

BRAKES

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BRAKES - BASE

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BRAKES - BASE

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

BRAKES - BASE (Continued)

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.

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, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS 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 corroded bushings or rusted slide surfaces.
- 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

BRAKES - BASE (Continued)

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
- Rusty caliper slide surfaces
- 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 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.

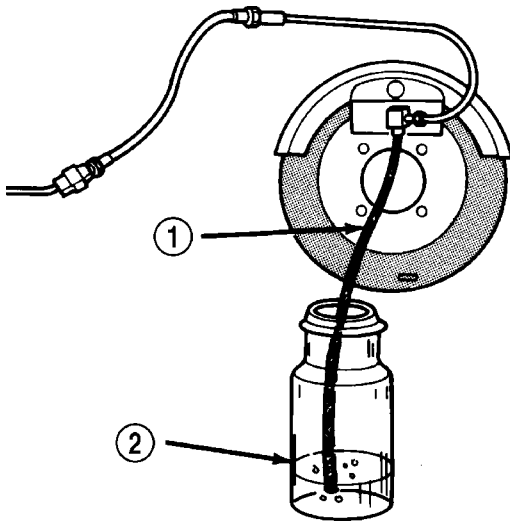
THUMP/CLUNK NOISE

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.

BRAKES - BASE (Continued)**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.



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Fig. 1 Bleed Hose Setup

- 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.

STANDARD PROCEDURE - PRESSURE BLEEDING

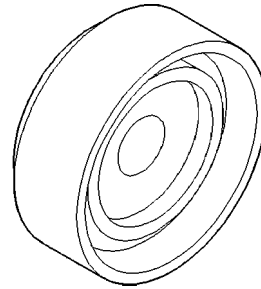
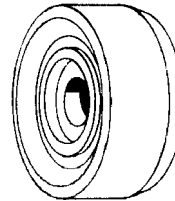
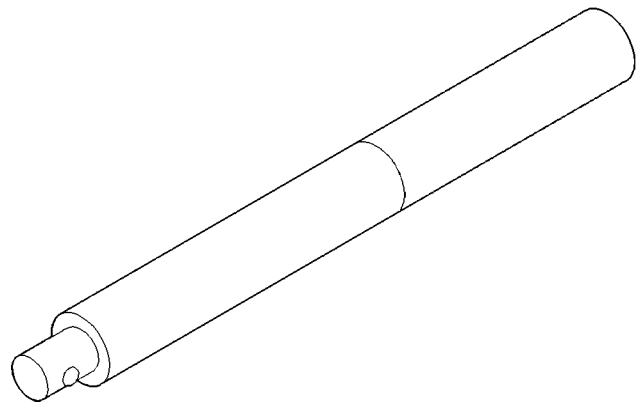
Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the

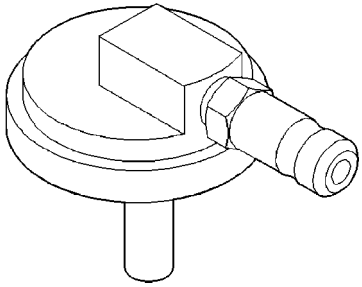
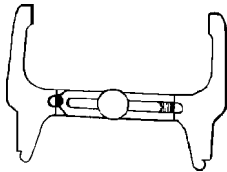
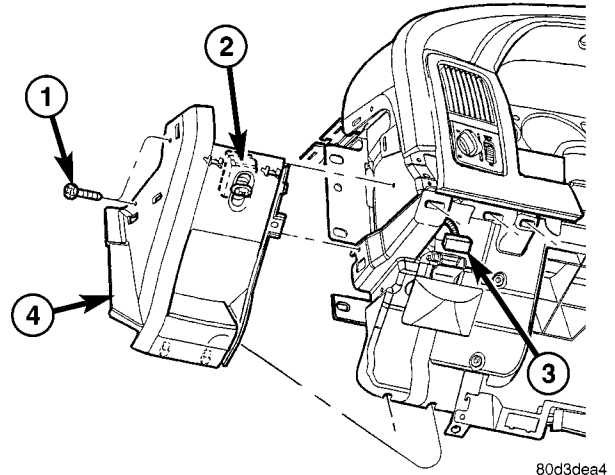
tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

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.

SPECIAL TOOLS**BASE BRAKES****INSTALLER, BRAKE CALIPER DUST BOOT C-4340****INSTALLER, BRAKE CALIPER DUST BOOT C-3716-A****HANDLE C-4171**

BRAKES - BASE (Continued)

**CAP, MASTER CYLINDER PRESSURE BLEED 6921****GAUGE, BRAKE SAFE-SET C-3919**

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Fig. 2 LOWER DRIVERS SIDE BEZEL

- 1 - SCREWS (2)
 2 - ADJUSTABLE PEDAL SWITCH
 3 - PEDAL SWITCH ELECTRICAL CONNECTOR
 4 - BEZEL

ADJUSTABLE PEDAL SWITCH**REMOVAL**

(1) Remove the lower drivers side bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DR SIDE BEZEL - REMOVAL).

(2) Disconnect the electrical connector from the adjustable pedal switch.

(3) Remove the switch from the lower drivers side bezel by squeezing the retaining clips together and pushing the switch outwards (Fig. 2).

INSTALLATION

(1) Install the switch to the lower drivers side bezel by pushing the switch inwards seating the retaining clips to the lower drivers side bezel.

(2) Reconnect the electrical connector to the adjustable pedal switch.

(3) Install the lower drivers side bezel (Fig. 2) (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DR SIDE BEZEL - INSTALLATION).

HYDRAULIC/MECHANICAL**SPECIFICATIONS****SPECIFICATIONS - TORQUE CHART****TORQUE SPECIFICATIONS**

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Booster Mounting Nuts	38	28	—
Master Cylinder Mounting Nuts	18	—	160
Caliper Mounting Pins	32	24	—
Caliper Adapter Mounting Bolts	176	130	—
Junction Block Bolts To Frame	10	7.5	—
Brake Pedal Assembly Bracket Nuts	28	21	—

HYDRAULIC/MECHANICAL (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Support Plate Mounting Bolts/Nuts	64	47	—
Brake Line Fittings Master Cylinder	19	14	170
Brake Line Fittings Junction Block	19	14	170
Caliper Brake Line Banjo Bolt	27	20	245
Brake Hose Front Bolts To Frame	10	7.5	—
Brake Hose Front Fitting	19	14	250
Brake Hose Rear Fitting	19	14	250
Parking Brake Pedal Assembly	19	14	250
Hub/Bearing Bolts	163	120	—

BASE BRAKE*SPECIFICATIONS*

DESCRIPTION	SPECIFICATION
Front Disc Brake Caliper Type	Dual Piston Sliding
Rear Disc Brake Caliper Type	Single Piston Sliding
Front Disc Brake Caliper	54 mm (2.00 in.)
Front Disc Brake Rotor	336×28 mm (13.2×1.1 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.)
Minimum Front Rotor Thickness	26.4 mm (1.039 in.)
Minimum Rear Rotor Thickness	28.39 mm (1.117 in)
Rear Disc Brake Caliper	1x54 mm (2.12 in)
Rear Disc Brake Rotor	350x22 mm (.86 in)
Brake Booster Type Gasoline Engines	Vacuum Dual Diaphragm

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

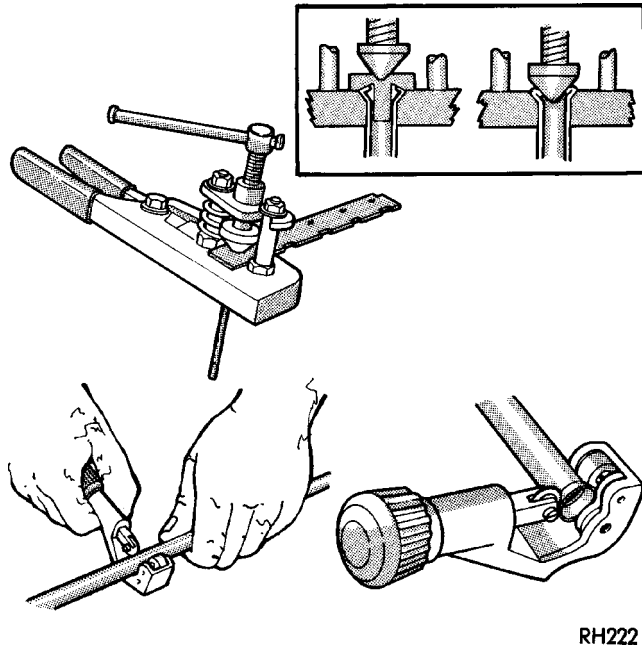
A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

- (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. 3).
- (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.

STANDARD PROCEDURE - ISO FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel

BRAKE LINES (Continued)

**Fig. 3 Inverted Flare Tools**

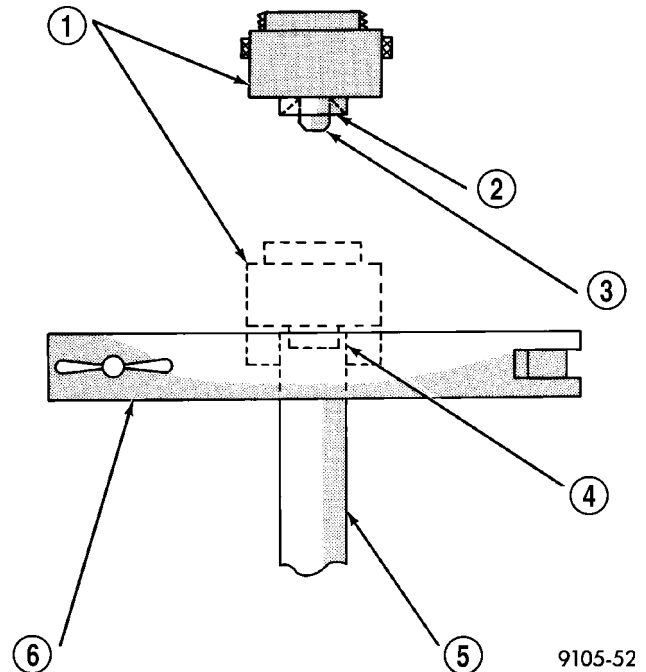
tube can be used for emergency repair when factory replacement parts are not readily available.

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

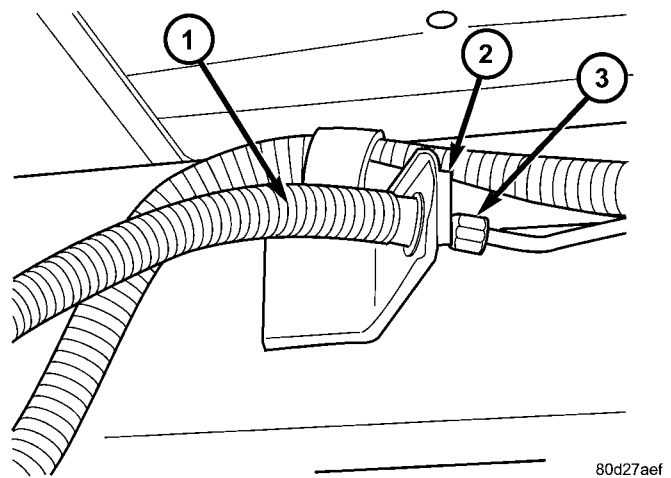
- (1) Cut off damaged tube with Tubing Cutter.
- (2) Remove any burrs from the inside of the tube.
- (3) Install tube nut on the tube.
- (4) Position the tube in the flaring tool flush with the top of the tool bar (Fig. 4). Then tighten the tool bar on the tube.
- (5) Install the correct size adaptor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

REMOVAL**REMOVAL - REAR BRAKE HOSE**

- (1) Install prop rod on the brake pedal to keep pressure on the brake system.
- (2) Raise and support the vehicle.
- (3) Remove the brake line from the hose at the frame (Fig. 5).
- (4) Remove the brake hose clip at the top of the hose located at the frame (Fig. 5).
- (5) Remove the vent tube (Fig. 6).
- (6) Remove the two brake lines at the bottom of the hose located at the axle (Fig. 6).
- (7) Remove the mounting bolt for the brake hose at the axle (Fig. 6).
- (8) Remove the hose.

**Fig. 4 ISO Flaring**

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

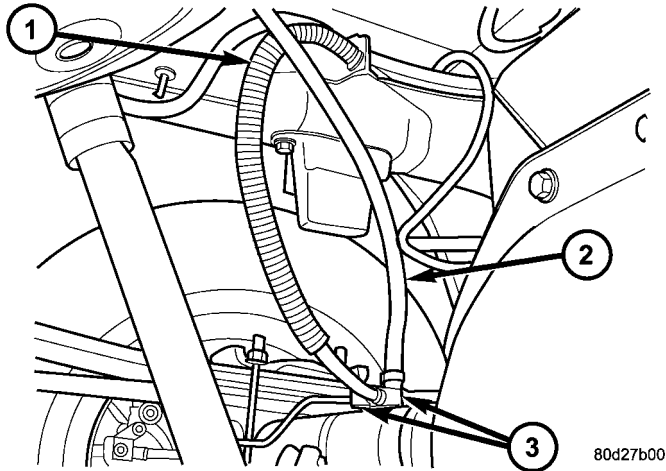
**Fig. 5 BRAKE LINE CLIP**

- 1 - BRAKE HOSE
- 2 - CLIP
- 3 - BRAKE LINE

REMOVAL - REAR TUBE / HOSE ASSEMBLY

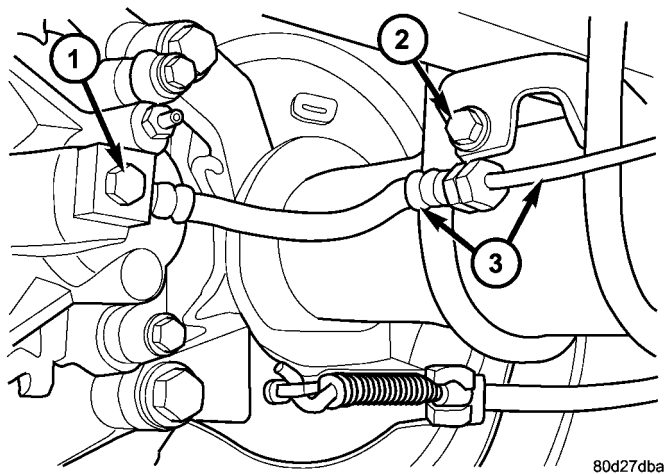
- (1) Install prop rod on the brake pedal to keep pressure on the brake system.
- (2) Raise and support the vehicle.
- (3) Remove the brake line located at the axle.
- (4) Remove the mounting bolt for the brake hose at the axle (Fig. 7).

BRAKE LINES (Continued)

**Fig. 6 REAR HOSE**

- 1 - BRAKE HOSE
- 2 - VENT HOSE
- 3 - BRAKE LINES

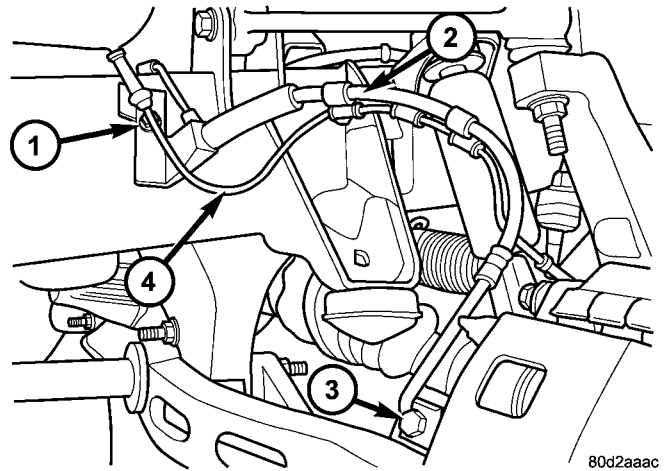
- (5) Remove the banjo bolt at the caliper (Fig. 7).
- (6) Remove the hose.

**Fig. 7 BRAKE LINE WITH RUBBER HOSE**

- 1 - BANJO BOLT
- 2 - MOUNTING BOLT
- 3 - REAR TUBE / HOSE ASSEMBLY

REMOVAL - FRONT HOSE

- (1) Install a prop rod on the brake pedal to keep pressure on the brake system.
- (2) Raise and support vehicle.
- (3) Remove the tire and wheel assembly.
- (4) Remove the brake hose from the brake line located at the frame (Fig. 8).
- (5) Remove the brake hose banjo bolt at the caliper (Fig. 8).
- (6) Remove the mounting bolt securing the brake hose to the frame and remove the wheel speed sensor wire from the brake hose (Fig. 8).
- (7) Remove the hose.

**Fig. 8 BRAKE HOSE MOUNTED PASSENGER SIDE**

- 1 - MOUNTING BOLT
- 2 - BRAKE HOSE
- 3 - BANJO BOLT
- 4 - WHEEL SPEED SENSOR WIRE

INSTALLATION**INSTALLATION - REAR BRAKE HOSE**

- (1) Install the hose.
- (2) Install the mounting bolt for the brake hose at the axle (Fig. 6).
- (3) Install the two brake lines at the bottom of the hose located at the axle (Fig. 6).
- (4) Install the vent tube (Fig. 6).
- (5) Install the brake hose clip at the top of the hose located at the frame (Fig. 5).
- (6) Install the brake line to the hose at the frame (Fig. 5).
- (7) Lower the vehicle and remove the support.
- (8) Remove the prop rod.
- (9) Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

INSTALLATION - REAR TUBE / HOSE ASSEMBLY

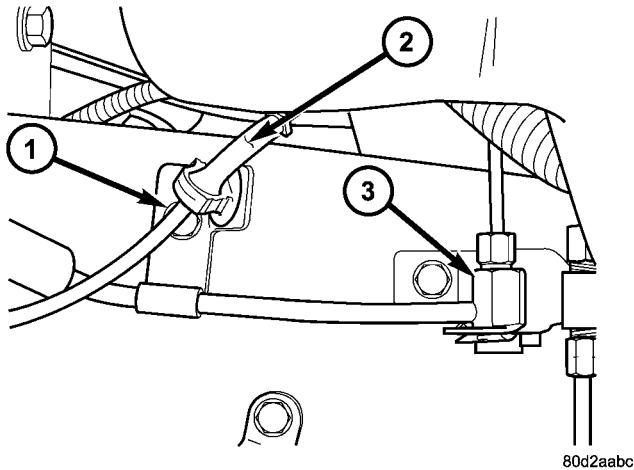
- (1) Install the hose.
- (2) Install the banjo bolt at the caliper (Fig. 7).
- (3) Install the mounting bolt for the brake hose at the axle (Fig. 7).
- (4) Install the brake line located at the axle.
- (5) Lower the vehicle and remove the support.
- (6) Remove the prop rod.
- (7) Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

INSTALLATION - FRONT BRAKE HOSE

- (1) Install the hose.
- (2) Install the mounting bolt for the brake hose at the frame (Fig. 9).

BRAKE LINES (Continued)

- (3) Install the brake hose banjo bolt at the caliper (Fig. 8).
- (4) Reinstall the wheel speed sensor wire to the brake hose (Fig. 8).
- (5) Remove the support and lower the vehicle.

**Fig. 9 BRAKE HOSE MOUNT DRIVERS SIDE**

- 1 - MOUNTING BOLT
- 2 - WHEEL SPEED SENSOR WIRE
- 3 - BRAKE HOSE

- (6) Remove the prop rod from the brake pedal.
- (7) Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

BRAKE PADS/SHOES

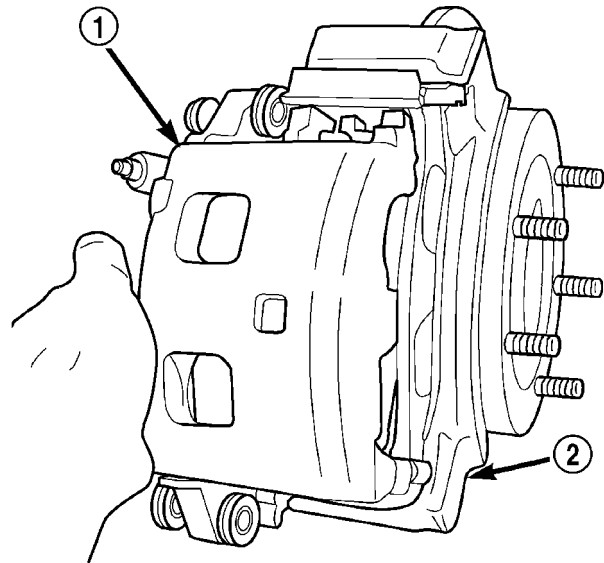
REMOVAL

- (1) Raise and support vehicle.
- (2) Remove the wheel and tire assemblies.
- (3) Compress the caliper.
- (4) Remove the caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
- (5) Remove the caliper by tilting the top up and off the caliper adapter (Fig. 10).

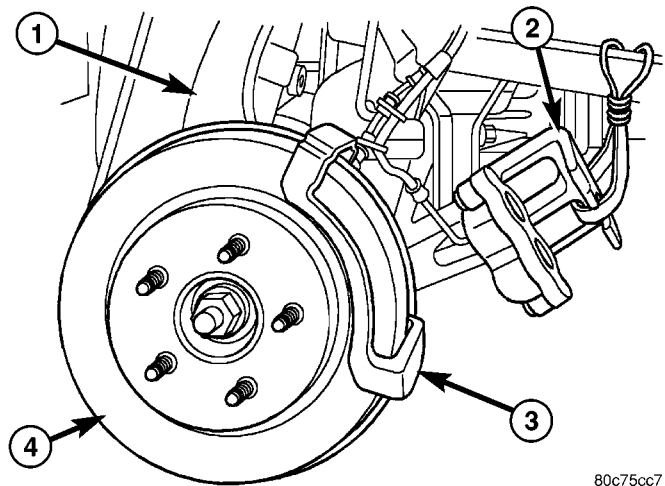
NOTE: Do not allow brake hose to support caliper assembly.

- (6) Support and hang the caliper. (Fig. 11)
- (7) Remove the inboard brake shoe from the caliper adapter (Fig. 12).
- (8) Remove the outboard brake shoe from the caliper adapter (Fig. 13).
- (9) Remove the anti-rattle springs from the caliper adapter (Fig. 14) and (Fig. 15).

NOTE: Anti-rattle springs are not interchangeable.

**Fig. 10 Caliper**

- 1 - CALIPER
- 2 - CALIPER ADAPTER

**Fig. 11 DISC BRAKE CALIPER - FRONT**

- 1 - STEERING KNUCKLE
- 2 - DISC BRAKE CALIPER
- 3 - CALIPER MOUNTING ADAPTER
- 4 - DISC BRAKE ROTOR

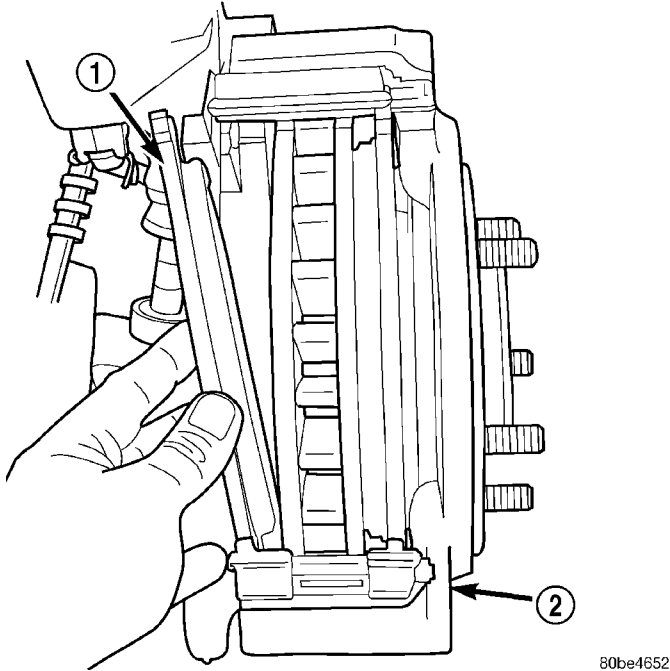
INSTALLATION

- (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.

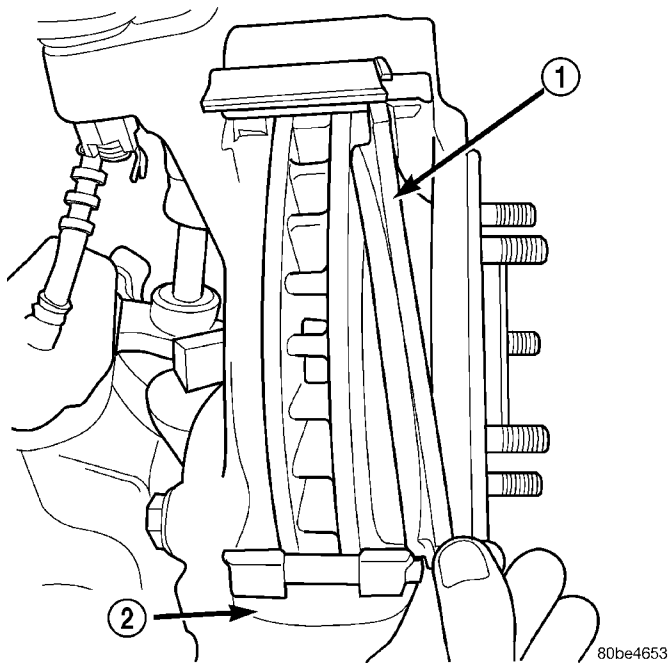
NOTE: Anti-rattle springs are not interchangeable.

- (5) Install inboard brake shoe in adapter.

BRAKE PADS/SHOES (Continued)

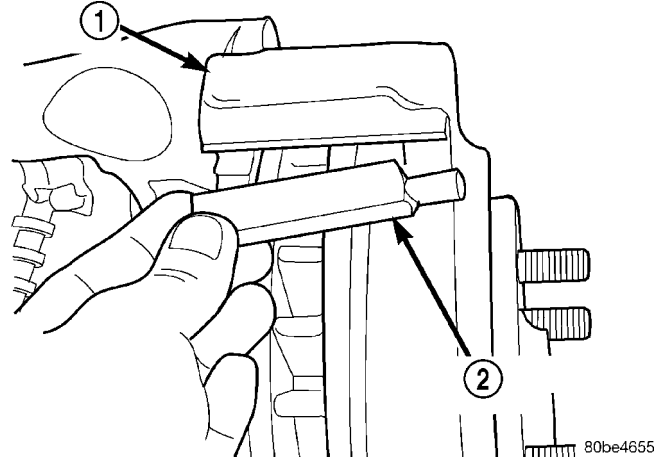
**Fig. 12 Inboard Brake Shoe**

- 1 - INBOARD SHOE
2 - CALIPER ADAPTER

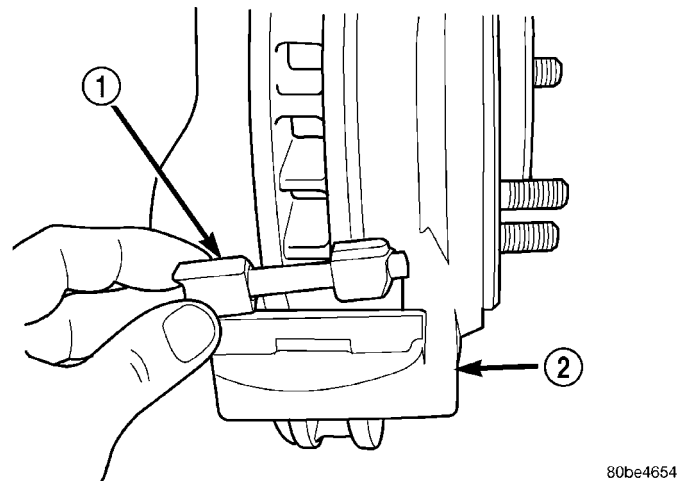
**Fig. 13 Outboard Brake Shoe**

- 1 - OUTBOARD SHOE
2 - CALIPER ADAPTER

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

**Fig. 14 Top Anti-Rattle Spring**

- 1 - CALIPER ADAPTER
2 - ANTI-RATTLE SPRING

**Fig. 15 Bottom Anti-Rattle Spring**

- 1 - ANTI-RATTLE SPRING
2 - CALIPER 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.

DISC BRAKE CALIPERS

DESCRIPTION

The calipers are a single piston type in the rear and dual piston type in the front. The calipers are free to slide laterally, this allows continuous compensation for lining wear.

DISC BRAKE CALIPERS (Continued)

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. 16).

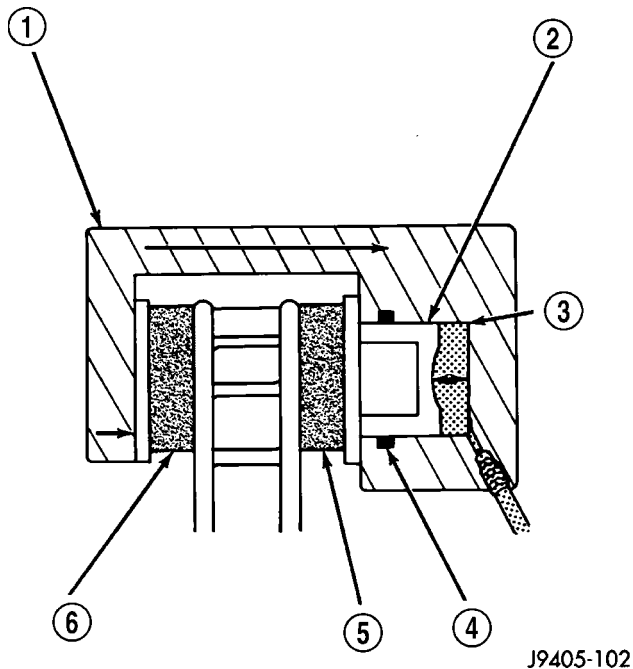


Fig. 16 Brake Caliper Operation

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

Fluid pressure applied to the piston is transmitted directly to the inboard brake pad. This forces the pad 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 pad 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.

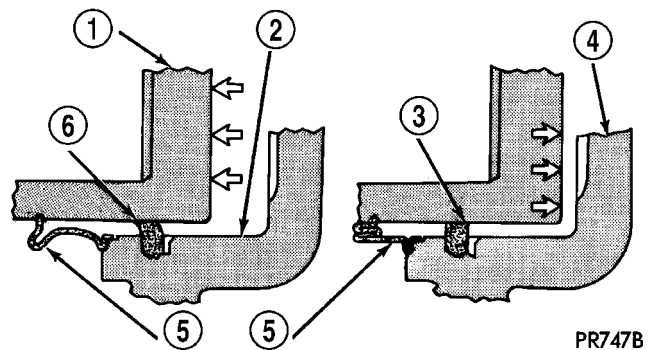
Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake pads do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to 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.

During brake application, the seal is deflected outward by fluid pressure and piston movement (Fig. 17). 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 pad.



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Fig. 17 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

REMOVAL

REMOVAL - REAR

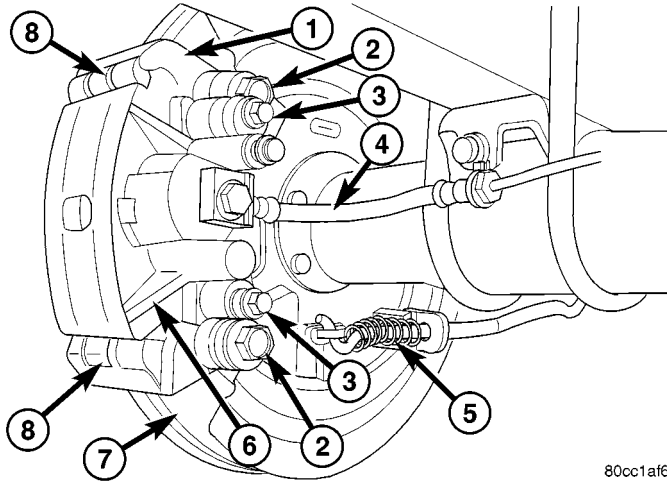
- (1) Install prop rod on the brake pedal to keep pressure on the brake system.
- (2) Raise and support vehicle.
- (3) Remove the wheel and tire assembly.
- (4) Drain small amount of fluid from master cylinder brake reservoir with suction gun.
- (5) Remove the brake hose banjo bolt if replacing caliper (Fig. 18).
- (6) Remove the caliper mounting slide pin bolts (Fig. 18).
- (7) Remove the caliper from vehicle.

REMOVAL - FRONT

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.

- (1) Install prop rod on the brake pedal to keep pressure on the brake system.

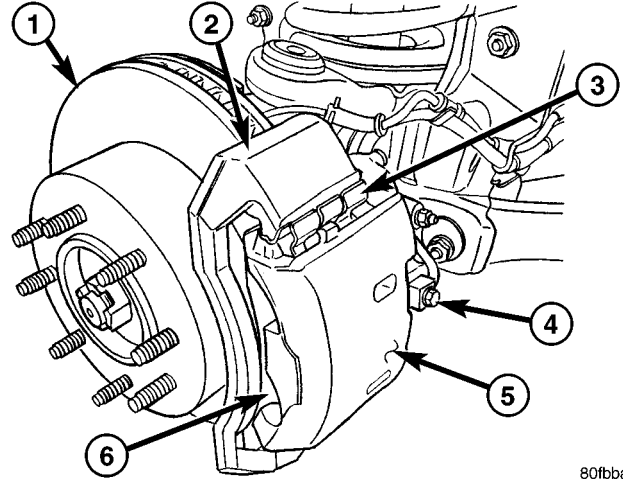
DISC BRAKE CALIPERS (Continued)



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Fig. 18 DISC BRAKE CALIPER - REAR

- 1 - CALIPER ADAPTER
- 2 - CALIPER ADAPTER MOUNTING BOLTS
- 3 - CALIPER SLIDE BOLTS
- 4 - BRAKE HOSE
- 5 - CABLE
- 6 - CALIPER
- 7 - ROTOR
- 8 - ANTI-RATTLE CLIPS



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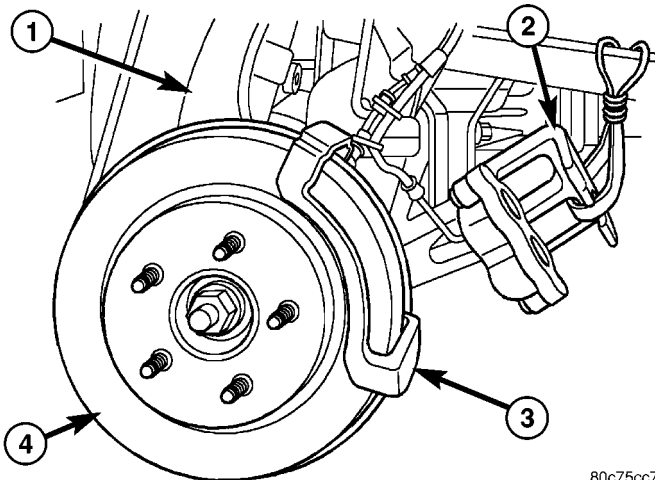
Fig. 20 8 LUG ROTOR & CALIPER ASSEMBLY

- 1 - ROTOR
- 2 - CALIPER ADAPTER
- 3 - ANTI-RATTLE CLIPS
- 4 - BRAKE HOSE WITH BANJO BOLT
- 5 - DISC BRAKE CALIPER
- 6 - OUTBOARD BRAKE PAD

DISASSEMBLY

- (1) Drain the brake fluid from caliper.
- (2) C-clamp a block of wood over one piston (Fig. 21).

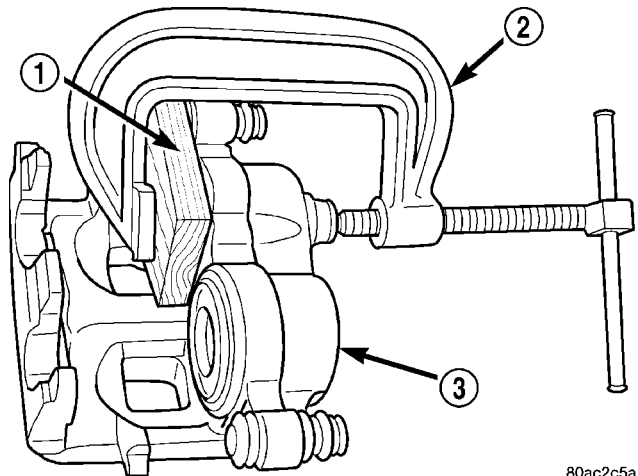
- (2) Raise and support the vehicle.
- (3) Remove the tire and wheel assembly.
- (4) Compress the disc brake caliper.
- (5) Remove the banjo bolt and discard the copper washer.
- (6) Remove the caliper slide pin bolts.
- (7) Remove the disc brake caliper (Fig. 19) or (Fig. 20).



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Fig. 19 DISC BRAKE CALIPER - FRONT

- 1 - STEERING KNUCKLE
- 2 - DISC BRAKE CALIPER
- 3 - CALIPER MOUNTING ADAPTER
- 4 - DISC BRAKE ROTOR



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Fig. 21 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. 22).

- (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)

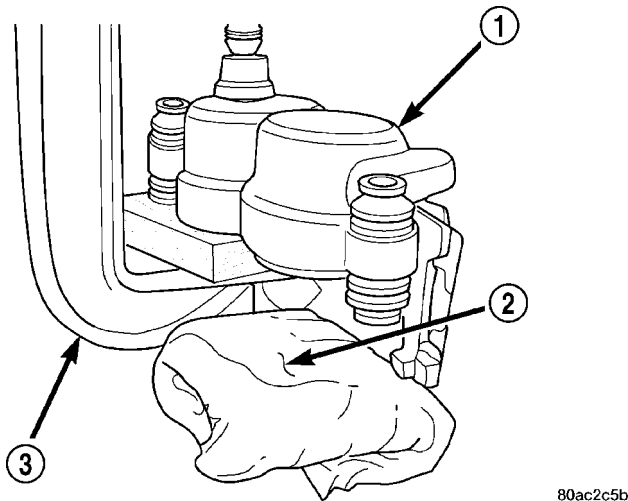


Fig. 22 Protect Caliper Piston

- 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. 23).

(9) Remove piston seals from caliper (Fig. 24).

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. 25).

(11) Remove caliper bleed screw.

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.

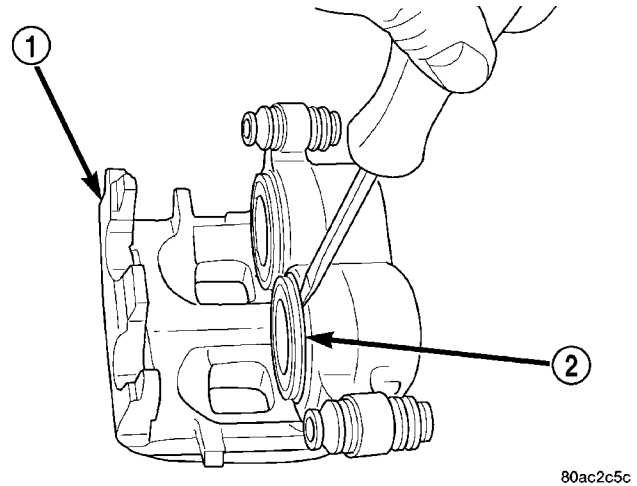


Fig. 23 Piston Dust Boot Removal

- 1 - CALIPER
- 2 - DUST BOOT

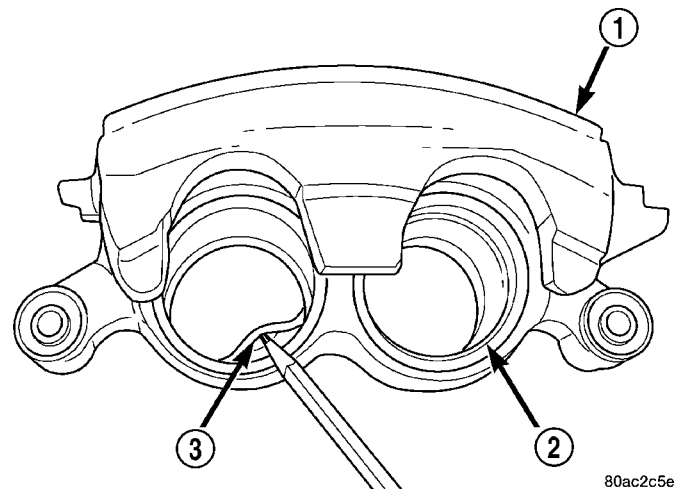


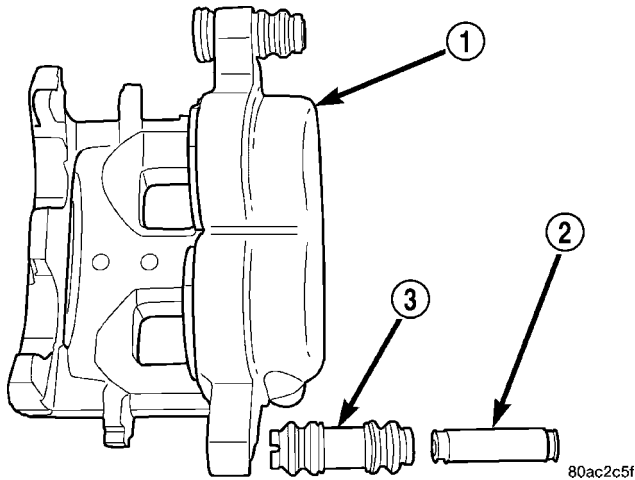
Fig. 24 Piston Seal

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

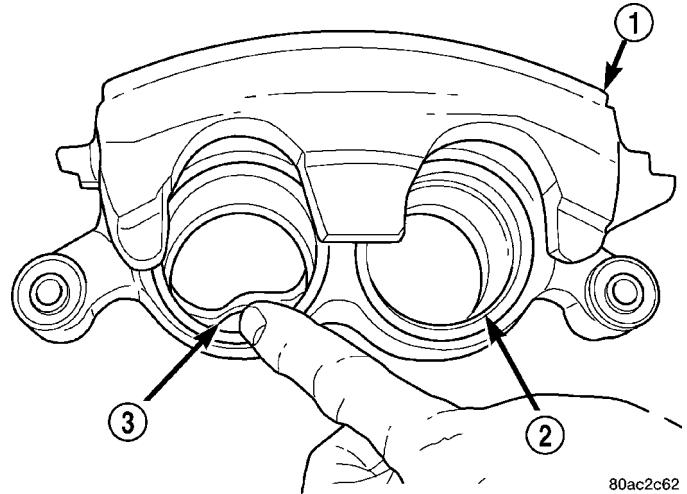
CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections (Fig. 26). 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).

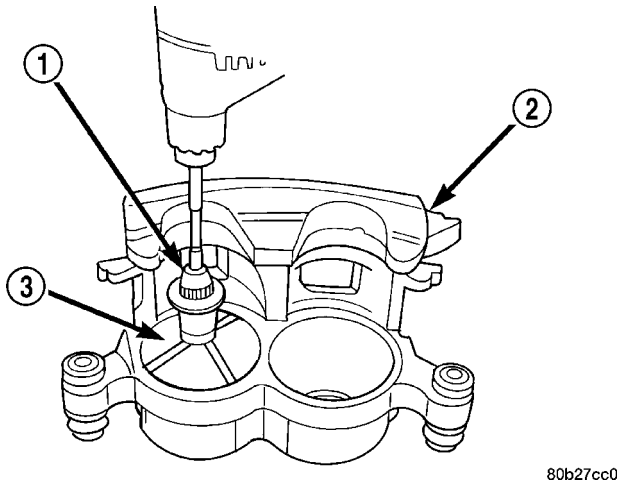
DISC BRAKE CALIPERS (Continued)

**Fig. 25 Bushings And Boot Seals**

- 1 - CALIPER
2 - BUSHING
3 - BOOT SEAL

**Fig. 27 Piston Seal**

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

**Fig. 26 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.

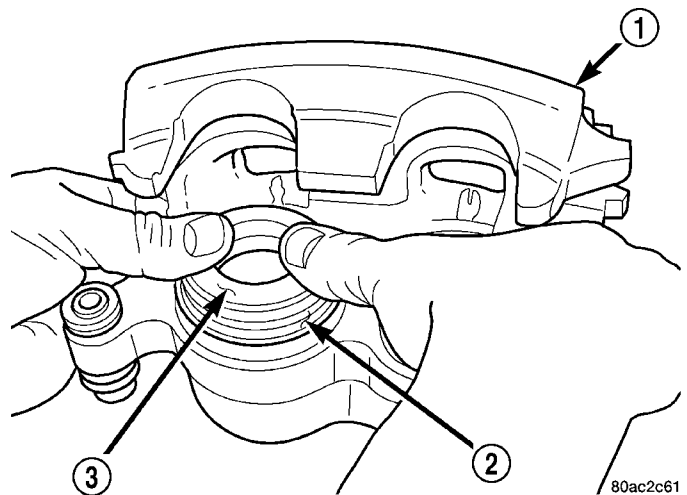
(2) Install new piston seals into caliper bores (Fig. 27).

NOTE: Verify seal is fully seated and not twisted.

(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. 28).

**Fig. 28 Caliper Piston Installation**

- 1 - CALIPER
2 - DUST BOOT
3 - PISTON

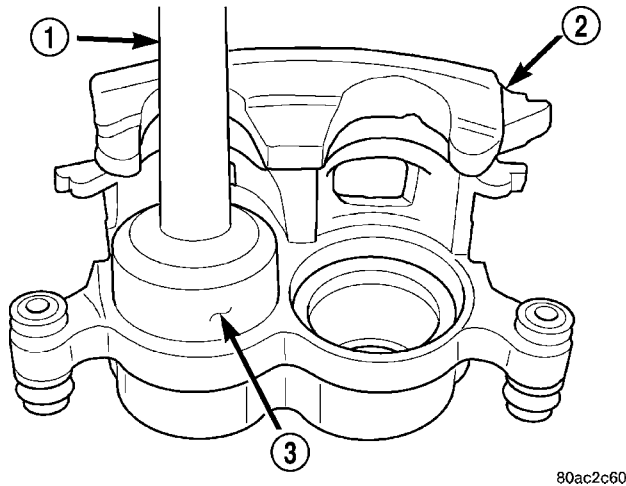
(6) Seat dust boot in caliper (Fig. 29) with Handle C-4171 and Installer:

- 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.

DISC BRAKE CALIPERS (Continued)

**Fig. 29 Seating Dust Boot**

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

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.

(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**

- (1) Install caliper to the caliper adapter.
- (2) Coat the caliper mounting slide pin bolts with silicone grease. Then install and tighten the bolts to 15 N·m (11 ft. lbs.).
- (3) Install the brake hose banjo bolt if removed.
- (4) Install the brake hose to the caliper with **new seal washers** and tighten fitting bolt to 31 N·m (23 ft. lbs.).

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

- (5) Remove the prop rod from the vehicle.
- (6) Bleed the base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
- (7) Install the wheel and tire assemblies (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
- (8) Remove the supports and lower the vehicle.
- (9) Verify a firm pedal before moving the vehicle.

INSTALLATION - FRONT

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

(1) Install the disc brake caliper (Fig. 19) or (Fig. 20).

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

- (2) Install the banjo bolt with new copper washers to the caliper. Tighten to 27 N·m (20 ft. lbs.)
- (3) Install the caliper slide pin bolts. tighten to 32 N·m (24 ft. lbs.)
- (4) Remove the prop rod.
- (5) Bleed the base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).
- (6) Install the tire and wheel assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
- (7) Lower the vehicle.

DISC BRAKE CALIPER ADAPTER**REMOVAL****REMOVAL - REAR**

- (1) Raise and support the vehicle.
- (2) Remove the wheel and tire assembly.
- (3) Drain a small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.
- (4) Bottom the caliper pistons into the caliper by prying the caliper over.
- (5) Remove the caliper mounting bolts (Fig. 30).
- (6) Remove the disc brake caliper from the mount.

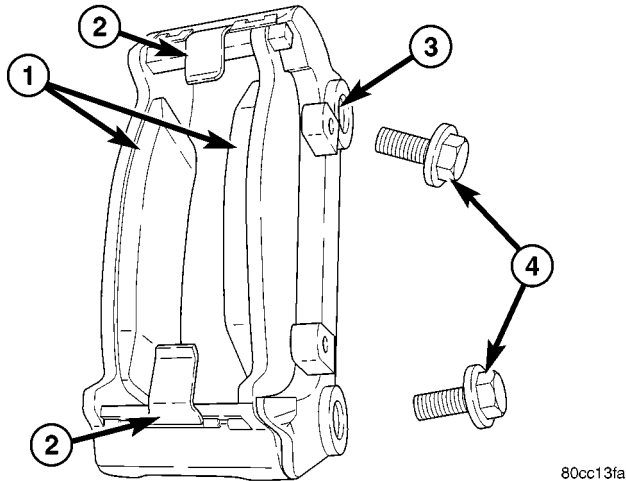
CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.

- (7) Remove the inboard and outboard brake pads (Fig. 30).
- (8) Remove the anti-rattle clips (Fig. 30).
- (9) Remove the caliper adapter mounting bolts (Fig. 30).

REMOVAL - FRONT

- (1) Raise and support the vehicle.
- (2) Remove the tire and wheel assembly.

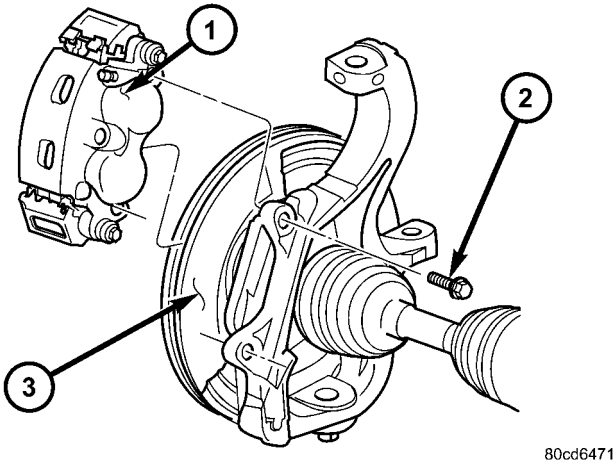
DISC BRAKE CALIPER ADAPTER (Continued)

**Fig. 30 CALIPER MOUNT**

- 1 - DISC BRAKE PADS
- 2 - ANTI-RATTLE CLIPS
- 3 - CALIPER ADAPTER
- 4 - MOUNTING BOLTS

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

(4) Remove the bolts securing the caliper adapter to the steering knuckle (Fig. 31)

**Fig. 31 CALIPER ADAPTER**

- 1 - CALIPER ASSEMBLY
- 2 - MOUNTING BOLT
- 3 - DISC BRAKE ROTOR

(5) Remove the caliper adapter.

INSTALLATION**INSTALLATION - REAR**

(1) Install the caliper adapter mounting bolts. Tighten the mounting bolts to 135 N·m (100 ft.lbs) (Fig. 30).

- (2) Install the anti-rattle clips (Fig. 30).
- (3) Install the inboard and outboard pads (Fig. 30).
- (4) Install the caliper mounting bolts.
- (5) Install the tire and wheel assembly

INSTALLATION - FRONT

(1) Install the caliper adapter to the steering knuckle (Fig. 31).

(2) Install the caliper adapter mounting bolts and tighten to 176 N·m (130 ft.lbs.) (Fig. 31).

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

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

(5) Remove the support and lower the vehicle.

DISC BRAKE CALIPER ADAPTER MOUNT**REMOVAL - REAR**

(1) Remove wheel and tire assembly.

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

(3) Remove the caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

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

(5) Remove the axle shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/AXLE SHAFTS - REMOVAL).

(6) Remove the park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - REMOVAL).

(7) Remove the parking brake cable from the brake lever.

(8) Remove the bolts attaching the support plate to the axle and remove the support plate (Fig. 54).

(9) Remove the caliper adapter mount from the axle housing (Fig. 32).

INSTALLATION

(1) Install the caliper adapter mount on the axle housing (Fig. 32).

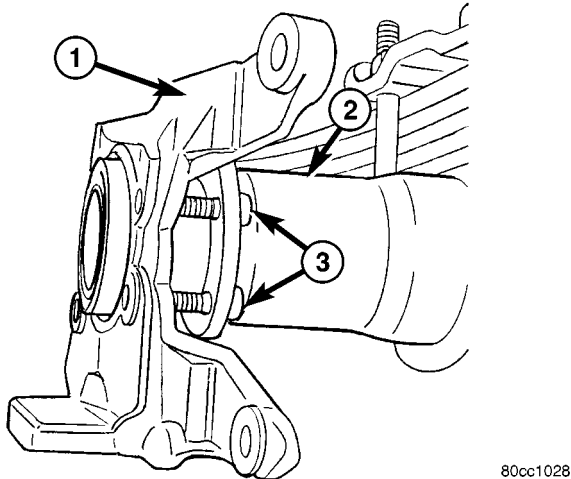
(2) Install support plate on axle flange (Fig. 55). Tighten attaching bolts to 115 N·m (85 ft. lbs.).

(3) Install parking brake cable in the brake lever.

(4) Install the park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - INSTALLATION). (Fig. 55).

(5) Install axle shaft, (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/AXLE SHAFTS - INSTALLATION).

DISC BRAKE CALIPER ADAPTER MOUNT (Continued)



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Fig. 32 CALIPER ADAPTER MOUNT - REAR

- 1 - CALIPER ADAPTER MOUNT
- 2 - AXLE TUBE
- 3 - MOUNTING STUDS

(6) Adjust brake shoes to drum with brake gauge (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

(7) Install the rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(8) Install the caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

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

(10) Install wheel and tire assembly.

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.

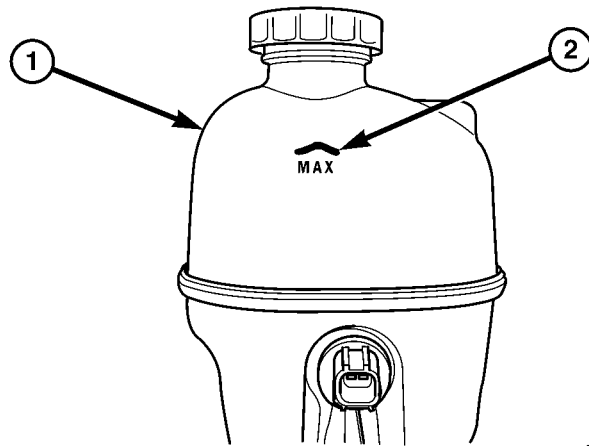
If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

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. 33).

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



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Fig. 33 FLUID LEVEL

- 1 - FLUID RESERVOIR
- 2 - MAX LEVEL MARK

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.

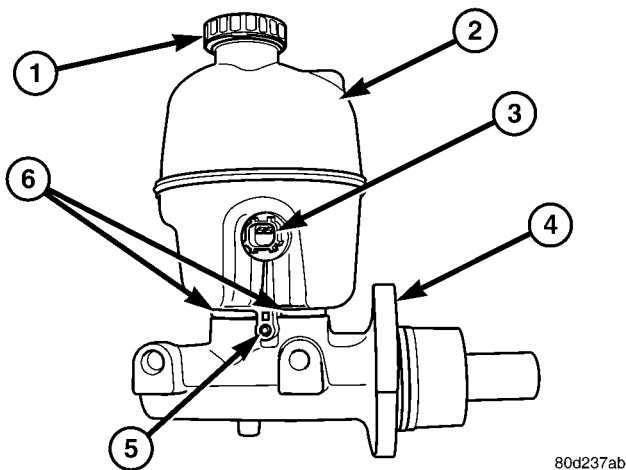
CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.

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) Install the prop rod on the brake pedal to keep pressure on the brake system.
- (2) Remove the reservoir cap and siphon fluid into a drain container (Fig. 34).
- (3) Remove the electrical connector from the fluid level switch in the reservoir (Fig. 34).
- (4) Remove the reservoir mounting bolt (Fig. 34).
- (5) Remove the reservoir from the master cylinder by pulling upwards.
- (6) Remove old grommets from cylinder body (Fig. 34).



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Fig. 34 FLUID RESERVOIR

- 1 - MASTER CYLINDER CAP
- 2 - FLUID RESERVOIR
- 3 - FLUID LEVEL SWITCH
- 4 - MASTER CYLINDER
- 5 - MOUNTING BOLT
- 6 - GROMMETS

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.

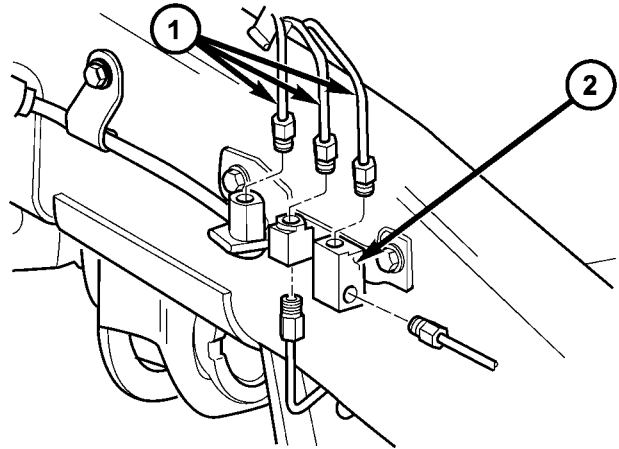
- (1) Lubricate the new grommets with clean brake fluid and install new grommets in cylinder body. Use finger pressure to install and seat grommets.
- (2) Start the reservoir in grommets. Then rock the reservoir back and forth while pressing downward to seat it into the grommets.
- (3) Install the mounting bolt for the reservoir to the master cylinder.
- (4) Reconnect the electrical connector to the fluid reservoir level switch.
- (5) Remove the prop rod from the vehicle.

- (6) Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).

BRAKE JUNCTION BLOCK

REMOVAL

- (1) Remove the brake lines from the junction block (Fig. 35).
- (2) Remove the junction block mounting bolt and remove the junction block from the bracket (Fig. 35).



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Fig. 35 JUNCTION BLOCK

- 1 - BRAKE LINES
- 2 - JUNCTION BLOCK

INSTALLATION

- (1) Position the junction block on the bracket and install the mounting bolt. Tighten the mounting bolt to 23 N·m (210 in. lbs.) (Fig. 35).
- (2) Install the brake lines into the junction block and tighten to 19-23 N·m (170-200 in. lbs.) (Fig. 35).
- (3) Bleed the base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).

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 and has a switch for indicating low fluid levels. 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 cir-

MASTER CYLINDER (Continued)

cuit 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. 36).

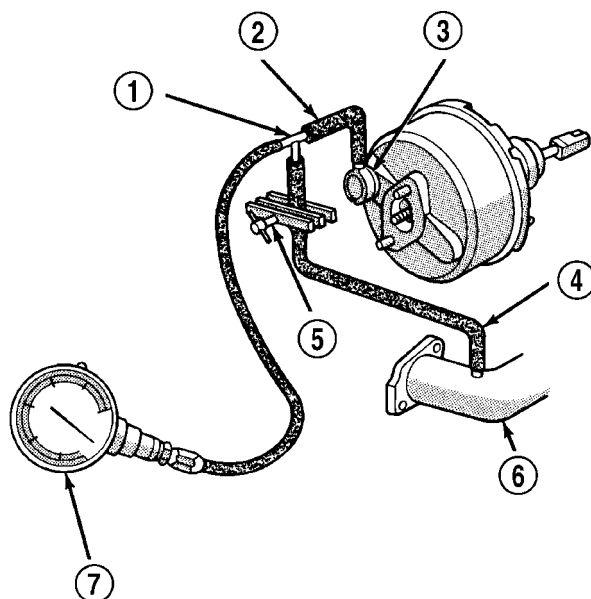
(2) Start and run engine at curb idle speed for one minute.

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

(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. 36 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.

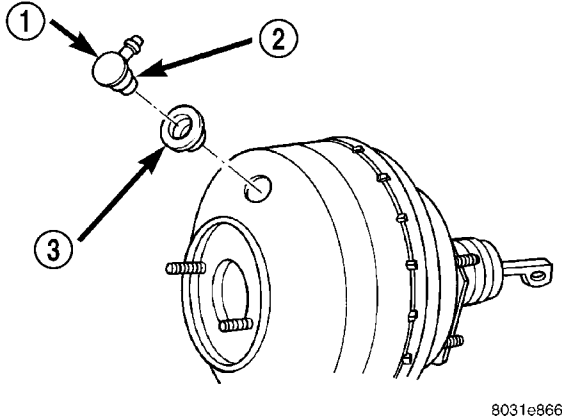
(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 37).

(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

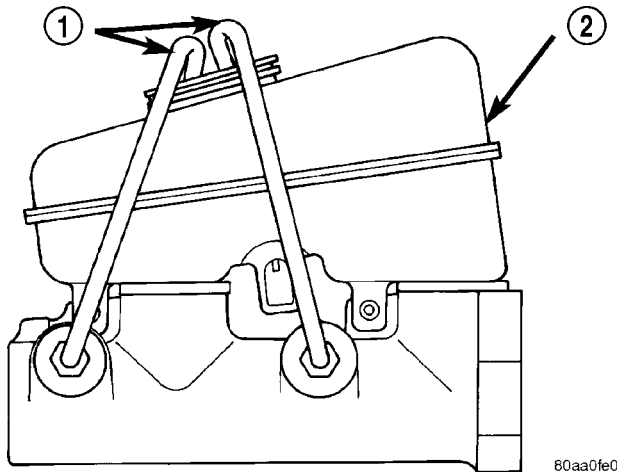
A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

MASTER CYLINDER (Continued)

**Fig. 37 Vacuum Check Valve And Seal**

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

(1) Mount master cylinder in vise.
(2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into reservoir (Fig. 38).
(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.

**Fig. 38 Master Cylinder Bleeding-Typical**

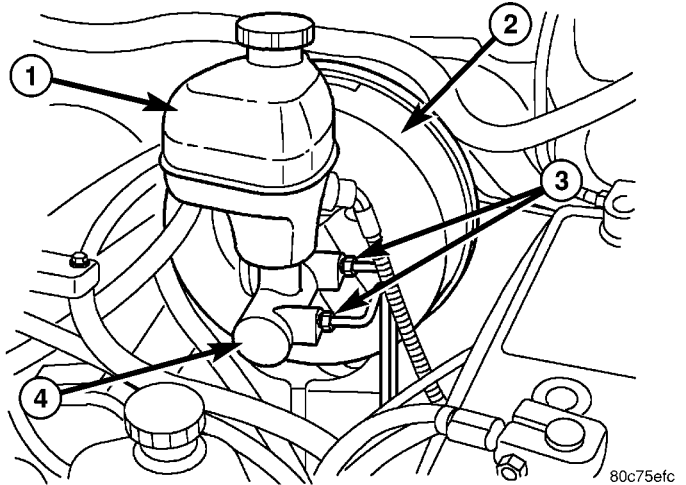
- 1 - BLEEDING TUBES
2 - RESERVOIR

REMOVAL

REMOVAL - ALL EXCEPT HYDROBOOST

- (1) Remove the brake lines from the master cylinder (Fig. 39).
(2) Disconnect the electrical connector for the low fluid level.
(3) Remove the mounting nuts from the master cylinder (Fig. 39).
(4) Remove the master cylinder.

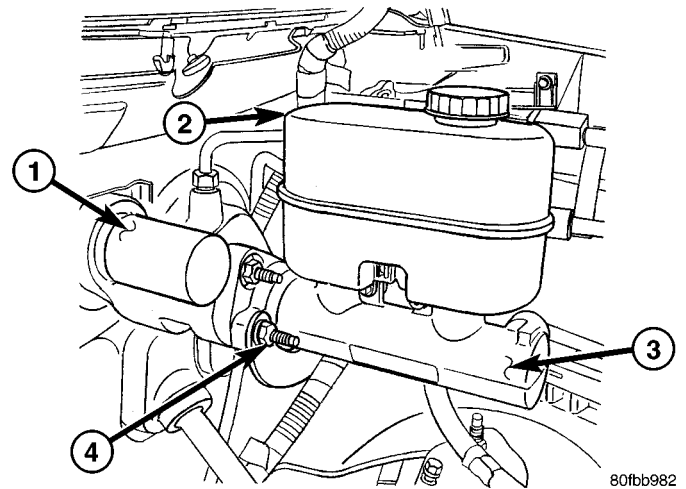
NOTE: Using care remove the master cylinder directly forward in order not to dislodge the output rod from its seat inside the booster.

**Fig. 39 MASTER CYLINDER**

- 1 - MASTER CYLINDER RESERVOIR
2 - POWER BRAKE BOOSTER
3 - BRAKE LINES
4 - MASTER CYLINDER

REMOVAL - HYDROBOOST

- (1) Remove the brake lines from the master cylinder (Fig. 40).

**Fig. 40 HYDROBOOST MASTER CYLINDER**

- 1 - HYDROBOOST UNIT
2 - MASTER CYLINDER RESERVOIR
3 - MASTER CYLINDER
4 - MOUNTING NUTS

- (2) Disconnect the electrical connector for the low fluid level.
(3) Remove the mounting nuts from the master cylinder (Fig. 40).
(4) Remove the master cylinder.

MASTER CYLINDER (Continued)

NOTE: Using care remove the master cylinder directly forward in order not to dislodge the output rod from its seat inside the booster.

INSTALLATION

INSTALLATION - ALL EXCEPT HYDROBOOST

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

NOTE: Make sure the output rod of the brake booster is in position before mounting of the master cylinder "This position will enable the output rod to enter inside of the master cylinder plunger sleeve during installation". Proper position is obtained when the output rod is centered perpendicular to the master cylinder mounting hole (Fig. 41).

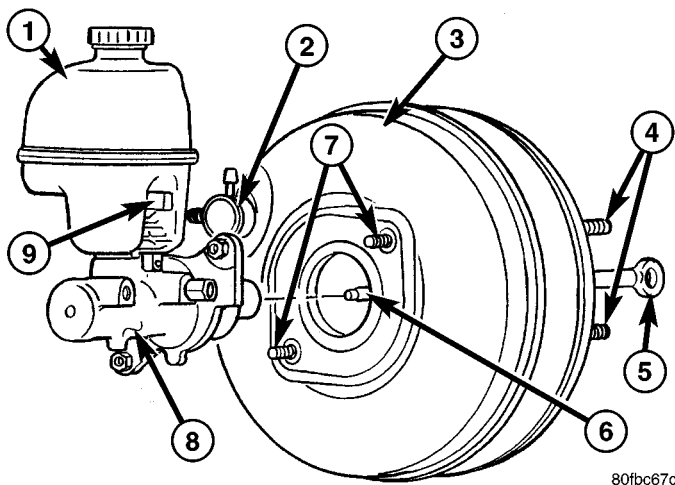


Fig. 41 OUTPUT ROD ORIENTATION

- 1 - MASTER CYLINDER RESERVOIR
- 2 - CHECK VALVE
- 3 - BOOSTER
- 4 - BOOSTER MOUNTING STUDS
- 5 - INPUT ROD
- 6 - OUTPUT ROD
- 7 - MASTER CYLINDER MOUNTING STUDS
- 8 - MASTER CYLINDER
- 9 - ELECTRICAL CONNECTOR

NOTE: Before installing the master cylinder, pump the brake pedal several times with the engine off to remove vacuum from the booster.

- (1) Install the master cylinder on the booster mounting studs.
- (2) Install new mounting nuts and tighten to 25 N·m (221 in. lbs.)
- (3) Install the brake lines and tighten to 19 N·m (170 in. lbs.)

(4) Reconnect the electrical connector for the low fluid level switch.

(5) Fill and bleed the base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

INSTALLATION - HYDROBOOST

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

NOTE: Make sure the output rod of the brake booster is in position before mounting of the master cylinder "This position will enable the output rod to enter inside of the master cylinder plunger sleeve during installation". Proper position is obtained when the output rod is centered perpendicular to the master cylinder mounting hole (Fig. 41).

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PEDAL

DESCRIPTION

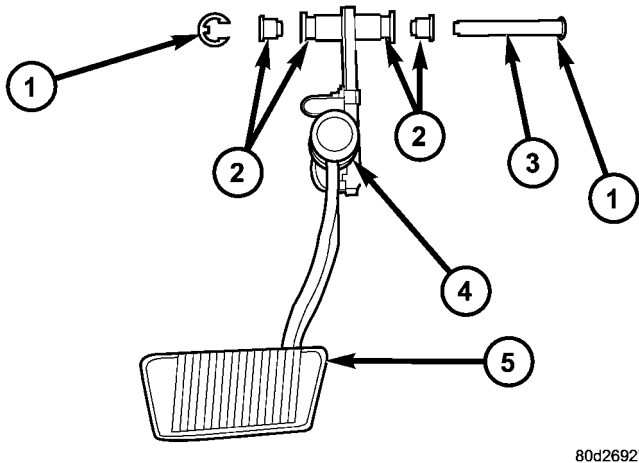
NOTE: The brake pedal is serviced as a complete assembly including accelerator pedal and the bracket.

A suspended-type brake pedal is used. The pedal is attached to the pedal support bracket with a pivot shaft pin and bushings. If the bushings become dry a spray lubricant can be used to eliminate noises. The booster push rod is attached to the pedal with a clip. The pedal, bushings, pivot pin and support bracket are not serviceable components (Fig. 42).

OPERATION

The brake pedal is attached to the booster push rod. 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.

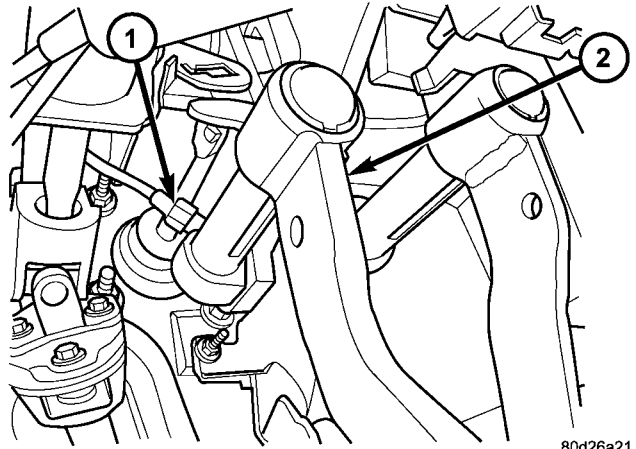
PEDAL (Continued)



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Fig. 42 BRAKE PEDAL

- 1 - CLIP
- 2 - BUSHINGS
- 3 - PIVOT SHAFT PIN
- 4 - PEDAL ASSEMBLY
- ADJUSTABLE PEDAL SHOWN
- NON ADJUSTABLE PEDAL IS SIMILIAR
- 5 - PAD



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Fig. 43 PEDAL/CABLE

- 1 - CABLE
- 2 - BRAKE PEDAL ASSEMBLY

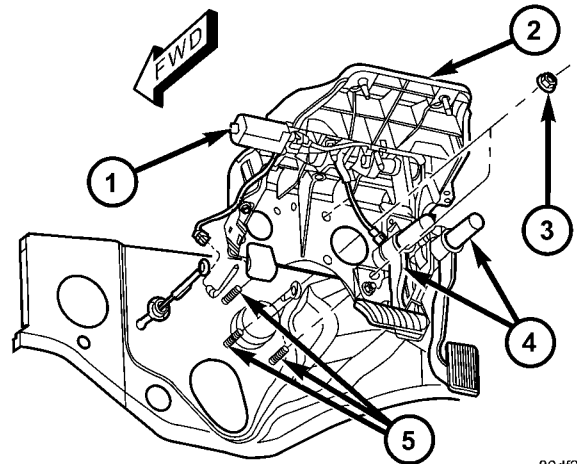
REMOVAL

NOTE: The brake pedal is serviced as a complete assembly including accelerator pedal and the bracket.

- (1) Disconnect the negative battery cable.
- (2) Remove the steering column opening cover(Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
- (3) Remove the brake lamp switch and discard(Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
- (4) **On vehicles equipped with adjustable pedals.** Disconnect the adjuster cable to the pedal (Fig. 43).
- (5) Remove the steering column (Refer to 19 - STEERING/COLUMN - REMOVAL).
- (6) Remove the brake booster (Fig. 44)(Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - REMOVAL).
- (7) Disconnect the electrical connectors.
- (8) Remove the module mounting bolts.
- (9) Disconnect the accelerator pedal cable.
- (10) Remove the pedal assembly mounting nuts/fasteners (Fig. 44).

INSTALLATION

- (1) Install the pedal assembly to the vehicle (Fig. 44).
- (2) Install the mounting bolts (Fig. 44) and tighten to 28 N·m (21 ft. lbs.).
- (3) Reconnect the accelerator cable to the pedal.



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Fig. 44 PEDAL ASSEMBLY (ADJUSTABLE PEDALS SHOWN)

- 1 - ADJUSTABLE PEDAL MOTOR
- 2 - PEDAL ASSEMBLY BRACKET
- 3 - MOUNTING NUT
- 4 - BRAKE & ACCELERATOR PEDAL
- 5 - BRAKE BOOSTER MOUNTING STUDS

- (4) Install the module mounting bolts and tighten to 38 N·m (28 ft. lbs.).
- (5) Reconnect the electrical connectors.
- (6) Install the brake booster (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - INSTALLATION).
- (7) Install the steering column (Refer to 19 - STEERING/COLUMN - INSTALLATION).
- (8) Install a new brake lamp switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
- (9) **On vehicles equipped with adjustable brake pedal.**Reconnect the electrical connector to the motor and the adjuster cable at the pedal.

PEDAL (Continued)

(10) Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(11) Reconnect the negative battery cable.

ADJUSTABLE PEDAL MOTOR

DESCRIPTION

The Adjustable Pedals System (APS) is designed to enable the fore and aft repositioning of the brake and accelerator pedals. This results in improved ergonomics in relation to the steering wheel for taller and shorter drivers. Being able to adjust the pedal positions also allows the driver to set steering wheel tilt and seat position to the most comfortable position. The position of the brake and accelerator pedals can be adjusted without compromising safety or comfort in actuating the pedals.

Change of pedal position is accomplished by means of a motor driven screw. Operating the adjustable pedal switch activates the pedal drive motor (Fig. 45). The pedal drive motor turns a screw that changes the position of the brake and accelerator pedals. The pedal can be moved rearward (closer to the driver) or forward (away from driver). The brake pedal is moved on its drive screw to a position where the driver feels most comfortable.

The accelerator pedal is moved at the same time and the same distance as the brake pedal.

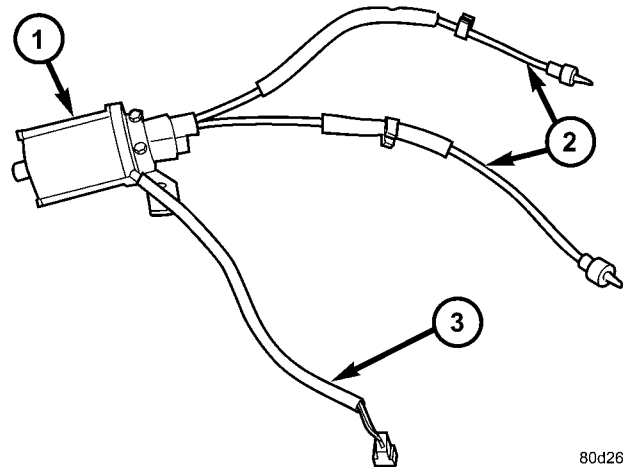
Neither the pedal drive motor (Fig. 45) nor drive mechanism are subject to the mechanical stress of brake or accelerator application.

- SYSTEM FEATURES:

- Range of Adjustment: The pedals may be adjusted up to 3 in. (75 mm)
- Pedal Adjustment Speed: 0.5 in./sec (12.5 mm/sec)
- Pedal Adjustment Inhibitors: Pedal adjustment is inhibited when the vehicle is in reverse or when cruise control is activated.

REMOVAL

- (1) Disconnect the negative battery cable.
- (2) Remove the kneeblocker (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
- (3) Remove the brake light switch and discard (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
- (4) Disconnect the adjustable pedal cables from the brake and accelerator pedals.
- (5) Disconnect the electrical connector.
- (6) Unclip the cable fasteners to the support.



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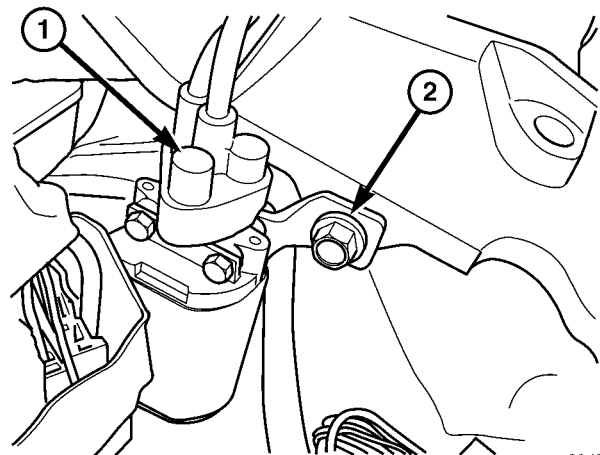
Fig. 45 ADJUSTABLE PEDAL MOTOR

- 1 - ADJUSTABLE PEDAL MOTOR
- 2 - CABLES
- 3 - ELECTRICAL CONNECTOR

(7) Remove the one mounting bolt for the adjustable pedal motor (Fig. 46).

(8) Remove the adjustable pedal motor with the cables.

NOTE: Adjustable pedal cables are not serviceable. If they need service the adjustable pedal motor with the cables must be installed.



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Fig. 46 ADJUSTABLE PEDAL MOTOR

- 1 - ADJUSTABLE PEDAL MOTOR
- 2 - MOUNTING BOLT

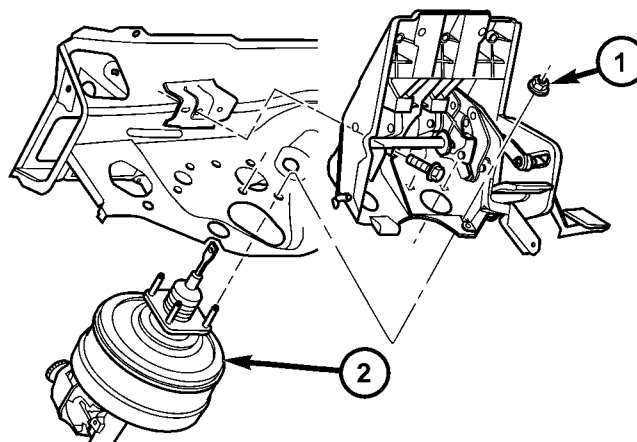
INSTALLATION

NOTE: Adjustable pedal cables are not serviceable. If they need service the adjustable pedal motor with the cables must be installed.

- (1) Install the adjustable pedal motor with the cables.

ADJUSTABLE PEDAL MOTOR (Continued)

- (2) Install the one mounting bolt for the adjustable pedal motor (Fig. 46).
- (3) Clip the cable fasteners to the support.
- (4) Reconnect the electrical connector.
- (5) Reconnect the adjustable pedal cables to the brake and accelerator pedals.
- (6) Install the new brake light switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
- (7) Install the kneeblocker (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
- (8) Reconnect the negative battery cable.
- (9) Check for proper operation of the pedals.



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POWER BRAKE BOOSTER**DESCRIPTION**

All models use a tandem diaphragm, power brake booster.

NOTE: The power brake booster is not a repairable component. The booster must be replaced as an assembly if diagnosis indicates a malfunction has occurred.

OPERATION

The booster unit consists of a single housing divided into two by a tandem diaphragm. The outer edge of the diaphragm is secured to the housing. The booster push rod, which connects the booster to the brake pedal and master cylinder, is attached to the center of the diaphragm. A check valve is used in the booster outlet connected to the engine intake manifold. Power assist is generated by utilizing a combination of vacuum and atmospheric pressure to boost brake assist.

REMOVAL

- (1) Remove master cylinder. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).
- (2) Disconnect vacuum line at booster.
- (3) Remove clip securing booster push rod to brake pedal (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/PEDAL - REMOVAL). (Fig. 47).
- (4) Remove the nuts from the booster mounting studs (Fig. 47).
- (5) Remove the booster and gasket from front cowl panel.

INSTALLATION

- (1) Guide the booster studs into the cowl panel holes and seat the booster on the panel (Fig. 47).

Fig. 47 POWER BRAKE BOOSTER

- 1 - MOUNTING NUT
2 - POWER BRAKE BOOSTER

- (2) Install and tighten new booster attaching nuts to 28 N·m (250 in. lbs.).
- (3) Install the booster push rod on brake pedal and install clip (Fig. 47).
- (4) Install the booster check valve if removed and connect the vacuum hose to the check valve.
- (5) Install the master cylinder. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - INSTALLATION).
- (6) Fill and bleed the brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

HYDRO-BOOST 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.

HYDRO-BOOST BRAKE BOOSTER (Continued)

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

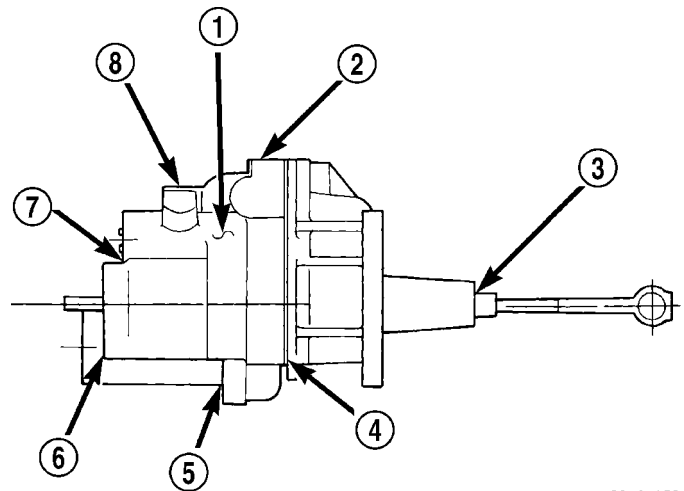
(1) Start the engine, apply the brakes and turn the steering wheel from lock to lock. This will ensure the accumulator is charged. Turn off the engine and let the vehicle sit for one hour. After one hour there should be at least two power assisted brake application with the engine off. If the system 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. 48).

- **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. 48 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

HYDRAULIC BOOSTER DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
Slow Brake Pedal Return	1. Excessive seal friction in booster. 2. Faulty spool valve action. 3. Restriction in booster return hose. 4. Damaged input rod.	1. Replace booster. 2. Replace booster. 3. Replace hose. 4. Replace booster.
Excessive Brake Pedal Effort.	1. Internal or external seal leakage. 2. Faulty steering pump.	1. Replace booster. 2. Replace pump.

HYDRO-BOOST BRAKE BOOSTER (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Brakes Self Apply	1. Dump valve faulty. 2. Contamination in hydraulic system. 3. Restriction in booster return hose.	1. Replace booster. 2. Flush hydraulic system and replace booster. 3. Replace hose.
Booster Chatter, Pedal Vibration	1. Slipping pump belt. 2. Low pump fluid level.	1. Replace power steering belt. 2. Fill pump and check for leaks.
Grabbing Brakes	1. Low pump flow. 2. Faulty spool valve action.	1. Test and repair/replace pump. 2. Replace booster.

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.

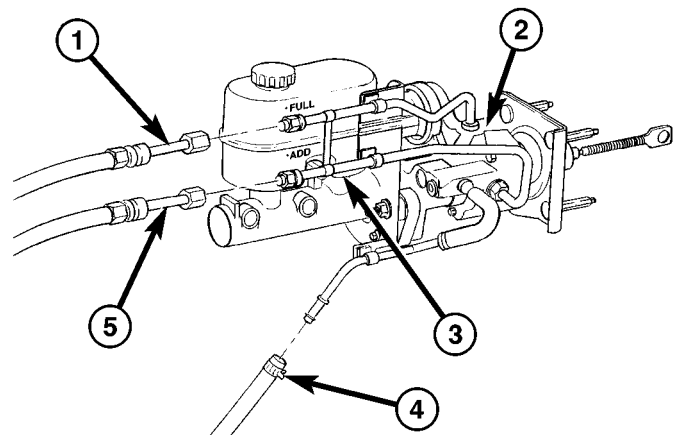
NOTE: If fluid foaming occurs, wait for foam to dissipate and repeat steps 7 and 8.

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. 49).

- (7) Remove the booster push rod clip, washer and rod remove from the brake pedal.
- (8) Remove the mounting nuts from the hydraulic booster and remove the booster.



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Fig. 49 HYDRO-BOOST UNIT

- 1 - INLET HOSE
- 2 - HYDRO-BOOST UNIT
- 3 - MASTER CYLINDER UNIT
- 4 - RETURN HOSE
- 5 - OUTLET HOSE

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.).

HYDRO-BOOST BRAKE BOOSTER (Continued)

(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: MOPAR (MS-9602) ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

(12) Bleed the hydraulic booster (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - STANDARD PROCEDURE).

ROTORS

REMOVAL

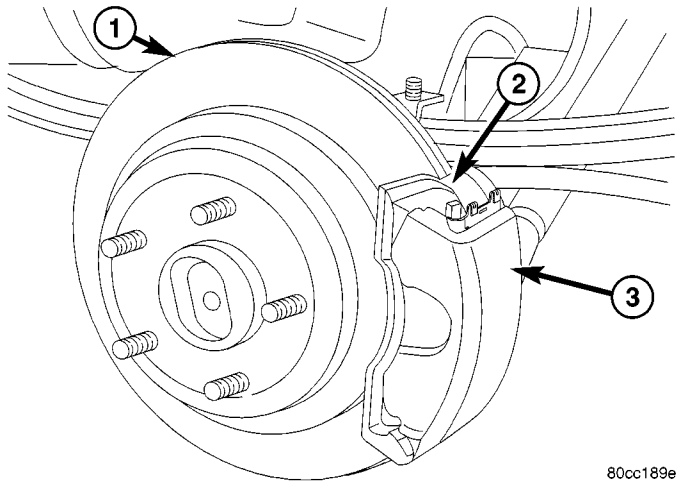
REMOVAL - REAR

- (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 (Fig. 50). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL)
- (5) Remove the retianing clips and rotor assembly (Fig. 50).

REMOVAL - FRONT

- (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. 51).

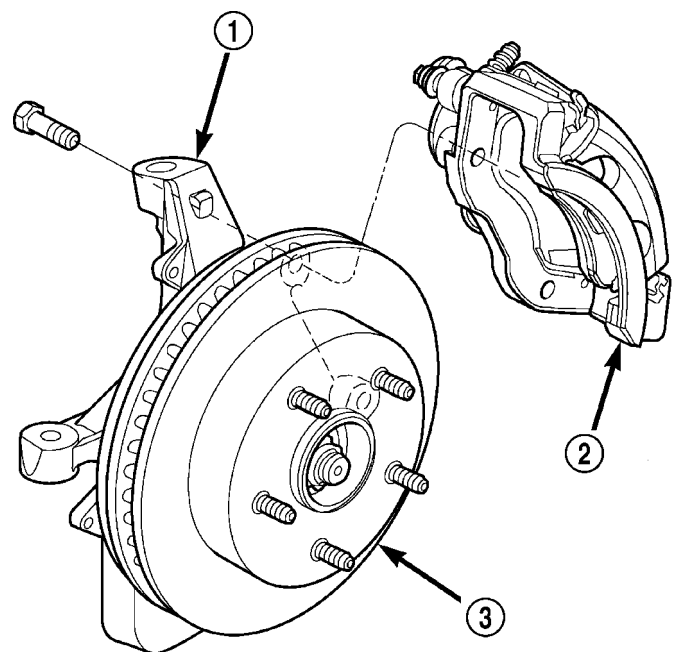
NOTE: Do not allow brake hose to support caliper adapter assembly.



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Fig. 50 REAR ROTOR

- 1 - ROTOR
- 2 - CALIPER ADAPTER
- 3 - CALIPER



80be4656

Fig. 51 Caliper Adapter Assembly

- 1 - KNUCKLE
- 2 - CALIPER
- 3 - ROTOR

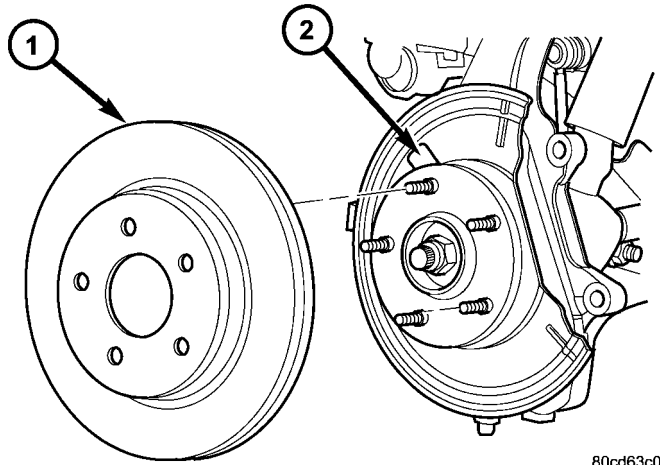
(4) Remove the rotor from the hub/bearing wheel studs (Fig. 52) or (Fig. 53).

INSTALLATION

INSTALLATION - REAR

- (1) Install the rotor to the axleshaft (Fig. 50).

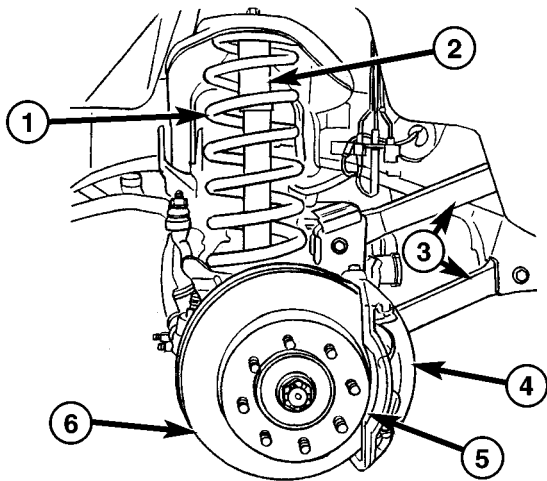
ROTORS (Continued)



80cd63c0

Fig. 52 FRONT ROTOR

- 1 - ROTOR
2 - HUB/BEARING



80ftbab2

Fig. 53 8 LUG ROTOR ASSEMBLY

- 1 - SPRING
2 - SHOCK
3 - UPPER AND LOWER SUSPENSION ARMS
4 - DISC BRAKE CALIPER
5 - DISC BRAKE CALIPER ADAPTER
6 - ROTOR

(2) Install the caliper adapter (Fig. 50) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

(3) Install the caliper adapter bolts (Fig. 50) and tighten the mounting bolts to 135 N·m (100 ft.lbs).

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

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

(6) Lower the vehicle.

INSTALLATION - FRONT

(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 the 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:

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

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

SUPPORT PLATE**REMOVAL**

(1) Remove wheel and tire assembly.

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

(3) Remove the caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

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

(5) Remove the axle shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/AXLE SHAFTS - REMOVAL).

(6) Remove the park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - REMOVAL).

(7) Remove the parking brake cable from the brake lever.

(8) Remove the bolts attaching the support plate to the axle and remove the support plate (Fig. 54).

INSTALLATION

(1) Install support plate on axle flange (Fig. 55). Tighten attaching bolts to 115 N·m (85 ft. lbs.).

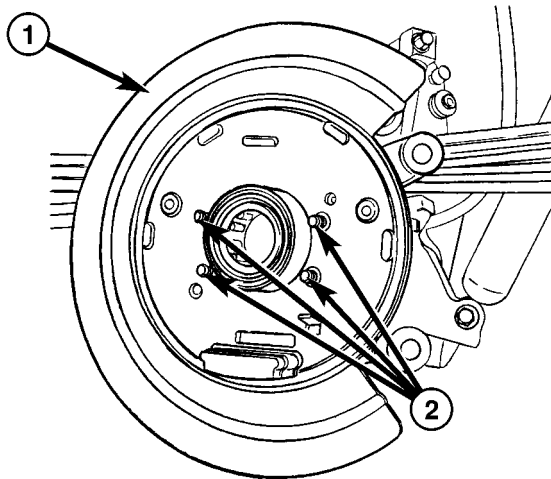
(2) Install parking brake cable in the brake lever.

(3) Install the park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - INSTALLATION). (Fig. 55).

(4) Install axle shaft, (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/AXLE SHAFTS - INSTALLATION).

(5) Adjust brake shoes to drum with brake gauge (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

SUPPORT PLATE (Continued)



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Fig. 54 SUPPORT PLATE

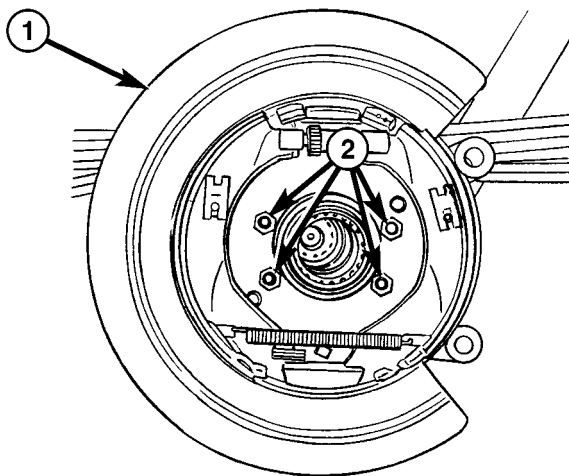
- 1 - SUPPORT PLATE
2 - MOUNTING STUDS

(6) Install the rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(7) Install the caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

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

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



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Fig. 55 SUPPORT PLATE WITH BRAKES MOUNTED

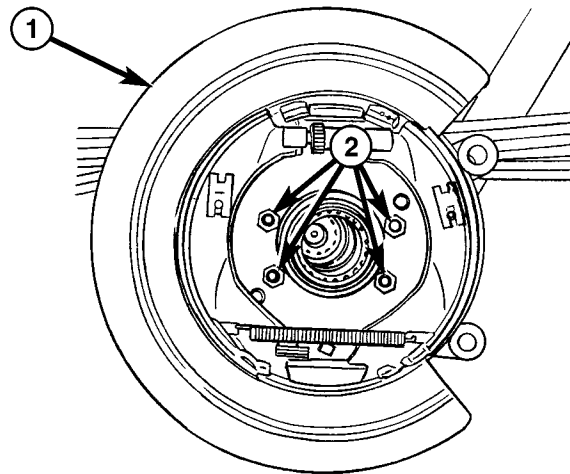
- 1 - SUPPORT PLATE
2 - MOUNTING NUTS

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. 56).



80cc071a

Fig. 56 SUPPORT PLATE WITH BRAKES MOUNTED

- 1 - SUPPORT PLATE
2 - MOUNTING NUTS

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.

CABLES

REMOVAL

REMOVAL - FRONT PARKING BRAKE CABLE

- (1) Raise and support vehicle.
- (2) Lockout the parking brake cable (Fig. 58).
- (3) Loosen adjusting nut to create slack in front cable.
- (4) Remove the front cable from the cable connector.
- (5) Compress cable end fitting at underbody bracket and remove the cable from the bracket.
- (6) Lower vehicle.
- (7) Push ball end of cable out of pedal clevis with small screwdriver.
- (8) Compress cable end fitting at the pedal bracket and remove the cable (Fig. 57).

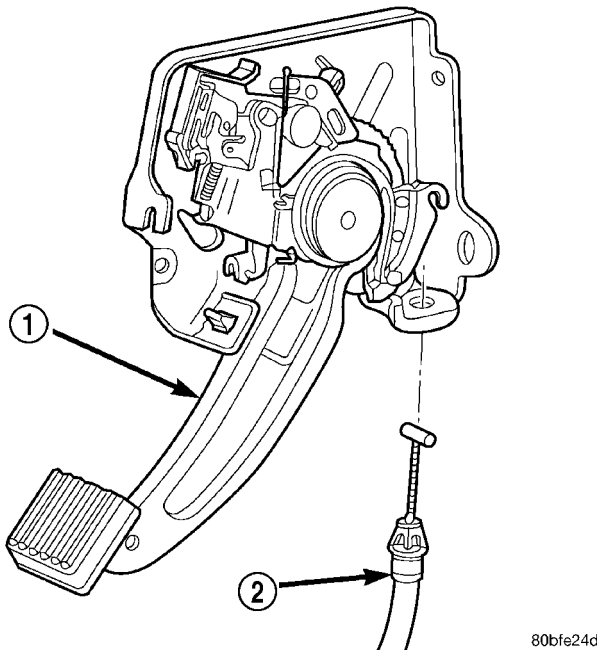


Fig. 57 Parking Brake Pedal

- 1 - PARK BRAKE PEDAL
2 - FRONT CABLE

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

REMOVAL - REAR PARK BRAKE CABLE

- (1) Raise and support the vehicle.
- (2) Lockout the parking brake cable (Fig. 58).
- (3) Loosen cable adjuster nut.
- (4) Remove the rear park brake cable from the intermediate park brake cable.

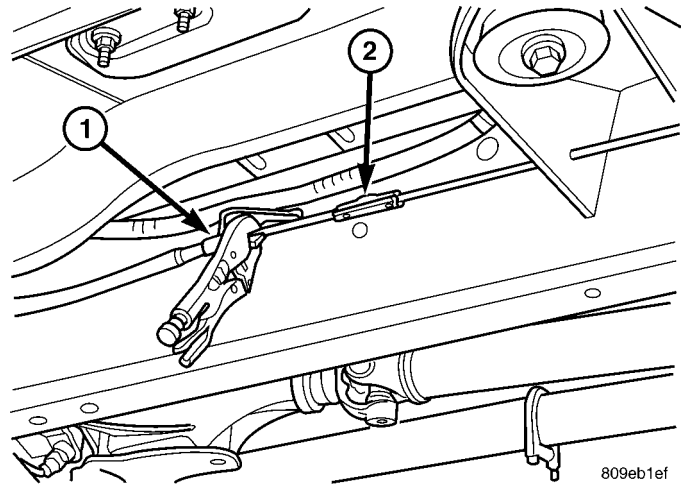


Fig. 58 LOCK OUT PARKING CABLE

- 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. 59).

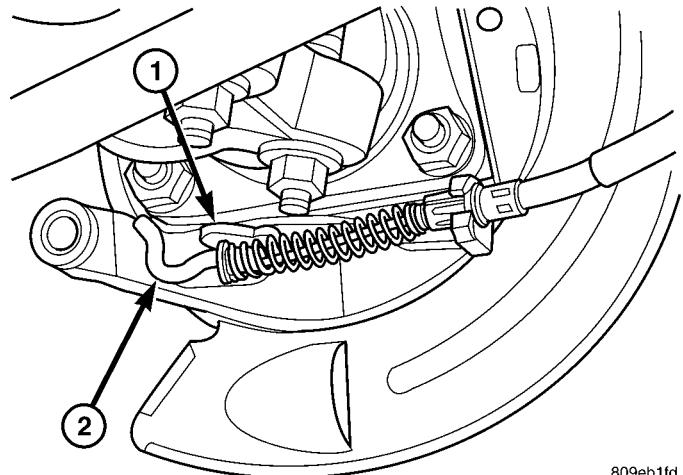


Fig. 59 DISENGAGEMENT OF CABLE

- 1 - LEVER
2 - CABLE END

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

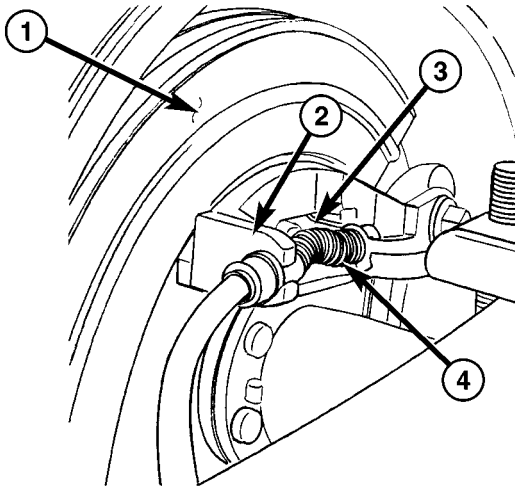
- (8) Remove the cables from the brake cable support plates.

REMOVAL - RIGHT REAR CABLE

- (1) Raise and support the vehicle.
- (2) Lockout the parking brake cable (Fig. 58).
- (3) Loosen the brake cable at the equalizer and adjuster nut.
- (4) Remove the right cable from the front cable.
- (5) Remove the right cable from the equalizer.

CABLES (Continued)

- (6) Remove the cable from the frame bracket.
- (7) Remove the cable from the axle bracket.
- (8) Remove the cable bracket from the shock bracket.
- (9) Remove the brake cable from the brake lever. (Fig. 60)

**Fig. 60 CABLE MOUNT**

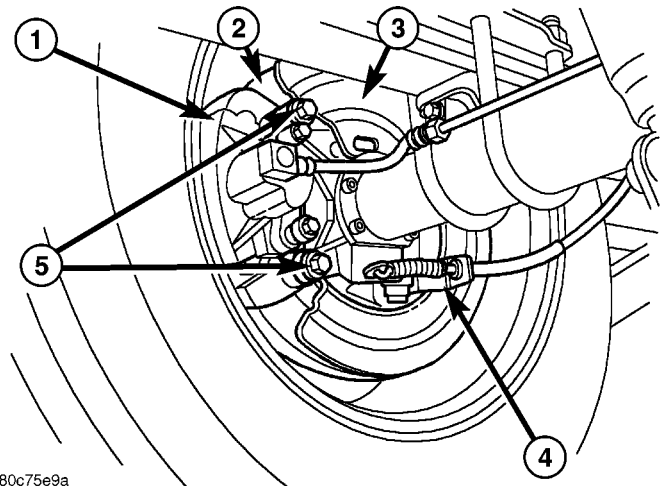
- 1 - SUPPORT PLAT
- 2 - CABLE MOUNT
- 3 - PARK BRAKE LEVER
- 4 - CABLE

REMOVAL - LEFT REAR CABLE

- (1) Raise and support the vehicle.
- (2) Lockout the parking brake cable (Fig. 58).
- (3) Loosen the brake cable at the equalizer and adjuster nut.
- (4) Remove the left brake cable from the equalizer.
- (5) Remove the brake cable from the frame bracket.
- (6) Remove the brake cable from the brake lever. (Fig. 61)

INSTALLATION**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 through the floorpan and install the body grommet.
- (5) Place the carpet down and install the left cowl trim and sill plate.
- (6) Raise and support the vehicle.
- (7) Route the cable through the underbody bracket and seat the cable end fitting in the bracket.



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Fig. 61 REAR DISC BRAKE

- 1 - DISC BRAKE CALIPER
- 2 - DISC BRAKE ROTOR
- 3 - DUST SHIELD
- 4 - REAR PARKING BRAKE CABLE
- 5 - DISC BRAKE CALIPER MOUNTING BOLTS

- (8) Connect the cable to the cable connector.
- (9) Perform the park brake adjustment procedure, (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).
- (10) Lower the vehicle.

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.

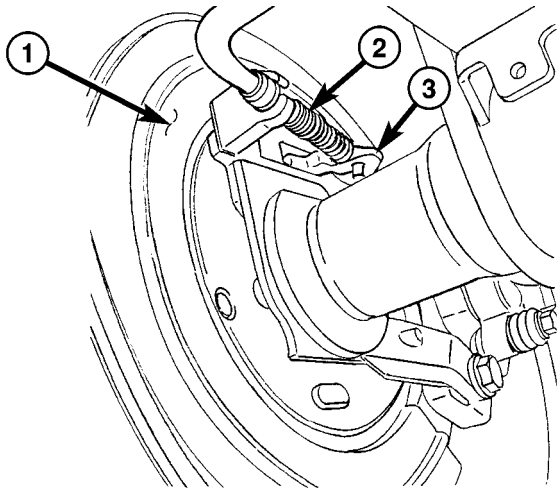
- (2) Push the cable through the frame bracket.
- (3) Lock the left cable end fitting tabs into the frame bracket hole.
- (4) Install the rear cables into the tensioner rod behind the rear of the brake assembly.
- (5) Install the cable to the intermediate cable connector.
- (6) Release and remove the 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 - RIGHT REAR CABLE

- (1) Install the brake cable to the brake lever. (Fig. 62)
- (2) Install the cable bracket to the shock bracket.
- (3) Install the cable to the axle bracket.
- (4) Install the cable to the frame bracket.
- (5) Install the right cable to the equalizer.

CABLES (Continued)

- (6) Install the right cable to the front cable.
- (7) Adjust the brake cable at the equalizer and using the adjuster nut.

**Fig. 62 PARKING BRAKE CABLE**

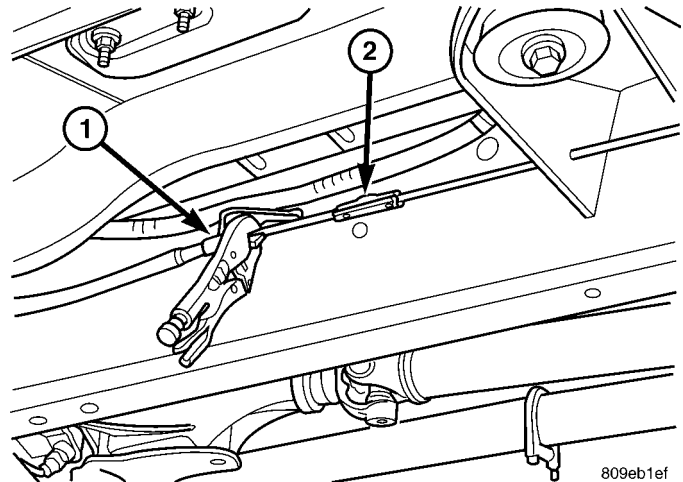
- 1 - SUPPORT PLAT
- 2 - CABLE
- 3 - LEVER

INSTALLATION - LEFT REAR CABLE

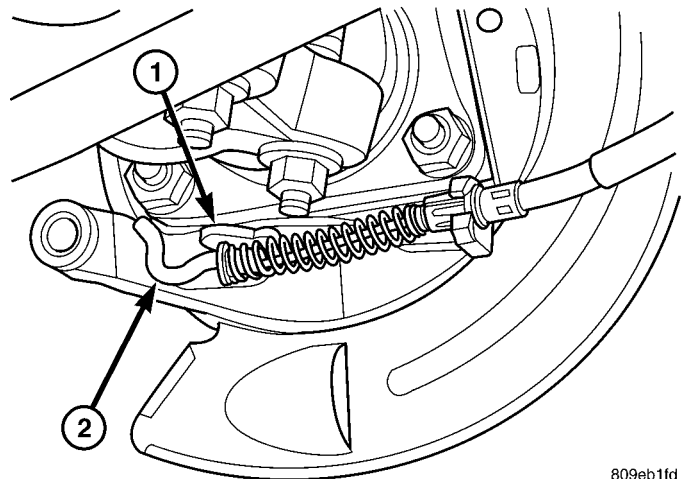
- (1) Install the brake cable to the brake lever (Fig. 61).
- (2) Install the brake cable to the frame bracket.
- (3) Install the left brake cable to the equalizer.
- (4) Adjust the brake cable at the equalizer and adjuster nut.

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. 63).
- (6) Disengage the park brake cable from behind the rotor assembly to allow easier disassembly of the park brake shoes (Fig. 64).
- (7) Remove the axleshaft (Fig. 65) (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/ AXLE SHAFTS - REMOVAL).
- (8) Disassemble the rear park brake shoes (Fig. 56).

**Fig. 63 LOCK OUT PARKING CABLE**

- 1 - LOCKING PLIERS
- 2 - PARKING BRAKE CABLE

**Fig. 64 DISENGAGEMENT OF CABLE**

- 1 - LEVER
- 2 - CABLE END

CLEANING - REAR DRUM IN HAT BRAKE

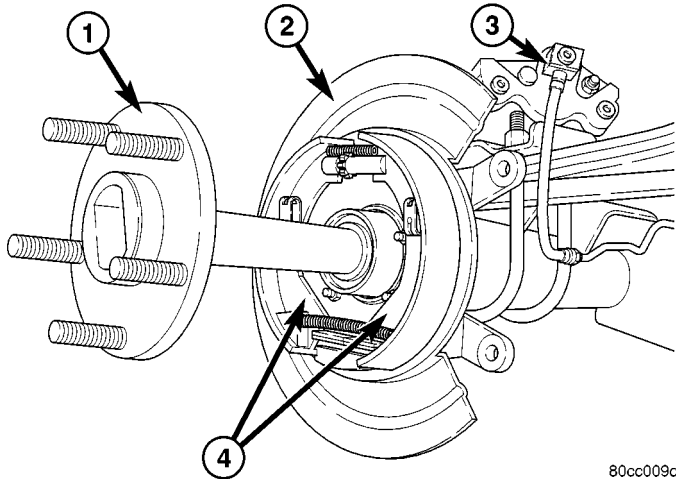
Clean the individual brake components, including the support plate exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSPECTION - REAR DRUM IN HAT BRAKE

As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be

SHOES (Continued)



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Fig. 65 AXLE SHAFT

- 1 - AXLE SHAFT
- 2 - SUPPORT PLATE
- 3 - CALIPER
- 4 - PARK BRAKE SHOE ASSEMBLY

replaced and the drum checked for runout or taper (Fig. 66).

Inspect the adjuster screw assembly. Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded (Fig. 66).

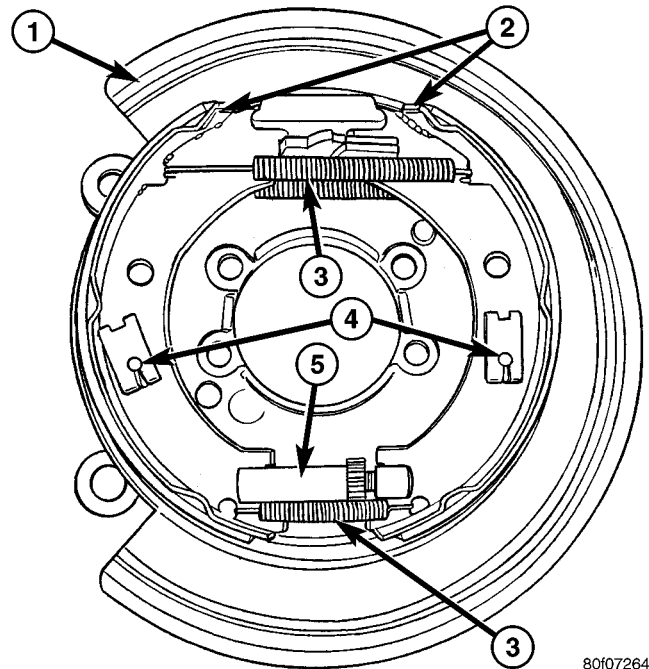
Discard the brake springs and retainer components if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

Inspect the brake shoe contact pads on the support plate, replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted (Fig. 66).

INSTALLATION

NOTE: On a new vehicle or after parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake foot pedal.

- (1) Reassemble the rear park brake shoes (Fig. 56).
- (2) Install the axleshaft (Fig. 65) (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/ AXLE SHAFTS - INSTALLATION).
- (3) Install the park brake cable to the lever behind the support plate.
- (4) Unlock the park brake cable.
- (5) Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).



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Fig. 66 PARK BRAKE SHOES

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

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

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

(9) Lower the vehicle.

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).

SHOES (Continued)

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. 67).

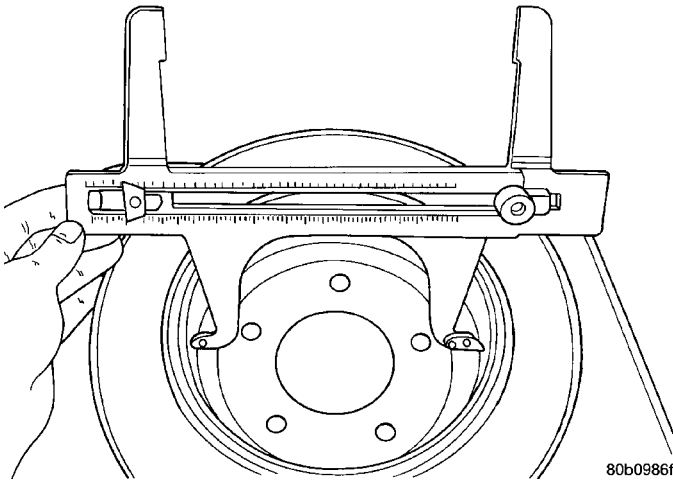


Fig. 67 Measuring Park Brake Drum Diameter

(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. 68).

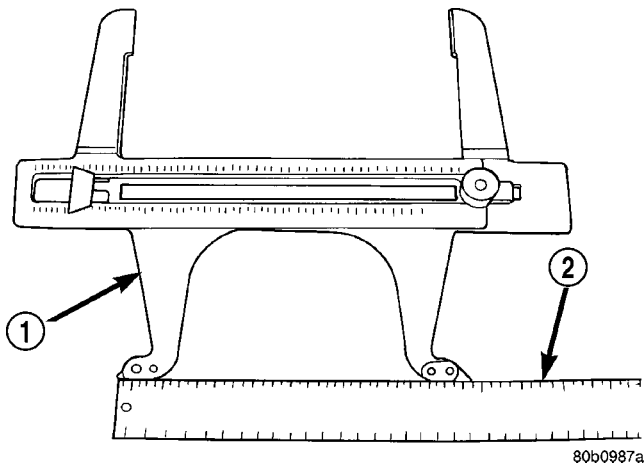


Fig. 68 Reading Park Brake Drum Diameter

1 - SPECIAL TOOL C-3919
2 - RULER

(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. 69).

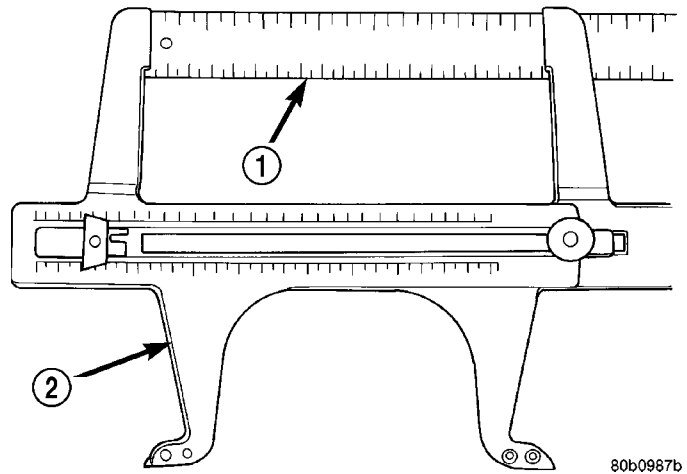


Fig. 69 Setting Gauge To Park Brake Shoe Measurement

1 - RULER
2 - SPECIAL TOOL C-3919

(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.

SHOES (Continued)

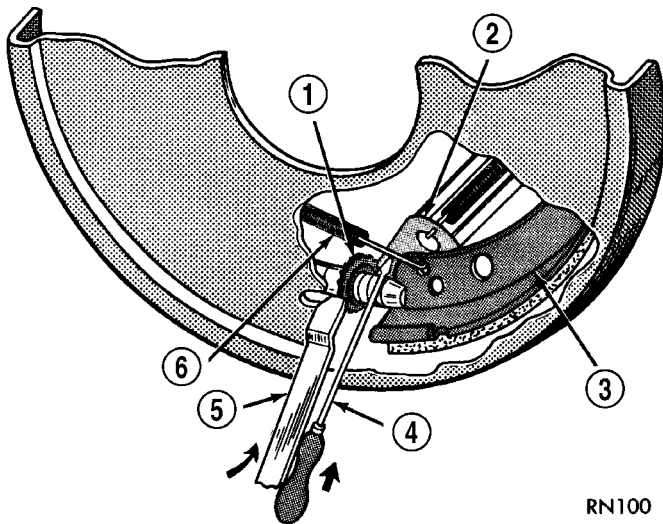
NOTE: On a new vehicle or after parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake foot pedal.

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

ADJUSTMENT - WITH ADJUSTING TOOL

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

- (1) Be sure parking brake lever is fully released.
- (2) Raise vehicle so rear wheels can be rotated freely.
- (3) Remove plug from each access hole in brake support plates.
- (4) Loosen parking brake cable adjustment nut until there is slack in front cable.
- (5) Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel (Fig. 70).

**Fig. 70 Brake Adjustment**

- 1 - STAR WHEEL
- 2 - LEVER
- 3 - BRAKE SHOE WEB
- 4 - SCREWDRIVER
- 5 - ADJUSTING TOOL
- 6 - ADJUSTER SPRING

(6) Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.

(7) Push and hold adjuster lever away from star wheel with thin screwdriver.

(8) Back off adjuster screw star wheel until brake drag is eliminated.

(9) Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.

(10) Install support plate access hole plugs.

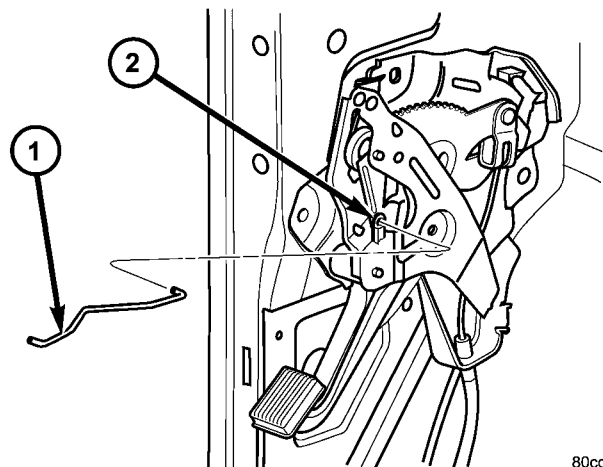
(11) Adjust parking brake cable and lower vehicle.

(12) Depress park brake pedal and make sure park brakes hold the vehicle stationary.

(13) Release park brake pedal.

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 release rod (Fig. 71) from the arm on the pedal assembly.
- (9) Remove the bolts/nuts from the pedal assembly and remove the assembly.

**Fig. 71 PARKING BRAKE PEDAL**

- 1 - RELEASE ROD
- 2 - PEDAL ASSEMBLY

INSTALLATION

(1) Position the replacement pedal assembly on the dash and cowl.

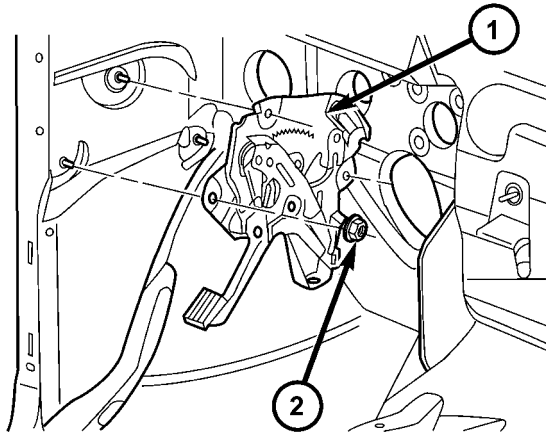
(2) Install the bolts/nuts and tighten to 28 N·m (21 ft. lbs.) (Fig. 72).

(3) Install the park brake release rod.

(4) Connect the front cable to the arm on the pedal assembly.

PEDAL (Continued)

- (5) Tighten the front cable grommet to the floorpan and the cable retainer, roll the carpet back.
- (6) Connect the wires to the brake lamp switch.
- (7) Install the knee bolster, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
- (8) Raise the vehicle.
- (9) Adjust the parking brake cable tensioner (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).



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Fig. 72 PARKING BRAKE ASSEMBLY

- 1 - PEDAL ASSEMBLY
2 - MOUNTING NUT

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 rotors (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
- (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 (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).
- (7) Install the rotors (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION) and verify that the rotors rotate 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.

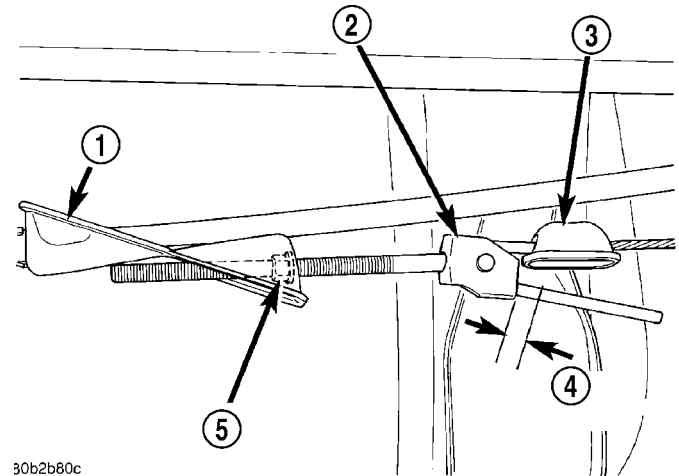
NOTE: Leave park brakes applied until adjustment is complete.

- (10) Raise the vehicle again.
- (11) Mark the tensioner rod 6.35 mm (1/4 in.) from edge of the tensioner (Fig. 73).
- (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. 73 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. 74).

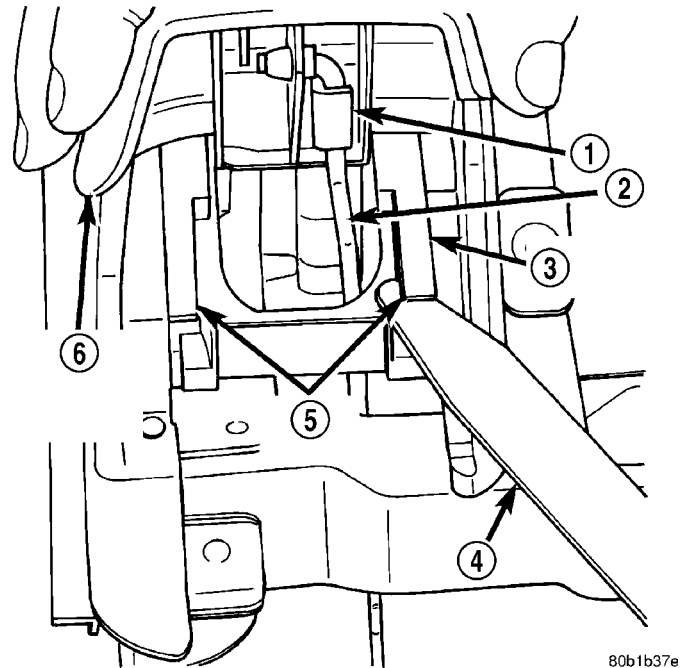
(8) With both of the park brake release handle mounting bracket latches released, slide the handle and bracket assembly down and out of the instrument panel receptacle.

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



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Fig. 74 Park Brake Release Handle Remove/Install

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

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.

BRAKES - ABS

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BRAKES - ABS

DESCRIPTION

The antilock brake system (ABS) is an electronically operated, three channel brake control system. The vehicle has Electronic Variable Brake Proportioning (EVBP) designed into the system which eliminates the combination/proportioning valve.

The system is designed to prevent wheel lockup and maintain steering control during 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. 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

OPERATION

Battery voltage is supplied to the CAB. The CAB performs a system initialization procedure at start up. A check of the ABS motor is performed at 15 miles per hour. 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 solenoids to verify operation. An audible noise may be heard during this self check. This noise should be considered normal. The ABS motor and pump are then checked at a speed of 15 mile per hour.

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.

BRAKES - ABS (Continued)

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

The antilock CAB activates the system whenever sensor signals indicate periods of wheel slip.

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 is energized which acts to prevent further 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.

STANDARD PROCEDURE - ABS BRAKE BLEEDING

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

(1) Perform base brake bleeding,(Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).

(2) Connect 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 - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - 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 Mounting Bolts	15	11	—
ABS Assembly CAB Screws	3.5	—	31
ABS Assembly Brake Line Fittings	19	—	170
Wheel Speed Sensors Front Sensor Bolt	21	—	190
Wheel Speed Sensors Bracket To Knuckle	6.7	—	60
Wheel Speed Sensors Rear Sensor Stud	22.5	—	200
Controller Mounting Screws	6	—	53
RWAL Module Mounting Bolts	15	11	—

BRAKES - ABS (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
RWAL Valve Brake Line Fittings	19	—	170
Rear Wheel Speed Sensor Mounting Bolt	24	—	200

FRONT WHEEL SPEED SENSOR

DESCRIPTION

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

OPERATION

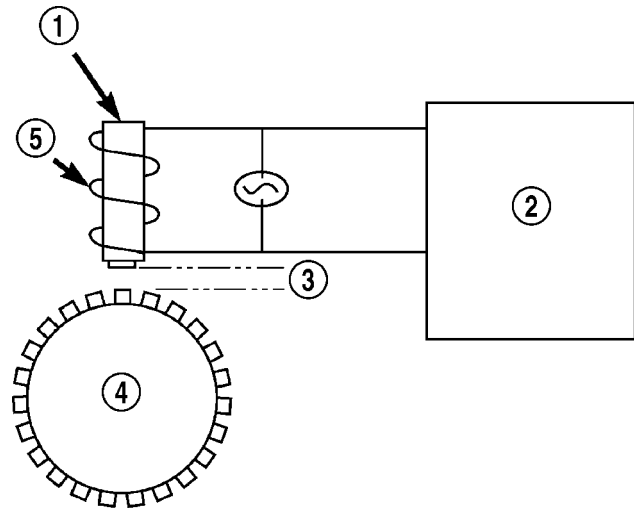
The Wheel Speed Sensor consists of a magnet surrounded by windings from a single strand of wire. The sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (exciter ring or tone wheel) passes the stationary 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. 1) 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 toler-



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Fig. 1 Operation of the Wheel Speed Sensor

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

ances. 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.

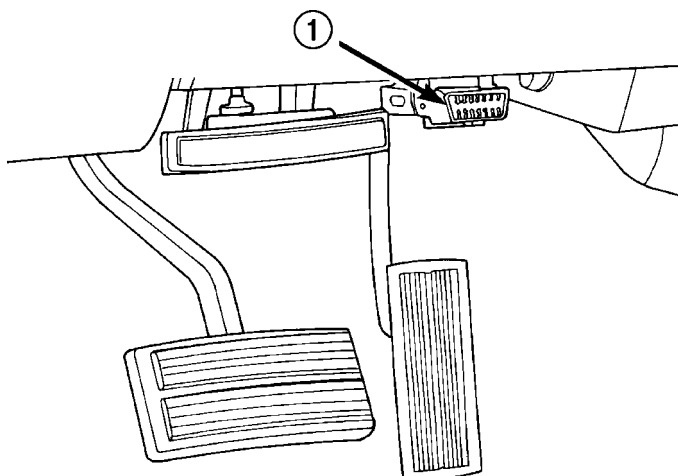
The assembly plant performs a “Rolls Test” on every vehicle that leaves the assembly plant. One of the test performed is a test of the WSS. To properly test the sensor, the assembly plant connects test equipment to the Data Link Connector (DLC). This connector is located to the right of the steering column and attached to the lower portion of the instrument panel (Fig. 2). 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.

REMOVAL

(1) Remove the front rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

(2) Remove the wheel speed sensor mounting bolt from the hub. (Fig. 3)

FRONT WHEEL SPEED SENSOR (Continued)

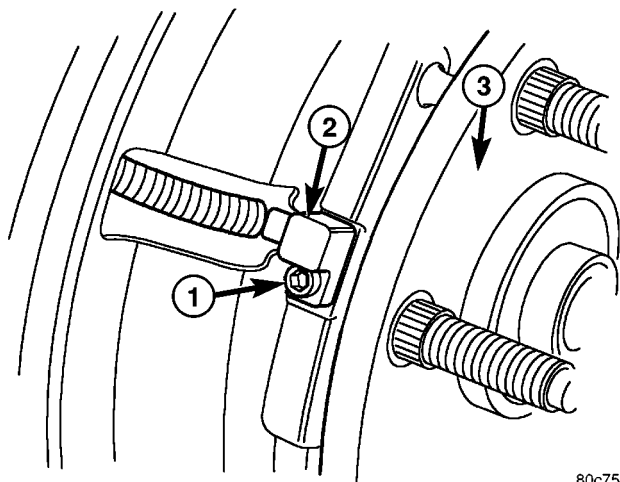


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Fig. 2 Data Link Connector - Typical

1 - 16-WAY DATA LINK CONNECTOR

- (3) Remove the wheel speed sensor from the hub.
- (4) Remove the wiring from the clips and disconnect the electrical connector.



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Fig. 3 WHEEL SPEED SENSOR

- 1 - WHEEL SPEED SENSOR MOUNTING BOLT
- 2 - WHEEL SPEED SENSOR
- 3 - HUB/BEARING

INSTALLATION

- (1) Install the wiring to the clips and Reconnect the electrical connector.
- (2) Install the wheel speed sensor to the hub.
- (3) Install the wheel speed sensor mounting bolt to the hub. Tighten the bolt to 21 N·m (190 in. lbs.).
- (4) Install the front rotor and brake caliper assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

REAR WHEEL SPEED SENSOR**DIAGNOSIS AND TESTING - REAR WHEEL ANTILOCK**

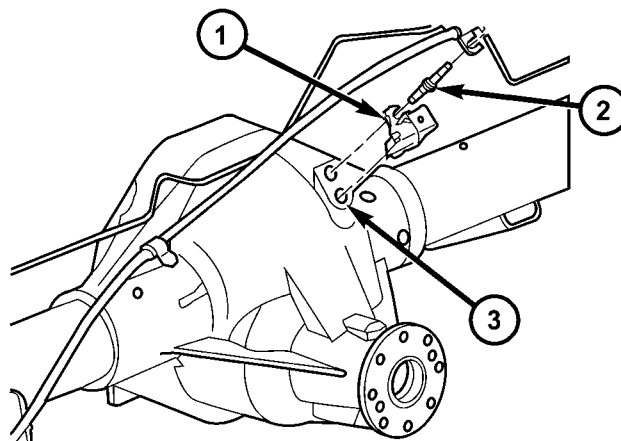
Diagnosis of base brake conditions which are mechanical in nature should be performed first. This includes brake noise, lack of power assist, parking brake, or vehicle vibration during normal braking.

The RWAL 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 RWAL system. For test procedures refer to the Chassis Diagnostic Manual.

REMOVAL

- (1) Raise the vehicle on a hoist.
- (2) Remove the brake line mounting nut and remove the brake line from the sensor stud.
- (3) Remove the mounting stud from the sensor and shield (Fig. 4).



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Fig. 4 REAR WHEEL SPEED SENSOR

- 1 - WHEEL SPEED SENSOR
- 2 - MOUNTING BOLT
- 3 - AXLE HOUSING

- (4) Remove the sensor and shield from the differential housing.
- (5) Disconnect the sensor wire harness and remove the sensor.

REAR WHEEL SPEED SENSOR (Continued)

INSTALLATION

(1) Connect the harness to the sensor. **Be sure the seal is securely in place between the sensor and the wiring connector.**

(2) Install the O-ring on the sensor (if removed).

(3) Insert the sensor in the differential housing.

(4) Install the sensor shield.

(5) Install the sensor mounting stud and tighten to 24 N·m (200 in. lbs.).

(6) Install the brake line on the sensor stud and install the nut.

(7) Lower the vehicle.

TRAILER WHEEL**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.

HYDRAULIC/MECHANICAL**DESCRIPTION - ELECTRONIC VARIABLE BRAKE PROPORTIONING**

Vehicles equipped with ABS use electronic variable brake proportioning (EVBP) to balance front-to-rear braking. The EVBP is used in place of a rear proportioning valve. The EVBP system uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves located in the integrated control unit (ICU).

OPERATION - ELECTRONIC VARIABLE BRAKE PROPORTIONING

EVBP is able to decrease, hold and increase rear brake pressure without activating full ABS control. Upon entry into EVBP the inlet valve for the rear brake circuit is switched on so that the fluid supply

from the master cylinder is shut off. In order to decrease the rear brake pressure, the outlet valve for the rear brake circuit is pulsed. This allows fluid to enter the low pressure accumulator (LPA) in the hydraulic control unit (HCU) resulting in a drop in fluid pressure to the rear brakes. In order to increase the rear brake pressure, the outlet valve is switched off and the inlet valve is pulsed. This increases the pressure to the rear brakes.

The EVBP will remain functional during many ABS fault modes. If both the red BRAKE and amber ABS warning indicators are illuminated, the EVBP may not be functioning.

HCU (HYDRAULIC CONTROL UNIT)**DESCRIPTION**

The HCU consists of a valve body, pump motor, low pressure accumulators, inlet valves, outlet valves and noise attenuators.

OPERATION

Accumulators in the valve body store extra fluid released to the system for ABS mode operation. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the CAB.

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.

During antilock braking, the solenoid valves are opened and closed as needed.

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.

NOTE: The three modes mentioned below do occur but not necessarily in the order listed everytime.

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

PRESSURE DECREASE

The outlet valve is opened and the inlet valve is closed 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

HCU (HYDRAULIC CONTROL UNIT) (Continued)

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

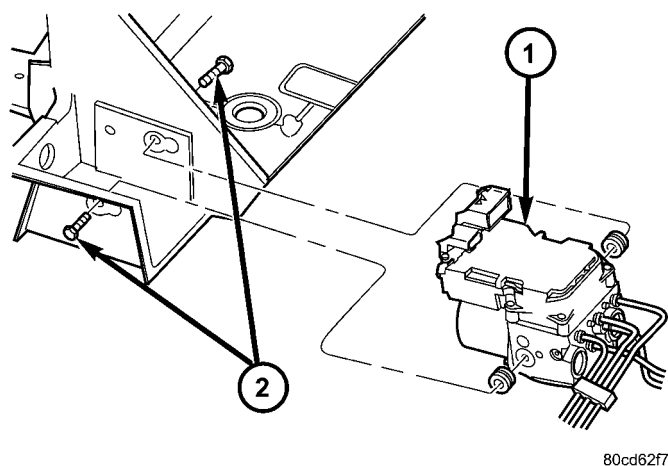
Both solenoid valves are closed in the pressure hold cycle but only the inlet valve is energized. Fluid apply pressure in the control channel is maintained at a constant rate. The CAB maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

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 reapply the brakes. This cycle controls re-application of fluid apply pressure.

REMOVAL

- (1) Install a prop rod on the brake pedal to keep pressure on the brake system.
- (2) Disconnect the battery cables from the battery.
- (3) Remove the battery.
- (4) Disconnect the two electrical harness connectors (Fig. 5).
- (5) Remove the five brake lines from the HCU (Fig. 5).
- (6) Remove HCU/CAB mounting bolts and remove the HCU/CAB (Fig. 5).



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Fig. 5 HYDRAULIC CONTROL UNIT

1 - HYDRAULIC CONTROL UNIT
2 - MOUNTING BOLTS

INSTALLATION

NOTE: If the CAB is being replaced with a new CAB is must be reprogrammed with the use of a DRB III.

- (1) Install HCU/CAB on the mounts and Tighten the bolts to 15N·m (11 ft. lbs.) (Fig. 5).
- (2) Install the five brake lines to the HCU and tighten to 19 N·m (170 in. lbs.) (Fig. 5).
- (3) Install the two electrical harness connectors to the HCU/CAB and push down on the release to secure the connectors.
- (4) Install the battery.
- (5) Install the battery cables to the battery.
- (6) Remove the prop rod on the brake pedal.
- (7) Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

RWAL VALVE**DESCRIPTION**

Rear Wheel Antilock (RWAL) brake system is standard equipment on 1500 series vehicles. The RWAL brake system is designed to prevent rear wheel lock-up on virtually all types of road surfaces. RWAL braking is desirable because a vehicle which is stopped without locking the rear wheels will retain directional stability. This allows the driver to retain greater control of the vehicle during braking.

The valve is located on the drivers side inner fender under the hood. The valve modulates hydraulic pressure to the rear brakes.

The RWAL components include:

- RWAL Valve
- Controller Antilock brake (CAB)
- Rear Wheel Speed Sensor (WSS)

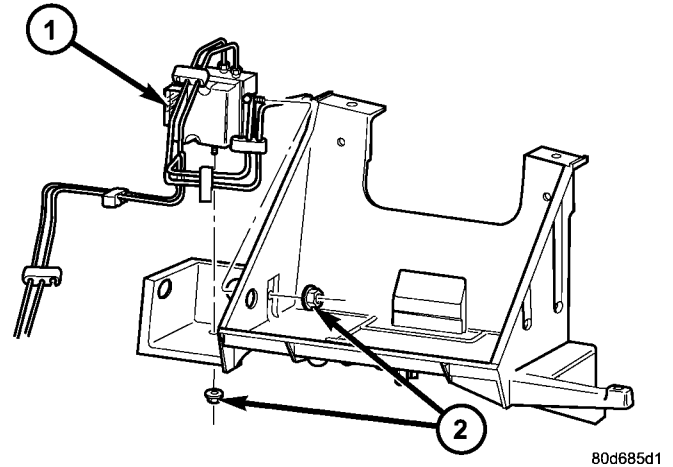
OPERATION

When the brakes are applied, hydraulic fluid is routed from the master cylinder's secondary circuit to the RWAL valve. From there hydraulic fluid is routed to the rear brakes. The Controller Antilock Brake (CAB) contains an Electronic Variable Brake Proportioning (EVBP) control algorithm, which proportions the applied braking force to the rear wheels during braking. The EVBP function of the RWAL system takes the place of a conventional hydraulic proportioning valve. The CAB monitors the rear wheel speed through the rear wheel speed sensor and calculates an estimated vehicle deceleration. When an established deceleration threshold is exceeded, an isolation valve is closed to hold the applied brake pressure to the rear brakes constant. Upon further increases in the estimated vehicle deceleration, the isolation valve is selectively opened to increase rear

RWAL VALVE (Continued)

brake pressure in proportion to the front brake pressure. If impending rear wheel lock-up is sensed, the CAB signals the RWAL valve to modulate hydraulic brake pressure to the rear wheels to prevent lock-up.

NORMAL BRAKING Since the RWAL valve also performs the EVBP or proportioning function, vehicle deceleration under normal braking may be sufficient to trigger the EVBP function of the RWAL system without full RWAL activity as would normally occur during an impending rear wheel lock-up. As previously mentioned, the isolation valve is selectively closed and opened to increase rear brake pressure in proportion to the front brake pressure under EVBP control. Slight brake pedal pulsations may be noticed as the isolation valve is opened.



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REMOVAL

- (1) Install a prop rod on the brake pedal to keep pressure on the brake system.
- (2) Disconnect the battery cables from the battery.
- (3) Remove the battery.
- (4) Disconnect the electrical harness connector (Fig. 6).
- (5) Remove the brake lines from the rwal valve (Fig. 6).
- (6) Remove rwal valve mounting nuts and remove the rwal valve (Fig. 6).

INSTALLATION

- (1) Install rwal valve and Tighten the nuts to 15 N·m (11 ft. lbs.) (Fig. 6).

Fig. 6 RWAL VALVE

- 1 - RWAL VALVE
2 - MOUNTING NUTS

- (2) Install the brake lines to the rwal valve and tighten to 19 N·m (170 in. lbs.) (Fig. 6).
- (3) Install the electrical harness connector to the rwal valve and secure the connector.
- (4) Install the battery.
- (5) Install the battery cables to the battery.
- (6) Remove the prop rod on the brake pedal.
- (7) Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).