tension (Valve Open) . . . . 549 - 611 N @ 29.3 mm (123 - 137 lbs. @ 1.53 in.)

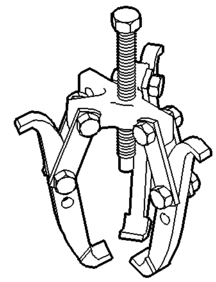
SPECIFICATIONS (Continued)

TORQUE CHART 2.0L DOHC

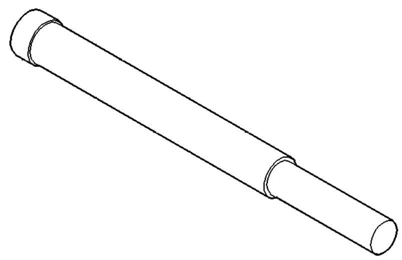
DESCRIPTION	TORQUE
Camshaft Sensor Pick-Up	
Bolts	9.6 N·m (85 in. lbs.)
Timing Belt Cover	
Bolts M6	12 N·m (105 in. lbs.)
Camshaft Sprocket	
Bolt	115 N·m (85 ft. lbs.)
Connecting Rod Cap	
Bolts	27 N·m (20 ft. lbs.) Plus 1/4 Turn
Crankshaft Main Bearing Cap/Bedplate	
M8 Bedplate Bolts	30 N·m (22 ft. lbs.)
M11 Main Cap Bolts	81 N·m (60 ft. lbs.)
Crankshaft Damper	
Bolt	142 N·m (105 ft. lbs.)
Cylinder Head	
Bolts	Refer To Cylinder Head Installation
Cylinder Head Cover	
Bolts	12 N·m (105 in. lbs.)
Engine Mount Bracket	
Bolts	41 N·m (30 ft. lbs.)
Exhaust Manifold to Cylinder Head	
Bolts	23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield	
Bolts	15 N·m (130 in. lbs.)
Intake Manifold	
Bolts	28 N·m (250 in. lbs.)
Oil Filter Adapter	
Fastener	80 N·m (60 ft. lbs.)
Oil Filter	20 N·m (15 ft. lbs.)
Oil Pan	
Bolts	12 N·m (105 in. lbs.)
Drain Plug	34 N·m (25 ft. lbs.)
Oil Pump Attaching	
Bolts	28 N·m (250 in. lbs.)
Oil Pump Cover Fastener	12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Bolt	28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap	55 N·m (40 ft. lbs.)
Spark Plugs	
Plug	28 N·m (20 ft. lbs.)
Thermostat Housing	
Bolts	23 N·m (200 in lbs.)
Timing Belt	
Tensioner	28 N·m (250 in. lbs.)
Timing Belt Tensioner Pulley Assembly Plate-Backing	
Bolts	41 N·m (30 ft. lbs.)
Timing Belt Tensioner Pulley	
Bolt	68 N·m (50 ft. lbs.)
Water Pump Mounting	
Bolts	12 N·m (105 in. lbs.)

SPECIAL TOOLS

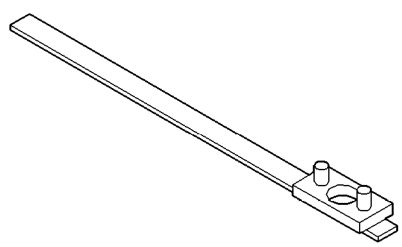
ENGINE 2.0L DOHC



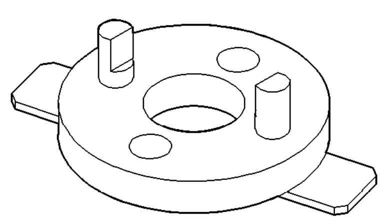
Puller 1026



Crankshaft Damper Removal Insert 6827-A

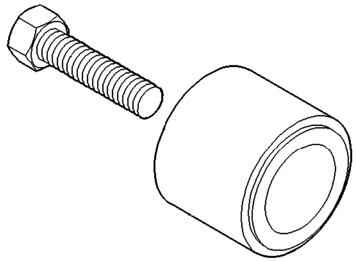


Camshaft Sprocket Remover/Installer C-4687

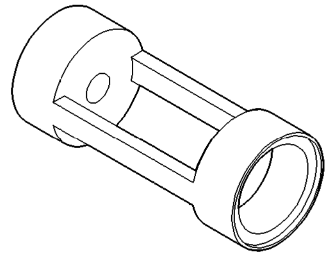


Camshaft Sprocket Remover/Installer Adapter C-4687-1

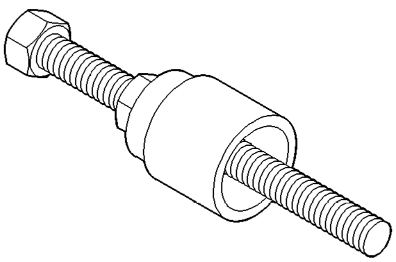
SPECIAL TOOLS (Continued)



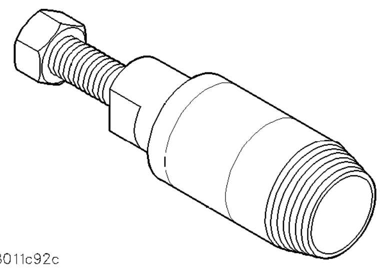
Camshaft Seal Installer MD-998713



Adapter Spring Compressor 6779



Installer Crankshaft Damper 6792



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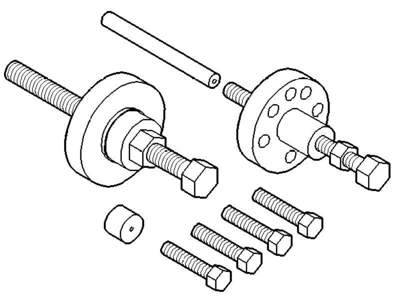
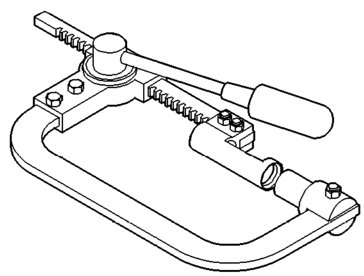
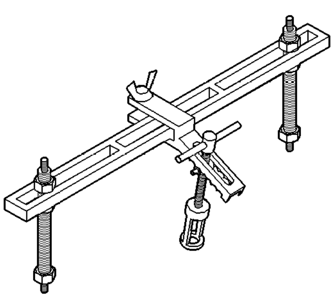
Front Crankshaft Seal Remover 6771



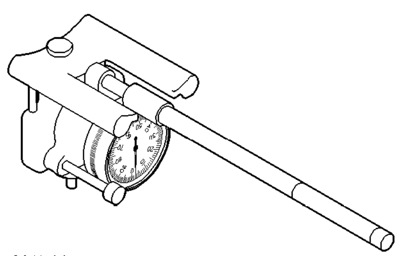
Installer Crankshaft Damper C-4685-C



Valve Spring Compressor C-3575-A



Valve Spring Compressor MD-998772-A



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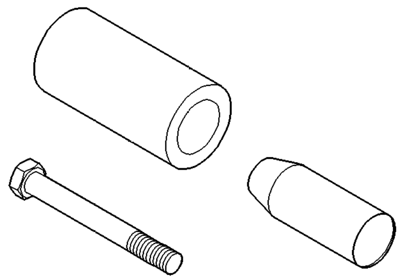
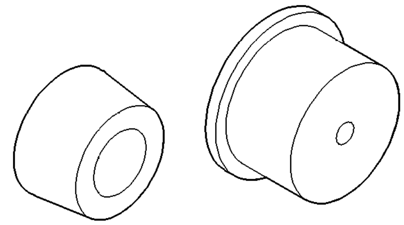
Cylinder Bore Indicator C-119

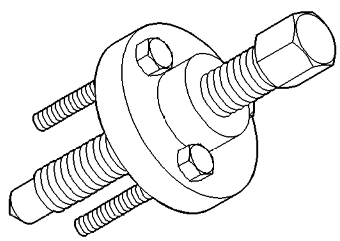
SPECIAL TOOLS (Continued)



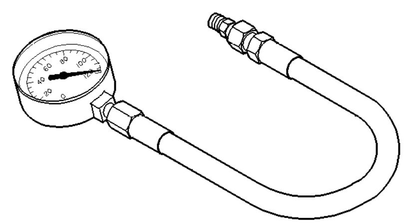
Front Crankshaft Seal Installer 6780



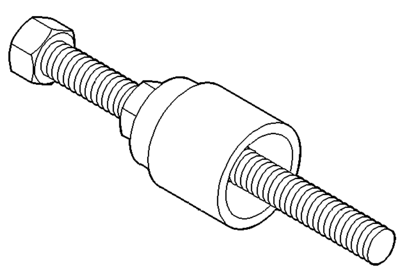
Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



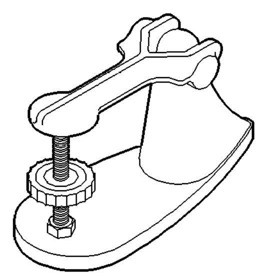
Crankshaft Sprocket Remover 6793



Pressure Gage C-32932



Crankshaft Sprocket Installer 6792



Valve Spring Tester C-647

EXHAUST SYSTEM AND INTAKE MANIFOLD

CONTENTS

GENERAL INFORMATION

EXHAUST SYSTEMS

The exhaust system has an underfloor catalytic converter, tail pipe, and muffler (Fig. 1).

EXHAUST BALL JOINT COUPLING

An exhaust ball joint coupling (Fig. 2) is used to secure the exhaust pipe to the engine exhaust manifold. This flexible joint 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 (Fig. 3). If damaged, the converter must be replaced.

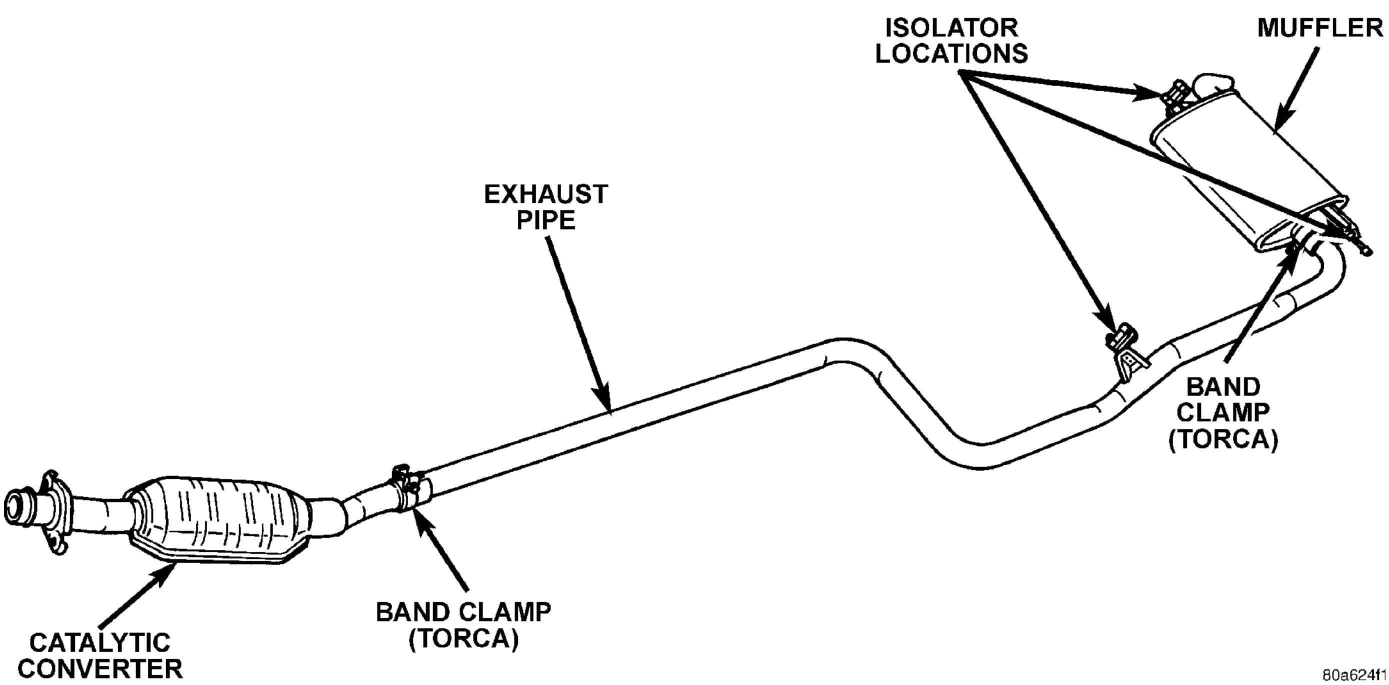


Fig. 1 Exhaust System

GENERAL INFORMATION (Continued)

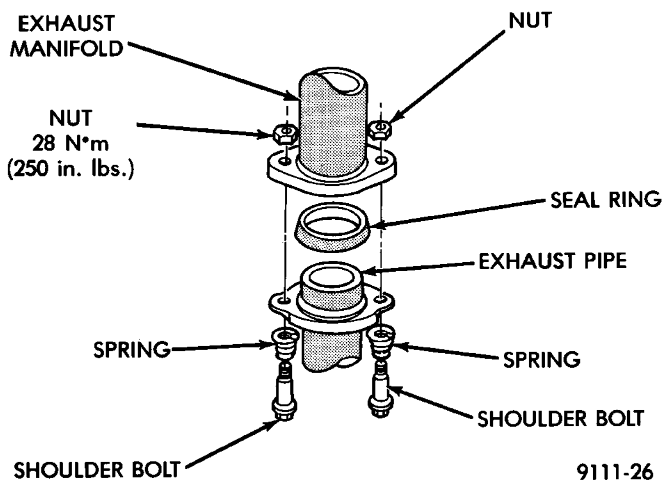


Fig. 2 Ball Joint Connection

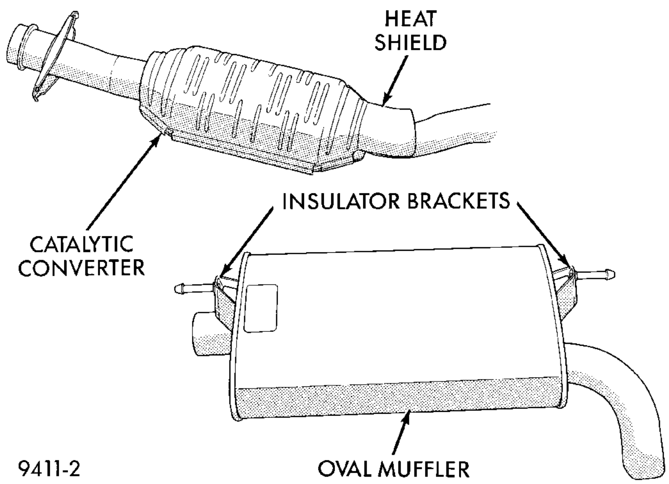


Fig. 3 Exhaust System Components

CAUTION: Due to exterior physical similarities of some catalytic converters with pipe assemblies, extreme care should be taken with replacement parts.

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 a 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.

HEAT SHIELDS

The heat shield (Fig. 4) is needed to protect both the car and the environment from the high temperatures developed in the vicinity of the catalytic converter.

Refer to Group 23, Body and Sheet Metal for service procedures.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shield on cars if equipped. Light over-spray near the edges is permitted. Application of coating will greatly reduce the efficiency of the heat shields resulting in excessive floor pan temperatures and objectionable fumes.

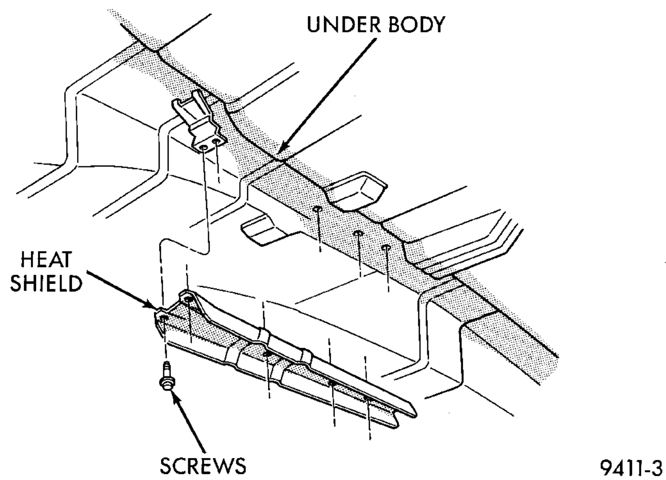


Fig. 4 Heat Shield Installation

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 the number four exhaust port through a hole in the end of the cylinder head. REFER TO GROUP 25, EMISSION SYSTEMS FOR A COMPLETE DESCRIPTION, DIAGNOSIS AND SERVICE PROCEDURES ON THE EXHAUST GAS RECIRCULATION SYSTEM AND COMPONENTS.

DESCRIPTION AND OPERATION

INTAKE MANIFOLD SOHC

The intake manifold is a molded plastic composition, attached to the cylinder head with ten fasteners. This long branch design enhances low and midrange torque. If removing the intake manifold for any reason, the fasteners can not be reused.

INTAKE MANIFOLD DOHC

The intake manifold is a two piece aluminum casting, attached to the cylinder head with ten fasteners. This long branch fan design enhances low and midrange torque.

EXHAUST MANIFOLD

The exhaust manifold is made of nodular cast iron for strength and high temperatures. Exhaust gasses exit through a machined, articulated joint connection to the exhaust pipe.

DIAGNOSIS AND TESTING

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 a, EGR Valve to Manifold Gasket b, EGR Valve to EGR Tube Gasket c, EGR Tube to Manifold Tube Nut	(c) a, Tighten nuts or replace gasket b, Tighten nuts or replace gasket c, Tighten tube nut
	(d) Exhaust Flex Joint a, Spring height, installed not correct	(d) 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.

REMOVAL AND INSTALLATION

EXHAUST PIPE AND MUFFLER

REMOVAL

(1) Raise vehicle on hoist and apply penetrating oil to band clamp fastener of component being removed (Fig. 5).

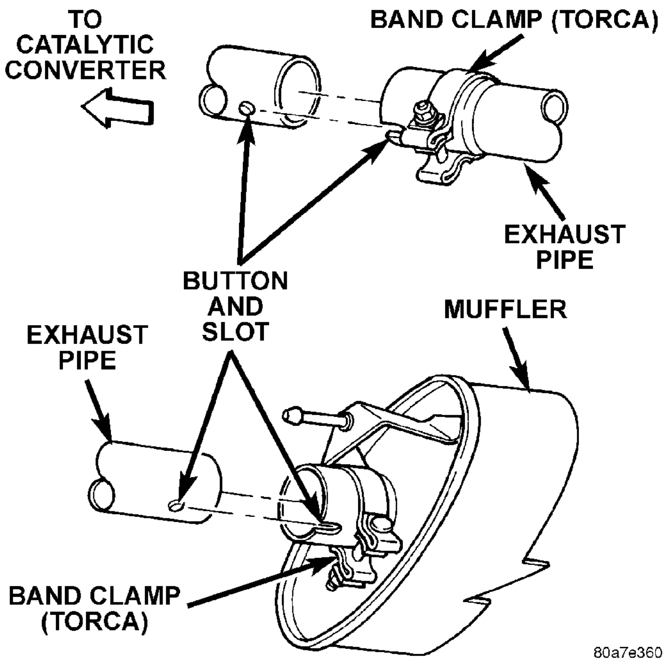


Fig. 5 Slip Joint Connection

NOTE: Do not use petroleum-based lubricants when removing/installing muffler or exhaust pipe isolators as it may compromise the life of the part. A suitable substitute is a mixture of liquid dish soap and water.

(2) Loosen band clamp and remove support insulators at muffler (Fig. 6). Remove muffler from exhaust pipe.

(3) Disconnect downstream heated oxygen sensor from the catalytic converter pipe.

(4) Remove clamp at the catalytic converter to exhaust pipe slip joint (Fig. 7). Separate at slip joint.

(5) When removing exhaust pipe, raise rear of vehicle to relieve body weight from rear suspension to provide clearance between pipe and lateral arms.

(6) Remove catalytic converter to exhaust manifold attaching bolts (Fig. 8).

(7) Clean ends of pipes and/or muffler to assure mating of all parts. Discard broken or worn insulators, rusted clamps, supports and attaching parts.

NOTE: When replacement is required on any component of the exhaust system, you must use original equipment parts (or their equivalent).

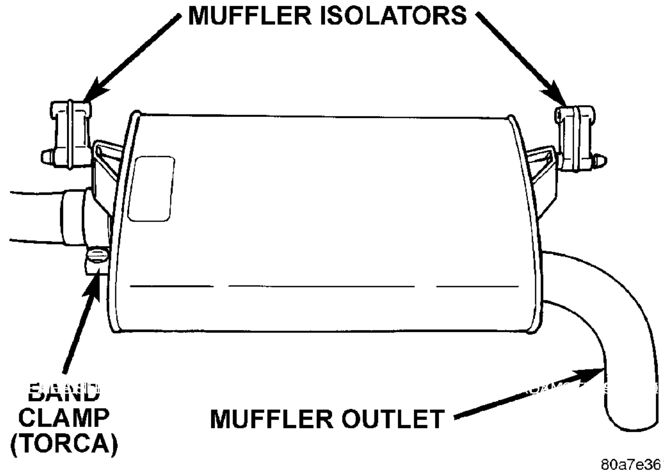


Fig. 6 Exhaust Pipe and Muffler Support Insulators

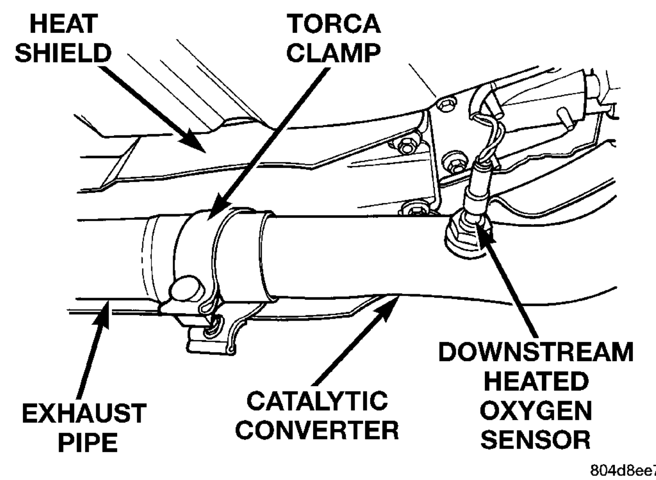


Fig. 7 Catalytic Converter to Exhaust Pipe Connection

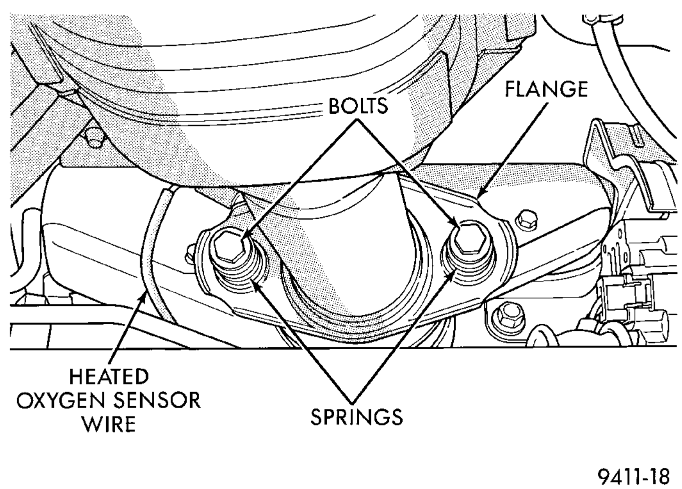


Fig. 8 Catalytic Converter to Exhaust Manifold Connection

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

When assembling exhaust system **do not** tighten clamps until components are aligned and clearances are checked.

(1) Assemble catalytic convertor to exhaust manifold ball joint connection (Fig. 8).

(2) Assemble exhaust pipe to catalytic convertor and the support to the underbody

(3) Install the muffler to exhaust pipe and the supports to the underbody.

(4) Working from the front of system;

(5) Align and tighten the catalytic convertor to exhaust manifold ball joint bolts (Fig. 8).

(6) Align each component to maintain position and proper clearance with underbody parts and tighten clamps to specifications (Fig. 9).

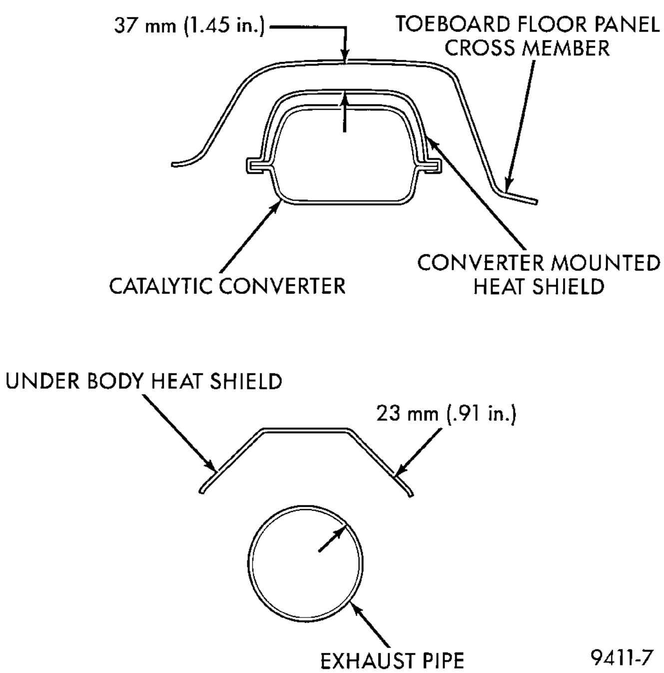


Fig. 9 Exhaust Clearance

(7) Connect the downstream heated oxygen sensor.

(8) A new style band clamp (Torca) will be used on the PL exhaust system (Fig. 10).

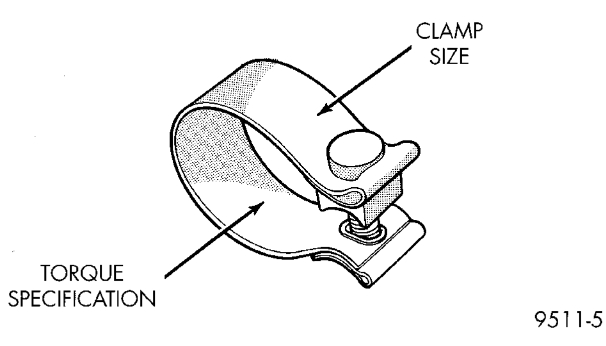


Fig. 10 Band Clamp (Torca)

INTAKE MANIFOLD—SINGLE OVERHEAD CAM ENGINE (SOHC)

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap.

(3) Remove the fresh air duct (Fig. 13).

(4) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 11).

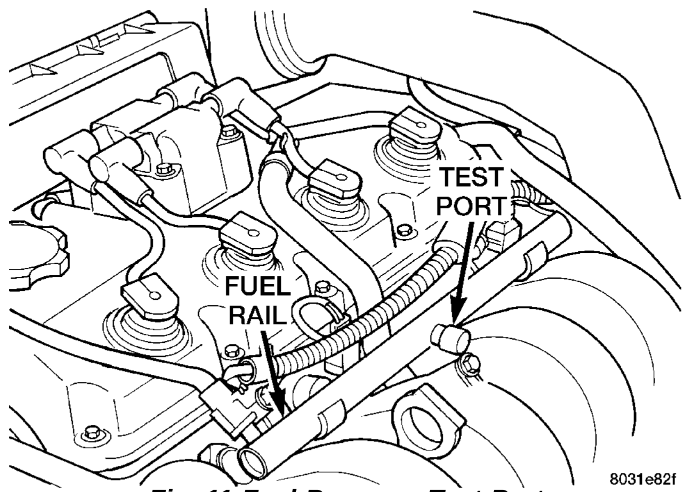


Fig. 11 Fuel Pressure Test Port

(5) 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 to the fuel pressure test port (Fig. 12). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

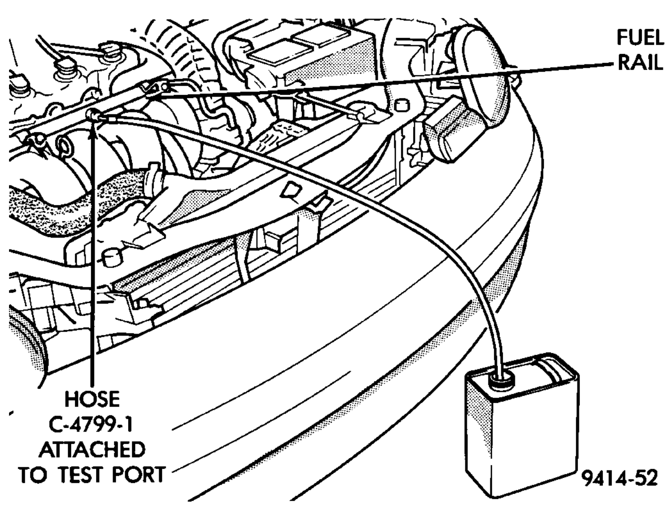


Fig. 12 Releasing Fuel Pressure

REMOVAL AND INSTALLATION (Continued)

(6) Perform fuel system pressure release procedure **before attempting any repairs.**

(7) Disconnect the fuel supply line quick connect at the fuel tube assembly.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

(8) Remove fuel rail assembly attaching screws and remove fuel rail assembly from engine. Cover injector holes with suitable covering.

CAUTION: Do not set fuel injectors on their tips, damage may occur to the injectors

(9) Remove clean air duct and upper air filter housing (Fig. 13).

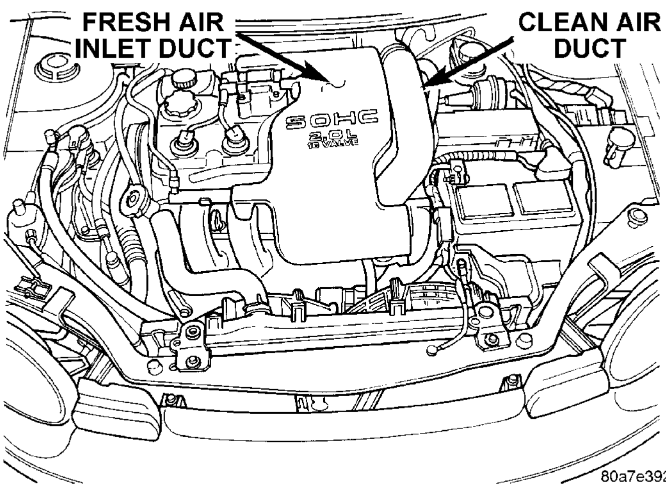


Fig. 13 Clean Air Duct to Throttle Body Assembly

(10) Remove accelerator, kickdown and speed control cables from throttle lever and bracket. Refer to Group 14, Fuel System Throttle Body Removal for procedures.

(11) Disconnect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors (Fig. 14).

(12) Disconnect vacuum hoses from throttle body (Fig. 14).

(13) Disconnect Manifold Absolute Pressure/Intake Air Temperature Sensor (TMAP), electrical connector (Fig. 15). Disconnect vapor and brake booster hoses.

(14) Disconnect knock sensor electrical connector (Fig. 16) and disconnect wiring harness from tab located on the intake manifold.

(15) Disconnect wiring at starter.

(16) Remove transmission to throttle body support bracket fasteners at the throttle body and loosen the fastener at the transmission end.

(17) Remove throttle body.

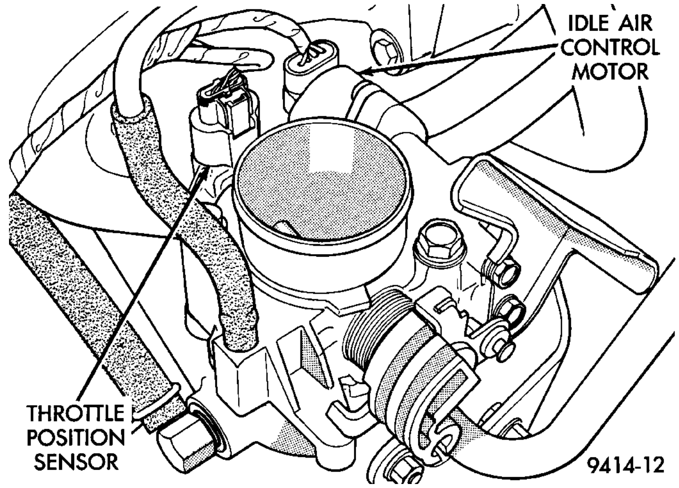


Fig. 14 Idle Air Control (IAC) Motor and Throttle Position Sensor (TPS) Wiring Connectors and Vacuum Hose Connection

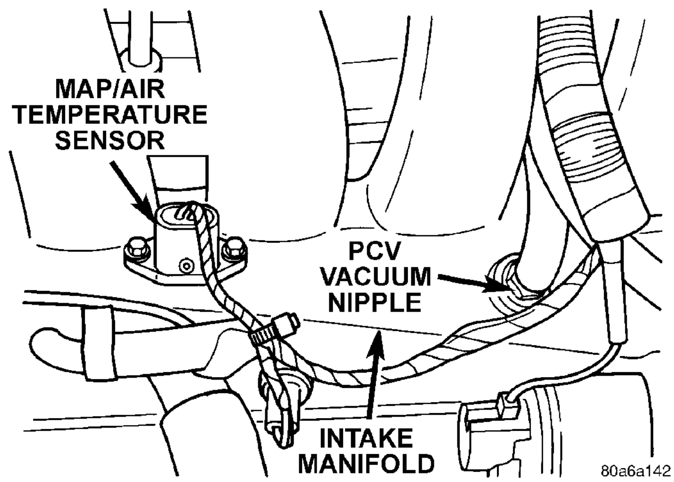


Fig. 15 Intake Manifold Electrical and Vacuum Hose Connections

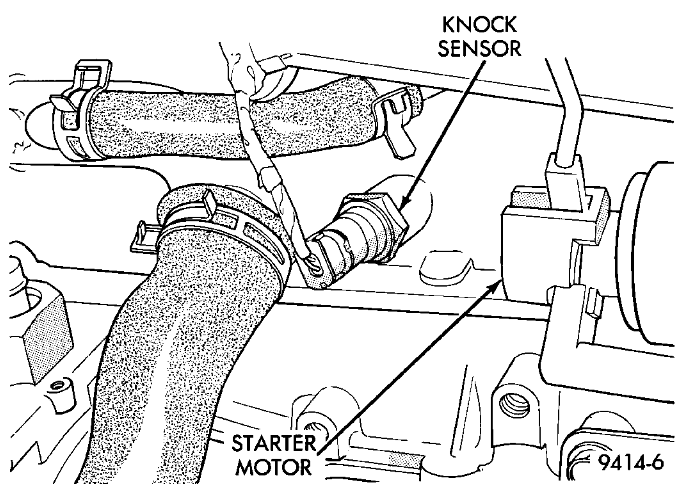


Fig. 16 Knock Sensor

REMOVAL AND INSTALLATION (Continued)

(18) Remove EGR tube bolts at the valve and at the intake manifold (Fig. 17). Remove tube from engine.

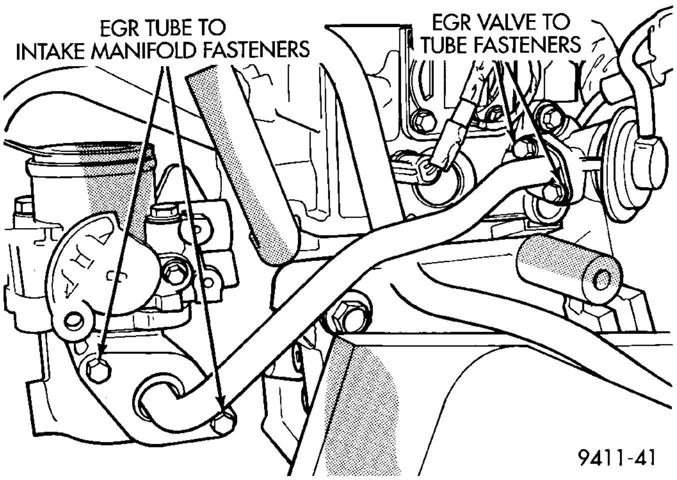


Fig. 17 EGR Tube Assembly

(19) Remove the intake manifold to inlet water tube support fastener (Fig. 18).

(20) Remove 10 intake manifold screw and washer. Discard the fasteners. Remove intake manifold.

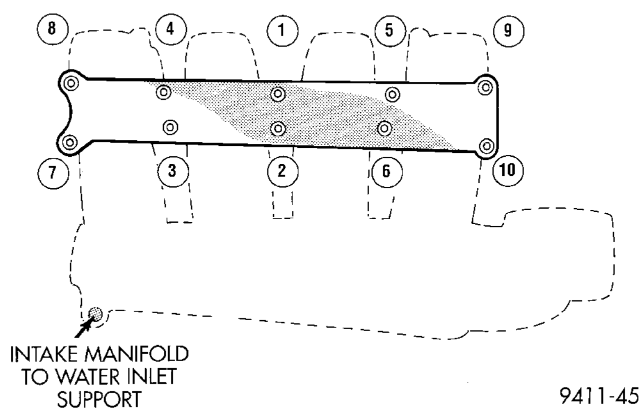


Fig. 18 Intake Manifold Tightening Sequence

INSTALLATION

Before installing manifold. Clean all mating surfaces. Replace all seals, with new seals. All intake manifold fasteners and washers are to be discarded and **NEW** fasteners and washers are to be used.

(1) Install intake manifold onto cylinder head and tighten fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 18).

(2) Install intake manifold to water inlet support fastener (Fig. 18) tighten to 12 N·m (105 in. lbs.).

(3) Remove covering from fuel injector holes and insure the holes are clean. Install fuel rail assembly to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(4) Connect PCV and brake booster hoses.

(5) Inspect quick connect fittings for damage, replace if necessary Refer to Group 14, Fuel System for procedure. Lube tube with clean 30w engine oil, Connect fuel supply hose to fuel rail assembly. Check connection by pulling on connector to insure it locked into position.

(6) Install throttle body. Tighten fastener to 22 N·m (200 in. lbs.). Install transmission to throttle body support bracket and tighten to 11.9 N·m (105 in. lbs.) at the throttle body first. Next tighten the bracket at the transmission.

(7) Connect Manifold Absolute Pressure/Intake Air Temperature Sensor (TMAP) wiring connector.

(8) Connect knock sensor connector, and wiring at starter. Connect wiring harness to intake manifold tab.

(9) Connect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors.

(10) Connect vacuum hoses to throttle body.

(11) Install accelerator, kickdown and speed control cables to their bracket and connect them to the throttle lever. Refer to Group 14, Fuel System Throttle Body Installation for procedure.

(12) Loose assemble the EGR tube onto valve and intake manifold finger tight. Tighten tube fasteners at the EGR valve first to 11 N·m (95 in. lbs.) then, tighten the intake manifold side fasteners to 11 N·m (95 in. lbs.).

(13) Install clean air duct to air filter housing. Tighten clamp to 3 N·m (30 in. lbs.).

(14) Connect negative battery cable.

(15) Install fresh air duct to air cleaner and tighten wing nut.

(16) With the DRB scan tool use ASD Fuel System Test to pressurize system to check for leaks.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

INTAKE MANIFOLD—DUAL OVERHEAD CAM ENGINE (DOHC)

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap.

REMOVAL AND INSTALLATION (Continued)

(3) Remove fresh air inlet duct (Fig. 21). Remove wing nut on intake.

(4) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 19).

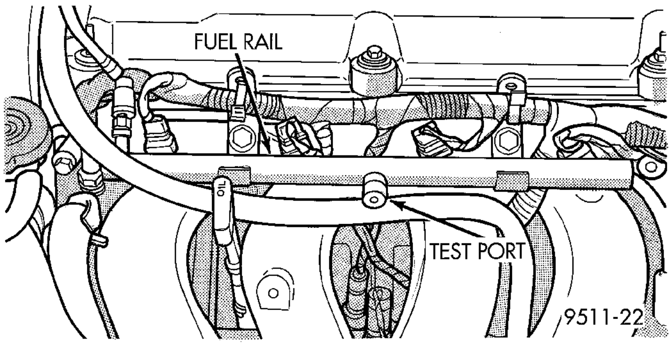


Fig. 19 Fuel Pressure Test Port

(5) 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 to the fuel pressure test port (Fig. 20). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

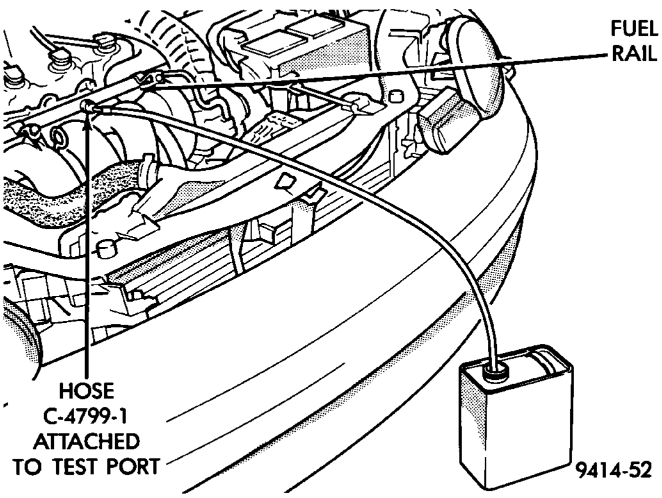


Fig. 20 Releasing Fuel Pressure—Typical

(6) Disconnect the fuel supply line-connect at the fuel tube assembly.

(7) Remove clean air inlet duct.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

(8) Disconnect the coolant temperature sensor (Fig. 22).

(9) Remove fuel rail assembly attaching screws and remove fuel rail assembly from engine. Cover injector holes with suitable covering.

CAUTION: Do not set fuel injectors on their tips, damage may occur to the injectors

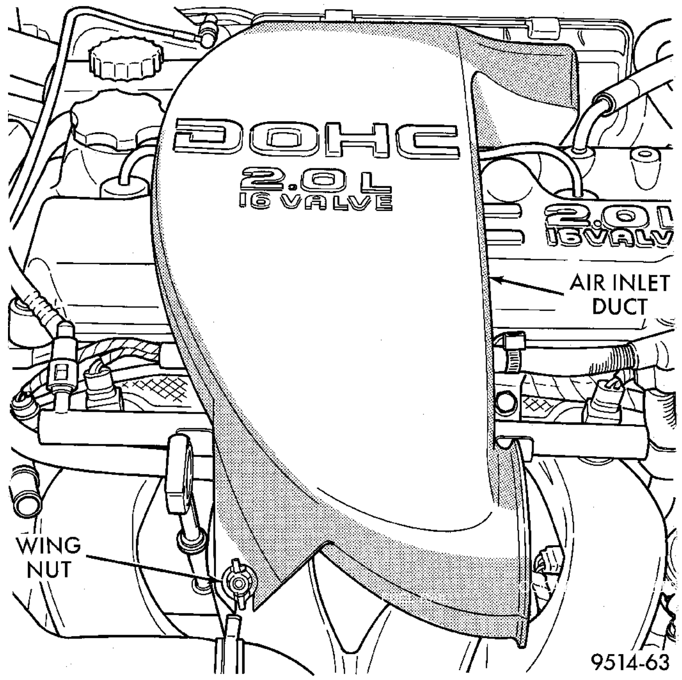


Fig. 21 Fresh Air Inlet Duct

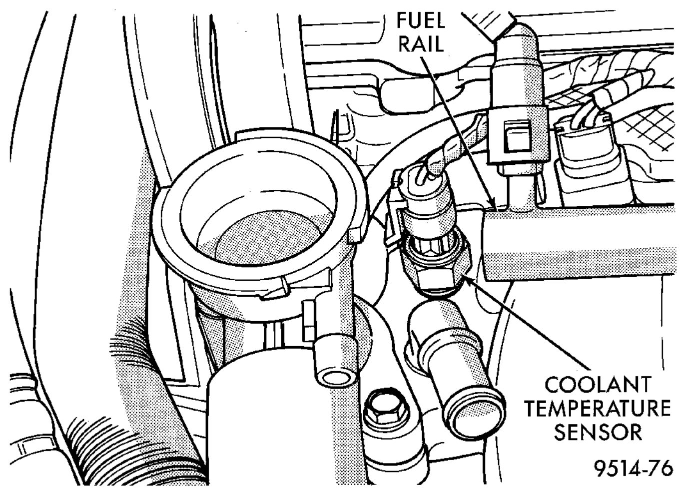


Fig. 22 Engine Coolant Temperature Sensor

(10) Remove accelerator, kickdown and speed control cables from throttle lever and bracket. Refer to Group 14, Fuel System Throttle Body Removal for procedures.

(11) Remove throttle body.

(12) Disconnect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors (Fig. 23).

(13) Disconnect vacuum hoses from throttle body.

(14) Disconnect Manifold Absolute Pressure/Intake Air Temperature sensor (TMAP) electrical connector. Disconnect vapor and brake booster hoses (Fig. 24).

(15) Disconnect knock sensor electrical connector and disconnect wiring harness from tab located on the intake manifold (Fig. 25).

REMOVAL AND INSTALLATION (Continued)

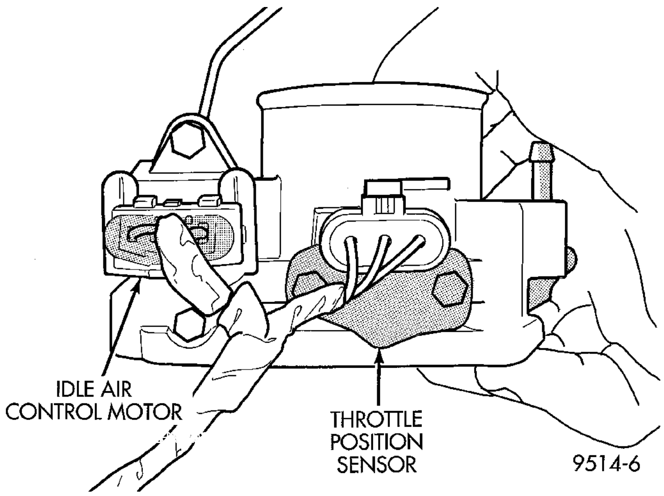


Fig. 23 Idle Air Control (IAC) Motor and Throttle Position Sensor (TPS) Wiring Connectors

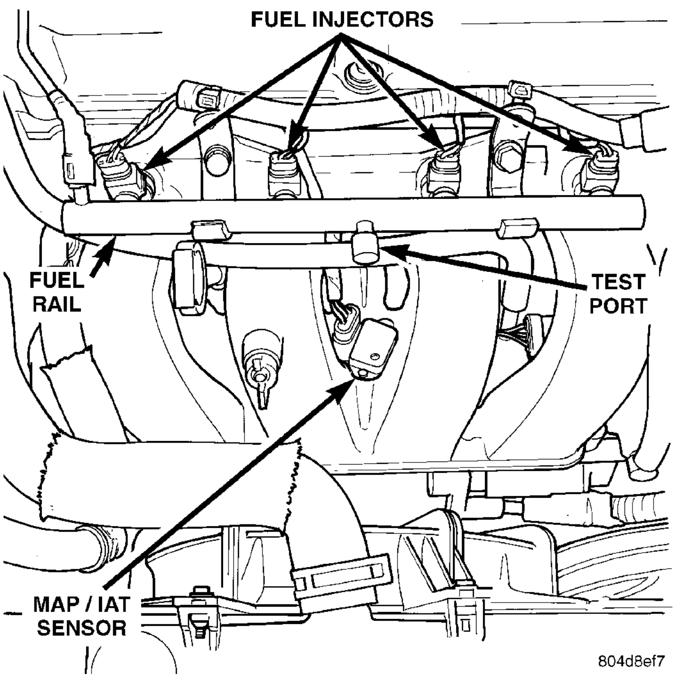


Fig. 24 Manifold Absolute Pressure/Intake Air Temperature Sensor (TMAP) Electrical Connector

(16) Disconnect wiring from starter.

(17) Remove EGR tube bolts at the valve and at the intake manifold (Fig. 26). Remove tube from engine.

(18) Remove intake manifold fastener. Remove intake manifold.

INSTALLATION

Before installing manifold. Clean all mating surfaces. Replace all gaskets, with new.

(1) Install intake manifold onto cylinder head and tighten fasteners to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 27).

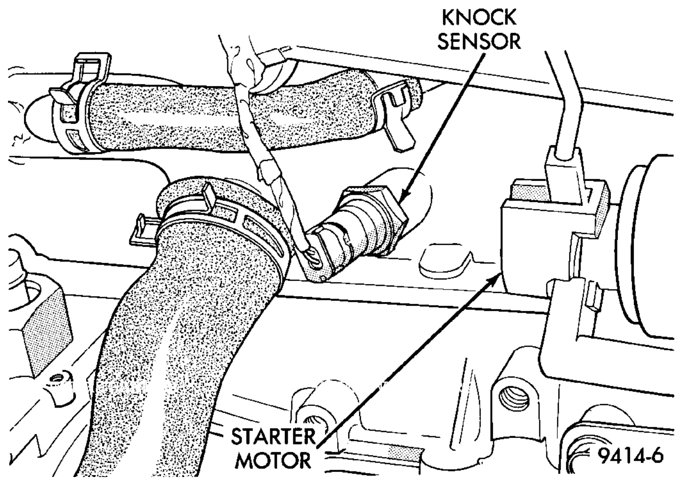


Fig. 25 Knock Sensor Electrical

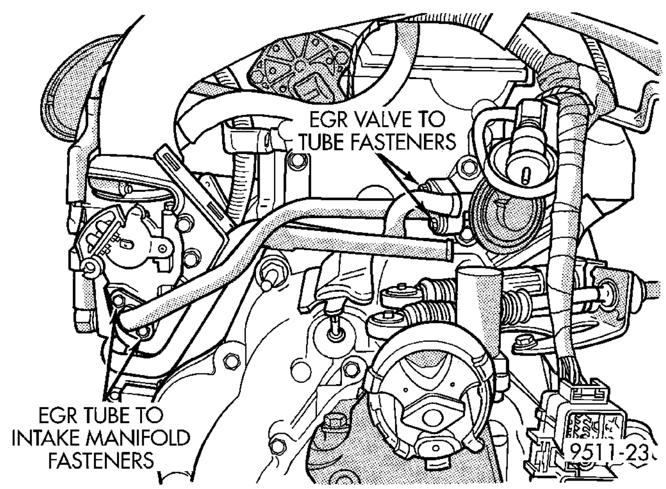


Fig. 26 EGR Tube Assembly

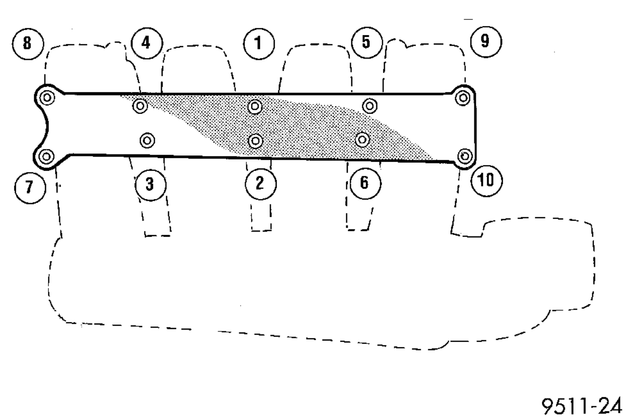


Fig. 27 Intake Manifold Tightening Sequence

(2) Remove covering from fuel injector holes and insure the holes are clean. Install fuel rail assembly to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(3) Connect PCV and brake booster hoses.

REMOVAL AND INSTALLATION (Continued)

(4) Inspect quick connect fittings for damage, replace if necessary Refer to Group 14, Fuel System for procedure. Lube tube with clean 30w engine oil, Connect fuel supply hose to fuel rail assembly. Check connection by pulling on connector to insure it locked into position.

(5) Install throttle body. Tighten fastener to 22 N·m (200 in. lbs.).

(6) Connect Manifold Absolute Pressure/Intake Air Temperature Sensor (TMAP) wiring connector.

(7) Connect knock sensor connector and starter wires. Connect wiring harness to intake manifold tab.

(8) Connect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors.

(9) Connect vacuum hoses to throttle body.

(10) Install accelerator, kickdown and speed control cables to their bracket and connect them to the throttle lever. Refer to Group 14, Fuel System Throttle Body Installation for procedure.

(11) Loose assemble the EGR tube onto valve and intake manifold finger tight. Tighten tube fasteners at the EGR valve first to 11 N·m (95 in. lbs.) then, tighten the intake manifold side fasteners to 11 N·m (95 in. lbs.).

(12) Install clean air duct.

(13) Install fresh air duct to air filter housing. Tighten clamp to 3 N·m (25 in. lbs.).

(14) Connect negative battery cable.

(15) With the DRB scan tool use ASD Fuel System Test to pressurize system to check for leaks.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

EXHAUST MANIFOLD

REMOVAL

(1) Remove air cleaner assembly and bracket.

(2) Remove exhaust manifold heat shield (Fig. 28).

(3) Disconnect upstream heated oxygen sensor connector.

(4) Remove exhaust pipe from manifold.

(5) Remove 8 exhaust manifold retaining fasteners and remove exhaust manifold (Fig. 29).

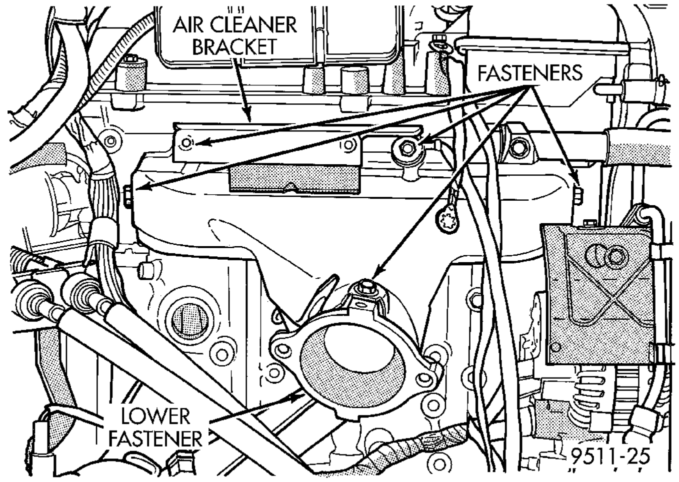


Fig. 28 Exhaust Manifold Heat Shield

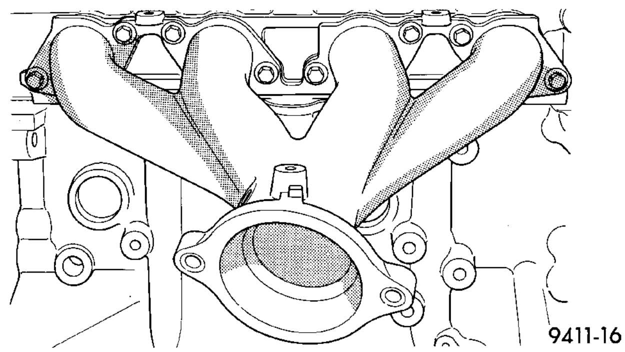


Fig. 29 Exhaust Manifold

INSTALLATION

NOTE: Discard gasket and clean all gasket surfaces of manifolds and cylinder head.

(1) Set exhaust manifold and gasket in place. Apply Loctite 271 or equivalent to fasteners and tighten to 23 N·m (200 in. lbs.) starting at center and progressing outward in both directions. Repeat this procedure until all fasteners are at specified torque.

(2) Install exhaust manifold heat shield.

(3) Connect upstream heated oxygen sensor connector.

(4) Install air cleaner bracket and assembly.

(5) Attach exhaust pipe and tighten fasteners to 28 N·m (250 in. lbs.)

CLEANING AND INSPECTION

INTAKE MANIFOLD SOHC

INSPECT AND CLEAN

Check for:

• Inspect manifold for cracks or distortions.

• Check for torn or missing O-rings at the mating surface of the manifold (Fig. 30).

INTAKE MANIFOLD DOHC

INSPECT AND CLEAN

Check for:

• Inspect manifold for cracks or distortions.

CLEANING AND INSPECTION (Continued)

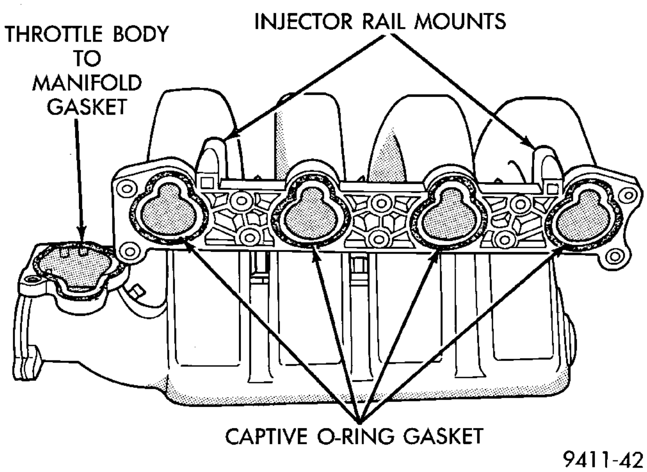


Fig. 30 Intake Manifold O-Rings

- Check for torn gasket at the mating surface of the manifold.

EXHAUST MANIFOLD

CLEAN AND INSPECT

(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.

SPECIFICATIONS

TORQUE CHART

EGR Tube Attaching
Bolts . . . . 11 N·m (95 in. lbs.)
Exhaust Manifold to Exhaust Pipe
Nuts . . . . 27 N·m (20 ft. lbs.)
Exhaust Manifold Mounting
Bolts . . . . 23 N·m (200 in. lbs.)
Intake Manifold Mounting
Bolts SOHC . . . . 12 N·m (105 in. lbs.)
Bolts DOHC . . . . 28 N·m (250 in. lbs.)
Heat Shield Mounting (Body)
Bolts . . . . 4 N·m (35 in. lbs.)
Exhaust System Band Clamps (Torca)
Fastener . . . . 75 N·m (55 ft. lbs.)
Exhaust Manifold Heat Shield
Bolts . . . . 23 N·m (200 in. lbs.)

FRAME AND BUMPERS

CONTENTS

BUMPERS

INDEX

REMOVAL AND INSTALLATION

FRONT BUMPER FASCIA

REMOVAL

(1) Remove nuts holding front bumper fascia bracket to bottom of fender forward of front wheels.

(2) Remove screws holding front fascia to inner wheelhouse.

(3) Remove bolts holding fascia to bumper reinforcement forward of radiator (Fig. 1).

(4) Remove bolts holding fascia to bottom of bumper reinforcement.

(5) Separate fascia from vehicle.

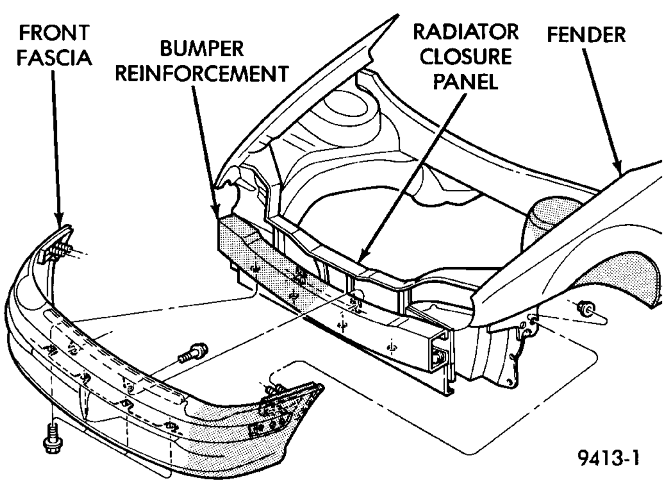


Fig. 1 Front Bumper Fascia

INSTALLATION

(1) Position fascia on vehicle.

(2) Install bolts holding fascia to bottom of bumper reinforcement.

(3) Install bolts holding fascia to bumper reinforcement forward of radiator (Fig. 1).

(4) Install screws holding front fascia to inner wheelhouse.

(5) Install radiator grille, refer to Group 23, Body for proper procedures.

FRONT BUMPER REINFORCEMENT

REMOVAL

(1) Remove front fascia.

(2) Support bumper reinforcement on a suitable lifting device.

(3) Remove nuts holding reinforcement to radiator closure panel (Fig. 2).

(4) Separate bumper reinforcement from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR BUMPER FASCIA

REMOVAL

(1) Release trunk lock and open trunk lid.

(2) Remove bolts holding fascia to tail closure panel.

(3) Remove push–in fasteners holding fascia to bottom of rear bumper reinforcement (Fig. 3).

REMOVAL AND INSTALLATION (Continued)

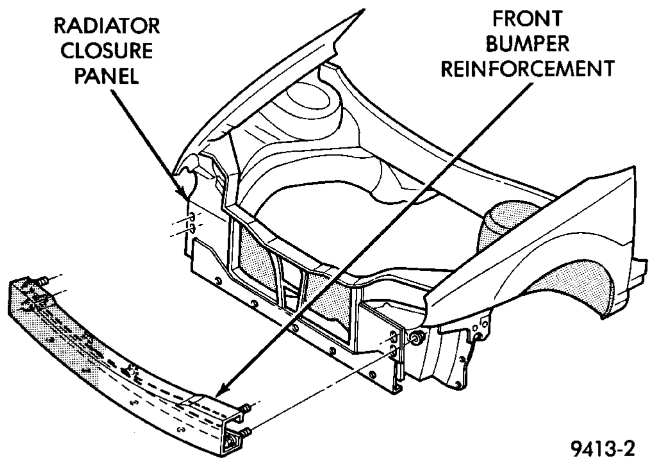


Fig. 2 Front Bumper Reinforcement

(4) Remove bolts holding fascia bracket to lower quarter panels.

(5) Separate fascia from vehicle.

INSTALLATION

(1) Position fascia on vehicle.

(2) Install bolts holding fascia bracket to lower quarter panels.

(3) Install push–in fasteners holding fascia to bottom of rear bumper reinforcement (Fig. 3).

(4) Install bolts holding fascia to tail closure panel.

REAR BUMPER REINFORCEMENT

REMOVAL

(1) Remove rear fascia.

(2) Support bumper reinforcement on a suitable lifting device.

(3) Remove nuts holding reinforcement to rear closure panel (Fig. 4).

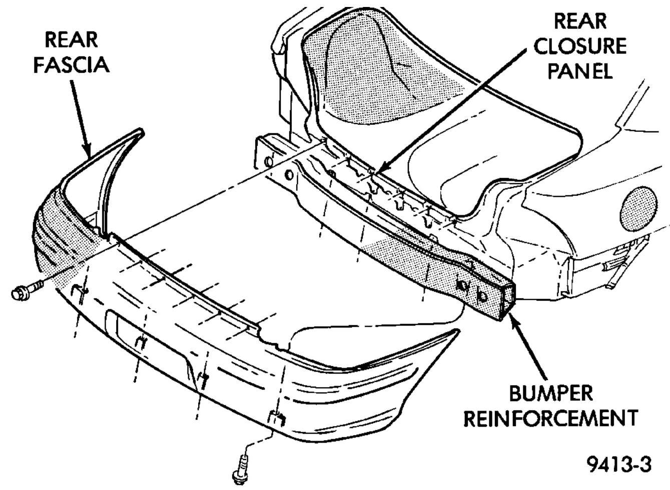


Fig. 3 Rear Bumper Fascia

(4) Separate bumper reinforcement from vehicle.

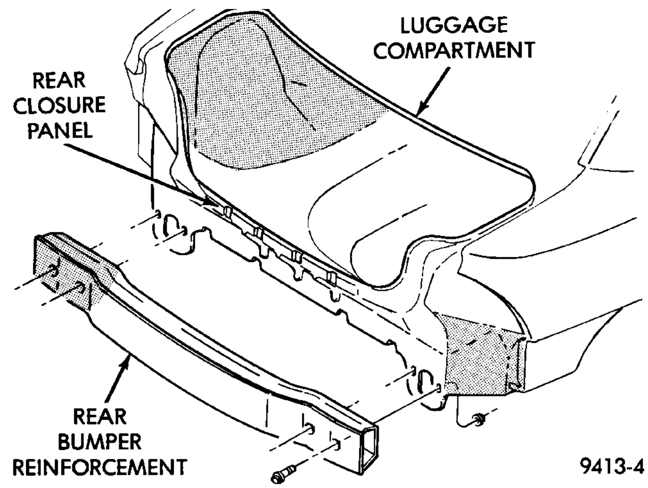


Fig. 4 Rear Bumper Reinforcement

INSTALLATION

Reverse the preceding operation.

FRAMES

INDEX

REMOVAL AND INSTALLATION

FRONT SUSPENSION CROSSMEMBER

WARNING: IF SUSPENSION CROSSMEMBER IS REPLACED DUE TO COLLISION DAMAGE, INSPECT THE STEERING COLUMN TO STEERING GEAR COUPLING FOR DAMAGE. REFER TO GROUP 19, STEERING FOR INSTRUCTIONS.

Before removing front suspension crossmember, index mark location of crossmember on frame to aid installation .

The front suspension crossmember must be properly installed to achieve design camber, caster settings and wheel stagger. The crossmember can be installed out of position on the frame rails due to its design. Bolts and cage nuts hold the rear of the crossmember to the frame torque boxes. Bolts and J-nuts hold the front of the crossmember to the frame rails. No designed in locating device is used to position the crossmember in the vehicle. Before removing the crossmember mark the frame torque box around the rear mounting location to aid installation. A crossmember that is removed during service must be installed in the same position from which it was removed. To verify that crossmember is in the proper position, refer to the dimensions provided. Front end dimensions are gauged from the principal locating point (PLP) holes located under the frame torque boxes rearward of the front wheels. After removal and installation of the crossmember is performed, verify that front suspension alignment is within specifications. If camber, caster settings and wheel stagger is not within specifications, loosen and reposition crossmember to bring suspension within specifications. Refer to Group 2, Front Suspension and Driveshaft for additional information.

REMOVAL

(1) Hoist and support vehicle on safety stands.
(2) Using a suitable marking device, mark the outline of the suspension crossmember on the frame torque box around the rear mounting location.
(3) Remove front wheels from vehicle.
(4) Remove pinch bolts holding front ball joints to spindles.
(5) Separate ball joints from spindles.
(6) Position a suitable lifting device under the crossmember.
(7) Remove bolts holding suspension crossmember to frame rails above lower control arms (Fig. 1).
(8) Remove bolts holding crossmember to frame torque boxes and allow front of crossmember to swing down.
(9) Remove bolts holding steering gear to crossmember.
(10) Separate steering gear from crossmember.
(11) Tie steering gear to a suitable structure above to support gear after crossmember is removed.
(12) Separate front suspension crossmember from vehicle.

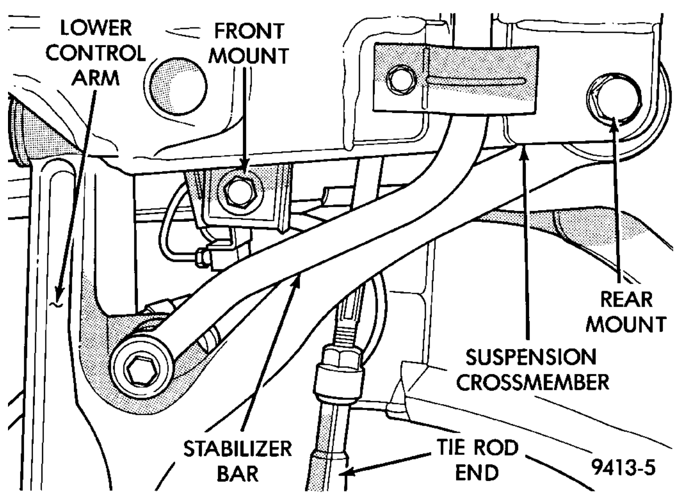


Fig. 1 Front Suspension Crossmember

INSTALLATION

If a new crossmember is to be installed, transfer stabilizer bar and lower control arms from original crossmember. Refer to Group 2, Suspension and Driveshaft for proper procedures.
(1) Place front suspension crossmember in position on vehicle.
(2) Remove tie device supporting steering gear.

REMOVAL AND INSTALLATION (Continued)

(3) Place steering gear in position on crossmember.

(4) Install bolts to hold steering gear to crossmember.

(5) Position lifting device under the crossmember.

(6) Lift crossmember to frame rails.

(7) Engage bolts to hold crossmember rear mounts into cage nuts in the frame torque boxes. Do not tighten bolts.

(8) Install bolts to hold crossmember to frame rails above lower control arms.

(9) Lower and remove lifting device.

(10) Align crossmember to index marks. Verify that crossmember is at the specified dimensions from the PLPs (Fig. 2).

(11) Tighten bolts to hold suspension crossmember to frame rails and torque boxes.

(12) Insert ball joints into spindles.

(13) Install pinch bolts to hold front ball joints to spindles.

(14) Install front wheels on vehicle.

(15) Lower vehicle and verify front suspension alignment. If camber, caster settings and wheel stagger is not within specifications, loosen and reposition crossmember to bring suspension within specifications. Refer to Group 2, Front Suspension and Driveshaft for additional information.

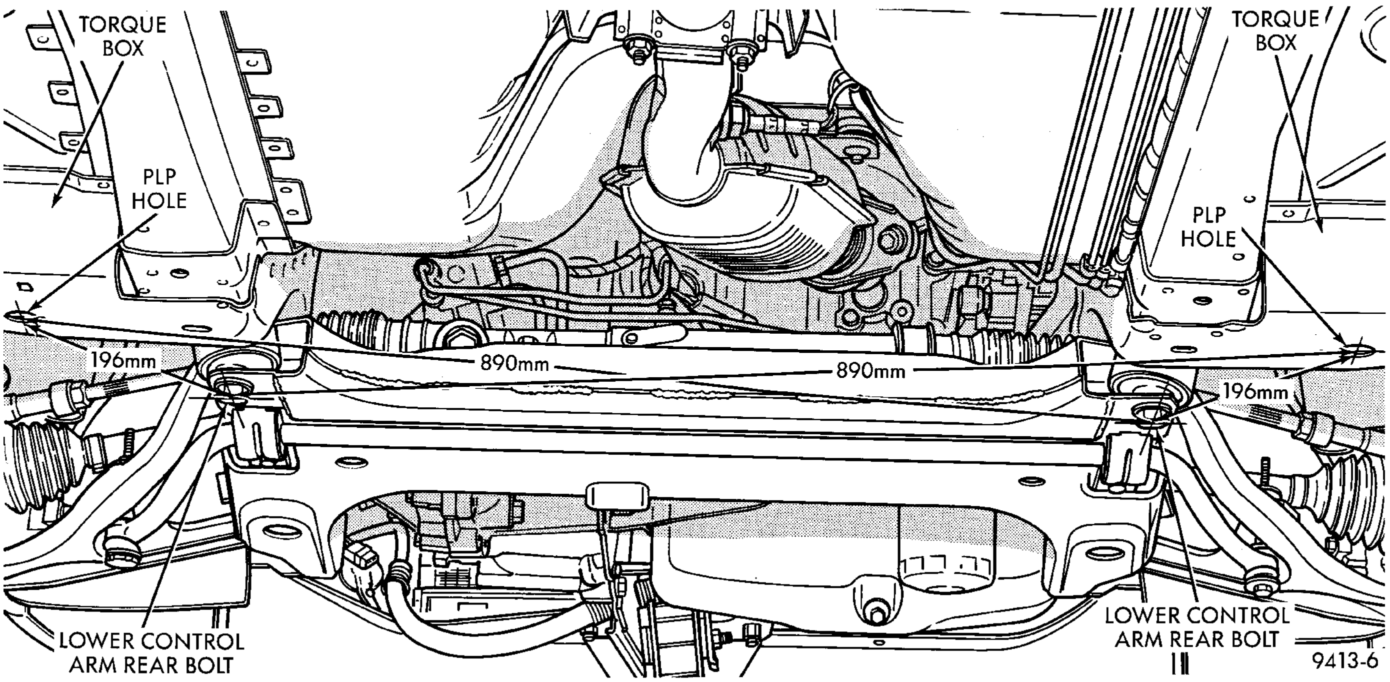


Fig. 2 Forward Frame and Suspension Crossmember

SPECIFICATIONS

STRUCTURAL DIMENSIONS

Structural dimensions are listed in metric measurements. All dimensions are from center to center of Principal Locating Point (PLP), or from center to center of PLP and fastener location (Fig. 3), (Fig. 4), (Fig. 5), (Fig. 6), (Fig. 7), and (Fig. 8).

PT	MM	PT	MM
A.	150.0	E.	1184.0
B.	149.0	F.	973.0
C.	1299.0	G.	1305.0
D.	1028.0		

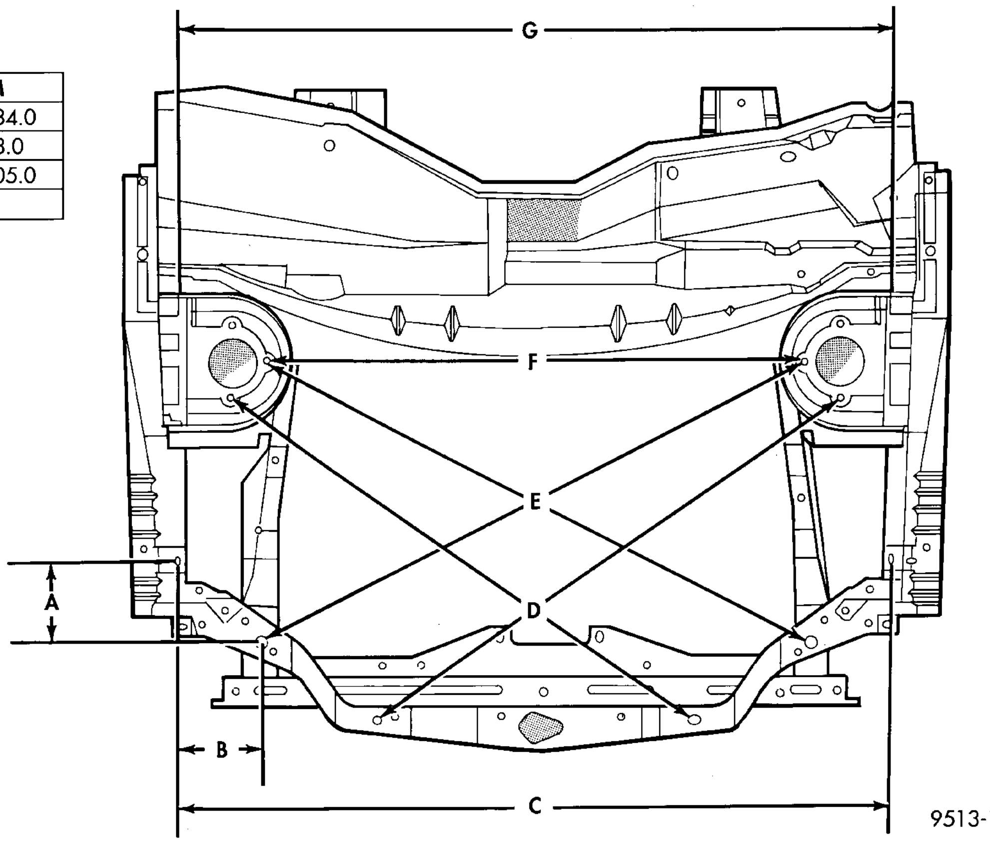


Fig. 3 Engine Compartment Top View

SPECIFICATIONS (Continued)

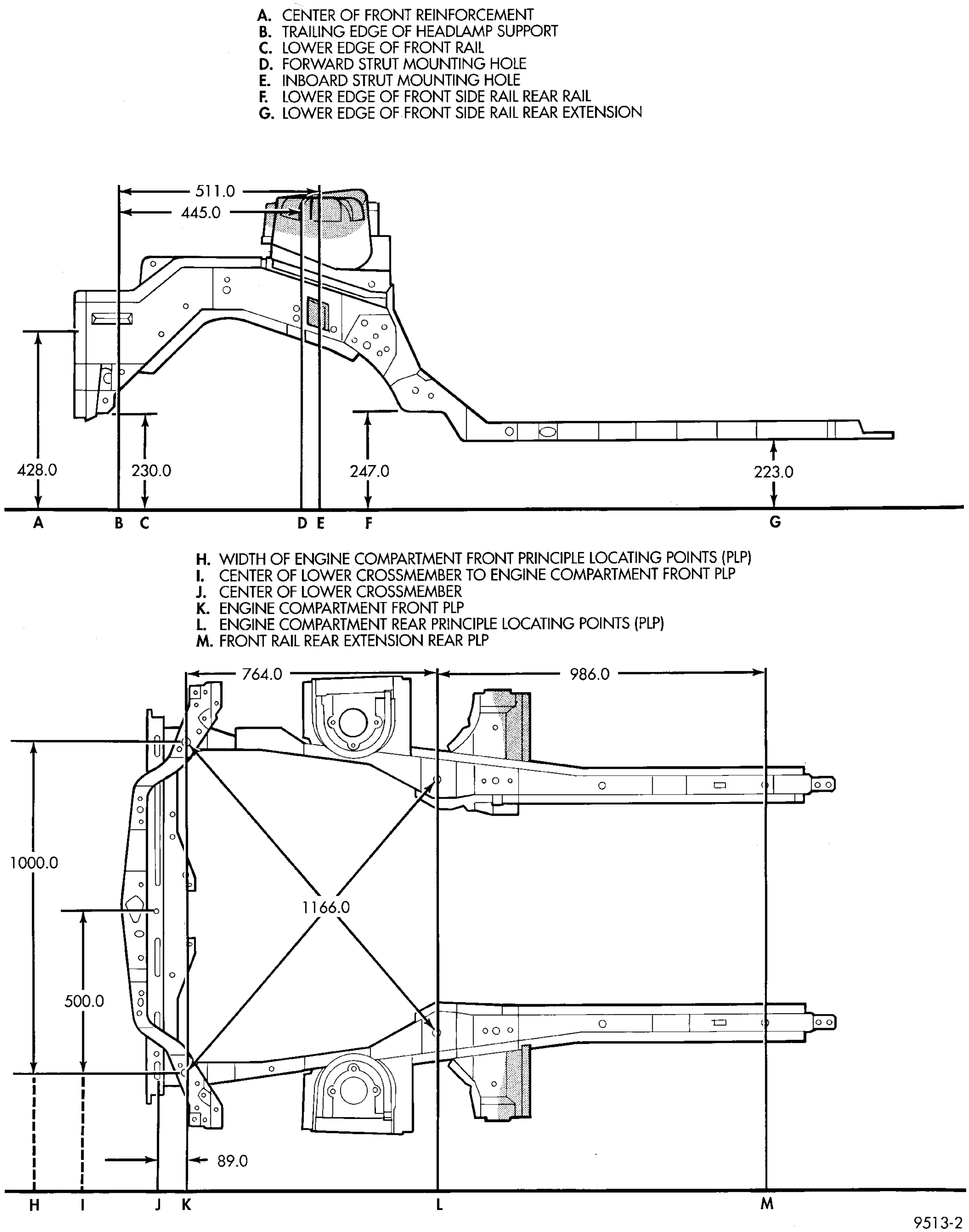


Fig. 4 Engine Compartment Side and Bottom View

SPECIFICATIONS (Continued)

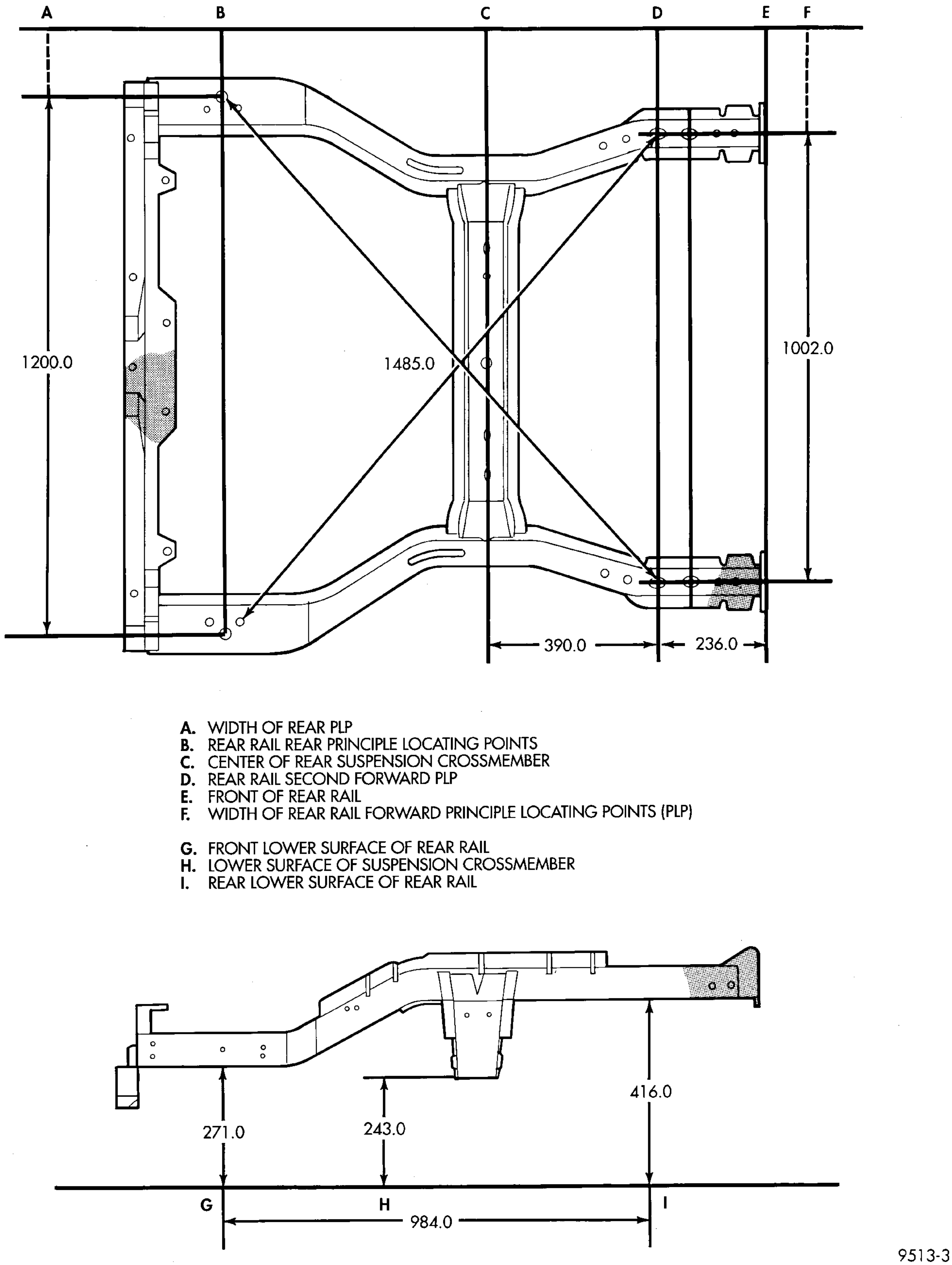


Fig. 5 Rear Frame Section Side and Bottom View

SPECIFICATIONS (Continued)

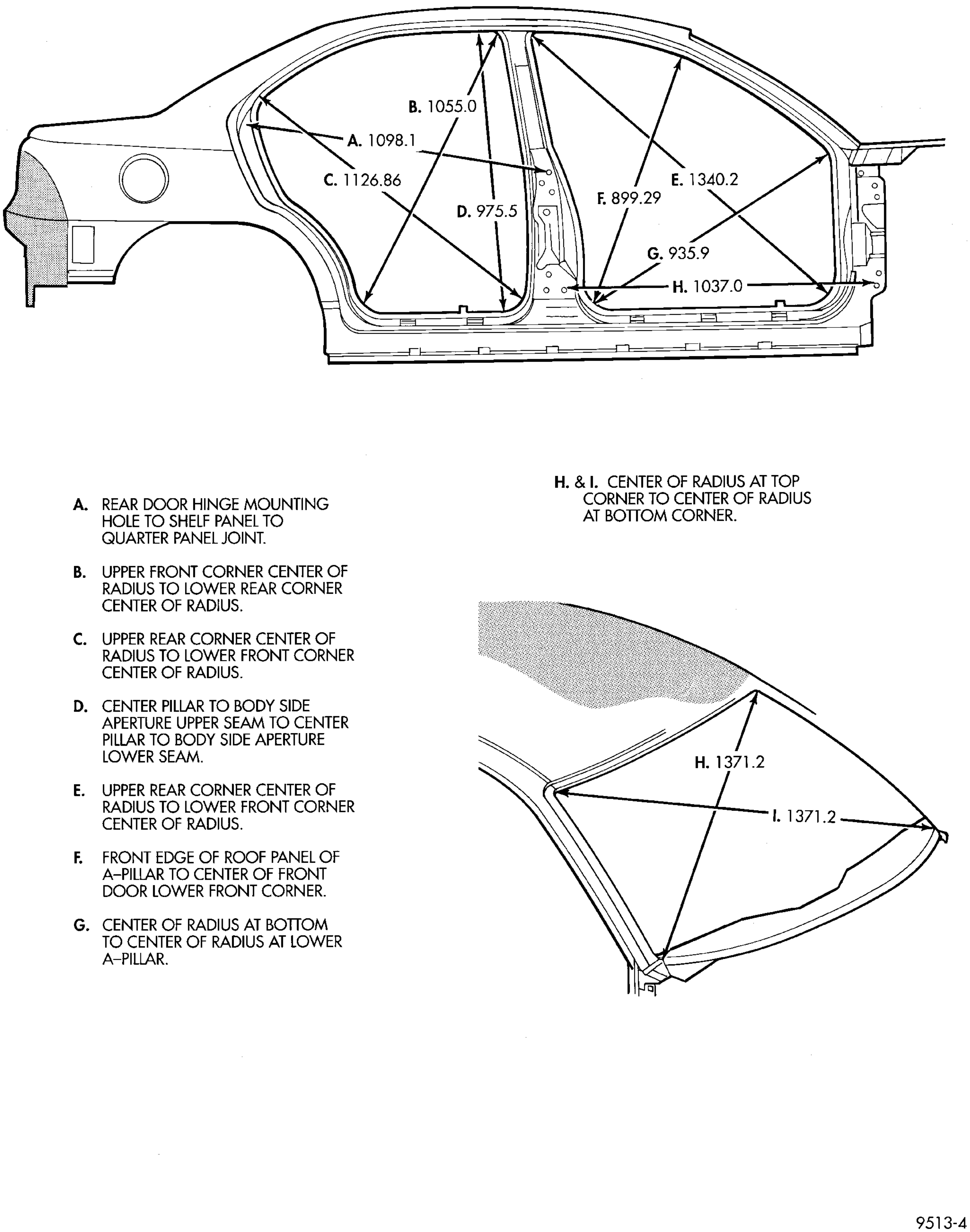


Fig. 6 Door and Windshield Openings—4 Door

SPECIFICATIONS (Continued)

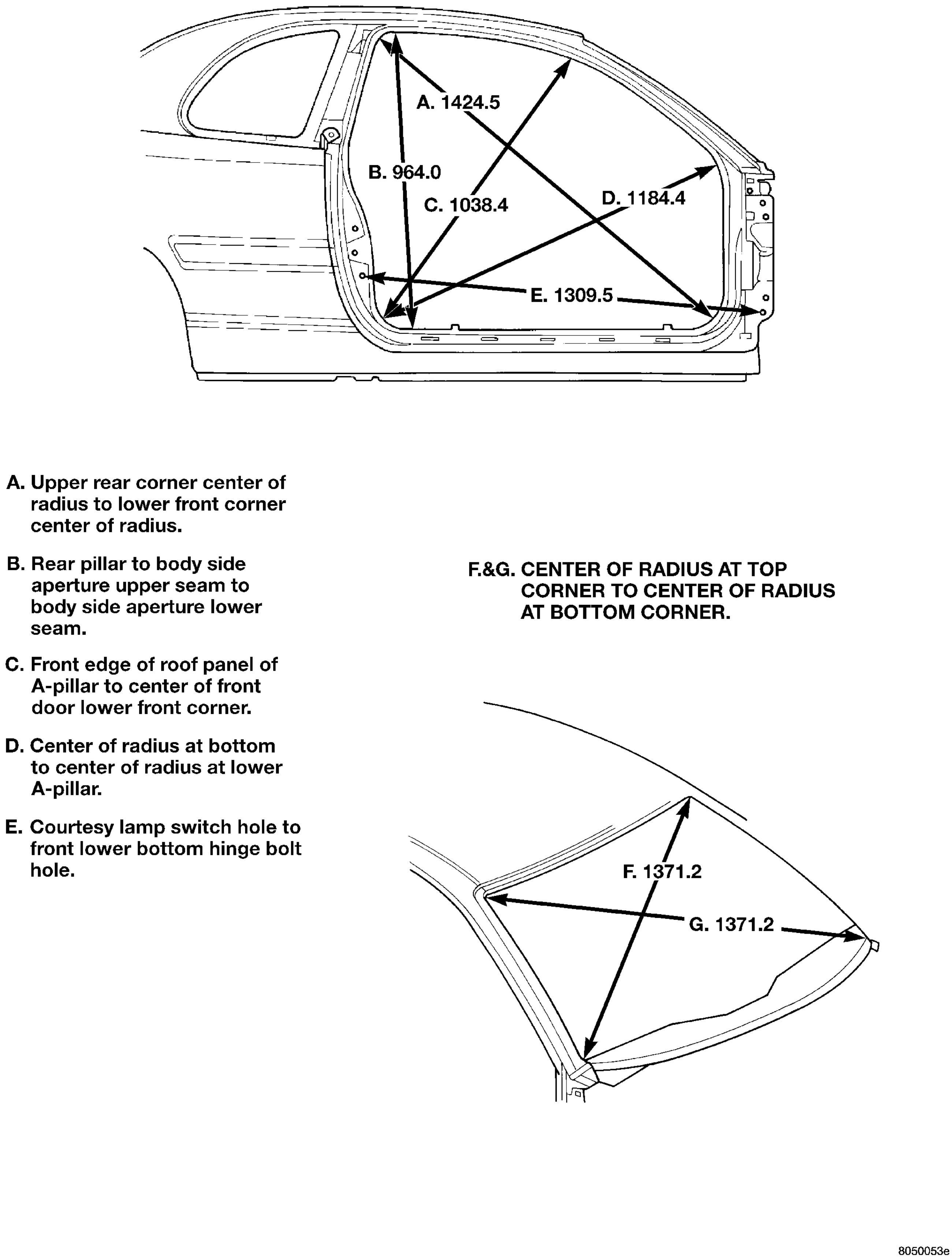


Fig. 7 Door and Windshield Openings—2 Door

SPECIFICATIONS (Continued)

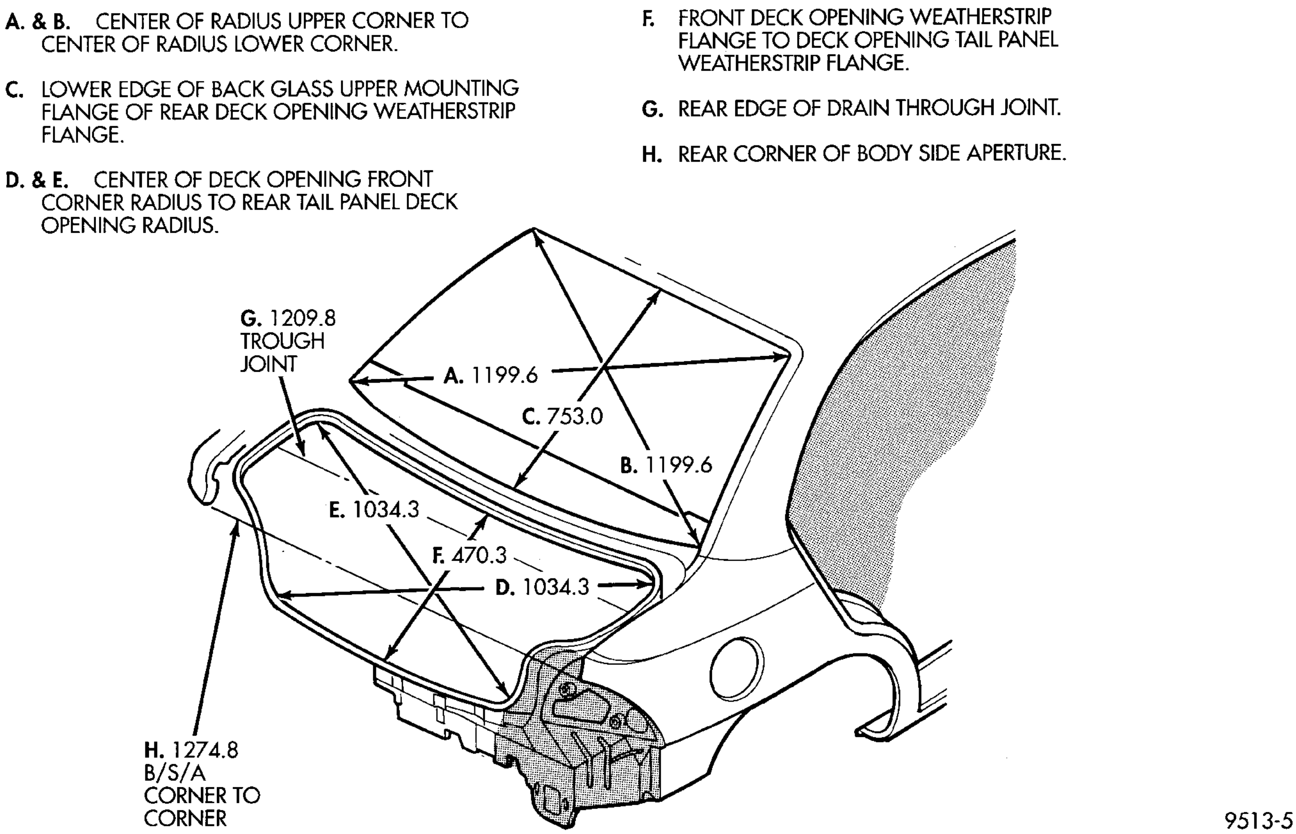


Fig. 8 Rear Window and Trunk Openings

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Front Bumper Reinforcement Nut. .	156 N·m (115 ft. lbs)
Rear Bumper Reinforcement Nut .	156 N·m (115 ft. lbs)
Front Crossmember To Body Mounting Bolts .	163 N·m (120 ft. lbs)

FUEL SYSTEM

CONTENTS

GENERAL INFORMATION

INDEX

GENERAL INFORMATION

INTRODUCTION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

The Evaporation Control System, is also considered part of the fuel system. The system reduces the emission of fuel vapor into the atmosphere.

The description and function of the Evaporation Control System is found in Group 25 of this manual.

FUEL REQUIREMENTS

Your vehicle was designed to meet all emission regulations and provide excellent fuel economy when using high quality unleaded gasoline.

Use unleaded gasolines having a minimum posted octane of 87.

If your vehicle develops occasional light spark knock (ping) at low engine speeds this is not harmful. However; continued heavy knock at high speeds can cause damage and should be reported to your dealer immediately. Engine damage as a result of heavy knock operation may not be covered by the new vehicle warranty.

In addition to using unleaded gasoline with the proper octane rating, those that contain detergents, corrosion and stability additives are recommended. Using gasolines that have these additives will help improve fuel economy, reduce emissions, and maintain vehicle performance.

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

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with materials that contain oxygen such as alcohol, MTBE (Methyl Tertiary Butyl Ether) and ETBE (Ethyl Tertiary Butyl Ether). Oxygenates are required in some areas of the country during winter months to reduce carbon monoxide emissions. The type and amount of oxygenate used in the blend is important.

The following are generally used in gasoline blends:

Ethanol - (Ethyl or Grain Alcohol) properly blended, is used as a mixture of 10 percent ethanol and 90 percent gasoline. Gasoline blended with ethanol may be used in your vehicle.

MTBE/ETBE - Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline and up to 15 percent MTBE. Gasoline and ETBE (Ethyl Tertiary Butyl Ether) are blends of gasoline and up to 17 percent ETBE. Gasoline blended with MTBE or ETBE may be used in your vehicle.

Methanol - Methanol (Methyl or Wood Alcohol) is used in a variety of concentrations blended with unleaded gasoline. You may encounter fuels containing 3 percent or more methanol along with other alcohols called cosolvents.

DO NOT USE GASOLINES CONTAINING METHANOL.

GENERAL INFORMATION (Continued)

Use of methanol/gasoline blends may result in starting and driveability problems and damage critical fuel system components.

Problems that are the result of using methanol/gasoline blends are not the responsibility of Chrysler Corporation and may not be covered by the vehicle warranty.

Reformulated Gasoline

Many areas of the country are requiring the use of cleaner-burning fuel referred to as **Reformulated Gasoline** . Reformulated gasolines are specially blended to reduce vehicle emissions and improve air quality.

Chrysler Corporation strongly supports the use of reformulated gasolines whenever available. Although your vehicle was designed to provide optimum performance and lowest emissions operating on high quality unleaded gasoline, it will perform equally well and produce even lower emissions when operating on reformulated gasoline.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain active solvents of similar ingredients that can be harmful to fuel system gasket and diaphragm materials.

FUEL DELIVERY SYSTEM

INDEX

DESCRIPTION AND OPERATION

FUEL DELIVERY SYSTEM

The fuel delivery system consists of: the electric fuel pump, fuel filter/fuel pressure regulator, fuel tubes/lines/hoses, fuel rail, fuel injectors, fuel tank, accelerator pedal and throttle cable.

A fuel return system is used on all models (all engines). Fuel is returned through the fuel pump module and back into the fuel tank through the fuel filter/fuel pressure regulator. A separate fuel return line from the engine to the tank is no longer used with any engine.

The fuel tank assembly consists of: the fuel tank, filler tube, fuel gauge sending unit/electric fuel pump module, a pressure relief/rollover valve and a pressure-vacuum filler cap.

Also to be considered part of the fuel system is the evaporation control system. This is designed to reduce the emission of fuel vapors into the atmosphere. The description and function of the Evaporative Control System is found in Group 25, Emission Control Systems.

FUEL PUMP MODULE

The fuel pump module is installed in the top of the fuel tank (Fig. 1). The fuel pump module contains the following:

- Electric fuel pump
- Fuel pump reservoir
- Inlet strainer
- Fuel filter/pressure regulator
- Fuel gauge sending unit
- Fuel supply line connection

The inlet strainer, fuel pressure regulator and fuel level sensor are the only serviceable items. If the fuel pump requires service, replace the fuel pump module.

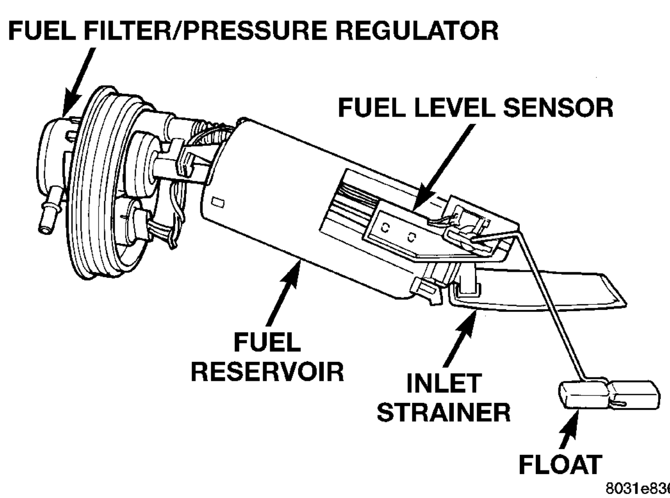


Fig. 1 Fuel Pump Module

DESCRIPTION AND OPERATION (Continued)

ELECTRIC FUEL PUMP

The electric fuel pump is located in and is part of the fuel pump module. It is a positive displacement, gerotor type, immersible pump with a permanent magnet electric motor. The fuel pump module is suspended in fuel in the fuel tank. The pump draws fuel through a strainer and pushes it through the motor to the outlet. The pump contains a check valves. The valve, in the pump outlet, maintains pump pressure during engine off conditions. The fuel pump relay provides voltage to the fuel pump.

The fuel pump has a maximum deadheaded pressure output of approximately 880 kPa (130 psi). The regulator adjusts fuel system pressure to approximately 338 kPa (49 psi).

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor (track). The resistor track is used to send electrical signals to the Powertrain Control Module (PCM) for fuel gauge operation and for OBD II emission requirements.

For fuel gauge operation: As fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the fuel gauge to read full. As fuel level decreases, the float and arm move down. This increases the sending unit resistance causing the fuel gauge to read empty.

After this fuel level signal is sent to the PCM, the PCM will transmit the data across the CCD bus circuits to the instrument panel. Here it is translated into the appropriate fuel gauge level reading.

For OBD II emission requirements: The voltage signal is sent from the resistor track to the PCM to indicate fuel level. The purpose of this feature is to prevent a false setting of misfire and fuel system monitor trouble codes. This is if the fuel level in the tank is less than approximately 15 percent of its rated capacity.

FUEL FILTER/FUEL PRESSURE REGULATOR

A combination fuel filter and fuel pressure regulator is used on all gas powered engines. It is located on the top of the fuel pump module. A separate frame mounted fuel filter is not used.

Fuel Pressure Regulator Operation: The pressure regulator is a mechanical device that is calibrated to maintain fuel system operating pressure of approximately 338 kPa (49 psi) at the fuel injectors.

It contains a diaphragm, calibrated springs and a fuel return valve. The internal fuel filter (Fig. 2) is also part of the assembly.

Fuel is supplied to the filter/regulator by the electric fuel pump through an opening tube at the bottom of filter/regulator.

The fuel pump module contains a check valve to maintain some fuel pressure when the engine is not operating. This will help to start the engine.

If fuel pressure at the pressure regulator exceeds approximately 49 psi, an internal diaphragm closes and excess fuel pressure is routed back into the tank through the pressure regulator. A separate fuel return line is not used with any gas powered engine.

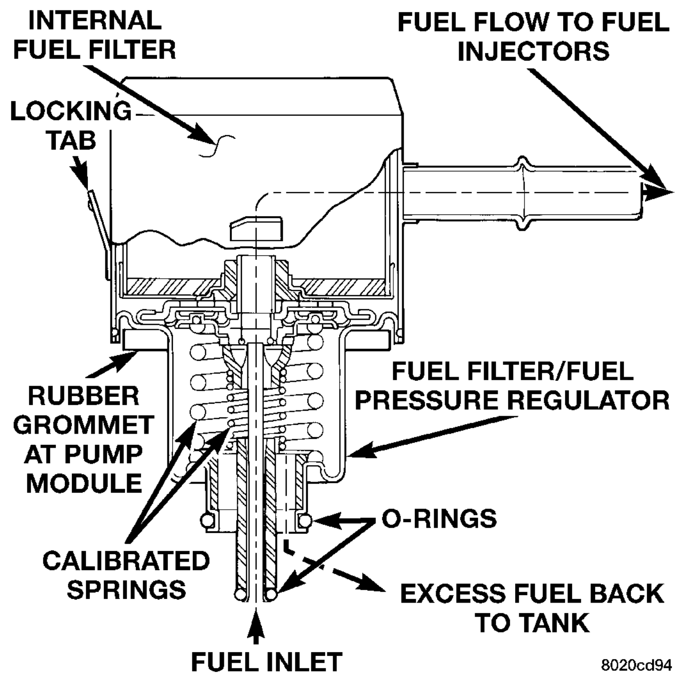


Fig. 2 Side View—Filter/Regulator

FUEL TANK

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

All models have a pressure relief/rollover valve mounted on the top of the fuel pump module.

An evaporative control system is used to reduce emissions of fuel vapors into atmosphere by evaporation and to reduce unburned hydrocarbons emitted by vehicle engine. When fuel evaporates from fuel tank, vapors pass through vent hoses or tubes to a charcoal canister. The vapors are temporarily held in the canister. When the engine is running, the vapors are drawn into intake manifold. Refer to Group 25, Emission Control System for additional information.

FUEL RAIL

The fuel rail supplies the necessary fuel to each individual fuel injector and is mounted to the intake manifold (Fig. 3). The fuel pressure regulator is no

DESCRIPTION AND OPERATION (Continued)

longer mounted to the fuel rail on any engine. It is now located on the fuel tank mounted fuel pump module. Refer to Fuel Filter/Fuel Pressure Regulator in the Fuel Delivery System section of this group for information. The fuel rail is not repairable.

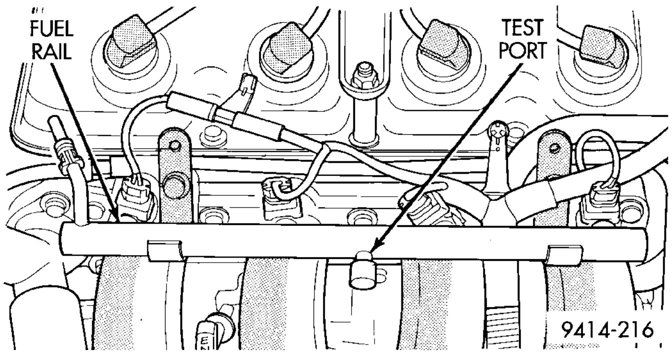


Fig. 3 Fuel Rail—Typical

FUEL INJECTORS

The fuel injectors are 12 ohm electrical solenoids (Fig. 4). 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.

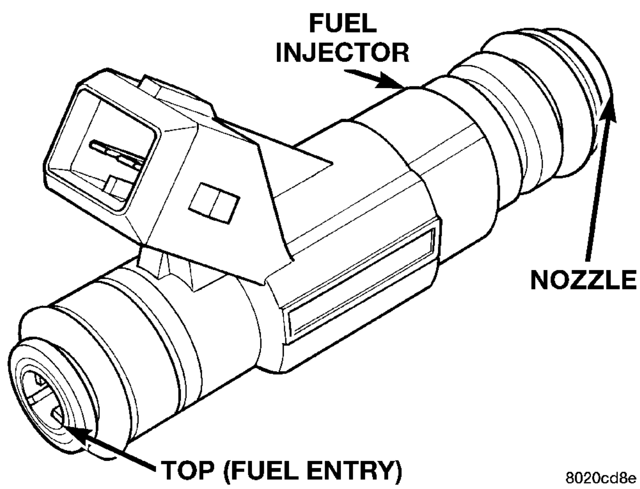


Fig. 4 Fuel Injector

The injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port (Fig. 5).

PRESSURE-VACUUM FILLER CAP

The loss of any fuel or vapor out of the filler neck is prevented by the use of a safety filler cap. The cap will release pressure only under significant pressure of 10.9 to 13.45 kPa (1.58 to 1.95 psi). The vacuum release for all gas caps is between 0.97 and 2.0 kPa (0.14 and 0.29 psi). The cap must be replaced by a similar unit if replacement is necessary.

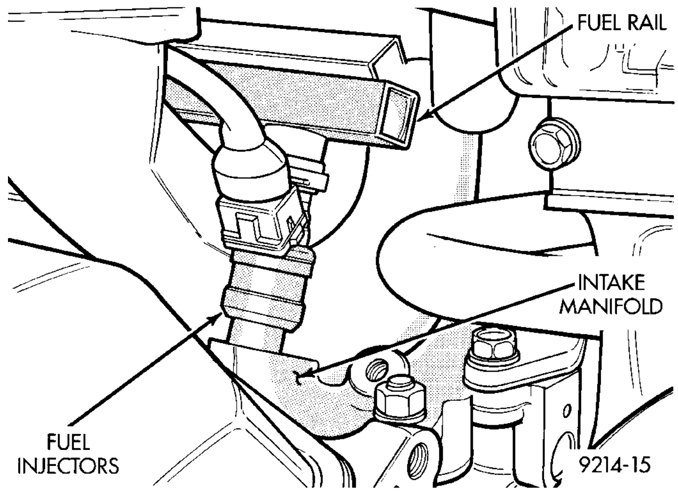


Fig. 5 Fuel Injector Location—Typical

WARNING: REMOVE FILLER CAP TO RELIEVE TANK PRESSURE BEFORE REMOVING OR REPAIRING FUEL SYSTEM COMPONENTS.

Fuel Tank Capacity

Vehicle	Liters	U.S.Gallons
PL	47	12.5

NOTE: Nominal refill capacities are shown. A variation may be observed from vehicle due to manufacturing tolerance and refill procedure.

QUICK-CONNECT FITTINGS

Different types of quick-connect fittings are used to attach various fuel system components. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Refer to the Removal/Installation section for more information.

CAUTION: The interior components (o-rings, spacers) of quick-connect fitting are not serviced separately. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

Fuel tubes connect fuel system components with plastic quick-connect fuel fittings. The fitting contains non-serviceable O-ring seals (Fig. 6).

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.

DESCRIPTION AND OPERATION (Continued)

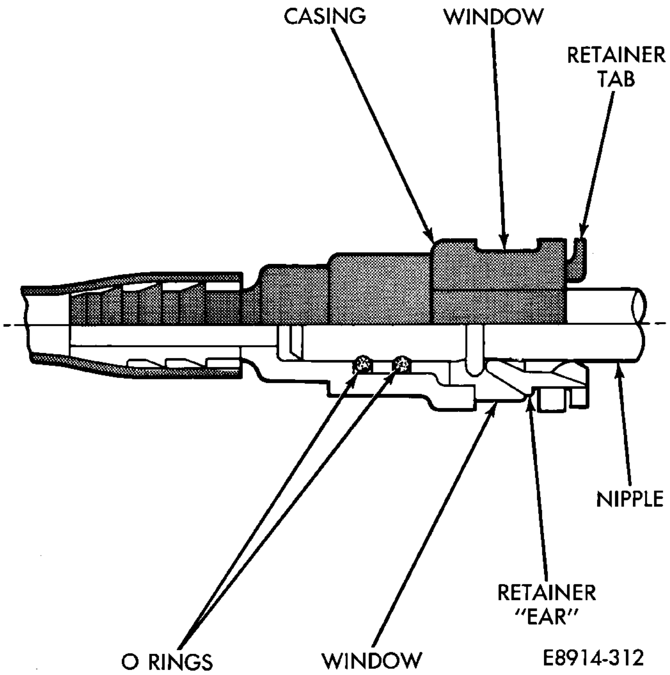


Fig. 6 Plastic Quick-Connect Fittings

The quick-connect fitting consists of the O-rings, retainer and casing (Fig. 6). When the fuel tube enters the fitting, the retainer locks the shoulder of the nipple in place and the O-rings seal the tube.

ROLLOVER VALVES

All PL vehicles have two rollover valves. One in the fuel filler tube and the other on the top of the fuel tank. The valves prevent fuel flow through the fuel tank vent valve hoses should the vehicle rollover.

DIAGNOSIS AND TESTING

FUEL PUMP PRESSURE TEST

The fuel system operates at approximately 338 kPa (49 psi). Check fuel system pressure at the test port on the fuel rail (Fig. 7).

(1) Remove cap from fuel pressure test port on fuel rail.

(2) Connect Fuel Pressure Gauge C-4799B to test port (Fig. 8).

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(3) Place the ignition key in the ON position. Using the DRB scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

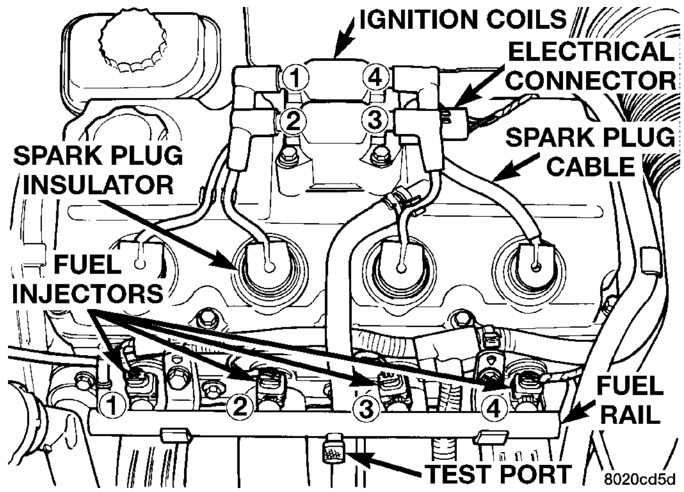


Fig. 7 Fuel Pressure Test Port—Typical

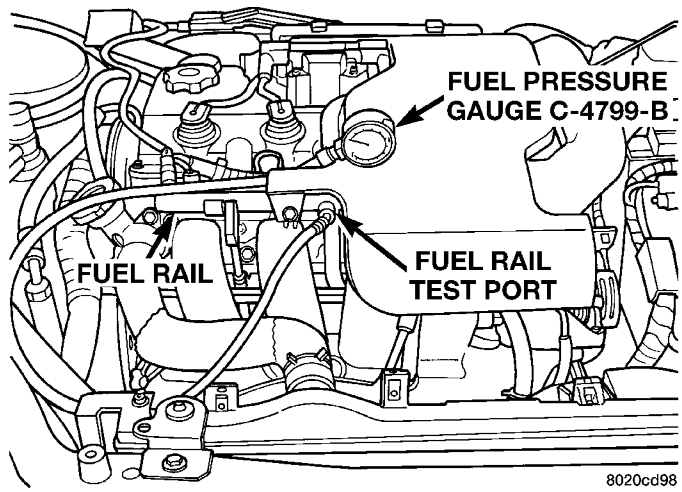


Fig. 8 Checking Fuel Pressure at Intake Manifold—Typical

- If the gauge reading equals 338 kPa (49 PSI) further testing is not required. If pressure is not correct, record the pressure.
- If fuel pressure is below specifications, refer to the Fuel Pressure Diagnosis Chart (Fig. 9).
- If fuel pressure is above specifications (54 psi or higher) check for a kinked or restricted fuel supply line. If the supply line is not kinked or restricted, replace the Fuel Filter/Pressure Regulator.

DIAGNOSIS AND TESTING (Continued)

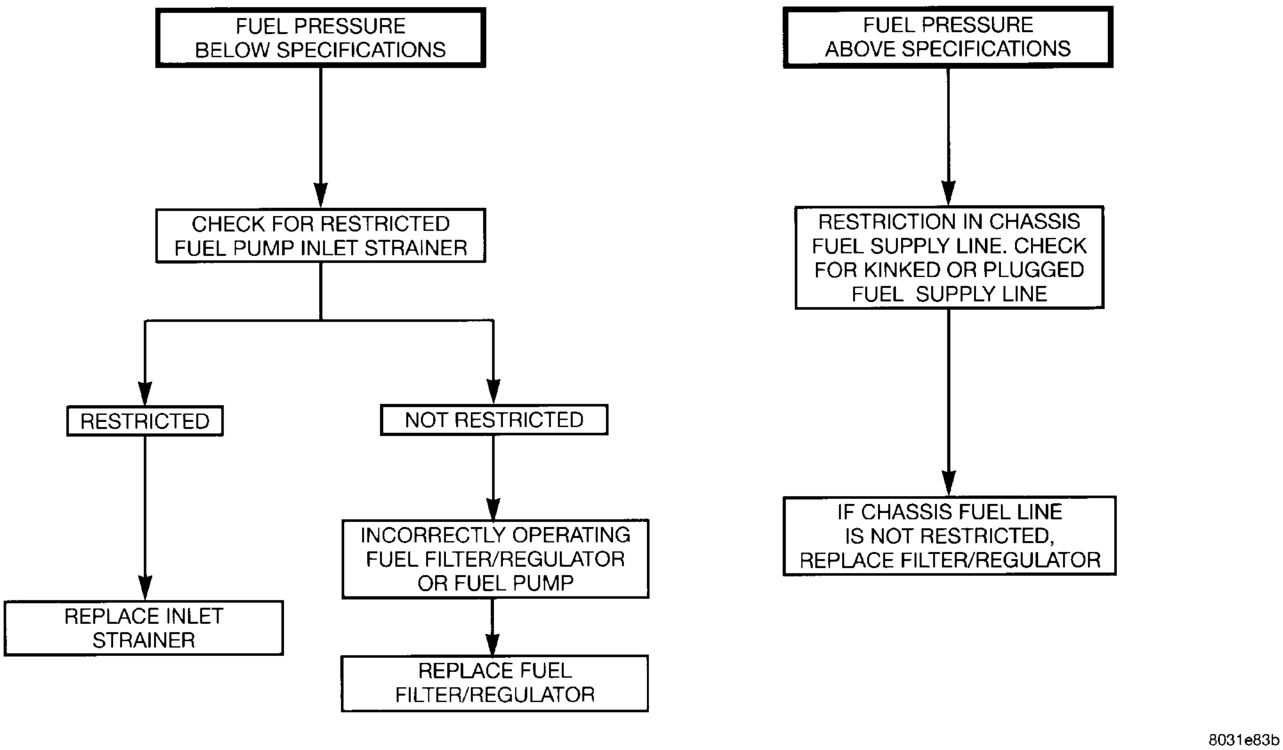


Fig. 9 Fuel Pressure Diagnosis Chart

DIAGNOSIS AND TESTING (Continued)

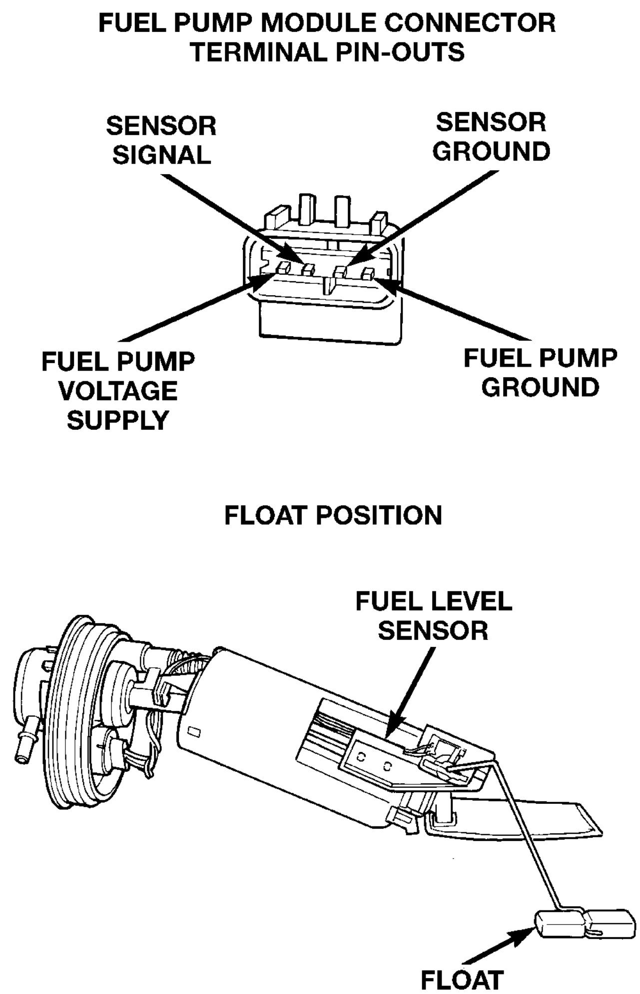
FUEL LEVEL SENSOR

This procedure tests the resistance of the level sensor itself. It does not test the level sensor circuit. Refer to Group 8W - Wiring Diagrams for circuit identification.

The level sensor is a variable resistor. Its resistance changes with the amount of fuel in the tank. The float arm attached to the sensor moves as the fuel level changes. To test the level sensor, connect an ohmmeter across the sensor signal and sensor ground terminals of the fuel pump module connector (Fig. 10). Move the float lever to the positions shown in the resistance chart (Fig. 10). Record the resistance at each point. Replace the level sensor if the resistance is not within specifications.

FUEL INJECTORS

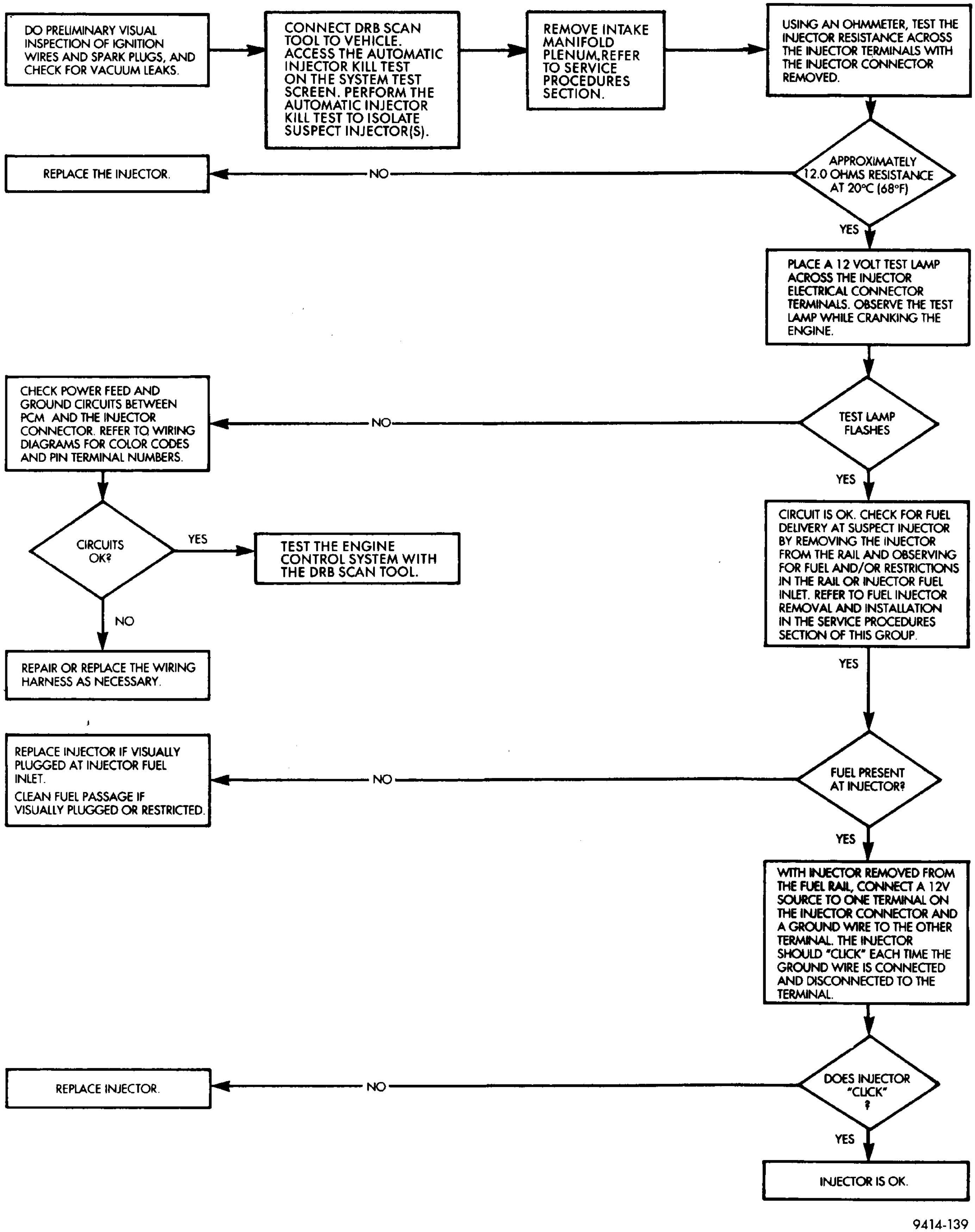
For fuel injector diagnosis, refer to the Fuel Injector Diagnosis charts. For poor fuel economy diagnosis or engine miss, also refer to Transmission Driveplate in this section



FLOAT POSITION (HEIGHT)	RESISTANCE
SENSOR FULL STOP....................	70±20 OHMS
SENSOR EMPTY STOP............	1050±30 OHMS

Fig. 10 Level Sensor Diagnosis 8031e837

DIAGNOSIS AND TESTING (Continued)



FUEL INJECTOR DIAGNOSIS

SERVICE PROCEDURES

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect negative cable from battery.

(2) Remove fuel filler cap.

(3) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 11).

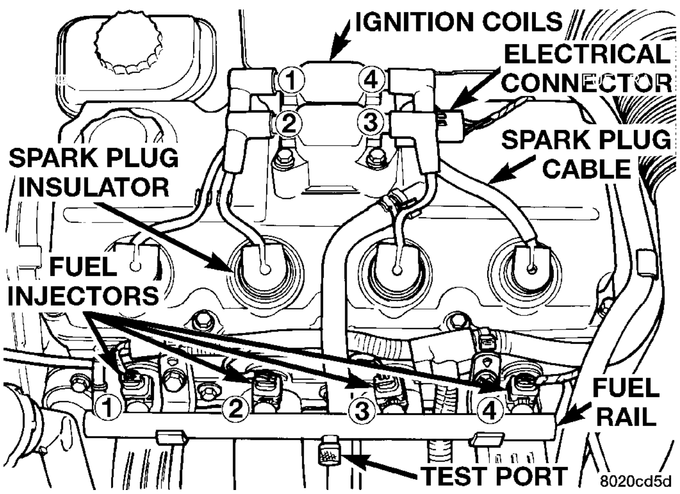


Fig. 11 Fuel Pressure Test Port—Typical

(4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 12). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

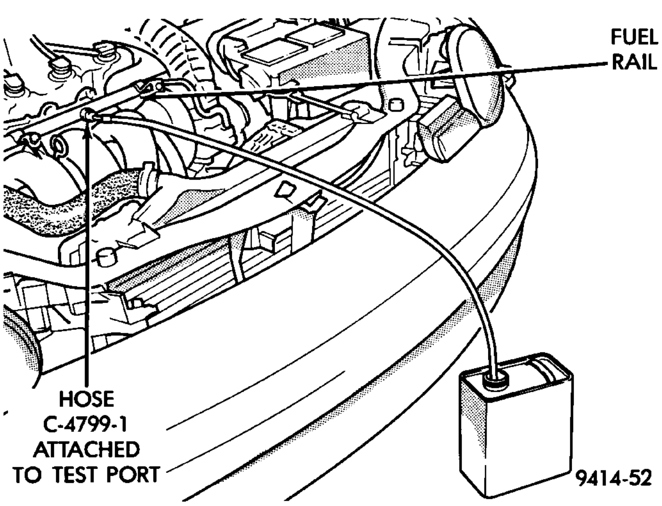


Fig. 12 Releasing Fuel Pressure

DRAINING FUEL TANK

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Remove fuel filler cap.

(2) Perform the Fuel System Pressure Release procedure.

(3) Disconnect negative cable from battery.

(4) Raise vehicle on hoist.

(5) Remove quick connect cap from drain port. The drain port is located on rear top of fuel tank. Push a siphon hose into the drain port (Fig. 13).

(6) Drain fuel tank into holding tank or a properly labeled **Gasoline** safety container.

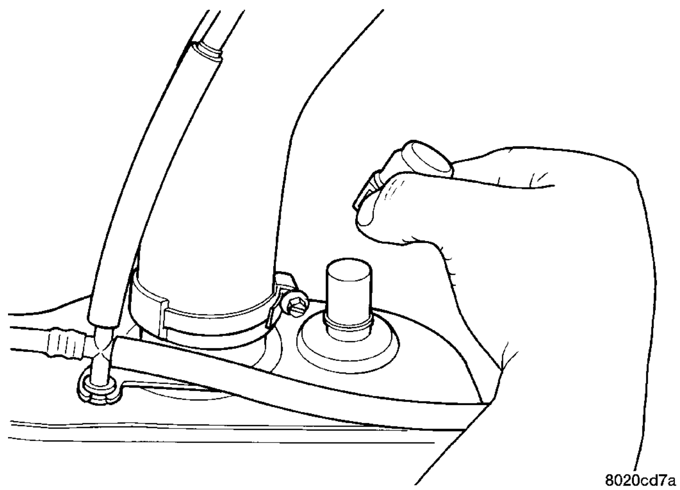


Fig. 13 Drain Port Location

HOSES AND CLAMPS

Inspect all hose connections (clamps and quick connect fittings) for completeness and leaks. Replace cracked, scuffed, or swelled hoses. Replace hoses that rub against other vehicle components or show sign of wear.

Fuel injected vehicles use specially constructed hoses. When replacing hoses, only use hoses marked EFM/EFI.

When installing hoses, ensure that they are routed away from contact with other vehicle components that could rub against them and cause failure. Avoid contact with clamps or other components that cause abrasions or scuffing. Ensure that rubber hoses are properly routed and avoid heat sources.

The hose clamps have rolled edges to prevent the clamp from cutting into the hose. Only use clamps that are original equipment or equivalent. Other types of clamps may cut into the hoses and cause high pressure fuel leaks. Tighten hose clamps to 1 N·m (10 in. lbs.) torque.

SERVICE PROCEDURES (Continued)

QUICK-CONNECT FITTINGS

REMOVAL

When disconnecting a quick-connect fitting, the retainer will remain on the fuel tube nipple.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

(1) Disconnect negative cable from battery.

(2) Perform Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.

(3) Squeeze retainer tabs together and pull fuel tube/quick-connect fitting assembly off of fuel tube nipple. The retainer will remain on fuel tube.

INSTALLATION

CAUTION: Never install a quick-connect fitting without the retainer being either on the fuel tube or already in the quick-connect fitting. In either case, ensure the retainer locks securely into the quick-connect fitting by firmly pulling on fuel tube and fitting to ensure it is secured.

(1) Using a clean lint free cloth, clean the fuel tube nipple and retainer.

(2) Prior to connecting the fitting to the fuel tube, coat the fuel tube nipple with clean 30 weight engine oil.

(3) Push the quick-connect fitting over the fuel tube until the **retainer seats and a click is heard.**

(4) The plastic quick-connect fitting has windows in the sides of the casing. When the fitting completely attaches to the fuel tube, the retainer locking ears and the fuel tube shoulder are visible in the windows. If they are not visible, the retainer was not properly installed (Fig. 14). **Do not rely upon the audible click to confirm a secure connection.**

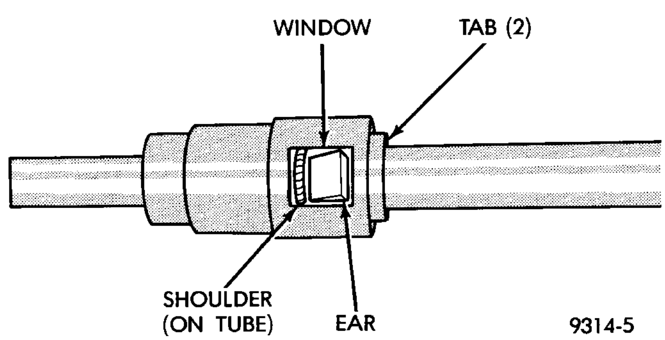


Fig. 14 Plastic Quick-Connect Fitting/Fuel Tube Connection

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) Relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

(5) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

PLASTIC RETAINER RING TYPE FITTING

This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 15) usually black in color.

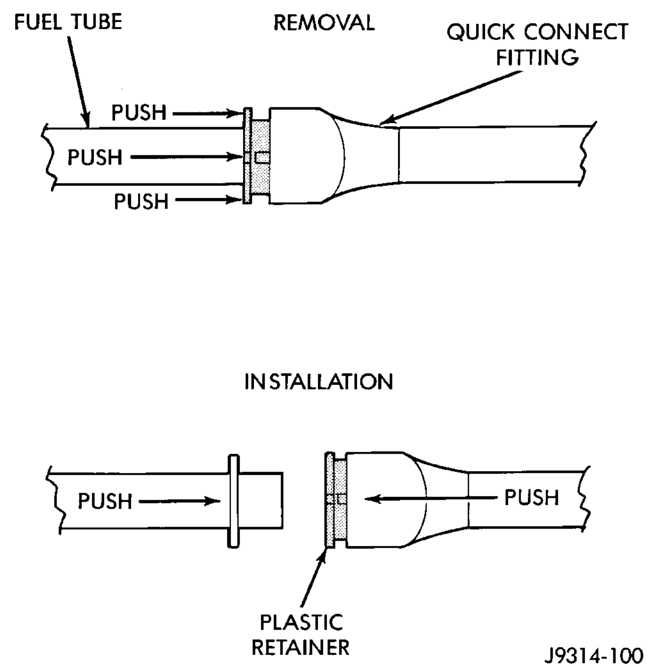


Fig. 15 Plastic Retainer Ring Type Fitting

CAUTION: The interior components (o-rings, spacers, retainers) of this type of quick-connect fitting are not serviced separately. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

DISCONNECTION/CONNECTION

(1) Disconnect negative battery cable from the battery.

SERVICE PROCEDURES (Continued)

(2) Perform the fuel pressure release procedure. Refer to the Fuel Pressure Release Procedure in this section.

(3) Clean the fitting of any foreign material before disassembly.

(4) To release the fuel system component from the quick-connect fitting, firmly push the fitting towards the component being serviced while firmly pushing the plastic retainer ring into the fitting (Fig. 15). With the plastic ring depressed, pull the fitting from the component. **The plastic retainer ring must be pressed squarely into the fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on the shoulder of the plastic retainer ring to aid in disconnection.**

(5) After disconnection, the plastic retainer ring will remain with the quick-connect fitting connector body.

(6) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

(7) Prior to connecting the quick-connect fitting to component being serviced, check condition of fitting and component. Clean the parts with a lint-free cloth. Lubricate them with clean engine oil.

(8) Insert the quick-connect fitting into the component being serviced until a click is felt.

(9) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(10) Connect negative battery cable to battery.

(11) Start engine and check for leaks.

REMOVAL AND INSTALLATION

AUTOMATIC SHUTDOWN RELAY

The relay is located in the Power Distribution Center (PDC) (Fig. 16). The PDC is located next to the battery in the engine compartment. For the location of the relay within the PDC, refer to the PDC cover for location. Check electrical terminals for corrosion and repair as necessary.

FUEL PUMP RELAY

The fuel pump relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

FUEL PUMP MODULE

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

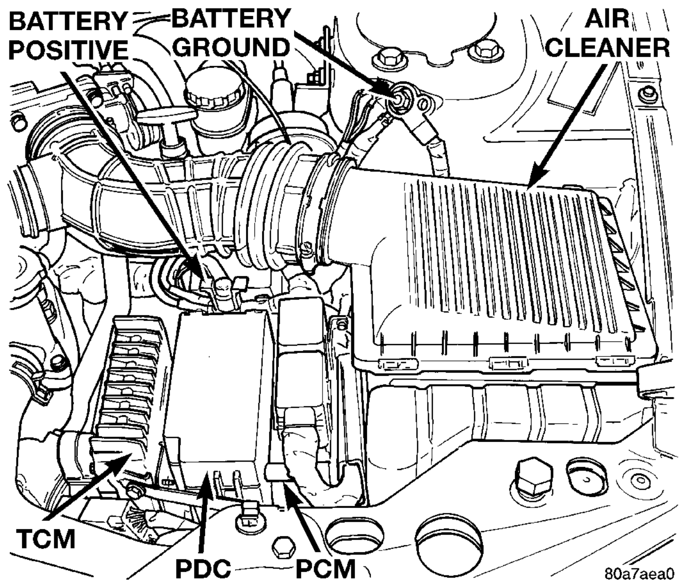


Fig. 16 Power Distribution Center (PDC)

(1) Drain the fuel. Refer to Draining Fuel Tank in the Fuel Tank section of this group.

WARNING: THE FUEL RESERVOIR OF THE FUEL PUMP MODULE DOES NOT EMPTY OUT WHEN THE TANK IS DRAINED. THE FUEL IN THE RESERVOIR WILL SPILL OUT WHEN THE MODULE IS REMOVED.

(2) Disconnect fuel line from fuel pump module by depressing quick connect retainers with thumb and fore finger.

(3) Slide fuel pump module electrical connecter lock to unlock.

(4) Disconnect the electrical connection from the fuel pump module, by pushing down on connector retainer and pulling connector off of module.

(5) Use a transmission jack to support the fuel tank. remove bolts from fuel tank straps.

(6) Lower tank slightly.

(7) Use Special Tool 6856 to remove fuel pump module locknut (Fig. 18).

(8) Remove fuel pump and O-ring seal from tank. Discard old seal.

INSTALLATION

(1) Wipe seal area of tank clean and place a new seal in position in the tank opening.

(2) Position fuel pump in the tank. Make sure the aligment tab on the underside of the fuel pump module flange sits in the notch on the fuel tank.

(3) Position the locknut over the fuel pump module.

REMOVAL AND INSTALLATION (Continued)

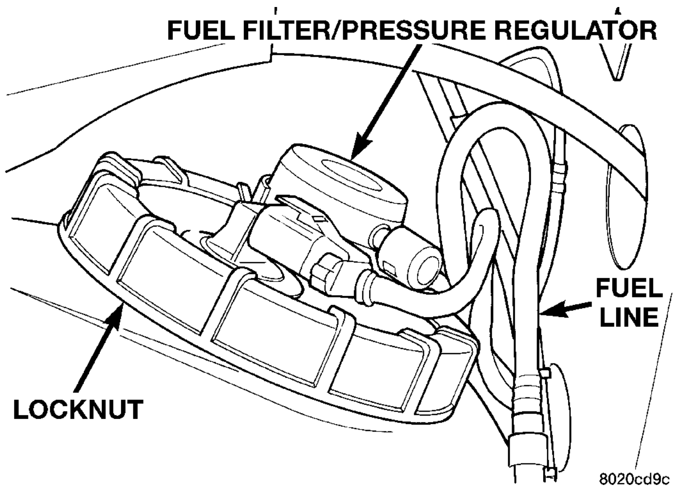


Fig. 17 Fuel Pump Module Removal

(4) Tighten the locknut using Special Tool 6856 to 55 N·m (40.5 ft. lbs.) (Fig. 18).

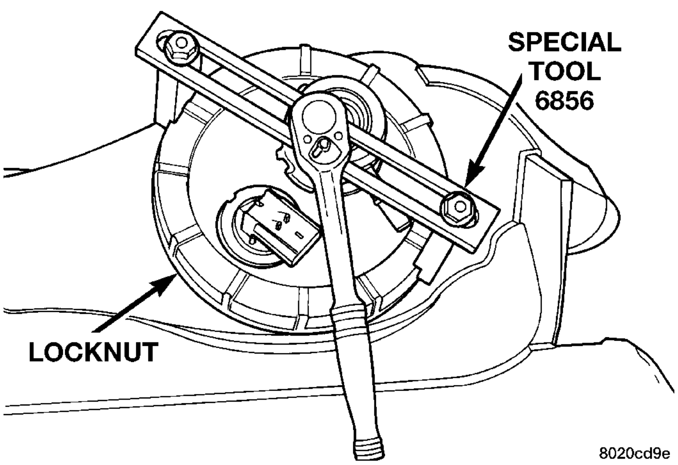


Fig. 18 Fuel Tank Locknut

CAUTION: Over tightening the pump lock ring may result in a leak.

(5) Fill fuel tank. Check for leaks.

FUEL FILTER / PRESSURE REGULATOR

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE, EVEN WITH ENGINE OFF. BEFORE SERVICING THE FUEL FILTER/FUEL PRESSURE REGULATOR, THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

(1) Refer to Fuel System Pressure Release in the Fuel Delivery System section of this group.

The fuel filter/fuel pressure regulator is located on the top of fuel pump module. Fuel pump module removal is not necessary.

(2) Raise vehicle on hoist.

(3) Disconnect fuel supply line at the Filter/Regulator nipple (refer to Quick Connect Fittings in this section).

(4) Depress locking spring tab on side of Fuel/Regulator (Fig. 19) and rotate 90° counter-clockwise and pull out.

NOTE: Make sure that the upper and lower O-rings are on the Filter/Regulator assembly.

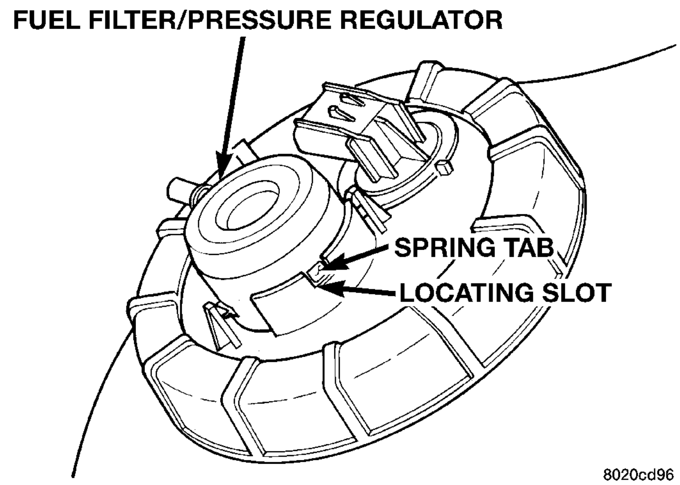


Fig. 19 Locking Spring Tab

INSTALLATION

Lightly lubricate the O-rings with engine oil.

(1) Insert Filter/Regulator into the opening in the fuel pump module, align the two hold down tabs with the flange.

(2) While applying downward pressure, rotate the Filter/Regulator clockwise until the the spring tab engages the locating slot (Fig. 20).

(3) Connect the fuel line to the Filter/Regulator.

(4) Lower vehicle from hoist.

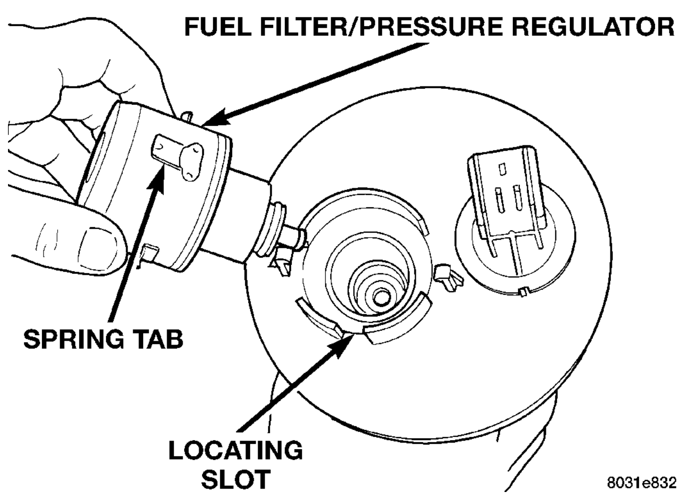


Fig. 20 Spring Tab In Locating Slot

REMOVAL AND INSTALLATION (Continued)

FUEL PUMP INLET STRAINER

REMOVAL

(1) Remove fuel pump module. Refer to Fuel Pump Module Removal in this section.

(2) Using a thin straight blade screwdriver, pry back the locking tabs on fuel pump reservoir and remove the strainer (Fig. 21).

(3) Remove strainer O-ring from the fuel pump reservoir body.

(4) Remove any contaminants in the fuel tank by washing the inside of the fuel tank.

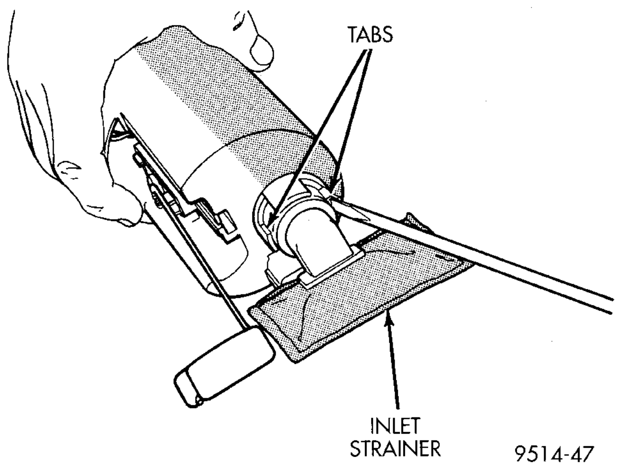


Fig. 21 Inlet Strainer Removal

INSTALLATION

(1) Lubricate the strainer O-ring with clean engine oil.

(2) Insert strainer O-ring into outlet of strainer so that it sits evenly on the step inside the outlet.

(3) Push strainer onto the inlet of the fuel pump reservoir body. Make sure the locking tabs on the reservoir body lock over the locking tangs on the strainer.

(4) Install fuel pump module. Refer to Fuel Pump Module Installation in this section.

FUEL LEVEL SENSOR

REMOVAL

Remove fuel pump module. Refer to Fuel Pump Module in this section.

(1) Depress retaining tab and remove the fuel pump/level sensor connector from the bottom of the fuel pump module electrical connector (Fig. 22).

(2) Pull off blue locking wedge (Fig. 23).

(3) Using a small screwdriver lift locking finger away from terminal and push terminal out of connector (Fig. 24).

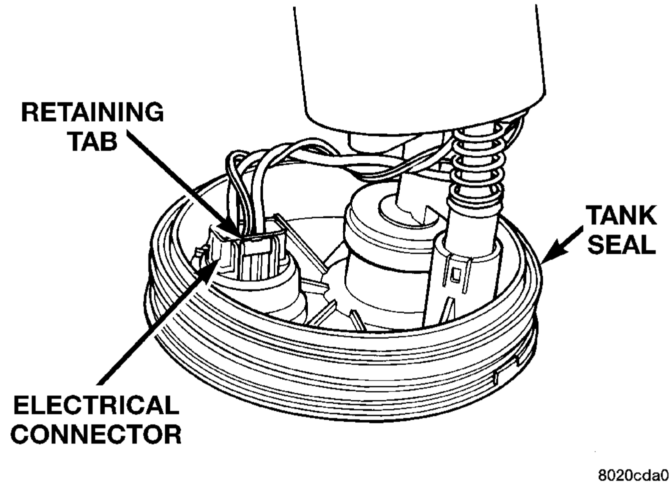


Fig. 22 Fuel Pump/Level Sensor Electrical Connector

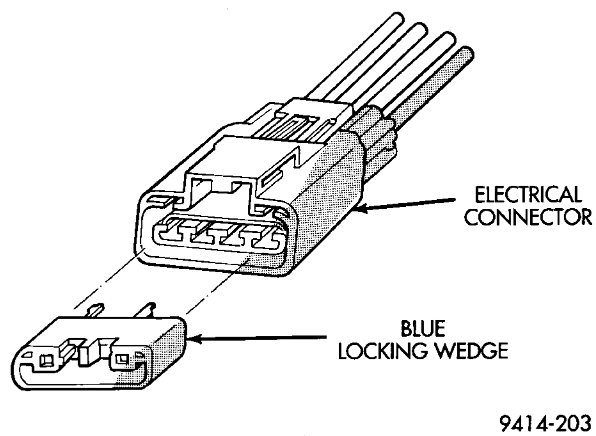


Fig. 23 Wire Terminal Locking Wedge

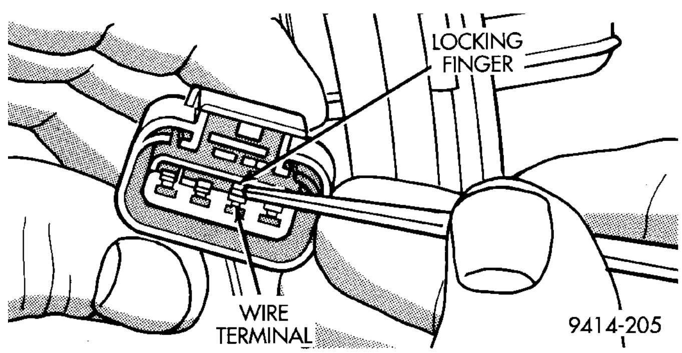


Fig. 24 Wire Terminal Locking Finger

REMOVAL AND INSTALLATION (Continued)

(4) Push level sensor signal and ground terminals out of the connector (Fig. 25).

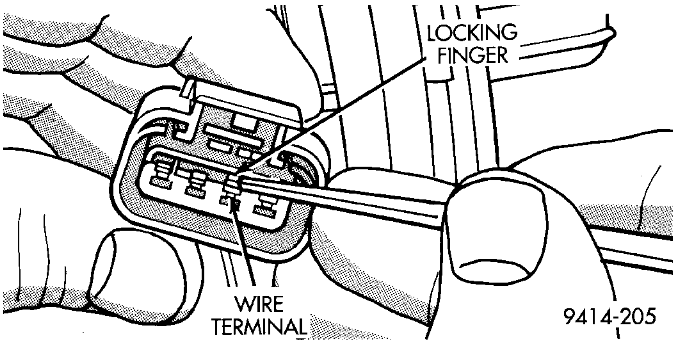


Fig. 25 Removing Wires From Connector

(5) Insert a screwdriver between the fuel pump module and the top of the level sensor housing (Fig. 26). Push level sensor down slightly.

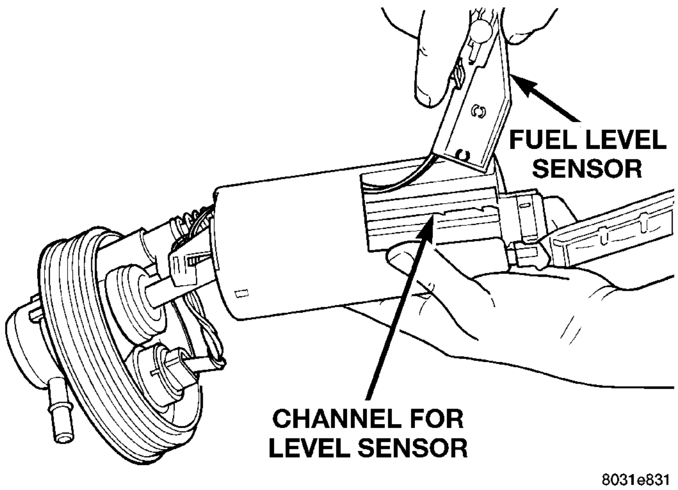


Fig. 26 Loosening Level Sensor

(6) Slide level sensor wires through opening fuel pump module (Fig. 27).

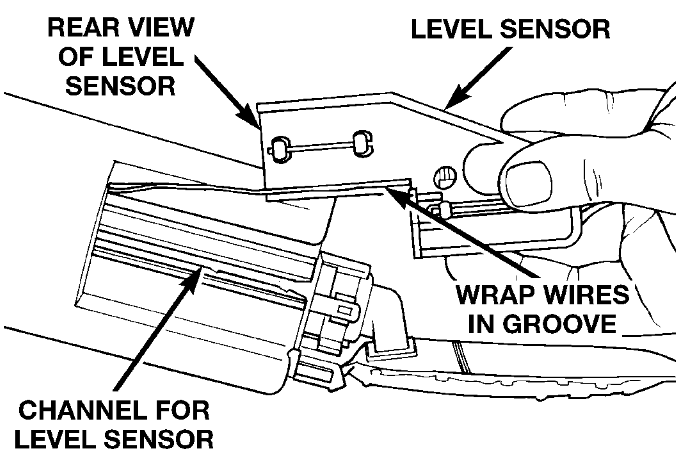


Fig. 27 Level Sensor Removal/Installation

(7) Slide level sensor out of installation channel in module.

INSTALLATION

(1) Insert level sensor wires into bottom of opening in module.

(2) Wrap wires into groove in back of level sensor (Fig. 26).

(3) While feeding wires into guide grooves, slide level sensor up into channel until it snaps into place (Fig. 27). Ensure tab at bottom of sensor locks in place.

(4) Install level sensor wires in connector. Push the wires up through the connector and then pull them down until they lock in place. Ensure signal and ground wires are installed in the correct position.

(5) Install locking wedge on connector.

(6) Push connector up into bottom of fuel pump module electrical connector.

(7) Install fuel pump module. Refer to Fuel Pump Module in this section.

FUEL INJECTORS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Release fuel system pressure. Refer to Fuel System Pressure Release procedure in this section.

(3) Disconnect fuel supply tube from rail. Refer to Quick-Connect Fittings in the Fuel Delivery section of this group.

(4) Disconnect electrical connectors from fuel injectors (Fig. 28).

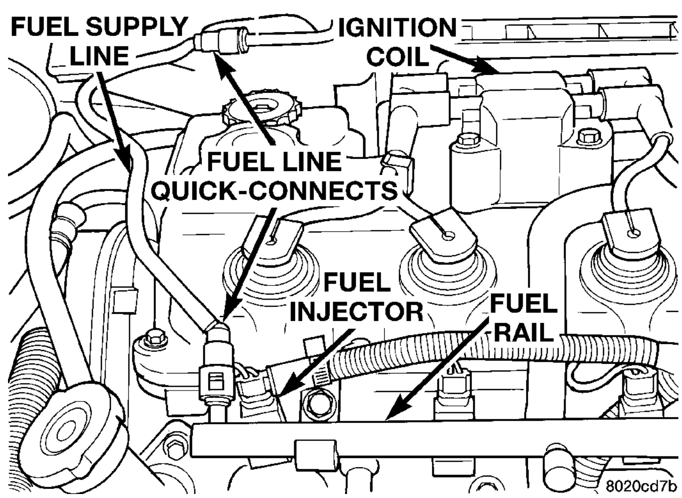


Fig. 28 Fuel Rail and Injectors

REMOVAL AND INSTALLATION (Continued)

(5) Remove fuel rail mounting screws.

(6) Lift rail off of intake manifold. Cover the fuel injector openings in the intake manifold.

(7) Remove fuel injector retainer (Fig. 29).

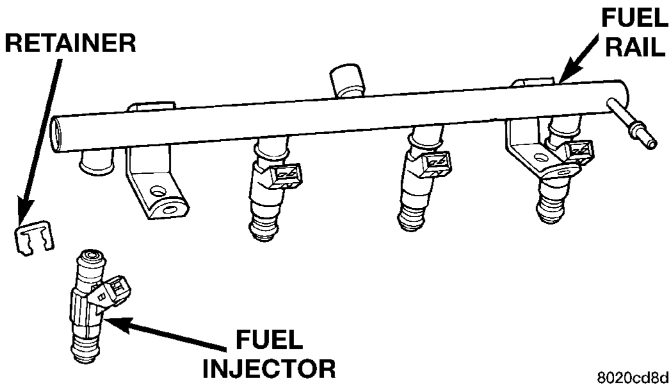


Fig. 29 Fuel Injector Retainer

(8) Pull injector out of fuel rail. Replace fuel injector O-rings (Fig. 30).

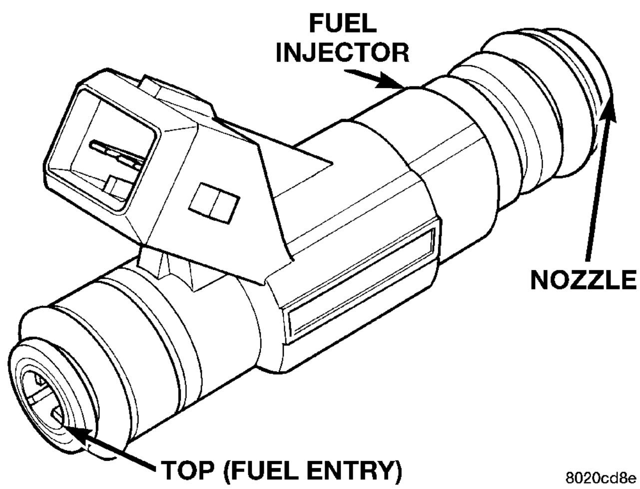


Fig. 30 Fuel Injector O-Rings

INSTALLATION

(1) Apply a light coating of clean engine oil to the upper O-ring.

(2) Install injector in cup on fuel rail.

(3) Install retaining clip.

(4) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

(5) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail mounting screws to 22.5 N·m ± 3 N·m (200±30 in. lbs.).

(6) Attach electrical connectors to fuel injectors.

(7) Connect fuel supply tube to fuel rail. Refer to Quick Connect Fittings in the Fuel Delivery Section of this Group.

FUEL TANK

REMOVAL

(1) Perform fuel system pressure release.

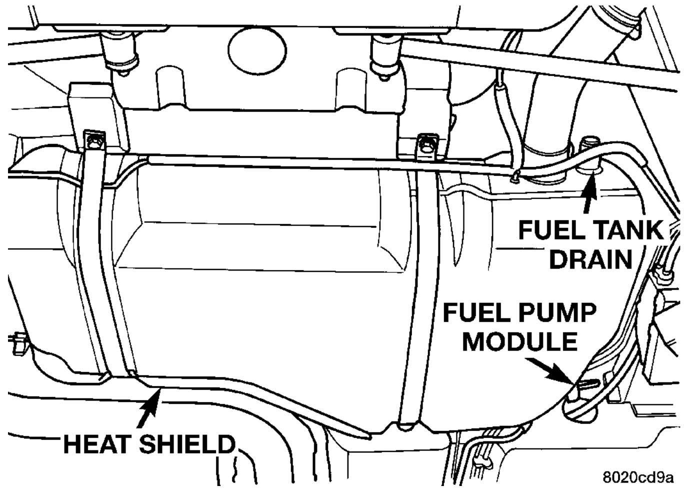


Fig. 31 Fuel Tank

(2) Drain fuel tank. Refer to Draining Fuel Tank in this section (Fig. 31).

(3) Raise vehicle on hoist.

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(4) Disconnect fuel pump module electrical connector (Fig. 32).

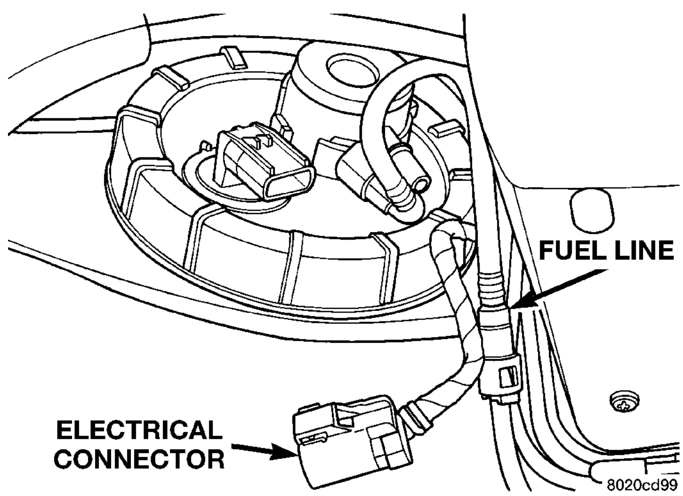


Fig. 32 Fuel Pump Module Electrical Connector

(5) Disconnect the fuel tube from Fuel Filter/Regulator. Refer to Quick Connect Fittings in the Fuel Delivery section of this group.

(6) Support tank with transmission jack. Loosen tank mounting straps and lower tank slightly.

(7) Disconnect fuel filler tube and filler vent tube from filler hose at fuel tank (Fig. 33).

REMOVAL AND INSTALLATION (Continued)

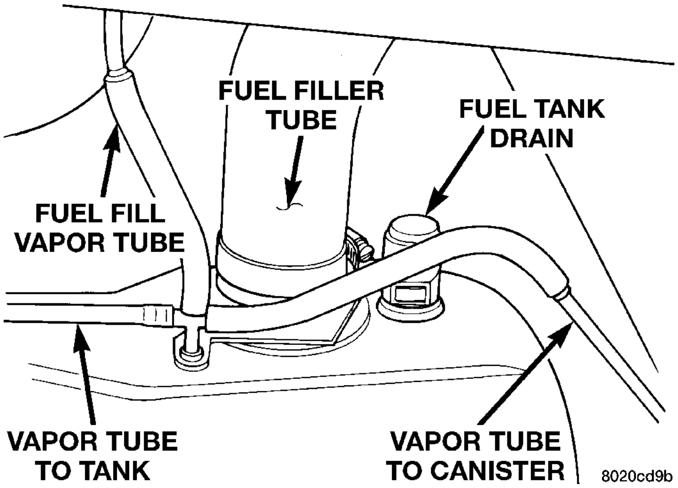


Fig. 33 Fuel Filler Tube and Vent Tubes

(8) Disconnect fuel filler vapor relief tube from tee connecting it to the tank vapor relief tube and EVAP canister tube.

(9) Disconnect vapor line from Evap canister tube.

(10) Remove tank mounting straps and lower tank.

INSTALLATION

(1) Position fuel tank on transmission jack.

(2) Raise tank into position. Connect fuel filler tube tank inlet nipple.

(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) Attach fuel tubes to pump module and chassis fuel tube. Refer to Quick Connect Fittings in the Fuel Delivery section of this Group.

(5) Connect fuel vapor tube to tee, then to Evap canister tube.

(6) Attach electrical connector to fuel pump module.

(7) Lower vehicle.

(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 DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL FILLER NECK

REMOVAL

(1) Loosen fuel filler tube cap.

(2) Remove fuel filler neck screws (Fig. 34).

(3) Disconnect fuel fill vapor tube.

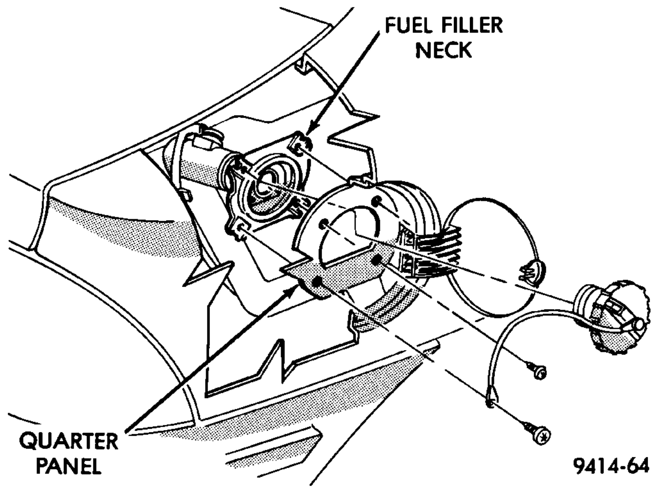


Fig. 34 Fuel Filler Neck

(4) Disconnect fuel filler tube from fuel tank. Remove filler neck.

INSTALLATION

(1) Reverse for installation.

FUEL FILLER TUBE ROLLOVER VALVE

REMOVAL

The rollover valve is mounted in the fuel filler tube (Fig. 35).

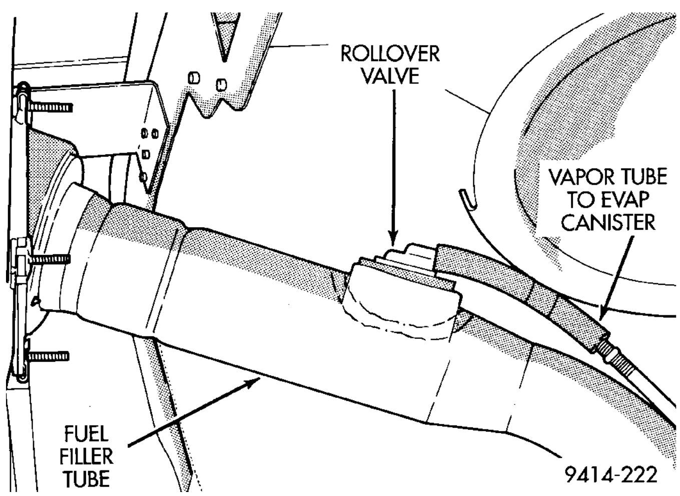


Fig. 35 Fuel Filler Tube Rollover Valve

(1) To release fuel tank pressure, remove the fuel filler tube cap.

(2) Disconnect vapor tube from rollover valve.

(3) Using a straight screwdriver, pry the valve out of the grommet in the fuel filler tube.

INSTALLATION

(1) Apply a light coating of power steering fluid to the grommet.

(2) Install valve in grommet.

REMOVAL AND INSTALLATION (Continued)

(3) Attach vapor tube to valve.

(4) Install fuel filler tube cap.

ACCELERATOR PEDAL

CAUTION: When servicing the accelerator pedal, throttle cable or speed control cable, do not damage or kink the core wire inside the cable sheathing.

REMOVAL

(1) Working from the engine compartment, remove the throttle control shield.

(2) Hold the throttle body throttle lever in the wide open position. Remove the throttle cable from the throttle body cam.

(3) From inside the vehicle, hold up the pedal and remove the cable retainer and throttle cable from the upper end of the pedal shaft (Fig. 36) and (Fig. 37).

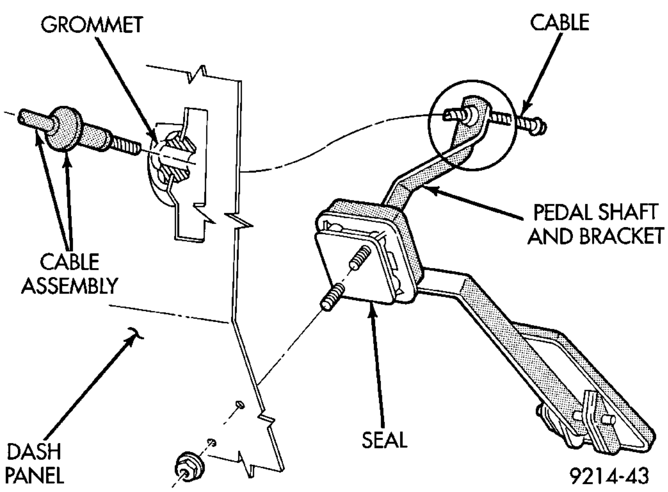


Fig. 36 Accelerator Pedal and Throttle Cable—Front View

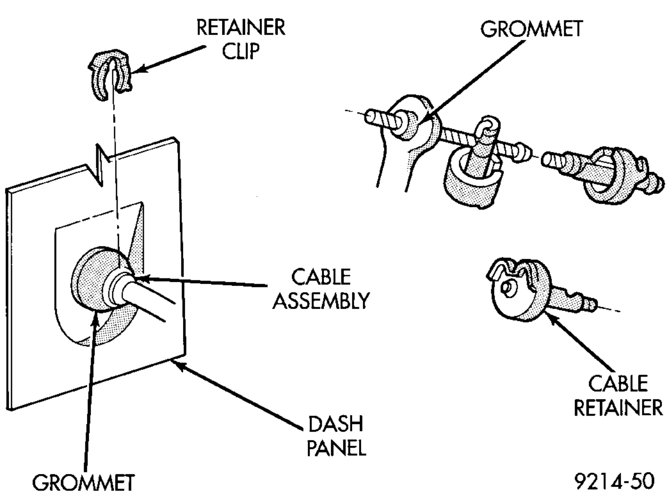


Fig. 37 Accelerator Pedal and Throttle Cable—Rear View

(4) Working from the engine compartment, remove nuts from accelerator pedal attaching studs (Fig. 36). 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. Install the throttle control shield.

THROTTLE CABLE—MANUAL TRANSMISSION

REMOVAL

(1) Remove throttle control shield (Fig. 38).

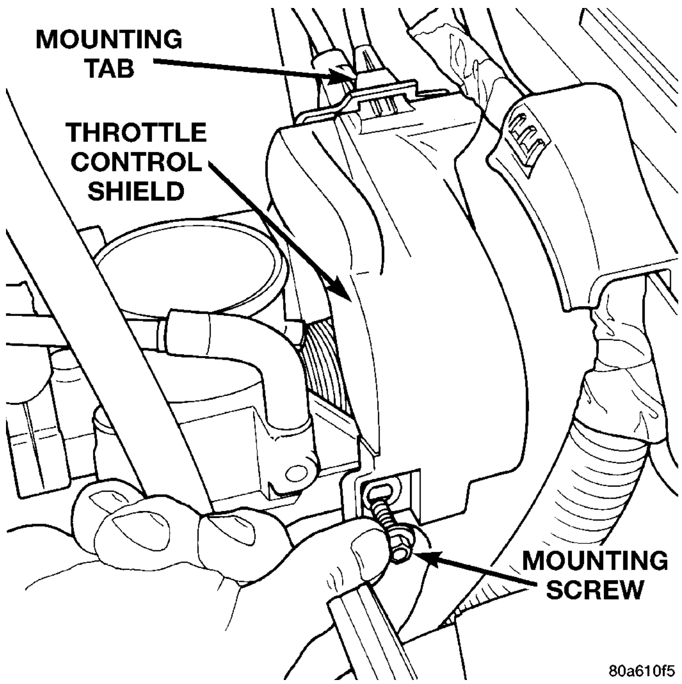


Fig. 38 Throttle Control Shield

(2) Working from the engine compartment, remove the throttle cable from the throttle body lever (Fig. 39) and (Fig. 40).

(3) Compress the retaining tabs on the cable and slide cable out of bracket.

(4) From inside the vehicle, hold the accelerator pedal up and remove the cable retainer and cable from upper end of pedal shaft (Fig. 36) and (Fig. 37).

(5) Remove retainer clip from throttle cable and grommet at the dash panel.

(6) From the engine compartment, pull the throttle cable out of the dash panel grommet. The grommet should remain in the dash panel.

REMOVAL AND INSTALLATION (Continued)

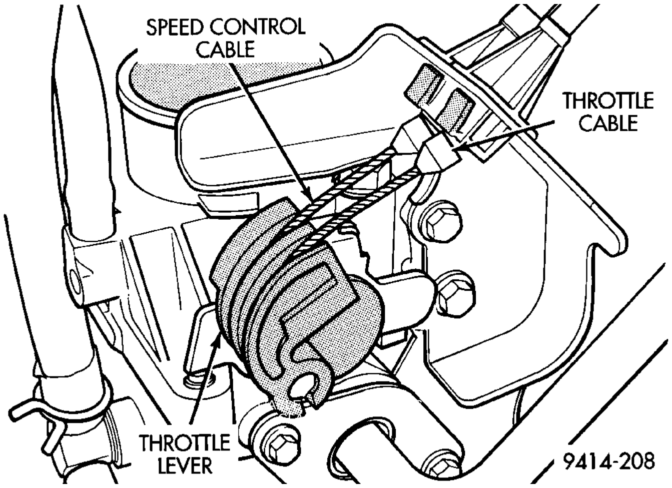


Fig. 39 Throttle Cable Attachment to Throttle Body

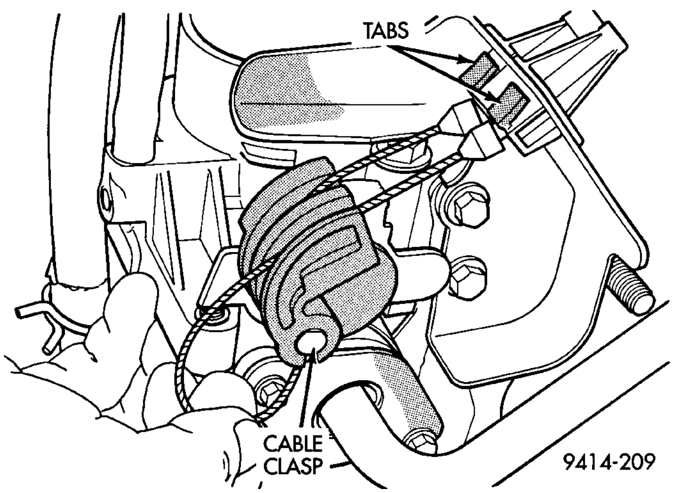


Fig. 40 Disconnecting Throttle Cable

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.

(4) Install cable retainer clip.

(5) From the engine compartment, rotate the throttle lever forward to the wide open position and install cable clasp (Fig. 40).

(6) Install throttle control shield (Fig. 38). Tighten screw to 5.6 N·m (50 in. lbs.).

THROTTLE CABLE—AUTOMATIC TRANSMISSION

REMOVAL

(1) Remove throttle control shield (Fig. 38).

(2) Working from the engine compartment, remove throttle cable from throttle body cam (Fig. 41) and (Fig. 42).

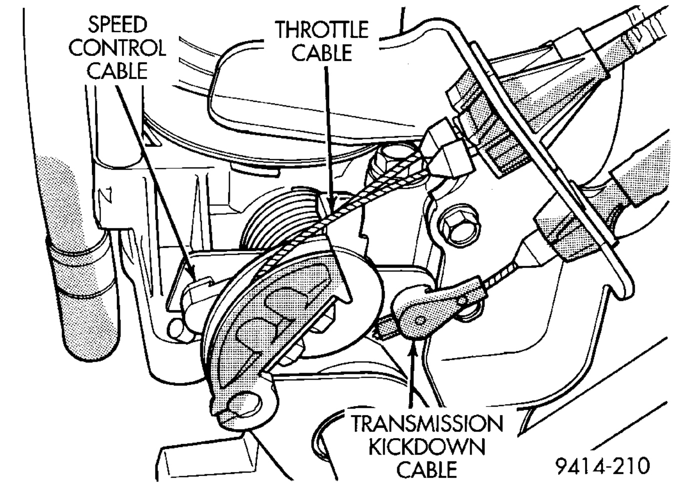


Fig. 41 Throttle Body Cables Attachment to Throttle Body

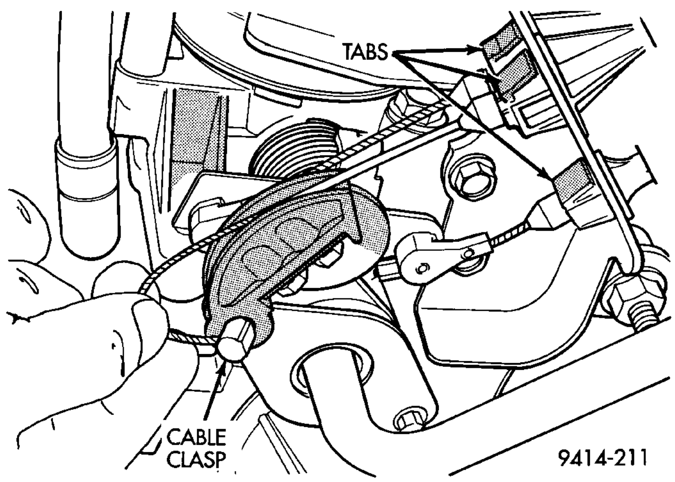


Fig. 42 Disconnecting Throttle Cable

(3) Compress the retaining tabs on the cable and slide cable out of bracket.

(4) From inside the vehicle, hold the throttle pedal up and remove the cable retainer and cable from upper end of pedal shaft (Fig. 36) and (Fig. 37).

(5) Remove retainer clip from throttle cable and grommet at the dash panel.

(6) From the engine compartment, pull the throttle cable out of the dash panel grommet. The grommet should remain in the dash panel.

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. 37).

(4) Install cable retainer clip.

REMOVAL AND INSTALLATION (Continued)

(5) From the engine compartment, rotate the throttle lever forward to the wide open position and install cable clasp (Fig. 42).

(6) Install throttle ontrol shield (Fig. 38). Tighten to 5.6 N·m (50 in. lbs.).

SPECIFICATIONS

TORQUE SPECIFICATION

DESCRIPTION	TORQUE
Accelerator Pedal to Dash Nuts	12 N·m (105 in. lbs.)
Fuel Pump Module Locknut	55 N·m (40 ft. lbs.)
Fuel Tank Strap Bolts	23 N·m (250 in. lbs.)
Fuel Rail Bolts	23 N·m (195 in. lbs.)
Ignition Coil Mounting Bolts	11 N·m (95 in. lbs.)
Intake Manifold Bolts	11 N·m (95 in. lbs.)
Throttle Control Shield	5.6 N·m (50 in. lbs.)

FUEL INJECTION SYSTEM

INDEX

SPECIFICATIONS (Continued)

GENERAL INFORMATION

INTRODUCTION

All engines used in this section have a sequential Multi-Port Electronic Fuel Injection system. The MPI system is computer regulated and provides precise air/fuel ratios for all driving conditions. The Powertrain Control Module (PCM) operates the fuel injection system.

The PCM regulates:

- Ignition timing
- Air/fuel ratio
- Emission control devices
- Cooling fan
- Charging system
- Idle speed
- Vehicle speed control

Various sensors provide the inputs necessary for the PCM to correctly operate these systems. In addition to the sensors, various switches also provide inputs to the PCM.

All inputs to the PCM are converted into signals. The PCM can adapt its programming to meet changing operating conditions.

Fuel is injected into the intake port above the intake valve in precise metered amounts through electrically operated injectors. The PCM fires the injectors in a specific sequence. Under most operating conditions, the PCM maintains an air fuel ratio of 14.7 parts air to 1 part fuel by constantly adjusting injector pulse width. Injector pulse width is the length of time the injector is open.

The PCM adjusts injector pulse width by opening and closing the ground path to the injector. Engine RPM (speed) and manifold absolute pressure (air density) are the primary inputs that determine injector pulse width.

MODES OF OPERATION

As input signals to the PCM change, the PCM adjusts its response to output devices. For example, the PCM must calculate a different injector pulse width and ignition timing for idle than it does for Wide Open Throttle (WOT). There are several different modes of operation that determine how the PCM responds to the various input signals.

There are two different areas of operation, OPEN LOOP and CLOSED LOOP.

During OPEN LOOP modes the PCM receives input signals and responds according to preset PCM programming. Inputs from the upstream and downstream heated oxygen sensors are not monitored during OPEN LOOP modes, except for heated oxygen sensor diagnostics (they are checked for shorted conditions at all times).

During CLOSED LOOP modes the PCM monitors the inputs from the upstream and downstream heated oxygen sensors. The upstream heated oxygen sensor input tells the PCM if the calculated injector pulse width resulted in the ideal air-fuel ratio of 14.7 to one. By monitoring the exhaust oxygen content through the upstream heated oxygen sensor, the PCM can fine tune injector pulse width. Fine tuning injector pulse width allows the PCM to achieve optimum fuel economy combined with low emissions.

For the PCM to enter CLOSED LOOP operation, the following must occur:

(1) Engine coolant temperature must be over 35°F.

- If the coolant is over 35° the PCM will wait 44 seconds.
- If the coolant is over 50°F the PCM will wait 38 seconds.
- If the coolant is over 167°F the PCM will wait 11 seconds.

(2) For other temperatures the PCM will interpolate the correct waiting time.

(3) O2 sensor must read either greater than .745 volts or less than .1 volt.

(4) The multi-port fuel injection systems 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

(5) The engine start-up (crank), engine warm-up, deceleration with fuel shutoff and wide open throttle modes are OPEN LOOP modes. Under most operating conditions, the acceleration, deceleration (with A/C on), idle and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes.

IGNITION SWITCH ON (ZERO RPM) MODE

When the ignition switch activates the fuel injection system, the following actions occur:

GENERAL INFORMATION (Continued)

• The PCM monitors the engine coolant temperature sensor and throttle position sensor input. The PCM determines basic fuel injector pulse width from this input.

• The PCM determines atmospheric air pressure from the MAP sensor input to modify injector pulse width.

When the key is in the ON position and the engine is not running (zero rpm), the Auto Shutdown (ASD) and fuel pump relays de-energize after approximately 1 second. Therefore, battery voltage is not supplied to the fuel pump, ignition coil, fuel injectors and heated oxygen sensors.

ENGINE START-UP MODE

This is an OPEN LOOP mode. If the vehicle is in park or neutral (automatic transaxles) or the clutch pedal is depressed (manual transaxles) the ignition switch energizes the starter relay. 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) and fuel pump relays. If the PCM does not receive both signals within approximately one second, it will not energize the ASD relay and fuel pump relay. The ASD and fuel pump relays supply battery voltage to the fuel pump, fuel injectors, ignition coil and heated oxygen sensors.

• The PCM energizes all four injectors (on the 69° degree falling edge) for a calculated pulse width 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. It adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

• When the engine idles within ±64 RPM of its target RPM, the PCM compares current MAP sensor value with the atmospheric pressure value received during the Ignition Switch On (zero RPM) mode. If the PCM does not detect a minimum difference between the two values, it sets a MAP diagnostic trouble code into memory.

Once the ASD and fuel pump relays have been energized, the PCM determines injector pulse width based on the following:

- Battery voltage
- Engine coolant temperature
- Engine RPM
- Intake air temperature (IAT)
- Throttle position
- The number of engine revolutions since cranking was initiated

During Start-up the PCM maintains ignition timing at 9° BTDC.

ENGINE WARM-UP MODE

This is an OPEN LOOP mode. The following inputs are received by the PCM:

- Engine coolant temperature
- Manifold Absolute Pressure (MAP)
- Intake air temperature (IAT)
- Crankshaft position (engine speed)
- Camshaft position
- Knock sensor
- Throttle position
- A/C switch
- Battery voltage
- Power steering pressure switch
- Vehicle speed
- Speed control
- Both O2 sensors
- All diagnostics

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 or idle the following inputs are received by the PCM:

- Intake air temperature
- Engine coolant temperature
- Manifold absolute pressure
- Crankshaft position (engine speed)
- Camshaft position
- Knock sensor
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Power steering pressure switch
- Battery voltage
- Vehicle speed

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 (measured by the upstream and downstream heated oxygen sensor).

The PCM monitors for engine misfire. During active misfire and depending on the severity, the PCM either continuously illuminates or flashes the malfunction indicator lamp (Check Engine light on instrument panel). Also, the PCM stores an engine misfire DTC in memory.

GENERAL INFORMATION (Continued)

The PCM performs several diagnostic routines. They include:

- Oxygen sensor monitor
- Downstream heated oxygen sensor diagnostics during open loop operation (except for shorted)
- Fuel system monitor
- EGR monitor
- Purge system monitor
- All inputs monitored for proper voltage range.
- All monitored components (refer to Group 25 for On-Board Diagnostics).

The PCM compares the upstream and downstream heated oxygen sensor inputs to measure catalytic convertor efficiency. If the catalyst efficiency drops below the minimum acceptable percentage, the PCM stores a diagnostic trouble code in memory.

During certain idle conditions, the PCM may enter a variable idle speed strategy. During variable idle speed strategy the PCM adjusts engine speed based on the following inputs.

- A/C sense
- Battery voltage
- Battery temperature
- Engine coolant temperature
- Engine run time
- Power steering pressure switch
- Vehicle mileage

ACCELERATION MODE

This is a CLOSED LOOP mode. The PCM recognizes an abrupt increase in Throttle Position sensor output voltage or MAP sensor output voltage 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:

- A/C pressure transducer
- A/C sense
- Battery voltage
- Intake air temperature
- Engine coolant temperature
- Crankshaft position (engine speed)
- Exhaust gas oxygen content (upstream heated oxygen sensor)
- Knock sensor
- Manifold absolute pressure
- Power steering pressure switch
- Throttle position
- IAC motor control changes in respones to MAP sensor feedback

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. In response, the PCM may momentarily turn off the injectors. This helps improve fuel economy, emissions and engine braking.

If decel fuel shutoff is detected, downstream oxygen sensor diagnostics is performed.

WIDE-OPEN-THROTTLE MODE

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are received by the PCM:

- Intake air temperature
- Engine coolant temperature
- Engine speed
- Knock sensor
- Manifold absolute pressure
- Throttle position

When the PCM senses a wide-open-throttle condition through the Throttle Position Sensor (TPS) it de-energizes the A/C compressor clutch relay. This disables the air conditioning system.

The PCM does not monitor the heated oxygen sensor inputs during wide-open-throttle operation except for downstream heated oxygen sensor and both shorted diagnostics. The PCM adjusts injector pulse width to supply a predetermined amount of additional fuel.

IGNITION SWITCH OFF MODE

When the operator turns the ignition switch to the OFF position, the following occurs:

- All outputs are turned off, unless 02 Heater Monitor test is being run. Refer to Group 25, On-Board Diagnostics.
- No inputs are monitored except for the heated oxygen sensors. The PCM monitors the heating elements in the oxygen sensors and then shuts down.

DESCRIPTION AND OPERATION

SYSTEM DIAGNOSIS

The PCM can test many of its own input and output circuits. If the PCM senses a fault in a major system, the PCM stores a Diagnostic Trouble Code (DTC) in memory.

Technicians can display stored DTC's by two different methods.

For DTC information, refer to Group 25, Emission Control Systems. See On-Board Diagnostics.

DESCRIPTION AND OPERATION (Continued)

POWER DISTRIBUTION CENTER

The power distribution center (PDC) is located next to the battery (Fig. 1). The PDC contains the starter relay, radiator fan relay, A/C compressor clutch relay, auto shutdown relay, fuel pump relay and several fuses.

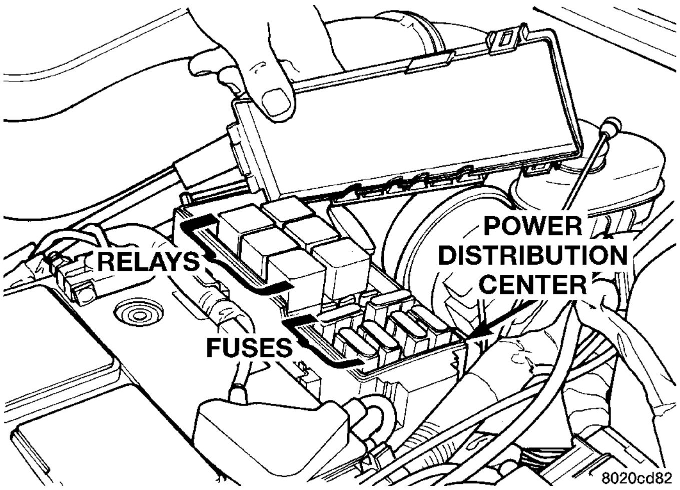


Fig. 1 Power Distribution Center (PDC)

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.

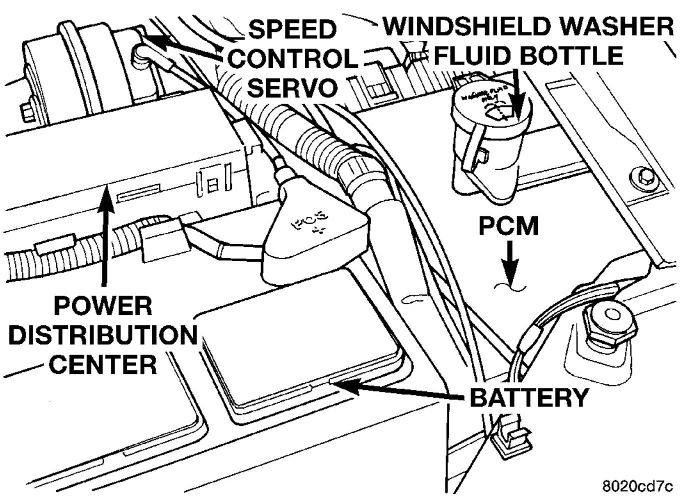


Fig. 2 Powertrain Control Module (PCM)

PCM Inputs:

- Air Conditioning Controls
- Battery Voltage
- Battery Temperature Sensor
- Brake Switch
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Engine Coolant Temperature Sensor
- Fuel Level Sensor
- Ignition Switch
- Intake Air Temperature Sensor
- Knock Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensors
- Power Steering Pressure Switch
- SCI Receive
- Speed Control Switches
- Throttle Position Sensor
- Transmission Park/Neutral Switch (automatic transmission)
- Vehicle Speed Sensor

PCM Outputs:

- Air Conditioning WOT Relay
- Auto Shutdown (ASD) Relay
- Charging Indicator Lamp
- Data Link Connector
- Duty Cycle EVAP Canister Purge Solenoid
- EGR Solenoid
- Fuel Injectors
- Fuel Pump Relay
- Generator Field
- Idle Air Control Motor
- Ignition Coils
- Malfunction Indicator (Check Engine) Lamp
- Radiator Fan Relay
- Speed Control Solenoids
- Tachometer
- Torque Convertor Clutch Solenoid

Based on inputs it receives, the PCM adjusts fuel injector pulse width, idle speed, ignition spark advance, ignition coil dwell and EVAP 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 also performs diagnostics.

The PCM adjusts injector pulse width (air-fuel ratio) based on the following inputs.

- Battery voltage
- Coolant temperature
- Intake air temperature
- Exhaust gas content (oxygen sensor)
- Engine speed (crankshaft position sensor)
- Manifold absolute pressure
- Throttle position

The PCM adjusts ignition timing based on the following inputs.

- Coolant temperature
- Intake air temperature
- Engine speed (crankshaft position sensor)
- Knock sensor
- Manifold absolute pressure
- Throttle position

DESCRIPTION AND OPERATION (Continued)

- Transmission gear selection (park/neutral switch)

The PCM also adjusts engine idle speed through the idle air control motor based on the following inputs.

- Air conditioning sense
- Battery voltage
- Battery temperature
- Brake switch
- Coolant temperature
- Engine speed (crankshaft position sensor)
- Engine run time
- Manifold absolute pressure
- Power steering pressure switch
- Throttle position
- Transmission gear selection (park/neutral switch)
- Vehicle distance (speed)

The Auto Shutdown (ASD) and fuel pump relays are mounted externally, but turned on and off by the PCM.

The crankshaft position sensor signal is sent to the PCM. If the PCM does not receive the signal within approximately one second of engine cranking, it deactivates the ASD relay and fuel pump relay. When these relays deactivate, power is shut off from the fuel injectors, ignition coils, heating element in the oxygen sensors and the fuel pump.

The PCM contains a voltage converter that changes battery voltage to a regulated 9 volts direct current to power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5 volt direct current supply for the manifold absolute pressure sensor and throttle position sensor.

AIR CONDITIONING PRESSURE TRANSDUCER—PCM INPUT

The Powertrain Control Module (PCM) monitors the A/C compressor discharge (high side) pressure through the air conditioning pressure transducer. The transducer supplies an input to the PCM. The PCM engages the A/C compressor clutch if pressure is sufficient for A/C system operation.

AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT

The ASD sense circuit informs the PCM when the ASD relay energizes. A 12 volt signal at this input indicates to the PCM that the ASD has been activated. This input is used only to sense that the ASD relay is energized.

When energized, the ASD relay supplies battery voltage to the fuel injectors, ignition coils and the heating element in each oxygen sensor. If the PCM does not receive 12 volts from this input after grounding the ASD relay, it sets a Diagnostic Trouble Code (DTC).

BATTERY VOLTAGE—PCM INPUT

The PCM monitors the battery voltage input to determine fuel injector pulse width and generator field control.

If battery voltage is low the PCM will increase injector pulse width (period of time that the injector is energized).

BATTERY TEMPERATURE SENSOR—PCM INPUT

The PCM uses the temperature of the battery area to control the charge rate. The signal is used to regulate the system voltage. The system voltage is higher at cold temperatures and is gradually reduced as temperature is increased.

BRAKE SWITCH—PCM INPUT

When the brake switch is activated, the PCM receives an input indicating that the brakes are being applied. The brake switch is mounted on the brake pedal support bracket.

DESCRIPTION AND OPERATION (Continued)

CAMSHAFT POSITION SENSOR—PCM INPUT

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor (Fig. 3) or (Fig. 4) and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

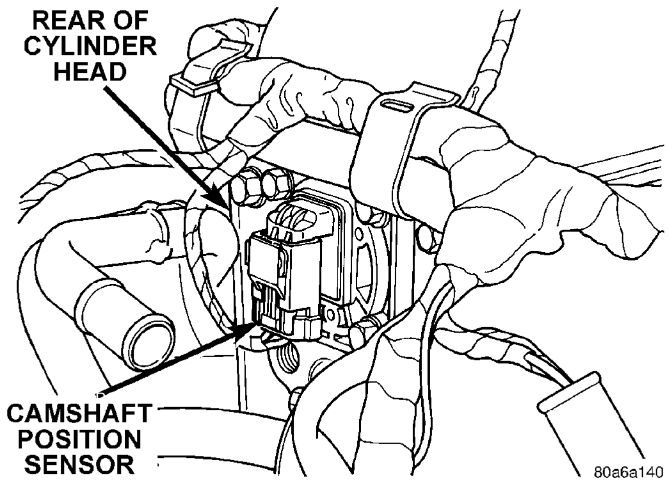


Fig. 3 Camshaft Position Sensor—SOHC

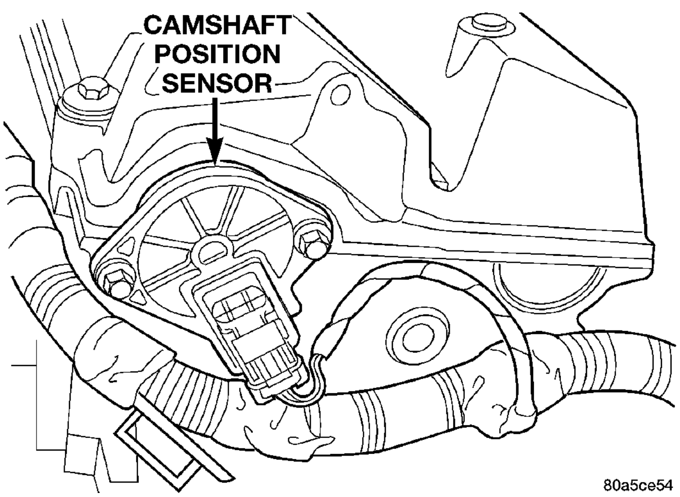


Fig. 4 Camshaft Position Sensor—DOHC

The camshaft position sensor attaches to the rear of the cylinder head. A target magnet attaches to the rear of the camshaft and indexes to the correct position. The target magnet has four different poles arranged in an asymmetrical pattern (Fig. 5). As the target magnet rotates, the camshaft position sensor senses the change in polarity (Fig. 6). The sensor output switch switches from high (5.0 volts) to low (0.5 volts) as the target magnet rotates. When the north pole of the target magnet passes under the sensor, the output switches high. The sensor output switches low when the south pole of the target magnet passes underneath.

The sensor also acts as a thrust plate to control camshaft endplay.

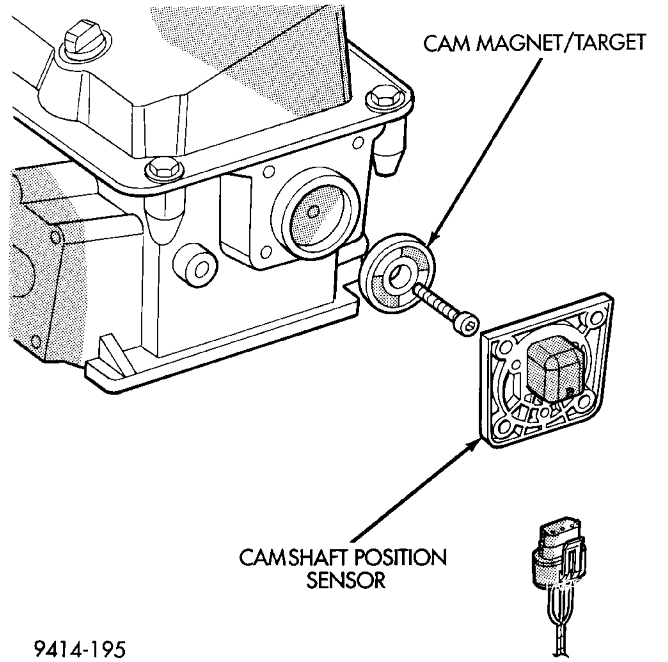


Fig. 5 Target Magnet—Typical

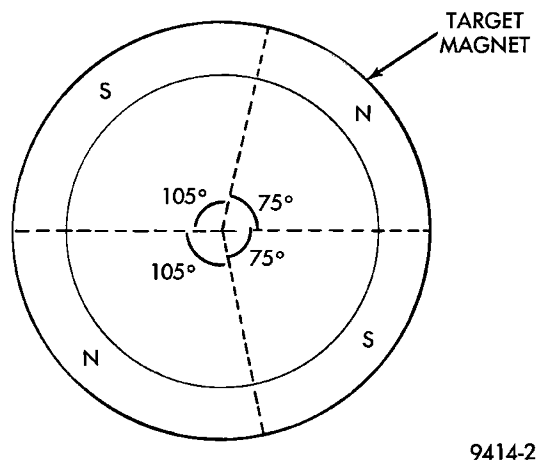


Fig. 6 Target Magnet Polarity

CRANKSHAFT POSITION SENSOR—PCM INPUT

The PCM determines what cylinder to fire from the crankshaft position sensor input and the camshaft position sensor input. The second crankshaft counterweight has two sets of four timing reference notches including a 60 degree signature notch (Fig. 7). From the crankshaft position sensor input the PCM determines engine speed and crankshaft angle (position).

The notches generate pulses from high to low in the crankshaft position sensor output voltage. When a metal portion of the counterweight aligns with the crankshaft position sensor, the sensor output voltage goes low (less than 0.5 volts). When a notch aligns with the sensor, voltage goes high (5.0 volts). As a group of notches pass under the sensor, the output

DESCRIPTION AND OPERATION (Continued)

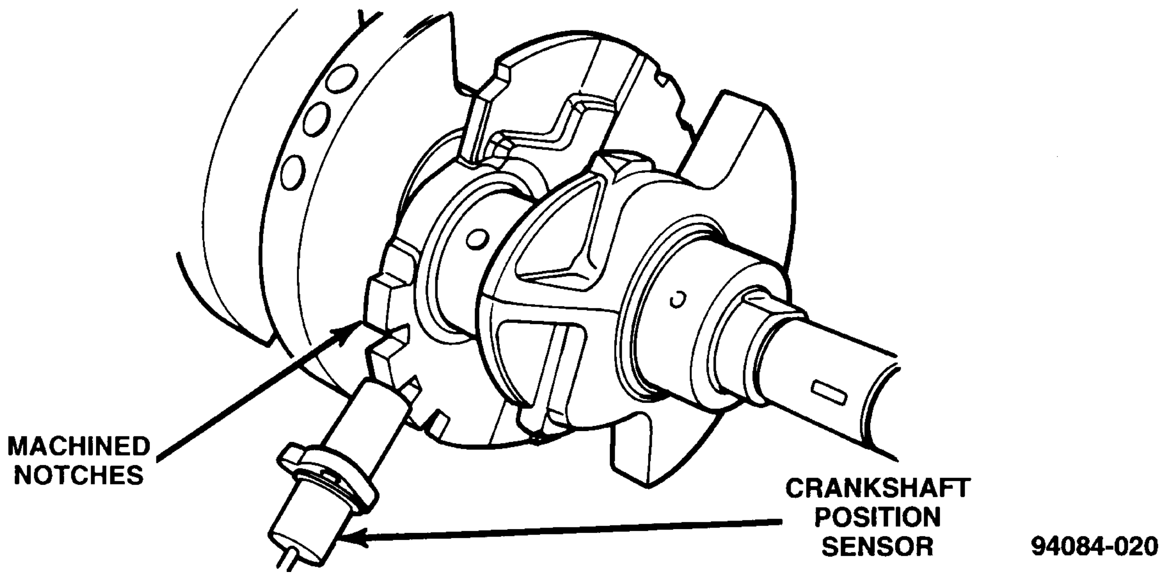


Fig. 7 Timing Reference Notches

voltage switches from low (metal) to high (notch) then back to low.

If available, an oscilloscope can display the square wave patterns of each voltage pulses. From the width of the output voltage pulses, the PCM calculates engine speed. The width of the pulses represent the amount of time the output voltage stays high before switching back to low. The period of time the sensor output voltage stays high before switching back to low is referred to as pulse width. The faster the engine is operating, the smaller the pulse width on the oscilloscope.

By counting the pulses and referencing the pulse from the 60 degree signature notch, the PCM calculates crankshaft angle (position). In each group of timing reference notches, the first notch represents 69 degrees before top dead center (BTDC). The second notch represents 49 degrees BTDC. The third notch represents 29 degrees. The last notch in each set represents 9 degrees before top dead center (TDC).

The timing reference notches are machined at 20° increments. From the voltage pulse width the PCM tells the difference between the timing reference notches and the 60 degree signature notch. The 60 degree signature notch produces a longer pulse width than the smaller timing reference notches. If the camshaft position sensor input switches from high to low when the 60 degree signature notch passes under the crankshaft position sensor, the PCM knows cylinder number one is the next cylinder at TDC.

The crankshaft position sensor mounts to the engine block behind the alternator, just above the oil filter (Fig. 8).

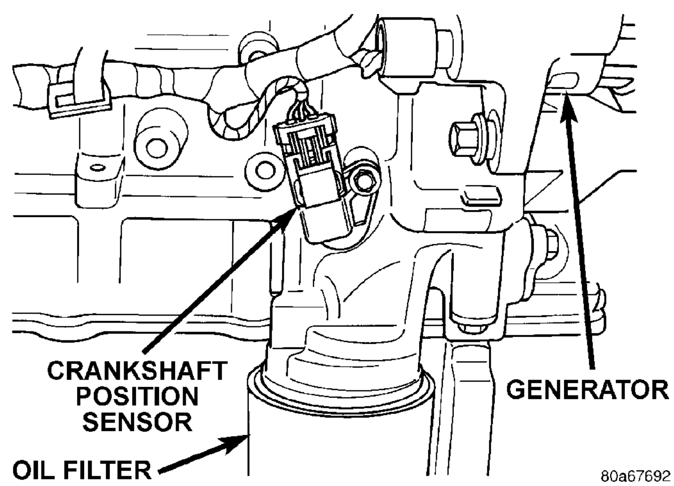


Fig. 8 Crankshaft Position Sensor

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The combination coolant temperature sensor has two elements. One element supplies coolant temperature signal to the PCM. The other element supplies coolant temperature signal to the instrument panel gauge cluster. The PCM determines engine coolant temperature from the coolant temperature sensor.

As coolant temperature varies the coolant temperature sensors resistance changes resulting in a different input voltage to the PCM and the instrument panel gauge cluster.

When the engine is cold, the PCM will provide slightly richer air- fuel mixtures and higher idle speeds until normal operating temperatures are reached.

DESCRIPTION AND OPERATION (Continued)

SOHC

The coolant sensor threads into the rear of the cylinder head, next to the camshaft position sensor (Fig. 9). New sensors have sealant applied to the threads.

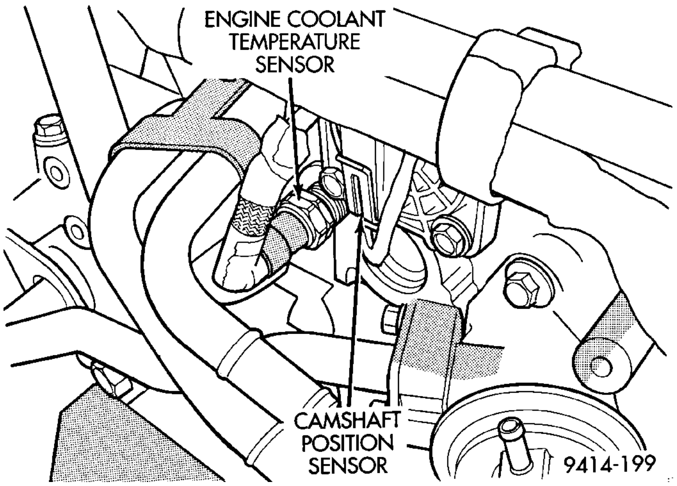


Fig. 9 Engine Coolant Temperature Sensor—SOHC

DOHC

The coolant sensor threads into the intake manifold next to the thermostat housing (Fig. 10). New sensors have sealant applied to the threads.

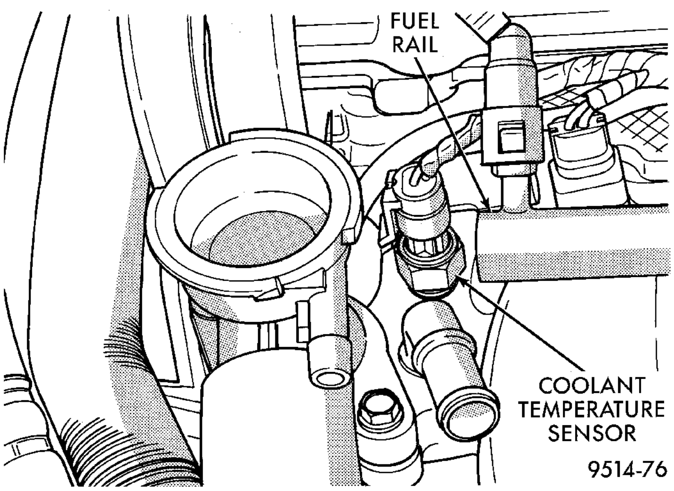


Fig. 10 Engine Coolant Temperature Sensor—DOHC

FUEL LEVEL SENSOR—PCM INPUT

The fuel level sensor (fuel gauge sending unit) sends a signal to the PCM to indicate fuel level. The purpose of this feature is to prevent a false setting of misfire and fuel system monitor trouble codes if the fuel level is less than approximately 15 percent of its rated capacity. It is also used to send a signal for fuel gauge operation via the CCD bus circuits.

HEATED OXYGEN SENSOR (O2S SENSOR)—PCM INPUT

As vehicles accumulate mileage, the catalytic convertor deteriorates. The deterioration results in a less efficient catalyst. To monitor catalytic convertor deterioration, the fuel injection system uses two heated oxygen sensors. One sensor upstream of the catalytic convertor, one downstream of the convertor. The PCM compares the reading from the sensors to calculate the catalytic convertor oxygen storage capacity and converter efficiency. Also, the PCM uses the upstream heated oxygen sensor input when adjusting injector pulse width.

When the catalytic converter efficiency drops below emission standards, the PCM stores a diagnostic trouble code and illuminates the malfunction indicator lamp (MIL).

The O2S sensors produce voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas in the exhaust manifold. When a large amount of oxygen is present (caused by a lean air/fuel mixture), the sensors produces a low voltage. When there is a lesser amount present (rich air/fuel mixture) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensors act as a rich- lean switch.

The oxygen sensors are equipped with a heating element that keeps the sensors at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors the O2S sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the O2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

The Automatic Shutdown (ASD) relay supplies battery voltage to both the upstream and downstream heated oxygen sensors. The oxygen sensors are equipped with a heating element. The heating elements reduce the time required for the sensors to reach operating temperature.

UPSTREAM OXYGEN SENSOR

The input from the upstream heated oxygen sensor tells the PCM the oxygen content of the exhaust gas. Based on this input, the PCM fine tunes the air-fuel ratio by adjusting injector pulse width.

The sensor input switches 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 voltage as low as 0.1 volt. When there is a lesser amount of oxygen present (rich air-fuel mixture) the sensor produces a voltage as high as 1.0 volt. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

DESCRIPTION AND OPERATION (Continued)

The heating element in the sensor provides heat to the sensor ceramic element. Heating the sensor 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, the PCM adjusts injector pulse width based on the upstream heated oxygen sensor input along with other inputs. In Open Loop, the PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

The upstream oxygen sensor threads into the outlet flange of the exhaust manifold (Fig. 11).

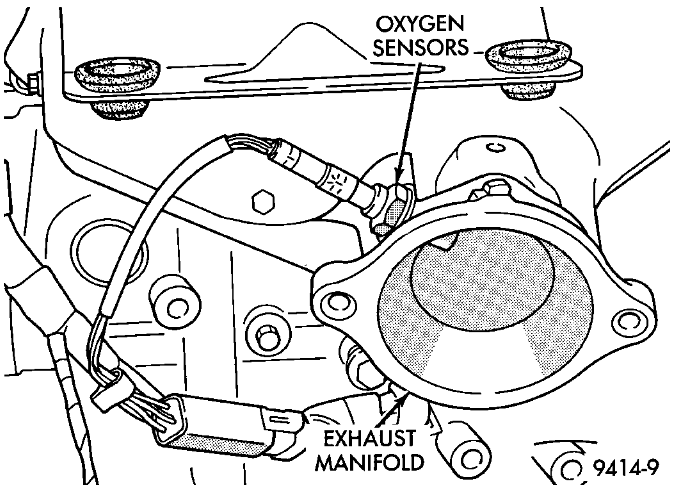


Fig. 11 Upstream Heated Oxygen Sensor

DOWNSTREAM OXYGEN SENSOR

The downstream heated oxygen sensor threads into the outlet pipe at the rear of the catalytic convertor (Fig. 12). The downstream heated oxygen sensor input is used to detect catalytic convertor deterioration. As the convertor deteriorates, the input from the downstream sensor begins to match the upstream sensor input except for a slight time delay. By comparing the downstream heated oxygen sensor input to the input from the upstream sensor, the PCM calculates catalytic convertor efficiency.

IGNITION CIRCUIT SENSE—PCM INPUT

The ignition circuit sense input tells the Powertrain Control Module (PCM) the ignition switch has energized the ignition circuit. Refer to the wiring diagrams for circuit information.

INTAKE AIR TEMPERATURE SENSOR—PCM INPUT

The Intake Air Temperature (IAT) sensor measures the temperature of the intake air as it enters the engine. The sensor supplies one of the inputs the PCM uses to determine injector pulse width and spark advance.

As Intake Air temperature varies the Intake Air Temperature sensors resistance changes resulting in a different input voltage to the PCM.

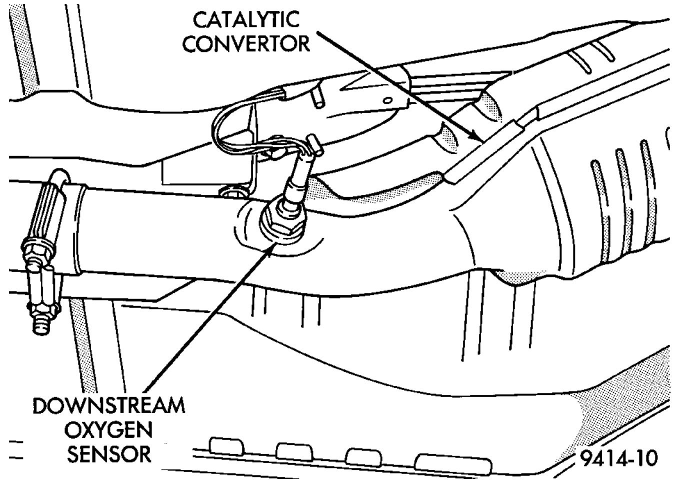


Fig. 12 Downstream Heated Oxygen Sensor

The IAT sensor and Manifold Absolute Pressure (MAP) switch are a combined into a single sensor that attachs to the intake manifold (Fig. 13) or (Fig. 14).

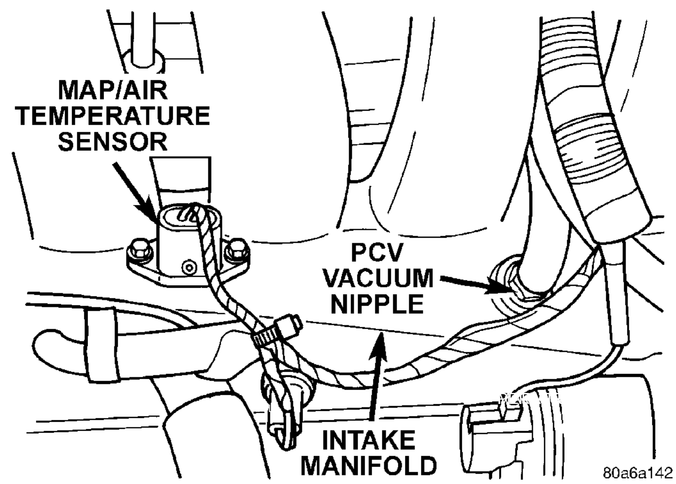


Fig. 13 / MAP/Intake Air Temperature Sensor—SOHC

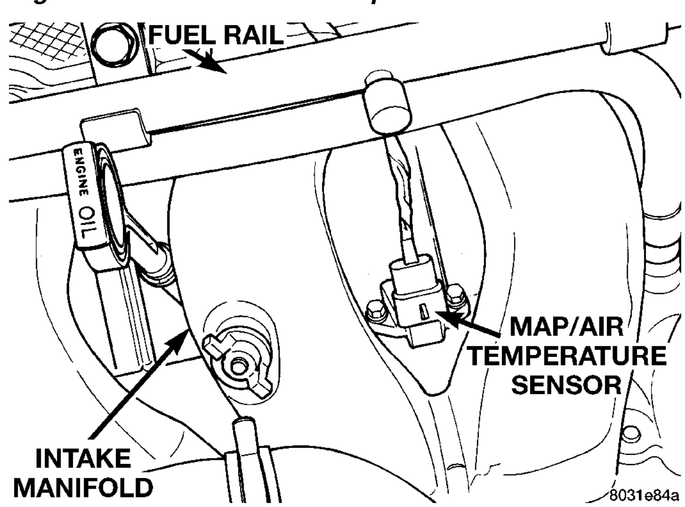


Fig. 14 MAP/Intake Air Temperature Sensor—DOHC

DESCRIPTION AND OPERATION (Continued)

KNOCK SENSOR—PCM INPUT

The knock sensor threads into the side of the cylinder block in front of the starter (Fig. 15). When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which sends an input voltage (signal) to the PCM. As the intensity of the engine knock vibration increases, the knock sensor output voltage also increases.

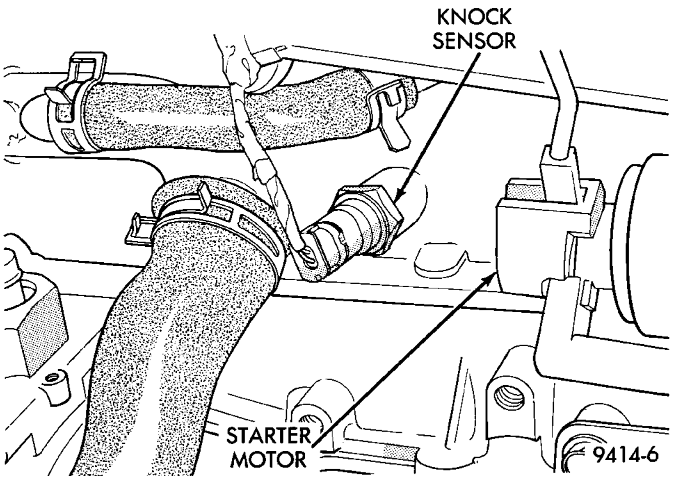


Fig. 15 Knock Sensor

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

The PCM supplies 5 volts direct current 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.

At key on, before the engine is started, 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/Intake Air Temperature sensor mounts to the intake manifold (Fig. 13) and (Fig. 14).

POWER STEERING PRESSURE SWITCH—PCM INPUT

A pressure sensing switch is located on the power steering gear. The switch (Fig. 16) provides an input to the PCM during periods of high pump load and low engine RPM; such as during parking maneuvers.

When power steering pump pressure exceeds 2758 kPa (400 psi), the switch is open. The PCM increases idle air flow through the IAC motor to prevent engine stalling. When pump pressure is low, the switch is closed.

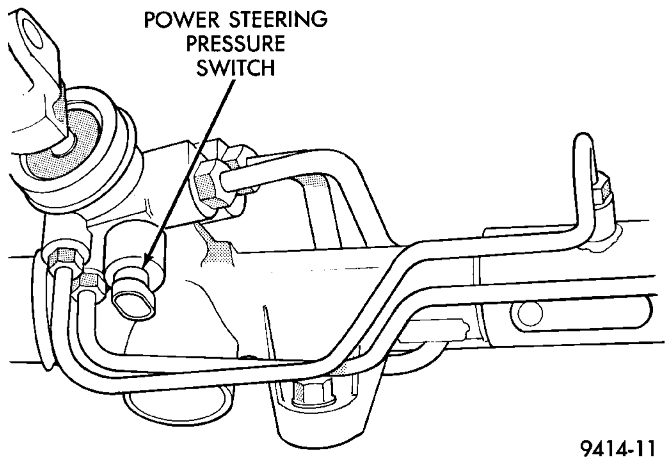


Fig. 16 Power Steering Pressure Switch

SENSOR RETURN—PCM INPUT

The sensor return circuit provides a low electrical noise ground reference for all of the systems sensors. The sensor return circuit connects to internal ground circuits within the powertrain control module.

SPEED CONTROL—PCM INPUT

The speed control system provides five separate voltages (inputs) to the Powertrain Control Module (PCM). The voltages correspond to the ON/OFF, SET, RESUME and CANCEL.

The speed control ON voltage informs the PCM that the speed control system has been activated. The speed control SET voltage informs the PCM that a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control CANCEL voltage tells the PCM to deactivate but retain set speed in memory (same as depressing the brake pedal). The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for more speed control information.

DESCRIPTION AND OPERATION (Continued)

SCI RECEIVE—PCM INPUT

SCI Receive is the serial data communication receive circuit for the DRB scan tool. The Powertrain Control Module (PCM) receives data from the DRB through the SCI Receive circuit.

PARK/NEUTRAL POSITION SWITCH—PCM INPUT

The park/neutral position switch is located on the automatic transaxle housing (Fig. 17). Manual transaxles do not use park/neutral switches. The switch provides an input to the PCM to indicate 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) and ignition timing advance. The park/neutral input is also used to cancel vehicle speed control. The park/neutral switch is sometimes referred to as the neutral safety switch.

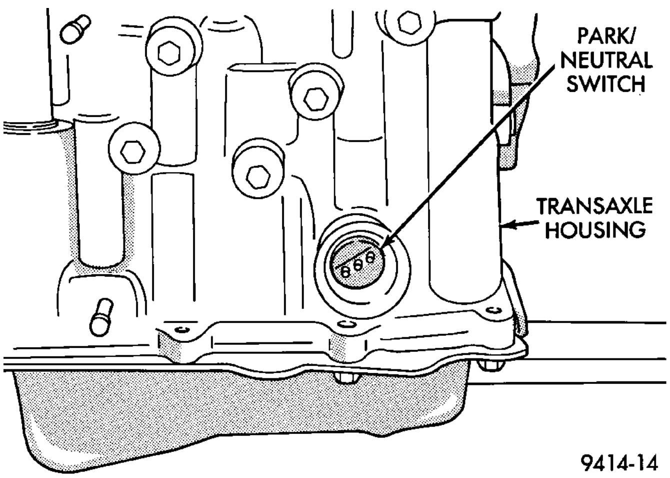


Fig. 17 Park/Neutral Switch

THROTTLE POSITION SENSOR—PCM INPUT

The throttle position sensor mounts to the side of the throttle body (Fig. 18) and (Fig. 19).

The Throttle Position Sensor (TPS) connects to the throttle blade shaft. 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 DC to the TPS. The TPS output voltage (input signal to the powertrain control module) represents throttle blade position. The TPS output voltage to the PCM varies from approximately 0.35 to 1.03 volts at minimum throttle opening (idle) to a maximum of 3.1 to 4.0 volts at wide open throttle.

Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. The PCM also adjusts fuel injector pulse width and ignition timing based on these inputs.

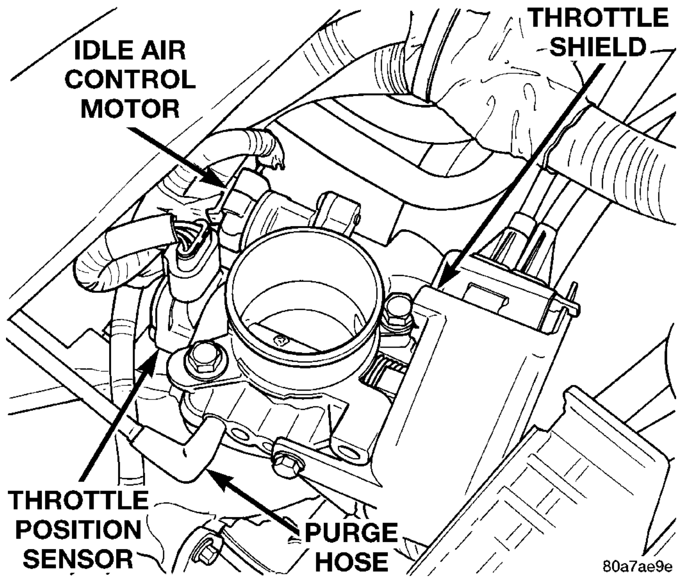


Fig. 18 Throttle Position Sensor and Idle Air Control Motor—SOHC

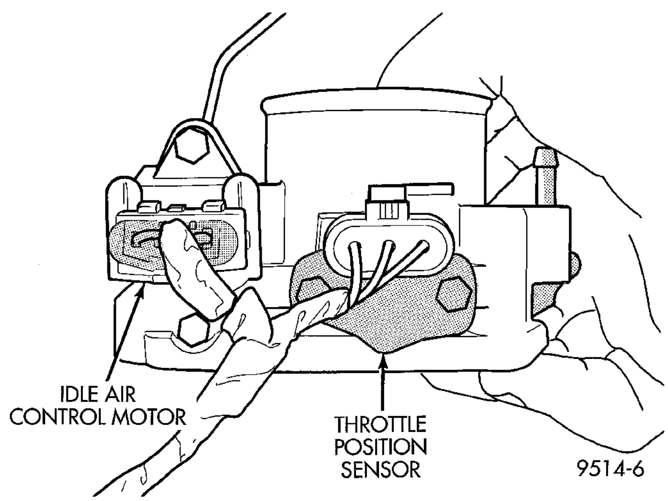


Fig. 19 Throttle Position Sensor and Idle Air Control Motor—DOHC

DESCRIPTION AND OPERATION (Continued)

VEHICLE SPEED SENSOR—PCM INPUT

The vehicle speed sensor is located in the transmission extension housing (Fig. 20) and (Fig. 21). The sensor input is used by the PCM to determine vehicle speed and distance traveled.

The vehicle speed sensor generates 8 pulses per sensor revolution. These signals, in conjunction with a closed throttle signal from the throttle position sensor, indicate a closed throttle deceleration to the PCM. Under deceleration conditions, the PCM adjusts the Idle Air Control (IAC) motor to maintain a desired MAP value.

When the vehicle is stopped at idle, a closed throttle signal is received by the PCM (but a speed sensor signal is not received). Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

The vehicle speed sensor signal is also used to operate the following functions or systems:

- Speedometer
- Speed control
- Daytime Running Lights (Canadian Vehicles only).

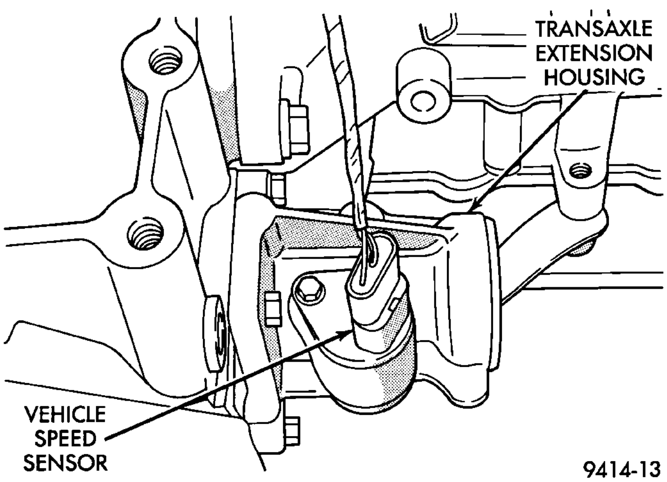


Fig. 20 Vehicle Speed Sensor—Automatic Transmission

AIR CONDITIONING CLUTCH RELAY—PCM OUTPUT

The PCM controls the air conditioning clutch relay ground circuit. Buss bars in the Power Distribution Center (PDC) supply voltage to the solenoid side and power side of the relay. When the PCM receives an air conditioning input, it grounds the A/C compressor clutch relay and the radiator fan relay.

When the PCM senses low idle speeds or wide open throttle through the throttle position sensor, it removes the ground for the A/C compressor clutch relay. When the relay de-energizes, the contacts open preventing air conditioning clutch engagement. Also, if the PCM senses a part throttle launch condition, it disables the A/C compressor clutch for several seconds.

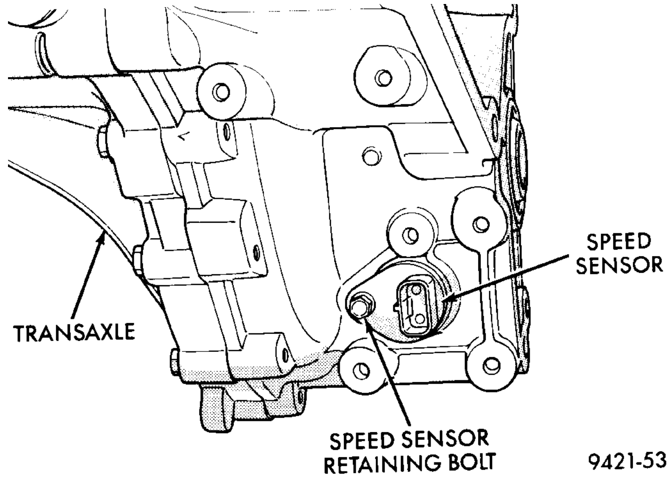


Fig. 21 Vehicle Speed Sensor—Manual Transmission

The air conditioning clutch relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

AUTOMATIC SHUTDOWN RELAY—PCM OUTPUT

The automatic shutdown (ASD) relay supplies battery voltage to the fuel injectors, electronic ignition coil and the heating elements in the oxygen sensors.

A buss bar in the power distribution center (PDC) supplies voltage to the solenoid side and contact side of the relay. The ASD relay power circuit contains a 20 amp fuse between the buss bar in the PDC and the relay. The fuse also protects the power circuit for the fuel pump relay and pump. The fuse is located in the PDC. Refer to Group 8W, Wiring Diagrams for circuit information.

The PCM controls the relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position unless the 02 Heater Monitor test is being run. Refer to Group 25, On-Board Diagnostics. When the ignition switch is in the On or Crank position, the PCM monitors the crankshaft position sensor and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive the crankshaft position sensor and camshaft position sensor signals when the ignition switch is in the Run position, it will de- energize the ASD relay.

The ASD relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

CHARGING SYSTEM INDICATOR LAMP—PCM OUTPUT

The PCM turns the instrument panel Charging System Lamp on. Refer to Group 8C for charging system information.

DESCRIPTION AND OPERATION (Continued)

FUEL PUMP RELAY—PCM OUTPUT

The fuel pump relay supplies battery voltage to the fuel pump. A buss bar in the Power Distribution Center (PDC) supplies voltage to the solenoid side and contact side of the relay. The fuel pump relay power circuit contains a 20 amp fuse between the buss bar in the PDC and the relay. The fuse also protects the power circuit for the Automatic Shutdown (ASD) relay. The fuse is located in the PDC. Refer to Group 8W, Wiring Diagrams for circuit information.

The PCM controls the fuel pump relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position. When the ignition switch is in the On position, the PCM energizes the fuel pump. If the crankshaft position sensor does not detect engine rotation, the PCM de- energizes the relay after approximately one second.

The fuel pump relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

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 engine enters closed loop operation after it reaches a specified temperature and the programmed time delay ends. During closed loop operation, the PCM energizes and de-energizes the solenoid 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 is energized.

The solenoid attaches to a bracket near the front engine mount (Fig. 22). To operate correctly, the solenoid must be installed with the electrical connector on top.

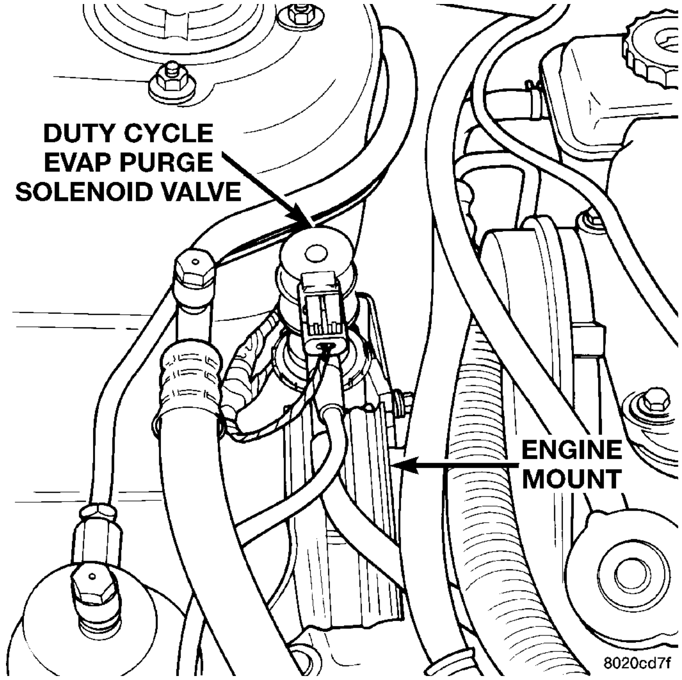


Fig. 22 Duty Cycle EVAP Purge Solenoid

ELECTRIC EGR TRANSDUCER—PCM OUTPUT

The Electric EGR Transducer contains an electrically operated solenoid and a back-pressure controlled vacuum transducer (Fig. 23). The PCM operates the solenoid based on inputs from the multiport fuel injection system. The transducer and EGR valve are serviced as an assembly.

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the vacuum transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of the vacuum signal applied to the EGR valve. Varying the strength of the vacuum signal changes the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

The transducer and EGR valve mount to the rear of the cylinder head (Fig. 23).

GENERATOR FIELD—PCM OUTPUT

The PCM regulates the charging system voltage within a range of 12.9 to 15.0 volts. Refer to Group 8A for Battery system information and 8C for charging system information.

IDLE AIR CONTROL MOTOR—PCM OUTPUT

The Idle Air Control (IAC) motor is mounted on the throttle body. The PCM operates the idle air control motor (Fig. 24). The PCM adjusts engine idle speed through the idle air control motor to compensate for engine load, coolant temperature or barometric pressure changes.

The throttle body has an air bypass passage that provides air for the engine during closed throttle idle. 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 IAC motor pintle in and out of the bypass passage.

DESCRIPTION AND OPERATION (Continued)

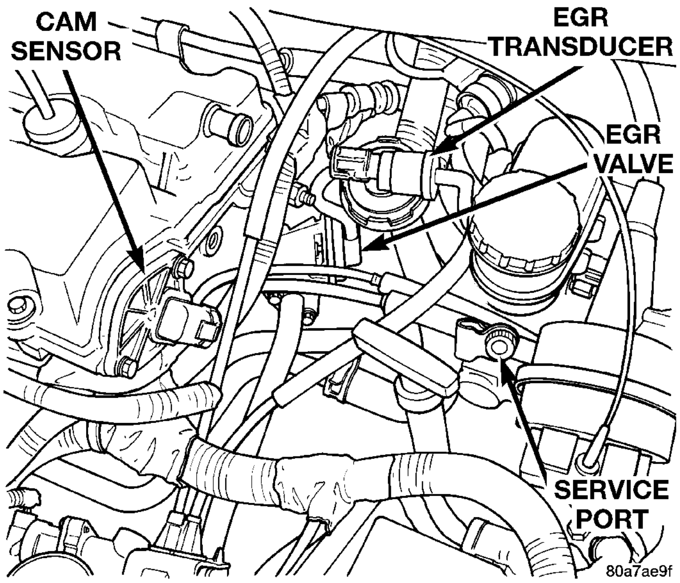


Fig. 23 Electric EGR Backpressure Transducer—Typical

The adjustments are based on inputs the PCM receives. The inputs are from the throttle position sensor, crankshaft position sensor, coolant temperature sensor, MAP sensor, vehicle speed sensor and various switch operations (brake, park/neutral, air conditioning).

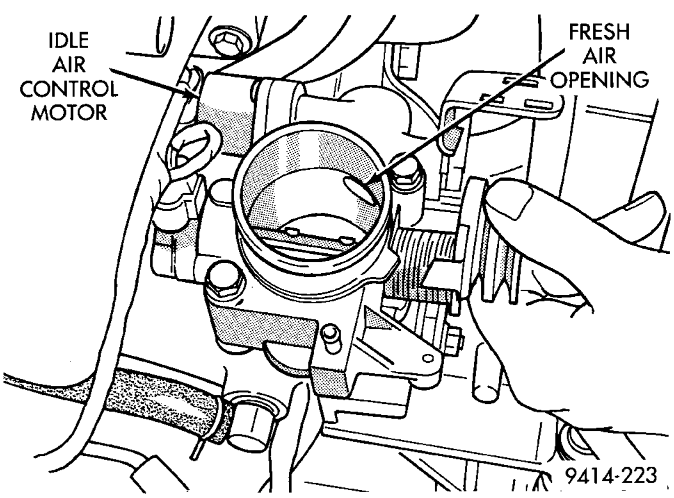


Fig. 24 Idle Air Control Motor Air Bypass Passage—Typical

DATA LINK CONNECTOR

The data link connector (diagnostic connector) links the DRB scan tool with the powertrain control module (PCM). Refer to On-Board Diagnostics in the General Diagnosis section of this group. The data link connector is located inside the vehicle, under the instrument panel, left of the steering column (Fig. 25).

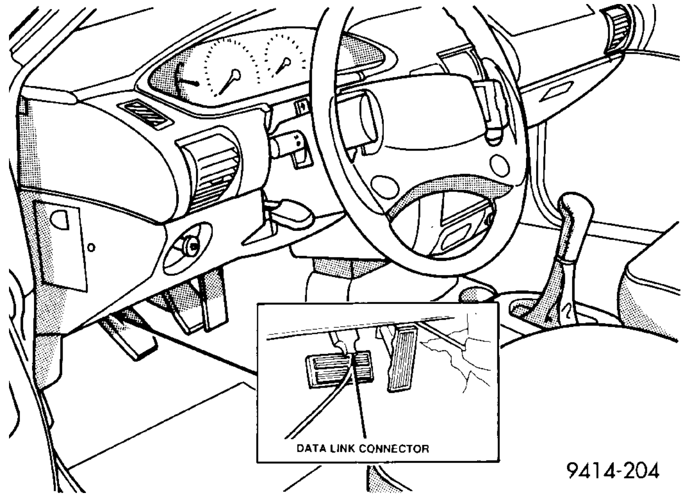


Fig. 25 Data Link Connector

FUEL INJECTORS—PCM OUTPUT

The 2.0L engine uses electrically operated top feed fuel injectors (Fig. 26). The Automatic Shutdown (ASD) relay supplies battery voltage to the fuel injectors. The PCM controls the ground path for each injector in sequence. By switching the ground paths on and off, the PCM fine-tunes injector pulse width. Injector pulse width refers to the amount of time an injector operates.

The PCM determines injector synchronization from the camshaft position sensor and crankshaft position sensor inputs. The PCM grounds the ASD and fuel pump relays after receiving the camshaft position sensor and crankshaft position sensor inputs.

The PCM energizes the injectors in a sequential order during all engine operating conditions except start-up. For the first injector pulse width during start-up, all injectors are energized at the same time. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.

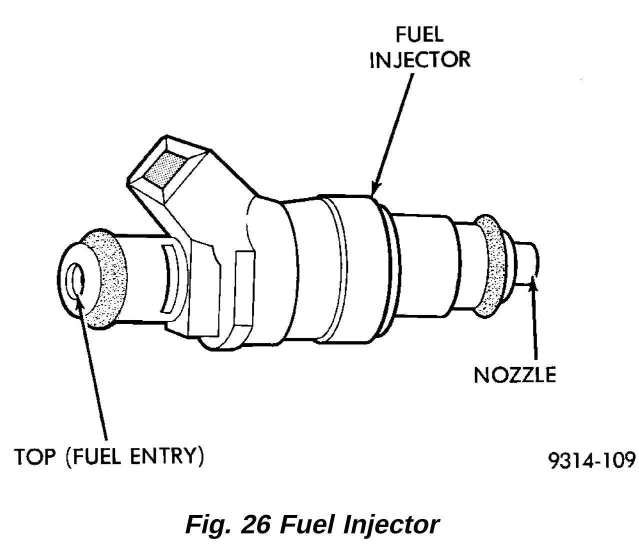


Fig. 26 Fuel Injector

DESCRIPTION AND OPERATION (Continued)

IGNITION COIL—PCM OUTPUT

The coil assembly consists of 2 coils molded together. The coil assembly is mounted over the valve cover (Fig. 27) or (Fig. 28). 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. Coil number one fires cylinders 1 and 4. Coil number two fires cylinders 2 and 3. The PCM determines which of the coils to charge and fire at the correct time.

The Auto Shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs. Refer to Auto Shutdown (ASD) Relay—PCM Output in this section for relay operation.

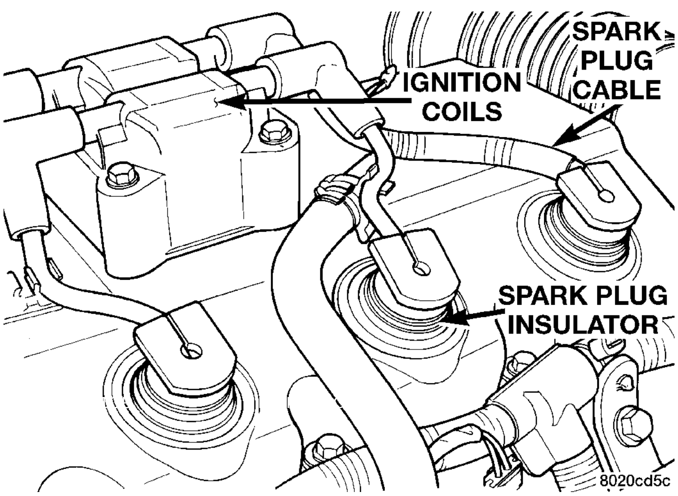


Fig. 27 Ignition Coil Pack—SOHC

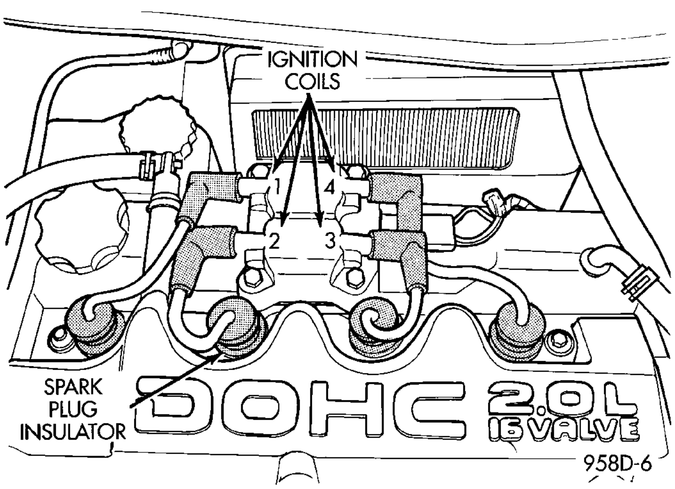


Fig. 28 Ignition Coil Pack—DOHC

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT

The PCM supplies the malfunction indicator (check engine) lamp on/off signal to the instrument panel through the CCD Bus. The CCD Bus is a communications port. Various modules use the CCD Bus to exchange information.

The Check Engine lamp comes on each time the ignition key is turned ON and stays on for 3 seconds as a bulb test.

The Malfunction Indicator Lamp (MIL) stays on continuously, when the PCM has entered a Limp-In mode or identified a failed emission component. During Limp-in Mode, the PCM attempts to keep the system operational. The MIL signals the need for immediate service. In limp-in mode, the PCM compensates for the failure of certain components that send incorrect signals. The PCM substitutes for the incorrect signals with inputs from other sensors.

If the PCM detects active engine misfire severe enough to cause catalyst damage, it flashes the MIL. At the same time the PCM also sets a Diagnostic Trouble Code (DTC).

For signals that can trigger the MIL (Check Engine Lamp) refer to Group 25, On-Board Dianostics.

The MIL can also display diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within 5 seconds and any diagnostic trouble codes stored in the PCM will be displayed. Refer to On-Board Diagnostics in Group 25, Emission Control Systems Diagnostic Trouble Code Descriptions.

RADIATOR FAN CONTROL MODULE—PCM OUTPUT

The radiator fan runs when coolant temperature and A/C system pressure demand cooling. The radiator fan circuit contains a Pulse Width Module (PWM). Refer to the Group 8W for a circuit schematic.

A 5 volt signal is supplied to the PWM. The PCM provides a pulsed ground for the PWM. Depending upon the amount of pulse on time, the PWM puts out a proportional voltage to the fan motor at the lower speed. For instance, if the on time is 30 percent, then the voltage to the fan motor will be 3.6 volts.

When engine coolant reaches approximately 99°C (210°F) the PCM grounds the PWM relay. When the PCM grounds the relay it operates at a 30% duty cycle and immediately ramps up to 100% duty cycle. The PCM de-energizes the PWM relay when coolant temperature drops to approximately 93°C (199°F).

Also, when the air conditioning pressure switch closes, the PCM grounds the PWM. The air conditioning switch closes at 285 psi ±10 psi. When air

DESCRIPTION AND OPERATION (Continued)

conditioning pressure drops approximately 40 psi, the pressure switch opens and the fan turns off.

The PWM relay is located on the left front inner frame just behind the radiator.

SPEED CONTROL—PCM INPUT

The speed control system provides five separate voltages (inputs) to the Powertrain Control Module (PCM). The voltages correspond to the ON/OFF, SET, RESUME and CANCEL.

The speed control ON voltage informs the PCM that the speed control system has been activated. The speed control SET voltage informs the PCM that a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control CANCEL voltage tells the PCM to deactivate but retain set speed in memory (same as depressing the brake pedal). The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for more speed control information.

SCI RECEIVE—PCM INPUT

SCI Receive is the serial data communication receive circuit for the DRB scan tool. The Powertrain Control Module (PCM) receives data from the DRB through the SCI Receive circuit.

TACHOMETER—PCM OUTPUT

The PCM operates the tachometer on the instrument panel. The PCM calculates engine RPM from the crankshaft position sensor input.

TORQUE CONVERTOR CLUTCH SOLENOID—PCM OUTPUT

Three-speed automatic transaxles use a torque converter clutch solenoid. The PCM controls the engagement of the torque converter clutch through the solenoid (Fig. 29). The torque converter clutch is engaged up only in direct drive mode. Refer to Group 21 for transmission information.

DIAGNOSIS AND TESTING

VISUAL INSPECTION—SOHC

Before diagnosing or servicing the fuel injection system, perform a visual inspection for loose, disconnected, or misrouted wires and hoses (Fig. 30). A thorough visual inspection that includes the following checks saves unnecessary test and diagnostic time.

(1) Inspect the battery connections. Clean corroded terminals (Fig. 31).

(2) Check the 2 PCM 40-way connector for stretched wires on pushed out terminals (Fig. 31).

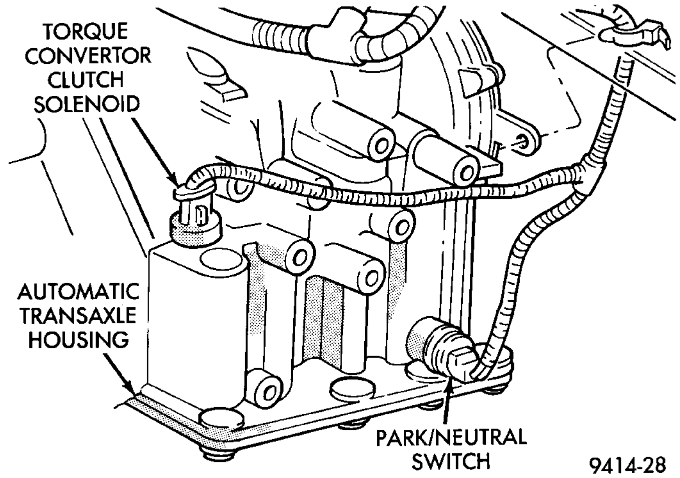


Fig. 29 Torque Convertor Clutch Solenoid

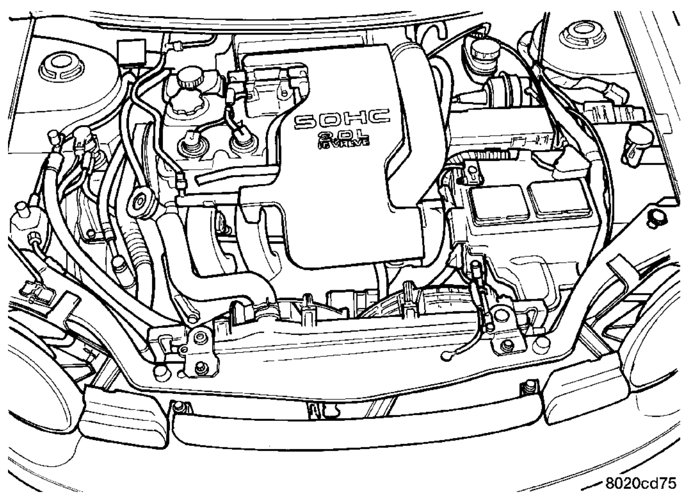


Fig. 30 2.0L SOHC Engine Compartment

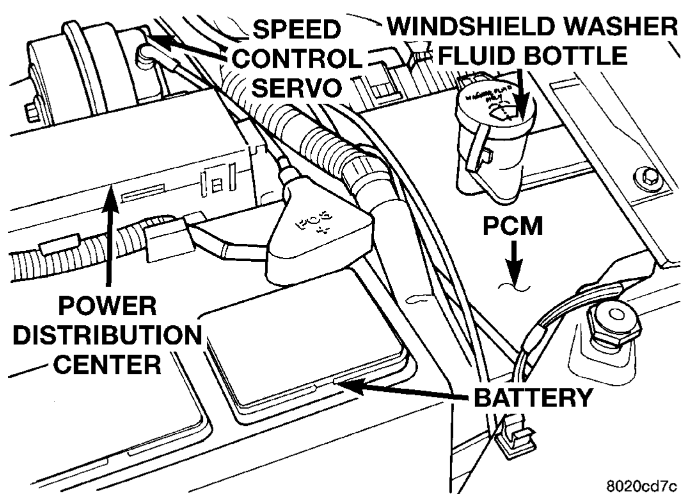


Fig. 31 Battery, PCM, and PDC

DIAGNOSIS AND TESTING (Continued)

(3) Open the Power Distribution Center (PDC). Check for blown fuses. Ensure the relays and fuses are fully seated in the PDC (Fig. 32). A label on the underside of the PDC cover shows the locations of each relay and fuse.

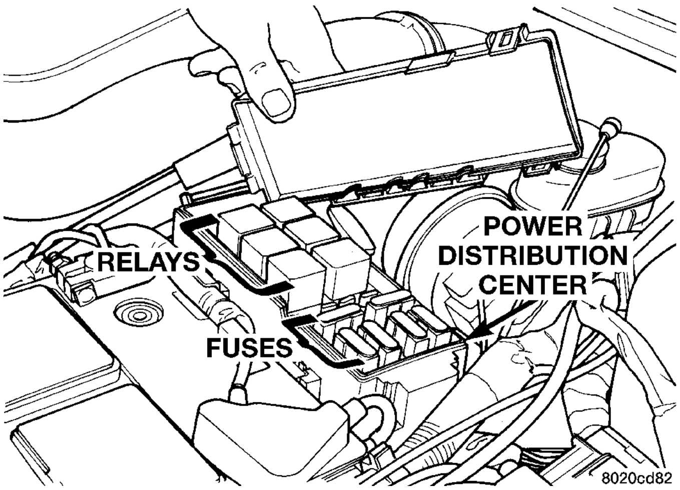


Fig. 32 Power Distribution Center

(4) Verify the throttle cable operates freely (Fig. 33).

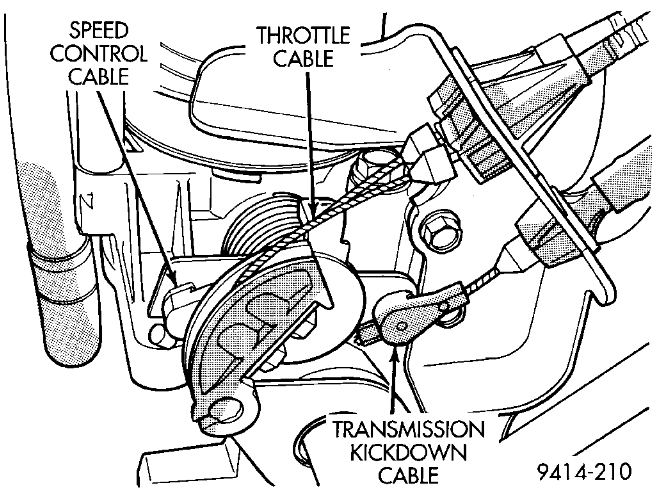


Fig. 33 Throttle Cable—Automatic Transmission

(5) Check the electrical connections at the idle air control motor and throttle position sensor (Fig. 34).

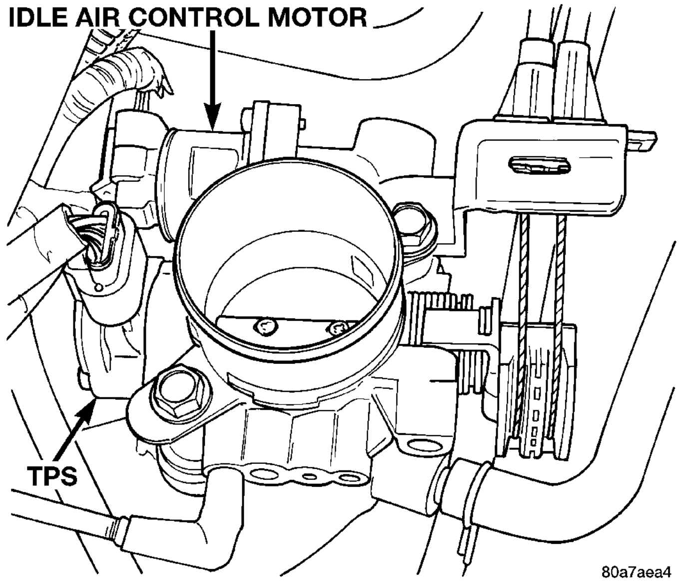


Fig. 34 Idle Air Control Motor and Throttle Position Sensor—Typical

(6) Check hose connections between the PCV valve, vacuum port - intake manifold and the oil separator (Fig. 35).

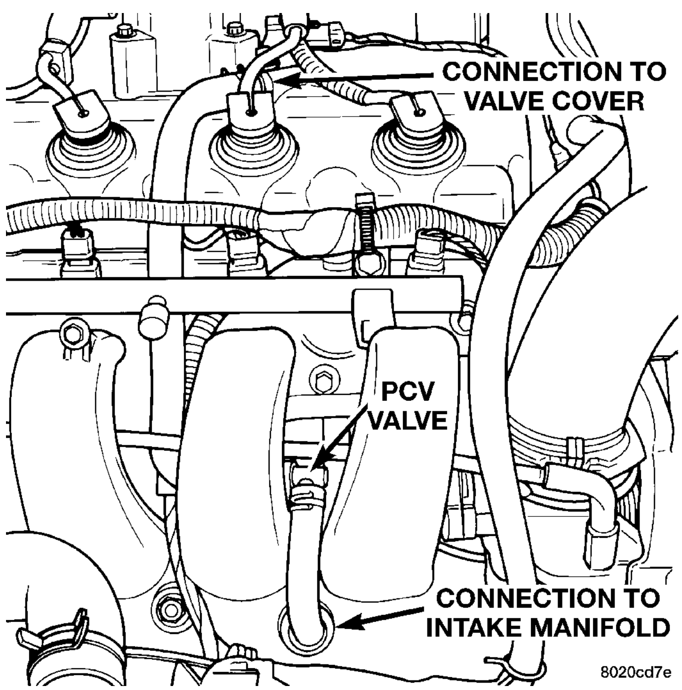


Fig. 35 PCV Valve

DIAGNOSIS AND TESTING (Continued)

(7) Inspect the electrical connections at the MAP sensor/intake air temperature sensor and the (Fig. 36).

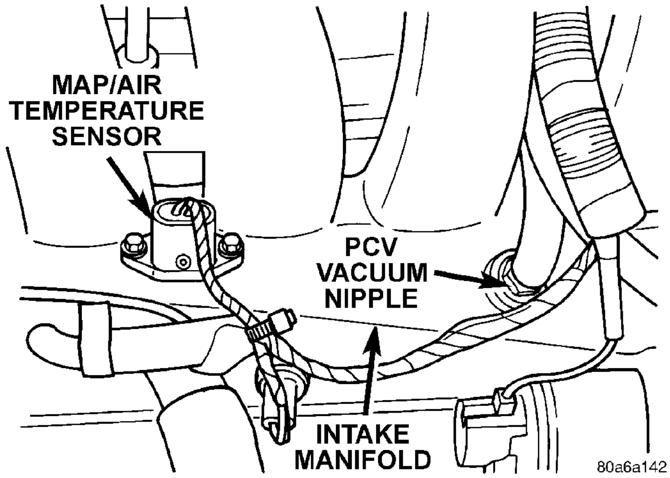


Fig. 36 MAPIntake Air Temperature Sensor

(8) Inspect the fuel injector electrical connections (Fig. 37).

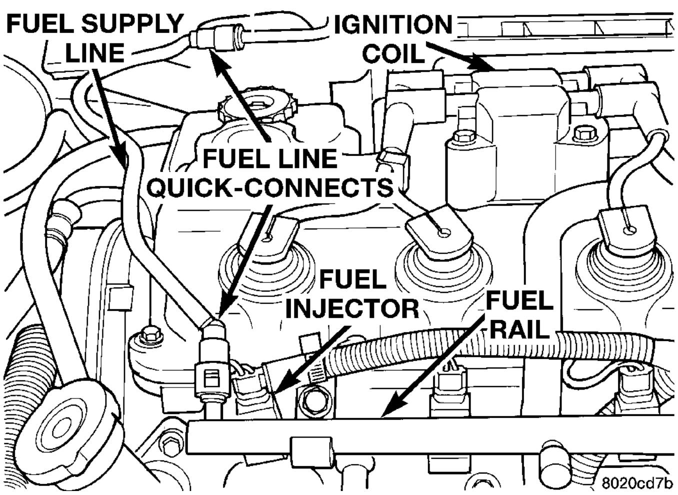


Fig. 37 Fuel Injectors

(9) Inspect the ignition coil electrical connector. Ensure the spark plug insulators are firmly seated over the spark plugs (Fig. 38).

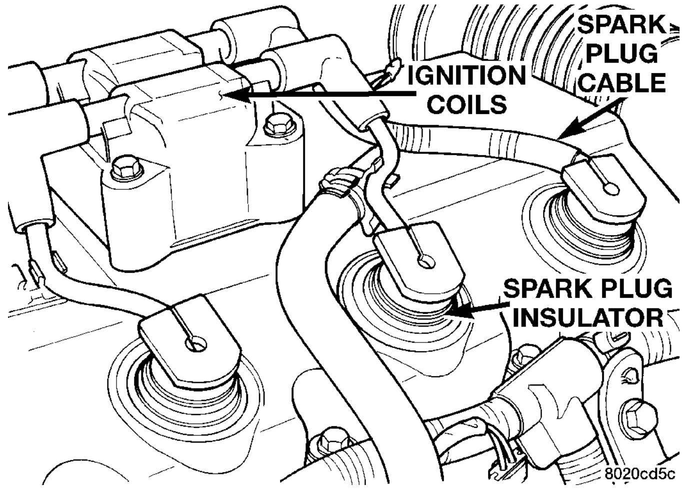


Fig. 38 Ignition Coil and Spark Plugs—Typical

(10) Inspect the electrical and hose connections at the duty cycle purge solenoid (Fig. 39).

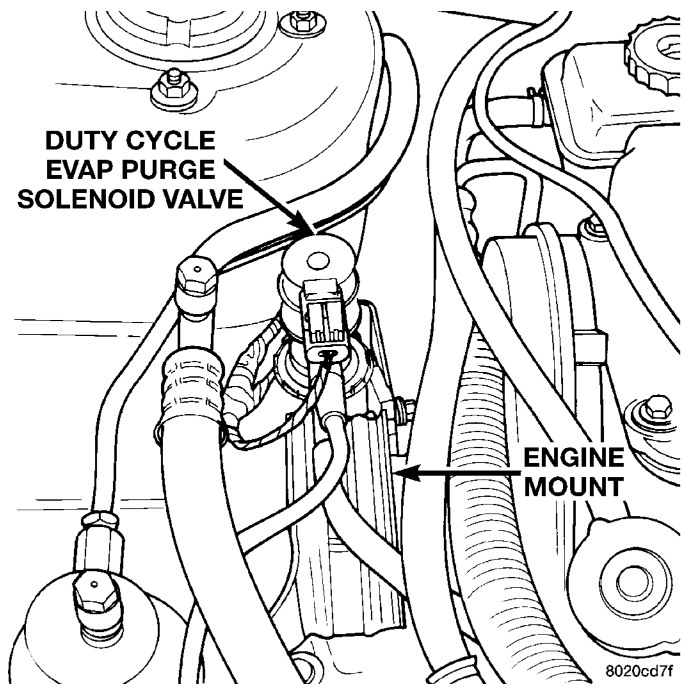


Fig. 39 Duty Cycle Purge Solenoid

DIAGNOSIS AND TESTING (Continued)

(11) Check the electrical connection to the radiator fan.

(12) Inspect for corrosion on the electrical connections at the starter motor solenoid. Check the ground cable connection below the starter motor (Fig. 40).

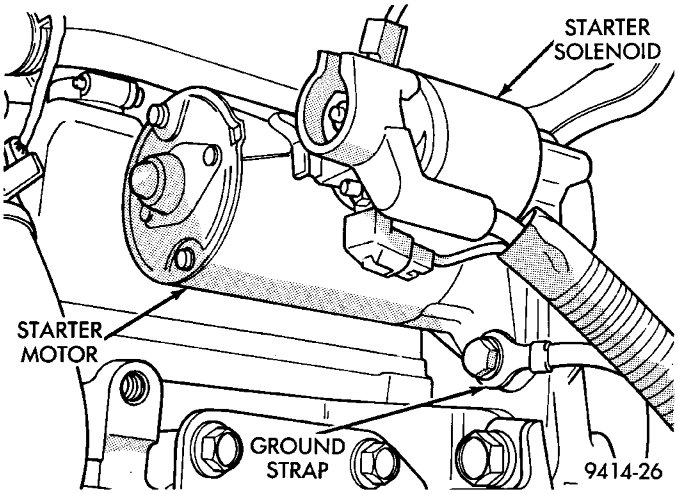


Fig. 40 Starter Motor and Ground Strap

(13) Inspect the air cleaner filter element. Replace as necessary. Check the air induction system for restrictions.

(14) Check the electrical connection at the knock sensor (Fig. 41).

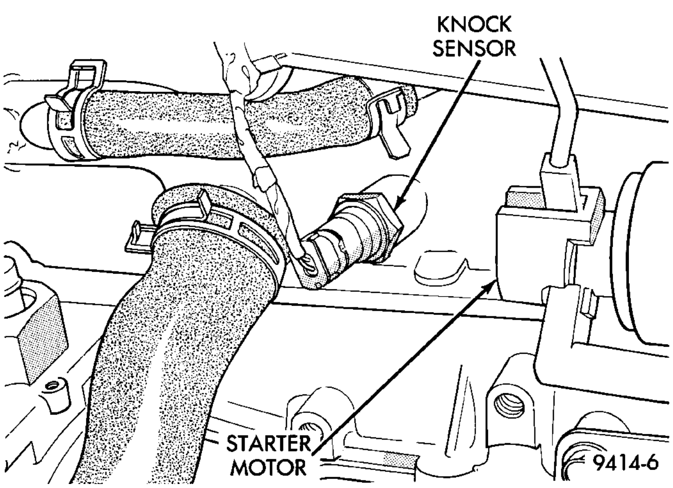


Fig. 41 Knock Sensor

(15) Check the electrical connections at the camshaft position sensor and engine coolant temperature sensor (Fig. 42).

(16) Check the electrical connector at the Electronic EGR Transducer. Inspect the vacuum and back pressure hoses at the solenoid and transducer for leaks (Fig. 43).

(17) Inspect the electrical connections at the generator (Fig. 44). Check the generator belt for glazing or damage.

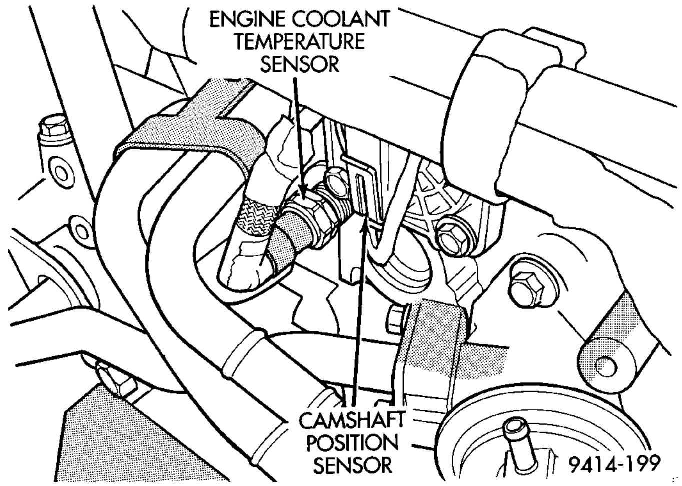


Fig. 42 Camshaft Position Sensor and Engine Coolant Temperature Sensor

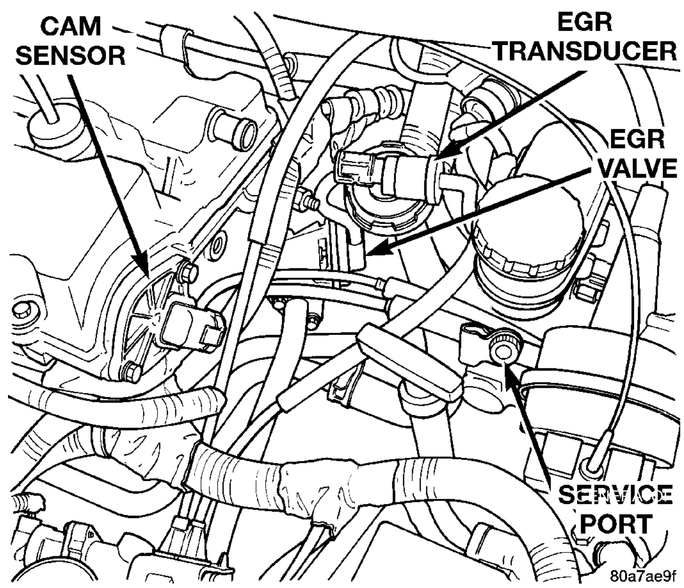


Fig. 43 Electronic EGR Transducer

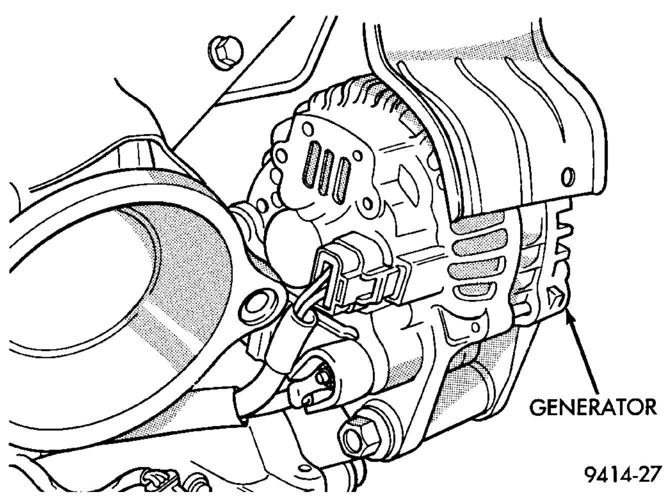


Fig. 44 Generator

DIAGNOSIS AND TESTING (Continued)

(18) Inspect the electrical connector at the crankshaft position sensor (Fig. 45).

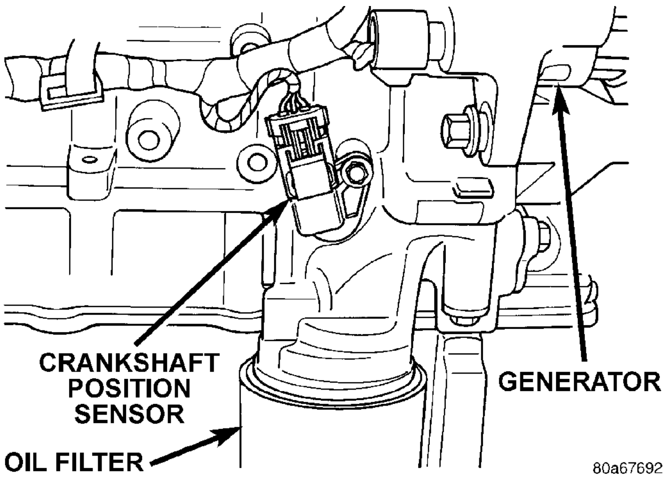


Fig. 45 Crankshaft Position Sensor

(19) Check the electrical connection at the vehicle speed sensor (Fig. 46).

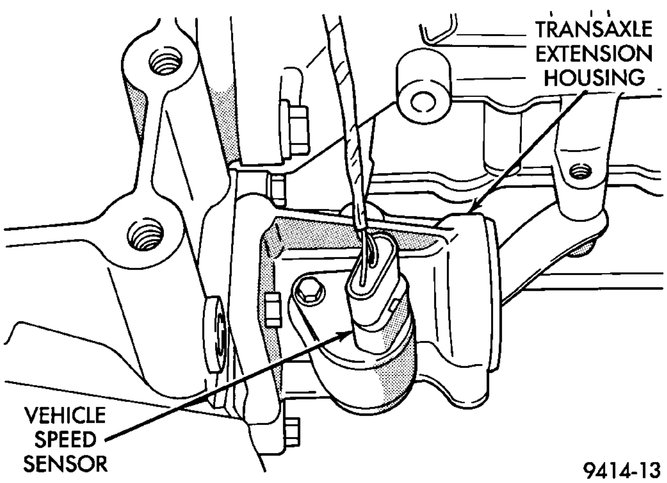


Fig. 46 Vehicle Speed Sensor

(20) Check the electrical connection at the power steering pressure switch on the power steering gear housing (Fig. 47).

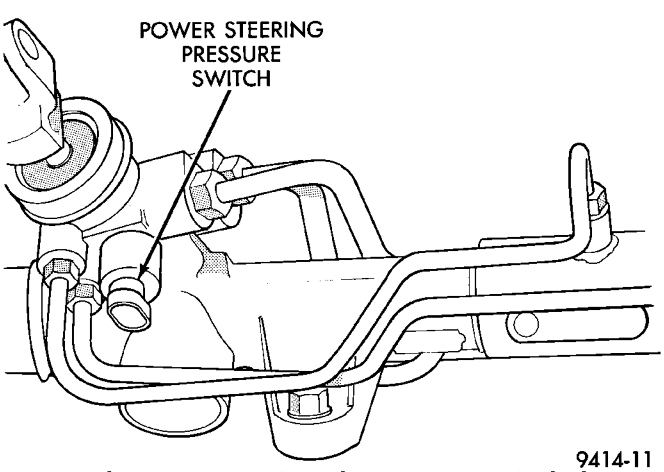


Fig. 47 Power Steering Pressure Switch

(21) On vehicles with automatic transaxles, check the electrical connections at the park/neutral switch and the torque convertor clutch solenoid (Fig. 48).

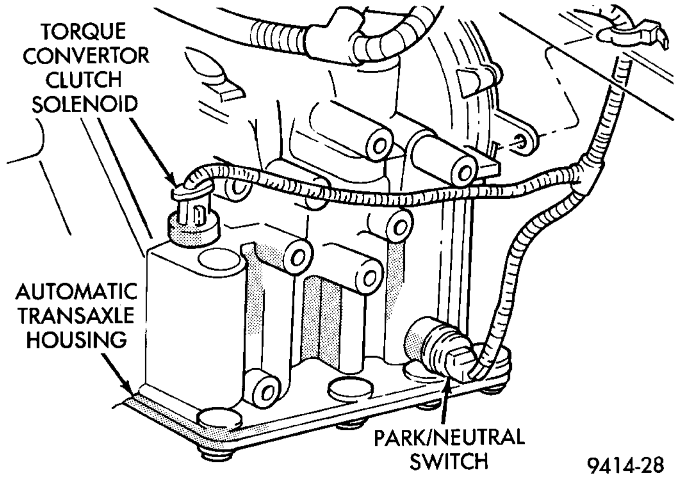


Fig. 48 Park/Neutral Switch and Torque Convertor Clutch Solenoid

(22) Inspect the electrical connections at the upstream and downstream heated oxygen sensors (Fig. 49) and (Fig. 50).

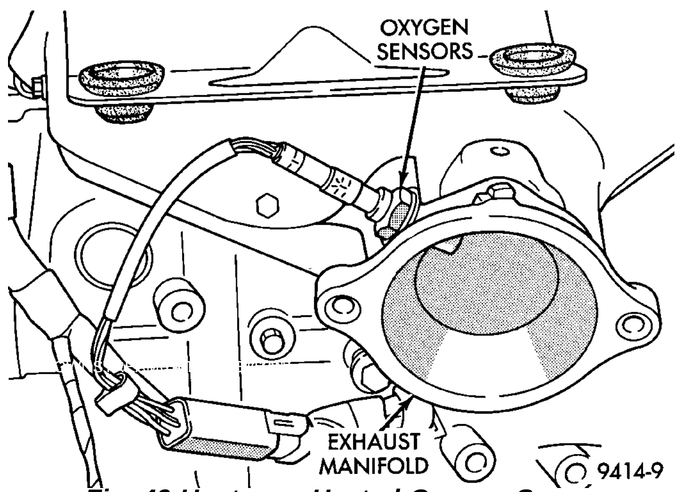


Fig. 49 Upstream Heated Oxygen Sensor

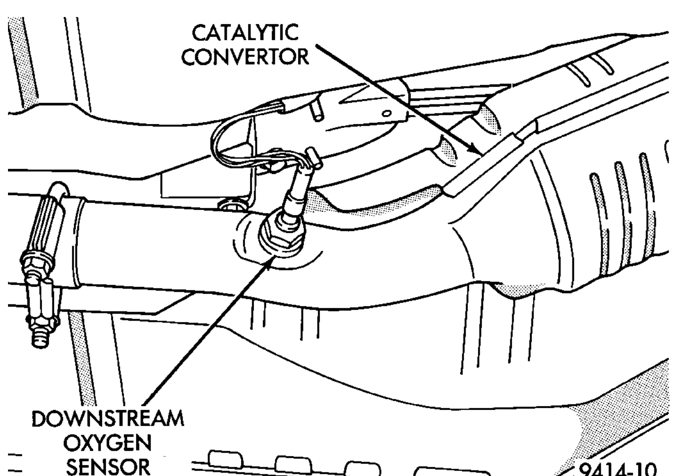


Fig. 50 Downstream Heated Oxygen Sensor

DIAGNOSIS AND TESTING (Continued)

(23) Inspect the fuel pump module electrical connection at the fuel tank for corrosion or damage (Fig. 51). Check for pinched, kinked or damaged fuel supply tube.

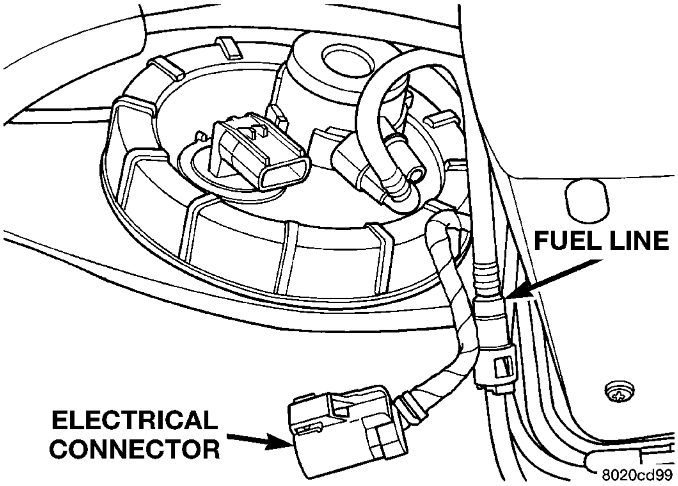


Fig. 51 Fuel Pump Module Electrical Connector

(24) Inspect the connections to the speed control servo, if equipped (Fig. 31). Refer to Group 8H, Vehicle Speed Control.

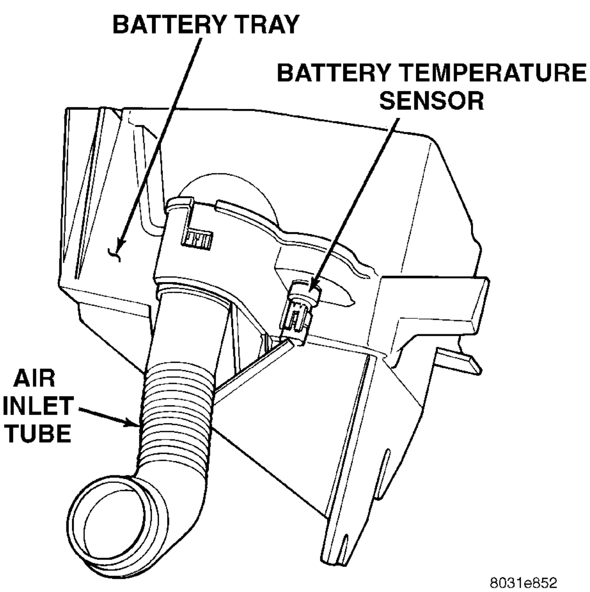


Fig. 52 Battery Temp. Sensor Connectors

(25) Inspect the connection at the battery temperature sensor (Fig. 52).

VISUAL INSPECTION—DOHC

Before diagnosing or servicing the fuel injection system, perform a visual inspection for loose, disconnected, or misrouted wires and hoses (Fig. 53). A thorough visual inspection that includes the following checks saves unnecessary test and diagnostic time.

(1) Inspect the battery connections. Clean corroded terminals (Fig. 31).

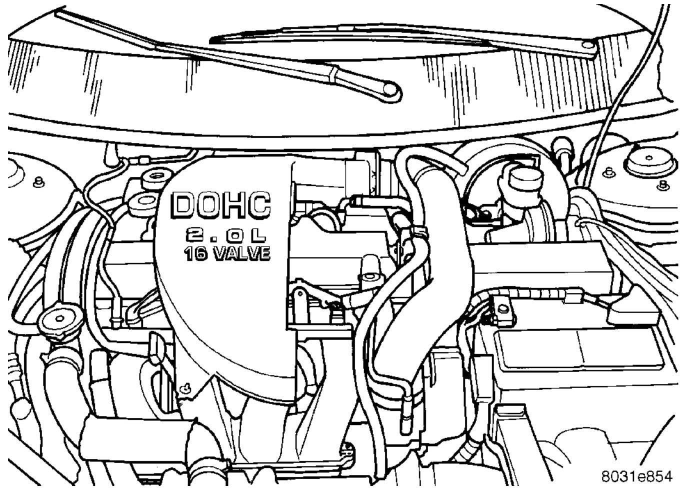


Fig. 53 2.0L DOHC Engine Compartment

(2) Check the 2 PCM 40-way connector for stretched wires on pushed out terminals (Fig. 54).

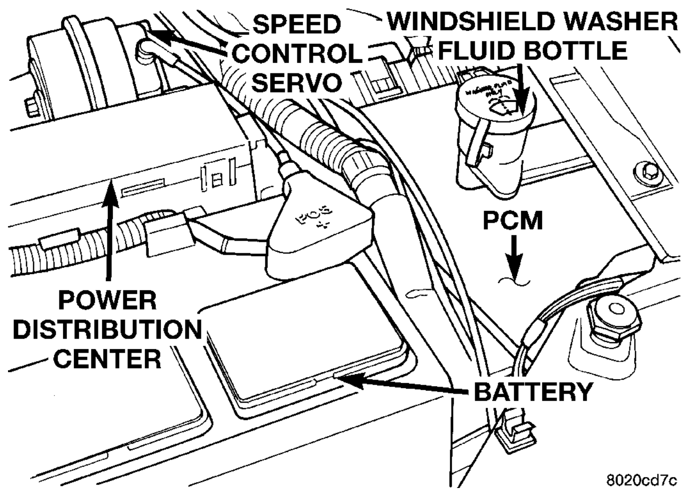


Fig. 54 Battery, PCM, and PDC

(3) Open the Power Distribution Center (PDC). Check for blown fuses. Ensure the relays and fuses are fully seated in the PDC (Fig. 55). A label on the underside of the PDC cover shows the locations of each relay and fuse.

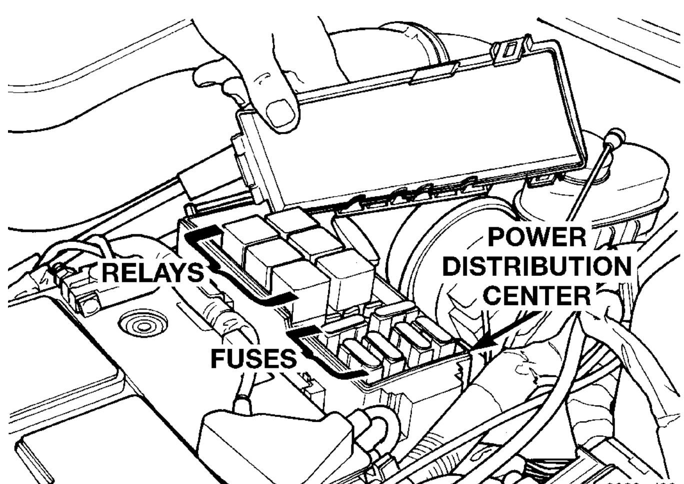


Fig. 55 Power Distribution Center

DIAGNOSIS AND TESTING (Continued)

(4) Verify the throttle cable operates freely (Fig. 56).

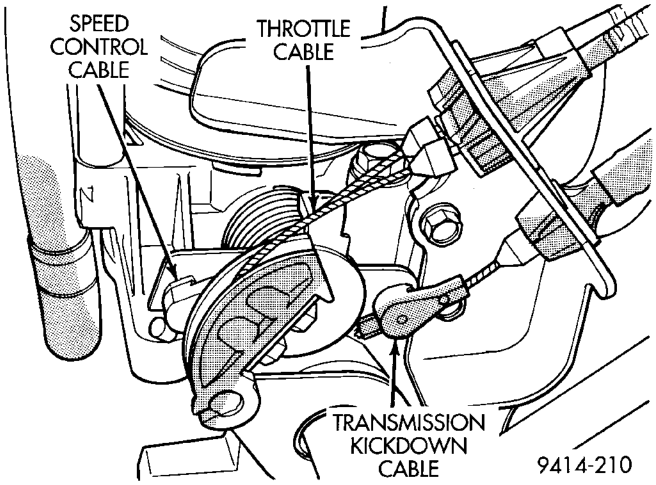


Fig. 56 Throttle Cable—Automatic Transmission

(5) Check the electrical connections at the idle air control motor and throttle position sensor (Fig. 57).

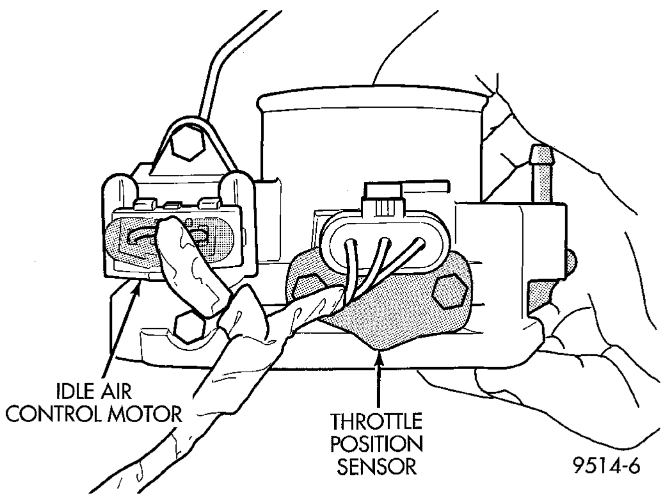


Fig. 57 Idle Air Control Motor and Throttle Position Sensor—Typical

(6) Check hose connections between the PCV valve, vacuum port - intake manifold and the oil separator (Fig. 58).

(7) Inspect the electrical connections at the MAP sensor/intake air temperature sensor and the (Fig. 59).

(8) Inspect the fuel injector electrical connections (Fig. 60).

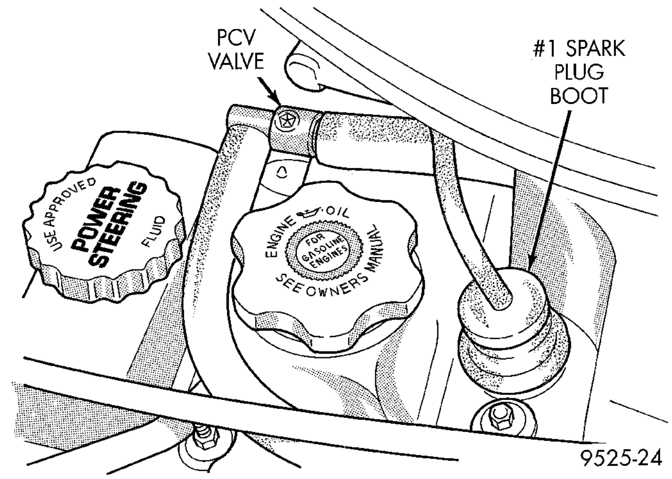


Fig. 58 PCV Valve

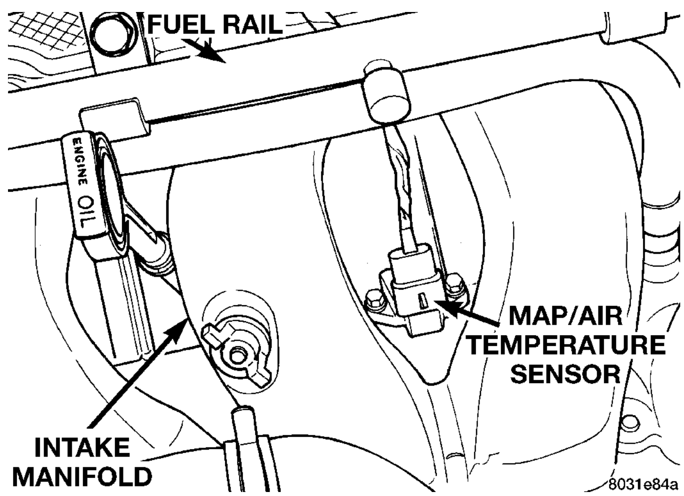


Fig. 59 MAP/Intake Air Temperature Sensor

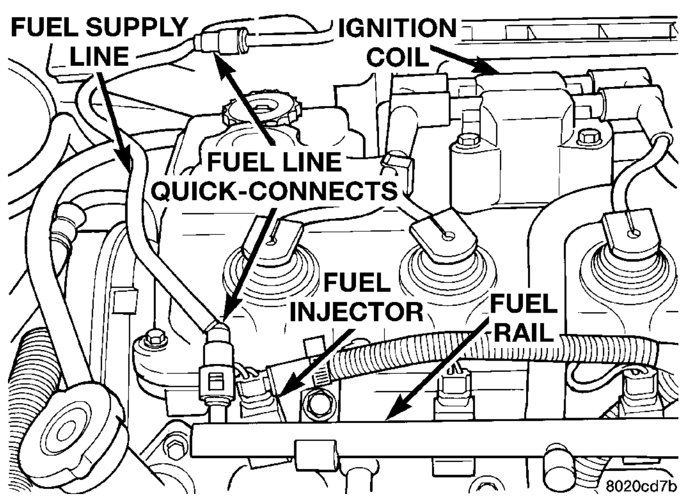


Fig. 60 Fuel Injectors—Typical

DIAGNOSIS AND TESTING (Continued)

(9) Inspect the ignition coil electrical connector. Ensure the spark plug insulators are firmly seated over the spark plugs (Fig. 61).

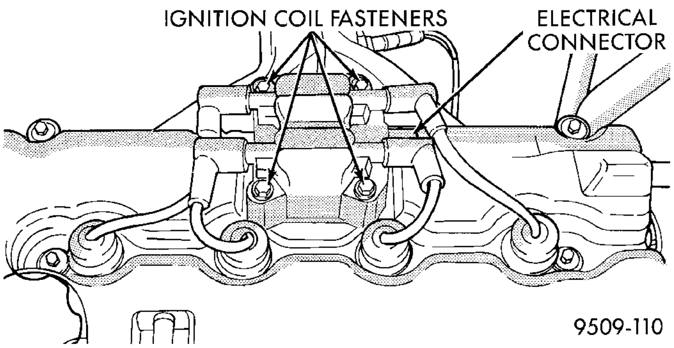


Fig. 61 Ignition Coil and Spark Plugs

(10) Inspect the electrical and hose connections at the duty cycle purge solenoid (Fig. 62).

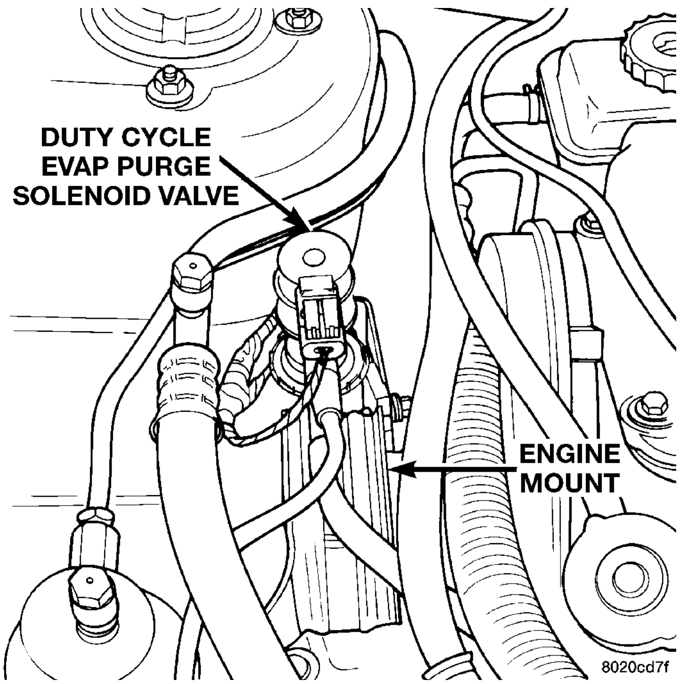


Fig. 62 Duty Cycle Purge Solenoid

(11) Check the electrical connection to the radiator fan.

(12) Inspect for corrosion on the electrical connections at the starter motor solenoid. Check the ground cable connection below the starter motor (Fig. 63).

(13) Inspect the air cleaner filter element. Replace as necessary. Check the air induction system for restrictions.

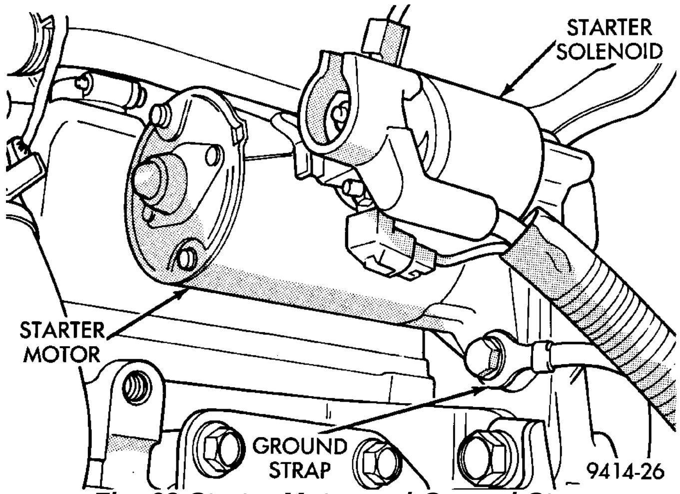


Fig. 63 Starter Motor and Ground Strap

(14) Check the electrical connection at the knock sensor (Fig. 64).

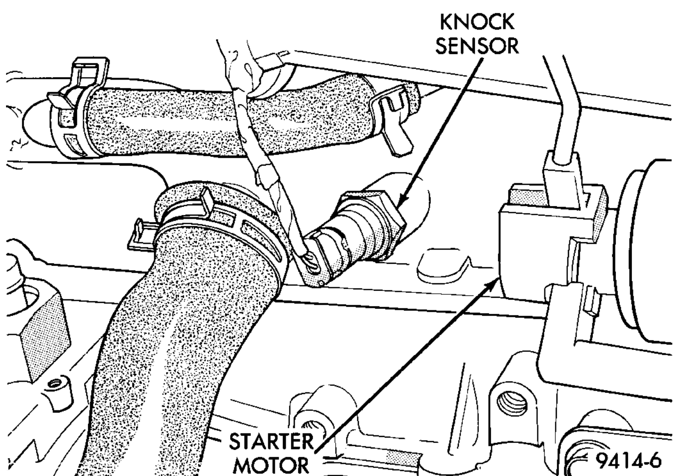


Fig. 64 Knock Sensor

(15) Check the electrical connections at the camshaft position sensor (Fig. 65) and engine coolant temperature sensor (Fig. 66).

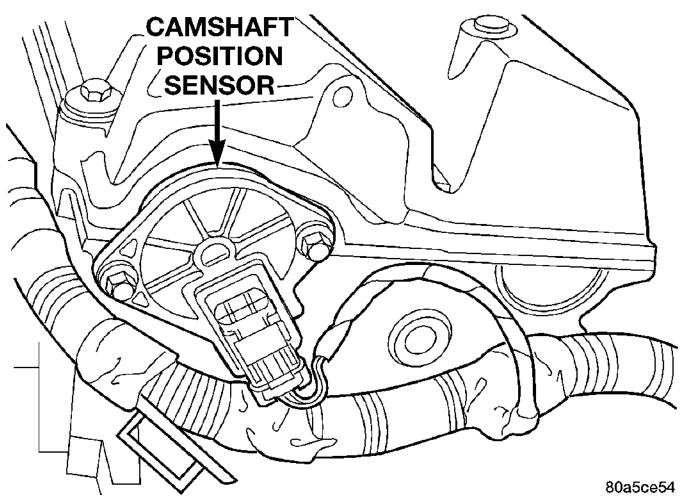


Fig. 65 Camshaft Position Sensor

DIAGNOSIS AND TESTING (Continued)

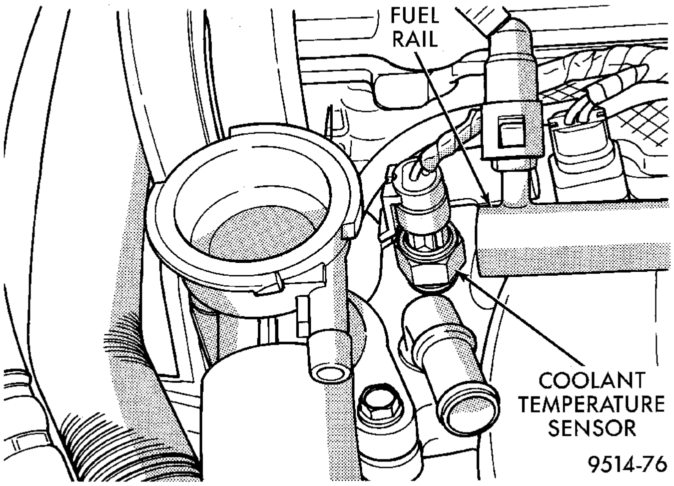


Fig. 66 Engine Coolant Temperature Sensor

(16) Check the electrical connector at the Electronic EGR Transducer. Inspect the vacuum and back pressure hoses at the solenoid and transducer for leaks (Fig. 67).

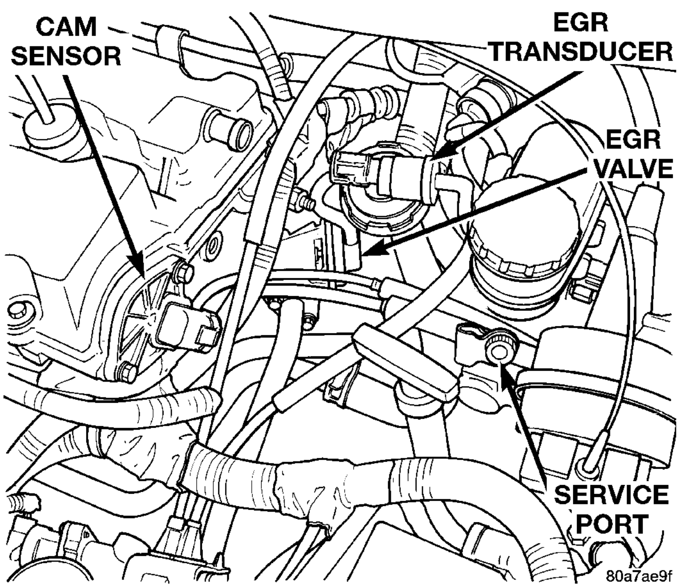


Fig. 67 Electronic EGR Transducer

(17) Inspect the electrical connections at the generator (Fig. 68). Check the generator belt for glazing or damage.

(18) Inspect the electrical connector at the crankshaft position sensor (Fig. 69).

(19) Check the electrical connection at the vehicle speed sensor (Fig. 70).

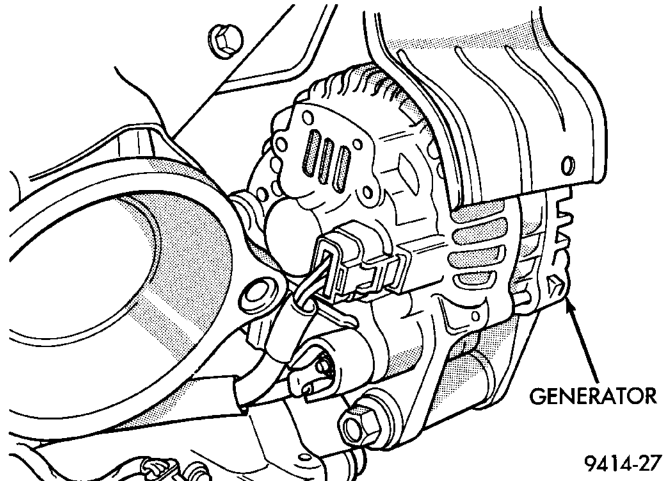


Fig. 68 Generator

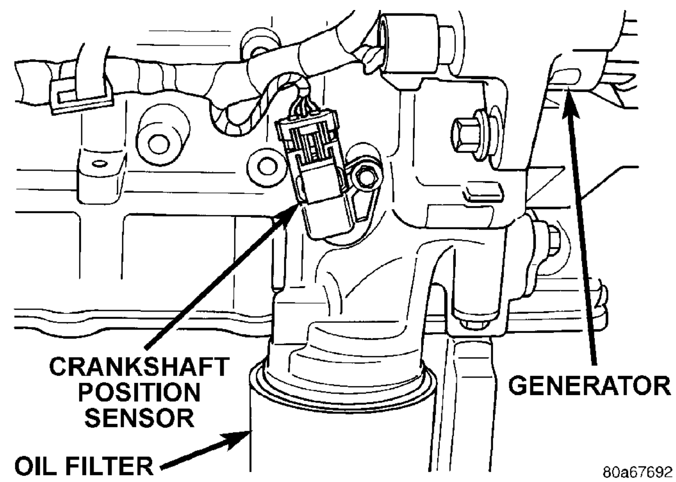


Fig. 69 Crankshaft Position Sensor

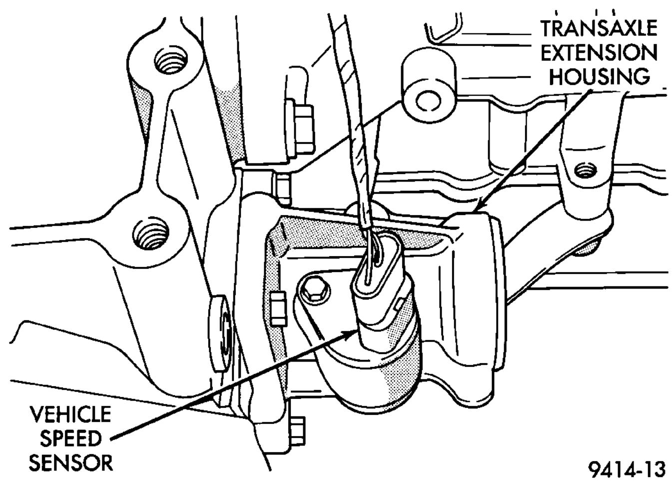


Fig. 70 Vehicle Speed Sensor

DIAGNOSIS AND TESTING (Continued)

(20) Check the electrical connection at the power steering pressure switch on the power steering gear housing (Fig. 71).

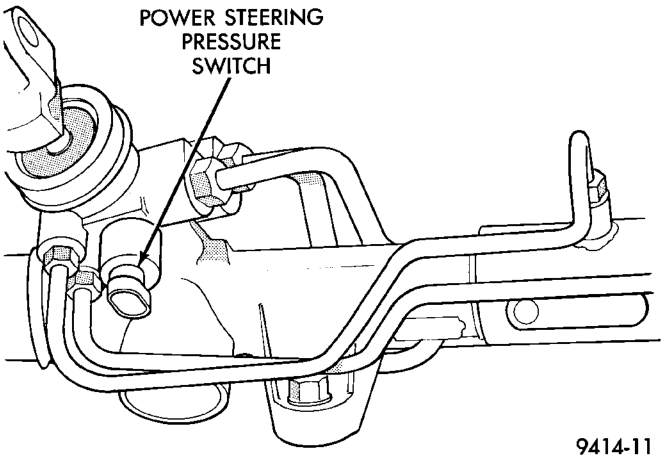


Fig. 71 Power Steering Pressure Switch

(21) On vehicles with automatic transaxles, check the electrical connections at the park/neutral switch and the torque convertor clutch solenoid (Fig. 72).

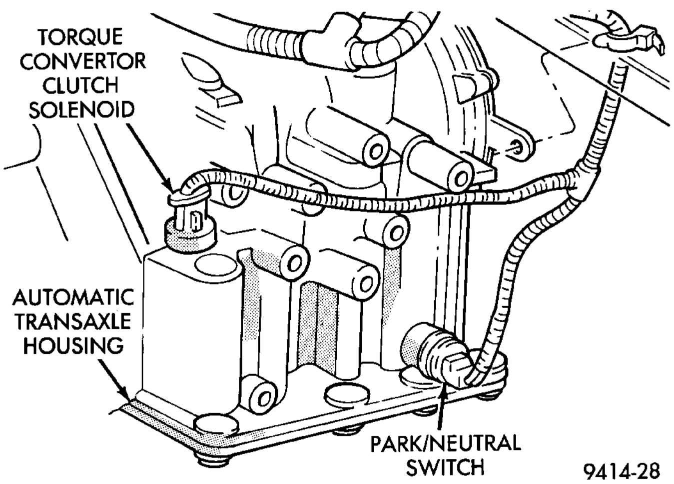


Fig. 72 Park/Neutral Switch and Torque Convertor Clutch Solenoid

(22) Inspect the electrical connections at the upstream and downstream heated oxygen sensors (Fig. 73) and (Fig. 74).

(23) Inspect the fuel pump module electrical connection at the fuel tank for corrosion or damage (Fig. 75). Check for pinched, kinked or damaged fuel supply tube.

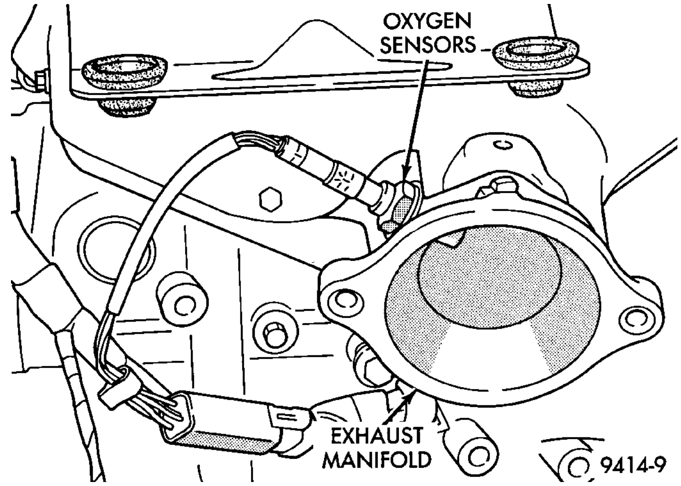


Fig. 73 Upstream Heated Oxygen Sensor

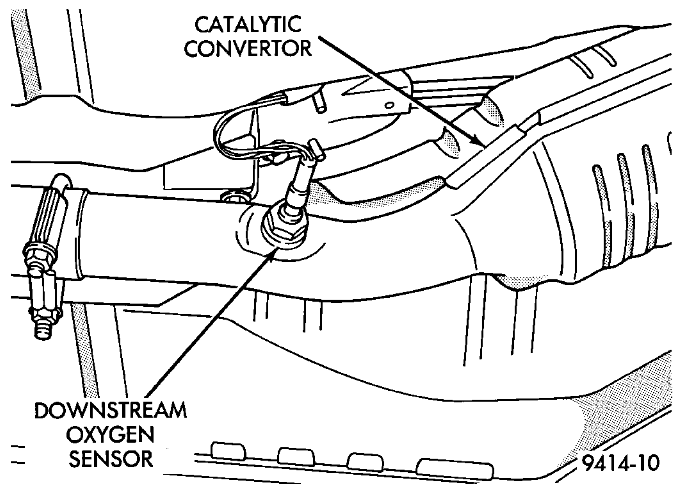


Fig. 74 Downstream Heated Oxygen Sensor

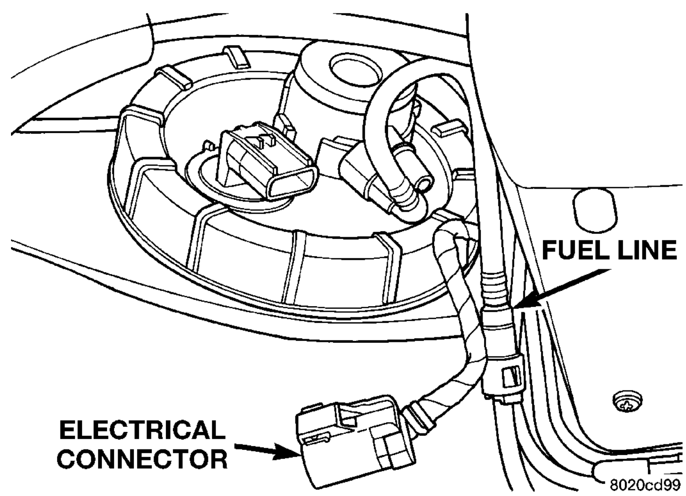


Fig. 75 Fuel Pump Module Electrical Connector

DIAGNOSIS AND TESTING (Continued)

(24) Inspect the connections to the speed control servo, if equipped (Fig. 54). Refer to Group 8H, Vehicle Speed Control.

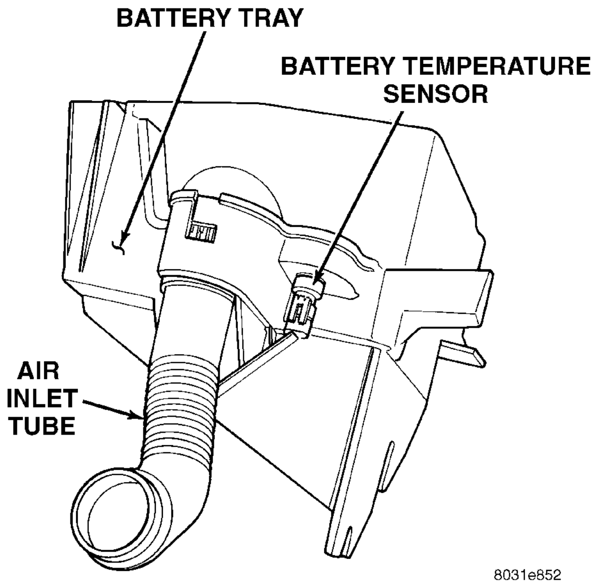
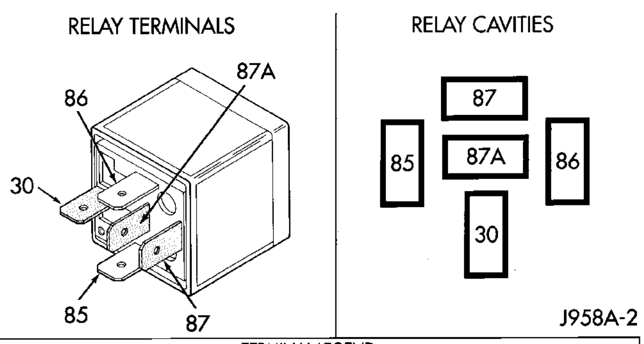


Fig. 76 Battery Temp. Sensor Connectors

(25) Inspect the connection at the battery temperature sensor (Fig. 76).

ASD AND FUEL PUMP RELAYS

The following description of operation and tests apply only to the Automatic Shutdown (ASD) and fuel pump relays . The terminals on the bottom of each relay are numbered (Fig. 77).



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 77 ASD and Fuel Pump Relay Terminals

OPERATION

- Terminal number 30 is connected to battery voltage. For both the ASD relay and fuel pump relays, terminal 30 is connected to battery voltage at all times.
- The Powertrain Control Module (PCM) grounds the coil side of the relay through terminal number 85.
- Terminal number 86 supplies voltage to the coil side of the relay.
- When PCM de-energizes the ASD and fuel pump relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay. There is no wire or terminal in the cavity.
- When the PCM energies ASD and fuel pump relays energize, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

TESTING

The following procedure applies to the ASD and fuel pump relays.

(1) Remove relay from connector before testing.

(2) With the relay removed from the vehicle, use an ohmmeter to check the resistance between terminals 85 and 86 of the relay. The resistance should be between 75 ±5 ohms.

(3) Connect the ohmmeter between relay terminals 30 and 87A of the relay. The ohmmeter should show continuity between terminals 30 and 87A.

(4) Connect the ohmmeter between relay terminals 87 and 30 of the relay. The ohmmeter should not show continuity at this time.

(5) Connect one end of a jumper wire (16 gauge or heavier) to relay terminal 85. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or heavier) to the power side of the 12 volt power source. **Do not attach the other end of the jumper wire to the relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST.

(7) Attach the other end of the jumper wire to relay terminal 86. This activates the relay. The ohmmeter should now show continuity between relay terminals 87 and 30. The ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

(9) Replace the relay if it did not pass the continuity and resistance tests. If the relay passed the tests, it operates properly. Check the remainder of the ASD and fuel pump relay circuits. Refer to group 8W, Wiring Diagrams.

CAMSHAFT AND CRANKSHAFT POSITION SENSOR

Refer to Group 8D, Ignition for Diagnosis and Testing of Camshaft and Crankshaft Sensors.

DIAGNOSIS AND TESTING (Continued)

ENGINE COOLANT TEMPERATURE SENSOR

(1) With the key off, disconnect wire harness connector from coolant temperature sensor (Fig. 78) or (Fig. 79).

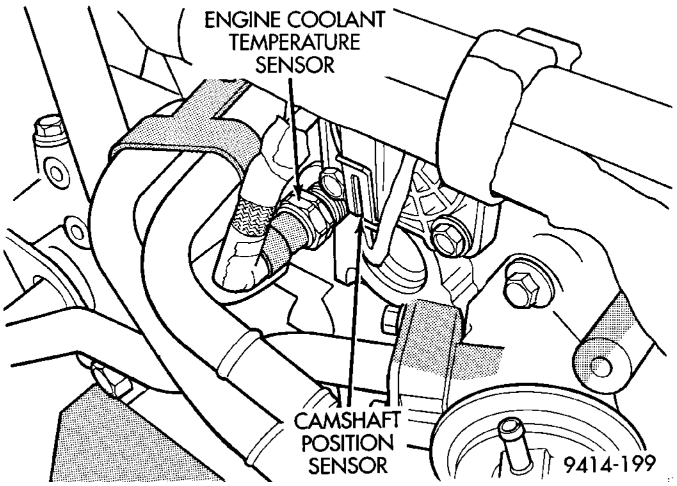


Fig. 78 Engine Coolant Temperature Sensor Location—SOHC

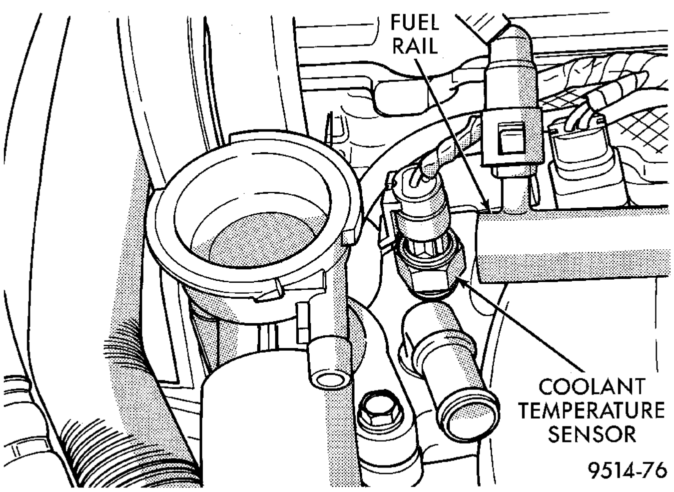


Fig. 79 Engine Coolant Temperature Sensor Location—DOHC

(2) Connect a high input impedance (digital) volt-ohmmeter to terminals A and B (Fig. 80). 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.

(3) Test the resistance of the wire harness between the PCM 60-way connector terminal 28 and the sensor harness connector. Also check for continuity between PCM 60-way connector terminal 51 and the sensor harness connector. Refer to Group 8W, Wiring diagrams for circuit information. If the resistance is greater than 1 ohm, repair the wire harness as necessary.

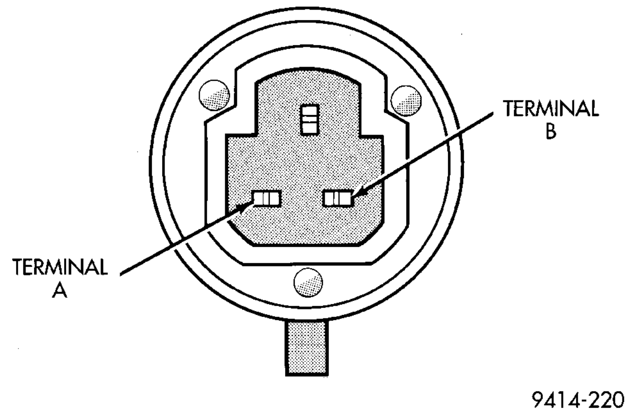


Fig. 80 Engine Coolant Temperature Sensor

HEATED OXYGEN SENSOR

Use an ohmmeter to test the heating element of the oxygen sensors. Disconnect the electrical connector from each oxygen sensor. The white wires in the sensor connector are the power and ground circuits for the heater. Connect the ohmmeter test leads to terminals of the white wires in the heated oxygen sensor connector. Replace the heated oxygen sensor if the resistance is not between 4 and 7 ohms.

IDLE AIR CONTROL (IAC) MOTOR TEST

To preform a complete test of IAC motor and its circuitry, refer to DRB scan tool and the appropriate Powertrain Diagnostics Procedures manual.

KNOCK SENSOR

The knock sensor can be tested with a digital voltmeter. Sensor output should be between 80 mV and 4 volts with the engine running between 576 and 2208 rpm. If the output falls outside of this range a DTC will be set.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

To perform a complete test of the MAP sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the MAP sensor only, refer to the following:

CAUTION: When testing the MAP sensor, be sure that the harness wires are not damaged by the test meter probes.

(1) Test the MAP sensor output voltage at the MAP sensor connector between terminals 1 and 4 (Fig. 81). With the ignition switch ON and the engine not running, output voltage should be 4 to 5 volts.

DIAGNOSIS AND TESTING (Continued)

The voltage should drop to 1.5 to 2.1 volts with a hot, neutral idle speed condition. If OK, go to next step. If not OK, go to step 3.

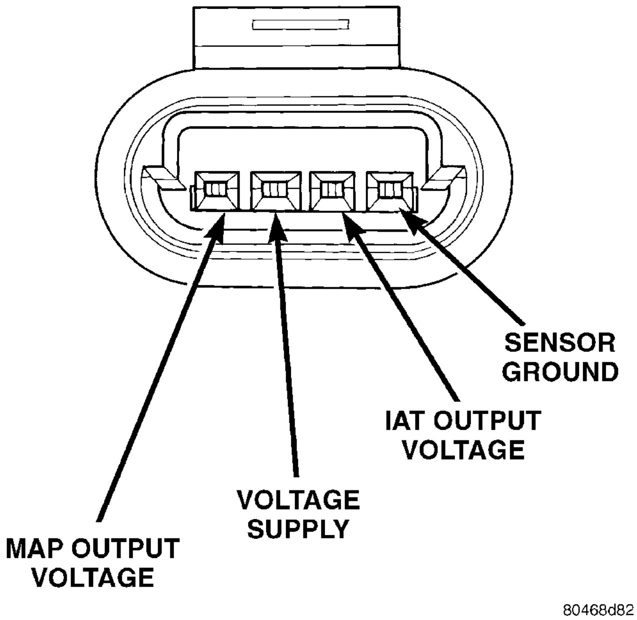


Fig. 81 MAP Sensor Connector

(2) Test PCM terminal 36 for the same voltage described in the previous step to verify wire harness condition. Repair as required.

(3) Test the MAP sensor ground circuit at sensor connector terminal 1 and PCM terminal 43. If OK, go to next step. If not OK, repair as required.

(4) Test MAP sensor supply voltage between sensor connector terminals 3 and 1 with the key ON. The voltage should be approximately 5 volts (±.5V). Five volts (±.5V) should also be at terminal 61 of the PCM. If OK, replace MAP sensor. If not OK, repair or replace the wire harness as required.

THROTTLE POSITION SENSOR

To perform a complete test of the this sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the throttle position sensor only, refer to the following:

The Throttle Position Sensor (TPS) can be tested with a digital voltmeter (DVM). The center terminal of the sensor is the output terminal. One of the other terminals is a 5 volt supply and the remaining terminal is ground.

Connect the DVM between the center and sensor ground terminal. Refer to Group 8W - Wiring Diagrams for correct pinout.

With the ignition switch in the ON position, check the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at Wide-Open-Throttle (WOT). At idle, TPS output voltage should be approximately 0.38 volts to 1.2 volts. At wide open throttle, TPS output voltage should be approximately 3.1 volts to 4.4 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

THROTTLE BODY MINIMUM AIR FLOW

(1) Turn ignition key to Off.

(2) Disconnect the PCV valve hose from the intake manifold nipple (Fig. 82). Cap the PCV vacuum nipple.

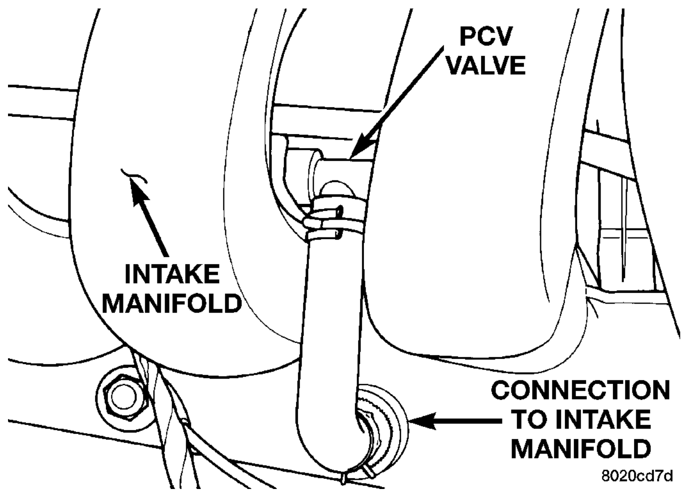


Fig. 82 PCV Vacuum Nipple

(3) Disconnect purge hose from the nipple on the throttle body (Fig. 83).

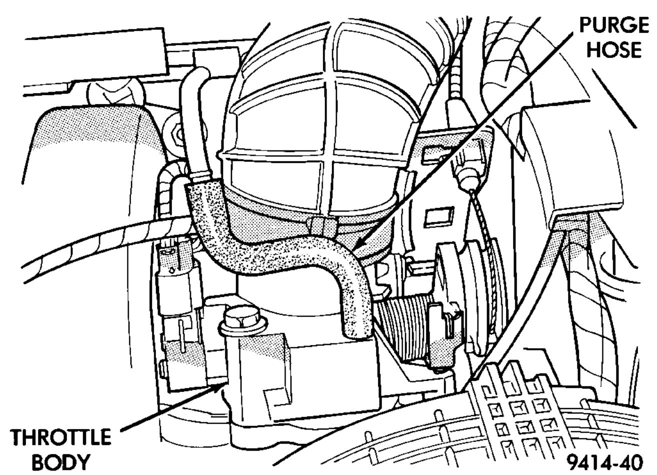


Fig. 83 Purge Hose

DIAGNOSIS AND TESTING (Continued)

(4) Use a piece of hose to attach Air Metering Orifice 6457 (0.125 in. orifice) to the purge nipple on the throttle body (Fig. 84).

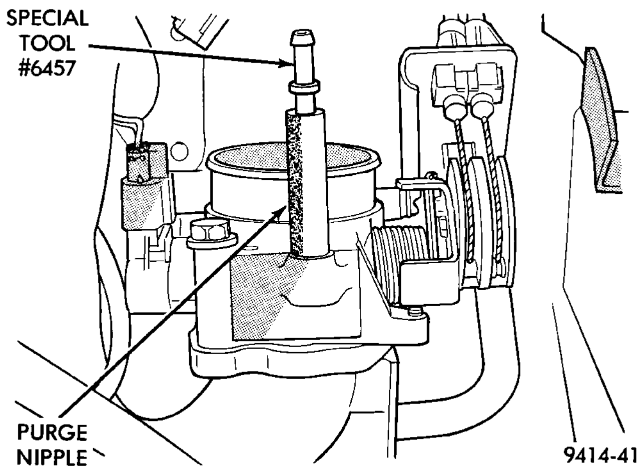


Fig. 84 Orifice 6457 Attached to Purge Nipple

(5) Ensure that all accessories are off.

(6) Connect the DRB scan tool to the data link connector inside the passenger compartment.

(7) Run engine in Park or Neutral until the cooling fan has cycled on and off at least once (180°F).

(8) Using the DRB scan tool, access Minimum Airflow Idle Speed.

(9) The following will then occur:

- Idle air control motor will fully close
- Idle spark advance will become fixed
- PCM will go open loop enriched
- DRB scan tool displays engine RPM

(10) If idle RPM is within the range shown in the Idle Specification chart, throttle body minimum airflow is set correctly.

IDLE SPECIFICATION —2.0L ENGINE

Odometer Reading	**Idle RPM**
Below 1000 Miles	550–1300 RPM
Above 1000 Miles	600–1300 Miles

(11) If idle RPM is above specifications, use the DRB scan tool to check idle air control motor operation. If idle air control motor is OK, replace throttle body. If idle air flow is below specification, shut off the engine and clean the throttle body as follows:

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

(a) Remove the throttle body from engine.

(b) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(c) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when closed, must be free of deposits.**

(d) Use compressed air to dry the throttle body.

(e) Inspect throttle body for foreign material.

(f) Install throttle body on manifold.

(g) Repeat steps 1 through 14. If the minimum air flow is still not within specifications, the problem is not caused by the throttle body.

(12) Shut off engine.

(13) Remove Air Metering Orifice 6457. Install purge hose.

(14) Remove cap from PCV valve. Connect hose to PCV valve.

(15) Remove DRB scan tool.

VEHICLE SPEED SENSOR

To perform a complete test of the sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures Manual.

REMOVAL AND INSTALLATION

THROTTLE BODY—MANUAL TRANSMISSION

Remove throttle body cables using the following procedures.

REMOVAL

(1) Remove throttle cable cover.

(2) Remove throttle cable from the throttle body cam (Fig. 85) and (Fig. 86).

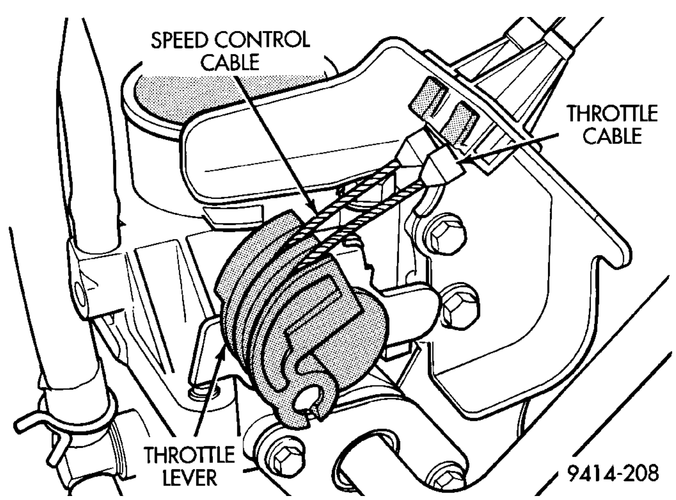


Fig. 85 Throttle Cable Attachment to Throttle Body

REMOVAL AND INSTALLATION (Continued)

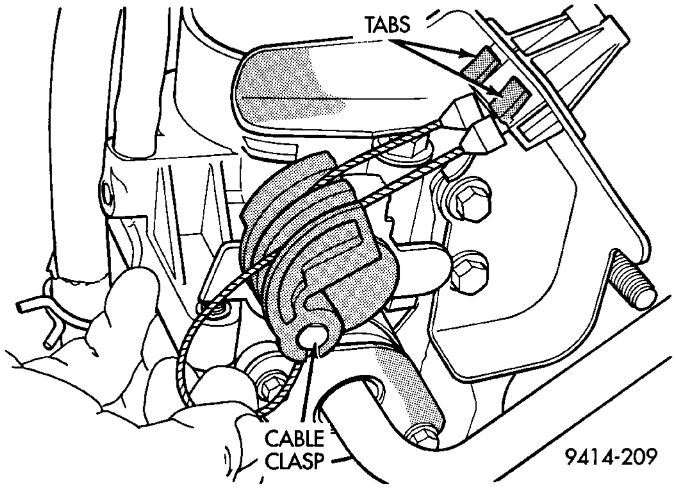


Fig. 86 Disconnecting Throttle Cable

(3) Compress the retaining tabs on the cable and slide cable out of bracket (Fig. 86).

(4) If equipped with speed control, remove speed control cable from throttle lever by sliding clasp out hole used for throttle cable.

(5) Remove 2 screws holding cable mounting bracket and support bracket.

(6) Remove TPS connector.

(7) Remove Idle Air Control motor connector.

(8) Remove the EVAP purge hose.

(9) Remove throttle body mounting bolts. Remove throttle body.

(10) The rubber O-ring gasket on the intake manifold is reusable. Wipe the O-ring clean before installing throttle body (Fig. 91).

INSTALLATION

(1) Install throttle body on intake manifold. Tighten mounting bolts.

(2) Attach cable mounting bracket and support bracket with 2 screws.

(3) Connect the electrical connetion to the throttle body.

(4) Connect the EVAP purge hose to the throttle body.

(5) Install cable housing(s) retainer tabs into bracket.

(6) If equipped with speed control, rotate the throttle lever forward to the wide open position and install speed control cable clasp (Fig. 86).

(7) Rotate throttle lever to wide open position and install throttle cable clasp (Fig. 86).

(8) Install throttle cable cover. Tighten bolt to 5.6 N·m (50 ins. lbs.).

THROTTLE BODY—AUTOMATIC TRANSMISSION

REMOVAL

(1) Remove throttle cable cover.

(2) Remove throttle body cables using the following procedures.

(3) Remove throttle cable from throttle body cam (Fig. 87) and (Fig. 88).

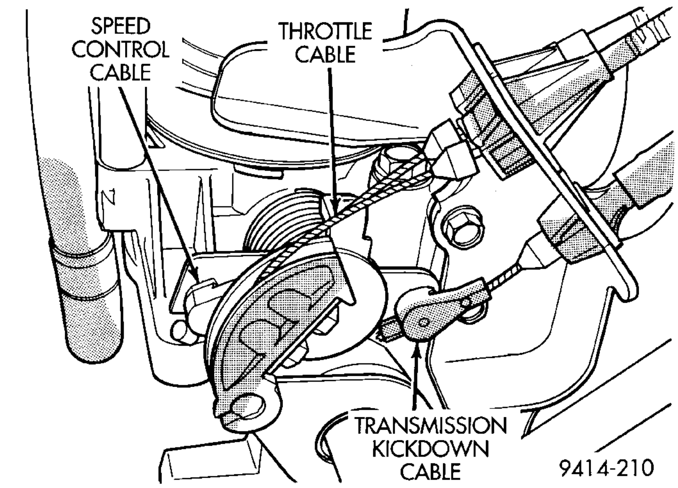


Fig. 87 Throttle Body Cables Attachment to Throttle Body

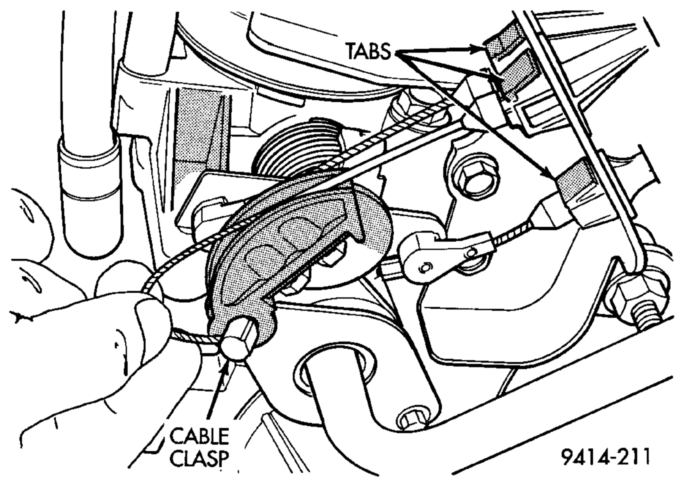


Fig. 88 Disconnecting Throttle Cable

(4) Compress the retaining tabs on the cable and slide cable out of bracket (Fig. 88).

(5) Hold throttle lever in the wide open position. Using finger pressure only, remove kickdown cable by PUSHING connector off the lever nail head (Fig. 87) and (Fig. 89). DO NOT try to pull connector off perpendicular to the lever.

(6) Compress the retaining tabs on the cable and slide cable out of bracket (Fig. 88).

(7) if equipped with speed control, hold throttle lever in the wide open position. Using finger pressure only, remove speed control cable by PUSHING connector off the lever nail head (Fig. 87) and (Fig. 90). DO NOT try to pull connector off perpendicular to the lever.

REMOVAL AND INSTALLATION (Continued)

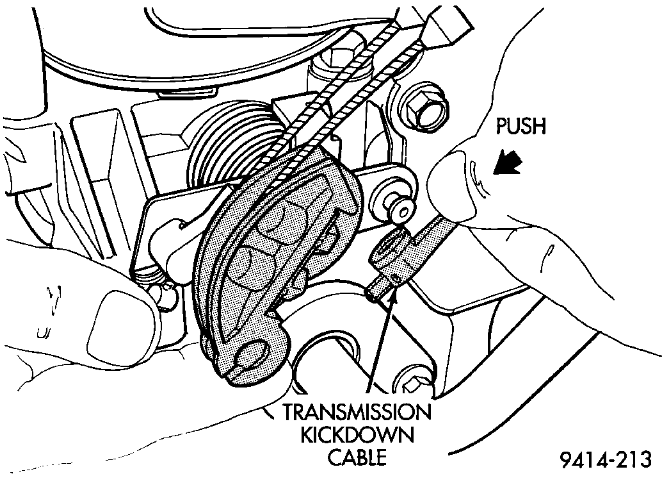


Fig. 89 Transmission Kickdown Cable Connector

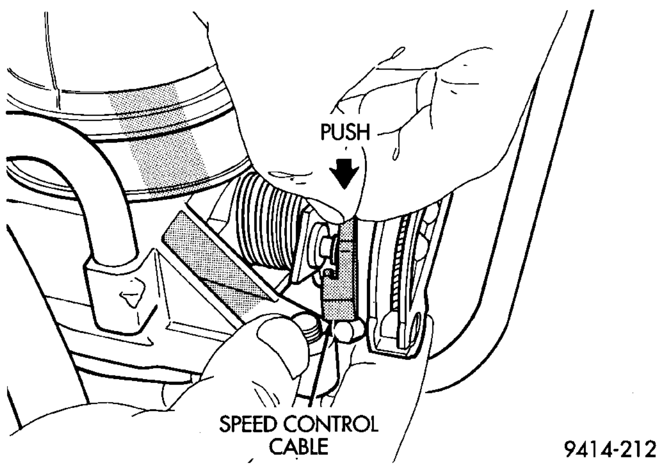


Fig. 90 Speed Control Cable Connector

(8) Compress the retaining tabs on the cable and slide cable out of bracket (Fig. 88).

(9) Remove 2 screws holding cable mounting bracket and support bracket.

(10) Remove TPS connector.

(11) Remove Idle Air Control motor connector.

(12) Remove EVAP purge hose.

(13) Remove throttle body mounting bolts. Remove throttle body.

(14) The rubber O-ring gasket on the intake manifold is reusable. Wipe the O-ring clean before installing throttle body (Fig. 91).

INSTALLATION

(1) Install throttle body on intake manifold. Tighten mounting bolts.

(2) Attach cable mounting bracket and support bracket with 2 screws.

(3) Connect electrical connection to throttle body.

(4) Connect the EVAP purge hose.

(5) Install cable housing(s) retainer tabs into bracket.

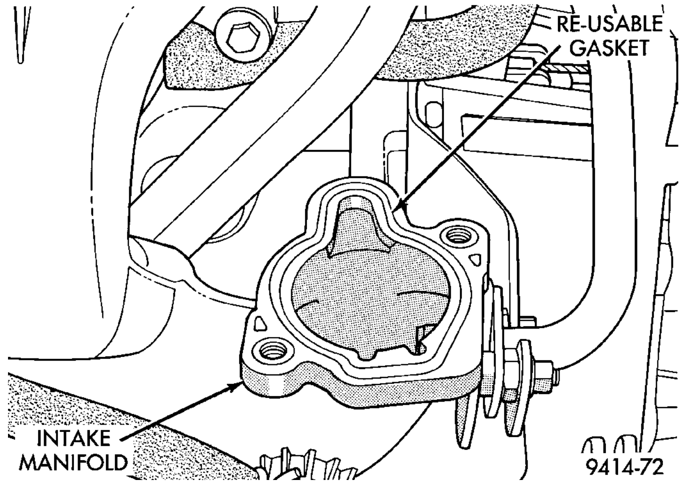


Fig. 91 Re-Usable Throttle Body Gasket

(6) Install throttle body cables using the following procedures.

(7) From the engine compartment, rotate the throttle lever forward to the wide open position and install throttle cable clasp (Fig. 88).

(8) If equipped with speed control, rotate throttle lever forward to the wide open position and slide speed control cable connector onto nail head.

(9) Rotate throttle lever forward to the wide open position and slide kickdown cable connector onto nail head.

(10) Install throttle cable cover. Tighten bolt to 5.6 N·m (50 ins. lbs.).

THROTTLE POSITION SENSOR (TPS)

The throttle position sensor attaches to the side of the throttle body (Fig. 92).

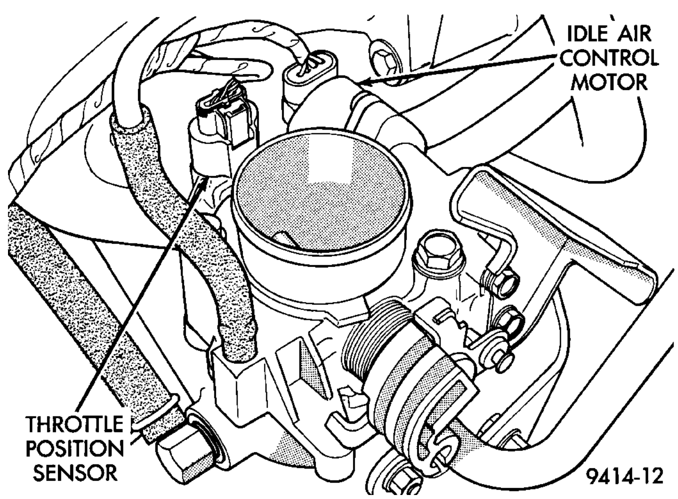


Fig. 92 Throttle Position Sensor and Idle Air Control Motor

REMOVAL

(1) Disconnect EVAP purge hose from throttle body.

REMOVAL AND INSTALLATION (Continued)

(2) Disconnect electrical connector from idle air control motor and throttle position sensor.

(3) Remove throttle body. Refer to Throttle Body in this section.

(4) Remove throttle position sensor mounting screws.

(5) Remove throttle position sensor.

INSTALLATION

(1) The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 93). The socket has two tabs inside it. The throttle shaft rests against the tabs. When indexed correctly, the TPS can rotate clockwise a few degrees to line up the mounting screw holes with the screw holes in the throttle body. The TPS has slight tension when rotated into position. If it is difficult to rotate the TPS into position, install the sensor with the throttle shaft on the other side of the tabs in the socket. Tighten mounting screws to 2 N·m (17 in. lbs.) torque.

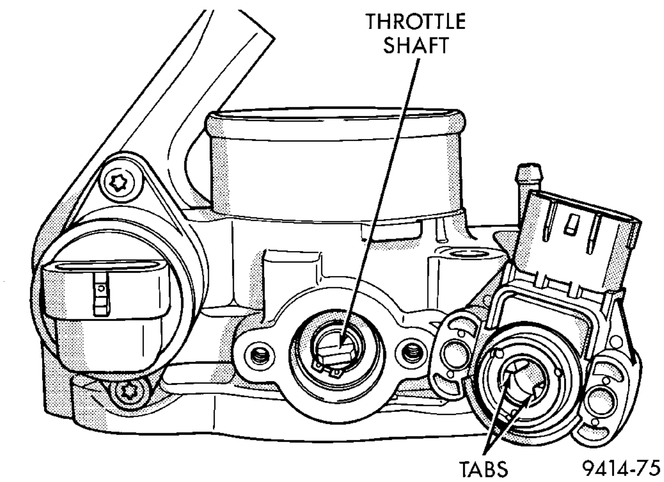


Fig. 93 Throttle Position Sensor Installation

(2) After installing the TPS, the throttle plate should be closed. If the throttle plate is open, install the sensor on the other side of the tabs in the socket.

(3) Install throttle body. Refer to Throttle Body in this section.

(4) Attach electrical connectors to idle air control motor and throttle position sensor.

(5) Install EVAP purge hose to throttle body nipple.

IDLE AIR CONTROL MOTOR

When servicing throttle body components, always reassemble components with new O-rings and seals where applicable. Never use lubricants on O-rings or seals, damage may result. If assembly of component is difficult, use water to aid assembly. Use care when removing hoses to prevent damage to hose or hose nipple.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove electrical connector from idle air control motor and throttle position sensor.

(3) Remove the EVAP purge hose from the throttle body.

(4) Remove throttle body. Refer to Throttle Body in this section.

(5) Remove idle air control motor mounting screws (Fig. 94).

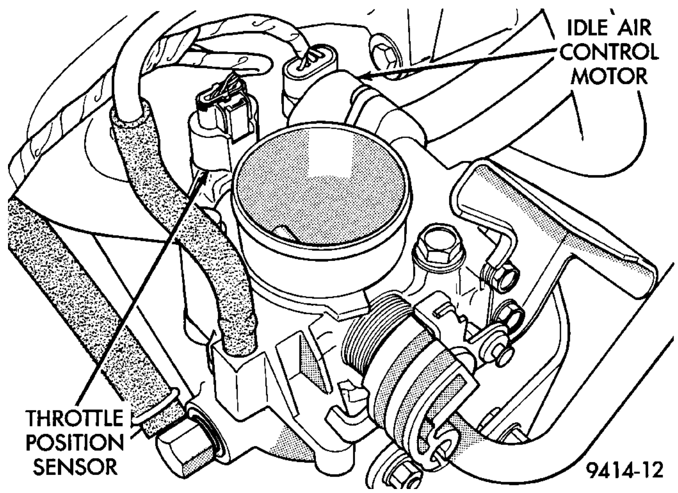


Fig. 94 Servicing Idle Air Control Motor

(6) Remove motor from throttle body. Ensure the O-ring is removed with the motor.

INSTALLATION

(1) The new idle air control motor has a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRB Idle Air Control Motor Open/Close Test to retract the pintle (battery must be connected.)

(2) Carefully place idle air control motor into throttle body.

(3) Install mounting screws. Tighten screws to 2 N·m (17 in. lbs.) torque.

(4) Install throttle body. Refer to Throttle Body in this section.

(5) Connect electrical connector to idle air control motor and throttle position sensor.

(6) Connect the EVAP purge hose to the throttle body nipple.

(7) Connect negative cable to battery.

MAP/IAT SENSOR—SOHC

The MAP/IAT sensor attaches to the intake manifold plenum (Fig. 95).

REMOVAL

(1) Disconnect the electrical connector from the MAP/IAT sensor.

(2) Remove sensor mounting screws.

(3) Remove sensor.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Insert sensor into intake manifold while making sure not to damage O-ring seal.

(2) Tighten mounting screws to 2 N·m (20 in. lbs) torque for plastic manifold and 3 N·m (30 in. lbs.) for aluminum manifold.

(3) Attach electrical connector to sensor.

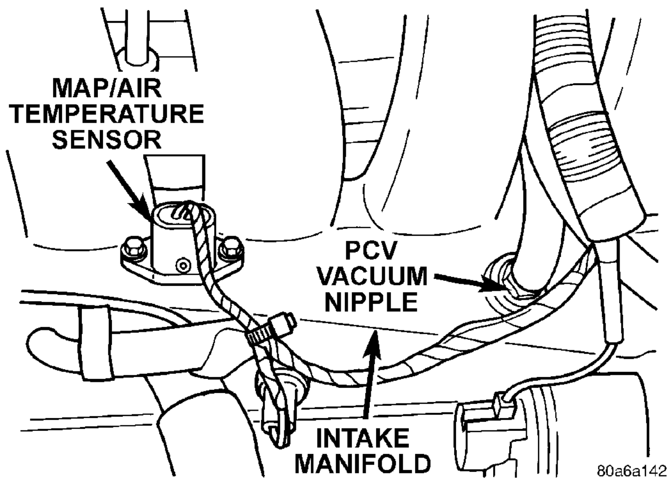


Fig. 95 MAP/IAT Sensor—SOHC

MAP/IAT SENSOR—DOHC

The MAP/IAT sensor attaches to the intake manifold plenum (Fig. 97).

REMOVAL

(1) Remove air inlet duct wing nut and duct from intake manifold (Fig. 96).

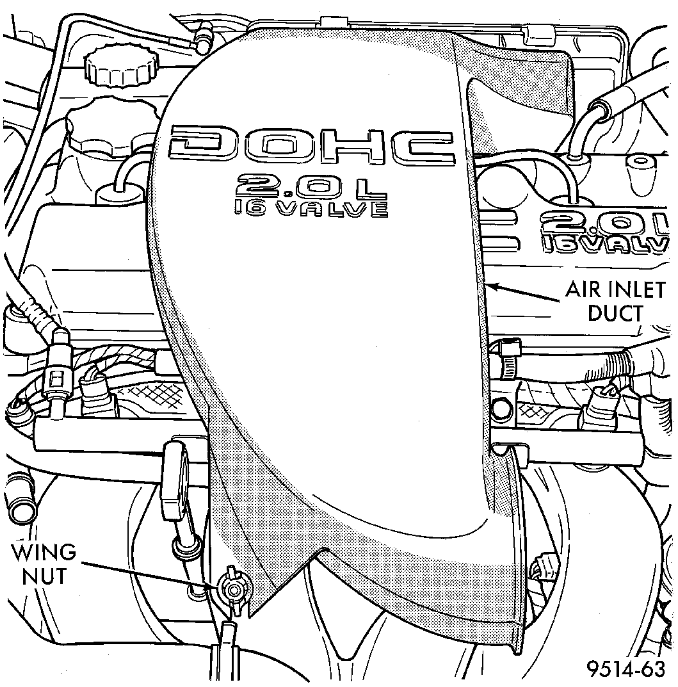


Fig. 96 Air Inlet Duct—DOHC

(2) Disconnect the electrical connector from the MAP/IAT sensor.

(3) Remove sensor mounting screws.

(4) Remove sensor.

INSTALLATION

(1) Insert sensor into intake manifold while making sure not to damage O-ring seals.

(2) Tighten mounting screws to 2 N·m (20 in. lbs) torque foe a plastic manifold and 3 N·m (30 in. lbs) for a aluminum manifold.

(3) Attach electrical connector to sensor.

(4) Install air inlet duct wing nut and duct from intake manifold, insure that the duct does not interfer with ignition cables.

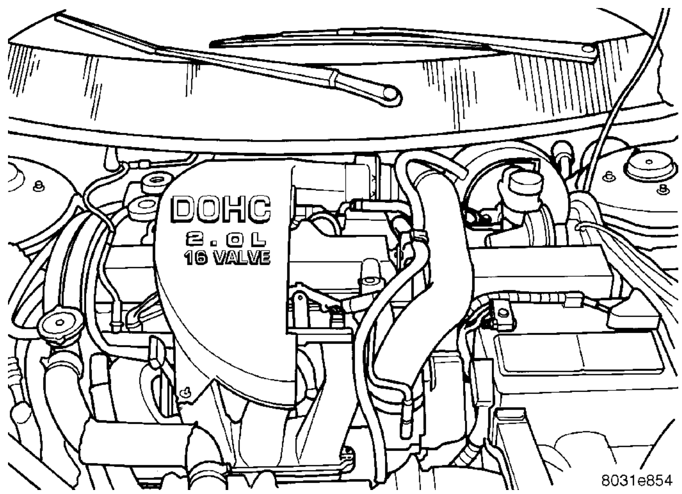


Fig. 97 MAP/IAT Sensor—DOHC

DUTY CYCLE EVAP PURGE SOLENOID VALVE

The solenoid attaches to a bracket near the front engine mount (Fig. 98). The solenoid will not operate unless it is installed correctly.

REMOVAL

(1) Disconnect electrical connector from solenoid.

(2) Disconnect vacuum tubes from solenoid.

(3) Remove solenoid from bracket.

INSTALLATION

The top of the solenoid has TOP printed on it. The solenoid will not operate unless it is installed correctly.

(1) Install solenoid on bracket.

(2) Connect vacuum tube to solenoid.

(3) Connect electrical connector to solenoid.

POWERTRAIN CONTROL MODULE (PCM)

The PCM attaches to the inner fender panel next to the washer fluid bottle on the passenger side (Fig. 99).

REMOVAL AND INSTALLATION (Continued)

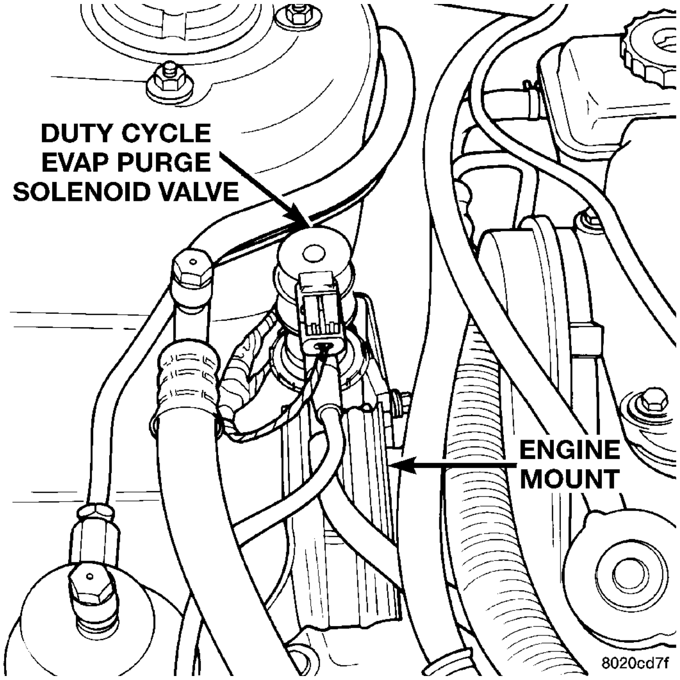


Fig. 98 Duty Cycle EVAP Purge Solenoid Valve

REMOVAL

(1) Disconnect negative cable from battery.
(2) Disconnect positive cable from battery.
(3) Remove washer bottle neck.
(4) Squeeze tabs on PDC while pulling PDC up to remove it from bracket. Lay PDC aside to gain access to PCM bracket screws.
(5) Remove screws attaching PCM to body.
(6) Lift PCM up and disconnect the 2 40-way connector.
(7) Remove PCM.

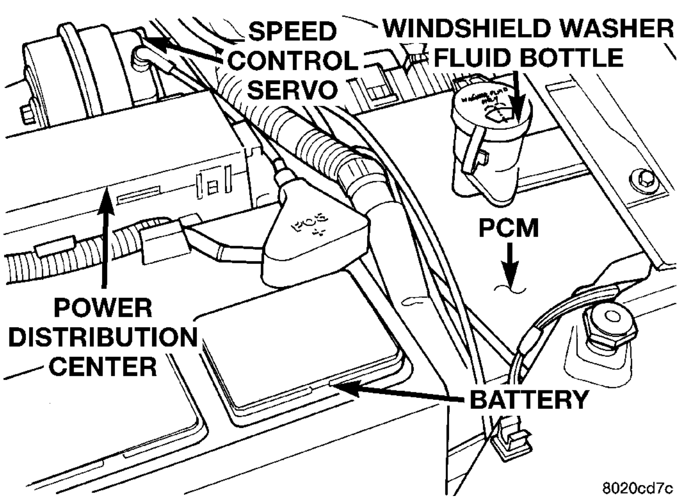


Fig. 99 Powertrain Control Module

INSTALLATION

(1) Attach the 2 40-way connector to PCM.
(2) Install PCM. Tighten mounting screws to 9 N·m (80 in. lbs.) torque.
(3) Install PDC by pushing down into brackets.
(4) Install washer bottle neck.
(5) Connect positive cable to battery.
(6) Connect negative cable to battery.

CRANKSHAFT POSITION SENSOR

For removal/installation procedures refer to group 8D - Ignition System, Service Procedures.

CAMSHAFT POSITION SENSOR

For removal/installation procedures refer to group 8D - Ignition System, Service Procedures.

UPSTREAM HEATED OXYGEN SENSOR

REMOVAL

(1) Raise and support vehicle.
(2) Unplug sensor connector.
(3) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 100).
(4) 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.

INSTALLATION

New sensors have compound on the threads and do not require an additional coating.
(1) Install sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 100). Tighten the sensor to 28 N·m (20 ft. lbs.) torque.
(2) Plug sensor connector.
(3) Lower vehicle.

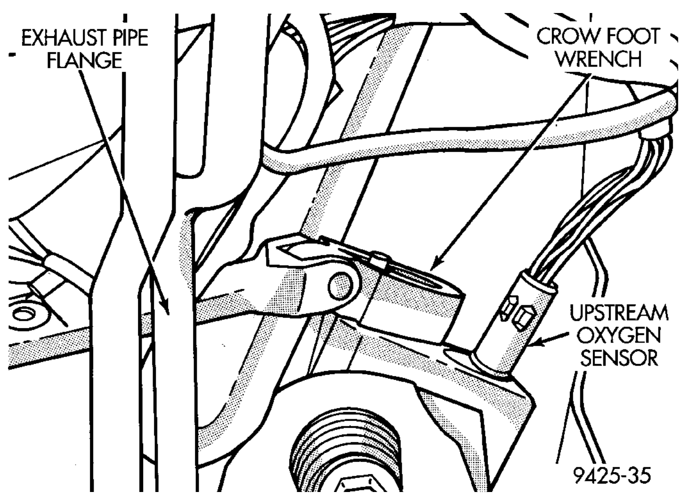


Fig. 100 Upstream Heated Oxygen Sensor Removal/ Installation

REMOVAL AND INSTALLATION (Continued)

DOWNSTREAM HEATED OXYGEN SENSOR

The downstream heated oxygen sensor threads into the exhaust outlet pipe behind the catalytic convertor (Fig. 101).

REMOVAL

(1) Raise vehicle.

(2) Disconnect electrical connector from sensor.

(3) Disconnect sensor electrical harness from clips along body.

(4) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 102).

(5) 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.

INSTALLATION

New sensors have compound on the threads and do not require an additional coating.

(1) Install sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 102). Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect sensor electrical harness from clips along body.

(3) Connect electrical connector from sensor.

(4) Lower vehicle.

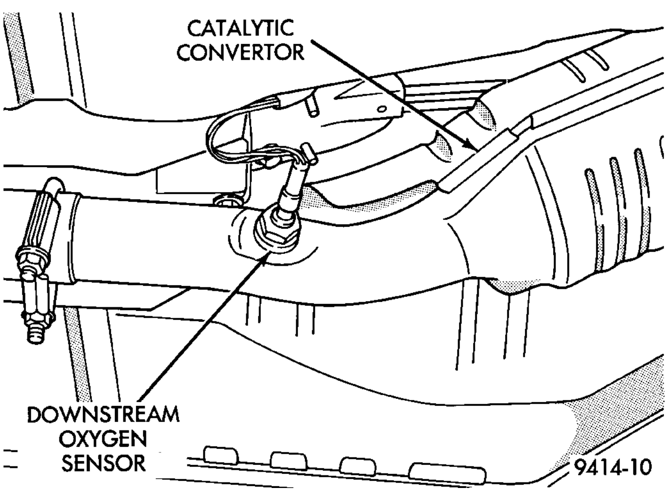


Fig. 101 Downstream Heated Oxygen Sensor

AIR CLEANER ELEMENT

Neon vehicles do not use a heated air inlet system. The PCM adjusts fuel injector pulse width and ignition timing to compensate for different ambient temperatures.

The air cleaner attaches to a bracket on the rear of the cylinder head. An ambient air duct supplies underhood air for the engine.

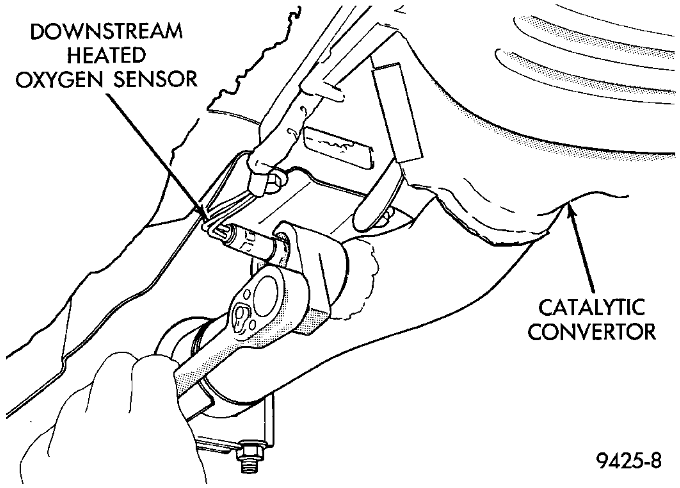


Fig. 102 Downstream Heated Oxygen Sensor Removal/Installation

REMOVAL

(1) Remove air intake tube (Fig. 103) from air cleaner and intake manifold (Fig. 104).

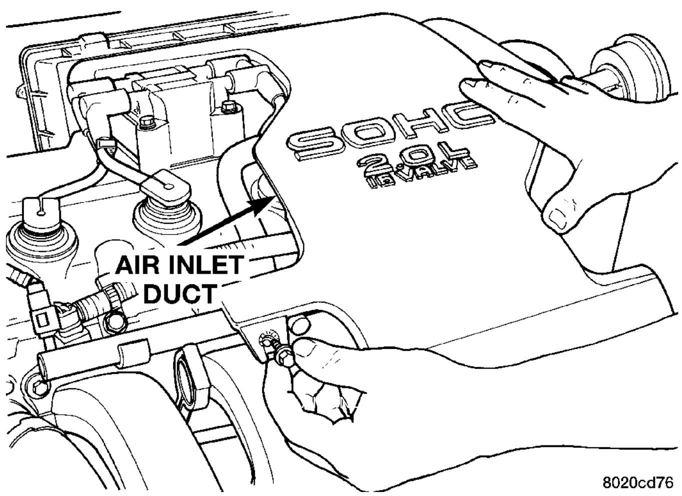


Fig. 103 Air Intake Duct

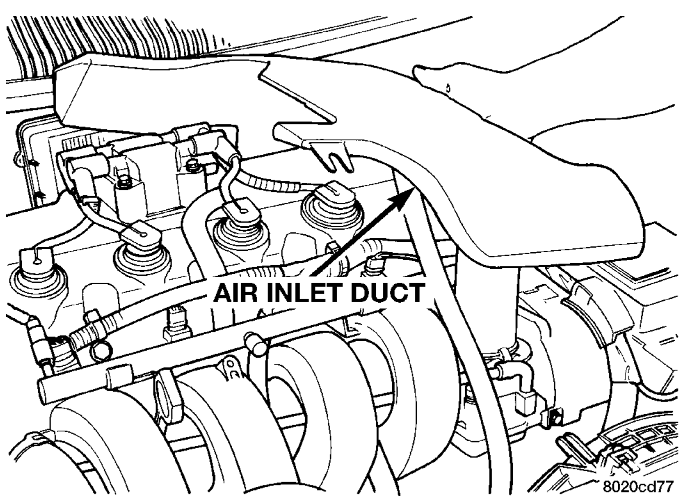


Fig. 104 Removal/Installation of Air Inlet Duct

REMOVAL AND INSTALLATION (Continued)

(2) Unfasten clasps on top of air cleaner housing. Rotate front of housing forward then lift front away from air cleaner housing (Fig. 105).

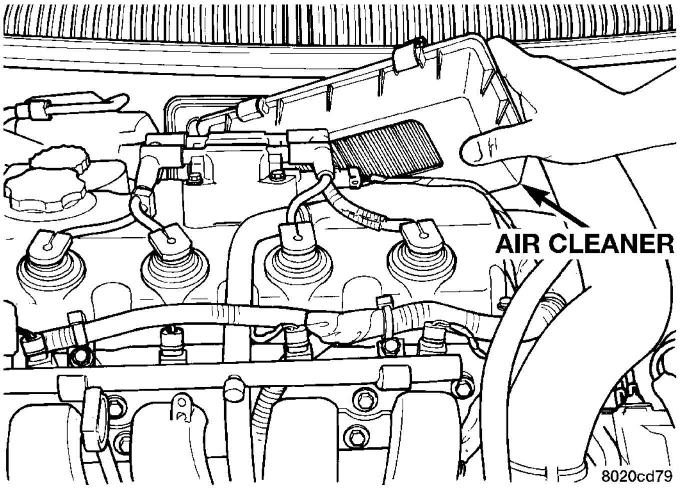


Fig. 105 Removal/Installation Air Cleaner Front Housing and Element

(3) Remove air cleaner element from front housing (Fig. 105).

INSTALLATION

(1) Install air cleaner element into front housing.

(2) Rotate front of housing forward then lower into place and locate tabs in slots. Fasten clasps on top of air cleaner housing.

(3) Install air intake duct at air cleaner and intake manifold.

ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature sensor threads into the rear of the cylinder head (Fig. 106) or (Fig. 107).

REMOVAL

(1) With the engine cold, drain coolant until level drops below cylinder head. Refer to Group 7, Cooling System.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to 18 N·m (165 in. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to Group 7, Cooling System.

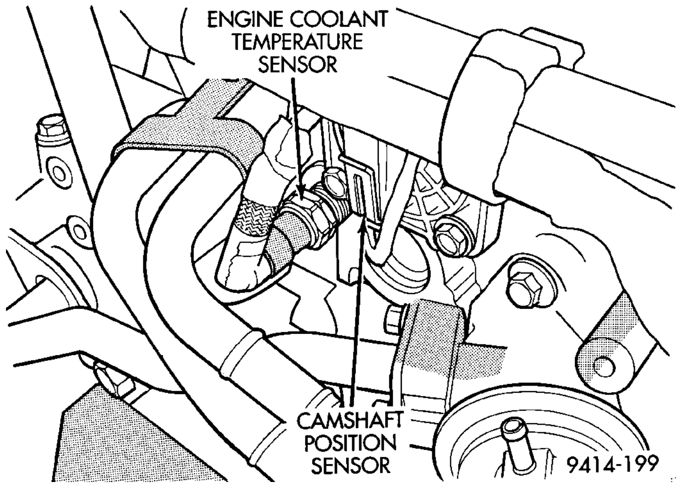


Fig. 106 Engine Coolant Temperature Sensor—SOHC

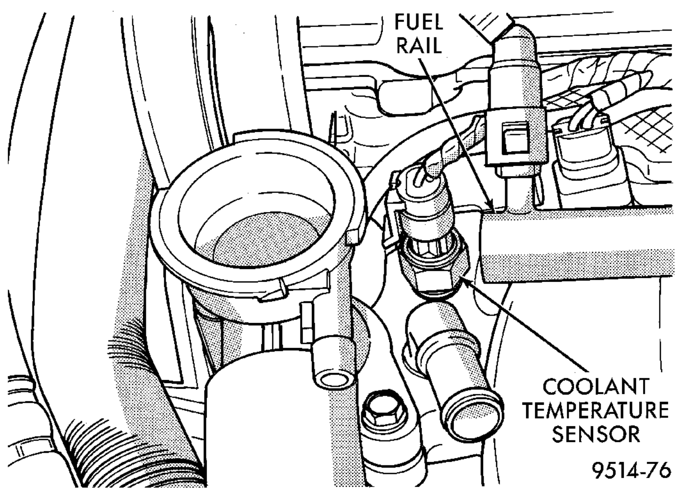


Fig. 107 Engine Coolant Temperature Sensor—DOHC

REMOVAL AND INSTALLATION (Continued)

VEHICLE SPEED SENSOR

The vehicle speed sensor is located in the transmission extension housing (Fig. 108).

REMOVAL

(1) Disconnect electrical connector from sensor.

(2) Remove the sensor mounting bolt.

(3) Lift the sensor out of the transaxle extension housing. Ensure the O-ring was removed with the sensor.

INSTALLATION

The speed sensor gear meshes with a gear on the output shaft.

(1) With O-ring in place, install sensor.

(2) Install mounting bolt.

(3) Connect electrical connector to sensor.

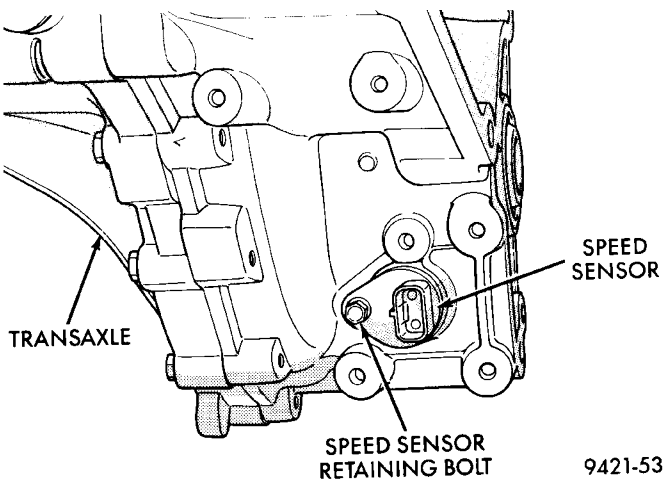


Fig. 108 Vehicle Speed Sensor

KNOCK SENSOR

For removal/installation procedures refer to Group 8D- Ignition System, Service Procedures.

SPECIFICATIONS

VECI LABEL

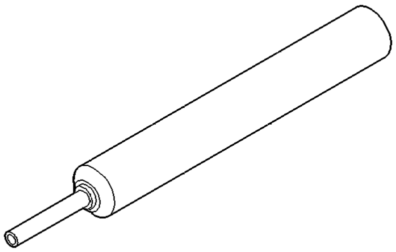
If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label. The VECI label is located in the engine compartment.

TORQUE SPECIFICATIONS

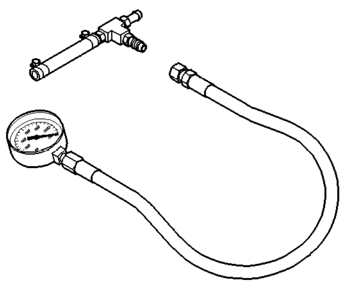
DESCRIPTION	TORQUE
Air Cleaner Wingnut	1.5 N·m (15 in. lbs.)
Air Cleaner Mount. Stud-To-Thrott. Body	10 N·m (90 in. lbs.)
Crankshaft Position Sensor Mounting Bolts	8 N·m (70 in. lbs.)
Engine Coolant Temperature Sensor	18 N·m (165 in. lbs.)
IAC Motor-To-Throttle Body Bolts	7 N·m (60 in. lbs.)
MAP/IAT Sensor	2 N·m (20 in. lbs.)
MAP/IAT Sensor	3 N·m (30 in. lbs.)
Oxygen Sensor	28 N·m (20 ft. lbs.)
Powertrain Control Module (PCM) Mounting Screws	4 N·m (35 in. lbs.)
Throttle Body Mounting Bolts	23 N·m (200 in. lbs.)
Throttle Position Sensor Mounting Screws	2 N·m (20 in. lbs.)
Vehicle Speed Sensor Mounting Bolt	2.2 N·m (20 in. lbs.)

SPECIAL TOOLS

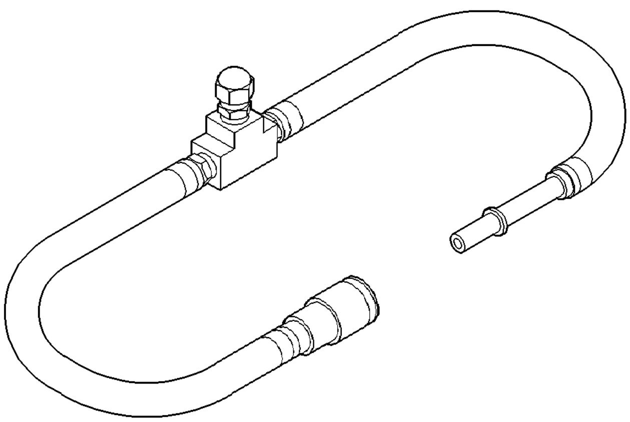
FUEL



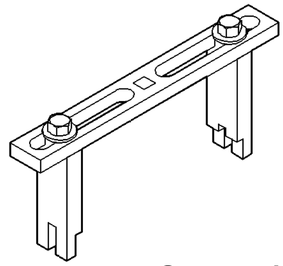
Extractor C–4334



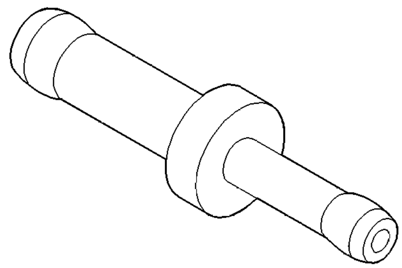
Pressure Gauge Assembly C–4799–B



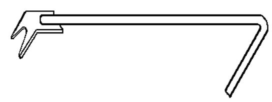
Fuel Pressure Test Adapter 6539



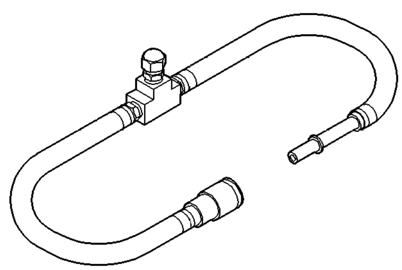
Spanner Wrench 6856



Metering Orifice

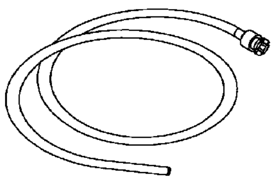


Fuel Line Tool



Fuel Line Adapter

SPECIAL TOOLS (Continued)



Fuel Line Adapter 1/4

STEERING

CONTENTS

GENERAL INFORMATION

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GENERAL INFORMATION

STEERING SYSTEM AND COMPONENT DESCRIPTION

This vehicle comes with power steering as standard equipment and is the only steering system available.

The power steering system consists of these six major components. Power Steering Pump, Power Steering Gear, Power Steering Reservoir, Power Steering Supply and Pressure Hoses, and Power Steering Fluid Return Hose. 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.

DIAGNOSIS AND TESTING

STEERING SYSTEM DIAGNOSIS CHARTS

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at standstill parking. Hiss is a very high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every valve and results in 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 at end of travel or slowly turning at standstill.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Objectionable Hiss Or Whistle	1. Damaged or mispositioned steering column coupler to dash panel seal. 2. Noisy valve in power steering gear.	1. Check for proper seal between steering column coupler and dash seal. 2. Replace steering gear assembly.
Rattle Or Clunk	1. Steering gear loose on front suspension crossmember.	1. Check steering gear to front suspension crossmember mounting bolts. Tighten to the specified torque if found to be loose.
	2. Front suspension crossmember to frame bolts or studs loose.	2. Tighten the front suspension crossmember attaching bolts or studs to the specified torque.
	3. Loose tie rod (outer or inner).	3. Check tie rod pivot points for wear. Replace worn/loose parts as required.
	4. Loose lower control arm to front suspension crossmember bolts.	4. Tighten control arm mounting bolts to the specified torques.
	5. Loose strut assembly to body attaching bolts or nuts.	5. Check upper strut mount to body attaching bolts or nuts for looseness. If required, tighten to the specified torques.
	6. Power steering fluid pressure hose touching the body of the vehicle.	6. Adjust hose to proper position by loosening, repositioning, and tightening fitting to specified torque. Do not bend tubing.
	7. Noise internal to power steering gear.	7. Replace steering gear assembly.
	8. Damaged front suspension crossmember.	8. Replace front suspension crossmember.
Chirp or squeal (in the area of the power steering pump). Particularly noticeable at full wheel travel and during standstill parking.	1. Loose power steering pump drive belt.	1. Adjust power steering pump drive belt to specified tension.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Power steering pump growl results from the development of high pressure fluid flow. Normally this noise should not be high enough to be objectionable. Abnormal situations, such as a low oil level causing aeration or hose touching the vehicle body, can create a noise level that could bring complaints.		
Whine Or Growl (Pump Noise)	1. Low fluid level. 2. Power steering hose touching vehicle body or frame. 3. Extreme wear of power steering pump internal parts.	1. Fill power steering fluid reservoir to proper level and perform leakage diagnosis. (Recheck fluid level after power steering fluid is free of air.) 2. Reposition power steering hose. Replace hose if tube ends are bent. 3. Replace power steering pump and flush system.
Sucking Air Sound	1. Loose clamp on power steering fluid low pressure hose. 2. Missing O-Ring on power steering hose connection. 3. Low power steering fluid level 4. Air leak between power steering fluid reservoir and power steering pump.	1. Tighten or replace hose clamp. 2. Inspect connection and replace O-Ring as required. 3. Fill power steering fluid reservoir to proper level and perform leakage diagnosis. 4. Inspect and or replace power steering fluid reservoir as required.
SQUEAK OR RUBBING SOUND	1. Sound coming from steering column. 2. Sound internal to steering gear.	1.Check for squeak in steering column. Inspect for contact between shroud, intermediate shaft, column, and steering wheel. Realign if necessary. 2. Check for lack or grease on steering column dash panel to lower coupler seal. 1. Replace steering gear assembly.
SCRUBBING OR KNOCKING SOUND	1. Incorrect tire size. 2. Check clearance between tires and other vehicle components, through the full travel of the suspension. 3. Check for interference between steering gear and other components. 4.Incorrect steering gear supplied.	1. Verify that tire size on vehicle is the same as originally supplied. 2. Correct as necessary. 3.Correct as necessary. 4. Replace steering gear with correct steering gear for specific vehicle.

DIAGNOSIS AND TESTING (Continued)

BINDING STICKING SEIZED

CONDITION	POSSIBLE CAUSES	CORRECTION
CATCHES, STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN.	1. Low power steering fluid level.	1. Fill power steering fluid reservoir to specified level and perform leakage diagnosis.
	2. Tires not inflated to specified pressure.	2. Inflate tires to the specified pressure.
	3. Lack of lubrication in front suspension control arm ball joints.	3. Lubricate ball joints if ball joints are not a lubricated for life type ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm.
	4. Lack of lubrication in front suspension outer tie rod ends.	4. Lubricate tie rod ends if they are not a lubricated for life type. If tie rod end is a lubricated for life type, replace tie rod end.
	5. Loose power steering pump drive belt.	5. Tighten the power steering pump drive belt to the specified tension. See accessory drive in service manual.
	6. Faulty power steering pump flow control. (Verify cause using Power Steering Pump Test Procedure.)	6. Replace power steering pump.
	7. Excessive friction in steering column or intermediate shaft.	7. Correct condition. (See Steering Column Service Procedure)
	8. Steering column coupler binding.	8. Realign the steering column to eliminate the binding condition.
	9. Binding upper strut bearing.	9. Correct binding condition in strut bearing.
	10 Excessive friction in steering gear.	10 Replace steering gear assembly.

DIAGNOSIS AND TESTING (Continued)

SHAKE SHUDDER VIBRATION

CONDITION	POSSIBLE CAUSES	CORRECTION
VIBRATION OF THE STEERING WHEEL AND/OR DASH DURING DRY PARK OR LOW SPEED STEERING MANEUVERS.	1. Air in the fluid of the power steering system.	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 the specified pressure.
	3. Excessive engine vibration.	3. Ensure that the engine is running properly.
	4. Loose tie rod end.	4. Check that the inner to outer tie rod jam nut for is tight. If required, tighten the jam nut to the specified torque.
	5.Overcharged air conditioning system.	5.Check air conditioning pump head pressure. (See Air Conditioning Refrigerant System Diagnosis)

LOW ASSIST, NO ASSIST, HARD STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
STIFF, HARD TO TURN, SURGES, MOMENTARY INCREASE IN EFFORT WHEN TURNING.	1. Tires not properly inflated.	1. Inflate tires to specified pressure.
	2. Low power steering fluid level.	2. Add power steering fluid as required to power steering fluid reservoir to obtain proper level. Perform leakage diagnosis on power steering system.
	3. Loose power steering pump drive belt.	3. Adjust the power steering pump drive belt to the specified tension. If drive belt is defective replace and correctly tension.
	4. Lack of lubrication in control arm ball joints.	4. Lubricate ball joints if ball joints are not a lubricated for life type ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm.
	5. Low power steering pump pressure. (Verify using Power Steering System Test Procedure)	5. Verify cause using the Power Steering System Test Procedure. Replace the power steering pump if necessary.
	6. High internal leak in steering gear assembly.	6. Check steering system using the Power Steering System Test Procedure. If steering gear is defective replace steering gear.

DIAGNOSIS AND TESTING (Continued)

POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION.	1. Tires not inflated to specified pressure.	1. Inflate tires to specified pressure.
	2. Improper front wheel alignment.	2. Check and adjust as necessary.
	3. Lack of lubrication in front suspension control arm ball joints.	3. Lubricate ball joints if ball joints are not a lubricated for life type of ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm.
	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 shaft. Turn the steering wheel and feel or listen for internal rubbing in steering column.
	6. Steering wheel rubbing.	6. Adjust steering column shrouds to eliminate rubbing condition.
	7. Damaged, mis-positioned or un-lubricated steering column coupler to dash seal.	7. Determine condition which exists and correct.
	8. Binding upper strut bearing.	8. Correct binding condition in strut bearing.
	9. Tight shaft bearing in steering column assembly.	9. Replace the steering column assembly.
	10. Excessive friction in steering column coupler.	10. Replace steering column coupler.
	11. Excessive friction in steering gear.	11. Replace steering gear.

DIAGNOSIS AND TESTING (Continued)

LOOSE STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE STEERING WHEEL KICKBACK OR TO MUCH STEERING WHEEL FREE PLAY.	1. Air in the fluid of the power steering system.	1. Fill power steering fluid reservoir to the specified level. Perform procedure to bleed the air out of the power steering system. Perform leakage diagnosis.
	2. Steering gear loose on front suspension crossmember.	2. Check steering rear to front suspension crossmember mounting bolts. Tighten to specified torque if found to be loose.
	3. Worn, broken or loose steering column to steering gear coupler.	3. Check for worn universal joint, broken isolator or loose fasteners.
	4. Free play in steering column.	4.Check components of the steering system and repair or replace as required.
	5. Loose front suspension control arm ball joints.	5. Check and or replace the ball joint or control arm as required.
	6. Loose steering knuckle to ball joint stud pinch bolt.	6. Check pinch bolts and tighten if required to specified torque.
	7. Front wheel bearings loose or worn.	7. Tighten hub nut to specified torque or replace with new parts as necessary.
	8. Loose outer tie rod ends.	8. Check free play of outer tie rod ends and replace if required.
	9. Loose inner tie rod ends.	9. Replace steering gear assembly.
	10 Defective steering gear rotary valve.	10. Replace steering gear assembly.

DIAGNOSIS AND TESTING (Continued)

VEHICLE LEADS TO THE SIDE

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT WANT RETURN TO CENTER POSITION.	1. Radial tire lead.	1.Rotate tires as recommended in the Tire And Wheel Group of this service manual.
	2. Front suspension misaligned.	2. Align the front suspension as required. Refer to the Wheel Alignment Procedure in the Suspension Group of this service manual for the required wheel alignment procedure.
	3. Wheel braking.	3. Check for dragging brakes. Refer to the procedures in the Brake Group of this service manual.
	4. Unbalanced steering gear valve. (If this is the cause, the steering efforts will be very light in direction of lead and heavier in the opposite direction.	4. Replace steering gear.
STEERING WHEEL HAS FORE AND AFT LOOSENESS.	1. Steering wheel to steering column shaft retaining nut not properly tightened and torqued.	1. Tighten the retaining nut to its specified torque specification.
	2. Steering column lower bearing spring retainer slipped on steering column shaft.	2. Replace steering column.

DIAGNOSIS AND TESTING (Continued)

POWER STEERING FLUID LEAK

CONDITION	POSSIBLE CAUSES	CORRECTION
LOW FLUID LEVEL WITH: NO VISIBLE SIGNS OF A LEAK ON THE STEERING GEAR, POWER STEERING PUMP, FLOOR OR ANYWHERE ELSE.	1. Overfilled power steering pump fluid reservoir.	1. Adjust the power steering fluid fill to the correct level.
LOW FLUID LEVEL WITH: VISIBLE LEAK ON STEERING GEAR, POWER STEERING PUMP, FLOOR OR ANYWHERE ELSE.	2. Power steering hose connections at the power steering pump or steering gear.	2. Check for loose fittings and if found, tighten the fitting to its specified torque. If fittings are tight examine the fittings for damaged or missing O-ring seals and replace as required.
	3. Power steering pump or power steering gear leaking.	3. Identify the location of the leak and repair or replace the component as required. Refer to Power Steering Pump and/or Power Steering Gear in this group of the service manual for required procedures.

FOAMY OR MILKY POWER STEERING FLUID

CONDITION	POSSIBLE CAUSES	CORRECTION
AERATION AND OVERFLOW OF FLUID.	1. Air leaks.	1. Check for an air leak into the power steering system as described under Sucking Air Diagnosis and correct condition.
	2. Low fluid level.	2. Extremely cold temperatures may cause power steering fluid aeration if the power steering fluid is low. Add power steering fluid as required to bring level up to specification.
	3. Cracked power steering pump housing.	3. Remove power steering pump from vehicle and inspect the power steering pump housing for cracks. If a defect in the housing is found, replace the power steering pump.
	4. Water contamination.	4. Drain the power steering fluid from the system if there is evidence of contamination. Then refill the system with fresh clean power steering fluid.

POWER STEERING PUMP

INDEX

DESCRIPTION AND OPERATION

POWER STEERING PUMP

On all vehicles equipped with power steering, the hydraulic pressure for operation of the power steering gear is provided by a belt driven power steering pump (Fig. 1). The TTA power steering pump is a constant flow rate and displacement, vane type pump.

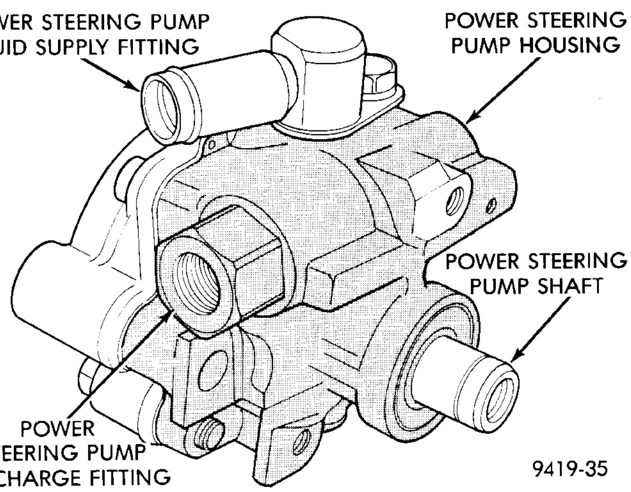


Fig. 1 TTA Power Steering Pump Assembly

In the event of a power steering pump drive belt failure, manual steering control of the vehicle can still be maintained. However, under these conditions, steering effort will be significantly increased.

All vehicles equipped with power steering use a remote mounted reservoir for the power steering fluid. The power steering fluid remote reservoir is mounted to the rear of the cylinder head on the passenger side of the vehicle.

The service procedures for the TTA power steering pump are limited to the areas and components listed below. **No repair procedures are to be done on internal components of the TTA 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 pump id (Fig. 1). 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.

DESCRIPTION AND OPERATION (Continued)

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, the 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.

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.

DIAGNOSIS AND TESTING

POWER STEERING SYSTEM TEST PROCEDURE

The following procedure can be used to test the operation of the power steering system on the vehicle. This test will provide the flow rate of the power steering pump along with the maximum relief pressure. This test is to be performed any time a power steering system problem is present to determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Pressure/Flow Tester, Special Tool 6815 (Fig. 2).

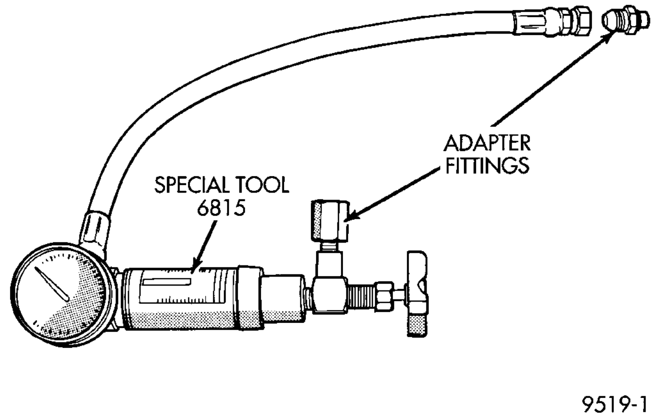


Fig. 2 Power Steering Pump Flow/Pressure Tester

POWER STEERING PUMP FLOW AND PRESSURE TEST PROCEDURE

(1) Check power steering pump drive belt tension and adjust as necessary.

(2) Disconnect power steering fluid pressure hose, at power steering pump. Use a container for dripping fluid.

(3) Connect Pressure Gauge, Special Tool from kit 6815 (Fig. 3) to both hoses using adapter fittings. Connect spare pressure hose, to power steering pump pressure hose banjo fitting.

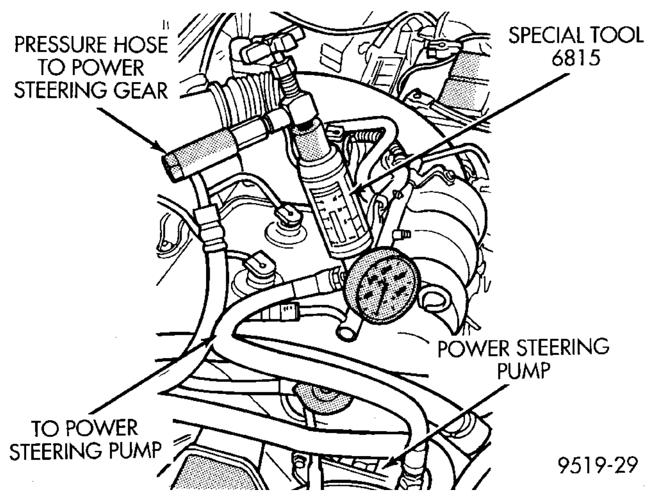


Fig. 3 Power Steering Pump Flow/Pressure Tester Connected To Power Steering Pump

(4) Completely open valve on Special Tool 6815 (Fig. 3).

(5) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test and get air out of fluid. Then shut off engine.

(6) Check power steering fluid level, and add fluid as necessary. Start engine again and let idle.

(7) Pressure gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading

DIAGNOSIS AND TESTING (Continued)

should be in the range of 345-552 kPa (50-80 psi). The flow meter should read between 1.3 and 1.4 GPM

CAUTION: The following test procedure involves testing power steering pump maximum pressure output and flow control valve operation. Do not leave valve closed for more than 5 seconds as the pump could be damaged.

(8) Close valve fully three times and record highest pressure indicated each time. **All three readings must be above specifications and within 345 kPa (50 psi) of each other.**

NOTE: Power steering pump maximum relief pressure is 8240 to 8920 kPa (1195 to 1293 psi.).

- If power steering pump pressures above specifications but not within 345 kPa (50 psi) of each other, then replace power steering pump.
- If pressures within 345 kPa (50 psi) of each other but below specifications, then replace power steering pump.

CAUTION: Do not force the pump to operate against the stops for more than 5 seconds at a time because, pump damage will result.

(9) Open test valve. Turn steering wheel to the extreme left and right positions until against the stops, recording the highest indicated pressure at each position. Compare pressure gauge readings to power steering pump specifications. If highest output pressures are not the same against either stop, the steering gear is leaking internally and must be replaced.

SERVICE PROCEDURES

POWER STEERING SYSTEM FLUID LEVEL CHECK

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING PARTS. DO NOT USE AUTOMATIC TRANSMISSION FLUID IN THE POWER STEERING SYSTEM. DO NOT OVERFILL THE POWER STEERING SYSTEM.

Wipe reservoir filler cap free of dirt. Then check fluid level. The dipstick should indicate COLD when fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F). In all pumps add fluid as necessary, use only **Mopar Power Steering Fluid, or equivalent. DO NOT USE ANY TYPE OF AUTOMATIC TRANSMISSION FLUID.**

POWER STEERING PUMP INITIAL OPERATION

CAUTION: The fluid level should be checked with engine off to prevent injury from moving components. Use only Mopar® Power Steering Fluid. Do not use automatic transmission fluid. Do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **FULL COLD** when the fluid is at normal temperature of approximately 21°C to 27°C (70°F to 80°F).

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(2) Start the engine and let run for a few seconds. Then turn the engine off.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(6) Add power steering fluid if necessary.

(7) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(8) Stop the engine. Check the fluid level and refill as required.

(9) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

POWER STEERING PUMP FLOW CONTROL VALVE SEAL

The power steering pump does not require removal from the engine for removal and replacement of the flow control valve fitting O-Ring.

REMOVE

(1) Remove the power steering fluid pressure hose from the power steering pump pressure fitting (Fig. 4).

(2) Remove the flow control valve fitting from the power steering pump housing (Fig. 5). **Prevent flow control valve and spring from sliding out of housing bore.**

(3) Remove and discard O-ring seal from fitting.

INSTALL

(1) If necessary, clean and install flow control valve and spring in pump housing bore.

(2) Install new O-ring seal on fitting.

(3) Install fitting in pump housing and tighten to 75 N·m (55 ft. lbs.)

(4) Install power steering fluid pressure hose on flow control valve fitting.

SERVICE PROCEDURES (Continued)

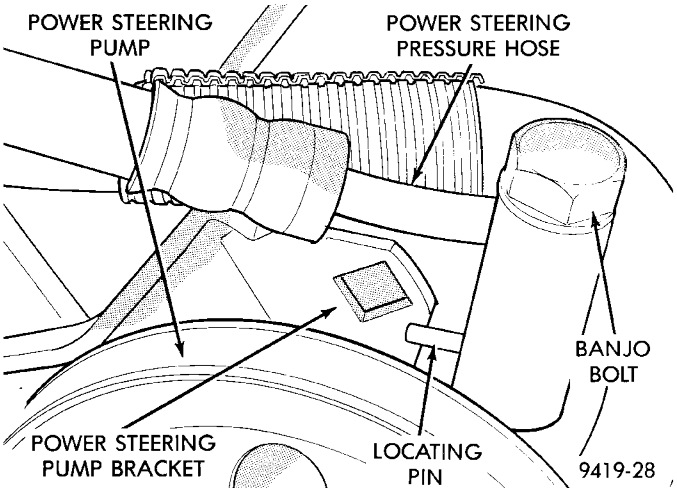


Fig. 4 Pressure Hose Attachment To Power Steering Pump

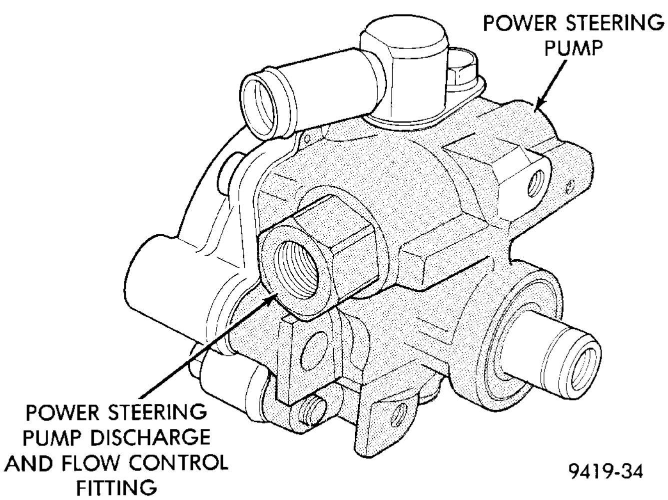


Fig. 5 Pump Discharge And Flow Control Valve Fitting

(5) Position locating pin on power steering pressure hose banjo fitting so it is against power steering pump mounting bracket (Fig. 4). While holding locating pin against power steering pump bracket, torque banjo bolt to 34 N·m (25 ft. lbs.).

POWER STEERING PUMP SUCTION PORT SEAL

The power steering pump does not require removal from the engine for removal and replacement of the suction port O-Ring seal.

REMOVE

(1) Remove power steering fluid supply hose from power steering pump suction port fitting (Fig. 6).

(2) Remove bolt (Fig. 6) attaching power steering pump suction port fitting to the power steering pump.

(3) Remove the suction port fitting (Fig. 6) from the power steering pump.

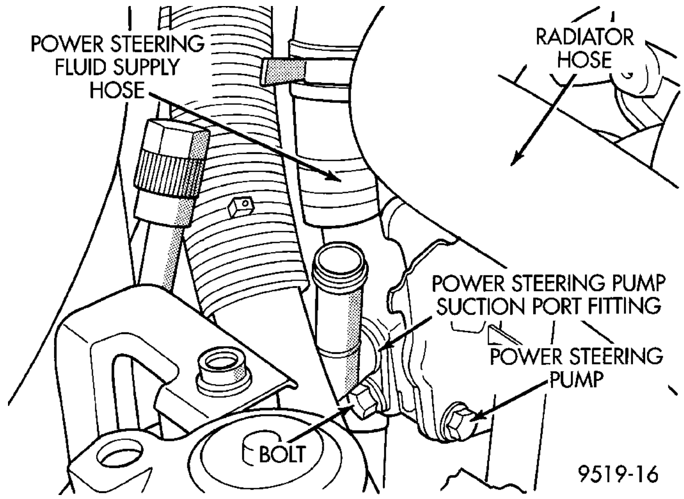


Fig. 6 Power Steering Pump Suction Port Fitting

(4) Remove and discard O-ring seal from suction port fitting.

INSTALL

(1) Install new O-ring seal on suction fitting.

(2) Install suction port fitting in power steering pump. Install and securely tighten the suction port fitting attaching bolt.

(3) Install power steering fluid supply hose on suction port fitting, being sure hose clamp is installed on hose past upset bead on suction port fitting.

REMOVAL AND INSTALLATION

POWER STEERING PRESSURE SWITCH

On vehicles equipped with power steering, a power steering pressure switch is used to improve the vehicle's idle quality. The pressure switch improves vehicle idle quality, by controlling engine idle speed when required.

The pressure switch functions by signaling 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 (Fig. 7) is mounted directly to the power steering gear on vehicle's requiring its usage.

REMOVAL AND INSTALLATION (Continued)

REMOVE

CAUTION: When removing and installing the power steering pressure switch, the use of a 7/8 inch deep well socket is required. The deep well socket will prevent damage to the plastic, electrical connector area, of the power steering pressure switch.

(1) Disconnect negative battery cable from the negative post of the battery. Be sure cable is isolated from negative post on battery.

(2) Raise vehicle.

(3) Locate power steering pressure switch (Fig. 7) on back side of power steering gear.

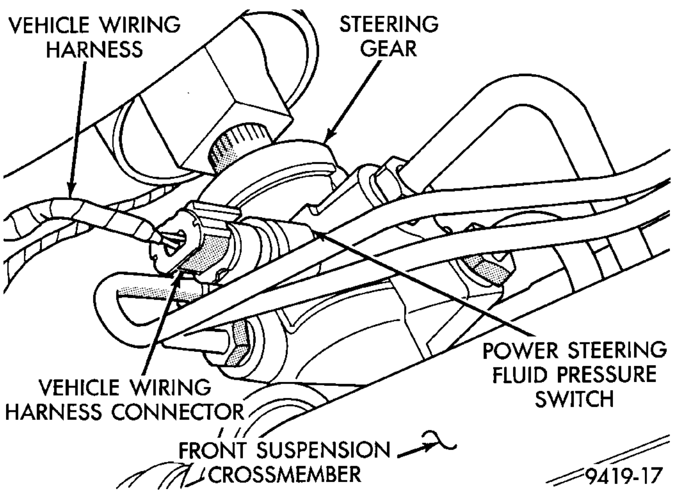


Fig. 7 Power Steering Pressure Switch Location On Steering Gear

(4) Remove vehicle wiring harness connector (Fig. 7), from power steering pressure switch.

(5) Remove power steering pressure switch, from power steering gear.

INSTALL

CAUTION: When installing the power steering pressure switch in the steering gear, do not exceed the torque specification shown in step 1 below. Over-torquing will result in stripping the threads out of the power steering pressure switch port on the steering gear.

(1) By hand, install the power steering pressure switch into the power steering gear until fully seated. Then tighten the power steering pressure switch to a maximum torque of 8 N·m (70 in. lbs.).

(2) Install vehicle wiring harness connector (Fig. 7) 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 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 FLUID PRESSURE HOSE

CAUTION: 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 the following figure numbers. These figures show the hose bracket locations, hose routings and fitting locations. Use these figure numbers when referring to the removal or installation procedures for the power steering hoses listed below.

REMOVE

(1) Raise vehicle.

(2) Remove bolt attaching power steering hose routing bracket to front suspension crossmember (Fig. 8).

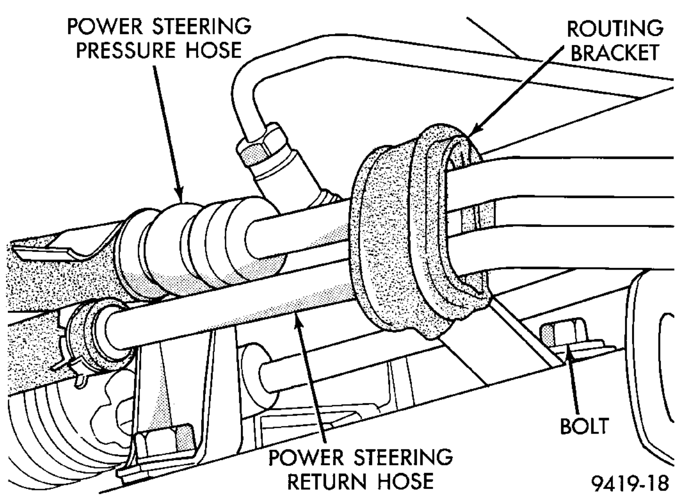


Fig. 8 Power Steering Hose Routing Bracket

REMOVAL AND INSTALLATION (Continued)

(3) Disconnect power steering pressure hose (Fig. 9) at power steering gear. Drain power steering fluid from power steering pump and hose through open end of hose.

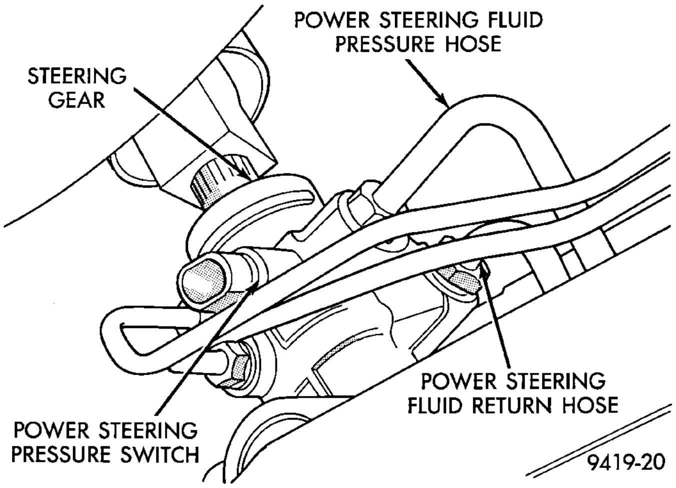


Fig. 9 Power Steering Pressure Hose At Steering Gear

(4) Remove power steering pressure hose from routing clip on generator shield (Fig. 10).

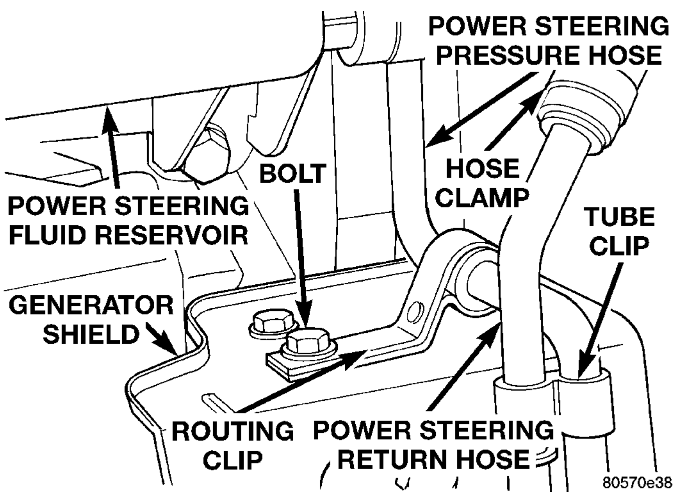


Fig. 10 Power Steering Pressure Hose Routing Clip At Generator Shield

(5) Lower vehicle.

(6) Remove bolt, attaching power steering pressure hose routing clip, to generator shield (Fig. 11).

(7) Loosen and remove Banjo bolt, and power steering pressure hose from pressure fitting on power steering pump (Fig. 12).

(8) Power steering fluid pressure hose is removed from the vehicle from the top of the engine compartment.

(9) Discard all used O-rings located at ends of power steering pressure hose and Banjo bolt.

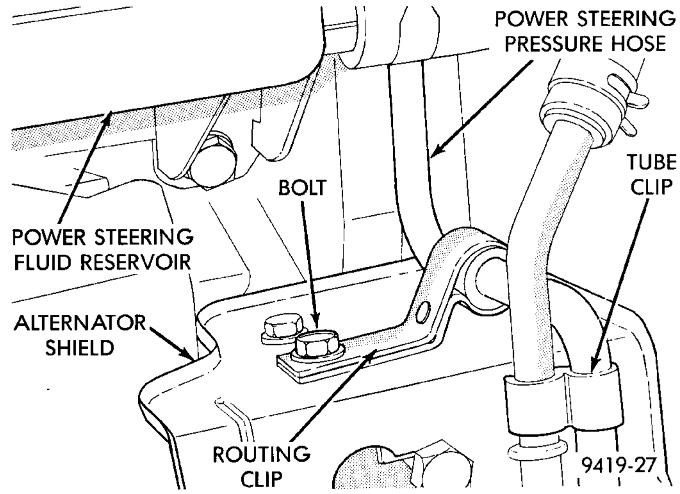


Fig. 11 Power Steering Hose Attachment To Generator Shield

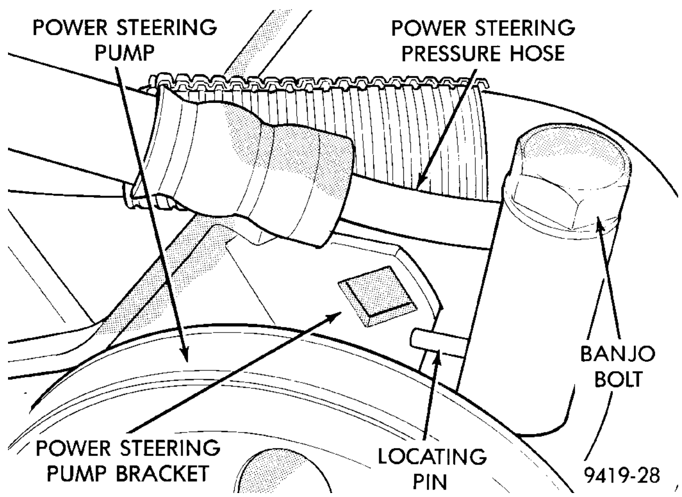


Fig. 12 Power Steering Hose Attachment To Power Steering Pump

INSTALL

(1) Install power steering pressure hose in vehicle from top of engine compartment.

(2) Using a lint free towel, wipe clean all open power steering hose ends, and the power steering pump and steering gear ports.

(3) Install new O-ring on end of power steering pressure hose banjo fitting (Fig. 13).

(4) Install a new O-ring (Fig. 14) on power steering pressure hose banjo fitting bolt.

(5) Lubricate both O-rings using fresh clean power steering fluid.

(6) Install banjo bolt into the power steering pressure hose banjo fitting (Fig. 14).

(7) Attach power steering pressure hose to outlet fitting on power steering pump (Fig. 12). **Do not tighten or torque pressure fitting Banjo bolt at this time.**

REMOVAL AND INSTALLATION (Continued)

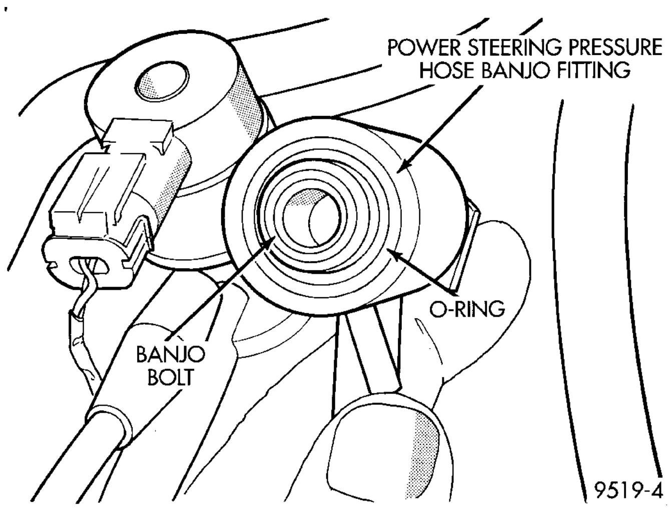


Fig. 13 O-ring Installed On Power Steering Hose Banjo Fitting

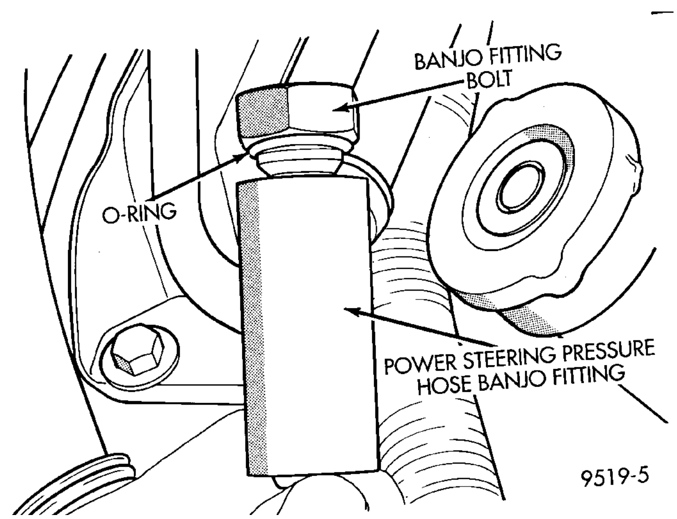


Fig. 14 O-ring Installed On Banjo Fitting Bolt

(8) Correctly route power steering pressure hose avoiding tight bends or kinking of the hose. Install power steering pressure hose to generator shield routing clip attaching screw (Fig. 11) **but do not tighten at this time.**

(9) Raise vehicle.

CAUTION: Hoses must remain away from exhaust system, vehicle components and unfriendly surfaces causing possible damage to power steering hoses.

(10) Route power steering pressure hose to pressure port on power steering gear. Install power steering pressure hose, on steering gear and loosely install tube nut into steering gear (Fig. 9). **Tighten and torque tube nut after routing bracket is installed, correctly positioning hoses in vehicle.**

(11) Install the power steering pressure and return hose routing clip on hoses (Fig. 8). Install bolt attaching routing clip to front suspension crossmember. Torque routing clip to front suspension crossmember attaching bolt to 23 N·m (17 ft. lbs.)

(12) Torque power steering pressure hose to steering gear tube nut to 34 N·m (25 ft. lbs.).

(13) Install power steering pressure hose in routing clip on generator shield (Fig. 10).

(14) Lower Vehicle.

(15) Position locating pin on power steering pressure hose banjo fitting so it is against power steering pump mounting bracket (Fig. 12). While holding locating pin against power steering pump bracket, torque pump end Banjo bolt to 34 N·m (25 ft. lbs.).

(16) Securely tighten bolt attaching power steering pressure hose bracket to generator shield.

(17) Start the engine and let run for a few seconds. Then turn the engine off.

(18) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(19) Raise front wheels of vehicle off the ground.

(20) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(21) Add power steering fluid if necessary.

(22) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(23) Stop the engine. Check the fluid level and refill as required.

(24) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(25) After hose is installed, check for leaks at all hose connections.

POWER STEERING FLUID RETURN HOSE

CAUTION: 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.

REMOVE

(1) Raise vehicle.

(2) Remove hose clamp, attaching return hose to steel tube at power steering gear (Fig. 15). Let power

REMOVAL AND INSTALLATION (Continued)

steering fluid, drain from return hose and power steering fluid reservoir, until reservoir is empty.

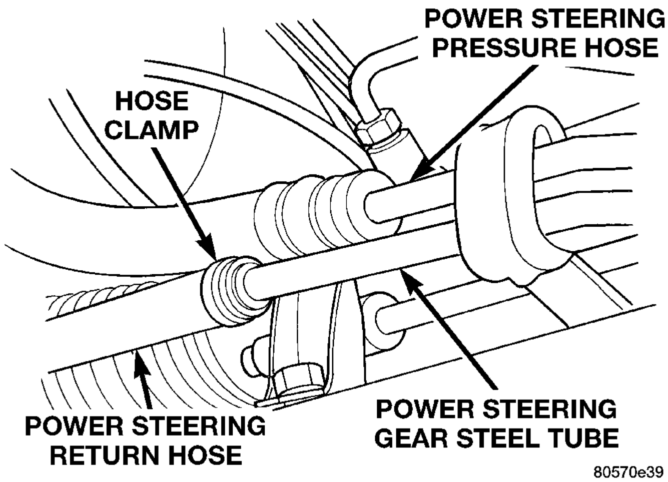


Fig. 15 Power Steering Return Hose At Steering Gear

(3) Remove power steering return hose from routing clip on generator shield (Fig. 16).

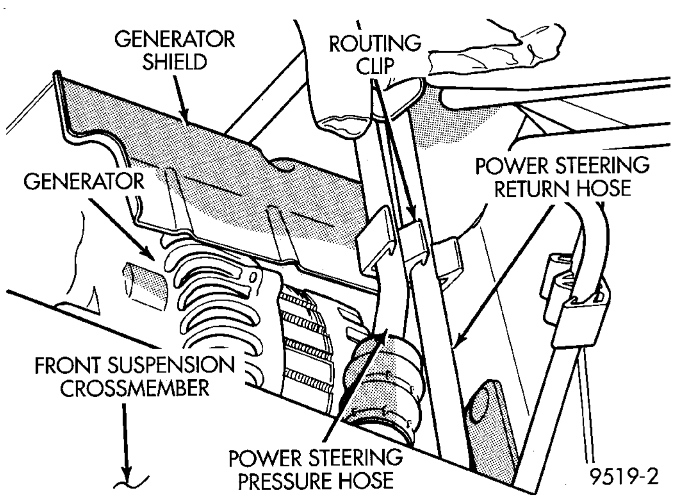


Fig. 16 Power Steering Hose Routing Clip At Generator Shield

(4) Lower vehicle.

(5) Remove tube clip at generator shield (Fig. 17) attaching power steering fluid return hose to power steering fluid pressure hose.

CAUTION: Care must be used when removing power steering fluid return hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

(6) Remove hose clamp, attaching power steering return hose to power steering fluid reservoir (Fig.

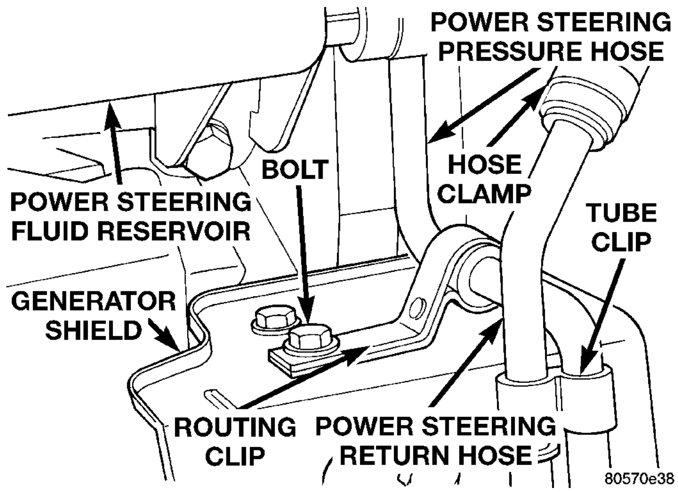


Fig. 17 Tube Clip At Generator Shield

18). Then remove power steering return hose from power steering fluid reservoir.

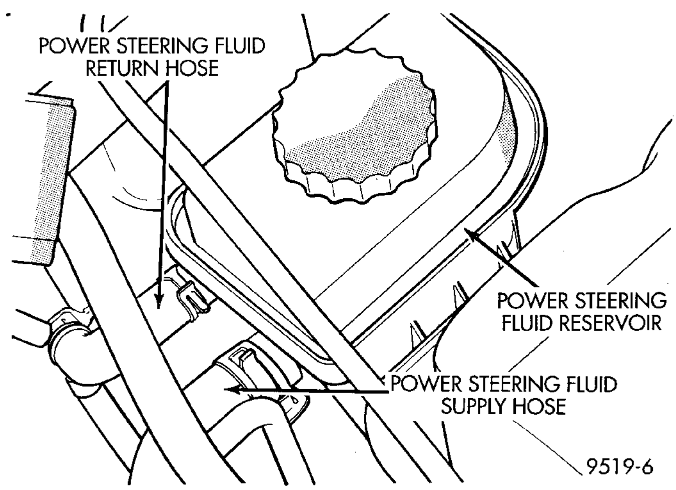


Fig. 18 Power Steering Return Hose At Reservoir

(7) Remove the power steering return hose from the vehicle. The power steering return hose is removed from the top of the engine compartment.

INSTALL

(1) Install power steering return hose on vehicle. Power steering return hose is installed from the top of the vehicles engine compartment.

CAUTION: Care must be used when installing power steering fluid return hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

(2) Install power steering return hose on power steering fluid reservoir fitting. Install hose clamp on power steering return hose at power steering fluid reservoir (Fig. 18). **Be sure hose clamp is**

REMOVAL AND INSTALLATION (Continued)

installed on return hose past upset bead on power steering fluid reservoir.

(3) Raise vehicle.

(4) Clip power steering return hose and pressure hose together (Fig. 17).

(5) Install power steering return hose on steel tube at power steering gear (Fig. 15). Install hose clamp on power steering return hose at power steering gear (Fig. 15). **Be sure hose clamp is installed on return hose past upset bead on steel tube at power gear.**

(6) Install power steering return hose on routing clip at generator shield (Fig. 16).

(7) Lower vehicle.

(8) Start the engine and let run for a few seconds. Then turn the engine off.

(9) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(10) Raise front wheels of vehicle off the ground.

(11) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(12) Add power steering fluid if necessary.

(13) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(14) Stop the engine. Check the fluid level and refill as required.

(15) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(16) After hose is installed, check for leaks at all hose connections.

POWER STEERING FLUID SUPPLY HOSE RESERVOIR TO POWER STEERING PUMP

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.

REMOVE

CAUTION: Care must be used when removing the power steering fluid supply hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

(1) Remove hose clamp, attaching power steering fluid supply hose to power steering fluid reservoir (Fig. 19). Then remove power steering fluid supply hose from power steering fluid reservoir.

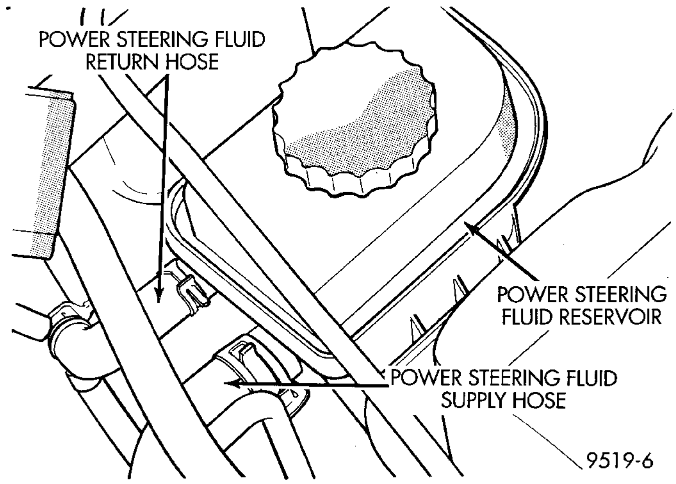


Fig. 19 Power Steering Fluid Supply Hose At Reservoir

(2) Remove hose clamp, attaching power steering fluid supply hose to the power steering pump (Fig. 20). Then remove power steering fluid supply hose from power steering pump fitting.

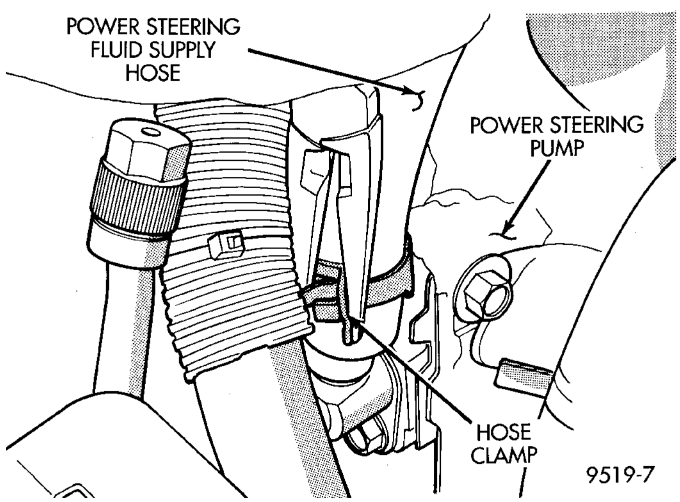


Fig. 20 Power Steering Fluid Supply Hose At Power Steering Pump

(3) Remove power steering fluid supply hose from engine.

INSTALL

(1) Install power steering fluid supply hose back on engine making sure it is correctly routed.

CAUTION: Care must be used when installing power steering fluid supply hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

REMOVAL AND INSTALLATION (Continued)

(2) Install power steering fluid supply hose on power steering fluid reservoir fitting. Install hose clamp on power steering fluid supply hose at power steering fluid reservoir (Fig. 19). **Be sure hose clamp is installed on return hose past upset bead on power steering fluid reservoir.**

(3) Install power steering fluid supply hose on power steering pump fitting. Install hose clamp on power steering fluid supply hose at power steering pump fitting (Fig. 20). **Be sure hose clamp is installed on power steering fluid supply hose past upset bead on power steering pump fitting.**

(4) Start the engine and let run for a few seconds. Then turn the engine off.

(5) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(6) Raise front wheels of vehicle off the ground.

(7) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(8) Add power steering fluid if necessary.

(9) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(10) Stop the engine. Check the fluid level and refill as required.

(11) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(12) After hose is installed, check for leaks at all hose connections.

POWER STEERING PUMP (ALL ENGINES)

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.

The power steering pump removal procedure and pump and bracket fastener locations are the same for both engine applications used for this vehicle. The front power steering pump bracket must be removed as an assembly with the power steering pump and removed from the pump after removing the pulley from the power steering pump.

REMOVE

(1) Remove battery cable from (-) negative post on battery.

(2) Remove Banjo Bolt and power steering fluid pressure hose from pressure fitting on power steering pump (Fig. 21).

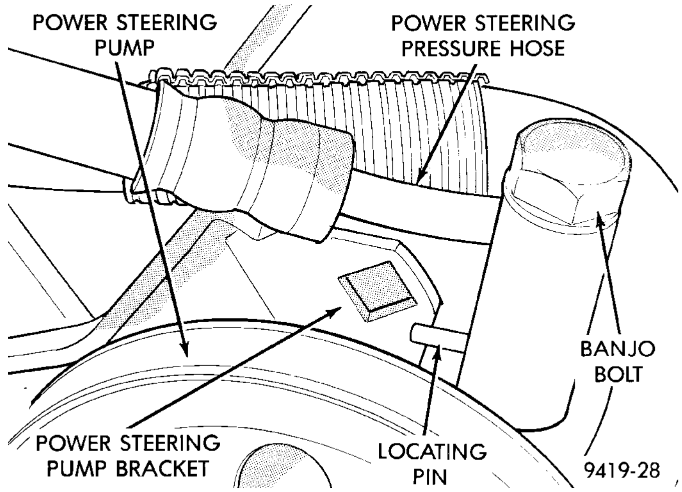


Fig. 21 Power Steering Hose Attachment To Power Steering Pump

(3) Discard all used O-rings on the power steering pressure hose Banjo fitting and Banjo bolt.

(4) Remove hose clamp attaching power steering fluid supply hose to the power steering pump suction fitting (Fig. 22). Remove power steering fluid supply hose from power steering pump fitting.

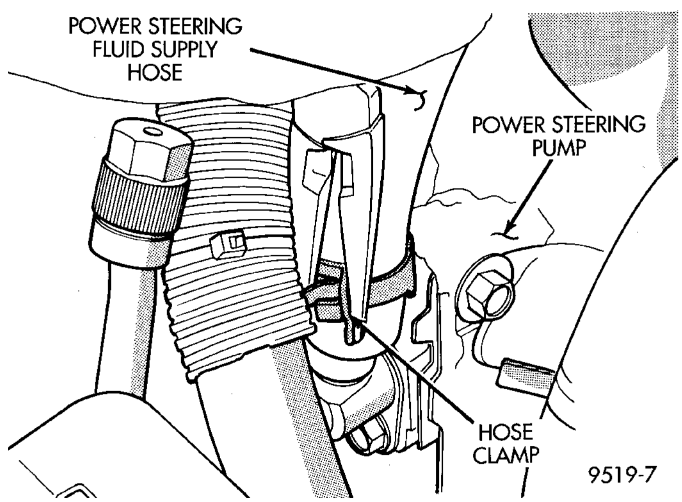


Fig. 22 Power Steering Fluid Supply Hose At Power Steering Pump

(5) Raise vehicle on jackstands or centered on a frame contact type hoist. See hoisting in the Lubrication And Maintenance Section of this service manual for the required lifting procedure to be used for this vehicle.

NOTE: If the vehicle is equipped with a dual overhead cam engine, the bolt attaching the coolant tube to the intake manifold needs to be removed. Refer to following step for required procedure.

(6) Remove the bolt attaching the coolant tube (Fig. 23) to the bottom of the intake manifold. **The**

REMOVAL AND INSTALLATION (Continued)

bolt requires removal to allow the coolant tube to be moved out of the way for access to the power steering pump mounting bolt. The coolant tube does not need to be removed or the cooling system drained.

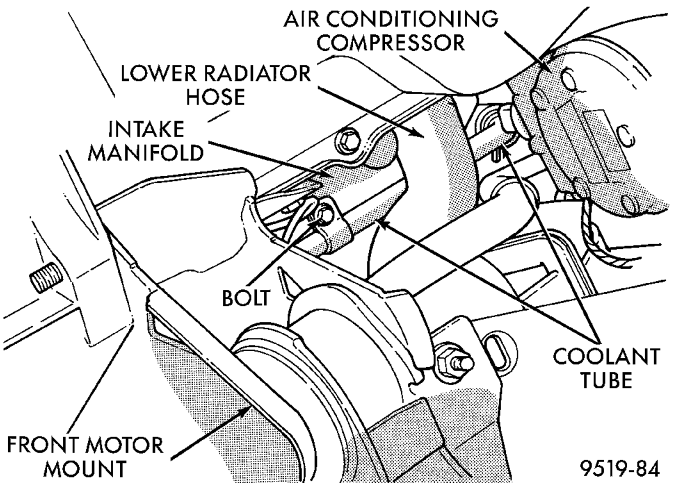


Fig. 23 Coolant Tube To Intake Manifold Attachment

(7) Remove the 2 power steering pump to cast bracket mounting and adjustment bolts (Fig. 24).

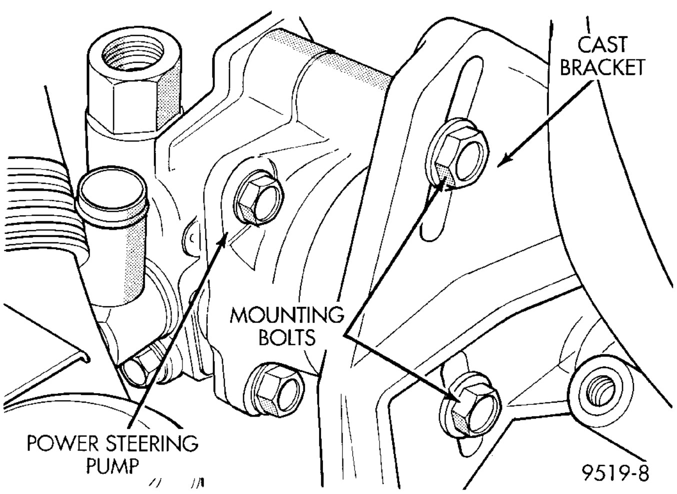


Fig. 24 Power Steering Pump Mounting Bolts (Rear)

NOTE: The power steering pump front mounting bracket is slotted at the bolt attaching it to the front engine mount (Fig. 25). This bolt only needs to be loosened to remove mounting bracket from engine.

(8) Loosen bolt (Fig. 25) attaching the power steering pump front mounting to the front engine mount only far enough to slide the bracket out from under the bolt.

(9) Remove power steering pump drive belt from power steering pump pulley.

(10) Remove power steering pump and front mounting bracket as an assembly from the engine (Fig. 26).

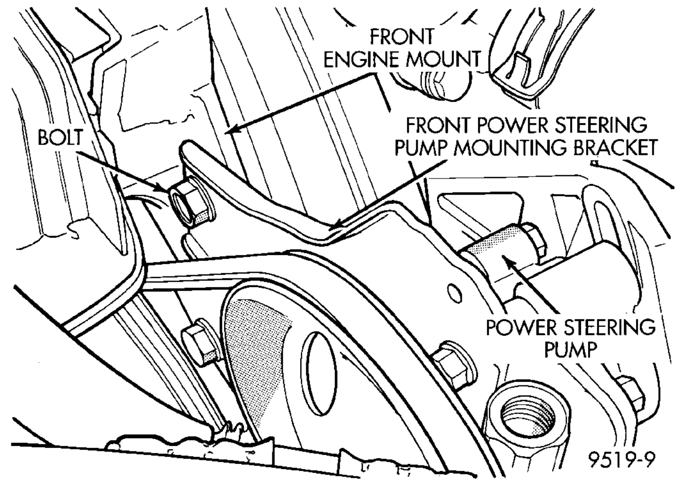


Fig. 25 Power Steering Pump Front Mounting Bracket Bolt

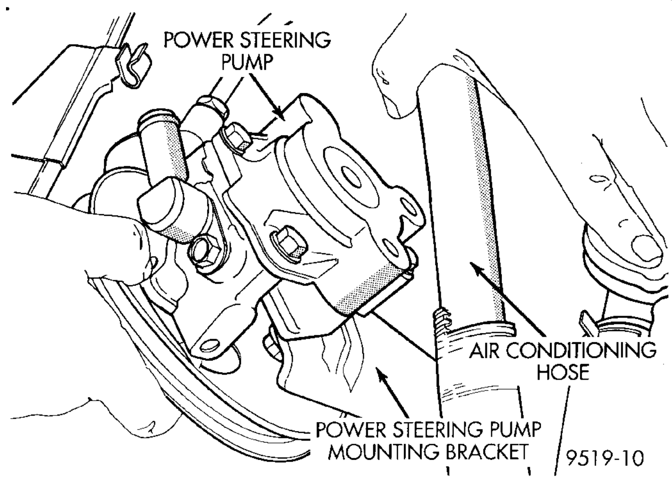


Fig. 26 Power Steering Pump And Bracket

(11) Transfer required parts from removed power steering pump to replacement power steering pump.

INSTALL

(1) Install power steering pump and mounting bracket as an assembly (Fig. 26) back on the engine using reverse of removal procedure.

(2) Slide front power steering pump bracket between bracket mounting bolt and front engine mount (Fig. 25). **Be sure washer on bolt is between the head of the bolt and bracket and does not get trapped between bracket and engine mount.**

(3) Install the 2 power steering pump to cast mounting bracket attaching bolts (Fig. 24). **Do not tighten bolts at this time.**

(4) Install power steering pump drive belt on power steering pump pulley.

(5) Install a 1/2 in. breaker bar in the square hole in the front power steering pump mounting bracket (Fig. 27). Then rotate pump in to obtain the correct

REMOVAL AND INSTALLATION (Continued)

drive belt tension. See Accessory Drive Belts in Group 7 Cooling System of this service manual for the correct drive belt tension specification. When correct drive belt tension is obtained torque the 2 bolts at the power steering pump cast mounting bracket (Fig. 24) to 54 N·m (40 ft. lbs.). Then torque the front power steering pump mounting bracket bolt (Fig. 25) to 54 N·m (40 ft. lbs.).

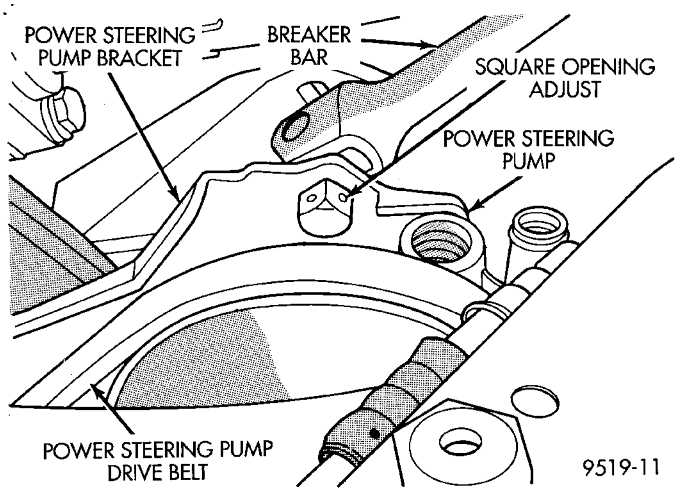


Fig. 27 Setting Power Steering Pump Drive Belt Tension

(6) Install power steering supply hose on power steering pump suction fitting (Fig. 22). Install hose clamp on hose, being sure hose clamp is installed on hose past upset bead on power steering pump tube.

(7) Using a lint free towel, wipe clean all open power steering hose ends, and power steering pump fittings.

(8) Install a new O-ring on the end of the power steering pressure hose banjo fitting (Fig. 28).

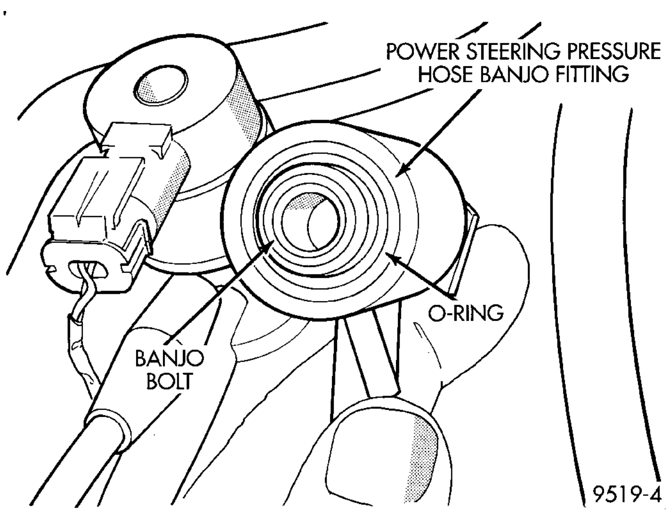


Fig. 28 O-Ring Installed On Power Steering Hose Banjo Fitting

(9) Install a new O-ring (Fig. 29) on power steering fluid pressure hose banjo fitting bolt.

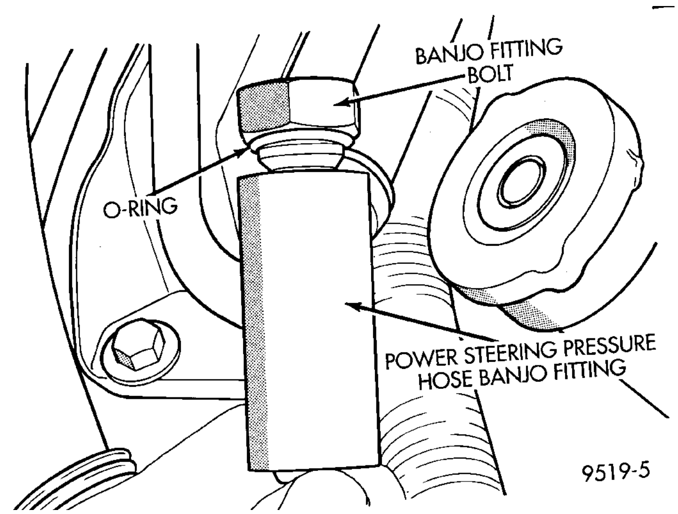


Fig. 29 O-Ring Installed On Banjo Fitting Bolt

(10) Lubricate both O-rings using fresh clean power steering fluid.

(11) Install banjo bolt into the power steering pressure hose banjo fitting.

(12) Attach power steering pressure hose on outlet fitting of the power steering pump (Fig. 21).

(13) Position locating pin on power steering pressure hose banjo fitting so it is against power steering pump mounting bracket (Fig. 21). While holding locating pin against power steering pump bracket, torque pump end Banjo bolt to 34 N·m (25 ft. lbs.).

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(14) Fill power steering reservoir to correct fluid level.

(15) Connect negative cable back on negative post of battery.

(16) Start the engine and let run for a few seconds. Then turn the engine off.

(17) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(18) Raise front wheels of vehicle off the ground.

(19) Start engine, then slowly turn steering wheel right and left several times until lightly contacting the wheel stops. Then turn the engine off.

(20) Add power steering fluid if necessary.

(21) Lower the vehicle. Start engine again and turn the steering wheel slowly from lock to lock.

(22) Stop the engine. Check the fluid level and refill as required.

REMOVAL AND INSTALLATION (Continued)

(23) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(24) After power steering pump is installed, check for leaks at all hose connections and power steering pump fittings.

POWER STEERING FLUID RESERVOIR

REMOVE

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

(2) Remove hose clamp, attaching return hose to steel tube at power steering gear (Fig. 30). Let power steering fluid drain from return hose and power steering fluid reservoir, until reservoir is empty.

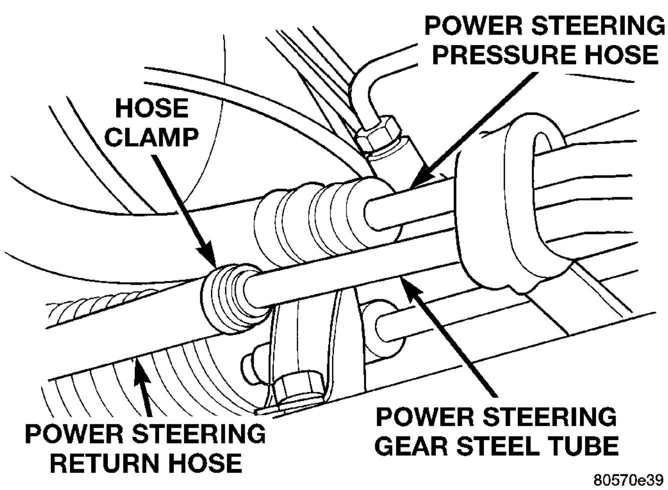


Fig. 30 Power Steering Return Hose At Steering Gear

(3) Lower vehicle.

(4) Remove the coolant overflow hose from the coolant recovery system (CRS) tank (Fig. 31).

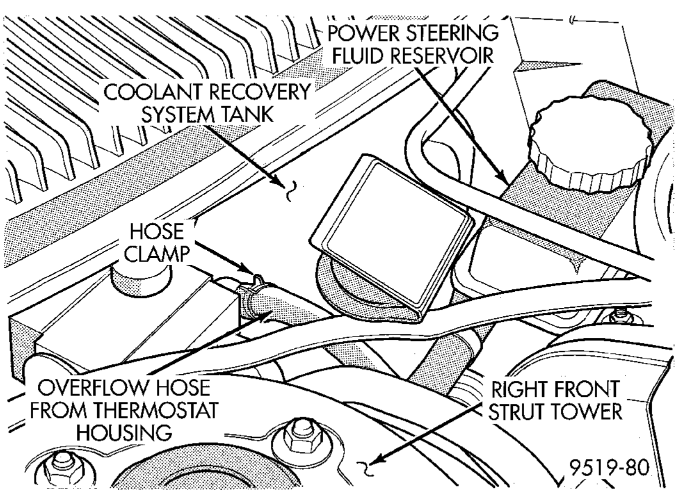


Fig. 31 Overflow Hose Connection At CRS Tank

NOTE: Removal of the CRS tank improves access to the power steering fluid reservoir attaching bolts.

(5) Remove the nut and screw attaching the CRS tank to the dash panel (Fig. 32). Remove the CRS tank from the dash panel and lower it down on top of the steering gear toward the center of the vehicle.

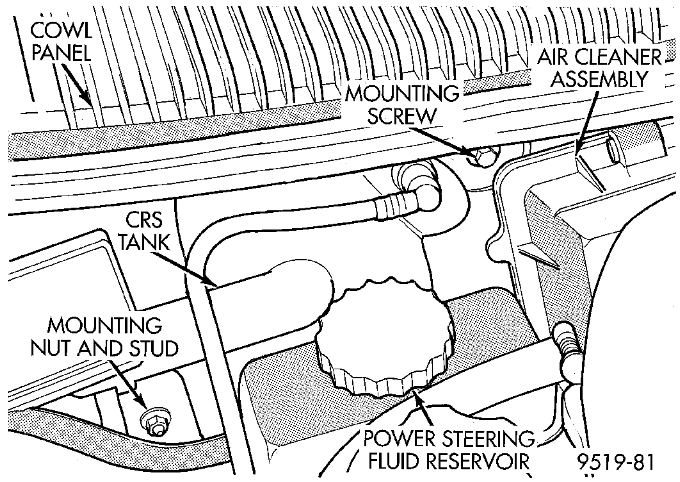


Fig. 32 CRS Tank Mounting Bolt And Screw

CAUTION: Care must be used when removing and installing power steering fluid hoses on the power steering fluid reservoir. If excessive force is used when trying to remove or install hoses on nipples of power steering fluid reservoir, nipples can be broken off the reservoir.

(6) Remove the power steering fluid return and supply hose from the power steering fluid reservoir (Fig. 33).

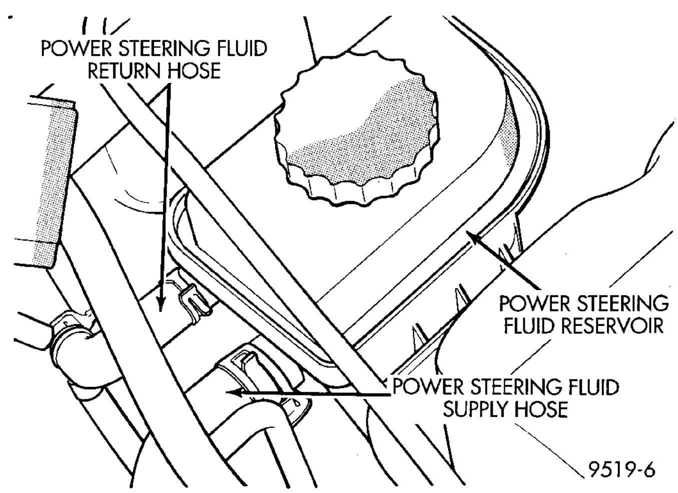


Fig. 33 Power Steering Fluid Hoses At Reservoir

(7) **If vehicle is equipped with the single overhead cam engine,** remove the 3 bolts (Fig. 34) attaching the power steering fluid reservoir to the cylinder head.

REMOVAL AND INSTALLATION (Continued)

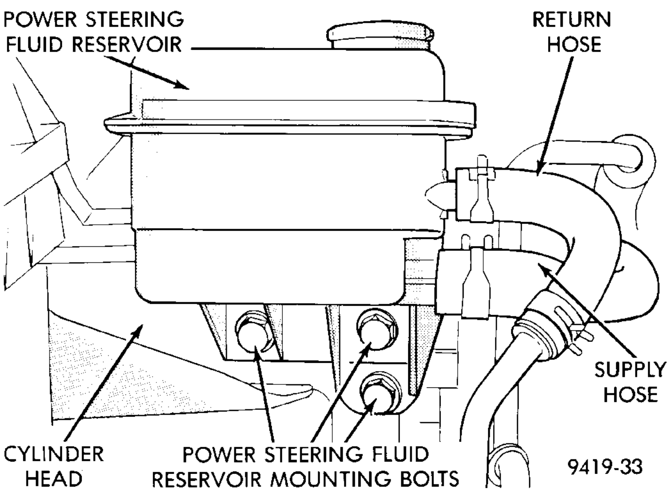


Fig. 34 Power Steering Fluid Reservoir Hoses And Mounting

(8) **If vehicle is equipped with the dual overhead cam engine,** remove the 2 nuts (Fig. 35) attaching the power steering fluid reservoir to the cylinder head.

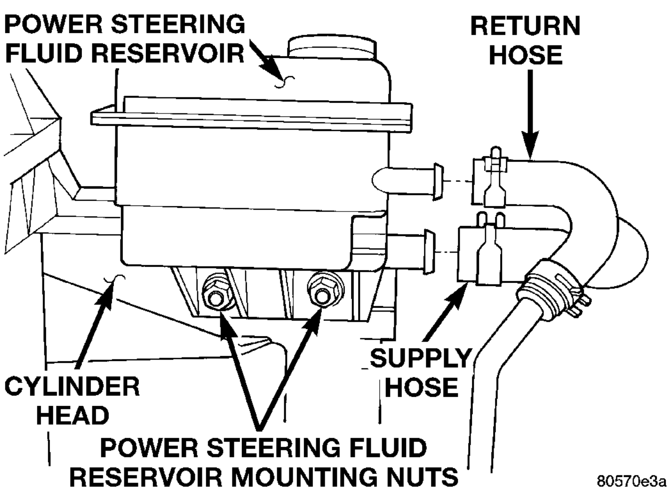


Fig. 35 Power Steering Fluid Reservoir Mounting

(9) Remove power steering fluid reservoir from vehicle.

INSTALL

(1) Install power steering fluid reservoir on cylinder head. Install and securely tighten the power steering fluid reservoir to cylinder head attaching bolts (Fig. 34) or. (Fig. 35)

(2) Install the power steering fluid return and supply hose, on the power steering fluid reservoir fittings (Fig. 33). **Be sure both hose clamps are installed on hose past upset bead on power steering reservoir fittings.**

(3) Install engine coolant recovery system tank on dash panel of vehicle. Install and securely tighten attaching bolts (Fig. 32).

(4) Install the coolant overflow hose from the coolant recovery system (CRS) tank (Fig. 31)

(5) Raise vehicle.

(6) Install power steering return hose, on the steel tube at the power steering gear (Fig. 30). **Be sure hose clamp is installed on hose past upset bead on power steering gear steel tube.**

(7) Fill power steering pump fluid reservoir to the proper level.

(8) Start the engine and let run for a few seconds. Then turn the engine off.

(9) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(10) Raise front wheels of vehicle off the ground.

(11) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(12) Add power steering fluid if necessary.

(13) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(14) Stop the engine. Check the fluid level and refill as required.

(15) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

DISASSEMBLY AND ASSEMBLY

POWER STEERING PUMP DRIVE PULLEY

The power steering pump must be removed from the vehicle for removal of the power steering pump pulley. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual.

REMOVE

(1) Remove power steering pump from engine. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Mount power steering pump in a vise using the power steering pump mounting bracket (Fig. 36). Install Puller, Special Tool C-4333 or C- 4068 on power steering pump pulley (Fig. 36). Remove the power steering pump pulley from the power steering pump shaft.

(3) Replace power steering pump pulley if bent, cracked, or loose.

DISASSEMBLY AND ASSEMBLY (Continued)

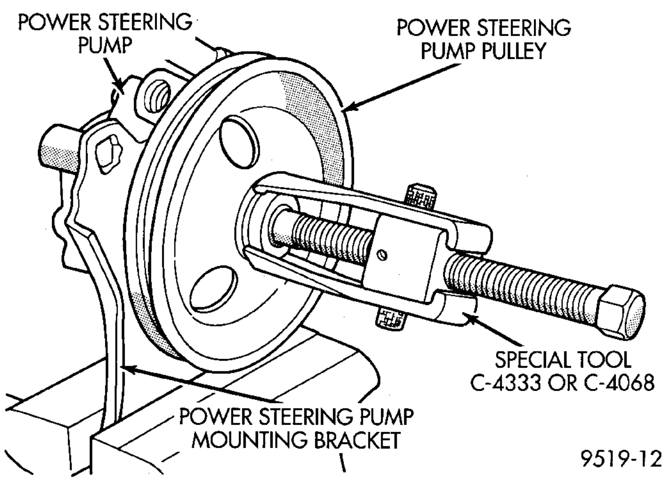


Fig. 36 Pulley Removal From Power Steering Pump Shaft

INSTALL

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(1) Mount power steering pump in a vise using the power steering pump mounting bracket (Fig. 37). Then place power steering pump pulley squarely on end of power steering pump shaft. Mount Installer, Special Tool C-4063 in internal threads of the power steering pump shaft and against power steering pump pulley (Fig. 37).

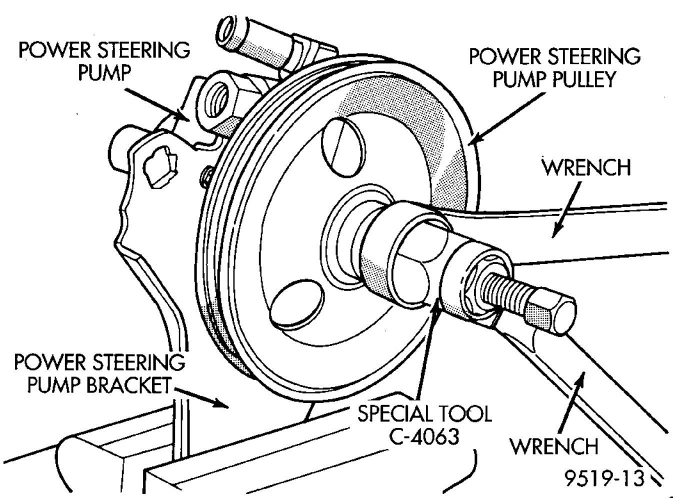


Fig. 37 Pulley Installation On Power Steering Pump Shaft

(2) Ensuring that special tool and pulley remain aligned with pump shaft, force pulley onto power steering pump shaft until flush with the end of the shaft (Fig. 38). **When pulley is flush with shaft tool will no longer be able to be turned.**

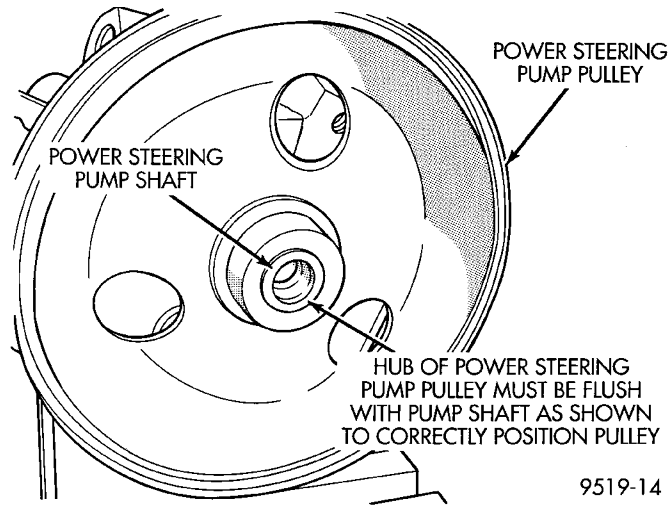


Fig. 38 Correctly Installed Power Steering Pump Pulley

(3) Remove Installer, Special Tool C-4063 from power steering pump.

(4) Install power steering pump and mounting bracket back on engine. Refer to Power Steering Pump Installation in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

POWER STEERING PUMP MOUNTING BRACKET

DISASSEMBLE

(1) Remove power steering pump from engine. Refer to Power Steering Pump Removal And Installation in the Power Steering Pump section in this group of the service manual for required procedure.

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Mount the power steering pump in a vise using the power steering pump mounting bracket (Fig. 39). Mount Puller, Special Tool C-4333 or C- 4068 on power steering pump pulley (Fig. 39). Remove the power steering pump pulley from the power steering pump shaft.

(3) Remove the 3 bolts attaching the power steering pump to the mounting bracket (Fig. 40).

(4) Remove power steering pump from mounting bracket.

ASSEMBLE

(1) Install power steering pump on mounting bracket. Install the 3 power steering pump mounting bolts (Fig. 40). Torque the 3 mounting bolts to 54 N·m (40 ft. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

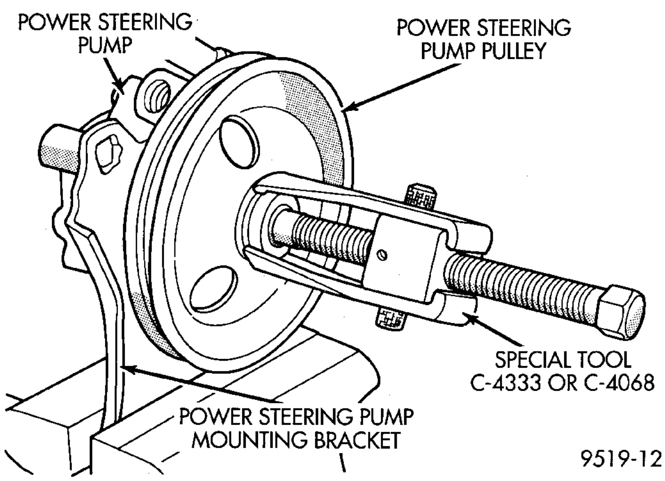


Fig. 39 Pulley Removal From Power Steering Pump Shaft

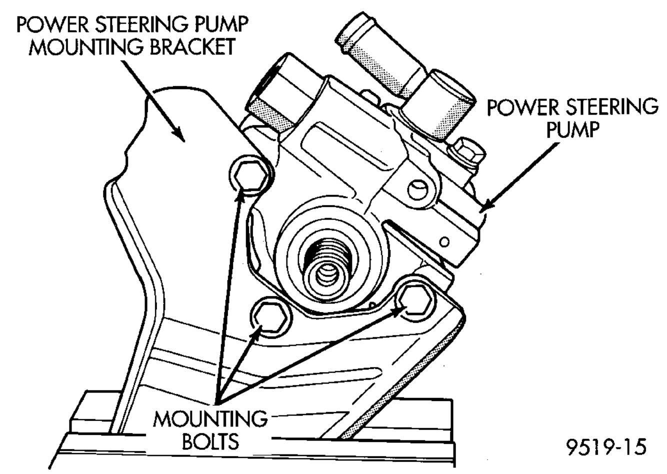


Fig. 40 Power Steering Pump Mounting Bolts

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Place power steering pump pulley squarely on end of power steering pump shaft. Mount Installer, Special Tool C-4063 in internal threads of the power steering pump shaft and against power steering pump pulley (Fig. 41).

(3) Ensuring that special tool and pulley remain aligned with pump shaft, force pulley onto power steering pump shaft until flush with the end of the shaft (Fig. 42). **When pulley is flush with shaft tool will no longer be able to be turned.**

(4) Remove Installer, Special Tool C-4063 from power steering pump.

(5) Install power steering pump and bracket assembly back on engine. Refer to Power Steering Pump Installation in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

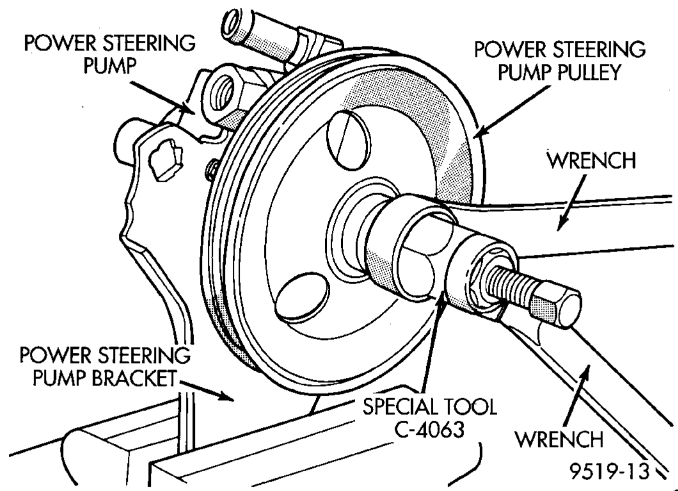


Fig. 41 Installing Pulley On Power Steering Pump Shaft

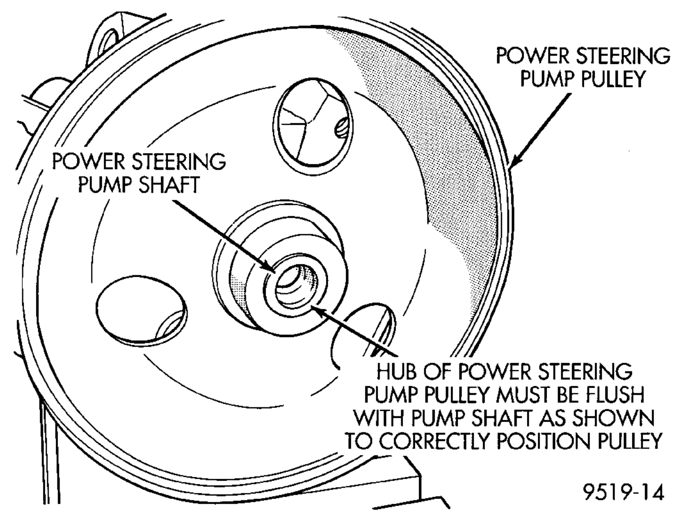


Fig. 42 Correctly Installed Power Steering Pump Pulley

SPECIFICATIONS

POWER STEERING PUMP FLOW SPECIFICATIONS

Power Steering Pump Flow:

At 1500 RPM And Minimum Pressure . . . . 4.9 to 5.3 Liters/Min (1.3 to 1.9 GPM)

Control Valve Pressure Relief . . . . 8240 to 8920 kPa (1195 to 1293 psi)

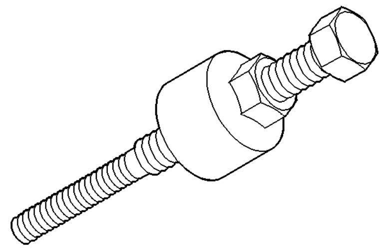
SPECIFICATIONS (Continued)

POWER STEERING PUMP FASTENER TORQUE SPECIFICATIONS

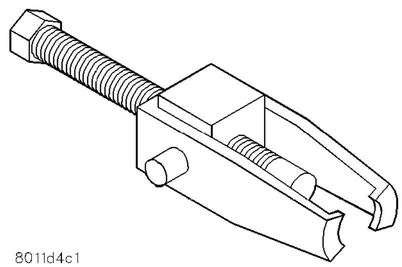
DESCRIPTION	TORQUE
Power Steering Hose:	
Tube Nuts Pressure And Return	31 N·m (275 in. lbs.)
Bracket To Front Crossmember Attaching Bolt	23 N·m (17 ft. lbs.).
Power Steering Pump:	
Pressure Hose Banjo Bolt	34 N·m (25 ft. lbs.).
Discharge Fitting	75 N·m (55 ft. lbs.)
To Bracket Mounting Bolts	54 N·m (40. ft. lbs.)
Brackets To Engine Mounting Bolts	54 N·m (40 ft. lbs.)

SPECIAL TOOLS

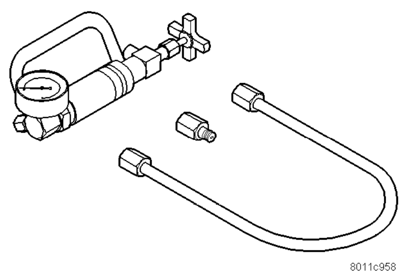
POWER STEERING PUMP



Installer C-4063B



Puller C-4333



P/S System Analyzer 6815

STEERING GEAR

INDEX

DESCRIPTION AND OPERATION

STEERING GEAR

The power steering system consists of these four major components. Power Steering Gear (Fig. 1), 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. 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.

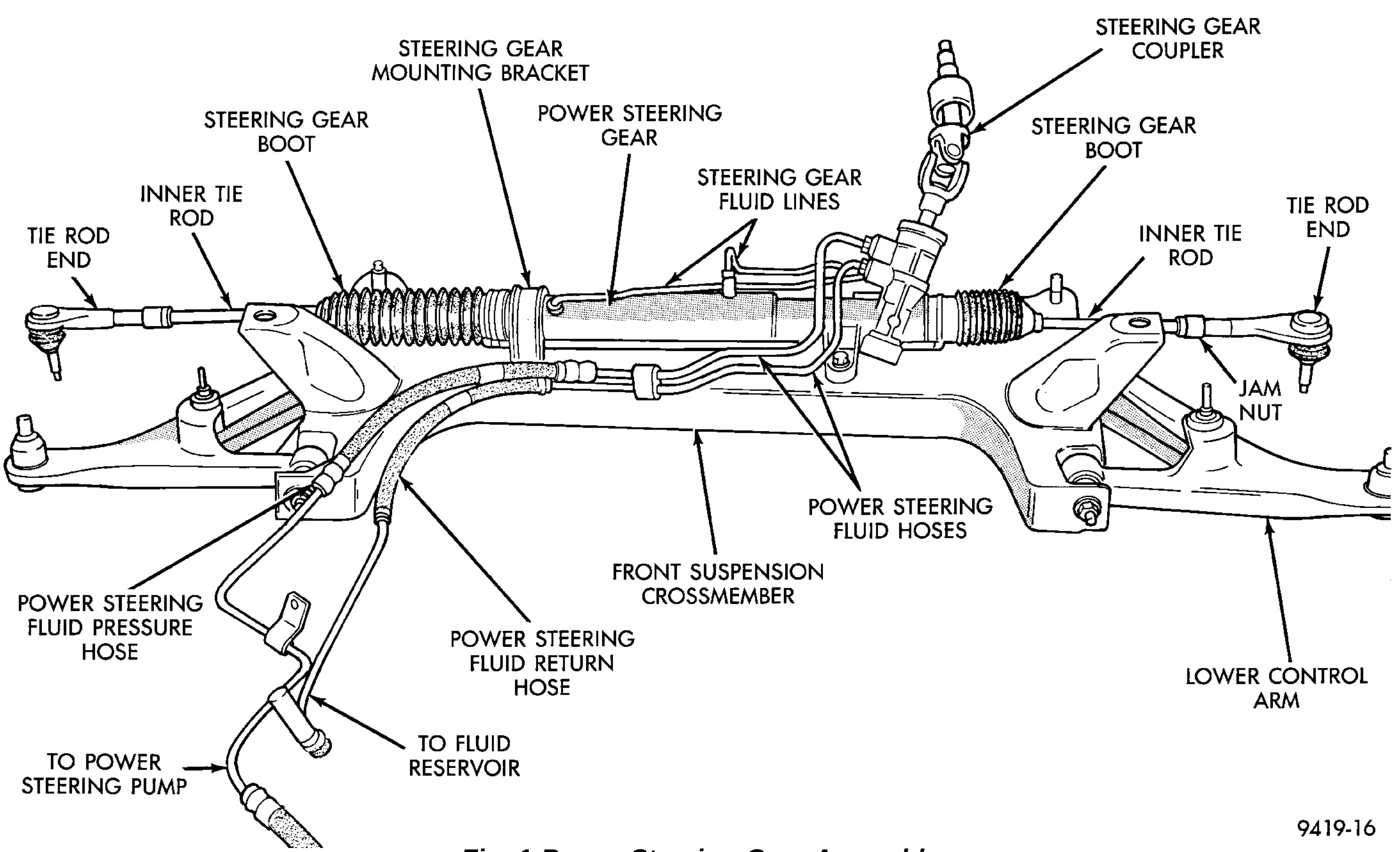


Fig. 1 Power Steering Gear Assembly

DESCRIPTION AND OPERATION (Continued)

NOTE: The power steering gear (Fig. 1) should NOT be serviced or adjusted. If a malfunction or oil leak occurs with the steering gear, the complete steering gear needs to be replaced.

DIAGNOSIS AND TESTING

POWER STEERING SYSTEM TEST PROCEDURE

The following procedure can be used to test the operation of the power steering system on the vehicle. This test will provide the flow rate of the power steering pump along with the maximum relief pressure. This test is to be performed any time a power steering system problem is present to determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Pressure/Flow Tester, Special Tool 6815 (Fig. 2).

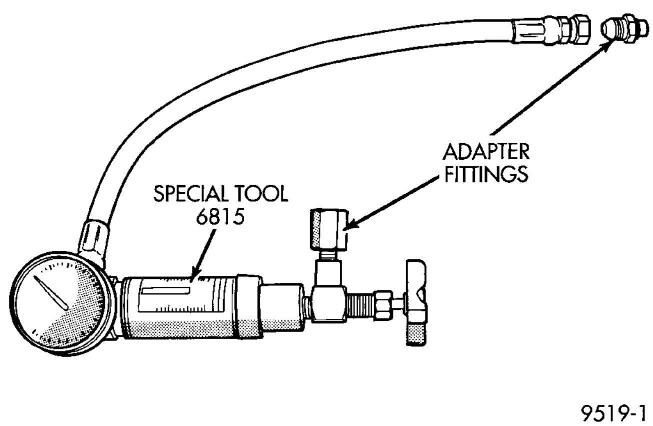


Fig. 2 Power Steering Pump Flow/Pressure Tester

POWER STEERING PUMP FLOW AND PRESSURE TEST PROCEDURE

(1) Check power steering pump drive belt tension and adjust as necessary.

(2) Disconnect power steering fluid pressure hose, at power steering pump. Use a container for dripping fluid.

(3) Connect Pressure Gauge, Special Tool from kit 6815 (Fig. 3) to both hoses using adapter fittings. Connect spare pressure hose, to power steering pump pressure hose banjo fitting.

(4) Completely open valve on Special Tool 6815 (Fig. 3).

(5) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test and get air out of fluid. Then shut off engine.

(6) Check power steering fluid level, and add fluid as necessary. Start engine again and let idle.

(7) Pressure gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading should be in the range of 345-552 kPa (50-80 psi). The flow meter should read between 1.3 and 1.4 GPM

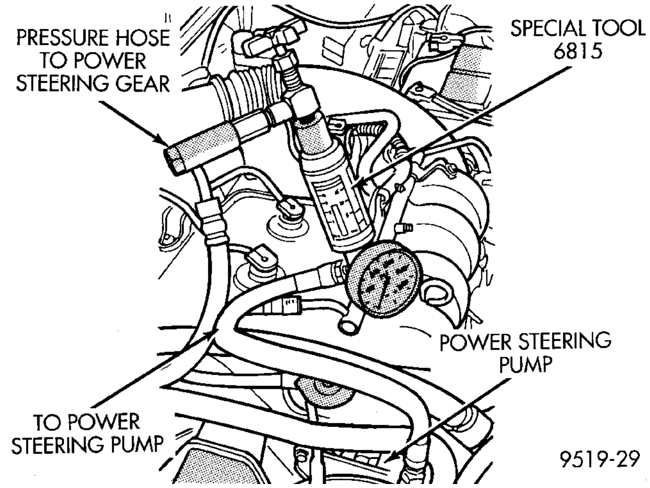


Fig. 3 Power Steering Pump Flow/Pressure Tester Connected To Power Steering Pump

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.**

NOTE: Power steering pump maximum relief pressure is 8240 to 8920 kPa (1195 to 1293 psi.).

- If power steering pump pressures above specifications but not within 345 kPa (50 psi) of each other, then replace power steering pump.
- If pressures within 345 kPa (50 psi) of each other but below specifications, then replace power steering pump.

CAUTION: Do not force the pump to operate against the stops for more than 5 seconds at a time because, pump damage will result.

(9) Open test valve. Turn steering wheel to the extreme left and right positions until against the stops, recording the highest indicated pressure at each position. Compare pressure gauge readings to power steering pump specifications. If highest output pressures are not the same against either stop, the steering gear is leaking internally and must be replaced.

REMOVAL AND INSTALLATION

MANUAL AND POWER STEERING GEAR

The removal and replacement procedure for both the manual and power steering gears is the same. The only additional steps of the procedure for the power steering gear, is the removal and replacement of the power steering fluid lines at the steering gear.

REMOVE

(1) From interior of vehicle, disconnect the steering gear coupler, from the steering column shaft coupler (Fig. 4).

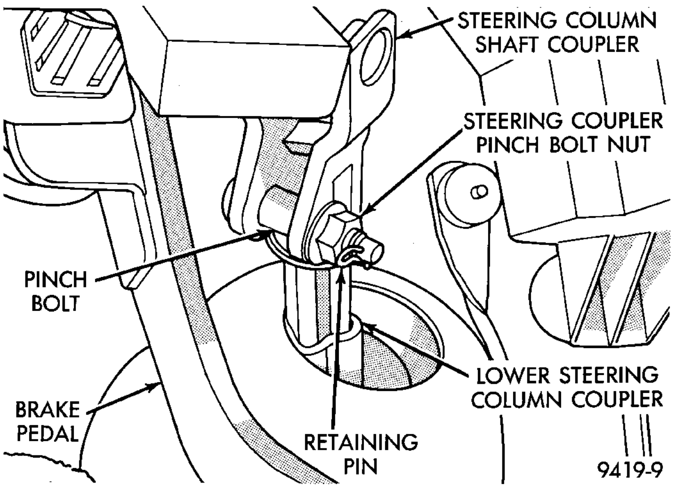


Fig. 4 Steering Column To Steering Gear Coupler

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

(3) Remove both front wheel and tire assemblies from the vehicle.

(4) Remove engine/transaxle bobble dampener, on vehicles so equipped, from front suspension crossmember (Fig. 5). Bobble strut does not need to be removed from transaxle assembly.

(5) Remove nuts attaching both outer tie rod ends to the steering knuckles (Fig. 6). **Nuts are to be removed from tie rod ends using the following procedure, hold tie rod end stud with an 11/32 socket, while loosening and removing nut with wrench.**

(6) Remove both tie rod end studs, from the steering knuckles, using Remover, Special Tool MB-990635 (Fig. 7).

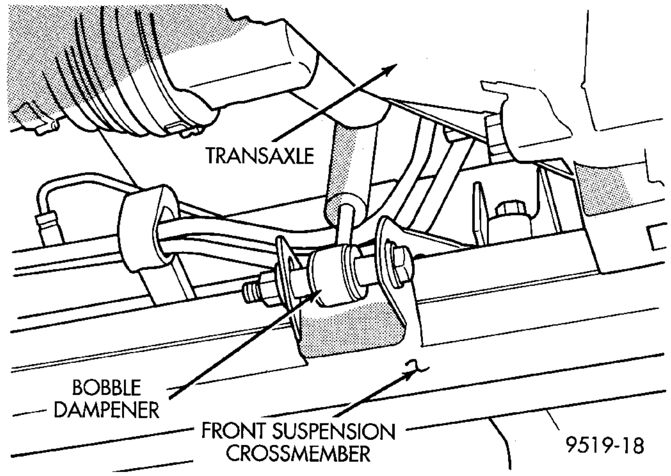


Fig. 5 Engine/Transaxle Bobble Dampener

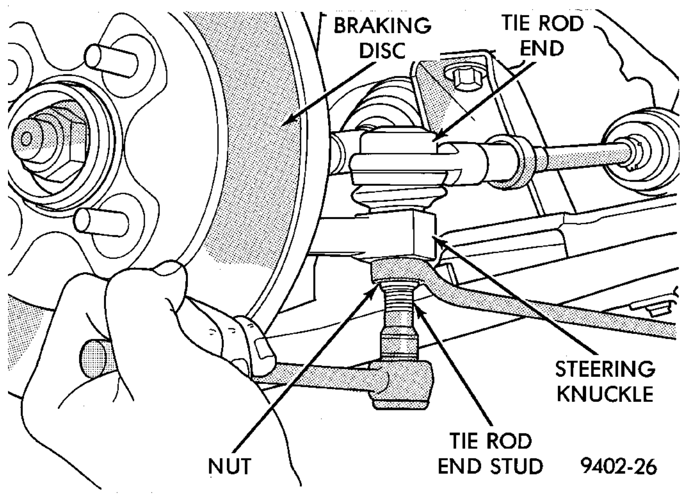


Fig. 6 Removing Tie Rod End Attaching Nut

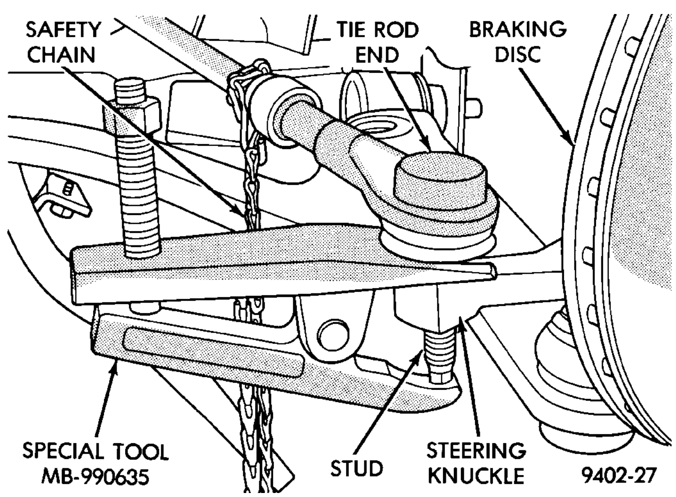


Fig. 7 Tie Rod End Removal From Steering Knuckle

REMOVAL AND INSTALLATION (Continued)

(7) If equipped, remove vehicle wiring harness connector from the power steering fluid pressure switch (Fig. 8).

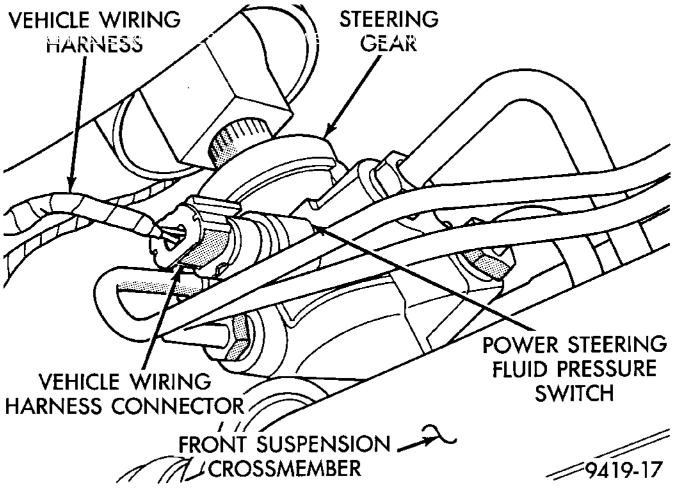


Fig. 8 Power Steering Fluid Pressure Switch Electrical Connector

(8) If vehicle is equipped with power steering, remove power steering pressure and return hose routing bracket from front suspension crossmember (Fig. 9). **The hose routing bracket does not have to be removed from the power steering pressure and return hoses.**

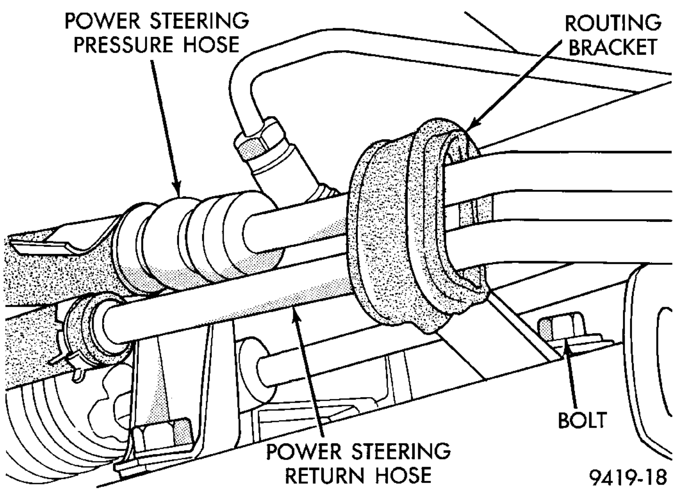


Fig. 9 Power Steering Pressure And Return Hose Routing Bracket

(9) If vehicle is equipped with power steering, remove power steering fluid, pressure and return hoses (Fig. 10) from the power steering gear assembly.

NOTE: This vehicle is designed and assembled using NET BUILD front suspension alignment settings. This means that front suspension alignment settings are determined as the vehicle is designed by the location of front suspension components in

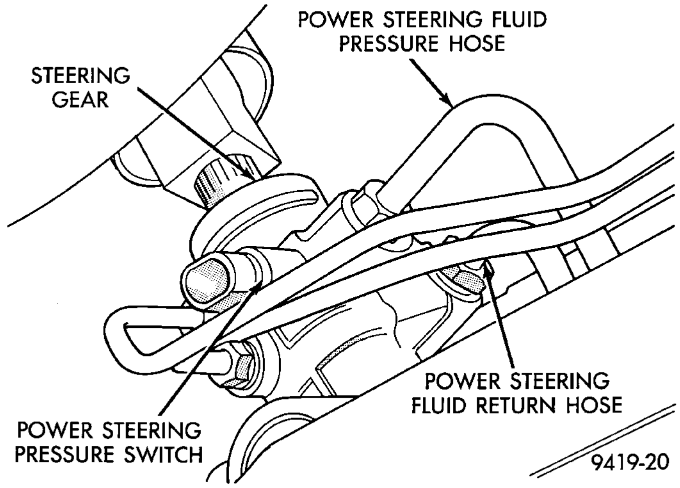


Fig. 10 Power Steering Fluid Pressure And Return Hoses

relation to the vehicle body. This process is carried out when building the vehicle, by accurately locating the front suspension crossmember, to master gage holes located in the underbody of the vehicle. With this method of designing and building a vehicle, it is no longer possible to adjust a vehicles front suspension alignment settings to the required specifications. Due to this, whenever the front suspension crossmember is removed from a vehicle, it MUST be replaced in the same location on the body of the vehicle it was removed from. Front suspension Toe settings though are still adjustable by the outer tie rod ends.

CAUTION: Before removing front suspension crossmember from the vehicle, the location of the front suspension crossmember MUST be scribbed on body of vehicle per (Fig. 9). This must be done so crossmember can be relocated against body of vehicle in the same location when it is reinstalled. If location of front suspension crossmember to body of vehicle is not maintained when vehicle is assembled, NET BUILD front suspension alignment settings will not be obtained. This may lead to handling and or tire wear problems.

(10) Using an awl, scribe a line (Fig. 11) marking the location of where front suspension crossmember is mounted against the body of the vehicle.

(11) Position a transmission jack under the center of the front suspension crossmember (Fig. 12). Transmission jack is used to lower, support and raise front suspension crossmember when removing steering gear assembly.

(12) Loosen and fully remove the front 2 bolts (Fig. 13) attaching front suspension crossmember to frame rails of vehicle. Then loosen the 2 rear bolts (Fig. 13)

REMOVAL AND INSTALLATION (Continued)

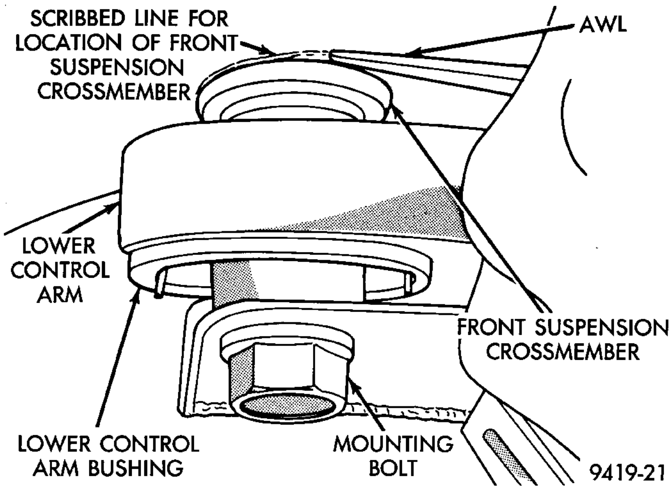


Fig. 11 Marking Front Suspension Crossmember Location

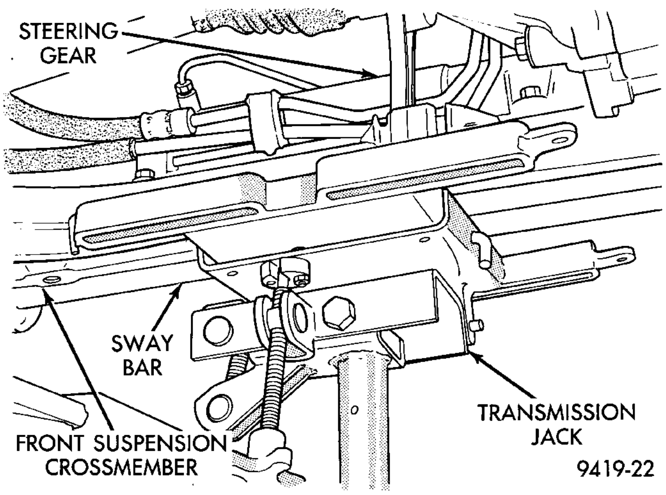


Fig. 12 Supporting Front Suspension Crossmember

attaching front suspension crossmember and lower control arm to body of vehicle. **Lower front suspension crossmember while loosening rear bolts, but do not remove rear bolts from crossmember.**

(13) Using transmission jack, lower front suspension crossmember enough to allow steering gear to be removed from crossmember (Fig. 14). **When lowering front suspension crossmember, do not let crossmember hang from lower control arms weight of crossmember should be supported by transmission jack.**

(14) Loosen and remove the 4 bolts (Fig. 15), attaching steering assembly to front suspension crossmember. Then remove the steering gear assembly from the front suspension crossmember.

(15) Transfer required parts from removed steering gear assembly to the replacement steering gear, if a new steering gear is being installed.

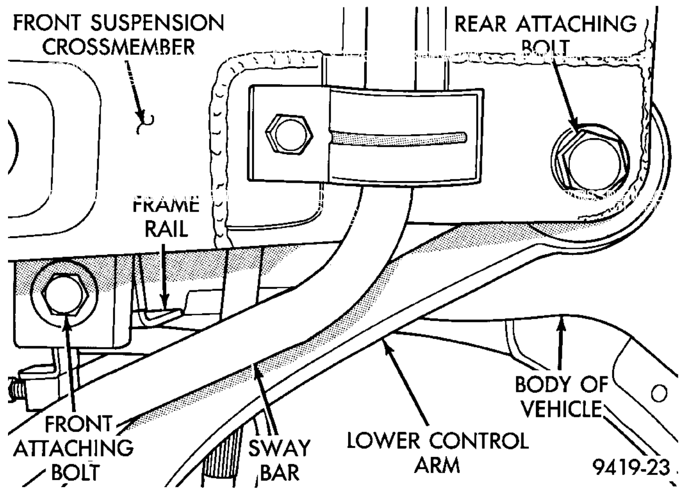


Fig. 13 Front Suspension Crossmember Mounting Bolts

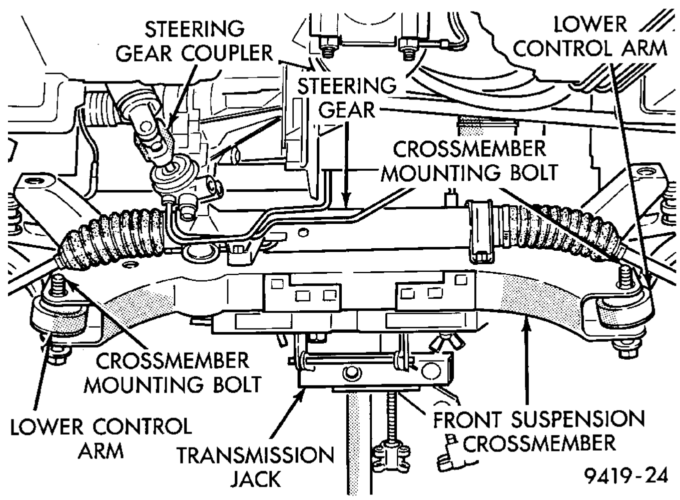


Fig. 14 Crossmember Lowered For Removal Of Steering Gear

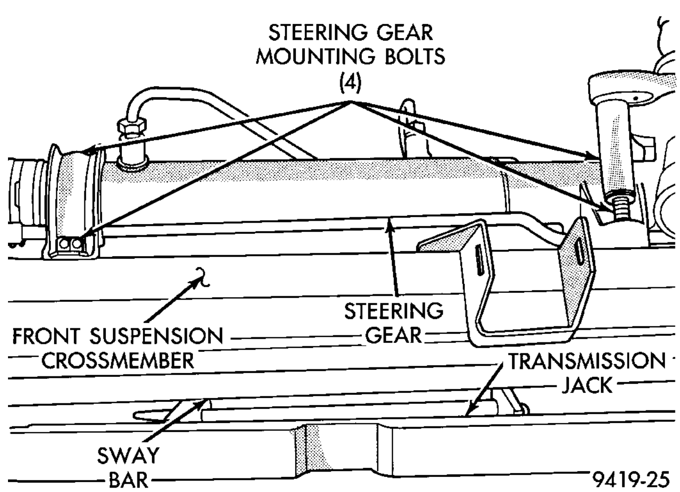


Fig. 15 Steering Gear Assembly Mounting Bolts

REMOVAL AND INSTALLATION (Continued)

INSTALL

(1) Install steering gear assembly on front suspension crossmember. Install the 4 steering gear assembly to front crossmember mounting bolts (Fig. 15). Torque the 4 steering gear mounting bolts to 68 N·m (50 ft. lbs.).

(2) Using the transmission jack, raise front suspension crossmember and steering gear against body and frame rails of vehicle. Start the 2 rear bolts into tapping plates, attaching front suspension crossmember to body of vehicle (Fig. 13). Then install the 2 front bolts, attaching front suspension crossmember to frame rails of vehicle (Fig. 13). Tighten the 4 mounting bolts, until front suspension crossmember is against body of vehicle at the 4 mounting points. Then torque the 4 mounting bolts to 2 N·m (20 in. lbs.) to hold front suspension crossmember in position.

CAUTION: When front suspension crossmember is installed back in vehicle, crossmember MUST be aligned with positioning marks previously scribbed into body of vehicle (Fig. 16). This MUST be done to maintain NET BUILD front suspension alignment settings.

(3) Using a soft face hammer, tap front suspension crossmember into position, until it is aligned with the 2 previously scribbed positioning marks on body of vehicle (Fig. 16). When front suspension crossmember is correctly positioned, torque the 2 rear crossmember/lower control arm mounting bolts to 163 N·m (120 ft. lbs.). Then torque the 2 front crossmember to frame rail attaching bolts to 163 N·m (120 ft. lbs.) (Fig. 13).

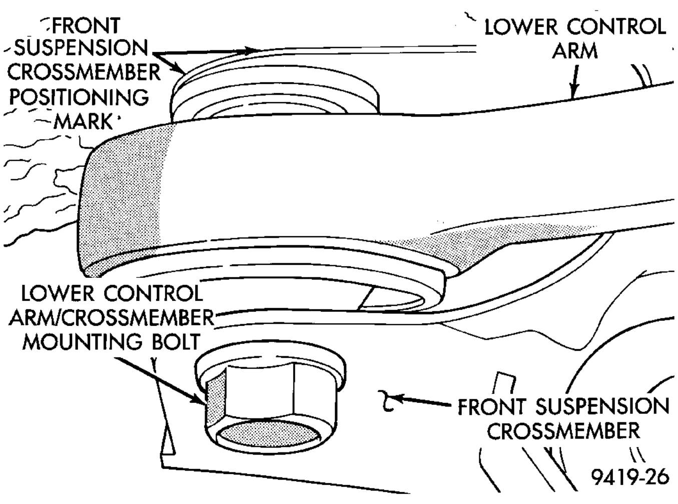


Fig. 16 Crossmember Aligned With Positioning Marks

(4) If vehicle is equipped with power steering, install power steering fluid pressure and return hoses into correct fluid ports on power steering gear assembly (Fig. 10). Torque power steering fluid pressure and return lines to steering gear tube nuts (Fig. 10) to 31 N·m (275 in. lbs.).

(5) If vehicle is equipped with power steering, install power steering pressure and return hose routing bracket and attaching screw on front suspension crossmember (Fig. 9). Torque hose routing bracket to crossmember attaching bolt (Fig. 9) to 23 N·m (17 ft, lbs.).

(6) If the vehicle is equipped with power steering, install vehicle wiring harness connector onto power steering fluid pressure switch on steering gear assembly (Fig. 8). Be sure locking tab on wiring harness connector is securely latched to pressure switch.

(7) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 6). Then using a crowfoot and 11/32 socket (Fig. 17), torque tie rod end attaching nut to 55 N·m (40 ft. lbs.).

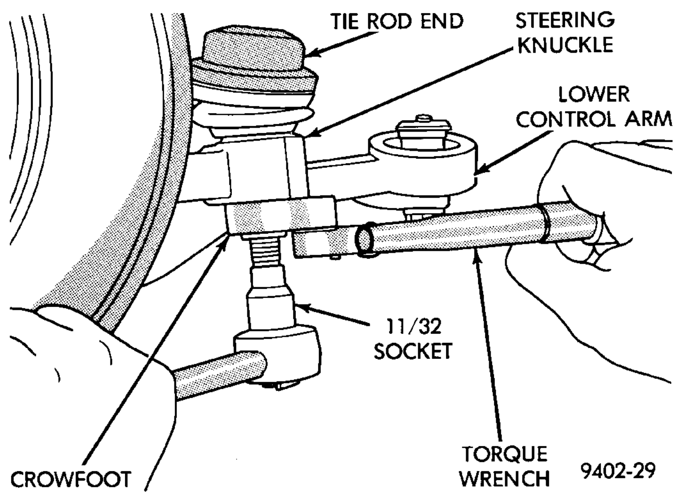


Fig. 17 Torquing Tie Rod End Attaching Nut

(8) Install engine/transaxle bobble strut (Fig. 5) back on front suspension crossmember bracket. Install and securely tighten the dampener to crossmember attaching bolt.

(9) Install the wheel and tire assemblies back on vehicle. Tighten the wheel nuts to 135 N·m (100 ft. lbs.) torque.

(10) Lower vehicle.

(11) From interior of vehicle, reconnect the steering gear coupler with the steering column shaft coupler. Install steering gear coupler retaining pinch bolt and torque to 28 N·m (250 in. lbs.). **Be sure to install the upper to lower steering coupler retaining bolt, retention pin (Fig. 4).**

CAUTION: Do not use automatic transmission fluid.

REMOVAL AND INSTALLATION (Continued)

(12) Fill power steering pump fluid reservoir to the (Full-Cold) proper level.

(13) Start the engine and let run for a few seconds. Then turn the engine off.

(14) Add fluid if necessary.

(15) Raise front wheels of vehicle off the ground.

(16) 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.

(17) Lower front wheels of vehicle back on the ground.

CAUTION: During this procedure do not allow the steering gear inner tie rod boots to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(18) Adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

(19) Tighten tie rod jam nut (Fig. 18) to 61 N·m (45 ft.lbs.) torque.

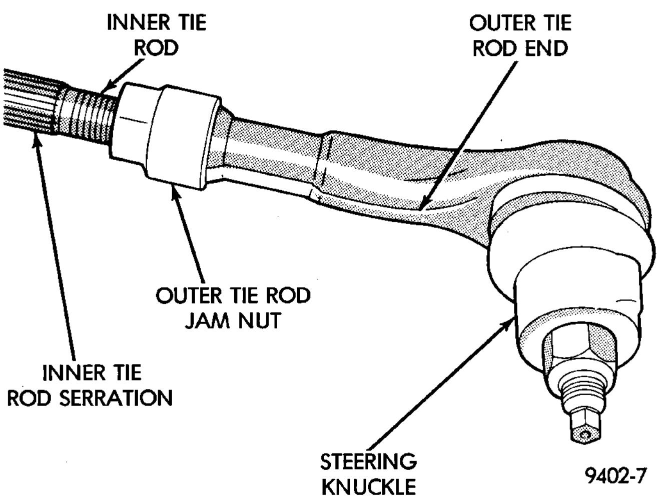


Fig. 18 Outer Tie Rod End Jam Nut

(20) Adjust steering gear to tie rod boots at tie rods.

DISASSEMBLY AND ASSEMBLY

OUTER TIE ROD END

DISASSEMBLE

(1) Loosen the inner tie rod to outer tie rod jam nut (Fig. 19).

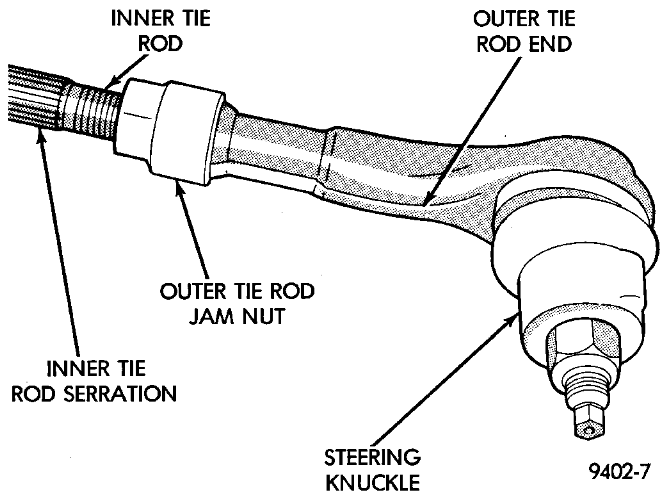


Fig. 19 Outer Tie Rod

(2) Remove the nut attaching the outer tie rod end to steering knuckle (Fig. 20). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench.**

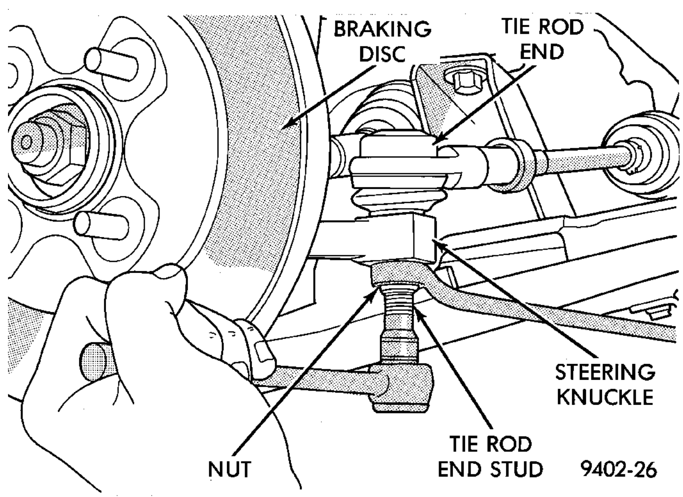


Fig. 20 Removing /Installing Tie Rod End Attaching Nut

(3) Remove the tie rod end stud from steering knuckle arm, using Remover, Special Tool MB-990635 (Fig. 21).

(4) Remove the outer tie rod end from the inner tie rod by un-threading it from the inner tie rod.

ASSEMBLE

(1) Install outer tie rod onto inner tie rod. **Make sure jam nut is on inner tie rod (Fig. 19).**

(2) Do not tighten jam nut.

(3) Install the tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steer-

DISASSEMBLY AND ASSEMBLY (Continued)

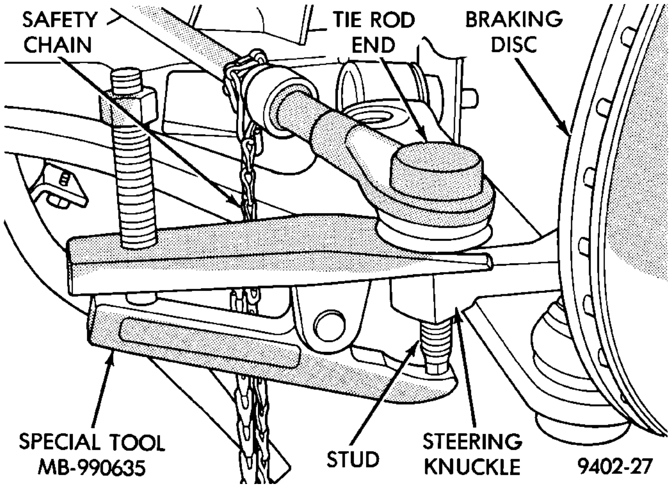


Fig. 21 Tie Rod End Removal From Steering Knuckle

ing knuckle attaching nut (Fig. 20). Then using a crowfoot and 11/32 socket (Fig. 22), torque the tie rod end attaching nut to 61 N·m (45 ft. lbs.).

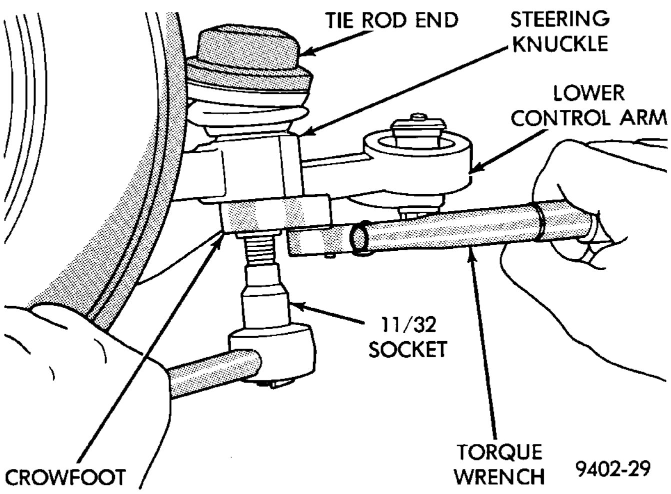


Fig. 22 Torquing Tie Rod End Attaching Nut

CAUTION: During this procedure do not allow the steering gear boot to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(4) Adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

(5) Torque the tie rod jam nut (Fig. 19) to a torque of 55 N·m (40 ft. lbs.) torque.

(6) Adjust the steering gear to inner tie rod boots at inner tie rod if they became twisted during Toe adjustment.

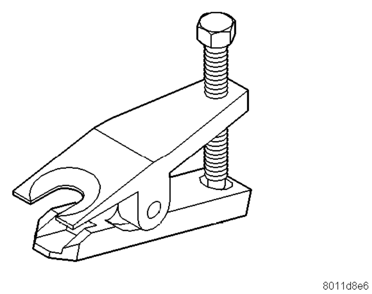
SPECIFICATIONS

STEERING GEAR FASTENER TORQUE SPECIFICATIONS

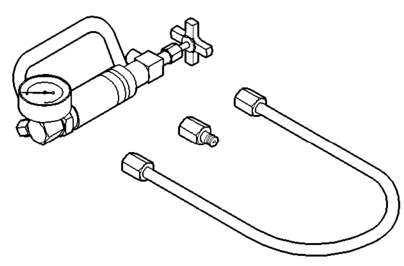
DESCRIPTION	TORQUE
FRONT SUSPENSION CROSSMEMBER:	
To Body Mounting Bolts	163 N·m (120 ft. lbs.)
STEERING GEAR:	
To Crossmember Mounting Bolts	68 N·m (50 ft. lbs.)
OUTER TIE ROD:	
To Steering Knuckle Nut	55 N·m (40 ft. lbs.)
To Inner Tie Rod Jam Nut	61 N·m (45 ft. lbs.)
POWER STEERING HOSE:	
Tube Nuts	31 N·m (275 in. lbs.)
Routing Bracket At Crossmember	23 N·m (17 ft. lbs.)

SPECIAL TOOLS

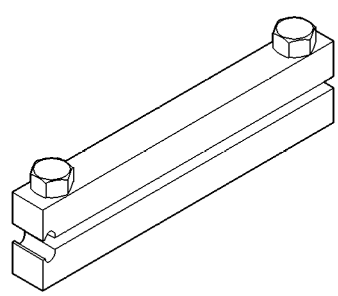
POWER STEERING GEAR



Remover Tie Rod End MB–990635



P/S System Analyzer 6815



Installer Boot Clamp C-4975A

STEERING COLUMN

INDEX

DESCRIPTION AND OPERATION

STEERING COLUMN ASSEMBLY

Both the standard non-tilt and tilt steering columns (Fig. 1) have been designed to be serviced only as complete assemblies, if a component of the steering column is defective. The only replaceable components of the steering column assembly, are the key cylinder, ignition switch, multi- function switch, clock spring, trim shrouds and steering wheel. These replaceable components of the steering column can be serviced without requiring removal of the steering column from the vehicle.

DESCRIPTION AND OPERATION (Continued)

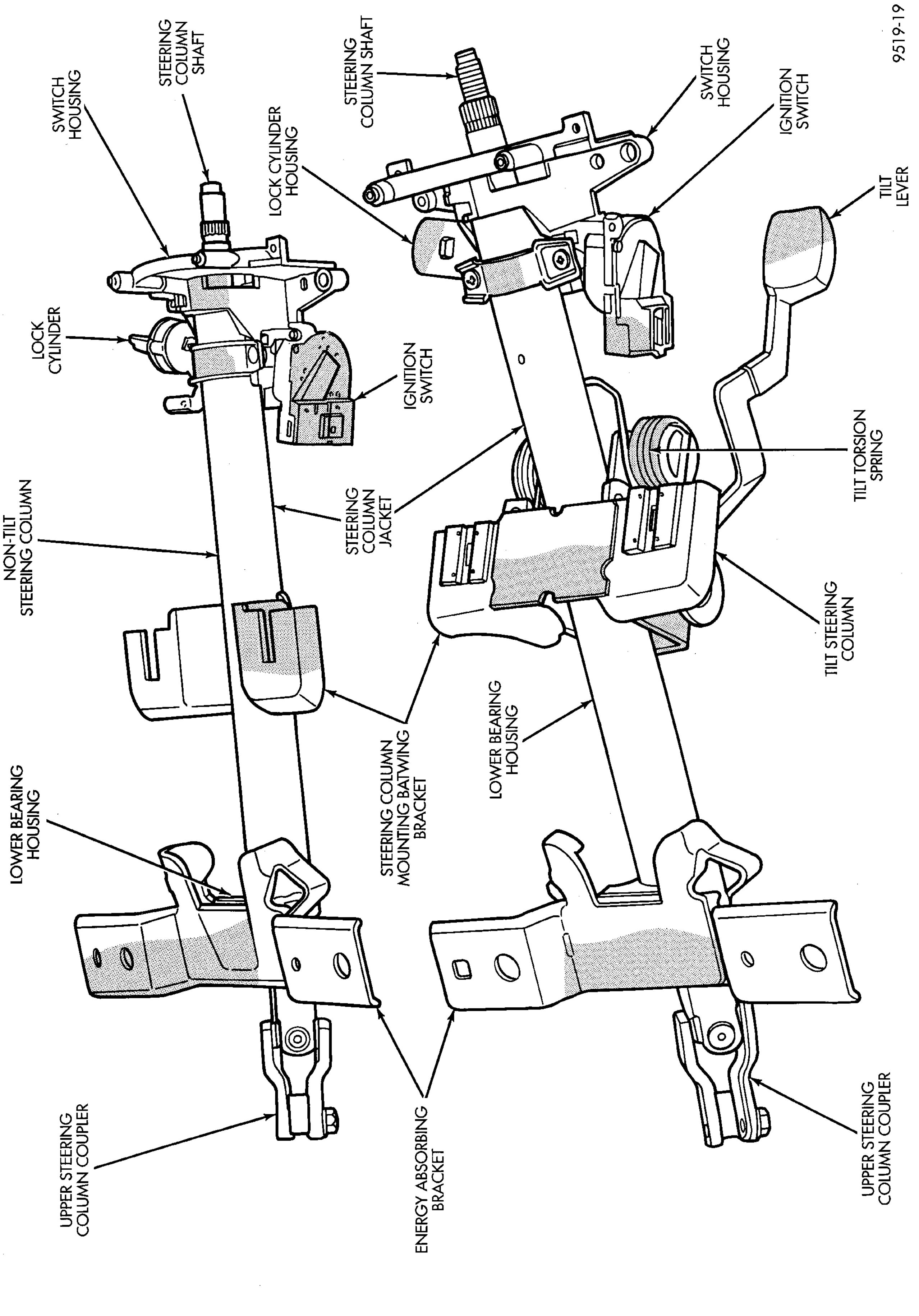


Fig. 1 Non-Tilt And Tilt Steering Column Assemblies

DESCRIPTION AND OPERATION (Continued)

STEERING GEAR TO STEERING COLUMN COUPLING

This vehicle uses a differently designed coupling for connecting the steering column to the steering gear (Fig. 2).

This coupling (Fig. 2) is different in its appearance and in the way it functions than the previous coupling used on this vehicle and couplings used on other Chrysler vehicles. This coupling functions by bending at the bellows section (Fig. 2) of the coupling on impact, where as the previous coupling separated at its detachable joint on an impact.

This coupling incorporates a hollow convoluted tube (Fig. 2) which allows the coupling to bend as required when a vehicle is involved in a collision. The previous coupling used on this vehicle incorporated 2 release washers which allowed the coupling to separate into 2 pieces, if necessary, when a vehicle was involved in a collision.

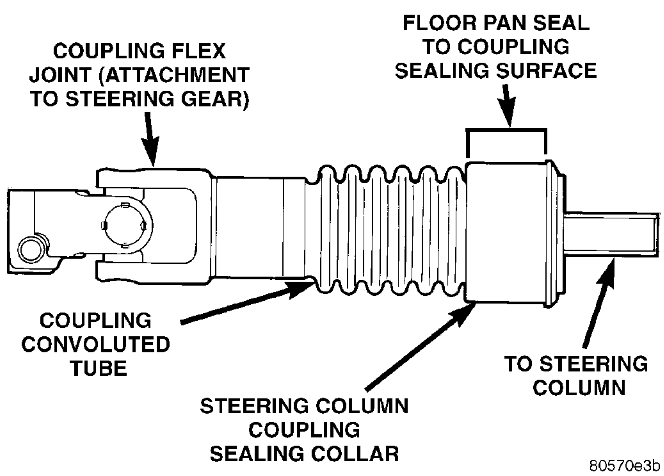


Fig. 2 Steering Column Coupler

DIAGNOSIS AND TESTING

STEERING COLUMN

For diagnosis of conditions relating to the steering column, refer to the steering system diagnosis charts, in the diagnosis and testing section at the beginning of this group.

STEERING COLUMN TO STEERING GEAR COUPLING

STEERING COLUMN COUPLING INSPECTION

The steering column coupling **MUST** be inspected whenever a vehicle is involved in an impact or whenever any of the following conditions exist.

(1) The steering column coupling must be inspected whenever a vehicle is involved in a collision which deploys the air bag, regardless of the extent of damage done to the vehicle.

(2) If a vehicle is involved in an impact of the vehicles front suspension or under carriage, which results in any type of damage to the front suspension crossmember.

(3) Under any conditions which result in the steering column assembly or steering column shaft receiving a force great enough to move the steering column or shaft forward or rearward in a vehicle.

STEERING COUPLING INSPECTION PROCEDURE

(1) Remove the pinch bolt safety pin from the steering column shaft coupling pinch bolt (Fig. 3).

(2) Loosen the coupling pinch bolt retaining nut and remove pinch bolt (Fig. 3) from steering coupler. **(Pinch bolt nut is caged to coupler and is not removable.)** Then separate the steering column shaft coupling from the steering column to steering gear coupling.

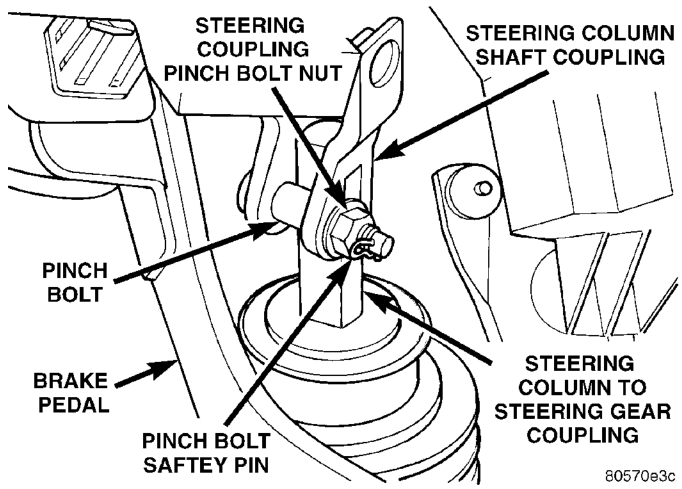


Fig. 3 Steering Column To Coupling Attachment

(3) Remove the silencer seal (Fig. 4) enclosing the steering column coupling.

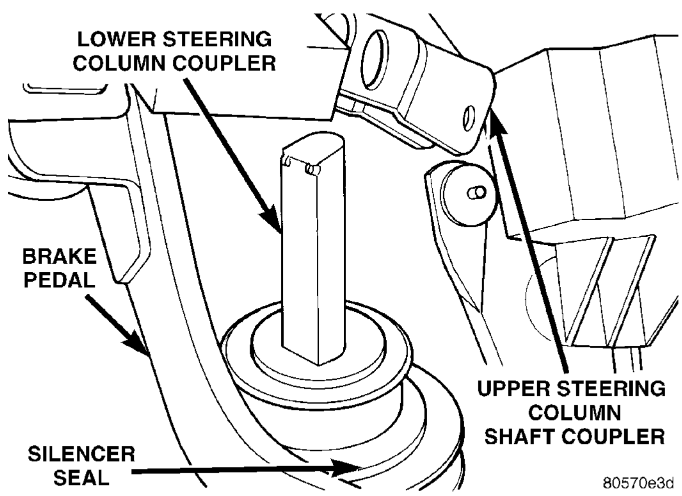


Fig. 4 Steering Column Coupling Seal

DIAGNOSIS AND TESTING (Continued)

(4) Inspect steering column coupling in the following areas for signs of damage:

- Inspect the sealing collar on the steering column coupling (Fig. 5) to ensure the it is not cracked, broken, or otherwise damaged requiring coupling replacement.
- Inspect the convoluted section (Fig. 5) of the steering column coupling for the following conditions or any other visible signs of damage.
  - Uneven spacing between the convolutes on the coupling.
  - Dings or dents in the convolutes of the coupling or anywhere else on the coupling wall.
  - A bend in the convoluted section of the coupling.

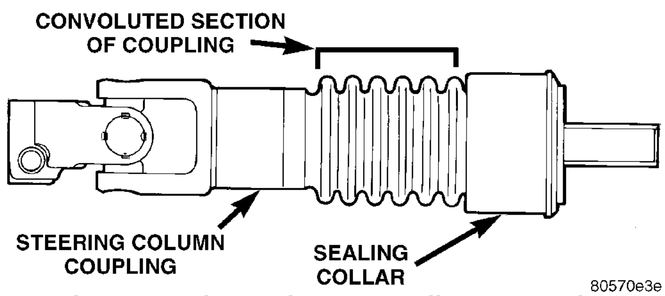


Fig. 5 Steering Column Coupling Inspection

If any of the preceding conditions exist the steering coupling **MUST** be replaced.

The steering gear must be removed from the vehicle to allow access for replacement of the steering coupling. Refer to Steering Gear Service Procedures in this group of the service manual for the required steering gear removal procedure.

(5) If steering coupling does not require replacement, install steering column coupling silencer seal (Fig. 4) back on vehicle.

(6) Ensure front wheels of vehicle are positioned straight-ahead and then align and attach steering column to steering coupling (Fig. 3). Install the coupling pinch bolt (Fig. 3). Tighten the pinch bolt nut to a torque of 28 N·m (250 in. lbs.). **Be sure to install upper to lower steering coupling pinch bolt safety pin (Fig. 3).**

REMOVAL AND INSTALLATION

STEERING COLUMN SERVICE PROCEDURE WARNINGS

WARNING: BEFORE BEGINNING ANY SERVICE PROCEDURES THAT INVOLVES REMOVING THE AIR BAG. REMOVE AND ISOLATE THE NEGATIVE (-) BATTERY CABLE (GROUND) FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIR BAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIR BAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIR BAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIR BAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIR BAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS. BEFORE SERVICING A STEERING COLUMN EQUIPPED WITH AN AIR BAG, REFER TO GROUP 8M, ELECTRICAL FOR PROPER AND SAFE SERVICE PROCEDURES.

NOTE: Safety goggles should be worn at all times when working on steering columns.

CAUTION: Disconnect negative (ground) cable from the battery, before servicing any column component.

CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Damage will occur.

STEERING COLUMN

REMOVE

(1) Disconnect the negative (ground) cable from the battery and isolate cable.

(2) Before beginning removal of steering column assembly from vehicle, be sure front wheels of vehicle are in the **straight ahead** position.

(3) Remove the 4 screws attaching steering column cover, to lower instrument panel. Then remove the trim panel from the instrument panel (Fig. 6).

(4) Remove 3 screws (Fig. 7) attaching the steering column cover liner to the instrument panel. Remove the liner from the lower instrument panel.

(5) If vehicle is equipped with speed control, remove the speed control switches from the steering wheel (Fig. 8). If vehicle is not equipped with speed control, remove the trim covers from the sides of the steering wheel.

REMOVAL AND INSTALLATION (Continued)

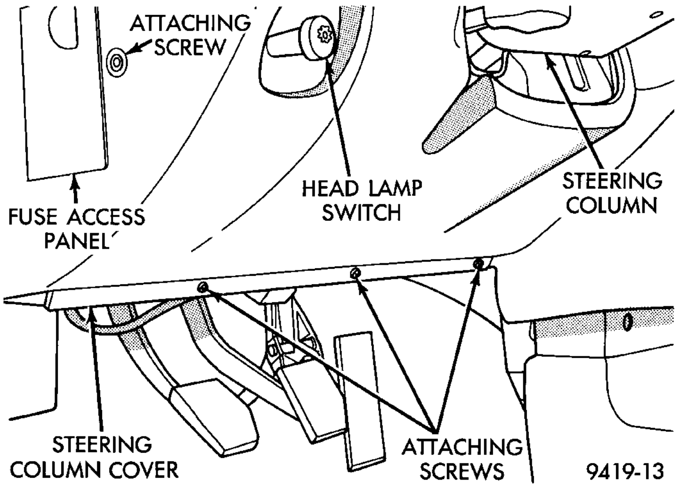


Fig. 6 Steering Column Cover

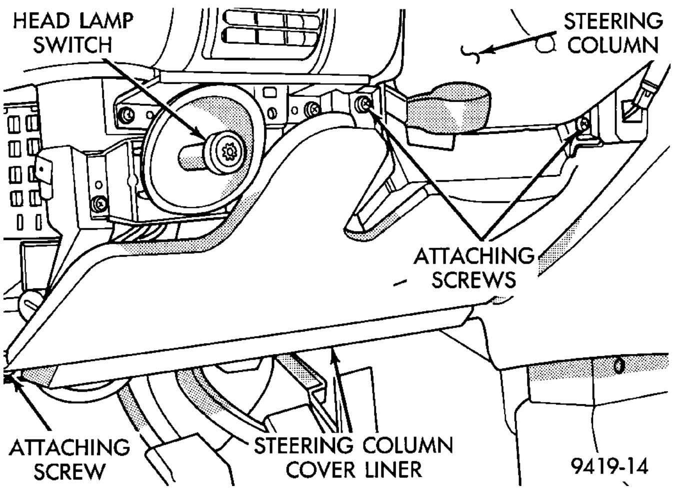


Fig. 7 Steering Column Cover Liner

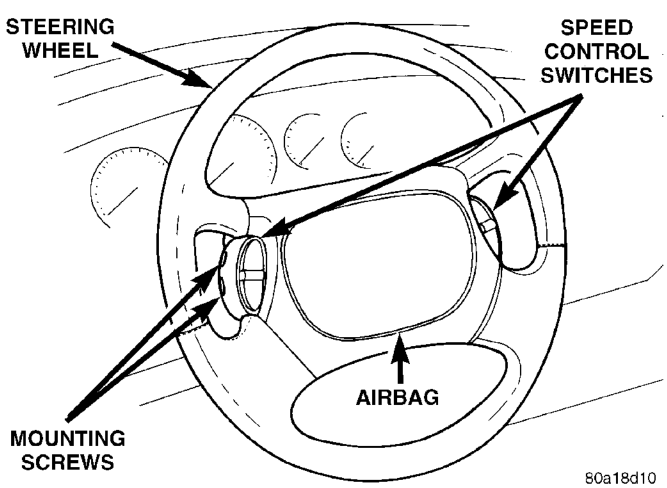


Fig. 8 Speed Control Switches

WARNING: 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.

(6) Remove the 2 fasteners, 1 on each side of steering wheel, attaching the air bag module to the steering wheel (Fig. 9).

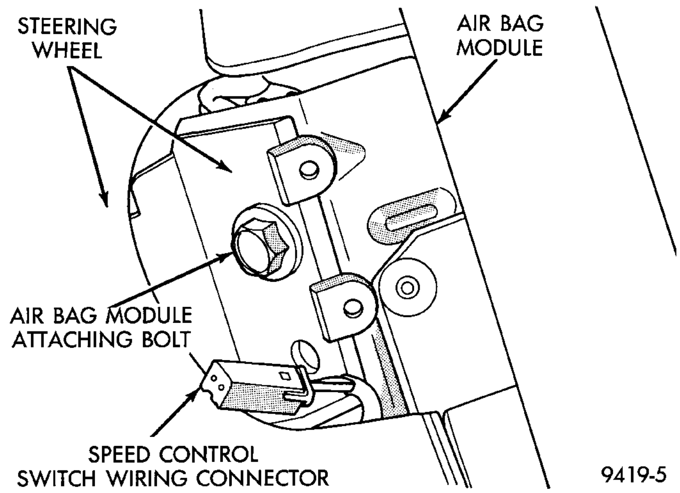


Fig. 9 Air Bag Module Mounting Bolts

WARNING: WHEN HANDLING AN UNDEPLOYED AIR BAG MODULE DURING SERVICING OF THE STEERING COLUMN THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED. AT NO TIME SHOULD ANY SOURCE OF ELECTRICITY BE PERMITTED NEAR THE INFLATOR ON THE BACK OF THE AIR BAG MODULE. WHEN CARRYING A LIVE MODULE, THE TRIM COVER SHOULD BE POINTED AWAY FROM THE BODY TO MINIMIZE INJURY IF MODULE ACCIDENTLY DEPLOYS. IF AIR BAG MODULE IS PLACED ON A BENCH OR OTHER SURFACE, PLASTIC COVER SHOULD BE FACE UP TO MINIMIZE MOVEMENT IN CASE OF ACCIDENTAL DEPLOYMENT.

REMOVAL AND INSTALLATION (Continued)

(7) Remove air bag module from center of steering wheel. Then disconnect the clock spring electrical lead from the back of the air bag module (Fig. 10).

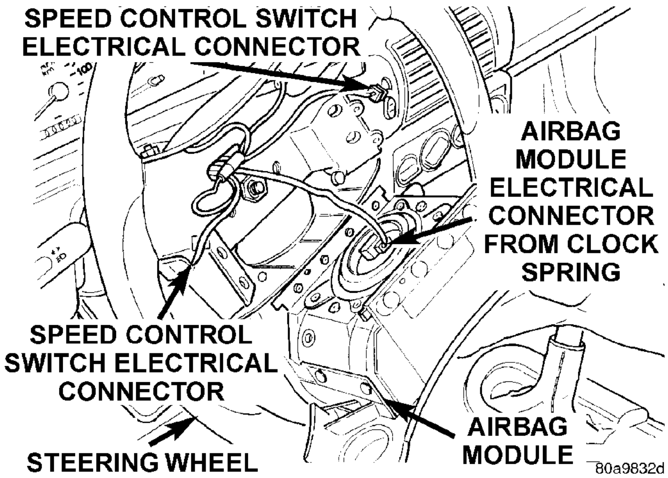


Fig. 10 Air Bag Module Electrical Connection

(8) Disconnect the wiring lead for the horn switch in the airbag module from the wiring lead coming from the clockspring (Fig. 11).

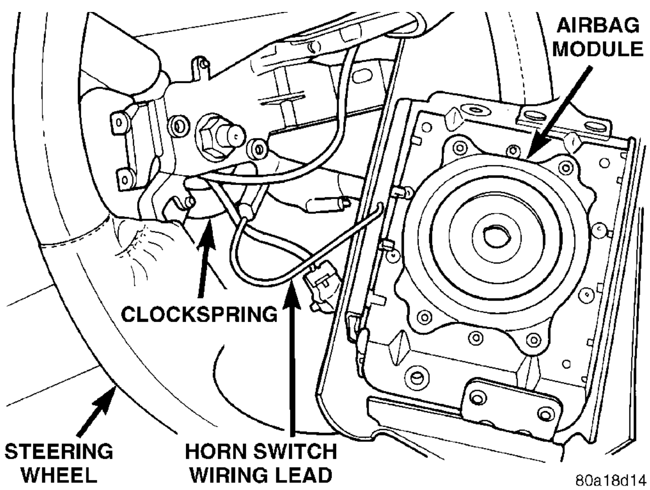


Fig. 11 Clock Spring To Horn Switch Wiring Connection

(9) Turn the lock cylinder to the **off** position and remove the key from the lock cylinder

(10) Turn the steering wheel to the left 1/2 a turn (180°) until the steering column lock is engaged (Fig. 12).

(11) Remove the steering wheel retaining nut, from the steering column shaft (Fig. 12).

CAUTION: When installing Puller, Special Tool C-3428-B on steering wheel be sure puller bolts are fully seated in threaded puller holes on steering wheel. If bolts are not fully seated in threaded holes, threads may be stripped out when puller is tightened to remove steering wheel.

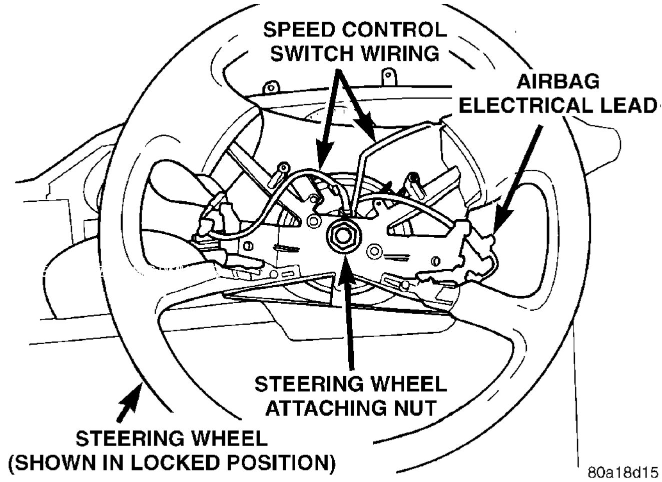


Fig. 12 Steering Wheel Attaching Nut

(12) Install Puller, Snap-On CJ2001P or an equivalent on the steering wheel (Fig. 13).

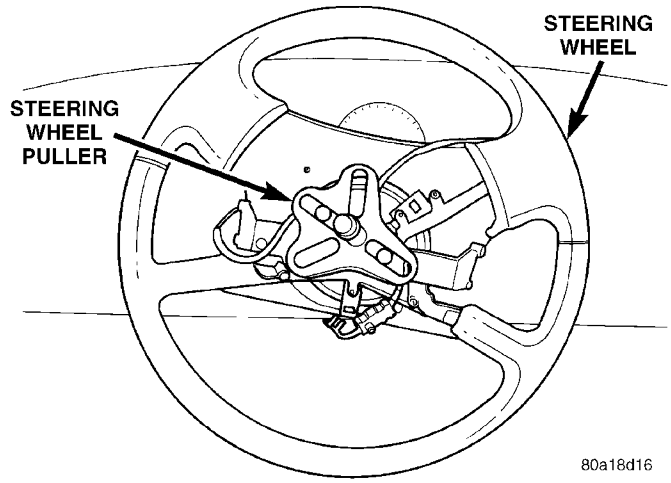


Fig. 13 Steering Wheel Puller Installed

CAUTION: Do not bump or hammer on steering wheel or steering column shaft when removing steering wheel from steering column.

(13) Remove steering wheel assembly from steering column shaft using Puller, Special Tool C-3428-B or equivalent.

(14) Remove key lock cylinder from steering column. Key lock cylinder is removed from steering column using the following procedure. Place the key lock cylinder in the Run position. Then through the hole in lower shroud, (Fig. 14) depress lock cylinder retaining tab and remove key lock cylinder.

(15) Remove the 3 screws attaching the upper and lower shroud to the steering column (Fig. 15). First remove lower shroud from steering column, then release tilt lever and tilt steering column to its lowest point. Then remove upper shroud from steering column.

REMOVAL AND INSTALLATION (Continued)

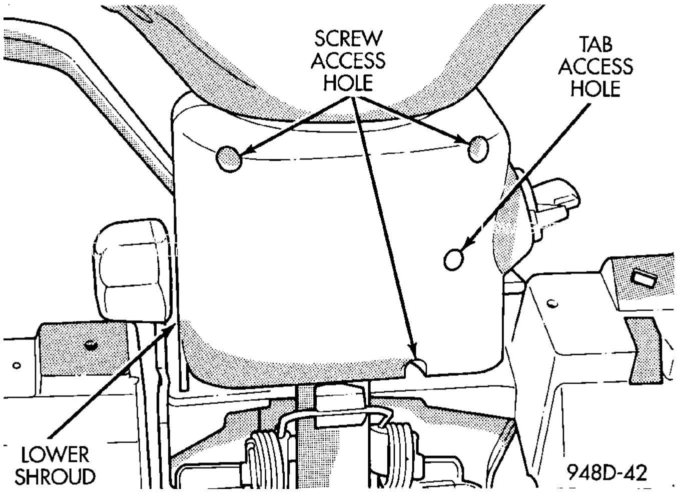


Fig. 14 Key Lock Cylinder Access Hole In Steering Column Shrouds

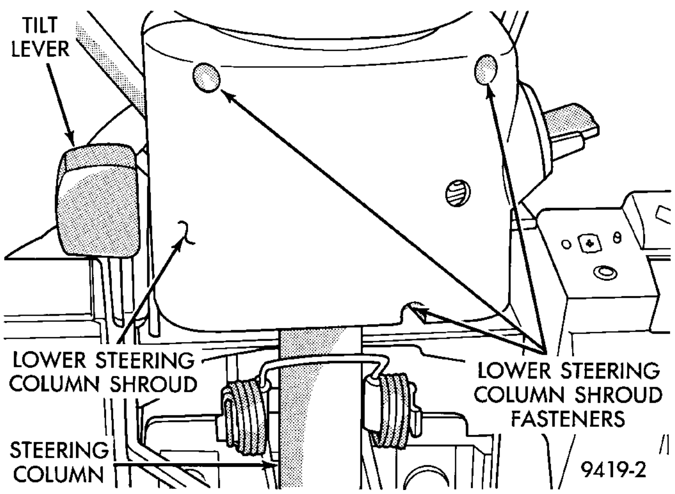


Fig. 15 Upper And Lower Steering Column Shrouds

(16) Remove retaining pin in the upper to lower steering column coupler pinch bolt (Fig. 16).

(17) Loosen the upper to lower steering coupler pinch bolt retaining nut and remove pinch bolt (Fig. 16) from steering coupler. **(Pinch bolt nut is caged to coupler and is not removable.)** Then separate upper steering coupler from lower steering coupler shaft.

(18) Remove the 4 nuts attaching the lower mounting bracket of the steering column to the boby mounting bracket for the steeing column.

(19) Remove the 2 steering column assembly upper bat wing bracket to support bracket nuts (Fig. 17).

(20) Lower steering column assembly in the steering column access opening of the lower instrument panel.

(21) Remove routing clip (Fig. 18) holding wiring harness to jacket of steering column. Then remove wiring harness connectors from the multi- function switch and the windshield wiper switch (Fig. 18).

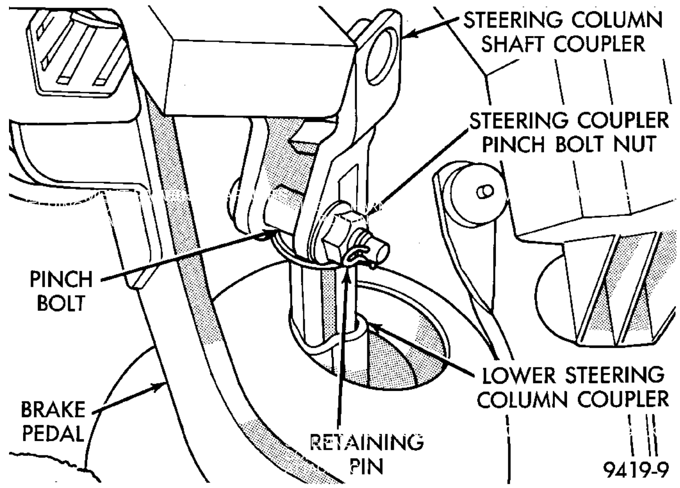


Fig. 16 Upper To Lower Steering Column Coupler Disassembly

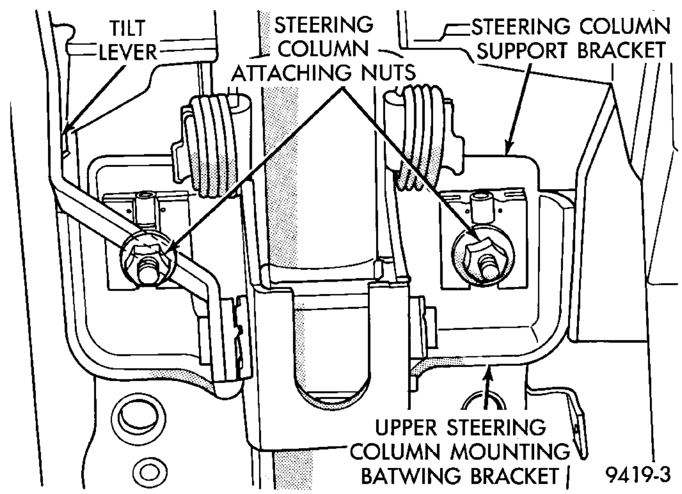


Fig. 17 Steering Column Upper Support Bracket Attaching Nuts

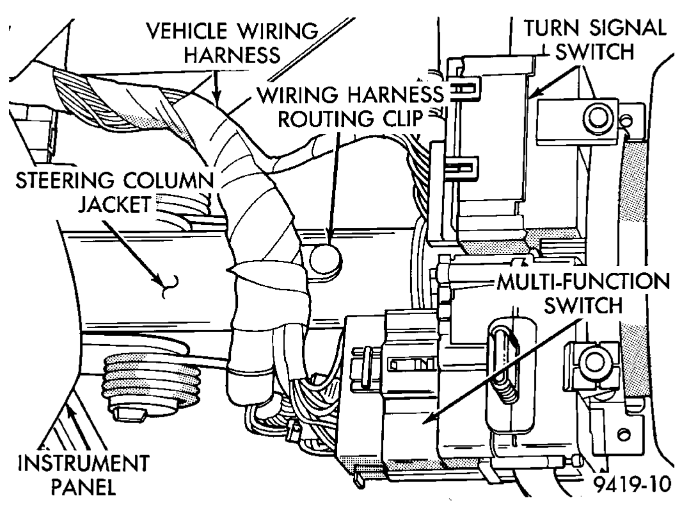


Fig. 18 Steering Column Wiring Connections

REMOVAL AND INSTALLATION (Continued)

(22) Remove the vehicle wiring harness connectors from the ignition switch and clock spring (Fig. 19).

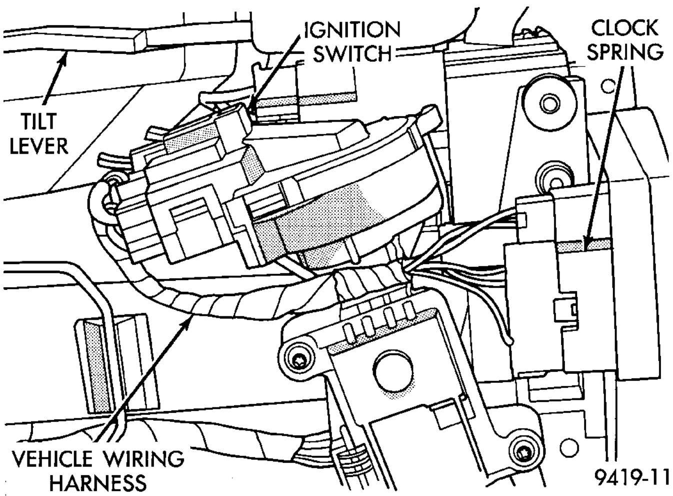


Fig. 19 Steering Column Wiring Connections

(23) Remove steering column assembly from vehicle through the drivers door of the passenger compartment. Use care to avoid damaging the paint or interior trim.

INSTALL

(1) Install steering column into steering column access opening in lower instrument panel.

(2) Install the vehicle wiring harness connectors, into the ignition switch and clock spring assembly (Fig. 19).

(3) Install vehicle wiring harness connectors into multi-function switch and turn signal switch (Fig. 18) on steering column assembly. Install routing clip (Fig. 18) holding wiring harness to jacket of steering column.

(4) Install the studs in the steering column support bracket, into the slots in the plastic capsules of the upper mounting bracket of the steering column (Fig. 17). Partially install the 2 upper steering column assembly mounting bracket to support bracket attaching nuts (Fig. 17). **Do not tighten the 2 mounting nuts at this time.**

(5) Align the bolt holes in the steering column lower mounting bracket with the threaded holes in the boby mounting bracket for the steeing column. Install and loosely tighten the steering column lower mounting bracket bolts.

(6) Install the upper and lower steering column shrouds onto the lock housing of the steering column assembly. Install and securely tighten the 3 upper to lower steering column shroud to lock housing attaching screws (Fig. 15).

(7) Be sure both breakaway capsules are still fully seated in the slots of the upper steering column mounting bracket. Equally tighten both steering column mounting nuts, until upper steering column mounting bracket is seated against support bracket. Then tighten the 2 steering column upper mounting bracket nuts to a torque of 17 N·m (150 in. lbs.).

(8) Tighten the steering column lower mounting bracket nuts (2) to a torque of 17 N·m (150 in. lbs.).

(9) Assemble the steering column flex coupler to the intermediate steering coupler (Fig. 16). Install the steering coupler pinch bolt. Torque the pinch bolt nut to 28 N·m (250 in. lbs.). **Be sure to install upper to lower steering coupler pinch bolt retaining pin (Fig. 16).**

(10) Install the lower instrument panel steering column cover liner onto lower instrument panel. Install and securely tighten the 3 liner to instrument panel attaching screws (Fig. 7).

(11) Install lower instrument panel steering column cover (Fig. 6) on lower instrument panel. Install and securely tighten the 4 screws (Fig. 6) attaching steering column cover, to lower instrument panel.

CAUTION: Clock spring centering procedure MUST be performed prior to installing steering wheel assembly. If clock spring is not centered it may be overextended, causing clock spring assembly to become inoperative.

(12) Center the clock spring using the following procedure.

- Depress the 2 plastic locking pins to disengage clockspring locking mechanism.
- Keeping locking mechanism disengaged, rotate the clockspring rotor in the CLOCKWISE DIRECTION to the end of the travel. Do not apply excessive torque.
- From the end of travel, rotate the rotor 2 full turns and an additional half turn in the counterclockwise direction. (The horn wire should end up at the top and the squib wire at the bottom.) Engage the clockspring locking mechanism.

CAUTION: Do not install steering wheel onto shaft of steering column assembly by driving it onto the shaft. Pull steering wheel down onto steering column shaft using ONLY the steering wheel retaining nut.

REMOVAL AND INSTALLATION (Continued)

(13) Feed clock spring wiring leads through hole in steering wheel (Fig. 20). Position steering wheel on shaft of steering column assembly, making sure to fit flats on hub of steering wheel with formations on inside of clockspring.

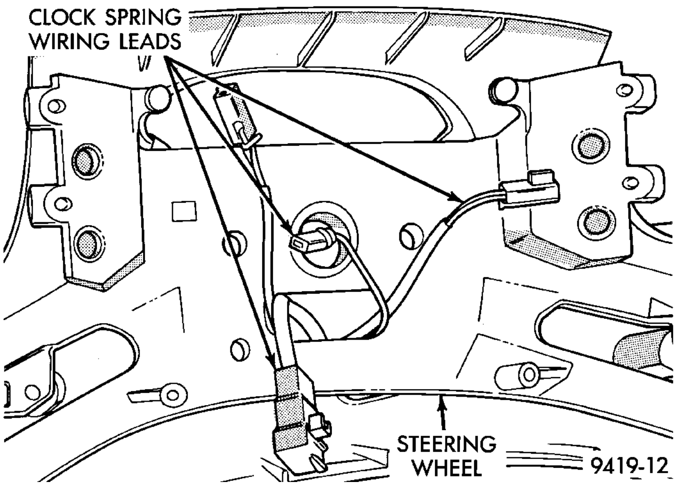


Fig. 20 Steering Wheel Installation

(14) Install steering wheel to steering column shaft retaining nut and tighten until steering wheel is fully installed on shaft. The tighten steering wheel retaining nut to a torque of 61 N·m (45 ft. lbs.).

(15) Connect the clockspring electrical leads to components such as horn switches and speed control switches located in the steering wheel (Fig. 11).

(16) Install air bag electrical lead from clock spring, into connector on back of air bag module (Fig. 10). **Be sure electrical connector from clock-spring is securely latched into air bag module connector.**

CAUTION: The fasteners, screws, and bolts, originally used for the air bag components are specifically designed for the air bag system. They must never be replaced with any substitutes. Anytime a new fastener is needed, replace only with correct fasteners provided in service packages or fasteners listed in the parts book.

(17) Install air bag module into center of steering wheel. Align air bag module mounting holes with bolt holes in steering wheel. Install **only the 2 original or correct replacement** air bag module attaching bolts (Fig. 9). Torque the 2 air bag module attaching bolts to 10 N·m (90 in. lbs.).

(18) Install key lock cylinder into lock housing. Key lock cylinder is installed by positioning key cylinder in the run position so retaining tab can be depressed and the pushing key cylinder into lock hosing until retaining tab locks into key lock cylinder.

(19) Reconnect ground cable to Negative post of the battery. **When reconnecting battery on a vehicle that has had the air bag module removed, the following procedure should be used.**

- Remove forward console or cover as necessary.
- Connect DRB II to ASDM diagnostic 6-way connector, located at right side of the ASDM module.
- Turn ignition key to ON position. Exit vehicle with the DRB II. Install the latest version of the proper diagnostic cartridge into the DRB II.
- Ensuring that their are no occupants in the vehicle, connect negative cable to negative post of the battery.
- Using the DRB II read and record active fault codes. Also read and record any stored fault codes. Refer to the Passive Restraint Diagnostic Test Manual if any faults are found.
- Erase stored faults if there are no active fault codes. If problems remain, fault codes will not erase.
- From the passenger side of the vehicle, turn ignition key to OFF and then ON observing instrument cluster air bag lamp. It should go on for six to eight seconds, then go out. This will indicate that the air bag system is functioning normally.

(20) **If air bag warning lamp fails to light, blinks on and off or goes on and stays on, there is an air bag system malfunction.** Refer to the Passive Restraint Diagnostic Test Manual to diagnose the system malfunction.

(21) Test the operation of the horn, lights and any other functions that are steering column operated. If applicable reset the radio and the clock.

(22) Road test vehicle to ensure proper operation of the steering system and the speed control system.

SPECIFICATIONS

STEERING COLUMN FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Steering Wheel	
Retaining Nut	61 N·m (45 ft. lbs.)
Steering Column Assembly	
Upper Mounting Bracket Attaching Nuts	17 N·m (150 in. lbs.)

TRANSAXLE

CONTENTS

NV T350 (A-578) MANUAL TRANSAXLE

INDEX

GENERAL INFORMATION

NV T350 MANUAL TRANSAXLE

NOTE: Safety goggles should be worn at all times when working on these transaxles.

This five speed is a constant-mesh manual transaxle. All gear ranges, except reverse, are synchronized. The reverse gear utilizes a brake and blocking ring for shifting ease. The reverse idler gear is supported on a sliding spindle idler shaft. The transaxle case is aluminum with a steel end–plate bearing cover. It is housed in a die-cast aluminum case featuring a two–piece, middle split design (Fig. 1).

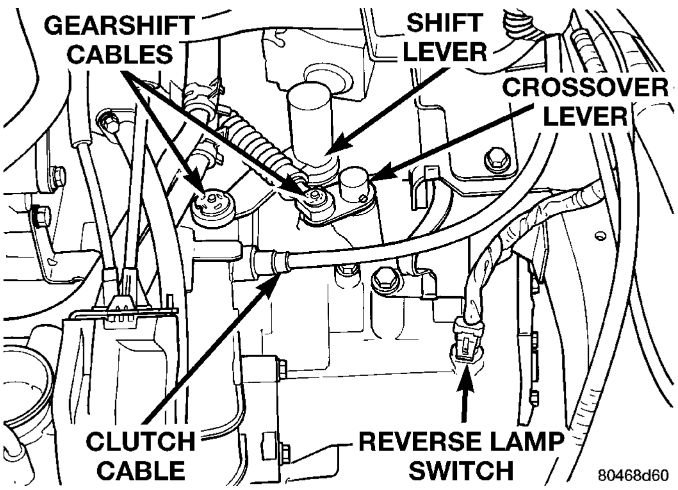


Fig. 1 External Transaxle Components

The NV T350 (A-578) transaxle internal components can be serviced only by separating the gear case from the bellhousing case.

CAUTION: The transaxle output shaft is serviced as a unit. No disassembly and reassembly is possible. Damage to the transaxle may result.

TRANSAXLE IDENTIFICATION INFORMATION

The transaxle model, assembly number, and build date are on a metal I.D. tag that is attached to the end cover of the transaxle (Fig. 2). This information is also shown on a bar code label that is attached to the front of the transaxle (Fig. 3).

NOTE: Transaxles use various final drive gear ratios in different vehicle applications. Therefore, it is necessary that the correct transaxle assembly number is used when ordering service parts.

The last eight digits of the Vehicle Identification Number (V.I.N.) are stamped on the case, below the back–up lamp switch.

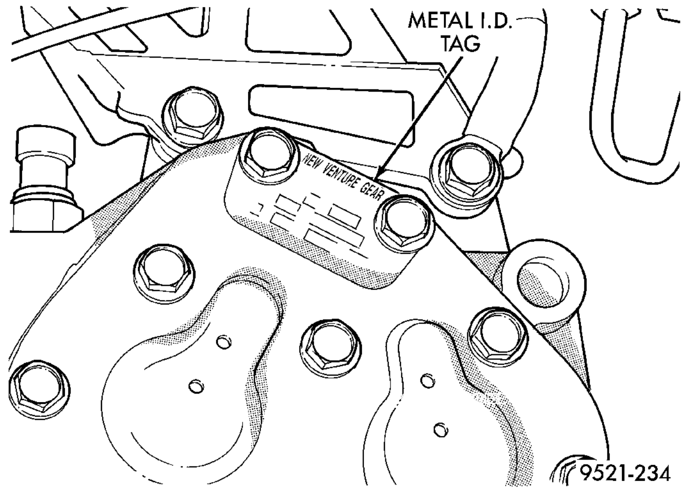


Fig. 2 Metal I.D. Tag

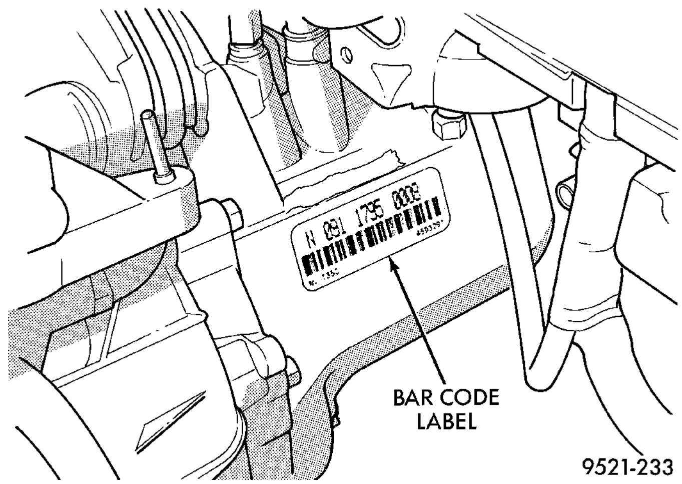


Fig. 3 Bar Code Label

NOTE: There are four different versions of this transaxle. There are no external differences between the models. Refer to the identification tag on the transaxle to determine which transaxle the vehicle is equipped with.

SELECTION OF LUBRICANT

NV T350 (A-578) transaxles use Mopar® Type M.S. 9417 Manual Transaxle Fluid. **Hypoid gear lube, engine oil, and/or automatic transmission fluid should not be used in this transaxle.** Hard shifting effort, bearing, gear, and/or synchronizer failure may occur if incorrect fluid is used.

SPECIAL ADDITIVES

The addition of any fluids to the transaxle, other than the fluid listed above, is not recommended. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

GENERAL INFORMATION (Continued)

SEALANTS

The sealant used to seal the transaxle case halves and input bearing is Mopar® Gasket Maker, Loctite® 518, or equivalent. The sealant used for the bearing end plate cover is Mopar® RTV.

GEAR RATIOS

CAUTION: All gears and shafts must not be interchanged with other transaxles; they will not function correctly.

The differential is a conventional arrangement of gears that is supported by tapered roller bearings. The final output gear turns the ring gear and differential assembly, thereby turning the drive axle shafts.

All transaxles have a torque capacity of 136 lb. ft. The gear ratios of each transaxle are shown in the following chart. The chart also shows which transaxles are available with the reverse–input shaft brake. This brake allows easier shifting into reverse and helps eliminate reverse gear clash.

GEARSHIFT PATTERN

The NV T350 (A-578) transaxle shift pattern is a modified H–pattern (Fig. 4). Overdrive fifth and reverse gears are in–line and outboard of the first through fourth gear positions.

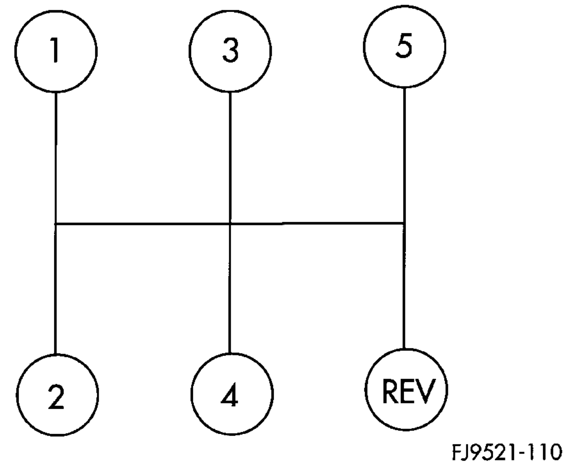


Fig. 4 NV T350 (A-578) Shift Pattern

ENGINE / GEAR	2.0 SOHC	2.0 DOHC (U.S. ONLY)	2.0 SOHC or DOHC W/COMP PKG. SALES CODE ACR OR MEXICO	2.0 SOHC and DOHC-EUROPE ONLY	2.0 SOHC-RIGHT HAND DRIVE ONLY
1st	3.54	3.54	3.54	3.54	3.54
2nd	2.13	2.13	2.13	2.13	2.13
3rd	1.36	1.36	1.36	1.36	1.36
4th	1.03	1.03	1.03	1.03	1.03
5th	0.72	0.72	0.81	0.72	0.72
FINAL DRIVE	3.55	3.94	3.94	3.55	3.55
REVERSE BRAKE	NO	YES	YES	YES	YES
CLUTCH RELEASE SYSTEM	CABLE	CABLE	CABLE	CABLE	HYDRAULIC

DESCRIPTION AND OPERATION

SHIFT LEVERS

The shift levers are serviceable in the vehicle. The shift levers are different from each other and do not interchange.

SELECTOR LEVER

The selector shaft uses a lever with a weight on the end (Fig. 5). The weight is used to improve shift feel and reduce noise.

The selector lever is retained by two roll pins (one inside the other).

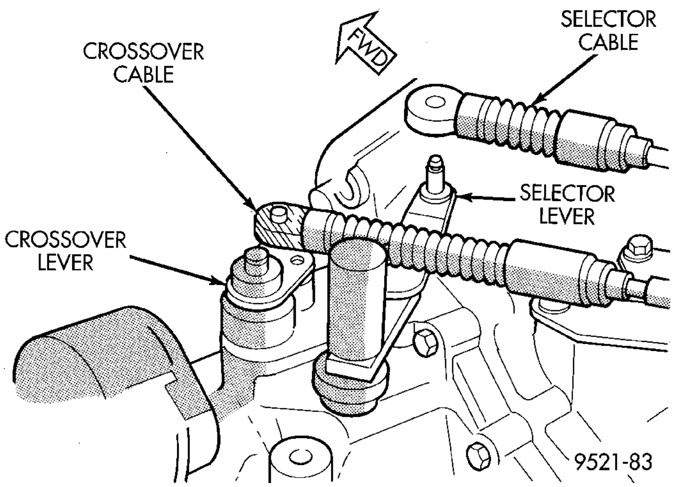


Fig. 5 Selector Lever

AXLE SEALS

The axle shaft seals are identical for both sides of the differential and will interchange.

DIAGNOSIS AND TESTING

COMMON PROBLEM CAUSES

The majority of transaxle malfunctions are a result of:

- Insufficient lubrication
- Incorrect lubricant
- Misassembled or damaged internal components
- Improper operation

HARD SHIFTING

Hard shifting may be caused by a misadjusted crossover cable. If hard shifting is accompanied by gear clash, synchronizer clutch and stop rings, or gear teeth may be worn or damaged.

Misassembled synchronizer components also cause shifting problems. Incorrectly installed synchronizer sleeves, struts, or springs can cause shift problems.

NOISY OPERATION

Transaxle noise is most often a result of worn or damaged components. Chipped, broken gear or synchronizer teeth, and brinnelled, spalled bearings all cause noise.

Abnormal wear and damage to the internal components is frequently the end result of insufficient lubricant.

SLIPS OUT OF GEAR

Transaxle disengagement may be caused by misaligned or damaged shift components, or worn teeth on the drive gears or synchronizer components. Incorrect assembly also causes gear disengagement.

LOW LUBRICANT LEVEL

Insufficient transaxle lubricant is usually the result of leaks, or inaccurate fluid level check or refill method. Leakage is evident by the presence of oil around the leak point. If leakage is not evident, the condition is probably the result of an underfill.

If air–powered lubrication equipment is used to fill a transaxle, be sure the equipment is properly calibrated. Equipment out of calibration can lead to an underfill condition.

CLUTCH PROBLEMS

Worn, damaged, or misaligned clutch components can cause difficult shifting, gear clash, and noise.

A worn or damaged clutch disc, pressure plate, or release bearing can cause hard shifting and gear clash.

SERVICE PROCEDURES

FLUID DRAIN AND FILL

All NV T350 (A-578) transaxles are equipped with a fill plug. The fill plug is located on the left side of the transaxle differential area (Fig. 6). The fluid level should be within 3/16 inch from the bottom of the transaxle fill hole (vehicle must be level when checking).

All NV T350 (A-578) transaxles are equipped with a drain plug. The drain plug is located on the lower right side of the transaxle differential housing (Fig. 7). Tighten drain plug to 28 N·m (250 in. lbs.)

Dry fill lubricant capacity is approximately 1.9-2.2 liters (4.0-4.6 pints). Wipe the outside of the transaxle if any lubricant spills.

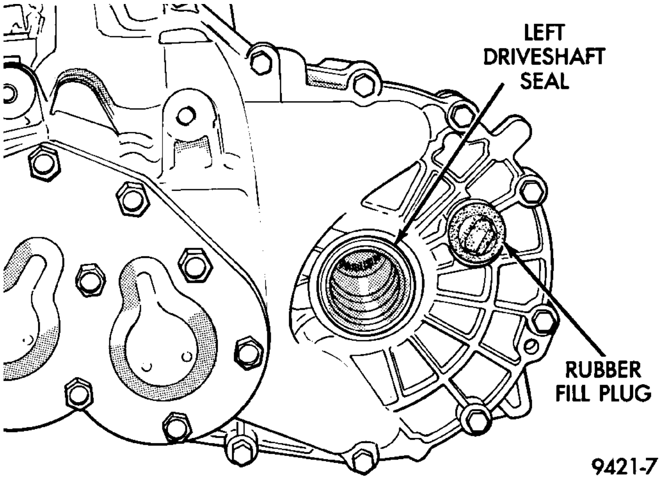


Fig. 6 Fill Plug Location

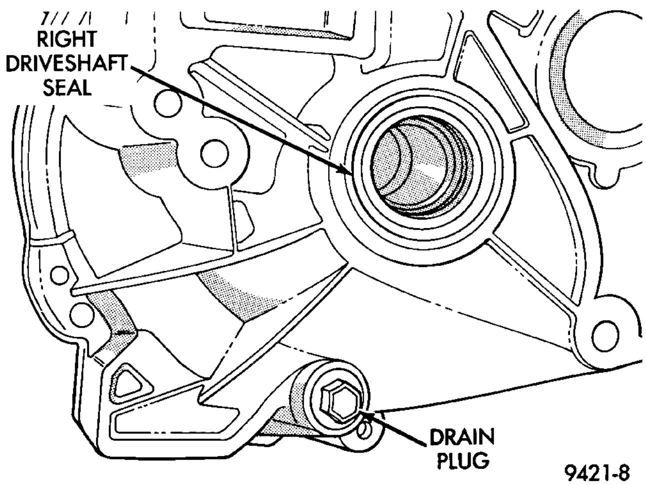


Fig. 7 Drain Plug Location

REMOVAL AND INSTALLATION

GEARSHIFT KNOB

REMOVAL

(1) Pull shifter boot down and away from shifter roll pin.

(2) Pry legs of shift knob away from shift lever roll pin using a flat blade pry tool.

(3) Remove knob from shifter handle (Fig. 8).

INSTALLATION

(1) For installation, reverse removal procedure.

GEARSHIFT BOOT

REMOVAL

(1) Remove shifter knob. Refer to gearshift knob removal.

(2) Remove the console assembly. Refer to Group 23, Body.

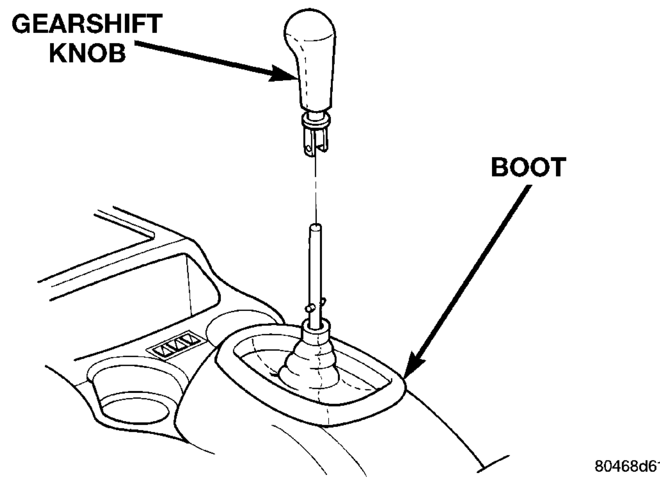


Fig. 8 Gearshift Knob

(3) Snip the plastic retaining clips at the base of the boot (Fig. 9). Remove the boot from the gearshift mechanism.

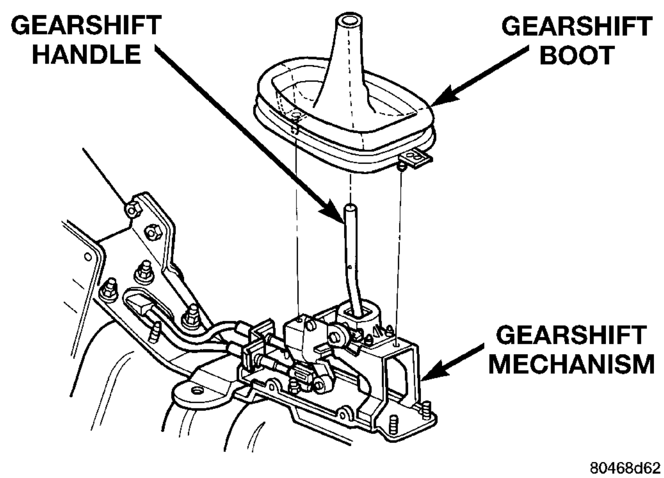


Fig. 9 Gearshift Boot

INSTALLATION

(1) For installation, reverse removal procedure. Install new plastic retaining clips.

GEARSHIFT CABLES

Use this procedure if either of the shift cables require replacement.

REMOVAL

(1) Disconnect Power Distribution Center from battery tray and set aside.

(2) Remove air cleaner inlet horn.

(3) Remove battery and battery tray.

(4) Disconnect gear shift cable ends from transaxle shift levers (Fig. 10) (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

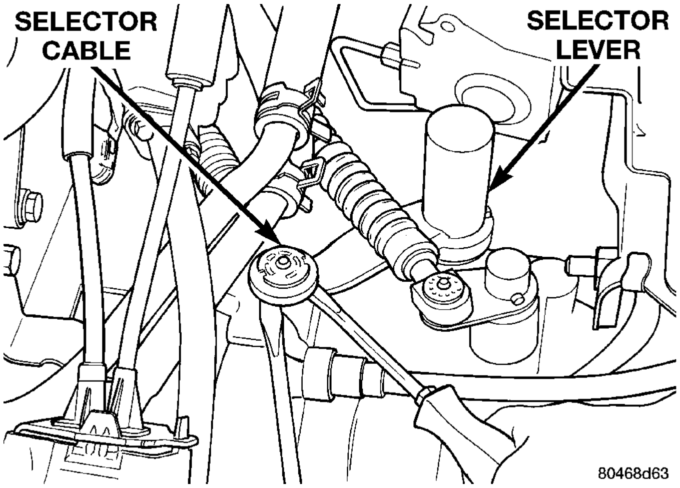


Fig. 10 Selector Cable Removal

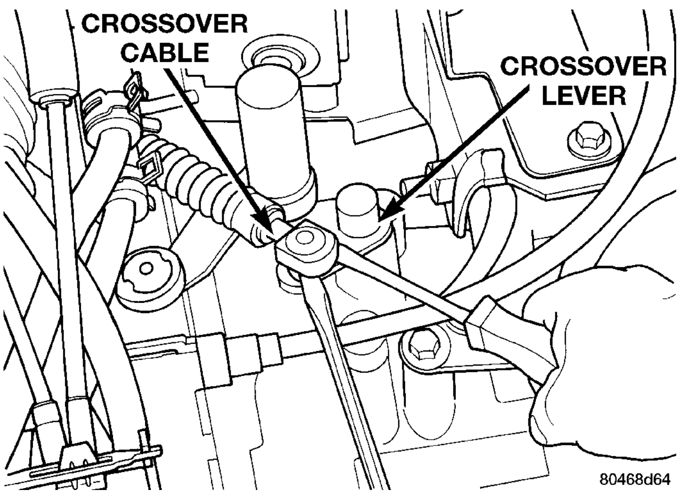


Fig. 11 Crossover Cable Removal

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushings to avoid damaging cable isolator bushings.

(5) Remove cable to bracket retaining clips at transaxle.

CAUTION: It is recommended that new cable retaining clips be used for reinstallation.

(6) Pull cables up out of transaxle bracket.

(7) Remove console from vehicle. Refer to Group 23, Body.

(8) Remove floor pan grommet retaining nuts (Fig. 12).

(9) Remove cable retaining clips at shifter (Fig. 13).

CAUTION: It is recommended that new cable retaining clips be used for reinstallation.

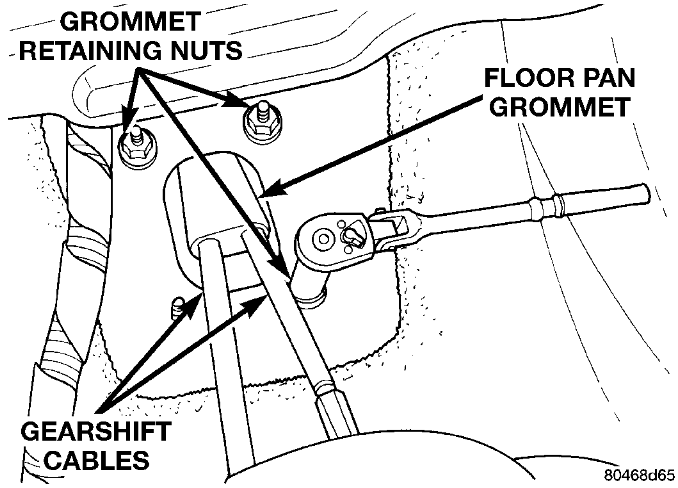


Fig. 12 Grommet Retaining Nuts (Interior)

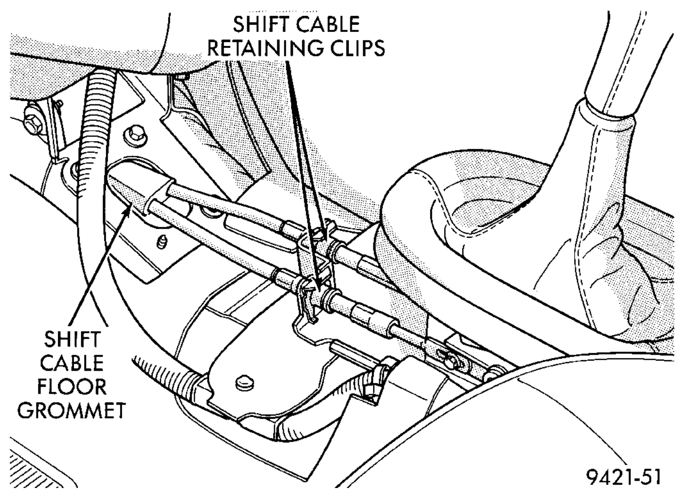


Fig. 13 Cable Retaining Clips

(10) Disconnect shift cables from shifter. Pry with equal force on both sides of shifter cable isolator bushings to avoid damaging bushings.

(11) Lift vehicle on hoist. Remove self-tapping screw securing grommet plate to underbody heat shield and floor pan (Fig. 14).

(12) Detach cables from cable support clip in tunnel above exhaust catalyst.

(13) Remove shift cable assembly from vehicle.

INSTALLATION

CAUTION: Gearshift cable bushings must not be lubricated or the bushings will swell and split.

(1) To install, reverse removal procedure. After cables have been replaced, cable adjustment should be checked. Refer to cable adjustment procedure in this section.

REMOVAL AND INSTALLATION (Continued)

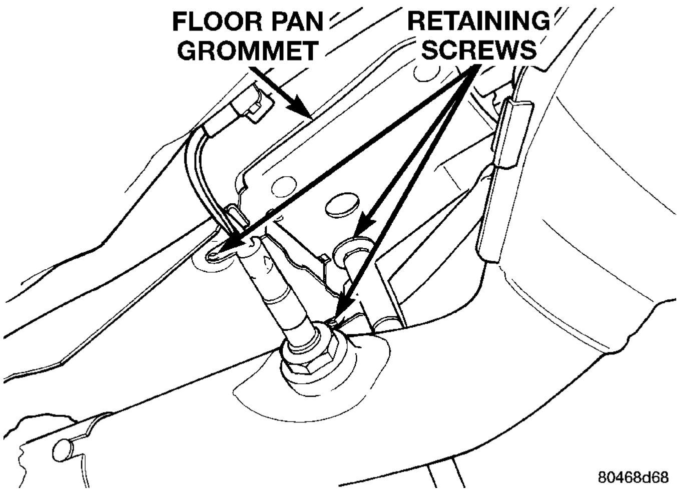


Fig. 14 Grommet Retaining Screw (Underbody)

CAUTION: Only the crossover cable is adjustable. The selector cable does not have any adjustment capabilities.

GEARSHIFT CROSSOVER CABLE ADJUSTMENT

(1) Remove shift console from vehicle.

(2) Loosen adjusting screw on crossover cable at shifter (Fig. 15).

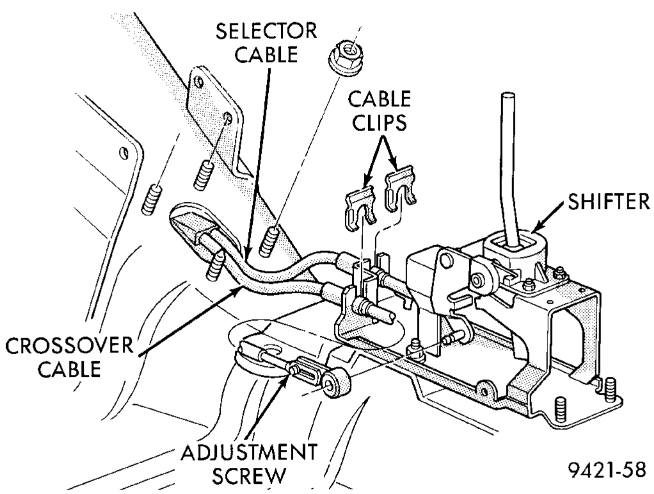


Fig. 15 Crossover Cable Adjustment Screw

(3) Pin transaxle crossover lever in 3-4 neutral position using a 1/4 inch drill bit. Align hole in crossover lever with the hole in the boss on the transaxle case (Fig. 16). Be sure drill bit goes into transaxle case at least one half inch.

(4) The shifter is spring–loaded and self–centering. Allow shifter to rest in its neutral position. Torque adjustment screw to 8 N·m (70 in. lbs.). Care must be taken to avoid moving the shift mechanism off-center during screw tightening.

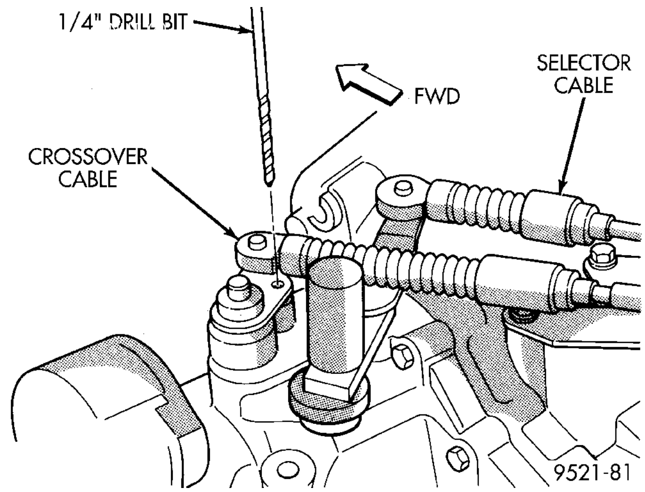


Fig. 16 Crossover Lever Pin Procedure

(5) Remove drill bit from transaxle case and perform functional check by shifting transaxle into all gears.

(6) Reinstall center shift console. Blouse boot out around console. Seat boot lip on top of console.

GEARSHIFT MECHANISM REPLACEMENT

REMOVAL

(1) Remove shifter knob.

(2) Remove console assembly. Refer to Group 23, Body for procedure.

(3) Remove shifter boot.

(4) Remove gearshift cables.

(5) Remove the parking brake mechanism. Refer to Group 5, Brakes for procedure.

(6) Remove the airbag control module. Refer to Group 8M, Passive Restraint System for procedure.

(7) Remove the two remaining nuts at the base of the gearshift mechanism (Fig. 17). Remove shifter.

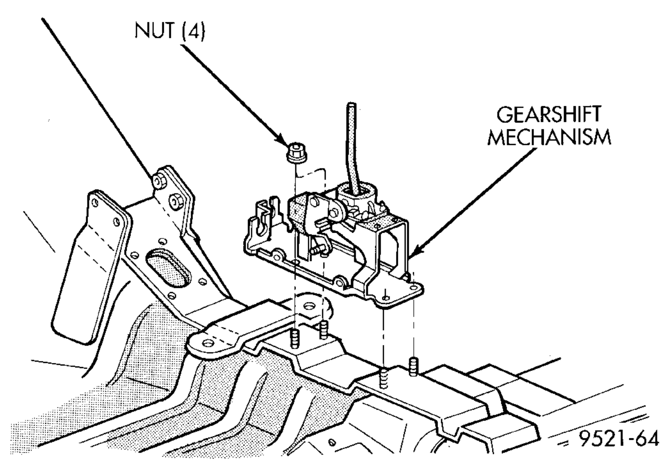


Fig. 17 Gearshift Mechanism

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) For installation, reverse removal procedure.

VEHICLE SPEED SENSOR DRIVE GEAR

REMOVAL

(1) Raise vehicle on hoist.
(2) Remove wiring connector from speed sensor.

CAUTION: Clean area around speed sensor before removing. This prevents the possibility of dirt from entering the transaxle during speed sensor removal.

(3) Remove speed sensor retaining bolt (Fig. 18).

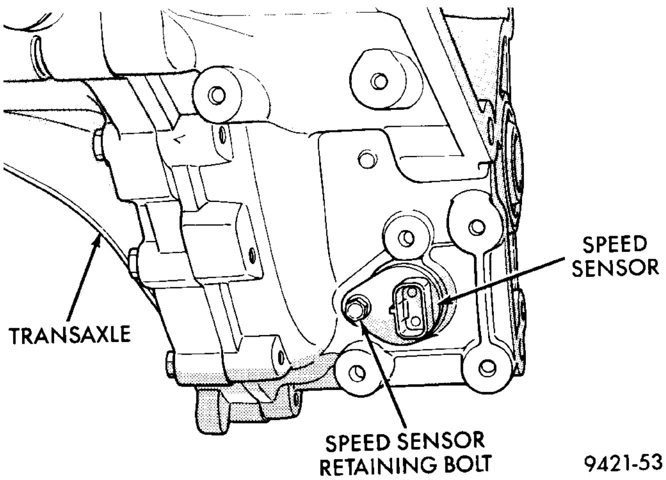


Fig. 18 Speed Sensor Retaining Bolt

(4) Remove speed sensor from transaxle.

CAUTION: Carefully remove vehicle speed sensor so that sensor drive gear does not fall into transaxle. Should sensor drive gear fall into the transaxle during sensor removal, drive gear must be reattached to sensor.

(5) Remove speed sensor drive gear from speed sensor.

INSTALLATION

(1) To install, reverse removal procedure.
(2) Confirm vehicle speedometer is functioning properly following installation.

BACK-UP LAMP SWITCH

The back-up lamp switch is located on the top left front side of the transaxle case (Fig. 19).

REMOVAL

(1) Lift vehicle on hoist.
(2) From bottom side of vehicle, remove wiring connector from switch.
(3) Unscrew switch from transaxle.

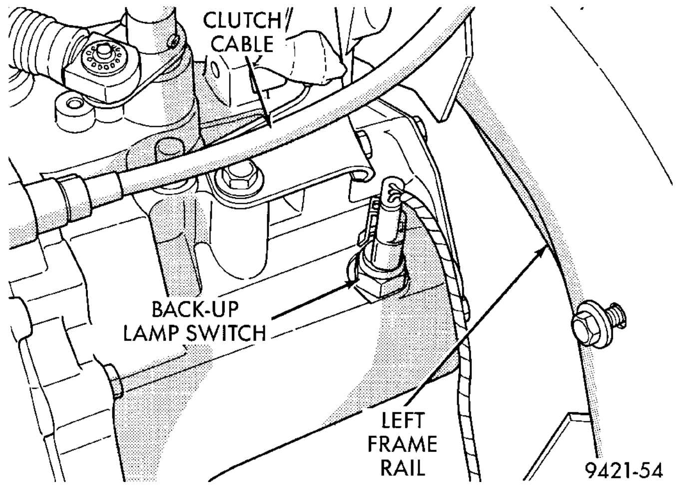


Fig. 19 Back-up Lamp Switch

INSTALLATION

(1) To install, reverse removal procedure. Teflon tape or equivalent must be used on switch threads.

CAUTION: Do not overtighten switch.

(2) Confirm back-up lamps are functioning properly following installation.

CROSSOVER LEVER

REMOVAL

(1) Remove crossover cable. Refer to Gearshift Cable removal.
(2) Using a pin punch, remove the crossover roll pin from lever.
(3) Pull up and remove the crossover lever from the transaxle crossover shaft (Fig. 20).

INSTALLATION

(1) For installation, reverse removal procedure. Replace the roll pin that was removed with a new one.

SELECTOR LEVER

The selector shaft uses a lever with a weight on the end. The weight is used to improve shift–feel and reduce noise.

The selector lever is retained by two roll pins (one inside the other).

REMOVAL

(1) Remove the selector cable. Refer to Gearshift Cable removal.
(2) Using a pin punch, remove both roll pins from the lever.
(3) Pull up and remove the selector lever from the transaxle selector shaft

REMOVAL AND INSTALLATION (Continued)

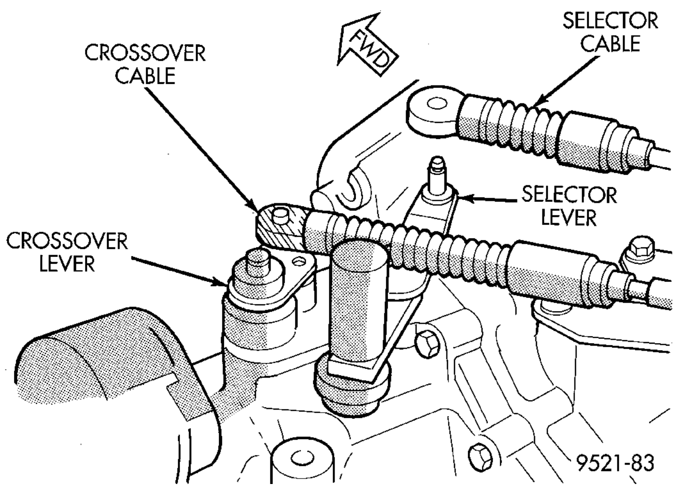


Fig. 20 Crossover Lever

INSTALLATION

(1) For installation, reverse removal procedure. Replace the roll pins that were removed with new ones. The correct orientation for the roll pins is shown in (Fig. 21).

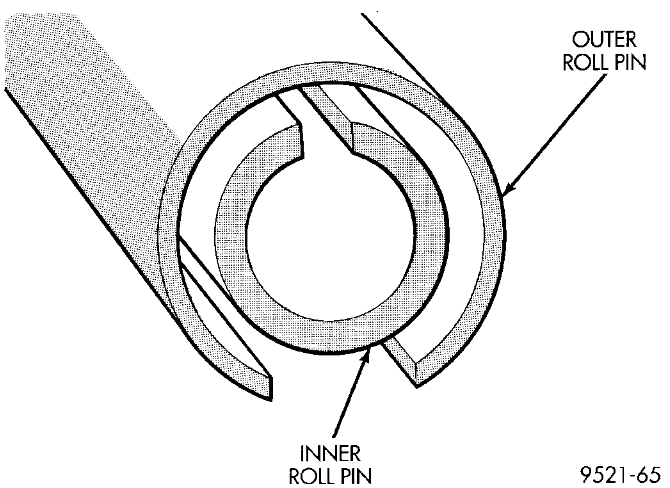


Fig. 21 Correct Orientation of Roll Pins

AXLE SEALS

The axle shaft seals are identical for both sides of the differential and will interchange.

REMOVAL

(1) Remove axle shaft. Refer to Group 2, Suspension and Driveshafts for service procedures.

(2) Insert a flat–blade pry tool at outer edge of axle shaft seal (Fig. 22).

(3) Tap on the pry tool with a small hammer and remove axle shaft seal.

INSTALLATION

(1) Clean axle shaft seal bore of any excess sealant.

(2) Align axle shaft seal with axle shaft seal bore.

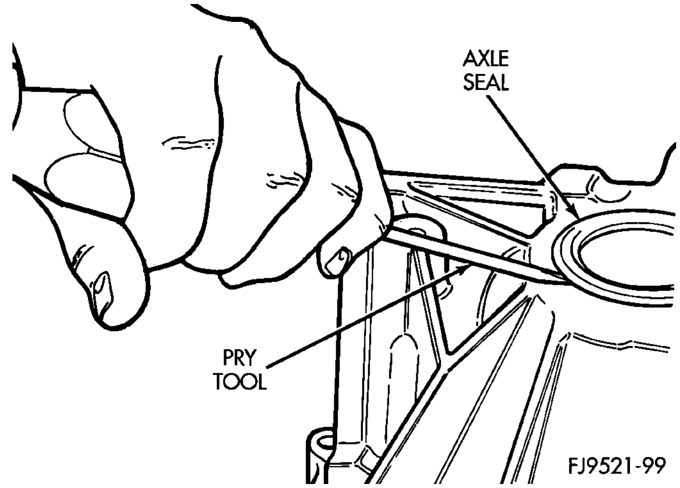


Fig. 22 Axle Shaft Seal Removal

(3) Install axle seal on tool #6709 and C-4171 and insert into axle shaft seal bore.

(4) Tap seal into position.

SHIFT SHAFT SEALS

It is **not** necessary to remove the shift shafts from the transaxle to service the shift shaft seals.

REMOVAL

(1) Using a pick tool, pry up on the shift shaft seal and remove seal from bore.

INSTALLATION

(1) Position new shift shaft seal in bore.

(2) Install shift shaft seal into bore using an appropriate size deep–well socket.

TRANSAXLE

NOTE: The transaxle can be removed from the vehicle without having to remove the engine.

All transaxle components are serviced with the transaxle out of the vehicle with the exception of:

- Selector shaft seal
- Crossover shaft seal
- End plate
- Axle shaft seals
- Shift levers
- Back up lamp switch
- Vehicle speed sensor

REMOVAL

(1) Disconnect the battery.

(2) Pull Power Distribution Center up and out of its holding bracket. Set Power Distribution Center aside to gain clearance.

(3) Remove battery heat shield and remove battery from engine compartment. Remove battery tray from

REMOVAL AND INSTALLATION (Continued)

engine compartment. Disconnect cruise control (if equipped).

(4) Remove vehicle speed sensor wire.

(5) Disconnect back-up lamp switch wiring at transaxle.

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushing to avoid damaging cable isolator bushing.

(6) Disconnect both gear shift cables ends from transaxle shift levers (Fig. 23).

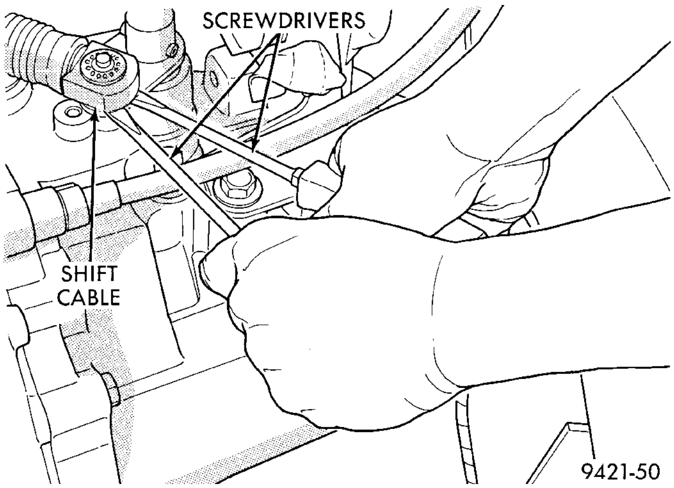


Fig. 23 Shift Cables

(7) Remove clutch housing vent cap, exposing the clutch cable end and clutch release lever. Then remove clutch cable from transaxle bellhousing (Fig. 24) (Fig. 25).

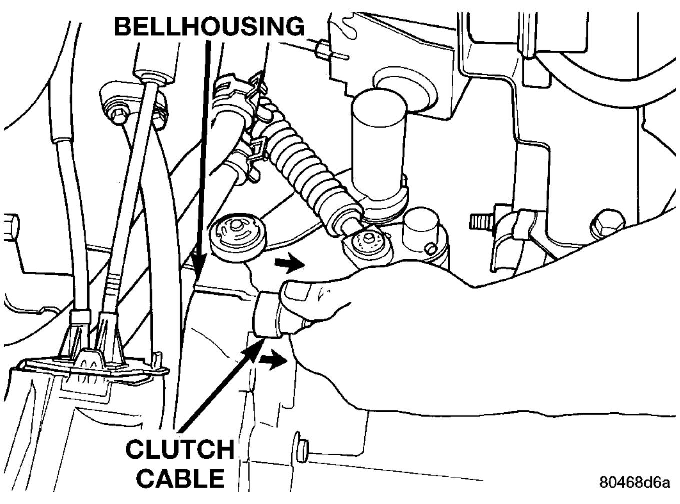


Fig. 24 Pull Clutch Cable Backward

(8) Remove shift cable mounting bracket (Fig. 26).

(9) Remove Accelerator cable shield (if equipped).

(10) Remove intake manifold support bracket (if equipped) and upper starter bolt.

(11) Remove upper bellhousing bolts.

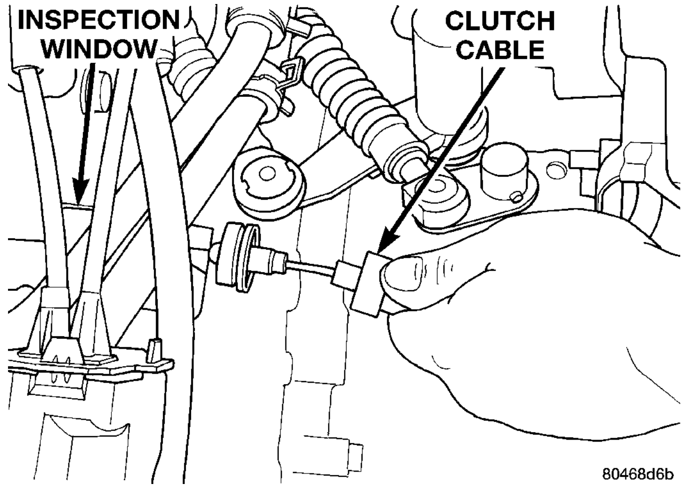


Fig. 25 Remove Clutch Cable From Lever

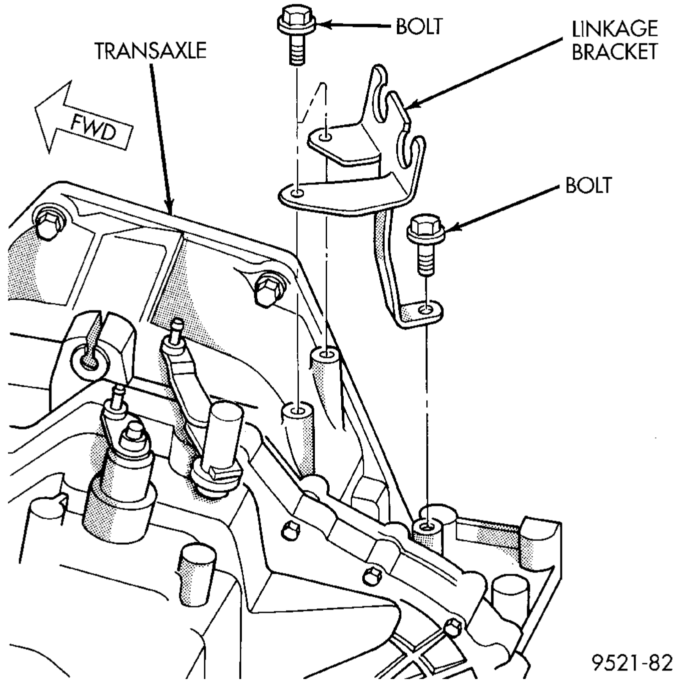


Fig. 26 Linkage Bracket Bolts

(12) Install engine bridge fixture and support engine.

(13) Lift vehicle on hoist and remove front wheels.

(14) Drain fluid from transaxle.

(15) Remove both front driveshafts. Refer to Group 2, Suspension for procedure.

CAUTION: When reinstalling driveshafts, new driveshaft retaining clips must be used. Do not reuse old clips. Failure to use new clips may result in disengagement of inner constant-velocity joint.

(16) Remove power hop damper and bracket.

(17) Remove lower starter bolt (Fig. 27).

(18) Remove transaxle to rear lateral bending strut from engine and transaxle (Fig. 28).

REMOVAL AND INSTALLATION (Continued)

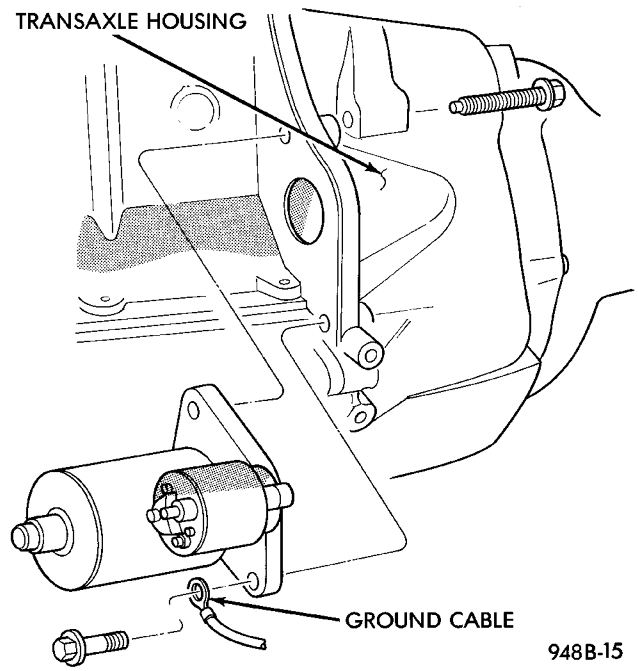


Fig. 27 Starter Bolts

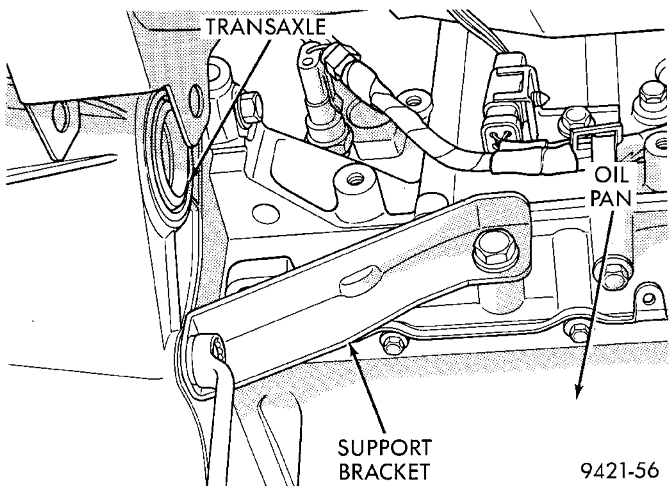


Fig. 28 Bracket Removal

(19) Support transaxle with a transmission jack.

(20) Remove front motor mount through-bolt. Remove front motor mount bolts from engine and transaxle.

(21) Remove lower dust–shield screw and dust shield.

(22) Rotate engine crankshaft clockwise to expose driveplate–to–modular clutch bolts.

NOTE: Before removal of bolts, mark the driveplate and clutch pressure plate for ease of assembly alignment.

(23) Remove four driveplate–to–modular clutch bolts to separate driveplate from clutch assembly.

(24) Push modular clutch assembly into the transaxle bellhousing for easier transaxle removal.

(25) Remove frame rail to left transaxle mount through-bolt (Fig. 29).

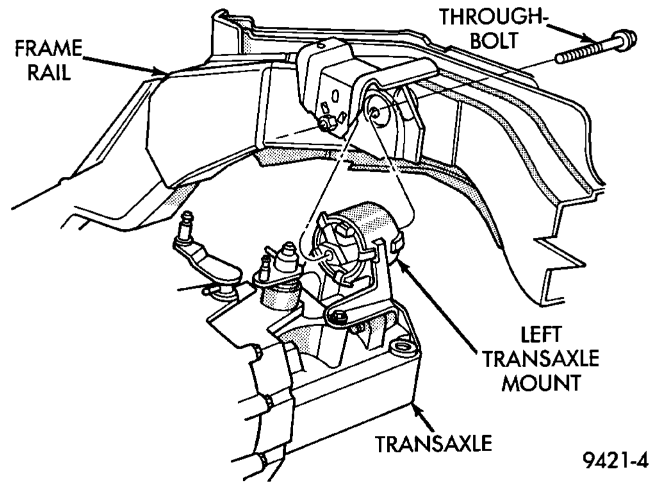


Fig. 29 Left Transaxle Mount Through-Bolt

(26) Remove left transaxle mount from transaxle. Then push mount up to gain clearance for transaxle removal.

(27) Remove transaxle from vehicle.

(28) Remove modular clutch assembly from transaxle input shaft.

INSTALLATION

(1) To install transaxle, reverse removal procedure.

(2) After installing transaxle, fill transaxle to bottom of fill plug hole (vehicle level on hoist). Fill transaxle with Mopar® type M.S. 9417 Manual Transaxle Fluid before lowering vehicle to floor.

(3) Verify that vehicle's back-up lights and speedometer are functioning properly. Crossover cable adjustment procedure is required after installing transaxle in car to ensure proper shifter adjustment. Road test vehicle for proper transaxle function.

DISASSEMBLY AND ASSEMBLY

TRANSAXLE

The NV T350 (A-578) transaxle internal components can be serviced only by separating the gear case from the bellhousing case.

CAUTION: The transaxle output shaft is serviced as a unit. No disassembly and reassembly is possible. Damage to the transaxle may result.

DISASSEMBLY

(1) Place transaxle on bench.

(2) Remove shift levers. Remove transaxle case half bolts (Fig. 30).

DISASSEMBLY AND ASSEMBLY (Continued)

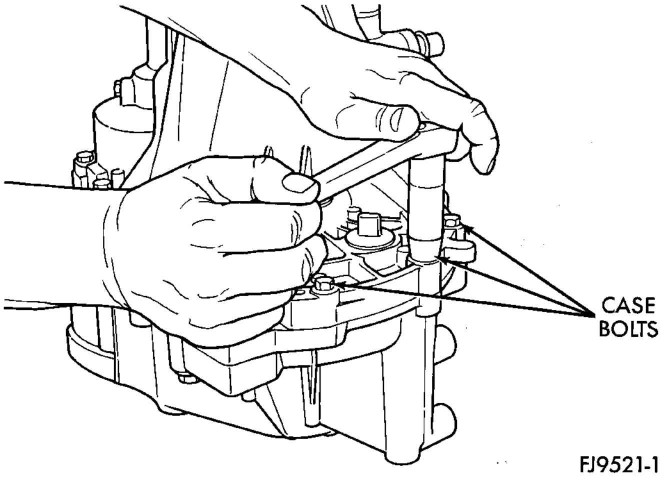


Fig. 30 Case Bolts

(3) Place two screwdrivers into the slots provided in the case halves near the dowels (Fig. 31). Separate the case halves (Fig. 32).

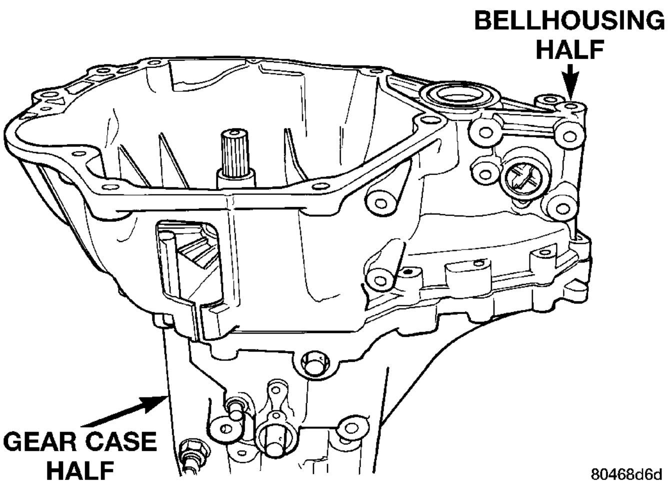


Fig. 31 Transaxle Case Halves

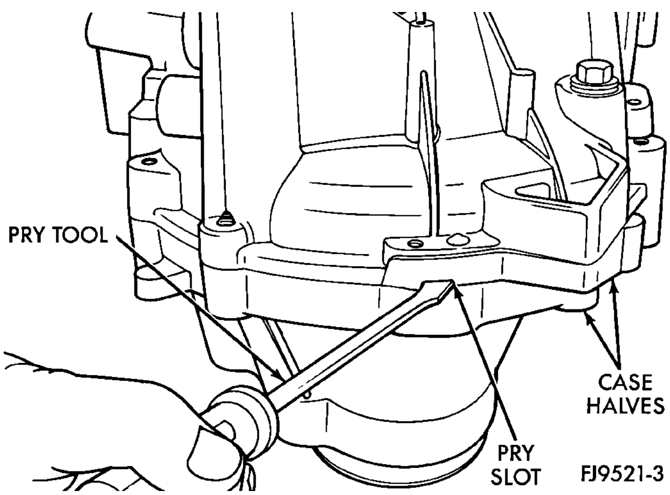


Fig. 32 Separate Case Halves

(4) Remove bellhousing half from gear case half (Fig. 33).

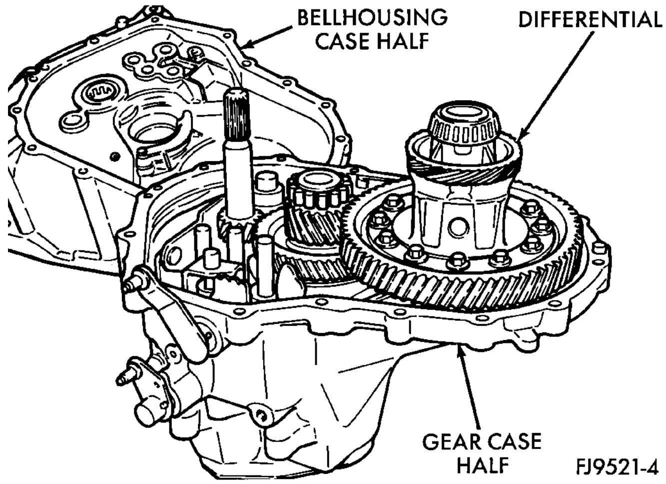


Fig. 33 Bellhousing Case Half Removal

(5) Remove output shaft roller bearing from output shaft.

(6) Remove differential assembly (Fig. 34).

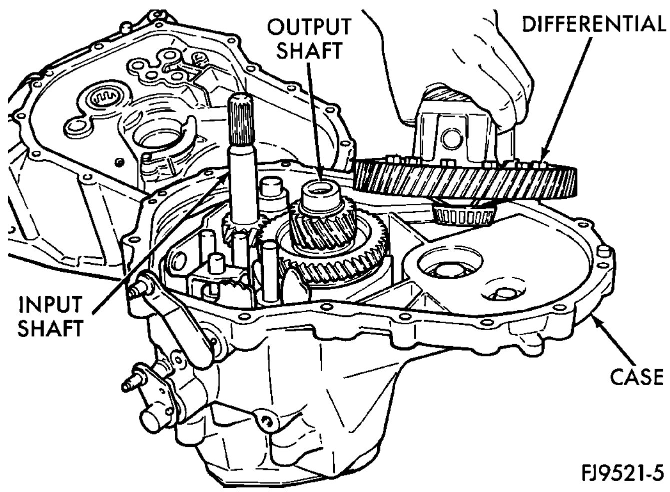


Fig. 34 Differential Assembly Removal

(7) Remove reverse idler shaft bolt (Fig. 35). Remove reverse idler gear (Fig. 36).

(8) Remove two screws retaining reverse fork bracket (Fig. 37). Remove reverse fork bracket and reverse cam blockout assembly (Fig. 38).

(9) Using snap–ring pliers, remove selector shaft spacer (Fig. 39).

(10) Pull the selector shaft shift pin out of the slot in the blocker assembly. Turn selector shaft up and out of the way (Fig. 40).

(11) Remove transaxle end cover (Fig. 41) (Fig. 42).

(12) Remove two snap rings retaining the output shaft and the input shaft to the bearings (Fig. 43).

(13) Using bench fixture and shims provided (Miller tools # 6785, 6785-1, and 6785-2), turn transaxle over. Install transaxle onto bench fixture (Fig. 44).

DISASSEMBLY AND ASSEMBLY (Continued)

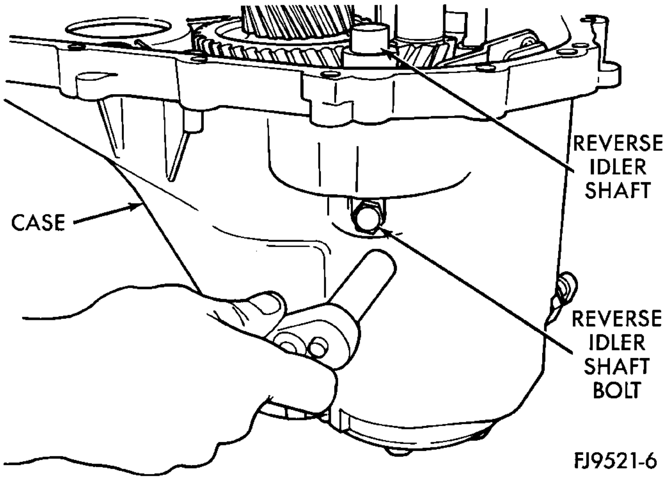


Fig. 35 Reverse Idler Shaft Bolt Removal

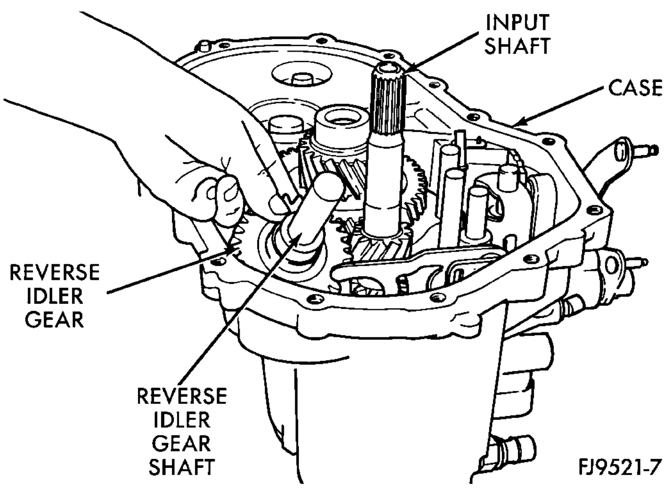


Fig. 36 Reverse Idler Gear Removal

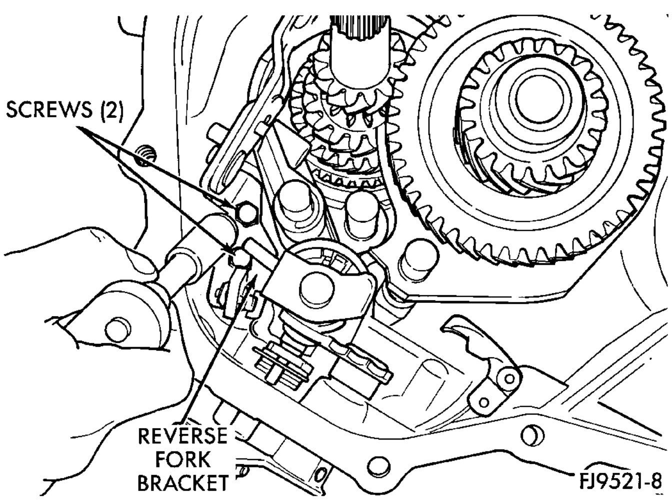


Fig. 37 Screws Retaining Reverse Fork Bracket

Verify shim spacers are in position on bench fixture. Install transaxle into shop press.

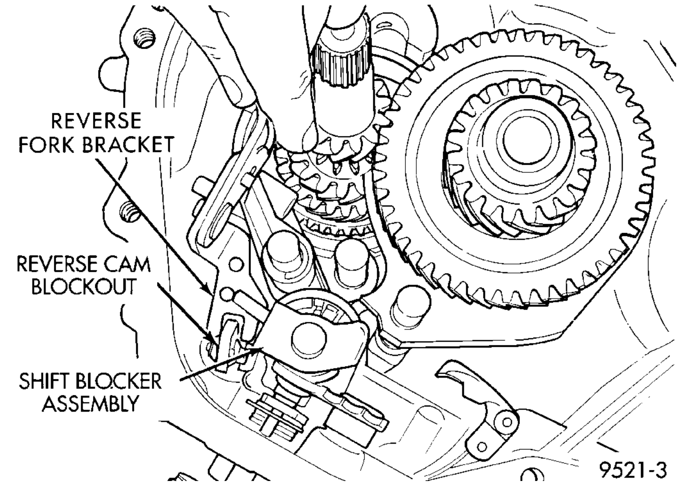


Fig. 38 Remove Reverse Fork Bracket

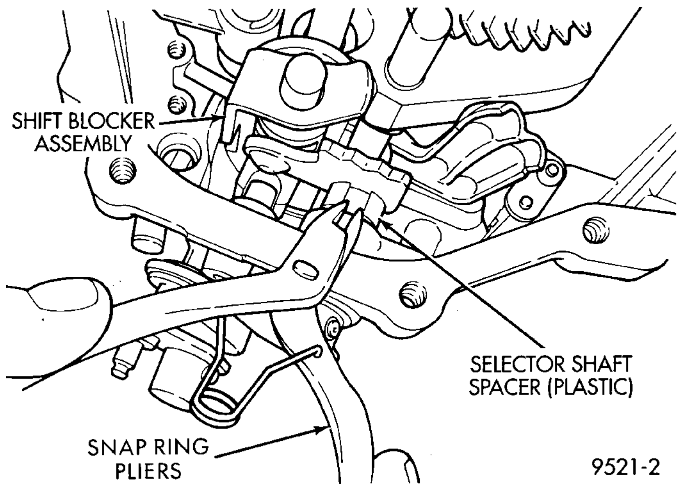


Fig. 39 Remove Selector Shaft Spacer

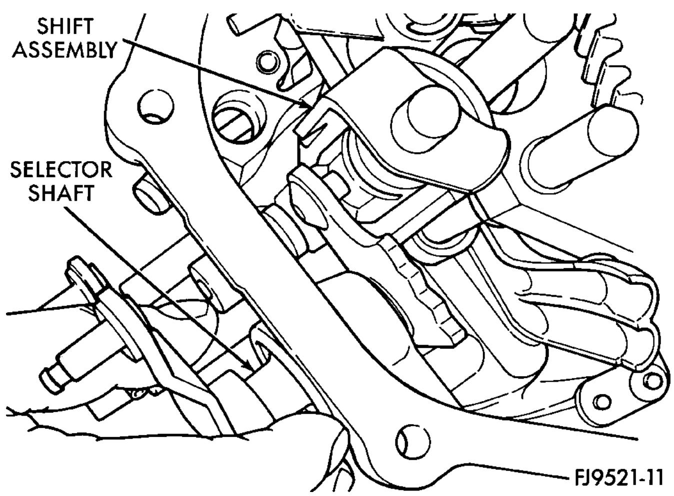


Fig. 40 Selector Shaft

(14) Install bearing fixture Miller tool #6768 onto transaxle end bearings (Fig. 45). Verify tool is properly aligned to input and output shafts.

DISASSEMBLY AND ASSEMBLY (Continued)

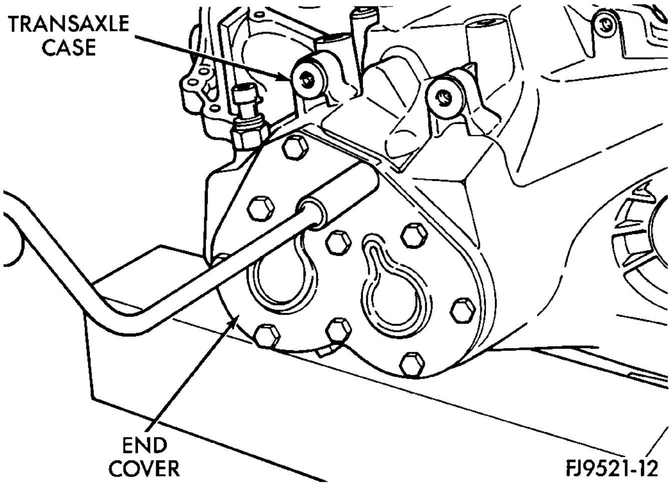


Fig. 41 Transaxle Cover Removal

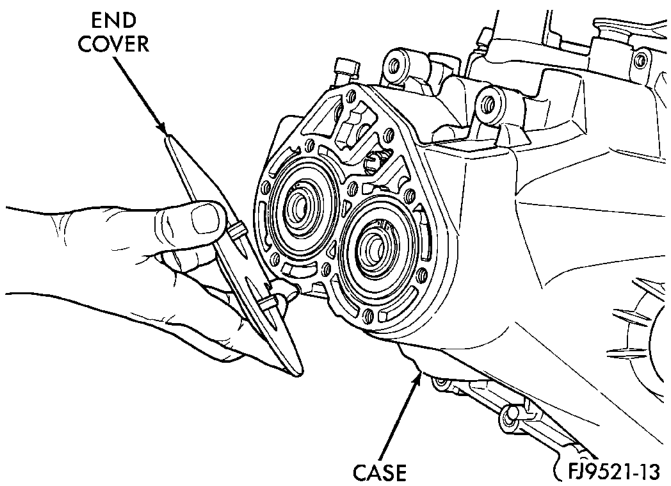


Fig. 42 End Cover

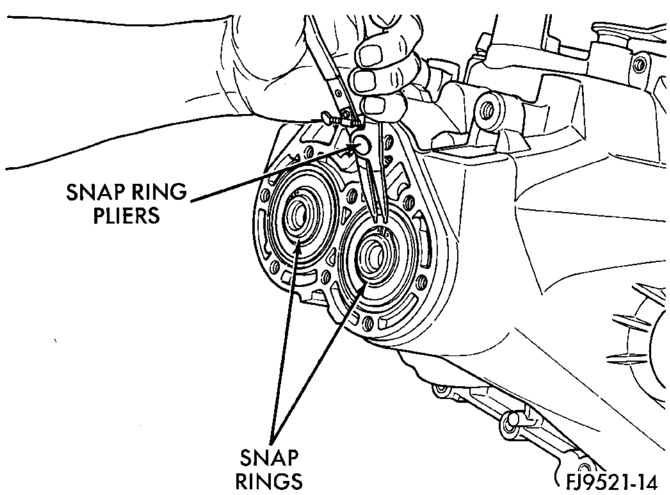


Fig. 43 Snap Rings Retaining Bearings

CAUTION: The oil dams in the input and output shafts can be damaged while pressing on the shafts if the bearing fixture is not used properly.

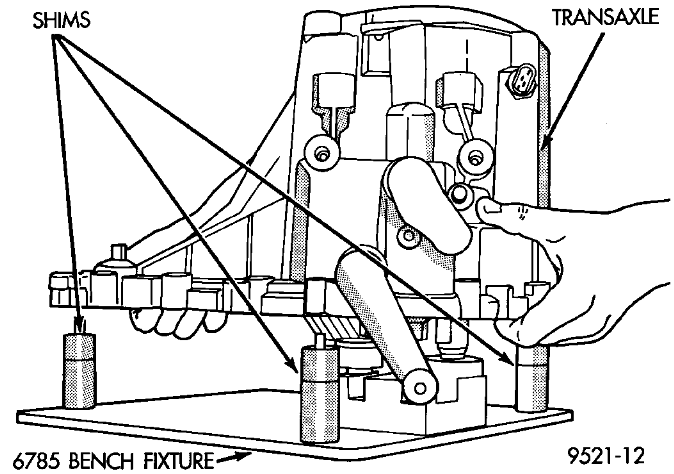


Fig. 44 Bench Fixture

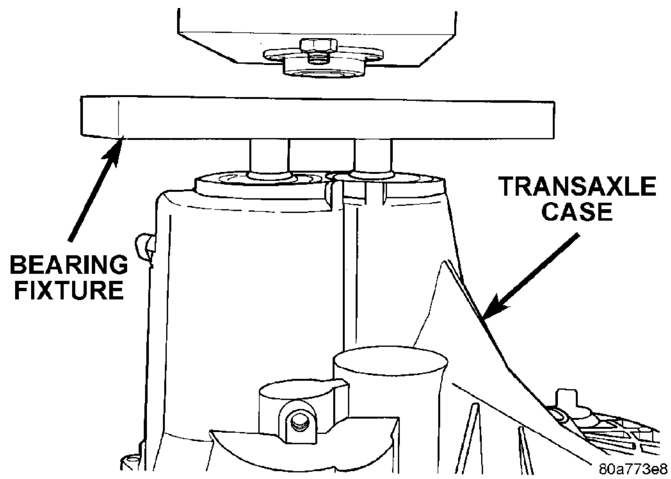


Fig. 45 Bearing Fixture

(15) Install transaxle gear case into shop press. Press output and input shaft assemblies out of case (Fig. 46).

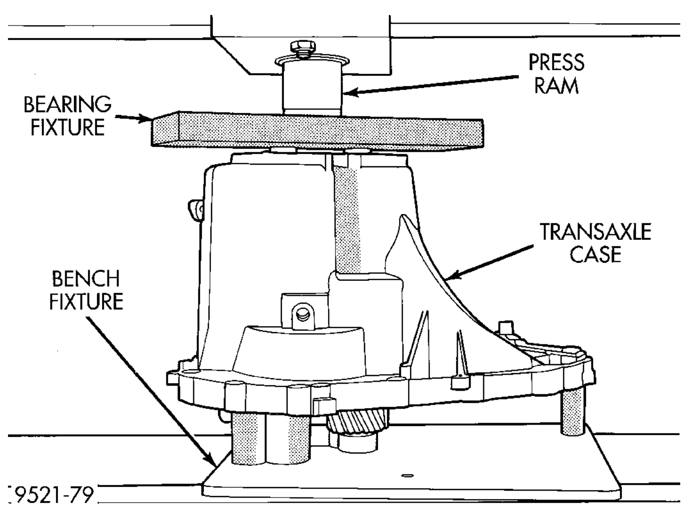


Fig. 46 Pressing Gears Out of Case

DISASSEMBLY AND ASSEMBLY (Continued)

(16) Remove transaxle from press.

(17) Carefully remove transaxle case from the shaft assemblies and bench fixture (Fig. 47). Be sure the oil–feed trough to the end bearings is not damaged (Fig. 48).

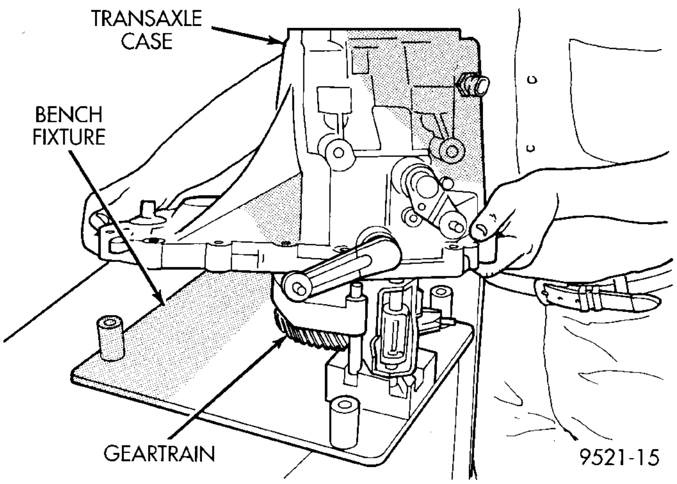


Fig. 47 Transaxle Case Removal

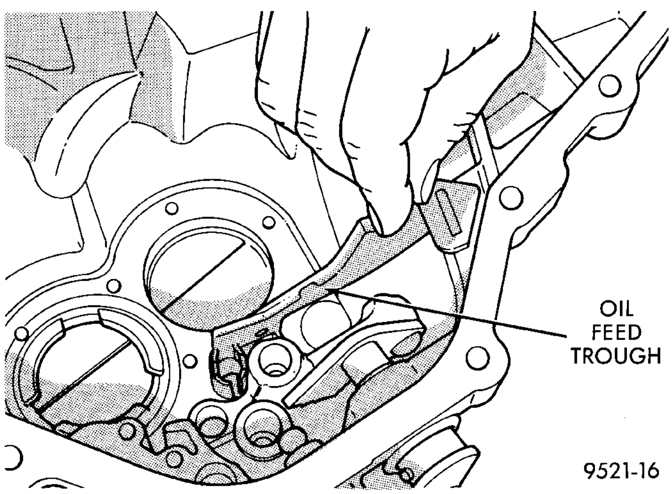


Fig. 48 Oil Feed Trough

(18) **TRANSAXLE W/REVERSE BRAKE:** Remove the reverse brake blocking ring, shim, reverse brake friction cone, bearing and race from the input shaft assembly (Fig. 49) (Fig. 50) (Fig. 51) (Fig. 52) (Fig. 53). **TRANSAXLE W/O REVERSE BRAKE:** Remove plastic spacer from the input shaft assembly.

(19) Remove the shift blocker assembly from the bench fixture (Fig. 54).

(20) Remove the 1-2 shift fork from the output shaft (Fig. 55).

(21) Remove input and output shaft assemblies from bench fixture (Fig. 56).

CAUTION: The output shaft assembly is serviced as an assembly. Do not try to repair any component on the output shaft. If the 1-2 synchronizer or gear fails, it is necessary to replace the complete output shaft assembly.

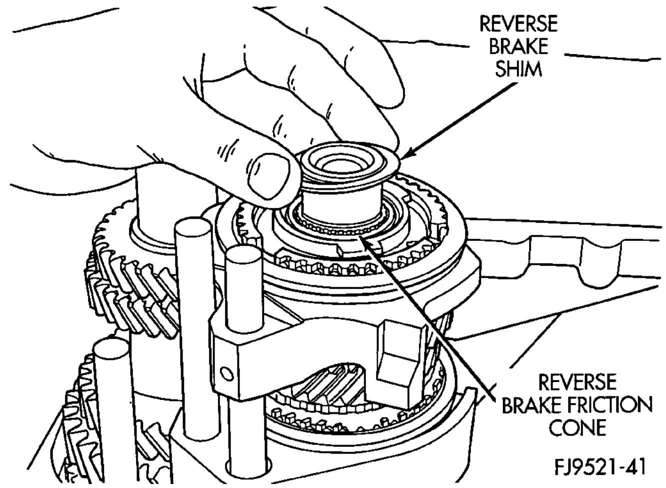


Fig. 49 Reverse Brake Shim

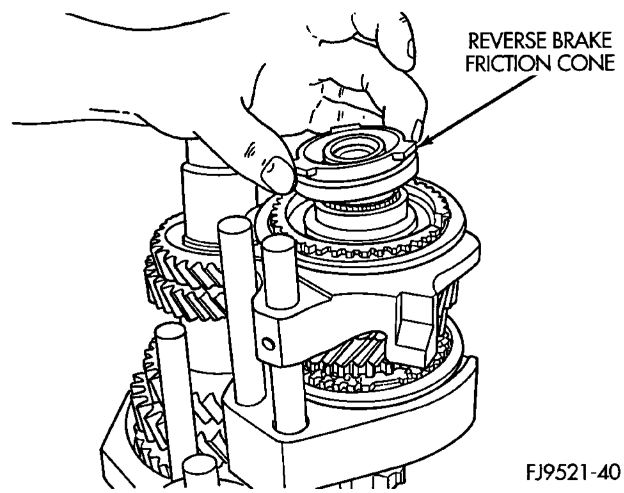


Fig. 50 Reverse Brake Friction Cone

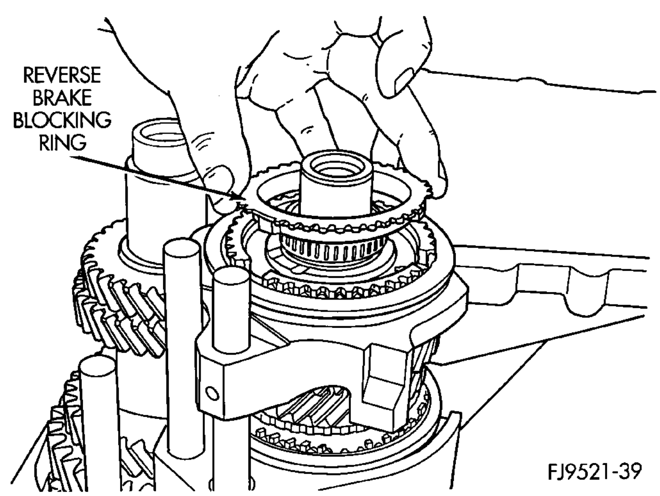


Fig. 51 Reverse Brake Blocking Ring

DISASSEMBLY AND ASSEMBLY (Continued)

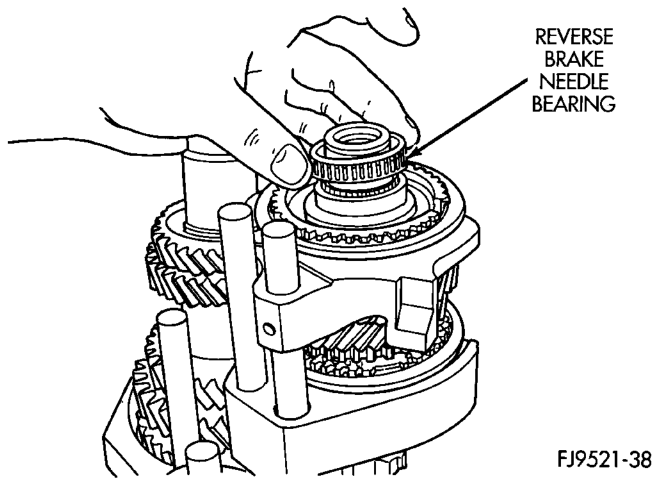


Fig. 52 Reverse Brake Needle Bearing

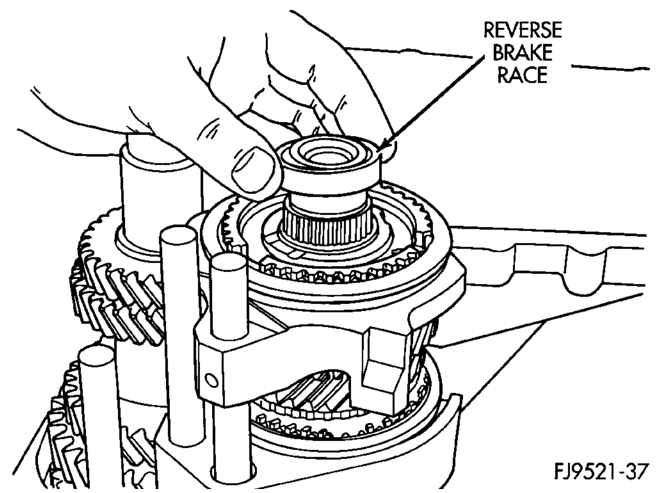


Fig. 53 Reverse Brake Race

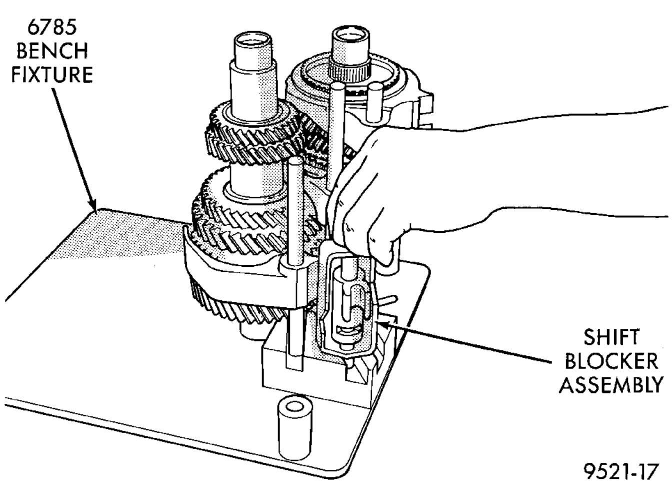


Fig. 54 Shift Blocker Removal

ASSEMBLY

The sealant used to seal the transaxle case halves is Mopar® Gasket Maker, Loctite® 518, or equivalent.

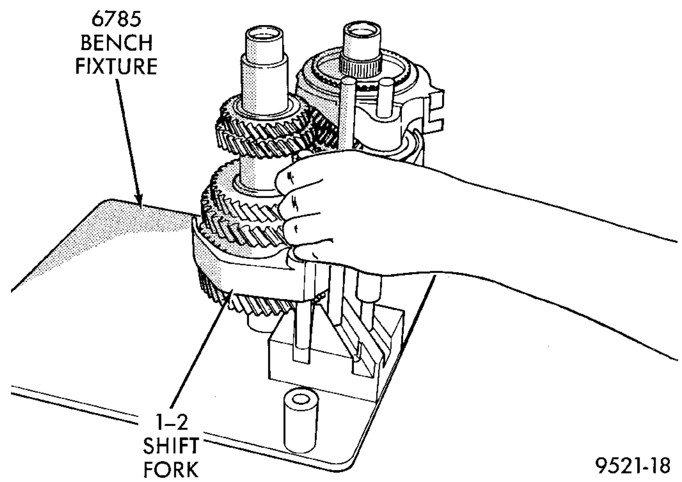


Fig. 55 1–2 Shift Fork Removal

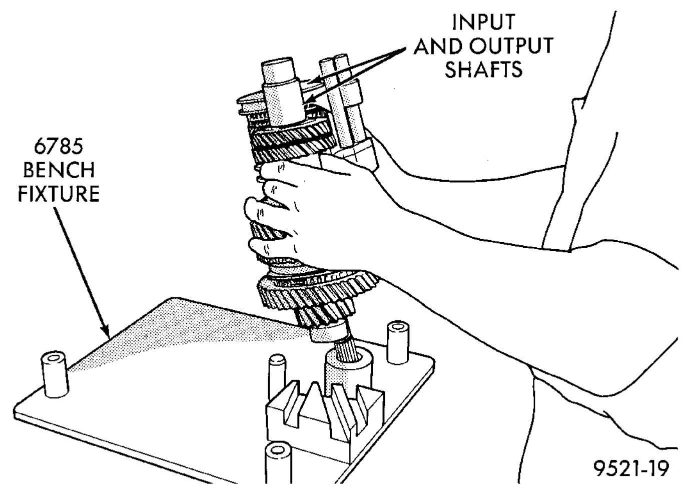


Fig. 56 Gear Train Removal

The sealant used for the bearing end plate cover is Mopar® RTV.

(1) Verify bench fixture shims are removed from bench fixture. Install output and input shafts into bench fixture (Miller tool #6785) (Fig. 57).

(2) Install shift rails and forks into bench fixture (Fig. 58).

(3) Install shift blocker assembly into bench fixture (Fig. 59).

(4) Install reverse brake race onto input shaft (Fig. 60).

(5) Install reverse brake needle bearing (Fig. 61).

(6) Install reverse brake blocking ring (Fig. 62).

(7) Install reverse brake friction cone (Fig. 63).

(8) Install reverse brake shim (Fig. 64). Apply petroleum jelly to shim to hold in place.

(9) Install gear–case half over bench fixture (Fig. 65). Line up shift finger over 3-4 lug.

(10) Line up reverse brake friction cone lugs to the slots in the gear case (Fig. 66). Verify reverse brake shim is in position.

DISASSEMBLY AND ASSEMBLY (Continued)

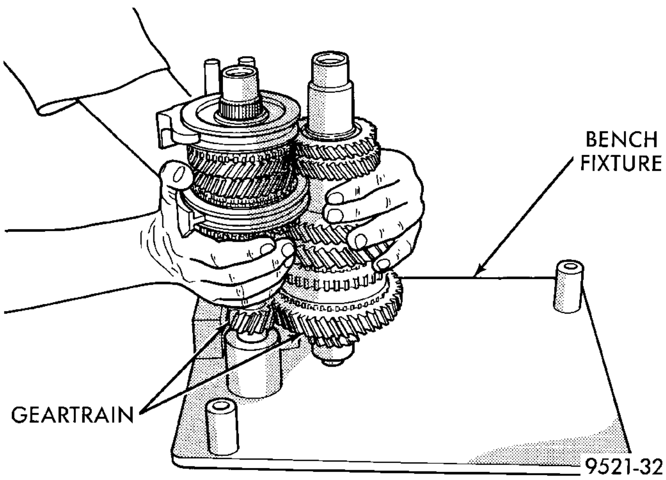


Fig. 57 Bench Fixture

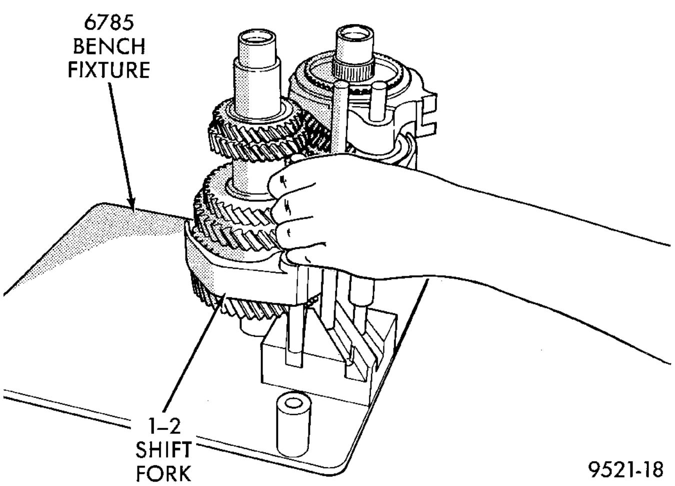


Fig. 58 Shift Rail Installation

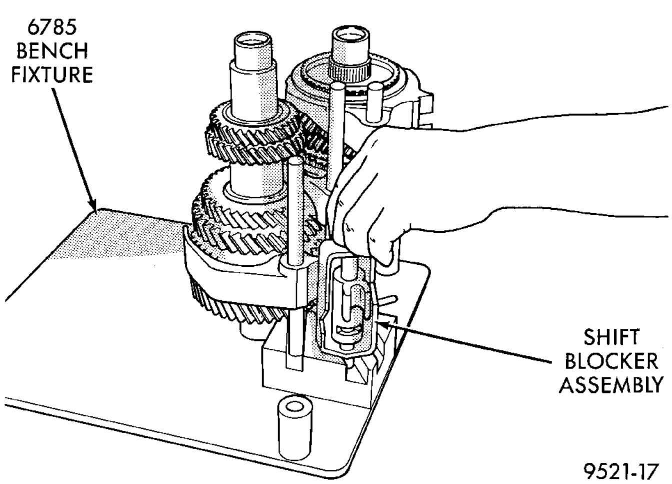


Fig. 59 Shift Blocker Installation

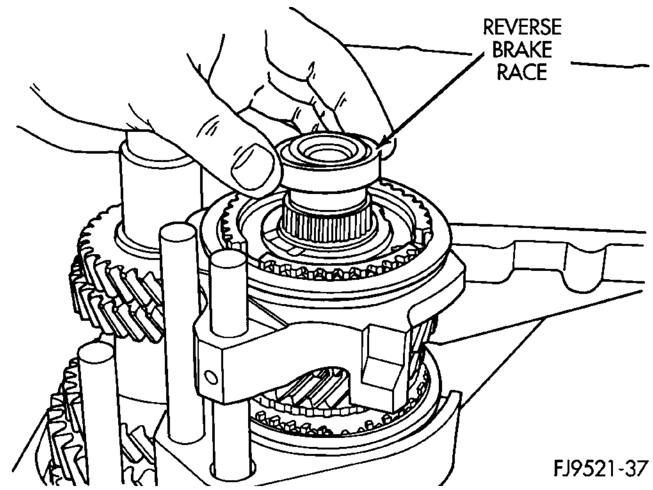


Fig. 60 Reverse Brake Race Installation

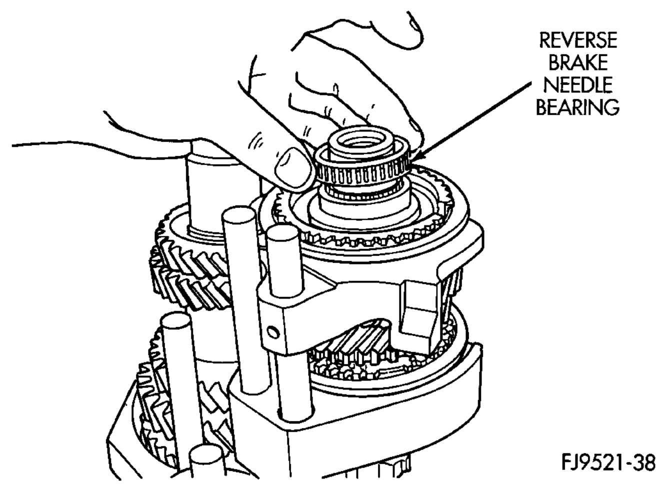


Fig. 61 Reverse Brake Needle Bearing

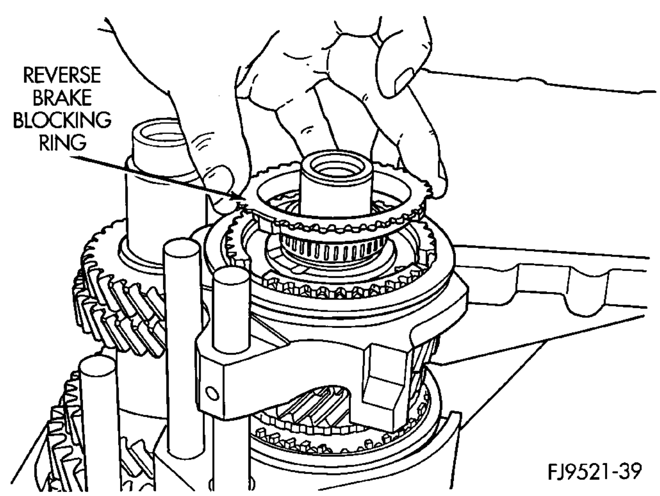


Fig. 62 Reverse Brake Blocking Ring Installation

(11) Position input and output bearings on the shafts. Using Miller tool C-4992-1, press on input and output shaft bearings until they bottom into the case and against the shafts (Fig. 67).

(12) Install shaft snap rings at input and output bearings (Fig. 68).

(13) Apply Mopar® RTV sealant to end–cover outer edge and around bolt holes. Install end–cover onto

DISASSEMBLY AND ASSEMBLY (Continued)

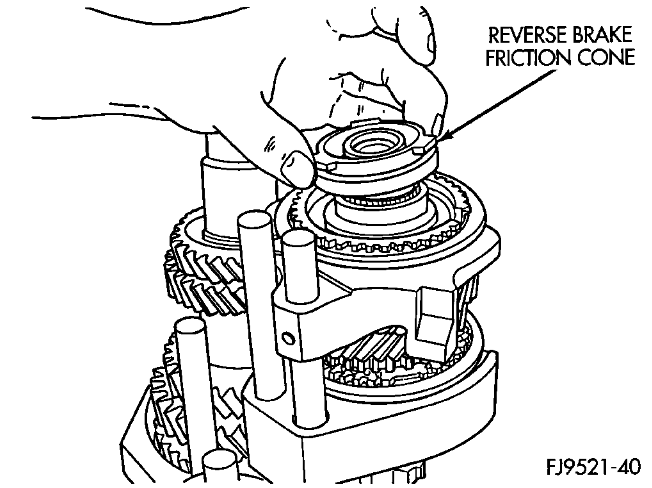


Fig. 63 Reverse Brake Friction Cone Installation

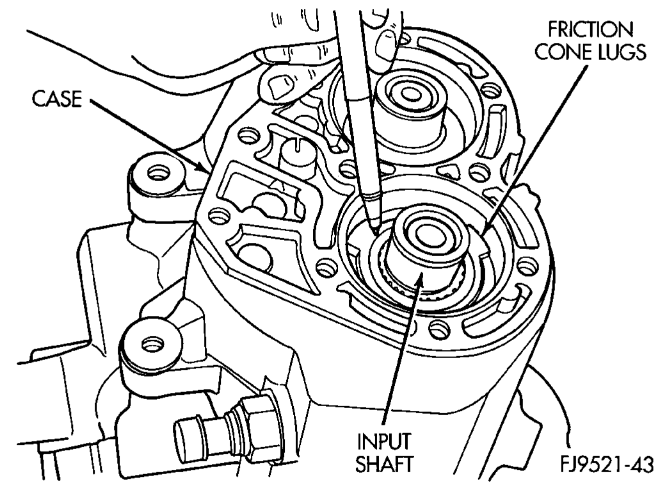


Fig. 66 Friction Cone Lugs

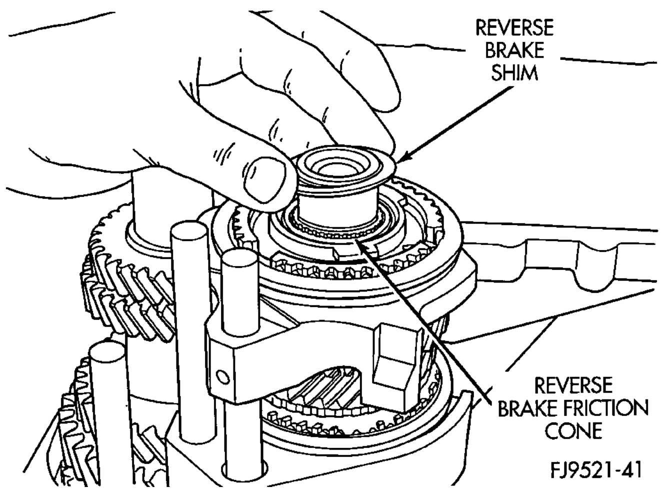


Fig. 64 Reverse Brake Shim

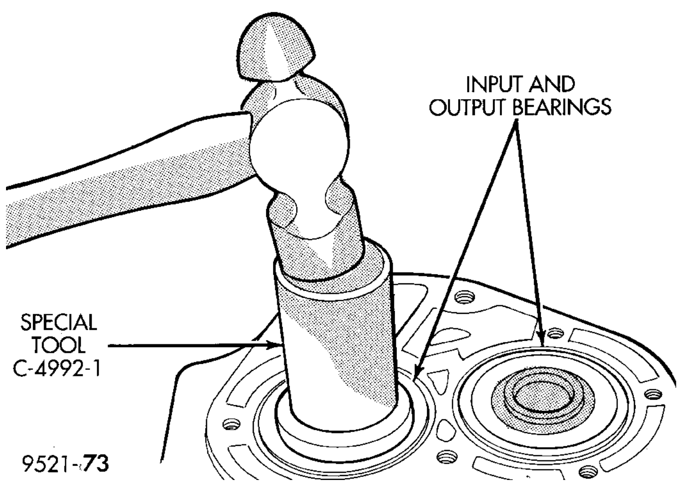


Fig. 67 Installing Input and Output Bearings

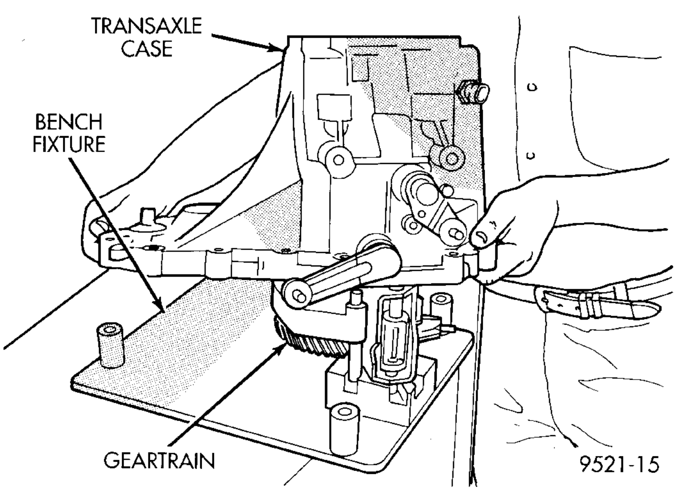


Fig. 65 Gear Case Half

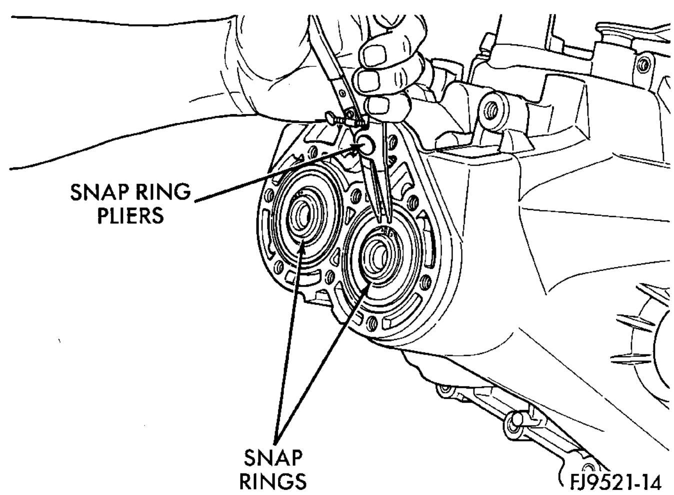


Fig. 68 Snap Rings Retaining Bearings

gear case. Tighten end cover bolts to 29 N·m (21 ft. lbs.) torque (Fig. 69).

(14) Remove gear case from bench fixture.

(15) Install gear case in a holding fixture with end cover facing down.

(16) Turn selector shaft into slot on blocker assembly (Fig. 70).

DISASSEMBLY AND ASSEMBLY (Continued)

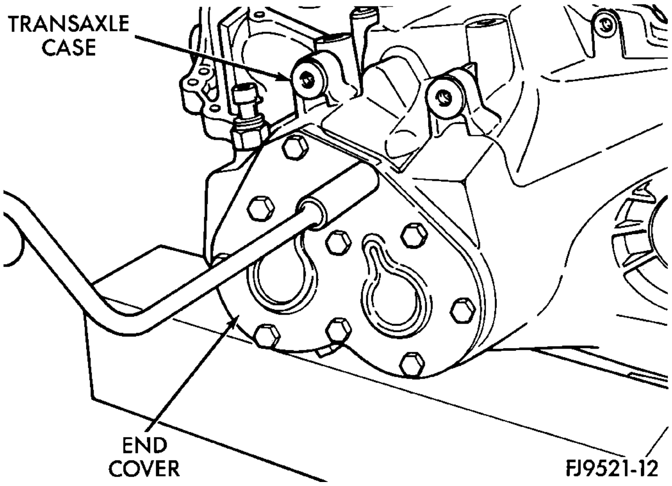


Fig. 69 Transaxle End Cover

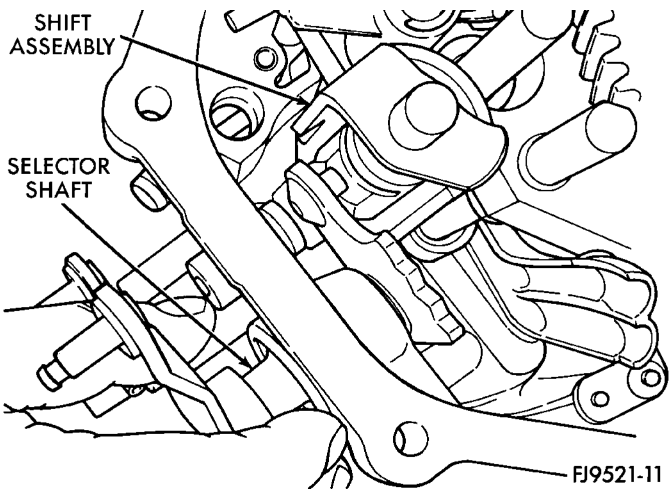


Fig. 70 Selector Shaft

(17) Push selector shaft spacer clip onto selector shaft. Install shift levers.

(18) Install reverse idler gear and shaft. Install bolt into shaft. Tighten bolt on shaft to 26 N·m (19 ft. lbs.) torque (Fig. 71) (Fig. 72).

(19) Install reverse fork bracket and reverse lock-out. Tighten screws to 11 N·m (96 in. lbs.) torque (Fig. 73) (Fig. 74).

(20) Install differential into gear case (Fig. 75).

BEARING ADJUSTMENT PROCEDURE

(1) Use extreme care when removing and installing bearing cups and cones. Use only an arbor press for installation, as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat gives 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.

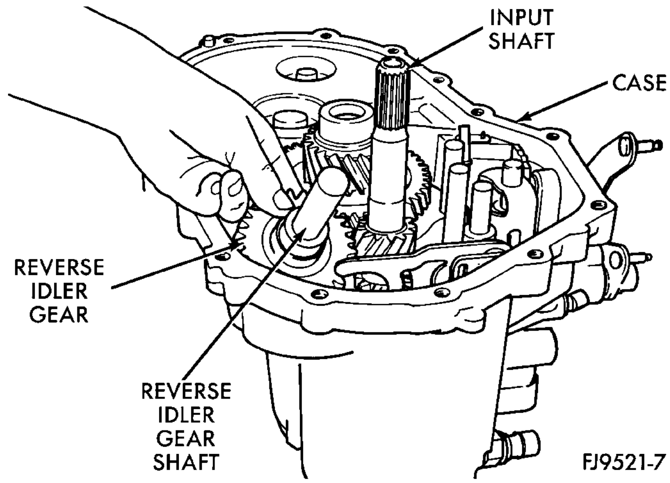


Fig. 71 Reverse Idler Gear

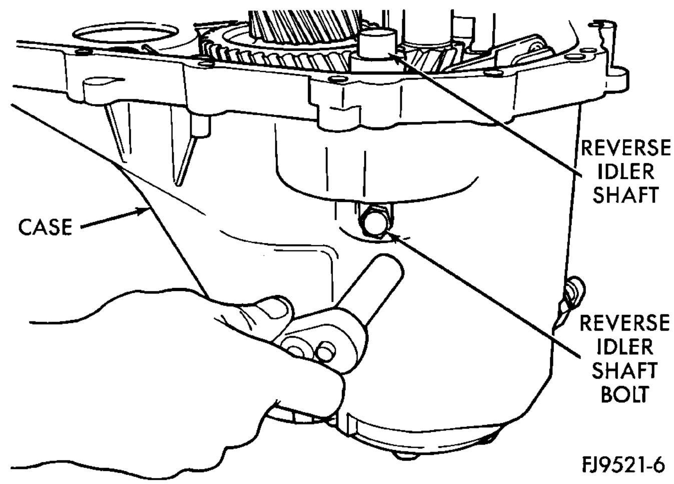


Fig. 72 Reverse Idler Shaft Bolt

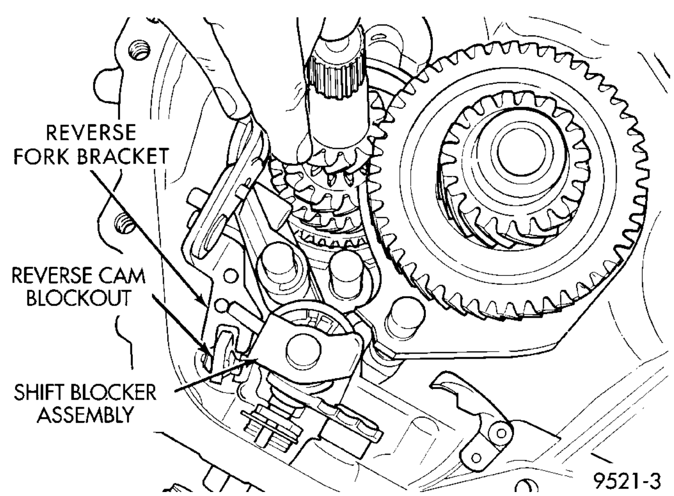


Fig. 73 Reverse Fork Bracket

(3) Bearing preload and drag torque specifications must be maintained to avoid premature bearing failures. Used (original) bearings may lose up to 50% of the original drag torque after break–in. All bearing

DISASSEMBLY AND ASSEMBLY (Continued)

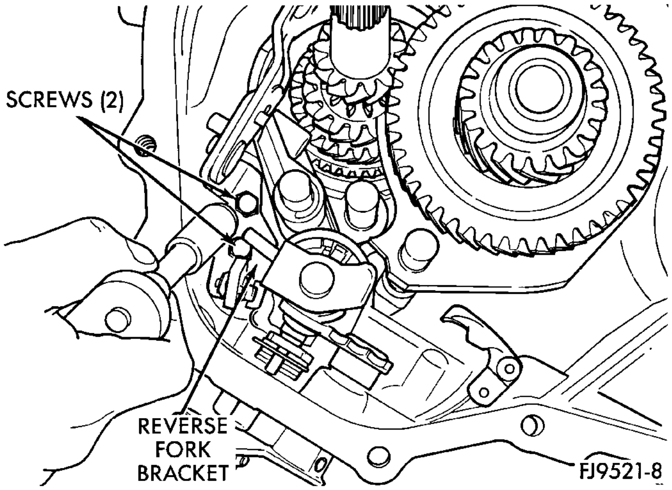


Fig. 74 Reverse Fork Screws

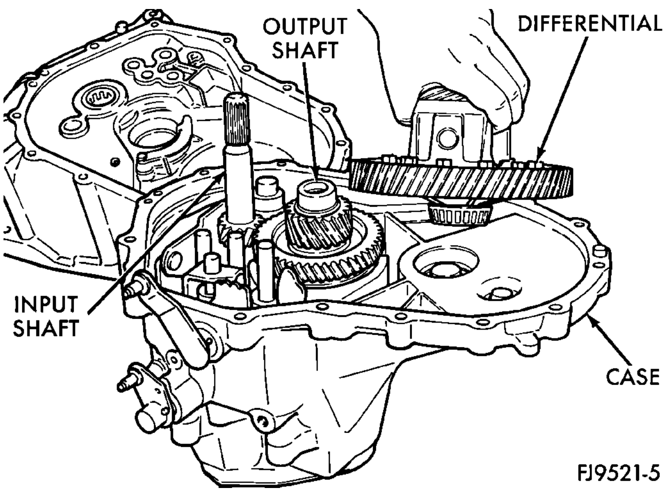


Fig. 75 Differential Assembly

adjustments must be made with no other component interference or gear intermesh.

(4) Replace bearings as a pair: If one differential bearing is defective, replace both differential bearings, 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.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

NOTE: True bearing turning–torque readings can be obtained only with the geartrain removed from the case.

(1) Remove bearing cup and existing shim from clutch bellhousing case.

(2) Press in new bearing cup into bellhousing case (or use a cup that has been ground down on the outer edge for ease of measurement).

(3) Press in new bearing cup into gear case side.

(4) Oil differential bearings with Mopar® type M.S. 9417 Manual Transaxle Fluid. Install differential assembly in transaxle gear case. Install clutch bellhousing over gear case. Install and torque case bolts to 29 N·m (21 ft. lbs.).

(5) Position transaxle with bellhousing facing down on workbench with C-clamps. Position dial indicator.

(6) 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 the dial indicator. To obtain end play readings, apply a medium load in an upward direction while rolling differential assembly back and forth (Fig. 76). Record end play.

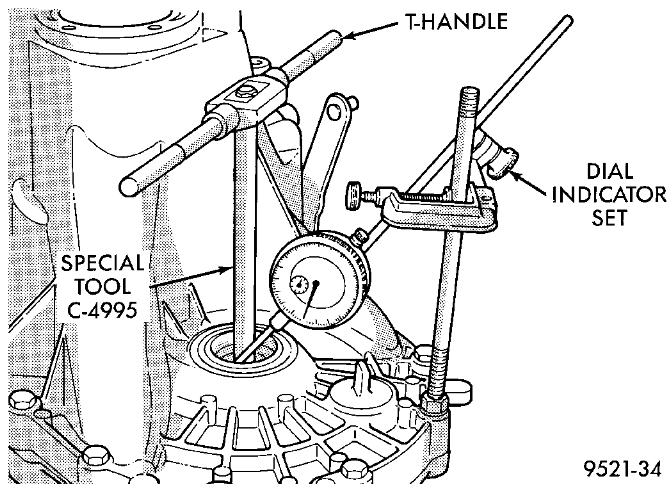


Fig. 76 Checking Differential Bearing End Play To Determine Shim Thickness

(7) The shim required for proper bearing preload is the **total of end play, plus (constant) preload of 0.18mm (0.007 in.).** Never combine shims to obtain the required preload.

(8) Remove case bolts. Remove clutch bellhousing differential bearing cup. Install shim(s) selected in Step 7. Then press the bearing cup into clutch bellhousing.

(9) Install clutch bellhousing. Install and torque case bolts to 26 N·m (19 ft. lbs.).

(10) Using Special Tool C-4995 and an inch-pound torque wrench, check turning torque of the differential assembly (Fig. 77). **The turning torque should be 6 to 12 in. lbs. If the turning torque is too high, install a 0.05mm (0.002 inch) thinner shim. If the turning torque is too low, install a 0.05mm (0.002 inch) thicker shim.**

(11) Recheck turning torque. Repeat Step 10 until the proper turning torque is obtained.

Once proper turning torque has been established, place gear case on the end plate. Draw a bead of Mopar® Gasket Maker, Loctite® 518, or equivalent,

DISASSEMBLY AND ASSEMBLY (Continued)

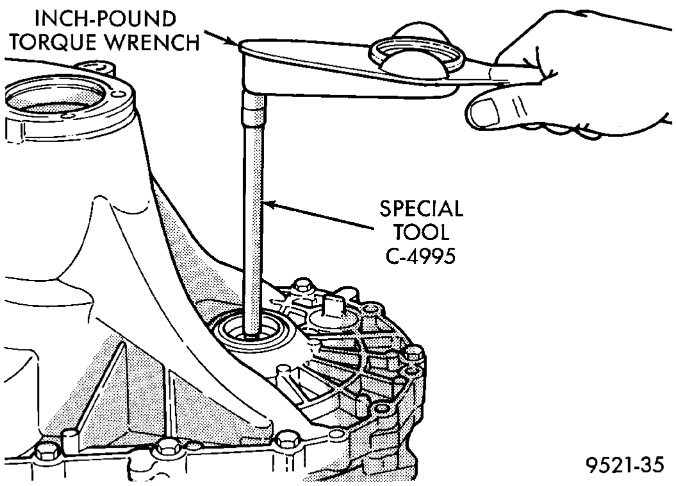


Fig. 77 Checking Differential Bearing Turning Torque

on the flat surface of the case mating flange. Install clutch bellhousing onto gear case. Install and tighten case bolts to 29 N·m (21 ft. lbs.).

INPUT SHAFT

DISASSEMBLY

Before disassembly of the input shaft, it is necessary to check the synchronizer stop ring gap. Use a feeler gauge to measure the gaps between the stop rings and the speed gears. The correct gaps are listed below:

- 1st—1.04-1.72 mm (0.041-0.069 in).
- 2nd—0.94-1.72 mm (0.038-0.069 in).
- 3rd—1.37-1.93 mm (0.054-0.076 in).
- 4th—1.41-1.97 mm (0.056-0.078 in).
- 5th—1.37-1.93 mm (0.054-0.076 in).

If a stop ring gap does not fall within the specifications, it must be inspected for wear and replaced. If the 1st or 2nd synchronizer stop ring is worn beyond specifications, the complete output shaft assembly must be replaced.

The input shaft incorporates the 3rd, 4th, and 5th speed gears and synchronizers on the assembly (Fig. 78).

(1) Install bearing splitter behind 5th speed gear. Remove snap ring at 5th synchronizer hub on input shaft (Fig. 79).

(2) Remove synchronizer and gear using shop press (Fig. 80).

(3) Remove caged needle bearing (Fig. 81).

(4) Remove 4-5 gears split thrust washer ring (Fig. 82).

(5) Remove split thrust washer (Fig. 83).

(6) Remove split thrust washer separation pin (Fig. 84).

(7) Remove 4th gear (Fig. 85).

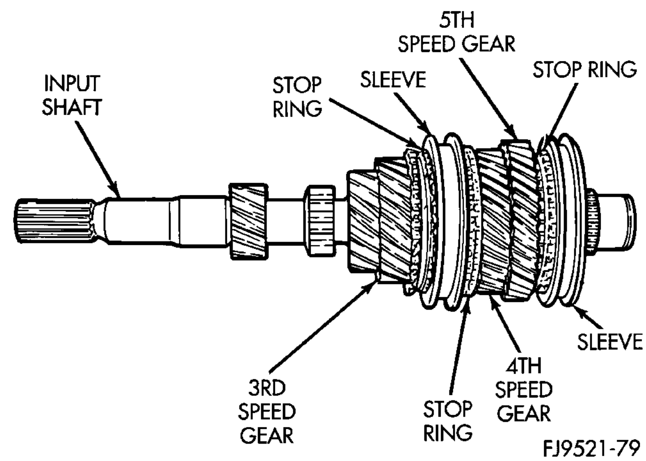


Fig. 78 Input Shaft

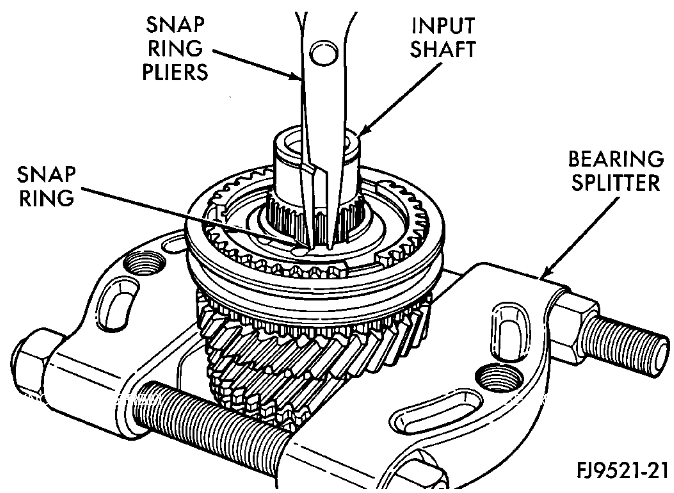


Fig. 79 5th Synchro and Hub Snap Ring Removal

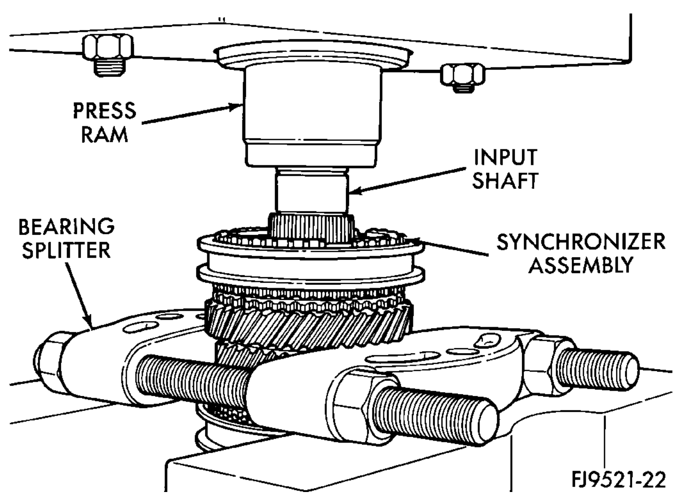


Fig. 80 Remove Synchronizer Using Shop Press

(8) Remove 4th gear caged needle bearing (Fig. 86). Check the caged needle bearing for a broken retention spring.

DISASSEMBLY AND ASSEMBLY (Continued)

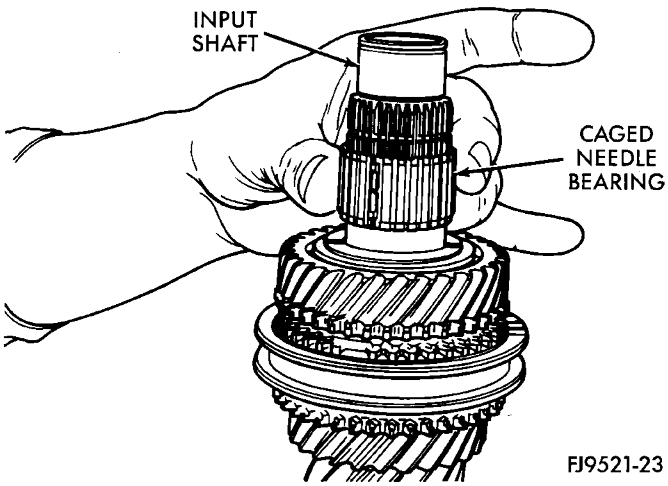


Fig. 81 Caged Needle Bearing Removal

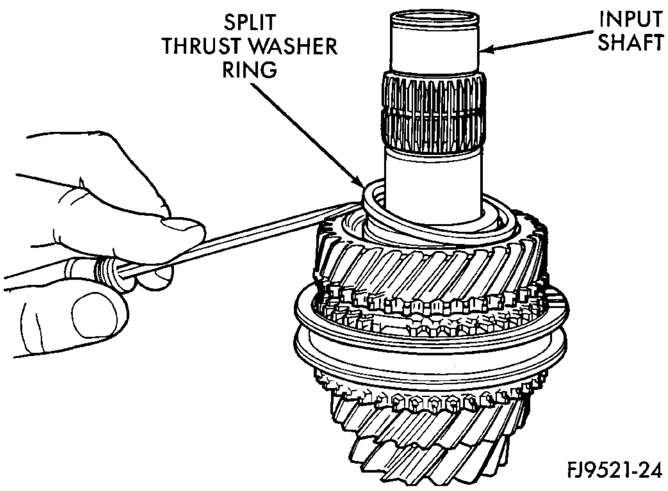


Fig. 82 Split Thrust Washer Ring Removal

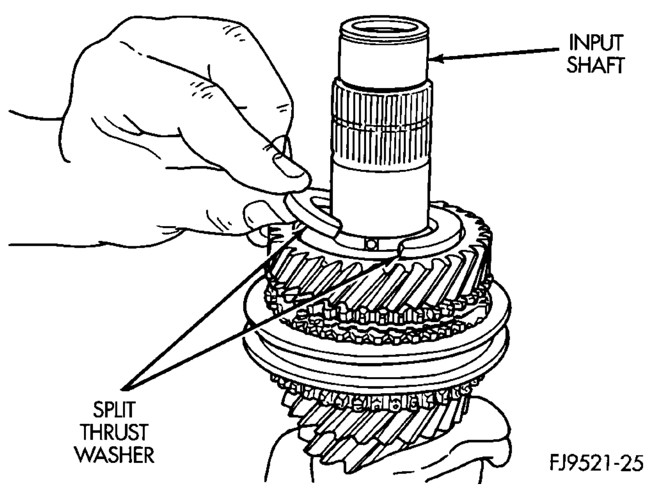


Fig. 83 Split Thrust Washer Removal

(9) Remove blocking ring. Remove 3-4 synchronizer hub retaining snap ring (Fig. 87).

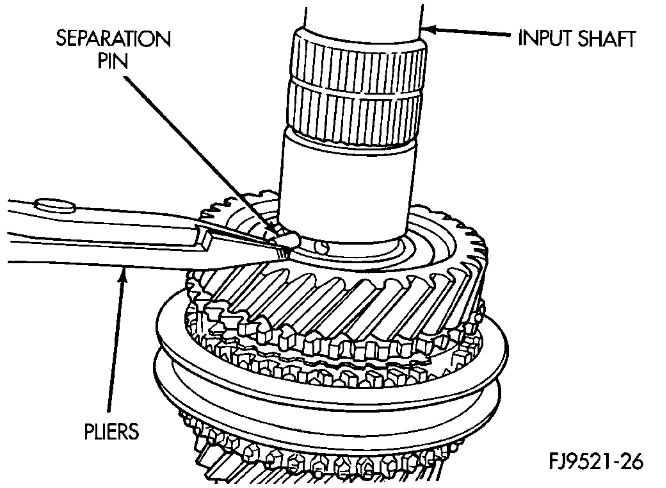


Fig. 84 Split Thrust Washer Separation Pin

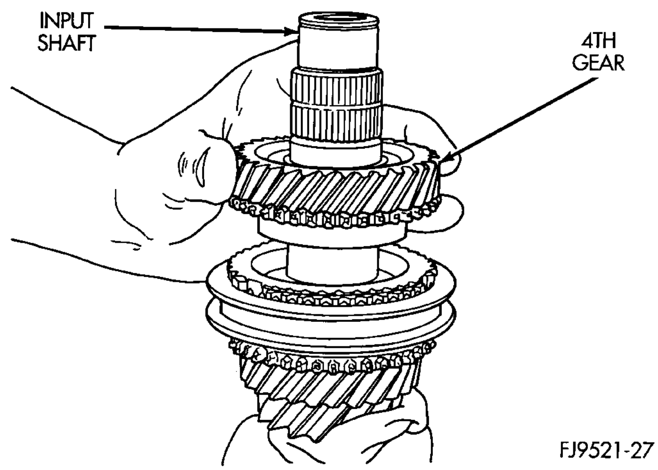


Fig. 85 4th Gear Removal

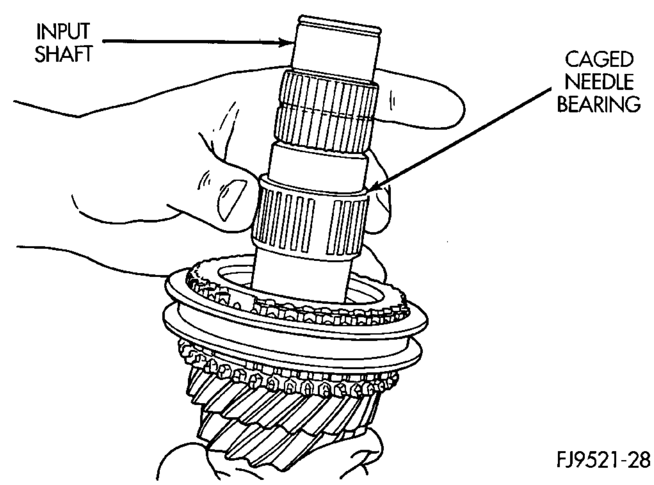


Fig. 86 Caged Needle Bearing Removal

(10) Install input shaft in shop press. Using bearing splitter, remove 3-4 synchronizer and 3rd gear (Fig. 88).

DISASSEMBLY AND ASSEMBLY (Continued)

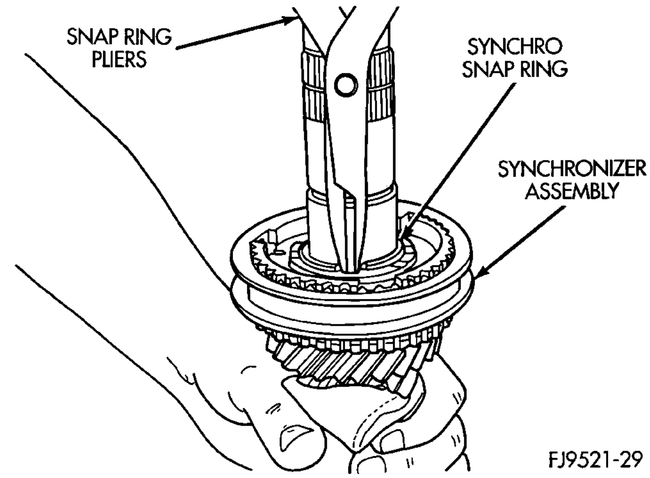


Fig. 87 3-4 Synchronizer Hub Snap Ring

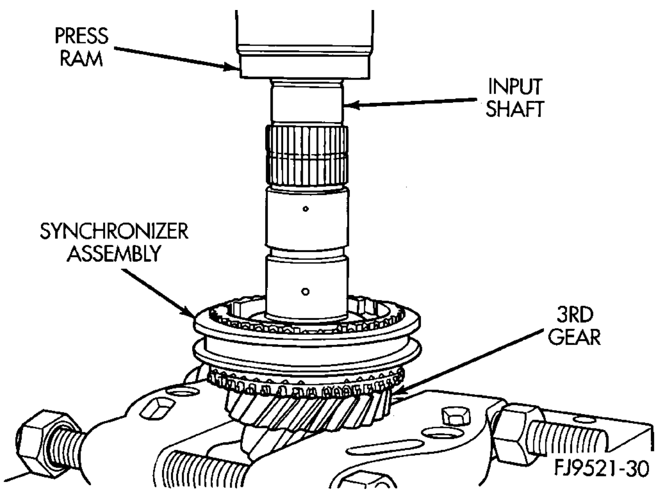


Fig. 88 3rd Gear Removal

(11) Remove 3rd gear caged needle bearing (Fig. 89). Check the caged needle bearing for a broken retention spring.

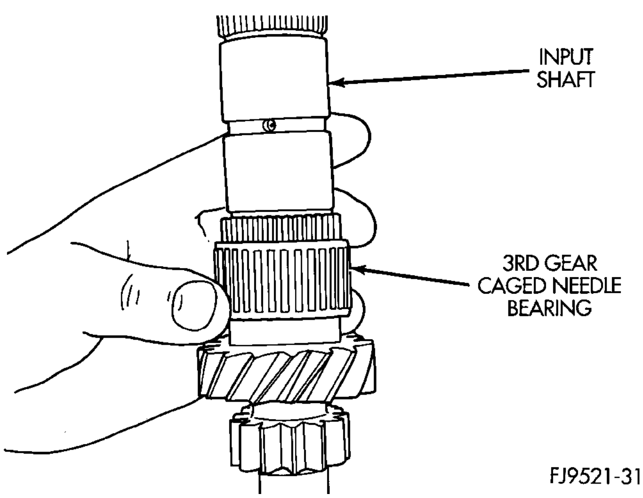


Fig. 89 3rd Gear Caged Needle Bearing

(12) Inspect the input shaft for worn or damaged bearing races or chipped gear teeth. Replace as necessary.

ASSEMBLY

The snap rings that are used on the input shaft are available in select fit sizes. Use the thickest snap ring that fits in each snap ring groove.

(1) Place input shaft into shop press.

(2) Install 3rd gear caged needle bearing on input shaft.

(3) Install 3rd gear and 3-4 synchronizer onto input shaft. Install Tool #C-3717 over input shaft and press on synchronizer hub and 3rd gear (Fig. 90). The synchronizer hub has the letter **U** stamped on the top face of the hub. This designates that the hub must be installed with the **U** facing upward.

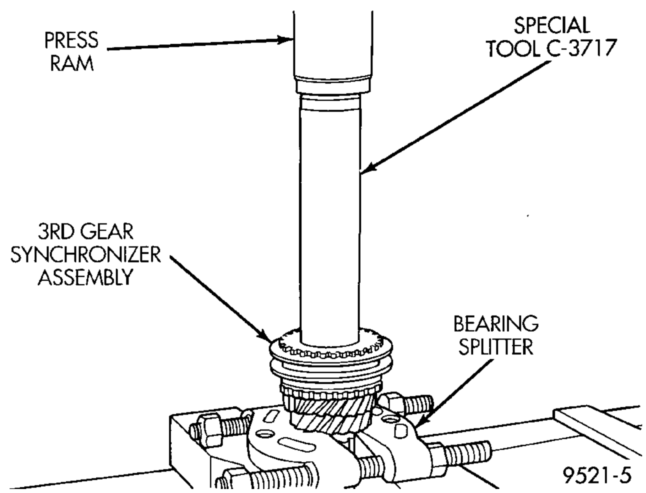


Fig. 90 Press On 3rd Gear Synchronizer Hub

(4) Install 3-4 synchronizer snap ring into slot on input shaft.

(5) Install blocking ring into 3-4 synchronizer. Install 4th gear caged needle bearing.

(6) Install 4th gear onto input shaft.

(7) Install 4-5 split thrust washer separation pin (Fig. 91).

(8) Install split thrust washer onto input shaft (Fig. 92).

(9) Install split thrust washer retaining ring (Fig. 93).

(10) Install 5th gear caged needle bearing (Fig. 94).

(11) Using special tool #C-3717, install 5th speed gear and synchronizer (Fig. 95). The 5th gear synchronizer hub has the letter **S** stamped on the top face of the hub. This designates that the hub must be installed with the **S** facing upward.

(12) Install 5th gear synchronizer snap ring (Fig. 96).

DISASSEMBLY AND ASSEMBLY (Continued)

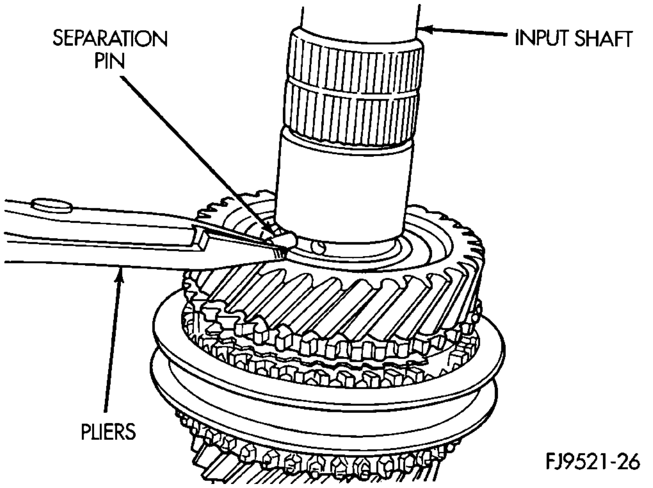


Fig. 91 Split Thrust Washer Separation Pin Installation

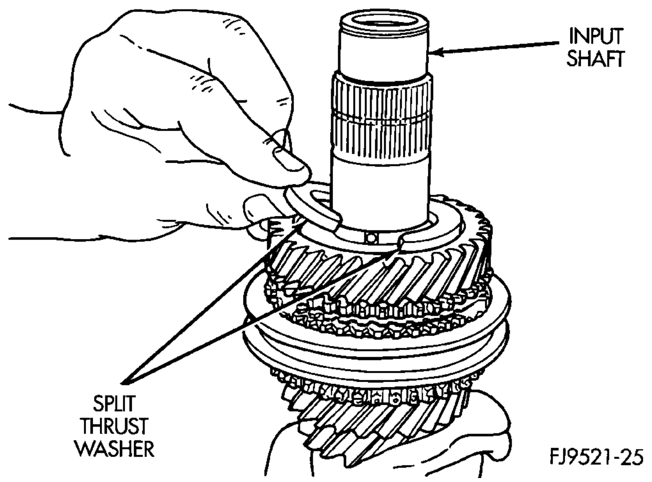


Fig. 92 Split Thrust Washer Installation

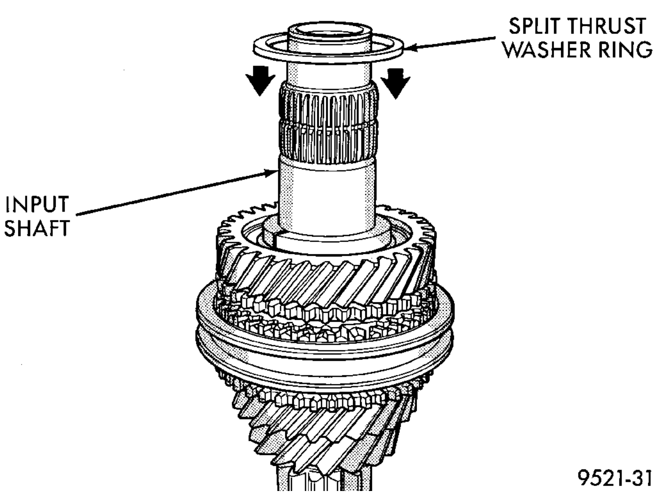


Fig. 93 Retaining Ring Installation

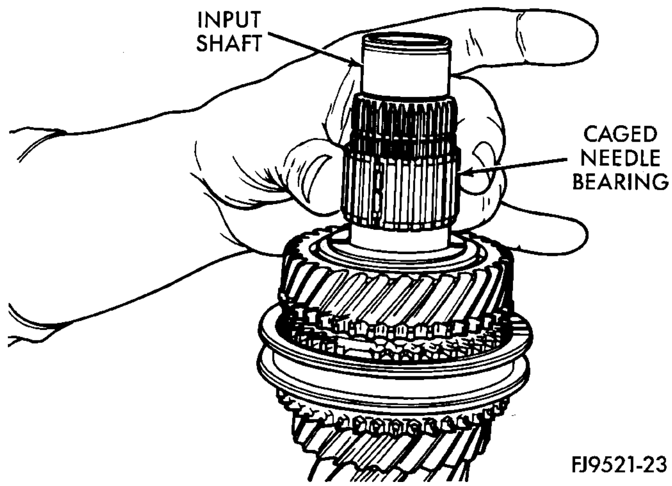


Fig. 94 Caged Needle Bearing Installation

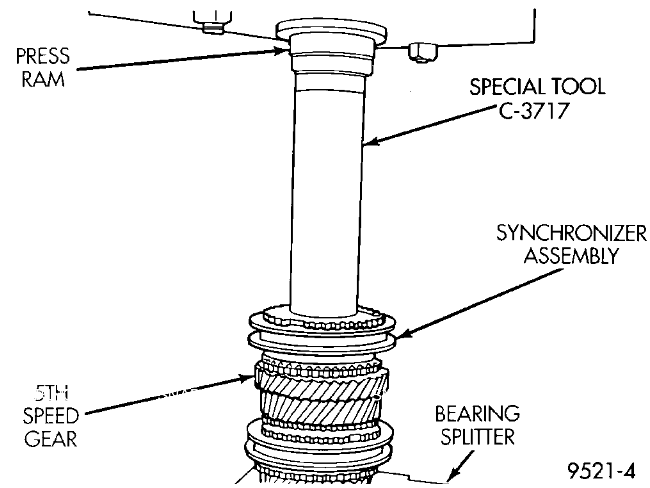


Fig. 95 5th Speed Gear Installation

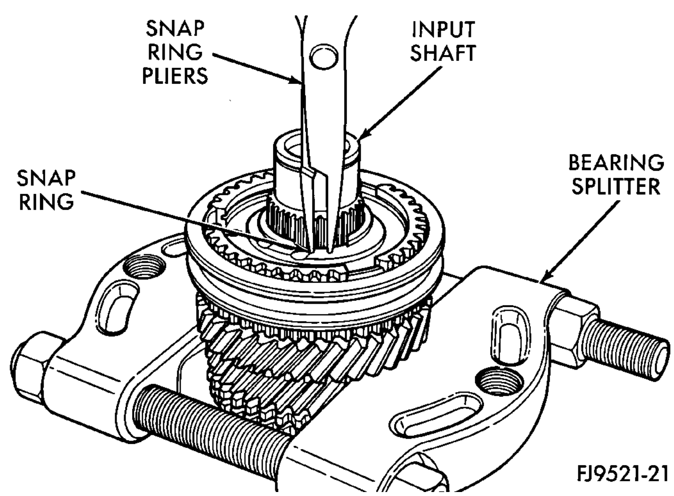


Fig. 96 5th Gear Synchronizer Snap Ring Installation

DISASSEMBLY AND ASSEMBLY (Continued)

OUTPUT SHAFT

CAUTION: The output shaft is serviced as an assembly. Do not try to repair any component on the output shaft. If the 1-2 synchronizer or gear fails, it is necessary to replace the output shaft assembly.

It is necessary to check the synchronizer stop ring gap. Use a feeler gauge to measure the gaps between the stop rings and the speed gears. The correct gaps are listed below:

- 1st—1.04-1.72 mm (0.041-0.069 in).
- 2nd—0.94-1.72 mm (0.038-0.069 in).
- 3rd—1.37-1.93 mm (0.054-0.076 in).
- 4th—1.41-1.97 mm (0.056-0.078 in).
- 5th—1.37-1.93 mm (0.054-0.076 in).

If a stop ring gap does not fall within the specifications it must be inspected for wear and replaced. If the 1st or 2nd synchronizer stop ring is worn beyond specifications, the complete output shaft assembly must be replaced.

The output shaft incorporates the 1st and 2nd gears and synchronizers on the assembly (Fig. 97).

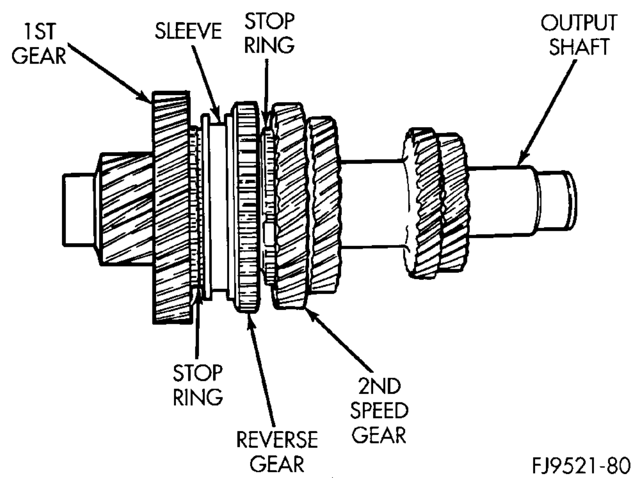


Fig. 97 Output Shaft

DIFFERENTIAL

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle gear case
- Clutch bellhousing case
- Differential case
- Differential bearings

Refer to **Bearing Adjustment Procedure** in the Adjustments section at the end of this section to determine proper shim thickness. This will provide correct bearing preload and proper bearing turning torque.

DIFFERENTIAL BEARINGS

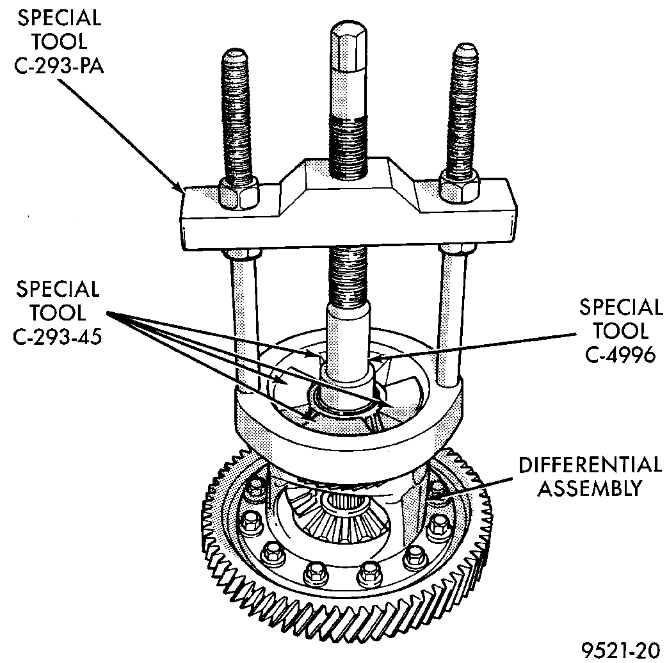


Fig. 98 Remove Differential Bearing Cone

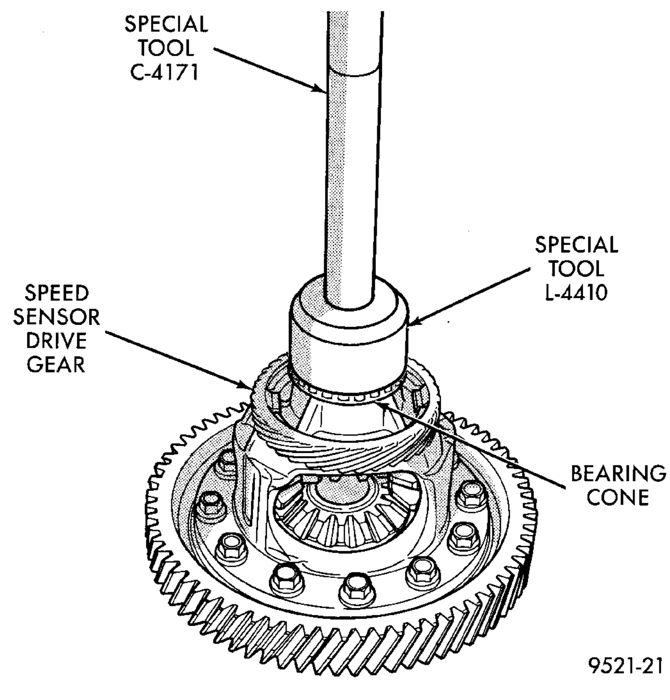


Fig. 99 Install Differential Bearing Cone

DISASSEMBLY AND ASSEMBLY (Continued)

RING GEAR

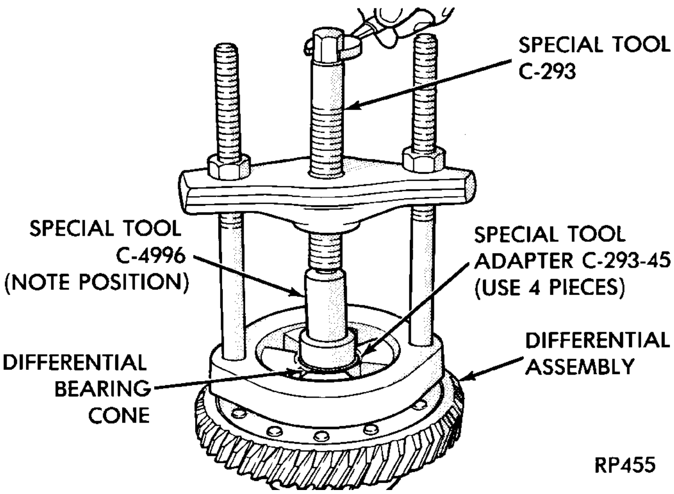


Fig. 100 Remove Differential Bearing Cone

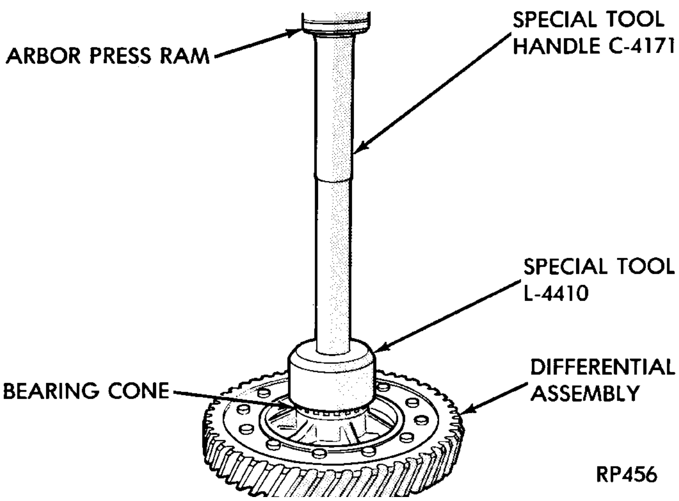


Fig. 101 Install Differential Bearing Cone

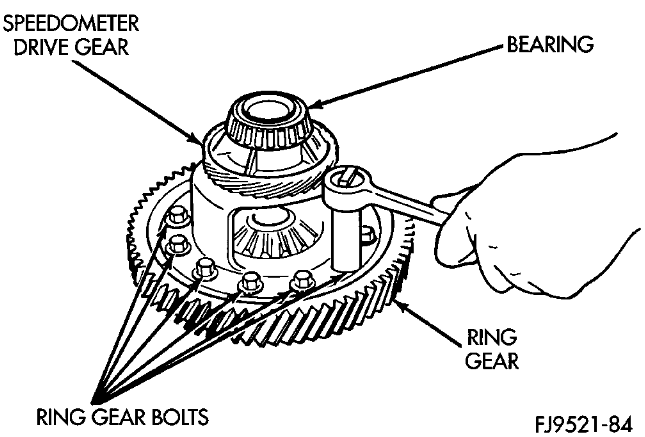


Fig. 102 Remove or Install Ring Gear Bolts and Ring Gear

CAUTION: Always install new ring gear bolts. Tighten ring gear bolts to 81 N·m (60 ft. lbs.) torque.

SPEEDOMETER DRIVE GEAR

NOTE: The plastic speedometer drive gear must be removed from the differential case in order to service the differential gears

REMOVAL

(1) Pry the plastic speedometer drive gear off of the differential case using a flat blade pry tool (Fig. 103) (Fig. 104).

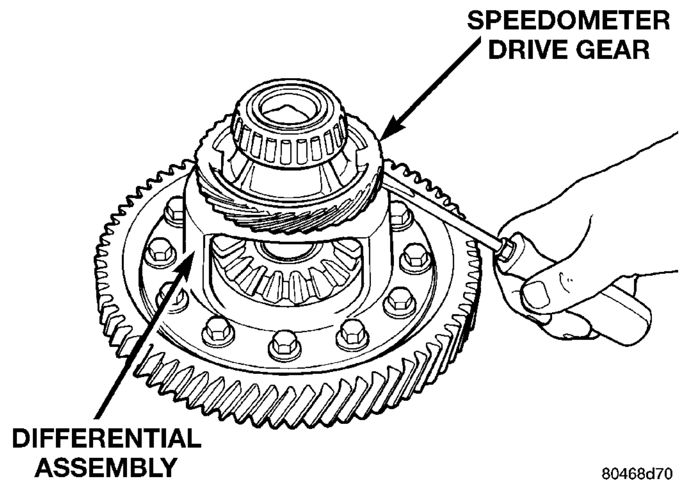


Fig. 103 Pry Off Speedometer Drive Gear

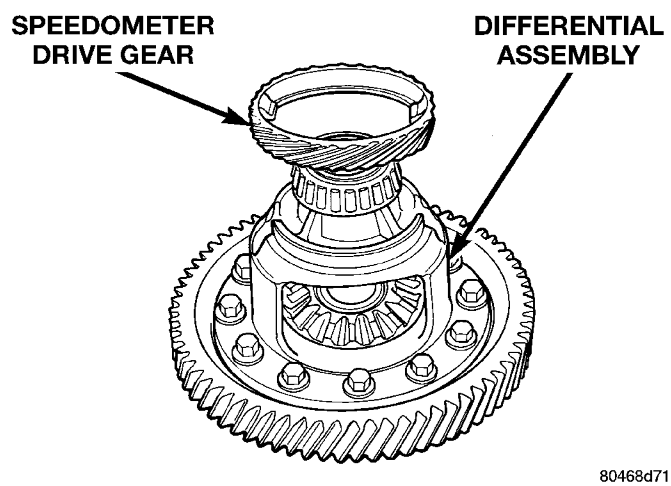


Fig. 104 Speedometer Drive Gear Removed

INSTALLATION

NOTE: A new speedometer drive gear must be installed on differential assembly. The lip on the speedometer drive gear must be positioned downward when installing onto differential assembly.

DISASSEMBLY AND ASSEMBLY (Continued)

(1) Position speedometer drive gear onto differential assembly (Fig. 105).

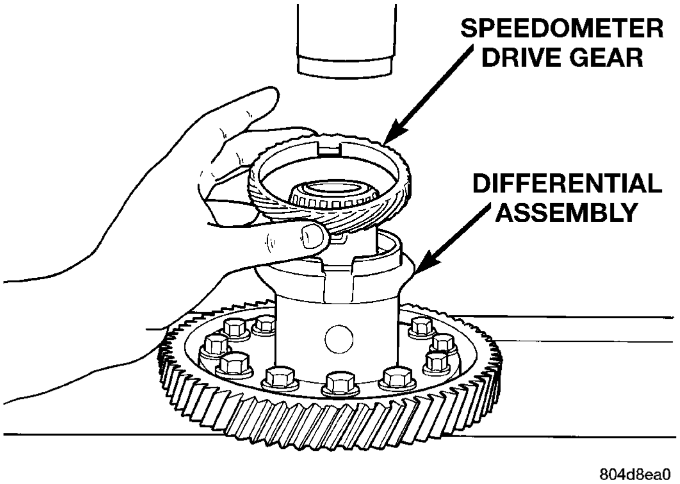


Fig. 105 Speedometer Drive Gear

(2) Using Miller Tool # L-4440 and steel stock, press speedometer drive gear onto differential (Fig. 106) (Fig. 107). Do not use a hammer.

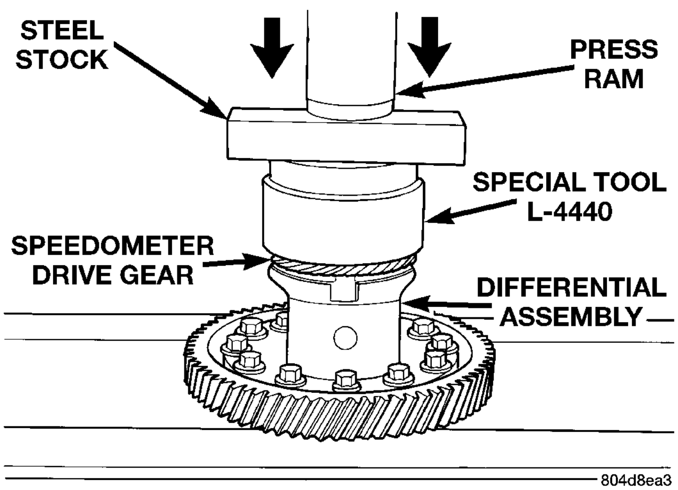


Fig. 106 Press Gear onto Diferential

DIFFERENTIAL GEARS

NOTE: The plastic speedometer drive gear must be removed from the differential case in order to service the differential gears. Refer to Speedometer Drive Gear for service information.

REMOVAL

(1) Remove pinion shaft retaining pin (Fig. 108) (Fig. 109).

(2) Remove pinion shaft (Fig. 110).

(3) Rotate side gears to opening in differential (Fig. 111).

(4) Remove differential gears (Fig. 112).

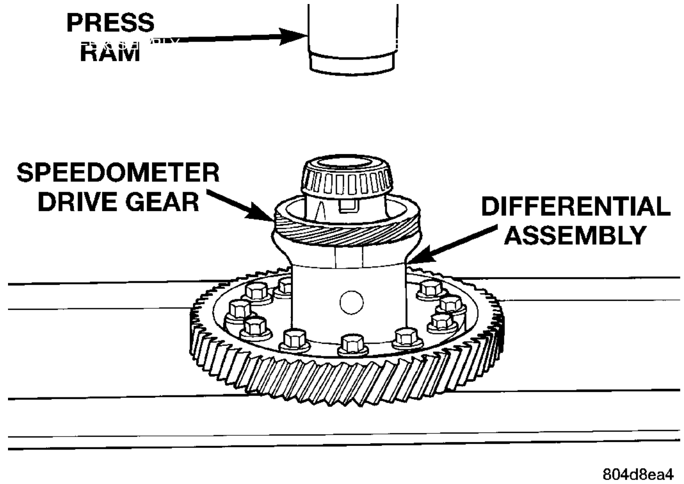


Fig. 107 Drive Gear Pressed onto Differential

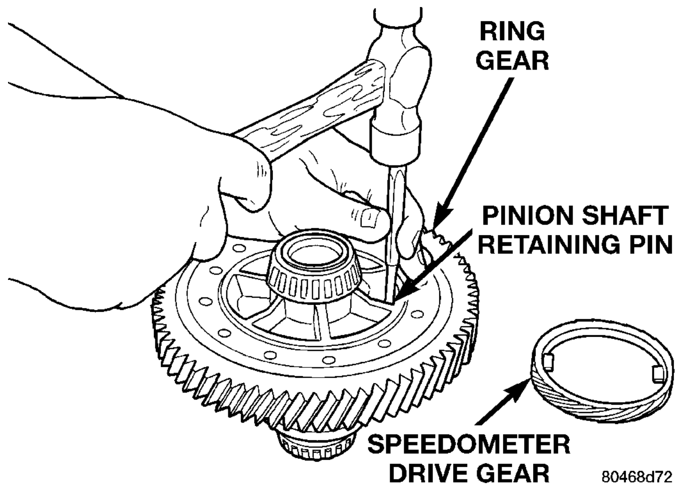


Fig. 108 Remove Pinion Shaft Retaining Pin

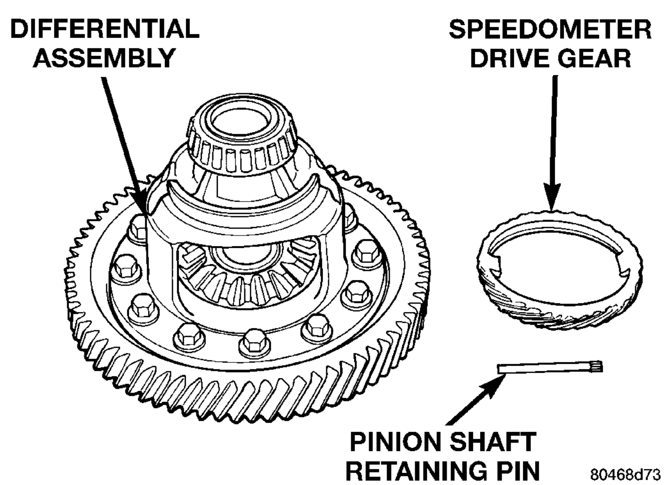


Fig. 109 Retaining Pin Removed

INSTALLATION

(1) Assemble the differential side gears, pinion gears and pinion gears with the pinion gear washers.

(2) Install pinion shaft retaining pin (Fig. 113).

DISASSEMBLY AND ASSEMBLY (Continued)

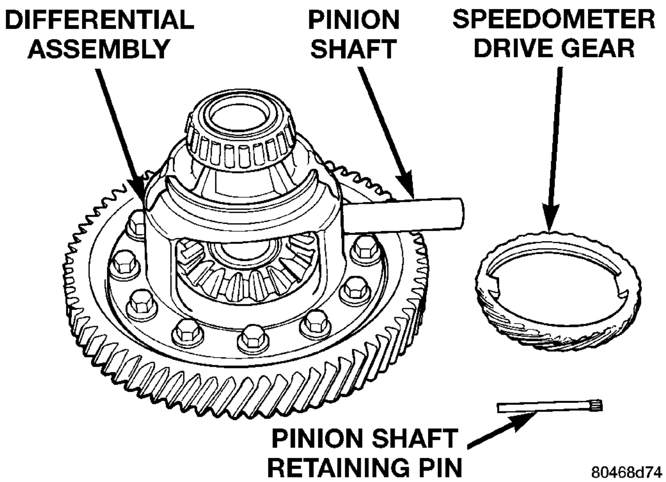


Fig. 110 Pinion Shaft Removal

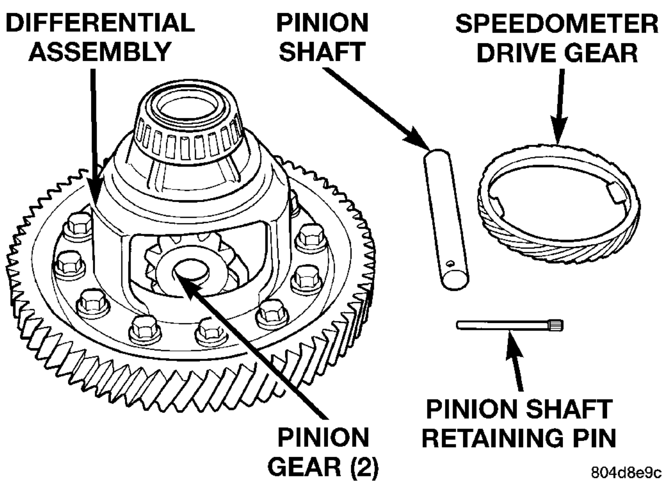


Fig. 111 Remove Pinion Gears, Side Gears, and Thrust Washers by Rotating Side Gears to Opening in Case

(3) Stake pinion shaft retaining pin with a suitable chisel (Fig. 114).

(4) Rotate the assembly two full revolutions both clockwise and counterclockwise.

(5) Set up dial indicator as shown and record end play (Fig. 115) (Fig. 116). Rotate side gear 90 degrees and record another end play. Again, rotate side gear 90 degrees and record a final end play.

(6) Using the smallest end play recorded, shim that side gear to within 0.001 to 0.013 inch. The other side gear should be checked using the same procedure.

CAUTION: Side gear end play must be within 0.001 to 0.013 inch. Five select thrust washers are available: 0.027, 0.032, 0.037, 0.042, and 0.047 inch.

(7) After the end play is measured and adjusted, replace speedometer drive gear with a new one. Install drive gear lip downward. For service information, refer to Speedometer Drive Gear service in this section.

SYNCHRONIZER

DISASSEMBLY

Place synchronizer in a clean shop towel and wrap. Press on inner hub. Carefully open up shop towel and remove springs, balls, keys, hub, and sleeve.

ASSEMBLY

(1) Position synchronizer hub onto a suitable holding fixture (input shaft). The synchronizer hubs are directional. The hubs must be installed with the **U** facing upward.

(2) Install springs into hub slot (Fig. 117).

(3) Insert key into hub and spring.

(4) Apply petroleum jelly to the hole in the key. Insert balls into each key (Fig. 118).

(5) Slide sleeve over the hub and depress balls as you carefully slip the sleeve into position (Fig. 119).

(6) Line up stop ring tang over the keys in the hub (Fig. 120). Install stop rings. Center the keys and balls by pushing on both stop rings.

SHIFT RAILS OVERHAUL

(1) Remove shift rails from the geartrain.

(2) To service the 5-R shift rail, remove the C-clip retaining the reverse shift lever arm. Remove the 5th shift fork roll pin and remove the 5th shift fork. Remove the shift lug roll pin and remove the shift lug. Replace parts as necessary.

(3) To service the 3-4 shift rail, remove the roll pin retaining the 3-4 shift fork. Remove the shift fork. Remove the shift lug roll pin and remove the shift lug. Replace parts as necessary.

(4) To service the 1-2 shift rail, remove the roll pin retaining the 1-2 shift fork. Remove the shift fork and replace parts as necessary.

TRANSAXLE CASE OVERHAUL

The sealant used to seal the transaxle case halves is Mopar® Gasket Maker, Loctite® 518, or equivalent. The sealant used for the bearing end–plate cover is Mopar® RTV.

The components that are left in the gear cases when the gear train is pulled out are the:

- Axle shaft seals
- Output bearing race and retainer
- Input bearing and sleeve
- Differential bearing cones
- Shift rail bushings
- Shift shafts
- Shift shaft seals
- Shift shaft bushings
- Rear bearing oil feed trough

DISASSEMBLY AND ASSEMBLY (Continued)

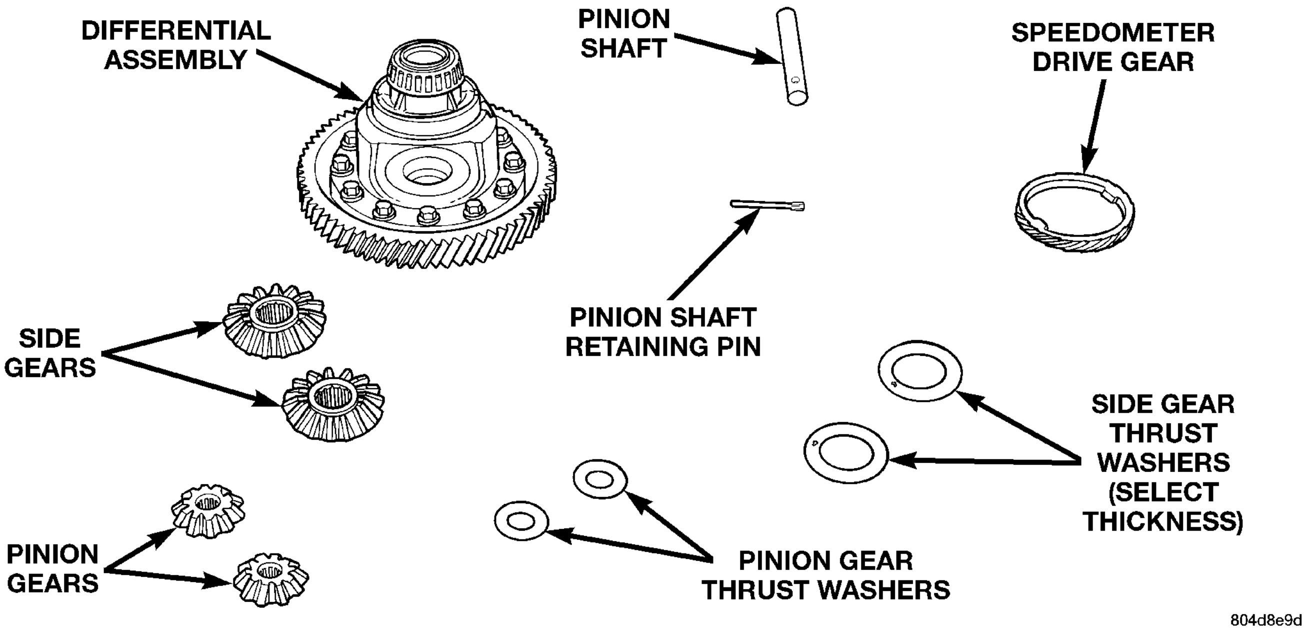


Fig. 112 Differential Gears

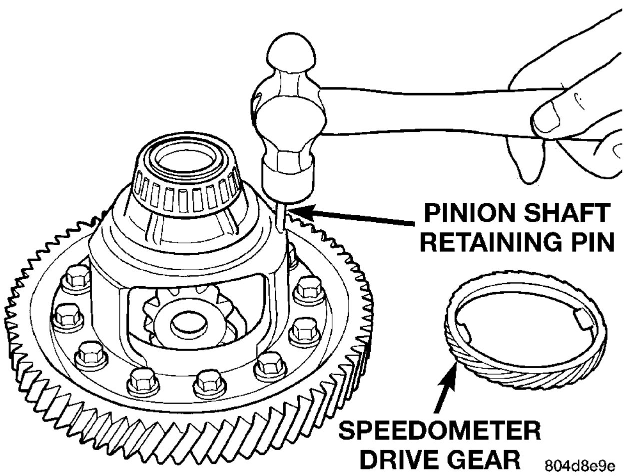


Fig. 113 Install Retaining Pin

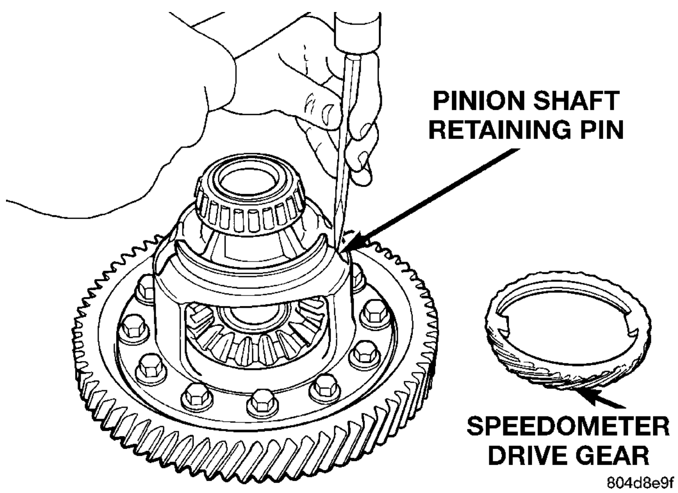


Fig. 114 Staking Retaining Pin

AXLE SHAFT SEALS

REMOVAL

(1) Insert a flat–blade pry tool at outer edge of axle shaft seal (Fig. 121).

(2) Tap on the pry tool with a small hammer and remove axle shaft seal.

INSTALLATION

(1) Clean axle shaft seal bore of any excess sealant.

(2) Align axle shaft seal with axle shaft seal bore.

(3) Install axle seal on tool #6709 with C-4171 and insert into axle shaft seal bore.

(4) Tap seal into position (Fig. 122).

OUTPUT BEARING

REMOVAL

NOTE: The position of the output shaft bearing is critical. The bearing is not identical end–to–end. Install bearing with larger diameter cage ring facing out.

(1) Remove caged roller bearing from output bearing race (Fig. 123).

(2) Remove screws at output bearing retainer strap (Fig. 124).

(3) Install tool #6787 and slide hammer (Fig. 125). Tighten tool to output bearing race.

DISASSEMBLY AND ASSEMBLY (Continued)

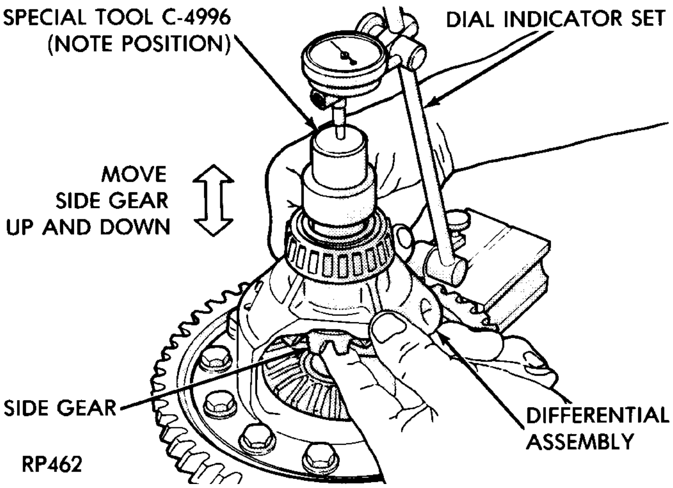


Fig. 115 Checking Side Gear End Play (Typical)

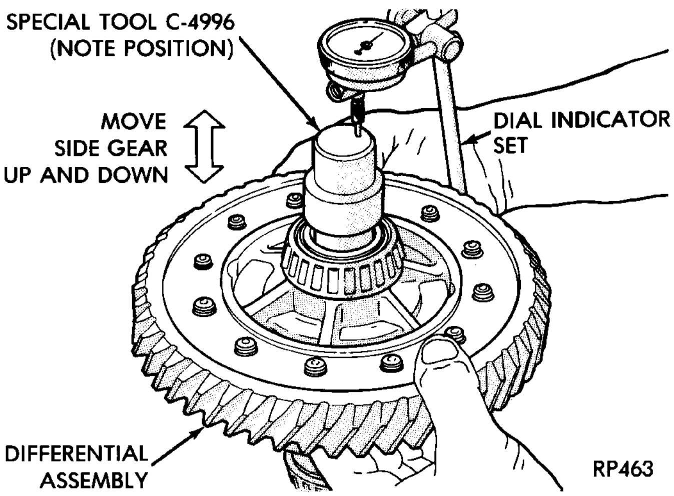


Fig. 116 Checking Side Gear End Play (Typical)

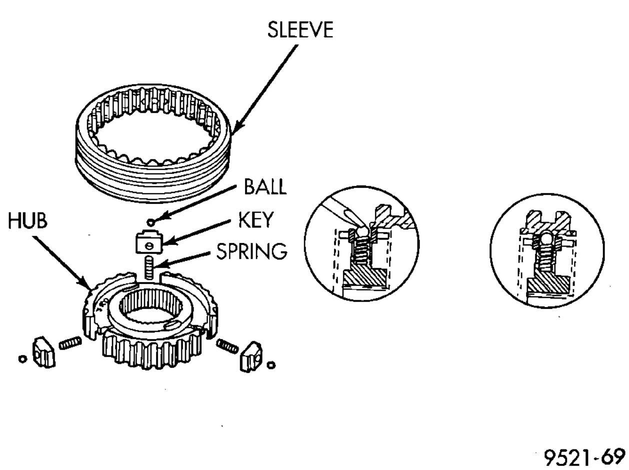


Fig. 117 Synchronizer Assembly

(4) Using slide hammer, remove output bearing race.

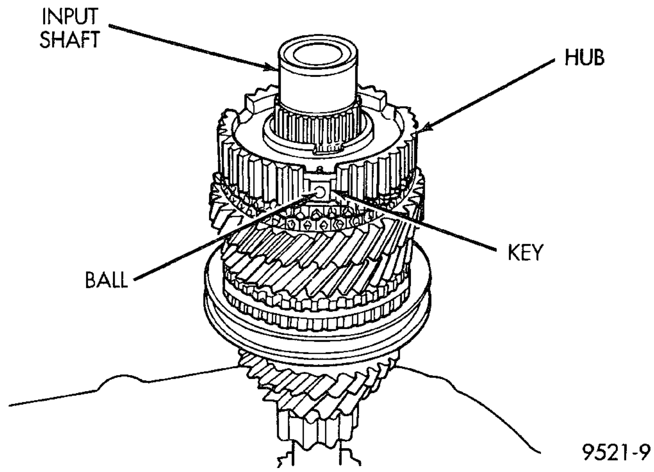


Fig. 118 Synchronizer Balls

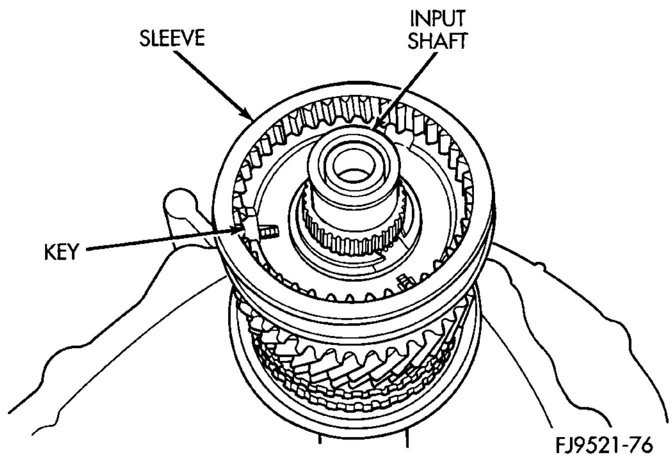


Fig. 119 Synchronizer Sleeve

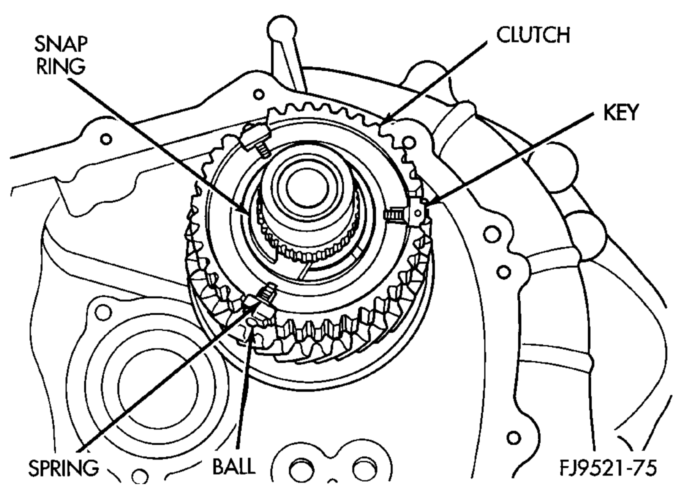


Fig. 120 Keys in Hub

INSTALLATION

(1) Line up output bearing race to race bore.

(2) Insert tool #4628 with C-4171 into output bearing race (Fig. 126). Tap race into bore. Install output bearing into race. Verify that the larger diameter

DISASSEMBLY AND ASSEMBLY (Continued)

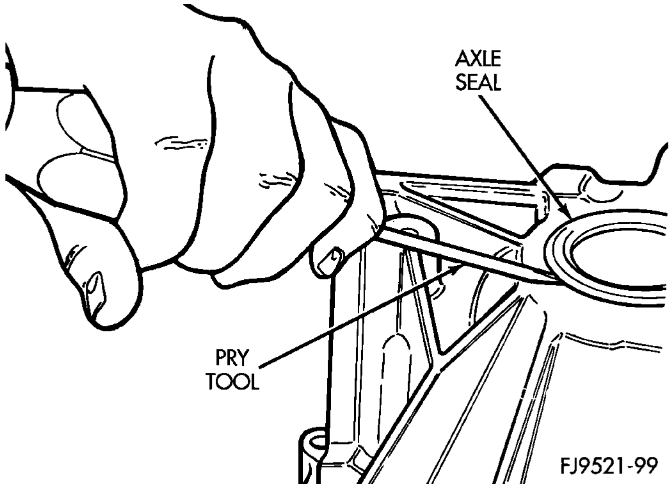


Fig. 121 Axle Shaft Seal Removal

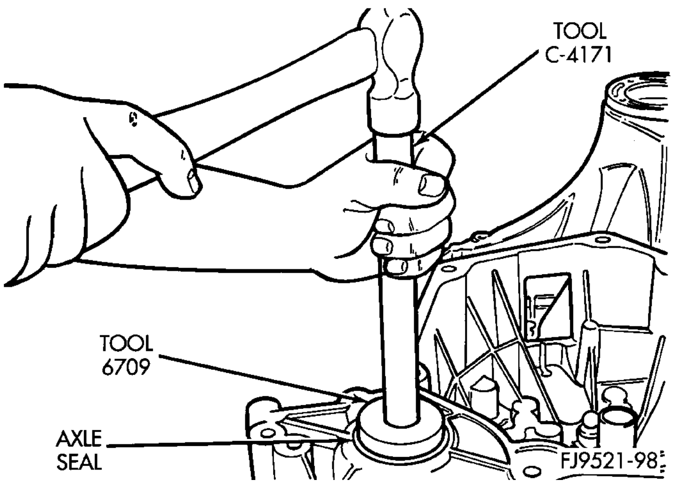


Fig. 122 Axle Seal Installation

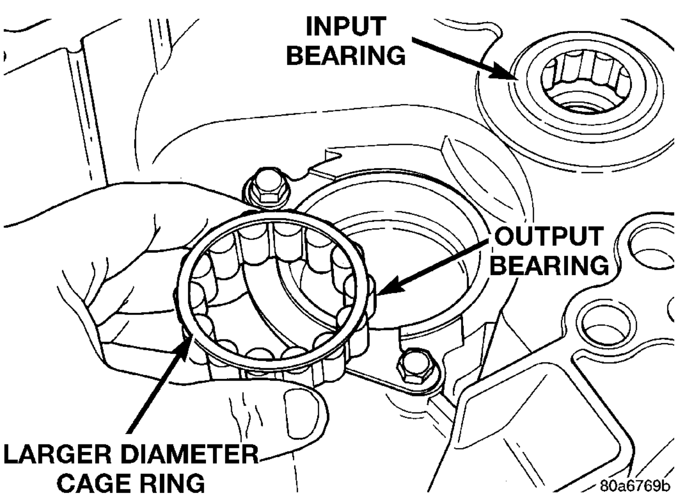


Fig. 123 Output Roller Bearing

cage is facing outward. Position bearing retaining strap. Tighten bolts to 11 N·m (96 in. lbs.).

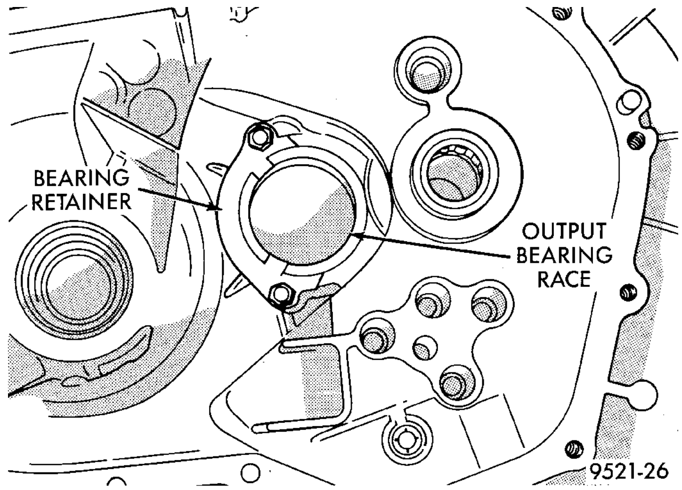


Fig. 124 Output Bearing Strap

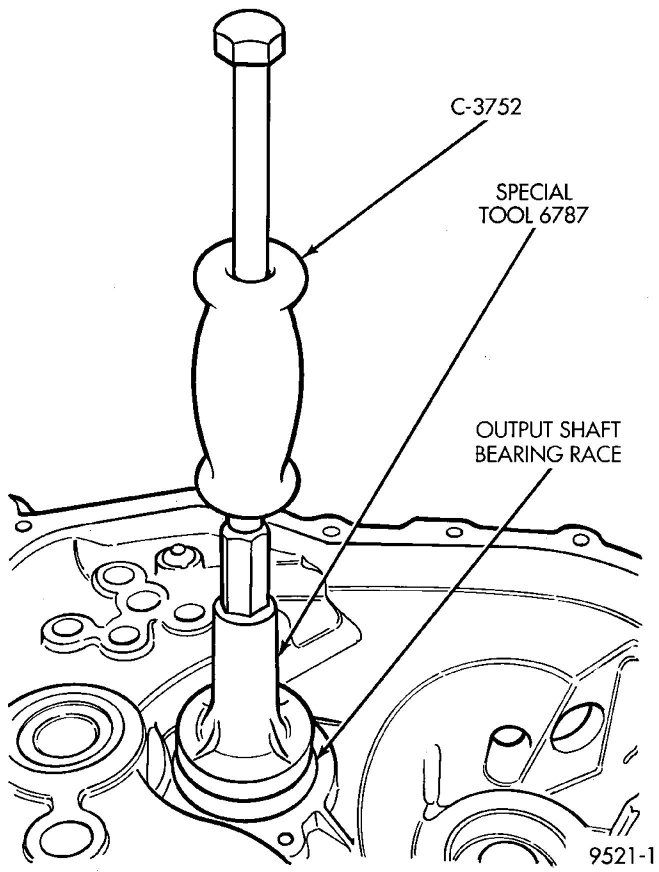


Fig. 125 Output Bearing Race Removal

INPUT BEARING AND SLEEVE

The input bearing is a one–piece bearing and sleeve unit (Fig. 127). The sleeve is the slide point for the clutch–release bearing and lever.

REMOVAL

(1) Install tool #6342 over input bearing on the gear case side of the transaxle clutch housing.

DISASSEMBLY AND ASSEMBLY (Continued)

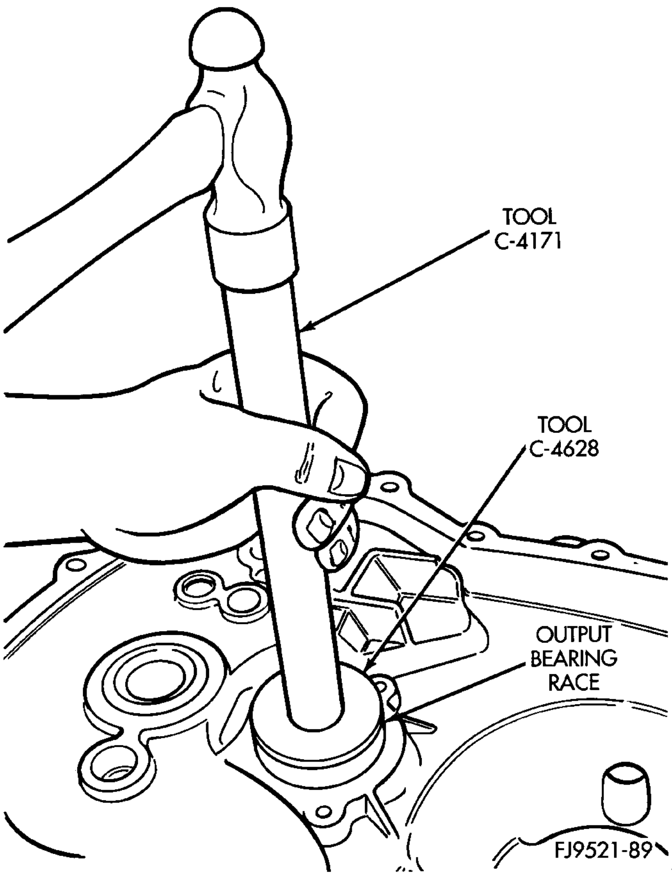


Fig. 126 Output Bearing Race Installation

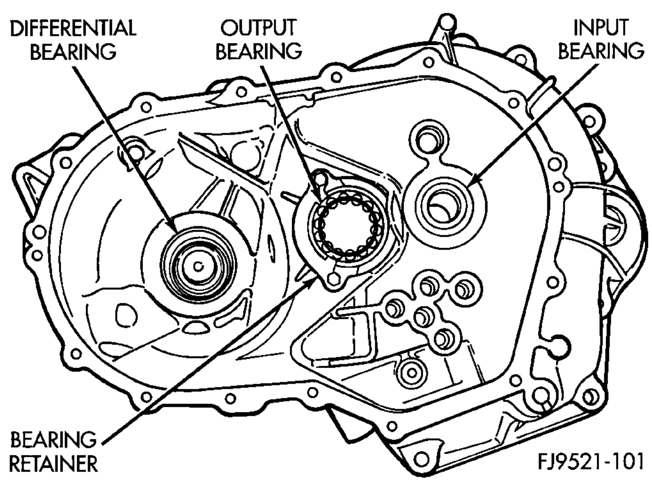


Fig. 127 Input Bearing And Sleeve

(2) Press the input bearing out of the housing (Fig. 128).

INSTALLATION

(1) Apply coating of Loctite® sealant on bearing outer diameter. Position sleeve and bearing assembly at input bearing bore.

(2) Install tool #C-4680-1 over input bearing (Fig. 129).

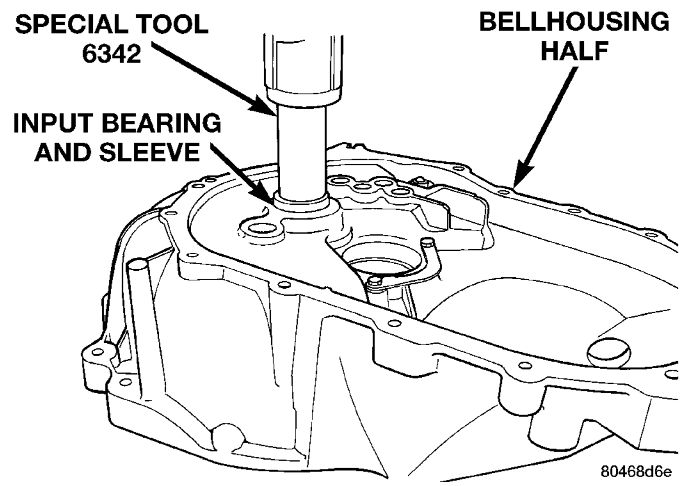


Fig. 128 Input Bearing Removal

(3) Using the spacer tool #4894 and shop press, install input bearing into bore until it is fully seated (Fig. 130).

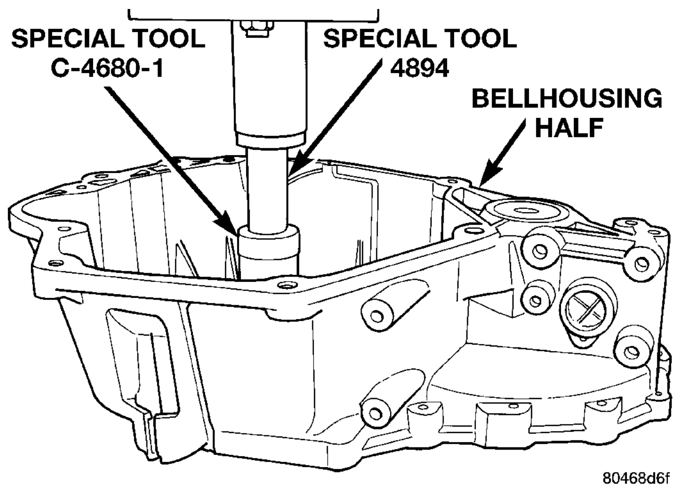


Fig. 129 Input Bearing Tool

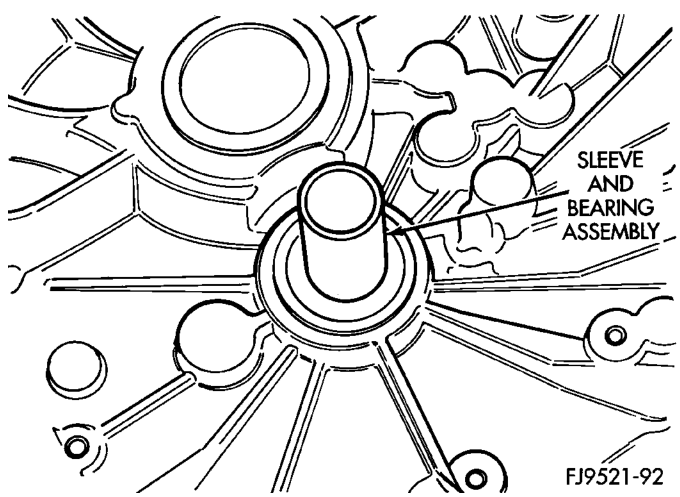


Fig. 130 Input Bearing Installed

DISASSEMBLY AND ASSEMBLY (Continued)

DIFFERENTIAL BEARING CUPS

REMOVAL

(1) Remove differential assembly from gear case using the procedure outlined in this group.

(2) Install Miller tool #L-4518 into the differential bearing cup (Fig. 131).

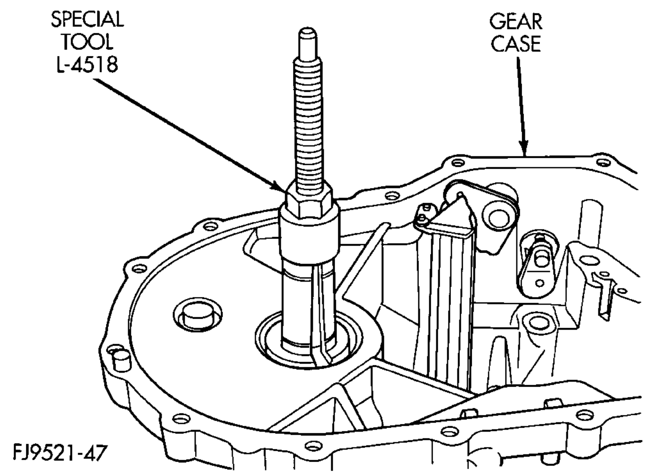


Fig. 131 Tool Installed in Bearing

(3) Install the tool cup over the tool (Fig. 132).

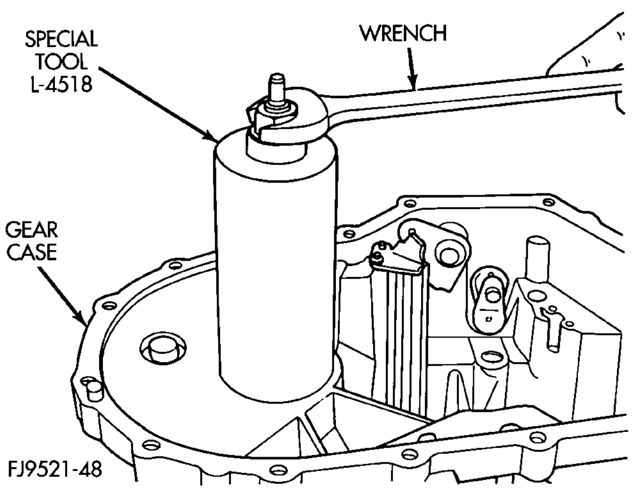


Fig. 132 Tool Cup Installed

(4) Tighten the tool until the race is removed from the case.

INSTALLATION

(1) Position the bearing cup into the case.

(2) Install the bearing cup onto Miller tool #L-4520.

(3) Using Miller tool #L-4520 and C-4171 driver, install differential bearing cup into the transaxle case.

SHIFT RAIL BUSHINGS

REMOVAL

(1) Thread tool #6786 into shift rail bushing.

(2) Install slide hammer #3752 onto tool.

(3) Remove bushing using slide hammer and tool assembly (Fig. 133).

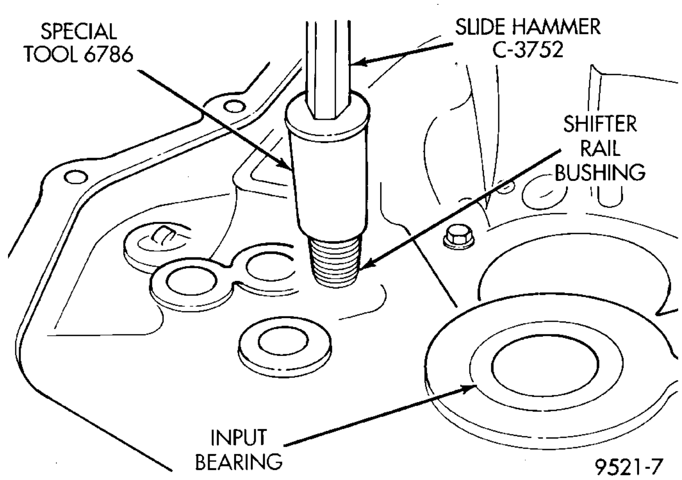


Fig. 133 Shift Rail Bushing Removal

INSTALLATION

(1) Line up replacement bushing in bore.

(2) Using tool #MD998343, tap bushing into bore until flush with the chamfer in the case.

SHIFT SHAFT SEALS

It is not necessary to remove the shift shafts from the transaxle to service the shift shaft seals.

REMOVAL

(1) Using a pick tool, pry up on the shift shaft seal and remove seal from bore.

INSTALLATION

(1) Position new shift shaft seal in bore.

(2) Install shift shaft seal into bore using an appropriate size deep-well socket.

SHIFT SELECTOR SHAFT

REMOVAL

(1) Disassemble transaxle using the procedure outlined in this group.

(2) With the transaxle disassembled, remove the selector shaft by pushing on the shaft from the outside. Pull shaft out from the inside.

INSTALLATION

(1) Reverse removal procedure to install selector shaft.

DISASSEMBLY AND ASSEMBLY (Continued)

SHIFT CROSSOVER SHAFT

REMOVAL

(1) Disassemble transaxle using the procedure outlined in this group.

(2) With the transaxle disassembled, remove the crossover shaft seal.

(3) Using snap–ring pliers, remove the snap ring at the crossover shaft bore (Fig. 134).

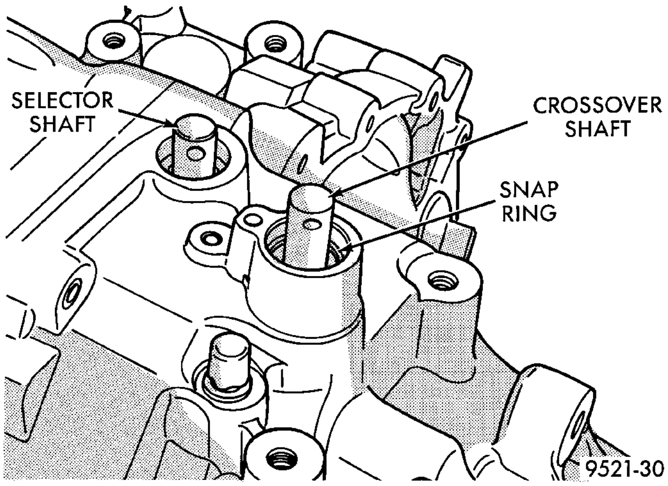


Fig. 134 Crossover Shaft Snap Ring

(4) Push the crossover shaft in the case and remove the crossover assembly.

INSTALLATION

(1) Reverse removal procedure to install crossover shaft.

SHIFT SELECTOR SHAFT BUSHING

REMOVAL

(1) Remove selector shaft using procedure in this group.

(2) Thread tool #6786 into bushing.

(3) Install slide hammer #3752 onto tool and remove bushing using slide hammer (Fig. 135).

INSTALLATION

(1) Position replacement bushing over selector shaft bore.

(2) Using an appropriate size deep–well socket, install bushing in selector shaft bore (Fig. 136).

SHIFT CROSSOVER SHAFT BUSHING

REMOVAL

(1) Install slide hammer #3752 through the crossover bushing.

(2) Thread nut and washer onto slide hammer.

(3) Using the slide hammer, remove the crossover shaft bushing (Fig. 137).

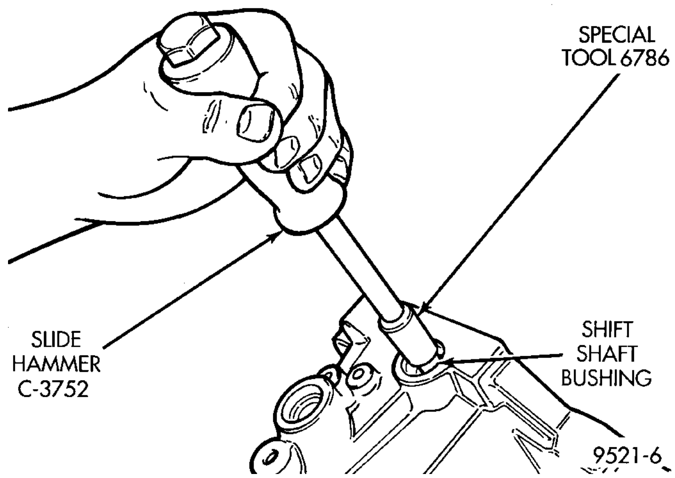


Fig. 135 Selector Shaft Bushing Removal

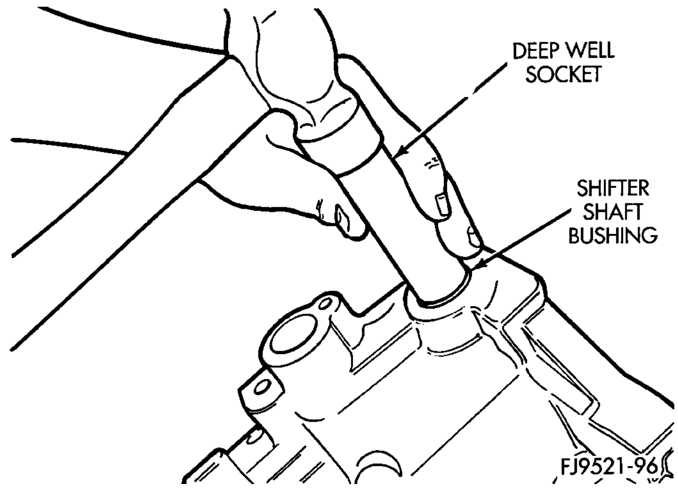


Fig. 136 Selector Shaft Bushing Installation

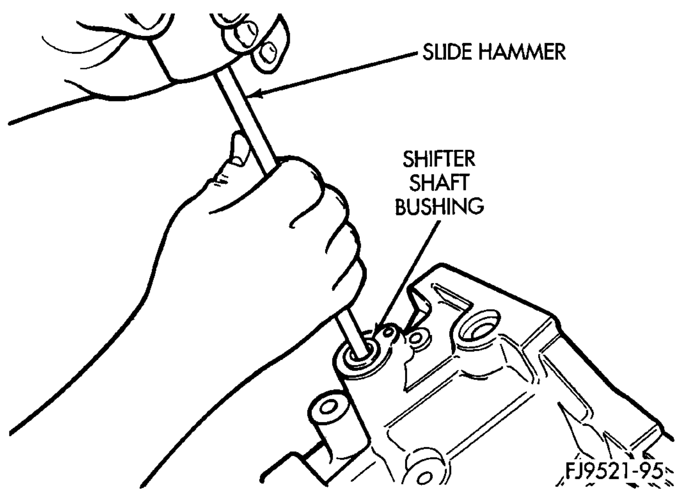


Fig. 137 Crossover Shaft Bushing Removal

INSTALLATION

(1) Position the replacement crossover shaft bushing over the crossover shaft bushing bore.

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Using an appropriate size deep–well socket, install the crossover shaft bushing into the bushing bore.

REAR BEARING OIL FEED TROUGH

The bearing oil feed trough is retained in the case by a pin that is molded into the case and clips that are part of the trough (Fig. 138).

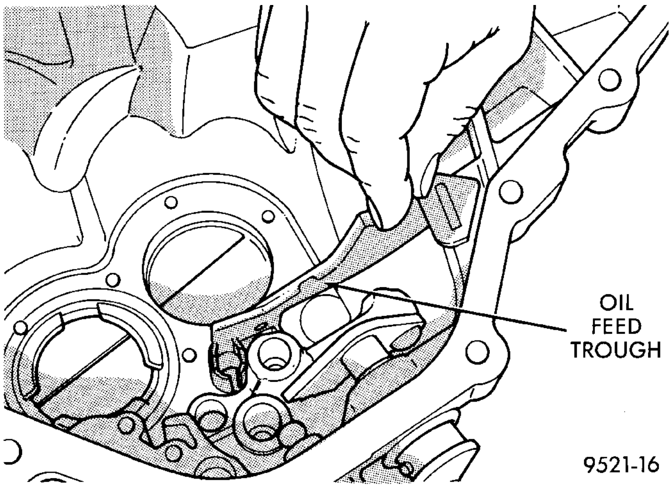


Fig. 138 Oil Feed Trough

REMOVAL

(1) Using light plier pressure, squeeze the clips together at the rear of the trough.

(2) Slide the trough over the retaining pin that locates the trough in the case.

INSTALLATION

(1) Reverse removal procedure to install oil feed trough.

CLEANING AND INSPECTION

TRANSAXLE

Clean the gears, bearings, shafts, synchronizers, thrust washers, oil feeder, shift mechanism, gear case, and bellhousing with solvent. Dry all parts except the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

Inspect the gears, bearings, shafts and thrust washers. Replace the bearings and cups if the rollers are worn, chipped, cracked, flat spotted, or brinnelled, or if the bearing cage is damaged or distorted. Replace the thrust washers if cracked, chipped, or worn. Replace the gears if the teeth are chipped, cracked, or worn thin. Inspect the synchronizers. Replace the sleeve if worn or damaged in any way. Replace the stop rings if the friction material is burned, flaking off, or worn. Check the condition of the synchro keys and springs. Replace these parts if worn, cracked, or distorted.

SYNCHRONIZER

CLEAN

Do not attempt to clean the blocking rings in solvent. The friction material will become contaminated. Place synchronizer components in a suitable holder and clean with solvent. Air dry.

INSPECT

Proper inspection of components involve:

- Teeth, for wear, scuffed, nicked, burred, or broken teeth
- Keys, for wear or distortion
- Balls and springs, for distortion, cracks, or wear

If any of these conditions exist in these components, replace as necessary.

ADJUSTMENTS

GEARSHIFT CROSSOVER CABLE

(1) Remove shift console from vehicle.

(2) Loosen adjusting screw on crossover cable at shifter (Fig. 139).

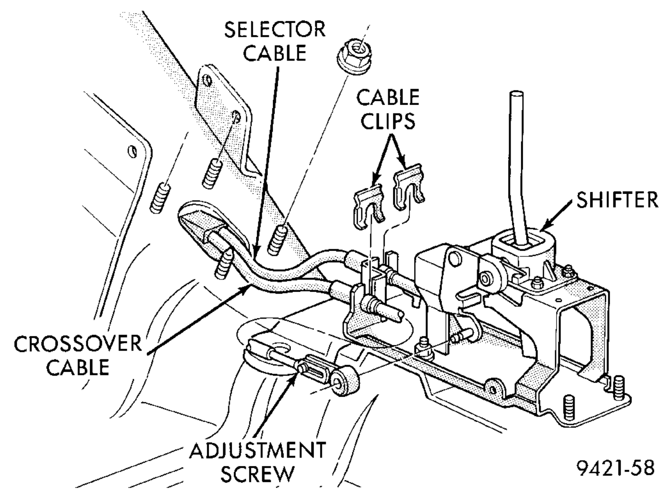


Fig. 139 Crossover Cable Adjustment Screw

(3) Pin transaxle crossover lever in 3-4 neutral position using a 1/4 inch drill bit. Align hole in crossover lever with the hole in the boss on the transaxle case (Fig. 140). Be sure drill bit goes into transaxle case at least one–half inch.

(4) The shifter is spring–loaded and self–centering. Allow shifter to rest in its neutral position. Torque adjustment screw to 8 N·m (70 in. lbs.). Care must be taken to avoid moving the shift mechanism off-center during screw tightening.

ADJUSTMENTS (Continued)

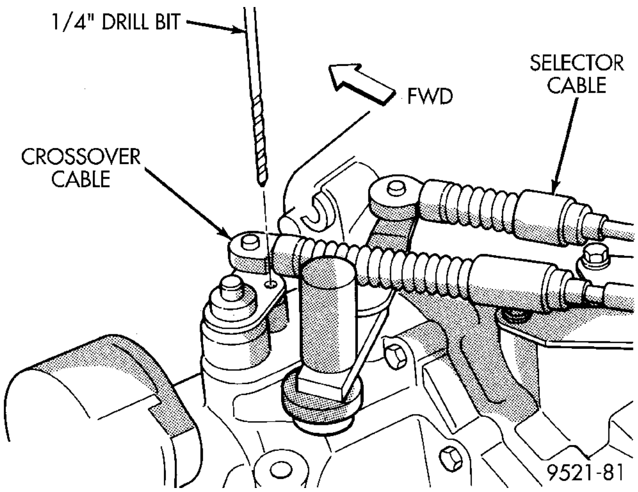


Fig. 140 Crossover Lever Pin Procedure

(5) Remove drill bit from transaxle case and perform functional check by shifting transaxle into all gears.

(6) Reinstall center shift console. Blouse boot out around console. Seat boot lip on top of console.

BEARING ADJUSTMENT PROCEDURE

GENERAL RULES ON SERVICING BEARINGS

(1) Use extreme care when removing and installing bearing cups and cones. Use only an arbor press for installation, as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat will give a false end play reading while gauging for proper shims. Improperly seated bearing cups and cones are subject to low–mileage failure.

(2) Bearing cups and cones should be replaced if they show signs of pitting or heat distress. If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

(3) Bearing preload and drag torque specifications must be maintained to avoid premature bearing failures. Used (original) bearings may lose up to 50% of their original drag torque after break in. All bearing adjustments must be made with no other component interference or gear intermesh.

(4) Replace bearings as a pair: If one differential bearing is defective, replace both differential bearings, 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.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

NOTE: True bearing turning torque readings can be obtained only with the geartrain removed from the case.

(1) Remove bearing cup and existing shim from clutch bellhousing case.

(2) Press in new bearing cup into bellhousing case (or use a cup that has been ground down on the outer edge for ease of measurement).

(3) Press in new bearing cup into gear case side.

(4) Oil differential bearings with Mopar® type M.S. 9417 Manual Transaxle Fluid. Install differential assembly in transaxle gear case. Install clutch bellhousing over gear case. Install and torque case bolts to 29 N·m (21 ft. lbs.).

(5) Position transaxle with bellhousing facing down on workbench with C-clamps. Position dial indicator.

(6) 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 the dial indicator. To obtain end play readings, apply a medium load in an upward direction while rolling differential assembly back and forth (Fig. 141). Record end play.

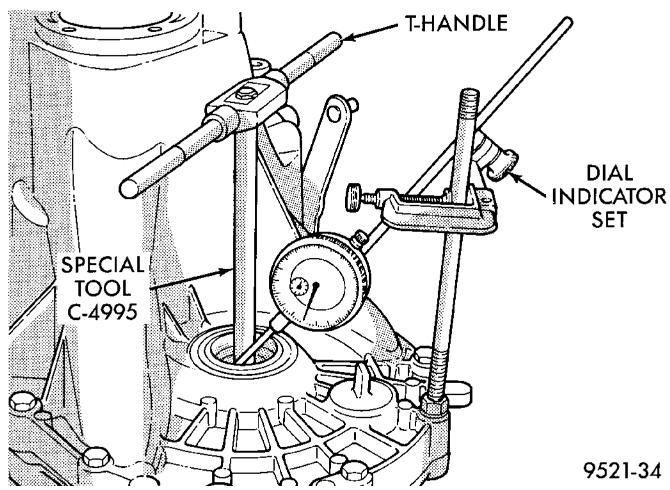


Fig. 141 Checking Differential Bearing End Play to Determine Shim Thickness

(7) The shim required for proper bearing preload is the **total of end play, plus (constant) preload of 0.18mm (0.007 in.).** Never combine shims to obtain the required preload.

(8) Remove case bolts. Remove clutch bellhousing differential bearing cup. Install shim(s) selected in Step 7. Then press the bearing cup into clutch bellhousing.

(9) Install clutch bellhousing. Install and torque case bolts to 26 N·m (19 ft. lbs.).

(10) Using Special Tool C-4995 and an inch-pound torque wrench, check turning torque of the differential assembly (Fig. 142). **The turning torque should be 6 to 12 in. lbs. If the turning torque is too high, install a 0.05mm (0.002 inch) thinner**

ADJUSTMENTS (Continued)

shim. If the turning torque is too low, install a 0.05mm (0.002 inch) thicker shim.

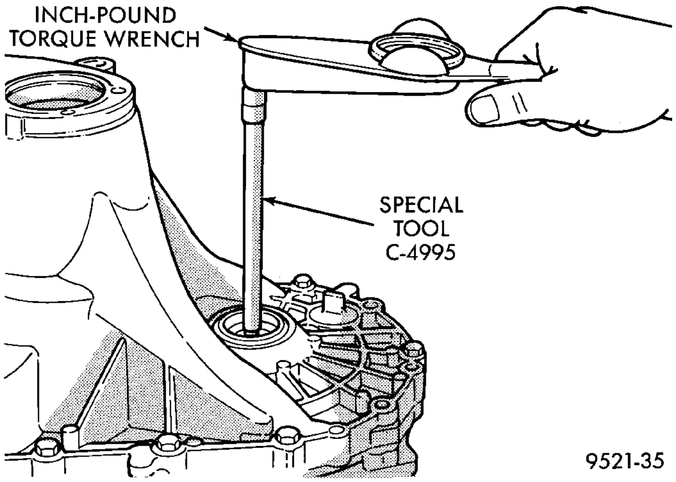


Fig. 142 Checking Differential Bearing Turning Torque

(11) Recheck turning torque. Repeat Step 10 until the proper turning torque is obtained.

SPECIFICATIONS

NV T350 (A-578) SPECIFICATIONS

DESCRIPTION	TORQUE
Back-up Lamp Switch	24 N·m (18 ft. lbs.)
Crossover Cable Adj. Screw	8 N·m (70 in. lbs.)
Drain Plug	30 N·m (267 in. lbs.)
Differential Ring Gear Bolts	81 N·m (60 ft. lbs.)
Dust Shield to Transaxle	12 N·m (105 in. lbs.)
End Plate Cover Bolts	29 N·m (21 ft. lbs.)
Front Engine Mount to Trans	108 N·m (80 ft. lbs.)
Front Mount Through Bolt	61 N·m (45 ft. lbs.)
Front Mount to Engine Bolt	54 N·m (40 ft. lbs.)
Lateral Bending Strut to Engine	54 N·m (40 ft. lbs.)
Lateral Bending Strut to Trans.	54 N·m (40 ft. lbs.)
Left Mount Through Bolt	108 N·m (80 ft. lbs.)
Left Mount to Transaxle	54 N·m (40 ft. lbs.)
Output Bearing Race Ret. Strap	11 N·m (96 in. lbs.)
Power Hop Damper Bkt. to Trans.	54 N·m (40 ft. lbs.)
Power Hop Damper to Frame Bkt.	54 N·m (40 ft. lbs.)
Power Hop Damper to Trans. Bkt.	54 N·m (40 ft. lbs.)
Reverse Fork Bracket	11 N·m (96 in. lbs.)
Reverse Idler Shaft Bolt	26 N·m (19 ft. lbs.)
Shift Cable Bracket to Transaxle	28 N·m (250 in. lbs.)
Transaxle Case Bolts	29 N·m (21 ft. lbs.)
Transaxle to Engine Bolt	95 N·m (70 ft. lbs.)
Trans. to Eng. Intake Bkt. Bolts	95 N·m (70 ft. lbs.)
Vehicle Speed Sensor	7 N·m (60 in. lbs.)
Vertical Bending Strut to Engine	108 N·m (80 ft. lbs.)
Vertical Bending Strut to Trans.	108 N·m (80 ft. lbs.)

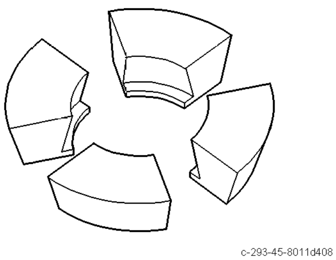
NOTE: Bolts that have thread sealer or torque lock patches should not be reused. Always install new bolts in these applications.

NV T350 (A-578) MANUAL TRANSAXLE FLUID FILL

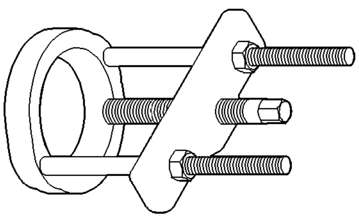
TRANSAXLE	METRIC MEASURE	U.S. MEASURE
NV T350	1.9-2.2 Liters	2.0-2.3 Quarts

SPECIAL TOOLS

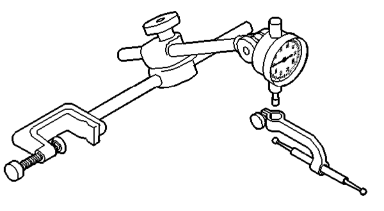
SPECIAL TOOLS–NV T350 (A-578) MANUAL TRANSAXLE



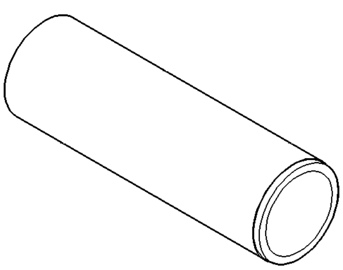
Adapter Blocks C-293–45



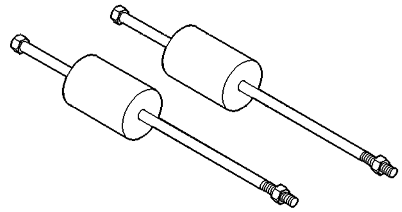
Puller Press C-293–PA



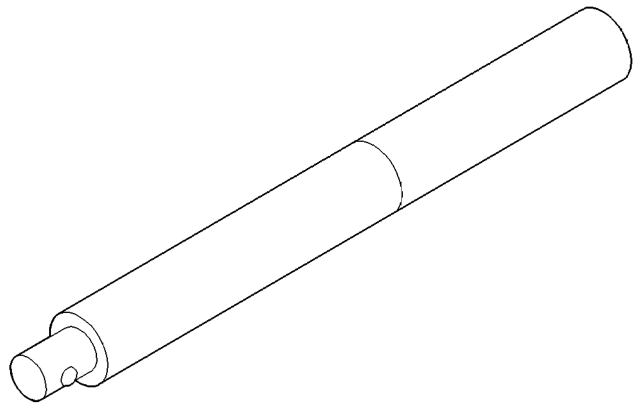
Dial Indicator C-3339



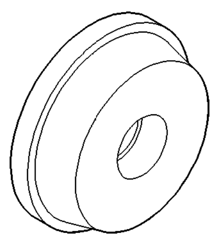
Sleeve C-3717



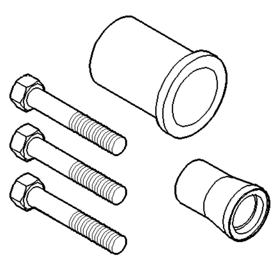
Slide Hammer C-3752



Universal Handle C-4171

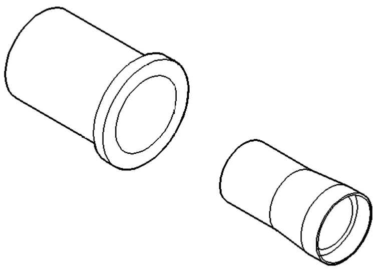


Bearing Installer C-4628

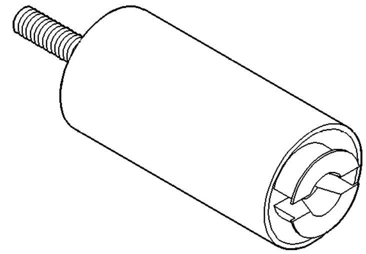


Seal Remover C-4680

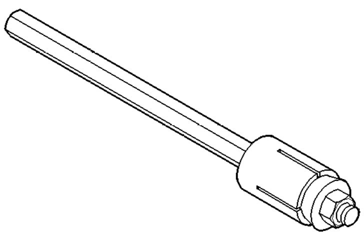
SPECIAL TOOLS (Continued)



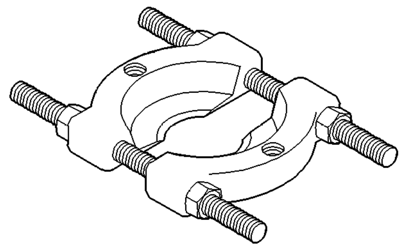
Seal Installer C-4992



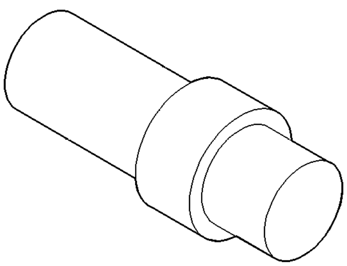
Special Jaw Set L-4518



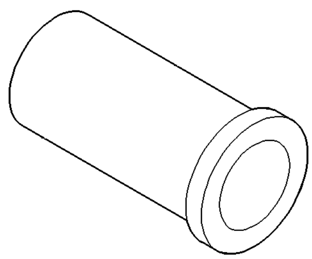
Torque Tool C-4995



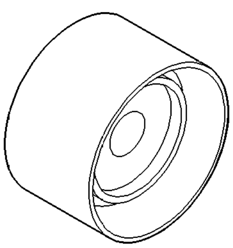
Bearing Splitter 1130



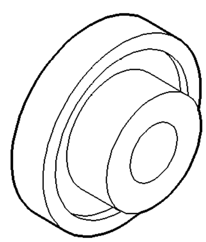
Adapter C-4996



Driver 6342

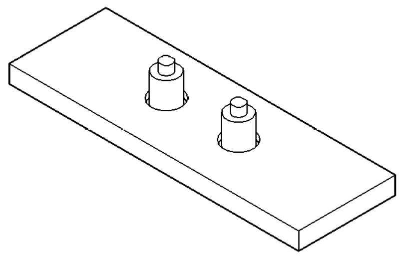


Installer L-4410

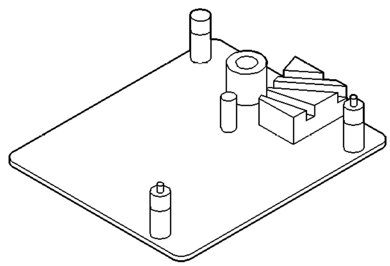


Seal Installer 6709

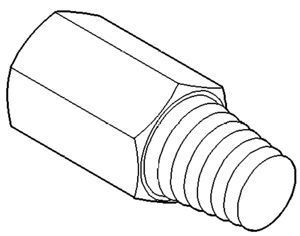
SPECIAL TOOLS (Continued)



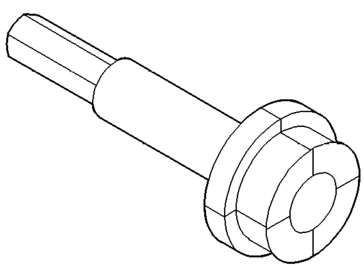
Bearing Remover 6768



Bench Fixture 6785



Remover 6786



Remover 6787

31TH AUTOMATIC TRANSAXLE

INDEX

GENERAL INFORMATION

GENERAL INFORMATION

NOTE: Safety goggles should be worn at all times when working on these transaxles.

This transaxle combines torque converter, three speed transmission, final drive gearing, and differential into a front wheel drive system. The identification markings and usage of the transaxle are charted in Diagnosis and Tests.

NOTE: Transaxle operation requirements are different for each vehicle and engine combination. Some internal parts will be different to provide for this. Therefore, when replacing parts, refer to the seven digit part number stamped on rear of the transaxle oil pan flange.

Within this transaxle, there are three primary areas:

(1) Main center line plus valve body.

(2) Transfer shaft center line (includes governor and parking sprag).

(3) Differential center line.

Center distances between the main rotating parts in these three areas are held precise to maintain a low noise level.

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 a remote cooler. There are two types of coolers used. An oil-to-water type cooler located in the radiator side tank and/or an oil-to-air heat exchanger. The torque converter assembly is a sealed unit that cannot be disassembled.

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 and 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
- Two planetary gear sets

This provides three forward ratios and a reverse ratio. The common sun gear of the planetary gear sets is connected to the front clutch by a driving shell. The driving shell is splined to the sun gear and front clutch retainer. The hydraulic system consists of an oil pump and a single valve body which contains all of the valves except the governor valves. The transaxle sump and differential sump are both vented through the dipstick. Output torque from the main center line is delivered through helical gears to the transfer shaft. This gear set is a factor in the transaxle final drive (axle) ratio. The shaft also carries the governor and parking sprag. An integral helical gear on the transfer shaft drives the differential ring gear. The final drive gearing is completed with one of two gear ratios; 2.98 or 3.19 depending on model and application.

FLUID LEVEL AND CONDITION

NOTE: The transmission and differential sump have a common oil sump with a communicating opening between the two.

The torque converter fills in both the P (Park) and N (Neutral) positions. Place the selector lever in P (Park) to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground. This will ensure complete oil level stabilization between differential and transmission.** The fluid should be at normal operating temperature (approximately 82° C. or 180° F.). The fluid level is correct if it is in the HOT region (cross-hatched area) on the dipstick.

Low fluid level can cause a variety of conditions, because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy therefore, pressures will be low and will build up slowly.

Improper filling also can raise the fluid level too high. When the transaxle has too much fluid, the gears churn up foam and cause the same conditions that occur with a low fluid level.

In either case, the air bubbles can cause overheating, fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and servo operation. Foaming also can result in fluid escaping from the transaxle dipstick, where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, or 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.

GENERAL INFORMATION (Continued)

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 ensuring optimum transmission performance. Fluids of the type labeled DEXRON II Automatic Transmission Fluid should be used only if the recommended fluid is not available. If more than a small amount of Dexron fluid is used, shudder or shift quality problems may be encountered. 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 that fluid listed above. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

DESCRIPTION AND OPERATION

TORQUE CONVERTER CLUTCH

A torque converter clutch is standard on all vehicles. The torque converter clutch is activated only in direct drive and is controlled by the engine electronics. A solenoid on the valve body, is powered by the powertrain control module to activate the torque converter clutch.

HYDRAULIC CONTROL SYSTEM

The hydraulic control system makes the transaxle fully automatic, and has four important functions to perform. The components of any automatic control system may be grouped into the following basic groups:

- Pressure supply system
- Pressure regulating valves
- Flow control valves
- Clutches
- 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 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 selected by the vehicle operator.

The 1-2 shift valve automatically shifts the transaxle from first to second or from second to first, depending on the vehicle operation.

The 2-3 shift valve automatically shifts the transaxle from second to third or from third to second depending on the vehicle operation.

The kickdown valve makes possible a forced downshift from third to second, second to first, or third to first (depending on vehicle speed). This can be done by depressing the accelerator pedal past the detent feel near wide open throttle.

The shuttle valve has two separate functions and performs each independently of the other. The first is providing fast release of the kickdown band, and smooth front clutch engagement when a lift-foot upshift from second to third is made. The second function is to regulate the application of the kickdown servo and band when making third–to–second kickdown.

The bypass valve provides for smooth application of the kickdown band on 1-2 upshifts.

The torque converter clutch solenoid allows for the electronic control of the torque converter clutch. It also disengages the torque converter at closed throttle. This is done during engine warm-up and part-throttle acceleration.

The switch valve directs oil to apply the torque converter clutch in one position. The switch valve releases the torque converter clutch in the other position.

CLUTCHES, BAND SERVOS, AND ACCUMULATOR

The front and rear clutch pistons, and both servo pistons, are moved hydraulically to engage the clutches and apply the bands. The pistons are released by spring tension when hydraulic pressure is released. On the 2-3 upshift, the kickdown servo piston is released by spring tension and hydraulic pressure.

The accumulator controls the hydraulic pressure on the apply–side of the kickdown servo during the 1-2 upshift; thereby cushioning the kickdown band application at any throttle position.

DESCRIPTION AND OPERATION (Continued)

AUTOMATIC TRANSMISSION SHIFTER/IGNITION INTERLOCK

The Shifter/Ignition Interlock, is a mechanical 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 shift lever into the PARK position 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. Also the interlock system prevents the ignition switch from being turned to LOCK or ACCESSORY position, unless shifter is in the PARK position.

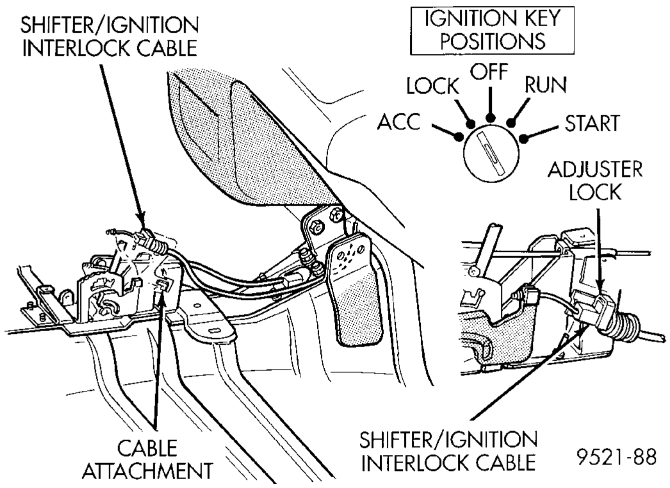


Fig. 1 Shifter Ignition Interlock System Components

GEARSHIFT AND PARKING LOCK CONTROLS

The transaxle is controlled by a **lever type** gearshift incorporated within the console. 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.**

TORQUE CONVERTER CLUTCH SOLENOID WIRING CONNECTOR

If the solenoid wiring connector is unplugged, the torque converter will not engage (Fig. 2).

GOVERNOR

The governor can be serviced by removing the transaxle oil pan and valve body assembly. The governor can be unbolted from the governor support and removed from the transaxle for reconditioning or replacement.

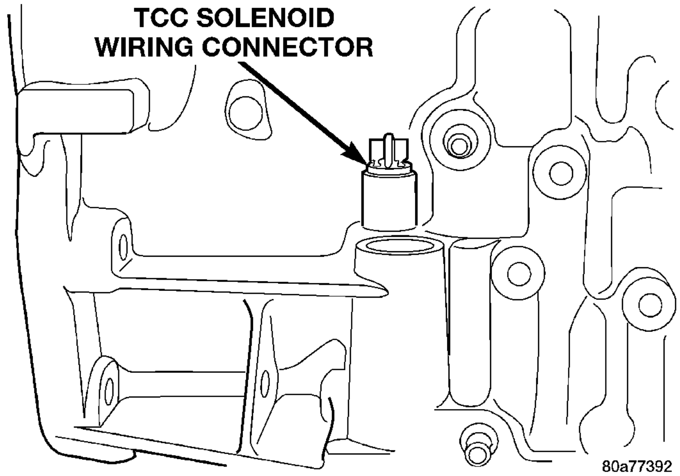


Fig. 2 Torque Converter Clutch Solenoid Wiring Connector

When cleaning or assembling the governor, be sure the governor valves move freely in the bores of the governor body.

DIAGNOSIS AND TESTING

31TH TRANSAXLE DIAGNOSIS AND TESTS

Automatic transaxle malfunctions can be caused by four general conditions:

(1) Poor engine performance
(2) Improper adjustments
(3) Hydraulic malfunctions
(4) Mechanical malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment, and throttle pressure cable adjustment. Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure tests should be performed

31TH HYDRAULIC TROUBLE CODE CHARTS

The following charts should be used to help diagnose hydraulic or mechanical faults in the transaxle.

ROAD TEST

Prior to performing a road test, check the fluid level and control cable adjustments.

During the road test, the transaxle should be operated in each position to check for slipping and any variation in shifting.

If vehicle operates at high speeds, but has poor acceleration, the converter's overrunning clutch may be slipping. If acceleration is normal, but high throt-

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT FROM NEUTRAL TO DRIVE	Engine idle speed too high	Check engine curb idle speed. Correct as necessary.
	Valve body malfunction	Inspect valve body and repair.
	Hydraulic pressure too high	Check fluid pressure at ports.
	Worn or faulty rear clutch	Replace discs and seals at rear clutch.
	Rear clutch spring load high	Replace rear clutch spring.
	Engine performance	Check engine specs.
HARSH ENGAGEMENT FROM NEUTRAL TO REVERSE	Low/Reverse band misadjusted	Adjust band to specs.
	Engine idle speed too high	Set up engine to specs.
	Low/Reverse band worn out	Replace Low/Reverse band.
	Low/Reverse band, servo or linkage malfunction	Repair Low/Reverse servo. Adjust band and linkage
	Hydraulic pressure too high	Check fluid pressure at ports.
	Worn or faulty rear clutch	Replace discs and seals at rear clutch.
	Engine performance	Set up engine to specs.
DELAYED ENGAGEMENT FROM NEUTRAL TO DRIVE	Hydraulic pressure too low	Check fluid pressure at ports.
	Valve body malfunction	Inspect valve body and repair.
	Low fluid level	Fill transaxle to proper level.
	Incorrect gearshift linkage adjustment	Adjust gearshift linkage.
	Oil filter clogged	Replace oil filter.
	Faulty oil pump	Replace oil pump.
	Worn input shaft seal rings	Replace input shaft seal rings.
	Aerated fluid	Replace transaxle fluid.
	Engine idle speed too low	Set engine to specs.
	Worn or faulty rear clutch	Replace discs and seals at rear clutch.

tle opening is needed for high speeds, the stator clutch may have seized.

Observe closely for slipping or engine speed flare-up. Slipping or flare-up in any gear usually indicates clutch, band, or overrunning clutch problems. If the condition is far advanced, an overhaul will probably be necessary to restore normal operation.

In most cases, the clutch or band that is slipping can be determined by noting the transaxle operation in all selector positions and 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 that does not use one of those units, the unit that 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 that slips and to confirm proper operation of good units. Road testing can usually diagnose slipping units, although the actual cause of the problem may not be detected. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT FROM NEUTRAL TO REVERSE	1. Low reverse band misadjusted. 2. Hydraulic pressures too low. 3. Low reverse band worn out. 4. Valve body malfunction. 5. Low reverse band, servo or linkage malfunction. 6. Low fluid level. 7. Incorrect gearshift linkage adjustment. 8. Oil filter clogged. 9. Faulty oil pump. 10. Worn input shaft seal rings. 11. Aerated fluid. 12. Engine idle speed too low. 13. Worn reaction shaft support seal rings. 14. Worn or faulty front clutch.	1. Adjust bands to specs. 2. Check fluid pressure at ports. 3. Replace low reverse band. 4. Inspect valve body and repair. 5. Repair low reverse servo. Adjust reverse band and linkage. 6. Fill trans. to level. 7. Adjust gearshift linkage. 8. Replace oil filter. 9. Replace oil pump. 10. Replace input shaft seal rings. 11. Replace trans. fluid. 12. Set up engine to specs. 13. Inspect and replace reaction shaft support seal rings. 14. Replace discs and seal at front clutch.
RUNAWAY UPSHIFT	1. Hydraulic pressures too low. 2. Valve body malfunction. 3. Low fluid level. 4. Oil filter clogged. 5. Aerated fluid. 6. Incorrect throttle linkage. 7. Worn reaction shaft support seal rings. 8. Governor malfunction. 9. Kickdown band, servo or linkage malfunction. 10. Worn front clutch.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace oil filter. 5. Replace trans. fluid. 6. Adjust throttle linkage. 7. Replace reaction shaft support seal rings. 8. Inspect and repair governor. 9. Inspect and repair kickdown band, servo or linkage. 10. Replace discs and seals at front clutch.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO UPSHIFT	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Incorrect throttle linkage. 6. Governor support seal rings worn. 7. Worn reaction shaft support seal rings. 8. Governor malfunction. 9. Kickdown band, servo or linkage malfunction. 10. Worn front clutch. 11. Engine performance.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Adjust throttle linkage. 6. Replace governor support seal rings. 7. Replace reaction shaft support seal rings. 8. Inspect and repair governor. 9. Inpsect and repair kickdown band, servo or linkage. 10. Replace discs and seals at front clutch. 11. Set up engine to specs.
3-2 KICKDOWN RUNAWAY	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Aerated fluid. 5. Incorrect throttle linkage adjustment. 6. Kickdown band out of adjustment. 7. Governor support seal rings worn. 8.Kickdown band, servo or linkage malfunction. 9. Worn front clutch.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace trans. fluid. 5. Adjust throttle linkage. 6. Adjust kickdown band. 7. Replace governor support seal rings. 8. Inspect and repair kickdown band, servo or linkage. 9. Replace discs and seals at front clutch.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Valve body malfunction. 2. Incorrect throttle linkage adjustment. 3. Governor malfunction. 4. Kickdown band, servo or linkage malfunction.	1. Inspect valve body and repair. 2. Adjust throttle linkage. 3. Inspect and repair governor. 4. Inspect and repair kickdown band, servo or linkage.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SHIFTS ERRATIC	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Oil filter clogged. 6. Faulty oil pump. 7. Aerated fluid. 8. Incorrect throttle linkage adjustment. 9. Governor support seal rings worn. 10. Worn reaction shaft support seal rings. 11. Governor malfunction. 12. Kickdown band, servo or linkage malfunction. 13. Worn front clutch. 14. Engine performance.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Replace oil filter. 6. Replace oil pump. 7. Replace trans. fluid. 8. Adjust throttle linkage. 9. Replace governor support seal rings. 10. Replace reaction shaft support seal rings. 11. Inspect and repair governor. 12. Inspect and repair kickdown band, servo or linkage. 13. Replace discs and seals at front clutch. 14. Set up engine to specs.
SLIPS IN FORWARD DRIVE POSITIONS	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Incorrect gearshift linkage adjustment. 5. Oil filter clogged. 6. Faulty oil pump. 7. Worn input shaft seal rings. 8. Aerated fluid. 9. Incorrect throttle linkage adjustment. 10. Overrunning clutch not holding. 11. Worn rear clutch. 12. Overrunning clutch worn, broken or seized.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Adjust gearshift linkage. 5. Replace oil filter. 6. Replace oil pump. 7. Replace input shaft seal rings. 8. Replace trans. fluid. 9.Adjust throttle linkage. 10. Inspect and repair overrunning clutch. 11. Replace discs and seals at rear clutch. 12. Replace overrunning clutch assembly.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN REVERSE ONLY	1. Low reverse band misadjusted. 2. Hydraulic pressure too low. 3. Low reverse band worn out. 4. Valve body malfunction. 5. Low reverse band, servo or linkage malfunction. 6. Low fluid level. 7. Incorrect gearshift linkage adjustment. 8. Faulty oil pump. 9. Aerated fluid. 10. Worn reaction shaft suppport seal rings. 11. Worn front clutch.	1. Adjust low reverse band. 2. Check fluid pressure at ports. 3. Replace low reverse band. 4. Inspect valve body and repair. 5. Repair low reverse servo. Adjust reverse band and linkage. 6. Fill trans. to level. 7. Adjust gearshift linkage. 8. Replace oil pump. 9. Replace trans. fluid. 10. Replace reaction shaft support seal rings. 11. Replace discs and seals at front clutch.
SLIPS IN ALL POSITIONS	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Oil filter clogged. 5. Faulty oil pump. 6. Worn input shaft seal rings. 7. Aerated fluid.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace oil filter. 5. Replace oil pump. 6. Replace input shaft seal rings. 7. Replace trans. fluid.
NO DRIVE IN ANY POSITION	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Oil filter clogged. 5. Faulty oil pump. 6. Planetary gear sets broken or seized.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace oil filter. 5. Replace oil pump. 6. Replace planetary gear sets.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE IN FORWARD DRIVE POSITIONS	1. Hydraulic pressure too low. 2. Valve body malfunction. 3. Low fluid level. 4. Worn input shaft seal rings. 5. Overrunning clutch not holding. 6. Worn rear clutch. 7. Planetary gear sets broken or seized. 8. Overrunning clutch worn, broken or seized.	1. Check fluid pressure at ports. 2. Inspect valve body and repair. 3. Fill trans. to level. 4. Replace input shaft seal rings. 5. Inspect and repair overrunning clutch. 6. Replace discs and seals at rear clutch. 7. Replace planetary gear sets. 8. Replace overrunning clutch assembly.
NO DRIVE IN REVERSE	1. Hydraulic pressure too low. 2. Low reverse band worn out. 3. Valve body malfunction. 4. Low reverse band, servo or linkage malfunction. 5. Incorrect gearshift linkage adjustment. 6. Worn reaction shaft support seal rings. 7. Worn front clutch. 8. Worn rear clutch. 9. Planetary gear sets broken or seized.	1. Check fluid pressure at ports. 2. Replace low reverse band. 3. Inspect valve body and repair. 4. Repair low reverse servo. Adjust reverse band and linkage. 5. Adjust gearshift linkage. 6. Replace reaction shaft support seal rings. 7. Replace discs and seals at front clutch. 8. Replace discs and seals at rear clutch. 9. Replace planetary gear sets.
DRIVES IN NEUTRAL	1. Valve body malfunction. 2. Incorrect gearshift linkage adjustment. 3. Insufficient clutch plate clearance. 4. Worn rear clutch. 5. Rear clutch dragging.	1. Inspect valve body and repair. 2. Adjust gearshift linkage. 3. Check and adjust clutch plate clearance. 4. Replace discs and seals at rear clutch. 5. Inspect and repair rear clutch.
DRAGS OR LOCKS	1. Low reverse band worn out. 2. Kickdown band adjustment too tight. 3. Planetary gear sets broken or seized. 4. Overrunning clutch worn, broken or seized.	1. Replace low reverse band. 2. Adjust kickdown band. 3. Replace planetary gear sets. 4. Replace overrunning clutch assembly.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GRATING, SCRAPING, OR GROWLING NOISE	1. Low reverse band worn out. 2. Kickdown band out of adjustment. 3. Drive shaft bushing damaged. 4. Planetary gear sets broken or seized. 5. Overrunning clutch worn, broken or seized.	1. Replace low reverse band. 2. Adjust kickdown band. 3. Replace drive shaft bushing. 4. Replace planetary gear sets. 5. Replace overrunning clutch assembly.
BUZZING NOISE	1. Valve body malfunction. 2. Low fluid level. 3. Aerated fluid. 4. Overrunning clutch inner race damaged.	1. Inspect valve body and repair. 2. Fill fluid to level. 3. Replace trans. fluid. 4. Replace overrunning clutch assembly.
HARD TO FILL, OIL BLOWS OUT FILLER HOLE	1. Oil filter clogged. 2. Aerated fluid. 3. High fluid level.	1. Replace oil filter. 2. Replace trans. fluid. 3. Adjust fluid level to specs.
TRANSAXLE OVERHEATS	1. Stuck cooler flow switch valve. 2. Engine idle speed too high. 3. Hydraulic pressures too low. 4. Low fluid level. 5. Incorrect gearshift linkage adjustment. 6. Faulty oil pump. 7. Kickdown band adjustment too tight. 8. Faulty cooling system. 9. Insufficient clutch plate clearance.	1. Replace switch valve behind oil pump housing. 2. Adjust engine idle to specs. 3. Check fluid pressure at ports. 4. Fill trans. to level. 5. Adjust gearshift linkage. 6. Replace oil pump. 7. Adjust kickdown band. 8. Check cooling system temperature and repair as needed. 9. Check and adjust clutch plate clearance.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH UPSHIFT	1. Hydraulic pressures too low. 2. Incorrect throttle linkage adjustment. 3. Kickdown band out of adjustment. 4. Hydraulic pressure too high. 5. Engine performance.	1. Check fluid pressure at ports. 2. Adjust throttle linkage. 3. Adjust kickdown band. 4. Check fluid pressure at ports. 5. Set up engine to specs.
DELAYED UPSHIFT	1. Incorrect throttle linkage adjustment. 2. Kickdown band out of adjustment. 3. Governor support seal rings worn. 4. Worn reaction shaft support seal rings. 5. Governor malfunction. 6. Kickdown band, servo or linkage malfunction. 7. Worn front clutch. 8. Engine performance.	1. Adjust throttle linkage. 2. Adjust kickdown band. 3. Replace governor support seal rings. 4. Replace reaction shaft support seal rings. 5. Inspect and repair governor. 6. Inspect and repair kickdown band, servo or linkage. 7. Replace discs and seals at front clutch. 8. Set up engine to specs.
NO TORQUE CONVERTER CLUTCH APPLICATION	1. Stuck cooler flow switch valve. 2. Hydraulic pressures too low. 3. Low fluid level. 4. Faulty oil pump. 5. Worn input shaft seal rings. 6. Aerated fluid.	1. Replace switch valve behind oil pump housing. 2. Check fluid pressure at ports. 3. Fill trans. to level. 4. Replace oil pump. 5. Replace input shaft seal rings. 6. Replace trans. fluid.

Diagnosis Guide

DIAGNOSIS AND TESTING (Continued)

Lever Position	Start Safety	Parking Sprag	Clutches				Bands	
			Front	Rear	Lockup	Overrunning	(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

ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER

Therefore, unless the condition is obvious, the transaxle should never be disassembled until hydraulic pressure tests have been performed.

HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transaxle problems.

Before performing pressure tests, check fluid level and condition, as well as control cable adjustments. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer. Raise vehicle on a hoist that 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.

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transaxle all the way rearward (1 position).

(4) Read pressures on both gauges as throttle lever on transaxle is moved from full clockwise position to full counterclockwise position.

(5) Line pressure should read 52 to 58 psi with throttle lever clockwise. Pressure should gradually increase to 80 to 88 psi.as lever is moved counterclockwise.

(6) Low/reverse pressure should read the same as line pressure, within 3 psi.

(7) This tests pump output, pressure regulation, and condition of rear clutch and rear servo hydraulic circuits.

TEST TWO (SELECTOR IN 2)

(1) Attach one gauge to line pressure port, and tee another gauge into lower cooler line fitting. This will allow lubrication pressure readings to be taken..

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transaxle one detent forward from full rearward position. This is selector 2 position.

(4) Read pressures on both gauges as throttle lever on transaxle is moved from full clockwise position to full counterclockwise position.

(5) Line pressure should read 52 to 58 psi with throttle lever clockwise. Pressure should gradually increase to 80 to 88 psi. as lever is moved counterclockwise.

(6) Lubrication pressure should be 10 to 25 psi with lever clockwise and 10 to 35 psi with lever at full counterclockwise.

(7) This tests pump output, pressure regulation, and condition of rear clutch and lubrication hydraulic circuits.

TEST THREE (SELECTOR IN D)

(1) Attach gauges to line and kickdown release ports.

(2) Operate engine at 1600 rpm for test.

(3) Move selector lever on transaxle two detents forward from full rearward position. This is selector D position.

(4) Read pressures on both gauges as throttle lever on transaxle is moved from full clockwise to the full counterclockwise position.

DIAGNOSIS AND TESTING (Continued)

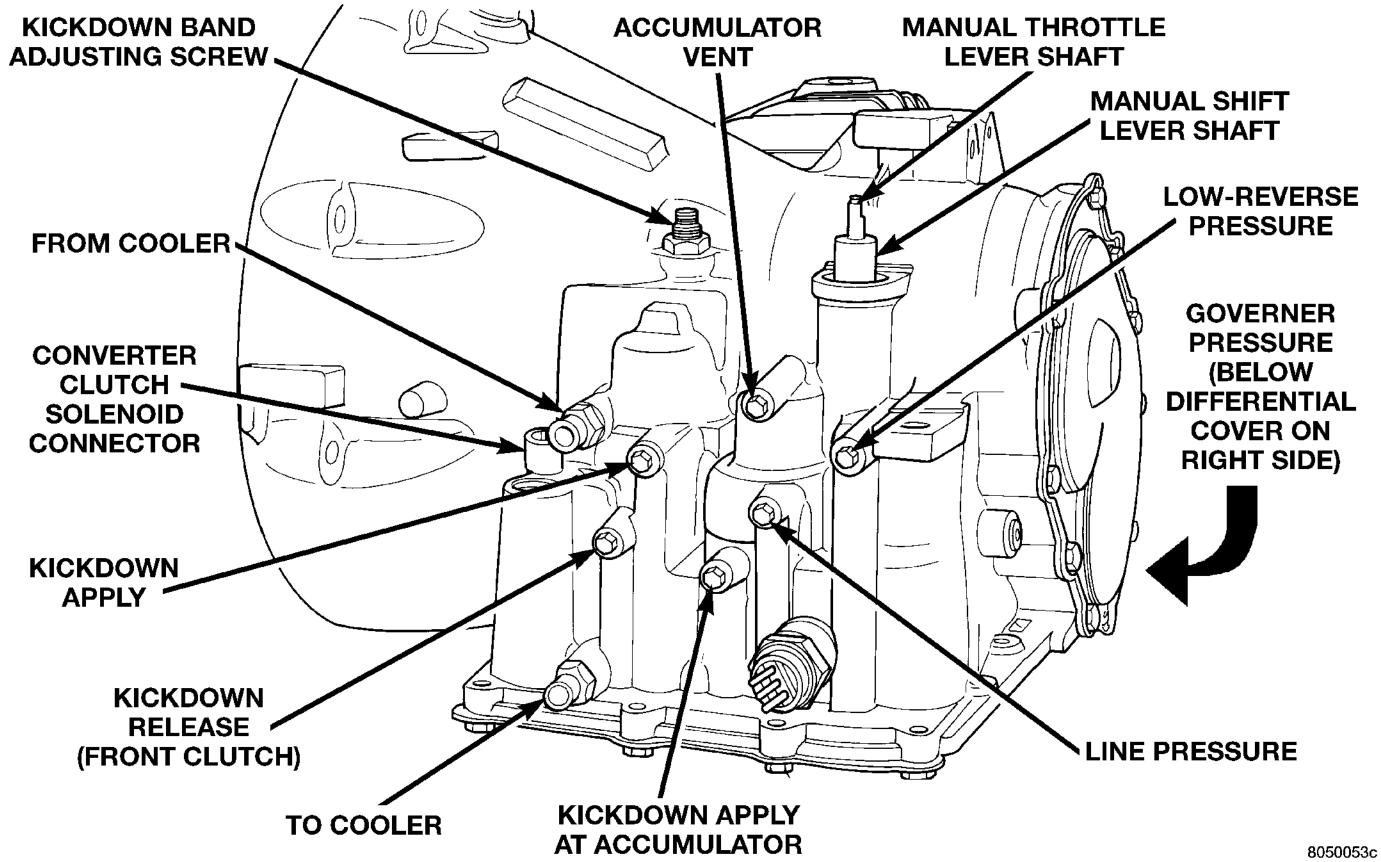


Fig. 3 Test Port Locations

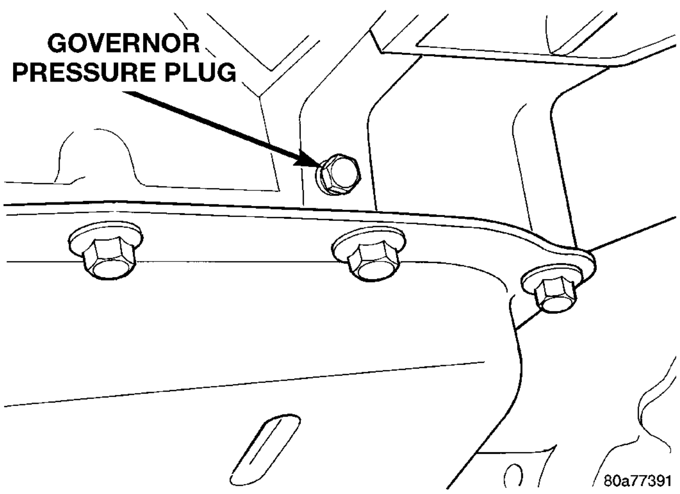


Fig. 4 Governor Pressure Tap

(5) Line pressure should read 52 to 58 psi with throttle lever clockwise. Pressure should gradually increase to 80 to 88 psi. as lever is moved counter-clockwise.

(6) Kickdown release is pressurized only in direct drive and should be same as line pressure within 3 psi, up to kickdown point.

(7) This tests pump output, pressure regulation, and condition of rear clutch, front clutch, and hydraulic circuits.

TEST FOUR (SELECTOR IN REVERSE)

(1) Attach 300 psi gauge to low-reverse port.

(2) Operate engine at 1600 rpm for test.

(3) Move selector lever on transaxle four detents forward from full rearward position. This is selector R position.

(4) Low/reverse pressure should read 180 to 220 psi with throttle lever clockwise. Pressure should gradually increase to 260 to 300 psi. as lever is moved counterclockwise.

(5) This tests pump output, pressure regulation, and condition of front clutch and rear servo hydraulic circuits.

(6) Move selector lever on transaxle to D position to check that low/reverse pressure drops to zero.

(7) This tests for leakage into rear servo, due to case porosity, which can cause reverse band burn out.

TEST RESULT INDICATIONS

(1) If proper line pressure, minimum to maximum, is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in D, 1, and 2 but correct pressure in R, indicates rear clutch circuit leakage.

(3) Low pressure in D and R, but correct pressure in 1 indicates front clutch circuit leakage.

DIAGNOSIS AND TESTING (Continued)

(4) Low pressure in R and 1, but correct pressure in 2 indicates rear servo circuit leakage.

(5) Low line pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

GOVERNOR PRESSURE

Test only if transaxle shifts at wrong vehicle speeds when throttle cable is correctly adjusted.

(1) Connect a 0-150 psi pressure gauge to governor pressure take-off point. It is located at lower right side of case, below differential cover.

(2) Operate transaxle in third gear to read pressures. The governor pressure should respond smoothly to changes in mph and should return to 0 to 3 psi when vehicle is stopped. High pressure (above 3 psi) at standstill will prevent the transaxle from downshifting.

THROTTLE PRESSURE

No gauge port is provided for throttle pressure. Incorrect throttle pressure should be suspected if part throttle upshift speeds are either delayed or occur too early in relation to vehicle speed. Engine runaway on shifts can also be an indicator of low throttle pressure setting, or misadjusted throttle cable.

In no case should throttle pressure be adjusted until the transaxle throttle cable adjustment has been verified to be correct.

CLUTCH AND SERVO AIR PRESSURE TESTS

A no–drive condition might exist even with correct fluid pressure, because of inoperative clutches or bands. The inoperative units, clutches, bands, and servos can be located through a series of tests. This is done by substituting air pressure for fluid pressure (Fig. 5).

The front and rear clutches, kickdown servo, and low/reverse servo can be tested by applying air pressure to their respective passages. To make air pressure tests, proceed as follows:

NOTE: Compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

Remove oil pan and valve body. Refer to Valve Body for removal procedure.

FRONT CLUTCH

Apply air pressure to front clutch apply passage and listen for a dull thud, which indicates that front clutch is operating. Hold air pressure on for a few seconds and inspect system for excessive oil leaks.

REAR CLUTCH

Apply air pressure to rear clutch apply passage and listen for a dull thud, which indicates that rear clutch is operating. Also, inspect for excessive oil leaks. If a dull thud cannot be heard in the clutches, place finger tips on clutch housing and again apply air pressure. Movement of piston can be felt as the clutch is applied.

KICKDOWN SERVO (FRONT)

Direct air pressure into KICKDOWN SERVO ON passage. Operation of servo is indicated by a tightening of front band. Spring tension on servo piston should release the band.

LOW AND REVERSE SERVO (REAR)

Direct air pressure into LOW/REVERSE SERVO APPLY passage. Operation of servo is indicated by a tightening of rear band. Spring tension on servo piston should release the band.

If clutches and servos operate properly, no upshift indicates that a malfunction exists in the valve body.

FLUID LEAKAGE-TRANSAXLE TORQUE CONVERTER HOUSING AREA

(1) Check for source of leakage.

(2) Since fluid leakage near the torque converter area may be from an engine oil leak, the area should be checked closely. Factory fill fluid is dyed red and, therefore, can be distinguished from engine oil.

(3) Prior to removing the transaxle, perform the following checks:

(4) When leakage is determined to originate from the transaxle, check fluid level prior to removal of the transaxle and torque converter.

(5) High oil level can result in oil leakage out the vent in the dipstick. If the fluid level is high, adjust to proper level.

(6) After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle. This will determine if the torque converter or transaxle is leaking.

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter (peripheral) weld
- Torque converter hub weld
- Torque converter impeller shell cracked adjacent to hub
- At drive lug welds

NOTE: Hub weld is inside and not visible. Do not attempt to repair. Replace torque converter.

DIAGNOSIS AND TESTING (Continued)

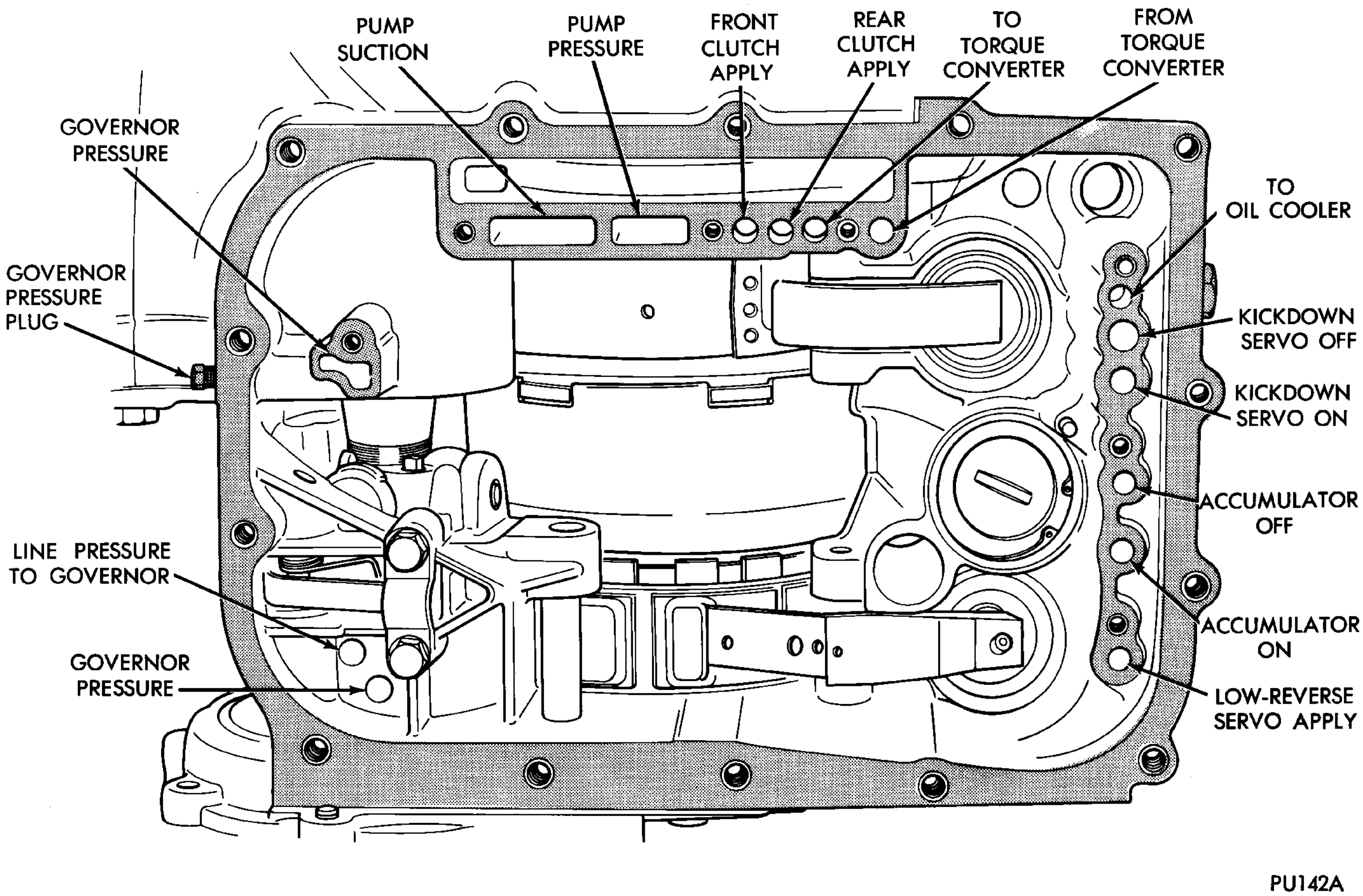


Fig. 5 Air Pressure Tests

INTERLOCK SYSTEM OPERATION CHECK

(1) Place shifter in PARK, the ignition switch should rotate freely from OFF to LOCK position. When the shifter is moved to the DRIVE position, the ignition switch should not rotate from OFF to LOCK.

(2) Moving shifter out of PARK should be possible only when ignition switch is in the OFF or the RUN position. Movement of the shifter from the PARK position should not be possible when the ignition switch is in the LOCK or the ACCESSORY position.

(3) If the interlock system, operates in any way other than as described above, repair of the interlock system is required. See Adjustment and Repair procedures in this section for the required procedures.

SERVICE PROCEDURES

FLUID AND FILTER CHANGE

NOTE: 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 (inside of oil pan) should be cleaned with a clean, dry cloth.

NOTE: 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 Group 0, Lubrication). Place a drain container, with a large opening, under transaxle oil pan.

(2) Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.

(3) Install a new filter and gasket on bottom of the valve body and tighten retaining screws to 5 N·m (40 inch-pounds).

(4) Clean the oil pan and magnet. Reinstall pan using new sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).

(5) Pour four quarts of Mopar ATF PLUS (Automatic Transmission Fluid) type 7176 into the transaxle filler tube.

SERVICE PROCEDURES (Continued)

(6) Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the PARK or NEUTRAL position.

(7) Add sufficient fluid to bring level to 1/8 inch below the ADD mark.

(8) Recheck fluid level after transaxle is at normal operating temperature. The level should be in the HOT region.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transaxle case and valve body can be repaired by the use of Heli-Coils. This repair consists of drilling out the worn-out or damaged threads. Then tap the hole with a Heli-Coil tap, and install a Heli-Coil insert into the hole. This brings the hole back to its original thread size.

Heli-Coil tools and inserts are readily available from most automotive parts suppliers.

FLUSHING COOLERS AND TUBES

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed. The cooler bypass valve in the transaxle must be replaced also. The torque converter must also be replaced with an exchange unit. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transaxle.

There are two different procedures for flushing coolers and lines. The recommended procedure is to use Tool 6906 Cooler Flusher. The other procedure is to use a hand suction gun and mineral spirits.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906

(1) Remove cover plate filler plug on Tool 6906. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission (Fig. 6).

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

COOLER FLUSH USING SUCTION GUN AND MINERAL SPIRITS

(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. 6) 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 (under 40 psi.) in intermittent spurts, blow any remaining mineral spirits from the cooler, again in the reverse direction.

(4) Pump one (1) quart of automatic transmission fluid through the cooler before reconnecting.

SERVICE PROCEDURES (Continued)

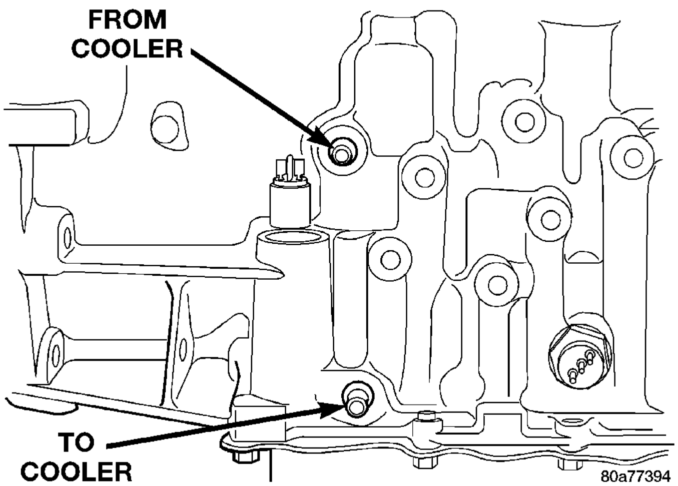


Fig. 6 Cooler Line Location

(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 and filled, the oil cooler 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 takes more than 20 seconds to collect one quart, 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 transaxle to the proper level, using the approved type of automatic transmission fluid.

REMOVAL AND INSTALLATION

GEARSHIFT CABLE

REMOVAL

(1) Disconnect both battery cables.

(2) Pull up and remove the power distribution center.

(3) Remove the battery thermoguard.

(4) Remove the battery and battery holddown from the battery tray.

(5) Remove the battery tray and cruise control servo (if equipped).

(6) Remove the screw from the cable bracket at the transaxle (Fig. 7).

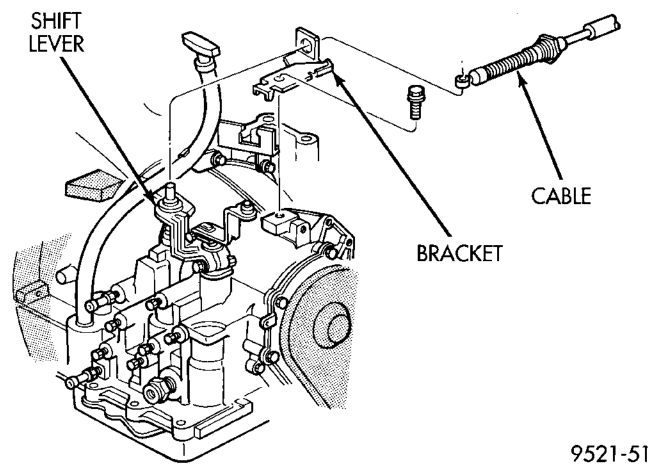


Fig. 7 Gearshift Cable

(7) Squeeze the three metal tabs in and remove the cable from the bracket.

(8) Remove the floor console. Refer to Group 23, Body.

(9) Remove the gearshift knob set screw and knob (Fig. 8).

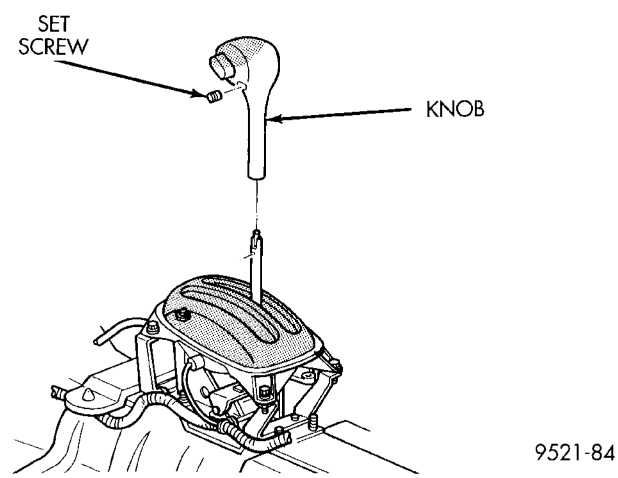


Fig. 8 Gearshift Handle

(10) Remove gearshift indicator lamp at shifter bezel.

(11) Remove the screws retaining the shifter bezel (Fig. 9).

(12) Using a flat–blade pry tool, remove the shifter cable core end from the shift lever pin (Fig. 10).

(13) Using a small screwdriver, pry the cable conduit end tabs away from the shifter mechanism. Pull up on the conduit end and slide the end out of the gearshift mechanism.

(14) Remove the three nuts retaining the shift cable grommet plate to the floor pan (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

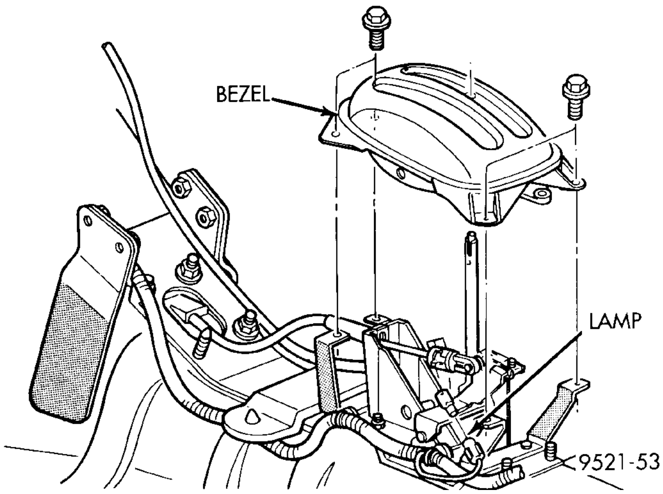


Fig. 9 Gearshift Bezel

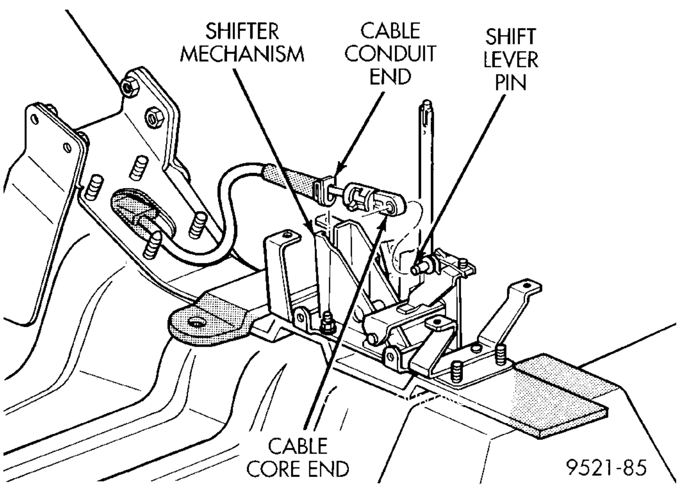


Fig. 10 Gearshift Cable

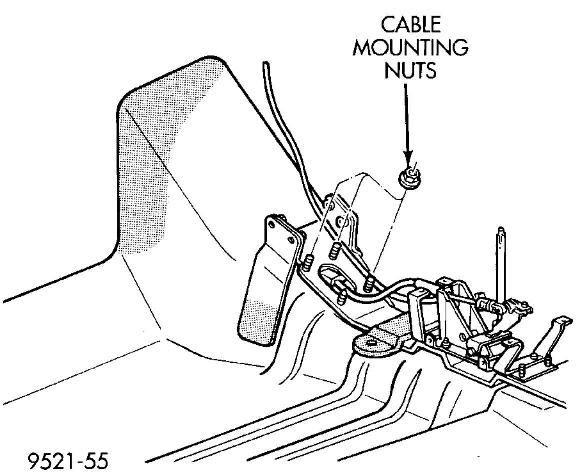


Fig. 11 Cable Mounting

(15) Hoist vehicle. Refer to Group 0, Lubrication and Maintenance.

(16) Remove the one screw at the shift cable grommet plate (Fig. 12).

(17) Loosen screws on shift cable grommet plate. Slide plate out and away from heat shield.

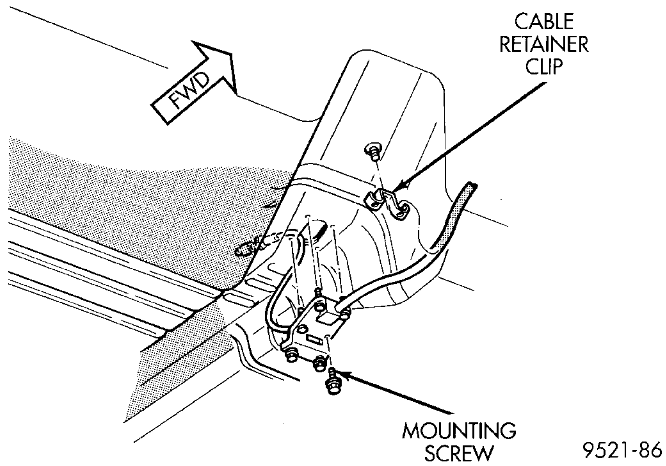


Fig. 12 Cable Mounting Underbody

(18) Carefully remove the cable from the underbody by unfolding the cable retainer clip as you go along.

INSTALLATION

(1) To install gearshift cable, reverse removal procedure.

(2) Adjust gearshift cable using the adjustment procedure in this Group.

GEARSHIFT MECHANISM

REMOVAL

(1) Disconnect battery negative cable and isolate.

(2) Remove console assembly. Refer to Group 23, Body.

(3) Remove the gearshift knob set screw and knob (Fig. 13).

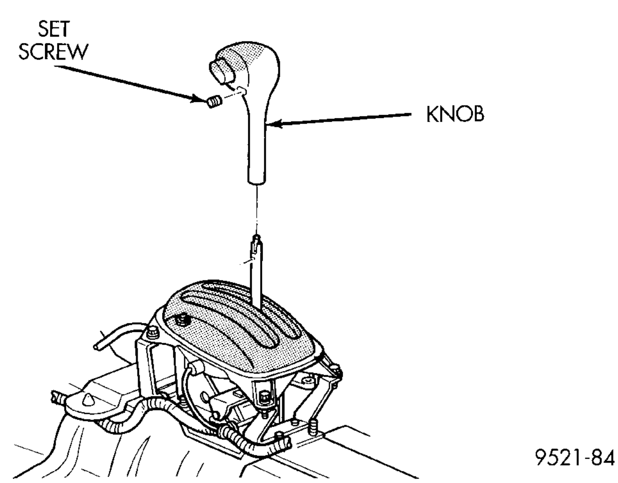


Fig. 13 Gearshift Handle

REMOVAL AND INSTALLATION (Continued)

(4) Remove the screws retaining the gearshift indicator bezel and remove bezel and indicator lamp.

(5) Using a flat–blade pry tool, remove the shifter cable end from the gearshift pin (Fig. 14).

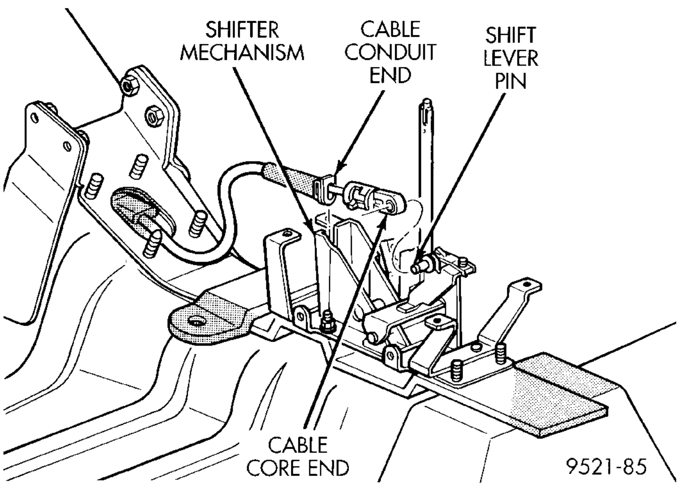


Fig. 14 Gearshift Cable

(6) Pry the two tabs on the cable conduit end away from the gearshift mechanism and pull up on the cable. Remove the gearshift cable from the gearshift mechanism.

(7) Pry up the adjuster lock on the shifter/ignition interlock cable. Unsnap the shifter/ignition interlock cable end fitting from the groove in the gearshift mechanism. Remove the cable core end from the plastic cam of the shifter mechanism (Fig. 15).

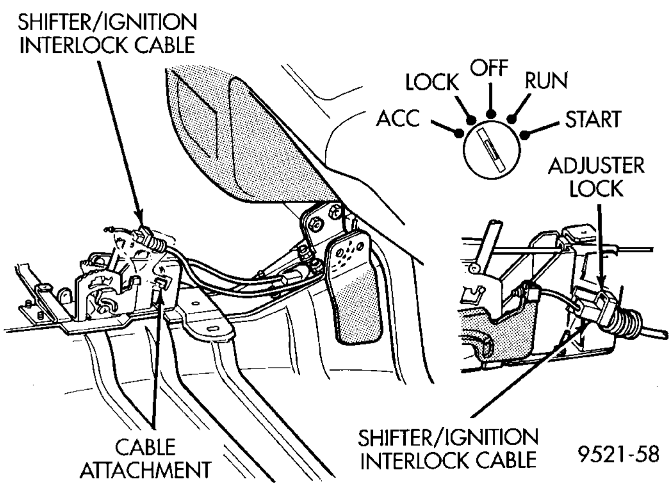


Fig. 15 Shifter Ignition Interlock Cable

(8) Remove the nuts at the base of the gearshift mechanism (Fig. 16). Remove the shifter mechanism.

INSTALLATION

(1) For installation, reverse removal steps. Refer to Cable Adjustment for proper cable adjustment procedure.

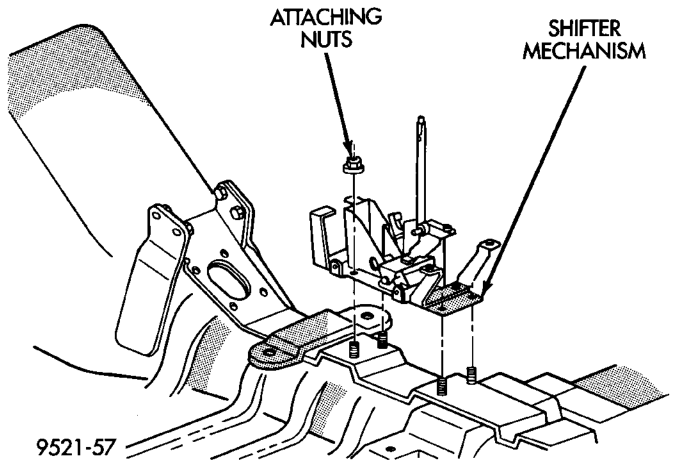


Fig. 16 Gearshift Mechanism

THROTTLE PRESSURE CABLE

REMOVAL

(1) Unsnap the throttle pressure cable end at the throttle control lever at transaxle (Fig. 17).

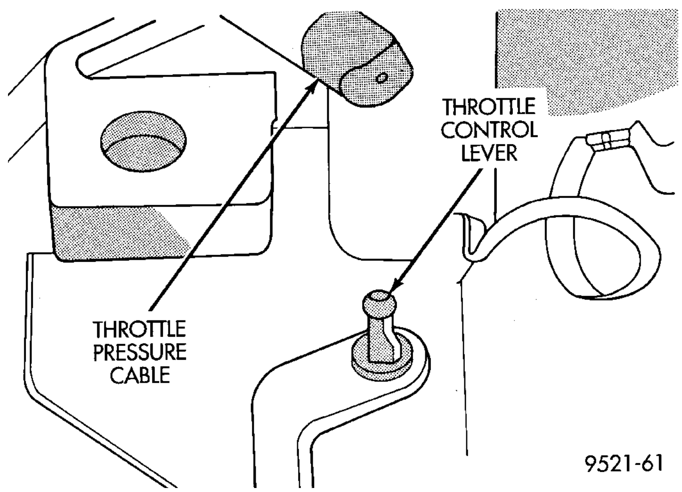


Fig. 17 Throttle Pressure Cable And Lever

(2) Squeeze the retaining tabs inward at the mounting bracket (Fig. 18). Remove the cable from the bracket.

(3) Unsnap the cable end from the throttle linkage cam. Squeeze the tabs inward at the bracket (Fig. 19). Remove the cable from the vehicle.

INSTALLATION

(1) To install cable, reverse removal procedure. Refer to cable adjustment procedure for proper cable adjustment.

THROTTLE PRESSURE CABLE ADJUSTMENT PROCEDURE

The throttle pressure cable adjustment is very important to proper transaxle operation. This adjustment positions a valve that controls shift speed, shift

REMOVAL AND INSTALLATION (Continued)

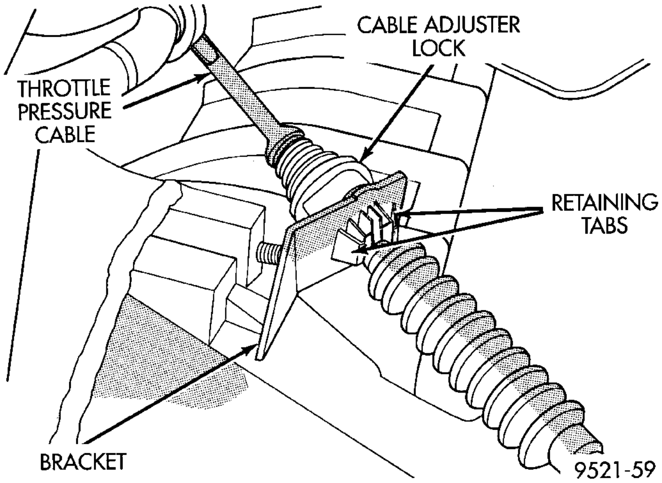


Fig. 18 Throttle Pressure Cable Bracket

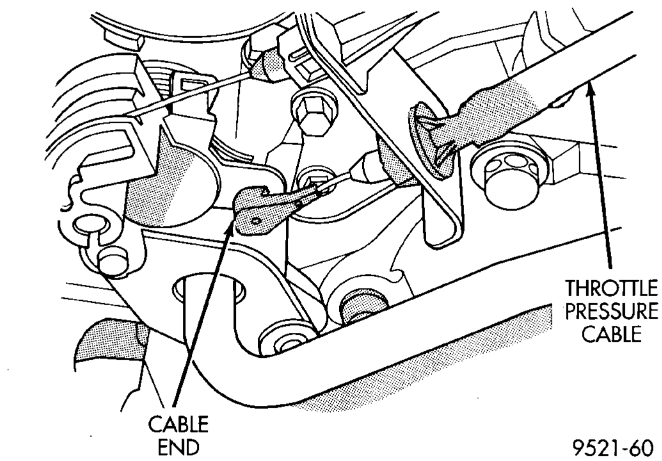


Fig. 19 Cable End At Throttle Linkage

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.

(1) Perform transaxle throttle pressure cable adjustment while engine is at normal operating temperature.

(2) Release cross-lock on the cable assembly (pull cross-lock upward) See (Fig. 18).

(3) 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.

(4) Move transaxle throttle control lever fully clockwise, against its internal stop, and press cross-lock downward into locked position.

The adjustment is complete and transaxle throttle cable backlash was automatically removed.

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).

No lubrication is required for any component of the throttle cable system.

SHIFTER IGNITION INTERLOCK CABLE

REMOVAL

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove console assembly. Refer to Group 23, Body.

(3) Remove the gearshift knob set screw and knob (Fig. 20).

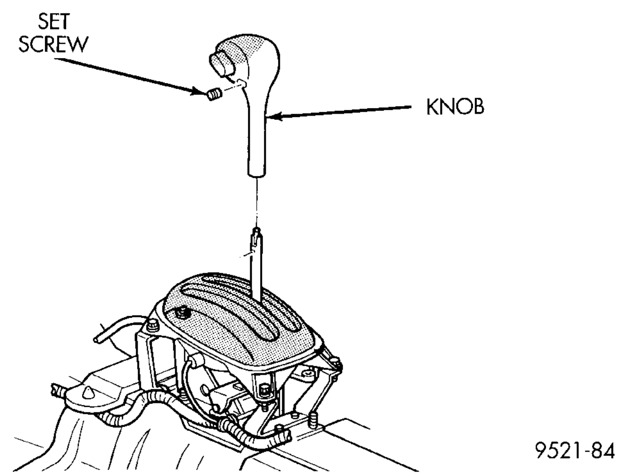


Fig. 20 Gearshift Handle

(4) Remove the screws retaining the gearshift indicator bezel and remove bezel and indicator lamp (Fig. 21).

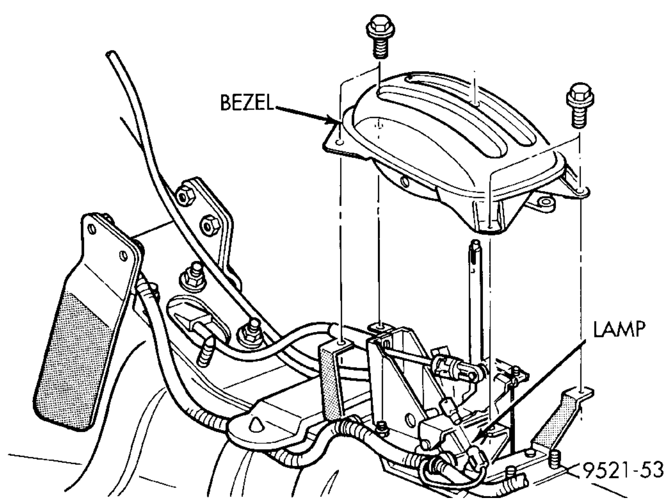


Fig. 21 Shift Indicator Bezel

(5) Pry up the adjuster lock on the shifter/ignition interlock cable. Unsnap the shifter/ignition interlock cable end fitting from the groove in the gearshift mechanism (Fig. 22).

(6) Remove the cable core end from the plastic cam of the shifter mechanism.

REMOVAL AND INSTALLATION (Continued)

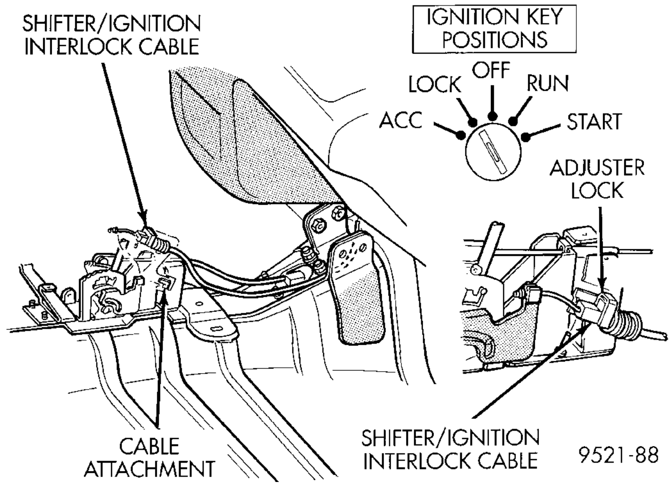


Fig. 22 Shifter Ignition Interlock Cable

(7) Pull cable up and out of the gearshift mechanism.

(8) Remove the three screws along the bottom of the lower steering column cover and screw on the left outward face of cover (Fig. 23).

(13) Insert a screwdriver into access hole in the lower shroud. Depress the cylinder button while rotating the cylinder with the key inserted between the ON and START positions. This will disengage the cylinder from the column (Fig. 24).

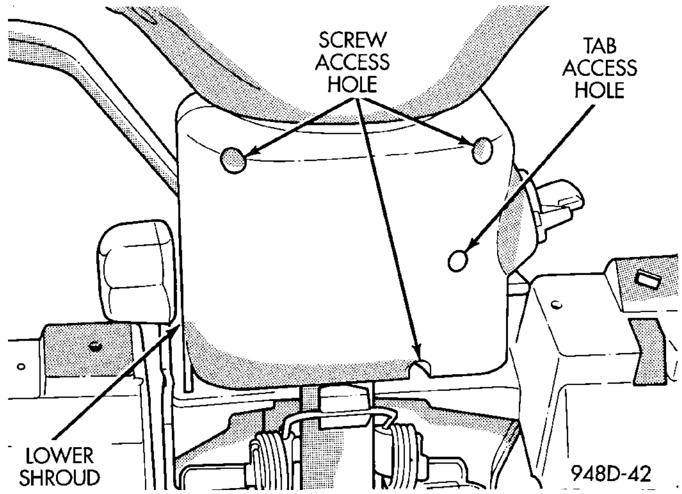


Fig. 24 Ignition Lock Cylinder

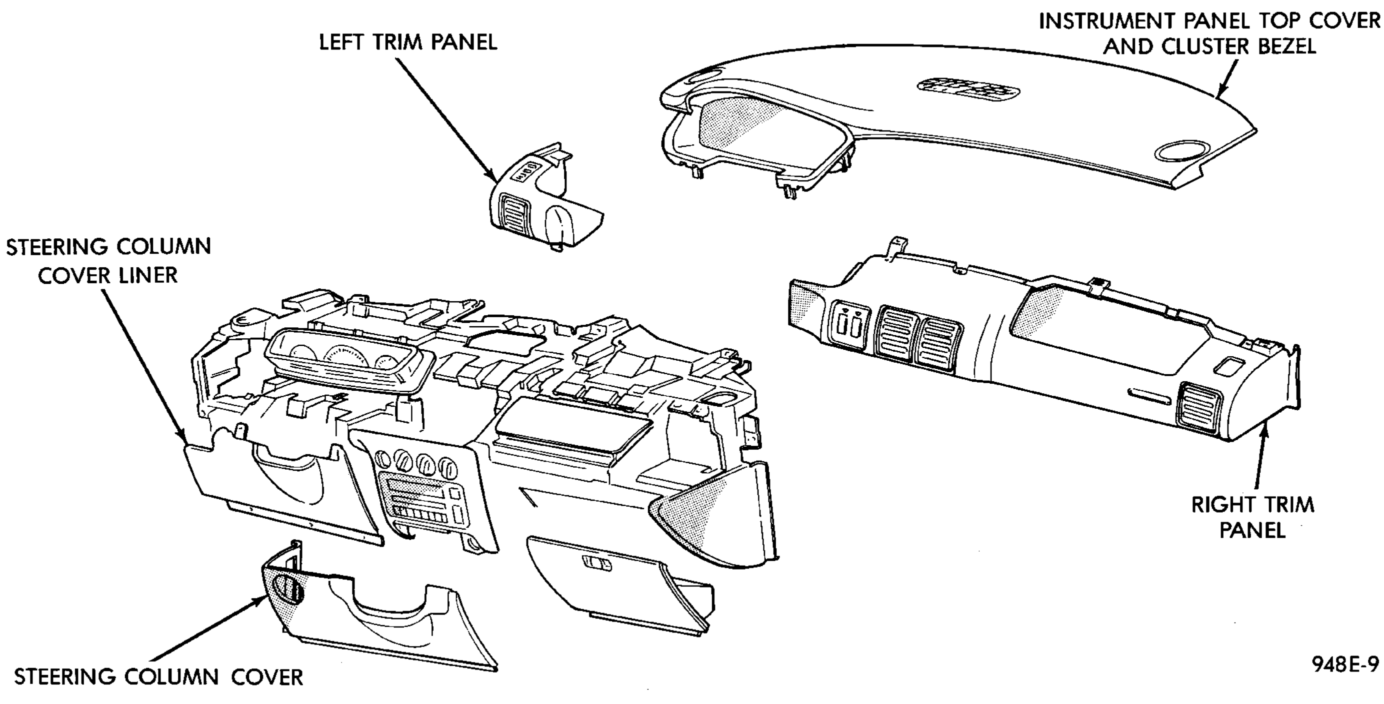


Fig. 23 Lower Column Covers

(9) Grasp the cover and pull rearward until the clips disengage.

(10) Remove two screws at the upper area of the column liner and lower left corner.

(11) Remove steering column cover and steering column cover liner.

(12) Lift up the top cover and cluster bezel until the clips disengage and separate to provide clearance.

(14) Pull out the key cylinder.

(15) Remove the three lower–to–upper shroud attaching screws through the bottom of the lower shroud (Fig. 25).

(16) Separate the upper and lower shrouds.

(17) Grasp the interlock cable clip and connector. Remove the cable from the interlock housing (Fig. 26).

(18) Unclip the cable from the retaining clip located within the wiring harness.

REMOVAL AND INSTALLATION (Continued)

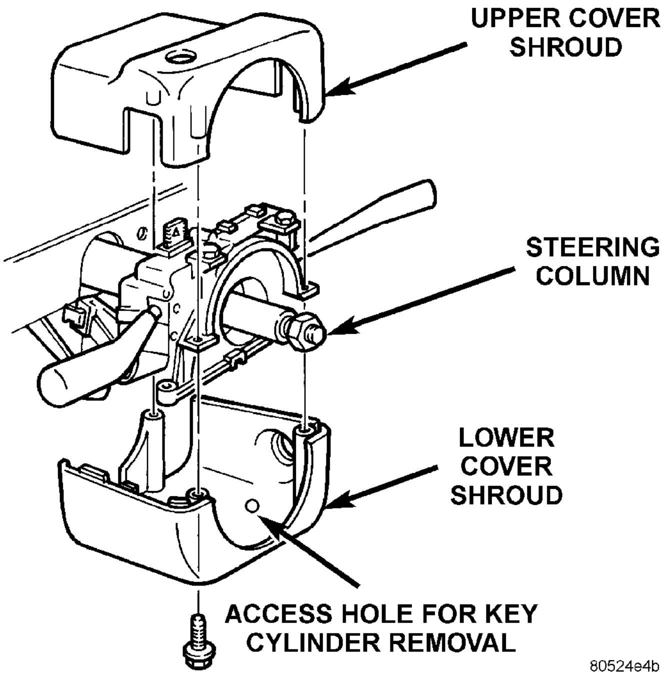


Fig. 25 Upper/Lower Shroud

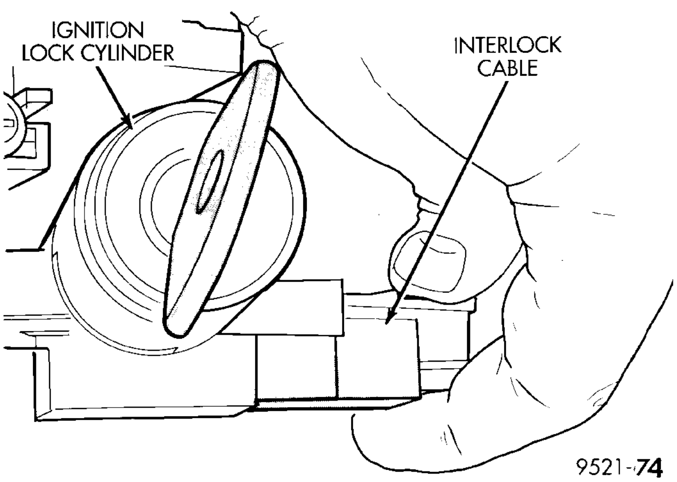


Fig. 26 Interlock Cable and Connector

(19) Remove interlock cable from under center console mounting bracket and out front of dash panel.

INSTALLATION

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.

(2) Install the ignition switch into housing. Turn the ignition switch to the RUN position.

(3) Install the interlock cable into the interlock housing at the steering column (Fig. 27). Verify the cable snaps into the housing.

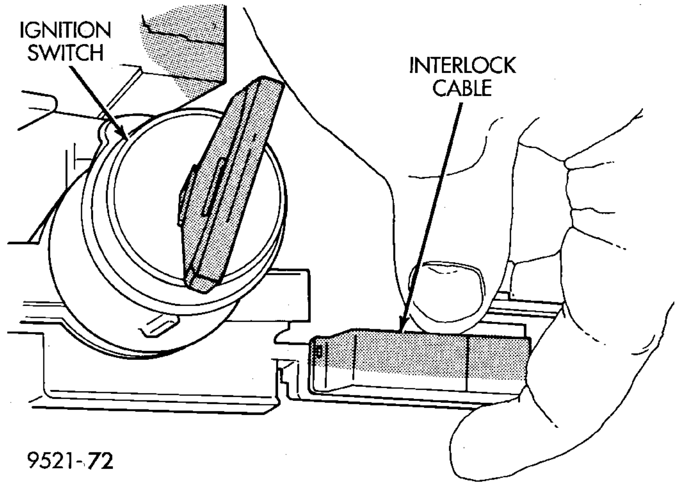


Fig. 27 Interlock Cable at Interlock Housing

(4) Install interlock cable into routing clip located within the wiring harness.

(5) Route interlock cable to the console.

(6) Install the cable core end to the plastic cam of the shifter mechanism. Snap the shifter/ignition interlock cable end fitting into the groove in the gearshift mechanism.

(7) Adjust the Shifter/Ignition Interlock System. See Interlock System Adjustment, in this section.

(8) Perform the Shifter/Ignition Interlock System operation check, as described in the beginning of this section.

(9) Install console assembly. Refer to Group 23, Body.

(10) Install screws retaining the gearshift indicator bezel and install bezel and indicator lamp.

(11) Install the gearshift knob set screw and knob.

(12) Install two screws at the upper area of the column liner and lower left corner.

(13) Snap the clips in at the lower column cover. Install the three screws along the bottom of the lower steering column cover and screw on the left outward face of cover.

(14) Install key cylinder.

(15) Position the shrouds in place. Install the three lower–to–upper shroud attaching screws through the bottom of the lower shroud.

(16) Reinstall the ignition lock cylinder into housing.

(17) Reconnect the battery negative (-) cable to the vehicle battery.

INTERLOCK SYSTEM ADJUSTMENT

If ignition switch cannot be turned to the LOCK position, with shifter in PARK, an adjustment of the Interlock System may be required. To adjust Shifter/ Ignition Interlock System, follow procedure listed below.

REMOVAL AND INSTALLATION (Continued)

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove console assembly. Refer to Group 23, Body.

(3) Remove the gearshift knob set screw and knob.

(4) Remove the screws retaining the gearshift indicator bezel and remove bezel and indicator lamp.

(5) Reinstall the gearshift knob.

(6) Place shifter in PARK.

(7) Turn ignition switch to the LOCK or ACCESSORY position. If cable has lost its adjustment, manually position cable to get key into LOCK or ACCESSORY position. Grasp slug on interlock cable with needle nose pliers and pull back on cable. This will allow the ignition switch to be turned to the LOCK or ACCESSORY position.

(8) Check that the interlock cable slug is completely seated into the shifter interlock lever.

(9) Check that the ignition switch is still in the LOCK or ACCESSORY position.

(10) Pry up the adjuster lock on the shifter/ignition interlock cable (Fig. 28).

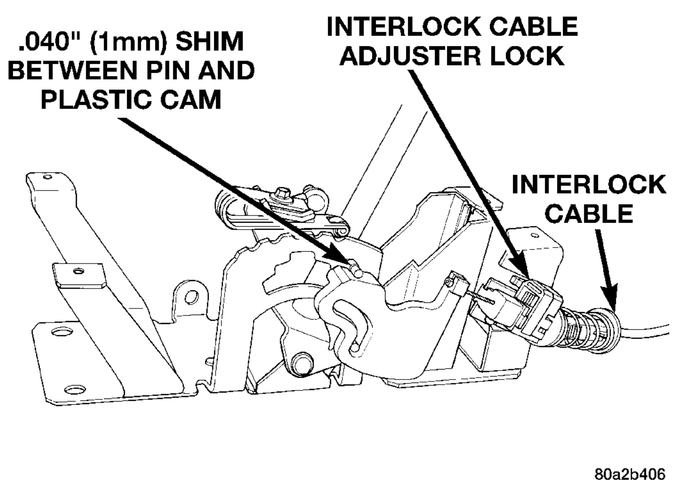


Fig. 28 Interlock Cable Adjuster Lock

(11) Place a 1mm (0.040) shim between the larger diameter portion of the shifter gate pin and the plastic cam (Fig. 28).

(12) The spring on the interlock cable should automatically compensate for the slack in the adjuster.

(13) Snap down the interlock adjuster lock onto the cable and remove the shim.

(14) After adjusting the interlock system, perform the Interlock System Operation Check in the Adjustments section of this group.

INTERLOCK MECHANISM

REMOVAL

(1) Remove the lower column covers, ignition switch, and shrouds. Refer to Interlock Cable Replacement.

(2) Grasp the interlock cable and connector firmly. Remove the interlock cable (Fig. 29).

(3) Remove the two interlock mechanism–to–steering column attaching screws (Fig. 30). Remove the interlock housing.

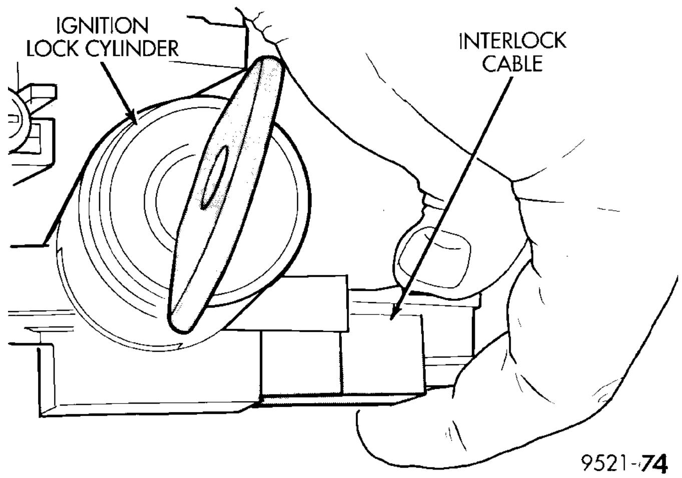


Fig. 29 Interlock Cable

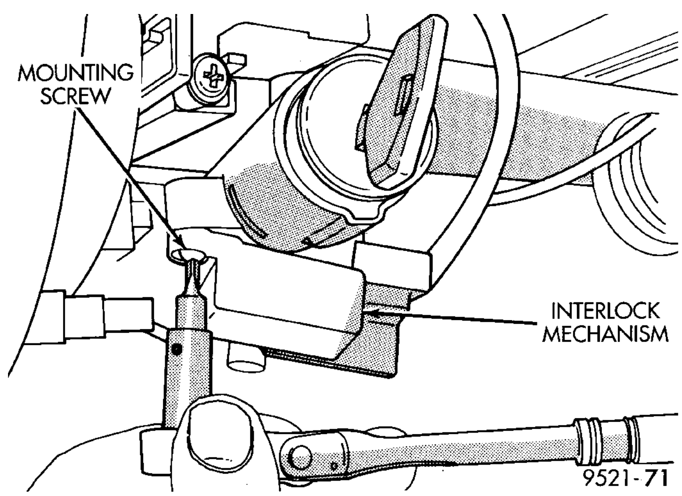


Fig. 30 Interlock Mechanism

INSTALLATION

(1) Position the interlock housing at steering column. Install the two interlock mechanism–to–steering column attaching screws. Torque screws to 3 N·m (21 in. lbs.).

(2) Snap the interlock cable into the housing.

(3) Install the lower column covers, shrouds, and ignition switch. Refer to Interlock Cable Replacement.

VEHICLE SPEED SENSOR PINION GEAR

When the sensor is removed for any reason, a NEW O-ring must be installed on its outside diameter.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove harness connector from sensor. Be sure weather seal stays on harness connector.

(2) Remove bolt securing the sensor in the extension housing.

(3) Carefully pull sensor and pinion gear assembly out of extension housing.

(4) Remove pinion gear from sensor.

INSTALLATION

(1) To install, reverse the above procedure. Be sure extension housing and sensor flange are clean prior to installation. Always use a NEW sensor O-ring.

(2) Tighten bolt to 7 N·m (60 in. lbs.). Tighten speedometer cable to 4 N·m (35 in. lbs.).

PARK/NEUTRAL STARTING AND BACK-UP LAMP SWITCH

TEST

The park/neutral starting switch is the center terminal of the three terminal switch. It provides ground for the starter solenoid circuit through the selector lever in PARK and NEUTRAL positions only.

(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 that tests bad.

REMOVAL

(1) Unscrew switch from transaxle case allowing fluid to drain into a container. Move selector lever to PARK, then to NEUTRAL position, and inspect to see the switch operating lever fingers are centered in switch opening.

INSTALLATION

(1) Screw the switch with a new seal into transaxle case and tighten to 33 N·m (24 ft. lbs.). Retest switch with the test lamp.

(2) Add fluid to transaxle to bring up to proper level.

(3) The back-up lamp switch circuit is through the two outside terminals of the three terminal switch.

(4) To test switch, remove wiring connector from switch and test for continuity between the two outside pins.

(5) Continuity should exist only with transaxle in REVERSE position.

(6) No continuity should exist from either pin to the case.

TRANSAXLE

REMOVAL

NOTE: The transaxle can be removed from the vehicle without having to remove the engine.

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.

All transaxle components are serviced with the transaxle out of the vehicle. The components that are serviceable in the vehicle are:

- Axle shaft seals
- Back–up lamp switch
- End plate
- Extension housing
- Neutral safety switch
- Shift lever
- Transaxle oil pan
- Valve Body
- Vehicle speed sensor

(1) Disconnect the battery.

(2) Pull Power Distribution Center up and out of its holding bracket. Set Power Distribution Center aside to gain clearance.

(3) Remove battery heat shield and remove battery from engine compartment. Remove battery tray from engine compartment. Disconnect cruise control (if equipped).

(4) Remove vehicle speed sensor wiring.

(5) Disconnect neutral safety switch and torque converter control wiring at transaxle.

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushing to avoid damaging cable isolator bushing.

(6) Disconnect gear shift cable end from transaxle shift lever (Fig. 31). Remove bracket bolt at transaxle (Fig. 32).

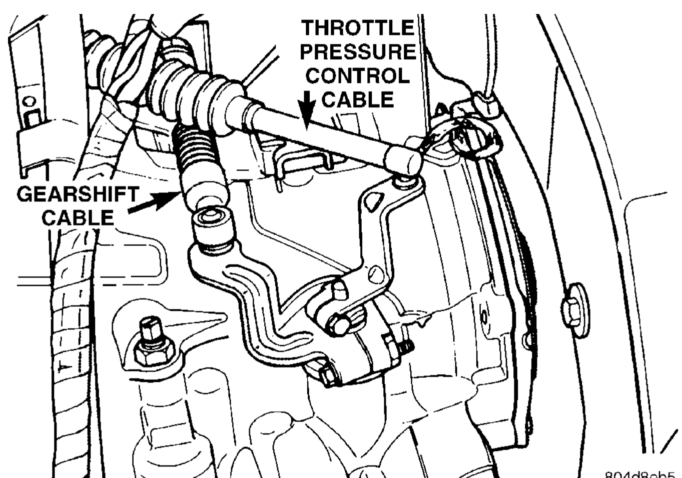


Fig. 31 Gearshift Cable

REMOVAL AND INSTALLATION (Continued)

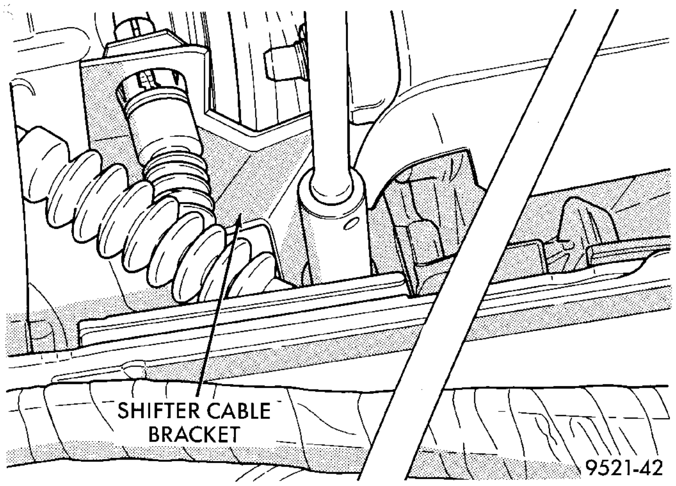


Fig. 32 Shifter Cable Bracket

(7) Remove throttle pressure control cable from lever. Then remove bracket bolts at the transaxle (Fig. 33).

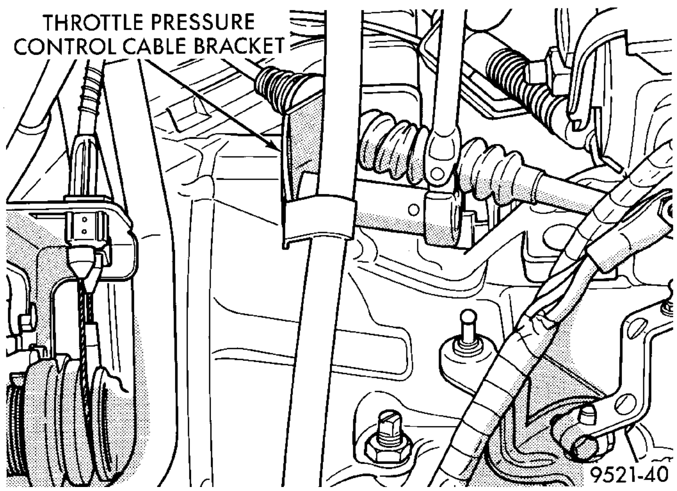


Fig. 33 Bracket Removal

(8) Remove dipstick tube.

(9) Remove transaxle cooler lines and plug lines (Fig. 34).

(10) Remove throttle pressure control cable support bracket bolts. Remove upper bellhousing bolts and upper starter bolt (Fig. 35).

(11) Install engine bridge fixture and support engine (Fig. 36).

(12) Lift vehicle on hoist and remove front wheels.

(13) Remove both front driveshafts. Refer to Group 2, Suspension for procedure.

CAUTION: When reinstalling driveshafts, new driveshaft retaining clips must be used. Do not reuse old clips. Failure to use new clips may result in disengagement of inner constant–velocity joint.

(14) Remove transaxle to rear lateral bending strut from engine and transaxle (Fig. 37).

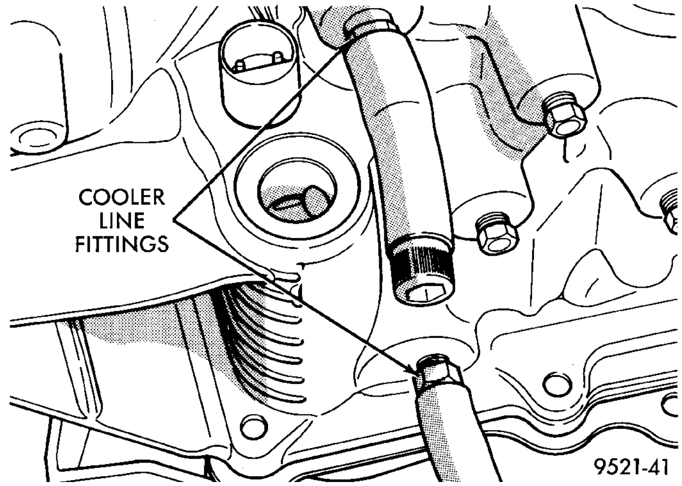


Fig. 34 Cooler Lines

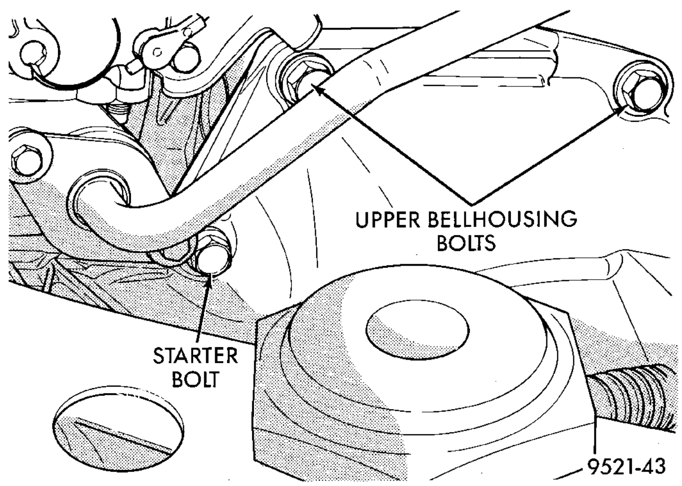


Fig. 35 Starter and Bellhousing Bolts

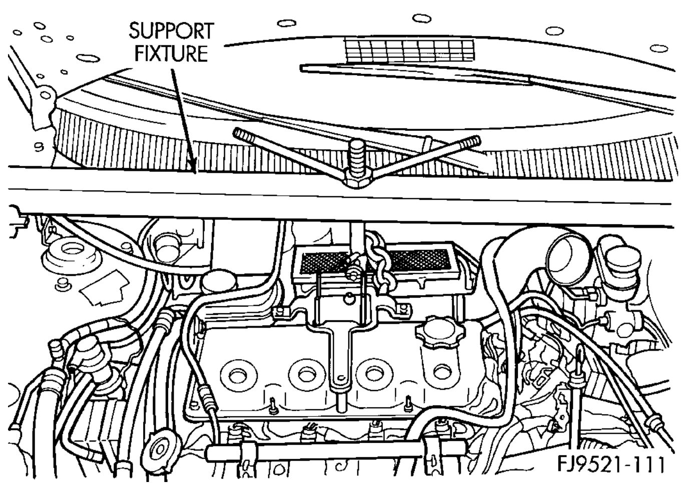


Fig. 36 Engine Bridge Fixture

(15) Remove front engine bracket through–bolt. Remove front engine bracket bolts (Fig. 38).

(16) Remove lower starter bolt (Fig. 39).

(17) Remove lower dust shield screw.

REMOVAL AND INSTALLATION (Continued)

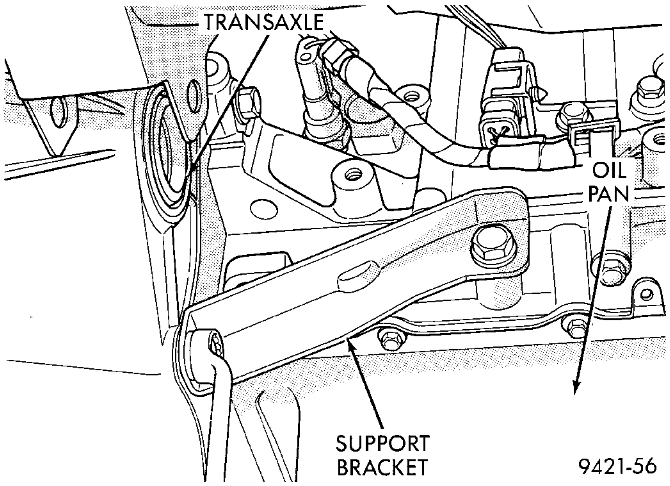


Fig. 37 Bracket Removal

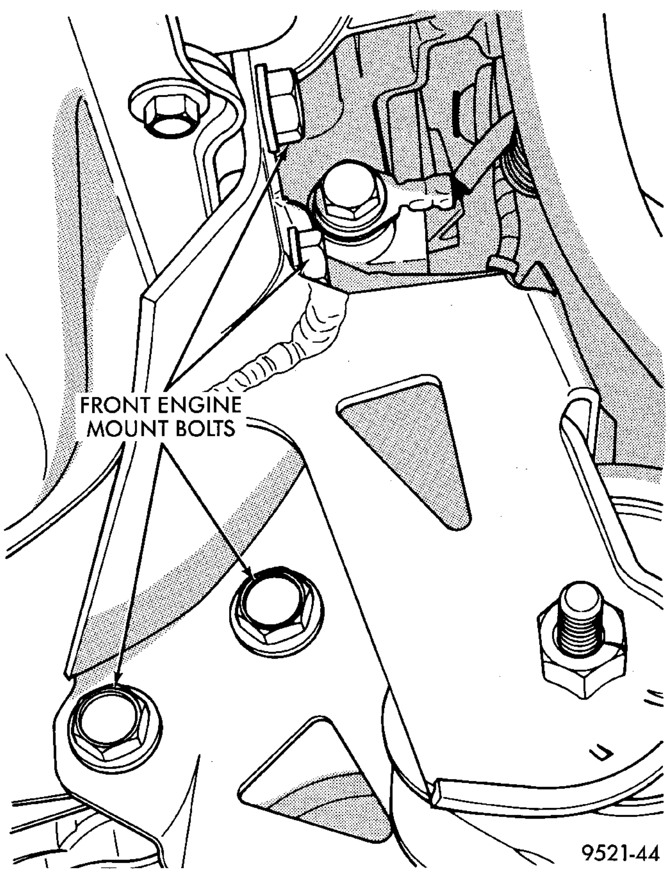


Fig. 38 Front Engine Bracket

(18) Rotate engine clockwise to gain access to converter bolts (Fig. 40). Remove torque converter bolts (Fig. 41). Mark converter to flex plate for reassembly ease.

(19) Support transaxle with a transmission jack.

(20) Remove left mount through–bolt (Fig. 42). Remove left mount bolts from transaxle (Fig. 43).

(21) Remove left transaxle mount from transaxle.

(22) Remove rear engine bolt at transaxle.

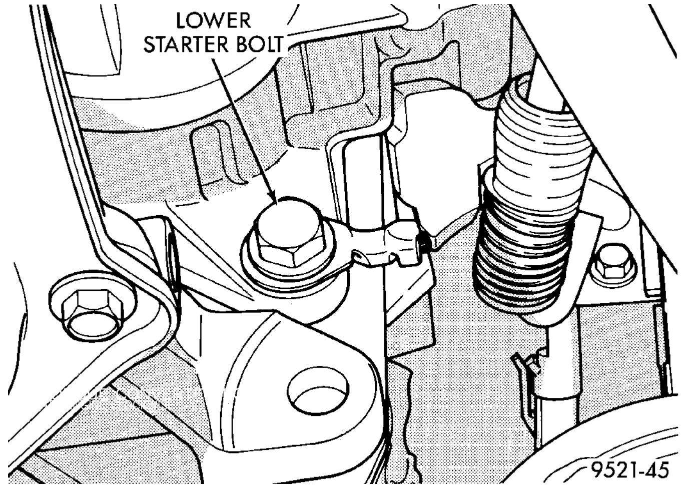


Fig. 39 Starter Bolts

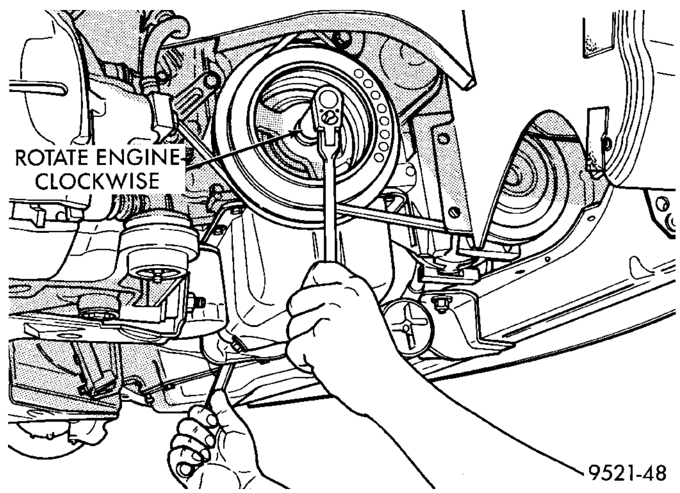


Fig. 40 Rotate Engine

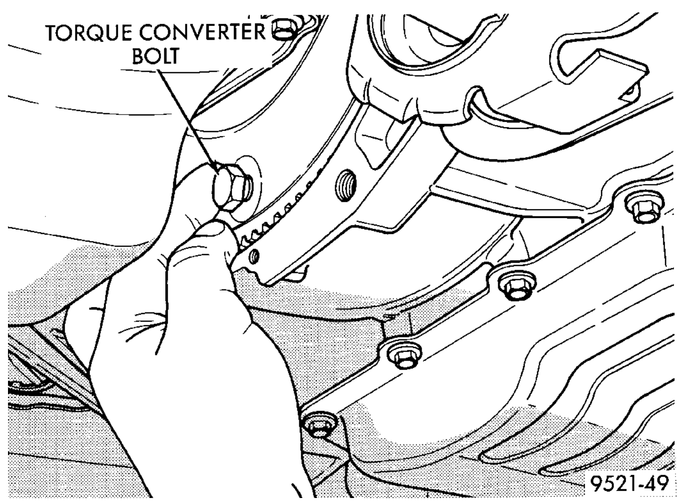


Fig. 41 Torque Converter Bolts

(23) Carefully work transaxle and torque converter assembly rearward off engine block dowels. Disengage converter hub from end of crankshaft. **Attach a small C-clamp to edge of bellhousing. This will**

REMOVAL AND INSTALLATION (Continued)

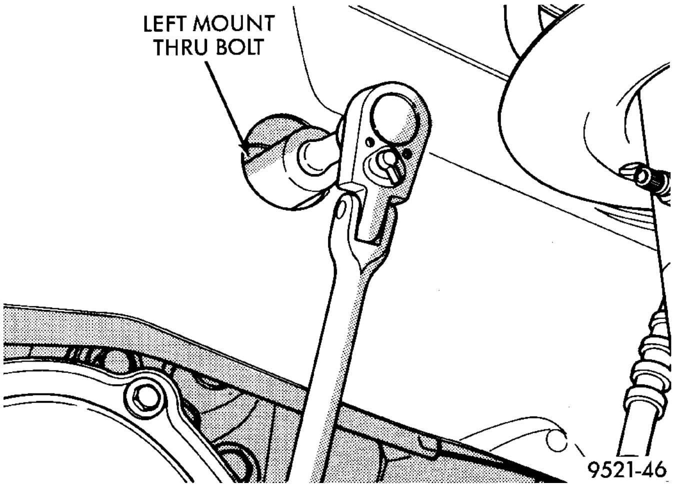


Fig. 42 Left Transaxle Mount Through–Bolt

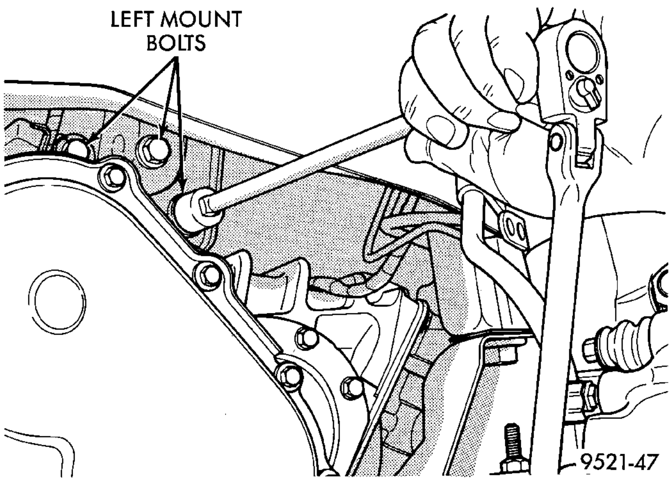


Fig. 43 Left Mount Bolts

hold torque converter in place during transaxle removal. Lower transaxle and remove assembly from under the vehicle.

INSTALLATION

(1) To install transaxle, reverse removal procedure.

(2) If torque converter was removed from transaxle be sure to align pump inner gear pilot flats with torque converter impeller hub flats.

(3) Adjust gearshift and throttle cables.

(4) Refill transaxle with MOPAR® ATF PLUS (Automatic Transmission Fluid) type 7176.

(5) Verify that vehicle's back-up lights and speedometer are functioning properly.

PUMP OIL SEAL

The pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transaxle case.

REMOVAL

(1) Screw seal remover Tool C-3981-B into seal (Fig. 44), then tighten screw portion of tool to withdraw the seal.

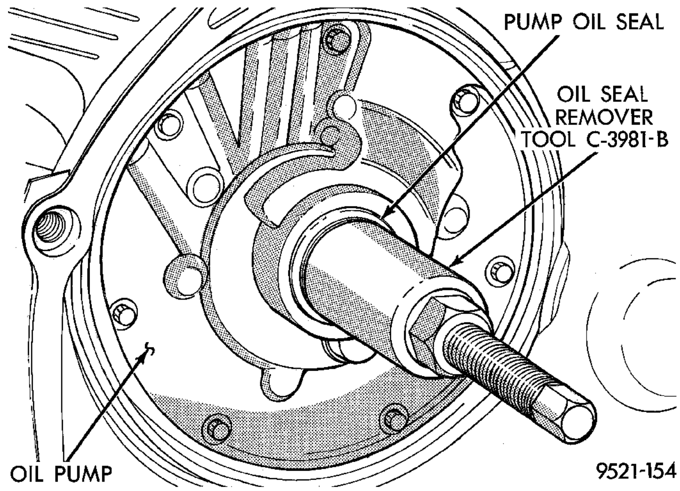


Fig. 44 Remove Pump Oil Seal

INSTALLATION

(1) To install a new seal, place seal in opening of the pump housing (lip side facing inward). Using Tool C-4193 and Handle Tool C-4171, drive new seal into housing until tool bottoms (Fig. 45).

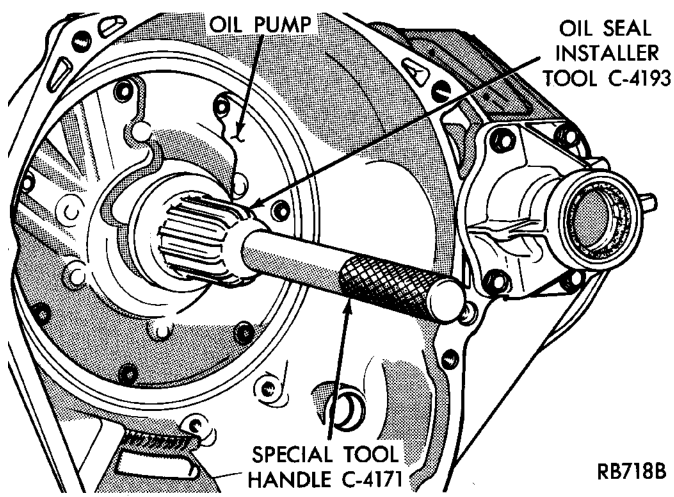


Fig. 45 Install Pump Oil Seal

DISASSEMBLY AND ASSEMBLY

TRANSAXLE

Prior to removing any transaxle parts, plug all openings and clean the unit, preferably with steam. When disassembling, each part should be washed in a suitable solvent, then dried with compressed air. Do not wipe parts with shop towels. All mating surfaces in the transaxles are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

DISASSEMBLY AND ASSEMBLY (Continued)

DISASSEMBLY

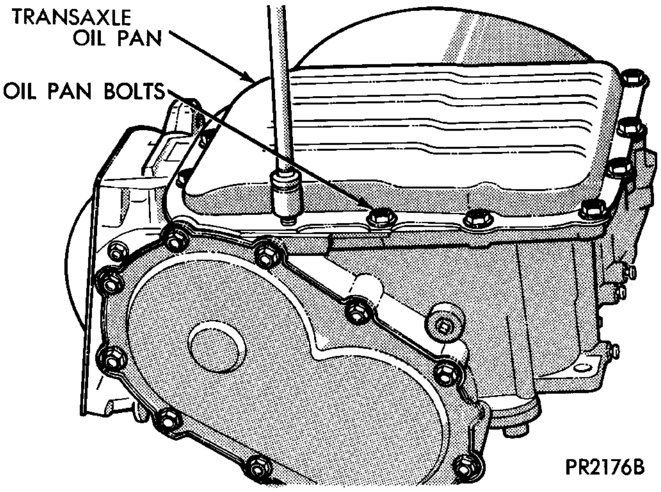


Fig. 46 Transaxle Oil Pan Bolts

Remove all old sealant before applying new sealant.

Use only Mopar® Silicone Rubber Sealant or equivalent when installing oil pan.

Put sealant on the oil pan flange (Fig. 47) and on all oil pan bolts (underside of bolt head).

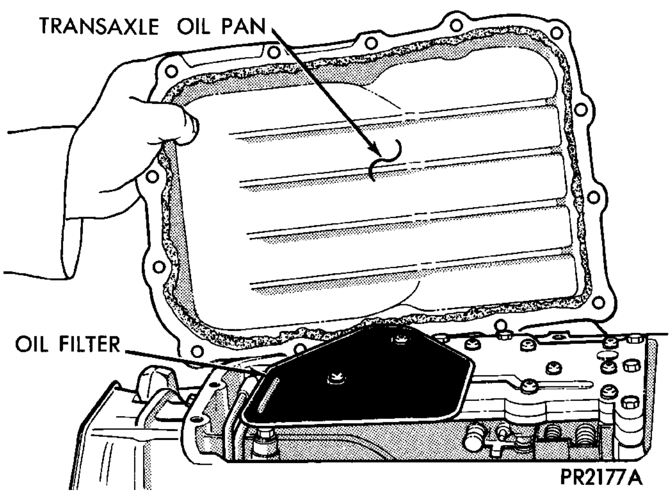


Fig. 47 Transaxle Oil Pan

Remove neutral starting and back-up lamp switch.

Measuring input shaft end play before disassembly will usually indicate if a thrust washer change is required. The thrust washer is located between input and output shafts.

Attach a dial indicator to transaxle bell housing with its plunger seated against end of input shaft (Fig. 54).

Move input shaft in and out to obtain end play reading. End play specifications are 0.19 to 1.50 mm (0.008 to 0.060 inch).

Record indicator reading for reference when reassembling the transaxle.

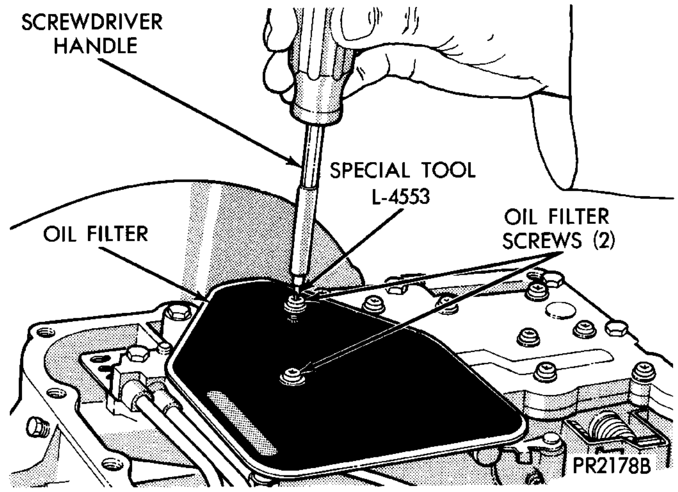


Fig. 48 Oil Filter Screws

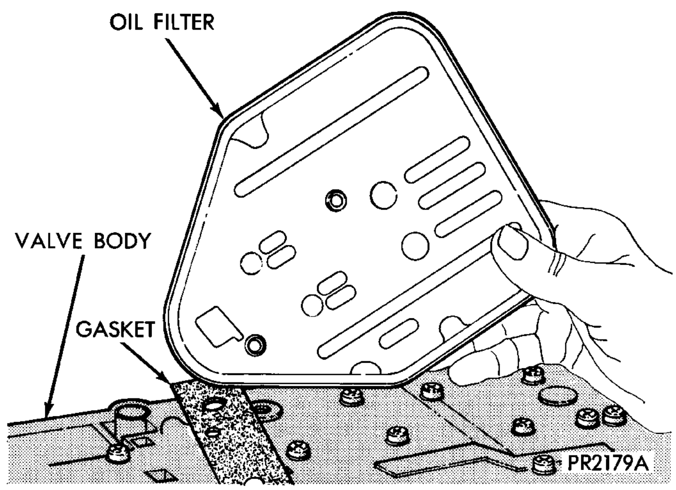


Fig. 49 Oil Filter

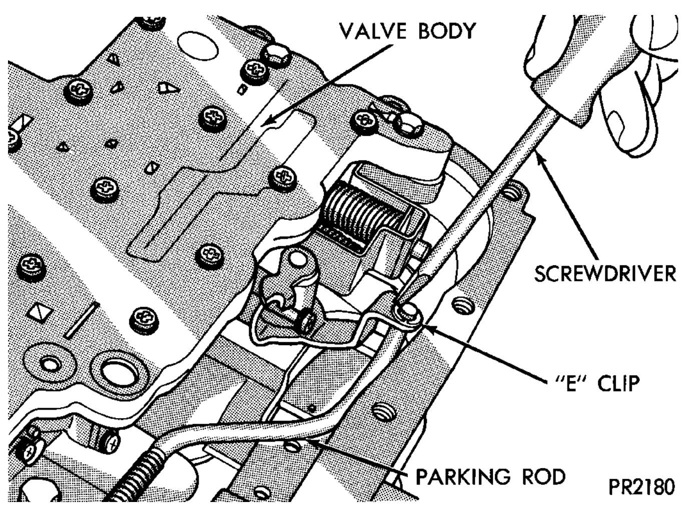


Fig. 50 Remove Parking Rod E-Clip

CAUTION: The input shaft for torque converter without a clutch has two seal rings. The input shaft for torque converter with a clutch has three seal rings.

DISASSEMBLY AND ASSEMBLY (Continued)

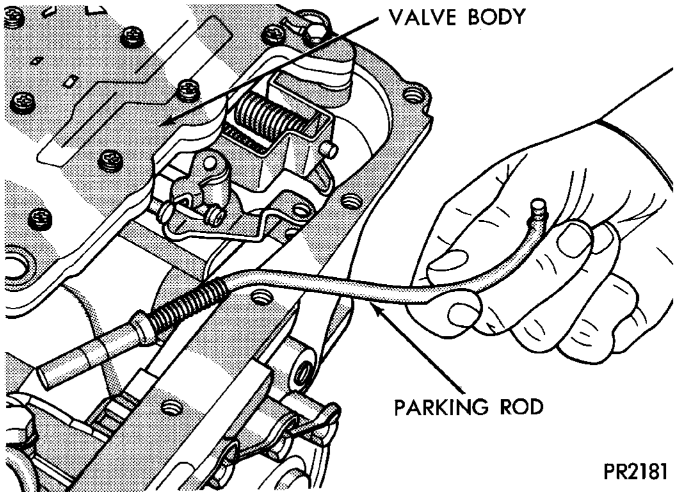


Fig. 51 Parking Rod

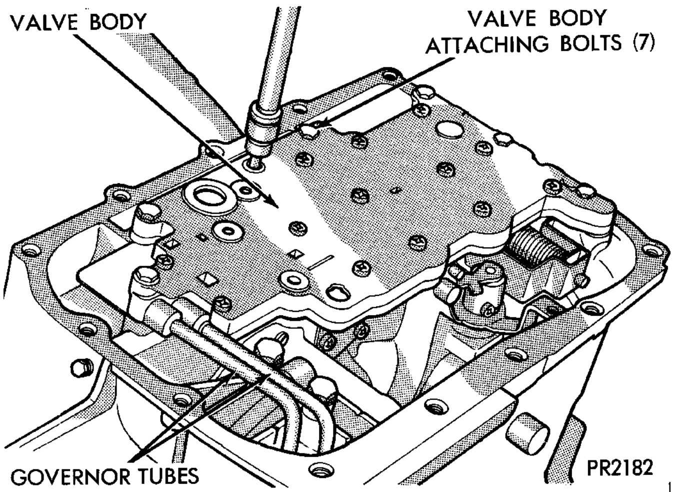


Fig. 52 Valve Body Attaching Bolts

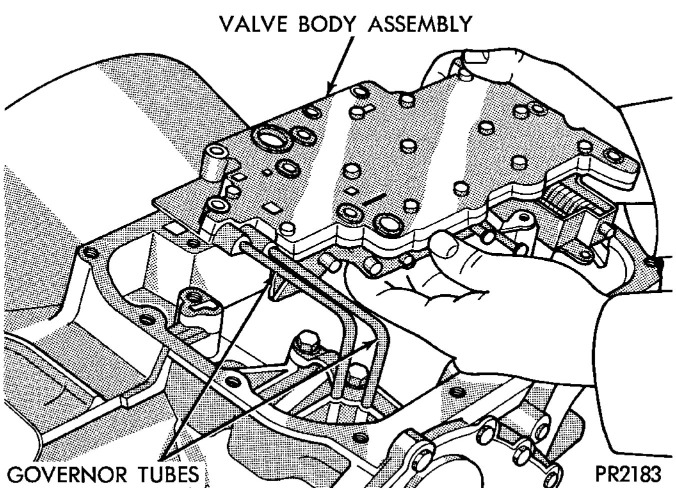


Fig. 53 Valve Body and Governor Tubes

Remove Number 6 thrust washer from sun gear driving shell.

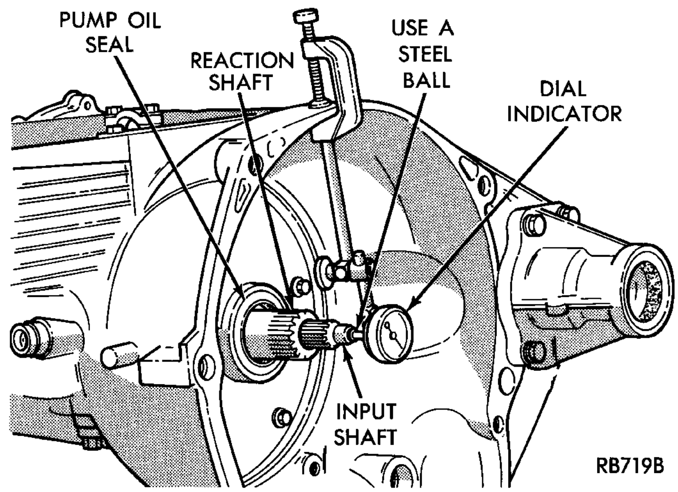


Fig. 54 Measure Input Shaft End Play

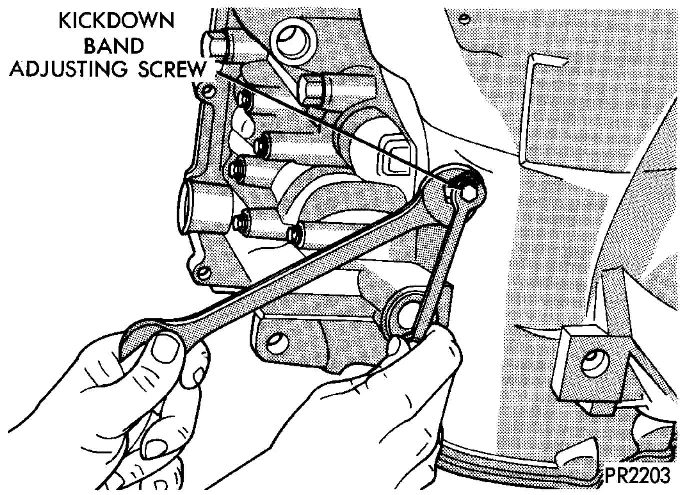


Fig. 55 Loosen Lock Nut and Tighten Kickdown Band Adjusting Screw

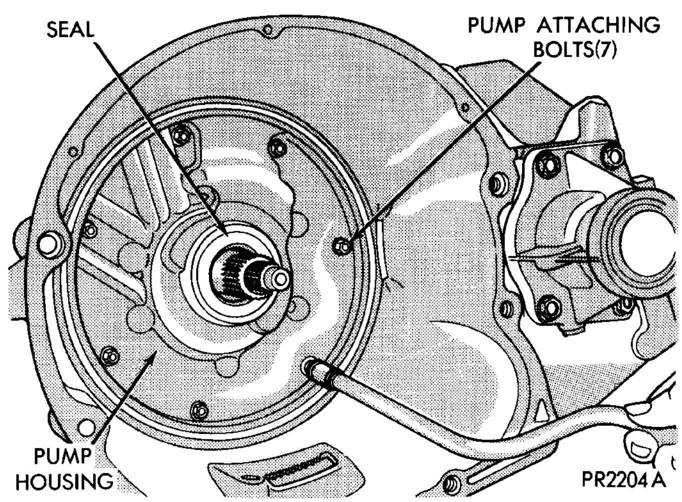


Fig. 56 Pump Attaching Bolts

DISASSEMBLY AND ASSEMBLY (Continued)

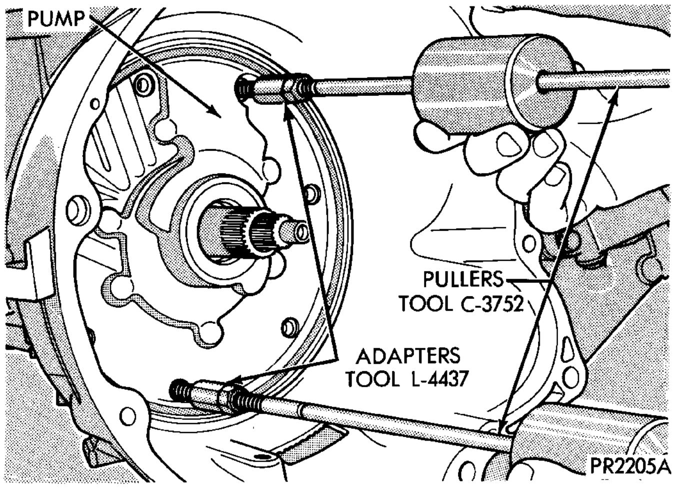


Fig. 57 Install Tool C-3752 with Adapters L-4437

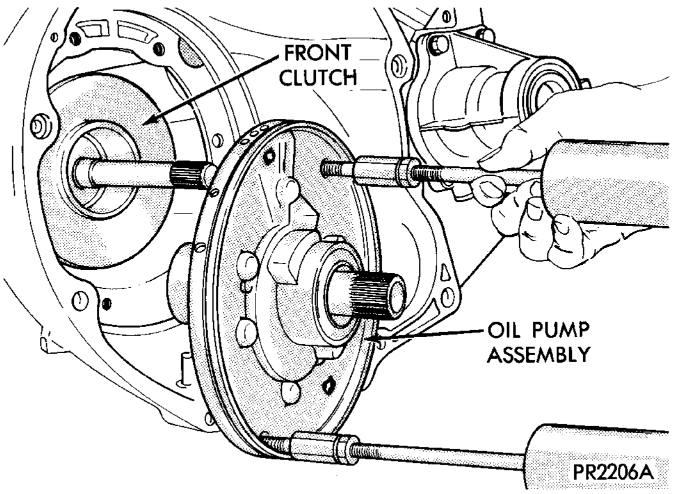


Fig. 58 Oil Pump with No. 1 Thrust Washer

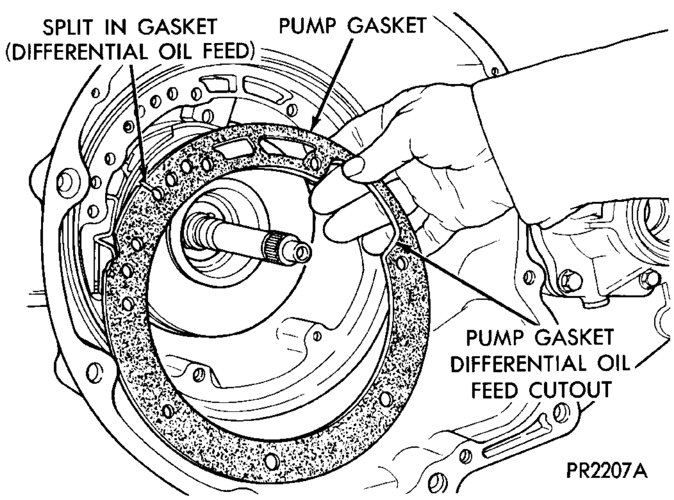


Fig. 59 Oil Pump Gasket

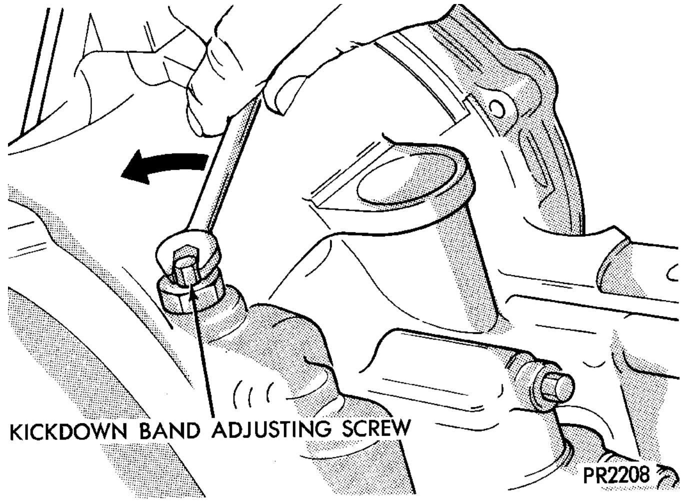


Fig. 60 Loosen Kickdown Band Adjusting Screw

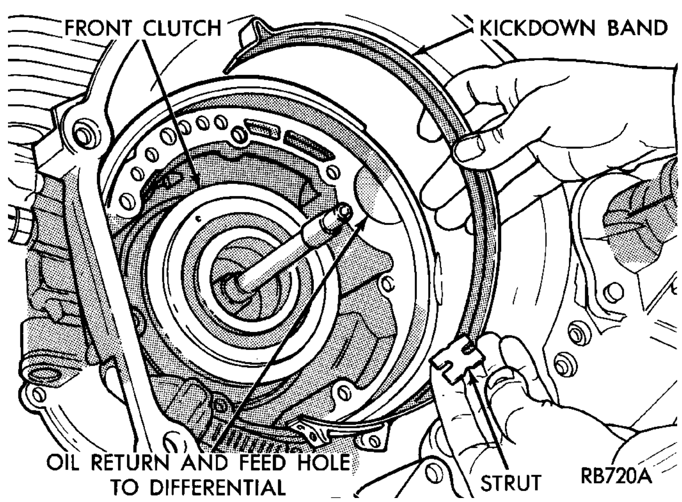


Fig. 61 Kickdown Band and Strut

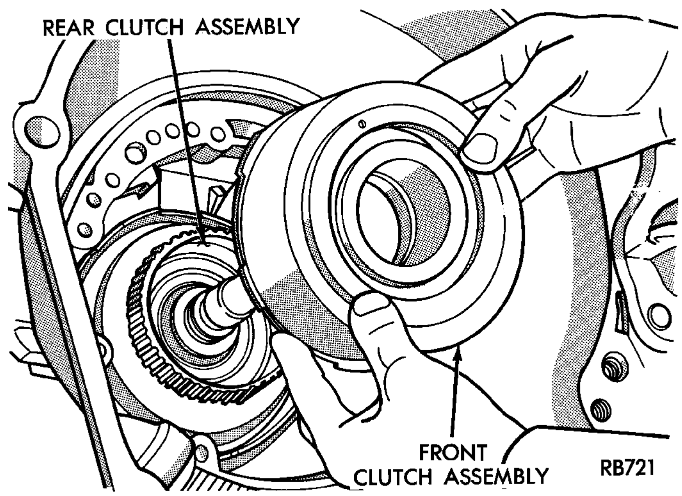


Fig. 62 Front Clutch Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

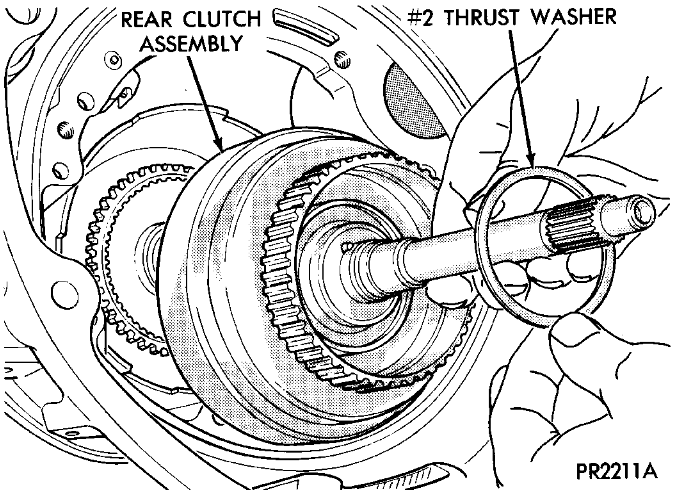


Fig. 63 No. 2 Thrust Washer and Rear Clutch

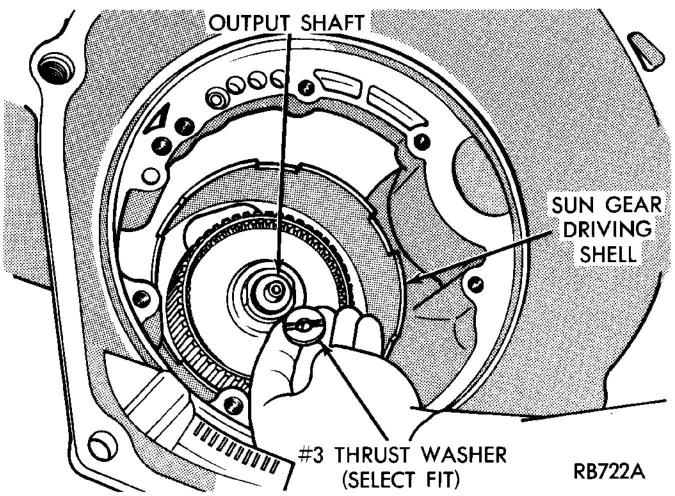


Fig. 64 No. 3 Thrust Washer

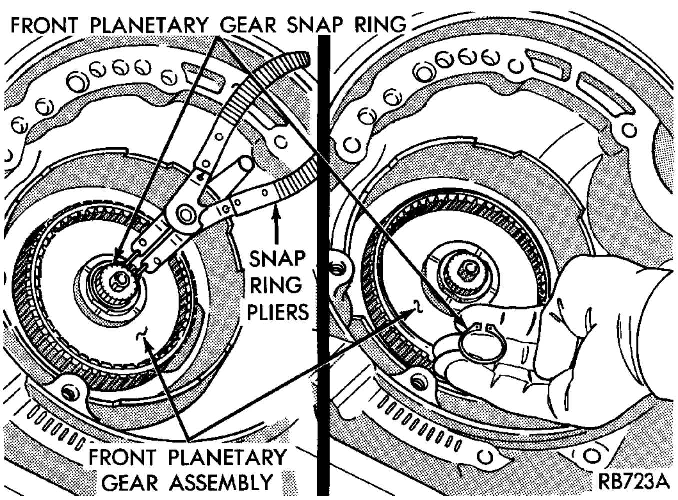


Fig. 65 Front Planetary Gear Snap Ring

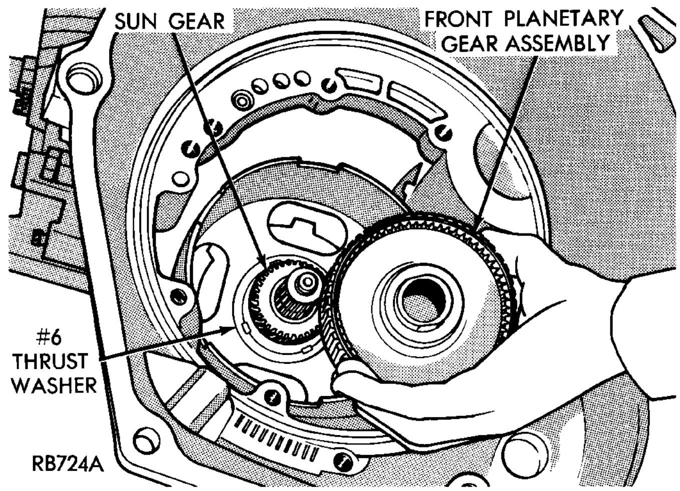


Fig. 66 Front Planetary Gear Assembly

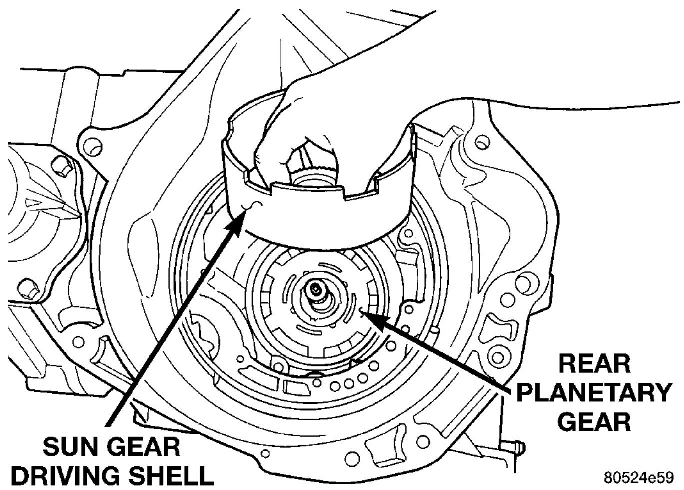


Fig. 67 Sun Gear Driving Shell

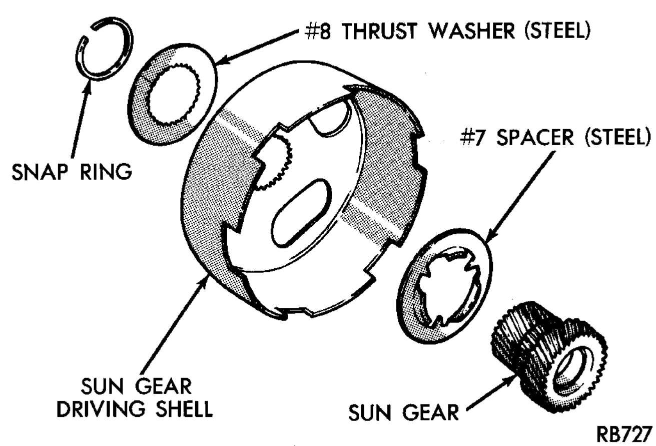


Fig. 68 Sun Gear Driving Shell Components

ASSEMBLY

When rebuilding, reverse the above procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

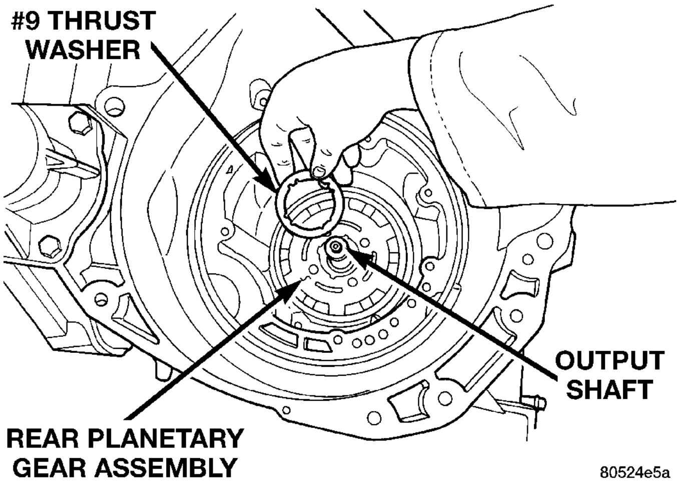


Fig. 69 No. 9 Thrust Washer

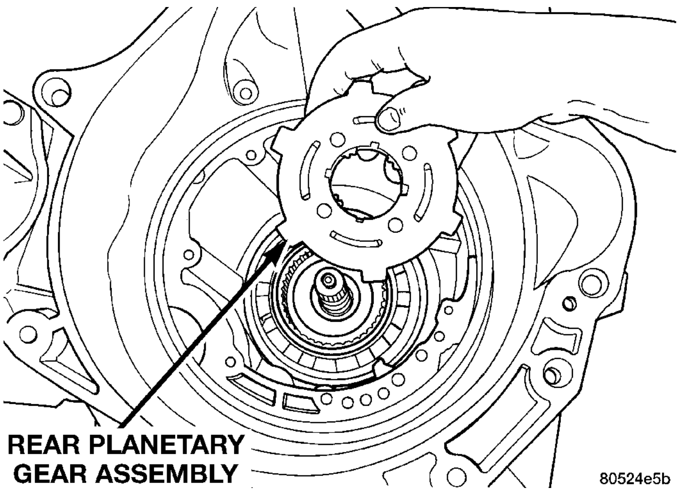


Fig. 70 Rear Planetary Gear Assembly

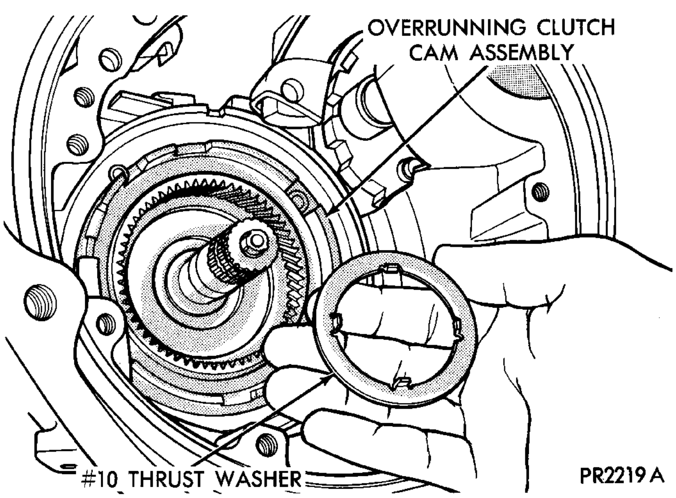


Fig. 71 No. 10 Thrust Washer

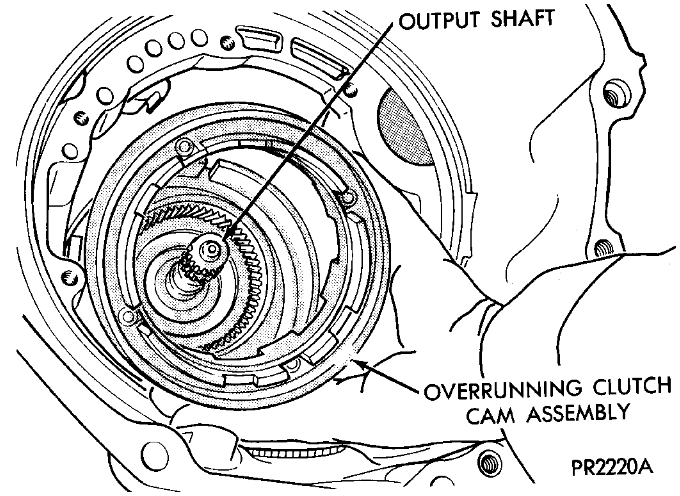


Fig. 72 Overrunning Clutch Cam Assembly

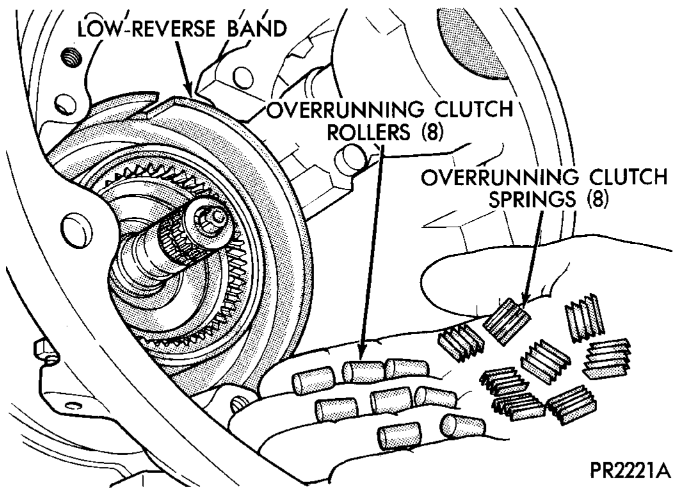


Fig. 73 Overrunning Clutch Rollers and Spring

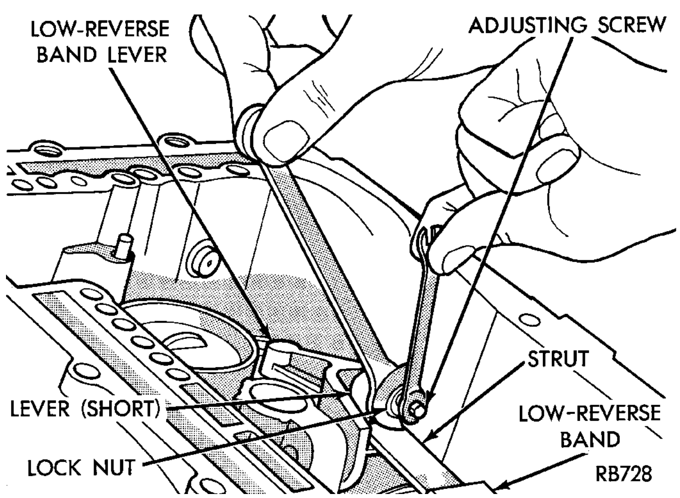


Fig. 74 Loosen or Adjust Low/Reverse Band

DISASSEMBLY AND ASSEMBLY (Continued)

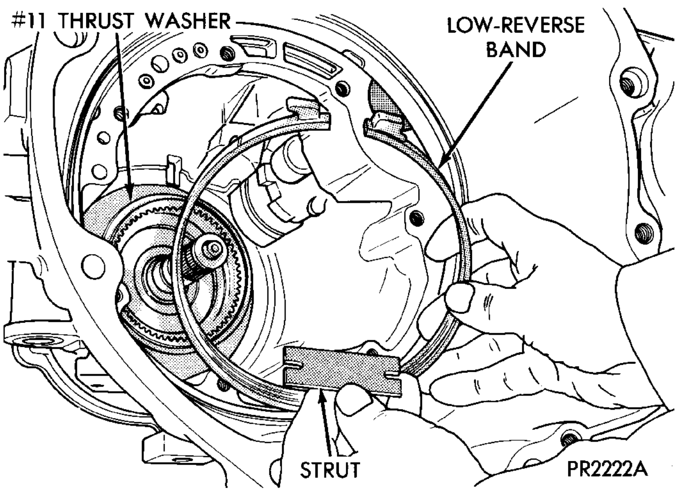


Fig. 75 Low/Reverse Band and Strut

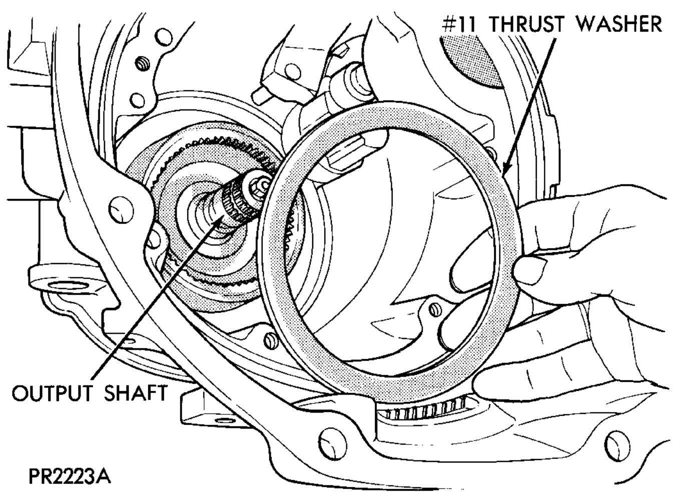


Fig. 76 No. 11 Thrust Washer

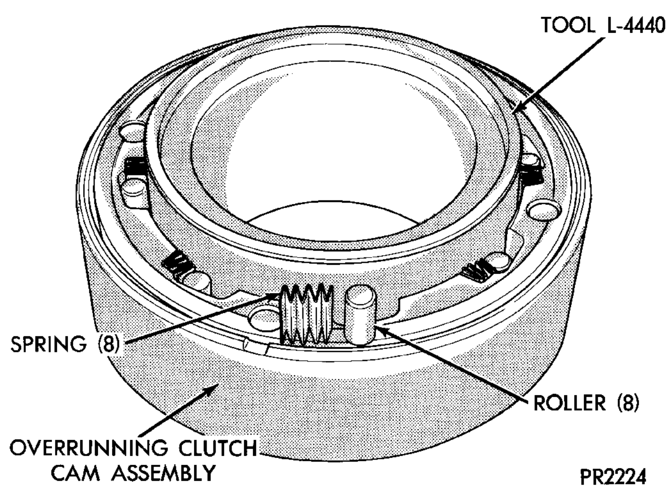


Fig. 77 Install Overrunning Clutch Rollers and Springs

VALVE BODY RECONDITION

NOTE: Tighten all valve body screws to 5 N·m (40 in. lbs.)

Do not clamp any portion of valve body or transfer plate in a vise. Any slight distortion of the aluminum body or transfer plate will result in sticking valves, excessive leakage, or both. **When removing or installing valves or plugs, slide them in or out carefully. Do not use force.**

NOTE: TAG ALL SPRINGS AS THEY ARE REMOVED FOR REASSEMBLY IDENTIFICATION.

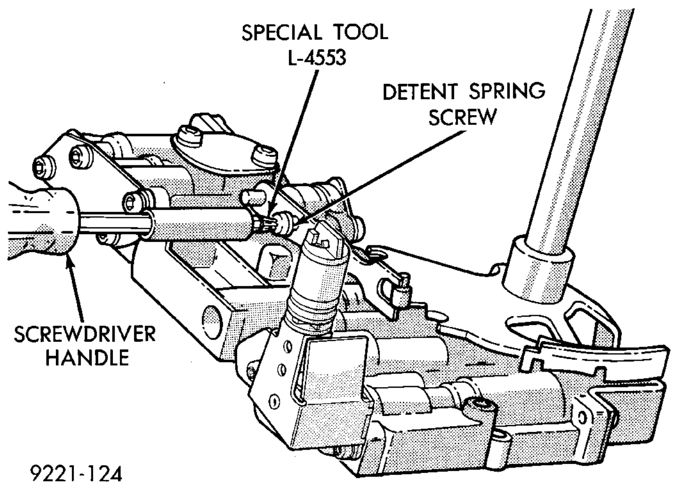


Fig. 78 Detent Spring Attaching Screw and Spring

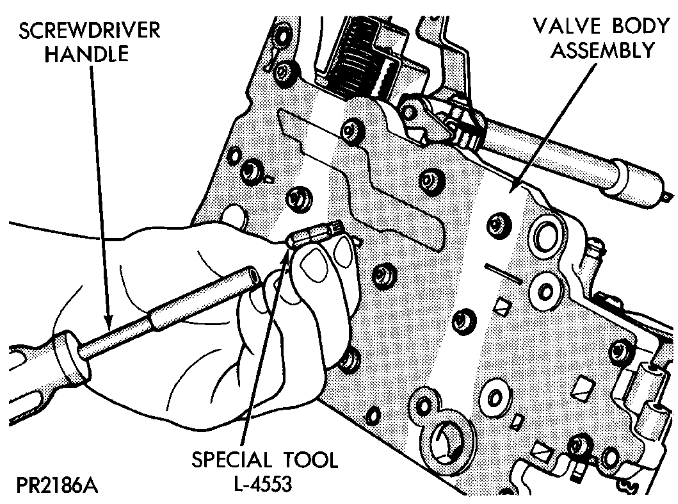


Fig. 79 Using Tool L-4553 on Valve Body Screw

DISASSEMBLY AND ASSEMBLY (Continued)

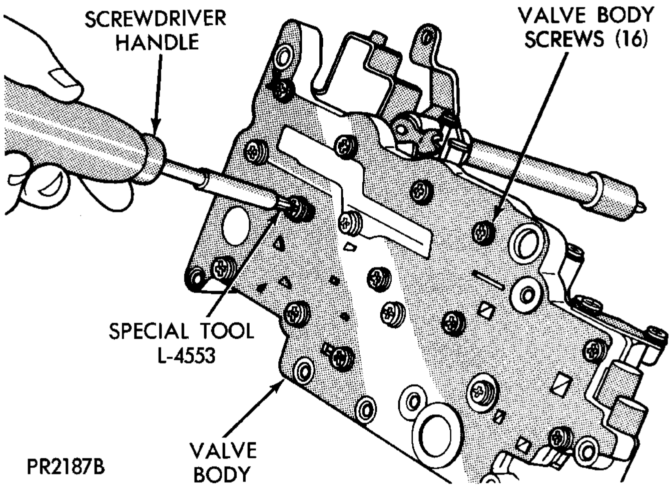


Fig. 80 Remove or Install Valve Body Screws

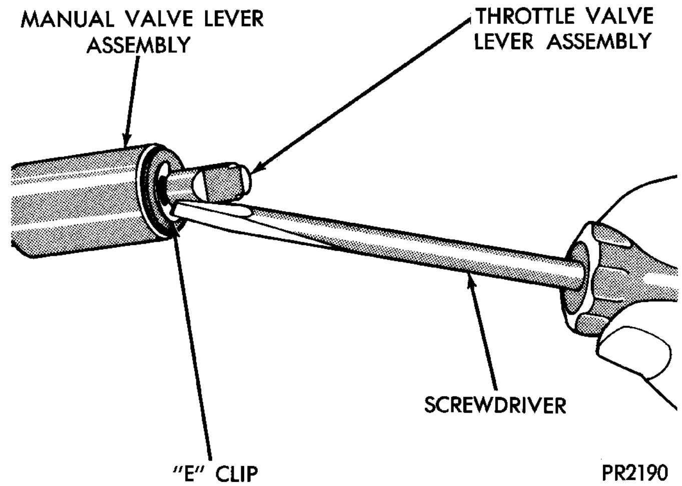


Fig. 83 Remove or Install Throttle Shaft E-Clip

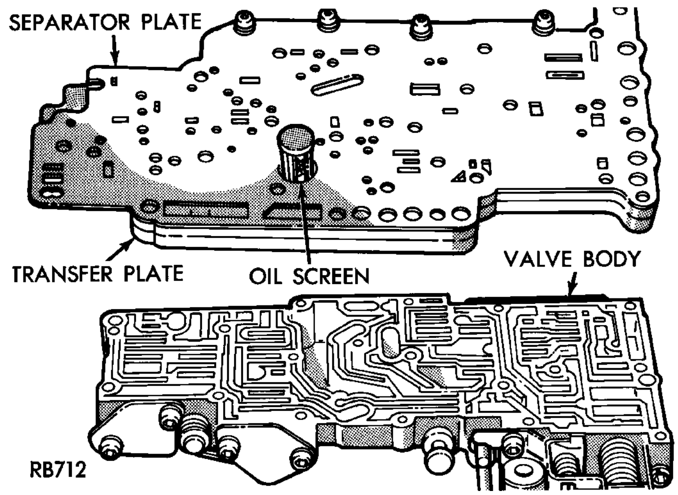


Fig. 81 Transfer Plate and Separator Plate

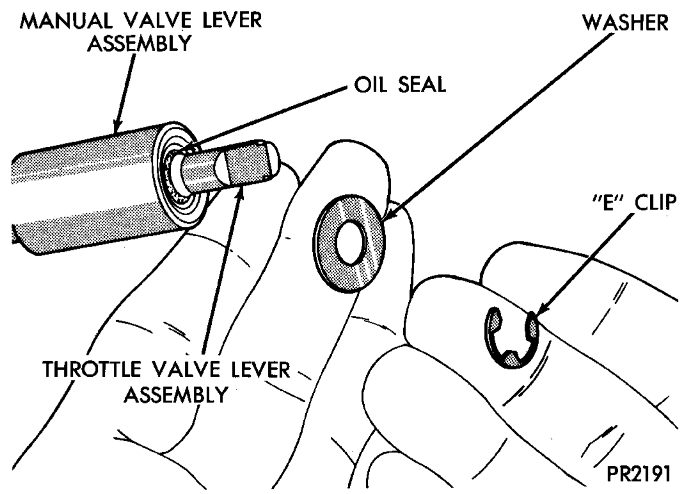


Fig. 84 Throttle Shaft E-Clip, Washer, and Seal

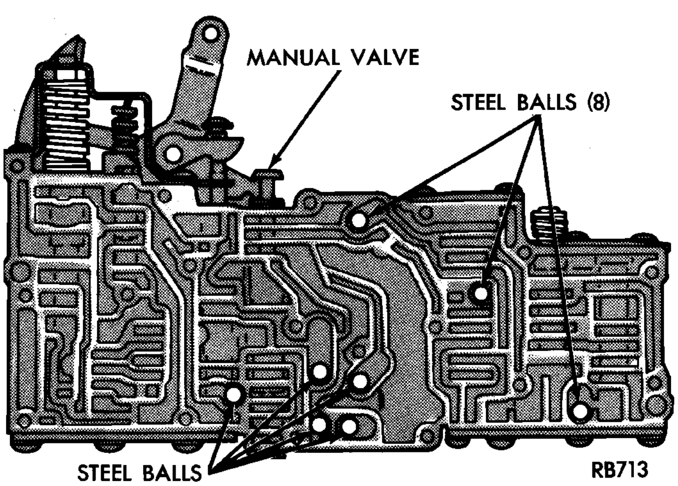


Fig. 82 Steel Ball Locations

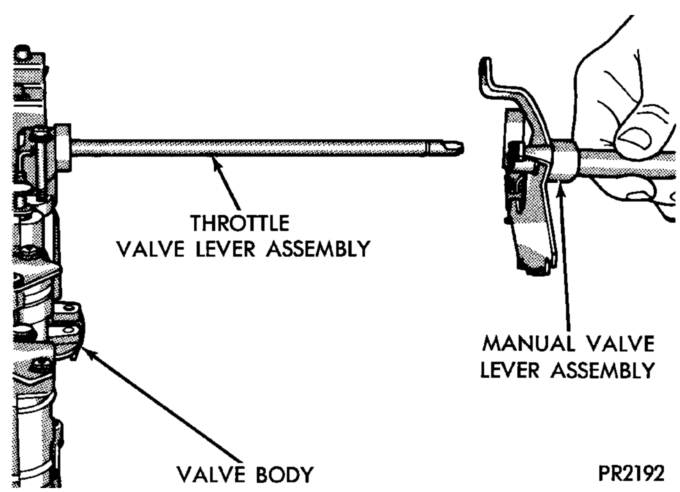


Fig. 85 Manual Valve Lever Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

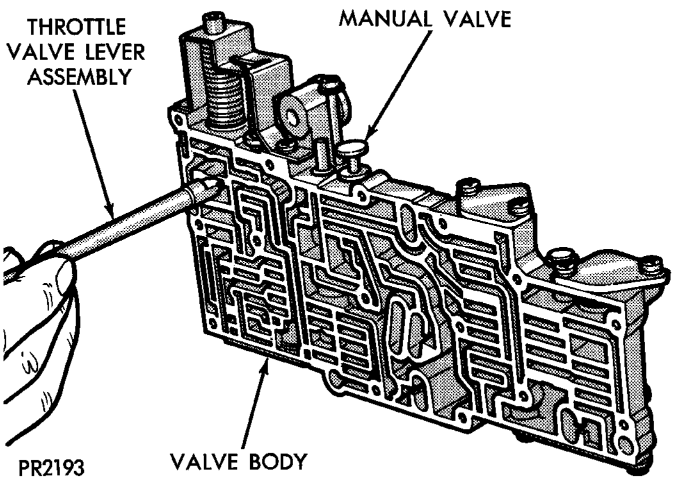


Fig. 86 Throttle Valve Lever Assembly

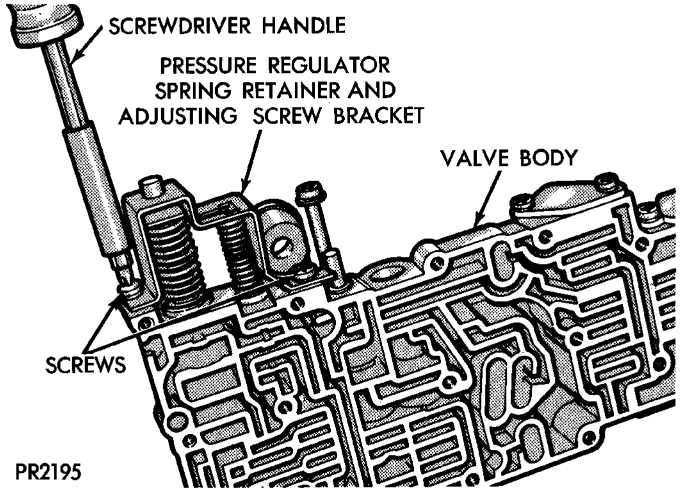


Fig. 88 Pressure Regulator and Adjusting Screw Bracket

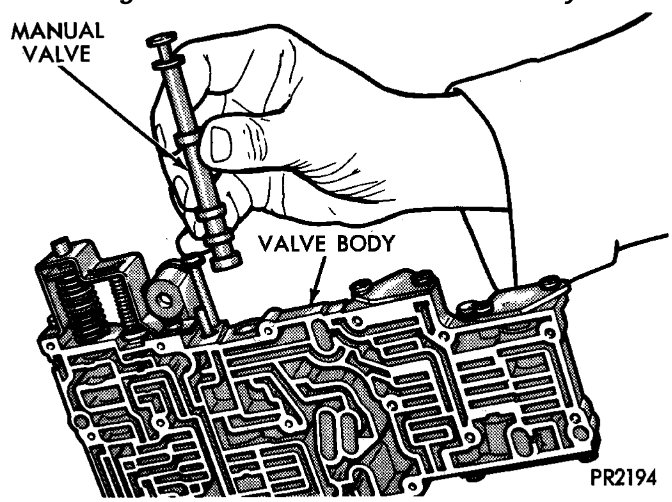


Fig. 87 Manual Valve

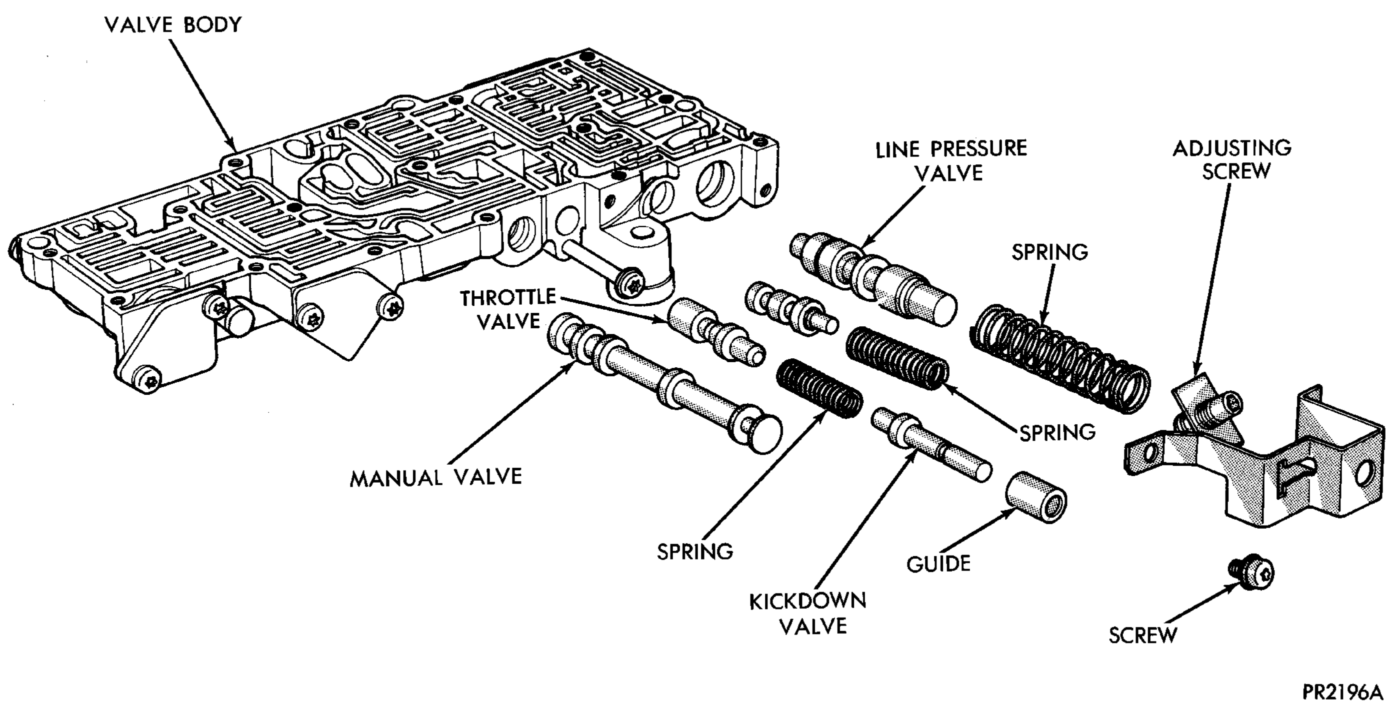


Fig. 89 Pressure Regulators and Manual Controls

DISASSEMBLY AND ASSEMBLY (Continued)

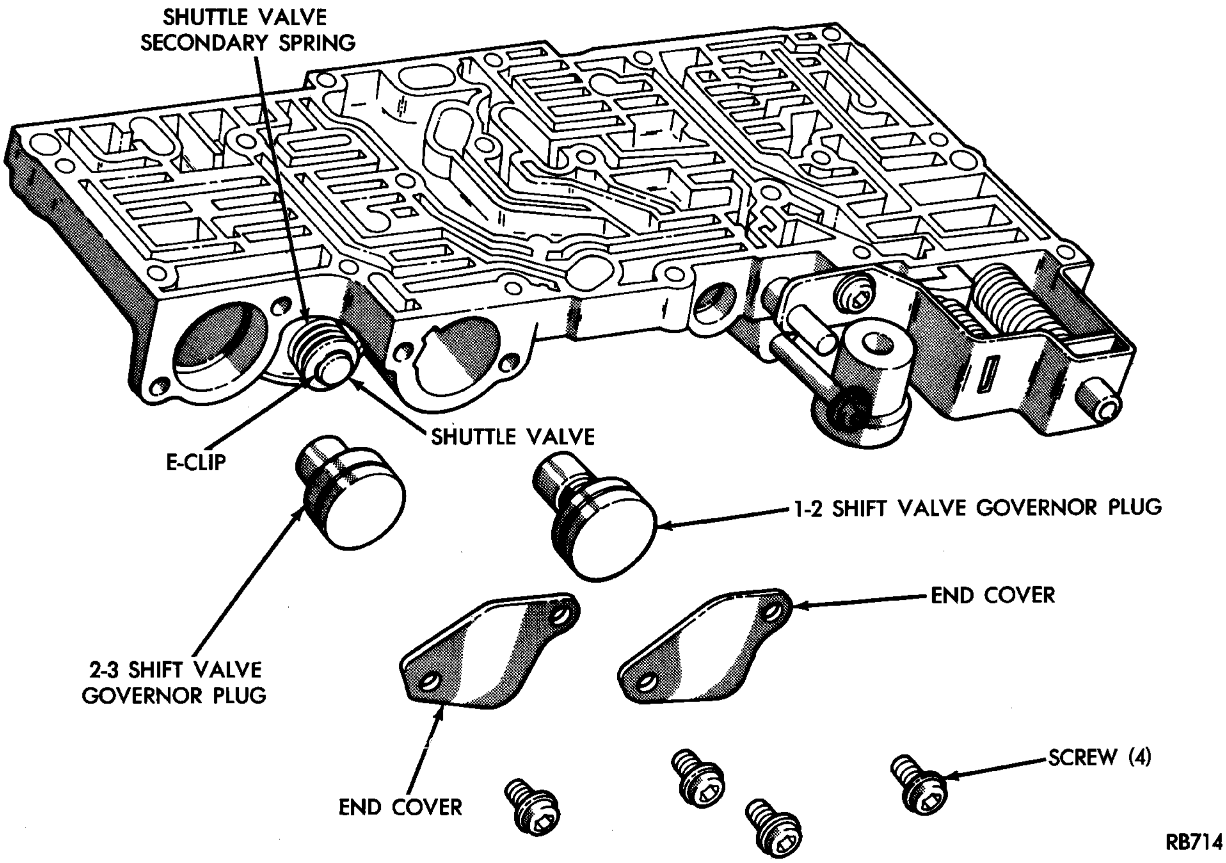


Fig. 90 Governor Plugs

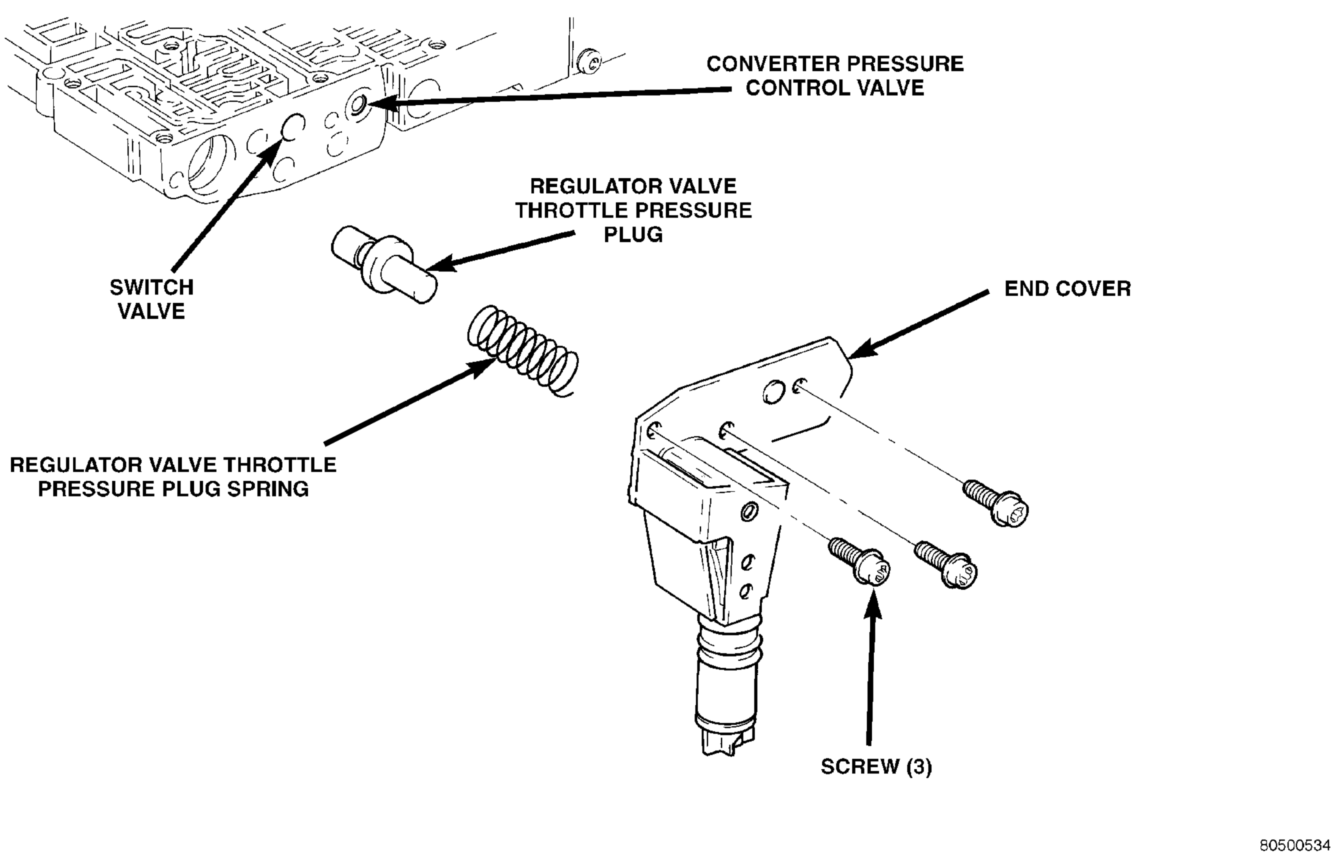


Fig. 91 Pressure Regulator Valve Plugs

DISASSEMBLY AND ASSEMBLY (Continued)

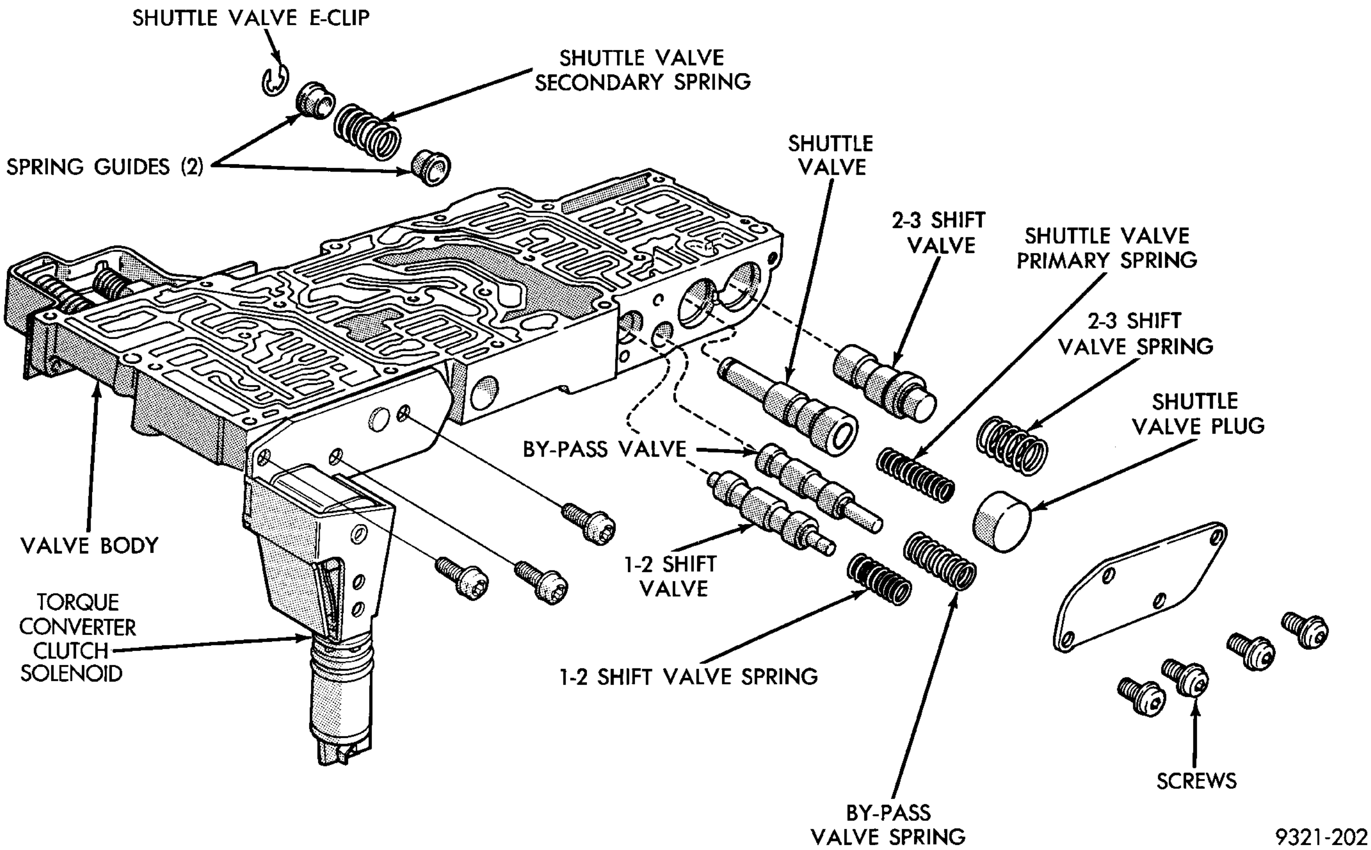


Fig. 92 Shift Valves and Shuttle Valve

OIL PUMP-RECONDITION

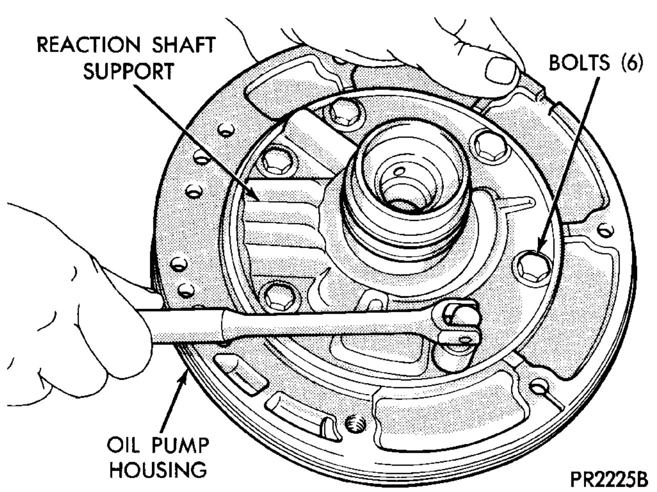


Fig. 93 Reaction Shaft Support Bolts

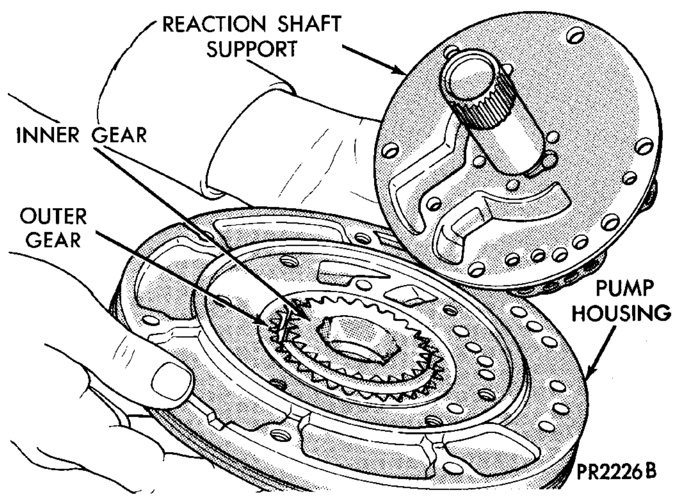


Fig. 94 Reaction Shaft Support

DISASSEMBLY AND ASSEMBLY (Continued)

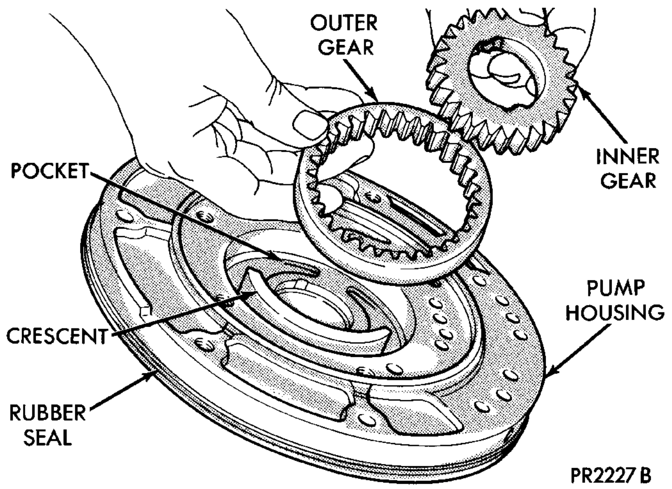


Fig. 95 Inner and Outer Pump Gears

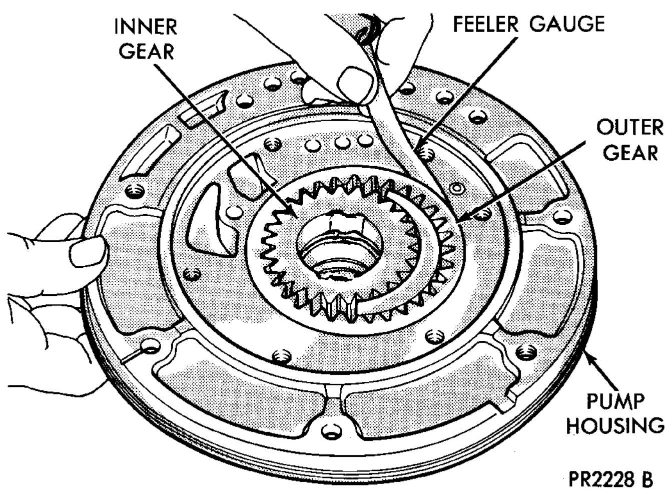


Fig. 96 Measuring Pump Clearance (Gear to Pocket)

NOTE: Also, check gear side clearance with a straight edge and a feeler gauge (See Specifications).

FRONT CLUTCH-RECONDITION

DISASSEMBLY

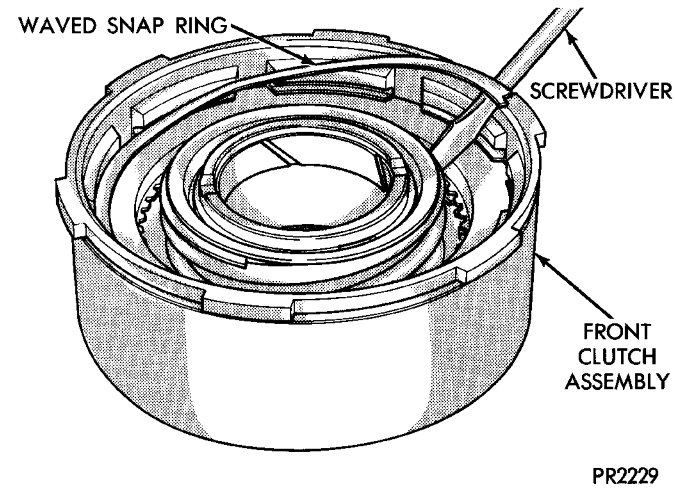


Fig. 97 Front Clutch Waved Snap Ring

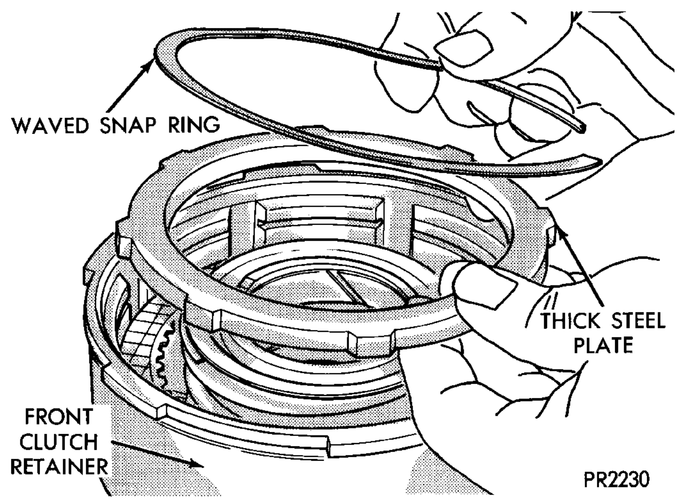


Fig. 98 Thick Steel Plate and Waved Snap Ring

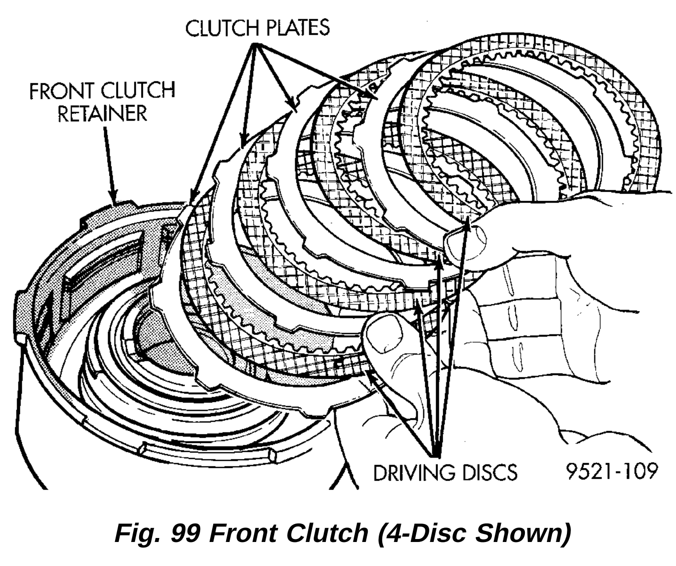


Fig. 99 Front Clutch (4-Disc Shown)

DISASSEMBLY AND ASSEMBLY (Continued)

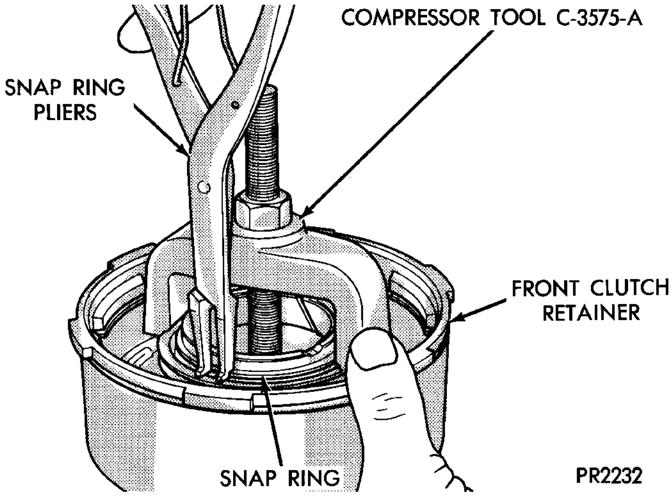


Fig. 100 Front Clutch Return Spring Snap Ring

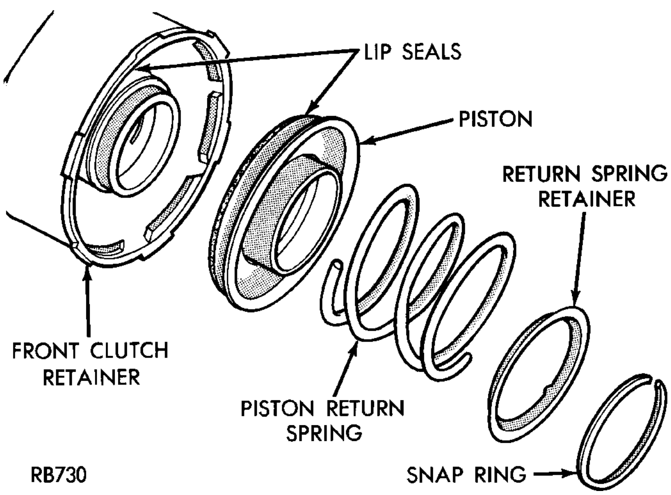


Fig. 101 Front Clutch Return Spring and Piston

ASSEMBLY

To reassemble, reverse the above procedure.

MEASURING PLATE CLEARANCE

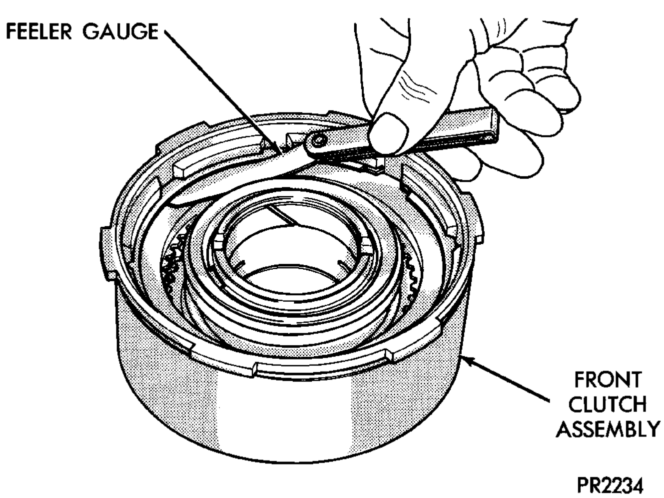


Fig. 102 Measuring Front Clutch Plate Clearance

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. Replace 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; be 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 0.061 to 0.063 inch. Replace if necessary.

DISASSEMBLY

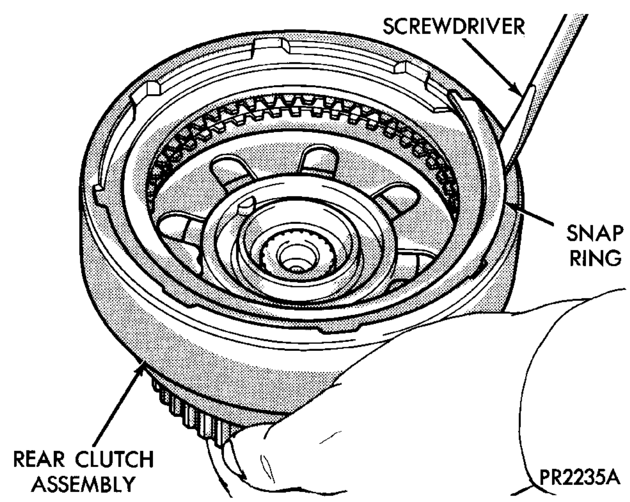


Fig. 103 Rear Clutch Outer Snap Ring

Press out input shaft, if required.

ASSEMBLY

To reassemble, reverse the above procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

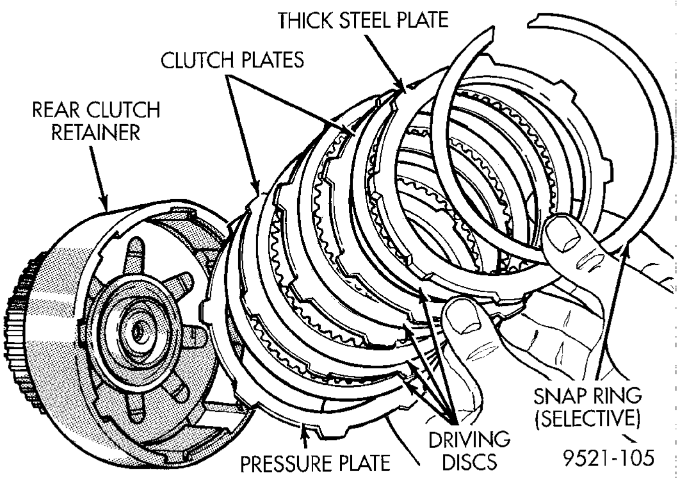


Fig. 104 Rear Clutch (4-Disc Shown)

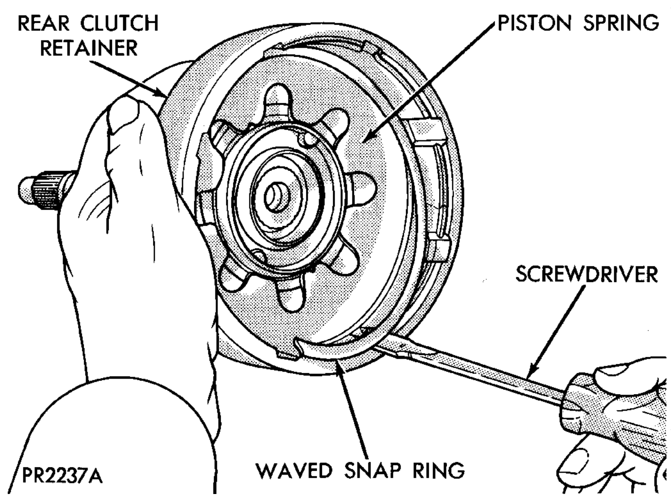


Fig. 105 Piston Spring Waved Snap Ring

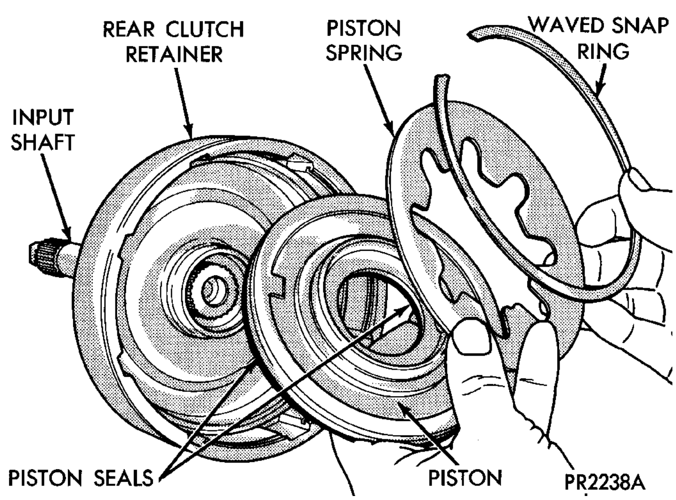


Fig. 106 Rear Clutch Piston and Piston Spring

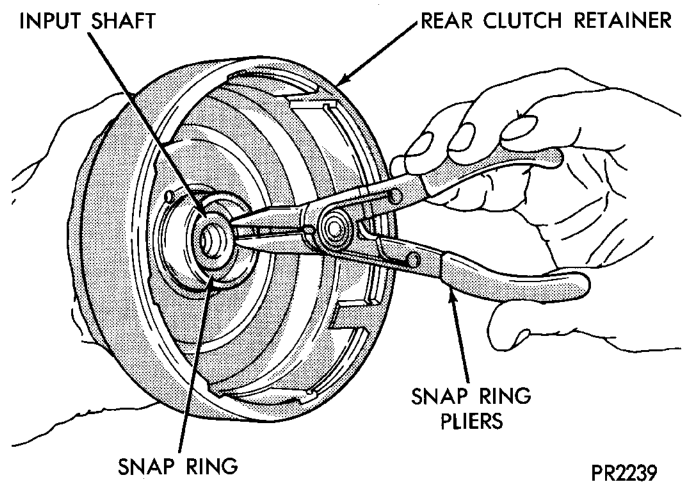


Fig. 107 Remove or Install Input Shaft Snap Ring

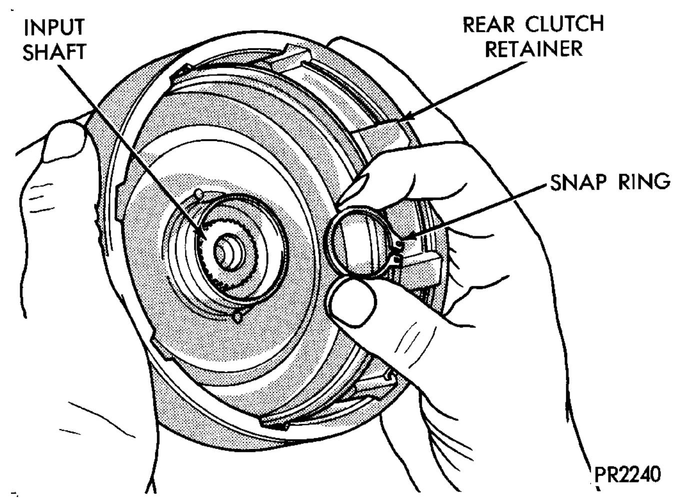


Fig. 108 Input Shaft Snap Ring

MEASURING PLATE CLEARANCE

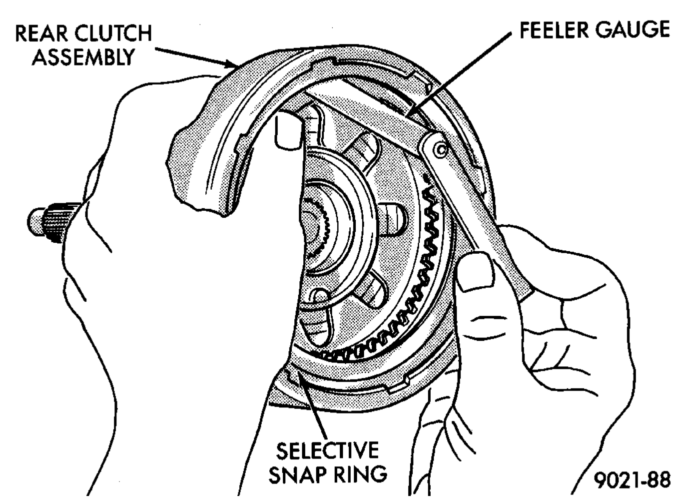


Fig. 109 Measuring Rear Clutch Plate Clearance

DISASSEMBLY AND ASSEMBLY (Continued)

FRONT PLANETARY AND ANNULUS GEAR-RECONDITION

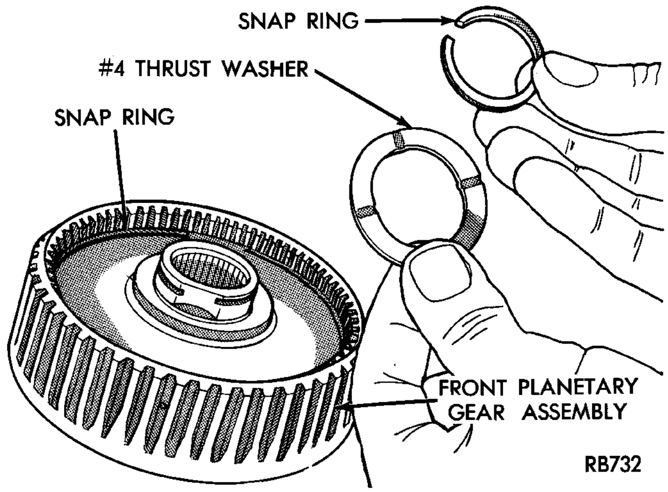


Fig. 110 Front Planetary Gear Snap Ring and No. 4 Thrust Washer (Always Install a New Snap Ring)

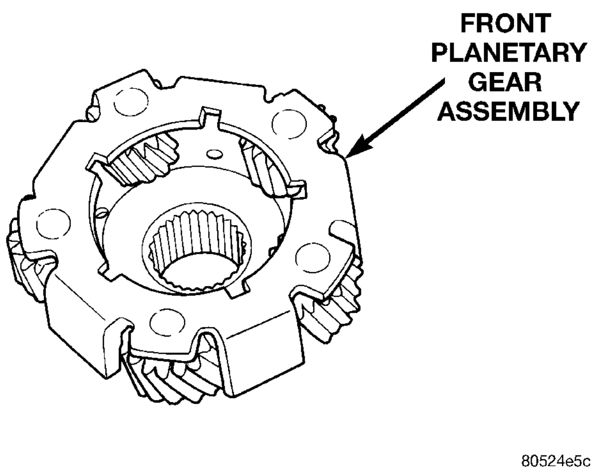


Fig. 111 Front Planetary Gear

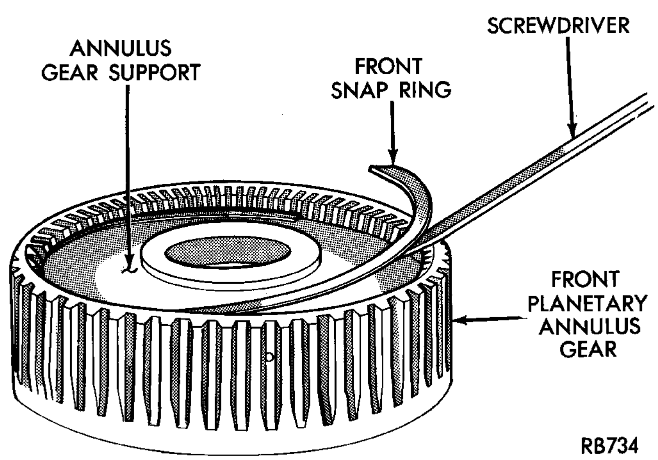


Fig. 112 Annulus Gear Support Front Snap Ring

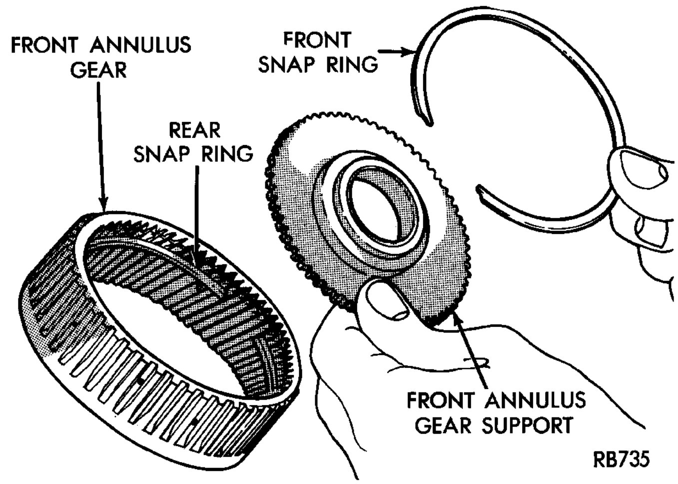


Fig. 113 Front Annulus Gear Support and Snap Ring

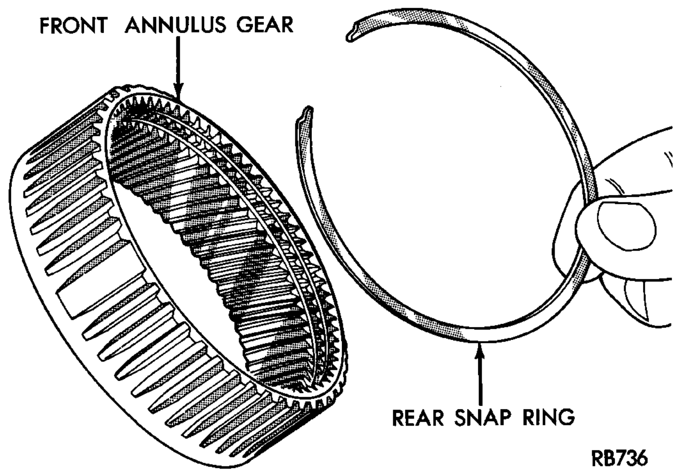


Fig. 114 Front Annulus Gear Support Snap Ring

LOW/REVERSE (REAR) SERVO-RECONDITION

DISASSEMBLY

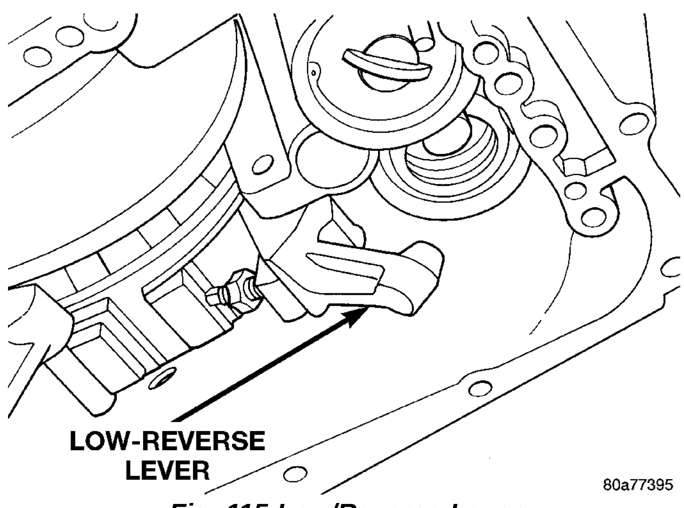


Fig. 115 Low/Reverse Lever

DISASSEMBLY AND ASSEMBLY (Continued)

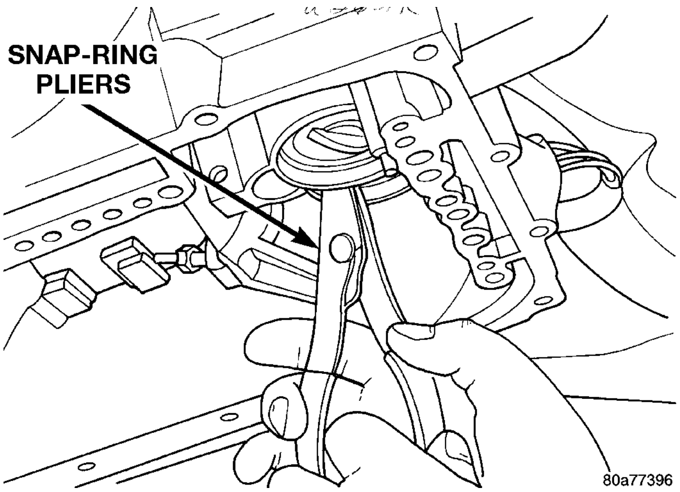


Fig. 116 Low/Reverse Servo Snap Ring

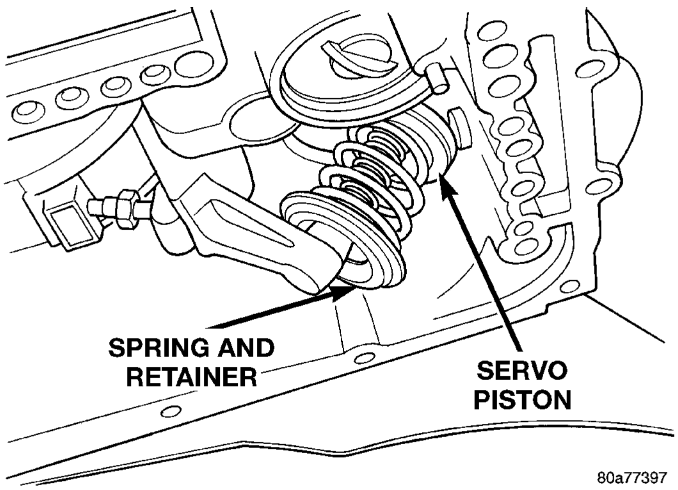


Fig. 117 Remove Retainer, Spring and Servo

ASSEMBLY

To assemble, reverse the above procedure.

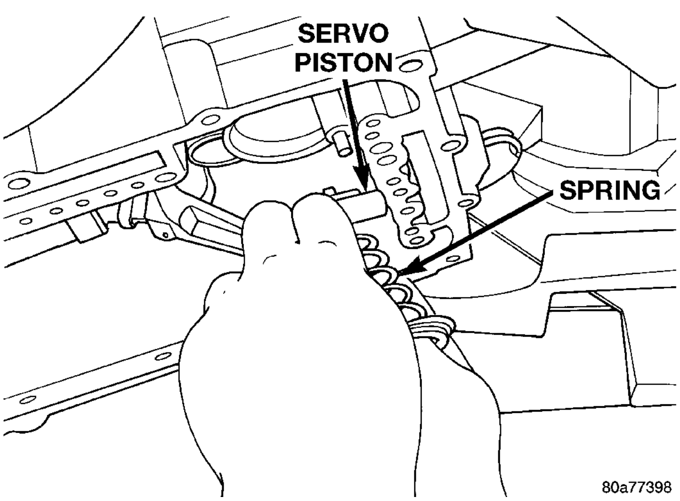


Fig. 118 Low/Reverse Servo Assembly

ACCUMULATOR-RECONDITION

DISASSEMBLY

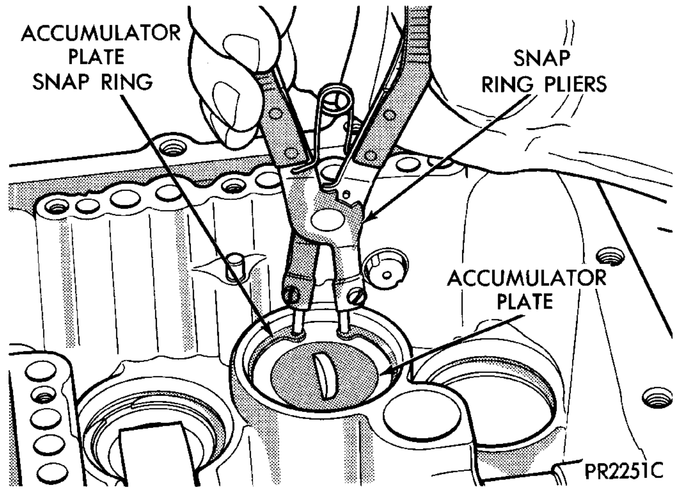


Fig. 119 Accumulator Snap Ring

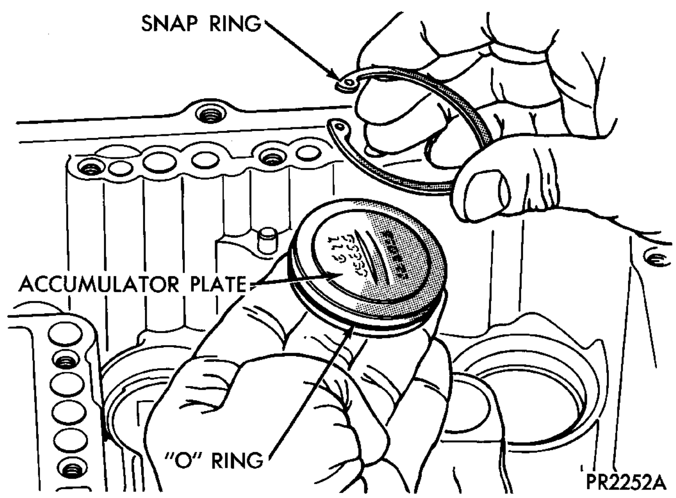


Fig. 120 Accumulator Plate and Snap Ring

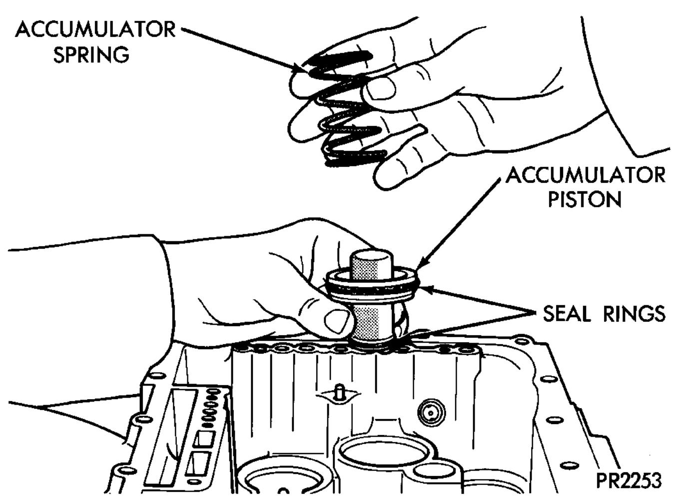


Fig. 121 Accumulator Spring and Piston

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

To assemble, reverse the above procedure.

KICKDOWN SERVO (CONTROLLED LOAD)-RECONDITION

DISASSEMBLY

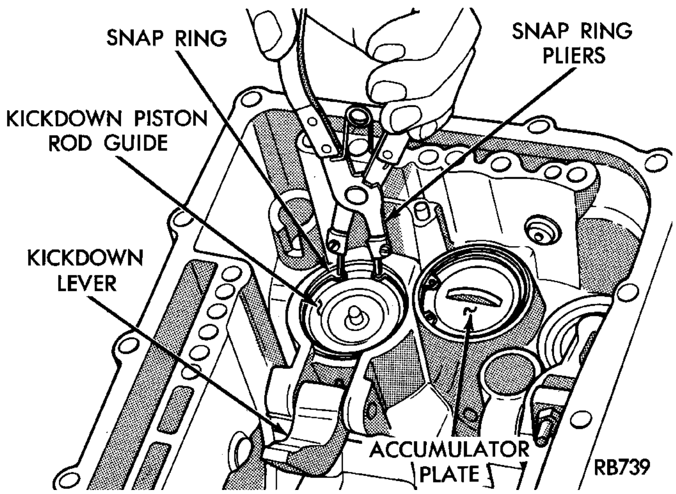


Fig. 122 Kickdown Servo Snap Ring

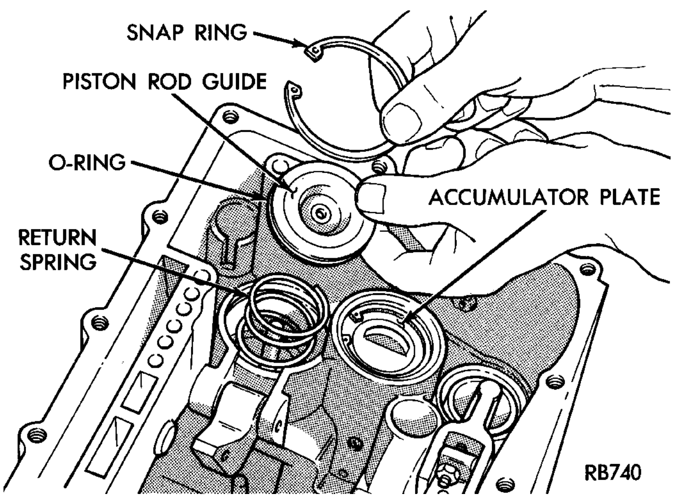


Fig. 123 Kickdown Servo Rod Guide and Snap Ring

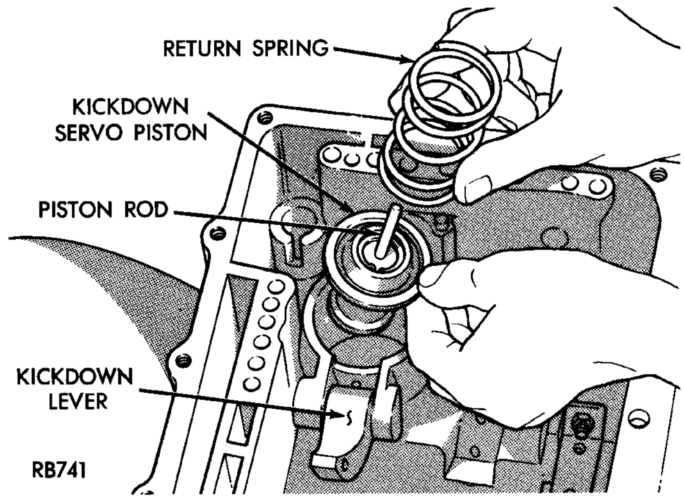


Fig. 124 Kickdown Piston Return Spring and Piston

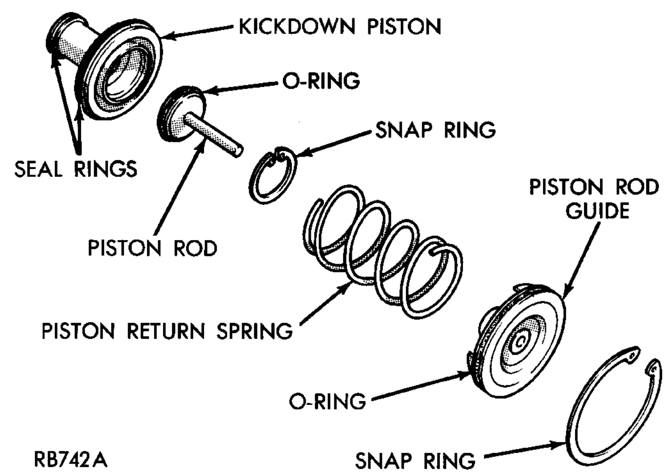


Fig. 125 Controlled Load Kickdown Servo

ASSEMBLY

To assemble, reverse the above procedure.

TRANSFER SHAFT REPAIR

DISASSEMBLY

NOTE: Remove old sealant before applying new sealant. Use Mopar® RTV sealant, or equivalent, when installing cover.

STIRRUP AND STRAP REMOVAL

NOTE: A stirrup and retaining strap is attached to the transfer gear. The stirrup prevents the transfer gear retaining nut from turning and backing off the transfer shaft. The strap is used to hold the stirrup to the transfer gear and prevent the stirrup retaining bolts from backing out.

DISASSEMBLY AND ASSEMBLY (Continued)

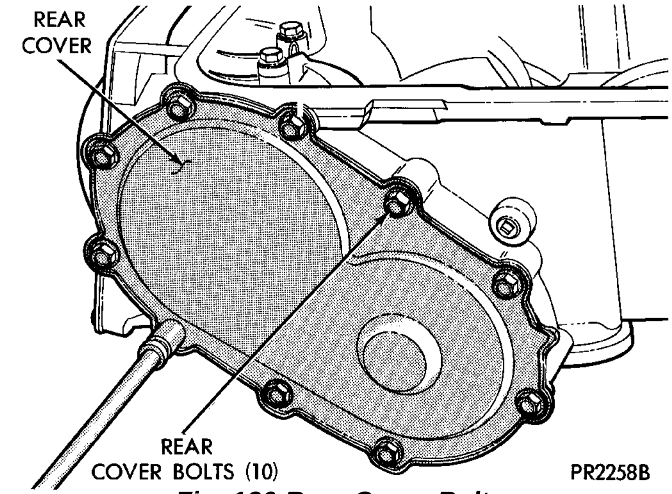


Fig. 126 Rear Cover Bolts

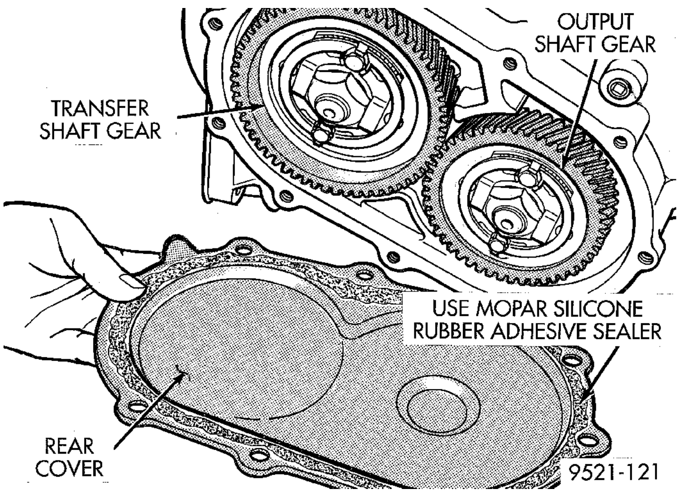


Fig. 127 Remove or Install Rear Cover

(1) Using a punch, bend tabs on strap flat against transfer gear.

(2) Remove bolts holding retaining strap to stirrup.

(3) Remove strap from transfer gear and stirrup.

(4) Remove stirrup from transfer gear.

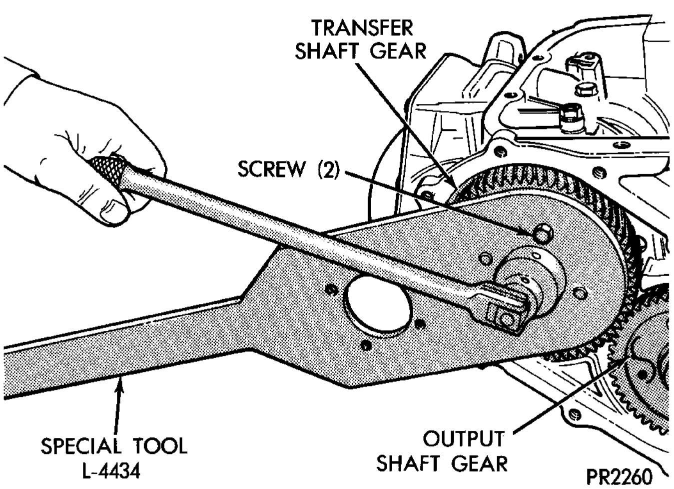


Fig. 128 Remove Transfer Shaft Gear Retaining Nut

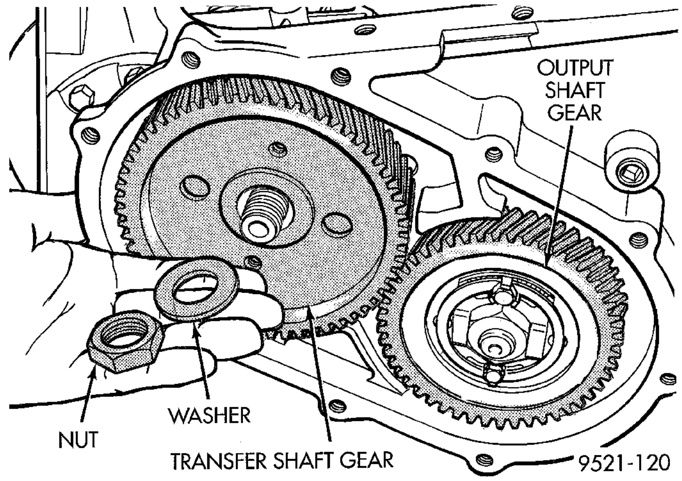


Fig. 129 Transfer Shaft Gear Nut and Washer

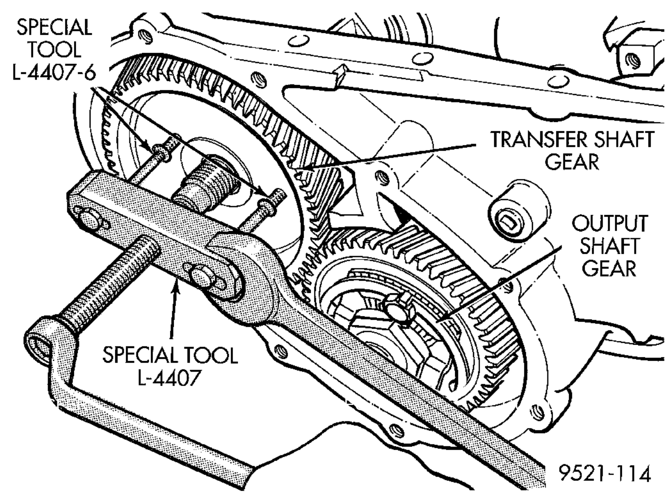


Fig. 130 Remove Transfer Shaft Gear

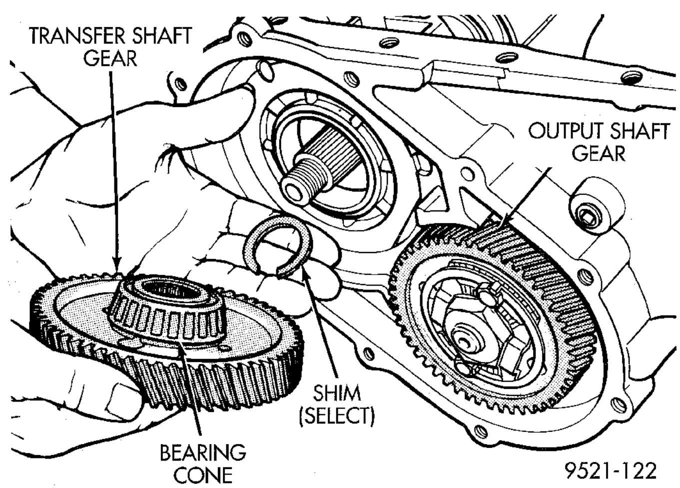


Fig. 131 Transfer Shaft Gear and (Select) Shim

DISASSEMBLY AND ASSEMBLY (Continued)

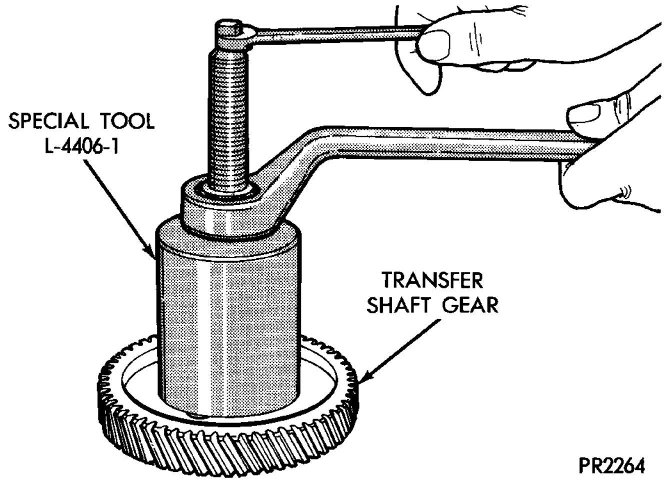


Fig. 132 Using Tool L-4406-1 with Adapter L-4406-3, Remove Transfer Shaft Gear Bearing Cone

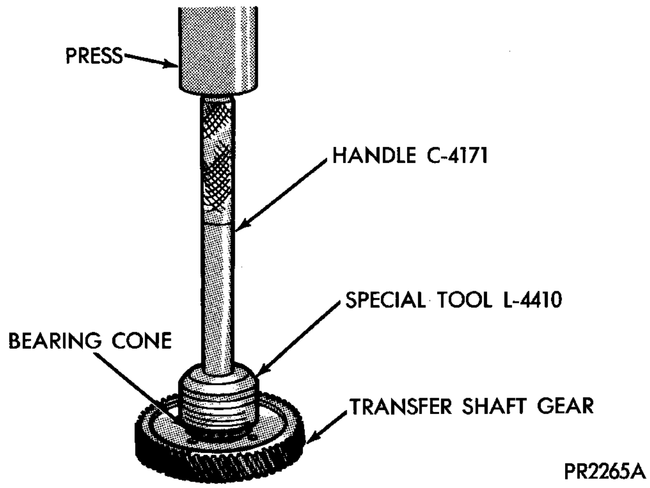


Fig. 133 Install Transfer Shaft Gear Bearing Cone

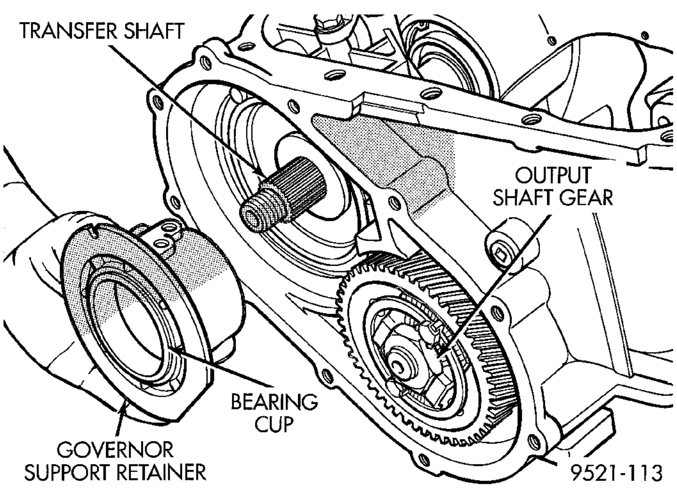


Fig. 134 Governor Support Retainer

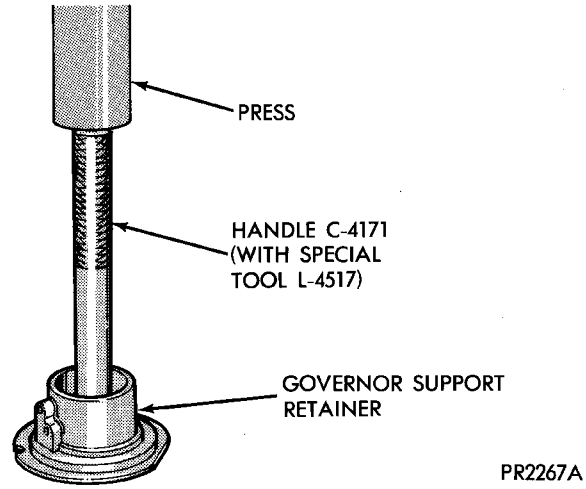


Fig. 135 Remove Governor Support Retainer Bearing Cup

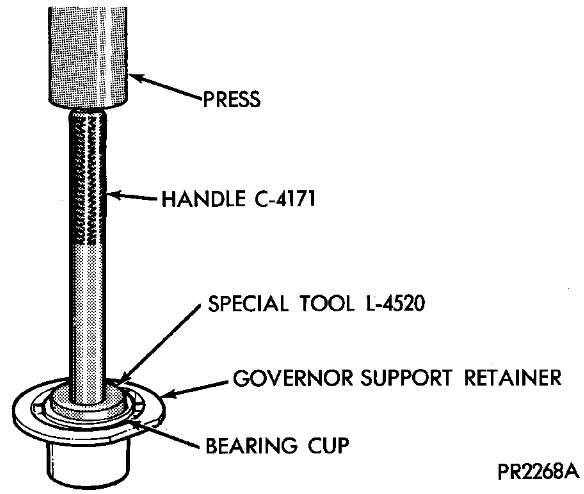


Fig. 136 Install Governor Support Retainer Bearing Cup

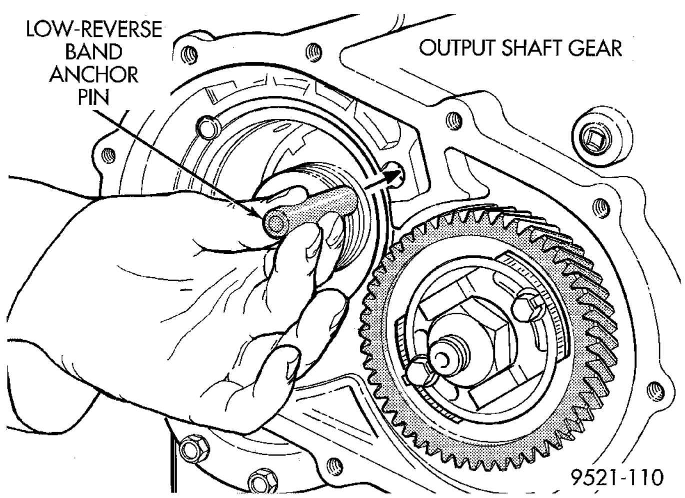


Fig. 137 Low/Reverse Band Anchor Pin

DISASSEMBLY AND ASSEMBLY (Continued)

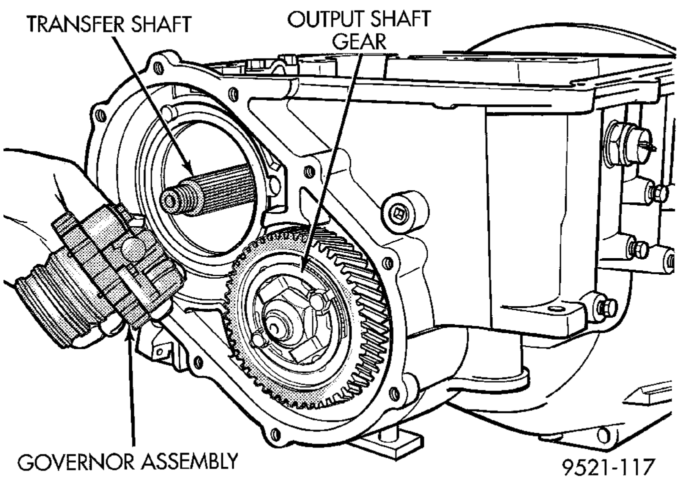


Fig. 138 Governor Assembly

NOTE: Remove or install both governor valves and governor body.

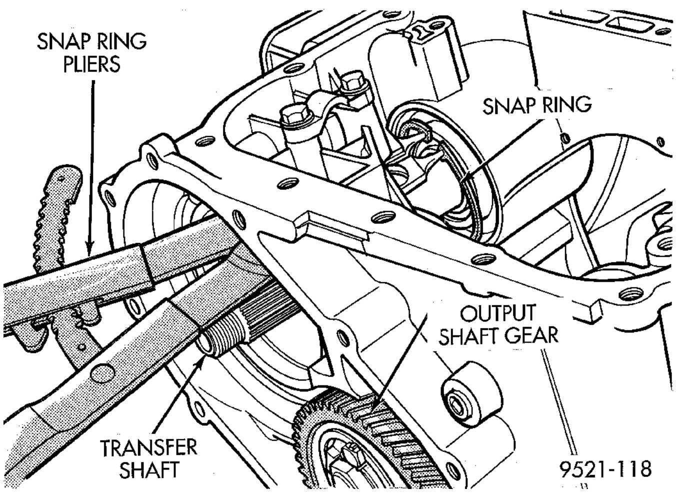


Fig. 139 Transfer Shaft Bearing Snap Ring

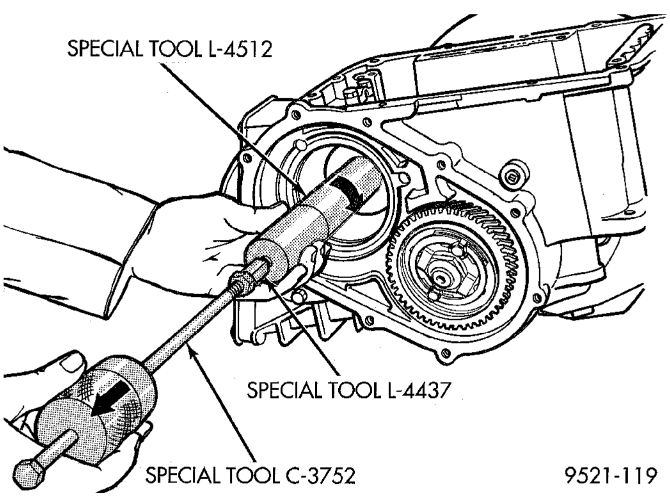


Fig. 140 Remove Transfer Shaft and Bearing Retainer Assembly

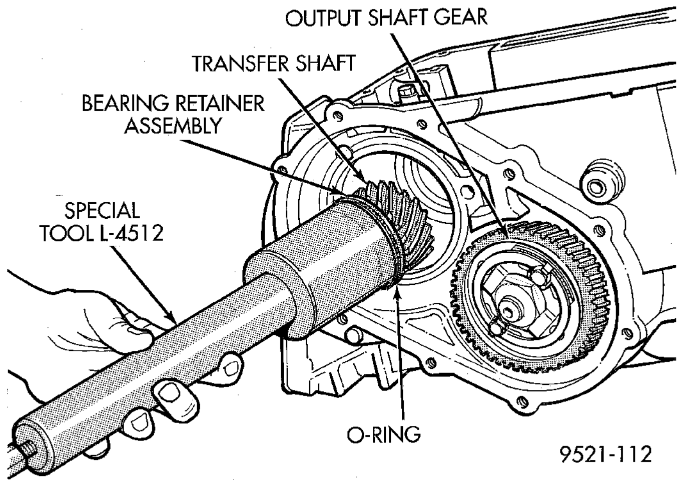


Fig. 141 Remove or Install Transfer Shaft and Bearing Retainer Assembly Using Tool L-4512

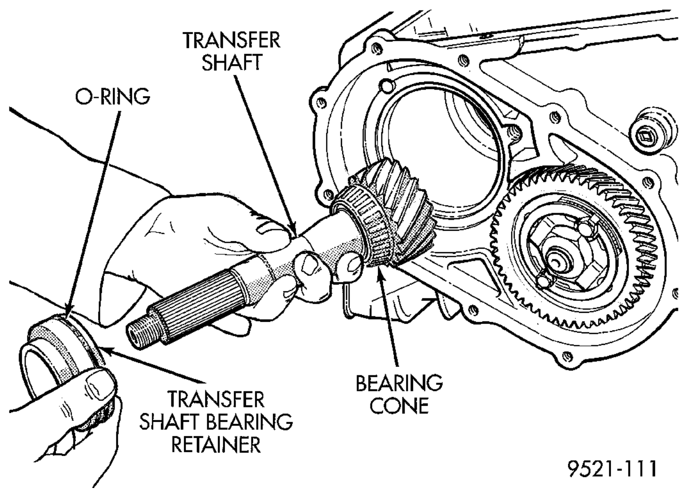


Fig. 142 Transfer Shaft and Bearing Retainer

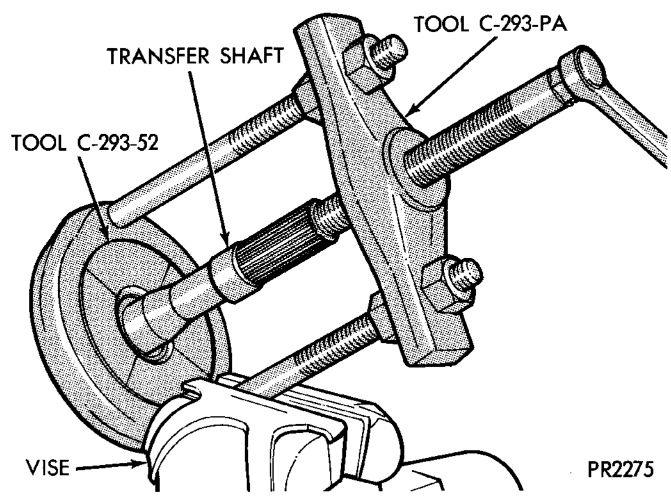


Fig. 143 Remove Transfer Shaft Bearing Cone

DISASSEMBLY AND ASSEMBLY (Continued)

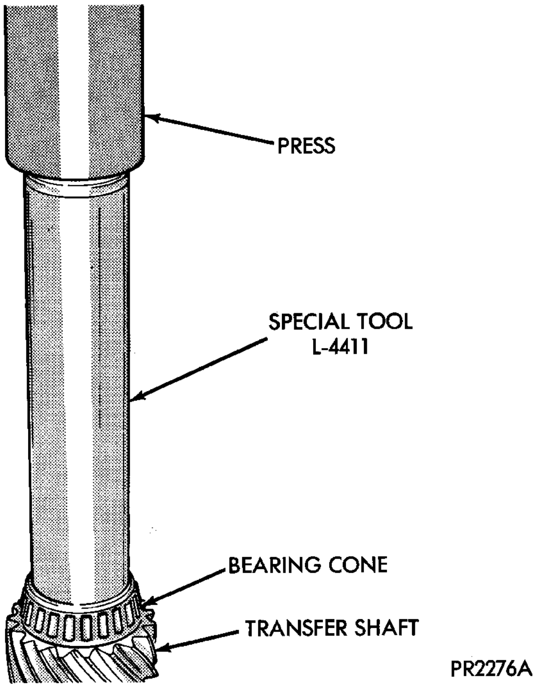


Fig. 144 Install Transfer Shaft Bearing Cone

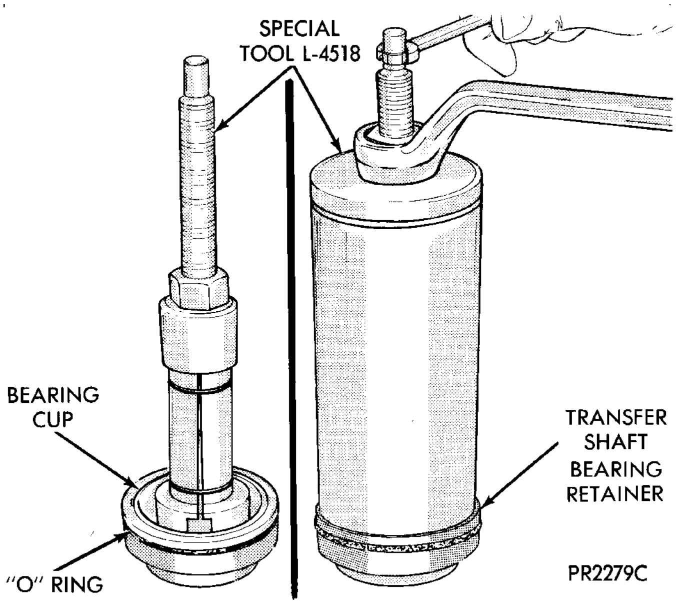


Fig. 145 Remove Transfer Shaft Bearing Cup

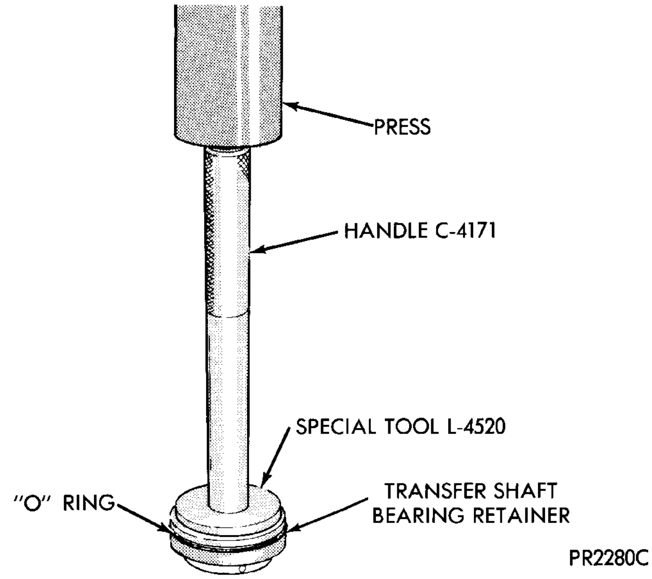


Fig. 146 Install Transfer Shaft Bearing Cup

DETERMINING SHIM THICKNESS

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Transfer shaft
- Transfer shaft gear
- Transfer shaft bearings
- Governor support retainer
- Transfer shaft bearing retainer
- Retainer snap ring
- Governor support

Refer to Bearing Adjustment Procedure in rear of this section to determine proper shim thickness.

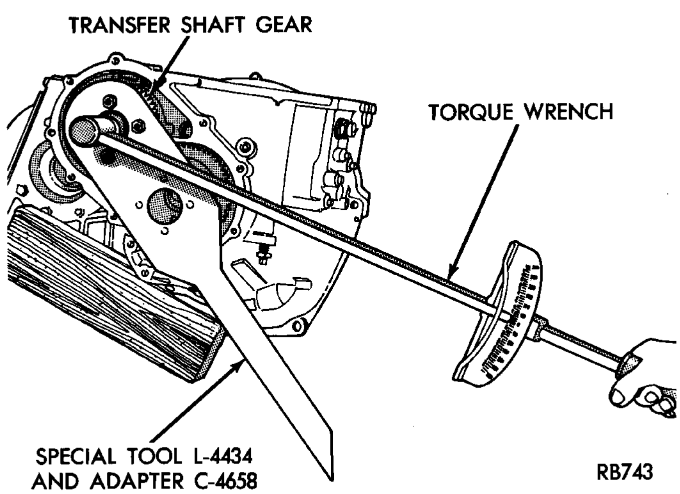


Fig. 147 Tighten Transfer Shaft Gear Retaining Nut to 271 N·m (200 ft. lbs.)

DISASSEMBLY AND ASSEMBLY (Continued)

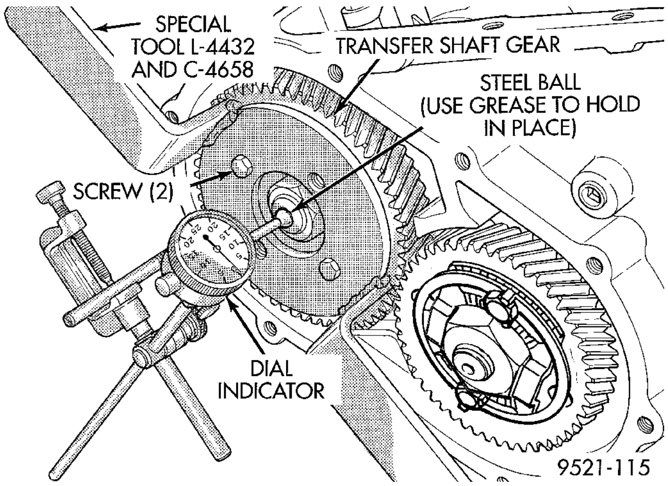


Fig. 148 Checking Transfer Shaft End Play

STIRRUP AND STRAP INSTALLATION

Once bearing shim selection has been adjusted, install stirrup and strap assembly onto transfer gear.

NOTE: Once the stirrup assembly is positioned onto the transfer gear, it is necessary to "clock" the stirrup against the flats of the transfer gear retaining nut.

(1) Position the stirrup on the transfer gear.

(2) Position strap.

(3) Install retaining bolts into transfer gear. Finger–tighten bolts.

(4) Turn stirrup clockwise against the flats of the transfer gear retaining nut.

(5) Tighten retaining bolts to 23 N·m (200 in. lbs.).

(6) Bend tabs of strap up against "flats"of retaining bolts.

ASSEMBLY

To install transfer shaft, reverse the above procedure.

PARKING PAWL

DISASSEMBLY

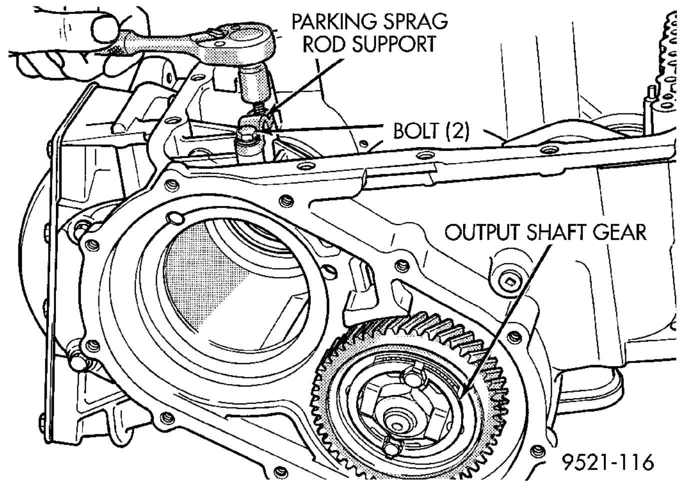


Fig. 149 Parking Sprag Rod Support

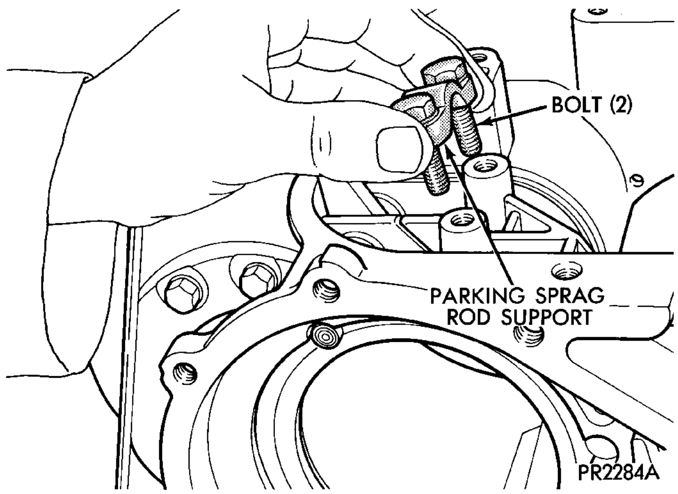


Fig. 150 Support and Bolts

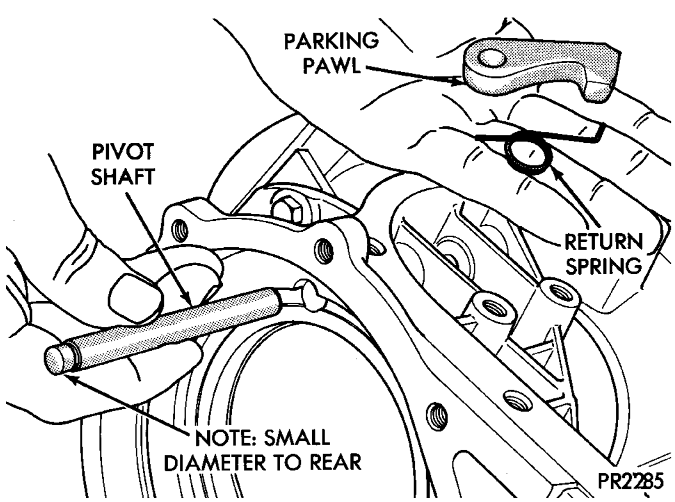


Fig. 151 Parking Pawl, Return Spring, and Pivot Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

To install, reverse the above procedure.

OUTPUT SHAFT REPAIR

NOTE: Transfer shaft should be removed for repair of output shaft. Planetary gear sets must be removed to accurately check output shaft bearing turning torque.

STIRRUP AND RETAINING STRAP

NOTE: A stirrup and retaining strap (Fig. 152) is attached to the output gear. The stirrup prevents the output gear retaining nut from turning and backing off the output shaft. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.

REMOVAL

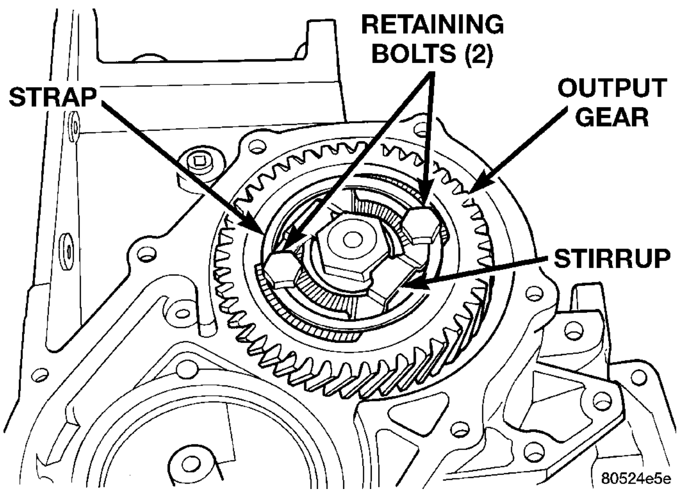


Fig. 152 Stirrup and Retaining Strap Assembly

(1) Using a punch, bend tabs on strap flat against output gear (Fig. 153).

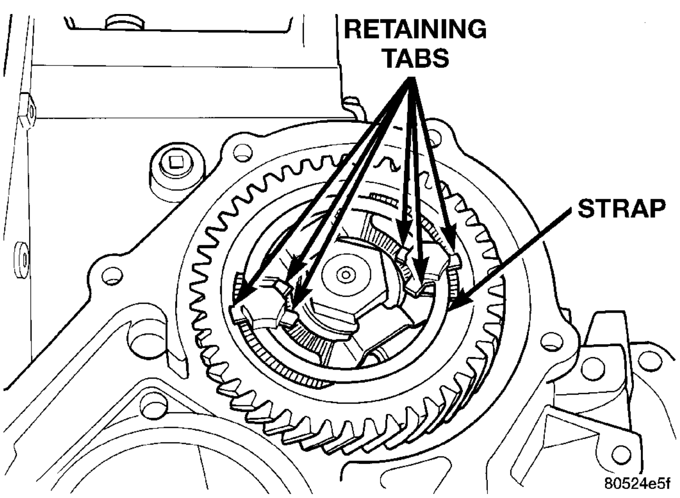


Fig. 153 Bend Strap Tabs Flat

(2) Remove bolts holding retaining strap to stirrup (Fig. 154).

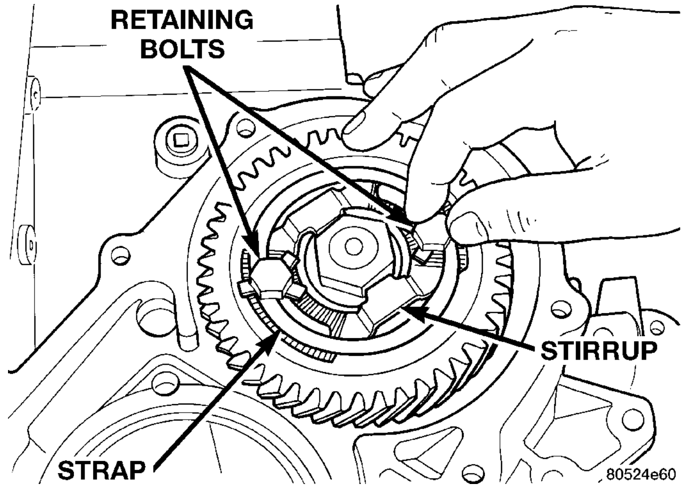


Fig. 154 Remove Strap Bolts

(3) Remove strap from output gear and stirrup (Fig. 155).

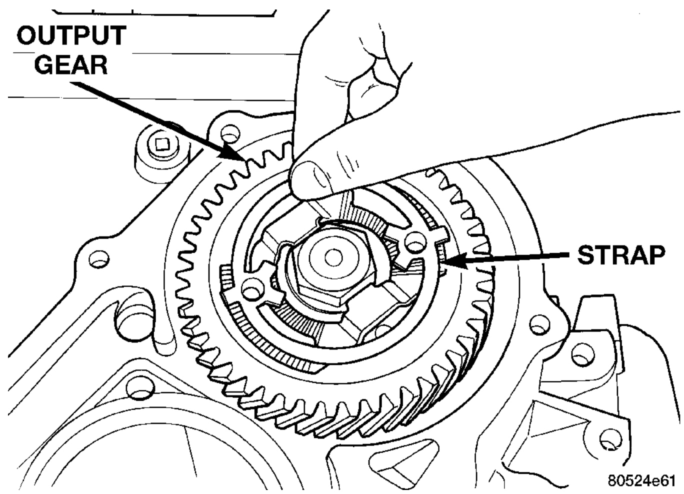


Fig. 155 Remove Strap From Stirrup and Gear

(4) Remove stirrup from output gear (Fig. 156) (Fig. 157).

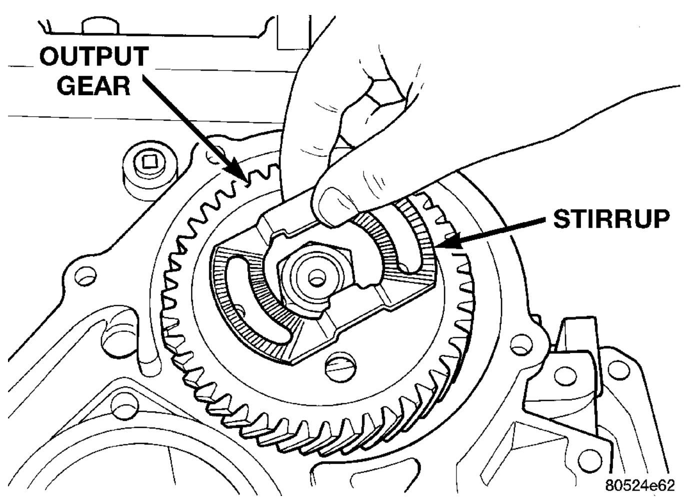


Fig. 156 Remove Stirrup From Gear

DISASSEMBLY AND ASSEMBLY (Continued)

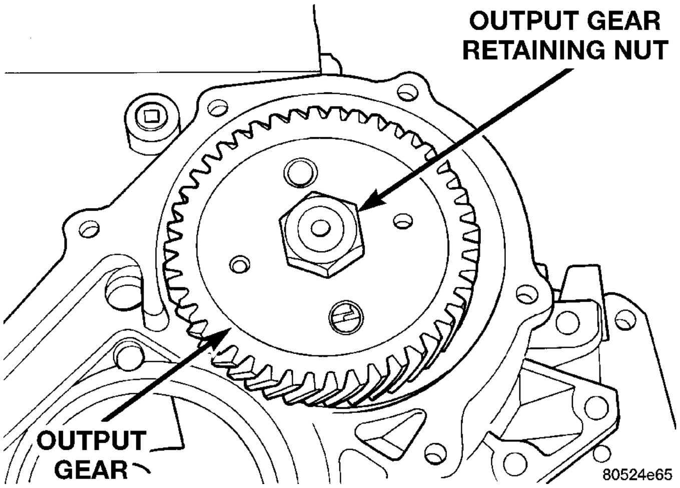


Fig. 157 Stirrup and Strap Removed From Output Gear

OUTPUT GEAR AND SHAFT

DISASSEMBLY

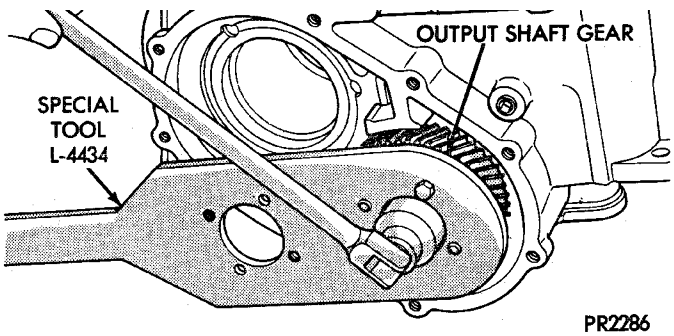


Fig. 158 Remove Output Shaft Retaining Nut and Washer

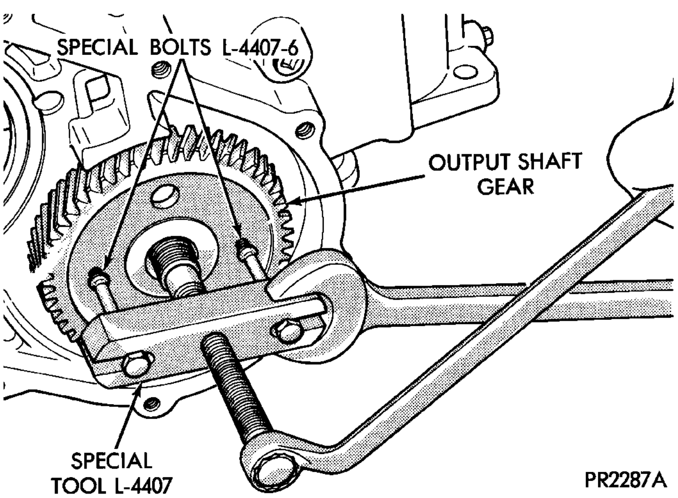


Fig. 159 Remove Output Shaft Gear

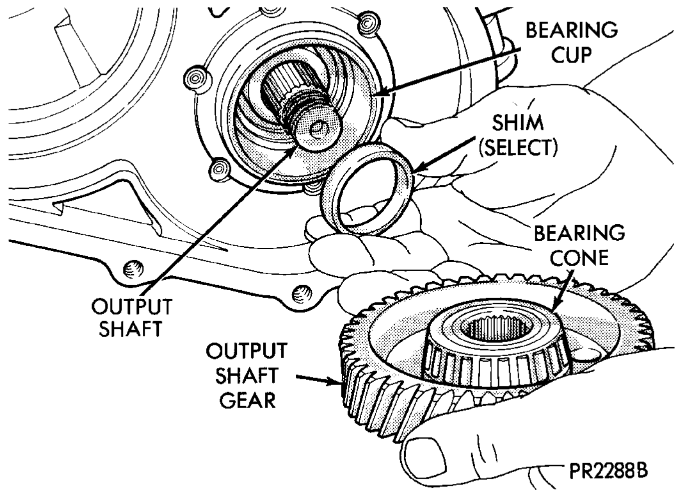


Fig. 160 Output Shaft Gear and (Select) Shim

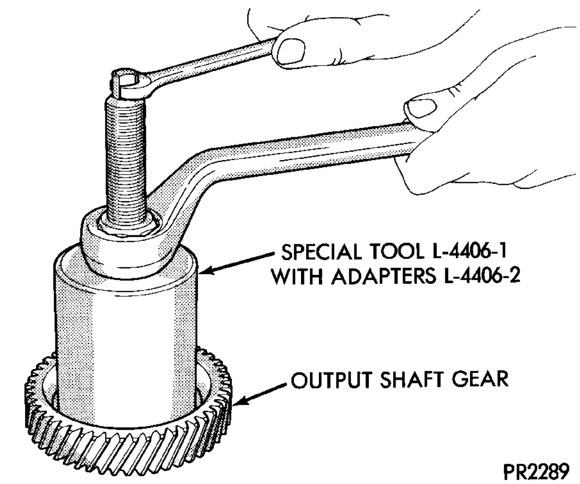


Fig. 161 Remove Output Shaft Gear Bearing Cone

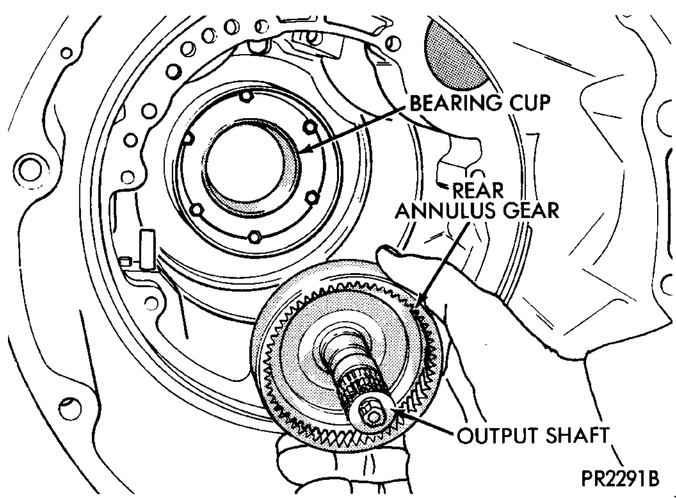


Fig. 162 Remove Output Shaft and Rear Annulus Gear Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

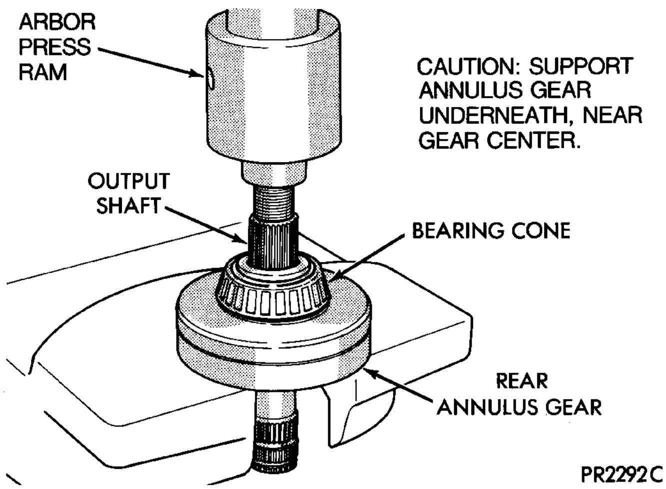


Fig. 163 Remove Output Shaft

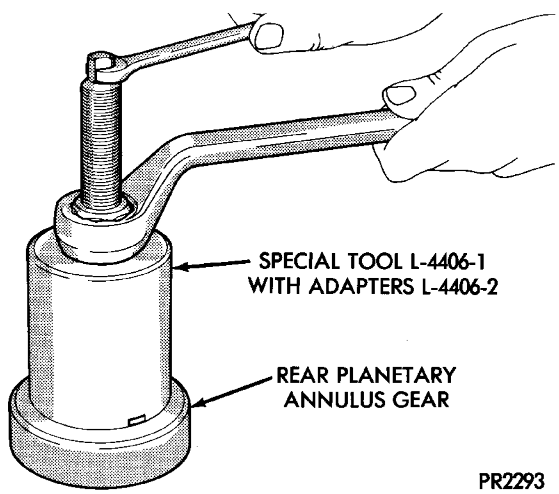


Fig. 164 Remove Rear Planetary Annulus Gear Bearing Cone

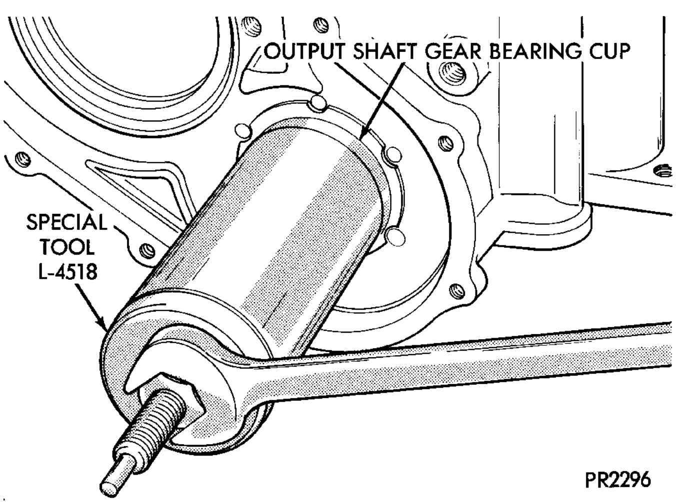


Fig. 165 Remove Output Shaft Gear Bearing Cup

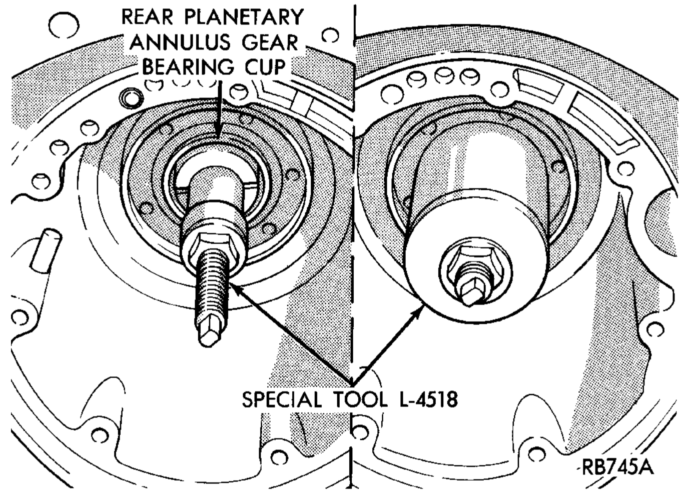


Fig. 166 Remove Rear Planetary Annulus Gear Bearing Cup

ASSEMBLY

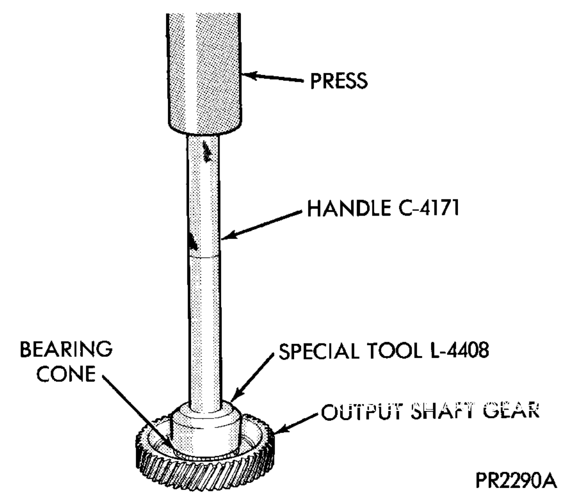


Fig. 167 Install Output Shaft Gear Bearing Cone

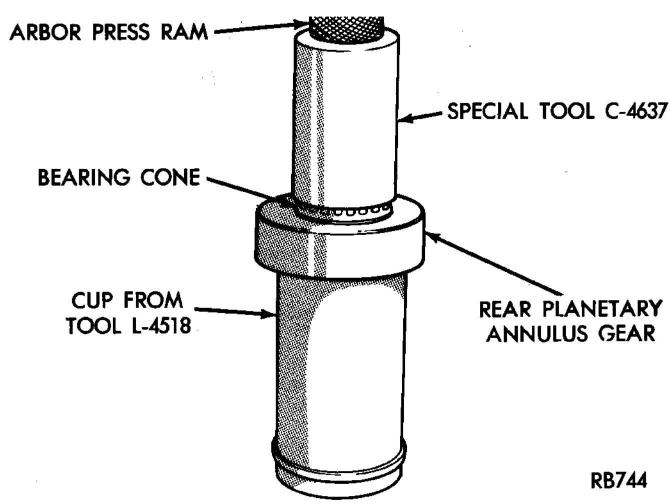


Fig. 168 Install Rear Planetary Annulus Gear Bearing Cone

DISASSEMBLY AND ASSEMBLY (Continued)

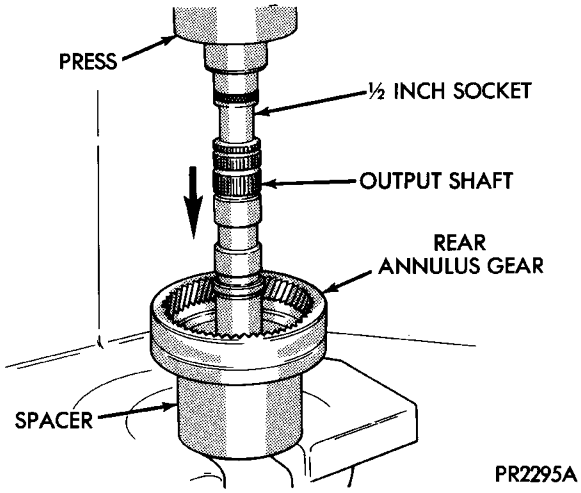


Fig. 169 Install Output Shaft into Rear Planetary Annulus Gear

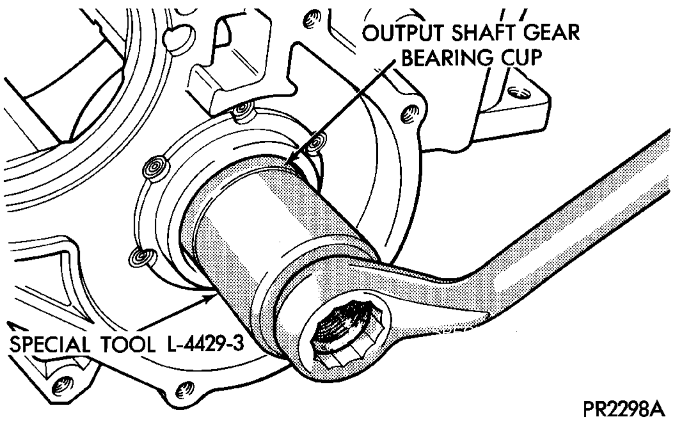


Fig. 170 Install Output Shaft Gear Bearing Cup

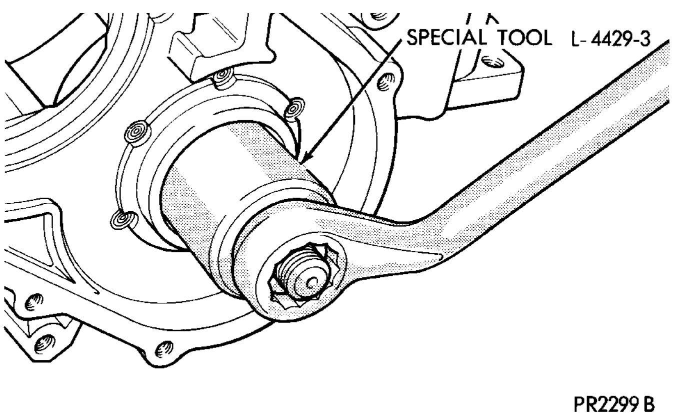


Fig. 171 Install Rear Planetary Annulus Gear Bearing Cup

DETERMINING SHIM THICKNESS

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Output shaft
- Rear planetary annulus gear
- Output shaft gear
- Rear annulus and output shaft gear bearing cones
- Overrunning clutch race cups

Refer to Bearing Adjustment Procedure at the rear of this section, to determine proper shim thickness. **Check output shaft bearing turning torque, using an inch-pound torque wrench. If turning torque is 3 to 8 inch-pounds, the proper shim has been installed.**

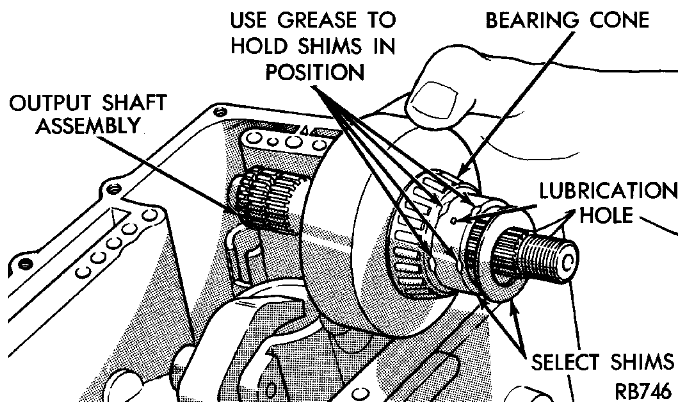


Fig. 172 Install Output Shaft Assembly

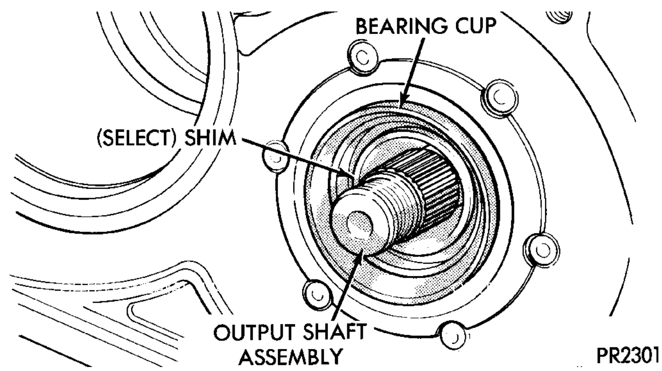


Fig. 173 Output Shaft and (Select) Shims in Position

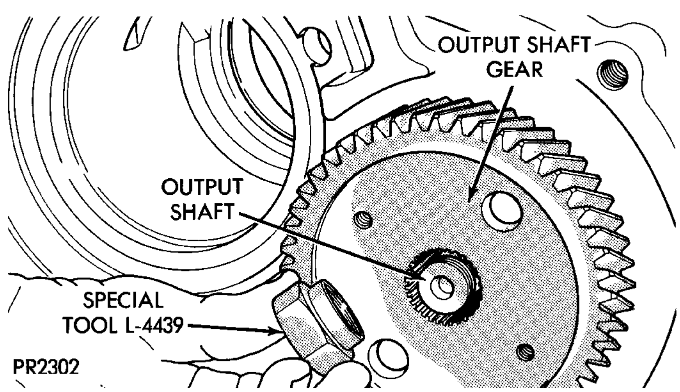


Fig. 174 Start Output Shaft Gear onto Output Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

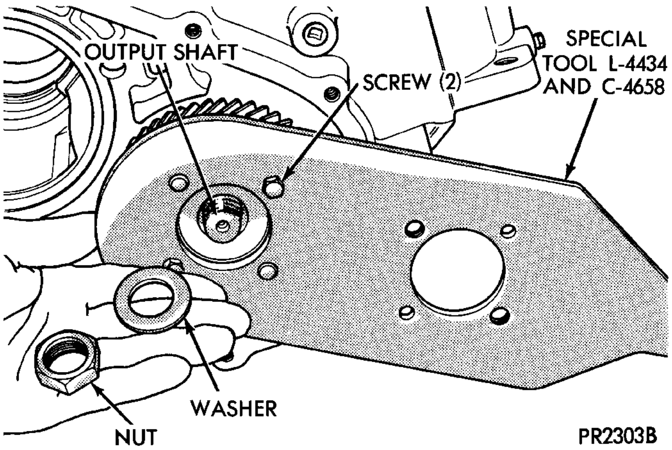


Fig. 175 Holding Output Shaft Gear

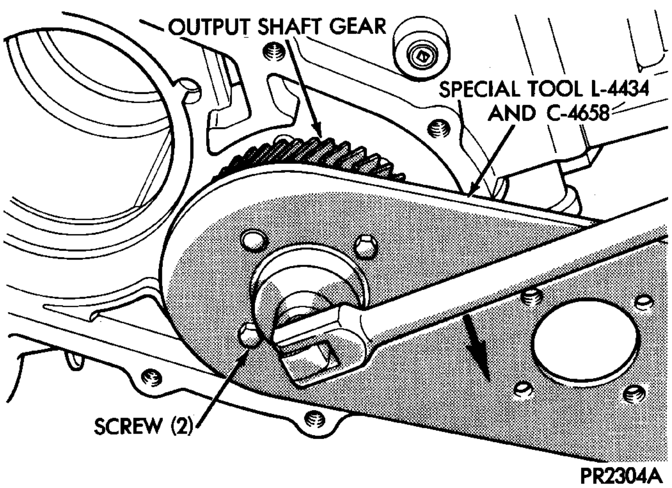


Fig. 176 Tighten Output Shaft Retaining Nut to 271 N·m (200 ft. lbs.)

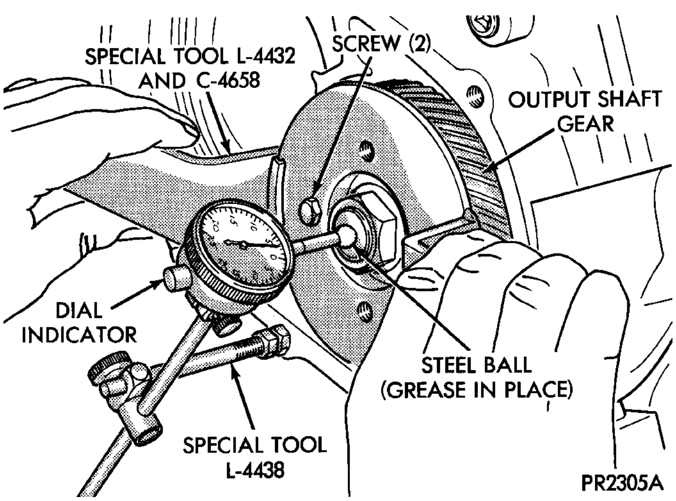


Fig. 177 Checking Output Shaft End Play

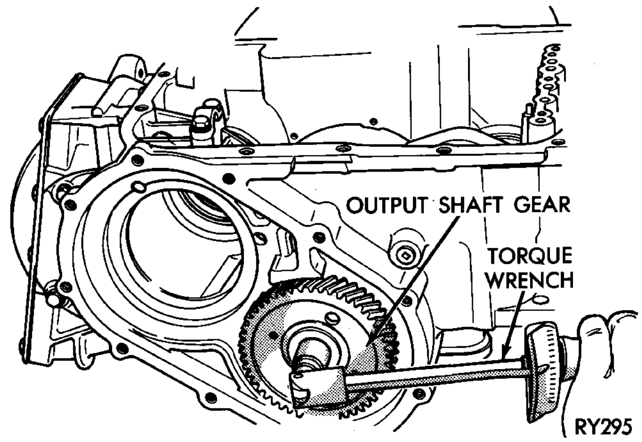


Fig. 178 Checking Bearing Turning Torque

STIRRUP AND RETAINING STRAP

INSTALLATION

Once bearing turning torque and shim selection has been adjusted, install stirrup and strap assembly onto output gear.

NOTE: Once the stirrup assembly is positioned onto the output gear, it is necessary to "clock" the stirrup against the flats of the output gear retaining nut.

(1) Position the stirrup on the output gear.

(2) Position strap.

(3) Install retaining bolts into output gear. Finger–tighten bolts.

(4) Turn stirrup clockwise against the flats of the output gear retaining nut (Fig. 179).

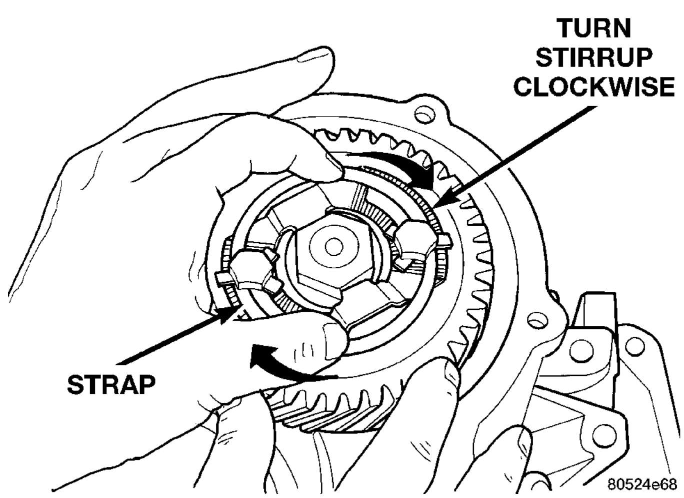


Fig. 179 Turn Stirrup Clockwise Against Flats Of Retaining Nut

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Tighten retaining bolts to 23 N·m (200 in. lbs.) (Fig. 180).

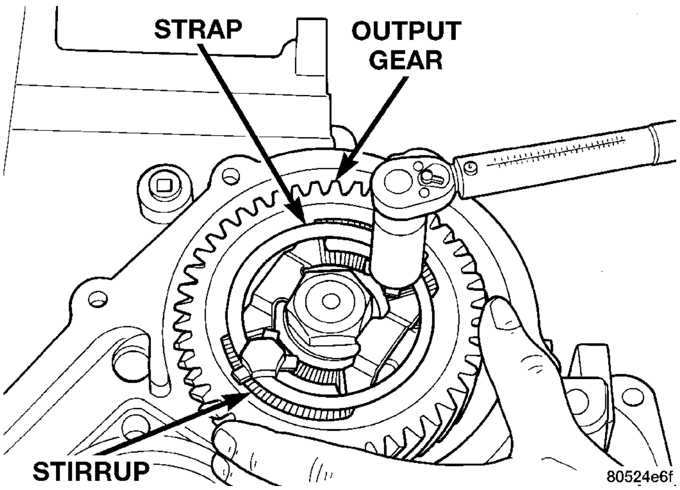


Fig. 180 Tighten Strap Retaining Nuts

(6) Bend tabs of strap up against “flats”of retaining bolts.

DIFFERENTIAL REPAIR

NOTE: The transfer shaft should be removed for differential repair and bearing turning torque checking.

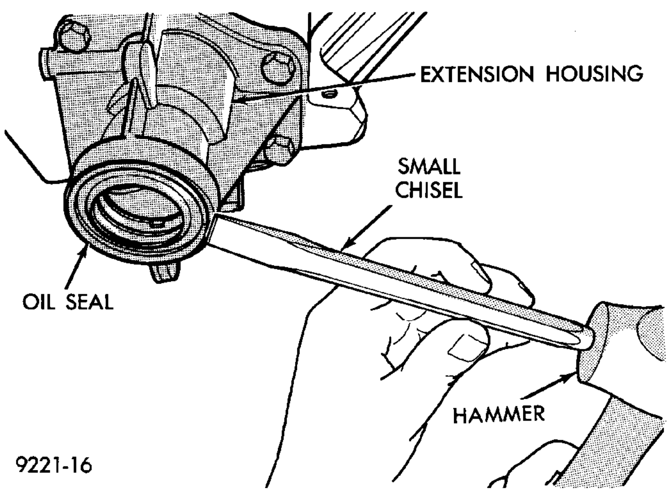


Fig. 181 Remove Extension Seal

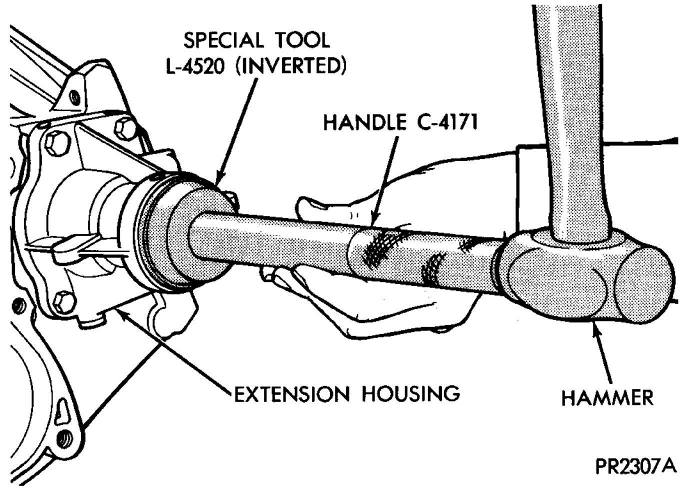


Fig. 182 Install New Seal into Extension

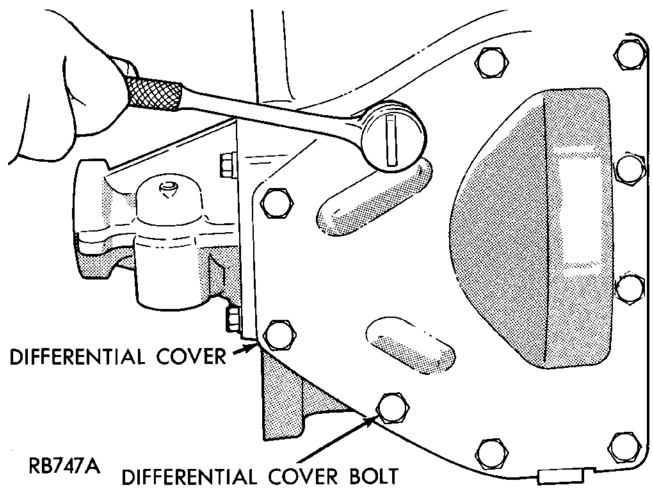


Fig. 183 Differential Cover Bolts

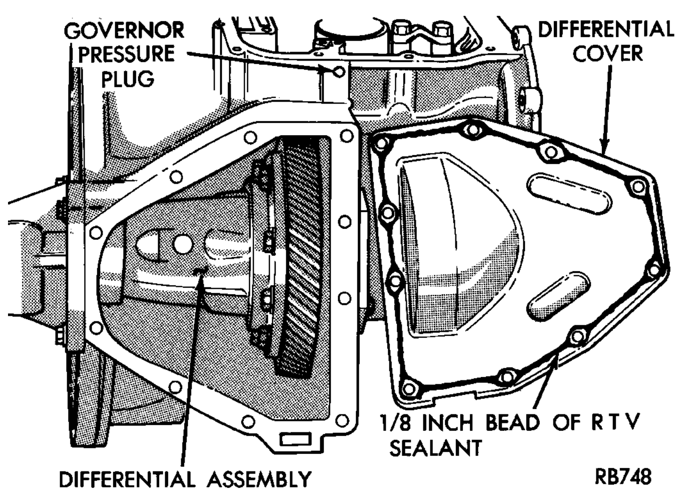


Fig. 184 Remove or Install Differential Cover

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Use Mopar® RTV sealant, or equivalent, when installing differential cover.

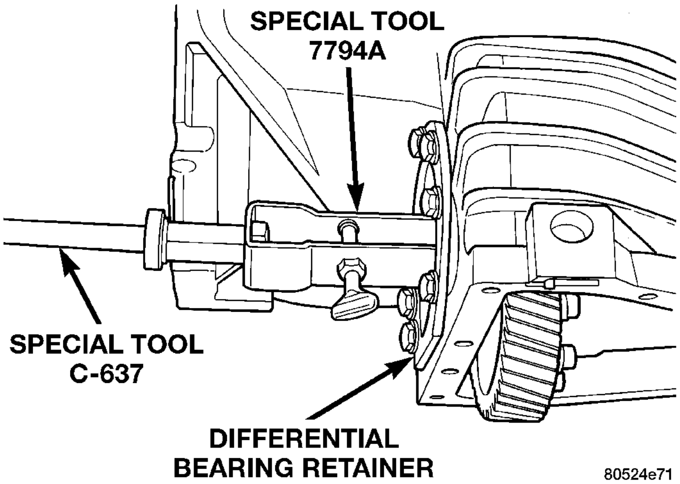


Fig. 185 Remove Bearing Retainer Axle Seal

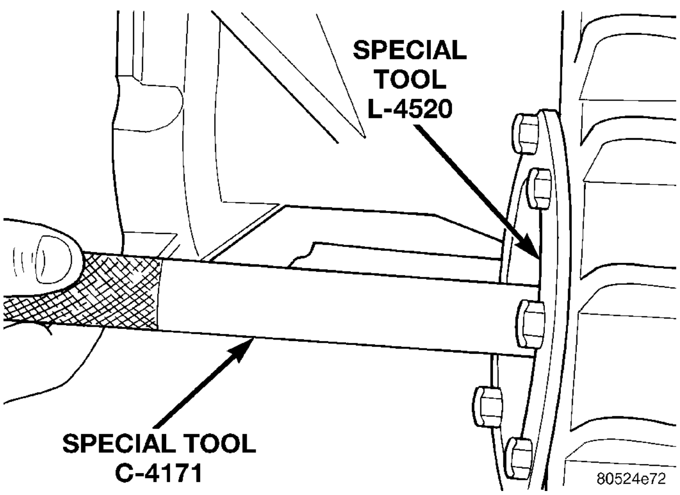


Fig. 186 Install Bearing Retainer Axle Seal

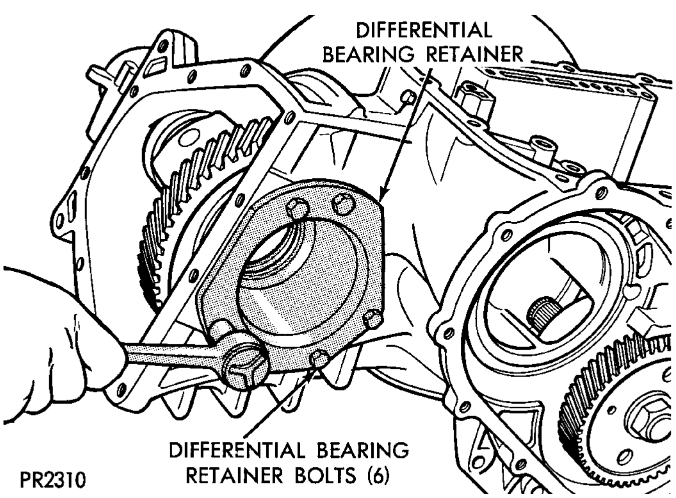


Fig. 187 Differential Bearing Retainer Bolts

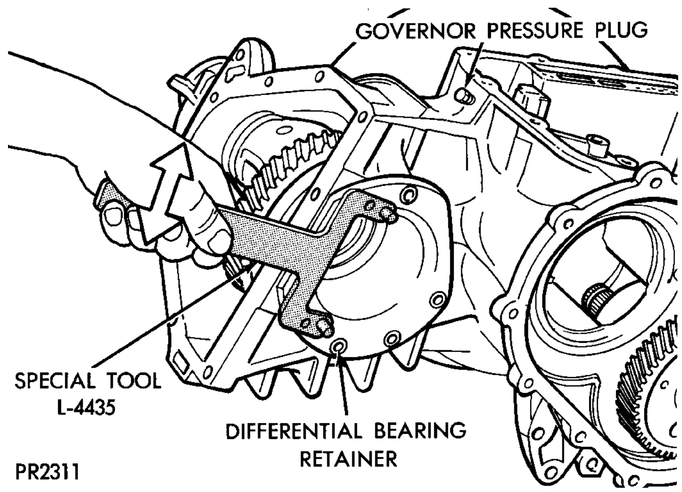


Fig. 188 Remove or Install Bearing Retainer

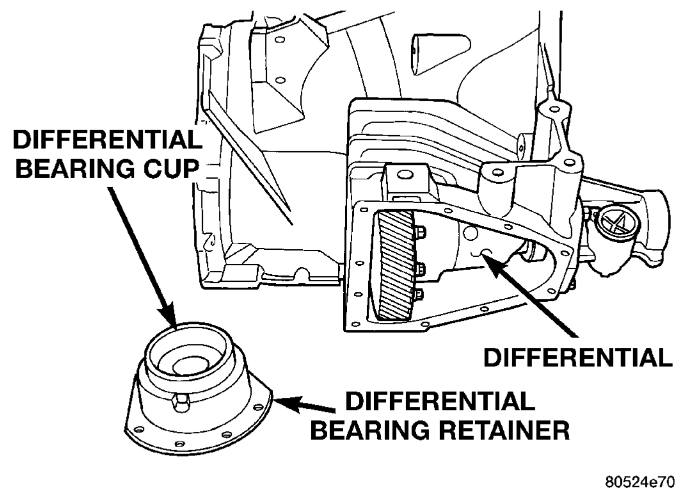


Fig. 189 Differential Bearing Retainer (Typical)

NOTE: Use Mopar® RTV sealant, or equivalent, when installing differential bearing retainer.

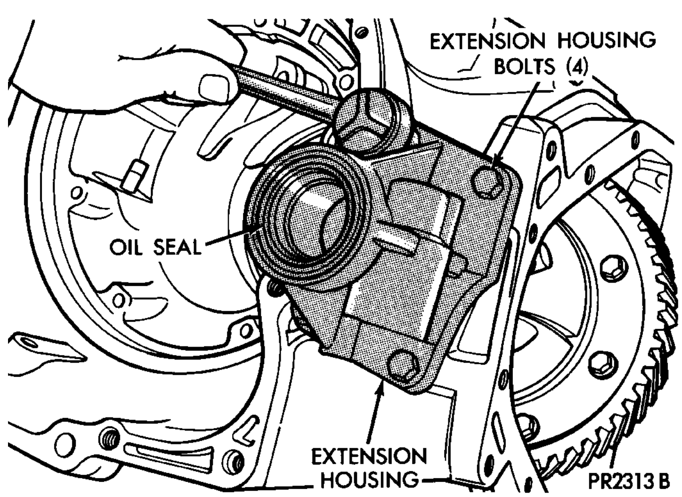


Fig. 190 Extension Bolts

DISASSEMBLY AND ASSEMBLY (Continued)

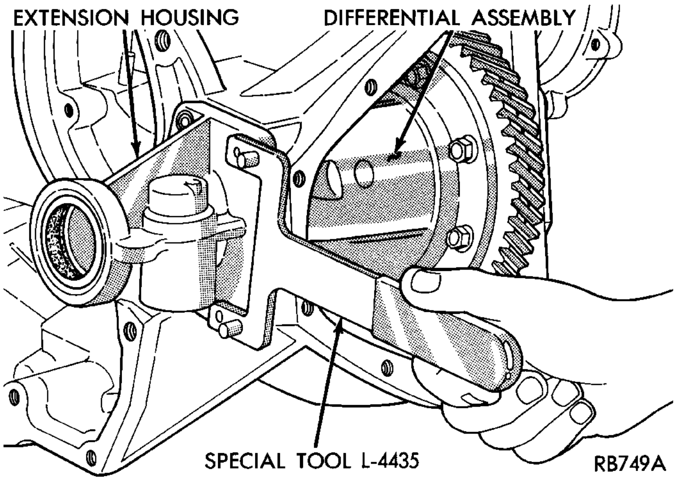


Fig. 191 Remove or Install Extension Housing

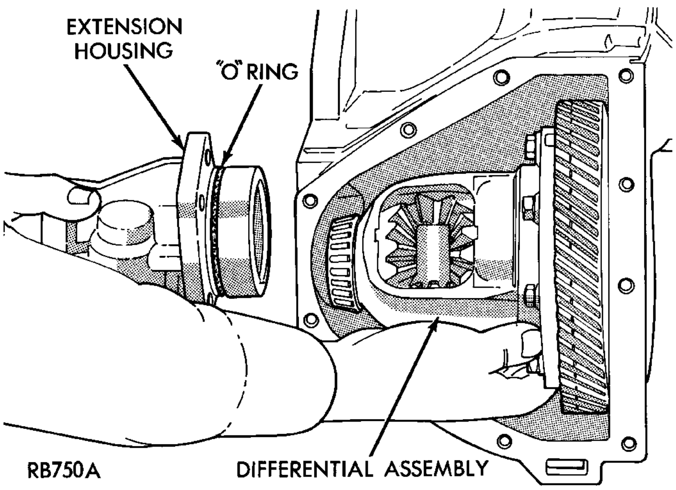


Fig. 192 Differential and Extension

WARNING: HOLD ONTO DIFFERENTIAL ASSEMBLY TO PREVENT IT FROM ROLLING OUT OF HOUSING.

Use Mopar® Silicone Rubber Adhesive Sealant, or equivalent, when installing extension housing.

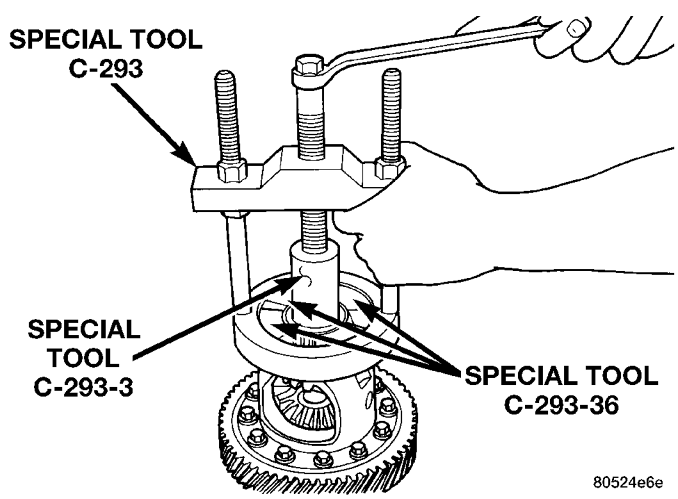


Fig. 193 Remove Differential Bearing Cone (Extension Housing Side)

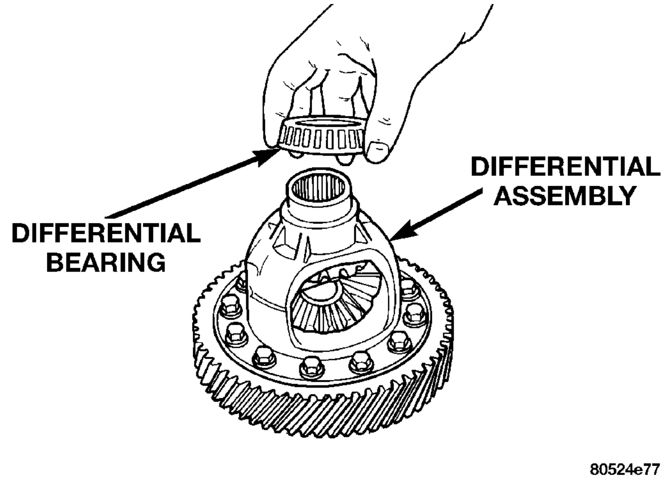


Fig. 194 Position Bearing Cone Onto Differential

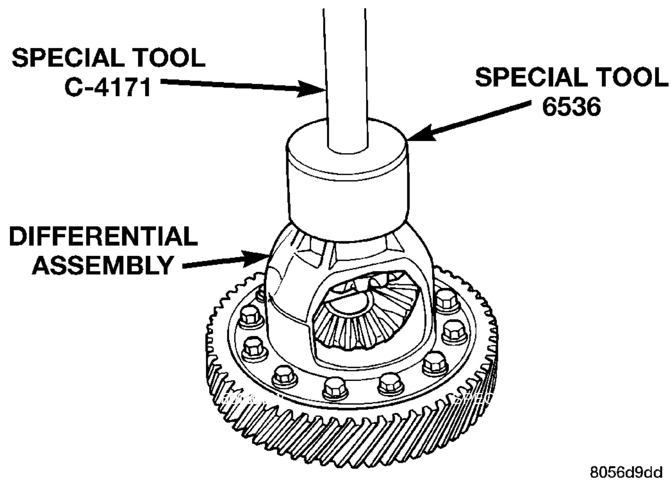


Fig. 195 Install Differential Bearing Cone

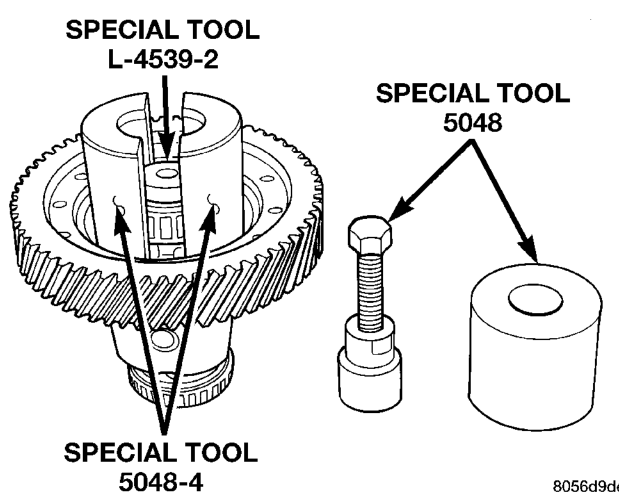


Fig. 196 Position Button and Collets Onto Differential and Bearing (Ring Gear Side)

DISASSEMBLY AND ASSEMBLY (Continued)

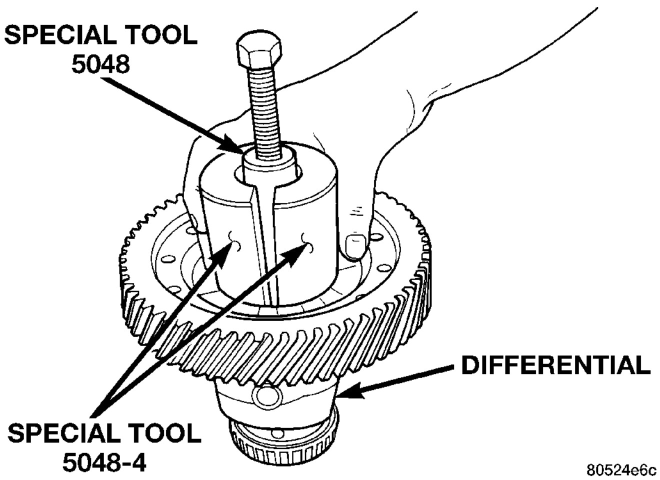


Fig. 197 Position Tool 5048 Over Button and Collets at Differential Bearing

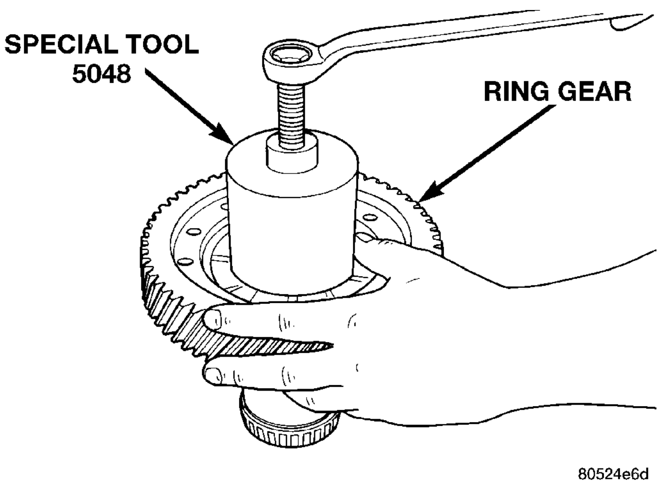


Fig. 198 Remove Differential Bearing Cone

To install the differential bearing cup and cone on the ring gear side, use Special Tool 5052, and Special Tool C-4171.

NOTE: The differential is serviced as an assembly. The only parts that are serviceable within the differential are the differential bearing cups and cones. If any other part fails within the differential, you must replace the differential assembly along with the transfer shaft.

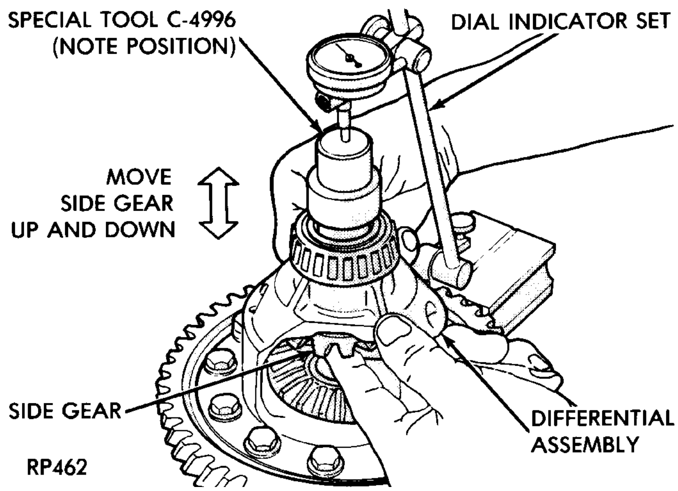


Fig. 199 Checking Side Gear End Play

CAUTION: Side gear end play must be BETWEEN 0.001 to 0.013 inch.

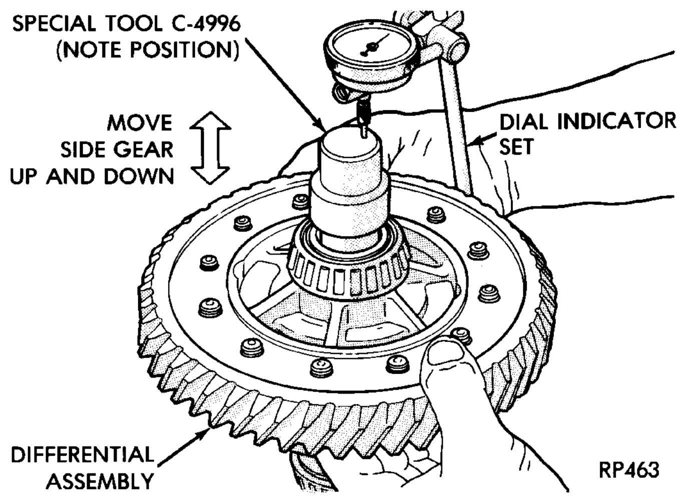


Fig. 200 Checking Side Gear End Play (Typical)

DISASSEMBLY AND ASSEMBLY (Continued)

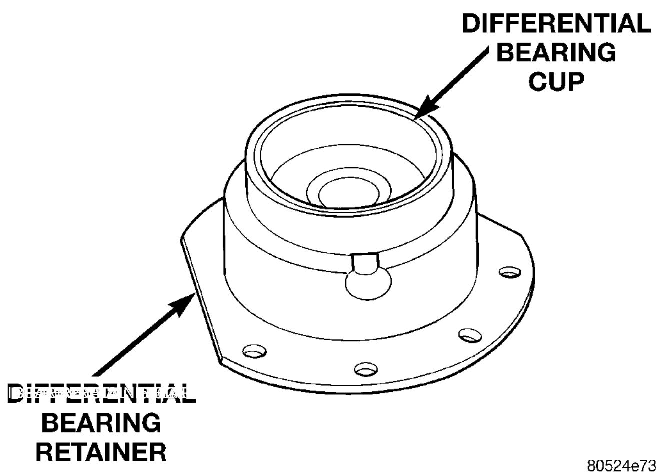


Fig. 201 Differential Bearing Retainer

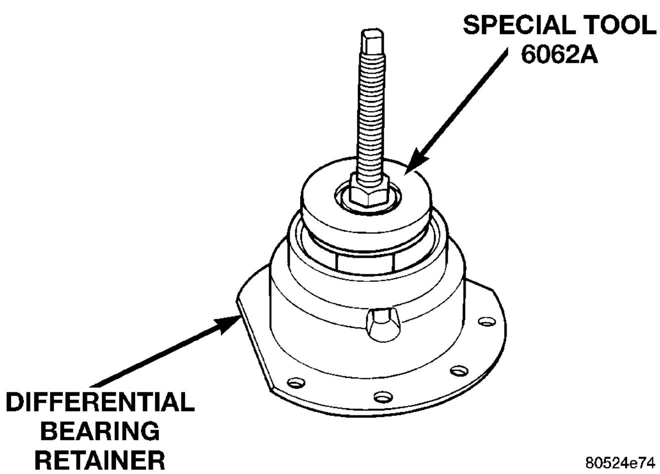


Fig. 202 Position Bearing Cup Remover Tool in Retainer

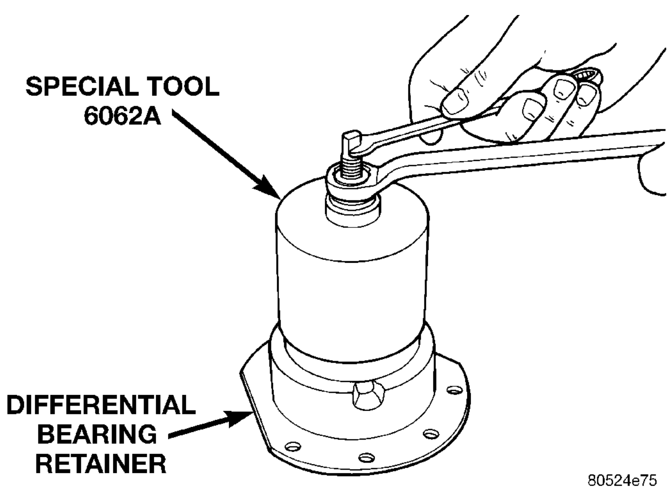


Fig. 203 Remove Bearing Cup

To remove the differential bearing cup from the extension housing/adapter side, use Special Tool 6062A, Remover. To install the differential bearing cup on the extension housing/adapter side, use Special Tool 6536, Driver and Special Tool C-4171, Handle.

DETERMINING SHIM THICKNESS

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Differential carrier
- Differential bearing retainer
- Extension housing
- Differential bearing cups and cones

Refer to Bearing Adjustment Procedure in rear of this section to determine proper shim thickness.

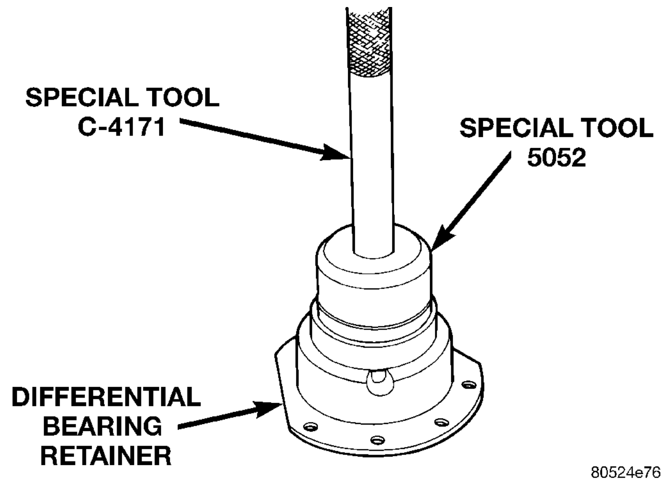


Fig. 204 Install Bearing Cup

CLEANING AND INSPECTION

VALVE BODY

Allow all parts to soak a few minutes in a suitable clean solvent. Wash thoroughly and blow dry with compressed air. Be 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. Be sure all metering holes in steel plate are open. Using a penlight, 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

CLEANING AND INSPECTION (Continued)

these edges is vitally important. It prevents foreign matter from lodging between valve and valve body. This reduces the possibility of sticking. Inspect all valves and plugs for freedom of operation in valve body bores.

When bores, valves, and plugs are clean and dry, the valves and plugs should fall freely in the bores. The valve body bores do not change their 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 a valve body unless it is damaged in handling.

ADJUSTMENTS

GEARSHIFT CABLE

Normal operation of the Park/Neutral Position Switch provides a quick check to confirm proper linkage adjustment.

Move the selector level slowly forward until it clicks into the PARK (P) position. The starter should operate.

After checking the (P) position, move selector slowly toward the NEUTRAL (N) position until lever drops in the (N) position. If the starter will operate also at this point, the gearshift linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

ADJUSTMENT

(1) Set parking brake.

(2) Remove floor console. Refer to Group 23, Body.

(3) Place gearshift lever in the (PARK) (P) position.

(4) Push down on the tab and unsnap the collar at the shifter cable to allow the cable to be adjusted (Fig. 205).

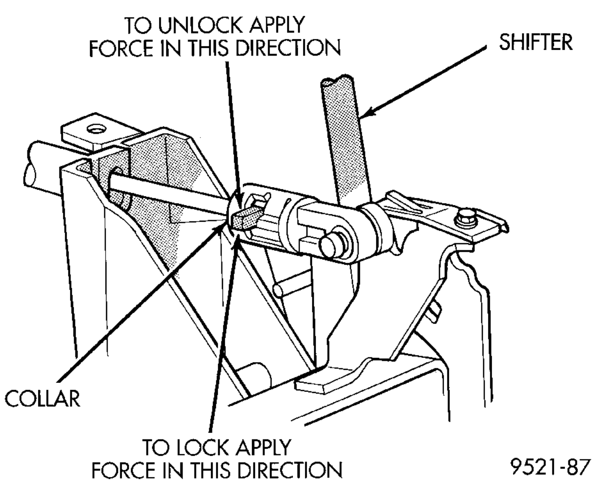


Fig. 205 Gearshift Cable Adjustment

(5) Move the gearshift lever on the transaxle to the PARKposition.

(6) Verify the shift lever and transaxle are in the PARK position. Rotate collar on the shift cable adjuster end up until it seats against the plastic housing. NOTE: If the collar will not rotate to the fully detented lock position, rotate the collar back to its initial unlocked position. Position the ATX in the gated PARK position. Apply a slight load to the shift lever, fore or aft in vehicle, while simultaneously rotating the collar upward to the LOCK position. The collar must seat against the plastic housing to achieve the required detented lock position. The gearshift linkage should now be properly adjusted.

Check adjustment as follows:

(7) Detent position for NEUTRAL and DRIVE should be within limits of hand lever gate stops.

(8) Key start must occur only when the shift lever is in PARK or NEUTRAL positions.

THROTTLE PRESSURE CABLE ADJUSTMENT PROCEDURE

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.

(1) Perform transaxle throttle pressure cable adjustment while engine is at normal operating temperature.

(2) Release cross-lock on the cable assembly (pull cross-lock upward) see (Fig. 206).

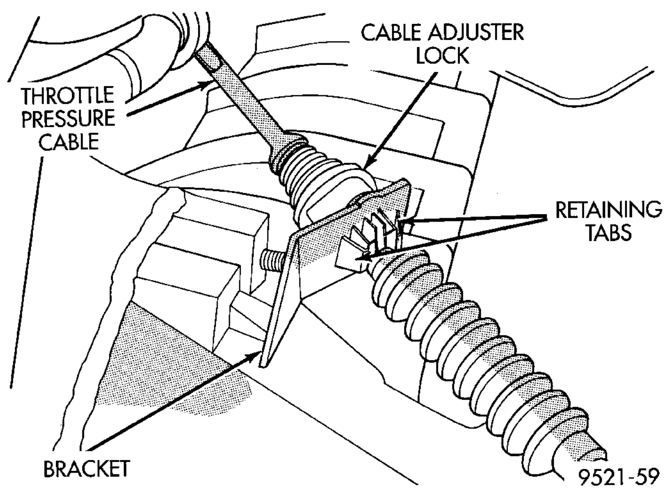


Fig. 206 Throttle Pressure Cable Adjuster Lock

(3) To ensure proper adjustment, the cable must be free to slide all the way toward the engine, against its stop, after the cross-lock is released.

ADJUSTMENTS (Continued)

(4) Move transaxle throttle control lever fully clockwise, against its internal stop, and press cross-lock downward into locked position.

The adjustment is complete and transaxle throttle cable backlash was automatically removed.

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).

No lubrication is required for any component of the throttle cable system.

SHIFTER/IGNITION INTERLOCK SYSTEM

If ignition switch cannot be turned to the LOCK position, with shifter in PARK, an adjustment of the Interlock System may be required. To adjust Shifter/Ignition Interlock System, follow procedure listed below.

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove console assembly. Refer to Group 23, Body.

(3) Remove the gearshift knob set screw and knob (Fig. 207).

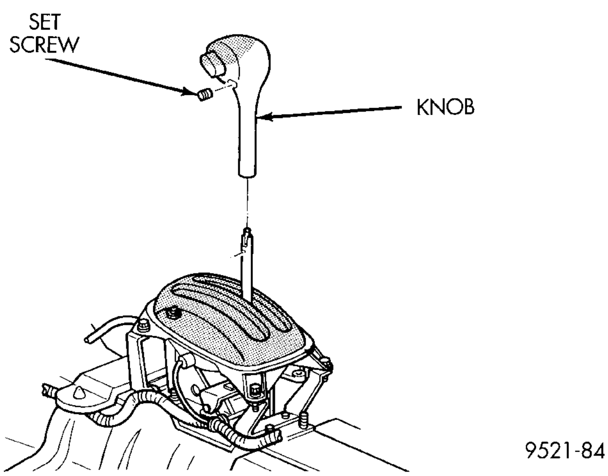


Fig. 207 Gearshift Handle

(4) Remove the screws retaining the gearshift indicator bezel and remove bezel and indicator lamp (Fig. 208).

(5) Reinstall the gearshift knob.

(6) Place shifter in PARK.

(7) Turn ignition switch to the LOCK or ACCESSORY position. If cable has lost its adjustment, manually position cable to get key into LOCK or ACCESSORY position. Grasp slug on interlock cable with needle–nose pliers and pull back on cable. This will allow the ignition switch to be turned to the LOCK or ACCESSORY position.

(8) Check that the interlock cable slug is completely seated into the shifter interlock lever.

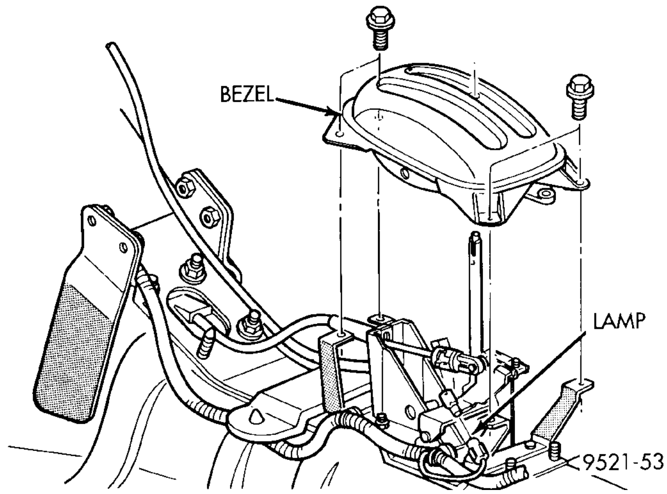


Fig. 208 Shift Indicator Bezel

(9) Check that the ignition switch is still in the LOCK or ACCESSORY position.

(10) Pry up the adjuster lock on the shifter/ignition interlock cable (Fig. 209).

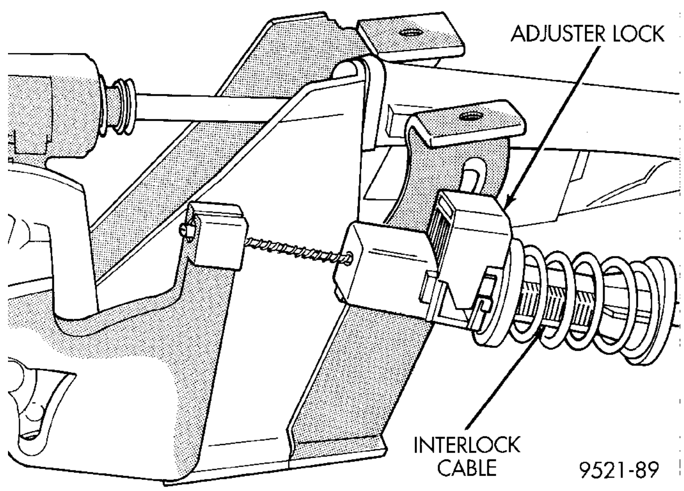


Fig. 209 Interlock Cable Adjuster Lock

(11) The spring on the interlock cable should automatically compensate for the slack in the adjuster.

(12) Then snap down the interlock adjuster lock onto cable.

(13) After adjusting the interlock system, perform the interlock system operation check. See Interlock System Operation Check in this section.

ADJUSTMENTS (Continued)

BAND ADJUSTMENT

KICKDOWN BAND (FRONT)

The kickdown band adjusting screw is located on left side (top front) of the transaxle case.

(1) Loosen locknut and back–off nut approximately five turns. Test adjusting screw for free turning in the transaxle case.

(2) Using wrench, tighten adjusting screw to 8 N·m (72 in. lbs.).

(3) Back–off adjusting screw the number of turns listed in Specifications. Hold adjusting screw in this position and tighten locknut to 47 N·m (35ft. lbs.)

LOW/REVERSE BAND (REAR)

To adjust low/reverse band, proceed as follows:

(1) Loosen and back off locknut approximately five 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. A chart is located at the rear of this section.

(4) Tighten locknut to 14 N·m (10 ft. lbs.).

HYDRAULIC CONTROL PRESSURE ADJUSTMENTS

LINE PRESSURE

An incorrect throttle pressure setting will cause incorrect line pressure readings even though line pressure adjustment is correct. Always inspect and correct throttle pressure adjustment before adjusting the line pressure.

The approximate adjustment for line pressure is 1-5/16 inches, measured from valve body to inner edge of adjusting nut. However, due to manufacturing tolerances, the adjustment can be varied to obtain specified line pressure.

The adjusting screw may be turned with an Allen wrench. One complete turn of adjusting screw changes closed throttle line pressure approximately 1-2/3 psi. Turning adjusting screw counterclockwise increases pressure, and clockwise decreases pressure.

THROTTLE PRESSURE

Throttle pressures cannot be tested accurately; therefore, the adjustment should be measured if a malfunction is evident.

(1) Insert gauge pin of Tool C-3763 between the throttle lever cam and kickdown valve.

(2) By pushing in on tool, compress kickdown valve against its spring so throttle valve is completely bottomed inside the valve body.

(3) While compressing spring, turn throttle lever stop screw with adapter C-4553. Turn until head of screw touches throttle lever tang, with throttle lever cam touching tool and throttle valve bottomed. Be sure adjustment is made with spring fully compressed and valve bottomed in the valve body.

BEARING ADJUSTMENT PROCEDURES

(1) Take extreme care when removing and installing bearing cups and cones. **Use only an arbor press for installation, as a hammer may not properly align the bearing cup or cone.** Burrs or nicks on the bearing seat will give a false end play reading, while gauging for proper shims. Improperly seated bearing cup and cones are subject to low-mileage failure.

(2) Bearing cups and cones should be replaced if they show signs of pitting or heat distress.

(3) If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

NOTE: Bearing end play and drag torque specifications must be maintained to avoid premature bearing failures.

(4) Used (original) bearing may lose up to 50 percent of the original drag torque after break-in.

NOTE: All bearing adjustments must be made with no other component interference or gear intermesh, except the transfer gear bearing.

(5) Refer to the conversion chart in specifications to convert inches to millimeter measurements. Refer to bearing shim chart for proper shim thicknesses.

OUTPUT SHAFT BEARING

With output shaft gear removed, install a 13.65 mm (0.537 inch) and a 1.34 mm (0.053 inch) gauging shim on the planetary rear annulus gear hub using grease to hold the shim 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.

Install output shaft gear and bearing assembly, torque to 271 N·m (200 ft. lbs.).

To measure bearing end play:

(1) Attach Tool L-4432 to the output shaft gear.

(2) Mount a steel ball with grease into the end of the output shaft.

(3) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(4) Using a dial indicator mounted to the transaxle case, measure output shaft end play.

(5) Once bearing end play has been determined, refer to the output shaft bearing shim chart.

(6) The 12.65 mm (0.498 inch), 13.15 mm (0.518 inch) or 13.65 mm (0.537 inch) shims are always installed first. **These shims have lubrication slots that are necessary for proper bearing lubrication.**

ADJUSTMENTS (Continued)

(7) Shims thinner than 12.65 mm listed in the chart are common to both the transfer shaft and output shaft bearings.

(8) Use tool L-4434 to remove the retaining nut and washer. To remove the output shaft gear use tool L-4407.

(9) 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.

(10) Install the retaining nut and washer, and torque to 271 N·m (200 ft. lbs.).

(11) Using an inch-pound torque wrench, check the turning torque. **The torque should be between 3 and 8 inch-pounds.**

(12) If the turning torque is too high, install a 0.05mm (0.002 inch) thicker shim. If the turning torque is too low, install a 0.05 mm (0.002 inch) thinner shim. Repeat until the proper turning torque is 3 to 8 inch pounds.

End Play (with 13.65 mm and 1.34 mm gauging shims installed)		Required Shim Combination	Total Thickness	
mm	inch	mm	mm	inch
.0	.0	13.65 + 1.34	14.99	.590
.05	.002	13.65 + 1.24	14.89	.586
.10	.004	13.65 + 1.19	14.84	.584
.15	.006	13.65 + 1.14	14.79	.582
.20	.008	13.65 + 1.09	14.74	.580
.25	.010	13.65 + 1.04	14.69	.578
.30	.012	13.65 + .99	14.64	.576
.35	.014	13.65 + .94	14.59	.574
.40	.016	13.15 + 1.39	14.54	.572
.45	.018	13.15 + 1.34	14.49	.570
.50	.020	13.15 + 1.29	14.44	.568
.55	.022	13.15 + 1.24	14.39	.566
.60	.024	13.15 + 1.19	14.34	.564
.65	.026	13.15 + 1.14	14.29	.562
.70	.028	13.15 + 1.09	14.24	.560
.75	.030	13.15 + 1.04	14.19	.558
.80	.032	13.15 + .99	14.14	.556
.85	.034	13.15 + .94	14.09	.554
.90	.036	12.65 + 1.39	14.04	.552
.95	.038	12.65 + 1.34	13.99	.550
1.00	.040	12.65 + 1.29	13.94	.548
1.05	.042	12.65 + 1.24	13.89	.547
1.10	.044	12.65 + 1.19	13.84	.545
1.15	.046	12.65 + 1.14	13.79	.543
1.20	.048	12.65 + 1.09	13.74	.541
1.25	.049	12.65 + 1.04	13.69	.539
1.30	.051	12.65 + .99	13.64	.537
1.35	.053	12.65 + .94	13.59	.535

Average Conversion .05 mm = .002 inch 9121-17

OUTPUT SHAFT BEARING SHIM CHART

DIFFERENTIAL BEARING

(1) Position the transaxle assembly vertically on the support stand, differential bearing retainer side up.

(2) Install Tool L-4436A into the differential and onto the pinion mate shaft.

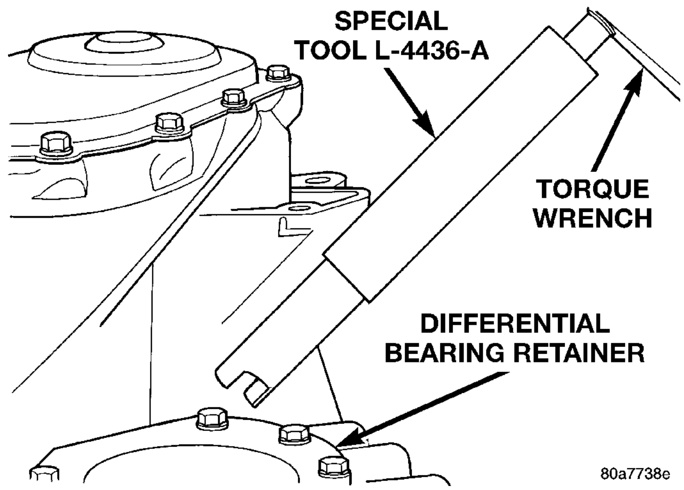


Fig. 210 Tool L-4436 and Torque Wrench

(3) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(4) Using Tool L-4436A and an inch-pound torque wrench, check the turning torque of the differential. **The turning torque should be between 5 and 18 inch-pounds.**

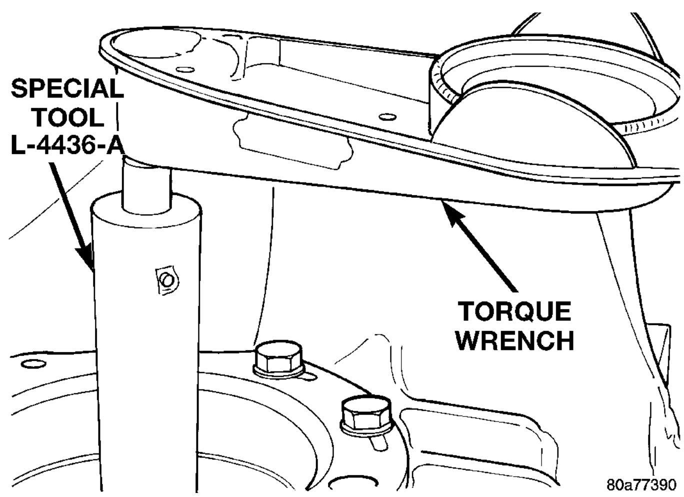


Fig. 211 Checking Differential Bearings Turning Torque

(5) If the turning torque is within specifications, remove tools. Setup is complete.

(6) If turning torque is not within specifications proceed with the following steps.

(a) Remove differential bearing retainer from the transaxle case.

ADJUSTMENTS (Continued)

(b) Remove the bearing cup from the differential bearing retainer using Tool 6062A.

(c) Remove the existing shim from under the cup.

(d) Measure the existing shim.

NOTE: If the turning torque was too high when measured, install a .05 mm (.002 inch) thinner shim. If the turning torque is was too low, install a .05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained.

Oil Baffle is not required when making shim selection.

(e) Install the proper shim under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(f) Install the differential bearing retainer using Tool 5052 and C-4171. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N·m (250 in. lbs.).

DIFFERENTIAL BEARING SHIM CHART

SHIM	THICKNESS
MM	INCH
.980	0.0386
1.02	0.0402
1.06	0.0418
1.10	0.0434
1.14	0.0449
1.18	0.0465
1.22	0.0481
1.26	0.0497
1.30	0.0512
1.34	0.0528
1.38	0.0544
1.42	0.0560
1.46	0.0575
1.50	0.0591
1.54	0.0607
1.58	0.0623
1.62	0.0638
1.66	0.0654
1.70	0.0670
2.02	0.0796
2.06	0.0812

(7) Using Tool L-4436A and an inch-pound torque wrench, recheck the turning torque of the differential. **The turning torque should be between 5 and 18 inch-pounds.**

TRANSFER SHAFT BEARING

(1) Use tool L-4434 to remove the retaining nut and washer. Remove the transfer shaft gear using tool L-4407.

(2) Install a 2.29 mm (0.090 inch) and a 1.39 mm (0.055 inch) gauging shims on the transfer shaft behind the governor support.

(3) Install transfer shaft gear and bearing assembly and torque the nut to 271 N·m (200 ft. lbs.).

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.

e. Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

f. Use tool L-4434 to remove the retaining nut and washer. Remove the transfer shaft gear using tool L-4407.

g. Remove the two gauging shims and install the correct shim combination. Install the transfer gear and bearing assembly.

h. Install the retaining nut and washer and torque to 271 N·m (200 ft. lbs.). Measure transfer shaft end play, end play should be 0.05 to 0.25 mm (0.002 to 0.010 inch).

i. Measure bearing end play. End play should be between .05 mm and .25 mm (.002 to .010 inch).

NOTE: If end play is too high, install a 0.05 mm (0.002 inch) thinner shim combination. If end play is too low, install a 0.05 mm (0.002 inch) thicker shim combination. Repeat until 0.05 to 0.25 mm (0.002 to 0.010 inch) end play is obtained.

SCHEMATICS AND DIAGRAMS (Continued)

End Play (with 2.29 mm and 1.39 mm gauging shims installed)		Required Shim Combination	Total Thickness	
mm	inch	mm	mm	inch
.0	.0	2.29 + 1.39	3.68	.145
.05	.002	2.29 + 1.39	3.68	.145
.10	.004	2.29 + 1.39	3.68	.145
.15	.006	2.29 + 1.39	3.68	.145
.20	.008	2.29 + 1.34	3.63	.143
.25	.010	2.29 + 1.29	3.58	.141
.30	.012	2.29 + 1.24	3.53	.139
.35	.014	2.29 + 1.19	3.48	.137
.40	.016	2.29 + 1.14	3.43	.135
.45	.018	2.29 + 1.09	3.38	.133
.50	.020	2.29 + 1.04	3.33	.131
.55	.022	2.29 + .99	3.28	.129
.60	.024	1.84 + 1.39	3.23	.127
.65	.026	1.84 + 1.34	3.18	.125
.70	.028	1.84 + 1.29	3.13	.123
.75	.030	1.84 + 1.24	3.08	.121
.80	.032	1.84 + 1.19	3.03	.119
.85	.034	1.84 + 1.14	2.98	.117
.90	.036	1.84 + 1.09	2.93	.115
.95	.038	1.84 + 1.04	2.88	.113
1.00	.040	1.84 + .99	2.83	.111
1.05	.042	1.39 + 1.39	2.78	.109
1.10	.044	1.39 + 1.34	2.73	.107
1.15	.046	1.39 + 1.29	2.68	.105
1.20	.048	1.39 + 1.24	2.63	.103
1.25	.049	1.39 + 1.19	2.58	.101
1.30	.050	1.39 + 1.14	2.53	.099
1.35	.052	1.39 + 1.09	2.48	.097
1.40	.055	1.39 + 1.04	2.43	.095
1.45	.057	1.39 + .99	2.38	.093
1.50	.059	.94 + 1.39	2.33	.091
1.55	.061	.94 + 1.34	2.28	.089
1.60	.063	.94 + 1.29	2.23	.087

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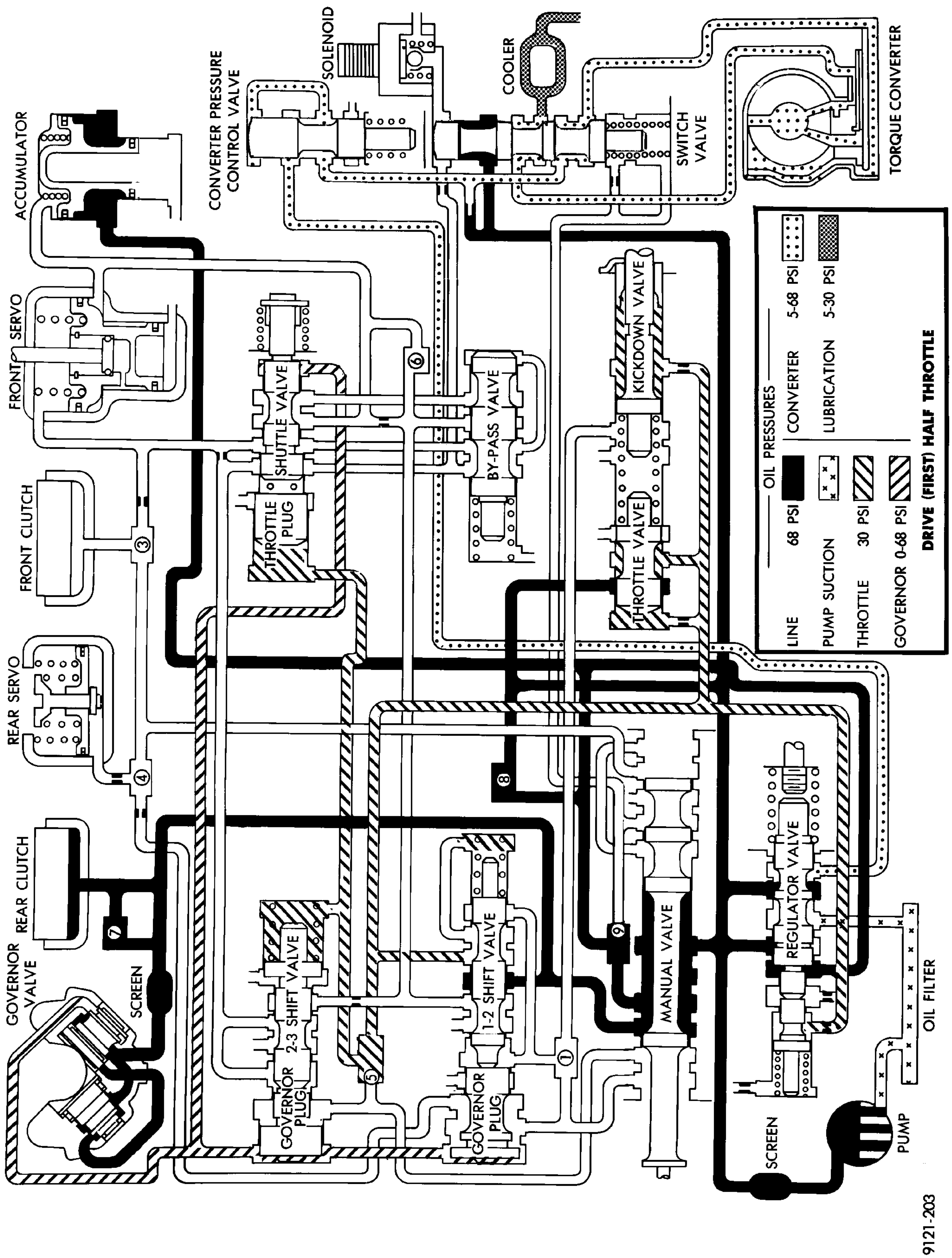
TRANSFER BEARING SHIM CHART

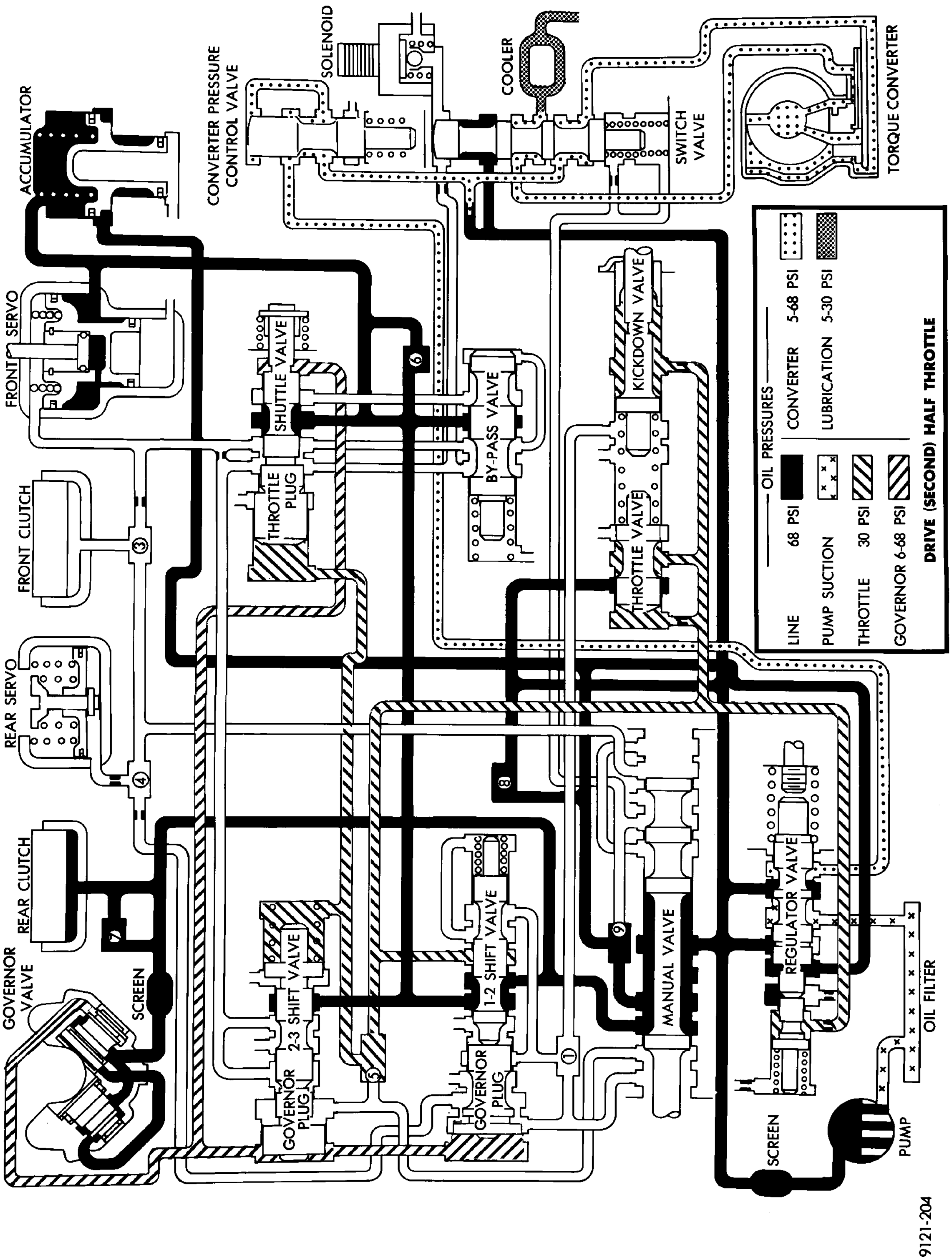
SCHEMATICS AND DIAGRAMS

31TH TRANSAXLE HYDRAULIC SCHEMATIC



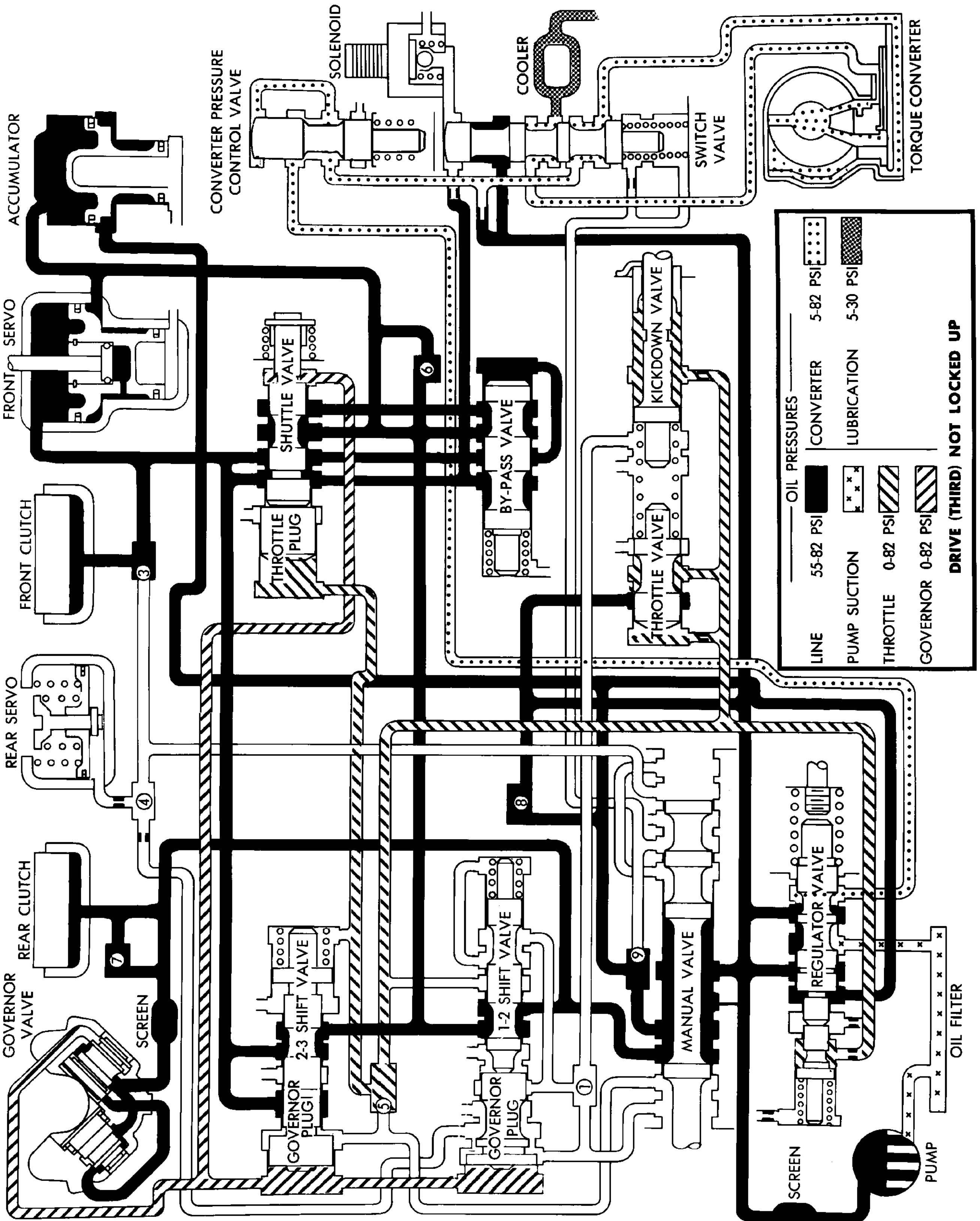
31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

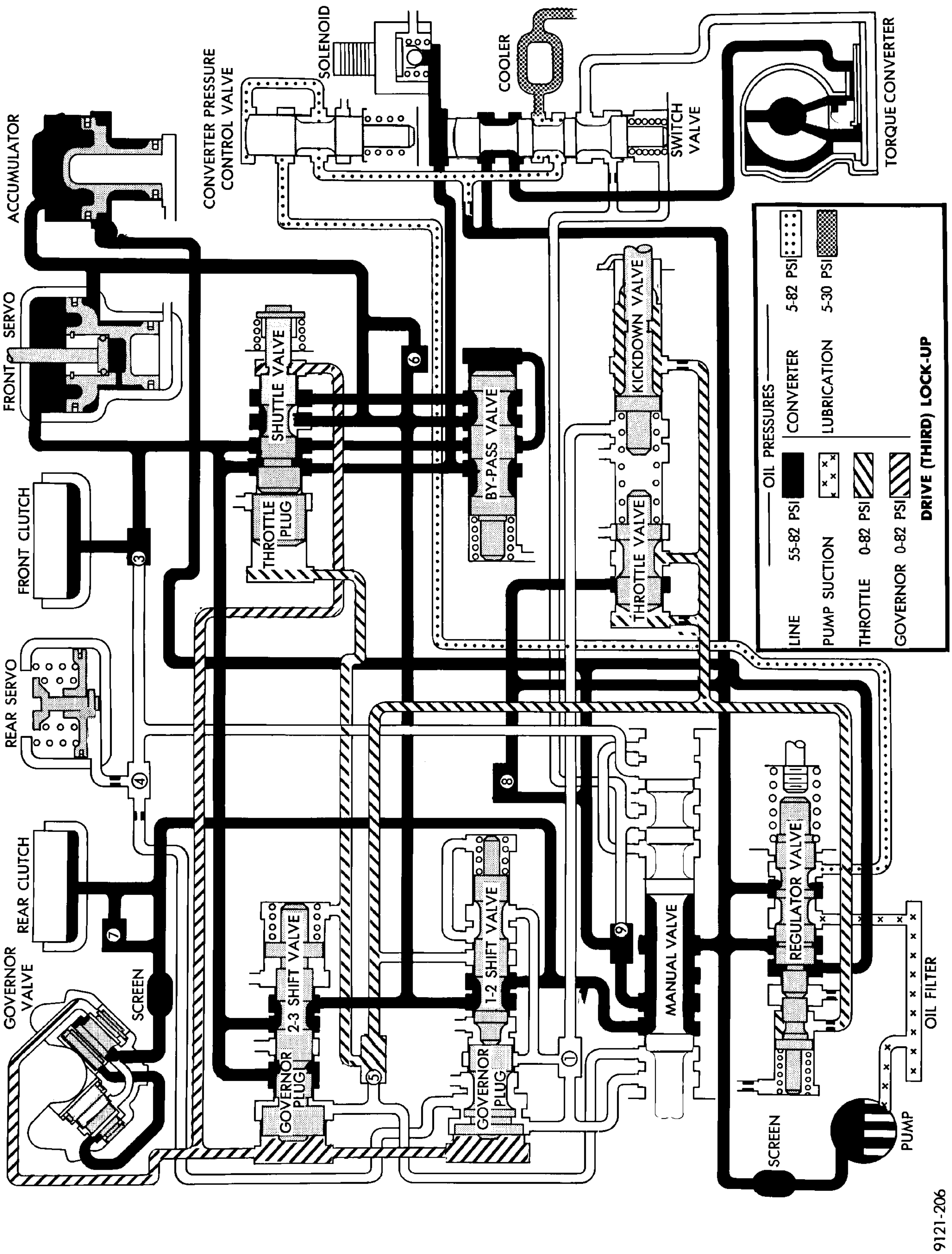
SCHEMATICS AND DIAGRAMS (Continued)



9121-205

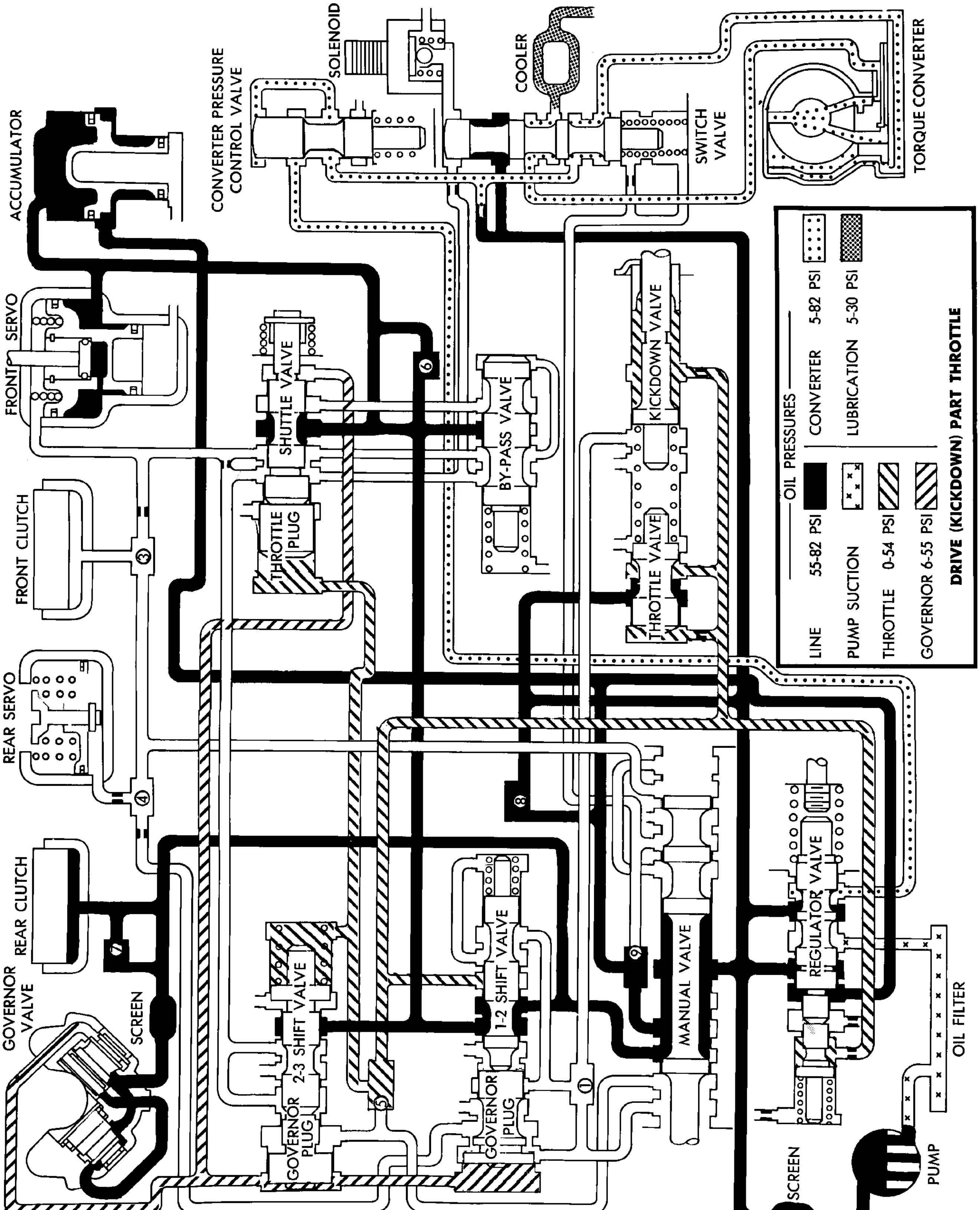
31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

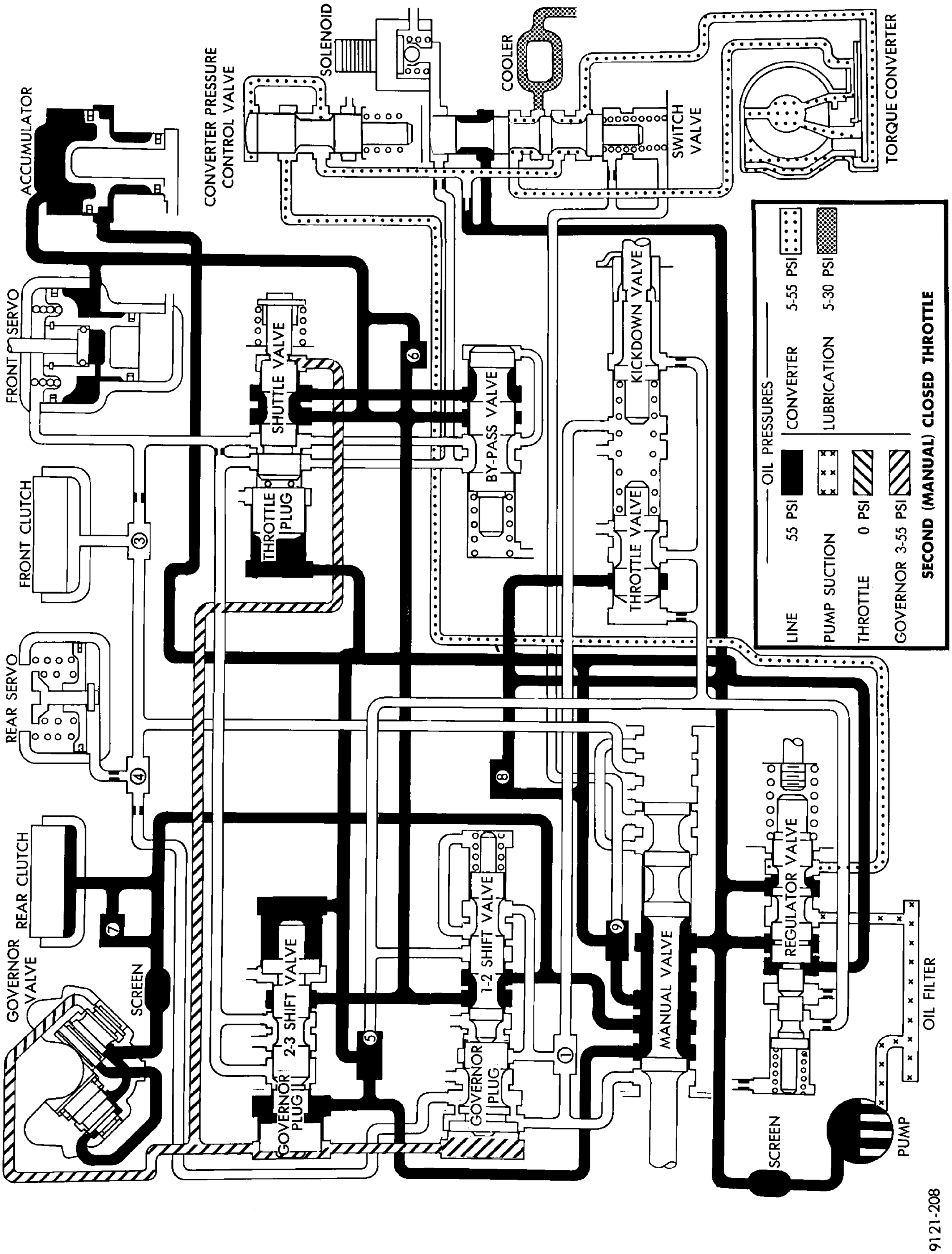
SCHEMATICS AND DIAGRAMS (Continued)



9121-207

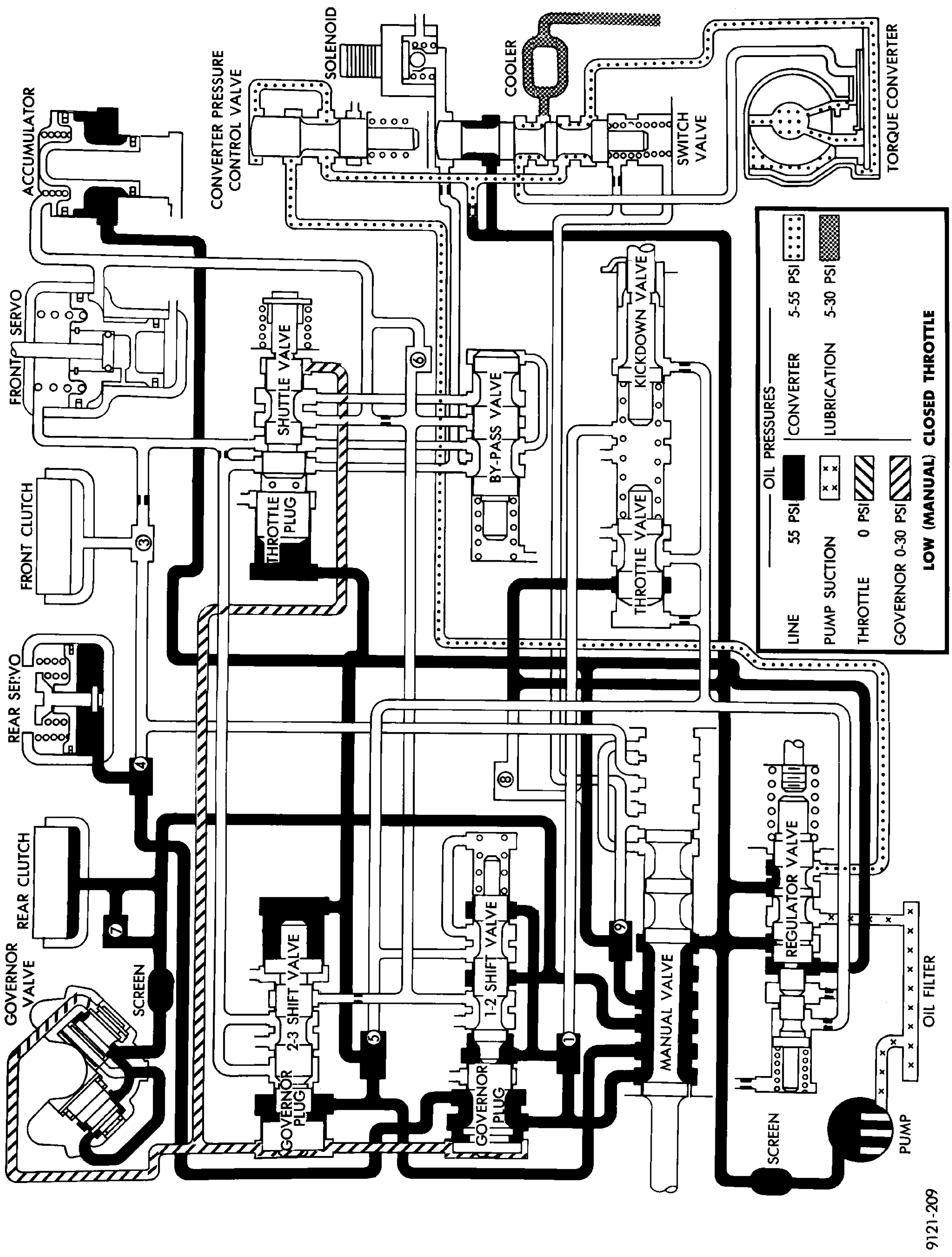
31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



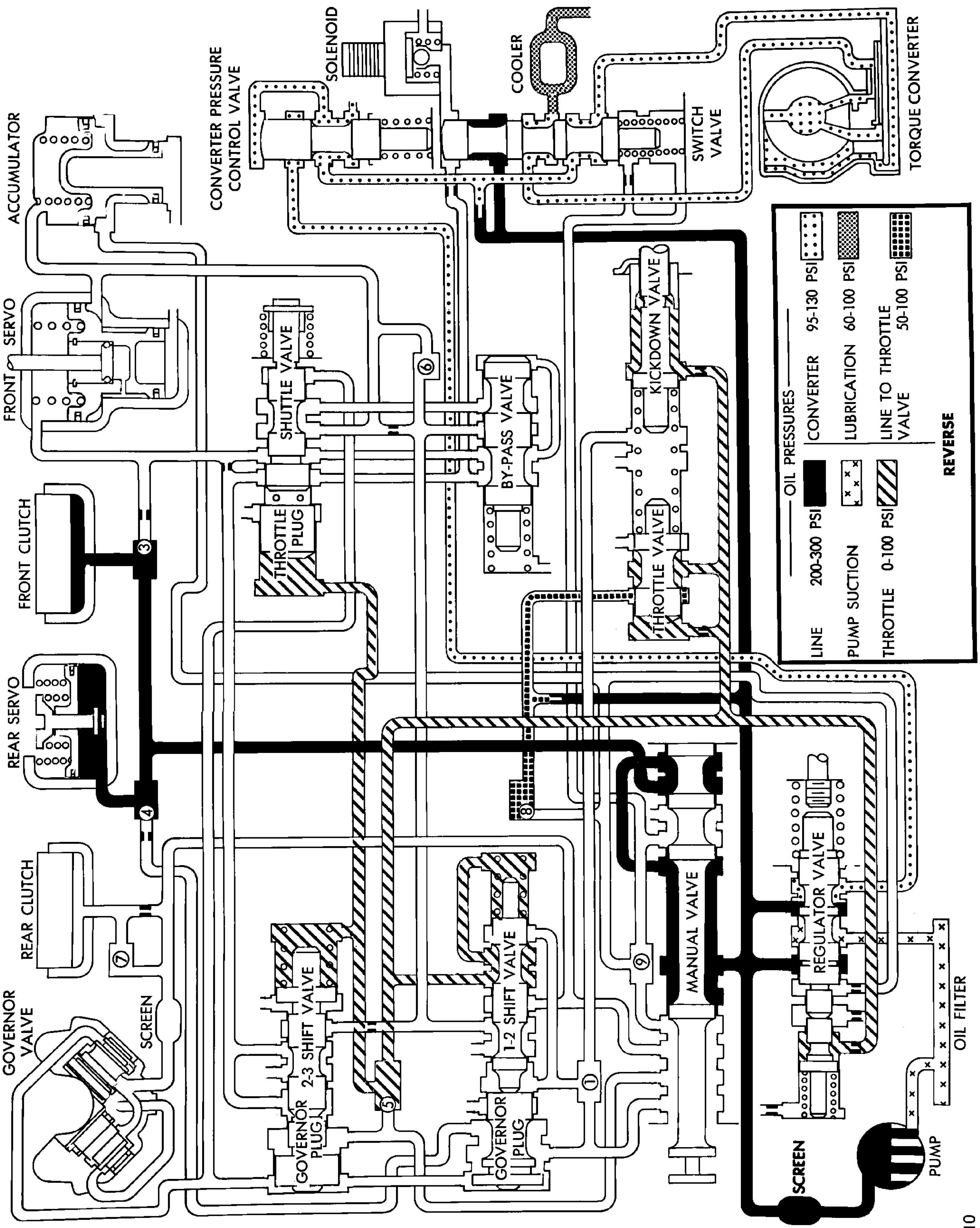
31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



31TH TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



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31TH TRANSAXLE HYDRAULIC SCHEMATIC

SPECIFICATIONS

31TH TRANSAXLE SPECIFICATIONS

		Metric Measure	U.S. Measure
Type		Automatic Three Speed With Torque Converter and Integral Differential	
Torque Converter Diameter		24.1 millimeters	9.48 inches
Oil Capacity—Transaxle and Torque Converter:		8.4 Liters	8.9 qts.
Use MOPAR ATF Automatic Transmission Fluid Type 7176 (or DEXRON II)			
Cooling Method		Water-Heat Exchanger 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**
Input 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			
	4 Disc	1.27-2.79	.050-.110
Rear Clutch (4 Disc) Adjustable			
	4 Disc	.71-1.10	.028-.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.)		2-1/4 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

31TH AUTOMATIC TRANSAXLE

SPECIFICATIONS (Continued)

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

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CONVERSION CHART

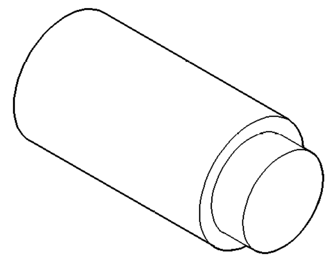
SPECIFICATIONS (Continued)

31TH TRANSAXLE TORQUE SPECIFICATIONS

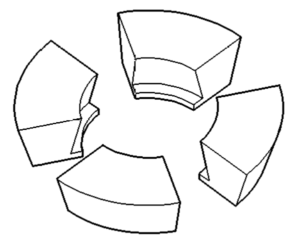
DESCRIPTION	TORQUE
Bell Housing Cover Bolts	12 N·m (105 in. lbs.)
Cooler Hose To Rad. Conn.	12 N·m (105 in. lbs.)
Cooler Line Conn.	28 N·m (250 in. lbs.)
Diff. Bear. Ret. To Case Bolt	34 N·m (300 in. lbs.)
Diff. Cover To Case Bolt	19 N·m (165 in. lbs.)
Exten. Hous. To Case Bolt	28 N·m (250 in. lbs.)
Flex Plate To Crankshaft Bolts	95 N·m (70 ft. lbs.)
Flex Plate To Torque Conv. Bolts	68 N·m (50 ft. lbs.)
Fluid Filter Screw	5 N·m (45 in. 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 Adj. Lock Nut	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 Trans. Case Bolt	28 N·m (250 in. lbs.)
Manual Control Lever Screw	12 N·m (105 in. lbs.)
Oil Pan To Trans. Case Screw	19 N·m (165 in. lbs.)
Output Gear Strap Bolts	23 N·m (17 ft. 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 Bolts	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 Adj. Lock Nut	14 N·m (125 in. lbs.)
Reverse Band Shaft Plug	7 N·m (60 in. lbs.)
Ring Gear Screw	95 N·m (70 ft. lbs.)
Speedo. To Ext. Hous. Screw	7 N·m (60 in. lbs.)
Sprag Ret. To Transfer Case Bolt	28 N·m (250 in. lbs.)
Starter To Trans. Bell Bolts	54 N·m (40 ft. lbs.)
Stirrup Strap Ret. Bolts	23 N·m (200 in. lbs.)
Throttle Cable To Trans. Case Bolt	12 N·m (105 in. lbs.)
Throttle Lever To Trans. Shaft Bolts	12 N·m (105 in. lbs.)
Trans. To Cyl. Block Bolt	95 N·m (70 ft. lbs.)
Transfer Shaft Nut	271 N·m (200 ft. lbs.)
Transfer Gear Strap Bolts	23 N·m (17 ft. lbs.)
Valve Body Assy. To Case Bolts	12 N·m (105 in. lbs.)
Valve Body Screw	5 N·m (45 in. lbs.)

SPECIAL TOOLS

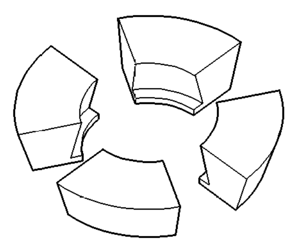
31TH AUTOMATIC TRANSAXLE



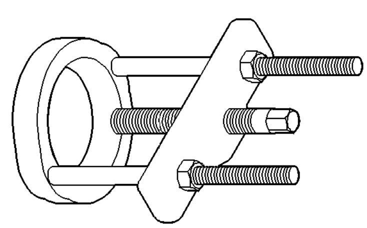
Puller Press Extension C-293-3



Adapter Blocks C-293–36

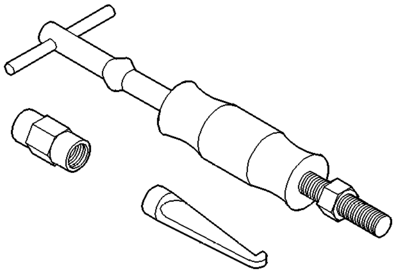


Adapter Blocks C-293–52

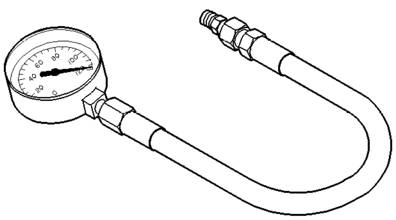


Puller Press C-293–PA

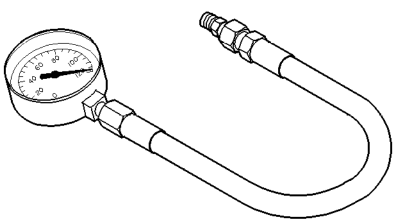
SPECIAL TOOLS (Continued)



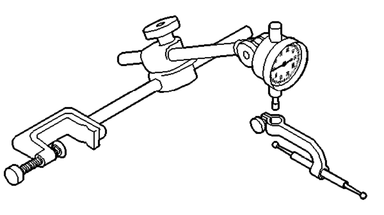
Slide Hammer C-637



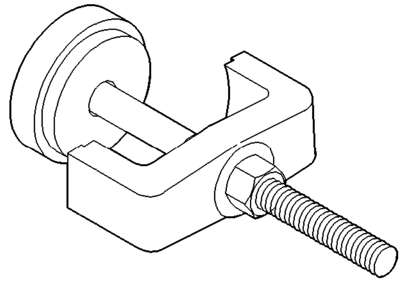
Pressure Gauge (Low) C-3292



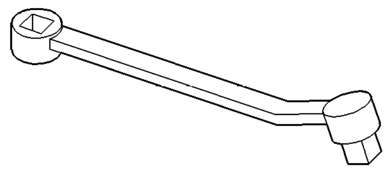
Pressure Gauge (High) C-3293SP



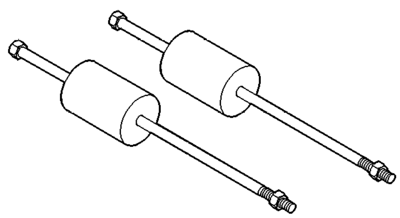
Dial Indicator C-3339



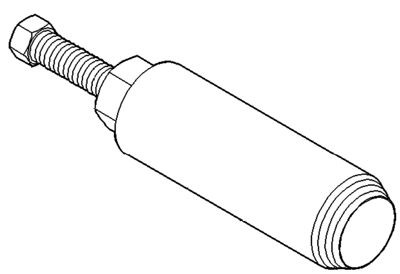
Spring Compressor C-3575–A



Band Adjusting Adapter

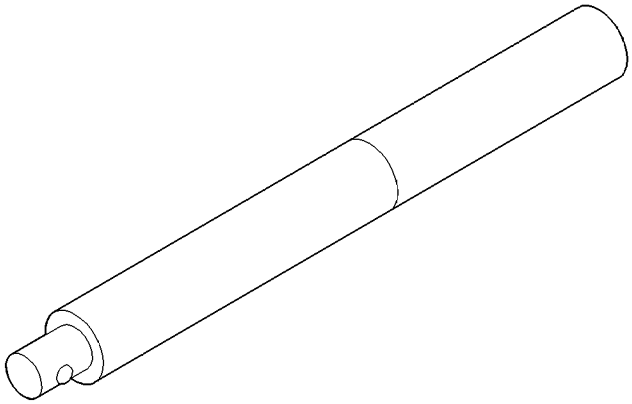


Oil Pump Puller C-3752

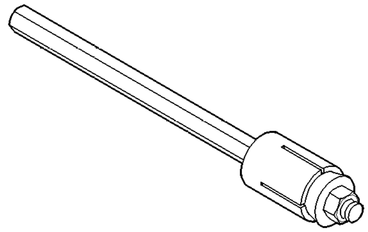


Seal Puller C-3981B

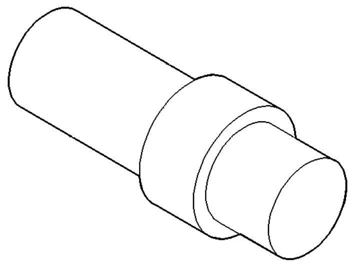
SPECIAL TOOLS (Continued)



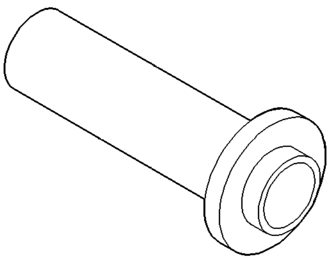
Universal Handle C-4171



Torque Tool C-4995



Adapter C-4996



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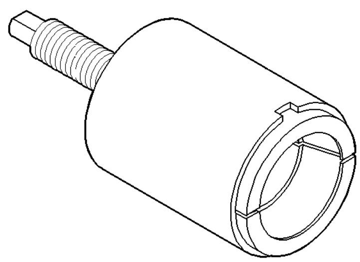
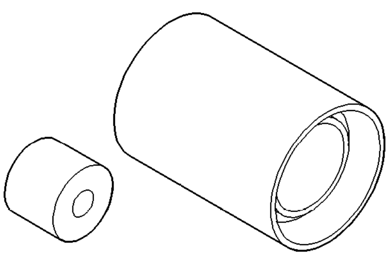
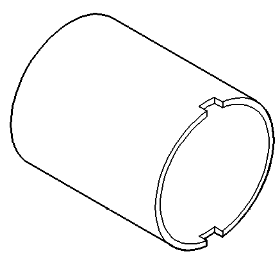


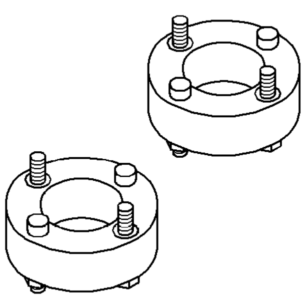
Remover Kit L-4406



Bearing Installer C-4637

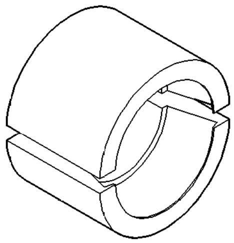


Bearing Remover Cup L-4406–1

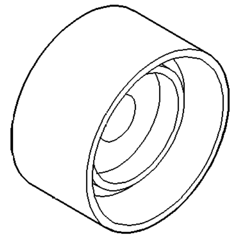


Adapter C-4658

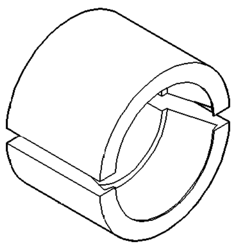
SPECIAL TOOLS (Continued)



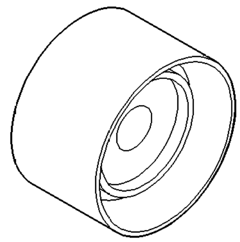
Bearing Remover Jaws L-4406–2



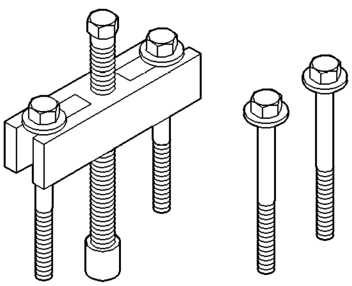
Bearing Installer L-4408



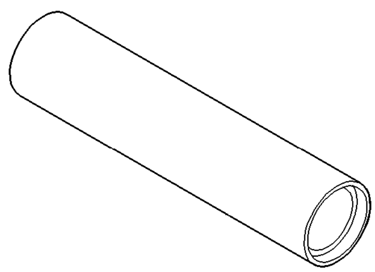
Adapter L-4406–3



Bearing Installer L-4410



Gear Puller L-4407A



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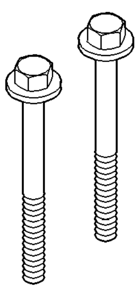
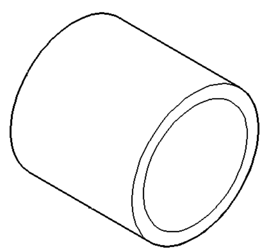
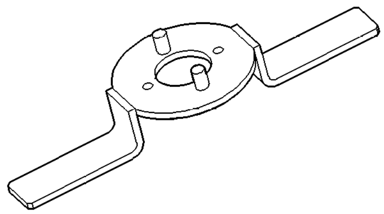


Puller L-4407–6

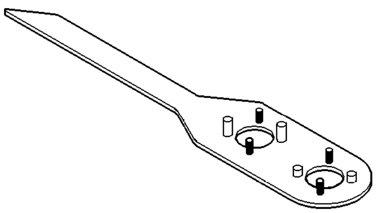


Installer Adapter L-4429-3

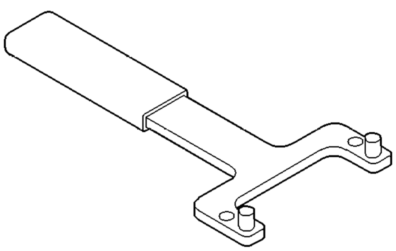
SPECIAL TOOLS (Continued)



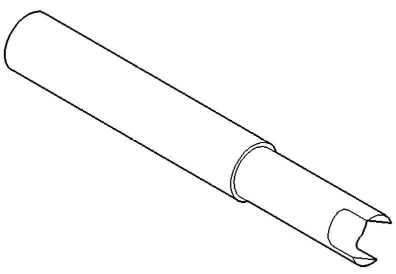
Gear Checking Plate L-4432



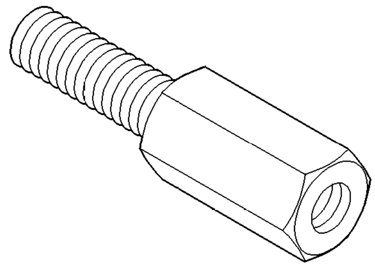
Gear Removing Plate L-4434



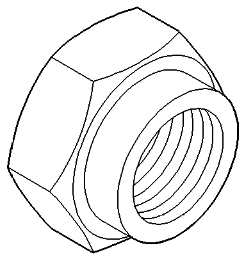
Bearing Puller L-4435



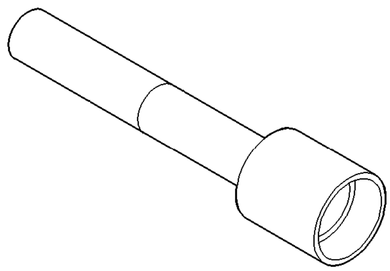
Differential Tool L-4436A



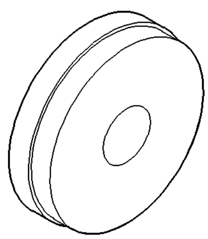
Housing Remover Adapter L-4437



Starter Nut L-4439

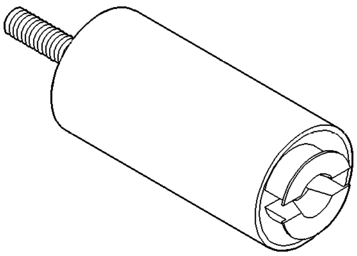


Transfer Shaft Remover-Installer L-4512

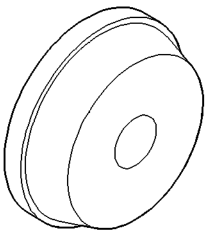


Bearing Cup Remover L-4517

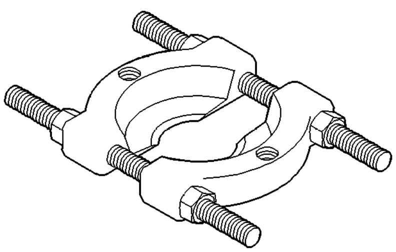
SPECIAL TOOLS (Continued)



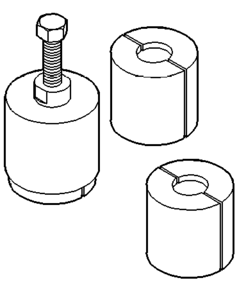
Special Jaw Set L-4518



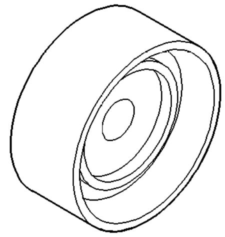
Installer L-4520



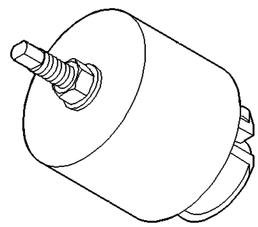
Bearing Splitter P-334



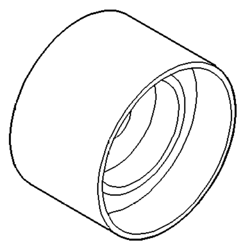
Bearing Cone Remover 5048



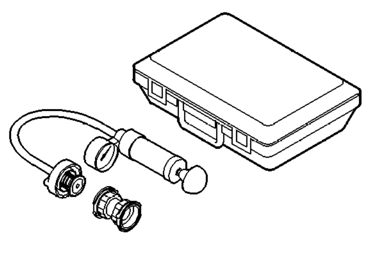
Bearing Installer 5052



Bearing Cup Remover 6062-A

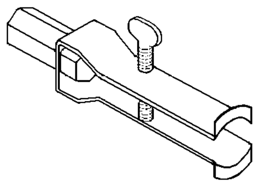


Bearing Installer 6536-A



Cooling System Tester 7700

SPECIAL TOOLS (Continued)



Seal Remover 7794-a

TIRES AND WHEELS

CONTENTS

TIRES

INDEX

DESCRIPTION AND OPERATION

TIRE INFORMATION

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles

Radial ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation. This will help to achieve a greater tread-life potential.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 1).

Performance tires will have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. The letter **S** indicates that the tire is speed rated up to 112 mph.

- **Q** up to 100 mph
- **T** up to 118 mph
- **U** up to 124 mph
- **H** up to 130 mph
- **V** up to 149 mph
- **Z** more than 149 mph (consult the tire manufacturer for the specific speed rating)

An All Season type tire will have either **M + S, M & S or M-S** (indicating mud and snow traction) imprinted on the side wall.

TIRE CHAINS

This vehicle was not designed to allow the use of snow chains on the tires. If snow chains are installed on the tires, there may not be sufficient clearance under all driving conditions. This may cause damage

DESCRIPTION AND OPERATION (Continued)

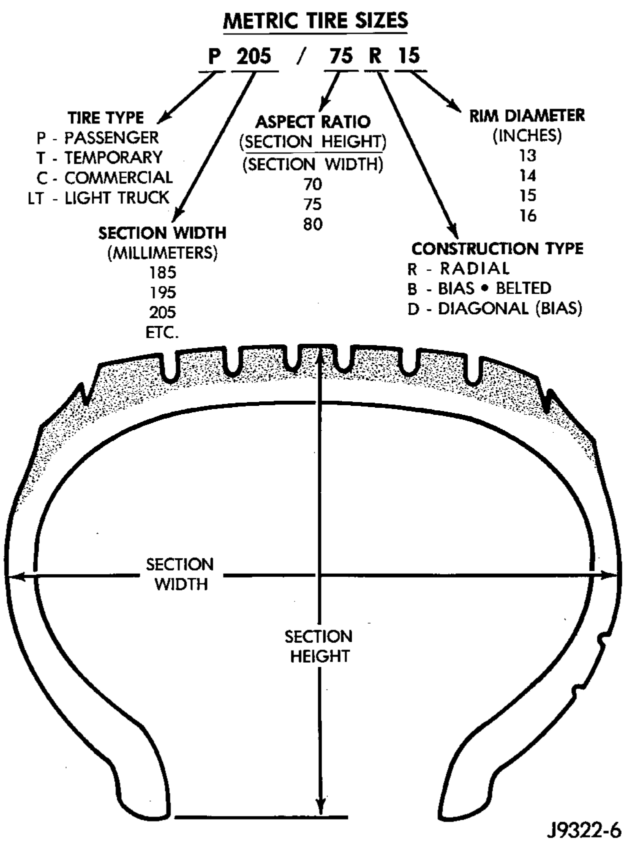


Fig. 1 Tire Identification

to the body and/or suspension components of the vehicle.

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life, ride quality and decrease rolling resistance.

Radial-ply tires must always be used in sets of four and under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

It is recommended that tires from different manufactures NOT be mixed. The proper tire pressure should be maintained on all four tires. For proper tire pressure refer to the Tire Inflation Pressure Chart provided with the vehicle.

SPARE TIRE (TEMPORARY)

The temporary spare tire is designed for emergency use only. The original tire should be repaired and reinstalled at the first opportunity, or a new tire purchased. Do not exceed speeds of 50 MPH. Refer to Owner's Manual for complete details.

TIRE INFLATION PRESSURES

Under inflation causes rapid shoulder wear, tire flexing, and can result in tire failure (Fig. 2).

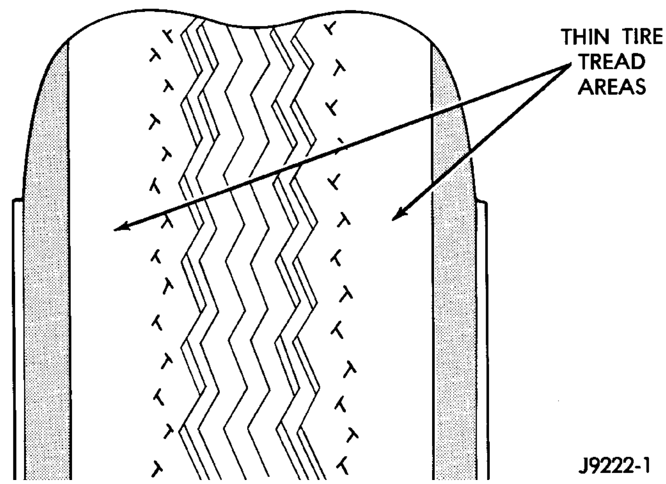


Fig. 2 Under Inflation Wear

Over inflation causes rapid center wear and loss of the tire's ability to cushion shocks (Fig. 3).

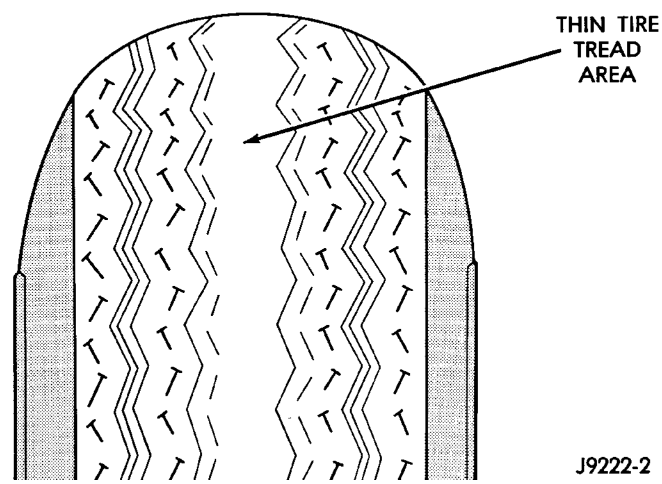


Fig. 3 Over Inflation Wear

Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- The vehicle to drift.

For proper tire pressure specification refer to the Tire Inflation Pressure Chart Placard provided with the vehicle.

DESCRIPTION AND OPERATION (Continued)

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once per month. Check tire pressure more frequently when the weather temperature varies widely. Tire pressure will decrease when the outdoor temperature drops.

Inflation pressures specified on the placard are always the cold inflation pressure of the tire. Cold inflation pressure is obtained after the vehicle has not been operated for at least 3 hours, or the vehicle is driven less than one mile after being inoperative for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING. THE TIRE CAN FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

TIRE PRESSURE FOR HIGH—SPEED OPERATION

Chrysler Corporation advocates driving at safe speeds within posted speed limits. Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 75 mph (120 km/h), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 75 mph (120 km/h), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high-speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommend that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires not listed in the specification charts may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

PRESSURE GAUGES

A high-quality air-pressure gauge is recommended to check tire pressure. After checking with the gauge, replace valve caps and finger tighten.

TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band.

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs (Fig. 4).

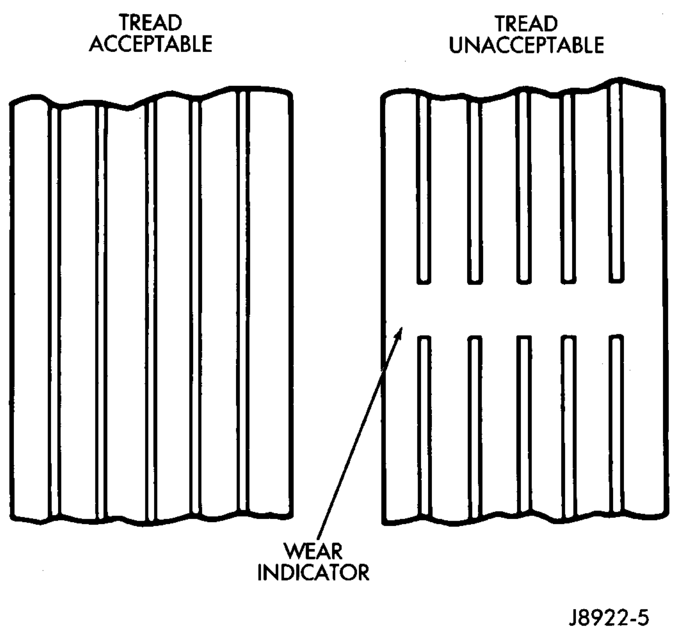


Fig. 4 Tread Wear Indicators

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.

DIAGNOSIS AND TESTING (Continued)

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. 5).

TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the effect of acceleration and deceleration on noise level. Differential and exhaust noises will change in intensity as speed varies, while tire noise will usually remain constant.

LEAD CORRECTION CHART

Use the following chart to diagnose a vehicle that has a complaint of a drift or lead condition. The use of the chart will held to determine if the lead condition is the result of a bad tire or is caused by the front wheel alignment.

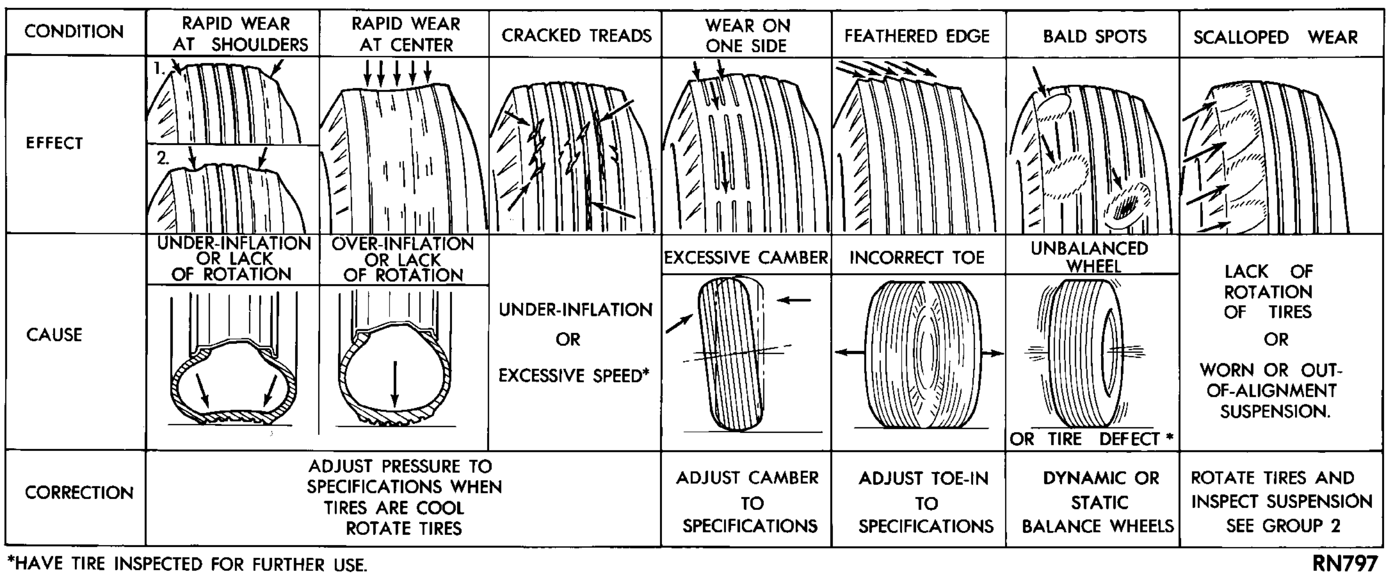
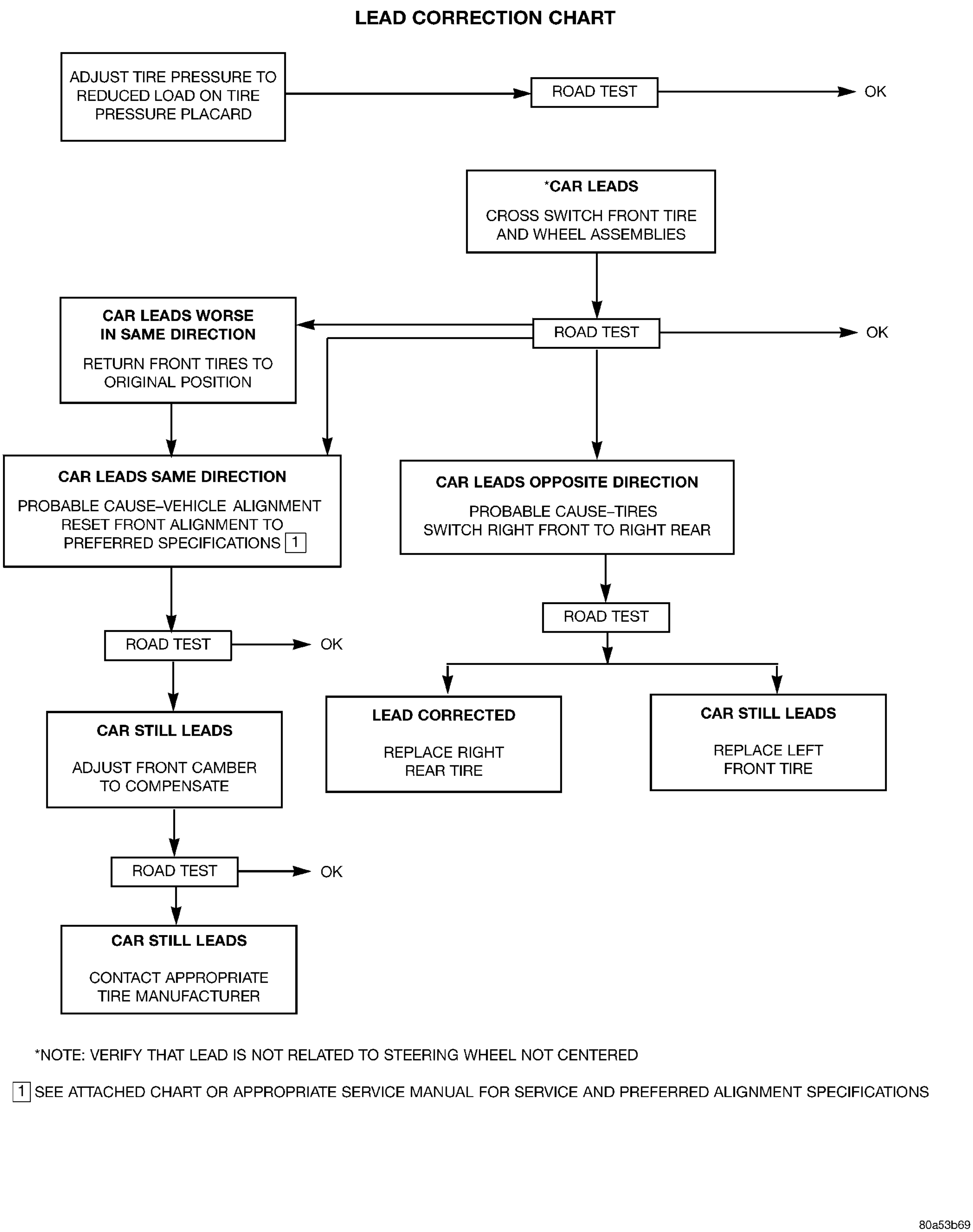


Fig. 5 Tire Wear Patterns


LEAD CORRECTION CHART
ADJUST TIRE PRESSURE TO REDUCED LOAD ON TIRE PRESSURE PLACARD
ROAD TEST
OK
*CAR LEADS
CROSS SWITCH FRONT TIRE AND WHEEL ASSEMBLIES
CAR LEADS WORSE IN SAME DIRECTION
RETURN FRONT TIRES TO ORIGINAL POSITION
ROAD TEST
OK
CAR LEADS SAME DIRECTION
PROBABLE CAUSE–VEHICLE ALIGNMENT RESET FRONT ALIGNMENT TO PREFERRED SPECIFICATIONS 1
CAR LEADS OPPOSITE DIRECTION
PROBABLE CAUSE–TIRES SWITCH RIGHT FRONT TO RIGHT REAR
ROAD TEST
OK
ROAD TEST
CAR STILL LEADS
ADJUST FRONT CAMBER TO COMPENSATE
LEAD CORRECTED
REPLACE RIGHT REAR TIRE
CAR STILL LEADS
REPLACE LEFT FRONT TIRE
ROAD TEST
OK
CAR STILL LEADS
CONTACT APPROPRIATE TIRE MANUFACTURER
*NOTE: VERIFY THAT LEAD IS NOT RELATED TO STEERING WHEEL NOT CENTERED
1 SEE ATTACHED CHART OR APPROPRIATE SERVICE MANUAL FOR SERVICE AND PREFERRED ALIGNMENT SPECIFICATIONS
80a53b69

SERVICE PROCEDURES

TIRE AND WHEEL ROTATION

NON-DIRECTIONAL TREAD PATTERN TIRES

Tires on the front and rear axles operate at different loads and perform different functions. For these reasons, they wear at unequal rates, and tend to develop irregular wear patterns. These effects can be reduced by timely rotation of tires. The benefits of rotation are especially worthwhile. Rotation will increase tread life, help to maintain mud, snow, and wet traction levels, and contribute to a smooth, quiet ride.

The suggested rotation method is the forward-cross tire rotation method (Fig. 6). This method takes advantage of current tire industry practice which allows rotation of radial-ply tires. Other rotation methods may be used, but may not have all the benefits of the recommended method.

NOTE: Only the 4 tire rotation method may be used if the vehicle is equipped with a low mileage or temporary spare tire.

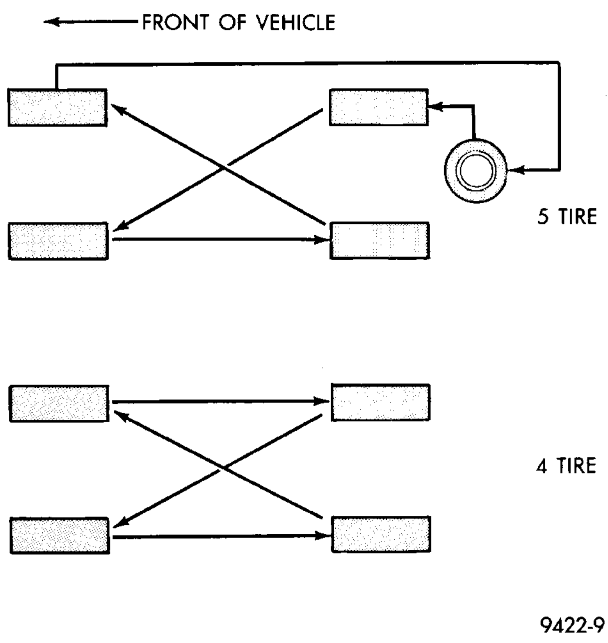


Fig. 6 Forward-Cross Tire Rotation Method

DIRECTIONAL TREAD PATTERN TIRES

Some vehicles are fitted with special high-performance tires having a directional tread pattern. These tires are 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.

REPAIRING TIRE LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 7). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before dismounting tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and progressively tighten the 5 wheel nuts to a torque of 135 N·m (100 ft. lbs.).

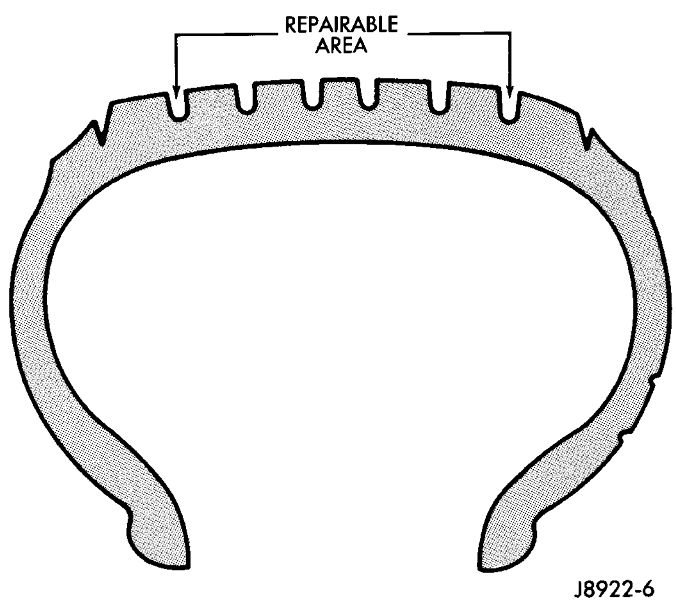


Fig. 7 Tire Repair Area

TIRE AND WHEEL MATCH MOUNTING

Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. This technique is used to reduce run-out in the wheel/tire assembly. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot or line on the inside of the rim. If the outside label has been removed the tire will have to be removed to locate the dot or line on the inside of the rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve

SERVICE PROCEDURES (Continued)

stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Measure the total indicator runout on the center of the tire tread rib. Record the indicator reading. Mark the tire to indicate the high spot. Place a mark on the tire at the valve stem location (Fig. 8).

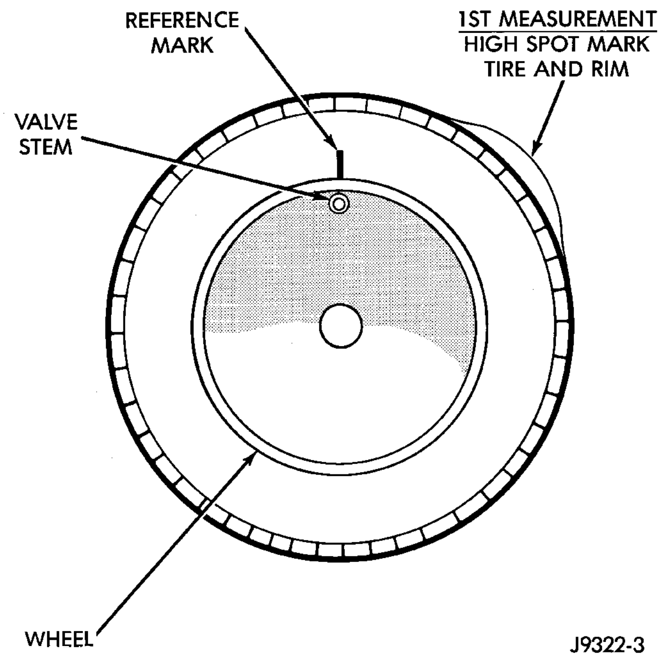


Fig. 8 First Measurement On Tire

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 9).

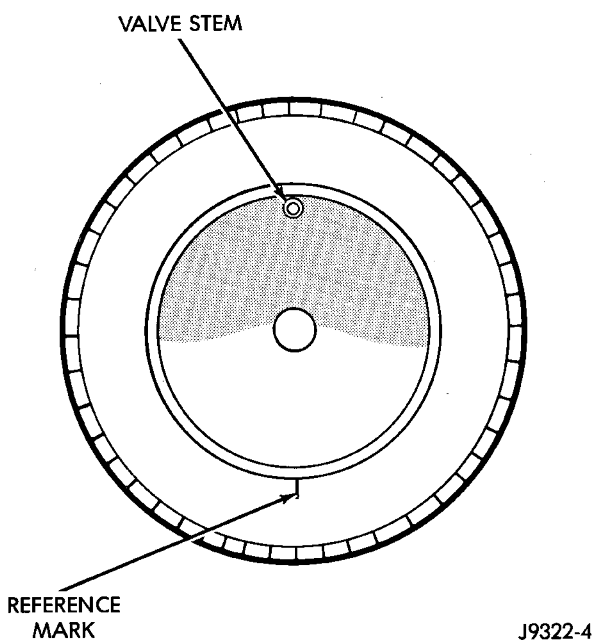


Fig. 9 Remount Tire 180 Degrees

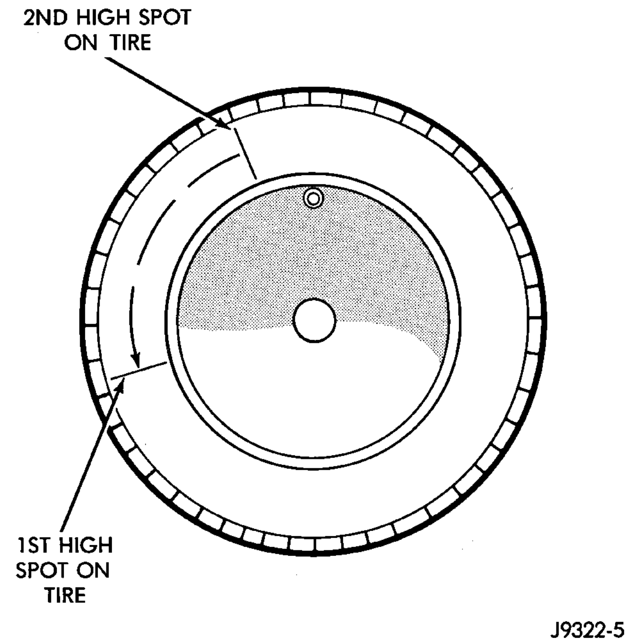


Fig. 10 Remount Tire 90 Degrees In Direction of Arrow

(3) Measure the total indicator runout again. Mark the tire to indicate the high spot.

(4) If runout is still excessive, the following procedures must be done.

- If the high spot is within 102 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 102 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 102 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 10). This procedure will normally reduce the runout to an acceptable amount.

CLEANING AND INSPECTION

CLEANING OF TIRES

Remove protective coating on tires before delivery of vehicle. The coating could cause deterioration of tires.

Remove protective coating by:

- Applying warm water
- Letting it soak one minute
- 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.

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.	

WHEELS

INDEX

DESCRIPTION AND OPERATION

WHEEL INFORMATION

Original equipment wheels are designed for proper operation at all loads up to the specified maximum vehicle capacity.

All models use steel or cast aluminum drop center wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 1).

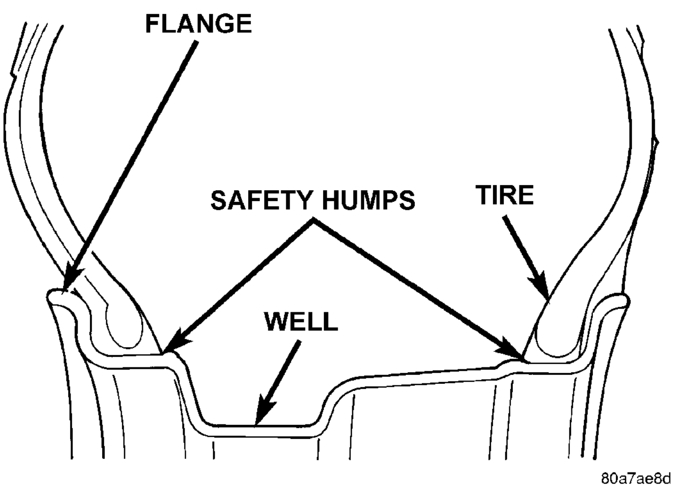


Fig. 1 Safety Rim

Initial inflation of the tires forces the bead over these raised sections. In case of air loss the raised sections 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 to fit on the thicker flange of the rim and special wheel clamps for the alignment equipment.

The wheel studs and nuts are designed for specific wheel applications and must be replaced with equivalent parts. Do not use replacement parts of lesser quality or of a substitute design. All aluminum wheels use wheel nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels.

Vehicles that are equipped with bolt-on wheel covers use large nose wheel nuts. The wheel nuts used on a vehicle equipped with bolt-on wheel covers are externally threaded so that the wheel covers can be attached to the wheel nuts.

Before installing a wheel, remove any buildup of corrosion on the wheel mounting surface.

WARNING: INSTALLING WHEELS WITHOUT GOOD METAL-TO-METAL CONTACT COULD CAUSE LOOSENING OF WHEEL LUG NUTS. THIS COULD ADVERSELY AFFECT THE SAFETY AND HANDLING OF YOUR VEHICLE.

WHEEL COVER (LOCK-ON)

For the 1997 model year, a lock-on type wheel cover (Fig. 2) is used on certain models of this vehicle.

The wheel cover is locked to the wheel using the 5 nuts located in the wheel cover (Fig. 2). The nuts in the wheel cover thread onto a special externally threaded wheel nut (Fig. 2). This is the method used to retain the wheel cover to the wheel.

The wheel cover retaining nut (Fig. 2) is retained in the wheel cover and will stay on the wheel cover when un-threaded from the wheel nut. If required, the retaining nut for the lock-on wheel cover can be removed from the wheel cover and replaced as a separate part of the lock-on wheel cover.

DESCRIPTION AND OPERATION (Continued)

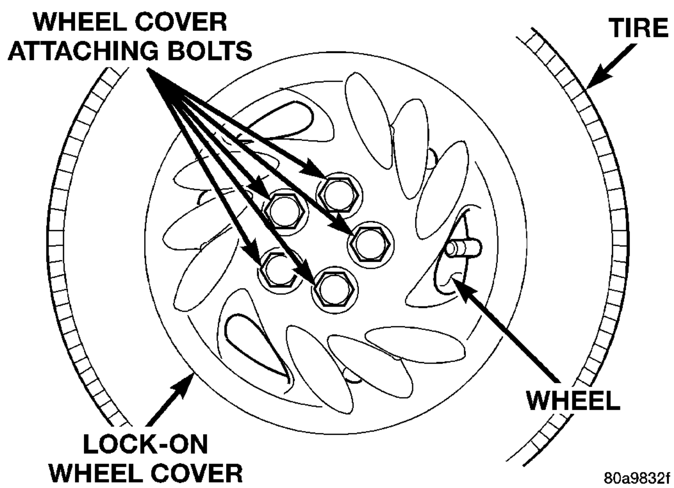


Fig. 2 Wheel Nut And Wheel Cover Retaining Nut

The lock-on wheel cover can not be removed from the wheel until all 5 of wheel cover retaining nuts are un-threaded from the wheel nuts. Then the lock-on wheel cover can be removed by hand from the wheel.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE.

WARNING: REPLACEMENT WITH USED WHEELS IS NOT RECOMMENDED. THE SERVICE HISTORY OF THE RIM MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

Wheels must be replaced if they:
- Have excessive run out
- Are bent or dented
- Leak air from any area or surface of the rim
- Have damaged wheel lug/ nut holes

Wheel repairs employing hammering, heating, welding or repairing leaks are not allowed.

Original equipment replacement wheels should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The physical dimensions (diameter, width, offset, pilot hole and bolt circle) of the wheel should be the same as the original wheel.

TIRE AND WHEEL RUNOUT

NOTE: Runout should always be measured off the vehicle and on a suitable balance machine.

Radial run out is the difference between the high and low points on the outer edge of the tire or wheel.

Lateral run out is the total side–to–side wobble of the tire or wheel.

Radial run out of more than 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 at the side of the tire as close to the tread as possible may cause the vehicle to shake.

Sometimes radial run out can be reduced by relocating the wheel and tire on the wheel studs (See Method 1). If this does not reduce run out to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

METHOD 1 (RELOCATE WHEEL ON HUB)

Check accuracy of the wheel mounting surface; adjust wheel bearings.

Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

Verify all wheel nuts are tightened and properly torqued in the correct sequence (Fig. 3).

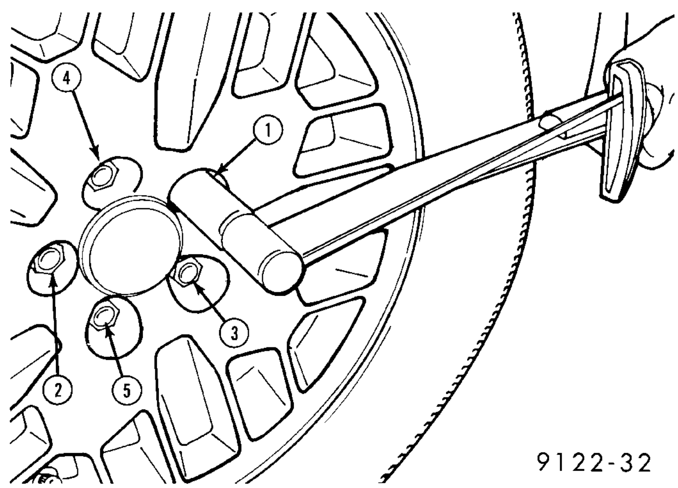


Fig. 3 Tightening Wheel Nuts

Use run out gauge D-128-TR to determine run out (Fig. 4).

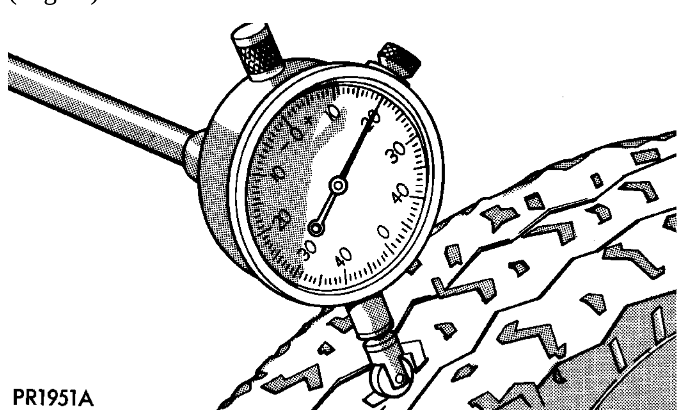


Fig. 4 Run Out Gauge

DIAGNOSIS AND TESTING (Continued)

Relocate the wheel on the mounting studs, two studs over from the original position.

Retighten wheel nuts until all are properly torqued. This will prevent brake distortion.

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.

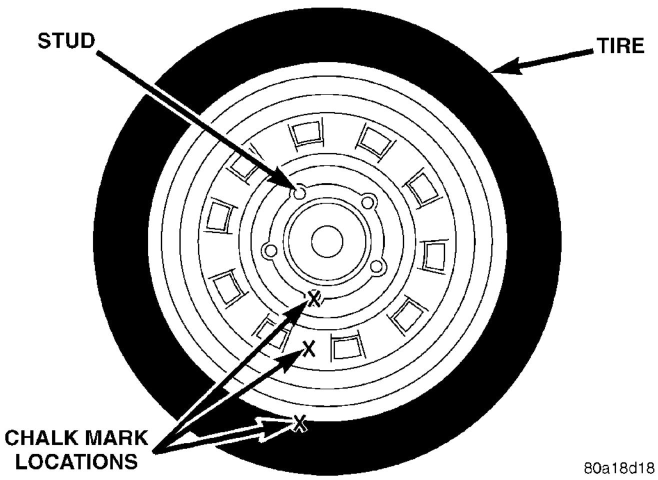


Fig. 5 Chalk Marking On Wheel, Tire And Stud

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 the radial run out of the wheel (Fig. 6). The radial runout should be no more than 0.762 mm (0.030 inch).

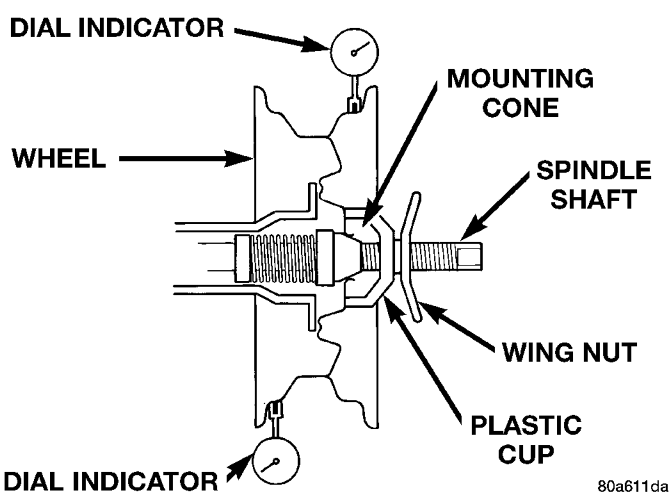


Fig. 6 Checking Wheel Radial Run Out

Check the lateral run out of the wheel (Fig. 7). The lateral run out should be no more than 0.762 mm (0.030 inch).

If the point of greatest wheel radial run out is near the original chalk mark, remount the tire on the rim 180 degrees from its original position. Recheck the

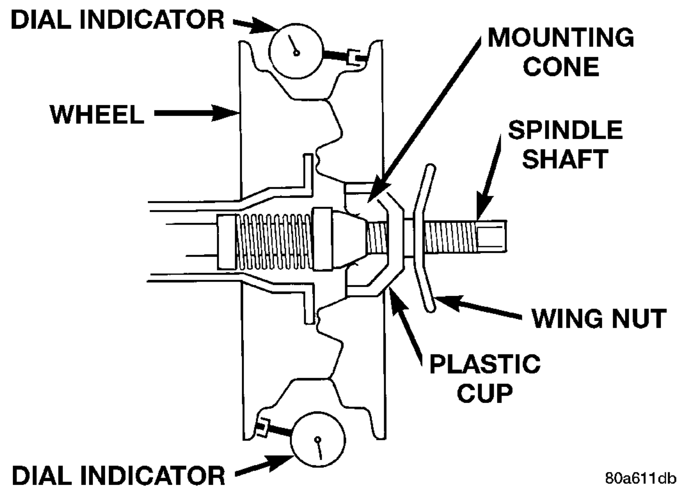


Fig. 7 Checking Wheel Lateral Run Out

run out. If this does not reduce the run out to an acceptable level, replace the wheel and/or the tire.

SERVICE PROCEDURES

TIRE AND WHEEL BALANCE

Balancing need is indicated by vibration of seats, floor pan, or steering wheel. The vibration will be noticed mostly when driving over 90 km/h (55 mph) on a smooth road.

It is recommended that a two plane dynamic balancer be used when a wheel and tire assembly require balancing. Static should be used only when a two plane balancer is not available.

Off-vehicle tire and wheel balancing is recommended to be used on this vehicle.

NOTE: If on vehicle equipment is being used to balance the tire /wheel assemblies, remove the opposite tire/wheel from the vehicle.

For static balancing, find the location of heavy spot on tire/wheel causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counterbalance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 8).

For dynamic balancing, the balancing equipment is designed to indicate the location and amount of weight to be applied to both the inner and outer rim flanges (Fig. 9)

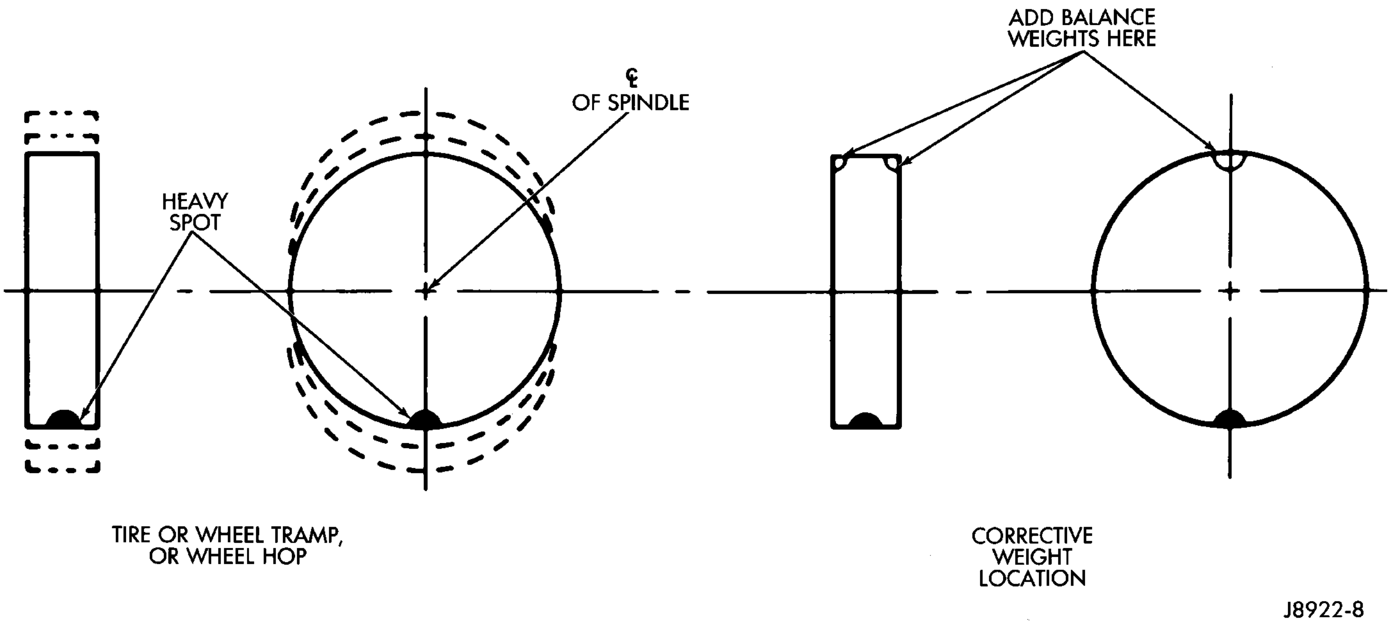


Fig. 8 Static Unbalance & Balance

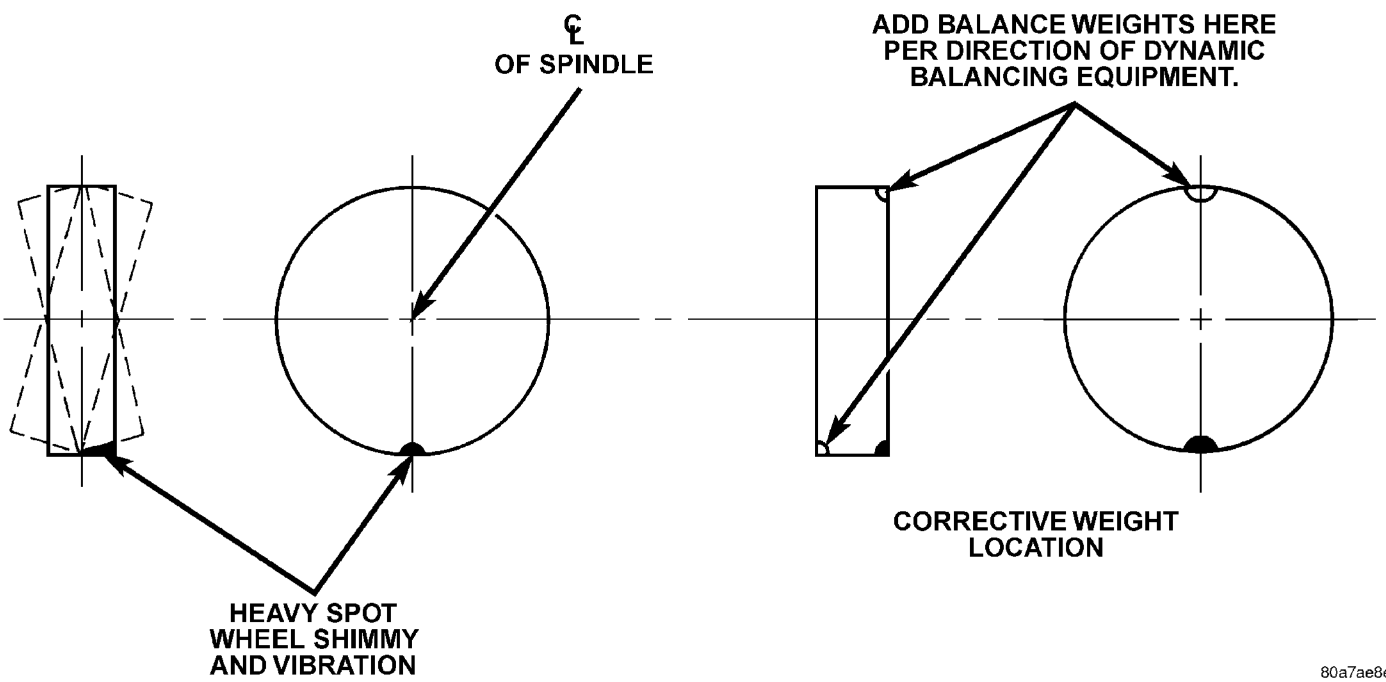


Fig. 9 Dynamic Unbalance & Balance

REMOVAL AND INSTALLATION

WHEEL COVER (LOCK-ON)

REMOVE

NOTE: When unthreading the wheel cover retaining nuts (Fig. 10) from the wheel nuts it is recommended that a hand wrench be used and not an impact wrench. Use of an impact wrench could result in damage to the lock-on wheel cover retaining nuts.

(1) Un-thread the 5 nuts (Fig. 10) attaching the wheel cover to the wheel nuts.

(2) Grasp the wheel cover and pull straight outward from the wheel. This will remove the wheel cover from the wheel.

REMOVAL AND INSTALLATION (Continued)

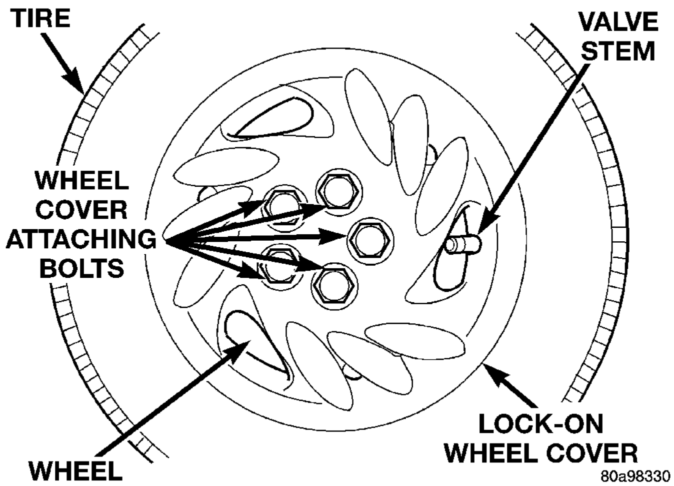


Fig. 10 Wheel Cover Attaching Nuts

INSTALL

(1) Align the valve notch in the wheel cover with the valve stem on the wheel (Fig. 10). Align the wheel cover retaining nuts with the externally threaded wheel nuts.

(2) By hand, start to thread all 5 of the wheel cover retaining nuts onto the externally threaded wheel nuts.

NOTE: When tightening the wheel cover retaining nuts it is recommended that a hand wrench be used and not an impact wrench. Use of an impact wrench could result in damage to the lock-on wheel cover retaining nuts.

(3) Tighten each of the wheel cover retaining nuts. If the retaining nut "jumps" a thread (slips), which is an override feature of the retaining nut, retighten the retaining nut to a point just prior to this occurring. To avoid rattling of the wheel cover be sure all five retaining nuts are correctly tightened.

WHEEL AND TIRE

CAST ALUMINUM WHEEL

To install the wheel, first 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 the proper sequence (Fig. 11). Then tighten wheel nuts in the proper sequence to a torque of 135 N·m (100 ft. lbs.). Never use oil or grease on studs or nuts.

STEEL WHEEL

REMOVE

CAUTION: When removing the wheel cover, do not attempt pry the wheel cover off the wheel. This can result in damage to the wheel cover. The wheel cover is removed by un-threading the wheel cover retaining nuts and pulling it off the wheel by hand.

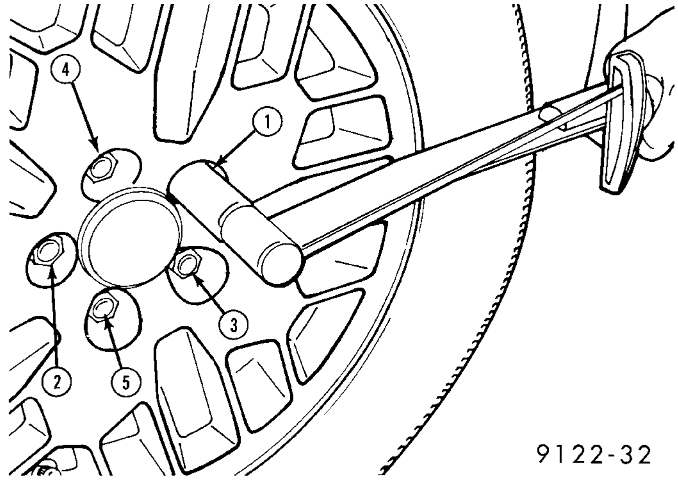


Fig. 11 Tightening Wheel Nuts

NOTE: When unthreading the wheel cover retaining nuts (Fig. 12) from the wheel nuts it is recommended that a hand wrench be used and not an impact wrench. Use of an impact wrench could result in damage to the lock-on wheel cover retaining nuts.

(1) Un-thread the 5 nuts (Fig. 12) attaching the wheel cover to the wheel nuts.

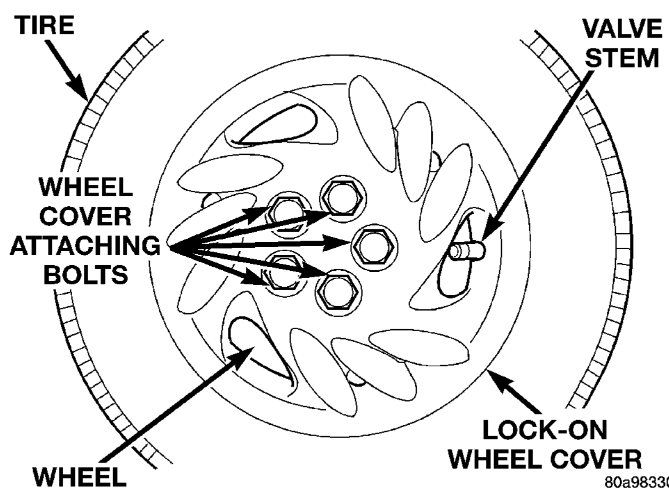


Fig. 12 Wheel Cover Locking Nuts

(2) Grasp the wheel cover and pull straight outward. This will remove the wheel cover from the wheel.

(3) Remove the wheel nuts (Fig. 13) from the studs.

(4) Remove the wheel and tire from the hub.

REMOVAL AND INSTALLATION (Continued)

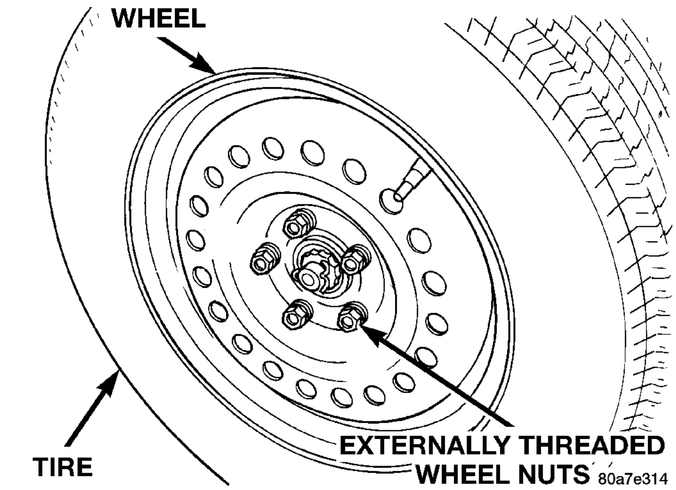


Fig. 13 Wheel Nuts

INSTALL

(1) To install the wheel, first position it properly on the studs and hub mounting surface using the hub pilot as a guide. Install and **lightly tighten** the wheel nuts in the proper sequence (Fig. 14).

CAUTION: When installing the wheel/tire never use oil or grease on studs or nuts.

(2) Progressively tighten the 5 wheel nuts in the proper sequence (Fig. 14) until tightened to half of the specified torque. Then tighten the wheel nuts in the proper sequence to a torque of 135 N·m (100 ft. lbs.).

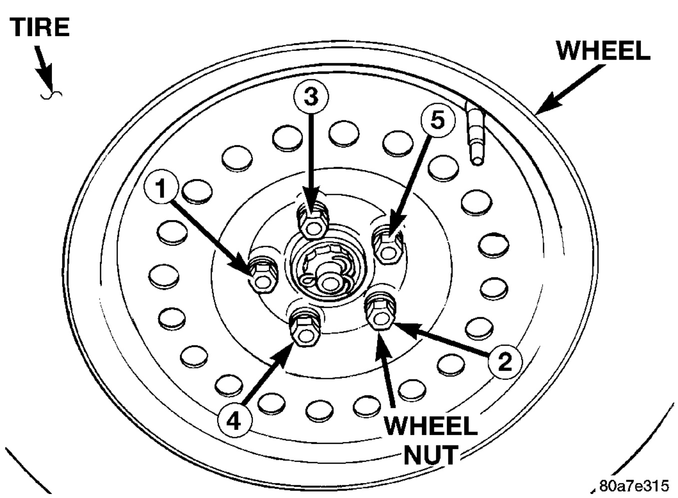


Fig. 14 Wheel Nut Tightening Sequence

(3) Align the valve notch in the wheel cover with the valve stem on the wheel (Fig. 12). Align the wheel cover retaining nuts with the externally threaded wheel nuts.

(4) By hand, start to thread all 5 of the wheel cover retaining nuts onto the externally threaded wheel nuts.

NOTE: When tightening the wheel cover retaining nuts it is recommended that a hand wrench be used and not an impact wrench. Use of an impact wrench could result in damage to the lock-on wheel cover retaining nuts.

(5) Tighten each of the wheel cover retaining nuts. If the retaining nut "jumps" a thread (slips), which is an override feature of the retaining nut, retighten the retaining nut to a point just prior to this occurring. To avoid rattling of the wheel cover be sure all five retaining nuts are correctly tightened.

WHEEL COVER RETAINING NUT

If a retaining nut for the lock-on wheel is damaged, it can be replaced as a separate part of the wheel cover. Use the following procedure for replacing a wheel cover retaining nut.

REMOVE

(1) If required, remove the wheel cover from the wheel. Refer to Wheel Cover Lock-On in the Removal And Installation Section in this group of the service manual for the procedure.

NOTE: The retaining nut flange can not be forced past the large retaining tab. When removing retaining nut from wheel cover, the flange on the retaining nut must be forced past the 2 small retaining tabs on wheel cover.

(2) From the back side of the wheel cover, push outward and tilt the retaining nut sideways forcing the flange on the retaining nut past the 2 small retaining tabs in the retaining nut hole of the wheel cover (Fig. 15).

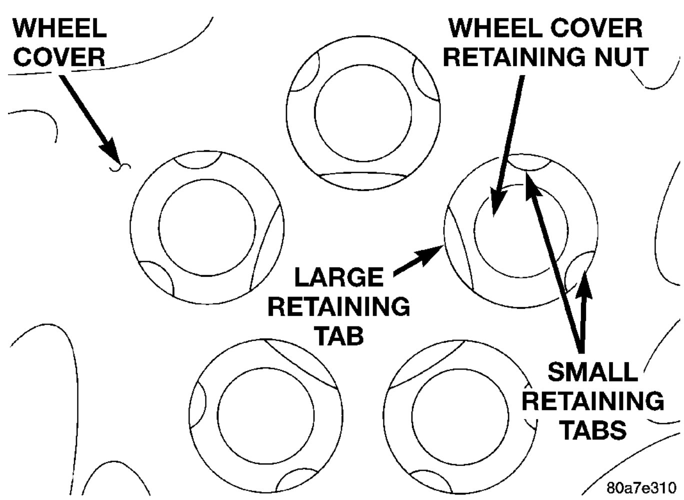


Fig. 15 Wheel Cover Retaining Nut Retention

(3) When flange on retaining nut is past the 2 retaining tabs on the wheel cover, remove retaining

REMOVAL AND INSTALLATION (Continued)

nut from wheel cover by pushing or pulling from hole in wheel cover.

INSTALL

(1) Install retaining nut in hole of wheel cover with retaining nut flange positioned under the large retaining flange (Fig. 15).

(2) Push on hex of retaining nut forcing the retaining nut flange past the 2 small retaining tabs in wheel cover.

SPECIFICATIONS

WHEEL SPECIFICATIONS

Wheel:

Mounting Stud Size . . . . M12 x 1.5 mm
Mounting Stud Lug Nut Hex Size . . . . 19 mm
Mounting Lug Nut Tightening
Torque (4 and 5 Stud Wheels) . . . . . 109–150 N·m
(80 to 110 ft. lbs.)

BODY

CONTENTS

GENERAL SERVICE INFORMATION

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GENERAL INFORMATION

SAFETY PRECAUTIONS AND WARNINGS

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL– BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

DO NOT STAND UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.

CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.

Always have a fire extinguisher ready for use when welding.

Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.

Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.

Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.

Chrysler Corporation uses many different types of push-in fasteners to secure the interior and exterior trim to the body. Most of these fasteners can be reused to assemble the trim during various repair procedures. At times, a push-in fastener cannot be removed without damaging the fastener or the component it is holding. If it is not possible to remove a fastener without damaging a component or body, cut or break the fastener and use a new one when installing the component. Never pry or pound on a plastic or pressed-board trim component. Using a suitable fork-type prying device, pry the fastener from the retaining hole behind the component being removed. When installing, verify fastener alignment with the retaining hole by hand. Push directly on or over the fastener until it seats. Apply a low-force pull to the panel to verify that it is secure.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges holding the component in place.

PAINT

INDEX

GENERAL INFORMATION

PAINT CODE

A paint code is provided on the body code plate located in the engine compartment. Refer to the Introduction section at the front of this manual for body code plate description. The paint and trim codes are also included on the Vehicle Safety Label located on the driver's door end frame.

BASE COAT/CLEAR COAT FINISH

On most vehicles a two-part paint application (base coat/clear coat) is used. Color paint that is applied to primer is called base coat. The clear coat protects the base coat from ultraviolet light and provides a durable high-gloss finish.

WET SANDING, BUFFING, AND POLISHING

Minor acid etching, orange peel, or smudging in clear coat or single-stage finishes can be reduced with light wet sanding, hand buffing, and polishing. **If the finish has been wet sanded in the past, it cannot be repeated. Wet sanding operation should be performed by a trained automotive paint technician.**

CAUTION: Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat for durability.

PAINTED SURFACE TOUCHUP

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.

TOUCHUP 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 touchup 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 touchup paint to dry hard.

(5) On vehicles without clear coat, the touchup color can be lightly wet sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touchup paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

GENERAL INFORMATION (Continued)

AFTERMARKET PAINT REPAIR PRODUCTS

1997 EXTERIOR COLORS

EXTERIOR COLOR	CHRY CODE*	PPG	BASF	DUPONT	S-W ACME M-S	AKZO NOBEL SIKKENS
Magenta Clear Coat	SH1	74171	26079	B9615	51522	CHA96:SH1
Flame Red Clear Coat	PR4	4679	23043	B9326	4691	CHA93:PR4
Strawberry Pearl Coat	PRE	4791	24074	B9454	48542	CHA94:PRE
Deep Amethyst Pearl Coat	TCN	5246	27038	B9736	52566	CHA97:TCN
Emerald Green Pearl Coat	PGS	4785	24075	B9460	48539	CHA94:PGS
Bright Jade Satin Glow	SQM	18885	26094	B9620	51534	CHA96:SQM
Lapis Blue Clear Coat	RC4	4935	24098	B9531	50218	CHA95:RC4
Brilliant Blue Pearl Coat	PCH	4784	24073	B9452	48538	CHA94:PCH
Light Iris Pearl Coat	PC5	4788	24078	B9455	48782	CHA94:PC5
Black Clear Coat	DX8	9700	15214	99	35858 90-5950	CHA85:DX8
Bright White Clear Coat	GW7	4037	18238	B8833	37298	CHA88:GW

*Herberts Standox and Spies Hecker use the Chrysler paint code as listed on the Body Code Plate.

1997 INTERIOR COLORS

INTERIOR COLOR	CHRY CODE	PPG	BASF	DUPONT	S-W ACME M-S
Agate	AZ	9856/2-1461	22135	C9208	45994
Camel	K5	27731	26120	C9603	51541

STATIONARY GLASS

INDEX

DESCRIPTION AND OPERATION

SAFETY PRECAUTIONS

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT.

URETHANE ADHESIVES ARE APPLIED AS A SYSTEM. USE GLASS CLEANER, GLASS PREP SOLVENT, GLASS PRIMER, PVC (VINYL) PRIMER AND PINCHWELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.

BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

VAPORS THAT ARE EMITTED FROM THE URETHANE ADHESIVE OR PRIMER COULD CAUSE PERSONAL INJURY. USE THEM IN A WELL-VENTILATED AREA.

SKIN CONTACT WITH URETHANE ADHESIVE SHOULD BE AVOIDED. PERSONAL INJURY MAY RESULT.

ALWAYS WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS.

CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers.

Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

It is difficult to salvage a windshield during the removal operation. The windshield is part of the structural support for the roof. The urethane bonding used to secure the windshield to the fence is difficult to cut or clean from any surface. If the moldings are set in urethane, it would also be unlikely they could be salvaged. Before removing the windshield, check the availability of the windshield and moldings from the parts supplier.

REMOVAL AND INSTALLATION

WINDSHIELD

The urethane adhesive holding the windshield to the opening pinch weld (fence) can be cut using a sharp cold knife from the exterior of the vehicle. Using the cold knife method is effective if the windshield is already broken. If the glass must be salvaged, cutting the urethane adhesive from the interior of the vehicle using a reciprocating or oscillating power knife is recommended.

RECOMMENDED TOOLS AND ADHESIVE

POWER KNIFE

- Fein® Power Cut-out Knife
- Equalizer® Magnum, Interior Auto Glass Cut Out Knife

ADHESIVE, PRIMER AND CLEANER

The following urethane adhesive systems are OEM certified and conform to the FMVSS 212 windshield retention standard and the FMVSS 216 roof crush standard.

- Essex™ U-400 HV High Viscosity Adhesive
- Essex™ U-400 Adhesive
- Essex™ U-401 Glass Prep
- Essex™ U-402 Glass Primer
- Essex™ U-413 Pinchweld Primer

WINDSHIELD REMOVAL—EXTERIOR METHOD

(1) Remove inside rear view mirror.

(2) Remove windshield wiper arms.

(3) Remove cowl cover.

(4) Place protective covers over instrument panel and hood.

(5) Remove windshield moldings (Fig. 1) using a suitable hook tool and trim stick.

(6) Using a sharp cold knife, cut urethane adhesive holding the windshield to the A-pillars, roof header and cowl pinch weld fences (Fig. 2). A power cutting device can be used if available.

(7) Separate windshield from vehicle.

REMOVAL AND INSTALLATION (Continued)

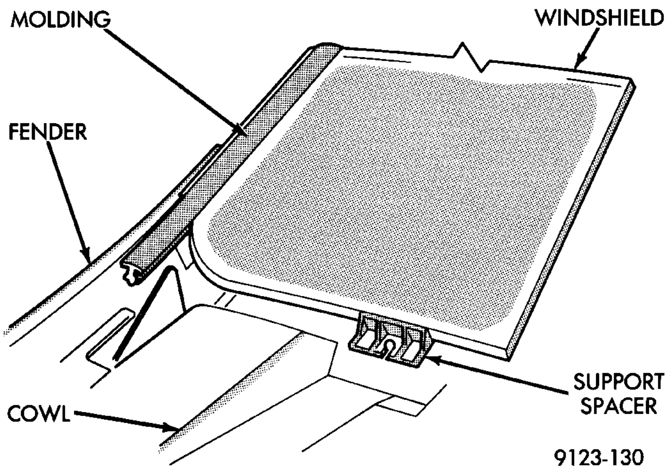


Fig. 1 Windshield Molding

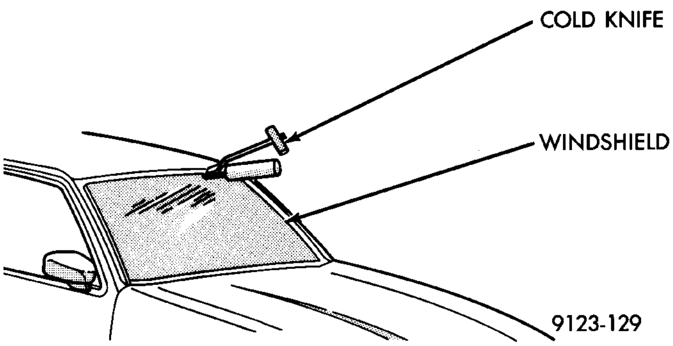


Fig. 2 Cut Urethane Around Windshield

WINDSHIELD REMOVAL—INTERIOR METHOD

(1) Remove inside rear view mirror.

(2) Remove instrument panel top cover, refer to Group 8E, Instrument Panel.

(3) Remove A-pillar trim covers.

(4) Place protective covers over instrument panel and hood.

(5) Using a reciprocating or oscillating power knife, cut urethane adhesive holding the windshield to the A-pillars, roof header and cowl pinch weld fences. Refer to instructions provided with the equipment being used.

(6) Separate windshield from vehicle.

WINDSHIELD INSTALLATION

CAUTION: Open the left front door glass before installing windshield to avoid pressurizing the passenger compartment. If a door is slammed before urethane bonding is cured, water leaks can result.

Allow the urethane at least 24 hours to cure before returning the vehicle to use.

To avoid stressing the replacement windshield, the urethane bonding material on the windshield fence should be smooth and consistent to the shape of the replacement windshield. The support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

(1) Place replacement windshield into windshield opening and position glass in the center of the opening against the support spacers.

(2) Verify the glass lays evenly against the pinch weld fence at the sides, top and bottom of the replacement windshield. If not, the pinch weld fence must be formed to the shape of the new glass.

(3) Mark the glass at the support spacers with a grease pencil or pieces of masking tape and ink pen to use as a reference for installation (Fig. 3).

(4) Remove replacement windshield from windshield opening.

(5) Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart (Fig. 4).

WARNING: DO NOT USE SOLVENT BASED GLASS CLEANER TO CLEAN WINDSHIELD BEFORE APPLYING GLASS PREP AND PRIMER. POOR ADHESION CAN RESULT.

(6) Clean inside of windshield with ammonia based glass cleaner and lint-free cloth.

(7) Apply molding to perimeter of windshield.

(8) Apply Glass Prep adhesion promoter 25 mm (1 in.) wide around perimeter of windshield and wipe with clean/dry lint-free cloth until no streaks are visible.

(9) Apply Glass Primer 25 mm (1 in.) wide around perimeter of windshield. Allow at least three minutes drying time.

(10) Using a razor knife, remove as much original urethane as possible. Do not damage paint on windshield fence.

(11) Apply pinch weld primer 15 mm (.75 in.) wide around the windshield fence. Allow at least three minutes drying time.

(12) If a low viscosity urethane adhesive is used, install compression spacers on the fence around the windshield opening (Fig. 5).

(13) Apply a 10 mm (0.4 in.) bead of urethane on centerline of windshield fence.

(14) With the aid of a helper, position the windshield over the windshield opening. Align the reference marks at the bottom of the windshield to the support spacers.

(15) Slowly lower windshield glass to windshield opening fence. Guide the molding into proper position as necessary. Push windshield inward molding is flush to roof line and A-pillars (Fig. 6).

(16) Clean access urethane from exterior with Mopar®, Super Clean or equivalent.

(17) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold molding in place until urethane cures.

(18) Install cowl cover and wipers.

REMOVAL AND INSTALLATION (Continued)

(19) Install inside rear view mirror.

(20) After urethane has cured, remove tape strips and water test windshield to verify repair.

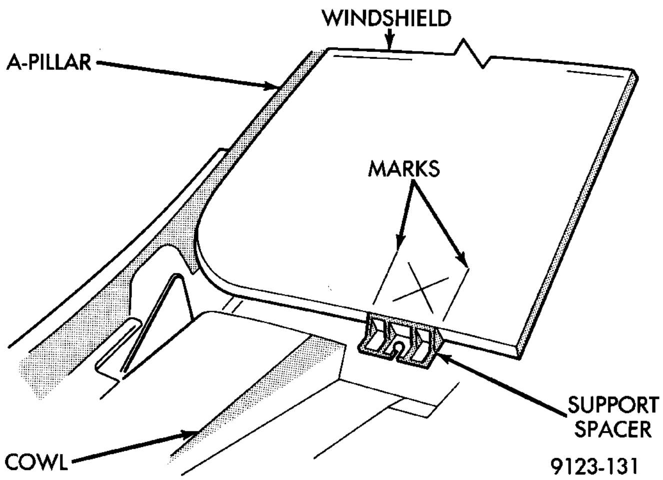


Fig. 3 Center Windshield and Mark at Support Spacers

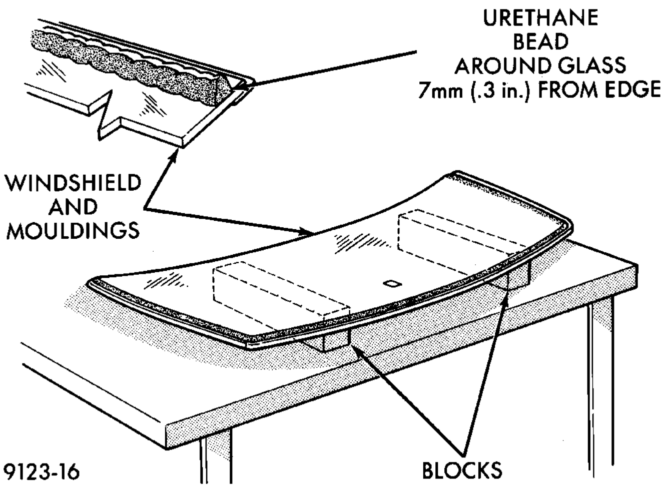


Fig. 4 Work Surface Set up and Molding Installation

QUARTER GLASS

REMOVAL

(1) Remove quarter trim panel.

(2) Remove nuts holding quarter glass to quarter panel opening.

(3) Remove B-pillar applique.

(4) Using a razor knife from inside of vehicle, cut butyl tape adhesive around quarter glass while pushing outward on glass.

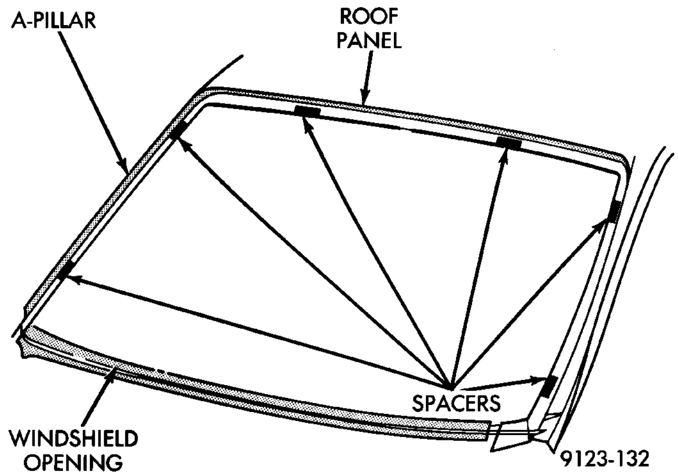


Fig. 5 Position Urethane Compression Spacers

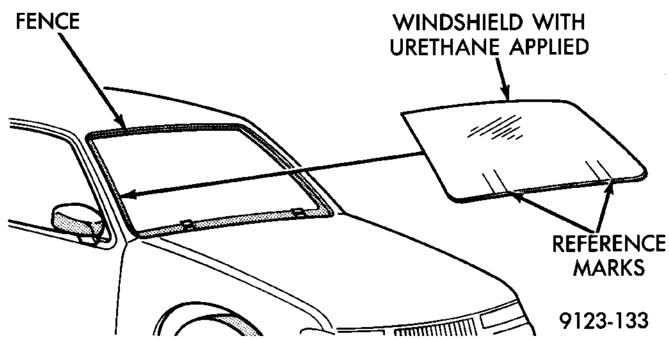


Fig. 6 Lower Windshield Into Position

(5) Separate quarter glass from vehicle (Fig. 7).

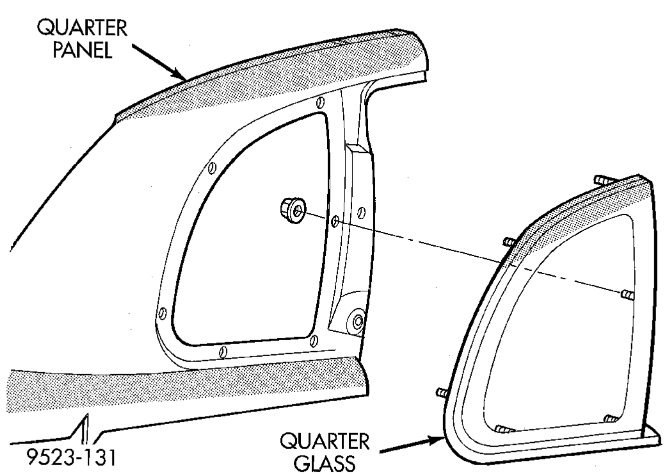


Fig. 7 Quarter Glass

INSTALLATION

(1) Clean old butyl tape adhesive from around quarter glass opening in quarter panel.

(2) If original quarter glass is reused, clean old butyl from around glass.

(3) Prime perimeter of quarter glass fence in quarter panel opening with black-out primer.

REMOVAL AND INSTALLATION (Continued)

(4) Prime perimeter of quarter glass with black-out primer.

(5) Install a 5/16 bead of round butyl tape around perimeter of quarter glass.

(6) Place quarter glass into opening in quarter panel.

(7) Install nuts to hold quarter glass to quarter panel opening.

(8) Install B-pillar applique.

(9) Install quarter trim panel.

REAR WINDOW

Refer to the windshield paragraph of this section for a description of tools and adhesive systems that are recommended for use in this procedure.

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT. BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

CAUTION: Open the left front door glass before installing the rear window to avoid pressurizing the passenger compartment if a door is slammed before the urethane bonding is fully cured. Water leaks can result

REAR WINDOW REMOVAL

(1) Remove rear window moldings.

(2) Remove upper quarter trim panel.

(3) Disengage wire connectors from rear window defogger.

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 rear window glass. Refer to Windshield section of this group for proper procedures.

(5) Separate the rear window from the vehicle.

REAR WINDOW 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. 8).

(3) Install the rear window molding on glass.

(4) Apply a 10 mm (0.4 in.) bead of urethane around the perimeter of the glass.

(5) Install the glass in the same manner described in the Windshield section of this group (Fig. 8).

(6) Connect rear window defogger wiring and 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.

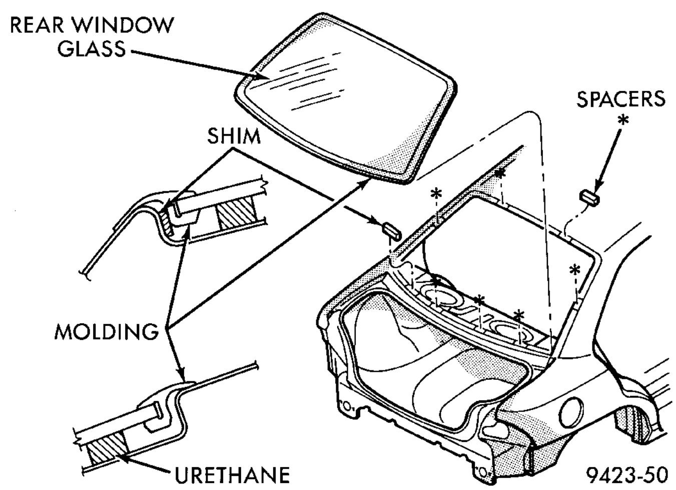


Fig. 8 Rear Window Glass

SEATS

INDEX

REMOVAL AND INSTALLATION

FRONT SEAT

REMOVAL

(1) Move seat to forward position.

(2) Remove bolts holding rear of seat track to floor.

(3) Move seat to rearward position.

(4) Remove bolts holding front of seat track to floor crossmember (Fig. 1).

(5) Separate seat from vehicle.

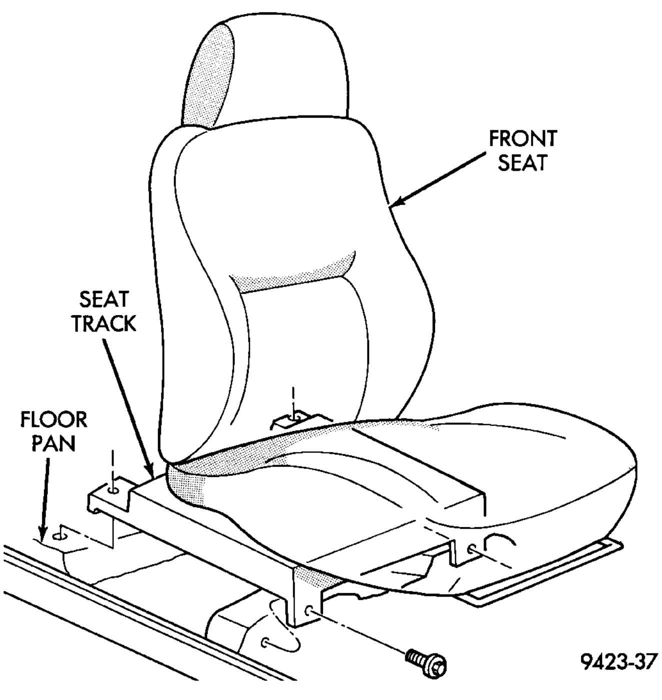


Fig. 1 Front Seat

INSTALLATION

(1) Move seat to full rearward position and **verify** that both seat tracks are locked into position.

(2) Move seat into position in vehicle. Do not use the head restraint, side shield, recliner handle, or the adjuster lift bar to move the seat.

(3) Ensure that the locating tabs on the front mounting feet are installed through the slits in the carpet and into the openings in the floor pan crossmember.

(4) Install and tighten front inboard bolt holding seat track to floor crossmember.

(5) Install and tighten front outboard bolt holding seat track to floor crossmember.

(6) Move seat to forward position.

(7) Install and tighten bolts holding rear of seat track to floor.

NOTE: The torque specification for all front seat retaining bolts is 55 N·M (40 ft. lbs.).

REAR SEAT CUSHION

REMOVAL

(1) Pull upward at each end of the rear seat cushion to disengage retainer loops from cups in floor.

(2) Separate rear seat cushion from vehicle (Fig. 2).

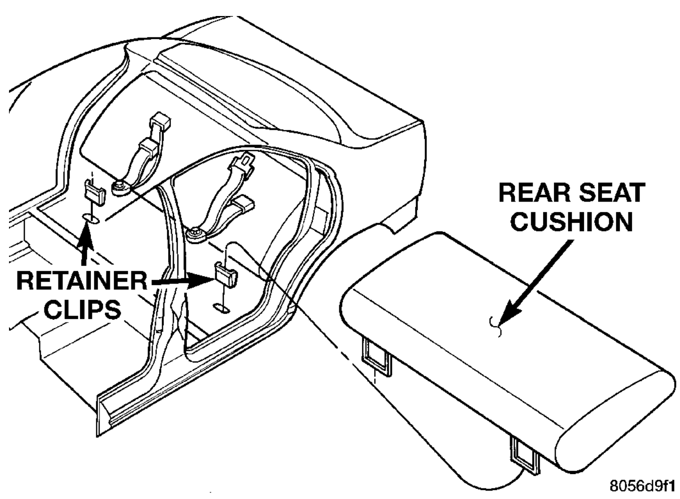


Fig. 2 Rear Seat Cushion

INSTALLATION

(1) Place rear seat cushion in position under bottom of seat back.

(2) Position inboard seat belts on top of seat cushion.

(3) Guide seat cushion loops into retainer cups in floor pan.

(4) Push downward on the front corners of the seat cushion to engage retainers.

REMOVAL AND INSTALLATION (Continued)

REAR SEAT BACK

REMOVAL

(1) Remove rear seat cushion.

(2) Remove bolts holding rear seat back and seat belts to floor.

(3) Push rear seat back upward to disengage hooks at top of seat back (Fig. 3).

(4) Separate rear seat from vehicle.

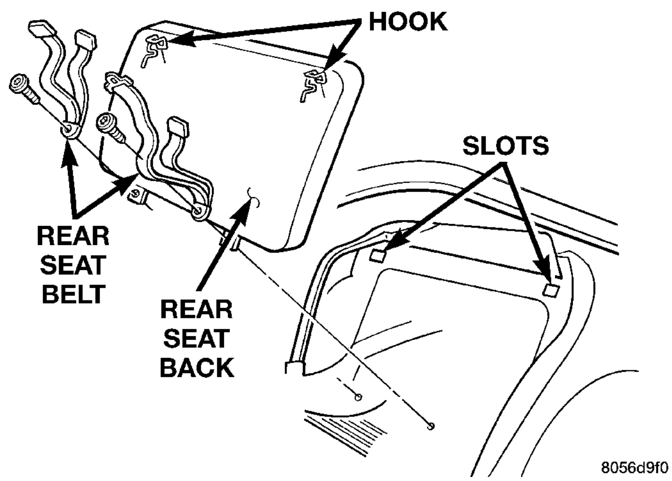


Fig. 3 Rear Seat Back

INSTALLATION

(1) Move rear seat back into position in vehicle.

(2) Push seat back downward to engage hooks at top of seat back.

(3) Install bolts holding rear seat back and seat belts to floor.

NOTE: The torque specification for the inner seat belt/rear seat back retaining bolts is 57 N·M (42 ft. lbs.).

(4) Install rear seat cushion.

CHILD RESTRAINT SEAT BACK

REMOVAL

(1) Remove rear seat cushion.

(2) Open child seat and remove lining.

(3) Remove bolts holding seat back frame to trunk closure panel through access holes in child seat module (Fig. 4).

(4) Remove bolts holding bottom of rear seat back and seat belts to floor.

(5) Lift seat back upward to disengage retainer hooks from trunk closure panel.

(6) Separate rear seat back from vehicle.

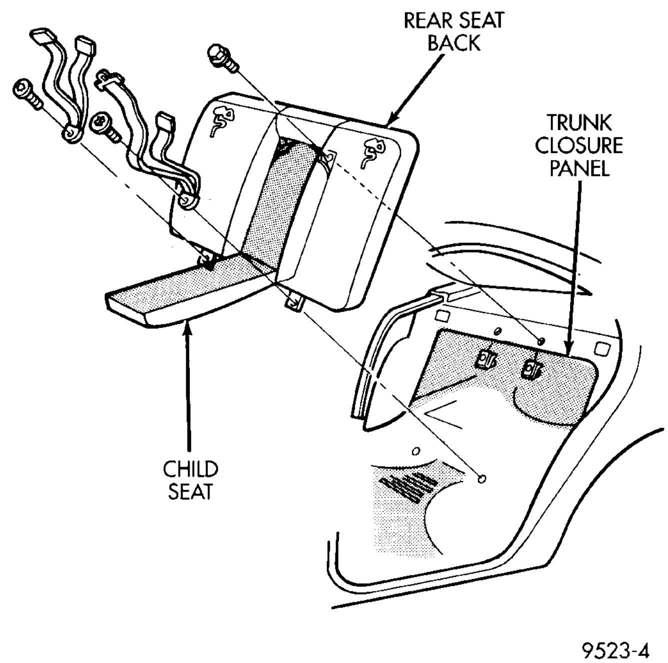


Fig. 4 Child Restraint Seat Back

INSTALLATION

(1) Move child restraint seat back into position in vehicle.

(2) Push seat back downward to engage hooks into trunk closure panel.

(3) Install bolts holding bottom of rear seat back and seat belts to floor.

(4) Install bolts holding seat back frame to trunk closure panel through access holes in child seat module.

(5) Install child seat lining and close child seat.

(6) Install rear seat cushion.

REMOVAL AND INSTALLATION (Continued)

CHILD SEAT MODULE

REMOVAL

(1) Remove rear seat back from vehicle.

(2) Slide lower bolster cushion retainer from channel on child seat cushion.

(3) Separate lower bolster from seat child seat.

(4) Remove liner from child seat module.

(5) Disengage push-in fasteners holding upper bolster to child seat module above shoulder belts.

(6) Remove screws holding top of child seat module to seat back frame from behind shoulder belts.

(7) Remove screws holding bottom of child seat module to seat back frame (Fig. 5).

(8) Separate child seat module from seat back.

INSTALLATION

(1) Place child seat module in position on seat back.

(2) Install screws to hold bottom of child seat module to seat back frame.

CAUTION: Do not capture seat belt webbing between module and seat back frame when installing upper screws.

(3) Install screws to hold top of child seat module to seat back frame from behind shoulder belts.

(4) Engage push-in fasteners to hold upper bolster to child seat module above shoulder belts.

(5) Install liner in child seat module.

(6) Place lower bolster in position on seat child seat.

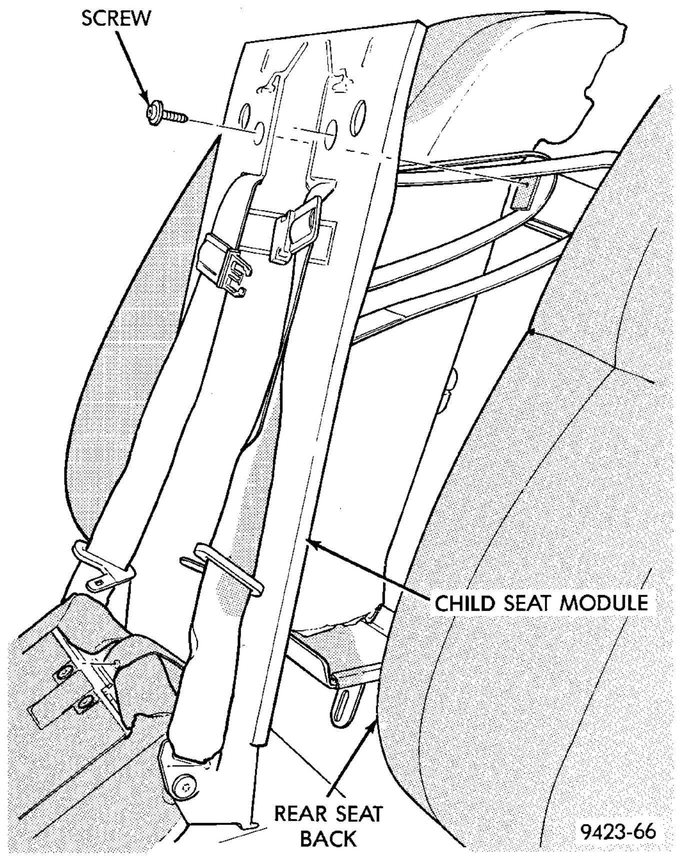


Fig. 5 Child Seat Module

(7) Slide lower bolster cushion retainer into channel on child seat cushion.

(8) Install rear seat back in vehicle.

SUNROOF

INDEX

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

Before beginning sunroof diagnostics verify that all other power accessories are in proper operating condition. If not, a common electrical problem may exist. Refer to the Wiring Diagrams section of this publication for circuit, splice and component descriptions. Check the condition of the circuit protection (fuses, circuit breakers or fuse links). Inspect all wiring connector pins for proper engagement and continuity. Check for battery voltage at the power sunroof control switches. If battery voltage is detected at the control switches, proceed with the following tests.

SUNROOF DIAGNOSIS

REMOVAL AND INSTALLATION

SUNROOF PROCEDURE INFORMATION

The numbered call-outs in the following service procedures refer the numbered parts found in the figure at the end of this section.

SUNROOF MODULE

REMOVAL

(1) Remove headlining.
(2) Remove fasteners attaching sunroof module to vehicle roof and support braces.
(3) With the aid of a helper, separate sunroof module from roof.
(4) Remove sunroof module from vehicle.

INSTALLATION

(1) With the aid of a helper, position sunroof module in vehicle.
(2) Install fasteners holding sunroof module to vehicle roof.
(3) Tighten all fasteners, starting from the front and working rearward and then the motor bracket.
(4) Adjust glass panel for flushness to roof. Refer to glass adjustment procedure in this section.
(5) Install headlining.
(6) Verify correct operation.

SUNROOF GLASS PANEL

REMOVAL

(1) Position sunroof sunshade (4) in full rearward position.
(2) Remove six glass attachment screws.
(3) Push glass panel upward from underside until glass panel clears the roof panel.
(4) Lift glass panel from vehicle.

INSTALLATION

(1) Position glass panel (4) in opening in vehicle roof.
(2) Install, but do not tighten, glass attachment screws.
(3) With the aid of a helper, hold the glass panel in position and tighten glass attachment screws.
(4) Verify the correct glass height. Refer to Glass Height Adjustment procedure in this section.

SUNROOF DRIVE MOTOR

CAUTION: Do not cycle the sunroof drive motor prior to installation. The drive motor is shipped in the closed position. The sunroof vent position is programmed into the drive motor and is dependent upon the drive motor closed position. If the drive motor and the sunroof mechanism are not both in the closed position, the sunroof vent height will not be correct.

REMOVAL AND INSTALLATION (Continued)

SYMPTOM	POSSIBLE CAUSE
Sunroof motor inoperative.	• Contaminated or corroded slides and channels. • Binding cable or linkage. • Faulty circuit ground. • Faulty power circuit to sunroof drive motor. • Faulty sunroof drive motor. • Faulty sunroof motor connector.
Audible whine when switch is depressed, sunroof does not operate.	• Faulty motor drive clutch. • Binding linkage. • Faulty sunroof motor connections.
Sunroof opens, but does not close.	• Binding linkage. • Faulty circuit. • Faulty switch.
Sunroof vents, but does not open.	• Binding linkage. • Faulty circuit. • Faulty switch.
Sunroof does not vent	• Binding cable. • Faulty circuit. • Faulty switch.
Sunroof vents and opens but does not close	• Binding linkage. • Faulty circuit. • Faulty switch.
Sunroof water leak.	• Drain tubes clogged or kinked. • Glass panel improperly adjusted. • Faulty glass panel seal.
Wind noise from sunroof.	• Front of glass panel too high or rear too low. • Glass panel not centered in opening. • Faulty glass panel seal.
Glass panel hangs up or snaps between vent and open.	• Glass panel improperly adjusted. • Glass panel seal has inconsistent compression.
Rattles from open sunroof while driving	• Loose attaching hardware. • Weak springs on wind deflector. • Sunshade out of the track.
Rattles from closed sunroof while driving	• Loose attaching hardware. • Wind deflector contacting glass panel or drain trough. • Sunshade out of the track.

REMOVAL

(1) Remove headlining until the sunroof drive motor (10) can be accessed.

(2) If the drive motor is to be reused, cycle the sunroof to the full forward position.

(3) Disconnect wire harness connector from motor.

(4) Remove the three screws attaching drive motor to sunroof module bracket.

(5) Separate drive motor (10) from bracket.

INSTALLATION

(1) With the aid of a helper, hold the sunroof glass panel in the closed position and engage the drive motor (10) into the sunroof drive cables.

(2) Install screws holding drive motor to bracket.

(3) Connect wire harness to drive motor.

(4) Install headlining.

SUNROOF WIND DEFLECTOR

REMOVAL

(1) Open sunroof to full open position.

(2) Pull one end of wind deflector flap out of the wind deflector beam (13).

(3) Release corner piece locking tab and separate corner piece from wind deflector beam.

(4) Rotate corner piece outboard to release tab from roof flange.

(5) Rotate corner piece to a vertical position and pull it up through hole in guide (5).

(6) Repeat for other corner piece.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Hold corner piece vertically and push tab down through hole in guide (5).

(2) Rotate corner piece inward and place tab under roof flange.

(3) Connect corner piece to wind deflector beam (13).

(4) Install wind deflector flap into wind deflector beam.

(5) Repeat for other corner piece.

SUNROOF SUNSHADE

REMOVAL

(1) Remove sunroof glass panel (4). Refer to procedure found in this section.

(2) Slide sunshade (11) to full forward position.

(3) Disengage slide blocks on one side of sunshade from sunshade guide (6).

(4) Lift and pull sunshade out of opposite sunshade guide.

INSTALLATION

(1) Place sunshade with cloth side down and install one side's slide blocks into the track on the sunshade guide (6).

(2) Slide the other side's slide blocks to fully inward position and insert them into the sunshade guide (6).

(3) Verify that all four slide blocks are fully engaged in the sunshade guide (6).

(4) Slide sunshade (11) fully rearward.

(5) Install sunroof glass panel (4). Refer to procedure found in this section.

SUNROOF GUIDE AND MECHANISM ASSEMBLY

REMOVAL

(1) Remove sunroof glass panel (4). Refer to procedure in this section.

(2) Remove front locator (7 or 8).

(3) Disengage cable from mechanism (9).

(4) Remove screws holding sunroof guide (5) and mechanism (9) assembly to sunroof module.

(5) Lift assembly from module.

(6) Rotate assembly to disengage wind deflector (13) from assembly.

INSTALLATION

(1) Engage wind deflector (13) into guide (5) and mechanism (9) assembly.

(2) Position assembly onto module and install screws holding assembly to sunroof module.

(3) Engage drive cable to mechanism.

(4) Install front locator (7 or 8). It may ease installation to move sunroof mechanism slightly rearward.

(5) Install sunroof glass panel. Refer to procedure found in this section.

SUNROOF CABLES

REMOVAL

(1) Remove sunroof glass panel (4). Refer to procedure found in this section.

(2) Cycle the sunroof mechanism to the full forward position.

CAUTION: Do not remove sunroof drive motor unless sunroof mechanism is in the full forward position.

(3) Remove sunroof drive motor (10). Refer to procedure found in this section.

(4) Remove front locator (7 or 8) for appropriate sunroof cable.

(5) Disengage sunroof cable from sunroof mechanism (9).

(6) Pull sunroof cable from drive tube (2 or 3).

INSTALLATION

(1) Push sunroof cable through drive tube (2 or 3).

(2) Engage sunroof cable into sunroof mechanism (9) making sure cable connecting rod is rotated at a 45 degree angle towards inside of vehicle (Fig. 1).

(3) Install front locator (7 or 8) over sunroof cable. Moving the sunroof mechanism rearward slightly will ease locator installation.

(4) Move sunroof to full forward position.

(5) Install sunroof drive motor (10).

(6) Install sunroof glass panel (5). Refer to procedure found in this section.

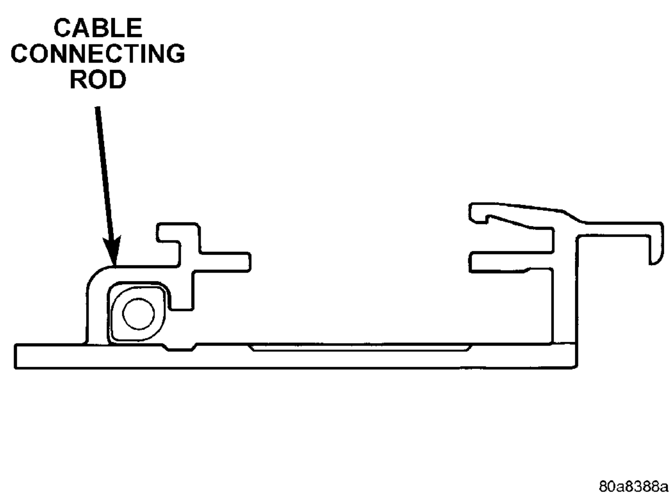


Fig. 1 Front View of Guide

REMOVAL AND INSTALLATION (Continued)

SUNROOF COMPONENTS

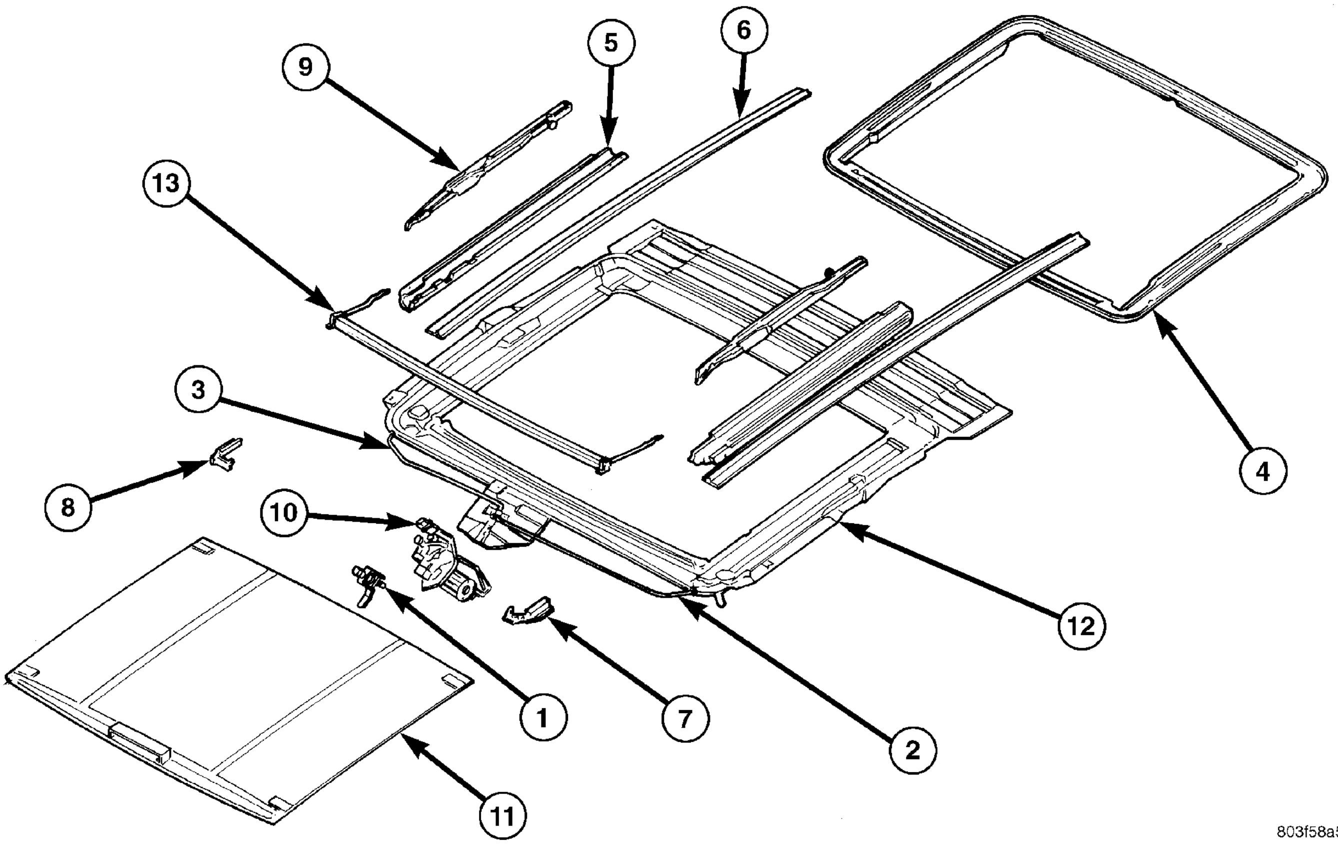


Fig. 2 Sunroof Components

Item Number	Component Name	Item Number	Component Name
1	Drive Tube Locator	8	Locator R.H.
2	Drive Tube L.H.	9	Mechanism
3	Drive Tube R.H.	10	Drive Motor
4	Glass Reinforcment Panel	11	Sunshade
5	Guide	12	Tray Assembly
6	Sunshade Guide	13	Wind Deflector
7	Locator L.H.		

ADJUSTMENTS

SUNROOF GLASS HEIGHT ADJUSTMENT

FLUSHNESS

(1) Position sunshade in full rearward position.

(2) To adjust front of glass;

(a) Loosen front and middle glass attachment screws

(b) Adjust front of sunroof glass panel so that the corners are flush to 1.0 mm below the top surface of the roof panel.

(c) Tighten all glass attachment screws.

(3) To adjust rear of glass;

(a) Loosen rear and middle glass attachment screws

(b) Adjust rear of sunroof glass panel so that the corners are flush to ± 1.0 mm off the top surface of the roof panel.

(c) Tighten all glass attachment screws.

VENT HEIGHT

(1) Cycle the sunroof module to vent position using the drive motor.

(2) Check glass height in tilt using the appropriate measuring tool.

(3) If the vent height is greater than 35 mm, using switch slowly set to correct height.

(4) After setting correct height, remove drive motor.

(5) With the motor removed, use the switch to set tilt by operating the gear to the full closed position.

(6) Using tilt switch only, operate the motor until it comes to a full stop at tilt position.

(7) Install drive motor and verify correct operation.

BODY COMPONENTS

INDEX

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water-test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

DIAGNOSIS AND TESTING (Continued)

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high crosswinds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

REMOVAL AND INSTALLATION

GRILLE

REMOVAL

(1) Release hood latch, open and support hood on prop rod.

(2) Remove screws holding grille to parking lamps (Fig. 1).

(3) Remove screw holding grille to radiator closure panel.

(4) Separate grille from vehicle.

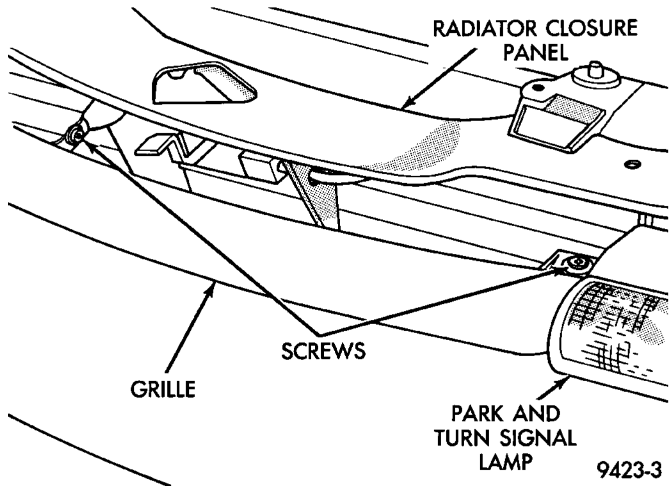


Fig. 1 Grille

INSTALLATION

(1) Place grille into position on vehicle.

(2) Install screw holding grille to radiator closure panel.

(3) Install screws holding grille to parking lamps.

HOOD LATCH

REMOVAL

(1) Release hood latch and open hood.

(2) Support hood on prop rod.

(3) Remove grille.

(4) Remove screws holding hood latch to radiator closure panel (Fig. 2).

(5) Separate hood latch from closure panel.

(6) Disengage remote release cable from latch.

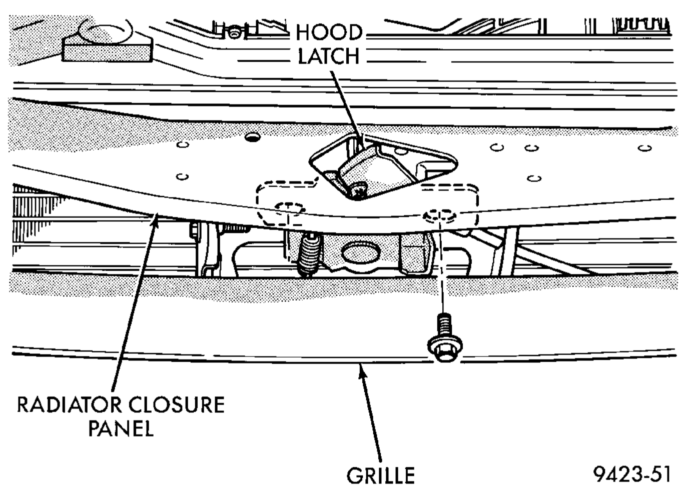


Fig. 2 Hood Latch

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Engage remote release cable into latch.

(2) Place hood latch onto radiator closure panel.

(3) Install bolts holding latch to closure panel.

(4) Install grille.

(5) Close hood and verify alignment of hood and that latch is securely engaged.

HOOD RELEASE CABLE

REMOVAL

(1) Disconnect remote hood release cable from hood latch.

(2) Remove left front cowl trim panel.

(3) Remove screws holding hood release handle to cowl panel (Fig. 3).

(4) Disengage rubber grommet from dash panel behind instrument panel.

(5) Pull release cable through hole in dash panel.

(6) Separate cable and handle from vehicle.

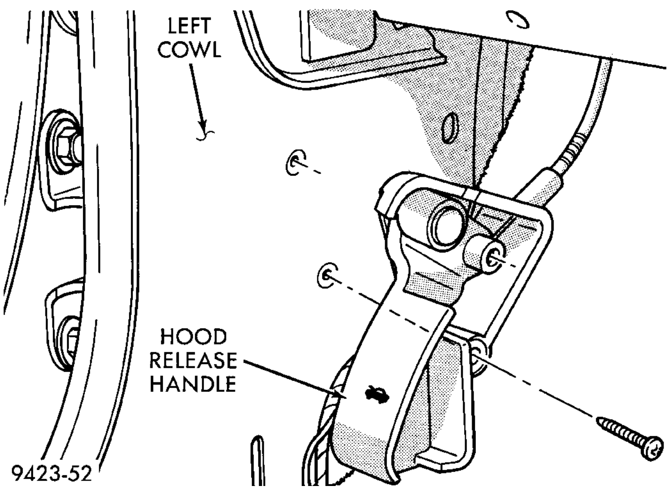


Fig. 3 Hood Release Cable

INSTALLATION

(1) Assemble cable and handle onto vehicle.

(2) Push release cable through hole in dash panel.

(3) Engage rubber grommet into dash panel.

(4) Install screws holding hood release handle to cowl panel.

(5) Install left front cowl trim panel.

(6) Connect remote hood release cable to hood latch.

(7) Close hood and verify operation.

HOOD

REMOVAL

(1) Raise hood to full up position.

(2) Disengage under hood lamp wire connector from engine compartment wire harness.

(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 bolts holding hood to hinge and loosen the bottom bolts until they can be removed by hand.

(5) With assistance from a helper at the opposite side of the vehicle to support the hood, remove bottom bolts holding hood to hinge.

(6) Separate the hood from the vehicle.

INSTALLATION

(1) Place hood in position on vehicle. With assistance from a helper at the opposite side of the vehicle to support the hood, install bottom bolts to hold hood to hinge finger tight.

(2) Install top bolts to hold hood to hinge finger tight.

(3) Position bolts at marks and tighten bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders.

(4) Engage under hood lamp wire connector to engine compartment wire harness.

(5) Verify hood operation and alignment.

HOOD HINGE

REMOVAL

(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 bolts holding hood to hinge.

(4) Remove bolts holding hood hinge to front fender flange and separate hinge from vehicle. If necessary, paint new hinge before installation.

INSTALLATION

(1) If necessary, paint new hinge before installation.

(2) Place hinge in position on vehicle.

(3) Install bolts to hold hood hinge to front fender flange.

(4) Install bolts to hold hood to hinge.

(5) 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.

(6) Remove support from under hood and verify hood operation.

REMOVAL AND INSTALLATION (Continued)

COWL COVER

REMOVAL

(1) Release hood latch and open hood.

(2) Remove windshield wiper arms, refer to Group 8K, Windshield Wiper and Washer Systems for proper procedures.

(3) Remove push-in fasteners holding cowl cover to cowl at base of windshield opening (Fig. 4).

(4) Separate cowl cover from vehicle.

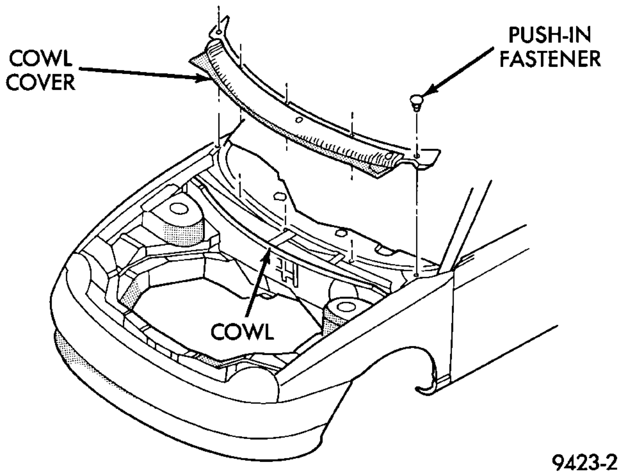


Fig. 4 Cowl Cover

INSTALLATION

(1) Place cowl panel in place on vehicle.

(2) Install push-in fasteners holding cowl panel to cowl at base of windshield opening.

(3) Install windshield wiper arms, refer to Group 8K, Windshield Wiper and Washer Systems, for proper procedures.

FRONT DOOR TRIM—2 DOOR

REMOVAL

(1) Release door latch and open door.

(2) Lower door glass.

(3) Remove screw inside pull cup holding door trim panel to bracket (Fig. 5).

(4) Pull and hold inside latch release handle away from door trim.

(5) Remove screw holding trim panel to door from behind inside door handle (Fig. 6).

(6) Remove window regulator crank, if so equipped.

(7) Disengage hidden clips holding trim panel to door from around perimeter of trim panel (Fig. 7).

(8) Tilt trim panel outward to clear locator pins on backside of trim panel.

(9) Disengage trim panel from retainer channel on inner belt weatherstrip at the top of the door by lifting and gently jiggling.

(10) Move trim panel away from door and disengage clip holding door latch linkage to back of inside door handle.

(11) Separate latch rod from handle.

CAUTION: Do not allow door trim panel to hang by the wire connector or wiring.

(12) Disengage wire connector from power door lock switch, mirror switch, and power window switch, if so equipped.

(13) Separate trim panel from vehicle.

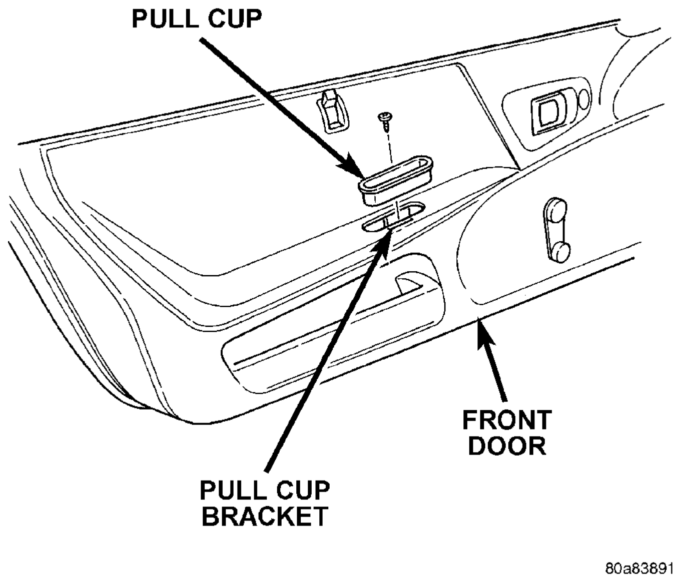


Fig. 5 Front Door Pull Cup

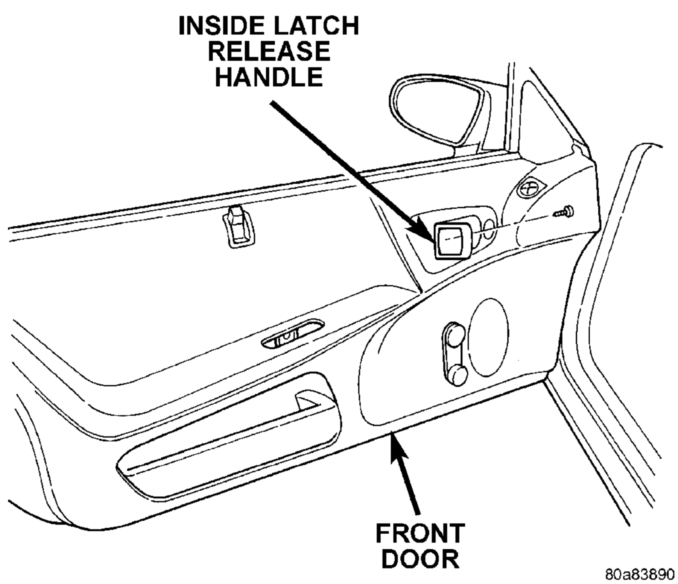


Fig. 6 Inside Door Handle Screw

INSTALLATION

(1) Replace any damaged or missing push–in fasteners from around perimeter of door trim panel.

(2) Place trim panel near door.

(3) Engage wire connector to power lock switch, mirror switch, and power window switch, if so equipped.

(4) Insert latch rod into inside latch release.

REMOVAL AND INSTALLATION (Continued)

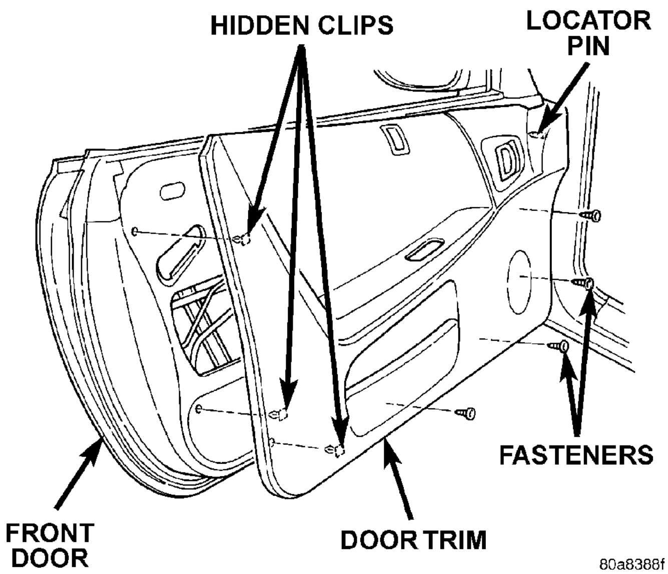


Fig. 7 Door Trim Panel

(5) Engage clip holding door latch linkage to back of inside door handle.

(6) Engage trim panel into retainer channel at top of door and push down to seat.

(7) Locate door trim panel to inner door panel by aligning locating pins on backside of trim panel to mating holes in inner door panel. Gently shift panel forward or rearward if necessary.

(8) Engage hidden clips holding trim panel to door from around perimeter of trim panel.

(9) With the window in the down position, orientate the window regulator crank handle appropriately. Install the right handle at the 10 o'clock position and the left handle at the 2 o'clock position, if so equipped.

(10) Install screw holding trim panel to door from behind inside door handle.

(11) Install screw inside pull cup holding door trim panel to bracket.

FRONT DOOR TRIM—4 DOOR

REMOVAL

(1) Release door latch and open door.

(2) Lower door glass.

(3) Remove window regulator crank, if so equipped (Fig. 8).

(4) Remove screw from inside arm rest pull cup (Fig. 9).

(5) Pull and hold inside latch release handle away from door trim.

(6) Remove screw from behind inside latch release handle (Fig. 9).

(7) Disengage push-in fasteners holding trim to door panel around perimeter of trim panel.

(8) Tilt trim panel outward to clear locator pins on backside of trim panel.

(9) Disengage trim panel from retainer channel in inner belt weatherstrip at top of door by lifting while gently jiggling.

(10) Move trim panel away from door and disengage clip holding latch rod to handle.

(11) Separate latch rod from handle.

CAUTION: Do not allow door trim panel to hang by the wire connector or wiring.

(12) Disengage wire connector from power door lock switch, mirror switch, and power window switch if so equipped.

(13) Separate trim panel from door.

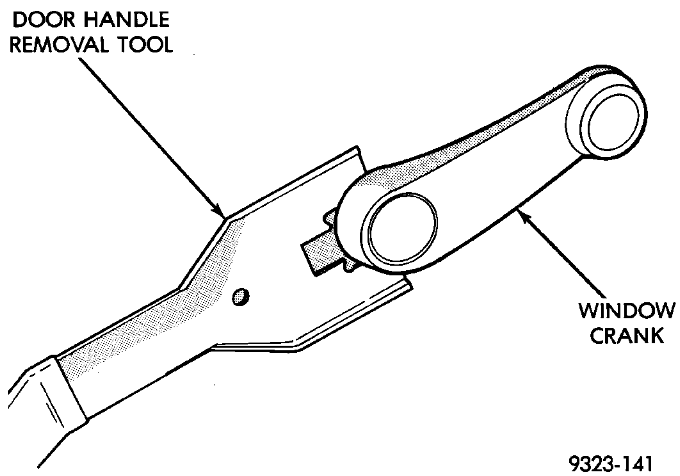


Fig. 8 Window Crank

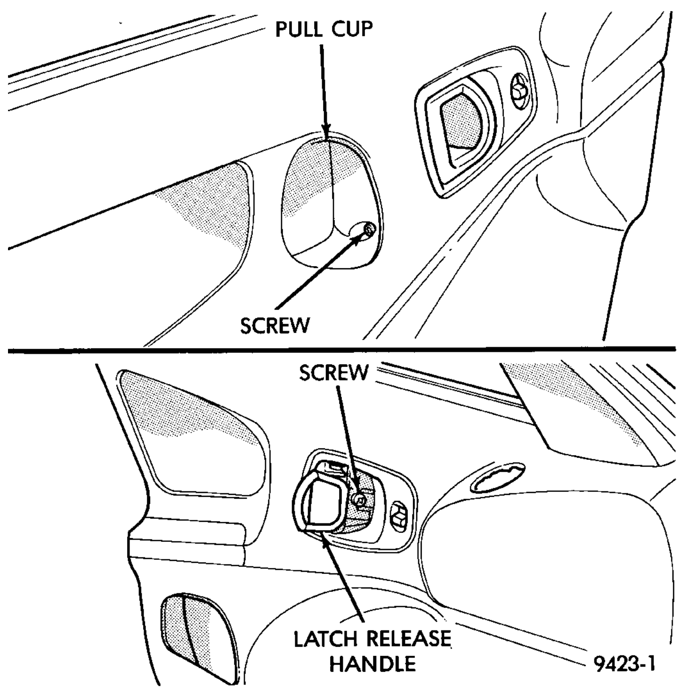


Fig. 9 Front Door Trim

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Replace any damaged or missing push–in fasteners from around perimeter of door trim panel.

(2) Place trim panel near door.

(3) Engage wire connector into power door lock switch, mirror switch, and power window switch, if so equipped.

(4) Insert latch rod into handle and engage clip.

(5) Engage trim panel into retainer channel at top of door and push down to seat.

(6) Locate door trim panel to inner door panel by aligning locating pins on backside of trim panel to mating holes in inner door panel.

(7) Engage push-in fasteners to hold trim to door panel around perimeter of trim panel.

(8) Install screw behind inside latch release handle.

(9) Install screw inside arm rest pull cup.

(10) With the window in the down position, orientate the window regulator crank handle appropriately. Install the right handle at the 10 o'clock position and the left handle at the 2 o'clock position, if so equipped.

FRONT DOOR WATER SHIELD

REMOVAL

(1) Remove door trim panel.

(2) Remove Door speaker, if equipped.

(3) Remove door trim pull cup mount bracket.

(4) Disengage clip holding lock linkage to lock button bell crank.

(5) Peel water shield away from adhesive around perimeter of inner door panel (Fig. 10).

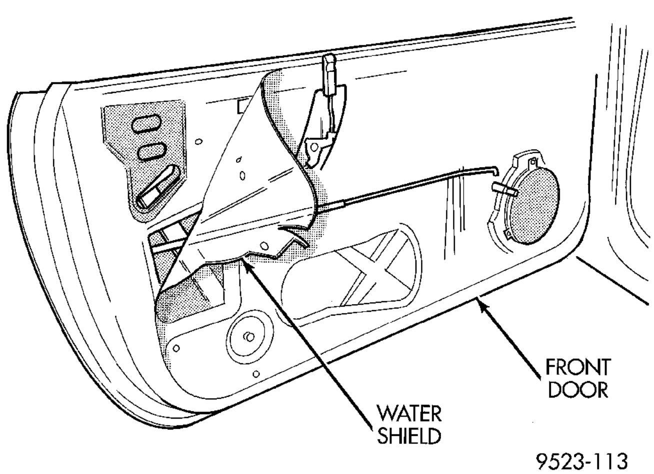


Fig. 10 Water Shield

INSTALLATION

(1) Insure that enough adhesive remains to securely retain the watershield. Replace as necessary.

(2) Place the watershield into position and press securely to adhesive making sure to properly route wiring and linkages.

(3) Engage clip holding lock linkage to lock button bell-crank.

(4) Install door trim pull cup mount bracket.

(5) Install door speaker, if equipped.

(6) Install door trim panel.

LOCK BUTTON BELL-CRANK

REMOVAL

(1) Remove door trim panel.

(2) Disengage clip holding lock linkage to bell-crank

(3) Rotate bell-crank until retaining ears align with slots in door panel.

(4) Separate bell-crank from door (Fig. 11).

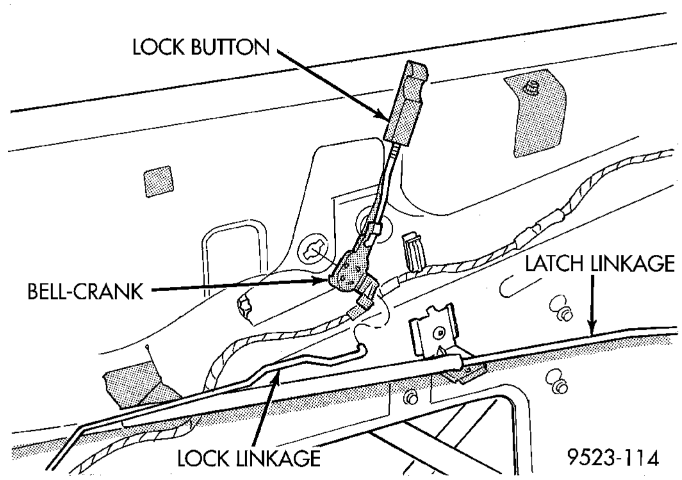


Fig. 11 Lock Button Bell-crank

INSTALLATION

Reverse the preceding operation.

FRONT DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.

(2) Separate weatherstrip from door.

INSTALLATION

(1) Push down on weatherstrip to engage channel to door panel.

(2) Install door trim panel.

WINDOW INNERBELT STABILIZER

REMOVAL

(1) Remove door trim panel.

(2) Remove nut holding inner belt stabilizer to door panel.

REMOVAL AND INSTALLATION (Continued)

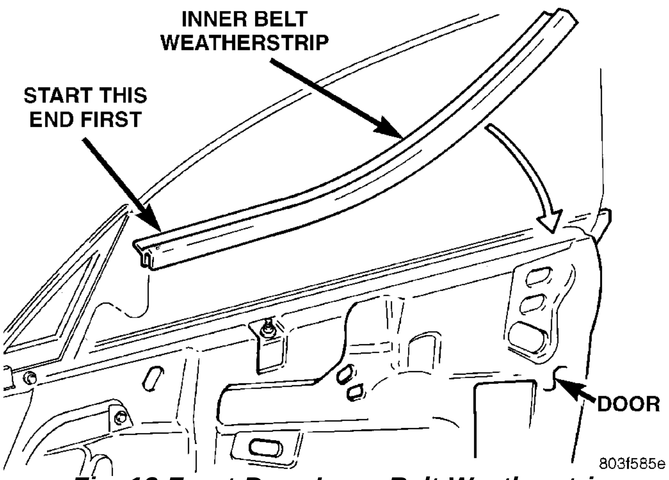


Fig. 12 Front Door Inner Belt Weatherstrip

(3) Separate inner belt stabilizer from door. (Fig. 13)

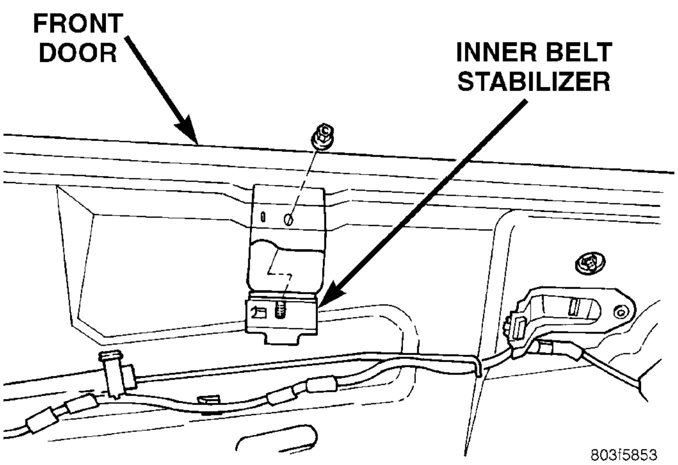


Fig. 13

INSTALLATION

Reverse the preceding operation. Adjust inner belt stabilizer against glass with enough tension to allow free up and down movement.

FRONT DOOR GLASS—2 DOOR

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove inner and outer door belt weather-strips.

(3) Loosen inner belt stabilizer.

(4) Lower door glass to bottom of travel to access glass attachment bolts.

(5) Remove bolts holding regulator lift channel to door glass (Fig. 15).

(6) Remove bolts holding rear guide plate to door glass (Fig. 14).

(7) Separate rear guide plate from door glass.

(8) Lift door glass upward and out of opening at top of door (Fig. 16).

(9) Remove front guide plate from door glass.

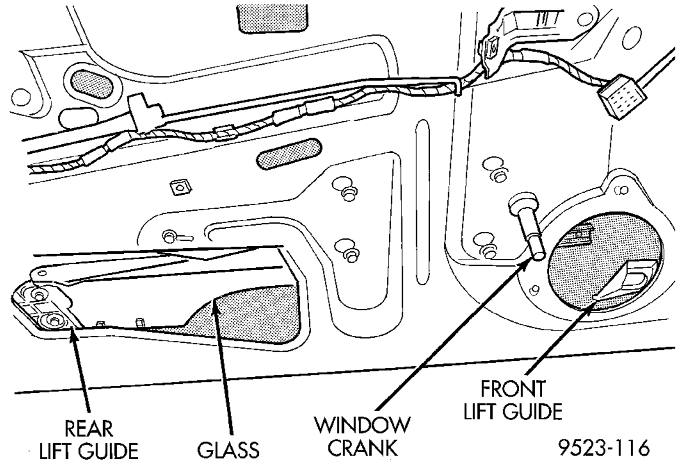


Fig. 14 Guide Bolts

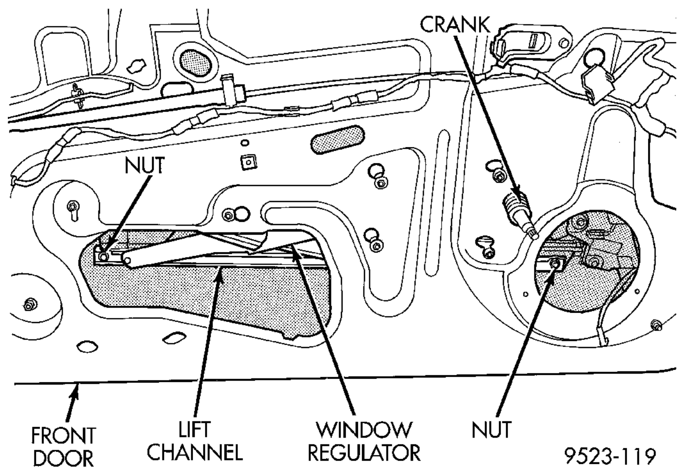


Fig. 15 Regulator Lift Channel

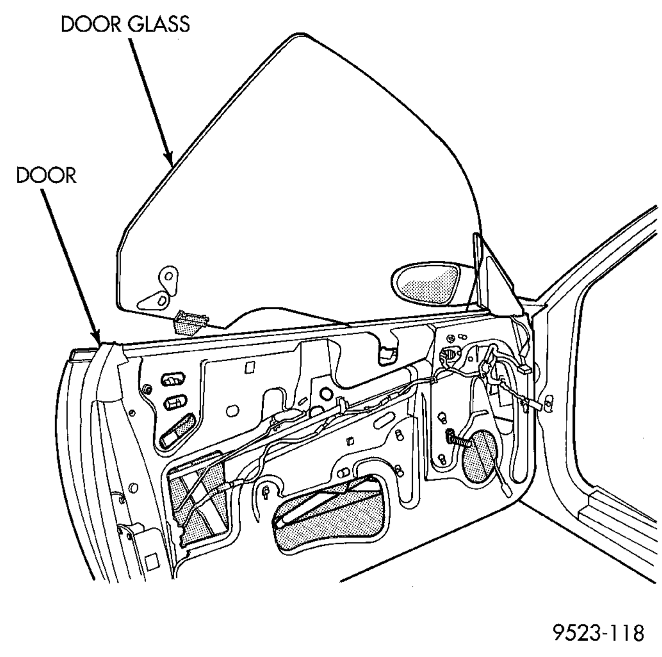


Fig. 16 Door Glass

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install front guide plate to door glass.

(2) Carefully lower door glass through opening in top of door.

(3) Position rear guide plate onto door glass and install bolts.

(4) Install nuts holding regulator lift channel to door glass.

(5) Tighten all door glass fasteners.

(6) Tighten window inner belt stabilizer.

(7) Install inner and outer door belt weatherstrips.

(8) Install door trim panel and water shield.

FRONT DOOR GLASS—4 DOOR

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove inner door belt weatherstrip.

(3) Loosen window inner belt stabilizer.

(4) Lower door glass to bottom of door to gain access to attaching bolts.

(5) Remove bolts holding door glass to window regulator lift plates (Fig. 17).

(6) Disengage door glass from regulator.

(7) Lift door glass upward out of the opening at the top of door.

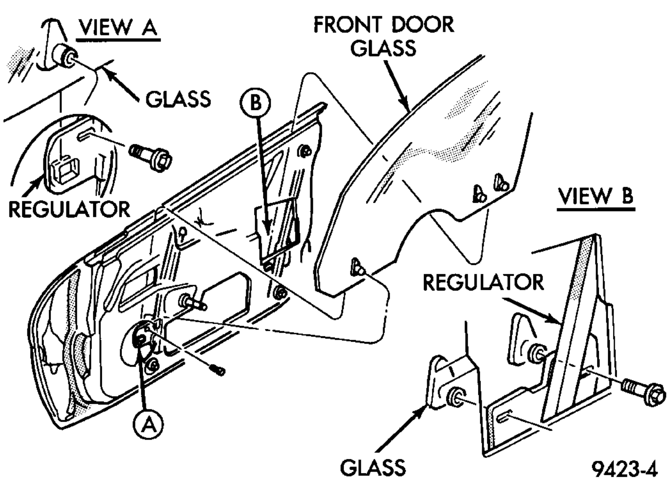


Fig. 17 Front Door Glass

INSTALLATION

(1) Carefully lower door glass through opening in top of door.

(2) Position door glass into window regulator lift plates.

(3) Install bolts securing door glass to lift plates.

(4) Tighten window inner belt stabilizer.

(5) Install inner door belt weatherstrip.

(6) Install door trim panel and water shield.

WINDOW REGULATOR—2 DOOR

NOTE: Power and manual door glass regulators are serviced using the same procedures. For power window motor service procedures, refer to Group 8S, Power Windows.

REMOVAL

(1) Remove door trim panel and water shield.

(2) Disconnect wire connector to power window motor, if so equipped.

(3) Remove nuts holding regulator lift channel to door glass (Fig. 18).

(4) Secure door glass in upward position.

(5) Mark position of rear bolt of roller channel to inner door panel to aid in installation.

(6) Remove bolt holding rear of roller channel to door panel.

(7) Loosen bolt holding front of roller channel to door panel.

(8) Separate roller channel from door panel (Fig. 19).

(9) Loosen bolts holding window regulator to inner door panel.

(10) Separate bolt heads from key-hole slots in inner door panel.

(11) Remove window regulator through large hole in inner door panel (Fig. 20) and (Fig. 21).

(12) Remove power window motor from regulator, if so equipped. Refer to Group 8S for Power Window Motor procedure.

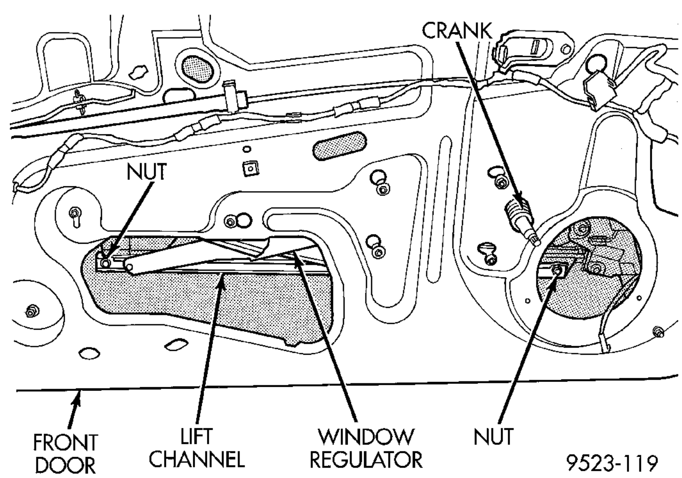


Fig. 18 Regulator Lift Channel

REMOVAL AND INSTALLATION (Continued)

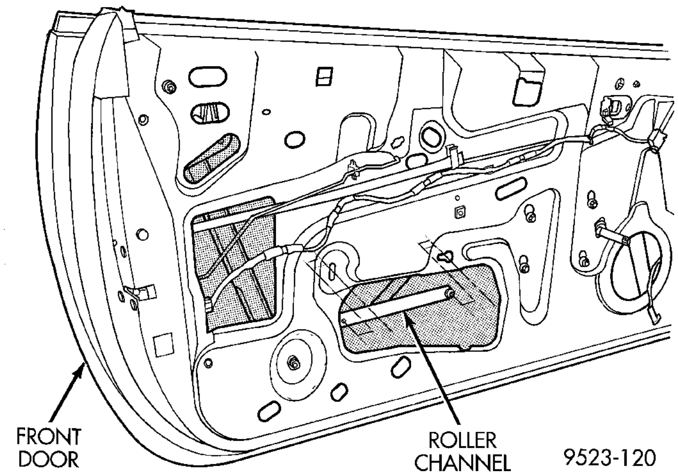


Fig. 19 Roller Channel

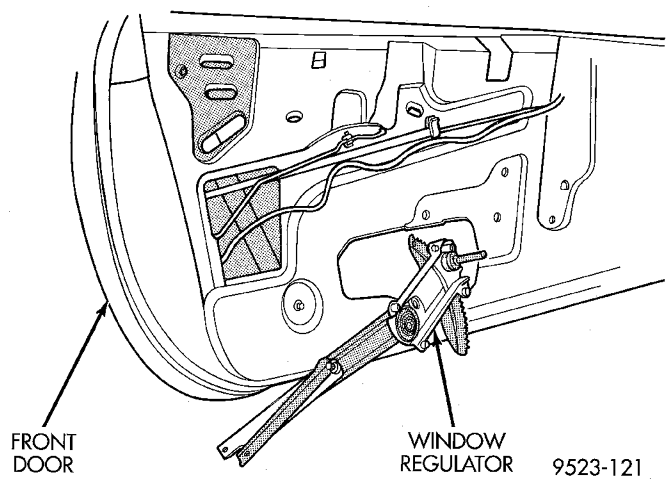


Fig. 20 Manual Window Regulator

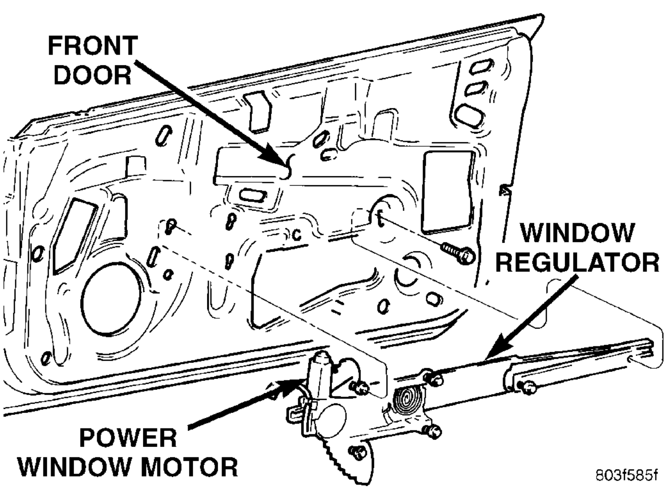


Fig. 21 Power Window Regulator

INSTALLATION

(1) Install power window motor on regulator, if so equipped. Refer to group 8S for Power Window Motor procedures.

(2) Move window regulator into position in door and engage bolt heads into key-hole slots in inner door panel and tighten bolts.

(3) Install roller channel to door panel.

(4) Install bolt at rear of roller channel. Make sure that bolt is aligned to mark on inner door panel made previously.

(5) Tighten front and rear bolts of roller channel.

(6) Install nuts holding regulator lift channel to door glass.

(7) Adjust door glass as described in this section.

(8) Connect wire connector to power window motor, if so equipped.

(9) Install door speaker, if so equipped.

(10) Install door trim panel and water shield.

WINDOW REGULATOR—4 DOOR

NOTE: Power and manual door glass regulators are serviced using the same procedures. For power window motor service procedures, refer to Group 8S, Power Windows.

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove door glass.

(3) Disconnect wire connector to power window motor, if so equipped.

(4) Remove nuts holding top of regulator to inner door panel.

(5) Remove nuts holding bottom of regulator to door panel (Fig. 22) and (Fig. 23).

(6) Loosen bolts holding regulator crank/motor to door panel.

(7) Disengage bolts from key hole slots in door panel.

(8) Remove window regulator from access hole in door panel.

(9) Remove power window motor from regulator, if so equipped. Refer to Group 8S for Power Window Motor procedures.

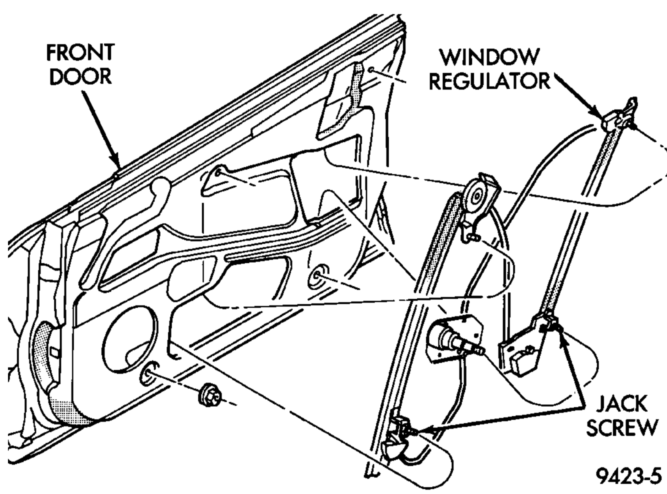


Fig. 22 Front Door Manual Window Regulator

REMOVAL AND INSTALLATION (Continued)

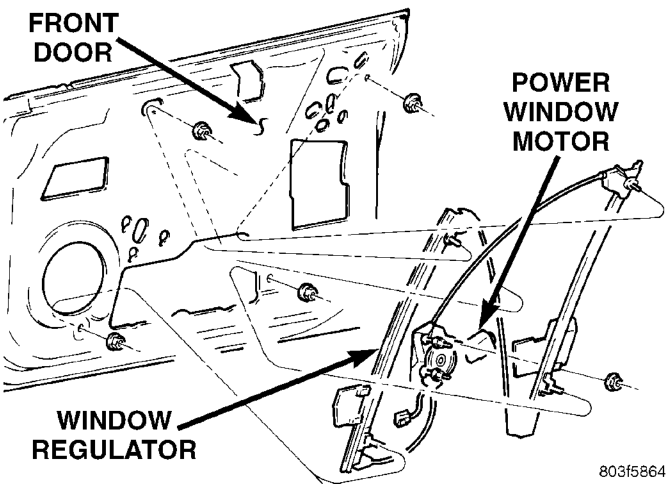


Fig. 23 Front Door Power Window Regulator

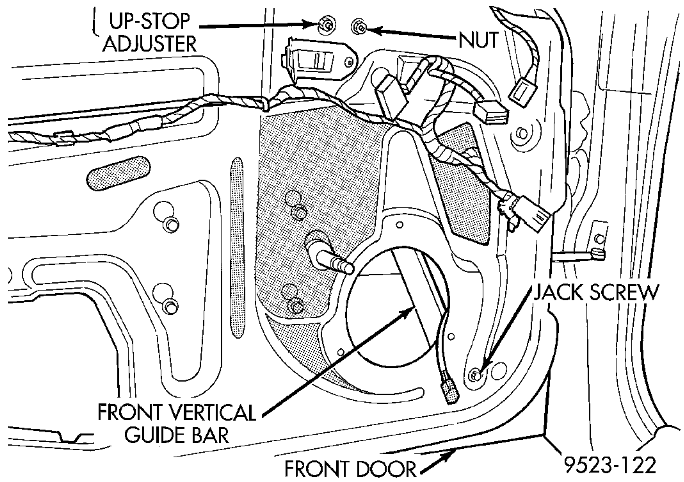


Fig. 24 Front Vertical Guide Bar

INSTALLATION

(1) Install power window motor on regulator, if so equipped. Refer to Group 8S for Power Window Motor procedures.

(2) Move window regulator into position in door and engage bolt heads in key-slots in inner door panel.

(3) Tighten bolts attaching regulator crank/motor to door panel.

(4) Install nuts holding top and bottom of window regulator to door panel.

(5) Install door glass. Refer to procedures in this section to verify and adjust glass alignment.

(6) Connect wire connector to power window motor, if so equipped.

(7) Install door speaker, if so equipped.

(8) Install door trim panel and water shield.

FRONT VERTICAL GUIDE BAR

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove door speaker, if equipped.

(3) Remove front lift guide.

(4) Remove bolt holding top of front guide bar to inner door panel.

(5) Using a Snap-on® flare-nut socket (FRXM10) and a hex wrench, remove nut holding bottom of guide bar to door panel while holding jack screws. (Fig. 24)

(6) Remove front vertical guide bar through speaker hole in inner door panel (Fig. 25).

INSTALLATION

Reverse the preceding operation. Verify door glass alignment, adjust if necessary.

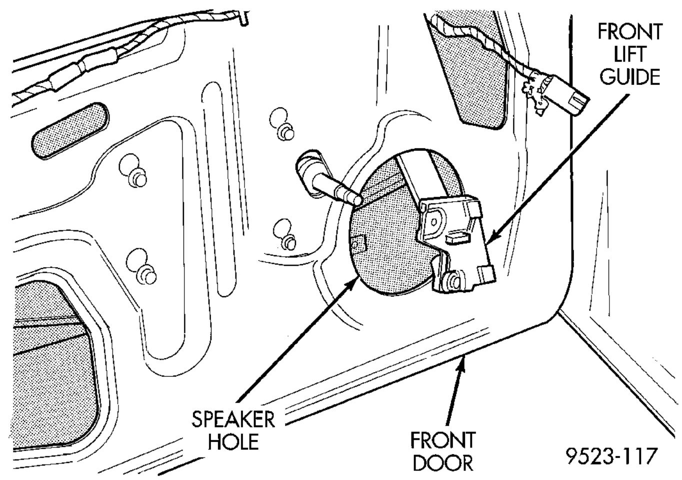


Fig. 25 Front Guide

REAR VERTICAL GUIDE BAR

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove nut holding top of rear guide bar to inner door panel.

(3) Using a Snap-on® flare-nut socket (FRXM10) and a hex wrench, remove nut holding bottom of guide bar to door panel while holding jack screws.

(4) Remove rear vertical guide bar through large access hole in inner door panel (Fig. 26).

INSTALLATION

Reverse the preceding operations and verify glass alignment.

FRONT DOOR LATCH

REMOVAL

(1) Remove door trim panel and water shield.

(2) Close door glass.

REMOVAL AND INSTALLATION (Continued)

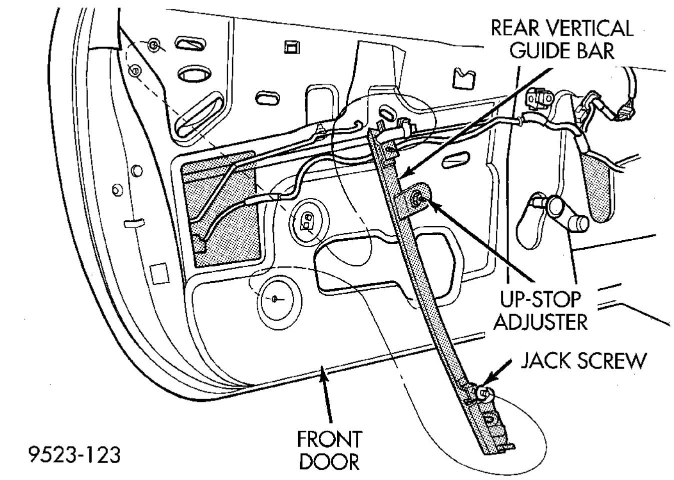


Fig. 26 Rear Vertical Guide Bar

(3) Disconnect lock and latch rods from door latch (Fig. 27).

(4) Disengage wire connector from power door lock motor, if equipped.

(5) Remove screws holding latch to door end frame.

(6) Separate door latch from vehicle.

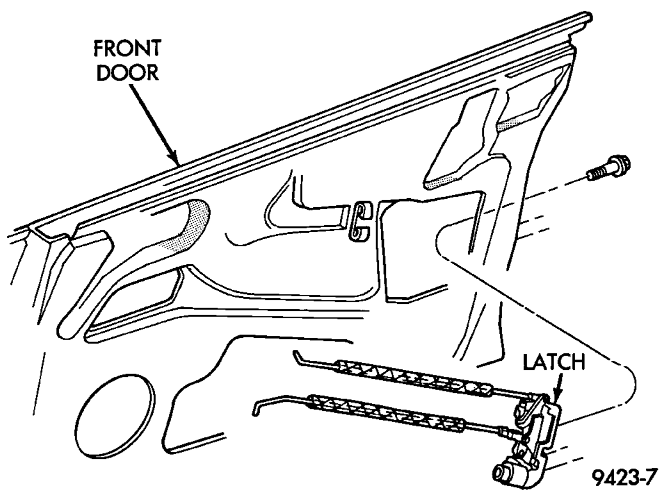


Fig. 27 Front Door Latch

INSTALLATION

CAUTION: Do not close door before adjusting the door latch. Door may fail to re-open.

(1) Position door latch inside door and install screws holding latch to door end frame.

(2) Engage wire connector into power door lock motor, if so equipped.

(3) Connect latch and lock rods to door latch.

(4) Install door trim panel and water shield.

(5) Adjust door latch using procedure in this section.

FRONT DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove door trim panel and water shield.

(2) Close door glass.

(3) Disconnect lock and latch rods from door latch.

(4) Remove nut holding door handle retainer to outer door panel (Fig. 28).

(5) Separate retainer from back of door handle.

(6) Separate door handle from vehicle.

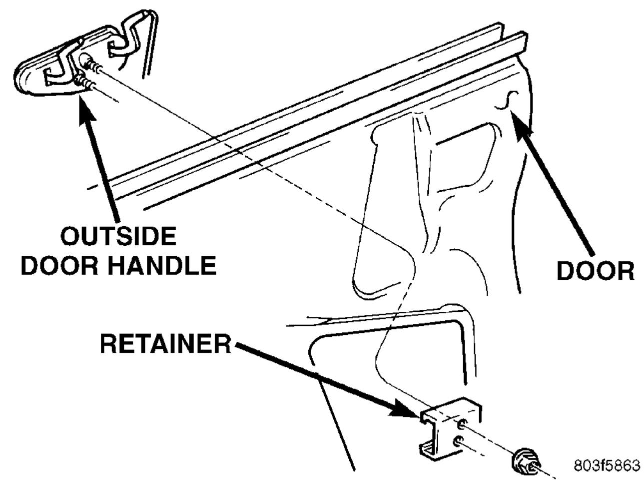


Fig. 28 Front Door Outside Handle

INSTALLATION

(1) Position door handle into door and install retainer at back of handle.

(2) Install nut holding door handle retainer to outer door panel.

(3) Connect lock and latch rods to door latch.

(4) Install door trim panel and water shield.

DOOR LOCK CYLINDER

REMOVAL

(1) Remove door trim panel and water shield.

(2) Close door glass.

(3) Disconnect door lock rod from latch.

(4) Remove clip holding lock cylinder to door handle.

(5) Pull lock cylinder from door handle (Fig. 29).

INSTALLATION

(1) Push lock cylinder into door handle.

(2) Install clip holding lock cylinder to door handle.

(3) Connect door lock rod from latch.

(4) Install door trim panel and water shield.

REMOVAL AND INSTALLATION (Continued)

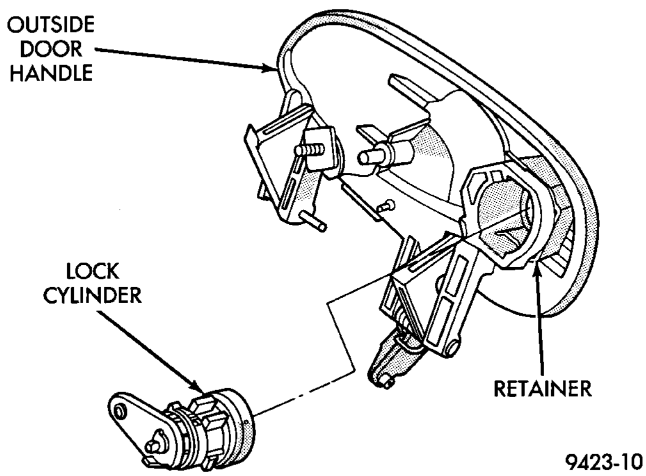


Fig. 29 Door Lock Cylinder

FRONT DOOR CHECK STOP

REMOVAL

(1) Remove door trim panel and water shield.
(2) Remove bolt holding check stop to hinge pillar.
(3) Remove door speaker.
(4) Remove bolts holding check stop to door end frame (Fig. 30).
(5) Separate check stop from vehicle.

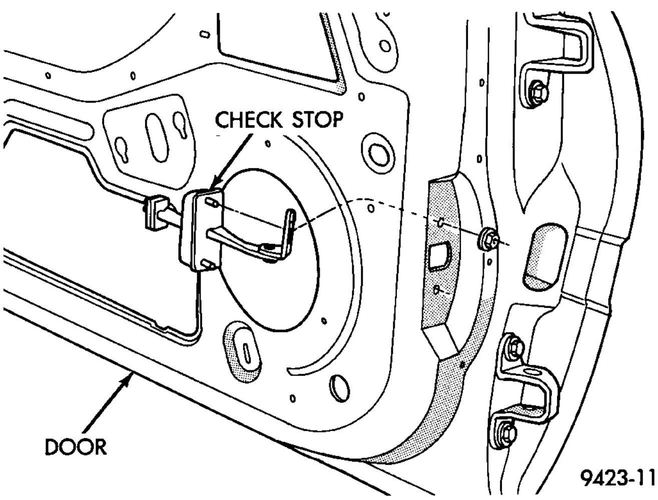


Fig. 30 Front Door Check Stop

INSTALLATION

(1) Position door check on vehicle and install bolts attaching stop to door end frame.
(2) Install door speaker, if so equipped.
(3) Install bolt holding door check stop to hinge pillar.
(4) Install door trim panel and water shield.

SIDE VIEW MIRROR TRIM COVER

REMOVAL

(1) Disengage clips holding side view mirror cover to stanchion (Fig. 31).
(2) Separate mirror cover from vehicle.

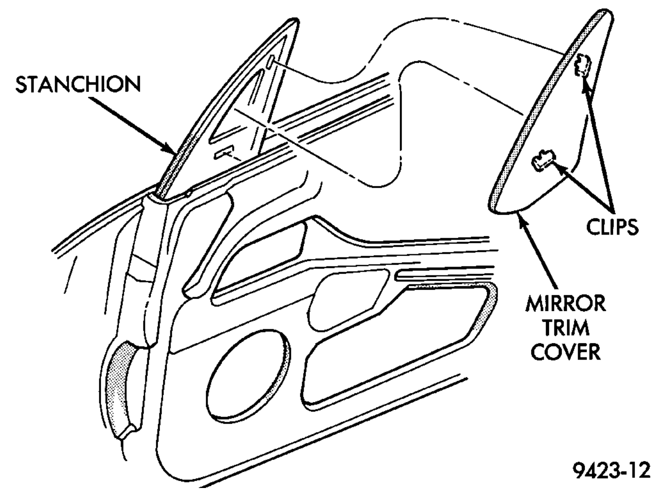


Fig. 31 Side View Mirror Trim Cover

INSTALLATION

Reverse the preceding operation.

SIDE VIEW MIRROR

REMOVAL

(1) Remove side view mirror cover.
(2) Remove door trim panel.
(3) Remove water shield if equipped with power mirror.
(4) Disengage wire connector from power mirror motor, if equipped.
(5) Remove bolts holding mirror to stanchion (Fig. 32).
(6) Separate mirror from vehicle.

INSTALLATION

(1) Position side view mirror on vehicle and install nuts attaching mirror to stanchion.
(2) Engage wire connector from power window motor, if so equipped.
(3) Install water shield if equipped with power mirror.
(4) Install door trim panel.
(5) Install side view mirror trim cover.

REMOVAL AND INSTALLATION (Continued)

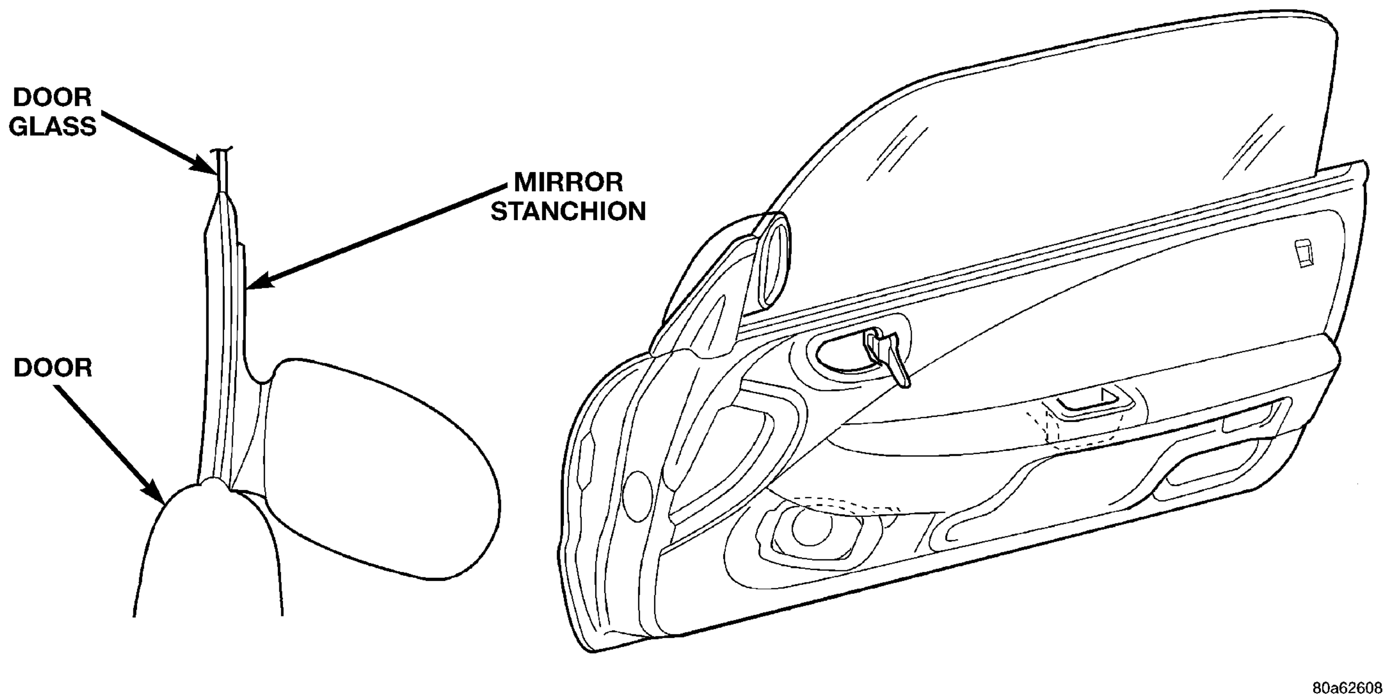


Fig. 32 Side View Mirror

SIDE VIEW MIRROR STANCHION

REMOVAL

(1) Remove side view mirror.

(2) Remove bolt holding top of side view mirror stanchion to inner door panel.

(3) Remove bolts holding stanchion to outer door panel (Fig. 33).

(4) Remove nut holding stanchion jack-screw to inner door panel.

(5) Disengage push-in fastener holding door opening weatherstrip to stanchion.

(6) Separate stanchion from vehicle.

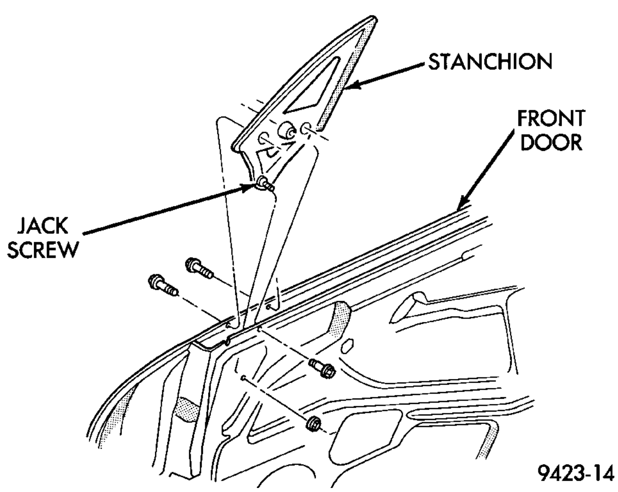


Fig. 33 Side View Mirror Stanchion

INSTALLATION

Reverse the preceding operation. Using a Snap-on flare-nut socket (FRXM10) and hex-wrench adjust the jack-screw at bottom of stanchion to achieve proper alignment.

FRONT DOOR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Open door glass.

(2) Pull upward at rear end of outer belt weatherstrip.

(3) Separate outer belt weatherstrip from vehicle (Fig. 34).

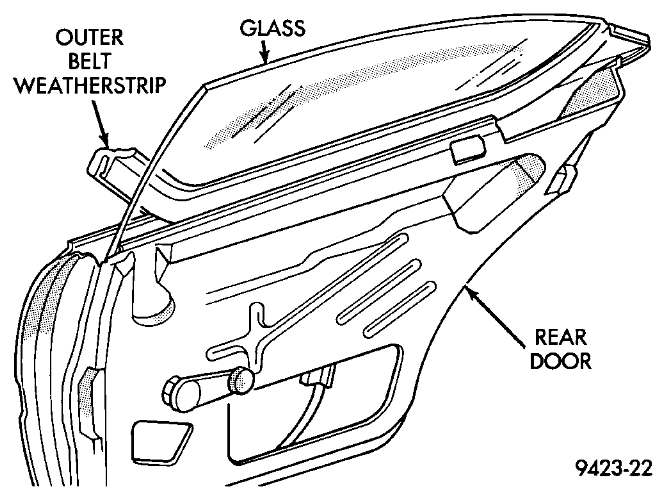


Fig. 34 Outer Belt Weatherstrip—Typical

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Starting at leading edge of door, press weather-strip onto door.

(2) Operate window and check for interference

DOOR

The procedure for servicing the front and rear doors are the same. Refer to the following procedure when servicing either door.

REMOVAL

NOTE: The retaining clips used on the door hinge pins are not to be re-used. Verify availability prior to proceeding.

(1) Open and support door on a suitable lifting device.

(2) Disengage wire connector at hinge pillar, if necessary.

(3) Remove bolts holding door check strap to hinge pillar.

(4) Remove clip holding hinge pin in lower door hinge.

(5) Remove pin from lower hinge (Fig. 35).

(6) Remove clip holding hinge pin in upper hinge.

(7) Remove pin from upper hinge (Fig. 35).

(8) Separate door from vehicle.

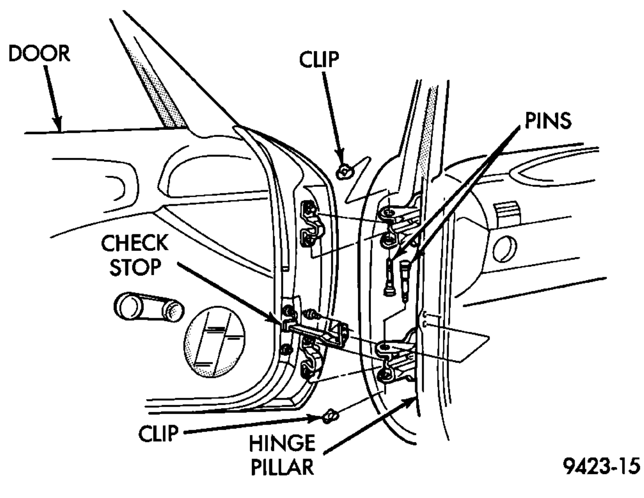


Fig. 35 Door

INSTALLATION

(1) Apply Mopar® Multimileage Grease to inside of door hinge bushings.

(2) Position door on vehicle and install pin in upper hinge. Align knurling on hinge pin with the grooves in the door hinge prior to driving in the hinge pin.

(3) Install pin in lower hinge.

NOTE: Verify that head of each hinge pin is fully seated into door hinge.

(4) Install new clip holding hinge pin in upper hinge.

(5) Install new clip holding pin in lower hinge.

(6) Install bolts holding door check strap to hinge pillar.

(7) Engage wire connector at hinge pillar, if necessary.

DOOR HINGE

The procedure for replacing the front and rear door hinges are the same. Refer to the following procedure when servicing either hinge.

NOTE: If both hinges on one door are to be replaced, remove and install one hinge completely prior to beginning the second hinge.

REMOVAL

(1) Open and support door on a suitable lifting device.

(2) Remove bolts holding door check strap to lower A–pillar for greater access, if necessary.

(3) Mark position of hinge on both the door end frame and lower A–pillar to ease installation.

(4) Remove bolts holding hinge to door end frame (Fig. 36).

(5) Remove bolts holding hinge to lower A–pillar.

(6) Separate door hinge from vehicle.

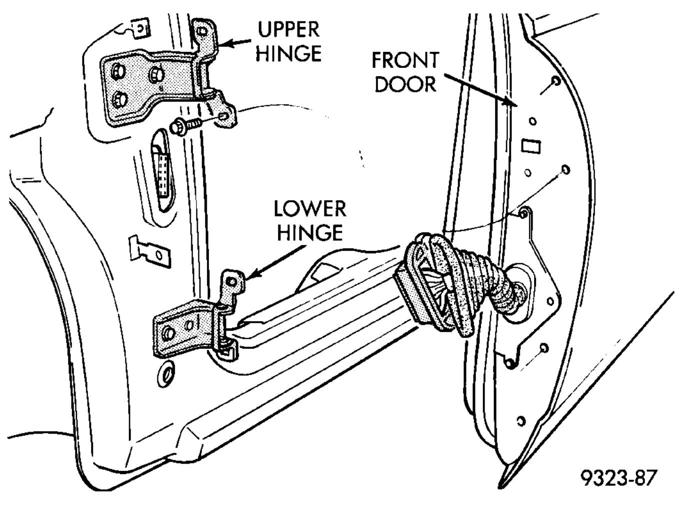


Fig. 36 Door and Hinge—Typical

INSTALLATION

CAUTION: When installing a new hinge, make sure that the head of each hinge pin is fully seated into the door hinge. Also, remove the plastic shipping clip and replace it with the correct metal retaining clip once the hinge pin is seated.

(1) If necessary, paint new door hinge prior to installation.

REMOVAL AND INSTALLATION (Continued)

(2) Position door hinge on vehicle.

(3) Loosely install bolts holding hinge to lower A–pillar.

(4) Loosely install bolts holding hinge to door end frame.

(5) Align hinge to marks made previously and tighten all bolts.

(6) Install bolts holding door check strap to lower A–pillar, if removed previously.

(7) Verify door fit and operation. Adjust door hinge for proper door alignment, if necessary.

FRONT DOOR LATCH STRIKER

REMOVAL

(1) Mark outline of door latch striker on B-pillar to aid installation.

(2) Remove screws holding door latch striker to B-pillar (Fig. 37).

(3) Separate door latch striker from vehicle.

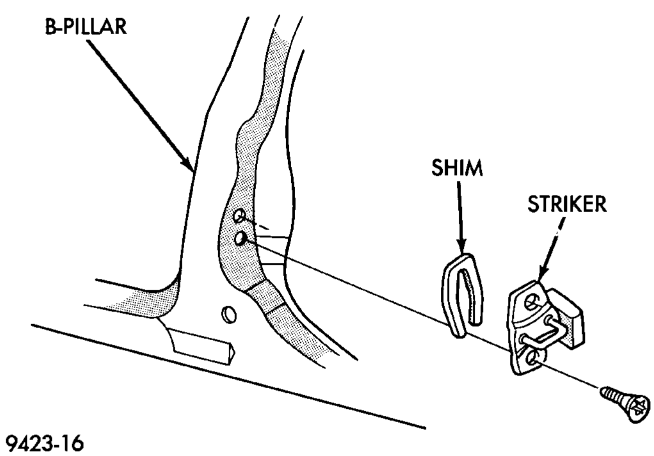


Fig. 37 Front Door Latch Striker

INSTALLATION

Reverse the preceding operation.

FRONT DOOR WEATHERSTRIP

REMOVAL

(1) Using a fork-type prying tool, disengage push-in fasteners holding weatherstrip to door (Fig. 38).

(2) Separate weatherstrip from door.

INSTALLATION

Reverse the preceding operation.

ROOF RAIL WEATHERSTRIP

REMOVAL

(1) Using a fork tool C-4829, Disengage push-in fasteners holding bottom of weatherstrip to B-pillar.

(2) Disengage push-in fasteners holding bottom of weatherstrip to A-pillar (Fig. 39).

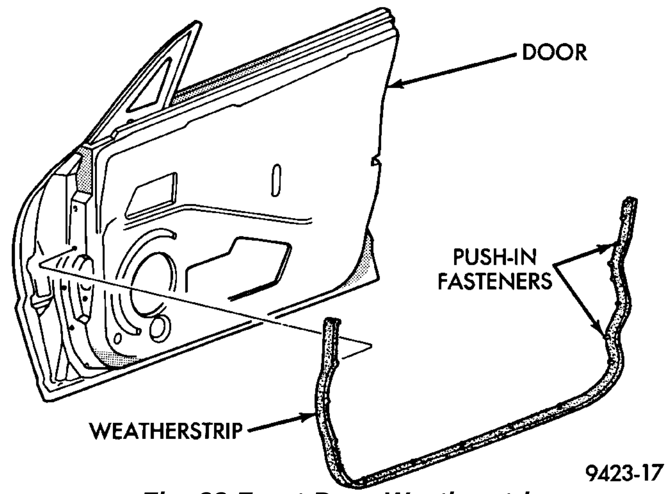


Fig. 38 Front Door Weatherstrip

(3) Pull roof rail weatherstrip from retainer channel.

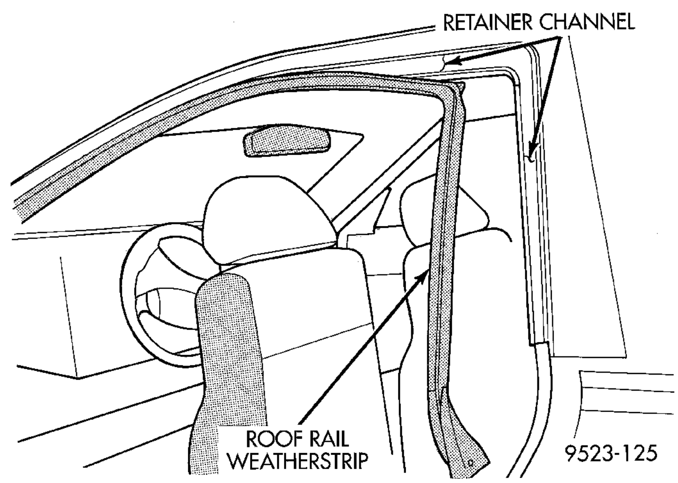


Fig. 39 Roof Rail Weatherstrip

INSTALLATION

Reverse the preceding operation. Zip roof rail weatherstrip into retainer channel using a suitable awl (Fig. 40).

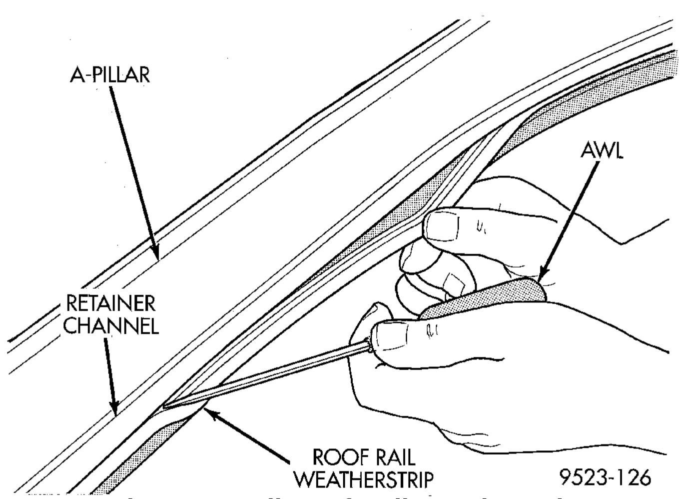


Fig. 40 Install Roof Rail Weatherstrip

REMOVAL AND INSTALLATION (Continued)

ROOF RAIL WEATHERSTRIP

REMOVAL

(1) Remove B-pillar applique.

(2) Remove push-in fasteners holding bottom of roof rail weatherstrip to B-pillar.

(3) Remove push-in fastener holding rearward end of weatherstrip to quarter panel.

(4) Remove push-in fasteners holding weatherstrip to front door hinge pillar.

(5) Pull weatherstrip from retainer channel under drip rail (Fig. 41).

(6) Pull weatherstrip from B-pillar channels.

(7) Separate roof rail weatherstrip from vehicle.

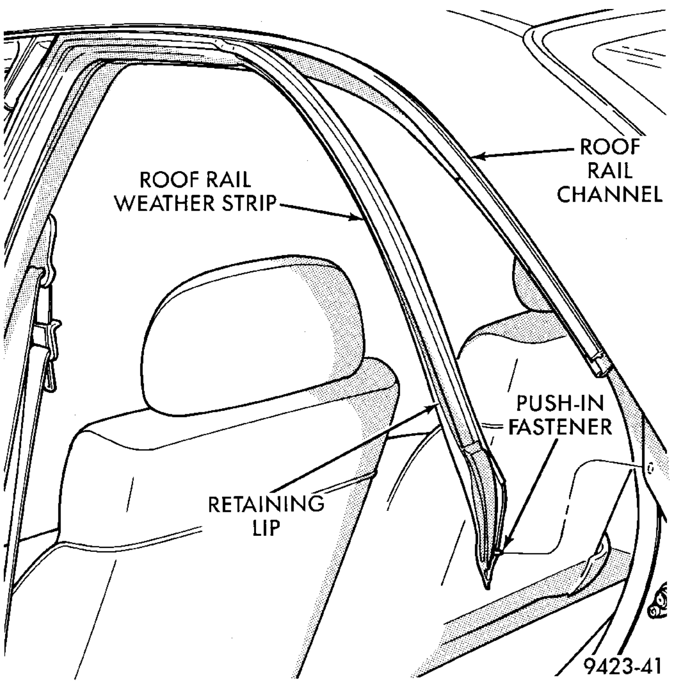


Fig. 41 Roof Rail Weatherstrip

INSTALLATION

(1) Place weatherstrip in position on B-pillar retainer channels.

(2) Insert weatherstrip into channels.

(3) Using a suitable awl, zip retaining lip on back of weatherstrip into B-pillar and roof rail channels.

(4) Install push-in fasteners to hold weatherstrip to B-pillar, hinge pillar and quarter panel.

B-PILLAR APPLIQUE—2 DOOR

REMOVAL

(1) Using a trim stick C-4755, pry bottom of applique away from B-pillar.

(2) Disengage push-in fastener holding bottom of applique to B-pillar.

(3) Separate applique from body side molding tape on back of applique (Fig. 42).

(4) Disengage push-in fastener holding top of applique to B- pillar.

(5) Separate applique from vehicle.

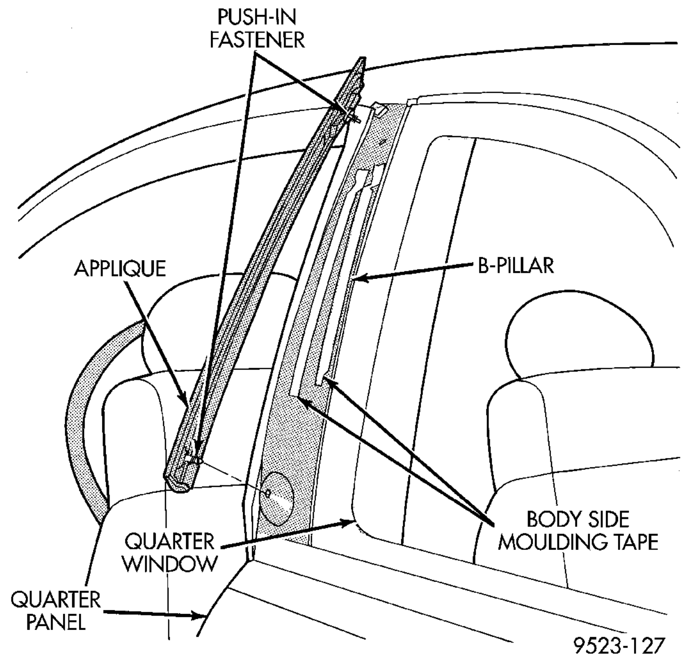


Fig. 42 B-pillar Applique

INSTALLATION

Reverse the preceding operation. Carefully remove adhesive residue from back of applique and B-pillar. Install new body side molding adhesive tape on back of applique.

B-PILLAR APPLIQUE—4 DOOR

REMOVAL

(1) Open doors to gain access to bottom of B-pillar applique.

(2) Disengage push-in fastener holding bottom of applique to B-pillar.

(3) If temperature in work area is below 21°C (70°F), heat applique to aid adhesive separation from fastening tape.

(4) Pull outward at bottom of applique to separate tape from B-pillar.

(5) Disengage push-in fastener holding top of applique to B-pillar.

(6) Separate applique from vehicle (Fig. 43).

INSTALLATION

Reverse the preceding operation. Carefully remove adhesive residue from applique and car body. Apply new body side molding adhesive tape on back side of applique.

REMOVAL AND INSTALLATION (Continued)

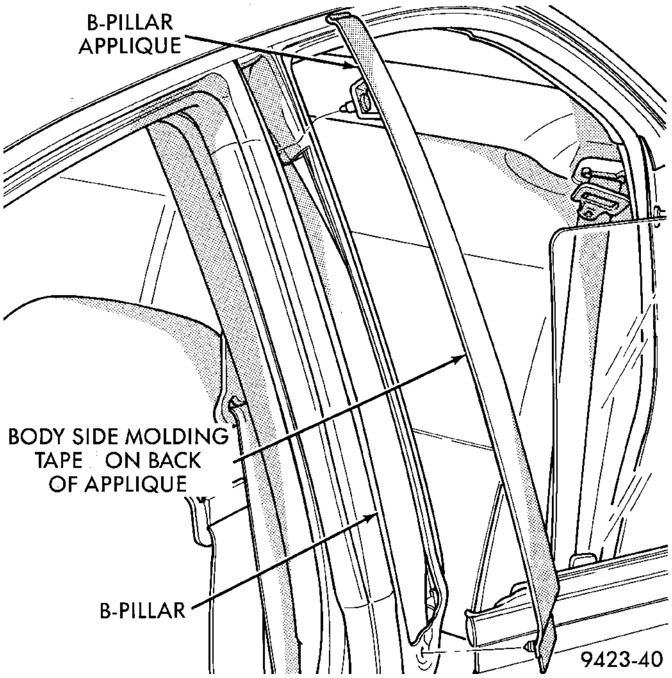


Fig. 43 B-pillar Applique

B-PILLAR WEATHERSTRIP CHANNEL

REMOVAL

(1) Remove B-pillar applique.

(2) Remove push-in fasteners holding weatherstrip to B-pillar.

(3) Pull weatherstrip from B-pillar channels.

(4) Remove screws holding channels to B-pillar (Fig. 44).

(5) Separate channels from B-pillar.

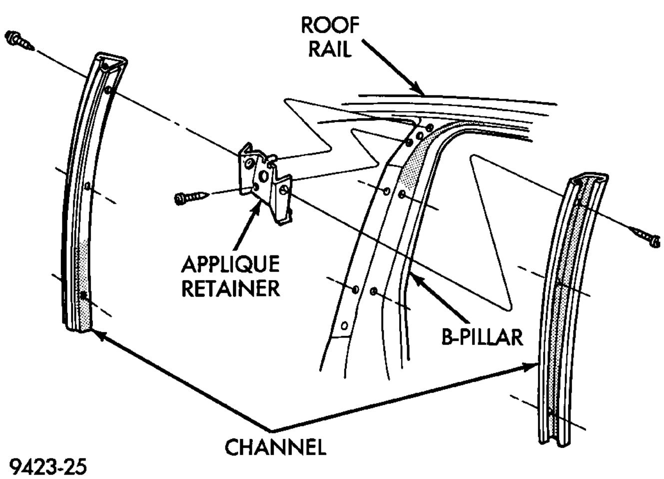


Fig. 44 B-pillar Weatherstrip Channel

INSTALLATION

Reverse the preceding operation.

REAR DOOR TRIM

REMOVAL

(1) Release door latch and open door.

(2) Lower window glass.

(3) Remove window regulator crank.

(4) Remove screw from inside arm rest pull cup.

(5) Remove screw from behind inside latch release handle (Fig. 45).

(6) Disengage push-in fasteners holding trim to door panel around perimeter of trim panel.

(7) Disengage trim panel from retainer channel in inner belt weatherstrip at top of door by lifting while jiggling.

(8) Tilt top of trim panel away from door and disengage clip holding latch rod to handle.

(9) Separate latch rod from handle.

(10) Separate trim panel from door.

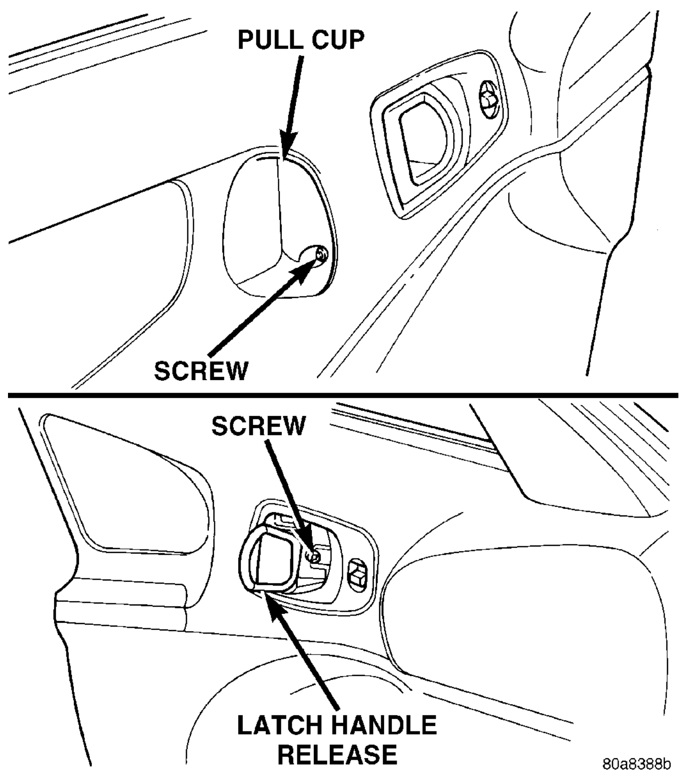


Fig. 45 Rear Door Trim

INSTALLATION

(1) Replace any damaged or missing push–in fasteners from around perimeter of door trim panel.

(2) Place trim panel in position on door.

(3) Insert latch rod into handle and engage clip.

(4) Engage trim panel into retainer channel at top of door.

(5) Locate door trim panel to inner door panel by aligning locating pins on backside of trim panel to mating holes in inner door panel.

(6) Engage push-in fasteners to hold trim to door panel around perimeter of trim panel.

REMOVAL AND INSTALLATION (Continued)

(7) Install screw behind inside latch release handle.

(8) Install screw inside arm rest pull cup.

(9) Install window regulator crank.

REAR DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.

(2) Pull weatherstrip from top of door panel (Fig. 46).

(3) Separate weatherstrip from door.

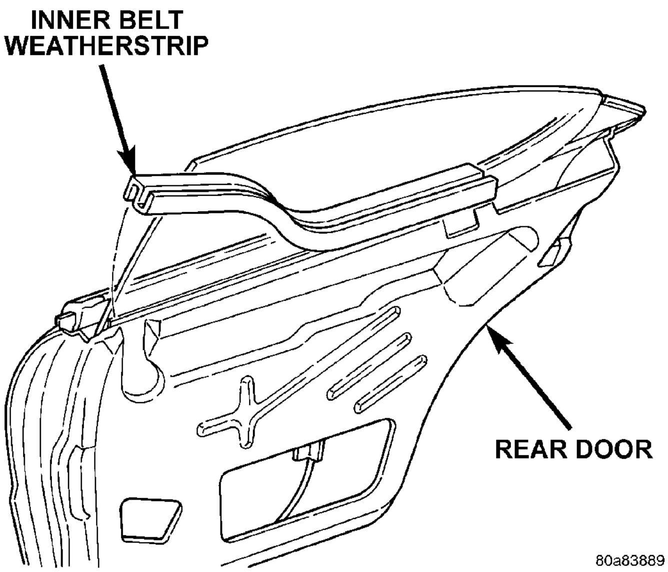


Fig. 46 Rear Door Inner Belt Weatherstrip

INSTALLATION

(1) Place inner belt weatherstrip in position on door.

(2) Push down on weatherstrip to engage channel to door panel.

(3) Install door trim panel.

REAR DOOR GLASS

REMOVAL

(1) Remove door trim panel and water shield.

(2) Remove inner door belt weatherstrip.

(3) Loosen door glass jounce bumper.

(4) Lower door glass to bottom of door.

(5) Remove nuts holding door glass to window regulator lift plate (Fig. 47).

(6) Disengage door glass from regulator.

(7) Lift door glass upward out of the opening at the top of door.

INSTALLATION

(1) Lower door glass through opening in top of door and into position in the window regulator.

(2) Install nuts holding door glass to window regulator lift plate.

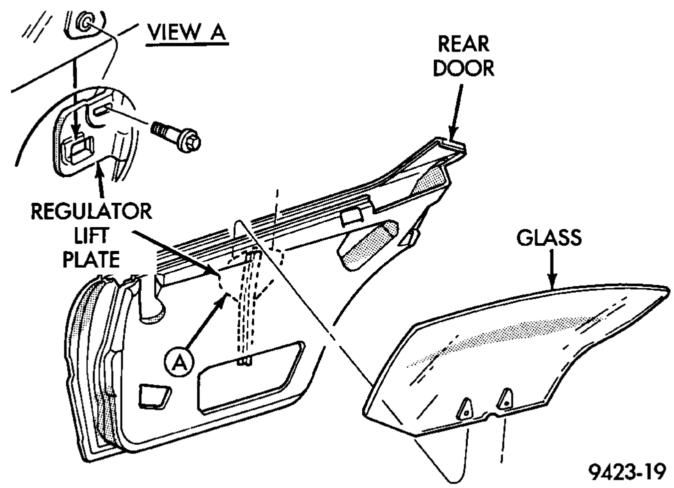


Fig. 47 Rear Door Glass

(3) Raise glass and tighten window inner belt stabilizer.

(4) Install inner door belt weatherstrip, watershield, and door trim panel.

(5) Operate window and check for interference. Adjust glass as necessary.

REAR DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel and watershield.

(2) Remove door glass.

(3) Loosen bolts holding window regulator crank/motor to door panel.

(4) Disengage bolt heads from keyhole slots in door panel.

(5) Loosen bolts holding window regulator lift bar to door panel.

(6) Disengage bolt heads from keyhole slots in door panel (Fig. 48).

(7) Remove window regulator from door through access hole in inner panel.

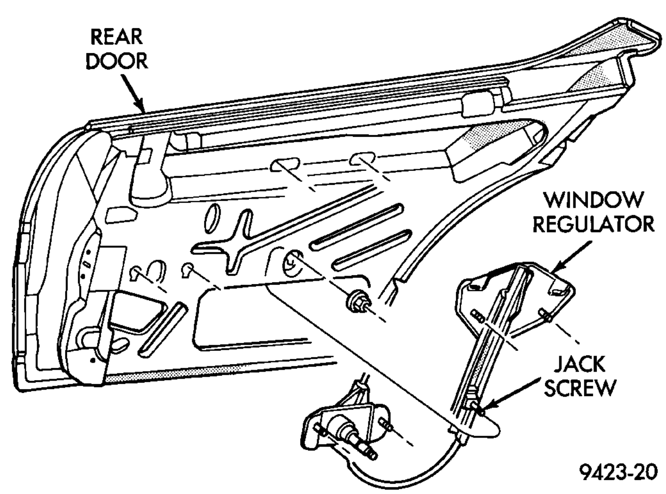


Fig. 48 Rear Door Window Regulator

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Move window regulator into position and engage bolt heads into key-hole slots in inner door panel.

(2) Tighten bolts holding window regulator lift bar to inner door panel.

(3) Engage window regulator crank/motor bolts into key-hole slots in door panel.

(4) Tighten window regulator crank/motor bolts.

(5) Install door glass, watershield, and door trim panel.

REAR DOOR LATCH

REMOVAL

(1) Remove door trim panel and water shield.

(2) Close door glass.

(3) Disconnect lock and latch rods from door latch.

(4) Disengage wire connector from power door lock motor, if equipped.

(5) Remove screws holding latch to door end frame (Fig. 49).

(6) Separate door latch from vehicle.

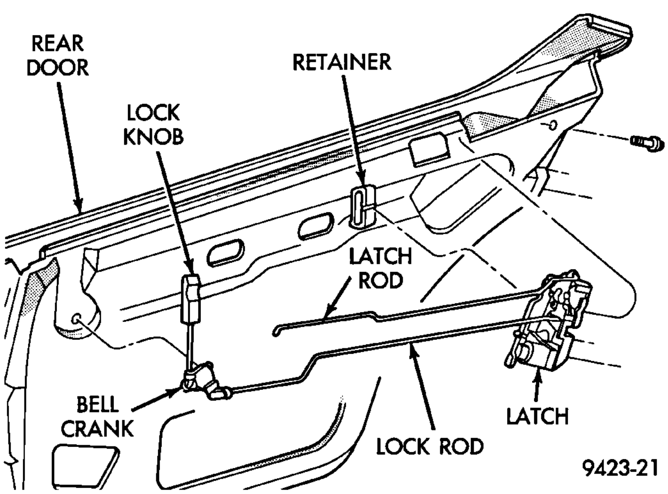


Fig. 49 Rear Door Latch

INSTALLATION

CAUTION: Do not close door before adjusting the door latch. Door may fail to open.

(1) Position door latch on vehicle and install screws holding latch to door end frame.

(2) Engage wire connector to power door lock motor, if so equipped.

(3) Connect lock and latch rods to door latch.

(4) Install watershield and door trim panel.

REAR DOOR LOCK BELL CRANK

REMOVAL

(1) Remove door trim panel and water shield.

(2) Disengage clips holding lock rods to bell crank.

(3) Separate lock rods from bell crank.

(4) Rotate bell crank to align retaining tabs to slots in door panel.

(5) Separate bell crank from door.

INSTALLATION

Reverse the preceding operation.

REAR DOOR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Open door glass.

(2) Pull upward at rear end of outer belt weather-strip.

(3) Separate outer belt weatherstrip from vehicle (Fig. 50).

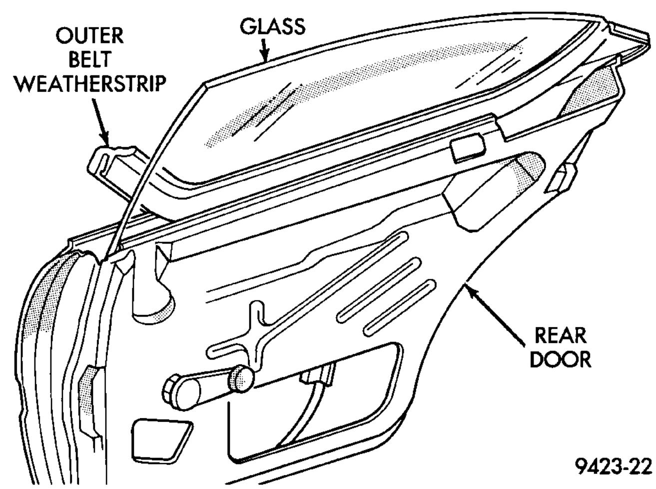


Fig. 50 Rear Door Outer Belt Weatherstrip

INSTALLATION

Reverse the preceding operation.

REAR DOOR LATCH STRIKER

REMOVAL

(1) Mark outline of door latch striker on B-pillar to aid installation.

REMOVAL AND INSTALLATION (Continued)

(2) Remove screws holding door latch striker to B-pillar (Fig. 51).

(3) Separate door latch striker from vehicle.

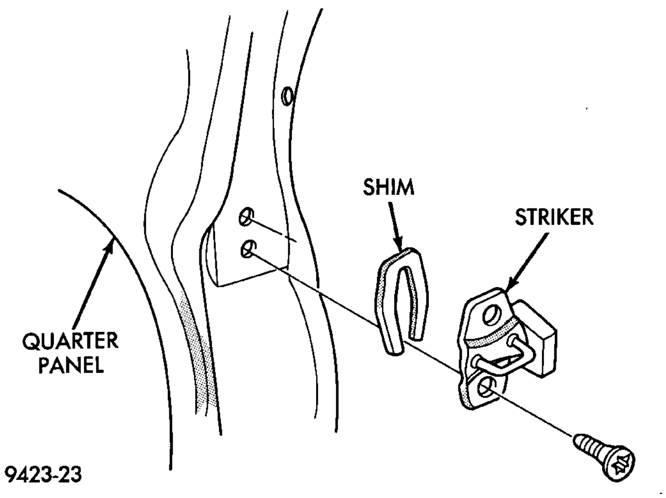


Fig. 51 Rear Door Latch Striker

INSTALLATION

Reverse the preceding operation.

REAR DOOR INTERLOCK LATCH STRIKER

REMOVAL

(1) Release door latch and open rear door.

(2) Mark outline of interlock striker on C-pillar to aid installation.

(3) Remove interlock striker from vehicle (Fig. 52).

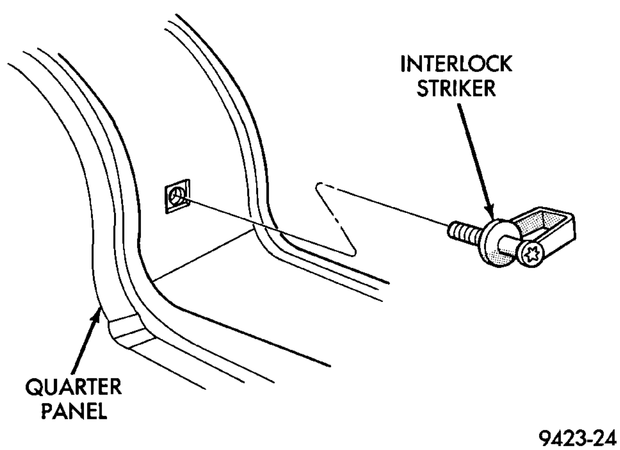


Fig. 52 Rear Door Interlock Latch Striker

INSTALLATION

Reverse the preceding operation.

FLOOR CONSOLE

REMOVAL

(1) Fully apply parking brake.

(2) Remove screw cover plugs over screws just rearward of cupholders.

(3) Remove screws holding console to floor bracket just rearward of cupholders (Fig. 53).

(4) Open console storage compartment lid, if so equipped.

(5) Remove screw cover plugs over screws near rear of console, if vehicle is equipped with a non–armrest console.

(6) Remove screws holding console to floor bracket.

(7) Snap out side attachment covers, if equipped (Fig. 53).

(8) Remove side attachment bolts holding rear of console to floor bracket, if equipped.

(9) Remove shift lever knob, if vehicle is equipped with a manual transmission.

(10) Lift console upward over gear selector and park brake handle.

(11) Separate console from vehicle.

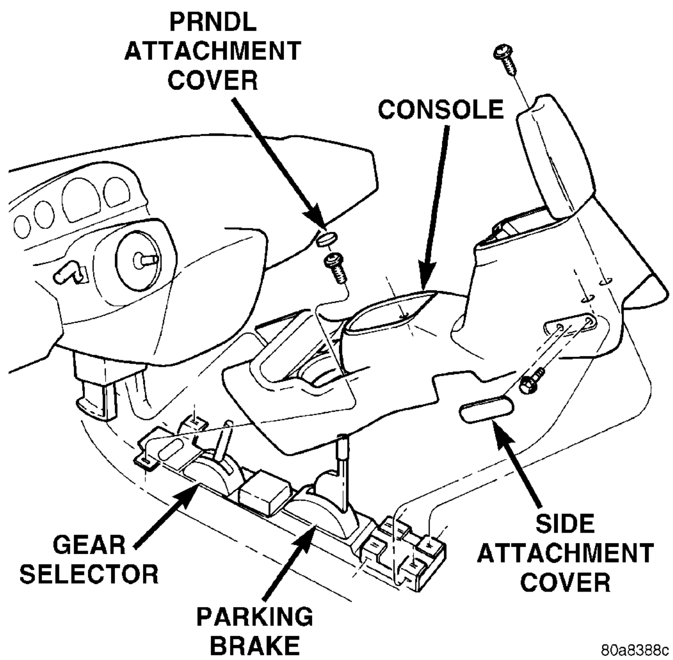


Fig. 53 Floor Console

INSTALLATION

(1) Move floor console into position in vehicle.

(2) Install screws holding console to floor brackets.

(3) Install screw cover plugs.

(4) Install side attachment covers, if equipped.

(5) Install shift lever knob, if vehicle is equipped with a manual transmission.

(6) Release parking brake and close console storage compartment lid, if so equipped.

DOOR SILL TRIM

REMOVAL

(1) Open door to gain access to sill trim.

REMOVAL AND INSTALLATION (Continued)

(2) Disengage clips holding sill trim to door sill and door opening flange.

(3) Separate door sill trim from vehicle (Fig. 54).

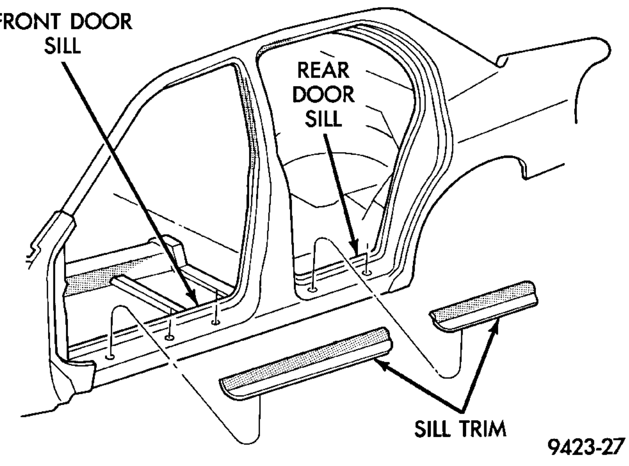


Fig. 54 Door Sill Trim

INSTALLATION

(1) Position door sill trim on door sill.

(2) Align locating pins on backside of trim panel to holes in door sill.

(3) Engage clips on trim panel into slots in door sill.

(4) Engage clips on trim panel onto door opening flange.

(5) Press downward on trim panel to fully engage all clips.

DOOR OPENING TRIM WELT

REMOVAL

(1) Open door to gain access to trim welt.

(2) Remove door sill trim panel.

(3) Pull trim welt from door opening flange (Fig. 55).

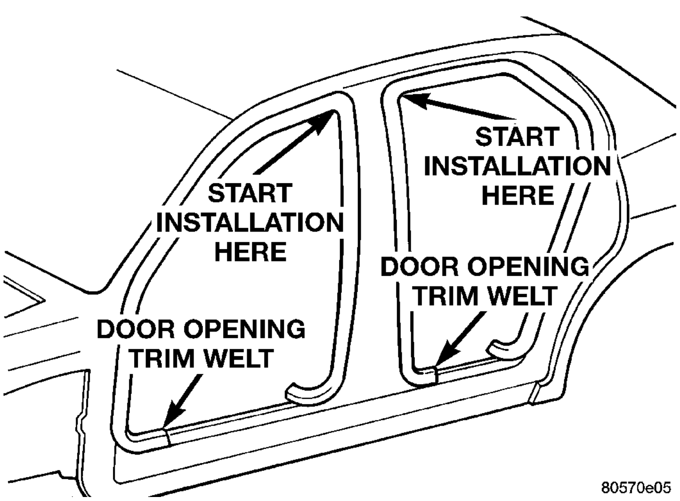


Fig. 55 Door Opening Trim Welt

INSTALLATION

(1) Locate paint dot on backside of trim welt.

(2) Position trim welt to vehicle with paint dot in the appropriate position.

(3) Press trim welt onto door opening flange starting at the paint dot position.

(4) Install door sill trim panel

A-PILLAR TRIM

REMOVAL

(1) Remove instrument panel top cover.

(2) Disengage clips holding trim to A-pillar.

(3) Separate A-pillar trim from vehicle (Fig. 56).

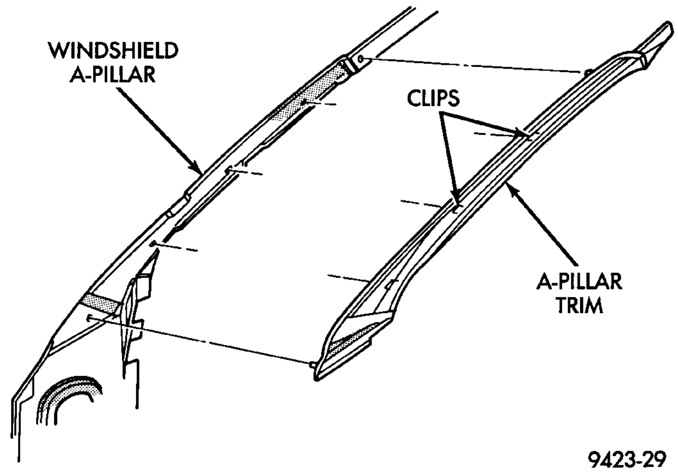


Fig. 56 A-pillar Trim

INSTALLATION

(1) Position A–pillar trim panel to A–pillar.

(2) Align locating pins on backside of trim panel to mating holes in A–pillar.

(3) Push clips on trim panel into slots in A–pillar.

(4) Install instrument panel top cover.

SIDE COWL TRIM

REMOVAL

(1) Disengage clips holding cowl trim to cowl side panel.

(2) Separate cowl trim from vehicle (Fig. 57).

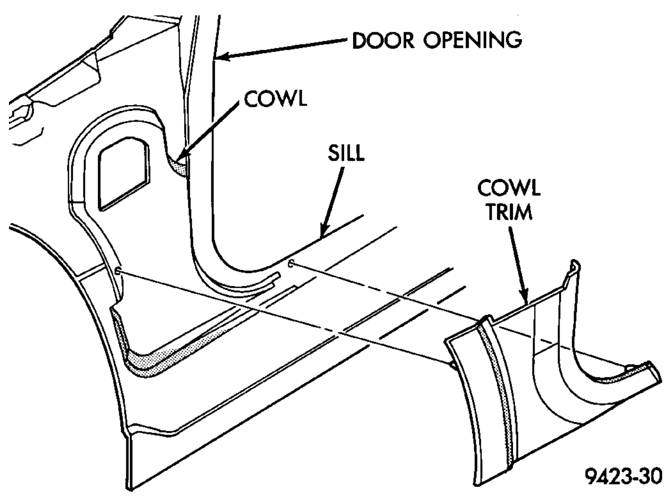


Fig. 57 Side Cowl Trim

INSTALLATION

(1) Position cowl trim panel to inner cowl panel.

REMOVAL AND INSTALLATION (Continued)

(2) Align locating pins on backside of cowl trim panel to mating holes in inner cowl panel.

(3) Push clips on trim panel into slots in inner cowl panel.

B-PILLAR TRIM—4 DOOR

REMOVAL

(1) Remove bolt holding lower seat belt anchor to floor pan kick-up.

(2) Remove shoulder belt height control knob.

(3) Remove bolt holding turning loop to belt adjuster (Fig. 58).

(4) Remove access cover from B-pillar trim.

(5) Disengage clips holding trim to B-pillar.

(6) Feed seat belt turning loop and seat belt through trim panel.

(7) Separate B-pillar trim from vehicle.

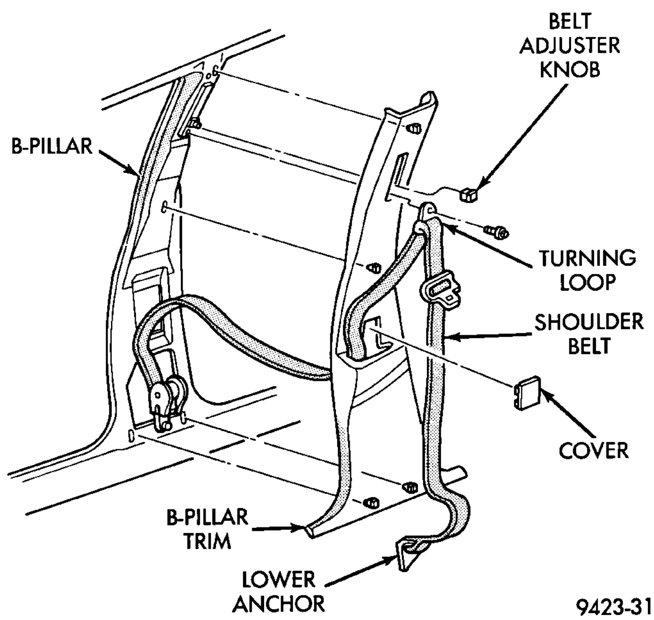


Fig. 58 B-pillar Trim

INSTALLATION

(1) Position B–pillar trim panel near B–pillar.

(2) Feed seat belt turning loop and seat belt through trim panel.

(3) Align locating pins on backside of trim panel to mating holes in B–pillar.

(4) Push clips on trim panel into slots in B–pillar.

(5) Install access cover to B-pillar trim.

(6) Install bolt holding turning loop to belt adjuster.

(7) Install shoulder belt height control knob.

(8) Install bolt holding lower seat belt anchor to floor pan kick-up.

QUARTER TRIM PANEL—2 DOOR

REMOVAL

(1) Remove rear seat cushion and back.

(2) Slide lower seat belt anchor cover up the webbing to expose the belt.

(3) Remove bolt holding lower seat belt anchor to floor.

(4) Separate seat belt from floor.

(5) Remove screw holding coat hook to top of quarter trim panel.

(6) Disengage hidden clips holding quarter trim panel to inner quarter panel. (Fig. 59)

(7) Separate trim from quarter panel.

(8) Feed seat belt webbing through access hole in trim panel.

(9) Separate quarter trim panel from vehicle.

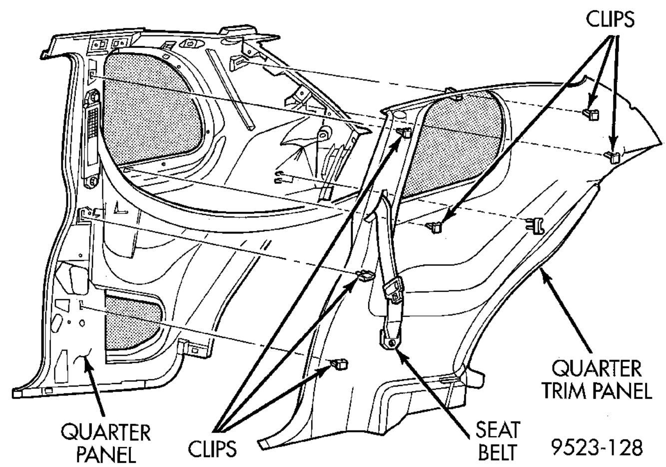


Fig. 59 Quarter Trim Panel

INSTALLATION

(1) Feed seat belt webbing through access hole in trim panel.

(2) Position trim panel near inner quarter panel.

(3) Align locating pins on backside of trim panel to mating holes in inner quarter panel.

(4) Push clips on trim panel into slots in inner quarter panel starting with the clips located near locating pins.

(5) Install screw holding coat hook to top of quarter trim panel.

(6) Install bolt securing seat belt anchor to floor.

(7) Slide lower seat belt anchor cover down to cover anchor bolt.

(8) Install rear seat cushion and seat back.

REMOVAL AND INSTALLATION (Continued)

UPPER QUARTER TRIM—4 DOOR

REMOVAL

(1) Disengage clips holding trim to upper quarter panel (Fig. 60).

(2) Separate upper trim panel from vehicle.

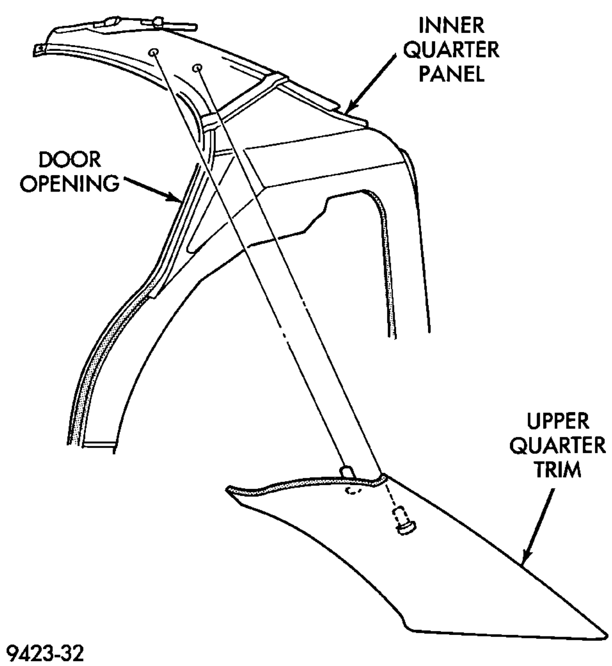


Fig. 60 Upper Quarter Trim

INSTALLATION

(1) Check to ensure that electric rear window wiring is positioned correctly in the roof channel provided.

(2) Position trim panel in vehicle.

(3) Align locating pins on backside of trim panel to mating holes in upper quarter panel.

(4) Push clips on trim panel into slots in upper quarter panel.

LOWER QUARTER TRIM—4 DOOR

REMOVAL

(1) Remove upper quarter trim panel.

(2) Remove rear seat cushion and back.

(3) Disengage clips holding trim to lower quarter panel.

(4) Remove seat belt from slot in trim panel.

(5) Separate lower quarter trim from vehicle (Fig. 61).

INSTALLATION

(1) Position lower quarter trim panel to vehicle.

(2) Install seat belt to slot in trim panel.

(3) Align locating pins on backside of trim panel to mating holes in inner quarter panel.

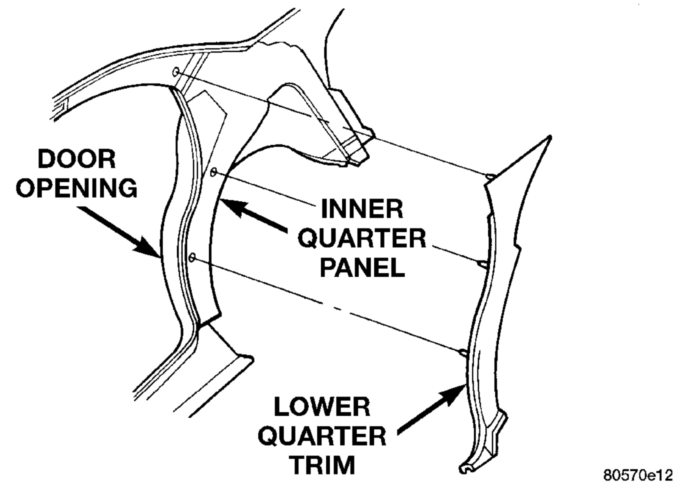


Fig. 61 Lower Quarter Trim—4 Door

(4) Press clips on trim panel into slots in inner quarter panel.

(5) Install rear seat back and cushion.

(6) Install upper quarter trim panel.

PARCEL SHELF TRIM

REMOVAL

(1) Remove upper quarter trim from one side of vehicle.

(2) Remove rear seat cushion and back.

(3) Remove bolts holding rear seat shoulder belt lower anchors to floor pan.

(4) Disengage seat belt bezel from parcel shelf.

(5) Separate parcel shelf trim from vehicle.

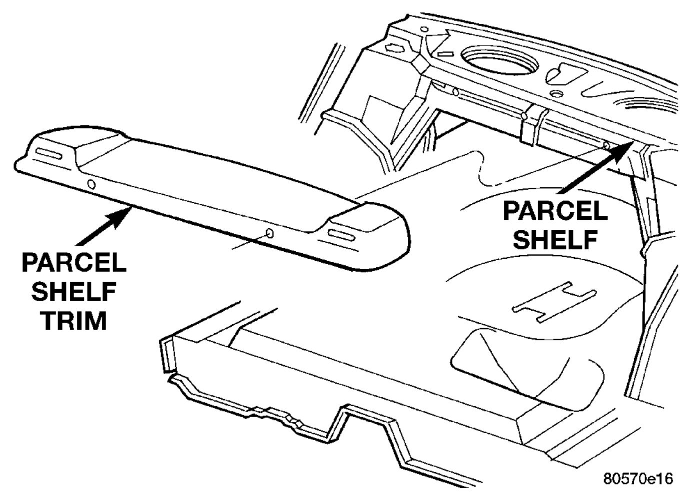


Fig. 62 Parcel Shelf Trim

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

FRONT OUTBOARD SEAT BELT

REMOVAL

(1) Slide lower seat belt anchor cover upward to expose bolt.

(2) Remove bolt holding lower anchor bolt to floor below door sill (Fig. 63).

(3) Separate lower anchor from floor.

(4) Remove rear seat cushion and back.

(5) Remove quarter trim panel.

(6) Guide seat belt webbing through slot in quarter trim panel.

(7) Disengage wire connector from seat belt retractor.

(8) Remove bolts holding seat belt retractor to B-pillar (Fig. 64).

(9) Separate seat belt retractor from vehicle.

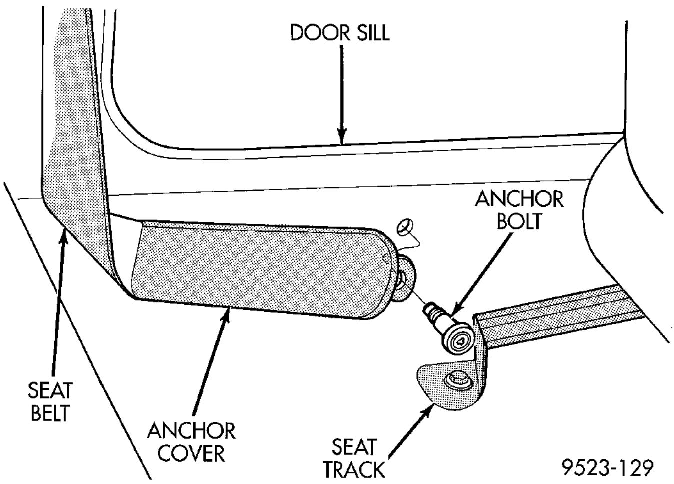


Fig. 63 Front Outboard Seat Belt Anchor

INSTALLATION

Reverse the preceding operation. Tighten seat belt anchor bolt to 39 N·m (29 ft. lbs.).

FRONT SEAT BELT BUCKLE

REMOVAL

(1) Move front seat to the forward position.

(2) Remove bolt holding seat belt buckle to seat.

(3) Separate seat belt buckle from seat.

INSTALLATION

Reverse the preceding operation.

FRONT SEAT BELT RETRACTOR

REMOVAL

(1) Remove B-pillar trim.

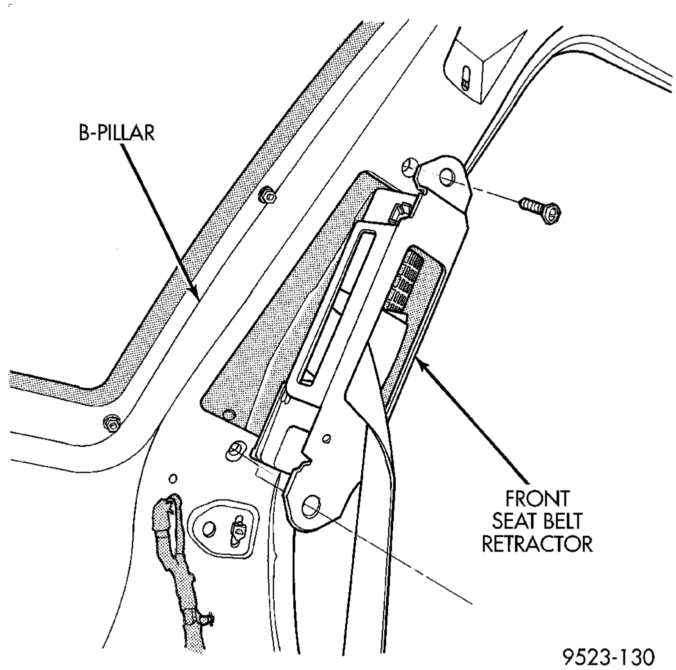


Fig. 64 Front Outboard Seat Belt Retractor

(2) Remove bolt holding seat belt retractor to B-pillar (Fig. 65).

(3) Separate seat belt retractor from vehicle.

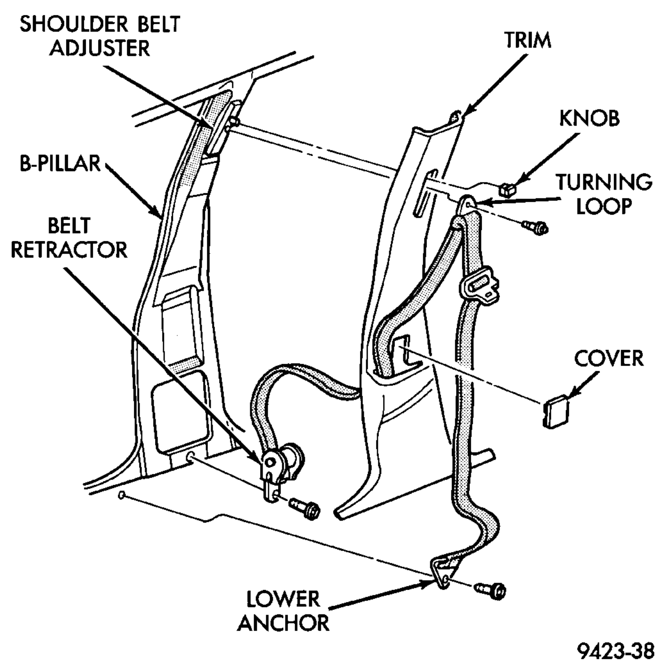


Fig. 65 Front Seat Belt Retractor

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

FRONT SHOULDER BELT ADJUSTER

REMOVAL

(1) Remove B-pillar trim.

(2) Remove bolt holding shoulder belt adjuster to B-pillar (Fig. 66).

(3) Separate shoulder belt adjuster from vehicle.

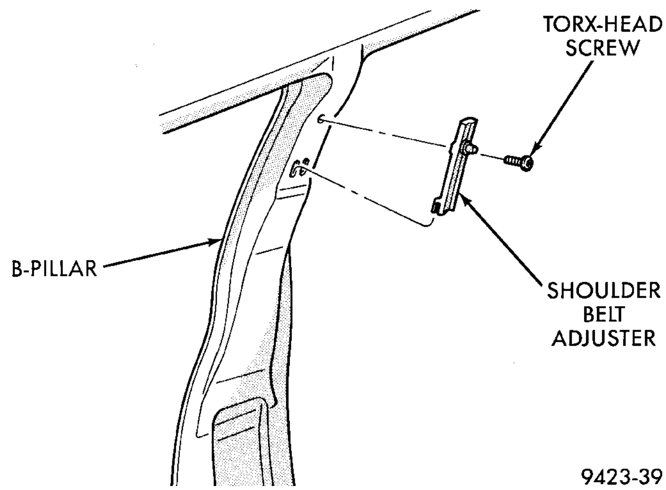


Fig. 66 Front Shoulder Belt Adjuster

INSTALLATION

Reverse the preceding operation.

REAR SEAT BELT BUCKLE

REMOVAL

(1) Remove rear seat cushion.

(2) Remove rear seat back.

(3) Separate rear seat belt buckle from vehicle.

INSTALLATION

Reverse the preceding operation.

REAR SEAT BELT RETRACTOR

REMOVAL

(1) Remove rear seat cushion and back.

(2) Remove seat belt bezel from parcel shelf cover.

(3) Remove rear seat closure panel silencer pad as necessary to gain access to retractor.

(4) Remove bolt holding seat belt lower anchor to floor.

(5) Remove bolt holding retractor to rear seat closure panel (Fig. 67).

(6) Push seat belt bezel and buckle stab through access hole in parcel shelf.

(7) From in luggage compartment, separate rear seat belt retractor from vehicle.

INSTALLATION

Reverse the preceding operation.

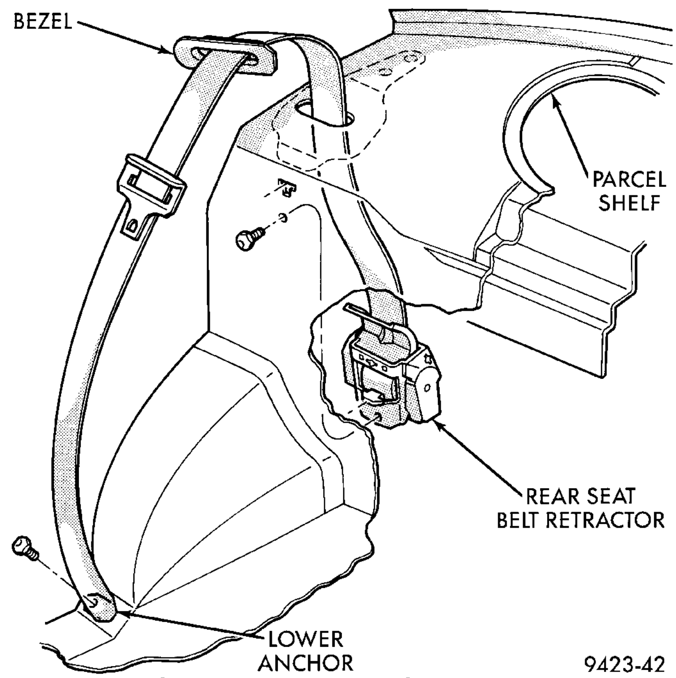


Fig. 67 Rear Seat Belt Retractor

CARPET

REMOVAL

(1) Remove front seats.

(2) Remove rear seat cushion.

(3) Remove bolts holding front seat belt lower anchors to floor (Fig. 68).

(4) Remove door sill trim covers.

(5) Remove cowl trim covers.

(6) Remove center floor console.

(7) Remove trunk release assist handle.

(8) Remove lower fasteners from B–pillar trim panel.

(9) Pull carpet from behind trim panel.

(10) Fold carpet in half toward rear seat.

(11) Remove carpet through rear door opening.

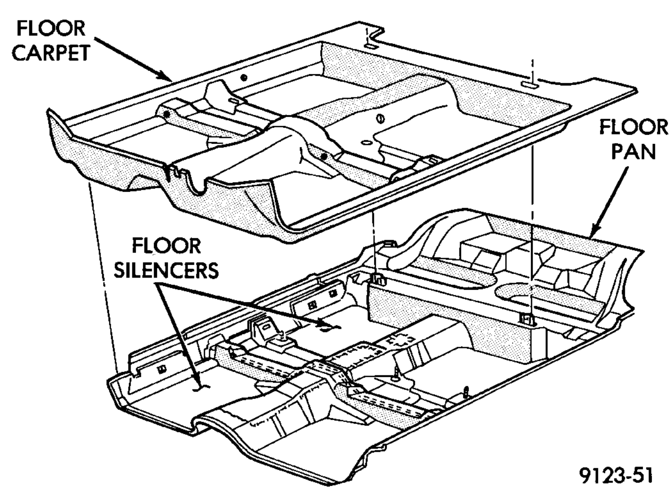


Fig. 68 Carpet

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install carpet through rear door opening.
(2) Unfold carpet.
(3) Tuck carpet behind trim panel.
(4) Install lower fasteners holding B–pillar trim panel.
(5) Install trunk release assist handle.
(6) Install center floor console.
(7) Install cowl trim covers.
(8) Install door sill trim covers.
(9) Install bolts holding front seat belt lower anchors to floor.
(10) Install rear seat cushion.
(11) Install front seats.

HEADLINING

REMOVAL

(1) Remove screws holding sun visors to roof header panel.
(2) Disengage wire connector from lighted vanity mirror, if so equipped.
(3) Separate sun visors from vehicle.
(4) Remove A-pillar trim covers.
(5) Remove B-pillar trim panels, if vehicle is a 4 door.
(6) Remove (upper) quarter panel trim panels.
(7) Remove assist handles, if so equipped.
(8) Remove sun visor hooks.
(9) Remove coat hooks, if vehicle is a 4 door.
(10) If vehicle is equipped with a sunroof;
(a) Open sunroof.
(b) Remove trim welt around sunroof opening (Fig. 69).
(c) Remove sunroof switch pod.
(d) Disconnect sunroof switch pod wire connectors.
(e) Remove screw holding switch pod retainer to roof.
(11) Remove push–in fastener at rear of headlining.
(12) Disengage dome lamp wire connector, at rear of headlining.
(13) Remove push–in fastener holding wiring to C–pillar.
(14) Remove headlining through door opening (Fig. 70).

INSTALLATION

(1) Position headlining in vehicle.
(2) Install sun visor hooks.
(3) Install coat hooks, if vehicle is a 4 door.
(4) Install push–in fastener at rear of headlining.
(5) Install assist handles, if so equipped.
(6) Install push–in fastener holding headliner wiring to C–pillar.

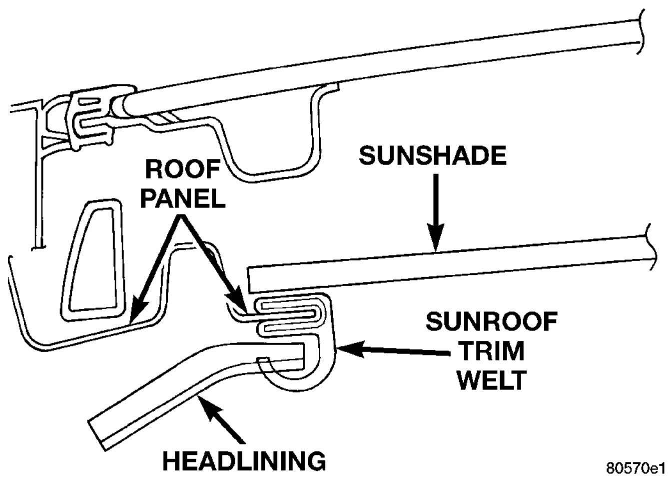


Fig. 69 Sunroof Opening Trim Welt

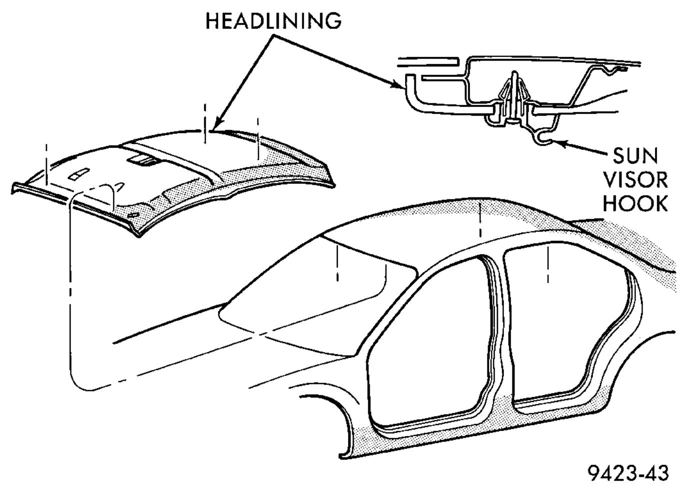


Fig. 70 Headlining

(7) Engage dome lamp wire connector, at rear of headlining.
(8) If vehicle is equipped with a sunroof;
(a) Install screw holding switch pod retainer to roof.
(b) Connect sunroof switch pod wire connectors.
(c) Install sunroof switch pod.
(d) Install trim welt around sunroof opening (Fig. 69).
(e) Close sunroof.
(9) Install (upper) quarter panel trim panel.
(10) Install B-pillar trim panels, if vehicle is a 4 door.
(11) Install A-pillar trim covers.
(12) Install sun visors, lighted vanity mirror wire connector, if so equipped, and screws holding sun visors to roof header panel.

REMOVAL AND INSTALLATION (Continued)

BODY VENT

REMOVAL

(1) Hoist rear end of vehicle and support on safety stands.

(2) From behind rear bumper fascia below quarter panel, disengage clips holding body vent to trunk well.

(3) Separate body vent from vehicle (Fig. 71).

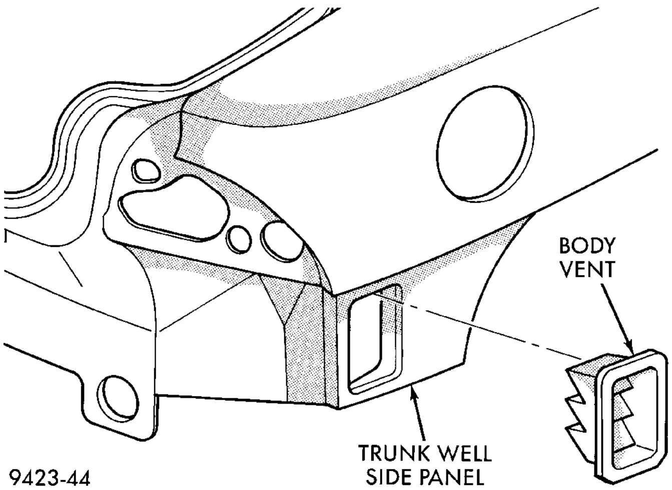


Fig. 71 Body Vent

INSTALLATION

Reverse the preceding operation.

TRUNK LID

REMOVAL

(1) Release trunk latch and open trunk lid.

(2) Mark bolt locations on inside of trunk lid to aid installation.

(3) Disengage clips holding wire harness and trunk lid release cable to trunk lid.

(4) Disengage wire connector and release cable from trunk latch.

(5) Remove bolts holding top of hinge to trunk lid (Fig. 72).

(6) With aid from a helper, remove bolts holding bottom of hinge to trunk lid.

(7) Separate trunk lid from vehicle.

INSTALLATION

(1) Place trunk lid in position on vehicle.

(2) With aid from a helper, install bolts to hold bottom of hinge to trunk lid.

(3) Install bolts to hold top of hinge to trunk lid.

(4) Align trunk lid to achieve equal spacing on all sides and flush across gaps.

(5) Verify trunk lid operation and sealing.

(6) Connect wire connector and release cable on latch.

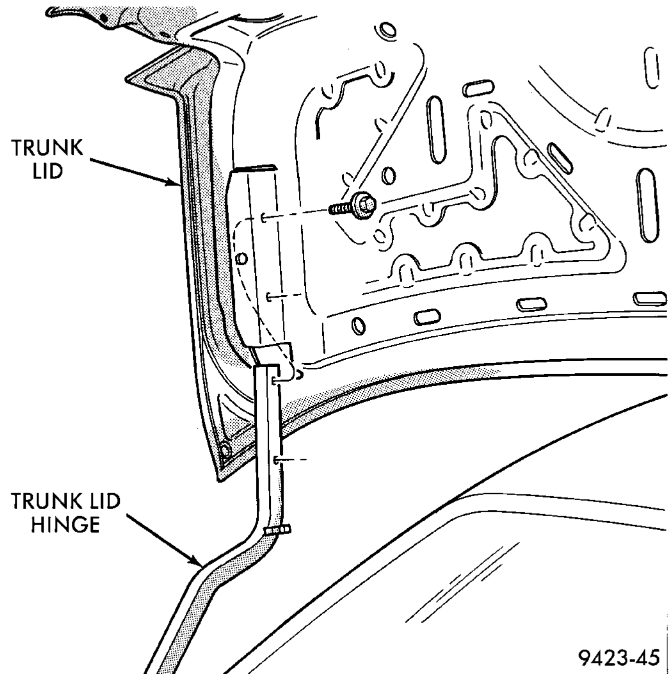


Fig. 72 Trunk Lid

(7) Install clips to hold wire harness and cable to trunk lid.

TRUNK LID LIFT SPRINGS

REMOVAL

WARNING: USE EYE AND HAND PROTECTION WHEN REMOVING SPRINGS, PERSONAL CAN RESULT.

(1) Release trunk and open trunk lid.

(2) Support trunk lid on a suitable prop device.

(3) Pull split cover from lift spring (Fig. 73).

(4) Using a common plier, disengage spring from adjustment slot under trunk opening side trough.

(5) Disengage spring from trunk lid hinge.

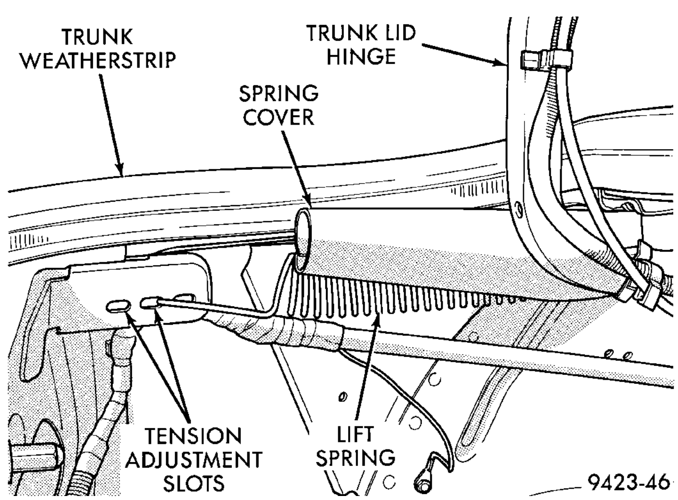


Fig. 73 Trunk Lid Lift Springs

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

Reverse the preceding operation.

TRUNK WEATHERSTRIP

REMOVAL

(1) Release trunk lid latch and open trunk lid.

(2) Pull trunk lid weatherstrip form trunk opening fence (Fig. 74).

(3) Separate weatherstrip from vehicle.

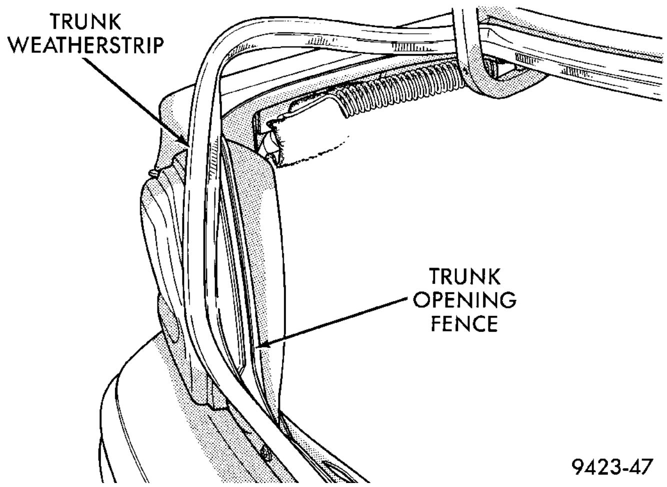


Fig. 74 Trunk Weatherstrip

INSTALLATION

Reverse the preceding operation.

TRUNK LATCH STRIKER

REMOVAL

(1) Release trunk lid latch and open trunk lid.

(2) Remove push-in fasteners holding trunk lining to tail panel.

(3) Separate trunk lining from tail panel.

(4) Remove bolts holding trunk latch striker to tail panel (Fig. 75).

(5) Separate striker from vehicle.

INSTALLATION

Reverse the preceding operation.

TRUNK LATCH

REMOVAL

(1) Release trunk lid latch and open trunk lid.

(2) Remove bolts holding trunk latch to trunk lid (Fig. 76).

(3) Separate trunk latch from trunk lid.

(4) Disconnect remote trunk latch release cable form trunk latch.

(5) Disengage trunk ajar switch connector from latch.

(6) Separate latch from vehicle.

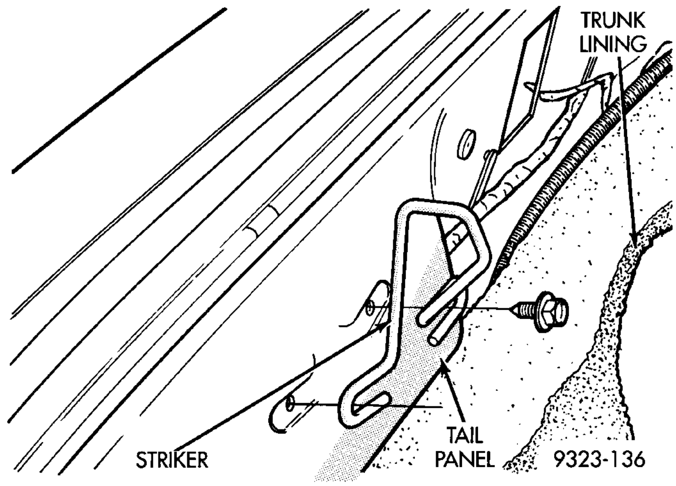


Fig. 75 Trunk Latch Striker

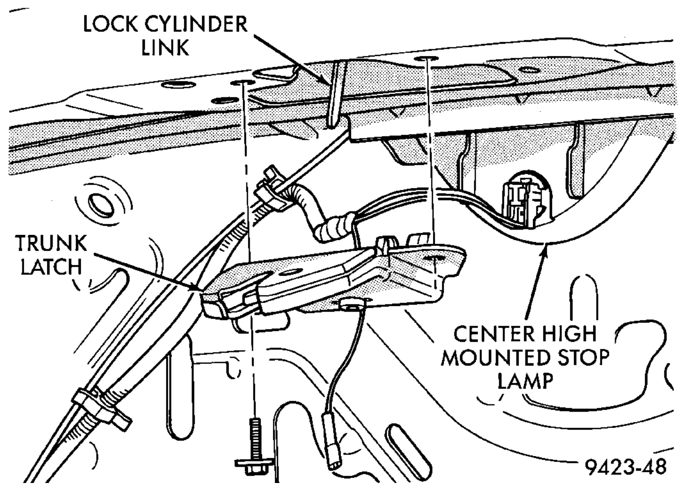


Fig. 76 Trunk Latch

INSTALLATION

(1) Position latch in vehicle and engage trunk ajar switch connector to latch.

(2) Connect remote trunk latch release cable to trunk latch.

(3) Install bolts holding trunk latch to trunk lid.

TRUNK LOCK CYLINDER

REMOVAL

(1) Remove trunk latch.

(2) Remove clip holding trunk lock cylinder to trunk lid.

(3) Pull lock cylinder from trunk lid (Fig. 77).

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

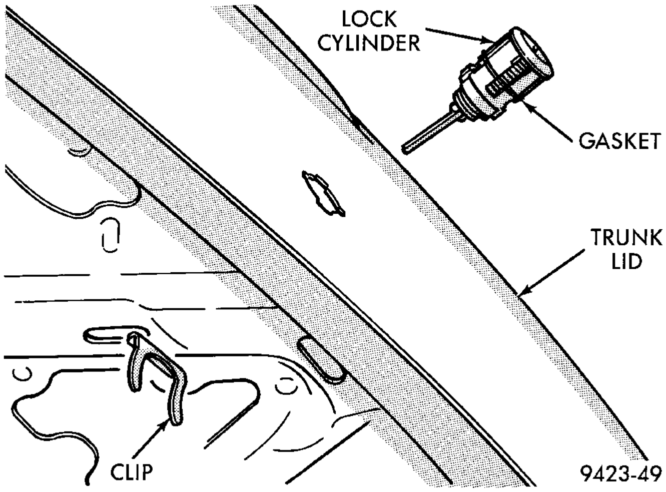


Fig. 77 Trunk Lock Cylinder

TRUNK CARPET

REMOVAL

(1) Remove push in fasteners holding carpet to shelf panel. Fasteners are accessed from inside the vehicle (Fig. 78).

(2) Pull out leading flaps of the carpet through the opening from the shelf panel.

(3) Pull carpet from under the springs.

(4) Remove trunk carpet from vehicle.

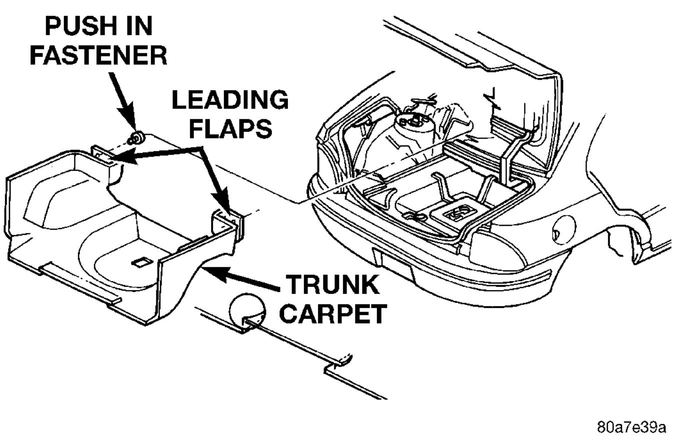


Fig. 78 Trunk Carpet

INSTALLATION

(1) Place carpet in truck and smooth out.

(2) Tuck both sides of the carpet ends under springs.

(3) Position the leading flaps of the carpet through the opening onto the shelf panel.

(4) Install push in fasteners to secure the carpet to shelf panel (install fasteners from inside the vehicle).

(5) Overlap the slits in the back of the carpet so the center section lays over the outer sections.

TRUNK TRIM PANEL

Removal

(1) Remove fasteners holding trunk trim panel to vehicle (Fig. 79).

(2) Remove trunk trim panel from vehicle.

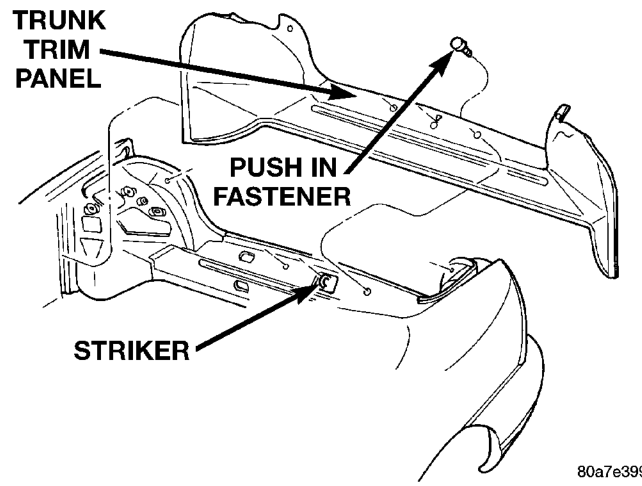


Fig. 79 Trunk Trim Panel

Installation

(1) Position panel to deck lid over the stricker.

(2) Install push in fasteners.

(3) Position and tuck the upper flange into existing trim panel on both sides.

(4) Push the corners in place under seal.

(5) Seat the lower edges of the carpet and smooth out.

REAR SPOILER

REMOVAL

(1) Release trunk latch and open trunk lid.

(2) Remove nuts holding spoiler to trunk lid.

(3) Separate spoiler from trunk lid (Fig. 80).

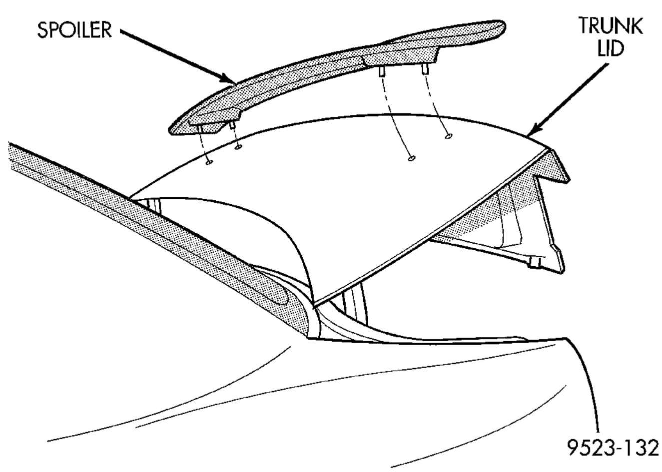


Fig. 80 Rear Spoiler

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

Apply water sealing putty around spoiler mounting studs and reverse the preceding operation.

ROOF APERTURE (RAP) MOLDING

The RAP molding is set in urethane adhesive. The RAP molding is difficult to salvage during removal. Verify part availability before proceeding with removal procedure. The temperature in the work area and the vehicle should be at least 21°C (70°F) to avoid damaging the rear window and windshield moldings. Apply masking tape to surrounding area of the RAP molding to protect the finish.

REMOVAL

(1) Using a trim stick, gently lift rear window molding upward to gain access to end of RAP molding.

(2) Using a sharp hook tool, pierce the rear end of the molding.

(3) Lift the rear of the RAP molding upward until it clears the rear window molding.

(4) Using a common plier, pull the RAP molding forward to separate molding from urethane bonding.

(5) Separate RAP molding from vehicle.

INSTALLATION

(1) Using a sharpened trim stick, scrape urethane bonding material from the roof seam trough.

(2) Using touch-up paint, repair scratches in roof seam trough to prevent corrosion.

(3) Inspect the bottom of the roof seam trough for gaps in caulking. Repair gaps with suitable seam sealer following manufacturers instructions.

(4) Apply black-out primer to bottom of roof seam trough. Allow at lease three minutes before bonding is applied.

(5) Install RAP molding into the roof seam trough and position molding so both ends are covered by the glass moldings. If the molding will not lay flat on the bottom of the trough, trim the ends of the molding until proper fit achieved.

(6) Using a suitable marking pencil, mark an index line across the RAP molding and the adjacent surfaces.

(7) Remove the RAP molding from the roof seam trough.

(8) Apply a 5 mm (0.2 in.) bead of urethane adhesive on the bottom/center of the trough along the entire length.

(9) Place RAP molding in position in roof seam trough (Fig. 81).

(10) Insert both ends of RAP molding under glass moldings.

(11) Align index marks across trough and molding.

(12) Gently press RAP molding into urethane adhesive until molding lays smooth and flat.

(13) Remove protective tape from around the RAP molding.

(14) Clean excess urethane from exterior with Mopar, Super Clean or equivalent.

(15) Apply a length of 50 mm (2 in.) masking tape over the RAP molding to retain the molding until the urethane adhesive is cured. Curing time for most urethane adhesive is at least 24 hours.

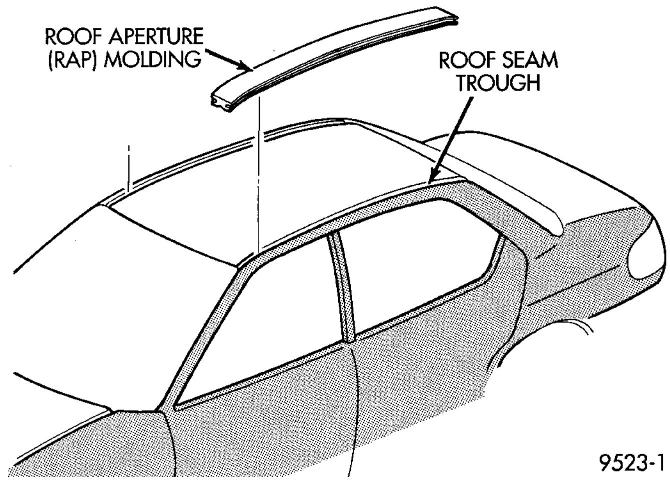


Fig. 81 RAP Molding

ROOF RACK

The roof rack insulator gasket is bonded to the base of the side rail. If the gasket comes loose during servicing, secure the gasket to the side rail with Mopar, Bond-all Gel Adhesive or equivalent.

REMOVAL

(1) Remove screws holding roof rack side rails to the roof panel (Fig. 82).

(2) Separate roof rack from vehicle.

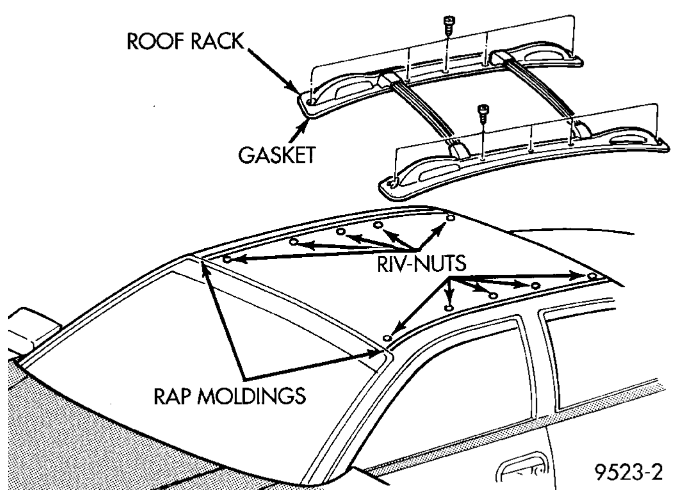


Fig. 82 Roof Rack

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

ROOF RACK CROSS RAILS

The roof rack side rail do not have to be removed to replace the cross rails.

REMOVAL

(1) Remove screws holding cross rail to the side rails.

(2) Separate the cross rail from the roof rack.

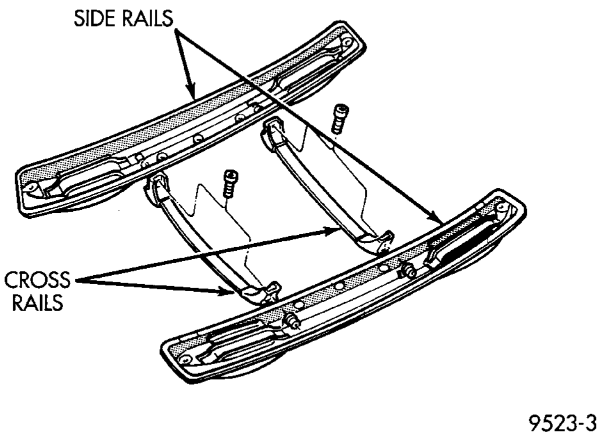


Fig. 83 Roof Rack Cross Rails

INSTALLATION

Reverse the preceding operation.

ADJUSTMENTS

FRONT DOOR GLASS ADJUSTMENT

UP-STOP ADJUSTMENTS

(1) Remove door trim panel.

(2) Remove water shield as necessary to gain access to adjuster.

(3) Loosen up-stop nut.

(4) Close door and raise door glass.

(5) Adjust up-stop to achieve proper glass height.

(6) Adjust glass so that a piece of paper can be pulled between the glass and weatherstrip with some tension.

NOTE: The top edge of the door glass should be beneath the lip of the weatherstrip

(7) Tighten fasteners.

TOP OF GLASS—INBOARD/OUTBOARD ADJUSTMENTS

(1) Remove door trim panel.

(2) Remove water shield as necessary to gain access to adjusters.

(3) Using a Snap-on® flare-nut socket (FRXM10), loosen the lower jack-screw jamb-nuts.

(4) Close door and raise glass.

(5) Using a suitable allen-wrench, rotate jack-screws to achieve proper in/out positioning at the top edge of the glass.

(6) Adjust glass so that a piece of paper can be pulled between the glass and weatherstrip with some tension.

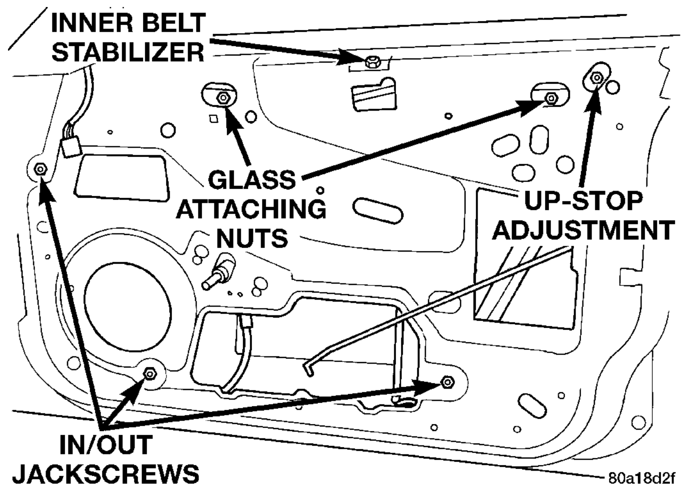


Fig. 84 Glass Adjustment—4 Door

(7) Tighten all fasteners.

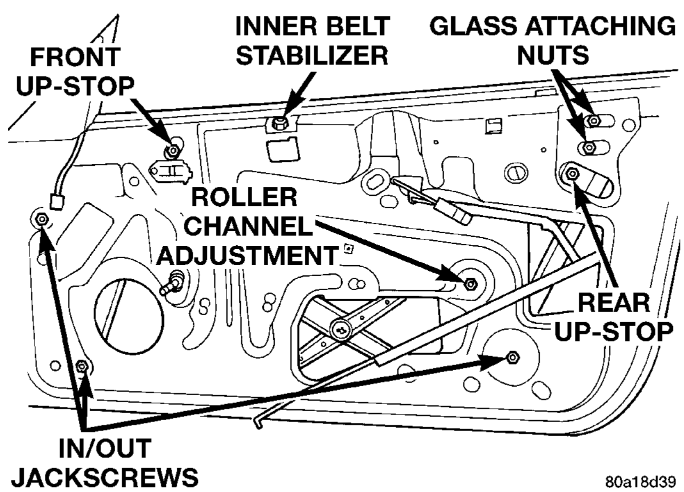


Fig. 85 Glass Adjustment—2 Door

GLASS—FRONT/REAR ADJUSTMENT

(1) Remove door trim panel and water shield.

(2) Lower door glass to bottom of travel to gain access to glass attachments. (Fig. 86)

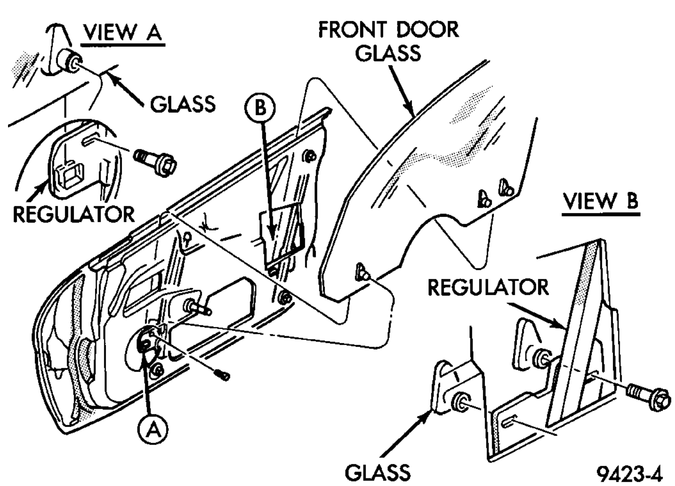


Fig. 86 Front door glass

ADJUSTMENTS (Continued)

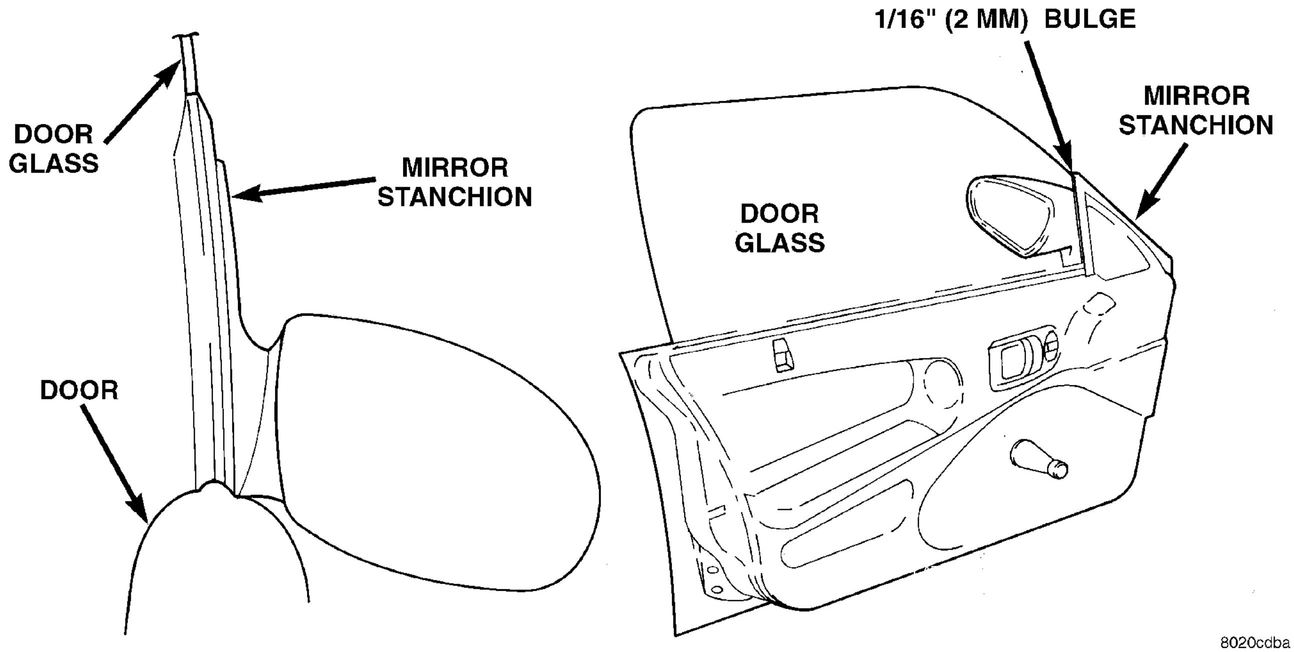


Fig. 87 Front/Rear Glass Position

(3) Loosen three glass attachment bolts.

(4) Raise glass to top of travel and adjust glass to fit the B-pillar seal. Glass to B-pillar applique gap should be approximately 13mm (1/2 inch).

(5) Tighten the two accessible glass fasteners in the full up position.

(6) Lower door glass to the full down position and tighten the remaining glass fastener.

(7) Raise glass to top of travel and verify positioning. (Fig. 87)

FRONT DOOR LATCH ADJUSTMENT

(1) Insert a hex-wrench through the elongated hole in the door end frame near the latch striker opening (Fig. 88).

(2) Loosen socket head screw on the side of the latch linkage.

(3) Lift upward on outside door handle and release it.

(4) Tighten socket head screw on latch.

(5) Verify latch operation.

REAR DOOR GLASS ADJUSTMENT

UP-STOP ADJUSTMENTS

(1) Remove door trim panel.

(2) Remove water shield as necessary to gain access to adjusters.

(3) Using a Snap-on® flare-nut socket (FRXM10), loosen up- stop eccentric jamb-nut (Fig. 89).

(4) Using a suitable hex-wrench, rotate up-stop eccentric to achieve proper glass height.

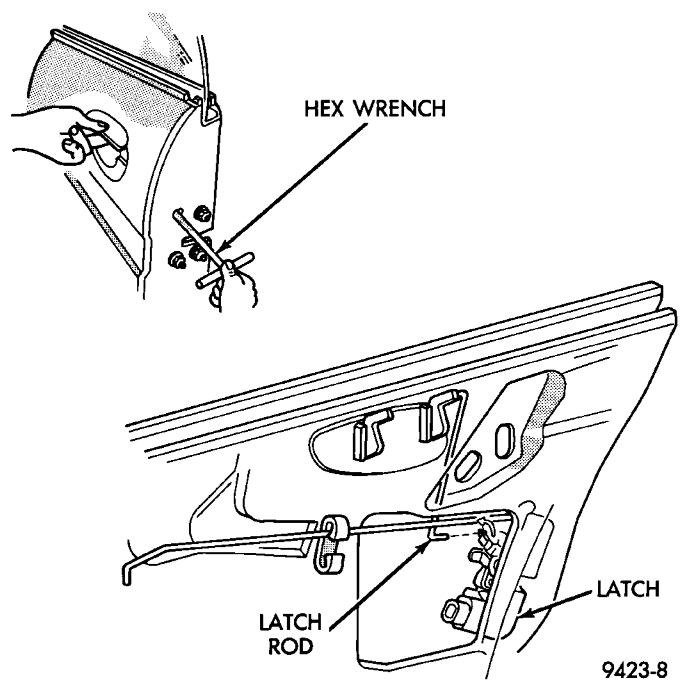


Fig. 88 Door Latch Adjustment

(5) Adjust glass so that a piece of paper can be pulled between the glass and weatherstrip with some tension.

TOP OF GLASS—INBOARD/OUTBOARD ADJUSTMENTS

(1) Remove door trim panel.

(2) Remove water shield as necessary to gain access to adjusters.

ADJUSTMENTS (Continued)

(3) Using a Snap-on® flare-nut socket (FRXM10), loosen the lower jack-screw jamb-nuts (Fig. 89).

(4) Using a suitable hex-wrench, rotate jack-screws to achieve proper tension at the top of the glass.

(5) Adjust glass so that a piece of paper can be pulled between the glass and weatherstrip with some tension.

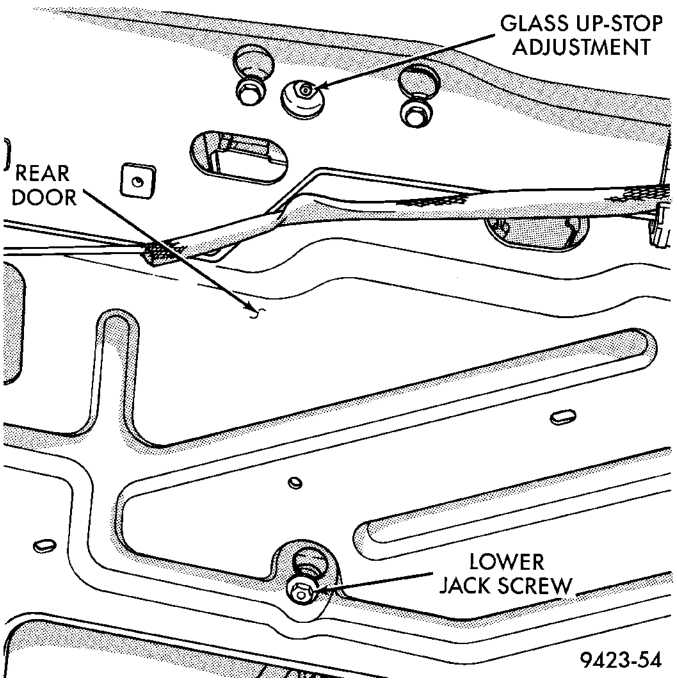


Fig. 89 Rear Door Glass Adjustment—Typical

REAR DOOR LATCH ADJUSTMENT

(1) Insert a hex-wrench through the elongated hole in the door end frame near the latch striker opening (Fig. 90).

(2) Loosen socket head screw on the side of the latch linkage.

(3) Lift upward on outside door handle and release it.

(4) Tighten socket head screw on latch.

(5) Verify latch operation.

SPECIFICATIONS

BODY LUBRICATION SPECIFICATIONS

LUBRICATION REQUIREMENTS

Body mechanisms and linkages should be inspected, cleaned, and lubricated, as required, to maintain ease of operation and to provide protection against rust and wear. When performing other underhood services, the hood latch release mechanism and safety catch should be inspected, cleaned, and lubricated. During the winter season, external door lock cylinders should be lubricated to assure proper operation when exposed to water and ice.

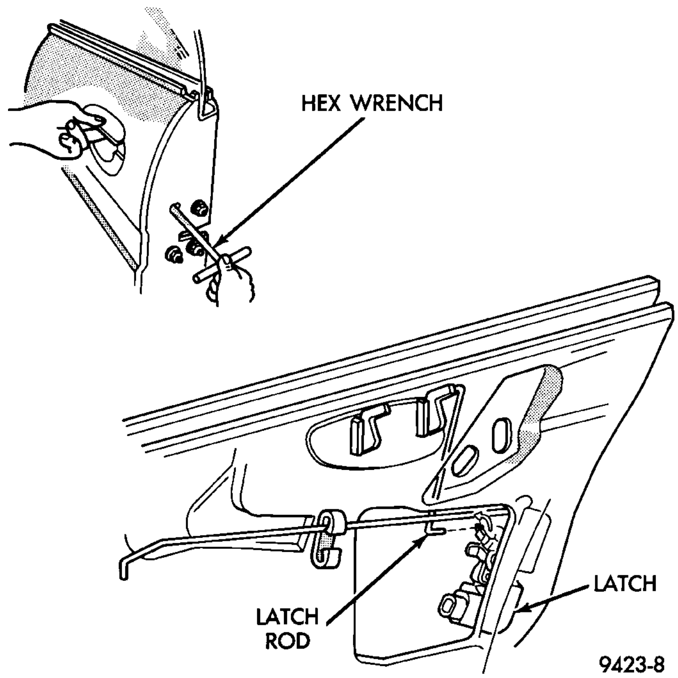


Fig. 90 Door Latch Adjustment

Prior to the application of any lubricant, the parts concerned should be wiped clean to remove dust and grit. If necessary, a suitable solvent can be used to clean the item to be lubricated. After lubricating a component, any excess oil or grease should be removed.

LUBRICANT APPLICATION

DOOR LOCK CYLINDERS

(1) Apply a small amount of lubricant directly into the lock cylinder.

(2) Apply a small amount of lubricant to the key.

(3) Insert key into lock cylinder and cycle the mechanism from the locked to the unlocked position.

NOTE: Do not add more lubricant.

(4) Cycle the lock cylinder mechanism several times to allow the lubricant to flow throughout the cylinder.

(5) Wipe all lubricant from exterior of lock cylinder and key.

ALL OTHER BODY MECHANISMS

(1) Clean component as described above.

(2) Apply specified lubricant to all pivoting and sliding contact areas of component.

SPECIFICATIONS (Continued)

LUBRICANT USAGE

ENGINE OIL

- Door Hinges—Hinge Pin and Pivot Contact Areas
- Hood Hinges—Pivot Points
- Liftgate Hinges
- Trunk Lid Hinges

MOPAR® SPRAY WHITE LUBE OR EQUIVALENT

- Door Check Straps
- Liftgate Latches
- Liftgate Prop Pivots
- Ash Receiver
- Fuel Filler Door Remote Control Latch Mechanism
- Parking Brake Mechanism
- Sliding Seat Tracks
- Trunk Latch

MOPAR® MULTI–PURPOSE GREASE OR EQUIVALENT

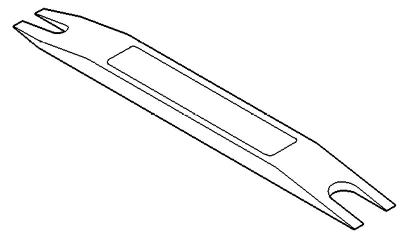
- All Other Hood Mechanisms

MOPAR® LOCK CYLINDER LUBRICANT OR EQUIVALENT

- Door Lock Cylinders
- Trunk Lock Cylinder

SPECIAL TOOLS

BODY



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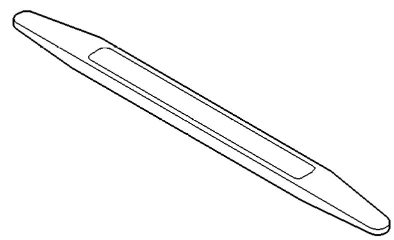

STICK, TRIM C4755

HEATING AND AIR CONDITIONING

CONTENTS

GENERAL INFORMATION

INTRODUCTION

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.

The unit housing is divided into two sides. The left side is called the air distribution module. The air distribution module is the same on vehicles with or without air conditioning. On the right side there is either a blower module (non-A/C vehicles) or an evaporator/blower module (vehicles with A/C). The blower module is unique to heater only systems (Fig. 1).

The air distribution module contains the heater core and doors used to control air flow. The vehicle uses the same air distribution module on all models (with or without air conditioning).

GENERAL INFORMATION (Continued)

The air conditioning evaporator is located in the evaporator/blower module (Fig. 2).

To service the heater core, evaporator and/or any of the air doors the unit housing must be removed from the vehicle.

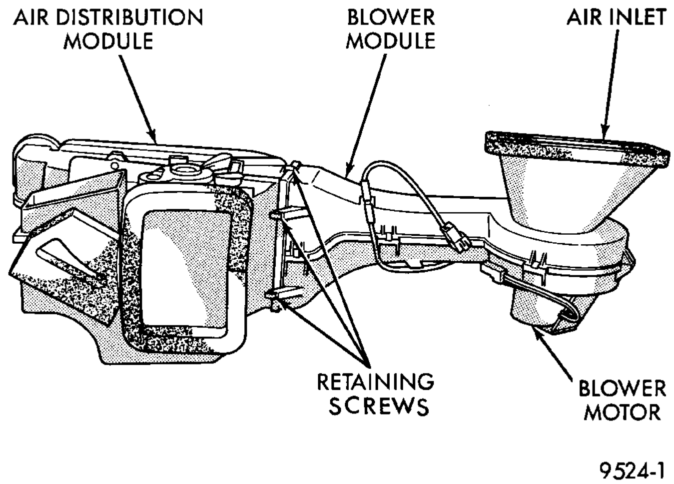

Fig. 1 Heater Only Unit Housing

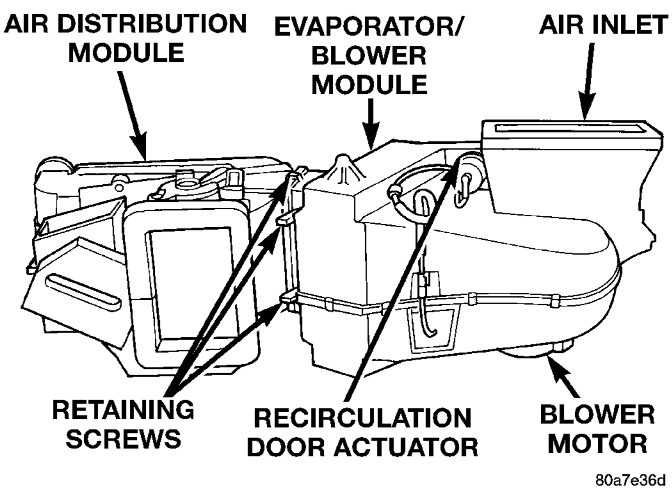

Fig. 2 A/C Heater Unit Housing

NOTE: This group covers both Left-Hand Drive (LHD) and Right-Hand Drive (RHD) versions of this model. Whenever required and feasible, the RHD versions of affected vehicle components have been constructed as mirror-image of the LHD versions. While most of the illustrations used in this group represent only the LHD version, the diagnostic and service procedures outlined can generally be applied to either version. Exceptions to this rule have been clearly identified as LHD, RHD, or Export if a special illustration or procedure is required.

SAFETY PRECAUTIONS AND WARNINGS

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM EYE CONTACT WITH REFRIGERANT. IF EYE CONTACT IS MADE, SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC TYPE LEAK DETECTOR IS RECOMMENDED.

LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

THE EVAPORATION RATE OF REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH REFRIGERANT. R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR.

SOME MIXTURES OF AIR and R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. SEEK MEDICAL ATTENTION IMMEDIATELY IF SWALLOWED OR INHALED. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN AND PETS.

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

CAUTION: The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi). Allow the vehicle to cool a minimum of 15 minutes before opening the cooling system. Refer to Group 7, Cooling System.

DESCRIPTION AND OPERATION

A/C REFRIGERANT LINES

DISCHARGE LINE

The discharge line is the line that goes from the compressor to the condenser (Fig. 3). It has no serviceable parts except the rubber O- rings. If the line is found to be leaking or is damaged it must be replaced as an assembly.

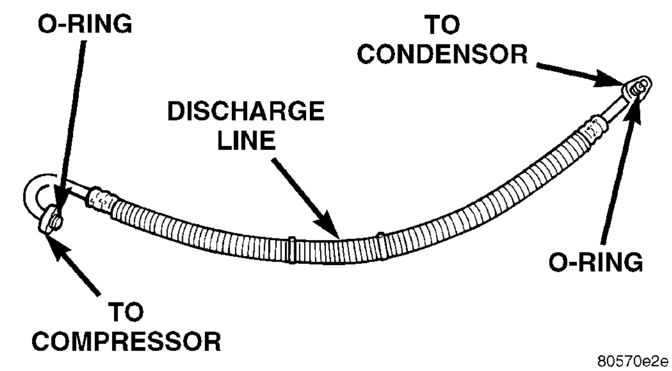

Fig. 3 Discharge Line

LIQUID LINE

The liquid line is the line that goes from the condenser to drier (Fig. 4). It has no serviceable parts except the rubber O-rings. If the line is found to be leaking or is damaged it must be replaced as an assembly.

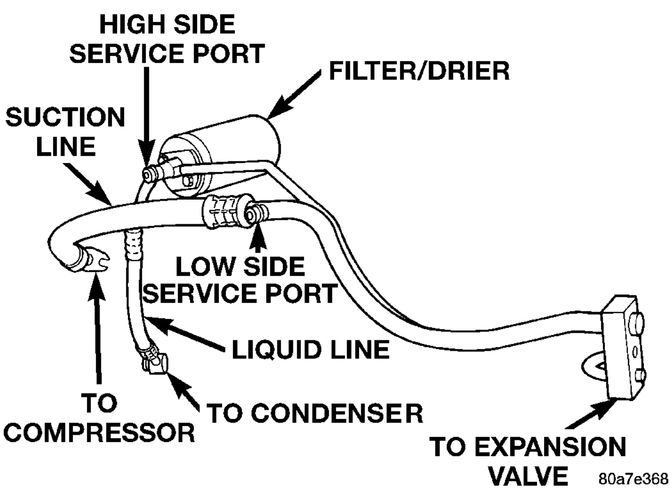

Fig. 4 Liquid/Suction Line

SUCTION LINE

The suction line is the large line that connects to the expansion valve and goes to the compressor (Fig. 4). It also has a small line that goes to the filter/ drier. The suction line uses a gasket on the expansion valve side and rubber O-rings on all other connections.

There are no serviceable parts on the suction line other than the rubber O-rings and expansion valve gasket. If the line is found to be leaking or is damaged it must be replaced as an assembly.

A/C SERVICE PORT VALVE CORES

The A/C service port valve cores are serviceable (Fig. 5) and (Fig. 6).

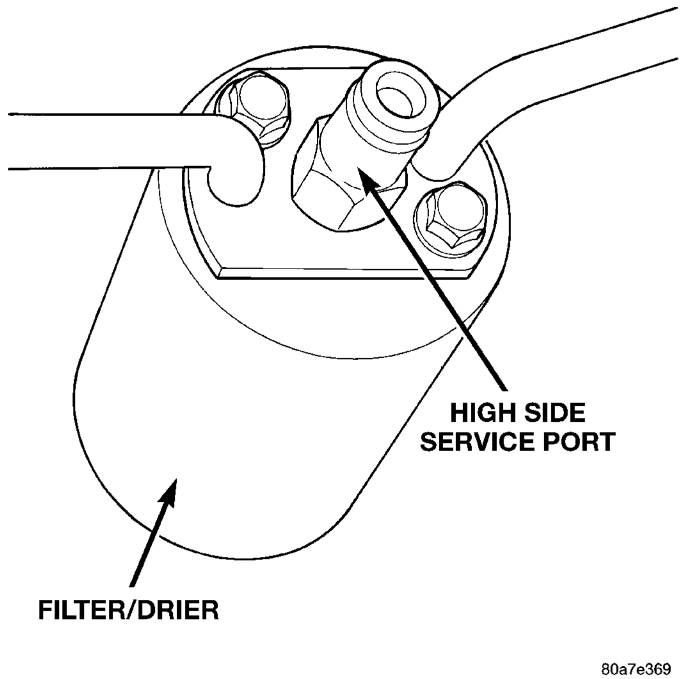

Fig. 5 High Side Service Port Valve

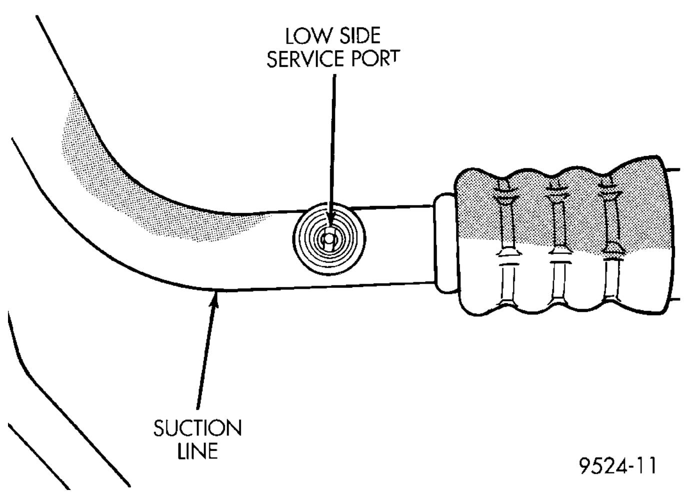

Fig. 6 Low Side Service Port Valve

BLOWER MOTOR RESISTOR

The blower motor resistor is located in the cowl, at the base of the windshield. There are two different resistor blocks depending on whether the vehicle is equipped with A/C or not. The blower motor resistors will get hot when in use. Do not touch resistor block if the blower motor has been running (Fig. 7).

DESCRIPTION AND OPERATION (Continued)

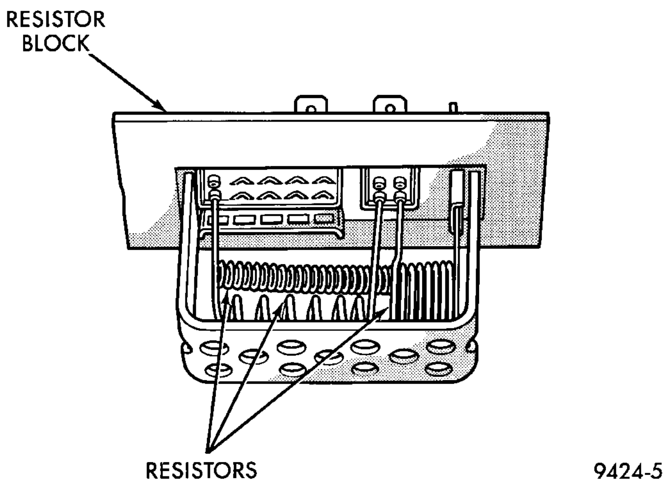

Fig. 7 Resistor Block

COMPRESSOR

The compressor used on this vehicle is a Nippondenso 10PA17 R-134a. This compressor uses an aluminum swash plate, teflon coated pistons and aluminum sleeved cylinder walls.

CAUTION: A 10PA17 R-12 compressor looks identical to a 10PA17 R-134a and will bolt up to the vehicle. The 10PA17 R-12 compressor must not be used on this system. It is extremely important that a 10PA17 R-134a compressor is identified prior to using compressor in question. Check tag located on compressor for model number.

NOISE

Excessive noise that occurs when the air conditioning is being used may be caused by:

- Loose bolts
- Mounting brackets
- Loose compressor clutch
- Excessive high refrigerant operating pressure

Verify the following before compressor repair is performed:

(1) Compressor drive belt condition

(2) Proper refrigerant charge

(3) Thermal expansion valve (TXV) operating correctly

(4) Head pressure is normal

COMPRESSOR FRONT SHAFT SEAL

The compressor front shaft seal is not serviceable. If a leak is detected at the shaft seal, the compressor must be replaced as a unit.

CONDENSATION DRAIN TUBE

Condensation that accumulates in the evaporator housing is drained from a tube through the dash and on to the ground. This tube must be kept open to prevent condensate water from collecting in the bottom of the 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.

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain ample temperature levels from the heating-A/C system, the cooling system must be in proper working order. Refer to Group 0, Lubrication and Maintenance or Group 7, Cooling System of this manual.

The use of a bug screen is not recommended. Any obstructions forward of the condenser can reduce the effectiveness of the air conditioning system.

EVAPORATOR PROBE

The evaporator probe can be replaced without having to remove the unit housing from the vehicle.

The evaporator probe is located in the unit housing and placed in the evaporator fins. The probe prevents evaporator 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 evaporator probe uses a thermistor probe in a capillary tube. The tube is inserted between the evaporator fins in the heater-A/C unit housing.

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.

DESCRIPTION AND OPERATION (Continued)

CAUTION: The system must be completely empty before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been emptied. If any pressure is noticed as a fitting is loosened, retighten fitting and evacuate the system again.

A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 3 inches (80 mm) from the exhaust manifold. Inspect all flexible hose lines to make sure they are in good condition and properly routed.

The use of correct wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings.

The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities.

When opening a refrigeration system, have everything you will need to repair the system ready. This will minimize the amount of time the system must be opened. Cap or plug all lines and fittings as soon as they are opened. This will help prevent the entrance of dirt and moisture. All new lines and components should be capped or sealed until they are ready to be used.

All tools, including the refrigerant dispensing manifold, the manifold gauge set, and test hoses should be kept clean and dry.

HIGH PRESSURE CUT OUT SWITCH

The high pressure cut out switch is located in the compressor manifold (Fig. 8). It turns off the compressor if the system pressure exceeds 3240 kPa (470 psi)

LOW PRESSURE CUT OFF SWITCH

The Low Pressure Cut Off Switch (Fig. 9) monitors the refrigerant gas pressure on the suction side of the system. The low pressure cut off switch is located on the expansion valve. The low pressure cut off switch turns off voltage to the compressor clutch coil when refrigerant gas pressure drops to levels that could damage the compressor. The low pressure cut out switch is a sealed factory calibrated unit. It must be replaced if defective.

SIDE WINDOW DEMISTERS

The demisters direct air from the unit housing through the outlets located on the top corners of the instrument panel. The demisters operate when the mode selector is anywhere between floor and defrost settings. Some air may be noticeable from the demister outlets when the mode selector is in the bilevel to floor positions.

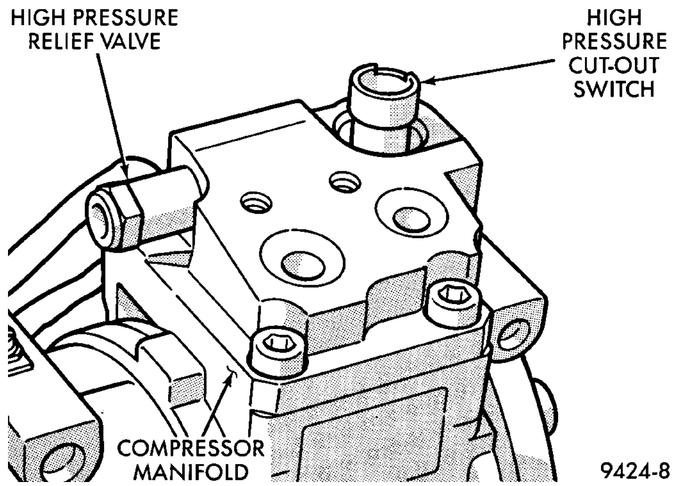

Fig. 8 High Pressure Cut Out Switch Location

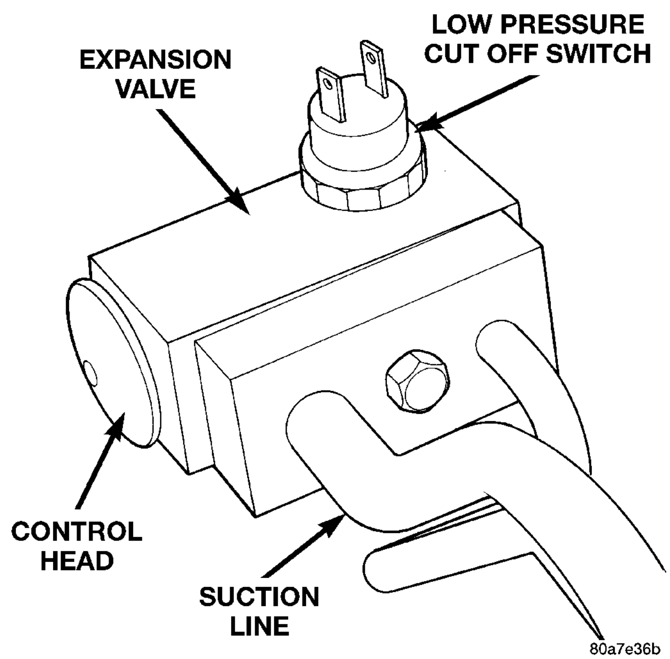

Fig. 9 Low Pressure Cut Off Switch

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 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 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, floor and defrost

DESCRIPTION AND OPERATION (Continued)

outlets in various combinations using the mode selector. There are 17 different mode selections possible. Air flow velocity can be adjusted with the blower speed selector switch on the instrument panel.

On A/C equipped vehicles the ambient air intake can be controlled by opening and closing the recirculating air door. When placed in RECIRC, air that is inside vehicle is removed continuously and recirculated through unit housing. Ambient air cannot be controlled on vehicles without A/C. The system uses outside air at all times.

The air conditioning compressor can be engaged by turning the fan switch counterclockwise from the off position. It can also be engaged by placing the mode control in the defrost position. This will remove heat and humidity from the air before it is directed through or around the heater core.

SYSTEM OIL LEVEL

It is important to have the correct amount of oil in the A/C system to ensure proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling capacity of the system and consequently result in higher discharge air temperatures.

NOTE: The oil used in the compressor is ND8 PAG R-134a refrigerant oil. Only refrigerant oil of the same type should be used to service the system. Do not use any other oil. The oil container should be kept tightly capped until it is ready for use. Tightly cap afterwards to prevent contamination from dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with. Special effort must be used to keep all R-134a system components moisture-free. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

It will not be necessary to check oil level in the compressor or to add oil unless there has been an oil loss. Oil loss at a leak point will be evident by the presence of a wet, shiny surface around the leak.

REFRIGERANT OIL LEVEL CHECK

When an air conditioning system is first assembled, all components (except the compressor) are refrigerant oil free. After the system has been charged with R-134a refrigerant and operated, the oil in the compressor is dispersed through the lines and components. The evaporator, condenser, and filter-drier will retain a significant amount of oil, refer to the Refrigerant Oil Capacities chart. When a component is replaced, the specified amount of refrigerant oil must be added. When the compressor is replaced, the amount of oil that is retained in the rest of the system must be drained from the replacement compressor. When a line or component has ruptured and oil has escaped, the compressor should be removed and drained. The filter-drier must be replaced along with the ruptured part. The oil capacity of the system, minus the amount of oil still in the remaining components, can be measured and poured into the suction port of the compressor.

REFRIGERANT OIL CAPACITIES

REFRIGERANT OIL CAPACITIES		
COMPONENT	**ML**	**OZ**
Total System	200ml	6.75 oz
Filter-Drier	30 ml	1.0 oz
Condenser	30 ml	1.0 oz
Evaporator	59 ml	2.0 oz
All Refrigerant Lines	44 ml	1.5 oz

VACUUM CONTROL SYSTEM

The neon uses vacuum to operate only the circulation door. All other controls are cable. When vacuum is supplied to the actuator the door moves to the Recirculation position. The actuator is spring loaded so the door moves to the Outside-air position when there is no vacuum supplied. The operation of the door can be viewed by removing the blower motor and looking up into the unit inlet.

Normally vacuum is supplied to the actuator by placing the Circulation control knob in the Recirculation position. **If the Mode control is at or near the Defrost position, vacuum will not be applied to the actuator regardless of the position of the Circulation control knob.** This is to prevent window fogging.

DIAGNOSIS AND TESTING

A/C PERFORMANCE TEST

The air conditioning system is designed to remove heat and humidity from the air entering the passenger compartment. The evaporator, located in the heater A/C unit, is cooled to temperatures near the freezing point. As warm damp air passes over the fins in the evaporator, moisture in the air condenses to water, dehumidifying the air. Condensation on the evaporator fins reduces the evaporators ability to absorb heat. During periods of high heat and humidity, an air conditioning system will be less effective. With the instrument control set to RECIRC, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels rise.

DIAGNOSIS AND TESTING (Continued)

PERFORMANCE TEST PROCEDURE

Review Safety Precautions and Warnings in this group before proceeding with this procedure. Air temperature in test room and on vehicle must be 21° C (70°F) minimum for this test.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

(1) Connect a tachometer and manifold gauge set.

(2) Set control to A/C, RECIRC, and PANEL, temperature lever on full cool and blower on high.

(3) Start engine and hold at 1000 rpm with A/C clutch engaged.

(4) Engine should be warmed up with doors and windows closed.

(5) Insert a thermometer in the left center A/C outlet and operate the engine for five minutes. The A/C clutch may cycle depending on ambient conditions.

(6) With the A/C clutch engaged, compare the discharge air temperature to the A/C Performance Temperatures chart (Fig. 10).

(7) If the discharge air temperature fails to meet the specifications in the performance temperature chart. Refer to the Refrigerant Service Procedures for further diagnosis.

BLOWER MOTOR ELECTRICAL DIAGNOSIS

Refer to the Blower Motor Electrical System Diagnosis chart (Fig. 11) in this section. Also refer to Group 8W, Wiring Diagrams for more information.

BLOWER MOTOR VIBRATION AND/OR NOISE DIAGNOSIS

The resistor block supplies the blower motor with varied voltage (low and middle speeds) or battery voltage (high speed).

CAUTION: Stay clear of the blower motor and resistor block (Hot). Do not operate the blower motor with the resistor block removed from the heater-A/C housing.

Refer to the Blower Motor Vibration/Noise chart (Fig. 12) for diagnosis.

COMPRESSOR NOISE DIAGNOSIS

Excessive noise while the A/C is being used, can be caused by loose mounts, loose clutch, or high operating pressure. Verify compressor drive belt condition, proper refrigerant charge and head pressure before compressor repair is performed.

If the A/C drive belt slips at initial start-up, it does not necessarily mean the compressor has failed.

With the close tolerances of a compressor it is possible to experience a temporary lockup. The longer the A/C system is inactive, the more likely the condition to occur.

This condition is the result of normal refrigerant movement within the A/C system caused by temperature changes. The refrigerant movement may wash the oil out of the compressor.

Ambient Temperature	21°C (34-46°F)	26.5°C (80°F)	32°C (90°F)	37.5°C (100°F)	43°C (110°F)
Air Temperature at Left Center Panel Outlet	1-8°C (34-46°F)	3-9°C (37-49°F)	4-10°C (39-50°F)	6-11°C (43-52°F)	7-18°C (45-65°F)
Compressor Discharge Pressure After the Filter Drier	1034-1724 kPa (150-250 PSI)	1517-2275 kPa (220-330 PSI)	1999-2620 kPa (290-380 PSI)	2068-2965 kPa (300-430 PSI)	2275-3421 kPa (300-500 PSI)
Evaporator Suction Pressure	103-207 kPa (15-30 PSI)	117-221 kPa (17-32 PSI)	138-241 kPa (20-35 PSI)	172-269 kPa (25-39 PSI)	207-345 kPa (30-50 PSI)

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Fig. 10 A/C PERFORMANCE TEMPERATURES

DIAGNOSIS AND TESTING (Continued)

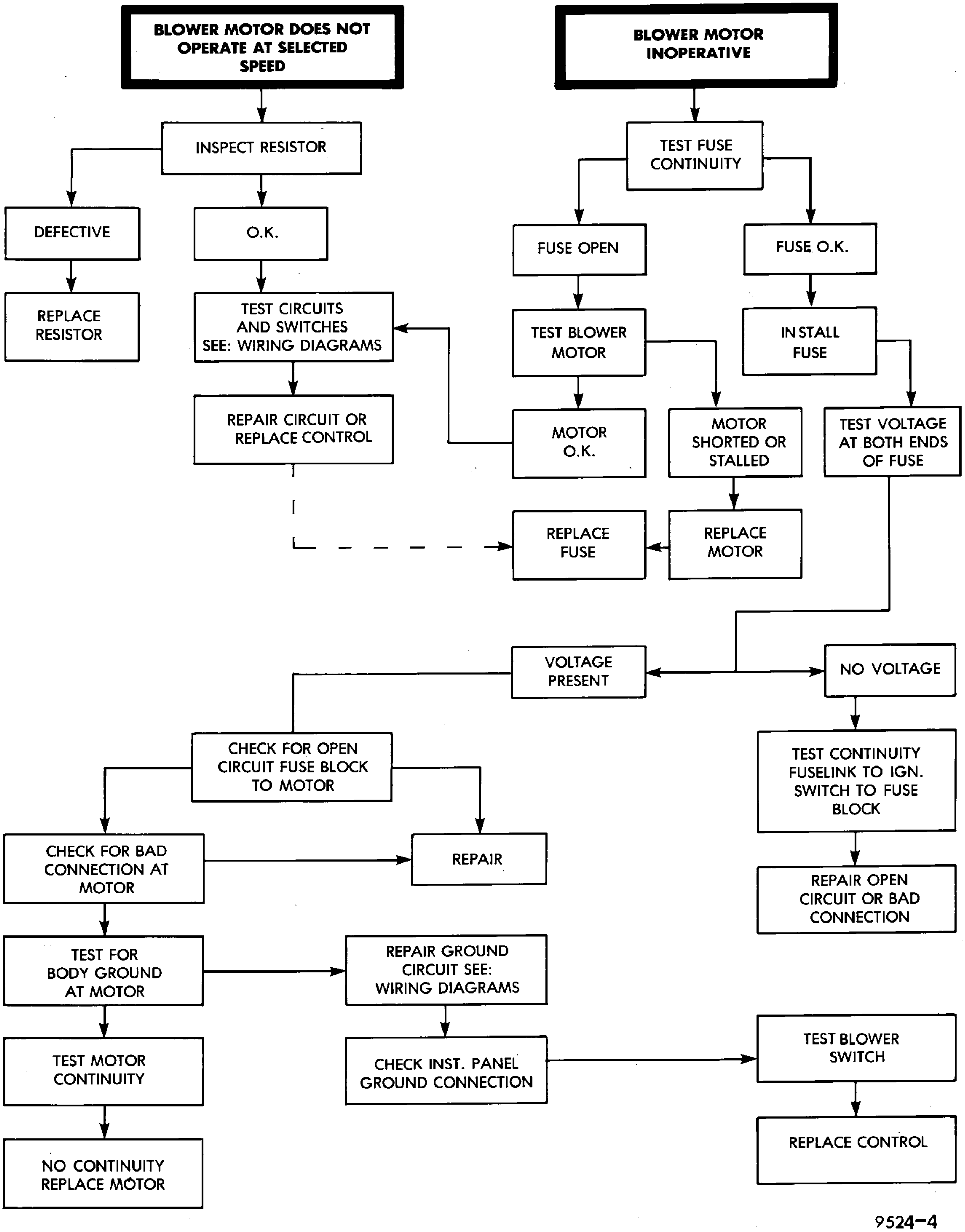


Fig. 11 Blower Motor Electrical Diagnosis

DIAGNOSIS AND TESTING (Continued)

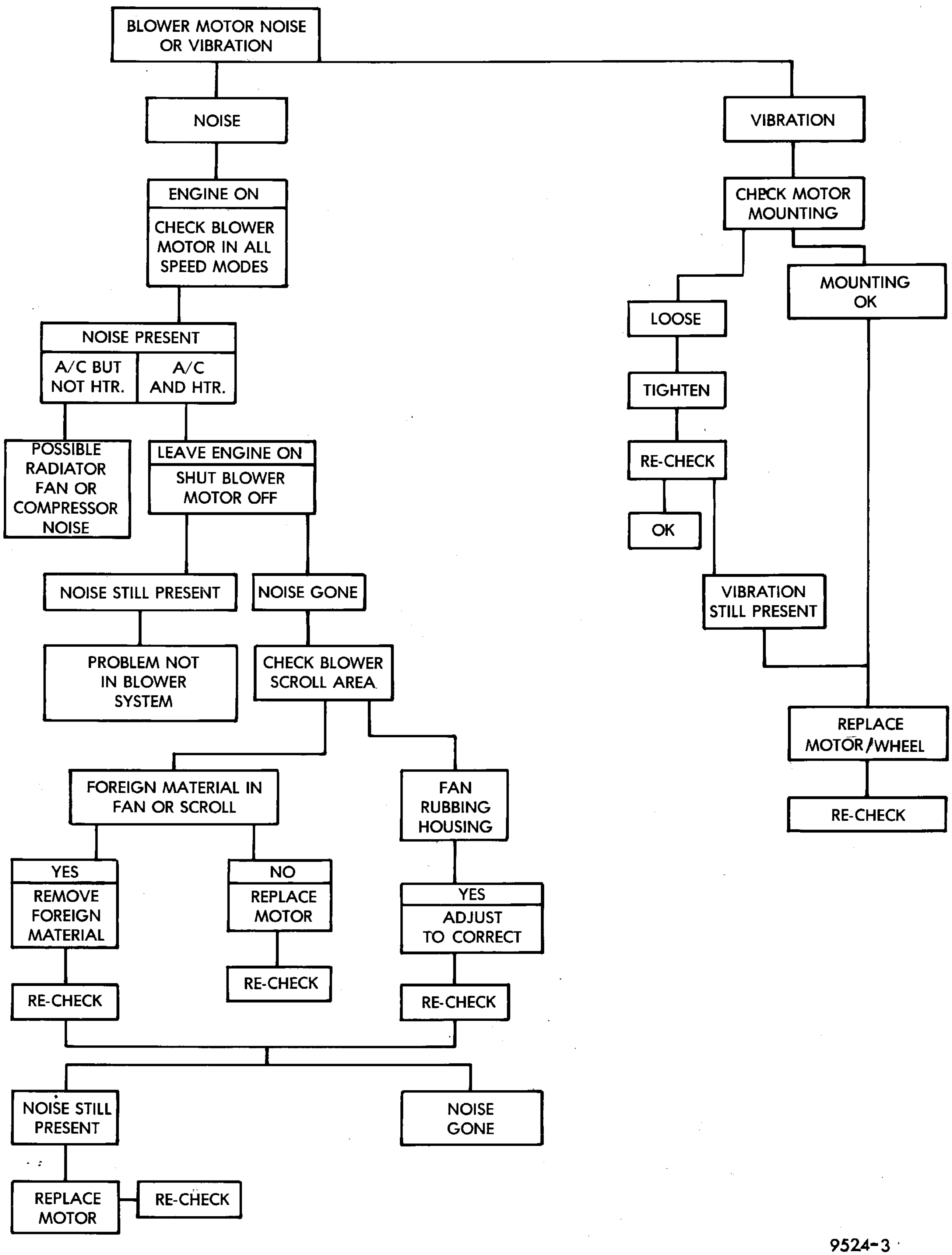


Fig. 12 Blower Motor Noise/Vibration Diagnosis

DIAGNOSIS AND TESTING (Continued)

EXPANSION VALVE

NOTE: Expansion valve tests should be performed after compressor tests.

Liquid CO2 is required to test the expansion valve. It is available from most welding supply facilities. CO2 is also available from companies which service and sell fire extinguishers.

Review Safety Precautions and Warnings in the General Information section of this Group. The work area and vehicle must be 21° to 27°C (70° 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) Disconnect wire connector at low pressure cut-off switch (Fig. 13). Using a jumper wire, jump terminals inside wire connector boot.

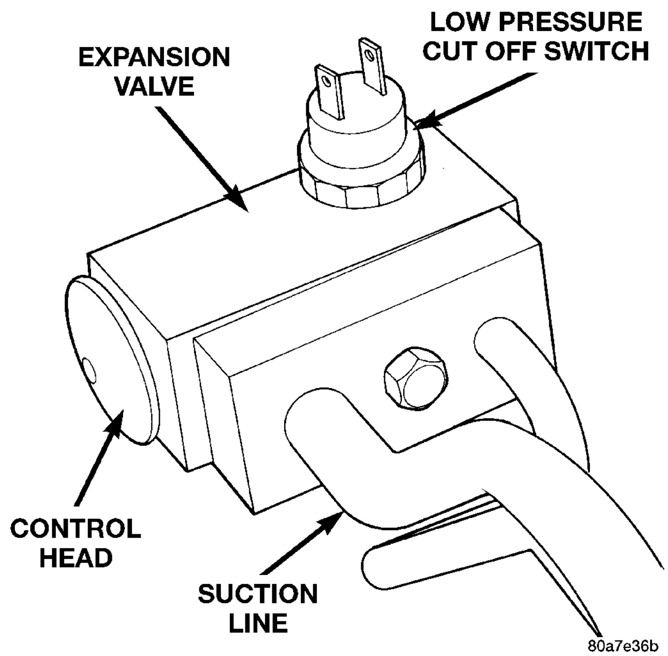


Fig. 13 Low Pressure Cut-Off Switch

(3) Close all doors, windows and vents to the passenger compartment.

(4) Set Heater-A/C control to A/C, full heat, floor, RECIRC. and high blower.

(5) 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.

(6) If the refrigerant charge is sufficient, discharge (high pressure) gauge should read 965 to 2620 kPa (140 to 380 psi). Suction (low pressure) gauge should read 103 to 2417 kPa (15 to 35 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 CO2 PERSONAL INJURY CAN RESULT.

(7) If suction side low pressure is within specified range, freeze the expansion valve control head (Fig. 13) for 30 seconds. Use a super cold substance (liquid CO2). **Do not spray refrigerant on the expansion valve for this test.** Suction side low pressure should drop to 34.5 kPa (5 psi) If not, replace expansion valve.

(8) Allow expansion valve to thaw. The low pressure gauge reading should stabilize at 103 to 241 kPa (15 to 35 psi). If not, replace expansion valve.

(9) 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.

EVAPORATOR PROBE TEST

The work area and vehicle must be between 16° C (60° F) and 32° C (90° F) when testing the switch.

(1) Disconnect the three wire connector from the evaporator probe lead located behind the glove box.

(2) Start engine and set A/C to low blower motor speed, panel, full cool, and RECIRC.

(3) Using a voltmeter, check for battery voltage between Pin 1 and 2. If no voltage is detected, there is no power to the switch. Check wiring and fuses. Refer to Group 8W, Wiring Diagrams for circuit diagnosis.

(4) Using a voltmeter, check for battery voltage between Pin 1 and Pin 3. If no voltage is detected, there is no voltage from the Powertrain Control Module. Refer to Group 8W, Wiring Diagrams. If voltage is OK, connect a jumper wire between Pin 1 and Pin 3. The compressor clutch should engage. If the clutch engages, remove the jumper wire immediately and go to Step 5. If the compressor clutch does not engage, check the operation of the clutch and repair as necessary.

(5) If compressor clutch engages, connect the evaporator probe 3-way connector. The compressor clutch should engage or cycle depending on evaporator temperature. If OK, go to Step 6. If not OK, replace the clutch cycling switch.

(6) The engine running and the A/C set to:

- Blower motor on low speed
- Panel position
- Full cool
- RECIRC.

Close all doors and windows. Place a thermometer in the center discharge vent.

(7) If the clutch does not begin to cycle off between 2° C to 7° C (35° F to 45° F), verify that the evaporator probe is fully installed and not loose in evaporator. If it is not properly installed, install probe and

DIAGNOSIS AND TESTING (Continued)

retest outlet temperature. If the evaporator probe is properly installed, replace the clutch cycling switch.

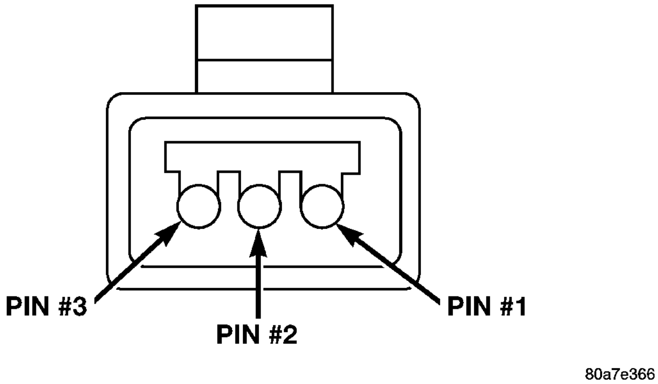


Fig. 14 Evaporator Probe Harness Connector

HEATER PERFORMANCE TEST

PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings in this group before performing the following procedures.

Check the coolant level, drive belt tension, vacuum line connections, radiator air flow and fan operation. Start engine and allow to warm up to normal temperature.

WARNING: DO NOT REMOVE RADIATOR CAP WHEN ENGINE IS HOT, PERSONAL INJURY CAN RESULT.

If vehicle has been run recently, wait 15 minutes before removing cap. Place a rag over the cap and turn it to the first safety stop. Allow pressure to escape through the overflow tube. When the system stabilizes, remove the cap completely.

MAXIMUM HEATER OUTPUT: TEST AND ACTION

Engine coolant is provided to the heater system by two 16 mm (5/8 inch inside diameter) heater hoses. With engine idling at normal running temperature, set the control to maximum heat, floor, and high blower setting. Using a test thermometer, check the air temperature coming from the floor outlets, refer to Temperature Reference chart.

TEMPERATURE REFERENCE CHART

Ambient	Temp.	Minimum Floor	Outlet Temp.
Celsius	Fahrenheit	Celsius	Fahrenheit
15.5°	60°	62.2°	144°
21.1°	70°	63.8°	147°
26.6°	80°	65.5°	150°
32.2°	90°	67.2°	153°

If the floor outlet air temperature is insufficient, refer to Group 7, Cooling Systems for specifications. Both heater hoses should be HOT to the touch (coolant return hose should be slightly cooler than the supply hose). If coolant return hose is much cooler than the supply hose, locate and repair engine coolant flow obstruction in heater system.

POSSIBLE LOCATIONS OR CAUSE OF OBSTRUCTED COOLANT FLOW

(1) Pinched or kinked heater hoses.

(2) Improper heater hose routing.

(3) Plugged heater hoses or supply and return ports at cooling system connections, refer to Group 7, Cooling System.

(4) Plugged heater core.

(5) Air locked heater core.

(6) If coolant flow is verified and outlet temperature is insufficient, a mechanical problem may exist.

POSSIBLE LOCATION OR CAUSE OF INSUFFICIENT HEAT

(1) Obstructed cowl air intake.

(2) Obstructed heater system outlets.

(3) Blend-air door not functioning properly.

TEMPERATURE CONTROL

If temperature cannot be adjusted with the TEMP lever on the control panel, the following could require service:

(1) Blend-air door binding.

(2) Faulty blend-air door cable.

(3) Improper engine coolant temperature.

(4) Faulty Instrument Panel Control.

LOW PRESSURE CUT-OFF SWITCH

The work area must not be below 21°C (70°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 low pressure cut off 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, low pressure out off switch will complete the clutch circuit. If the low pressure gauge reads below 140 kPa (20 psi), the system is low on refrigerant charge or empty due to a leak. Refer to Service–Procedures, System Leak Checking in this section.

DIAGNOSIS AND TESTING (Continued)

(6) Install connector boot on switch and repeat Step 3. If the clutch does not engage, replace the low pressure cut off switch.

SYSTEM CHARGE LEVEL TEST

The procedure below should be used to check and/or fill the refrigerant charge in the air conditioning system.

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

NOTE: The maximum amount of R-134a refrigerant that the air conditioning system holds is 784 grams (28 oz. or 1.57 lbs.)

It is recommended to use the gauges or reclaim/recycle equipment.

(1) Use a manifold gauge and check the liquid line pressure.

(2) Attach a clamp-on thermocouple (P.S.E. 66-324-0014 or 80PK-1A) or equivalent to the liquid line near the filter/drier.

(3) The vehicle must be in the following modes:

- Automatic transaxle in park or manual transaxle in neutral.
- Engine at idle
- A/C controls set to outside air
- Panel mode
- A/C ON full cool
- Blower motor ON high speed
- Vehicle windows closed

(4) Operate system for a couple of minutes to allow the system to stabilize.

(5) Observe filter/drier pressure and Liquid line temperature. Using the Charge Determination Chart (Fig. 15) determine where the system is currently operating. If the system is not in the proper range, reclaim all the refrigerant and recharge per A/C label.

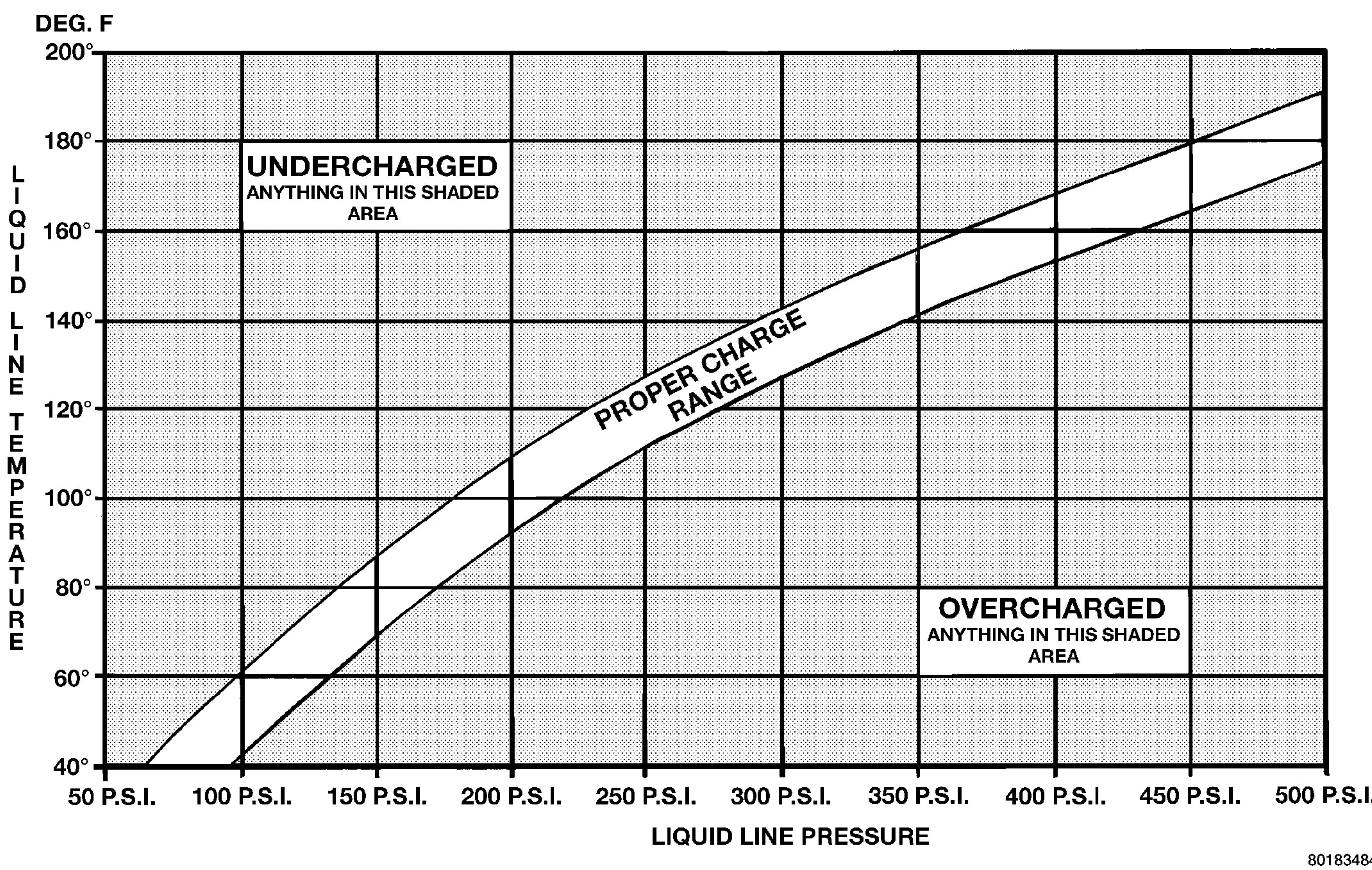


Fig. 15 Charge Determination Chart

DIAGNOSIS AND TESTING (Continued)

VACUUM CONTROL SYSTEM

Use an adjustable vacuum test set (Special Tool C-3707) and a suitable vacuum pump to test the heater-A/C vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 16), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.). Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

ONE-WAY CHECK VALVE

(1) Disconnect the heater-A/C vacuum supply (Black) tube in the engine compartment. This tube passes through an opening in the dash panel.

(2) Remove the one-way vacuum check valve. The valve is located on the (Black) vacuum supply hose at the brake power booster.

(3) Connect the test set vacuum supply hose to the heater side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to step Step 4. If not OK, replace the faulty valve.

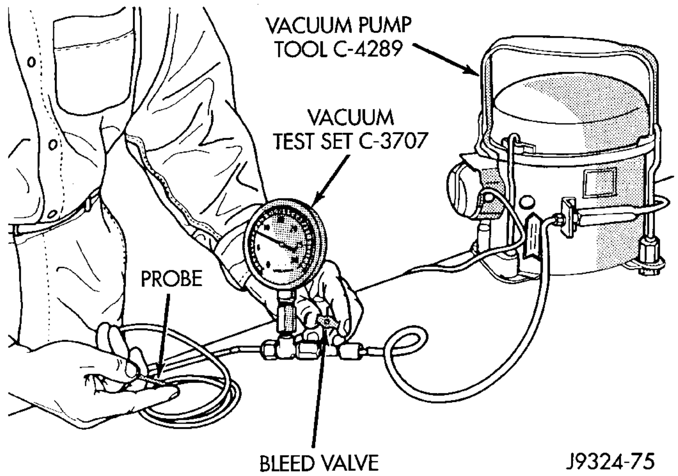


Fig. 16 Adjust Vacuum Test Bleed Valve

(4) Connect the test set vacuum supply hose to the engine vacuum side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

CONDITION	POSSIBLE CAUSES	CORRECTION
NO FORCED AIR IN HEAT POSITION	1. Vacuum line pinched or leaking.	1. Locate and repair vacuum leak or pinched line.
	2. Faulty heat defroster or mode door.	2. Test actuators and door operation. Repair as necessary.
	3. Faulty selector switch.	3. Test selector switch and replace if necessary.
	4. Vacuum check valve.	4. Test check valve and replace if necessary.
NO FORCED AIR IN PANEL POSITION	1. Vacuum line pinched or leaking.	1. Locate and repair vacuum leak or pinched line.
	2. Faulty mode door.	2. Test actuator and door operation. Repair as necessary.
	3. Faulty selector switch.	3. Test selector switch and replace if necessary.
	4. Vacuum check valve.	4. Test check valve and replace if necessary.
NO FORCED AIR IN DEFROST POSITION	1. Vacuum line pinched or leaking.	1. Locate and repair vacuum leak or pinched line.
	2. Faulty heat defroster or mode door.	2. Test actuators and door operation. Repair as necessary.
	3. Faulty selector switch.	3. Test selector switch and replace if necessary.
	4. Vacuum check valve.	4. Test check valve and replace if necessary.

Heater-A/C Vacuum System Diagnosis

DIAGNOSIS AND TESTING (Continued)

HEATER-A/C CONTROLS

The operation of the Circulation door can be viewed by removing the blower motor and looking up into the unit inlet. See Blower Motor Wheel and Assembly removal and installation in this section for service procedures.

(1) Connect the test set vacuum probe to the heater-A/C vacuum supply (Black) hose in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Start with the Mode control in the Panel position and the Circulation control in the Ouside-air position.

(3) Move the Circulation control to the Recirculation position (the Circulation door should move into the Recirculation position). After a short pause move the Mode control to the Defrost position (the Circulation door should move to the Outside-air position). The test gauge should return to the calibrated setting of 27 kPa (8in. Hg.) after each selection is made. If the gauge cannot achieve the calibrated setting, the vacuum circuit or a component has a leak.

(4) If the gauge achieves the calibrated setting but the door does not move, there is either a pinched vacuum line or a failed actuator.

LOCATING VACUUM LEAKS

(1) Connect the test vacuum probe to the vehicles (Black) supply hose. Position the vacuum test gauge so it can be viewed from the passenger compartment.

(2) Place the Mode in the Panel position and the Circulation control in the Recirculation position.

(3) Remove the instrument panel top cover.

(4) Remove the right side upper instrument panel bezel

(5) Remove the center vent duct.

(6) Remove and block the Supply (Black) vacuum line at the control. The test gauge should return to the calibrated setting of 27 kPa (8 in. Hg). If not, there is a leak in the Supply line.

(7) If there is no leak in the Supply line, reconnect it to the Control and remove the Actuator Feed (Red) line from the Control. Block the vacuum connection on the Control from where the line was removed. The test gauge should return to the calibrated setting of 27 kPa (8 in. Hg.). If not, there is a leak in the Control.

(8) If there is no leak in the Supply line or the Control, reconnect the Actuator Feed (Red) line to the control. Remove and block the Actuator Feed (Red) line at the Actuator. The test gauge should return to the calibrated setting of 27 kPa (8 in. Hg.). If not there is a leak in the Actuator Feed line.

(9) If there is no leak in the Supply line, Control, or the Actuator Feed line, the leak must be in the Actuator itself. Connect the Vacuum hose from the Vacuum Test Gauge directly to the Actuator to verify the leak. The Actuator vacuum port is accessible behind and above the Glove Box.

LOCATING PINCHED VACUUM LINES

The operation of the Circulation door can be viewed by removing the blower motor and looking up into the unit inlet. See Blower Motor Wheel and Assembly removal and installation in this section for service procedures.

(1) Connect the test vacuum probe to the vehicles (Black) supply hose. Position the vacuum test gauge so it can be viewed from the passenger compartment.

(2) Place the Mode in the Panel position and the Circulation control in the Recirculation position.

(3) Remove the right instrument panel top cover.

(4) Remove the right side upper instrument panel bezel.

(5) Remove the center vent duct.

(6) Remove the Supply (Black) vacuum line at the control. The test gauge should drop indicating free flow through the Supply line. If not, there is a blockage in the Supply line.

(7) If there is no blockage in the Supply line, reconnect it to the Control. Remove the Actuator Feed (Red) line from the Control. The test gauge should drop indicating free flow through the Supply line and Control. If not the vacuum switches on the Control are not functioning.

(8) If there is no blockage in the Supply line or the Control, reconnect the Actuator Feed (Red) line to the control. Remove the Actuator Feed (Red) line at the Actuator. The Actuator vacuum port is accessible behind and above the Glove Box. The test guage should drop indicating free flow through the supply line, Control, and the Actuator Feed line. If not, there is a blockage in the Actuator Feed line.

(9) If there is no blockage in the Supply line, Control, or the Actuator Feed line, the Actuator must have failed. Connect the Vacuum hose from the Vacuum Test Gauge directly to the Actuator to verify the Actuator has failed.

SERVICE PROCEDURES

CHARGING A/C SYSTEM

PARTIAL CHARGE

This vehicle does not have a sight glass. It is not possible to determine the amount of (R-134a) charge in the system. Therefore it is necessary to completely evacuate and recover the system, and then recharge the system fully.

EVACUATION

Before adding refrigerant, all air must be evacuated from the system.

SERVICE PROCEDURES (Continued)

- Connect a manifold gauge set to the A/C service ports (Fig. 17).
- Use a vacuum pump or charging station and evacuate system to 95 kPa (28 inches Hg) for 30 minutes.
- Go to Charging A/C System below.

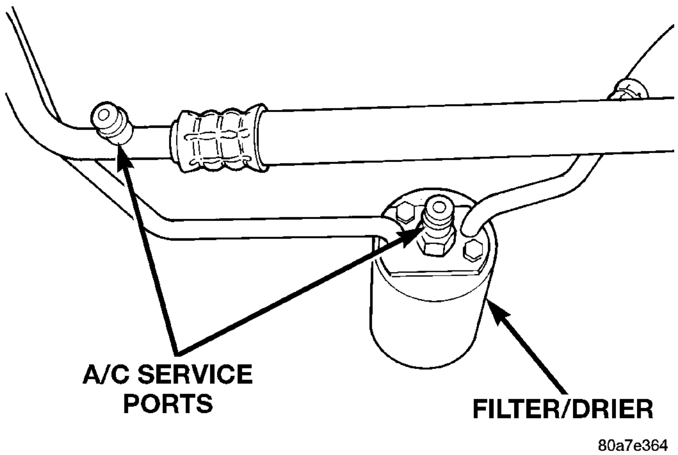


Fig. 17 A/C Service Ports

CHARGING A/C SYSTEM

The procedure below should be used to fill the refrigerant charge in the air conditioning system. This A/C system does not have or use a sight glass to check or charge the system.

WARNING: REVIEW SAFETY PRECAUTIONS AND WARNINGS IN THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

CAUTION: Do not overcharge refrigerant system, as excessive compressor head pressure can cause noise and system failure.

After the system has been tested for leaks and evacuated, a refrigerant (R-134a) charge can be injected into the system.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

(1) If using a separate vacuum pump close all valves before disconnecting pump. Connect manifold gauge set to the A/C service ports (Fig. 17).

NOTE: The air conditioning system in this vehicle holds 784 grams (28 oz. or 1.57 lbs.) of R-134a refrigerant.

(2) Measure refrigerant (refer to capacities). Refer to the instructions provided with the equipment being used.

(3) Verify engine is shut off. Open the suction and discharge valves. Open the charge valve to allow the refrigerant to flow into the system. When the transfer of refrigerant has stopped, close the suction and discharge valve.

(4) If all of the charge did not transfer from the dispensing device, put vehicle controls into the following mode:

- Automatic transaxle in park or manual transaxle in neutral
- Engine idling at 700 rpm
- A/C control set in 100 percent outside air
- Panel mode
- Blower motor ON high speed
- Vehicle windows closed

If the A/C compressor does not engage, test the compressor clutch control circuit and correct any failure. Refer to Group 8W, Wiring Diagrams.

(5) Open the suction valve to allow the remaining refrigerant to transfer to the system.

WARNING: TAKE CARE NOT TO OPEN THE DISCHARGE (HIGH-PRESSURE) VALVE AT THIS TIME.

(6) Close all valves and test the A/C system performance.

(7) Disconnect the charging station or manifold gauge set. Install the service port caps.

EVACUATING REFRIGERANT SYSTEM

NOTE: Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

If a compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the per-

SERVICE PROCEDURES (Continued)

formance of the air conditioner and damage the compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

(1) Connect a suitable charging station, refrigerant recovery machine, and a manifold gauge set with vacuum pump (Fig. 18).

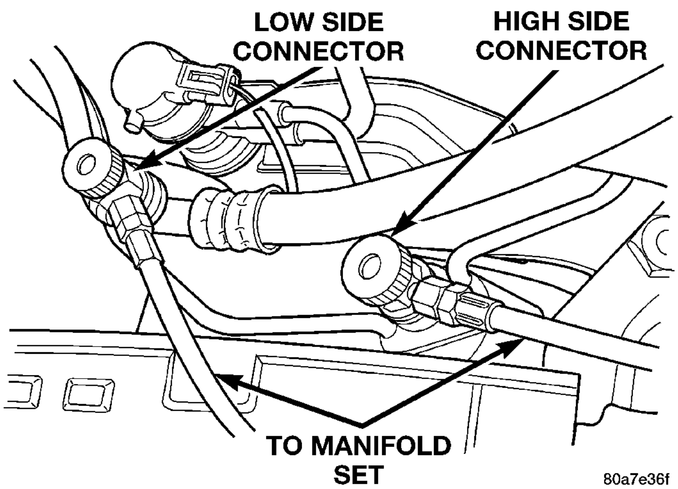


Fig. 18 Refrigerant Recovery Machine Hookup

(2) Open the suction and discharge valves and start the vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge to eliminate all moisture in system. When the suction gauge reads -88 kPa (- 26 in. Hg) vacuum or greater for 45 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.

(3) Close all valves. Turn off and disconnect the vacuum pump.

(4) The refrigerant system is prepared to be charged with refrigerant.

R-134a REFRIGERANT

This vehicle uses a new type of refrigerant called R-134a. It is a non-toxic, non-flammable, clear colorless liquefied gas.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 in a R-134a system could cause compressor failure, refrigerant oil to sludge and/or poor performance. **Never add any other type of refrigerant to a system designed to use R-134a refrigerant. System failure will occur.**

The high pressure service port is located on the ffilter/drier. The low pressure service port is located on the suction line near the strut tower.

When servicing a system, it is required that an air conditioning charging recovery/recycling machine be used (Fig. 19). Contact an automotive service equipment supplier for proper equipment. Refer to the operating instructions provided with the equipment for proper operation.

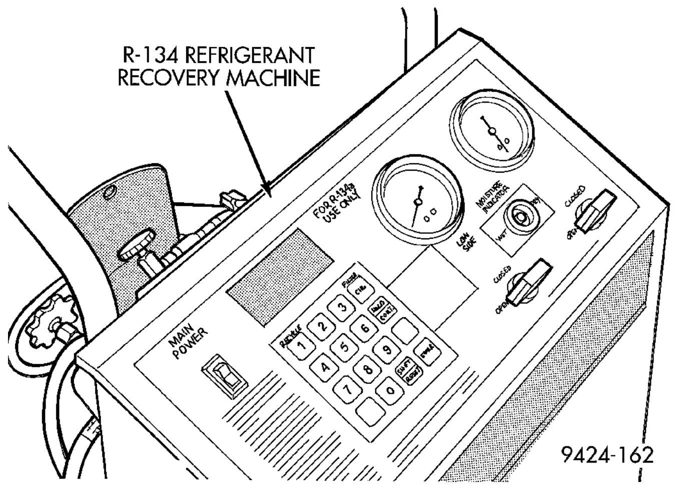


Fig. 19 Refrigerant Recovery/Recycling Station (Typical)

A manifold gauge set (Fig. 20) must also be used in conjunction with the charging and/or recovery/recycling device. Only use gauges that have not been used for R-12. The service hoses on the gauge set should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant R-134a from being released into the atmosphere.

R-134a refrigerant requires a special type of compressor oil. When adding oil, make sure to use the oil that is specified on the under hood label.

Due to the different characteristics of R-134a it requires all new service procedures.

The use of R-134a will have a positive environmental impact due to it’s zero ozone depletion and low global warming impact.

SERVICING REFRIGERANT OIL LEVEL

CAUTION: The refrigerant oil used in a R-134a A/C system is unique. Use only oils which were designed to work with R-134a refrigerant. The oil designated for this vehicle is ND8 PAG (polyalkalene glycol).

SERVICE PROCEDURES (Continued)

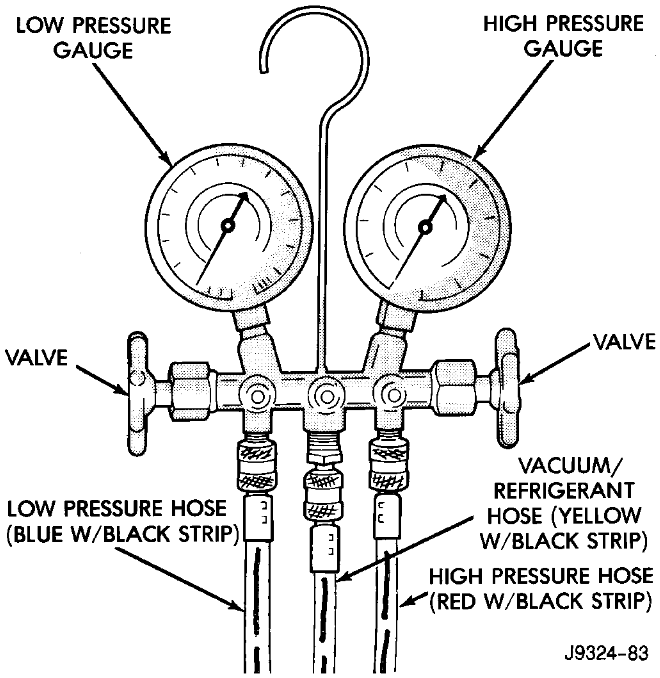


Fig. 20 Manifold Gauge Set- Typical

Recovery/recycling equipment will measure the lubricant being removed. This is the amount of lubricant to be added back to the system. If a new compressor is being installed, drain lubricant from old compressor, measure the amount drained and discard old lubricant. Drain the lubricant from the new compressor into a clean container. Return the amount of lubricant measured from the old compressor, plus the amount reclaimed from the system back into the new compressor.

(1) Discharge refrigerant system using recovery/recycling equipment if charge is present.

(2) Disconnect refrigerant lines from A/C compressor. Cap the open lines to prevent moisture from entering system.

(3) Remove compressor from vehicle.

(4) From suction port on top of compressor, drain lubricant from compressor.

(5) Add system capacity minus the capacity of components that have not been replaced. Refer to the Lubricant Capacity Chart. Add lubricant through the suction port on compressor. This is not to exceed 200 ml (6.75 oz.) in total.

(6) Install compressor and connect refrigerant lines. Then evacuate and charge refrigerant system.

SYSTEM LEAK CHECKING

WARNING: R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

If the A/C system is not cooling properly, determine if the refrigerant system is fully charged with R-134a. This is accomplished by performing a system Charge Level-Check or Fill. If while performing this test A/C liquid line pressure is less than 345 kPa (50 psi) proceed to Empty Refrigerant System Leak Test. If liquid line pressure is greater than 345 kPa (50 psi) proceed to low refrigerant level leak test. If the refrigerant system is empty or low in refrigerant charge, a leak at any line fitting or component seal is likely. A review of the fittings, lines and components for oily residue is an indication of the leak location. To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

EMPTY REFRIGERANT SYSTEM LEAK TEST

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible (approx. 28 in Hg.). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed with this procedure.

(2) Prepare a .284 Kg. (10 oz.) refrigerant charge to be injected into the system.

(3) Connect and dispense .284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.

(4) Proceed to Step 2 of Low Refrigerant Level Leak Test.

LOW REFRIGERANT LEVEL LEAK TEST

(1) Determine if there is any (R-134a) 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 with the system set to the following:

- Transaxle in Park
- Engine Idling at 700 rpm
- A/C Controls Set in 100 percent outside air
- Blower switch in the high A/C position
- A/C in the ON position
- Open all windows

SERVICE PROCEDURES (Continued)

CAUTION: A leak detector designed for R-12 refrigerant (only) will not detect leaks in a R-134a refrigerant system.

(4) Shut off the vehicle and wait 2 to 7 minutes. Then use an Electronic Leak Detector that is designed to detect R-134a type refrigerant and search for leaks. Fittings, lines, or components that appear to be oily usually indicates a refrigerant leak. To inspect the evaporator core for leaks, insert the leak detector probe into the drain tube opening or a heat duct. A R-134a dye is available to aid in leak detection, use only Chrysler approved refrigerant dye.

If a thorough leak check has been completed without indication of a leak, proceed to System Charge Level.

REMOVAL AND INSTALLATION

A/C SERVICE PORT VALVE CORES

REMOVAL

(1) Remove the valve caps (Fig. 5) and (Fig. 6)

(2) Using a R-134a refrigerant recovery machine, Remove the refrigerant from A/C system.

(3) Using a standard valve core tool, remove the valve core. **Be careful to prevent any dirt/debris from entering the valve core opening or getting on the replacement valve core.**

INSTALLATION

(1) When assembling the new valve core into the port, the core should be oiled with clean ND8 PAG compressor oil.

CAUTION: A valve that is not fully seated can lead to damage to the valve during evacuation and charge. This can result in system refrigerant discharge while uncoupling the charge adapters.

(2) Install valve core into port.

(3) Evacuate and charge the A/C system.

(4) Install the valve caps.

BLOWER MOTOR AND WHEEL ASSEMBLY

The blower motor is located on the bottom right side of the unit housing. The blower motor can be removed from the vehicle without having to remove the unit housing assembly.

WITH AIR CONDITIONING

REMOVAL

(1) Remove right side scuff plate.

(2) Pull back carpet.

(3) Cut wheel housing silencer in line with blower motor wiring.

(4) Disconnect blower motor wiring connector.

(5) RHD vehicle remove the motor cover.

(6) Remove three blower motor retaining screws (Fig. 21).

(7) Lower blower motor assembly from unit housing.

INSTALLATION

For installation, reverse the above procedures. Then tape silencer into position.

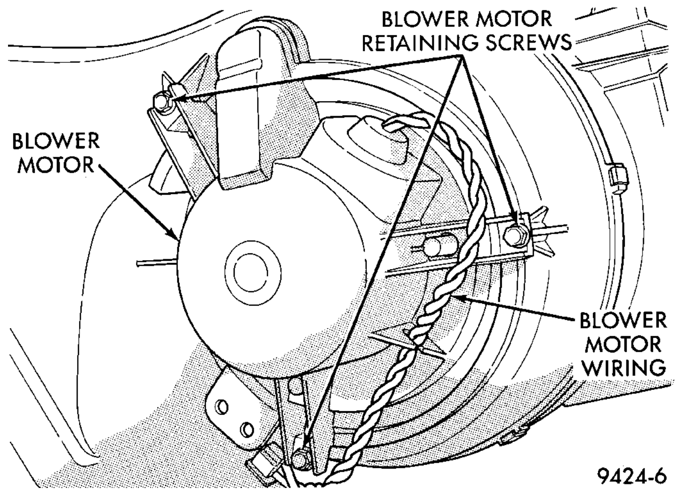


Fig. 21 Blower Motor Retaining Screws

WITHOUT AIR CONDITIONING

REMOVAL

(1) Disconnect blower motor wiring connector.

(2) Grasp the blower motor while pulling down tab. Turn approximately 1/8 turn counterclockwise and remove blower motor assembly from unit housing (Fig. 22).

INSTALLATION

For installation, reverse the above procedures.

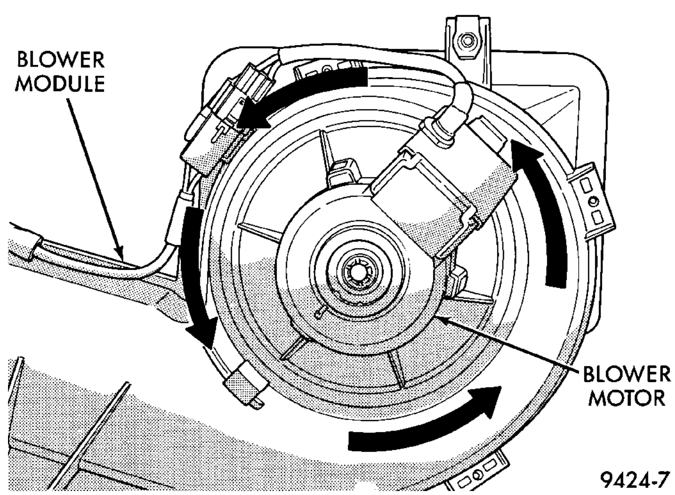


Fig. 22 Blower Motor Removal

REMOVAL AND INSTALLATION (Continued)

BLOWER MOTOR RESISTOR

CAUTION: Stay clear of the blower motor and resistor block (Hot). Do not operate the blower motor with the resistor block removed.

REMOVAL

(1) Remove windshield wipers.

(2) Remove cowl top screen.

(3) Disconnect the resistor block wiring connector.

(4) Remove two resistor block retaining screws. The screw threads attaching the resistor block are not full length. It is necessary to gently pry out the resistor block while turning the screws counterclockwise enabling the threads to engages.

(5) Remove resistor block from vehicle.

INSTALLATION

For installation, reverse the above procedures.

BLOWER MOTOR WHEEL

The blower motor wheel is only serviced with the blower motor. The wheel and the motor are balanced as an assembly. If the blower motor wheel requires replacement, the blower motor must also be replaced. Refer to blower motor for replacement procedure.

COMPRESSOR

CAUTION: Add only new lubricant when system requires additional lubricant. Do not use old reclaimed lubricant.

REMOVAL

The A/C compressor may be unbolted and repositioned without discharging the refrigerant system. Discharging is not necessary if removing the compressor clutch/coil assembly, engine, cylinder head, or alternator.

WARNING: REFRIGERANT PRESSURES REMAIN HIGH EVEN THOUGH THE ENGINE MAY BE TURNED OFF. DO NOT TWIST OR KINK THE REFRIGERANT LINES WHEN REMOVING A FULLY CHARGED COMPRESSOR. SAFETY GLASSES MUST BE WORN.

(1) Disconnect battery negative cable.

(2) Loosen and remove drive belts, refer to Group 7, Engine Cooling.

(3) Using a R-134a refrigerant recovery machine, remove the refrigerant from A/C system. If the compressor is being replaced.

(4) Disconnect compressor clutch wire lead.

(5) Remove refrigerant lines from compressor, if necessary.

(6) If system is left open place plug/cap over open lines.

(7) Remove compressor attaching bolt.

(8) Remove compressor. If refrigerant lines were not removed, lift compressor/clutch assembly and tie it to a suitable component.

INSTALLATION

For installation, reverse the above procedures.

COMPRESSOR CLUTCH/COIL ASSEMBLY

Compressor assembly must be removed from mounting. Although, refrigerant discharge is not necessary.

REMOVAL

(1) Remove the compressor shaft bolt (Fig. 23). A band type oil filter removal tool can be placed around the clutch plate to aid in bolt removal.

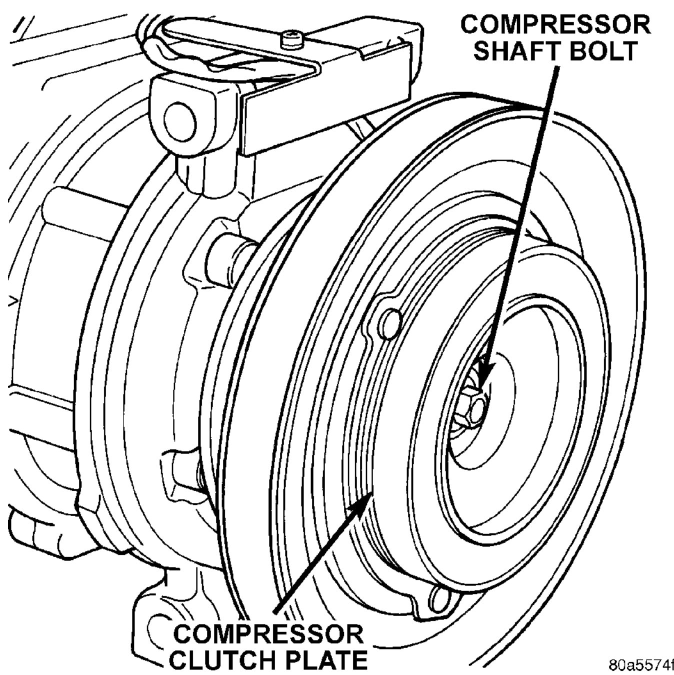


Fig. 23 Compressor Shaft Bolt and Clutch Plate

REMOVAL AND INSTALLATION (Continued)

(2) Tap the clutch plate with a plastic hammer and remove clutch plate and shim(s) (Fig. 24).

CAUTION: Do not use screwdrivers between the clutch plate assembly and pulley to remove front plate as this may damage the front plate assembly.

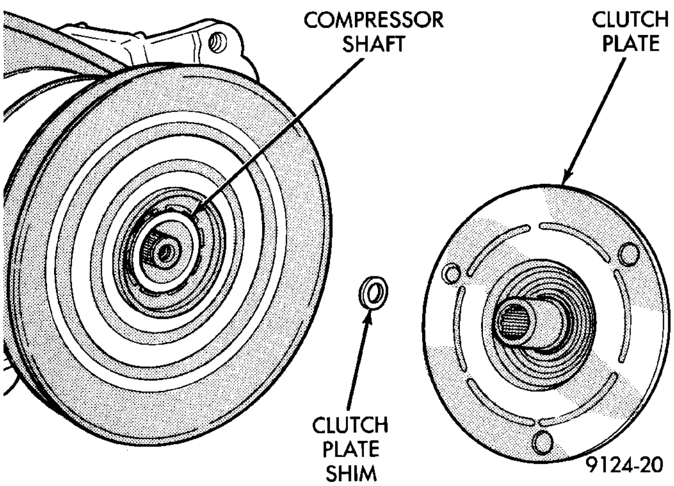


Fig. 24 Clutch Plate and Shim(s)

(3) Remove pulley retaining snap ring with Snap Ring Pliers, and slide pulley assembly off of compressor (Fig. 25).

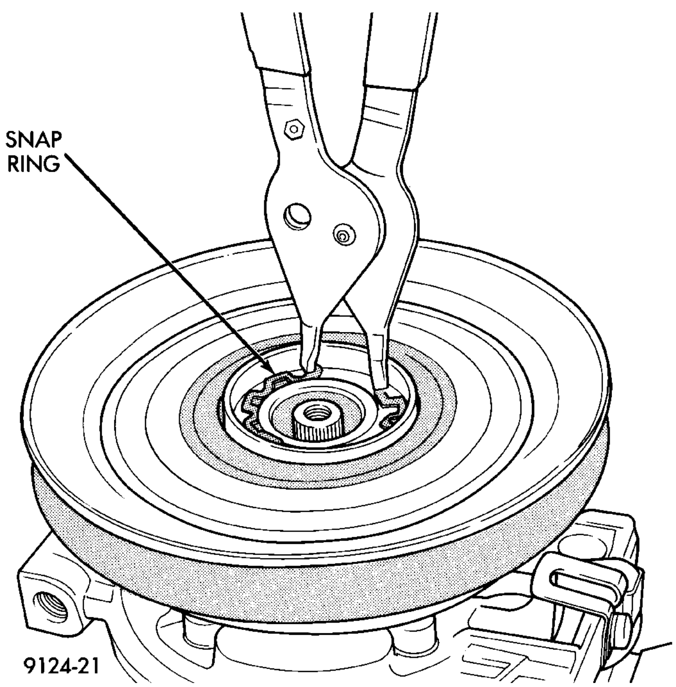


Fig. 25 Removing Pulley Snap Ring

(4) Remove coil wire bracket/ground clip screw and wire harness.

(5) Remove snap ring retaining field coil onto compressor housing (Fig. 26). Slide field coil off of compressor housing.

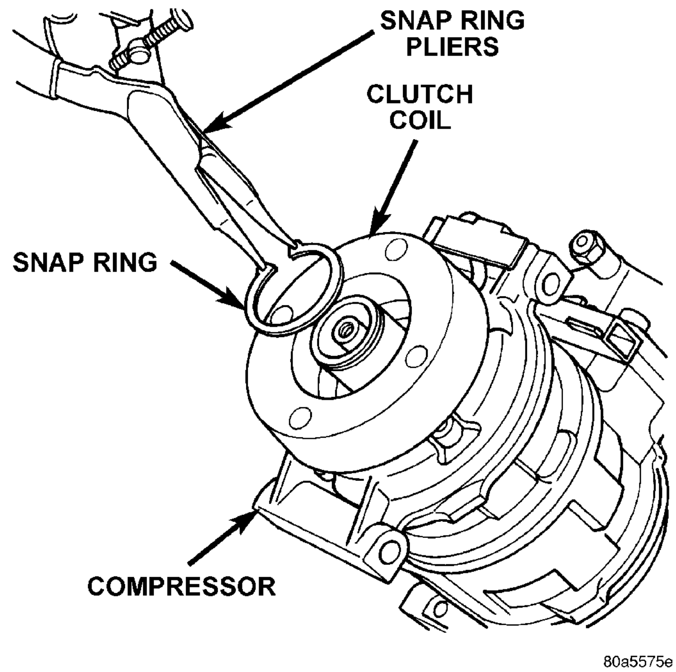


Fig. 26 Clutch Coil Snap Ring

(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 the coil wire bracket/ground retaining screw.

NOTE: The bevel side of the snap ring must be outward.

(2) Install field coil retaining snap ring with Snap Ring Pliers. 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.
Do not mar the pulley frictional surface.

(3) Install pulley assembly to compressor. If necessary, tap gently with a block of wood on the friction surface (Fig. 27).

(4) Install pulley assembly retaining snap ring (bevel side outward) with Snap Ring Pliers. Press the

REMOVAL AND INSTALLATION (Continued)

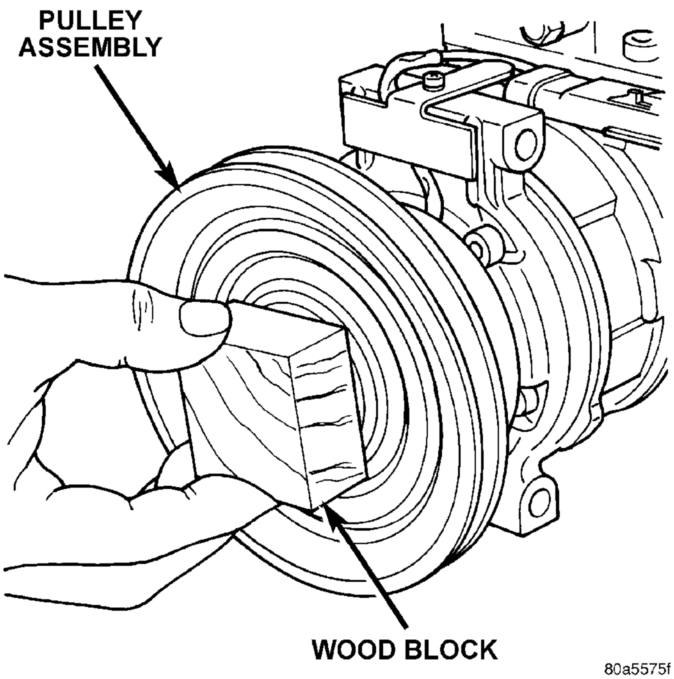


Fig. 27 Installing Pulley Assembly

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) If installing a new front plate and/or pulley assembly, the gap between front plate and pulley face must be checked. Use the following procedure:

(a) Attach a dial indicator to front plate so that movement of the plate can be measured.

(b) With the dial indicator zeroed on the front plate, energize the clutch and record the amount of movement.

(c) The readings should be 0.35 to 0.65 mm (0.014 to 0.026 in.). If proper reading is not obtained, add or subtract shims until desired reading is obtained.

(8) Install compressor shaft bolt. Tighten to 17.5 ± 2 N·m (155 ± 20 in. lbs.) torque.

NOTE: Shims may compress after tightening shaft nut. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

CLUTCH BREAK-IN

After new clutch installation, cycle the A/C clutch 20 times (5 seconds on and 5 seconds 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.

CONDENSATION DRAIN TUBE

REMOVAL

(1) Raise vehicle.

(2) Locate rubber drain tube on right side of dash panel (Fig. 28).

(3) Squeeze clamp and remove drain tube.

INSTALLATION

To install, reverse the preceding operation. Check the drain tube nipple on the heater-A/C housing for any obstructions.

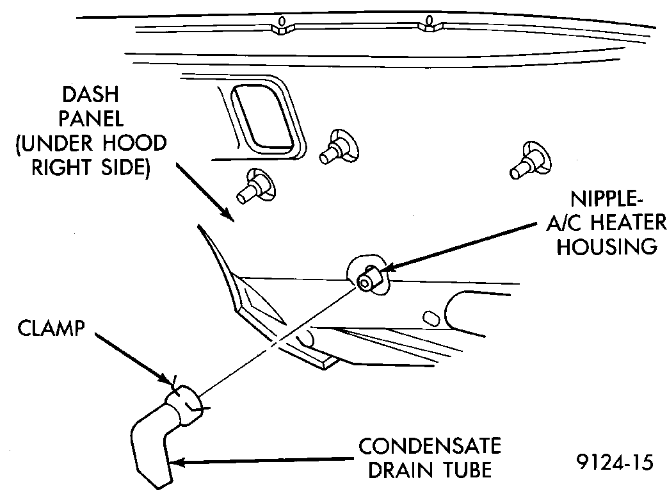


Fig. 28 Condensate Water Drain Tube – Typical

CONDENSER

The condenser is located in front of the engine radiator. It has no serviceable parts. If damaged or leaking, the condenser assembly must be replaced.

WARNING: THE REFRIGERANT MUST BE REMOVED FROM THE SYSTEM BEFORE REMOVING THE CONDENSER.

REMOVAL

(1) Using a R-134a refrigerant recovery machine, remove the refrigerant from the A/C system.

(2) Remove battery support strut.

(3) Remove refrigerant lines from condenser.

(4) Remove upper radiator mounts.

(5) Remove condenser to radiator mounting screws.

(6) Tilt radiator back and remove condenser.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

DISCHARGE LINE

WARNING: THE REFRIGERANT SYSTEM MUST BE RECOVERED BEFORE SERVICING ANY PART OF THE REFRIGERANT SYSTEM.

REMOVAL

(1) Using a R-134a refrigerant recovery machine, remove the refrigerant from A/C system.

(2) From the top side of the vehicle, remove line at compressor (Fig. 29).

(3) From the bottom side of the vehicle, remove line at condenser.

INSTALLATION

For installation, reverse the above procedures.

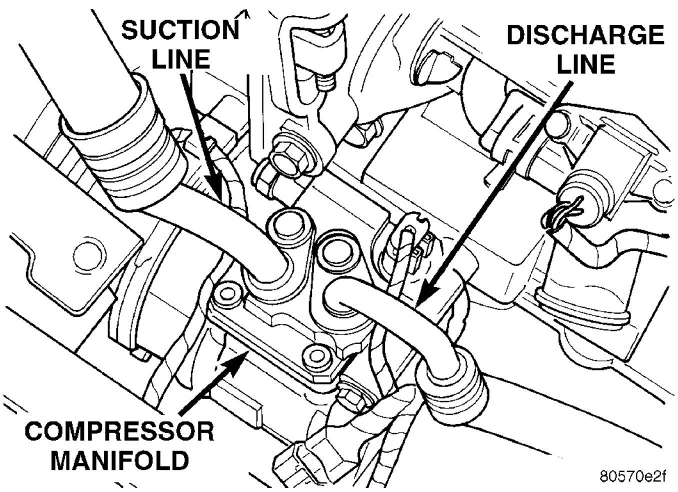


Fig. 29 Discharge Line

EVAPORATOR

This vehicle uses an aluminum plate and fin style evaporator. It is located in the Evaporator/Blower module.

The unit housing must be removed from the vehicle before beginning with this procedure. Refer to Unit Housing in this section for removal procedure.

Use this procedure if any or all of the following items require service:

- Evaporator
- Air inlet duct
- Recirculation door
- Evaporator/Blower module case

DISASSEMBLE

The RHD vehicle Unit Housing does not separate, and is only one unit.

(1) Remove the clips and screws that hold the Unit Housing to the Evaporator/Blower Module. Then separate the two units.

(2) Remove the evaporator to dash panel foam seal (Fig. 30).

(3) Disconnect fin sensing switch from harness.

(4) Remove upper to lower case retaining clips and screws.

(5) Separate the case halves (Fig. 31).

(6) Lift the evaporator out of the module (Fig. 32).

ASSEMBLE

To reassemble, reverse the above procedures.

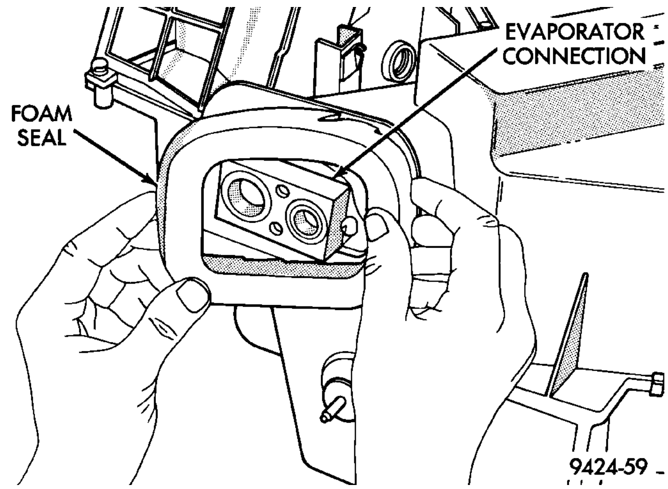


Fig. 30 Foam Seal Removal

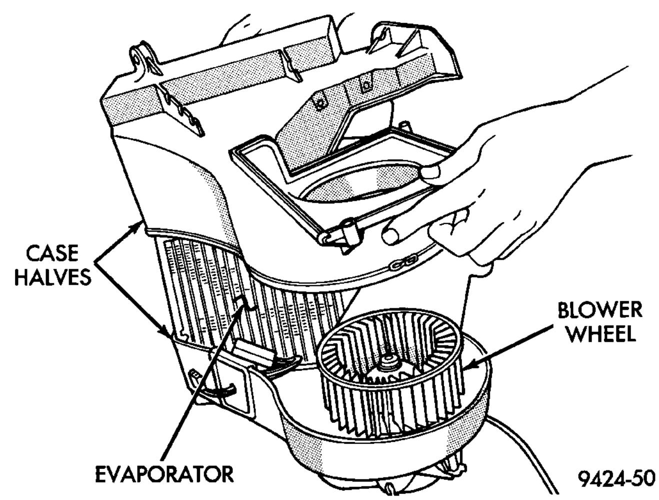


Fig. 31 Case Separation

EVAPORATOR PROBE

The evaporator probe can be removed without removing the Unit Housing from the vehicle.

REMOVAL

(1) Disconnect probe wiring connector from behind the glove box.

(2) Remove rubber grommet from evaporator/blower module (Fig. 33).

(3) Note which of the three pilot holes the evaporator probe is located in.

(4) Pull probe out of evaporator fins.

REMOVAL AND INSTALLATION (Continued)

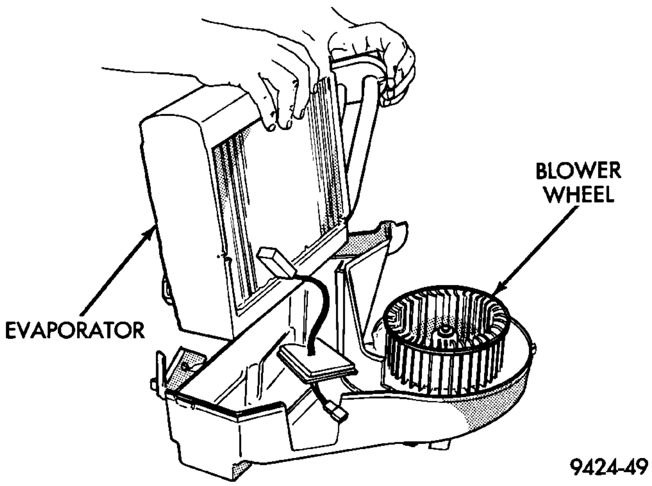


Fig. 32 Evaporator Removal

INSTALLATION

(1) There are three pilot holes available for the probe. The top hole is for service. If top hole was not used by previous probe, install probe in top hole.

(2) If previous probe was removed from top hole, use a small plastic stick and make a new hole. Make the hole 1/4 inch above or below the original hole in the evaporator core.

(3) Insert new probe into hole between evaporator fins.

(4) Reinstall rubber grommet into evaporator probe access hole.

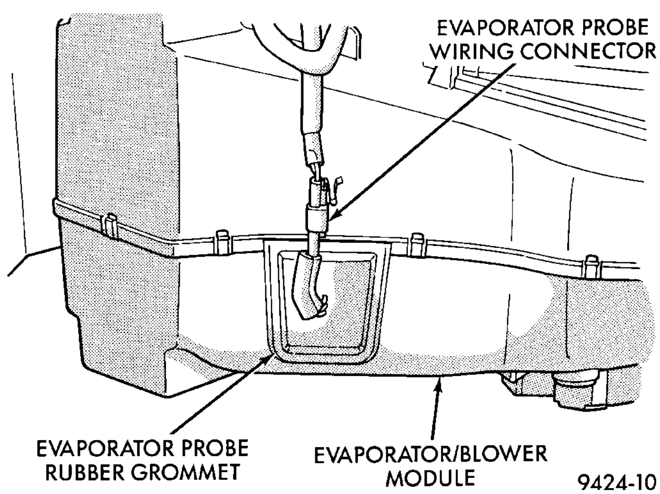


Fig. 33 Evaporator Probe Location

EXPANSION VALVE

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

REMOVAL

(1) Remove the boot-type wire connector from the pressure cut-off switch.

(2) Remove the center bolt of refrigerant line plumbing sealing plate (Fig. 34).

(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.

INSTALLATION

(1) Remove and replace the aluminum gasket on the evaporator sealing plate.

(2) Carefully hold the expansion valve to the evaporator sealing plate so not to scratch the sealing surface. Install two screws and tighten to 11 ± 3 N·m (100 ± 30 in. lbs.).

(3) Remove and replace the aluminum gasket 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 in. 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.

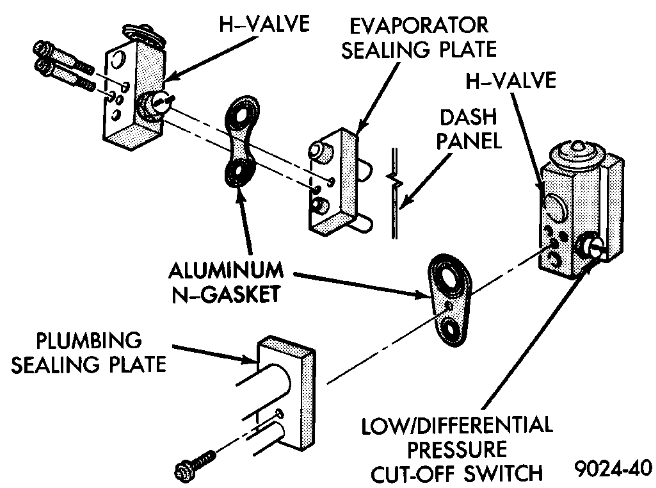


Fig. 34 Expansion Valve

A/C FILTER/DRIER

The filter/drier is mounted in a rubber grommet on the right side of the engine compartment. The refrigerant must be recovered from the A/C system before replacing the filter/drier assembly.

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY RECOVERED BEFORE PROCEEDING WITH THIS OPERATION.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect liquid line from filter/drier.

(2) Disconnect liquid line on suction line assembly from filter/drier.

(3) Pull filter/drier out of rubber grommet.

INSTALLATION

For installation, reverse the above procedures.

HIGH PRESSURE CUT OUT SWITCH

WARNING: THE REFRIGERANT MUST BE REMOVED FROM THE SYSTEM BEFORE REMOVING THE HIGH PRESSURE CUT OUT SWITCH.

REMOVAL

(1) Disconnect wiring connector at the switch (Fig. 35).

(2) Remove internal snap ring.

(3) Pull switch out of manifold.

INSTALLATION

For installation, reverse the above procedures.

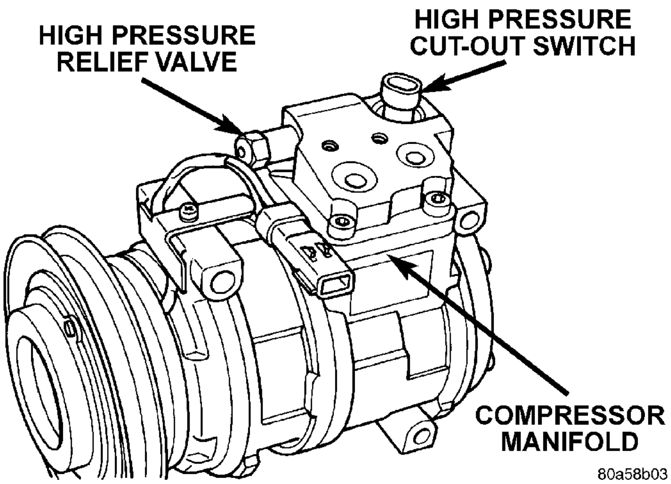


Fig. 35 High Pressure Relief Valve Location

HIGH PRESSURE RELIEF VALVE

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

REMOVAL

(1) Using a R-134a refrigerant recovery machine, remove the refrigerant from A/C system.

(2) Rotate the high pressure relief valve counterclockwise and separate relief valve from the vehicle (Fig. 35).

INSTALLATION

For installation, reverse the above procedures using a new O-ring seal. Evacuate and charge the refrigerant system.

HEATER CORE

Refer to Air Distribution Recondition of this section for heater core removal procedure.

HEATER HOSES

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.

NOTE: Review Cooling System Precautions before proceeding with this operation.

REMOVAL

(1) Drain engine cooling system. Refer to Group 7, Cooling System.

(2) Remove clamp at end of heater hose to be removed.

(3) RHD vehicles, heater hoses at the heater core connection have quick connects (Fig. 36). The quick connect consist of two pieces; a quick connect and insert. The quick connect is removed by compressing the insert with a pliers, pull quick connect free of insert/nipple. Carefully compressed insert pulling the quick connect from connector nipple. The insert will remain on the connector nipple as the quick connect is removed.

(4) Remove the heater hose clamp from the heater hose at the block and remove hose.

INSTALLATION

NOTE: The insert should be remove from the connector nipple and place it in side of the quick connect.

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

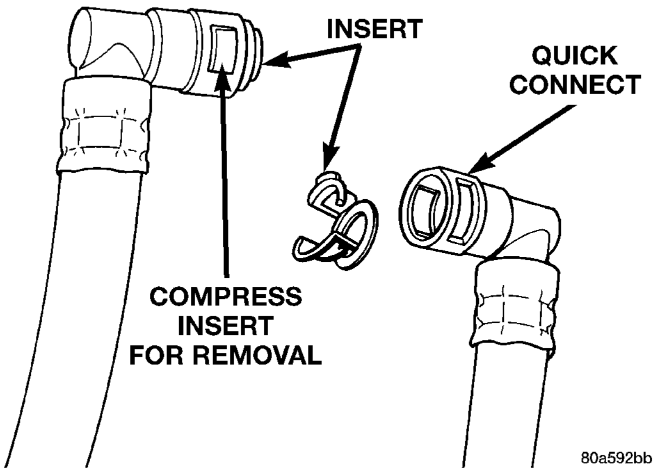


Fig. 36 Heater Hose Quick Connect

LIQUID LINE

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY EMPTY BEFORE PROCEEDING WITH THIS OPERATION.

REMOVAL

(1) Using a R-134a refrigerant recovery machine, remove the refrigerant from A/C system.

(2) Disconnect liquid line at drier.

(3) Disconnect liquid line at condenser.

INSTALLATION

For installation, reverse the above procedures.

LOW PRESSURE CUT OFF SWITCH

WARNING: THE REFRIGERATION SYSTEM MUST BE COMPLETELY RECOVERED BEFORE PROCEEDING WITH THIS OPERATION. REFER TO REFRIGERANT RECOVERY SECTION.

REMOVAL

(1) Disconnect the boot like wire connector at the cut off switch.

(2) Using a sender unit removal socket, remove the switch from the expansion valve (Fig. 37).

INSTALLATION

NOTE: Verify the O-ring condition on the replacement switch.

For installation, reverse the above procedures. Evacuate and charge the system.

MODE CONTROL CABLE

The Mode Control Cable can be removed and installed without having to remove the instrument panel from the vehicle.

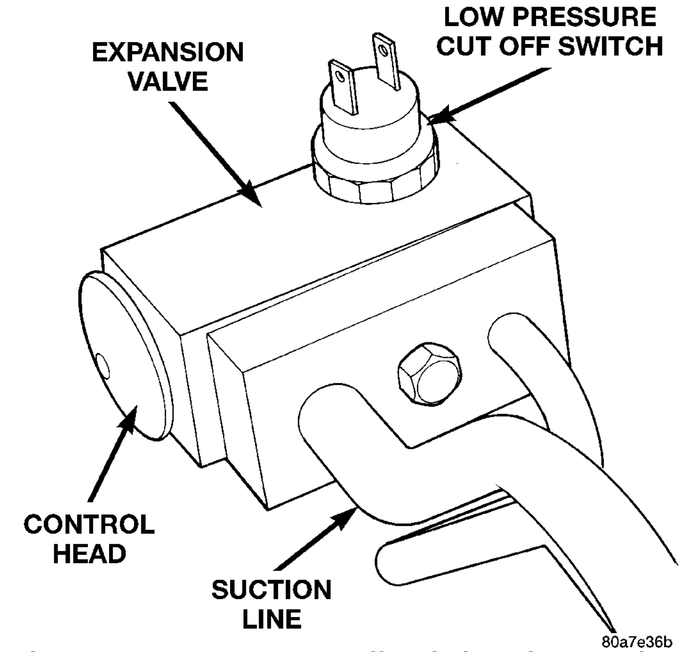


Fig. 37 Low Pressure Cut-Off Switch and Expansion Valve – Typical

REMOVAL

(1) Remove instrument panel upper cowl panel.

(2) Remove right side upper instrument panel bezel (Fig. 38).

(3) Remove center vent duct (Fig. 39).

(4) Remove upper defrost duct (Fig. 40).

(5) Remove inner defrost duct (Fig. 41).

(6) Disconnect cable at heater unit.

(7) Disconnect cable at control panel.

(8) Remove cable from vehicle.

INSTALLATION

For installation, reverse the above procedures, adjust cable and test. Refer to Mode Control Cable Adjustment at the end of this section.

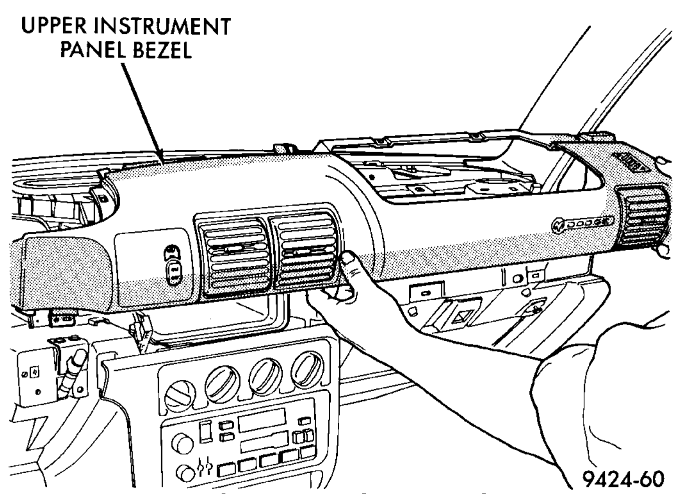


Fig. 38 Bezel Removal

REMOVAL AND INSTALLATION (Continued)

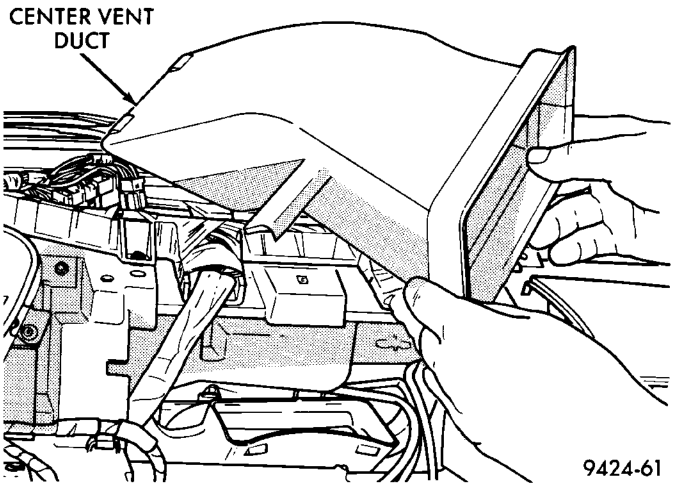


Fig. 39 Instrument Panel Center Vent

RECIRCULATION CONTROL CABLE (RHD)

The instrument panel and unit housing must be removed from the vehicle to gain access to the recirculation cable. Refer to Group 8E, Instrument Panel for removal procedure.

REMOVAL

(1) Remove instrument panel from vehicle. Refer to group 8E for procedure.
(2) Remove cable at control end.
(3) Remove cable at recirculation door end.

INSTALLATION

For installation, reverse the above procedures, adjust cable and test. See Recirculation Control Cable Adjustment toward the end of this section.

RECIRCULATION DOOR ACTUATOR

The recirculation door actuator is a vacuum controlled actuator used to control movement of the recirculation door in air conditioned equipped vehicles.

The instrument panel must be removed from the vehicle to gain access to the recirculation door actuator. Refer to

REMOVAL

(1) Remove instrument panel from vehicle. Refer to Group 8E, Instrument Panel And Systems for removal procedures.
(2) Disconnect vacuum line from actuator (Fig. 42).
(3) Remove two nuts retaining vacuum actuator to recirculation door housing.
(4) Disconnect actuator from recirc. door link.
(5) Remove recirculation door actuator from vehicle.

INSTALLATION

For installation, reverse the above procedures.

SUCTION LINE

WARNING: THE REFRIGERANT MUST BE RECOVERED BEFORE SERVICING ANY PART OF THE REFRIGERANT SYSTEMS.

REMOVAL

(1) Using a R-134a refrigerant recovery machine, remove the refrigerant from A/C system.
(2) Remove retaining bolt at expansion valve (Fig. 43).
(3) Remove line at drier.
(4) Remove line at compressor.

INSTALLATION

For installation, reverse the above procedures.

TEMPERATURE CONTROL CABLE

The Control Cable can be removed and installed without having to remove the instrument panel from the vehicle.

REMOVAL

(1) Remove instrument panel upper cowl panel.
(2) Remove right side upper instrument panel bezel (Fig. 38).
(3) Remove center vent duct (Fig. 39).
(4) Remove upper defrost duct (Fig. 40).
(5) Remove inner defrost duct (Fig. 41).
(6) Disconnect cable at heater unit.
(7) Disconnect cable at control panel. Remove control from instrument panel.
(8) Remove cable from vehicle.

INSTALLATION

For installation, reverse the above procedures, adjust cable and test. See Temperature Control Cable Adjustment in this section.

REMOVAL AND INSTALLATION (Continued)

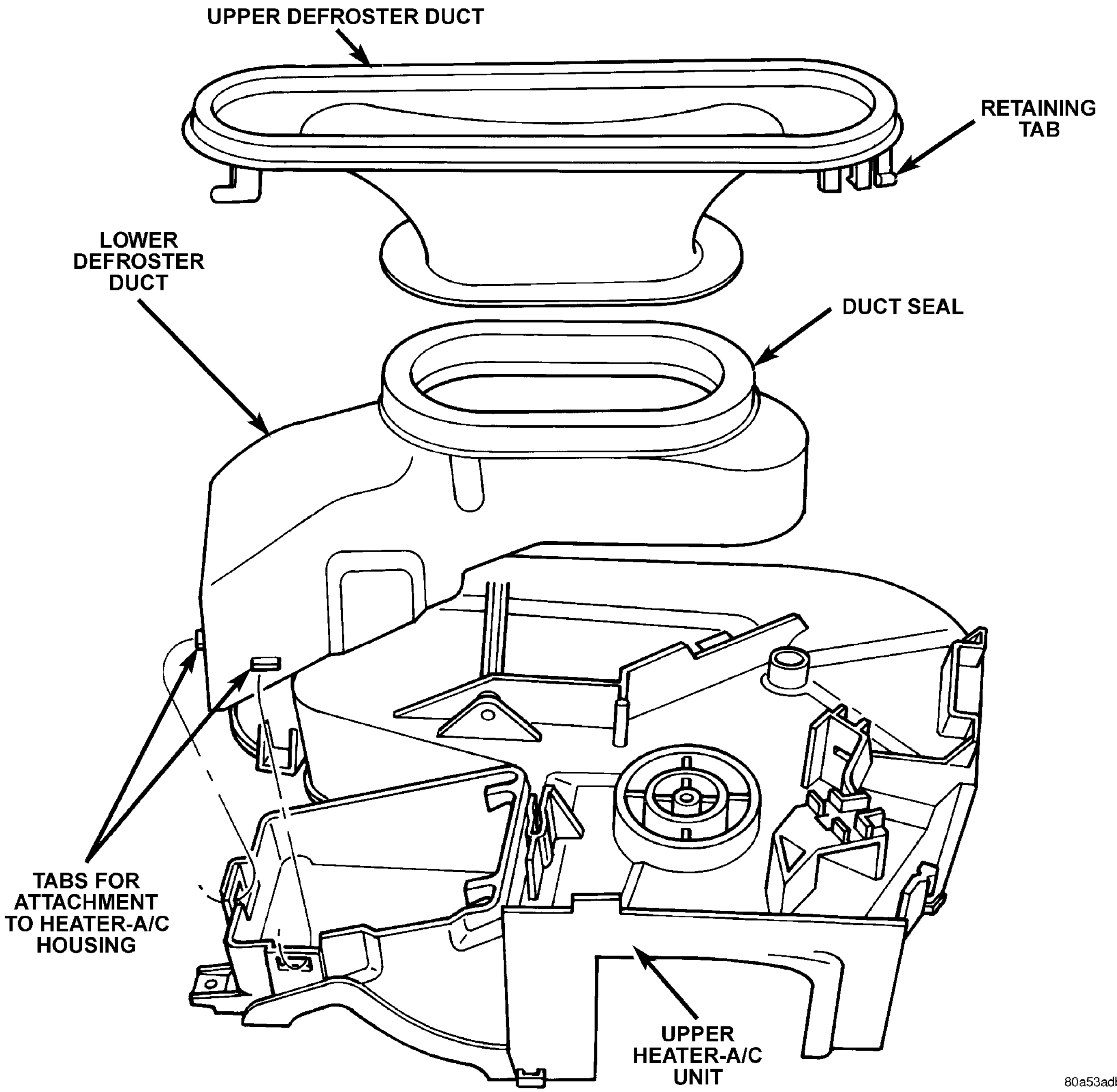


Fig. 40 Instrument Panel Defrost Duct

REMOVAL AND INSTALLATION (Continued)

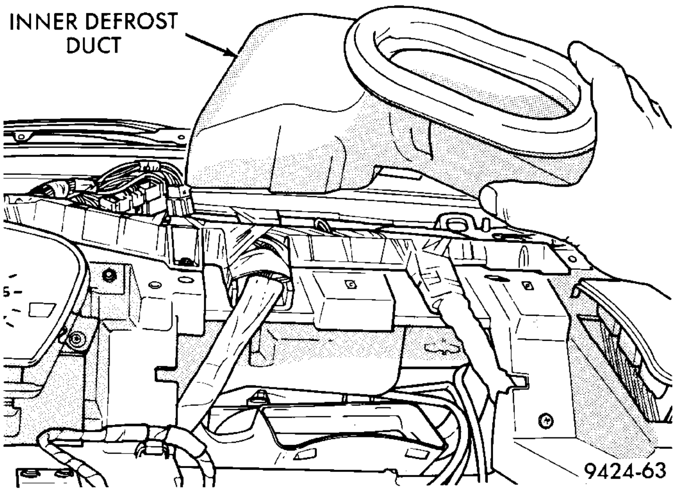


Fig. 41 Instrument Panel Inner Defrost Duct

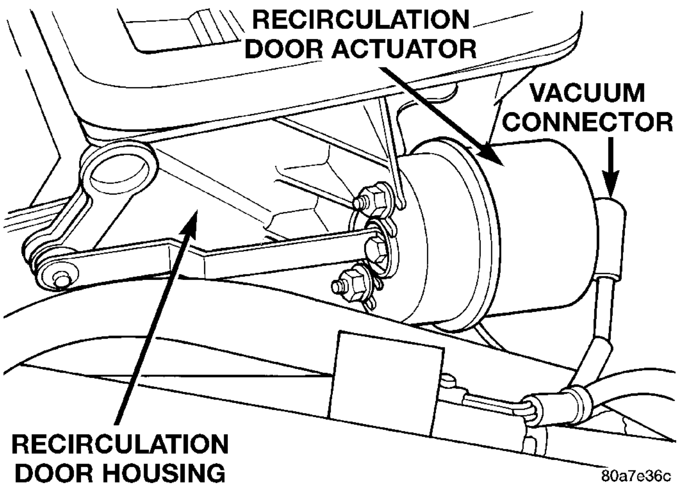


Fig. 42 Recirculation Door Actuator

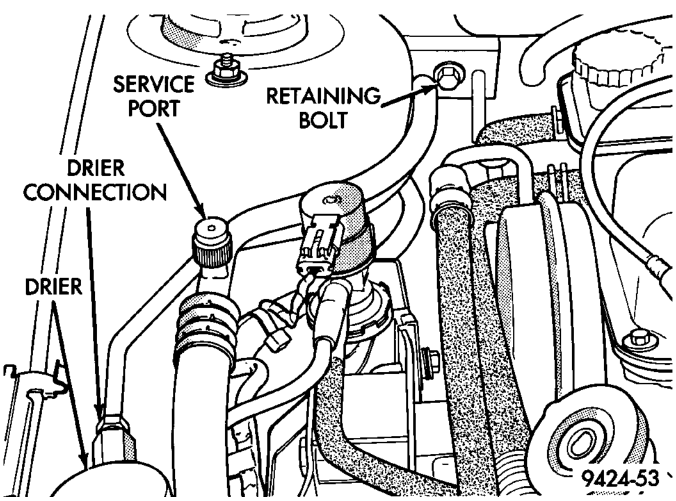


Fig. 43 Bolt Removal

UNIT HOUSING

The instrument panel must be removed in order to remove the Unit Housing. Refer to group 8E Instrument Panel and Gauges for detailed procedure.

WARNING: THE R-134a REFRIGERANT SYSTEM MUST BE RECOVERED BEFORE SERVICING ANY PART OF THE REFRIGERANT SYSTEM.

REMOVAL

(1) Remove instrument panel from vehicle. Refer to group 8E Instrument Panel and Gauges for detailed procedure.

(2) Drain cooling system and remove heater hoses at the dash panel. Place plugs in the heater core outlets to prevent coolant spillage during unit housing removal.

(3) Using a refrigerant recovery machine, remove the refrigerant from the A/C system, if equipped.

(4) Remove suction line at expansion valve. Place a piece of tape over open refrigerant line to prevent moisture and/or dirt from entering the line.

(5) Remove expansion valve from evaporator. Place a piece of tape over open evaporator fitting to prevent moisture and/or dirt from entering the evaporator.

(6) Remove rubber drain tube extension from condensation drain tube.

(7) Remove three retaining nuts located in the engine compartment, on the dash panel (Fig. 44).

(8) Remove the right side retaining screw (Fig. 45).

(9) Remove remaining nut located on dash panel stud.

(10) Disconnect the blue five way connector from the plenum. Module wiring harness must be removed with module.

(11) Remove assembly from the vehicle.

INSTALLATION

For installation, reverse the above procedures.

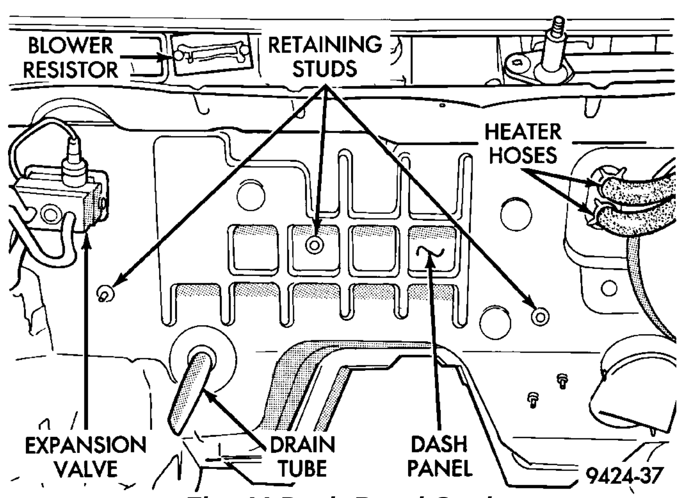


Fig. 44 Dash Panel Studs

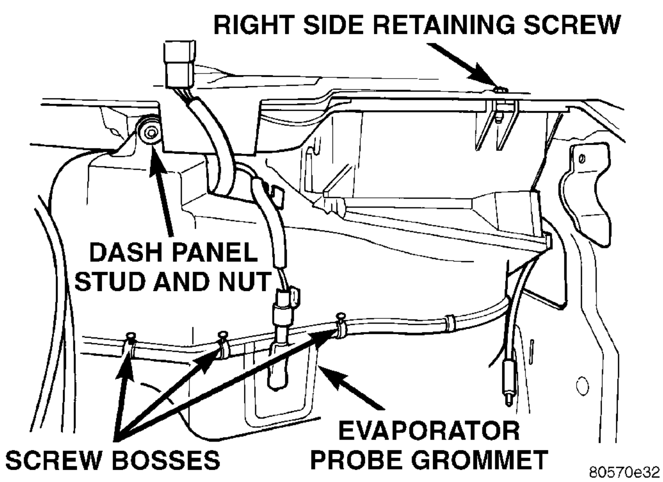


Fig. 45 Retaining Screws

DISASSEMBLY AND ASSEMBLY

AIR DISTRIBUTION MODULE – RECONDITION

Use this procedure if any or all of the following items require service:

- Heater core
- Temperature door
- Mode door
- Heat/Defrost door
- Assembly housing

The unit housing must be removed from the vehicle before beginning with this procedure. Refer to Unit Housing in this section for removal procedure.

DISASSEMBLE

For RHD vehicles, the Unit Housing does not separate. It is a one piece unit and must be replaced as a whole.

(1) Remove the clips and screws that hold the Air Distribution Module to the Evaporator/Blower Module. Then separate the two units (Fig. 46).

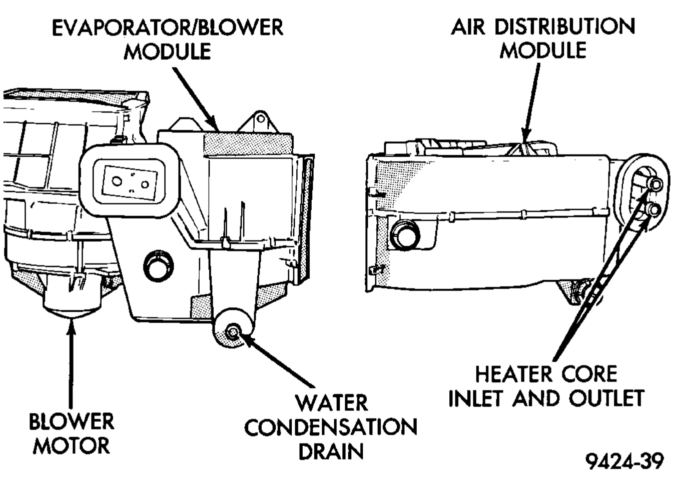


Fig. 46 Air Distribution and Evaporator/Blower Module Separation

(2) Remove the panel opening foam seal, demister opening foam seal, and heater core tube foam seals from unit.

(3) Remove the retaining clips and screws that hold the upper and lower housings together (Fig. 47).

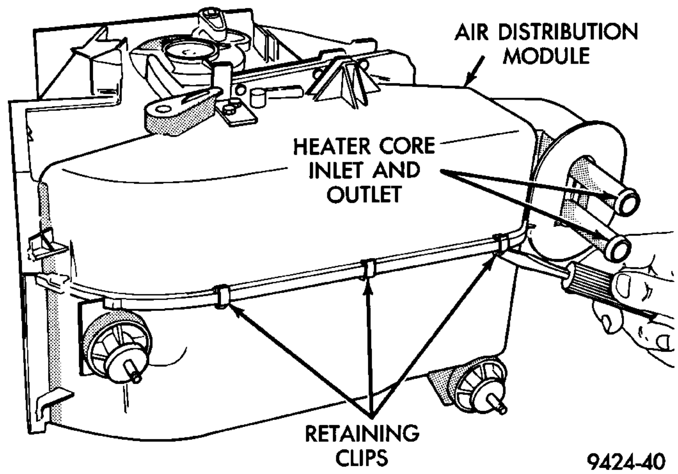


Fig. 47 Retaining Clip Removal

(4) Place the unit in the upside down position. Then separate the two halves of the module (Fig. 48).

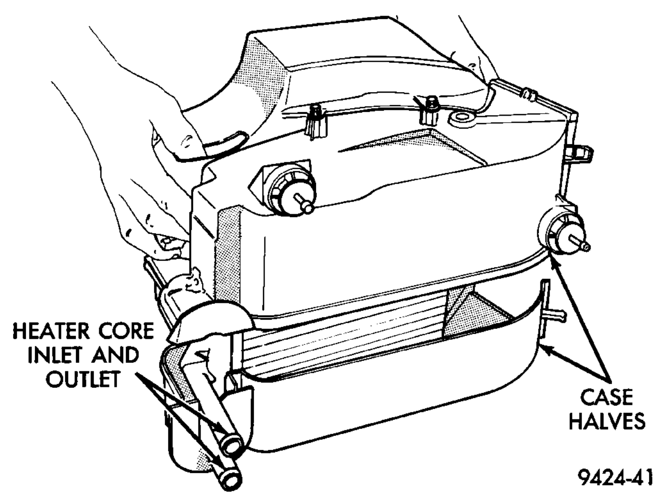


Fig. 48 Case Separation

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Lift the heater core out of the case (Fig. 49).

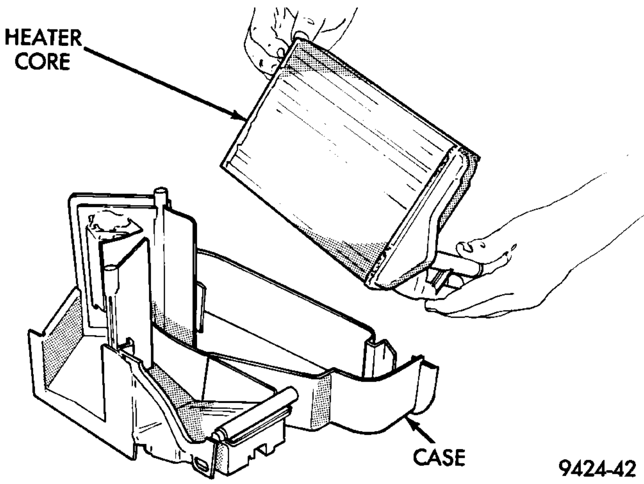


Fig. 49 Heater Core Removal

(6) Press tab in at base of temperature door and release door from lever (Fig. 50). Then remove the door.

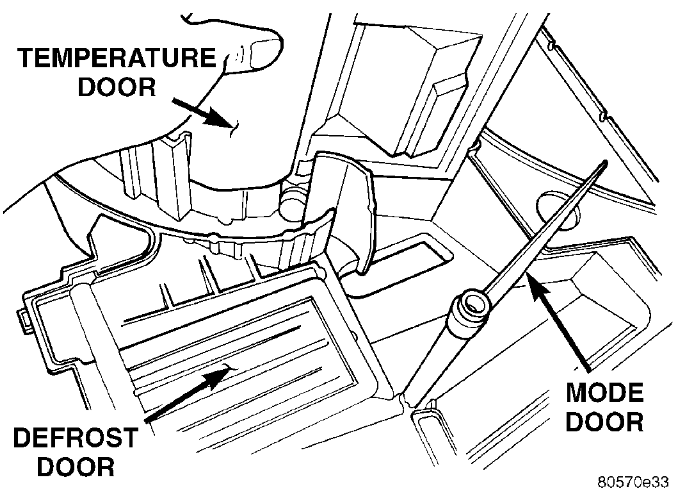


Fig. 50 Temperature Door Removal

(7) Press tab in at base of mode door and release door from lever (Fig. 51).

(8) Remove Heat/Defrost door cam screw (Fig. 52).

(9) Lift the cam and mode door lever off of the housing (Fig. 53).

(10) Remove the Heat/Defrost link pivot screw (Fig. 54).

(11) Lift the Heat/Defrost link and the door as an assembly. Then separate the link from the door.

ASSEMBLE

To reassemble, reverse the above procedures.

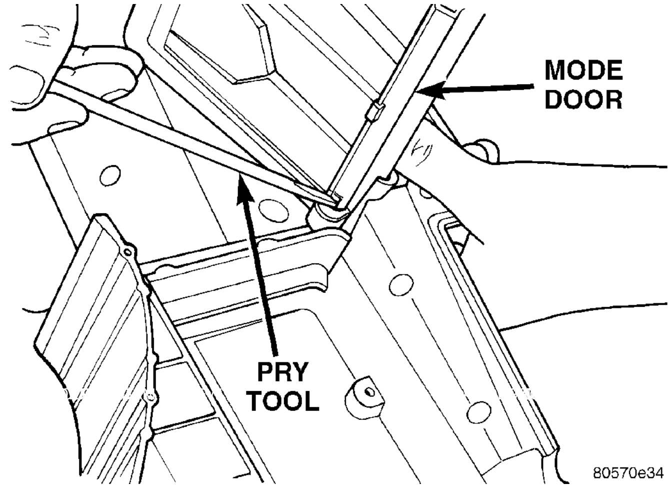


Fig. 51 Mode Door Removal

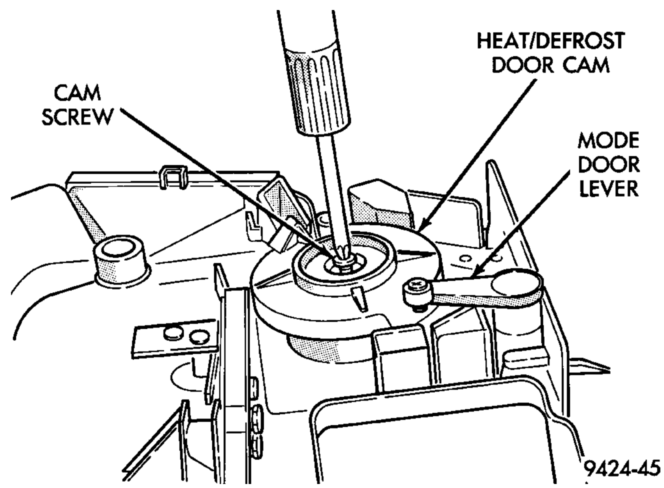


Fig. 52 Cam Screw Removal

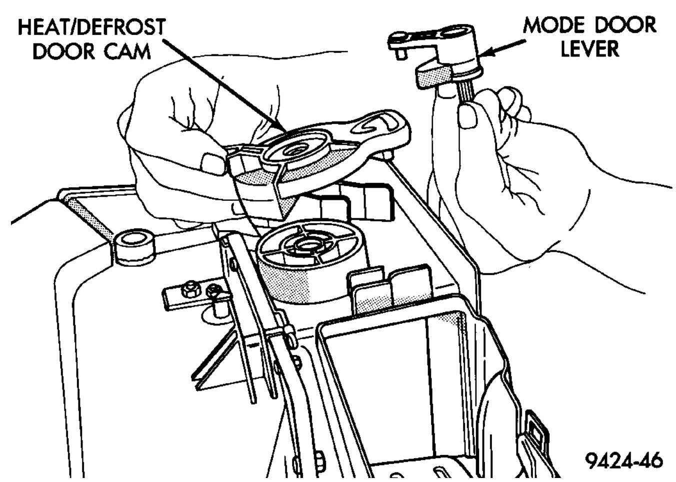


Fig. 53 Cam and Lever Removal

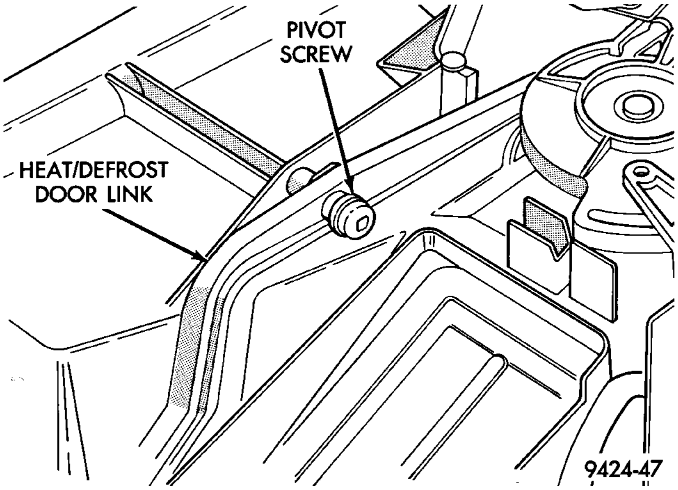


Fig. 54 Pivot Screw Removal

ADJUSTMENTS

MODE CONTROL CABLE

(1) Attach cable to actuator arm on mode door and clip black casing against the stop.

(2) Attach other end of cable to instrument panel control.

(3) Turn the mode knob completely counterclockwise.

(4) While holding the knob in the counterclockwise position, pull on the black casing of the mode cable. This will take up any free play in the cable and index the mode door to the mode knob.

(5) Then snap the cable hold down clip into position.

RECIRCULATION CONTROL CABLE (RHD)

(1) Attach cable to actuator arm on recirc. door and clip black casing against the stop.

(2) Attach other end of cable to instrument panel control.

(3) Turn the recirc. knob completely counterclockwise.

(4) While holding the knob in the counterclockwise position, pull on the black casing of the recirc. cable. This will take up any free play in the cable and index the recirc. door to the recirc. knob.

TEMPERATURE CONTROL CABLE

(1) Attach cable to actuator arm on temperature door and clip black casing against the stop.

(2) Attach other end of cable to instrument panel control.

(3) Turn the temperature knob completely counterclockwise.

(4) While holding the knob in the counterclockwise position, pull on the black casing of the temperature cable. This will take up any free play in the cable and index the temperature door to the temperature knob.

(5) Then snap the cable hold down clip into position.

(6) Remount control.

EMISSION CONTROL SYSTEMS

CONTENTS

ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

SYSTEM DESCRIPTION

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warmup cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). Refer to Malfunction Indicator Lamp in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example** , assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, use the DRB scan tool to erase all DTC's and extinguish the MIL.

Technicians can display stored DTC's by two different methods. Refer to Diagnostic Trouble Codes in this section. For DTC information, refer to charts in this section.

DESCRIPTION AND OPERATION

MALFUNCTION INDICATOR LAMP (MIL)

As a functional test, the Malfunction Indicator Lamp (MIL) illuminates at key-on before engine

DESCRIPTION AND OPERATION (Continued)

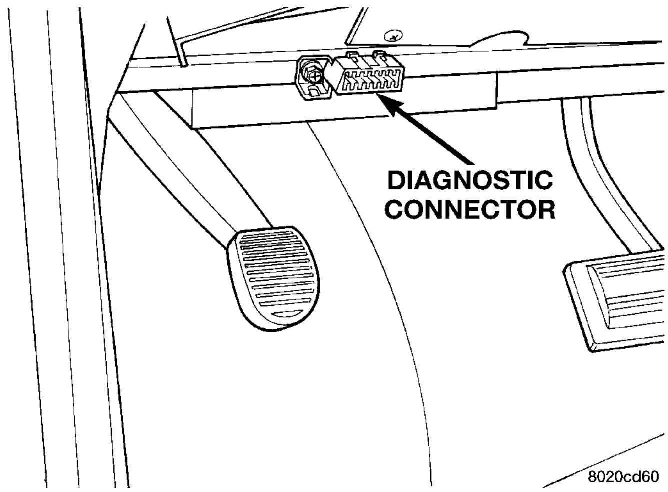


Fig. 1 Data Link (Diagnostic) Connector

cranking. Whenever the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) that affects vehicle emissions, it illuminates the MIL. If a problem is detected, the PCM sends a message over the CCD Bus to the instrument cluster to illuminate the lamp. The PCM illuminates the MIL only for DTC's that affect vehicle emissions. The MIL stays on continuously when the PCM has entered a Limp-In mode or identified a failed emission component or system. The MIL remains on until the DTC is erased. Refer to the Diagnostic Trouble Code charts in this group for emission related codes.

Also, the MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring in this section.

Additionally, the PCM may reset (turn off) the MIL when one of the following occur:

• PCM does not detect the malfunction for 3 consecutive trips (except misfire and fuel system monitors).

• PCM does not detect a malfunction while performing three successive engine misfire or fuel system tests. The PCM performs these tests while the engine is operating within ± 375 RPM of and within 10 % of the load of the operating condition at which the malfunction was first detected.

STATE DISPLAY TEST MODE

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. From the state display screen, access either State Display Inputs and Outputs or State Display Sensors.

CIRCUIT ACTUATION TEST MODE

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly.

DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

The technician can retrieve and display DTC's in two different ways:

• The preferred and most accurate method of retrieving a DTC is by using the DRB scan tool. The scan tool supplies detailed diagnostic information which can be used to more accurately diagnose causes for a DTC.

• The second method is by observing the two-digit number displayed at the Malfunction Indicator Lamp (MIL). The MIL is displayed on the instrument panel as the Check Engine lamp. This method is to be used as a "quick-test" only. Always use the DRB scan tool for detailed information.

Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

NOTE: For a list of DTC's, refer to the charts in this section.

BULB CHECK

Each time the ignition key is turned to the ON position, the malfunction indicator (check engine) lamp on the instrument panel should illuminate for approximately 2 seconds then go out. This is done for a bulb check.

OBTAINING DTC'S USING DRB SCAN TOOL

(1) Connect the DRB scan tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel; near the steering column.

(2) Turn the ignition switch on and access the "Read Fault" screen.

(3) Record all the DTC's and "freeze frame" information shown on the DRB scan tool.

(4) To erase DTC's, use the "Erase Trouble Code" data screen on the DRB scan tool. **Do not erase any**

DESCRIPTION AND OPERATION (Continued)

DTC's until problems have been investigated and repairs have been performed.

OBTAINING DTC'S USING MIL LAMP

(1) Cycle the ignition key On - Off - On - Off - On within 5 seconds.

(2) Count the number of times the MIL (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 two digit trouble codes.

An example of a flashed DTC is as follows:

- Lamp flashes 4 times, pauses, and then flashes 6 more times. This indicates a DTC code number 46.
- Lamp flashes 5 times, pauses, and flashes 5 more times. This indicates a DTC code number 55. A DTC 55 will always be the last code to be displayed. This indicates the end of all stored codes.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

HEX CODE	MIL CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
	12*		Battery Disconnect	Direct battery input to PCM was disconnected within the last 50 Key-on cycles.
	55*			Completion of fault code display on Check Engine lamp.
01	54**	P0340	No Cam Signal at PCM	No camshaft signal detected during engine cranking.
02	53**	P0601	Internal Controller Failure	PCM Internal fault condition detected.
05	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 circuit.
06	46***		Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
0A	42*		Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
0B	41***		Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
0C	37**	P0743	Torque Converter Clutch Soleniod/Trans Relay Circuits	An open or shorted condition detected in the torque converter part throttle unlock solenoid control circuit (3 speed auto RH trans. only).
0E	35**	P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the low speed radiator fan relay control circuit.
0F	34*		Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
10	33*		A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay circuit.
11	32**	P0403	EGR Solenoid Circuit	An open or shorted condition detected in the EGR transducer solenoid circuit.
12	31**	P0443	EVAP Purge Solenoid Circuit	An open or shorted condition detected in the duty cycle purge solenoid circuit.
13	27**	P0203	Injector #3 Control Circuit	Injector #3 output driver does not respond properly to the control signal.

DESCRIPTION AND OPERATION (Continued)

HEX CODE	MIL CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
		or		
14		P0202	Injector #2 Control Circuit	Injector #2 output driver does not respond properly to the control signal.
		or		
15		P0201	Injector #1 Control Circuit	Injector #1 output driver does not respond properly to the control signal.
19	25**	P0505	Idle Air Control Motor Circuits	A shorted or open condition detected in one or more of the idle air control motor circuits.
1A	24**	P0122	Throttle Position Sensor Voltage Low	Throttle position sensor input below the minimum acceptable voltage.
		or		
1B		P0123	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
1E	22**	P0117	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below minimum acceptable voltage.
		or		
1F		P0118	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above maximum acceptable voltage.
20	21**	P0134	Right Rear (or just) Upstream O2S Stays at Center	Neither rich or lean condition detected from the oxygen sensor.
21	17*		Engine Is Cold Too Long	Engine did not reach operating temperature within acceptable limits.
23	15**	P0500	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
24	14**	P0107	MAP Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
		or		
25		P0108	MAP Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
27	13**	P1297	No Change in MAP From Start to Run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading from start-up.
28	11*		No Crank Reference Signal at PCM	No crank reference signal detected during engine cranking.
2A		P0352	Ignition Coil #2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
		or		
2B		P0351	Ignition Coil #1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
2C	42*		No ASD Relay Output Voltage at PCM	An Open condition Detected In The ASD Relay Output Circuit.
2E	32**	P0401	EGR System Failure	Required change in air/fuel ratio not detected during diagnostic test.

DESCRIPTION AND OPERATION (Continued)

HEX CODE	MIL CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
30	62*	P1697	PCM Failure SRI Miles Not Stored	Unsuccessful attempt to update EMR mileage in the PCM EEPROM
31	63**	P1696	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
39 3A	23**	P0112 or P0113	Intake Air Temp Sensor Voltage Low Intake Air Temp Sensor Voltage High	Intake air temperature sensor input below the maximum acceptable voltage. Intake air temperature sensor input above the minimum acceptable voltage.
3C	61	P0106	Baro Out of Range	
3D	27**	P0204	Injector #4 Control Circuit	Injector #4 output driver does not respond properly to the control signal.
3E	21**	P0132	Right Rear (or just) Upstream O2S Shorted to Voltage	Oxygen sensor input voltage maintained above the normal operating range.
44	53**	P0600	PCM Failure SPI Communications	PCM Internal fault condition detected.
52	77		S/C Power Relay Ckt	
65	42*		Fuel Pump Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
66 67 69	21**	P0133 or P0135 or P0141	Right Bank Upstream O2S Slow Response Right Rear (or just) Upstream O2S Heater Failure Right Rear (or just) Downstream O2S Heater Failure	Oxygen sensor response slower than minimum required switching frequency. Upstream oxygen sensor heating element circuit malfunction. Oxygen sensor heating element circuit malfunction.
6A 6B 6C 6D 6E	43**	P0300 or P0301 or P0302 or P0303 or P0304	Multiple Cylinder Mis-fire Cylinder #1 Mis-fire Cylinder #2 Mis-fire Cylinder #3 Mis-fire Cylinder #4 Mis-fire	Misfire detected in multiple cylinders. Misfire detected in cylinder #1. Misfire detected in cylinder #2. Misfire detected in cylinder #3. Misfire detected in cylinder #4.
70	72**	P0420	Right Rear (or just) Catalyst Efficency Failure	Catalyst efficiency below required level.
71	31	P0441	Incurrect Pruge Flow	

DESCRIPTION AND OPERATION (Continued)

HEX CODE	MIL CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
72	37**	P1899	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch, auto. trans. only.
73	65*	P0551	Power Steering Switch Failure	Power steering high pressure seen at high speed (2.5L only).
76	52**	P0172	Right Rear (or just) Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
77	51**	P0171	Right Rear (or just) Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
7E	21**	P0138	Right Rear (or just) Downstream O2S Shorted to Voltage	Oxygen sensor input voltage maintained above the normal operating range.
80	17**	P0125	Closed Loop Temp Not Reached	Engine does not reach 20°F within 5 minutes with a vehicle speed signal.
81	21**	P0140	Right Rear (or just) Downstream O2S Stays at Center	Neither reich or lean condition detected from the downstream oxygen sensor.
84	24**	P0121	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor.
8A	25**	P1294	Target Idle Not Reached	Actual idle speed does not equal target idle speed.
91	25**	P1299	Vacuum Leak Found (IAC Fully Seated)	MAP sensor signal does not correlate to throttle position sensor signal. Possible vacuum leak.
92	71**	P1496	5 Volt Supply Output Too Low	5 volt output from regulator does not meet minimum requirement.
94	37*	P0740	Torq Conv Clu, No RPM Drop At Lockup	Relationship between engine speed and vehicle speed indicates no torque converter clutch engagement (auto. trans. only).
95	42*		Fuel Level Sending Unit Volts Too Low	Open circuit between PCM and fuel gauge sending unit.
		or		
96			Fuel Level Sending Unit Volts Too High	Circuit shorted to voltage between PCM and fuel gauge sending unit.
		or		
97			Fuel Level Unit No Change Over Miles	No movement of fuel level sender detected.
98	65**	P0703	Brake Switch Stuck Pressed or Released	No release of brake switch seen after too many accelerations.
99	44**	P1493	Ambient/Batt Temp Sen VoltsToo Low	Battery temperature sensor input voltage below an acceptable range.
		or		
9A		P1492	Ambient/Batt Temp Sensor VoltsToo High	Battery temperature sensor input voltage above an acceptable range.
9B	21**	P0131	Right Rear (or just) Upstream O2S Shorted to Ground	O2 sensor voltage too low, tested after cold start.

DESCRIPTION AND OPERATION (Continued)

HEX CODE	MIL CODE	GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
9C		or P0137	Right Rear (or just) Downstream O2S Shorted to Ground	O2 sensor voltage too low, tested after cold start.
9D	11**	P1391	Intermittent Loss of CMP or CKP	Intermittent loss of either camshaft or crankshaft position sensor.
AO A1	31**	PO442 or PO455	Evap Leak Monitor Small Leak detected Evap Leak Monitor Large Leak Detected	A small leak has been detected by the leak detection monitor. The leak detection monitor is unable to pressurize Evap system, indicating a large leak.
B7 B8	31**	P1495 or P1494	Leak DetectionPump Soleniod Circuit Leak detect Pump Sw or Mechanical Fault	Leak detection pump soleniod circuit fault (open or Short). Leak detection pump switch does not respond to input.
BA	11**	P1398	Mis-fire Adaptive Numerator at Limit	CKP sensor target windows have too much variation.
BB	31	P1486	Evap Hose Pinched	A pinched or bent Evap hose.
CO	21	PO133	Cat Mon Slow O2 Upstream	Oxygen sensor response slower than minimum required switching frequency.

* Check Engine Lamp (MIL) will not illuminate if this Diagnostic Trouble Code was recorded. Cycle Ignition key as described in manual and observe code flashed by Check Engine lamp.

** Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

*** Generator Lamp illuminated

MONITORED SYSTEMS

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator (Check Engine) Lamp will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the check engine lamp or a scan tool.

The following is a list of the system monitors:

- EGR Monitor
- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Evaporative System Leak Detection Monitor

Following is a description of each system monitor, and its DTC.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

DTC 21—HEX 66, and 7A—OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calcu-

DESCRIPTION AND OPERATION (Continued)

late the fuel injector pulse width. This maintains a 14.7 to 1 air fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrous oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the EGR, Catalyst and Fuel Monitors.

The O2S may fail in any or all of the following manners:

- Slow response rate
- Reduced output voltage
- Dynamic shift
- Shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

DTC 21—HEX 67, 69, 7C, and 7D—OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) DTC as well as a O2S heater DTC, the O2S fault MUST be repaired first. After the O2S fault is repaired, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 °to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S must be tested to ensure that it is heating the sensor properly.

The O2S circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S output voltage from the other effects.

DTC 32—HEX 2E—EGR MONITOR

The Powertrain Control Module (PCM) performs an on-board diagnostic check of the EGR system.

The EGR system consists of two main components: a vacuum solenoid and a vacuum operated valve with a back pressure transducer. The EGR monitor is used to test whether the EGR system is operating within specifications. The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the EGR is turned off (solenoid energized) and the O2S compensation control is monitored. Turning off the EGR shifts the air fuel (A/F) ratio in the lean direction. The O2S data should indicate an increase in the O2 concentration in the combustion chamber when the exhaust gases are no longer recirculated. While this test does not directly measure the operation of the EGR system, it can be inferred from the shift in the O2S data whether the EGR system is operating correctly. Because the O2S is being used, the O2S test must pass its test before the EGR test.

DTC 43—HEX 6A,6B, 6C, 6D, 6E, AE, and AF—MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

DTC 51/52—HEX 76, 77, 78, and 79—FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the air fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual air-fuel ratio with the O2S (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be

DESCRIPTION AND OPERATION (Continued)

determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

DTC 64—HEX 70, and B4—CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2Ss strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstraem O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL (check engine lamp) will be illuminated.

DTC 31—HEX A0, A1, B7, and B8—LEAK DETECTION PUMP MONITOR

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5" H20. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at .040" orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the

LDP's solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

TRIP DEFINITION

A "Trip" means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system. The monitors must successfully pass before the PCM can verify that a previously malfunctioning component is meeting the normal operating conditions of that component. For misfire or fuel system malfunction, the MIL may be extinguished if the fault does not recur when monitored during three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first determined.

Anytime the MIL is illuminated, a DTC is stored. The DTC can self erase only when the MIL has been extinguished. Once the MIL is extinguished, the PCM must pass the diagnostic test for the most recent DTC for 40 warm-up cycles (80 warm-up cycles for the Fuel System Monitor and the Misfire Monitor). A warm-up cycle can best be described by the following:

- The engine must be running
- A rise of 40°F in engine temperature must occur from the time when the engine was started
- Engine coolant temperature must reach at least 160°F
- A "driving cycle" that consists of engine start up and engine shut off.

Once the above conditions occur, the PCM is considered to have passed a warm-up cycle. Due to the conditions required to extinguish the MIL and erase the DTC, it is most important that after a repair has been made, all DTC's be erased and the repair verified.

COMPONENT MONITORS

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (Check Engine) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum and 1600 rpm.

Any component that has an associated limp in will set a fault after 1 trip with the malfunction present.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

NON-MONITORED CIRCUITS

The PCM does not monitor all circuits, systems and conditions that could have malfunctions causing driveability problems. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code.

The major non-monitored circuits are listed below along with examples of failures modes that do not directly cause the PCM to set a DTC, but for a system that is monitored.

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

DESCRIPTION AND OPERATION (Continued)

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system. It may set a EGR or Fuel system fault or O2S.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

THROTTLE BODY AIR FLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

LOAD VALUE

ENGINE	IDLE/NEUTRAL	2500 RPM/NEUTRAL
2.0L SOHC	2% to 8% of Maximum Load	8% to 15% of Maximum Load
2.4L DOHC	2% to 8% of Maximum Load	7% to 15% of Maximum Load
2.5L SOHC	2% to 8% of Maximum Load	7% to 15% of Maximum Load

EVAPORATIVE EMISSION CONTROLS

INDEX

DESCRIPTION AND OPERATION

EVAPORATION CONTROL SYSTEM

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to a charcoal filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

All engines use a duty cycle purge system. The PCM controls vapor flow by operating the duty cycle EVAP purge solenoid. Refer to Duty Cycle EVAP Purge Solenoid in this section.

NOTE: The evaporative system uses specially manufactured hoses. If they need replacement, only use fuel resistant hose.

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 should the vehicle rollover. 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 charcoal filled evaporative canister stores the vapors. For pressure relief/rollover valve service, refer to the Fuel Tank section of Group 14.

EVAP CANISTER

All vehicles use a sealed, maintenance free, evaporative (EVAP) canister. 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 PCM purges the canister through the duty cycle EVAP purge solenoid. The PCM purges the canister at predetermined intervals and engine conditions.

The canister mounts to a bracket behind the front fascia on the passengers side of the vehicle (Fig. 1). The vacuum and vapor tube connect to the top of the canister.

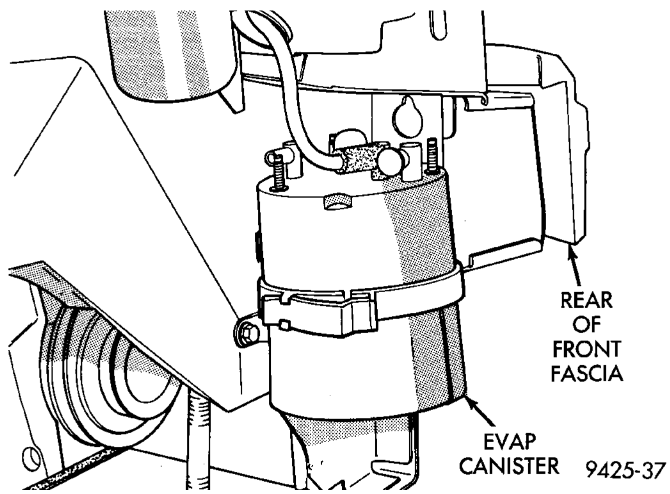


Fig. 1 EVAP Canister

DUTY CYCLE EVAP PURGE SOLENOID VALVE

The duty cycle EVAP purge solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged.

When purging, the PCM energizes and de-energizes the solenoid approximately 5 or 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time the solenoid energizes.

DESCRIPTION AND OPERATION (Continued)

The solenoid attaches to a bracket which is attached to the front engine mount (Fig. 2). The solenoid will not operate properly unless it is installed with the electrical connector at the top.

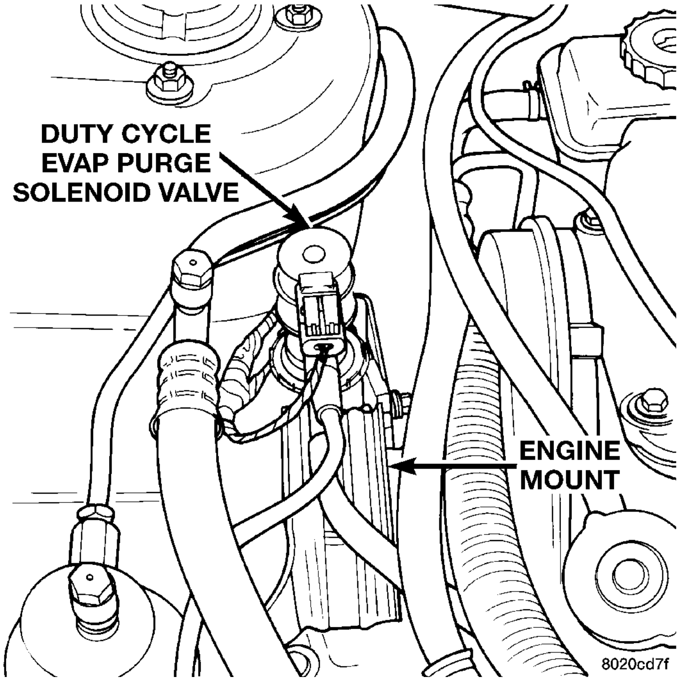


Fig. 2 Duty Cycle EVAP Purge Solenoid Valve

PRESSURE-VACUUM FILLER CAP

CAUTION: Remove the fuel filler cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or servicing the fuel tank.

A pressure-vacuum relief cap seals the fuel tank (Fig. 3). Tightening the cap on the fuel filler tube forms a seal between them. The relief valves in the cap are a safety feature. They prevent possible excessive pressure or vacuum in the tank. Excessive fuel tank pressure could be caused by a malfunction in the system or damage to the vent lines.

The seal between the cap and filler tube breaks when the cap is removed and relieves fuel tank pressure.

If the filler cap needs replacement, only use the correct part.

LEAK DETECTION PUMP

The leak detection pump is a device used to detect a leak in the evaporative system.

The pump contains a 3 port solenoid, a pump that contains a switch, a spring loaded canister vent valve seal, 2 check valves and a spring/diaphragm.

Immediately after a cold start, when the engine temperature is between 40°F and 86°F, the 3 port solenoid is briefly energized. This initializes the

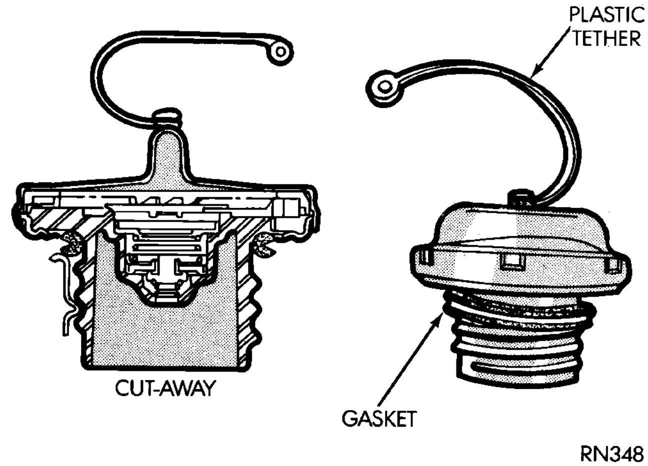


Fig. 3 Pressure Vacuum Filler Cap

pump by drawing air into the pump cavity and also closes the vent seal. During non-test test conditions, the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling. This is due to the operation of the 3 port solenoid which prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized, allowing atmospheric pressure to enter the pump cavity. This permits the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de-energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

PUMP MODE: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test time.

TEST MODE: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5 inches of water.

When the pump starts, the cycle rate is quite high. As the system becomes pressurized, pump rate drops. If there is no leak, the pump will quit. If there is a leak, the test is terminated at the end of the test mode.

If there is no leak, the purge monitor is run. If the cycle rate increases due to the flow through the purge system, the test is passed and the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

DESCRIPTION AND OPERATION (Continued)

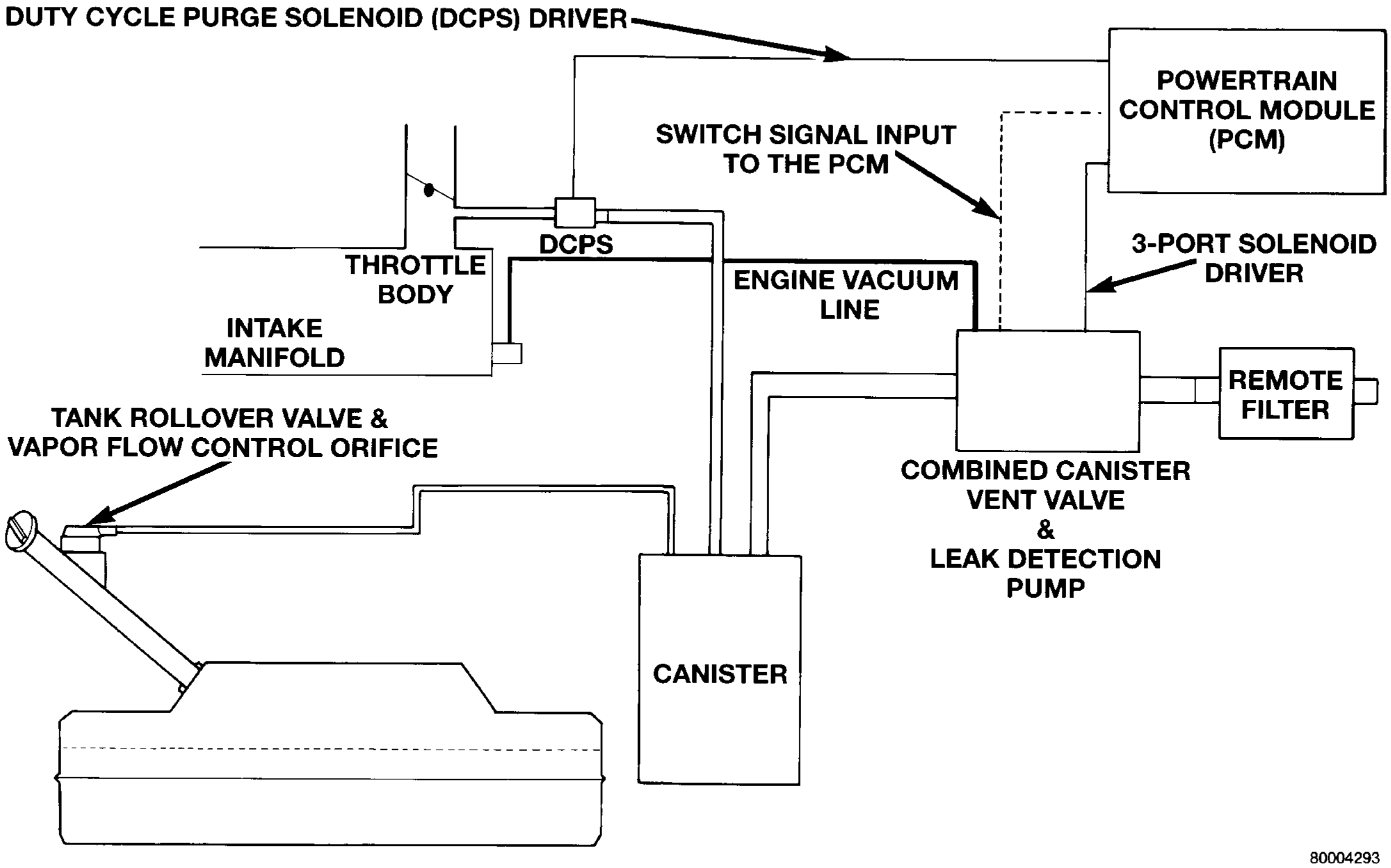


Fig. 4 Evaporative System Monitor Schematic

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.

PCV VALVE

The PCV valve contains a spring loaded plunger. The plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

When the engine is not operating or during an engine backfire, the spring forces the plunger back against the seat. This prevents vapors from flowing through the valve (Fig. 7).

When the engine is at idle or cruising, high manifold vacuum is present. At these times manifold vacuum is able to completely compress the spring and pull the plunger to the top of the valve (Fig. 8). In this position there is minimal vapor flow through the valve.

During periods of moderate intake manifold vacuum the plunger is only pulled part way back from the inlet. This results in maximum vapor flow through the valve (Fig. 9).

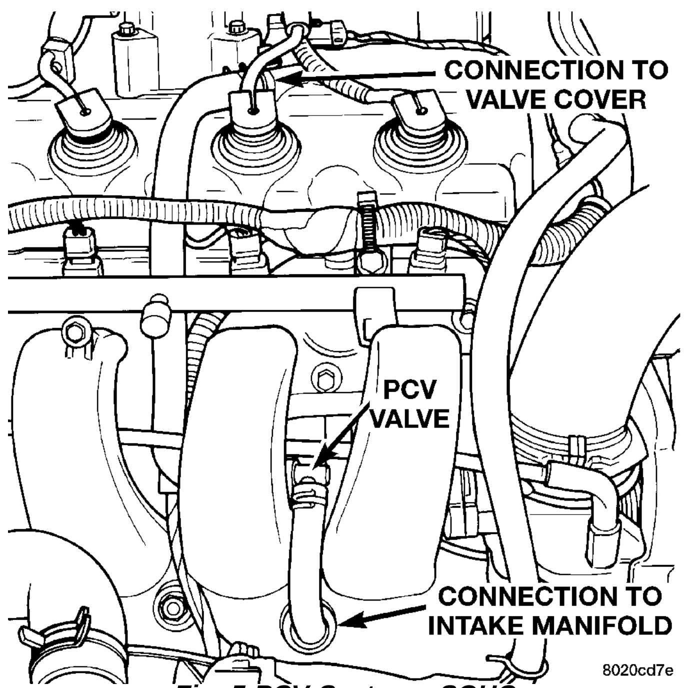


Fig. 5 PCV System—SOHC

DESCRIPTION AND OPERATION (Continued)

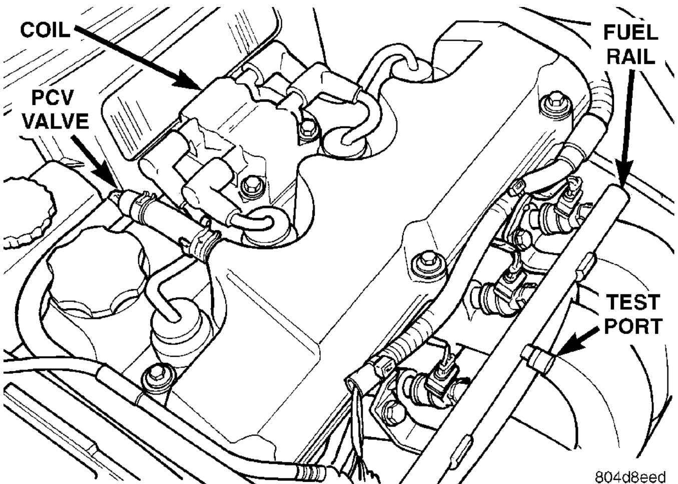


Fig. 6 PCV System—DOHC

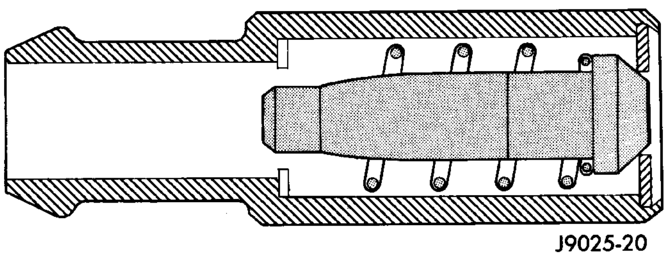


Fig. 7 Engine Off or Engine Backfire—No Vapor Flow

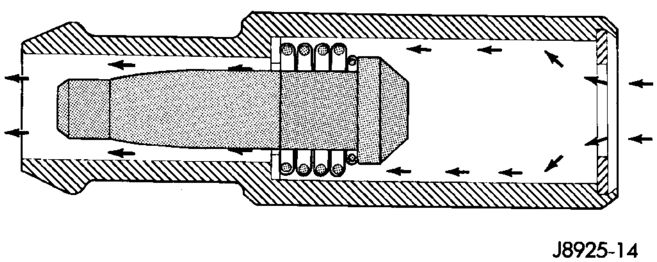


Fig. 8 High Intake Manifold Vacuum—Minimal Vapor Flow

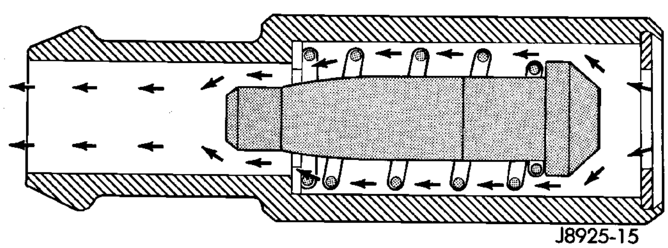


Fig. 9 Moderate Intake Manifold Vacuum—Maximum Vapor Flow

VEHICLE EMISSION CONTROL INFORMATION LABEL

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

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

If any difference exists between the VECI label on the vehicle and the vacuum schematic in the Service Manual, refer to the label on the vehicle.

DIAGNOSIS AND TESTING

LEAK DETECTION PUMP

Refer to the appropriate Powertrain Diagnostic Procedures Manual for testing procedures.

PCV VALVE TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST OR ADJUSTMENT WITH THE ENGINE OPERATING.

With the engine idling, remove the PCV valve from its attaching point. If the valve is operating properly, a hissing noise will be heard and a strong vacuum felt when placing a finger over the valve inlet (Fig. 10). With the engine off, shake the valve. The valve should rattle when shaken. Replace the valve if it does not operate properly. **Do not attempt to clean the PCV valve.**

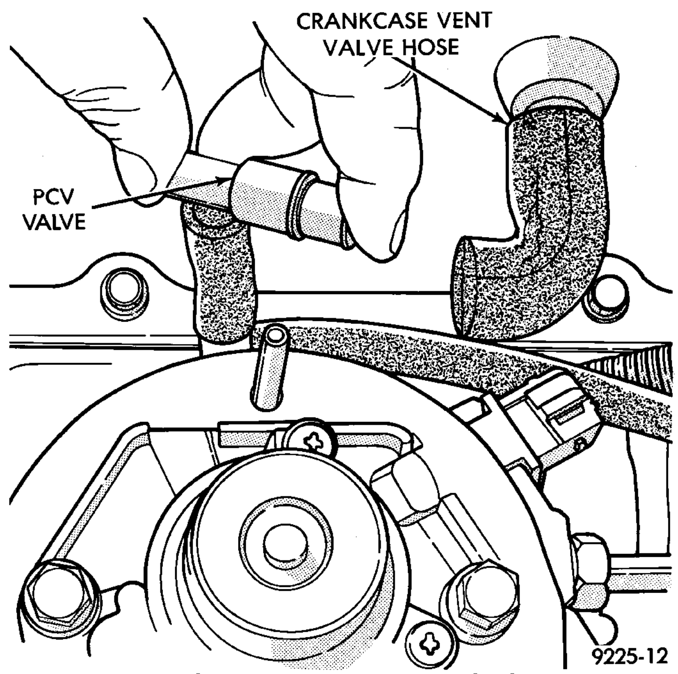
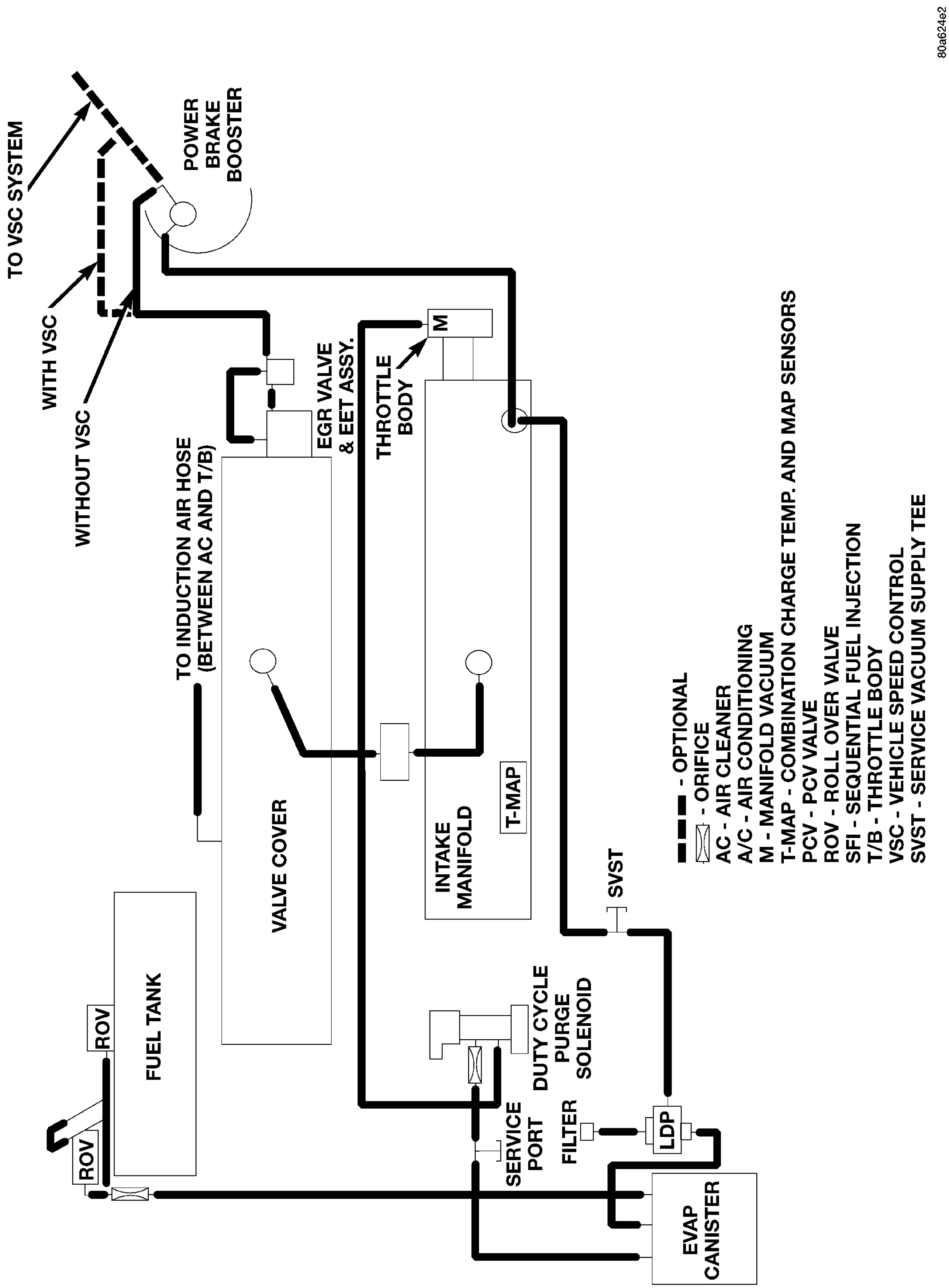


Fig. 10 PCV Test —Typical

VACUUM SCHEMATIC

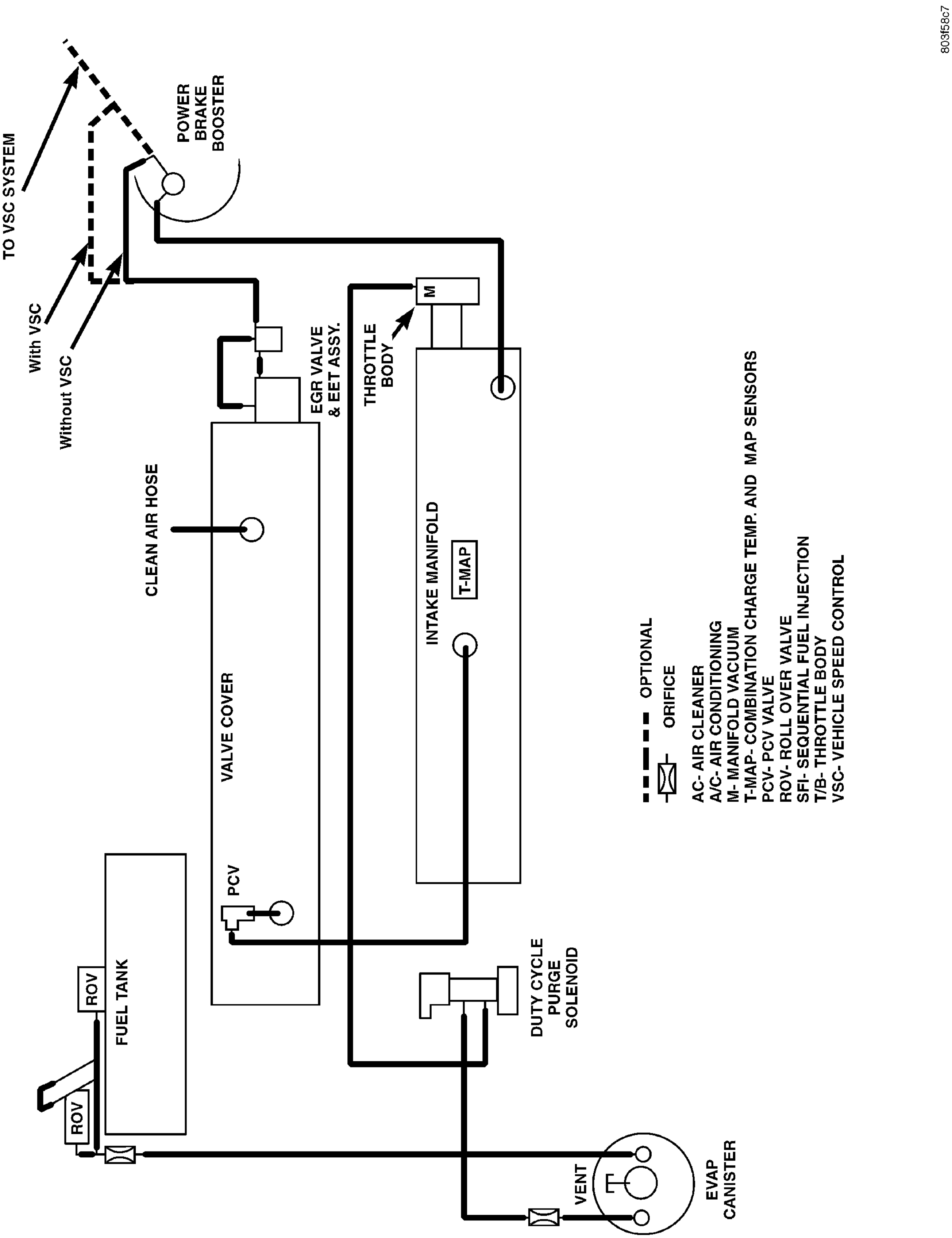
If any difference exists between the diagram on the Vehicle Emission Control Information (VECI) label and this illustration, refer to the label on the vehicle.

DIAGNOSIS AND TESTING (Continued)



ENGINE VACUUM SCHEMATIC—SOHC

DIAGNOSIS AND TESTING (Continued)



ENGINE VACUUM SCHEMATIC—DOHC

REMOVAL AND INSTALLATION

LEAK DETECTION PUMP REPLACEMENT

REMOVAL

(1) Raise and support vehicle on a hoist.
(2) Remove right front wheel.
(3) Remove splash shield.
(4) Disconnect vacuum lines from EVAP canister.
(5) Push locking tab on electrical connector to unlock and remove connector.
(6) Remove 3 nuts from EVAP canister and remove canister.
(7) Remove pump and bracket as an assembly.
(8) Remove pump from bracket.

INSTALLATION

(1) Install pump to bracket and tighten bolts to 1.2 N·m (10.6 in. lbs.).
(2) Install pump and bracket assembly to body and tighten bolts to 10 N·m (90 in. lbs.).
(3) Install EVAP canister to bracket and tighten nutts to 5.6 N·m (50 in. lbs.).
(4) Install electrical connetor to pump and push locking tab to lock.
(5) **Before installing hoses to LDP, make sure they are not cracked or split. If a hose leaks, it will cause the Check Engine Lamp to illumunate.** Connect lines to EVAP canister and LDP.
(6) Use the DRB scan tool, verify proper operation of LDP.
(7) Install splash shield.
(8) Install wheel.
(9) Lower vehicle

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

INDEX

DESCRIPTION AND OPERATION

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Refer to Monitored Systems - EGR Monitor in this group for more information.

The EGR system reduces oxides of nitrogen (NOx) in engine exhaust and helps prevent detonation (engine knock). Under normal operating conditions, engine cylinder temperature can reach more than 3000°F. Formation of NOx increases proportionally with combustion temperature. To reduce the emission of these oxides, the cylinder temperature must be lowered. 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 (Fig. 1):

- EGR tube
- EGR valve
- Electronic EGR Transducer (EET)
- Connecting hoses.

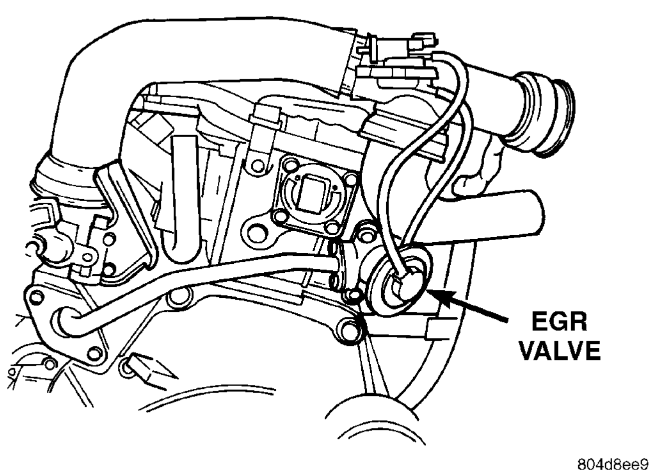


Fig. 1 EGR System

The electronic EGR transducer contains an electrically operated solenoid and a back-pressure transducer (Fig. 2). The Powertrain Control Module (PCM) operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back- pressure controls the transducer.

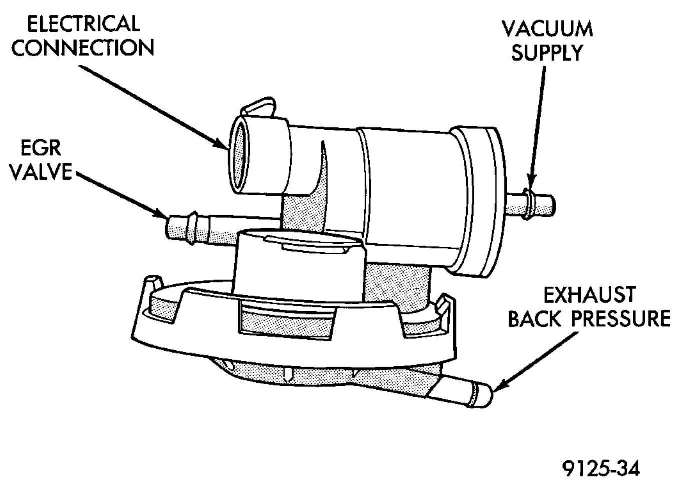


Fig. 2 Electronic EGR Transducer

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of vacuum applied to the EGR valve. Varying the strength of the vacuum changes the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

This system does not allow EGR at idle.

DIAGNOSIS AND TESTING

EGR SYSTEM ON-BOARD DIAGNOSTICS

The PCM performs an on-board diagnostic check of the EGR system. The diagnostic system uses the electronic EGR transducer for the system tests.

The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the PCM energizes the transducer solenoid to disable the EGR. The PCM checks for a change in the heated oxygen sensor signal. If the air-fuel mixture goes lean, the PCM will attempt to enrichen the mixture. The PCM registers a Diagnostic Trouble Code (DTC) if the EGR system has failed or degraded. After registering a DTC, the PCM turns on the malfunction indicator (Check Engine) lamp. The Malfunction Indicator Lamp (MIL) indicates the need for service.

If a problem is indicated by the MIL and a DTC for the EGR system is set, check for proper operation of the EGR system. Use the System Test, EGR Gas Flow Test and EGR Diagnosis Chart. If the EGR system tests properly, check the system using the DRB scan tool. Refer to On-Board Diagnosis sections in this Group. Also, refer to the DRB scan tool and the appropriate Powertrain Diagnostics Procedure manual.

EGR SYSTEM TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE TESTING THE EGR SYSTEM.

(1) Check the condition of all EGR system hoses and tubes for leaks, cracks, kinks and hardening of rubber hoses. Repair and correct these conditions before performing any tests.

(2) Be sure the hoses at both the EGR valve and EGR valve control are connected to the proper fittings (Fig. 3).

(3) Be sure the electrical connector is firmly connected at the valve control.

(4) To check EGR system operation, connect the DRB scan tool to the 16–way data link connector. The data link connector is located on the lower edge of the instrument panel near the steering column. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool when diagnosing the EGR system.

(5) After checking the system with the DRB scan tool, proceed to the following EGR Valve Leakage and EGR Valve Control Tests and repair as necessary.

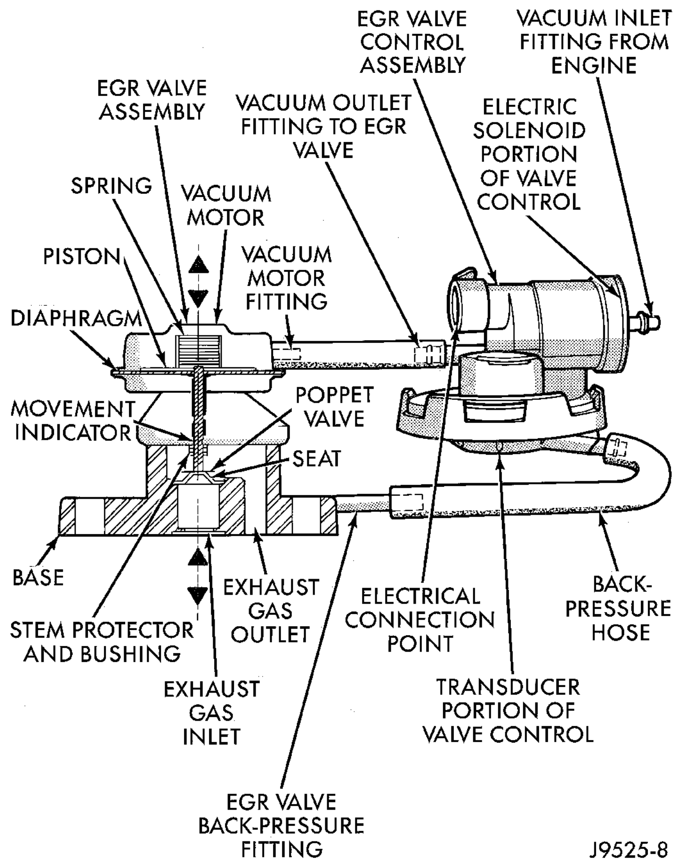


Fig. 3 EGR Value and EGR Value —Typical

EGR GAS FLOW TEST

Use the following test procedure to determine if exhaust gas is flowing through the EGR valve. It can also be used to determine if the EGR tube is plugged, or the system passages in the intake or exhaust manifolds are plugged.

This is not to be used as a complete test of the EGR system.

The engine must be started, running and warmed to operating temperature for this test.

DIAGNOSIS AND TESTING (Continued)

(1) All engines are equipped with two fittings located on the EGR valve (Fig. 4). The upper fitting (located on the vacuum motor) supplies engine vacuum to a diaphragm within the EGR valve for valve operation. The lower fitting (located on the base of the EGR valve) is used to supply exhaust back-pressure to the EGR valve control.

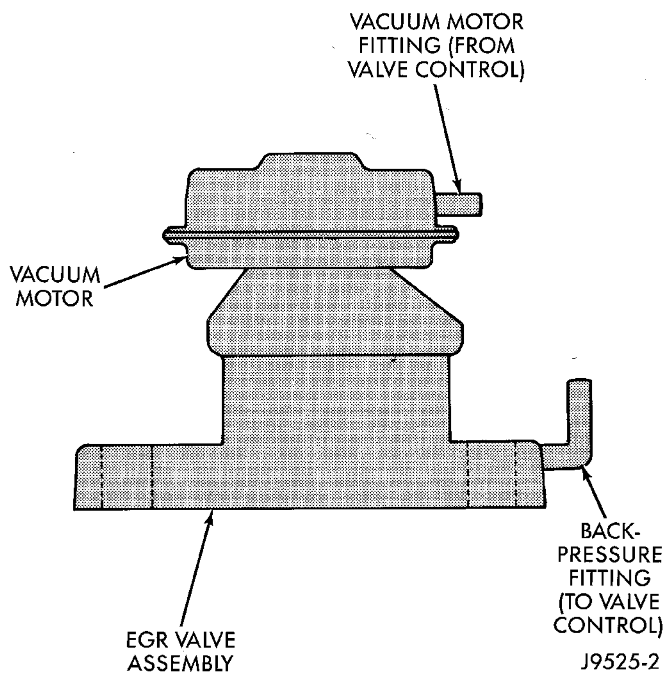


Fig. 4 Typical EGR Valve

(2) Disconnect the rubber hose at the vacuum motor fitting (Fig. 4) on the top of the EGR valve vacuum motor.

(3) Connect a hand-held vacuum pump to this fitting.

(4) Start the engine.

(5) Slowly apply 5 inches of vacuum to the fitting on the EGR valve motor.

(6) While applying vacuum, a minimum of 3 inches of vacuum, and with the engine running at idle speed, the idle speed should drop or the engine may even stall, if the vacuum is applied quickly. This is indicating that exhaust gas is flowing through the EGR tube between the intake and exhaust manifolds.

(7) If the engine speed did not change, the EGR valve may be defective, or EGR tube may be plugged with carbon, or the passages in the intake and exhaust manifolds may be plugged with carbon.

(a) Remove EGR valve from engine. Refer to EGR Valve Removal in this group.

(b) Apply vacuum to the vacuum motor fitting and observe the stem on the EGR valve. If the stem is moving, it can be assumed that the EGR valve is functioning correctly. The problem is in either a plugged EGR tube or plugged passages at the intake or exhaust manifolds, refer to step (c). If the stem will not move, replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one unit. Refer to EGR Valve Removal/Installation in this group.

(c) Remove the EGR tube between the intake and exhaust manifolds. Check and clean the EGR tube and its related openings on the manifolds. Refer to EGR Tube in this group for procedures.

(8) Do not attempt to clean the EGR valve. If the valve shows evidence of heavy carbon build-up near the base, replace it.

EGR VALVE LEAKAGE TEST

This is not to be used as a complete test of the EGR system.

If the engine will not idle, dies out on idle, or idle is rough or slow, the poppet valve (Fig. 3) at the base of the EGR valve may be leaking in the closed position.

(1) The engine should be off for the following test.

(2) Disconnect the rubber hose from the fitting (Fig. 3) at the top (vacuum motor) side of the EGR valve.

(a) Connect a hand-held vacuum pump to this fitting.

(b) Apply 15 inches of vacuum to the pump.

(c) Observe the gauge reading on the pump.

(d) If vacuum falls off, the diaphragm in the EGR valve has ruptured.

(e) Replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group.

(f) Proceed to the next step.

(3) A small metal fitting (back-pressure fitting) is located at the base of the EGR valve (Fig. 3). A rubber back-pressure hose connects it to the back-pressure fitting on the EGR valve control. Disconnect this rubber hose at the EGR valve fitting.

(4) Remove the air cleaner housing from the throttle body.

(5) Using compressed air, and using an air nozzle with a rubber tip, apply approximately 50 psi of regulated shop air to the metal back- pressure fitting on the EGR valve.

(6) By hand, open the throttle to the wide open position. Air **SHOULD NOT BE HEARD** emitting from the intake manifold while applying air pressure at the back-pressure fitting.

(7) If air **CAN BE HEARD** emitting from the intake manifold, the poppet valve (Fig. 3) is leaking at the bottom of the EGR valve. Replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group. Do not attempt clean the old EGR valve.

DIAGNOSIS AND TESTING (Continued)

EGR VALVE CONTROL (TRANSDUCER) TEST

TESTING ELECTRICAL SOLENOID PORTION OF VALVE

This is not to be used as a complete test of the EGR system.

Electrical operation of the valve should be checked with the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool. Replace solenoid if necessary, unit serviced only as an assembly.

TESTING VACUUM TRANSDUCER PORTION OF VALVE

The first part of this test will determine if the transducer diaphragm at the back-pressure side of the valve has ruptured or is leaking. The second part of the test will determine if engine vacuum (full-manifold) is flowing from the inlet to the outlet side of the valve. This is not to be used as a complete test of the EGR system.

(1) Disconnect the rubber back-pressure hose from the fitting at the bottom of EGR valve (Fig. 3).

(2) Connect a hand-held vacuum pump to this fitting.

(3) Apply 10 inches of vacuum to this fitting.

(4) If vacuum falls off, the valve diaphragm is leaking.

(5) Replace the EGR valve assembly. Proceed to next step for further testing.

(6) Remove the rubber hose at the vacuum **inlet** fitting (Fig. 3) on the EGR valve.

(7) Connect a vacuum gauge to this disconnected hose.

(8) Start the engine and bring to operating temperature. Hold engine speed at approximately 1500 rpm.

(9) Check for steady engine vacuum (full-manifold) at this hose.

(10) If engine vacuum (full-manifold) is not present, check vacuum line to engine and repair as necessary before proceeding to next step.

(11) Reconnect the rubber hose to the vacuum **inlet** fitting (Fig. 3) on the EGR valve.

(12) Disconnect the rubber hose at the vacuum **outlet** fitting (Fig. 3) on the EGR valve.

(13) Connect a vacuum gauge to this fitting.

(14) Disconnect the electrical connector (Fig. 3) at the valve control. This will simulate an open circuit (no ground from the PCM) at the valve.

(15) Start the engine and bring to operating temperature.

(16) Hold the engine speed to approximately 2000 rpm while checking for engine vacuum (full-manifold) at this fitting. **To allow full manifold vacuum to flow through the valve, exhaust back-pressure must be present at valve. It must be high enough to hold the bleed valve in the transducer portion of the valve closed.** Have a helper momentarily (a second or two) hold a rag over the tailpipe opening to build some exhaust back-pressure while observing the vacuum gauge. Heavy gloves should be worn. **Do not cover the tailpipe opening for an extended period of time as damage to components or overheating may result.**

(17) As temporary back-pressure is built, full manifold vacuum should be observed at the vacuum outlet fitting. Without back-pressure, and engine at approximately 2000 rpm, the gauge reading will be low. This low reading is normal. At idle speed, the gauge reading will be erratic. This is also normal.

(18) If full manifold vacuum is not present at the outlet fitting, but was present at the inlet fitting, replace the valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group.

REMOVAL AND INSTALLATION

EGR VALVE

If the EGR system operates incorrectly, replace the entire EGR valve and transducer together. The EGR valve and electrical transducer (EET) are calibrated together.

REMOVAL

The EGR valve attaches to the rear of the cylinder head (Fig. 5). EGR transducer is attached to the air inlet duct.

(1) Remove EGR transducer from air inlet duct.

(2) Disconnect vacuum supply tube from EGR transducer solenoid.

(3) Disconnect electrical connector from solenoid.

(4) Remove air inlet duct.

(5) Remove EGR tube to EGR valve screws.

(6) Remove EGR valve mounting screws. Remove EGR valve and transducer.

(7) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

INSTALLATION

(1) Loosely install EGR valve with new gaskets.

(2) Finger tighten EGR tube fasteners.

(3) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.

(4) Tightening EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.

(5) Install air inlet duct.

(6) Connect vacuum supply tube to solenoid.

(7) Attach electrical connector to solenoid.

(8) Install EGR transducer onto air inlet duct.

EGR TUBE

The EGR tube attaches to the intake manifold plenum below the throttle body and EGR valve.

REMOVAL

(1) Remove screws attaching EGR tube to intake manifold (Fig. 6).

(2) Remove EGR tube to EGR valve screws.

(3) Remove EGR tube. Clean gasket surface on the EGR valve. Wipe clean the grommet on the intake manifold.

INSTALLATION

The rubber grommet that seals the EGR tube to intake manifold connection is reusable.

(1) Loosely install the EGR tube and fasteners.

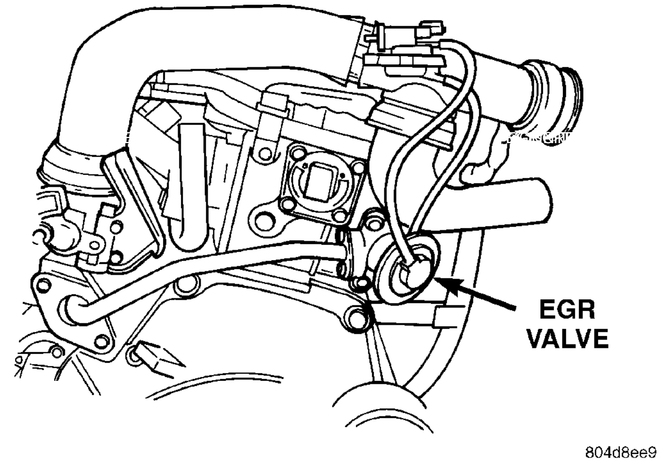


Fig. 5 EGR System

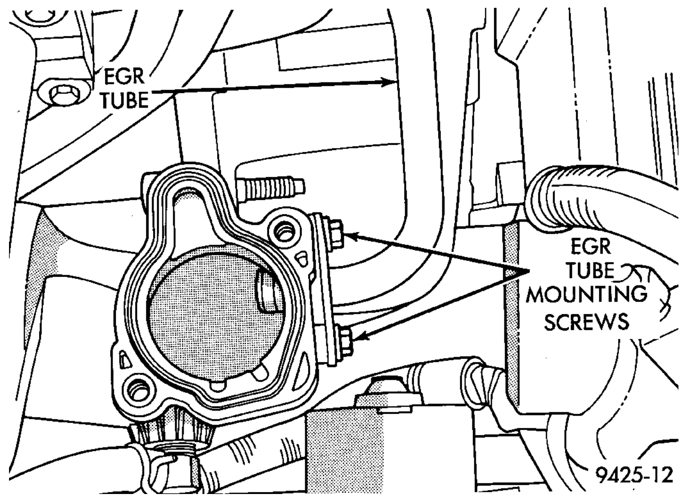


Fig. 6 EGR Tube Stud Bolts

(2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.

(3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.

SPECIFICATIONS

TORQUE

Description	Torque
EGR valve to cyl. head	22 N·m (200 in. lbs.)
EGR tube to EGR valve	11 (95 in. lbs.)
EGR tube to intake manifold	11 N·m (95 in. lbs.)

INTRODUCTION

CONTENTS

GENERAL INFORMATION

VEHICLE IDENTIFICATION NUMBER

The Vehicle Identification Number (VIN) is located on the upper left corner of the instrument panel, near the left A-Pillar. The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle (Fig. 1). Refer to VIN Code Decoding Chart.

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.

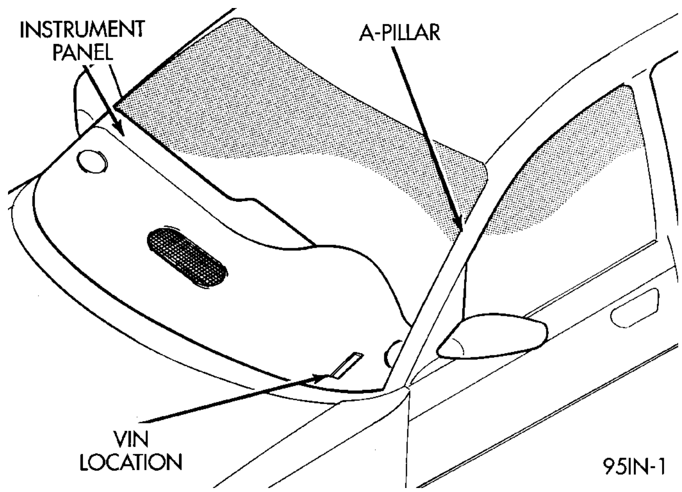


Fig. 1 Vehicle Identification Number

GENERAL INFORMATION (Continued)

VIN CODE DECODING

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1= United states
		3= Mexico
2	Make	B= Dodge
		P= Plymouth
3	Vehicle Type	3 = Passenger Car
4	Pass. Safety	E = Active Restraints, Driver & Passenger Airbags
5	Car Line	S = Neon / Neon Sport (sold in U.S./Canada)
		6= Neon/Neon Sport (sold in Mexico)
6	Series	2 = Low Line
		4 = High Line 6 = Sport
7	Body Style	2 = 2 Door Pillared Hardtop
		7 = 4 Door Pillared Hardtop
8	Engine	C = 2.0L 4 Cyl. 16V
		Y = 2.0L 4 Cyl. DOHC
9	Check Digit	
10	Model Year	V = 1997
11	Assembly Plant	D = Belvidere
		T = Toluca
12 Thru 17	Vehicle Build Sequence	Assembly Sequence

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.

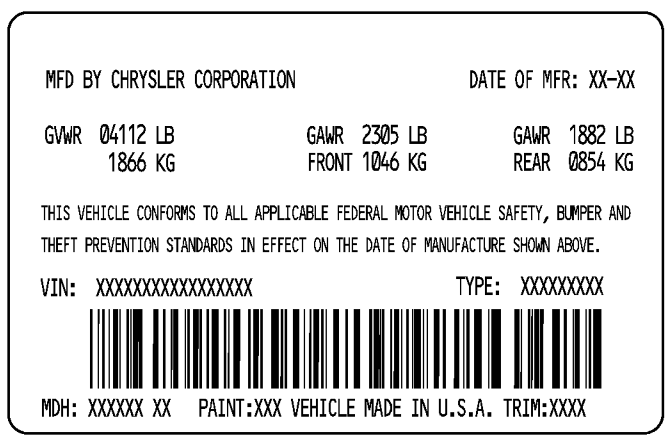


Fig. 2 Vehicle Safety Certification Label

BODY CODE EMBOSS

The Body Code Emboss is located in the engine compartment on the front of the right strut tower. There are two lines of information in the body code emboss.

BODY CODE EMBOSS LINE 1

Line 1 contains the Vehicle Identification Number (VIN). Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

BODY CODE EMBOSS LINE 2

DIGITS 1-3 —Paint Code

Refer to Group 23, Body for paint information.

DIGITS 4-7 —Trim Code

Refer to Parts Catalog for more information.

DIGITS 5-10 —Open

DIGITS 11-14 —Vehicle Order Number

GENERAL INFORMATION (Continued)

STANDARD BODY DIMENSIONS

INTERIOR DIMENSIONS

CAR	BODY STYLE	HEAD ROOM		LEG ROOM		SHOULDER ROOM		HIP ROOM	
		FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR
PL	PL-42	1005 mm 39.6 in.	928 mm 36.5 in.	1080 mm 42.5 in.	891 mm 35.1 in.	1333 mm 52.5 in.	1329 mm 52.3 in.	1290 mm 50.8 in.	1286 mm 50.6 in.
PL	PL-22	1005 mm 39.6 in.	928 mm 36.5 in.	1080 mm 42.5 in.	891 mm 35.1 in.	1321 mm 52.0 in.	1391 mm 54.7 in.	1277 mm 50.3 in.	1369 mm 53.9 in.

EXTERIOR DIMENSIONS

CAR	BODY STYLE	WHEEL BASE	FRONT TRACK	REAR TRACK	OVERALL LENGTH	OVERALL WIDTH	OVERALL HEIGHT
		MM/IN.	MM/IN.	MM/IN.	MM/IN.	MM/IN.	MM/IN.
PL	PL-42	2642/104	1458/57.4	1458/57.4	4364/171.8	1708/67.2	1395/54.9
PL	PL-22	2642/104	1458/57.4	1458/57.4	4364/171.8	1711/67.4	1395/54.9

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

The graphic symbols illustrated in the following chart (Fig. 3) are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

INTERNATIONAL CONTROL AND DISPLAY SYMBOLS

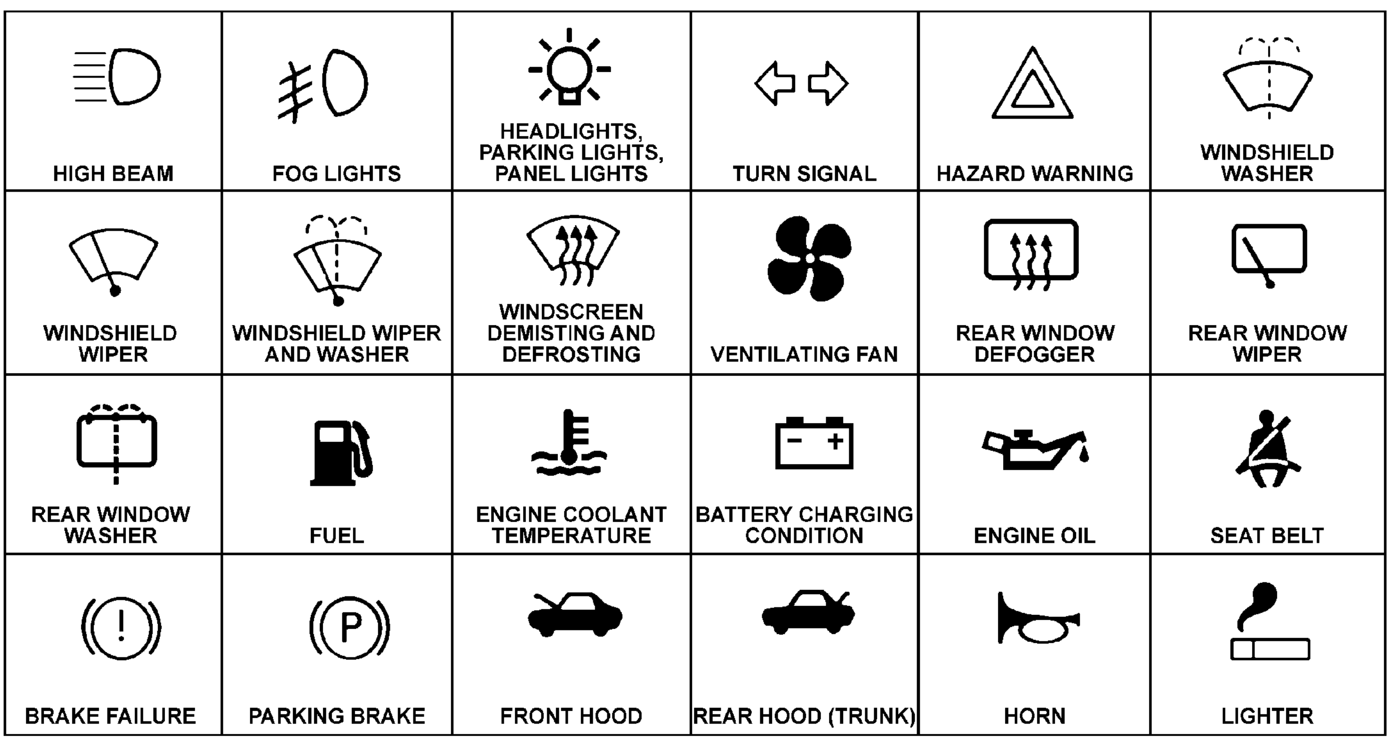


Fig. 3

80a53b2d

GENERAL INFORMATION (Continued)

FASTENER IDENTIFICATION

FASTENER IDENTIFICATION

THREAD IDENTIFICATION

SAE and metric bolt/nut threads are not the same. The difference is described in the Thread Notation chart (Fig. 4).

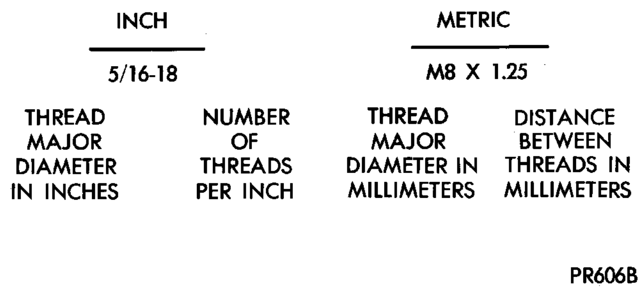


Fig. 4 Thread Notation—SAE and Metric

GRADE/CLASS IDENTIFICATION

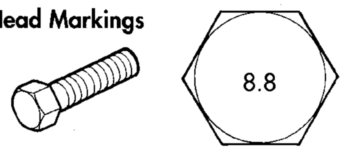
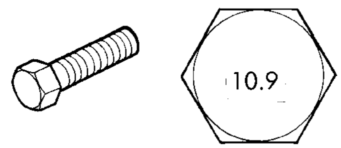
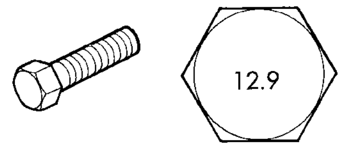
The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 12.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

GENERAL INFORMATION (Continued)

FASTENER IDENTIFICATION

Bolt Markings and Torque - Metric

Commercial Steel Class

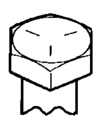
	8.8	10.9	12.9
Bolt Head Markings			

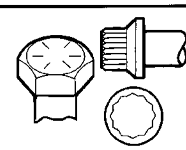
Body Size	Torque				Torque				Torque			
Diam.	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35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

Bolt Markings and Torque Values - U.S. Customary

SAE Grade Number **5** **8**

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





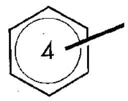
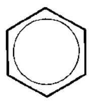
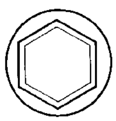
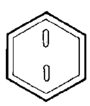
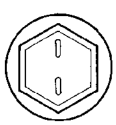
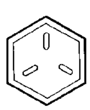
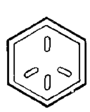
Body Size	Bolt Torque - Grade 5 Bolt				Bolt Torque - Grade 8 Bolt			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40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

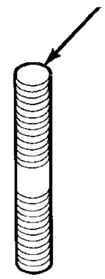
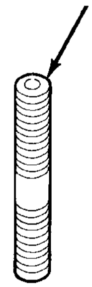
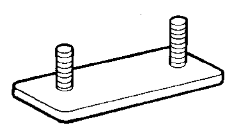
95IN-6

GENERAL INFORMATION (Continued)

FASTENER STRENGTH

HOW TO DETERMINE BOLT STRENGTH

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

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

95IN-4

GENERAL INFORMATION (Continued)

METRIC SYSTEM

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

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

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

The metric system is based on quantities of one, ten, one hundred, one thousand and one million (Fig. 5).

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

Fig. 5 Metric Prefixes

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

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

CONVERSION FORMULAS AND EQUIVALENT VALUES

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

COMMON METRIC EQUIVALENTS

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

GENERAL INFORMATION (Continued)

METRIC CONVERSION

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

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

GENERAL INFORMATION (Continued)

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

GENERAL INFORMATION (Continued)

TORQUE REFERENCES

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

TORQUE SPECIFICATIONS

SPECIFIED TORQUE FOR STANDARD BOLTS

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

GROUP TAB LOCATOR