

# BRAKES

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## GENERAL INFORMATION

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## GENERAL INFORMATION

### BASE BRAKE SYSTEM COMPONENT 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 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 as vehicles not equipped with ABS. The

ABS system does however use a different master cylinder and chassis brake tube assembly. 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 used on all vehicle equipped with or without Antilock Brakes is made from a lightweight, anodized, aluminum. On all vehicles the master cylinder has a piston bore diameter of 22.2 mm.

## BASE BRAKE SYSTEM

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## 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 pads and linings

The front disc brakes used on this vehicle are Allied Signal Inc. double pin floating caliper assemblies.

The front disc brake double pin 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. 1), (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 pedal is released. This maintains the proper brake shoe to rotor clearance (Fig. 4).

## DESCRIPTION AND OPERATION (Continued)

All the front brake forces generated during braking of the vehicle are 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.

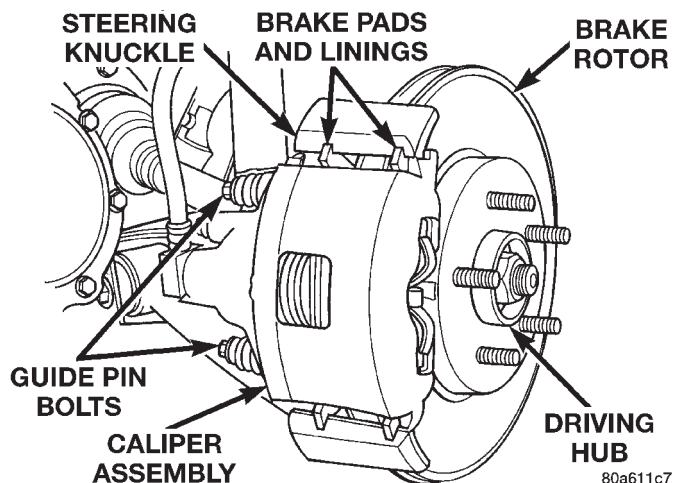


**Fig. 1 Front Disc Brake Components**

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).

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.

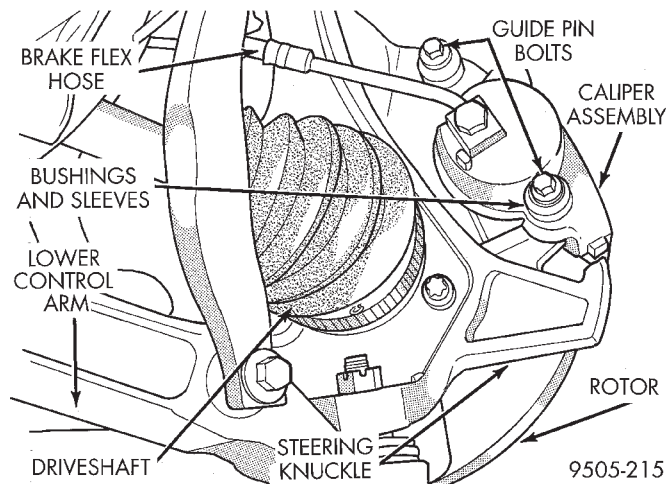


**Fig. 3 Front Disc Brake Caliper Mounting**

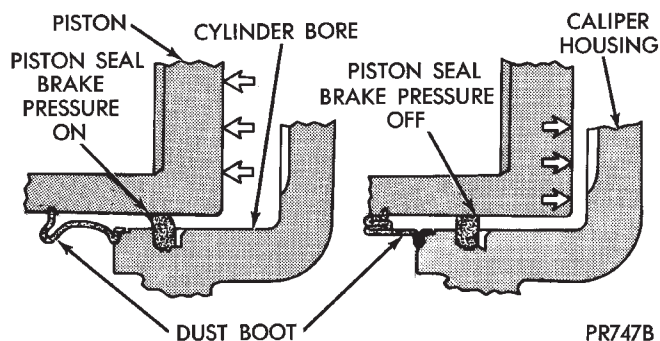


**Fig. 4 Piston Seal Function for Automatic Adjustment**

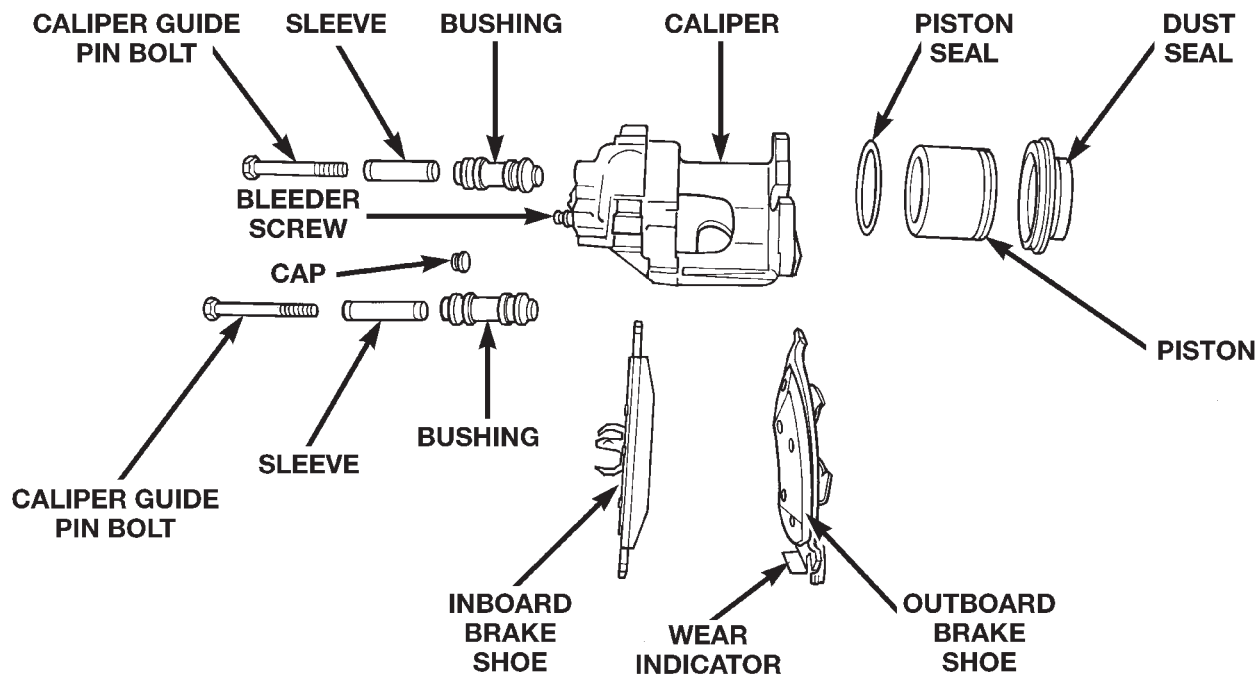


**Fig. 2 Front Disc Brake Caliper (Exploded View)**

## DESCRIPTION AND OPERATION (Continued)

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 sensor (Fig. 2) on the outboard brake pad. This sensor emits a sound when the brake lining may need inspection and/or replacement.

**REAR DRUM BRAKES**

This vehicles rear wheel drum brakes, are a two shoe leading/trailing internal expanding type, with an automatic self adjuster mechanism. The automatic self adjuster mechanism used on this vehicle is a screw type adjuster. This type of self adjuster mechanism is actuated each time the vehicles service brakes are applied. The automatic adjuster mechanism is located directly below the rear wheel cylinder (Fig. 5).

The original equipment rear drum brakes used on this vehicle are supplied by Kelsey Hayes Inc. (Fig. 5).

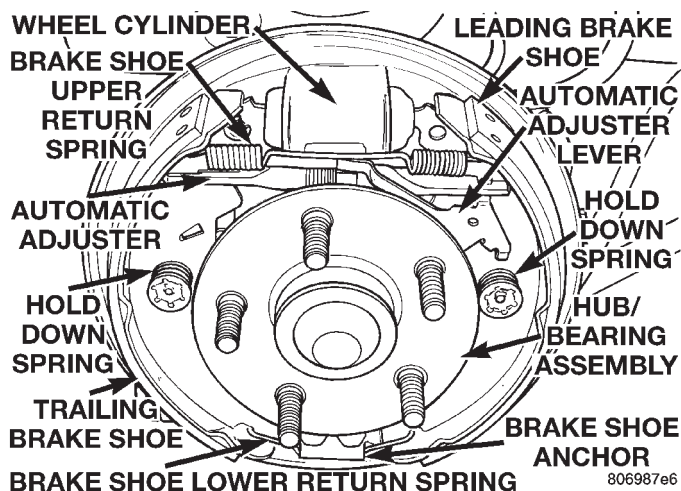


*Fig. 5 Kelsey Hayes Rear Wheel Brake Assembly*

**PARKING BRAKES**

All vehicles are equipped with a center mounted, hand operated park brake lever (Fig. 6). This lever is an 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 rear drum brake shoe adjustment.

On this vehicle, 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.

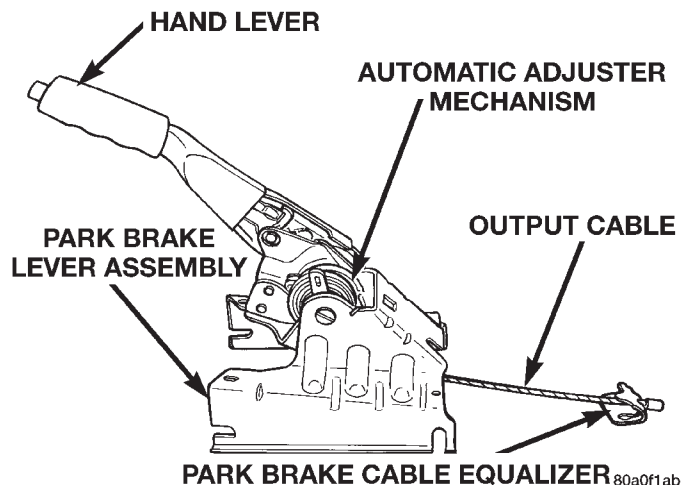


*Fig. 6 Park Brake Lever Assembly*

**PROPORTIONING VALVES**

This vehicle uses in-line proportioning valves. The proportioning valves are located in the rear brake tubes on vehicles not equipped with Antilock Brakes (Fig. 7) or at the rear brake outlet ports of the hydraulic control unit (HCU) on vehicles equipped with Antilock Brakes (Fig. 8). The in-line proportioning valves used on this vehicle, replace the combination valve used in prior brake hydraulic systems. With this design, the chassis brake tubes connect directly from the master cylinder or (HCU) to the brake flex hose at the wheel. The non ABS equipped proportioning valves are located in the same area of the vehicle as the hydraulic unit on ABS equipped vehicles (Fig. 7).

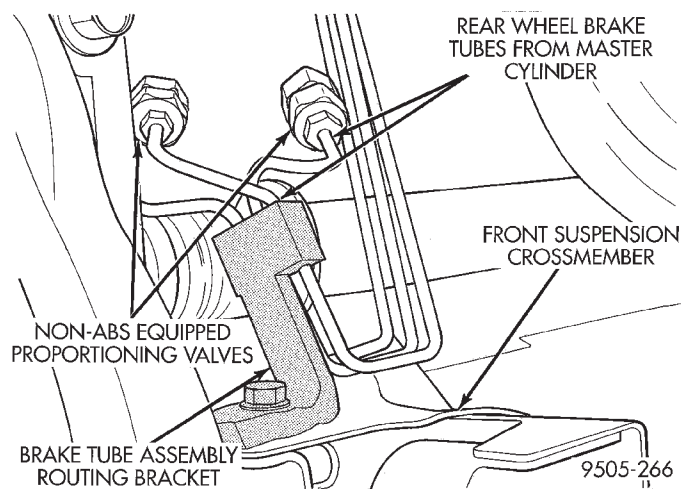


*Fig. 7 Proportioning Valves For Non ABS Equipped Vehicles*

Proportioning valves balance front to rear braking by controlling at a given ratio, the increase in rear

DESCRIPTION AND OPERATION (Continued)

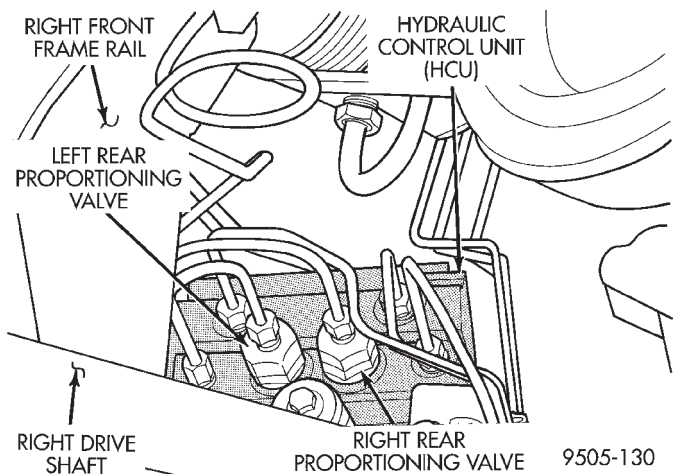


**Fig. 8 Proportioning Valve Location For Antilock Brake Equipped Vehicles**

brake system hydraulic pressure above a preset level (split point). Under light pedal application, the proportioning valve allows full hydraulic pressure to be applied to the rear brakes.

There are two different styles of proportioning valve assemblies used in each vehicle. Due to differences in thread sizes, each proportioning valve has a different part number. During any service procedures identify valve assemblies by supplier part number and or the bar code label and stamp identification band (Fig. 9) or (Fig. 10). All vehicle brake systems use a common calibration for the proportioning valve.

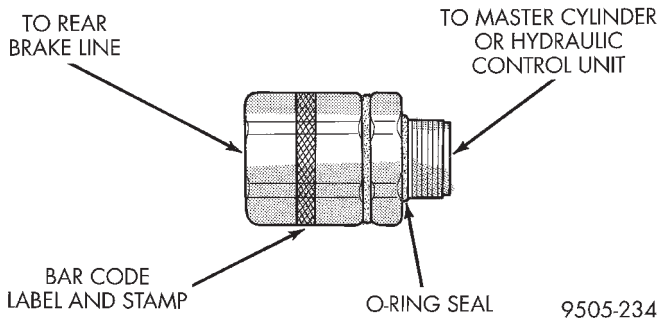


**Fig. 9 Proportioning Valve With Antilock Brakes**

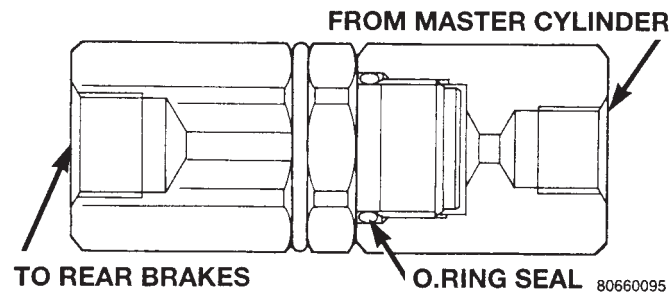


**Fig. 10 Proportioning Valve Without Antilock Brakes**

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 uses 2 differently designed master cylinder assemblies depending on whether the vehicle is or is not equipped with antilock brakes.

Vehicles not equipped with ABS use a standard compensating port master cylinder design, while vehicles equipped with ABS use a center valve design master cylinder.

On vehicles equipped with ABS brakes, the master cylinder is a two outlet design. On vehicles not equipped with ABS brakes, the master cylinder is a 4 outlet design. All vehicles are equipped with a master cylinder having a bore diameter of 22.2 mm.

The master cylinder assembly (Fig. 11) 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.

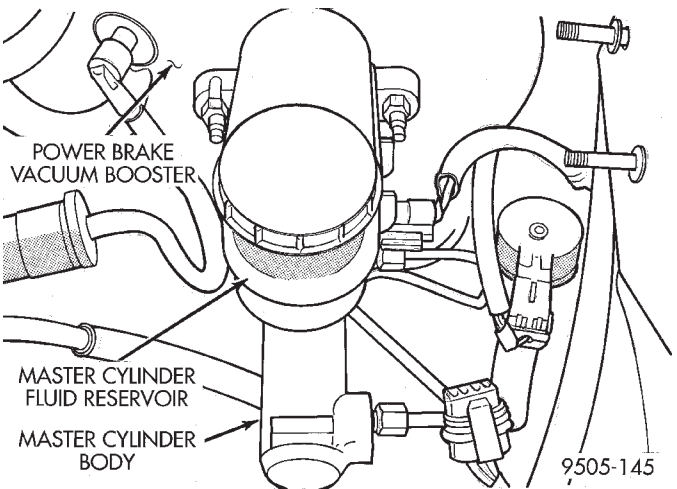


**Fig. 11 Master Cylinder Assembly**

On Non-ABS master cylinders, the primary outlet ports (Fig. 12) supply hydraulic pressure to the right front and left rear brakes. The secondary outlet ports (Fig. 12) supply hydraulic pressure to the left front and right rear brakes.

On ABS master cylinders, the primary outlet port (Fig. 13) supplies hydraulic pressure to the right

## DESCRIPTION AND OPERATION (Continued)

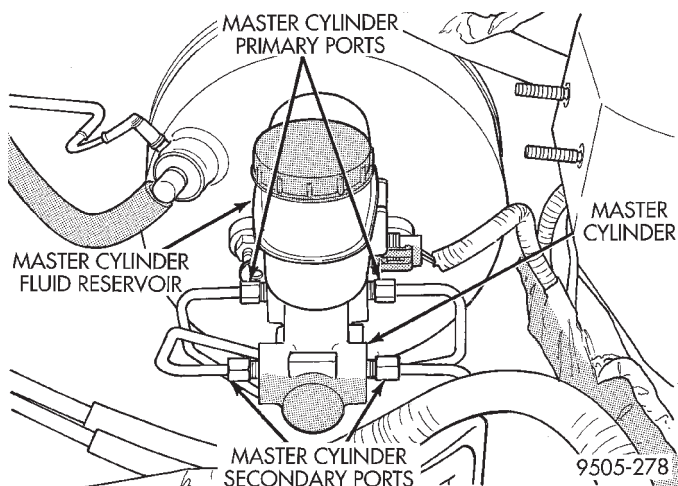


**Fig. 12 Primary And Secondary Ports Without ABS**

front and left rear brakes. The secondary outlet port (Fig. 13) supplies hydraulic pressure to the left front and right rear brakes.

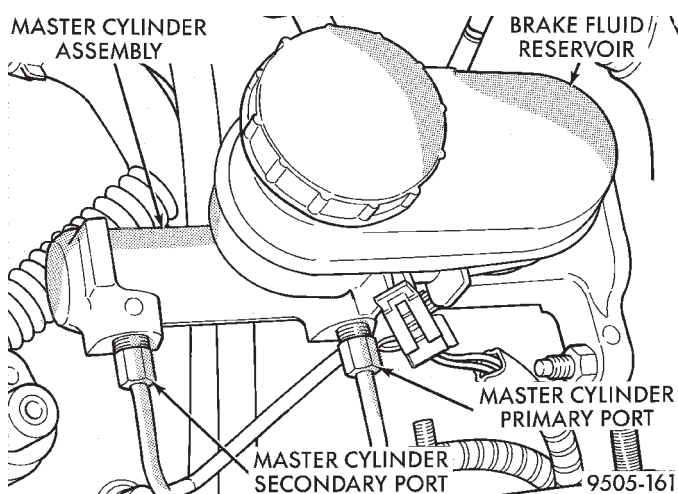


**Fig. 13 Primary And Secondary Ports With ABS**

### VACUUM BOOSTER

All vehicles use a 205 mm tandem diaphragm vacuum booster. The vacuum booster though, may be unique for the type of brake system the vehicle is equipped with. For this reason, if the power brake vacuum booster requires replacement, be sure it is replaced with the correct part for the type of brake system that the vehicle is equipped with.

The vacuum booster can be identified if required, by the tag attached to the body of the vacuum booster (Fig. 14). This tag contains the following information: The production part number of the vacuum booster, the date it was built, and who manufactured it.

**NOTE:** The vacuum 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 vac-

uum booster check valve is not repairable but can be replaced as a component of the vacuum booster.

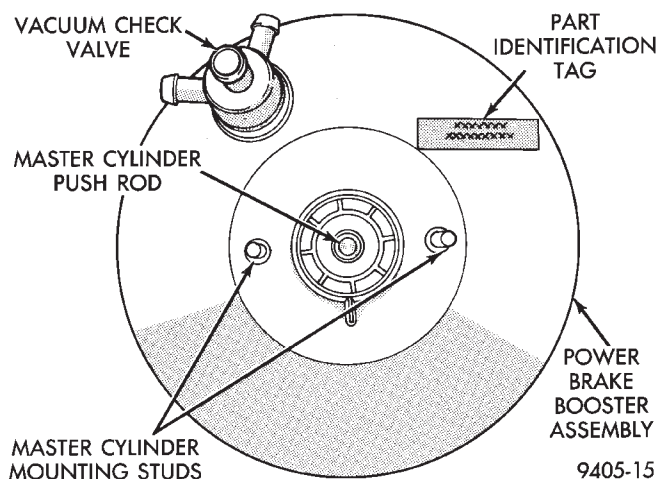


**Fig. 14 Vacuum Booster Identification**

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

The vacuum booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 14).

As the brake pedal is depressed, the vacuum booster input rod moves forward (Fig. 15). This opens and closes valves in the vacuum 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 vacuum booster (Fig. 15) 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 systems and engine combinations require different vacuum hose routings.

The 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. 15). A vacuum line connects the vacuum booster to the intake manifold. The master cylinder is bolted to the front of the 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, the parking brake is applied or that the antilock brake system (ABS) has a fault but could not turn on the yellow ABS warning lamp. 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

## DESCRIPTION AND OPERATION (Continued)

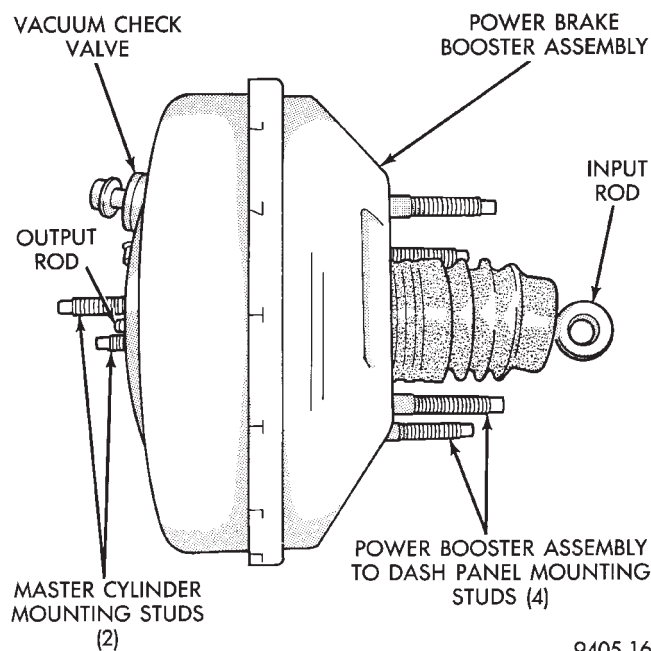


**Fig. 15 Vacuum Booster Assembly**

where the warning lamp fails to turn on when it should, or remains on when it should not.

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, the ignition switch in the crank position or the ABS CAB.

The Brake Fluid Level sensor is located in the brake fluid reservoir of the master cylinder assembly (Fig. 16). The purpose of the sensor is to provide the driver with an early warning that brake fluid level in 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.

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.**

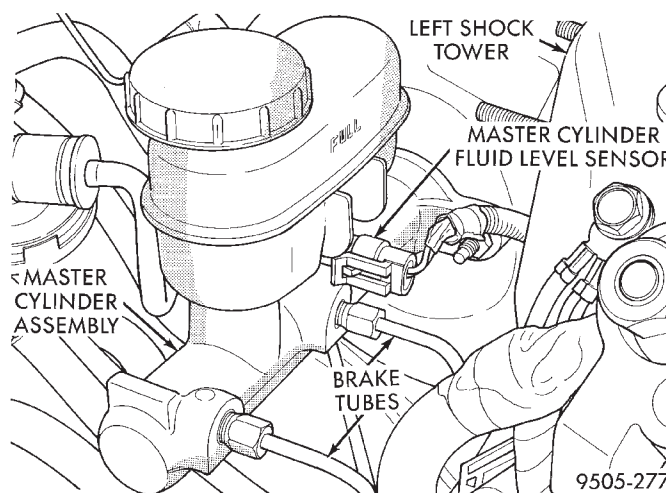


**Fig. 16 Master Cylinder Fluid Level Sensor**

### 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.

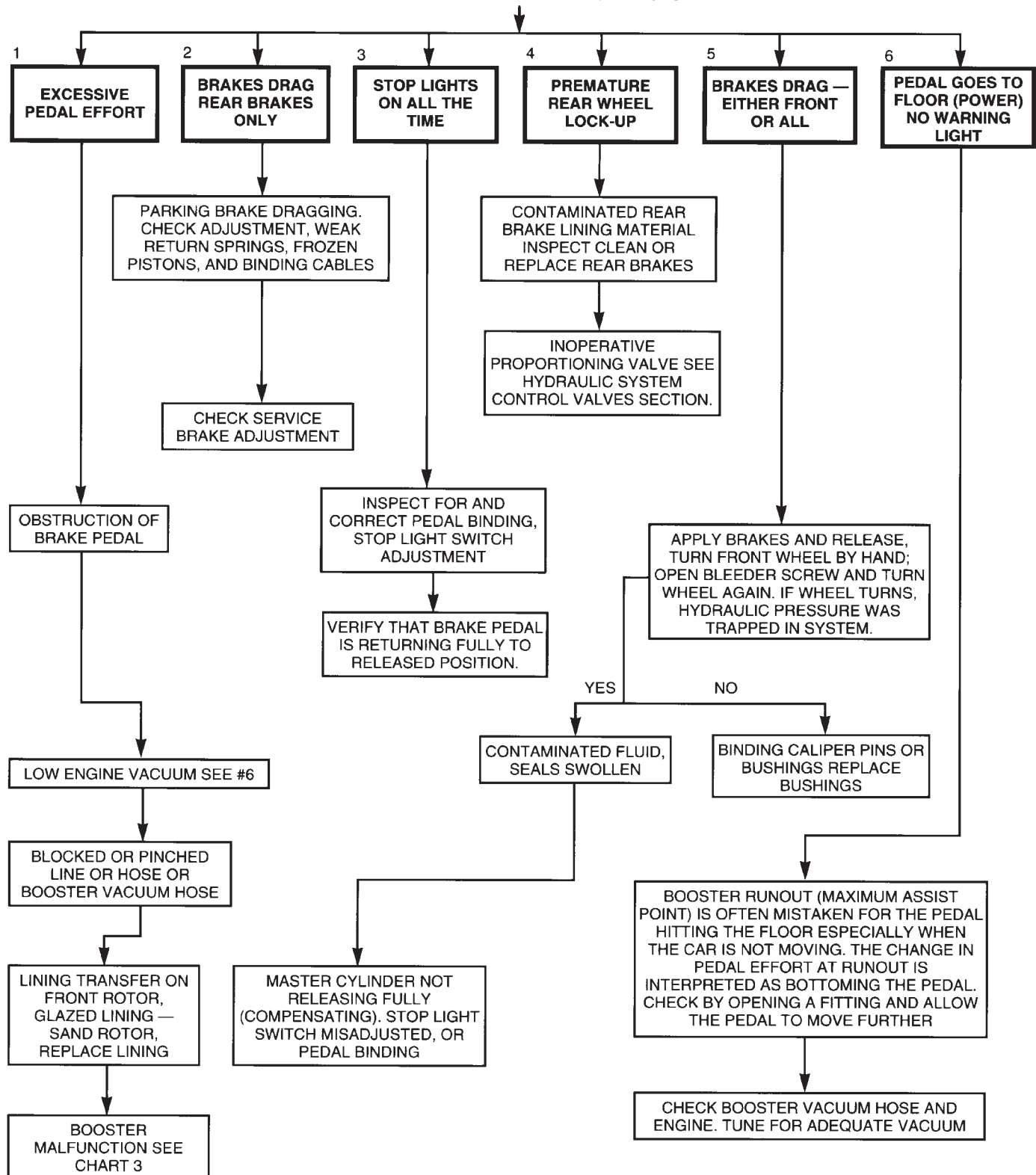
## DIAGNOSIS AND TESTING

## BRAKE SYSTEM BASIC DIAGNOSIS GUIDE

| SYMPTOM                       | CHART 1<br>MISC.<br>COND. | CHART 2<br>WARNING<br>LIGHT | CHART 3<br>POWER<br>BRAKES | CHART 4<br>BRAKE<br>NOISE | CHART 5<br>WHEEL<br>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**

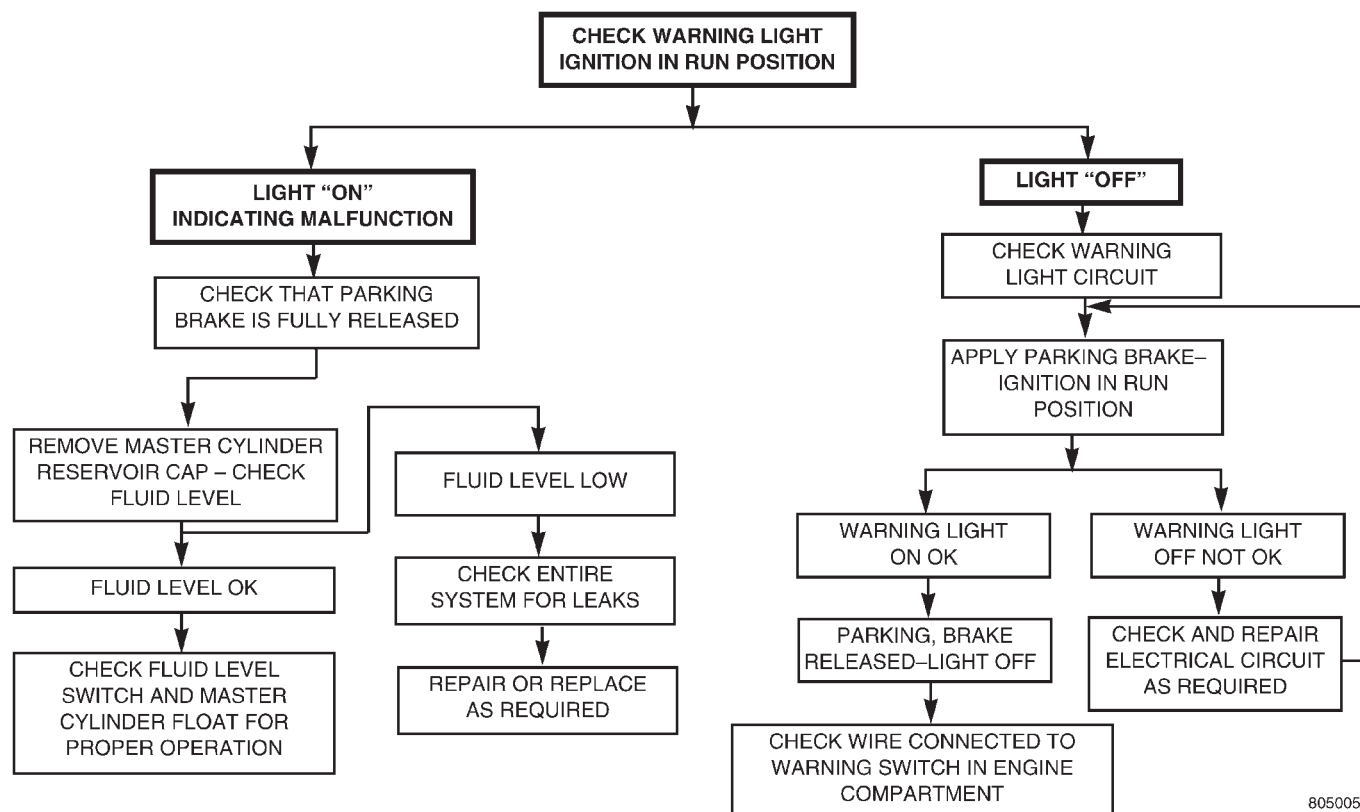
## MISCELLANEOUS BRAKE SYSTEM CONDITIONS **CHART 1 MISCELLANEOUS CONDITIONS**



## DIAGNOSIS AND TESTING (Continued)

## RED BRAKE WARNING LAMP FUNCTION

CHART 2 WARNING LAMP FUNCTION

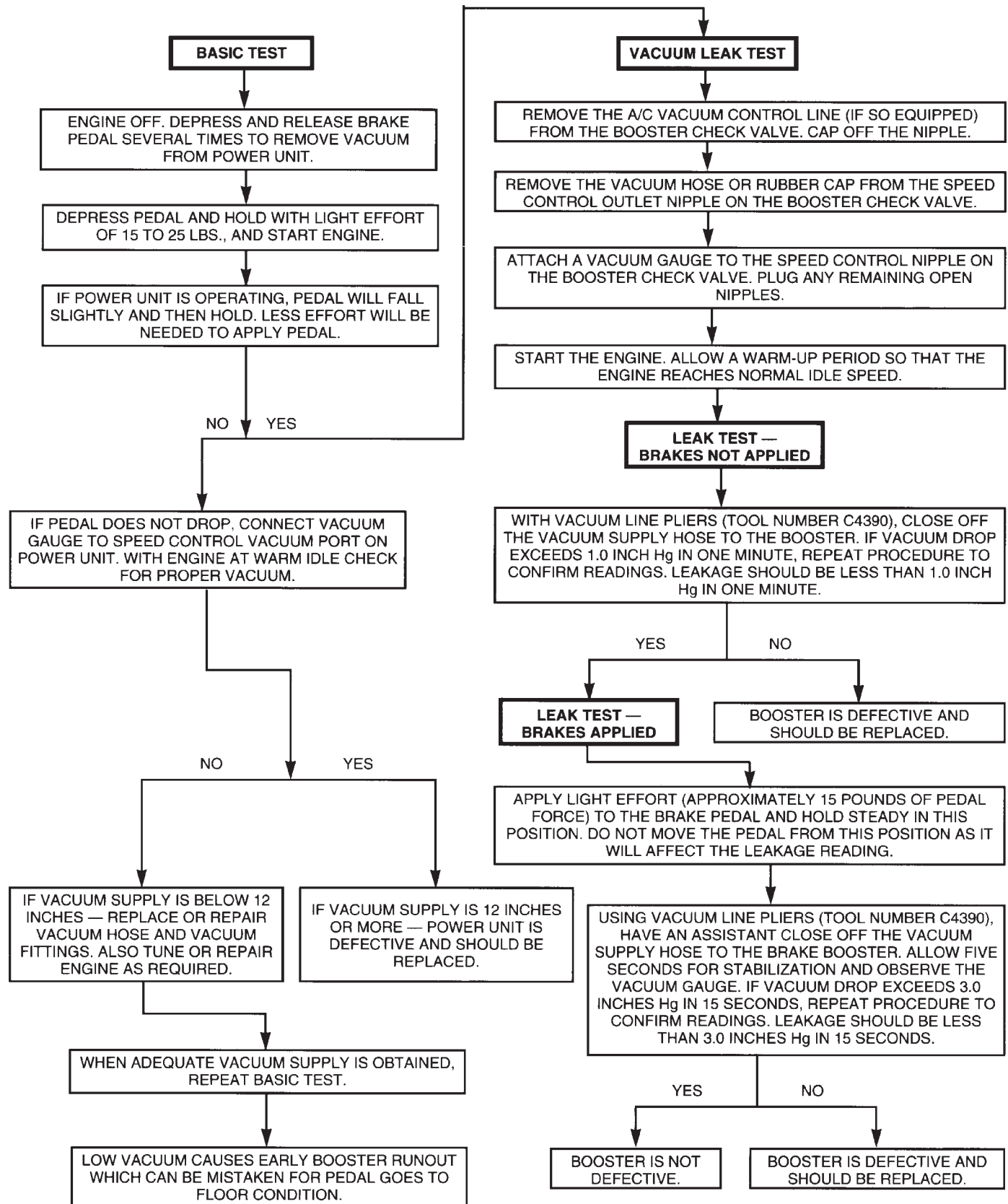


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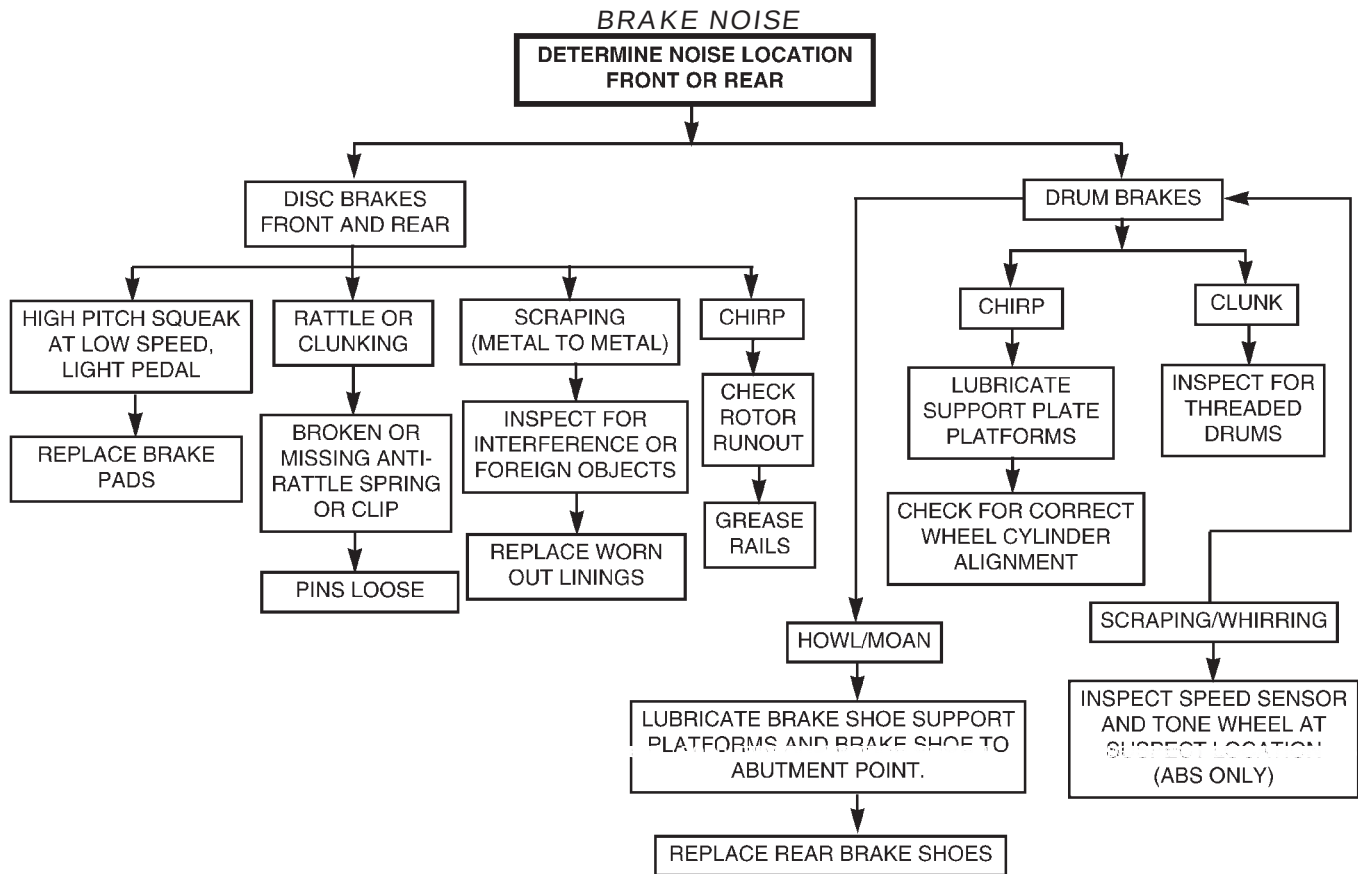
# DIAGNOSIS AND TESTING (Continued)

## POWER BRAKE SYSTEM DIAGNOSTICS

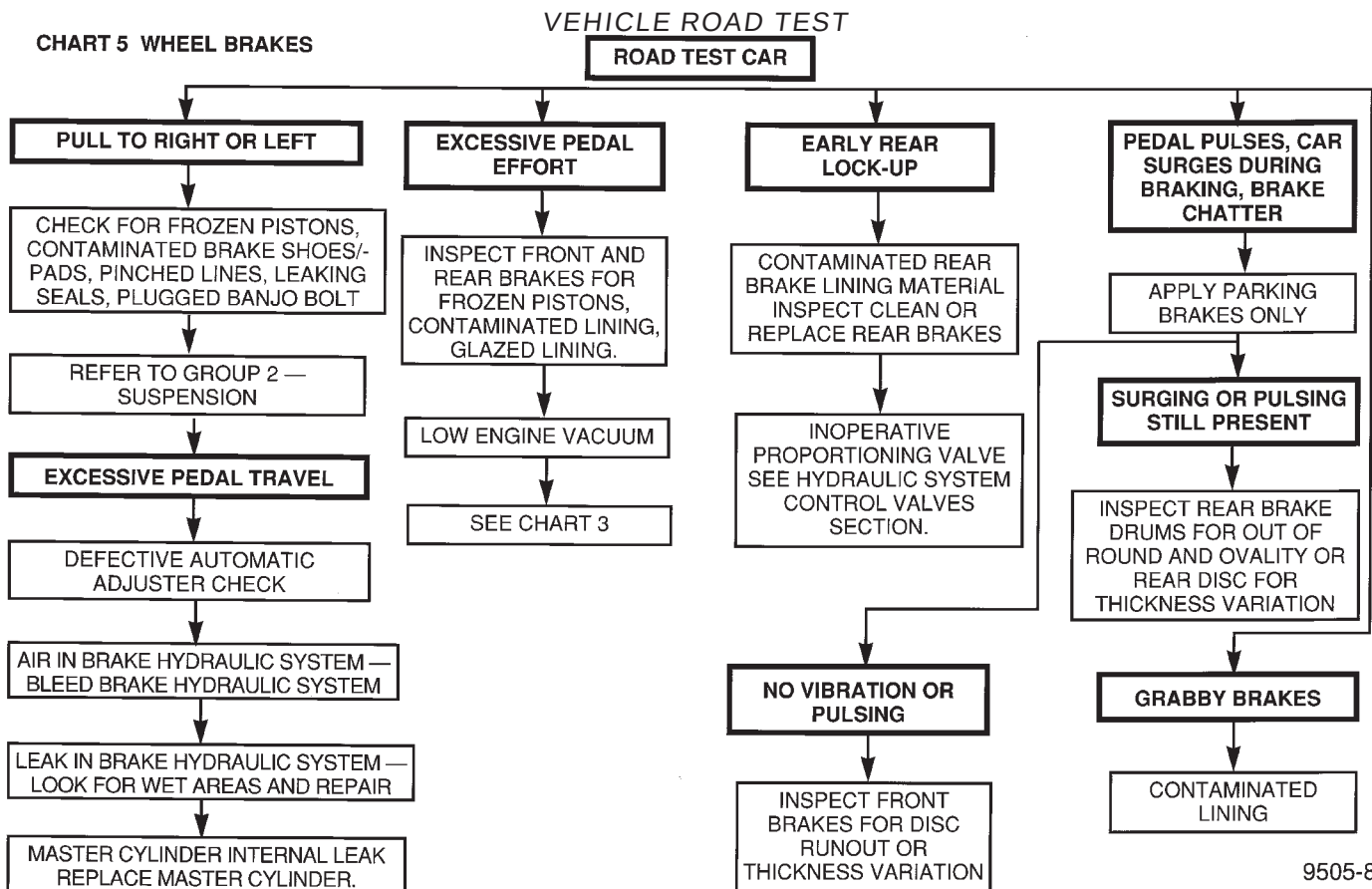
CHART 3 POWER BRAKES



## DIAGNOSIS AND TESTING (Continued)



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9505-85

## DIAGNOSIS AND TESTING (Continued)

**DRUM BRAKE AUTOMATIC ADJUSTER OPERATION**

Place the vehicle on a frame contact hoist with a helper in the driver's seat to apply the brakes. Raise the vehicle. Remove the adjuster access hole plug, from the rear brake support plate (Fig. 17). This will allow access to the star wheel on the automatic adjuster mechanism. Then, to eliminate the possibility of maximum adjustment, insert a small screwdriver through the access hole in the support plate (Fig. 18) and back off the adjuster star wheel approximately 10 notches. **It will be necessary to hold the adjuster lever away from the star wheel to perform this adjustment procedure.**

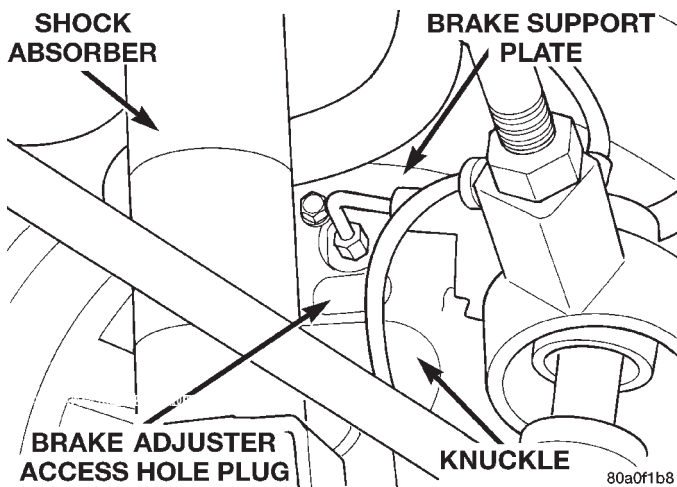


**Fig. 17 Adjuster Access Hole Plug**

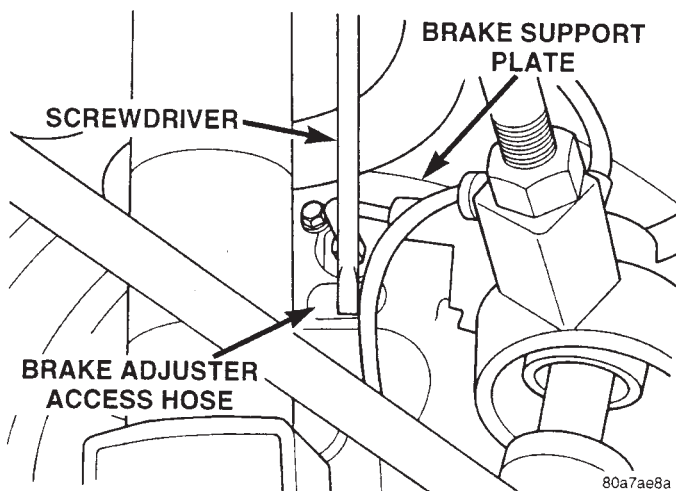


**Fig. 18 Accessing The Automatic Adjuster**

Fully apply the brake pedal which will cause the brake shoes to leave the anchor. Upon application of the brake pedal, the adjuster lever should move downward, turning the star wheel on the adjuster. 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 brake drum must be removed for servicing of the adjuster mechanism.

**BRAKE 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).

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.

## DIAGNOSIS AND TESTING (Continued)

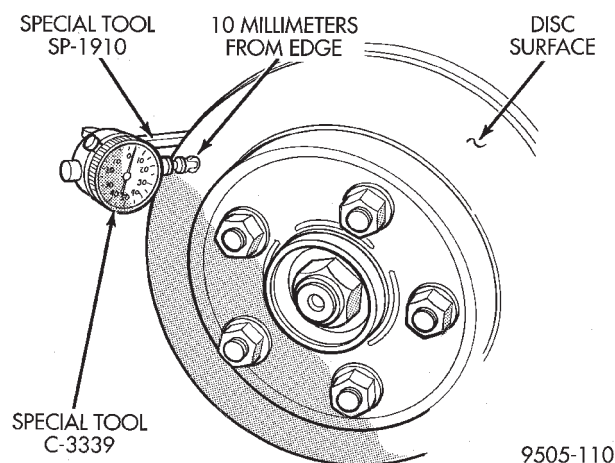


Fig. 19 Checking Rotor For Runout

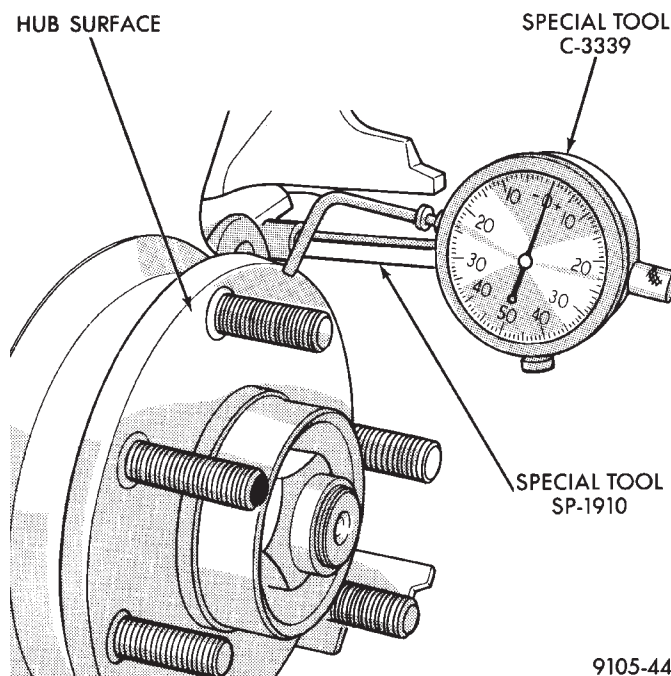


Fig. 21 Checking Hub for Runout

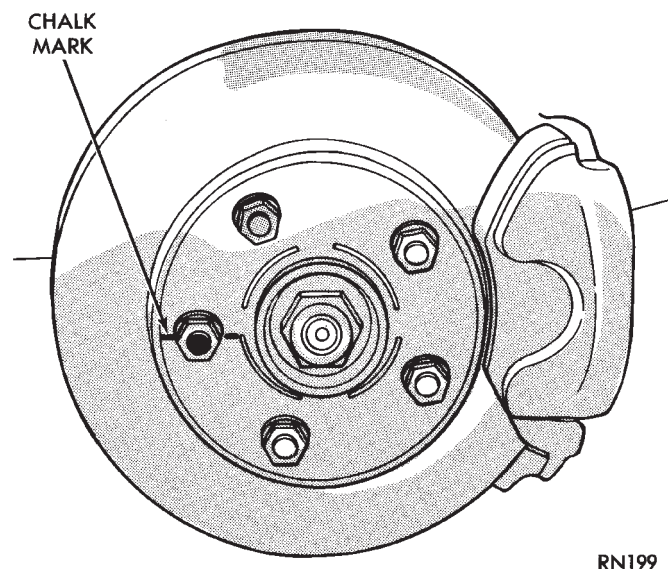


Fig. 20 Marking Rotor and Wheel Stud

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 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.**

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.

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 thick-

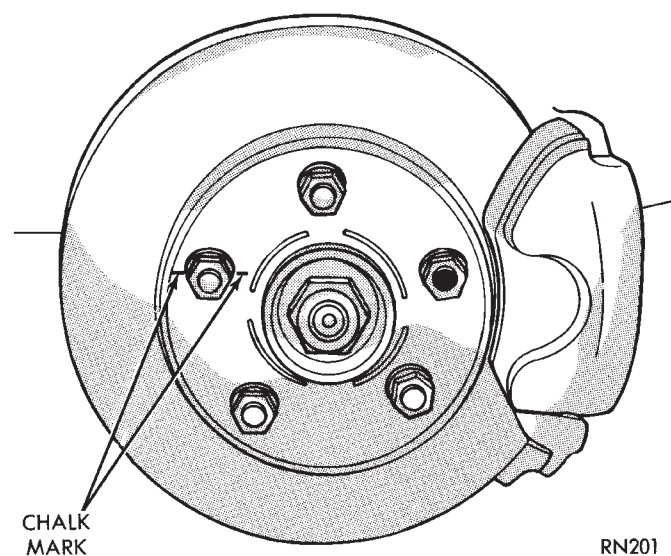


Fig. 22 Index Rotor And Wheel Stud

ness 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.

Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the rotor must be

## DIAGNOSIS AND TESTING (Continued)

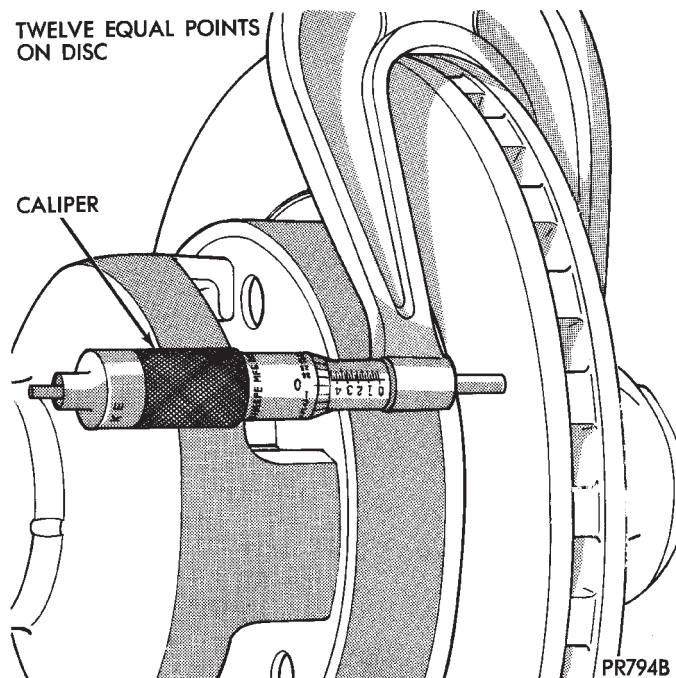


**Fig. 23 Checking Rotor For Thickness**

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 for proper proportioning valve function. The pressure fittings are installed before and after the proportioning valve being tested. This is to verify the proportioning valve is maintaining the required hydraulic pressure to the rear wheel brake 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 than 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 new Pressure Fittings, Special Tool 6805 (Fig. 24) which are to be used for testing the proportioning valves. These same pressure fittings are used if the proportioning valves are either mounted in the HCU, on an antilock equipped vehicle,

or in-line on the brake tube on non-antilock equipped vehicles.

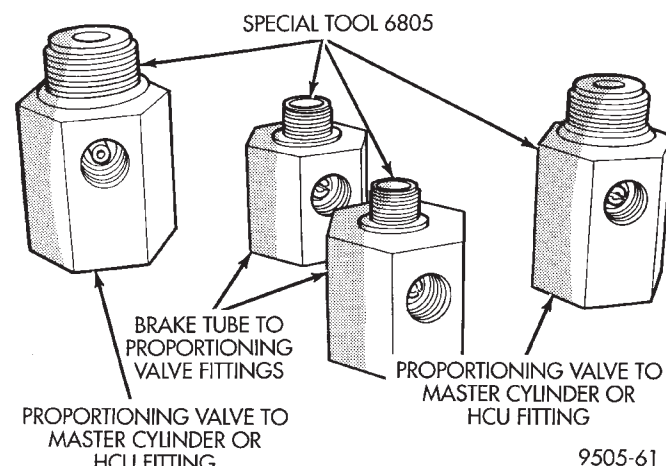


**Fig. 24 Proportioning Valve Pressure Test Fittings**

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

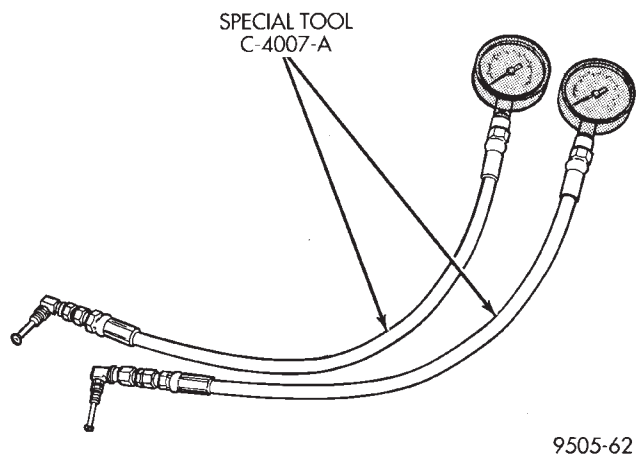


**Fig. 25 Proportioning Valve Pressure Test Gauge Set**

### PROPORTIONING VALVE TESTING NON-ABS BRAKES

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

## DIAGNOSIS AND TESTING (Continued)

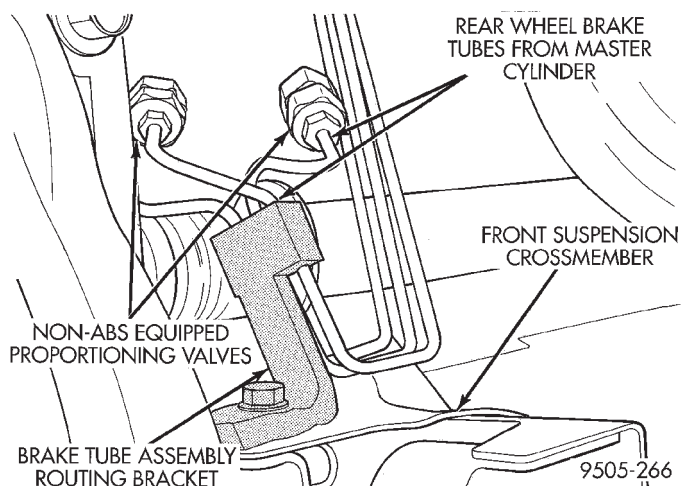


**Fig. 26 Non-ABS Brake Proportioning Valve Location**

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 brake line (Fig. 26) from the proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(3) Remove the proportioning valve from the rear brake line.

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

(4) Install Pressure Test Fitting, Special Tool 6805-1 or 6805-2 on rear brake tube which the proportioning valve was removed from.

(5) Install proportioning valve into pressure test fitting installed on rear brake tube.

**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 into outlet of the proportioning valve.

(7) Connect brake hydraulic line onto pressure test fitting installed in proportioning valve.

(8) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting. 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.

(11) Install proportioning valve in rear brake line and hand tighten both tube nuts until they are fully seated in proportioning valve.

(12) Tighten both brake line tube nuts at the proportioning valve to a torque of 17 N·m (145 in-lbs.).

(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 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. 27). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which is skidding first is determined, use the following procedure to diagnose the proportioning valve.

The test procedure for premature rear wheel ABS cycling 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 the vehicle to determine which wheel exhibits premature ABS cycling, 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 the vehicle to determine which rear wheel exhibits premature ABS cycling, refer to (Fig. 27) to determine which proportioning valve needs to be tested.

## DIAGNOSIS AND TESTING (Continued)

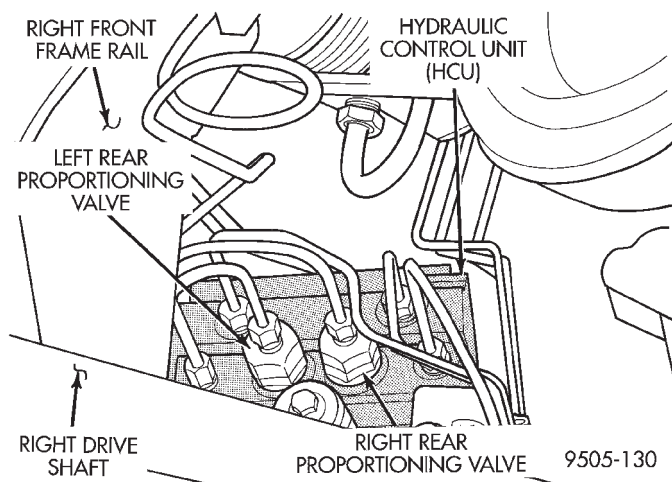


**Fig. 27 Proportioning Valve Locations On HCU**

(2) Remove hydraulic brake line (Fig. 27) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(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 into the outlet port of the HCU.

(5) Install proportioning valve 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 into the outlet of the proportioning valve.

(7) Connect brake hydraulic line onto pressure test fitting installed in proportioning valve.

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

(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.

(11) 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.).

(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 APPLICATIONS AND PRESSURE SPECIFICATIONS

| Sales Code | Brake System Type     | Split Point | Slope | Identification       | Inlet Pressure | Outlet Pressure |
|------------|-----------------------|-------------|-------|----------------------|----------------|-----------------|
| BRA        | 14" Disc/Drum W/O ABS | 600 psi     | 0.59  | Black Or Gold Stripe | 1000 psi       | 800-900 psi     |
| BRJ        | 14" Disc/Drum W/ABS   | 600 psi     | 0.59  | Bar Code Label       | 1000 psi       | 800-900 psi     |

## DIAGNOSIS AND TESTING (Continued)

**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. 28).

**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. 28).

**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.

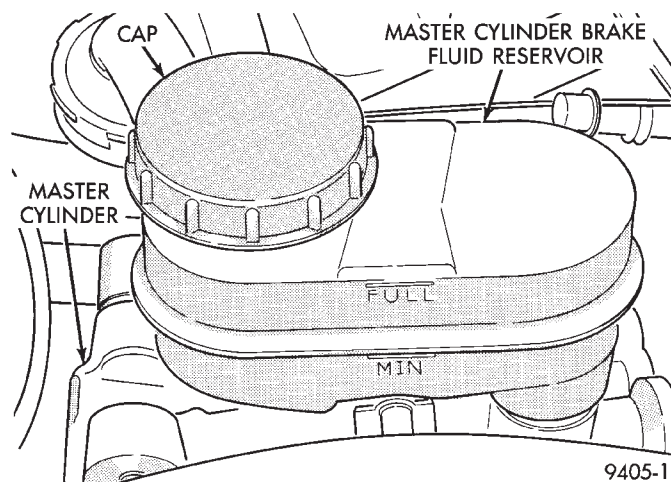


*Fig. 28 Master Cylinder Fluid Level*

**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. 29). Therefore, it is essential to have a fast flow of a large volume of brake fluid when bleeding the brakes to ensure all the air gets out.

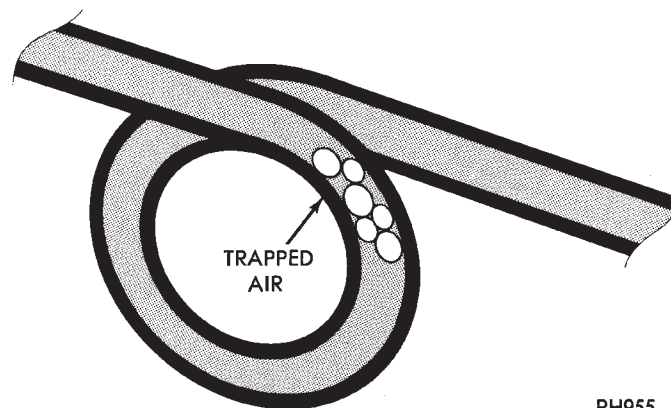


*Fig. 29 Trapped Air in Brake Line*

## SERVICE PROCEDURES (Continued)

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. 30).

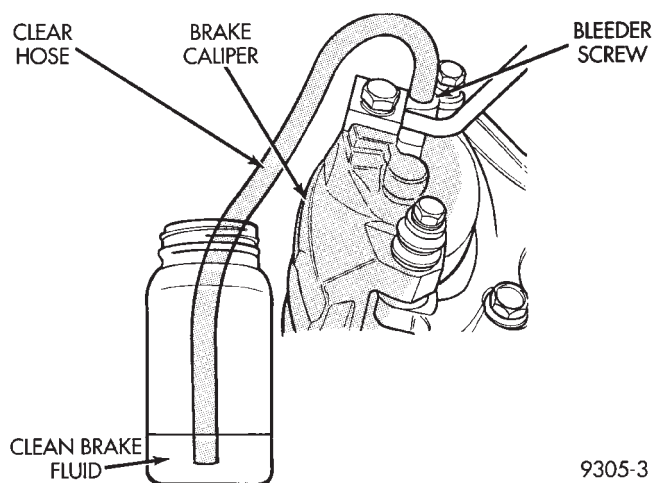


**Fig. 30 Proper Method for Purging Air From Brake System (Typical)**

(2) Open the bleeder screw at least **one full turn** or more to obtain an steady stream of brake fluid (Fig. 31).

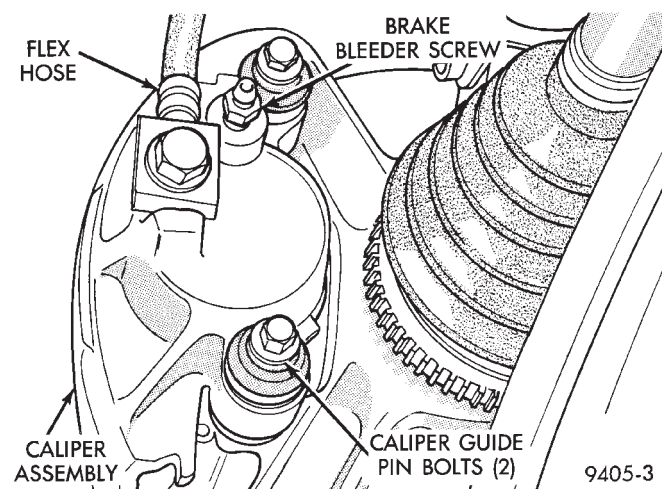


**Fig. 31 Open Bleeder Screw at Least One Full Turn**

(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 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. 30).

(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.

### MASTER CYLINDER BLEEDING PROCEDURE

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder outlet ports (Fig. 32) or (Fig. 33). Position bleeding tubes so the outlets of the bleeding tubes will be below the surface of the brake fluid when reservoir is filled to proper level.

(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. 34). Depress push rod slowly, and then allow pistons to return to

## SERVICE PROCEDURES (Continued)

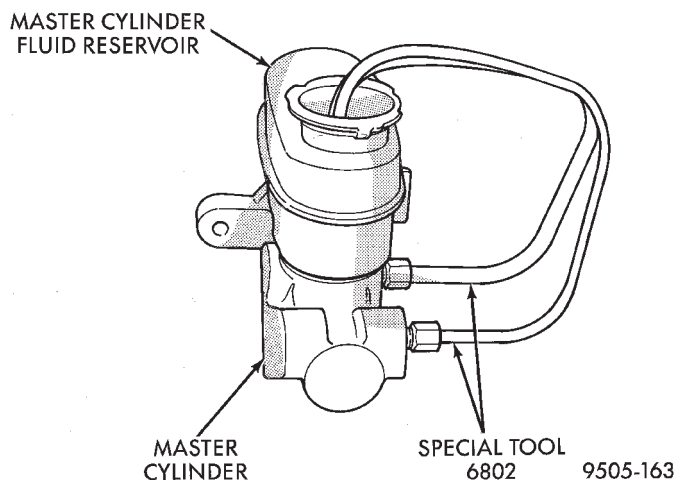


**Fig. 32 Bleeding Tubes Attached To Master Cylinder With ABS**

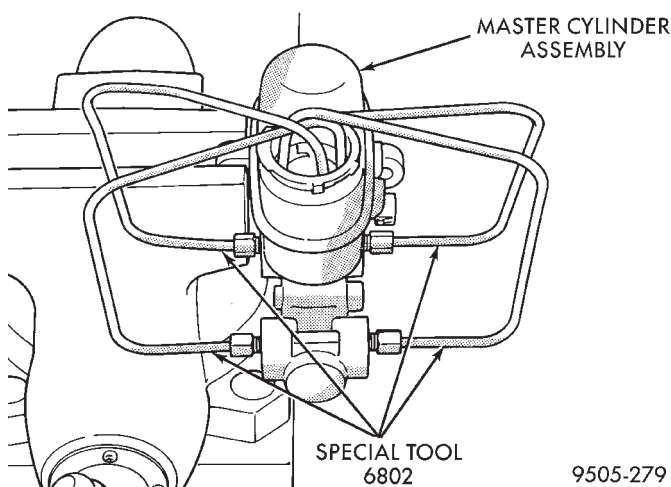


**Fig. 33 Bleeding Tubes Attached to Master Cylinder With Out ABS**

the released position. Continue to repeat this step several times after no more air bubbles are expelled from bleed tubes to ensure all air is bled from the 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 brakes entire hydraulic system after replacing the master cylinder. However, the master cylinder must have been thoroughly bled and filled to the proper level upon installation on the power brake vacuum booster.

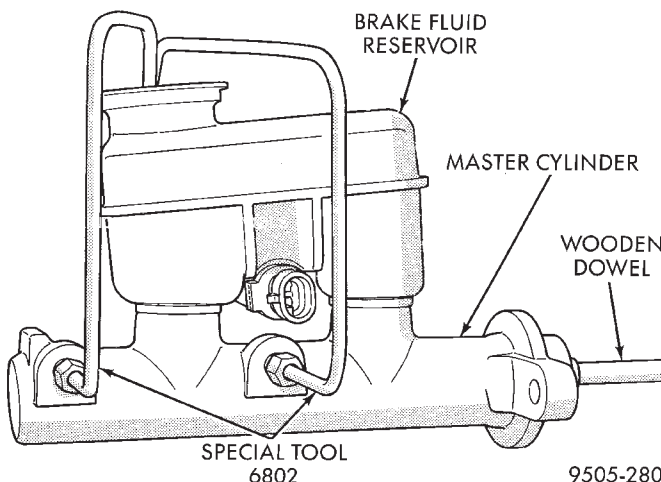


**Fig. 34 Bleeding Master Cylinder**

## BRAKE ROTOR MACHINING

## DISC BRAKE ROTOR TURNING PROCEDURES

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

## BRAKE ROTOR REFINISHING INFORMATION

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or pulsation, the rotor should be resurfaced or refaced (Fig. 35) or (Fig. 36).

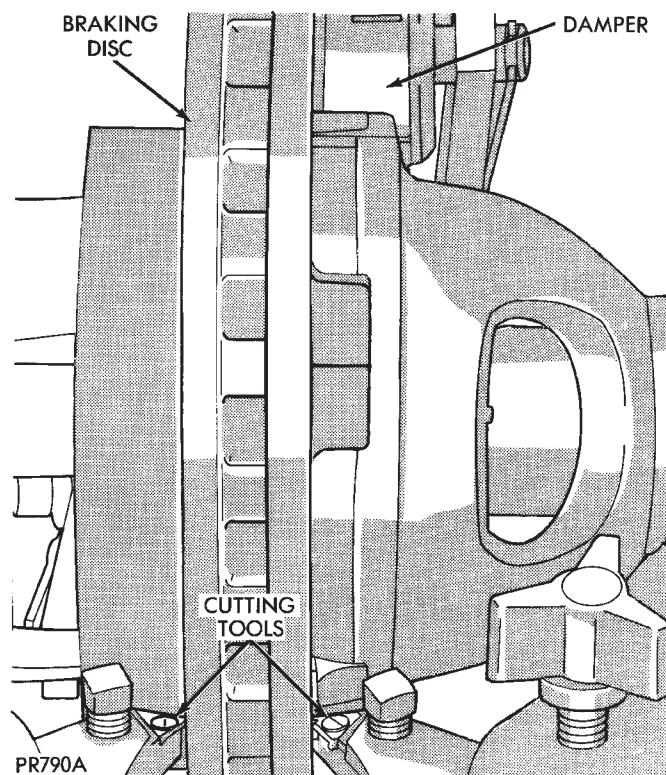


**Fig. 35 Refacing Brake Rotor**

# SERVICE PROCEDURES (Continued)

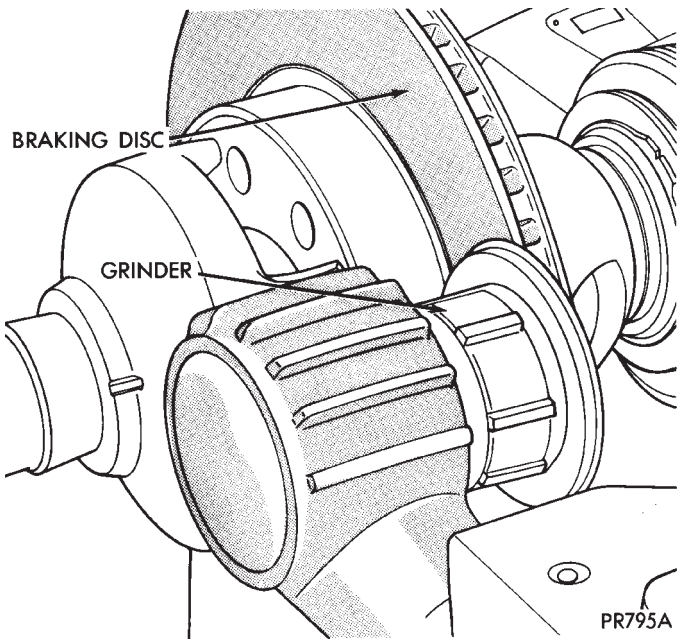


**Fig. 36 Resurfacing Brake Rotor (Final Finish)**

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. 37).

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 0.10 mm (0.004 inch) TIR (Total Indicator Reading) and 0.013 mm

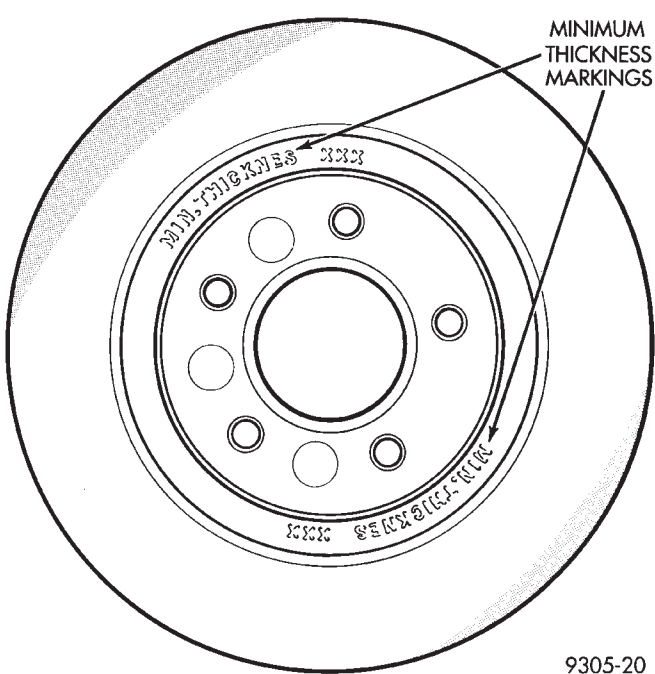


**Fig. 37 Minimum Brake Rotor Thickness Markings (Example)**

(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. 35) 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 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

### BRAKE ROTOR REFINISHING LIMITS

| Braking Rotor                                       | Rotor Thickness                  | Minimum Rotor Thickness | Rotor Thicness Variation | Rotor Run Out *      | Rotor Micro Finish |
|-----------------------------------------------------|----------------------------------|-------------------------|--------------------------|----------------------|--------------------|
| All Front Disc Brakes                               | 23.13-22.87 mm<br>.911 -.900 in. | 21.4 mm<br>.843 in      | 0.013 mm<br>0.0005 in.   | 0.13 mm<br>0.005 in. | 15-80 RMS          |
| * TIR Total Indicator Reading (Measured On Vehicle) |                                  |                         |                          |                      |                    |

## SERVICE PROCEDURES (Continued)

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. 38).

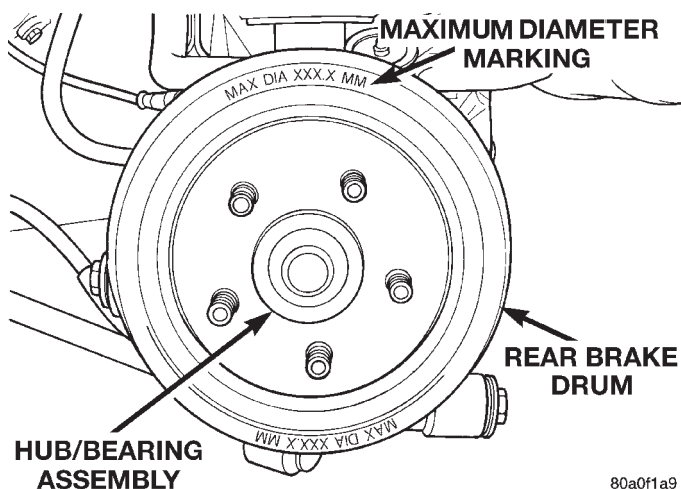


**Fig. 38 Maximum Brake Drum Diameter Identification**

## 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. 39). Ream out any burrs or rough edges showing on inside of tubing (Fig. 40). This will make the ends of tubing square (Fig. 40) 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. 41) and (Fig. 42). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the tubing size. Squeeze handles of flaring tool and lock tubing in place. Place 3/16 inch plug of gauge (A) down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of

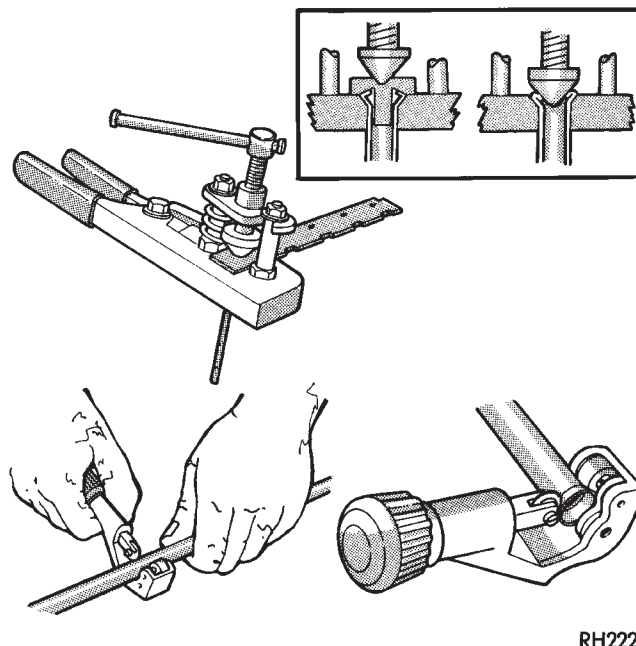
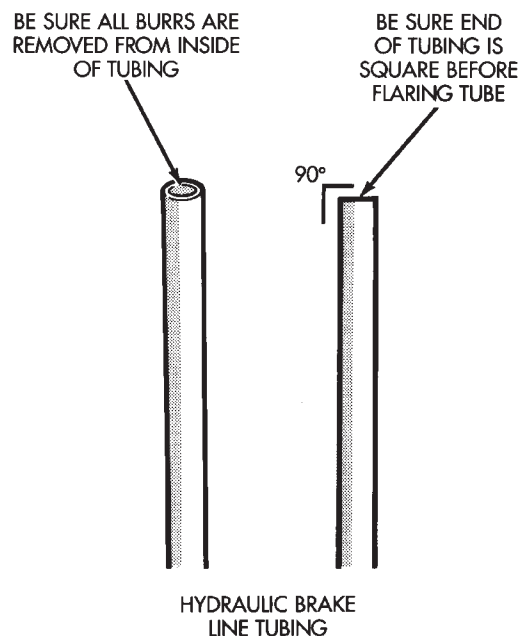


**Fig. 39 Cutting And Flaring Of Brake Fluid Tubing**

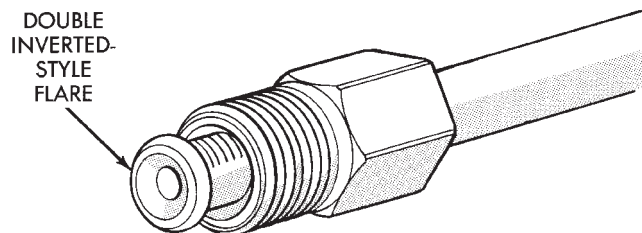


9205-175

**Fig. 40 Brake Fluid Tube Preparation For Flaring**

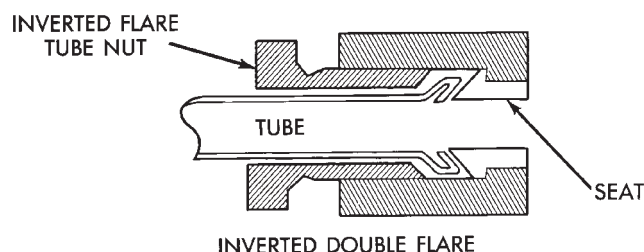
disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.

## REMOVAL AND INSTALLATION (Continued)



9405-5

**Fig. 41 Double Inverted Brake Line Tubing Flare**



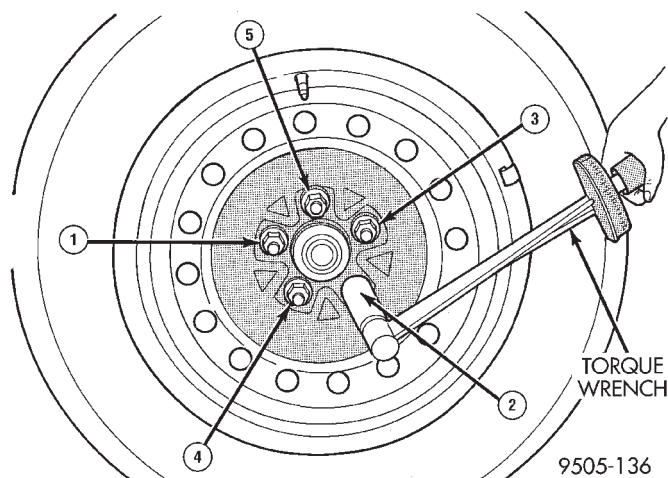
9405-6

**Fig. 42 Double Wall Inverted Flare Connection**

## REMOVAL AND INSTALLATION

### WHEEL AND TIRE

To install the wheel and tire assembly, first position it properly on the mounting surface using the hub pilot as a guide. Then progressively tighten the lug nuts in the proper sequence to half of the required torque. Finally tighten the lug nuts in the proper sequence to 135 N·m (100 ft. lbs.) (Fig. 43). Never use oil or grease on studs or nuts.



9505-136

**Fig. 43 Five Lug Wheel Nut Tightening Sequence**

### FRONT DISC BRAKE CALIPER

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.

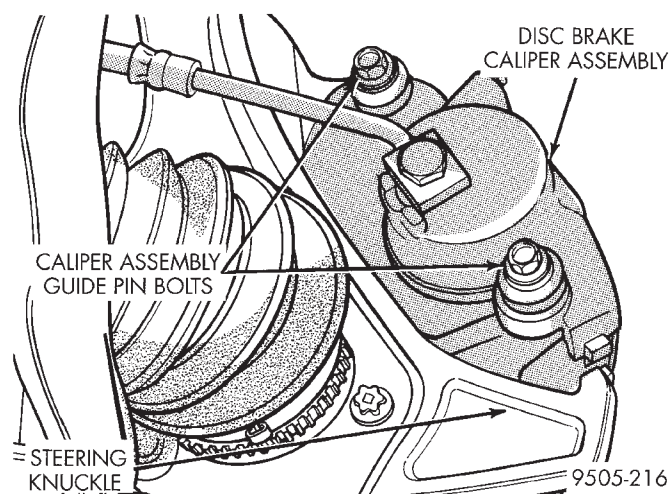
**NOTE:** Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

### REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove front wheel and tire assemblies from vehicle.

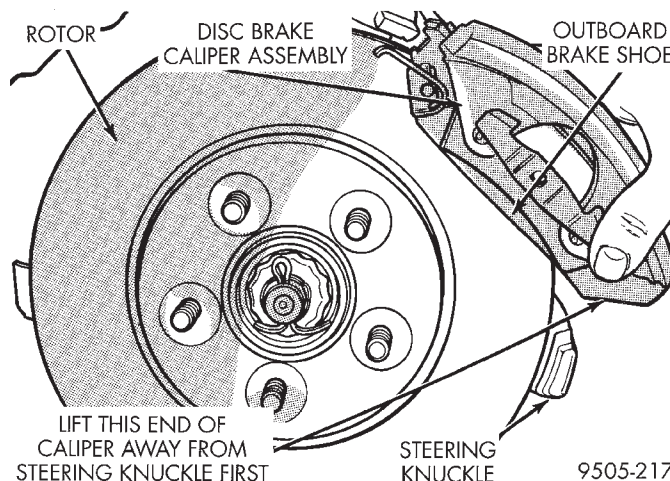
(3) Remove the 2 caliper to steering knuckle guide pin bolts (Fig. 44).



9505-216

**Fig. 44 Removing Caliper Guide Pin Bolts**

(4) Remove brake caliper from steering knuckle, by first rotating bottom end of caliper away from steering knuckle. Then slide top of caliper down from the machined abutment on steering knuckle (Fig. 45).



9505-217

**Fig. 45 Removing / Installing Brake Caliper**

## REMOVAL AND INSTALLATION (Continued)

(5) **Support caliper from upper control arm to prevent weight of caliper from being supported by brake flex hose. Supporting disc brake caliper from flex hose can damage the hose (Fig. 46).**

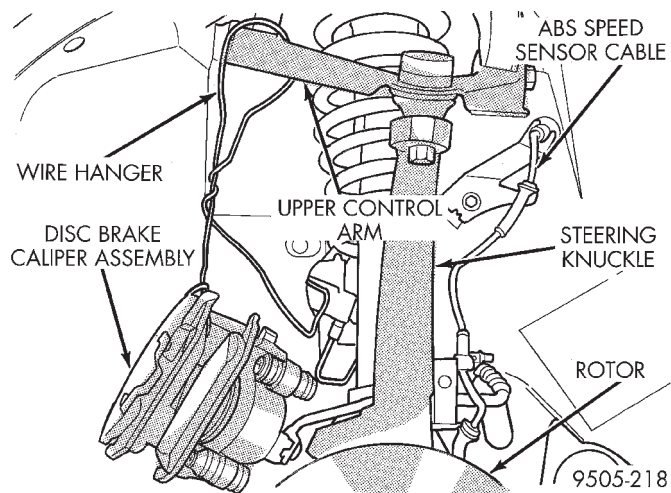


**Fig. 46 Storing Caliper**

## INSTALL

(1) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(2) If removed, install the front rotor on the hub, making sure it is squarely seated on face of hub.

**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.

(3) Carefully position caliper and brake shoe assemblies over brake rotor by first hooking top of brake shoes on the machined abutment on upper steering knuckle (Fig. 45). Then rotate the bottom of the brake caliper into position on the steering knuckle. **Make sure that caliper guide pin bolts, bushings and sleeves are clear of the steering knuckle bosses.**

**NOTE:** When being installed, extreme caution must be taken not to cross thread the caliper guide pin bolts.

(4) Install the brake caliper guide pin bolts (Fig. 44). Then tighten the guide pin bolts to a torque of 22 N·m (16 ft. lbs.).

(5) Install the wheel and tire assembly.

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

(7) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.**

(8) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

## FRONT 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 AFTER MARKET 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 AIR-TIGHT 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.

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 front wheel and tire assemblies from vehicle.

## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** When prying the piston back into the bore of the caliper do not use a hard pry bar. The use of a hard pry bar will damage the braking surface of the rotor.

(3) Slightly pry the piston back into the bore of the disc brake caliper. The piston is to be pryed back by inserting a soft tool (such as a trim stick) between the inboard brake shoe and the rotor and prying against the inboard brake shoe. This will force the piston back into the caliper.

(4) Remove the 2 brake caliper to steering knuckle guide pin bolts (Fig. 47).

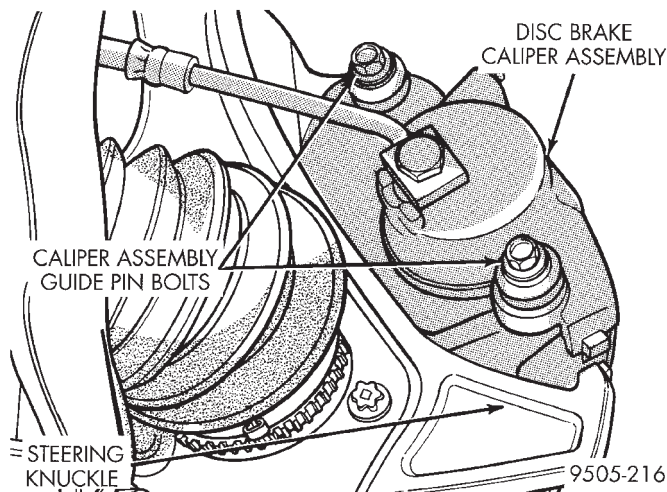


**Fig. 47 Removing Caliper Guide Pin Bolts**

(5) Remove brake caliper from steering knuckle, by first rotating bottom of brake caliper away from the steering knuckle. Then slide top of brake shoes down and out from the top machined abutment on steering knuckle (Fig. 48).

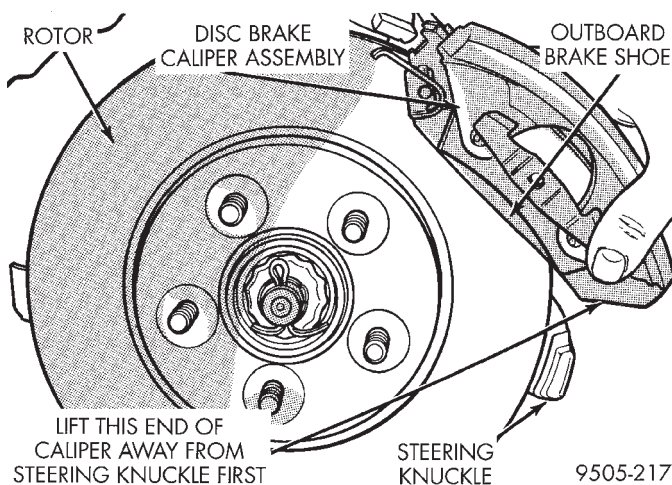


**Fig. 48 Removing Brake Caliper**

(6) Support brake caliper from upper control arm to prevent weight of caliper from being supported by brake flex hose. Supporting disc

brake caliper from flex hose can damage the hose (Fig. 49).

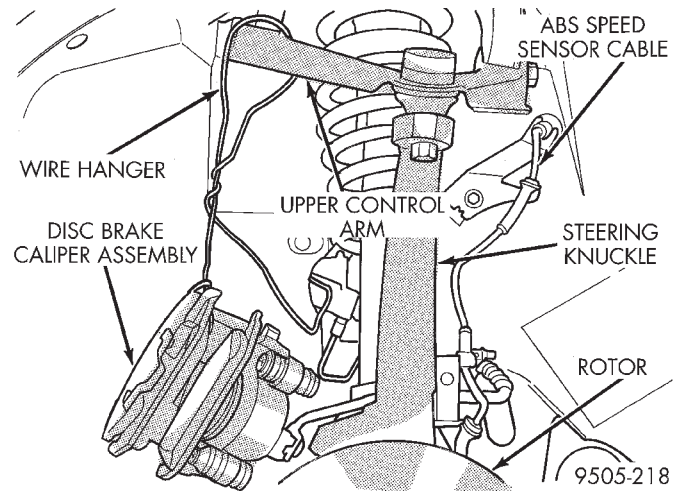


**Fig. 49 Storing Caliper**

(7) Remove the brake rotor from the front hub (Fig. 50).

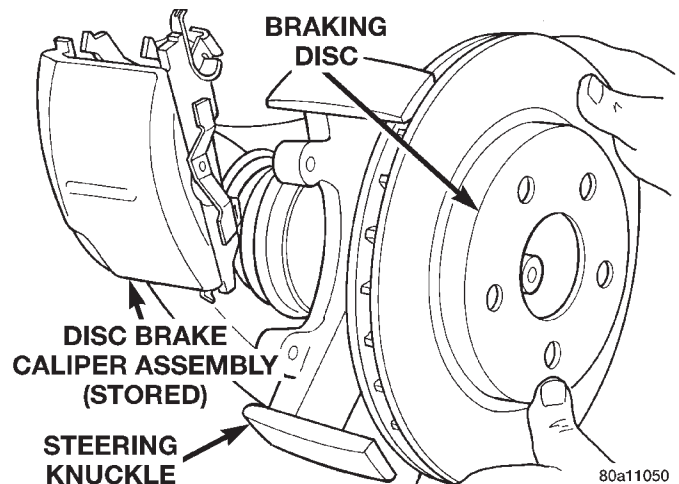


**Fig. 50 Removing / Installing Brake Rotor**

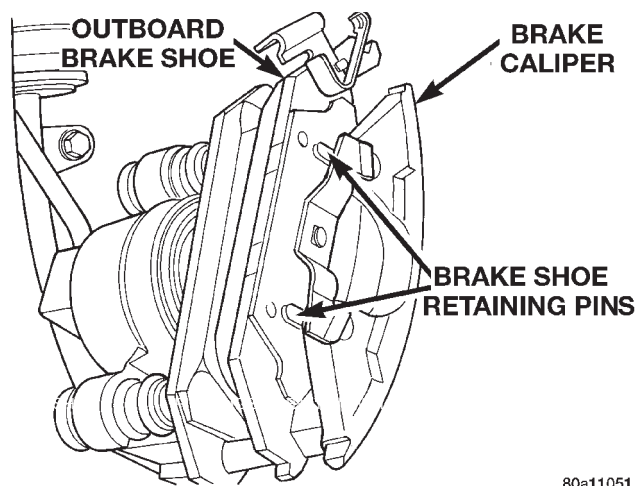
(8) Remove outboard brake shoe by pushing the brake shoe inward until retaining pins on brake shoe can be removed from holes in caliper (Fig. 51). Then slide the brake shoe off the caliper.

(9) Pull inboard brake shoe away from piston until retaining clip is free from cavity in piston (Fig. 52).

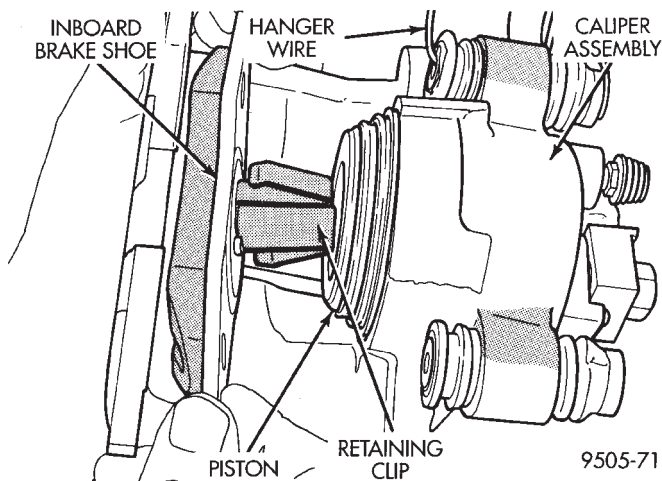
#### CALIPER INSPECTION

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.

## REMOVAL AND INSTALLATION (Continued)



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**Fig. 51 Removing / Installing Outboard Brake Shoe**

9505-71

**Fig. 52 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 assembly. This is required for caliper installation with new brake shoe assemblies.

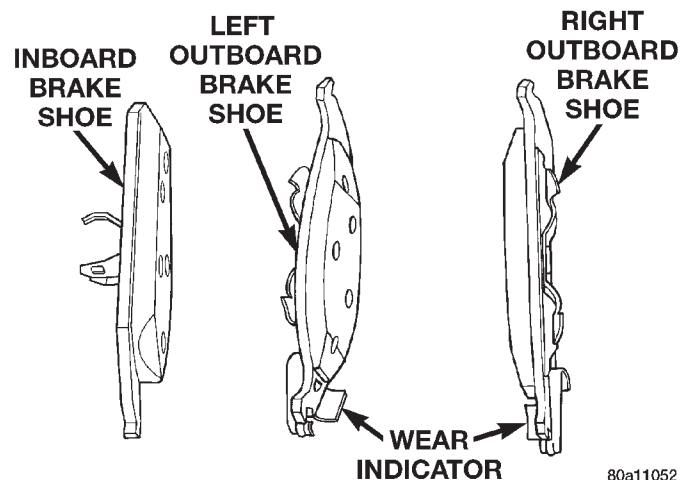
(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install the front rotor on the hub, making sure it is squarely seated on face of hub (Fig. 50).

(4) Remove the protective paper from the noise suppression gasket on both the inner and outer brake shoe assemblies (if equipped).

**NOTE:** Note: The inboard and outboard brake shoes are not common (Fig. 53). Be sure the cor-

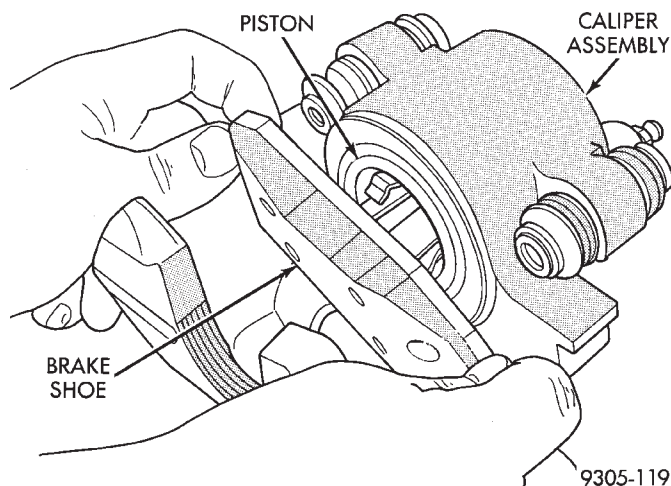
rect outer brake shoe is installed in the correct caliper. The left and right outer brake shoes are different and must be installed correctly. The wear sensor (Fig. 53) and the hold down clip must be on the upper end of the caliper when the caliper and brake shoes are installed on the steering knuckle.



80a11052

**Fig. 53 Front Brake Shoe Assembly Identification**

(5) Install the new inboard brake shoe assembly into the caliper piston by firmly pressing into piston bore (Fig. 54). Be sure inboard brake shoe assembly is positioned squarely against face of caliper piston.



9305-119

**Fig. 54 Installing Inboard Brake Shoe Assembly**

(6) Slide the new outboard brake shoe assembly onto the caliper assembly (Fig. 51).

**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. Also, make sure that caliper guide pin bushings and sleeves are clear of the steering knuckle bosses

## REMOVAL AND INSTALLATION (Continued)

(7) Carefully position brake caliper and brake shoes over brake rotor by first hooking top of brake shoes onto upper abutment on steering knuckle (Fig. 55). Then rotate caliper into position at bottom of steering knuckle.

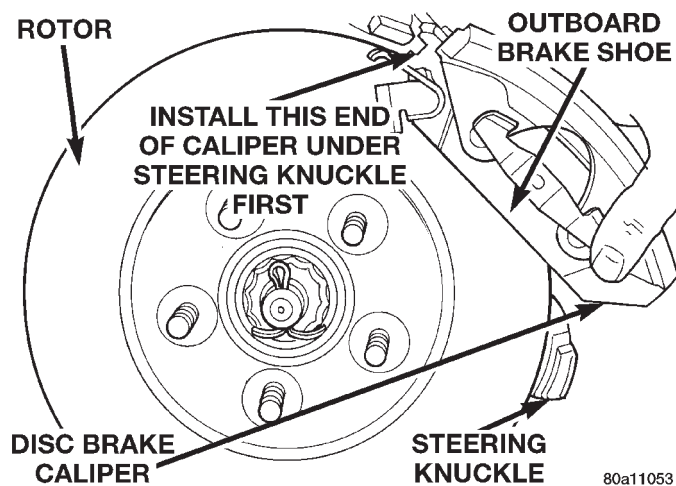


*Fig. 55 Installing Brake Caliper*

**NOTE:** When installing guide pin bolts, extreme caution should be taken not to cross thread the caliper guide pin bolts.

(8) Install the caliper guide pin bolts (Fig. 47) and tighten to a torque of 22 N·m (16 ft. 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 shoes.

## REAR BRAKE DRUM

### REMOVE

If the vehicle has high mileage, the brake drums may have a ridge worn in them by the brake shoes. This ridge causes the brake drum to interfere with the brake shoes thus, not allowing the brake drum to be removed. Further clearance can be obtained by backing off the brakes automatic self adjuster mechanism, using the following procedure.

(1) Remove the rubber plug (Fig. 56) from the brake support plate.

(2) Insert a screwdriver, through the automatic adjuster access hole, in the rear brake support plate (Fig. 57). Engage screwdriver with the teeth on the adjuster mechanism quadrant. Then rotate quadrant

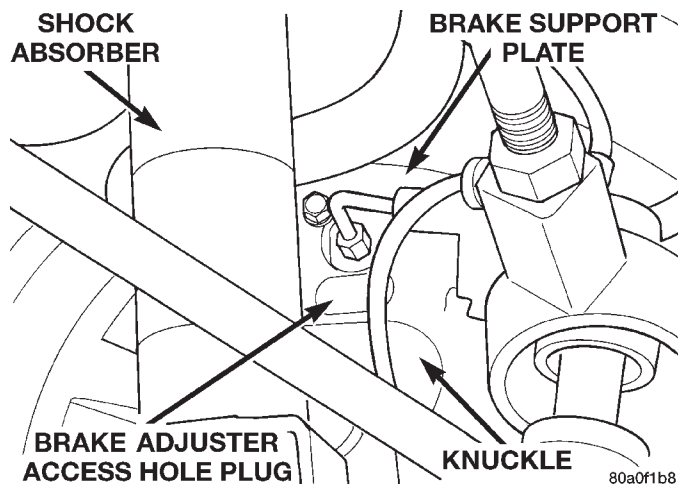


*Fig. 56 Automatic Adjuster Access Hole Plug*

so that the teeth on the quadrant are moved toward the front of the vehicle (Fig. 57). This will back off the adjustment of the rear brake shoes.

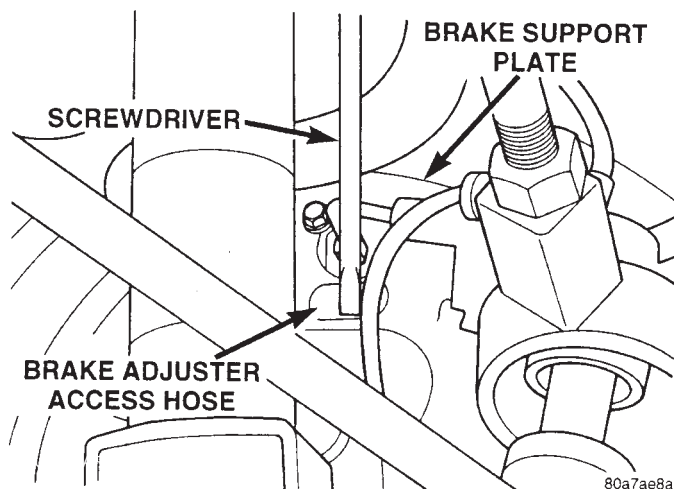


*Fig. 57 Backing Off Rear Brake Shoe Adjustment*

(3) Remove the rear brake drum from the rear hub and bearing assembly (Fig. 58).

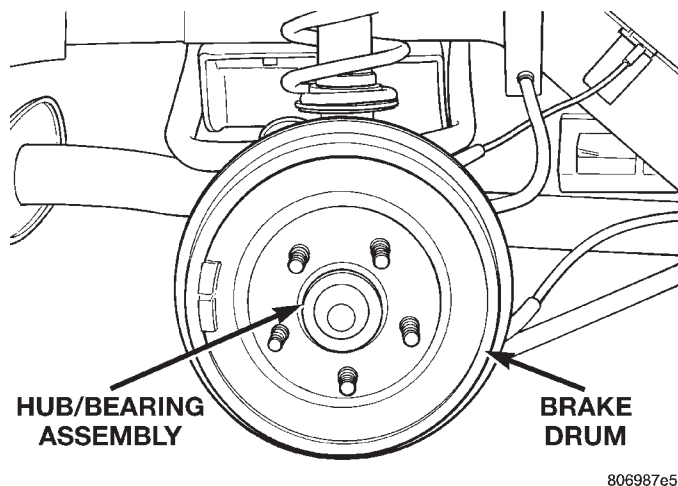


*Fig. 58 Brake Drum And Hub And Bearing Assembly*

## REMOVAL AND INSTALLATION (Continued)

## INSTALL

- (1) Install rear brake drum 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.).
- (4) Adjust rear brakes.

## REAR BRAKE SHOES

**NOTE:** When replacing the rear brake shoes on this vehicle, remove the brake shoes from only one side of the vehicle at a time. This is due to the automatic adjustment feature of the park brake system. If the brake shoe assemblies are removed from both rear wheels at the same time the adjuster will remove all the slack from the park brake cables, making installation of the brake shoes extremely difficult.

## 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 rear brake drum to hub retaining clips (if equipped). Then remove rear brake drum from hub and bearing assembly (Fig. 59).

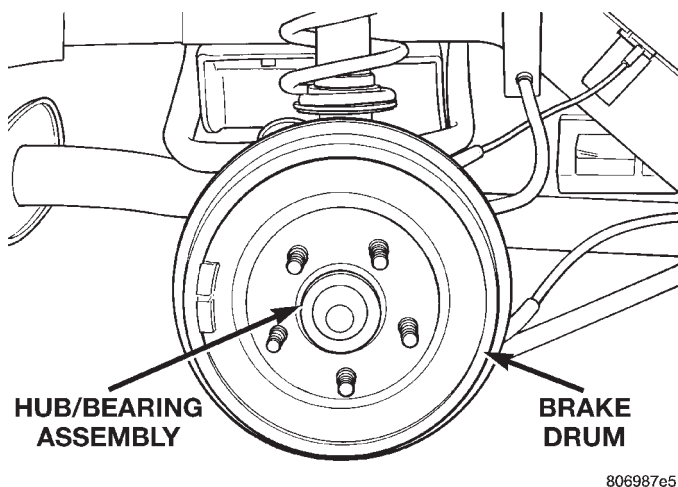


**Fig. 59 Rear Brake Drum Assembly**

- (4) Remove the automatic adjuster lever actuating spring from the leading brake shoe (Fig. 60). Then remove the automatic adjuster actuating lever from the leading brake shoe (Fig. 60).
- (5) Thread the automatic adjuster star wheel (Fig. 61) all the way into the adjuster, removing all tension from the adjuster. Then remove the upper return spring (Fig. 61) from the brake shoes.

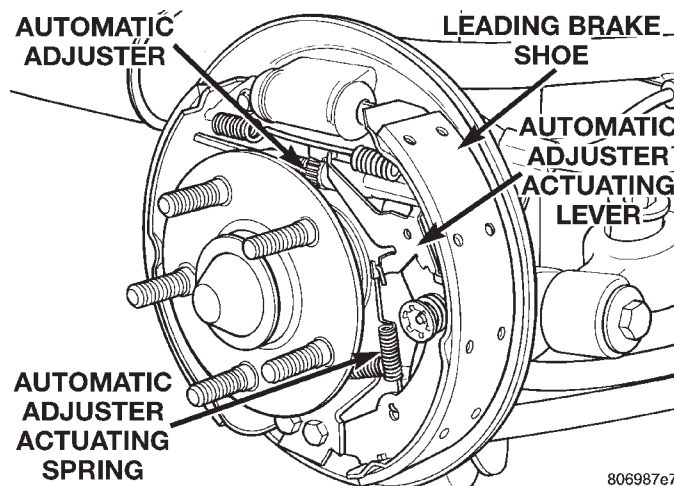


**Fig. 60 Automatic Adjuster Actuating Spring And Lever**

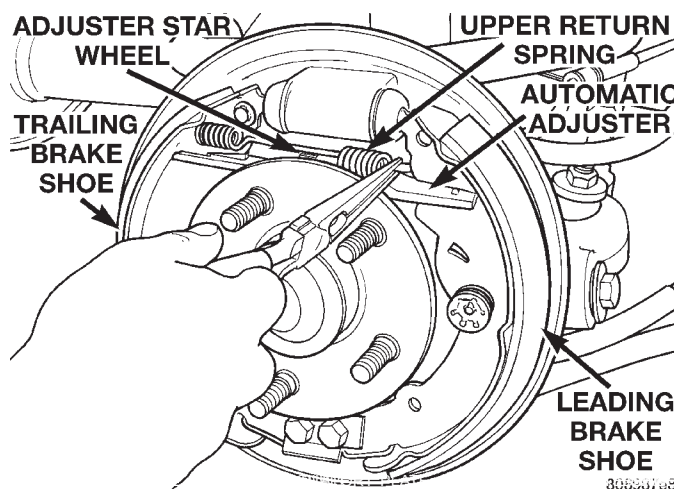


**Fig. 61 Brake Shoe Upper Return spring**

- (6) Remove the brake shoe lower return spring (Fig. 62).

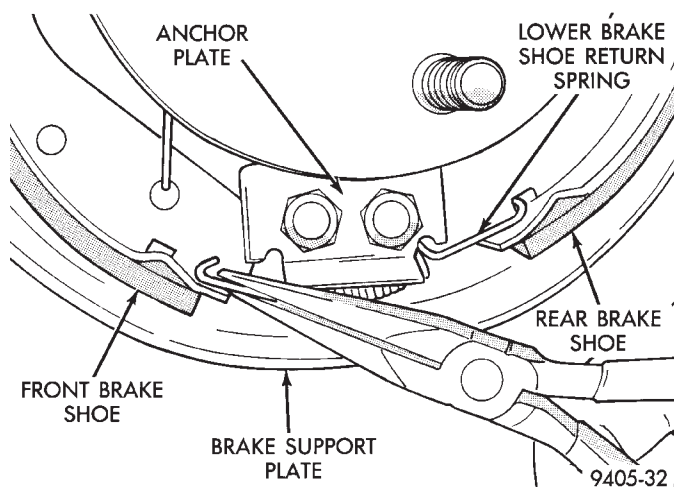


**Fig. 62 Brake Shoe Lower Return Spring**

## REMOVAL AND INSTALLATION (Continued)

(7) Remove the hold down spring and attaching pin (Fig. 63) from the leading brake shoe.

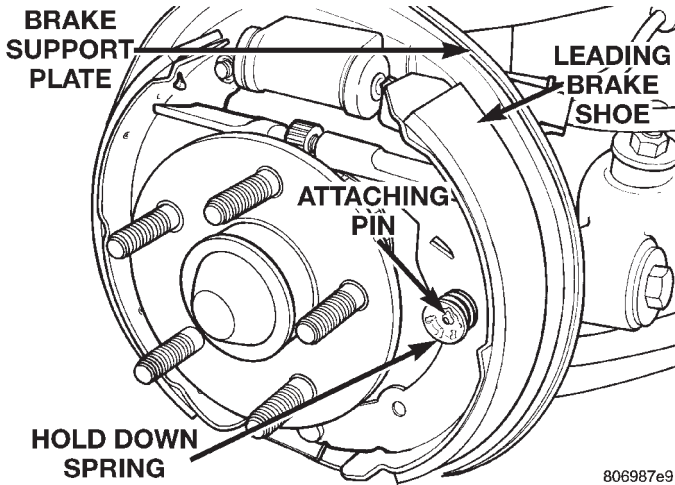


**Fig. 63 Hold Down Spring And Pin**

(8) Remove the leading brake shoe from the brake support plate.

(9) Remove the automatic adjuster (Fig. 64) from the trailing brake shoe and park brake actuating lever.

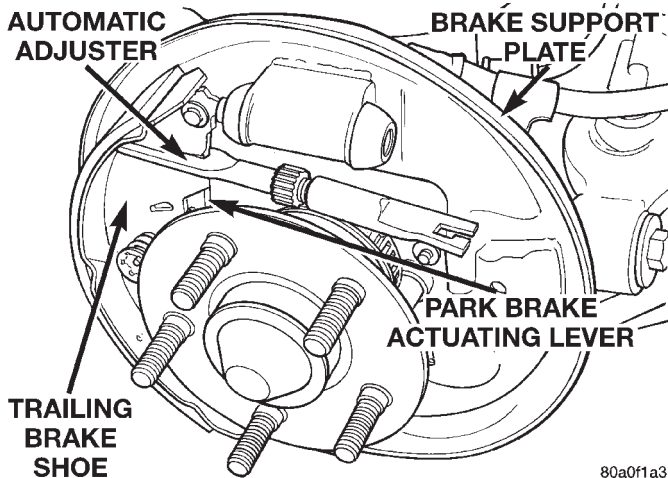


**Fig. 64 Automatic Adjuster**

(10) Remove the retaining clip (Fig. 65) holding the park brake actuating lever to the trailing brake shoe.

(11) Remove the hold down spring and attaching pin (Fig. 66) from the trailing brake shoe.

(12) Remove the trailing brake shoe from the brake support plate and the park brake actuating lever (Fig. 67).

## CLEANING AND INSPECTION

Clean metal portion of brake shoes. Check to see if shoes are bent.

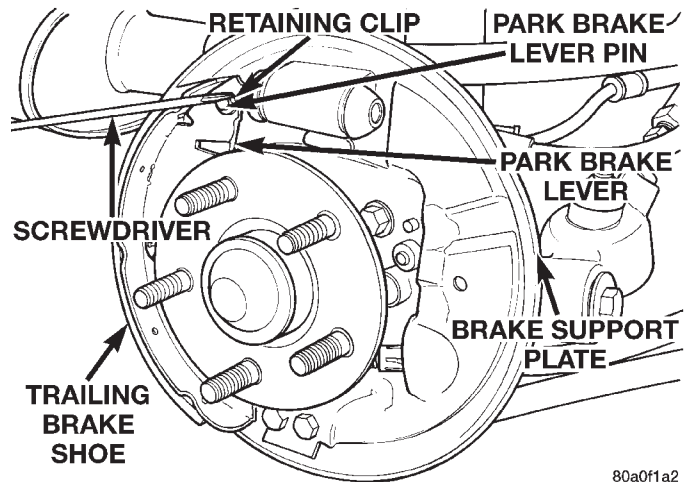


**Fig. 65 Park Brake Lever Retaining Clip**

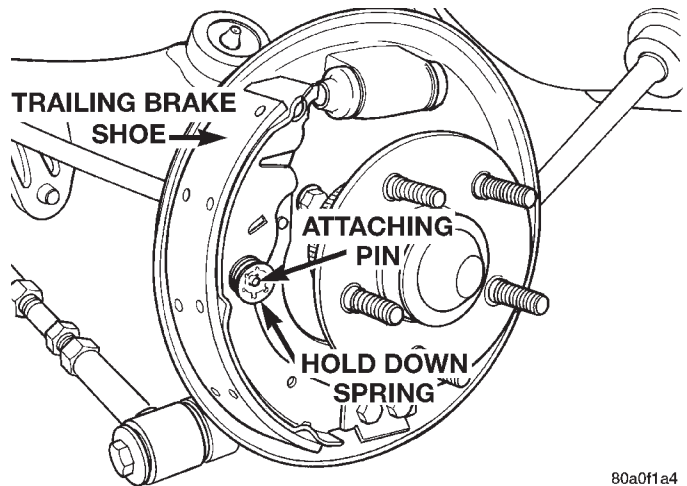


**Fig. 66 Hold Down Spring And Pin**

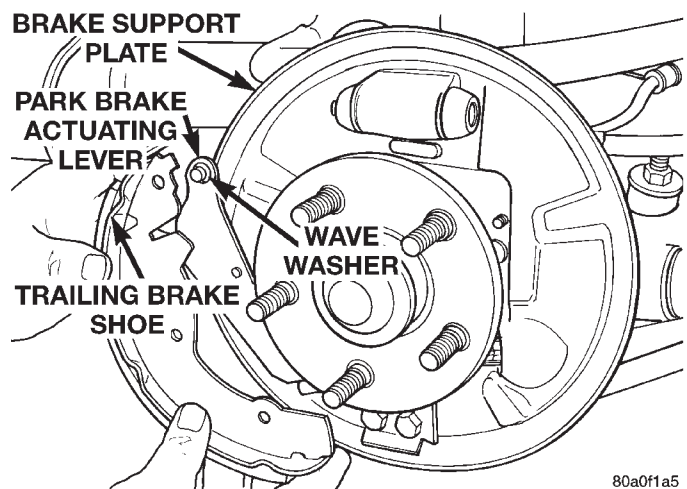


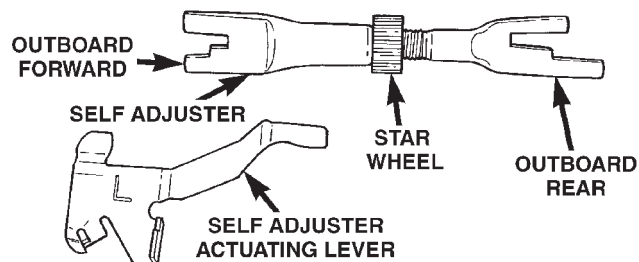
**Fig. 67 Remove /Install Trailing Brake Shoe**

Brake shoe lining should show contact across its entire width and from the heel to the toe of the lining, otherwise replace.

## REMOVAL AND INSTALLATION (Continued)

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. 68). Replace adjusting screw if corroded.



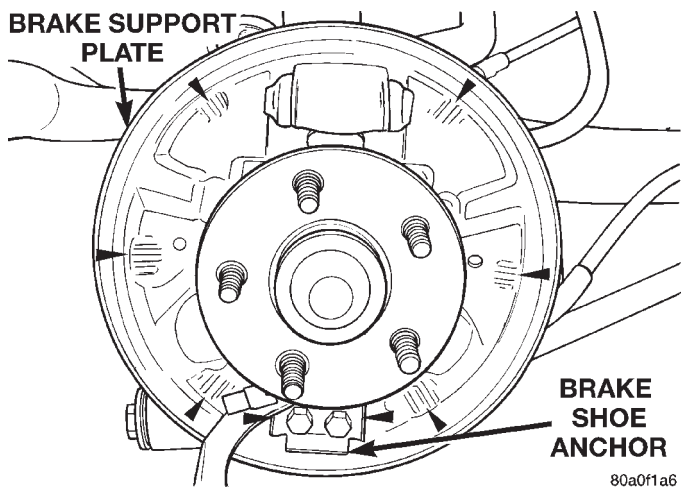
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**Fig. 68 Adjuster Screw and Lever (Typical)**

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

## INSTALL

(1) Lubricate the six brake shoe contact areas on the brake support plate and the brake shoe contact points on the brake shoe anchor (Fig. 69) using Mopar Multi-Purpose Lubricant or equivalent.



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**Fig. 69 Brake Shoe Contact Areas on Support Plate**

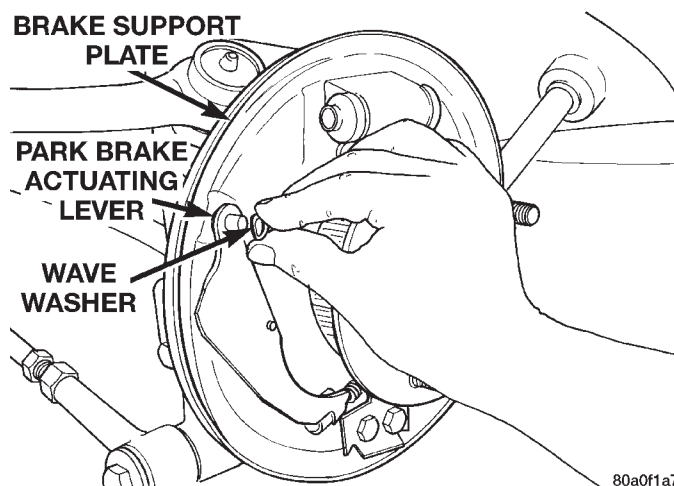
(2) Install the wave washer on the pin of the park brake actuating lever (Fig. 70).

(3) Install the trailing brake shoe on the park brake actuating lever (Fig. 67)

(4) Install the trailing brake shoe on the brake support plate. Install the attaching pin and hold down spring for the trailing brake shoe (Fig. 66).

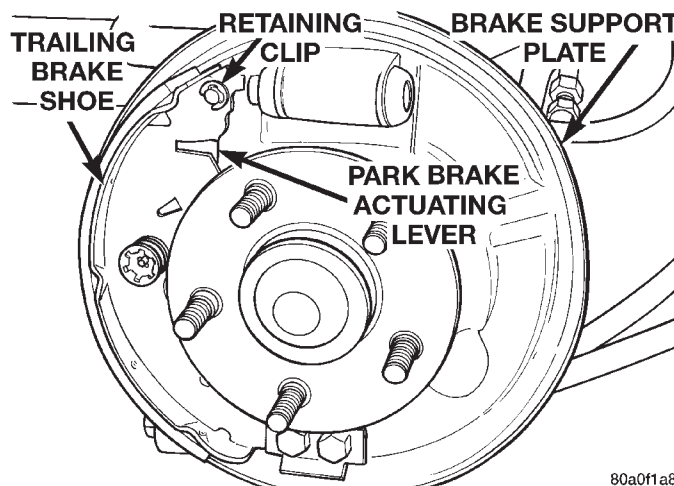
(5) Install the retaining clip attaching the park brake actuating lever to the trailing brake shoe (Fig. 71).

(6) Install the automatic adjuster on the trailing brake shoe and park brake actuating lever (Fig. 64).



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**Fig. 70 Wave Washer Installation**



80a0f1a8

**Fig. 71 Park Brake Actuating Lever Retaining Clip Installed**

(7) Install the leading brake shoe on the brake support plate. Then install the attaching pin and hold down spring for the leading brake shoe (Fig. 63).

(8) Install the brake shoe lower return spring (Fig. 62).

(9) Install the upper return spring on the brake shoes (Fig. 61)

(10) Install the automatic adjuster actuating lever and the actuating spring on the leading brake shoe (Fig. 60).

(11) Manually adjust the brake shoes assemblies out as far as possible but not so as to interfere with brake drum installation.

(12) Install the rear brake drums on the hubs.

(13) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.

(14) Install the wheel and tire assembly.

(15) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half

## REMOVAL AND INSTALLATION (Continued)

specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(16) Road test vehicle. The automatic adjuster will continue the brake adjustment during the road test of the vehicle.

**REAR BRAKE 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 from the rear hub and bearing assembly (Fig. 72).

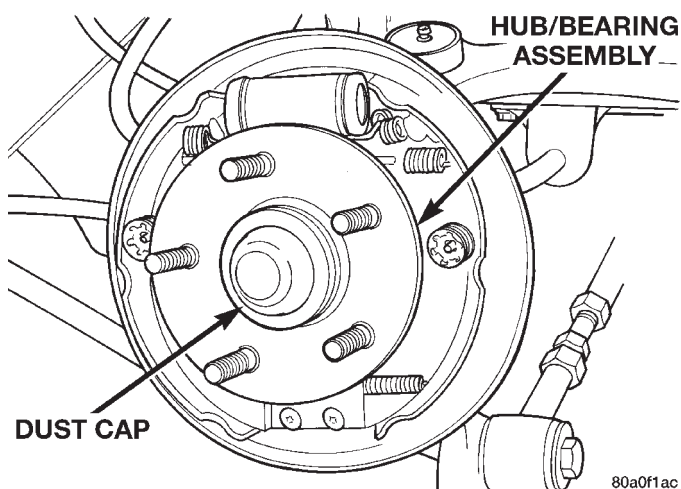


**Fig. 72 Hub And Bearing Dust Cap**

(4) Remove the rear hub and bearing assembly retaining nut (Fig. 73). Then remove the hub and bearing assembly from the rear knuckle.

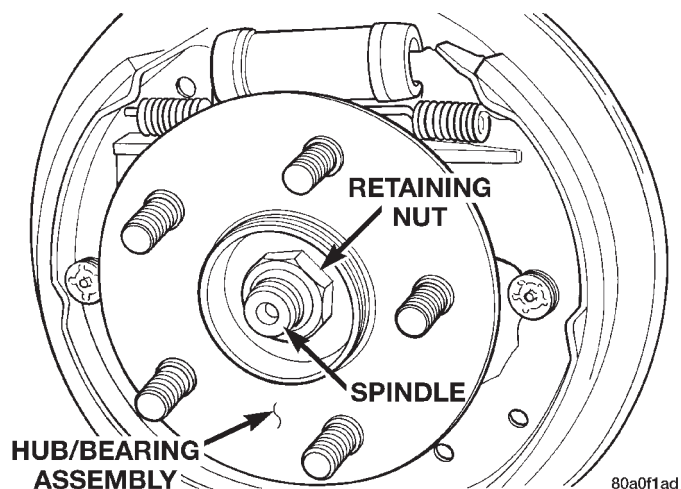


**Fig. 73 Hub And Bearing Retaining Nut**

(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 rear brake flex hose tube from wheel cylinder and remove the brake flex hose bracket from the brake support plate (Fig. 74).

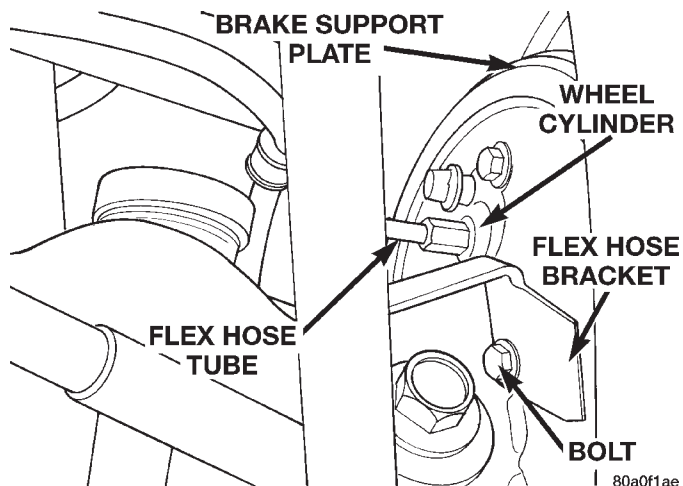


**Fig. 74 Brake Flex Hose Tube At Wheel Cylinder**

(7) Position a 1/2 wrench over the retainer fingers on the end of the parking brake cable (Fig. 75). Compress cable housing retaining fingers and start cable housing out of support plate (Fig. 75). 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.

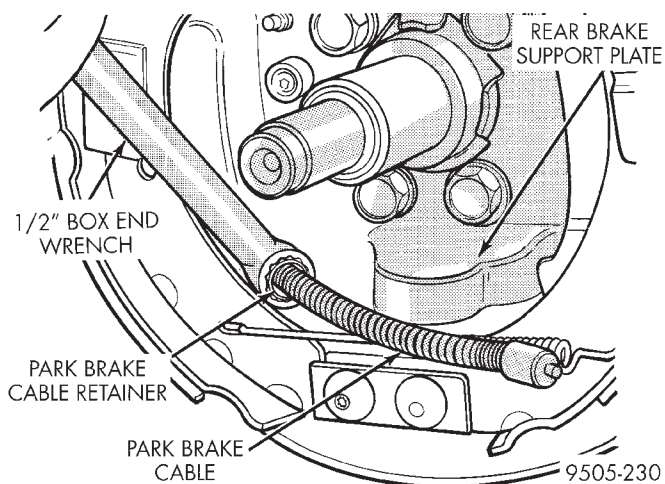


**Fig. 75 Removing Park Brake Cable From Support Plate**

(8) Remove the 4 bolts attaching the brake support plate to the knuckle. Separate brake support plate from rear suspension knuckle.

## REMOVAL AND INSTALLATION (Continued)

**INSTALL**

(1) Install the gasket and brake support plate on rear suspension knuckle. Torque the brake support plate to knuckle 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. Tighten tube nut to a torque of 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 hub and bearing assembly on rear knuckle. Install a **NEW** hub and bearing assembly retaining nut (Fig. 73). Tighten the hub and bearing assembly retaining nut to a torque of 250 N·m (185 ft. lbs.). Install dust cap.

(6) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(7) Install brake drum on rear hub/bearing assembly.

(8) Bleed the vehicle's base brakes hydraulic system.

(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 129 N·m (95 ft. lbs.).

**REAR BRAKE WHEEL CYLINDER****REMOVE**

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.

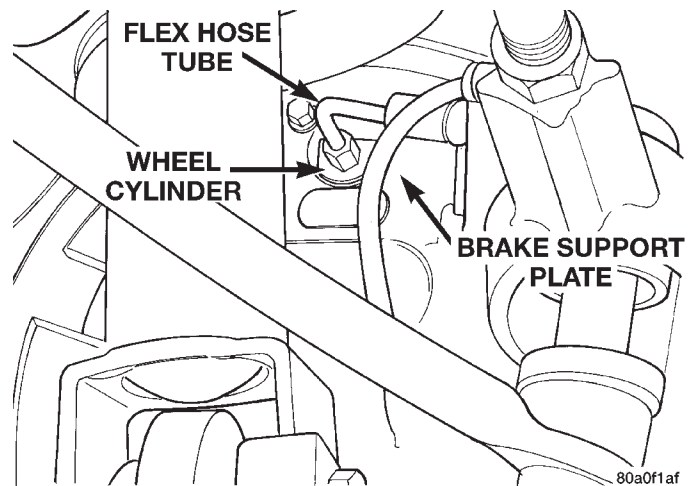
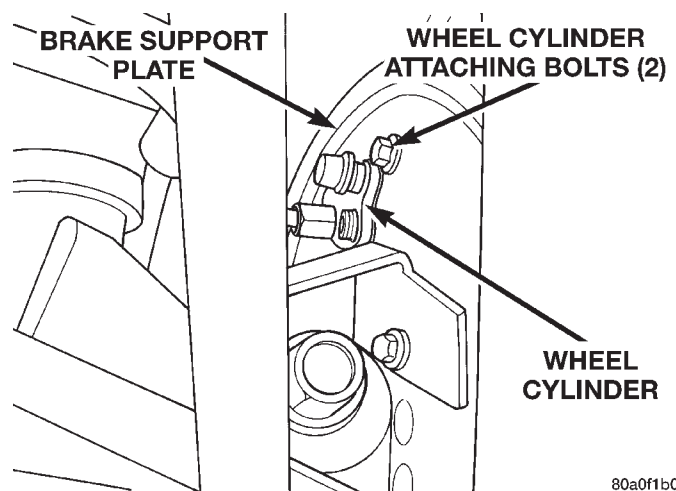
(1) In case of a leak, remove brake shoes (replace if soaked with grease or brake fluid.)

(2) Disconnect rear brake flex hose tube from wheel cylinder and remove the flex hose routing bracket from the brake support plate (Fig. 76).

(3) Remove rear wheel cylinder attaching bolts (Fig. 77). Then pull wheel cylinder assembly off brake support plate.

**INSTALL**

(1) Apply a small bead of silicone sealer around the mating surface of the wheel cylinder to brake support plate.

**Fig. 76 Brake Flex Hose At Wheel Cylinder****Fig. 77 Wheel Cylinder Attaching Bolts**

(2) Install wheel cylinder onto brake support plate. Tighten the attaching bolts (Fig. 77) to a torque of 13 N·m (115 in. lbs.).

(3) Hand start the hydraulic brake hose tube fitting into the wheel cylinder (Fig. 76). Tighten the tube nut to a torque of 17 N·m (145 in. lbs.).

(4) Install brake shoes on support plate. Follow procedure for Installing Brake Shoe Assemblies in this section of the service manual.

(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 129 N·m (95 ft. lbs.).

(7) Adjust the rear brakes. See Adjusting Service Brakes in Service 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.

## REMOVAL AND INSTALLATION (Continued)

## REAR HUB AND 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) If installed, remove brake drum retaining clips from wheel studs and discard.

(4) Remove the brake drum (Fig. 78) from the rear hub/bearing assembly.

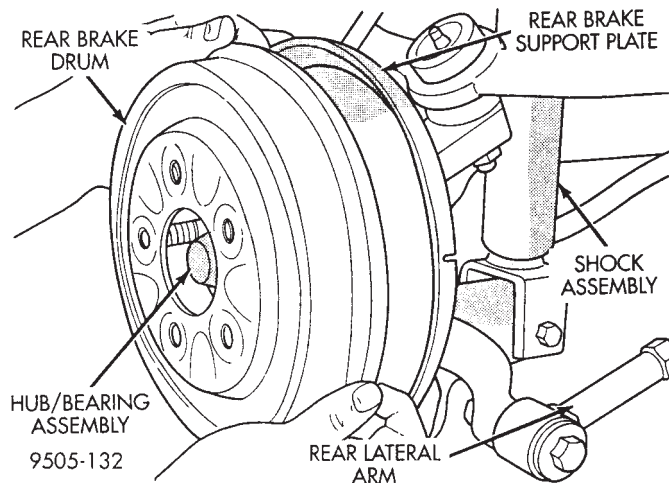


**Fig. 78 Rear Brake Drum**

(5) Remove dust cap (Fig. 79) from rear hub/bearing assembly.

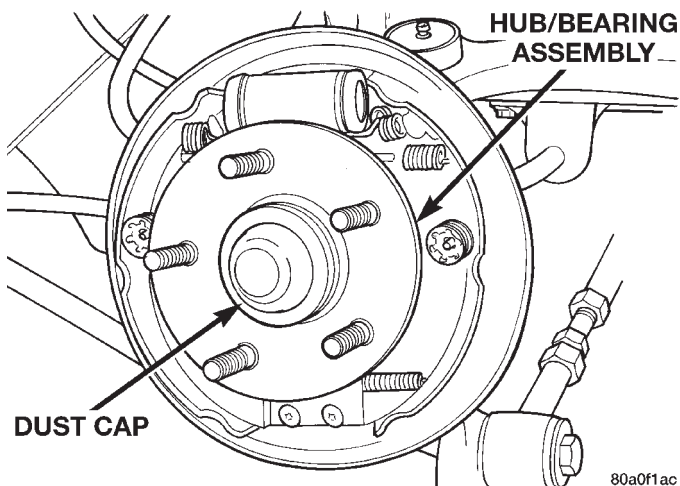


**Fig. 79 Rear Hub/Bearing Dust Cap**

(6) Remove hub/bearing assembly to rear spindle retaining nut (Fig. 80).

(7) Remove rear hub/bearing assembly from knuckle, by pulling it straight off the knuckle by hand.

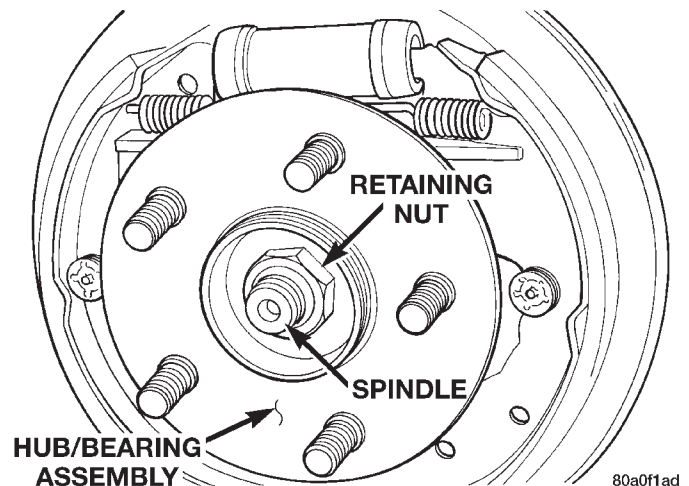


**Fig. 80 Hub/Bearing Assembly Retaining Nut**

## INSTALL

(1) Install the hub/bearing assembly on the knuckle. Then install a **NEW** rear hub/bearing assembly retaining nut (Fig. 80). Tighten the hub/bearing assembly retaining nut to a torque of 250 N·m (185 ft. lbs.).

(2) Install hub/bearing assembly dust cap, (Fig. 79) using a soft faced hammer.

(3) Install the rear brake drum (Fig. 78) on the hub/bearing assembly.

(4) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half the specified torque. Then repeat pattern, fully tightening the stud nuts to a torque of 129 N·m (95 ft. lbs.).

(5) Lower vehicle.

## MASTER CYLINDER

## REMOVE

(1) Remove wiring harness connector from brake fluid level sensor in master cylinder brake fluid reservoir (Fig. 81).

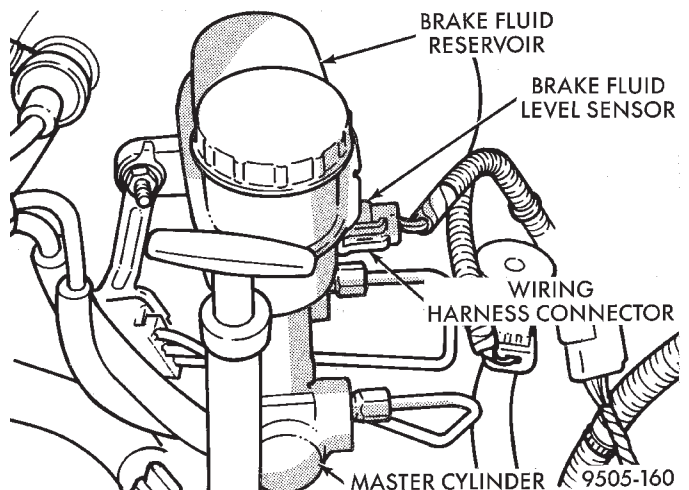


**Fig. 81 Master Cylinder Fluid Level Sensor**

## REMOVAL AND INSTALLATION (Continued)

(2) Disconnect the primary and secondary brake tubes from the master cylinder outlet ports (Fig. 82) (Fig. 83). Install plugs at all open brake tube outlets on master cylinder assembly.

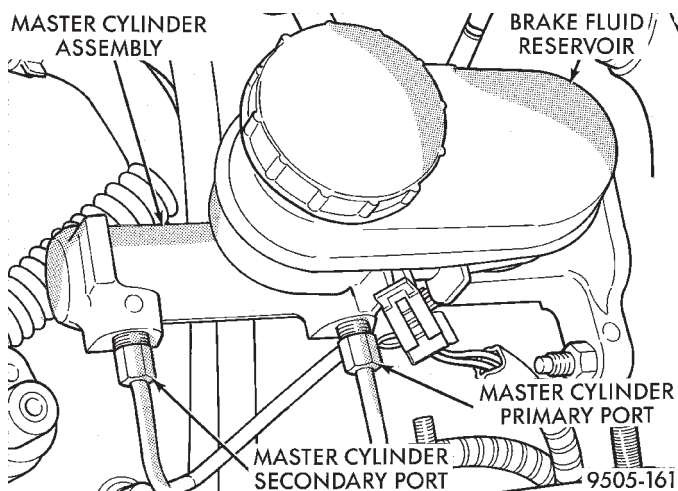


**Fig. 82 Master Cylinder Primary And Secondary Ports With ABS**

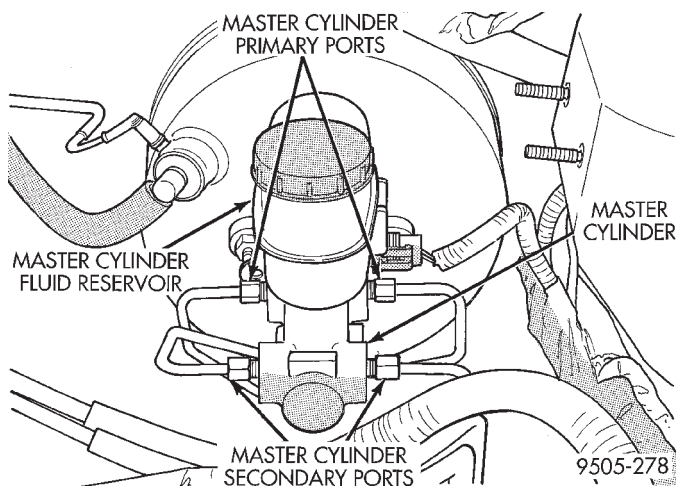


**Fig. 83 Master Cylinder Primary And Secondary Ports Without ABS**

(3) Using Mopar, Brake Parts Cleaner or an equivalent, clean the area where the master cylinder attaches to the vacuum booster.

(4) Remove the 2 nuts (Fig. 84) attaching the master cylinder to the vacuum booster.

**CAUTION:** When removing the routing clip and brake tubes from the mounting stud, do not bend or kink the chassis brake line tubes.

(5) Remove the routing clip and chassis brake tubes (Fig. 84) (as an assembly) from the mounting stud for the master cylinder.

(6) Slide the master cylinder straight off its mounting studs on the vacuum booster.

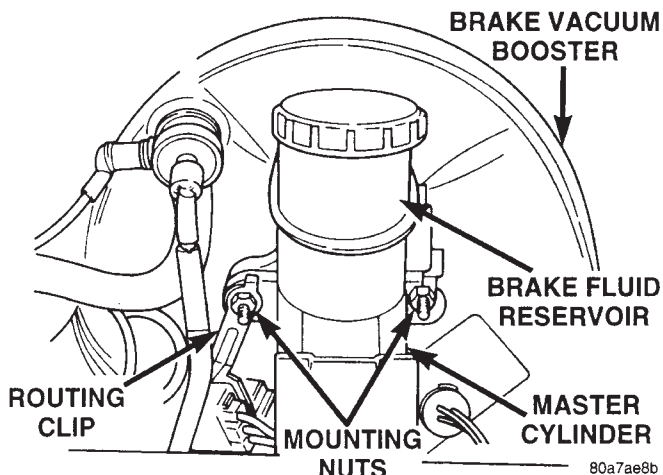


**Fig. 84 Master Cylinder Mounting To Vacuum Booster**

## BLEEDING MASTER CYLINDER

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder outlet ports (Fig. 85) (Fig. 86). **Position the bleeding tubes so outlets of the tubes will be below the surface of the brake fluid when reservoir is filled to the proper level.**

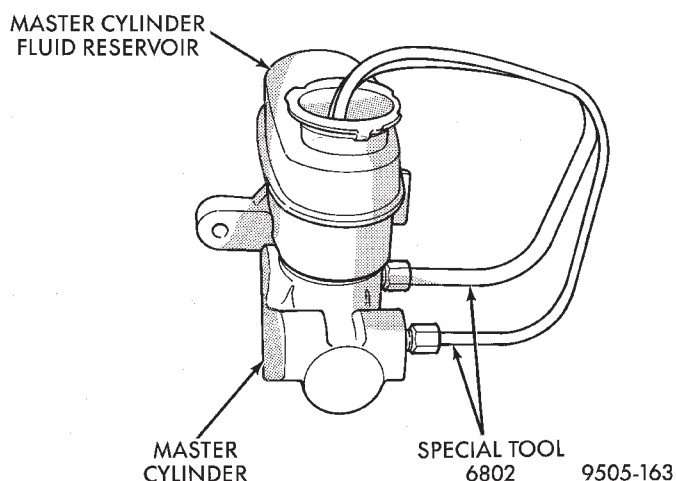


**Fig. 85 Bleeding Tubes Attached to ABS Master Cylinder**

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

(3) Insert an appropriate size wooden dowel in the end of the master cylinder piston (Fig. 87). Using the dowel, slowly depress the piston to the full extent of its travel and then allow the piston to return to its released position. Continue to repeat this step until bubbles no longer appear in the brake fluid. After no more air bubbles are expelled from the bleed tubes repeat the above procedure several more times to ensure all air is bled from master cylinder.

## REMOVAL AND INSTALLATION (Continued)

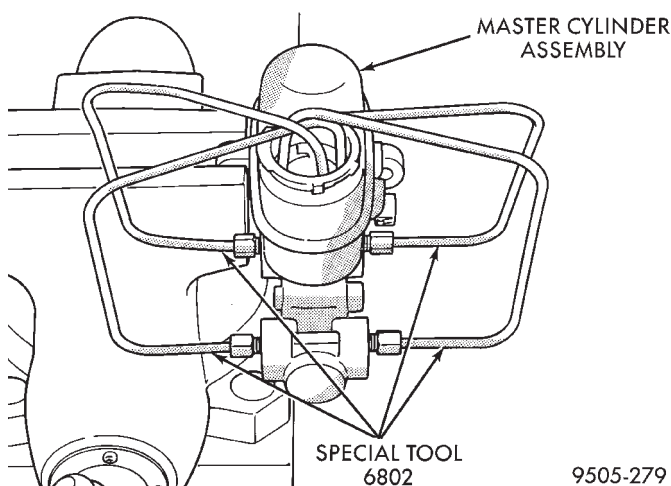


**Fig. 86 Bleeding Tubes Attached to Non-ABS Master Cylinder**

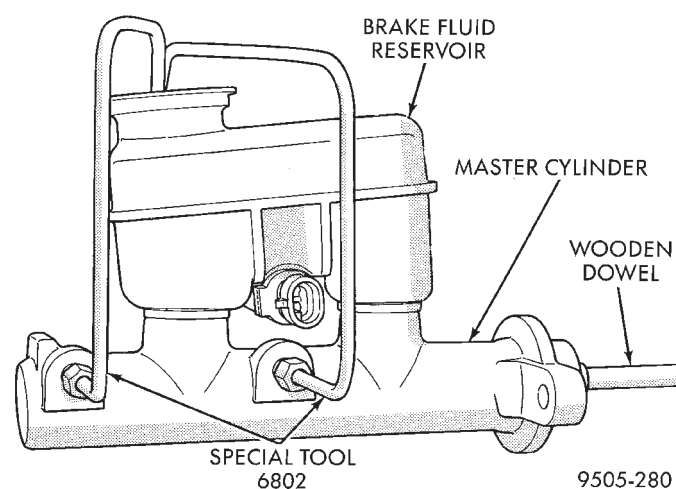


**Fig. 87 Bleeding Master Cylinder**

(4) Remove the bleeding tubes from the outlet ports of the master cylinder.

(5) Plug outlet ports of master cylinder and install the cap on the reservoir.

(6) Remove the master cylinder from the vise.

**NOTE:** Note: It is not necessary to bleed the entire hydraulic system after replacing the master cylinder. However, the master cylinder must have been bled and filled upon installation.

**INSTALL**

(1) Position master cylinder assembly on studs of power brake unit, aligning push rod on power brake vacuum booster with piston of master cylinder.

**CAUTION:** When installing the routing clip and brake tubes on the mounting stud, do not bend or kink the chassis brake line tubes. Be sure the chassis brake tubes are routed correctly. The chassis brake tubes can not touch each other or other components or the body of the vehicle.

(2) Install the routing clip and chassis brake tubes (Fig. 84) on the inboard mounting stud for the master cylinder.

(3) Install the 2 master cylinder to power brake vacuum booster mounting nuts (Fig. 84). Tighten both nuts to a torque of 28 N·m (250 in. lbs.).

(4) Connect brake tubes to master cylinder primary and secondary ports (Fig. 82). Then tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

(5) Install the connector from the vehicle wiring harness on the fluid level sensor in the master cylinder fluid reservoir (Fig. 81)

**VACUUM BOOSTER 2.4 LTR. Engine****REMOVE**

(1) Remove the remote ground cable from the ground stud located on the left strut tower (Fig. 88).

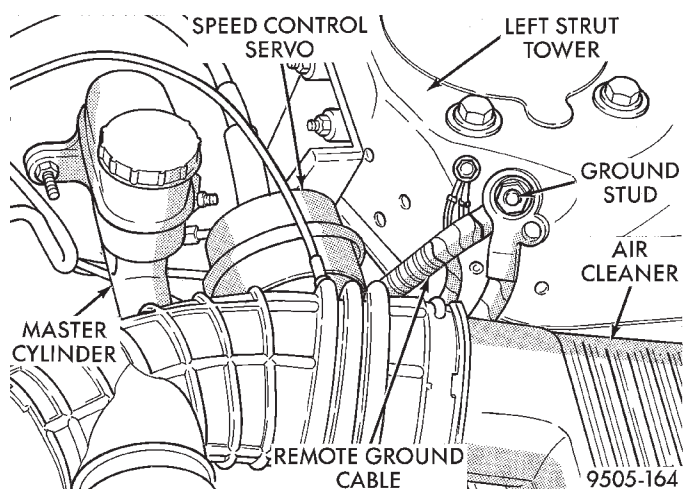


**Fig. 88 Ground Cable Attachment At Strut Tower**

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 89). **This will prevent accidental grounding of the remote ground cable.**

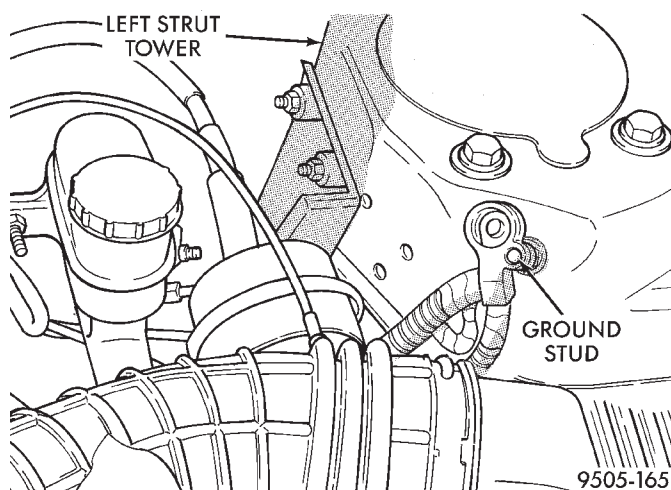


**Fig. 89 Correctly Isolated Remote Ground Cable**

## REMOVAL AND INSTALLATION (Continued)

(3) If equipped, remove the vehicle's wiring harness connector from the speed control servo. Remove the 2 speed control servo mounting bracket to strut tower attaching nuts (Fig. 90). Without removing speed control cable from servo, move speed control servo out of the way.

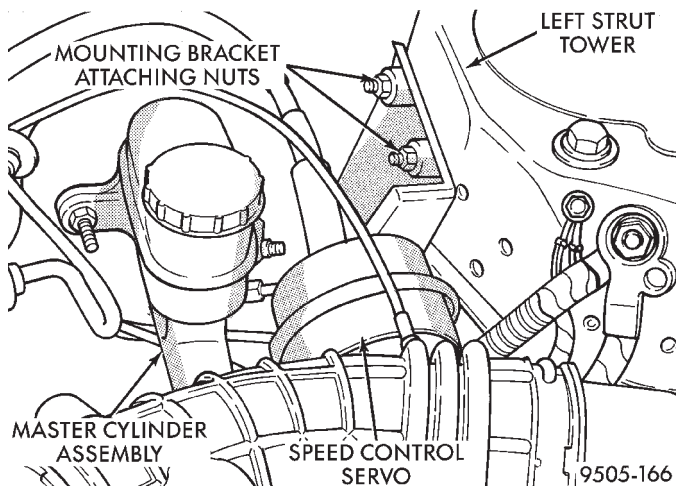


**Fig. 90 Speed Control Servo Attachment**

(4) Remove the vacuum harness connector and electrical connector from the purge solenoid (Fig. 91). Remove purge solenoid from vehicle.

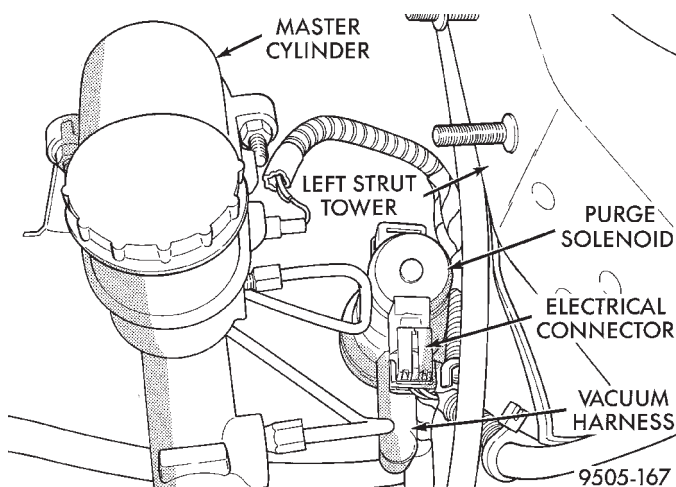


**Fig. 91 Purge Control Solenoid**

(5) Remove the air inlet resonator and air inlet hose (Fig. 92) as an assembly, from the engine mounted air inlet resonator and air cleaner housing (Fig. 92).

(6) Remove the vacuum hoses (Fig. 93) from the check valve located on the power brake vacuum booster.

(7) Remove EGR valve transducer assembly and vacuum hoses (Fig. 94) from the EGR valve. **Valve removal is necessary for required clearance to remove power brake vacuum booster from vehicle and not damage transducer during removal.**

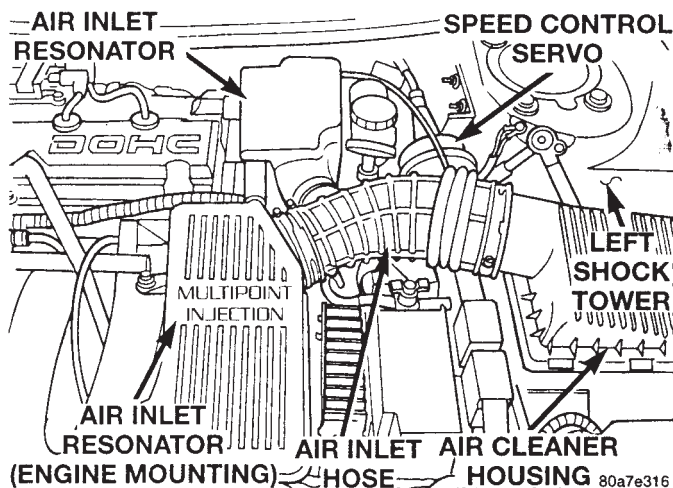


**Fig. 92 Air Inlet Resonator And Tube**

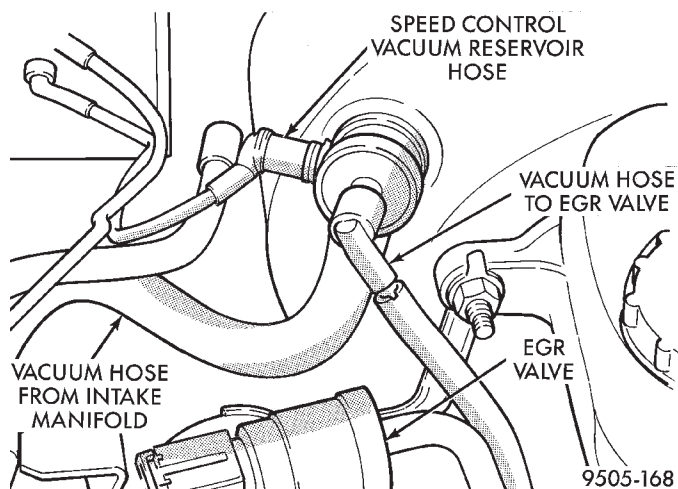


**Fig. 93 Vacuum Hose Attachment To Check Valve**

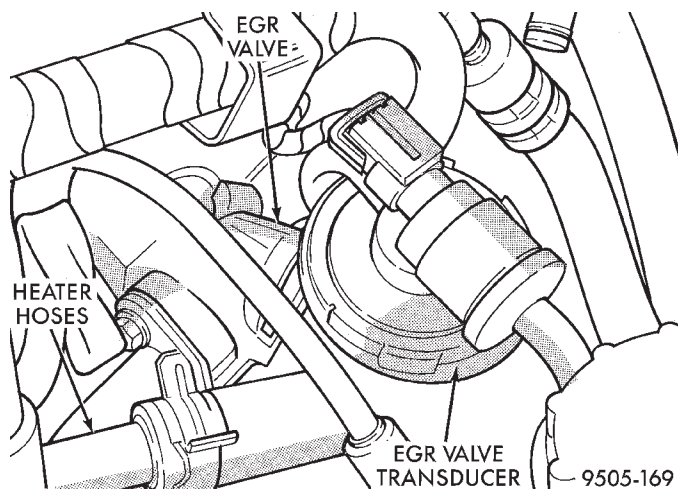


**Fig. 94 EGR Valve Transducer Assembly**

## REMOVAL AND INSTALLATION (Continued)

(8) Remove the vehicle's wiring harness connector from the master cylinder brake fluid level sensor (Fig. 95).

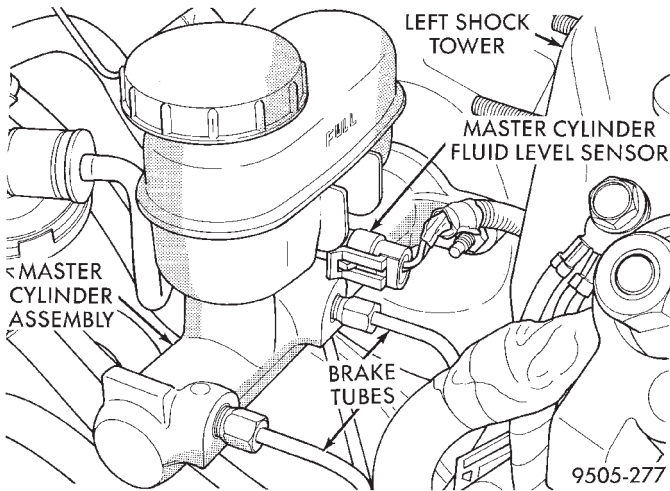


**Fig. 95 Master Cylinder Brake Fluid Level Sensor**

(9) Remove the 2 nuts (Fig. 96) attaching the master cylinder assembly to the power brake vacuum booster.

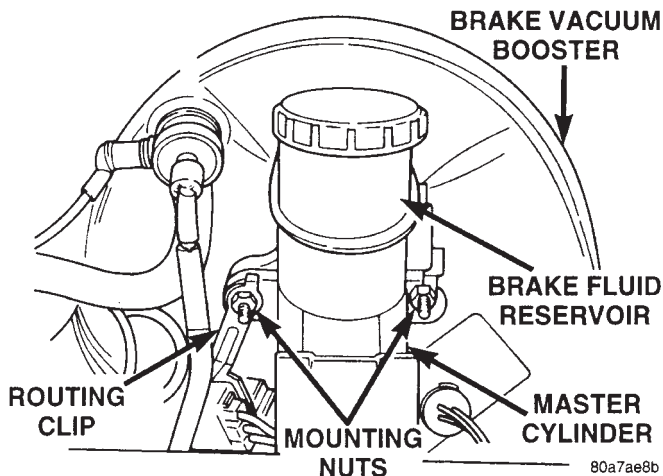


**Fig. 96 Master Cylinder Mounting**

**CAUTION:** When removing the routing clip and brake tubes from the mounting stud do not bend or kink the chassis brake line tubes.

(10) Remove the routing clip and chassis brake tubes (Fig. 96) (as an assembly) from the mounting stud for the master cylinder.

(11) Without removing the brake tubes from master cylinder, remove it from the power brake vacuum booster. Then carefully lower master cylinder and brake tubes as an assembly until it is positioned on top of the transaxle (Fig. 97).

(12) Locate the vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the retaining clip center

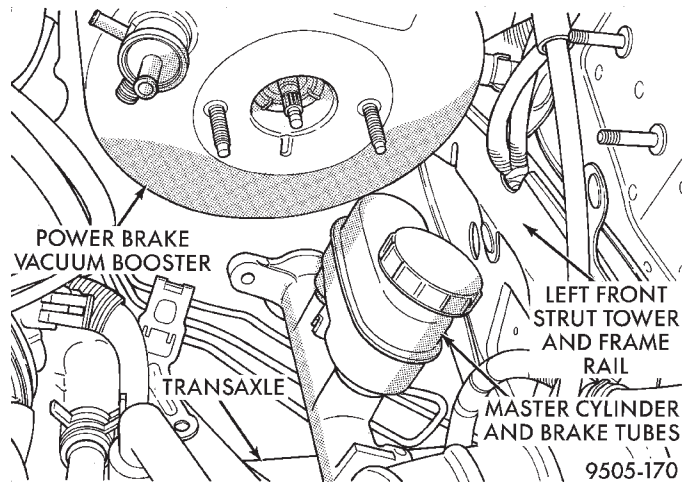


**Fig. 97 Master Cylinder Assembly Positioned For Booster Removal**

tang and the retaining clip (Fig. 98). Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. Replace only with a new retaining clip when assembled.**

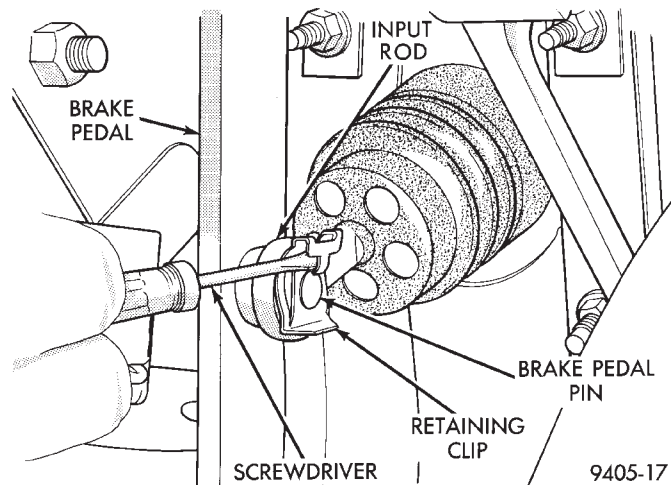


**Fig. 98 Input Rod Retaining Pin**

(13) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly (Fig. 99).

(14) Slide vacuum booster forward until mounting studs clear dash panel and then tilt up and rotate toward center of vehicle to remove (Fig. 100).

**CAUTION:** Do not attempt to disassemble the power brake vacuum booster it is to be serviced **ONLY** as a complete assembly.

## REMOVAL AND INSTALLATION (Continued)

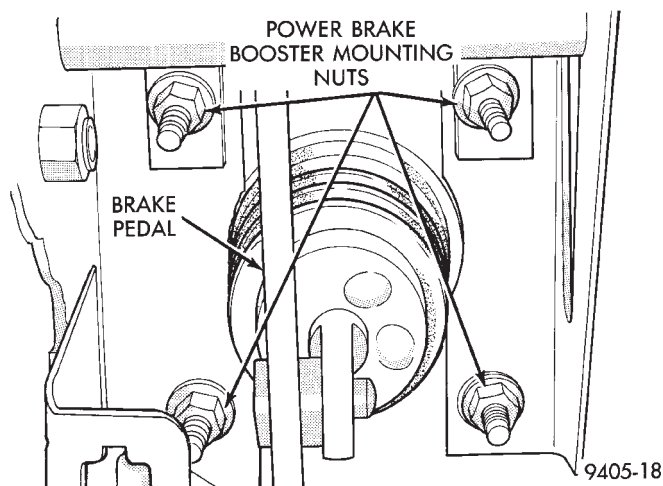


Fig. 99 Vacuum Booster Mounting

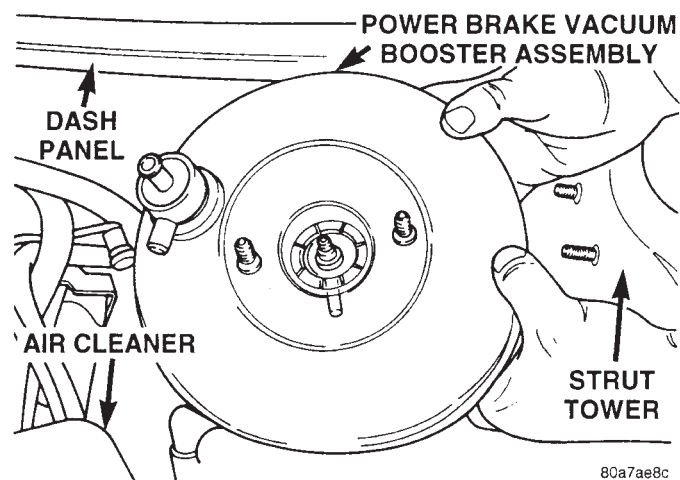


Fig. 100 Vacuum Booster Removal

## INSTALL

(1) Install vacuum booster onto dash panel using the reverse procedure of removal.

(2) Install and tighten the 4 vacuum booster mounting nuts (Fig. 99) to a torque of 37 N·m (27 ft. lbs.) torque.

(3) Using lubriplate, or an equivalent, coat the surfaces of the brake pedal pin that contact the power vacuum booster input rod.

(4) Connect 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) Position master cylinder on studs of vacuum booster, aligning push rod on vacuum booster with piston of master cylinder.

**CAUTION:** When installing the routing clip and brake tubes on the mounting stud, do not bend or kink the chassis brake line tubes. Be sure the chassis brake tubes are routed correctly. The chassis brake tubes can not touch each other or other components or the body of the vehicle.

(6) Install the routing clip and chassis brake tubes (Fig. 96) on the inboard mounting stud for the master cylinder.

(7) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 96). Tighten the 2 mounting nuts to a torque of 28 N·m (250 in. lbs.).

(8) Install the vehicle's wiring harness connector on the master cylinder brake fluid level sensor (Fig. 95).

(9) Install the purge control solenoid (Fig. 91) on the left front frame rail. Tighten the purge control solenoid mounting bolt.

(10) Install the EGR transducer assembly on the EGR valve (Fig. 94). Install the vehicle wiring harness connector (Fig. 94) on the EGR transducer, ensuring the retaining clip is fully engaged with transducer.

(11) Connect all previously removed vacuum hoses onto the power brake vacuum booster check valve (Fig. 93).

(12) If equipped, install speed control servo on the mounting studs in the left strut tower (Fig. 90). Install the 2 speed control servo bracket mounting nuts (Fig. 90). Tighten the 2 mounting nuts to a torque of 6 N·m (55 in. lbs.).

(13) Install the air inlet resonator and air inlet tube (Fig. 92) on the air cleaner housing and the throttle body.

(14) Check brake light switch for correct adjustment. If required, adjust stop lamp switch as necessary. See required procedure in the Service Adjustments Section in this group of the service manual.

(15) Road test vehicle to ensure proper operation of the vehicles brake system.

## VACUUM BOOSTER 2.5 LTR. ENGINE

## REMOVE

(1) Remove the remote ground cable from the ground stud located on the left shock tower (Fig. 101).

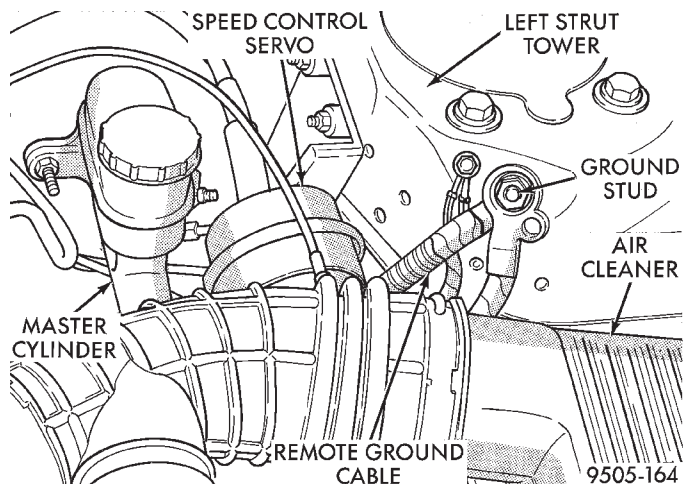


Fig. 101 Ground Cable Attachment To Strut Tower

## REMOVAL AND INSTALLATION (Continued)

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 102). **This will prevent accidental grounding of the remote ground cable.**

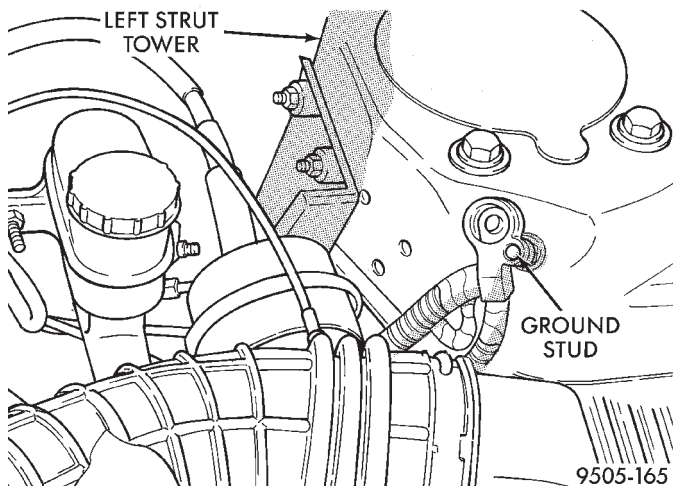


**Fig. 102 Correctly Isolated Remote Ground Cable**

(3) Remove the PCV hose (Fig. 103) from the air chamber located on the front of the intake manifold. Remove bolt (Fig. 103) attaching the air chamber to the intake manifold. Then unlatch lid of air cleaner from air cleaner housing and loosen clamp attaching air inlet hose to throttle body (Fig. 103). Remove the air cleaner lid, air inlet hose and air chamber (Fig. 103) as an assembly from the engine.

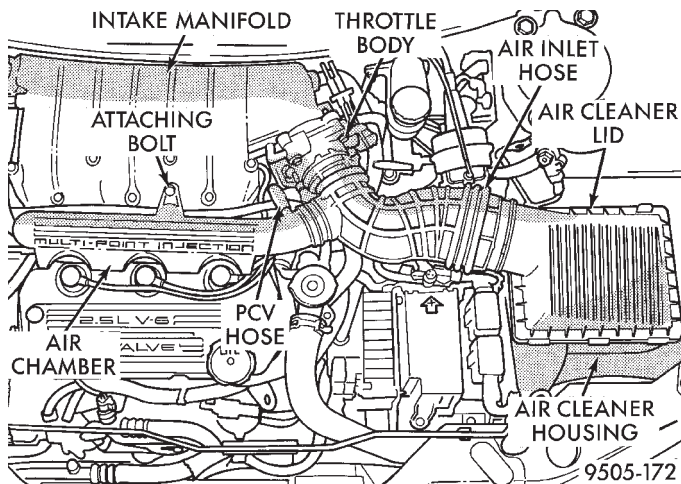


**Fig. 103 Engine Air Intake System Components**

(4) Remove the throttle cable and if equipped the speed control cable from the throttle body (Fig. 104). Remove the vacuum hose (Fig. 104) from the throttle body. Remove the wiring harness connectors from AIS motor and the Throttle Position Sensor (Fig. 104) on the throttle body. Then, remove the 4 bolts (Fig. 104) attaching the throttle body to the intake manifold and remove it from intake manifold.

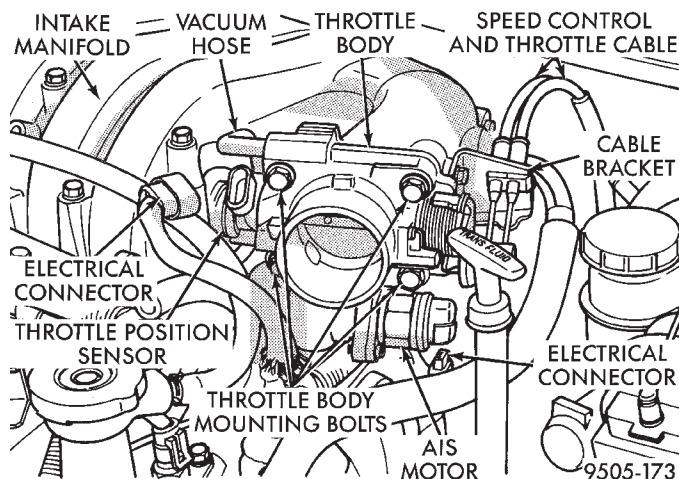


**Fig. 104 Throttle Body Attachment To Intake Manifold**

(5) Without removing cables from bracket, remove the throttle and speed control cable mounting bracket (Fig. 104) from the intake manifold.

(6) Remove the EGR tube (Fig. 105) from the intake manifold and EGR valve.

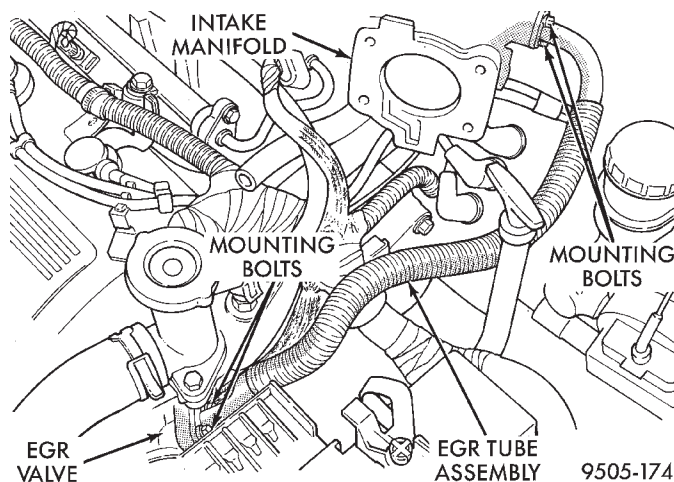


**Fig. 105 EGR Tube Attachment To Intake Manifold And EGR Valve**

## REMOVAL AND INSTALLATION (Continued)

(7) If equipped, remove the vehicle's wiring harness connector from the speed control servo. Remove the 2 speed control servo mounting bracket to strut tower attaching nuts (Fig. 106). Without removing speed control cable from servo, move speed control servo out of the way.

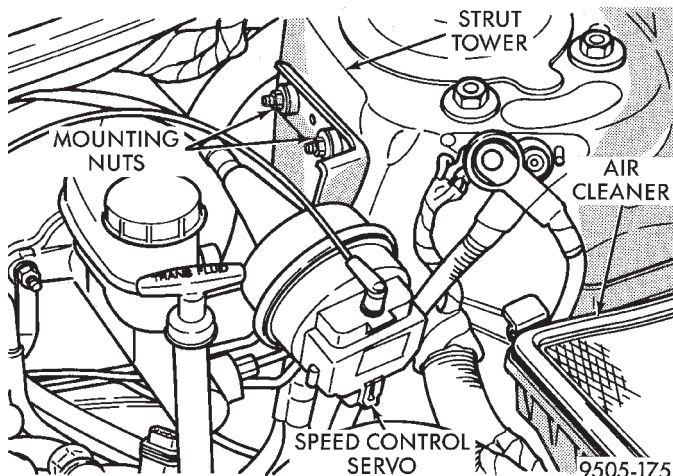


**Fig. 106 Speed Control Servo Attachment To Strut Tower**

(8) Remove the wiring harness connector from the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 107).

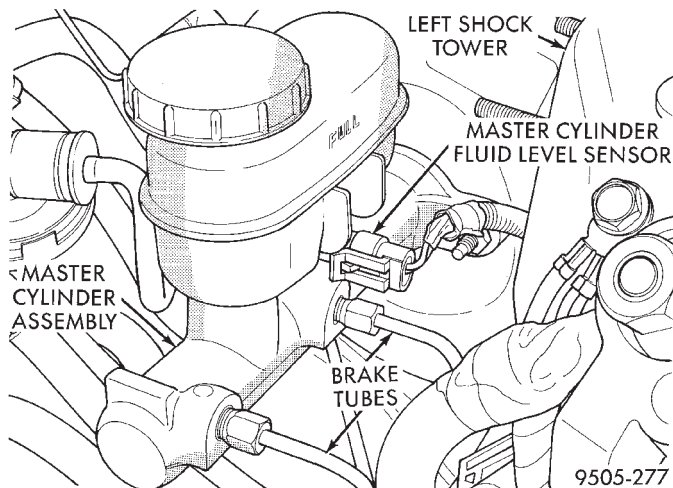


**Fig. 107 Master Cylinder Brake Fluid Level Sensor**

(9) Remove the primary and secondary brake tubes (Fig. 108) or (Fig. 109) from the master cylinder.

(10) Remove the 2 nuts (Fig. 110) attaching the master cylinder assembly to the power brake vacuum booster.

**CAUTION:** When removing the routing clip and brake tubes from the mounting stud do not bend or kink the chassis brake line tubes.

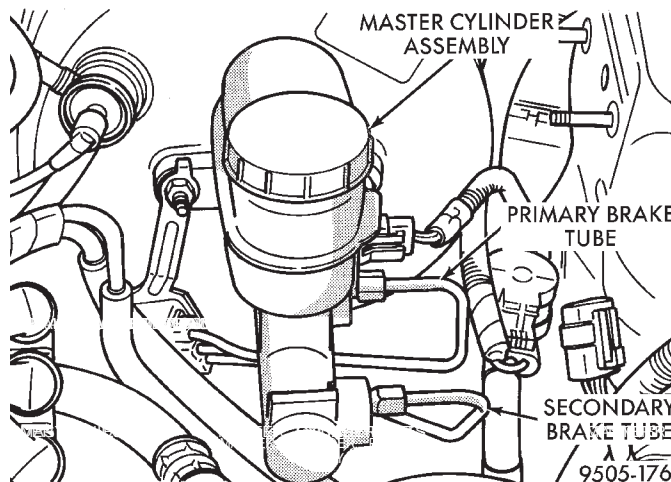


**Fig. 108 Primary And Secondary Brake Tubes With Antilock Brakes**

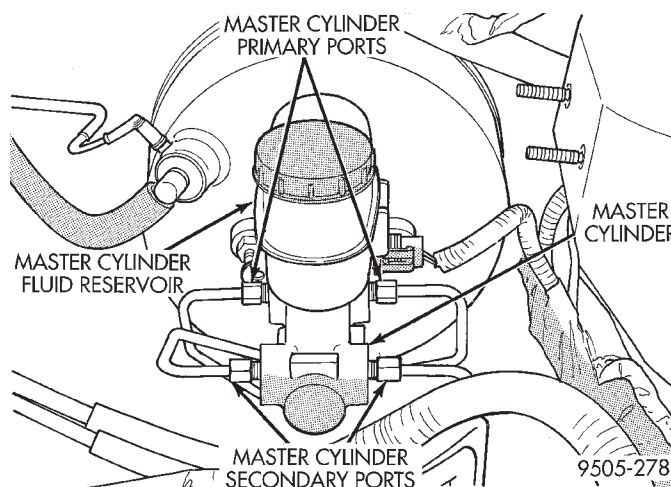


**Fig. 109 Primary And Secondary Brake Tubes Without Antilock Brakes**

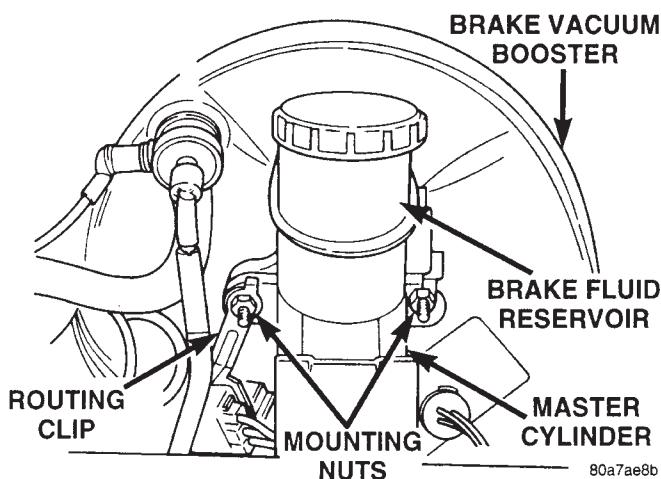


**Fig. 110 Master Cylinder Mounting To Vacuum Booster**

## REMOVAL AND INSTALLATION (Continued)

(11) Remove the routing clip and chassis brake tubes (Fig. 110) (as an assembly) from the

(12) mounting stud for the master cylinder.

(13) Remove the master cylinder from the vacuum booster.

(14) Remove the vacuum harness connector and electrical connector from the purge solenoid (Fig. 111). Remove bracket and purge solenoid as an assembly from the vehicle.

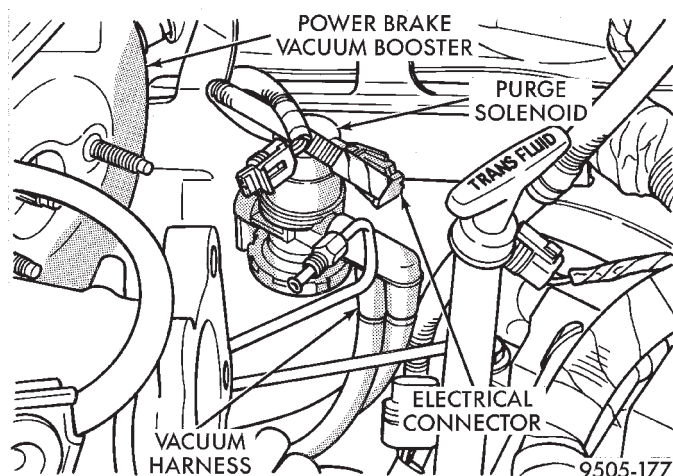


**Fig. 111 Purge Control Solenoid**

(15) Remove dipstick tube attaching bolt (Fig. 112). Then remove the dipstick tube and dipstick (Fig. 112) as an assembly from the transaxle.

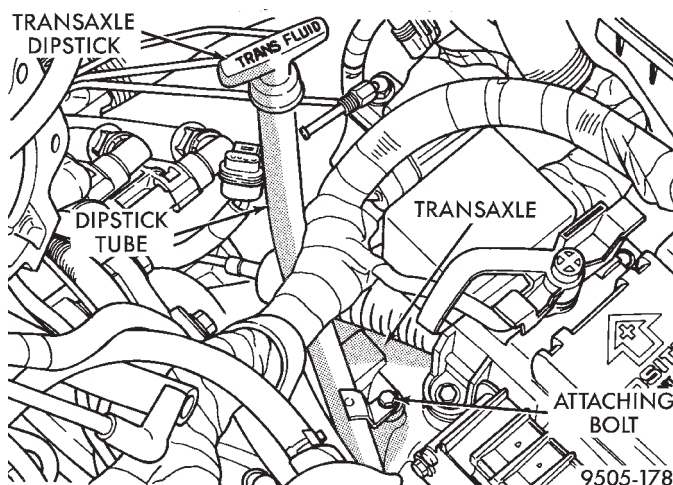


**Fig. 112 Transaxle Dipstick Tube**

(16) Remove the vacuum hoses from the check valve located on the power brake vacuum booster.

(17) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 113). Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. Replace only with a new retaining clip when assembled.**

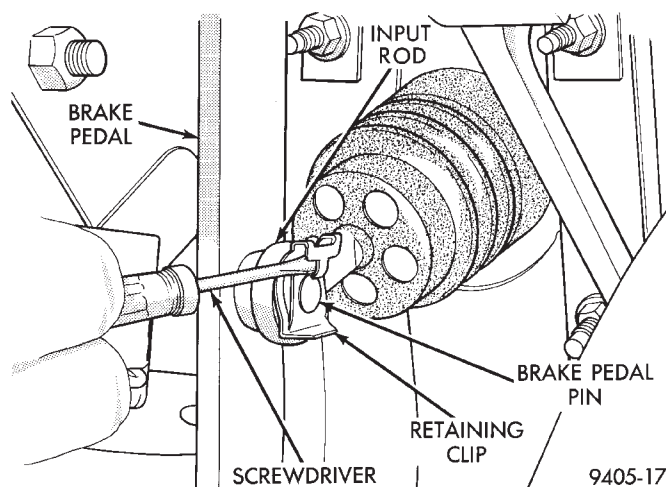


**Fig. 113 Input Rod Retaining Pin**

(18) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly (Fig. 114).

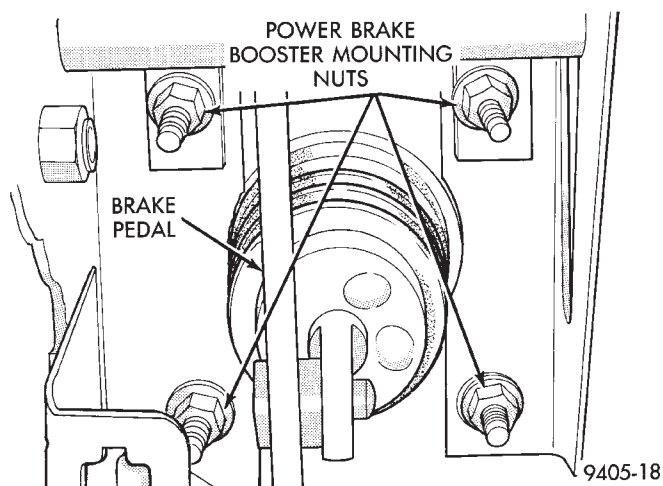


**Fig. 114 Vacuum Booster Mounting**

## REMOVAL AND INSTALLATION (Continued)

(19) Slide the vacuum booster straight forward until mounting studs clear dash panel. Then lift the vacuum booster straight up to remove it from the vehicle (Fig. 115).

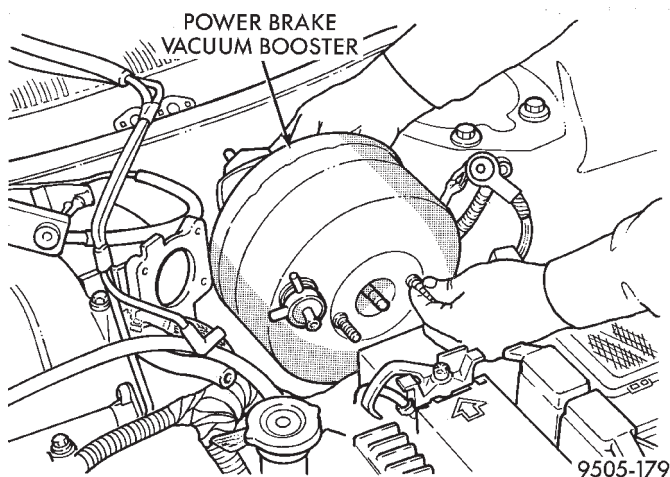


**Fig. 115 Power Brake Vacuum Booster Removal**

**CAUTION:** Do not attempt to disassemble the power brake vacuum booster if it is to be serviced **ONLY** as a complete assembly.

**INSTALL**

- (1) Position power brake booster onto dash panel.
- (2) Install and torque the 4 power brake vacuum booster mounting nuts (Fig. 114) to 37 N·m (27 ft. lbs.) torque.
- (3) Using lubriplate, or an equivalent, coat the surfaces of the brake pedal pin that contact the power 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) Install the dipstick tube in transaxle (Fig. 112). Install dipstick tube attaching bolt and securely tighten (Fig. 112).
- (6) Install the vacuum hoses on the check valve in the power brake vacuum booster.
- (7) Position purge control solenoid (Fig. 111) on left front strut tower and install and securely tighten attaching bolt. Then correctly route and install the vacuum harness connector and electrical connector (Fig. 111) on the purge control solenoid.
- (8) Position master cylinder on vacuum booster, aligning push rod on vacuum booster with the piston of the master cylinder.

**CAUTION:** When installing the routing clip and brake tubes on the mounting stud, do not bend or kink the chassis brake line tubes. Be sure the chassis brake tubes are routed correctly. The chassis

**brake tubes can not touch each other or other components or the body of the vehicle.**

(9) Install the routing clip and chassis brake tubes on the inboard mounting stud for the master cylinder.

(10) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 110). Tighten the 2 mounting nuts to a torque of 28 N·m (250 in. lbs.).

(11) Install the primary and secondary brake tubes (Fig. 108) in the outlet ports of the master cylinder. Tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

(12) Install the vehicle's wiring harness connector on the master cylinder brake fluid level sensor (Fig. 107).

(13) If equipped, install speed control servo on the mounting studs in the left strut tower (Fig. 106). Install the 2 speed control servo bracket mounting nuts (Fig. 106). Tighten the 2 mounting nuts to a torque of 6 N·m (55 in. lbs.). Install electrical connector on speed control servo.

(14) Install the EGR tube with **NEW** gaskets on the intake manifold and EGR valve (Fig. 105). Install the 4 mounting bolts and tighten to a torque of 11 N·m (95 in. lbs.).

(15) Install the throttle body and a **NEW** gasket on the intake manifold. Install the 4 throttle body attaching bolts (Fig. 104) and tighten to a torque of 22 N·m (200 in. lbs.).

(16) Install the vacuum hose (Fig. 104) on the throttle body. Install the wiring harness connectors on the AIS motor and the Throttle Position Sensor (Fig. 104) located on the throttle body.

(17) Install the mounting bracket for the throttle cable and speed control cable onto the intake manifold and securely tighten the mounting bolts.

(18) Install the throttle cable, and if equipped, the speed control cable on the cam of the throttle body assembly.

(19) Install the air cleaner lid, air inlet hose and air chamber (Fig. 103) as an assembly on the engine. Latch lid of air cleaner to air cleaner housing. Securely tighten the clamp attaching the air inlet hose to the throttle body (Fig. 103). Install and securely tighten the bolt attaching the air chamber to the intake manifold (Fig. 103).

(20) Install the remote ground cable (Fig. 101) on the ground stud located on the left strut tower (Fig. 101). Install and securely tighten the ground cable attaching nut.

(21) Check brake light switch for correct adjustment. If required, adjust stop lamp switch as necessary. See required procedure in the Service Adjustments Section in this group of the service manual.

(22) Road test vehicle to ensure proper operation of the vehicle's brake system.

## REMOVAL AND INSTALLATION (Continued)

## BRAKE PEDAL

## REMOVE

(1) Remove the remote ground cable from the ground stud located on the left strut tower (Fig. 116).

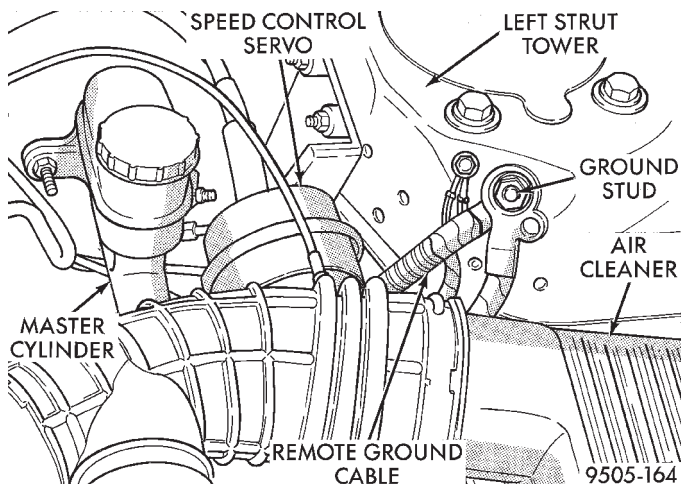


**Fig. 116 Ground Cable Attachment At Strut Tower**

**NOTE:** Step 2 2 below is to be done to prevent the accidental grounding of the remote ground cable.

(2) Correctly isolate remote ground by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 117)

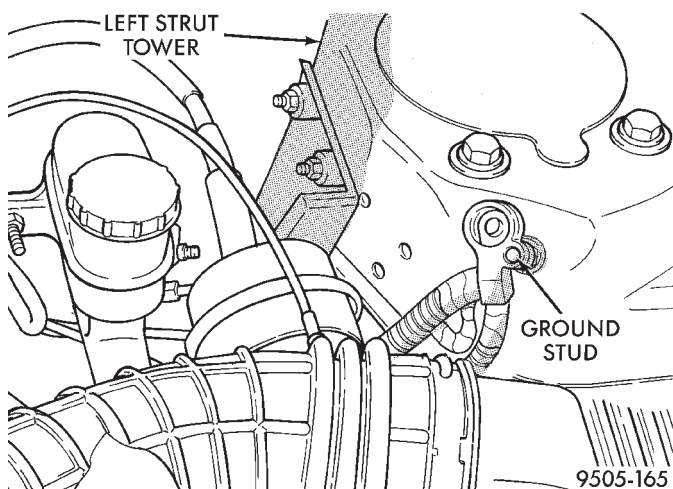


**Fig. 117 Correctly Isolated Remote Ground Cable**

(3) Remove the stop lamp switch from the brake pedal bracket. Stop lamp switch is removed using the following procedure. Depress and hold the brake pedal while rotating stop lamp switch (Fig. 118) in a counter-clockwise direction approximately 30 degrees.

(4) Remove the retaining clip (Fig. 119) from the brake pedal pin using following procedure. Position a small screwdriver (Fig. 119) between the center tang on the retaining clip and the brake pedal pin. Rotate blade of screwdriver enough so center tang on retain-

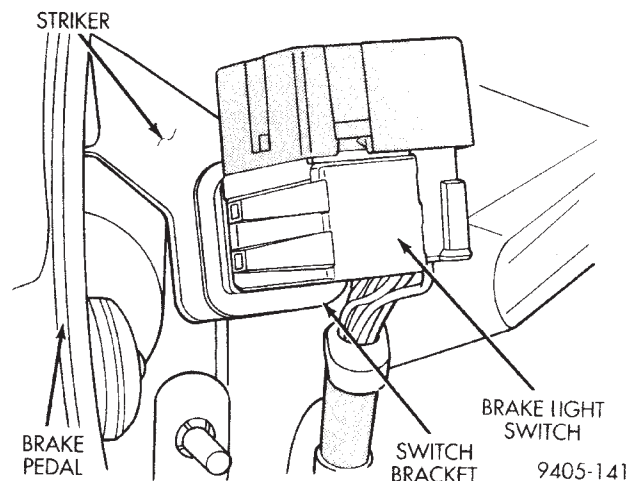


**Fig. 118 Stop Lamp Switch**

ing clip can pass over end of brake pedal pin (Fig. 119). Then pull retaining clip off brake pedal pin.

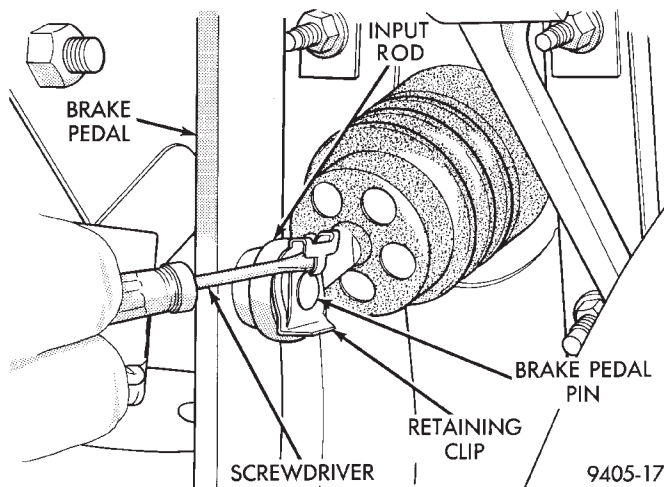


**Fig. 119 Brake Pedal Retaining Clip**

- (5) Remove the nut from the brake pedal pivot pin.
- (6) Remove brake pedal pivot pin from the brake pedal and pedal mounting bracket.
- (7) Remove brake pedal from mounting bracket.

## INSTALL

(1) Lubricate the brake pedal pivot pin and brake pedal bushings using Mopar Lubriplate or an equivalent.

(2) Install the brake pedal in the pedal bracket. Align the pivot pin hole in brake pedal with pivot pin holes in pedal bracket.

(3) Install nut on brake pedal pivot pin. Tighten pivot pin attaching nut to a torque of 34 N·m (25 ft. lbs.).

(4) Install the vacuum booster push rod on the brake pedal pin.

## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** When installing the retaining clip on the brake pedal pin a **NEW** retaining clip must be used to ensure the retention of the vacuum booster push rod.

(5) Install a **NEW** retaining clip (Fig. 119) on the brake pedal pin.

(6) Using Mopar Lubriplate or an equivalent, lightly lubricate the surface of the brake pedal striker (Fig. 118) which the plunger of the stop lamp switch contacts.

**NOTE:** Prior to installing stop lamp switch into bracket, the plunger must be moved to its fully extended position using the procedure in Step 7.

(7) Hold stop lamp switch firmly in one hand. Using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(8) Connect the wiring harness connector to the stop lamp switch.

(9) Install the stop lamp switch in the brake pedal bracket. Stop lamp switch is installed using the following procedure. Depress the brake pedal as far down as possible. Then while holding brake pedal down, align index key on switch with slot in square hole of mounting bracket. When switch is fully installed in bracket, rotate stop lamp switch (Fig. 118) in a clockwise direction approximately 30 degrees.

**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 stop lamp switch or striker (Fig. 118) can result.

(10) Gently pull back on the brake pedal until it stops moving. This will cause the switch plunger to ratchet back to its correct position.

(11) Install the silencer panel/air duct.

(12) Connect the remote ground cable for the battery on the ground post located on left shock tower (Fig. 116).

## CHASSIS BRAKE 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 disc brake caliper. After routing the flex hose around the strut, hand start the

chassis brake tube nut into the end of the flex hose. Following this procedure will prevent twisting of the flex hose when the flex hose bracket is attached to the front frame rail. Then tighten all brake line fitting to the specified torques.

On vehicles equipped with rear drum brakes, loosely connect the flex hose tube nut to the wheel cylinder, and then secure the flex hose bracket to the brake support plate. After the flex hose bracket is secured to the brake support plate, tighten the flex hose to wheel cylinder tube nut to the specified torque. Then hand start the chassis tube nut to the opposite end of the flex hose. After chassis tube nut is hand started into flex hose attach the flex hose bracket to the rear frame rail. Then tighten the nut on the chassis brake tube to the specified torque. Following this procedure will reduce the potential for twisting the flex hose during the installation procedure.

Only double wall 4.75 mm (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.

## PARK BRAKE LEVER

## REMOVE

(1) Remove the shift knob from the shifter. **The shift knob is attached to the shifter using a set screw (Fig. 120). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench.**

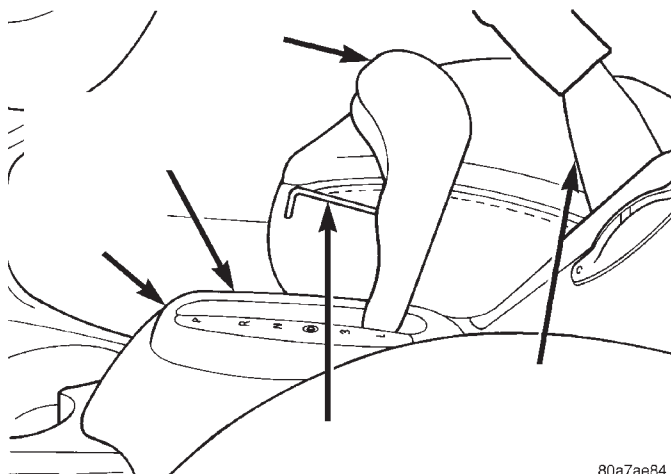


Fig. 120 Shift Knob Retaining Screw

(2) Remove the 3 screws (Fig. 121) attaching the rear of the center console to the console bracket.

(3) Remove the shift range indicator from the center console. The shift range indicator is attached to

## REMOVAL AND INSTALLATION (Continued)

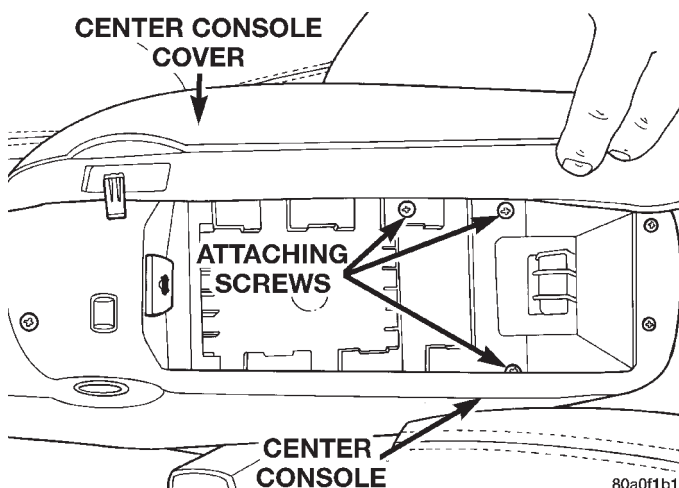


**Fig. 121 Center Console Rear Attaching Screws**

the center console using retaining clips. It is removed by carefully prying it off the center console. The shift range indicator covers the 2 screws attaching the center console to the shifter mechanism. (Fig. 122).

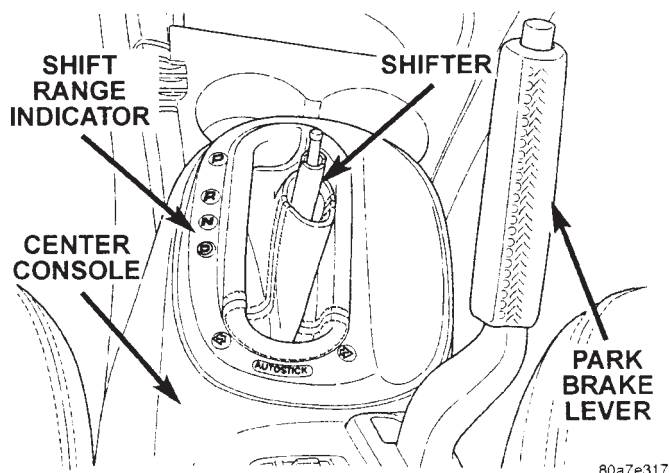


**Fig. 122 Shift Range Indicator**

(4) Remove the 2 screws (Fig. 123) attaching the center console to the shifter.

(5) Raise the park brake hand lever to approximately a 45° angle. This is for the required clearance to remove the center console.

(6) Raise the rear of the center console high enough to access the center console wiring harness connector (Fig. 124). Disconnect the center console wiring harness connector from the vehicle wiring harness 10 way connector (Fig. 124).

(7) Remove the center console from the vehicle.

(8) Lower park brake lever handle.

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE PARK BRAKE CABLES**

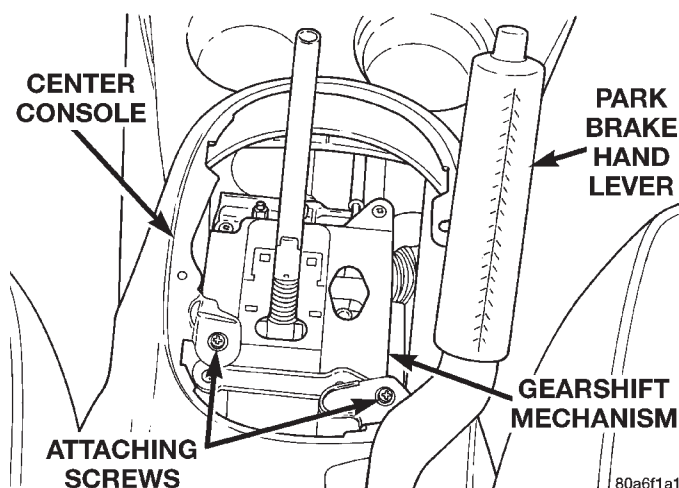


**Fig. 123 Center Console Front Attaching Screw**

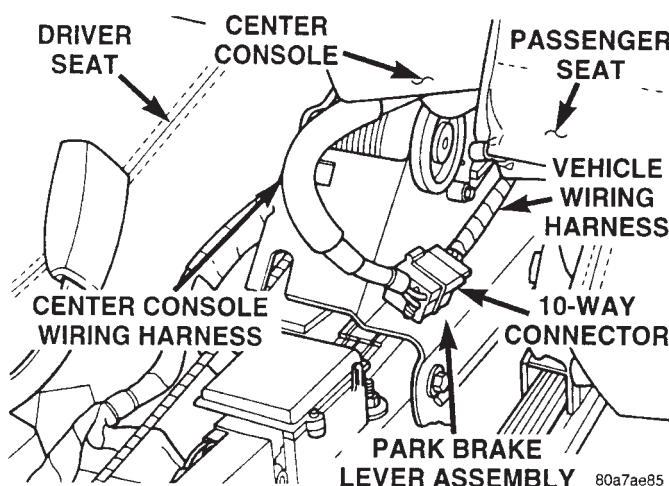


**Fig. 124 Console Wiring Harness Connector**

**FROM THE EQUALIZER UNTIL THE AUTO ADJUSTER IS RELOADED. FAILURE TO RELOAD THE ADJUSTER MECHANISM BEFORE REMOVING PARK BRAKE CABLES FROM EQUALIZER COULD RESULT IN SERIOUS INJURY.**

(9) Reload the adjuster mechanism on the park brake lever using the following procedure.

- Ensure the park brake lever is in the **full down position** when attempting to pull on park brake lever output cable (Fig. 125).
- Grasp the park brake lever output cable (Fig. 125) by hand and pull upward.
- Continue to pull upward on cable until a 15/64 drill bit can be inserted in the adjuster mechanism as shown in (Fig. 125). This will lock-out the auto adjuster mechanism removing the tension from the park brake lever output cable. This will then allow the rear park brake cables to be easily removed from the equalizer.

## REMOVAL AND INSTALLATION (Continued)

**NOTE:** If the output cable of the park brake mechanism will not move when pulled on, first, be sure the park brake lever is in the full down position. If park brake lever is in the full down position and the output cable will not move, use the following procedure to reload the adjuster mechanism.

Using a screw driver (Fig. 126) push down on the end of the clutch spring where shown (Fig. 126). While end of clutch spring is held down, pull outward on park brake mechanism output cable.

If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 126) to assist in pulling on cable.

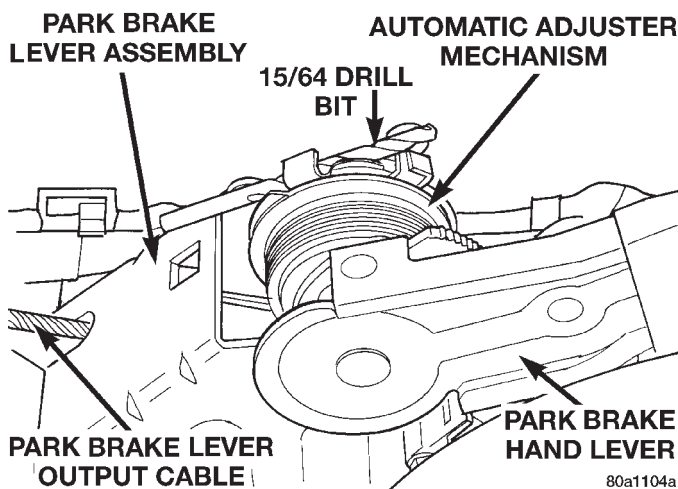


**Fig. 125 Park Brake Lever Correctly Reloaded**

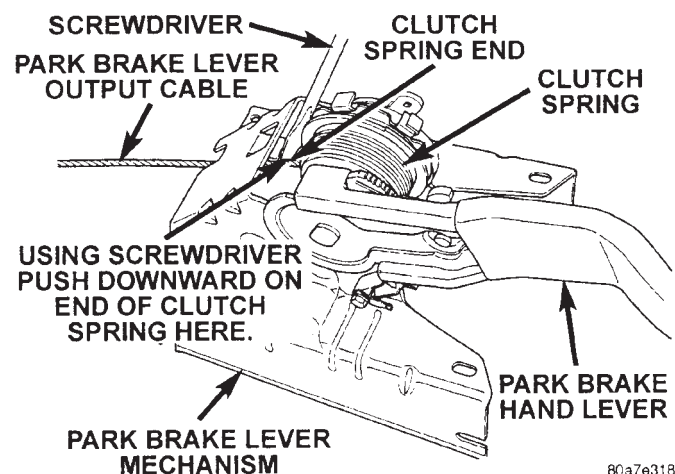


**Fig. 126 Releasing Clutch Spring**

(10) Remove the rear wheel park brake cables from the park brake cable tension equalizer (Fig. 127).

**NOTE:** If auto adjuster was not reloaded before removing the tension equalizer from both rear park brake cables, (Fig. 126) the park brake lever output

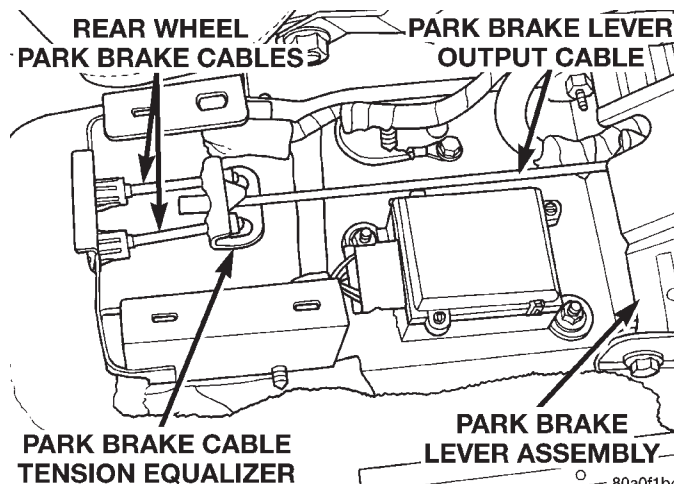


**Fig. 127 Park Brake Cables At Tension Equalizer**

cable (Fig. 126) will be pulled into the park brake mechanism.

If this happens the auto adjuster can be reloaded using the following procedure.

Using a screw driver (Fig. 126) push down on the end of the clutch spring where shown (Fig. 126). While the end of the clutch spring is held down, pull outward on park brake mechanism output cable. If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 126) to assist in pulling on cable.

(11) Disconnect the wiring harness from the ground switch on the park brake lever (Fig. 128).

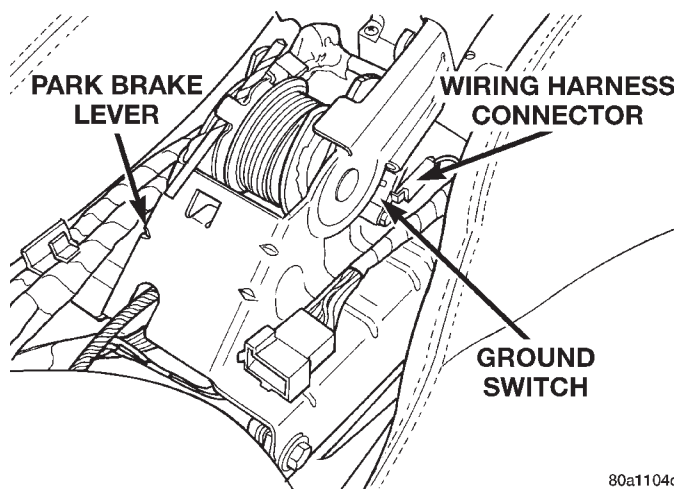


**Fig. 128 Wiring Harness Connection To Ground Switch**

(12) Remove the wiring harness routing clips from both sides of the park brake mechanism bracket. Move the wiring harnesses out of the way.

## REMOVAL AND INSTALLATION (Continued)

**NOTE:** The mounting holes in the park brake lever bracket are slotted, which requires the mounting bolts to only be loosened but not removed.

(13) Loosen **but do not remove** the 4 bolts attaching the park brake lever to the console bracket (Fig. 129).

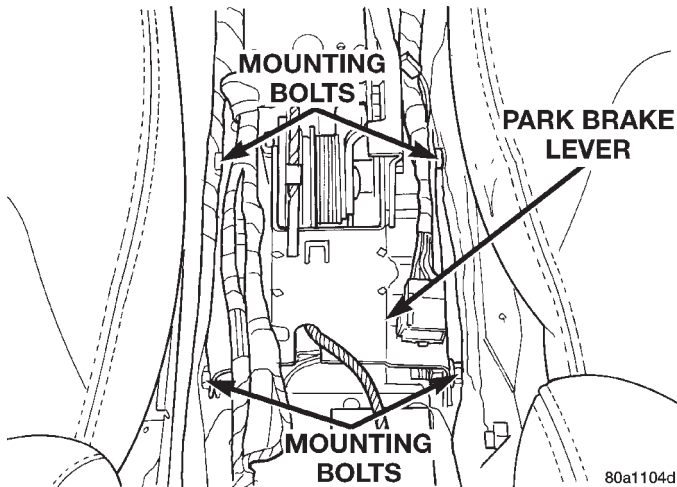


**Fig. 129 Park Brake Lever Attaching Bolts**

(14) Remove the park brake lever assembly from console bracket using the following procedure. First rotate the back of the lever bracket upward off the 2 rear mounting bolts, then slide the lever bracket rearward off the front mounting bolts.

### INSTALL

**NOTE:** If the park brake lever mounting bolts are not installed in the console bracket install them before installing the park brake lever on the console bracket.

(1) Install the park brake lever on the console bracket using the following procedure. First slide the front of the park brake lever bracket on the 2 forward mounting bolts, then rotate the rear of the bracket downward onto the 2 rear mounting bolts. Tighten the 4 attaching bolts (Fig. 129) to a torque of 24 N·m (20 ft. lbs.).

(2) Install the rear park brake cables on the park brake cable tension equalizer (Fig. 127).

**WARNING:** THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT UNLOAD THE ADJUSTER MECHANISM USING A PROCEDURE OTHER THEN THE PROCEDURE IN Step 3 FAILURE TO UNLOAD THE ADJUSTER MECHANISM USING AN ALTERNATE PROCEDURE COULD RESULT IN SERIOUS INJURY.

(3) Unload the adjuster mechanism on the park brake lever using the following procedure.

- Ensure the park brake lever is in the **full down position** when attempting to pull on park brake lever output cable (Fig. 125).

- Grasp the park brake lever output cable by hand and pull upward until all tension is removed from the drill bit used to reload the adjuster mechanism (Fig. 125).

- Remove the drill bit from the adjuster mechanism of the park brake lever (Fig. 125).

- Slowly release the park brake lever output cable until all slack is removed from the cable.

(4) Clip the wiring harness to the park brake lever bracket.

(5) Install the wiring harness connector on the ground switch of the park brake lever (Fig. 128).

(6) Cycle the park brake lever once from the released position to the fully applied position and then back to the released position. This will position the park brake cables and fully adjust them to their proper tension.

(7) Check the rear wheels of the vehicle with the park brake lever fully released, they should rotate freely without dragging.

(8) Raise the park brake hand lever to approximately a 45° angle. This is necessary for the required clearance to install the center console.

(9) Install the center console back in the vehicle.

(10) Install the wiring harness connector for the center console into the vehicle wiring harness (Fig. 124).

(11) Install the 2 screws attaching the front of the center console to the shifter. (Fig. 123).

(12) Install the 3 screws attaching the rear of the console to the console bracket (Fig. 121).

(13) Install the transmission range indicator (Fig. 122) in the center console.

(14) Install the shift knob on the shifter. Install and securely tighten the shift knob retaining screw (Fig. 130).

### PARK BRAKE LEVER OUTPUT CABLE

On this vehicle, the park brake lever output cable is not replaceable as a separate component of the park brake lever. Never attempt to repair the park brake output cable in any manner.

### PARK BRAKE CABLES

**NOTE:** Remove only one rear park brake cable from the vehicle at a time. Failure to do so will result in high efforts required to connect the park brake cables to the tension equalizer and the park brake lever at the rear wheel brakes.

## REMOVAL AND INSTALLATION (Continued)

For servicing of either the left or right rear park brake cable, follow the procedure as listed below.

**REMOVE**

(1) Remove the shift knob from the shifter. The gear shift knob is attached to the shifter using a set screw (Fig. 130). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench.

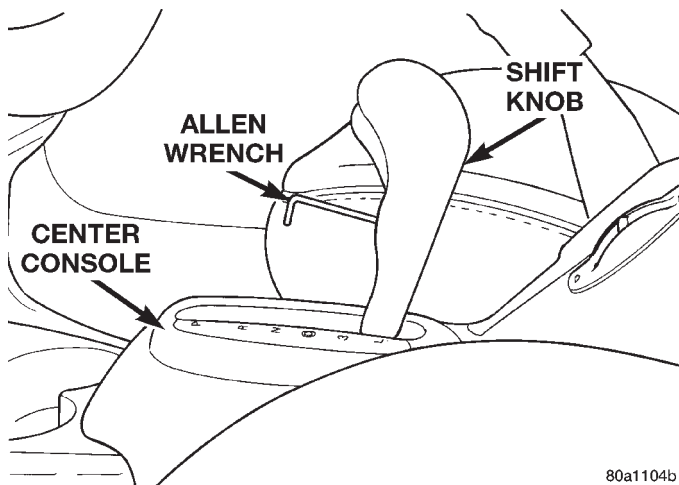


**Fig. 130 Shift Knob Retaining Screw**

(2) Remove the shift range indicator (Fig. 131) from the center console. The shift range indicator is attached to the center console using retaining clips. It is removed by carefully prying it off the center console. The shift range indicator covers the 2 attaching screws for the center console.

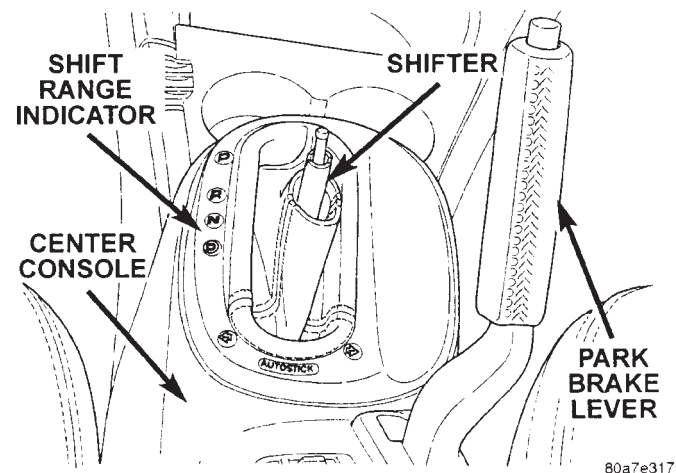


**Fig. 131 Shift Range Indicator**

(3) Remove the 2 screws (Fig. 132) attaching the center console to the shifter.

(4) Remove the 3 screws attaching the rear of the center console to the console bracket (Fig. 133).

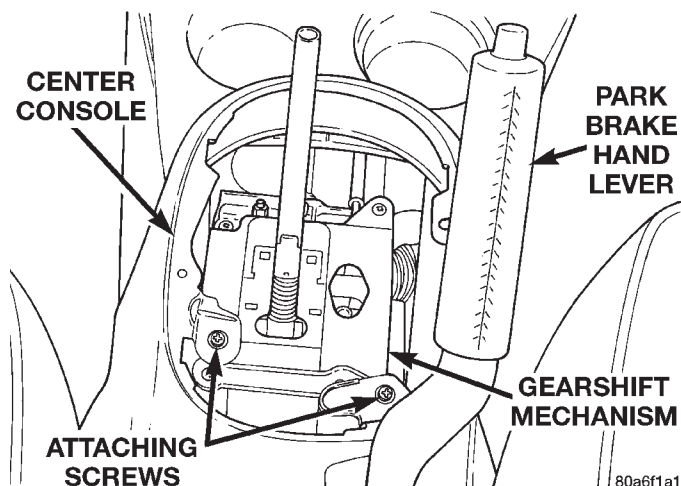


**Fig. 132 Center Console Front Attaching Screw**

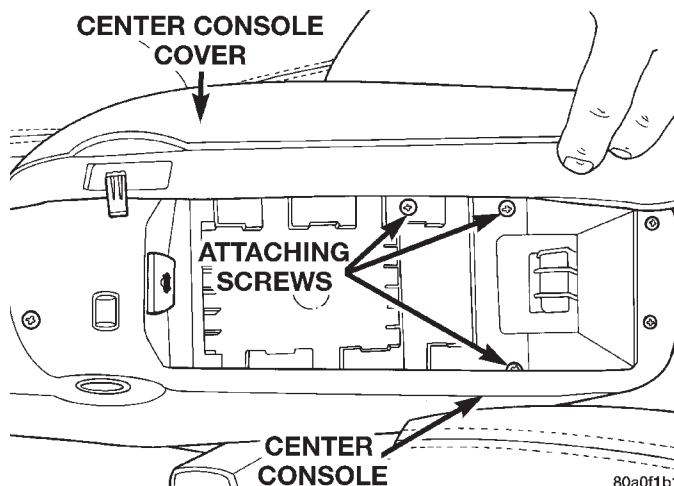


**Fig. 133 Center Console Rear Attaching Screws**

(5) Raise the park brake lever to a 45° angle. This is required for clearance to remove the center console.

(6) Raise the rear of the center console high enough to access the center console wiring harness connector (Fig. 134). Disconnect the center console wiring harness connector from the vehicle wiring harness 10-way connector (Fig. 134).

(7) Remove the center console from the vehicle.

(8) Lower the park brake lever to its fully released position.

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE PARK BRAKE CABLES FROM THE EQUALIZER UNTIL THE AUTO ADJUSTER IS RELOADED. FAILURE TO RELOAD THE ADJUSTER MECHANISM BEFORE REMOVING PARK BRAKE CABLES FROM EQUALIZER COULD RESULT IN SERIOUS INJURY.**

# REMOVAL AND INSTALLATION (Continued)

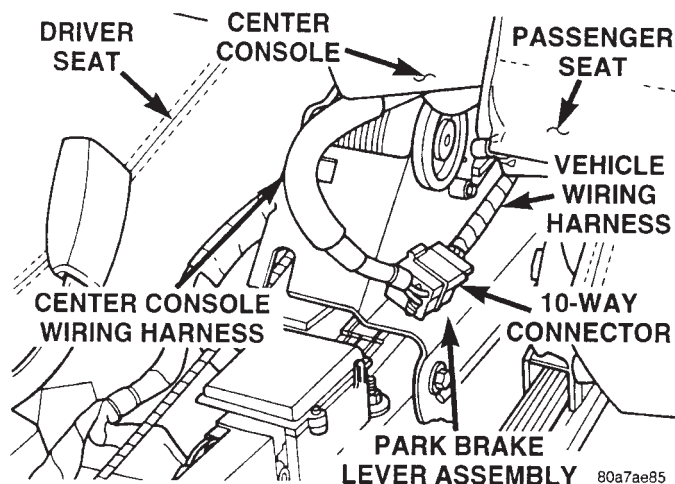


**Fig. 134 Console Wiring Harness Connector**

(9) Reload the adjuster mechanism on the park brake lever using the following procedure.

- Ensure the park brake lever is in the **full down position** when attempting to pull on park brake lever output cable (Fig. 135).
- Grasp the park brake lever output cable (Fig. 135) by hand and pull upward.
- Continue to pull upward on cable until a 15/64 drill bit can be inserted in the adjuster mechanism as shown in (Fig. 135). This will lock-out the auto adjuster mechanism removing the tension from the park brake lever output cable. This will then allow the rear park brake cables to be easily removed from the equalizer.

**NOTE:** If the output cable of the park brake mechanism will not move when pulled on, first, be sure the park brake lever is in the full down position. If park brake lever is in the full down position and the output cable will not move, use the following procedure to reload the adjuster mechanism.

Using a screw driver (Fig. 136) push down on the end of the clutch spring where shown (Fig. 136). While end of clutch spring is held down, pull outward on park brake mechanism output cable.

If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 136) to assist in pulling on cable.

(10) Remove both rear wheel park brake cables from the park brake cable tension equalizer (Fig. 137).

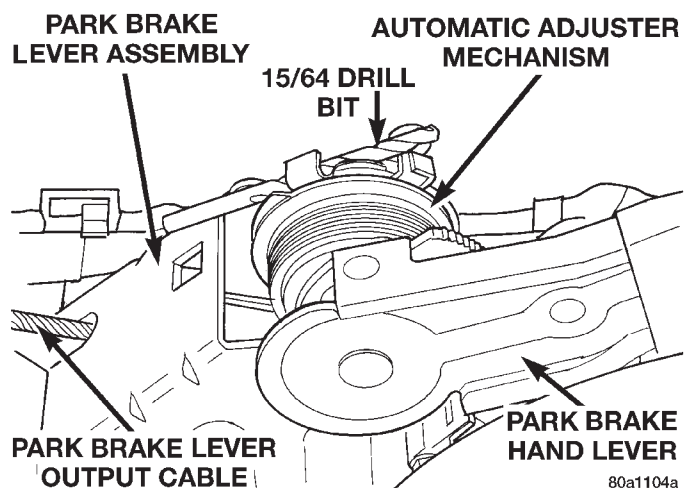


**Fig. 135 Park Brake Lever Correctly Reloaded**

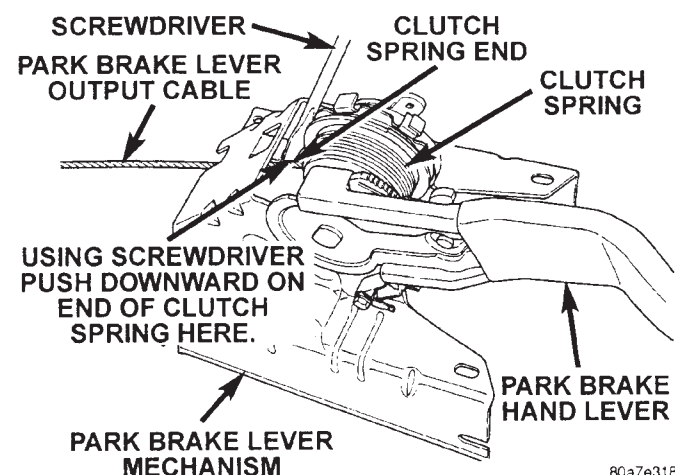


**Fig. 136 Releasing Clutch Spring**

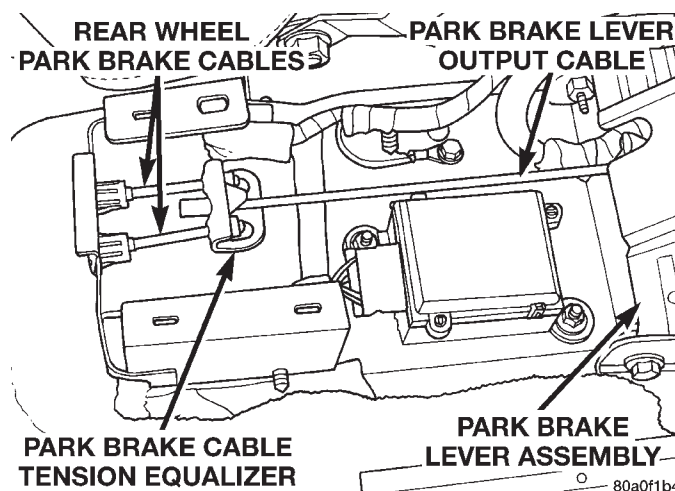


**Fig. 137 Park Brake Cables At Tension Equalizer**

## REMOVAL AND INSTALLATION (Continued)

**NOTE:** If auto adjuster was not reloaded before removing the tension equalizer from both rear park brake cables, (Fig. 137) the park brake lever output cable (Fig. 137) will be pulled into the park brake mechanism.

If this happens the auto adjuster can be reloaded using the following procedure.

Using a screw driver (Fig. 136) push down on the end of the clutch spring where shown (Fig. 136). While end of clutch spring is held down, pull outward on park brake mechanism output cable. If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 136) to assist in pulling on cable.

(11) Remove the rear seat lower cushion from the vehicle.

(12) Remove scuff plates from right and left 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.

(13) Remove the quarter trim panel from both sides of the vehicle. Refer to Group 23 Body in this group of the service manual for the required removal procedure.

(14) Remove the 2 wiring harness routing clips from the cross car beam.

(15) Remove the 2 clips attaching the carpeting to the cross car beam.

(16) Fold rear carpeting forward to expose park brake cables.

(17) Remove the routing clip (Fig. 138) attaching the rear park brake cables to the floor pan.

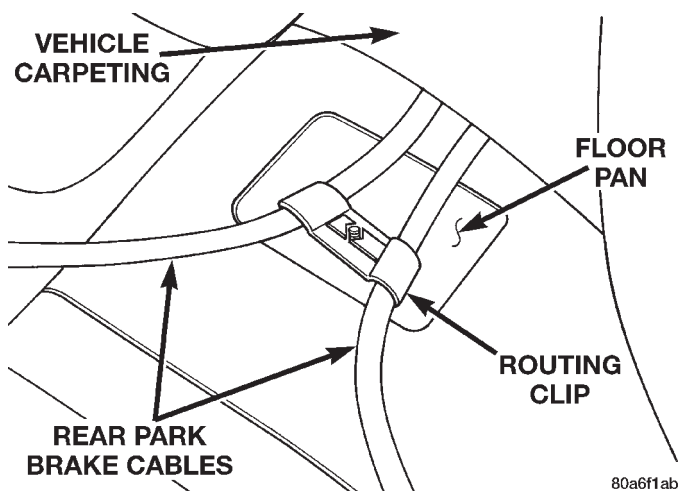


**Fig. 138 Park Brake Cable Attachment To Floor Pan**

(18) Install the box end of a 1/2 in. wrench over the park brake cable retainer as indicated in (Fig. 139). 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.

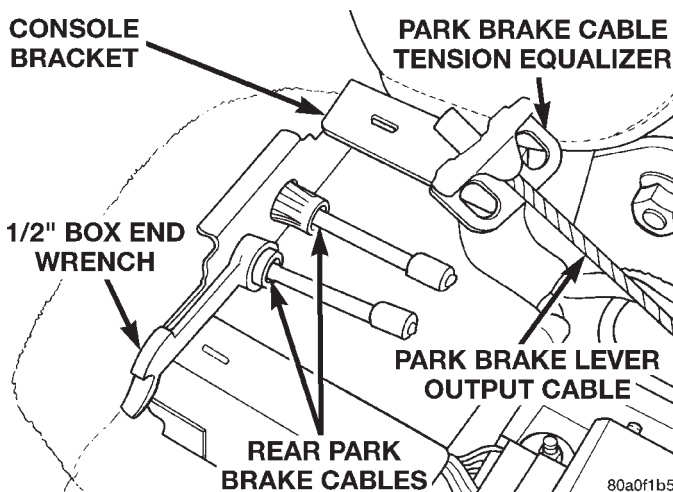


**Fig. 139 Compressing Park Brake Cable Retaining Tabs**

(19) 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.

(20) Remove rear wheel and tire assembly from the side of the vehicle requiring park brake cable service.

(21) Remove the rear brake drum (Fig. 140) from the rear hub/bearing assembly.

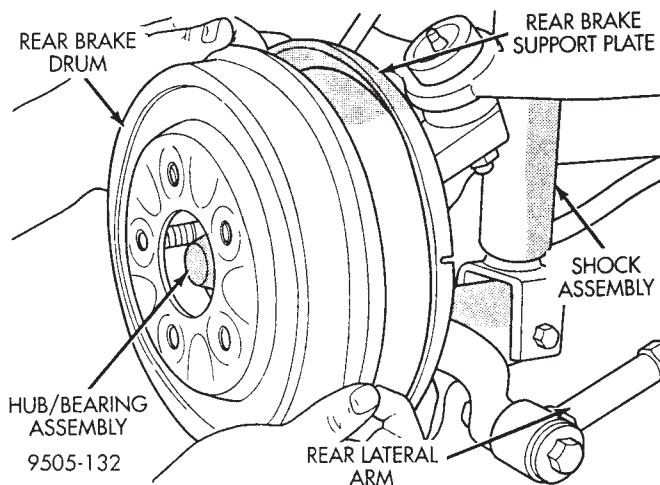


**Fig. 140 Rear Brake Drum**

## REMOVAL AND INSTALLATION (Continued)

(22) Remove the dust cap (Fig. 141) from the rear hub/bearing assembly.

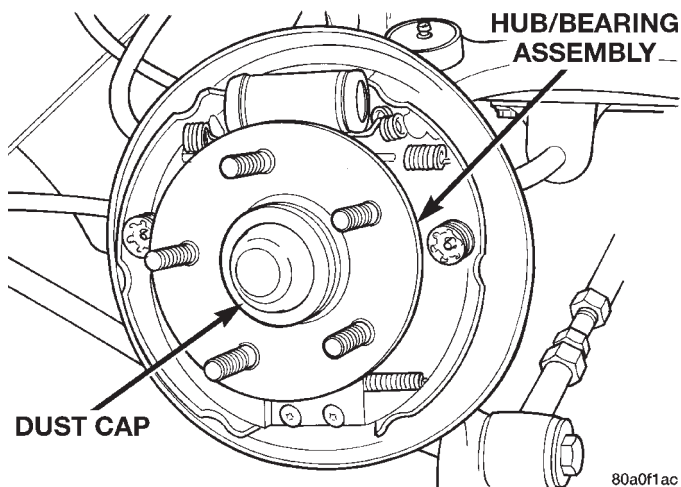


**Fig. 141 Rear Hub/Bearing Dust Cap**

(23) Remove the rear hub/bearing retaining nut (Fig. 142).

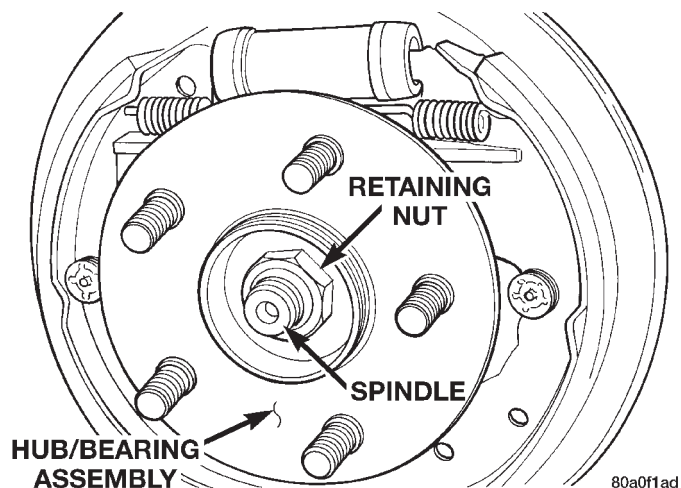


**Fig. 142 Hub/Bearing Retaining Nut**

(24) Remove the hub/bearing from the spindle.

(25) Remove the park brake cable from the park brake actuating lever on the trailing brake shoe (Fig. 143).

(26) Remove park brake cable (Fig. 144) from rear brake support plate. Park brake cable is removed from brake support plate using a 1/2 in. wrench as shown in (Fig. 144) to compress locking tabs on park brake cable retainer.

(27) Raise vehicle.

(28) Remove the 2 routing brackets (Fig. 145) attaching the park brake cable to the vehicle frame rail.

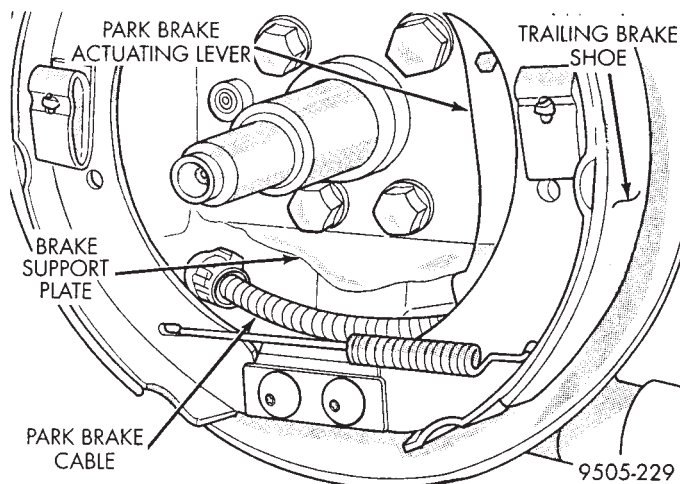


**Fig. 143 Rear Park Brake Cable At Actuating Lever**

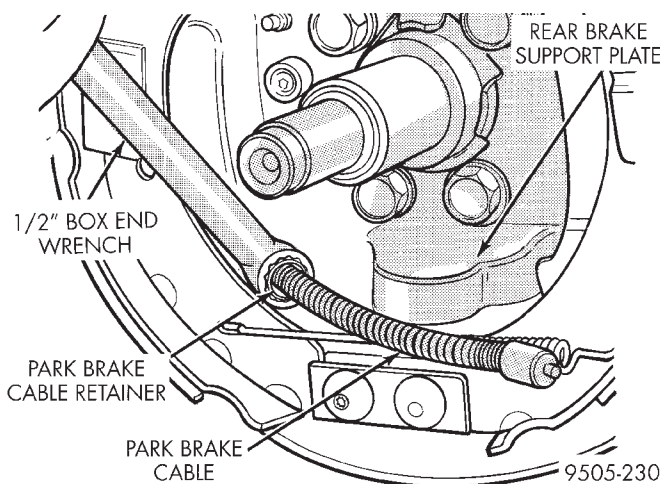


**Fig. 144 Park Brake Cable Removal From Brake Support Plate**

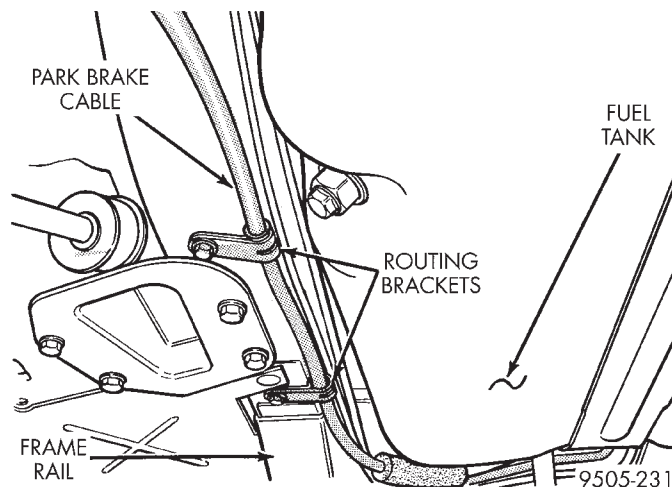


**Fig. 145 Park Brake Cable Routing Brackets**

## REMOVAL AND INSTALLATION (Continued)

(29) Remove the park brake cable and sealing grommet (Fig. 146) from the floor pan of the vehicle.

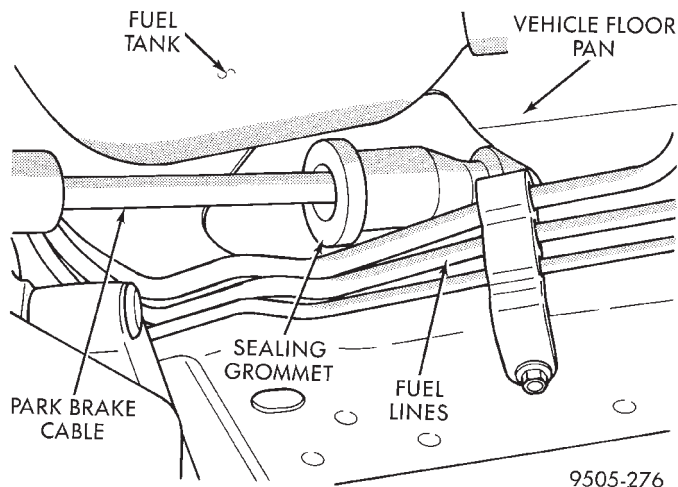


**Fig. 146 Park Brake Cable Removal / Installation At Floor Pan**

## INSTALL

(1) Install the park brake cable into the floor pan. Make sure sealing grommet on park brake cable (Fig. 146) is installed in floor pan as far as possible to insure a proper seal.

(2) Install the 2 park brake cable routing brackets (Fig. 145) on the frame rail. Install and securely tighten the routing bracket attaching bolts.

(3) Install the park brake cable into the rear brake support plate **but do not** lock the locking tabs on the cable attachment retainer into the brake support plate.

(4) Install the park brake cable on the park brake actuating lever of the trailing brake shoe (Fig. 143). **Be sure the end of the spring is under the lip on the park brake actuating lever.**

(5) Push the park brake cable fully into the rear brake support plate. Be sure locking tabs on cable retainer are expanded to ensure park brake cable is securely held in the support plate.

(6) Install hub/bearing assembly on rear spindle. Then install **a new** rear hub/bearing assembly retaining nut (Fig. 142). Torque hub/bearing assembly to spindle retaining nut to 250 N·m (185 ft. lbs.).

(7) Install hub/bearing assembly dust cap, (Fig. 141) using a soft faced hammer.

(8) Install the rear brake drum on the hub/bearing assembly (Fig. 140).

(9) 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.).

(10) Lower vehicle.

(11) Grasp park brake cable to floor pan seal grommet by hand and pull it into the floor pan to ensure seal grommet is fully seated into the floor pan.

(12) Route park brake cable under carpeting and up to park brake cable hole in console bracket on floor pan. Then install park brake cable into console bracket (Fig. 147). Be sure tabs (Fig. 147) on park brake cable retainer, have expanded out to hold park brake cable in console bracket.

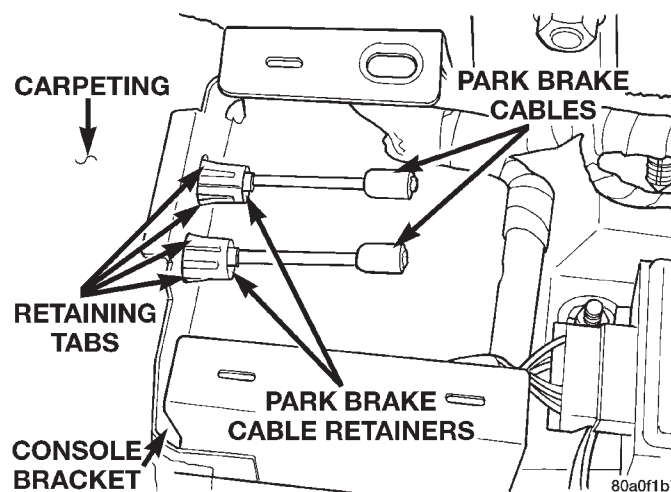


**Fig. 147 Park Brake Cables Installed In Console Bracket**

(13) Install the routing bracket holding park brake cables to the floor pan of the vehicle (Fig. 138).

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT UNLOAD THE ADJUSTER MECHANISM USING A PROCEDURE OTHER THEN THE PROCEDURE IN Step 14 FAILURE TO UNLOAD THE ADJUSTER MECHANISM USING AN ALTERNATE PROCEDURE COULD RESULT IN SERIOUS INJURY.**

(14) Unload the adjuster mechanism on the park brake lever using the following procedure. Grasp the park brake lever output cable by hand and pull upward until all tension is removed from the drill bit (Fig. 135). used to reload the adjuster mechanism. Remove the drill bit from the clock spring of the park brake lever adjuster mechanism. Then, slowly release the park brake lever output cable until all slack is removed from the cable.

(15) Clip the wiring harness to the park brake lever bracket.

(16) Install the wiring harness connector on the ground switch of the park brake lever.

(17) Cycle the park brake lever once from the released position to the fully applied position and then back to the released position. This will position the park brake cables and fully adjust them to thier proper tension.

## REMOVAL AND INSTALLATION (Continued)

(18) Check the rear wheels of the vehicle with the park brake lever fully released, they should rotate freely without dragging.

(19) Raise the park brake hand lever to approximately a 45° angle. This is necessary for the required clearance to install the center console.

(20) Install the center console back in the vehicle.

(21) Install the wiring harness connector for the center console into the vehicle wiring harness (Fig. 134).

(22) Install the 2 screws attaching the front of the center console to the shifter (Fig. 132). Install the screw hole garnish cap and the PRNDL strip on the center console.

(23) Install the 3 screws attaching the rear of the center console to the console bracket (Fig. 133).

(24) Install the transmission range indicator (Fig. 131) in the center console.

(25) Install the shift knob on the shifter. Install and securely tighten the shift knob retaining screw.

(26) Fold the carpeting back into position on the rear floor of the vehicle.

(27) Install the 2 clips attaching the carpeting to the cross car beam.

(28) Install the 2 wiring harness routing clips on the cross car beam.

(29) Install the quarter trim panels. Refer to Group 23 Body in this service manual for the required installation procedure.

(30) Install both door sill plate scuff moldings, by snapping them onto the door sills.

(31) Install lower rear seat cushion. Be sure lower seat cushion is fully installed in retainers on floor pan of vehicle.

## STOP LAMP SWITCH

## REMOVE

(1) Depress and hold the brake pedal while rotating stop lamp switch (Fig. 148) 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.

(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.

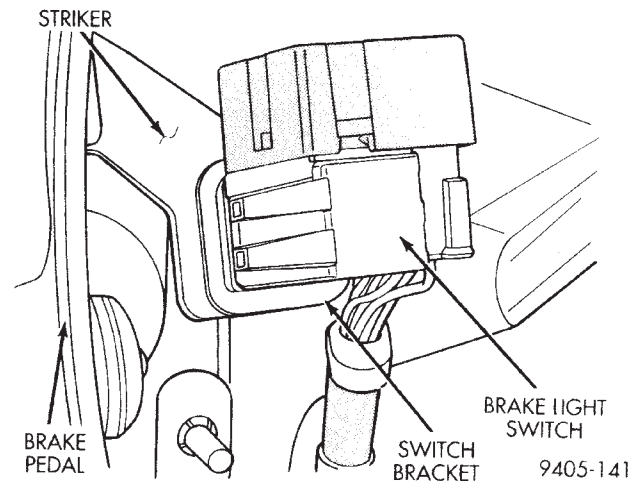


**Fig. 148 Stop Lamp Switch**

(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 too much force is used, damage to the stop lamp switch or striker (Fig. 148) 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:** To replace the master cylinder brake fluid reservoir on this vehicle, it is not necessary to remove the master cylinder from the power brake vacuum booster.

(1) Using Mopar, Brake Parts Cleaner or an equivalent, thoroughly clean the master cylinder and brake fluid reservoir.

(2) Remove the brake fluid reservoir filler cap.

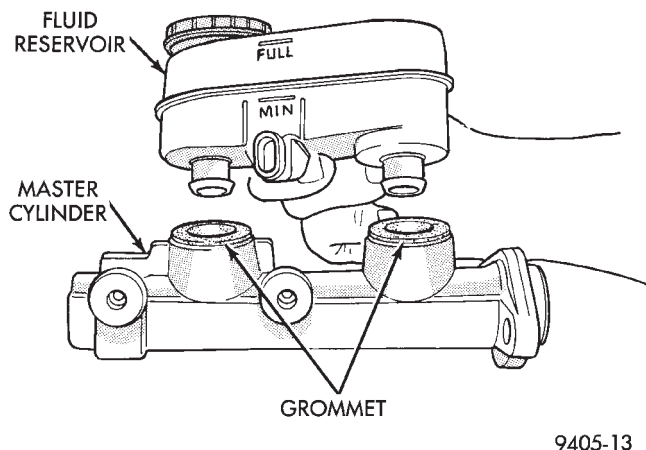
(3) Using a syringe or equivalent type tool, empty as much brake fluid as possible from the reservoir.

**CAUTION:** Do not pry fluid reservoir off master cylinder using a tool, damage to the reservoir or master cylinder can result.

## DISASSEMBLY AND ASSEMBLY (Continued)

(4) Remove brake fluid reservoir from master cylinder by rocking the reservoir from side to side while pulling upward on the fluid reservoir.

(5) Remove master cylinder housing to brake fluid reservoir sealing grommets (Fig. 149).



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**Fig. 149 Removing Fluid Reservoir From Master Cylinder**

**CAUTION:** To ensure a leak proof seal when installing a fluid reservoir, never reuse the original fluid reservoir to master cylinder sealing grommets.

(6) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 149) in master cylinder housing.

(7) 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.

(8) Be sure reservoir is positioned properly.

(9) Make sure bottom of fluid reservoir touches top of both sealing grommets.

### BRAKE FLUID LEVEL SWITCH

The master cylinder or brake fluid reservoir does not have to be removed from the vehicle for replacement of the brake fluid level sensor.

(1) Remove wiring harness connector from brake fluid reservoir level sensor (Fig. 150).

(2) Compress the retaining tabs (Fig. 151) on the end of the brake fluid level sensor.

(3) While compressing retaining tabs, grasp opposite end of brake fluid level sensor and pull it out of master cylinder fluid reservoir (Fig. 152).

### 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 ripples, brittleness or damage to the piston dust boot.

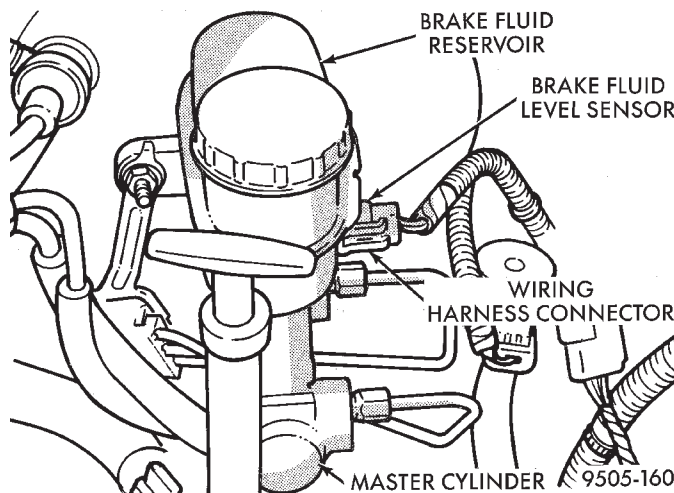


**Fig. 150 Master Cylinder Fluid Level Sensor**

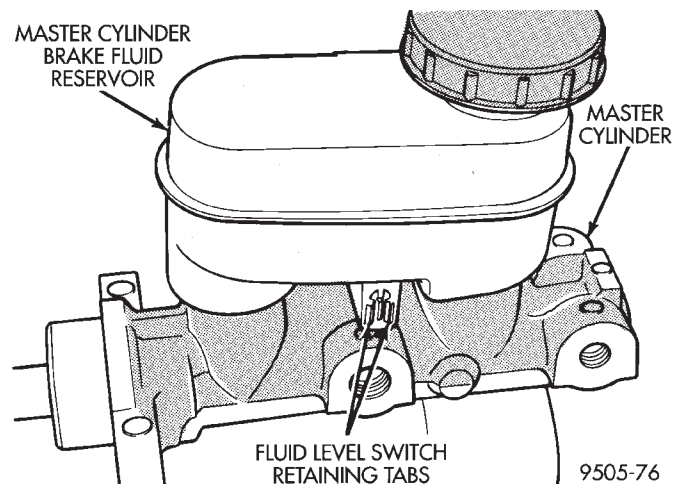


**Fig. 151 Brake Fluid Level Switch Retaining Tabs**

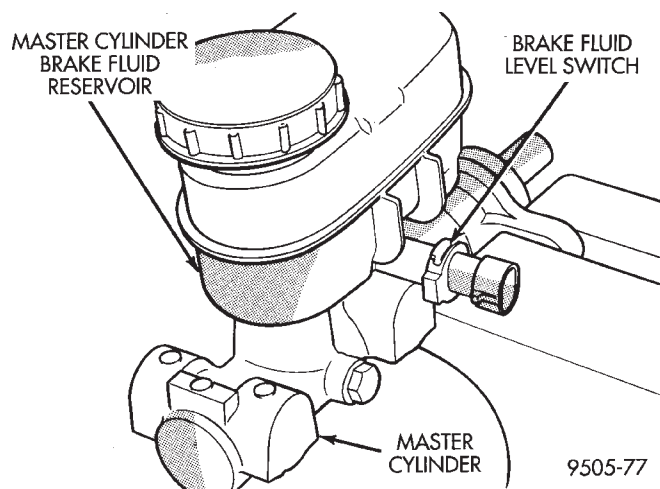


**Fig. 152 Removing Fluid Level Switch From Reservoir**

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

## DISASSEMBLY AND ASSEMBLY (Continued)

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. 153).

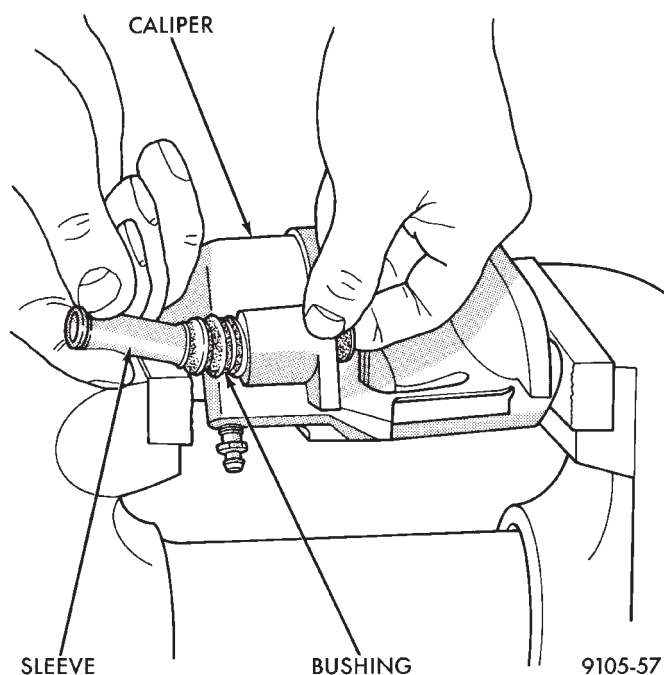


**Fig. 153 Removing Inner Sleeve From Bushing**

(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. 154).

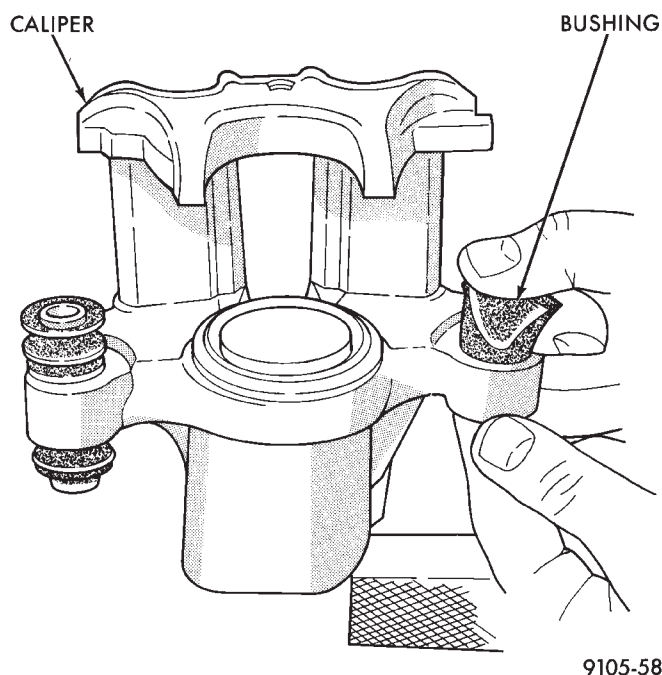


**Fig. 154 Removing Bushing From Caliper**

#### INSTALLING CALIPER GUIDE PIN BUSHINGS

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 155).

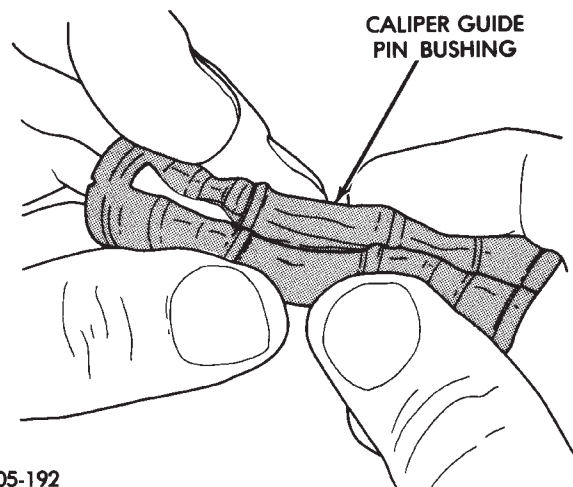


**Fig. 155 Folded Caliper Guide Pin Bushing**

## DISASSEMBLY AND ASSEMBLY (Continued)

(2) Insert the folded bushing into the caliper housing (Fig. 156). **Do not use a sharp object to perform this step due to possible damage to the bushing.**

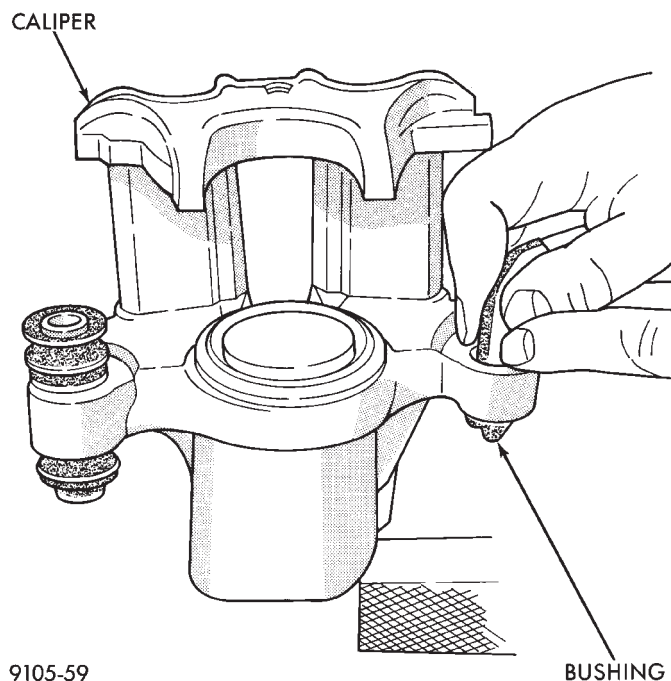


**Fig. 156 Installing Caliper Guide Pin Bushing**

(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. 157).

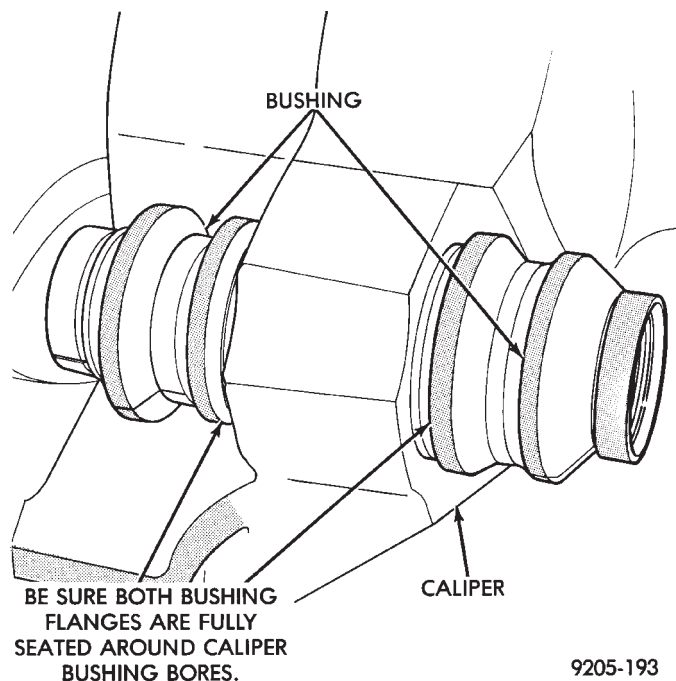
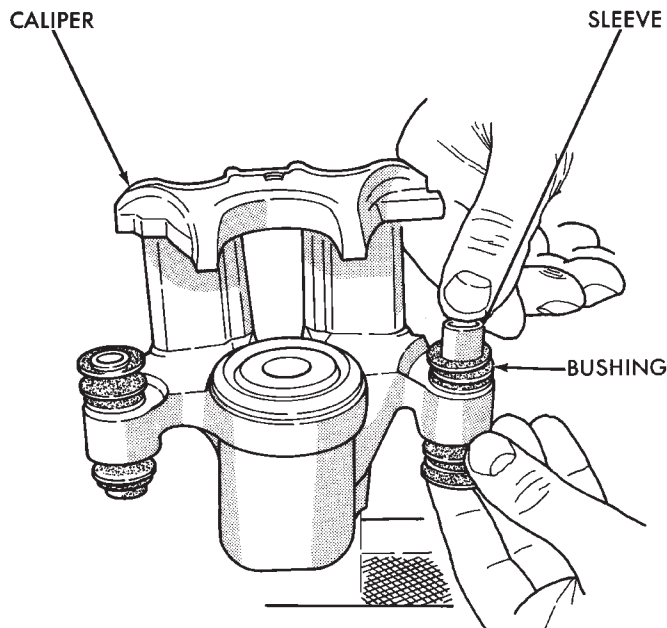


**Fig. 157 Bushing Correctly Installed In Caliper**

(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. 158).



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**Fig. 158 Installing Sleeve In Bushing**

(6) Holding convoluted boot end of bushing with one hand, push steel sleeve bushing through boot until one end of bushing is fully seated into seal groove on one end of sleeve (Fig. 158).

(7) Holding sleeve in place, work other end of bushing over end of sleeve and into the seal groove on sleeve (Fig. 159). Be sure other end of bushing did not come out of seal groove in sleeve.

(8) When the sleeve is seated properly into the bushing, the sealed for life sleeve/bushing can be held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

#### 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.

## DISASSEMBLY AND ASSEMBLY (Continued)

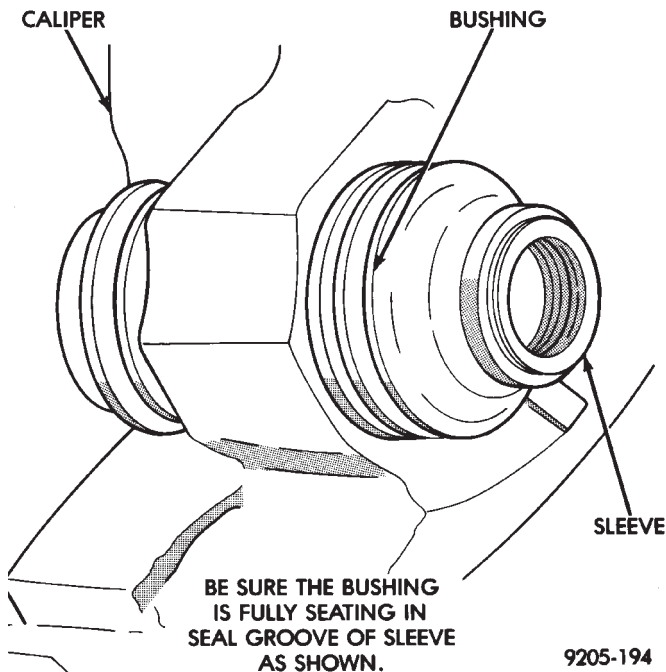


**Fig. 159 Correctly Installed Caliper Sleeve And Bushing**

(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. 160).

(8) Using a soft tool, such as a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 161). 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

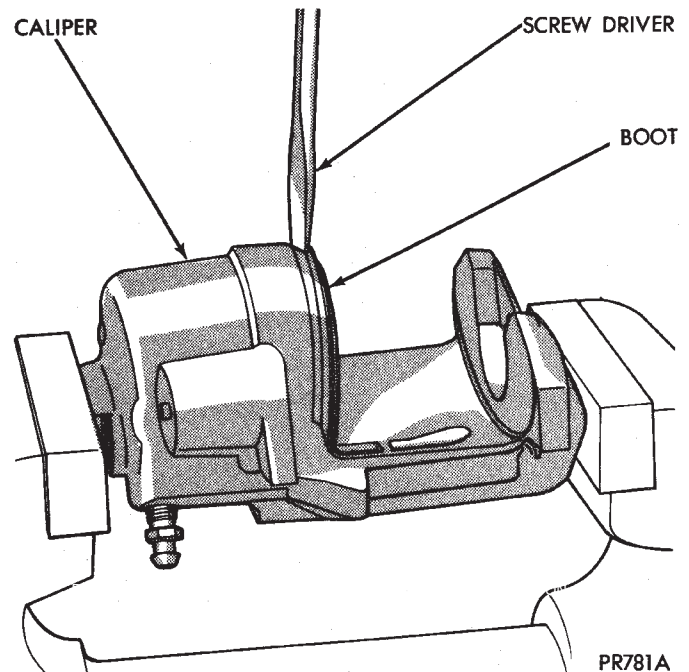


**Fig. 160 Removing Caliper/Piston Dust Boot**

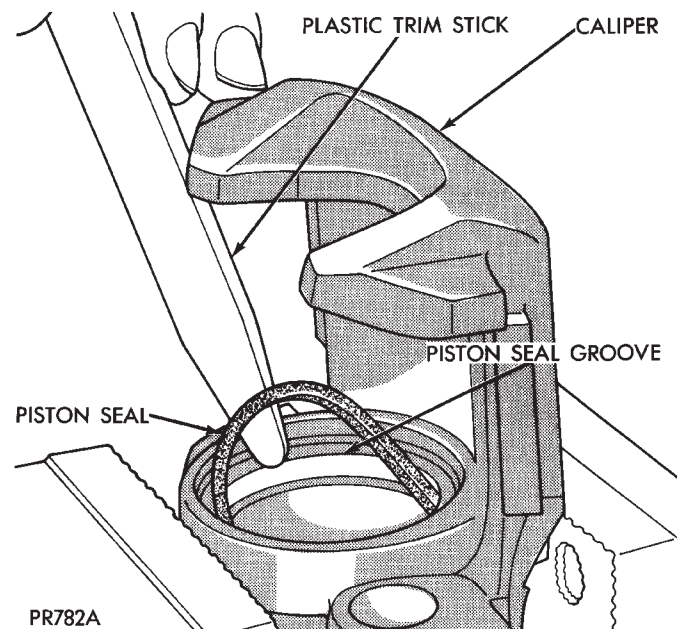


**Fig. 161 Removing Piston Seal From Caliper**

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

## DISASSEMBLY AND ASSEMBLY (Continued)

the bore is not increased more than 0.0254 mm (0.001 inch) (Fig. 162).

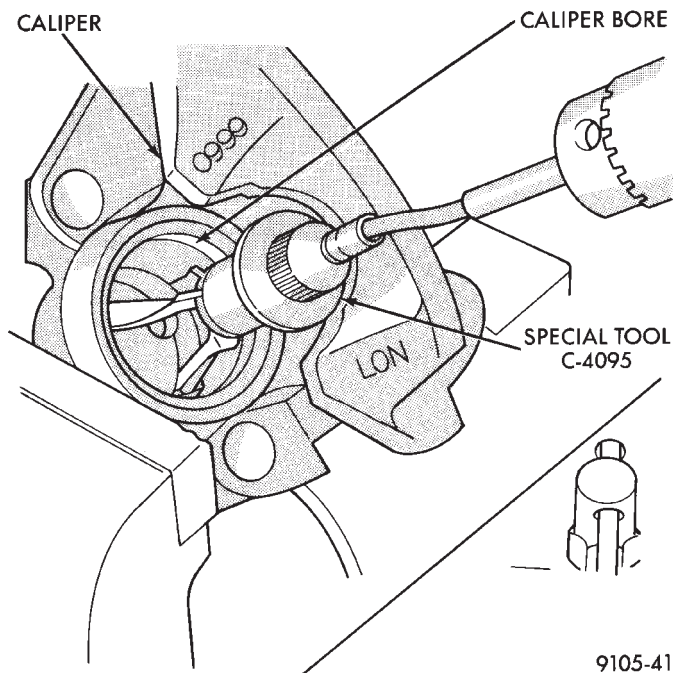


**Fig. 162 Honing Brake Caliper Piston Bore**

(11) If the bore does not clean up within this specification, a new caliper housing should be installed. Install a new piston if the old one is pitted or scored.

**NOTE:** When using Caliper Honing Tool, Special Tool C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush.

**NOTE:** Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lint free cloth and then clean a second time.

**CAUTION:** When inspecting caliper piston, do not use anything but solvents to clean piston surface. If surface of piston cannot be cleaned using only solvents, piston must be replaced.

(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. 163), 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. 163).

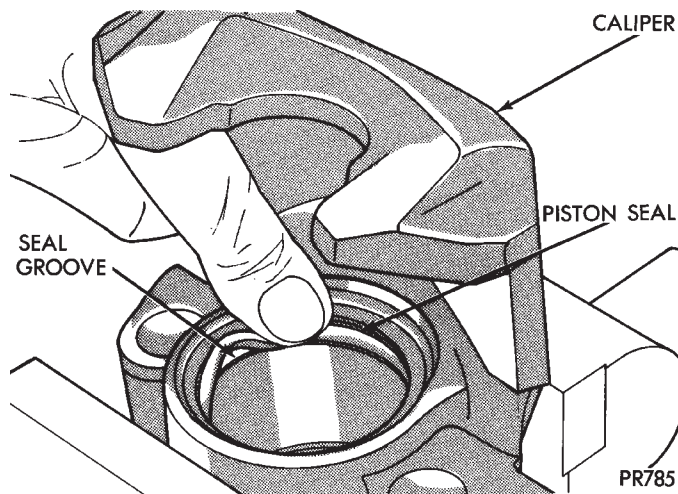


**Fig. 163 Installing New Piston Seal In Caliper**

(3) Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

(4) Position dust boot over piston after coating with brake fluid.

**CAUTION:** Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

(5) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 164).

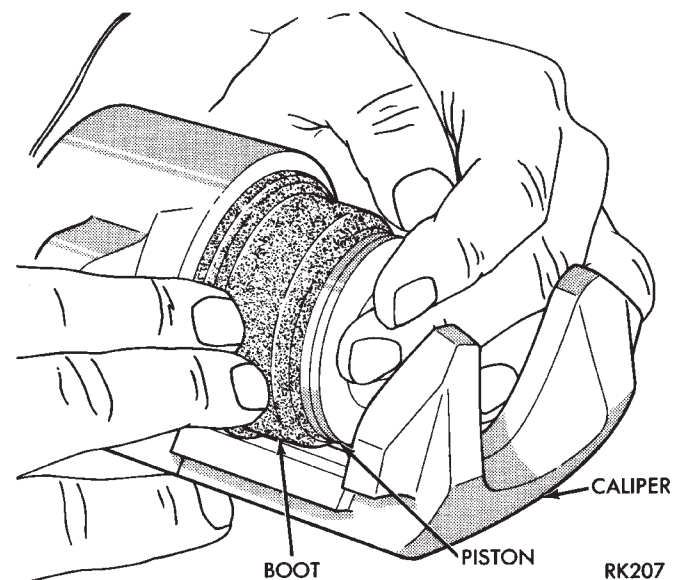


**Fig. 164 Installing Piston Into Caliper Bore**

## DISASSEMBLY AND ASSEMBLY (Continued)

(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. 165).

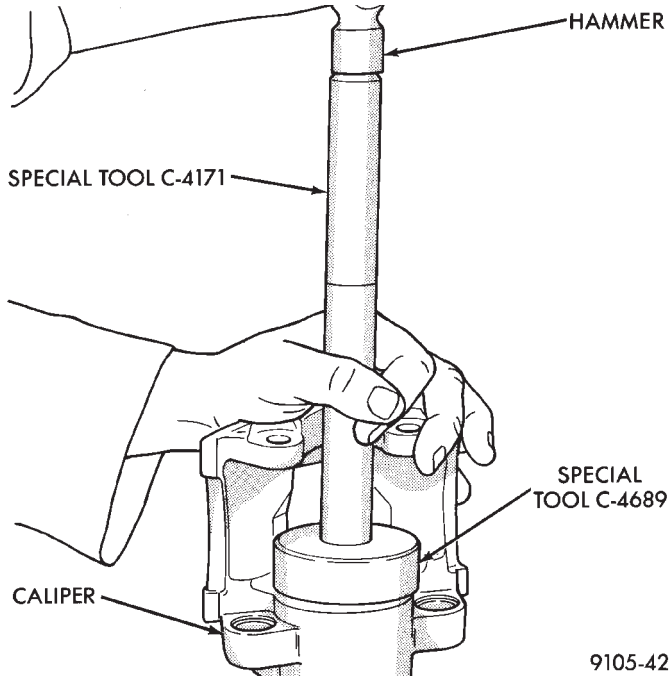


**Fig. 165 Installing Dust Boot In Caliper Counterbore**

(8) Install guide pin sleeves and bushings. See Install Guide Pin Bushings section in the caliper disassembly section of this manual.

(9) Install brake pads. See Installing Brake Pads in the Brake Pad Service Procedures section of this manual.

(10) Before installing caliper assembly on vehicle, inspect brake rotor. If any conditions as described in Checking Brake Rotor for Runout and Thickness are present the rotor, must be replaced or refaced. If the rotor does not require any servicing, install caliper assembly.

(11) Install brake hose onto caliper using banjo bolt. Torque the brake hose to caliper assembly banjo bolt to 33 N·m (24 ft. lbs.). **New seal washers 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. 166).

(2) Press **IN** on one piston to force out opposite piston, cup and spring (Fig. 166). 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. 166) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

### ASSEMBLE

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with 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. 166).

(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. 166).

(5) Install a boot over each end of cylinder (Fig. 166). **Be careful not to damage boot during installation.**

## CLEANING AND INSPECTION

### FRONT DISC BRAKE COMPONENT INSPECTION

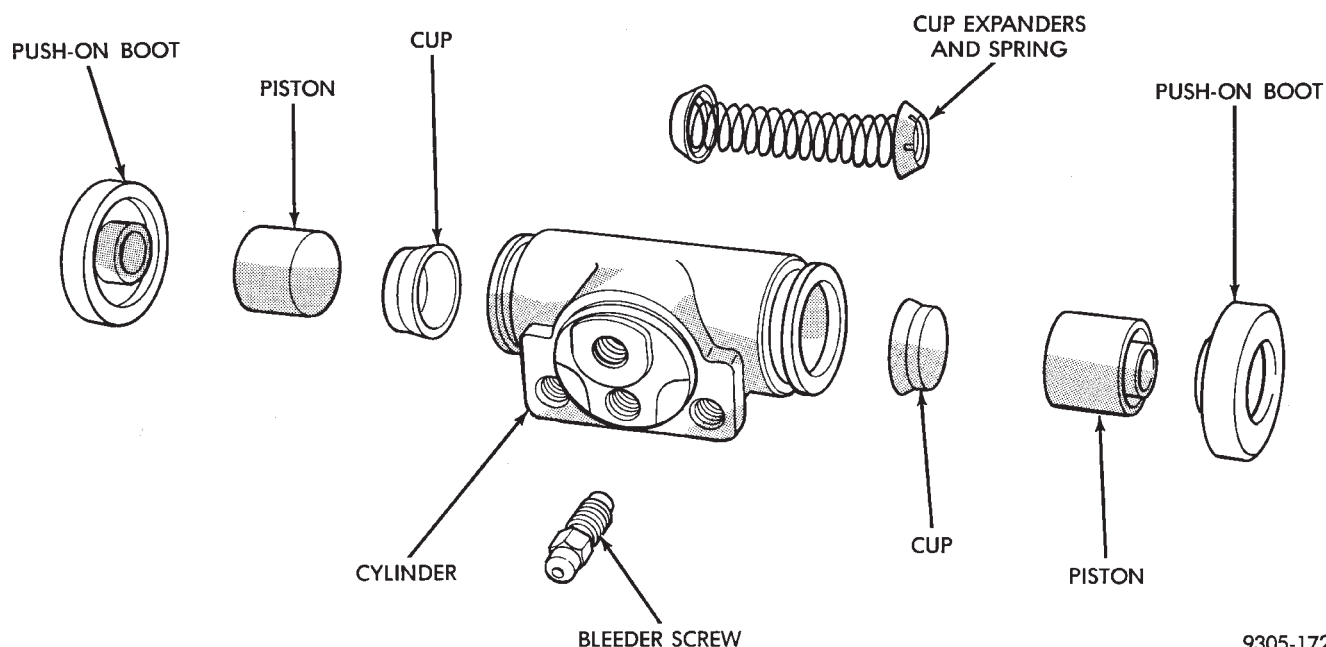
#### BRAKE PAD LINING WEAR

If a visual inspection does not adequately determine the condition of the front disc brake shoe lining, a physical check will be necessary. To check the amount of brake shoe lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the front brake shoes. (See Brake Shoe Removal paragraph).

Combined front brake shoe thickness should be measured at the thinnest part of the assembly.

## CLEANING AND INSPECTION (Continued)



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**Fig. 166 Rear Wheel Cylinder (Exploded View)**

When a set of brake shoes are worn to a total thickness of approximately 9.0 mm (3/8 inch) they should be replaced.

**Replace both brake shoes (inboard and outboard) on both front sides of the vehicle.**

If the front disc brake shoes do not require replacement, reinstall the brake shoes making sure each brake shoe is returned to the original position on the vehicle it was removed from. (See Brake Pad Installation).

**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.

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.

**REAR DRUM BRAKES**

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.

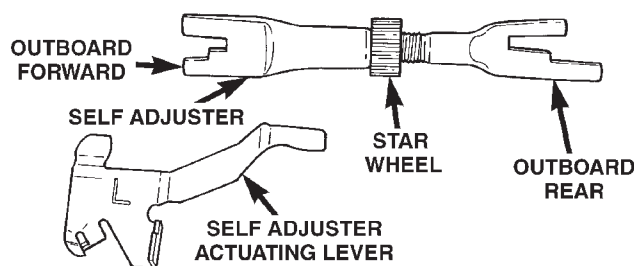
Shoes with lack of contact at toe or heel may be improperly ground.

Clean and inspect the brake support plate and the automatic self adjusting mechanism.

Visually examine the adjuster assembly to ensure it is functioning correctly by checking for the following operation.

- Be sure the star wheel on the adjuster (Fig. 167) is free to rotate throughout its entire adjustment range.
- Ensure that the adjuster actuating lever is free to move on the brake shoe.
- Inspect the adjuster actuating spring (Fig. 167) for any signs of excessive wear or damage.
- Ensure that the teeth on the star wheel are not damaged (Fig. 167).
- Overall, examine the adjuster mechanism for excessive wear or damage and replace if necessary.

If the adjuster mechanism is re-useable, apply a light coat of Mopar Multi-Purpose Lubricant or equivalent, on the threads of the adjuster mechanism (Fig. 167).



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**Fig. 167 Automatic Self Adjuster Mechanism And Actuating Lever**

CLEANING AND INSPECTION (Continued)

If any return, hold down, or actuating springs have overheated or are damaged, replace them. 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. 168) 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. 168) to ratchet backward to the correct position.

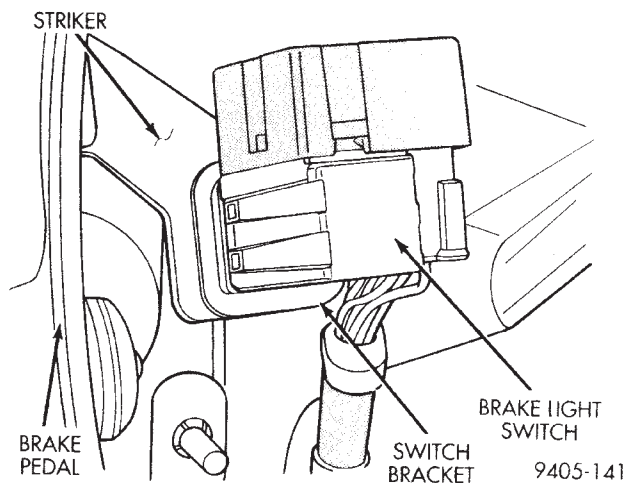


Fig. 168 Stop Light Switch Location In Vehicle

REAR DRUM BRAKE SHOE ADJUSTMENT

**NOTE:** Normally, self adjusting drum brakes will not require manual brae shoe adjustment. Although in the event that the rear brake shoes are replaced it is advisable to make the initial adjustment manually to speed up the initial adjustment time.

## ADJUSTMENTS (Continued)

(1) Raise vehicle using a frame contact type hoist or supported as required using jack stands. See moistening in the Lubrication And Maintenance group of this service manual for the required hoisting or jacking procedure to be used for this vehicle.

(2) Remove the rubber plug (Fig. 169) from the brake adjuster access hole in the brake support plate.

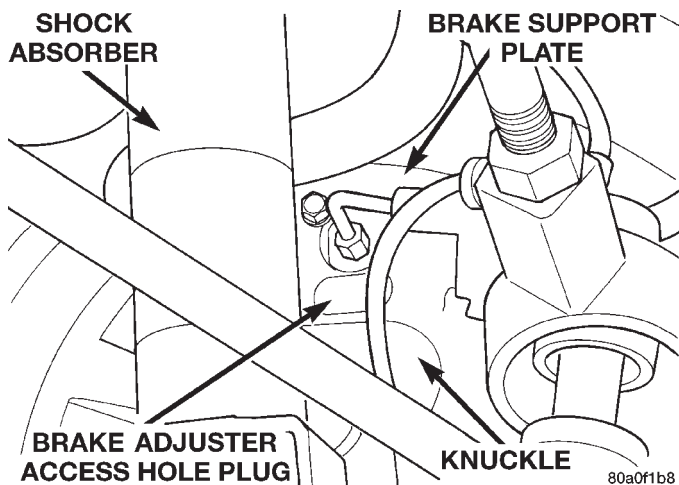


**Fig. 169 Brake Adjuster Access Hole Plug**

(3) Be sure parking brake lever is fully released.

(4) Insert a thin screwdriver through the adjuster access hole in the brake support plate (Fig. 170). Engage the tip of the screwdriver with the star wheel on the automatic adjuster. Move the handle of the screwdriver downward (toward the ground). Repeat the above procedure until drag is felt when rear wheel is rotated.

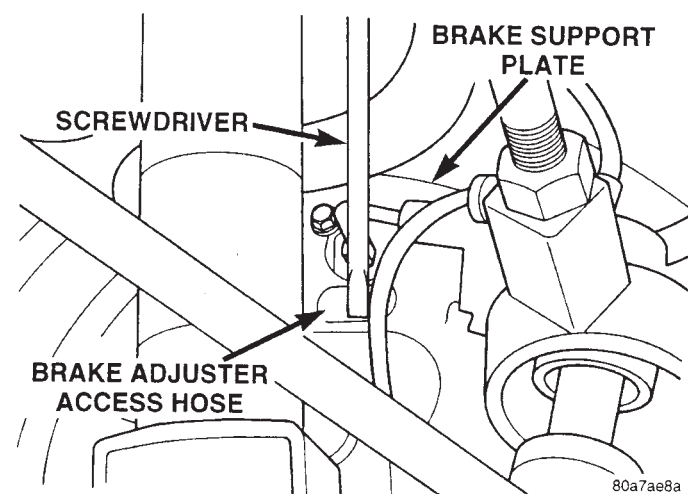


**Fig. 170 Rear Brake Shoe Adjustment**

**CAUTION:** When performing the procedure in Step 5, care must be taken not to bend the adjuster actuating lever or distort the lever actuating spring.

(5) Insert a thin screwdriver or a piece of welding rod through the adjuster access hole. Carefully push the adjuster actuating lever out of engagement with the adjuster star wheel. While holding the adjuster actuating lever away from the star wheel insert a second screwdriver in access hole and engage it with the star wheel on the adjuster. Back off the adjuster star wheel until no drag is present when rotating the wheel.

(6) Repeat the above adjustment procedure at the other rear wheel.

(7) Apply and release the park brake lever one time after the rear brake shoes are adjusted. This will correctly adjust the tension of the park brake cables.

(8) Install the rubber plugs into the adjuster access holes in the brake support plates (Fig. 169).

## PARKING BRAKES

Due to the automatic adjustment feature of the parking brake system used on this vehicle, manual adjustment of the parking brakes is not required. Proper adjustment of the parking brakes on this vehicle relies on the proper adjustment of the rear drum brake shoes. See Rear Brake Adjustment in the Service Adjustments Section in this group of the service manual for the required rear brake shoe adjustment procedure.

## SPECIFICATIONS

## BRAKE FLUID

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

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

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

SPECIFICATIONS (Continued)

BRAKE ACTUATING SYSTEM

ACTUATION:

Vacuum Operated Power Brakes . . . . . Standard  
 Hydraulic System . . . . . Dual-Diagonally Split

MASTER CYLINDER ASSEMBLY:

Supplier . . . . . Allied Signal  
 Type . . . . . Center Valve Design  
 Body Material . . . . . Anodized Aluminum  
 Reservoir Material . . . . . Polypropelene

MASTER CYLINDER BORE / STROKE AND  
 SPLIT:

ABS . . . . . 22.2 mm x 33.4 mm  
 (.874 in. x 1.32 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 . . . . Double Wall Inverted Flare

ABS HYDRAULIC CONTROL UNIT:

Hydraulic Tube Fitting Type . . Double Wall Inverted  
 Flare

BOOSTER:

Make/Type . . . . . Allied Signal Vacuum Assist  
 Mounting Studs . . . . . M8 x 1.25  
 Type . . . . . 205 mm Tandem  
 Boost At 20 inches Of Manifold Vacuum . . . 4690 All

SCREW IN PROPORTIONING VALVE:

Material . . . . . Aluminum  
 Function . . . . . Hydraulic Pressure Proportioning

BRAKE PEDAL

Pedal Ratio . . . . . 3.32

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION TORQUE

BRAKE TUBES:

Tube Nuts To Fittings And  
 Components . . . . . 20 N·m (180 in. lbs.)

BRAKE HOSE:

Front Caliper Banjo Bolt . . . . . 48 N·m (35 ft. lbs.)  
 Rear Intermediate Bracket . . 11 N·m (100 in. lbs.)  
 Front And Rear Brackets To  
 Frame Rails . . . . . 10 N·m (95 in. lbs.)

MASTER CYLINDER:

To Vacuum Booster Mounting  
 Nut . . . . . 28 N·m (250 in. lbs.)

BRAKE BOOSTER:

To Dash Panel Mounting Nuts . 37 N·m (27 ft. lbs.)

BRAKE PEDAL

To Dash Panel Plenum Mounting  
 Nut . . . . . 37 N·m (27 ft. lbs.)  
 Shaft To Brake Pedal Bracket  
 Nut . . . . . 34 N·m (25 ft. lbs.)

REAR WHEEL CYLINDER:

To Support Plate Mounting Bolts . . . . . 13 N·m  
 (115 in. lbs.)  
 Bleeder Screw . . . . . 10 N·m (90 in. lbs.)

BRAKE SUPPORT PLATE:

To Axle Mounting Bolts . . . . . 75 N·m (55 ft. lbs.)

DISC BRAKE CALIPER:

Guide Pin Bolts . . . . . 22 N·m (16 ft. lbs.)  
 Bleeder Screw . . . . . 20 N·m (15 ft. lbs.)

ABS HYDRAULIC CONTROL UNIT:

To Mounting Bracket Bolts . . 28 N·m (250 in. lbs.)  
 Bracket To Crossmember Mounting  
 Bolts . . . . . 28 N·m (250 in. lbs.)

PARKING BRAKE:

Lever Mounting Nuts . . . . . 24 N·m (18 ft. lbs.)

REAR HUB AND BEARING:

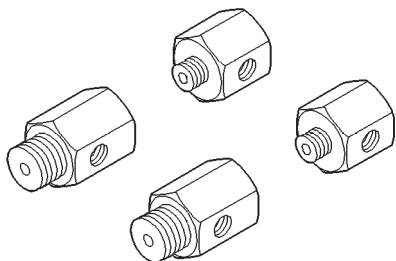
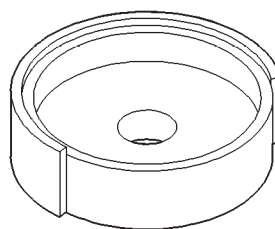
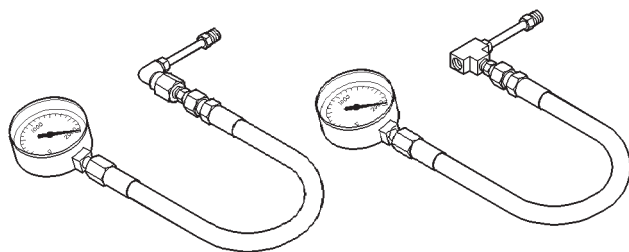
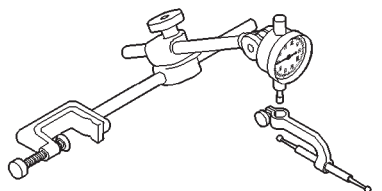
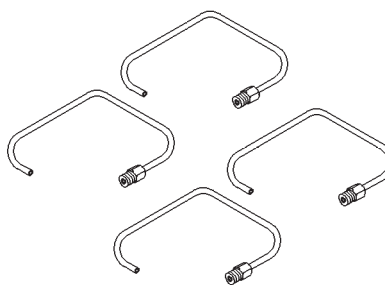
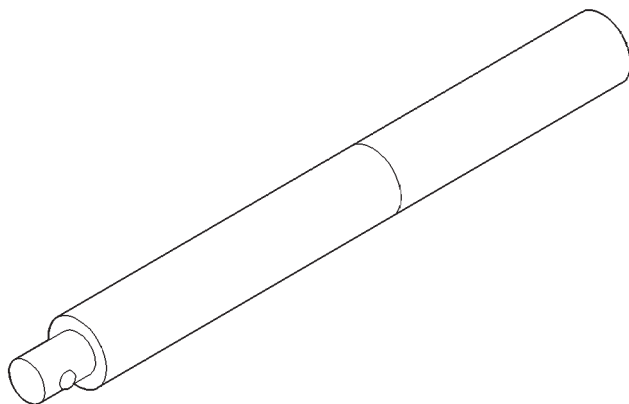
To Knuckle Retaining Nut . . 250 N·m (185 ft. lbs.)

WHEEL:

Stud Lug Nut . . . . . 115–155 N·m (85–115 ft. lbs.)

## SPECIAL TOOLS

## BASE BRAKE SYSTEM

*Adapters, Brake Pressure Test 6805**Installer, Dust Boot C-4689**Gauge Set C-4007-A**Dial Indicator C-3339**Tubes, Master Cylinder Bleeding 6802**Handle, Universal C-4171*

# ANTILOCK BRAKE SYSTEM-ALLIED SIGNAL ABX-4

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## 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 Allied Signal 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 Allied Signal ABX-4 Brake System. These components are listed below for your reference.

- CAB—Controller Antilock Brake (Electronic)
- 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 than 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 to 30%. 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)

**ABS BRAKES 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 on the right side of the vehicle, mounted to the front suspension (Fig. 1). The HCU is mounted to the front suspension crossmember using a mounting bracket attached to the crossmember, which the HCU is mounted to using 3 isolation bushings. The HCU contains the following components for controlling brakes 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. 1).

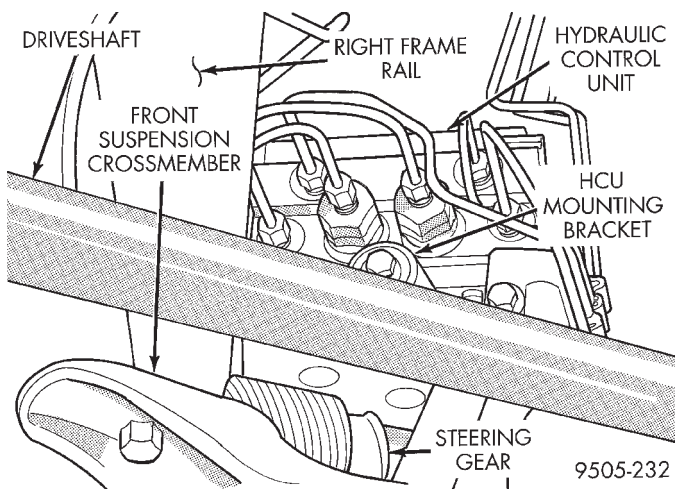


**Fig. 1 Hydraulic Control Unit Mounting Location**

**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.

**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. 2) 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. 2).

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.

**SYSTEM RELAY OPERATION**

The main purpose of the system relay is to put the ABS system into a stand-by mode for ABS operation.

## DESCRIPTION AND OPERATION (Continued)

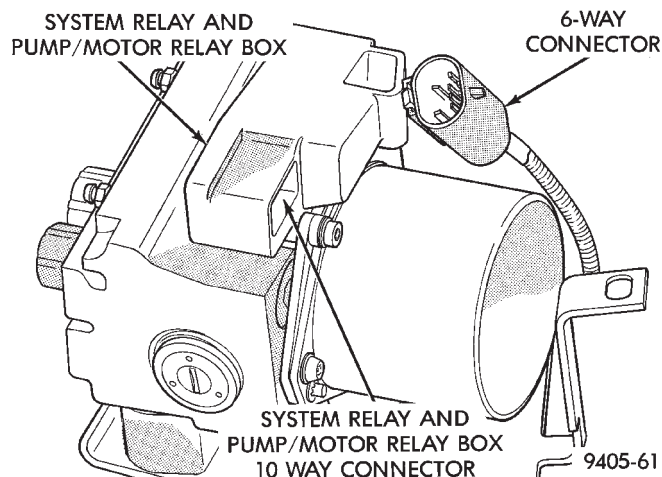


**Fig. 2 System Relay And Pump/Motor Relay Box**

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 VALVE

Two Proportioning Valves are used in the Allied Signal ABX-4 ABS system, one for each rear wheel brake hydraulic circuit. The proportioning valves function the same as in a standard brake system. The proportioning valves (Fig. 3) are located on the front of the HCU. The proportioning valve can be identified by the bar code label and stamp on the proportioning valve (Fig. 3). Be sure replacement proportioning valve has the same stamp as the proportioning valve being replaced.

## WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS) is located at each wheel (Fig. 4) and (Fig. 5), 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. 4) and (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

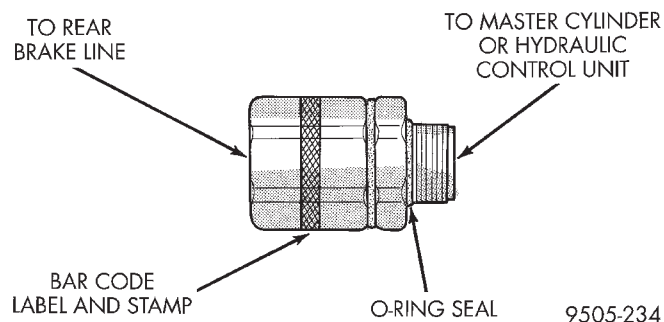


**Fig. 3 Proportioning Valve Identification**

pressure via the HCU to prevent the wheel(s) from locking.

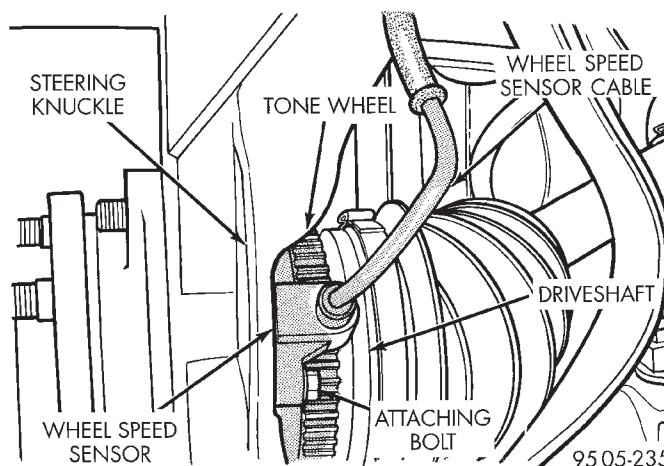


**Fig. 4 Front Wheel Speed Sensor And Tone Wheel**

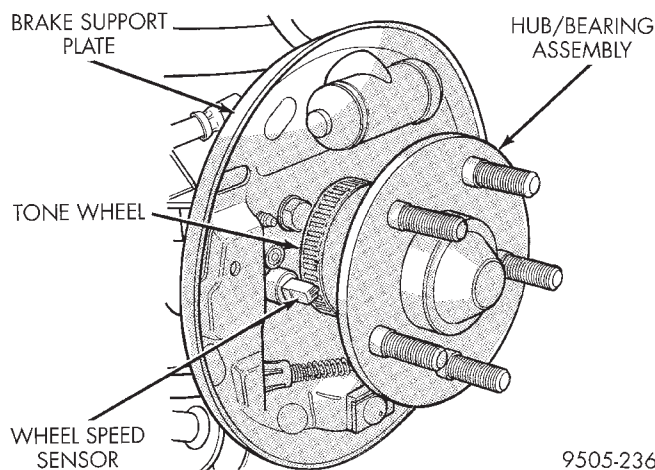


**Fig. 5 Rear Wheel Speed Sensor And Tone Wheel With Drum Brakes**

The front Wheel Speed Sensor is attached to a boss in the steering knuckle (Fig. 4). The tone wheel is part of the outboard constant velocity joint (Fig. 4). The rear Wheel Speed Sensor on rear drum brake applications is mounted to the rear brake support

## DESCRIPTION AND OPERATION (Continued)

plate (Fig. 5) and the rear tone wheel is an integral part of the rear wheel hub and bearing assembly.

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 BRAKES (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 in the right front corner of the engine compartment using an integral mounting bracket to attach it to the inner fender (Fig. 6). 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**

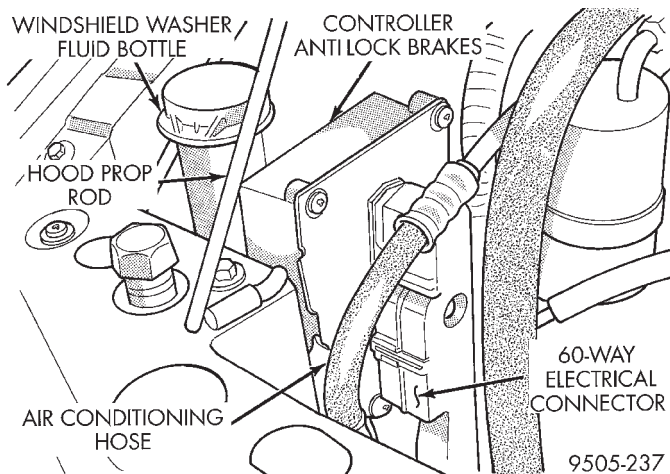


**Fig. 6 Location Of Controller Antilock Brake**

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 scan tool 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 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 scan tool. 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 scan tool, or they will be automatically cleared from the memory after a minimum of 3500 vehicle miles are accumulated.

**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. (Single line ISOK)
- Pump motor relay actuation
- Brake Lamp (Low Fluid/Pressure).

**ABS AMBER 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 4-5 seconds after the ignition switch is turned on). When the ABS warning lamp is on, only the ABS function of the brake system is affected. The standard brake system and the ability to stop the car will not be affected when only the ABS warning lamp is on.

**NOTE:** When the CAB detects a problem with the Amber Warning Lamp Circuit and a ABS fault is also detected at the same time, and results in shutting down the ABS Brakes, then the CAB will turn on the Red Brake Warning Lamp.

## DESCRIPTION AND OPERATION (Continued)

**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 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 Allied Signal ABX-4 Brake System. Specifically, this section should be used to help diagnose conditions which result in any of the following conditions:

- 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 Allied Signal 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 Allied Signal 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.

**ABS (DRB) DIAGNOSTIC CONNECTOR**

On this vehicle, the ABX-4 diagnostic connector is located under the lower instrument panel directly next to the left kick panel (Fig. 7). 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.

**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.

## DIAGNOSIS AND TESTING (Continued)

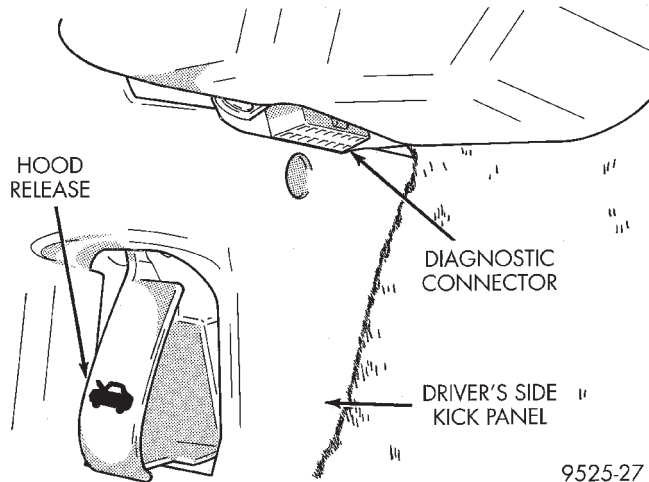


**Fig. 7 ABS System Diagnostic Connector Location**

#### 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 erased automatically is the (CAB) fault. 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 disap-

peared. Other faults are non-latching, 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,

## DIAGNOSIS AND TESTING (Continued)

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.

## HYDRAULIC SYSTEM PROPORTIONING VALVE

**CAUTION:** Proportioning valves (Fig. 8) should never be disassembled.

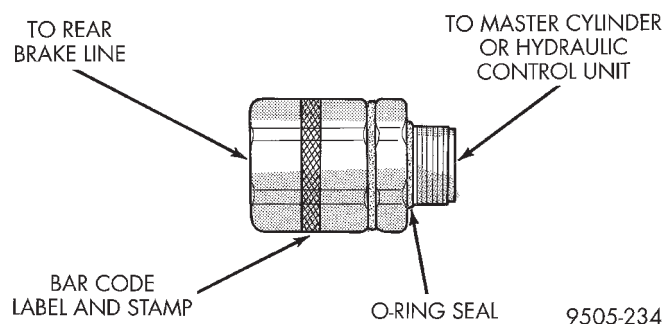


**Fig. 8 Proportioning Valve Identification**

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

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake. Therefore, a road test to determine which rear brake slides first is essential.

If a malfunctioning proportioning valve is suspected on a vehicle equipped with ABS brakes. Refer to Proportioning Valve Test With ABS Brakes in the Proportioning Valves 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.

## DIAGNOSIS AND TESTING (Continued)

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.

### ABS HYDRAULIC SYSTEM BLEEDING PROCEDURE INFORMATION

The base brake system must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake lines, hoses or components. The ABS system, particularly the HCU, should only be bled when the HCU is replaced or removed from the vehicle, or if there is reason to believe the HCU has ingested air. Under most circumstances that would require brake bleeding, only the base brake system needs to be bled.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During bleeding operations, be sure that the brake fluid level remains close to the FULL level in the reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The Allied Signal 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 scan tool 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 Adjustments section at the beginning of this group 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 scan tool to the diagnostics connector. The diagnostics connector is located under the lower instrument panel next to the left kick panel (Fig. 9).

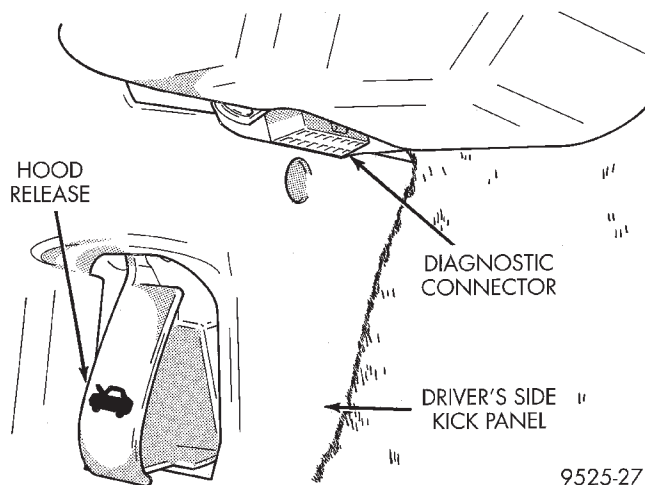


**Fig. 9 ABS System Diagnostic Connector Location**

(3) Using the DRB scan tool, check to make sure the CAB does not have any fault codes stored. If it does, remove them using the DRB scan tool.

## SERVICE PROCEDURES (Continued)

**WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.**

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in the Service Adjustments section of this service manual.

(5) Using the DRB scan tool, 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.

**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) Remove the remote ground cable from the ground stud located on the left strut tower (Fig. 10).

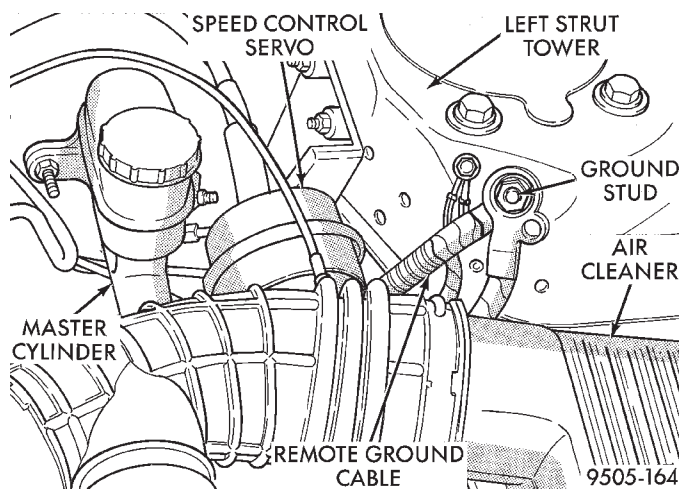


**Fig. 10 Remote Ground Cable Attachment To Strut Tower**

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 11). **This will prevent accidental grounding of the remote ground cable.**

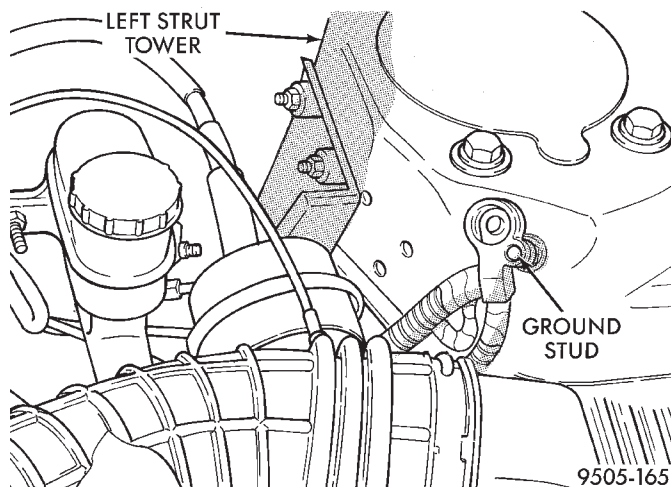


**Fig. 11 Correctly Isolated Remote Ground Cable**

(3) Using a brake pedal positioning tool such as shown in (Fig. 12) depress brake pedal past its first 1 inch of travel and hold in this position. This will iso-

## REMOVAL AND INSTALLATION (Continued)

late the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

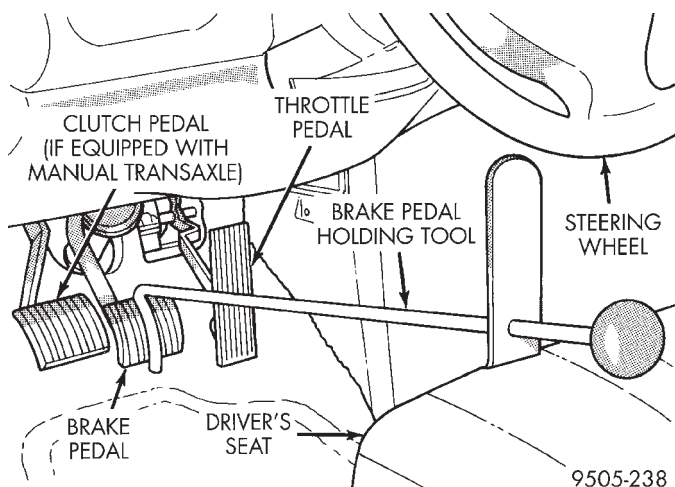


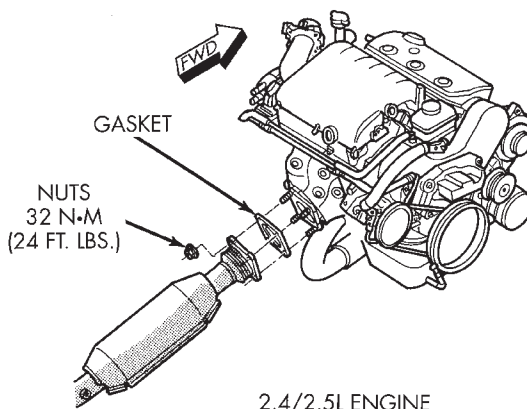
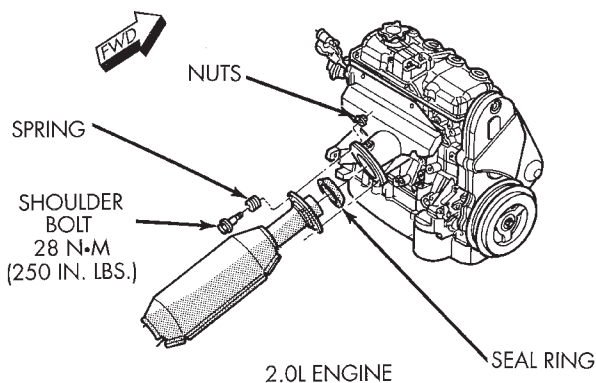
**Fig. 12 Brake Pedal Holding Tool Installed**

(4) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(5) Using Mopar, Brake Parts Cleaner or an equivalent, thoroughly clean all surfaces of the HCU. Also, thoroughly clean all brake line tube nut to HCU and proportioning valve connections.

(6) Remove the entire exhaust system from the vehicle as a complete assembly using following steps.

- Remove attaching bolts from exhaust pipe at exhaust manifold on engine (Fig. 13).
- Remove all exhaust system support/isolators from the vehicle's exhaust system (Fig. 14). Remove



9511-33

**Fig. 13 Exhaust Pipe Mounting To Exhaust Manifold**

support/isolators from brackets on exhaust system components and leave attached to body of vehicle.

- Lower exhaust system as a complete assembly away from the underbody of the vehicle.

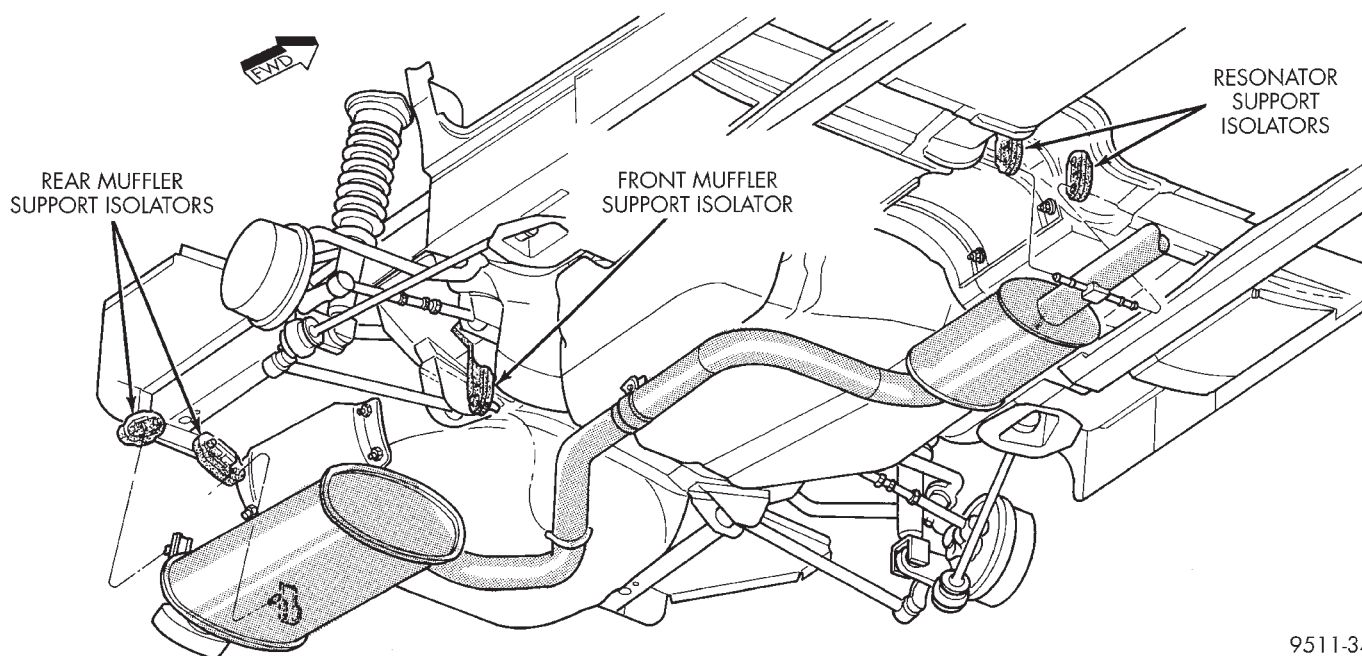


**Fig. 14 Exhaust System Support/Isolator Locations**

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## REMOVAL AND INSTALLATION (Continued)

(7) Remove right side engine compartment splash shield (Fig. 15) from the vehicle.

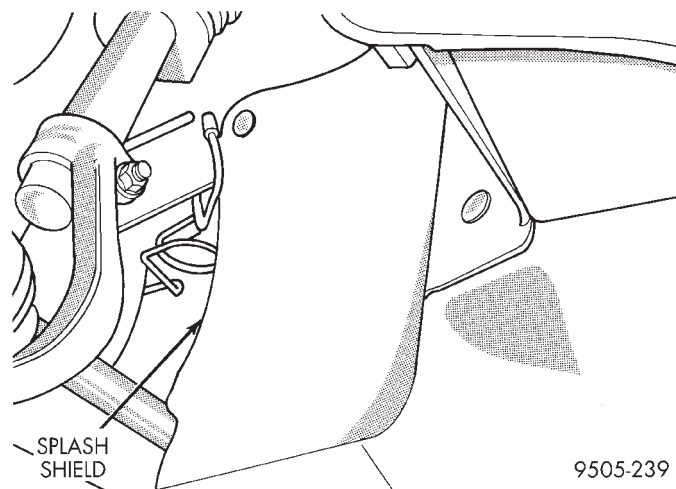


**Fig. 15 Right Side Splash Shield**

(8) Remove the HCU heat shield (Fig. 16) from the HCU mounting bracket.

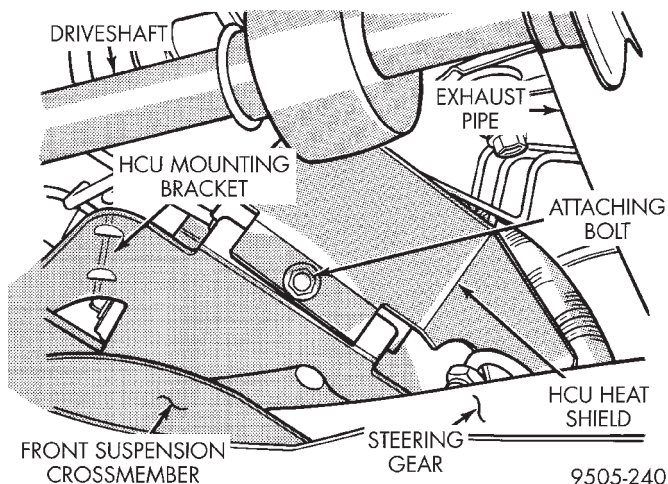


**Fig. 16 HCU Heat Shield**

(9) Disconnect the 6 way connector from the HCU wiring harness and the 10 way connector from the relay box located on the HCU (Fig. 17).

(10) Remove the brake tube routing clip (Fig. 18) from the HCU mounting bracket. Then remove the 2 brake tubes coming from master cylinder and the brake tube going to the left front wheel (Fig. 18) from the HCU ports.

(11) Remove the 2 rear brake tubes from the proportioning valves and the right front brake tube from the outlet port of the HCU (Fig. 19).

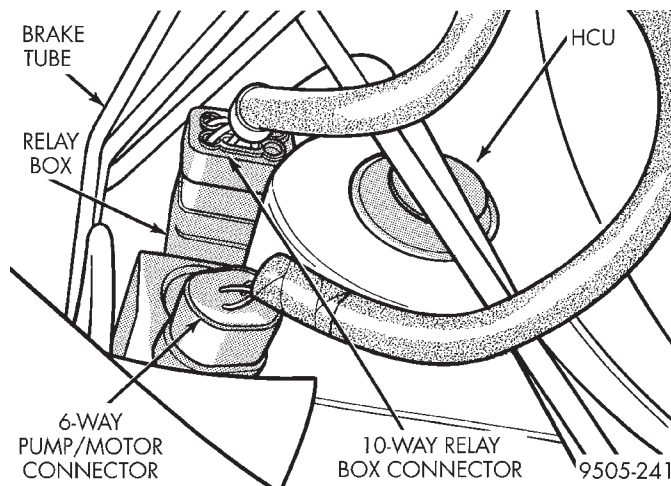


**Fig. 17 Electrical Connections At HCU And Relay Box**

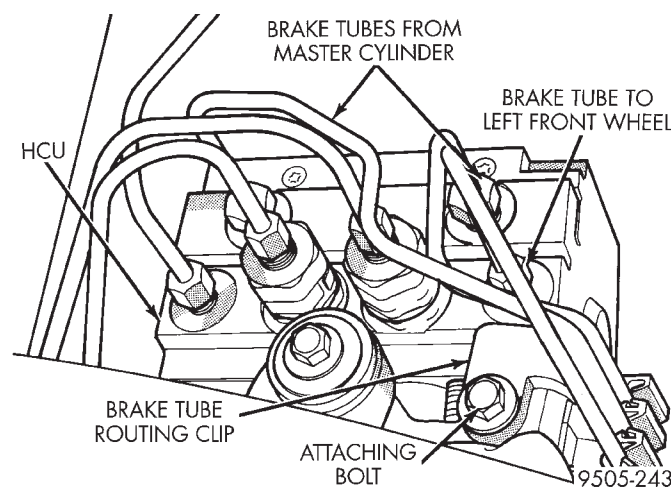


**Fig. 18 Brake Tubes At HCU**

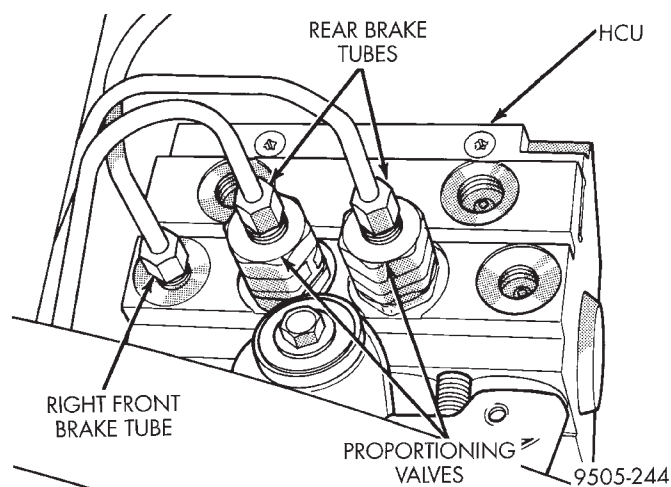


**Fig. 19 Rear Brake Tubes And Right Front Brake Tube At HCU**

## REMOVAL AND INSTALLATION (Continued)

(12) Remove bolt (Fig. 20) attaching the front of the HCU to its mounting bracket.

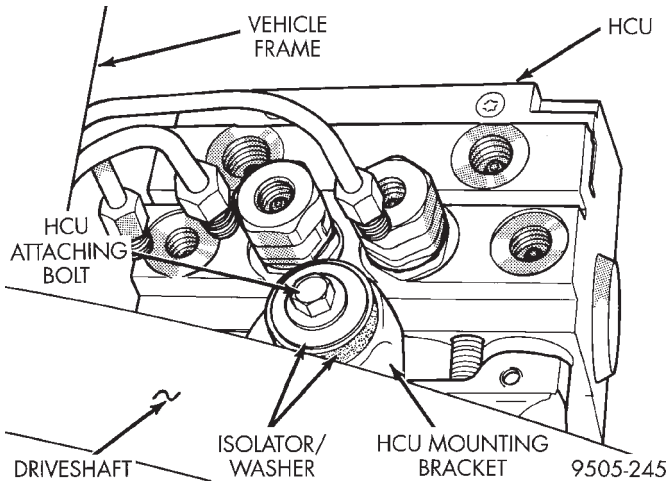


**Fig. 20 Front Attachment Of HCU To Mounting Bracket**

(13) Remove the 2 bolts (Fig. 21) attaching the rear of the HCU to its mounting bracket. **If vehicle being service is equipped with a 2.5 ltr. engine, remove the tube as indicated in (Fig. 21) and (Fig. 22). Removing this tube will make it easier to remove the HCU assembly from the vehicle.**

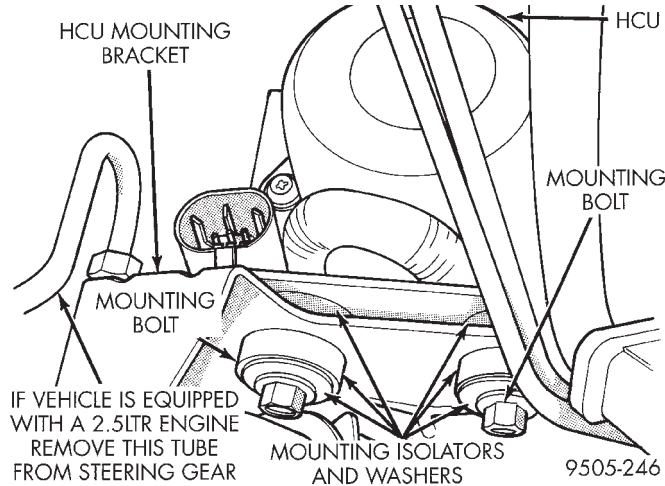


**Fig. 21 Rear Attachment Of HCU To Mounting Bracket**

(14) Remove HCU from its mounting bracket. Then remove HCU from vehicle out through the exhaust tunnel in the floor pan of the vehicle (Fig. 22).

## INSTALL

(1) Install the HCU back in the vehicle and on its mounting bracket using the reverse order of its removal.

(2) Install mounting isolators, washers and attaching bolts, (Fig. 21) mounting the rear of the HCU to

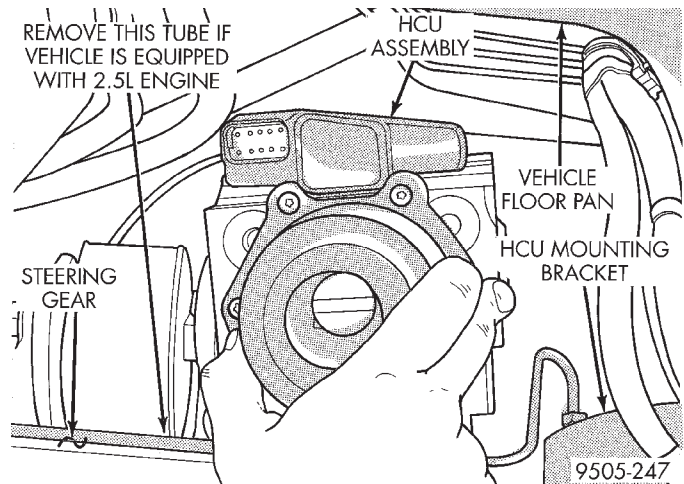


**Fig. 22 Removal Of HCU Assembly From Vehicle**

the mounting bracket. **Do not tighten bolts at this time.**

(3) Install mounting isolator, washer and attaching bolt, (Fig. 20) mounting the front of the HCU to the mounting bracket. **Do not tighten bolt at this time.**

(4) Then tighten the 3 HCU mounting bolts to a torque of 28 N·m (248 in. lbs.).

(5) Install the 2 rear brake tubes on the proportioning valves and the right front brake tube in the outlet port of the HCU (Fig. 19). Tighten the 3 brake tube nuts to a torque of 20 N·m (180 in. lbs.).

(6) Install the 2 brake tubes coming from master cylinder and the brake tube to the left front wheel (Fig. 18) in the HCU ports. Tighten the 3 brake tube nuts to a torque of 20 N·m (180 in. lbs.). Install the brake tube routing clip (Fig. 18) on the HCU mounting bracket and securely tighten attaching bolt.

(7) Install the 6 way connector on the HCU wiring harness and the 10 way connector on the relay box of the HCU (Fig. 17).

(8) Install the HCU heat shield (Fig. 16) on the HCU mounting bracket. Install and securely tighten attaching bolt.

(9) Install exhaust system in vehicle using the reverse steps of its removal.

(10) Install right side engine compartment splash shield (Fig. 15) back on the vehicle.

(11) Install the remote ground cable onto the ground stud located on left shock tower (Fig. 10). Install the remote ground cable attaching nut and tighten to a torque of 28 N·m (250 in. lbs.).

(12) Bleed the base brakes and the ABS brakes hydraulic system. Refer to the Bleeding ABS System in this section of the manual for the proper bleeding procedure.

(13) Road test vehicle to ensure proper operation of the base and ABS systems.

## REMOVAL AND INSTALLATION (Continued)

## HYDRAULIC SYSTEM PROPORTIONING VALVES

**CAUTION:** Proportioning valves (Fig. 23) should never be disassembled.

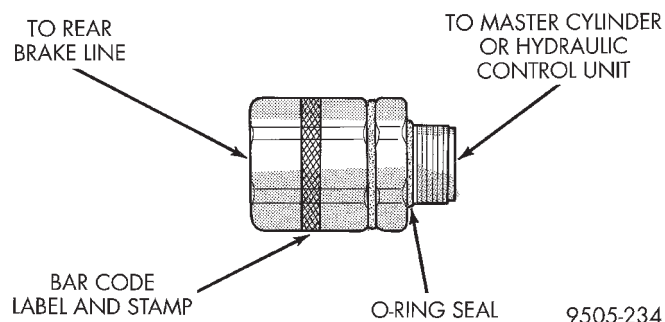


**Fig. 23 Proportioning Valve Identification**

The HCU does not require removal from the vehicle for the replacement of the proportioning valves.

## REMOVE

- (1) Disconnect brake tube fitting from proportioning valve requiring removal from HCU (Fig. 24).
- (2) Remove proportioning valve requiring replacement (Fig. 24) from the HCU.

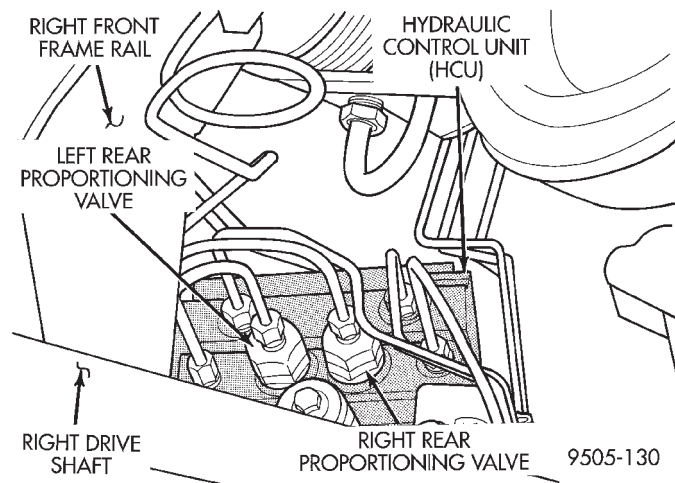


**Fig. 24 Rear Wheel Proportioning Valve Location On HCU**

## INSTALL

- (1) Wet O-ring seal on new proportioning valve using clean fresh brake fluid.
- (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 affected brake line. See Bleeding Brake System in the Service Procedures section of the manual for proper bleeding procedure.

## 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.

## HYDRAULIC CONTROL UNIT 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 the 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 in this group of the service manual, for the required removal procedure for the HCU.
- (3) Remove the 2 screws (Fig. 25) 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. 25).**

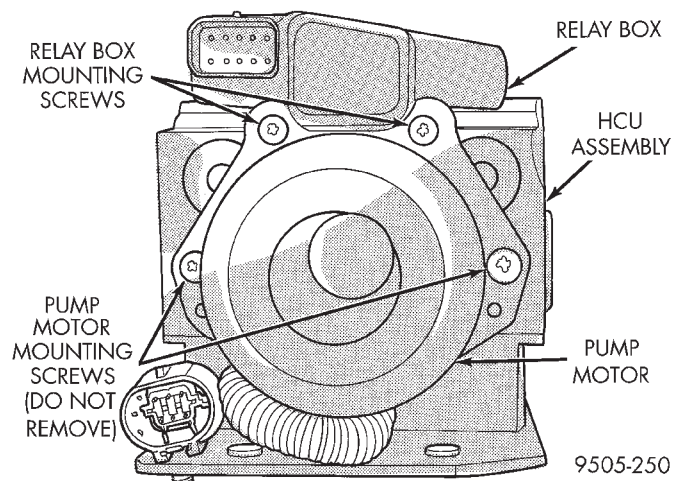


**Fig. 25 Relay Box To HCU Mounting Screws**

- (4) Grasp relay box with both hands. Without twisting or rocking, pull relay box away from pump motor housing until connector on relay box unplugs from the pump motor terminal (Fig. 26). **This is a tight connection, relay box will require a good amount of force to unplug it from the pump motor.**

- (5) Remove relay box from HCU.

## REMOVAL AND INSTALLATION (Continued)

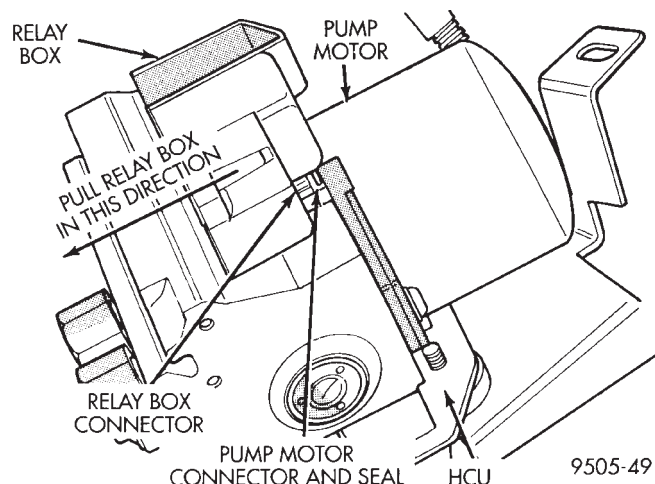


**Fig. 26 Relay Box To HCU Electrical Connection**

### INSTALL

(1) Be sure electrical connector seal (Fig. 27) 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.

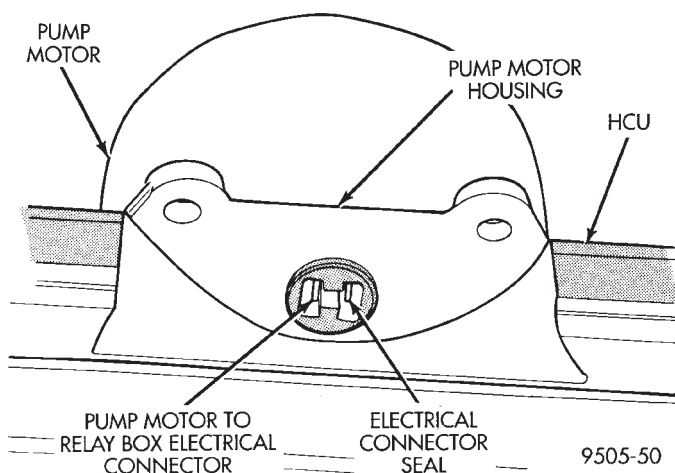


**Fig. 27 Pump Motor To Relay Box Electrical Connection Seal**

(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. 25) attaching the relay box assembly to the HCU.

(5) Install the HCU back in the vehicle. See Hydraulic Control Unit in the Removal And Installation Section in this group of the service manual, for the required installation procedure for the HCU.

(6) Connect the negative (-) ground cable back on the negative post of the battery.

(7) Bleed the base brakes and the ABS brakes hydraulic system. Refer to the Bleeding ABS System in this section of the manual for the proper bleeding procedure.

(8) Road test vehicle to ensure proper operation of the base and ABS systems.

## CONTROLLER ANTILOCK BRAKES (CAB)

The CAB is located in the right front corner of the engine compartment (Fig. 28). It is mounted to the vehicle using an integral mounting bracket, which is attached by 2 bolts, to the inner fender and the front crossmember.

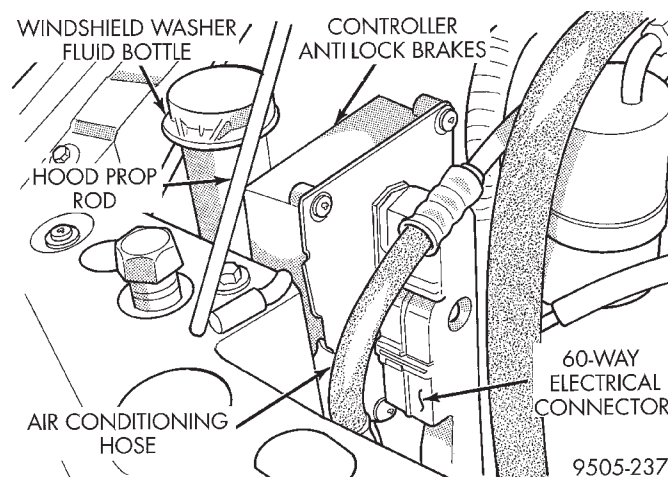


**Fig. 28 Controller Antilock Brake (CAB) Location**

### REMOVE

(1) Turn vehicle ignition off.

(2) Disconnect the wiring harness 60 way connector (Fig. 29) from the Controller Antilock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

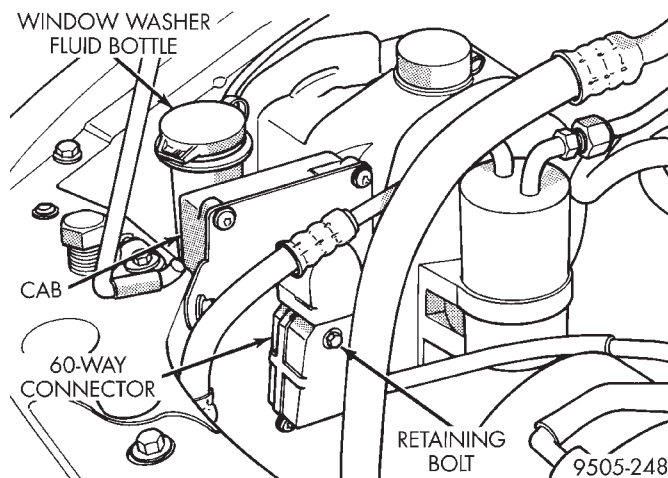


**Fig. 29 CAB 60-Way Wiring Harness Connector**

## REMOVAL AND INSTALLATION (Continued)

(3) Remove the 2 bolts (Fig. 30) attaching the CAB mounting bracket to inner fender and front upper crossmember.

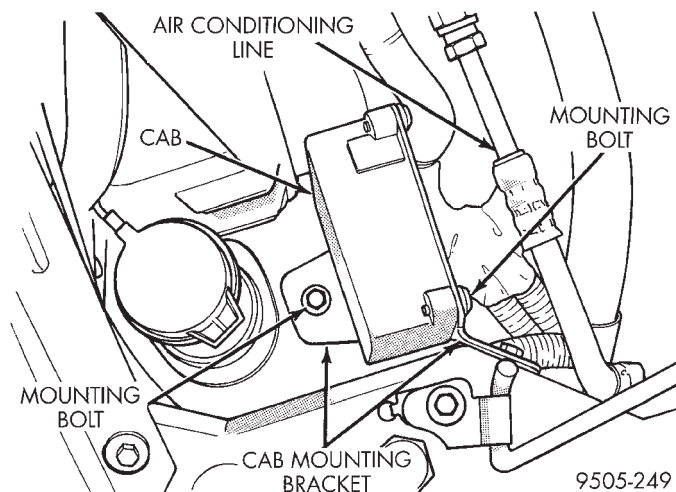


**Fig. 30 CAB Bracket To Engine Compartment Mounting**

(4) Remove the CAB from the vehicle.

## INSTALL

(1) Install the CAB and the mounting bracket assembled, on the right inner fender of the vehicle. (Fig. 30).

(2) Install the 2 bolts mounting the CAB bracket to the vehicle. Tighten both mounting bolts to a torque of 9 N·m (75 in. lbs.).

(3) Install 60-way wiring harness connector (Fig. 29) into the CAB 60-way connector by hand until seated as far as possible. Then use CAB connector retaining bolt (Fig. 29) to fully seat wiring harness connector into the CAB.

(4) Tighten the 60-way connector retaining bolt (Fig. 29) to a torque of 4 N·m (35 in. lbs.).

## FRONT WHEEL SPEED SENSOR

## 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 the speed sensor cable routing bracket (Fig. 31) from the steering knuckle. Remove the wiring harness sealing grommet retainer and speed sensor routing bracket from the inner fender.

(4) Remove speed sensor sealing grommet from the inner fender (Fig. 32). Then unplug the speed sensor cable from the vehicle wiring harness (Fig. 32).

(5) Remove bolt (Fig. 33) attaching the speed sensor head to the steering knuckle. Then remove speed sensor head from steering knuckle

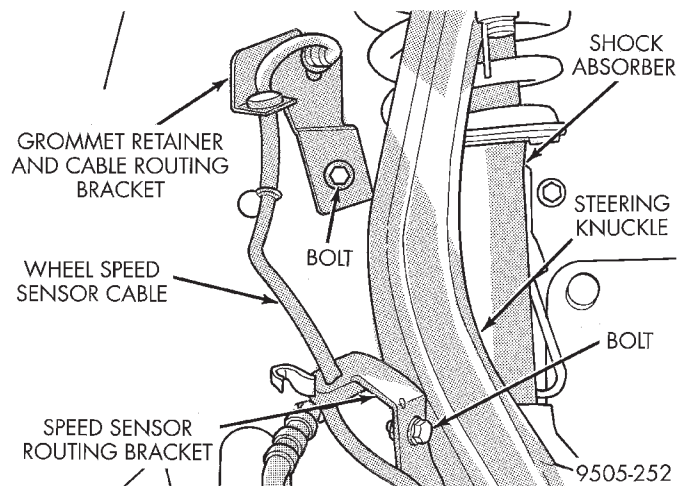


**Fig. 31 Speed Sensor Cable Routing Brackets**

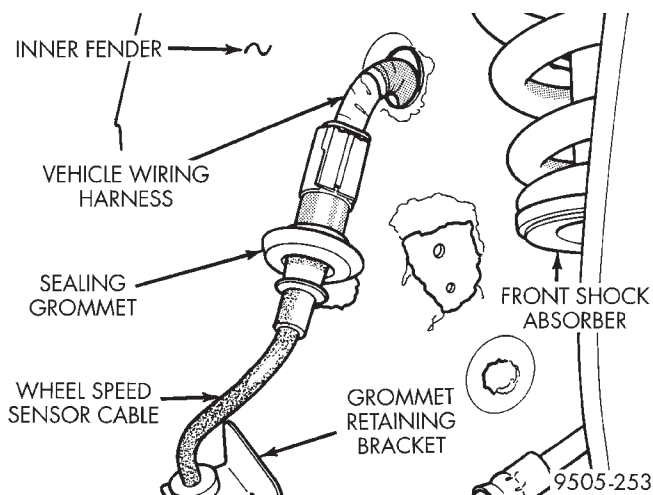


**Fig. 32 Wheel Speed Sensor Connection To Vehicle Wiring Harness**

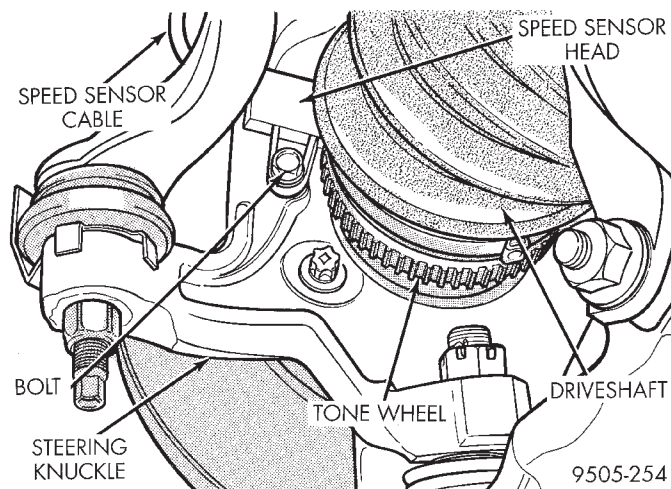


**Fig. 33 Speed Sensor Head Attachment To Steering Knuckle**

## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** If speed sensor head locating pin has seized to the steering knuckle, do not attempt to remove speed sensor head by grasping with pliers and turning. This will damage the speed sensor head. Use only the following procedure.

(6) If speed sensor head can not be removed from steering knuckle by hand, the locating pin on the speed sensor head has seized to the steering knuckle do to corrosion. Remove speed sensor head from steering knuckle using the following procedure. Remove disc brake caliper from steering knuckle, and remove brake rotor from hub/bearing assembly. Then insert a pin punch through hole in front steering knuckle (Fig. 34) and tap speed sensor head locating pin out of steering knuckle.

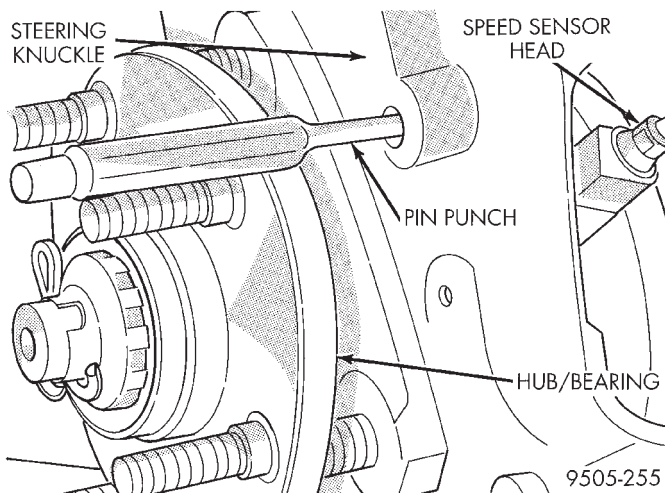


**Fig. 34 Speed Sensor Head Removal From Steering Knuckle**

## INSTALL

**CAUTION:** Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Connect the wheel speed sensor cable connector to the vehicle wiring harness (Fig. 32).

(2) Install the speed sensor cable assembly grommet into the front inner fender (Fig. 31). Install speed sensor cable grommet retainer/routing bracket on the inner fender of the vehicle and install and securely tighten attaching bolt (Fig. 31).

**CAUTION:** When installing the wheel speed sensor cable routing bracket on the steering knuckle, (Fig. 31) the speed sensor cable must be looped toward the shock absorber as shown in (Fig. 35). If speed

sensor cable is not routed in this direction it will rub against the tire or wheel, damaging the speed sensor cable.

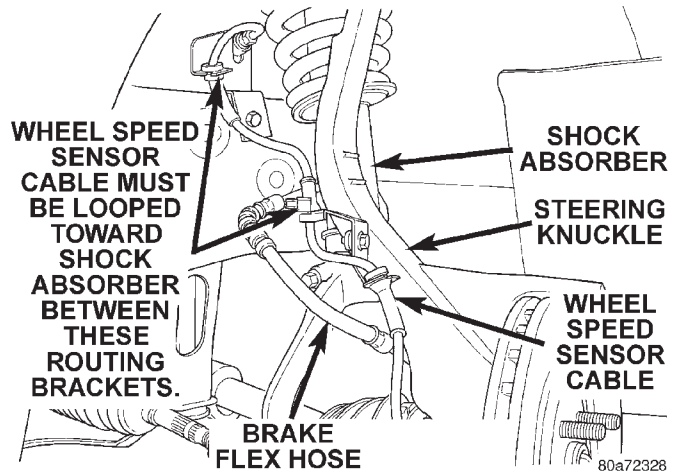


**Fig. 35 Correct Front Wheel Speed Sensor Cable Routing**

(3) Install the speed sensor cable routing bracket on the steering knuckle. Install and tighten routing bracket mounting bolt to a torque of 12 N·m (105 in. lbs.)

(4) Install speed sensor head on steering knuckle (Fig. 36). When installing speed sensor head on steering knuckle, apply a small amount of grease on speed sensor locating pin (Fig. 36). Use Mopar, Multi-Purpose Grease or an equivalent on speed sensor head locating pin. Install the speed sensor head attaching screw and tighten to a torque of 6 N·m (55 in. lbs.).

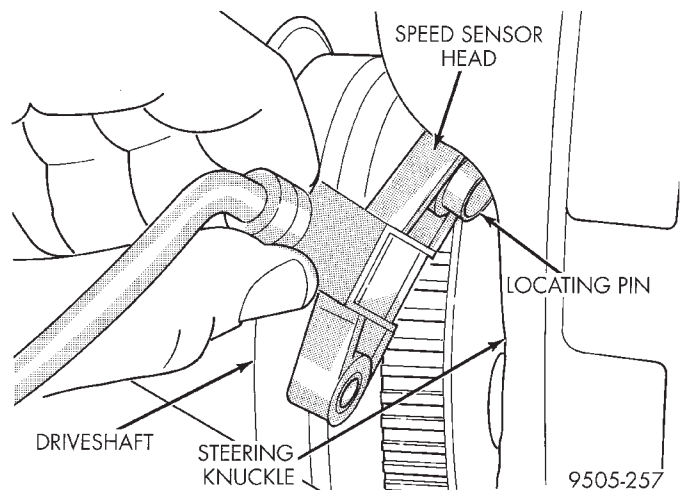


**Fig. 36 Installing Speed Sensor Head In Steering Knuckle**

(5) Install the wheel and tire assembly on vehicle.

(6) Road test vehicle to ensure proper operation of the base and ABS systems.

## REMOVAL AND INSTALLATION (Continued)

## REAR WHEEL SPEED SENSORS

## REMOVE

(1) Unplug the speed sensor cable connector from the vehicle wiring harness (Fig. 37). **Access for speed sensor cable to vehicle wiring harness connection is in the trunk of the vehicle.**

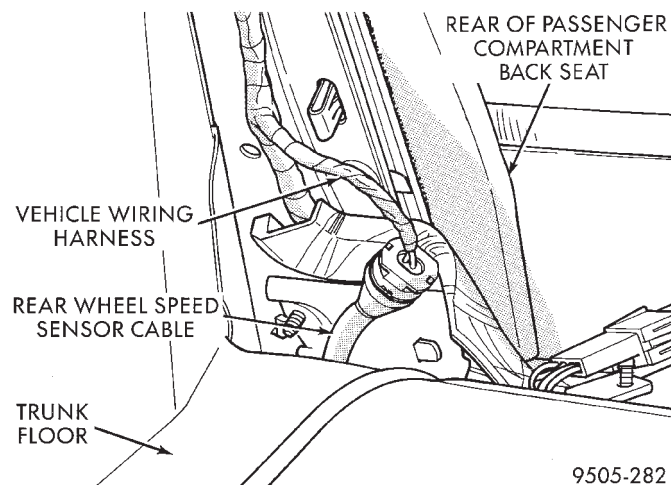


**Fig. 37 Rear Speed Sensor Cable Connection To Vehicle Wiring Harness**

(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 the rear tire and wheel assembly from the vehicle.

(4) Remove speed sensor cable sealing grommet retainer (Fig. 38) from the rear frame rail of the vehicle. Then remove speed sensor cable sealing grommet and cable from hole in body of vehicle.

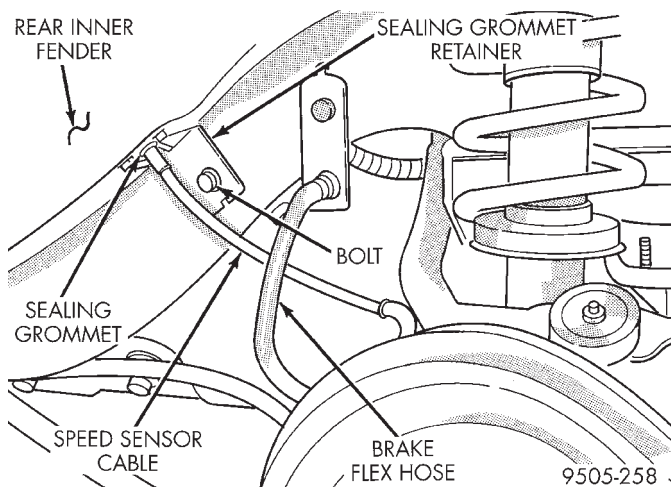


**Fig. 38 Rear Speed Sensor Cable Attachment To Body**

(5) Remove speed sensor routing clips from the rear upper control arm and brake flex hose routing bracket (Fig. 39).

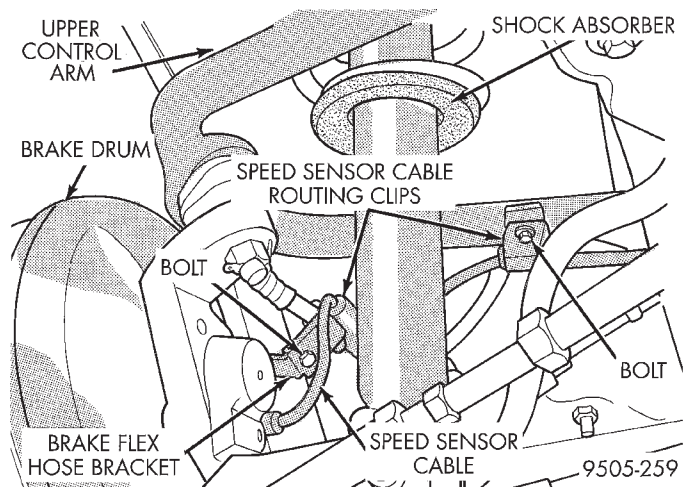


**Fig. 39 Speed Sensor Cable Attachment To Rear Suspension**

(6) Remove the rear speed sensor head from the rear brake support plate (Fig. 40).

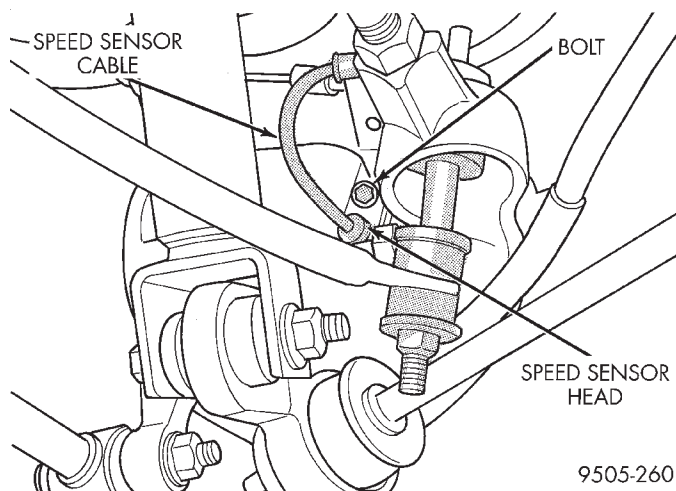


**Fig. 40 Rear Speed Sensor Head Attachment To Brake Support Plate**

## INSTALL

**CAUTION:** Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Install speed sensor head into brake support plate (Fig. 40).

## REMOVAL AND INSTALLATION (Continued)

(2) Install wheel speed sensor attaching bolt (Fig. 40). Tighten the speed sensor head attaching bolt to 8 N·m (75 in. lbs.)

(3) Install speed sensor cable routing clips (Fig. 39) on the brake flex hose bracket and the bracket on the upper control arm. Install and securely tighten the routing clip attaching bolts.

(4) Install connector end of speed sensor cable through hole in inner fender and into trunk of vehicle.

(5) Install speed control sealing grommet into hole in inner fender. Install the sealing grommet retainer and attaching bolt (Fig. 38) on rear frame rail. Securely tighten retainer attaching bolt.

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

(7) Lower vehicle.

(8) Plug speed sensor cable connector into vehicle wiring harness (Fig. 37). **Install foam sleeve back over the speed sensor cable to vehicle wiring harness connection to prevent connector from rattling against body of vehicle.**

(9) 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 0.15 mm (.006 in.).

### WHEEL SPEED SENSOR TO TONE WHEEL CLEARANCE

#### FRONT WHEEL

Minimum Clearance .35mm (.014 in.)  
Maxamum Clearance 1.2 mm (.047 in.)

#### REAR WHEEL

Minimum Clearance .40mm (.016 in.)  
Maxamum Clearance 1.2 mm (.047 in.)

## BRAKE FASTENER TORQUE SPECIFICATIONS

| DESCRIPTION                                      | TORQUE                        |
|--------------------------------------------------|-------------------------------|
| <b>BRAKE TUBES:</b>                              |                               |
| Tube Nuts To Fittings And Components . . . . .   | 20 N·m (180 in. lbs.)         |
| <b>BRAKE HOSE:</b>                               |                               |
| Front Caliper Banjo Bolt . . . . .               | 48 N·m (35 ft. lbs.)          |
| Rear Intermediate Bracket . . . . .              | 11 N·m (100 in. lbs.)         |
| Front And Rear Brackets To Frame Rails . . . . . | 10 N·m (95 in. lbs.)          |
| <b>MASTER CYLINDER:</b>                          |                               |
| To Vacuum Booster Mounting Nut . . . . .         | 28 N·m (250 in. lbs.)         |
| <b>BRAKE BOOSTER:</b>                            |                               |
| To Dash Panel Mounting Nuts . . . . .            | 37 N·m (27 ft. lbs.)          |
| <b>BRAKE PEDAL</b>                               |                               |
| To Dash Panel Plenum Mounting Nut . . . . .      | 37 N·m (27 ft. lbs.)          |
| Shaft To Brake Pedal Bracket Nut . . . . .       | 34 N·m (25 ft. lbs.)          |
| <b>REAR WHEEL CYLINDER:</b>                      |                               |
| To Support Plate Mounting Bolts . . . . .        | 13 N·m (115 in. lbs.)         |
| Bleeder Screw . . . . .                          | 10 N·m (90 in. lbs.)          |
| <b>BRAKE SUPPORT PLATE:</b>                      |                               |
| To Axle Mounting Bolts . . . . .                 | 75 N·m (55 ft. lbs.)          |
| <b>DISC BRAKE CALIPER:</b>                       |                               |
| Guide Pin Bolts . . . . .                        | 22 N·m (16 ft. lbs.)          |
| Bleeder Screw . . . . .                          | 20 N·m (15 ft. lbs.)          |
| <b>ABS HYDRAULIC CONTROL UNIT:</b>               |                               |
| To Mounting Bracket Bolts . . . . .              | 28 N·m (250 in. lbs.)         |
| Bracket To Crossmember Mounting Bolts . . . . .  | 28 N·m (250 in. lbs.)         |
| <b>PARKING BRAKE:</b>                            |                               |
| Lever Mounting Nuts . . . . .                    | 24 N·m (18 ft. lbs.)          |
| <b>REAR HUB AND BEARING:</b>                     |                               |
| To Knuckle Retaining Nut . . . . .               | 250 N·m (185 ft. lbs.)        |
| <b>WHEEL:</b>                                    |                               |
| Stud Lug Nut . . . . .                           | 115–155 N·m (85–115 ft. lbs.) |

