

# BRAKES

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## BRAKES - BASE

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**BRAKES - BASE****SPECIFICATIONS****BASE BRAKE***SPECIFICATIONS*

| DESCRIPTION                                          | SPECIFICATION              |
|------------------------------------------------------|----------------------------|
| Front/Rear Disc Brake Caliper Type                   | Dual Piston Sliding        |
| Front Disc Brake Caliper Piston Diameter HD          | 56 mm (2.00 in.)           |
| Front Disc Brake Rotor                               | 326.5×36 mm (12.5×1.5 in.) |
| Front/Rear Disc Brake Rotor Max. Runout              | 0.127 mm (0.005 in.)       |
| Front/Rear Disc Brake Rotor Max. Thickness Variation | 0.025 mm (0.001 in.)       |

| DESCRIPTION                                          | SPECIFICATION          |
|------------------------------------------------------|------------------------|
| Minimum Front Rotor Thickness                        | 33.90 mm (1.334 in.)   |
| Minimum Rear Rotor Thickness                         | 28.39 mm (1.117 in.)   |
| Rear Disc Brake Caliper 2500                         | 2x45 mm (1.77 in.)     |
| Rear Disc Brake Caliper 3500                         | 2x51 mm (2.00 in.)     |
| Rear Disc Brake Rotor 2500/3500                      | 323.5x30 mm (1.18 in.) |
| Brake Booster Type 2500 Gasoline Engines             | Vacuum Dual Diaphragm  |
| Brake Booster Type All 3500/2500 Diesel Engines Only | Hydraulic              |

## BRAKES - BASE (Continued)

## TORQUE CHART

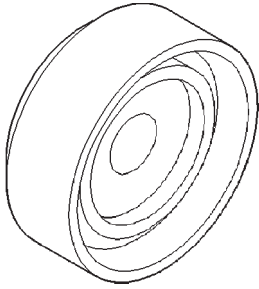
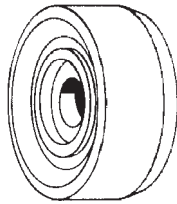
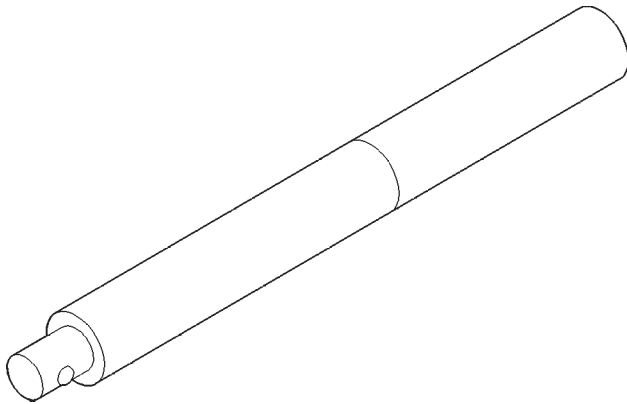
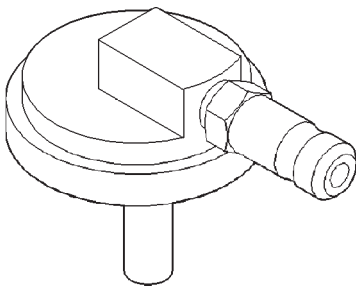
## TORQUE SPECIFICATIONS

| DESCRIPTION                                         | N·m | Ft. Lbs. | In. Lbs. |
|-----------------------------------------------------|-----|----------|----------|
| Booster<br>Mounting Nuts To<br>Dashpanel            | 28  | 21       | 250      |
| Master Cylinder<br>Mounting Nuts                    | 23  | 17       | 200      |
| Master Cylinder<br>Brake Lines                      | 21  | 16       | 190      |
| Combination Valve<br>Mounting Bolt                  | 23  | 17       | 210      |
| Combination Valve<br>Brake Lines                    | 21  | 16       | 190      |
| Proportioning Valve<br>Mounting Nuts                | 34  | 25       | 300      |
| Proportioning Valve<br>Brake Hose                   | 31  | 23       | 276      |
| Proportioning Valve<br>Brake Lines                  | 21  | 16       | 190      |
| Front Caliper<br>Mounting Bolts                     | 33  | 24       | —        |
| Front Caliper<br>HD Adapter Bolts                   | 285 | 210      | —        |
| Rear Caliper<br>Slide Pins                          | 33  | 24       | 300      |
| Rotor to Hub Rear<br>Bolt                           | 128 | 95       | —        |
| All Caliper<br>Banjo Bolts                          | 40  | 30       | 360      |
| Support Plate<br>Mounting Bolts                     | 58  | 43       | —        |
| Park Brake Pedal<br>Assembly<br>Mounting Bolts/Nuts | 28  | 21       | 250      |
| Hub/Bearing<br>HD 4x2 Spindle Nut                   | 380 | 280      | —        |
| Hub/Bearing<br>4x4 Hub/Bearing Bolts                | 170 | 125      | —        |

## BRAKES - BASE (Continued)

## SPECIAL TOOLS

## BASE BRAKES

*Installer, Brake Caliper Dust Boot C-4340**Installer, Brake Caliper Dust Boot C-3716-A**Handle C-4171**Cap, Master Cylinder Pressure Bleed 6921*

## HYDRAULIC/MECHANICAL

## DESCRIPTION

This vehicle is equipped with front disc brakes and rear drum brakes also certain vehicles have four wheel disc brakes. The front and rear disc brakes consist of dual piston calipers and ventilated rotors. The rear brakes are dual brake shoe, internal expanding units with cast brake drums. The parking brake mechanism is cable operated and connected to the rear brake trailing shoes. Power brake assist is standard equipment. A vacuum operated power brake booster is used on gas engine vehicles. A hydraulic booster is used on diesel engine vehicles.

Two antilock brake systems are used on this vehicle. A rear wheel antilock (RWAL) brake system and all-wheel antilock brake system (ABS). The RWAL and ABS systems are designed to retard wheel lockup while braking. Retarding wheel lockup is accomplished by modulating fluid pressure to the wheel brake units. Both systems are monitored by a microprocessor which controls the operation of the systems.

## WARNING

**WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF ASBESTOS FIBERS FROM BRAKE COMPONENTS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WITH A WATER DAMPENED CLOTH. DO NOT SAND, OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DISPOSE OF ALL RESIDUE CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE EXPOSURE TO YOURSELF AND OTHERS. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.**

## HYDRAULIC/MECHANICAL (Continued)

**CAUTION:** Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.

**CAUTION:** Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.

**CAUTION:** Use Mopar multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.

## DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, wheel cylinders, brake drums, rotors, brake lines, master cylinder, booster, and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, or vacuum operated component.

The first diagnosis step is the preliminary check.

### PRELIMINARY BRAKE CHECK

(1) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.

(2) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.

(3) Inspect brake fluid level and condition. Note that the brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**

(a) If fluid level is abnormally low, look for evidence of leaks at calipers, wheel cylinders, brake lines, and master cylinder.

(b) If fluid appears contaminated, drain out a sample to examine. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals and cups will also have to be replaced after flushing. Use clean brake fluid to flush the system.

(4) Check parking brake operation. Verify free movement and full release of cables and pedal. Also note if vehicle was being operated with parking brake partially applied.

(5) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(6) Check booster vacuum check valve and hose.

(7) If components checked appear OK, road test the vehicle.

## ROAD TESTING

(1) If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

(2) Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under constant foot pressure.

(3) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.

(4) Attempt to stop the vehicle with the parking brake only and note grab, drag, noise, etc.

### PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper/wheel cylinder. If leakage is severe, fluid will be evident at or around the leaking component.

Internal leakage (seal by-pass) in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

An internal leak in the ABS or RWAL system may also be the problem with no physical evidence.

### LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, worn linings, rotors, drums, or rear brakes out of adjustment are the most likely causes. The proper course of action is to inspect and replace all worn component and make the proper adjustments.

## HYDRAULIC/MECHANICAL (Continued)

**SPONGY PEDAL**

A spongy pedal is most often caused by air in the system. However, thin brake drums or substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, and replace thin drums and substandard quality brake hoses if suspected.

**HARD PEDAL OR HIGH PEDAL EFFORT**

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty.

**PEDAL PULSATION**

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums. Other causes are loose wheel bearings or calipers and worn or damaged tires.

**NOTE:** Some pedal pulsation may be felt during ABS/EBD activation.

**BRAKE DRAG**

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Common causes of brake drag are:

- Seized or improperly adjusted parking brake cables
- Loose/worn wheel bearing
- Seized caliper or wheel cylinder piston
- Caliper binding on damaged or missing anti-rattle clips or bushings
- Loose caliper mounting
- Drum brake shoes binding on worn/damaged support plates
- Mis-assembled components

- Long booster output rod

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

**BRAKE FADE**

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

**BRAKE PULL**

Front brake pull condition could result from:

- Contaminated lining in one caliper
- Seized caliper piston
- Binding caliper
- Loose caliper
- Damaged anti-rattle clips
- Improper brake shoes
- Damaged rotor

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

**REAR BRAKE GRAB OR PULL**

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or proportioning valve could be at fault.

**BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES**

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a

## HYDRAULIC/MECHANICAL (Continued)

mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and/or replacement will be necessary.

### BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or wheel cylinders, worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

### WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

### BRAKE NOISES

Some brake noise is common with rear drum brakes and on some disc brakes during the first few stops after a vehicle has been parked overnight or stored. This is primarily due to the formation of trace corrosion (light rust) on metal surfaces. This light corrosion is typically cleared from the metal surfaces after a few brake applications causing the noise to subside.

### BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors and drums can become so scored that replacement is necessary.

### BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

### THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brake shoes can also produce a thump noise.

## STANDARD PROCEDURE

### STANDARD PROCEDURE - MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

- (1) Remove reservoir filler caps and fill reservoir.
- (2) If calipers, or wheel cylinders were overhauled, open all caliper and wheel cylinder bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.
- (3) Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 1). Be sure end of bleed hose is immersed in fluid.

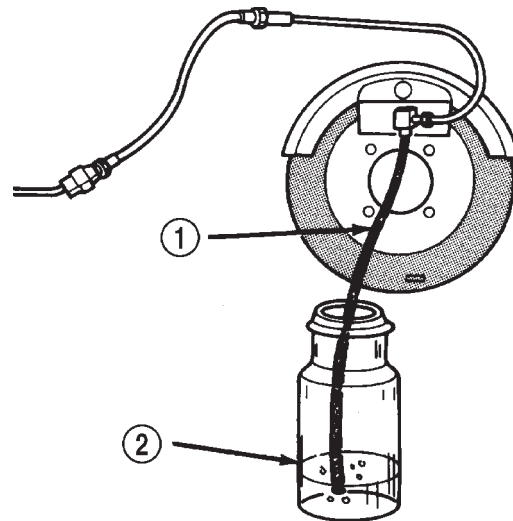


**Fig. 1 Bleed Hose Setup**

J8905-18

- 1 - BLEED HOSE
- 2 - FLUID CONTAINER PARTIALLY FILLED WITH FLUID

- (4) Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

## HYDRAULIC/MECHANICAL (Continued)

**STANDARD PROCEDURE - PRESSURE BLEEDING**

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

If pressure bleeding equipment will be used, the front brake metering valve will have to be held open to bleed the front brakes. The valve stem is located in the forward end or top of the combination valve. The stem must either be pressed inward, or held outward slightly. A spring clip tool or helper is needed to hold the valve stem in position.

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

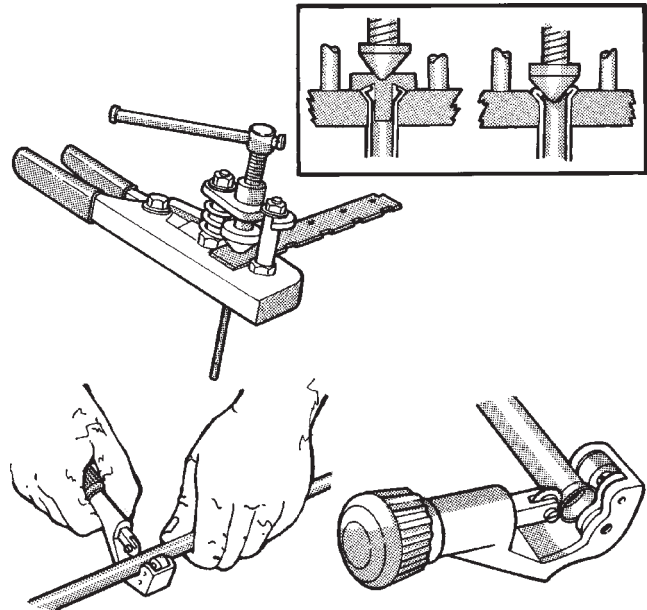
Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

**BRAKE LINES****STANDARD PROCEDURE****STANDARD PROCEDURE - DOUBLE INVERTED FLARING**

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

- (1) Cut off damaged tube with Tubing Cutter.
- (2) Ream cut edges of tubing to ensure proper flare.
- (3) Install replacement tube nut on the tube.
- (4) Insert tube in flaring tool.
- (5) Place gauge form over the end of the tube.
- (6) Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.
- (7) Tighten the tool bar on the tube
- (8) Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc (Fig. 2).
- (9) Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.
- (10) Remove the plug gauge and complete the inverted flare.



RH222

**Fig. 2 Inverted Flare Tools****STANDARD PROCEDURE - ISO FLARING**

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

To make a ISO flare use an ISO flaring tool kit.

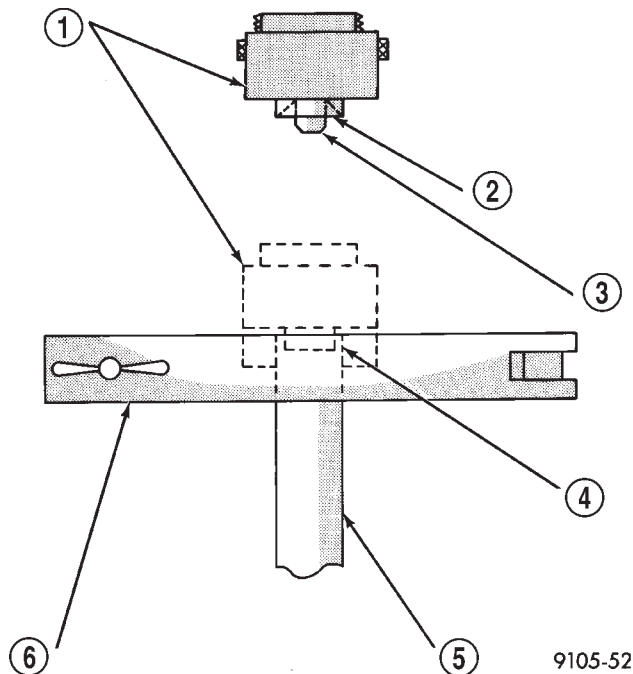
- (1) Cut off damaged tube with Tubing Cutter.
- (2) Remove any burrs from the inside of the tube.
- (3) Install tube nut on the tube.
- (4) Position the tube in the flaring tool flush with the top of the tool bar (Fig. 3). Then tighten the tool bar on the tube.
- (5) Install the correct size adaptor on the flaring tool yoke screw.
- (6) Lubricate the adaptor.
- (7) Align the adaptor and yoke screw over the tube (Fig. 3).
- (8) Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

**COMBINATION VALVE****DESCRIPTION**

The combination valve/rear brake proportioning valve are not repairable and must be replaced as an assembly.

The pressure differential switch is connected to the brake warning lamp.

## COMBINATION VALVE (Continued)

**Fig. 3 ISO Flaring**

- 1 - ADAPTER
- 2 - LUBRICATE HERE
- 3 - PILOT
- 4 - FLUSH WITH BAR
- 5 - TUBING
- 6 - BAR ASSEMBLY

**OPERATION****PRESSURE DIFFERENTIAL SWITCH**

The switch is triggered by movement of the switch valve. The purpose of the switch is to monitor fluid pressure in the separate front/rear brake hydraulic circuits.

A decrease or loss of fluid pressure in either hydraulic circuit will cause the switch valve to shuttle forward or rearward in response to the pressure differential. Movement of the switch valve will push the switch plunger upward. This closes the switch internal contacts completing the electrical circuit to the warning lamp. The switch valve may remain in an actuated position until repair restores system pressures to normal levels.

**DIAGNOSIS AND TESTING - COMBINATION VALVE****Pressure Differential Switch**

- (1) Have helper sit in drivers seat to apply brake pedal and observe red brake warning light.
- (2) Raise vehicle on hoist.

(3) Connect bleed hose to a rear wheel cylinder and immerse hose end in container partially filled with brake fluid.

(4) Have helper press and hold brake pedal to floor and observe warning light.

(a) If warning light illuminates, switch is operating correctly.

(b) If light fails to illuminate, check circuit fuse, bulb, and wiring. The parking brake switch can be used to aid in identifying whether or not the brake light bulb and fuse is functional. Repair or replace parts as necessary and test differential pressure switch operation again.

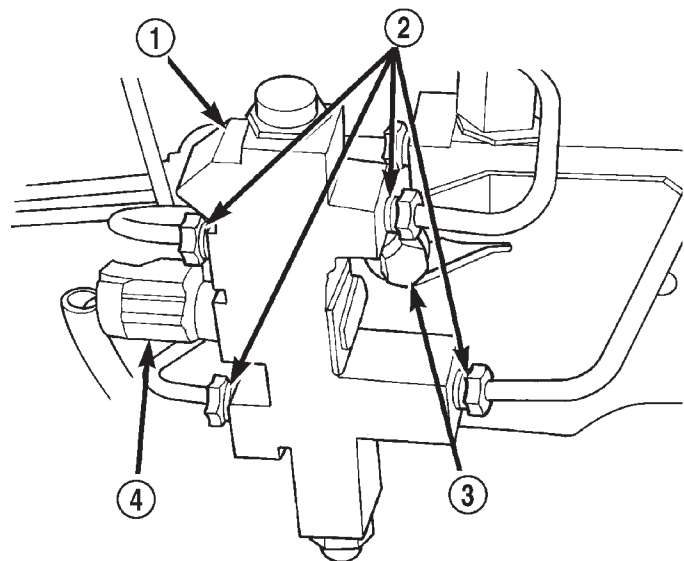
(5) If warning light still does not illuminate, switch is faulty. Replace combination valve assembly, bleed brake system and verify proper switch and valve operation.

**REMOVAL**

(1) Remove pressure differential switch wire connector (Fig. 4) from the valve.

(2) Remove the brake lines from the valve.

(3) Remove the valve mounting bolt and remove the valve from the bracket.



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**Fig. 4 Pressure**

- 1 - COMBINATION VALVE
- 2 - BRAKE LINES
- 3 - MOUNTING BOLT
- 4 - PRESSURE DIFFERENTIAL SWITCH

**INSTALLATION**

(1) Position the valve on the bracket and install the mounting bolt. Tighten the mounting bolt to 23 N·m (210 in. lbs.).

(2) Install the brake lines into the valve and tighten to 19-23 N·m (170-200 in. lbs.).

## COMBINATION VALVE (Continued)

(3) Connect the pressure differential switch wire connector.

(4) Bleed base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

## DISC BRAKE CALIPERS

## DESCRIPTION

The caliper is a one-piece casting. The piston bores are located in the inboard side. A square-cut piston seal is located in a machined groove in the cylinder bore.

The caliper pistons dust boot prevents dirt, water and road splash from entering the piston bore. The boot is seated in a groove machined at the outer end of the caliper piston. The boot retaining flange is seated in a counterbore machined in the outer end of the caliper piston bore.

Ventilated disc brake rotors are used for all applications. The rotors are serviceable and can be machined to restore surface finish when necessary.

## OPERATION

When the brakes are applied fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal (Fig. 5).

Fluid pressure applied to the piston is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will attempt to stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake shoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

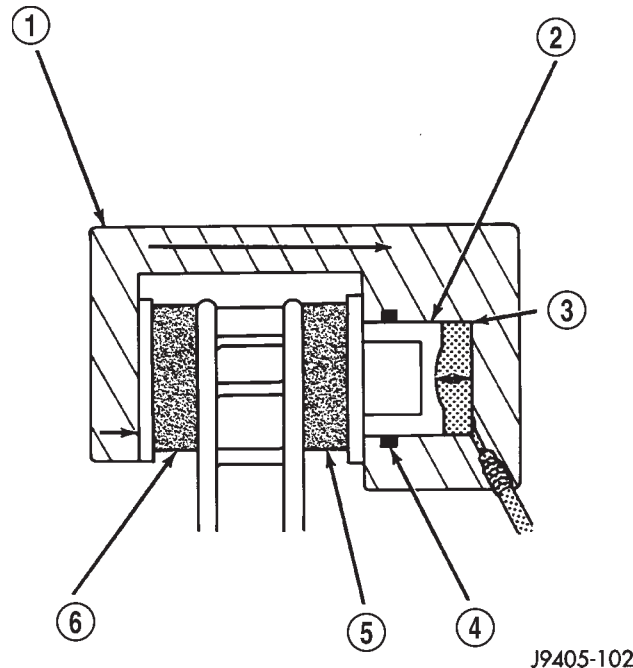


**Fig. 5 Brake Caliper Operation**

- 1 - CALIPER
- 2 - PISTON
- 3 - PISTON BORE
- 4 - SEAL
- 5 - INBOARD SHOE
- 6 - OUTBOARD SHOE

During brake application, the seal is deflected outward by fluid pressure and piston movement (Fig. 6). When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

The amount of piston retraction is determined by the amount of seal deflection. Generally the amount is just enough to maintain contact between the piston and inboard brake shoe.

## REMOVAL

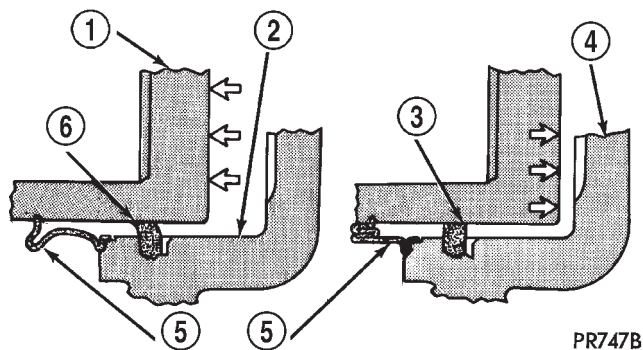
## REMOVAL - REAR

- (1) Raise and support the vehicle.
- (2) Remove the tire and wheel assembly.
- (3) Compress the disc brake caliper using tool #C4212F.
- (4) Remove the caliper pin bolts.
- (5) Remove the banjo bolt and discard the copper washer.

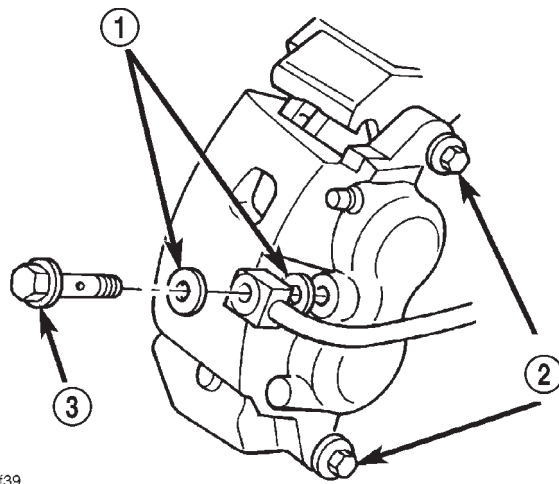
**CAUTION:** Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose with result. Provide a suitable support to hang the caliper securely.

- (6) Remove the rear disc brake caliper (Fig. 7).

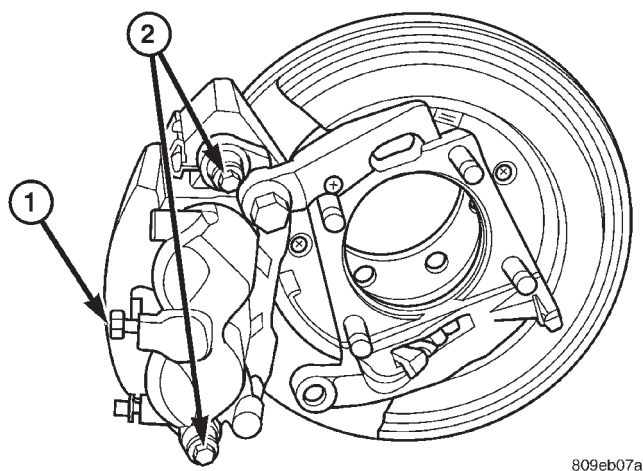
## DISC BRAKE CALIPERS (Continued)

**Fig. 6 Lining Wear Compensation By Piston Seal**

- 1 - PISTON
- 2 - CYLINDER BORE
- 3 - PISTON SEAL BRAKE PRESSURE OFF
- 4 - CALIPER HOUSING
- 5 - DUST BOOT
- 6 - PISTON SEAL BRAKE PRESSURE ON

**Fig. 8 Caliper**

- 1 - WASHERS
- 2 - MOUNTING BOLTS
- 3 - HOSE BOLT

**Fig. 7 REAR CALIPER**

- 1 - Banjo Bolt
- 2 - Caliper Pin Bolts

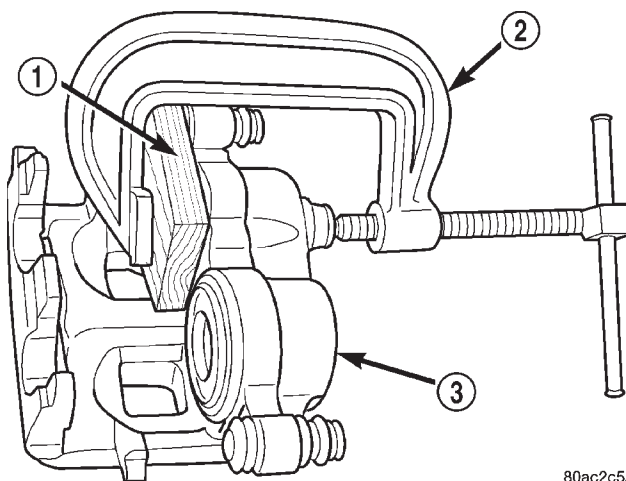
**REMOVAL - FRONT**

- (1) Raise and support vehicle.
- (2) Remove front wheel and tire assembly.
- (3) Remove caliper brake hose bolt, washers and hose (Fig. 8).
- (4) Remove caliper mounting bolts.
- (5) Tilt the top of the caliper up and remove it from the adapter.
- (6) Remove anti-rattle springs.

**NOTE:** Upper and lower anti-rattle springs are not interchangeable.

**DISASSEMBLY**

- (1) Drain the brake fluid from caliper.
- (2) C-clamp a block of wood over one piston (Fig. 9).

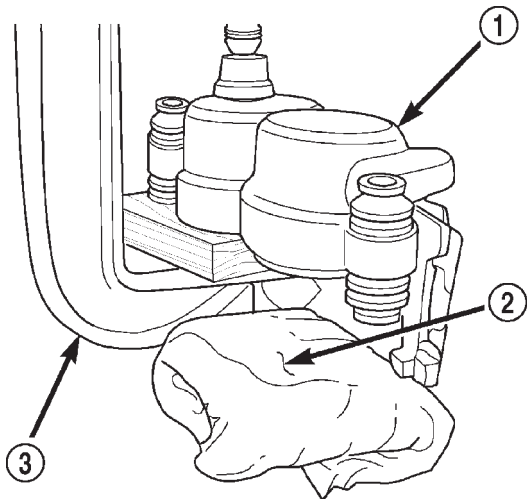
**Fig. 9 C-Clamp One Piston**

- 1 - BLOCK OF WOOD
- 2 - C-CLAMP
- 3 - CALIPER

(3) Take another piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the other piston. This will cushion and protect caliper piston during removal (Fig. 10).

(4) To remove the caliper piston direct **short bursts of low pressure air** with a blow gun through the caliper brake hose port. Use only enough air pressure to ease the piston out.

## DISC BRAKE CALIPERS (Continued)



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**Fig. 10 Protect Caliper Piston**

- 1 - CALIPER
- 2 - PADDED BLOCK OF WOOD
- 3 - C-CLAMP

**CAUTION:** Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston.

**WARNING:** NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS COULD RESULT IN PERSONAL INJURY.

(5) Remove the C-clamp and block of wood from the caliper and clamp it over the dust boot of the first piston removed. This will seal the empty piston bore.

(6) Move the padded piece of wood in front of the other piston.

(7) Remove the second piston using the same procedure with **short bursts of low pressure air**.

(8) Remove piston dust boots with a suitable pry tool (Fig. 11).

(9) Remove piston seals from caliper (Fig. 12).

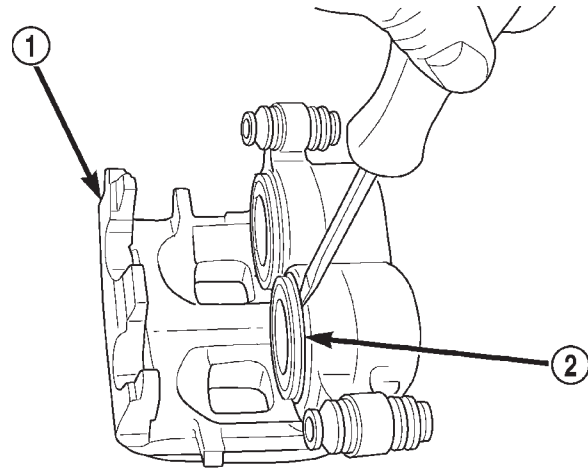
**CAUTION:** Do not scratch piston bore while removing the seals.

(10) Push caliper mounting bolt bushings out of the boot seals and remove the boot seals from the caliper (Fig. 13).

(11) Remove caliper bleed screw.

**CLEANING**

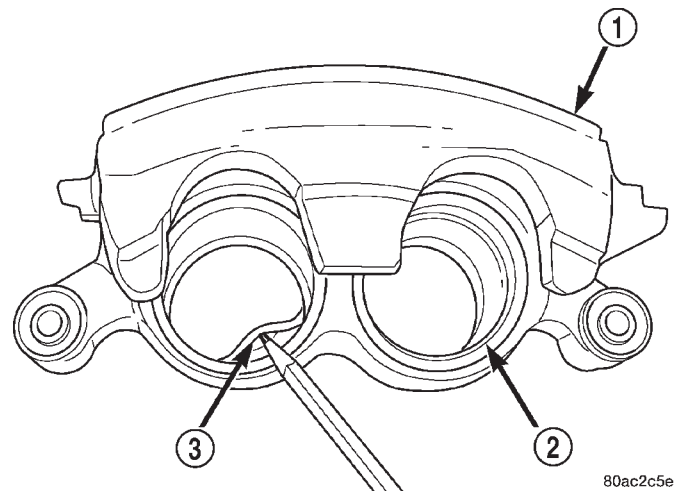
Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.



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**Fig. 11 Piston Dust Boot Removal**

- 1 - CALIPER
- 2 - DUST BOOT



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**Fig. 12 Piston Seal**

- 1 - CALIPER
- 2 - PISTON BORE
- 3 - PISTON SEAL

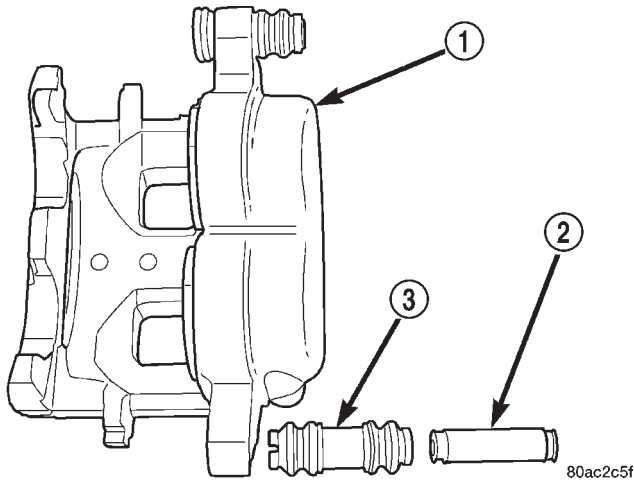
**CAUTION:** Do not use gasoline, kerosene, thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.

**INSPECTION**

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

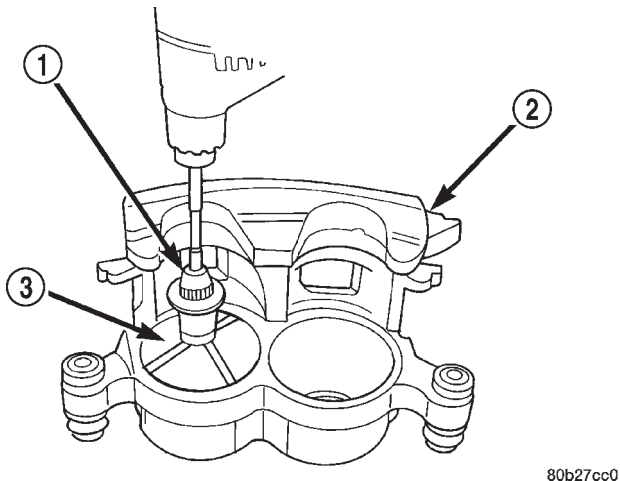
## DISC BRAKE CALIPERS (Continued)

**Fig. 13 Bushings And Boot Seals**

- 1 - CALIPER
- 2 - BUSHING
- 3 - BOOT SEAL

**CAUTION:** If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections (Fig. 14). The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).

**Fig. 14 Polishing Piston Bore**

- 1 - HONE
- 2 - CALIPER
- 3 - PISTON BORE

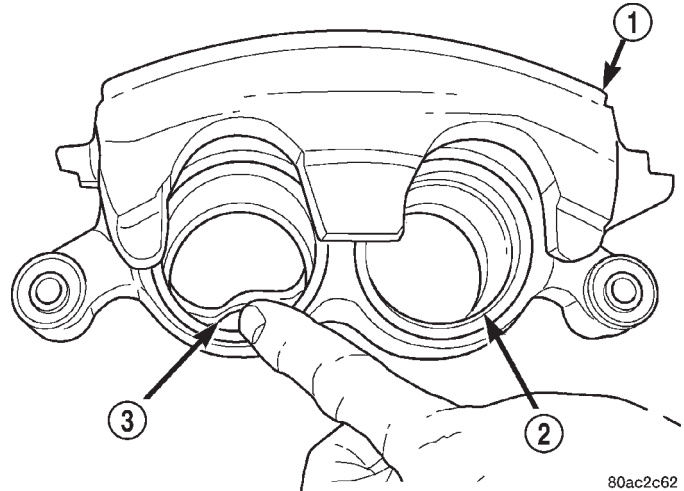
**ASSEMBLY**

**CAUTION:** Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

(1) Lubricate caliper pistons, piston seals and piston bores with clean, fresh brake fluid.

(2) Install new piston seals into caliper bores (Fig. 15).

**NOTE:** Verify seal is fully seated and not twisted.

**Fig. 15 Piston Seal**

- 1 - CALIPER
- 2 - PISTON BORE
- 3 - PISTON SEAL

(3) Lightly lubricate lip of new boot with silicone grease. Install boot on piston and work boot lip into the groove at the top of piston.

(4) Stretch boot rearward to straighten boot folds, then move boot forward until folds snap into place.

(5) Install piston into caliper bore and press piston down to the bottom of the caliper bore by hand or with hammer handle (Fig. 16).

(6) Seat dust boot in caliper (Fig. 17) with Handle C-4171 and Installer:

- HD 56 mm caliper: Installer C-4340
- LD 54 mm caliper: Installer C-3716-A

(7) Install the second piston and dust boot.

(8) Lubricate caliper mounting bolt bushings, boot seals and bores with Mopar brake grease or Dow Corning® 807 grease only.

**CAUTION:** Use of alternative grease may cause damage to the boots seals.

(9) Install the boot seals into the caliper seal bores and center the seals in the bores.

## DISC BRAKE CALIPERS (Continued)

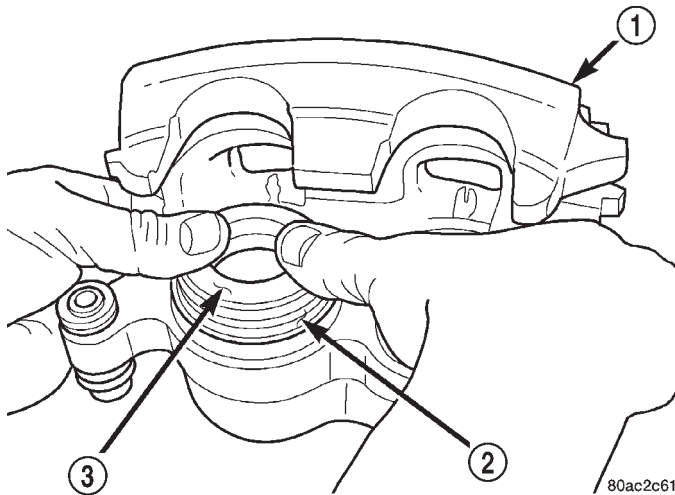


Fig. 16 Caliper Piston Installation

- 1 - CALIPER
- 2 - DUST BOOT
- 3 - PISTON

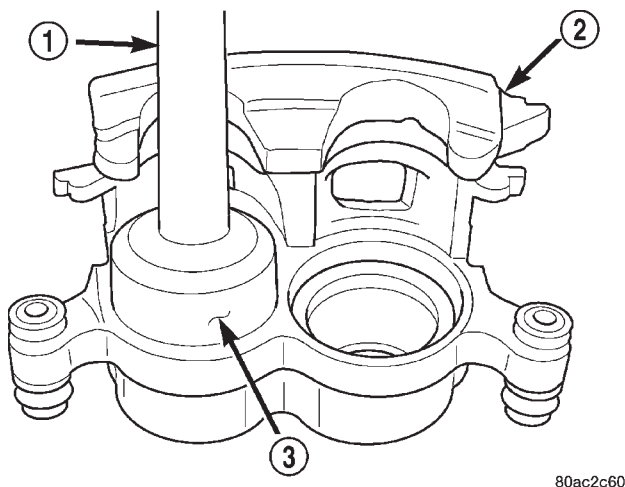


Fig. 17 Seating Dust Boot

- 1 - HANDLE
- 2 - CALIPER
- 3 - DUST BOOT INSTALLER

(10) Install mounting bolt bushings into the boot seals and insure seal lip is engaged into the bushing grooves at either end of the bushing.

(11) Install caliper bleed screw.

## INSTALLATION

## INSTALLATION - REAR

**NOTE:** Install a new copper washers on the banjo bolt when installing

(1) Install the rear disc brake caliper (Fig. 18).

(2) Install the banjo bolt with new copper washers to the caliper. Tighten to 38 N·m (28 ft. lbs.)

(3) Install the caliper pin bolts. Tighten to 33 N·m (25 ft. lbs.)

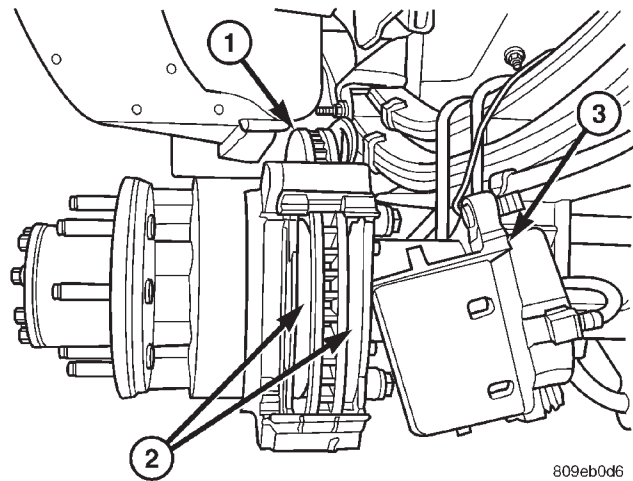


Fig. 18 REAR CALIPER INSTALL

- 1 - ROTOR
- 2 - BRAKE SHOES
- 3 - DISC BRAKE CALIPER

(4) Bleed the base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

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

(6) Lower the vehicle.

## INSTALLATION - FRONT

(1) Clean the caliper mounting adapter and the anti-rattle springs and grease with Mopar brake grease or Dow Corning® 807 grease only.

(2) Install the anti-rattle springs.

(3) Tilt the bottom of the caliper over the rotor and under the adapter. Then push the top of the caliper down onto the adapter.

(4) Install the caliper mounting bolts and tighten to 33 N·m (24 ft. lbs.).

(5) Install the brake hose to caliper with **new seal washers** and tighten fitting bolt to 24 N·m (18 ft. lbs.).

**CAUTION:** Verify brake hose is not twisted or kinked before tightening fitting bolt.

(6) Bleed the base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

(7) Install the wheel and tire assemblies, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

## DISC BRAKE CALIPERS (Continued)

- (8) Remove the supports and lower the vehicle.
- (9) Verify a firm pedal before moving the vehicle.

## FLUID

## DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

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

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

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

## STANDARD PROCEDURE - BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and caps before checking fluid level. If not cleaned, dirt could enter the fluid.

The fluid fill level is indicated on the side of the master cylinder reservoir (Fig. 19).

The correct fluid level is to the FULL indicator on the side of the reservoir. If necessary, add fluid to the proper level.

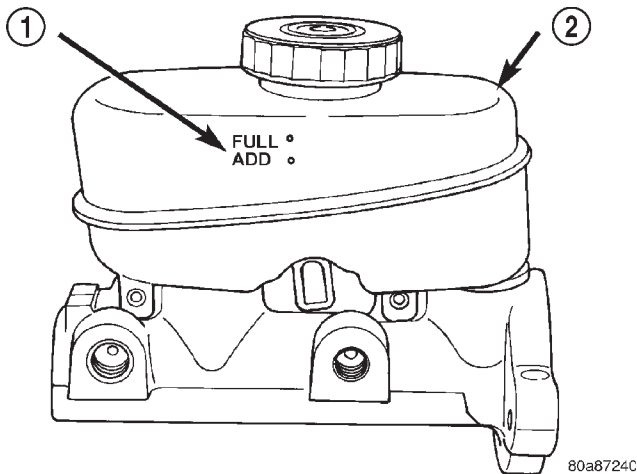


**Fig. 19 Master Cylinder Fluid Level - Typical**

- 1 - INDICATOR
- 2 - RESERVOIR

## SPECIFICATIONS

## BRAKE FLUID

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

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

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

## FLUID RESERVOIR

## REMOVAL

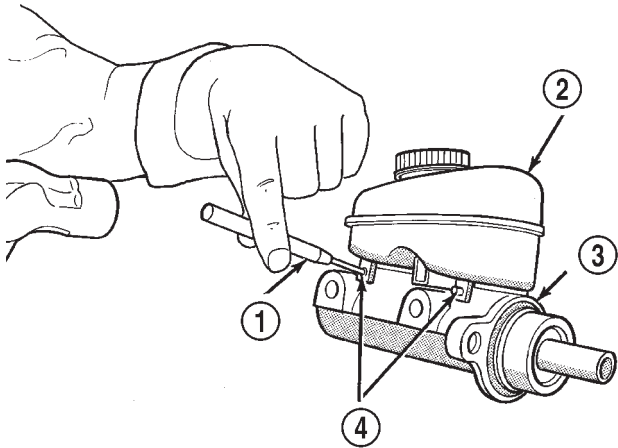
- (1) Remove reservoir cap and empty fluid into drain container.
- (2) Clamp cylinder body in vise with brass protective jaws.
- (3) Remove pins that retain reservoir to master cylinder. Use hammer and pin punch to remove pins (Fig. 20).
- (4) Loosen reservoir from grommets with pry tool (Fig. 21).
- (5) Remove reservoir by rocking it to one side and pulling free of grommets (Fig. 22).
- (6) Remove old grommets from cylinder body (Fig. 23).

## INSTALLATION

**CAUTION:** Do not use any type of tool to install the grommets. Tools may cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only.

- (1) Lubricate new grommets with clean brake fluid and install new grommets in cylinder body (Fig. 24). Use finger pressure to install and seat grommets.
- (2) Start reservoir in grommets. Then rock reservoir back and forth while pressing downward to seat it in grommets.

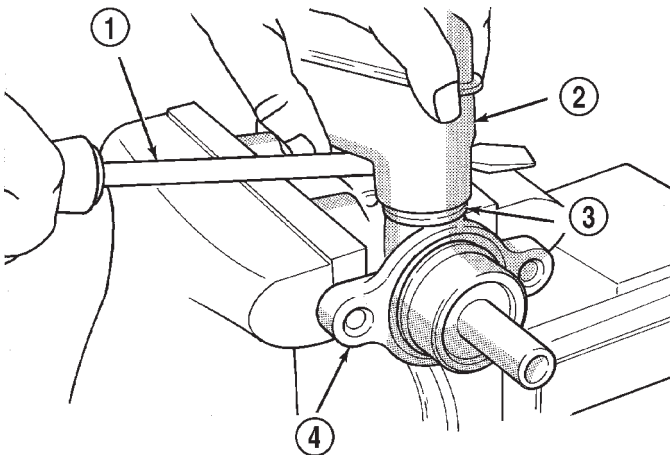
FLUID RESERVOIR (Continued)



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**Fig. 20 Reservoir Retaining Pins**

- 1 - PIN PUNCH
- 2 - RESERVOIR
- 3 - BODY
- 4 - ROLL PINS



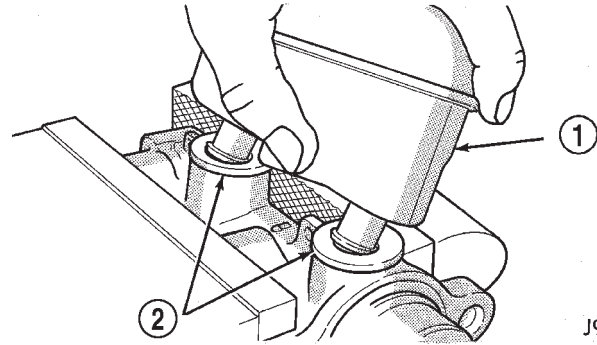
J9505-47

**Fig. 21 Loosening Reservoir**

- 1 - PRY TOOL
- 2 - RESERVOIR
- 3 - GROMMET
- 4 - MASTER CYLINDER BODY

(3) Install pins that retain reservoir to cylinder body.

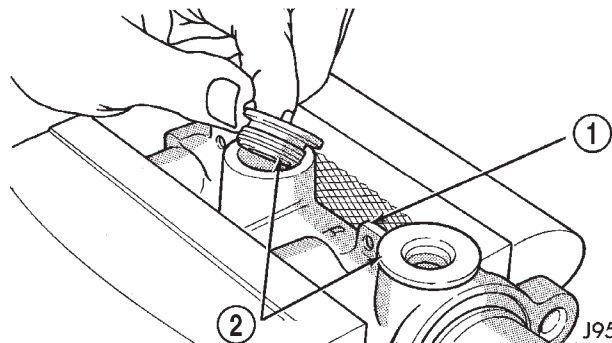
(4) Fill and bleed master cylinder on bench before installation in vehicle.



J9505-48

**Fig. 22 Reservoir Removal**

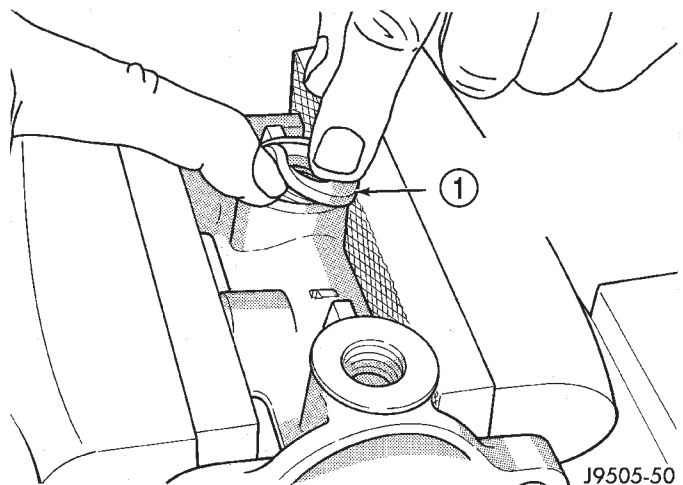
- 1 - RESERVOIR
- 2 - GROMMETS



J9505-49

**Fig. 23 Grommet Removal**

- 1 - MASTER CYLINDER BODY
- 2 - GROMMETS



J9505-50

**Fig. 24 Grommet Installation**

- 1 - WORK NEW GROMMETS INTO PLACE USING FINGER PRESSURE ONLY

## PEDAL

### DESCRIPTION

The brake booster is operated by a suspended type brake pedal. The pedal pivots on a shaft located in a mounting bracket attached to the dash panel. The pedal shaft is supported by bushings in the pedal and mounting bracket. The brake pedal is attached to the booster push rod.

### OPERATION

When the pedal is depressed, the primary booster push rod is depressed which move the booster secondary rod. The booster secondary rod depress the master cylinder piston.

### REMOVAL

(1) Remove knee bolster, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(2) Remove brake lamp switch, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).

(3) Remove switches from tabs on brake lamp switch bracket.

(4) Remove brake lamp switch bracket bolts and remove bracket (Fig. 25).

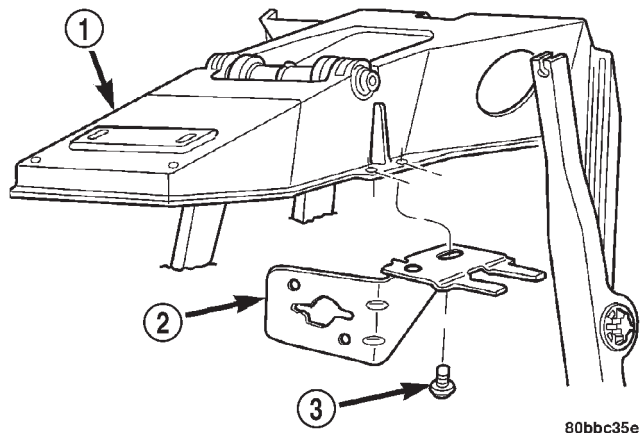


**Fig. 25 Brake Lamp Switch Bracket**

- 1 - PEDAL BRACKET
- 2 - BRAKELIGHT SWITCH BRACKET
- 3 - BRACKET SCREWS (2)

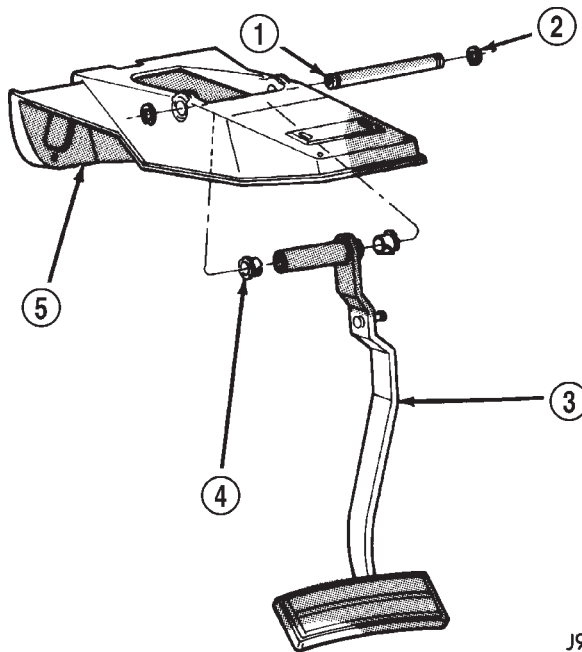
(5) Remove clip and washer attaching booster push rod and slide push rod off pedal.

(6) Remove E-clip from passenger side of pedal shaft (Fig. 26). Use flat blade screwdriver to pry clip out of shaft groove.

(7) Push shaft toward driver side of bracket just enough to expose opposite E-clip. Then remove E-clip with flat blade screwdriver.

(8) Push pedal shaft back and out of passenger side of bracket (Fig. 26).

(9) Remove pedal shaft, brake pedal, wave washer and bushings from vehicle.



J9405-86

**Fig. 26 Brake Pedal Mounting (With Automatic Transmission)**

- 1 - PEDAL SHAFT
- 2 - SHAFT RETAINING E-CLIPS (2)
- 3 - BRAKE PEDAL
- 4 - PEDAL BUSHING (2)
- 5 - PEDAL MOUNTING BRACKET

### INSTALLATION

(1) Replace bracket and pedal bushings if necessary. Lubricate shaft bores in bracket and pedal before installing bushings with Mopar Multi-mileage silicone grease.

(2) Apply liberal quantity of Mopar multi-mileage grease to pedal shaft and to pedal and bracket bushings.

(3) Position brake pedal in mounting bracket.

(4) Slide pedal shaft into bracket and through pedal from passenger side.

(5) Push pedal shaft out driver side of mounting bracket just enough to allow installation of retaining E-clip.

(6) Install the wave washer between the bracket and the pedal bushing on the passenger side.

(7) Push pedal shaft back toward passenger side of bracket and install remaining E-clip on pedal shaft.

(8) Install booster push rod on brake pedal. Secure push rod to pedal with washer and retaining clip.

(9) Install brake lamp switch bracket and switch, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING -

## PEDAL (Continued)

## EXTERIOR/BRAKE LAMP SWITCH - INSTALLATION).

(10) Install knee bolster, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

## POWER BRAKE BOOSTER

## DIAGNOSIS AND TESTING - HYDRAULIC BOOSTER

The hydraulic booster uses hydraulic pressure from the power steering pump. Before diagnosing a booster problem, first verify the power steering pump is operating properly. Perform the following checks.

- Check the power steering fluid level.
- Check the brake fluid level.
- Check all power steering hoses and lines for leaks and restrictions.
- Check power steering pump pressure.

## NOISES

The hydraulic booster unit will produce certain characteristic booster noises. The noises may occur when the brake pedal is used in a manner not associated with normal braking or driving habits.

## HISSING

A hissing noise may be noticed when above normal brake pedal pressure is applied, 40 lbs. or above. The noise will be more noticeable if the vehicle is not moving. The noise will increase with the brake pedal pressure and an increase of system operating temperature.

## CLUNK-CHATTER-CLICKING

A clunk-chatter-clicking may be noticed when the brake pedal is released quickly, after above normal brake pedal pressure is applied 50-100 lbs..

## BOOSTER FUNCTION TEST

With the engine off depress the brake pedal several times to discharge the accumulator. Then depress the brake pedal using 40 lbs. of force and start the engine. The brake pedal should fall and then push back against your foot. This indicates the booster is operating properly.

## ACCUMULATOR LEAKDOWN

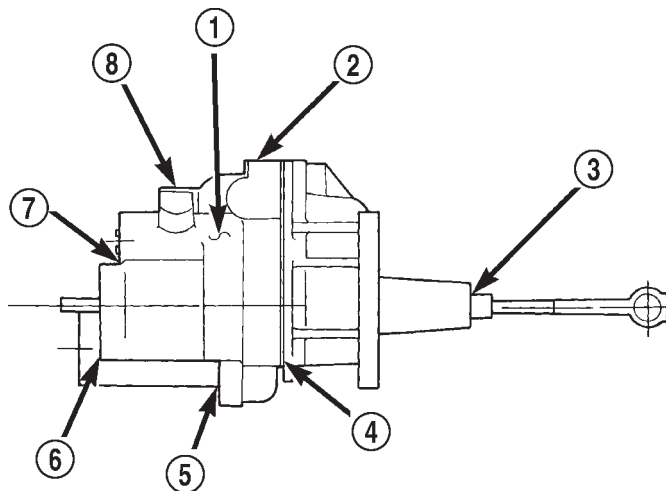
(1) Start the engine, apply the brakes and turn the steering wheel from lock to lock. This will ensure the accumulator is charged. Turn off the engine and let the vehicle sit for one hour. After one hour there should be at least two power assisted brake application with the engine off. If the system does not retain a charge the booster must be replaced.

(2) With the engine off depress the brake pedal several times to discharge the accumulator. Grasp the accumulator and see if it wobbles or turns. If it does the accumulator has lost a gas charge and the booster must be replaced.

## SEAL LEAKAGE

If the booster leaks from any of the seals the booster assembly must be replaced (Fig. 27).

- **INPUT ROD SEAL:** Fluid leakage from rear end of the booster.
- **PISTON SEAL:** Fluid leakage from vent at front of booster.
- **HOUSING SEAL:** Fluid leakage between housing and housing cover.
- **SPOOL VALVE SEAL:** Fluid leakage near spool plug.
- **RETURN PORT FITTING SEAL:** Fluid leakage from port fitting.



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**Fig. 27 Hydraulic Booster Seals**

- 1 - PUMP
- 2 - GEAR
- 3 - INPUT SEAL
- 4 - HOUSING SEAL
- 5 - ACCUMULATOR SEAL
- 6 - PISTON SEAL
- 7 - SPOOL PLUG SEAL
- 8 - RETURN

## POWER BRAKE BOOSTER (Continued)

## HYDRAULIC BOOSTER DIAGNOSIS CHART

| CONDITION                        | POSSIBLE CAUSES                                                                                                                                                                                                | CORRECTION                                                                                                                                                |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slow Brake Pedal Return          | <ol style="list-style-type: none"> <li>1. Excessive seal friction in booster.</li> <li>2. Faulty spool valve action.</li> <li>3. Restriction in booster return hose.</li> <li>4. Damaged input rod.</li> </ol> | <ol style="list-style-type: none"> <li>1. Replace booster.</li> <li>2. Replace booster.</li> <li>3. Replace hose.</li> <li>4. Replace booster.</li> </ol> |
| Excessive Brake Pedal Effort.    | <ol style="list-style-type: none"> <li>1. Internal or external seal leakage.</li> <li>2. Faulty steering pump.</li> </ol>                                                                                      | <ol style="list-style-type: none"> <li>1. Replace booster.</li> <li>2. Replace pump.</li> </ol>                                                           |
| Brakes Self Apply                | <ol style="list-style-type: none"> <li>1. Dump valve faulty.</li> <li>2. Contamination in hydraulic system.</li> <li>3. Restriction in booster return hose.</li> </ol>                                         | <ol style="list-style-type: none"> <li>1. Replace booster.</li> <li>2. Flush hydraulic system and replace booster.</li> <li>3. Replace hose.</li> </ol>   |
| Booster Chatter, Pedal Vibration | <ol style="list-style-type: none"> <li>1. Slipping pump belt.</li> <li>2. Low pump fluid level.</li> </ol>                                                                                                     | <ol style="list-style-type: none"> <li>1. Replace power steering belt.</li> <li>2. Fill pump and check for leaks.</li> </ol>                              |
| Grabbing Brakes                  | <ol style="list-style-type: none"> <li>1. Low pump flow.</li> <li>2. Faulty spool valve action.</li> </ol>                                                                                                     | <ol style="list-style-type: none"> <li>1. Test and repair/replace pump.</li> <li>2. Replace booster.</li> </ol>                                           |

**STANDARD PROCEDURE - BLEEDING**

The hydraulic booster is generally self-bleeding, this procedure will normally bleed the air from the booster. Normal driving and operation of the unit will remove any remaining trapped air.

- (1) Fill power steering pump reservoir.
- (2) Disconnect fuel shutdown relay and crank the engine for several seconds, Refer to Fuel System for relay location and WARNING.
- (3) Check fluid level and add if necessary.
- (4) Connect fuel shutdown relay and start the engine.
- (5) Turn the steering wheel slowly from lock to lock twice.
- (6) Stop the engine and discharge the accumulator by depressing the brake pedal 5 times.
- (7) Start the engine and turn the steering wheel slowly from lock to lock twice.
- (8) Turn off the engine and check fluid level and add if necessary.

**NOTE:** If fluid foaming occurs, wait for foam to dissipate and repeat steps 7 and 8.

**REMOVAL**

**NOTE:** If the booster is being replaced because the power steering fluid is contaminated, flush the power steering system before replacing the booster.

- (1) With engine off depress the brake pedal 5 times to discharge the accumulator.

- (2) Remove brake lines from master cylinder.

- (3) Remove mounting nuts from the master cylinder.

- (4) Remove the bracket from the hydraulic booster lines and master cylinder mounting studs.

- (5) Remove the master cylinder.

- (6) Remove the return hose and the two pressure lines from the hydraulic booster (Fig. 28).

- (7) Remove the booster push rod clip, washer and rod remove from the brake pedal. (Fig. 29).

- (8) Remove the mounting nuts from the hydraulic booster and remove the booster (Fig. 30).

**INSTALLATION**

- (1) Install the hydraulic booster and tighten the mounting nuts to 28 N·m (21 ft. lbs.).

- (2) Install the booster push rod, washer and clip onto the brake pedal.

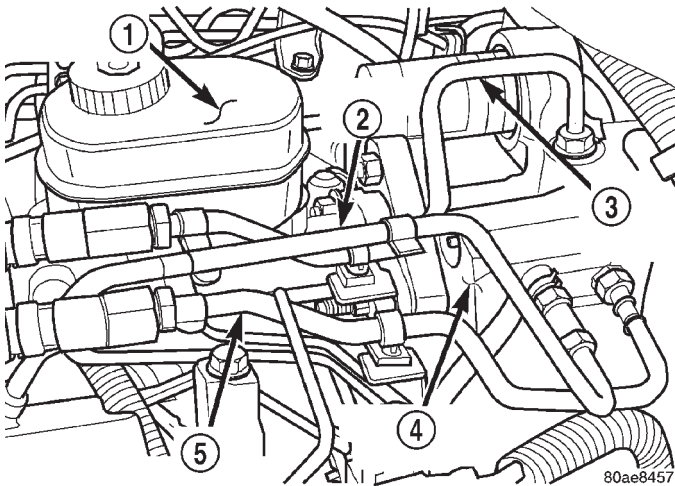
- (3) Install the master cylinder on the mounting studs. and tighten the mounting nuts to 23 N·m (17 ft. lbs.).

- (4) Install the brake lines to the master cylinder and tighten to 19-200 N·m (170-200 in. lbs.).

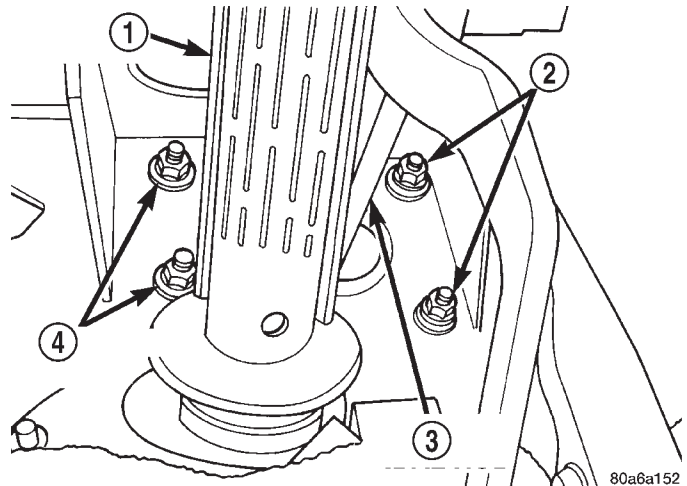
- (5) Install the hydraulic booster line bracket onto the master cylinder mounting studs.

- (6) Install the master cylinder mounting nuts and tighten to 23 N·m (17 ft. lbs.).

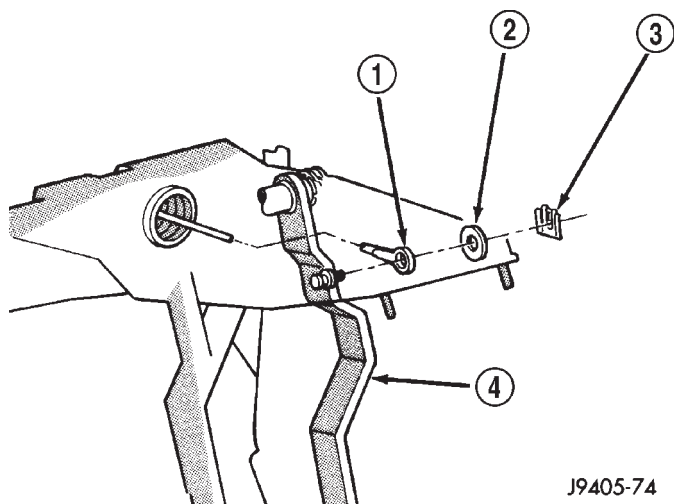
## POWER BRAKE BOOSTER (Continued)

**Fig. 28 Master Cylinder And Booster**

- 1 - MASTER CYLINDER
- 2 - RETURN LINE
- 3 - LINE FROM PUMP
- 4 - HYDRAULIC BOOSTER
- 5 - LINE TO GEAR

**Fig. 30 Booster Mounting**

- 1 - STEERING COLUMN
- 2 - MOUNTING NUTS
- 3 - BOOSTER PEDAL ROD
- 4 - MOUNTING NUTS

**Fig. 29 Booster Push Rod**

- 1 - BOOSTER PUSH ROD
- 2 - WASHER
- 3 - CLIP
- 4 - PEDAL

(7) Install the hydraulic booster pressure lines to the bracket and booster.

(8) Tighten the pressure lines to 41 N·m (30 ft. lbs.).

**NOTE:** Inspect o-rings on the pressure line fittings to insure they are in good condition before installation. Replace o-rings if necessary.

(9) Install the return hose to the booster.

(10) Bleed base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

(11) Fill the power steering pump with fluid, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

**CAUTION:** Use only MOPAR power steering fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

(12) Bleed the hydraulic booster.

## ROTORS

## DIAGNOSIS AND TESTING

### DISC BRAKE ROTOR

The rotor braking surfaces should not be refinished unless necessary.

Light surface rust and scale can be removed with a lathe equipped with dual sanding discs. The rotor surfaces can be restored by machining with a disc brake lathe if surface scoring and wear are light.

Replace the rotor for the following conditions:

- Severely Scored
- Tapered
- Hard Spots
- Cracked
- Below Minimum Thickness

## ROTORS (Continued)

### ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if below minimum thickness, or if machining would reduce thickness below the allowable minimum.

Rotor minimum thickness is usually specified on the rotor hub. The specification is either stamped or cast into the hub surface.

### ROTOR RUNOUT

Check rotor lateral runout with dial indicator C-3339 (Fig. 31). Excessive lateral runout will cause brake pedal pulsation and rapid, uneven wear of the brake shoes. Position the dial indicator plunger approximately 25.4 mm (1 in.) inward from the rotor edge.

**NOTE:** Be sure wheel bearing has zero end play before checking rotor runout.

Maximum allowable rotor runout is 0.127 mm (0.005 in.).

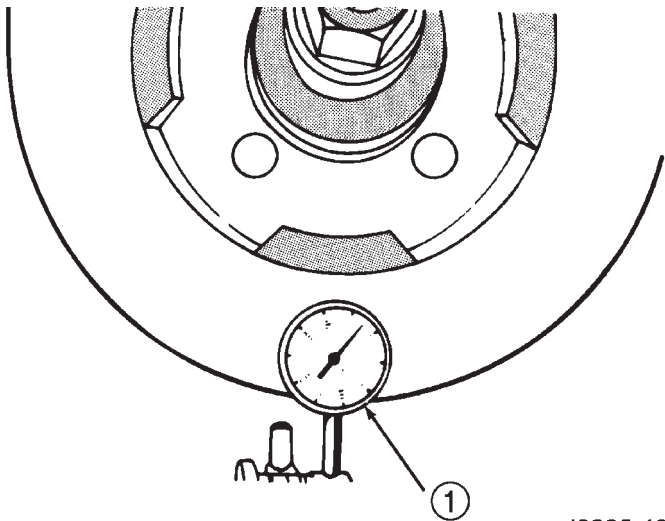


**Fig. 31 Checking Rotor Runout And Thickness Variation**

1 - DIAL INDICATOR

### ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at 6 to 12 points around the rotor face (Fig. 32).

Position the micrometer approximately 25.4 mm (1 in.) from the rotor outer circumference for each measurement.

Thickness should not **vary** by more than 0.025 mm (0.001 in.) from point-to-point on the rotor. Machine or replace the rotor if necessary.

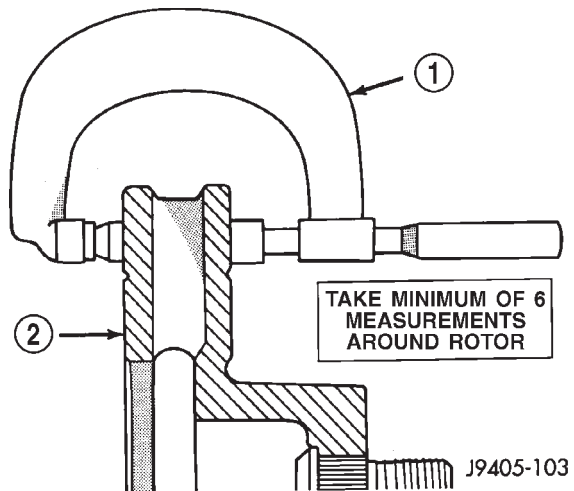


**Fig. 32 Measuring Rotor Thickness**

1 - MICROMETER

2 - ROTOR

## REMOVAL

### REMOVAL - REAR

- (1) Raise and support the vehicle
- (2) Remove the tire and wheel assembly.
- (3) Remove the disc brake caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (4) Remove the caliper adapter bolts.
- (5) Remove the rear axle shaft from the housing on dual rear wheels, (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 286RBI/AXLE SHAFTS - REMOVAL).
- (6) Remove the hub and rotor assembly (C3500 only) (Fig. 33).

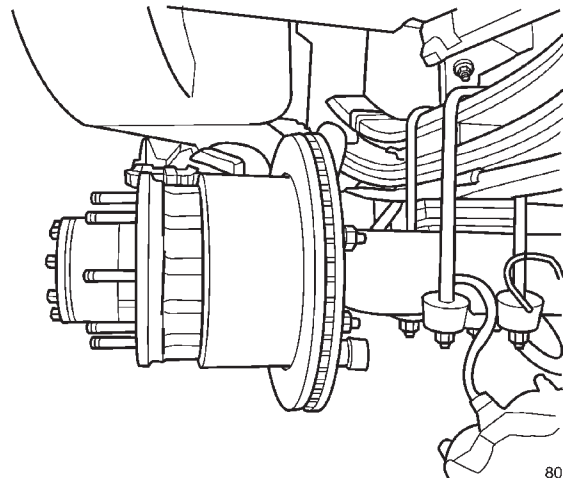


**Fig. 33 ROTOR / HUB REMOVAL**

## ROTORS (Continued)

**REMOVAL - FRONT - 2500**

- (1) Raise and support the vehicle.
- (2) Remove the wheel and tire assembly.
- (3) Remove the caliper from the steering knuckle, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL) and remove caliper adapter assembly (Fig. 34).

**NOTE:** Do not allow brake hose to support caliper adapter assembly.

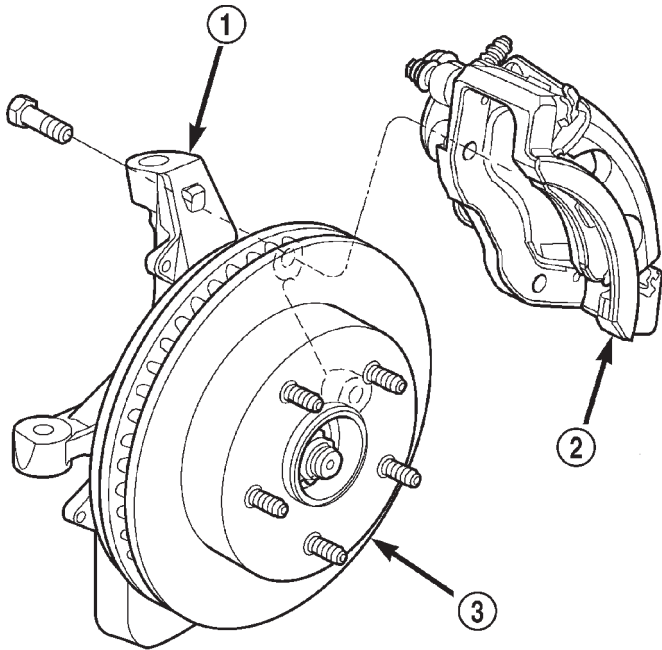


**Fig. 34 Caliper Adapter Assembly**

- 1 - KNUCKLE  
2 - CALIPER  
3 - ROTOR

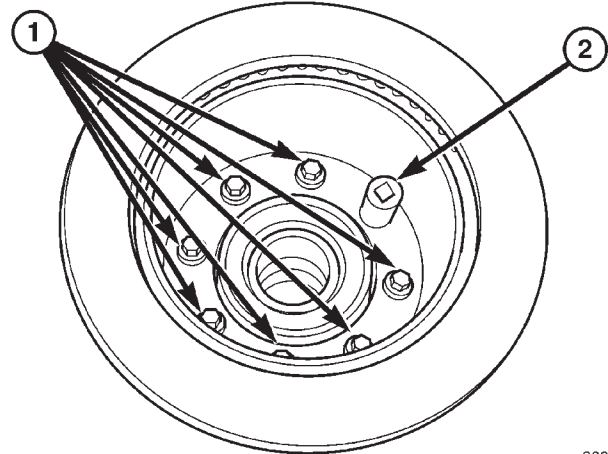
- (4) Remove the rotor from the hub/bearing wheel studs.

**REMOVAL - FRONT - 3500**

- (1) Raise and support the vehicle.
- (2) Remove the wheel and tire assembly.
- (3) Remove the hub extension mounting nuts and remove the extension from the rotor if equipped.
- (4) Remove the brake caliper adapter assembly. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (5) Remove the rotor assembly.

**INSTALLATION****INSTALLATION - REAR**

- (1) Install the hub to the rotor. Tighten the bolts to 128 N·m (95 ft. lbs.) (Fig. 35).

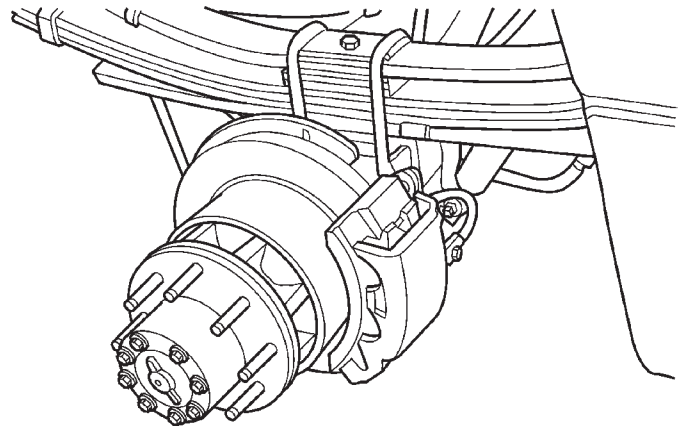


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**Fig. 35 ROTOR TO HUB**

- 1 - Hub Bolts  
2 - Socket

- (2) Install the hub and rotor assembly.
- (3) Install the rear axle shaft to the housing with dual wheels, (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 286RBI/AXLE SHAFTS - INSTALLATION).
- (4) Install the caliper adapter bolts.
- (5) Install the disc brake caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION). (Fig. 36).



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**Fig. 36 ROTOR INSTALLED**

- (6) Install the tire and wheel assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
- (7) Lower the vehicle.

## ROTORS (Continued)

### INSTALLATION - FRONT - 2500

(1) On models with all-wheel antilock system (ABS), check condition of tone wheel on hub/bearing. If teeth on wheel are damaged, hub/bearing assembly will have to be replaced (tone wheel is not serviced separately).

(2) Install rotor onto the hub/bearing wheel studs.

(3) Install the caliper adapter assembly, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION) and tighten adapter bolts to:

- LD 1500: 176 N·m (130 ft lbs.)
- HD 2500: 285 N·m (210 ft lbs.)

(4) Install the wheel and tire assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE) and lower vehicle.

(5) Apply brakes several times to seat brake shoes. Be sure to obtain firm pedal before moving vehicle.

### INSTALLATION - FRONT - 3500

(1) Position the rotor on the hub/bearing.

(2) Install the brake caliper adapter assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION) and tighten adapter bolts to 285 N·m (210 ft. lbs).

(3) Install the wheel and tire assemblies, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(4) Remove the support and lower the vehicle.

(5) Apply brakes several times to seat brake shoes and caliper piston. Do not move vehicle until firm brake pedal is obtained.

## BRAKE PADS/SHOES

### REMOVAL

#### REMOVAL - REAR

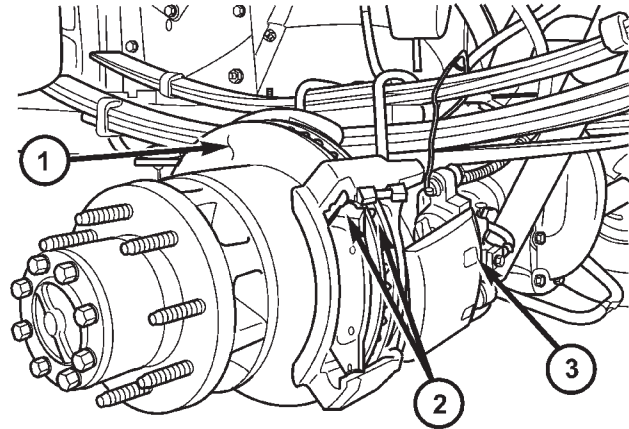
- (1) Raise and support the vehicle.
- (2) Remove the rear wheel and tire assemblies.
- (3) Compress the caliper.
- (4) Remove caliper mounting bolts

**NOTE: Do not allow brake hose to support caliper assembly.**

(5) Remove the caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL) and then tilt the top up and off the caliper adapter (Fig. 37).

(6) Remove inboard brake shoe from the caliper adapter (Fig. 38).

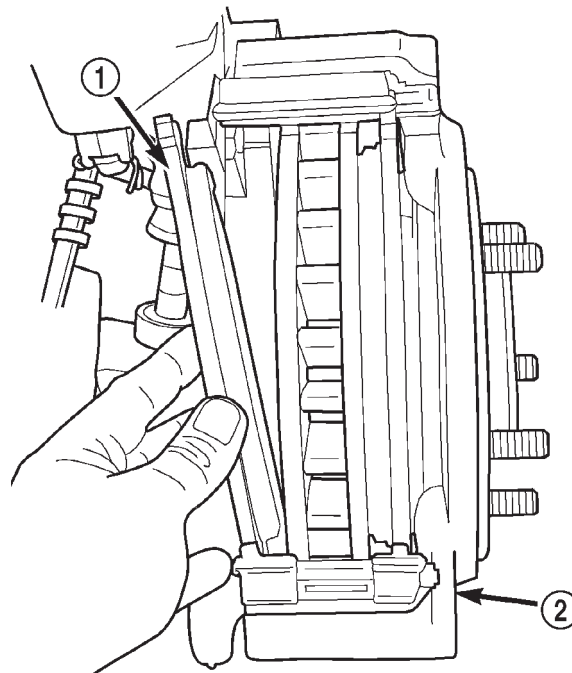
(7) Remove outboard brake shoe from caliper adapter (Fig. 39).



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**Fig. 37 ROTOR / PADS/ CALIPER**

- 1 - ROTOR
- 2 - BRAKE SHOES
- 3 - DISC BRAKE CALIPER



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**Fig. 38 Inboard Brake Shoe**

- 1 - INBOARD SHOE
- 2 - CALIPER ADAPTER

(8) Remove the anti-rattle springs from the caliper adapter (Fig. 40) and (Fig. 41).

**NOTE: Anti-rattle springs are not interchangeable.**

BRAKE PADS/SHOES (Continued)

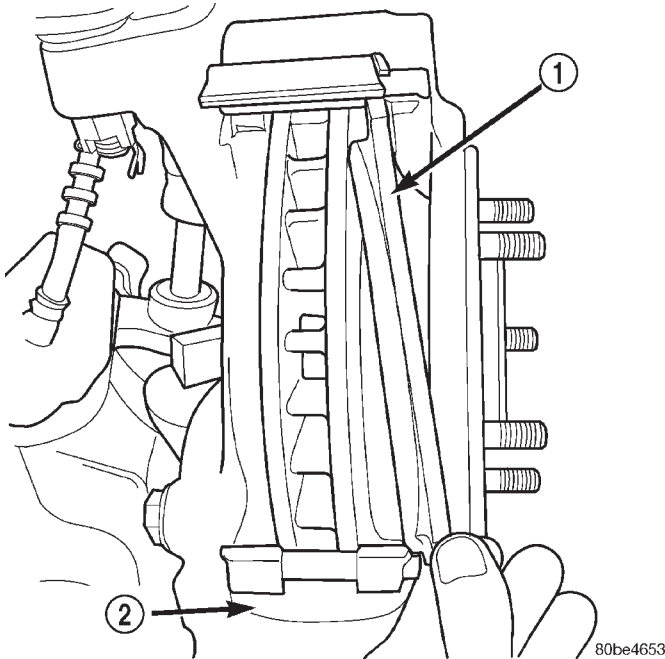


**Fig. 39 Outboard Brake Shoe**

- 1 - OUTBOARD SHOE
- 2 - CALIPER ADAPTER

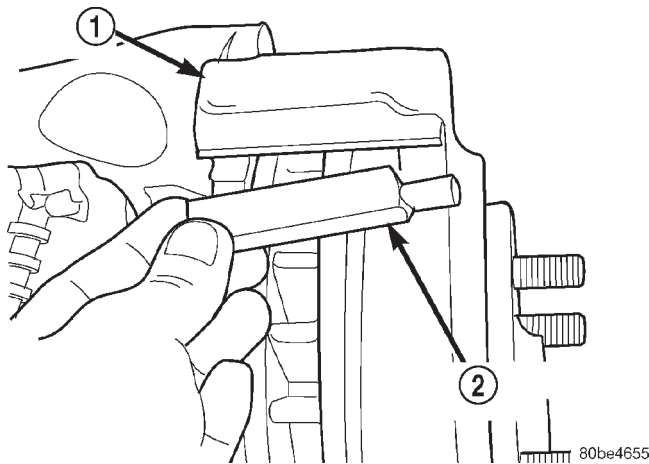


**Fig. 40 Top Anti-Rattle Spring**

- 1 - CALIPER ADAPTER
- 2 - ANTI-RATTLE SPRING

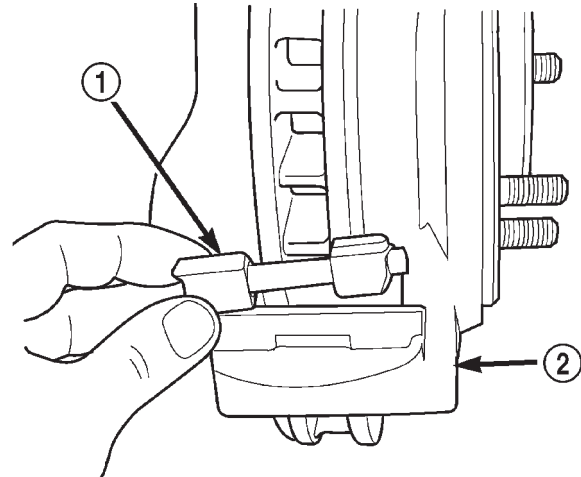


**Fig. 41 Bottom Anti-Rattle Spring**

- 1 - ANTI-RATTLE SPRING
- 2 - CALIPER ADAPTER

**NOTE:** Do not allow brake hose to support caliper assembly.

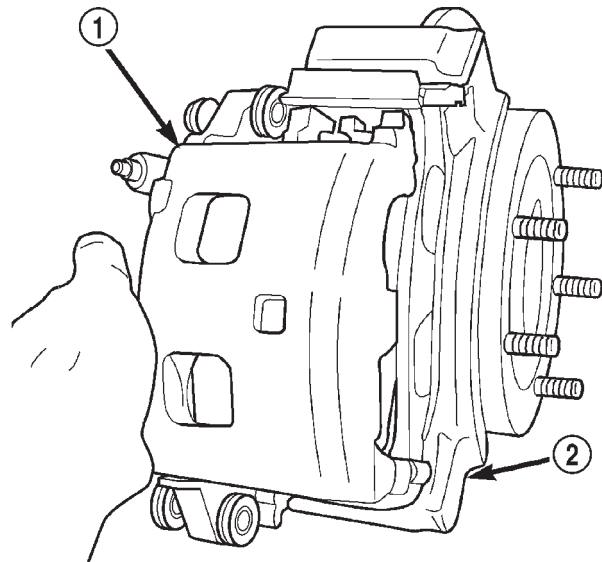


**Fig. 42 Caliper**

- 1 - CALIPER
- 2 - CALIPER ADAPTER

**REMOVAL - FRONT**

- (1) Raise and support vehicle.
- (2) Remove front wheel and tire assemblies.
- (3) Compress caliper.
- (4) Remove caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (5) Remove caliper by tilting the top up and off the caliper adapter (Fig. 42).

- (6) Remove inboard brake shoe from the caliper adapter (Fig. 43).

- (7) Remove outboard brake shoe from caliper adapter (Fig. 44).

- (8) Remove the anti-rattle springs from the caliper adapter (Fig. 45) and (Fig. 46).

**NOTE:** Anti-rattle springs are not interchangeable.

BRAKE PADS/SHOES (Continued)

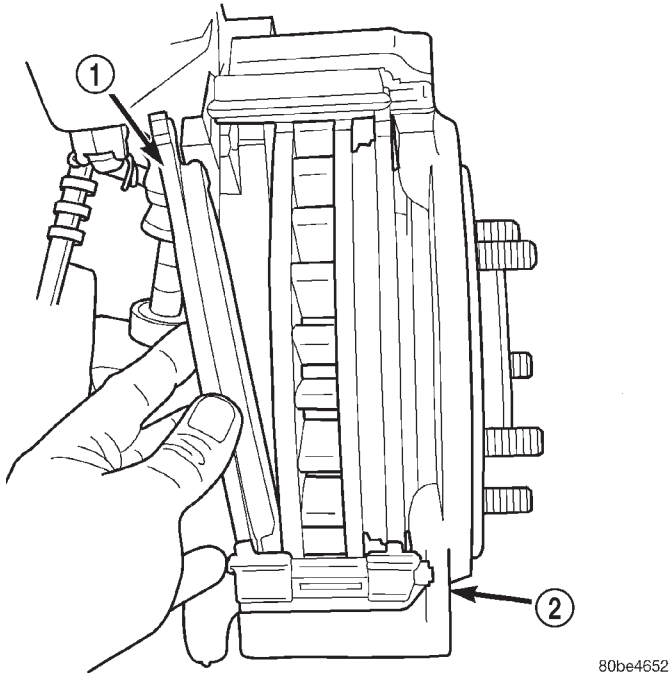


**Fig. 43 Inboard Brake Shoe**

- 1 - INBOARD SHOE
- 2 - CALIPER ADAPTER

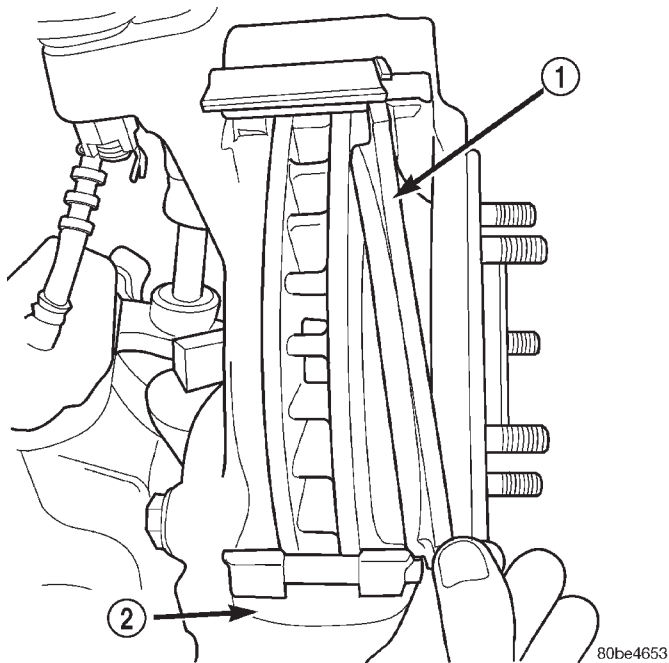


**Fig. 44 Outboard Brake Shoe**

- 1 - OUTBOARD SHOE
- 2 - CALIPER ADAPTER

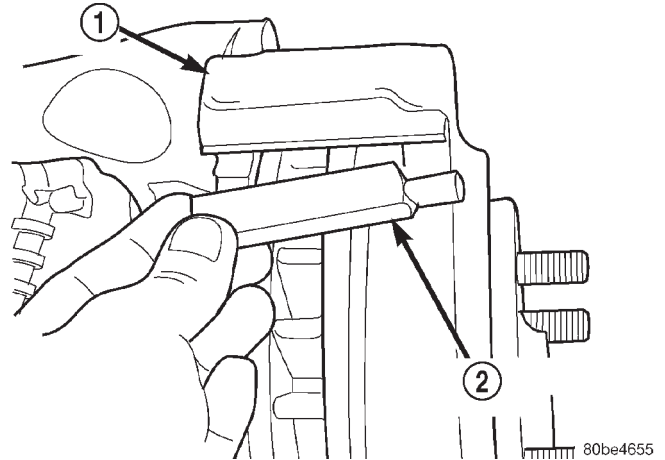


**Fig. 45 Top Anti-Rattle Spring**

- 1 - CALIPER ADAPTER
- 2 - ANTI-RATTLE SPRING

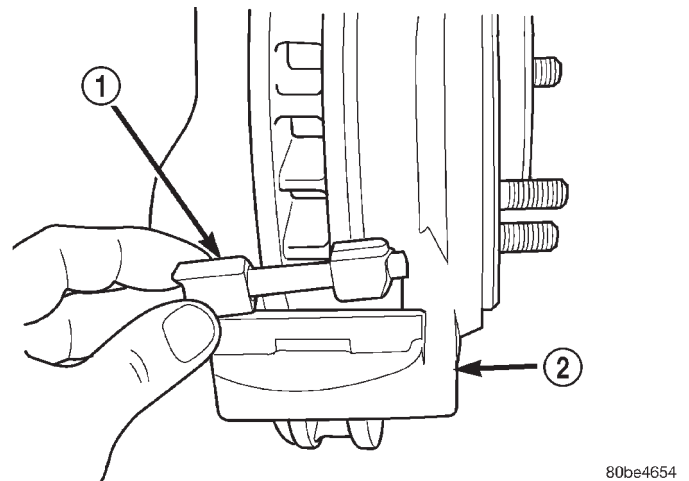


**Fig. 46 Bottom Anti-Rattle Spring**

- 1 - ANTI-RATTLE SPRING
- 2 - CALIPER ADAPTER

## INSTALLATION

### INSTALLATION - REAR

- (1) Clean caliper mounting adapter and anti-rattle springs.
- (2) Lubricate anti-rattle springs with Mopar brake grease.
- (3) Install anti-rattle springs.

**NOTE: Anti-rattle springs are not interchangeable.**

- (4) Install inboard brake shoe in adapter.
- (5) Install outboard brake shoe in adapter.
- (6) Tilt the bottom of the caliper over rotor and under adapter. Then push the top of the caliper down onto the adapter.

## BRAKE PADS/SHOES (Continued)

(7) Install caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(8) Install wheel and tire assemblies and lower vehicle, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(9) Apply brakes several times to seat caliper pistons and brake shoes and obtain firm pedal.

(10) Top off master cylinder fluid level.

## INSTALLATION - FRONT

(1) Bottom pistons in caliper bore with C-clamp. Place an old brake shoe between a C-clamp and caliper piston.

(2) Clean caliper mounting adapter and anti-rattle springs.

(3) Lubricate anti-rattle springs with Mopar brake grease.

(4) Install anti-rattle springs.

**NOTE: Anti-rattle springs are not interchangeable.**

(5) Install inboard brake shoe in adapter.

(6) Install outboard brake shoe in adapter.

(7) Tilt the bottom of the caliper over rotor and under adapter. Then push the top of the caliper down onto the adapter.

(8) Install caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(9) Install wheel and tire assemblies and lower vehicle, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(10) Apply brakes several times to seat caliper pistons and brake shoes and obtain firm pedal.

(11) Top off master cylinder fluid level.

## MASTER CYLINDER

## DESCRIPTION

A two-piece master cylinder is used on all models. The cylinder body containing the primary and secondary pistons is made of aluminum. The removable fluid reservoir is made of nylon reinforced with glass fiber. The reservoir stores reserve brake fluid for the hydraulic brake circuits. The reservoir is the only serviceable component.

The fluid compartments of the nylon reservoir are interconnected to permit fluid level equalization. However, the equalization feature does not affect circuit separation in the event of a front or rear brake malfunction. The reservoir compartments will retain enough fluid to operate the functioning hydraulic circuit.

Care must be exercised when removing/installing the master cylinder connecting lines. The threads in the cylinder fluid ports can be damaged if care is not exercised. Start all brake line fittings by hand to avoid cross threading.

The cylinder reservoir can be replaced when necessary. However, the aluminum body section of the master cylinder is not a repairable component.

**NOTE: If diagnosis indicates that an internal malfunction has occurred, the aluminum body section must be replaced as an assembly.**

## OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes.

## DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

(1) Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage).

(5) Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.

(6) If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

## POWER BOOSTER VACUUM TEST

(1) Connect vacuum gauge to booster check valve with short length of hose and T-fitting (Fig. 47).

(2) Start and run engine at curb idle speed for one minute.

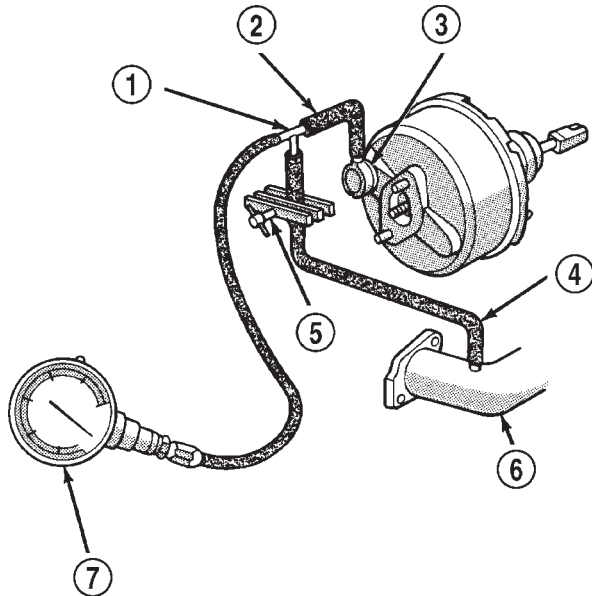
(3) Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.

## MASTER CYLINDER (Continued)

(4) Clamp hose shut between vacuum source and check valve.

(5) Stop engine and observe vacuum gauge.

(6) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.



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**Fig. 47 Typical Booster Vacuum Test Connections**

- 1 - TEE FITTING
- 2 - SHORT CONNECTING HOSE
- 3 - CHECK VALVE
- 4 - CHECK VALVE HOSE
- 5 - CLAMP TOOL
- 6 - INTAKE MANIFOLD
- 7 - VACUUM GAUGE

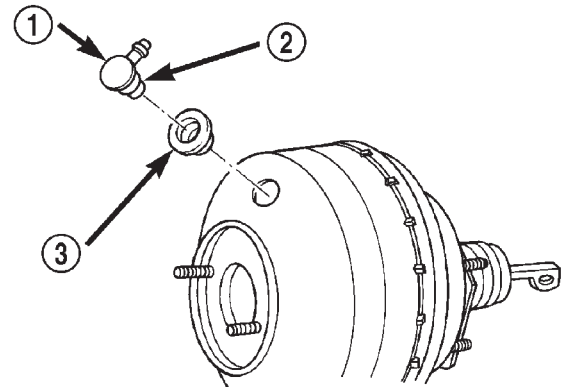
## POWER BOOSTER CHECK VALVE TEST

- (1) Disconnect vacuum hose from check valve.
- (2) Remove check valve and valve seal from booster.
- (3) Use a hand operated vacuum pump for test.
- (4) Apply 15-20 inches vacuum at large end of check valve (Fig. 48).
- (5) Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

## STANDARD PROCEDURE - MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

- (1) Mount master cylinder in vise.
- (2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into reservoir (Fig. 49).

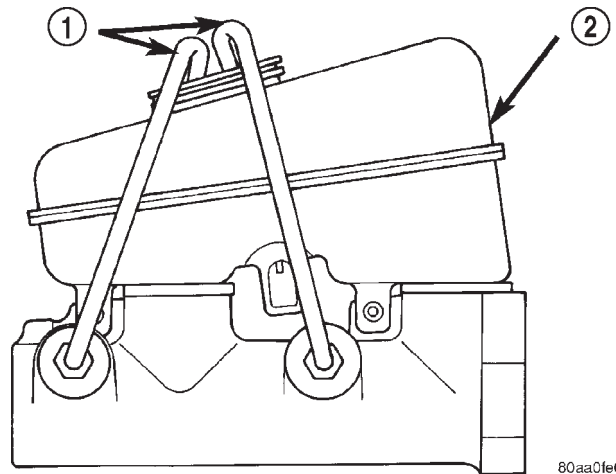


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**Fig. 48 Vacuum Check Valve And Seal**

- 1 - BOOSTER CHECK VALVE
- 2 - APPLY TEST VACUUM HERE
- 3 - VALVE SEAL

- (3) Fill reservoir with fresh brake fluid.
- (4) Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.



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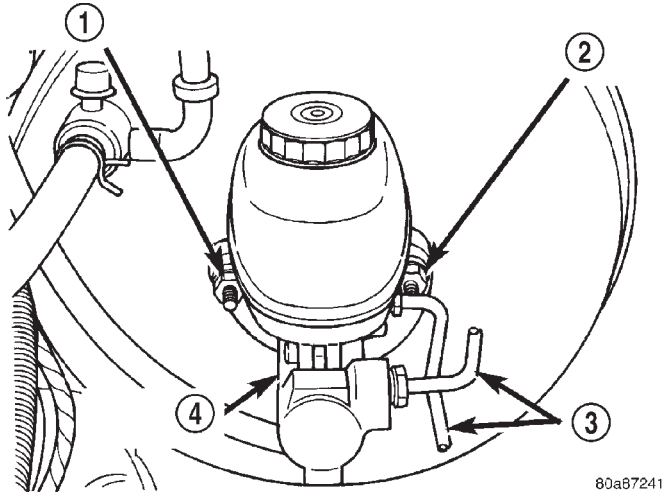
**Fig. 49 Master Cylinder Bleeding-Typical**

- 1 - BLEEDING TUBES
- 2 - RESERVOIR

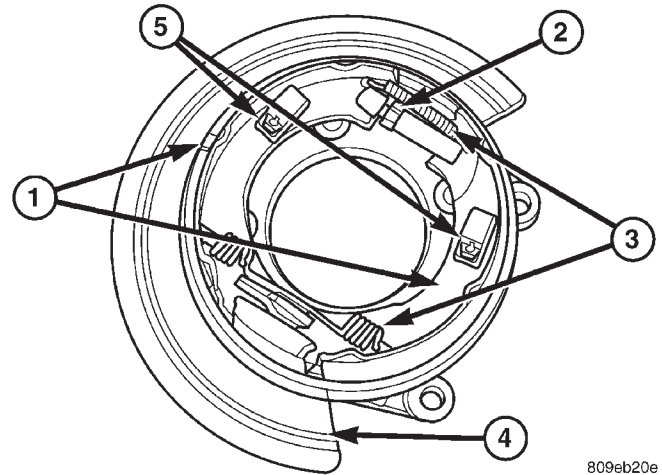
## REMOVAL

- (1) Pump the brake pedal several times to deplete booster vacuum reserve.
- (2) Remove brake lines from the master cylinder (Fig. 50).
- (3) Remove mounting nuts from the master cylinder (Fig. 50).
- (4) Remove the master cylinder.

## MASTER CYLINDER (Continued)

**Fig. 50 Master Cylinder**

- 1 - MOUNTING NUT
- 2 - MOUNTING NUT
- 3 - BRAKE LINES
- 4 - MASTER CYLINDER

**Fig. 51 SHOES REMOVAL**

- 1 - PARK BRAKE SHOES
- 2 - ADJUSTER
- 3 - RETURN SPRINGS
- 4 - SPLASH SHIELD
- 5 - HOLD DOWNS

**INSTALLATION**

**NOTE:** If master cylinder is replaced, bleed cylinder before installation.

- (1) Install master cylinder on the booster mounting studs.
- (2) Install mounting nuts and tighten to 23 N·m (17 ft. lbs.).
- (3) Install brake lines and tighten to 19-23 N·m (170-200 in. lbs.).
- (4) Bleed base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE)

**PARKING BRAKE****DESCRIPTION**

The parking brakes are operated by a system of cables and levers attached to a primary and secondary shoe positioned within the drum section of the rotor.

The drum-in-hat design utilizes an independent set of shoes to park the vehicle (Fig. 51).

**OPERATION**

To apply the parking brake the pedal is depressed. This creates tension in the cable which pulls forward on the park brake lever. The lever pushes the park brake shoes outward and into contact with the drum section of the rotor. The contact of shoe to rotor parks the vehicle.

A torsion locking mechanism is used to hold the pedal in an applied position. Parking brake release is accomplished by the hand release.

A parking brake switch is mounted on the parking brake lever and is actuated by movement of the lever. The switch, which is in circuit with the red warning light in the dash, will illuminate the warning light whenever the parking brake is applied.

Parking brake adjustment is controlled by a cable tensioner mechanism. The cable tensioner, once adjusted at the factory, should not need further adjustment under normal circumstances. Adjustment may be required if a new tensioner, or cables are installed, or disconnected.

**PEDAL****REMOVAL**

- (1) Release the parking brake.
- (2) Raise the vehicle.
- (3) Loosen the cable tensioner nut at the equalizer to create slack in the front cable.
- (4) Lower the vehicle.
- (5) Remove the knee bolster, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
- (6) Disconnect the brake lamp wire from the switch on the pedal assembly.
- (7) Roll the carpet back, loosen the front cable grommet from the floorpan and the cable retainer.
- (8) Disengage the cable end connector (Fig. 52) from the arm on the pedal assembly.

## PEDAL (Continued)

(9) Remove the bolts/nuts from the pedal assembly and remove the assembly.

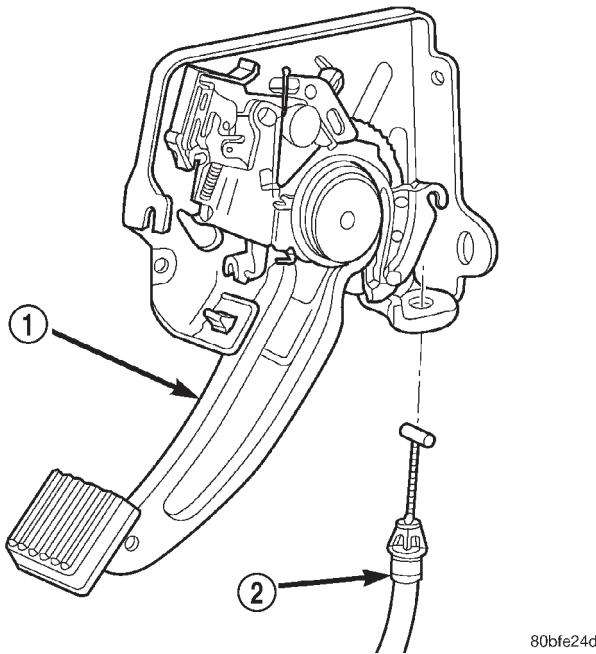


**Fig. 52 Parking Brake Pedal Assembly**

- 1 - PARK BRAKE PEDAL
- 2 - FRONT CABLE

## INSTALLATION

- (1) Position the replacement pedal assembly on the dash and cowl.
- (2) Install the bolts/nuts and tighten to 28 N·m (21 ft. lbs.).
- (3) Connect the front cable to the arm on the pedal assembly.
- (4) Tighten the front cable grommet to the floorpan and the cable retainer, roll the carpet back.
- (5) Connect the wires to the brake lamp switch.
- (6) Install the knee bolster, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
- (7) Raise the vehicle.
- (8) Adjust the parking brake cable tensioner.

## CABLES

## REMOVAL

### REMOVAL - REAR PARK BRAKE CABLE

- (1) Raise and support the vehicle.
- (2) Lockout the parking brake cable (Fig. 53).
- (3) Loosen cable adjuster nut.
- (4) Remove the rear park brake cable from the intermediate park brake cable.

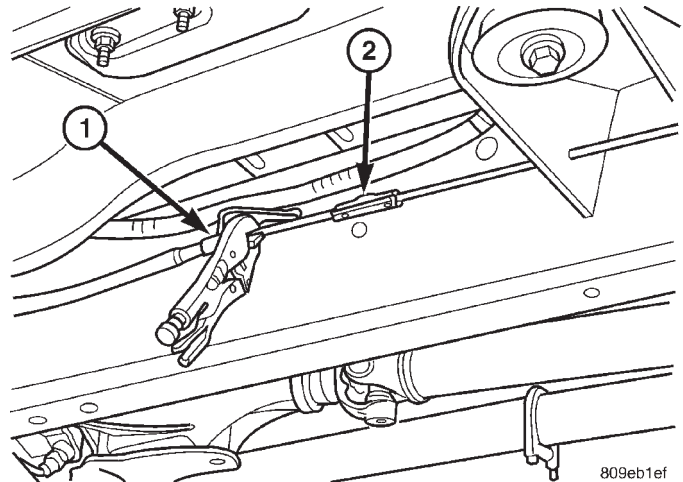


**Fig. 53 LOCK OUT PARKING CABLE**

- 1 - LOCKING PLIERS
- 2 - PARKING BRAKE CABLE

(5) Compress tabs on cable end fitting on the rear park brake cable to the frame mount bracket. Then pull the cable through the bracket.

(6) Disengage the park brake cable from behind the rotor assembly. (Fig. 54).

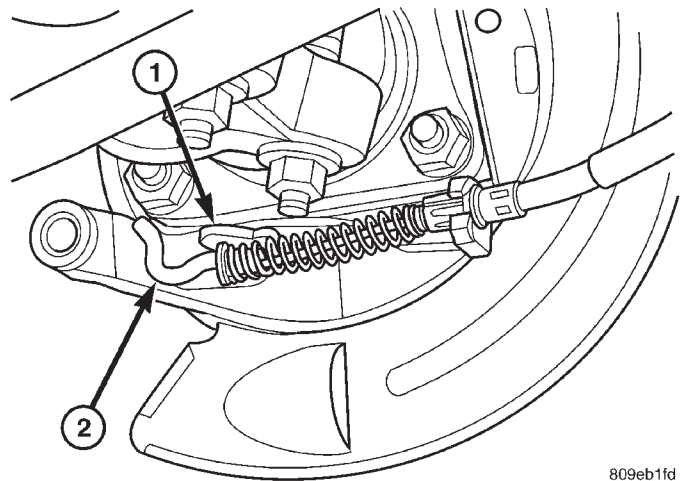


**Fig. 54 DISENGAGEMENT OF CABLE**

- 1 - LEVER
- 2 - CABLE END

(7) Compress cable tabs on each cable end fitting at the brake cable support plate.

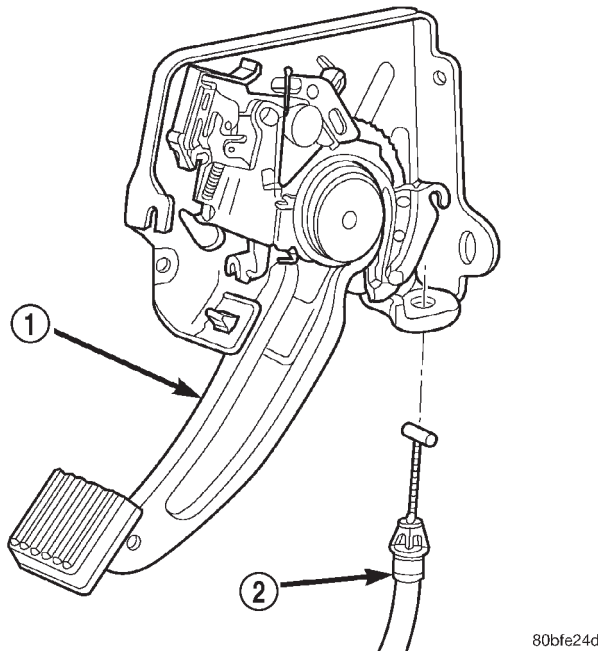
(8) Remove the cables from the brake cable support plates.

### REMOVAL - FRONT PARKING BRAKE CABLE

- (1) Raise and support vehicle.
- (2) Loosen adjusting nut to create slack in front cable.

## CABLES (Continued)

- (3) Remove the front cable from the cable connector.
- (4) Compress cable end fitting at underbody bracket and remove the cable from the bracket.
- (5) Lower vehicle.
- (6) Push ball end of cable out of pedal clevis with small screwdriver.
- (7) Compress cable end fitting at the pedal bracket and remove the cable (Fig. 55).

**Fig. 55 Parking Brake Pedal**

- 1 - PARK BRAKE PEDAL  
2 - FRONT CABLE

- (8) Remove the left cowl trim and sill plate.
- (9) Pull up the carpet and remove the cable from the body clip.
- (10) Pull up on the cable and remove the cable with the body grommet.

## INSTALLATION

**INSTALLATION - REAR PARK BRAKE CABLE**

- (1) Push each cable end through the brake cable support plate hole until the cable end fitting tabs lock into place.

**NOTE:** Pull on the cable to ensure it is locked into place.

- (2) Push the cable through the frame bracket.
- (3) Lock the left cable end fitting tabs into the frame bracket hole.
- (4) Install the rear cables into the tensioner rod behind the rear of the brake assembly.

- (5) Install the cable to the intermediate cable connector.
- (6) Release and remove the lock out device.
- (7) Perform the park brake adjustment procedure, (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).
- (8) Remove the supports and lower the vehicle.

**INSTALLATION - FRONT PARKING BRAKE CABLE**

- (1) From inside the vehicle, insert the cable end fitting into the hole in the pedal assembly.
- (2) Seat the cable retainer in the pedal assembly.
- (3) Engage the cable ball end in clevis on the pedal assembly.
- (4) Route the cable along the top of the wheel well and clip in place.
- (5) Route the cable through the floorpan and install the body grommet.
- (6) Place the carpet down and install the left cowl trim and sill plate.
- (7) Raise and support the vehicle.
- (8) Route the cable through the underbody bracket and seat the cable housing retainer in the bracket.
- (9) Connect the cable to the cable connector.
- (10) Perform the park brake adjustment procedure, (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).
- (11) Lower the vehicle.

## CABLE TENSIONER

## ADJUSTMENTS

**ADJUSTMENT**

**NOTE:** Tensioner adjustment is only necessary when the tensioner, or a cable has been replaced or disconnected for service. When adjustment is necessary, perform adjustment only as described in the following procedure. This is necessary to avoid faulty park brake operation.

- (1) Raise the vehicle.
- (2) Back off the cable tensioner adjusting nut to create slack in the cables.
- (3) Remove the rear wheel/tire assemblies. Then remove the brake drum in hat assembly.
- (4) Verify the brakes are in good condition and operating properly.
- (5) Verify the park brake cables operate freely and are not binding, or seized.
- (6) Check the rear brake shoe adjustment with standard brake gauge.

## CABLE TENSIONER (Continued)

(7) Install the drum in hat assembly and verify that the rotor rotates freely without drag.

(8) Install the wheel/tire assemblies, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(9) Lower the vehicle enough for access to the park brake foot pedal. Then fully apply the park brakes.

**NOTE: Leave park brakes applied until adjustment is complete.**

(10) Raise the vehicle again.

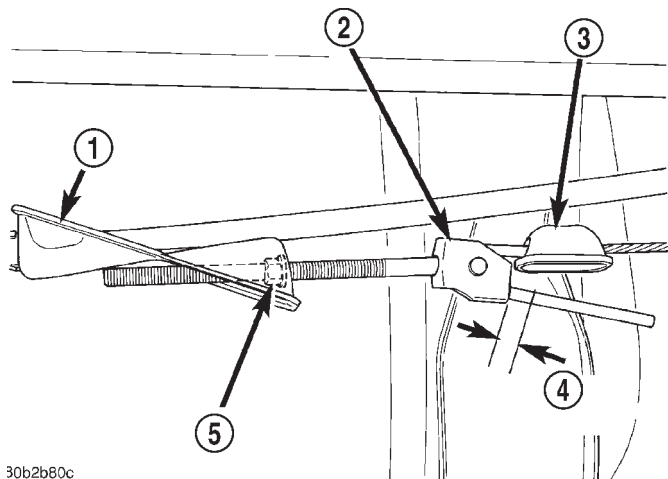
(11) Mark the tensioner rod 6.35 mm (1/4 in.) from edge of the tensioner (Fig. 56).

(12) Tighten the adjusting nut on the tensioner rod until the mark is no longer visible.

**CAUTION: Do not loosen, or tighten the tensioner adjusting nut for any reason after completing adjustment.**

(13) Lower the vehicle until the rear wheels are 15-20 cm (6-8 in.) off the shop floor.

(14) Release the park brake foot pedal and verify that rear wheels rotate freely without drag. Then lower the vehicle.



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**Fig. 56 Adjustment Mark**

- 1 - TENSIONER CABLE BRACKET
- 2 - TENSIONER
- 3 - CABLE CONNECTOR
- 4 - 6.35mm (1/4 IN.)
- 5 - ADJUSTER NUT

## RELEASE HANDLE

## REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Reach under the driver side outboard end of the instrument panel to access and unsnap the plastic

retainer clip that secures the park brake release linkage rod to the park brake mechanism on the left cowl side inner panel.

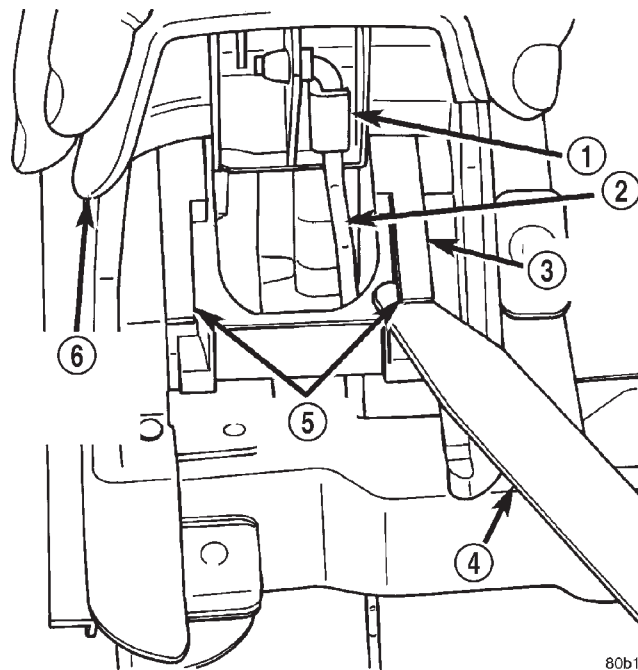
(3) Disengage the park brake release linkage rod end from the park brake mechanism.

(4) Lift the park brake release handle to access and unsnap the plastic retainer clip that secures the park brake release linkage rod to the lever on the back of the park brake release handle.

(5) Lower the park brake release handle and reach under the driver side outboard end of the instrument panel to disengage the park brake release linkage rod end from the lever on the back of the park brake release handle.

(6) Lift the park brake release handle to access the handle mounting bracket.

(7) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the park brake release handle mounting bracket latch tabs away from the retaining notches in the instrument panel receptacle (Fig. 57).



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**Fig. 57 Park Brake Release Handle Remove/Install**

- 1 - CLIP
- 2 - ROD
- 3 - MOUNTING BRACKET
- 4 - TRIM STICK
- 5 - LATCH TABS
- 6 - PARK BRAKE RELEASE HANDLE

(8) With both of the park brake release handle mounting bracket latches released, slide the handle and bracket assembly down and out of the instrument panel receptacle.

## RELEASE HANDLE (Continued)

**INSTALLATION**

(1) Position the park brake release handle to the instrument panel.

(2) Slide the handle and bracket assembly up into the instrument panel receptacle until both of the park brake release handle mounting bracket latches are engaged with the notches in the instrument panel receptacle.

(3) Lower the park brake release handle and reach under the driver side outboard end of the instrument panel to engage the park brake release linkage rod end with the lever on the back of the park brake release handle.

(4) Lift the park brake release handle to access and snap the plastic retainer clip that secures the park brake release linkage rod to the lever on the back of the park brake release handle over the linkage rod.

(5) Reach under the driver side outboard end of the instrument panel to access and engage the park brake release linkage rod end to the park brake mechanism.

(6) Snap the plastic retainer clip that secures the park brake release linkage rod to the park brake mechanism on the left cowl side inner panel over the linkage rod.

(7) Reconnect the battery negative cable.

**SHOES****REMOVAL**

(1) Raise and support the vehicle.

(2) Remove the tire and wheel assembly.

(3) Remove the disc brake caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL)

(4) Remove the disc brake rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL)

(5) Lockout the parking brake cable (Fig. 58).

(6) Disengage the park brake cable from behind the rotor assembly to allow easier disassembly of the park brake shoes (Fig. 59).

(7) Disassemble the rear park brake shoes (Fig. 60).

**INSTALLATION**

(1) Reassemble the rear park brake shoes (Fig. 61).

(2) Release the parking brake cable.

(3) Adjust the rear park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

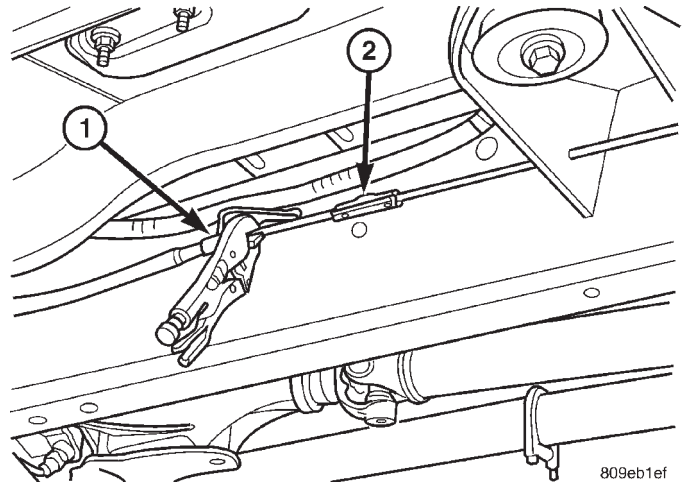


**Fig. 58 LOCK OUT PARKING CABLE**

1 - LOCKING PLIERS

2 - PARKING BRAKE CABLE

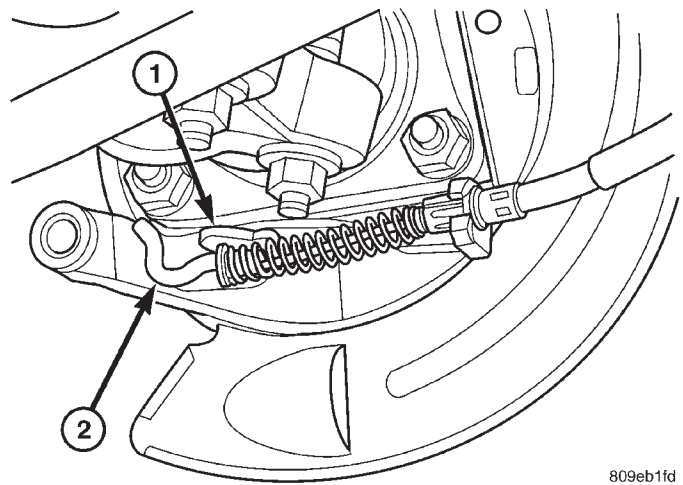


**Fig. 59 DISENGAGEMENT OF CABLE**

1 - LEVER

2 - CABLE END

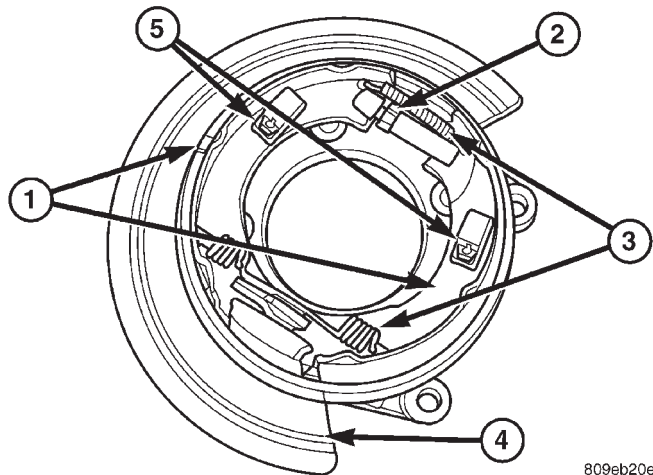
(4) Install the disc brake rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(5) Install the disc brake caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

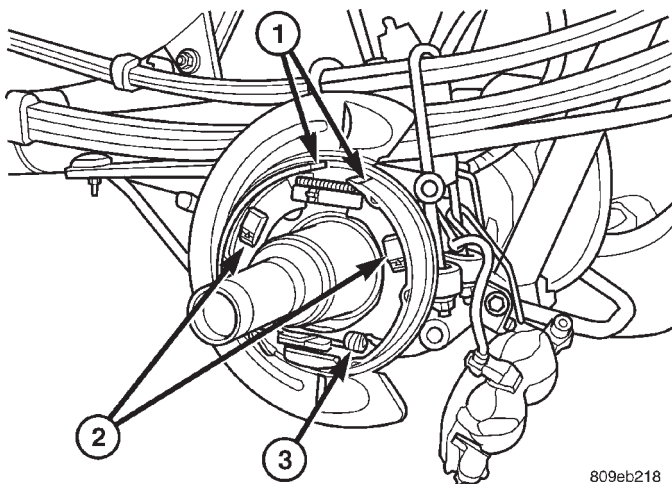
(6) Install the tire and wheel assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(7) Lower the vehicle.

## SHOES (Continued)

**Fig. 60 SHOES REMOVAL**

- 1 - PARK BRAKE SHOES
- 2 - ADJUSTER
- 3 - RETURN SPRINGS
- 4 - SPLASH SHIELD
- 5 - HOLD DOWNS

**Fig. 61 SHOE ASSEMBLY**

- 1 - Park Brake Shoes
- 2 - Hold Downs
- 3 - Return Springs

## ADJUSTMENTS

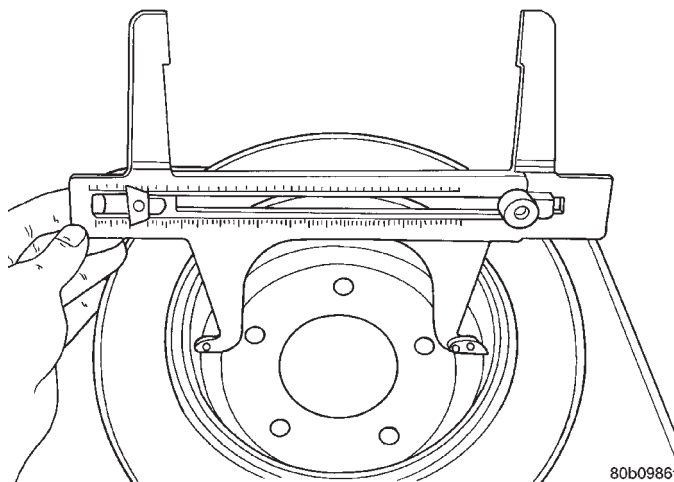
## ADJUSTMENT - PARKING BRAKE SHOES

**CAUTION:** Before adjusting the park brake shoes be sure that the park brake pedal is in the fully released position. If park brake pedal is not in the fully released position, the park brake shoes can not be accurately adjusted.

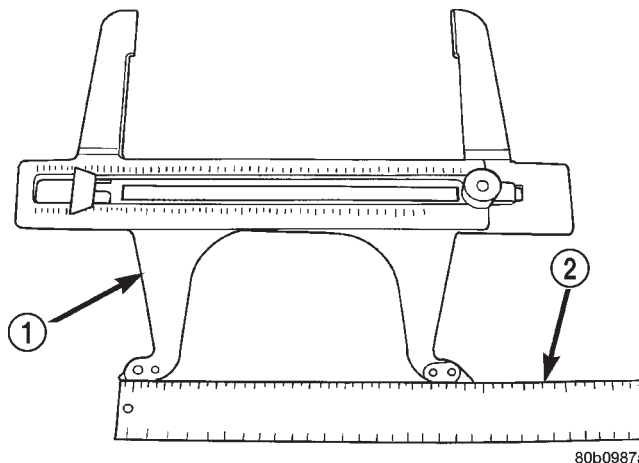
- (1) Raise vehicle.
- (2) Remove tire and wheel.
- (3) Remove disc brake caliper from caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (4) Remove rotor from the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

**NOTE:** When measuring the brake drum diameter, the diameter should be measured in the center of the area in which the park brake shoes contact the surface of the brake drum.

- (5) Using Brake Shoe Gauge, Special Tool C-3919, or equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor (Fig. 62).

**Fig. 62 Measuring Park Brake Drum Diameter**

- (6) Using a ruler that reads in 64th of an inch, accurately read the measurement of the inside diameter of the park brake drum from the special tool (Fig. 63).

**Fig. 63 Reading Park Brake Drum Diameter**

## SHOES (Continued)

(7) Reduce the inside diameter measurement of the brake drum that was taken using Special Tool C-3919 by 1/64 of an inch. Reset Gauge, Brake Shoe, Special Tool C-3919 or the equivalent used, so that the outside measurement jaws are set to the reduced measurement (Fig. 64).

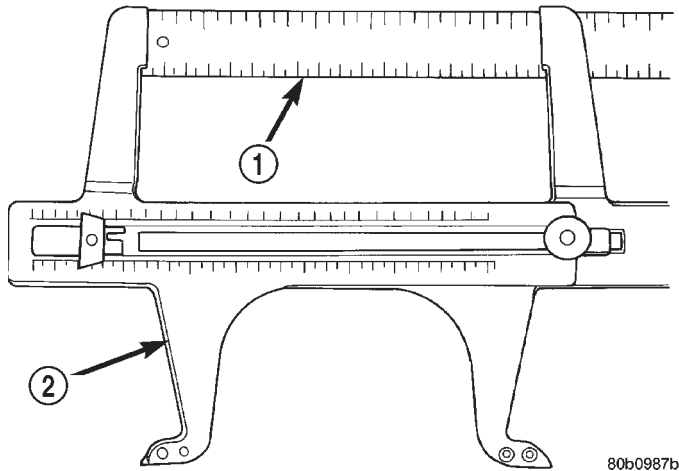


**Fig. 64 Setting Gauge To Park Brake Shoe Measurement**

(8) Place Gauge, Brake Shoe, Special Tool C-3919, or equivalent over the park brake shoes. The special tool must be located diagonally across at the top of one shoe and bottom of opposite shoe (widest point) of the park brake shoes.

(9) Using the star wheel adjuster, adjust the park brake shoes until the lining on the park brake shoes just touches the jaws on the special tool.

(10) Repeat step 8 above and measure shoes in both directions.

(11) Install brake rotor on the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION) .

(12) Rotate rotor to verify that the park brake shoes are not dragging on the brake drum. If park brake shoes are dragging, remove rotor and back off star wheel adjuster one notch and recheck for brake shoe drag against drum. Continue with the previous step until brake shoes are not dragging on brake drum.

(13) Install disc brake caliper on caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(14) Install wheel and tire.

(15) Tighten the wheel mounting nuts in the proper sequence until all nuts are torqued to half the specified torque. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(16) Lower vehicle.

(17) Apply and release the park brake pedal one time. This will seat and correctly adjust the park brake cables.

**CAUTION: Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.**

(18) Road test the vehicle to ensure proper function of the vehicle's brake system.

## BRAKES - ABS

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## BRAKES - ABS

### DESCRIPTION

The antilock brake system (ABS) is an electronically operated, all wheel brake control system. 2500 and 3500 vehicles have Electronic Brake Distribution (EBD) designed into the system which eliminates the combination/proportioning valve.

The system is designed to prevent wheel lockup and maintain steering control during periods of high wheel slip when braking. Preventing lockup is accomplished by modulating fluid pressure to the wheel brake units.

The hydraulic system is a three channel design. The front wheel brakes are controlled individually and the rear wheel brakes in tandem (Fig. 1). The ABS electrical system is separate from other electrical circuits in the vehicle. A specially programmed controller antilock brake unit operates the system components.

ABS system major components include:

- Controller Antilock Brakes (CAB)
- Hydraulic Control Unit (HCU)
- Wheel Speed Sensors (WSS)

- ABS Warning Light

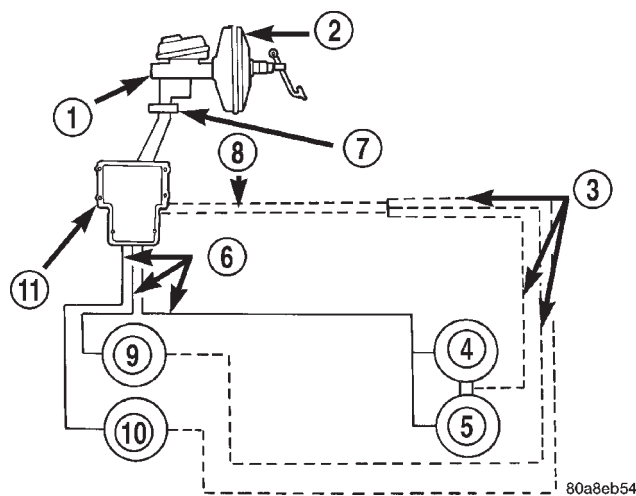


**Fig. 1 Antilock Brake System**

- 1 - MASTER CYLINDER AND RESERVOIR
- 2 - POWER BRAKE BOOSTER
- 3 - WIRES TO WHEEL SPEED SENSORS
- 4 - RIGHT REAR WHEEL
- 5 - LEFT REAR WHEEL
- 6 - HYDRAULIC BRAKE LINES TO WHEELS
- 7 - COMBINATION VALVE
- 8 - HARNESS
- 9 - RIGHT FRONT WHEEL
- 10 - LEFT FRONT WHEEL
- 11 - CAB/HCU

## BRAKES - ABS (Continued)

**OPERATION**

Battery voltage is supplied to the CAB when a speed of 15 miles per hour is reached. The CAB performs a system initialization procedure at this point. Initialization consists of a static and dynamic self check of system electrical components.

The static and dynamic checks occurs at ignition start up. During the dynamic check, the CAB briefly cycles the pump and solenoids to verify operation. An audible noise may be heard during this self check. This noise should be considered normal.

If an ABS component exhibits a fault during initialization, the CAB illuminates the amber warning light and registers a fault code in the microprocessor memory.

The CAB monitors wheel speed sensor inputs continuously while the vehicle is in motion. However, the CAB will not activate any ABS components as long as sensor inputs indicate normal braking.

During normal braking, the master cylinder, power booster and wheel brake units all function as they would in a vehicle without ABS. The HCU components are not activated.

The purpose of the antilock system is to prevent wheel lockup during periods of high wheel slip. Preventing lockup helps maintain vehicle braking action and steering control.

The antilock CAB activates the system whenever sensor signals indicate periods of wheel slip. Periods of wheel slip occur when brake stops involve high pedal pressure and rate of vehicle deceleration.

The antilock system prevents lockup during a wheel slip condition by modulating fluid apply pressure to the wheel brake units.

Brake fluid apply pressure is modulated according to wheel speed, degree of slip and rate of deceleration. Sensors at each front wheel convert wheel speed into electrical signals. These signals are transmitted to the CAB for processing and determination of wheel slip and deceleration rate.

The ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem. A speed sensor input signal indicating a wheel slip condition activates the CAB antilock program.

There are Two solenoid valves (Isolation and Dump valve) which are used in each antilock control channel. The valves are all located within the HCU valve body and work in pairs to either increase, hold, or decrease apply pressure as needed in the individual control channels.

During an ABS stop the ISO valve actuates, Stopping anymore pressure build —up to the calipers. Then the Dump valve dumps off pressure until the wheel unlocks. This will continue until the wheels quit slipping altogether.

**DIAGNOSIS AND TESTING - ANTILOCK BRAKES**

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the systems input and output circuits to verify the system is operating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

**NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.**

**NOTE: The MDS or DRB III scan tool is used to diagnose the ABS system. For additional information refer to the Antilock Brake section in Group 8W. For test procedures refer to the Chassis Diagnostic Manual.**

**STANDARD PROCEDURE****STANDARD PROCEDURE - RWAL SERVICE PRECAUTIONS**

The RWAL uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits. **In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter or the DRB tester as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

**CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, ect.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.**

**STANDARD PROCEDURE - BLEEDING ABS BRAKE SYSTEM**

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the

## BRAKES - ABS (Continued)

HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

(1) Perform the base brake bleeding, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

(2) Connect the scan tool to the Data Link Connector.

(3) Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.

(4) Perform base brake bleeding a second time, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

(5) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

## SPECIFICATIONS

## TORQUE CHART

## TORQUE SPECIFICATIONS

| DESCRIPTION                         | N·m | Ft. Lbs. | In. Lbs. |
|-------------------------------------|-----|----------|----------|
| ABS Assembly Bracket Bolts          | 13  | 10       | 120      |
| ABS Assembly Mounting Nuts          | 13  | 10       | 102      |
| ABS Assembly CAB Screws             | 4   | 3        | 35       |
| ABS Assembly Brake Lines            | 21  | 15       | 190      |
| Wheel Speed Sensor Frt. Bolts (4x2) | 23  | 17       | 200      |
| Wheel Speed Sensor Frt. Bolts (4x4) | 14  | 10       | 120      |
| Wheel Speed Sensor Rear Bolt        | 24  | 18       | 210      |

## FRONT WHEEL SPEED SENSOR

### DESCRIPTION

The ABS brake system uses 3 wheel speed sensors. A sensor is mounted to each front steering knuckles. The third sensor is mounted on top of the rear axle differential housing.

### OPERATION

The Wheel Speed Sensor consists of a magnet surrounded by windings from a single strand of wire. The sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (exciter ring or tone wheel) passes the stationary magnetic WSS.

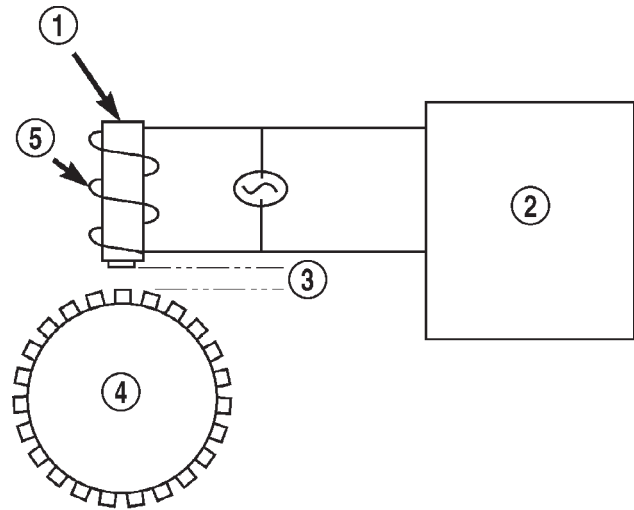
When the ring gear is rotated, the exciter ring passes the tip of the WSS. As the exciter ring tooth approaches the tip of the WSS, the magnetic lines of force expand, causing the magnetic field to cut across the sensor's windings. This, in turn causes current to flow through the WSS circuit (Fig. 2) in one direction. When the exciter ring tooth moves away from the sensor tip, the magnetic lines of force collapse cutting the winding in the opposite direction. This causes the current to flow in the opposite direction. Every time a tooth of the exciter ring passes the tip of the WSS, an AC signal is generated. Each AC signal (positive to negative signal or sinewave) is interpreted by the CAB. It then compares the frequency of the sinewave to a time value to calculate vehicle speed. The CAB continues to monitor the frequency to determine a deceleration rate that would indicate a possible wheel-locking tendency.

The signal strength of any magnetic induction sensor is directly affected by:

- Magnetic field strength; the stronger the magnetic field, the stronger the signal
- Number of windings in the sensor; more windings provide a stronger signal
- Exciter ring speed; the faster the exciter ring/tone wheel rotates, the stronger the signal will be
- Distance between the exciter ring teeth and WSS; the closer the WSS is to the exciter ring/tone wheel, the stronger the signal will be

The rear WSS is not adjustable. A clearance specification has been established for manufacturing tolerances. If the clearance is not within these specifications, then either the WSS or other components may be damaged. The clearance between the WSS and the exciter ring is 0.005 – 0.050 in.

The assembly plant performs a "Rolls Test" on every vehicle that leaves the assembly plant. One of the test performed is a test of the WSS. To properly

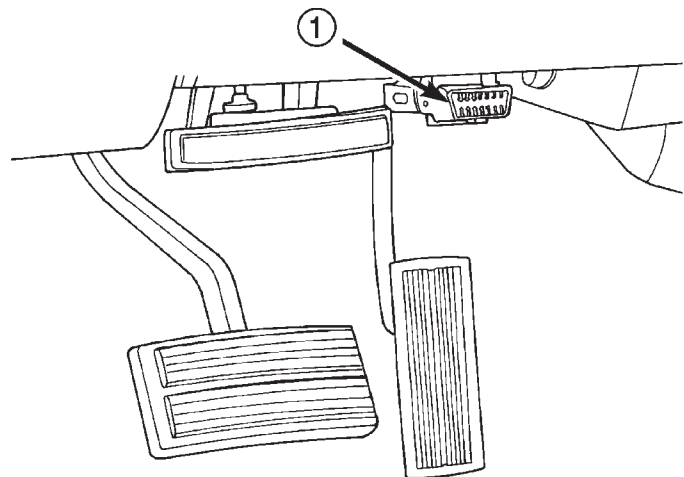


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**Fig. 2 Operation of the Wheel Speed Sensor**

- 1 - MAGNETIC CORE
- 2 - CAB
- 3 - AIR GAP
- 4 - EXCITER RING
- 5 - COIL

test the sensor, the assembly plant connects test equipment to the Data Link Connector (DLC). This connector is located to the right of the steering column and attached to the lower portion of the instrument panel (Fig. 3). The rolls test terminal is spliced to the WSS circuit. The vehicle is then driven on a set of rollers and the WSS output is monitored for proper operation.



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**Fig. 3 Data Link Connector - Typical**

- 1 - 16-WAY DATA LINK CONNECTOR

## REMOVAL

### REMOVAL - 4X2

- (1) Raise and support vehicle.
- (2) Disconnect the ABS wheel speed sensor wire from under the hood. Remove sensor wire from the frame, brake hose and steering knuckle.
- (3) Remove sensor bolt from the backside of the steering knuckle and remove the sensor (Fig. 4).

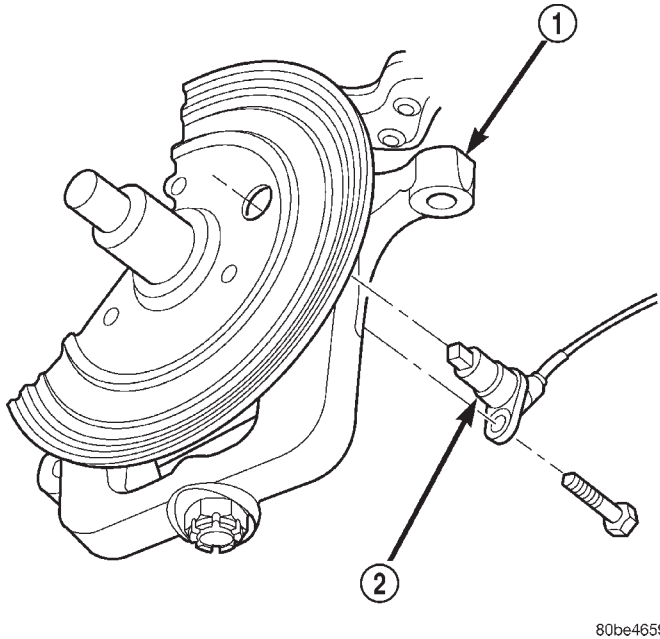
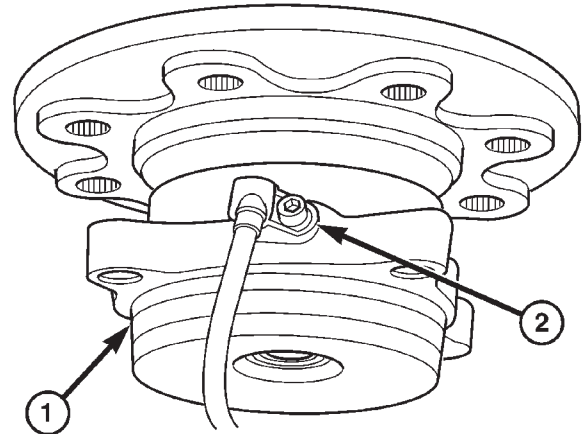


**Fig. 4 Wheel Speed Sensor - 4x2**

- 1 - KNUCKLE  
2 - SENSOR

### REMOVAL - 4X4

- (1) Disconnect the ABS wheel speed sensor wire from under the hood.
- (2) Raise and support the vehicle.
- (3) Remove the tire and wheel assembly.
- (4) Remove the sensor wire from the clips on the brake hose.
- (5) Remove the brake caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (6) Remove the disc brake rotor and adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
- (7) Bend the tab on the dust shield upwards to allow access to the bolt.
- (8) Remove the bolt attaching the sensor to the hub bearing. (Fig. 5)
- (9) Remove the sensor wire.



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**Fig. 5 WHEEL SPEED SENSOR - 4X4**

- 1 - HUB/BEARING  
2 - WHEEL SPEED SENSOR

## INSTALLATION

### INSTALLATION - 4X2

- (1) Position sensor in knuckle.
- (2) Install and tighten sensor bolt to 23 N·m (17 ft. lbs.). **Use original or replacement sensor bolt only. The bolt is special and must not be substituted.**
- (3) Install sensor wire to the steering knuckle, brake hose and frame. Connect the wheel speed sensor wire under the hood.
- (4) Check sensor wire routing. Be sure wire is clear of all chassis components and is not twisted or kinked at any spot.
- (5) Remove support and lower the vehicle.
- (6) Verify sensor operation with scan tool.

### INSTALLATION - 4X4

**NOTE: Use original or replacement sensor bolts only. The bolts are special and must not be substituted.**

- (1) Install the sensor in the hub bearing and tighten the bolt to 14 N·m (11 ft. lbs.). (Fig. 5)
- (2) Bend the dust shield tab back downwards into position.
- (3) Install the disc brake rotor and caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
- (4) Install the brake caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (5) Route the wire into the clips.

## FRONT WHEEL SPEED SENSOR (Continued)

**NOTE:** Check the sensor wire routing. Be sure the wire is clear of all chassis components and is not twisted or kinked at any spot.

- (6) Install the tire and wheel assembly.
- (7) Remove the support and lower the vehicle.
- (8) Reconnect the ABS wheel speed sensor wire electrical connector inside the engine compartment.
- (9) Apply the brakes several times to seat the brake shoes and caliper piston. Do not move the vehicle until a firm brake pedal is obtained.
- (10) Verify the wheel speed sensor operation with a scan tool.

## REAR WHEEL SPEED SENSOR

## DIAGNOSIS AND TESTING - REAR WHEEL SPEED SENSOR

Diagnosis of base brake conditions which are mechanical in nature should be performed first. This includes brake noise, lack of power assist, parking brake, or vehicle vibration during normal braking.

The Antilock brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the system inputs and outputs circuits to verify the system is operating properly. If the CAB senses a malfunction in the system it will set a DTC into memory and trigger the warning lamp.

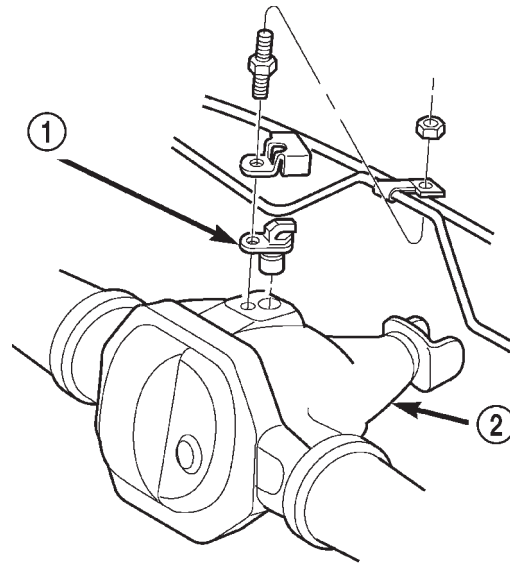
**NOTE:** The MDS or DRB III scan tool is used to diagnose the Antilock Brake system. For test procedures refer to the Chassis Diagnostic Manual.

## REMOVAL

- (1) Raise vehicle on hoist.
- (2) Remove brake line mounting nut and remove the brake line from the sensor stud.
- (3) Remove mounting stud from the sensor and shield (Fig. 6) .
- (4) Remove sensor and shield from differential housing.
- (5) Disconnect sensor wire harness and remove sensor.

## INSTALLATION

- (1) Connect harness to sensor. **Be sure seal is securely in place between sensor and wiring connector.**
- (2) Install O-ring on sensor (if removed).
- (3) Insert sensor in differential housing.
- (4) Install sensor shield.
- (5) Install the sensor mounting stud and tighten to 24 N·m (18 ft. lbs.).



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**Fig. 6 Rear Speed Sensor Mounting**

- 1 - WHEEL SPEED SENSOR
- 2 - AXLE

- (6) Install the brake line on the sensor stud and install the nut.
- (7) Lower vehicle.

## HCU (HYDRAULIC CONTROL UNIT)

## DESCRIPTION

The hydraulic control unit (HCU) consists of a valve body, pump, two accumulators and a motor. The assembly is mounted on the driverside inner fender under the hood.

## OPERATION

The pump, motor, and accumulators are combined into an assembly attached to the valve body. The accumulators store the extra fluid which had to be dumped from the brakes. This is done to prevent the wheels from locking up. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the CAB.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

The valve body contains the solenoid valves. The valves modulate brake pressure during antilock braking and are controlled by the CAB.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining channels control the front wheel brakes individually.

## HCU (HYDRAULIC CONTROL UNIT) (Continued)

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure decrease, pressure hold, and pressure increase. The valves are all contained in the valve body portion of the HCU.

**PRESSURE DECREASE**

The inlet valve is closed and the outlet valve is opened during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the CAB closes the inlet to prevent the driver from further increasing the brake pressure and locking the brakes. The CAB then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the CAB closes the outlet valve and begins a pressure increase or hold cycle as needed.

**PRESSURE HOLD**

Both solenoid valves are closed in the pressure hold cycle. Fluid apply pressure in the control channel is maintained at a constant rate. The CAB maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

**PRESSURE INCREASE**

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

**REMOVAL**

- (1) Disconnect battery negative cable.
- (2) Push the harness connector locks to release the locks, then remove the connectors from the CAB.
- (3) Disconnect brake lines from HCU (Fig. 7).
- (4) Remove the two mounting bolts on either side of the assembly which attach the assembly to the mounting bracket.
- (5) Tilt the assembly upward where the brake lines attach and remove the assembly from the mounting bracket.

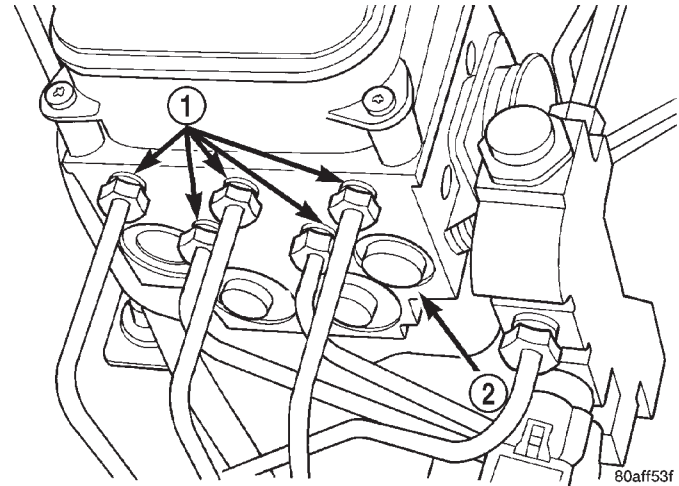


**Fig. 7 Brake Lines**

- 1 - BRAKE LINES  
2 - HCU

**INSTALLATION**

- (1) Install the assembly into the mounting bracket.
- (2) Install the mounting bolts and tighten to 12 N·m (102 in. lbs.).
- (3) Connect the CAB harnesses.
- (4) Connect the brake lines to the HCU. Tighten brake line fittings to 19-23 N·m (170-200 in. lbs.).
- (5) Connect battery.
- (6) Bleed brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).

